

		Manufacturing Design Capabilities Guidelines	
ATTRIBUTE	ENGINEERING APPROVALS	PRODUCTION MINIMUMS	IMPORTANT CONSIDERATIONS/ NOTES
FEATURE OUTERS, nonGOLD PLATED:			
Line/Space, 3.00 Oz and above	Required	Required	
Line/Space, 2.00 Oz	<.0050 T/T 0.0045 T/P	.0070 T/T 0.0055 T/P	.002" etch comp
Line/Space, 1.00 Oz	<.004 T/T 0.0035 T/P	.005 T/T 0.004 T/P	.001" etch comp
Line/Space, 0.50 Oz	<.0035 T/T 0.0035 T/P	.004 T/T 0.0035 T/P	.0005" etch comp
Line/Space, 0.375 Oz	<.003 T/T 0.003 T/P	.003 T/T 0.003 T/P	.000375" Etch comp
Line/Space, 0.25 Oz	<.0020 T/T 0.0020 T/P	.002 T/T 0.002 T/P	.00025" Etch comp
Embedded Feature Space (2 Oz)	<.009	0.01	
Embedded Feature Space (1 Oz)	<.007	0.008	
Embedded Feature Space (0.5 Oz)	<.005	0.006	
Embedded Feature Space (0.375 Oz)	<.004	0.005	
Embedded Feature Space (0.25 Oz)	<.0035	0.0035	
Embedded Feature Space (>1.00 Oz)	Required		Jobs requiring via fill and planerization require minimum 3/8 oz foil start
FEATURE OUTERS, GOLD PLATED:			
	Required	Required	
Line/Space, 3.00 Oz and above	<.0080	0.0080	Not recommended for Au body boards
Line/Space, 2.00 Oz	<.0070	0.0070	Not recommended for Au body boards
Line/Space, 1.00 Oz	<.0060	0.0060	Not preferred
Line/Space, 0.50 Oz	<.0050	0.0050	
Line/Space, 0.375 Oz	<.0040	0.0040	
Embedded Feature Space	<.0060	0.0060	
FEATURE INNERS (nonPLATED):			
	Required	Required	
Line/Space, 3.00 Oz	<.006 T/T 0.0055 T/P	.006 T/T 0.0055 T/P	.003" etch comp
Line/Space, 2.00 Oz	<.006 T/T 0.0050 T/P	.006 T/T 0.0050 T/P	.002" etch comp
Line/Space, 1.00 Oz	<.004 T/T 0.004 T/P	.004 T/T 0.0040 T/P	.001" etch comp
Line/Space, 0.50 Oz	<.0035 T/T 0.003 T/P	.0035 T/T 0.0030 T/P	.0005" etch comp
Embedded Feature Space- 2 Oz	<.006	0.0060	
Embedded Feature Space- 1 Oz	<.005	0.005	*All Mil Spec and class 3 jobs require tol. +/- .0005" (traces) for Cu weights up to 1 Oz.
Embedded Feature Space- .5 Oz	<.004	0.004	
Isolation Bars	<0.0055	0.006	1 oz
			*Cu weights for 2oz and above = +/- .0008"
FEATURES MISC:			
Copper to Edge	<0.01	0.01	
O/L Dryfilm Feature (in a grid)	<0.0043	0.0043	
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PAD/HOLE RATIO:			
		0.010"	Sequential Lam jobs requires an additional .002"
Pad Size Outer, Dia Over Drill	<.008	0.008	Values are for tangency, assumes no A/R
Pad Size Inner, Dia Over Drill	<.008	0.008	Values are for tangency, assumes no A/R
Antipad Size, Dia Over Drill	<.016	0.016	
Pad Capture, Dia Over Microvia	<.006	0.006	
Drill-To-Copper (also called hole-to-Cu)	<.0065	0.008	Applies to inners only - not laser holes
For panel sizes larger than 19x25	<.010	0.01	Applies to inners only - not laser holes
For panel sizes 19x25 to 18x21	<.008	0.008	Any job outside min requires inspecta
For panel sizes less than 18x21	<.0075	0.0075	FA to be verified by Eng.
Drill-To-Board Edge	<.012	0.012	
Drill Size (thru&buried)	<.008	0.008	.005 min holes sizes allowed on boards or sub > .040 without approval
Drill Size (thru&buried - Filled CB-100)	<.010/8:1 aspect ratio	.010/8:1 aspect ratio	.010 minimum drilled via size
Drill Sizes (thru&buried - Filled San ei)	<.006/9:1 aspect ratio	.006/9:1 aspect ratio	

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Drill Size (blind)	<.008	0.008	.005 min holes sizes allowed on boards or sub > .040 without approval
Drill Size, Microvia	<.004	0.004	
Drill Size, maximum	>.257	0.257	
Drill DF Tent Size, maximum	>.187	0.187	
Drill Castellation Size	<.020	0.02	
Backdrill depth tolerance	<+/- .005	+/- .005	Increase drill by .006"- .008" larger than drill size for back drill
Backdrill size over through hole size	<0.006	.008	
Minimum drill to drill spacing	0.015	.015 edge to edge	This is only a recommendation to eliminate CAF issues
Drill Placement Tolerance	<+/- .003	+/- .003	
Hole Plated Size Tolerance	<+/- .002	+/- .002	Also means .004" spread
Hole unPlated Size Tolerance	<+/- .001	+/- .001	Only if nominal drill size is available
Aspect Ratio (thru&buried) thk/drl, max	>15:1	15:1	
Aspect Ratio Microvia Diel/drl, max	>0.75:1	0.75:1	1:1 is allowed on some situations (Will need to evaluated on job by job basis)
Fill-Hole Surface Planarity	<+/- .001	+/- .001	
Min. distance between drilled vias in a plane	<.003	0.003	
ETCHBACK, maximum	>.001	0.001	.0002 to .0005 is what is preferred to target with a absolute .0002 minimum
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WRAP REQUIREMENTS PER IPC-6012C			Required only if blind, or filled vias are required - .0005 minimum wrap required for class 3 & .0002 required for class 2
Minimum space required for class 3 wrap	<.007	0.007	If less than .007 but greater than .004 is present on data we recommend a class 2 wrap (This is no show stopper)
Minimum space required for class 2 wrap	<.0045	0.0045	If spacing is equal to or less than .004 on data we recommend waiving the wrap requirement (This is no show stopper)
PANEL SIZES, STANDARD =====			* Grain direction.
	12" X18, 16" X18, 24"X30, 26"X32, 12 X24*, 18 X21*X 18.5 X24.5*, 19X 25*, 21 X26*		
Thickness Finished, maximum	>.250	0.25	
Thickness Finished (includes plated subs)	<.005	0.005	
Thickness Finished Tolerance	<+/-8%	+/-8%	
Layers Number, maximum	>48	48	
Dielectric Core	<.002	0.002	
Dielectric Preg	<.0016	0.0016	
Warpage Per Inch	<7%	7%	Also means .007 in/in
Construction	Core/Cap Construction	Foil Construction Preferred	Core/Cap Construction requires Pilot This includes laminating subs as cap
Mask and Legend:			
Mask Web SMT * Teflon Mat'l need S/M clearance at cut outs/Rout.	<.0030	0.0030	+ .002 for all colors other than green, blue or clear LPI
Mask Web BGA	<.0035	0.0035	+ .002 for all colors other than green, blue or clear LPI
Mask Clearance (per side)	<.002	0.0020	Assumes no mask on pads
Legend Line	<.006	0.006	Depending on type of silk applied can maintain a .002 to .006 line width
Legend Width/Heigth	15/25	15/25	35/45 is required if epoxy ink is used
Via Plug - Largest Hole Size		.029 drilled/.025 finished	Holes to be via filled larger than 13.5 mils
			must be pre-filled
FINISHES (with Recommended Thickness Ranges): =====			
Immersion Silver	6 - 8	micro inches	
Immersion Gold:	2 minimum	micro inches	

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Ni Under plate	100 - 300	micro inches	
Immersion Tin	10 - 40	micro inches	
Entek (OSP)	2 - .4	micro inches	
Hard Gold Flash:	2 - 5	micro inches	Any Au thickness greater than 15 micro-inches we prefer to full body Au flash and selective Au plate required area
Ni Under plate	150 - 300	micro inches	
Selective Hard Gold	25 - 80	micro inches	
Soft Gold Plate:	Hard Au Strike or Hard Au Flash	micro inches	
Ni Under plate	150 - 300	micro inches	
Selective Soft Gold	25 - 75	micro inches	
HAL	100 - 1500	micro inches	See constraint in " HAL Thickness Consid."
Final copper thickness with 1oz start	1 1/2 oz minimum (.002 absolute minimum)		Based on Class 2 plating requirements
Final copper thickness with .5oz start	1 oz minimum (.0014 absolute minimum)		Based on Class 2 plating requirements
Final copper thickness with .375oz start	1 oz minimum (.0012 absolute minimum)		Based on Class 2 plating requirements
Final copper thickness with .25oz start	1 oz minimum (.001 absolute minimum)		Based on Class 2 plating requirements
FINISH - FEATURE SIZE Considerations:			
Feature Size For HAL	<.012	0.012	For planarity issue
Feature Size for Any Finish	<.005	0.005	Note: "dot" at end of elongated feature
Mask Diameter/ Opening	<.010	0.01	
ROUT:			
Rout Dim Tolerance, min	<+/- .005	+/- .005	
Internal Radius, min	<.015	0.015	
Vscore Depth Tolerance, min	<+/- .003	+/- .003	
ELECTRICAL:			
Pitch/ Feature Size, min	<.010 / .005	.010 / .005	
Isolation Resistance, Mohms	>100	100	
Continuity, Ohms	<10	10	
Impedance Tolerance, %	<5%	10%	5% requires a pilot run - MUST NOTIFY QUALITY DEPT>