



Product Change Notification



Product Group: DD/Tue Oct 25, 2022/PCN-DD-028-2022-REV-0

Manufacturing Location Change for Automotive Grade 1.5KE TVS Products

DESCRIPTION OF CHANGE: Vishay Diodes Division will be transferring the assembly & final test location of automotive grade 1.5KE Axial Transient Voltage Suppressors (TVS) products from Vishay Shanghai, China to Vishay Tianjin, China. All materials, process and controls are kept the same as in the current production in Shanghai. There is no change in form, fit and functions of the devices in customer applications. The label size of inner reel/box is different from the products manufactured in Shanghai factory however all the required information could be found on the label for identification. Please refer to annex 1 for label images and LTB/LTS information.

REASON FOR CHANGE: Production line consolidation

EXPECTED INFLUENCE ON QUALITY/RELIABILITY/PERFORMANCE: No change in quality and reliability performance

PART NUMBERS/SERIES/FAMILIES AFFECTED: Please see materials list on the succeeding page.

VISHAY BRAND(s): Vishay General Semiconductor

TIME SCHEDULE:

Start Shipment Date: Wed Feb 1, 2023

SAMPLE AVAILABILITY: Available upon request

PRODUCT IDENTIFICATION: Suffix "A" on Date code (XXXXA) marking for identification of new Tianjin assembly site.

QUALIFICATION DATA: Available upon request

This PCN is considered approved, without further notification, unless we receive specific customer concerns before Sat Jan 28, 2023 or as specified by contract.

ISSUED BY: Ivan Chen, Product Marketing Director – TVS, ivan.chen@vishay.com

For further information, please contact your regional Vishay office.

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Vishay Intertechnology, Inc.

Corporate Headquarters 63 Lincoln Highway, Malvern, PA 19355-2143 U.S.A. Phone (610) 644-1300 Fax (610) 296-0657 www.vishay.com

ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DISCRETE SEMICONDUCTORS AND PASSIVE COMPONENT



Product Change Notification



Product Group: DD/Tue Oct 25, 2022/PCN-DD-028-2022-REV-0

1.5KE6.8AHE3_A/C	1.5KE7.5AHE3_A/C	1.5KE8.2AHE3_A/C	1.5KE9.1AHE3_A/C	1.5KE10AHE3_A/C
1.5KE11AHE3_A/C	1.5KE12AHE3_A/C	1.5KE13AHE3_A/C	1.5KE15AHE3_A/C	1.5KE16AHE3_A/C
1.5KE18AHE3_A/C	1.5KE20AHE3_A/C	1.5KE22AHE3_A/C	1.5KE24AHE3_A/C	1.5KE27AHE3_A/C
1.5KE30AHE3_A/C	1.5KE33AHE3_A/C	1.5KE36AHE3_A/C	1.5KE39AHE3_A/C	1.5KE43AHE3_A/C
1.5KE47AHE3_A/C	1.5KE51AHE3_A/C	1.5KE56AHE3_A/C	1.5KE62AHE3_A/C	1.5KE68AHE3_A/C
1.5KE75AHE3_A/C	1.5KE82AHE3_A/C	1.5KE91AHE3_A/C	1.5KE100AHE3_A/C	1.5KE110AHE3_A/C
1.5KE120AHE3_A/C	1.5KE130AHE3_A/C	1.5KE150AHE3_A/C	1.5KE160AHE3_A/C	1.5KE170AHE3_A/C
1.5KE180AHE3_A/C	1.5KE200AHE3_A/C	1.5KE220AHE3_A/C	1.5KE6.8CAHE3_A/C	1.5KE7.5CAHE3_A/C
1.5KE8.2CAHE3_A/C	1.5KE9.1CAHE3_A/C	1.5KE10CAHE3_A/C	1.5KE11CAHE3_A/C	1.5KE12CAHE3_A/C
1.5KE13CAHE3_A/C	1.5KE15CAHE3_A/C	1.5KE16CAHE3_A/C	1.5KE18CAHE3_A/C	1.5KE20CAHE3_A/C
1.5KE22CAHE3_A/C	1.5KE24CAHE3_A/C	1.5KE27CAHE3_A/C	1.5KE30CAHE3_A/C	1.5KE33CAHE3_A/C
1.5KE36CAHE3_A/C	1.5KE36CA81HE3_A/C	1.5KE39CAHE3_A/C	1.5KE43CAHE3_A/C	1.5KE43CA81HE3_A/D
1.5KE47CAHE3_A/C	1.5KE47CAHE3_A/D	1.5KE51CAHE3_A/C	1.5KE56CAHE3_A/C	1.5KE62CAHE3_A/C
1.5KE68CAHE3_A/C	1.5KE75CAHE3_A/C	1.5KE82CAHE3_A/C	1.5KE91CAHE3_A/C	1.5KE100CAHE3_A/C
1.5KE110CAHE3_A/C	1.5KE120CAHE3_A/C	1.5KE130CAHE3_A/C	1.5KE150CAHE3_A/C	1.5KE160CAHE3_A/C
1.5KE170CAHE3_A/C	1.5KE180CAHE3_A/C	1.5KE200CAHE3_A/C	1.5KE220CAHE3_A/C	1N6267AHE3_A/C
1N6268AHE3_A/C	1N6269AHE3_A/C	1N6270AHE3_A/C	1N6271AHE3_A/C	1N6272AHE3_A/C
1N6273AHE3_A/C	1N6274AHE3_A/C	1N6275AHE3_A/C	1N6276AHE3_A/C	1N6277AHE3_A/C
1N6278AHE3_A/C	1N6279AHE3_A/C	1N6280AHE3_A/C	1N6281AHE3_A/C	1N6282AHE3_A/C
1N6283AHE3_A/C	1N6284AHE3_A/C	1N6285AHE3_A/C	1N6286AHE3_A/C	1N6287AHE3_A/C
1N6288AHE3_A/C	1N6289AHE3_A/C	1N6290AHE3_A/C	1N6291AHE3_A/C	1N6292AHE3_A/C
1N6293AHE3_A/C	1N6294AHE3_A/C	1N6295AHE3_A/C	1N6296AHE3_A/C	1N6297AHE3_A/C
1N6298AHE3_A/C	1N6299AHE3_A/C	1N6300AHE3_A/C	1N6301AHE3_A/C	1N6302AHE3_A/C
1N6303AHE3_A/C				

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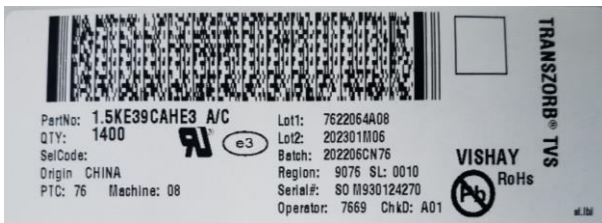


Annex 1

1.5KE label size of inner reel/box is different from the products manufactured in Shanghai factory however all the required information could be found on the label for identification.

Inner label (size 4.09*1.42")

Vishay Shanghai, China



Inner label (size 3*1.5")

Vishay Tianjin, China



For LTB and LTB, the time schedule as below:

Last time buy date: April 28, 2023 (Vishay Shanghai factory)

Last time shipment date: October 28, 2023 (Vishay Shanghai factory)



Part Number Cross List

PN List-Before	PN List-After
1.5KE100AHE3_A/C	1.5KE100AHE3_B/C
1.5KE100CAHE3_A/C	1.5KE100CAHE3_B/C
1.5KE10AHE3_A/C	1.5KE10AHE3_B/C
1.5KE10CAHE3_A/C	1.5KE10CAHE3_B/C
1.5KE110AHE3_A/C	1.5KE110AHE3_B/C
1.5KE110CAHE3_A/C	1.5KE110CAHE3_B/C
1.5KE11AHE3_A/C	1.5KE11AHE3_B/C
1.5KE11CAHE3_A/C	1.5KE11CAHE3_B/C
1.5KE120AHE3_A/C	1.5KE120AHE3_B/C
1.5KE120CAHE3_A/C	1.5KE120CAHE3_B/C
1.5KE12AHE3_A/C	1.5KE12AHE3_B/C
1.5KE12CAHE3_A/C	1.5KE12CAHE3_B/C
1.5KE130AHE3_A/C	1.5KE130AHE3_B/C
1.5KE130CAHE3_A/C	1.5KE130CAHE3_B/C
1.5KE13AHE3_A/C	1.5KE13AHE3_B/C
1.5KE13CAHE3_A/C	1.5KE13CAHE3_B/C
1.5KE150AHE3_A/C	1.5KE150AHE3_B/C
1.5KE150CAHE3_A/C	1.5KE150CAHE3_B/C
1.5KE15AHE3_A/C	1.5KE15AHE3_B/C
1.5KE15CAHE3_A/C	1.5KE15CAHE3_B/C
1.5KE160AHE3_A/C	1.5KE160AHE3_B/C
1.5KE160CAHE3_A/C	1.5KE160CAHE3_B/C
1.5KE16AHE3_A/C	1.5KE16AHE3_B/C
1.5KE16CAHE3_A/C	1.5KE16CAHE3_B/C
1.5KE170AHE3_A/C	1.5KE170AHE3_B/C
1.5KE170CAHE3_A/C	1.5KE170CAHE3_B/C
1.5KE180AHE3_A/C	1.5KE180AHE3_B/C
1.5KE180CAHE3_A/C	1.5KE180CAHE3_B/C
1.5KE18AHE3_A/C	1.5KE18AHE3_B/C
1.5KE18CAHE3_A/C	1.5KE18CAHE3_B/C
1.5KE200AHE3_A/C	1.5KE200AHE3_B/C
1.5KE200CAHE3_A/C	1.5KE200CAHE3_B/C
1.5KE20AHE3_A/C	1.5KE20AHE3_B/C
1.5KE20CAHE3_A/C	1.5KE20CAHE3_B/C
1.5KE220AHE3_A/C	1.5KE220AHE3_B/C
1.5KE220CAHE3_A/C	1.5KE220CAHE3_B/C
1.5KE22AHE3_A/C	1.5KE22AHE3_B/C
1.5KE22CAHE3_A/C	1.5KE22CAHE3_B/C
1.5KE24AHE3_A/C	1.5KE24AHE3_B/C
1.5KE24CAHE3_A/C	1.5KE24CAHE3_B/C
1.5KE27AHE3_A/C	1.5KE27AHE3_B/C
1.5KE27CAHE3_A/C	1.5KE27CAHE3_B/C
1.5KE30AHE3_A/C	1.5KE30AHE3_B/C
1.5KE30CAHE3_A/C	1.5KE30CAHE3_B/C
1.5KE33AHE3_A/C	1.5KE33AHE3_B/C
1.5KE33CAHE3_A/C	1.5KE33CAHE3_B/C
1.5KE36AHE3_A/C	1.5KE36AHE3_B/C
1.5KE36CA81HE3_A/C	1.5KE36CA81HE3_B/C
1.5KE36CAHE3_A/C	1.5KE36CAHE3_B/C
1.5KE39AHE3_A/C	1.5KE39AHE3_B/C
1.5KE39CAHE3_A/C	1.5KE39CAHE3_B/C
1.5KE43AHE3_A/C	1.5KE43AHE3_B/C
1.5KE43CA81HE3_A/D	1.5KE43CA81HE3_B/D
1.5KE43CAHE3_A/C	1.5KE43CAHE3_B/C
1.5KE47AHE3_A/C	1.5KE47AHE3_B/C
1.5KE47CAHE3_A/C	1.5KE47CAHE3_B/C
1.5KE47CAHE3_A/D	1.5KE47CAHE3_B/D
1.5KE51AHE3_A/C	1.5KE51AHE3_B/C

PN List-Before	PN List-After
1.5KE51CAHE3_A/C	1.5KE51CAHE3_B/C
1.5KE56AHE3_A/C	1.5KE56AHE3_B/C
1.5KE56CAHE3_A/C	1.5KE56CAHE3_B/C
1.5KE6.8AHE3_A/C	1.5KE6.8AHE3_B/C
1.5KE6.8CAHE3_A/C	1.5KE6.8CAHE3_B/C
1.5KE62AHE3_A/C	1.5KE62AHE3_B/C
1.5KE62CAHE3_A/C	1.5KE62CAHE3_B/C
1.5KE68AHE3_A/C	1.5KE68AHE3_B/C
1.5KE68CAHE3_A/C	1.5KE68CAHE3_B/C
1.5KE7.5AHE3_A/C	1.5KE7.5AHE3_B/C
1.5KE7.5CAHE3_A/C	1.5KE7.5CAHE3_B/C
1.5KE75AHE3_A/C	1.5KE75AHE3_B/C
1.5KE75CAHE3_A/C	1.5KE75CAHE3_B/C
1.5KE8.2AHE3_A/C	1.5KE8.2AHE3_B/C
1.5KE8.2CAHE3_A/C	1.5KE8.2CAHE3_B/C
1.5KE82AHE3_A/C	1.5KE82AHE3_B/C
1.5KE82CAHE3_A/C	1.5KE82CAHE3_B/C
1.5KE9.1AHE3_A/C	1.5KE9.1AHE3_B/C
1.5KE9.1CAHE3_A/C	1.5KE9.1CAHE3_B/C
1.5KE91AHE3_A/C	1.5KE91AHE3_B/C
1.5KE91CAHE3_A/C	1.5KE91CAHE3_B/C
1N6267AHE3_A/C	1N6267AHE3_B/C
1N6268AHE3_A/C	1N6268AHE3_B/C
1N6269AHE3_A/C	1N6269AHE3_B/C
1N6270AHE3_A/C	1N6270AHE3_B/C
1N6271AHE3_A/C	1N6271AHE3_B/C
1N6272AHE3_A/C	1N6272AHE3_B/C
1N6273AHE3_A/C	1N6273AHE3_B/C
1N6274AHE3_A/C	1N6274AHE3_B/C
1N6275AHE3_A/C	1N6275AHE3_B/C
1N6276AHE3_A/C	1N6276AHE3_B/C
1N6277AHE3_A/C	1N6277AHE3_B/C
1N6278AHE3_A/C	1N6278AHE3_B/C
1N6279AHE3_A/C	1N6279AHE3_B/C
1N6280AHE3_A/C	1N6280AHE3_B/C
1N6281AHE3_A/C	1N6281AHE3_B/C
1N6282AHE3_A/C	1N6282AHE3_B/C
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1N6284AHE3_A/C	1N6284AHE3_B/C
1N6285AHE3_A/C	1N6285AHE3_B/C
1N6286AHE3_A/C	1N6286AHE3_B/C
1N6287AHE3_A/C	1N6287AHE3_B/C
1N6288AHE3_A/C	1N6288AHE3_B/C
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1N6291AHE3_A/C	1N6291AHE3_B/C
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1N6297AHE3_A/C	1N6297AHE3_B/C
1N6298AHE3_A/C	1N6298AHE3_B/C
1N6299AHE3_A/C	1N6299AHE3_B/C
1N6300AHE3_A/C	1N6300AHE3_B/C
1N6301AHE3_A/C	1N6301AHE3_B/C
1N6302AHE3_A/C	1N6302AHE3_B/C
1N6303AHE3_A/C	1N6303AHE3_B/C

* Ordering part number: Use underscore “_” + revision code “B” following base part numbers as the identification.

Device Marking: Suffix “A” on Date code (XXXXA) marking for identification of new Tianjin assembly site.

* Upon the approval of this PCN, all future and customized part number for related product in the same package will adopt the same change.

PPAP



Product: 1.5KE (PCN-DD-028-2022)

Customer:

Revision: 0

Date of Revision: Oct 2022

PPAP N: 2022 - 243 - Tianjin



DIODES PPAP

Production Part Approval Process (PPAP)

Vishay Part Number 1.5KE (PCN-DD-028-2022)
Customer Part Number

FRONT END Location

Supplier Name Vishay General Semiconductor Taiwan Ltd.
City New Taipei City
State Zip 23145 Taiwan

BACK END Location

Supplier Name Vishay General Semiconductor China Co. Ltd
City Tianjin
State Zip 300457 China
Internet www.vishay.com

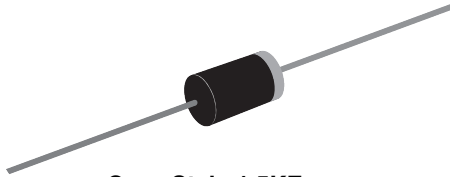


DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

1.
Design Records

TRANSZORB® Transient Voltage Suppressors



Case Style 1.5KE

PRIMARY CHARACTERISTICS	
V_{BR} unidirectional	6.8 V to 540 V
V_{BR} bidirectional	6.8 V to 220 V
V_{WM} unidirectional	5.8 V to 459 V
V_{WM} bidirectional	5.8 V to 185 V
P_{PPM}	1500 W
P_D	6.5 W
I_{FSM} (unidirectional only)	200 A
T_J max.	175 °C
Polarity	Unidirectional, bidirectional
Package	1.5KE

DEVICES FOR BIDIRECTION APPLICATIONS

For bidirectional types, use CA suffix (e.g. 1.5KE220CA)
Electrical characteristics apply in both directions.

FEATURES

- Glass passivated chip junction
- Available in unidirectional and bidirectional
- 1500 W peak pulse power capability with a 10/1000 μ s waveform, repetitive rate (duty cycle): 0.01 %
- Excellent clamping capability
- Very fast response time
- Low incremental surge resistance
- AEC-Q101 qualified available
- Solder dip 275 °C max. 10 s, per JESD 22-B106
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

TYPICAL APPLICATIONS

Use in sensitive electronics protection against voltage transients induced by inductive load switching and lighting on ICs, MOSFET, signal lines of sensor units for consumer, computer, industrial, automotive, and telecommunication.

MECHANICAL DATA

Case: molded epoxy body over passivated junction
Molding compound meets UL 94 V-0 flammability rating
Base P/N-E3 - RoHS compliant, commercial grade
Base P/NHE3_X - RoHS compliant, and AEC-Q101 qualified
("X" denotes revision code e.g. A, B, ...)

Terminals: matte tin plated leads, solderable per J-STD-002 and JESD 22-B102

E3 suffix meets JESD 201 class 1A whisker test, HE3 suffix meets JESD 201 class 2 whisker test

Note

- 1.5KE250A to 1.5KE540A are commercial grade only
- Bidirectional is available from 1.5KE6.8CA to 1.5KE220CA only

Polarity: for unidirectional types the color band denotes cathode end, no marking on bidirectional types

MAXIMUM RATINGS ($T_A = 25$ °C unless otherwise noted)			
PARAMETER	SYMBOL	VALUE	UNIT
Peak pulse power dissipation with a 10/1000 μ s waveform ⁽¹⁾ (fig. 1)	P_{PPM}	1500	W
Peak pulse current with a 10/1000 μ s waveform ⁽¹⁾	I_{PPM}	See next table	A
Power dissipation on infinite heatsink at $T_L = 75$ °C (fig. 5)	P_D	6.5	W
Peak forward surge current 8.3 ms single half sine-wave unidirectional only ⁽²⁾	I_{FSM}	200	A
Maximum instantaneous forward voltage at 100 A for unidirectional only ⁽³⁾	V_F	3.5/5.0	V
Operating junction and storage temperature range	T_J, T_{STG}	-55 to +175	°C

Notes

- (1) Non-repetitive current pulse, per fig. 3 and derated above $T_A = 25$ °C per fig. 2
- (2) Measured on 8.3 ms single half sine-wave or equivalent square wave, duty cycle = 4 pulses per minute maximum
- (3) $V_F = 3.5$ V for 1.5KE220A and below; $V_F = 5.0$ V for 1.5KE250A and above



ELECTRICAL CHARACTERISTICS (T _A = 25 °C unless otherwise noted)									
JEDEC® TYPE NUMBER	GENERAL SEMICONDUCTOR PART NUMBER	BREAKDOWN VOLTAGE V _{BR} AT I _T ⁽¹⁾ (V)		TEST CURRENT I _T (mA)	STAND-OFF VOLTAGE V _{WM} (V)	MAXIMUM REVERSE LEAKAGE AT V _{WM} I _D ⁽⁴⁾ (µA)	MAXIMUM PEAK PULSE CURRENT I _{PPM} ⁽²⁾ (A)	MAXIMUM CLAMPING VOLTAGE AT I _{PPM} V _C (V)	MAXIMUM TEMPERATURE COEFFICIENT OF V _{BR} (%/°C)
		MIN.	MAX.						
1N6267A	(+) ⁽⁺⁾ 1.5KE6.8A	6.45	7.14	10	5.80	1000	143	10.5	0.057
1N6268A	(+) ⁽⁺⁾ 1.5KE7.5A	7.13	7.88	10	6.40	500	133	11.3	0.061
1N6269A	(+) ⁽⁺⁾ 1.5KE8.2A	7.79	8.61	10	7.02	200	124	12.1	0.065
1N6270A	(+) ⁽⁺⁾ 1.5KE9.1A	8.65	9.55	1.0	7.78	50	112	13.4	0.068
1N6271A	(+) ⁽⁺⁾ 1.5KE10A	9.50	10.5	1.0	8.55	10	103	14.5	0.073
1N6272A	(+) ⁽⁺⁾ 1.5KE11A	10.5	11.6	1.0	9.40	5.0	96.2	15.6	0.075
1N6273A	(+) ⁽⁺⁾ 1.5KE12A	11.4	12.6	1.0	10.2	5.0	89.8	16.7	0.078
1N6274A	(+) ⁽⁺⁾ 1.5KE13A	12.4	13.7	1.0	11.1	5.0	82.4	18.2	0.081
1N6275A	(+) ⁽⁺⁾ 1.5KE15A	14.3	15.8	1.0	12.8	1.0	70.8	21.2	0.084
1N6276A	(+) ⁽⁺⁾ 1.5KE16A	15.2	16.8	1.0	13.6	1.0	66.7	22.5	0.086
1N6277A	(+) ⁽⁺⁾ 1.5KE18A	17.1	18.9	1.0	15.3	1.0	59.5	25.2	0.089
1N6278A	(+) ⁽⁺⁾ 1.5KE20A	19.0	21.0	1.0	17.1	1.0	54.2	27.7	0.090
1N6279A	(+) ⁽⁺⁾ 1.5KE22A	20.9	23.1	1.0	18.8	1.0	49.0	30.6	0.092
1N6280A	(+) ⁽⁺⁾ 1.5KE24A	22.8	25.2	1.0	20.5	1.0	45.2	33.2	0.094
1N6281A	(+) ⁽⁺⁾ 1.5KE27A	25.7	28.4	1.0	23.1	1.0	40.0	37.5	0.096
1N6282A	(+) ⁽⁺⁾ 1.5KE30A	28.5	31.5	1.0	25.6	1.0	36.2	41.4	0.097
1N6283A	(+) ⁽⁺⁾ 1.5KE33A	31.4	34.7	1.0	28.2	1.0	32.8	45.7	0.098
1N6284A	(+) ⁽⁺⁾ 1.5KE36A	34.2	37.8	1.0	30.8	1.0	30.1	49.9	0.099
1N6285A	(+) ⁽⁺⁾ 1.5KE39A	37.1	41.0	1.0	33.3	1.0	27.8	53.9	0.100
1N6286A	(+) ⁽⁺⁾ 1.5KE43A	40.9	45.2	1.0	36.8	1.0	25.3	59.3	0.101
1N6287A	(+) ⁽⁺⁾ 1.5KE47A	44.7	49.4	1.0	40.2	1.0	23.1	64.8	0.101
1N6288A	(+) ⁽⁺⁾ 1.5KE51A	48.5	53.6	1.0	43.6	1.0	21.4	70.1	0.102
1N6289A	(+) ⁽⁺⁾ 1.5KE56A	53.2	58.8	1.0	47.8	1.0	19.5	77.0	0.103
1N6290A	(+) ⁽⁺⁾ 1.5KE62A	58.9	65.1	1.0	53.0	1.0	17.6	85.0	0.104
1N6291A	(+) ⁽⁺⁾ 1.5KE68A	64.6	71.4	1.0	58.1	1.0	16.3	92.0	0.104
1N6292A	(+) ⁽⁺⁾ 1.5KE75A	71.3	78.8	1.0	64.1	1.0	14.6	104	0.105
1N6293A	(+) ⁽⁺⁾ 1.5KE82A	77.9	86.1	1.0	70.1	1.0	13.3	113	0.105
1N6294A	(+) ⁽⁺⁾ 1.5KE91A	86.5	95.5	1.0	77.8	1.0	12.0	125	0.106
1N6295A	(+) ⁽⁺⁾ 1.5KE100A	95.0	105	1.0	85.5	1.0	10.9	137	0.106
1N6296A	(+) ⁽⁺⁾ 1.5KE110A	105	116	1.0	94.0	1.0	9.9	152	0.107
1N6297A	(+) ⁽⁺⁾ 1.5KE120A	114	126	1.0	102	1.0	9.1	165	0.107
1N6298A	(+) ⁽⁺⁾ 1.5KE130A	124	137	1.0	111	1.0	8.4	179	0.107
1N6299A	(+) ⁽⁺⁾ 1.5KE150A	143	158	1.0	128	1.0	7.2	207	0.106
1N6300A	(+) ⁽⁺⁾ 1.5KE160A	152	168	1.0	136	1.0	6.8	219	0.108
1N6301A	(+) ⁽⁺⁾ 1.5KE170A	162	179	1.0	145	1.0	6.4	234	0.108
1N6302A	(+) ⁽⁺⁾ 1.5KE180A	171	189	1.0	154	1.0	6.1	246	0.108
1N6303A	(+) ⁽⁺⁾ 1.5KE200A	190	210	1.0	171	1.0	5.5	274	0.108
-	(+) ⁽⁺⁾ 1.5KE220A	209	231	1.0	185	1.0	4.6	328	0.108
-	1.5KE250A	237	263	1.0	214	1.0	4.4	344	0.110
-	1.5KE300A	285	315	1.0	256	1.0	3.6	414	0.110
-	1.5KE350A	333	368	1.0	300	1.0	3.1	482	0.110
-	1.5KE400A	380	420	1.0	342	1.0	2.7	548	0.110
-	1.5KE440A	418	462	1.0	376	1.0	2.5	602	0.110
-	1.5KE480A	456	504	1.0	408	1.0	2.28	658	0.110
-	1.5KE510A	485	535	1.0	434	1.0	2.15	698	0.110
-	1.5KE540A	513	567	1.0	459	1.0	2.03	740	0.110

Notes

- (1) Pulse test: t_p ≤ 50 ms
- (2) Surge current waveform per fig. 3 and derate per fig. 2
- (3) All terms and symbols are consistent with ANSI/IEEE CA62.35
- (4) For bidirectional types with V_R 10 V and less the I_D limit is doubled
- (+)⁽⁺⁾ Underwriters laboratory recognition for the classification of protectors (QVGQ2) under the UL standard for safety 497B and file number E136766 for both unidirectional and bidirectional devices



THERMAL CHARACTERISTICS (T _A = 25 °C unless otherwise noted)			
PARAMETER	SYMBOL	VALUE	UNIT
Typical thermal resistance, junction to ambient	R _{θJA}	75	°C/ W
Typical thermal resistance, junction to lead	R _{θJL}	15.4	

ORDERING INFORMATION (Example)				
PREFERRED PIN	UNIT WEIGHT (g)	PREFERRED PACKAGE CODE	BASE QUANTITY	DELIVERY MODE
1.5KE6.8A-E3/54	0.968	54	1400	13" diameter paper tape and reel
1.5KE6.8AHE3_B/C (1)(2)	0.968	C	1400	13" diameter paper tape and reel

Notes

(1) AEC-Q101 qualified

(2) Applied for 1.5KE6.8AHE3_B to 1.5KE220AHE3_B, and 1.5KE6.8CAHE3_B to 1.5KE220CAHE3_B

RATINGS AND CHARACTERISTICS CURVES (T_A = 25 °C unless otherwise noted)

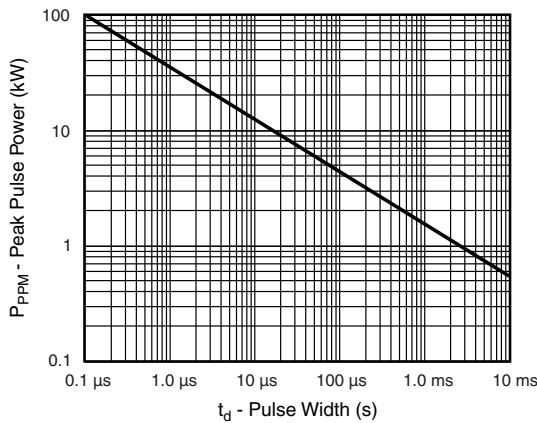


Fig. 1 - Peak Pulse Power Rating Curve

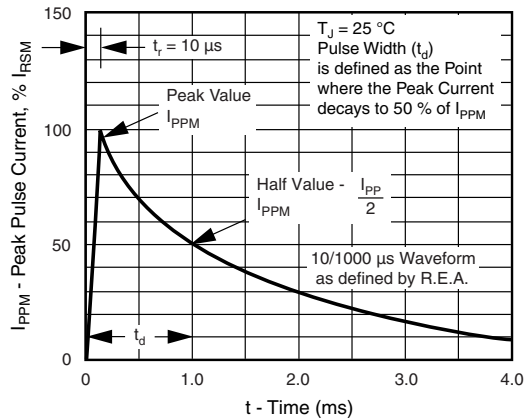


Fig. 3 - Pulse Waveform

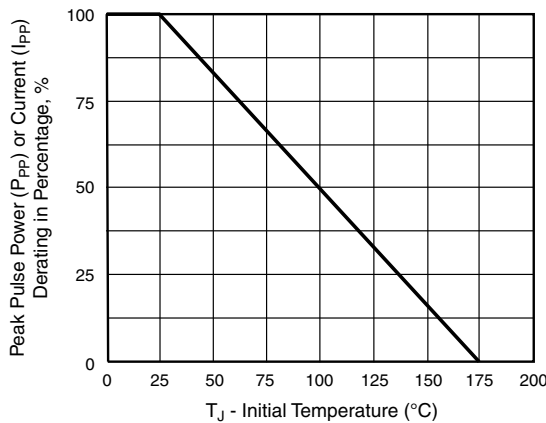


Fig. 2 - Pulse Power or Current vs. Initial Junction Temperature

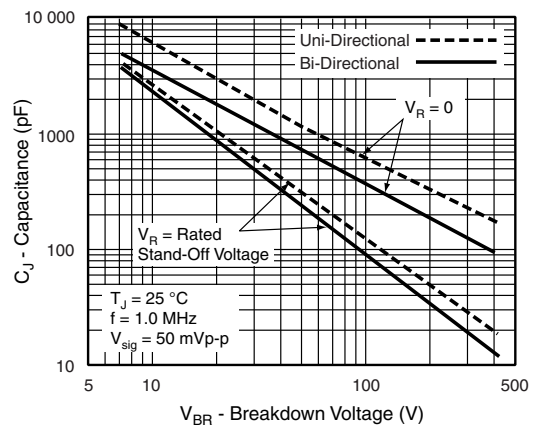


Fig. 4 - Typical Junction Capacitance

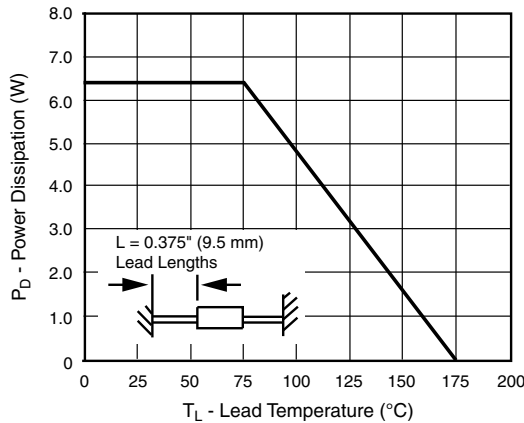


Fig. 5 - Power Derating Curve

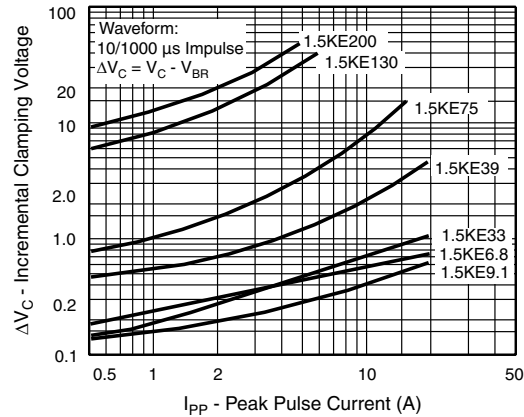


Fig. 8 - Incremental Clamping Voltage Curve (Unidirectional)

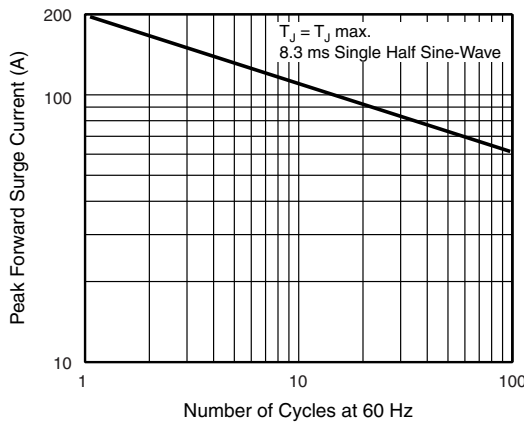


Fig. 6 - Maximum Non-Repetitive Forward Surge Current Unidirectional only

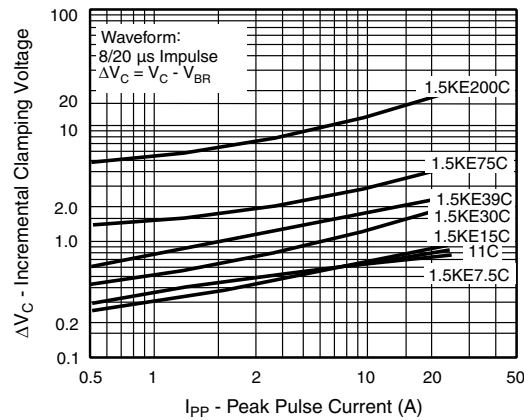


Fig. 9 - Incremental Clamping Voltage Curve (Bidirectional)

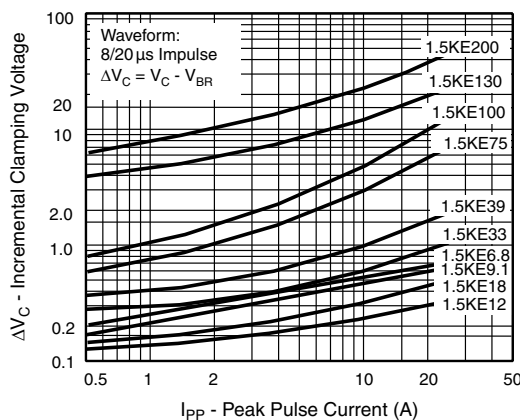


Fig. 7 - Incremental Clamping Voltage Curve (Unidirectional)

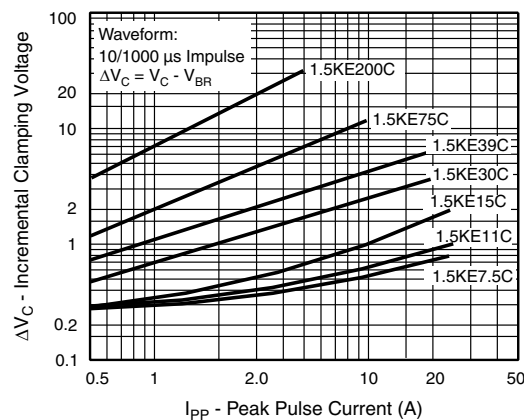


Fig. 10 - Incremental Clamping Voltage Curve (Bidirectional)

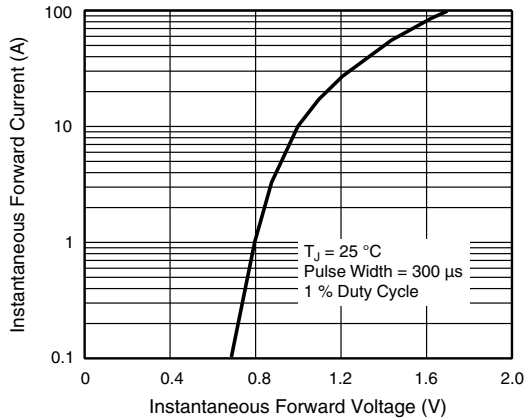


Fig. 11 - Instantaneous Forward Voltage Characteristics Curve

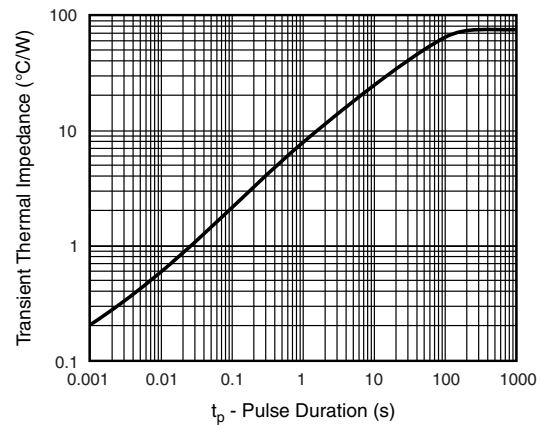
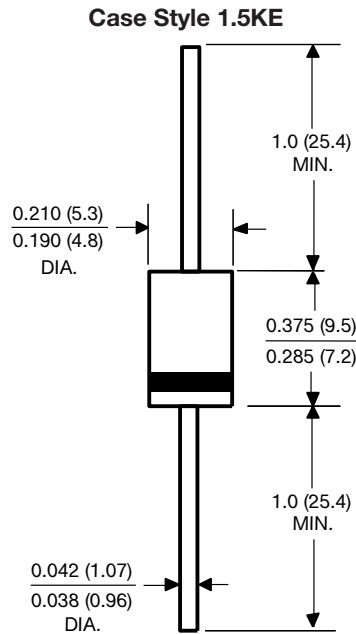


Fig. 12 - Typical Transient Thermal Impedance

PACKAGE OUTLINE DIMENSIONS in inches (millimeters)



APPLICATION NOTES

- This series of Silicon Transient Suppressors is used in applications where large voltage transients can permanently damage voltage-sensitive components.
- The TVS diode can be used in applications where induced lightning on rural or remote transmission lines presents a hazard to electronic circuitry (ref: R.E.A. specification P.E. 60).
- This Transient Voltage Suppressor diode has a pulse power rating of 1500 W for 1 ms. The response time of TVS diode clamping action is effectively instantaneous (1×10^{-9} s bi-directional); therefore, they can protect integrated circuits, MOS devices, hybrids, and other voltage sensitive semiconductors and components. TVS diodes can also be used in series or parallel to increase the peak power ratings.



Packaging Information

Table with columns: ANTI-STATIC PACKAGE CODE, PREFERRED PACKAGE CODE, PACKAGING DESCRIPTION. Rows include various package codes like 51, A, 52, 52T, 2D, etc., and their corresponding descriptions.

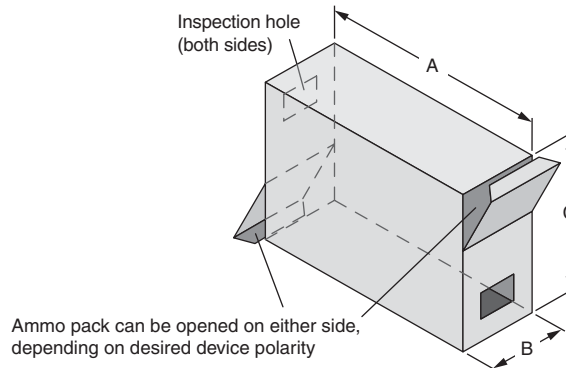
Notes

- "P" and bold letter denotes preferred package code
• A "T" suffix added to the packaging codes for SMA, SMB and SMC products indicates that the patented folded-frame construction is used.
(1) Formerly sold by Vishay Telefunken® (Telefunken® is a registered trademark of Electro Holding GmbH)



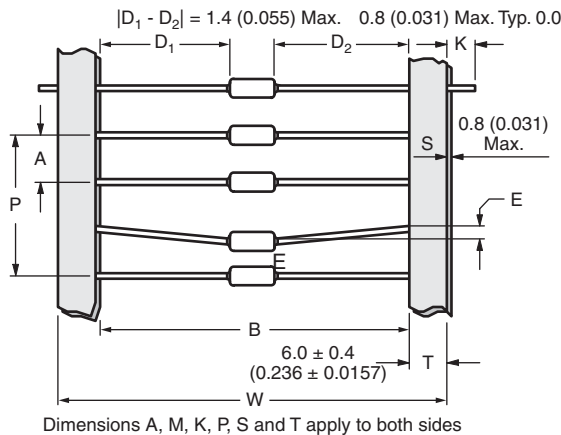
BULK PACKAGING					
CASE TYPES	PREFERRED PACKAGE CODE	PACKAGING	BOX SIZE		QUANTITY
			INCHES	cm	EA.
DF-M, DF-S, DFL-S	45	Anti-static plastic tubes	17.4 length	44.1 length	50
GSIB-5S, PB	45	Anti-static plastic tubes	24.2 length	61.5 length	20
GBU, BU	45	Anti-static plastic tubes	18.5 length	47 length	20
GBL	45	Anti-static plastic tubes	17.5 length	44.5 length	20
TO-220AB / AC, ITO-220AC / AB, TO-262AA	45, 4W	Anti-static plastic tubes	21.0 length	53.7 length	50
TO-247AD	45	Anti-static plastic tubes	20.0 length	50.8 length	30
MBS (TO-269AA)	45	Anti-static plastic tubes	20.3 x 0.41	51.5 x 1.04	100
GBL	51	Anti-static PVC tray	12.5 x 6.1 x 1.0	31.7 x 15.5 x 2.5	400
GBPC12-35W	51	Paper box	12.5 x 12.5 x 1.7	31.7 x 31.7 x 4.3	100
GBPC6	51	Paper box	7.5 x 7.5 x 1.43	19.0 x 19.0 x 3.6	100
KBL	51	Anti-static PVC tray	12.2 x 6.1 x 1.5	30.9 x 15.5 x 3.8	300
GBPC12-35	51	Paper box	12.5 x 12.5 x 1.7	31.7 x 31.7 x 4.3	100
KBU4, 6, 8	51	Anti-static PVC tray	12.2 x 6.1 x 1.5	30.9 x 15.5 x 3.8	250
WOG, 2WOG	51	Plastic bags	-	-	100
GBU / BU	51	Paper tray	13.1 x 6.6 x 1.2	33.2 x 16.8 x 3.0	250

AXIAL-LEADED TAPE AND REEL PACKAGING



All axial-leaded devices are packed in accordance with EIA standard RS-296-E. The diagrams given below refer to these specifications.

TABLE 1 - AMMO PACK PACKAGING						
PACKAGING	AVAILABLE PRODUCT OUTLINES	PREFERRED PACKAGE CODE	DIMENSION A	DIMENSION B	DIMENSION C	QUANTITY BOX
26 mm horizontal tape, ammo pack	DO-41(DO-204AL), MPG06 DO-15 (DO-204AC) P300	53, B 53, B 53, B	9.7" (247 mm)	1.7" (44 mm)	3.7" (95 mm)	3.0K 1.5K 0.75K
52 mm horizontal tape, ammo pack	DO-41(DO-204AL), MPG06 DO-15 (DO-204AC) DO-201AD, GP20 P600	73, D 73, D 73, D 73, D	10.0" (255 mm)	3.15" (80 mm)	4.53" (115 mm)	3.0K 2.0K 1.0K 0.3K
Pseudo / radial tape, ammo pack	MPG06	100, V	13.4" (340 mm)	1.8" (47 mm)	7.9" (200 mm)	2.0K

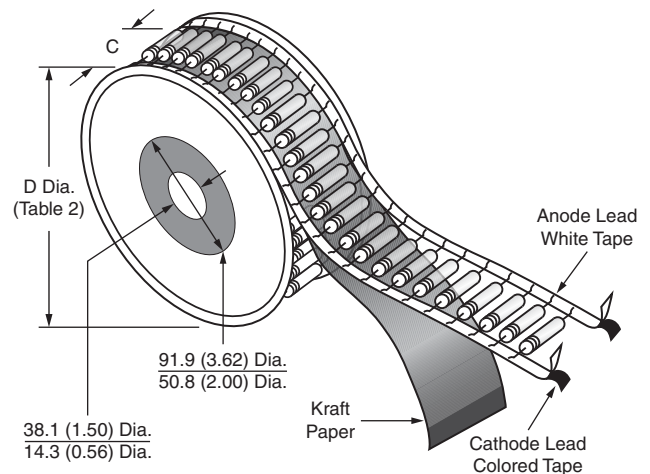


Dimensions in millimeters (inches)

Description	Symbol	
Component Pitch	A	2, 3
Inside Tape Spacing	B	2, 3
Lead to Lead Eccentricity	D1 - D2	-
Lead Extension	K	-
Lead Bending	E	2
Cumulative Pitch	P	3
Exposed Adhesive	S	-
Tape Width	T	-

All polarized components shall be oriented in the same direction

Fig. 1



The "C" dimension of Fig. 2 is between flanges of the component reel and shall be 1.5 mm (0.059") to 8.00 mm (0.315") greater than the overall taped component width "W" (Fig. 1). Where "W" dimension is 68.2 mm (2.68") max.

Fig. 2



AXIAL-LEADED TAPE AND REEL PACKAGING

TABLE 2 - REEL AND AMMO PACK TAPING SPECIFICATIONS

COMPONENT CASE TYPE	PREFERRED PACKAGE CODE	UNITS PER REEL	COMPONENT PITCH "A" Fig. 1		INSIDE TAPE SPACING "B" Fig. 1		REEL DIMENSION "D" Fig. 2		LEAD BENDING "E" Fig. 1	
			EA.	INCHES	mm	INCHES	mm	INCHES	mm	INCHES
DO-15 (DO-204AC)	54, C	4000	0.200	5.0	2.06	52.4	13.0	330	0.047	1.2
DO-201AD	54, C	1400	0.395	10.0	2.06	52.4	13.0	330	0.047	1.2
DO-41 (DO-204AL)	54, C	5500	0.200	5.0	2.06	52.4	13.0	330	0.047	1.2
DFS Surface-Mount	77	1500	Fig. 8		-	-	13.0	330	Fig. 8	-
GF1 (DO-214BA)	67A, H / 5CA, I	1500 / 6500			-	-	7.0 / 13.0	178 / 330	Fig. 8	-
GL34 (DO-213AA)	98, H / 83, I	2500 / 9000			-	-	7.0 / 13.0	178 / 330	Fig. 8	-
GL41 (DO-213AB)	96, H / 97, I	1500 / 5000			-	-	7.0 / 13.0	178 / 330	Fig. 8	-
GP10E Radial	Fig. 5 and Fig. 6	2500	0.500	12.7	-	-	13.0	330	0.079	2.0
GP10E	54, C	5500	0.200	5.0	2.06	52.4	13.0	330	0.047	1.2
GP20/1.5KE	54, C	1400	0.395	10.0	2.06	52.4	13.0	330	0.047	1.2
MPG06	54, C	5500	0.200	5.0	2.06	52.4	13.0	330	0.047	1.2
P600	54, C	800	0.395	10.0	2.06	52.4	13.0	330	0.047	1.2
SMP (DO-220AA)	84A, H / 85A, I	3000 / 10 000	Fig. 8		-	-	7.0 / 13.0	178 / 330	Fig. 8	-
SMF (DO-219AB)	H / I	3000 / 10 000			-	-	7.0 / 13.0	178 / 300	Fig. 8	-
SMPD (TO-263AC) / SMPA (DO-221BC)	I	2000 / 14 000			-	-	13.0	330	Fig. 8	-
MicroSMP (DO-219AD) / MicroSMF (DO-219AC)	89A / H	4500			-	-	7.0	178	Fig. 8	-
SMPC (TO-277A)	86A, H / 87A, I	1500 / 6500			-	-	7.0 / 13.0	178 / 330	Fig. 8	-
SMA (DO-214AC)	61, 61T, TR, H / 5A, 5AT, TR3, I	1800 / 7500			-	-	7.0 / 13.0	178 / 330	Fig. 8	-
SMB (DO-214AA) / SMBG (DO-215AA)	52, 52T, H / 5B, 5BT, I	750 / 3200			-	-	7.0 / 13.0	178 / 330	Fig. 8	-
SMC (DO-214AB) / SMCG (DO-215AB)	57, 57T, H / 9A, 9AT, I	850 / 3500			-	-	7.0 / 13.0	178 / 330	Fig. 8	-
DO-218AB / AC	2D / I	750			-	-	13.0	330	Fig. 8	-
D ² PAK (TO-263AB)	81, 8W, I	800			-	-	13.0	330	Fig. 8	-
MBS (TO-269AA)	80, I	3000			-	-	13.0	330	Fig. 8	-
SlimSMA (DO-221AC)	6A, H / 6B, I	3500 / 14 000			-	-	7.0 / 13.0	178 / 330	Fig. 8	-
SlimSMAW (DO-221AD)	H, I	3500 / 14 000			-	-	7.0 / 13.0	178 / 330	Fig. 8	-
SlimDPAK (TO-252AE)	I	4500			-	-	13.0	330	Fig. 8	-
FlatPAK 5 x 6	H / I	1500 / 6000			-	-	7.0 / 13.0	178 / 330	Fig. 8	-
MicroSMP (DO-219AD)	I	16 000			-	-	13.0	330	Fig. 8	-
SMPA (DO-221BC)	H	3500	-	-	7.0	178	Fig. 8	-		

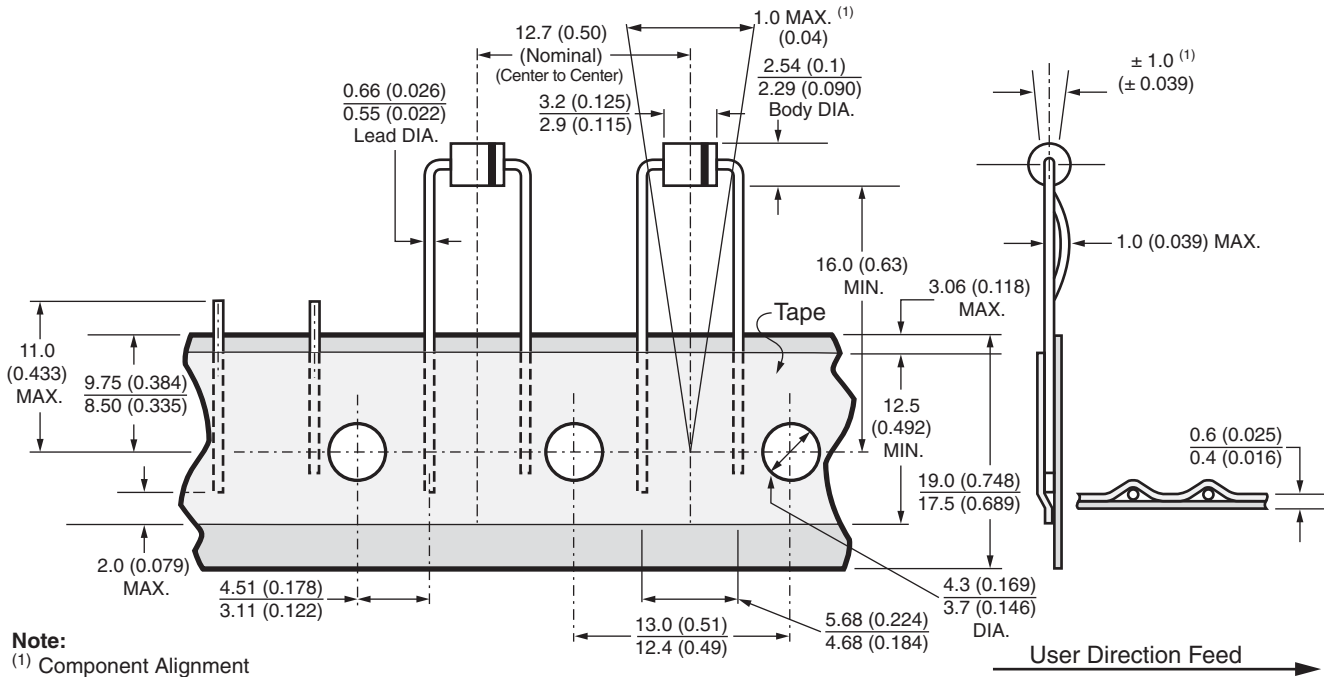
Note

- Package codes, 61/5A, 52/5B are matrix-frame constructions for TRANSZORB[®] TVS in SMA and SMB only

TABLE 3 - COMPONENT AND INSIDE HORIZONTAL TAPE SPACING

COMPONENT BODY DIAMETER	COMPONENTS SPACING A (LEAD TO LEAD)	INSIDE TAPE SPACING "B"	CUMULATIVE PITCH TOLERANCE
0 mm to 5 mm (0.0" to 0.197")	5.0 mm ± 0.5 mm (0.197" ± 0.020")	26 mm + 1.5 mm / - 0.0 mm (1.024" + 0.059" / - 0.0")	Not to exceed 1.5 mm (0.059") over 6 consecutive components
0 mm to 5 mm (0.0" to 0.197")	5.0 mm ± 0.5 mm (0.197" ± 0.020")	52.4 mm + 1.5 mm / - 0.4 mm (2.062" + 0.059" / - 0.016")	
5.01 mm to 10 mm (0.197" to 0.394")	10 mm ± 0.5 mm (0.394" ± 0.020")	52.4 mm + 1.5 mm / - 0.4 mm (2.062" + 0.059" / - 0.016")	

DIMENSIONS in millimeters (inches)



Note:
 (1) Component Alignment

Available only for MPG06 Product in Ammo Pack in Accordance with EIA Standard RS-468-A Utilizing 0.61 mm (0.024") Diameter Leads. Maximum Cumulative Pitch Tolerance: 1.0 mm (0.039")/20 Pitch.

Fig. 3 - Pseudo Radial

RADIAL TAPE PACKAGING

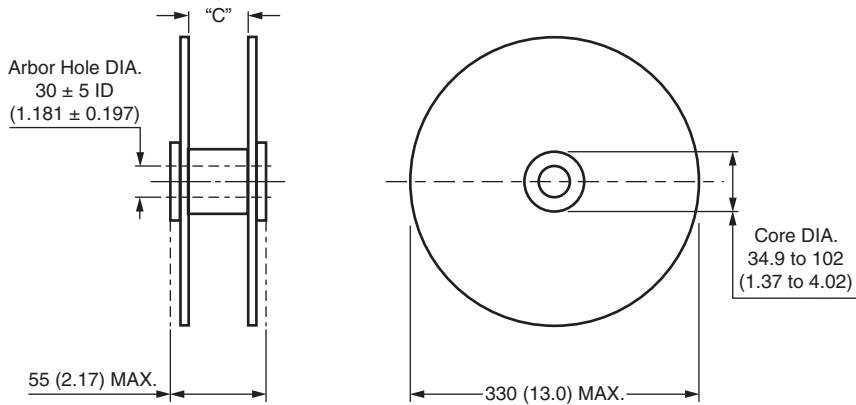


Fig. 4 - Reel Dimensions

Notes

- "C" dimension between the reel flanges shall be governed by the overall width of the taped components and shall be 1.5 mm (0.057") to 8.0 mm (0.315") greater than the overall width
- All leaded devices are packaged in accordance with EIA standard RS-468-A specification and are available on reel or in fan fold box (ammo pack)
- All dimensions are in millimeters and (inches)

SURFACE MOUNT TAPE AND REEL PACKAGING

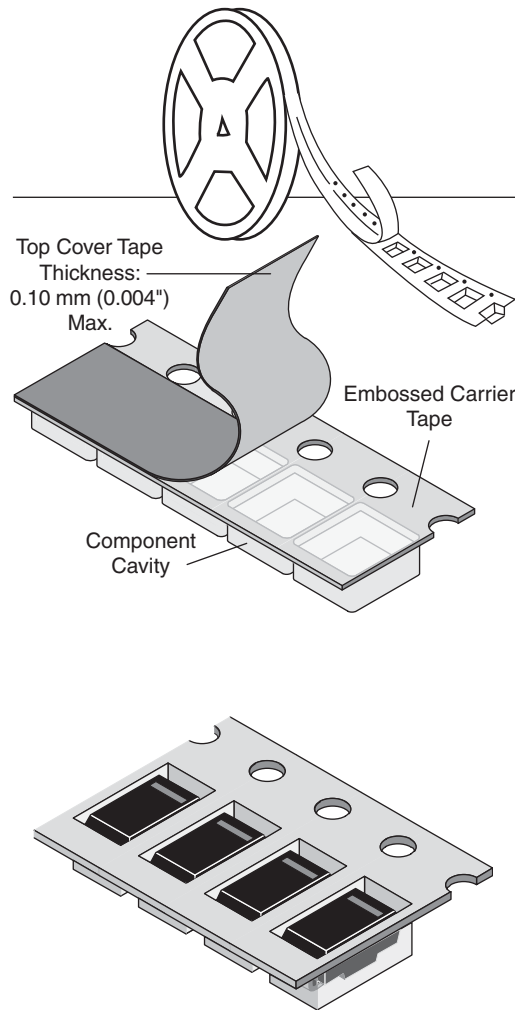


Fig. 5

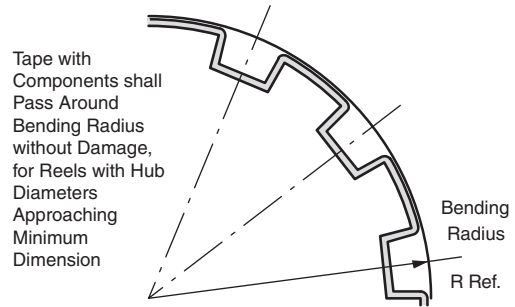


Fig. 6

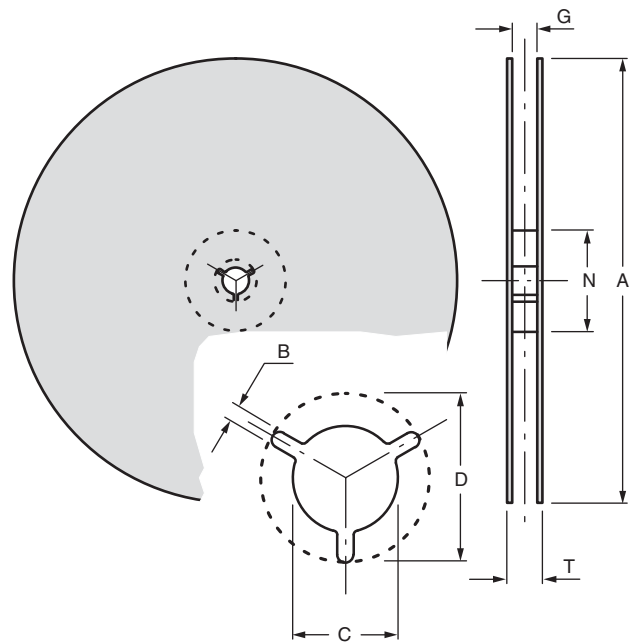


Fig. 7

DIMENSIONS in millimeters (inches)							
TAPE SIZE	A MAX.	B MIN.	C	D MIN.	N MIN.	G MAX.	T MAX.
8 mm (0.315)	330 ± 2.0 (13.0 ± 0.079) 178 ± 2.0 (7.0 ± 0.079)	1.5 (0.059)	13.0 ± 0.20 (0.51 ± 0.008)	20.2 (0.795)	50 (1.97)	9.9 (0.389)	14.4 (0.567)
12 mm (0.472)	330 ± 2.0 (13.0 ± 0.079) 178 ± 2.0 (7.0 ± 0.079)	1.5 (0.059)	13.0 ± 0.20 (0.51 ± 0.008)	20.2 (0.795)	50 (1.97)	14.4 (0.567)	18.4 (0.724)
16 mm (0.630)	330 ± 2.0 (13.0 ± 0.079) 178 ± 2.0 (7.0 ± 0.079)	1.5 (0.059)	13.0 ± 0.20 (0.51 ± 0.008)	20.2 (0.795)	50 (1.97)	18.4 (0.724)	22.4 (0.802)
24 mm (0.945)	330 ± 2.0 (13.0 ± 0.079) 178 ± 2.0 (7.0 ± 0.079)	1.5 (0.059)	13.0 ± 0.20 (0.51 ± 0.008)	20.2 (0.795)	50 (1.97)	26.4 (1.039)	30.4 (1.197)

SURFACE MOUNT TAPE AND REEL PACKAGING

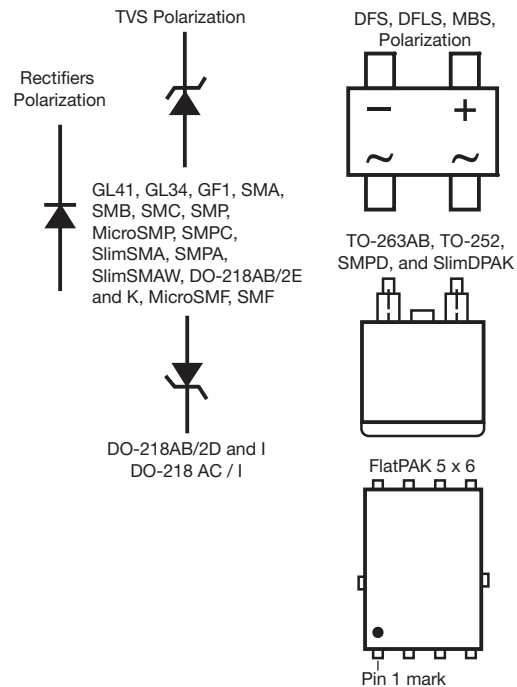
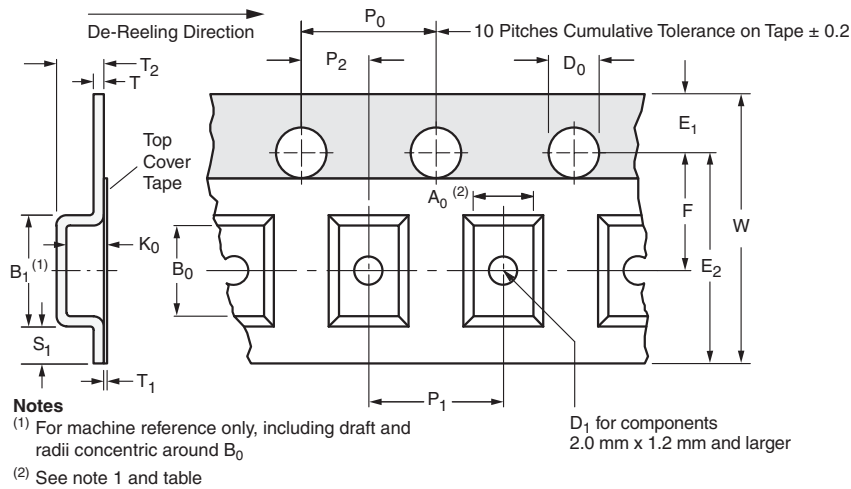


Fig. 8

8 mm, 12 mm, 16 mm, AND 24 mm EMBOSSED TAPE in millimeters (inches)									
TAPE SIZE	D_0	E_1	P_0	P_2	A_0, B_0, K_0	S_1 MIN.	T MAX.	T_1 MAX.	
8 mm, 12 mm	1.5 ± 0.1 (0.059 \pm 0.004)	1.75 ± 0.1 (0.069 \pm 0.004)	4.0 ± 0.1 (0.157 \pm 0.004)	2.0 ± 0.05 (0.079 \pm 0.002)	(1)	0.6 (0.024)	0.600 (0.024)	0.1 (0.004)	
16 mm, 24 mm				2.0 ± 0.1 (0.079 \pm 0.004)					



DIMENSIONS in millimeters (inches)									
CASE TYPE	TAPE SIZE	B ₁ MAX.	D ₁ MIN.	E ₂ MIN.	F	P ₁	R REF.	T ₂ MAX.	W MAX.
GL34 (DO-213AA)	8 (0.315)	4.2 (0.165)	1.0 (0.039)	6.25 (0.246)	3.5 ± 0.05 (0.138 ± 0.002)	4.0 ± 0.10 (0.157 ± 0.004)	20 (0.787)	2.4 (0.094)	8.3 (0.327)
MicroSMP (DO-219AB) / MicroSMF (DO-219AD)		3.28 (0.129)		6.05 (0.238)				1.919 (0.076)	
SMF (DO-219AB)		-		-				1.8 (0.07)	8.2 (0.322)
GL34 (DO-213AA)	12 (0.472)	8.2 (0.323)	1.5 (0.059)	10.25 (0.404)	5.5 ± 0.05 (0.217 ± 0.002)	8.0 ± 0.10 (0.315 ± 0.004)	25 (0.984)	4.5 (0.177)	12.3 (0.484)
GF1 (DO-214BA)								3.25 (0.128)	
SMA (DO-214AC)								2.64 (0.104)	
SMP (DO-220AA)								1.84 (0.072)	
SMPC (TO-277A)		7.0 (0.276)						1.43 (0.056)	
SMB (DO-214AA) / SMBG (DO-215AA)		8.2 (0.323)						2.77 (0.109)	
SL34 (DO-213AA)	16 (0.630)	12.1 (0.476)	1.5 (0.059)	14.25 (0.561)	7.5 ± 0.1 (0.295 ± 0.004)	8.0 ± 0.10 (0.315 ± 0.004)	25 (0.984)	2.64 (0.104)	16.3 (0.642)
SlimDPAK (TO-252AE)								2.0 (0.079)	
DFS								12.0 ± 0.10 (0.472 ± 0.004)	
D ² PAK (TO-263AB) DO-218AB / AC	24 (0.945)	20.1 (0.791)	1.5 (0.059)	22.25 (0.876)	11.5 ± 0.1 (0.453 ± 0.004)	16.0 ± 0.10 (0.630 ± 0.004)	25 (0.984)	5.31 (0.209)	24.3 (0.957)
SMPD (TO-263AC)								12.0 ± 0.10 (0.472 ± 0.004)	
SlimSMA (DO-221AC) / SMPA (DO-221BC)	12 (0.472)	6.2 (0.244)	1.5 (0.059)	10.25 (0.404)	5.5 ± 0.05 (0.217 ± 0.002)	4.0 ± 0.10 (0.157 ± 0.004)	25 (0.984)	1.53 (0.060)	12.3 (0.484)
SlimSMAW (DO-221AD)								1.61 (0.063)	
FlatPAK 5 x 6								6.4 (0.252)	

Notes

- (1) A₀, B₀, and K₀ are determined by the maximum dimensions of the component size. The clearance between the component and the cavity must be within 0.05 mm (0.002") min. to 0.5 mm (0.02") max. for 8 mm tape and 12 mm tape, 0.15 mm (0.066") min. to 0.90 mm (0.035") max. for 16 mm tape and 0.15 mm (0.006") min. to 1.0 mm (0.59") max. for 24 mm tape
- (2) All surface mount components are packed in accordance with EIA standard 481-E



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CERTIFICATION OF DESIGN, CONSTRUCTION AND QUALIFICATION

In reference to AEC Q-101 Rev.E

Item Name	Supplier Response
1. User's Part Number:	
2. Supplier Part Number/Generic Part Number:	1.5KE6.8A-220AHE3_B 1N6267A-1N6303AHE3_B 1.5KE6.8CA-220CAHE3_B
3. Device Description:	TVS
4. Wafer/Die Fab Location & Process ID: a. Facility name/plant #: b. Street address: c. Country:	Vishay General Semiconductor Taiwan Ltd. 233, Baoqiao Road, New Taipei Xindian, Taiwan Taiwan
5. Wafer Probe Location: a. Facility name/plant #: b. Street address: c. Country:	Vishay General Semiconductor China Co., Ltd. Vishay General Semiconductor Taiwan Ltd. No. 88, 6th Avenue, TEDA, Tianjin, China 233, Baoqiao Road, New Taipei Xindian, Taiwan China/ Taiwan
6. Assembly Location & Process ID: a. Facility name/plant #: b. Street address: c. Country:	Vishay General Semiconductor China Co., Ltd. No. 88, 6th Avenue, TEDA, Tianjin, China China
7. Final Quality Control A (Test) Location: a. Facility name/plant #: b. Street address: c. Country:	Vishay General Semiconductor China Co., Ltd. No. 88, 6th Avenue, TEDA, Tianjin, China China
8. Wafer/Die: a. Wafer size: b. Die family: c. Die mask set revision & name:	4 inch TVS 4S114/M3 (1.5KE6.8A-82A/1N6267A-1N6293A) 4S125/M3 (1.5KE91A-220A/1N6294A-1N6303A) 4S114/M2 (1.5KE6.8CA-22CA) 4S125/M2 (1.5KE24CA-220CA)
9. Wafer/Die Technology Description: a. Wafer/Die process technology: b. Gate oxide thickness (MOSFETs only): c. Number of mask steps:	TVS N/A 3 (uni-directional) 2 (bi-directional)
10. Die Dimensions: a. Die width: b. Die length: c. Die thickness (finished):	114mil (1.5KE6.8A-82A/1N6267A-1N6293A/1.5KE6.8CA-22CA) 125mil (1.5KE91A-220A/1N6294A-1N6303A/1.5KE24CA-220CA) 114mil (1.5KE6.8A-82A/1N6267A-1N6293A/1.5KE6.8CA-22CA) 125mil (1.5KE91A-220A/1N6294A-1N6303A/1.5KE24CA-220CA) 14mil (uni-directional) 14.5mil (bi-directional)
11. Die (frontside) Metallization: a. Die metallization material(s): b. Number of layers: c. Thickness (per layer): d. % of alloys (if present):	Ni/Au 2 Typ. 1.1 um N/A
12. Die Passivation: a. Number of passivation layers: b. Die passivation material(s): c. Thickness(es) & tolerances:	1 Glass >1mil
13. Die Overcoat Material (e.g., Polyimide):	N/A
14. Die Prep Backside: a. Die prep method: b. Die metallization: c. Thickness(es) & tolerances:	Confidential Ni/Au Typ. 1.1 um
15. Die Separation Method: a. Kerf width (mm): b. Kerf depth (if not 100% saw): c. Saw method:	Blade saw <0.05 N/A Single <input checked="" type="checkbox"/> Dual <input type="checkbox"/>
16. Die Attach: a. Die attach material ID: b. Die attach method: c. Die placement diagram:	92.5Pb/2.5Ag/5Sn Reflow soldering See attached <input checked="" type="checkbox"/> Not available <input type="checkbox"/>
17. Package: a. Type of package (e.g., plastic, ceramic, unpackaged): b. JEDEC designation (e.g., MS029, MS034, etc.):	Plastic 1.5KE
18. Mold Compound: a. Mold compound supplier & ID: b. Mold compound type: c. Flammability rating: d. Fire Retardant type/composition: e. Tg (glass transition temperature)(°C): f. CTE (above & below Tg)(ppm/°C):	Confidential Epoxy Compound UL 94 V1 <input type="checkbox"/> UL 94 V0 <input checked="" type="checkbox"/> Confidential Min. 150°C CTE1 (below Tg) < 30 CTE2 (above Tg) < 85
19. Wire Bond: a. Wire bond material: b. Wire bond diameter (mils): c. Type of wire bond at die: d. Type of wire bond at leadframe: e. Number of bonds over active area:	N/A N/A N/A N/A N/A
20. Leadframe (if applicable): a. Header material: b. Header width (mils): c. Header length (mils): d. Header plating composition: e. Header plating thickness (µinch): f. Leadframe material: g. Leadframe bonding plating composition: h. Leadframe bonding plating thickness (µinch): i. External lead plating composition: j. External lead plating thickness (µinch):	Copper (lead wire) Confidential Confidential None N/A Copper (lead wire) None N/A Pure Sn Min. 8µm
21. Thermal Resistance: a. θ_{JA} °C/W (approx): b. θ_{JC} °C/W (approx): c. θ_{JA} junction-to-lead °C/W (approx): d. θ_{JA} junction-to-mounting base °C/W (approx):	75°C/W N/A 15.4°C/W N/A
22. Maximum Process Exposure Conditions: a. MSL @ rated SnPb temperature: b. MSL @ rated Pb-free temperature:	* Note: Temperatures are as measured on the center of the plastic package body top surface. N/A N/A
Attachments, Requirements: Die Photo <input checked="" type="checkbox"/> Package Outline Drawing <input type="checkbox"/> Die Cross-Section Photo/Drawing <input type="checkbox"/> Wire Bonding Diagram <input type="checkbox"/> Die Placement Diagram <input checked="" type="checkbox"/>	Requirements: 1. A separate Certification of Design, Construction & Qualification must be submitted for each part number, wafer fab, and assembly location. 2. Design, Construction & Qualification shall be signed by the responsible individual at the supplier who can verify the above information is accurate and complete. Type name and sign below.
Completed by: Fanny Fan Date: 10/18/2022	Certified by: Selina Yan Date: 10/18/2022
Typed or Printed: Fanny Fan Signature: Title: VGSC Product engineer	Typed or Printed: Selina Yan Signature: Title: Quality Manager



PRODUCT DESCRIPTION

Product : 1.5KE6.8A~220AHE3_B 1N6267A~1N6303AHE3_B 1.5KE6.8CA~220CAHE3_B	Package: 1.5KE	Issued by: Fanny Fan
Cust. P/N:	Technology : TVS	Date : 10/18/2022

Functional Description : [Transient Voltage Suppressors](#)

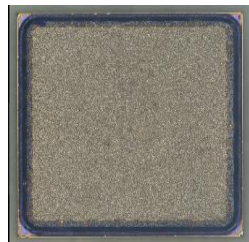
Fab factory Taiwan	Assembly factory China	Testing factory China	
--	--	---	--

Product:
Chip

Sub-assembly



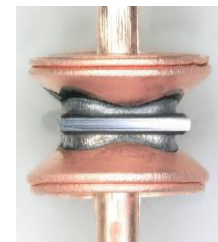
[1.5KE6.8A~220A](#)
[1N6267A~1N6303A](#)



[1.5KE6.8CA~220CA](#)



[1.5KE6.8A~220A](#)
[1N6267A~1N6303A](#)



[1.5KE6.8CA~220CA](#)

Finish Goods



[1.5KE6.8A~220A](#)
[1N6267A~1N6303A](#)



[1.5KE6.8CA~220CA](#)



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

2.
**Engineering Change
Document**



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

There have been no design changes on this part



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

3.
Customer Engineering
Approval



D

DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

Customer Engineering Approval is not applicable for this part



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

4. Design FMEA



Vishay General Semiconductor

Customer: _____

Part Number: _____ Part Name: 1.5KE

This letter is to confirm that Vishay General Semiconductor has not included a Design FMEA in the PPAP package for PN: 1.5KE based on the pre-existing design of this part.

The corresponding Vishay General Semiconductor part number is in a package. This product family was designed prior to Vishay General Semiconductors' QS-9000 certification in 1995.

If you have any further questions on this formation, please contact me at e-mail:
frank.meng@vishay.com

Sincerely,

A handwritten signature in blue ink, appearing to read "Frank Meng".

PPAP Coordinator
Vishay General Semiconductor



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

5. Process Flow Diagrams

**VISHAY GENERAL SEMICONDUCTOR TAIWAN LIMITED
PROCESS SPECIFICATION**

DEVICE WAFER FAB.	OPERATION MASTER SPEC. LIST	NO. MSL-050
		REVISION 10(03/28/22')
		SHEET 1 OF 2

PURPOSE:

This MSL is served as wafer process flow for uni-directional TSGPP products.

SCOPE:

STEP NUMBE RA	PROCESS STEP TITLE	PROCESS INSTRUCTION (PI) VARIANT			MAIN PI #
		TSGPP PG (30)	TSGPP 5KP (30/3L)	TSGPP SAC/LCE (37)	
10	LASER MARKING	x	x	x	PI-1050F
20	MEGASONIC CLEAN	x	x	x	PI-1020M
30	BOAT LOADING	x	x	x	PI-1030M
40	P/B PAPER BURN OFF	x	x	x	PI-2010M
50	P/B DEPOSITION	x	x	x	PI-2020M
70	SLICE SEPARATION	x	x	x	PI-1040M
80	WAFER CLEAN	x	x	x	PI-1010F
90	BOAT LOADING	x	x	x	PI-1030M
100	DRIVE IN	x	x	x	PI-2040M
110	HF SOAK	x	x	x	PI-1090M
120	SANDBLAST	x	x	x	PI-1060F
130	WAFER CLEAN	x	x	x	PI-1010F
140	OXIDATION	x	x	x	PI-2050M
150	HMDS PRIMING	x	x	x	PI-3010M
160	P.R. COATING	x	x	x	PI-3020M
170	SOFT BAKING	x	x	x	PI-3030M
180	EXPOSURE (GRID)	x	x	x	PI-3040M
190	DEVELOP	x	x	x	PI-3050M
200	HARD BAKING	x	x	x	PI-3030M
210	P.R. COATING	x	x	x	PI-3020M
220	HARD BAKING	x	x	x	PI-3030M
230	GRID ETCH	x	x	x	PI-1110M
240	JUNCTION POLISH	x	x	x	PI-1140M
250	P.R. STRIP	x	x	x	PI-1120M
260	OXIDE STRIP	x	x	x	PI-1130M
270	JUNCTION POLISH	x	x	x	PI-1140M
280	PRODUCT WAFER INSPECTION	x	x	x	PI-9010M
290	SC1/SC2 CLEAN	x	x	x	PI-1150M
300	SIPOS/MTO DEPOSITION	x*1	x*1		PI-2060M
310	POLY NITRIDE DEPOSITION			x	PI-2065M
320	PRODUCT WAFER INSPECTION	x*1	x*1	x	PI-9010M
330	LTO DEPOSITION				PI-2080M
340	DEHYDRATION BAKE	x			PI-3060M
350	P.G. COATING	x			PI-3065M
360	SOFT BAKING	x			PI-3030M

**VISHAY GENERAL SEMICONDUCTOR TAIWAN LIMITED
PROCESS SPECIFICATION**

DEVICE	OPERATION	NO. MSL-050
WAFER FAB.	MASTER SPEC. LIST	REVISION 10(03/28/22')
		SHEET 2 OF 2

370	EXPOSURE (P.G.)	x			PI-3040M
380	P.G. DEVELOP	x			PI-3070M
390	HARD BAKE	x			PI-3030M
400	P.G. BURN OFF & FIRING	x			PI-2100M
410	1ST GLASS APPLICATION		x	x	PI-3080M
420	BURN OFF & GLASS FIRING		x	x	PI-2100M
430	PRODUCT WAFER INSPECTION		x	x	PI-9010M
440	2ND GLASS APPLICATION		x	x	PI-3080M
450	BURN OFF & GLASS FIRING		x	x	PI-2100M
460	LTO DEPOSITION	x	x	x	PI-2080M
470	HMDS PRIMING	x	x	x	PI-3010M
480	P.R. COATING	x	x	x	PI-3020M
490	SOFT BAKING	x	x	x	PI-3030M
500	EXPOSURE (CONTACT)	x	x	x	PI-3040M
510	DEVELOP(BATHE)	x	x		PI-3050M
520	DEVELOP(SVG)			x	PI-3055M
530	HARD BAKING	x	x	x	PI-3030M
540	CONTACT ETCH	x	x	x	PI-1160M
550	PLASMA ETCH			x	PI-5010M
560	P.R. STRIP	x	x	x	PI-1120M
570	1ST NI PLATE	x	x	x	PI-1170M
580	1ST NICKEL SINTERING	x	x	x	PI-2120M
590	2ND NI PLATE	x	x	x	PI-1170M
600	2ND NICKEL SINTERING	x	x	x	PI-2120M
610	3RD NI PLATE	x	x	x	PI-1170M
620	GOLD PLATE	x	x	x	PI-1180M
630	PRODUCT WAFER INSPECTION	x	x	x	PI-9010M

Note:

1. "x*1" – for products with SIPOS/MTO
2. "x*2" – for products without SIPOS/MTO
3. Products with SIPOS/MTO are:
 - A. TSGPP (PG) VB ≥ 51V
 - B. 5KP8.5A ~ 9A, 16A ~ 30A, 60A ~ 188A, and part number with special house number except 5KP12A-37

Changeover Key
 P=Product
 T=Tooling
 S=Software
 D=Dunnage
 L=Label

Inspection Key
 A=Automatic
 M=Manual
 V=Visual
 Q=Quality Audit

For Process: 1.5KE Flow Chat
 For Sites: VGSC
 Prepared By: Vincen Wang

Doc. # FC-044 1.5KE
 Rev. # 3
 Rev. Date : 2022/10/12
 Vishay GS Part #
 Customer Part #

Op-Seq	Symbol Instructions						Changeover	Operation Description	Special Char. Class	Significant Product Characteristics (Outputs)	Special Char. Class	Significant Process Characteristics (Inputs)
	Fab/Assem	Move	Store/Get	Inspect	Rework	Scrap/Contain						
	◇	○	△	□	●	●						
								Lead Wire				
								Solder Wafer				
								Dice				
OP-020								Lead Polarizing				
OP-035								Soldering Jig Loading				
OP-040								Soldering				
OP-050								Trans Loading				
								Molding Compound				
OP-205								Transfer Molding				
OP-210								Wet Deflash				
OP-215								Post Molding Cure				
OP-335								Pure Tin Barrel Plating	DT	PB content in pure-tin plating layer		PB content in pure-tin plating bath
OP-350								Tin Stripping and Plating Rework	DD	Plating solderability Plating thickness Aging test		
OP-400								Lead Straightening				
OP-405								Mechanical Inspection				
OP-520								TMTT	DD	Elec: IR,VF,VZ,VC etc.		Tester accuracy
OP-550								V/M Inspection				
GSC-4676								Outgoing Quality Control Procedure				
OP-600								Packing				



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

6. Process FMEA



POTENTIAL FAILURE MODE AND EFFECTS ANALYSIS (PROCESS FMEA)

GS-7311 Attachment 1

FMEA Number: FMEA-042&044&046&047&049
Product: Axial
Project #: NA

Customer Part Number: NA
Date (Orig.):10/15/CY2020
Core Team: Hoson Li, Vincen Wang, Paul Zhou, Carl Guo, Cherry Gong

Prepared by: Vincen Wang
Date (Rev.): 07/08/22
FMEA Rev.: 56
ECN #: 22-7341

Table with columns: Process Step (O/PI/OP), Sub Process, Micro Operation, Function, Requirements, Potential Failure Mode, Potential Effect(s) of Failure, Severity Classification, Potential Cause(s)/Mechanism(s) of Failure, Current Process Prevention, Current Process Controls Detection, Occurrence, Detection, R, P, S, N, O, Recommended Action(s), Responsibility & Target Completion Date, Actions Taken Completion Date, Severity, Occurrence, Detection, R, P, S, N, O.



POTENTIAL FAILURE MODE AND EFFECTS ANALYSIS (PROCESS FMEA)

GS-7311 Attachment 1

FMEA Number: FMEA-042&044&046&047&049
Product: Axial
Project #: NA

Customer Part Number: NA
Date (Orig.):10/15/CY2020
Core Team: Hoson LI, Vincen Wang, Paul Zhou, Carl Guo, Cherry Gong

Prepared by: Vincen Wang
Date (Rev.): 07/08/22
FMEA Rev.: 56
ECN #:22-7341

Process Step (O/PI/OP#)	Sub Process	Micro Operation	Function	Requirements	Potential Failure Mode	Potential Effect(s) of Failure	Severity Classification	Potential Cause(s)/ Mechanism(s) of Failure	Current Process Prevention	Current Process Occurrence	Current Process Controls Detection	Detection	R. P. N.	S. + O.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results						
																	Actions Taken Completion Date	Severity	Occurrence	Detection	R. P. N.	S. + O.	
De-runner	De-runner	Punch the runner out	Molding compound in shelf life	No molding/PE/Void/Partial body/burr	Mech. Loss; Hermetic problem	5	Compound unfreeze out of life	Unfreeze 24hrs and use -up within 70hrs	2	Unfreeze 24hrs and use -up within 70hrs	4	40	10										
			Molding parameter is correct	Bend lead	Mech. Yield loss	3	Derunner time too long after opening the chase	Stop the other operation to derunner	3	100% visual check	5	45	9										
			Correct pressure	Bend lead	Mech. Yield loss	3	Derunner m/c pressure too high	None	3	Check the pressure per shift	6	54	9										
			Unloading	Cassette transfer m/c unloading	Cassette transfer m/c unloading	Correct direction	Bend lead	Mech. Yield loss	3	Unloading machine's loaction pin and stick's notch to wrong direction	Unloading machine's loaction pin and stick's notch to ensure right direction	3	1. Visual check 400EA per start; 100% visual check when unloading	4	36	9							
210	Cassette loading	Lay the cover on the cassette	Chases cleaning	Molding chase is normal	Copper brush wire short	Electrical fail	7	Copper brush wire remained in mold chase cavit	Only use copper brush for molding shift cleaning, not use for shot by shot clean	2		5	70	14									
			Fix devices position	Cassette and cover no damage	Flash on lead	Mech. Loss	3	Deformed cassette and cover	None	3	1. Check the cover per shift; 2. Randomly check and sort out when unloading	6	54	9									
Wet Deflash	Wet Deflash	Cassette transfer to wet deflash	Machine stability	Body damaged/lead damaged	Mech. Yield loss	5	Wet deflashing m/c jamming	100% scrap the devices in W/D machine when abnormal stopping happens, such as jamming.	4	Auto-alarm and stop	3	60	20										
			Correct concentrate	Body damaged/lead damaged	Mech. Yield loss	3	Too high glass slurry concentrate	None	2	Check the glass slurry per start and per 4hrs	6	36	6										
			Correct air pressure	Body damaged/lead damaged	Mech. Yield loss	3	Too high air pressure	None	2	Check the air pressure per shift start	6	36	6										
			Correct air pressure	Flash on lead	Mech. Loss	5	Too low air pressure	None	2	Check the air pressure per shift start	6	60	10										
			No Nozzle worn out	Flash on lead	Mech. Loss	5	Nozzle worn out	None	2	Check the nozzle per shift	6	60	10										
			Correct speed	Flash on lead	Mech. Loss	5	Too fast running speed	None	2	Check the belt speed per shift	6	60	10										
			No Nozzle block	Flash on lead	Mech. Loss	5	Nozzle block	None	2	Check the nozzle per shift	6	60	10										
210	Cassette unloading	Cassette unloading	Cassette unloading	No deformed cassette and cover	Flash on lead	Mech. Loss	5	Deformed cassette and cover	None	3	1. Check the cover per shift; 2. Randomly check and sort out when unloading	6	90	15									
212	Chemical Deflash	Chemical Deflash	Remove body deflashing	Correct temperature	Body discoloration	Mech. Yield loss	5	Solution temperature out of upper limit	None	2	1. Check the temperature per shift; 2. Randomly check the parts when unloading	6	60	10									
			Correct time	Body discoloration	Mech. Yield loss	5	Solution time out of upper limit	None	2	1. Check the time per shift; 2. Randomly check the parts when unloading	6	60	10										
			Correct temperature	Flash on lead	Mech. Yield loss	5	Solution temperature out of lower limit	None	2	1. Check the temperature per shift; 2. Randomly check the parts when unloading	6	60	10										
			Correct time	Flash on lead	Mech. Yield loss	5	Solution time out of lower limit	None	2	1. Check the time per shift; 2. Randomly check the parts when unloading	6	60	10										
215	Post Molding Cure	Post Molding Cure	Molding Cure	Correct temperature	Under cure	Hermetic failure	6	Too low cure temperature	None	2	1. Check the temperature and time setting per shift; 2. Measure the profile per 3months	6	72	12									
			Correct time	The cure time is not enough	None	2	1. Check the temperature and time setting per shift; 2. Measure the profile per 3months	6	72	12													
			Correct temperature	Over cure	Hermetic failure	3	Too high cure temperature	None	2	1. Check the temperature and time setting per shift; 2. Measure the profile per 3months	6	36	6										
			Correct time	The cure time is too long	None	2	1. Check the temperature and time setting per shift; 2. Measure the profile per 3months	6	36	6													
400 Lead Straightening (Only for MPG06,PAKE,P6KE,1.5KE product)	Manually straighten out leads	Manually straighten out leads	Manual straightening devices of lead bend	Meet lead form spec	Lead defect/ Kink/Twist/ damaged/body damaged)	Mech. Yield loss	3	Incoming parts bend	None	3	Manually pre-straighten, scrap the defect part	7	63	9									
	Lead Straightening	Lead Straightening	Auto straightening devices of lead bend	Meet lead form spec	Lead defect/ Kink/Twist/ damaged/body damaged)	Mech. Yield loss	3	Straighten wheel / Sintrol bow dirty	Clean it per 2hrs	3	None	7	63	9									
405 Mechanical Inspection	Mechanical Inspection	Mechanical Inspection	Inspection defect device	Correct inspect defect device	Mix type	Yield loss	4	The operator don't clean up the parts 100% before next lot	Only a lot is permitted to check at 56 the same worktable.	2	None	7	56	8									
520	Parts loading	Vibration bowl	Device transfer to parts feeder	Correct position	Lead bend	Auto insertion problem	7	Bending of leads not fully straightened	Devices need to do lead straight before TMTT_Follow OP-405	2	1.M/C auto alarm 2.100% F/V	4	56	14									
		Parts feeder	Device transfer to orientation rotation	Correct position	Lead bend	Auto insertion problem	7	Bending of leads not fully straightened	Devices need to do lead straight before TMTT_Follow OP-405	2	1.M/C auto alarm 2.100% F/V	4	56	14									
		Orientation rotation	Polarity adjust	Polarity consistent	Reverse polarity	Customer assembly etc. Failure	8	TMTT polarity detector out of function	None	2	Check it per day with golden samples	2	32	16									
520	Straightening 1	Straightening 1	Straightening devices of lead bend	Meet lead form spec	Lead bend	Auto insertion problem	7	Lead lead straighten roller foreign matter	Clean the lead straighten roller every 2 hour	2	1.M/C auto alarm 2.100% F/V	4	56	14									
								7	Binning accuracy not achieved	Binning accuracy check	2	1.100% TMTT sorting; 2.Sampling check	4	56	14								



POTENTIAL FAILURE MODE AND EFFECTS ANALYSIS (PROCESS FMEA)

GS-7311 Attachment 1

FMEA Number: FMEA-042&044&046&047&049
Product: Axial
Project #: NA

Customer Part Number: NA
Date (Orig.):10/15/CY2020
Core Team: Hoson Li, Vincen Wang, Paul Zhou, Carl Guo, Cherry Gong

Prepared by: Vincen Wang
Date (Rev.): 07/08/22
FMEA Rev.: 56
ECN #: 22-7341

Table with columns: Process Step (O/P/OP), Sub Process, Micro Operation, Function, Requirements, Potential Failure Mode, Potential Effect(s) of Failure, Severity Classification, Potential Cause(s)/Mechanism(s) of Failure, Current Process Prevention, Current Process Controls Detection, Deviation, R, S, P, N, O, Recommended Action(s), Responsibility & Target Completion Date, Actions Taken Completion Date, Severity, Occurrence, Detection, R, S, P, N, O.



POTENTIAL FAILURE MODE AND EFFECTS ANALYSIS (PROCESS FMEA)

GS-7311 Attachment 1

FMEA Number: FMEA-042&044&046&047&049
 Product: Axial
 Project #: NA

Customer Part Number: NA
 Date (Orig.):10/15/CY2020
 Core Team: Hoson LI, Vincen Wang, Paul Zhou, Carl Guo, Cherry Gong

Prepared by: Vincen Wang
 Date (Rev.): 07/08/22
 FMEA Rev.: 56
 ECN #:22-7341

Process Step (O/P/OP#)	Sub Process	Micro Operation	Function	Requirements	Potential Failure Mode	Potential Effect(s) of Failure	Severity Classification	Potential Cause(s)/ Mechanism(s) of Failure	Current Process				R. P. N.	S. + O.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results										
									Current Process Controls Prevention	Occurrence	Current Process Controls Detection	Detection					Actions Taken Completion Date	Severity	Occurrence	R. P. N.	S. + O.						
Testing 5				devices		Failure	7	Test speed is too high	Only authorized people can adjust it	2	1.Check the testing speed display per shift; 2. M/C auto alarm	2	28	14													
								Wrong testing program	Scan bar code of RC65 sheet and auto load test program to prevent human error.	2	Sampling check	4	56	14													
								Binning accuracy not achieved	Binning accuracy check	2	1.100% TMTT sorting; 2.Sampling check	4	56	14													
								Testing accuracy not achieved	Tester Calibration Periodly	2	1.100% TMTT sorting; 2.Sampling check	4	56	14													
								Test speed is too high	Only authorized people can adjust it	2	1.Check the testing speed display per shift; 2. M/C auto alarm	2	28	14													
	Blowing 1	Collect rejected devices			Meet electrical specifications Correct detect electrical failure devices	Elec. Failure (VF/RI/IR/TRR/VC)	Customer assembly elec. Failure	7	Wrong reject bin	Binning accuracy check	2	1.Sampling check 2. Checklist	4	56	14												
									Wrong testing program	Scan bar code of RC65 sheet and auto load test program to prevent human error.	2	Sampling check	4	56	14												
									Binning accuracy not achieved	Binning accuracy check	2	1.100% TMTT sorting; 2.Sampling check	4	56	14												
									Testing accuracy not achieved	Tester Calibration Periodly	2	1.100% TMTT sorting; 2.Sampling check	4	56	14												
									Test speed is too high	Only authorized people can adjust it	2	1.Check the testing speed display per shift; 2. M/C auto alarm	2	28	14												
Blowing 2	Collect rejected devices			Meet electrical specifications Correct detect electrical failure devices	NA	NA	7	Wrong reject bin	Binning accuracy check	2	1.Sampling check 2. Checklist	4	56	14													
								Wrong testing program	Scan bar code of RC65 sheet and auto load test program to prevent human error.	2	Sampling check	4	56	14													
Marking	UV marking	UV marking in devices	UV marking in devices	Complete marking	Marking defect (Partial marking)	Difficult identification the P/N of parts	7	Marking stamp and marking roller is dirty	Routine clean it per running to a reel normal cycle parts and clean when empty running 20pcs	2	Check the marking per 2hrs; 100% FV	4	56	14													
								New/dold marking stamp is mixed to use	Marking stamp use/scrap Qty. is recorded	2	Check 100pcs parts marking per 2hrs; 100% FV	4	56	14													
								Ink tank and roller at marking section are dirty	Clean it per 6 days	2	Check 100pcs parts marking per 2hrs; 100% FV	4	56	14													
								Marking stamp worn out	The parts qty. applied the same marking stamp is recorded	2	Check 100pcs parts marking per 2hrs; 100% FV	4	56	14													
								Marking time sequence unmatched	None	2	Check the marking per 2hrs; 100% FV	4	56	14													
	UV curing	UV marking curing	UV marking curing	Correct temp	Poor marking permanency	No marking or illegible marking	7	UV lamp reflector worn out, fall off or dirty	Clean it up per 3days	2	1.Check the UV lamp shine per shift 2.Marking permanency test by machine (day shift/per 3 days)	4	56	14													
								Too long UV lamp life	8000hrs life is specified	2	1.Check the testing speed display per shift; 2. M/C auto alarm 3.2.Marking permanency test by machine (day shift/per 3 days)	2	28	14													
								the stored temp. of UV ink is out of control	Keeping in the refrigeratory	2	1.Check 100pcs parts marking per 2hrs; 2.100% FV; 3.Marking permanency test by machine (day shift/per 3 days)	4	56	14													
								Bend lead	Auto-alarm	2	100% VM	4	56	14													
								Residual tin attach on the marking-stamp roller	Remove all tin residue before TMTT	2	100% VM	4	56	14													
Durm3 testing	Testing 1	Electrical test		Meet electrical specifications Correct detect electrical failure devices	Elec. Failure (VF/RI/IR/TRR/VC)	Customer assembly elec. Failure	7	Binning accuracy not achieved	Binning accuracy check	2	1.100% TMTT sorting; 2.Sampling check	4	56	14													
								Testing accuracy not achieved	Tester Calibration Periodly	2	1.100% TMTT sorting; 2.Sampling check	4	56	14													
								Test speed is too high	Only authorized people can adjust it	2	1.Check the testing speed display per shift; 2. M/C auto alarm	2	28	14													
								Wrong testing program	Scan bar code of RC65 sheet and auto load test program to prevent human error.	2	Sampling check	4	56	14													
								Binning accuracy not achieved	Binning accuracy check	2	1.100% TMTT sorting; 2.Sampling check	4	56	14													
	Testing 2	Electrical test			Meet electrical specifications Correct detect electrical failure devices	Elec. Failure (VF/RI/IR/TRR/VC)	Customer assembly elec. Failure	7	Testing accuracy not achieved	Tester Calibration Periodly	2	1.100% TMTT sorting; 2.Sampling check	4	56	14												
									Test speed is too high	Only authorized people can adjust it	2	1.Check the testing speed display per shift; 2. M/C auto alarm	2	28	14												
									Wrong testing program	Scan bar code of RC65 sheet and auto load test program to prevent human error.	2	Sampling check	4	56	14												
									Binning accuracy not achieved	Binning accuracy check	2	1.100% TMTT sorting; 2.Sampling check	4	56	14												
									Testing accuracy not achieved	Tester Calibration Periodly	2	1.100% TMTT sorting; 2.Sampling check	4	56	14												
	Testing 3	Electrical test			Meet electrical specifications Correct detect electrical failure devices	Elec. Failure (VF/RI/IR/TRR/VC)	Customer assembly elec. Failure	7	Testing accuracy not achieved	Tester Calibration Periodly	2	1.100% TMTT sorting; 2.Sampling check	4	56	14												
									Test speed is too high	Only authorized people can adjust it	2	1.Check the testing speed display per shift; 2. M/C auto alarm	2	28	14												
									Wrong testing program	Scan bar code of RC65 sheet and auto load test program to prevent human error.	2	Sampling check	4	56	14												
									Binning accuracy not achieved	Binning accuracy check	2	1.100% TMTT sorting; 2.Sampling check	4	56	14												
									Testing accuracy not achieved	Tester Calibration Periodly	2	1.100% TMTT sorting; 2.Sampling check	4	56	14												



POTENTIAL FAILURE MODE AND EFFECTS ANALYSIS (PROCESS FMEA)

GS-7311 Attachment 1

FMEA Number: FMEA-042&044&046&047&049
Product: Axial
Project #: NA

Customer Part Number: NA
Date (Orig.):10/15/CY2020
Core Team: Hoson LI, Vincen Wang, Paul Zhou, Carl Guo, Cherry Gong

Prepared by: Vincen Wang
Date (Rev.): 07/08/22
FMEA Rev.: 56
ECN #:22-7341

Table with columns: Process Step (O/PI/OP), Sub Process, Micro Operation, Function, Requirements, Potential Failure Mode, Potential Effect(s) of Failure, Severity Classification, Potential Cause(s)/Mechanism(s) of Failure, Current Process Prevention, Current Process Controls Detection, Deviation, R, S, P, N, O, Recommended Action(s), Responsibility & Target Completion Date, Actions Taken Completion Date, Severity, Occurrence, Date, R, S, P, N, O.

Axial Includes: MP06/P4KE/P6KE/1.5KE/SKP/6KA.

* means alternative solution
means error proofing in prevention



Vishay General Semiconductor

POTENTIAL FAILURE MODE AND EFFECTS ANALYSIS (PROCESS FMEA)

Prepared by: Mike Liu

Date (Rev.): 2022/8/29

FMEA Rev.: 4

FMEA Number: FMEA-123 Plating

Customer Part Number:

Product: All package

Date (Orig.): 10/15/02

Project # :

Core Team: Letty Zhang, Jessie Li, George Yu, Berry Li, Wanfu Tian, Owen Liu, Mike Liu, William Wang

ECN # : 22-2139

Process Step (OI/PI/OP#)	Sub Process	Micro Operation	Function	Requirements	Potential Failure Mode	Potential Effect(s) of Failure	Severity Classification	Potential Cause(s)/ Mechanism(s) of Failure	Current Process				R. P. N.	S * O	Recommended Action(s)	Responsibility & Target Completion Date	Action Results													
									Current Process Controls Prevention	Occurrence	Current Process Controls Detection	Detection					Actions Taken Completion Date	Severity	Occurrence	Detection	R. P. N.	S * O								
TOP-336 Auto barrel plating	Set up	Adjust liquid	For liquid to correct position	Ensure liquid height correct	Poor solderability	De-wetting	8	Incorret liquid height	Error proofing, auto alarm by machine	1	Solder-ability test by shift	6	48	8																
		Adjust liquid	For liquid to correct	Ensure liquid height correct	Discoloration	Cosmetic failure	5	Incorret liquid height	Error proofing, auto alarm by machine	1	Check list and 100% auto-vision	4	20	5																
		Fine-tune concentration	Concentration meet production condition	Ensure concentration in spec	Plating thickness out of spec	Non-wetting	8	D D	Low plating chemical content	Daily lab analysis	2	X-ray test and auto dosing	5	80	16															
		Confirm temperature	Temperature meet production condition	Temperature confirm	Cu exposure	Cosmetic failure	5		Degreaser temperature below spec	Error proofing, auto alarm by machine	1	Check list and 100% auto-vision	4	20	5															
		Confirm temperature	Temperature meet production condition	Temperature confirm	Discoloration	Cosmetic failure	5		Post treatment temperature below spec	Error proofing, auto alarm by machine	1	Check list and 100% auto-vision	4	20	5															
		Confirm temperature	Temperature meet production condition	Temperature confirm	Plating thickness out of spec	Non-wetting	8	D D	Plating temperature below spec	Error proofing, auto alarm by machine	1	X-ray test per lot	5	40	8															
		Check water rinse flowmeter	Water rinse flowmeter meet spec	Ensure water rinse flowmeter in spec	Discoloration	Cosmetic failure	5		Rinse folowmeter below spec	PM and routine check	2	Check list and 100% auto-vision	4	40	10															
	Set up recipe download	Ensure correct recipe loaded	Correct program setting	Plating thickness out of spec	Non-wetting	8	D D	Use wrong recipe	Load recipe	2	X-ray test per lot	5	80	16																
	Loading	Devices put into barrel	Loading all product in barrel	Ensure device don't fall off	Mix type	Customer application	8	D D	Device fall off out of barrel	Operator pick up the drop material	2	Operator confirm	6	96	16															
	Degreaser	Alkaline degreaser	Remove residual resin & activate Cu lead	Solution nomally	Cu exposure	Cosmetic failure	5		Low degreaser chemical PH	Daily lab analysis	2	Check list and 100% auto-vision	4	40	10															
	Activation	Activate Cu lead	Remove oxide from Cu surface	Solution nomally	Poor solderability	De-wetting	8	D D	Low chemical solution content	Daily lab analysis	2	a. Solution content auto alarm b. Solder-ability test by shift	5	80	16															
	Plating	Sn plating	Sn plating in Cu surface	Ensure current in spec	Thickness out of spec	Non-wetting	8	D D	Current lower than spec	Error proofing, auto alarm by machine	1	X-ray test per program change	5	40	8															
		Sn plating	Sn plating in Cu surface	Ensure Pb content below spec	Pb content out of spec	High Pb content over spec	9	D T	Tin ball Pb content out of spec	No Pb plating and anode solder ball	2	AAS and analysis report	2	36	18															
		Sn plating	Sn plating in Cu surface	Ensure additive concentration in spec	Poor solderability	Non-wetting	8	D D	Additive higher than spec	Auto dosing and routine analysis	2	CVS and analysis report	5	80	16															
		Sn plating	Sn plating in Cu surface	Ensure additive concentration in spec	Plating thickness out of spec	Non-wetting	8	D D	Additive lower than spec	Auto dosing and routine analysis	2	CVS and analysis report	5	80	16															
	Water rinse	Clean by tank water	Remove plating chemical	Ensure flowmeter in spec	Tin-dregs	Cosmetic failure	5		Plating temeperature over	Error proofing, auto alarm by machine	1	Operator check and check list	6	30	5															
	Neutralization	Neutralization acid	Neutralize plating acid on frame & body	Ensure PH in spec	Lead contamination	Non-wetting	8	D D	Rinse folowmeter below spec	PM and routine check	2	Solder-ability test by shift	6	96	16															
		Neutralization acid	Neutralize plating acid on frame & body	Ensure PH in spec	Discoloration	Cosmetic failure	5		Lower PH	Daily replace and lab analysis	2	Check list and 100% auto-vision	4	40	10															
	Hot DI water rinse	Clean by tank hot water	Remove chemical and impurity	Ensure water rinse normally	Lead contamination	Non-wetting	8	D D	Lower PH	Daily replace and lab analysis	2	a. Solution content auto alarm b. Solder-ability test by shift	5	80	16															
		Clean by tank hot water	Remove chemical and impurity	Ensure flowmeter in spec	Discoloration	Cosmetic failure	5		Lack of hot DI water	Daily replace and lab analysis	2	Solder-ability test by shift	6	96	16															
	Drying	Hot spin drying	Remove water	Ensure temperature in spec	Discoloration	Cosmetic failure	5		Rinse folowmeter below spec	PM and routine check	2	Check list	6	60	10															
		Hot spin drying	Remove water	Ensure temperature in spec	Discoloration	Cosmetic failure	5		Temperature below spec	Error proofing, auto alarm by machine	1	Operator check and check list	6	30	5															
	Annealing	Annealing	Reduce Cu and tin layer stress	Ensure time and temperaure	Tin whisker	Customer application	8	D D	Time below spec	Error proofing, auto alarm by machine	1	Operator check and check list	6	30	5															
									Wrong time and N2 flowmeter	Error proofing, auto alarm by machine	1	Start check and check list	6	48	8															



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

7. Control Plan



控制计划

控制计划编号: CP-042&044&046&047&049 Axial		主要联系人: 电话: (0086)-22-25291088		日期(编制): 10/23/89		日期(修订): 07/06/22		版本号: 56						
产品编号/最新版本号: 参考工程标准/内部测试标准/图纸		核心小组: Hoson Li, Vincen Wang, Paul Zhou, Carl Guo, Cherry Gong		客户工程批准/日期(如需要): N/A										
产品料号/描述: Axial 产品		过程名称: 轴向产品		特殊特性符号: "DD" 与安全或法律法规无关; "DT" 与安全或法律法规相关		客户质量批准/日期(如需要): N/A								
供方/工厂: VGSC		供方代号: 无		ECN批准号: 22-7341										
工艺序号	工艺名称及描述	生产用机器, 设备, 材料及工具, 夹具	责任	特性			方法				反应计划			
				产品特性	工艺特性	特殊特性分类	产品/工艺规格	检查方法	抽样	控制方法				
								抽样数	抽样频率					
020 & 035	焊接件的装填	对于Axial所有产品晶粒/导线/焊片/铜粒/镍粒	P	晶粒/导线/焊片/铜粒/镍粒/外观			失效比例小于<=1%	目检	1个焊接舟	每批	检查表 SOP-Axial#003 Soldering checklist-01/02/03/04	材料隔离, 同时通知PE.		
			P		装填的数量检查			装填失效比例< 0.5%	目检	1个焊接舟	每种产品开始/每4hrs/每更换焊盘	检查表 SOP-Axial#003 Soldering checklist-10	停止使用通知EE/PE 检查	
				自动绕盘机 SL04		装填机器气体压力设定 真空压力: -0.09±0.01Mpa			压缩空气压力: 0.5±0.1Mpa 真空压力: -0.09±0.01Mpa	目检	1个焊接舟	每种产品开始/每4hrs/每更换焊盘	检查表 SOP-Axial#003 Soldering checklist-11	停止使用通知EE/PE 检查
			P	自动导线装填机 LL17, LL18, LL21, LL24		装填的外观检查			装填失效比例<=0.5%	目检	2个焊接舟	每4小时	检查表 SOP-Axial#003 Soldering checklist-10	失效比例大于0.5%, 需要停机, 调整引线装填机
			P			焊接舟破损检查			孔位破损<1%, 堵孔<0.75%	目检, 针规	所有焊接舟	每月	检查表 SOP-Axial#003 Soldering checklist-05/06/07/08/09	更换新的焊接舟
P			对于Axial所有产品的装填盘			装填盘破损检查	孔位破损< 0.5%	目检	所有装填盘	每月	检查表 SOP-Axial#003 Soldering checklist-05/06/07/08/09	更换新的装填盘		
040 & 050	焊接 & 焊棒后卸料	焊接炉 FS29, FS36	P	焊接炉条件检查 A) 炉温&气体流量/压力/冷却水流量			参照文件OP-040	目检温度计和流量计	-	每2小时	检查表 SOP-Axial#003 Soldering checklist-12	停止入炉通知EE/PE 检查.		
			P		B) 焊条速度			参照文件OP-040	秒表/尺子	-	每2小时	检查表 SOP-Axial#003 Soldering checklist-12		
			P		C) 炉温曲线			参照文件OP-040	温度记录仪/热电偶	-	每周	检查表 SOP-Axial#003 Soldering checklist-12	重新测量炉温曲线, 如果仍超出标准, 通知工程师调整	
			P		空焊接舟装载检查			参照文件OP-040	系统自动检测和报警	100%	在线实时监控	记录	纠正错误操作/隔离相关材料	
			IPOC		拉力测试			拉力失效率<=1/20	1磅/2磅/3磅/5磅重锤	20EA	每种产品, 每班开始和每4hrs	NP 图检查表 SOP-Axial#003 Soldering checklist-14/15/16/17	>1/20-通知工程师采取行动 >3/20-停机	
			IPOC		外观检查			锡渣 <=1% 锡渣<=0.25% 溢流=0%	20倍显微镜检查	10个铁片	每班每4hrs (对于双向的晶粒, 每2小时一次, 若有双向叠焊产品)	检查表 SOP-Axial#003 Soldering checklist-13	1. 锡渣 >1% & <5% 锡渣 >0.25% & <5% 溢流 >0% & <5% ** 遵循EER 规则 ** 通知工程师和主管 ** 100% 显微镜检查 2. 锡球 / 锡渣/溢流>=5% ** 此批次隔离并保留晶粒/焊片和导线 ** 遵循EER 规则	
IPOC		焊接失败率			焊接失败率<1%	外观目检	5个焊接舟	每种产品每次开始生产和结束生产时	P 图检查表 SOP-Axial#003 Soldering checklist-1R	>=1%-通知主管或工程师				
205	塑封成型	塑封机 PR-3203, PR-1114, MP03	P				参照文件OP-205	糊温计	每条模子一点	每班开班一次	检查表 SOP-Axial#003 Molding checklist-02	>5%-停机 通知主管或工程师		
			P		机器设定条件			参照文件OP-205	目检	-	每班开班一次	检查表 SOP-Axial#003 Molding checklist-01	通知主管或工程师	
			P		糊温损坏/破损状况			参照文件OP-205	目检	一糊	每班开班一次	检查表 SOP-Axial#003 Molding checklist-04/05	1. 停止生产 2. 通知工程师	
			IPOC		外观检查(未注满, 气孔, 导线损伤, 导线弯曲, 导线沾胶)			外观不良数量< 4EA	目检	一糊	每班每种产品开始生产时一次	C 图 SOP-Axial#003 Molding checklist-06	1. 停止生产;	
210	水吹砂	吹砂机 DF03, DF08, DF12	P				150~190cc/1000cc	使用浓度计检查	-	开班和每4小时	检查表 SOP-Axial#003 Wet Deflash-02	超出规格, 需要停机, 调整		
			P		机器设定条件检查 (如: 吹砂压力)			OP-210	目检	-	每班开班一次	检查表 SOP-Axial#003 Wet Deflash-01	超出规格, 需要停机, 调整	
			IPOC		去残胶失败率			去残胶失败率≅1%	目检	10个铁片	每班每种产品开始生产时和每4小时	NP chart SOP-Axial#003 Wet Deflash-06	超出规格, 需要停机, 调整	
			P		卡夹盖损坏			SOP (AXI-05-WD)	目检	100%	每班开班一次	检查表 SOP-Axial#003 Wet Deflash-03	翻修或报废	
212	化学煮洗胶皮	化学煮洗胶皮设备 (对于MPG06产品) DF44	P		机器设定条件检查(如 药液温度)			参照文件OP-212	目检	-	每班开班一次	检查表 SOP-Axial#003 Wet Deflash-04	通知主管或工程师	
215	塑封后固化	烤箱	P		烤箱温度/时间设定			参照文件OP-215	目视	-	每班每种产品开始生产时一次	检查表 SOP-Axial#003 Wet Deflash-05	通知主管或工程师	



控制计划

控制计划编号: CP-042&044&046&047&049 Axial		主要联系人/电话: (0086)-22-25291088		日期(编制): 10/23/89		日期(修订): 07/06/22		版本号: 56					
产品编号/最新版本号: 参考工程标准/内部测试标准/图纸		核心小组: Hoson Li,Vincen Wang,Paul Zhou, Carl Guo,Cherry Gong		客户工程批准/日期(如需要): N/A									
产品料号/描述: Axial 产品		过程名称: 轴向产品		特殊特性符号: "DD" 与安全或法律法规无关; "DT" 与安全或法律法规相关		客户质量批准/日期(如需要): N/A		ECN批准号: 22-7341					
供方工厂: VGSC		供方代号: 无											
工艺序号	工艺名称及描述	生产用机器, 设备, 材料及工具, 夹具	责任	特性			方法		控制方法	反应计划			
				产品特性	工艺特性	特殊特性分类	产品/工艺规格	检查方法			抽样		
400	导线引直	OV52.OV35.OV36.OV22.OV40 引直机 LS18.LS19.LS05.LS01.LS28.LS15.LS22 (对于MPG06/P4KE/P6KE/1.5KE产品)	P	外观检查 -导线弯曲 -导线扭曲 -导线断裂 -导线短路	温度曲线		不良比例小于<1%	目视检查	400EA	每3个月检查一次	温度曲线检查表	通知主管或工程师	
405	外观检查	TW 自动测试机	P	*测试准确性			达到标准件精度要求	标准件样品	每台测试机	每天一次	检查表 Axial#003 TMTT-01	SOP- Axial#003 Lead Straightrning-01	停机.通知主管/EE/PE 检查
520	TMTT自动测试系统	TT12,TT13,TT14,TT33,TT34,TT41,TT48,TT49	P	*分BIN准确性			所有的排料准确性测试样品材料都能被打下来同时和计数器上的数字一致	IR/VF/TRR/VRC/DVF各5个	每台测试机	每天一次	检查表 Axial#003 TMTT-03/05/07/09/11	SOP- Axial#003 TMTT-01	停机通知主管或EE工程师检查
			P	测试速度			参照文件OP-520	链速表测速器显示	每台机器	每班开始生产时和更换产品类	检查表 Axial#003 TMTT-01	SOP- Axial#003 TMTT-01	请EE调节设定
			P	程序设定			RC65 单	双重确认	每张RC65 单	RC65 单上签字			纠正设定并通知 F / M 或 P
			P	印字不清, 无印字, 无阴拔环			GSC-4775/GSC-4785	外观目检	100EA	每2 小时	检查表 Axial#003 TMTT-12	SOP- Axial#003 TMTT-12	1. 100%挑出 2. 停机并通知 E E 调整
			IPQC	印字永久性			0/22	印字永久性测试	22EA	每班开班第一天	检查表 Axial#003 TMTT-13	SOP- Axial#003 TMTT-13	隔离成品, 通知EE/PE 检查
			IPQC	成品在胶带上的尺寸位置 (A&B尺寸公差)			参照文件OP-550	投影仪检查	10ea	每班开班或调整机器	检查表 Axial#003 TMTT-15	SOP- Axial#003 TMTT-15	停机通知主管或EE工程师检查
			P		所有的上卷处 / 胶带处问题		GSC-4775/GSC-4785	目检	100EA	2 小时	检查表 Axial#003 TMTT-12	SOP- Axial#003 TMTT-12	停机通知主管或EE工程师检查
			P	100% 标签 / 包装检查			按RC65单	双重确认和扫描	100%	每卷 / 盒	在卷 / 盒上签字和检查表		停止生产, 并进入DMD A
			P	外观缺陷 (如印字不良, 破损等)			GSC-4775/GSC-4785	目检	RC65 单	100%	记录本		>0.5 %;For DO210AD/P600,>2% 通知工程师 / 主管, 如重要缺陷通知EE
			IPQC	尺寸不良 (仅针对 53 包装方式)	无		GS-4775 (D1-D2<=0.8mm)	投影仪或游标卡尺	每次连续20ea	每班开班或调整机器	检查表 SOP-Axial#003 TMTT-17		如果最大值超过0.8mm, 通知PE/EE/MFG, 并且隔离此卷
			P	补料	混料		专人核对补料及报废数量	目视	每张RC65单	100%	记录本/记录表		>=1EA 差异立即隔离材料通知EE
550	目检和磁带盒包装	磁带盒标签	P	标签错误			SOP# PKG01	目检	每盒	100%	在卷 / 盒上签字		100% 检验
			P	上卷错误			GSC-4775/GSC-4785	目检	每盒	100%	在卷 / 盒上签字		通知主管/工程师
560	PANASERT/ AVISERT 成型/包装 (EURO-FORM RAIAI)	弯腿成型机 LF23 (对于MPG06产品)	P		测试准确性		提供的校准值	标准件	IR 测试机	每班开班一次	检查表 Axial#003 TMTT-15	SOP- Axial#003 TMTT-15	停机通知EE工程师检查
			P	弯腿尺寸超出标准			参照文件OP-560	投影仪	3EA	开始 & 每4小时	检查表 SOP-Axial#003 TMTT-14		停机通知EE 工程师进行调整
			P	外观缺陷 (如变形, 破损等)			SOP(AXI-10-FM);	目检机器识别	100%	每RC65 单	检查表 SOP-Axial#003 TMTT-16		停机通知主管 / EE工程师检查
			P	100% 标签 / 包装检查			SOP(AXI-10-FM: PKG01)	双重确认和扫描	100%	每卷 / 盒	检查后在卷 / 盒上签字		停止生产, 并进入DMD A
			P	排料功能			所有的不良都能被检测到	测试程序 & 变形材料	3EA/3EA	每班开班一次	检查表 Axial#003 TMTT-15	SOP- Axial#003 TMTT-15	停止生产, 并通知EE工程师检查

P* - 指生产线

Axial includes: MPG06/P4KE/P6KE/1.5KE/5KP/6KA.

备注: 针对设备异常断电导致的停机, 在恢复生产时, 控制方法不变 (CP定义), 增加确认一次.

☆代表替代方案

★代表防错

Control Plan Number: CP-123-Plating		Key Contact / Phone:		Date (Orig.): 10/15/02	Date (Rev.): 08/29/22	Rev. No.: 4							
Part Number/Latest Change Level:		Core Team: Letty Zhang, Jessie Li, George Yu, Barry Li, Wanfu Tian, Owen Liu, Mike Liu, William Wang		Customer Engineering Approval / Date (if Req'd):									
Part Name: All package		Special Characteristic Symbols: "DD" for not relating safety or legal ; "DT" for safety or legal consideration		Customer Quality Approval / Date (if Req'd):									
Supplier/Plant:		ECN approval number: 22-2139											
Process Number	Process Name / Operation Description	Machine, Device, Jig, Tools For Mfg.	Responsibility	Characteristics			Methods			Reaction Plan			
				Product	Process	Special Char. Class	Product/Process Specification / Tolerance	Evaluation Measurement Technique	Size		Sample Freq.	Control Method	
336	PURE IN PLATING	YIDU	P	TANK# 2#, 5#, 8#, 12#, 16#, 22#-30# PLATING TANK TEMP.		TOP-336 (C) TANK#2 = 55-65 TANK#5 = 25-35 TANK#8 = 25-35 TANK#12 = 55-65	CHECK M/C DISPLAY	-	ONCE PER 4 HOURS	CHECK LIST TSOP-B5005(PL11)-01	INFORM EE AND PE FOR ACTION		
			P	NO.8 ACTIVATION BATH STATUS		TOP-336	VISUAL INSPECTION		ONCE PER 4 HOURS	CHECK LIST TSOP-B5005(PL11)-01	INFORM EE AND PE FOR ACTION		
			P	LIQUID LEVEL HEIGHT		MACHINE DISPLAY	CHECK M/C	-	ONCE PER 4 HOURS	CHECK LIST TSOP-B5005(PL11)-02	INFORM EE AND PE FOR ACTION		
			P	THE CURRENT OF TANK#22-30		TOP-336&TSOP-B5005	CHECK M/C DISPLAY	-	ONCE PER 4 HOURS	CHECK LIST TSOP-B5005(PL11)-02	INFORM EE AND PE FOR ACTION		
			PE*	No. 22-30 PLATING BATH INGREDIENT		MSA CON =160-240 ML/L Sn+2 CON =15-30 G/L PE SOP-0027	CHEM. LAB ANALYSIS		EVERY DAY	PL11 BARREL PLATING ANALYSIS REPORT	INFORM EE AND PE FOR ACTION		
				NO.2812 TANK PH		PH=9	CHEM. LAB ANALYSIS				INFORM EE AND PE FOR ACTION		
				NO.5 & NO.8 ACTIVATION CONTENT		Concentration: 8# Cu ACTIVATION 6-18% 8# Ni ACTIVATION 25-40%	CHEM. LAB ANALYSIS		EVERY DAY		INFORM EE AND PE FOR ACTION		
				AUTO BARREL	P	BARREL CONDITION		REFER TOP-336 TSOP-B5005(PL11)	VISUAL INSPECTION		EVERY SHIFT	CHECK LIST TSOP-B5005(PL11)-04&15	INFORM EE AND PE FOR ACTION
						BARREL ROTATION STATION		REFER TOP-336 TSOP-B5005(PL11)	AUTO ALARM		EVERY MACHINE PM	PM CHECK LIST EE-SMX-PM1-503	INFORM EE AND PE FOR ACTION
				AUTO	P	BARREL PLATING LINE RELATED EQUIPMENT STATION CHECK		REFER TOP-336 TSOP-B5005(PL11)	VISUAL INSPECTION		EVERY SHIFT	CHECK LIST TSOP-B5005(PL11)-05	INFORM EE AND PE FOR ACTION
					BARREL ROTATION SPEED		REFER TOP-336 TSOP-B5005(PL11)	VISUAL INSPECTION		EVERY SHIFT	CHECK LIST TSOP-B5005(PL11)-05	INFORM EE AND PE FOR ACTION	
			PL11	P	2#, 5#, 8#, 12#, 16#, 21#, 22#-30# FLOW METER		TOP-336&TSOP-B5005	CHECK FLOWMETER DISPLAY	-	ONCE PER 4 HOURS	CHECK LIST TSOP-B5005(PL11)-01,02	INFORM EE AND PE FOR ACTION	
				P	PLATING THICKNESS	DD	320 UNINCH ~1000 UNINCH	X-RAY	10EA	ONCE PER BARREL	X BAR S CHART	1. STOP MACHINE 2. NOTIFY MGF/EE/PE 3. REFER TO OCAP-Plating-002	
				PE*	PB CONTENT IN PLATING SOLUTION	DT	<50PPM	AA ANALYSIS	PER TANK	ONCE PER MONTH	Pb & Cu CONTENT AA ANALYSIS REPORT	QUARANTINE PROBLEM MATERIAL, ISSUE MRB1, INFORM PE AND EE ENGINEER FOR ACTION	
				PE*	PB CONTENT IN PLATING LAYER	DT	<350PPM	AA ANALYSIS	SMX ONE PRODUCT PER TANK	ONCE PER MONTH		QUARANTINE PROBLEM MATERIAL, ISSUE MRB1, INFORM PE AND EE ENGINEER FOR ACTION	
				PE*	CU CONTENT IN PLATING SOLUTION		<50PPM	--	--	ONCE PER MONTH		QUARANTINE PROBLEM MATERIAL, ISSUE MRB1, INFORM PE AND EE ENGINEER FOR ACTION	
				P	SOLDERABILITY	DD	SOLDER COVERAGE >=95% SOP#3007(QA DEPT.) TSOP-B5005(PL11)	QA-SOP#3007	55EA	ONCE PER SHIFT , 11EA/SMA, 11EA/SMB, 11EA/SMC,11EA/SMD,11EA/AXIAL	SOLDERABILITY TEST CHECK LIST TSOP-B5005(PL11)-06	QUARANTINE PROBLEM MATERIAL, ISSUE MRB1, INFORM PE AND EE ENGINEER FOR ACTION	
				IPOC AGING TEST		DD	SOLDER COVERAGE >=95% SOP#3007(QA DEPT.) TSOP-B5005(PL11)	QA-SOP#3007	55EA	ONCE PER WEEK , 11EA/SMA, 11EA/SMB, 11EA/SMC,11EA/SMD,11EA/AXIAL	AGING TEST CHECK LIST TSOP-B5005(PL11)-08	QUARANTINE PROBLEM MATERIAL, ISSUE MRB1, INFORM PE AND EE ENGINEER FOR ACTION	
				PE*	WETTING BALANCE TEST		245+-1 (244-246) °C, <1.5S SOAKAGE	MACHINE DISPLAY	15EA	ONCE PER DAY, 3 LOTS SMA, SEALOT	CHECK LIST BARREL PLATING WETTING BALANCE	QUARANTINE PROBLEM MATERIAL, ISSUE MRB1, INFORM PE AND EE ENGINEER FOR ACTION	
				P	VISUAL INSPECTION		GS-4775 TSOP-B5005(PL11)	VISUAL INSPECTION	SMX & SMD 200#//AXIAL 50#	EVERY FLYING BAR PER SHIFT	CHECK LIST TSOP-B5005(PL11)-07 & 16	1. STOP MACHINE 2. NOTIFY MGF/EE/PE 3. REFER TO OCAP-Plating-002	
		P	SPIN DRYING TEMPERATURE AND TIME SET-UP		REFER TOP-336 TSOP-B5005(PL11)	VISUAL INSPECTION	--	ONCE PER SHIFT	CHECK LIST TSOP-B5005(PL11)-09	IF FOUND ONE ABNORMAL,ISSUE MRB1, INFORM PE AND EE ENGINEER FOR ACTION			
		P	ANNEALING TEMPERATURE AND N2 CURRENT		155+-5 (150-160) °C, 80L/MIN TSOP-B5005(PL11)	MACHINE DISPLAY	--	ONCE PER SHIFT	CHECK LIST TSOP-B5005(PL11)-13	QUARANTINE PROBLEM MATERIAL, ISSUE MRB1, INFORM PE AND EE ENGINEER FOR ACTION			

AFTER MACHINE PM, CHECK MACHINE SETTING AND DEVICES AS ROUTINE START CHECK
REMARK: MACHINE POWER OFF BY ACCIDENT, AT THE BEGINNING OF MACHINE RECOVERY TO MASS PRODUCTION, KEEP THE SAME CONTROL METHOD, DOUBLE CONFIRMATION FOR ONE MORE TIME. REFER GSC4681
◊ MEANS ALTERNATIVE SOLUTION
◆ MEANS ERROR PROOFING IN PREVENTION



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

8. Measurement System Analysis Studies



Vishay General Semiconductor

Subject : Gage R & R Summary

Part Name: 1.5KE

Area	Section	Item	Parameter	Gauge No.	Date	GRR%	ndc	Result
Assembly / Test	TMTT TT48	Tester	VF	T2	2022/7/15	9.13%	15	Pass
			IR	T2	2022/7/15	1.11%	126	Pass
			VZ	T11	2022/7/15	3.53%	40	Pass
			VC	T3	2022/7/15	2.58%	54	Pass
			DVF	T9	2022/7/15	9.77%	14	Pass
	TMTT	Shadow Graph	Dimension	PE28	2022/6/30	3.51%	40	Pass
	Plating	X-Ray	Thickness	MFG465	2022/6/30	9.22%	15	Pass



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

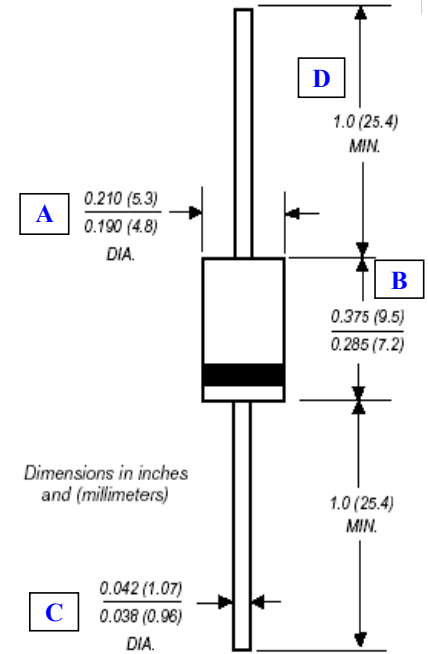
9. Dimensional Results



1.5KE Outline Dimension

Unit: inch

Unit: inch	A	B	C	D
Low spec	0.190	0.285	0.038	1.000
Upper spec	0.210	0.375	0.042	
Min	0.201	0.351	0.039	1.060
Max	0.203	0.355	0.040	1.077
Average	0.202	0.353	0.040	1.069
Sigma	0.000	0.001	0.0003	0.005
Cpk	6.61	6.87	2.09	4.76
1	0.202	0.351	0.040	1.074
2	0.202	0.354	0.040	1.072
3	0.202	0.352	0.040	1.066
4	0.201	0.352	0.040	1.068
5	0.203	0.353	0.040	1.074
6	0.202	0.354	0.040	1.072
7	0.201	0.354	0.040	1.061
8	0.202	0.353	0.040	1.060
9	0.202	0.354	0.040	1.073
10	0.202	0.353	0.040	1.064
11	0.202	0.353	0.040	1.066
12	0.202	0.352	0.040	1.063
13	0.202	0.354	0.040	1.065
14	0.202	0.355	0.040	1.071
15	0.202	0.353	0.040	1.069
16	0.202	0.351	0.040	1.066
17	0.202	0.353	0.040	1.061
18	0.202	0.355	0.040	1.072
19	0.202	0.354	0.040	1.075
20	0.202	0.354	0.040	1.070
21	0.201	0.355	0.040	1.077
22	0.202	0.352	0.040	1.066
23	0.202	0.353	0.040	1.074
24	0.201	0.355	0.040	1.064
25	0.201	0.355	0.039	1.076
26	0.201	0.353	0.040	1.072
27	0.201	0.352	0.040	1.065
28	0.202	0.353	0.040	1.065
29	0.201	0.354	0.040	1.075
30	0.201	0.354	0.040	1.073





PRODUCTION PART APPROVAL PROCESS

10.

Material, Performance Test Results

**Production Part Approval -
Environmental Test Summary**

Date: 08/10/2022

Request Part Number	1.5KE6.8A~220AHE3_B ; 1.5KE6.8CA~220CAHE3_B		
Package	1.5KE	Ni/Au	92.5Pb/5Sn/2.5Ag
FAB	TVS		

Package Qualification:	1.5KE		
Metalization	Ni/Au		
Die attach	92.5Pb/5Sn/2.5Ag		
Package Process Used	1.5KE6.8AHE3_B	1.5KE	
	1.5KE220AHE3_B	1.5KE	
	1.5KE6.8CAHE3_B	1.5KE	

FAB Process:	Requested	TVS	
FAB Process Used		1.5KE6.8AHE3_B	TVS
		1.5KE220AHE3_B	TVS
		1.5KE6.8CAHE3_B	TVS

Test Item & Condition	Duration	1.5KE6.8AHE3_B	1.5KE220AHE3_B	1.5KE6.8CAHE3_B
HTRB	Ta / Bias	170°C / 5.8V	165°C / 185V	170°C / 5.8V
	168 Hrs	0 / 77	0 / 77	0 / 77
	500 Hrs	0 / 77	0 / 77	0 / 77
	1000 Hrs	0 / 77	0 / 77	0 / 77
ESD(HBM) @ 100pF / 1500 Ω	2KV	0 / 10	0 / 10	0 / 10
	6KV	0 / 10	0 / 10	0 / 10
	8KV	0 / 10	0 / 10	0 / 10
ESD(MM) @ 0Ohm / 200pF	100V	0 / 10	0 / 10	0 / 10
	400V	0 / 10	0 / 10	0 / 10
Solder Dip @280°C/10sec	Post	0 / 30	0 / 30	0 / 30
Solderability @245°C/5sec	Post	0 / 10	0 / 10	0 / 10
Pre-conditioning @solder dip 280°C / 10sec		0 / 291	0 / 291	0 / 291
Temperature Cycling @-55°C / +150°C / 30min.	168 Cys	0 / 77	0 / 77	0 / 77
	500 Cys	0 / 77	0 / 77	0 / 77
	1000 Cys	0 / 77	0 / 77	0 / 77
UHAST @130°C / 85%RH / 33.3Psia	16 Hrs	0 / 77	0 / 77	0 / 77
	48 Hrs	0 / 77	0 / 77	0 / 77
	96 Hrs	0 / 77	0 / 77	0 / 77
HAST @130°C / 85%R.H. / 80%VR (max42V)/33.3Psia	16 Hrs	0 / 77	0 / 77	0 / 77
	48 Hrs	0 / 77	0 / 77	0 / 77
	96 Hrs	0 / 77	0 / 77	0 / 77
Bend test @ 2LB/90Degree/3Times	Post	0 / 30	0 / 30	0 / 30
Pull test @ 12LB/15Sec	Post	0 / 30	0 / 30	0 / 30



Vishay Power Diodes Division

Destructive Physical Analysis Report (AEC-Q101)

DPA No/FAR No. **C220597** Date Issued: 2022-3-12 Page 1 of 6

GS Part No. **1.5KE Series Product** Product: **1.5KE**
 Manufacturer: **VGSC** Hi-Rel/Exp. No. -
 Date Code: - Requestor: **Fanny Fan**

Subject: **1.5KE Series Product DPA Report**

1. QUANTITY SUBMITTED INFORMATION:

Test Item	Exp./Lot No.	Quantity	Failure Mode	Qty Analyzed
HAST-96H	-	2	Good	2
TC-1000H	-	2		2

2. ANALYSIS PROCEDURE EMPLOYED

<input checked="" type="checkbox"/>	External visual inspection
	X-Ray radiography
<input checked="" type="checkbox"/>	Chemical decapsulation
	Mechanical decapsulation
	Subassembly internal inspection (Visual/SEM)
	Cross-section

3- ANALYSIS RESULTS

- External visual inspection: Normal.
- Subassembly internal inspection/Analysis: Normal.
- Chip inspection/Analysis: Normal.

4. Failure Mode/Mechanism/ Comment:

The structures of these devices are normal.

Prepared by:	YZHANG	Approved by:	Sara Wan
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Vishay Power Diodes Division

Destructive Physical Analysis Report (AEC-Q101)

DPA No/FAR No.

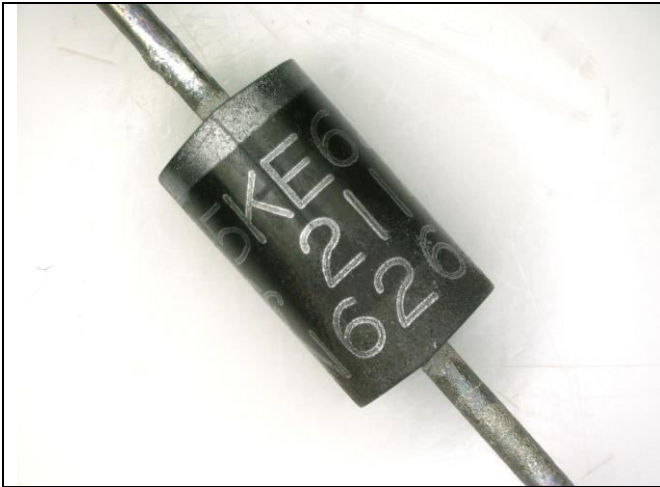
C220597

Date Issued:

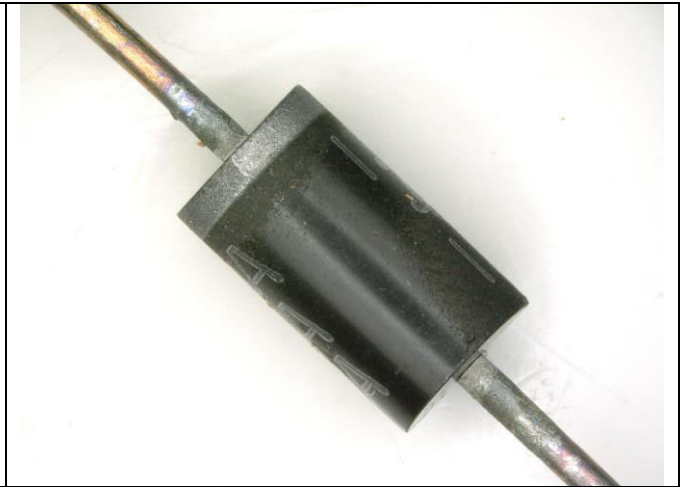
2022-3-12

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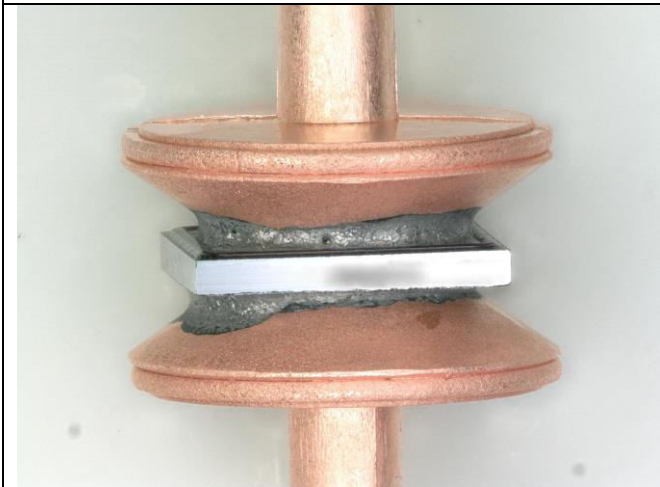
HAST-96H:



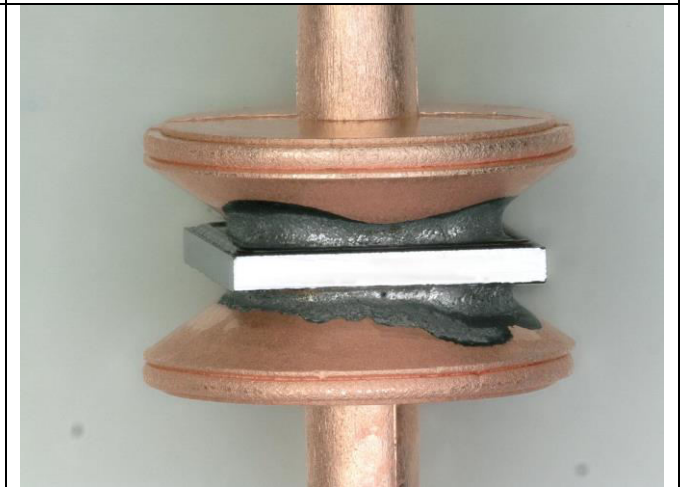
FIG#1-1: External top view – normal.



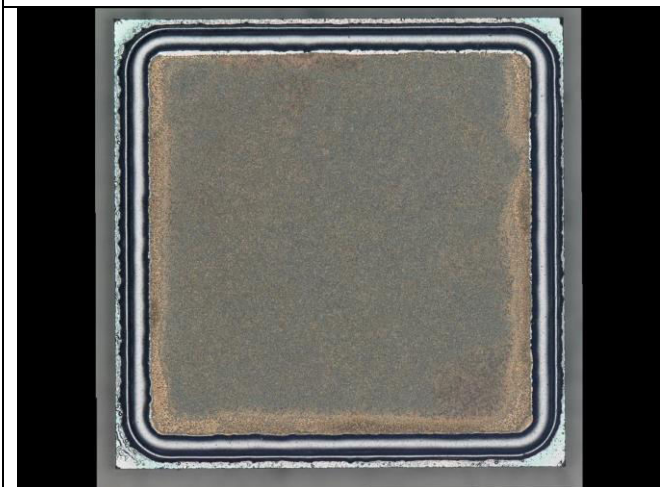
FIG#1-2: External top view (rotate 180) – normal.



FIG#1-3: Subass'y side view – normal.



FIG#1-4: Subass'y side view (rotate 180) – normal.



FIG#1-5: Die top view – normal.

Prepared by: YZHANG Approved by: Sara Wan



Vishay Power Diodes Division

Destructive Physical Analysis Report (AEC-Q101)

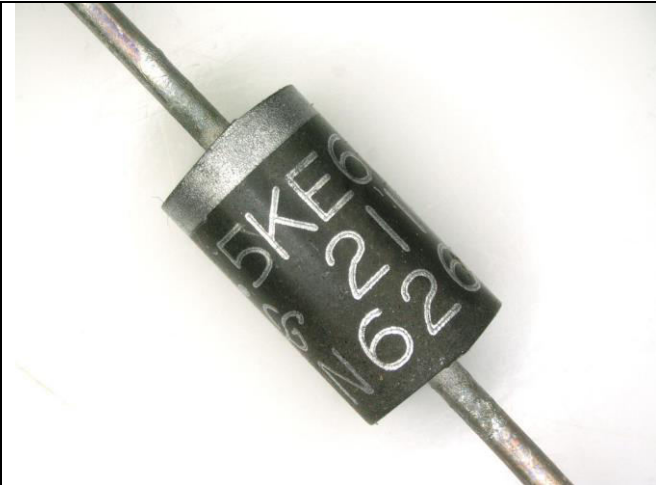
DPA No/FAR No.

C220597

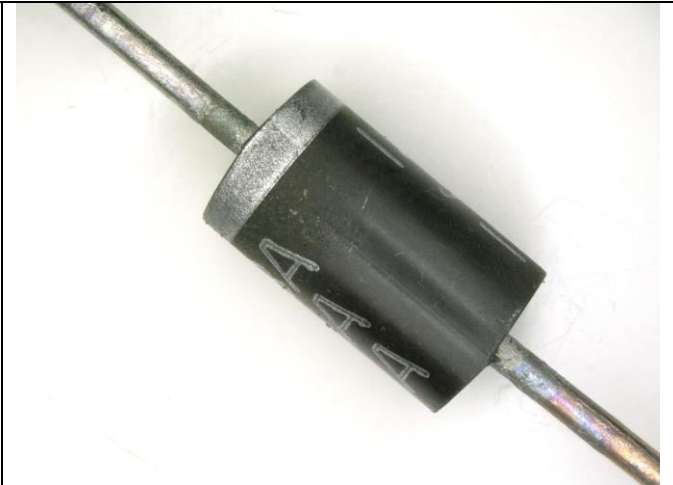
Date Issued:

2022-3-12

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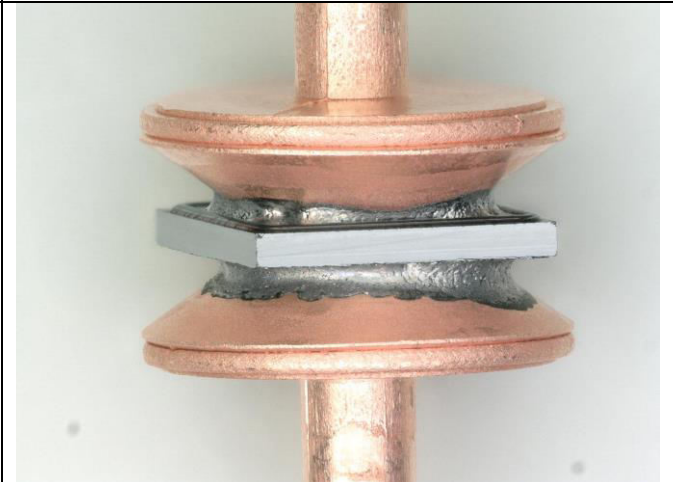
FIG#2-1: External top view – normal.



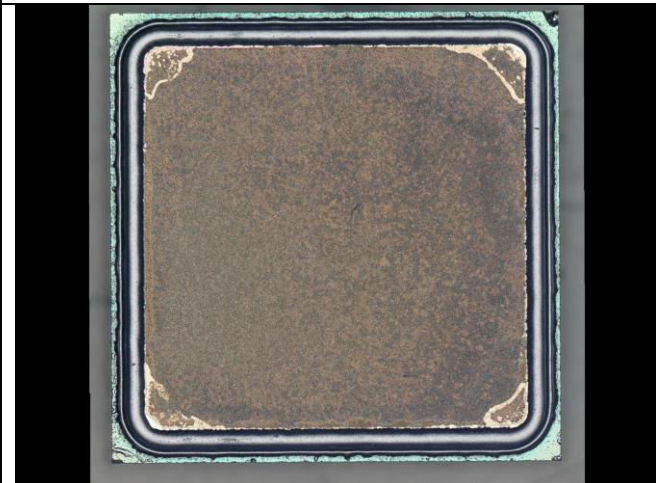
FIG#2-2: External top view (rotate 180) – normal.



FIG#2-3: Subass'y side view – normal.



FIG#2-4: Subass'y side view (rotate 180) – normal.



FIG#2-5: Die top view – normal.



Vishay Power Diodes Division

Destructive Physical Analysis Report (AEC-Q101)

DPA No/FAR No.

C220597

Date Issued:

2022-3-12

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TC-1000H



FIG#1-1: External top view – normal.



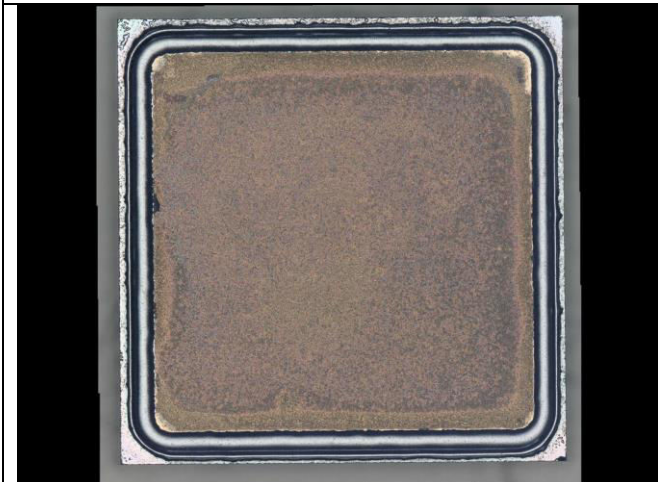
FIG#1-2: External top view (rotate 180) – normal.



FIG#1-3: Subass'y side view – normal.



FIG#1-4: Subass'y side view (rotate 180) – normal.



Prepared by:	YZHANG	Approved by:	Sara Wan
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Vishay General Semiconductor China Limited
Form#269

No. 88, 6th Avenue, TEDA, Tianjin, P.R. China (86-22-25291088)

Rev. 11/9/2017



Vishay Power Diodes Division

Destructive Physical Analysis Report (AEC-Q101)

DPA No/FAR No.

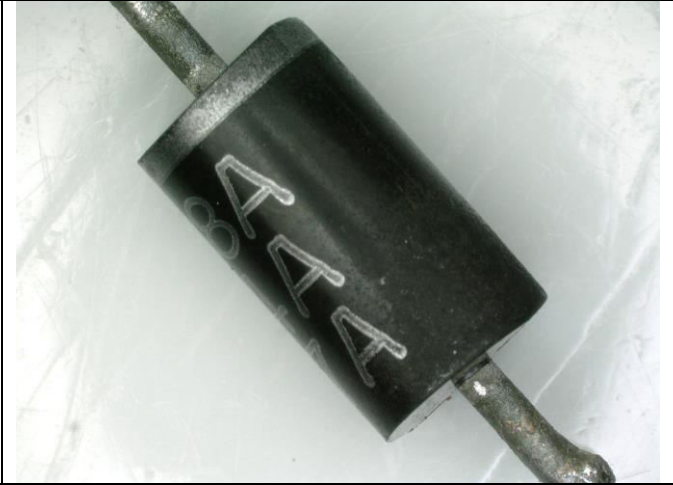
C220597

Date Issued:

2022-3-12

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FIG#1-5: Die top view – normal.



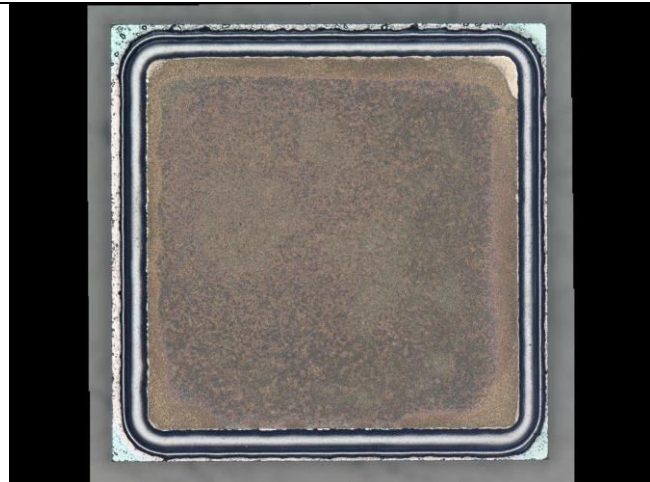
FIG#2-1: External top view – normal.



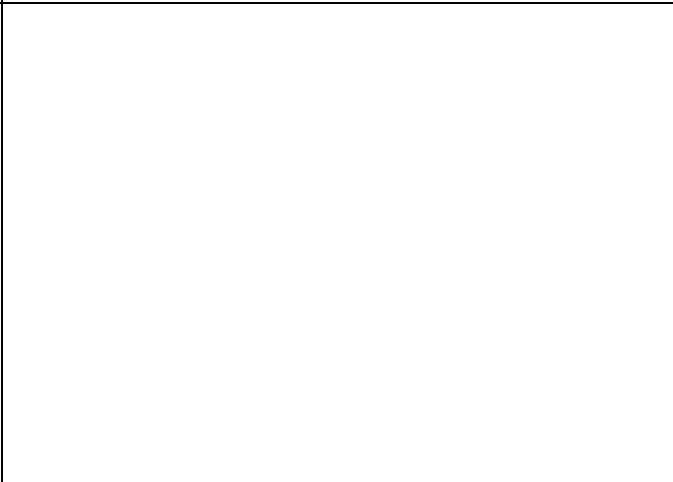
FIG#2-2: External top view (rotate 180) – normal.



FIG#2-3: Subass'y side view – normal.



FIG#2-4: Subass'y side view (rotate 180) – normal.



FIG#2-5: Die top view – normal.

Prepared by: YZHANG

Vishay General Semiconductor China Limited
Form#269

Approved by: Sara Wan

No. 88, 6th Avenue, TEDA, Tianjin, P.R. China (86-22-25291088)

Rev. 11/9/2017



Production Part Approval- Parametric Verification Summary											
PART NUMBER 1.5KE6.8AHE3_B							CUSTOMER P/N		S.S. 25 EA per lot		
TEST	UNIT	CONDITION.	Spec LSL	Spec USL	Lot#	Temp.(°C)	MIN	Max.	AVG.	Std. Dev.	Cpk
IR	mA	@5.8V	-	-	1	-40°C	0.100	0.359	0.182	0.060	-
IR	mA	@5.8V	-	1.0	1	25°C	0.184	0.628	0.324	0.099	2.28
IR	mA	@5.8V	-	-	1	85°C	0.348	1.098	0.586	0.162	-
IR	mA	@5.8V	-	-	1	100°C	0.411	1.409	0.707	0.205	-
IR	mA	@5.8V	-	-	1	125°C	0.551	1.746	0.912	0.251	-
IR	mA	@5.8V	-	-	1	150°C	0.693	2.333	1.169	0.332	-
IR	mA	@5.8V	-	-	1	175°C	0.931	3.086	1.530	0.439	-
VBR	V	@10mA	6.45	7.14	1	25°C	6.72	6.89	6.83	0.03	-
VF	V	@100A	-	3.5	1	25°C	1.140	1.157	1.149	0.005	155.14
VC	V	@143A	-	10.5	1	25°C	7.750	8.090	7.957	0.082	10.33
IR	mA	@5.8V	-	-	2	-40°C	0.082	0.401	0.158	0.066	-
IR	mA	@5.8V	-	1.0	2	25°C	0.152	0.541	0.278	0.092	2.62
IR	mA	@5.8V	-	-	2	85°C	0.289	0.803	0.505	0.146	-
IR	mA	@5.8V	-	-	2	100°C	0.351	0.933	0.606	0.170	-
IR	mA	@5.8V	-	-	2	125°C	0.463	1.205	0.783	0.216	-
IR	mA	@5.8V	-	-	2	150°C	0.608	1.557	1.017	0.279	-
IR	mA	@5.8V	-	-	2	175°C	0.792	1.983	1.313	0.348	-
VBR	V	@10mA	6.45	7.14	2	25°C	6.740	6.890	6.837	0.038	-
VF	V	@100A	-	3.5	2	25°C	1.145	1.167	1.154	0.005	153.8
VC	V	@143A	-	10.5	2	25°C	7.830	8.100	7.978	0.075	11.28
IR	mA	@5.8V	-	-	3	-40°C	0.095	0.575	0.195	0.088	-
IR	mA	@5.8V	-	1.0	3	25°C	0.177	0.752	0.338	0.107	2.07
IR	mA	@5.8V	-	-	3	85°C	0.335	1.045	0.602	0.147	-
IR	mA	@5.8V	-	-	3	100°C	0.401	1.161	0.711	0.167	-
IR	mA	@5.8V	-	-	3	125°C	0.535	1.402	0.927	0.210	-
IR	mA	@5.8V	-	-	3	150°C	0.712	1.723	1.213	0.270	-
IR	mA	@5.8V	-	-	3	175°C	0.926	2.119	1.557	0.345	-
VBR	V	@10mA	6.45	7.14	3	25°C	6.790	6.890	6.838	0.021	-
VF	V	@100A	-	3.5	3	25°C	1.146	1.162	1.153	0.005	150.39
VC	V	@143A	-	10.5	3	25°C	7.850	8.140	8.012	0.068	12.11

Production Part Approval- Parametric Verification Summary											
PART NUMBER 1.5KE6.8CAHE3_B							CUSTOMER P/N		S.S. 25 EA per lot		
TEST	UNIT	CONDITION.	Spec LSL	Spec USL	Lot#	Temp.(°C)	MIN	Max.	AVG.	Std. Dev.	Cpk
IR	mA	@5.8V	-	-	1	-40°C	0.549	1.088	0.797	0.131	-
IR	mA	@5.8V	-	2.0	1	25°C	0.813	1.446	1.125	0.167	1.75
IR	mA	@5.8V	-	-	1	85°C	1.300	2.192	1.730	0.248	-
IR	mA	@5.8V	-	-	1	100°C	1.480	2.464	1.948	0.274	-
IR	mA	@5.8V	-	-	1	125°C	1.853	3.015	2.382	0.330	-
IR	mA	@5.8V	-	-	1	150°C	2.209	3.579	2.850	0.378	-
IR	mA	@5.8V	-	-	1	175°C	2.859	4.593	3.609	0.488	-
VBR	V	@10mA	6.45	7.14	1	25°C	6.93	7.09	7.01	0.04	-
VC	V	@143A	-	10.5	1	25°C	8.66	8.91	8.73	0.06	10.51
IR	mA	@5.8V	-	-	2	-40°C	0.597	1.284	0.852	0.124	-
IR	mA	@5.8V	-	2.0	2	25°C	0.855	1.694	1.201	0.157	1.70
IR	mA	@5.8V	-	-	2	85°C	1.305	2.351	1.822	0.219	-
IR	mA	@5.8V	-	-	2	100°C	1.471	2.587	2.050	0.243	-
IR	mA	@5.8V	-	-	2	125°C	1.804	3.039	2.487	0.288	-
IR	mA	@5.8V	-	-	2	150°C	2.178	3.599	2.967	0.342	-
IR	mA	@5.8V	-	-	2	175°C	0.719	4.496	3.650	0.620	-
VBR	V	@10mA	6.45	7.14	2	25°C	6.93	7.10	7.01	0.04	-
VC	V	@143A	-	10.5	2	25°C	8.63	8.95	8.75	0.07	8.73
IR	mA	@5.8V	-	-	3	-40°C	0.517	1.131	0.786	0.121	-
IR	mA	@5.8V	-	2.0	3	25°C	0.777	1.689	1.219	0.151	1.73
IR	mA	@5.8V	-	-	3	85°C	1.196	2.452	1.834	0.208	-
IR	mA	@5.8V	-	-	3	100°C	1.369	2.729	2.069	0.229	-
IR	mA	@5.8V	-	-	3	125°C	1.694	3.272	2.526	0.274	-
IR	mA	@5.8V	-	-	3	150°C	2.125	3.968	3.122	0.332	-
IR	mA	@5.8V	-	-	3	175°C	2.608	4.786	3.814	0.405	-
VBR	V	@10mA	6.45	7.14	3	25°C	6.93	7.07	6.99	0.04	-
VC	V	@143A	-	10.5	3	25°C	8.65	8.94	8.77	0.07	8.09



Production Part Approval-
Parametric Verification Summary

PART NUMBER
1.5KE220AHE3_B

CUSTOMER P/N

S.S.

25 EA per lot

TEST	UNIT	CONDITION.	Spec LSL	Spec USL	Lot#	Temp.(°C)	MIN	Max.	AVG.	Std. Dev.	Cpk
IR	uA	@185V	-	-	1	-40°C	0.002	0.005	0.003	0.001	-
IR	uA	@185V	-	1.0	1	25°C	0.200	0.263	0.221	0.017	15.58
IR	uA	@185V	-	-	1	85°C	4.329	5.208	4.647	0.231	-
IR	uA	@185V	-	-	1	100°C	9.070	10.800	9.674	0.44	-
IR	uA	@185V	-	-	1	125°C	28.27	32.98	30.44	1.30	-
IR	uA	@185V	-	-	1	150°C	82.85	96.42	89.72	3.95	-
IR	uA	@185V	-	-	1	175°C	229.2	266.3	248.6	12.0	-
VBR	V	@1.0mA	209	231	1	25°C	221.5	227.9	224.3	1.5	-
VF	V	@100A	-	3.5	1	25°C	1.910	2.413	2.127	0.138	3.32
VC	V	@4.6A	-	328	1	25°C	239.9	246.5	242.8	1.4	19.88
IR	uA	@185V	-	-	2	-40°C	0.002	0.005	0.003	0.001	-
IR	uA	@185V	-	1.0	2	25°C	0.196	0.268	0.220	0.017	15.65
IR	uA	@185V	-	-	2	85°C	4.220	5.273	4.568	0.252	-
IR	uA	@185V	-	-	2	100°C	8.930	10.860	9.577	0.48	-
IR	uA	@185V	-	-	2	125°C	27.80	33.31	30.03	1.39	-
IR	uA	@185V	-	-	2	150°C	80.98	96.22	88.36	3.88	-
IR	uA	@185V	-	-	2	175°C	214.50	262.40	243.26	11.59	-
VBR	V	@1.0mA	209	231	2	25°C	221.0	227.6	224.3	1.7	-
VF	V	@100A	-	3.5	2	25°C	1.847	2.387	2.068	0.170	2.80
VC	V	@4.6A	-	328	2	25°C	237.9	246.3	243.0	1.9	14.61
IR	uA	@185V	-	-	3	-40°C	0.002	0.005	0.003	0.001	-
IR	uA	@185V	-	1.0	3	25°C	0.201	0.303	0.229	0.022	11.58
IR	uA	@185V	-	-	3	85°C	4.121	5.659	4.635	0.351	-
IR	uA	@185V	-	-	3	100°C	8.770	11.620	9.790	0.62	-
IR	uA	@185V	-	-	3	125°C	27.47	35.34	30.66	1.75	-
IR	uA	@185V	-	-	3	150°C	80.81	99.43	90.53	4.58	-
IR	uA	@185V	-	-	3	175°C	220.60	274.10	250.20	13.60	-
VBR	V	@1.0mA	209	231	3	25°C	221.3	226.6	223.8	1.4	-
VF	V	@100A	-	3.5	3	25°C	1.908	2.352	2.098	0.124	3.77
VC	V	@4.6A	-	328	3	25°C	238.5	244.8	242.3	1.7	17.16



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

11. Initial Process Study



Vishay General Semiconductor

Subject: Process Capability Studies

Part Number: 1.5KE

	Operation	Critical Characteristics	Data Category	Q1 '22	Q2 '22	Unit
Assembly	Plating thickness	Barrel plating thickness	Variable	1.34	1.33	Cpk

Remarks: (1). Sampling frequency is defined in CP.
(2). SPC method is defined in CP.



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

12.
**Qualified Laboratory
Documentation**



Vishay Diodes

Subject: Laboratory Accreditation and Scope of Accreditation

To Whom it May Concern:

Vishay Diodes is a IATF16949 certified manufacture for discrete semiconductor components for Automotive industry. as such all locations internally are considered suitably and accredited to perform the following:

1. Qualifications, inspections & Reliability testing per:
AEC requirements, JEITA EIA
JEDEC MIL-STD
IEC IPC

No third party or outside testing is used for any of the above items.

If you have any questions, please contact Vishay Diodes (VGSC) Reliability Manager.

Sincerely,

A handwritten signature in black ink that reads "Rick Chu".

Rick Chu,
Manager
Diodes VGSC Reliability



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

13.
Appearance Approval
Report



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

This section is not applicable



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

14.
Sample Product



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

This section is available upon request

COMPANY PRIVATE & CONFIDENTIAL



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

15.
Master Sample



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

This section is stored at supplier side



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

16. Checking Aids



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

This section is not applicable



DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

17.
**Records of Compliance with
Customer-Specific
Requirements**

Certificate IATF 0400224
Certificate SGS TW04/0547

The management system of

Vishay General Semiconductor Taiwan Limited

233, Baoqiao Rd., Xindian District,
New Taipei City 231, Taiwan



has been assessed and certified as meeting the requirements of

IATF 16949:2016

Edition 1

For the following activities

Design and manufacture of power rectifiers and protection devices.

EXCLUSIONS: None

3 Year certification is valid from 20 May 2021 until 19 May 2024 and
remains valid subject to satisfactory surveillance audits.
Version no.010 Current version updated 20 May 2021

Authorised by



Veto Power Authority

Contracted Office: SGS United Kingdom Ltd, Station Road, Oldbury, B69 4LN, UK.
E-mail: Neil.Hall@sgs.com

SGS IATF16949 0417

Page 1 of 2



Certificate IATF 0400224
Certificate SGS TW04/0547

SGS

Vishay General Semiconductor Taiwan Limited

IATF16949:2016

Edition 1



Additional facilities

Vishay Hong Kong Limited.

**5/F, Phase 2, YKK Building, No. 2 San Lik Street, Tuen Mun,
N.T., Hong Kong, China**

Summary of Activities

Logistics, Packaging, Warehousing

Additional facilities

Vishay Electronica Dale de Mexico

**Calle Joule No. 1920, Parque Ind, Antonio J. Bermudez, Ciudad Juarez,
Chihuahua, 32470, Mexico**

Summary of Activities

Logistics, Packaging, Warehousing



Page 2 of 2

MANAGEMENT SYSTEM CERTIFICATE

Certificate No.: 132648-2013-AQ-RGC-IATF

Valid until:
12 May 2021 – 08 May 2024

IATF Certificate No.: 0399042

This is to certify that the management system of

Vishay General Semiconductor (China) Co., Ltd.

No. 88, 6th Avenue, TEDA, Tianjin, P.R. China
and, if applicable, the remote support locations as mentioned in the Appendix
accompanying this Certificate

has been found to conform to quality management system standard:
IATF 16949:2016

This certificate is valid for the following Scope:

**DESIGN AND MANUFACTURE OF POWER RECTIFIERS AND
PROTECTION DEVICES**

Place and date:
Katy, TX. 12 May 2021



For the issuing office:
DNV GL - Business Assurance
1400 Ravello Drive, Katy, TX 77449-
5164 USA

Sherif Mekkawy
Management Representative

Certificate No.: 132648-2013-AQ-RGC-IATF
 IATF Certificate No.: 0399042
 Place and date: **Katy, TX.** 12 May 2021

Appendix to Certificate

Vishay General Semiconductor (China) Co., Ltd.

Remote Support Locations included in the certification are as follows:

Name	Address	RSL Activities	Certification Body
Vishay Hong Kong Limited	5/F, Phase 2, YKK Building, No.2 San Lik Street, Tuen Mun, N.T., Hong Kong	Logistic, Packaging, Warehousing	SGS
Vishay General Semiconductor Taiwan Limited	No. 233 Pao Chiao Road, Hsin Tien District, New Taipei City, Taiwan	Marketing, Product Design	SGS
Vishay SA	199 Boulevard de la Medeleine, 06003, Nice Cedex 1, France	Contract Review, Customer Service	BVC
Vishay Semiconductor Italiana SPA	VIA LIGURIA49-10071 BORGARO TORINESE (TO)	Product Design	CISQ
Vishay Semiconductor (Austria) Ges.m.b.H	Telefunkenstrasse 5, 4840 Vöcklabruck, Austria	Product Design	TUV SUD
Vishay Juarez Regional Warehouse	Calle Joule No. 1920, Parque Ind, Antonio J. Bermudez, Ciudad Juarez, Chihuahua, Mexico	Distribution, Logistics, Packing, Warehousing	BSI
VISHAY INTERTECHNOLOGY ASIA PTE. LTD.	37A TAMPINES STREET 92 #07-01 SG-528886 SINGAPORE	Customer Service	SIRIM QAS





DIODES PPAP

PRODUCTION PART APPROVAL PROCESS

18.
Part Submission Warrant

Vishay Material Code	Customer Material	Location	Total Quantity	Backlog Quantity
1.5KE47CAHE3_A/D		Maisach Gernlinden	0	0
1.5KE47CAHE3_A/D	GES1.5KE47CAHE3-A/D	FT WORTH	30000	0
1.5KE47CAHE3_A/D	GES1.5KE47CAHE3-A/D	FT. WORTH	0	0
1.5KE47CAHE3_A/D	GES1.5KE47CAHE3-A/D	Maisach - Gernlinden	451000	137000
1.5KE47CAHE3_A/D	GES1.5KE47CAHE3-A/D	Maisach Gernlinden	2508000	2363000