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Product Change Notification

Product Group: DD/Tue Apr 30, 2024/PCN-DD-012-2024-REV-0



Additional Wafer Foundry for Commercial Rectifier RS1/RS2/RS3

For further information, please contact your regional Vishay office.

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Description of Change: In addition to the existing in-house wafer source, Vishay Diodes Division is introducing an additional wafer manufacturing location in subcon, China for commercial grade high voltage SMA, SMB and SMC fast switching rectifiers. There will be no change in form, fit and function on all affected products.

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

Reason for Change: Capacity expansion

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: Mon Jul 1, 2024

Sample Availability: Available upon request

Product Identification: Wafer source traceability is done through Lot Number

Qualification Data: Available upon request

This PCN is considered approved, without further notification, unless we receive specific customer concerns before Sun Jun 30, 2024 or as specified by contract.

Issued By: Jill Li, JILL.LI@VISHAY.COM



The DNA of tech.™

Product Change Notification



Product Group: DD/Tue Apr 30, 2024/PCN-DD-012-2024-REV-0

RS1J-E3/5AT	RS1J-E3/61T	RS1J-M3/5AT	RS1J-M3/61T	RS1K-E3/5AT
RS1K-E3/61T	RS1K-M3/5AT	RS1K-M3/61T	RS2J-E3/52T	RS2J-E3/5BT
RS2J-M3/52T	RS2J-M3/5BT	RS2K-E3/52T	RS2K-E3/5BT	RS2K-M3/52T
RS2K-M3/5BT	RS3J-E3/57T	RS3J-E3/9AT	RS3J-M3/57T	RS3J-M3/9AT
RS3K-E3/57T	RS3K-E3/9AT	RS3K-M3/57T	RS3K-M3/9AT	

Qual Pack

INNOVATIVE PACKAGES

eSMP® Series



MicroSMF (DO-219AC)



MicroSMP (DO-219AD)



SlimDPAK (TO-252AE)



SlimSMA (DO-221AC)



SlimSMAW (DO-221AD)



SMF (DO-219AB)



SMP (DO-220AA)



SMPA (DO-221BC)



SMPC (TO-277A)



SMPD (TO-263AC)

iSoCinK+



BU Bridge



PB Bridge

FlatPAK 5 × 6



FlatPAK 5 × 6 Dual



FlatPAK 5 × 6 Single

DFN Series



DFN3820A



DFN33A



DFN1006-2A



DFN1110-3A

CONVENTIONAL PACKAGES

Surface-Mount



SMA (DO-214AC)



SMB (DO-214AA)



SMC (DO-214AB)



DPAK (TO-252AA)



D²PAK (TO-263AB)

Power Pack



TO-220 FullPAK 2L



TO-220AC 2L



TO-247AC 3L



TO-247AD 2L



Content

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- 2. Certificate of Design and Construction**
- 3. Product Description**
- 4. Data Sheet**
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- 7. Unit Pack Specifications**
- 8. Electrical Parameters Verification**
- 9. Reliability Qualification Report**
- 10. Soldering Profile**
- 11. Materials Declaration Report**
- 12. Certificates**



1. Background

In addition to the existing in-house wafer source, Vishay Diodes Division is introducing an additional wafer manufacturing location in subcon, China for commercial grade high voltage SMA, SMB and SMC fast switching rectifiers. There will be no change in form, fit and function on all affected products.

Part Numbers / Series/ Families affected: Involved part numbers are listed in below table.

RS1J-E3/5AT	RS1J-E3/61T	RS1J-M3/5AT	RS1J-M3/61T	RS1K-E3/5AT
RS1K-E3/61T	RS1K-M3/5AT	RS1K-M3/61T	RS2J-E3/52T	RS2J-E3/5BT
RS2J-M3/52T	RS2J-M3/5BT	RS2K-E3/52T	RS2K-E3/5BT	RS2K-M3/52T
RS2K-M3/5BT	RS3J-E3/57T	RS3J-E3/9AT	RS3J-M3/57T	RS3J-M3/9AT
RS3K-E3/57T	RS3K-E3/9AT	RS3K-M3/57T	RS3K-M3/9AT	



2. CDC (Certificate of Design Construction)

Item Name	Supplier Response
1. Supplier Part Number/Generic Part Number:	RS1K-E3
2. Device Description:	STD
3. Wafer/Die Fab Location : a. Facility name/plant #: b. Country:	Vishay General Semiconductor Taiwan Ltd. Subcon Taiwan / China
4. Assembly Location : a. Facility name/plant #: b. Country:	Vishay General Semiconductor China Co., Ltd. Vishay General Semiconductor Taiwan Ltd. ,Nanzi Branch China/Taiwan
5. Final Quality Control A (Test) Location: a. Facility name/plant #: b. Country:	Vishay General Semiconductor China Co., Ltd. Subcon Vishay General Semiconductor Taiwan Ltd. ,Nanzi Branch China/Taiwan
6. Wafer/Die: a. Wafer size: b. Die family:	4 inch STD
7. Die (frontside) Metallization: a. Die metallization material(s):	Ni/Au
8. Die Passivation: a. Die passivation material(s):	Glass
9. Die Overcoat Material (e.g., Polyimide):	N/A
10. Die Prep Backside: a. Die metallization:	Ni/Au
11. Die Separation Method:	Blade saw
12. Die Attach: a. Die attach method:	Reflow soldering
13. Package: a. Type of package (e.g., plastic, ceramic, unpackaged): b. JEDEC designation (e.g., MS029, MS034, etc.):	Plastic SMA(DO-214AC)
14. Mold Compound: a. Mold compound type: b. Flammability rating: c. Tg (glass transition temperature)(°C):	Epoxy Compound UL 94 V1 ☐ UL 94 V0 ☒ Min. 150°C
15. Wire Bond: a. Wire bond material:	N/A
16. Leadframe (if applicable): a. Header material: b. Leadframe material: c. Leadframe bonding plating composition: d. External lead plating composition: e. External lead plating thickness (μinch):	Copper Copper None Pure Sn Min. 8μm

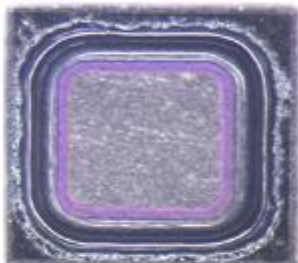
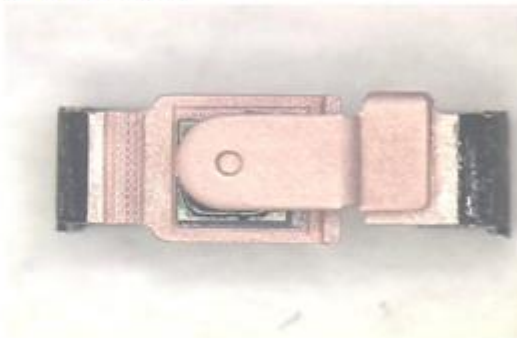


Item Name	Product : RS2K-E3
1. Supplier Part Number/Generic Part Number:	RS2K-E3
2. Device Description:	STD
3. Wafer/Die Fab Location :	
a. Facility name/plant #:	Vishay General Semiconductor Taiwan Ltd. Subcon
b. Country:	Taiwan / China
4. Assembly Location :	
a. Facility name/plant #:	Vishay General Semiconductor China Co., Ltd. Vishay General Semiconductor Taiwan Ltd. ,Nanzhi Branch
b. Country:	China/Taiwan
5. Final Quality Control A (Test) Location:	
a. Facility name/plant #:	Vishay General Semiconductor China Co., Ltd. Subcon
b. Country:	Vishay General Semiconductor Taiwan Ltd. ,Nanzhi Branch China/Taiwan
6. Wafer/Die:	
a. Wafer size:	4 inch
b. Die family:	STD
7. Die (frontside) Metallization:	
a. Die metallization material(s):	Ni/Au
8. Die Passivation:	
a. Die passivation material(s):	Glass
9. Die Overcoat Material (e.g., Polyimide):	N/A
10. Die Prep Backside:	
a. Die metallization:	Ni/Au
11. Die Separation Method:	Blade saw
12. Die Attach:	
a. Die attach method:	Reflow soldering
13. Package:	
a. Type of package (e.g., plastic, ceramic, unpackaged):	Plastic
b. JEDEC designation (e.g., MS029, MS034, etc.):	SMB (DO-214AA)
14. Mold Compound:	
a. Mold compound type:	Epoxy Compound
b. Flammability rating:	UL 94 V1 ☐ UL 94 V0 ☒
c. Tg (glass transition temperature)(°C):	Min. 150°C
15. Wire Bond:	
a. Wire bond material:	N/A
16. Leadframe (if applicable):	
a. Header material:	Copper
b. Leadframe material:	Copper
c. Leadframe bonding plating composition:	None
d. External lead plating composition:	Pure Sn
e. External lead plating thickness (μinch):	Min. 8um
17. Thermal Resistance:	
a. θ_{JA} °C/W (approx):	55°C/W
b. θ_{JC} °C/W (approx):	N/A
c. θ_{JA} junction-to-lead °C/W (approx):	18°C/W
d. θ_{JB} junction-to-mounting base °C/W (approx):	N/A
18. Maximum Process Exposure Conditions:	* Note: Temperatures are as measured on the center of the plastic package body top surface.
a. MSL @ rated SnPb temperature:	1. at 235 °C (SnPb)



Item Name	Product : RS3K-E3
1. Supplier Part Number/Generic Part Number:	RS3K-E3
2. Device Description:	STD
3. Wafer/Die Fab Location : a. Facility name/plant #: b. Country:	Vishay General Semiconductor Taiwan Ltd. Subcon Taiwan / China
4. Assembly Location : a. Facility name/plant #: b. Country:	Vishay General Semiconductor China Co., Ltd. Vishay General Semiconductor Taiwan Ltd., Nanzi Branch China/Taiwan
5. Final Quality Control A (Test) Location: a. Facility name/plant #: b. Country:	Vishay General Semiconductor China Co., Ltd. Subcon Vishay General Semiconductor Taiwan Ltd., Nanzi Branch China/Taiwan
6. Wafer/Die: a. Wafer size: b. Die family:	4 inch STD
7. Die (frontside) Metallization: a. Die metallization material(s):	Ni/Au
8. Die Passivation: a. Die passivation material(s):	Glass
9. Die Overcoat Material (e.g., Polyimide):	N/A
10. Die Prep Backside: a. Die metallization:	Ni/Au
11. Die Separation Method:	Blade saw
12. Die Attach: a. Die attach method:	Reflow soldering
13. Package: a. Type of package (e.g., plastic, ceramic, unpackaged): b. JEDEC designation (e.g., MS029, MS034, etc.):	Plastic SMC (DO-214AB)
14. Mold Compound: a. Mold compound type: b. Flammability rating: c. Tg (glass transition temperature)(°C):	Epoxy Compound UL 94 V1 ☐ UL 94 V0 ☒ Min. 150°C
15. Wire Bond: a. Wire bond material:	N/A
16. Leadframe (if applicable): a. Header material: b. Leadframe material: c. Leadframe bonding plating composition: d. External lead plating composition: e. External lead plating thickness (μinch):	Copper Copper None Pure Sn Min. 8μm
17. Thermal Resistance: a. θ_{JA} °C/W (approx): b. θ_{JC} °C/W (approx): c. θ_{JL} junction-to-lead °C/W (approx): d. θ_{JB} junction-to-mounting base °C/W (approx):	50°C/W N/A 15°C/W N/A
18. 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. <u>1 at 235 °C (SnPb)</u> <u>1 at 260 °C (Pb-free)</u>

3. Product Description

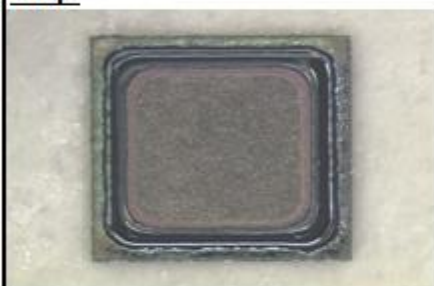
PRODUCT DESCRIPTION			
Product : RS1K-E3		Package : SMA (DO-214AC)	Issued by : Sam Liao
Cust. P/N: -----		Technology : STD	Date : 2/22/2024
Functional Description : 800V, 1A Surface-Mount Fast Switching Rectifier			
Fab factory Taiwan/China	Assembly factory China / Taiwan	Testing factory China / Taiwan	
<u>Product:</u> <u>Chip</u>  <u>Sub-Assembly</u> 			
<u>Sub-Assembly</u>  <u>Finish Goods</u> 			

PRODUCT DESCRIPTION			
Product : RS2K-E3		Package : SMB (DO-214AA)	Issued by : Sam Liao
Cust. P/N: -----		Technology : STD	Date : 2/22/2024
Functional Description : 800V, 2A Surface-Mount Fast Switching Rectifier			
Fab factory Taiwan/China	Assembly factory China/Taiwan	Testing factory China/Taiwan	
Product: Chip  Sub-Assembly 			
Sub-Assembly  Finish Goods 			

PRODUCT DESCRIPTION			
Product : RS3K-E3		Package : SMC (DO-214AB)	Issued by : Sam Liao
Cust. P/N: -----		Technology : STD	Date : 2/22/2024
Functional Description : 800V, 3A Surface-Mount Fast Switching Rectifier			
Fab factory	Assembly factory	Testing factory	
Taiwan/China	China/Taiwan	China/Taiwan	

Product:

Chip



Sub-Assembly



Sub-Assembly



Finish Goods





4. Data Sheet

- please see the next pages
- Visit <https://www.vishay.com/docs/88707/rs1a.pdf> for the latest version
- Visit <https://www.vishay.com/docs/88708/rs2a.pdf> for the latest version
- Visit <https://www.vishay.com/docs/88709/rs3a.pdf> for the latest version

Surface-Mount Fast Switching Rectifier


SMA (DO-214AC)

Cathode  Anode

LINKS TO ADDITIONAL RESOURCES



PRIMARY CHARACTERISTICS	
$I_{F(AV)}$	1.0 A
V_{RRM}	50 V, 100 V, 200 V, 400 V, 600 V, 800 V
I_{FSM}	30 A
t_{rr}	150 ns, 250 ns, 500 ns
V_F	1.3 V
T_J max.	150 °C
Package	SMA (DO-214AC)
Circuit configuration	Single

FEATURES

- Low profile package
- Ideal for automated placement
- Glass passivated pellet chip junction
- Fast switching for high efficiency
- High forward surge capability
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- AEC-Q101 qualified available
 - Automotive ordering code: base P/NHE3 or P/NHM3
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



TYPICAL APPLICATIONS

For use in fast switching rectification of power supply, inverters, converters, and freewheeling diodes for consumer, automotive and telecommunication.

MECHANICAL DATA

Case: SMA (DO-214AC)

Molding compound meets UL 94 V-0 flammability rating

Base P/N-E3 - RoHS-compliant, commercial grade

Base P/N-M3 - halogen-free, RoHS-compliant, commercial grade

Base P/NHE3_X - RoHS-compliant and AEC-Q101 qualified

Base P/NHM3_X - halogen-free, 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, M3, HE3 and HM3 suffix meets JESD 201 class 2 whisker test

Polarity: color band denotes cathode end

MAXIMUM RATINGS ($T_A = 25\text{ °C}$ unless otherwise noted)								
PARAMETER	SYMBOL	RS1A	RS1B	RS1D	RS1G	RS1J	RS1K	UNIT
Device marking code		RA	RB	RD	RG	RJ	RK	
Maximum repetitive peak reverse voltage	V_{RRM}	50	100	200	400	600	800	V
Maximum RMS voltage	V_{RMS}	35	70	140	280	420	500	V
Maximum DC blocking voltage	V_{DC}	50	100	200	400	600	800	V
Maximum average forward rectified current at $T_L = 90\text{ °C}$	$I_{F(AV)}$	1.0						A
Peak forward surge current 8.3 ms single half sine-wave superimposed on rated load	I_{FSM}	30						A
Operating junction and storage temperature range	T_J, T_{STG}	-55 to +150						°C

**ELECTRICAL CHARACTERISTICS** ($T_A = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)

PARAMETER	TEST CONDITIONS		SYMBOL	RS1A	RS1B	RS1D	RS1G	RS1J	RS1K	UNIT
Maximum instantaneous forward voltage	1.0 A		V _F	1.3						V
Maximum DC reverse current at rated DC blocking voltage		T _A = 25 °C	I _R	5.0						μA
		T _A = 125 °C		50						
Maximum reverse recovery time	I _F = 0.5 A, I _R = 1.0 A, I _{rr} = 0.25 A		t _{rr}	150				250	500	ns
Typical junction capacitance	4.0 V, 1 MHz		C _J	10				7.0		pF

THERMAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)

PARAMETER	SYMBOL	RS1A	RS1B	RS1D	RS1G	RS1J	RS1K	UNIT
Typical thermal resistance	$R_{\theta JA}^{(1)}$	105						°C/W
	$R_{\theta JL}^{(1)}$	32						

Note

⁽¹⁾ Thermal resistance from junction to ambient and from junction to lead mounted on PCB with 0.2" x 0.2" (5.0 mm x 5.0 mm) copper pad areas

ORDERING INFORMATION (Example)

PREFERRED P/N	UNIT WEIGHT (g)	PREFERRED PACKAGE CODE	BASE QUANTITY	DELIVERY MODE
RS1J-E3/61T	0.064	61T	1800	7" diameter plastic tape and reel
RS1J-E3/5AT	0.064	5AT	7500	13" diameter plastic tape and reel
RS1JHE3_A/H ⁽¹⁾	0.064	H	1800	7" diameter plastic tape and reel
RS1JHE3_A/I ⁽¹⁾	0.064	I	7500	13" diameter plastic tape and reel
RS1J-M3/61T	0.064	61T	1800	7" diameter plastic tape and reel
RS1J-M3/5AT	0.064	5AT	7500	13" diameter plastic tape and reel
RS1JHM3_A/H ⁽¹⁾	0.064	H	1800	7" diameter plastic tape and reel
RS1JHM3_A/I ⁽¹⁾	0.064	I	7500	13" diameter plastic tape and reel

Note

⁽¹⁾ AEC-Q101 qualified



RATINGS AND CHARACTERISTICS CURVES ($T_A = 25^\circ\text{C}$ unless otherwise noted)

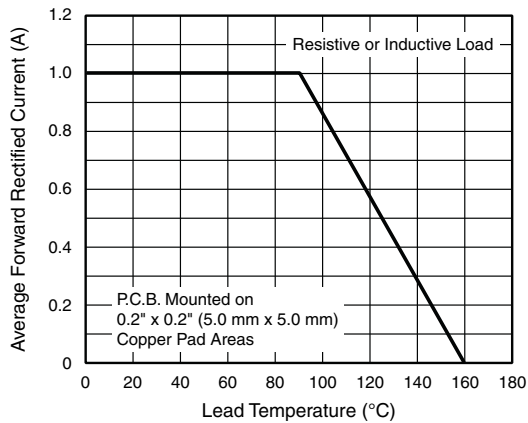


Fig. 1 - Forward Current Derating Curve

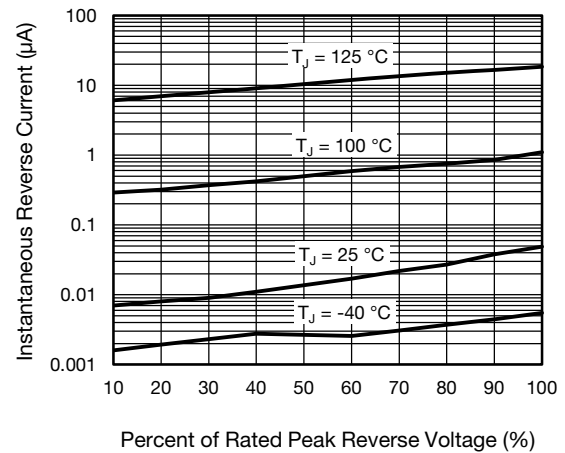


Fig. 4 - Typical Reverse Characteristics

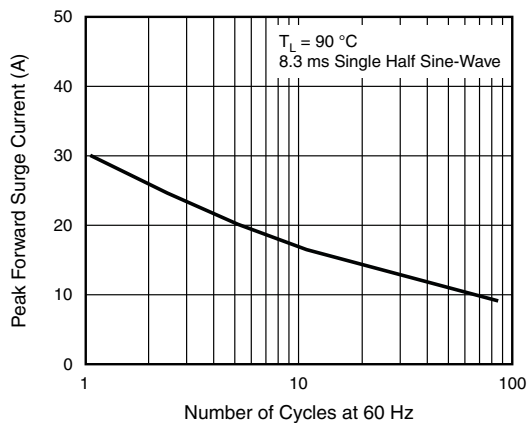


Fig. 2 - Maximum Non-Repetitive Peak Forward Surge Current

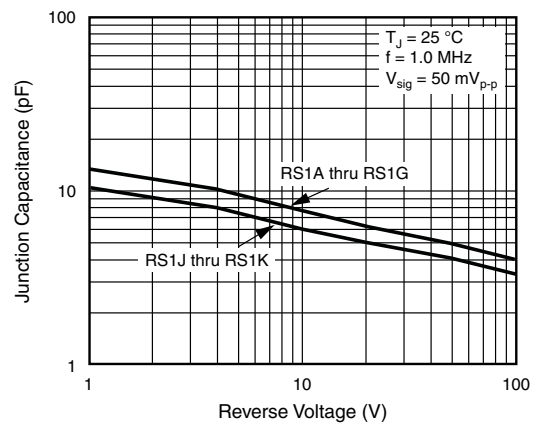


Fig. 5 - Typical Junction Capacitance

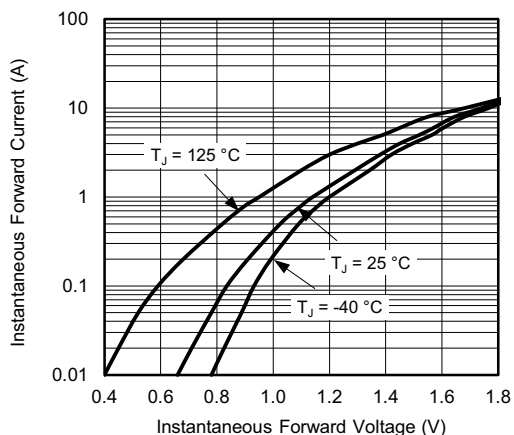


Fig. 3 - Typical Instantaneous Forward Characteristics

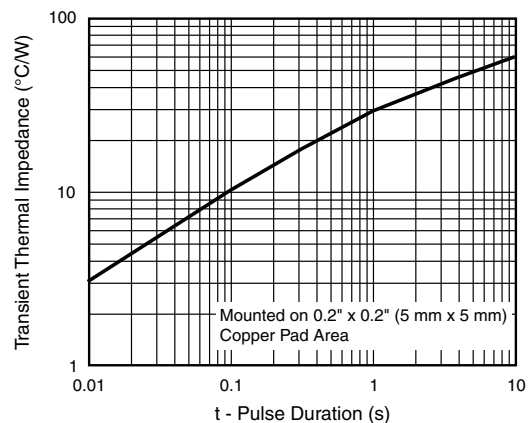
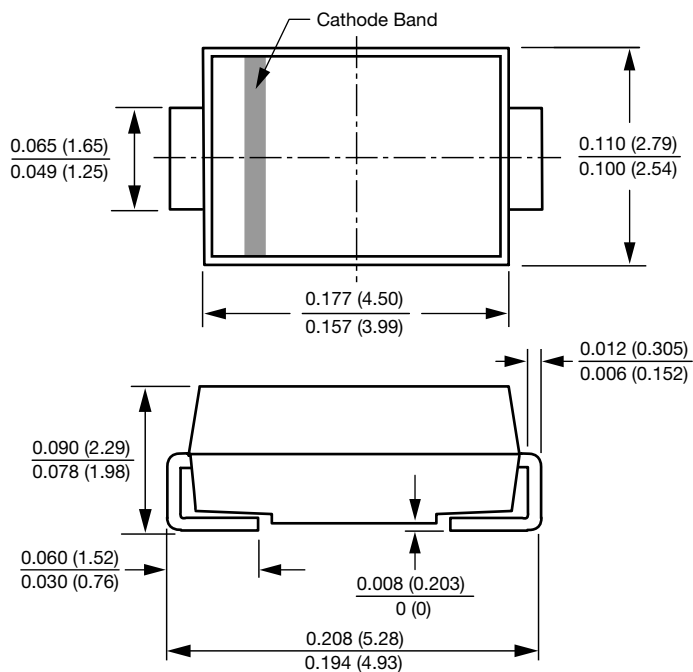


Fig. 6 - Typical Transient Thermal Impedance

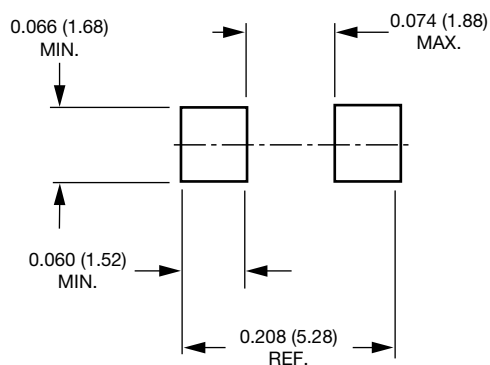


PACKAGE OUTLINE DIMENSIONS in inches (millimeters)

SMA (DO-214AC)

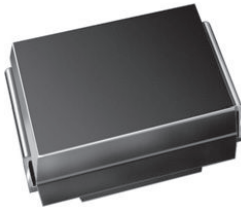


Mounting Pad Layout





Surface-Mount Fast Switching Rectifier



SMB (DO-214AA)

Cathode  Anode

FEATURES

- Low profile package
- Ideal for automated placement
- Glass passivated pellet chip junction
- Fast switching for high efficiency
- High forward surge capability
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- AEC-Q101 qualified available
 - Automotive ordering code: base P/NHE3 or PN/HM3
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



ADDITIONAL RESOURCES



TYPICAL APPLICATIONS

For use in fast switching rectification of power supply, inverters, converters, and freewheeling diodes for consumer, automotive, and telecommunication.

PRIMARY CHARACTERISTICS

$I_{F(AV)}$	1.5 A
V_{RRM}	50 V, 100 V, 200 V, 400 V, 600 V, 800 V
I_{FSM}	50 A
t_{rr}	150 ns, 250 ns, 500 ns
V_F	1.3 V
T_J max.	150 °C
Package	SMB (DO-214AA)
Circuit configuration	Single

MECHANICAL DATA

Case: SMB (DO-214AA)

Molding compound meets UL 94 V-0 flammability rating

Base P/N-E3 - RoHS-compliant, commercial grade

Base P/N-M3 - halogen-free, 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, M3, and HE3 suffix meets JESD 201 class 2 whisker test

Polarity: color band denotes cathode end

MAXIMUM RATINGS ($T_A = 25\text{ °C}$ unless otherwise noted)

PARAMETER	SYMBOL	RS2A	RS2B	RS2D	RS2G	RS2J	RS2K	UNIT
Device marking code		RA	RB	RD	RG	RJ	RK	
Maximum repetitive peak reverse voltage	V_{RRM}	50	100	200	400	600	800	V
Maximum RMS voltage	V_{RMS}	35	70	140	280	420	500	V
Maximum DC blocking voltage	V_{DC}	50	100	200	400	600	800	V
Maximum average forward rectified current at $T_L = 100\text{ °C}$	$I_{F(AV)}$	1.5						A
Peak forward surge current 8.3 ms single half sine-wave superimposed on rated load	I_{FSM}	50						A
Operating junction and storage temperature range	T_J, T_{STG}	-55 to +150						°C



ELECTRICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)

PARAMETER	TEST CONDITIONS		SYMBOL	RS2A	RS2B	RS2D	RS2G	RS2J	RS2K	UNIT
Maximum instantaneous forward voltage	1.5 A		V _F	1.3						V
Maximum DC reverse current at rated DC blocking voltage		T _A = 25 °C	I _R	5.0						μA
		T _A = 125 °C		200						
Maximum reverse recovery time	I _F = 0.5 A, I _R = 1.0 A, I _{rr} = 0.25 A		t _{rr}	150				250	500	ns
Typical junction capacitance	4.0 V, 1 MHz		C _J	20				17		pF

THERMAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)

PARAMETER	SYMBOL	RS2A	RS2B	RS2D	RS2G	RS2J	RS2K	UNIT
Typical thermal resistance	R _{θJA} ⁽¹⁾	55						°C/W
	R _{θJL} ⁽¹⁾	18						

Note

(1) Thermal resistance from junction to ambient and from junction to lead mounted on PCB with 0.27" x 0.27" (7.0 mm x 7.0 mm) copper pad

ORDERING INFORMATION (Example)

PREFERRED P/N	UNIT WEIGHT (g)	PREFERRED PACKAGE CODE	BASE QUANTITY	DELIVERY MODE
RS2J-E3/52T	0.096	52T	750	7" diameter plastic tape and reel
RS2J-E3/5BT	0.096	5BT	3200	13" diameter plastic tape and reel
RS2JHE3_A/H ⁽¹⁾	0.096	H	750	7" diameter plastic tape and reel
RS2JHE3_A/I ⁽¹⁾	0.096	I	3200	13" diameter plastic tape and reel
RS2J-M3/52T	0.096	52T	750	7" diameter plastic tape and reel
RS2J-M3/5BT	0.096	5BT	3200	13" diameter plastic tape and reel

Note

(1) AEC-Q101 qualified

RATINGS AND CHARACTERISTICS CURVES ($T_A = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)

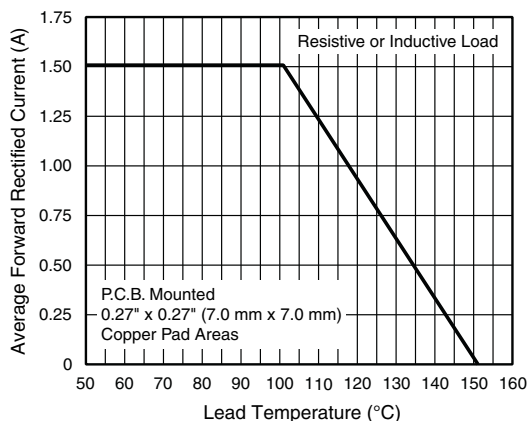


Fig. 1 - Forward Current Derating Curve

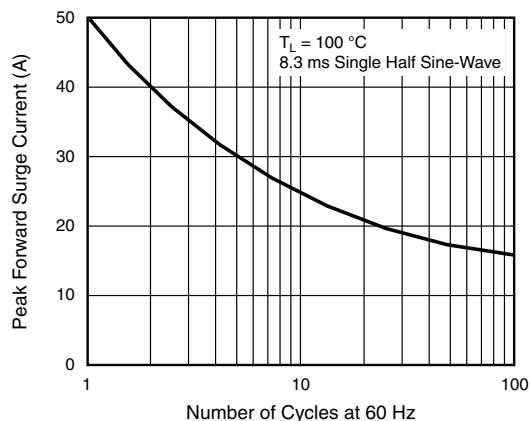


Fig. 2 - Maximum Non-Repetitive Peak Forward Surge Current

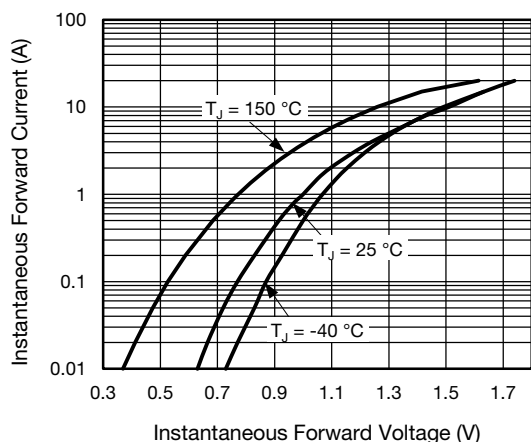


Fig. 3 - Typical Instantaneous Forward Characteristics

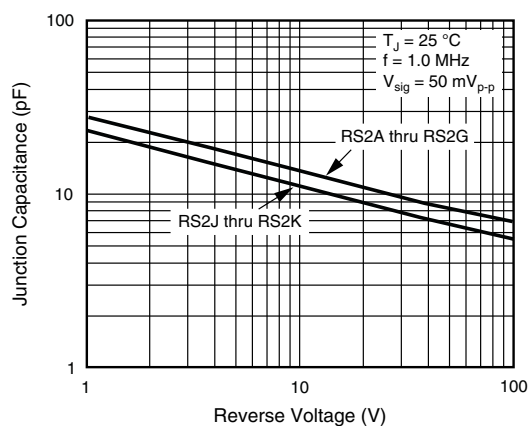


Fig. 5 - Typical Junction Capacitance

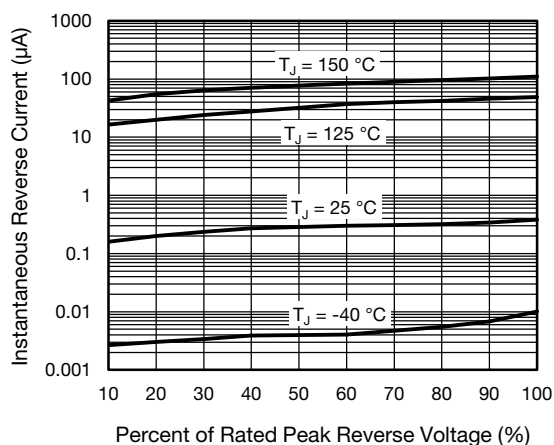
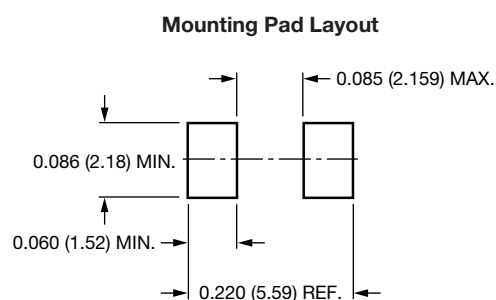
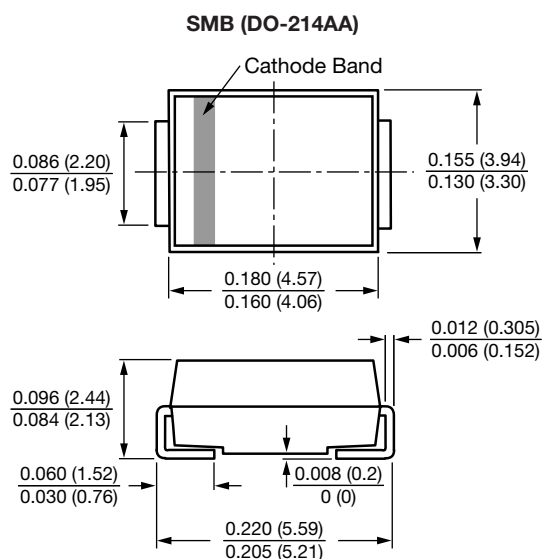


Fig. 4 - Typical Reverse Characteristics

PACKAGE OUTLINE DIMENSIONS in inches (millimeters)


Surface-Mount Fast Switching Rectifier


SMC (DO-214AB)

Cathode  Anode

ADDITIONAL RESOURCES



FEATURES

- Low profile package
- Ideal for automated placement
- Glass passivated pellet chip junction
- Fast switching for high efficiency
- High forward surge capability
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- AEC-Q101 qualified available
 - Automotive ordering code: base P/NHE3 or P/NHM3
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT
HALOGEN
FREE

TYPICAL APPLICATIONS

For use in fast switching rectification of power supply, inverters, converters, and freewheeling diodes for consumer, automotive and telecommunication.

MECHANICAL DATA

Case: SMC (DO-214AB)

Molding compound meets UL 94 V-0 flammability rating

Base P/N-E3 - RoHS-compliant, commercial grade

Base P/N-M3 - halogen-free, RoHS-compliant, commercial grade

Base P/NHE3_X - RoHS-compliant and AEC-Q101 qualified

Base P/NHM3_X - halogen-free, 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, M3, HE3 and HM3 suffix meets JESD 201 class 2 whisker test

Polarity: color band denotes cathode end

PRIMARY CHARACTERISTICS	
$I_{F(AV)}$	3.0 A
V_{RRM}	50 V, 100 V, 200 V, 400 V, 600 V, 800 V
I_{FSM}	100 A
t_{rr}	150 ns, 250 ns, 500 ns
V_F	1.3 V
T_J max.	150 °C
Package	SMC (DO-214AB)
Circuit configuration	Single

MAXIMUM RATINGS ($T_A = 25\text{ °C}$ unless otherwise noted)								
PARAMETER	SYMBOL	RS3A	RS3B	RS3D	RS3G	RS3J	RS3K	UNIT
Device marking code		RA	RB	RD	RG	RJ	RK	
Maximum repetitive peak reverse voltage	V_{RRM}	50	100	200	400	600	800	V
Maximum RMS voltage	V_{RMS}	35	70	140	280	420	500	V
Maximum DC blocking voltage	V_{DC}	50	100	200	400	600	800	V
Maximum average forward rectified current at $T_L = 75\text{ °C}$	$I_{F(AV)}$	3.0						A
Peak forward surge current 8.3 ms single half sine-wave superimposed on rated load	I_{FSM}	100						A
Operating junction and storage temperature range	T_J, T_{STG}	-55 to +150						°C

**ELECTRICAL CHARACTERISTICS** ($T_A = 25^\circ\text{C}$ unless otherwise noted)

PARAMETER	TEST CONDITIONS		SYMBOL	RS3A	RS3B	RS3D	RS3G	RS3J	RS3K	UNIT
Maximum instantaneous forward voltage	2.5 A		V _F	1.3						V
Maximum DC reverse current at rated DC blocking voltage		T _A = 25 °C	I _R	10						μA
		T _A = 125 °C		250						
Maximum reverse recovery time	I _F = 0.5 A, I _R = 1.0 A, I _{rr} = 0.25 A		t _{rr}	150				250	500	ns
Typical junction capacitance	4.0 V, 1 MHz		C _J	44				34		pF

THERMAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

PARAMETER	SYMBOL	RS3A	RS3B	RS3D	RS3G	RS3J	RS3K	UNIT
Typical thermal resistance	R _{θJA} ⁽¹⁾	50						°C/W
	R _{θJL} ⁽¹⁾	15						

Note

⁽¹⁾ Thermal resistance from junction to ambient and from junction to lead mounted on PCB with 0.3" x 0.3" (8.0 mm x 8.0 mm) copper pad area

ORDERING INFORMATION (Example)

PREFERRED P/N	UNIT WEIGHT (g)	PREFERRED PACKAGE CODE	BASE QUANTITY	DELIVERY MODE
RS3J-E3/57T	0.211	57T	850	7" diameter plastic tape and reel
RS3J-E3/9AT	0.211	9AT	3500	13" diameter plastic tape and reel
RS3JHE3_A/H ⁽¹⁾	0.211	H	850	7" diameter plastic tape and reel
RS3JHE3_A/I ⁽¹⁾	0.211	I	3500	13" diameter plastic tape and reel
RS3J-M3/57T	0.211	57T	850	7" diameter plastic tape and reel
RS3J-M3/9AT	0.211	9AT	3500	13" diameter plastic tape and reel
RS3JHM3_A/H ⁽¹⁾	0.211	H	850	7" diameter plastic tape and reel
RS3JHM3_A/I ⁽¹⁾	0.211	I	3500	13" diameter plastic tape and reel

Note

⁽¹⁾ AEC-Q101 qualified

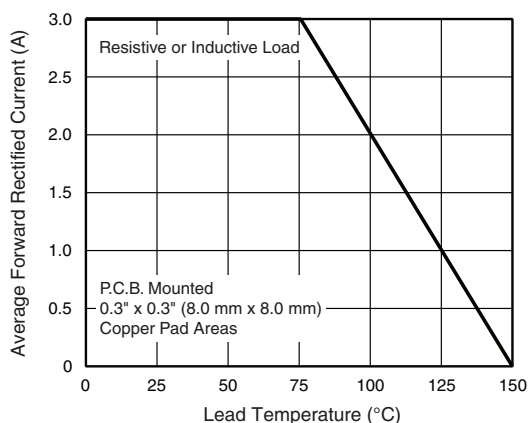
RATINGS AND CHARACTERISTICS CURVES ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Fig. 1 - Forward Current Derating Curve

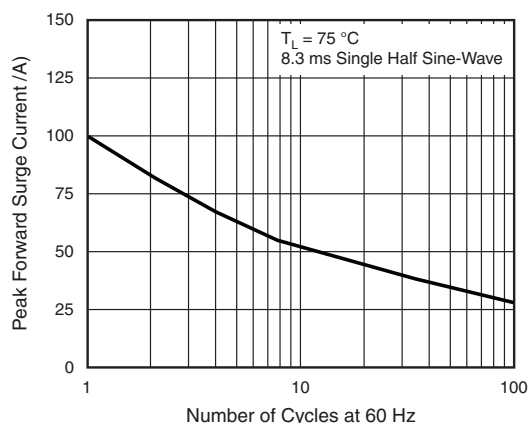


Fig. 2 - Maximum Non-Repetitive Peak Forward Surge Current

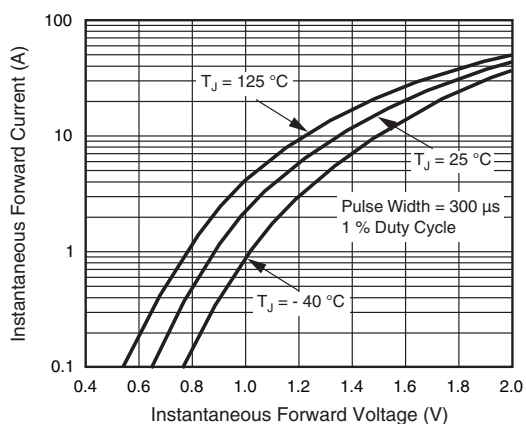


Fig. 3 - Typical Instantaneous Forward Characteristics

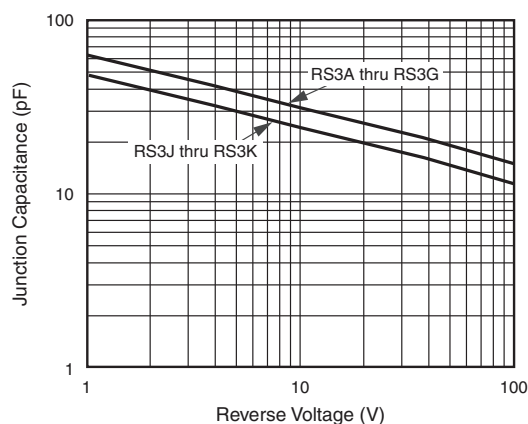


Fig. 5 - Typical Junction Capacitance

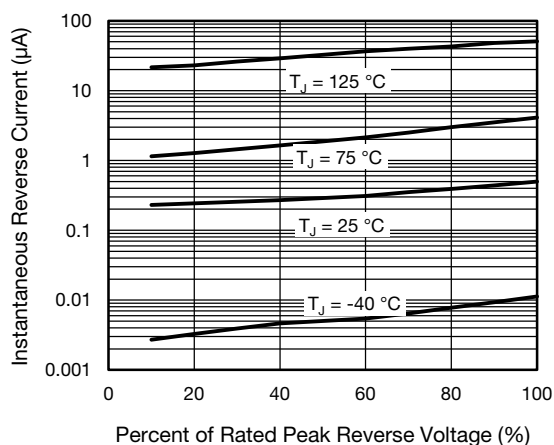


Fig. 4 - Typical Reverse Characteristics

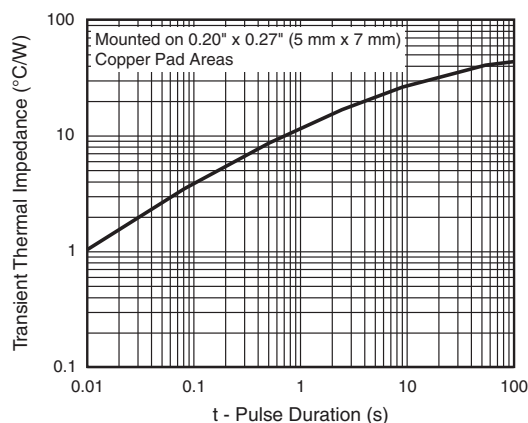
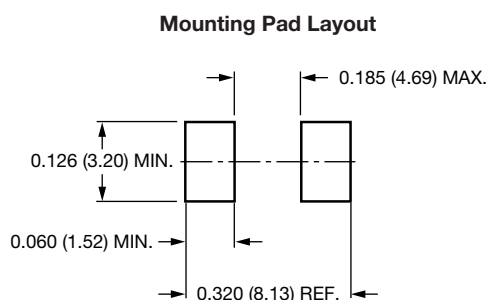
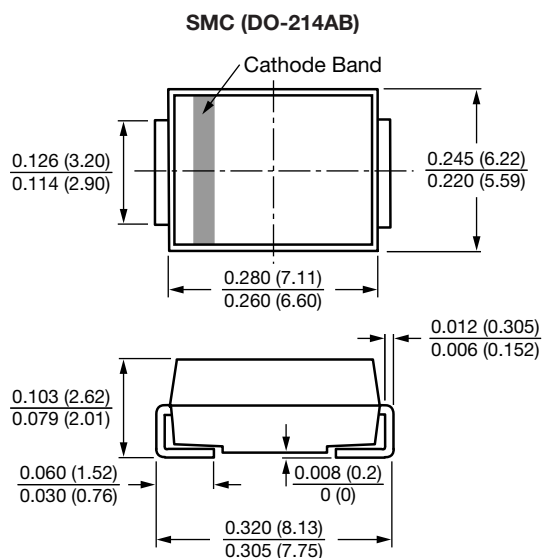


Fig. 6 - Typical Transient Thermal Impedance

PACKAGE OUTLINE DIMENSIONS in inches (millimeters)




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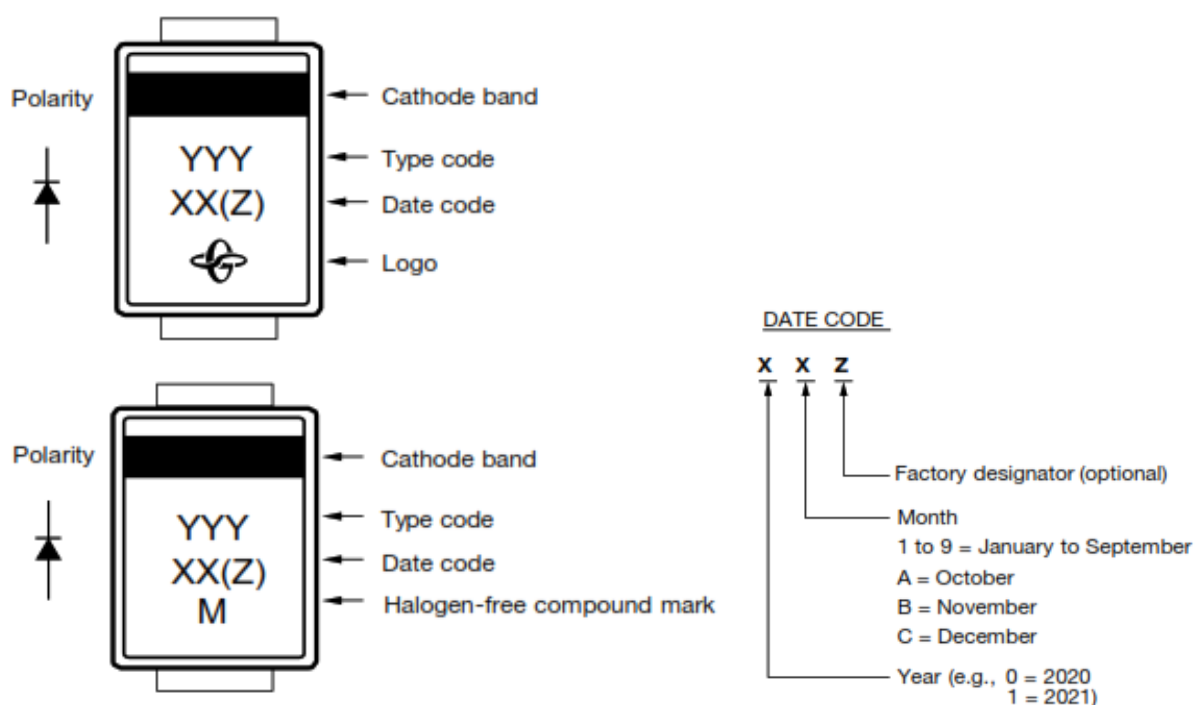
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5. Body Marking

(Visit <https://www.vishay.com/docs/88912/diodesgroupbodymarking.pdf> for the latest marking version)



Notes

- Type code refers to individual datasheet
- Cathode band: marked with one or more lines



6. Process Flow

Changeover Key		Inspection Key		For Process:		Doc. #		FC-055-Folded (T)				
P=Product		A=Automatic		Folded SMA&SMB&SMC Process		Rev. #		17				
T=Tooling		M=Manual		For Sites: VGSC		Rev. Date :		2023/10/31				
S=Software		V=Visual				Vishay GS Part #		FSMX Process				
D=Dunnage		Q=Quality Audit		Prepared By: Tracy Mu		Customer Part #						
L=Label	Symbol Instructions											
Op-Seq	Fab/Assem	Move	Store/Get	Inspect	Rework	Scrap/Contain	Changeover	Operation Description	Special Char. Class	Significant Product Characteristics (Outputs)	Special Char. Class	Significant Process Characteristics (Inputs)
	◇	○	△	□	⬆	●						
OP-049								Lead Frame				
								Solder Paste				
								Die				
								Flux (Only for products with pre-bump dice, for example, it's not required for the BYG series with Non-bump dice)				
		◇						Auto Soldering	DD	Bottom solder area and position		
OP-515	◇							Post Cleaning				
OP-205/206								Molding compound				
	◇							Transfer molding				
OP-221	◇							Trimming				
OP-215	◇							Post molding curing				
OP-340								Pure tin solder ball				
	◇							Pure tin strip plating	DT	PB content in pure-tin plating layer	DT	PB content in pure-tin plating bath
								Plating solderability test Plating thickness measurement	DD	Plating solderability Plating thickness Aging test		
OP-220	◇							Forming				
								Forming dimension measurement	DD	Forming dimension		
OP-535 or Subcon (None-automotive)								Carrier Tape				
								Cover Tape				
								Reel				
	◇							Test/Mark/Mechanical/Tape or Sub-con(Only for None automotive)	DD	Elec:IR/BVR/VF/TRR(FER)		
								Tape peeling force test	DD	Tape peeling force		
OP-550								Final inspection				
GSC-4775								Outgoing quality control (Elec.&Mech.)				
OP-600	◇							Packing				



7. Unit Pack Specifications

PACKAGING ORDERING CODE		
ANTI-STATIC PACKAGE CODE	PREFERRED PACKAGE CODE	PACKAGING DESCRIPTION
51, A		Bulk
52, 52T	P	SMB (DO-214AA) / SMBG (DO-215AA), 12 mm tape, 7" diameter plastic reel
2D	P	SM5-8A (DO-218AB), 24 mm tape, 13" diameter plastic reel, anode towards sprocket hole
2E, K		SM5-8A (DO-218AB), 24 mm tape, 13" diameter plastic reel, cathode towards sprocket hole
2M, P		Tube packaging for 5KP/6KA type lead formed components
53, B		26 mm horizontal taping and ammo box packaging
54, C	P	52.4 mm horizontal tape, 13" diameter paper reel
5A, 5AT	P	SMA (DO-214AC), 12 mm tape, 13" diameter plastic reel
5B, 5BT	P	SMB (DO-214AA) / SMBG (DO-215AA), 12 mm tape, 13" diameter plastic reel
5CA	P	GF1 (DO-214BA), 12 mm tape, 13" diameter plastic reel
57, 57T	P	SMC (DO-214AB) / SMCG (DO-215AB), 16 mm tape, 7" diameter plastic reel
6A	P	SlimSMA (DO-221AC), 12 mm tape, 7" diameter plastic reel
6B	P	SlimSMA (DO-221AC), 12 mm tape, 13" diameter plastic reel
9A, 9AT	P	SMC (DO-214AB) / SMCG (DO-215AB), 16 mm tape, 13" diameter plastic reel
61, 61T	P	SMA (DO-214AC), 12 mm tape, 7" diameter plastic reel
67A	P	GF1 (DO-214BA), 12 mm tape, 7" diameter plastic reel
72, E	P	Bulk pack for bridge and special axial-leaded formed devices
73, D		52.4 mm horizontal tape and ammo box packaging
77	P	DFS bridge, 16 mm tape, 13" diameter paper reel
80	P	MB-S (TO-269AA) bridge, 12 mm tape, 13" diameter paper reel
81	P	D ² PAK (TO-263AB) 24 mm tape, 13" diameter reinforced hub plastic reel
8W	P	D ² PAK (TO-263AB) (wire bond) 24 mm tape, 13" diameter reinforced hub plastic reel
83	P	GL34 (DO-213AA) 8 mm tape, 13" diameter plastic reel
84A	P	SMP (DO-220AA) 12 mm tape, 7" diameter plastic reel
85A	P	SMP (DO-220AA) 12 mm tape, 13" diameter plastic reel
86A	P	SMPC (TO-277A), 12 mm tape, 7" diameter plastic reel
87A	P	SMPC (TO-277A), 12 mm tape, 13" diameter plastic reel
89A	P	MicroSMP (DO-219AD), 8 mm tape, 7" diameter plastic reel
45, P	P	Anti-static tube packaging for Bridge and Power Pack
4W, P	P	Anti-static tube packaging for wire bond TO-220, ITO-220, TO-262 and TO-263
96	P	GL41 (DO-213AB), 12 mm tape, 7" diameter plastic reel
97	P	GL41 (DO-213AB), 12 mm tape, 13" diameter plastic reel
98	P	GL34 (DO-213AA), 8 mm tape, 7" diameter plastic reel
100, V		MPG06 pseudo radial tape, cathode first out of ammo pack
H	P	Tape in 7" diameter plastic reel
I	P	Tape in 13" diameter plastic reel
TR	P	SMA (DO-214AC), 12 mm tape, 7" diameter plastic reel ⁽¹⁾
TR3	P	SMA (DO-214AC), 12 mm tape, 13" diameter plastic reel ⁽¹⁾



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	mm
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, TD2. 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")	

SURFACE MOUNT TAPE AND REEL PACKAGING

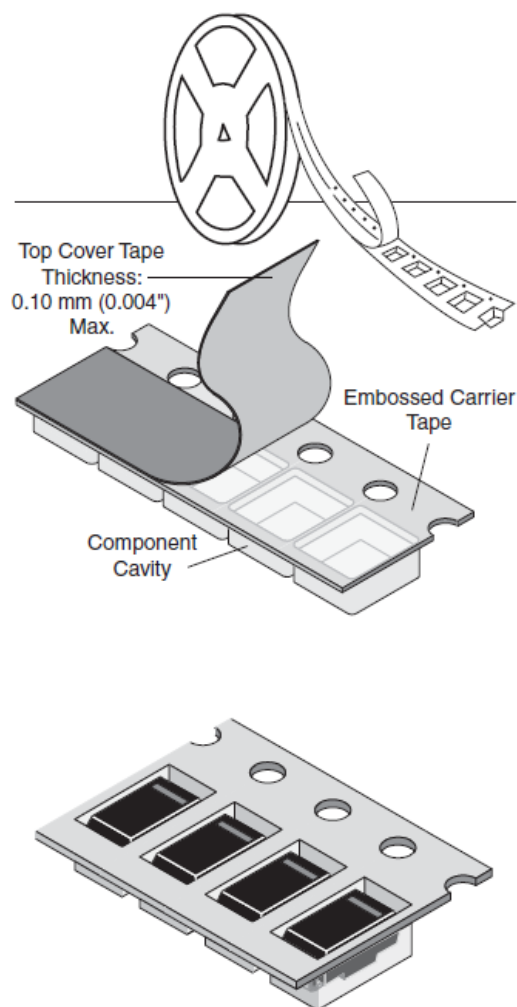


Fig. 5

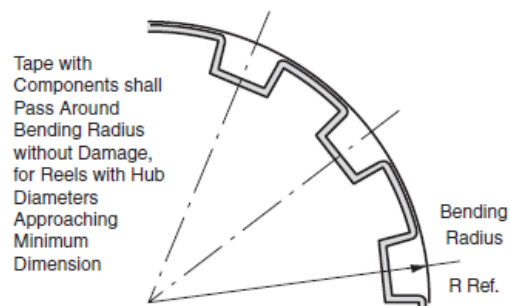


Fig. 6

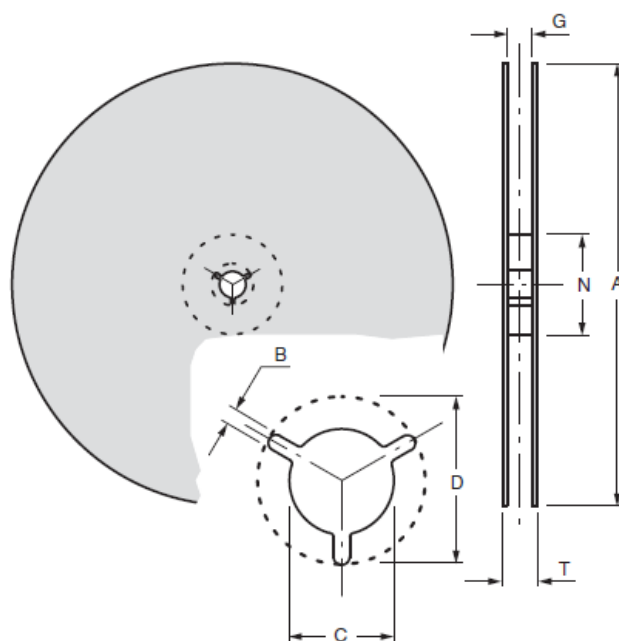


Fig. 7

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

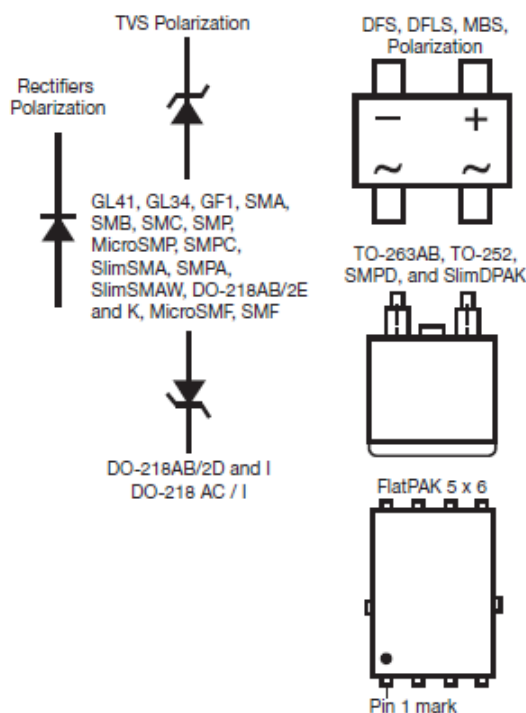
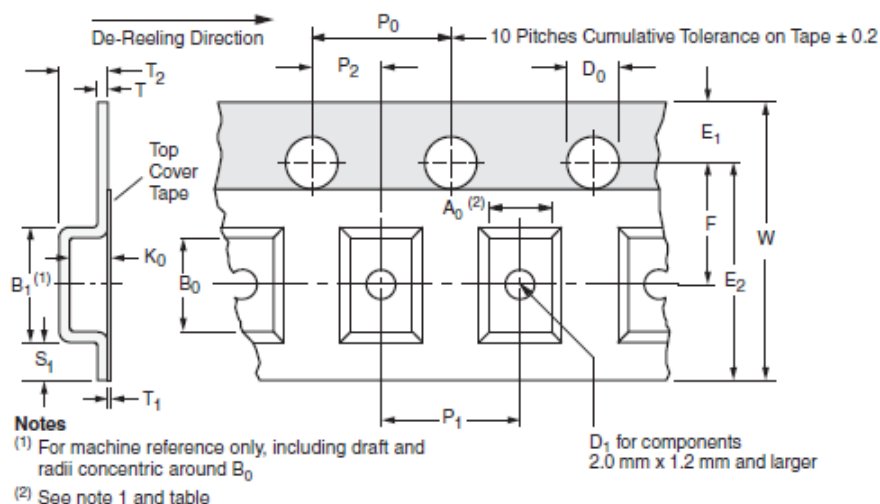


Fig. 8



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 ± 0.004)	1.75 ± 0.1 (0.069 ± 0.004)	4.0 ± 0.1 (0.157 ± 0.004)	2.0 ± 0.05 (0.079 ± 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 ± 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)							
SMC (DO-214AB) / SMCG (DO-215AB)	16 (0.630)	12.1 (0.476)		14.25 (0.561)	7.5 ± 0.1 (0.295 ± 0.004)	12.0 ± 0.10 (0.472 ± 0.004)		2.64 (0.104)	16.3 (0.642)		
SlimDPAK (TO-252AE)								2.0 (0.079)			
DFS								3.91 (0.154)			
D ² PAK (TO-263AB) DO-218AB / AC	24 (0.945)	20.1 (0.791)		22.25 (0.876)	11.5 ± 0.1 (0.453 ± 0.004)	16.0 ± 0.10 (0.630 ± 0.004)		5.31 (0.209)	24.3 (0.957)		
SMPD (TO-263AC)						12.0 ± 0.10 (0.472 ± 0.004)		2.35 (0.093)			
SlimSMA (DO-221AC) / SMPA (DO-221BC)	12 (0.472)	6.2 (0.244)		10.25 (0.404)	5.5 ± 0.05 (0.217 ± 0.002)	4.0 ± 0.10 (0.157 ± 0.004)		1.53 (0.060)	12.3 (0.484)		
SlimSMAW (DO-221AD)								1.61 (0.063)			
FlatPAK 5 x 6						6.4 (0.252)		8.0 ± 0.10 (0.315 ± 0.004)		1.20 ± 0.10 (0.047 ± 0.004)	

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

8. Electrical Parameters Verification

RS1K-E3 - Electrical Parametric Verification

		Value
<i>IR (uA)<5.0</i> <i>VR=800V</i> <i>Ta=25°C</i>	<i>max</i>	0.051
	<i>min</i>	0.032
	<i>avg</i>	0.040
	<i>sigma</i>	0.004
<i>IR (uA)<50</i> <i>VR=800V</i> <i>Ta=125°C</i>	<i>max</i>	11.87
	<i>min</i>	10.41
	<i>avg</i>	10.98
	<i>sigma</i>	0.37
<i>VF (V)<1.3</i> <i>IF=1.0A</i> <i>Ta=25°C</i>	<i>max</i>	1.148
	<i>min</i>	1.075
	<i>avg</i>	1.102
	<i>sigma</i>	0.019
<i>Trr (ns) <500</i> <i>@IF=0.5A, IR=1.0A</i> <i>Irr=0.25A</i>	<i>max</i>	151.0
	<i>min</i>	121.0
	<i>avg</i>	138.8
	<i>sigma</i>	7.3
<i>Cj (pF), Typ: 7</i> <i>@1Mhz/4V</i>	<i>max</i>	6.0
	<i>min</i>	5.1
	<i>avg</i>	5.4
	<i>sigma</i>	0.2

RS2K-E3 - Electrical Parametric Verification

		Value
<i>IR (uA)<5.0</i> <i>VR=800V</i> <i>Ta=25°C</i>	<i>max</i>	0.084
	<i>min</i>	0.059
	<i>avg</i>	0.068
	<i>sigma</i>	0.007
<i>IR (uA)<200</i> <i>VR=800V</i> <i>Ta=125°C</i>	<i>max</i>	19.42
	<i>min</i>	11.53
	<i>avg</i>	14.51
	<i>sigma</i>	1.67
<i>VF (V)<1.3</i> <i>IF=1.5A</i> <i>Ta=25°C</i>	<i>max</i>	1.102
	<i>min</i>	1.031
	<i>avg</i>	1.056
	<i>sigma</i>	0.015
<i>Trr (ns)<500</i> <i>@IF=0.5A, IR=1.0A</i> <i>Irr=0.25A</i>	<i>max</i>	148.0
	<i>min</i>	121.0
	<i>avg</i>	136.7
	<i>sigma</i>	7.2
<i>Cj (pF), Typ: 17</i> <i>@1Mhz/4V</i>	<i>max</i>	15.5
	<i>min</i>	13.0
	<i>avg</i>	13.5
	<i>sigma</i>	0.5

RS3K-E3 - Electrical Parametric Verification

		Value
<i>IR (uA)<10</i> <i>VR=800V</i> <i>Ta=25°C</i>	<i>max</i>	0.147
	<i>min</i>	0.127
	<i>avg</i>	0.138
	<i>sigma</i>	0.005
<i>IR (uA)<250</i> <i>VR=800V</i> <i>Ta=125°C</i>	<i>max</i>	22.80
	<i>min</i>	16.35
	<i>avg</i>	18.81
	<i>sigma</i>	1.54
<i>VF (V)<1.3</i> <i>IF=2.5A</i> <i>Ta=25°C</i>	<i>max</i>	0.937
	<i>min</i>	0.903
	<i>avg</i>	0.917
	<i>sigma</i>	0.009
<i>Trr (ns)<500</i> <i>@IF=0.5A, IR=1.0A</i> <i>Irr=0.25A</i>	<i>max</i>	176.0
	<i>min</i>	148.0
	<i>avg</i>	161.9
	<i>sigma</i>	8.8
<i>Cj (pF), Typ: 34</i> <i>@1Mhz/4V</i>	<i>max</i>	32.2
	<i>min</i>	27.1
	<i>avg</i>	29.0
	<i>sigma</i>	1.2



9. Reliability Qualification Report

Request Part Number	RS1x/RS2x/RS3x-E3; RS1x/RS2x/RS3x-M3		
Package	DO-214AA/AB/AC	Ni/Au	92.5PB / SSN / 2.5Ag
FAB	STD		

Package Qualification:	DO-214AA/AB/AC		
Metalization	Ni/Au		
Die attach	92.5PB / SSN / 2.5Ag		
Package Process Used	RS1K-E3	DO-214AC	
	RS2K-E3	DO-214AA	
	RS3K-E3	DO-214AB	

FAB Process:	Requested	STD	
FAB Process Used	RS1K-E3	STD	
	RS2K-E3	STD	
	RS3K-E3	STD	

Test Item & Condition	Duration	RS1K-E3	RS2K-E3	RS3K-E3
HTRB	Ta / Bias	140°C / 800V	140°C / 800V	140°C / 800V
	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
	4KV			0 / 10
	6KV	0 / 10	0 / 10	
ESD(CDM)	500V	0 / 10	0 / 10	0 / 10
	1000V	0 / 10	0 / 10	0 / 10
Pre-conditioning		0 / 308	0 / 308	0 / 308
@Bake:125°C/24H --> Moisture Soak:85°C/85%RH/168H --> Reflow 3 times:TP=260°C				
Temperature Cycling @-55°C / +150°C / 30min.	168 Cyps	0 / 77	0 / 77	0 / 77
	500 Cyps	0 / 77	0 / 77	0 / 77
	1000 Cyps	0 / 77	0 / 77	0 / 77
UHASt @130°C/85%R.H. / 33.3Psia	48 Hrs	0 / 77	0 / 77	0 / 77
	96 Hrs	0 / 77	0 / 77	0 / 77
IOL @DTJ=100°C / TON=TOFF=2min.	2520 Cyps	0 / 77	0 / 77	0 / 77
	7500 Cyps	0 / 77	0 / 77	0 / 77
	15K Cyps	0 / 77	0 / 77	0 / 77
HAST @130°C / 85%R.H. / 80%VR (max42V)/33.3Psia	48 Hrs	0 / 77	0 / 77	0 / 77
	96 Hrs	0 / 77	0 / 77	0 / 77

10. Soldering Profile

Soldering Process

VISHAY GENERAL SEMICONDUCTOR RECOMMENDED SOLDERING PROCESS

Through hole device (THD) and surface mount device (SMD) imply different soldering technologies leading to different constraints.

In THD, the package body is exposed to relatively low temperatures ($< 150^{\circ}\text{C}$) because the lead extremities are only dipped in the soldering alloy, whereas in SMD the whole package body is exposed to a very high temperature ($> 240^{\circ}\text{C}$) during reflow soldering process.

In addition, molding compounds used for encapsulation absorb moisture from the ambient medium. During rapid heating in solder reflow process; this absorbed moisture can vaporize, generating pressure at lead frame pad/silicon to plastic interfaces in the package, with a risk of package cracking and potential degradation of device reliability.

Wave soldering with SMD packages is not recommended because the thermal shock associated with package body solder dipping may induce internal structural damage to the package (interface delamination) that may affect long term reliability.

SMD package characterizations performed as a standard by Vishay only induce Solder Reflow Resistance assessment.

JEDEC® JESD A111 recommends that wave soldering of SMD packages should be evaluated by the USER, because the stress induced inside the package is very dependant of solder process parameters.

Due to the higher melting point of lead (Pb)-free alloys, the temperature of the solder pot will also increase to improve solderability and shorten contact times. For AgSnCu with melting point of 217°C , the solder pot temperature will be between 250°C to 270°C or as high as 260°C to 280°C for SnCu.

RECOMMENDED WAVE SOLDERING PROFILE FOR THROUGH HOLE COMPONENTS

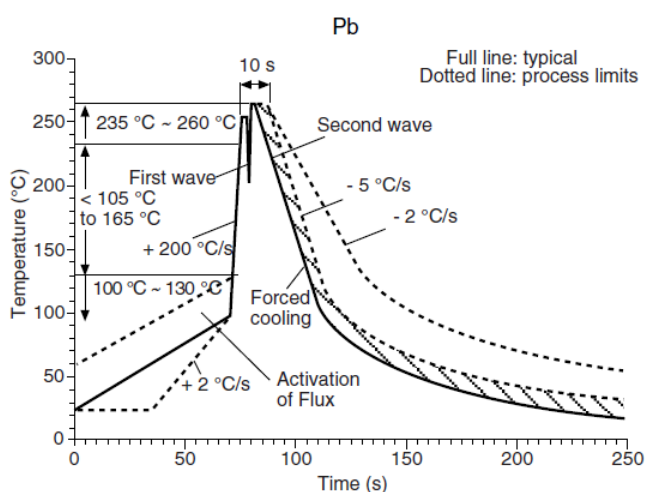
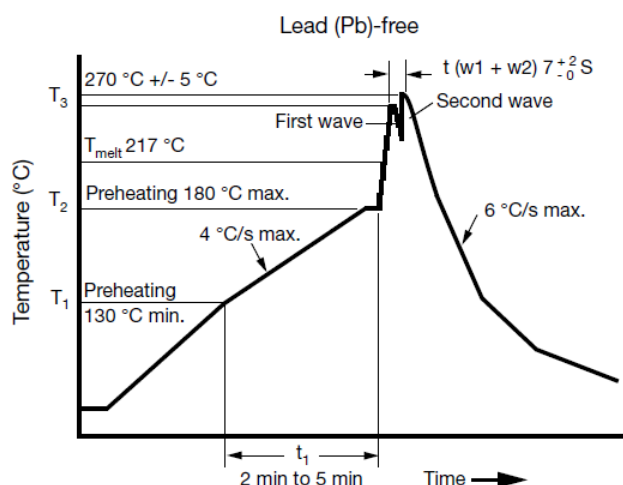


Fig. 1



Notes

- Temperature jump from T_2 to T_3 (w_1): 150°C max.
- Time from 25°C to T_3 (wave temp.): 8 min max.

Fig. 2

REFLOW FOR SURFACE MOUNTED COMPONENTS

TABLE 1 - CLASSIFICATION REFLOW PROFILE		
PROFILE FEATURE	Sn-Pb EUTECTIC ASSEMBLY	LEAD (Pb)-FREE ASSEMBLY
Preheat and soak		
Temperature min. ($T_{Smin.}$)	100 °C	150 °C
Temperature max. ($T_{Smax.}$)	150 °C	200 °C
Time ($T_{Smin.}$ to $T_{Smax.}$) (t_s)	60 s to 120 s	60 s to 120 s
Average ramp-up rate ($T_{Smax.}$ to T_p)	3 °C/s maximum	
Liquidus temperature (T_L)	183 °C	217 °C
Time to liquidus (t_L)	60 s to 150 s	60 s to 150 s
Peak package temperature (T_p) ⁽¹⁾	See classification temperature in table 2	See classification temperature in table 3
Time (t_p) ⁽²⁾ with 5 °C of the specified classification temperature (T_C)	20 s ⁽²⁾	30 s ⁽²⁾
Average ramp-down rate (T_p to $T_{Smax.}$)	6 °C/s maximum	
Time 25 °C to peak temperature	6 min maximum	8 min maximum

Notes

⁽¹⁾ Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and user maximum

⁽²⁾ Tolerance for time at peak profile temperature (T_p) is defined as a supplier minimum and user maximum

REFLOW PROFILE

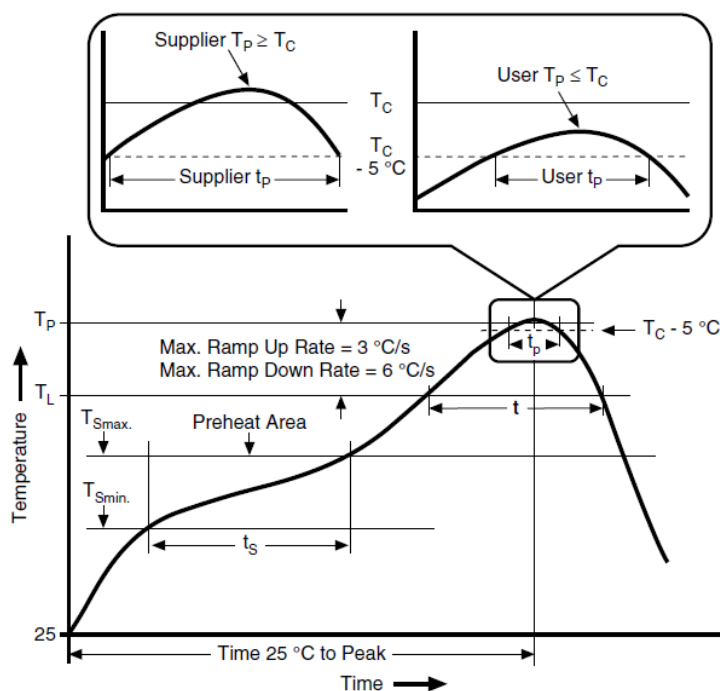


Fig. 3



TABLE 2 - Sn-Pb EUTECTIC PROCESS PACKAGE PEAK REFLOW TEMPERATURES

PACKAGE THICKNESS	VOLUME mm ³ < 350	VOLUME mm ³ ≥ 350
< 2.5 mm	235 °C	220 °C
≥ 2.5 mm	220 °C	220 °C

TABLE 3 - LEAD (Pb) - FREE PROCESS PACKAGE CLASSIFICATION REFLOW TEMPERATURES

PACKAGE THICKNESS	VOLUME mm ³ < 350	VOLUME mm ³ 350 TO 2000	VOLUME mm ³ > 2000
< 1.6 mm	260 °C	260 °C	260 °C
1.6 mm to 2.5 mm	260 °C	250 °C	245 °C
≥ 2.5 mm	250 °C	245 °C	245 °C

Tolerance: The device manufacturer / supplier shall assure process compatibility up to and including the stated classification temperature at the rated MSL level.

Notes

- Package volume excludes external terminals (balls, bumps, lands, leads) and/or non-integral heatsinks
- The maximum component temperature reached during reflow depends on package thickness and volume. The use of convection reflow processes reduces the thermal gradients between packages. However, thermal gradients due to differences in thermal mass of SMD packages may still exist
- Recommended soldering process is accordance with J-STD-020D



11. Materials Declaration Report

Material Declaration Sheet								
Vishay General Semiconductor - VGSC								
						Date	15/Aug/23	
Part / Product Family Details								
Vishay Part Number	RoHS Compliance Status	RoHS Compliance Date Code dd-mm-yyyy	Total product Weight (gm)	Resistance value	3rd Party Lab ICP Test Report Available	Manufacturing Location	Number of Exemption used	
ES1A-(H)E3 to ES1K-(H)E3 ES1A-(H)E3 to ES1D-(H)E3 ES1A-(H)E3 to ES1K-(H)E3 S1A-(H)E3 to S1M-(H)E3 S1A-(H)E3 to S1MA-(H)E3 SA2B-E3 to SA2M-E3 SM1A2B-(H)E3 to SM1A2M-(H)E3 US1A-(H)E3 to US1G-(H)E3 US1A-(H)E3 to US1M-(H)E3 CS1D, CS1G, CS1U, CS1K, CS1MA, HIE3 CSA2D, CSA2G, CSA2J, CSA2K, CSA2M, HIE3	YES WITH EXEMPTION	01-12-2004	0.064	N/A	Yes	China	Two	
Material Composition								
Homogenous Material Name	Material Classification	Substance Name	CAS number	Weight of Substance (gm)	With respect to Homogenous Material		% with respect to Total Product Weight	RoHS Exemptions Used
					%	ppm		
Chip	Electronics (e.g. pc boards, displays)	Silicon and others (business secret)	-	0.00130	100.00	1000000	2.03	Exemption No.7(c)-I
Lead Frame	Copper (e.g. copper amounts in cable harnesses)	Copper	7440-50-8	0.02300	100.00	1000000	35.94	
Solder 92.5	Other special metals	Lead	7439-92-1	0.00231	92.50	925000	3.61	Exemption No.7(a)
		Tin	7440-31-5	0.00013	5.00	50000	0.20	
		Silver	7440-22-4	0.00006	2.50	25000	0.10	
Encapsulation	Other diureters	Quartz (SiO2)	14008-60-7	0.02492	70.00	700000	30.93	
		Epichlorohydrin, o-cresol, formaldehyde polymer	29690-52-2	0.00509	16.00	160000	6.89	
		Phenol-formaldehyde resin	9003-35-4	0.00427	12.00	120000	6.06	
		Antimony oxide (Sb2-O3)	1309-64-4	0.00036	1.00	10000	0.56	
		Carbon-Black	1333-86-4	0.00009	0.25	2500	0.14	
		Active & know-how	-	0.00027	0.75	7500	0.42	
Surface finish	Other special metals	Tin	7440-31-5	0.00160	100.00	1000000	2.30	
EU-RoHS Directive-2015/863/EU MCV of 0.1% by mass (1000 PPM) in homogeneous material for: Lead (Pb), Mercury, Hexavalent Chromium, Polybrominated Biphenyls (PBB), Polybrominated Diphenyl Ethers (PBDE) and MCV of 0.01% by mass cadmium, Bis(2-ethylhexyl) phthalate (DEHP), Butyl benzyl phthalate (BBP), Dibutyl phthalate (DBP) and Diisobutyl phthalate (DIBP)								
Exemption Used 7(a) - Lead in high melting temperature type solders (i.e. lead-based alloys containing 95 % by weight or more lead) 7(c)-I - Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectric devices, or in a glass or ceramic matrix compound								
Note > (i) All information is based on data received from our vendors & subjected to change without prior notice. (ii) Substance weight are derived from MSDS.								
Build Vishay into your Design			Vishay General Semiconductor - VGSC No.88 8th Avenue TEDA Tianjin P.R. China ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DISCRETE SEMICONDUCTORS AND PASSIVE COMPONENTS			One of the World's Largest Manufacturers of Discrete Semiconductors and Passive Components		

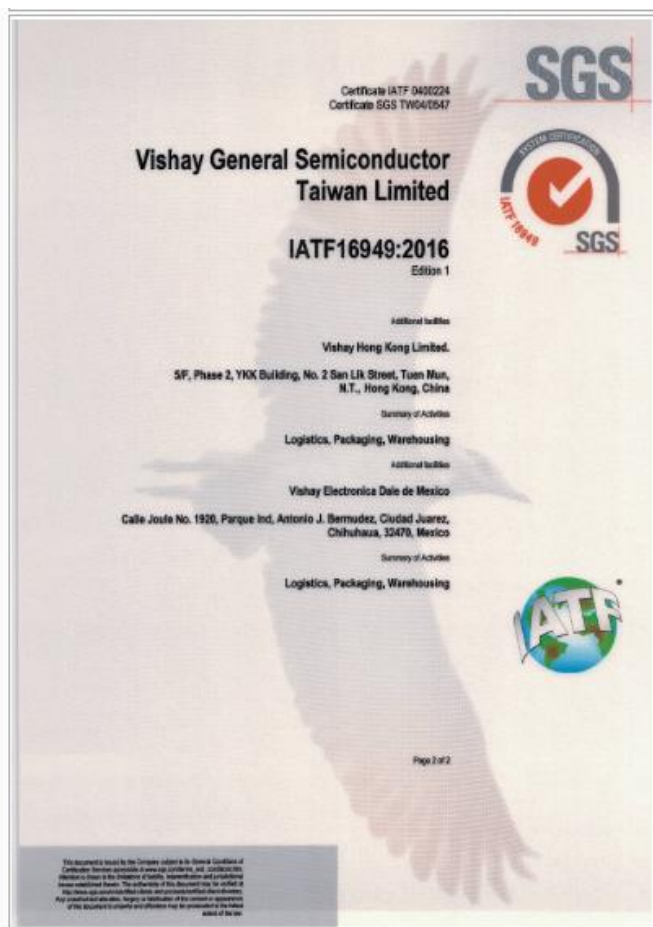
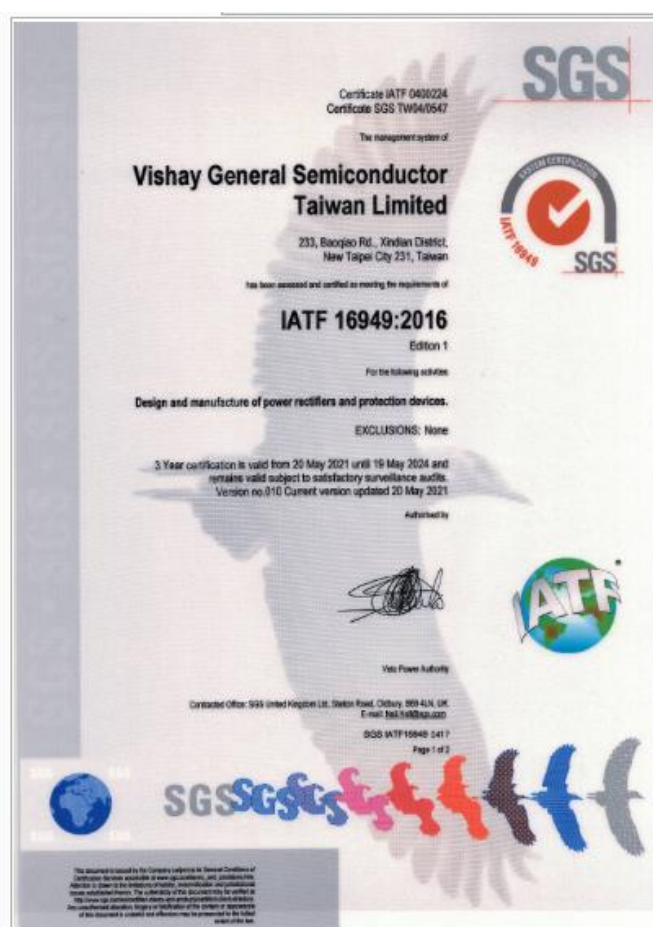


Material Declaration Sheet								
Vishay General Semiconductor - VGSC								
Date						15/Aug/23		
Part / Product Family Details								
Vishay Part Number	RoHS Compliance Status	RoHS Compliance Date Code dd-mm-yyyy	Total product Weight (gm)	Resistance value	3rd Party Lab ICP Test Report Available	Manufacturing Location	Number of Exemption used	
ES2A-HIE3 to ES2D-HIE3 ES2F-HIE3 to ES2G-HIE3 ES2H-HIE3 to ES2J-HIE3 MURS120-HIE3 to MURS160-HIE3 MURS240-HIE3 to MURS280-HIE3 MURS340-HIE3 to MURS380-HIE3 RS2A-HIE3 to RS2K-HIE3 S2A-HIE3 to S2M-HIE3 S2AHIE3_A to S2MHIE3_A USB260-HIE3 CS2D, CS2G, CS2J, CS2K, CS2M-HIE3	YES WITH EXEMPTION	01-12-2004	0.093	N/A	Yes	China	Two	
Material Composition								
Homogenous Material Name	Material Classification	Substance Name	CAS number	Weight of Substance (gm)	With respect to Homogenous Material		% with respect to Total Product Weight	RoHS Exemptions Used
Chip	Electronics (e.g. pc boards, displays)	Silicon and others (business secret)	-	0.00260	100.00	1000000	2.36	Exemption No:7(c)-4
Lead Frame	Copper (e.g. copper amounts in cable harnesses)	Copper	7440-50-5	0.00550	100.00	1000000	35.92	
Solder 92.5	Other special metals	Lead	7439-92-1	0.00315	92.50	925000	3.30	Exemption No:7(a)
		Tin	7440-31-5	0.00017	5.00	50000	0.16	
		Silver	7440-22-4	0.00009	2.50	25000	0.09	
Encapsulation	Other duromers	Quartz (SiO2)	14805-65-7	0.00423	70.00	700000	36.51	
		epichlorohydrin-o-cresol formalde polymer	29950-62-2	0.00762	16.00	160000	6.41	
		Phenol-formaldehyde resin	9003-35-4	0.00987	12.00	120000	6.31	
		Antimony oxide (SnO2-O3)	1309-64-4	0.00049	1.00	10000	0.53	
		Carbon-Black	1333-56-4	0.00012	0.25	2500	0.13	
		Additive & know-how	-	0.00036	0.75	7500	0.39	
Surface finish	Other special metals	Tin	7440-31-5	0.00210	100.00	1000000	2.26	
EU-RoHS Directive-2015/085/EU MCV of 0.1% by mass (1000 PPM) in homogeneous material for: Lead (Pb), Mercury, Hexavalent Chromium, Polybrominated Biphenyls (PBB), Polybrominated Diphenyl Ethers (PBDE) and MCV of 0.01% by mass cadmium, Bis(2-ethylhexyl) phthalate (DEHP), Butyl benzyl phthalate (BBP), Dibutyl phthalate (DBP) and Diisobutyl phthalate (DIBP)								
Exemption Used 7(a) - Lead in high melting temperature type solders (i.e. lead-based alloys containing 95 % by weight or more lead) 7(c)-4 - Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectric devices, or in a glass or ceramic matrix compound								
Note > (i) All information is based on data received from our vendors & subjected to change without prior notice. (ii) Substance weight are derived from MSDS.								
Build Vishay into your Design			Vishay General Semiconductor - VGSC No.85 8th Avenue TEDA Tianjin P.R. China ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DISCRETE SEMICONDUCTORS AND PASSIVE COMPONENTS			One of the World's Largest Manufacturers of Discrete Semiconductors and Passive Components		

Material Declaration Sheet								
Vishay General Semiconductor - VGSC								
Date						15/Aug/23		
Part / Product Family Details								
Vishay Part Number	RoHS Compliance Status	RoHS Compliance Date Code dd-mm-yyyy	Total product Weight (gm)	Resistance value	3rd Party Lab ICP Test Report Available	Manufacturing Location	Number of Exemption used	
ES3A-(0)E3 to ES3D-(0)E3 ES3F-(0)E3 to ES3G-(0)E3 ES3H-(0)E3 to ES3J-(0)E3 MURS320-(0)E3 to MURS360-(0)E3 SSA-(0)E3 to SSK-(0)E3 SSA-(0)E3 to SSF-(0)E3 SSA-(0)E3 to SSN-(0)E3 SSM-(0)E3 MRS460-E3 CS3D, CS3G, CS3J, CS3K, CS3M-(0)E3 1.50Kxx(A)-(0)E3 SMI51xx(A)-(0)E3 SMCxx(A)-(0)E3 SMCJxx(A)-(0)E3 1.50Kxx(A)-(0)E3 SMI51xx(A)-(0)E3 SMCxx(A)-(0)E3 SMCJxx(A)-(0)E3	YES WITH EXEMPTION	01-12-2004	0.21	N/A	Yes	China	Two	
Material Composition								
Homogenous Material Name	Material Classification	Substance Name	CAS number	Weight of Substance (gm)	With respect to Homogenous Material		% with respect to Total Product Weight	RoHS Exemptions Used
Chip	Electronics (e.g. pc boards, displays)	Silicon and others (business secret)	-	0.00496	100.00	1000000	2.36	Exemption No:7(c)-4
Lead Frame	Copper (e.g. copper amounts in cable harnesses)	Copper	7440-50-5	0.07366	100.00	1000000	34.79	
Solder 92.5	Other special metals	Lead	7439-92-1	0.00777	92.50	925000	3.70	Exemption No:7(a)
		Tin	7440-31-5	0.00042	5.00	50000	0.20	
		Silver	7440-22-4	0.00021	2.50	25000	0.10	
Encapsulation	Other duromers	Quartz (SiO2)	14805-65-7	0.00013	70.00	700000	40.54	
		epichlorohydrin-o-cresol formalde polymer	29950-62-2	0.01947	16.00	160000	9.27	
		Phenol-formaldehyde resin	9003-35-4	0.01460	12.00	120000	6.95	
		Antimony oxide (SnO2-O3)	1309-64-4	0.00122	1.00	10000	0.56	
		Carbon-Black	1333-56-4	0.00029	0.25	2500	0.14	
		Additive & know-how	-	0.00060	0.75	7500	0.43	
Surface finish	Other special metals	Tin	7440-31-5	0.00196	100.00	1000000	0.93	
EU-RoHS Directive-2015/085/EU MCV of 0.1% by mass (1000 PPM) in homogeneous material for: Lead (Pb), Mercury, Hexavalent Chromium, Polybrominated Biphenyls (PBB), Polybrominated Diphenyl Ethers (PBDE) and MCV of 0.01% by mass cadmium, Bis(2-ethylhexyl) phthalate (DEHP), Butyl benzyl phthalate (BBP), Dibutyl phthalate (DBP) and Diisobutyl phthalate (DIBP)								
Exemption Used 7(a) - Lead in high melting temperature type solders (i.e. lead-based alloys containing 95 % by weight or more lead) 7(c)-4 - Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectric devices, or in a glass or ceramic matrix compound								
Note > (i) All information is based on data received from our vendors & subjected to change without prior notice. (ii) Substance weight are derived from MSDS.								
Build Vishay into your Design			Vishay General Semiconductor - VGSC No.85 8th Avenue TEDA Tianjin P.R. China ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DISCRETE SEMICONDUCTORS AND PASSIVE COMPONENTS			One of the World's Largest Manufacturers of Discrete Semiconductors and Passive Components		

12. Certificates

Locations		Country	City	Certificates			
Front-End	Vishay Taiwan	Taiwan	Taipei	IATF16949	ISO9001	ISO14001	ISO45001
Front-End	Subcon	China	Jiangsu	IATF16949	ISO9001	ISO14001	ISO45001
Back-End	Vishay Tianjin	China	Tianjin	IATF16949	ISO9001	ISO14001	ISO45001



DNV·GL

MANAGEMENT SYSTEM CERTIFICATE

Certificate No.: 132948-2013-AQ-RGC-IATF
IATF Certificate No.: 0398942

Valid until:
12 May 2021 – 08 May 2024

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 Sapelo Drive, Katy, TX 77449-3184 USA



Sherif Mekky
Management Representative

Level of fulfillment of conditions as set out in the Certification Agreement may render this Certificate invalid.
AC0802100 UNB7 DNV GL - Business Assurance, 1400 Sapelo Drive, Katy, TX 77449, Tel.: +1-281-590-1238, www.dnvgl.com

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DNV·GL

Certificate No.: 132948-2013-AQ-RGC-IATF
IATF Certificate No.: 0398942
Place and date: Katy, TX, 12 May 2021

Appendix to Certificate

Vishay General Semiconductor (China) Co., Ltd.

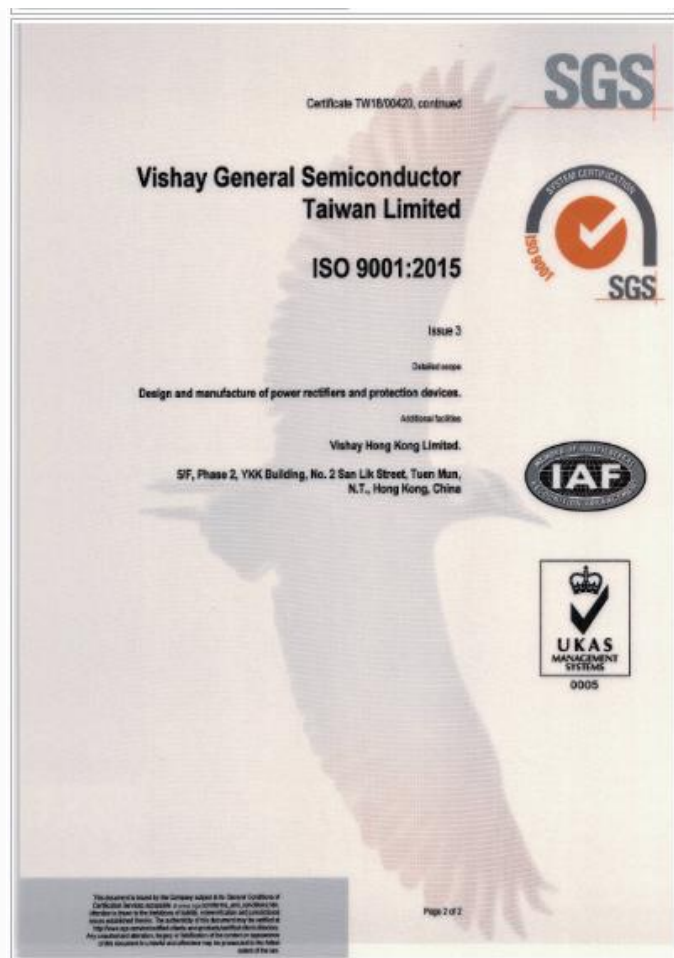
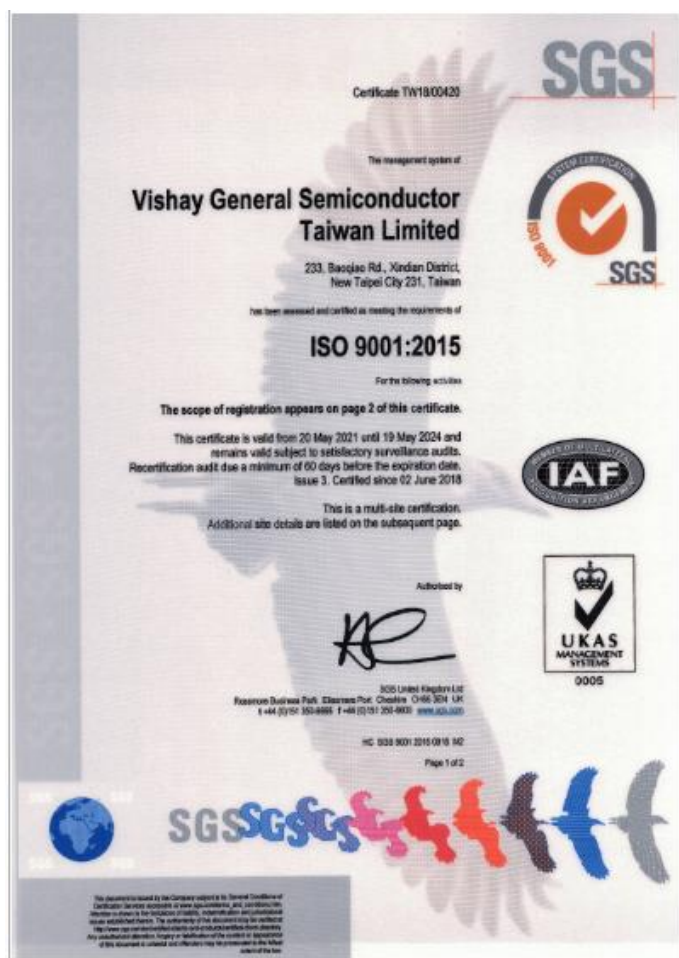
Remote Support Locations included in the certification are as follows:

Name	Address	BSI Activities	Certification Body
Vishay Hong Kong Limited	3/F, Phase 2, YKK Building, No. 2 San Lok Street, Tuen Mun, N.T., Hong Kong	Logistics, 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 Méditerranée, 06003, Nice Cedex 1, France	Contract Review, Customer Service	SVC
Vishay Semiconductor Italiana SPA	VIA LIGURIA 49-10071 BORGARO TORINESE (TO)	Product Design	CISQ
Vishay Semiconductor (Austria) Ges.m.b.H	Telefunkenstrasse 5, 4840 Vicklabruck, 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 ASSA PTE. LTD.	37A TAMPOINES STREET 92 #07-01 SG-529886 SINGAPORE	Customer Service	SGS QAS



Level of fulfillment of conditions as set out in the Certification Agreement may render this Certificate invalid.
AC0802100 UNB7 DNV GL - Business Assurance, 1400 Sapelo Drive, Katy, TX 77449, Tel.: +1-281-590-1238, www.dnvgl.com

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DNV-GL

MANAGEMENT SYSTEM CERTIFICATE

Certificate No: 255198-2016-AQ-RGC-RvA Initial certification date: 23 April, 2018 Valid: 23 April, 2021 – 23 April, 2024

This is to certify that the management system of

Vishay General Semiconductor (China) Co., Ltd.

No. 88, 6th Avenue, TEDA, Tianjin, P.R. China

has been found to conform to the Quality Management System standard:
GB/T 19001-2016/ISO 9001:2015

This certificate is valid for the following scope:

Design and Manufacture of Power Rectifiers and Protection Devices

Place and date:
Shanghai, 22 April, 2021






For the issuing office:
DNV GL - Business Assurance
Suite A, Building 9, No.1591 Hongqiao
Road, Changning District, Shanghai
200336, P.R. China
TEL: +86 21 32799000



Zhu Hai Ming
Management Representative

Lack of fulfillment of conditions as set out in the Certification Agreement may render this Certificate invalid.
ACCREDITED UNIT: DNV GL Business Assurance B.V., Zandvoort 1, 2014 LB, Beverwijk, Netherlands. TEL: +31 (0)20 6912089. www.dnv.com/assurance

--End of Report--