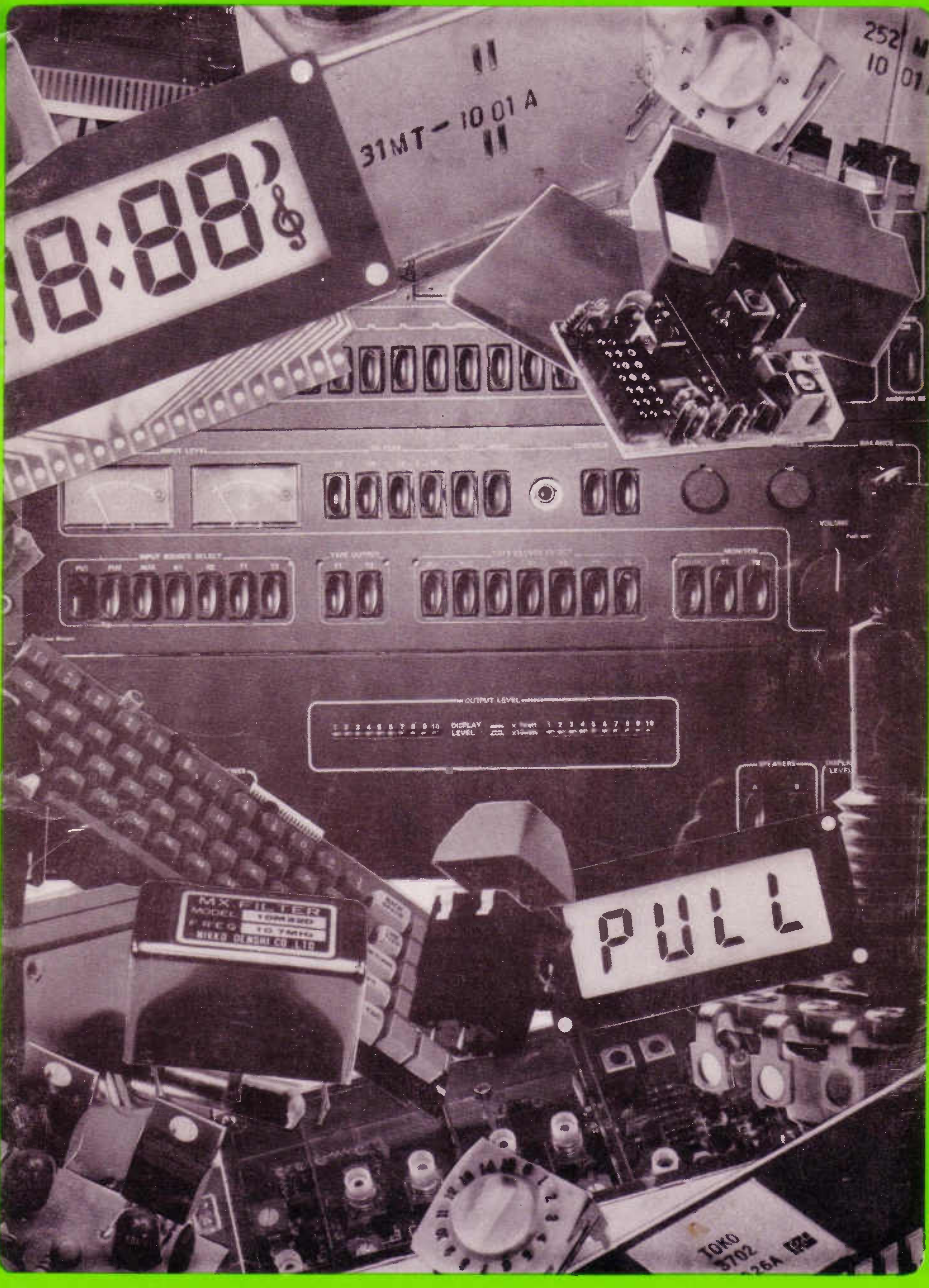
not the Radio Times......



but ambit international's part 4 catalogue.

Catalogue Part	2	3	4
A			
AM radio ICs	34,35,46	5,55,56,66	18,23,24,26, 66,67
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Bezel			64
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Books	CO		
Boxes - equip	PL		
Bridge Recs	PL		
Buzzer - Piezo			46
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Cable	CO		
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Trimmer	PL		
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Cases	PL		
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Coax Sockets			69
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Consultancy-Ambyte			94
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F			
Feedthru Caps	PL		
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Toroid	40		
Formers			7
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W			
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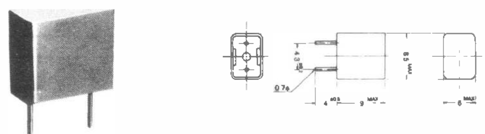
Fixed Value Inductors 1uH to 1.5H

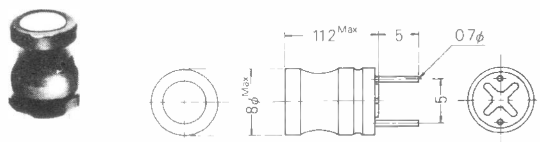
Small Signal Chokes: 7BA 8RB 10RB 10RBH

7BA 144LY	8RB 187LY	10RB 181LY	10RBH 239LY	Inductance	Q	Freq Mhz	R	I DC Max mA.	Self res. MHZ.
1R0				1.0 uH	30	7.96	1.0	30	360
1R2				1.2 uH	30	7.96	1.0	30	300
1R5				1.5 uH	30	7.96	1.0	30	230
1R8				1.8 uH	30	7.96	1.0	30	180
2R2				2.2 uH	30	7.96	1.0	30	150
2R7				2.7 uH	30	7.96	1.0	30	130
3R3				3.3 uH	30	7.96	1.0	30	100
3R9				3.9 uH	30	7.96	1.0	30	90
4R7				4.7 uH	30	7.96	1.5	30	80
5R6				5.6 uH	30	7.96	1.5	30	70
6R8				6.8 uH	30	7.96	1.5	30	60
8R2				8.2 uH	30	7.96	1.5	30	50
100				10.0 uH	30	2.52	2.0	30	37
120				12.0 uH	30	2.52	2.0	30	33
150				15.0 uH	30	2.52	2.0	30	29
180				18.0 uH	30	2.52	2.0	30	25
220				22.0 uH	30	2.52	2.0	30	21
270				27.0 uH	30	2.52	2.5	30	19
330				33.0 uH	30	2.52	2.5	30	17
390				39.0 uH	30	2.52	2.5	30	15
470				47.0 uH	30	2.52	3.0	30	11.5
560				56.0 uH	30	2.52	3.0	30	11
680				68.0 uH	30	2.52	3.0	30	9.5
820				82.0 uH	30	2.52	4.0	30	9
101				100.0 uH	30	2.52	4.0	30	8
	101			100.0 uH	80	.796	2.0	200	
121				120.0 uH	30	.796	4.0	30	7.5
	121			120.0 uH	80	.796	2.0	200	
151				150.0 uH	30	.796	4.0	30	7
	151			150.0 uH	80	.796	2.0	200	
181				180.0 uH	30	.796	6.0	30	6
	181			180.0 uh	80	.796	3.0	200	
221				220.0 uH	30	.796	6.0	30	5.5
	221			220.0 uH	80	.796	3.0	200	
271				270.0 uH	30	.796	6.0	30	5
	271			270.0 uH	80	.796	3.0	200	
331				330.0 uH	30	.796	6.0	30	4.5
	331			330.0 uH	80	.796	4.0	200	
391				390.0 uH	30	.796	9.0	30	4.5
	391			390.0 uH	80	.796	4.0	200	
471				470.0 uH	30	.796	9.0	30	4
	471			470.0 uH	80	.796	4.0	200	
561				560.0 uH	30	.796	10.0	30	3.5
	561			560.0 uH	80	.796	4.0	200	
681				680.0 uH	30	.796	12.0	30	3.5
	681			680.0 uH	80	.796	4.0	200	
821				820.0 uH	30	.796	12.0	30	3
	821			820.0 uH	80	.796	6.0	200	
102				1.0 mH	30	.796	14.0	30	3
	102			1.0 mH	90	.252	6.0	150	
	122			1.2 mH	90	.252	9.0	150	
	152			1.5 mH	90	.252	9.0	150	
	182			1.8 mH	90	.252	9.0	100	
	222			2.2 mH	90	.252	13.0	100	
	272			2.7 mH	90	.252	13.0	100	
	332			3.3 mH	90	.252	13.0	100	
	392			3.9 mH	90	.252	13.0	50	
	472			4.7 mH	90	.252	18.0	50	
	562			5.6 mH	90	.252	18.0	50	
	682			6.8 mH	90	.252	26.0	50	
	822			8.2 mH	90	.252	26.0	50	
	103			10.0 mH	100	.0796	40	40	
	123			12.0 mH	100	.0796	40	40	
	153			15.0 mH	100	.0796	60	40	
	183			18.0 mH	100	.0796	60	30	
	223			22.0 mH	100	.0796	80	30	
	273			27.0 mH	100	.0796	80	30	
	333			33.0 mH	100	.0796	80	30	
		333		33.0 mH	100	.05	26	17	
		393		39.0 mH	100	.05	45	15	
		473		47.0 mH	100	.05	52	13	
		563		56.0 mH	100	.05	58	12	
		683		68.0 mH	100	.05	66	12	
		820		82.0 mH	100	.05	71	10	
		104		100 mH	100	.05	82	9	
		124		120 mH	100	.05	97	8	
			154	150 mH	90	.0252	75	3.6	
			184	180 mH	90	.0252	85	3.4	
			224	220 mH	90	.0252	95	3.2	
			274	270 mH	90	.0252	105	3.1	
			334	330 mH	80	.0252	125	3	
			394	390 mH	80	.0252	140	2.5	
			474	470 mH	80	.0252	190	2.1	
			564	560 mH	80	.0252	215	2	
			684	680 mH	60	.0252	250	2	
			824	820 mH	60	.016	265	1.8	
			105	1.0 H	60	.016	295	1.7	
			125	1.2 H	50	.016	385	1.5	
			155	1.5 H	50	.016	435	1.2	

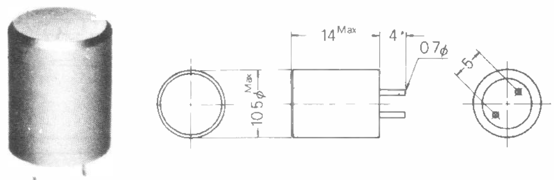
The Ambit range of low cost, ex-stock inductors includes a comprehensive range from 1uH to 1.5H. The complete E12 range is available ex-stock, E24 values are available to special order, where a minimum order of 500 per value is required. Samples will be made available for pre-production purposes.
Chokes listed here are held in quantity stocks, for immediate delivery. We anticipate that this selection should fill the majority of choke applications.



7BA
Miniature low cost fixed inductor. Large range from 1uH to 1000uH in E24 series available. Operating temperature from -20°C to +80°C. Low self capacitance. 7.5mm pin spacing also available.



8RB
Small size, high Q, wide range. Wound on ferrite bobbin covered by plastic sleeve. The smaller 8RBS is also available; only 6.2mm in height, basic parameters similar to the 8RB except slightly lower Q.



10RB and 10RBH
Large inductance; 10RB from 1mH to 120mH, 10RBH from 150mH to 1.5H. High Q. Sheilded ferrite case.

Notes:
The rated DC current is not necessarily an indication of the fusing value of DC current, but it is the DC current that affects the stated inductance by more than 20%.
The Qs quoted are minimum values, the resistances quoted are maximum values.

Numbering System:
The chokes are stamped with the value and tolerance, in the following form:
(7BA indicated by prefix 144, not stamped on choke.)

(144 H Y) 150 J

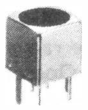
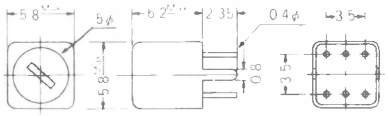
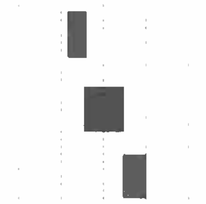
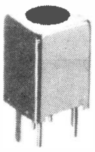
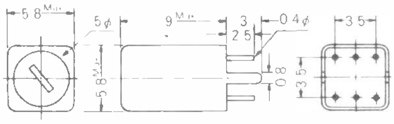
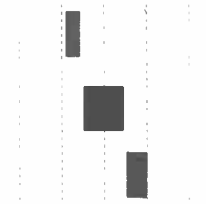
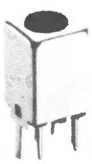
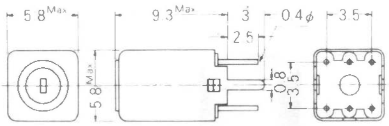
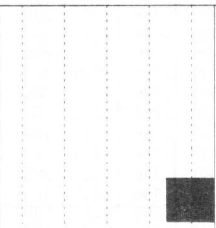
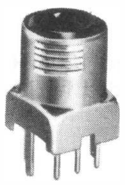
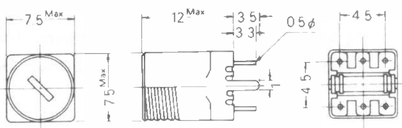
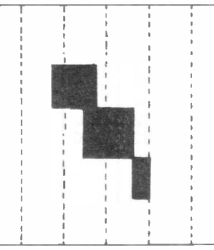
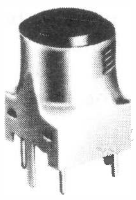
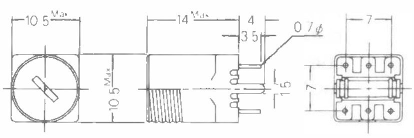
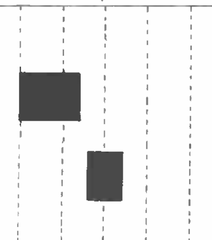
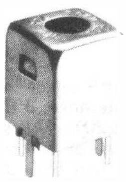
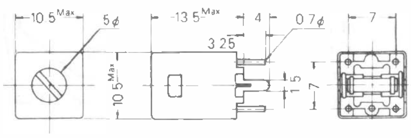
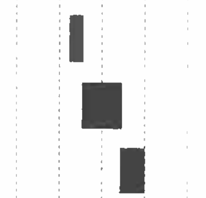
H indicates ferrite type
Y indicates 5mm pin spacing
First two figures give value
Third figure gives multiplier ie 10°

Final letter indicates tolerance; J:5%, K:10%, M:20%. (All stock types 10% or better. Most are in fact 5% - J types).

TOKO's standard coil range includes a wide variety of styles for signal processing applications (ie not power types) in the region 10kHz to 300MHz. The listing given here is intended to include all the major styles commonly used in broadcast receivers, communications and TV.

The variable styles all offer some 20-30% tuning of the nominal centre frequency, enabling a wide number of applications to be encompassed by "stock types". If you have an application that cannot be fulfilled from the stock lists - then please give us details of the exact requirement, and we will see if we can use an alternative style of coil to suit the application.

It is necessary to impose a minimum order restriction of between 500 and 1000 pieces for all custom design coils - although the efficient and reliable sampling service is usually free of charge in such cases. The styles listed here cover the range from 5mm to 13mm (length of one side of the base) formats - and with the increasing tendency towards miniaturization, we suggest that all new applications should employ the smallest format coil consistant with the required 'Q' factor and signal handling. Multiple windings and tappings are possible on all the styles shown here - although the larger tuneable inductors do not have facilities for built-in tuning capacitors.

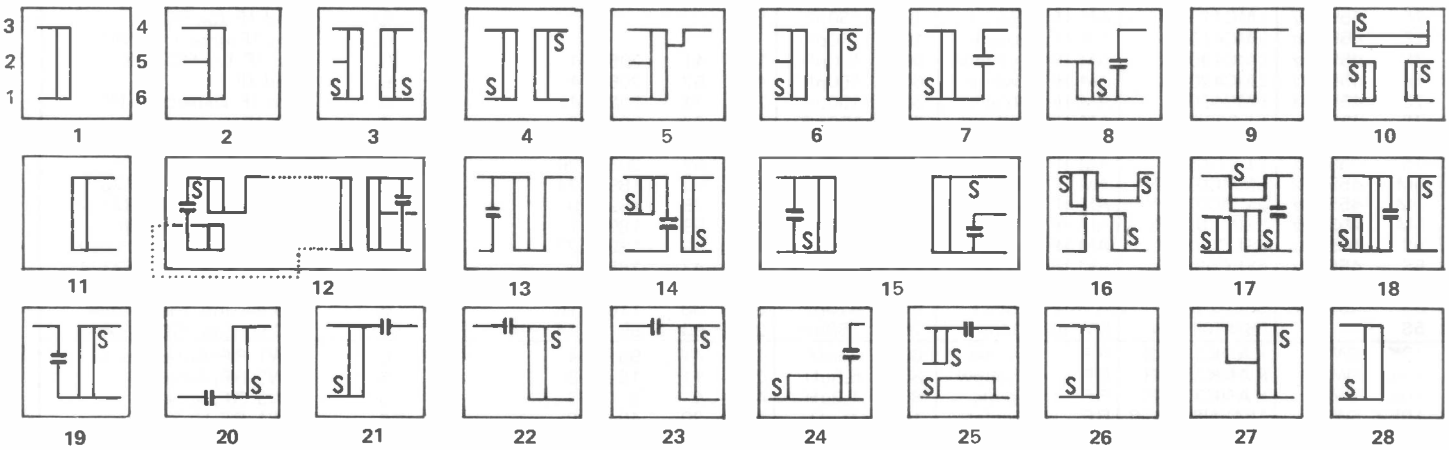
Type	Form	Dimensions (m/m)	Tuning Method	Freq. Range kHz 10 · kHz 100 · MHz 1 · MHz 10 · MHz 100	L. Range	Qu(typ.)	W/int.cap. on option;
5S					1μH ~ 680μH	70	180pF 1500pF 18~47pF (E-12 series)
5M					1μH ~ 1.0mH	100	180pF 1500pF 18~47pF (E-12 series)
5A					0.03μH ~ 0.3μH	50 ~ 70	None
7P 7PA					1μH ~ 20mH	70 ~ 110	430pF 180pF 5~100pF (E-12 series)
10P 10PA					30μH ~ 55mH	110	180pF
10EZ					2μH ~ 2.0mH	70 ~ 140	430pF 180pF 5~100pF (E-12 series)

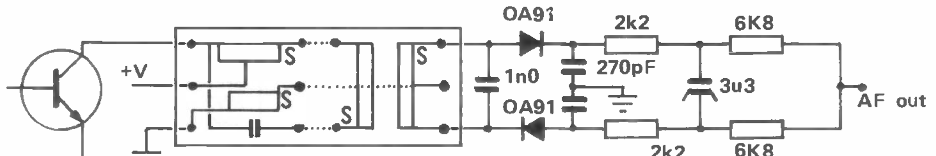
Coil Style	Type no..	Use	Colour	Q	Int. C (or L)	Winding details 1-2	2-3	1-3	4-6	other	Base No.	Comments
10PA	CAN1898HM	LF	orange	50	7mH			396			1	MPX tuning/filter coil
10PA	CAN1980BX	LF	yellow	50	7mH	40		396		1/4:198½	5	MPX tuning/filter
10PA	CAN1979A	LF	white	50	11.75mH	257	257	514	257		3	MPX tuning/filter
10PA	CAN1896HM	LF	black	85	22mH	695					1	MPX tuning/ AF filters
10PA	CLNS30568Z	LF	black	70	23mH			640			1	MPX /AF filter (Dolby)
10PA	CLNS30569Z	LF	black	100	36mH			780			1	MPX /AF filter (Dolby)
10PA	CAN1A350EK	LW	red	100	3.5mH	27	234	261	27		6	LW RF/Antenna coil
10ME	87BN134HM	LF	orange	55	7mH			349			1	See CAN1898HM
10ME	87BN135BX	LF	yellow	55	7mH	35	314	349		1/4:174	5	See CAN1980BX
10ME	87BN133AT	LF	white	55	11.8mH	226	226	452	226		3	See CAN1979A
10ME	87BN132HM	LF	black	100	22mH			618			1	See CAN1896HM
7PA	126ANSA5305	LF	yellow	55	7mH	39		349		1/4:195	5	7mm version CAN1980BX
7PA	126ANSA5306	LF	orange	55	12mH	257	257	514	136		3	7mm version CAN1979A
10E 468kHz	YRCS11098AC	AM IF	orange	90	180pF	140	25	165	4		6	Ist IF, low Z coupling
10E 468kHz	YRCS12374AC	AM IF	yellow	90	180pF	127	38	165	6		6	2nd IF
10E 468kHz	YHCS11100AC	AM IF	black	140	180pF	104	36	140	20		6	3rd IF /detector
10E 468kHz	YHCS1A589R	AM IF	blue	150	180pF	15	125	140	6		6	Hi Q 2nd IF
10E 468kHz	YHCS1A590R	AM IF	white	150	180pF	80	60	140	15		6	Hi Q IF
10E 468kHz	YMCS2A740A	AM IF	brown	90	180pF			158			7	Series tuned trap
10E 468kHz	YHCS17103D	AM IF	white	140	180pF					2/6:149	8	Series tuned trap
10E 468kHz	YMCS17104G	AM IF	yellow	110	180pF	98	67	165			2	Gen. IF /osc for BFO
10E 468kHz	YLE4A888EK	AM IF	black	70	430pF	55	55	110	15		6	Balanced AM detectors
10E	YRCS18576AQ	MW osc	green	120	100uH			59	36		4	For varicap tuning
10E	YMRS80046N	MW osc	blue	70	158uH	2	79	81	9		6	300pF tuning
10E	YMRS16726Z	MW osc	red	130	158uH	2				3/4:83	10	5/6:9. 3 wdg type
10E	YWOS6A356E	MW osc	blue	70	158uH	2	64	66	7		6	Low int C
10EZ	RWR331208	MW osc	red	70	330uH	2	92	94	8		6	Also MW RF
10EZ	RWO6A6408	MW osc	red	80	360uH	95	3	98	12		6	Also MW RF
10EZ	RWO6A775EK	LW osc	green	80	630uH	9	114	123	13		6	LW/RDF band osc
10E	YXNS3045OE	LF	blue	80	2mH				270		11	LPF/LF osc
10E	YXNS6A139	LW	green	80	940uH					1/4:185	9	LW RF padder
10E	YXNS6A140	LW	red	80	120uH			64			1	LW osc padder
10WA	WFDC1115P	AM IF	pink	80	180pF	107				3/4:45	12	AM Double tuned
	WFDC1115S		blue	80	180pF	3			158	5/6:5	12	
7P 468kHz	7MCS2197R	AM IF	blue	110	180pF	15	125	140	6		6	7mm YHCS1A589
7P 468kHz	7MCS2198R	AM IF	black	110	180pF	104	36	140	20		6	7mm YHCS11100AC
7P 468kHz	7MCS2199DC	AM IF	white	110	180pF	80	60	140	15		6	7mm YHCS1A590R
7P 468kHz	7MCS2194AA	AM IF	brown	110	180pF			140			7	7mm YMCS2A740A
7P 455kHz	7MCS4718N	AM IF	black	115	180pF	69	77	146	14		6	2k filter matching in
7P 455kHz	7MCS4876N	AM IF	black	115	180pF	130	16	146	14		6	2k filter matching out
7E 455kHz	LMC4100A	AM IF	yellow	105	150pF						6	!st IF for RC RXs
7E 455kHz	LMC4101A	AM IF	white	105	150pF						6	2nd IF for RC
7E 455kHz	LMC4102A	AM IF	black	105	150pF						6	3rd IF/detect for RC
7E 455kHz	LMC4200A	AM IF	yellow	60	150pF	164	41	205	4		6	1st IF for RC RXs
7E 455kHz	LMC4201A	AM IF	white	60	150pF	143	62	205	4		6	2nd IF
7E 455kHz	LMC4202A	AM IF	black	60	150pF	134	74	208	42		6	3rd IF/Detect for RC
7E 455kHz	LLC238	AM IF	white	70	150pF	143	62	205	8		6	1st IF
7E 455kHz	LLC4827	AM IF	yellow	70	150pF	126	79	205	10		6	2nd IF
7E 455kHz	LLC4828	AM IF	black	70	150pF	153	52	205	26		6	3rd IF/detector
5M 455kHz	5MMC0124N	AM IF	black	110	180pF	139	50	189	24		6	5M version LLC4828
5M 455kHz	5MMC0273N	AM IF	black	125	180pF	114	75	189	9		6	5M version LLC4827
5M 455kHz	5MMC0272N	AM IF	black	125	180pF	130	59	189	7		6	5M version LLC238
5S 455kHz	5SLC0184R	AM IF	black	77	180pF	137	43	180	27		6	5S version YHCS11100
5S 455kHz	5SLC0333R	AM IF	black	80	180pF	142	43	185	7		6	5S version YRCS12374
5S 455kHz	5SLC0331R	AM IF	black	80	180pF	104	76	180	20		6	5S version YHCS1A590
5S 455kHz	5SL0190N	AM IF	black	85	470pF	58	58	116	16		6	5S version YLE4A888
5S	5SNR0187N	MW osc	blue	75	158uH	2	93	95	14		6	5S version YMRS80046
10K SW1	KANK3333R	RF	violet	60	45uH	14	41	55	4		6	SW1 RF/Antenna coil
10K SW2	KANK3334R	RF	yellow	85	5.5uH	7	11	18	3		6	SW2 RF/Antenna
10K SW3	KANK3335R	RF	pink	85	1.2uH	4	4	8	2		6	SW3 RF/Antenna
10EZ SW1	154FN8A6438	RF	violet	100	45uH	10	30	40	8		6	SW1 RF Hi-Z
10EZ SW2	154FN8A6439	RF	yellow	110	5.5uH	4	10	14	6		6	SW2 RF Hi-Z
10K SW3	KXNK3767EK	RF	pink	80	1,2uH	2	6	8	5		6	SW3 RF Hi-Z
10K SW1	KAN3426R	Osc	white	65	38uH	3	48	51	4		6	SW1 osc
10K SW2	KANK3337R	Osc	green	50	5uH	2	25	27	3		6	SW2 osc
10K SW3	KANK3428R	Osc	blue	60	1.1uH	2	10	12	3		6	SW3 osc
10EZ SW1	154AN7A6440E	Osc	white	90	38uH	10	31	41	9		6	SW1 osc Hi-Z
10EZ SW2	154AN7A6441E	Osc	green	70	5uH	4	11	15	7		6	SW2 osc Hi-Z
10K SW3	KXNK3766EK	Osc	blue	80	1.1uH	2	6	8	5		6	SW3 osc Hi-Z
10KN SW2	K2027	RF/Osc	none	75	9uH	3	25	28	6		6	SW2 RF/osc
10K 10.7	KALS4520A	FM IF	red	100	50pF	8	7	15	1		6	1st IF, low Z link
10K 10.7	KACSK3892A	FM IF	red	80	82pF	7	7	14	2		6	FM IF, filter match
10K 10.7	KACSK3893A	FM IF	red	80	82pF	7	7	14	3		6	FM IF
10K 10.7	KACSK3894A	FM IF	red	80	82pF	7	7	14	4		6	FM IF
10K 10.7	KAC1506A	FM IF	black	100	51pF	3	12	15	2		6	FM IF, Hi-Lo/Z in
10K 10.7	KAC6184A	FM IF	black	65	82pF	10	3	13	3		6	FM IF, Hi-Lo/Z in
10K 10.7	KACSK586HM	FM det	pink	100	82pF			12			1	FM quadrature coil
10K 10.7	TKACS34342	FM det	black	70	51pF			15	1		4	Double quad with.....
10K 10.7	TKACS34343	FM det	black	70	51pF					3/4:15	13	double quad with above
10K 10.7	KAC8448PJQ	FM rat.	pink	65	68pF		14		11		14	Half ratio detector ....
10K 10.7	KAC8449SZ	FM rat	blue	65	68pF	7	7	14	1		6	...2nd half ratio detect.
10E 10.7	94AES30465	FM IF	brown	75	120pF	6	3	9	1		6	FM IF
10E 10.7	94AES30466	FM IF	pink	75	none	6	3	9	1		3	FM IF no int cap.
10K 10.7	KAN1508PAM	FM rat.	pink	100	ext.30p			13		3/4:7½	16	FM ratio detector....
10K 10.7	KAXS1509SZ	FM rat.	blue	80	91pF	6	6	12	1		6	...FM ratio detector
10E 10.7	94ACS10516	FM rat.	pink	80	32pF		18		5		14	FM ratio detector...
10E 10.7	94FCS10517	FM rat.	blue	80	51pF	1			13	3/4-3/6:6½	17	...FM ratio detector
10WF 10.7	125LCS30035	FM dt.	pink	75	82pF			12			15	(Double tuned IF...
10WF 10.7	125LCS30036	FM dt.	blue	75	82pF					6/8:13	15	...other half of above)

Some of the above numbers do not include full letter suffixes due to shortage of space. Use the Prefix and numerical designation when ordering.

Coil Style	Type no.	Use	Colour	Q	Int. C	Winding details 1-2	2-3	1-3	4-6	Other	Base No.	Comments
7E 10.7	85FC4402SEJ	FM IF	Blue	100	100pF	6	6	12	1		3	1 turn link IF
7P 10.7	119LC30099N	FM IF	Orange	90	82pF	8	2	10	4		6	Hi-Z secondary
5S 10.7	5SPN0186N	FM IF	black	70	ext 125p	7	3	10	2		3	5mm 94AES30466
5S 10.7	5SPC0185N	FM IF	red	80	47pF	8	7	15	1		6	5mm KALS4520A
5S 10.7	5SPC0210Z	FM det.	black	95	47pF			15			1	5mm KACSK586HM
27MHz RC												
10K 27.0	MKXCSK3464BM	RF	black	100	27pF			8	2		3	RF/Antenna coil
7KC 27.0	119CCA127EK	RF	black	70	47pF	4	4	8	1		6	RF/Antenna coil
7KN 27.0	113CN2K159DZ	RF	black	90	ext.55p			8	2		4	RF/Antenna coil
7KN 27.0	113KN2K241DC	RF	black	80	ext.27p	7	2	9	2		3	RF/Antenna coil
7KN 27.0	113CN2K509ADZ	RF	black	90	ext.56p	1	1	2	8		3	RF/Antenna coil
MISC. TYPES												
10EZ 9MHz	154PC7A6602EK	IF	black	50	47pF	8	8	16	16		6	Det. coil AM/SSB
10EZ 9	154AES7A6661EA	IF	green	60	150pF	4		10	1		18	IF
10EZ 9	154AES7A6662EA	IF	yellow	60	150pF	5		10	1		18	IF
10EZ 9	154PE7A6663AO	IF	white	50	150pF			10	1		4	IF
10K 4-6MHz	MKANK4174HM	osc	black	100	4.8uH			17			1	VFO osc coil
10K 9	KXNK4173AO	osc	brown	80	3uH			15	3		4	9MHz CIO coil
10K 28MHz	KXNSK4612BM	RF	white	45	1.7uH			11	3		4	RF/Antenna coil
10K 28	KXNSK4613BM	RF	white	45	1.7uH			11	1		4	RF/Antenna coil
10K 28	KXNSK4172EK	RF	black	65	1.4uH	1	8	9	3		6	RF/Antenna
10K 28	TKXNS22250N	RF	black	80	1.4uH	1	8	9	1		6	RF/Antenna
7KN 28	113KN2K1026HM	RF	black	45	1.7uH			14			1	RF/trap
10K 36MHz	TKXCA34732CQN	TV vif	white	85	27pF				9		19	TV video IF
10K 36	KXCAK3347AHC	TV	white	85	27pF				9		20	TV
10K 41.4	TKXCAK3346AEU	TV	white	80	39pF			6	9		21	TV vif trap
10K 31.9	TKXCA34735EMD	TV	white	68	82pF				6		22	TV vif
10K 31.9	KXCAK3345AEU	TV	white	85	27pF			11			21	TV vif
10K 40.4	KXCAK3344AM2	TV	white	80	27pF				7		23	TV vif
10K 33.5	KXCAK2499ABZ	TV	white	75	12pF					1/6:16	24	TV vif
10K 37	TKCA34909EMH	TV	white	65	27pF		9			1/6:4	25	TV vif
10K 6.0	MKANSK1731HM	TV	black	75	ex.560p			8			26	TV sound detect.
10K 4.43	KANFK2495ET	TV	none	35	ex1n2				10	3/4:5	27	Chroma
10K 5.5	BKANK3360AGM	TV	pink	41	ex.1no			7			26	TV euro sound if
10WA 455kHz	WRHC1A516/7	nbfm	pink/blu	100		see base diagram					28	455/470 ratio detct.

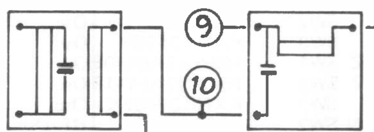
BASE CONNECTIONS: S = Start of Winding



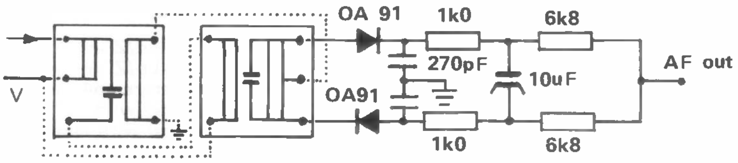


455/470kHz ratio detector WRHC1A516/7

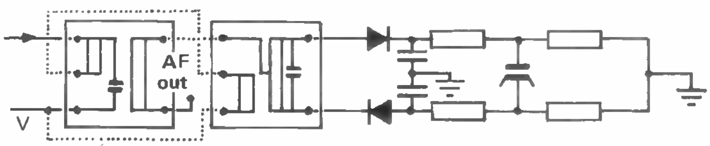
Double tuned quadrature assembly



TKACS34342/3 connections to 3089 family



10.7MHz ratio detector TKAC8448PJQ/TKAC8449SZ

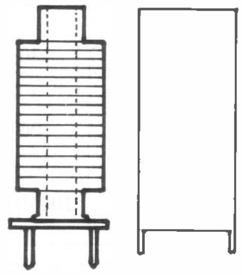


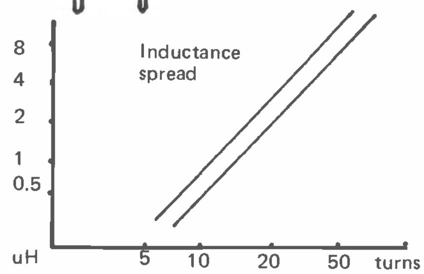
10.7MHz ratio detector 94ACS10516PJQ/94FCS10517STP2

The ratio detector is still a useful general purpose form of FM demodulator - particularly in applications where the signal level is rapidly fluctuating - such as mobile communications. The input to the ratio detector should be fully limited for best AM rejection - but unlike popular forms of quadrature, the performance below limiting is not particularly harsh and noisey.
The ratio detector can be driven from the IF output of ICs such as the CA3089/HA1137 families (MC3357 for 455/470kHz), which impart their excellent limiting characteristics, although the audio level may be low, since the internal chip AF amplifiers are not being used.
The AF output point can be taken from either point shown - and the DC centre zero tuning indication may be taken from the same point as the AF (use a sufficiently high impedance to avoid affecting the audio). With the secondary winding referred to ground, the AFC will swing about 0v, which must be taken into account with any AFC connections.

Coil formers 13K, 10K and 10E/10EZ

13K





The 13k series

The 13K is a 13mm square based coil, with a 5mm diameter centre former with integral spiral molding in which the windings are held with exceptional rigidity. Two slugs provide adjustment for double coils, if required, with the access available from either end. The wire diamaters may vary from between 0.5 and 1mm - though the larger the wire diameter used, the larger the Qu available.

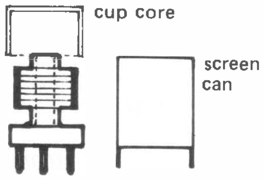
Characteristics:

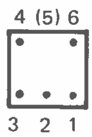
Torque of core	10-150 gm.cm
Dielectric strength	500v between each coil and the coil and case

Initial symbol	Frequency range	Temp coef	Qu*	Adjustment range
V4FCN	2-20MHz nom	220±60ppm	70	L± 10%
V4LCN	2-20MHz	150±60ppm	50	..
V4VMN	30-60MHz	0	100	..

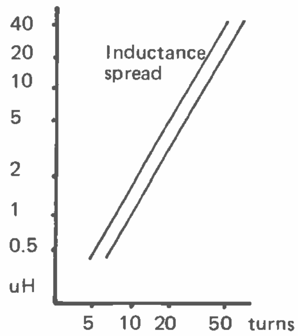
The 13k parameters above are given for wire of 0.4mm diameter
For HF oscillator applications, it is recommended that as little of the core as possible be employed in the tuning of the coil, since the drift of the coil assembley is largely a function of the ferrite employed.
13k formers supplied will have windings already - since these are sold primarily as "dead stock" items. Large quantities of formers are not available other than as ready wound items ie we cannot supply piece parts only.

10K





Base



The 10k series

The 10k is a 10mm square base coil, with 3mm diameter former, with integral spiral molding in which the windings are held rigidly. A single slug core is provided for adjustment, accessible from either end of the former body.
Conventionally, the primary winding should be placed between pins 1 &3, with pin one being 'earthy' wrt RF. The tap on the primary at pin 2, with secondary or coupling windings between pins 4 &6

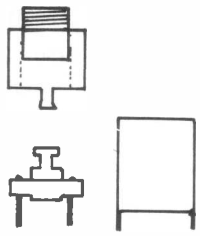
Characteristics:

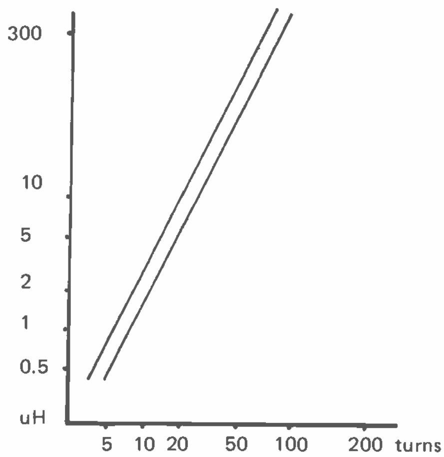
Torque of core	10-150 gm.cm
Dielectric strength	100v between windings and case, and between primary and secondary

Initial symbol	Frequency range	Temp coef	Qu	Adjustment range
KAN/KAC †	2-11MHz	220±100 ppm	100	F± 10%
KXN/KXC †	11-45MHz	..	100	..
KEN/KEC †	45-100MHz	..	80	F± 5%
KACA	2-11MHz	150±100ppm	80	..
KXCA	11-45MHz	..	80	..
KECA	45-100MHz	..	70	..

† Include ferrite cup core

10E





The 10E/10EZ series

The 10E and 10EZ may be considered as the same thing for the purposes of this description - in practise the 10E has the threaded adjustable cup core fixed in an extension of the base - whereas the 10EZ types have the threaded core held in a removable plastic holder, that snaps into place, after the winding has been fixed on the central ferrite bobbin core.
These coils are the basic types for use in the range 100kHz to 15MHz and offer exceptional Q combined with small size. The actual inductance is adjustable over as much as ±50% of its nominal value, though Q and TC may suffer if taken to such extremes. For the majority of amateur applications, the 10EZ style is probably one of the most effective coil systems to employ, combining high Q, small size, wide adjustment range and ease of winding.

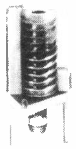
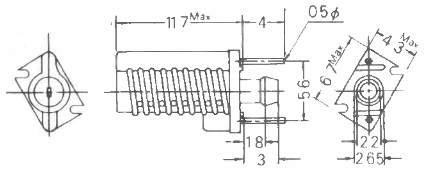
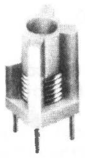
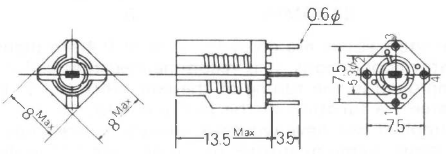
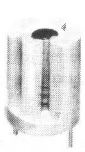
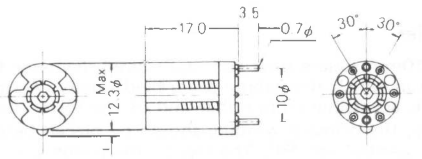
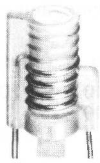
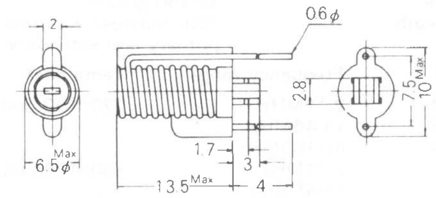
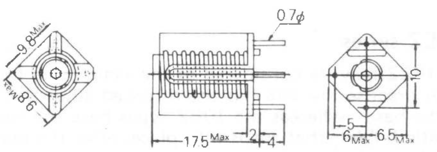
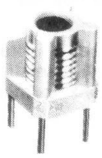
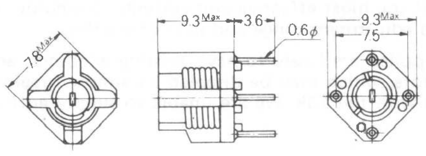
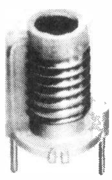
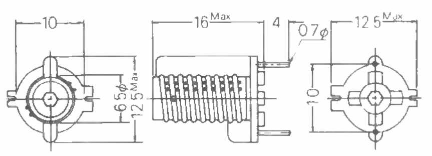
The formers supplied are likely to have existing windings, and in some instances, internal capacitors, which may be disabled by simply breaking with a small screwdriver. As with the 13k, we are unable to supply entirely blank formers in quantity

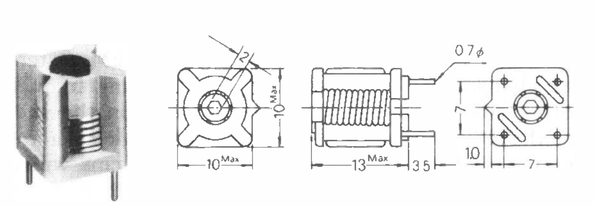
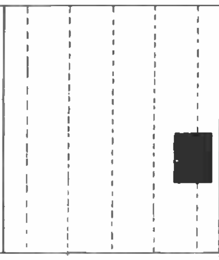
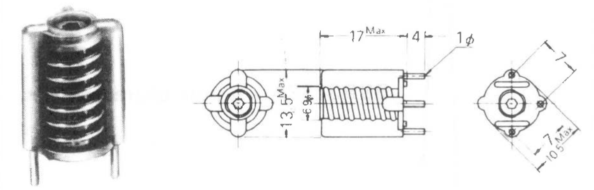
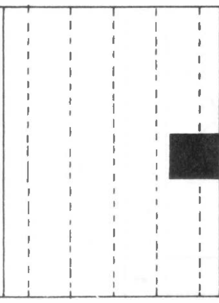
Characteristics:

Torque of core	40 - 500 gm.cm
Dielectric strength	Depends on wire insulation quality. Max 100v between case and windings

Initial symbol	Frequency range	Temp coef	Qu	Turns/uH
RL /YL	0.2 to 1MHz	750±120	70	172/640
RM/YM	..	..	110	165/640
RZ/RH/YH	..	..	140	148/640
154P	2 to 15MHz	220±100	60	14/4.3
154A	..	..	110	14/4.3
RW /YX	0.5 to 2MHz	150±100	110	85/290

For details of dimensions, and further descriptions, please refer to the general standard coil information sections of this catalogue

Type	Form	Dimensions (m/m)	Tuning Method	Freq. Range (kHz 10, kHz 100, MHz 1, MHz 10, MHz 100)	L. Range	Qu(typ.)	Tap. & Sec. Coil
MC108					0. 03μH ~ 0.17μH	130 ~ 190 at 100MHz	Single Winding only; no tap
MC111					0. 03μH ~ 0. 50μH	50~140 at 58MHz 110~140 at 100MHz	Single Winding, 2 taps possible; Sec. Available
MC110					0. 03μH ~ 1μH	200~260 at 58MHz 200~220 at 100MHz	Pri.; 2 taps; Sec. & Tert. Possible
MC115 MC116					0. 03μH ~ 0. 48μH	50~160 at 58MHz 110~180 at 100MHz	Single Winding only no tap
MC117					0. 03μH ~ 0. 35μH	100~220 at 58MHz 150~200 at 100MHz	1 tap possible; no Sec. Sealed Case Available
MC119					0. 03μH ~ 0. 2μH	50~120 at58MHz 120~180 at100MHz	Single Winding, 2 taps possible; Sec. Available
S18					0. 03μH ~ 0. 4μH	100~200 at 58MHz 160~220 at 100MHz	Single Winding only no tap

Type	Form / Dimensions (m/m)	Tuning Method	Freq. Range (kHz 10, kHz 100, MHz 1, MHz 10, MHz 100)	L. Range	Qu(typ.)	W/int.cap. on option / Tap & Sec.Coil
MC120				0.03μH ~ 0.44μH	100 ~ 200	Single Winding, 1 taps possible; no Sec. Sealed Case Available
MC107				0. 03μH ~ 0. 2μH	200 ~ 250 at 100MHz	Pri.; 1 tap; Sec.; None

MOLDED COIL: INDUCTANCE CHART

The inductance of a single winding is given in the table below - referred to both the generic style, and the specific type of ferrite core employed:

Suffix -H = 70-150MHz ferrite
-L = 30-70MHz ferrite
N = Air cored

Several of the styles offer only one type of ferrite covering 30-200MHz, and the -H ferrite is useable to 200MHz with very little degradation of coil performance. For Oscillators and very high stability applications, the Aluminium (-Al) core should be used if adjustment is required.

Coil style and ferrite type			Turns: 1	2	3	4	5	6	7	8	9	10	11
S18	H		0.04	0.06	0.11	0.18	0.23	0.3	0.39	0.45			
	Al		0.03	0.05	0.06	0.08	0.10	0.12	0.14	0.17			
	L		0.06	0.08	0.12	0.16	0.23	0.27	0.34	0.40			
MC107	H		0.03	0.06	0.09	0.15	0.19	0.23					
MC108	H/L		0.02	0.04	0.06	0.08	0.11	0.14	0.17				
	N		0.02	0.03	0.04	0.05	0.06	0.07	0.09				
MC111	H	close wnd.			0.08	0.12	0.16	0.22	0.30	0.36			
	L				0.08	0.12	0.16	0.20	0.26	0.35			
	Al				0.05	0.06	0.08	0.09	0.12	0.14			
	H	space wnd.			0.08	0.12	0.17						
	L				0.08	0.12	0.16						
	Al				0.04	0.05	0.06						
MC115	H		0.03	0.05	0.07	0.10	0.13	0.15	0.18				
	L		0.04	0.05	0.07	0.11	0.13	0.15	0.17				
	N		0.02	0.04	0.06	0.07	0.09	0.11	0.13				
MC116	H		0.03	0.05	0.08	0.11	0.17	0.22	0.26	0.29	0.37	0.43	0.50
	L		0.04	0.06	0.09	0.12	0.16	0.22	0.25	0.30	0.36	0.4	0.45
	N		0.03	0.04	0.07	0.09	0.12	0.16	0.19	0.23	0.28	0.29	0.32
MC117	L		0.04	0.07	0.11	0.15	0.22	0.25	0.32				
MC119	H	close wnd	0.03	0.05	0.09	0.14	0.20	0.24					
	H	space wnd.	0.03	0.05	0.08								
MC120	H	with can	0.04	0.06	0.09	0.14	0.17	0.21	0.24	0.28	0.33		
	H	without can	0.04	0.08	0.13	0.19	0.24	0.31	0.35	0.44	0.53		
	H	with can/space	0.03	0.05	0.08	0.10	0.13						
	H	no can/space	0.04	0.07	0.11	0.15	0.21						

Selecting and using TOKO Molded coils

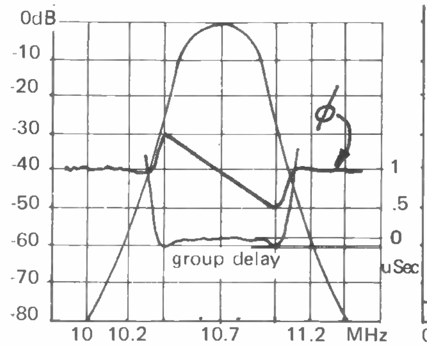
The repeatable nature of a molded coil ensures reliable circuit design, and predictable alignment procedures. When selecting a type for a particular application, use the largest format coil (with largest diameter wire) that space permits for best 'Q'. The S18 series has evolved as the "standard" range for most applications - and accordingly, a full range of these are held as stock items. For small volume requirements including tap/secondaries, it is frequently satisfactory to use an S18 for the primary and an overwind for the tap/secondary.

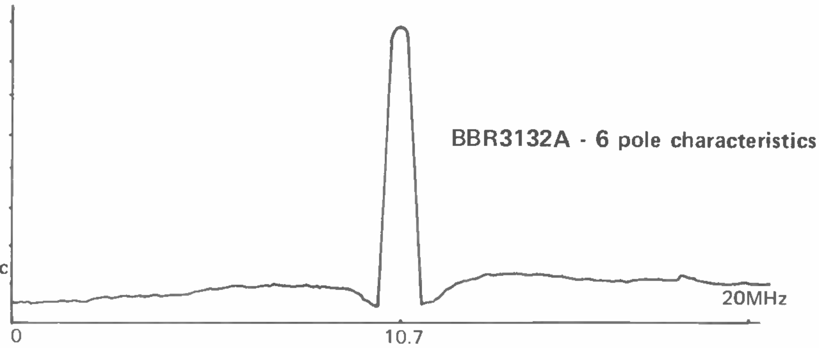
For applications at Band 2 and 140-170MHz, a range of MC111 coils are available from stock with a choice of secondary. But for custom applications requiring 500+ of a given type, then any combination of windings covered in the molded coil specification pack (10 double sided sheets) can be supplied after approval of samples.

Sample stocks of a broad range of the types described here are kept by Ambit to speed the process of approval - please submit a full specification of your requirements together with min/max dimensions to help us select the best coil for any given application.

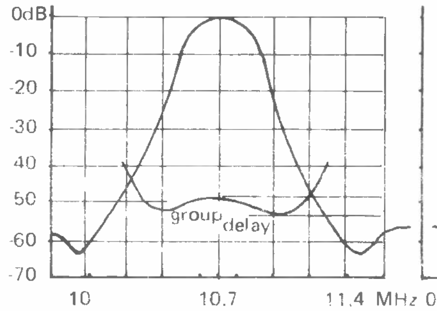
SEE THE CURRENT PRICE FOR DETAILS OF CURRENT STOCK TYPES AND PRICES. ALSO TRIMMER TOOLS FOR ALL TYPES.

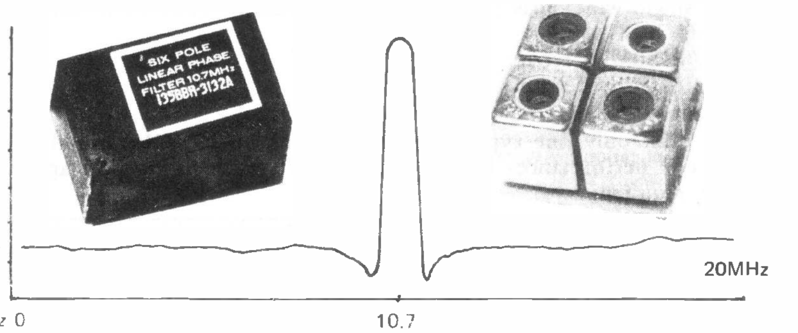
Linear Phase Filters are specifically designed to optimize performance in FM IF systems. Although the term is familiar, the actual mechanism of the filter is not as widely appreciated as it might be - which is a shame, since the explanation is quite simple and straightforward, and may be related to other aspects of FM design that are already widely understood.
Basically, a parallel resonant tuned circuit used in an FM quadrature detector may be considered to be a linear phase filter when sufficient damping has been applied to turn the inital "S" curve into a slightly flatter "Z" curve. This curve represents the change of phase of a sinewave passing through the coil (or applied across its terminals), and is primarily a function of "Q" - single tuned circuits with high "Q" will have a large swing on the curve, but the shape will be distorted into an "S" - which means that the rate of change of the phase is not linear with respect to frequency. The group delay is the measure of the deviation of the phase change from a linear plot, and so figures in the filter specifications. In an FM system, and particularly a stereo composite signal, the non-linearity of the phase change will lead to different modulating frequencies being detected at marginally different times - leading to phase errors. Since the FM stereo system hinges on the accuracy of the phase relationship between the 19kHz broadcast subcarrier, and the 38kHz regenerated signal - group delay across the 15Hz to 55kHz baseband spectrum is all important. And the better the IF filter response, the fewer problems will need to be compensated further down the chain - with palliatives such as RC phase advances, which can never quite match the original errors and cause adequate resolution of an IF phase delay error.

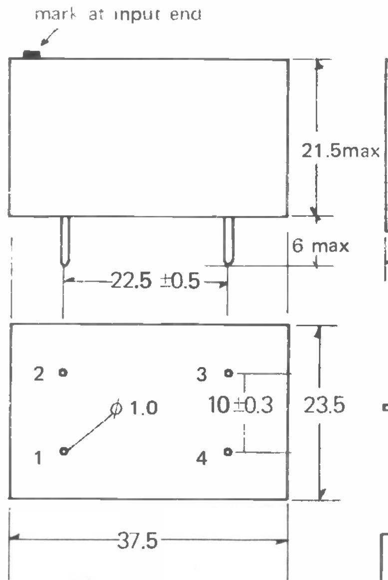




BBR3125N - 4 pole characteristics

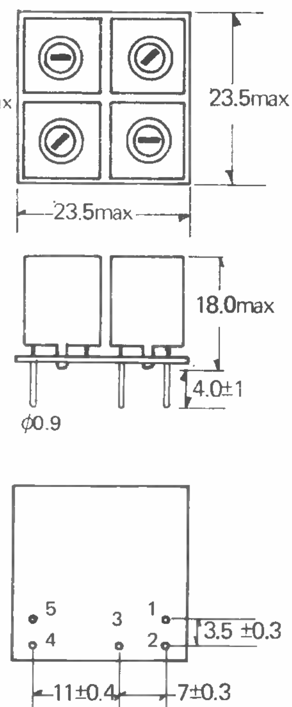






1 Ground
2 Input
3 ground
4 Output

NB A DC path exists between input and output



1 Signal in
2 Signal earth
3 Earth
4 Output earth
5 Output signal

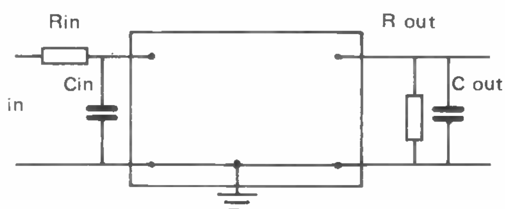
Specifications				
Type BBR:	-3dB BW	Group delay	Impedance in	out
3132A	240kHz	>0.5uSec	1kΩ	560Ω
3125N	230kHz	>0.5uSec	330Ω	330Ω

Notes:

The group delay is given for the following bandwidths
3132A: ± 175kHz 3125N:±150kHz

The insertion loss, for a correctly terminated filter :
3132A: max. 16dB, typically 13dB
3125N: max. 14dB, typically 10dB

Test circuit notes

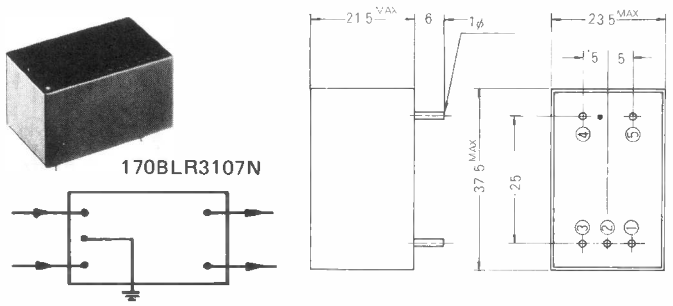


The input impedances given in the table above do not include the additional capacity required for a perfect match. The additional capacity must take into account all circuit strays.

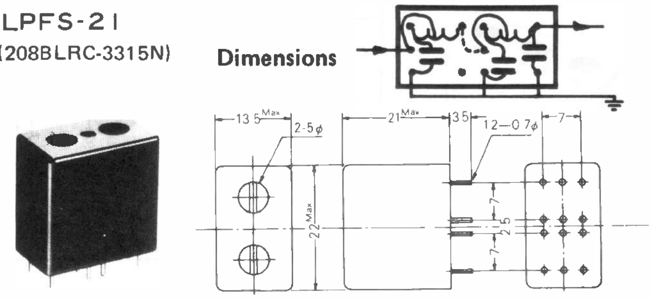
BBR3132A Cin / Cout = 10pF
BBR3125N Cin = 5pF Cout = 30pF

PILOT TONE FILTERS FOR MULTIFLEX

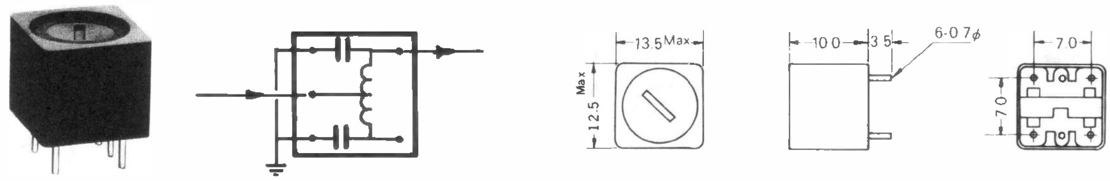
LPF **Dimensions**



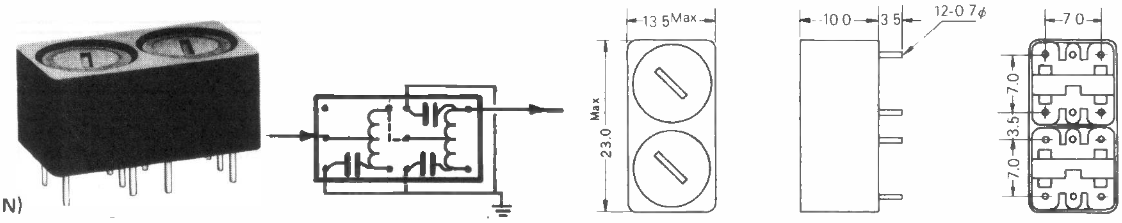
LPFS-21
(208BLRC-3315N) **Dimensions**



ABS-1OL

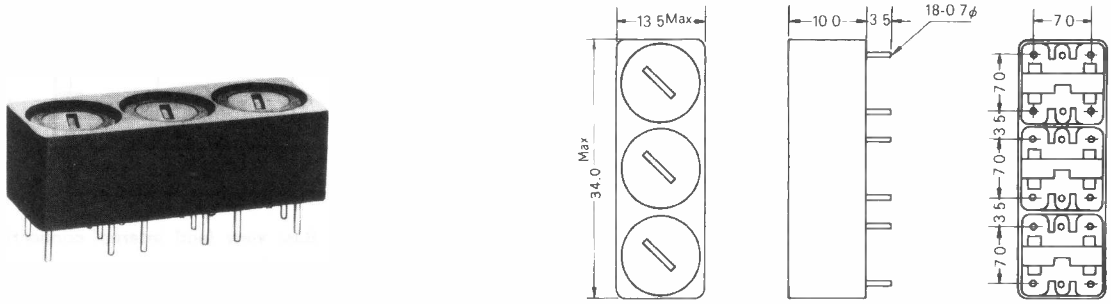


ABW-1OL

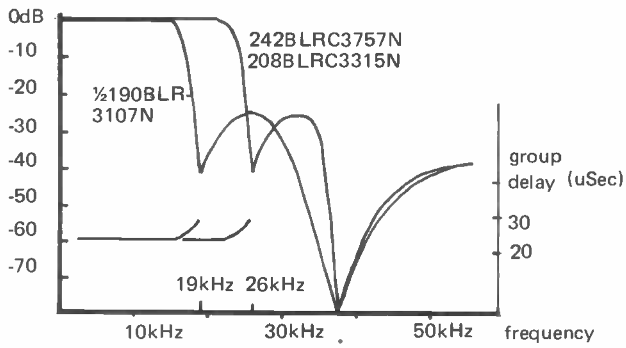


(242BLRC3757N)

ABT-1OL



Filter responses: 208BLRC3315N/242BLRC3757N



The use of 19kHz phase cancelling stereo decoder ICs has led to the development of LC pilot tone filters where the 38kHz notch has been retained, but the 19kHz notch has been shifted to 26kHz so that there is no degradation of frequency response in the audio band at 15kHz. This also assists in keeping the audio group delay flat - which although not as critical as the group delay associated with IF amplifier design, can nevertheless provide an obscure source of HF distortion.

It is essential to provide the correct resistive termination for all types of pilot tone filter - and there must be no de-emphasis capacitor on either the input or output. If the filter is placed at the output of a tuner - then remember that the capacitance of a screened audio lead will lead to distortion of the response.

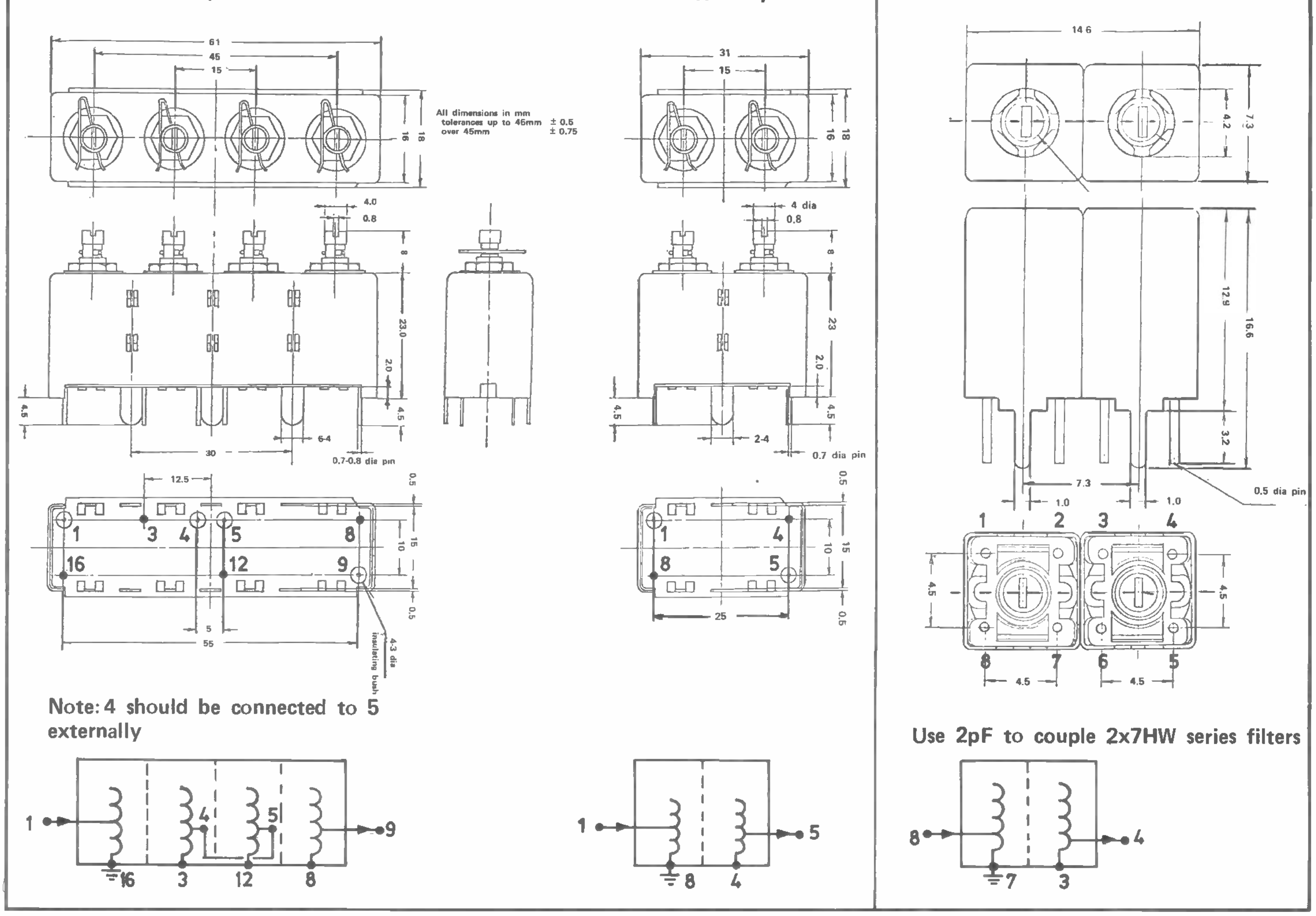
Stock Types - (also check current PL, which may include types available but not suitable for new designs)

Type	input impedance	output impedance	pole frequencies	15kHz loss
BLR3107N (dual)	4k7 ohms	4k7 ohms	19/38kHz	1.2dB max
208BLRC3315N	4k7	4k7	26/38kHz	0.6dB max
242BLRC3757N	4k7	4k7	26/38kHz	0.7dB max

The maximum inductance possible with the coils used in these filters is approx. 100mH, so a variety of audio filter configurations are possible for audio processing, telecommunications etc. The 3 pole version (ABT10L) is intended for applications in extremely precise applications, including stereo generators and laboratory test equipment.

Since the composite mutliplex spectrum includes the DSB modulation of the 38kHz signal extending from 23kHz to 53kHz, it is important to ensure that this band is effectively filtered in tuner applications - as well as the more obvious 19kHz. The tendency for ever more wideband audio amplification cab lead to either HF instability or unecessary and undesirable intermodulation products that can both cause unpleasant audio distortion - or damage sensitive loudspeaker elements.

HRQ 4-pole — HRW 2 pole — 7HW series



Standard Helical Filter Types (Check price list for current stock parts)

Type	Number	Frequency	Z in/out	1dB BW	Attenuation/MHz off centre	Insertion loss	Ripple	Temp. Coef.*	Power
7HW	252MT1001A	435MHz	50 ohms	12MHz	23dB/+30; 29dB/-30	1.5dB	0dB	23ppm/°C	500mW
	252MT1090A	470MHz	50 ohms	8MHz					
2x7HW	252MT.........	....	....	....	25dB/+15MHz; 27dB/-15MHz	3.0dB	0dB	23ppm/°C	500mW
HRW	231MT-1001A	435MHz	50 ohms	12MHz	22dB/+30; 27dB/-30	0.3dB	0.3dB	23ppm/°C	5W
HRQ	232MT-1001A	435MHz	50 ohms	11MHz	28dB/+15; 31dB/-15	1.8dB	0.7dB	23ppm/°C	5W
	232MT-1021A	470MHz	50 ohms	8MHz	28dB/+15; 31dB/-15	1.6dB	0.6dB	23ppm/°C	5W

*the TC is designed so that from -10° to +60°, the maximum frequency shift does not exceed 0.1% of the nominal value for HRQ/W, and 0.12% for the 7HW series units.

TOKO Helical filters for UHF

TOKO have introduced a range of 2 and 4 cavity helical filters for applications at UHF, including microwave IF filters, and communications input/output filters.

The permissable range is 380-480MHz, but specifically for 435MHz and 470MHz for the amateur and commercial mobile radio allocations.

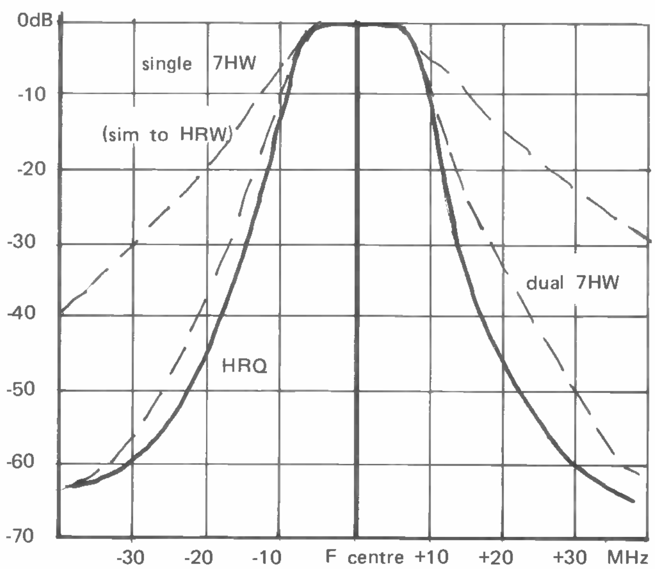
The basic filters can be adjusted to a small extent with the tuning slug system provided - although it is essential to have a spectrum analyzer and sweep generator during such modifications. The filters also provide a useful basis for experimentation, since they can be dismantled relatively easily to adjust tap points and turns/coupling.

The HRQ/HRW series are primarily intended as receiver input filters where their high Q and low insertion loss cannot readily be matched by any other techniques. However, they are also suited to use in signal generator/transmitter signal multiplier outputs, IF stages for satellite TV reception. The 7HW is a miniature filter for hand held UHF equipment - or less demanding applications in low power frequency multiplier stages.

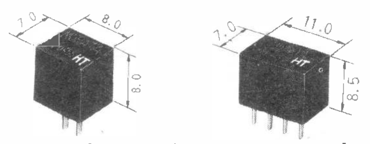
A pair of 7HW filters may be cascaded for improved response - although if used in a receiver application, it may be advisable to place some gain between the filters to assist in optimizing NF.

When using these filters, it is necessary to use double sided PC for best results - the prime danger of this frequency being the ease with which unwanted input/output coupling can occur. In the test data alongside, the primary limiting factor for the 4 pole ultimate attenuation is the layout and measurement equipment capability.

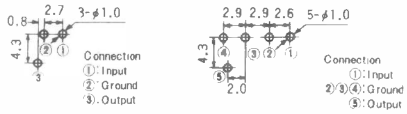
Abbreviated response analysis (fuller analysis OA)



CFU/LFB   CFW/LFHS



*** See price list for current stock types**



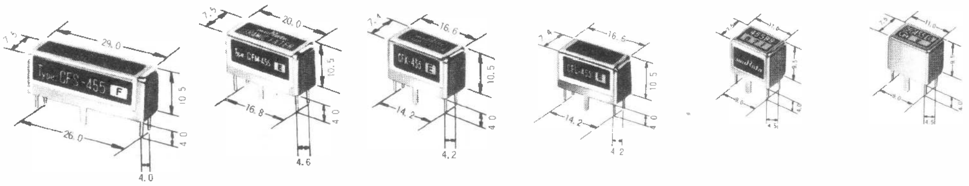
Part Number		Band Width Rank	6dB Band Width (KHz) min.	Att. Band Width (KHz) max	StepBandAtt. (dB) min.		Insertion Loss (dB) max	In. Output Impedance (KΩ)
CFU	CFW				CFU	CFW		
CFU455B2	CFW455B	B	±15	±30	27	35	4	1.5
CFU455C2	CFW455C	C	±12.5	±24	27	35	4	1.5
CFU455D2	CFW455D	D	±10	±20	27	35	4	1.5
CFU455E2	CFW455E	E	±7.5	±15	27	35	6	1.5
CFU455F2	CFW455F	F	±6	±12.5	27	35	6	2
CFU455G2	CFW455G	G	±4.5	±10	25	35	6	2
CFU455H2	CFW455H	H	±3	±9	25	35	6	2
CFU455I2	CFW455I	I	±2	±7.5	25	35	6	2
CFU455HT	CFW455HT	H	±3	±9	35	60	6	2
CFU455IT	CFW455IT	I	±2	±7.5	35	60	6	2

• Stop band attenuation is specified widthin 455±100KHz.

*CFW series available in 468kHz type SFR468H (6kHz)

Communication Use Ceramic Filter 455KHz

LFD CFS455□   LFC CFM455□   CLFD CFK455□   CFL455□   SLFD CFX455□   CFG455□



General Series   Small Size Series   Ultrasmall size Series

Unit: mm

Part Number \ Char.	Att. Width in 455±100KHz (dB) min.	Spurious Width in 0.1~1MHz (dB) min
CFS 455□	70 (J : 60)	50
CFK 455□	80	50
CFX 455□	70	50 (B~E : 40)
CFM455□	50 (E~H : 45)	30
CFL 455□	60	40
CFG 455□	50	25

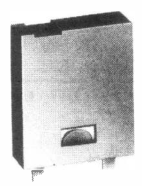
• □ indicates the alphabet of the band width rank.

For the current stock range - see the price list. The full list here include types frequently found in imported equipment, and is thus provided for reference. The worst case parameters listed here are considerably improved in practise - specific data relating to the various families covers bandpass phase response and mismatch conditions. Approx. 5 pages per series.

- Attenuation Band is specified the following band width
  CFS : 80dB B.W
  CFK : 70dB B.W
  CFX : 70dB B.W
  CFM : 60dB B.W.
  CFL : 70dB B.W.
  CFG : 60dB B.W.
- Ripple is 3dB band max. (when 3dB band width is specified within 3dB band width and in other cases is within 6dB band width).

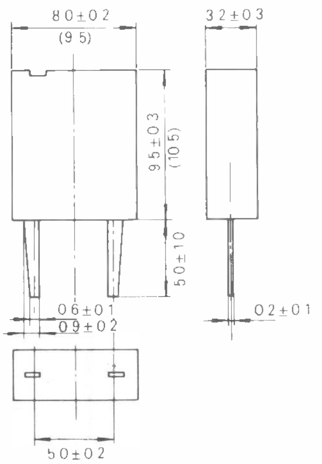
Band Width Rank	3dB Band Width (KHz) min.	6dB Band Width (KHz) min.	Attenuation Band Width (KHz) max.	Insertion Loss (dB) max.			In. Output Impedance (KΩ)			
				CFS	CFM	CFK, CFL CFX, CFG	CFS	CFM	CFK	CFL CFX, CFG
A	±13	±17.5	±30	4	3	—	1.5	1	—	—
B	±10	±15	±25	4	3	4	1.5	1	1	1
C	±9	±13	±23	4	3	4	1.5	1	1	1
D	±7	±10	±20	4	3	4	1.5	1.5	1.5	1.5
E	±5.5	±8	±16	6	5	6	1.5	1.5	1.5	1.5
E10	±5.0	±7.5	±12.5	—	—	6	—	—	1.5	1.5
F	±4.2	±6	±12	6	6	6	2	2	2	1.5
G	—	±4	±10	6	6	6	2	2	2	1.5
H	—	±3	±7.5	7	6	7 (CFG: 6)	2	2	2	1.5
I	—	±2	±5	8	7	8	2	2	2	2
J	—	±1.5	±4.5	8	—	8	2	—	2	2

CRM



These ceramic resonators are a low cost alternative to low frequency quartz crystals- and offer perfect solutions for clock circuits in MPU, DVM and remote controller systems.

The CFE series are intended for bypass and decoupling purposes - and as traps in antenna circuits.



CRM (parallel resonant)
CFE (series resonant)

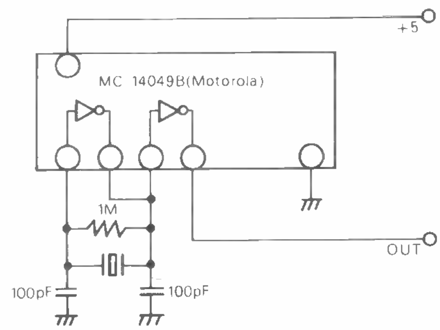
dimension in mm

Examples of Characteristics

Stock No.	CRM-400A	CRM-455A	CRM-600A
Osc. Frequency	400kHz	455kHz	600kHz
Tolerance	±2kHz	±2kHz	±2kHz
Resonant Resistance	20Ω, max.	20Ω, max.	20Ω, max.
Temp. Characteristic	±0.3%, max. (-20° to +80°C)		
Aging	±0.5%, max. (10yrs)		
Available F Range	380~455kHz	455~500kHz	500~600kHz

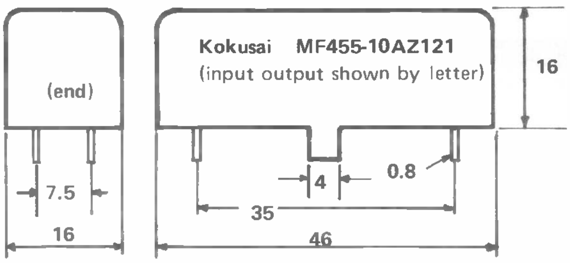
*** See price list for current stock types**

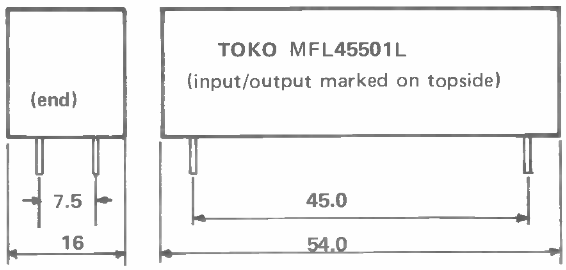
Oscillation Frequency Test Circuit

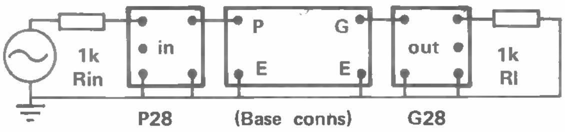


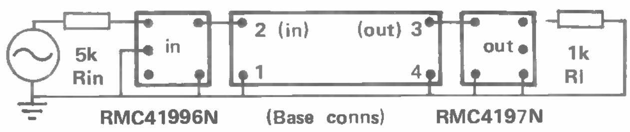
Mechanical filters for 455kHz (453.5kHz)

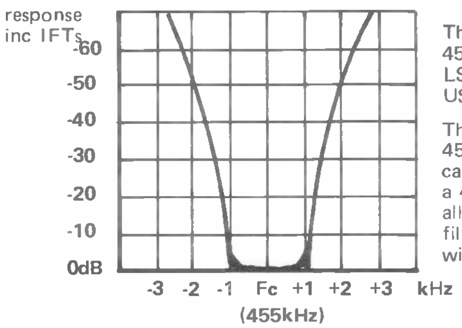
The Kokusai MF45510AZ121 and TOKO MFL45501L are intended to fulfill the need for a stable SSB filter in both receiver and transmitter applications. Despite recent advances, ceramic ladder filters cannot be manufacturerd to the same accuracy as these types which are individually calibrated and trimmed for optimum results. Apart from applications in original equipment, these filters are well suited to use in upgrading the responses of existing SSB communications receivers - notably the FRG7 and R1000 types, where the more tightly controlled response considerably enhances the reception of weak SSB in crowded spectrums. A filter switch unit - type 455F has been developed to enable a ceramic ladder filter/mechanical SSB filter to be DC switched for incorporation into RX applications. See page 72 of this catalogue for further details.





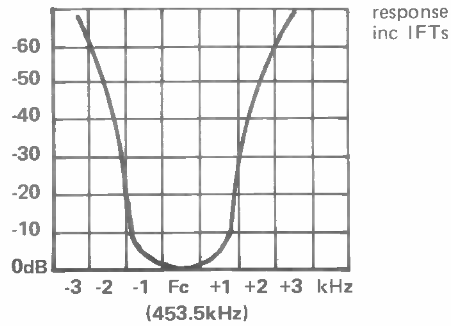






The Kokusai filter is designed for 455kHz centre frequency, enabling LSB with carrier at 453.5kHz, and USB with carrier at 456.5kHz.

The TOKO filter is centred on 453.5kHz - providind LSB with a carrier on 455kHz, and USB with a 452kHz. If used with a DFM, an allowance must be made with both filters on USB - although the MFL will read accurately on LSB.

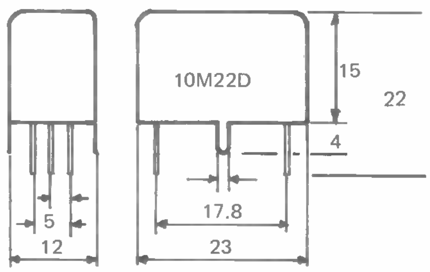


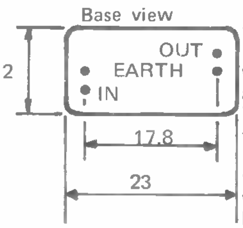
Typical specifications

Filter type	Input Z	Output Z	Zin IFT	Zout IFT	Insertion loss	6dB BW	60dB BW	Centre F	Typ. ripple	Accuracy (Hz)
MF45510AZ121			1k0	1k0	10dB	2kHz	4.3kHz	455kHz	0.9dB	300
MFL45501L	500E	500E	5k0	1k0	10dB	2.1kHz	5.1kHz	453.5kHz	1dB	300

10.7MHz 8-pole SSB crystal filter :NDK 10M22D

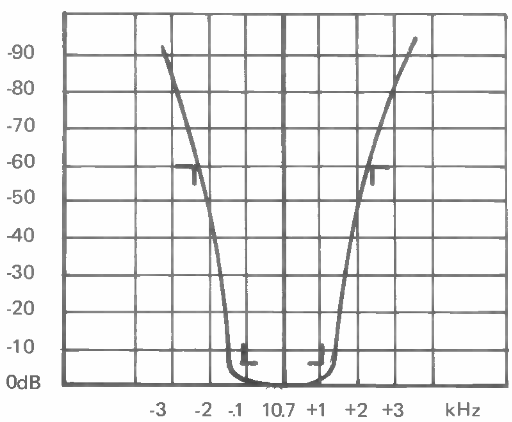
A low cost alternative to 9MHz SSB filters

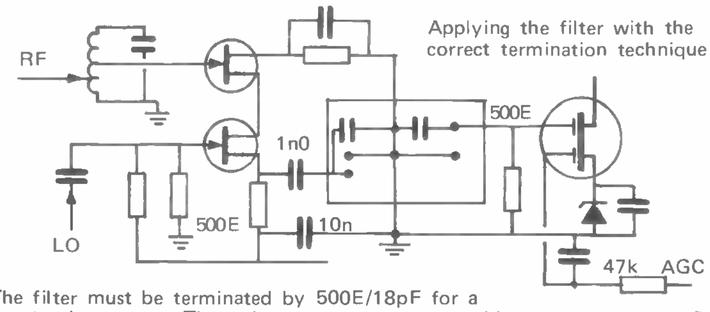




GENERAL: Why 10.7MHz SSB filters ??

First and foremost, they are far cheaper to make than LF SSB filters, thanks to the introduction of monolithic construction techniques. The crystals are not only smaller - but as there are a great many 'blanks' cut for 10.7MHz filters for VHF receivers - the volume of production is huge. Why 10.7 when most people have grown up with the idea of 9MHz as the 'standard' for this type of filter - well, why 9MHz ? The original SSB filters for 9MHz evolved because a VFO tuning 5.0-5.5MHz could be harmonically related to provide reception on both 80m and 20m - which seems like a pretty vague excuse. On the other hand, the availability of a DFM with 10.7MHz offset and 1kHz resolution looks like a far better reason to use 10.7MHz - plus the availability of other bandwidths at low cost for multimode applications, plus the ease of adding an SSB facility onto existing equipment etc.



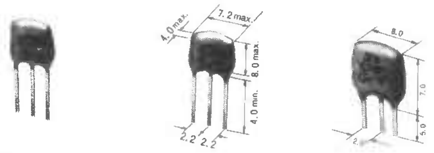


Applying the filter with the correct termination technique

The filter must be terminated by 500E/18pF for a copybook response. The unit includes internal matching transformers, so DC should not be applied to either terminal. The above cascode mixer provides an ideal match - and whilst transformer matching is possible, great care must be taken to provide the right conditions to take advantage of the superbly smooth bandpass characteristics of this filter. See the 91600 module for a more detailed application in an SSB transceiver design.

Specifications	Centre freq.	-6dB BW	-60dB BW	Insertion loss	Spurii	Match impedance	Temp. range
10M22D	10.7MHz	2.2kHz min	2.4kHz max	typ.3.2dB	-80dB	500E/18pF	–20° to +70°C

27MHz RF filter/ 50kHz BW 10.7MHz ceramic filter



Low cost alternative to Xtal monolithic duals.

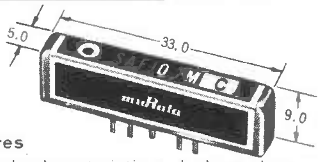
(Unit: mm)

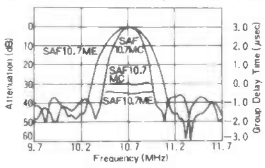
Part Number \ Char.	3dB Band Width	20dB Band Width	Insertion Loss	Spurious Response (24~30MHz)	In. Output Impedance
SFE27MA	27.185MHz ±315KHz min.	2.3MHz max.	6dB max.	25dB	270Ω

Part No. \ Char.	Center Frequency	3dB Band Width	Selectivity	Peak Separation	Applications
SFA10.7MF5	10.7MHz±30KHz	55±20KHz	f_o±100KHz (30dB)	———	IF Signal Detection

SURFACE ACOUSTIC WAVE FILTER FOR FM

FM Tuner SAF Filter 10.7MHz





■ Features

1. Amplitude characteristic and phase characteristic can be designed individually.
2. Excellent group delay time characteristic.
3. Less susceptible to external impedance change by virtue of being non-resonant type.

(Unit: mm) ● Temp. Range: −20~+80°C

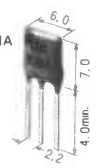
Part Number	SAF10.7MC-Z
Center Frequency	10.70MHz±30KHz (Red) 10.67MHz±30KHz (Blue) 10.73MHz±30KHz (Orange) 10.64MHz±30KHz (Black) 10.76MHz±30KHz (White)
3dB Band Width	190KHz±30KHz
20dB Band Width	500KHz max.
Insertion Loss	22dB max.
Spurious Response	33dB min.
G.D.T 0.5μs·Band Width	300KHz min.
Temp. Coeff.	−40±30ppm/°C

At last we bow to demands for an SAW for FM IFs. See the 911225S for an FM IF system using this filter.

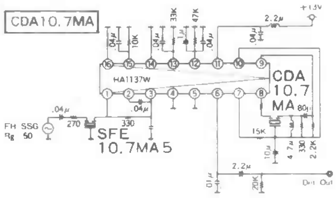
CERAMIC DISCRIMINATOR FOR FM

FM Detector Ceramic Discriminator 10.7MHz

CDA10.7MA



• 30%Dev. Typ.
• Adaptable to ICs of other manufacturs



Part Number \ Char.	Recovered Audio Volt. (mV)	Distortion Factor (%)	Recovered Audio 3dB Band Width (KHz)	Detection System
CDA 10.7MA	80	0.1	350	Quadrature

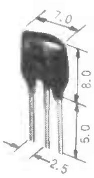
If you don't have the equipment to ensure the correct alignment of a double tuned quadrature coil - then this ceramic alternative provides a direct solution for a no-twiddle, low distortion FM detector stage. Also use for the TDA1090/ULN2242 series devices.

CERAMIC FILTER FOR FM

FM IF Tuner Ceramic Filter 10.7MHz

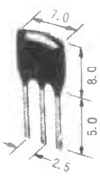
MX series

MX



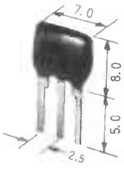
ML series

ML



MA series

MA8



(Unit: mm)

Notes

Ceramic filters for FM IFs have been steadily improved over the past few years, and now offer performance that nearly equals the coil block linear phase filter in many applications. A greatly detailed description of the filter construction and general application technique is given in part 2 of this catalogue series - but this section includes those types which are most suited to stereo receiver IFs.

The TOKO CFSE10.7 will be supplied as a direct alternative to the MA series.

As with most linear phase techniques - the better the phase response, the worse the insertion losses (the reduced 'Q' of the filter elements). Another point to bear in mind with ceramic linear phase filters is the level of out-of-band responses, which make it desirable to preceed such stages with a double tuned IFT - such as the type used at the output of many FM tunerheads.

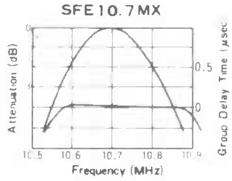
The Stock Range appears in the current price list, where you will see we have tended to use types that are most suited to the FM broadcast conditions prevailing in the UK - which are less crowded than the USA or parts of Europe. However, the best solution is to use the widest type available - and switch in a narrower type if conditions require. (see the 911225).

10.7 centre frequency types are supplied as standard for the ML and MX series - other types according to availability, or 10.7MHz with a surcharge of 20%.

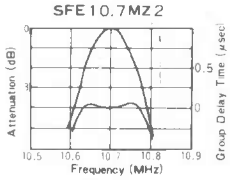
Part Number \ Char.	3dB Band Width (KHz)	20dB Band Width (KHz) max.	Insertion Loss (dB) max.	Spurious (8~12MHz) (dB) min.	G.D.T Band Width (KHz) min.
SFE10.7MX	250±40	670 (620)	12 (10)	25 (33)	0.2μsec. max within fo±110
SFE10.7MX2	220±40	610 (560)	12.5 (10.5)	30 (37)	0.15μsec. max within fo±80
SFE10.7MZ1	180±30	530 (460)	14 (12.3)	33 (38)	0.15μsec. max within fo±60
SFE10.7MZ2	150±30	500 (420)	14 (12.6)	35 (41)	0.15μsec. max. within fo±50
SFE10.7ML	280±50	650 (610)	9 (7)	25 (33)	0.25μsec. f_o± 70 (±105)
SFE10.7MP3	250±50	650 (550)	10 (8)	30 (35)	0.25μsec. f_o±65 (±90)
SFE10.7MM	230±50	600 (510)	11 (9)	30 (38)	0.25μsec. f_o±60 (±85)
SFE10.7MA8	280±50	650 (520)	6 (4)	30 (43)	0.5μsec. f_o±80 (±100)
SFE10.7MS2G	230±50	600 (420)	7 (4.5)	40 (45)	0.5μsec. f_o±60 (±75)
SFE10.7MS3G	180±40	520 (380)	9 (5)	40 (45)	0.5μsec. f_o±45 (±60)

● In. Output Impedance 330Ω ( ): Typ. value

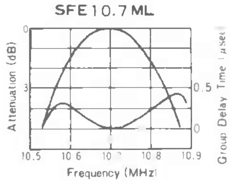
SFE10.7MX



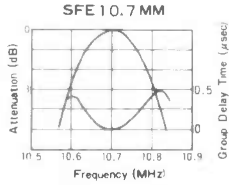
SFE10.7MZ2



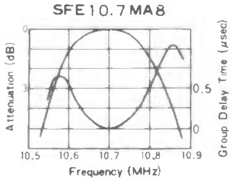
SFE10.7ML



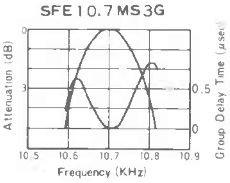
SFE10.7MM



SFE10.7MA8



SFE10.7MS3G



NOTE for FM

• The standard ranks of the center frequency are 10.64±0.03MHz(black) 10.67±0.03MHz(blue), 10.70MHz±0.03MHz(red), 10.73±0.03MHz (orange) and 10.76±0.03MHz(white). Ranks of 25KHz for steps between ranks are available for digital synthesizer. For stereo tuners steps of 20KHz between ranks are available.
• The GDT waveform is checked in all stereo tuner devices.
• Different varieties may be combined(in kit) according to the specifications of the set.
• The best frequency characteristics is obtained with an input/output matching impedance of 330Ω. The less the load capacitance of input and output, the better the frequency characteristics.
• Temperature characteristics of fo is ±50ppm/°C or less at −20°C to +80°C for all types.

The continuing story of the CA3089 and its ilk............

There can be very few electronics engineers/enthusiasts who have not yet heard of the CA3089E FM IF system. When it first appeared some 7 years ago from RCA, it was one of the most complex linear/RF ICs available, and it quickly established a huge market amongst manufacturers of all types of FM broadcast and communications radio. Early examples had one or problems - like the S/N was bad, since an internal zener diode could not be directly decoupled, the muting level was variable, and too heavily dependant on the noise level from the preceding stages. And, as some of you who have tried the device in early days will have discovered, the original CA3089 families were notoriously prone to all sorts of instability and oscillation.

Much of the trouble could be traced to the naive state of the art of designing around IC RF systems - especially those where the gain was as high as the CA3089E. The progressive discrete IF amplifier design tends to solve its own layout problems - and individual stages can be doctored quite readily - in the context of a monlithic IC, everything tends to be interactive - especially since the power supply line is common to both the input and output. Active decoupling of the biasing helps, but always tends to be at best precarious, and very concious of the nature of the earth routing. If you think high gain audio stages tend to be touchy, just imagine what scope exists at 10.7MHz, where the spectrum analyzer is is the only really satisfactory means of diagnosis.

After the initial experiences of the CA3089, a few remasked versions were offered - and then the battle was joined in a big way with the introduction of Hitachi's HA1137W - which offered improvements in all departments - but most specifically in the area of improved muting with both improved noise mute, and the introduction of deviation muting, where the actual muting bandwidth was programmed by the use of resistor between the AFC output and AFC reference.

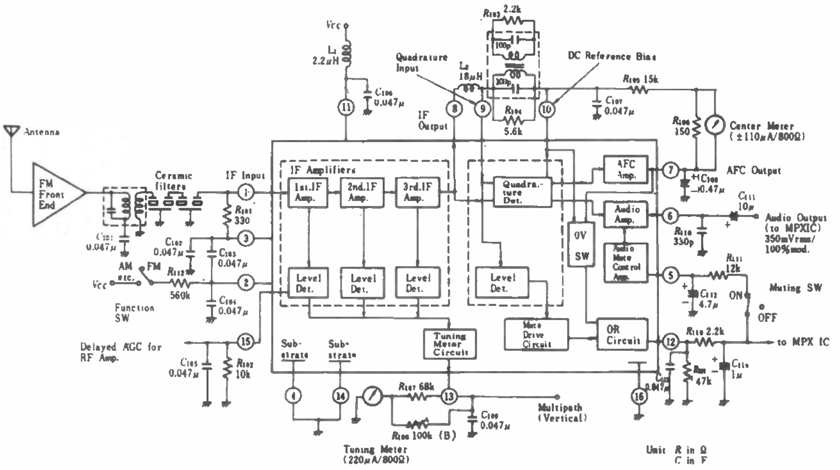
The HA1137W was then joined with several others, notably TOKO's KB4420 - which was a pin-for-pin replacement. However, since one of the prime areas of application for such a device was in car radio - the supply voltage limitation of 12v minimum caused a new version of the HA1137 and KB4420 to be provided to operate from an 8 volt supply rail: the HA12411 and KB4420B. Since it works over the range 7-16v, it is fully compatible with previous types - and if you still have equipment employing the CA3089, then it is a direct swap that will give you improved S/N, far better muting and improved distortion. The only change that may be required is in selecting the correct value of resistor in the path from pin 7 to 10, to determine the width of the deviation muting 'window'.

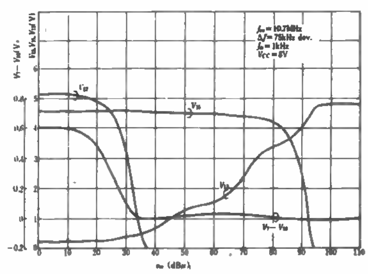
Applications, apart from FM radio, include deviation meters, phase detection, log RF amplifiers (using the meter output to provide a reference level over some 70dB input range). The meter output can also be used to provide a 'useful' AM monitoring point, provided the AGC can be set to hold the output below saturation.

Like all 3089 devices, they work down to LF inputs, although the size of the internal capacitors coupling such functions as the meter and mute level detectors are not usable below 6MHz.

With the exception of the programmable AF output level, and the presetable AGC, the device will substitute the CA3189E - and the discussion of the selection of the correct quadrature components for the CA3189E is fully applicable to these devices (as to any others, such as the HA11225, HA12412 etc).

As a passing thought - there is little enough innovation in UK amateur FM these days, but the deviation muting system available in these devices could be incorporated into a system that 'sidestepped' before switching off carrier - thereby operating the very fast deviation mute and avoiding the usual crash that breaks up a simplex communication link between 'overs'. Only a few kHz shift would be necessary.

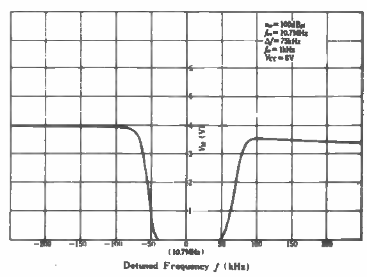




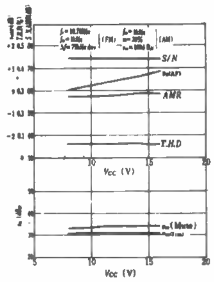
● **AC CHARACTERISTICS** ($Ta=25°C$, $V_{CC}=8V$, $f_C=10.7MHz$, $f_m=1kHz$, $\Delta f=75kHz$ dev.)

Item	Symbol	Test Conditions	min.	typ.	max.	Unit
Operating Current	I_{CC}	$V_{in}=100dB\mu$, Mute ON	—	32	39	mA
Limiting Sensitivity	$V_{in}(lim)$	at −3dB	—	31	37	dBμ
Recovered Output	$V_O(AF)$	$V_{in}=100dB\mu$	230	300	390	mVrms
Total Harmonic Distortion	$T.H.D$	$V_{in}=100dB\mu$	—	0.06	0.3	%
Signal-to-Noise Ratio	S/N	$V_{in}=100dB\mu$	67	75	—	dB
AM Rejection	AMR	$V_{in}=100dB\mu$, $f_m(AM)=1kHz$, 30% mod.	45	55	—	dB
Muting Attenuation	Mute(ATT)	$V_{in}=100dB\mu$, $V_5=2V$	68	75	—	dB
Muting Band Width	BW(Mute)	Detuned frepuency under 1.4V of Pin=12 voltage, $V_{in}=100dB\mu$	—	100	—	kHz
Muting Sensitivity	V_{in}(Mute)	V_{in} under 1.4V of Pin-12 voltage	—	35	—	dBμ
Analogue Control Voltage	V_{13-0}	Pin-13 voltage under $V_{in}=0dB\mu$	—	0.2	—	V
	V_{13-60}	Pin-13 voltage under $V_{in}=60dB\mu$	—	1.65	—	V
	V_{13-100}	Pin-13 voltage under $V_{in}=100dB\mu$	—	4.7	—	V
AGC Control Voltage	V_{15}	Pin-15 voltage under $V_{in}=86dB\mu$	—	3.7	—	V

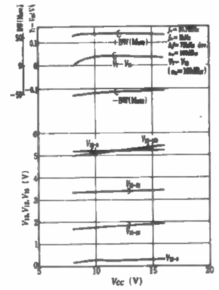
V_{12} VS. DETUNED FREQUENCY



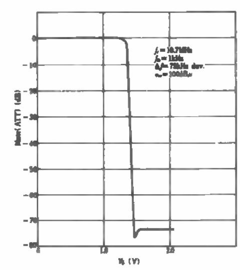
S/N, V_O(AF), AMR, T.H.D, V_{in}(lim), V_{in}(Mute) VS. V_{CC}



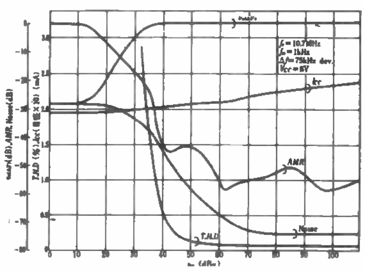
(V_7-V_{10}), V_{12-100}, V_{12-0}, V_{15-80}, V_{13-70}, V_{13-54}, V_{13-0} VS. V_{CC}



Mute(ATT), T.H.D VS. V_5 VOLTAGE



T.H.D, NOISE, V_{out}, I_{CC}, AMR VS. V_{in}



AM Radio - the state of the art in 1980

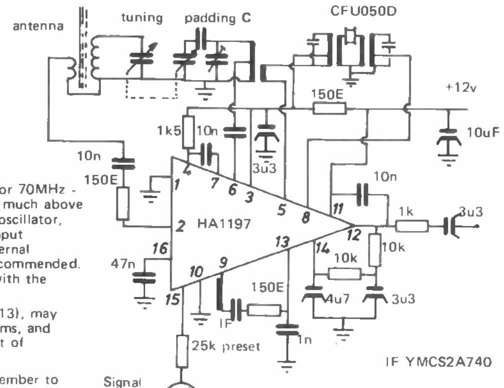
In accordance with the general policy of this issue to update and revise the contents of the original Part One, the shrinking of the AM radio section reflects the fact that devices listed here (bar the HA1197) should not be considered for any new design work. The best devices to choose are the TDA1220, TDA1090, TBA1083 - or the HA1197 where switching the oscillator in multiband operation is not required.
From the standpoint of absolute quality and S/N, the HA1197 is still about the best choice, although oscillator switching, overload and versatility of supply voltage favours the TDA1220 and the TDA1083. In fact, the price of the IC compared to the price of the problems that are associated with bandswitching makes the designer begin to wonder if it is not now a far more elegant and cheaper solution to produce a complete AM tuner for each band in question - thereby providing optimized performance with no need to compromise. This very appealing concept is certainly applicable to the types of application likely to be sought for high performance broadcast reception - since the IF bandwidth can also be tailored to suit the channeling of the band in question - eg 9kHz for MW/LW, and 5kHz for SW. All the switching is easily accomplished using DC, and no high impedance RF paths need ever get near each other. For any industrial/commercial users, the high cost of UK labour easily outweighs the cost of the components in an electronic product - so why not save time and trouble - and money using this approach ?? The TDA1090 multifunction broadcast tuner IC is available from AMBIT in the 92242 with a very versatile selection of frequency and mode coverage for 'standard' broadcast applications - so for 'special' purposes an IC per band is a good solution.
At the risk of repeating ourselves, these ICs, like many other radio devices, lend themselves to a number of other applications in both radio and general electronic applications, since they may be considered high gain linear/agc AC amplifier blocks. You don't have to the oscillator - the HA1197 makes an excellent agc IF stage for example. And the availability of high level IF output ffrom the CA3123E, combined with the programability of the AGC make this device applicable to wide range of multimode applications. Being DC coupled devices, the lower frequency limit is not a problem in most configurations - and the HF limit is limited largely by the stability of the layout, and the local oscillator. All these devices will perform to 30MHz with a suitable external circuit.

The HA1197

AM radio design has been more static than FM design over the past few years. Early attempts at combining all AM functions into one IC were distinctly unfavourable - the TAD100 and TAD110 were notoriously difficult to work with. Even the more popular de vice from SGS, the TBA651, is not recommended for the beginner, since layout and stability considerations require much patient experiment to optimize. But moreover, most AM ICs offer little advantge over a discrete circuit, using three or four transistors.
The HA1197 is the first significant advance in AM radio design, since the exceptional AGC and low THD are not readily duplicated in discrete form. The IC also feeds a signal level meter, which provides a really useful reading when checking relative signal strengths. Despite the internal detector, it is possible to use the device with an IF output, by simply omitting the RF decoupling capacitor at the audio output stage. (C107 at pin 12). This point must be well located away from the IF inputs, since the high level of IF signal can readily cause feedback instability - always feed this IF into a low impedance to keep the RF voltage low. The IF signal is rectified at pin 12, but a single IFT will regenerate a full IF signal for NBFM/SSB demodulation in a subsequent stage.

Typical dynamic characteristics

Current consumption	Vcc12v	15mA
Signal to noise ratio	74dBu in	53dB
	34dBu ..	33.5dB
THD	74dBu 90%mod	0.8%
	100dBu 30%mod	0.4%
AGC range	10dB AF shift	75d8
Output voltage	74dBu in	250mV
Meter current	100dBu in	240uA
All modulation levels taken as 30%, except where stated		



This circuit represents one of many possible applications, and is not intended as indicating compulsory component values or configurations.
(With a 156uH osc coil, use 270pF padding)

The HA1197 will work with its internal oscillator up to 60 or 70MHz - but it is not recommended to employ the internal oscillator much above 14MHz, if best stability is to be obtained. With an external oscillator, applications at 50MHz have worked very well, offering an input sensitivity of 4-10uV to the IC pin 2. When injecting an external oscillator, a level of some 250mV p-p injected at pin 6 is recommended. Alternatively, a higher level oscillation injected into pin 7, with the RF stage coupled into pin 6, instead of pin 7.

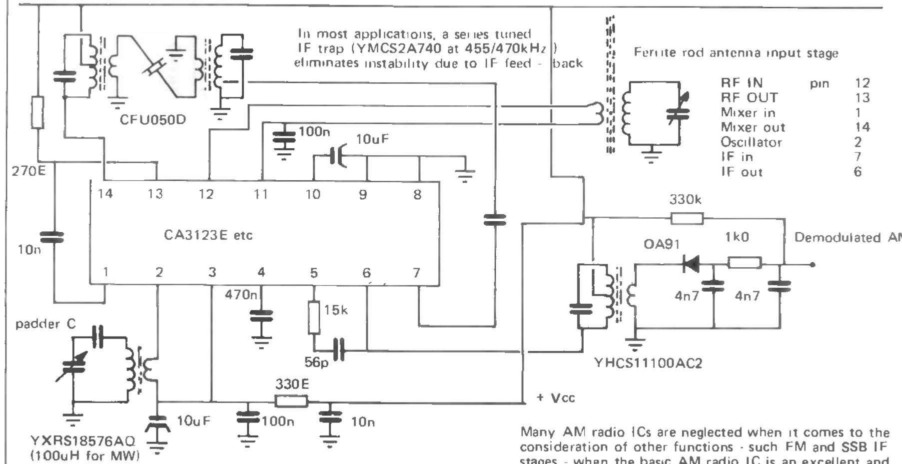
The resistor in series with the IF admitter circuit (pins 9 & 13), may be reduced progressively - or replaced by a preset of 500 ohms, and this will bring up the level of IF gain - probably to the point of instability. This is not a suitable point for a panel control.

All types of TOKO filters are suitable for the IF stages, remember to precede ceramic filters with an LC stage. The IF stages will operate at up to 10.7MHz with no apparent loss of performance, but the layout requirements become far more stringent when working at these frequencies. We are always pleased to hear about customer's applications , and will be printing such circuits in subsequent issues - so if you have an interesting application, please write and advise us.

Ambit Data: HA1197 5 pages

The Ca3123E/uA720/LM1820

Although primarily intended for applications as AM systems, this family is well suited to a variety of RF/IF gain applications, that include multifunction (AM/NBFM/SSB) operation in the region 0 1 to 30MHz (RF section) and up to 2MHz in the IF stages.



	pin
RF IN	12
RF OUT	13
Mixer in	1
Mixer out	14
Oscillator	2
IF in	7
IF out	6

Specifications

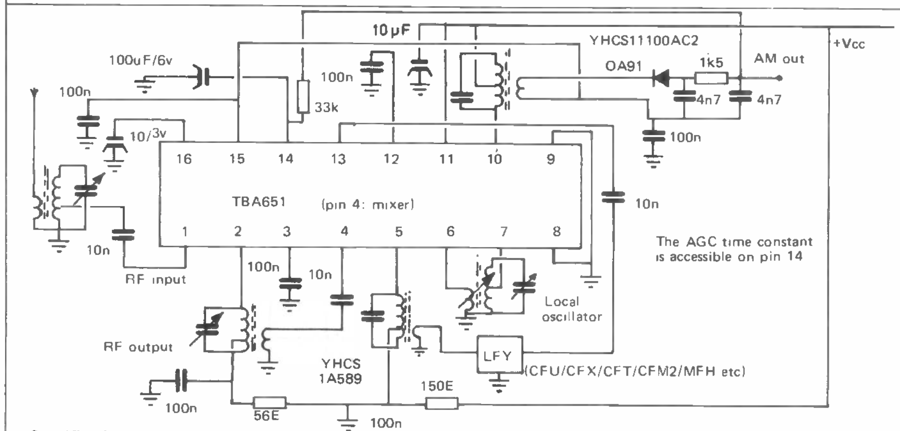
Operating voltage range		V	7 to 16
Supply current		mA	14 to 22
RF section input R/C	(pin 12)		1k/80pF
Mixer input R/C	(pin 1)		1k4/8pF
IF input R/C	(pin 7)		1k0/70pF
Transconductance	of RF	mho	120m
	of mixer	mho	2.5m
	of IF	mho	90m

Gain of a stage = $\frac{V_{out}}{V_{in}} = K_1\ gm\ R_L\ N\ K_2$

where gm is the transconductance, and K_1 & K_2 are the 6dB matching losses for output/input impedances. N = $Z_{secondary}/Z_{primary}$

Many AM radio ICs are neglected when it comes to the consideration of other functions - such FM and SSB IF stages - when the basic AM radio IC is an excellent and well defined solution. Instead of using the peak detector diode - simply use the amplified IF at this point to drive into the relevant detector system.
This IC has a well designed bandwidth, with the RF and IF responses tailored their specific functions - not provided with a pointlessly wide frequency response that would only lead to uncontrolable instability in the long run.
Under optimum matching conditions, 125dB of gain is possible, though in practical applications, this gain is reduced to avoid feedback instability problems. Full device data includes all the necessary design parameters for applications calculated from basic principles.

Ambit Data: CA3132 9 pages



Specifications

Operating voltage range		V	6 to 18v
Supply current	(12v supply)	mA	11.5
Input conductance	of RF	mΩ	0.7
	Mixer		0.4
	IF		0.25
AF voltage (80% mod)		mV	500
S/N ratio for 10uV input		dB	26
Input range for 10dB AF change		dB	80

The IF output of both the TBA651, and the CA3213E is an open collector of the mixer stage All types of filters may be used, but always drive the IF into an LC tuned circuit first, with secondary impedance to suit the chosen type of filter.

Like the CA3123E, the TBA651 is more than just an AM radio IC - but unlike the CA3123E, the TBA651 is wideband throughout, and thus requires very careful layout to acheive stable performance. The RF output stage tuned circuit at pin 2 should kept to a low Q of about 40 - which may require an additional damping resistor across the tuned circuit.

The internal oscillator of the TBA651 is not suitable for HF work, so an external oscillator should be injected into pin 7. Pin 7 should be taken to ground via a 1k resistor, and pin 8 via 330 ohms, decoupled with 10nF. The internal oscillator is quite satisfactory up to frequencies of 4-5MHz, and requires a conventional oscillator coil - with either tapped primary, and secondary - or three separate winding format.

Ambit Data: TBA651 11 pages

The KB4423 noise blanker system

The term 'noise blanker' is subject to a large degree of misinterpretation - but in this context, the device is intended as an impulse noise 'remover' in FM radio applications - the prime function being to remove ignition and electric motor noise from car radios- although fixed receivers that suffer from these types of interferences will benefit as well. The device operates by separating the incoming signal into the audio (base) band - which in the case of multiplex stereo is 0-55kHz. The signal is fed via the input buffer/amp to pin 3 - and is then internally routed to the gating circuit where the actual 'blanking. occurs.

The second filter separates the high frequencies (containing the noise edges) to be processed and detected. The processing includes an AGC system that isolates impulse spikes - which then trigger a monostable that opens the blanking gate for a period that is programmed by the time constants on pin 11. Although the duration of the gate pulse is very brief - an ungated feed of the 19kHz may be taken to the stereo decoder to provide continuity of the PLL during blanking periods. In most cases examined, this facility does not appear to provide any discernible benefit - although if the blanking period were to be stretched, than it would play a more significant part in the operation.

By placing this circuit between the FM detector and the decoder input, the KB4423 also performs the function of 55kHz LPF - but such are the phase shifts involved in this type of active filter, that the phase relationship between the 19kHz sub carrier and the 38kHz DSB (S) signal become misaligned, leading to loss of separation at higher frequencies. The separation drops to typically 20dB at 10kHz - and whilst this is an acceptable sacrifice to lose the more noticeable noise spikes, it means that the unit should be completely bypassed when used in HiFi applications where it may be only occasionally required. The TDA1028/9 DC audio switches can be used to provide remote switching facilities.

An indication of the operation of this circuit may be provided by monitoring pin 11 to detect the presence of blanking pulses. The module includes an LED facility for this purpose.

Other uses

The KB4423 may also be considered as a function block for adaptation to other forms of signal processing. The most frequently raised question concerns disc noise removal - but it is very important to stress that this applications requires the lowering of the base band cutoff point - since little noise will be detectable above 55kHz, unless you have a unique pickup cartridge.

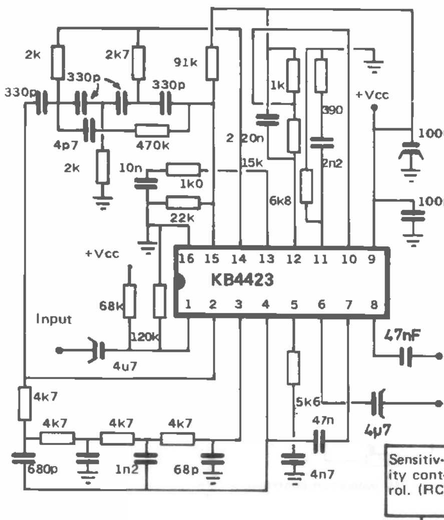
As a starting point, the values in the filters should be doubled - but the best type of solution for click removal is to use a delay line for the base band path, about 10uS is a useful start, but a 'bucket brigade' type of device would enable a more versatile positioning of the blanking pulse exactly where the noise spike occurs. And, of course, the width of the blanking pulse must be stretched - and the only really satisfactory means of getting this right is to observe the effects of noise on an oscilloscope, and set the blanking width accordingly. Alternatively, the 'R' of the RC constant at pin 11 could be made variable.

Ideally, the actual noise spike should be measured by timing between the rising and falling edges - then set the blank pulse width automatically. But using this approach could lead to some pressings being totally silenced from the moment the needle lands until the end. ....

Although yet to be verified by us, there have been suggestions that the wide band width of this device enables blanking to be used at IF frequencies, using L/C filters. Although this idea is appealing, it is questionable if the gate circuit would provide adequate isolation - although the processing of the noise spike and derivation of the control signal could be used for a more usual form of diode noise gate. Moving up to these frequencies will highlight the need for supply line decoupling and isolation, since there is every chance that the monostable itself will contribute more to the noise of the system than it removes. A 1mH choke in the supply, and isolating pin 9 from pins 14 and 12 with either R/C or L/C decoupling will save having to retrace these steps at a later stage of refienement.

A final point on the question of disc noise - since the RIAA equalizer would seem to provide an excellent low pass filter, it may be better to try and pick the noise off before the RIAA preamp stage has got hold of it-by entering the HPF from the output of the catridge. Any novel applications of this device would be gratefully received- and if you have a sufficiently well thought out circuit, then why not apply for a free IC under our ideas sponsorship scheme ??

Ambit Data: KB4423 10 pages



Specifications

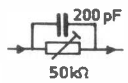
Parameter	min	typ	max	unit
Supply voltage	8	12	18	V
Power dissipation at 25°C			540	mW
Storage temp range	-55	20	125	°C
Operating temp range	-20	20	+70	°C
Current consumption			25	mA
Voltage gain	-1	0	+1	dB
Maximum output voltage K1%	1.5			V rms
Distortion (THD) at 0.5v rms out			0.1%	(K)
Gate time, pulse 100mV/1uS@1kHz		25		uSec
Noise input sensitivity	60			mV
Input impedance		30		kΩ

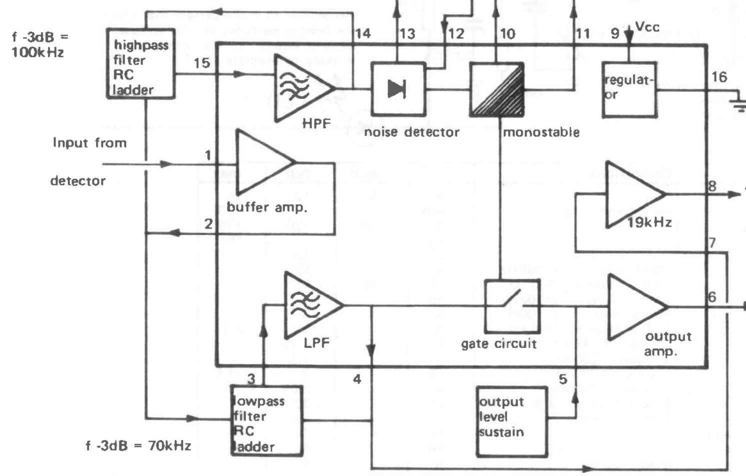
Special notes: The operational temperature range is specifically characterised outside usual commercial limits for operation in car radio enviroments.

Certain of these stated parameters are determined by the external components chosen - and are thus "programmable"

19kHz output to pin 11 of MC1310 series, pin 13 of HA HA1196, pin 12 of HA11223 pin 13 of KB4424

Main channel audio output. Separation may be optimized by use of a phase correction circuit between the detector and the input to the KB4423 :

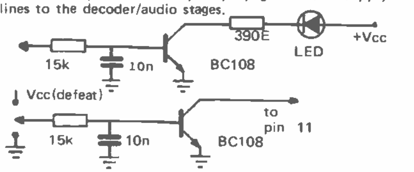




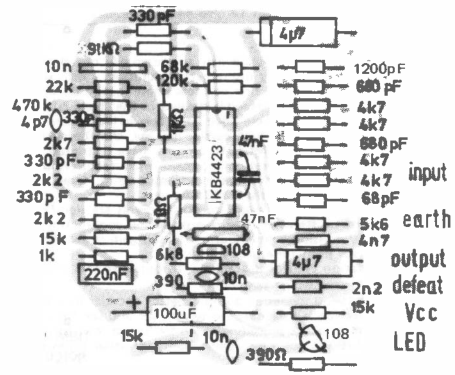
The 19kHz loop is not generally required due to the short period of the blanking pulse. In most instances it is therefore omitted leaving pin 8 oc

In the application board 11219B, two additional facilities are incorporated for defeating the gate operation, thus bypassing the blanking system, and for operating an LED lamp via the monostable pulse width control - thus providing a visual confirmation of the operation of the circuit.

Bearing in mind the rapid operation of the pulse and timing circuits, it is essential to decouple all power lines carefully, otherwise impulse noise may be propagated down supply lines to the decoder/audio stages.



With KB 4423, fit extra 47nF as shown, and see that defeat transistor collector is taken to pin 11.



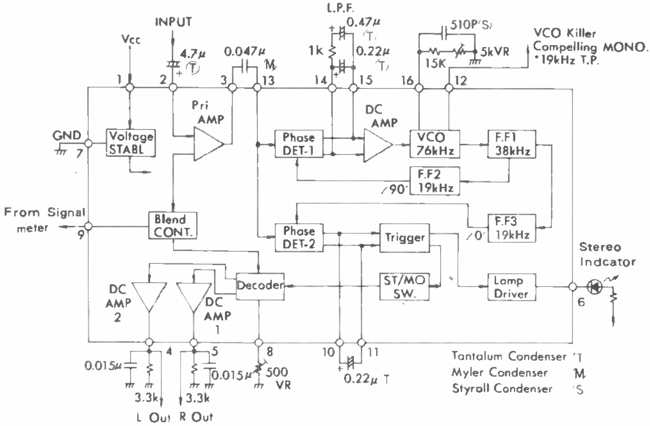
KB4448 : Sliding separation stereo decoder for fixed/auto FM stereo radio

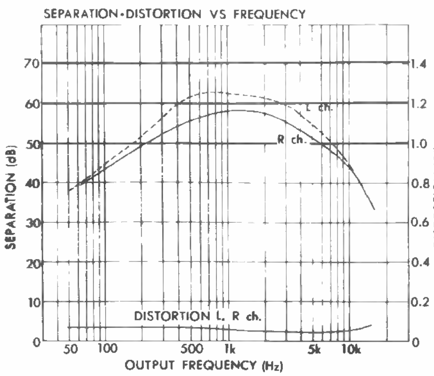
In applications where the signal level of a stereo FM transmission is prone to be variable - such as in car radio, or DX fixed reception, it is to be able to change the separation gradually - rather than switch from mono to stereo with the ensuing clicks and bursts of noise. The Motorola TCA4500 is an example of this art that has been published in Wireless World - but a lesser known and rather more satisfactory device is available from TOKO - the KB4448 - with improved distortion, phase error compensation and lower cost:

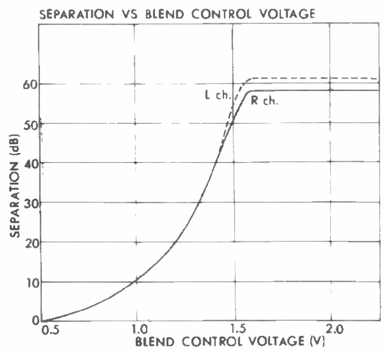
Specifications (typical performance at 8.5v Vcc - supply range 7-16v)

Current consumption	20mA	Capture range (30mV pilot)	3%
Output voltage (300mV in)	260mV rms	Blend voltage at 6dB sep.	0.9v
Channel balance-mono	0.5dB	Blend voltage at 20dB sep.	1.3v
Input Z	50k ohm	Min. sep. at pin 9=0v	1.5dB
Max input for 1% THD	1.3v rms	Blend control current	5uA
Mono THD at 1kHz	0.06%	Enforce mono /VCO kill	4.5v
Stereo THD at 1kHz	0.08%	SCA rejection	80dB
Separation at 1kHz	50dB	S/N ratio 300mV in	75dB
MPX beacon 'on' (19kHz)	9mV	Supply rejection ratio	30dB
Beacon off	7mV		
19/38kHz rejection	30dB		

System Block Diagram



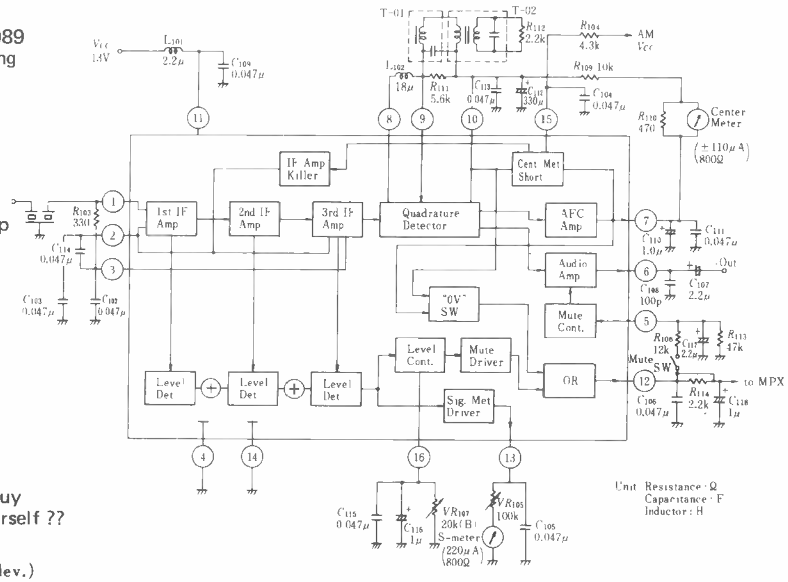




HA12412 .....the lowest noise, lowest THD FM IF amplifier/detector yet

This is yet another example of an improved CA3089/3189 device - the majority of the circuit is the same as the HA11225, excpet that no AGC pin is available - instead the meter voltage must be used (after inversion) - or a closed PIN diode loop agc frontend (EF5804/5402) should be used.

This version of the 3089 uses pin 15 for a tuning meter shorting system - since in AM/FM tuners the IF should not be turned off during AM or warm-up drift will occur when FM is reselected. At the same time the limiting IF amp is disabled to prevent wideband noise escaping into the AM input circuits. A fairly full set of specs are shown here - but as usual, plenty more info is available if you need. The difference between this and the HA11225 is marginal for the listener - but why not buy both, and judge for yourself ??



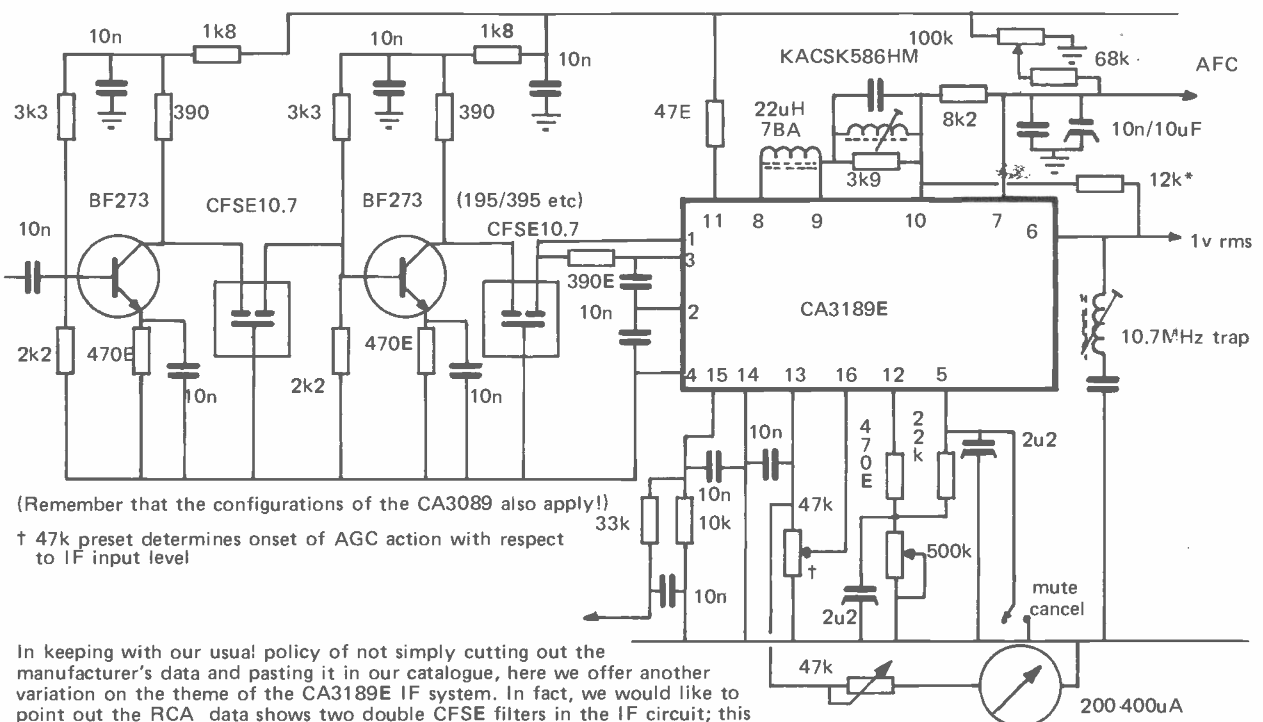
f_m=400Hz, f=75kHz dev.)

Item	Symbol	Test Conditions	min	typ	max	Unit
Operating Current	$I_{CC(MAX)}$	V_{in}=100dBμ; 2V supplied to pin-5; +150kHz-detuned	—	30.5	39.3	mA
Limiting Sensitivity	$V_{in(lim)}$	Input level lower by 3dB than ($V_{O(AF)}$ under 100dBμ of Input Voltage)	—	33.0	37.0	dBμ
Recovered AF Voltage	$V_{O(AF)}$	V_{in}=100dBμ	280	380	510	mV
Total Harmonic Distortion	THD	V_{in}=100dBμ	—	0.01	0.08	%
Signal-to-Noise Ratio	S/N	V_{in}=100dBμ	83	88	—	dB
AM Rejection	AMR	V_{in}=100dBμ, f_m=1kHz, Mod=30%	45	60	—	dB
Muting Attenuation	$M_{ute(ATT)}$	(Output Voltage under 100dBμ of V_{in} and with pin-5 open)=0dB, 2V fed to pin-5 via 12kΩ	83	100	—	dB
Muting Band Width	$BW_{(Mute)}$	the sum of plus- and minus-side Δfc's for V_{12}=1.4V, under 100dBμ of V_{in};	60	100	160	kHz
Muting Sensitivity	$V_{in(Mute)}$	without Muting-Level control; Pin-16 open; V_{12}=1.4V	36	43	60	dBμ
Muting-Sensitivity Control Range	$\Delta V_{in(Mute)}$	Max Input Level for Muting-Level Control	75	—	—	dBμ
Meter Driving Voltage (1)	V_{13-0}	V_{in}=0dBμ	—	0	—	V
Meter Driving Voltage (2)	V_{13-70}	V_{in}=70dBμ	0.9	1.60	—	V
Meter Driving Voltage (3)	V_{13-110}	V_{in}=110dBμ	4.5	5.5	—	V
Recovered AF Voltage Attenuation (for AM-band)	$V_{O(AF)}$	V_{in}=100dBμ; Pin-15 open; 13V supplied to pin-15 via 4.7kΩ	60	81	—	dB
Center-Meter Voltage (for AM-band)	$V_{CM(AM)}$	V_{in}=100dBμ; +150kHz-detuned; the voltage difference of pins 7 and 10, with 13V supplied to pin-15	-30	+7	+30	mV

The CA3189E

In spite of our efforts to persuade users of FM IF systems to adopt the alternative IF systems in all new designs, we cannot ignore the demands for the RCA version of this device - largely, it seems, because it was written about in Wireless World at some length - and anything that gets written in Wireless World "must be a Good Thing". Well, there are one or two facilities available with a 3189E that aren't available with the HA11225/KB4441/KB4420B etc - such as unreliable noise mute operation, offset centre zero readings and IF spraying out of the device in various places - but the programmable AGC and adjustable audio level are undeniably handy in some applications - albeit the programmable AGC can be duplicated from the meter output of any of the alternatives, using a single transistor inverter. We have used it for a long time in our modules as well - but only after a careful selection of the devices to avoid the above mentioned pitfalls. Well, if you must use it - here's some data we think you will find useful. In particular the discussion of quadrature design is applicable to all other members of family. Approx. 10 more RCA data sheets available.

Application at 10.7MHz



(Remember that the configurations of the CA3089 also apply!)

† 47k preset determines onset of AGC action with respect to IF input level

In keeping with our usual policy of not simply cutting out the manufacturer's data and pasting it in our catalogue, here we offer another variation on the theme of the CA3189E IF system. In fact, we would like to point out the RCA data shows two double CFSE filters in the IF circuit; this is neither necessary or desireable, since the IF bandwidth and characteristics will be narrowed too much for best stereo results.

The CA3189E offers two new features over and above those already offered on the HA1137W - namely a programmable AF output level, by virtue of the resistor placed between pins 6 and 10, and AGC with an adjustable mute threshold, set by the preset from pin 13 to earth. The first feature, combined with some other modifications to the basic CA3089E design, leads to a marginally improved S+N/N ratio of 72dB typ. (Though remember to check the measurement parameters - in this case 75kHz Δf) In a carefully designed application, this may be increased to some 79dB - and the greatly increased AF level may be used to help reduce the effects of noise/hum pickup in subsequent stages, by running those stages at lower gains.

As with the HA1137W, the deviation muting level is controlled by the resistor across pins 7 and 10. A value of 15k gives a muting bandwidth of some 80kHz, thus preventing the mute lifting when the station is off-tuned by more than 40kHz from the centre. However, pin 7 should be carefully decoupled to audio (it offers an AF signal, unaffected by mute operation) otherwise peak deviation is likely to have the disturbing effect of momentarily muting on sounds such a cymbal crashes etc. The operative function of the mute circuit is the voltage developed at pin 7, and since the function of current versus de-tuning is constant, changing the value of the resistor will amend the muting bandwidth - the larger the R, the narrower the mute bandwidth, and vice versa.

Distortion and muting action (noise mute) is largely determined by the tuned circuit and its associated feed choke - and since it is these two features that cause most misunderstanding, here is the derivation:

The mute is designed to operate with 150mV rms of IF signal across the quadrature coil - and since the output at pin 8 is 110mV rms at limiting, the function of the choke between pins 8 and 9 is to provide the necessary impedance.

So, the first calculation concerns the Q of the quadrature coil - as this function is independant of all other internal factors, and determines the detector bandwidth - which is chosen as 0.8MHz so that the portion of the 'S' curve used to demodulate the FM signal is as linear as possible. (The slope of the phase characteristics of a tuned circuit is primarily a function of Q).

Thus	*Fo*	=	*10.7MHz, and for the KACSK586HM, the unloaded Q, Qu, is 100.*					
and	*Q*	=	*Fo/Bandwidth*	=	*10.7/0.8*	=	*13.38*	
but	*Ql*	=	*R/XL, and so*	*R = Q.XL*		=	*13.38 . (2π. 10.7. 2.2)*	*(L of quad coil = 2.2uH)*

the total resistance across the quadrature coil is thus 1980 ohms.

To obtain the value of the coupling choke $XL = \frac{1980 \cdot 0.110}{0.15}$ *from* $XL = \frac{V \text{ at pin 8}}{\text{Current from pin 8......}}$

and current at pin 8 is the $\frac{V \text{ at pin 9}}{\text{resistance of quad coil}}$

so XL = 1453 ohms, which at 10,7MHz indicates an inductance of $\frac{XL}{\omega}$ *or 22uH.*

Now to find the Quad coil components, first find the parallel resistance of the unloaded coil = XL . Qu = 148.. 100 = 14.8k ohms the internal resistor at pin 8 of the CA3189E (and CA3089E) is 390 ohms, so a series to parallel conversion reveals:

$$\frac{(XL - choke)^2}{390} = \frac{1453^2}{390} = 5413\,\Omega$$

And so at last we have all the necessary information to determine the value of the added damping resistor, Rd :

total resistance across qud coil is 1980 ohms = Parallel R of unloaded coil // Parallel R at pin 8 // Rd (simple, eh?)

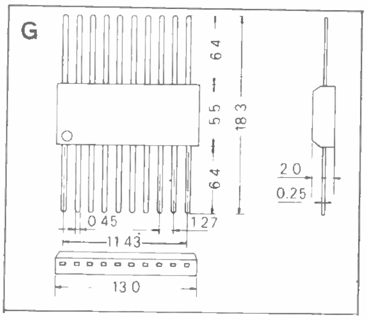
which is reduced to $Rd = \frac{1}{\frac{1}{1980} - \frac{1}{14800} - \frac{1}{5413}}$ *finally, therefore Rd = 3956.596175 ohms.*

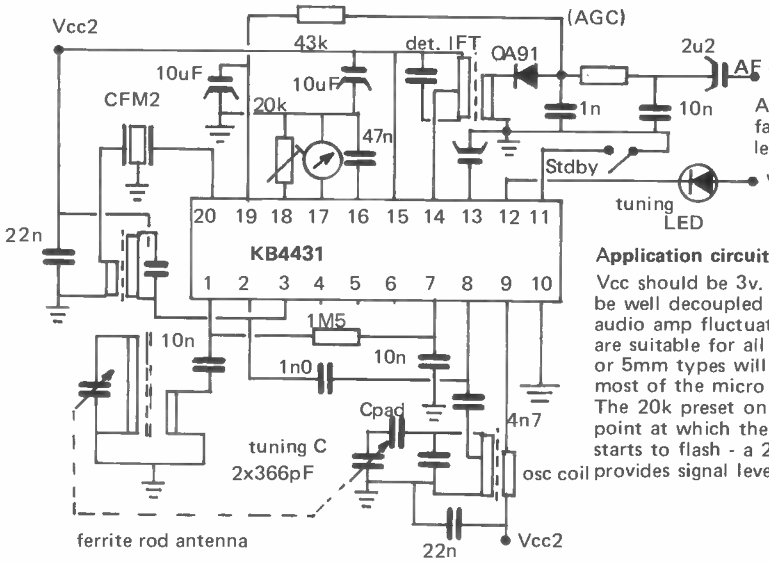
All done with Ohm's law and basic AC formulae !

Ultra miniature radio/audio ICs

The ICs described here are intended for applications in micro-thin radios, tape players etc. A particular feature of their application is the very low power supply voltage required - only 2-4v, enabling a pair of AA sized batteries to be used. Despite the diminutive dimensions, the devices contain as many features as their full scale counterparts, including LED tuning indicator drive, meter outputs, muting (KB4432) etc.

KB4431
AM RADIO SYSTEM





A current saving standby facility can be used by leaving pin 11 oc.

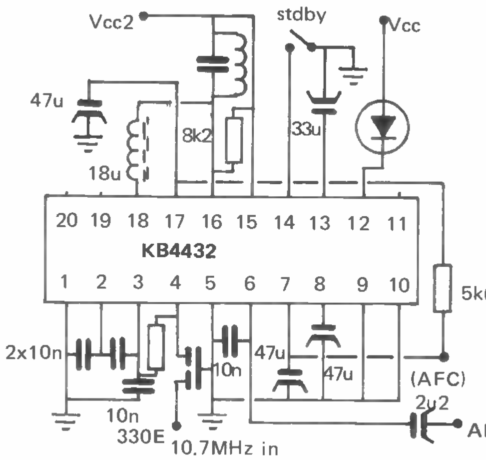
Application circuit: MW radio

Vcc should be 3v. Vcc2 also 3v but must be well decoupled from LED flashing and audio amp fluctuations. Standard coils are suitable for all applications - 7mm or 5mm types will obviously make the most of the micro size of the IC.

The 20k preset on pin 18 controls the point at which the LED tuning indicator starts to flash - a 200uA meter at pin 17 provides signal level indication.

KB4432: Micro FM ***Similar spec to CA3089E families, but designed for 3v supply (2 dry cells)**

KB4432
FM IF DET. SYSTEM



KB4432: Micro FM IF

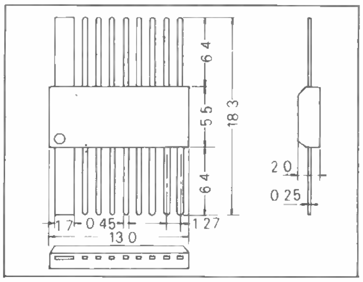
To all intents and purposes, the KB4432 offers the same performance and facilities as the KB4420 - except with 3v supply for operation of battery supplies.

A tuning LED is also provided with on-chip drive - although centre zero tuning is also possible in series with the AFC line.

The standby switch on pin 14 cuts current consumption from 26 to 13mA.

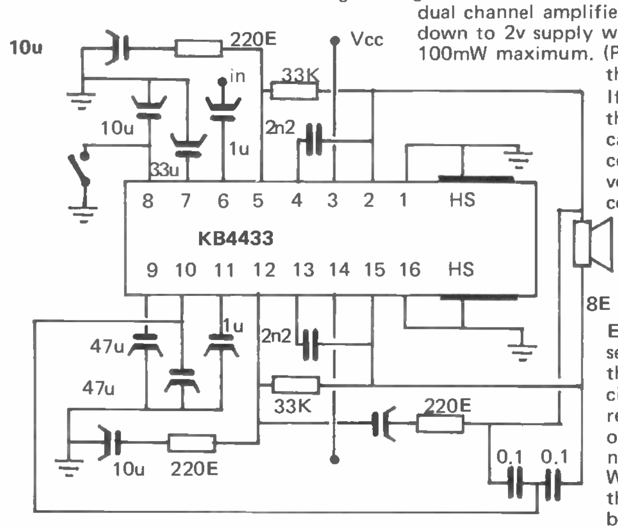
As with the KB4420, the device can be used at lower IFs, although internal funtions that are coupled by on-chip capacitors will not necessarily function correctly. Amplifiers/AFC etc are unaffected.

KB4433
140mW/4ohm POWER



KB4433: micropackage low voltage audio power amplifier: 250mW from a 3v supply

The KB4433 can be connected in bridge configuration (as shown here), or as a 2x 75mW dual channel amplifier. The amplifier is useable down to 2v supply when the output drops to 100mW maximum. (Pin 11 is the second of the inverting inputs.)



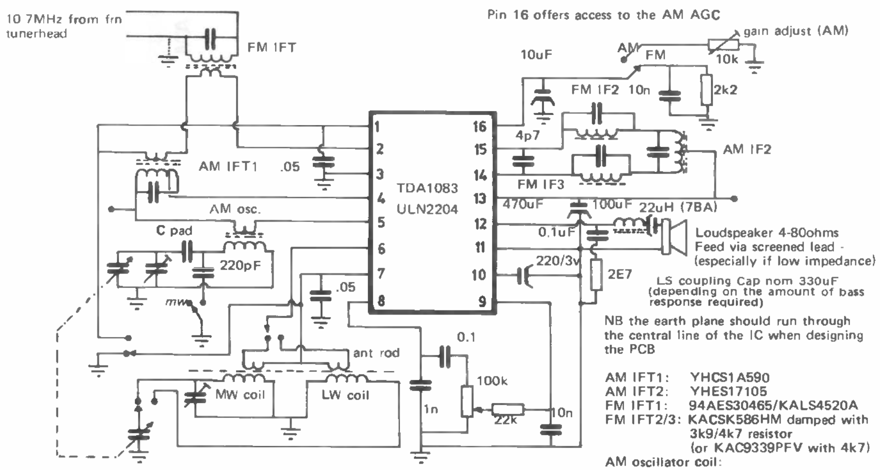
If used in conjunction with the KB4431 and KB4432, caution is required to make certain that the supply voltage is adequately de-coupled from audio peaks.

Each amplifier has a separate supply pin, and thus the consumption of the circuit may be halved if required, simply by connecting only half of the amplifier as necessary.

When used in dual channel mode the output shoul d be coupled by a 220uF capacitor.

AMBIT DATA SERVICE: 12 pages (includes all three types mentioned)

Typical circuit application



NB the earth plane should run through the central line of the IC when designing the PCB

AM IFT1: YHCS1A590
AM IFT2: YHES17105
FM IFT1: 94AES30465/KALS4520A
FM IFT2/3: KACSK586HM damped with 3k9/4k7 resistor (or KAC9339PFV with 4k7)
AM oscillator coil:
YXRS16726ZMS5 - padder C 270-300pF
YMRS80046 - padder C 270-300pF

Antenna for MW/LW: Ambit ET476/F14 18cms

Description:

Electrical specification

Characteristics	Test Conditions	Typical Spec	Comments
FM mode	f in:10.7MHz 75kHz dev. 400Hz modulation		
Input limiting threshold		40uV	2-3uV when combined with simple two transistor front end circuit
Output THD	10mV rms input	1.0%	
AM rejection	10mV rms input/30% AM	40dB	
AM mode	fin:1MHz, IF:455kHz, 30%/400Hz modulation		
Sensitivity	for max. volume	9.0uV	The high sensitivity permits use of a TOKO IF filter whilst maintaining good overall gain
Overload distortion	80% AM	10mV	
Useable sensitivity		20uV	
Audio amplifier	at 400Hz		
Gain		43dB	
Output power	Vcc 9.0v, 10% THD	800mW	Quiescent I 10mA am/ 12mA fm
	Vcc 6.0v, 10%	250mW	13mA am/ 16mA fm

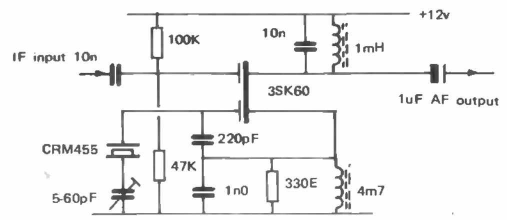
The TDA1083: Complete AM/FM/AF IC system

The TDA1083 marked the start of an era in multifunction radio IC systems. Namely those that were easy to work with, didn't actually employ just as many discrete components as a four transistor circuit, were not hopelessly prone to instability, and generally managed to exceed the performance levels set by good discrete designs. The basic reason being that the device employed the IC designers' craft to its full potential, and wasn't merely a translation of a transistor array in monolithic form.

This approach has incorporated a balanced mixer at the input to the AM stage, as much IF amplification as can practically be used, a superb AGC capability, and low level IF detection. It is the last feature that probably contributes as much to the simplicity of designing with this device, since AM detection with diode detectors requires a large amount of IF signal to be present close by the IC - with the consequent effect on stability when the input to the IF amplifier can get a whiff. This is not to say that it is impossible to persuade the TDA1083/HA12402 to 'take off' - but there isn't an RF amplifier yet that cannot be persuaded into oscillation through some means or another.

The AM oscillator requires only a single connection to the coil - which is a real boon when compared to techniques that employ multiple feedback windings on the oscillator coil. The oscillator stability is fine to about 15MHz for AM reception. Beyond that, the effects of the audio stage being fed from the same supply pin, coupled with the thermal effects of the audio power stage make the internal oscillator unsuitable for HF applications. Nevertheless, with an external VFO, the balanced mixer and IF stages can be used to good effect in a communications enviroment if required. In fact, the device is extremely versatile, and can be used like so many other linear ICs for applications no imagined by the designer - such as a mains FM intercom (at 100kHz), optical link receiver with IR etc. etc.

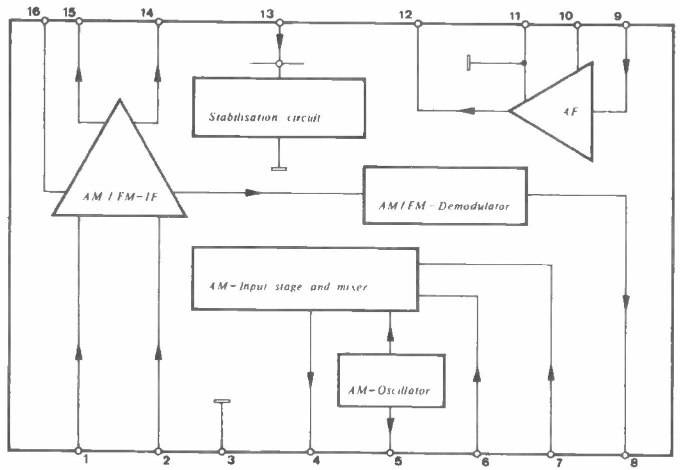
The FM section of the IC is "basic", but adequate for its intended purpose of a portable radio receiver stage with minimum power requirements. There is nothing stopping the IC being used for NBFM at 455kHz - using the correct coils of course - or even being employed as one of the more straightforward approaches to multimode IF amplification and detection, using the AM detector transformer secondary for an IF signal for an SSB product detector with a MOSFET in a self-oscillating product detector mode (use a CRM ceramic oscillator element in a colpitts circuit on gate two - and feed the IF into gate one.)

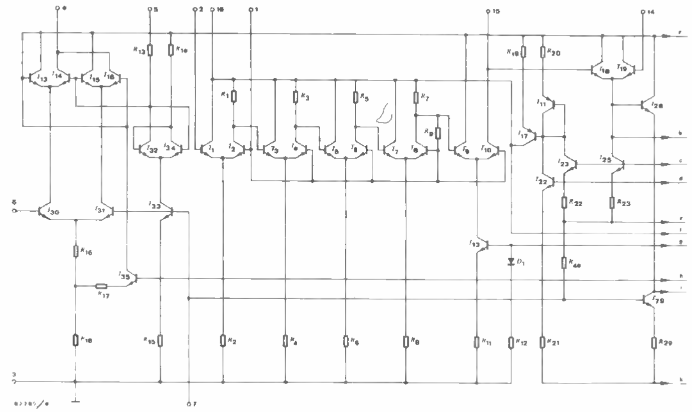


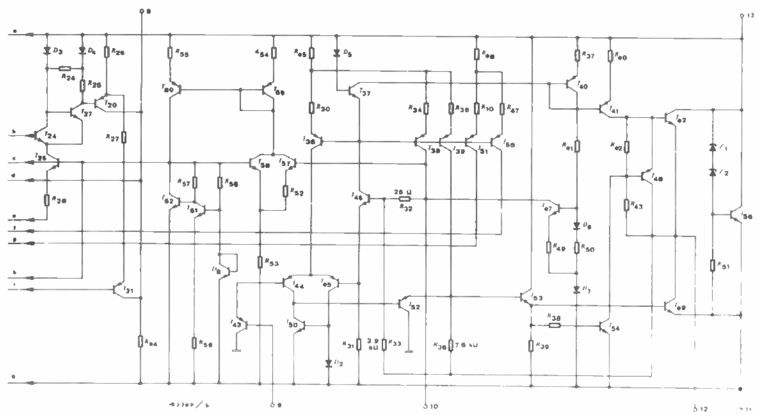
Combined BFO/product detector

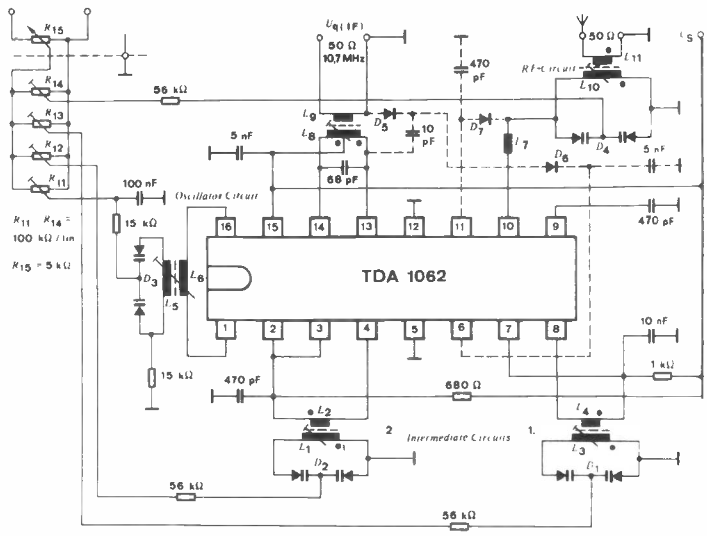
The circuit alongside neatly illustrates the dual gate MOSFET in one of its configurations as a mixer - except that the G1. facility is employed in the classic Colpitts configuration with a CRM ceramic resonator at the carrier injection frequency. The stability of this circuit is far better than a simple LC circuit - although to shift the resonator for both USB and LSB recpetion may require the use of fixed capacitor in parallel with the trimmer, and a small series inductance for pulling the circuit low and high respectively. The results are just as good as those obtainable using balanced mixer ICs - with the added advantage that AGC may be applied to Gate 2 if required.

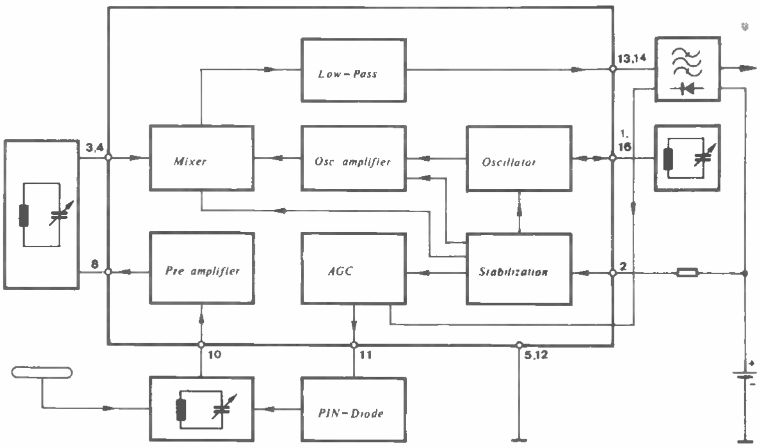
Ambit Data: 11 pages

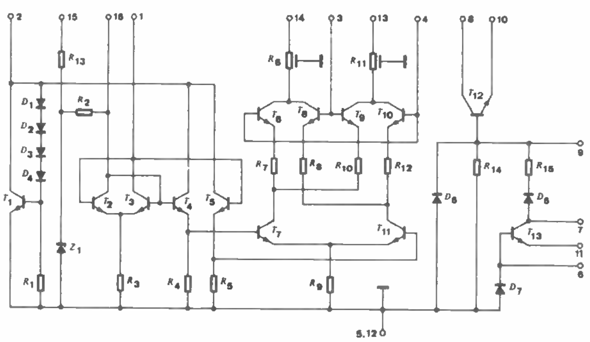












The above circuits are derived from Telefunken application notes for the TDA1062, and various modifications to the basic application are available to enhance the versatility of the device. It is particularly useful to use the FET input configuration used with the EF5402 circuit - since the reduced loading on the first rf circuit considerably eases the tracking alignment over very broad spans of band. A MOSFET can be used in this application as well, and thereby provide a further mode of AGC control. However, the capabilities of the mixer to cope with large signal overloads makes the single PIN diode system quite suitable for the majority of applications involving FM. For AM reception, a very fine degree of gain control may be helpful, but certainly not necessary in the types of application likely to be encountered outside very demanding communications systems.

An external oscillator may be used to feed the mixer - but care must be taken in transformer coupling to prevent the internal LO running at the winding resonance. A ferrite bead transformer is frequently the best solution for 100-200MHz use.

The basic design parameters of a good "front end" at any frequency (ie the input, RF and mixer) are :

1. Repeatable and stable performance
2. Good noise figure/sensitivity
3. Good large signal handling performance
4. Isolation of first local oscillator from the antenna and from pulling effects of strong signals.

The TDA1062 is single IC realization of all these points and thus is the first (and only) IC to have brought all the functions of "frontend" onto a single chip. Apart from the design aim of Band II (VHF FM) applications, the TDA1062 offers these advantages at various other frequencies - and can in fact be used in the range DC to 250MHz - although it should be noted that the mixer output is provided with a 15MHz LPF to reduce local oscillator leakage into the IF chain.

The device achieves this unique performance through the use of high current common base RF preamp - which offers both good stability and strong signal performance. The mixer employs the familiar double balanced configuration to provide signal handling with gain - and the oscillator is the emitter coupled form that is becoming as ubiquitous as the DBM in modern radio IC design. It is a very eager oscillator indeed - and care must be taken to prevent the circuit from oscillating at the resonance of the oscillator coupling winding (see the **EF5402** circuit for full details.)

The low level of the oscillator keeps stray signal down to a minimum - since the necessary level for DBM is provided by internal buffer/amplifier devices (T7, T11).

Since a very comprehensive applications note is available covering most of the main design criteria, (11 pages long), the remainder of this comment will concerntrate on aspects of the device that may not be immediately obvious at first glance - such as the behaviour of the IC in communications applications.

The TDA1062 at 140-170MHz

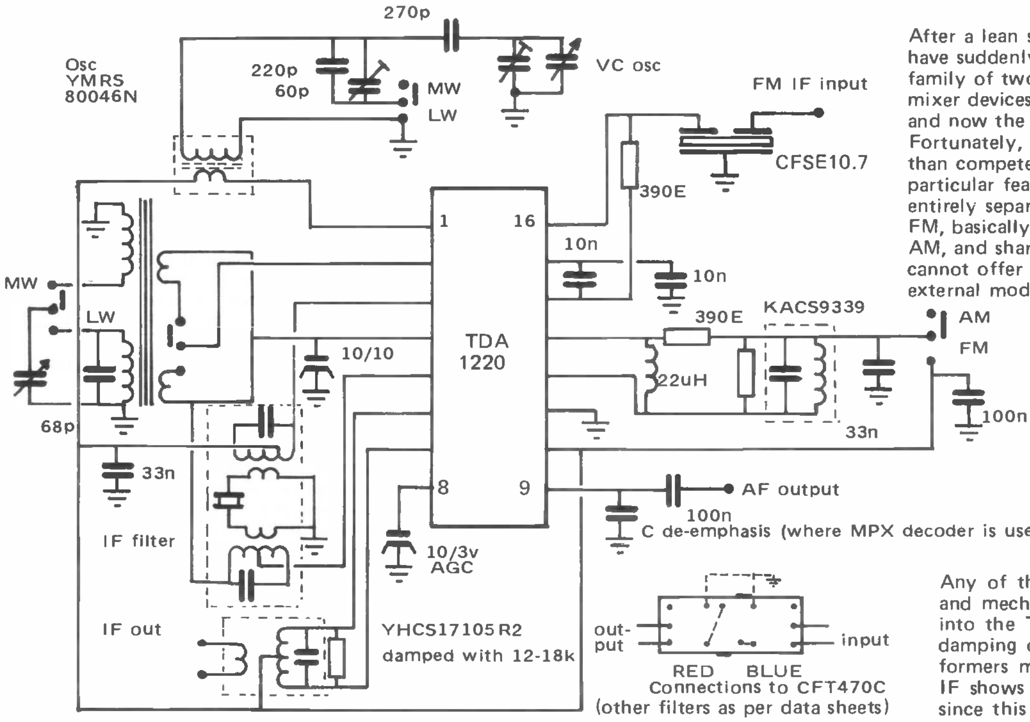
The internal AGC loop is derived from the IF output before filtering - and whilst this may be quite OK for broadcast FM channel spacing and transmission practice, it is necessary to operate the AGC after filtering in any sort of communications application. This may be acomplished by 'sniffing' the IF signal via a 10pF capacitor on the filter output - or the equipment AGC or meter line (whichever goes positive when the input level increases) can be taken to pin 6 of the IC to operate the PIN diode attenuator (BA379).

If used in 10.7MHz to 455kHz second conversion stage - the choice of AGC route should be made with regard to the selectivity dispersion in the design.

The use of the TDA1062 with a crystal controlled oscillator is possible - although the need to maintain a low resistance DC path from pin **1** to pin 16 means that a choke must be used - and the eager oscillator will be inclined to use this for determining the resonant frequency rather than the crystal. There are various ways of persuading the the circuit to operate at the crystal frequency, including experimenting with damping resistance across the choke, and placing an LPF (always make the choke far larger than the oscillator frequency requires) to ground from pin 16. The ideal solution will depend on the crystal type and mode - but parallel resonant overtone types are most frequenctly required to operate in this application - and these will require a good deal of direction to their correct overtone.

The RF and mixer performance at these frequencies is excellent - in fact, the device is fabricated using a 5GHz transistor process at the RF stage, so the practical top frequency is limited by considerations of lead length and PC layout. The performance specs of the IC at 150MHz are very little changed from the 100MHz figures (see **EF5402**), and the versatile tuning approach, coupled with the low oscillator voltage make it possible to design tracking frontend circuits that can span as much as 120-170MHz. Some loss of gain at extremes is inevitable unless very carefully selected and matching components are used - but the combination of frequency span and gain, coupled with good signal performance is hard to reproduce in discrete designs where the oscillator output tends to be very variable with simple discrete designs.

The TDA1062 has also been used in an experimental UHF front end - where the oscillator works at 480MHz - using stripline techniques. Since this gave no apparaent problems - other than those usually associated with UHF - it is anticipated that the device can be suqeezed even further, although the LPF on the mixer output restricts the use of high IF.



Antenna assembly: AM MWC2/LWC on rod of desired length (9.5mm dia)

After a lean stretch in radio IC presentations, we have suddenly been presented with a whole new family of two terminal oscillator, fully balanced mixer devices. The TDA1083, TDA1062, TDA1090 and now the TDA1220.

Fortunately, the ranges are complementary rather than competetitive, and so each has a set of particular features. The TDA1220 features almost entirely separate internal arrangements for AM and FM, basically switching the oscillator off to 'kill' AM, and sharing the audio output pin. The device cannot offer simultaneous AM and FM without external modification.

In fact, this latest batch have many features not found in some ICs previously considered as specialized 'communication' devices - like the famous Plessey SL600 series.

(Internal cct available)

Any of the stock ranges of ceramic and mechanical IF filters will match into the TDA1220. A degree of damping on the matching trans-formers may be necessary when the IF shows signs of instability - but since this is likely to be variable according to layout and filter used, try values from 4k7-100k

The TDA1220

Many internal features of the TDA1220 resemble the TDA1083 - the balanced mixer, the oscillator - and so it is not surprizing that this IC exhibits the same type of versatility, with operation of all AM functions in excess of 40MHz. The oscillator coil requires a slightly higher impedance than with the TDA1083, which means more coupling turns - the oscillator Z is given as being 5k, and for the higher SW bands, the entire tank circuit may be used instead of the coupling winding. The additional capacity aquired in this fashion is only 5pF, and so can easily be accounted for in the trimmer ranges. However, once again the oscillator amplitude is controlled via the AGC line,, and so SSB performance at frequencies above 5MHz is not particularly good. SSB may be derived in the same way as with the TDA1083 (see the "one chip communications receiver"), or it may be achieved with a separate MOSFET product detector.
The IC exhibits a fairly startling AM sensitivity, with 0.5uV of AM being discernible when fed directly to the chip at 1MHz. At 30MHz, this rises to about 2uV, which is nevertheless quite a substantial amount of gain, considering most of it takes place at a single frequency. The next word is therefore a cautionary one concerning stability - the IF may become unstable, particularly in the MW at 2IF (2.470kHz for example - 940kHz.) In fact, the 455kHz is rather better, since the AGC reduction when tuned to Radio 4 tends to mask the low frequency burbles. The answer is easily enough found, damp the input coupling on the IF filter until it stops - usually about 1.5k does the trick - and in many applications, this spot interference is not really much of a problem, and can be ignored in favour of using as much gain as can be achieved.
What all this adds up to is a superb device for a variety of broadcast and communications applications. In fact, the DC coupling of all the internal stages implies that the IC is ideal for use as a synchronous SSB receiver, with AF being filtered from the mixer output, and then amplified in the IF amp, used at audio. The AGC thus derived would be audio referred - which is what you need for best SSB, and the access to the AGC time constant at pin 8 permits tailoring of this response to suit the desired attack and hang characteristics.
Not much has yet been said about the FM section, and this is basically a cut down 3089, minus muting, and AFC outputs. The AFC may be derived (and in the usual sense) from the audio output - the detail given for the TDA1083 shows the method to use for the TDA1220. The absence of a muting facility shouldn't matter in the types of applications anticipated for this device, which are mainly in the areas of car radio, and the great reviving area of a simple mains power "table radio" (brought about by the massive increase in battery prices, as it costs almost 100 times less to power from the mains) and of course, the clock radio - where the added sophistication of an easily made SW feature is a big plus in many areas of the world. In non-stereo applications, the IF should have sufficient gain when driven directly from the tuner output (AT3302 for example - but since the FM section does possess potentially HiFi specifications, the use of an IF preamp will raise the general off-station noise to an uncomfortable level, and a noise mute is a necessary feature. An FET gate would permit a smoother mute transistion than the snappy type employed inside the 3089 family.

Specifications

Parameters	Test conditons	Min	Typ	Max	Units	Comments
Supply voltage		4		18	v	No internal shunt regulator, so OK for direct mobile power
Supply current	AM at Vcc 9v		15		mA	Not quite the same league as the amazing TDA1083
	FM at Vcc 9v		20		mA	
Input impedance	pin 2		5k/10pF			Use MWC2 coil
Input impedance	pin 5		2k/5pF			
Output impedance	pin 3		50k/3pF			
Oscillator	pin 1		5k/5pF			
Detector	pin 6-7		20k/5pF			
AM input sensitivity	pin 2 S/N 26dB at 1MHz		10		uV	Comms. use down to 0.5uV
Best S/N	10mV RF input		56		dB	
AGC range	AF level shift 3dB		75		dB	good
Recovered audio	1mV in, 80% mod at 1kHz		200		mV	
Distortion	1mV in. 30% mod at 1kHz		0.5		5	
Overload	THD 10% at 80% mod		15C		mV	very good for AM
Local oscillator dropout		2			V	as TDA1083
FM input limiting voltage	10.7MHz		25		uV	
AM rejection	Input 200uV+		45		dB	
Ultimate S/N	Input 10mV		65		dB	
THD	Full 75kHz dev. at 1kHz		1.0		%	
Recovered audio	Input 1mV, 75kHz dev. at 1kHz		220		mV	

Intro:

Radio Control enthusiasts will have noticed that there has been a good deal of activity in evidence from Japanese and Far Eastern RC manufacturers - largely, once again, to the detriment of the pioneers of the digital proportional RC system - UK manufacturers. One of the prime reasons for this sudden surge is the availability of single IC solutions to complete RC links, incorporating both coding and RF in a single package. Such a device is the KB4445 from TOKO - which provides all the facilities of FM radio control with considerably less bother than almost any other approach you can think of.

The KB4445/6 knocks spots off AM system performance in areas of high CB pollution - and puts the LM1871/2 AM system somewhat in the shade when it comes to serious model control applications. The very versatile IC operates using standard RC FM crystals at ½ the output frequency - and can do so from 8 to 50MHz, neatly covering all the RC bands except UHF. And as far as UHF is concerned, then perhaps thosedesigners who find ICs an unsatisfying solution to design problems concerned, think of the KB4445 as the shortcut to a UHF design.

The full data on the device includes a detailed internal system diagram that enables the adventurous to adjust and reprogramme the variables, such as reducing the deviation to suit UHF multiplication factors. The fact that each encoder stick control has a separate timing capacitor may at first sight seem unweildy - but this approach does provide excellent RF immunity, which is a failing that has been known to plague many otheriwse seemingly first rate designs.

The question of AM rejection is not particularly of the utmost importance - AM rejection in NBFM applications tends to be far less significant than in WBFM - it is usually possible to activate an FM RC receiver and decoder from an AM transmitter. Not only because most AM RC transmitters have a good deal of residual FM anyway, but due to phase modulation effects in filters etc. The most significant aspect of the FM system is the fact that the carrier is always present to quiet the receiver and surpress any background AM interference - which could otherwise break through to disturb the system.

KB4445

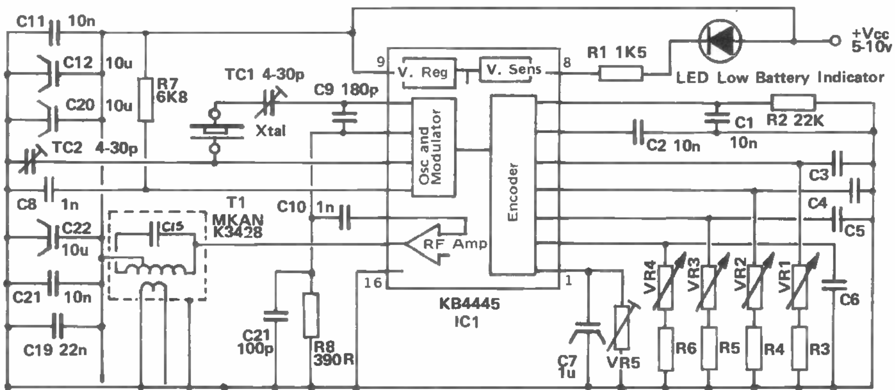
In an industry where you can count the number of semiconductor manufacturers who are both willing and capable of producing complex RF linears on the fingers of two hands - TOKO show more than share of ingenuity in this field. The combination of RC encoding and RF driver of the KB4445 is sufficient for ground based models without a PA stage - although for low powered applications, it is adviseable to use a scaled down output stage to provide adequate isolation of the antenna from the modulator.

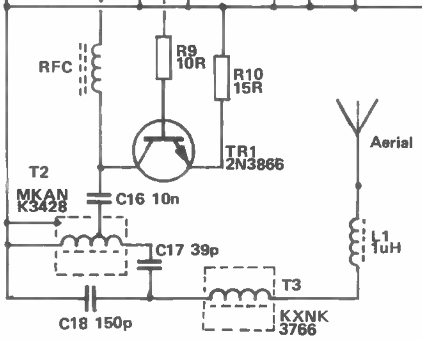
The stick pots should be 270° track types, although if you wish to use specialist narrow angle pots, 10K ohms is suitable, with C3 to C6 increased to 100nF.

For accurately aligned systems using the narrowest channel spacings, the crystal frequency alignment is more critical than with an AM approach - Where multiple channel use is required, the trimming of the transmit should be fixed for each channel, but it may be helpful to include a fixed parallel capacitor across the receiver crystals for exact alignment. Many commercial systems employing FM are obliged for reasons of practicality to ignore the fact that FM crystals are more prone to critical frequency alignment than AM, and so only the enthusiast with access to the time and equipment required to provide spot-on alignment of each channel can benefit from the narrowest channeling available.

The capacitor on pin 12 is primarily responsible for setting the deviation level (TC1 is for frequency centre), and the only way to get this right is to monitor the output of a known working receiver and adjust for best results as viewed on an oscilloscope, or possibly as recognized by a reasonably experienced ear. Using fairly broad IF filtering and broad deviation levels will reduce the precision needed at this stage of the process.

A comprehensive set of data and applications is available to guide the designer on uses of the IC - which are not restricted to RF link applications only, of course.



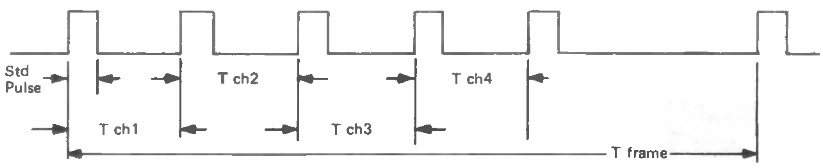


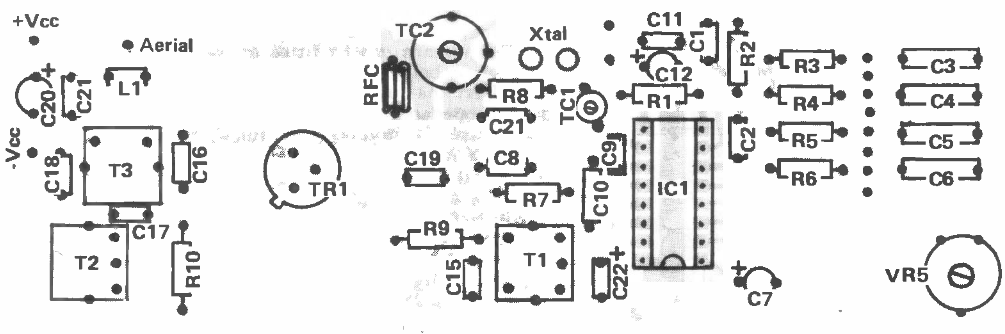
VR5 47K - Frame Time
VR1-4 220K - Control Pot

R3 - 6 8K2
C3 - 6 20n

Spec:	Unit	Min	Typ	Max	Remarks
Power supply	Vdc	4	6	12	LED flashes at 4.4v
Consumption	mA		20		Osc. stopped, no PA
Output	mW		30		at 6v
Encoder pulse	uSec		200		Width of leading pulse
Channel pulse	mSec		1.5		Std. servo control width
Frame	mSec		20		Depends on IF BW
Deviation	kHz	2	4		Programmable

Frame Format and timing





The KB4446

Those of you familiar with previous Ambit catalogues will perhaps notice the similarity between the KB4446 RF sections and the MC3357P nbfm processing device. The major difference is the oscillator, which is configured as a 3rD OT stage, rather than a fundamental colpitts that has to be persuaded onto the 3rD OT.

The IF filtering can be chosen to suit the channel spacing required - see the notes on the subject on the KB4445 page. The combination of CFU455 and CFM2 series provides both accurate bandpass shaping, and good spurii and out-of-band rejection that emulates filters costing a great deal more, which are far larger. The output of the detector stage at pin 1 may be monitored on an audio amplifier if required - or viewed on an oscilloscope to check that the waveform arriving at the input to the comparator is the same as on the output of the transmitter encoder. Any variance at this point is usually due to incorrect alignment of either the filter matching transformer, or the quadrature coil itself.

The component marked Rx on the component overlay diagram is used to provide damping for the quadrature, and should be chosen to suit the level of deviation used. For systems based on IF filtering of 12kHz, then the deviation level at the transmitter can be set at 4-5kHz, but this will mean the IFT in the quadrature circuit will need to be damped to prevent the detected signal from swinging past the rails (the positive and negative supply limits at this point in the circuit).

A 10-22k resistor is necessary for 4kHz deviation levels, and if the device is used primarily for speech reception (using the coding stream for selective adressing, for example), the quadrature will require slightly more damping to prevent excessive distortion of sinewave signals. A large degree of distortion is permissable with the pulse waveform - as long as it is in the form of compression without altering pulse widths.

The comparator is used to provide a very high degree of noise immunity, and immunity to false triggering. It integrates the outputs of the detector on pin 22, to provide a reference for the actual frame pulses on pin 21. The decoding process uses a standard flip-flop technique, with reset controlled by C13 - which must therefore be a close tolerance type.

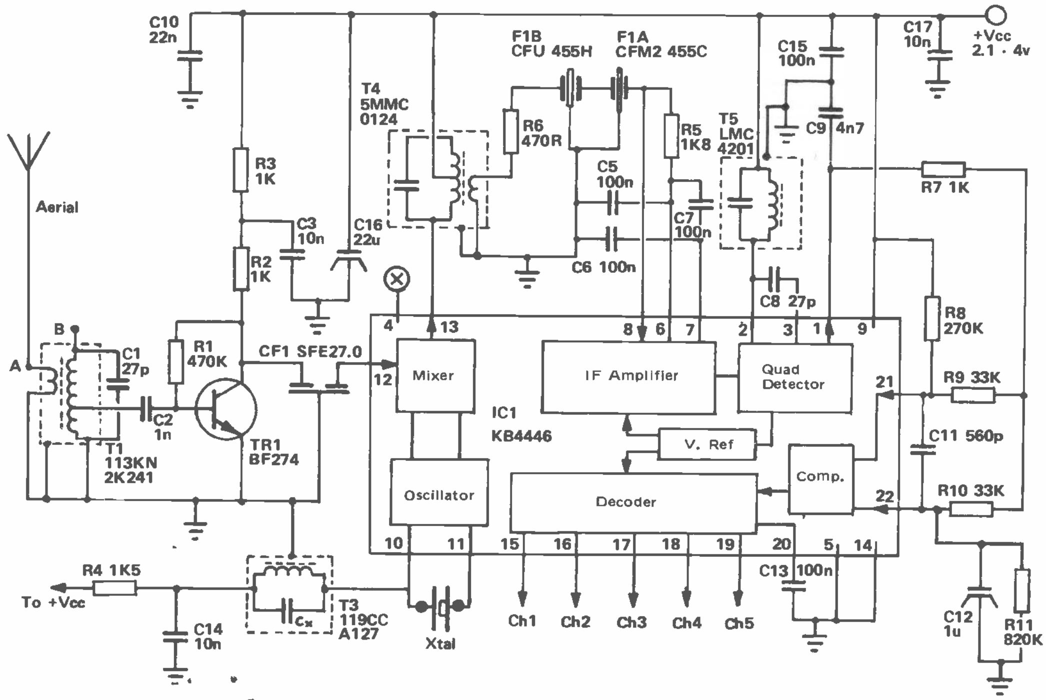
The radio control receiver system described herein was featured in ETI October 1980. We have made - and will continue to make - minor detail changes and modifications. As with all DIY RC projects, the use of home constructed equipment in airborne systems is not recommended until you have verified the system **thoroughly** *on land or water based vehicles. Notwithstanding this most important consideration, this receiver will form the basis of an easy-to-build RC system, being largely contained within a single IC*

Specification

Item	unit	min	typ	max	Notes
Supply	V	2.1	3.0	4.0	1
	mA	15	20	25	at 3v
Sensitivity	dBu		26		for 20dB s/n
Limiting onset	dBu		40		
Det. output	mV		300		at 60dBu in
LED current	mA		5		
Std pulse width	uSec		200		
Channel	mSec		1.5		
Frame	mSec		20		
Output current	uA		100		source
Output	mA		2.0		source

Notes

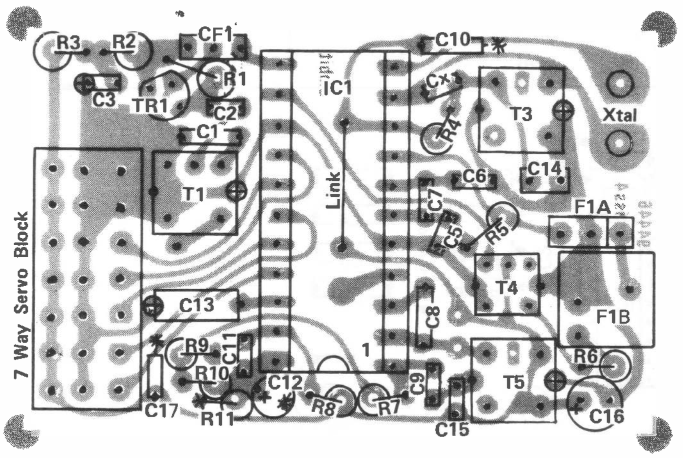
1. The low battery voltage indicator LED from pin 4 to Vcc starts to indicate at Vcc = 2.2v



In response to the age-old question of "How far ??" the answer is equally ill-defined, since total range will depend on:

1) Transmit power
2) Receiver sensitivity
3) Antennas at each end
4) Accuracy of tuning
5) Interference effects
6) Supply voltage purity

Item 6 is frequently the most limiting factor (especially if the RX is run from dry batteries along with the servos). The low supply requirements of this RX enable large amounts of supply decoupling to be applied to keep the effects of servo drain away from the sensitive parts of the decoder. And if you happen to operate motors with pulsed speed control - use very effective filtering for all parts of the supply, or the RFI will cripple the system before you start. If you are not bothered too much by adjacent channel effects - then a wider IF filter stage will be more tolerant of tuning inaccuracies.



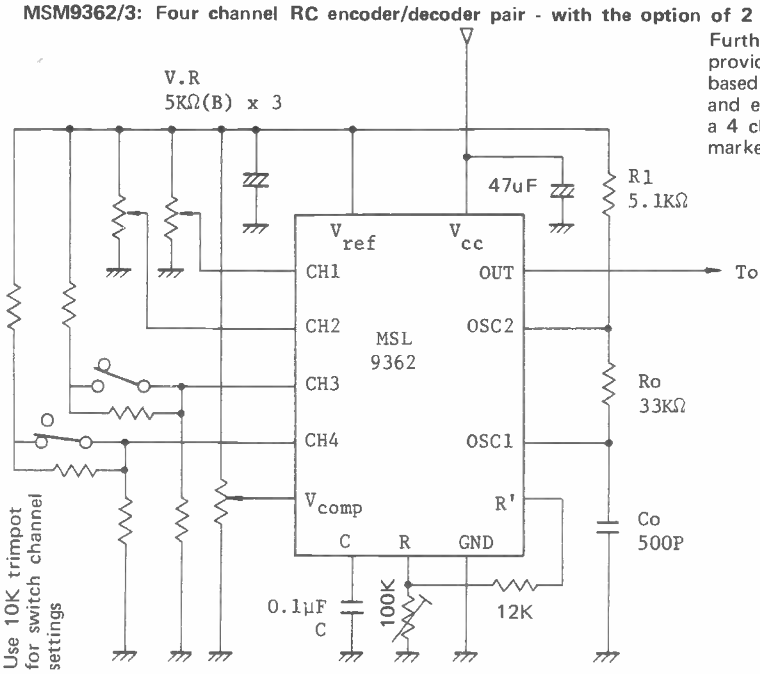
Ambit 94446 receiver module

The module is based on the case used for the RCRX4 (see part 3 catalogue.) In addition to employing the facilities of the KB4446, an RF preamp is used with a 27MHz ceramic filter to provide an exceptional degree of selectivity at the input frequency.

The antenna can be fitted at two point on the input coil - position A being advised in most applications, since this does not affect the tuning of the input transformer, and provides a low impedance matching. Point B is a high impedance input, and will influence the tuning by virtue of the capacitive effect of rod antennas on tank circuits. Maximum signal will be picked up at point B - although placing 10pF in series with the antenna will not affect sensitivitity severely, whilst it will buffer the affects on the tuning.

The crystal used is a standard 3rd OT (30pF parallel), by changing C1 for 22pF, and bypassing CF1 with a 100pF the unit will work at 35MHz with reduced RF selectivity.

MSM9362/3: Four channel RC encoder/decoder pair - with the option of 2 channels either proportional or latched & switched



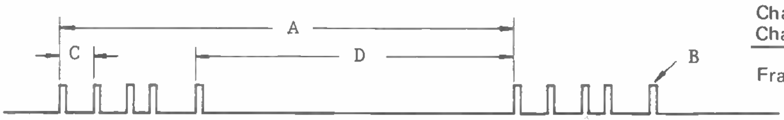
Further evidence that the IC has taken over from discrete logic is provided by these OKI devices. Although aimed specifically at land based models, and simple aircraft, these devices are highly accurate and easy to make RC system encoder/decoders that will provide a 4 channel link to equal the best discrete logic systems on the market today.

The 9362 encoder has certain similarity to the NE5044 7 channel device from Signetics (Cat. Prat 3). The frame rate (A on timing diagram) is set to nominally 20mSec by the components around Osc 1 and Osc 2.
Vref provides a very stable supply for the channel timing pots - and can handle Vcc varying over the range 7-13v without affecting the encoded output timing.
Pins C and R are used to set the correct range timing for the stick controls - which is a very useful feature.
The Vcomp. facility enables the idling (neutral) position of the output pulse to be adjusted without having to adjust the physical location of the sticks.

Specifications

Supply 9v nom.

Item	Unit	Min	Typ	Max
Voltage	Vdc	7	9	13
Current	mA		6.5	8.5
Output at "O"	Vdc		0.25	0.4
	mA	15		
Ref. voltage	Vdc		3.8	
Ref. current	mA	5		
Frame rate (A)	mS		20	
Channel pulse B	uS		200	
Channel width C	mS		1.5	



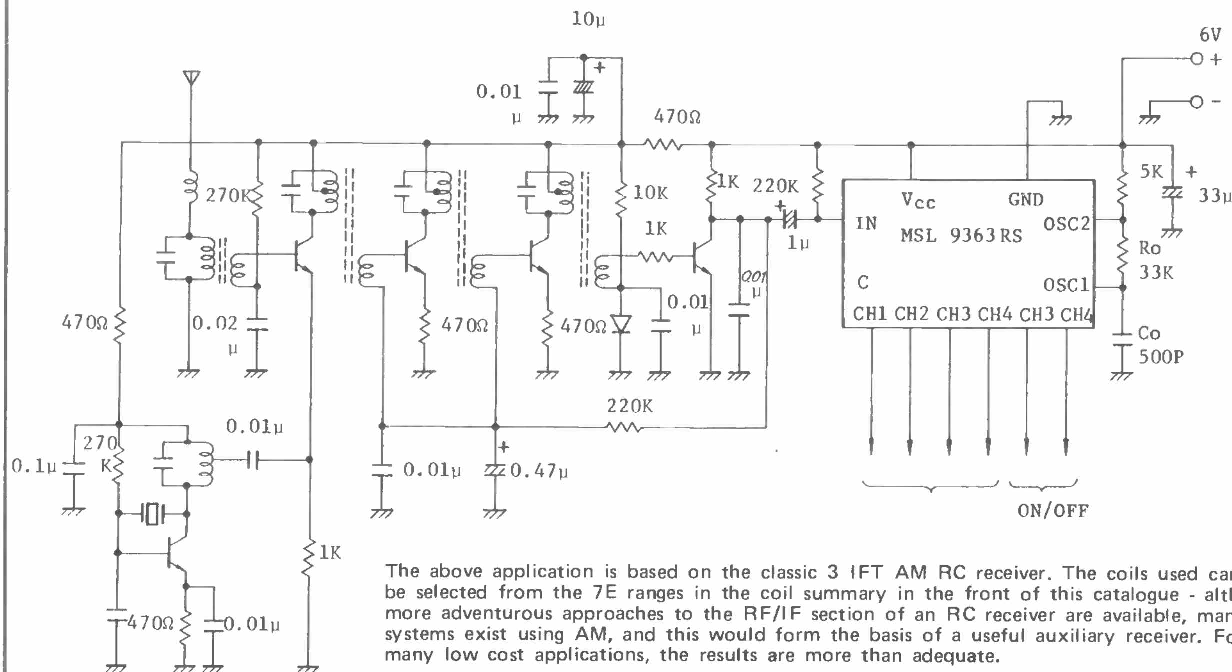
Frame rate/Channel pulse fixed ratio 80:1

Ambit Data: MSL9362 7 pages

The 9363 decoder includes an AF amp at the input, with access to the output to enable an LPF configuration to be used if required. The most interesting feature for many applications is the availability of 2 latched outputs for switching function (Ch.3&4) - which may be either dedicated switch channels, or driven in parallel with proportional outputs from the same encoded channels - such as relay operated reversing - or more commonplace on/off of lights, undercarriage etc.
The decoder uses a synchronous clock system, which uses the same value of timing as the transmitter encoder and imparts excellent immunity to spurious operation and interference.
The output will drive all standard servos directly.
The decoder is suited to all forms of carrier medium, and will obviously work from AM/FM or wired links that can supply the necessary demodulated frame signals.

Specifications

Item	Unit	Min	Typ	Max	Notes
Supply voltage	Vdc	4	5	8	
Supply current	mA		16		at 6v Vcc
Logic 1 input	V	1.5			at 4v Vcc
Logic O input	V			0.5	at 4v Vcc
Logic 1 input	mA	0.1		1.0	at 7v Vcc
Logic O input	uA			-0.5	at 7v Vcc
Logic 1 output	V	1.5			at 4v Vcc
Logic 1 output	mA	-8		-30	at 4v Vcc
Logic 0 output	V		0.25	0.4	I out 5mA



The above application is based on the classic 3 IFT AM RC receiver. The coils used can be selected from the 7E ranges in the coil summary in the front of this catalogue - although more adventurous approaches to the RF/IF section of an RC receiver are available, many RC systems exist using AM, and this would form the basis of a useful auxiliary receiver. For many low cost applications, the results are more than adequate.

Ambit Data: MSL9363 6 pages

The uA753 is a versatile limiting IF amplifier gain block aimed at applications in FM IF's at 10.7MHz. It has a low level output after the second stage - and this may be used for AGC detection purposes if required. The 330 ohm input/output impedance is fixed, and intended to drive ceramic IF filters - although other types of filter with suitable transformation may be used.
It is tempting to use the uA753 in front of ICs such as the CA3089/HA11225 etc., but the large amount of gain, coupled with the increased noise voltage will cause the muting systems to malfunction. However, if used before a SAW device, the gain and loss of the SAW will balance and result in excellent overall performance. Observe usual RF precautions in layouts.

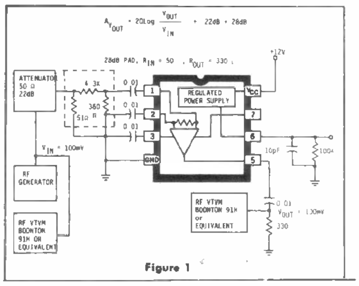


Figure 1

Ambit Data:
uA753 3 pages

STATIC ELECTRICAL CHARACTERISTICS

Operating Conditions $T_A = 25°C$, $V_{cc} = +12V$

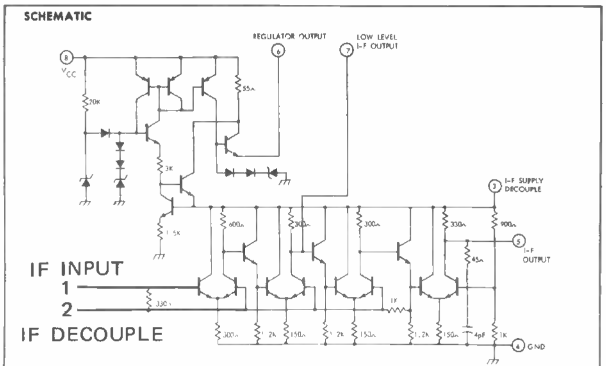
Parameter	Symbol	Test Pin	Test Figure	Test Conditions	Limits Min	Typ	Max	Units
Supply Current	I_{cc}	8	1		11	18	25	mA
Total Device Dissipation	P_d						400	mW
Terminal Voltage (See Note 1)	V_1	1	1			1 4		V
	V_2	2	1			1 4		V
	V_3	3	1			2 6		V
	V_5	5	1			2 0		V
	V_6	6		$I_C = 5mA$	7 2	7 8	8 3	V
	V_7	7	1			2.0		V

Note 1 All d-c voltage readings are with respect to network ground

DYNAMIC ELECTRICAL CHARACTERISTICS

Operating Conditions: $T_A = 25°C$, $V_{cc} = +12V$, Frequency = 10.7MHz unless otherwise noted

Parameter	Symbol	Test Pin	Test Figure	Test Conditions	Limits Min.	Typ	Max	Units
Input Limiting Threshold (at −3dB point)	V_{TH}	1	1			500		µV
Output Voltage Swing	V_{OM}	5	1		110			mVrms
Output Noise Voltage		5	2			4	16	mVrms
Input Impedance Parallel Input Resistance Parallel Input Capacitance	 R_{in} C_{in}	 1-2 1-2			 270 5	 330 7	 390 10	 Ω pF
Output Impedance Parallel Output Resistance Parallel Output Capacitance	 R_{out} C_{out}	 5 5			 270 5	 330 7	 390 10	 Ω pF
Output Voltage Gain	AV_{out}	5	1	V_{in} = 100mVrms, f = 10.7MHz	40	50	57	dB
Power Supply Rejection	V_{SR}	5	3	V_{in} = 250mVrms, f = 100Hz		−40		dB



The MC1350 provides a similar function to the uA753, except that the device offers an AGC input, and is thus suited to all forms of RF amplification. It is very comprehensively specified for use at all common IF frequencies, and although primarily intended for TV VIF stages, it offers a versatile low cost gain block for general communications and broadcast applications where linear RF/IF amplication is required.

The internal digram shows that the output is a balanced push-pull open collector stage, and should thus use a centre tapped IF transformer at the required frequency. The inputs are similarly 'balanced', although the device is more frequently shown with a single ended configuration.

MC1350

MAXIMUM RATINGS (T_A = +25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Power Supply Voltage	V^+	+18	Vdc
Output Supply Voltage	V_1, V_8	+18	Vdc
AGC Supply Voltage	V_{AGC}	V^+	Vdc
Differential Input Voltage	V_{in}	5.0	Vdc
Power Dissipation (Package Limitation) Plastic Package Derate above 25°C	P_D	 625 5.0	 mW mW/°C
Operating Temperature Range	T_A	0 to +75	°C

ELECTRICAL CHARACTERISTICS (V^+ = +12 Vdc; T_A = +25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
AGC Range, 45 MHz (5.0 V to 7.0 V) (Figure 1)		60	68	–	dB
Power Gain (Pin 5 grounded via a 5.1 kΩ resistor) f = 58 MHz, BW = 4.5 MHz (See Figure 5) f = 45 MHz, BW = 4.5 MHz (See Figure 5) f = 10.7 MHz, BW = 350 kHz (See Figure 6) f = 455 kHz, BW = 20 kHz (See Figure 6)	A_p	 – 46 – –	 48 50 58 62	 – – – –	dB
Maximum Differential Voltage Swing 0 dB AGC -30 dB AGC	V_o	 – –	 20 8.0	 – –	V_{p-p}
Output Stage Current (Pins 1 and 8)	$I_1 + I_8$	–	5 6	–	mA
Total Supply Current (Pins 1, 2 and 8)	I_S	–	14	17	mAdc
Power Dissipation	P_D	–	168	204	mW

DESIGN PARAMETERS, Typical Values (V+ = +12 Vdc, T_A = +25°C unless otherwise noted)

Parameter	Symbol	Frequency 455 kHz	10.7 MHz	45 MHz	58 MHz	Unit
Single-Ended Input Admittance	g_{11} b_{11}	0.31 0.022	0.36 0.50	0.39 2.30	0 5 2.75	mmhos
Input Admittance Variations with AGC (0 to 60 dB)	Δg_{11} Δb_{11}	– –	– –	60 0	– –	µmhos
Differential Output Admittance	g_{22} b_{22}	4.0 3.0	4.4 110	30 390	60 510	µmhos
Output Admittance Variations with AGC (0 to 60 dB)	Δg_{22} Δb_{22}	– –	– –	4.0 90	–	µmhos
Reverse Transfer Admittance (Magnitude)	$\lvert y_{12} \rvert$	<<1.0	<<1.0	<<1 0	<<1.0	µmho
Forward Transfer Admittance Magnitude Angle (0 dB AGC) Angle (−30 dB AGC)	 $\lvert y_{21} \rvert$ $\angle y_{21}$ $\angle y_{21}$	 160 -5.0 -3.0	 160 -20 -18	 200 -80 -69	 180 -105 -90	 mmhos degrees degrees
Single-Ended Input Capacitance	C_{in}	7 2	7.2	7.4	7.6	pF
Differential Output Capacitance	C_o	1.2	1.2	1.3	1 6	pF

Ambit Data:
MC1350 4 pages

AGC is positive going - so the output of the 3089 family AGC should be inverted before being applied to the MC1350. The companion AM detector (MC1330) can provide the necessary AGC drive directly.

FIGURE 4 CIRCUIT SCHEMATIC

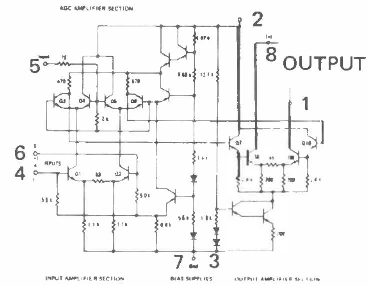
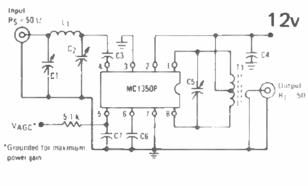


FIGURE 6 – POWER GAIN and AGC TEST CIRCUIT (455 kHz and 10 7 MHz)

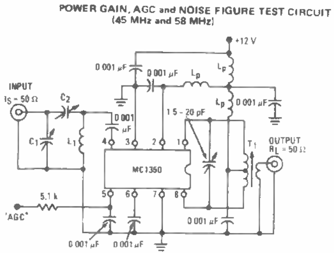


Note 1 Primary. 120 µH (center-tapped)
Q_u = 140 at 455 kHz
Primary Secondary turns ratio ≈ 13

Note 2 Primary 6 0 µH
Primary winding = 24 turns #36 AWG (close-wound on 1/4'' dia form)
Core = Arnold Type TH or equiv
Secondary winding = 1-1/2 turns #36 AWG, 1/4'' dia (wound over center-tap)

Component	Frequency 455 kHz	10.7 MHz
C1		80 450 pF
C2	–	5 0 80 pF
C3	0.05 µF	0 001 µF
C4	0 05 µF	0 05 µF
C5	0 001 µF	36 pF
C6	0 05 µF	0.05 µF
C7	0 05 µF	0.05 µF
L1		4 6 µH
T1	Note 1	Note 2

POWER GAIN, AGC and NOISE FIGURE TEST CIRCUIT (45 MHz and 58 MHz)



*Connect to ground for maximum power gain test.
All power-supply chokes (L_p), are self-resonate at input frequency $L_p \geq 20$ kΩ
See Figure 10 for frequency response curve

L_1 @ 45 MHz = 7 1/4 Turns on a 1/4" coil form
@ 58 MHz = 6 Turns on a 1/4" coil form
T_1 Primary Winding = 18 Turns on a 1/4" coil form, center tapped
Secondary Winding = 2 Turns centered over Primary Winding @ 45 MHz
= 1 Turn @ 58 MHz
Slug = Arnold TH Material 1/2 Long

	45 MHz		58 MHz	
L_1	0 4 µH	Q ≥ 100	0 3 µH	Q ≥ 100
T_1	1 3 -3 4 µH	Q ≥ 100 @ 2 µH	1 2 -3.8 µH	Q ≥ 100 @ 2 µH
C_1	50 - 160 pF		8 - 60 pF	
C_2	8 - 60 pF		3 - 35 pF	

FIGURE 2 – TYPICAL GAIN REDUCTION (Figures 5 and 6)

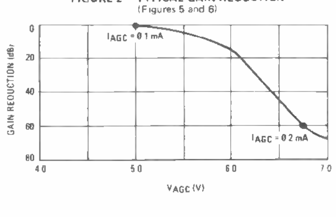
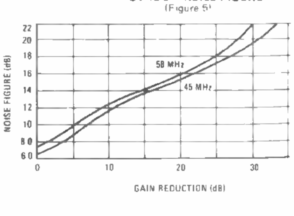
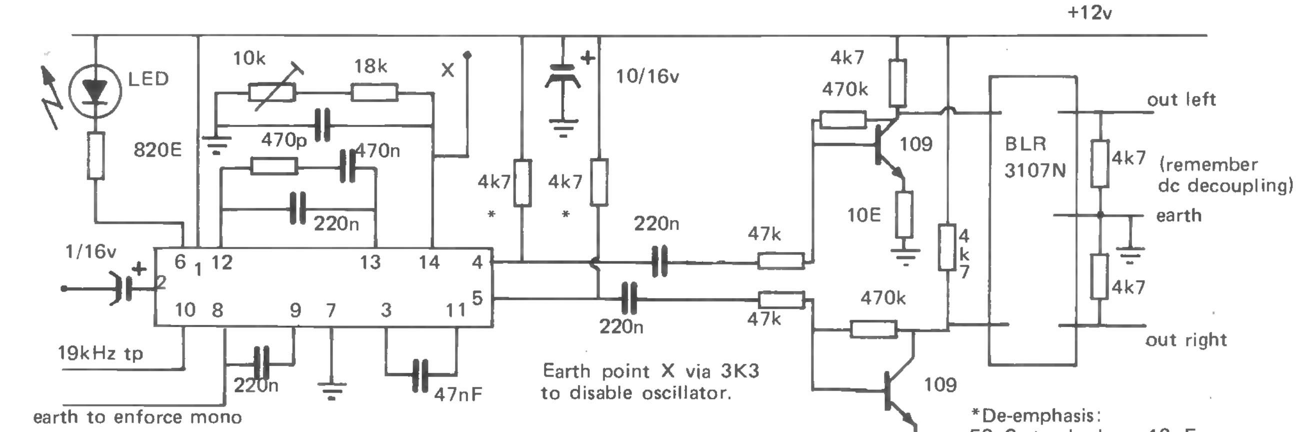


FIGURE 3 – NOISE FIGURE (Figure 5)



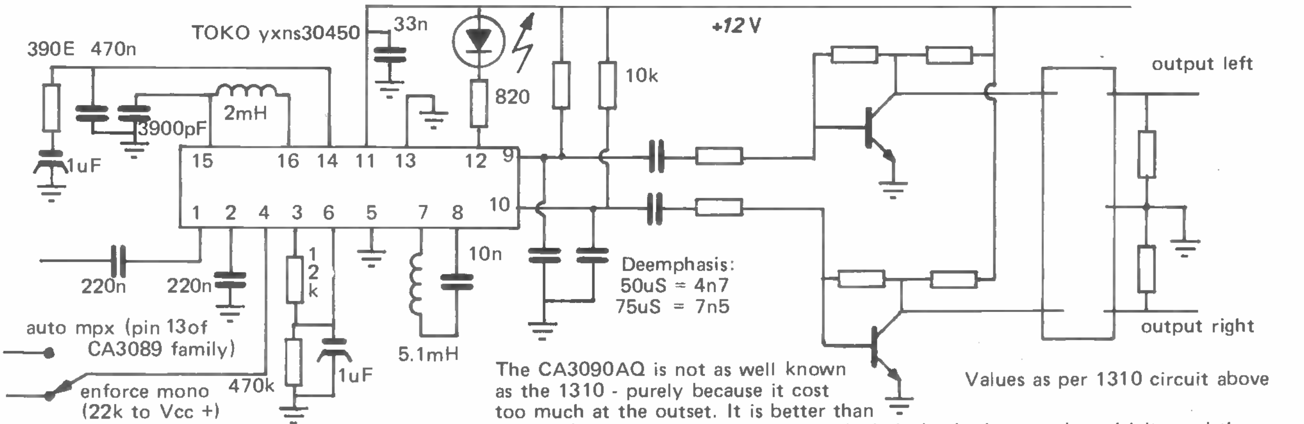
The MC1310P, CA1310E, SN76115N, HA11[illegible]W, KB4400, XR1310, SL1310 etc etc. Basic PLL mpx decoder



Much has been said and written about the MC1310 and its ilk, and so we will not go into great detail here - more data available on purchase of the IC or decoder module/kit

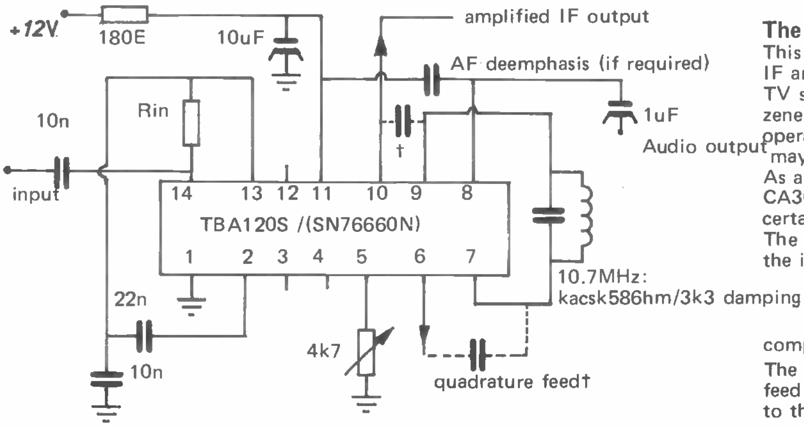
Input impedance	50k ohms
Channel separation	40dB at 1kHz
Stereo THD	.3% max at 1kHz
Output V 560mV in	300mV (before amp)
Pilot level to switch	16mV
S/N ratio	76dB
Supply voltage	8-16v DC
Supply current	13mA (no lamp)
Max input	1.3v rms

The one and only RCA CA3090AQ - the 'other' original PLL MPX decoder with never quite the same popularity as the 1310



The CA3090AQ is not as well known as the 1310 - purely because it cost too much at the outset. It is better than the 1310 series in most respects, particularly in the improved sensitivity and the auto stereo switch feature

Input impedance	50k
Channel sep.	40dB at 1kHz
Stereo THD	.2%
Output gain	6dB (before amp)
Pilot to switch	4mV
Max input	400mV composite
Voltage to enable stereo at pin 4	1.2v
S/N ratio	78dB
Supply voltage	9-16v
Supply current	22mA (ex. lamp)



The capacitors marked † are not required at 6 and 10.7MHz in the TBA120S, as these are furnished internally.

Supply voltage range	6-18v dc
Supply current	15-20mA
IF voltage gain at 6MHz	68dB
IF voltage at limiting (6&10)	170 - 250mV
AF output voltage	700-1000mV
THD	3-4% (at the high AF level stated)
Input limiting voltage	30-60uV
Input impedance	40k/5pF
AM rejection at 10mV input	68dB

The TBA120/ 120S and SN76660N

This family represents one of the original series of FM IF amplifier and detectors - developed primarily with TV sound IFs in mind. The device includes an internal zener stabilized supply, and an audio output attenuator, operated from pin 5. This is a strictly DC control, and may thus be operated remotely if desired.

As an IF/detector it has largely been superceded by the CA3089E, but in specialized applications, it still offers certain advantages, and excellent value.

The device may be used simply as an IF amplifier, where the internal DC coupling enables operation down to the bands used in ultrasonic and infra red remote controllers. The quadrature is simply a parallel resonant circuit, with Q arranged for the desired compromise between output and THD

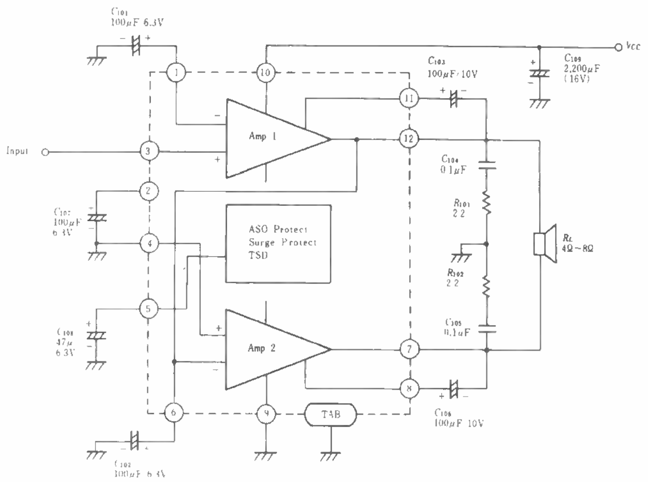
The SN76660N is identical, except that the quadrature feed capacitors (†) are not internal. This allows access to the excellent balanced mixer within the IC, which may be used in a variety of applications from SSB to general IF mixer functions - and is quite one of the cheapest ways of finding such a facility.

Devices TBA120B are simply the SN76660N type supplied in 14 QIL. Devices denoted TBA120A and TBA120AS are also supplied in QIL packages.

The internal 12v zener is from pin 12 to ground - those of you wishing to modify the application are advised to study the internal data - available on purchase of the IC

This is a high gain wideband device, and so the layout must be carefully chosen to observe good RF techniques- even when using the device at apparent low frequencies.

The HA1388 is probably the loudest thing on four wheels, since it is a bridge output amplifier intended for automotive applications in things like car radios, cassette and the "booster" amplifier. It is essentially a bridged version of the **TDA2002** amplifier, with careful balance to prevent DC offsets driving large currents through the loudspeaker. For applications in mobile radio, it makes an excellent modulator - and a generally versatile device for PA systems driven from 12v batteries.



This may seem rather obvious to most of you, but it must be underlined that the HA1388 draws a large amount of current on volume peaks. Amps of the stuff, and so it cannot be simply wired in without precautions to see that the power supply cable is of a sufficiently low impedance to prevent motorboating which occurs due to the modulation of the supply voltage itself. The fuses will need to be uprated if the **HA1388** is bolted onto a standard car radio - and the local supply decoupling must be enough to prevent the radio from becoming detuned and the panel lights dimming when the volume is turned up.

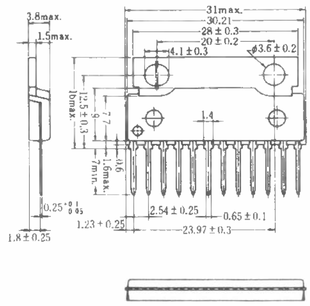
A complete PCB is available from Ambit for the HA1388, and since the device is a very high gain, high current amplifier with considerable HF capability, it is advisable to use this tried and tested layout to avoid the pitfalls of such designs.

As with all the audio amplifiers from Ambit, the HA1388 is short circuit protected, and cannot easily be blown up - except by reversing the power supply or chronically overdriving the input with DC.

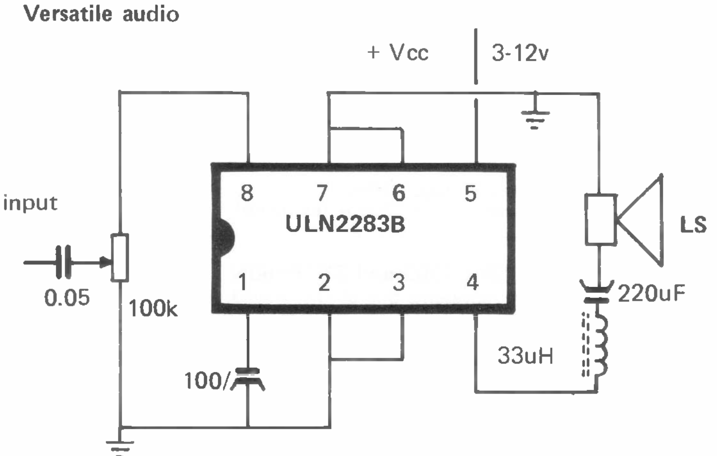
Ambit Data: HA1388 4 pages

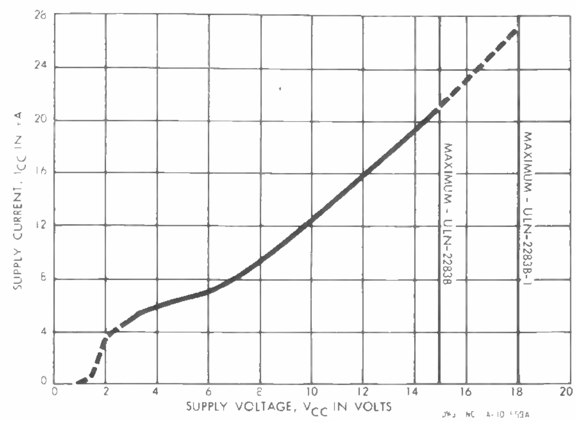
■ELECTRICAL CHARACTERISTICS ($V_{CC}=13.2V$, $f=1kHz$, $R_L=4\Omega$, $Ta=25°C$)

Item	Symbol	Test Condition		min.	typ.	max.	Unit
Quiescent Current	I_Q	$V_{in}=0$		40	80	160	mA
Input Bias Voltage	V_B	$V_{in}=0$		—	20	40	mV
Output Offset Voltage	ΔV_Q	$V_{in}=0$		—	—	±330	mV
Voltage Gain	G_V	$V_{in}=-55dBm$		53	55	57	dB
Output Power	P_{out}	$THD=10\%$	$R_L=4\Omega$	15	18	—	W
			$R_L=8\Omega$	—	11	—	
Total Harmonic Distortion	THD	$P_{out}=1.5W$		—	0.2	1.0	%
Wide Band Noise	WBN	$R_g=10k\Omega$, $BW=20Hz$ to $20kHz$		—	1.0	2.0	mV
Supply Voltage Rejection Ratio	SVR	$f=500Hz$		33	44	—	dB
Input Resistance	R_{in}			20	30	40	kΩ
Rolloff Frequency	f_L	$G_V=-3dB$ from	Low	—	20	—	Hz
	f_H	$f=1kHz$ Ref.	High	10	20	40	kHz



Versatile audio





SUPPLY CURRENT

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$, $f_{in} = 400 Hz$

Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Supply Voltage Range	V_{CC}		3.0	—	15	V
Quiescent Supply Current	I_{CC}	$V_{CC} = 6.0 V$	—	7.0	—	mA
		$V_{CC} = 12 V$	—	16	25	mA
Voltage Gain	A_e	$P_{OUT} = 0 W$	39	42	46	dB
Audio Power Output	P_{OUT}	$V_{CC} = 6.0 V$, $R_L = 8\Omega$, THD = 10%	250	350	—	mW
		$V_{CC} = 9.0 V$, $R_L = 8\Omega$, THD = 10%	800	1140	—	mW
		$V_{CC} = 12 V$, $R_L = 16\Omega$, THD = 10%	800	1200	—	mW
Input Resistance	R_{IN}	Pin 8	—	250	—	kΩ
Power Supply Rejection	PSRR	$C_D = 500 \mu F$, $f_{ripple} = 120 Hz$	28	34	—	dB

The ULN2283B is essentially the audio stage from the TDA1083 AM/FM radio IC. It is the simplest audio IC yet - and rather more versatile than the LM380 by virtue of its wide operating voltage range (down to 2v before it really gets unusable).
The capacitor on pin1 is for supply ripple rejection, and in battery applications that require only low volume, this may either be reduced down to 4u7 or omitted.

Ambit Data: ULN2283 7 pages

LM3914 Dot/Bar Display Driver

General Description

The LM3914 is a monolithic integrated circuit that senses analog voltage levels and drives 10 LEDs, providing a linear analog display. A single pin changes the display from a moving dot to a bar graph. Current drive to the LEDs is regulated and programmable, eliminating the need for resistors. This feature is one that allows operation of the whole system from less than 3V.

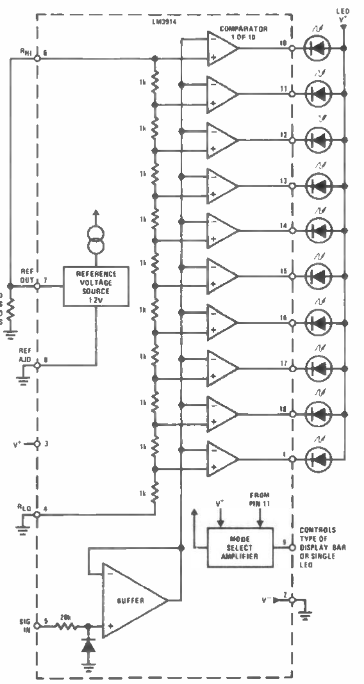
The circuit contains its own adjustable reference and accurate 10-step voltage divider. The low-bias-current input buffer accepts signals down to ground, or V^-, yet needs no protection against inputs of 35V above or below ground. The buffer drives 10 individual comparators referenced to the precision divider. Indication non-linearity can thus be held typically to 1/2%, even over a wide temperature range.

Versatility was designed into the LM3914 so that controller, visual alarm, and expanded scale functions are easily added on to the display system. The circuit can drive LEDs of many colors, or low-current incandescent lamps. Many LM3914s can be "chained" to form displays of 20 to over 100 segments. Both ends of the voltage divider are externally available so that 2 drivers can be made into a zero-center meter.

The LM3914 is very easy to apply as an analog meter circuit. A 1.2V full-scale meter requires only 1 resistor and a single 3V to 15V supply in addition to the 10 display LEDs. If the 1 resistor is a pot, it becomes the LED brightness control. The simplified block diagram illustrates this extremely simple external circuitry.

When in the dot mode, there is a small amount of overlap or "fade" (about 1 mV) between segments. This assures that at no time will all LEDs be "OFF", and thus any ambiguous display is avoided. Various novel displays are possible.

Much of the display flexibility derives from the fact that all outputs are individual, DC regulated currents. Various effects can be achieved by modulating these currents. The individual outputs can drive a transistor as well as a LED at the same time, so controller functions including "staging" control can be performed. The LM3914 can also act as a programmer, or sequencer.



Features

- Bar or dot display mode externally selectable by user
- Expandable to displays of 100 steps
- Internal voltage reference from 1.2V to 12V
- Operates with single supply of less than 3V
- Inputs operate down to ground
- Output current programmable from 2 to 30 mA
- No multiplex switching or interaction between outputs
- Input withstands ±35V without damage or false outputs
- LED driver outputs are current regulated, open-collectors
- Outputs can interface with TTL or CMOS logic
- The internal 10-step divider is floating and can be referenced to a wide range of voltages

The LM3914 will operate in a centre-zero mode of operation, thanks to the internally adjustable reference voltage.

The LM3914 is also available with 3dB log steps, part. no. LM3915. Certain applications that require wide dyanamic range may use LM3915s in cascaded configurations.

There are 26 pages of very useful design and application notes available for these devices which now seem established as the most popular of the programmable LED BGM drivers.

It should also be noted that both these drivers are capable of use with vacuum fluorescent displays if required.

Precision PPM System (WW August 1980)

For the price of the meter movement alone, this studio specification PPM provides the following facilities:

Dot or Bar mode indication
Attack time: 1mSec FSD
Decay: from 1mSec to infinity
Response (-3dB) 3Hz to 100kHz.

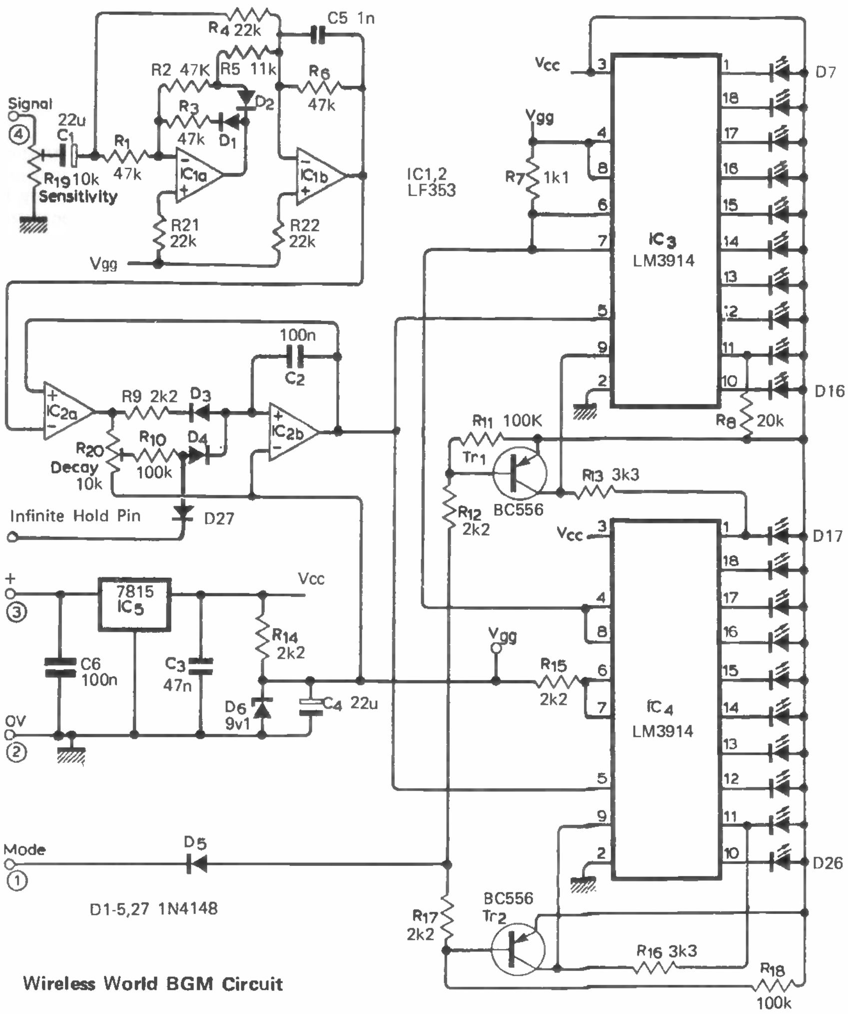
Being entirely repeatable, the unit can be used for any number of audio channels with no problems about matching - once the inital sensitivity and decay times have been set.

Any mixture of LEDs can be used - but since the forward current is set to approx. 10mA in this design, the use of ultra high efficiency orange-red LEDs is not advised except as overload warning indictaion.

The basic unit can be supplied with any mixture of colours in the AEG 2.5x5mm series LEDs.

The supply requirement is 17-35v - but since the bar mode maximum current is 220mA, care should be taken to increase the regulator heatsink area if a combination of high supply voltage and bar mode operation is required.

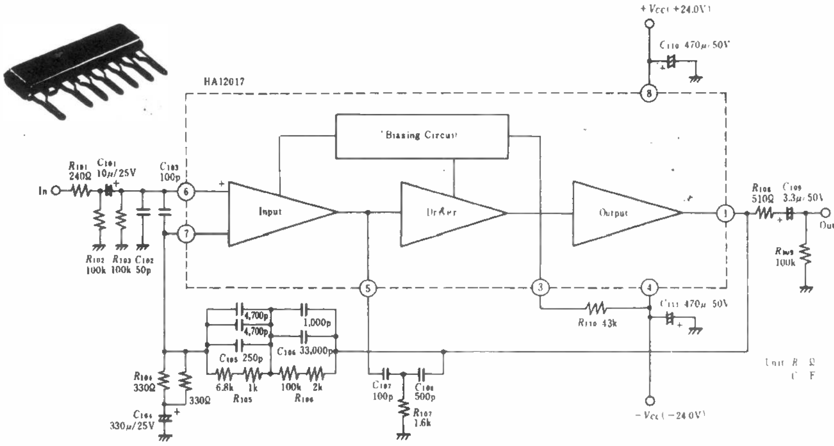
The kit supplied by Ambit incorporates 2% metal film resistors, and high stability polycarbonate capacitors in critical positions.



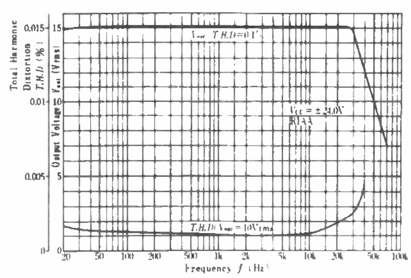
Wireless World BGM Circuit

Ambit Data: LM3914 12 pages LM3915 15 pages

At the risk of being contradicted, the HA12017 is the best audio preamp IC yet. Certainly it has no peer at the price - and even when compared to NE5534 series devices, the HA12017 is no worse - and by virtue of its low price and 10v RMS output capability - probably a lot better.



OUTPUT VOLTAGE AND TOTAL HARMONIC DISTORTION vs. FREQUENCY

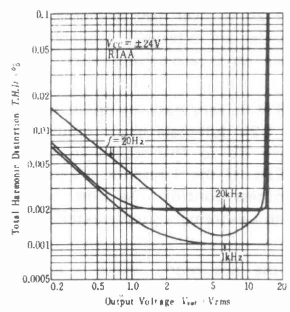


■ **ELECTRICAL CHARACTERISTICS** ($V_{CC}= \pm 24V$, $Ta = 25°C$)

Item*	Symbol	Test Conditions	min.	typ.	max.	Item
Quiescent Current	I_Q	no input signal	—	4.0	6.0	mA
Open Loop Voltage Gain	$G_{V(OL)}$	$f = 1kHz$	95	105	—	dB
Total Harmonic Distortion	THD	$f = 1kHz$, $V_{out} = 10V$	—	0.002	0.01	%
Output Voltage	V_{out}	$f = 1kHz$, $THD = 0.1\%$	13.5	14.7	—	V
Output Noise Voltage 1**	V_{n1}	$R_g = 43\Omega$, IHF-A Network	—	1.15	1.56	mV
Output Noise Voltage 2**	V_{n2}	$R_g = 3.3k\Omega$, BW = 20Hz to 20kHz	—	5.3	9.0	mV

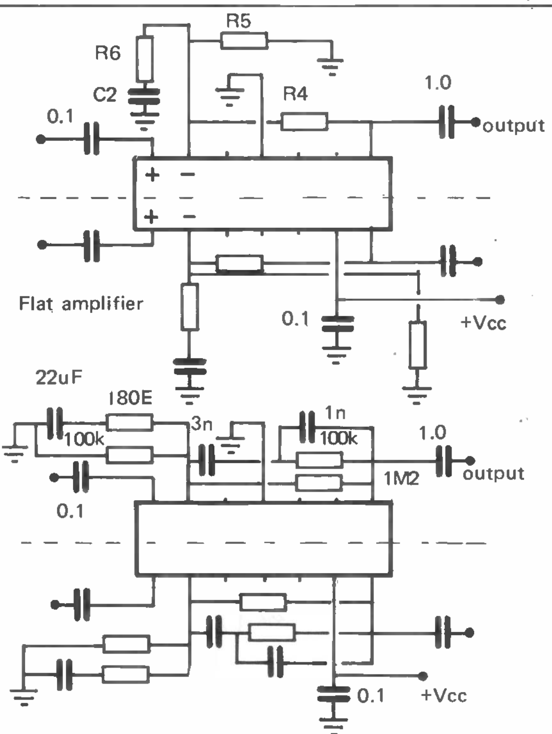
Notes : * All the items except $G_{V(OL)}$ is tested with RIAA curve and $G_V = 35.9dB$.
**These items are measured after the flat amplifier ($G_V = 40dB$).

TOTAL HARMONIC DISTORTION vs. OUTPUT VOLTAGE



The HA12017 will outperform any other pick-up preamp IC. The combination of ultra low noise, ultra low distortion and wide dynamic range can be matched only in discrete circuits employing about 5 to 10 times as many components. Don't listen to the biased raving of the HiFi pundits, since there is no better circuit available - yet. Hear one at work at Ambit and see for yourself. A complete stereo preamp PCB/kit is available to speed your appreciation of this superb IC.

Ambit Data: HA12017 4 pages



RIAA amplifier
(Input should be loaded to suit cartridge impedance)

In view of the wide bandwidth of the LM381, a ferrite bead should be placed as near to the input pins as possible - and the power supply should be decoupled as close to pin 9 as possible via a 0.1uF.
An additional capacitor (between pins 5/6 and 10/11) provides an HF rolloff facility - details of which are included in the LM381 application note.

Ambit data: LM381 12 pages

The LM381

The LM381 is an extremely high gain preamp for dual channel operation - the layout of pin functions is essentially symmetrical, allowing best channel isolation, and preventing feedback instability. Once again it may be likened to an op-amp, characterized for audio applications. It has very many HiFi applications in filter stages, preamps, tone controls etc., and also instrumentation applications, where the high gain is available over a wide bandwidth. An applications and design leaflet is available, with most formulae and worked examples applicable to various op-amp amplification stages.

Specifications at 14v Vcc

Parameter	unit	typ
Input resistance	ohm	100k (+ input)
		200k (- input)
Open loop voltage gain (single ended)	V/V	320,000
Supply voltage range	v	9 - 40v
Supply current	mA	10
Output resistance (open loop)	ohm	150
Output current source	mA	8
sink	mA	2
Output voltage swing	V	Vcc - 2
Small signal bandwidth	MHz	15
Power bandwidth 20v pp output	k Hz	75
Maximum input voltage for linear op	mV	300
Supply rejection ratio	dB	120
Channel separation	dB	60
THD with 75dB gain at 1kHz	%	0.1
Total equiv. input noise (Rs 600ohm)	uV rms	0.55
Noise figure 50k 10 - 10kHz	dB	1.0
10k 10 - 10kHz	dB	1.3
5k 10 - 10kHz	dB	1.6

Determining gain: in the 'Flat' (ie no frequency compensating feedback) configuration:

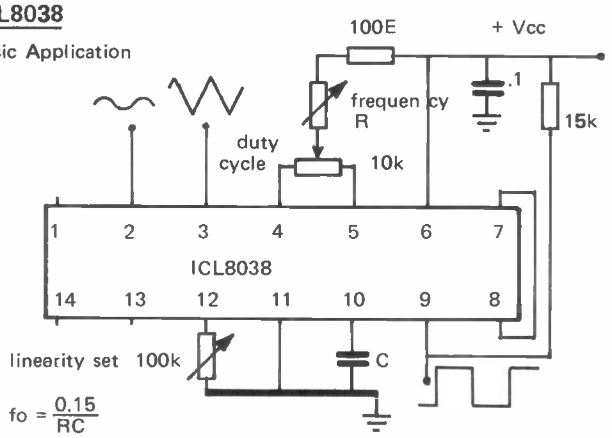
$\frac{R4 + R6}{R6}$ and C2 sets lower -3dB point where $C2 = \frac{1}{2\pi F_o R6}$

$$C\ rolloff = \frac{1}{2\pi f \cdot 2,600 \cdot 10^{A/20}}$$

where f is the HF -3dB point, A is the mid-band gain in dB

ICL8038

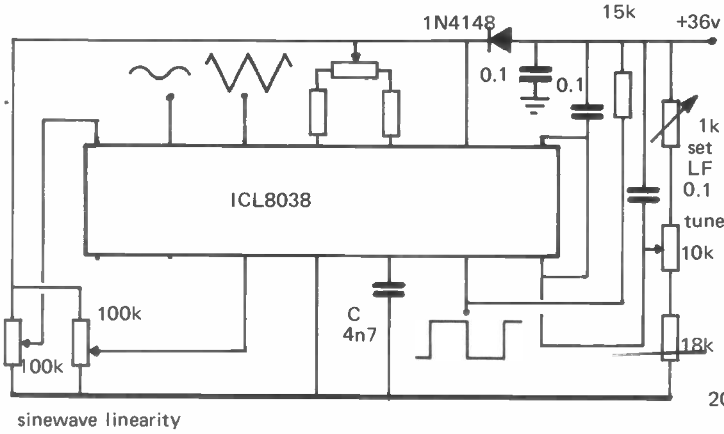
Basic Application



The 8038 is an exceptionally versatile waveform source for various applications in test equipment, musical sources, tone generation. Sine, square and triangle outputs are simultaneously available, with excellent amplitude stability.

Specifications

Characteristics	unit	min	typ	max
Supply voltage	V	10		30
Supply current	mA		12	20
Frequency range	Hz	.001		1M
FM linearity	%		0.2	
Square wave amplitude	xVcc		0.9	
Rise time	nS		100	
Fall time	nS		40	
Duty cycle adjustment	%	2		98
Triangle amplitude	xVcc		0.33	
Linearity	%		0.05	
Sine wave amplitude	xVcc	0.2	0.22	
THD in 1M	%		0.8	3



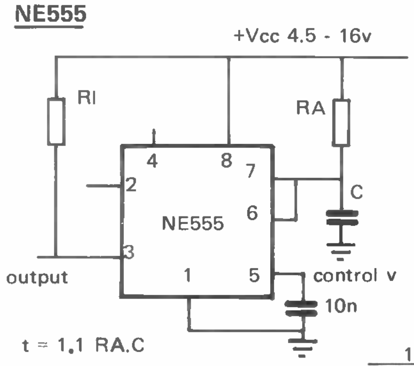
20Hz to 20kHz audio oscillator

The circuit shown here represents a complete AF signal source. The outputs should be buffered in voltage followers, and provided with attenuators to suit the desired application

The 8038 may also be used as a linear FM source - or phase locked to a reference in synthesis applications. The sweep input (pin8) permits operation in a variety of effects modes - and consequently, the 8038 has frequently featured in circuits published over the past couple of years. (Ambit were the first to bring you the 8038 - now almost a 'standard' !)

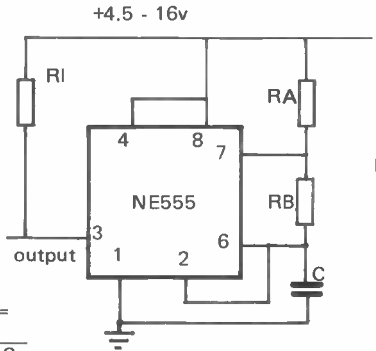
Ambit Data: ICL8038 4 pages

NE555



t = 1.1 RA.C

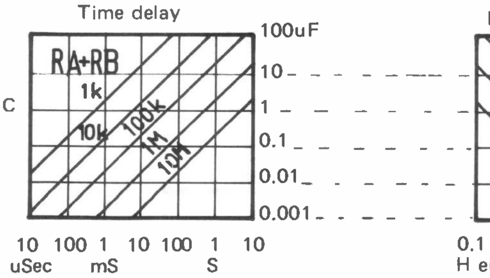
monostable - one-shot



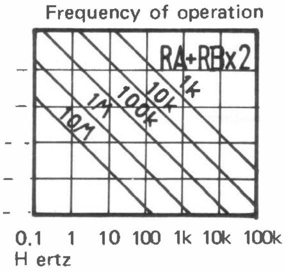
f = 1.46 / [RA+2RB] C

multivibrator

Time delay



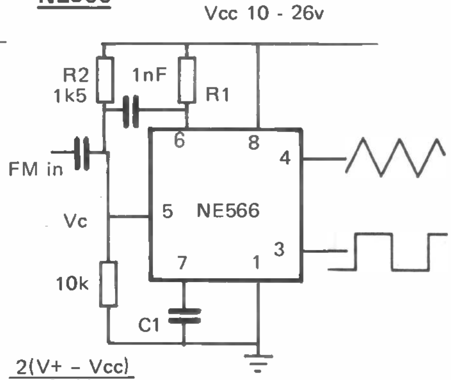
Frequency of operation



The standard timer: microseconds to hours

Specifications				
Parameters	unit	min	typ	max
Supply voltage	v	4.5		16
Temperature drift	ppm/°C		150	
Supply voltage drift	%/V		0.01	
Threshold voltage	%Vcc		66	
Trigger voltage at Vcc 15v	V		5	
5v	V		1.67	
Trigger current	uA		0.5	
Reset voltage	V	0.4	0.7	1.0
Current sink/source	mA			200
Power dissipation	mW			600

NE566



fo = $\frac{2(V+ - Vcc)}{R1.C1.Vcc}$

The NE566V is a wide range triangle/square wave function generator which can also be modulated over a ten to one range by a suitable choice of components

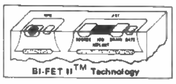
The NE566 is widely used in MF tone signalling and communications, and may be used in some 8038 applications where the sinewave output is superfluous.

Ambit Data: NE555 5 pages
Ambit Data: NE566 3 pages

	min	typ	max	
Supply voltage V	10		10	
Temp drift ppm.		200		
Supply current mA		7	12.5	
Max frequency MHz		1		
Supply v drift %/V		2		
Control terminal input impedance ohm		1M		
output impedance ohm		50		
Triangle output V		2.4		pp Vcc 12
Square output V		5.4		pp Vcc 12
Rise time nS		20		
Fall time nS		50		

National Semiconductor

Operational Amplifiers/Buffers


BI-FET II™ Technology

LF351 Wide Bandwidth JFET Input Operational Amplifier

General Description

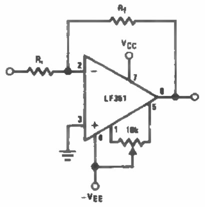
The LF351 is a low cost high speed JFET input operational amplifier with an internally trimmed input offset voltage (BI-FET II™ technology). The device requires a low supply current and yet maintains a large gain bandwidth product and a fast slew rate. In addition, well matched high voltage JFET input devices provide very low input bias and offset currents. The LF351 is pin compatible with the standard LM741 and uses the same offset voltage adjustment circuitry. This feature allows designers to immediately upgrade the overall performance of existing LM741 designs.

The LF351 may be used in applications such as high speed integrators, fast D/A converters, sample-and-hold circuits and many other circuits requiring low input offset voltage, low input bias current, high input impedance, high slew rate and wide bandwidth. The device has low noise and offset voltage drift, but for applications where these requirements are critical, the LF356 is recommended. If maximum supply current is important, however, the LF351 is the better choice.

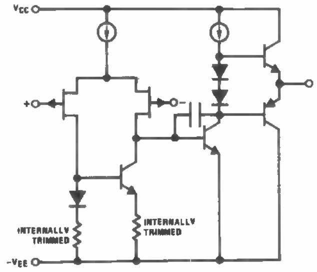
Features

- Internally trimmed offset voltage 2 mV
- Low input bias current 50 pA
- Low input noise voltage $16\ nV/\sqrt{Hz}$
- Low input noise current $0.01\ pA/\sqrt{Hz}$
- Wide gain bandwidth 4 MHz
- High slew rate 13 V/µs
- Low supply current 1.8 mA
- High input impedance $10^{12}\Omega$
- Low total harmonic distortion $A_V = 10$, $R_L = 10k$, $V_o = 20\ Vp\text{-}p$, BW = 20 Hz–20 kHz <0.02%
- Low 1/f noise corner 50 Hz
- Fast settling time to 0.01% 2 µs

Typical Connection

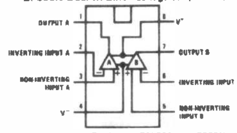


Simplified Schematic



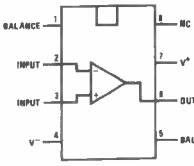
Connection Diagrams

LF353N Dual-In-Line Package (Top View)



Order Number LF353AN, LF353BN or LF353N
See NS Package N08A

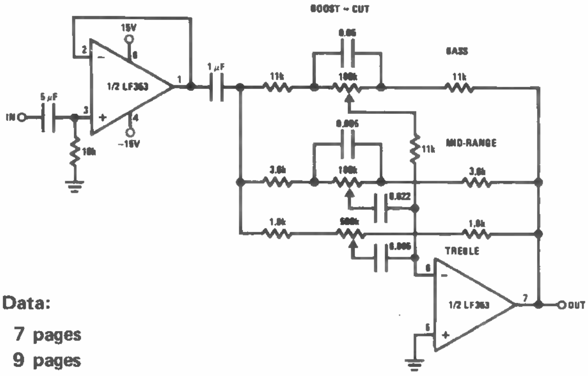
Dual-In-Line Package

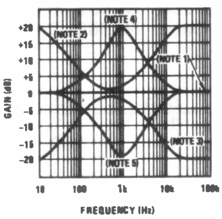


Order Number LF351N, LF351AN, LF351BN
See NS Package N08B

Typical Applications

Three-Band Active Tone Control





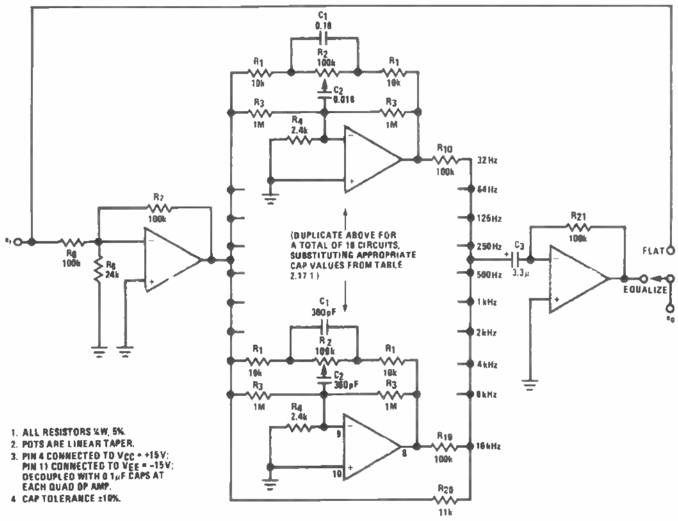
Note 1: All controls flat.
Note 2: Bass and treble boost, mid flat.
Note 3: Bass and treble cut, mid flat.
Note 4: Mid boost, bass and treble flat.
Note 5: Mid cut, bass and treble flat.

- All potentiometers are linear taper
- Use the LF347 Quad for stereo applications

Ambit Data:

LF351 7 pages
LF353 9 pages

It's hard to find anything inspiring to add to a page about op-amps. So I wont.



1. ALL RESISTORS ¼W, 5%.
2. POTS ARE LINEAR TAPER.
3. PIN 4 CONNECTED TO V_{CC} = +15V; PIN 11 CONNECTED TO V_{EE} = -15V; DECOUPLED WITH 0.1µF CAPS AT EACH QUAD OP AMP.
4. CAP TOLERANCE ±10%.

FIGURE 2.17.2 Ten Band Octave Equalizer

① ALL CONTROLS FLAT
② 500Hz BOOST/CUT, ALL OTHERS FLAT
③ 1kHz BOOST/CUT, ALL OTHERS FLAT
④ 500Hz, 1kHz, 2kHz, 4kHz BOOSTED ALL OTHERS FLAT

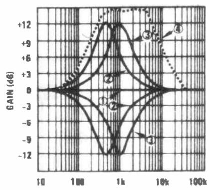
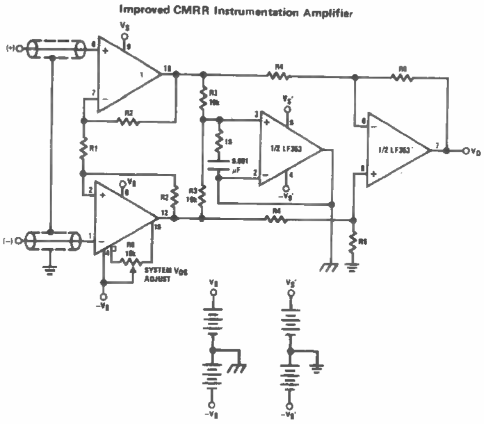


FIGURE 2.17.3 Typical Frequency Response of Equalizer

Typical Applications (Continued)

Improved CMRR Instrumentation Amplifier

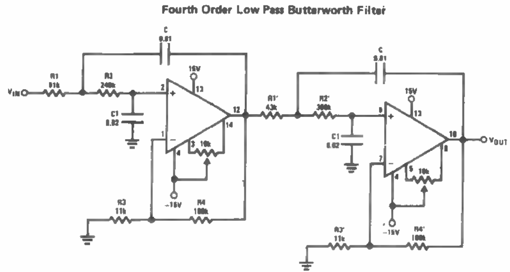


$$A_V = \left(\frac{2R2}{R1} + 1\right)\frac{R5}{R4}$$

⏚ and ⏚ are separate isolated grounds
Matching of R2's, R4's and R5's control CMRR
With A_{VT} = 1400, resistor matching = 0.01%: CMRR = 136 dB

- Very high input impedance
- Super high CMRR

Fourth Order Low Pass Butterworth Filter



- Corner frequency $(f_c) = \sqrt{\frac{1}{R1R2C C1}} \cdot \frac{1}{2\pi} = \sqrt{\frac{1}{R1'R2'CC1'}} \cdot \frac{1}{2\pi}$
- Passband gain $(H_O) = (1 + R4/R3)\ (1 + R4'/R3')$
- First stage Q = 1.31
- Second stage Q = 0.541
- Circuit shown uses nearest 5% tolerance resistor values for a filter with a corner frequency of 100 Hz and a passband gain of 100
- Offset nulling necessary for accurate DC performance

Overload, offset and thermal protection system

The HA12002 is an exceptionally versatile IC for monitoring various DC and AC conditions in connection with a relay 'trip'.

It is primarily aimed at audio amplifier systems, or though could equally readily be used in a wide number of other 'monitor' functions, such as transmitters:
SWR protection
Overdrive sensing
Thermal runaway
Fast interruption of transmit supply will result if any of the above occur, to save the PA and drivers from damage

Or power supplies:
Overheating, slow output decay, overvoltage and glitches in the mains supply.

Slot machine security trip etc

The protection is basically latching - but automatic reset may be achieved by simply grounding one pin.

Features

Switch on delay

A variable switch on delay prevents the inrush of current from damaging the load at a time when various bias levels may not have completely settled. These problems are usually brought about by the differing charge rates of capacitors decoupling the sensitive low signal level stages at the front end of the amplifier - leading to very large displacements at the output terminals.

Switch off instantly

When the amplifier is switched off, the main PSU reservoir capacitors can take a long time to discharge completely - and in the process cause distortion and instability on the way down. The IC will monitor the AC input to the rectifier and accordingly react the moment the AC signal disappears. This facility has hidden value - since that with many mains switches, the connections may be slightly 'noisey' or imperfect - leading to intermittent contact at the point of switchover that could otherwise cause loud and potentially damaging transients to pass through the amplifier to the load. The instant cut-out will prevent these transients getting past the relay stage.

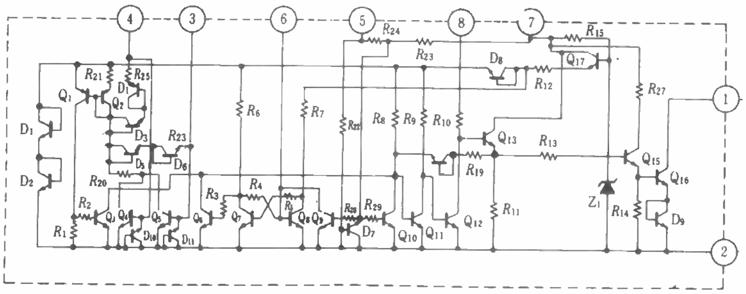
DC offsets

The major concern of the owner of a pair of costly loudspeakers is the damage that can occur due to DC offsets at the loudspeaker terminals. Not only in DC coupled output stages - but also in amps with capacitor coupled outputs where there is a distinct danger of the output capacitor going 'short circuit' in the fullness of time. The HA12002 can look out both channel outputs independantly or simultaneously - although in the case simultaneous operation, it is just possible that equal and opposite DC shifts would cancel and leave the load unprotected. With more than 1v of DC at the output of the amplifier, the HA12002 will release the relay, and remain off until the fault has been checked, and the relay control unit has been manually reset.

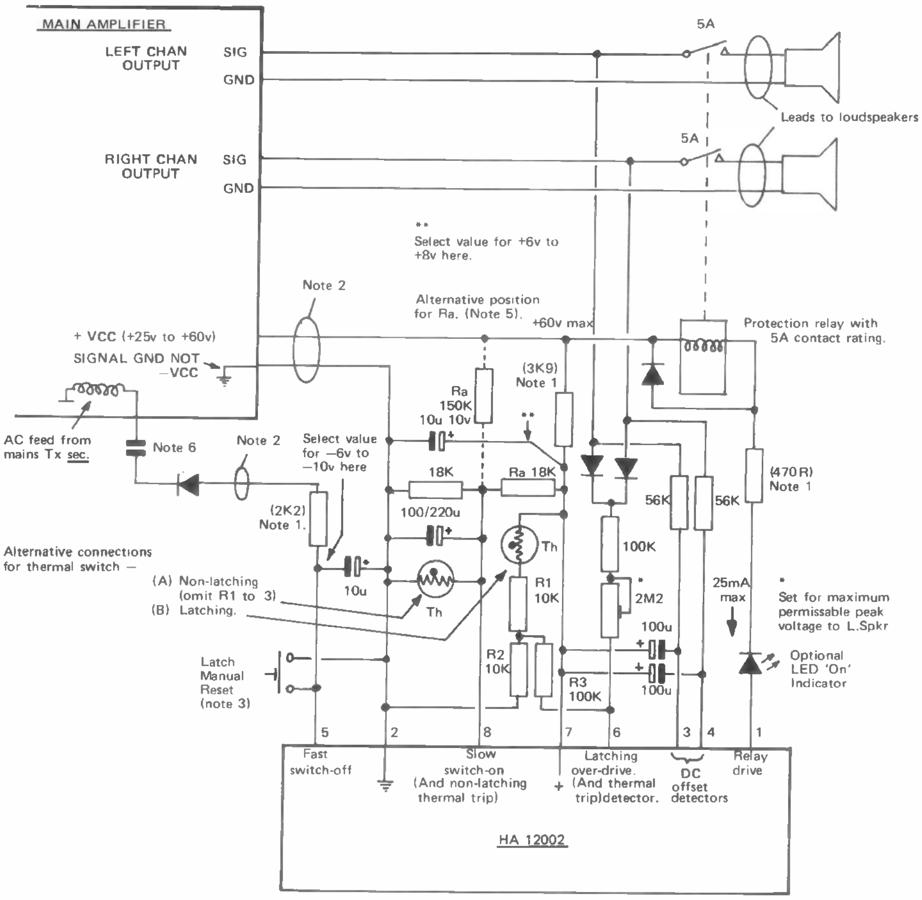
Overload protection

Thermal overload is a classic means of destroying a bipolar amplifier. Although most biassing arrangements try to prevent thermal runaway - sometimes they cannot cope and destruction results.
The HA12002 has a thermal sensing facility which will monitor heatsink or cabinet temperatures to ensure that the safe area of operation is not exceeded. More than one sensor can be connected, so that items such as the mains transformer, rectifiers etc may be simultaneously checked. This facility is nominally self-resetting once the equipment has cooled down - but may be made latching if required.

Internal HA12002 diagram - the full data (5 pages) gives details of the logic configurations and determination of all component values for a wide variety of supply voltages. The max relay drive current is 80mA provided total device dissipation does not exceed 400mW.



CIRCUIT OF A TYPICAL APPLICATION OF THE HA 12002



Overdrive

This is one of the most important safety facilities with modern high powered amplifiers - yet only infrequently used. Many HiFi amps are matched to loudspeakers of less than adequate ratings. Our HMOS PA is a good example - since although rated at 100W RMS nominal per channel, peak and 'pulse' overload can drive it to 150+W per channel - and only a few well designed loudspeakers (Rogers and Chartwell are good examples) can cope with that sort of mistreatment. Overdrive can result from all sorts of misuse, ranging from simply playing the amp too loud - to the more usual problem of dropping the stylus - or connecting a phono connector with the power on - where the signal lead makes contact before the earth does.

Thus any accidental blast of power will trip the loudspeaker protection relay until the reset is cleared - or the equipment is turned off and on again.

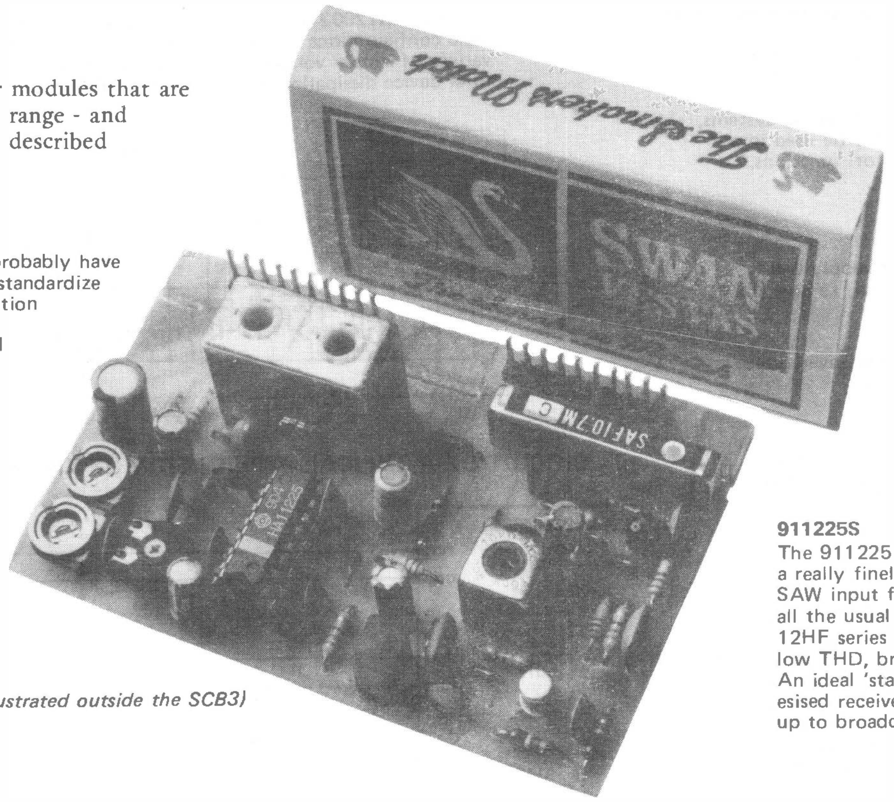
Notes

1. Values shown in brackets are typical for a +60v supply rail.
2. The +ve, ground and ac feeds can be derived either from the main amplifier or external PSU.
   The fast switch off facility will be retained if the mains to the PSU is switched via the main amplifier.
3. The manual reset is an optional facility. The latch will normally be reset by switching the mains power off and then on again.
4. All diodes are 1N4002
5. If the main amplifier PSU charge up time is to be included in the overall switch-on delay, then Ra is connected to the +Vcc rail of the main amplifier. A suitable value for Ra is 150K.

Picture round up

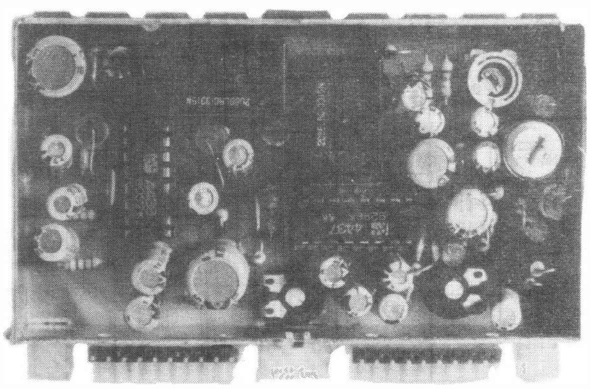
Some of the newer modules that are in the Ambit 1981 range - and some you will find described herein.

Ambit followers will probably have noticed our moves to standardize the format of presentation of our radio modules in these small screened enclosures - which are themselves available from our general range of radio components.

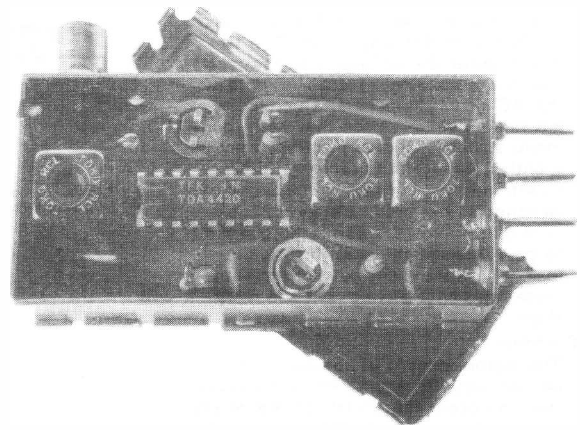


(Illustrated outside the SCB3)

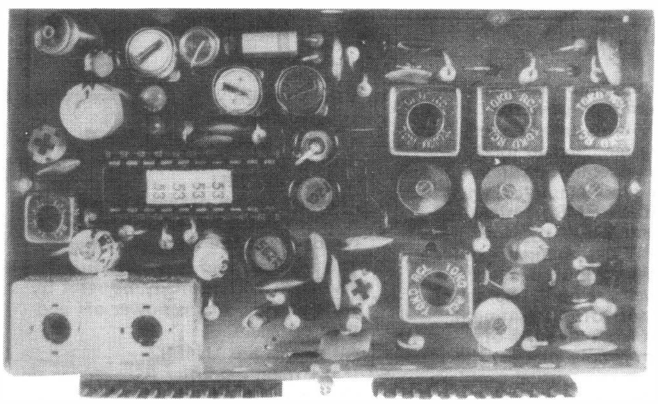
911225S
The 911225 as described in pt. 3 - but a really finely honed version with an SAW input filter, DC bandwidth switch, all the usual 911225 features - and the 12HF series detector assembly for ultra-low THD, broad tuning and high stability. An ideal 'state-of-the-art' IF for synthesised receivers, with performance well up to broadcast monitor standards.



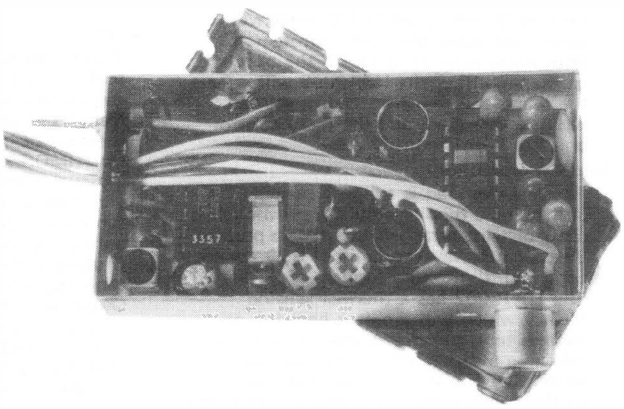
944378
The 944378 of pt. 2 of the catalgue - but now available in a shrunk format to fit one of the standard size screened boxes. Performance to match the 911225S - an ultra low noise, low distortion stereo decoder.



94420
A compact simultaneous AM/FM IF and demodulator - also capable of handling TV. Described elsewhere in this issue - includes AFC, AGC and video level adjustment.



92240
The 92240 extensively described elsewhere in this edition, but with the 12HF low distortion FM detector system. Available from March 81 on.



933402
A very low current AM/NBFM/800mW AF receiver subsystem - including a tone/noise squelch from the NBFM detector.

High Resolution Plotter Control

Although these devices are primarily intended for high resolution machine control (to 24 bit definition), they may be used for generating graphics displays on CRTs, driving radar arrays, guiding laser equipment etc.

The KM3701 is controlled from an 8 bit data bus, requiring information from the host CPU to advise it if the plot between the two coordinates supplied is:

a) A straight line
b) A circle
c) A parabola
d) Exponential
e) Logarithm

When the KM3701 has reached the end point set in the original CPU instruction, it provides an interrupt to request a further set of instructions to continue the plot.

The pulse distribution rate is 100kHz for straight lines, and 50kHz for other types of plot - ie 10 and 20 clock cycles respectively. So, depending on the degree of resolution you wish to employ, coordinate plotting is an extremely fast and easy task to accomplish.

A full description of the internal organization and function of the KM3701 is available from our data services. (16 pages)

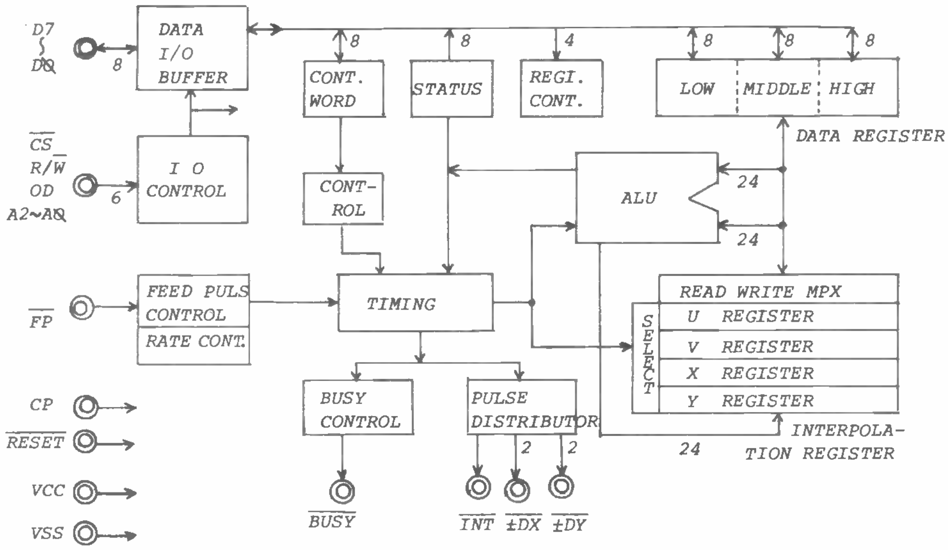
The KM3702 is an output verifying device for checking the excursion of the plotting medium with reference to predetermined limits. The obvious application in NC machine tool systems is to prevent the machine being driven into the boundaries of the piece of material - or to prevent damage due to the equipment trying to mill itself.

However, the KM3702 also monitors the output of the KM3701 axis control (one axis only) to generate output pulses that are proportional to the input pulse difference to drive a 16 bit D/A.

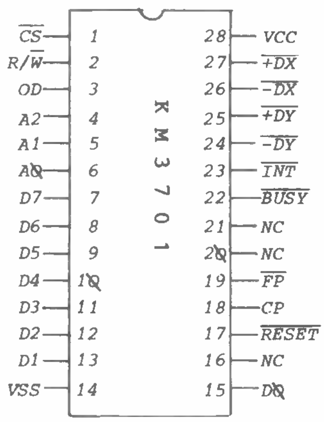
For general system monitor purposes, the KM3702 uses two internal 24 bit synchronous up/down counters - the contents of which may be read if required.

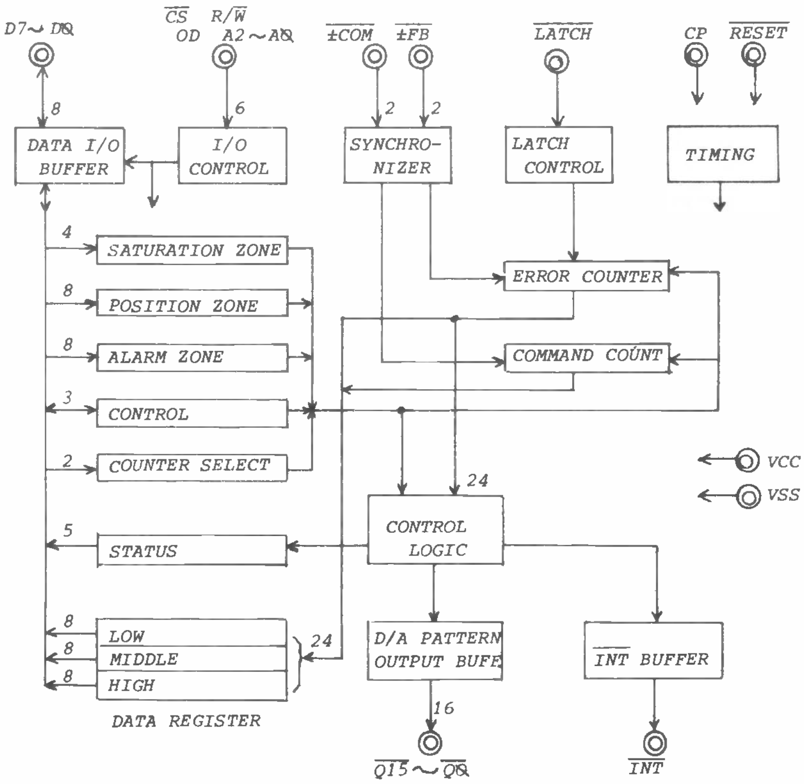
When an "overrange" signal is detected, it may first be recognized as the 'saturation zone' which selects the bit number for the D/A drive. Or if it is well outside the boundary of the required plot, then an alarm interupt stops the system and advises the CPU accordingly.

The combination of the KM3701 and KM3702 provides the designer with an exceptionally compact and direct means of coordinate control and generation - advice on applications is available from Ambit Data Systems department.



Pin Assignment:





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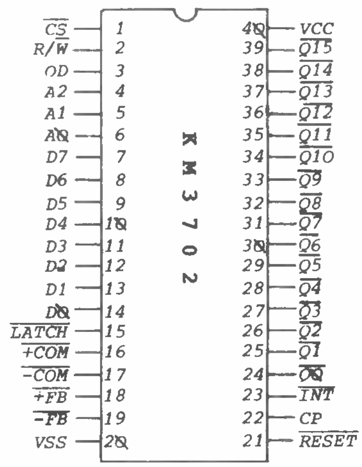
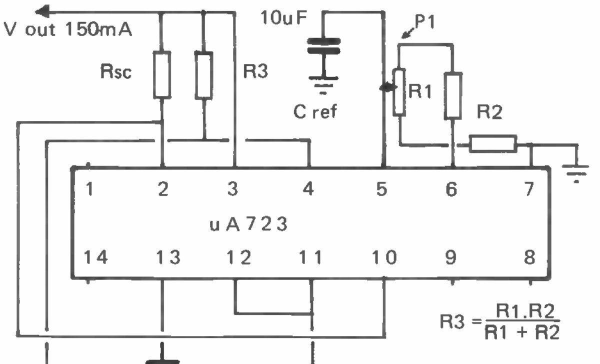
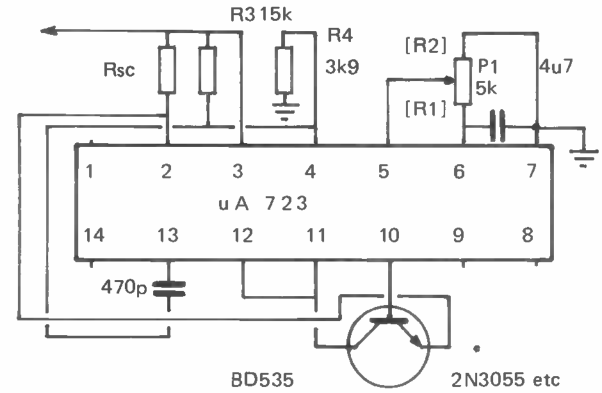


Voltage / Power supply regulators — uA723/NE550 and 78XX series



Basic regulator



Values chosen for 7 -35v output range

High current regulator with external NPN pass transistor

The 723 is the classic IC voltage regulator IC. With few external parts, the device can be made into a complete PSU of extremely high performance. Once again, remember that HF considerations apply, so good supply decoupling is necessary

Specifications uA723CN

Continuous input voltage	40	v
Power dissipation max.	660	mW
Operational temp range	0 - +70°	C
Line regulation Vin 12-15v	.01	%
12-40v	0.1	%
Load regulation load current 1mA-50mA	.03	%
Ripple rejection 50Hz to 10kHz	86	dB
Av. temp coeff. of output	.003	%/°C
Short circuit current limit (Rsc 10Ω)	65	mA
Output noise voltage C ref 10uF	2.5	uV
Standby current drain	1.3	mA
Input voltage range	9.5 - 40	v
Output voltage range	2.0 - 37	v
Input/output voltage differential	3.0 - 38	v

Pin functions (DIL package)
1: nc 2: current limit 3: current sense 4: Inv. input
5: non-inv. input 6: Vref 7: V- 8: nc 9: V zener
10: V out 11: Vc 12: V+ 13: Frequency comp
14: nc

The 723 output voltage is determined by the following

in the basic regulator circuit: $V\ ref\ \frac{R1 + R2}{R2} = Vo$

and the current limit I limit = Sense voltage/Rsc

In the case of the pass transistor output version:

$Vo = V\ ref\ \frac{R2}{R4} \cdot \frac{R3 + R4}{R1 + R2}$

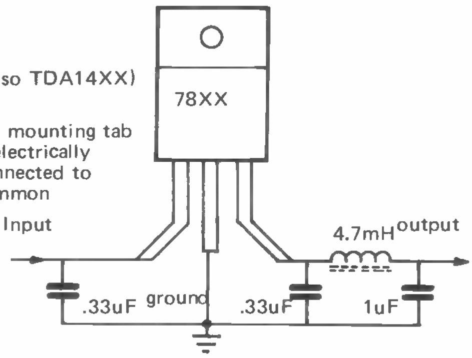
Sense voltage = 0.66 v at 20° 0.57v at 75° (C)

(Full manufacturer's data (National) 5 pages)

78XX series three terminal voltage regulators

(also TDA14XX)

the mounting tab is electrically connected to common



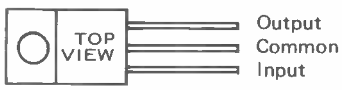
Three terminal voltage regulators are now well established as the leading means of achieving power regulation at fixed voltages. They are thermally protected and compensated - and apart from a tendency to produce RF noise, they are ideal for any application within their specification.

Specifications

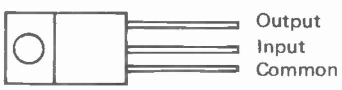
PARAMETER		78XXC	78MXXC	78LXXC
Max load current	A	1	0.5	0.1
P dissipation free air	W	2*	1.0	0.7†
P .. inf heat sink	W	15	5	1.7
Max load regulation	%	2	2	2
Max line regulation	%	2	2	2
Max quiescent I	mA	8	8	6
Typical ripple rejection	dB	70	65	74
Typ. dropout voltage	V	1.5-2	1.5-2	1.5-2
Thermal resistance	°C/W	4*	5*	40†
Max input voltage **	V	35	35	35

* TO220 † TO92 ** 40v for 20 & 24v devices

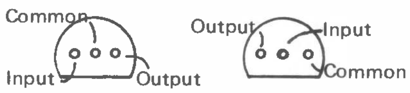
BASE CONNECTIONS



78 and 78M Series



79 Series



78L Series 79L Series

The three basic types offered here are positive voltage regulators where the main selection factor is the power dissipation sought. This is determined by subtracting the output voltage from the input voltage, and multiplying by the max current required.

eg 18volts in, 12v out at 200mA
6 x 0.2 = 1.2W

which is either covered by the 7812UC in free air conditions or the 78M12UC with a small heatsink. The heatsink is derived from the heatsink transfer characteristics, given in the form of the numbers of degrees C by which the heatsink ambient temperature rises per watt dissipated.

The maximum junction temperature is not the case temperature ! Where the max. junction temperature is given as 125°C - this indicates the onset of the thermal shutdown, so always aim to achieve a case temperature of 100°C max to allow for rises in ambient temperature conditions.

See Price List for stock types and voltages.

Earthing, once again, deserves special attention. As a general rule it is best to earth the regulator circuit to the same point as the rectifier / transformer circuit. The 78XX series are just as prone to HF instability as any other linear gain system, and so please note the careful decoupling described above. The 'π' section LC filter shown is advised for PSUs in radio reception equipment, in DC and AF applications, simply use 1uF - though better ripple rejection may be achieved with 100 -470uF.

Discrete Semiconductor Summary : Bipolar, FET, MOSFET, PIN, VARICAP, LED

The selection listed here may seem rarher abrupt when compared to the total range of semiconductor types available. But we have been careful to avoid including any obsolete or irrelevent types (eg why list 10 alternatives for a BC238?). There are precious few applications where other types of small signal devices are required - especially since our range includes the lowest noise types available - coupled with 120v ratings. The full range of AEG types is available for OEM users, but more of our customers are coming to appreciate the general principle of keeping the range of parts used 'short and sweet'. The same philosophy applies to the small signal RF selection - but here the question of 'horses for courses' is more relevant as far as the bipolar selection is concerned. Thankfully, though, FETs and MOSFETs are very interchangeable due to the extremely straightforward biasing techniques, and the range we offer combines reliability, performance and low cost as a result of the high volume usage of 'standard' lines.

SMALL SIGNAL AUDIO TRANSISTORS

		Ic max mA	Vceo volts	Ft at Ic MHz/mA	Hfe typ	Ptot mW	NF dB/1kHz
BC237	NPN plastic BC107 series	100	45	300/10	200	300	10max
BC238	NPN plastic BC108 series	100	20	300/10	200	300	10max
BC239	NPN plastic BC109 series	100	20	300/10	450	300	4max
BC307	PNP comp to BC237	100	45	300/10	200	300	10max
BC308	PNP comp to BC238	100	25	130/10	300	300	10max
BC309	PNP comp to BC239	100	20	130/10	450	300	4max
BC413	NPN 30v (lo noise BC239)	100	30	250/10	450	250	3max
BC414	NPN 40v (lo noise BC237)	100	45	250/10	350	250	3max
BC415	PNP 35v (nr comp to BC413)	100	35	200/10	350	250	2max
BC416	PNP 45v (nr comp to BC414)	100	45	200/10	350	250	2max
BC546	NPN 65v	100	65	300/10	300	500	10max
BC556	PNP comp to BC546	100	65	150/10	180	500	10max
BC550	NPN 45v lo noise	100	45	300/10	350	500	3max
BC560	PNP comp to BC550	100	45	150/10	350	500	2max
BC639	NPN 80v lamp/ 1watt	1000	80	50/50	100	1000	
BC640	PNP comp to BC639	1000	80	50/50	100	1000	
2SC1775A	NPN 120v lo noise	50	120	200/10	700	300	1.5max
2SA872A	PNP 120v comp to 2SC1775A	50	120	120/2	500	300	1.5max
2SD666A	NPN 100v 900mW driver	50	100	140/10	100	900	
2SB646A	PNP 100v comp to 2SD666A	50	100	140/10	100	900	
2SD668A	NPN 160V 1W driver TO-126	50	160	140/10	100	1000	
2SB648A	PNP 160v comp to 2SD668A	50	160	140/10	100	1000	
2SD760	NPN 200v 25 watt driver	2A	200	100/150	115	25W	
2SB720	PNP 200v comp to 2SD760	2A	200	100/150	125	25W	
2SC2546E	NPN 90v ultra lo noise	100	90	90/2	800	400	0.5*
2SA1084E	PNP 90v comp to 2SC2546E	100	90	90/2	800	400	0.5*
2SC2547E	NPN 120v ultra lo noise	100	120	90/2	800	400	0.5*
2SA1085E	PNP 120v comp to 2SC2547E	100	120	90/2	800	400	0.5*

*nV per root Hertz

AUDIO POWER DEVICES

2SD753	200v/150W NPN	15A	200	120	150W
2SB723	200v/150W PNP Comp to 753	15A	200	120	150W
2SK134	140v/100W N-Ch MOSFET	7A	140	1S	100W
2SK135	160v/100W N-Ch MOSFET	7A	160	1S	100W
2SJ 49	140v/100W P-Ch MOSFET	7A	140	1S	100W
2SJ 50	160v/100W P-Ch MOSFET	7A	160	1S	100W
2SK227	2SK135 in flatpak	7A	160	1S	100W
2SJ83	2SJ50 in flatpak	7A	160	1S	100W
BD377	60v/25W NPN	2A	60	80	25W
BD378	60v/25W PNP comp to BD377	2A	60	80	25W

SMALL SIGNAL RF DEVICES

							NF/MHz
BF194	General purpose NPN	100	20	260/1	125	250	4/100
BF195	(BF395)	100	20	200/1	80	250	4/100
BF224	Gen purpose NPN	150	30	800/7	55	360	4/100
BF241	Gen purp NPN	100	40	400/1	55	300	1.6/100
BF274	Gen purp NPN	100	20	700/1	120	200	2.5
BF440	Gen purp PNP (amp stages)	25	40	250/1	120	300	2
BF441	Gen purp PNP (osc stages)	25	40	250/1	80	300	2
BF362	UHF NPN T pack	20	20	800/1	20+	120	4.5/800
BF479	UHF PNP T pack	50	20	1850/10	20+	160	3.4/800
BF679S	UHF PNP T pack	30	35	800/2	70+	300	2-6/200
BFR91	UHF NPN ft 5000MHz	35	12	5000/14	50	180	2.4/500
BFW92	UHF NPN ft 1600MHz	25	15	1600/25	20+	130	4/500
BFT95	UHF PNP ft 5000MHz	25	15	5000/10	60	200	2/1000
BFY90	UHF in metalcan	25	15	1300/20	25+	200	5/500
40238	Metalcan RCA sim BFY90	35	15	1250/15	50	200	5/500

RF POWER/DRIVERS

VN66AF	VMOS/60v general purpose	2A	60	(50MHz)	.25S	15W
2N3866	800mW driver/output	400	30	10dB/100		5W

SMALL SIGNAL RF FET/MOST

BF256	N-ch JFET	10	25	8mS	200	2/100
2SK55	N-ch JFET	10	18	8mS	150	2/100
2SK168	N-ch JFET hi gain lo noise	10	30	10mS	200	1.7/100
J310	N-ch JFET	10	25	14mS	625	2.7/450
J176	P-ch JFET switch gate	50	30		350	
40822	Replaced by 3SK45					
40823	MOSFET (mixer)	50	20	12mS	330	2/100
40673	replaced by 3SK45 and 3SK51					
3SK45	(40822) VHF RF/Mix MOSFET	35	22	14mS	330	2.2/200
3SK51	Superior HF/VHF MOSFET	35	20	17mS	330	2.2/200
3SK60	Lo V, Lo IDss	33	18	16mS	330	2/200
MEM680	Lo noise VHF MOSFET	30	20	17mS	360	2.2/200
BF961	(BF900) plastic MEM680	30	20	9mS	200	2.2/200
BF960	UHF Hi gain, lo noise	30	20	24mS	200	2.8/400

VARICAP TUNING DIODES (spec applies to each diode in multiple units)

		Cap swing pF	V1:V Volts	Max Vr Volts	Max frequency for osc (MHz)
BA102	GP VHF/AFC etc	10-40	20-2	20	300
BA121	General VHF/AFC etc	3-10	20-2	30	300
ITT210	UHF/VHF AFC etc	6-16	14-4	20	1000
BB204B	(BB104) ...each diode...	20-70	20-0.8	30	300
BB105B	(BB205B)UHF tuning/afc	3-15	25-3	28	1000
BB109	VHF tuning/afc/modulator	5-30	25-3	28	300
MVAM115	replaced by KV1215/3 etc				
BB212	dual 1-8v AM tuning	25-500	8-1	15	15
KV1210	9v triple AM tuning (x3)	25-520	9-1	20	10
KV1211	9v dual AM tuning (x2)	25-520	9-1	20	10
KV1226	8v dual AM tuning (x2)	25-520	8-1	20	10
KV1235	8v triple AM tuning (x3)	25-520	8-1	20	10
KV1215	9v triple AM tuning (x3)	25-520	9-1	20	10
KV1225	25v triple AM tuning (x3)	18-550	25-1	30	40

SWITCHING, PIN DIODES & SCHOTTKY DIODES

		R on at mA ohms /mA	If max mA	Vr max volts	Cd at Vr pF/volts
1N6263	Schottky switch/mixer	0.4/1	15	60	2.2/0
BA182	RF switch diode (20v)	0.7 /5	100	35	1/20
BA244	RF switch diode (15v)	0.5 /10	100	20	2/15
BA379	PIN (alternative BA479)	0.7 /10	50	25	1/15
TDA1061	PI network PIN attenuator	5/10	50	30	na

SIGNAL/RECTIFIER DIODES - see price list for types available and brief specs

LEDS

NEW RANGE OF HIGH CONTRAST FLAT SURFACE SHAPED LEDS FROM AEG:

Shape	RED	ORANGE	GREEN	YELLOW
Round 3mm diameter	V-320	321	322	323
Square 3mm side	330	331	332	333
Equilateral triangle 3mm side	340	341	342	343
Round 5mm diameter	520	521	522	523
Square 5mm aide	530	531	532	533
Triangle with 5mm side	540	541	542	543
Triangle 2.5x5mm	550	551	552	553
Rectangle 2.5x5mm	510	511	512	513
5mm dome top (standard)	CQY40L	CQX38	CQY72L	CQY74L
5mm dome top clear lens end		CQX39B		
3mm dome top standard	V178	CQX41A	V179	V180
3mm dome top clear lens end	CQX25		CQX26	CQX27
2.5x5mm rectangular domed top	CQX10	CQX40	CQX11	CQX12

5mm INFRA RED EMITTER for remote control (Plessey, Siemens etc) CQY99
IR DETECTOR with filter for use as receiver of above BPW41
CNY37 IR optical coupler for safety trips, encoders, readers etc.

Varicap diodes

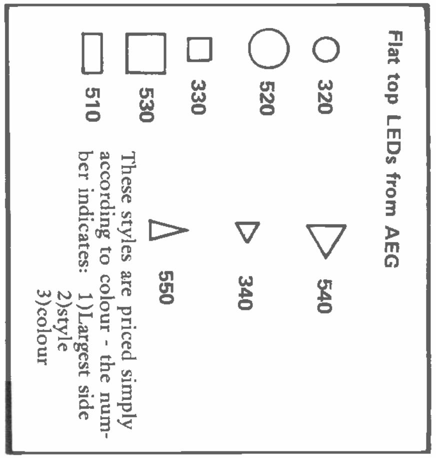
As the move to use varicap tuning gathers pace, we have extended what was already the most comprehensive stock range of general purpose tuning diodes to include types that are suitable for 3:1 band coverage with just 1-8v bias.
Since we have more experience in the use and application of these types of tuning diode than anybody else in the UK - please ask for advice when making a selection for a specific application.

Switch diodes

Whilst it is true that the standard types on 1N914 will 'do' for some RF switching applications, specifically designed switch diodes possess lower on resistance and much lower reverse capacitance for switching higher frequencies with good isolation. A PIN diode is the best choice of all, but its cost will prevent use except in the most demanding applications.

LEDs

AEGs latest series of high contrast flat surface LEDs will probably make all the earlier dome type redundant within a few years. These new diodes have near perfect even illumination of the face area - with 180^{o} viewing possible.
They use a technique of projecting the LED beam onto the front 'film', thus keep excellent contrast and low cost construction techniques. The basic shapes are drawn below.



Preferred Capacitor Types: Ceramic styles

The types illustrated here represent the styles of ceramic capacitor stocked by Ambit. The specific manufacturer may vary according to availability, but the general styles will remain the same.

The majority of ceramic capacitor applications are in RF, where the low inductance characteristics are most important. The basic two types are the ceramic disc/plate, and the monolithic ceramic capacitor (sometimes known as 'multilayer'). The dielectric constant may be likened to permeability in inductor core applications - since Hi-K dielectrics (high μ is the corresponding ferrite designation) pack a lot of capacitance into a small physical volume. But the penalty is that the dielectric tends to be relatively more unstable with regard to temperature.

In decoupling applications, which is the majority use for ceramic disc capacitors in RF circuits, the temperature coefficient ought to be unimportant. The majority of applications will tend to warm up rather than cool down in use - and the Hi-K characteristic is positive, leading to more capacitance - and possibly better decoupling action.

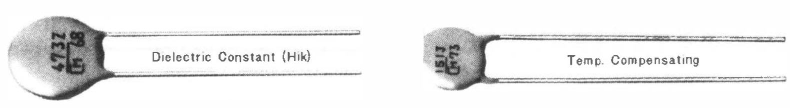
NPO= 0 ± 30ppm/^{o}C diel. constant 20-50
X7R= ± 15% from -55 to +125 ^{o}C (DC 2000)
Z5U= +22 to +56% from +10 to +85^{o}C (DC 8000)

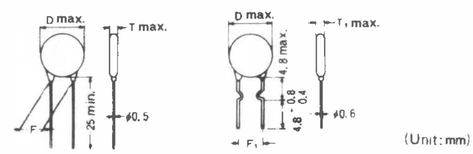
Specifically temperature compensating parts have the constant described as N^{xxx}, where the numbers after 'N' indicate the negative coefficient in ppm/^{o}C. The temperature characteristics are covered in great detail in data sheets relating to the specific type of capacitor used, and are available if your application requires specific information. These data sheets are available at standard charges, and are not free with each capacitor supplied.

The types listed beneath are specifically RF types, lead through devices being ideally suited to decoupling connections to screened assemblies - and the leadless types being suited to UHF decoupling where the faintest trace of lead inductance would cause unpredicted resonances that destroy the low impedance decoupling function at specific frequencies.

A complete catalogue of Murata capacitors is available, listing the world's broadest range of all types of ceramic capacitor. Only a restricted range is available on and ex-stock basis, and these are listed in current PLs.

50V Dielectric Constant (Hik.)

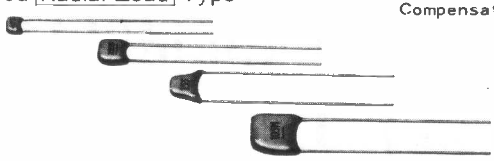




※1 ( ) Up to 470pF

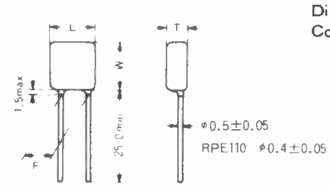
Part Number	Temp. Char. ❷/Cap. Value (pF) ❸					Dimensions (mm)				
	B	D	E	F	FZ	D max.	T	T_1	F	F_1
DD104-●●●● 50V	100~1000	—	—	—	—	4	3 (4) ※1	3.5 (4) ※1	2.5±1.0	5±0.8
DD105-●●●● 50V	1200·1500	—	1000~2200	4700	—	5	3	3.5	2.5±1.0	5±0.8
DD105-257●●● 50V	1800	—	—	—	—	5	3	3.5	5±1.5	5±0.8
DD106-●●●● 50V	2200·2700	3300	3300	6800	10000	6	3	3.5	5±1.5	5±0.8
DD107-●●●● 50V	3300~3900	4700	4700·6800	10000·15000	20000	7.5	3	3.5	5±1.5	5±0.8
DD108-●●●● 50V	4700	—	—	—	22000	8	3	3.5	5±1.5	5±0.8
DD109-●●●● 50V	5600·6800	6800	10000	22000	—	9.5	3	3.5	5±1.5	5±0.8
DD110-●●●● 50V	8200	10000	—	—	40000	10.5	3	3.5	5±1.5	5±0.8
DD111-●●●● 50V	—	—	15000	33000	47000	11	3	3.5	5±1.5	5±0.8
DD112-●●●● 50V	10000	15000	—	47000	50000	12.5	3	3.5	5±1.5	5±0.8
DD113-●●●● 50V	—	—	22000	—	68000	13.5	3	3.5	5±1.5	5±0.8
DD115-●●●● 50V	—	22000	—	—	100000	15	3	3.5	10±1.5	10±0.8

Dipped Radial Lead Type



Temperature Compensating

Part Number	Temp. Char. ●/Cap. Value (pF) ●			Dimensions (mm)			
	C△	R△	UJ	L max.	W max.	T max.	F±1.0
RPE110●●● 50V	0.5~470	3~560	3~750	3.5	3.0	2.5	2.5
RPE111●●● 50V	10~3900	—	—	5.0	5.0	3.15	2.5
RPE112●●● 50V	620~3900	—	—	5.0	5.0	3.15	5.0
RPE113●●● 50V	4300~13000	—	—	7.5	7.5	4.0	5.0
RPE114●●● 50V	15000~33000	—	—	10.0	10.0	4.0	5.0



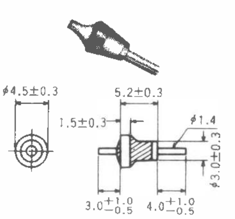
Dielectric Constant (HiK)

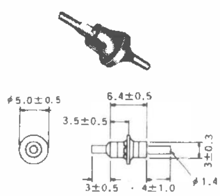
Part Number	Temp. Char. ●/Cap. Value (pF) ●		Dimensions (mm)			
	C	F	L max.	W max.	T max.	F± 1.0
RPE110●●● 50V	220~18000	1000~68000	3.5	3.0	2.5	2.5
RPE111●●● 50V	390~120000	15000~330000	5.0	5.0	3.15	2.5
RPE112●●● 50V	10000~120000	100000~330000	5.0	5.0	3.15	5.0
RPE113●●● 50V	150000~470000	470000~1500000	7.5	7.5	4.0	5.0
RPE114●●● 50V	560000~1200000	2200000~3300000	10.0	10.0	4.0	5.0

※△ : For cross reference with respect to temp. coeff., tol. and cap. value, see bottom of next page.

(Unit. mm)

Disk Feed Thru Type Capacitor

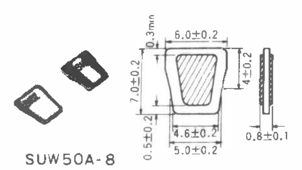




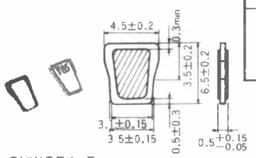
(Unit. mm) TF318-450E TF370—29

Part Number	Char. ❷	Cap. ❸	Cap.Tolerance❹
TF318-450E102P50V	E	1000	+100% −0
TF370-29●●● 50V	SL	2~ 10	±0.5pF
		12~ 33	± 10%
	YN	39~150	± 10%
	B	220 470 680	± 10%
	E	1000	+100% −0
	F	2200	+ 80% − 20

WedgeType



SUW50A-8



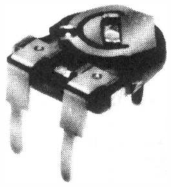
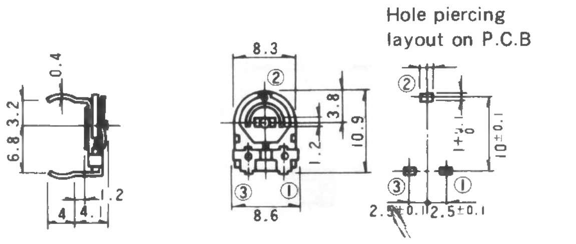
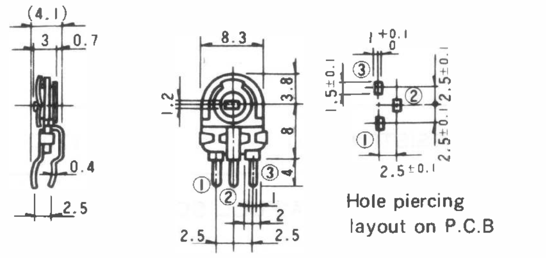
SUW35A-5

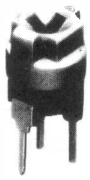
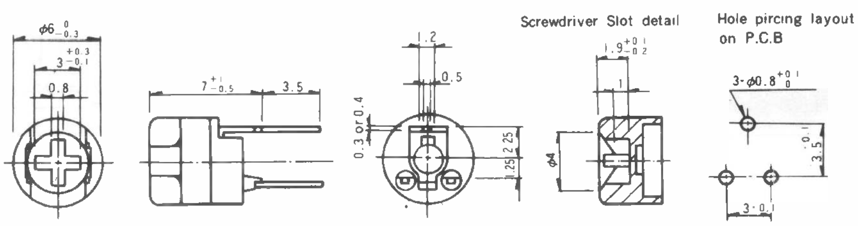
(Unit: mm)

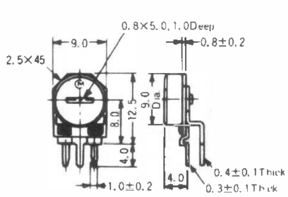
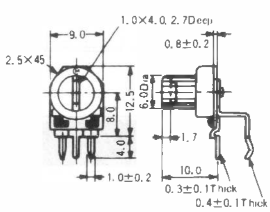
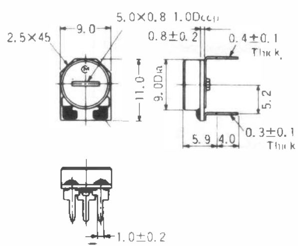
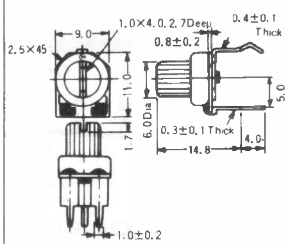
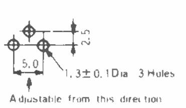
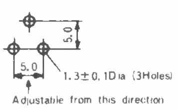
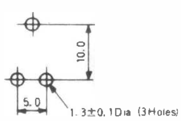
Part Number	Char. ❶ / Cap. Value (pF) ❷									
	C	P	R	S	T	U	SL	YN	B	E
SUW50A-8●●● 200V SUW35A-5●●● 50V	2 ~ 1.1	4 ~ 13	4 ~ 15	5 ~ 16	5 ~ 18	7 ~ 43	2 ~ 82	100	100 ~ 1000	1000

Preset resistors

The writer of this catalogue sometimes it difficult to wax lyrical about the more mundane components - so in order that at least a little life may be injected into preset resistors, we have gathered a range that are arguably the best value in their particular categories.
The VRA- series represent the low cost end of the range for non-specific applications. As such, they are not simply low cost, but reliable and made by a reputable manufacturer by the ten million.
VRB types are available in both carbon and metal film/ceramic base. They are an ideal replacement for costly TO5 can trimmers, since they acheive the same performance, whilst being far less fragile in both assembly, cleaning and adjustment, thanks to a rugged integral cap/adjuster. They are ideally suited to professional applications where dustproof performance is required,
VRC is direct alternative to existing expensive cermet 10mm trimmers. Again it is available with carbon or metal track - but both on a ceramic base to meet flame resistance requirements of many countries.
The stock ranges are listed in the current PL, and we are always pleased to quote our commercial customers for all non-stock ranges.

Model	Outline Drawings	Features/Individual Specifications
 VR-AV		● Horizontal type without knob. ● 4.1 mm standoff standard. With additional 3 mm, units with 7.1 mm height off the mounting plate also available.
 VR-AH		● Vertical type without knob.

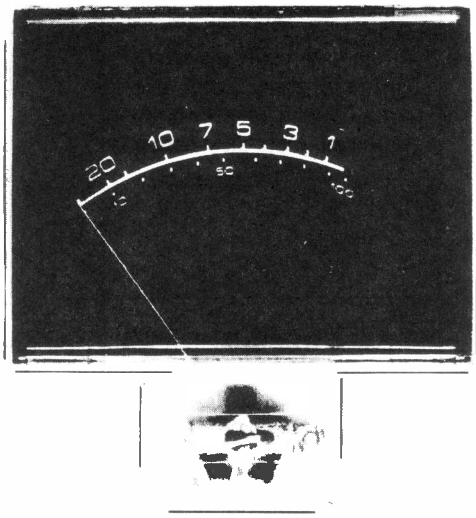
Model	Outline Drawings
 VR-B	

Type	 VR-CH	 VR-CHK	 VR-CV	 VR-CVK
Mounting Hole (Ref.)			 (Unit: mm)	

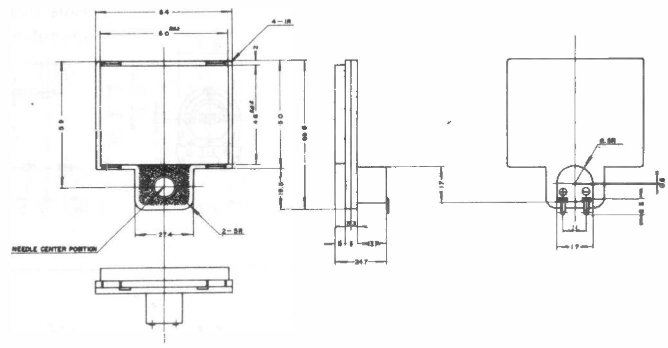
※ Resistance Value Tolerance: ±20% ● Resistance value except 200Ω ~ 2MΩ also available.

Meters from Ambit:

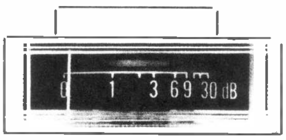
The styles illustrated on these pages represent the range of stock meters available from Ambit. There are many other basic styles in both low cost and accurate linear moving coil meters for OEM applications, so please ask for details (min. 500 off).
The scales illustrated are not necessarily representative of the range available, and the current price list should be consulted for stock information. However, it is possible to supply custom scales for most of these meters - either from your artwork, or basic guidelines. The costs will vary according to quantity and complexity of colour scheme, and may not be economic for less than 100 off of a particular scale type.
All stock types of the low cost 'indicator' meters, which are primarily intended for relative and not absolute accuracy, are 750 ohm/ 200uA movements. The 900 series include a 12v bulb for rear illumination.



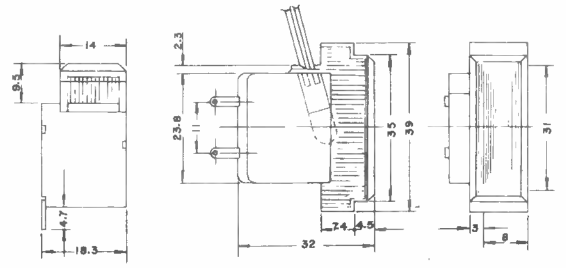
960 series



RESISTANCE(Ω)	1200	750	650	450
SENSITIVITY(μA)FULL SCALE	100	200	240	400 500

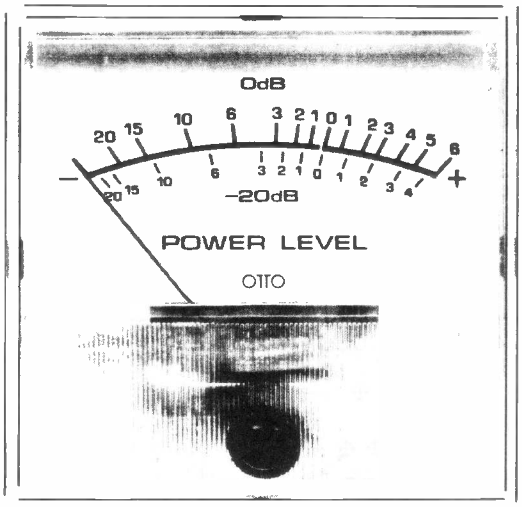


900 series

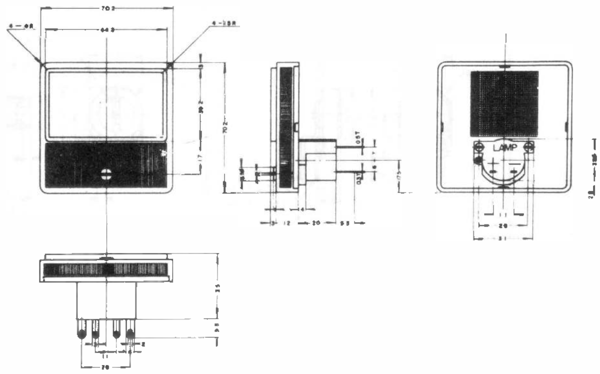


RESISTANCE(Ω)	1200	750	650	450
SENSITIVITY(μA)FULL SCALE	100	200	240	400 500

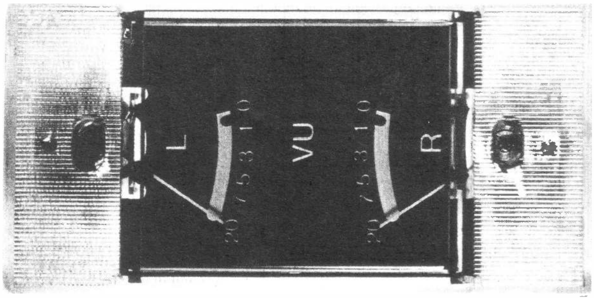
ACTUAL SIZE



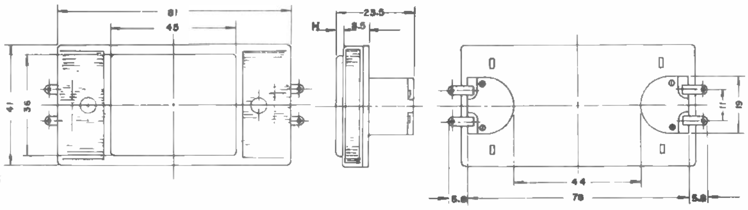
930 series



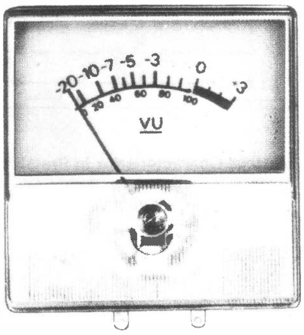
RESISTANCE(Ω)	1200	750	650	450
SENSITIVITY(μA)FULL SCALE	100	200	240	400 500



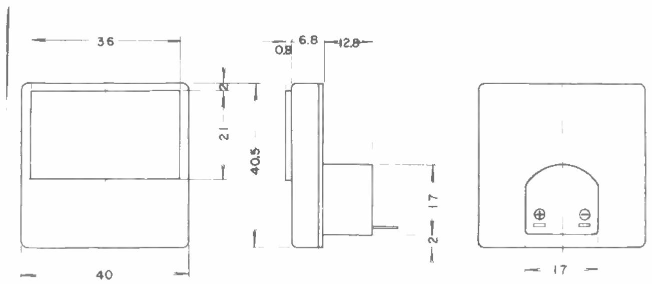
940 series



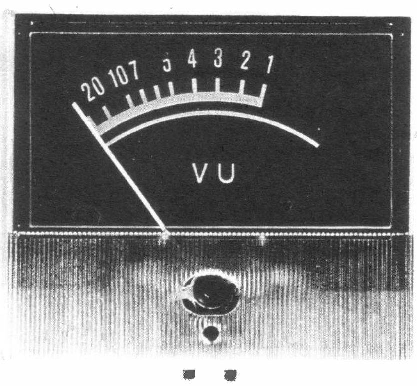
RESISTANCE(Ω)	1200	750	650	450
SENSITIVITY(μA)FULL SCALE	100	200	240	400 500



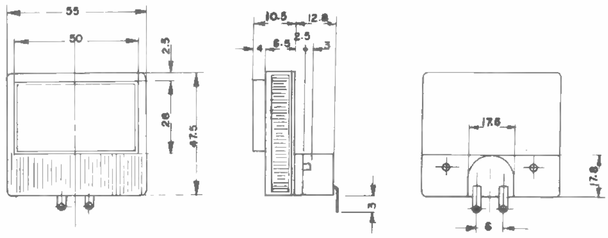
950 series



INTERNAL RESISTANCE(Ω)	1200	750	650	450
FULL SCALE SENSITIVITY(μA)	150	200	240	400 500

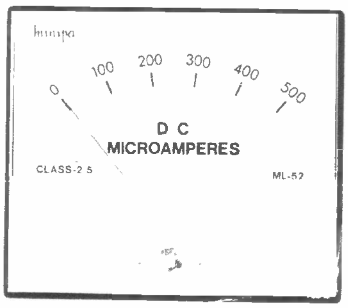


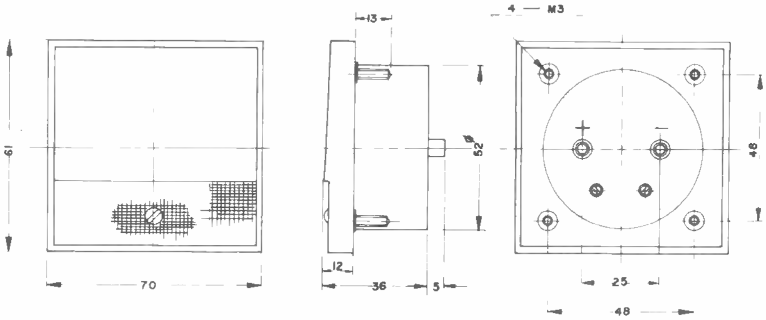
920 series



RESISTANCE(Ω)	1200	750		450
SENSITIVITY(μA)FULL SCALE				400 500

ML52 Stock range: 100uA, 1mA, 1A, 3A, 10A, 15v, 30v, 100v





General

Piezo-ceramic transducers are the most efficient means of converting electrical energy into sound energy. The principle of operation is the same as employed in ceramic filter technology - a piezo ceramic will exhibit distortion when driven by a voltage. In the case of an acoustic transducer, a carefully manufactured ceramic is deposited onto a brass disc of controlled dimensions, to act as an acoustic diaphragm.

Mounting these discs in free air is not recommended, since most of the efficiency is obtained in conjunction with a correctly designed suspension within an enclosure of calculated dimensions.

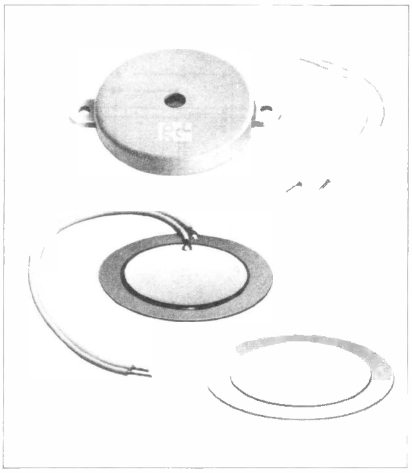
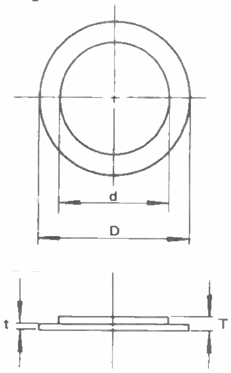
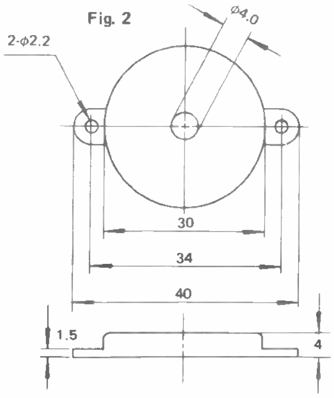


Fig. 1





TOKO PIEZO ACOUSTIC ELEMENTS:

Stock type	Resonance kHz	Static capacity pF +/-30%	Dimensions D	d	T	t
PBN-2720	4.6 +/-0.5	20000	27	20	.55	.25
2715	11.4 +/-1.0	12000	27	15	.55	.25
2711	11.6 +/-1.0	6000	27	11	.55	.25
2015	7.8 +/-0.7	12000	20	15	.50	.20
2011	19.5 +/-2.0	6000	20	11	.50	.20

ENCAPSULATED ELEMENTS:

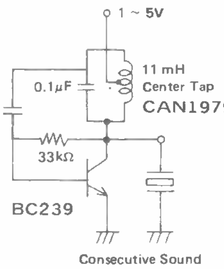
Stock type	Resonance kHz +/-0.5	Static capacity pF +/-30%	SPL dB(min)	Current mA max
PB-2720	4.5	20000	80	1.0
2715	4.5	12000	75	0.5
2711	4.5	6000	70	0.3

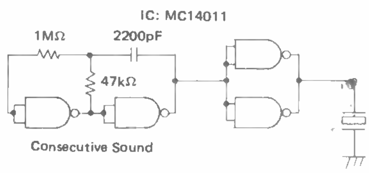
SPL is measured at 10cm, with 3v p-p drive at Fres.

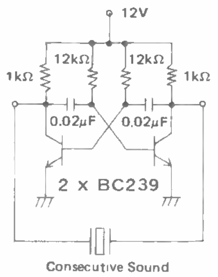
Driving piezo elements

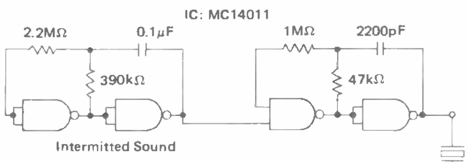
Drive circuits either adopt the basic resonance of the piezo element, or are simply external oscillators fed to the disc in much the same way as electromechanical sound transducer techniques. From the graphs of sound output versus frequency. it will be seen that maximum conversion efficiency occurs at resonance - although satisfactory output is obtained over a broad band from 1 to 7kHz.

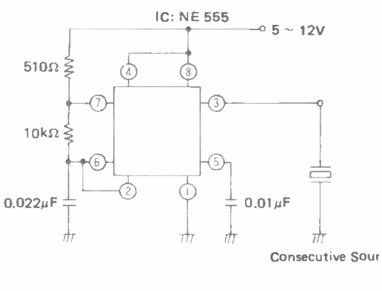
Using a parallel tuned tank circuit at resonance, the effective drive to the element can be multiplied considerably - with 50v p-p from a 9v DC supply being obtained from the illustrated circuit, for an SPL of approx. 110dB.



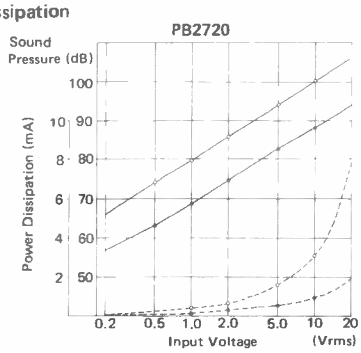


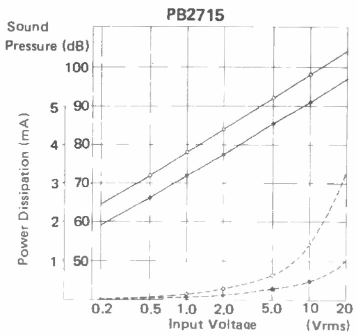


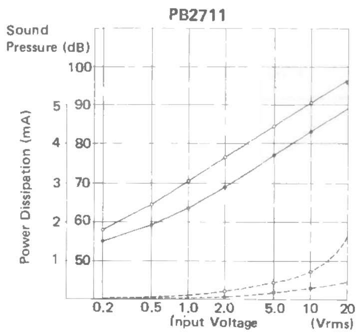




Input Voltage Characteristics in Pressure & Power Dissipation



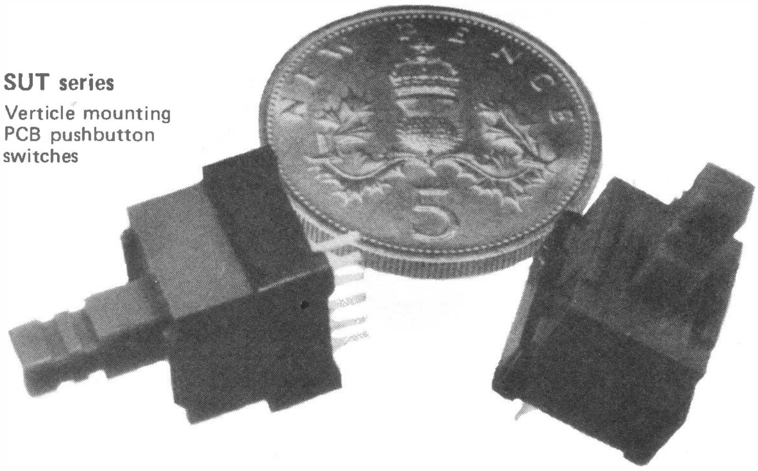


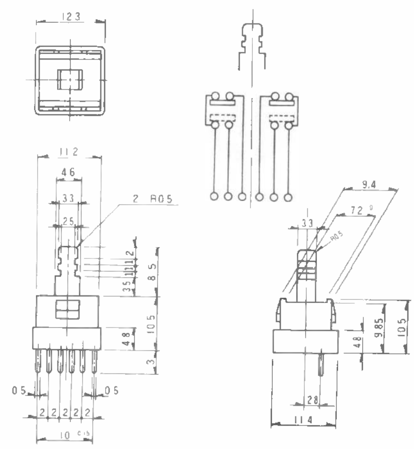


○ :at 4.8 kHz : Sound Pressure (Measuring distance 10 cm)
● :at 1.65 kHz : Power Dissipation

SUT series

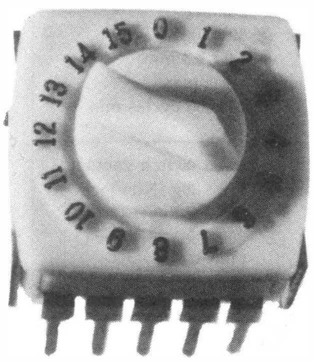
Verticle mounting PCB pushbutton switches

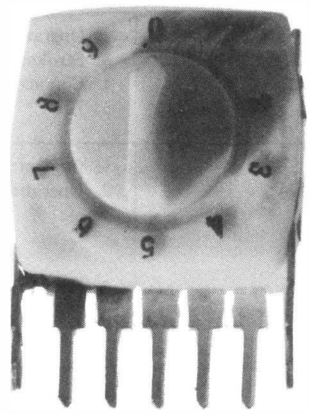




Low cost 2p c/o PC switch

The SUT series switches are 2pole c/o units available in either a self-lock or momentary action. The stock range comprises the individual blocks - although the SUT is essentially a 'bracket'. switch available in combinations of self lock/momentary/interlocking blocks up to 10 ways. The major advantage of this switch system over the more stark forms of data entry switch is the fact that will accept the standard range of pushbutton caps from the SUB6SUE etc range.





SRQ series BCD and HEX programme switches for PCBs

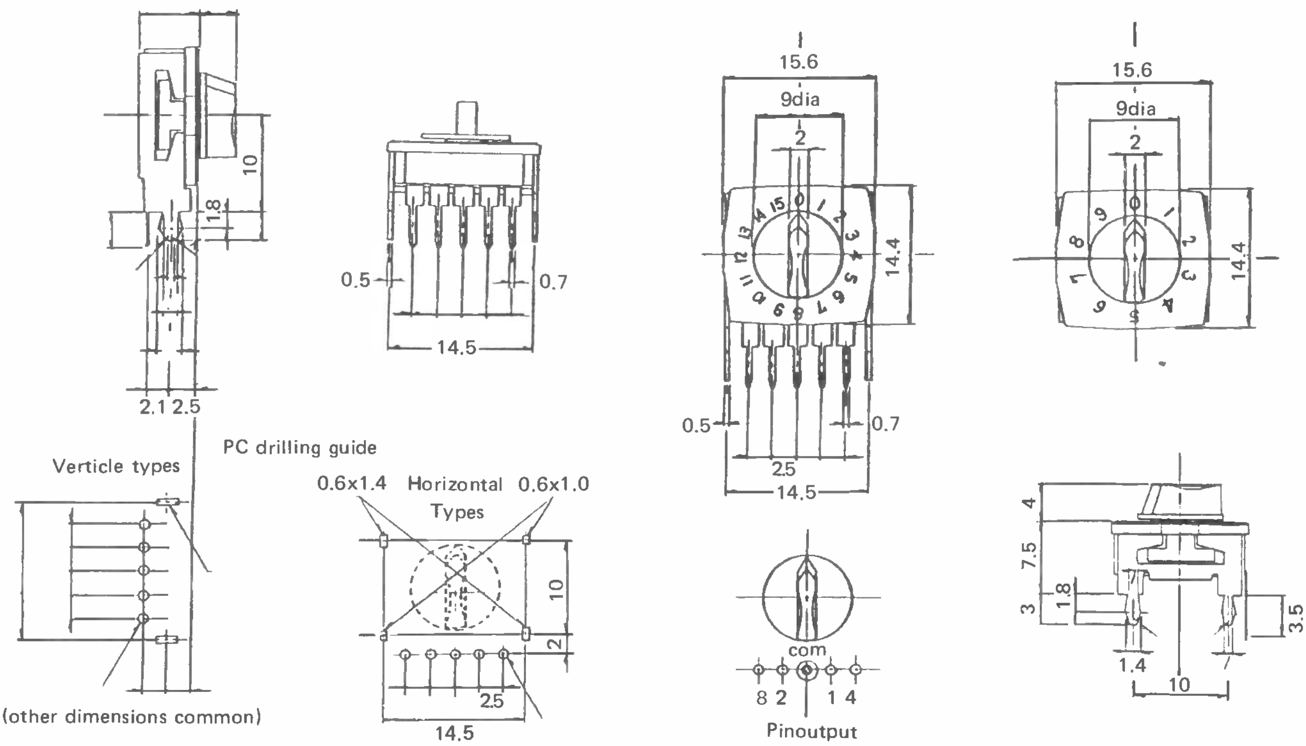
The rapid expansion of 'on-board' programming of functions that range from timing to synthesiser settings has at last produced an excellent and low cost alternative to the ubiquitous 'diode' matrix panel.

SRQ series switches are available in either 10 or 16 way format - with both verticle and horizontal mounting options. The illustrations here show the HEX horizontal mounting and BCD verticle mounting types at approx. 2x life size.

Panel mounting versions of programme code switches are available from our OEM division - and will be finding their way into the 'stock' range in the course of time.

Specifications or SRQ

Contacts	6v at 100mA continous, resistance less than 1 ohm
Lifetime	Resistance of contacts less than 1 ohm after 10,000 operations
Operational temp	-30º to +70ºC
Coding	Standard 4-bit, interchangeable pinout for all types

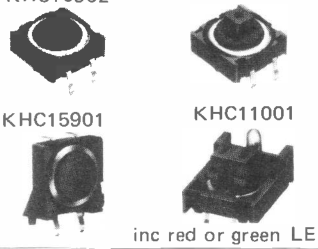


From the biggest keyswitch range in the world - for all types of momentary programming uses......

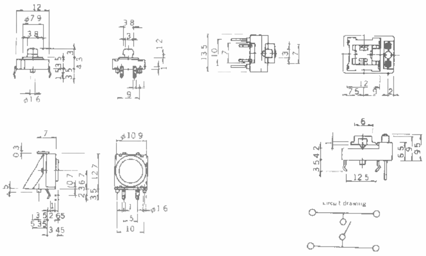
KHC series

KHC10902 KHC10901

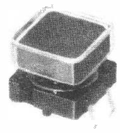
KHC15901 KHC11001



inc red or green LED



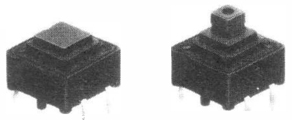
1. Contact: Mechanical contact
2. Operating force: 130±50g
3. Stroke: $0.3^{+0.2}_{-0.05}$mm
4. Contact registance: 100 mΩ max.
5. Life: 500,000 cycles min.

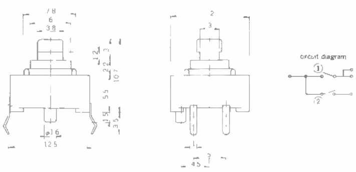


KHC10901 inc cap KT5

KHF series

KHF10901

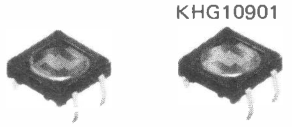


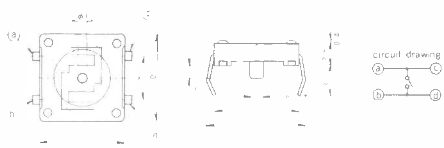


1. Contact: Mechanical double action contact
2. Operating force: First action 90g, second action 280g
3. Stroke: First action 0.7mm, second action 0.3mm
4. Contact registance: 100 mΩ max.
5. Life: 20,000 cycles min.

KHG series

KHG10901

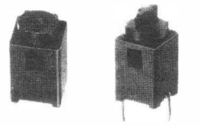


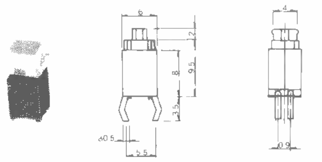


1. Contact: Mechanical contact
2. Operating force: 170±60g
3. Stroke: 0.3±0.1 mm
4. Contact registance: 100 mΩ max.
5. Life: 500 000 cycles min.

KEF series

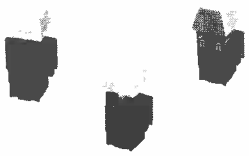
KEF11901

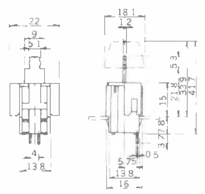




1. Contact: Conductive-rubber contact
2. Operating force: 80±40g
3. Stroke: 1.0±0.3 mm
4. Contact registance: 1 kΩ max.
5. Life: 100,000 cycles min.

KGF series

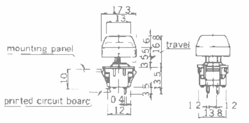




1. Contact: Reed switch contact
2. Operating force: 110±20g (Non-lock release key) 200±60g (Self-lock key)
3. Stroke: 4.3±0.5 mm
4. Contact registance: 200 mΩ max.
5. Life: 20 million

KCC Series

KCC10902

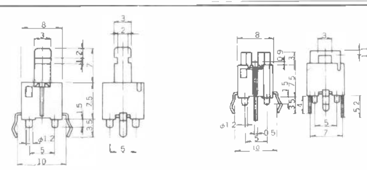


1. KCB10
   Operating force: 90±25g
   Stroke: 3.5±0.5 mm
   Operating life: 5 million cycles min
   Contact resistance: Less than 5 Ω

KEC series

KEC11901+KT9 KEC11901

inc red LED



1. Contact: Conductive-rubber contact
2. Operating force: 80±40g
3. Stroke: $0.8^{+0.4}_{-0.2}$mm
4. Contact registance: 1 kΩ max.
5. Life: 100,000 cycles min.

From the world's largest range of low cost keyswitches and keyboard switches....

The above represents the stock range of keyboard switches - although other types exist for specific functions, these are only available through our OEM sales division subject to minimum order conditions.

Caps

Two part caps (coloured base - clear overcap) are available for all the above switches. The data entry versions are also available with 2 shot moulded numeric .legends (see price list).

Complete alpha numeric keyboards with encoders are available with either the KCC or KGF switches - as well as capacitive effect types available only to OEM users.

Sealed membrane contact panels to custom designs are also supplied via OEM sales - in fact, since alps make the world's largest ranges of all types of keyboard switch - virtually any requirement can be met subject to minimum order conditions.

Guide to selection

A complete keyboard switch catalogue is available (32 pages) free to OEMs - although we regret have to make a charge for non-industrial or educational customers. (See PL). The prime type of data entry switch is the KCC, which is a mechanical contact type of exceptional durability and smoothness for applications such as calculators, process control etc. The KGF is a very low cost gold contact reed switch, and may be used in any application requiring extreme durability and immunity to hostile enviroments. The KT2 series keytops fit both the KCC and KGF series.

The wide range of 'tact' switches provide low cost with excellent tactile feedback for applications such as time setting, instrument function selection, intercom switching etc. The KHC is well suited to applications using a flexible 'over panel' to provide customized sealed switching for low volume applications.

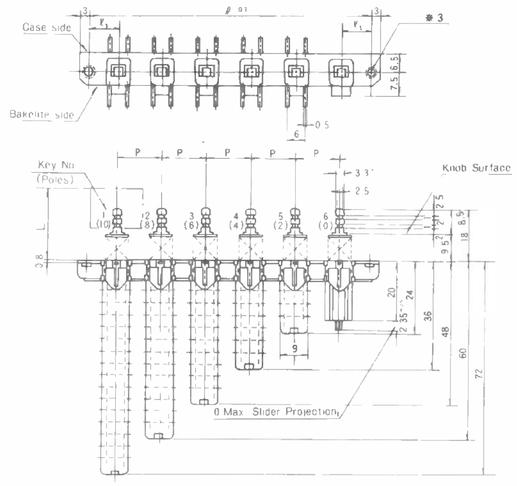
Two part keytops
KHC, KHF...use KT5
KEB....use KT7
KCC, KGF....use KT2/1, or KT2/2 for double unit width
Legended keytops for KCC/KGF....see current PL for availability.

LABPACK SELECTIONS

5 each of the standard range of keyswitches are available as a general purpose 'sample' pack for design and development purposes. Also keytops in both legended and 2-part styles - see the current PL for further details.

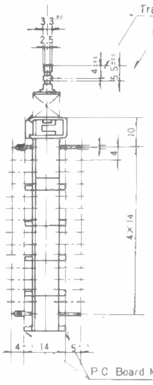
High quality light-action push button switch system : SUE/SUF

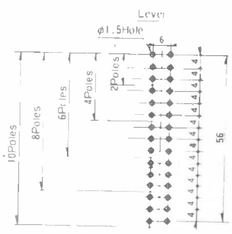
Outline Drawing



Printed Circuit Board Hole Diagram (reference)

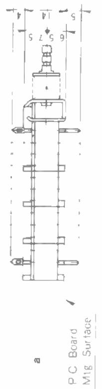
Tolerances unless otherwise specified ± 0.05



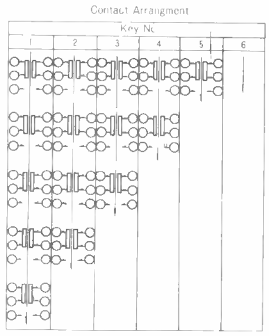


L : Height when our standard Knob used

Key Pitch	L
15	20
17.5	22
20	22
Round(φ10)	24



Circuit Diagram



These are the same switches as used on the Mark III series of HiFi equipment - and those of you who have occasionally asked if the switch system was available separately will be pleased to learn that we have now aquired a stock range of these switches on the following basis:
10mm, 15mm and 20mm module spacing with brackets and latchbars for up to 10 way operation
Brackets with M+ x0.5 fixing holes - PCB terminals with eyelets on topside for direct wiring.
Two types of mains switch are available that fit into the system with 15/20mm spacing - the SDU type being an extremely high quality unit with DC LT 2p changeover facility in addition to the 2 pole mains contacts. Maximum current is dependant on voltage to a certain extent - although the SDU will handle approx. 7A, and the SDW 5Amps.
The basic signal switch contacts are rated for 45v at 300mA - although specific details are given in the 9 pages of SUE data available. The SUF is essentially the same as SUF in terms of dimensions - but is only available as a very light action 2 pole unit.
The switch blocks are supplied with sealed bases to prevent flux seepage - and are simple to assemble into any configuration with a little practise.

Knobs/caps etc

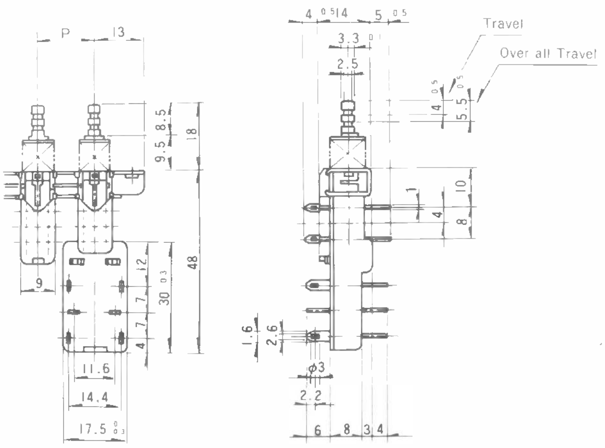
A range of standard caps is available for this series - which uses the same basic spigot sizes as the SUB and Lipa & Isostat switch types. (as well as most other types of push button switch system)

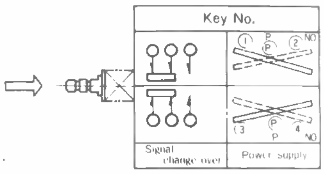
Compatibility

The SUE/F series use the same switching configuration and PC pin spacing as the SUB, Lipa. Schadow etc. The mounting broacket positions are essentially the same, although certain types of switch bracket may have marginally different fitting centres. The height of the centre of the spigot above the PCB should be compatible with alternative switch systems - though check in critical applications.

Type with Power Switch (SDU)

Outline drawing

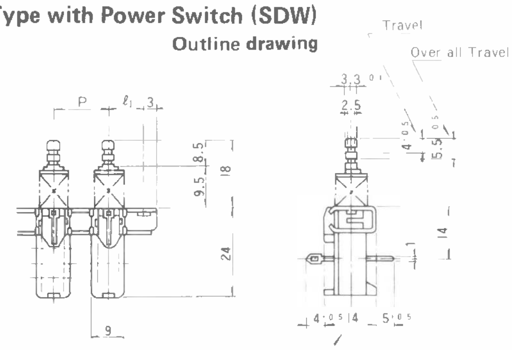


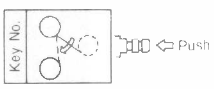


Notes:
1. SDU can be combined with any key regardless of its position if the key pitch is 15mm or more.
2. Two parallel use of SDUs requires at least 17.5mm key pitch.
3. When SDU is combined with a key with 12.5mm pitch, the adjacent key position must be set in blank.
4. SDU is provided with two signal switching circuits.
5. Circuit of SDU is available in SPST, SPDT, DPST and DPDT. The circuit shown in the drawing is DPDT.
6. Operation mode is available in linked (lock release) and independent (self-lock).
7. Approved by international safety standards (UL, SEMKO, etc.).

Type with Power Switch (SDW)

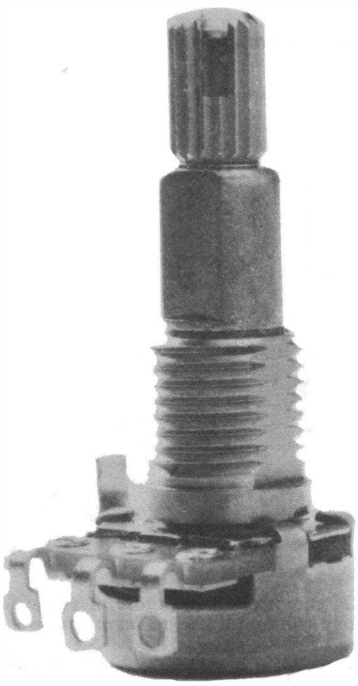
Outline drawing

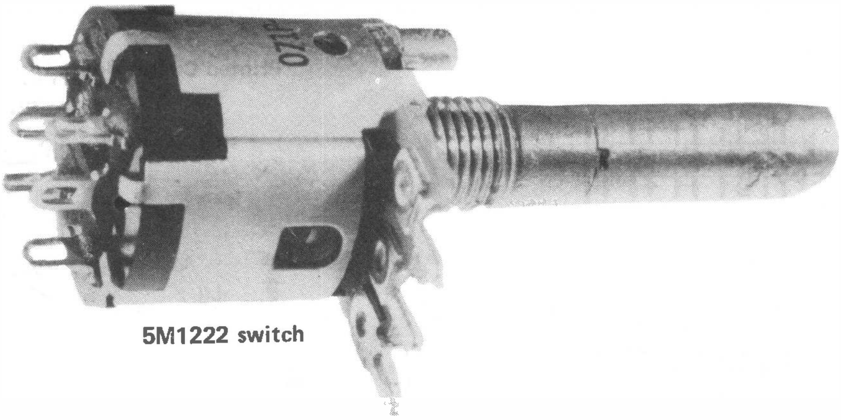




Notes:
1. SDW can be combined with any key regardless of its position.
2. Circuit of SDW is SPST only.
3. Operation mode is available in linked (lock release) and independent (self-lock).

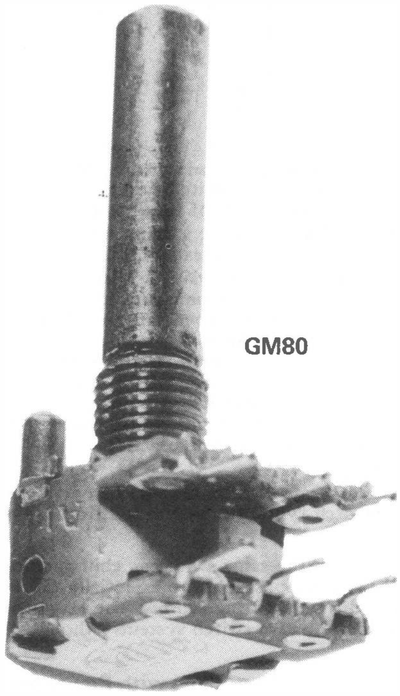
POTORAMA





5M1222 switch

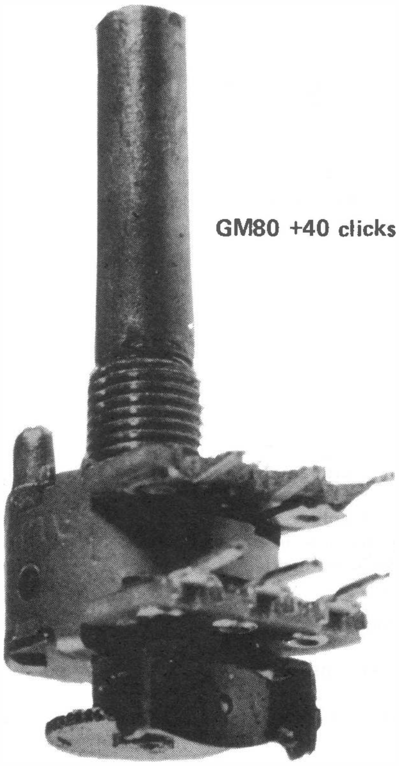
K16A20 - VM10 series with an integral 5:1 epicyclic reduction drive for tuning and applications requiring high resolution.



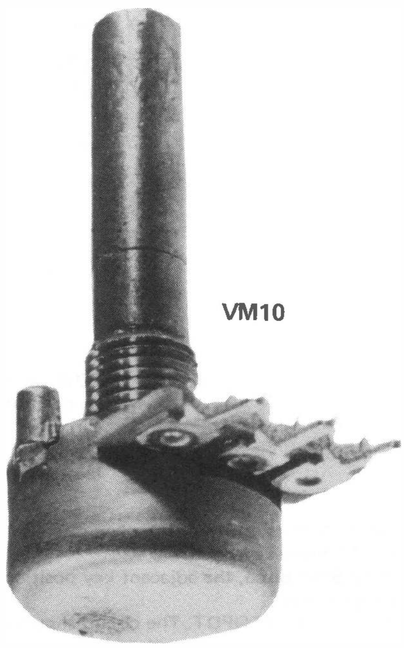
GM80

GM80+centre click

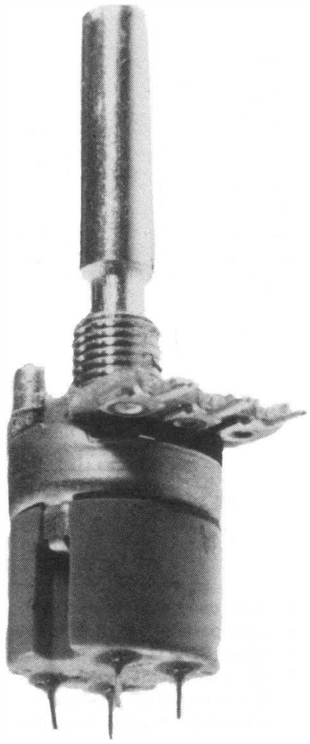
Just so as there's no confusion over our new range of high quality potentiometers - here are some enlarged photos of stock items, showing the terminal style, shaft and fixings.



GM80 +40 clicks



VM10



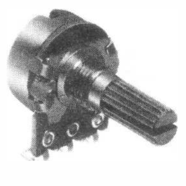
5M3121 switch

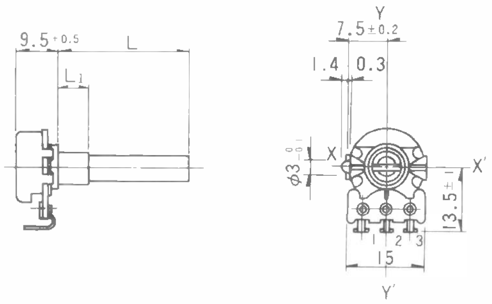
Potentiometers......16mm types with PCB mounting and 6mm diameter shafts (round)

Despite these illustrations, the 'stock' range has been chosen with PCB tags, 6mm dia round shafts of 30mm length. The total possible number of combinations of pot/shaft/fixing/terminal must now be over 10 million, so selecting a 'standard' range is not at all easy. OEMs who must are invited to give us their custom requirements - but whenever possible, we would appreciate sticking to the standard format. The values of the 'stock' range are shown in the current price lists but virtually any type is available to 'special order'. As well as standard log/lin single and dual pots (some available with up to 41 click stops - or a single centre click for balance control use/tone control use) we offer three types of pot mounted switch - the 5M1222 DPDT 3A/30v rotary switch. 5M2211 push on-push off SPST, and the 5M3121 push on - pull off. The push/pull and push push types are particularly useful for instrument designs where the setting need not be disturbed when switching on/off (or switching a function such as a calibrator) is required. Dual pots are matched to within 3dB per scetion over the range 0 to -60dB, and a very esoteric range of ultra low tracking error (less than 1dB from 0 to -70dB) is available for specialist OEM applications.

The range which we 'represent' (as opposed to actually holding in stock) extends to 8 ganged dual shaft systems amongst the 10 million or so possible combinations - so if we cannot offer a solution to your OEM requirements, then we are most surprised !

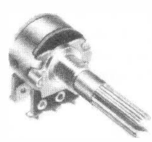
VM10

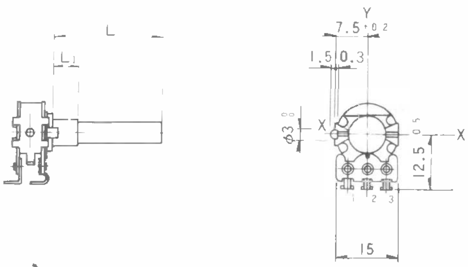




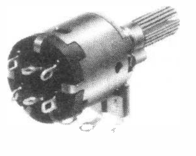
Single shaft, dual unit

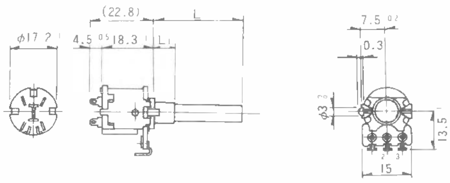
GM80



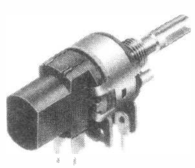


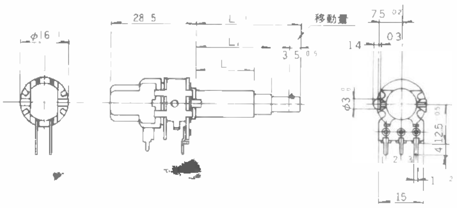
VM11A-5M1222



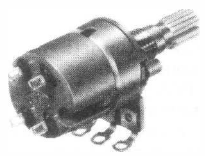


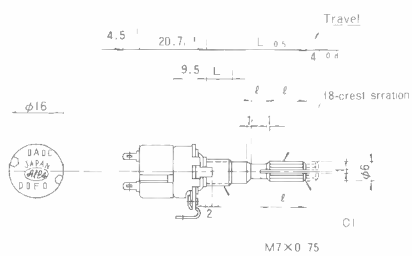
VM12R-5M2211





5M3121



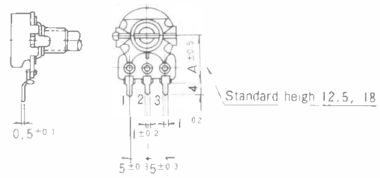


Tapers (track laws)

The standard linear law is obvious enough- but the log law we have chosen is widely known as 'law A' - which is a slightly modified version of true log - but now nearly universally adopted in all types of volume control application.

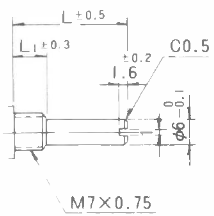
We also offer a true balance law control- where the front and rear sections offer 100% transmission to their respective channels at the centre position (marked by a click) but attenuate opposite channels linearly when rotated on either side of the centre position - a far more satisfactory solution than using a simple linear control at 50% rotation when the balance control both attenuates the overall signal at the centre position and then makes the adjustment by making opposing channels respectively quieter and louder.

Terminal dimensions



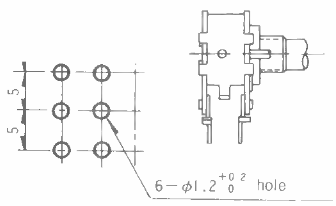
Shaft style: Slotted type (S type)

- Style

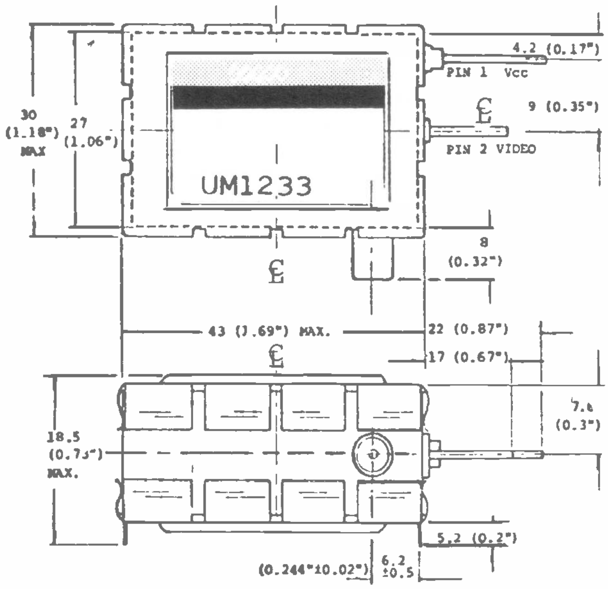


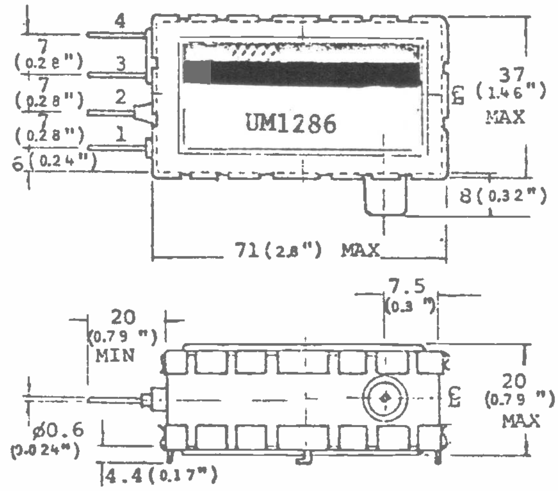
- Dimensions
  L = 30
  L_1 = 7

- Single shaft dual unit (K162)



Wide Bandwidth (High Definition) Colour and ic Sound UHF TV modulators





General - UM1233 E36 vision UHF modulator

Many small computer systems and TV games use a UHF vision modulator to provide on-screen displays from a composite video drive signal. Early examples of the breed tended to produce very fuzzy and blurred definition as a result of the modulator bandwidth being excessively restricted - leading to the bane of stereo reception : the distorted group delay response.

The UM1233E36 is designed for full colour bandwidth (with intercarrier in the drive signal) - and thus can readily be used to upgrade some of the earlier examples of Aztec modulator. to be found in the fuzzier TV games and small computer systems.

Specifications

Carrier frequency	591.25MHz Ch. E36
Supply voltage/current consumed	5v/6.0mA
Output voltage (high level) 2.4v mod	1.5mV
Output voltage (low level) 3.5v mod	-20dB
3dB bandwidth	8MHz
Spurii	-30dB or better
Oscillator stop voltage	3.5volts
Video input impedance	1k5 ohms
RF output impedance	75ohms
Frequency stability	1.5MHz/volt

UM1286 - coulour vision and sound modulator

Whilst the composite input to the UM1233 may include an intercarrier sound signal - the UM1286 providesa built-in 6MHz intercarrier modulator. In other words, just provide a 500kW amplifier and you can be the next 'Independant' TV station on the air.....

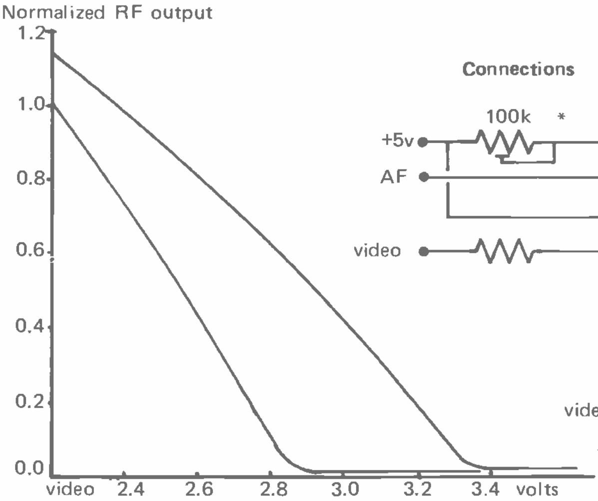
It is primarily useful with systems such as the Nascom 2, where the computer generated sounds can then be routed via the TV, and not via the compromise of an external amplifier/loudspeaker. TV games with loudspeakers on the control console may similarly be uprated - because of the different intercarrier standards, quite a few games have avoided the problem in this way.

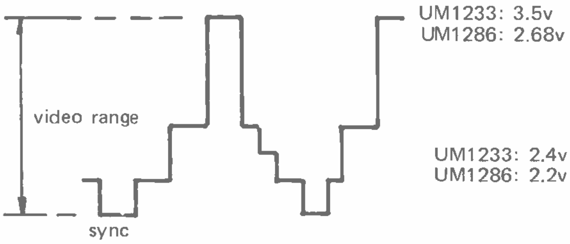
It will be featured in the 'Panorambit' spectrum monitor system for voltage tuned receiver systems - where the band condition is displayed spectrum analyzer fashion, with bright line tuning enabling specific carriers to be interrogated with the sound modulated via the TV.

Specifications

Carrier frequency	591.25MHz Ch. E36
Supply voltage/current consumed	5v/9mA
Output voltage 2.2v mod	2mV +/- 6dB
Output voltage 2.8v mod	less than -14dB
Intercarrier sound	-21dB wrt V out high
Intercarrier frequency	6MHz +/- 0.02MHz
Deviation slope of sound	10kHz per volt
Bandwidth	8MHz
Output impedance	75 ohms
Oscillator stop voltage	3.5v
Video input impedance	1k5 ohms
1.57MHz Chroma/sound IM	better than -50dB
Frequency stability	5MHz/volt (supply)

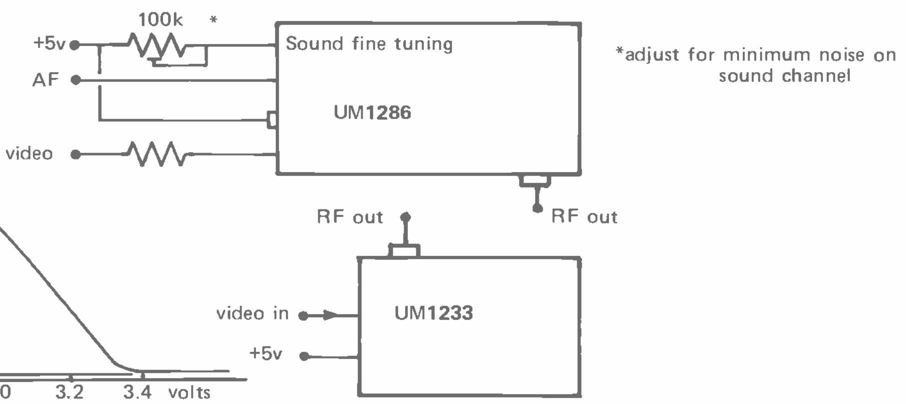
Normalized RF output





Typical video modulation waveform

Connections

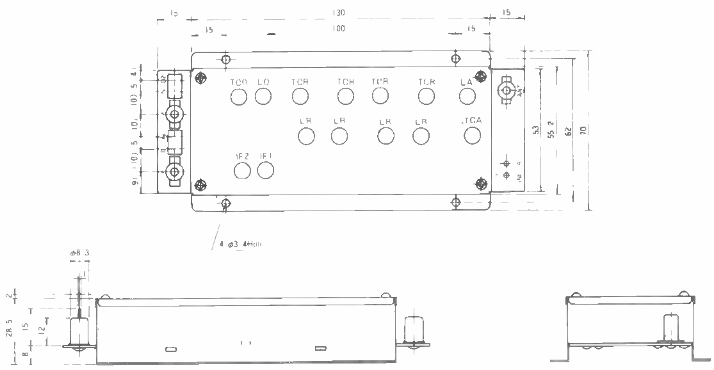


*adjust for minimum noise on sound channel

Note that the video input is referred to specific DC levels, and must therefore not be capacitor coupled unless provision is made for a potential divider at the input to set the correct operating point.

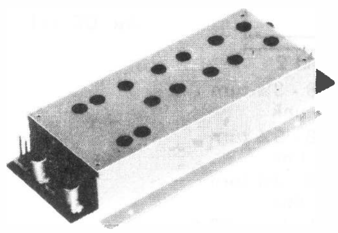
These modulators will handle all TV modulation formats - since the RF aspect is independant of the considerations that differentiate between systems such as PAL, SECAM NTSC and ordinary BW . Teletext information systems such as CEEFAX, ORACLE etc are suitable for modulation of these devices - which are especially suited to the high definition required when colour teletext is used.

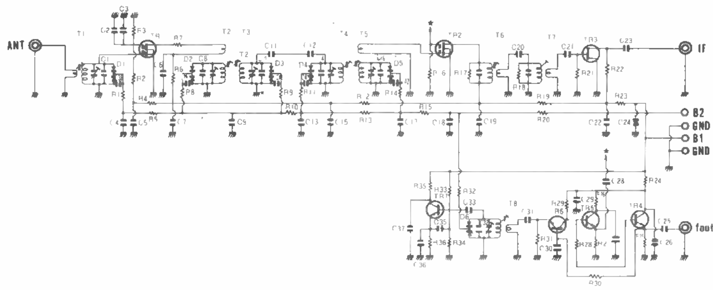
Band 2 (FM Broadcast 88-108 MHz) tunerheads: Alps FD811 and FD128



FD811

In view of the fact that the resources to make and test our EF5800 series tunerheads are limited by both personnel and the fact that each is hand made and very thoroughly tested - we offer the ALPS FD811 for OEM applications where a minor trade off of the ultimate performance versus. cost and availability in quantity is acceptable.
It is safe to assume that the FD811 will provide all the performance necessary to meet the highest broadcast requirements.



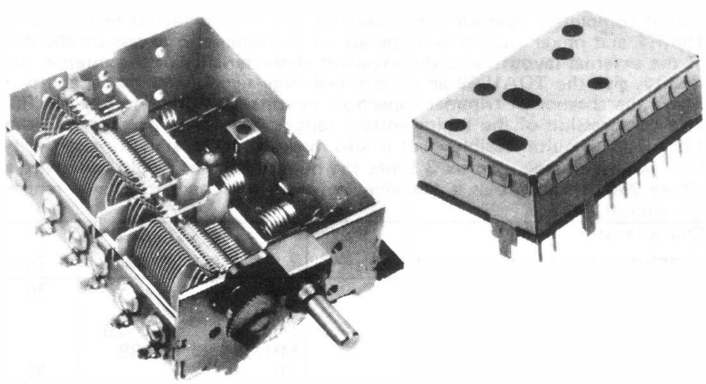


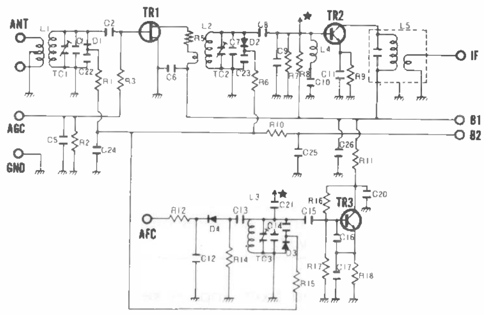
Specification

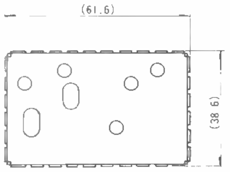
Antenna impedance	75 ohm (phono input)
IF output	300 ohm (..)
LO output	300mV rms
Tuning voltage	3-21 v DC
Power gain/noise figure	31/6dB worst case
Image/spurii rejection	100dB or better
Osc drift with temp	
25-55°C	+/- 100kHz max
+25 to -15°C	+/- 100kHz max
Tracking	6dB max error
Supply voltage/current	12v/80mA typical

FD128 (varicap) and FF317 (mechanical)

Apart from the RF esoterica we offer, many applications can survive with a very much less glamourous tunerhead - and with the end of the EC3302 and LP1186 series, the Alps FD128 and FF317 provide a very cost concious solution to both varicap FM only, and mechanically tuned FM with AM tuning capacitor.
For any battery applications, the use of varicap tuners is neither desirable or necessary in most conceivable applications. For those applications previously graced by the LP1186 - the FD128 is a better solution in all respects.(Despite the fact that the LP1186 has not been made for about 4 years, we **still** get asked for it.)
Despite the illustration, both the tuners we stock use a dual gate FET RF stage, with AGC on gate 2 - and the FD128 also has an FET buffered LO output of approx. 200mV rms.

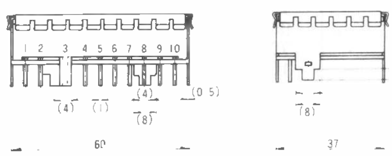


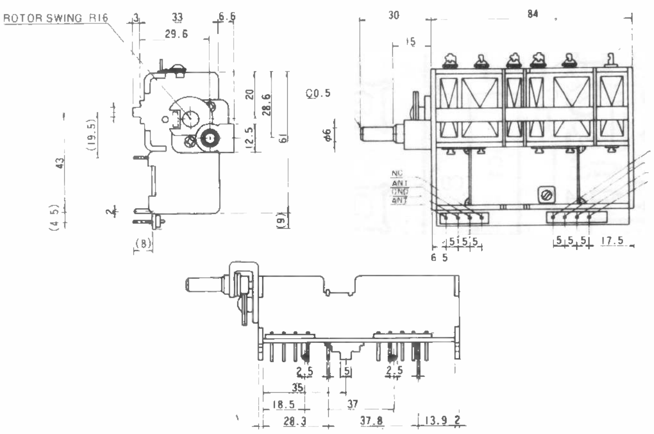




Terminal Connections

1	ANT
2	ANT
3	GND
4	AGC
5	B2
6	B1
7	IF
8	AFC
9	GND
10	NC or Fout

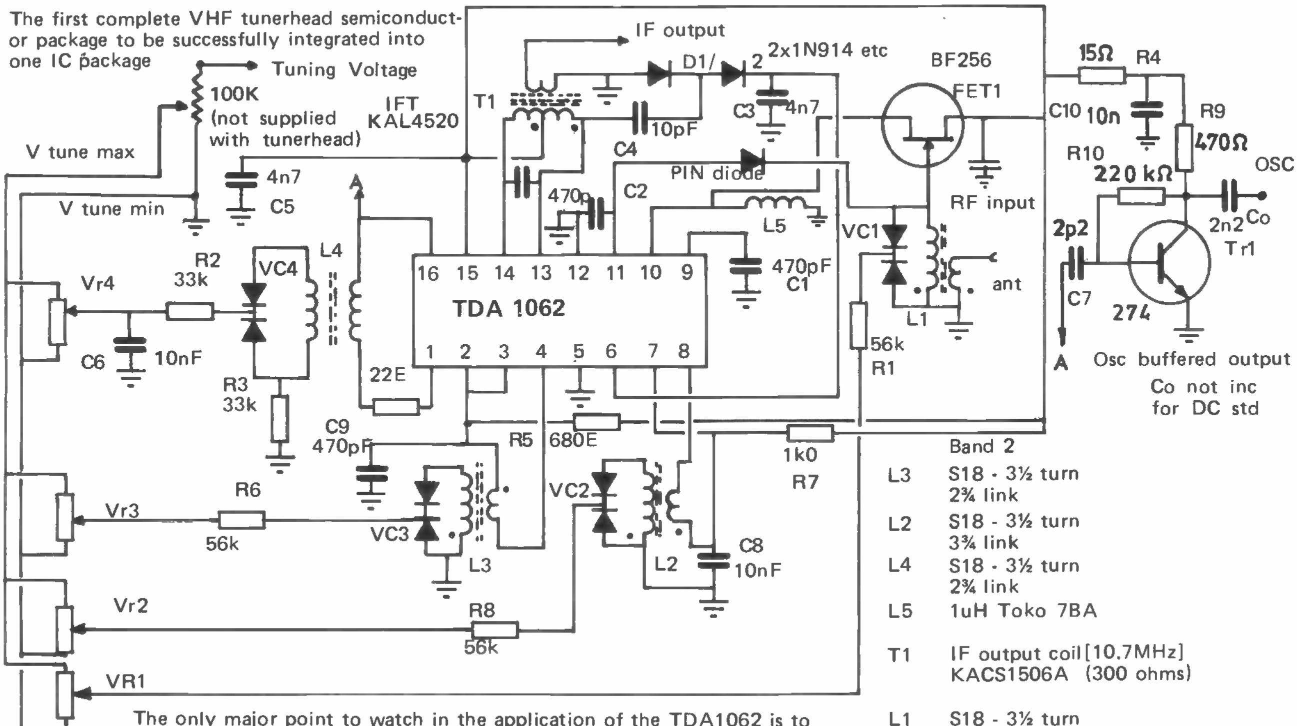




Specifications for FD128 and FF317

Antenna impedance	300/75 ohms
IF output impedance	300 ohms
LO output (FD128)	200mV rms
Tuning voltage (FD128)	3-9.5v (87-108.5)
AGC (Vagc +4 to 0v)	15dB min
Power gain/noise figure	35dB/7dB (FD128)
	31dB/6dB (FF317)
Image/spurii rejection	40dB/60dB min
Osc drift 20-40°C	+/- 150kHz 100kHz (FF317)
0-20°C	+/- 150kHz 100kHz (FF317)
Tracking	6dB max error
Supply voltage/current	12/35mA FD128
	9/17mA FF317

The first complete VHF tunerhead semiconductor package to be successfully integrated into one IC package



		Band 2
L3	S18 - 3½ turn 2¾ link	
L2	S18 - 3½ turn 3¾ link	
L4	S18 - 3½ turn 2¾ link	
L5	1uH Toko 7BA	
T1	IF output coil [10.7MHz] KACS1506A (300 ohms)	
L1	S18 - 3½ turn 1 turn link	

All TOKO S18 VHF molded coils to be used with VHF ferrite core

all presets 100k lin

The only major point to watch in the application of the TDA1062 is to ensure that the LO operates at the resonant frequency of the tuned winding, and not the coupling winding. The above circuit uses a series resistor to achieve this - without it, there is a tendency for the LO to hop to 430MHz if the primary Q drops too far at the LF end.

General

The TDA1062 represents a real breakthrough in tunerhead design. VHF 'front ends' have traditionally been the black art of FM receiver design - and whilst the TDA1062 is a very much more predictable and workable approach than most discrete designs - it cannot completely override the considerations of good layout technique, shielding and short signal paths.

The RF and mixer circuits will operate to frequencies in excess of 200MHz - the upper limit is primarily limited by the stability of the external layout - and the excellent characteristics of the internal double balanced mixer, coupled with the built in AGC facility, give the TDA1062 an exceptional large signal handling capability. Of great interest is the novel tuning system with varicaps, where the absence of trimmer capacitors permits the complete band of 88 to 108MHz to be tuned with just 2 - 7.5v bias.

This compression of the tuning voltage range offers many advantages - immediately it will be seen that operation from a fluctuating 12v supply is quite feasible - but it also means that the stability and purity of the tuning voltage rail is emphasized, where a small error would create approx 3 times the hum/noise that would otherwise appear in a more conventional 20v bias system.

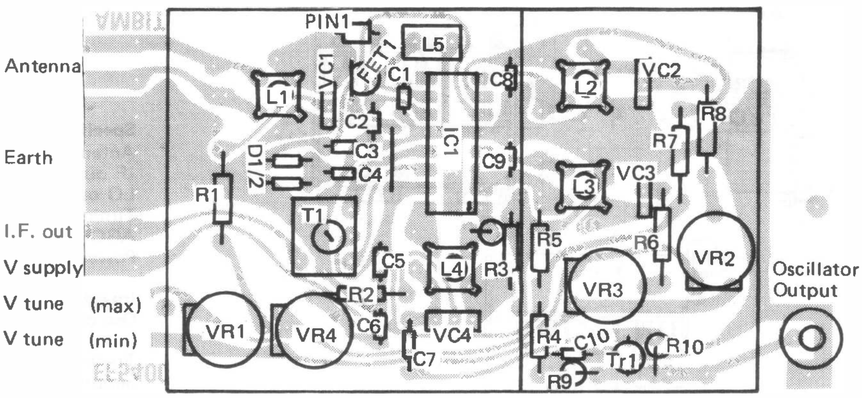
Where 20v of tuning bias is available, however, the upper frequency range of the unit is greatly extended allowing reception into the aircraft band.

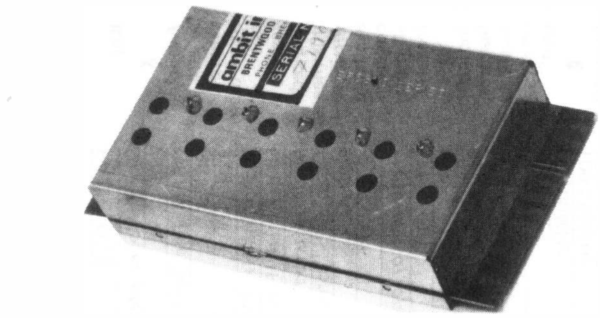
Characteristics: at 25°C ambient, 10v supply, 95MHz		Min	Typ	Max	Comments
Supply current	mA		30		
Supply voltage range	V	9		15	
Operating temp range	t°C	–25		+85	to +125 in storage
Tuning range from 2 - 7.5v bias	MHz	88		108	
Power amplification	dB		30		50 ohm source and load
Noise figure	dB		5.5		
IF bandwidth	MHz		0.5		
RF Bandwidth	MHz		1.7		
Image rejection	dB		80		Exceptional
IF rejection	dB		100		
Half IF rejection	dB		90		
Ultimate quieting	dB		70		
Oscillator pulling for 0dBm input	kHz		10		
	kHz		2		With external PIN diode AGC
Antenna input at AGC threshold	dBm		-30		7mV at the antenna
Oscillator radiation at antenna input	dBm		-60		
Tracking 88-108MHz	dB		1.5		Circuit uses most linear region of BB104

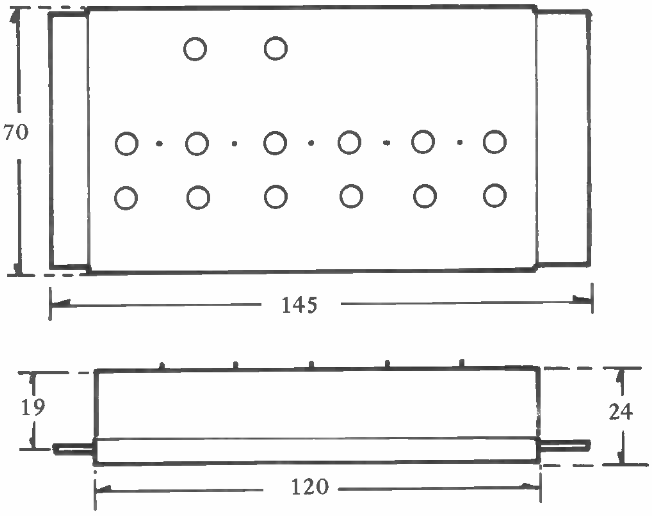
Typical layout viewed from top, as seen in the AMBIT 91062 tunerhead board. By changing the coil set, this board may be used to cover from 30 - 200MHz. See TDA1062 additional data for more design information covering all aspects of the unit's performance.

There is nothing contained in the TDA1062 data that says it will not operate effectively as an HF front end - and simply because we have not yet published a point-to-point design for an HF front end with the TDA 1062 doesn't mean you cannot make one !

We welcome applicants under our under-used sponsorship scheme who want to have a go at using this IC in one of its other guises. It will operate through the HF bands, but we simply haven't had time to provide full documentation yet.





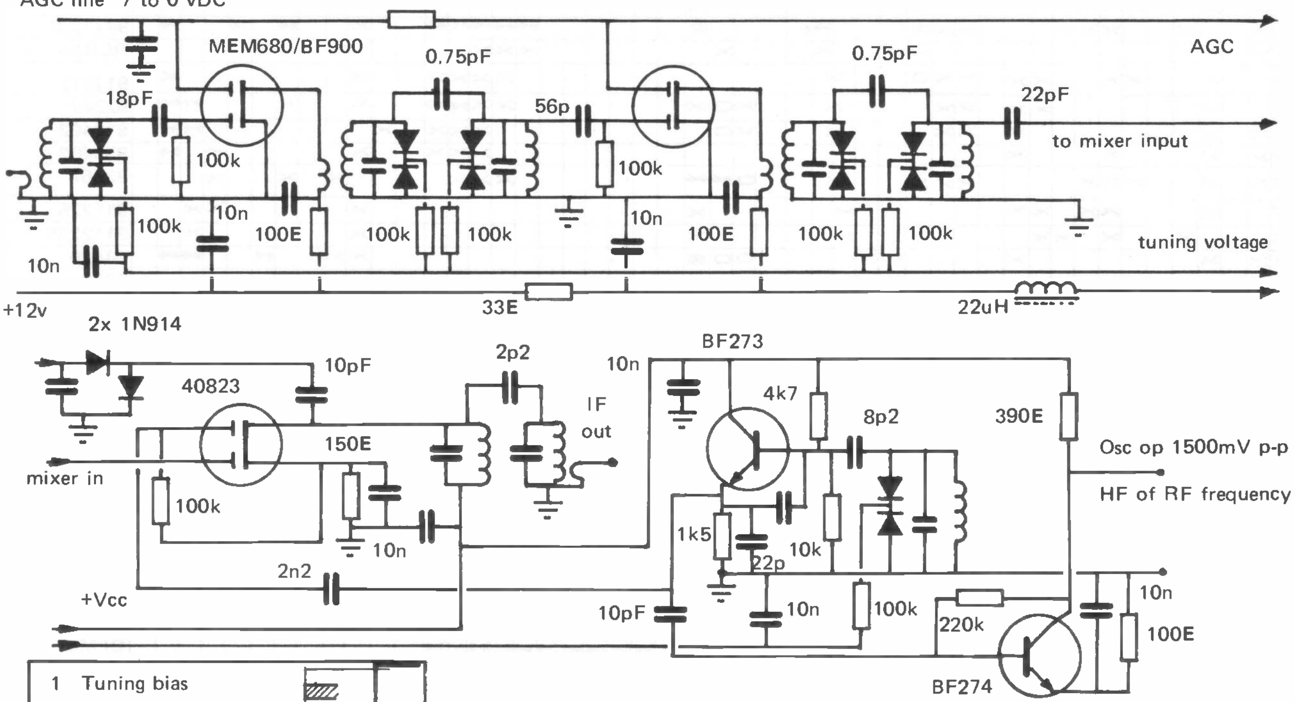


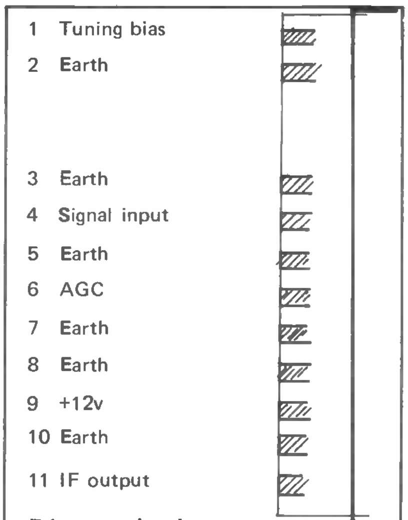
The **EF5803** completely supercedes the **EF5800** and **EF5801** series tunerheads, which are now discontinued. The **EF5803** will be offered in parallel with the **EF5804**, which is primarily intended for applications in professional and synthesised types of receiver in the range 30-200MHz. The **EF5803** is basically a band 2 FM tunerhead for high quality FM reception over large distances - typically in 'fringe' reception areas.

The basic design is configured for optimum symmetry to keep all stary capacitive effects well balanced to permit optimum tracking. TOKO molded VHF coils are used for the same reason - and the net result is a tunerhead that tracks from 88-108MHz at optimum performance all the way.

A degree of local AGC is provided on the gate of the second RF stage MOSFET to prevent extreme overloads at the mixer stage - although AGC from the IF amplifier will be necessary as well. The MOSFETs used in current production will be the best types currently available - and not necessarily the types described on the diagram.

The local oscillator output drive should be more than enough to drive any prescalaer for a synthesiser o r DFM - but please note that it is DC coupled, and may require the use of a blocking capacitor in some applications.





Edge terminations

Electrical specifications

Measurements with Tektronix 7L12 spectrum analyser, Dymar 525B sig source

Frequency range	Bias 2.25v to 9.5v	87.5 to 104 MHz
Supply voltage		12v DC (15v max)
Supply current	12v DC Vcc	32-40mA
Input impedance	standard	75 ohms
Output impedance	standard	300 ohms
Tracking	88-104MHz	±1.5dB
Voltage gain	5.5v on AGC line	44dB
	0v on AGC line	4dB
Image rejection	Measured at 88MHz	> 100dB
IF rejection		> 100dB
RF bandwidth	at -3dB	700kHz
	at -40dB	1.4MHz
Oscillator output	Fsignal + 10.7MHz	1500mV p-p
Noise figure	typical	4dB max

NB the AGC line may be used directly in conjunction with the AGC outputs associated with the CA3089/HA1137/CA3189

All tuned circuits employ BB104B type dual varicap diodes

RADIO/AUDIO module crosscheck

Key:

- **X** Available as std. Where more than one feature is marked' this means versions available covering all these features
- **X↔** Indicates features available on single unit
- **■** Indicates standard, but others available to special order. Please refer for details to tech. dept.
- **0** Indicates specifiable option
- **e** Indicates must be supplied externally
- **Ẋ** Indicates available on single module but used for diff. modes eg filter BWs

FACILITIES

Signal Modes (detector stages) / *Input required for useable signal*

Module	Cat.	AM	WBFM (inc MPX composite)	NBFM	SSB	Video (6MHz TV)	Undetected IF output available	.1-5 uV (50 ohms)	5-20uV	20-100uV
EF5402	4						X	X		
EF5804	3						X	X		
UM1181	3						X	X		
FD811U	4						X	X		
FD128U	4						X	X		
91062A							X	X		
96640	3			X				X		
94412/3	3	X↔			X↔		X↔		X	
RCRX4	3			X				X		
911972		X							X	
92242	4	X↔	X↔				X		X	
912402		X↔	X↔							X
933402		X↔		X↔					X	
93357	4			X			X	X		
911225	3		X	X					X	
911225S	4		X						X	
94420		X↔	X↔			X↔		X	X	
7230	4		X					X	X	
911223	2									
944378	4									
91196B	4									
9820M										
92002	2									
91388	4									
91370										
PA101B	3									
91600	4				X			X		
DFM1	3									
DFM2	3									
DFM4	3									
DFM7	3									
DFM6	3									
OSCABOX	4				X			X		
FS2A synths.	3									
HSYNTH	3									
HF-FE(X)	4							X		

Frequency of operation available (RF)

Module	LW	MW	SW1	SW2	SW3	30-60MHz	60-100MHz	100-150MHz	150-200MHz	88-108MHz (FM Band 2)
EF5402						X	X	X	X	X
EF5804						X	X	X	X	X
UM1181										X
FD811U										X
FD128U										X
91062A						X	X	X	X	X
96640							X	X	X	
94412/3	X↔	X↔	X↔	X↔	X↔					
RCRX4			X	X	X					
911972	X	X	X	X						
92242	X↔	X↔	X	X						
912402	X	X	X							
933402	X	X	X							
93357		X	X	X						
911225										
911225S										
94420										
7230										
911223										
944378										
91196B										
9820M										
92002										
91388										
91370										
PA101B										
91600	X↔	X↔	X↔	X↔	X↔	X↔	X↔	X↔	X↔	X↔
DFM1	X↔	X↔	X↔	X↔	X↔	X↔	X↔	X↔	X↔	X↔
DFM2	X↔	X↔								X↔
DFM4	X↔	X↔								X↔
DFM7	X↔	X↔	X↔	X↔	X↔	X↔	X↔	X↔	X↔	X↔
DFM6	X↔	X↔	X↔	X↔	X↔	X↔	X↔	X↔	X↔	X↔
OSCABOX			X							
FS2A synths.	X↔	—	—	—	—	—	—	—	—	X↔
HSYNTH	X	X		X						X
HF-FE(X)	X	X	X	X	X	X	X	X	X	

IF frequency / *Filter shape factor* / *Tuning mode*

Module	10.7MHz	455kHz	468kHz	Better than... 1:1.6	1:2	1:3	Other	Crystal fixed (No. of channels)	VFO variable	LO output for DFM or synthesis
EF5402	■								X	X
EF5804	■								X	X
UM1181	X								X	X
FD811U	X								X	X
FD128U	X								X	X
91062A	■							0	X	X
96640	X				X			g		
94412/3	■				X↔			e	X	X
RCRX4		X			X			1		
911972						Ẋ		0	X	X
92242	Ẋ	0	Ẋ			Ẋ			X	X
912402		0	X			Ẋ			X	X
933402										
93357	X↔	X↔	0			Ẋ		X	X	X
911225	X					X↔				
911225S	X					X↔				
94420	■	0	0				X			
7230	X					X↔				
911223										
944378										
91196B										
9820M										
92002										
91388										
91370										
PA101B										
91600	■				X			e	e	
DFM1	X↔	X↔	X↔							
DFM2	X↔	X↔	X↔							
DFM4	X↔	X↔	X↔							
DFM7	X↔	X↔	X↔							
DFM6	X↔	X↔	X↔							
OSCABOX		X			X				X	X
FS2A synths.										
HSYNTH										
HF-FE(X)	X	X								

Performance standards / *Availability* / *Audio output (watts)*

Module	Broadcast general	Broadcast high specification	Broadcast professional reference	Communications - amateur	Communications - commercial	Communications - professional link	Low volume specialist applications	Commercial OEM quantities	To special order only*	Kit	Built/tested	0.4-1.0	5-10	10-
EF5402	X	X	X	X	X	X		X			X			
EF5804		X	X	X	X	X	X				X			
UM1181	X	X						X			X			
FD811U		X	X			X		X			X			
FD128U	X							X			X			
91062A		X	X	X	X	X		X			X			
96640				X	X	X		X		X	X	X		
94412/3			X	X	X		X			X				
RCRX4								X		X				
911972	X	X			X	X		X			X			
92242	X	X						X			X			
912402	X							X		X	0	X		
933402	X				X			X		X	0	X		
93357				X	X	X		X		X	X			
911225	X	X		X	X			X			X			
911225S		X	X		X		X				X			
94420	X							X		X	X			
7230		X	X					X			X			
911223	X	X						X		X	X			
944378		X	X			X		X			X			
91196B	X	X						X		X	X			
9820M								X		X	0	X		
92002								X		X	0		X	
91388								X		X	0			X
91370								X		X	0			X
PA101B						X		X		X	0			X
91600				X	X	X		X		X		X		
DFM1	X	X		X				X			X			
DFM2	X							X		X	X			
DFM4	X							X		X	X			
DFM7		X	X	X	X	X		X			X			
DFM6		X		X	X	X	X				X			
OSCABOX				X			X			X	0	X		
FS2A synths.			X		X			X			X			
HSYNTH			X					X		X				
HF-FE(X)			X	X	X			X		X				

Module guide and cross reference

The range and scope of the Ambit series of modules for broadcast and communications applications is - we believe - unequalled in the world. The above list has omitted some less definable types of module - such as noise blankers and IF filter switching units - and is of course liable to be updated on a very regular basis. Modules described in catalogues are given the reference number of the catalogue in which they appear for easy access to fuller details - although now that our module range is becoming an increasingly important aspect of our business, we are revising each data sheet and expanding its detail as time allows.

We always welcome suggestions for additions to the ranges, and are pleased to support the efforts of those of you keen and persistant enough to see a project through to fruition in the shape of a magazine article.

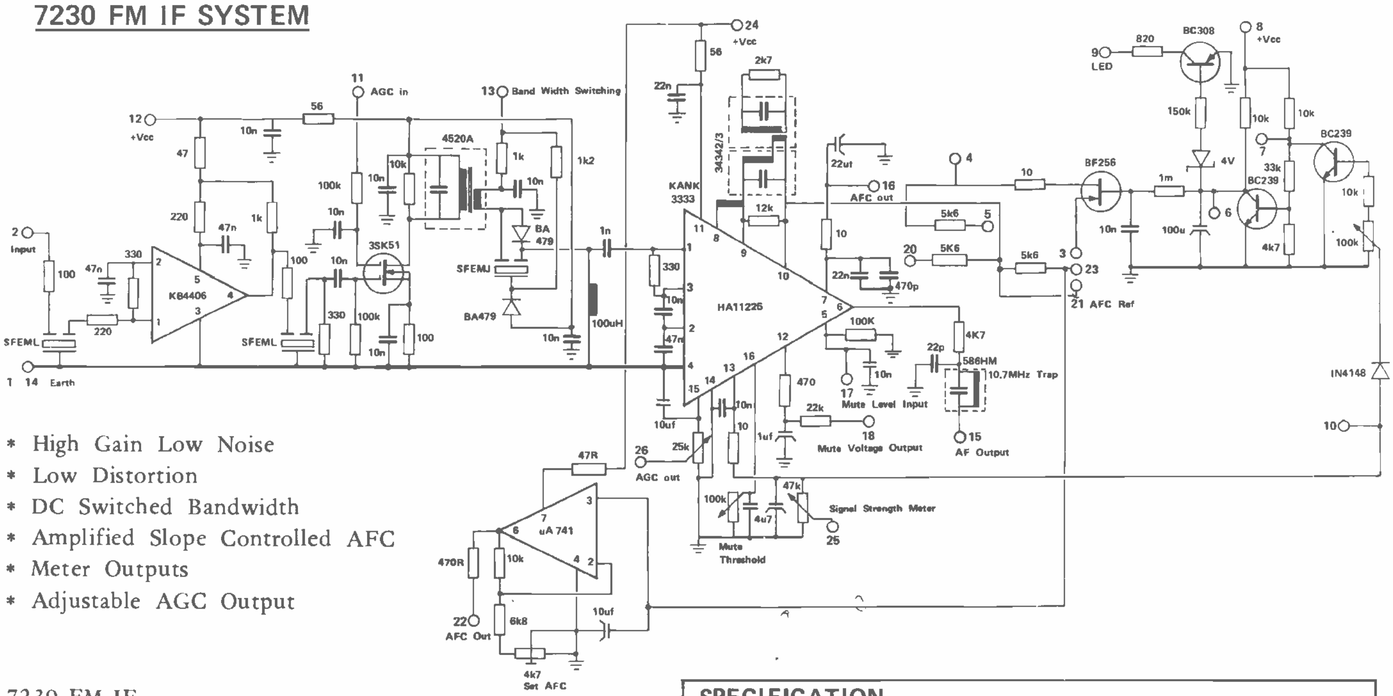
By simple coil changes, many of the modules may be made to tune to frequencies not immediately apparent on the existing data sheets - this chart sets out the possibilities, although even then, not every aspect can be fully covered in minute detail.

Features of Ambit modules

Apart from the features described herein, it is important to remember that we design modules (as far as possible) that include every conceivable option and facility. All the 'Hi Spec' broadcast WBFM IF systems employ deviation and signal level muting, AGC, AFC (the 7230 uses a very sophisticated version of signal level controllable AFC) and metering for signal level. The DFM's (digital frequency meters) include a great many more IF offsets than the basic three in the table - and the DFM1 incorporates a very comprehensive clock/timer facility as well as the RF readout.

It is no great secret that the module type number reflects the type of IC used in the major functions - and to a great extent it is possible for you to surmize the functions and facilities if you are familiar with this type of IC. However, we have also incorporated some novel features - such as making the MC3357 into a tuneable NBFM receiver thanks to the not very difficult task of spotting that the crystal oscillator is in fact a basic form of Colpitts - thus very amenable to LC tuning elements as well.

7230 FM IF SYSTEM



* High Gain Low Noise
* Low Distortion
* DC Switched Bandwidth
* Amplified Slope Controlled AFC
* Meter Outputs
* Adjustable AGC Output

7230 FM IF

FM radio is now firmly established as one of the foremost entertainment mediums - as evidenced by the continual decline in record and tape sales. One of the motivations for this trend has been the increasingly bad quality of commercial recordings - not just the obvious sort where the record is physically warped but the more subtle problems associated with the indifferent quality of the recording itself.

FM radio has just about overhauled the dynamic range capabilities of recordings, although it is a dubious benefit to be able to listen to the recording 'noise' of the BBC, rather than your own record collection.

The 7230 IF system sets out to provide the most available from the medium - plus one or two extra facilities not previously offered in modular FM equipment.

The foremost feature is the electronically alterable bandwidth function, controlled by DC, using PIN type switching diodes. The first two filters are the new SFE10.7ML types, offering linear phase performance that is substantially as good as a 4 pole LC unit, but the third is a narrower 180KHz filter.

The third filter is normally simply bypassed, but in conditions of band congestion, it may be switched into circuit to provide a very discernible improvement to the selectivity of the IF system. Using the narrow bandwidth does little to impair the distortion of the unit, but stereo separation is reduced by 5-7dB typ.

The input of the 7230 uses a carefully matched IF preamplification stage with the KB4406, followed by a gain controlled MOSFET that prevent overload of the final filter, and the IF subsystem IC itself.

The main IC of the processing system is one of the CA3089/3189 family, providing all the usual HiFi tuner features of signal strength meter, AGC, tuning meter, deviation and carrier mute etc. The AGC with the HA11225 has an adjustable threshold facility, to ensure best compatibility with any choice of VHF tunerhead employing an AGC in the range 0-7v.

The 7230 also includes an AFC amplifier, that can be used to provide a correction voltage for the entire tuning line, as opposed to the less effective approach of controlling the oscillator varicap only. The gain of the AFC system is fully adjustable, so that in systems requiring a fully tracking form of AFC (microwave receiver IFs), the AFC can hold a signal over the entire band of operation.

SPECIFICATION	
Supply Voltage	12 - 16v DC at 45mA typ
Input Frequency	10.7MHz
Sensitivity for 30dB S/N	1 - 2uV
Distortion*	Less than –60dB
Noise*	Less than –70dB
*Measured at 1KHz, 40% modulation, 1mV input.	
Bandwidth	280KHz wide
	180KHz narrow
AGC output	0 to +7v
I/P impedance	330 ohms
O/P impedance	>10K ohms
Dimensions	135 x 76 x 17mm

As a result of the even greater-than-usual pressure to get this catalogue finished and printed - and thence into the hands of an eager and patient public, some of the page make-up and trite humourous style has been more frayed than usual. So when PB handed me this page with a space about 4"x1" and said" fill it waffle", I was greatly taken aback.After all, this catalogue didn't get where it is today by mindless waffle and meaningless padding. But on the other hand, we are in a hurry....

Other improvements and developments evolved through various experimental stages of prototype work, have resulted in the inclusion of an IF trap in the audio output lead, and the use of a screened coil in the position of T5.

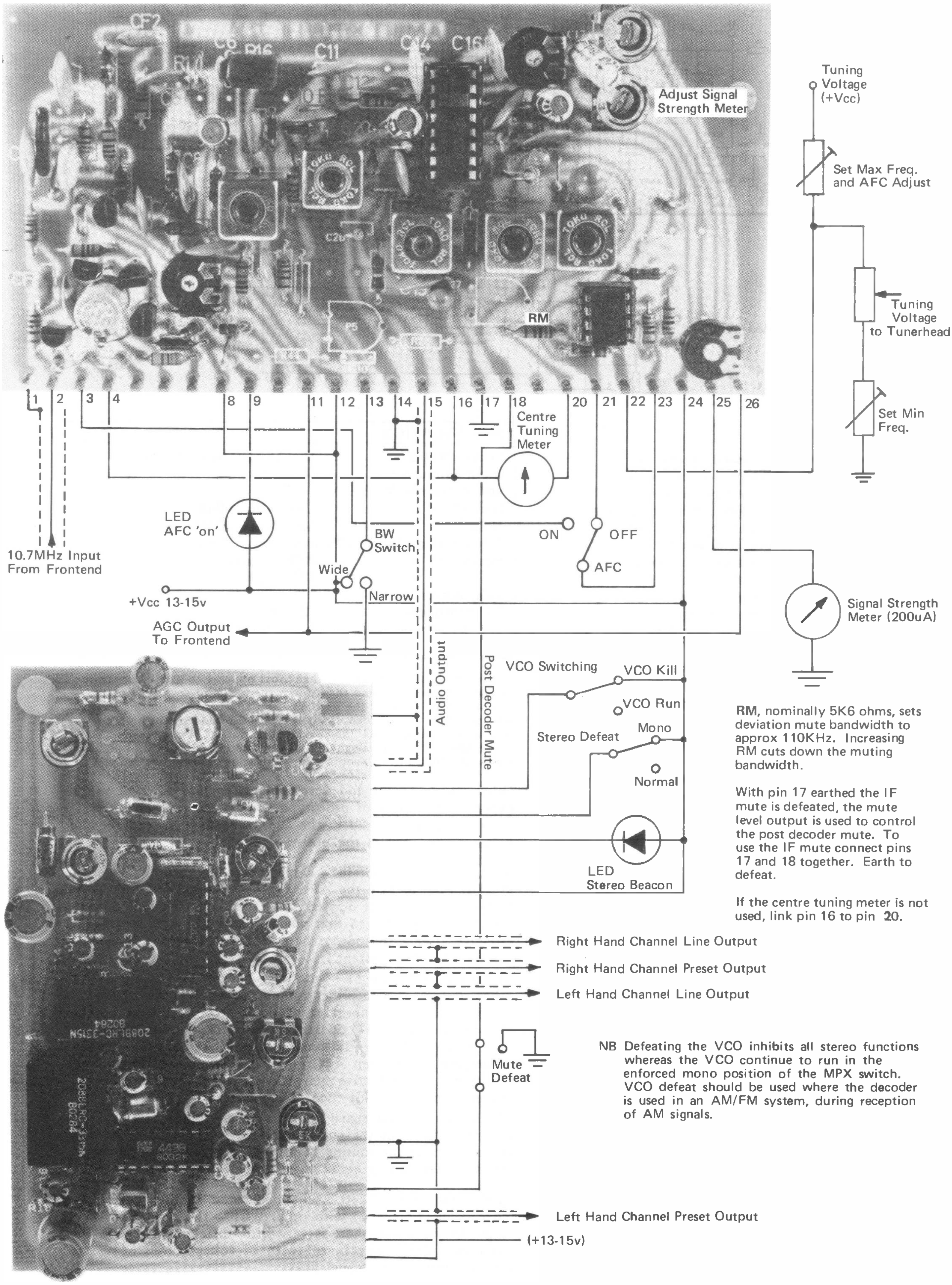
The module also contains a slope controlled AFC switch, which uses an FET to gate the AFC control voltage. The FET is fed from a switch circuit derived from the signal strength output - via a time constant, so that when in use, the AFC is only effective after a station has been tuned in (for the duration of the switch time constant.)

The presence of the FET gate, also permits AFC control from other sources, such a preset tuning potentiometer changeover switch - and most important of all, it provides a time constant that prevents the AFC operation during the 'power on' charge up - which so frequently compremises varicap tuners. Usually, a compremise between AFC range and the switch on problem results in a less effective syetem than might otherwise be implemented using this type of technique.

The deviation mute signal provides an alternative source of control drive - but the circuit supplied will also work with a station outside the muting bandwidth - yet still having some effect on the tuning meter signal level.

Application of the 7230 is intended to be almost interchangcable (edge connection wise) with other WBFM IFs from the Ambit range. In particular, there is very little difference between the 7130 and 7230 connections - with all voltage levels being the same on supply and signal lines.

INTERCONNECTIONS TO 7230 IF and 944378 DECODER



RM, nominally 5K6 ohms, sets deviation mute bandwidth to approx 110KHz. Increasing RM cuts down the muting bandwidth.

With pin 17 earthed the IF mute is defeated, the mute level output is used to control the post decoder mute. To use the IF mute connect pins 17 and 18 together. Earth to defeat.

If the centre tuning meter is not used, link pin 16 to pin 20.

NB Defeating the VCO inhibits all stereo functions whereas the VCO continue to run in the enforced mono position of the MPX switch. VCO defeat should be used where the decoder is used in an AM/FM system, during reception of AM signals.

944378-2 : a miniaturized version of the 944378 broadcast quality stereo decoder

The technical description and performance of this basic circuit is covered in part 2 of the Catalogue series under the 944378 heading. The 944378 is still available, but here we have shrunk it down to our standard SCB3 size box.

Since we introduced the 944378 as the best stereo decoder in the world for under £100 - there has been nothing else available to cause us change our minds. We have made one or two minor improvements by using Hitachi ultra-low noise transistors, and have added some additional supply decoupling at the vital point where the open collector decoder outputs are returned to Vcc. This point in the circuit is ultra susceptible to any hum and noise - since it is immediately impressed on the audio at a relatively low level point in the signal path. The same applies to the MC1310 and various other stereo decoder families with a similar output form. The lowpass filters illustrated are the 208BLR series - but in view of reduced height requirement for the SCB3 lid, we are now using the new low profile ABW series. The audio response remains the same.

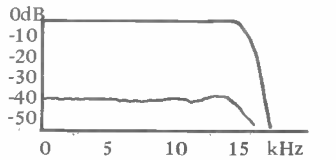
The preceding IF

The most vital thing about a good stereo decoder is to ensure that the 19kHz and 38kHz arrive in phase. Since the 19kHz signal is regenerated to provide an accurate reference to switch between the incoming L and R information - errors in phase will cause an overlap in the switching which results in crosstalk. The appearance of the ideal composite signal is:

1kHz mod

Phase delays in the IF system will appear as:

It is virtually impossible to avoid a small phase error - so the low pass birdy filter characteristic is tailored to provide a slight advance when critically adjusted.
In this way, separation of 45dB can be maintained from 30Hz to 15kHz although optimizing at specific audio frequencies will result in some unrealistic 'notching' where as much as 70dB will result. However, this then causes a deterioration at the HF end of the audio band - so the 944378 is set up using a swept audio input and spectrum analyzer to provide the flatest response:

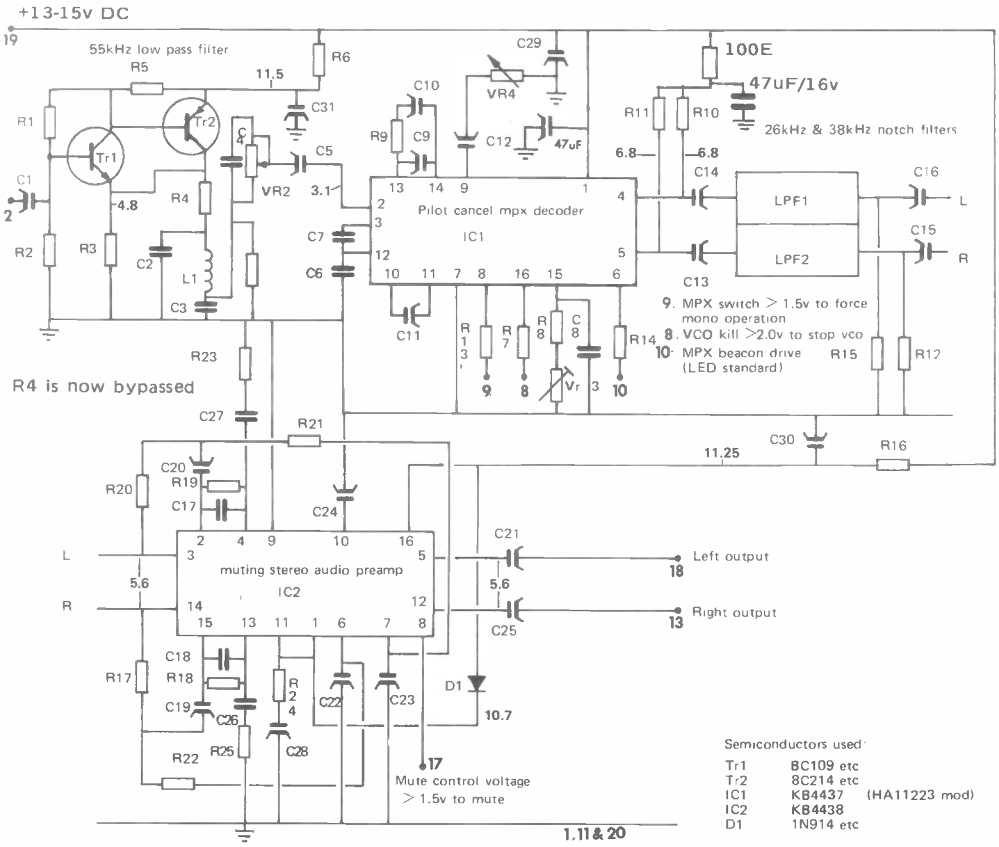


Each unit is aligned in a jig with a test IF and frontend system - since even the effects of the tuning of the output stage of the tunerhead can make a very significant difference to the overall performance.

Switching from 240kHz to 180kHz bandwidth with the 7230 or 911225 families of IF will cause the stereo separation to drop by approximately 10dB - being a reflection of the reduced phase linearity of the IF passband in this mode.

If your FM tuner has enough signal - and there is no multipath interaction to cause phasing distortion at the antenna - then switching from the mono to stereo positions of the 944378 will produce only a barely perceptible increase in noise level.

One of the most telling tests you can carry out on tuner 'sound' is to see how different the different stations sound. A good tuner will sound very different between different stations - not necessarily unpleasant - since if we are expected to accept that different pickup arms and turntables sound different, then this must be reflected in the FM broadcast as well - provided the tuner is detailed enough without excess colouration. Not many are.



Complete circuit of the 44378/2 **Test voltages are shown in bold type**

Table of component values

Resistors: all .25W / 10% or better (* indicates 5% min)

R number	nominal	permissable range	function
1	470k	330k-560k	birdy filter input biasing
2	as R1		
3	2k2	1k8-2k7	input load to filter network
4	–		
5	47k	39k-56k	biasing
6	56E	47E-100E	Birdy filter Vcc decoupling
7	47k	39k-56k	VCO killer coupling R
8*	15k	12k-18k	VCO timing
9	820E	680E-1k	Loop filter
10	4k7		MPX filter termination load
11	as R10		
12	as R10		
13	10k	10k-47k	MPX switchover coupling R
14	680E	680E-1k	LED beacon current limiter
15	as R10		
16	33E	27E-47E	Stereo preamp Vcc decoupling
17*	30k	27k-33k	preamp biasing
18	as R17		neg. feedback loop
19	as R17		
20	as R17		preamp biasing
21	1k8	1k5-2k2	
22	as R21		
23	680E	620E-750E	neg. feedback frequency res.
24	560E	470E-680E	mute "off" time constant
25	as R23		
VR2	47k	47k-100k	phase balance adjustment
VR3	4k7	4k7-10k	VCO timing set
VR4	25k	25k-47k	19kHz pilot cancel set

Capacitors and misc

C number	nominal	permissable range	function
1	2u2	1-10uF	input coupling
2	1500pF	1200-1800pF	filter tuning
3	680pF	560-820pF	filter tuning
4	470pF	390-560pF	mpx phase balance
5	2u2	1-10uF	IC1 input coupling
6	820pF	680-1000pF	PLL phase correction
7	47n	39-56n	phase det. coupling
8	470pF	390-560pF	vco tuning C
9	1u	1 2.2uF	loop filter
10	6u8	4.7-10uF	loop filter
11	1u	1-2.2uF	switch filter
12	1u	1-2.2uF	pilot cancel phasing
13	2u2	1-10uF	RH output
14	as C13		LH ..
15	2u2	1-10uF	RH input to IC2
16	as C15		LH ..
17	1n5	50uS	Deemphasis LH
	2n5	75uS	
C18	as C17		Deemphasis RH
C19	4u7	2 2-10uF	feedback coupling
C20	as C19		
C21	4u7	2.2-10uF	LH output coupling
C22	47u	33-100uF	RH bias decoupling
C23	as C22		LH ..
C24	33u	22-47uF	"on" delay control
C25	as C21		RH output coupling
C26	180pF	150-220pF	RH feedback rolloff
C27	as C26		LH ..
C28	100uF	100uF-330uF	"off"delay control
C29	47uF	33-100uF	IC1 supply decouple
C30	100uF	47-330uF	IC2 ..
C31	as C29		Birdy filter
L1	CAN1A350EK	3-5mH	Birdy filter tune
LPF1&2	208BLRC3155/2		26/38kHz filter

General

The 92242 has been designed and made in England by *Ambit* specifically for the purpose of computer controlled tuner systems.
All control functions are operated by DC voltages only - with only single pole switching required for any band selection.
The circuit incorporates a versatile muting facility that provides tightly controlled detune (deviation) muting on FM, enabling easy station detection with an adjustable ,window' width set by the resistance between the AFC output and the IC reference voltage.
The FM section includes a high gain IF preamp with a pair of ceramic IF filters, ensuring that adequate sensitivity can be achieved with almost any type of FM tunerhead.
The bandwidth and centre frequency selection of the ceramic filters may be specifically chosen for custom applications - the general specification table includes some details of common options.
AM performance is enhanced by the use of a mechanically coupled dual ceramic filter, and fully independently tuned circuits for each RF and oscillator tank circuit. A buffered local oscillator output is provided for use with DFM and tuning synthesis.

FM - circuit description

The 10.7MHz IF signal enters at pin 14 of the module via a screened connection from the tuner section. Provided the cable is less than 6 inches long, no special precautions need be taken to match the 330 ohm impedance exactly.
The transistor provides approx. 35dB of gain, providing a net 25dB after subtracting the the filter losses. Tunerheads with high gain may require the IF output to be attenuated to enable the noise (signal level) mute detector of the IC to function correctly - R4 may be increased, or a resistor may be placed in series with the IF input (possibly 270E to provide 50 ohm to 330 ohm matching.)
In synthesiser applications, the internal noise mute will not usually be required, as signals from the synthesiser controller provide the necessary control information.
Alternatively, the signal level mute may be set to operate from the AGC voltage, by taking the connection 'M' to the AGC output. A resistor may be required from pin 7 of the 92242 to ground to control the rate of mute attack and decay if the AGC is not taken to any other external connection providing a discharge path to ground. 10K is suitable.
The detune, or deviation muting is applied by fitting the external 47k resistor between pins 5 and 11 (see diagram). The internal signal level mute is now overriden (depending on the setting of Vr1 being sufficiently clockwise), and by selecting a connection between pins 6,7 and 8 - the level mute is referred either to the mute output, or the AGC output to provide differentiation between distant and local reception. In stereo radio applications, the AGC level mute is recommended, since it ensures that signals causing the mute to lift will be of a sufficiently high amplitude to enable noise-free stereo reception.
The deviation mute output is a step function, and enables the tuning to open across approx. 75kHz of IF bandwidth with the standard values shown. Reducing R10 will cause the muting bandwidth to increase - and increasing it will cause the muting bandwidth to decrease- the reason being that the AFC output at pin 7 of the IC is a current drive, thus the resistance in the path to the AFC reference voltage will determine the voltage applied to Tr3/4 which then operates the deviation mute if the AFC voltage exceeds the turn on voltage of the Tr3/4 switch.
The deviation muting bandwidth cannot exceed the IF bandwidth of the system - since the AFC output falls back towards the reference at the extremes.

The AF output passes through a 55kHz LPF formed by C4/C5/L4. This filter should be trimmed for best results with a stereo decoder in circuit. The 'S' channel mpx signal should be trimmed for a level baseline, or separation optimized at 1kHz and 5kHz.

AM circuit description

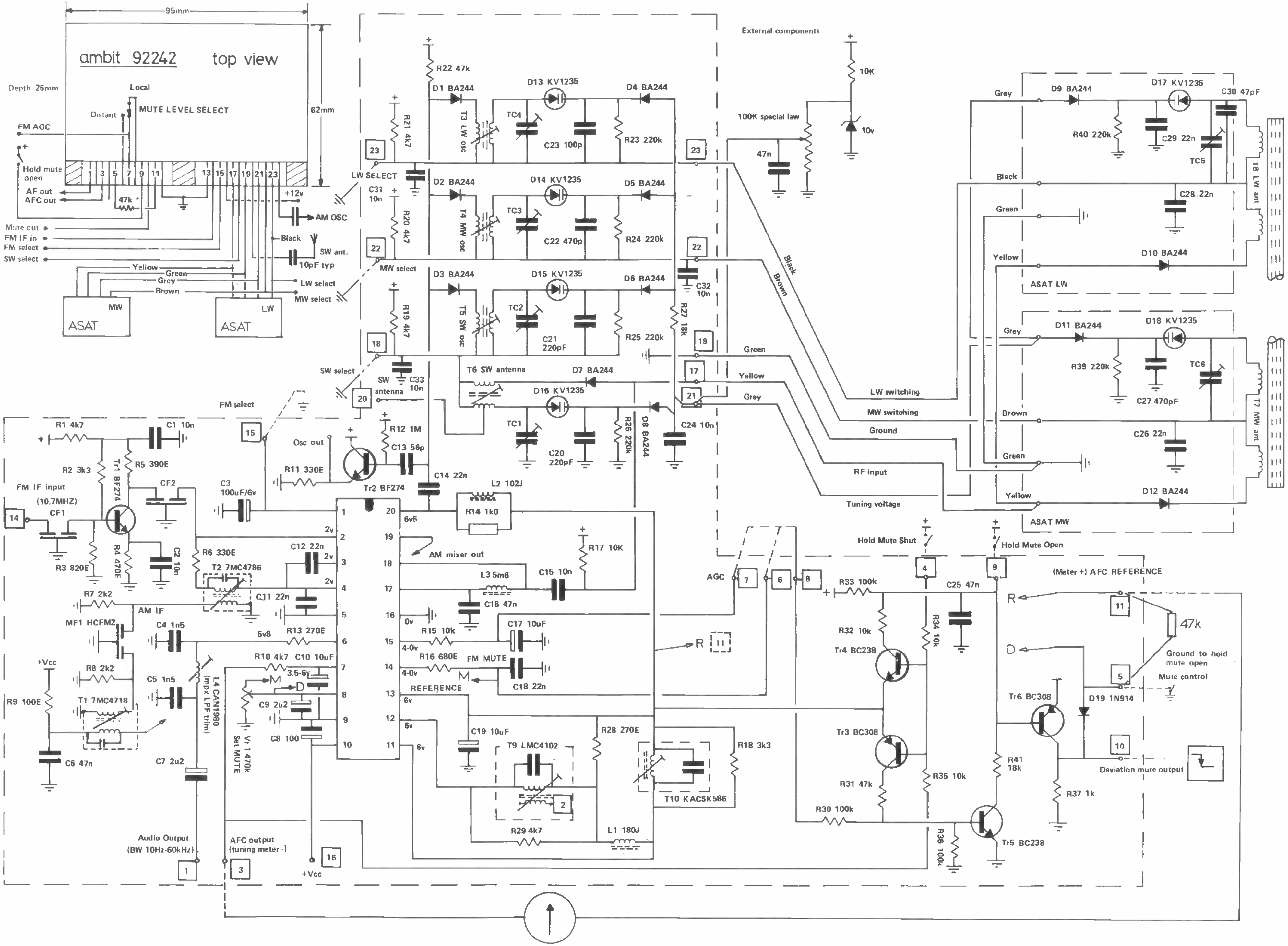
The AM tuner sections employ several novel features that enhance the signal performance, and provide an easy means of switching entire bands with only a single contact to ground.
The AM antenna for MW and LW uses a switching and tuning arrangement that keeps all high impedance sections of the tank circuit to a minimum length by placing the tuning varicap close against the coil together with the associated switching and trimming components. The RF is taken at the relatively lower impedance of the tap to the tuner module.
The SW section employs a transformer input stage for long-wire antenna, and is suited to about 5 feet of open wire in the application shown for broadcast reception. The SW section is not intended for "communications" reception purposes, although an external antenna tuning system may be used to improve image rejection and generally enhance reception under adverse conditions. An external RF preselector should use the same tuning system and coils as the internal T6 - then the tuning voltage may be made to track the preselector as well.
The input stage is a multiplicative mixer with wide dynamic range and low noise. In view of the RF switching arrangements, the RF feed is not fully balanced, so pin 17 of the IC is RF grounded.
The IF filter is a TOKO mechanically coupled unit with input/output matching transformers.
The IF amplifier AGC voltage is available for monitoring purposes at pin 15 of the module - and this also causes the FM tune meter (centre zero type) to deflect from centre to one side to provide signal level information on AM. The meter is placed across pins 3 and 11 of the module. (220uA).
The value of R29 is chosen to balance the AF level on both AM and FM using actual broadcast modulation levels for reference.
The AM output passes through the same 55kHz LPF as used for FM mpx - since it is not feasible to use the usual AM IF decoupling techniques of 10nF capacitors to ground - which would destroy the mpx information during FM reception.
The muting arrangements for FM are not operative during AM reception, although pin 8 of the IC can still be used to silence the audio stages. The internal coupling capacitors for the mute and AGC detectors have negligible effect at 455kHz.

Applications

The 92242 is primarily intended for use with synthesised tuning systems (eg Ambit Hsynth). All the interface connections have been designed for maximum versatility in any application - including remote control and MPU compatible control systems.
The unit should be connected to the IF output of the tunerhead with 6" or less of min. screened cable (min. 50 ohm if possible) - and all power connections to the frontend and IF should be decoupled with a choke of 22uH approx., and a 10nF disc ceramic capacitor to ground.
The external selection of the muting level reference may be switched or hardwired.
If you are relying on the internal signal level muting only, then the internal link 'M' should be shifted to the AGC output if you require muting action to be delayed so that only local signals are allowed through.
Externally grounding pin 5 of the module defeats the muting action of either the IC's internal muting, or in conjunction with the deviation muting arrangement shown.
The deviation muting window is set for approx. 70kHz - although this is programmable via R10. (See preceding description of FM operation).
The AGC output of the 92242 will require a 10K resistor to ground (pin 7) if not already taken to ground through a resistor in the frontend AGC circuit.
The AM section antenna is intended for mounting outside a screened case (MW/LW) - and whilst the antenna connecting leads may be extended without affecting the tuning of antenna rod assemblies, the additional length of the yellow RF input lead will provide additional stray pickup of HF images. If you need to operate the antenna remotely (ie more than a few feet away from the 92242) then the RF feed impedance must be dropped to approx 50-75 ohms using an FET source follower and a coax feed to pin 17 of the module.. Distances of up to 100m can be covered in this way - the AMBIT AASAT unit is suitable for this application.
AM only versions of the 92242 are also available, taking advantage of the exceptionally low noise and versatile performance available with this unit.
The AM detector transformer secondary is not connected as standard, since the effect of grounding one side of the winding causes a serious IF offset in FM operation. In AM only applications, this does not cause any problems, and provides an easy means of tapping the IF signal for alternative detection techniques - such as a tuneable IF with multimode performance. And since AM/FM selection is achieved by (amongst other internal things) grounding the AGC capacitor - separate AGC time constants can be used externally at pin 15 of the module.

92242... electrical specification			min	typical	max
Supply voltage		volts	10	12	16
Supply current		mA	26	36	40
Switching voltages	Band selection	volts			0
FM	**IF input at 10.7MHz**				
Input sensitivity	For 30dB S/N, 50 ohm source	uV		22	
	For 70dB S/N	uV		150	
Mute sensivity	Mute level reference	uV		2	10
	AGC level reference	uV		200	500
Distortion	At 200uV input, 1kHz 30%	% thd	0.2	0.3	0.5
IF bandwidth	1mV input , -3dB at IC input	kHz		240	
AM	**IF at 468kHz, all mod 30%**				
Sensitivity (20dB S/N)	at pin 17 of module, 50 ohm	uV		6.0	
Overload	at pin 17 of module, thd 10%	mV	25	50	
Coverage 1- 10v bias	MW: 513-1620kHz LW: 150-430kHz (tracked 150-280kHz only) SW: 5-10MHz				

For additional information, please refer to the ULN2242 data sheets (7 pages).


ambit 92242 top view
95mm
62mm
Depth 25mm
Local
Distant
MUTE LEVEL SELECT
FM AGC
Hold mute open
AF out
AFC out
47k *
+12v
AM OSC
Mute out
FM IF in
FM select
SW select
Black
SW ant.
10pF typ
Yellow
Green
Grey
Brown
LW select
MW select
ASAT MW
ASAT LW
R22 47k
D1 BA244
D13 KV1235
D4 BA244
R21 4k7
T3 LW osc
TC4
C23 100p
R23 220k
LW SELECT
C31 10n
R20 4k7
D2 BA244
D14 KV1235
D5 BA244
T4 MW osc
TC3
C22 470p
R24 220k
MW select
D3 BA244
D15 KV1235
D6 BA244
R19 4k7
T5 SW osc
TC2
C21 220pF
R25 220k
C32 10n
R27 18k
SW select
SW antenna
C33 10n
T6 SW antenna
D7 BA244
D16 KV1235
TC1
C20 220pF
R26 220k
D8 BA244
C24 10n
FM select
R1 4k7
C1 10n
R2 3k3
Tr1 BF274
R5 390E
FM IF input (10.7MHZ)
CF1
CF2
R3 820E
R4 470E
C2 10n
Osc out
R12 1M
C13 56p
R11 330E
C3 100uF/6v
Tr2 BF274
C14 22n
L2 102J
R14 1k0
R6 330E
C12 22n
T2 7MC4786
R7 2k2
CJ1 22n
AM IF
MF1 HCFM2
C4 1n5
5v8
R13 270E
R8 2k2
C5 1n5
R10 4k7
C10 10uF
T1 7MC4718
R9 100E
C6 47n
L4 CAN1980 (mpx LPF trim)
C9 2u2
C8 100
Vr 1 470k Set MUTE
C7 2u2
Audio Output (BW 10Hz-60kHz)
AFC output (tuning meter -)
+Vcc
6v5
AM mixer out
R17 10K
L3 5m6
C15 10n
C16 47n
0v
R15 10k
C17 10uF
R16 680E
FM MUTE
C18 22n
REFERENCE
C19 10uF
T9 LMC4102
R28 270E
R18 3k3
T10 KACSK586
R29 4k7
L1 180J
External components
10K
10v
100K special law
47n
AGC
Hold Mute Shut
Hold Mute Open
R33 100k
C25 47n
(Meter +) AFC REFERENCE
R32 10k
R34 10k
Tr4 BC238
47k
Ground to hold mute open
Mute control
Tr6 BC308
D19 1N914
Tr3 BC308
R41 18k
Deviation mute output
R31 47k
R35 10k
R37 1k
R30 100k
R36 100k
Tr5 BC238
Grey
D9 BA244
D17 KV1235
C30 47pF
R40 220k
C29 22n
TC5
T8 LW ant
Black
C28 22n
Green
Yellow
D10 BA244
D11 BA244
D18 KV1235
R39 220k
TC6
C27 470pF
T7 MW ant
Brown
C26 22n
D12 BA244
LW switching
MW switching
Ground
RF input
Tuning voltage

Some of the less obvious applications of standard radio ICs.......

General

One of the great temptations when faced with a comprehensive multifunction device such as the ULN2242, is to dismiss its use in any application that doesn't use up all the available features.
This outlook can overlook many advantages of the more lateral approach - which is to treat all ICs as function blocks - or groups of function blocks. Noone would dream of using a 741 to perform a variety of standard op-amp tasks by switching just one 741 into its guise as an active filter, or a voltage follower, or a level comparator. The obvious method is to use separate 741 for each task.
So if you can approach radio ICs in an open frame of mind, then many more of the potential applications will become more obvious.
The purpose of this page is to try and underline the major features of current radio ICs, and suggest alternative applications.

TDA1083/HA12402/ULN2204

This is one of the busiest 16 pin ICs of all time - yet each one of the individual blocks can be used in a number of applications that have nothing to do with portable AM/FM radio.
The first and most obvious thing is to forget the FM, and produce simply an AM receiver and audio stage. Deleting the FM components from the circuit diagram will reveal the simplicity of this approach, which although not quite so basic as the much publicised ZN414, provides a very much bertter performance, whose sound quality is primarily determined by the IF filter and the speaker enclosure.
As a fixed 6MHz receiver, the same IC in FM mode provides an extremely simple TV sound IF and output stage - or at 10.7MHz, provides a complete IF and demodulator system for a low cost and low power communications receiver.

In its FM guise, the TDA1083 will form the basis of a remote carrier intercom system - since the lower operating frequency is not limited in any way. By using 100kHz tuned circuits, an efficient and very simple mains powered intercom can be made using the device in its FM only receive mode, with audio output stage, and by switching to AM to enable the oscillator to be used in the 'transmit' mode, with a varicap providing FM via the audio stage. Some form of level boost will be required if using mains for the carrier transmission - and great care must be excercised when coupling the signal in and out of a 240v system.

If not using mains, a single cable will allow several intercoms to operate by frequency division techniques. The actual total being limited primarily by the bandwidth of the filters used.

The carrier frequency may be derived by dividing down a CRM or crystal oscillator to provide high stability - although phase modulation will be required instead of varicap modulated FM.

Fixed at 2.182MHz, the TDA1083 can make a complete marine frequency watch channel receiver. And by forcing the AGC to a fixed level - a TR form of metal detector can be made, using the AM local oscillator for the search head oscillator - although the design requires very careful attention to decoupling for best reults.

In FM mode, the detector can be used for limited SSB by injecting BFO into the secondary of the quadrature coil.

For HF generally, the TDA1083 can perform a number of interesting tasks - but the local oscillator stability considerations limit the useable audio power to 200mW. The fact that the LO has a degree of gain control will also cause the LO to shift with modulation (especially SSB), and an external oscillator should be injected at pin 5.

Since the mute is common to both AM and FM, applying 3-4 volts at pin 8 will mute either mode - although for AM, this signal will need to be derived by amplification of the AGC levels.

The TDA1083 may also be used as an ultrasonic - or carrier coded IR - alarm detector with built in audio amplifier. The applications are endless - and virtually any one of them correctly presented for publication will earn the resourceful author £150+.

The MC3357

Requiring hardly any volts, and barely any current, the MC3357 can provide a number of applications also covered by the TBA-1083 - remote carrier intercom, metal detector (using phase techniques), limited SSB etc. The local oscillator is a Colpitts system that may be used either with a crystal (fundamental and overtone) or a tuneable LC circuit. The availability of a programmable frequency bandpass filter op amp, coupled with a schmidt trigger make the MC3357 suitable for use in a varietu of pulse signal applications where the incoming signal needs 'cleaning' up. The RCRX4 FM radio control receiver demonstrates this quite neatly - although the same approach can be used for FM remote control with ultrasound or IR as the carrier medium.
The limiting amplifier make an excellent receiver for standard frequency transmissions - at 60kHz or 200kHz, the output of the IF is squarewave which can be used to clock logic - or more ambitiously, in a form of phase-lock standard receiver where the detector coil can select, say, 1MHz from the 5th harmonic of 200kHz, and use this to feed the mixer stage, into which a 1MHz crystal oscillator is also running. The mixer output will be like any other phase detector, and with suitable filtering, can be used to lock the crystal to the standard frequency transmission using a varicap.

The only shame is that the BBC have been told to move Droitwich to 198kHz in keeping with the Euro plan for LW.

The MC3357's low power makes it a suitable device for operation in an AM system where FM is also required - say for signalling purposes or the AFC. Devices such as the CA3089 family create unacceptably high IF noise which does not entirely disappear when the IF is limited by signal.

The MC3357's squelch amplifier can be persuaded down to the very low frequencies associated with 'tone' squelch - not perhaps of sufficiently narrow band for commercial sub-audio tone signalling systems, but quite adequate in communication systems where a shared channel causes annoyance through unwanted operation of the basic receiver muting facility. Transmitting a 150Hz tone to be amplified and detected by the MC3357 would eliminate such troubles.

The ULN2242

The AM sections of the ULN2242 have proved to be as good as - if not rather better than - the majority of 'specialized' AM only ICs. Accordingly, we are dropping the TDA1072 from our range of modules, to concerntrate on the ULN2242 based versions. The basic mixer, IF, detector and AGC of the ULN2242 offers extremely high performance - and the AGC voltages on the IC itself can be used to control an external bipolar RF stage. (pin 17). These same features turn the device into an excellent multimode receiver, since the IF and detectors for both AM and FM can operate at the same frequency, switching mode by simply grounding the AM/FM switchover pin of the IC (pin1). The oscillator is a negative resistance type of circuit, and as such, not readily crystal controlled - so if you require a crystal controlled conversion, then an external Colpitts circuit should be used and fed to the mixer at pin 20. (Terminate pin 20 to the ref. voltage via 1k).

With such injection, the device offers all the necessary features for a synchrodyne form of operation on SSB, using the AM IF system as an audio amplifier with audio derived AGC (adjust the time constants accordingly.)

MC1310 etc

Many LF PLL and tone decoder applications can be fulfilled with the MC1310/KB4400 type of stereo decoder. It has the basic advantage of being multiply sourced - and very cheap if bought in 'quantity'. The main thing to remember is that the VCO runs at four times the tone frequency - and the loop filter constants will need to be designed to suit. The VCO control voltage can be used for FM demodulation of subcarrier information in intercom systems - with the beacon output providing the switching signal. The TDA1083 can be used as the IF amplifier and audio stage.

TDA1054

This device has already been fairly widely described in various forms of speech and audio processing applications - and one application that has not yet appeared in print is in a bedside radio that uses the auto level control to prevent the "Jingles" from causing their usual annoyance, due to the fact that most broadcast stations seem to play them at +6dB relative to the phone-ins, and soothing music shows.
TV films with loud musical passages would also benfit from ALC - although no TV set manufacturer appears to have been astute enough to recognize this much required set feature.

TDA1062

The fact that this device works at frequencies other than just band 2 has already been covered in some detail on the appropriate page. It is an ideal device for all types of HF and VHF frontend - and will even work at frequencies below 100kHz.

TDA4420

The versatility of this device is well covered in the page on our new 94420 AM/FM IF subsystem. The fact that it has been labelled as a 'TV' IC has obscured many aspects of its potential as a communications part at other frequencies.

CA3089 families

The meter output of the CA3089 families is a very cheap means of achieving approx. log detection of the input signal. As such, the device may be used in spectrum display that cover a very broad dynamic range - with a further extension if the AGC facility is applied to the front end of the system.

The meter output of the CA3089 families may also be used to provide a facility for demodulating AM - although the AGC must be adequate to maintain semi-linear operation on strong inputs. The AM signal will be rather compressed, but is nonetheless suitable as a standby facility for communications quality transmissions.

KB4413

Although this is one of the most veratile ICs yet devised for general communication purposes, it is not yet fully appreciated by the RF fraternity. It may be mixed with SL-1600 series (same voltage/interface levels) and readily retrofitted to existing equipment. The KB4413 facilities of carrier level mute, meter output, agc, ANL plus a very effective AM demodulator and balanced SSB demodulator are not to found under one package anywhere else.

Finally

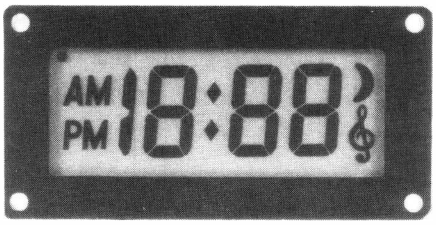
This page has briefly touched on a fraction of the more general aspects of the ICs heerin. We are always interested to learn of any others resulting from customers own work.

MULTIFUNCTION LCD CLOCKS

The following modules are shown approximately full size - illustrating the fact that they occupy barely less space than would be necessary to accomodate a conventional LCD alone. A single 1.5v battery will last for more than one year (assuming that backlight use is not excessive), allowing the modules to be incorporated into all types of applications, regardless of the main PSU.

CM161

Smallest of the range, the CM161 has a 6.4mm digit height. It has six available timekeeping modes : Month, Day, Date, Hours, Minutes, and seconds. The display can be selected (With solder straps) to show either a 12 or 24 hour format. Additionally the days/month format can be selected for either American (Mth / Date) or European (Date / Mth) presentation. An alarm output ,(With display indicator) will provide direct drive to a piezo - transducer, but the volume level will be low.



CM172

Provided with a 13mm digit LCD, the CM172 provides full 12 hour clock display with AM / PM indicators. The alarm output has a duration of 12 minutes and can provide five different types of output waveform. In addition a 10 minute 'SNOOZE' facility is provided. A one hour sleep timer is available — adjustable in one minute increments from 59 to 1 min. With the provision of one resistor a low battery detector will flash the display on and off every 2 secs when the battery requires replacement. Backlight available. Sleep and Alarm indicators are also provided on the display.

CM174 — CM174/5L

Available in 12 hour display (CM174) or solder strap selectable 12 or 24 hour display (CM174/5L), these modules provide the usual timekeeping functions with additional facilities : A 24 minute stopwatch and second time zone mode. A 24 hour alarm is also available. It should be noted that the stopwatch/dual time and alarm are inter — related and cannot be used simultaneously. A 4 minute 'SNOOZE' facility is available .
A sleep timer is provided with user selectable timing periods of 15, 30, 60 or 120 minutes duration.

Operating Specification & Dimensions

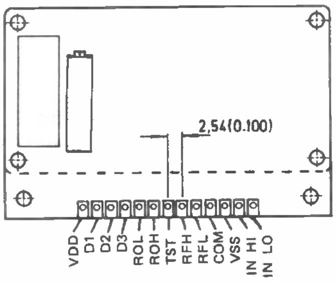
	CM161	CM172	CM174, CM174/5L
Supply Voltage	1.5v	1.5v	1.5v
Supply Current (typ)	6 uA	10 uA	10 uA
B/Light Supply (typ)	12.5 mA @ 1.5v	40 mA @ 1.5v	40 mA @ 1.5v
Height (mm)	18.5	30	38
Width (mm)	32	60	60
Depth (mm)	7.5	8.5	8.5
Digit Height (mm)	6.4	13	13
Bezel Available	NO	BEZ-10	BEZ-10
Operating Temp	All modules 0 to 50 centrigrade		
Storage Temp	All modules —10 to 60 centrigrade		

Full applications data sheets available on request
OEM prices OA.

DVM176

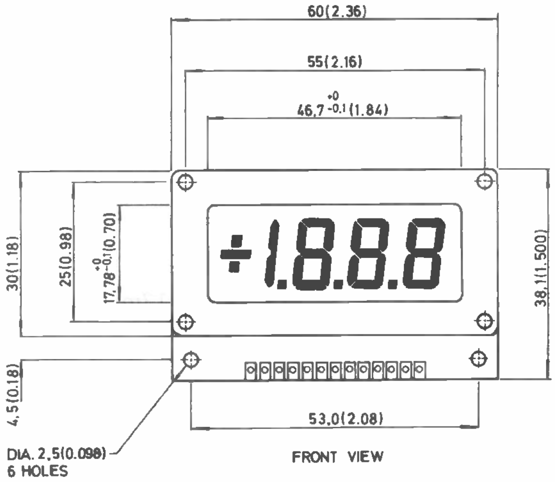
FEATURES

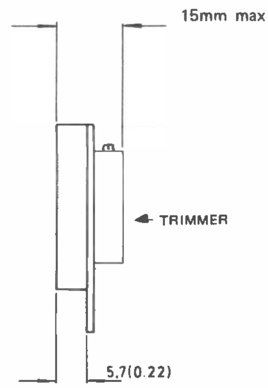
* 3½ digit display
* 0.5 inch digit height
* 200 mV full scale reading
* True differential input and reference
* Single 9v supply
* True polarity at zero for precise null detection
* Lower power dissipation — typically less than 20mW
* Guaranteed zero reading for 0 volts input on all scales
* 1pA typical input current



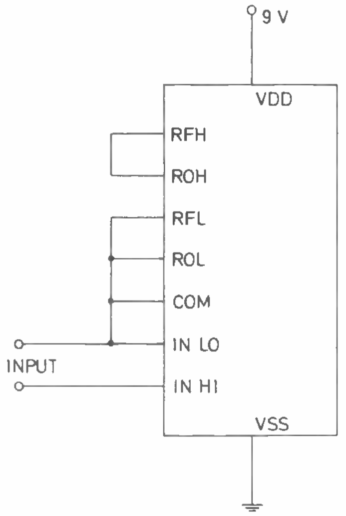
REAR VIEW

DIGITAL METER MODULE DIMENSIONS MM (INCH)





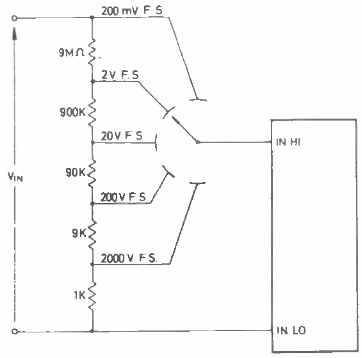
200mV DIGITAL VOLT METER



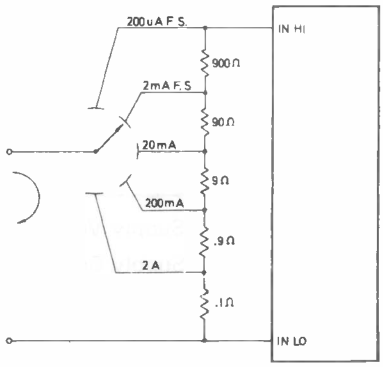
The DVM 176 can easily connected to obtain a 200mV DVM. When the ROL is connected to COM, a 100mV is generated across ROH and ROL. This voltage is then connected to the DVM. Ref voltage input by connecting RFH to ROH, RFL to ROL. The INLO is also connected to COM to obtain two terminals input.

In the application circuits, unless specified otherwise the connections are similar to 200mV DVM.

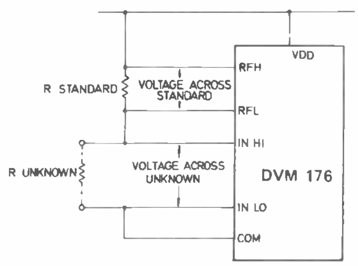
MULTIRANGE VOLTMETER



MULTIRANGE CURRENT METER



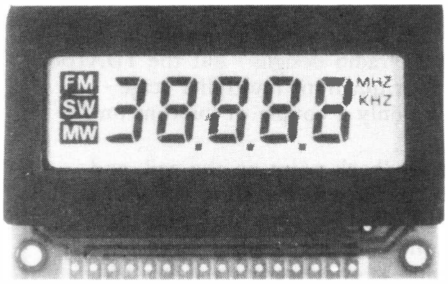
RESISTANCE MEASUREMENT



ELECTRICAL CHARACTERISTICS TA = 25°C

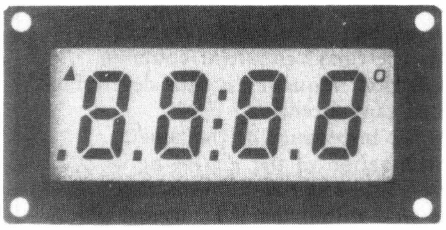
CHARACTERISTICS	CONDITIONS	MIN	TYP	MAX	UNITS
Zero Input Reading	Vin = 0.0V Full scale = 200.0 mV	-000.0	±000.0	+000.0	Digital Reading
Ratiometric Reading	Vin = Vref	999	999/1000	1000	Digital Reading
Linearity (Max. deviation from best straight line fit)	Full Scale = 200 mV	-1	±.2	+1	Counts
Noise (PK—PK value not exceeded 95% of time)	Vin = OV		15		μV
Leakage Current @ Input	Vin = OV		1	10	pA
Zero Reading Drift	Vin = 0 5° < TA < 45°C		0.2	1	μV/°C
Supply Current	Vin = 0		1	2	mA
Temperature Coefficient Analog Common (with respect to positive supply	25K between Common and positive supply		80		ppm/°C
Clock Frequency	V Supply = 9 volts	36	40	44	KHZ
Operating Temperature		0		50	°C
Storage Temperature		-10		60	°C

SPECIAL FUNCTION LCD MODULES



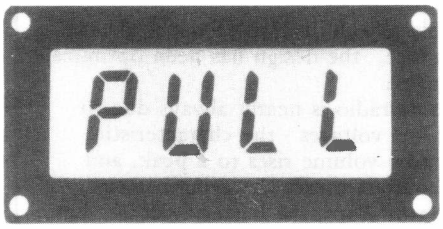
FC177

An extremly versatile module for use with superhet receivers to provide digital frequency display readout. An internal program selects up to 26 IF frequency offsets to cater for most common intermediate frequencies in common use. Additionally the FC177 will also function as a straight frequency counter with no IF offsets up to a max f of 4MHz. The 4½ digit LCD provides 100Hz resolution on LW and MW, 1KHz on SW, and 10KHz on VHF FM, along with auto selection of annunciators for MW, SW, FM, MHz and KHz. For operation above 4MHz a divide by 10 (SW) and divide by 100 (FM) prescaler is required. A complete module with prescaler and input amplifiers is available. (see DFM7, Cat 3 Page 51.).



DM180, DM181

Providing full decoding / display from mulitplexed BCD inputs, with full TTL / CMOS compatability, the modules are available in either 3½ digit (DM180) or 4 digit (DM181) versions. Two decode options are also available : Hexadecimal display — 0 to 9, A to F, or Code B — 0 to 9, Dash, E,H,L,P, Blank.

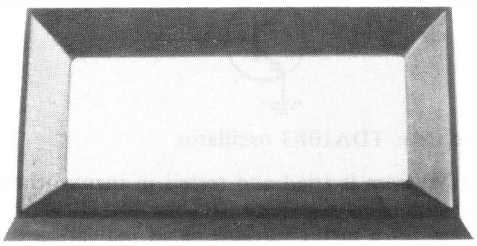


DM182, DM183

Similar to the DM180/1 but requiring a serial data input, the DM182 and DM183 are TTL, CMOS and NMOS compatable. In addition to the serial data input they require only a clock and load pulse from a microprocessor to provide full display / decoding with either 3½ or 4 digit formats.

BEZ — 10

Provides invisible fixing for CM172, CM174, CM174/5L, DVM176, DM180, DM181, DM182 and DM183.
Outside dimensions : 64mm x 34mm x 6mm



Operating Specification & Dimensions

	FC177	DM180**	DM181**	DM182	DM183
Supply Voltage	5 to 6v	3.5 to 6v	3.5 to 6v	3 to 15v	3 to 15v
Supply Current (typ)	5 mA	20 uA	20 uA	60 uA	60 uA
B/Light Supply (typ)	40 mA @ 5v	40 mA @ 5v	40 mA @ 5v	40 mA @ 5v	40 mA @ 5v
Height (mm)	38	30	30	30	30
Width (mm)	60	60	60	60	60
Depth (mm)	10.5	7	7	7	7
Digit Height & Number	9mm(4½)	13mm(3½)	13mm(4)	13mm(3½)	13mm(4)
Bezel Available	No *	BEZ-10	BEZ-10	BEZ-10	BEZ-10
Operating Temp	All Modules 0 to 50 centigrade				
Storage Temp	All Modules —10 to 60 centigrade				

* Bez-10 not mechanically compatable but can be used.
** Add suffix —1 for Hex decoding or —2 for Code B.
For the time being all decoder modules DM180,1,2,3 are subject to delivery 6 to 8 weeks from receipt of order. Please check with sales office for any change.

Full apllication data available on request.
OEM prices OA.

One of the benefits of of integration is that large scale complex functions cost little more than simple transistor arrays - on the micro scale of IC wafer production. The silicon slice has to be big enough to enable the bond wires to be fixed, so as the manufacturers have become more adept at the relatively new art of IC design, there has been a tendency to to produce an extremely refined system - since it costs little more than the simple reproduction of the basic discrete arrays/circuits.

The TDA1083 exemplifies this trend throughout its conception. A simple transistor AM mixer would probably have been acceptable to the consumer manufacturers bred on what are really extremely basic radio designs - but the TDA1083 goes off into the realms of communications technology, and ends up with a superb four quadrant multiplier stage - offering exceptional dynamic range, low oscillator leakage and low noise. After all, it's only a couple of microns on the chip.

Likewise, the oscillator stage could be a one transistor effort, with the need for two feedback point on the coil, and all the additional aggrevation that leaves the designer when band switching has to be considered. But since the lead of the CA3123E, the AM oscillator has been based arøund a differential transistor pair, forming something akin to an RF flip-flop but requiring only a single oscillator coupling winding - and in fact, the coupling winding itself is not really essential, but in the interests of purity, it is customary to use it to provide a lower loading on the tank circuit.

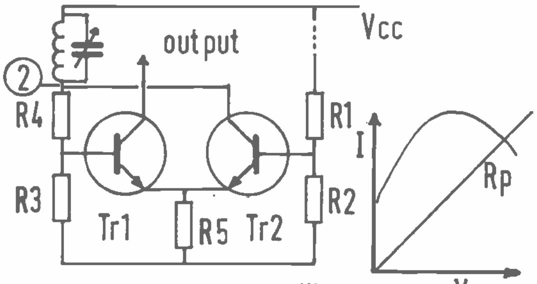


Figure one: CA3123E/uA720 oscillator

The bias on Tr2 is derived from the divider r1/r2, and since r4/r3 on Tr1 form the same divider ratio, pin 2 should be taken to the same positive reference for correct operation. Thus pin 2 goes to Vcc via the tuned circuit(or coupling winding thereof). The oscillation frequency is thus determined from a simple parallel tuned tank circuit.

To sustain oscillation, the AC impedance of the tuned circuit must exceed the attenuation of the R3/R4 network and the input impedance of Tr1. The parallel resistance of the tank circuit should lie well within the V/I curve at pin 2.

In the TDA1083, the oscillator looks like:

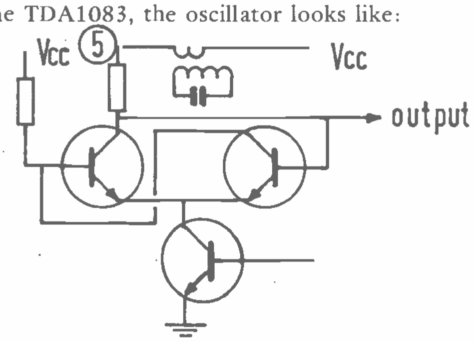


Figure two: TDA1083 oscillator

Which is easily recognizable as a derivation of the CA3123E type of oscillator. In this case, the design has been optimized for operation at low voltages.

The fading out of a portable radio is nearly always due to the oscillator stopping at low voltages - the characteristic "brown outs" when the radio volume rises to a peak, and then as the increased AF output causes the aging battery voltage to drop, the oscillator stops, the battery voltage rises and the whole process repeats itself creating a situation of slow oscillation.

The TDA1083 is almost unique in its operational voltage range, and thus battery life is extended to its very maximum. The FM oscillator, will however probably stop long before the AM section - you cannot have everything !

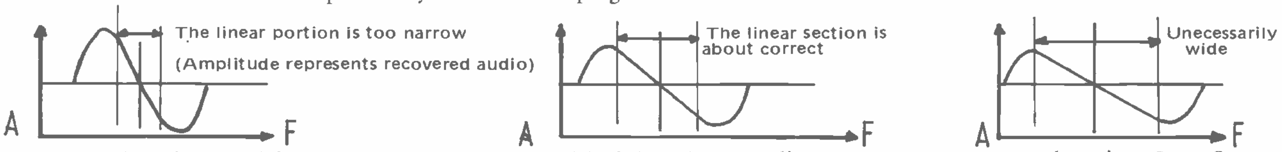
The IF system is tried and tested in many other ICs - and requires little explanation, except perhaps to point out the use of pin 16 as a gain control for the IF - the AGC voltage may be also be monitored at this point to provide a function for a meter suitable as an indication of signal level. The Detector stage is cleverly arranged so the FM IF transformers from pins 15 and 16 present low impedance to AM IF signals at 455-470kHz, whilst the AM IF transformer effectively decouples the top ends of the FM IFs at 10.7MHz.

In the AM mode, low level detection is provided by differential peak detection - a method that avoids the problems brought about in earlier ICs requiring external peak detection, where the final IF carrier voltage was big enough to find its way back along the board to foul up the IF input stages, and cause the whole IF system to behave in a manner not conducive to high sensitivity and stable operation. (The TBA651 is perhaps the classic example of this syndrome.)

In the FM mode, pin 15 represents a simple IF output point, and the coil on that pin is not directly concerned with the FM demodulation. In fact, the FM demodulator may be likened to that in the CA3089E - although it is a much simpler internal arrangement. The detector quadrature coil is at pin 8 - and instead of a choke feed (as per CA3089 family) a simple capacitor is used to provide phase shift of 90^{o} between the limiter output at pin 15, and quadrature coil at pin 14. In fact, a 22uH choke could be used here - but this would then effectively short circuit the AM detector coil at 455kHz. The detector coil has an "S" shaped frequency/phase characteristic (as does any tuned circuit of this type) and so the phase shift is only 90^{o}at the carrier centre point. (10.7MHz) During the excursion of FM, the phase relation ship of this coil will then vary - producing a continuous variation between the zero phase and quadrature signals. The limiter output then is a train of pulses of varying widths, which are subsequently integrated to provide the audio output.

It is worth mentioning here that the capacitor produces a DC drift at the audio output pin that although frequency related, is in the reverse sense to the AFC voltages usually associated with IC detector systems. The problem is not easily solved in a low cost fashion - and will be the subject of further discussion later in this feature.

The quadrature coil is provided with a damping resistor, mainly to provide a linear characteristic over the range of frequency associated with FM transmissions. In mono configurations, the bandwidth can be a great deal narrower than in stereo - and so the recovered audio can be improved by not over damping the coil.



No damping: High Q | Critical damping: Medium Q | Over damping: Low Q

Figure three: Quadrature phase and amplitude characteristics (Qu = F/Bandwidth)

Portable radio design philosophy and techniques

It's an eerie feeling to be writing a piece under this heading - since just about at the time of writing, the last vestige of mass production in the field of portable radio manufacturing has departed these shores. Only Roberts Radio still exist in the UK to make quality portable radio receivers - when at one time, the UK actually had an export business thriving in the market.

Like the HiFi business, we must adress ourselves to the 'specialist' end of the market. The major design failing of the Japanese and messrs. Foreign radios tends to be the cabinet - which is full of apertures, slots and other varied orifices where dirt and grime quickly defaces the once gleaming appearance. But to produce an intelligent and ergonic design without all these visual pleasnatries immediately identifies the product as an oddball in the eyes of those who seem to dictate what we should want to buy.

This is possibly a very obtuse form of market protectionism - since once the public have been persuaded that they want the radio with the most intricate and fiddly moulded plastic cabinet that injection moulding can provide - it becomes very difficult for any country without the guaranteed mass volume of Japan or the Far east to begin to compete - since the costs of tooling such designsare so immense in the West that the costs of amortizing the initial investment is now completely prohibitive. A simple MW/LW radio such you might find in any shop for £10-15 would probably cost £50,000-70,000 to set up for manufacture in Europe. And with European producers now looking at sales of 20,000-30,000 as 'good going', the added cost on set is as much as £10.

The far more economic (in terms of setting up costs) and arguably better sounding portables in essentially wooden cabinets don't really get a look in at the mass market, since the actual cost of such construction is inevitably higher than a plastic mould that has already turned out 200,000 boxes. So the first thing to remember is to design your radio to have intrinsic curiosity value. Merely trying to imitate the mass produced plastic buzz boxes of the Far East is not a worthwhile enterprise.

Carving the case from solid granite is one way to make a name - you would certainly get your product covered in the press for free. It is also technically justified in terms of damping cabinet resonances. And the 'olde worlde' carved Jacobean legs syndrome could be employed to persuade the public of its intrinsic worth. We await the offerings of our readers with great interest. A prize will be offered for the most stylish and appealing presentation of a portable radio with collector appeal - and who knows, maybe someone will actually take such a thing into production.

So, having digressed into some of the more philosophical aspects of the design philosophy - back to the TDA1083:

Evolving a circuit

Original thinking is commercially bad news - at least at the mass end of the market. However, we are not here, so a few new concepts are offered. Starting at the antenna end.....

A ferrite rod for MW and LW is still the best means of reception in a modern inviroment where the theoretically more effective rod antenna suffers from too many practical disadvantages. The major drawback of such antennas has always been that E field pickup on the wires that run from the switching to the tuning capacitor and thence to the rod coils - although the use of varicap tuning in the form used with the 92242 avoids that problem. However, the current consumption that is inherent in the DC tuning and switching of the antenna cannot be accepted in this portable design . And in any case, the problem tends to be far more manifest in mains operated designs.

If however, you consider another drawback of the conventional ferrite rod - namely the directional characteristics - then perhaps the DC tuning approach should not be dismissed to lightly - for if two short rods are arranged mutually at right angles, then provided they are not simultaneously tuned to the same frequency (the 'grid dip' effect), then the output of each rod if separately applied would give a true 360° coverage. Thus the set should be arranged to sample the output from each rod in turn, and then settle on the strongest signal level. A 3" rod is quite adequate for modern receiver front ends. Such a system will be described either in one of the electronics magazines or our next catalogue - since it answers all the problems associated with the directional properties of the ferrite rod in broadcast applications. Maybe a sufficiently low power technique will be evolved to enable its use in a portable design - stay tuned.

And if varicap tuning is available - then remember that the Hitachi CMOS MPU driven CMOS synthesiser only consumes 400uA in the MPU and 12-16mA for the PLL and programmable divider. Most of the current wastage of the mains powered tuner is in the VHF prescalar and the display system. A DFM7 would again use too much current by virtue of the prescalar - although a DFM2 can be squeezed to 12-15mA by dropping the supply to the 8629 - which will work at the frequency of band 2 down to about 3v in most examples. For LW/MW only, the DFM2 without FM facility - or the FC177 - provide a low consumption method of display. In fact, on LW and MW, the entire consumption of the MPU and display system can be kept to below 20mA at 5v - with a further 10-12 mA used in the radio and audio stages, making operation from a stack of AA sized pencells just feasible, and quite suitable if your granite enclosure has room for D cells (U2).

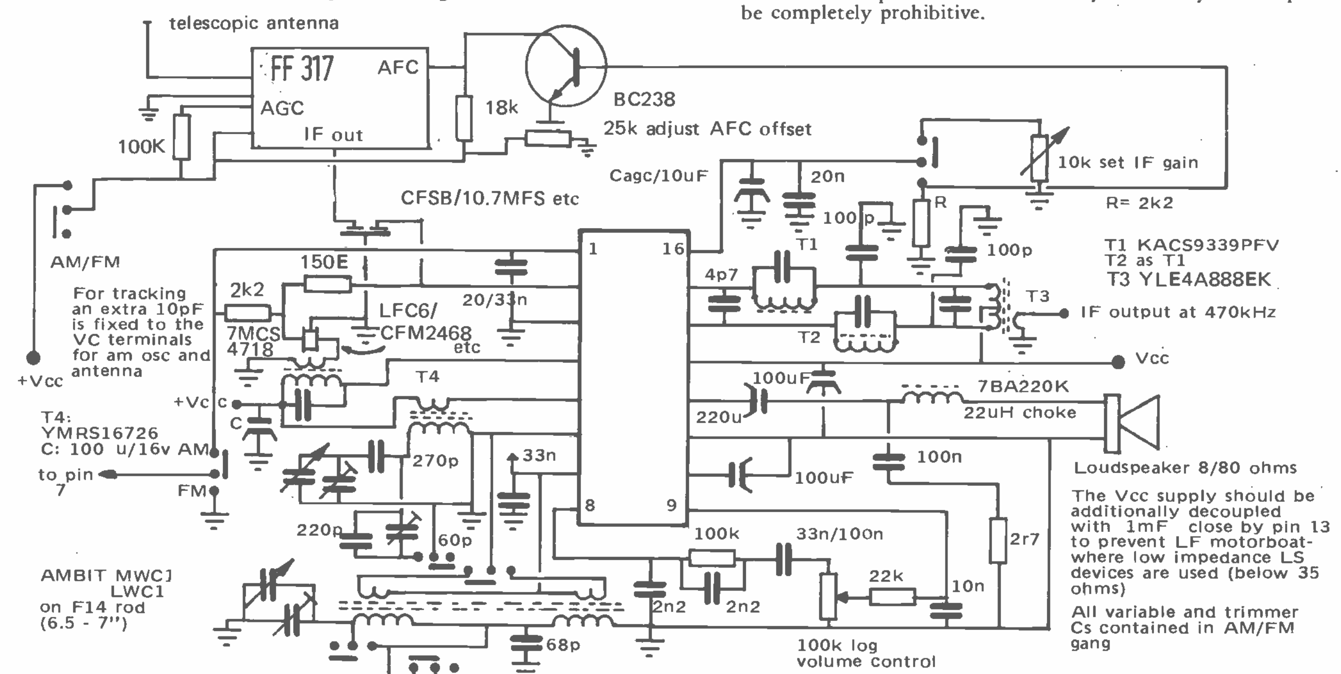
However, the high cost of primary cells is making the use of NiCads look a good deal more appealing - with the basic AA size offering around 500mAH capacity - the mechanically tuned version would run for around 15-20 hours between charges. The fact that the TDA1083 families operate down to 3v or less means that the batteries last a good deal longer than in the discrete designs where 'brownout' used to occur when the 9v supply had sagged to 6v.

Whilst dealing with the question of power - do not use more basic supply voltage than is necessary, since the quiescent drain of the radio/audio stages go up unecessarily above 6v. eg Iq at 9v is 13mA(AM) and only 9mA at 6v. The penalty is the output power of course - 800mW at 9v or just under 400mW at 6v. The batteries would not, however, last for long if used at 800mW output for long periods, a good solution is to use two sets of 4 AA cells, normally connected in parallel (via a diode in each positive lead) - or in series for high volume use as required.

A volume pot using the new push/pull switches might provide a handy means of achieving this facility.

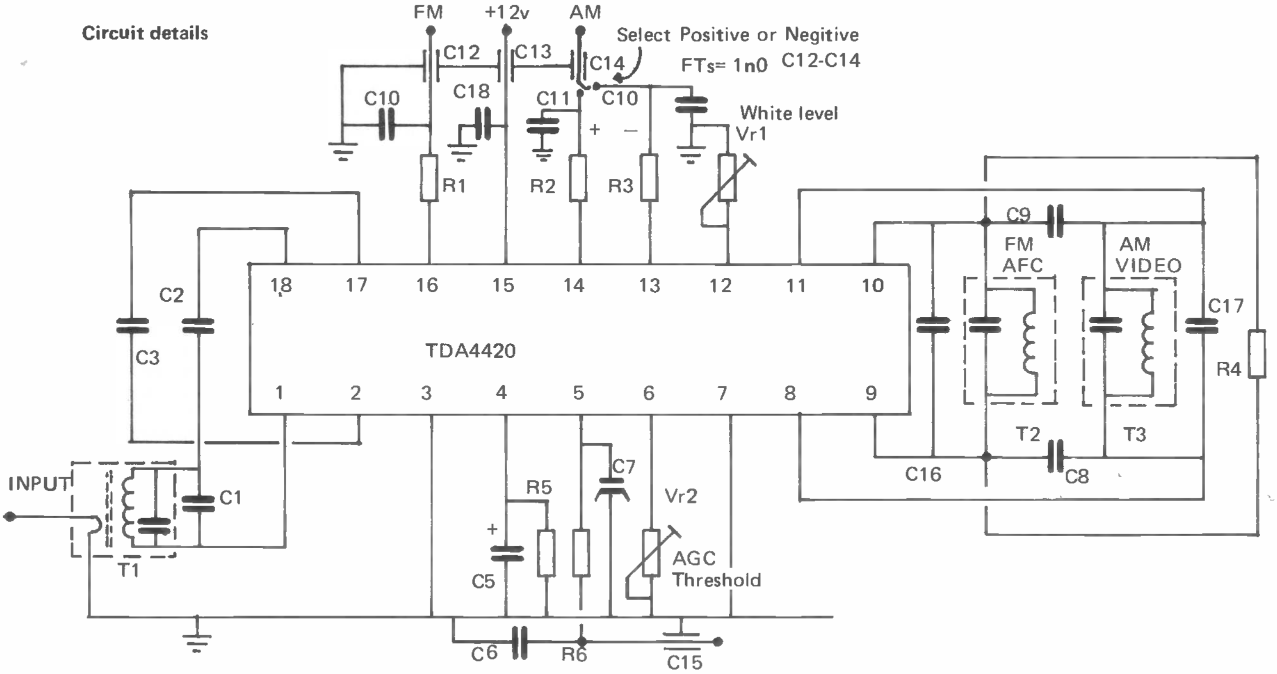
The circuit supplied here is probably the most direct means to any half respectable DIY portable AM/FM receiver design - and will be made available in due course in the form of DIY kit- described in such a way as to enable the complete novice constructor get experience of radio construction. The question of stereo FM does not really arise, since the waste of power in the decoder and second audio channel can only sensibly be met with a mains PSU. However, if you wish to make a mains/battery version then the stereo facility with the KB4423 decoder could be switchable to avoid running the batteries down.

More audio output comes into the same category as stereo from a power consumption point of view - so a TDA2002 or HA1388 PA stage could be incorporated to run only from a mains or vehicle power source. A portable radio should really be just that - so whatever frills you are compelled to attach should basically be intended for use when some external power is available - or your battery consumption will be completely prohibitive.



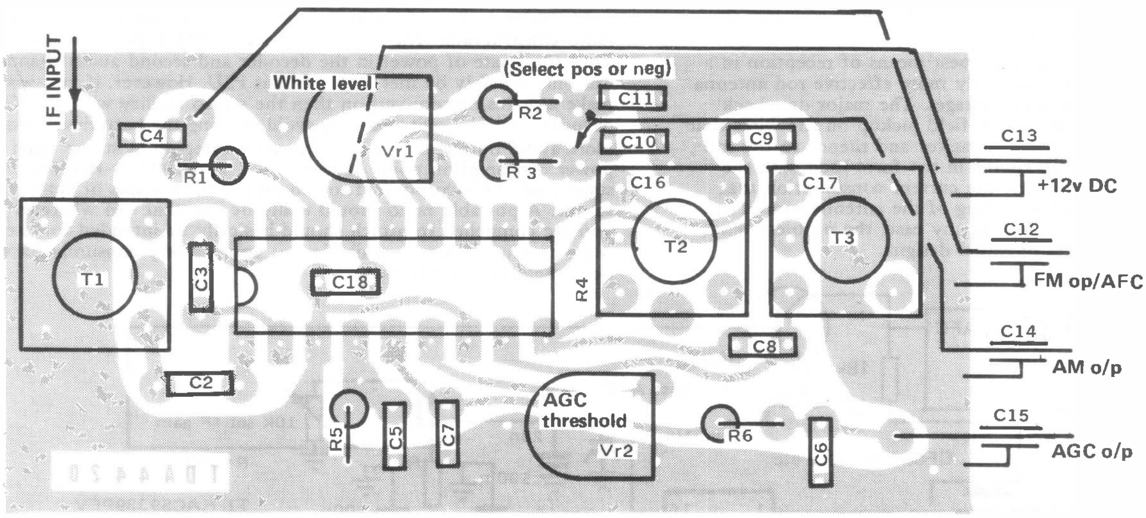
94420: Combined AM/FM if amplifier and simultaneous detector system

Circuit details



Capacitors:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Frequency																		
6MHz	120p	10n	4n7	10n	4u7	4u7	10n	22p	22p	10n	10n	FT	FT	FT	FT	120p	120p	100n
10.7MHz	na	10n	4n7	10n	4u7	10n	10n	2p2	2p2	10n	10n	FT	FT	FT	FT	22p	22p	100n
27MHz	22p	10n	4n7	100p	4u7	10n	na	2p2	2p2	100p	100p	na	FT	na	FT	22p	22p	100n
35MHz	15p	10n	4n7	100p	4u7	10n	na	2p2	2p2	100p	100p	na	FT	na	FT	15p	15p	100n

Resistors	1	2	3	4	5	6	Vr1	Vr2	IFTS: 1	2	3
6MHz	4k7	4k7	4k7	180E	56k	1k	25k	25k	KALS4520A†	KALS4520A	KALS4520A
10.7MHz	4k7	4k7	4k7	*	56k	2k2	25k	25k	KALS4520A†	KALS4520A	KALS4520A
27MHz	1k0	1k0	1k0		56K	2K2	5k	5k	KXNK3335	KXNK3335	KXNK3335
35MHz	1k0	1k0	1k0		56K	2K2	5k	5k	KXNK3335	KXNK3335	KXNK3335



† or alternative to match input to filter.

*Discriminator damping resistor

General

The 94420 is another example of a communications building block module built into the SCB2 screened can. It is designed as an ultra versatile simultaneous AM/FM IF and demodulator - being suitable for both voice TV reception.

The main IC is in fact a comprehensive TV vif subsystem that incorporates both a synch. AM demodulator (for picture), and an FM discriminator for AFC, together with AGC and selectable polarity AM outputs.

FM operation

The FM output also contains the DC AFC information, which must be separately decoupled via a standard RC network - or the AFC will act to cancel FM modulation.

Multiband Capability

The component value tables list the various bands for which 'stock' solutions exist. The basic IC will function from 100kHz to 50MHz and so other frequencies of IF may be covered simply by selecting the appropriate tuned circuit components.

At 10.7MHz, NBFM may be resolved with approx. 50mV/kHz deviation. Wideband FM requires a suitable value of R4 to fitted to damp the FM detector primary. (2k2 typ).

As a communications IF, the input required for 10dB SINAD is approx 9uV/AM, 25uV/FM. TV operation requires 150uV input.

Ambit Data: TDA4420 6 pages

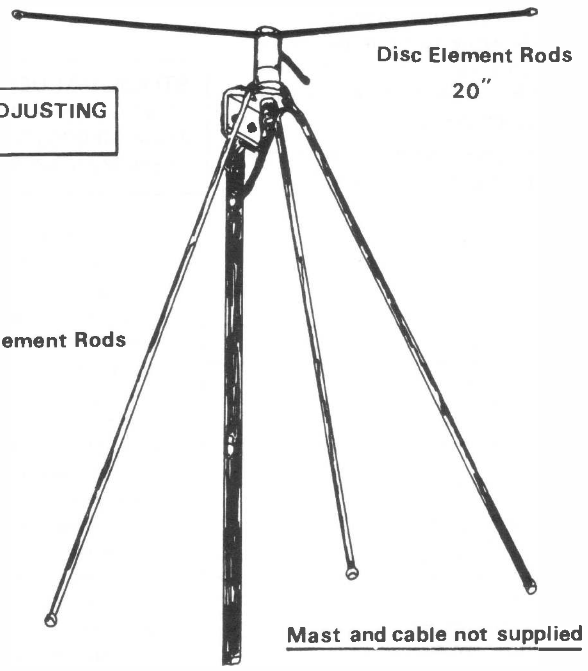
Specifications : video at 35MHz	
Supply voltage	10-15v DC
Supply current	40-65mA
Neg. video DC op	5.5v
Pos. video DC op	5.6v
AGC control current	15mA 10dB after threshold level
Composite video	3.3v
AGC range	50-60dB
Video bandwidth	8-10MHz
Input voltage	100-200uV
Communications : 10.7MHz	
AM input	10-12uV for 20dB S/N
FM input	20-30uV for 20dB S/N
Audio outputs (100uV input)	AM 30% mod 1v FM 5kHz dev. 300mV

WIDE BAND DISCONE MONITOR RECEIVER ANTENNA

This single large aperture antenna covers 40 to 700MHz.

SE-DISA3

NO TRIMMING OR ADJUSTING REQUIRED

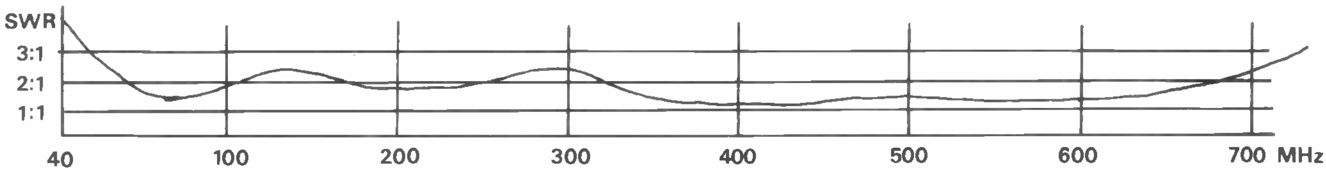


SE-DISA3

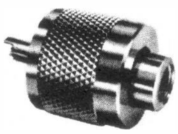
Communications accessories

The rapid increase in the sales of various types of VHF/UHF band scanners has led to an appreciation of the genuine wideband antenna - since the ubiquitous telescopic antenna sported on most of these units is a very half-hearted compromise. This low cost discone antenna can be mounted outdoors in an optimum locations to provide a truly broadband and omni directional coverage for units such as the Bearcat 220/250 etc. It is also a useful form of external antenna for all types of VHF/UHF omnidirectional system, including commercial, marine, amateur etc.
The unit includes a mast clamp, and PL259 socket at its base.

The PL259 series plugs, adapters and sockets listed on this page suit most types of professional and amateur HF/VHF/UHF communications systems operating on 50 ohm matching.
The connection achieved with the PL259 is one of the best price/performance combinations, and the system is recommended for all types of antenna installations. External use of these connectors should take into account the ravages of climate and atmosphere - liberal application of petroleum jelly, and sealing any joints in either plastic bags or rubber 'boots' will save much trouble in the long term - especially if these connections are at the tops of masts on building roofs etc.

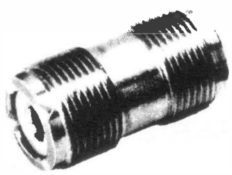


SE572
Solderless cable connector for 58/U cable
Net weight : 15gr.



PL259 series

SE553 (PL-258)
Double Female
Net weight : 22gr.

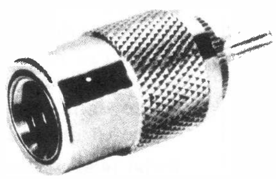


SE554F RECEPTACLE
(Die-cast Zinc)
Outside (front) Fastener type
Bakelite insulation
Net weight: 15gr

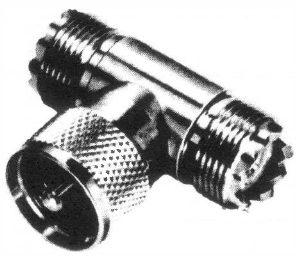
SE557 Universal jack Adaptor
Adapts PL-259 to Motorola type auto antenna jack or R.C.A. type phono jack
Net weight : 18gr.

SEGLC95A

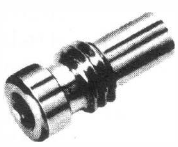
SE551 (PL-259)
Cable Connector
Net weight : 25gr.



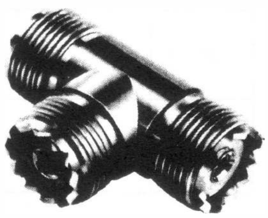
SE560 (M-358)
T-Connector
Net weight : 53gr.



SE555 (UG-175/U)
Adaptor for RG-58/U Cable
Net weight : 10gr.
SE556 (UG-176/U)
Adaptor for RG-59/U Cable
Net weight : 9gr.



SE559
Three Female "T" Adaptor
Net weight : 45gr.



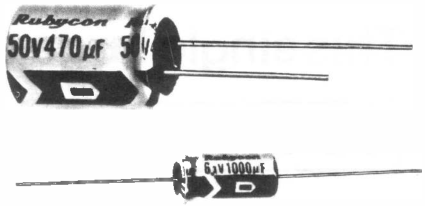
Miniature and standard electrolytic capacitors - the smallest yet

In furtherance of our general policy of expanding the ranges of staple components we offer - we are pleased to announce that we now stock a very comprehensive range of electrolytic capacitors in three ranges:

'MS' series which are superior to most other 'standard' ranges by virtue of their very low leakage (0.01CV as opposed to 0.02 and 0.03 for other manufacturers general grade types). **OEMs please note** that as well as offering the best grade of general purpose electrolytic, our quantity pricing is also the lowest.

'MS7' series are ultra miniature versions of the 'MS' - offering the same overall dimensions as a tantalum bead at far lower cost. The range is liable to be expanded in time - but again these devices outperform other micro-miniature electrolytics at lower cost. The cost is approx. 30% of a tantalum at the 16v/10u level, improving to 15% of an equivalent tantalum at 47uF/10v - when it is even smaller overall !

The ultra low leakage series on the next page provide an equivalent electrical performance to tantalum - at the penalty of being slightly larger than the MS7, although at nearly the same low cost.



STOCK VALUES:
Check current PL for stock types From 10,000uF/6.3v to 47uf/450v in the standard MS OEM series.

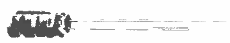
MS SERIES

SPECIFICATION TABLE I

1	RATED VOLTAGE RANGE	6.3V to 100V								
2	OPERATING TEMPERATURE RANGE	−40°C to +85°C								
3	CAPACITANCE TOLERANCE	−10% to +30% or +/−20%								
4	LEAKAGE CURRENT(μA max.) (Apply rated WV for 5 minutes before test)	I =0.01CV+ 3								
5	DISSIPATION FACTOR(tanδ max.)	RATED VOLTAGE	6.3	10	16	25	35	50	63	100
		tan δ	0.22	0.19	0.16	0.14	0.12	0.10	0.10	0.08
		For capacitors whose capacitance exceeds 1000μF, the value of tanδ is increased by 0.02 for every addition of 1000μF.								
6	LOW TEMPERATURE STABILITY (Impedance ratio against+20°C at 120Hz)	RATED VOLTAGE	6.3	10	16	25	35	50	63	100
		Z-25°C/+20°C	4	3	2	2	2	2	2	2
		Z-40°C/+20°C	8	6	6	4	4	3	3	3
7	LIFE TEST AT MAX. TEMPERATURE AND AT RATED VOLTAGE	TEST HOURS	1000±12 hours							
		LEAKAGE CURRENT	Less than the value given in column 4							
		CAPACITANCE CHANGE	Within ±25% of the initial value							
		DF (tanδ)	Less than 200% of the value of column 5							
8	OTHERS	Comply with JIS-C-5141 W character								

MS 7 SERIES

*Miniaturized and low profile case (7.5mm length)
*An excellent alternative to tantalum capacitor
*Specifications are as same as MS series shown in table 1



LIST OF STANDARD PRODUCTS

RATED VOLTAGE (VDC)	SURGE VOLTAGE (SV)	CAPACITANCE (μF)	CATALOG NUMBER	DIMENSIONS D +0.5MAX	L +1MAX	F ±0.5	d ±0.1
6.3	8	22	6R3 TW 22MS7	4	7.5	1.5	0.5
		33	6R3 TW 33MS7	5	7.5	2.0	0.5
		47	6R3 TW 47MS7	6.3	7.5	2.5	0.6
10	13	22	10 TW 22MS7	5	7.5	2.0	0.5
		33	10 TW 33MS7	6.3	7.5	2.5	0.6
		47	10 TW 47MS7	6.3	7.5	2.5	0.6
16	20	10	16 TW 10MS7	4	7.5	1.5	0.5
		22	16 TW 22MS7	6.3	7.5	2.5	0.6
		33	16 TW 33MS7	6.3	7.5	2.5	0.6
25	32	4.7	25 TW 4R7MS7	4	7.5	1.5	0.5
		10	25 TW 10MS7	5	7.5	2.0	0.5
35	44	3.3	35 TW 3R3MS7	4	7.5	1.5	0.5
		4.7	35 TW 4R7MS7	4	7.5	1.5	0.5
		10	35 TW 10MS7	6.3	7.5	2.5	0.6
50	63	0.47	50 TW 0R47MS7	4	7.5	1.5	0.5
		1	50 TW 1MS7	4	7.5	1.5	0.5
		2.2	50 TW 2R2MS7	4	7.5	1.5	0.5
		3.3	50 TW 3R3MS7	4	7.5	1.5	0.5
		4.7	50 TW 4R7MS7	5	7.5	2.0	0.5
63	79	0.47	63 TW 0R47MS7	4	7.5	1.5	0.5
		1	63 TW 1MS7	4	7.5	1.5	0.5
		2.2	63 TW 2R2MS7	4	7.5	1.5	0.5
		3.3	63 TW 3R3MS7	5	7.5	2.0	0.5
		4.7	63 TW 4R7MS7	6.3	7.5	2.5	0.6

Points on the MS series:

As with most passive components, it's hard to get excited about the electrolytic capacitor in the same way as an active device - so until you look at the specs and compare the basic parameters, it is understandable that many users treat them just as 'capacitors'.

The leakage current is one of the most obvious points, but with the increasing use of ICs in linear applications, the dissipation factor becomes a vital consideration for effective decoupling of supplies and bias points where several parts of a single high gain circuit may be referred.

HF noise the emanates from many internal voltage references (and in particular the '3-terminal' regulator series is a very serious nuisance for any radio design - and if you identify this problem, then you need the best bypassing you can find - not simply a 'capacitor'.

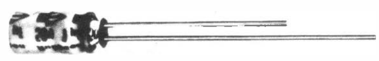
The different degrees of decoupling that can be obtained from different types of electrolytic can be quite surprising - so you might as well start with the best choice in the first place. It costs no more.

The MS7 is rapidly spreading into applications previously occupied by tantalum capacitors - primarily because of its size of course, but also because it has the same basic performance as the 'MS' series - which still surprises new users by its improvement over run-of-the-mill types in terms of specification.

The typical tan δ of a 50v/ 4.7uF MS series device is 0.04 at +20°C which can make the difference between an audio amplifier that is stable - and one that it is incurably prone to instability.

Axial lead versions are not available from general stock - since the standardization on radial leads has caused the cost of axial types to be virtually doubled. If it is essential - then we are able to supply it for OEM users - but please bear in mind radial in all new designs.

Ultra low leakage (radial) electrolytic capacitors

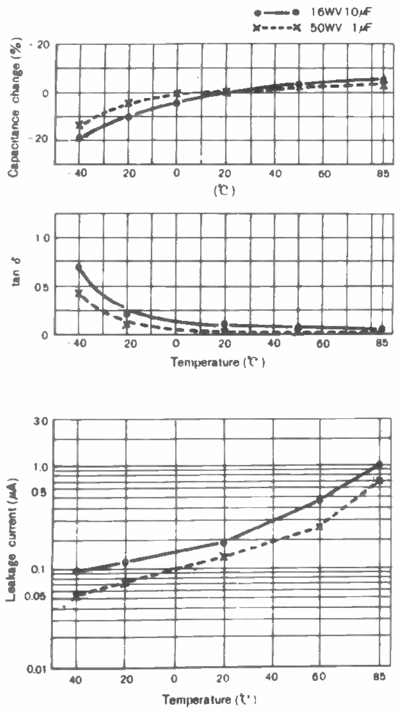


L, LR SERIES LOW LEAKAGE CURRENT

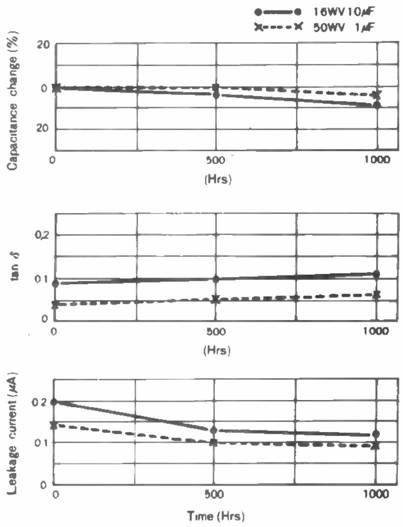
SPECIFICATION TABLE 7

No.	Item		Specification	
1	OPERATING TEMPERATURE RANGE		−40℃ to +85℃	
2	RATED VOLTAGE RANGE		16V to 50V	
3	LEAKAGE CURRENT (μA max.)		I = 0.002CV or 0.4μA whichever is greater	
4	CAPACITANCE TOLERANCE		−20% to +20%	
5	DISSIPATION FACTOR (tan δ max.)		RATED VOLTAGE	tan δ
			16V	0.16
			25V	0.14
			35V	0.12
			50V	0.10
6	LIFE TEST AT 85℃ AND AT RATED VOLTAGE	TEST HOURS	1000±12 hours	
		LEAKAGE CURRENT	Less than the value given in column 3	
		CAPACITANCE CHANGE	Within ±25% of the initial value	
		DF (tan δ)	Less than 200% of the value of column 5	
7	OTHERS		Comply with JIS-C-5141-W character	

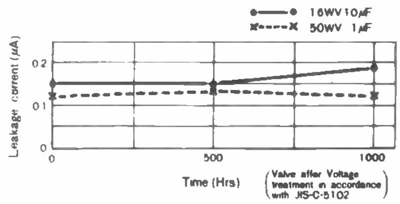
Temperature Characteristics (at 120Hz)



Load Life (at 85℃)



Shelf Life (at 85℃)



LIST OF STANDARD PRODUCTS

RATINGS: RATED VOLTAGE (VDC)	RATINGS: SURGE VOLTAGE (SV)	CAPACITANCE (uF)	CATALOGUE NUMBER	DIMENSIONS (D × L)
10	13	22	10 TW22L	5 × 11.2
		33	10 TW33L	6.3 × 11.2
		47	10 TW47L	6.3 × 11.2
		100	10 TW100L	8 × 11.2
16	20	10	16 TW10L	5 × 11.2
		22	16 TW22L	6.3 × 11.2
		33	16 TW33L	6.3 × 11.2
		47	16 TW47L	8 × 11.2
25	32	4.7	25 TW4R7L	5 × 11.2
		6.8	25 TW6R8L	5 × 11.2
		10	25 TW10L	6.3 × 11.2
		22	25 TW22L	8 × 11.2
		33	25 TW33L	8 × 11.2
35	44	4.7	35 TW4R7L	5 × 11.2
		6.8	35 TW6R8L	5 × 11.2
		10	35 TW10L	6.3 × 11.2
		22	35 TW22L	8 × 11.2
50	63	0.1	50 TW0R1L	5 × 11.2
		0.15	50 TW0R15L	5 × 11.2
		0.22	50 TW0R22L	5 × 11.2
		0.33	50 TW0R33L	5 × 11.2
		0.47	50 TW0R47L	5 × 11.2
		0.68	50 TW0R68L	5 × 11.2
		1.0	50 TW1L	5 × 11.2
		1.5	50 TW1R5L	5 × 11.2
		2.2	50 TW2R2L	5 × 11.2
		3.3	50 TW3R3L	5 × 11.2
		4.7	50 TW4R7L	6.3 × 11.2
		6.8	50 TW6R8L	6.3 × 11.2
		10	50 TW10L	8 × 11.2

In response to the world shortage of tantalum - followed by the inevitable huge rise in costs - the L series electrolytic has now managed to take so much of the pressure from tantalum bead resources that in the vast majority of applications once graced by a tant bead - the tantalum bead is beginning to look like an endangered species.

The performance of the L series in terms of leakage is better than many types of tantalum capacitor costing 5-7 times as much.

The standard range will be expanded in due course - although the present values only represent a fraction of the total range in th 'MS' style. And since most electrolytic capacitors are priced according to the can size - where a larger capacity is available in the same size as a smaller value at the same voltage - we will only stock the larger value in most instances.

PROFESSIONAL/INDUSTRIAL USERS:

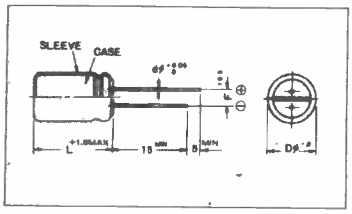
As well as the types listed on pages 70/71, the Rubycon range includes SMPS, mylar, PSU reservoir, flash discharge and low cost non-polar grade capacitors.

We will endeavour to supply a complete catalogue to requests on commercial/official notepaper - but due to limited supply, we may only be able to copy sections that relate specifically to the types of capacitor of immediate interest.

Many users will have come across various types of Japanese capacitors under 'own brand' labels from such as Mullard and Dubillier - manufacturers such at Nippon Chemicon, Matsushita etc. So come direct to the horses mouth for Rubycon, where you find the prices we are able to offer up to 50,000 off are by and large - quite unbeatable for products of equivalent quality.

We know that virtually all our general commercial customers must use capacitors - so if you are not already buying them from Ambit, then there is a good chance you are getting an imperfect deal in terms of price or quality - or most likely both .

That's enough of the hard sell, now read on......



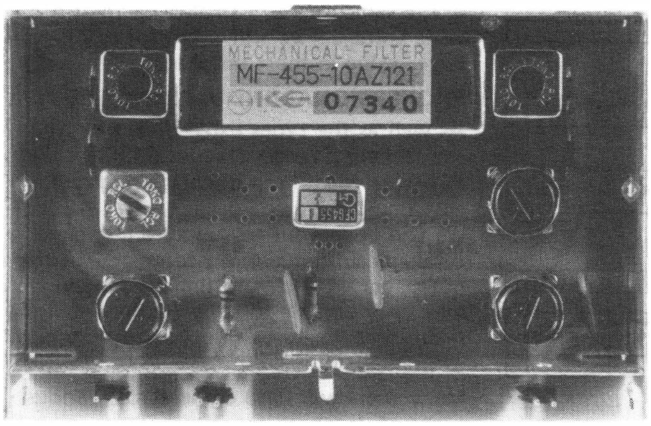
CASE DIMENSIONS

D		L		F		d		
inches	mm	inches	mm	inches	mm	inches	mm	AWG #
0.197	5	0.441	11.2	0.079	2.0	0.020	0.5	24
0.248	6.3	0.441	11.2	0.098	2.5	0.020	0.5	24
0.315	8	0.441	11.2	0.138	3.5	0.020	0.5	24

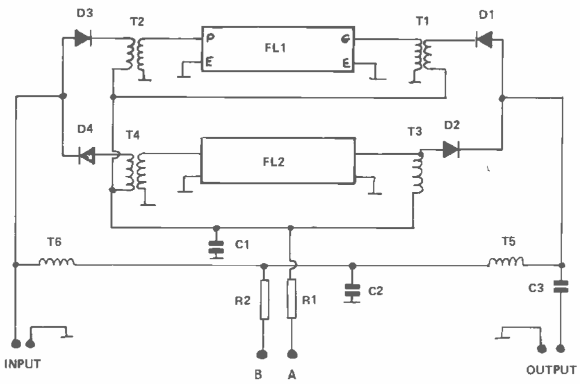
IMPROVING THE FRG7 – AMBIT'S NEW 455F SWITCHED FILTER KIT.

Over the past few years, many circuits have been published showing ways of improving the bandwidth and selectivity of the FRG7 receiver. Unfortunately many relied on filters which were either highly lossy or more recently not available. With much searching Ambit has at last found a suitable high quality filter to fulfill this role in the guise of the MF455 available from Kokusai of Japan. The new 455F kit, specifically designed for use with the FRG7, makes use of this high quality filter in addition to providing a far superior AM filter to that already fitted. The 455F kit is entirely DC switched, requiring only connection to the existing mode switch to provide automatic selection of the correct filter for AM or SSB. A minimal amount of modification is required to the FRG7, being the removal of the existing filter, and some additional wiring to the blank contacts on the function switch. The 455F kit is constructed on a fibre glass PCB and is contained within a completely screened metal case. No drilling is required to fit the 455F, it is simply placed behind the VFO dial using double sided tape to secure it to the metal chassis. All signal paths are made with miniature coax cable to ensure minimal IF re-radiation in the receiver. In addition all DC switching chokes use fully screened cans to reduce to a minimum crosstalk between filters.

The 455F module measures 97x56x22 mm. As standard it is supplied with the MF455 mechanical SSB filter and a high quality AM filter type CFG 455I, providing a 4Khz bandwidth on AM modes. Various options are available enabling the unit to use the existing AM filter instead of the 455I or a wider bandwidth (6Khz) filter type CFG455H can be fitted as an alternative.



INTERNAL VIEW OF 455F MODULE



CIRCUIT DIAGRAM OF 455F MODULE

The DC switching of filters in the 455F, whilst not especially a new idea, is fairly simple and easy to apply to other applications where two signal sources need to be switched only by DC. It requires only a double pole changeover switch connected via points A & B, and a ground and +ve supply (10 - 15v). When a +ve voltage is applied to A, a ground is applied to B. The +ve voltage is routed via R1 and thence to T1 - 4. The gnd appears via R2 and T5 and 6, on the common points of D1 - 4. It can be seen therefore, that in this situation D2 & 4 will be forward biased, allowing the signal to pass via T4, through FL2 to the output. In this condition D1 & D3 will be reverse biased, therfore the signal cannot pass through these diodes or through FL1. When the inputs to A & B are reversed, +ve now appears on the common connections of D1 - 4. At the same time all connections associated with point A assume a ground potential. Therefore D1 & 3 will become forward biased allowing the signal to pass via FL1, whilst D4 & 2 are reverse biased preventing the signal passing through FL2. In this application only C3 is required to prevent the switching voltages affecting the external circuitry. The FRG7 already has a blocking capacitor connected to the input. If the circuit is used with a different receiver, it may be necessary to fit a capacitor to the input (22nF).

MF455 Specification

Min BW @ 6dB	2.0Khz
Max BW @ 60dB	6.0Khz
Max Ins Loss	10dB

CFG455I Specification

Min BW @ 6dB	4.0Khz
Max BW @ 70dB	10.0 Khz
Max Ins Loss	8dB

COMPLETE COMPONENT LIST FOR 455F MODULE

FL1	Kokusai Mechanical Filter Type MF455
FL2	Murata Ceramic Filter Type CFG455I Type CFG455H if requested.
T1,T2	Filter matching transformers supplied with MF455. T1 coded G2805, T2 coded P2805.
T4	YHCS 1A 590
T3,T5, T6	CAN 1896. (CLNS 30568 may be supp as alternative).
C1,C2, C3.	22nF Ceramic disc
R1,R2	10k ¼watt
D1,D2, D3,D4.	BA244 switching diode

COIL BASICS:

Things you should know about tuned circuit design and theory

Impedance, Z, is related to L, C and Q in the following expressions:

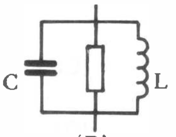
$$Z = Qu.Xl = Qu.2.\pi.f.l \quad ...1$$

where f is the tuned frequency in Hz and l is the inductance in Henrys

and $$Z = Qu.XC = \frac{Qu}{2\pi.f.C} \quad ...2$$

C is expressed in Farads.

Q is largely dependent on the core and bobbin materials - together with the DC winding resistance:



$$Q = \frac{'R'}{\omega L} \quad ...3$$

in fact, the analysis is a great deal more detailed, but the formulae given here will be quite sufficient for most of the practical situations that confront the circuit user.

Working an example from the TOKO IF range, take the LMC4202A 7mm 455IF:

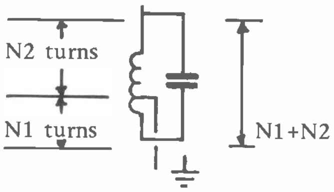
$Q = 105$ total turns 208
$C = 150.10^{-12}$

so, from (2) above

$$Z = \frac{105}{2.\pi.455.150.10^{-9}} = 244k\Omega$$

(all calculations used here will be rounded off for ease)

Fine, but most transistor and ICs need to work into much lower impedances than that, so a little transformer theory is necessary to lower Z to the more usual collector load, of say 37k.



Autotransformer tapping

The total tap point impedances are related by

$$\frac{Ztap}{Ztot} = \left[\frac{N1}{N1+N2}\right]^2$$

So, using our 37k value for Ztap:

$$\frac{37}{244} = \left[\frac{N1}{208}\right]^2$$

$$N1^2 = \frac{208^2 . 37}{244}$$

so N1 = 80

in fact, TOKO use 74 turns, but that isn't going to make a great deal of difference in practise.

The base coupling also requires a lowered impedance, and since it is not really desireable to employ another autotransformer type of tapping, a coupling secondary is used, where the primary and secondary are so tightly coupled, that the basic analysis may be considered identical to that used in the autotransformer case.

In the case of the coil used here, the coupling is used for the detector - so a reasonably high value of 12k is used;

$$\frac{12}{244} = \left[\frac{N1}{208}\right]^2$$

$$N1^2 = \frac{208^2 . 12}{244}$$

thus N1 = 46 turns - and in this instance, the actual value used is 42 t.

The slight differences that occur are due to certain intentional mismatch conditions, designed to reduce the loaded Q.

In a perfectly matched system, the gain of an amplifier stage can be calculated from the following:

$$Av = \frac{Vout}{Vin} = K.gm.Rload.N.K$$

where N is the turns ratio $\sqrt{\frac{Zsec}{Zpri}}$

K represents the 6dB match loss at both input and output
gm is the transconductance in mho (reciprocal ohm)
Rload is the load impedance

In the example used so far, the gain of the final IF before the detector would be:

$$= ½.gm.37k.\sqrt{\frac{12}{244}} . ½$$

with a gm of 90mmho:

= 184 or 45.3dB

The impedance may also be altered by a damping resistor; a popular means of lowering the Q and thereby stabilizing IFs that "take off" due to too much gain. Say to reduce a Q of 105 to Q of 40.

$$\text{then } Z = \frac{40}{\omega.\ 150.\ 10^{-12}}$$

$$= 93k\Omega$$

so to reduce our example, a parallel resistor is used, where

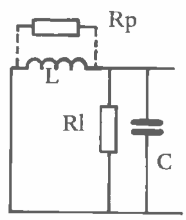
$$\frac{1}{93k} = \frac{1}{244k} + \frac{1}{R\ damp.}$$

$$R\ damp = 150k\Omega$$

Loading considerations

The loading of a tuned circuit of the type described here is first calculated by changing the tap impedance to a function known as the equivalent loading resistance, derived from the equivalent circuit:

The equivalent circuit:



Now Ql = Rp II Rl . Xc

or $$= \frac{Rp\ II\ Rl}{Xl}$$

as you might expect, Rl is taken from a similar transformation formula to the ones used so far:

$$Rl = \left[\frac{N1 + N2}{N1}\right]^2 . \text{Input impedance}$$

with the example before

$$= \left[\frac{208}{74}\right]^2 . 37k$$

Rl= 294k

so Ql= 244 II 294 .Xc

244II294 = 133.3kΩ

$$Ql = \frac{133,300}{2332} = 60$$

but dont forget the loading by the secondary winding !

$$Rl = \left[\frac{208}{42}\right]^2 . 12k = 294k -$$

now this is the same as Rl for the autotransformer tap, indicating that the optimum Rp would be 294k also.

Now Ql = 244II294II294.Xc

$$Ql = \frac{91,734}{2332} = 39.3 \text{ - which}$$

isn't far from the stated figure of 40.

So, to summarize the results:

Z = Rp = Qu.Xl = Qu.Xc

$$\frac{Ztap}{Ztot} = \left[\frac{\text{Tap turns}}{\text{Total turns}}\right]^2$$

$$\text{Gain} = ½.gm.Rload.\ \sqrt{\frac{\text{Tap turns}}{\text{Primary turns}}}\ .½$$

The two "½" multipliers refer to the 6dB loss associated with input/out termination. It will be seen from the loaded Q formulae, that under best matching conditions, when all equiv. load impedances are the same, the Q is reduced to a Ql of (½.½) Qu. Since Q is directly related to V in a tuned circuit, this also implies the voltage is reduced by the (½.½) factor.

Ql = Rp II Rl . Xc = Rp II Rl . Xl

$$\textbf{and } Rl = \left[\frac{\text{Total turns}}{\text{Tap turns}}\right]^2 . \text{Input imp}$$

Z = R in this feature - not to be confused with basic DC resistances.

Bandspread calculations for RF tuned circuits may look fearsome - but as long as a reasonable scientific calculator is used, the answers involve little difficulty.

The basic reason for bandspread in HF and communications recievers is simple: consider a general coverage application on SW3 (14MHz to 30MHz), and now think about the degree of electromechanical stability that is demanded of such a system when trying to resolve an SSB signal, where the carrier needs to be reinserted to within 50Hz. 50Hz on the basis of a coverage of 16MHz represents about one part in three million. This is not an easy task to acheive in terms of mechanical stability and tuning resolution on a dial where they may be only five to ten turns coverage. So the answer is to use a fine tuning capacitor connected in parallel across the main tuning capacitor, but having a greatly reduced capacitance-say one twentieth of the value of the main tuning gang.

This approach is fine in many applications, but does not really solve the problem where long term electro-mechanical stability is essential. It merely facilitates the vernier tuning by the operator.

So the next technique is the expansion of the band to absorb the whole range of the main tuning gang - say 360pF - over a relatively small RF space, as in the type of reciever that covers 'amateur' bands, or broadcast bands only. In this way 21 to 21.5MHz is made to take up all 366pF of the tuning gang swing instead of just a pF or two. This means that small changes in the tuning capacitor due to mechanical shock, heat etc., are greatly buffered in terms of the final frequency shift.

Examples:

The tuned frequency of L/C parallel circuit is given by

$$f = \sqrt{\frac{25330.3}{L.C}}$$

Where f is in MHz
L is in microhenrys
and C is in pF

(Derived from $f = \frac{1}{2\pi\sqrt{LC}}$)

So, in the gnereal coverage application, to reach 30MHz with a minimum tuning capacity of 30pF - to allow for strays, trimmers etc - the inductance required is only 0.9uH (approximations will be used to avoid unecessary decimal complications.)

so at 21.5MHz, a capacitor of 61pF is required, and at 21MHz, a value of 64pF in other words, a change of only 3pF covers 500kHz at 21MHz. It isn't difficult to see that the mechanical susceptibility of such a system is very poor.

So in the process of spreading the band, the endeavour is to make all 366pF do the work of 3pF, and thus make all minor changes in C insignificantly small.

The basic considerations in bandspread calculations

In a tuned circuit arrangement that employs a variable capacitor for tuning (as nearly all outside car radios do), the frequency range covered is determined by the ratio of the maximum and minimum (including strays) capacity that appears across the inductance of the tuned circuit.

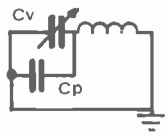
The required capacitance ratio, R,

$$(d^2) = \left[\frac{\text{Max frequency}}{\text{Min frequency}}\right]^2 \qquad (A)$$

let V = capacitance ratio of the tuning capacitor
Cv= maximum value of tuning capacitance
Cp= total parallel capacitance across tuning cap.
Cs= capacitance used in series with tuning cap.
BW= tuning range

$$\text{and BW} = [d-1]\sqrt{\frac{\text{fmax.fmin}}{d}} \qquad (B)$$

Parallel capacitors



There are two basic approaches to the techniques of electrical bandspread - for a variety of reasons, the usual result is a combination of the two, since the impedance of the tuned circuit is very low with a high value of parallel capacity - and thus not suited to many oscillator applications - or very high with a large value of inductor, where the stray capacities inherent in PCBs and wiring limit the overall tuning range through a tight restriction on the factor 'V' (Capacitor ratio)

$$Cp = \frac{Cv\,(V-R)}{V(R-1)} \qquad (C)$$

$$D = \frac{V(Cv+Cp)}{VCp + Cv} \qquad (D)$$

Now at the lowest frequency, the total tuning capacity is Ct = Cv+Cp

As an example, take an interpolation oscillator for tuneable IF of 10.6MHz to 10.8MHz

R = $(1.02)^2$ = 1.04

Using a BB104 varicap over a range of 2 to 10v bias C min is 12.5pF, and Cmax is 22.5pF so

V = $\frac{22.5}{12.5}$ = 1.8

Cv = 22.5pF

substituting in (C)

Cp = $\frac{22.5(\,1.8-1.04)}{1.8(1.04-1)}$
= 237.5pF

So, in order to leave room for strays, use 220pF fixed 5% with a 2-22pF trimmer.

The value of the inductor is then derived from the basic formula for the resonant frequency, where f= 10.8 and C= 237.5+12.5 = 250pF

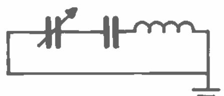
so L = 0.868uH,

but this leaves an impedance of Q.Xc
assume a Q of 100 and then Z = 100 x 5.89
which is only 589 ohms, and not generally much use in this context.

Before moving on, the tuning bandwidth may be confirmed from equation (B)

BW = 0.211MHz (since approx. are used)

So, the series capacitor method comes next:



This approach relies on the principal that a small capacitor placed in series with the Cv factor will reduce the effective parallel capacity across the tuned circuit to value that is

$$\frac{1}{\frac{1}{Cs} + \frac{1}{Cv}}$$

Using the various factors already discussed

$$Cs = \frac{Cv(R-1)}{V - R} \qquad (E)$$

As Csb will be fixed, Cp is solved using intermediate variables:

$$Cq = 4V.\,Cv\,.\left[\frac{Csb(V-R)}{R-1} - Cv\right] \qquad (R)$$

$$Cr = Cv(V+1) + VCsb \qquad (S)$$

$$Cp = \frac{\sqrt{Cq + Cr^2} - Cr}{2V} \qquad (T)$$

(It should be noted that all these various formulæ are basically algebraic manipulations of the basic LC resonance equation— and so derivations are not given here for reasons of space)

For a change, the example used here will relate to something different - coverage of the MW with the KV1210 varactor triplet. Reference to the data sheet of the KV1210 shows that from 2 to 9v bias, the capacity swing is from 400pF to 30pF typically (per diode)

$$V = 400/30 = 13.33$$
$$Cv = 400pF$$
$$BW = 1605/525\ kHz$$
$$R = BW^2 = 9.35$$

So, take Csb = 10000pF and insert in the formulae:

$$Cq = 4\,.\,13\,.\,400\left[\frac{10000\ (3.65)}{9.35-1} - 400\right]$$
$$= 8.26 \times 10^7$$

$$Cr = 400(13+1) + 13(10000) = 135600$$

$$\text{so } Cq + Cr^2 = 1.847 \times 10^{10}$$

$$\text{and } Cp = \frac{1.36 \times 10^5 - 135600}{2 \times 13} = 17pF$$

as far as the RF sections of the MW are concerned, then Cp is simply a 7/35pF trimmer, set halfway and trimmed to take up strays.

The inductance at a Ct of 417pF and a frequency of 525kHz is then

$$= \frac{25330.3}{417\ .\ (0.525)^2} = 220uH$$

which should also occur at 1605kHz and 47pF

$$= \frac{25330.3}{47\ .\ (1.605)^2} = 217uH$$

(The slight error is due to use of 400pF without taking into account the effect of the 10000pF in series)

The final part of this series of bandspread and tracking details will appear in the next issue - it concerns the tracking of the local oscillator at (signal frequency + IF) and covers both parallel gangs (where both the antenna(e) and oscillator sections of the tuning capacitors are the same) and non- parallel gangs eg 160+80 pF, as often found in imported MW only radio applications

Forthcoming attractions from AMBIT

With the regularization of catalogue production on a biannual basis, we will be finding far more space for more detailed analysis of specific ICs and applications thereof. Much work remains to be done to assess the potential of radio ICs in the sorts of applications outlined in page 62 - and it is really no exaggeration to suggest that 68 pages could be written on and about a single IC such as the TDA1083.

Another feature will be a detailed circuit analysis of the more unusual ICs we supply - since a little insight into the internal operation of such devices as the TDA1083 is the quickest way to appreciate its potential - and to provide a clue to fault finding and basic limitations in the operational parameters.

Is there really life out there ??

Judging from the number of times we hear the immortal words:

"I didn't know you did *that*"

There are still a lot of you out there who do not bother to read the whole catalogue and pricelist. The rather ragged index is one ploy to ensure that you have to wander through all the pages to find the specific items you are after - but this isn't really an intentional thing anyway.

With over 50 English Language publications each month competing for the precious attention of the electronics enthusiast and engineer, it is very tempting simply to skip through until the eye alights on a very specific topic of immediate interest. The fact that most publications attempt to be all things to all people in order to net the broadest range of advertizing revenue is rather obvious. Special feature issues attempt to focus attention from time to time, but only really as a means of concentrating the advertizing departments sights on one hapless industry at a time...

All this confusion of written communications has now led onto the fearsome 'symposium, seminar and conference syndrome', when companies and their employees are blackmailed to spend a day at some gathering or other, just to make certain that their competitiors aren't finding out something that they aren't.

The East Swaffam Electronics Show

Perhaps the most useful semina the electronics industry could attend would be one where all the commercial manufacturing companies decided to agree amongst themselves not to support more than one - or at the most - two, bumper trade shows each year. Such shows would encompass every possible aspect of the electronics and computer industry. For as long as we all allow ourselves to be cajoled into attending every two-bit exhibition an organizer can dream up, the conference/seminar business will continue to boom.

The most satisfactory solution would be a really comprehensive electronics trade magazine produced monthly at most, which set out to simply digest and condense everything of any use or relevance to the electronics business, index and catalogue very carefully all entries - and supply the result on disc media. The postman would probably collapse under the strain of a printed version.

The next best thing is for a magazine to stick strictly to one field of interest - and take great pains to be completely informed and up to date.

Yes, you've guessed. This is the intended format of the more regular version of the Ambit catalogue. To date, we have stuck strictly to being a catalogue of Ambit wares and their uses and applications - but from the next issue, items of general interest in the field of radio and allied topics will be included covering the frequency range DC to microwave. Such features may not necessarily be stock items.

Specific product data sheets are also being produced to provide a shortform type of reference to the stock ranges carried and represented by Ambit, since we appreciate that many professional and industrial users may not have the time to read each of catalogues as fully as they (or we) would like. This information will be sent to existing account customers when preparation is completed-which should be by January 1981.

So book now for *your* place at the East Swaffam Electronicorama '81 - just imagine what your competitors might be doing behind your back there ......

(series C bandspread....)

the capacitance ratio, R

$$= \frac{VCs + Cv}{Cs + Cv} \qquad (F)$$

The total effective C accross the tuned circuit is also derived from

$$Cc = \frac{Cv(D-1)}{V-1} \qquad (G)$$

The example used will be based on the same problem so Cs

$$= \frac{22.5(1.04 - 1)}{1.8 - 1.04}$$

$$= 1.18pF$$

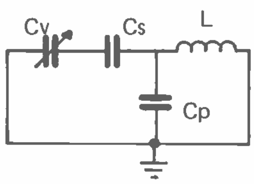
leading to L

$= 201uH$, and with a q of 100

$Z = 1.34$ Mohm

which is just about as unlikely as the result for basic parallel capacitor. The stability demands on the series capacitor are quite impossible to achieve - and no account of stray capacitance has been been made. So, to strike a useful medium, it is not surprizing to find that a combination of the two methods is used.

The Series/parallel technique



The circuit may be analyzed from a combination of the preceding formulae ((A) to (G)), using a mid-band value for the circuit impedance that is going to result in practical values and tolerances, or the following additional equations, which reduces the task to one of programming your calculator, and thinking of a few numbers:

Cta = Total maximum capacitance
Cps = Parallel capacitance
Ccs = Series capacitor
A = Intermediate capacitance ratio of the series arm of the network

and A is between the values of V and R

$$A = \frac{VCs + Cv}{Cs + Cv} \qquad (H)$$

$$Cpa = \frac{Cv(A-1)(A-R)}{A(R-1)(V-1)} \qquad (J)$$

$$Cta = \frac{RCv(A-1)^2}{A(R-1)(V-1)} \qquad (K)$$

$$\text{or } Cta = Cpa \cdot \frac{RCv(A-1)^2}{Cv(A-1)(A-R)} \qquad (L)$$

The value of A is found by introducing a few more variables:

$Cj = 2RCv$ then

$Ck = Cj + Cta(R-1)(V-1)$

$$\text{and } A = \frac{Ck + \sqrt{Ck^2 - Cj^2}}{Cj} \qquad (M)$$

which leads to

$$Cs = \frac{Cv(A-1)}{V-A} \qquad (N)$$

Now this technique is by far the most widely used in design and tracking of resonant circuits - and in the example used so far, where

$R = (1.02)^2 = 1.04$
$V = 1.8$
$Cv = 22.5pF$
Cta = chose a value that makes some practical sense here, say for Z of 10k ohms at 10.6MHz
= 150pF, which is quite manageable sort of choice, as the L is from

$$L = \frac{25530.3}{150(10.6)^2} = 1.5uH$$

the approx. value for A from (H)

$Cj = 2 \cdot 1.04 \cdot 22.5 = 46.8$

$Ck = 46.8 + (150[1.04-1][1.8-1]) = 51.6$

$A = 1.5669$

$$\text{so } Cs = \frac{22.5(1.5669-1)}{1.8 - 1.5669} = 54.72pF$$

The series capacitor is selected to be 56pF in this instance bearing in mind it is going to be a great deal more satisfactory to place any trimming C in parallel, where one side will be RF earth to permit adjustments without stray errors.

Plugging this back into (H)

$$A = \frac{(1.8 \cdot 56) + 22.5}{56+22.5} = 1.57$$

$$Cpa = \frac{22.5(1.57-1)(1.57-1.04)}{1.57(1.04-1)(1.8-1)} = 135.3pF$$

$(A-1)^2 = 0.325$

$$\text{so } Cta = \frac{1.04(22.5)(0.325)}{1.57(1.04-1)(1.8-1)}$$

$$= 151.37pF$$

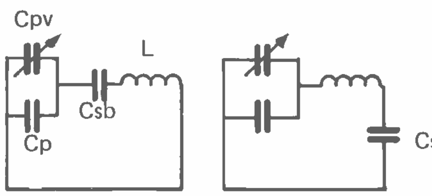
which confirms the original conditions

To allow for a trimmer, the final choice should be:

Cs = 56pF
Cp = 100pF
Ctrim= 0-60pF (in parallel with Cp)

remember that the distributed capacitance of the inductor will account for a few pF in Cp section of the equations- but this is not appreciable until layer wound LF coils are employed.

Alternative Parallel/series method



Csb = series capacitance
Ctb = total maximum capacitance
Cpv = max C in parallel arm
B = intermediate cap. ratio in parallel arm only (again, between V and R)

$$B = \frac{V(Cv + Cp)}{Cv + VCp} \qquad (O)$$

$$Csb = \frac{BCv(V-1)(R-1)}{V(B-1)(B-R)} \qquad (P)$$

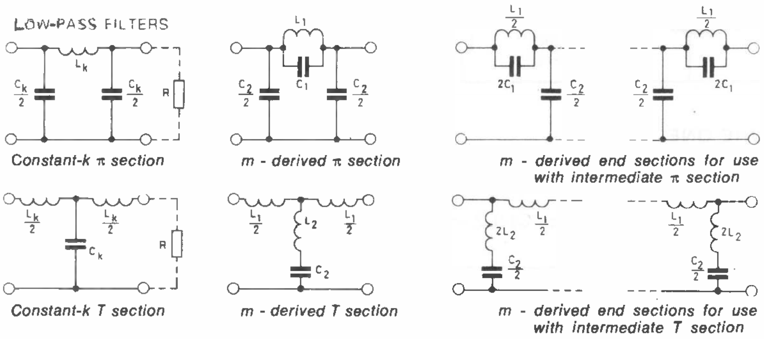
$$Ctb = \frac{BCv(V-1)(R-1)}{V(B-1)^2} \qquad (Q)$$

In a world submerged under radio equipment from the Orient, there may seem to be very little left up to the intelligence of the radio amateur these days. One of the things very much 'up to' transmitting enthusiasts is the need for keeping your RF out of other peoples TVs, HiFi, radio - and even cases of spurious tripping of newer types of solid state thermostat have been known. So to make certain you aren't 5 & 9 amongst the frozen peas, here's a collation of filter circuits and formulae that are frequently used.

The RSGB's 'Radio Data Reference Book' is certainly one of the best general reference works on the subject of the formulae necessary for the enthusiast to carry out his own circuit origination and is excellent value. One of the best ways to gather together snippets of useful design formulae is to photocopy the occasional feature from periodicals, and get as many manufacturers application notes as possible - since not only do these frequently contain a mine of useful information - the practise of providing sepecific abstract references is a useful lead onto further information sources.

Basic filter sections and design formulas. In the formulas *R* is in ohms, *C* in farads, *L* in henrys, and *f* in hertz.

LOW-PASS FILTERS



Constant-k π section — m - derived π section — m - derived end sections for use with intermediate π section

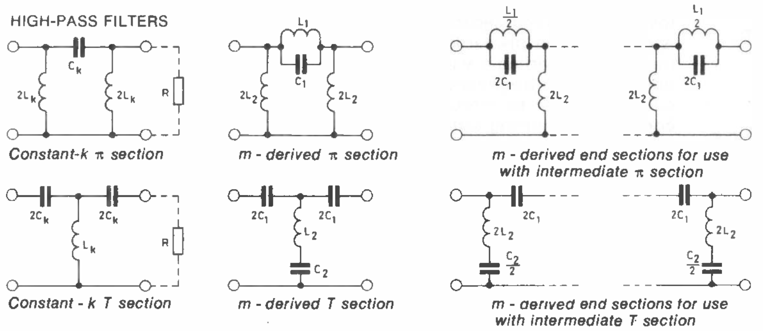
Constant-k T section — m - derived T section — m - derived end sections for use with intermediate T section

$$L_k = \frac{R}{\pi f_c} \qquad C_k = \frac{1}{\pi f_c R}$$

$$L_1 = mL_k \qquad C_1 = \frac{1-m^2}{4m} C_k \qquad L_1 = mL_k \qquad C_1 = \frac{1-m^2}{4m} C_k$$

$$L_2 = \frac{1-m^2}{4m} L_k \qquad C_2 = mC_k \qquad L_2 = \frac{1-m^2}{4m} L_k \qquad C_2 = mC_k$$

HIGH-PASS FILTERS



Constant-k π section — m - derived π section — m - derived end sections for use with intermediate π section

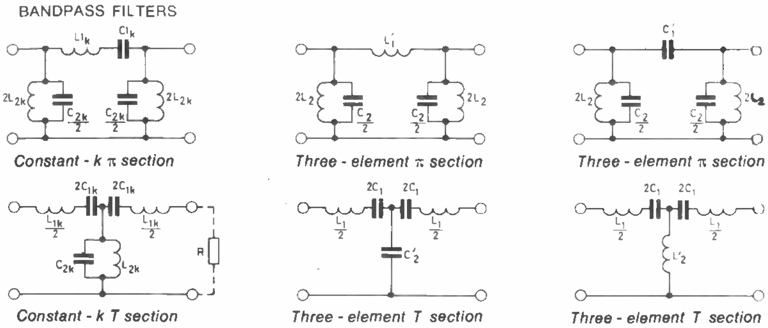
Constant - k T section — m - derived T section — m - derived end sections for use with intermediate T section

$$L_k = \frac{R}{4\pi f_c} \qquad C_k = \frac{1}{4\pi f_c R}$$

$$L_1 = \frac{4m}{1-m^2} L_k \qquad C_1 = \frac{C_k}{m} \qquad L_1 = \frac{4m}{1-m^2} L_k \qquad C_1 = \frac{C_k}{m}$$

$$L_2 = \frac{L_k}{m} \qquad C_2 = \frac{4m}{1-m^2} C_k \qquad L_2 = \frac{L_k}{m} \qquad C_2 = \frac{4m}{1-m^2} C_k$$

BANDPASS FILTERS



Constant - k π section — Three - element π section — Three - element π section

Constant - k T section — Three - element T section — Three - element T section

$$L_{1k} = \frac{R}{\pi(f_2-f_1)} \qquad C_{1k} = \frac{f_2-f_1}{4\pi f_1 f_2 R}$$

$$L_{2k} = \frac{(f_2-f_1)R}{4\pi f_1 f_2} \qquad C_{2k} = \frac{1}{\pi(f_2-f_1)R}$$

$$L_1 = L_{1k} \qquad L_1' = \frac{R}{\pi(f_1+f_2)}$$

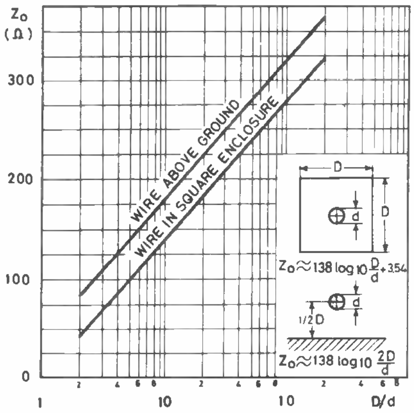
$$C_1 = \frac{f_2-f_1}{4\pi f_1^2 R} \qquad L_2 = \frac{(f_2-f_1)R}{4\pi f_1^2}$$

$$C_2 = C_{2k} \qquad C_2' = \frac{1}{\pi(f_1+f_2)R}$$

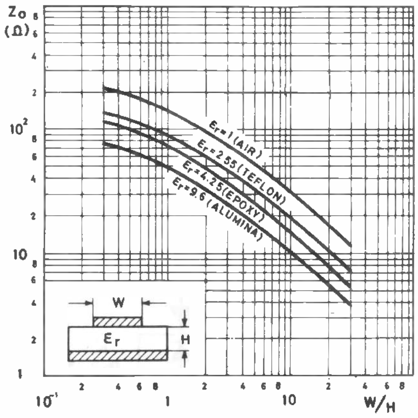
$$L_1 = \frac{f_1 R}{\pi f_2(f_2-f_1)} \qquad C_1 = C_{1k}$$

$$C_1' = \frac{f_1+f_2}{4\pi f_1 f_2 R} \qquad L_2 = L_{2k}$$

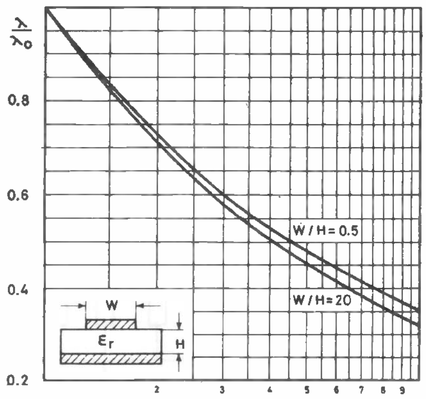
$$L_2' = \frac{(f_1+f_2)R}{4\pi f_1 f_2} \qquad C_2 = \frac{f_1}{\pi f_2(f_2-f_1)R}$$



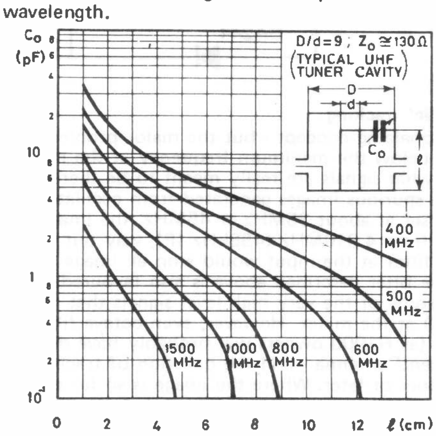
Characteristic impedance of a line



Microstrip characteristic impedance



Ratio of line wavelength to free space wavelength.



UHF Cavity design basics

Receiver 'front end' design techniques

The rapid advance of computerized digital frequency synthesis - as predicted in earlier issues of this catalogue - has still managed to get bogged down in some rather unoriginal receiver design concepts. The classic example being the way in which a synthesiser is 'attached' to a multiband track-tuned superhet communications receiver circuit to simply replace a simple mechanical tuning drive/capacitor by a rather more demanding electronic version.

The Trio R1000 points the way in some respects, although the synthesis is not truly complete, since a 1MHz interpolation tuning is still needed. However, the concept of wideband front-ends using blocks of bandpass filters is very appealing - provided the gain distribution and mixer overload capabilities are not stretched beyond linear regions. The use of a 1st IF above the frequency of the highest RF input frequency is by no means new, but at last the components and techniques are getting within the grasp of the keen amateur. The circuits here are provided as a lead for designs employing such principles.

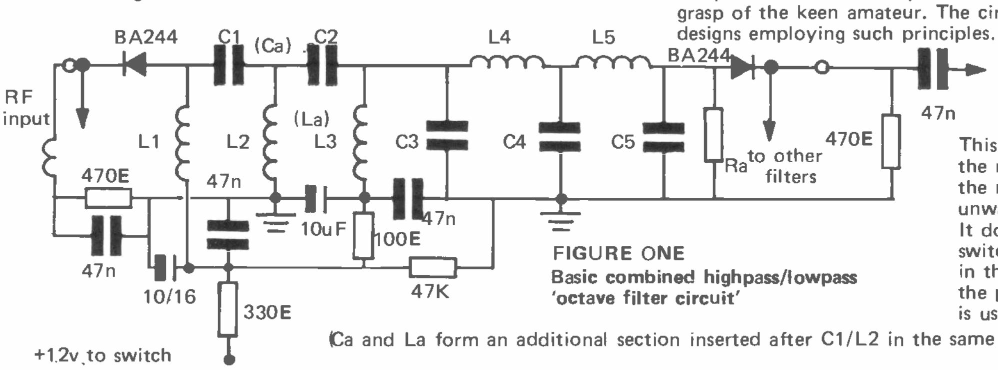


FIGURE ONE
Basic combined highpass/lowpass 'octave filter circuit'

This filter is used at the input stage of the receiver to provide both narrowing of the noise bandwidth, and restriction of unwanted signals to ease potential IMD. It does not require 'track tuning', only switching (via DC) which is readily provided in the synthesiser control programme - or the programme switch where parallel control is used.

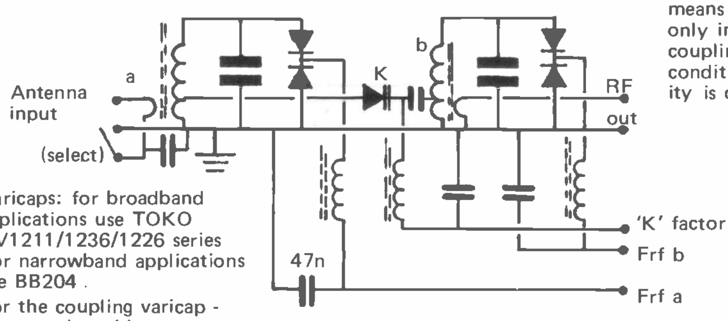
(Ca and La form an additional section inserted after C1/L2 in the same configuration)

FREQUENCY BAND (-3dB)	C1	C2	C3	C4	C5	L1	L2	L3	L4	L5	Ra	Ca	La
200kHz - 1MHz	1n2	1n2	270p	560p	270p	470u	220u	470u	120u	120u			
1-2MHz	220p	220p	150p	270p	150p	100u	47u	100u	68u	68u			
2-4MHz	100p	100p	68p	120p	68p	47u	22u	47u	33u	33u		100p	22u
4-8MHz	47p	47p	27p	56p	27p	22u	12u	22u	15u	15u		47p	12u
8-16MHz	27p	27p	15p	27p	15p	12u	5u6	12u	8u2	8u2	4k7		
16-30MHz	15p	12p	7p	15p	5p	5u6	2u7	5u6	3u9	3u9	4k7		

A Combined bandpass filter and attenuator with variable bandwidth

Most devotees of the radio art will recognize a simple bandpass pair as a reasonably effective single frequency filter stage - although when tuned over more than 10-20% of the nominal centre frequency, the coupling calculations dictate that the bandwidth varies quite noticeably. ie a small coupling capacitor at 4MHz, causes gross overcoupling at 10MHz, leading to a spreading of the response into two very steep peaks. In other words the flat top condition where the coupling factor K is 0.01 (Q=100) increases with increasing frequency. Detailed analysis requires consideration of the Q of both coils, and the frequency range.

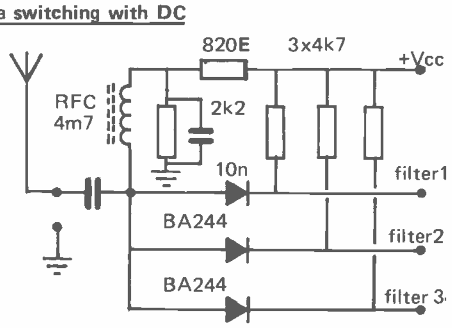
The circuit here exploits the use of a varicap as the coupling element instead of a fixed capacitor - thereby providing adjustable coupling. This is not intended primarily so that you can 'track' the K factor, but as a means of providing a variable bandwidth preselector. If you are interested only in a spot frequency, then the coupling is set to 0.01 or less - less coupling leader to sharper response and signal attenuation. Under band conditions requiring signal attenuation, it is also usual that more selectivity is desirable, and this way you both features simultaneously.



Varicaps: for broadband applications use TOKO KV1211/1236/1226 series
For narrowband applications use BB204.
For the coupling varicap - see text alongside

The actual positioning of the K varicap is very important with respect to the coil tappings - since the use of 5pF at the top of a tuned circuit produces the same results as 50pF at a lower tap impedance. It is always better to use a low impedance tap since the coupling can be more effectively controlled where the varicap range (BB204, KV1236) is 8-30pF or 15-400pF. There should be no mutual coupling between the coils in such a filter - and only well screened type should be used such as the 10K/10E/13K TOKO styles.

Antenna switching with DC

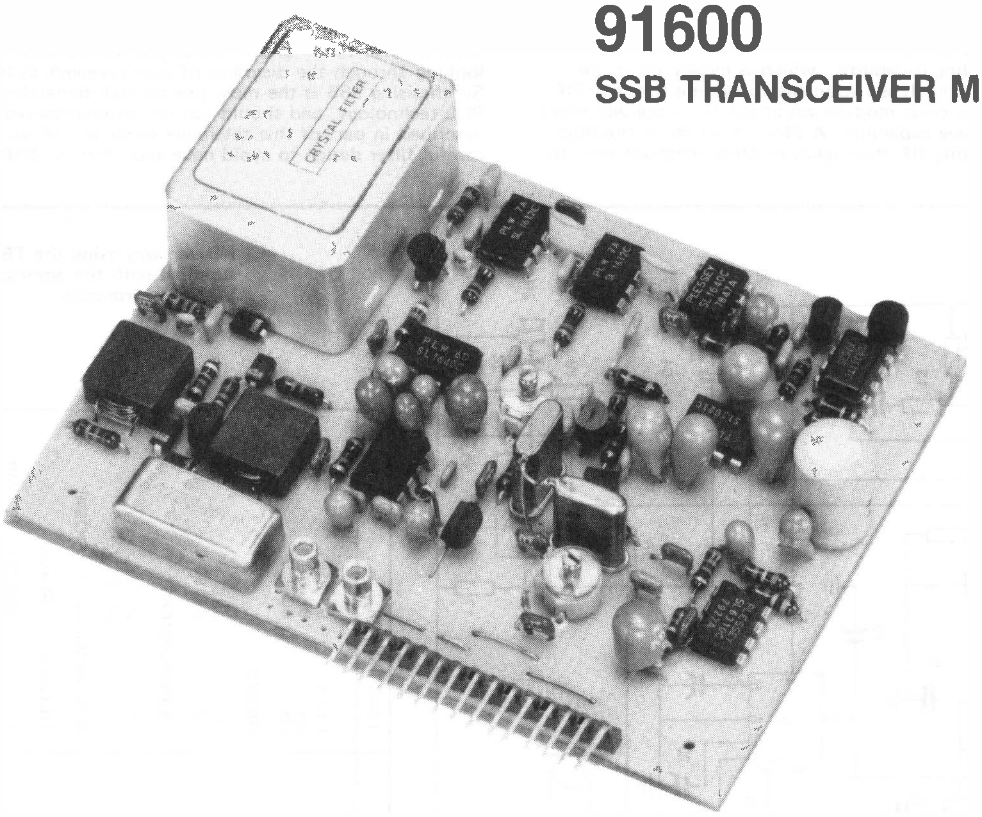


The increased cost complexity introduced into receiver design by apparently 'simple' forms of mechanical wafer switching has long since been surpassed in elegance and economics by designs that use a separate active device and coil set for each switchable band required. The difficulties of switching both the active devices and very highest impedance point of two tuned circuits - along with taps and secondaries is a small nightmare that has haunted many would-be communications receiver designers.
When the circuit alongside is used in conjunction with the bandpass input stage above, the input winding of first RF coil provides a suitable path to ground - making input filter selection a simple matter of grounding one terminal. (See also the 92242 for ideas on this topic).

The mixer of the receiver is then preceeded by tightly screened filters/front ends which do not present any design problems associated with wafer switching at the most potentially unstable points in the circuit, leading to fewer birdies, greatly improved image rejection and a design philosophy which relies less heavily on 'green fingered' twiddling to get right.

'Automatic' tracking

It is an appelaing concept - but the major problem with designs where the IF is below the maximum frequency at the input stage, is that of deciding what signals are really meant to be there, and which are the results of spurious images generated from oscillator harmonics. Where the IF is set at about 35MHz or 45MHz, the image of a signal at 4MHz has gone from 4.910MHz (455kHz IF), way out to 94MHz. A simple low pass filter at the input would stop all image problems - although the octave filter described above is also favoured as a means of restriction of some of the very high level signals that might otherwise cause sever IMD at the mixer. However, even octave filters are rather less than adequate (as R1000 owners will probably have discovered when fixing up a 'decent' antenna - and the question of tracking bandpass filters arises sooner or later. Where the image is so far removed from the RF a preselector may be coursely tuned (either manually, or by the MPU running the synthesiser) even to the extent of simply selecting the filter via the bandswitch, and then relying on the signal level output to provide fine tuning - automatically.
Aha - what about SSB ?? The signal goes up and down according to the speech level - likewise HF fading effects. The answer is simple, an HF noise source is switched in at the same time as the automatic tuning is activated. The resulting tuning voltage for the preselector can be stored on an FET gate indefinately. During the time it takes to settle (which should be a few milliseconds) the audio will need to be muted.
If you are tuning around - then the preselector tuning can be trimmed manually if required. The alternative is a £35 23dBm mixer stage to obtain completely un tuned RF performance with the same input range.



91600

SSB TRANSCEIVER MODULE

An extremely versatile USB/LSB transceiver module:

In response to requests received from radio enthusiasts, we have now introduced a versatile SSB transceiver building block that can conceivably fulfill the requirements of an exciter for any frequency in the range 100kHz to 1000MHz. It all depends on the LO input range and the choice of the first mixer.

Performance

Many radio enthusiasts will be familiar with the 'original' SL600 SSB transceiver units - and this derivative by James Bryant (G4CLF) has taken some of the shortcomings into account to produce a versatile transceiver with 0.2uV SSB input sensitivity, a tailored audio response of 24dB/octave above 3.5kHz, and 800mW of audio on-board.

The input/output connections are along one side of the PCB - with on-board supply regulation for 12v operation. All switching is accomplished remotely by DC.

The unit requires the injection of a local oscillator to tune the desired frequency band in the usual heterodyne manner: Frequency of RF (plus or minus) the chosen IF. In our adaptation of this unit we have used a 10.7MHz filter instead of 9MHz. Thoughts on the use of this filter as opposed to 9MHz units are covered elsewhere in this catalogue - but briefly, with 10.7MHz, our DFM4 enables easy and direct frequency readout to be achieved.

The first mixer should be selected according to the frequency range and IM performance you want:

Frequency range	LO level	use mixer type:
1-500MHz (RF)	+5-8dBm	SBL1 (SRA1)
100kHz to 200MHz (RF)	..	SBL1-8
10MHz to 1000MHz	..	SBL1-X
100kHz to 500MHz	..	SRA1-1
500kHz to 500MHz	+17dBm	SRA1H

The SBL1 is supplied as standard, and this is equivalent to the original MD108.

With the standard mixer, the unit has a useable dynamic range of about 114dB (250mV rms input) - with a possible AGC range of up to 140dB, which more than covers the requirement of this unit.

The AGC itself is audio derived, with an 18dB/octave rolloff above 3.5kHz being placed after the product detector stage to keep the audio response down to speech band requirements only. The SL series AGC generaots are amongst the most famous ICs in the range, and provide fast attack approx. 1 second hold, and fast decay.

Depending on availability, the audio stage may be either the SL6310, or the TBA820M. It is anticipated the version with TBA820M will prevail since Plessey want rather more money for the SL6310.

The Transmitter

Or, as it is more correctly termed, the exciter uses just two ICs and a transistor - plus some of the bits employed in the receiver. By the nature of the system, the transmitter will always be operating at the same frequency as the receiver - any RIT must be provided at the VFO.

The balanced mic amp is a VOGAD speech processor. The circuit is supplied with the SL6270 which is equally suited to operation with a single eneded (unbalanced) mic input.

The mic should be a low impedance (less than 600 ohms) unit with 1-30mV output. Apart from matching considerations, the use of a low impedance mic keeps the RF out of the modulator rather more satisfactorily. The carrier oscillators are provided with a capacitive trimmer - which should be set during reception for the characteristic SSB 'sound' in the absence of more precise techniques.

Electrical specifications:

Receiver sensitivity	(+12v supply, +7dBm LO)	0.3uV for 10dB sinad
Dynamic range	Wanted signals	114dB
Dynamic range	Out-of-band *Does not include RF selectivity considerations	88dB*
3rd order IMD		+7dBm
Audio output		800mW
Current consumption	at no signal in	60mA
Transmitter output	Single tone	-5dBm
Carrier	(Depends on filter)	-49dBm
IM Products	1.2 and 1.4 kHz 2 tone	-50dBm
VOGAD range		60dB
Current consumption		45mA

The minimum system

For reception, a front end filter and LO are all that is needed. The RF selectivity can either be a bandpass tuned circuit in the form of a preselector (remember AGC to any gain stage) - or a combination high/low pass filters depending which side of the IF you want the input frequency. Bandpass selectivity will assist in improving out of band IMD by what degree of selectivity you can introduce.

The high level of the LO cannot achieved by running a VFO stage 'hard' or drift will be inevitable. A buffer/amplifier must be used to raise the level. It is a brave designer who sets out to make such an amplifier a tracking tuned stage - a wideband amplifier with lowpass filter to attenuate harmonic content is the best solution.

With a bit of thought, the same amplifier can be used for the first stage of TX amplification - but the general considerations of a really high power SSB linear amplifier are outside this brief description. In a subsequent part of this series we hope to cover the theory and practise in some detail. Meantime, several designs have been published and we will supply copies if required.

Optimizing receiver performance

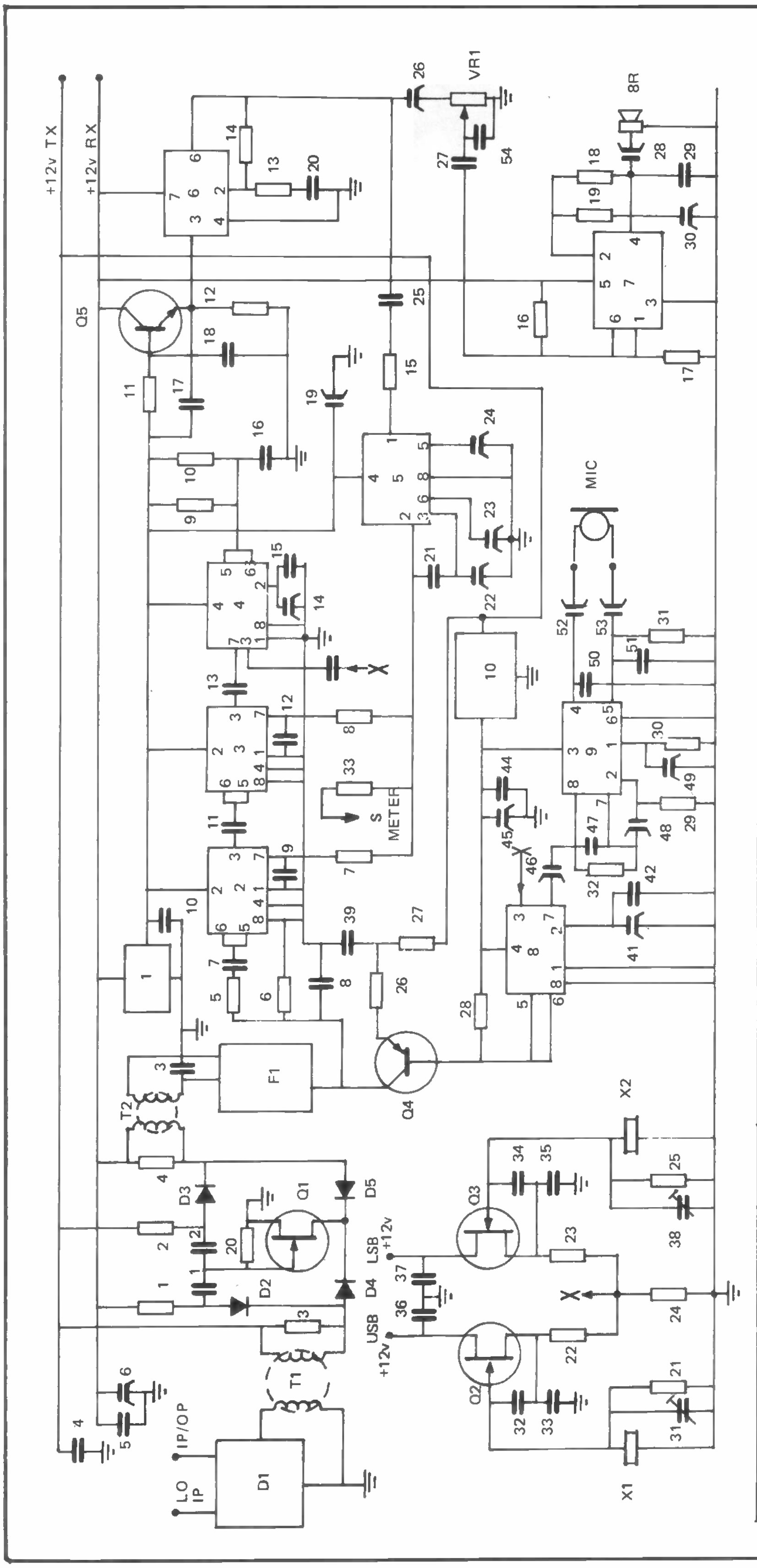
Omitting ICs 8&9 reduces the unit to a simple receive-only SSB system. The RF sections of a high performance SSB receiver should be designed primarily for the following criteria:

Good rejection of LO related spurii - such as simple image responses, beats between the CIO and the LO etc.

Good dynamic signal handling capability - which is largely up to the performance of the first mixer. It is reasonable to assume that any RF signal large enough to cause cross modulation at the RF stage will more than overload the mixer stage capability. A PIN attenuator is the most satisfactory means of cutting RF stage gain, as other methods tend to lead to a reduction in overload performance.

A noise blanker is particularly useful in audio derived AGC systems. Whilst some good can be done at audio, the best solution is to perform the task at IF frequencies, and thus avoid the stretching effect of a narrow filter. Various signal gating circuits have appeared in the press from time to time - and it is also possible to glean a good deal by looking through the diagrams of such receivers as the R1000.

Synthesising SSB is the most precise and demanding application of PLL technology, and should not be underestimated. The systems described in part of this catalogue series will all work - but require careful filter design to avoid noise and jitter for SSB reception.



NB versions using the TBA820M will be supplied with the appropriate circuit and layout information.

RESISTORS (All ¼w 10%)

R1,2	4K7
R3,4,6	560R
R5,26	47R
R7,8	100R
R9,28	330R (SL1641 only)
R10,11	10K
R12	3K3
R13	12K
R14	100K
R15	3K9
R16,17	270K
R18	120K
R19	2K2
R20	22K
R21,25	27K
R22,23,27,33	1K
R24	68R
R29	220R
R30	1M
R31	47K
R32	1K (Optional - See text)

CAPACITORS (C = Ceramic, T = Tantalum, A = Aluminium)

C1,2,7,40,50,51,54,43	1n	C
C3,8	22p	C
C4,5,10,15,16,20,25,39 27,29,36,37,42,44	100n	C
C6	220u	A
C9,12,17	10n	C
C11,13	100p	C
C14	10u	T
C18	2n2	C
C19,22,23,28	100u	T
C21	0.1 to 1uF (See Text)	
C24,45,49	47u	T
C26,48,52,53	2u2	T
C30	220n	T
C31,38	22p Variable	
C32,33,34,35	47p	C
C46	1u	T
C41	4u7	T
C47	4n7	C

TRANSISTORS

Q1,2,3	BF 256
Q4	BF 441
Q5	BC 239

DIODES

D1	SBL - 1
D2 – 5	BA182

TRANSFORMERS

T1	2t : 6t
T2	6t : 6t

Both use Mullard core FX2249

FILTER & CRYSTALS

F1	10M22D (10.7 MHz)
X1 & X2	USB & LSB Crystals 30pF, parallel resonant.

INTEGRATED CIRCUITS

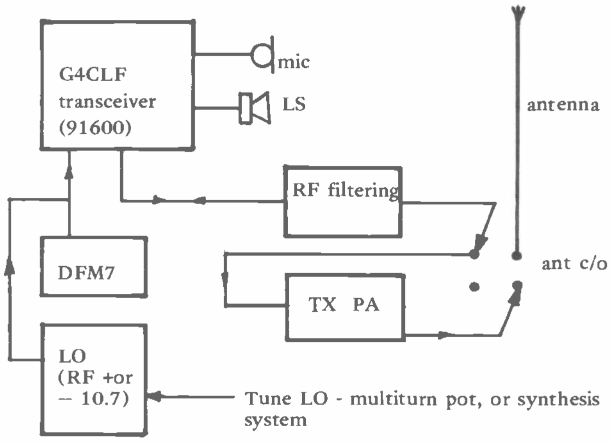
IC1 , 10	78L06 Regulator
IC2 , 3	SL 1612
IC4 , 8	SL 1640 or SL 1641
IC5	SL 1621
IC6	741 Op — Amp
IC7	SL 6310
IC9	SL 1626 or SL 6270

ACCESSORIES FOR THE G4CLF TRANSCEIVER

The G4CLF SSB transceiver requires the addition of an external local oscillator (10.7MHz offset from the RF frequency), and some form of RF selectivity. In transmit mode, the ultra low power output can be used by the very enthusiastic QRP fan - but most users will be seeking the benefits of additional linear RF amplification.

Ambit will be producing a series of suitable units in the course of the next few months - including a synthesised local oscillator system for all frequencies from 100kHz to 30MHz, and various VHF/UHF bands. The existing DFM7 will interface directly with a simple VFO to provide the RF frequency readout on both receive and transmit - although its resolution will be fixed at 1kHz. Nevertheless, this degree of calibration accuracy is still far better than can be achieved with a mechanical dial system.

The question of preselector design is covered elsewhere in this edition, and may either be passive for transceiver and transmit applications - or active (ie with gain) if used in a receive-only signal path.



A quick solution to frequency synthesis can be found if the Hitachi broadcast based tuning system (described in part 3 of the catalogue series) is adapted in a mixer loop system. The MPU and PLL/prog. divider can be used to provide 5kHz steps in two ways, both with 5kHz interpolation using a "pullable" reference oscillator. The display driver will produce irrelevant numbers, and so the DFM6 or 7 must still be used to provide the correct tuning information.

The two ways are: the SW mode, where the LO tunes from 5.95-9.775 with a +470kHz offset, and the FM less the /10 prescalar factor - tuning 8.75-10.81MHz with a +1.07MHz offset (also prescaled, remember). ie the two actual LO frequency spans are:

6.42MHz - 10.245MHz (in SW control mode)

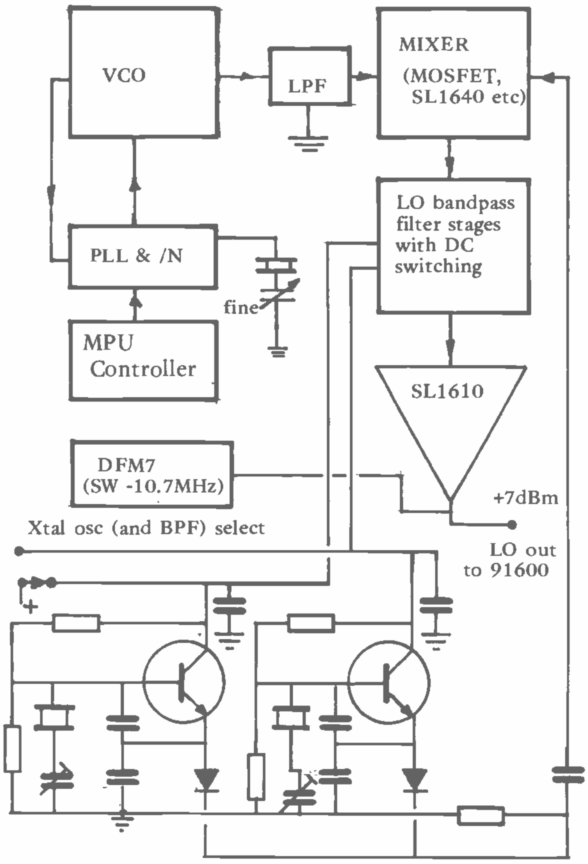
9.82MHz to 11.88MHz (in FM mode)

...but over these spans, all the facilities of slow/fast manual tuning, 8 preset channels, scan tuning, sample tuning and various forms of signal recognition to stop the scanning may be applied.

The use of the FM mode is in many ways preferable, although since the two ranges overlap, the reset condition ensures FM is always selected if the battery backup is omitted.

Mixing the output of the synthesised loop with fixed crystal oscillators will provide continuous coverage for an HF bands receiver. (Max. span per band will be 5.46MHz using both the SW and FM mode). The actual crystals are:

4.28MHz	0-5.46MHz (RF tuning range)
9.74	5.46-10.92 (10.7+/- 10kHz omitted)
15.2	10.92-16.38
20.66	16.38-21.84
26.12	21.84-27.3
31.58	27.3-32.76



The above system illustrates the use of two crystals and the associated BPF switching (see pages 77 & 78)) for the mixer synthesiser described. Additional stages may be cascaded on as required.

And by the same method, spans at VHF and UHF may also be covered, although filtering the mixing products gets more exacting as the products are a diminishing percentage of the centre frequency values.

The above scheme contains a few flaws - such as the crystal frequency appears in the actual RF range tuned, and thus will cause spot birdies - although not on any notable SSB communications channels.

The same points on spectral purity apply to the transmit drive signals - since although it is tempting to assume that a simple wideband stage will 'do' - great care must be taken to avoid letting any of the mixing products into the PA. Fully tracked bandpass tuning is a nuisance, but a correctly designed HPF and LPF combination will be quite satisfactory anyway. As the power levels increase, the use of ferrite cored transformers and inductors becomes dubious - so moving onto dust iron toroids and air cored inductors is necessary at levels above about 100-200mW. The unwary are strongly advised not to attempt linear SSB amplifier designs of more than 50W PEP - which ought to be enough for most applications anyway - unless working to very explicit constructional information.

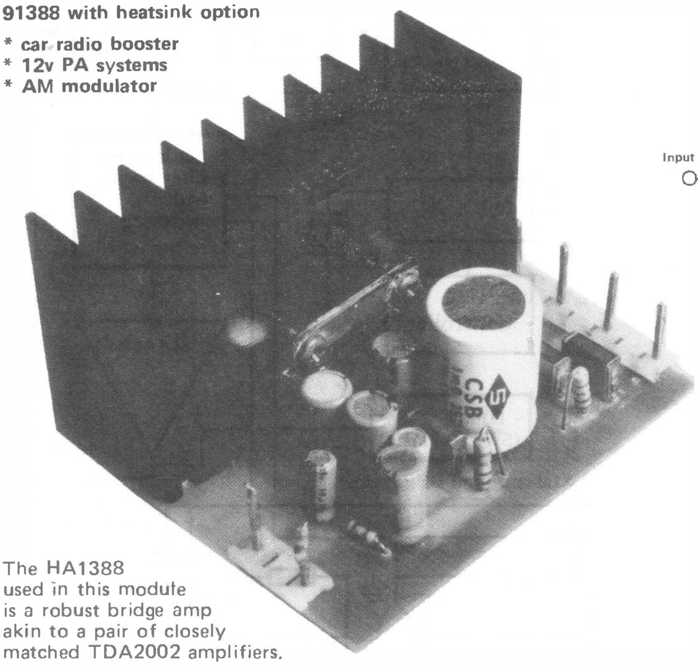
As you will find underlined elsewhere in this catalogue, much of the purpose of DIY radio construction is as an educational and instructional excercise. This particular project has the advantage of being both instructional in modern techniques - and providing a communications system that is competitively priced with commercial gear - whilst retaining the flexibility inherent in a modular approach.

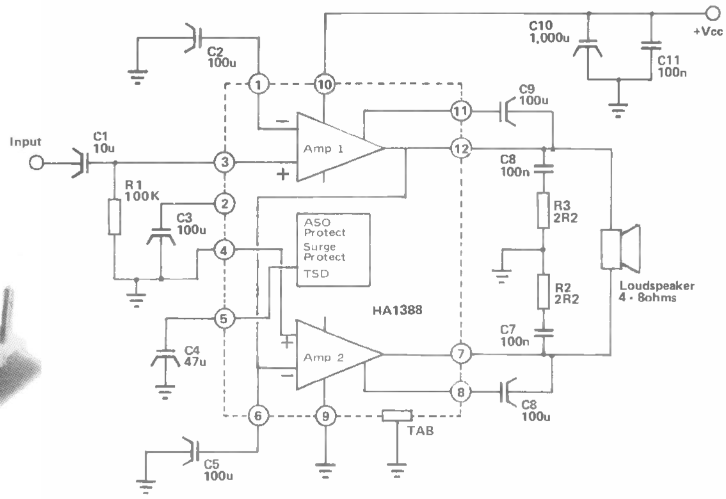
Whilst work is under way to provide a modular solution to the question of a stable tuning synthesiser at Ambit, we are offering the parts for the above synthesiser in our standard price list already - with a special 'package' deal for the CMOS MPU and PLL parts if bought with a DFM6 or 7. (Or the short version of the DFM7 for operation up to 30MHz (RF) only - the DFM7-S). A complete SSB transceiver fabricated in this way will provide an invaluable insight into many of the techniques not presently widely available to the enthusiast radio constructor.

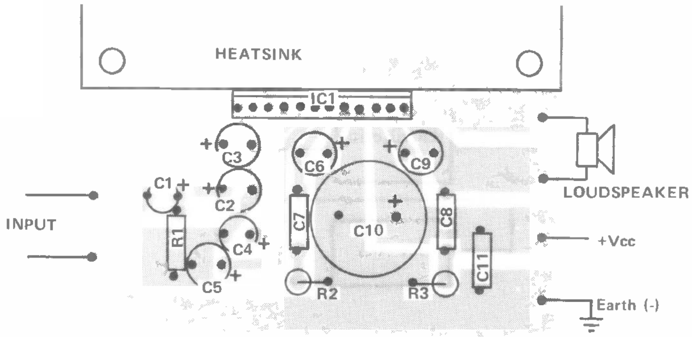
Audio PA modules : 91388 mono 18w/4ohms/13.8v, 91370 'dual' 20W/8ohms/44v

91388 with heatsink option

- car radio booster
- 12v PA systems
- AM modulator







The HA1388 used in this module is a robust bridge amp akin to a pair of closely matched TDA2002 amplifiers.

The bridge configuration drives a standard impedance loudspeaker to the practical maximum level you can tolerate in a car. Much cheaper than a new rear axle when it starts to whine...

Brief Spec: (Full details on HA1388 data sheets)

Operating voltage range	8 - 18v DC
Peak pulse overload	50v/200mSec
Gain	55dB
Output at 10% THD	18w/4ohms
THD at 1kHz /10W	1% max

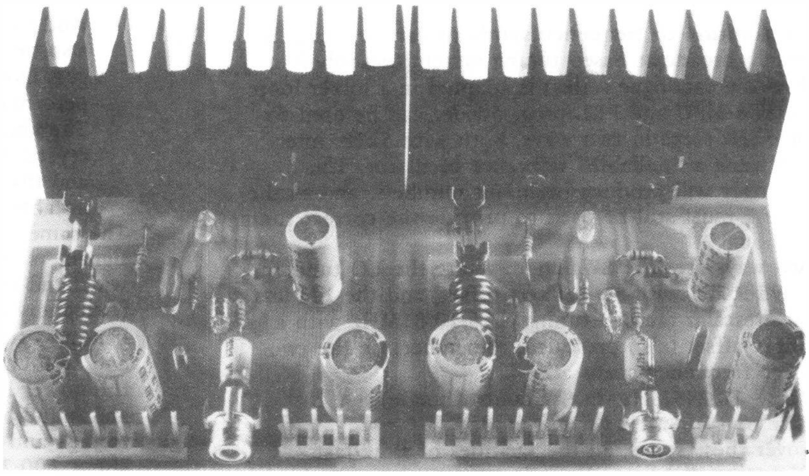
91370 x2 with heatsinks

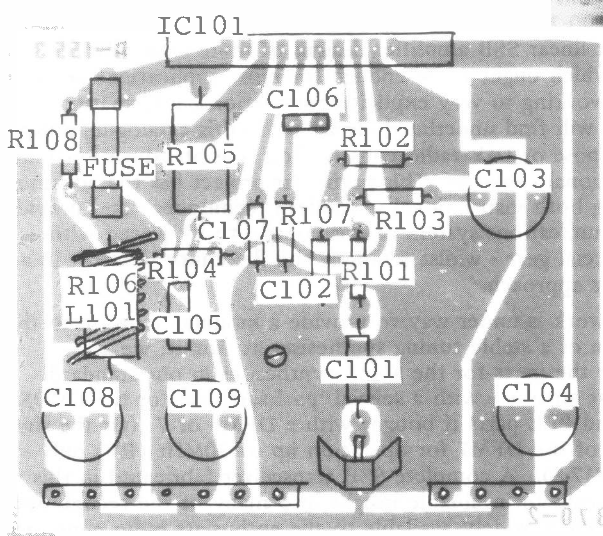
This 20W amplifier module has been designed for general purpose intermediate 'hiFi' applications using the HA1370 (HA1397) . This is one of the only really reliable PA ICs we have found, and is offered as either individual or dual units using the same basic layout.

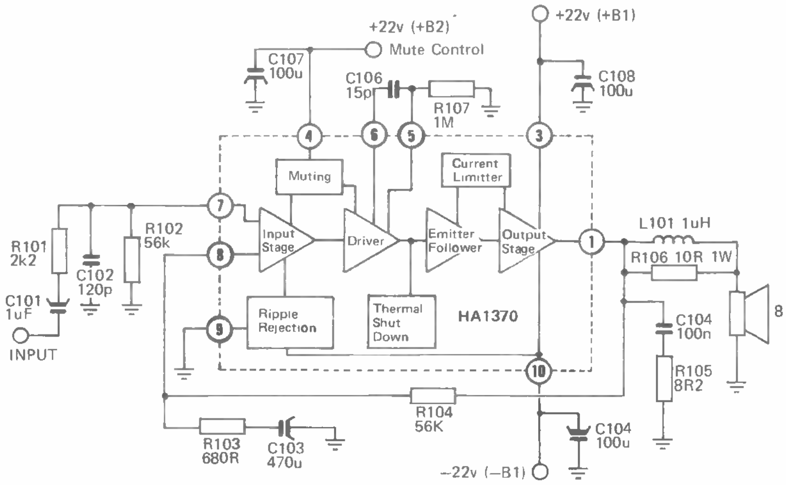
Brief spec: (Full details on HA1397 data sheets)

Operating voltage range	+/–	17-25v B1
		25vB2
Closed/open loop gain at 1kHz		38/88dB
Output at 0.5% THD into 8ohms		18W typ
THD at10W/20kHz		0.05%

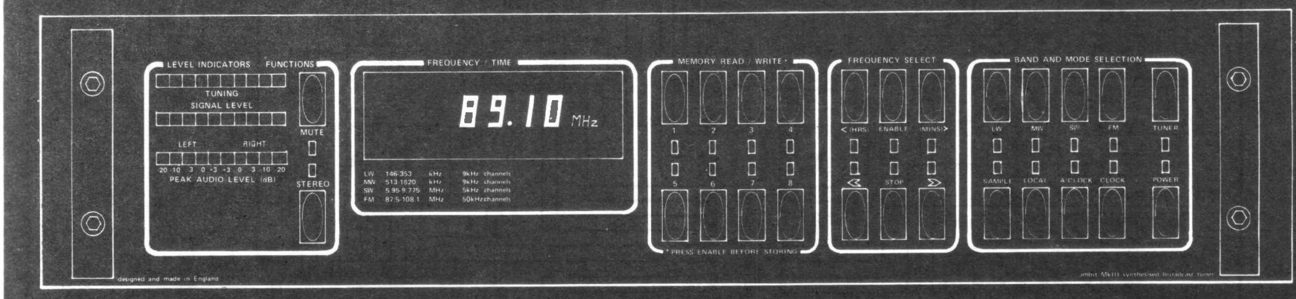
NB B2 provides switch-on mute to prevent pop-noise, and by delaying the rise of B2, muting is applied until the output has settled. 5mA is drawn from this supply. The 91370 includes output fusing at pin 1, with a 1K bypass to prevent the feedback being lost in case of the fuse being blown.







One day, all radios will be made this way.



The PW Sherborne

The Mark III synthesised tuner is a derivation of the PW Sherborne feature, being essentially the same circuit function, although modified extensively to produce a matching unit for our current range of HiFi.

The synthesised Mark III series tuner

When we started the Mark III series of DIY HiFi, we made the rather bold claim that we had set out to be even more 'professional' in style, performance and appearance than commercial audio gear. The Synthesised Mark III tuner continues this theme by bringing our Mark III series nearer to completion with a multiband tuner covering all broadcast bands - including the 31-49m SW bands. The above "artists impression" represents the overall proportion and style - athough we have used 3mm diameter round LEDs for the production versions to facilitate easier metalwork alignment and assembly.

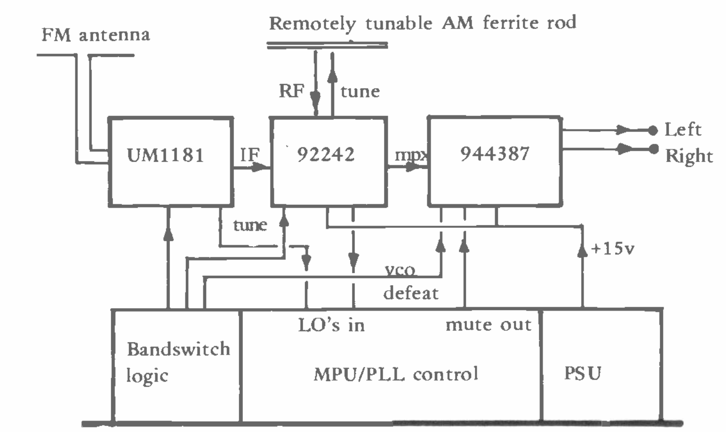
The heart of the tuner is the Hitachi frequency synthesiser system - and this unit is able to controllable virtually all types of DC tuned radio modules that cover the frequency ranges accepted by the unit. The tuning voltage output is limited to approx. 13v max - so where a higher voltage is required, the output of the phase detector should be routed via a voltage translator - such as one of the various active low pass filters that are described in Part 3 of the catalogue in the section on synthesis techniques.

The unit shown here is the 'all in' tuner control system, utilizing every facility available. It is nonetheless possible to use the unit in a variety of other types of tuner configuration - such as using the FM section to control a Mark III FM only tuner - thereby achieving the very best stereo performance in a cost-no-object system, and using the AM facilities to control a series of one-band AM tuners - or the 92242 version that omits the FM facilities.

If used in an FM only configuration, it is worth noting the system resets to the FM mode - so that the band selectors may be omitted altogether.

Perhaps one of the best ways to consider this type of system is as a replacement for the PSU and tuning pot/presets/AFC facilities of standard varicap tuners. And into the bargain, you get a clock, scan and sample tuning, plus the frequency display itself.

Block system



The tuner signal processing options....

The complete tuner comprises the 92242 three band AM tuner, with FM IF for the main signal processing sections. The UM1181 tunerhead for FM, and the 944387 for the stereo decoder and mute functions. These modules have been very carefully designed for versatile tuning and switching - and whilst the FM section is not quite up to the standard of the Mark III FM only tuner, the synthesiser can be used to control an external tuner by connecting the LO and tuning line from the other tuner - recent versions of the Mark III tuner have included a spare multiway rear panel connector for this purpose.

The unit is also available as a hardware and synthesiser-only package to enable the constructor's own choice of modules to be used.

To summarize the real benefits of this mode of tuning as opposed to the existing techniques:

1) Quartz crystal stability of all tuning
2) Versatile auto tuning capability
3) AM/FM band/station memory
4) Costs not much more than a DFM on its own ! (Ex-hardware)
5) Built in clock
6) Matches the rest of the only true HiFi system for the DIY enthusiast.

Description of facilities

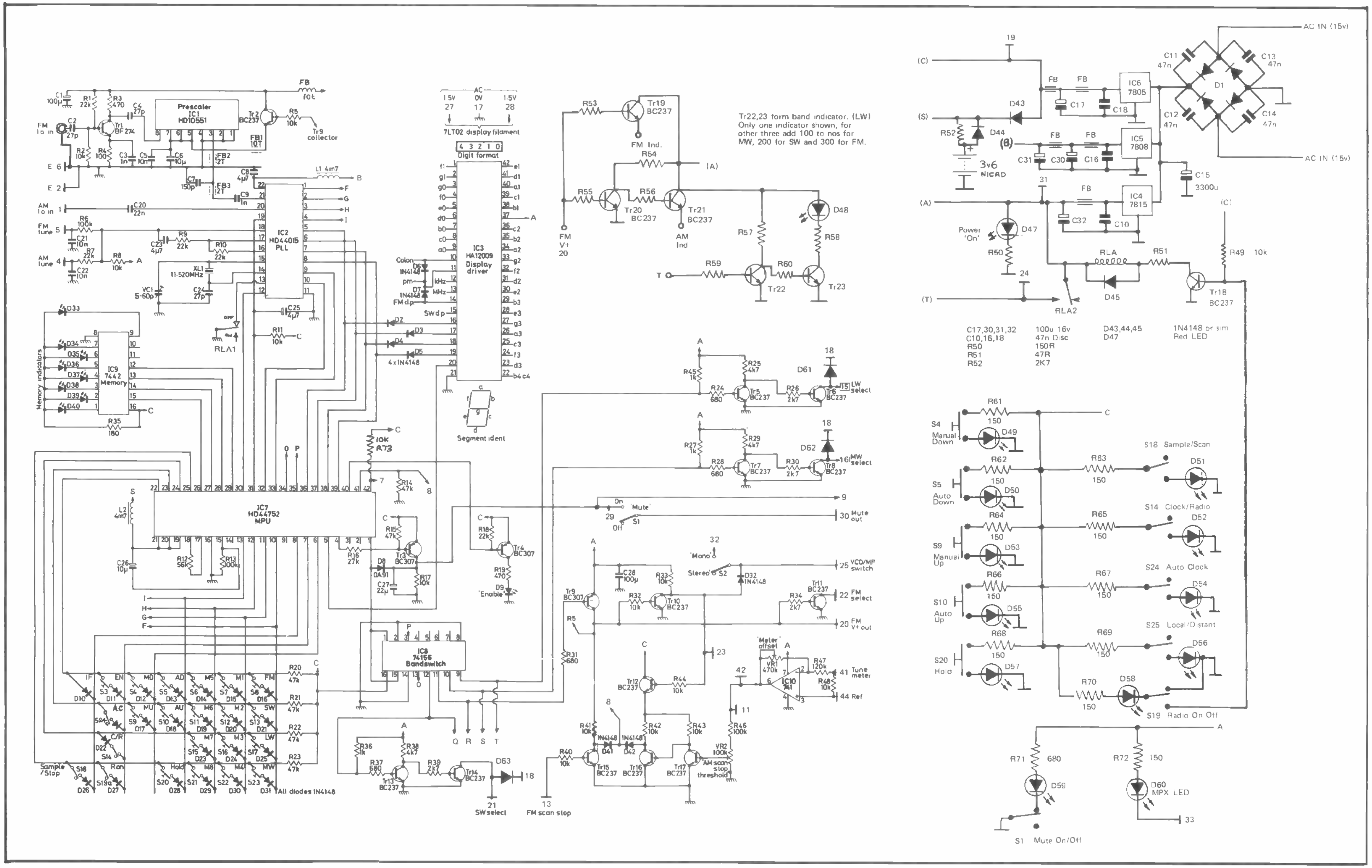
Tuning modes:

- a Manual push-button up/down setting Holding the button down selects fast rate
- b Automatic tuning between stations that exceed a preset signal level
- c Sample tuning that examines the station for 3 seconds and then moves on.
- d All scanning modes incorporate a 'roll-over' facility that automatically cyles from the HF to LF end and vice-versa.
- e Preset tuning is achieved by first locating the desired signal -then storing by pressing 'enable' followed by the required location number. Band and frequency are stored.
- f The scanning modes may be halted at any point by pressing 'stop'

Facilities

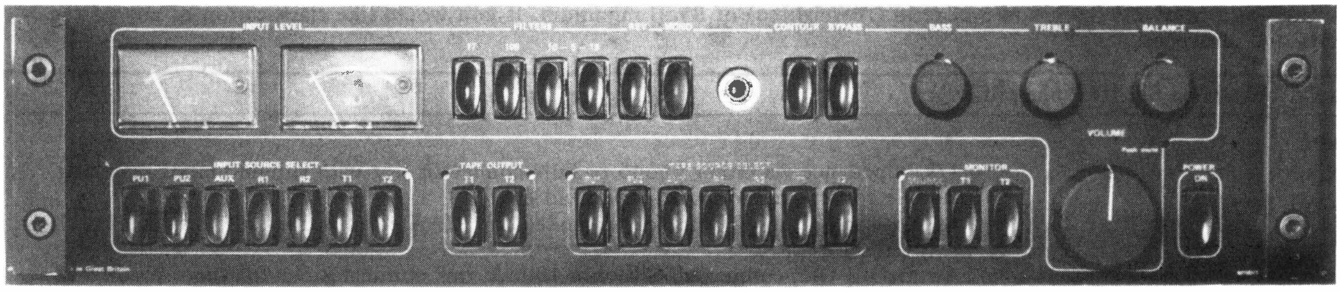
- a The unit provides a specific muting signal to silence the tuner whilst tuning between stations (in additional to any signal derived muting facilities)
- b Each band is provided with a transistor switch output - no mechanical selection is required.
- c When the tuner is turned off, the display reverts to displaying time in a 24 hour format.
- d The clock may be selected whilst the tuner is functioning - or the auot clock may be used - whereby the display shows the time until any of the radio function buttons is pressed, when it then reverts to displaying the received frequency for a period of 5 seconds before reverting back to time once again.
- e A local/distant switch enables the scan stop threshold to be varied to prevent reception of weak signals.

An optional battery memory support may be incorporated to enable the tuner mains PSU to be disconnected whilst the tuner is being moved.



Complete circuit diagram of Ambit H. SYNTH, including all key function indicator LED's.

THE MARK III AUDIO PREAMPLIFIER



The most versatile control preamplifier in the world ??

When we decided to add an audio amplifier and preamplifier to the Mark III range, we approached the task with the same degree of thoroughness as with the tuners in the range. After deciding on the facilities necessary for a really comprehensive control preamplifier - it was quickly evident that to try to provide such complexity with conventional mechanically linked switching and control would have resulted in a product that was virtually impossible to make for under £500 - the alternative being a cheap and cheerful birdsnest of point-to-point screened wiring which would be a nightmare to debug.

By opting for the best available purpose made DC controlled switch and potentiometer components, the interwiring of the entire system has been reduced to three snap-together ribbon cable links. (Plus some simple linking of the phono inputs to adjacent pins).

All selection of inputs, filters etc is acheieved using the TDA 1028 and TDA1029 devices - enabling maximum S/N and signal handling to be achieved, since none of the signal tracks approaches any of the control function buttons and is kept to the minimum necessary on the main control unit.

Three inputs are provided with multiple choice matching modules (primarily intended for PU, but also available for other types of interface') using the ultra low noise HA12017 preamp IC.

The remaining 4 inputs are standard 100mV/47k DIN facilities, which should provide sufficient coverage for even the most ardent HiFi enthusiast.

The two tape facilities permit tape-to-tape recording, and recording from a source selected independantly of the main channel to the PA. And if you try to record tape 1 or 2 from itself - then the system mutes fully, and flashes the tape output indicator LED.

The tone controls are designed to operate without affecting the midrange at all - although if you really must succumb to the vogue that treats such things as an anathema, then a full bypass facility reroutes the signal right around the stage. Loudness is adjustable to suit the volume setting you find most convenient.

Stabbing the volume control will mute the audio to a preset level, for the purposes of record changing etc. Or the facility may be operated remotely if required.

Full remote control of all the preamplifier functions will be available in 1981 - although the existing main control PCB may be directly interfaced to the type of RC currently available for TV as it stands.

The overload and output capability of this preamplifier makes it easy to interface to virtually any form of cartridge, source and PA available. The ultra low output impedance enables it drive PAs with low input impedance - although a 600 ohm line matching facility is also available at extra cost, to provide a balanced output.

The on/off switch also controls two shuttered mains outlets on the back panel - there are also two unswitched outlets to enable the entire system to be earthed via a single point and thus avoid annoying hum loops.

Third head tape monitoring is also available from the front panel, together with tape source where the source is different from the main programme.

Features such as input crosstalk, interchannel crosstalk, filters, overload and distortion comfortably exceed the standards currently established for 'specialist' HiFi. Proving that you can have real HiFi *and* a multiplicity of features and facilities in a single piece of equipment designed and made in England.

The Input Metering

Output meters on HiFi are very largely a complete waste of time. Unless the device can display infrasonic and ultrasonic signals, then you might as well leave it up to your ears to decide.

However, input metering enables you to establish the correct levels to avoid overdriving the input stages (which with 34dB overload margin before distortion exceeds -70dB, let alone approaches clipping) is quite difficult anyway.

Moreover, input level metering enables you to balance the various input levels from the 7 sources so that switching from one to another doesn't entail readjusting the volume all the time.

The meters on the preamplifier have been given a PPM drive characteristic - which is not intended to match any particular standard - but provides a far more useful indication of programme level. 6dB overloads are instantaneously registered on LEDs at the end of the scales - and the recommended input setting is where programme peaks just cause the LEDs to flash inter-mittently.

In providing a specification for equipment of this nature, it is not necessarily possible to use terms that directly relate to those used by all other manufacturers. The input overload can be represented in a number of ways - although '34dB' is probably the most technically ideal means of expression - it is frequently simply related to input levels. All input levels below relate to a rated output of 2V RMS, and S/N ratio (A-Weighted) of 85dB minimum. If you would like clarification of any of the criteria use, please ask.

The DC controlled Mk III Preamplifier

Inputs

Auxiliary	47k impedance via either phono or DIN connector - or with suitable input matching module for PU, microphone, tape head etc.
PU 1	As auxiliary, although primarily intended for RIAA equalization and cartridge matching.
PU 2	As PU 1
Tuner 1	A standard DIN connected 47k ohm 100mV rms nominal input for tuner input etc.
Tuner 2	As tuner 1
Tape 1	100mV 47k input, combined with tape output according to DIN standards. The tape output is selected independantly of the main programme source if required.
Tape 2	As tape 1
Monitor 1	A 100mV input for checking the recording on recorders fitted with a third head to verify the quality of the current recording.
Monitor 2	As Monitor 1.

Outputs

DIN	Less than 10 ohms impedance, up to 5v RMS without exceeding -70dB distortion.
Cannon	Optional 600 ohm line feed for professional audio applications.
Headphones	Via a stereo jack socket on the front panel, a separate 1W monitor amplifier is provided for use with headphones (nom. 8ohms).

Performance

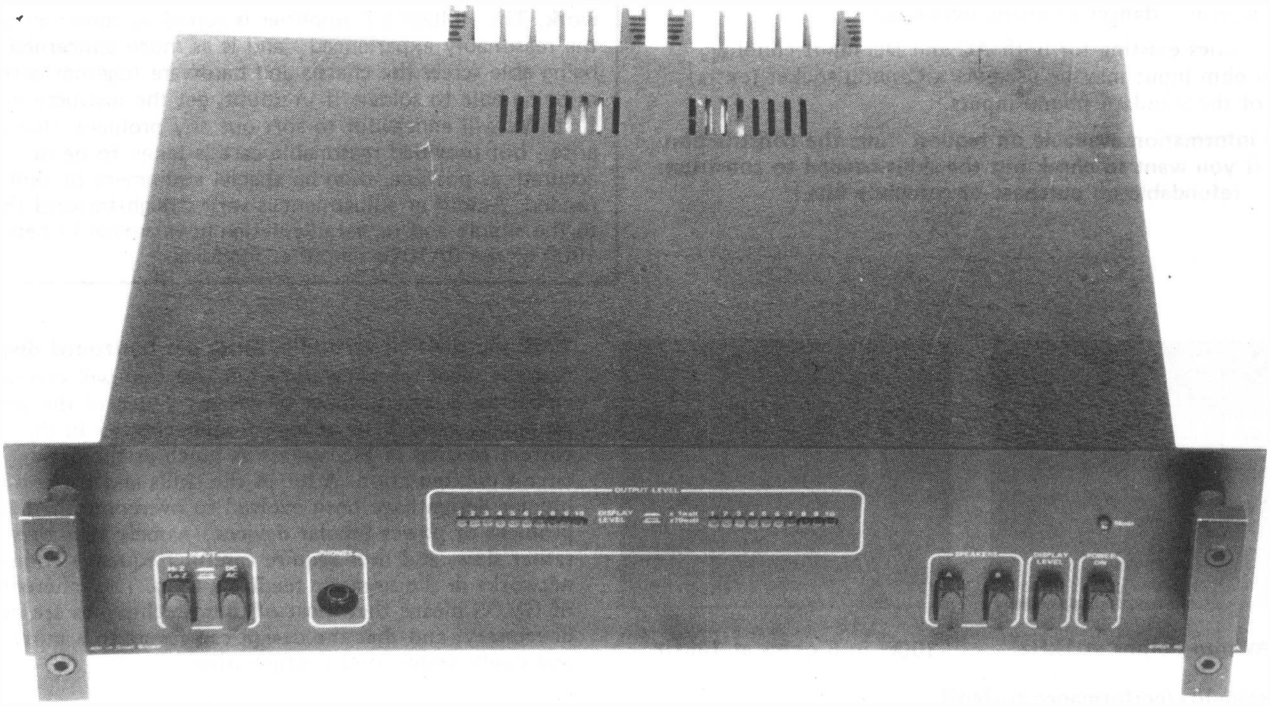
PU	Distortion less than 0.03% from 20Hz to 20kHz S/N ratio of input stage RIAA amplifier 83dB typically
Tuner/Tape inputs	Distortion less than 0.03% from 20Hz to 20kHz up to 5v RMS input Nominal input level for maximum output 100mV/47k ohms
Crosstalk	
.. .. ..	Better than -50dB from Left to right and vice versa from 30Hz to 15kHz
.. .. ..	Better than -65dB from adjacent loaded inputs (100mV reference)
Control range	
Bass	+15dB at 50Hz -16dB at 50Hz Tracking better than 2dB
Treble	+15dB at 5kHz - 18dB at 5kHz Tracking better than 2dB
Volume	better than 80dB with 1.5dB channel tracking
Contour	Characteristics adjustable to suit volume control settings Maximum bass lift at 50Hz approx. 10dB, maximum treble lift approx. 7dB at 5kHz.
Filters	18dB per octave slope, characterised for best transient response and minimum phase shift Corner frequencies: 17Hz Disc rumble and infrabass 105Hz Speech and PA use 5kHz Badly scratched records 7kHz AM radio 15kHz High frequency noise, pilot tone leakage, ultrasonic components etc.
PPM facility	0dB at 100mV nominal input. LED indication onset at +6dB input level.

Facilities

PU	Input matching modules available to cover cartridge outputs from 2 - 10mV (MM) Input matching modules available to cover cartridge outputs from 100-500uV (MC)
Muting	Partial muting :the level of which is adjustable is available by pressing the volume control button momentarily. Pressing the volume control again will restore the volume level gradually without instantaneous response. The muting facility may be operated remotely (for example by the record pickup arm). Complete muting occurs when T1 input is set to T1 output (and also on T2 functions) whereupon the tape selector LED will flash on and off - and the mute LED will light.
Outputs for mains	Via shuttered sockets on the rear panel. Two unfused, and unswitched outlets, plus two switched outlets with mains fuses in circuit. Switched outlets are controlled from the preamplifier on-off switching.
Data interface	Being entirely DC operated, it is possible for the preamplifier to be controlled via either remote control or a computer data bus. Information relating to this facility will be available early in 1981.
Misc.	Stereo reverse, mono, tone control bypass.

The above specifications are minimum specifications except where stated. We reserve the right to improve and amend specifications and facilities without notice.

2x100W HMOSFET POWER AMPLIFIER



The Ambit HMOSFET Mk III amplifier

The HMOSFET amplifier is based on the design published in ETI - and generally conceived to provide an alternative to those DIY enthusiasts who find other kit amplifiers to be unecessarily stark and generally 'unprofessional' in terms of design and finish.

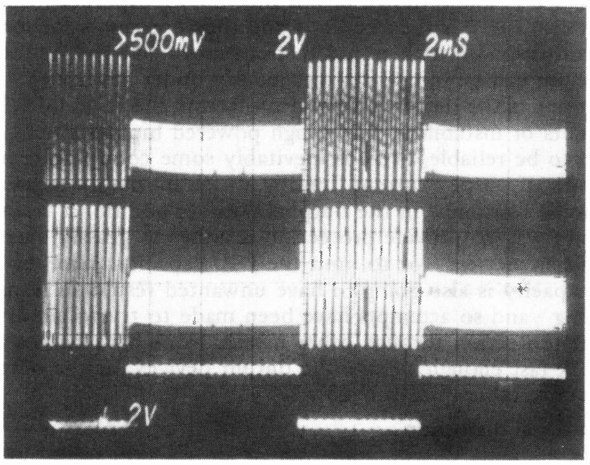
It is not cheap, for it is designed to last - with large reserve margins where appropriate, and fully tried and tested performance, into a variety of load conditions ranging from laboratory resistors, to real loudspeakers.....and ears. For it is not very difficult these days to produce amplifier designs with excellent measured performance, but there is still a discernible difference between those that sound 'alive' and those suffering from a variety of minor dynamic failings that add up to something not quite satisfying.

But since it is not possible to make an amplifier that sounds good without also producing good test results, here are the HMOS parameters:

Output per channel	into 8ohms	123W
	into 4ohms	156W
0.1% THD 20Hz to 20kHz both channels driven		
Distortion from 10W-100W output into 8 ohms		
	63Hz	0.03%
	1kHz	0.03%
	10kHz	0.03%
	20kHz	0.04%
IMD and products	1kHz+10kHz	0.04%
	10kHz+11kHz	0.05%
	19kHz+20kHz	0.06%
Slew rate	100W/8ohms	40v per uSec
Voltage gain		22x
Input for 100W output		1.4v
Residual hum/noise into 8 ohms (unweighted)		230uV
Offset voltage		3mV

All the above values are RMS - not many people still try to confuse the issue with peak powers - or worse.

Having established that the amplifier competes with the best in the field as far as the 'numbers' are concerned, it is very important to establish the dynamic behaviour beyond the limited insight afforded by IMD measurements. The tone burst test is quite revealing in many cases - showing up bad PSU design as much as anything. The illustration below is taken using the Mark III preamp, and switching the input selector line with the squarewave shown on the bottom trace. The input to the PA is the top trace, and the output is the middle trace. You will see that there is no discernible difference - with even the minute glitches being faithfully reproduced. (It also serves to demonstrate the click-free nature of the preamplifier input switching circuitry.)



With PSUs rated to more than twice the nominal output, overload recovery is instantaneous - which combined with the basic amplifier capacity of 100W+ makes all domestic listening completely strain free. There is no substitute for capacity - as with car engine design - and although smaller and more frantic amplifier designs can be made to 'sound' big - it's still like trying to squeeze another drop from the sponge rather than just pouring from a jug.

To keep everything going without fuss, a relay is used to connect the loudspeakers a short while after switch on - and also to disconnect the loudspeakers if any fault condition occurs that disturbs the DC offset voltage on the speakers. The pilot lamp flashes during the time the relay is open, to provide visual indication of the contact state - should the power to the protection unit fail, the relay will automatically fail safe.

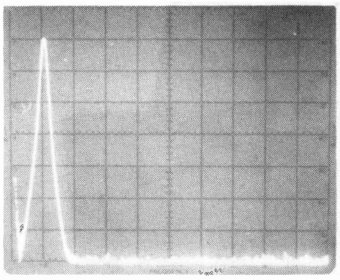
Two sets of loudspeaker terminals are provided on the rear panel - with switching via heavy duty mains switches using solid silver contacts. The relay terminals are gold plated, since there is a greater danger of arcing occuring.

Facilities existing for both AC and DC input coupling, also 600 ohm input may be used via a Cannon socket (extra) instead of the standard phono inputs.

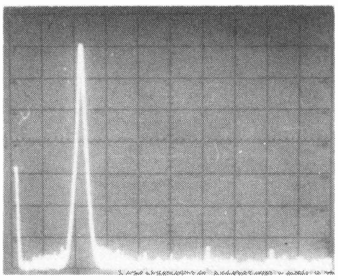
Further information available on request - inc. the construction manual if you want to check out the skills needed to construct. (£2.50 - refundable on purchase of complete kits.)

Should you attempt to make one ??

One of the most frequently asked questions concerning Ambit DIY HiFi concerns the degree of expertise needed to make it work. The HMOSFET amplifier is suited to construction by the reasonably experienced - and is as much concerned with being able screw the chassis and hardware together correctly as being able to solder. If in doubt, get the instruction book first. We will endeavour to sort out any problems that may arise - but provided reasonable care is taken to be as accurate as possible, then no special equipment or skill is needed. Amplifier adjustment is very straightforward thanks to the simple and repeatable design now proven in nearly 1000 of the PA101B amplifier modules.



100W into 8ohms at 1kHz



100W in 8 ohms at 10kHz

10dB per division vertically, 5kHz per horizontal division.

Not the most revealing test - but one that will certainly embarrass a large number of designs. Much of the art of producing good THD at high frequencies lies in the correct routing of PC layouts as much as the basic circuit configuration. A lot of the skills and tricks of bipolar design have been evolved to overcome the basic problem of power bipolar devices - namely that they are rather slow, and thus require careful frequency compensation networks in the negative feedback loop. The inherent speed of HMOS means that most of these techniques are now unecessary, and that the design can revert to a more simple and easily understood configuration.

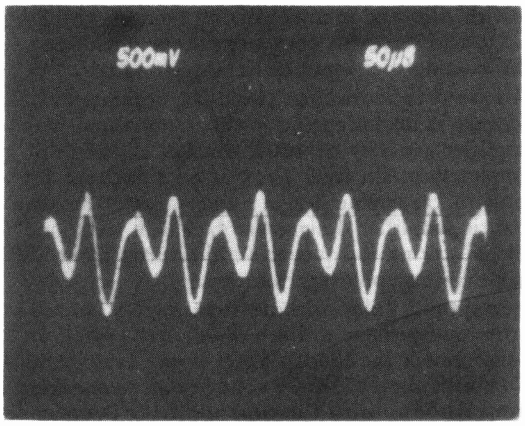
The reliability/performance tradeoff

The ultra low impedance of the bipolar power transistor is both its strongest and weakest point. Good because low output impedance in audio design means that the loudspeaker load impedance curve is flattened out and thus presents a far more constant response with regard to frequency - but bad because the device can be blown instantaneously under adverse conditions is the device is turned on 'across the rails' by HF transients or instability. For a high powered bipolar amplifier design to be reliable, there is inevitably some comrpomise in the form of output current limiting which inevitably means additional resistance in the output. Without additional resistance, the only way to provide protection is either to grossly overrate the output devices - or to limit the PSU capacity. Limiting the PSU capacity is also going to have unwanted results in transient handling - and so attempts have been made to try to get at the output protection through other means. None have been able to work fast enough to save the output devices (or the output devices are themselves too slow !!)

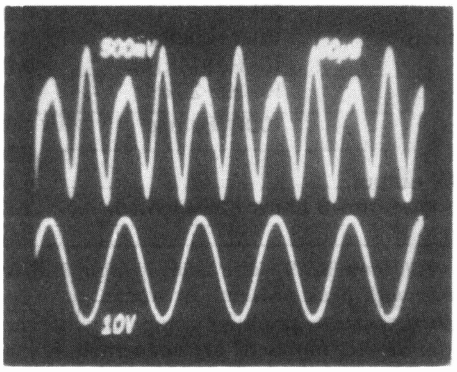
The HMOSFET possess inherent current limiting and thermal stabilization - which has allowed this amplifier design to provide direct connection of the sources of the output FETs to the load (via the relay). If you want the lowest possible impedance connection, then you may wire directly from the amplifier modules to the output terminals - although the dangers of DC offsets and switching transients make this policy very preacrious for the loudspeakers.
The HMOSFET amplifier will drive two pairs of loudspeakers in parallel if required - and if we want to demonstrate the output reliability by drawing sparks from a short circuit, the gound connection needs to very good before the output from the speaker concerned becomes noticeably distorted.
For very vigourous applications, PA modules with four output devices are also available - but we strongly suggest that you will be hard pressed to use this additional capacity in domestic applications (150W into 8 ohms with existing PSUs)

The residual distortion

One of the most revealing pictures of all is what's left after the fundamental sinewave has been notched out. However, since until some of you lot buy an HMOS amp we cannot afford a new low distortion oscillator - the measurements are somewhat limited by the residual distortion of the test oscillator. Disregarding the vertical gain shifts between the two traces, you will see that the output distortion closely follows the characteristics of the input distortion. There is no evidence of crossover spikes frequently claimed endemic in MOSFET design.



Residual distortion of audio oscillator (0.03%)

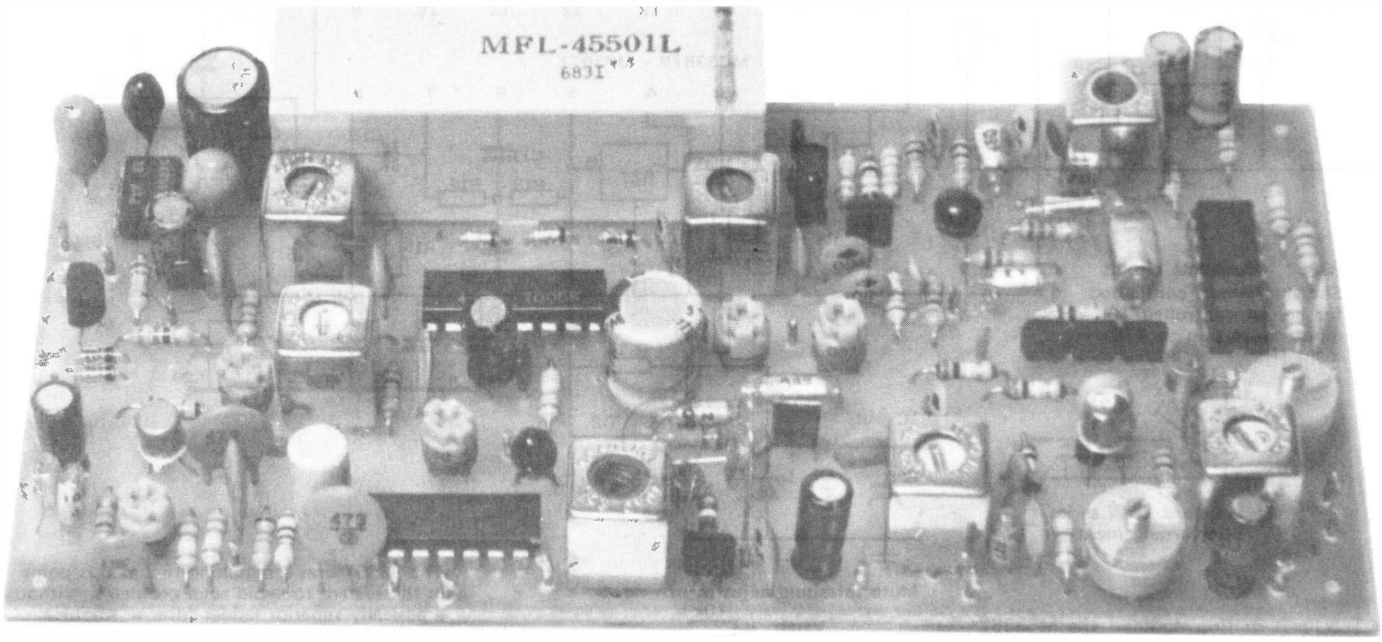


Residual distortion 10W into 8ohms at 10kHz

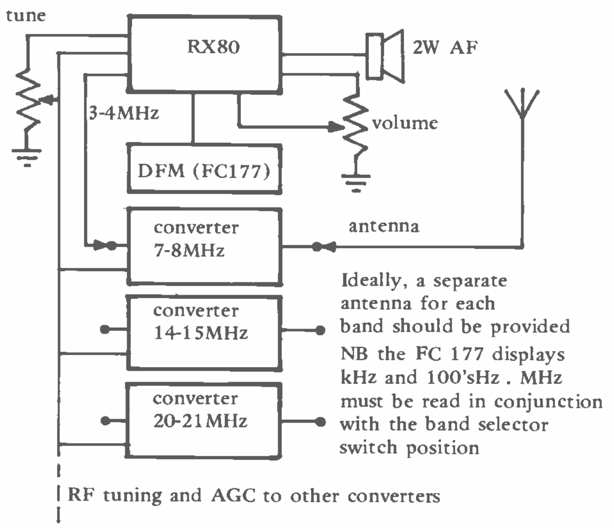
RX-80: A fully modular design dual conversion SSB receiver for the enthusiast constructor

Now that the time seems right to reassert some of the basic principles of 'amateur' radio - namely that the hobby largely evolved from a desire for self instruction and experimentation- it seems appropriate that we should introducing the successor to the famous G2DAF receiver.
The RX80 has been designed by A L Bailey (G3WPO) to be capable of providing a complete HF SSB receiver built from a series of modular sections that enable the constructor to select the bands and facilities required without trading off any of the basic capability of the complete system.

The RX-80 is being published in the RSGB's RADCOM, starting with the January 1981 issue - and thereafter on an 'ongoing situation' basis, to report developments, user comments and modifications etc. The heart of the system is the RX80 3.0-4.0MHz SSB receiver unit, using a combination of TOKO coils and filters (the famous MFL series), TOKO and Plessey communications ICs, and the KV series of ultra wide range varicap tuning diodes. The basic receiver/tunable IF has a very carefully designed low drift oscillator using a varicap - but still managing longterm drift measured in 100-200Hz, and thus capable of stabilization using a frequency correction counter.



The whole system is designed for 12v operation, and includes an LCD DFM display with 100Hz resolution - the practical limit for any manually tuned receiver.
As the article proceeds, Ambit will be supplying the various sections (all the components are already available from our usual stock) including PCBs, PSU and case. Additional instructional material and update notes will also be available from time to time to keep your RX80 system abreast of current developments.



Typical block system for the RX 80 HF receiver

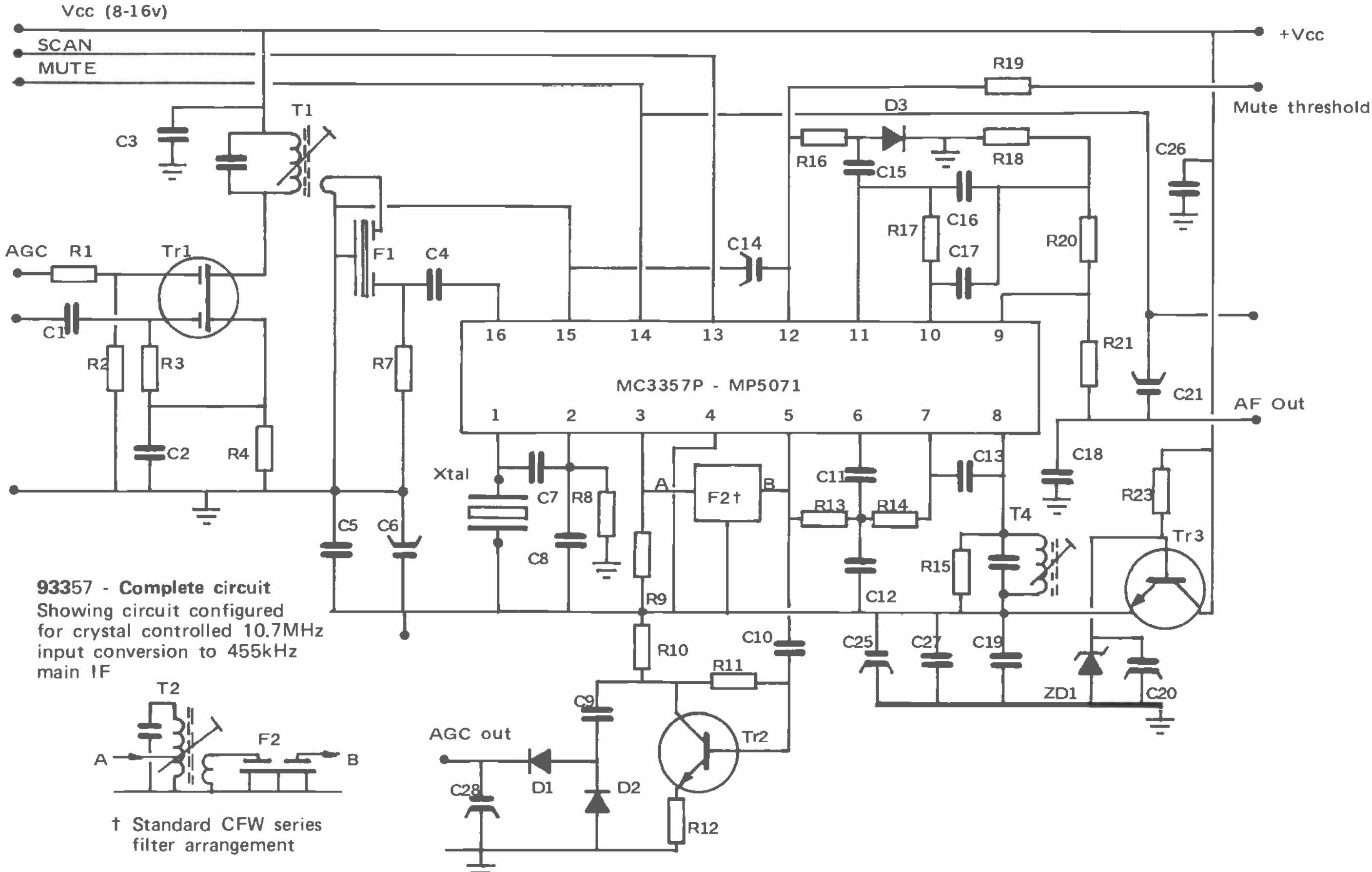
The System

The unit employs the "Classic" dual conversion technique, with crystal controlled converters covering the various 1MHz band segments to be covered. Use of varicap tuning of the front ends enables tracking to be maintained for best selectivity. The widespread use of varicap tuning means that the whole RX is readily converted to synthesised tuning systems.
Each front end has been optimised for a particular band, and avoids the need for complex high impedance switching. The receiver is thus a very high performance system, but still capable of being constructed by the relatively inexperienced, as each potential problem area has been broken down into an isolated module.

Abridged specifications

Frequency coverage	3.0-4.0MHz Basic tunable IF Various crystal controlled converters for desired HF band coverage.
Modes	SSB, CW (USB/LSB selectable)
Filter	MFL455 series 2.4kHz BW Audio filter for CW using MOSFET
Usable sensitivity	0.8uV for 10dB S/N SSB-CW
Selectivity	Image response - 60-80dB depending on band in use, tracking accuracy etc.
Frequency display	FC177 reading the 3-4MHz tuned frequency. 2.5kHz error on USB
Overload	3rd order intercept largely set by the amount of gain/tuning accuracy/agc action and RF selectivity available. IM will not present a serious problem until input levels exceed 100mV.
Power	11-14vDC (on board regulation)
Typical drift	200Hz 5mins, 100Hz/30mins after
Misc.	RX80 IF offset high of LO Balanced mixer stage/prod detector Audio derived AGC
Developments	Synthesised LOs, VHF/UHF converters AM, NBFM adapters, ultra high level mixer stage, IF noise blanker

93357 - Versatile communications NBFM subsystem



93357 - Complete circuit
Showing circuit configured for crystal controlled 10.7MHz input conversion to 455kHz main IF

† Standard CFW series filter arrangement

General

The heart of this module - the MC3357 or equivalent - has long been recognized as one of the most effective NBFM systems for applications from paging receivers to radio control. Much of this versatility is imparted through the thoughtful application of low power technologies that enable the MC3357 to operate from supplies as low as 3v and 2-3mA.

The 93357 includes several additional facilities - such as a gain controlled IF preamp, an AGC detector - and the facility to provide tuneable operation so the the 93357 can be used as a fully tuneable IF (WITH LO OUTPUT) with crystal controlled converters.

The IF Pre-Stage

In minimum current applications, the MOSFET IF preamp may be omited with only 4-7dB gain loss - as long as the front-end has a gain/NF ratio of around 30/4 dB. Using a 2 pole crystal filter in the 10.7/455 crystal controlled mode, input sensitivity for 10dB Sinad is better than 3uV typically.

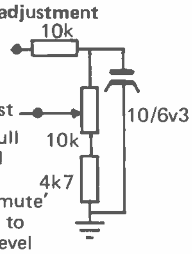
With the MOSFET in place, it is possible to improve sensitivity to better than 1uV - although measurements of this level at HF tend to be unreliable without screened room facilities.

The tunable option may be used with a wideband FM ceramic filter if only a narrow (250kHz or less) section of band is being covered. Otherwise T1 is coupled via a capacitor.

With only a single RF tuned circuit, the output of the frontend should be ganged to the main tuning voltage to achieve best image rejection (900kHz offset from desired RF input).

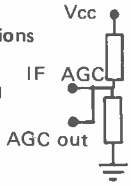
Gate 2 is available for use as an AGC terminal, although the overload capability of the MC3357 makes the use of this facility optional in most applications. The AGC terminal should then be wired

Mute threshold adjustment



Use of a push/pull switched pot will enable instant reference to 'unmute' without needing to reset threshold level

AGC connections



For use with negative going AGC output (see text)

to Vcc. Note that as shown, D1 and D2 are designed to provide positive going AGC (for a PIN diode attenuator) - and if this stage is used for the MOSFET AGC - simply reverse the polarity of C28,D1 and D2.

The Main IC block

The MC3357 is covered in some detail in the manufacturers data sheets - although certain aspects of its capability and behaviour are not fully described therein. The oscillator provided at pins 1&2 is a standard Colpitts circuit - and so the crystal may readily be substituted with a parallel tuned LC circuit to provide a tuneable option. A standard 10.7MHz IF has been used, and the relatively high capacity of this configuration ensures stable operation. The output of this stage is available for a DFM with 455kHz in SW (DF1 or DFM6/7) offset ROM.

The mixer output is an open collector - and whilst some applications use a simple resistive load - the passge of the 10.245MHz LO into the limiting IF can desensitize the IF amplifier and cause apparent instability.

The 93357 uses a matching IFT at this point in the system to avoid such problems - although a basically superior ladder filter at 455kHz (SLFD/CFG/CFX series) would not require this precaution.

The audio output from the quadrature stage contains HF noise when no signal is present to 'quiet' the system - and this noise is taken and amplified in an inverting op-amp whose input is at pin 10. C16/17, R17/8 form a bandpass filter tuned to about 12kHz - a full analysis of this type of active filter appears in various textbooks, and a copy is available from Ambit (4 pages).

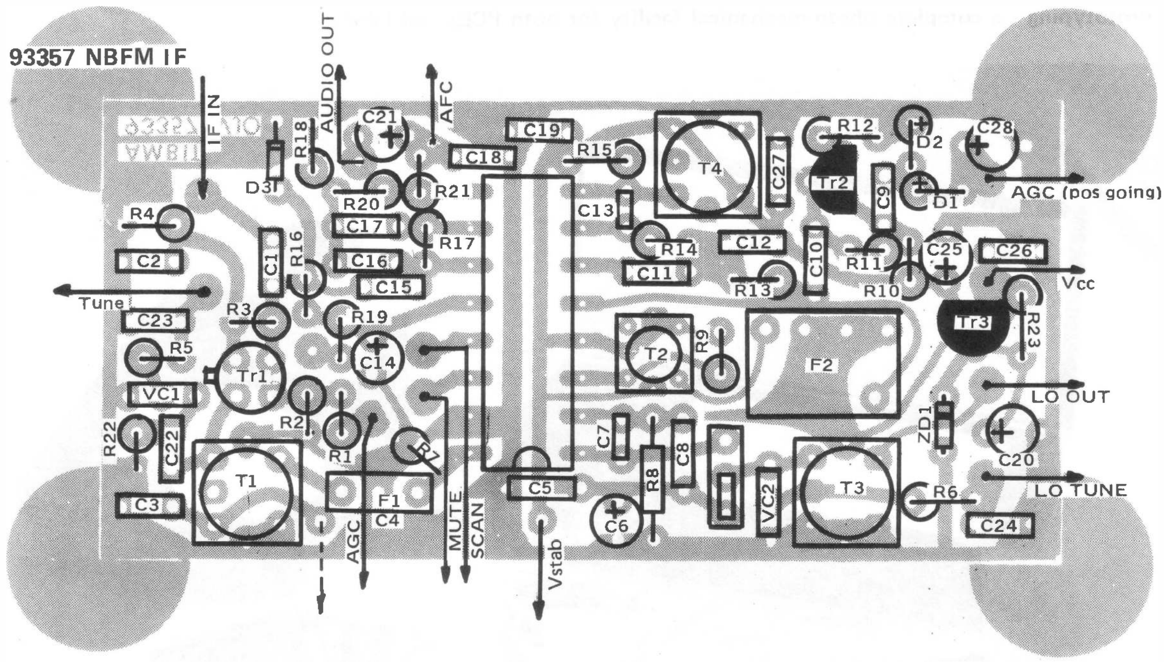
The squelch filter may thus also be used as a tone detector amplifier if required.

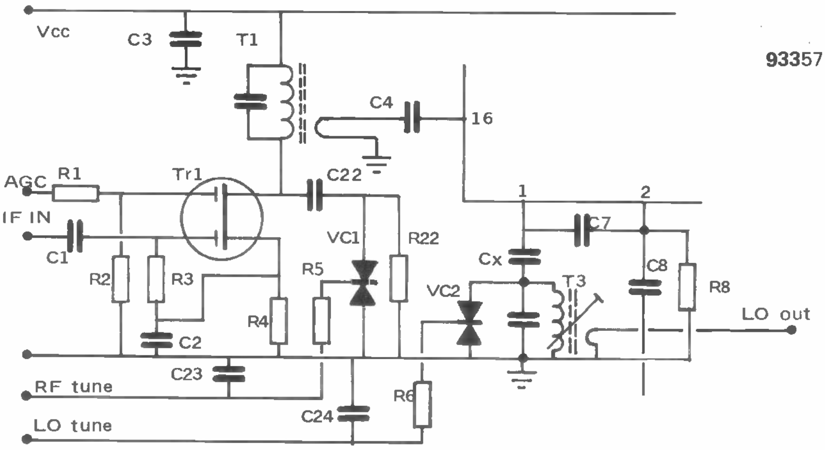
The amplified output of the squelch amp. is fed to D3 - and thus produces a negative going voltage at pin 12 to trigger the schmitd mute gate. The output of the trigger either switches the 'mute' line to ground, thus effectively shorting the audio via a capacitor, or at the scan output, a positive going signal is available to trigger counter latching circuitry. Mute threshold is set by providing a DC bias into pin 12 (via R19), and it is here that many MC3357 designs show signs of trouble as the muting gate 'chatters' on marginal signals. C14 provides slugging for the action of schmidt - which in some cases may be suplemented by additional CR networks into pin 12.

Power to the IC is regulated at approx. 6v via Tr3 and ZD1. The effects of supply line modulation by the audio output stage must be carefully decoupled - or mute chatter will result. Careful supply decoupling is used to achieve complete IF stability.

The output of the mixer is tapped into an AGC peak detector, which operates on high level inputs - after passing through the main selectivity at F2. The output is nominally positive going to operate a PIN diode form of signal attenuator at the front end of the system - although reversing the diodes and C28 will provide negative AGC for a MOSFET stage. A signal level meter operated at this point will provide a fairly crude level indication since without AGC, the response will be virtually linear.

93357 NBFM IF





93357 - A
Modification for use as a tuneable NBFM receiver subsystem
Other section as 93357

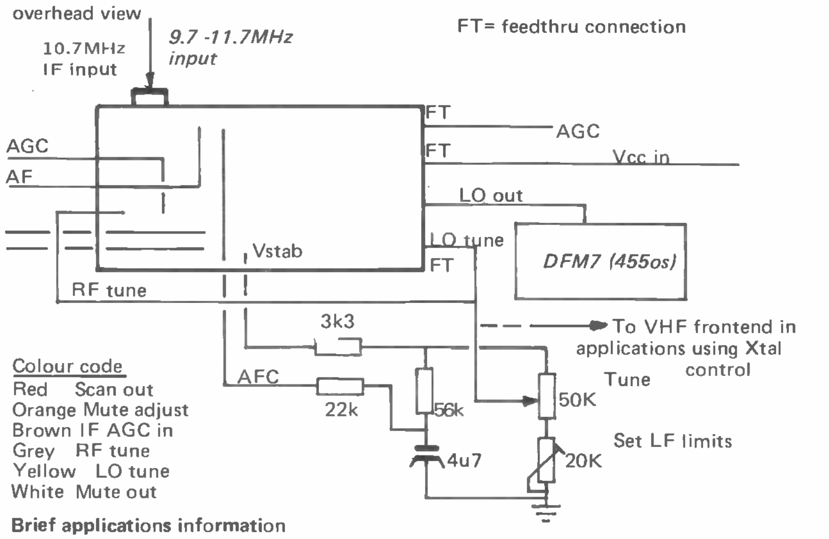
Mechanical Details:
The 93357 is designed to fit the SCB2 RF screened enclosure. Terminations marked FT on the applications connection diagram use 1000pF feedthrus - other connections being made via flying leads - except the IF input which is fitted with a phono socket.

Component Values

R1	100K	C14	1u/10v
R2	100K	C15	100n
R3	100K	C16	470p
R4	220E	C17	470p
R5 *	100K	C18	22n
R6 *	100K	C19	47n
R7 †	3k3/330E	C20	10/10v
R8	100K	C21	4u7/10v
R9 ††	(1k8)	C22	1n0
R10	2k7	C23	10n
R11	330K	C24	10n
R12	15E	C25	10/10v
R13	1k8	C26	100n
R14	47K	C27	22n
R15	33K		
R16	47K	D1-3	1N914 etc
R17	680K	VC1-2	BB204
R18	2k2	Tr1	3SK45/51
R19	47K	Tr2	BC238
R20	18K	Tr3	BC238
R21	8k2		
R22	100K	T1	119LCS30099
C1	1n0	T2	5MMC0184
C2	10n	T3 *	As T1
C3	10n	T4	LMC4200
C4	1n0		
C5	22n	F1	10M22 - CFSB10.7
C6	4u7/10v	F2	CFW/LFH series
C7	47p	ZD1	5v6
C8	100p	Xtal	10.245 (or 11.115MHz)
C9	22n	Cx	1n0 to 820pF
C10	82p	IC1	MC3357P, MPS5071
C11	47n		
C12	47n		
C13	10p		

* tuneable version only
† select to suit filter
†† Not used with T2

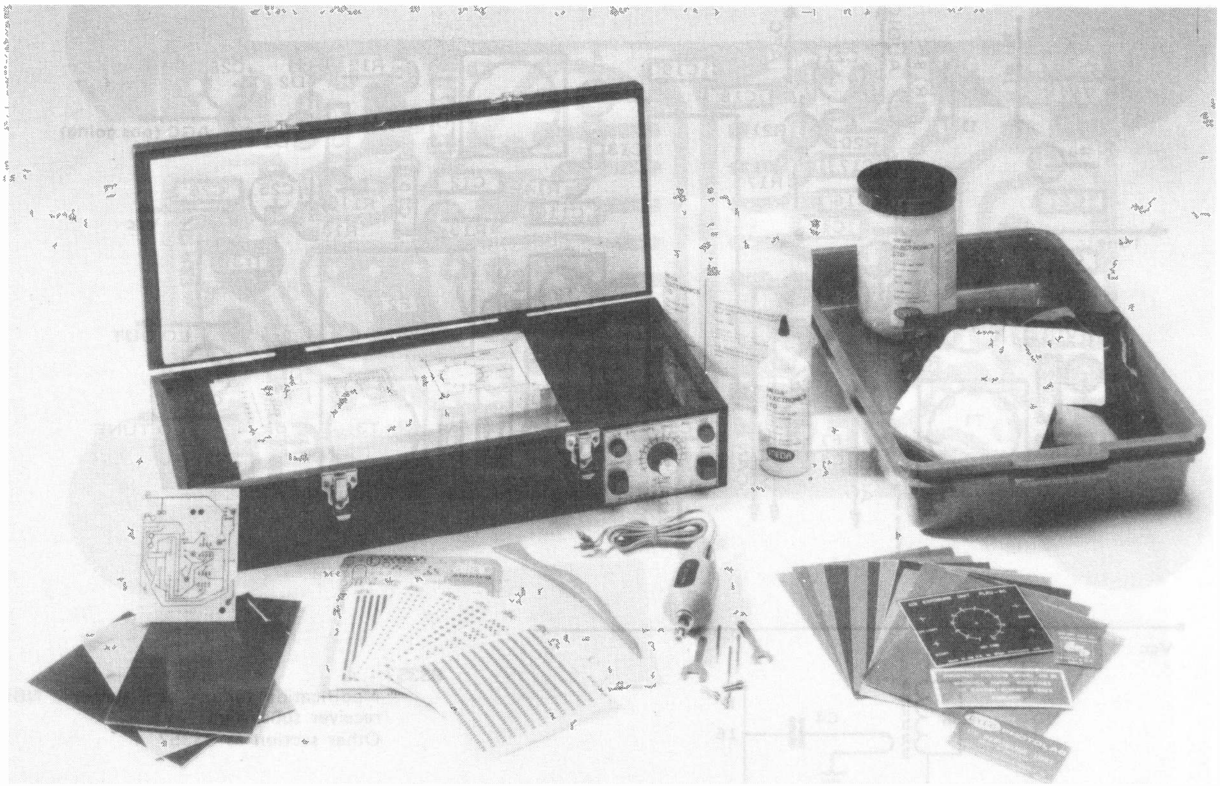
Application interconnection - crystal controlled version *(tuneable options)*



Colour code
Red Scan out
Orange Mute adjust
Brown IF AGC in
Grey RF tune
Yellow LO tune
White Mute out

Brief applications information
The module is primarily intended for fixed dual conversion (10.7/455), but may be used as a tuneable NBFM IF - or as a 455kHz "add-on" FM adapter for receivers such as the R1000, FRG7 etc. Details of applications are covered more specifically in the data that is supplied with the module - since the 'building block' nature of the 93357 precludes extensive applications detail in the space available here.
The AFC system shown above may be refined into the same sort of system as used with the 7230 broadcast FM IF amplifier - or the tuneable LO may be controlled via SW facility of the Hitachi based broadcast synthesiser control system. The unit has been designed for versatility, and should suit almost any NBFM application.

PCB prototyping - a complete photo-mechanical facility for both PCBs and labels



General

Most commercial electronics users will probably already have discovered the benefits of a custom PCB facility. And those of you who haven't might like to consider the benefits of an 'instant' prototype facility that is available at 4 am - or whenever yourparticular project is just beginning to warm up.
Even the keen enthusiast will rapidly appreciate the advantages (and eventual cost savings) of such a facility - particularly in the field of RF, where so much PCB design seems to 'evolve' rather than actually be based in predictable scientific theory.
For any 'experimental' users (schools, colleges etc) - the photolab is indispensable after a short while.

The Process

The PCB is supplied in various sizes (DS also available) with a coating of positive working photoresist that is 5 microns deep. A layer of black PVC film is laminated to the top surface to provide scratch resistance and accidental light exposure - but since the film is very slow indeed, accidental exposure is not really a problem except in the most direct sunlight.
Afeter cutting to size, the PCB is printed with the circuit pattern desired by placing either 1:1 positive artwork against the photo sensitive surface - or a film positive taken from a large scale artwork and reduced to be 1:1 - and then clamped into the exposure frame. The basic photolab accepts up to 250x165mm boards.
After exposure (full instructions with kit), the PCB is developed with the supplied chemical until the resist pattern is outlined. The PCB is then washed and immersed in ferric chloride to etch. A bubble etch tank with heater is available for those of you anticipating a reasonable volume of work.
The etched PCB is then rinsed, the remaining developed resist is removed with either the supplied chemical or some acetone based fluid - and then the board may be soldered - or tin plated using aseparetelysupplied solution. After stripping the remains of the etch resist, the PCB should be burnished with an emery stone, wire wool, or fine emery cloth. Cleaners such as 'Brasso' are also effective, but more longwinded to use.

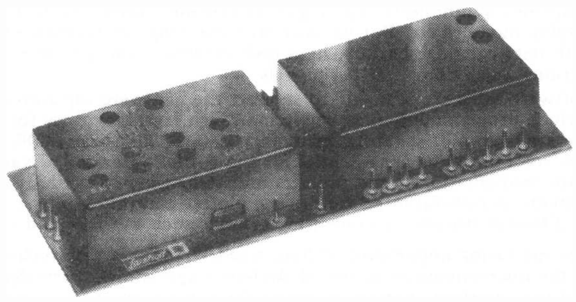
Photolab Kit Contents

UV exposure unit with 15 minute adjustable timer
Backing grid for layouts, tracing film, rub-down transfers.
PCB developer, trays, etching crystals
PCB material (presensitized)
12v hand drill with 3 collets and drill bits
Photographic label making materials
Label developer
Full Instructions

A Unique Service from Ambit

Whilst we do not undertake to produce prototype PCBs ourselves, we will provide the necessary photographic reduction facilities for 2:1 artwork - on a **same day service.** By appointment, 2:1 artwork can be reduced to 1:1 film positives while you wait & for a very reasonable sum (Approx. £1 per A5 area unit, see PL for up-to-date information).
This is because we appreciate that many applications that are in the course of production development cannot readily use a 1:1 drafting system in high definition layouts - and since the necessary photographic process can be a costly and timewasting excercise - a fast means of transfering your 2:1 artwork into a prototype PCB is a great benefit to Photolab users.
A full range of Chartpak circuit drafting aids is available from AMBIT (see part 2 of the catalogue) for 2:1 professional quality layouts.
The Photolab process (working from film positives of 2:1 master artowrk) can achieve extremely high definition that cannot possibly be matched by any manual techniques - IC pads with track between is quite simple using this system.
We will also produce fine dot paper prints from 1:1 negatives to enable the circuit board overlay and connection detail to be drafted in the same way as you will find on the 93357 herein (as an example). Simply draft the circuit layout on a photocopy, and then draw in using Rotring or Mars tubular tip pens.

Larsholt Double MOS FET Field Effect Tunerset MODEL 7252



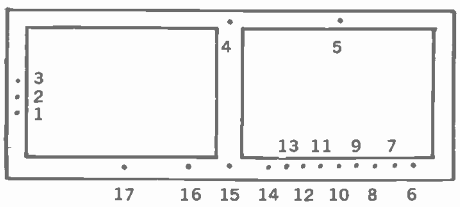
TECHNICAL SPECIFICATION

Frequency range, V tuning + 2.3 -12v dc	87.5-104.5 Mhz
V tuning + 2.3 -18v dc	87.5-108.5 Mhz
Supply voltage (negative earth)	+ 20v dc
Operating current	64mA
Sensitivity, 26 db S/N ratio 75 KHz Mod.	1 uV
Selectivity at ± 400 KHz	- 55dB
AM suppression, FM mod. 75KHz Am mod. 30% Input 1mV	- 55dB
Image rejection	- 56dB
IF rejection	- 80dB
IF bandwidth at - 3db greater than	210 KHz
IF frequency	10.7 MHz
Antenna input impedance	75 / 300 ohms
Audio output impedance (without preamps)	7.2 k ohms
Audio output level, Input greater than 2uV (without preamps)	330mV
Total harmonic distortion	0.1%
Signal plus noise to noise ratio, 1mV input (deviation 75 KHz f mod 400 Hz)	67dB
AFC pulling range, Input level greater than 10uv	± 400 KHz
Frequency pulling $\frac{dVs}{dF}$ (AFC defeated)	± 4 KHz / volt
Spurious radiation from antenna	Less than 500uV

Physical Size

167.5 mm x 65 mm x 25 mm
Fixing holes at 150 mm centres.

The unique FM tunerset, type 7252, combines a high quality tunerhead and IF, to provide an advanced VHF receiver module, with high gain and low distortion. Also included are features such as mute, AFC on all front end tuned circuits, and audio preamplification. The tunerhead employs 4 dual varactor (varicap) tuned circuits, dual gate MOSFET RF and Mixer stages, and a double tuned IF output circuit. Careful attention to screening and layout ensure excellent selectivity and immunity to spurious responses. The IF amplifier and detector stages use a bipolar transistor gain stage, followed by a double ceramic filter, and IC limiting amplifier. The quadrature detector uses a double tuned detector stage, thereby ensuring the lowest posible distortion. Muting and AFC are amplified in two stages of a quad Norton amp IC, leaving two uncommitted sections available for use as audio preamplifiers. The integrating analogue computer technique, controlling the tuning voltage across all four tunerhead circuits, locks the receiver exactly to the desired station. With a 10uV signal, the AFC is operational over a range of 800 kHz. Careful mechanical design, plus attention to screening of both IF and tunerhead, allow the 7252 to be easily located in any receiver design.



4	+20V stab
5	Signal Strength Meter
6	AFC (defeat)
9	AFC out
10	Audio out
15	Muting
16	Tuning voltage
17	Earth

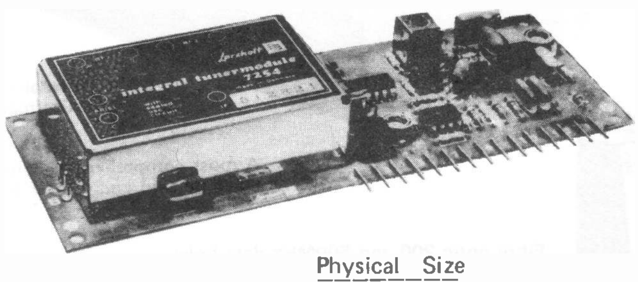
Pins 13 & 14, 12 & 11, are available for 2 channel preamplification

Connect pin 6 to pin 7 for AFC defeat.

O- Meter connection between pins 7 and 8, connect together if no meter used.

Larsholt Stereo FM System module Type 7254

The 7254 is Larsholt's most recent tunerset. It uses the TDA1062 in the front end with pin diode AGC, this gives exceptional strong signal performance. Low voltage varicaps are used allowing tuning up to 108 MHz with only 12 volts. The AFC is driven via an op-amp into the main tuning voltage lines, therby tracking all the tuned circuits simultaneously. The amount of AFC may be varied by ajusting resistor ratios to achieve the desired holding range — pull-in range being largely dependant on filter bandwidth.
Twin linear phase ceramic filters are used in the I.F. stage. Both noise muting, and deviation muting are provided on the IF system, thereby silencing interstation noise and side response effects commonly found in IC FM tuners. Facilty is provided to connect a digital frequency meter, the Larsholt 9005 may be used or any of the Ambit DFM's.



TECHNICAL SPECIFICATION

Frequency Range	87.5 - 108.5 MHz
Power supply	+12V 70mA
Tuning voltage	1.75 - 12 V approx
Sensitivity	1.2uV typ. 75KHz, 30db S/N
Signal + noise to noise	72dB 75KHz, 1mV, mono
Alternate channel select	55dB ± 400 KHz
AM suppression	50dB
Image rejection	70dB
IF Frequency	10.7 MHz
IF bandwidth	240KHz
IF rejection	85dB
Antenna impedance	75 ohm
AFC pulling range	± 400 KHz 10uV
THD	0.3%, 30KHz, 1mV input 400Hz
Audio level	125 mV max
Channel separation	42dB at 1KHz

Physical Size

162 mm x 62 mm x 25 mm
Fixing holes:- 154 mm x 54 mm

AMBYTE - Ambit's microprocessor consultancy group

When calling/writing, please address enquiries to Jonathan Burchell c/o AMBYTE division.

Introduction

Ambyte is the addition of new digital and 'processing' skills to Ambit's already well established analogue and RF expertise.

This combination of disciplines means that as a design group, we are uniquely qualified to develop processor based products that interface with the outside world of RF. The problems of RFI from a processor controlling functions within an RF sensitive enviroment (synthesisers etc) are not at all trivial - and it is unlikely that such designs can be undertaken by any one who did not possess sufficient skills 'in-house' to design, develop and manufacture the **complete** system in-house.

Coupled with this speciality, we feel that this approach sets us apart from other consultancy groups which are largely set up as the front door to large system 'houses' - or distributors of specific manufacturers products.

Being so closely associated with Ambit, prototype developments can be produced from existing stock parts at great speed. And the general commercial awareness imparted through this association means that designs will include readily available and cost-effect parts, hopefully preventing the spawning of DoDos.

A good example is the range of keyboard parts that we stock - enabling fast design capability for any type of keyboard - with off-the-shelf parts and keytops. And as distributors of components for keyboards, we are mindful of market developments and trends when making our selections.

What can AMBYTE do for you ???

Essentially, AMBYTE is an OEM and industrial facility intended to support the expanding range of Ambit digital products - such as the frequency synthesisers, digital plotter systems, serial data LCD decoder and display modules etc. But we also offer the range of Periflex S100 MCUs with data cartridge backup, hard disk capability and a wide variety of 'serious' small computer peripherals.

Software skills are available to support the hardware capability, and these include programming in assembler and high level languages for most of the available MPUs (8bit), including: Z80, 8080, 2650, 6800, 8048 etc. The software skills are essential for the correct interface of various hardware configurations - and projects undertaken include disk operating systems, peripheral interface drivers, plotter control - and the inclusion of different drivers into operating systems such as CP/M and CDOS.

The increasing importance of hard/fixed/Winchester disk technology in the microcomputer is one of Ambyte's specialities. Cartridge backup, and bus interface controllers are available for a variety of systems and applications.

Disk systems

As well as the hard disk systems mentioned above, we offer standard 8" and 5.25" floppy systems. The Micropolis hard disk system is probably one of the most reliable available, as well as offering a host of carefully considered features and facilities - including:

MPU based controller, fully asynch. buffered data transfers from host to controller - with automatic error recovery procedures, variable sectoring and sector size, the ability to transfer whole tracks at a time.

Spare sectors are provided to cope with media defects.

The interface is via an 8 bit bidirectional data bus and 9 control lines - a coupler for the S100 bus is available for the drives (which contain from 7.1M to 35.69M bytes of information - formatted)

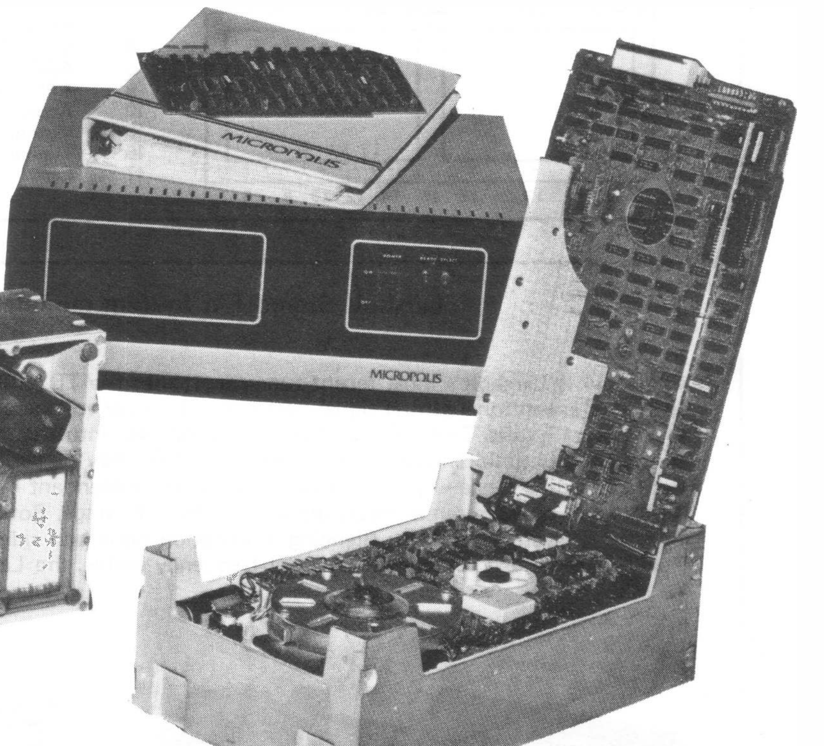
Micropolis 1220 series

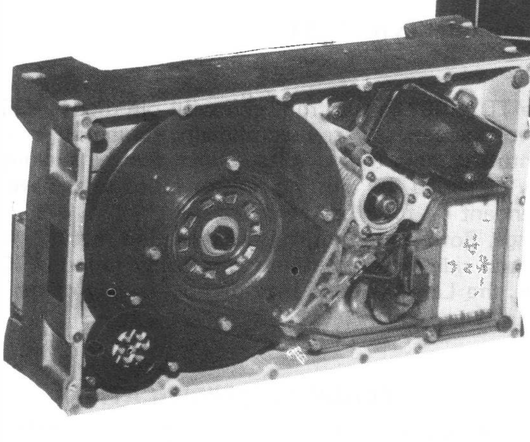
Up to 35.69 Megabyte of formatted storage with Micropolis reliability - average access time 34mSec., transfer rate 933kByte per second.

S100 hard disk interface

Enables any S100 user to attach the versatile Micropolis Winchester disc system - turning a microcomputer system into a serious tool for both commercial and industrial applications.

Interfaces for other forms of databus - complete with cartridge backup and operating system development are available to suit your custom requirements





High resolution (24 bit) graphics/machine contro

A most comprehensive solution to robc machine tool and plotter positioning.

Fibre optic 200 and 500MHz data links

An ideal combination of digital and analogue expertise for monitoring remote data aquisition systems under conditions of severe(up to 100kV/m pulsed RF) EMI. Optional IEEE 488 bus for computer/instrument interface. The remote rechargable NiCad powered transmitter is fully shielded - and operates up to 500m away from the receiver.

the "I didn't know you did that" page.....

The current price list contains details of the stock ranges of parts we have to offer. The fact that an item occurs in the price list is indicative of the fact that we "do it" and that it is available as a general stock part.

Briefly:

Small signal audio and radio transistors. ICs for audio, radio, communications, radio control, CMOS, TTL, LPSNTTL, standard linear devices, LEDs including IR link devices, MOSFETs for radio and 500W audio amplifiers, high voltage driver transistors, radio tuning sysnthesiser parts, varicap tuning diodes for applications from LF to UHF, diodes for switching and PIN attenuators.

Schottky barrier diode double balanced mixers, crystals, crystal filters, ceramic filters for radio, ceramic resonators, coils, chokes, signal transformers, filter blocks for audio, IF and UHF.

Coils for RF, IF and audio applications, ferrite rods, ferrite beads, ferrite transformer cores. Dust iron toroids for resonant circuits, and EMI filter applications.

Capacitors - electrolytic and ceramic. Polyester film, foil trimmers, ceramic trimmers, tantalum bead.

Panel meters of various types, LCD DVM modules, "Instrument" spec types, DIY scale meters.

IC sockets, screened RF sub assembly boxes, plastic boxes. RF connectors and adapters, miniature PCB mounting relays, push button switches, data entry keyboard switches, programme code switches.

Modules for radio: NBFM IF and detector, various WBFM IF and detector systems, AM modules, SSB modules, TV IF modules, HF/VHF tunerheads, stereo decoders, tuning synthesisers, complete VHF receivers for NBFM, complete broadcast FM receivers and combined fronted/IF/decoders, UHF video modulators, digital frequency displays, DFMs with timers.

LCD clocks, DVMs, data decoder with displays (BCD input), LCDs, LED bargraph meters.

Complete 100W audio amplifier kits, complete FM tuners, complete multi-facility preamp kit, complete synthesised broadcast tuners, complete HF SSB receiver kits (1981), complete pulse induction metal locator kits.

But where most confusion exists is the range of products that is also available from AMBIT OEM sales, although not necessarily listed in our 'stock' price list and catalogues:

AEG semiconductors - small signal transistors for radio/audio, LEDs, radio and TV ICs
TOKO non-destructive readout RAM/ROM with non-volatile plated wire technology. Video frame stores with digital interface for computer processing, security applications etc.
Micrometals toroids - widely proven as the best source of dust iron cores for EMI filter applications.
Rubycon electrolytic, polyester and non-polar electrolytic capacitors.
Potentiometers - rotary, linear, laser trimmed, trimpots and switches from ALPs and Noble.
Keyboard switches - by far the biggest range at the best prices and quality.
S100 microcomputers and systems. S100 interface for fixed disc systems. Software development for the S100 and other 8-bit MCs. 500MHz optical data link, 150MHz optical data link, custom optical and electro-optic design facility.
Complete radio receivers up to 500MHz. Any mode, any band for applications ranging from data telemetry to garage door openers. MPU controlled tuning synthesisers for custom applications.

Attention industrial and OEM customers

When telephoning, please ask for OEM sales division. Catalogues and sales literature are supplied FOC to all bone-fide commercial users.

We are frequently asked to keep our commercial customers 'informed' of what's going in our product range - and one of the best ways for both of us to achieve this is to have some form of regular commercial contact. Now that we offer a number of staple component lines of the utmost quality (small signal transistors, LEDs, capacitors, switches etc) and **the lowest prices available** we hope that it will possible for more of our industrial and commercial customers to remain in regular contact so that we can keep them advised of happenings.

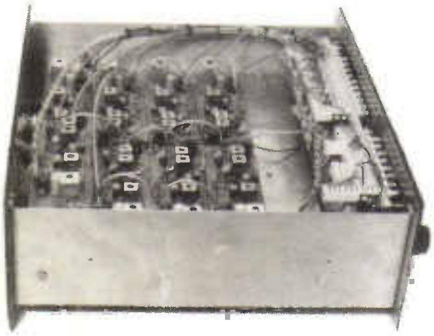
As mentioned elsewhere in this catalogue, a shortform summary listing of our general ranges will be published in 1981 for the benefit of industrial customers. If you would like a copy, then please lodge your request with our OEM division as soon as possible.

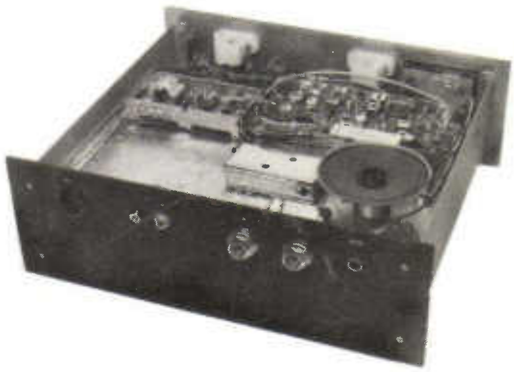
Part 5

The revision of part 2 will be included with the new part 5 - which may be ready by next July or even sooner. This may seem like a rather presumptive assumption in the light of the length of time it usually takes for an Ambit catalogue to reach the world - but work is scheduled to start almost immediately (Nov.'80). Part of the reason is that this issue does not contain as much detailed description and technical background as we would have liked, since most of the space has been devoted to the introduction of the new lines.

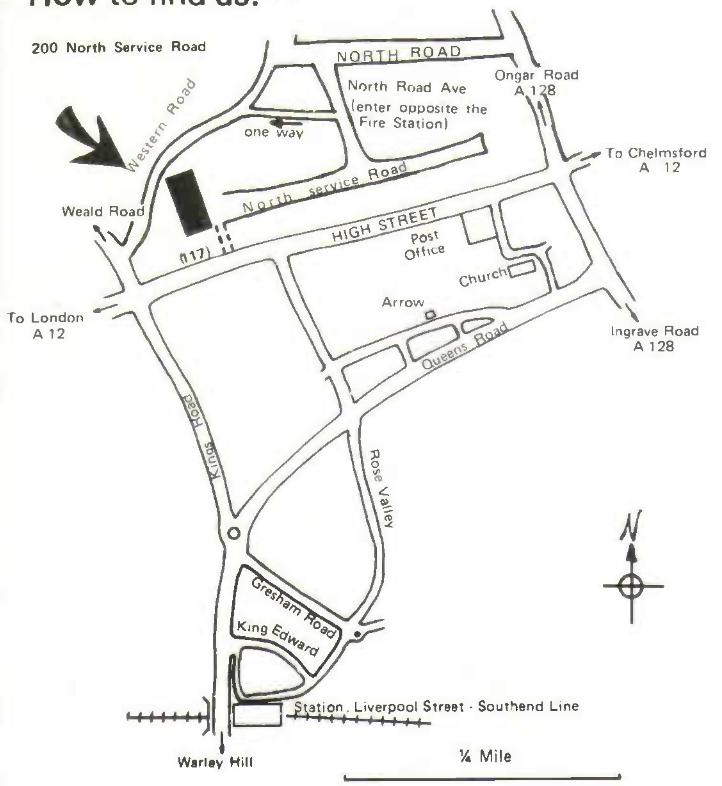
We would also like to know how many of you feel that is room for yet another electronics publication in the shape of a quarterly review of what's new in radio and audio electronics - since the existing media do not seem to be fulfilling the task very effectively - being mainly obsessed with microprocessors and the affairs and products of their major advertizing revenue sources. And rather too many new products reviews seem to be edited by people who are rather a long way out of touch with the interests and requirements of manufacturing industry. Without advertisement support - which is editorially the best way to treat products objectively - the cost would need to be £7 per year. Please write and tell us exactly what you would like to see in the pages of such a review - our basic aim would be to cull anything really new and worthwhile in the field of radio and audio electronics from the various press releases that occur,and present them as a digest with a little added perspective.

The RX80 - *An instructional/constructional modular HF communications receiver system - expandable from a single band HF SSB RX, to include all HF amateur bands, plus VHF converters AM, NBFM etc.*





How to find us: —



General Information

The terms of business for commercial and hobbyist customers are to be found in the price list supplement - which is now being reprinted at least every other month, to include the constantly expanding ranges of components and modules.

Callers are welcome at our retail sales counter (see map alongside) - although if you are coming from afar, we suggest that you contact us to establish availability on items you wish to purchase. Generally speaking, over 98% of the contents of the price list are available "ex-stock".

All goods supplied are first quality types. Liability for faulty goods is strictly limited to replacement cost.

We regret that we can accept no liability for any errors that occur in any literature published or supplied by Ambit. All prices that are published either in our price lists or advertisements are subject to change without notice.

ambit international

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