



# MANUFACTURING PROCESS CAPABILITIES

Specification	Standard Production	Advanced or Proto-type
<b>General</b>		
Panel Sizes (inches)	9"x12", 12"x18", 18"x24", 21"x24" 32" x 32" (SS / DS), 24" x 48" (SS / DS)	20" x 32" Call for any other sizes
Number of Copper Layers	1-20	>20
Workmanship Specification	Per IPC 6012 (Rigid Products) / 6018 (Microwave Products), Class 3, Class 3 DS, Class 3 DA MIL-PRF-31032 /1, /2, /3, /4 and MIL-PRF-55110, Appendix B	
<b>Materials:</b>		
Materials Rigid / Thermoset/Flex	Standard FR4 / Epoxy, High-Temp FR-4 / Epoxy, High Td FR-4 / Epoxy RoHS Compliant FR-4 / Epoxy Polyimide, High Temperature, Extreme Environment BT, Isola FR408, Itera, Astra, Megtron 4, 6 &7, Rogers 4000 Series, Hitachi Theta, Dupont, Panasonic	
Materials – Microwave & High Frequency Materials	Nelco, Rogers, Taconic – See Laminate Selector Guide FEP, Rogers 3001, Rogers 2929, , Itera, Astra, Megtron 6,7 Taconic FastRise, Pre-bonded RF Materials (Rogers, Taconic) Custom Order Pre-bonded	
IMS Materials	Bergquist, Aismalibar, C-Sem, Laird, Ventec, Totking	
Buried Passives	Capacitance: Farad Flex, C-Ply Resistors: Ticer, Ohmega Ply	
Foil Weight: (inner layer)	¼ oz - 6 oz 8 µm- 212 µm	>6 oz >212 µm
Foil Weight: (outer layer)	¼ oz-6 oz 8 µm-212 µm	>6 oz >212 µm
<b>Dielectric &amp; PWB thickness:</b>		
Overall board thickness:		
Double sided	.001"-.350" 0.0254 mm-8.89 mm	>.350" >8.89mm
Multi-layer	.008"-.350" 0.2032 mm-8.89 mm	>.350" >8.89mm
Thickness Tolerance	+/- 10%	Call for Specifics
Warp and Twist	0.7% std - dependant on material and stack-up	<0.7%



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<b>Line Width and Space:</b>		
¼ oz. Min. line width/spacing 8 µm Min. line width/spacing	0.003"/0.003" 75/75 µm	0.002"/0.002" 50/50 µm
½ oz. Min. line width/spacing 17 µm Min. line width/spacing	0.003"/0.003" 75/75 µm	0.002"/0.002" 50/50 µm
1 oz. Min. line width/spacing 35 µm Min. line width/spacing	0.004"/0.004" 100/100 µm	0.003"/0.003" 75/75 µm
Etch Tolerance (Inner Layers) ¼ oz. copper 8 µm copper	+/- .0003" (Design Specified) +/- 7 µm (Design Specified)	
½ oz. copper 17 µm copper	+/- .0005" (Design Specified) +/- 12 µm (Design Specified)	
1 oz. copper 35 µm copper	+/- .0005" (Design Specified) +/- 12 µm (Design Specified)	
2 oz. copper 71 µm copper	+/- .001" (Design Specified) +/- 25 µm (Design Specified)	
Etch Tolerance (Base Copper Outer Layers) ¼ oz. copper 8 µm copper	+/- .0003" (Design Specified) +/- 7 µm (Design Specified)	
½ oz. copper 17 µm copper	+/- .0005" (Design Specified) +/- 12 µm (Design Specified)	
1 oz. copper 35 µm copper	+/- .001" (Design Specified) +/- 25 µm (Design Specified)	
2 oz. copper 71 µm copper	+/- .002" (Design Specified) +/- 50µm (Design Specified)	
<b>Drilling:</b>		
Min. drilled hole diameter	0.008" 203 µm	0.004" 100 µm
Max. drilled hole diameter	0.250" 6.35 mm	
Max. Aspect Ratio	10:1	15:1
PTH diameter tolerance	+/- 0.002" +/- 50 µm	+/- 0.002" +/- 50 µm
NPTH diameter tolerance	+/- 0.002" +/- 50 µm	+/- 0.001" +/- 25 µm
Hole location tolerance	+/- 0.003" Hole to Edge +/-75 µm Hole to Edge	



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<b>Routing:</b>		
Edge-to-edge tolerance	+/- 0.005" +/- 127 µm	+/- 0.003" +/- 75 µm
Edge-to-datum hole tolerance	+/- 0.005" +/- 127 µm	+/- 0.002" +/- 75 µm
Min. internal radius	0.015" 381 µm	0.010" 254 µm
<b>Scoring:</b>		
Jump score capability	Yes	
Available scoring angles	20°, 30°, 45°	
<b>Edge beveling:</b>		
Available angles	30°, 45° +/- 5°	Call for specifics
<b>Multilayer lamination:</b>		
Technique	Hi-Temp Vacuum Assisted Hydraulic Pressing Capabilities	
Core to Core Registration	+/- 0.005" +/- 127 µm	Call for Specifics
Front to Back Registration	+/- 0.001" +/- 25 µm	+/- 0.0005" +/- 12 µm
<b>Soldermask:</b>		
Type	LPI, LDI LPI	
Colors	Green, Blue, Red, White, Black, Grey, Orange, Amber, Yellow	Custom
Min. soldermask clearance	0.002" (per side) 50 µm (per side)	0.0015" (per side) 37 µm (per side)
Min. soldemask web thickness	0.0033" Color Specific 83 µm	
<b>Legend:</b>		
Type	Ink Jet Printer, UV Thermal	
Colors	Ink Jet: White, Black UV Thermal: White, Black, Yellow	
Smallest line width:	Ink Jet Printer: .003", 75 µm UV Thermal: .010", 254 µm	



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<b>Hole Plugging</b>		
Conductive via plugging	Tatsuta AE3030 (Preferred), DuPont CB100 Min. Hole Size .010", Max. Hole size 0.030", R.=8:1max 1:1 min Min. Hole Size 254 µm, Max. Hole size 762 µm	
Non-conductive via plugging	Taiyo THP 100DX1, SanEi IR10F, Peters PP2795, A.R.=8:1max 1:1 min Min. Hole Size .010", Max. Hole size 0.030", Min. Hole Size 254 µm, Max. Hole size 762 µm Min. Hole Size .010", Max. Hole size 0.030", Min. Hole Size 254 µm, Max. Hole size 762 µm	
Copper filled vias	Hole sizes from .004" - .010" Aspect Ratio 1:1 Max	
<b>Surface Finishes:</b>		
Type	Hot Air Solder Level, ROHS Compliant Hot Air Level (SN100CL), OSP Entek Plus 106A, Electroless Nickel / Immersion Gold (ENIG), Electroless Nickel / Electroless Palladium/ Immersion Gold (ENEPIG), Electrolytic Nickel, Electrolytic Hard Gold, Electrolytic Soft Gold, Immersion Silver, Immersion Tin, Electrolytic Matte Tin, Plated Tin Lead, Hot Oil Reflow	
<b>Electrical Test:</b>		
Pitch	0.0197" 500 µm	0.012" 304 µm
<b>Fixture types</b>	2 Sided	
Test voltages available	Per Requirement up to 250V DC	
Resistivity testing:		
Open resistance	10 Ω	50 Ω max.
Short resistance	10 MΩ min.	100 MΩ max.
Netlist capability	Yes 100%	
<b>Flying Probe</b>	Yes	
Test voltages available	100 volts	30 -1000 volts
Controlled Impedance	+/- 10%	+/- 5%
Passives Testing	Buried Resistors / Capacitors	
Resistivity testing:		
Open resistance	17 MΩ min.	500 MΩ max
Short resistance	50 Ω	5-80 Ω max
<b>Hipot Test</b>	0-2500VDC	0-6000VDC



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## Heat Sink Bonding

Bonding processes	Thermally & Electrically Conductive Silicone Adhesive (Electrasil 2), Sweat Solder All available prepregs Emerson & Cumming CF3350, Ablestick 5025E & 0563ECF. Rogers Cool Span, 3M7373	
Sweat Solder Pastes	63% Tin, 37% Lead, 95% Tin, 5% Antimony SAC 305	Call for Other
Board to Carrier Registration	+/- 0.005" +/- 127 $\mu$ m	+/- 0.003" +/- 75 $\mu$ m

## Machining Capabilities

Profile / Feature Tolerance	+/- 0.005" +/- 127 $\mu$ m	+/- 0.002" +/- 50 $\mu$ m
Internal Radii (Min)	+/- 0.031" +/- 787 $\mu$ m	+/- 0.012" +/- 304 $\mu$ m
Machined Feature to Circuit Image	+/- 0.005" +/- 127 $\mu$ m	+/- 0.003" +/- 75 $\mu$ m
Depth Control (Pockets, Counterbore, Countersink)	+/- 0.002" +/- 127 $\mu$ m	+/- 0.001" +/- 25 $\mu$ m
Surface Finish	64 $\sqrt$	32 $\sqrt$

## Metal Carrier Finishes over Aluminum

Electroless Ni (per MIL-C-26074E, Class 1, Grade A)	100-300 $\mu$ in. Nickel 2.54-7.62 $\mu$ m Nickel	Nickel – Range Specified
Electrolytic Silver (per QQ-S-365D, Type I, Grade B)	200 $\mu$ in. min. Silver 5.08 $\mu$ m min. Silver	Silver – Range Specified
Electroless Ni (per MIL-C-26074E, Class 1, Grade A)	100-300 $\mu$ in. Nickel 2.54-7.62 $\mu$ m Nickel	Nickel – Range Specified
Electrolytic Matt Tin	200 $\mu$ in. min. Tin 5.08 $\mu$ m min. Tin	Tin – Range Specified
Electroless Ni (per MIL-C-26074E, Class 1, Grade A)	50-100 $\mu$ in. Nickel 1.27-2.54 $\mu$ m Nickel	Nickel – Range Specified
Electrolytic Ni (per MIL-S-QQN-290A, Class I, SD)	100-300 $\mu$ in. Nickel 2.54-7.62 $\mu$ m Nickel	Nickel – Range Specified
Electrolytic Soft Au (per MIL-G-45204C, Type III, Grade A)	3 $\mu$ in. min. Gold 0.0762 $\mu$ m min. Gold	Gold – Range Specified



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Electrolytic Ni (per MIL-S-QQN-290A, Class I, SD)	100-300 $\mu$ in. Nickel 2.54-7.62 $\mu$ m Nickel	
Electrolytic Hard Au (per MIL-G-45204C, Type II, Grade C)	3 $\mu$ in. min. Gold 0.0762 $\mu$ m min. Gold	Gold – Range Specified
Chromate conversion coating (per MIL-C-5541E, Class 3)	Coverage	

## Metal Carrier Finishes over Copper

Electrolytic Silver (per QQ-S-365D, Type I, Grade B)	75-150 $\mu$ in. Silver 1.905-2.667 $\mu$ m Silver	
Electrolytic Matt Tin	75-150 $\mu$ in. Tin 1.905-2.667 $\mu$ m Tin	
Electrolytic Ni (per MIL-S-QQN-290A, Class I, SD)	100-300 $\mu$ in. Nickel 2.54-7.62 $\mu$ m Nickel	Nickel – Range Specified
Electrolytic Soft Au (per MIL-G-45204C, Type III, Grade A)	3 $\mu$ in. min. Gold 6.6762 $\mu$ m min. Gold	Gold – Range Specified
Electrolytic Ni (per MIL-S-QQN-290A, Class I, SD)	100-300 $\mu$ in. Nickel 2.54-7.62 $\mu$ m Nickel	Nickel – Range Specified
Electrolytic Hard Au (per MIL-G-45204C, Type II, Grade C)	3 $\mu$ in. min. Gold 0.0762 $\mu$ m min. Gold	Gold – Range Specified
Electroless Ni (per MIL-C-26074E, Class 1, Grade A)	100-300 $\mu$ in. Nickel 2.54-7.62 $\mu$ m Nickel	Nickel – Range Specified
Immersion Au (per MIL-G-45204)	3-8 $\mu$ in. Gold 0.0762-0.2032 $\mu$ m Gold	