Actel CQFP – FBGA484 Adapter Boards

(SI-SX32-ACQ256SFG484 and SI-SX72-ACQ256SFG484)

Contents

1). Introduction

Actel CQFP- FBGA Adapter Boards

Introduction

Actel's expanded Adapter Board offering allows for easy prototyping. The CQFP to FBGA Adapter boards (SI-SX32-ACQ256SFG484 and SI-SX72-ACQ256SFG484) are specifically built for prototyping for the SXA and SXS families. This solution allows a customer to prototype with an A54SX32A-FG484 device and then for production switch to either an A54SX32A-CQ256 or an RT54SX32S-CQ256 device. Likewise, customers can prototype with an A54SX72A-FG484 device and then for production switch to either an A54SX72A-CQ256 or an RT54SX72S-CQ256 device.

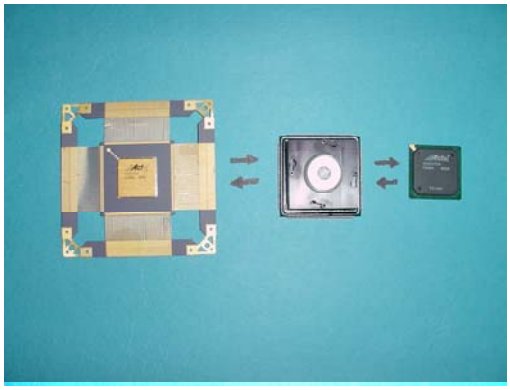

Figure 1. CQ256 to FG484 via CQFP to FBGA adapter board

Figure 2. Assembled "CQFP to FBGA adapter socket" Adapter Board with socket (SI-SX32-ACQ256SFG484)

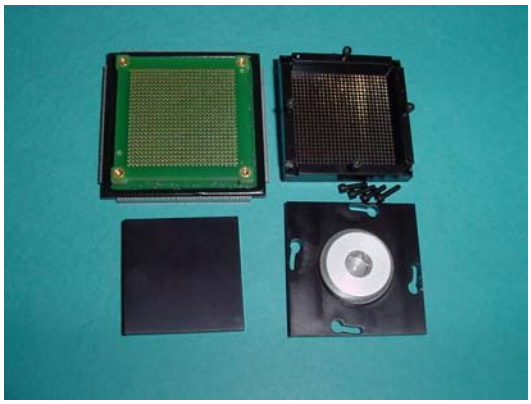

Figure 3. Before assembly of “CQFP to FBGA adapter socket” (SI-SX32-CQ256SFG484)
Top from left - adapter board, top frame
Bottom from left – compression plate, top lid

Assembly Procedure

The bottom piece of the adapter board should be soldered either reflow soldered or manual soldered to the customer’s board based on Ironwood “Gull Wing Surface mount Foot Soldering Instructions” in Appendix C (Figure 4). The top frame can then be tightened to the bottom piece using a .05” wrench (figure 5). The programmed FG484 packaged part can then be placed on the top frame (figure 6). Place the compression plate and top lid on top (figure 7 & 8). Secure the top lid by tightening down with a .05” wrench (figure 9). Use the Pre-Set 3 in-labs Torque-Limiting Screw Driver to apply force to compress the package (figure 10)

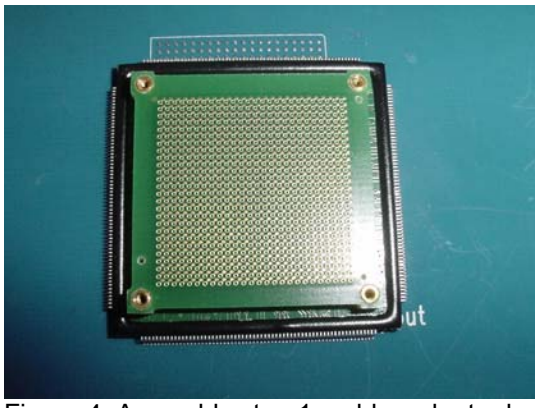

Figure 4. Assembly step 1- solder adapter board bottom to PCB

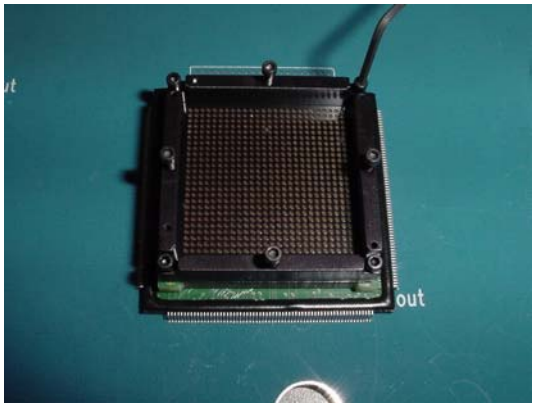

Figure 5. Assembly step 2 – tighten top frame with 0.5” wrench

Figure 6. Assembly step 3 – place in FG484 in socket

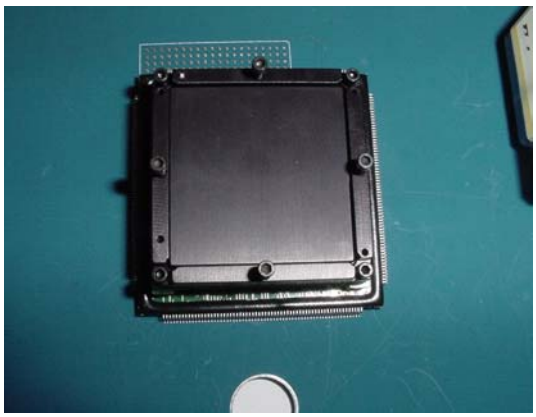
Figure 7. Assembly step 4 –place the compression plate on top of device

Figure 8. Assembly step 5 – put on top lid

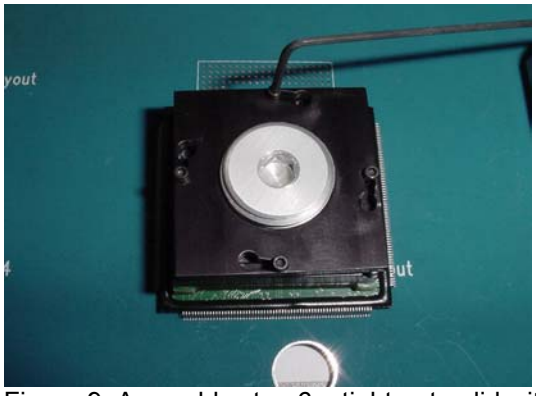

Figure 9. Assembly step 6 – tighten top lid with .05” wrench

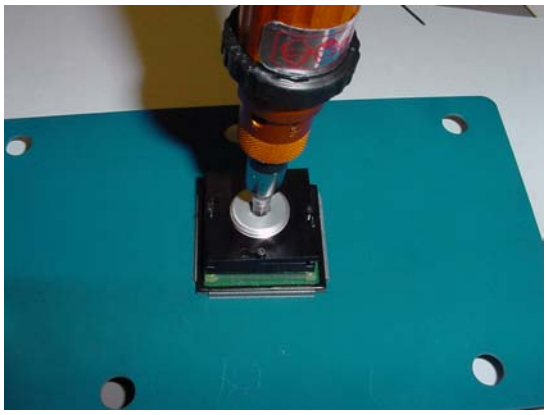

Figure 10. Assembly step 7 – tighten top compression screw using Pre-Set 3 lbf-in Torque Limiting Screw driver

During prototyping, if the design code changes and a new FPGA device is needed, it is very easy to remove the top lid and compression plate to replace the FPGA. To insert a new-programmed part, just place it on the top frame and replace the compression plate and top lid. This can be repeated multiple times during the prototyping design phase.

NOTE:

1). For more detailed assembly information also refer to Ironwood Electronics C4002 & C4228 assembly Instructions, online at www.ironwoodelectronics.com

2). Torque Limiting Screw Driver can be Mountz, Inc product. Refer Mountz, Inc products online at www.mountztorque.com

Mountz part #

Torque Limiting Screw Driver part #: 020066 (preset 3 lbf-in)

Hex Power Bit #: 120841

2). Appendix A – SI-SX32-ACQ256SFG484 Mechanical Drawing and Assembly instructions

Note:

Tighten top compression screw using preset 3 lbf-in Torque Limiting Screwdriver.

Torque Limiting Screw Driver can be Mountz, Inc product

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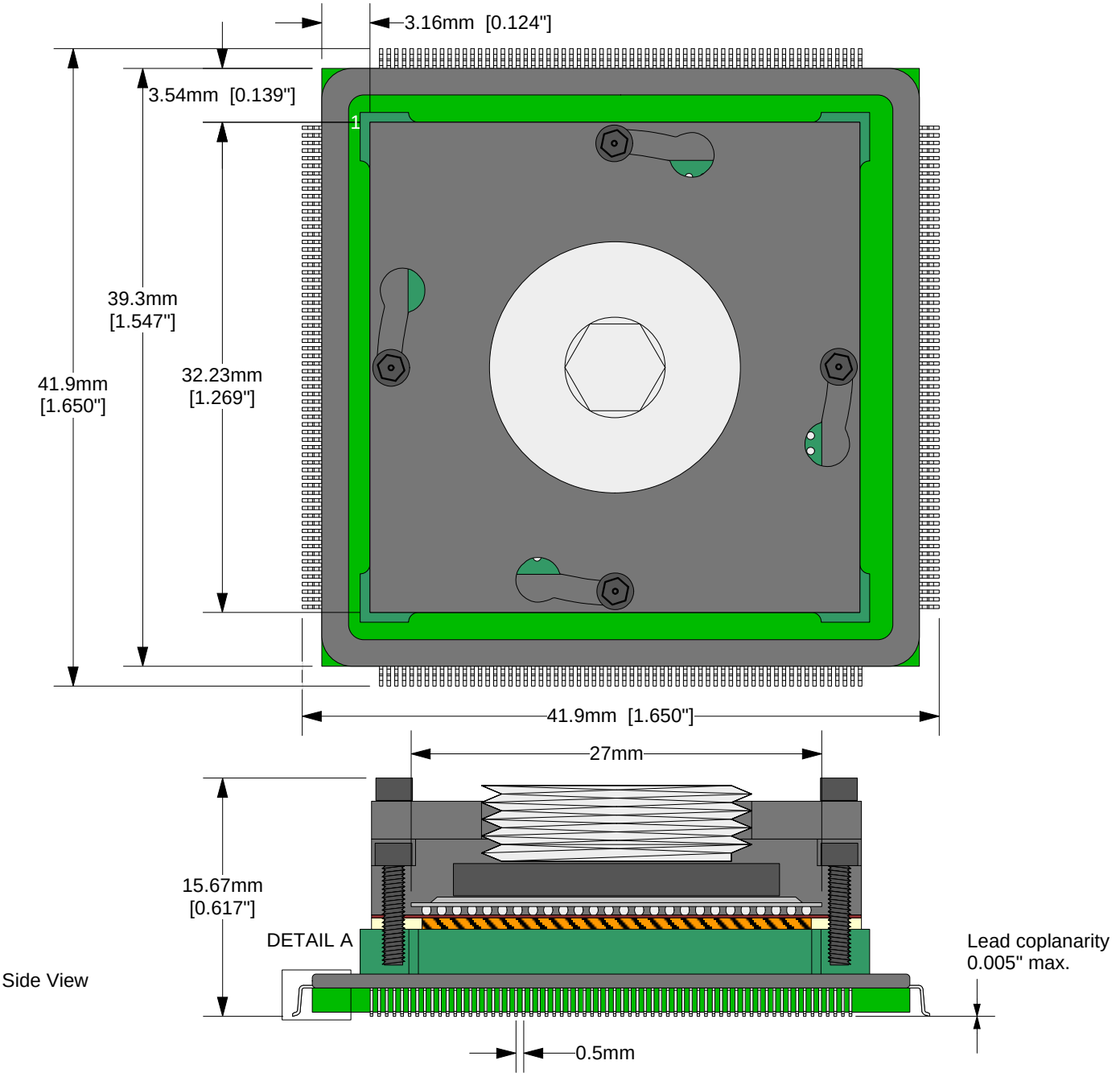
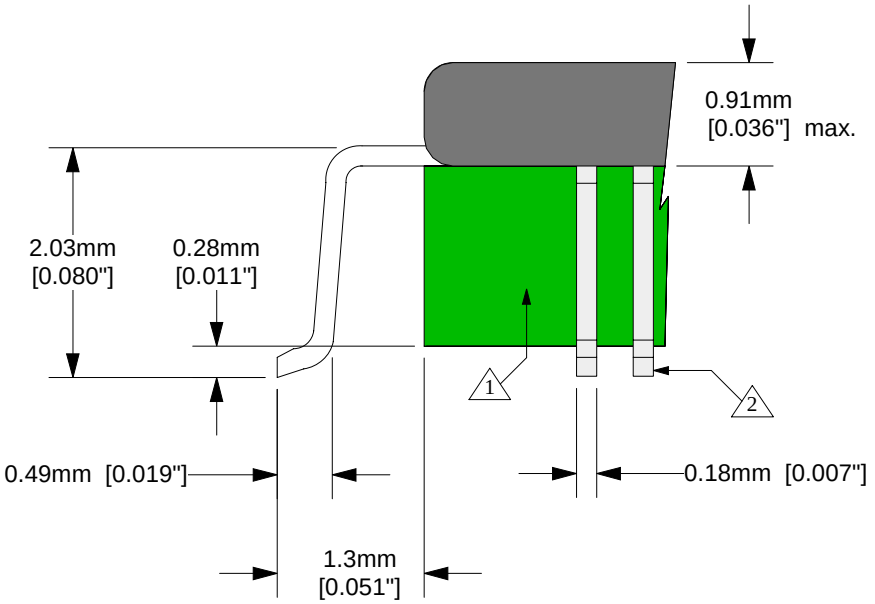


Description: BGA to QFP package converter
484 position BGA surface mount GHz BGA socket (1.00mm centers, 26X26 array, 27X27mm body) to 256 QFP, 0.5mm gull-wing leads. Pin assignment: A54Sx32A CQ256 to A54SX72A FG484

Tolerances: diameters ±0.03mm [±0.001"], PCB perimeters ±0.13mm [±0.005"], PCB thicknesses ±0.18mm [±0.007"], pitches (from true position) ±0.08mm [±0.003"], all other tolerances ±0.13mm [±0.005"] unless stated otherwise. Materials and specifications are subject to change without notice.

C4228 Drawing	Status: Released	Scale: 10:4	Rev: B
 PO BOX 21151 ST. PAUL, MN 55121 Tele: (651) 452-8100 www.ironwoodelectronics.com	Drawing: M. Tully	Date: 10/2/01	
	File: C4228 Dwg.mcd	Modified: 1/29/02, MT	

DETAIL A



1 Substrate: 1.59mm ±0.18mm [0.0625" ±0.007"] FR4/G10 or equivalent high temp material. 17µm [1/2 oz.] Cu clad. SnPb plating.

2 Leads: material- BeCu Alloy 194; plating- 80/20 SnPb.

Specifications:

Operating Temperature Range (1)	-40 ° C. to 55 ° C
Storage Temperature Range (1)	-62 ° C. to 85 ° C
Solderability (2)	260 ° C, 5 sec. maximum
Maximum Temperature, Substrate	290 ° C, 5 sec. maximum
Through path Resistance	10 milliohms at 200 mA
Packaging (3)	Best commercial practices

(1) per Mil-STD-202, method 107, test condition A
(2) per Mil-STD-202, method 208 (soldering heat per Method 210, condition B)
(3) Packaging contains Ironwood Electronics part number, Ironwood Electronics name and quantity of parts per shipment

Tolerances: diameters ±0.03mm [±0.001"], PCB perimeters ±0.13mm [±0.005"], PCB thicknesses ±0.18mm [±0.007"], pitches (from true position) ±0.08mm [±0.003"], all other tolerances ±0.13mm [±0.005"] unless stated otherwise. Materials and specifications are subject to change without notice.

C4228 Drawing	Status: Released	Scale: 15:1	Rev: B
PO BOX 21151 ST. PAUL, MN 55121 Tele: (651) 452-8100 www.ironwoodelectronics.com	Drawing: M. Tully	Date: 10/2/01	
	File: C4228 Dwg.mcd	Modified: 1/29/02, MT	

C4228 Assembly Instructions

1. Install the socket base assembly (A) on the target PCB using the Gullwing Surface Mount Soldering Instruction document.
   Solder procedure #2 or #3 are recommended to induce the least amount of thermal stresses on the base adaptor
2. Place the Socket/Elastomer assembly (B) onto the socket base, aligning the orientation mark on the assembly with the A1 indicator on the adaptor board (see page 4 for details)**.**

WARNING: ASSEMBLY (B) MUST BE REMOVED IF THE BASE WILL BE SUBJECT TO REFLOW AGAIN. THE ELASTOMER WILL NOT WITHSTAND TEMPERATURES ABOVE 100 degrees C.

3. Using the 4 Hex head screws (C), attach the Socket/ Elastomer assembly onto the socket base .

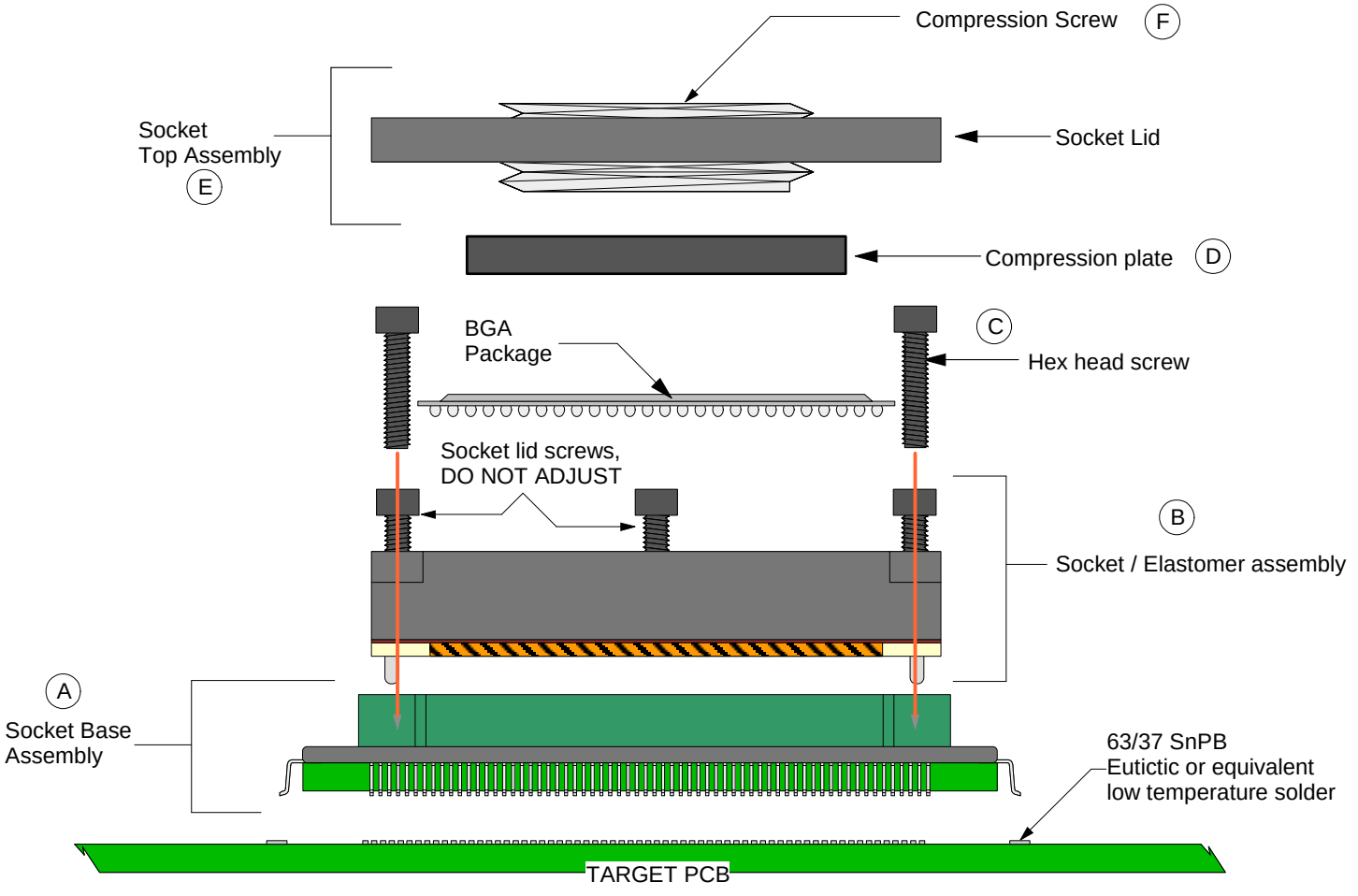
4. Place BGA package (solder ball side down) into the socket. NOTE: BGA orientation into socket is critical.

5. Place the compession plate (D), on top of the BGA package, orientation is not important.

6. Install the Socket Top assembly (E) by placing it over the socket lid screws and rotating.

7. Turn the compression screw (F) clockwise, until it makes contact with the compression plate.

8. Using a torque limiting screw driver or wrench set to 3 in-lbs, tighten the compression screw.



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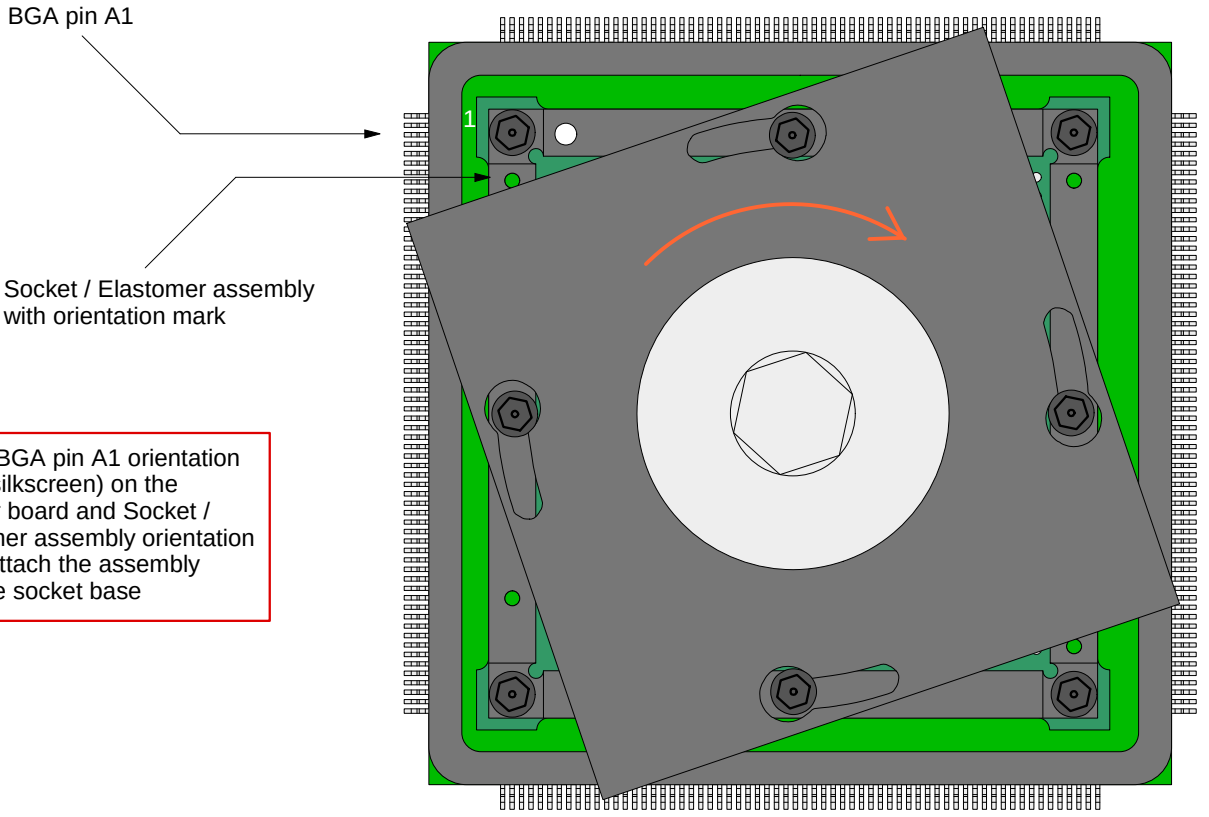
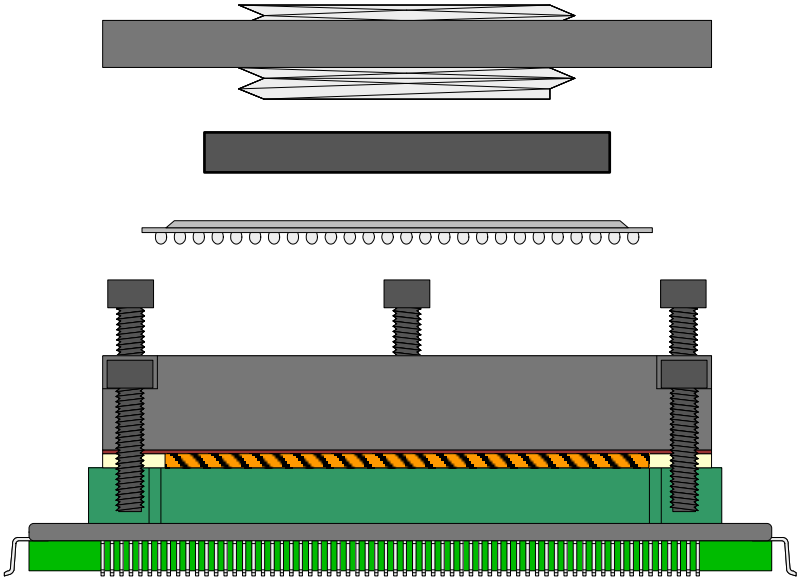


Noting BGA pin A1 orientation (white silkscreen) on the adaptor board and Socket / Elastomer assembly orientation mark, attach the assembly onto the socket base

Top view: Lid in initial attachment position



Note: The socket base assembly will have to be assembled to the Gull-wing adaptor board only once. In use, the complete adaptor will only require the lid and compression plate to be removed to exchange BGA IC's

Side view

Tolerances: diameters ±0.03mm [±0.001"], PCB perimeters ±0.13mm [±0.005"], PCB thicknesses ±0.18mm [±0.007"], pitches (from tru e position) ±0.08mm [±0.003"], all other tolerances ±0.13mm [±0.005"] unless stated otherwise. Materials and specifications are subject to change without notice.

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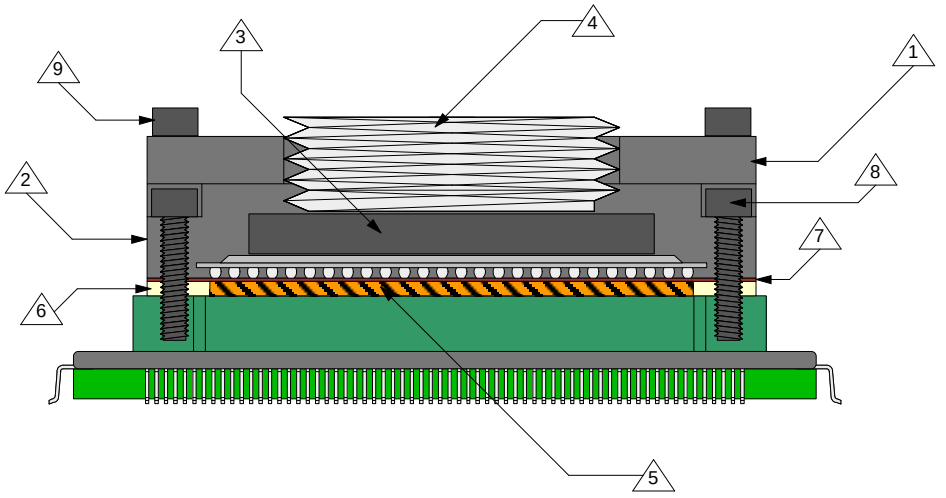
	File: C4228 Dwg.mcd	Modified: 1/29/02, MT	



Materials:

1. Socket Lid: Black anodized 6061 Aluminum. Thickness = 2.0mm.

2. Socket base: Black anodized 6061 Aluminum. Thickness = 5mm.

3. Compression Plate: Black anodized 6061 Aluminum. Thickness = 2.5mm.

4. Compression screw: Black anodized 6061 Aluminum. Thickness = 5mm, Hex socket = 5mm.

5. Elastomer: 30 micron dia gold plated brass filaments arranged symmetrically in a silicone rubber (63.5 degree angle). Thickness = 1.00mm.

6. Elastomer Guide: Non-clad FR4. Thickness = 0.75mm.

7. Ball Guide: Kapton polyimide.

8. Socket base screw: Socket head cap, 18-8 Stainles steel, 0-80 fine thread , 9.00mm long.

9. Socket lid screw: Socket head cap, 18-8 Stainless steel, 0-80 fine thread , 5.85mm long.

Tolerances: diameters ±0.03mm [±0.001"], PCB perimeters ±0.13mm [±0.005"], PCB thicknesses ±0.18mm [±0.007"], pitches (from tru e position) ±0.08mm [±0.003"], all other tolerances ±0.13mm [±0.005"] unless stated otherwise. Materials and specifications are subject to change without notice.

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3). Appendix B – SI-SX72-ACQ256SFG484 Mechanical Drawing and Assembly instructions

Note:

Tighten top compression screw using preset 3 lbf-in Torque Limiting Screwdriver.

Torque Limiting Screw Driver can be Mountz, Inc product

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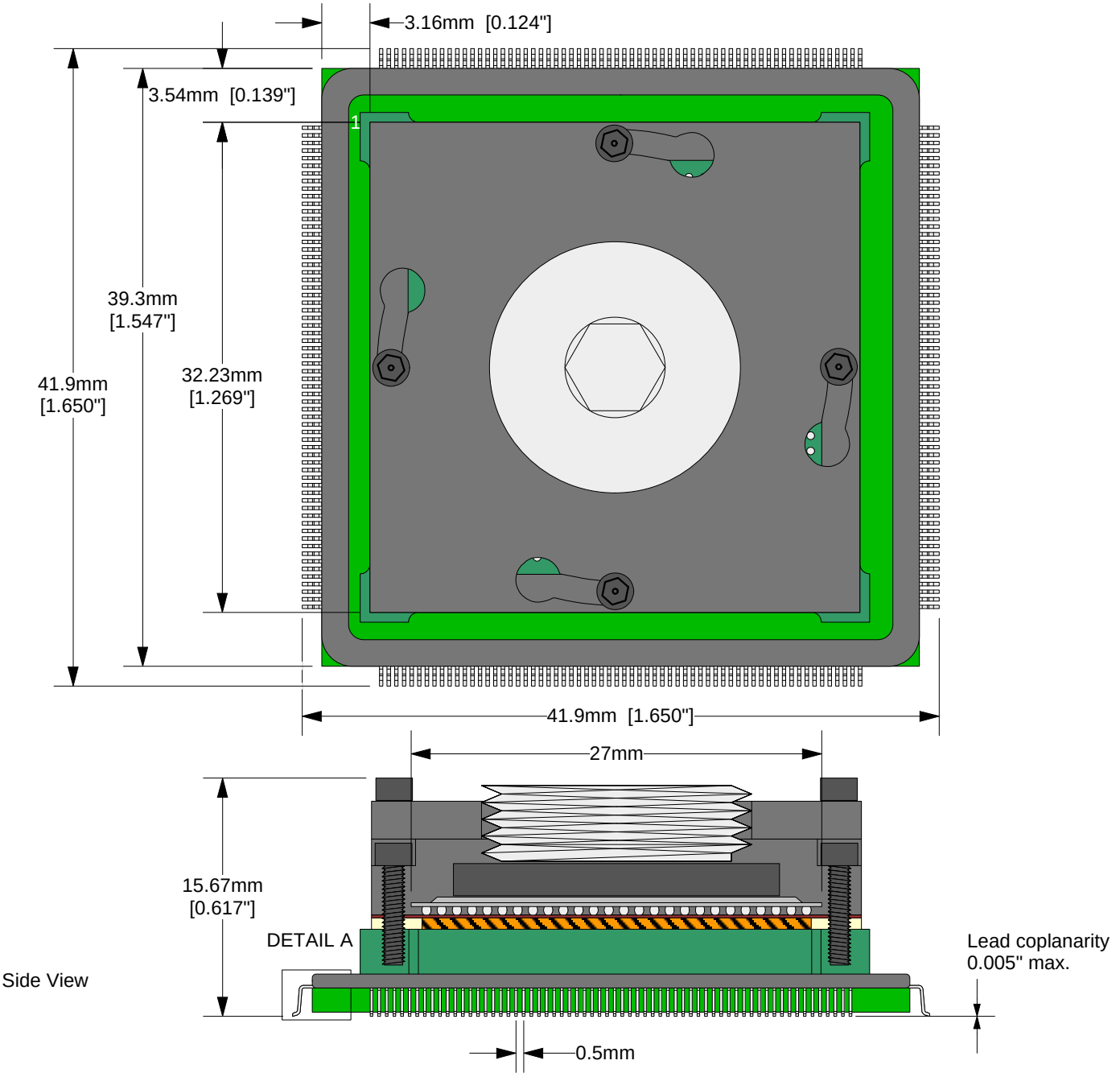
Mountz part#

Torque Limiting Screw Driver part #: 020066 (preset 3 lbf-in)

Hex Power Bit #: 120841



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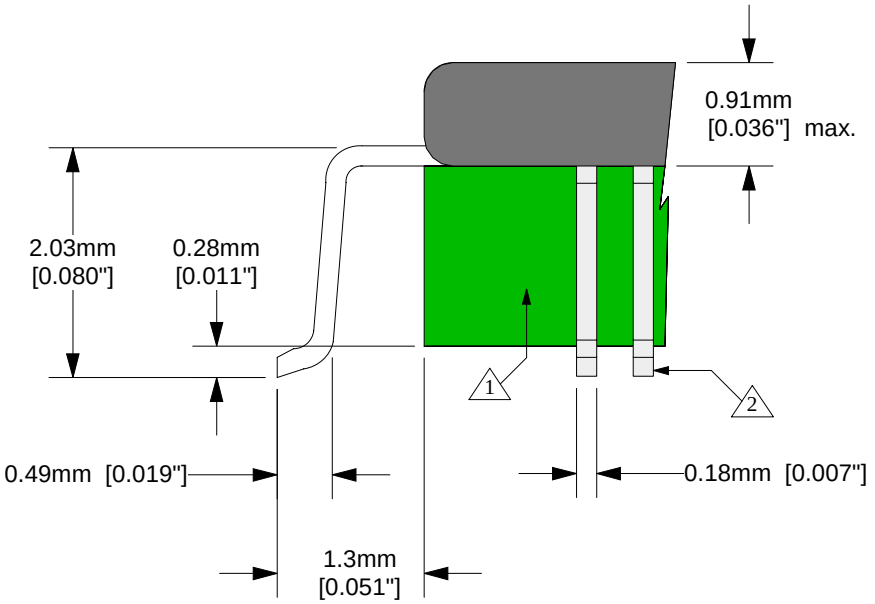
C4002 Drawing	Status: Released	Scale: 1:0.4	Rev: E
 PO BOX 21151 ST. PAUL, MN 55121 Tele: (651) 452-8100 www.ironwoodelectronics.com	Drawing: M. Tully	Date: 6/5/01	
	File: C4002 Dwg.mcd	Modified: 1/28/02. MT	

DETAIL A



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2 Leads: material- BeCu Alloy 194; plating- 80/20 SnPb.

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(1) per Mil-STD-202, method 107, test condition A
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(3) Packaging contains Ironwood Electronics part number, Ironwood Electronics name and quantity of parts per shipment

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	File: C4002 Dwg.mcd	Modified: 1/28/02. MT	

C4002 Assembly Instructions

1. Install the socket base assembly (A) on the target PCB using the Gullwing Surface Mount Soldering Instruction document.
   Solder procedure #2 or #3 are recommended to induce the least amount of thermal stresses on the base adaptor
2. Place the Socket/Elastomer assembly (B) onto the socket base, aligning the orientation mark on the assembly with the A1 indicator on the adaptor board (see page 4 for details)**.**

WARNING: ASSEMBLY (B) MUST BE REMOVED IF THE BASE WILL BE SUBJECT TO REFLOW AGAIN. THE ELASTOMER WILL NOT WITHSTAND TEMPERATURES ABOVE 100 degrees C.

3. Using the 4 Hex head screws (C), attach the Socket/ Elastomer assembly onto the socket base .

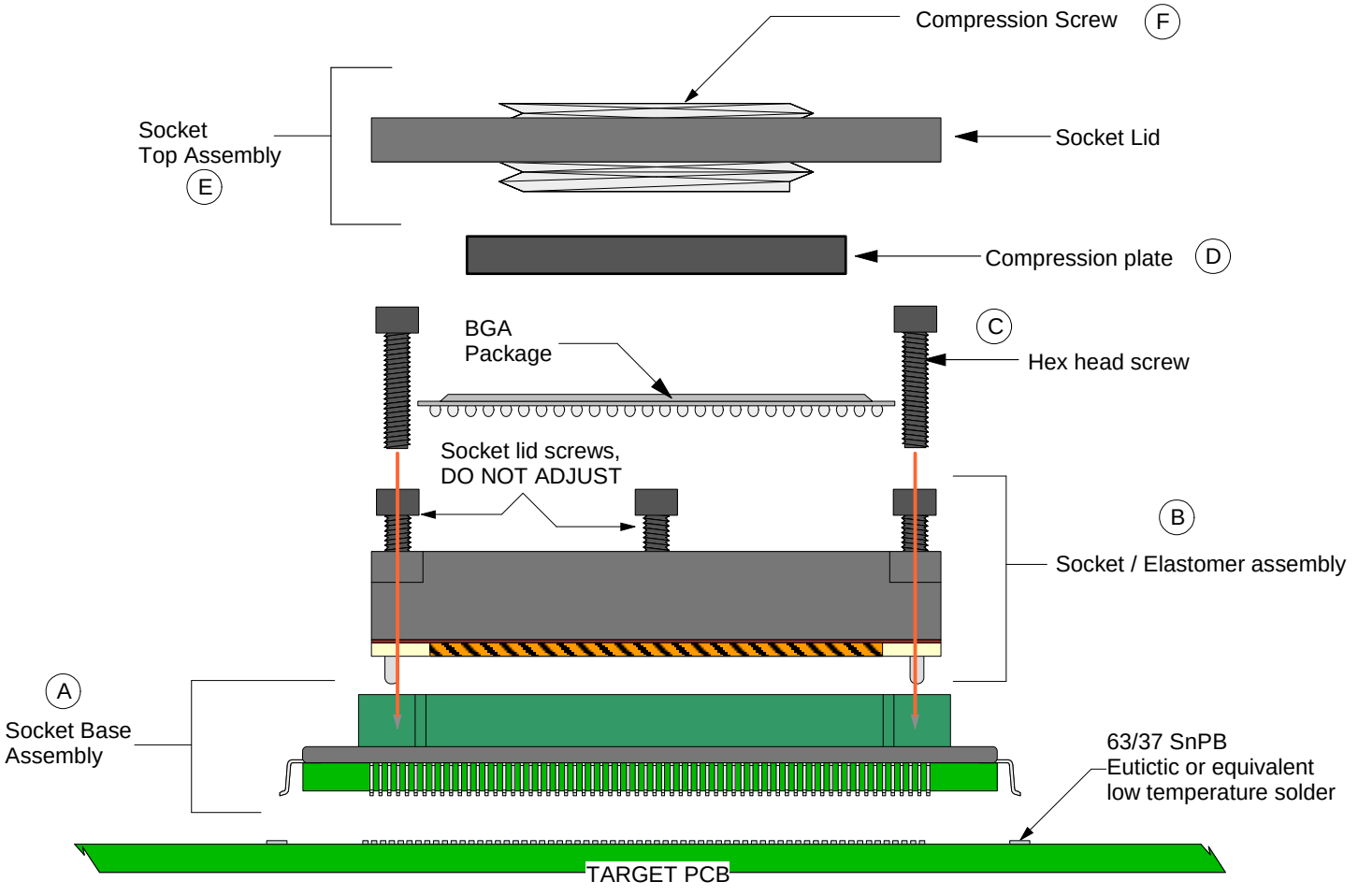
4. Place BGA package (solder ball side down) into the socket. NOTE: BGA orientation into socket is critical.

5. Place the compession plate (D), on top of the BGA package, orientation is not important.

6. Install the Socket Top assembly (E) by placing it over the socket lid screws and rotating.

7. Turn the compression screw (F) clockwise, until it makes contact with the compression plate.

8. Using a torque limiting screw driver or wrench set to 3 in-lbs, tighten the compression screw.



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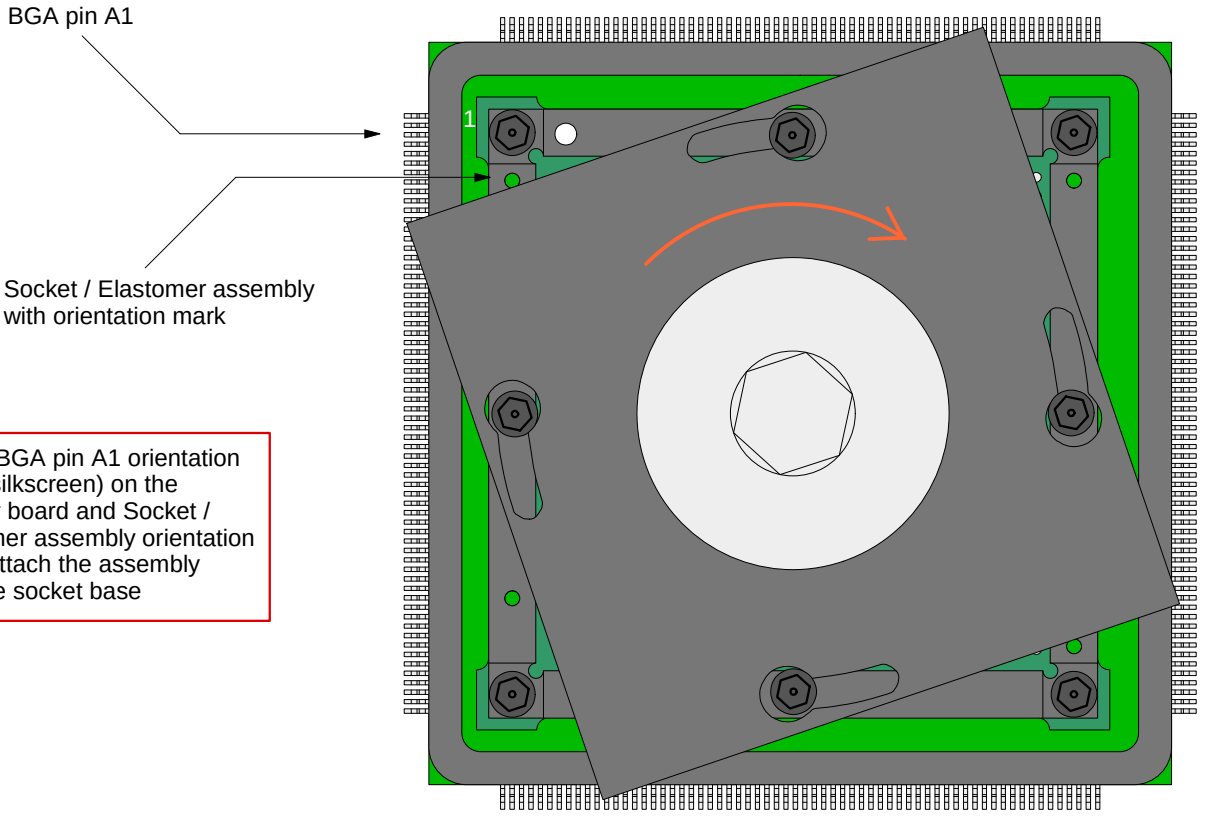
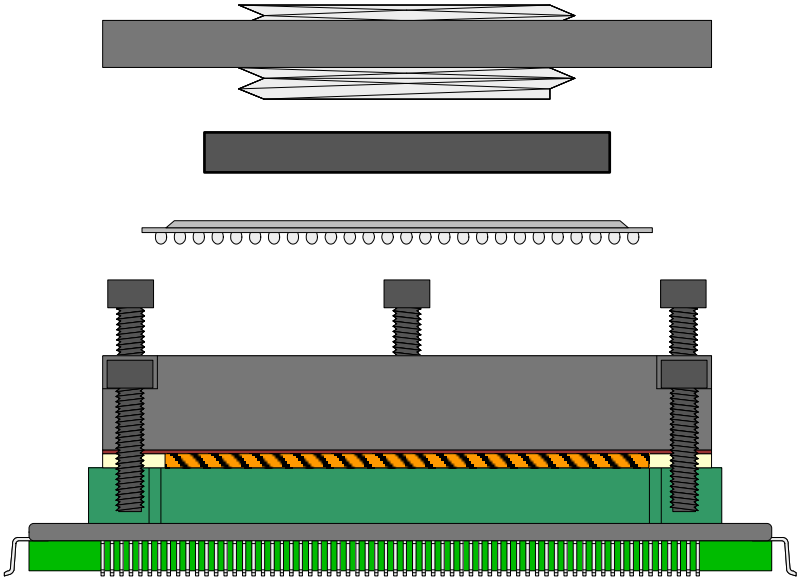


Noting BGA pin A1 orientation (white silkscreen) on the adaptor board and Socket / Elastomer assembly orientation mark, attach the assembly onto the socket base

Top view: Lid in initial attachment position



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Side view

Tolerances: diameters ±0.03mm [±0.001"], PCB perimeters ±0.13mm [±0.005"], PCB thicknesses ±0.18mm [±0.007"], pitches (from tru e position) ±0.08mm [±0.003"], all other tolerances ±0.13mm [±0.005"] unless stated otherwise. Materials and specifications are subject to change without notice.

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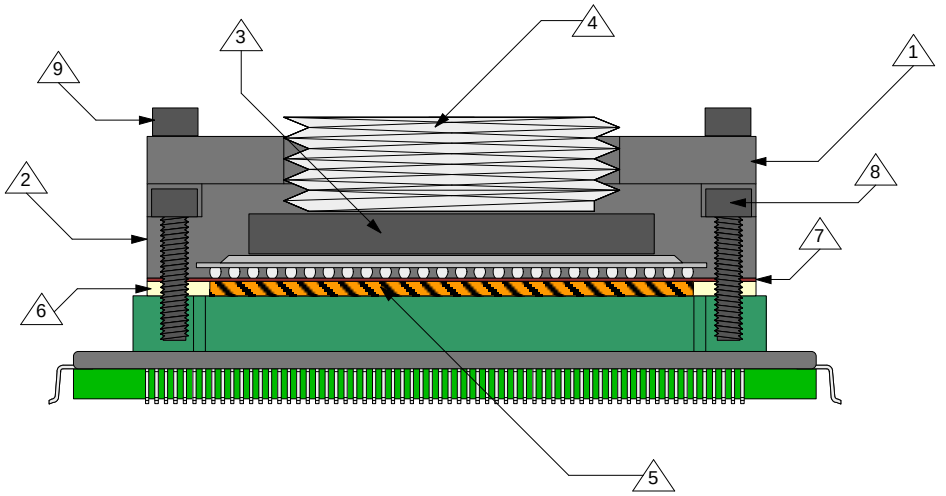

Materials:

1. Socket Lid: Black anodized 6061 Aluminum. Thickness = 2.0mm.

2. Socket base: Black anodized 6061 Aluminum. Thickness = 5mm.

3. Compression Plate: Black anodized 6061 Aluminum. Thickness = 2.5mm.

4. Compression screw: Black anodized 6061 Aluminum. Thickness = 5mm, Hex socket = 5mm.

5. Elastomer: 30 micron dia gold plated brass filaments arranged symmetrically in a silicone rubber (63.5 degree angle). Thickness = 1.00mm.

6. Elastomer Guide: Non-clad FR4. Thickness = 0.75mm.

7. Ball Guide: Kapton polyimide.

8. Socket base screw: Socket head cap, 18-8 Stainles steel, 0-80 fine thread , 9.00mm long.

9. Socket lid screw: Socket head cap, 18-8 Stainless steel, 0-80 fine thread , 5.85mm long.

Tolerances: diameters ±0.03mm [±0.001"], PCB perimeters ±0.13mm [±0.005"], PCB thicknesses ±0.18mm [±0.007"], pitches (from tru e position) ±0.08mm [±0.003"], all other tolerances ±0.13mm [±0.005"] unless stated otherwise. Materials and specifications are subject to change without notice.

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	File: C4002 Dwg.mcd	Modified: 1/28/02. MT	

4). Appendix C -- Gull Wing Surface mount Foot Soldering Instructions

Ironwood Electronics, Inc.
PO Box 21151 • St. Paul, MN 55121 • (651) 452-8100 • Fax (651) 452-8400

Gull Wing Surface mount Foot Soldering Instructions

The gull wing style, surface mount foot (parts with a '*SF-*' prefix and a '*-G*' suffix) is designed to solder to a quad flat pack (QFP) surface mount land pattern. The emulator foot emulates the physical characteristics of a QFP gull wing package very closely, allowing the foot to be soldered to a target board land pattern using the methods commonly employed in attaching actual QFP packages. The recommended method is explained below with visual aids showing the step-by-step process. This method has produced very good results. Figure 1 shows the surface mount emulator foot and a clean target printed circuit board. The steps involved in the soldering process follow.

CAUTION: During secondary reflow (i.e. mounting the emulator foot to a board), the temperature profile should be tightly controlled. The gull wing leads are attached to the emulator foot with 95/5 tin/silver solder(melting point 245°C). If the temperature during reflow exceeds 245°C, it will cause bridging between the leads or create opens at the clip head. The peak temperature during reflow should not reach more than 240°C. Peaks to 260°C are allowed only if the residence time is less that 40 seconds above 240°C. If you are attaching the emulator board to a target board using a hot soldering iron, this can easily happen. We strongly recommend that furnaces are profiled every day.

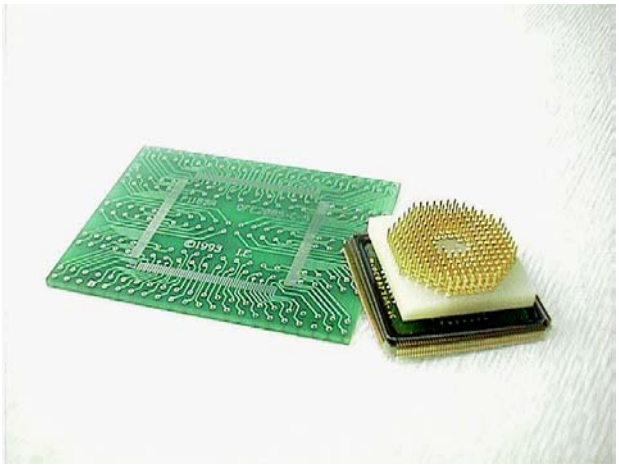

Figure 1: Target PCB/Emulator Foot

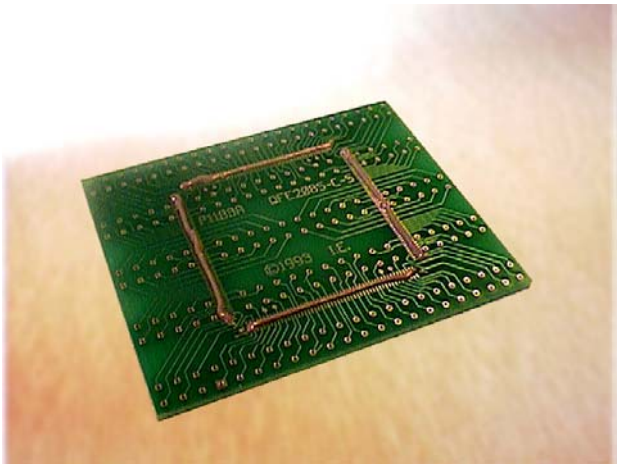

Figure 2: Apply Solder Paste

REFLOW OVEN - Soldering method #1

(a) Determine an appropriate temperature solder paste for your application.

(b) Apply a continuous bead of paste to the target PCB pads as shown in Figure 2. Cover approximately 1/3 of the pad between the center of the pad and the outer edge. Begin with this amount and add additional paste after reflow, if necessary (excessive paste on an initial trial will be difficult to remove).

(c) Note the target PCB QFP land pattern and the emulator foot Pin 1 locations.

(d) Align and place the emulator foot onto the solder paste and land pattern as shown in Figure 3. 'Pick and place' equipment or a vacuum pen, are recommended (if they will accommodate the foot), but, handling the foot by the gold pins and placing on the land pattern by hand will suffice.

(e) Reflow target PCB with emulator foot in reflow oven (convection, IR, etc.). The recommended reflow profile is shown in the Figure 5. Time and temperature settings will be determined by the manufactures of the solder paste and

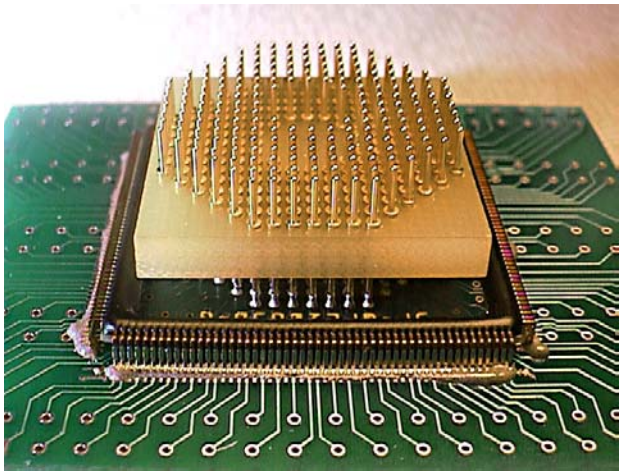

Figure 3: Align foot on the lands

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Gull wing Surface mount Foot Soldering Instructions (continued)

reflow oven. The Ironwood gull wing foot has a larger thermal mass than an actual QFP package, and therefore, may require longer reflow time and/or higher temperature settings.

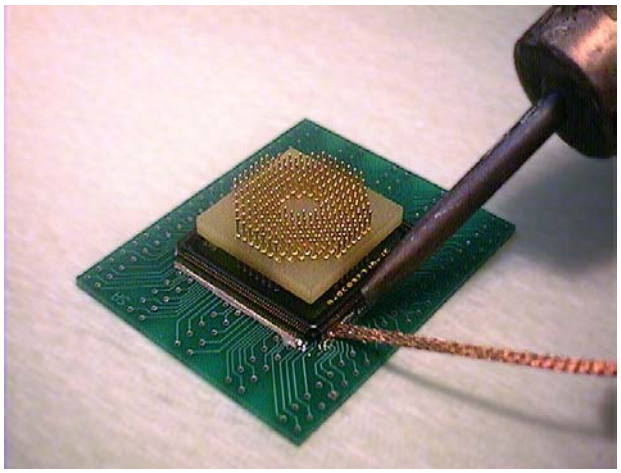

Figure 4: Removing excess solder

(f) Inspect solder fillets. Add additional solder paste to solder deficient areas as needed or remove excess with small tip solder iron and copper desoldering braid (Figure 4). If the solder has not completely reflowed, add solder flux and repeat step (e).

Because of the construction of the emulator foot, a **Low Temperature** solder paste must be used. Set reflow equipment to the lowest setting that will reflow the solder paste. Reflow the emulator foot with target assembly in a temperature range of **185 - 210 degree C**. This can be varied depending upon the profile of the oven and the customer assemblies. The above temperature range is safe for soldering the emulator foot without thermal damage to the foot. It is recommended that reflow oven be set for a minimum time initially. If reflow was not complete, reflux and reflow for a longer duration.

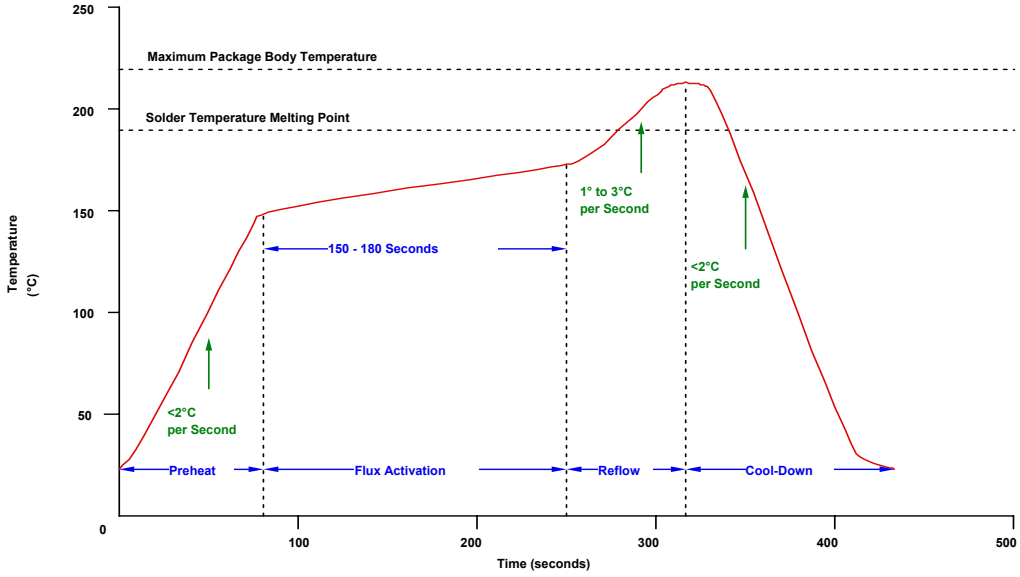

Figure 5: Recommended Convection Oven Reflow Profile

HOT AIR TOOL - Soldering method #2

Repeat steps (a) through (d) in method #1. The surface tension present between the solder and the emulator foot in method #1 will not be present in method #2, due to the fact that only a small portion of the solder in this method will be liquid at one time. It is necessary therefore, to align the foot over the land pattern with greater accuracy.

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Gull wing Surface mount Foot Soldering Instructions (continued)

(e) Reflow, with a hot air wand/gun, the solder over a few of the pads in opposite corners (diagonally) of the land pattern (Figure 6).
(f) Check the foot alignment.
(g) Continue by reflowing the remaining solder paste. Add or remove solder as needed (see step (f) in method 1.).

SOLDERING IRON - Soldering method #3
This method has produced very good results but may be more time consuming than the other two methods. Caution must be used when touching the soldering iron tip to the emulator foot. Excessive heat or pressure may damage the pads on the side of the foot.
(a) Using a small diameter solder wire (approx. 0.015" or smaller) and a very fine tipped soldering iron, add enough solder to two opposite corner (diagonal) pads to cover them.
(b) Align and place the emulator foot over the QFP land pattern (see steps (c) and (d) in method 1).
(c) Holding the foot in place, by pressing down gently on the gold terminal pins, place the iron tip on the two pads to reflow the solder. This will tack and keep the foot in alignment.

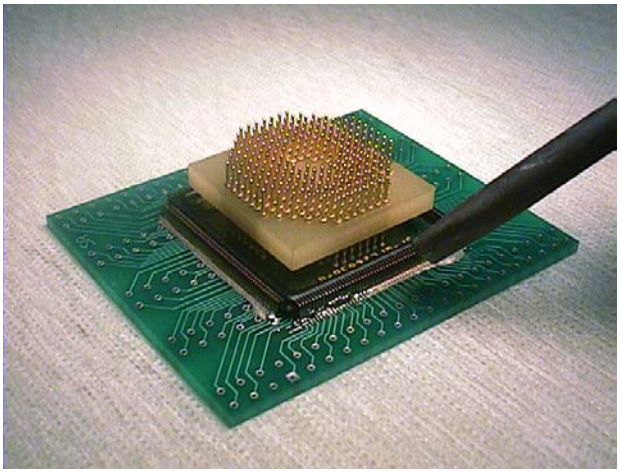


Figure 6: Reflow using hot air tool

(d) Under a microscope or magnifying lens, if available, solder the remaining edge pads of the foot to the target PCB land pattern using a liberal amount of solder (shorts between adjacent pads can be removed later).
(e) Apply a generous amount of flux along the side of the foot.
(f) Tilt the PCB and emulator foot at 30 - 45 degree angle. Start at one corner and pull the tip of the iron along the side of the foot to remove excess solder deposits. Clean the tip of the iron often. Repeat this step several times starting at a point on the foot ahead of the excess solder. Continue along the side of the foot until shorts are removed and a fillet is present between feet and target PCB pads.
(g) Repeat steps (e) and (f) for the remaining three sides. The finished solder connections are shown in Figure 7.

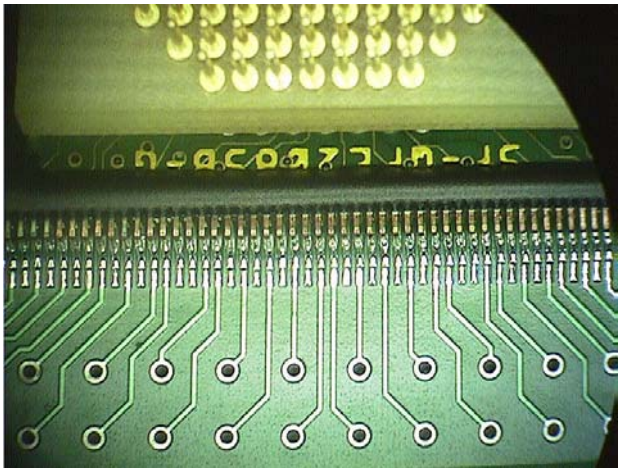


Figure 7: Finished Solder Fillets

Removing or Desoldering
Conventional methods can be used to remove a surface mount foot from your target board, however we recommend the use of PRB Line® D'SOLDER™.; This SMT device removal product avoids the use of excessive heat that can compromise the integrity of our product and your target board. The specially

Gull wing Surface mount Foot Soldering Instructions (continued)

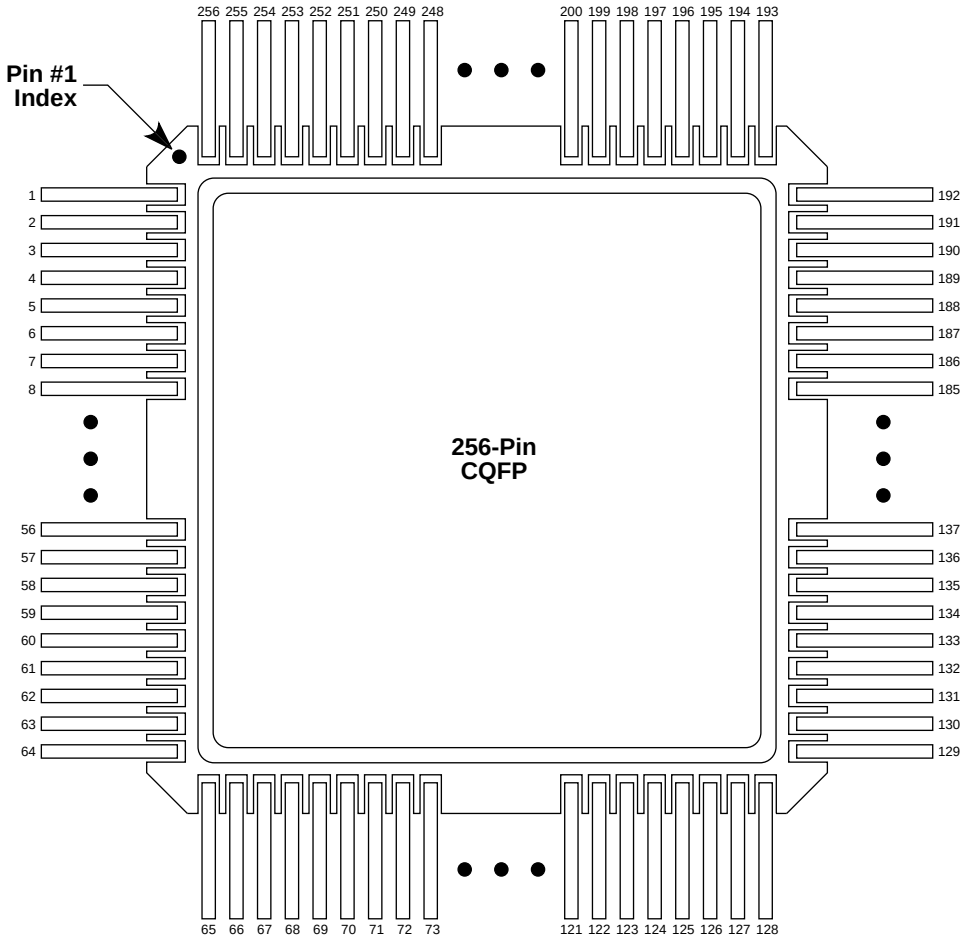
formulated alloy and flux make desoldering quick and easy. This solution can be a time and money saver for many applications. (P/N TL-DS123)

3. filename: GSI.doc, Rev C" with footer autotext filename, Rev. C.Replaced pcb with PCB.

5). Appendix D – CQ256 Package Pin Assignment List

Package Pin Assignments (continued)

256-Pin CQFP (Top View)



256-Pin CQFP

Pin Number	HiRel A54SX32A Function	HiRel A54SX72A Function
1	GND	GND
2	TDI, I/O	TDI, I/O
3	I/O	I/O
4	I/O	I/O
5	I/O	I/O
6	I/O	I/O
7	I/O	I/O
8	I/O	I/O
9	I/O	I/O
10	I/O	I/O
11	TMS	TMS
12	I/O	I/O
13	I/O	I/O
14	I/O	I/O
15	I/O	I/O
16	I/O	I/O
17	I/O	V_{CCI}
18	I/O	I/O
19	I/O	I/O
20	I/O	I/O
21	I/O	I/O
22	I/O	I/O
23	I/O	I/O
24	I/O	I/O
25	I/O	I/O
26	I/O	I/O
27	I/O	I/O
28	V_{CCI}	V_{CCI}
29	GND	GND
30	V_{CCA}	V_{CCA}
31	GND	GND
32	I/O	I/O
33	I/O	I/O
34	TRST, I/O	TRST, I/O
35	I/O	I/O
36	I/O	V_{CCA}
37	I/O	GND
38	I/O	I/O
39	I/O	I/O
40	I/O	I/O
41	I/O	I/O
42	I/O	I/O
43	I/O	I/O
44	I/O	I/O
45	I/O	I/O
46	V_{CCA}	V_{CCA}
47	I/O	V_{CCI}
48	I/O	I/O
49	I/O	I/O
50	I/O	I/O
51	I/O	I/O
52	I/O	I/O
53	I/O	I/O
54	I/O	I/O
55	I/O	I/O
56	I/O	GND
57	I/O	I/O
58	I/O	I/O
59	GND	GND
60	I/O	I/O
61	I/O	I/O
62	I/O	I/O
63	I/O	I/O
64	I/O	I/O
65	I/O	I/O
66	I/O	I/O
67	I/O	I/O
68	I/O	I/O
69	I/O	I/O
70	I/O	I/O
71	I/O	I/O
72	I/O	I/O
73	I/O	V_{CCI}
74	I/O	I/O
75	I/O	I/O
76	I/O	I/O
77	I/O	I/O
78	I/O	I/O
79	I/O	I/O
80	I/O	I/O
81	I/O	I/O
82	I/O	I/O
83	I/O	I/O
84	I/O	I/O
85	I/O	I/O
86	I/O	I/O
87	I/O	I/O
88	I/O	I/O
89	I/O	QCLKA
90	PRB, I/O	PRB, I/O
91	GND	GND
92	V_{CCI}	V_{CCI}
93	GND	GND
94	V_{CCA}	V_{CCA}
95	I/O	I/O
96	HCLK	HCLK
97	I/O	I/O
98	I/O	QCLKB
99	I/O	I/O
100	I/O	I/O
101	I/O	I/O
102	I/O	I/O
103	I/O	I/O
104	I/O	I/O

256-Pin CQFP (Continued)

Pin Number	HiRel A54SX32A Function	HiRel A54SX72A Function
105	I/O	I/O
106	I/O	I/O
107	I/O	I/O
108	I/O	I/O
109	I/O	I/O
110	GND	GND
111	I/O	I/O
112	I/O	I/O
113	I/O	I/O
114	I/O	I/O
115	I/O	I/O
116	I/O	I/O
117	I/O	I/O
118	I/O	I/O
119	I/O	I/O
120	I/O	V_{CCI}
121	I/O	I/O
122	I/O	I/O
123	I/O	I/O
124	I/O	I/O
125	I/O	I/O
126	TDO, I/O	TDO, I/O
127	I/O	I/O
128	GND	GND
129	I/O	I/O
130	I/O	I/O
131	I/O	I/O
132	I/O	I/O
133	I/O	I/O
134	I/O	I/O
135	I/O	I/O
136	I/O	I/O
137	I/O	I/O
138	I/O	I/O
139	I/O	I/O
140	I/O	I/O
141	V_{CCA}	V_{CCA}
142	I/O	V_{CCI}
143	I/O	GND
144	I/O	V_{CCA}
145	I/O	I/O
146	I/O	I/O
147	I/O	I/O
148	I/O	I/O
149	I/O	I/O
150	I/O	I/O
151	I/O	I/O
152	I/O	I/O
153	I/O	I/O
154	I/O	I/O
155	I/O	I/O
156	I/O	I/O
157	I/O	I/O
158	GND	GND
159	NC	NC
160	GND	GND
161	V_{CCI}	V_{CCI}
162	I/O	V_{CCA}
163	I/O	I/O
164	I/O	I/O
165	I/O	I/O
166	I/O	I/O
167	I/O	I/O
168	I/O	I/O
169	I/O	I/O
170	I/O	I/O
171	I/O	I/O
172	I/O	I/O
173	I/O	I/O
174	V_{CCA}	V_{CCA}
175	GND	GND
176	GND	GND
177	I/O	I/O
178	I/O	I/O
179	I/O	I/O
180	I/O	I/O
181	I/O	I/O
182	I/O	I/O
183	I/O	V_{CCI}
184	I/O	I/O
185	I/O	I/O
186	I/O	I/O
187	I/O	I/O
188	I/O	I/O
189	GND	GND
190	I/O	I/O
191	I/O	I/O
192	I/O	I/O
193	I/O	I/O
194	I/O	I/O
195	I/O	I/O
196	I/O	I/O
197	I/O	I/O
198	I/O	I/O
199	I/O	I/O
200	I/O	I/O
201	I/O	I/O
202	I/O	V_{CCI}
203	I/O	I/O
204	I/O	I/O
205	I/O	I/O
206	I/O	I/O
207	I/O	I/O
208	I/O	I/O

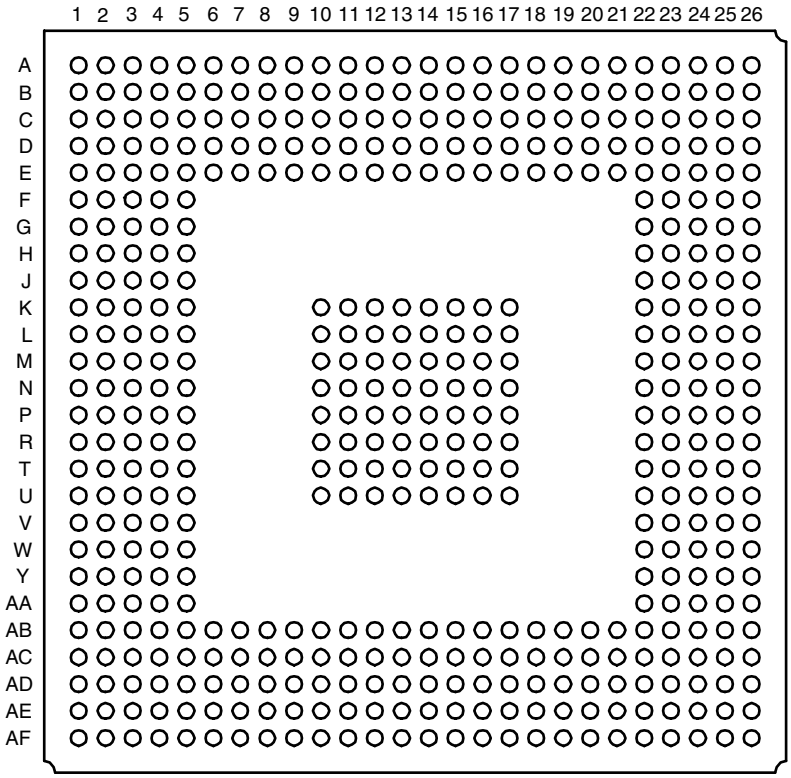
256-Pin CQFP (Continued)

Pin Number	HiRel A54SX32A Function	HiRel A54SX72A Function
209	I/O	I/O
210	I/O	I/O
211	I/O	I/O
212	I/O	I/O
213	I/O	I/O
214	I/O	I/O
215	I/O	I/O
216	I/O	I/O
217	I/O	I/O
218	I/O	QCLKD
219	CLKA	CLKA
220	CLKB	CLKB
221	V_{CCI}	V_{CCI}
222	GND	GND
223	NC	NC
224	GND	GND
225	PRA, I/O	PRA, I/O
226	I/O	I/O
227	I/O	I/O
228	I/O	V_{CCA}
229	I/O	I/O
230	I/O	I/O
231	I/O	QCLKC
232	I/O	I/O
233	I/O	I/O
234	I/O	I/O
235	I/O	I/O
236	I/O	I/O
237	I/O	I/O
238	I/O	I/O
239	I/O	I/O
240	GND	GND
241	I/O	I/O
242	I/O	I/O
243	I/O	I/O
244	I/O	I/O
245	I/O	I/O
246	I/O	I/O
247	I/O	I/O
248	I/O	I/O
249	I/O	V_{CCI}
250	I/O	I/O
251	I/O	I/O
252	I/O	I/O
253	I/O	I/O
254	I/O	I/O
255	I/O	I/O
256	TCK, I/O	TCK, I/O

6). Appendix E – FG484 Package Pin Assignment List

Package Pin Assignments (Continued)

484-Pin FBGA (Top View)



484-Pin FBGA

Pin Number	A54SX32A Function	A54SX72A Function
A1	NC	NC
A2	NC	NC
A3	NC	I/O
A4	NC	I/O
A5	NC	I/O
A6	I/O	I/O
A7	I/O	I/O
A8	I/O	I/O
A9	I/O	I/O
A10	I/O	I/O
A11	NC	I/O
A12	NC	I/O
A13	I/O	I/O
A14	NC	NC
A15	NC	I/O
A16	NC	I/O
A17	I/O	I/O
A18	I/O	I/O
A19	I/O	I/O
A20	I/O	I/O
A21	NC	I/O
A22	NC	I/O
A23	NC	I/O
A24	NC	I/O
A25	NC	NC
A26	NC	NC
AA1	NC	I/O
AA2	NC	I/O
AA3	V_{CCA}	V_{CCA}
AA4	I/O	I/O
AA5	I/O	I/O
AA22	I/O	I/O
AA23	I/O	I/O
AA24	I/O	I/O
AA25	NC	I/O
AA26	NC	I/O
AB1	NC	NC
AB2	V_{CCI}	V_{CCI}
AB3	I/O	I/O
AB4	I/O	I/O
AB5	NC	I/O
AB6	I/O	I/O
AB7	I/O	I/O
AB8	I/O	I/O
AB9	I/O	I/O
AB10	I/O	I/O
AB11	I/O	I/O
AB12	PRB, I/O	PRB, I/O
AB13	V_{CCA}	V_{CCA}
AB14	I/O	I/O
AB15	I/O	I/O
AB16	I/O	I/O
AB17	I/O	I/O
AB18	I/O	I/O
AB19	I/O	I/O
AB20	TDO, I/O	TDO, I/O
AB21	GND	GND
AB22	NC	I/O
AB23	I/O	I/O
AB24	I/O	I/O
AB25	NC	I/O
AB26	NC	I/O
AC1	I/O	I/O
AC2	I/O	I/O
AC3	I/O	I/O
AC4	NC	I/O
AC5	V_{CCI}	V_{CCI}
AC6	I/O	I/O
AC7	V_{CCI}	V_{CCI}
AC8	I/O	I/O
AC9	I/O	I/O
AC10	I/O	I/O
AC11	I/O	I/O
AC12	I/O	QCLKA
AC13	I/O	I/O
AC14	I/O	I/O
AC15	I/O	I/O
AC16	I/O	I/O
AC17	I/O	I/O
AC18	I/O	I/O
AC19	I/O	I/O
AC20	V_{CCI}	V_{CCI}
AC21	I/O	I/O
AC22	I/O	I/O
AC23	NC	I/O
AC24	I/O	I/O
AC25	NC	I/O
AC26	NC	I/O
AD1	I/O	I/O
AD2	I/O	I/O
AD3	GND	GND
AD4	I/O	I/O
AD5	I/O	I/O
AD6	I/O	I/O
AD7	I/O	I/O
AD8	I/O	I/O
AD9	V_{CCI}	V_{CCI}
AD10	I/O	I/O
AD11	I/O	I/O
AD12	I/O	I/O
AD13	V_{CCI}	V_{CCI}
AD14	I/O	I/O
AD15	I/O	I/O
AD16	I/O	I/O
AD17	V_{CCI}	V_{CCI}
AD18	I/O	I/O
AD19	I/O	I/O
AD20	I/O	I/O
AD21	I/O	I/O
AD22	I/O	I/O
AD23	V_{CCI}	V_{CCI}
AD24	NC	I/O
AD25	NC	I/O
AD26	NC	I/O
AE1	NC	NC
AE2	I/O	I/O
AE3	NC	I/O
AE4	NC	I/O
AE5	NC	I/O
AE6	NC	I/O
AE7	I/O	I/O
AE8	I/O	I/O
AE9	I/O	I/O
AE10	I/O	I/O
AE11	NC	I/O
AE12	I/O	I/O
AE13	I/O	I/O
AE14	I/O	I/O
AE15	NC	I/O
AE16	NC	I/O
AE17	I/O	I/O
AE18	I/O	I/O
AE19	I/O	I/O
AE20	I/O	I/O
AE21	NC	I/O
AE22	NC	I/O
AE23	NC	I/O
AE24	NC	I/O

484-Pin FBGA (Continued)

Pin Number	A54SX32A Function	A54SX72A Function
AE25	NC	NC
AE26	NC	NC
AF1	NC	NC
AF2	NC	NC
AF3	NC	I/O
AF4	NC	I/O
AF5	NC	I/O
AF6	NC	I/O
AF7	I/O	I/O
AF8	I/O	I/O
AF9	I/O	I/O
AF10	I/O	I/O
AF11	NC	I/O
AF12	NC	NC
AF13	HCLK	HCLK
AF14	I/O	QCLKB
AF15	NC	I/O
AF16	NC	I/O
AF17	I/O	I/O
AF18	I/O	I/O
AF19	I/O	I/O
AF20	NC	I/O
AF21	NC	I/O
AF22	NC	I/O
AF23	NC	I/O
AF24	NC	I/O
AF25	NC	NC
AF26	NC	NC
B1	NC	NC
B2	NC	NC
B3	NC	I/O
B4	NC	I/O
B5	NC	I/O
B6	I/O	I/O
B7	I/O	I/O
B8	I/O	I/O
B9	I/O	I/O
B10	I/O	I/O
B11	NC	I/O
B12	NC	I/O
B13	V_{CCI}	V_{CCI}
B14	CLKA	CLKA
B15	NC	I/O
B16	NC	I/O
B17	I/O	I/O
B18	V_{CCI}	V_{CCI}
B19	I/O	I/O
B20	I/O	I/O
B21	NC	I/O
B22	NC	I/O
B23	NC	I/O
B24	NC	I/O
B25	I/O	I/O
B26	NC	NC
C1	NC	I/O
C2	NC	I/O
C3	NC	I/O
C4	NC	I/O
C5	I/O	I/O
C6	V_{CCI}	V_{CCI}
C7	I/O	I/O
C8	I/O	I/O
C9	V_{CCI}	V_{CCI}
C10	I/O	I/O
C11	I/O	I/O
C12	I/O	I/O
C13	PRA, I/O	PRA, I/O
C14	I/O	I/O
C15	I/O	QCLKD
C16	I/O	I/O
C17	I/O	I/O
C18	I/O	I/O
C19	I/O	I/O
C20	V_{CCI}	V_{CCI}
C21	I/O	I/O
C22	I/O	I/O
C23	I/O	I/O
C24	I/O	I/O
C25	NC	I/O
C26	NC	I/O
D1	NC	I/O
D2	TMS	TMS
D3	I/O	I/O
D4	V_{CCI}	V_{CCI}
D5	NC	I/O
D6	TCK, I/O	TCK, I/O
D7	I/O	I/O
D8	I/O	I/O
D9	I/O	I/O
D10	I/O	I/O
D11	I/O	I/O
D12	I/O	QCLKC
D13	I/O	I/O
D14	I/O	I/O
D15	I/O	I/O
D16	I/O	I/O
D17	I/O	I/O
D18	I/O	I/O
D19	I/O	I/O
D20	I/O	I/O
D21	V_{CCI}	V_{CCI}
D22	GND	GND
D23	I/O	I/O
D24	I/O	I/O
D25	NC	I/O
D26	NC	I/O
E1	NC	I/O
E2	NC	I/O
E3	I/O	I/O
E4	I/O	I/O
E5	GND	GND
E6	TDI, IO	TDI, IO
E7	I/O	I/O
E8	I/O	I/O
E9	I/O	I/O
E10	I/O	I/O
E11	I/O	I/O
E12	I/O	I/O
E13	V_{CCA}	V_{CCA}
E14	CLKB	CLKB
E15	I/O	I/O
E16	I/O	I/O
E17	I/O	I/O
E18	I/O	I/O
E19	I/O	I/O
E20	I/O	I/O
E21	I/O	I/O
E22	I/O	I/O
E23	I/O	I/O
E24	I/O	I/O
E25	V_{CCI}	V_{CCI}
E26	GND	GND
F1	V_{CCI}	V_{CCI}
F2	NC	I/O
F3	NC	I/O
F4	I/O	I/O
F5	I/O	I/O
F22	I/O	I/O

484-Pin FBGA (Continued)

Pin Number	A54SX32A Function	A54SX72A Function
F23	I/O	I/O
F24	I/O	I/O
F25	I/O	I/O
F26	NC	I/O
G1	NC	I/O
G2	NC	I/O
G3	NC	I/O
G4	I/O	I/O
G5	I/O	I/O
G22	I/O	I/O
G23	V_{CCA}	V_{CCA}
G24	I/O	I/O
G25	NC	I/O
G26	NC	I/O
H1	NC	I/O
H2	NC	I/O
H3	I/O	I/O
H4	I/O	I/O
H5	I/O	I/O
H22	I/O	I/O
H23	I/O	I/O
H24	I/O	I/O
H25	NC	I/O
H26	NC	I/O
J1	NC	I/O
J2	NC	I/O
J3	I/O	I/O
J4	I/O	I/O
J5	I/O	I/O
J22	I/O	I/O
J23	I/O	I/O
J24	I/O	I/O
J25	V_{CCI}	V_{CCI}
J26	NC	I/O
K1	I/O	I/O
K2	V_{CCI}	V_{CCI}
K3	I/O	I/O
K4	I/O	I/O
K5	V_{CCA}	V_{CCA}
K10	GND	GND
K11	GND	GND
K12	GND	GND
K13	GND	GND
K14	GND	GND
K15	GND	GND
K16	GND	GND
K17	GND	GND
K22	I/O	I/O
K23	I/O	I/O
K24	NC	NC
K25	NC	I/O
K26	NC	I/O
L1	NC	I/O
L2	NC	I/O
L3	I/O	I/O
L4	I/O	I/O
L5	I/O	I/O
L10	GND	GND
L11	GND	GND
L12	GND	GND
L13	GND	GND
L14	GND	GND
L15	GND	GND
L16	GND	GND
L17	GND	GND
L22	I/O	I/O
L23	I/O	I/O
L24	I/O	I/O
L25	I/O	I/O
L26	I/O	I/O
M1	NC	NC
M2	I/O	I/O
M3	I/O	I/O
M4	I/O	I/O
M5	I/O	I/O
M10	GND	GND
M11	GND	GND
M12	GND	GND
M13	GND	GND
M14	GND	GND
M15	GND	GND
M16	GND	GND
M17	GND	GND
M22	I/O	I/O
M23	I/O	I/O
M24	I/O	I/O
M25	NC	I/O
M26	NC	I/O
N1	I/O	I/O
N2	V_{CCI}	V_{CCI}
N3	I/O	I/O
N4	I/O	I/O
N5	I/O	I/O
N10	GND	GND
N11	GND	GND
N12	GND	GND
N13	GND	GND
N14	GND	GND
N15	GND	GND
N16	GND	GND
N17	GND	GND
N22	V_{CCA}	V_{CCA}
N23	I/O	I/O
N24	I/O	I/O
N25	I/O	I/O
N26	NC	NC
P1	NC	I/O
P2	NC	I/O
P3	I/O	I/O
P4	I/O	I/O
P5	V_{CCA}	V_{CCA}
P10	GND	GND
P11	GND	GND
P12	GND	GND
P13	GND	GND
P14	GND	GND
P15	GND	GND
P16	GND	GND
P17	GND	GND
P22	I/O	I/O
P23	I/O	I/O
P24	V_{CCI}	V_{CCI}
P25	I/O	I/O
P26	I/O	I/O
R1	NC	I/O
R2	NC	I/O
R3	I/O	I/O
R4	I/O	I/O
R5	TRST, I/O	TRST, I/O
R10	GND	GND
R11	GND	GND
R12	GND	GND
R13	GND	GND
R14	GND	GND
R15	GND	GND
R16	GND	GND
R17	GND	GND
R22	I/O	I/O

484-Pin FBGA (Continued)

Pin Number	A54SX32A Function	A54SX72A Function
R23	I/O	I/O
R24	I/O	I/O
R25	NC	I/O
R26	NC	I/O
T1	NC	I/O
T2	NC	I/O
T3	I/O	I/O
T4	I/O	I/O
T5	I/O	I/O
T10	GND	GND
T11	GND	GND
T12	GND	GND
T13	GND	GND
T14	GND	GND
T15	GND	GND
T16	GND	GND
T17	GND	GND
T22	I/O	I/O
T23	I/O	I/O
T24	I/O	I/O
T25	NC	I/O
T26	NC	I/O
U1	I/O	I/O
U2	V_{CCI}	V_{CCI}
U3	I/O	I/O
U4	I/O	I/O
U5	I/O	I/O
U10	GND	GND
U11	GND	GND
U12	GND	GND
U13	GND	GND
U14	GND	GND
U15	GND	GND
U16	GND	GND
U17	GND	GND
U22	I/O	I/O
U23	I/O	I/O
U24	I/O	I/O
U25	V_{CCI}	V_{CCI}
U26	I/O	I/O
V1	NC	I/O
V2	NC	I/O
V3	I/O	I/O
V4	I/O	I/O
V5	I/O	I/O
V22	V_{CCA}	V_{CCA}
V23	I/O	I/O
V24	I/O	I/O
V25	NC	I/O
V26	NC	I/O
W1	I/O	I/O
W2	I/O	I/O
W3	I/O	I/O
W4	I/O	I/O
W5	I/O	I/O
W22	I/O	I/O
W23	V_{CCA}	V_{CCA}
W24	I/O	I/O
W25	NC	I/O
W26	NC	I/O
Y1	NC	I/O
Y2	NC	I/O
Y3	I/O	I/O
Y4	I/O	I/O
Y5	NC	I/O
Y22	I/O	I/O
Y23	I/O	I/O
Y24	V_{CCI}	V_{CCI}
Y25	I/O	I/O
Y26	I/O	I/O