MicroNote 107

Cross Referencing TVS Devices

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This note is intended to clarify the confusion that exists in silicon transient voltage suppressor (TVS) nomenclature and to provide guidance for cross-referencing. Examples will illustrate the selection process for choosing equivalent or near equivalent parts.

Some series have their part numbers based on the nominal breakdown voltage ($V_{(BR)}$) of the device while others are based on the rated working voltage (V_{WM}). Examples of both numbering systems include the P6SMB6.8 Motorola series, based on a nominal ($V_{(BR)}$), and the Microsemi SMBJ5.0 series, which is based on V_{WM}. Both of these devices are surface mount types rated for 600 W of peak pulse power (P_{PP}). cross-referencing is normally applicable only for devices of the same (P_{PP}) rating for equivalent TVS performance levels.

Initially, TVS device offerings were identified by part numbers based on breakdown voltage ($V_{(BR)}$). Subsequent product introductions were then labeled with the more practical working/operating voltage (V_{WM}) base. With the V_{WM} value integrated into the part number, a design engineer could more easily identify and select the part best suited for his/her application. A major advantage to using the V_{WM} based nomenclature is that the minimum V_{BR} and V_{WM} are identical for ±5% and ±10% tolerance parts. Hence, the ±10% part becomes a candidate for substitution as a ±5% device if required and may even provide a more permanent, cost-effective solution.

The first parameter to match in selecting an equivalent is the minimum breakdown voltage ($V_{(BR)}$), since most other ratings correlate well with this characteristic. Then check the fit of V_{WM}, peak pulse current (I_{PP}), and maximum clamping voltage (V_C). For example, selecting a replacement for the Motorola P6SMB10A, 10 V nominal $V_{(BR)}$, 600 W surface mount package part with a Microsemi equivalent is shown below:

Part Number	Min ($V_{(BR)}$)	(V_{WM})	(V_C) @ (I_{PP})	(I_{PP})
Motorola P6SMB10A	9.5 V	8.55 V	14.5 V	41 A
Microsemi Equivalent SMBJ8.5A	9.44 V	8.5 V	14.4 V	41.7 A

Note that the electrical parameters of the Microsemi part match very closely and are well within the needs for circuit performance and protection requirements. Both parts share essentially the same electrical characteristics and DO-214AA package outline although they are marked with different labels. This exercise in equivalent selection provides guidance to the user in choosing alternative sources and also allows for a broader supplier base.

cross-referencing is also required in converting from thru-hole to surface mount technology since most axial leaded part numbers are based on $V_{(BR)}$, while most surface mounts are based on V_{WM}. Illustrated below is an example cross-referencing an axial lead 1.5 kW device for operating in a 36 V circuit to an electrically equivalent surface mount chosen from the Microsemi Product Data Book.

Part Number	Min ($V_{(BR)}$)	(V_{WM})	(V_C) @ (I_{PP})	(I_{PP})
1.5KE43A	40.9 V	36.8 V	59.3 V	25.3 A
SMCJ36A	40.0 V	36.0 V	58.1 V	25.8 A

Here we show that the SMCJ36A surface mount is an acceptable electrical replacement for the axial leaded 1.5KE43A. In this example, the minimum $V_{(BR)}$ of the SMCJ36A compared favorably with that of the 1.5KE43A for matching. Subsequently, the remaining parameters were also a close match for the same 1.5 kW device rating.

Some parameters match more closely than others. In most cases, especially for ESD protection, the V_{WM} can be as high as 15 V for a 5 V operating circuit and still provide good performance. This has been proven in volume production.

In the event that a perfect match cannot be made, integrated circuits are normally quite forgiving for very short duration pulses, even though a substitute TVS may clamp a few volts higher. If you need additional guidance in cross-referencing devices or in selecting a TVS for your application, please contact your Microsemi sales representative.

Support

For additional technical information, please contact Design Support at:
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