



GRAPHIC MANUFACTURING CAPABILITY

Q217-18

All features are design dependent and may not be achievable in combination
 Reduced Yield / Special values up (or down) to the standard limit are design and application dependent
 Standard features only should be used for high reliability applications

Product Range	Single and Double Sided Rigid	IPC 6012 / 6018 types 1 and 2
	Single and Double Sided Flexibles	IPC 6013 types 1 and 2
	Multilayer	IPC 6012 / 6018 type 3
	Multilayer with blind and / or buried vias (inc micro-vias)	IPC 6012 / 6018 types 4 and 5
	Multilayer Flexibles	IPC 6013 type 3
	Multilayer Flexi-rigid	IPC 6013 type 4
	Mixed dielectric Multilayer	IPC 6018 type 4
	Mixed dielectric Multilayer with blind and / or buried vias	IPC 6018 type 6

Additional Features	Controlled Impedance
	Controlled Expansion
	Blind and / or buried vias (may require resin fill)
	Blind and / or buried micro-vias - laser or mechanical
	Copper Filled Micro-Vias
	Stacked Vias
	Sequential build-up - mechanical or laser drill
	Back Drilled Holes
	Buried Resistance
	Buried Capacitance
	Bonded Heatsinks
	Embedded RFID

Materials	FR4 - High Tg	(IPC 4101 / 24, 26, 98, 99, 126)
	Polyimide, BT and Cyanate Ester (glass reinforced)	
	PTFE (various types) - check availability	
	High Speed / Low Loss Materials - check availability	
	Polyimide Film (flexible material) adhesiveless	IPC 4204 /11
	Polyimide Film (flexible material) with adhesive	IPC 4204 /1
	Advanced / other substrates (check list)	
	Copper-Invar-Copper	IPC 6012 types 5 and 6
	Carbon Fibre (Stablcor)	

Reduced Yield / Special	Standard Limit
	x
	x
	x
	x
	x
	x
	By design / material
	By design / material
By design	By design
By design	By design
	x
By design	x
	x
By design	By design
	x
	x
By design	x
By design	x
	x
By design	x
Less than 75 micron	75 micron or thicker
Less than 75 micron	75 micron or thicker
By design	By design
Less than 75 micron	75 micron or thicker
Less than 50 micron	50 micron or thicker
Non-preferred	
By design	By design
	x
	By design

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Construction Finished Board Thickness
 Thinnest glass re-inforced layer
 Thinnest Layer
 Max buried assembly thickness without resin fill (design dependant)

Buried single assembly
 Buried multiple assemblies
 Blind assemblies

Minimum panel thickness for resin fill (planarised)
 Maximum drilled fill diameter
 Minimum drilled diameter for resin fill (dependent on aspect ratio, hole quantity and distribution)
 Minimum via pre-fill diameter for resin fill (dependent on aspect ratio, hole quantity and distribution)

Feature Sizes **All feature sizes are design dependent as materials and processing may affect combinations**

Blind micro-via stop pad (u-via = 125 micron)
 Blind micro-via top pad (u-via = 125 micron)
Minimum Design Annular Ring - Single Bond, Rigid Only, Similar Materials
 Minimum Design Annular Ring (end result 90° breakout - IPC class 2 with filleting)
 Minimum Design Annular Ring (end result tangency)
 Minimum Design Annular Ring (end result 0.025 mm - IPC class 3 and IPC class 2 without filleting)
 Minimum Design Annular Ring (end result 0.05 mm - MIL)
 Clearance: Copper to drilled hole (operating at <30 volts)
Minimum Design Annular Ring - 1 of Multiple Bond, Flexible component or mixed materials / copper
 Minimum Design Annular Ring (end result 90° breakout - IPC class 2 with filleting)
 Minimum Design Annular Ring (end result tangency)
 Minimum Design Annular Ring (end result 0.025 mm - IPC class 3 and IPC class 2 without filleting)
 Minimum Design Annular Ring (end result 0.05 mm - MIL)
 Clearance: Copper to drilled hole (operating at <30 volts)
Minimum Design Annular Ring - > 1 of Multiple Bond, Flexible component or mixed materials / copper
 Minimum Design Annular Ring (end result 90° breakout - IPC class 2)
 Minimum Design Annular Ring (end result tangency)
 Minimum Design Annular Ring (end result 0.025 mm - IPC class 3)
 Minimum Design Annular Ring (end result 0.05 mm - MIL)
 Clearance: Copper to drilled hole (operating at <30 volts)

Reduced Yield / Special	Standard Limit
< 5.00 mm	< 4.00 mm
50 micron	75 micron
25 micron	50 micron
1.0 mm	0.80 mm
	By design
0.80 mm	0.6 mm
0.6 mm	0.6 mm
1.0 mm	0.6 mm
0.20 mm	0.25 mm
0.15 mm	0.20 mm
0.225 mm	0.250 mm
0.300 mm	0.325 mm
0.090 mm	0.100 mm
0.100 mm	0.125 mm
0.125 mm	0.150 mm
0.150 mm	0.175 mm
0.150 mm	0.175 mm
0.125 mm	0.150 mm
0.150 mm	0.175 mm
0.175 mm	0.200 mm
0.20 mm	0.225 mm
0.175 mm	0.200 mm
0.150 mm	0.175 mm
0.175 mm	0.200 mm
0.200 mm	0.225 mm
0.225 mm	0.250 mm
0.200 mm	0.225 mm

Multiple levels of micro-via and through / buried drill structures may affect these figures.
 Scaling data may not be available for all materials / combinations - test batch may be necessary to obtain material scaling

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Conductor spacing to solderable feature - affects solder mask aperture)

- # @ Conductor Width - print and etch (assumes 12um starting foil)
- # @ Conductor Width - plated (assumes 12 um starting foil)
- # @ Conductor Spacing - print and etch (assumes 12um starting foil)
- # @ Conductor Spacing - plated (assumes 12 um starting foil)
- # @ Conductor Spacing - plated with IPC class 3 wrap requirement (assumes 12 um starting foil)
- # @ Conductor Spacing - plated with IPC class 2 wrap requirement (assumes 12 um starting foil)

- # @ Conductor Width - print and etch (assumes 17um starting foil)
- # @ Conductor Width - plated (assumes 17 um starting foil)
- # @ Conductor Spacing - print and etch (assumes 17um starting foil)
- # @ Conductor Spacing - plated (assumes 17 um starting foil)

- # @ Conductor Width - print and etch (assumes 35um starting foil)
- # @ Conductor Width - plated (assumes 35 um starting foil)
- # @ Conductor Spacing - print and etch (assumes 35 um starting foil)
- # @ Conductor Spacing - plated (assumes 35 um starting foil)

- # @ Conductor Width - print and etch (assumes 70um starting foil)
- # @ Conductor Width - plated (assumes 70 um starting foil)
- # @ Conductor Spacing - print and etch (assumes 70 um starting foil)
- # @ Conductor Spacing - plated (assumes 70 um starting foil)

Anti-pad clearance (moat) and spacing for thermals print and etch
 plated

Drawn hatch - line

Drawn hatch - pitch

Surface Feature to Flexible Hinge - min (construction dependent)

Plated Hole to Flexible Hinge - min

Solder Mask Radial Clearance

Solder mask plugged hole (maximum drilled)

Minimum drilled for solder mask covered vias (holes drilled smaller to be clear or plugged)

Solder Mask Feature HASL / Ag / Entek

Ni / Au

Ident Text Line Width - Font dependent White / Other colour

Text Clip

Reduced Yield / Special	Standard Limit
0.100 mm	0.125 mm
0.060 mm	0.075 mm
0.075 mm	0.090 mm
0.060 mm	0.075 mm
0.090 mm	0.090 mm
N/A	0.112 mm
N/A	0.100 mm
0.065 mm	0.080 mm
0.080 mm	0.095 mm
0.065 mm	0.080 mm
0.095 mm	0.095 mm
0.090 mm	0.100 mm
0.090 mm	0.100 mm
0.090 mm	0.100 mm
0.115 mm	0.115 mm
0.120 mm	0.130 mm
0.135 mm	0.150 mm
0.150 mm	0.160 mm
0.200 mm	0.225 mm
0.090 mm	0.100 mm
0.125 mm	0.150 mm
0.200mm minimum	0.250mm minimum
0.400mm minimum	0.500mm minimum
0.200 mm	0.250 mm
0.800 mm	1.00 mm
0.035 mm	0.050 mm
0.60 mm	0.50 mm
0.50 mm	0.60 mm
0.062 mm	0.075 mm
0.075 mm	0.090 mm
	0.1mm / 0.15mm
	Solder Mask + 0.075 mm

Nominal starting foil thickness stated. In practise this is normally less and foil treatment has to be taken into consideration (i.e. 35 um ~ 30 um)

Nominal surface plating for IPC class 3 adds 25 - 30 microns copper to starting foil. If requirement is greater, reduced yield or thicker starting foil required.

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		Reduced Yield / Special	Standard
Drilling	Minimum Drilled Hole	Mechanical - drill / material thickness	
		(Buried pairs - mechanical)	
		(Buried pairs - laser)	
		> 0.5mm	
		0.3 - 0.5mm	
		< 0.3 mm	
		Blind micro-via (hole : dielectric + copper)	
		HASL	
		Plated metal finish	
		Plated Hole Diameter Tolerance	
Positional Accuracy	Hole to Hole (diameter) Hole to Image Image to Edge Image to Image (layer to layer)	Based on standard tool sizes	
Coverlayer	Coverlayer radial clearance to pad Coverlayer minimum web (also depends on aspect ratio)		

Reduced Yield / Special	Standard
0.3 / 3.0	0.3 / 2.4
0.25 / 2.2	0.25 / 1.8
0.2 / 1.6	0.2 / 1.4
0.15 / 0.2	0.15 / 0.15
0.07 / 0.10	0.10 / 0.15
12 : 1	9:1
10 : 1	8:1
8:1	7:1
1 : 0.9	1: 0.8
+ / - 0.05 mm	+/- 0.07 mm
By design	+/- 0.05 mm
0.05 mm	0.07 mm
0.07 mm	0.1 mm
0.07 mm	0.1 mm
0.10 mm	0.125 mm
< 0.25 mm	0.25 mm
< 0.25 mm	0.25 mm

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Finishes

- Hot Air Solder Level (**SnPb not RoHS compliant**)
- Hot Air Solder Level (**RoHS compliant - sub-contract**)
- Electroless Nickel / Immersion Gold
- \$ Electroless Nickel / Electroless Palladium / Immersion Gold (s-c)
- \$ OSP [Entek (Lead free assembly compatible) sub-contract]
- Hard Gold (Edge Connector Finish)
- \$ Soft Gold (sub-contract)
- \$ All-over gold (electroplate - hard or soft - sub-contract)
- Unfused Tin-Lead (sub-contract)
- Fused Tin-Lead (sub-contract)
- \$ Immersion Tin (sub-contract) Non-preferred. Not MIL
- \$ Immersion Silver (sub-contract)

Reduced Yield / Special	Standard
	X
	X
	X
	X
	Dependent on circuit size
	X
	X
X	
	X
	X
	X
	X

\$ Sub-contract surface finishes will add to lead time and may not be available continuously.

All surface finishes require consideration for via hole (liquid) solder mask clearance to reduce risk of chemical or solder entrapment

Via Fill

- Conductive
 - DuPont CB 100
 - May not be suitable for all substrates
- Non-conductive
 - Peters 2795
 - May not be suitable for all substrates
 - Electra EMP 110

X	
	X
	X
X	
X	
X	

Solder Mask

- Liquid Photoimagable : (Green)
- Liquid Photoimagable : (Other)
- Screen Printed Two Part Epoxies :
- Dry Film Solder Mask
 - DuPont Vacrel 8100

All surface finishes require consideration for via hole (liquid) solder mask clearance to reduce risk of chemical or solder entrapment

Notation Ink

- Inkjet (allows serialisation)
 - White
- Screen Print (does not allow serialisation)
 - Various colours

	X
X	

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Data Required ODB++ (.TGZ) preferred
 Extended Gerber - RS274X
 Standard Gerber - RS274D non-preferred
 IPC-2581
Netlist Data IPC-D-356 or Mentor Neutral File

Reduced Yield / Special	Standard
	x
	x
x	Non-preferred
	x
If not supplied	x

Data Transmission Details on request

Standard Panels

608 x 457mm (24 x 18")
 304 x 457mm (18 x 12")
 608 x 608mm (24 x 24") design dependent - non-preferred

Reduced Yield / Special	Standard
	x
	x
x	

Electrical Test Maximum Test Area 609 x 609mm
 Maximum Test Voltage 500 Volts
 Maximum Isolation Threshold 500 Mohm
 Minimum Continuity Threshold 2 ohm
 Minimum Test Point Pitch 0.10 mm
 Automated Test Voltage - up to 500 Volts
 Hi-Pot Test - up to 5000 Volts

	x
	x

Controlled Impedance

@ TDR Measurement
 Impedance Prediction

Reduced Yield / Special	Standard
+ / - 7%	+ / - 10%
	Polar SI 8000

Optical Inspection Inner Layers 100% AOI
 Outer Layers 100% AOI
 Surface blind vias - laser drilled 100% AOI

For requirements outside of Standard Capability, please contact the Graphic applications team

All features are design dependent and may not be achievable in combination

@ Dependent on design, conductor thickness and etch compensation space availability - copper foil thickness may affect capability

Contract review required for all reduced yield

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Types of Material

Material availability may affect delivery. Some materials may not be suitable for multiple bond constructions or in combination with other materials.

Materials not listed may be used after initial qualification.

Glass reinforced		Flexible	Miscellaneous	
Standard FR4	Isola 370HR	Polyimide Film	PTFE	Rogers
	Ventec VT 47	DuPont AP		Arlon
	Arlon 49N (non-preferred)	DuPont LF (non-preferred)		Taconic
	Others on request - check availability	DuPont FR (non-preferred)		Nelco
Halogen Free	Panasonic R1566	Coverlayer		
		DuPont LF		
Polyimide	Arlon 85N	DuPont FR		
	Arlon 33N Non-preferred			
	Arlon 35N	Flexible adhesive material		
	Arlon 38N	DuPont LF	High speed adhesives	Arlon Genclad 280
	Nelco N7000-2 Non-preferred	DuPont FR		Rogers 2929
	Isola P96 / 26	3M VHB		
	Ventec VT 901			
BT Epoxy	Isola G200		Thermal Management	Stablcor
	Nelco N5000			Copper Invar Copper
Cyanate Ester	Nelco N8000			
High Speed	Isola FR408HR (and IS)			
	Isola I-Tera		Active materials	
	Isola Tachyon 100G		Resistance	Ohmega Ply
	Panasonic Megtron 6		Capacitance	3M ECM
	Rogers 4000 (4003 and 4350)			
	Nelco N4000-12 / -13 standard or SI (non-preferred for all constructions - not recommended for multiple bond constructions)			