

Actel provides simple step-by-step assembly flow instructions for attaching QFP and BGA sockets to a PCB. Also included is solder reflow information along with a sample standard reflow temperature profile.

Recommended method of attaching QFP prototype sockets to a PCB.

Prior to Attaching the Socket to the PCB:

1. The alignment holes in the Printed Circuit Board (PCB) enable accurate socket alignment during the solder reflow process, so make sure the PCB has a layout with alignment holes.
2. Before attaching the prototype socket to the PCB, check that the mounting pads have the correct solder mask openings. Please refer to the “EIA Standard Board Layout Recommendation” section for more information about prototype socket pad layout and solder mask openings in the QFP packages. If the mounting pad solder mask opening is too long it may result in insufficient solder coverage during the solder reflow process.

Note: It is recommended that different solder mask openings be used for prototype sockets and production QFP packages.

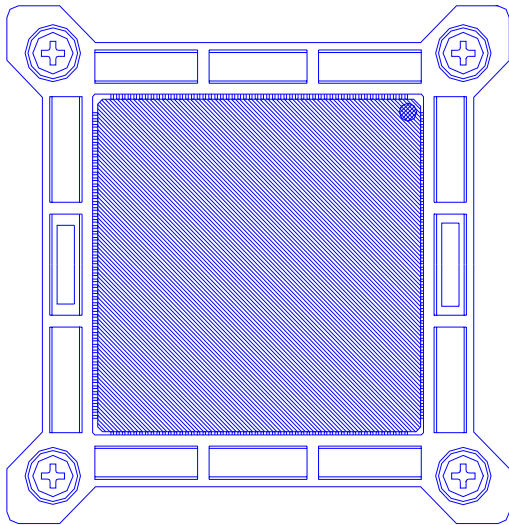
3. Socket manufacturers highly recommend that solder reflow be used to solder sockets onto the PCB. The alignment pins on the surface mount allow accurate socket placement during board assembly. Hand soldering of high pin count sockets is not recommended because the leads of the socket can be difficult to reach, which may result in solder bridging.
4. Since board designers use a variety of solder pastes and circuit boards, as well as different quantities and types of devices, no single temperature profile will work for all PCBs. However, **Figure 4** shows a sample temperature profile that can be used to reflow prototype sockets as well as QFP packages. The socket manufacturers also recommend using the following temperatures for different methods of soldering:
 - a. For VPS (Vapor Phase Soldering): 220 °C for a maximum of 60 seconds.
 - b. Infrared reflow: 200 °C to 250 °C for a maximum of 60 seconds.
 - c. Hand soldering: 360 °C for a maximum of 4 seconds.
5. For uniform heating, use convection and hybrid ovens rather than plain, infrared ovens. Some boards, particularly those with large devices or sockets, require fine-tuned ovens that provide uniform temperatures to all the devices on the board.

Procedure for Attaching the Socket to the PCB:

1. Remove the socket lid if it is attached when you receive the socket. This will reduce the socket mass during solder reflow and allow more accurate socket alignment.
2. Use the alignment pins from the socket to align the socket into the PCB. Then put the PCB with the other devices that are on the board into the solder reflow oven.
3. Once the socket has been soldered onto the PCB, inspect the solder joint of each lead for sturdiness and reliability.
4. After programming the device, but prior to placing it in the socket, inspect the package lead condition to make sure there is no lead damage. To prevent lead

damage, a vacuum wand must be used to pick up the device from the programming module and place it into the socket. Any lead damage may cause a continuity problem.

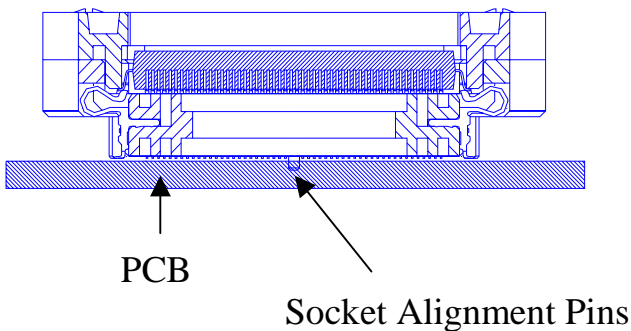
5. After placing the device into the socket, carefully replace the socket lid and tighten it to secure the device. All four corners should be tightened evenly to ensure uniform pressure. Uneven pressure may result in a continuity problem.



Socket top view



QFP Package



Socket

For greater accuracy, it is recommended that the socket be reflowed rather than hand soldered.

Figure 1 QFP Socket

Prototype BGA, FG, CS Socket

Please check the drawing for each package configuration and their options from the front page of “Prototype socket page” on the web.

General:

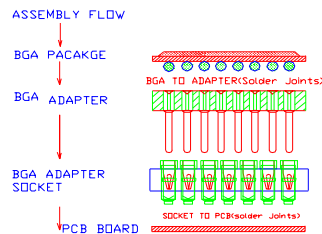
The BGA socket has a ball pitch of 1.27mm; the FG socket has a ball pitch of 1.0mm and CS socket has a ball pitch of 0.8mm.

Option 1:

Features:

- The Ball Grid Array (BGA) Adapter/Socket Module consists of two parts: the male pluggable adapter and the ultra light insertion force surface mount adapter socket. Refer to Figure 2 for details.
- The surface mount socket has the same footprint as the BGA package, and the Adapter/Socket Module has the same overall size as the BGA package.
- PCB layout is the same for the BGA package and the surface mount socket.

Figure 2



Adapter Socket Use:

Note: The adapter socket manufacturer recommends using a solder paste thickness of at least 0.008 inches to insure a reliable solder joint between the socket and the PCB.

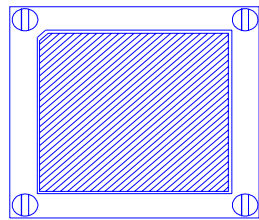
1. Attach the surface mount adapter socket to the PCB using the solder reflow method.
Note: It is recommended that the standard surface mount solder reflow temperature profile be used. See Figure 4 for details. If a rework station is used to solder the surface mount adapter socket to the PCB, remember to adjust the reflow duration to create good solder joints without increasing the socket body temperature beyond the allowed maximum of 220 °C (± 5 °C). The surface mount socket base material is FR4, which is the same material as the BGA substrate package. Therefore, the same reflow temperature that is applied to the BGA package should be applied to the socket.
2. After programming a device, solder reflow the BGA package onto the BGA adapter.
Note: This can be done using a solder reflow oven with the standard surface mount solder reflow temperature profile. However, if you use a rework reflow station, remember to adjust the reflow duration to create good solder joints without raising the device body temperature beyond the allowed maximum of 220 °C (± 5 °C).
3. Take the BGA adapter module that has already been soldered to the package and plug it into the surface mount adapter socket.
4. Under normal usage condition, the adapter socket insertion life is about 80 to 100 cycles. However, the insertion life cycle can be reduced dramatically if the socket contact is damaged during the process of inserting and removing the adapter socket. To remove the BGA adapter module from the surface mount adapter socket without causing any damage, you must use an extraction tool (part#: 828-01-010) from Mill-Max.

Option 2:

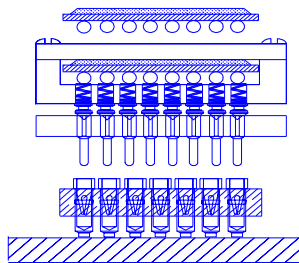
Features:

- The Ball Grid Array (BGA) Socket Module consists of two parts: the male screw lock pluggable socket and the ultra light insertion force surface mount adapter socket. Refer to Figure 3 for details.
- The surface mount socket has the same footprint and overall size as the BGA package. It is placed and reflowed onto the PCB in the same way as the BGA package.
- The screw lock pluggable socket does not require soldering of the BGA package as is required in option 1. Since the socket contact is spring loaded, the BGA package can be plugged in and removed from the socket.
- PCB layout is the same for the BGA package and the surface mount socket.

Figure 3



Socket Top View



BGA, FG, CS packages**

Socket (non-solder) side view
(Part# SE-BGxxx-A)

Adapter Socket - solder reflow to PCB

(Part#: SM-BGxxx-B)

PCB

Note:

FG and CS package sockets do not use Adapter socket, the sockets are reflowed to the PCB directly.

Adapter Socket Use:

1. Since the pluggable socket is slightly bigger than the surface mount adapter socket, be sure to check the pluggable socket drawing for specific dimensions before finalizing the PCB layout.

Note: The adapter socket manufacturer recommends a solder paste thickness of at least 0.008 inches to insure a reliable solder joint between the socket and the PCB.

2. Attach the surface mount adapter socket onto the PCB with the solder reflow method.

Note: It is recommended that the standard surface mount solder reflow temperature profile be used. See **Figure** for details. If you have to use a rework station to solder the surface mount socket to the PCB, remember to adjust the reflow duration to create a good solder joint without raising the socket body temperature beyond the maximum allowable temperature of 220 °C (±5 °C). The surface mount socket base material is FR4, which is the same material as the BGA substrate package. Therefore, the same reflow temperature that is applied to the BGA package should be applied to the socket.

3. Take the pluggable socket and plug it into the surface mount adapter socket that has already been soldered onto the PCB.

4. After programming the device, place the package device onto a pluggable socket. Then close the lid to secure the BGA package in the socket.

Note: When you tie down the screw (4 screws—one per side), you must use torque limiting screw driver (preset 7.0 cNm refer picture below) to tie them down gradually and evenly.



Torque Limiting Screw Driver

5. To remove the BGA package from the pluggable socket, unscrew the lid and take out the BGA package.

Trouble shooting when you encounter socket related problems:

For QFP package prototype sockets, make sure you follow the instruction on Page 1 when attaching the socket to the board. If you encounter the following problems, please follow the steps:

- For any adjacent pin short, please check the solder bridge from socket to PCB, and check the package unit to make sure the leads are not bent.
- For pin open, check the lead to PCB connection and make sure they are not open. Check the package unit to make sure the leads are not bent. Sometime the open is due to the package lead being bent and not able to make contact to the socket contactors.
- Check the socket contactors condition for both short and open problem. If the socket contactors are damaged, the problem will show up as opens and shorts.
- Four corner screws need to tighten down evenly to prevent uneven stress.

For BGA, FG, and CS packages prototype sockets, make sure you follow the instruction in Page 1 when attaching the socket to the board. If you encounter the following problems, please follow these steps:

- For any adjacent pin short – This is most likely due to the pins that are solder to the PCB are short, which are due to too much solder or to alignment problems. X-Ray can show the defect.
- For pin open – Check the socket pin to PCB connection and make sure they are not open. Check the socket contactors to make sure the spring contactors are sticking out from the base. If not, the solder ball might not able to make good contact.
- Four corner screws need to tighten down evenly to prevent uneven stress. This can cause damage to the package and thus cause pin open problems.