Flat-Clamp TVS Layout in SMA/SMB Footprints

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For systems in need of transient IEC 61000-4-5 surge protection, TI's new Flat-Clamp family of TVS devices offers flatter voltage clamping, improved reliability, and lower leakage currents in a much smaller package than industry standard solutions, leading to more efficient and effective input protection design. For more information on the Flat-Clamp family implementation and advantages, please see the Flat-Clamp surge protection technology for efficient system protection white paper.

While TI's much smaller device package is critical in many space constrained applications, for applications where space is not a factor it can be inconvenient that the Flat-Clamp devices do not share a footprint with industry standard SMA/SMB surge diode package footprints.

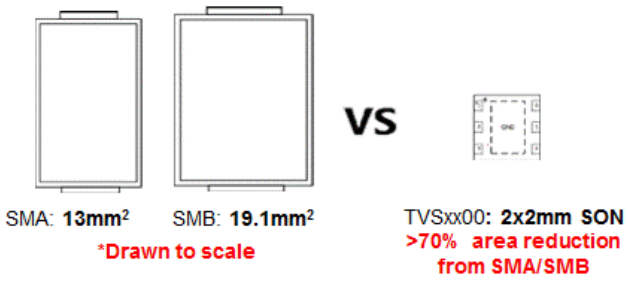

Figure 1. Package Size Comparison

For designers that want to use a common input stage for multiple designs, there is an advantage to being able to share a package footprint. A shared footprint enables a designer to use the same layout when switching between designs that require the precise Flat-Clamp voltage regulation and designs that are able to accept the poor voltage regulation of standard TVS diodes.

With creative use of board layout, it is possible to create a PCB footprint that can be used during production for both the unidirectional Flat-Clamp diodes 2x2 mm standard outline no-leads (SON) package and the conventional SMA/SMB package. This can be done because the large separation between the leads on the SMA/SMB package enables the entire SON package to sit in between the leads, so that there is no overlap in solder pads. The examples below show layout compatibility with the SMA package, however the SMB package is very similar with slightly taller pads that not should not affect the design.

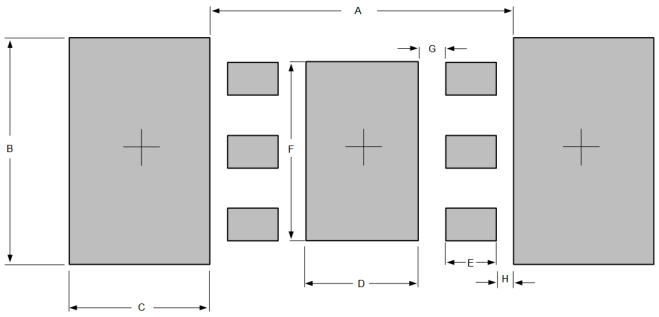

Figure 2. Recommended Footprint

Table 1. Stencil Dimensions

Dimension	Millimeters (Mils) Nominal
A	2.7 (106)
B	2.1 (83)
C	1.27 (50)
D	1.01 (40)
E	0.4572 (18)
F	1.6 (63)
G	0.25 (10)
H	0.14 (53)

During layout placement, superimpose both footprints with the SON package fitting between the SMA/SMB pins. Short the IN and GND pins of both packages respectively with a copper pour and then use solder mask openings for the individual pins. Figure 3 shows the solder mask openings in green and the copper planes that electrically short the pins in red. Keeping the solder mask openings separate is important to prevent assembly problems during reflow. The recommended SMA/SMB footprint will vary based on vendor, however the package is standardized and will allow for the layout shown in Figure 3. The landing pads above will allow for reliable manufacturing for SMA/SMB packages regardless of recommended manufacturer footprint.

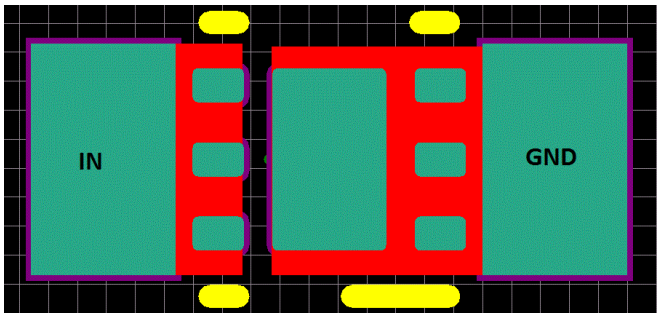

Figure 3. Layout Example

In addition, because the solder mask openings for the SMA/SMB and SON footprints are electrically shorted, if the SMA/SMB pins incidentally create a short there will not be any problems.

Figures 4 and 5 show the Flat-clamp and standard SMA respectively on the combined footprint

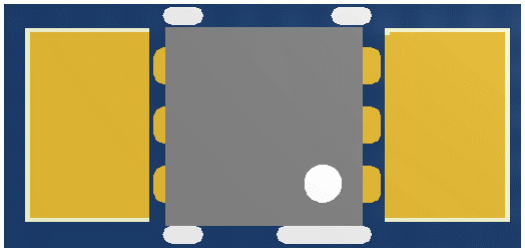

Figure 4. Flat-Clamp SON Package Populated

Figure 5. SMA Device Populated

Figure 6 shows a side view of the SMA device populated, showing that the pins of SMA package do not contact the solder mask of the SON footprint.

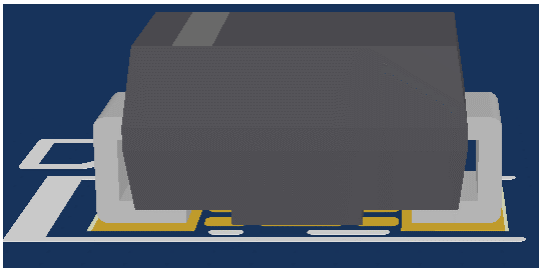

Figure 6. Package Footprint Comparison

This layout allows engineers to improve their design flexibility by having one layout for multiple TVS footprints, removing any challenge of TI's uniquely small footprint. For designers that do not always need the small size of the 2x2 mm SON package, this strategy can save costs and time by enabling a common front end layout with multiple protection options.

To ease the transition towards a new footprint, TI also offers a Flat-Clamp adapter board kit that easily enables evaluation of the Flat-Clamp devices in an existing SMA/SMB footprint, however the kit is intended for evaluation only and not for production.

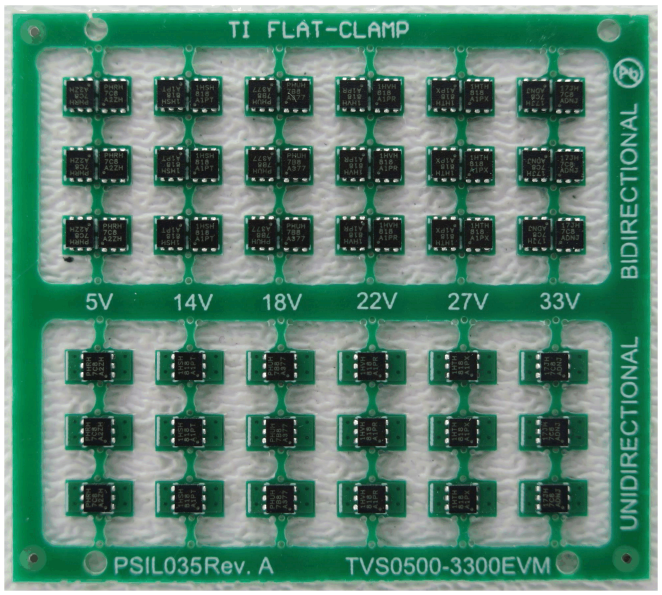

Figure 7. Flat-Clamp Evaluation Kit

Table 2. Device Recommendations

Device	V_{RWM} (V)	V_{CLAMP} (V)	I_{LEAK} (nA)	I_{PP} (A, 8/20 µs)
TVS3300	33	38	19	43
TVS2700	27	32.5	1.7	43
TVS2200	22	27.7	3.2	40
TVS1800	18	22.8	0.5	40
TVS1400	14	18.4	2	40
TVS0500	5	9.2	0.07	35

Related Documentation

Flat-Clamp surge protection technology for efficient system protection

TVS Surge Protection in High-Temperature Environments

TVS0500-3300EVM Adapter Board

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