

TVS/Chip™ Product Overview

For size and weight reduction of discrete diodes, the most common practice is to strip away the package, leaving only the silicon chip (die). Effective reduction is 90-95% in both weight and volume for direct mounting on high density substrates.

All Microsemi TVS diodes, are available in TVS/Chip or TVS/Cell options. Zeners, reference diodes and rectifiers are also available in chip or cell forms. Chips are typically mounted to the substrate with conductive epoxy while wire bonds connect to the top of the die for high density packaging.

Microsemi's offerings of TVS chip size products include:

TVS/Chip

Passivated TVS/Chip types of: a) planar, b) mesa and c) bidirectional mesa are illustrated in Figure 1. Bidirectional mesa chips may require a disc on the underside to prevent shorting of the bottom side junction when mounted. Chips are usually square or hexagonal depending on footprint and surge rating requirements.

Metalization is solderable (such as CrAgAu) on both top and bottom for attachment. For wire bonding,

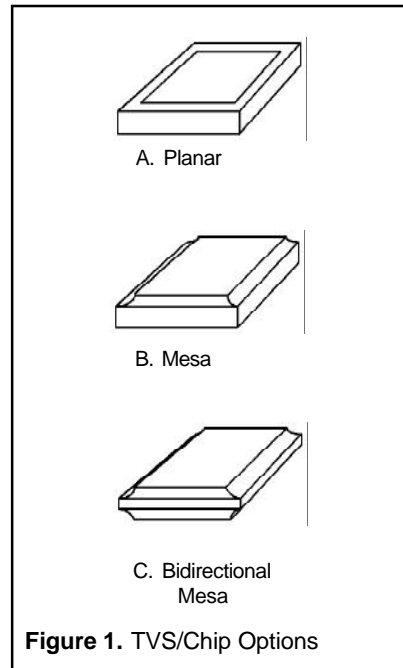


Figure 1. TVS/Chip Options

aluminum top is offered with gold bottom for conductive epoxy or gold-silicon eutectic bonding.

TVS/Cell™

For multiple wire attach, the windows can be effectively enlarged by a factor of 4 to 5 for more parallel bond wires by adding an aluminum clad disc on the top side as shown in Figure 2. A chip with a single disc is called a "half-cell".

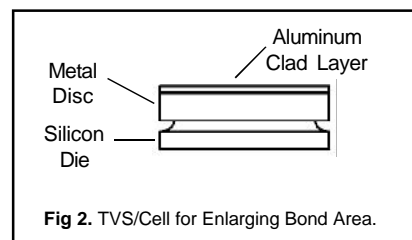


Fig 2. TVS/Cell for Enlarging Bond Area.

The attached disc (typically with 95Pb5Sn) in Figure 2 adds additional thermal mass to the

junction side of the die. This improves pulse power capability by conducting heat away from the junction plus spreading current more evenly across the junction. A TVS/Chip by itself is limited to about 1/2 to 2/3 of its capability compared to the same chip mounted in a leaded package having optimum electrical and thermal conductivity to conduct heat away from the junction.

The TVS/Cell with discs on both top and bottom are even more rugged for transient suppression as thermal mass is greatest in this configuration which is illustrated in Figure 3.

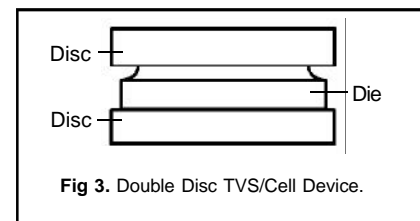


Fig 3. Double Disc TVS/Cell Device.

Chips can be stacked for higher power on a single cell footprint, e.g., two 14 V 1.5 kW chips can be stacked in series to produce a 28 V 3 kW rated cell (see MicroNote 112 on stacking TVSs for higher power). Maximum stack height is typically 3 chips.

SMT/Cell™

Cellular type TVS devices are available with both attachments on the bottom and do not require wire bonding. Both cathode and anode terminals of the device are in the same plane and can be surface mount attached between closely spaced bond pads with negligible parasitic inductance in the

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protective surge current path. Mounting is illustrated in Figure 4.

Higher power ratings, up to 6,000 W, are available in the SMT/Cell configurations. The chips may be hexagonal with round discs at the bottom or square with corresponding L contact depending on footprint or size requirements. Higher power requirements require proportionally greater size.

All TVS/Cell and SMT/Cell devices are fabricated with high temperature solder or bonding materials having melting temperatures in excess of 300°C to prevent remelt in subsequent processing.

TVS/FlipChip™

For low profile and pulse power ratings of 600W and below, the Microsemi Patented FlipChip is an excellent option for surface mount applications. The major advantage of this device is there is virtually no parasitic inductance, hence no $L(di/dt)$ effects, thus 100 ps rise-time ESD events are clamped to lowest possible levels.

TVS/FlipChip mounting is depicted in Figure 5.

All trace lengths in the protection path must be virtually zero for optimum performance (see MicroNote No. 111)

Voltages are offered across the spectrum of discrete component equivalents. If standard products do not meet your needs, custom devices can usually be tailored for voltage and power rating. More details on each of the above chip and cell type suppressors are provided in subsequent issues of MicroNotes which address each of these device types.

Other Chip Products

Microsemi also offers a broad line of zener diodes, rectifiers, Schottky rectifiers, thyristor suppressors and a host of other diode types to meet your needs. These are also available in chip, cell, or SMT/Cell forms as required.

Microsemi offers the broadest diode chip and cell offerings to the growing multichip module markets and we would like to assist with your design requirements.

TVS/Chip™, TVS/Cell™, SMT/Cell™ and TVS/FlipChip™ are registered trade marks of Microsemi Corp.

