Full EOS protection at working temperatures with new TVS generation

STMicroelectronics

SMX1J, SMAJ, SMBJ, SM6T, SMCJ, SM15T upgraded Transil™ series

Industrial equipment must comply with various standards, such as electrical overstress (EOS) surge standards and extended temperature range.

Protection devices, to help meet these standards, must be selected according to their operation at high junction temperatures, especially since most industrial applications are rated at 125 °C operating temperature, with some up to 150 °C.

ST's new Transils comply with IEC 61000-4-5 surge requirements, while maintaining a high operating temperature capability.

Upgraded performance

ST's large TVS portfolio has been upgraded to be rated with high surge power capability at high temperatures.

- SMX1J, the new smallest TVS: 100 W in µQFN package (1 x 1.45 mm)
- SMAJ series: 400 W in SMA package
- SMBJ and SM6T series: 600 W in SMB package
- SM15T and SMCJ series: 1500 W in SMC package

Key benefits

- Full EOS protection at application temperature
- Optimized footprint
- Low leakage current (0.2 µA @ 25 °C)
- Maximum clamping voltage specified according to 8/20 µs surge for IEC 61000-4-5 compatibility

Targeted applications

- Industrial equipment
- SMPS
- Telecom equipment

Surge parameters

IEC 61000-4-5 is the most common surge standard, whatever the application. It specifies that final equipment must be tested with 8/20 µs surges at various levels, depending on environment and applications.
Both peak pulse current (I_{PP}) and clamping voltage (V_{CL}) are key parameters according to 8/20 µs tests. Another key parameter is the dynamic resistance (R_D). This can be used to recalculate the clamping voltage according to the surge in the application, using the following formula:

$$V_{CL}\ max = R_D \times I_{PP} + V_{BR}\ max$$

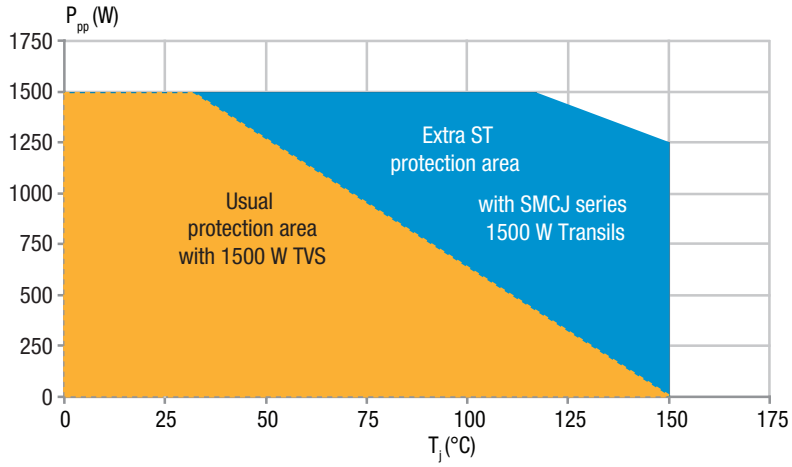
These key parameters should always be specified in the datasheet.
With increasingly sensitive IC technologies, a fine-tuned calculation is often required. The temperature coefficient (αT) can be used to recalculate V_{BR} (min, typ or max), whatever the temperature, with:

$$V_{BR} @ T_J = V_{BR} @ 25\ °C \times (1 + \alpha T \times (T_J - 25))$$

In addition, it helps recalculate the clamping voltage versus temperature.

Power capability

The maximum clamping voltage is an important parameter.
However, the protection device must still survive surges and be operational within the operating temperature range. This is determined by peak pulse power dissipation versus initial junction temperature.
As the figure shows, ST's Transil series are the only TVS able to maintain power capability as the temperature increases, while other protection solutions are derated to zero power at high temperatures. Using ST devices, designers can either increase equipment robustness or optimize space saving by selecting smaller packages.



Footprint

The previous power derating curve is given with a specified footprint, generally written with small characters.
Comparison of this footprint size for different 1500 W devices is given in the following table for ST and different competitors.

Supplier	ST	A	B	C
Recommended Pad (mm)	3.14 x 1.64	25.4 x 25.4	8 x 8	Infinite heatsink
Total footprint size (mm²)	25.7	1290	128	Unrealistic
Footprint drawing				Water cooling