EIA Standard Board Layout Drawing for BGA, CCGA, CSP, and QFN

April 2016

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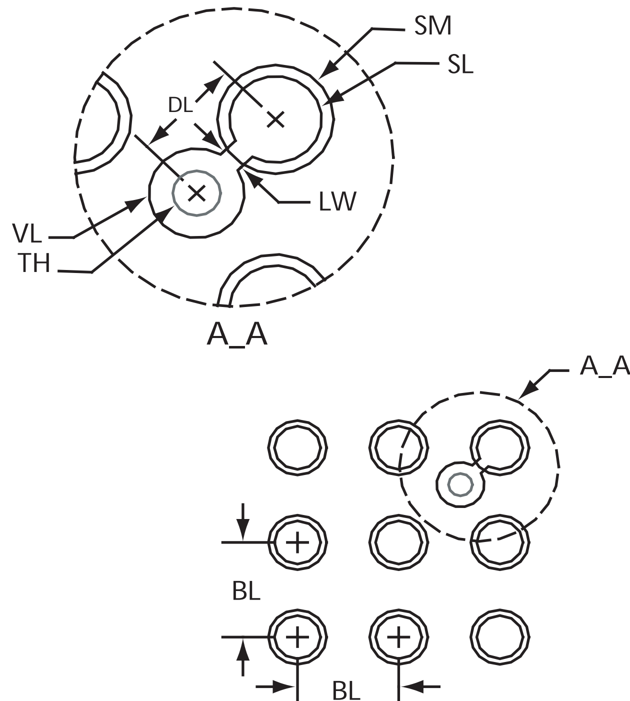

Figure 1: **Suggested Board Layout of Soldered Pads for BGA Packages**

Notes:

1. Table 2a through Table 6 on page 11 contain the recommended guidelines for board layout soldered pad dimensions for the following Microsemi packages (including pad dimension for prototyping socket accordingly): **CS** (Chip Scale BGA, 0.8 mm pitch), **FG** (Fine Pitch BGA, 1.00 mm pitch), **BG** (Plastic Ball Grid Array, 1.27 mm pitch, **CG** (Ceramic Column Grid Array, 1.27 mm pitch), CG adapter socket, and **QN** (Quad Fine Pitch No-Lead QFN, 0.5 mm pitch).
2. For E-tec prototyping socket soldering, Microsemi recommends using non-silver type solder paste with 6 mils thickness.

Table 1a: **Recommended PCB design guidelines for Microsemi CS (0.5 mm pitch BGA) package**

Dim.	uCS81	uCS81	CS81	CS121	CS196	CS201	CS281
Component Land Pad Diameter (SMD)	0.33	0.33	0.35	0.35	0.35	0.35	0.35
Solder Land Diameter (SL)	0.23	0.23	0.25	0.25	0.25	0.25	0.25
Solder Mask Opening Diameter (SM)	0.33	0.33	0.35	0.35	0.35	0.35	0.35
Solder Ball Land Pitch (BL)	0.4	0.4	0.50	0.50	0.50	0.50	0.50
Line Width Between Via and Solder Land (LW)	Via In Pad	Via In Pad	0.15 to 0.20	0.15 to 0.20	0.15 to 0.20	0.15 to 0.20	0.15 to 0.20
Distance Between Via and Solder Land (DL)	Via In Pad	Via In Pad	0.353	0.353	0.353	0.353	0.353
Via Land Diameter (VL)	See Land Diameter	See Land Diameter	0.200 to 0.250	0.200 to 0.250	0.200 to 0.250	0.200 to 0.250	0.200 to 0.250
Through Hole Diameter (TH)	0.100 to 0.125	0.100 to 0.125	0.100 to 0.125	0.100 to 0.125	0.100 to 0.125	0.100 to 0.125	0.100 to 0.125
Line Width (L)	0.075	0.075	0.075	0.075	0.075	0.075	0.075
Line Width (L) If Inner Outer Via's Staggered.	NA	NA	NA	NA	NA	NA	0.10
Line Space (S)	0.085	0.085	0.085	0.085	0.085	0.085	0.085
Pad Array	Full	Full	Full	Full	Full	Perimeter	Perimeter
Pad Matrix	6 × 6	9 × 9	9 × 9	11 × 11	14 × 14	15 × 15	19 × 19
Periphery Rows	–	–	–	–	–	4, 1, 5	2, 2, 7

Table 2a: **Recommended PCB Design Guidelines for Microsemi CS (0.8 mm Pitch BGA) Package**

Dimension	CS49	CS128	CS180
Component Land Pad Diameter (SMD)	0.35	0.35	0.35
Solder Land Diameter (SL)	0.30	0.30	0.30
Solder Mask Opening Diameter (SM)	0.45	0.45	0.45
Solder Ball Land Pitch (BL)	0.80	0.80	0.80
Line Width Between Via and Solder Land (LW)	0.15	0.15	0.15
Distance Between Via and Solder Land (DL)	0.56	0.56	0.56
Via Land Diameter (VL)	0.50	0.50	0.50
Through Hole Diameter (TH)	0.25	0.25	0.25
Pad Array	Full	Perimeter	Perimeter
Pad Matrix	7 × 7	12 × 12	14 × 14
Periphery Rows	–	4	5

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Table 2b: **Recommended PCB Design Guidelines for Prototyping Socket of CS Package**

Dimension	CS49 Prototyping Socket. Microsemi P/N: SE-CS49-H	CS128 Prototyping Socket. Microsemi P/N: SE-CS128-H	CS180 Prototyping Socket. Microsemi P/N: SE-CS180-H
Socket Pin Diameter	0.45	0.45	0.45
Solder Land Diameter (SL)	0.50	0.50	0.50
Solder Mask Opening Diameter (SM)	0.60	0.60	0.60
Solder Ball Land Pitch (BL)	0.80	0.80	0.80
Line Width Between Via and Solder Land (LW)	0.15	0.15	0.15
Distance Between Via and Solder Land (DL)	0.56	0.56	0.56
Via Land Diameter (VL)	0.50	0.50	0.50
Through Hole Diameter (TH)	0.25	0.25	0.25
Pad Array	Full	Perimeter	Perimeter
Pad Matrix	7 × 7	12 × 12	14 × 14
Periphery Rows	–	4	5

Table 3a: **Recommended PCB Design Guidelines for Microsemi FG (1.00 mm Pitch BGA) Package**

Dimension	FG144	FG256	FG324	FG484 23×23	FG484	FG676	FG896	FG1152
Component Land Pad Diameter (SMD)	0.40	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Solder Land Diameter (SL)	0.35	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Solder Mask Opening Diameter (SM)	0.50	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Solder Ball Land Pitch (BL)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Line Width Between Via and Solder Land (LW)	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Distance Between Via and Solder Land (DL)	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Via Land Diameter (VL)	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Through Hole Diameter (TH)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Pad Array	Full	Full	Full	Full	Perimeter	Full	Full	Full
Pad Matrix	12 × 12	16 × 16	18 × 18	22 × 22	26 × 26	26 × 26	30 × 30	34 × 34
Periphery Rows	–	–	–	–	5 + 8 × 8	–	–	–

Table 3b: **Recommended PCB Design Guidelines for Prototyping Socket of FG Package**

Dimension	FG144 Prototyping Socket. Microsemi P/N: SE-FG144-H	FG256 Prototyping Socket. Microsemi P/N: SE-FG256-HU	FG324 Prototyping Socket. Microsemi P/N: SE-FG324-H	FG484 23×23 Prototyping Socket. Microsemi P/N: SE-FG484-S-H	FG484 Prototyping Socket. Microsemi P/N: SE-FG484-H	FG676 Prototyping Socket. Microsemi P/N: SE-FG676-H	FG896 Prototyping Socket. Microsemi P/N: SE-FG896	FG1152 Prototyping Socket. Microsemi P/N: SE-FG1152
Socket Pin Diameter	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Solder Land Diameter (SL)	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58
Solder Mask Opening Diameter (SM)	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Solder Ball Land Pitch (BL)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Line Width Between Via and Solder Land (LW)	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Distance Between Via and Solder Land (DL)	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Via Land Diameter (VL)	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Through Hole Diameter (TH)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Pad Array	Full	Full	Full	Full	Perimeter	Full	Full	Full
Pad Matrix	12 × 12	16 × 16	18 × 18	22 × 22	26 × 26	26 × 26	30 × 30	34 × 34
Periphery Rows	–	–	–	–	5 + 8 × 8	–	–	–

Table 4a: **Recommended PCB Design Guidelines for Actel BG (1.27 mm Pitch BGA) Package**

Dimension	BG272	BG313	BG329	BG456	BG729
Component Land Pad Diameter (SMD)	0.63	0.63	0.63	0.63	0.63
Solder Land Diameter (SL)	0.58	0.58	0.58	0.58	.058
Solder Mask Opening Diameter (SM)	0.73	0.73	0.73	0.73	0.73
Solder Ball Land Pitch (BL)	1.27	1.27	1.27	1.27	1.27
Line Width Between Via and Solder Land (LW)	0.15	0.15	0.15	0.15	0.15
Distance Between Via and Solder Land (DL)	0.80	0.80	0.80	0.80	0.80
Via Land Diameter (VL)	0.60	0.60	0.60	0.60	0.60
Through Hole Diameter (TH)	0.30	0.30	0.30	0.30	0.30
Pad Array	Perimeter	Staggered	Perimeter	Perimeter	Full
Pad Matrix	20 × 20	25 × 25	23 × 23	26 × 26	27 × 27
Periphery Rows	4 + 4 × 4	–	4 + 5 × 5	5 + 6 × 6	–

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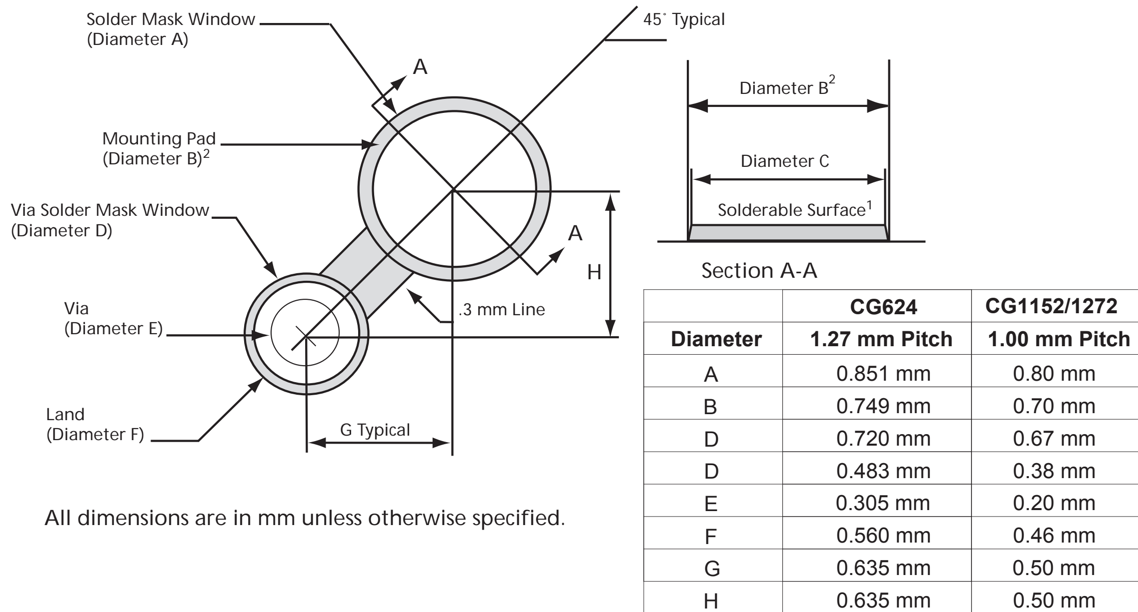
Table 4b: **Recommended PCB Design Guidelines for Prototyping Socket of BG Package**

Dimension	BG272 Prototyping Socket. Microsemi P/N: SM-BG272-B	BG313 Prototyping Socket. Microsemi P/N: SM-BG313-B	BG329 Prototyping Socket. Microsemi P/N: SM-BG329-B	BG456 Prototyping Socket. Microsemi P/N: SM-BG456-B	BG729 Prototyping Socket. Microsemi P/N: SE-BG729
Socket Pin Diameter	0.55	0.55	0.55	0.55	0.55
Solder Land Diameter (SL)	0.58	0.58	0.58	0.58	.058
Solder Mask Opening Diameter (SM)	0.73	0.73	0.73	0.73	0.73
Solder Ball Land Pitch (BL)	1.27	1.27	1.27	1.27	1.27
Line Width Between Via and Solder Land (LW)	0.15	0.15	0.15	0.15	0.15
Distance Between Via and Solder Land (DL)	0.80	0.80	0.80	0.80	0.80
Via Land Diameter (VL)	0.60	0.60	0.60	0.60	0.60
Through Hole Diameter (TH)	0.30	0.30	0.30	0.30	0.30
Pad Array	Perimeter	Staggered	Perimeter	Perimeter	Full
Pad Matrix	20 × 20	25 × 25	23 × 23	26 × 26	27 × 27
Periphery Rows	4 + 4 × 4	–	4 + 5 × 5	5 + 6 × 6	–

Table 5: **Recommended PCB Design Guidelines for Microsemi CCGA (Ceramic Column Grid Array or CG) Package**

The recommended guidelines for the 1.27 mm pitch package pertain to the Microsemi CG624 package, the CG624 to FG484 Adapter Socket, and the CG624 to FG896 Adapter Socket. The 1.00 mm pitch recommendations relate to the Microsemi CG1152 and CG1272 packages.

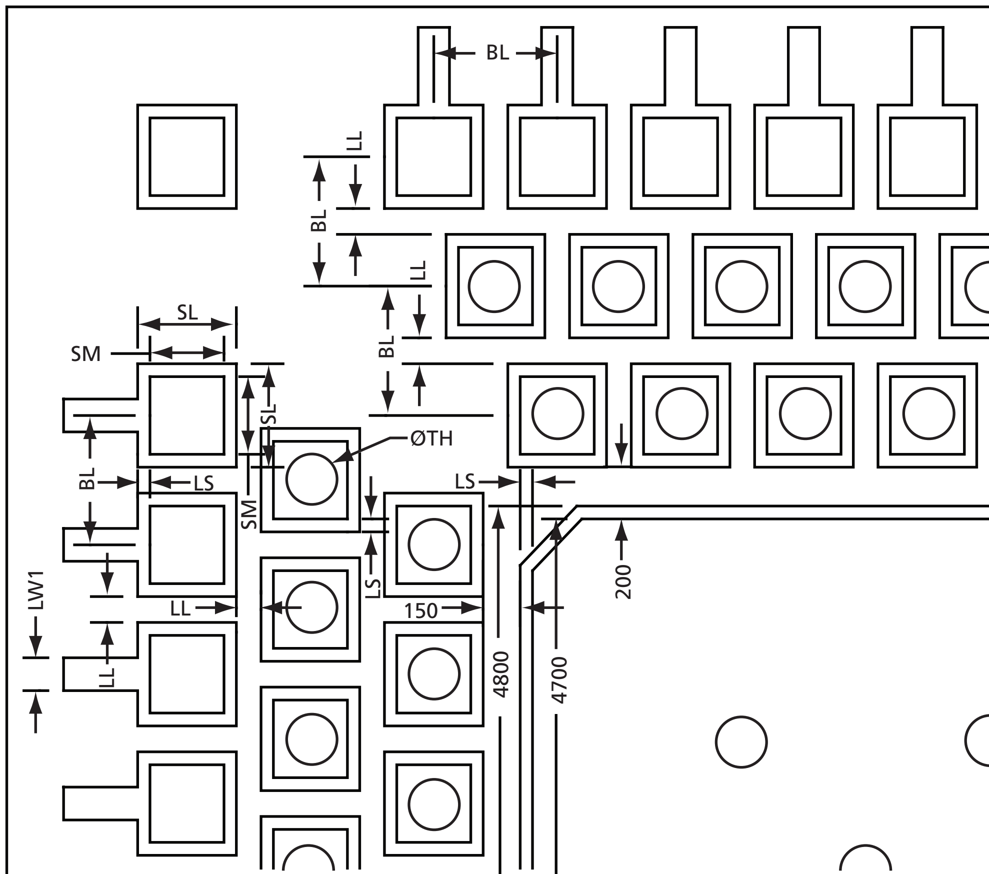


	CG624	CG1152/1272
Diameter	**1.27 mm Pitch**	**1.00 mm Pitch**
A	0.851 mm	0.80 mm
B	0.749 mm	0.70 mm
D	0.720 mm	0.67 mm
D	0.483 mm	0.38 mm
E	0.305 mm	0.20 mm
F	0.560 mm	0.46 mm
G	0.635 mm	0.50 mm
H	0.635 mm	0.50 mm

Notes:

1. *Functional surface*
2. *Normal diameter at Copper/Polyimate interface with typical edge angle*

Figure 2: **Recommended PCB Design Guidelines for Microsemi CCGA (Ceramic Column Grid Array or CG) Package**



Note: *This suggested board layout is for SMD. To use NSMD, swap SL and SM dimensions.*

Figure 3: **Suggested Board Layout of Soldered Pads for QFN (Top) Packages**

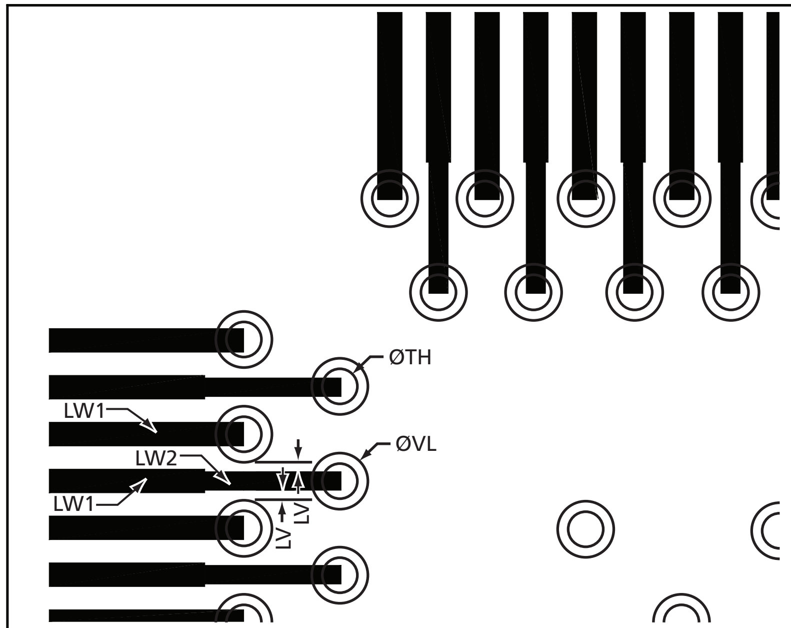


Figure 4: **Suggested Board Layout of Soldered Pads for QFN (Bottom) Packages**

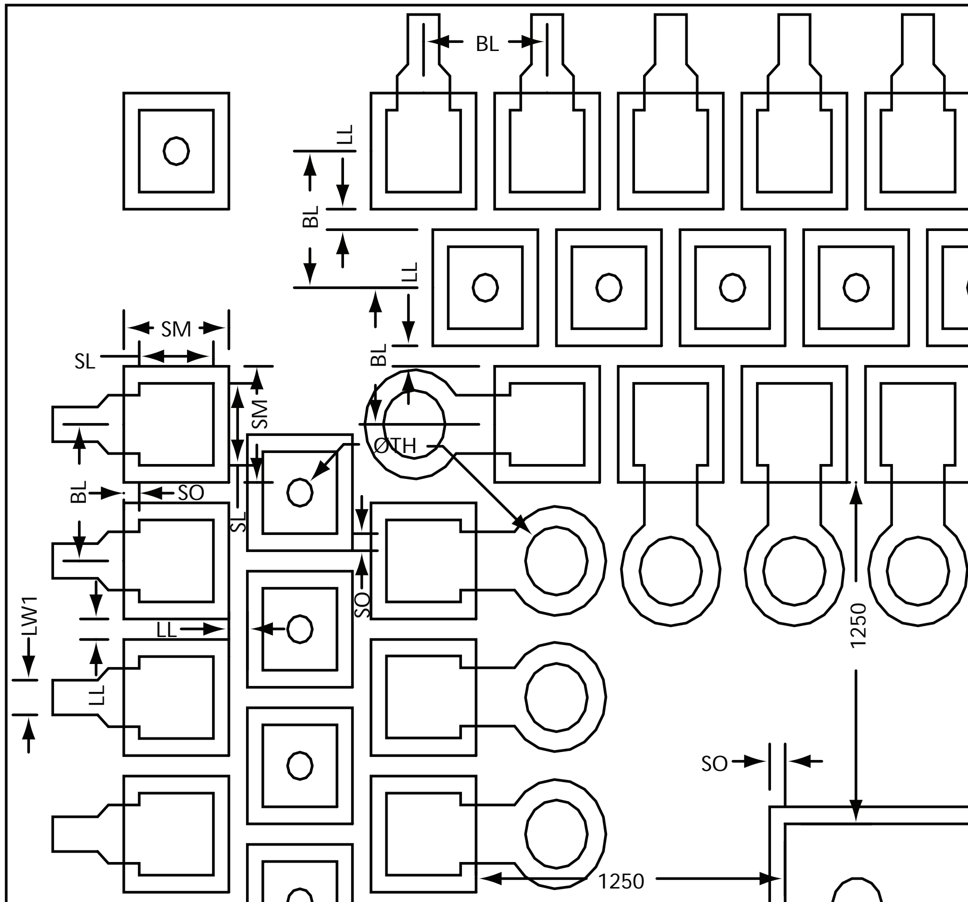


Figure 5: **Suggested Board Layout of Soldered Pads for QFN Packages (PCB Bottom Layer)**
This Suggested board layout is for reduced thermal pad, NSMD, to use SMD swap SL and SM dimensions.

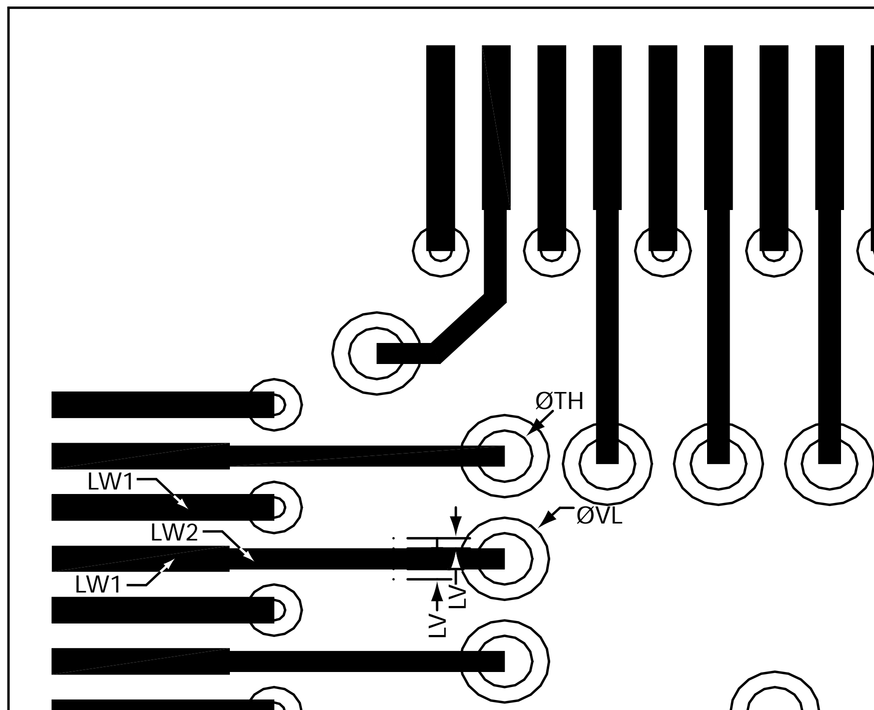


Figure 6: **Suggested Board Layout of Soldered Pads for QFN Packages (PCB Bottom Layer), Reduced Thermal Pad**

Table 6 contains the recommended guidelines for board layout soldered pad dimension for Microsemi QN (0.5 mm pitch QFN) packages only.

Table 6: **Recommended QFN Design Guidelines**

Dimension	**QN48***	**QN68***	**QN108**	**QN132**	**QN180**
Component Land Pad Diameter (SMD)	0.200/0.400	0.200/0.400	0.3	0.3	0.3
Solder Land Diameter (SL)	0.200/0.400	0.200/0.400	0.3	0.3	0.3
Solder Mask Opening Diameter (SM)	0.300/0.500	0.300/0.500	0.425	0.425	0.425
Solder Land To Solder Land (LL)	0.075	0.075	0.075	0.075	0.075
Solder Mask Overlap (SO)	0.0625	0.0625	0.0625	0.0625	0.0625
Solder Land Pitch (BL)	0.400	0.400	0.5	0.5	0.5
Line Width Between Via and Via Land (LW2)	N/A	N/A	0.1	0.1	0.1
Line Width Between Via out side Via Land (LW1)	0.127	0.127	0.127	0.127	0.127
Line to Via Land (LV)	N/A	N/A	0.050 - 0.100	0.050 - 0.100	0.050 - 0.100
Via Land Diameter (VL)	N/A	N/A	0.250 - 0.400	0.250 - 0.400	0.250 - 0.400
Through Hole Diameter (TH)	N/A	N/A	0.100 - 0.250	0.100 - 0.250	0.100 - 0.250
Die Attach Pad (DP)	2.920 × 2.920	2.920 × 2.920	4.700 × 4.700	5.700 × 5.700	6.300 × 6.300
Pad Array	Perimeter	Perimeter	Perimeter	Perimeter	Perimeter
Body Size	8 × 8	8 × 8	8 × 8	8 × 8	10 × 10
Periphery Rows	1	1	2	3	3

Note: **Component Land Pad and Solder Lands are rectangular, longest dimension is perpendicular to package edge.*

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PCB Land Pattern Design File

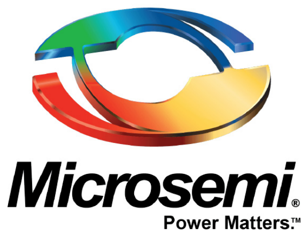
Download the QN132 PCB Land Patter design file from Microsemi website. This can be used to assist the layout of the board. Download the file from *http://soc.microsemi.com/download/rsc/?f=PCB_QN132_DF*.

List of Changes

The following table shows the important changes made in this document for each revision.

Previous Version	Changes in Current Version	Page
55700007-7/04.16*	Table 6: Recommended QFN Design Guidelines is updated to include QN48 data (SAR 76095).	11
55700007-6/7.08*	Table 1a: Recommended PCB design guidelines for Microsemi CS (0.5 mm pitch BGA) package was updated to include uC36 data.	3
55700007-5/3.08*	Table 1a: Recommended PCB design guidelines for Microsemi CS (0.5 mm pitch BGA) package was updated to include uC81 data.	3
	Table 6: Recommended QFN Design Guidelines was updated to include QN68 data.	11
55700007-4/2.08*	Table 1a: Recommended PCB design guidelines for Microsemi CS (0.5 mm pitch BGA) package was updated to include CS201 and CS281.	3
	Figure 5:Suggested Board Layout of Soldered Pads for QFN Packages (PCB Bottom Layer) This Suggested board layout is for reduced thermal pad, NSMD, to use SMD swap SL and SM dimensions. is new.	10
	Figure 6:Suggested Board Layout of Soldered Pads for QFN Packages (PCB Bottom Layer), Reduced Thermal Pad is new.	11
	Table 6: Recommended QFN Design Guidelines was updated.	11

Note: **The part number is located on the last page of the document.*



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