

# Advanced Circuits Capabilities

## Material

### FR4

Standard FR4	30
Isola FR406	30
ITEQ -180A	30

### RoHS

ITEQ -180A	30
Isola 370HR	30
Isola IS410 (CAF Resistant)	30
Isola FR408 and Isola FR408 HR	30
Isola BT-IS620	30
Nelco BT-N5000	30
Nelco 4000-29	30
Nelco 4000-13& 13SI	30
Nelco 4000-13EP and EPSI	30
Isola IS415 (CAF Resistant)	30
GETEK	30
Polyimide	30
Cynate Ester	20
Rogers 4350/4450	20

### RF Materials

Rogers 3000 Series	Max. 20 lyr. FR-4 w/ RO3000 caps
Rogers 4000 Series	20
Rogers 5870/5880	8
Taconic RF Materials	2

### Advanced RF Materials

Nelco 9000 Series (PTFE)	2
Rogers 6000 Series	2
Rogers 5000 Series	2

### Maximum Useable Panel Area

For 12" x 18" panel	10" x 16"
For 18" x 24" panel	16" x 22"
For 21" x 24" panel	19" x 22"
For 21" x 60" panel	18" x 58" (Up to 8 layer max)

## Stack-Ups

### Overall Thickness Range and Tolerances

Overall Board Thickness:	0.010" - 0.250"
<b>Overall Board Thickness Tolerance:</b>	
< 0.020" :	Standard +/- 0.004", Special +/- 0.003"
0.031" :	Standard +/- 0.004", Special +/- 0.003"
0.062" :	Standard +/- 0.006", Special +/- 0.004"
0.093" :	Standard +/- 0.009", Special +/- 0.006"
0.125" :	Standard +/- 0.012", Special +/- 0.009"
0.187" :	Standard +/- 0.018", Special +/- 0.014"
0.250" :	Standard +/- 0.025", Special +/- 0.018"

### Thinnest Dielectric Finished

Thin Board Overall Thickness:	0.010" (2-sided) 0.015" (4-layer)
Thinnest Plated Core:	0.004"

## Special Products/Unique Capabilities

Heavy copper up to 20 oz.	Available
Heat sinks	Available
Backplates	Available
2 Layers up to 37" x 120"	Available
Rohacell Foam Bonding	Available
Buried Chips Resistors	Available
Light Hand Assembly	Available
Resistance and Conductance Test Equipment	Available
Drill and Rout capabilities up to 38" x 120"	Available

# Mechanical Capabilities

## Plated Through Hole Capabilities

<b>Smallest Plated Through Hole Size with 0.001" Minimum Average Copper Requirement</b>	
Finished Panel Thickness < 0.020":	0.003" finished hole
Finished Panel Thickness 0.031":	0.003" finished hole
Finished Panel Thickness 0.062":	0.004" finished hole
Finished Panel Thickness 0.093":	0.008" finished hole
Finished Panel Thickness 0.125":	0.010" finished hole
Finished Panel Thickness 0.187":	0.012" finished hole
Finished Panel Thickness 0.250":	0.018" finished hole (Excluding HAL finish)
Plated Hole Size Tolerance:	+/- 0.003" Standard; Special +/- .002
Plated Hole Size Press Fit applications:	+/- 0.002" Typical
Aspect Ratio (with 0.010" drill):	12:1
Plated Hole Spacing Minimum (Drilled hole to hole):	0.008"
Maximum Copper Hole Plating:	0.008"

## Non-Plated Through Holes

Smallest Non Plated Hole Size: (Finished)	0.006"
Largest Non-Plated Hole Size Routed:	No limit
Non-plated Routed Hole Tolerance:	+/- 0.005" Typical +/- 0.003" Special
Minimum NPTH to Edge of Board Spacing:	0.010"

## Laser Microvia ( $\mu$ Via) Capabilities

Smallest (as ablated) Laser Via:	0.003"
Largest (as ablated) Laser Via:	0.010"
Via Aspect Ratio (Depth to Diameter)	0.5:1 Standard 1:1 Advanced
Capture Pad Size:	$\mu$ Via + 0.006"
Landing Pad Size:	$\mu$ Via + 0.006"
Stacked Via	$\mu$ Via + 0.006"
Type I Capabilities	2 - Stacked
Type II Capabilities	Yes
Type III Capabilities	Design Dependent
Copper-Filled Microvia:	Yes

## Machining Drill Capabilities

Primary Drilled Hole Location Tolerance to Datum (Hole) Zero (DTP):	0.005"
2nd Drill Hole Location Tolerance to Datum Zero (DTP):	0.005"
Minimum Clearance from Copper Conductor to Mechanical Drilled Hole:	0.006"
Minimum Clearance from Copper Conductor to a Laser Drilled Hole:	0.004"

## Control Depth Drill Capabilities

Backdrill-PTH Stub Removal	PTH + 0.010" Diameter (typical)
Minimum Backside Dielectric Separation	0.010"
Control Depth Drill Depth Tolerance	+/- 0.005"

## Back Drilling Capabilities

Minimum Back Drill Drilled Diameter	0.014"
Drilled Hole Over Finished Hole Size	0.010" Typical
Drill Depth Tolerance	0.005" Typical, 0.004" Minimum

## Scoring Capabilities

Angles:	Standard 30°, Available 20°, 45°, and 60°
Offset Tolerance:	+/- 0.005"
Optimum Remaining Web Thickness:	1/3 of thickness (0.014" Typical for 0.062")
Remaining Web Tolerance	+/- 0.005"
True Position Tolerance:	+/- 0.005"

## Edge Connector Bevel Capabilities

Finger Tip Angle:	15°, 20°, 30°, 45°
Bevel Depth Tolerance:	+/- 0.005"

## Profile Capabilities

Standard Router Bit Diameter:	0.093", 0.062", 0.031" (Router Bits) Special 0.020"
Routed Profile Tolerance: :	+/- 0.005" Standard, +/-0.004" Special
Minimum Internal Rout Radius:	0.015"
Minimum Routed PTH Slot Width:	0.018"

## Feature Size Capabilities

### Inner Layer Capabilities

Minimum Conductor Width and Spacing	
Internal Starting Cu Weight ½ oz.:	0.00275" finished
Internal Starting Cu Weight 1 oz.:	0.00375" finished
Internal Starting Cu Weight 2 oz.:	0.005" finished
Internal Starting Cu Weight 3 oz.:	0.009" finished
Internal Starting Cu Weight 4 oz.:	0.012" finished

### Outer Layer Capabilities

Minimum Conductor Width and Spacing	
External Cu Finished Thickness 1.0 oz.:	0.00275" finished
External Cu Finished Thickness 1.5 oz.:	0.004" finished
External Cu Finished Thickness 2.0 oz.:	0.005" finished
External Cu Finished Thickness 3.0 oz.:	0.009" finished
External Cu Finished Thickness 4.0 oz.:	0.011" finished
External Cu Finished Thickness 5.0 oz.:	0.020" finished
External Cu Finished Thickness 6.0 oz.:	0.030" finished
External Cu Finished Thickness 7.0 oz.:	0.045" finished
External Cu Finished Thickness 8.0 oz.:	0.060" finished
External Cu Finished Thickness 9.0-20+ oz.:	Call

### Pad Diameter to Drilled Hole Size

### IPC-6012 Class 2

Component holes:	Drilled size plus 0.010"
Via holes:	Drilled size plus 0.008"

### Pad Diameter to Drilled Hole Size

### IPC-6012 Class 3

Component holes:	Drilled size plus 0.012"
Via holes:	Drilled size plus 0.010"

### Pad Diameter to Laser Ablated Hole Size

Minimum:	Drilled size plus 0.004"
Standard:	Drilled size plus 0.008"

## Military

### Etchback

Yes

IPC Class 3 Etchback Specification 0.0002" - 0.002"

## Solder Mask and Silkscreen

### Solder Mask

Min. LPI Solder mask Clearance: (LPI Photo imaged)	0.002"/side (Pad size + 0.004")
Min. LPI Solder mask Clearance: (LDI Imaged)	1:1 (Design Dependent)
Pad size larger than NPTH:	0.005"/side (Pad size + 0.010")
Web Between Surface Mount Pads:	0.004" Preferred, 0.003" Minimum (green)
Solder Mask Colors:	Green, Blue, Red, Black, Yellow, White, Orange, Purple, Pink, Brown, Clear
Solder Mask Type:	Liquid Photo Imageable (LPI)
Solder Mask Type:	Laser Direct Imaging (LDI) Special
Minimum Mask Defined Pad Diameter:	0.005"

### Silkscreen

Minimum Stroke/Width Screened Legend:	0.005"
LPI Legend Capability:	Yes
Minimum Stroke/Width LPI Legend:	0.002"
Screened/LPI Legend Colors	White, Black, Yellow, Red, Blue

## Data & Documentation

### Tooling Formats

Film Data Formats:	DXF, RS-274X, RS-274D, ODB++
Drill Data Formats:	ASCII, Excellon Format; RS-274X, RS-274D
Electrical Test Formats:	IPC-D356
Netlist Compare Formats:	IPC-D356

### Tooling Communication

Media Types & Data Transfer:	E-mail, FTP
Compression Formats:	ZIP, TAR, TGZ
Secured Data Transfer Methods:	Secure Data Transfer, PGP



## Surface Finishes Options

### Surface Finishes Selection

Hot Air Solder Level (lead-free, lead based):	Yes
Immersion Silver:	Yes
OSP :	Yes
Electroless Nickel Immersion Gold:	Yes
Immersion Tin:	Yes
Full Body Gold:	Yes
Bondable Gold:	Yes
Plated Nickel	Yes
Electroless Nickel	Yes
Copper	Yes

### Mixed Finishes

HASL with Selective Gold:	Yes
Dual Gold Plating:	Yes
Immersion Gold with Selective Hard Gold:	Yes
Recessed Fingers:	Yes

## Via-in-Pad and HDI

### Epoxy Filled - Non Conductive

Epoxy Filled Thru Hole Capability	Yes
Epoxy Filled Thru Hole Minimum:	0.008" FHS
Epoxy Filled Thru Hole Maximum:	0.018" FHS
Minimum Board Thickness:	0.020"
Maximum Board Thickness:	0.125"
Via Fill Aspect Ratio:	10:1
Conductive VIP Options:	Yes
Non-Conductive VIP Options:	Yes

### Copper Plated / Filled

Copper Filled $\mu$ Via Process:	Yes, IPC-2226 Types I, II, & III
Copper Filled $\mu$ Via Hole Minimum:	0.003" Laser Drilled
Copper Filled $\mu$ Via Hole Maximum:	0.010" Laser Drilled
Via Fill Aspect Ratio:	0.5:1 Standard 1:1 Advanced

## Testing Capabilities

Minimum Test Continuity Resistance:	0.1 Ohms
Maximum Test Voltage:	1000 volts
Maximum Test Isolated Resistance:	1200.4 mOhms
Largest Test - Fixtured:	16" x 22"
Largest Test - Flying Probe:	27" x 24"
Electrical Test Pitch (Fixture Test):	0.020"
Electrical Test Pitch (Flying Probe Test):	0.004"
DC Line Resistance Testing:	Yes

## Electrical Performance

TDR Test Tolerance (Print and Etch):	Standard 10%, Advanced 5%
TDR Test Tolerance (Plated Copper):	Standard 10%, Advanced 5%
TDR Test Tolerance Differential Measurements:	Standard 10%, Advanced 5%
TDR Tolerance Single Ended Tolerance:	Standard 10%, Advanced 5%
HiPot Testing (AC & DC):	Yes

The above is subject to change without prior notice

**DOD Cleared; MIL-PRF-31032, MIL-PRF-55110G, AS9100C, and ISO 9001:2008 Certified; IPC-6012 Class 3/3A Qualified; ITAR Registered; UL Certified**



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