Purpose

This document is meant to serve as a guide for mounting E-tec Interconnect surface mount device (SMD) sockets to the printed circuit board (PCB). The recommendations described here are guidelines only, and modifications may be needed for your particular socket, PCB, and process.

Application

The sockets this document applies to are as follows: FastLock, ScrewLock, TwistLock, ClamShell, QuickLock and ReverseLock in SMD style. These sockets utilize the E-tec Interconnect patented spring-pin technology. This technology allows the pins to be soldered to the PCB while still providing compliance to the device under test (DUT) via springs located at the other end of the pin. The pins themselves do not have solder pre-forms as a BGA would with its solder balls. However, the sockets are designed to mount to the same PCB footprint and pads as required by the BGA, or any other IC package the socket was designed for (except if locating pegs are used; see 'Locating Pegs' section of this document). When compared to mounting a BGA, an extra volume of solder paste is required to mount the sockets to the PCB. To effect this, a properly dimensioned stencil is required. Once the paste has been applied, a standard reflow process is then used to solder the socket to the PCB. After the socket is verified to have proper electrical connection to the PCB, the system is then ready to be used.

Locating Pegs

Although designed to mount to the same footprint as the IC, with just a small amount of additional keep-out area, E-tec Interconnect sockets can also be offered with locating pegs. The sockets are typically mounted with two locating pegs, which require two through-holes drilled into the PCB. These pegs help to align the socket on the PCB, and hence align the socket's pins to the PCB's pads, during the soldering process. Furthermore, plating the through-holes allows the locating pegs to be soldered to the PCB for better mechanical stability during everyday use and handling of the socket. If the PCB design permits, E-tec Interconnect recommends the use of these locating pegs. For fine-pitch, low pin-count sockets without locating pegs, the mechanical strength of the solder joints may be insufficient and the same also applies to FastLock, QuickLock, ClamShell & ReverseLock SMT sockets. In these cases, it is recommended to epoxy the socket body to the PCB. 3M Scotch-Weld 2216 B/A is a suitable epoxy. In any case, the proper volume of solder paste is required to ensure mechanical and electrical integrity. Recommended stencil dimensions are given in the next section of this document.

Mini-grid SMT adapters as an alternative to SMT sockets

Certain customers may find it difficult to solder the E-tec Interconnect SMT sockets (especially high pincount) directly to the PCB, due to the mass of the socket which makes it difficult to properly adjust the soldering process & temperatures. As an alternative, E-tec Interconnect offers mini-grid adapters, i.e. light weight female sockets (mounted with pins or solderballs) for soldering to the PCB (similar to the BGA chip). Thereafter, a through-hole socket can be plugged into this mini-grid adapter, thus doing away with the soldering problems of a rather heavy weight socket.

Stencil

Table 1 shows the recommended stencil dimensions. A laser-cut, electro-polished and Ni-plated stainless steel stencil is recommended to give the most consistent paste release. The apertures can be made round except for smaller pitches, where square apertures are recommended. Remember to keep the stencil small enough to fit within the keep-out area of the socket, but yet have provisions to remove it from the PCB once the paste has been applied.

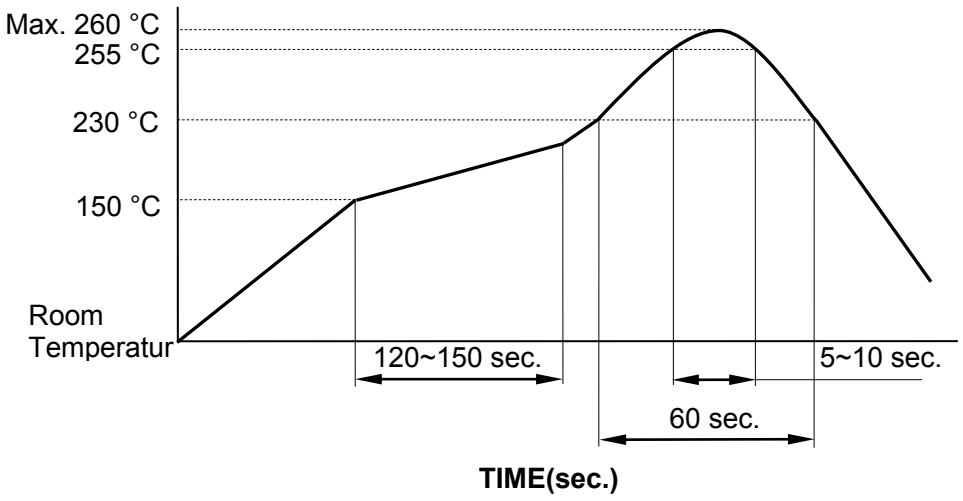
Table 1: Recommended stencil dimensions.

Device Pitch (mm)	PCB Pad Diameter (mm / in)	Stencil Thickness (mm/in)	Stencil Aperture (mm/in)
1.2	min. 0.60 / 0.023	0.15 / 0.006	round 0.66 / 0.026
1.0	min. 0.50 / 0.019	0.15 / 0.006	round 0.55 / 0.022
0.8	min. 0.40 / 0.016	0.13 / 0.005	round 0.44 / 0.017
0.7	min. 0.35 / 0.014	0.13 / 0.005	square 0.39 / 0.015
0.6	min. 0.35 / 0.014	0.13 / 0.005	square 0.39 / 0.015
0.5	min. 0.30 / 0.012	0.13 / 0.005	square 0.33 / 0.013

Solder Paste

E-tec Interconnect recommends using solder paste without (or <0.5%) silver (Ag) to reduce the solder's wetting ability and prevent the paste from running up the pins, thus maximizing the volume of solder left on the pads. Brands such as Qualitek (www.qualitek.com) or Alpha Assembly solutions (www.alphaassembly.com) produce such solder paste on customer request. For Sn/Pb solder paste we recommend Ecorel Easy 802S offered by Avantec (www.inventec.dehon.com).

Reflow Profile



Notes
1) Temperature indicated refers to the PCB surface temperature at solder tail area.
2) Actual reflow profile also depends on equipment, solder paste, PCB thickness, and Other components on the board.
Please consult your solder paste & reflow equipment manufacturer for their recommendations to adopt a suitable process.

Classification Reflow Profile as per IPC / JEDEC J-STD-020C

Table 5-2 Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average Ramp-Up Rate (Ts_{max} to Tp)	3 °C/second max.	3° C/second max.
Preheat – Temperature Min (Ts_{min}) – Temperature Max (Ts_{max}) – Time (ts_{min} to ts_{max})	 100 °C 150 °C 60-120 seconds	 150 °C 200 °C 60-180 seconds
Time maintained above: – Temperature (T_L) – Time (t_L)	 183 °C 60-150 seconds	 217 °C 60-150 seconds
Peak/Classification Temperature (Tp)	See Table 4.1	See Table 4.2
Time within 5 °C of actual Peak Temperature (tp)	10-30 seconds	20-40 seconds
Ramp-Down Rate	6 °C/second max.	6 °C/second max.
Time 25 °C to Peak Temperature	6 minutes max.	8 minutes max.

Note 1: All temperatures refer to topside of the package, measured on the package body surface.

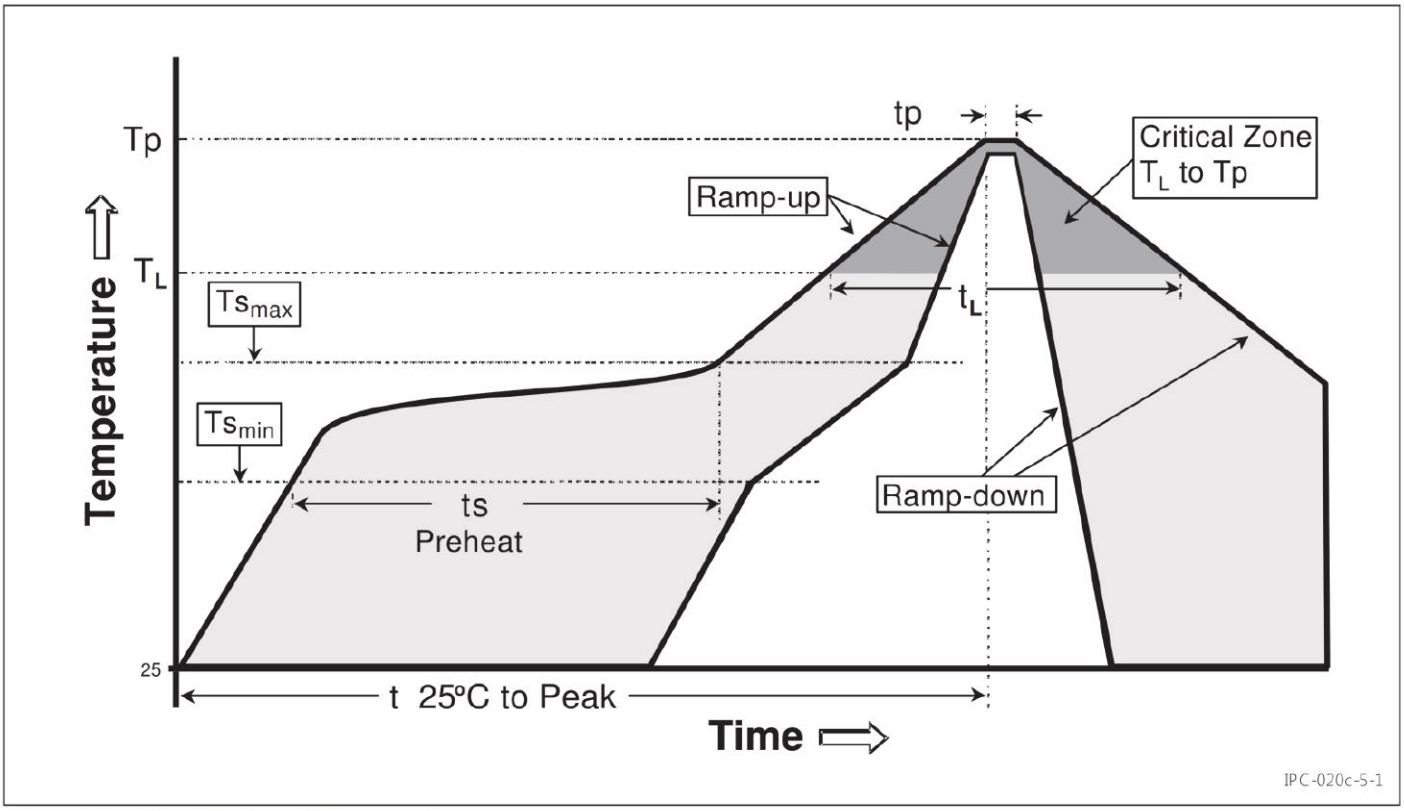


Figure 5-1 Classification Reflow Profile

Table 4-1 SnPb Eutectic Process – Package Peak Reflow Temperatures

Package Thickness	Volume mm³ <350	Volume mm³ ≥ 350
<2.5 mm	240 +0/-5 °C	225 +0/-5°C
≥ 2.5 mm	225 +0/-5°C	225 +0/-5°C

Table 4-2 Pb-free Process – Package Classification Reflow Temperatures

Package Thickness	Volume mm³ <350	Volume mm³ 350 - 2000	Volume mm³ >2000
<1.6 mm	260 +0 °C *	260 +0 °C *	260 +0 °C *
1.6 mm - 2.5 mm	260 +0 °C *	250 +0 °C *	245 +0 °C *
≥2.5 mm	250 +0 °C *	245 +0 °C *	245 +0 °C *
* Tolerance: The device manufacturer/supplier **shall** assure process compatibility up to and including the stated classification temperature (this means Peak reflow temperature +0 °C. For example 260 °C+0°C) at the rated MSL level.			

Note 1: The profiling tolerance is + 0 °C, -X °C (based on machine variation capability) whatever is required to control the profile process but at no time will it exceed - 5 °C. The producer assures process compatibility at the peak reflow profile temperatures defined in Table 4.2.
Note 2: Package volume excludes external terminals (balls, bumps, lands, leads) and/or nonintegral heat sinks.
Note 3: The maximum component temperature reached during reflow depends on package thickness and volume. The use of convection reflow processes reduces the thermal gradients between packages. However, thermal gradients due to differences in thermal mass of SMD packages may still exist.
Note 4: Components intended for use in a "lead-free" assembly process **shall** be evaluated using the "lead free" classification temperatures and profiles defined in Tables 4-1, 4.2 and 5-2 whether or not lead free.

Verifying the Assembly

After the socket has been reflowed to the PCB, open and short testing should be partaken to ensure proper assembly. The assembly house typically performs x-ray inspection to verify non-shorting of pins. However, as this is only a visual inspection, we recommend using a continuity tester or ohmmeter and simply sweeping random rows and columns of pins to ensure no shorting of pins. No damage to the springs will occur if very slight pressure from the meter's tips is applied (just touch the probes to the springs). For fine pitch sockets, a microscope would be helpful in placing the meter's tips appropriately.

After verifying the absence of shorts, open testing should be performed. The most direct, yet tedious, method is to use the continuity tester to directly probe each pin to a breakout or test point on the board. Again no damage will occur if the probes are touched to the springs. If heavy pressure is required to push the socket body towards the PCB to achieve continuity, this means a poor solder joint. If no such test points exist, then the BGA's via field on the backside of the PCB should be kept solder-mask free to allow for such probing. If the via field is kept open, a simpler open testing method can be performed. Simply use a wet sponge (or some other conductive material) and hold it onto the via field. This shorts all the pins together on the PCB. Insert one probe of the continuity tester into the sponge. Now sweep the pins of the socket with the other probe and check for continuity.

If the above procedures show any shorts or opens, then it is advisable to have the assembly house re-evaluate the assembly method used. An incorrect stencil can lead to too much or too little solder paste, easily leading short or open conditions and a solder paste with Ag contents (>=0.5%) may also result in solder joint failures. These are the primary reasons for socket mounting failures.

Important Notes:

a) Screw / TwistLock Socket

When tightening the lid of a Screw or TwistLock socket, it is imperative to not over-tighten the retention screws, otherwise irreparable damage may occur. Such damage is not covered by warranty and will be solely the end user's responsibility. The maximum allowed torque on these retention screws is 7cN-m (10oz-in) for sockets up to 800 pins and for sockets as of 800 pins the torque value needs to be increased but should not exceed a maximum of 10cN-m (14oz-in). E-tec Interconnect Interconnect sells the torque screwdriver TOL-7CN-TORQUE which is preset to 7cN-m, but which can be adjusted to higher torque values for the high pin count sockets.

b) FastLock / QuickLock / ClamShell / ReverseLock Socket

It is recommended to remove the FastLock, QuickLock, ClamShell and ReverseLock retainer from the socket base prior to soldering the sockets to the PCB. This will avoid socket displacement during the soldering process due to the weight of these retainers. User instructions on how to remove and reassemble the retainer from the socket base can be obtained from E-tec Interconnect Interconnect.

c) Pick & Place Pads

Pick & place pad options can be obtained on request for all SMT sockets. If required, please contact E-tec Interconnect prior to placing a purchase order, since such pick & place pad options may require special fixtures on the socket base which are not included in the standard socket design