



# TVS DIODES

## Vishay General Semiconductor

### TVS = Transient Voltage Suppressor

[www.vishay.com/diodes/protection-tvs-esd/](http://www.vishay.com/diodes/protection-tvs-esd/)

Result example:

Max. clamping voltage  $V_C$  at  $t_b = 10/1000 \mu s$   
Stand-off or reverse working voltage  $V_{RWM}$  of  $V_{WM}$

Black slashes: AEC-Q101 qualified

Gray slashes: Not AEC-Q101 qualified

Surge power at  $t_b = 10/1000 \mu s$  (blue and gray bars)

Axis located at bottom of table

Epoxy Type	Standard	AEC-Q101	Device Name	Stand-Off and Clamping Voltage														Technology	Uni- / Bi-Directional	Package Name	Temperature Range				
				3 V	4 V	5 V	7 V	10 V	20 V	30 V	40 V	50 V	70 V	100 V	200 V	300 V	400 V				500 V	700 V	-65 °C	-55 °C	+150 °C
✓	✓	✓	MSP3V3, MSP5.0A															TRANSZORB®	↕	MicroSMP					
✓	✓	no	MSMP6.0A to MSMP20A															TRANSZORB®	↕	MicroSMP					
✓	✓	✓	BZD27C7V5P to BZD27C200P															TRANSZORB®	↕	DO-219AB (SMF)					
✓	✓	✓	SMF5V0A to SMF58A															TRANSZORB®	↕	DO-219AB (SMF)					
✓	✓	✓	TPSMP6.8A															PAR®	↕	DO-220AA (SMP)					
✓	✓	no	P4KE530, P4KE550															TRANSZORB®	↕	DO-204AL (DO-41)					
✓	✓	yes	P4SMA100A to P4SMA540A															TRANSZORB®	↕	DO-214AC (SMA)					
✓	✓	yes	P4SMA100CA to P4SMA220CA															TRANSZORB®	↕	DO-214AC (SMA)					
✓	✓	yes	SMAJ85A to SMAJ188A															TRANSZORB®	↕	DO-214AC (SMA)					
✓	✓	yes	SMAJ85CA to SMAJ188CA															TRANSZORB®	↕	DO-214AC (SMA)					
✓	✓	yes	SMAJ530, SMAJ550															TRANSZORB®	↕	DO-214AC (SMA)					
✓	✓	✓	TPSMP7.5A to TPSMP12A															PAR®	↕	DO-220AA (SMP)					
✓	✓	yes	BZG04-8V2 to BZG04-220															TRANSZORB®	↕	DO-214AC (SMA)					
✓	✓	yes / no	P4KE6.8A to P4KE540A															TRANSZORB®	↕	DO-204AL (DO-41)					
✓	✓	yes / no	P4KE6.8CA to P4KE440CA															TRANSZORB®	↕	DO-204AL (DO-41)					
✓	✓	yes	VTVS5V0ASMF to VTVS63GSMF															TRANSZORB®	↕	DO-219AB (SMF)					
✓	✓	no	SMP3V3, SMP5.0A to SMP36A															TRANSZORB®	↕	DO-220AA (SMP)					
✓	✓	yes	P4SMA6.8A to P4SMA91A															TRANSZORB®	↕	DO-214AC (SMA)					
✓	✓	yes	P4SMA6.8CA to P4SMA91CA															TRANSZORB®	↕	DO-214AC (SMA)					
✓	✓	yes	SMAJ5.0A to SMAJ78A															TRANSZORB®	↕	DO-214AC (SMA)					
✓	✓	yes	SMAJ5.0CA to SMAJ78CA															TRANSZORB®	↕	DO-214AC (SMA)					
✓	✓	✓	TPSMP13A to TPSMP43A															PAR®	↕	DO-220AA (SMP)					
✓	✓	yes	TPSMA6.8A to TPSMA43A															PAR®	↕	DO-214AC (SMA)					
✓	✓	yes	SA5.0A to SA170A															TRANSZORB®	↕	DO-204AC (DO-15)					
✓	✓	yes	SA5.0CA to SA170CA															TRANSZORB®	↕	DO-204AC (DO-15)					
✓	✓	yes	SMA5J5.0A to SMA5J40A															TRANSZORB®	↕	DO-214AC (SMA)					
✓	✓	yes	SMA5J5.0CA to SMA5J40CA															TRANSZORB®	↕	DO-214AC (SMA)					
✓	✓	yes / no	P6KE6.8A to P6KE540A															TRANSZORB®	↕	DO-204AC (DO-15)					
✓	✓	yes / no	P6KE6.8CA to P6KE440CA															TRANSZORB®	↕	DO-204AC (DO-15)					
✓	✓	no	SMA6J5.0A to SMA6J28A															TRANSZORB®	↕	DO-214AC (SMA)					
✓	✓	no	SMA6F5.0A to SMA6F130A															TRANSZORB®	↕	DO-221AC (SlimSMA)					
✓	✓	yes	P6SMB6.8A to P6SMB540A															TRANSZORB®	↕	DO-214AA (SMB)					
✓	✓	yes	P6SMB6.8CA to P6SMB220CA															TRANSZORB®	↕	DO-214AA (SMB)					
✓	✓	yes	SMBJ3V3															TRANSZORB®	↕	DO-214AA (SMB)					
✓	✓	yes	SMBJ5.0A to SMBJ188A															TRANSZORB®	↕	DO-214AA (SMB)					
✓	✓	yes	SMBJ5.0CA to SMBJ188CA															TRANSZORB®	↕	DO-214AA (SMB)					
✓	✓	no	SMBJ5.0D to SMBJ188D															TRANSZORB®	↕	DO-214AA (SMB)					
✓	✓	no	SMBJ5.0CD to SMBJ120CD															TRANSZORB®	↕	DO-214AA (SMB)					
✓	✓	yes	TPSMB6.8A to TPSMB43A															PAR®	↕	DO-214AA (SMB)					
✓	✓	yes	TAGF6.8A to TAGF51A															PAR®	↕	DO-221AC (SlimSMA)					
✓	✓	yes	TAGL6.8A to TAGL51A															PAR®	↕	DO-221AD (SlimSMAW)					
✓	✓	no	LVB14A															TRANSZORB®	↕	DO-214AA (SMB)					
✓	✓	yes	SMB8J5.0CA to SMB8J40CA															TRANSZORB®	↕	DO-214AA (SMB)					
✓	✓	yes	SMB10J5.0A to SMB10J40A															TRANSZORB®	↕	DO-214AA (SMB)					
✓	✓	yes / no	1.5KE6.8A to 1.5KE540A															TRANSZORB®	↕	1.5KE					
✓	✓	yes	1N6267A to 1N6303A															TRANSZORB®	↕	1.5KE					
✓	✓	yes	1.5KE6.8CA to 1.5KE220CA															TRANSZORB®	↕	1.5KE					
✓	✓	yes	1.5SMC6.8A to 1.5SMC540A															TRANSZORB®	↕	DO-214AB (SMC)					
✓	✓	yes	1.5SMC6.8CA to 1.5SMC220CA															TRANSZORB®	↕	DO-214AB (SMC)					
✓	✓	yes	SMCJ5.0A to SMCJ188A															TRANSZORB®	↕	DO-214AB (SMC)					
✓	✓	yes	SMCJ5.0CA to SMCJ188CA															TRANSZORB®	↕	DO-214AB (SMC)					
✓	✓	no	SMPC5.0A to SMPC36A															TRANSZORB®	↕	TO-277A (SMPC)					
✓	✓	yes	SMPC22AN to SMPC85AN															TRANSZORB®	↕	TO-277A (SMPC)					
✓	✓	✓	TPC11CA to TPC36CA															PAR®	↕	TO-277A (SMPC)					
✓	✓	yes	TPSMC6.8A to TPSMC47A															PAR®	↕	DO-214AB (SMC)					
✓	✓	✓	TPC6.8A to TPC51A															PAR®	↕	TO-277A (SMPC)					
✓	✓	yes	SMC3K22CA to SMC3K78CA															TRANSZORB®	↕	DO-214AB (SMC)					
✓	✓	yes	3KASMC10A to 3KASMC43A															PAR®	↕	DO-214AB (SMC)					
✓	✓	yes	SM5S10AT to SM5S43AT   SM5A27T															PAR®	↕	DO-218AC					
✓	✓	yes	SM6S10AT to SM6S43AT   SM6A27T															PAR®	↕	DO-218AC					
✓	✓	yes	5KP8.5A to 5KP188A															TRANSZORB®	↕	P600					
✓	✓	yes	5KASMC10A to 5KASMC43A															PAR®	↕	DO-214AB (SMC)					
✓	✓	yes	SMC5K10A to SMC5K20A															TRANSZORB®	↕	DO-214AB (SMC)					
✓	✓	no	SMC5K22A to SMC5K85A															TRANSZORB®	↕	DO-214AB (SMC)					
✓	✓	yes	SM8S10AT to SM8S43AT   SM8A27T															PAR®	↕	DO-218AC					

Click to view datasheet Surge power at  $t_b = 10/1000 \mu s$

100 W 200 W 300 W 400 W 500 W 700 W 1000 W 2000 W 3000 W 4000 W 5000 W 6000 W 7000 W

#### SELECTOR GUIDE

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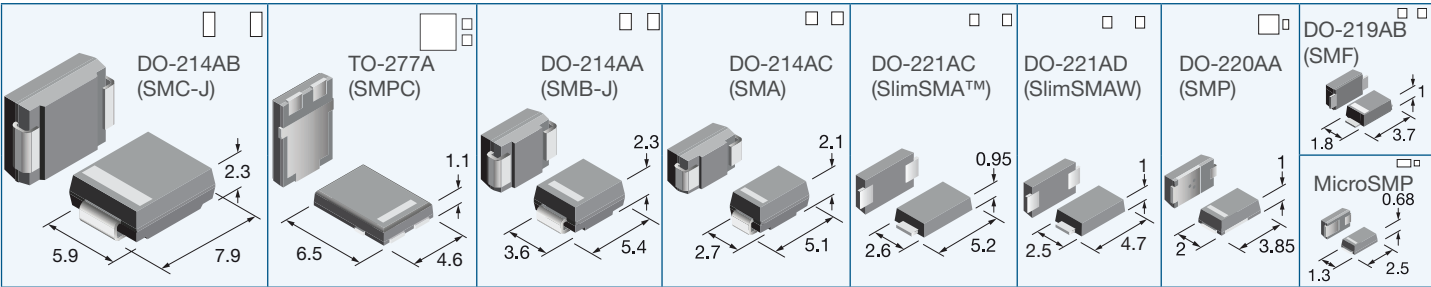
SG2192-2009 [www.vishay.com/doc?49477](http://www.vishay.com/doc?49477)



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### Package Dimensions and Footprint (in millimeters)



**RoHS COMPLIANT**  
Compliant to RoHS Directive 2011/65/EU



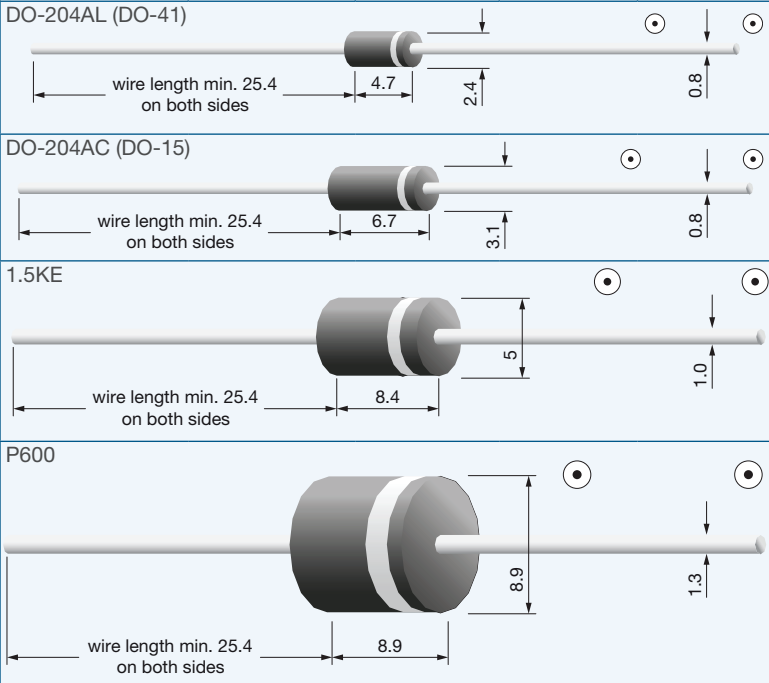
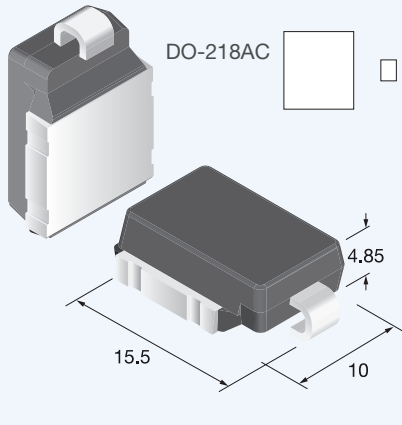
Terminations are lead (Pb)-free



Devices with this logo fulfill the automotive requirements such as:

- Manufactured in an ISO/TS 16949 certified facility
- **AEC-Q101 qualified\***
- Automotive grade 8Ds
- Change control / safe launch policy
- Maverick product policy
- Error-proofing

\* The diodes are electrically tested and qualified according the stress test conditions described in the Automotive Electronics Council (AEC) qualification plan (Q101).



### Uni-Directional or Bi-Directional

A simple diode consists of a “p-doped” and an “n-doped” silicon layer. The junction between both is called the “p-n junction”. Such a diode passes a “forward current” from the p-layer, or the “anode”, to the n-layer, or the “cathode,” with a low “forward voltage” drop. In the opposite direction, the “reverse direction”, the p-n junction is blocked, so that only a very low “leakage current” can flow from the cathode to the anode. At the moment when the applied “reverse voltage” generates a critical electric field in the p-n junction, an “avalanche breakdown” starts.

Diodes with just one p-n junction are “uni-directional avalanche breakdown diodes” and are called “uni-directional diodes.”

Diodes with three layers, such as p/n/p or n/p/n, have two p-n junctions so that an avalanche breakdown can occur in both directions. These are called “bi-directional diodes.”

### TVS Diodes and Temperature

TVS diodes are avalanche breakdown diodes made of silicon. The avalanche breakdown voltage depends on the design of the diode (doping profile) and the temperature of the p-n junction. But it is independent from the size of the diode. Any current passing through the diode causes thermal power to heat the diode up. The avalanche breakdown voltage rises with a temperature coefficient of about ~ 0.1 %/K.

At higher currents the low series resistance causes an additional voltage drop and contribution to the so-called “clamping voltage” of the diode. This is the major reason for increasing the clamping voltage during a surge pulse.

### Technology

**PAR®** stands for Passivated Anisotropic Rectifier technology. Diodes made with this technology offer high reliability with a maximum junction temperature (T<sub>j</sub>) up to 185 °C. PAR devices are the first choice for automotive applications.

**TRANSZORB®** is a product series recommend for general applications.

### Short? or Open?

During operation, when a high current passes the p-n junction, the diode gets hot. If the diode gets too hot the silicon in the p-n junction can melt (electrical overstress (EOS)) and the resistivity drops down. The diode gets usually “shorted.” But if the energy is just high enough, the diode can also be cracked or exploded. This can cause an open circuit.