



SUPERECTIFIER® Design Brings New Level of Reliability to Surface Mount Components

By Joseph M. Beck

Surface Mount technology is here to stay. After years of plodding through cautious experimentation, many manufacturers now have fully automated production lines in place. These production lines place circuit components at speeds that until recently would have been unthinkable. Finally being realized are the benefits of what was once considered a “Voo Doo” manufacturing technology. Component manufacturers have learned a great deal over the past several years as well. Initially most surface mount components were nothing more than retrofit, lead formed versions of their conventional leaded, through-hole counterparts. For most manufacturers this was the quickest and least costly method of “developing” a line of surface mountable components.

It was soon discovered, however, that this approach to component assembly would be unacceptable. Surface mount technology placed new demands upon circuit components. Electrically, the same power was being required from smaller and smaller packages. Package geometries and dimensions became critical in relation to pick and place equipment and circuit board mounting. In addition, the construction of these devices needed to be such that they would suffer no ill effects when subjected to the rigors of the new assembly environment that surface mount technology presented. Encountered in this environment was extremely high-speed pick and place equipment, component adhesive attachment, immersion in molten solder and rapid temperature changes associated with reflow soldering processes. All this meant that component manufacturers would have to re-think their approach to device fabrication. Yes, components needed to be smaller; but they also needed to be more reliable.

At Vishay General Semiconductor, the development of new surface mount components is not something that is taken lightly. It is realized that in order to produce a truly reliable surface mount product one must first consider all relevant aspects of the technology. Only when this process has been completed can a product be developed which is surface mountable, and inherently reliable.

SURFACE MOUNT SUPERECTIFIER®

Vishay General Semiconductor manufactures surface mount rectifiers in the popular MELF (metalized electro-face) package style. These devices, denoted as SUPERECTIFIERS, are available with a wide variety of electrical

characteristics. The main difference, however, between these rectifiers and other MELF style devices lies in the area of device construction. Fig. 1. shows the unique construction employed in the manufacture of the Superectifier.

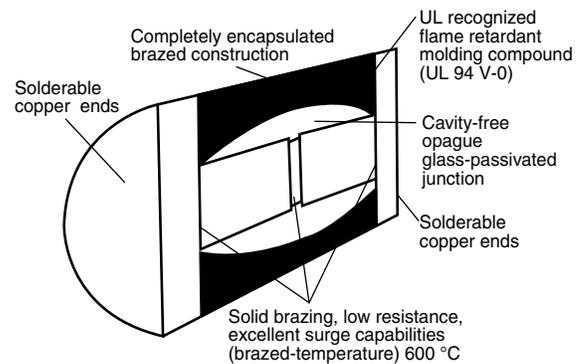


Fig. 1 - SUPERECTIFIER Construction

The construction of the Superectifier does not internally utilize any soft solders. All interconnects are accomplished by the use of a high temperature brazing process (600 °C). Hence, any chances of solder void occurrence or internal solder reflow during circuit board processing are eliminated. In addition, the silicon rectifier junction is completely encapsulated by a cavity-free glass. This glass encapsulation ensures that the rectifier junction is hermetically isolated from humidity and other harmful environmental intrusions.

The resultant sub-assembly could be considered to be a fully functional surface mount rectifier. In fact, many component manufacturers offer MELF devices which have this appearance; namely, an oblong glass bead with two protruding metal end terminations. However, in order that the device have a uniform shape, the General Semiconductor sub-assembly is over molded with epoxy. The result is a smooth, perfectly cylindrical package.

TWO SIZES

Two different size Superectifier MELF packages are available. Vishay General Semiconductor designation GL34 and GL41 are for 0.5 A and 1.0 A rectifier types, respectively. JEDEC® mechanical specifications DO-213AA and DO-213AB detail the dimensions of the GL34 and GL41, respectively. Fig. 2 gives these package dimensions.

APPLICATION NOTE

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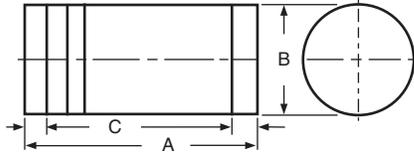


Fig. 2 - Dimensional Outline

DIMENSIONAL OUTLINE in inches				
DIMENSION	GL34 DO-213AA		GL41 DO-213AB	
	MIN.	MAX.	MIN.	MAX.
A	0.130	0.146	0.189	0.205
B	0.063	0.067	0.094	0.105
C	0.016	0.022	0.016	0.022

MANUFACTURING CONSIDERATIONS

Pick and Place-Surface mount SUPERECTIFIERS are supplied on tape and reel in accordance with JEDEC standard RS-481A. Removal of the devices from the embossed carrier tape is easily accomplished by all vacuum pick-up mechanisms which utilize a compliant tip. The compliant tip will form a tight seal around the cylindrical MELF design once contact with the device has been made. This is not always the case, however, when MELF devices with a non-uniform package outline are used. Fig. 3. shows two such MELF outlines. Fig. 3. A is a device with a concave package outline. This type of package is difficult to consistently remove from the carrier tape as the exact position of pick-up on the component body is critical. Fig. 3. B is that of the most common form of MELF packaging. This type of construction utilizes a nontransparent glass body which is often characterized by pitting and surface irregularities. The irregularities make it difficult for a vacuum pick-up to form a tight seal around the device body. The result is that components are often dropped onto the production room floor instead of being placed on the targeted circuit board. Vishay General Semiconductor solves these problems with a smooth surface and perfectly cylindrical package outline.

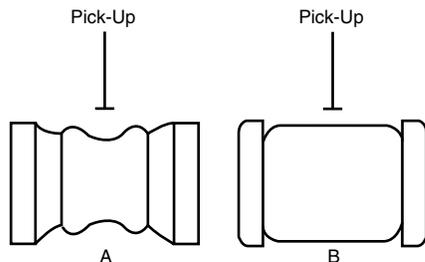


Fig. 3 - Non-Uniform Melf Outlines

Bonding Pads - The geometries and dimensions of bonding pads are critical to the proper mounting, soldering and overall performance of all surface mount components.

Fig. 4. gives the recommended pad layouts for GL34 and GL41 MELF outlines. Use of these pad layouts will be primary assistance in the following three areas:

- Surface mount technology by nature dictates that smaller component packages dissipate the same power as their larger through-hole counterparts. Hence, adequate bonding pad land area is required in order to aid the component package in the dissipation of this power. The recommended pad layouts provide the needed land area for GL34 and GL41 devices to operate safely at their maximum ratings.
- Component adhesive attachment allows the package to shift slightly from its original placement position prior to adhesive curing. In addition, most adhesives tend to spread during the curing process which also may allow package misalignment. The geometry of the recommended pad layouts will tend to minimize such movements. This assumes, of course, that the package was originally positioned correctly.
- During reflow soldering, solder surface tension can have a significant effect on the movement and final position of components in relations to their bonding pads. The recommended pad layouts will actually make use of the solder surface tensions to bring MELF devices into alignment with the two bonding pad land areas.

This means that MELF devices which are initially placed in slight misalignment on their bonding pads will reposition themselves during solder reflow until a position of alignment is reached.

Soldering - Surface mount SUPERECTIFIERS are capable of withstanding all present forms of wave and reflow soldering. The following guidelines should be followed, however, in order to ensure overall package integrity:

- GL34-Maximum temperature at device and terminations not to exceed 400 °C for 5 s. Complete device submersible temperature not to exceed 260 °C for 10 s in solder bath.
- GL41-Maximum temperature at device end terminations not to exceed 450 °C for 5 s. Complete device submersible temperature not to exceed 265 °C for 10 s in solder bath.

Vishay General Semiconductor's surface mount SUPERECTIFIERS combine superb electrical performance with unmatched levels of reliability. The construction of the SUPERECTIFIER virtually eliminates all problems associated with high-speed pick and place of MELF components. In addition, SUPERECTIFIER construction ensures that performance and reliability are never compromised when the device is subjected to the demands of surface mount assembly techniques or when other seemingly harmful environments are encountered. Quite simply, no other surface mount rectifier comes close to offering all the advantages of the SUPERECTIFIER MELF.

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All surface mount components are small and save space. However, performance and reliability should never be considered necessary trade-offs in order to utilize surface

mount technology. Use of Vishay General Semiconductor surface mount SUPERECTIFIERS requires no such sacrifices; no trade-offs.

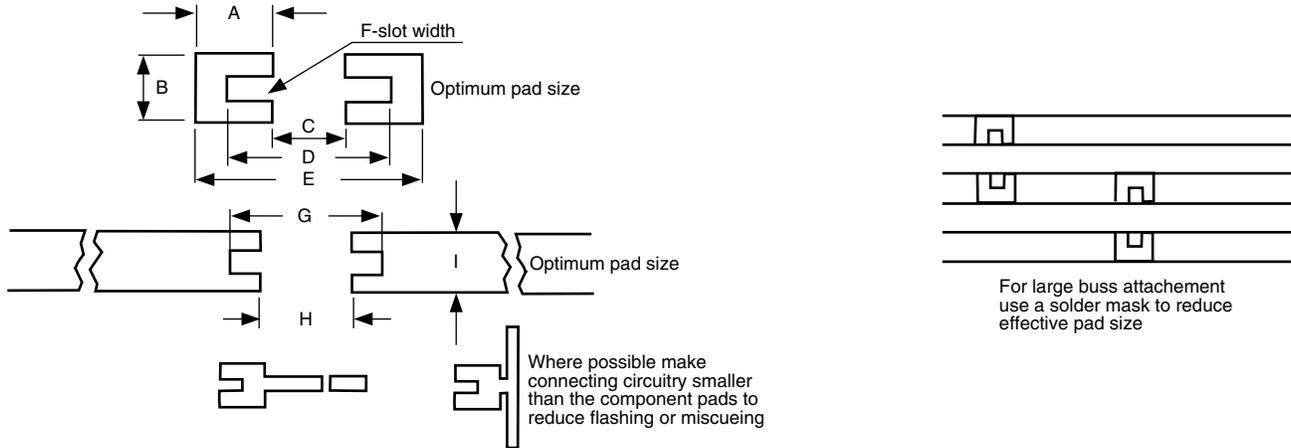


Fig. 4 - Recommended Pad Layout

RECOMMENDED PAD LAYOUT in inches		
DIMENSION	GL34	GL41
A	0.069	0.100
B	0.63	0.100
C	0.69	0.100
D	0.138	0.200
E	0.207	0.300
F	0.016	0.025
G	0.138	0.200
H	0.035 to 0.80	0.050 to 0.125
I	0.048 min.	0.075 min.

PART NUMBER	CURRENT (A)	VOLTAGE (V)	t _{rr} (ns)	PACKAGING
GENERAL PURPOSE				
GL34-J	0.5	50 to 600	-	GL34
1N6478-84	1.0	50 to 1000	-	GL41
GL41A-Y	1.0	50 to 1600	-	GL41
FAST RECOVERY				
RGL34A-J	0.5	50 to 600	150 to 250	GL34
RGL41A-M	1.0	50 to 1000	150 to 500	GL41
ULTRA FAST RECOVERY				
EGL34A-G	0.5	50 to 400	50.0	GL34
EGL41A-G	1.0	50 to 400	50.0	GL41