



Manufacturing Capabilities

Combined Representation of All Facilities

Product Types: Rigid, Flex, Rigid-flex, RF/microwave, Thermal Management

Attribute	Standard	Advanced	Emerging
Lamination			
Layer count	2 - 30	32 +	>48
Minimum panel size	12x18		
Maximum panel size	18x24	21"x24"	24"x30"
HDI layers	2-3	4	8+ as permitted by laminate type
Sequential laminations	2-3	4	8+ as permitted by laminate type
Layer-to-layer registration	+/- .002"		
Minimum board thickness, single/double sided	.005"		.002"
Maximum board thickness	.250"		.300"
Minimum core thickness	.001"		.0005"
Minimum core thickness (BC, Kapton)	.002"	.001"	.0005"
Minimum prepreg fill	.003"	.002"	<.002"
Drill			
Minimum drill diameter, mechanical drill	.006"	.005"	.004"
Mechanical drill aspect ratio, unfilled	12:1	15:1	30:1
Mechanical drill aspect ratio, filled	10:1	11:1	> 11:1
Drill to metal (rigid)	.008"	.007"	.00525"
Drill to metal (flex)	.012"	.007"	.00525"
Drill Edge to Rigid Flex Transition	.100"	.075"	< .050"
Antipad diameter over drill size	.020"+	.016"	< .016"
Minimum class 2 annular ring, mechanical drill	.005"	.004"	<.004"
Minimum class 3 annular ring, mechanical drill	.007"	.006"	<.006"
Minimum drill diameter, laser micro via	.004"	.003"	<.003"
Microvia aspect ratio	0.6:1	0.7:1	>0.7:1
Microvia capture pad / hole	+.007"	+.005"	+.004"
Control depth drill tolerance	Keep back .010" +/- .005"	Keep back .005" +/- .002"	Keep back .004 +/- .0015"
Back drill, diameter over primary drill	.008"	.007"	<.007"
Back drill anti-pad, diameter over primary drill	.016"	.014"	<.014"
Etch Features			
Min copper foil - Internal	1/2 oz	1/4 oz	1/4 oz
Max copper foil - Internal	2 oz	4 oz	6 oz
Min copper foil - External	3/8 oz	1/4 oz	1/4 oz
Max copper foil - External	1 oz	3 oz	>3 oz
Inner Layer Print and Etch			
Minimum designed line width/spacing, 1/4 ounce foil	.002"		<.002"
Minimum designed line width/spacing, 3/8 ounce foil	.003"/.003"	.0025"/.003"	<.0025"/.002"
Minimum designed line width/spacing, 1/2 ounce foil	.004"/.004"	.003"/.003"	<.003/.003"
Minimum designed line width/spacing, 1 ounce foil	.005"/.005"	.004"/.004"	.0035"/.004"
Minimum designed line width/spacing, 2 ounce foil	.008"/.008"	.006"/.008"	.006".006"



Manufacturing Capabilities

Combined Representation of All Facilities

Product Types: Rigid, Flex, Rigid-flex, RF/microwave, Thermal Management

Attribute	Standard	Advanced	Emerging
Minimum designed line width/spacing, 3 ounce foil	.010"/.010"	.008"/.010"	.008"/.008"
Plated External Layers			
Minimum designed line width/spacing, 1/4 ounce foil		.0025"/.0025	.002"/.002"
Minimum designed line width/spacing, 3/8 ounce foil	.004"/.004"	.003"/.003"	.0025"/.003"
Minimum designed line width/spacing, 1/2 ounce foil	.005"/.005"	.004"/.004"	.003"/.004"
Minimum designed line width/spacing, 1 ounce foil	.006"/.006"	.005"/.005"	.004"/.005"
Minimum designed line width/spacing, 2 ounce foil	.012"/.012"	.010"/.010"	.008"/.008"
Minimum designed line width/spacing, greater than 3 ounce foil			Requires engineering review
Copper fill to round feature spacing (donuts)	.006"	.005"	.005"
Flex Button Plate			
Flex PCB Button Plate: Pad + Drill, Button +Drill	Pad = DRL+ .016"/Button=DRL + .008"	Pad = DRL+ .014"/Button=DRL + .006"	Pad = DRL+ .012"/Button=DRL + .004"
Soldermask			
LDI solder mask minimum web width, green color	.004"	.003"	less than .003"
LDI solder mask clearance	+/- .002"	+/- .0015"	less than +/- .0015"
Legend			
Inkjet legend printing	White	White	White
Color options	Green	Red, Blue, Black, White	Red, Blue, Black, White
Mechanical			
Board profile dimensional tolerance	+/- .005"	+/- .002"	<+/- .002"
Plated through hole diameter tolerance	+/- .003"	+/- .002"	<+/- .002"
Non-plated through hole diameter tolerance	+ .002"/- .001"	+/- .001"	<+/- .001"
Board flatness, warp and twist Per IPC-TM-650 2.4.22	<.75%	<.5% Balanced Construction	Unbalanced Constructions AABUS
Impedance Testing			
Impedance controlled - single ended +/- %	+/-10%	+/-5%	<+/- 5%
Impedance controlled - edge coupled diff. +/- %	+/-10%	+/-8%	<+/- 5%
Impedance controlled - broad side diff. +/- %	+/-10%	+/-8%	<+/- 5%
Impedance controlled - broad side diff. +/- %	10%	5%	5%



Anaheim

Manufacturing Capabilities

Product Types: Rigid, HDI, Flex, Rigid-flex

Attribute	Standard	Advanced	Emerging
Lamination			
Layer count	2 - 30	32 +	40+
Minimum panel size	12x18		
Maximum panel size	18x24, 21x24	24x36	24x28 HDI
HDI layers	2-3	4 +	7+
Sequential laminations	2-3	4 +	7+
Layer to layer registration tolerance	.005"	.003"	.002"
Minimum board thickness	.020"	.005"	.002"
Maximum board thickness	.220"	.250"	.300"
Minimum core thickness	.002"	.001"	.0005"
Minimum core thickness (BC, Kapton)	.002"	.001"	.0005"
Minimum prepreg fill	.003"	.002"	<.002"
Drill			
Minimum drill mechanical	.0098"	0.006"	.004"
Mechanical drill aspect ratio, unfilled	10:1	14:1	>14:1
Mechanical drill aspect ratio, filled	10:1	14:1	>14:1
Drill to metal (rigid)	.010"	.008"	.006"
Drill to metal (flex)	.012"	.010"	.008"
Drill Edge to Rigid Flex Transition	.100"	.075"	< .050"
Antipad over drill size	.020"+	.016"+	.012"+
Minimum class 2 annular ring, mechanical drill	.005"	.004"	<.004"
Minimum class 3 annular ring, mechanical drill	.007"	.006"	<.006"
Laser via drill size	.005"	.004"	<.004"
Microvia aspect ratio	.6:1	.75:1	1:01
Microvia capture pad / hole	+.007"	+.005"	+.004"
Control depth drill tolerance	Keep back .010" +/- .005"	Keep back .005" +/- .002"	Keep back .004 +/- .0015"
Back drill, diameter over primary drill	.008"	.007"	<.007"
Back drill anti-pad, diameter over primary drill	.016"	.014"	<.014"
Etch Features			
Min copper foil - Internal	1/2 oz	1/4 oz	1/4 oz
Max copper foil - Internal	2 oz	4 oz	6 oz
Min copper foil - External	3/8 oz	1/4 oz	1/4 oz
Max copper foil - External	1 oz	3 oz	>3 oz
Inner Layer Print and Etch			
Minimum designed line width/spacing, 1/4 ounce foil	Not Standard	Not Advance	.002"/.002"
Minimum designed line width/spacing, 3/8 ounce foil	Not Standard	Not Advance	.0025"/.0025"
Minimum designed line width/spacing, 1/2 ounce foil	.004"/.004"	.003"/.003"	.002"/.0025"
Minimum designed line width/spacing, 1 ounce foil	.005"/.005"	.004"/.004"	.003"/.0035"
Minimum designed line width/spacing, 2 ounce foil	.006"/.006"	.005"/.006"	.004"/.006"
Minimum designed line width/spacing, 3 ounce foil	.012"/.012"	.010"/.010"	.008"/.008"



Anaheim

Manufacturing Capabilities

Product Types: Rigid, HDI, Flex, Rigid-flex

Attribute	Standard	Advanced	Emerging
Plated External Layers			
Minimum designed line width/spacing, 1/4 ounce foil	Not Standard	.0025"/.0025	.002"/.002"
Minimum designed line width/spacing, 3/8 ounce foil	.004"/.004"	.003"/.003"	.0025"/.003"
Minimum designed line width/spacing, 1/2 ounce foil	.005"/.005"	.004"/.004"	.003"/.004"
Minimum designed line width/spacing, 1 ounce foil	.006"/.006"	.005"/.005"	.004"/.005"
Minimum designed line width/spacing, 2 ounce foil	.012"/.012"	.010"/.010"	.008"/.008"
Minimum designed line width/spacing, greater than 3 ounce foil			Requires engineering review
Copper fill to round feature spacing (donuts)	.006"	.005"	.005"
Flex Button Plate			
Flex PCB Button Plate: Pad + Drill, Button +Drill	Pad = DRL+ .016"/Button=DRL + .008"	Pad = DRL+ .014"/Button=DRL + .006"	Pad = DRL+ .012"/Button=DRL + .004"
Soldermask			
LDI solder mask minimum web width, green color	.004"	.0035"	.003"
LDI solder mask clearance	.003"	.002"	.0015"
Color options	Green	Red, Blue, Black, White	Red, Blue, Black, White
Legend			
Inkjet legend printing	White	White	White
Color options	Green	Red, Blue, Black, White	Red, Blue, Black, White
Mechanical			
Board profile dimensional tolerance	+/- .005"	+/- .002"	<+/- .002"
Plated through hole diameter tolerance	+/- .003"	+/- .002"	<+/- .002"
Non-plated through hole diameter tolerance	+.002"/-.002"	+/- .001"	<+/- .001"
Board flatness, warp and twist Per IPC-TM-650 2.4.22	<.75%	<.5% Balanced Construction	Unbalanced Constructions AABUS
Impedance Testing			
Impedance controlled - single ended +/- %	10%	8%	5%
Impedance controlled - edge coupled diff. +/- %	10%	8%	5%
Impedance controlled - broad side diff. +/- %	10%	8%	5%



Chicago

Manufacturing Capabilities

Product Types: Rigid, Flex

Attribute	Standard	Advanced	Emerging
Lamination			
Layer count	10	24	24+
Minimum panel size	12x18		
Maximum panel size	18x24	24x28	
HDI layers	2-3	4	4+
Sequential laminations	2-3	4	4+
Layer to layer registration tolerance	.005"	.003"	.002"
Minimum board thickness	.012"	.010"	.006"
Maximum board thickness	< .250"	0.250"	.400"
Minimum core thickness	.003"	.002"	.001"
Minimum core thickness (BC, Kapton)	.002"	.001"	.0005"
Minimum prepreg fill	.004"	.003"	.002"
Drill			
Minimum drill diameter, mechanical drill	.009"	.008"	.006"
Mechanical drill aspect ratio, unfilled	8:1	10:1	16:1
Mechanical drill aspect ratio, filled	8:1	10:1	>14:1
Drill to metal (rigid)	.009"	.008"	.006"
Drill to metal (flex)	NA	NA	NA
Drill Edge to Rigid Flex Transition	NA	NA	NA
Antipad diameter over drill size	.018"	.016"	.012"
Minimum class 2 annular ring, mechanical drill	.005"	.004"	<.004"
Minimum class 3 annular ring, mechanical drill	.007"	.006"	<.006"
Minimum drill diameter, laser micro via	.006"	.004"	.003"
Microvia aspect ratio	.6:1	.75:1	1:01
Microvia capture pad / hole	+.007"	+.005"	+.004"
Control depth drill tolerance	Keep back .010" +/- .005"	Keep back .005" +/- .002"	Keep back .004 +/- .0015"
Back drill, diameter over primary drill	.008"	.007"	<.007"
Back drill anti-pad, diameter over primary drill	.016"	.014"	<.014"
Etch Features			
Min copper foil - Internal	1/2 oz	1/4 oz	1/4 oz
Max copper foil - Internal	2 oz	4 oz	6 oz
Min copper foil - External	3/8 oz	1/4 oz	1/4 oz
Max copper foil - External	1 oz	3 oz	3 oz
Inner Layer Print and Etch			
Minimum designed line width/spacing, 1/4 ounce foil	Non Standard	Not Advanced	< .003"/.003"
Minimum designed line width/spacing, 3/8 ounce foil	.004"/.004"	.003"/.003"	.0025"/.003"
Minimum designed line width/spacing, 1/2 ounce foil	.005"/.005"	.004"/.004"	.003"/.004"
Minimum designed line width/spacing, 1 ounce foil	.006"/.006"	.005"/.005"	.004"/.005"
Minimum designed line width/spacing, 2 ounce foil	.006"/.006"	.005"/.006"	.004"/.006"
Minimum designed line width/spacing, 3 ounce foil	.012"/.012"	.010"/.010"	.008"/.008"



Chicago

Manufacturing Capabilities

Product Types: Rigid, Flex

Attribute	Standard	Advanced	Emerging
Plated External Layers			
Minimum designed line width/spacing, 1/4 ounce foil	Not Standard	Not Standard	Not Standard
Minimum designed line width/spacing, 3/8 ounce foil	Not Standard	Not Standard	Not Standard
Minimum designed line width/spacing, 1/2 ounce foil	.004"/.004"	.003"/.003"	.002"/.0025"
Minimum designed line width/spacing, 1 ounce foil	.005"/.005"	.004"/.004"	.003"/.0035"
Minimum designed line width/spacing, 2 ounce foil	.006"/.006"	.005"/.006"	.004"/.006"
Minimum designed line width/spacing, greater than 3 ounce foil			Requires engineering review
Copper fill to round feature spacing (donuts)	.006"	.005"	<.005"
Flex Button Plate			
Flex PCB Button Plate: Pad + Drill, Button +Drill	.016"/Button=DRL + .008"	.014"/Button=DRL + .006"	.012"/Button=DRL + .004"
Soldermask			
LDI solder mask minimum web width, green color	.004"	.003"	.0015"
LDI solder mask clearance	.002"	.0015"	.001"
Color options	Green	Red, Blue, Black, White	Red, Blue, Black, White
Legend			
Inkjet legend printing	White	White	White
Color options	Green	Red, Blue, Black, White	Red, Blue, Black, White
Mechanical			
Board profile dimensional tolerance	+/- .005"	+/- .002"	<+/- .002"
Plated through hole diameter tolerance	+/- .003"	+/- .002"	<+/- .002"
Non-plated through hole diameter tolerance	+ .002"/- .001"	+/- .001"	<+/- .001"
Board flatness, warp and twist Per IPC-TM-650 2.4.22	<.75%	<.5% Balanced Construction	Unbalanced Constructions AABUS
Impedance Testing			
Impedance controlled - single ended +/- %	10%	+/-8%	5%
Impedance controlled - edge coupled diff. +/- %	10%	+/-8%	5%
Impedance controlled - broad side diff. +/- %	10%	+/-8%	5%



Hollister

Manufacturing Capabilities

Product Types: Rigid, HDI

Attribute	Standard	Advanced	Emerging
Lamination			
Layer count	1-24	26-36	>36
Minimum panel size	18 x 24		
Maximum panel size	18 x 24	21 x 24	
HDI layers	3	4	5
Sequential laminations	4	5	>5
Layer-to-layer registration	.005"	.003"	.002"
Minimum board thickness, single/double sided	.015"	.005"	.004"
Maximum board thickness	.250"	.265"	.275"
Minimum core thickness	.003"	.002"	.001"
Minimum core thickness (BC, Kapton)		.002"	.001"
Minimum prepreg fill	.003"	.0025"	.002"
Drill			
Minimum drill diameter, mechanical drill	.0059"	.0039"	.0039"
Mechanical drill aspect ratio, unfilled	10:1	14:1	20:1
Mechanical drill aspect ratio, filled	10:1	14:1	20:1
Drill to metal (rigid)	.010"	.007"	.006"
Drill to metal (flex)			
Drill Edge to Rigid Flex Transition			
Antipad diameter over drill size	.020"	.014"	.012"
Minimum class 2 annular ring, mechanical drill	.006"	.005"	.004"
Minimum class 3 annular ring, mechanical drill	.007"	.006"	.005"
Minimum drill diameter, laser micro via	.006"	.004"	.0025"
Microvia aspect ratio	.7:1	.8:1	1:1
Microvia capture pad / hole	+.005"	+.004"	+.003"
Control depth drill tolerance	Keep back .010" +/- .005"	Keep back .005" +/- .0025"	Keep back .004" +/- .002"
Back drill, diameter over primary drill	.010"	.008"	.006"
Back drill anti-pad, diameter over primary drill	.018"	.015"	.012"
Etch Features			
Min copper foil - Internal	1/2 oz	1/4 oz	<1/4 oz
Max copper foil - Internal	4 oz	6 oz	8 oz
Min copper foil - External	1/4 oz	1/4 oz	<1/4 oz
Max copper foil - External	3 oz	4 oz	4 oz
Inner Layer Print and Etch			
Minimum designed line width/spacing, 1/4 ounce foil	Not Standard	Not Standard	Not Standard
Minimum designed line width/spacing, 3/8 ounce foil	Not Standard	Not Standard	Not Standard
Minimum designed line width/spacing, 1/2 ounce foil	.004"/.004"	.002"/.0025"	.002"/.0025"
Minimum designed line width/spacing, 1 ounce foil	.005"/.005"	.004"/.004"	.0035"/.004"
Minimum designed line width/spacing, 2 ounce foil	.006"/.006"	.005"/.006"	.0045"/.006"
Minimum designed line width/spacing, 3 ounce foil	Not Standard	Not Standard	Not Standard



Hollister

Manufacturing Capabilities

Product Types: Rigid, HDI

Attribute	Standard	Advanced	Emerging
Plated External Layers			
Minimum designed line width/spacing, 1/4 ounce foil	.004"/.004"	.003"/.003"	.0025"/.003"
Minimum designed line width/spacing, 3/8 ounce foil	Not Standard	Not Standard	Not Standard
Minimum designed line width/spacing, 1/2 ounce foil	.005"/.005"	.004"/.004"	.0035"/.004"
Minimum designed line width/spacing, 1 ounce foil	.006"/.006"	.005"/.005"	.0045"/.005"
Minimum designed line width/spacing, 2 ounce foil	.012"/.012"	.010"/.010"	.008"/.008"
Minimum designed line width/spacing, greater than 3 ounce foil			Requires engineering review
Copper fill to round feature spacing (donuts)	.006"	.005"	.005"
Soldermask			
LDI solder mask minimum web width, green color	.004"	.003"	.003"
LDI solder mask clearance	.003"	.002"	.002"
Color options	Green	Any Color	Any Color
Legend			
Inkjet legend printing	White	White	Any Color
Color options	Black	Any Color	Any Color
Feature size	.005" x .060"	.006" x .03"	
Mechanical			
Board profile dimensional tolerance	+/- .005"	+/- .002"	<+/- .002"
Plated through hole diameter tolerance	+/- .003"	+/- .002"	<+/- .002"
Non-plated through hole diameter tolerance	+/- .003"	+/- .002"	<+/- .002"
Board flatness, warp and twist Per IPC-TM-650 2.4.22	<.75%	<.5% Balanced Construction	Unbalanced Constructions AABUS
Impedance Testing			
Impedance controlled - single ended +/- %	10%	5%	5%
Impedance controlled - edge coupled diff. +/- %	10%	5%	5%
Impedance controlled - broad side diff. +/- %	10%	5%	5%



Orange

Manufacturing Capabilities

Product Types: Rigid, Advanced HDI, RF/Microwave, High-speed Digital

Attribute	Standard	Advanced	Emerging
Lamination			
Layer count	2 - 30	32 +	40+
Minimum panel size	12x18		
Maximum panel size	18x24, 21x24	20x26	24x28
HDI layers	2-3	4 +	10+
Sequential laminations	2-3	4 +	10+
Layer-to-layer registration	.005"	.003"	.002"
Minimum board thickness, single/double sided	.020"	.006"	.004"
Maximum board thickness	.250"	.250"	.300"
Minimum core thickness	.003"	.001"	.001"
Minimum core thickness (BC, Kapton)	.002"	.001"	.0005"
Minimum prepreg fill	.003"	.002"	<.002"
Drill			
Minimum drill diameter, mechanical drill	.0078"	.004"	.004"
Mechanical drill aspect ratio, unfilled	10:1	16:1	>20:1
Mechanical drill aspect ratio, filled	8:1	12:1	>12:1
Drill to metal (rigid)	.010"	.007"	.00525"
Antipad diameter over drill size	.020"+	.016"+	.012"+
Minimum class 2 annular ring, mechanical drill	.005"	.004"	<.004"
Minimum class 3 annular ring, mechanical drill	.007"	.006"	<.006"
Minimum drill diameter, laser micro via	+.006"	+.004"	+.004"
Microvia aspect ratio	.6:1	.8:1	1:1
Microvia capture pad / hole	+.006"	+.004"	+.004"
Control depth drill tolerance	Keep back .010" +/- .005"	Keep back .005" +/- .002"	>Keep back .004" +/- .0015"
Back drill, diameter over primary drill	.008"	.007"	<.007"
Back drill anti-pad, diameter over primary drill	.016"	.014"	<.014"
Etch Features			
Min copper foil - Internal	1/2 oz	3/8 oz	1/4 oz
Max copper foil - Internal	2 oz	3 oz	3 oz
Min copper foil - External	3/8 oz	1/4 oz	1/4 oz
Max copper foil - External	1 oz	2 oz	2 oz
Inner Layer Print and Etch			
Minimum designed line width/spacing, 1/2 ounce foil	.003"/.0035"	.003"/.003"	.002"/.002"
Minimum designed line width/spacing, 1 ounce foil	.004"/.004"	.003"/.004"	.0025"/.0035"
Minimum designed line width/spacing, 2 ounce foil	.006"/.006"	.005"/.005"	.004"/.005"
Minimum designed line width/spacing, 3 ounce foil	.012"/.012"	.010"/.010"	.008"/.008"
Plated External Layers			
Minimum designed line width/spacing, 1/4 ounce foil	Not Standard	Not Advanced	<.002"/.002"
Minimum designed line width/spacing, 3/8 ounce foil	.003"/.004"	.003"/.003"	.002"/.0025"
Minimum designed line width/spacing, 1/2 ounce foil	.004"/.005"	.003"/.004"	.0025"/.0035"



Orange

Manufacturing Capabilities

Product Types: Rigid, Advanced HDI, RF/Microwave, High-speed Digital

Attribute	Standard	Advanced	Emerging
Minimum designed line width/spacing, 1 ounce foil	.005"/.006"	.004/.005"	.0035"/.0045"
Minimum designed line width/spacing, 2 ounce foil	.012"/.012"	.010"/.010"	.008"/.008"
Minimum designed line width/spacing, greater than 3 ounce foil			Requires engineering review
Copper fill to round feature spacing (donuts)	.006"	.005"	.005"
Soldermask			
LDI solder mask minimum web width, green color	.004"	.0035"	.003"
LDI solder mask clearance	.003"	.0015"	.0015"
Color options	Green	Red, Blue, Black, White	Red, Blue, Black, White
Legend			
Inkjet legend printing	White	White	White
Color options	Green	Red, Blue, Black, White	Red, Blue, Black, White
Mechanical			
Board profile dimensional tolerance	+/- .005"	+/- .002"	<+/- .002"
Plated through hole diameter tolerance	+/- .003"	+/- .002"	<+/- .002"
Non-plated through hole diameter tolerance	+ .002"/- .001"	+/- .001"	<+/- .001"
Board flatness, warp and twist Per IPC-TM-650 2.4.22	<.75%	<.5% Balanced Construction	Unbalanced Constructions AABUS
Impedance Testing			
Impedance controlled - single ended +/- %	10%	8%	5%
Impedance controlled - edge coupled diff. +/- %	10%	8%	5%
Impedance controlled - broad side diff. +/- %	10%	8%	5%
Non-plated through hole diameter tolerance	+ .002"/- .001"	+/- .001"	<+/- .001"
Board flatness, warp and twist Per IPC-TM-650 2.4.22	<.75%	<.5% Balanced Construction	Unbalanced Constructions AABUS
Impedance Testing			
Impedance controlled - single ended +/- %	10%	5%	5%
Impedance controlled - edge coupled diff. +/- %	10%	5%	5%
Impedance controlled - broad side diff. +/- %	10%	5%	5%



Santa Clara

Manufacturing Capabilities

Product Types: Rigid, Flex, Rigid-flex, Advanced HDI, High-speed Digital

Attribute	Standard	Advanced	Emerging
Lamination			
Layer count	2 - 30	32 +	>48
Minimum panel size	12x18		
Maximum panel size	18x24, 21x24		24x30
HDI layers	2-3	4	8+ as permitted by laminate type
Sequential laminations	2-3	4	8+ as permitted by laminate type
Layer-to-layer registration	+/- .005"	+/- .003"	+/- .002"
Minimum board thickness, single/double sided	.012"	.005"	.0005"
Maximum board thickness	.250"	.275"	.300"
Minimum core thickness	.001"		.0005"
Minimum core thickness (BC, Kapton)	.002"	.001"	.0005"
Minimum prepreg fill	.003"	.002"	<.002"
Drill			
Minimum drill diameter, mechanical drill	.006"	0.004"	.003"
Mechanical drill aspect ratio, unfilled	12:1	15:1	up to 20:1
Mechanical drill aspect ratio, filled	10:1	11:1	> 11:1
Drill to metal (rigid)	.008"	.007"	.00525"
Drill to metal (flex)	.012"	.010"	.008"
Drill Edge to Rigid Flex Transition	.100"	.075"	< .050"
Antipad diameter over drill size	.020"+	.016"	< .016"
Minimum class 2 annular ring, mechanical drill	.005"	.004"	<.004"
Minimum class 3 annular ring, mechanical drill	.007"	.006"	<.006"
Minimum drill diameter, laser micro via	.004"	.003"	<.003"
Microvia aspect ratio	0.6:1	0.7:1	>0.7:1
Microvia capture pad / hole	+.007"	+.005"	+.004"
Control depth drill tolerance	+/- .005"	+/- .002"	<+/- .002"
Back drill, diameter over primary drill	.008"	.007"	<.007"
Back drill anti-pad, diameter over primary drill	.015"	.014"	<.014"
Etch Features			
Min copper foil - Internal	1/2 oz	1/4 oz	1/4 oz
Max copper foil - Internal	2 oz	4 oz	6 oz
Min copper foil - External	3/8 oz	1/4 oz	1/4 oz
Max copper foil - External	1 oz	3 oz	>3 oz
Inner Layer Print and Etch			
Minimum designed line width/spacing, 1/4 ounce foil	.0025"	.002"	<.002"
Minimum designed line width/spacing, 3/8 ounce foil	.003"/.003"	.0025"/.003"	<.0025"/.002"
Minimum designed line width/spacing, 1/2 ounce foil	.004"/.004"	.003"/.003"	<.003/.003"
Minimum designed line width/spacing, 1 ounce foil	.005"/.005"	.004"/.004"	.0035"/.004"
Minimum designed line width/spacing, 2 ounce foil	.008"/.008"	.006"/.008"	.006".006"



Santa Clara

Manufacturing Capabilities

Product Types: Rigid, Flex, Rigid-flex, Advanced HDI, High-speed Digital

Attribute	Standard	Advanced	Emerging
Minimum designed line width/spacing, 3 ounce foil	.010"/.010"	.008"/.010"	.008"/.008"
Plated External Layers			
Minimum designed line width/spacing, 1/4 ounce foil	.0025"/.003"	.0025"/.0025	.002"/.002"
Minimum designed line width/spacing, 3/8 ounce foil	.004"/.004"	.003"/.003"	.0025"/.003"
Minimum designed line width/spacing, 1/2 ounce foil	.005"/.005"	.004"/.004"	.003"/.004"
Minimum designed line width/spacing, 1 ounce foil	.006"/.006"	.005"/.005"	.004"/.005"
Minimum designed line width/spacing, 2 ounce foil	.012"/.012"	.010"/.010"	.008"/.008"
Minimum designed line width/spacing, greater than 2 ounce foil			Requires engineering review
Copper fill to round feature spacing (donuts)	.006"	.005"	.005"
Flex Button Plate			
Flex PCB Button Plate: Pad + Drill, Button +Drill	Pad = DRL+ .016"/Button=DRL + .008"	Pad = DRL+ .014"/Button=DRL + .006"	Pad = DRL+ .012"/Button=DRL + .004"
Soldermask			
LDI solder mask minimum web width, green color	.004"	.003"	less than .003"
LDI solder mask clearance	+/- .002"	+/- .0015"	less than +/- .0015"
Color options	Green	Red, Blue, Black, White	Red, Blue, Black, White
Legend			
Inkjet legend printing	White	White	White
Color options	Green	Red, Blue, Black, White	Red, Blue, Black, White
Mechanical			
Board profile dimensional tolerance	+/- .005"	+/- .002"	<+/- .002"
Plated through hole diameter tolerance	+/- .003"	+/- .002"	<+/- .002"
Non-plated through hole diameter tolerance	+ .002"/- .001"	+/- .001"	<+/- .001"
Board flatness, warp and twist Per IPC-TM-650 2.4.22	<.75%	<.5% Balanced Construction	Unbalanced Constructions AABUS
Impedance Testing			
Impedance controlled - single ended +/- %	+/-10%	+/-5%	<+/- 5%
Impedance controlled - edge coupled diff. +/- %	+/-10%	+/-8%	<+/- 5%
Impedance controlled - broad side diff. +/- %	+/-10%	+/-8%	<+/- 5%
Impedance controlled - broad side diff. +/- %	10%	5%	5%



Santa Ana

Manufacturing Capabilities

Product Types: Rigid-flex, Flex, ATE, Semiconductor

Attribute	Standard	Advanced	Emerging
Lamination			
Layer count	38	40	42
Minimum panel size	12x18	N/A	N/A
Maximum panel size	18x24	N/A	N/A
HDI layers	38	40	42
Sequential laminations	3	4	5
Layer to layer registration tolerance	0.002	0.0015	0.001
Minimum board thickness	0.01	0.005	0.003
Maximum board thickness	0.187	0.25	0.3
Minimum core thickness	0.002	N/A	N/A
Minimum core thickness (BC, Kapton)	0.001	N/A	N/A
Minimum prepreg fill	0.003	0.0025	0.002
Drill			
Minimum drill mechanical	0.008	0.0059	0.004
Mechanical drill aspect ratio, unfilled	10:1	12:1	30:1
Mechanical drill aspect ratio, filled	10:1	12:1	30:1
Drill to metal (rigid)	0.007	0.0065	0.005
Drill to metal (flex)	0.007	N/A	N/A
Drill Edge to Rigid Flex Transition	0.01	0.008	0.005
Antipad over drill size	0.015	0.012	0.01
Minimum class 2 annular ring, mechanical drill	0.001	0.0015	0.0015
Minimum class 3 annular ring, mechanical drill	0.0015	0.002	
Laser via drill size	0.008	0.006	0.004
Microvia aspect ratio	1:1	.8:1	
Microvia capture pad / hole	0.004	0.003	0.002
Control depth drill tolerance	0.003	0.002	0.001
Back drill, diameter over primary drill	0.0025	0.002	0.0015
Back drill anti-pad, diameter over primary drill	0.0025	0.002	0.0015
Etch Features			
Min copper foil - Internal	1/2 oz	1/4 oz	N/A
Max copper foil - Internal	4 oz	5 oz	6 oz
Min copper foil - External	1/4 oz	1/8 oz	N/A
Max copper foil - External	2 oz	3 oz	4 oz
Inner Layer Print and Etch			
Minimum designed line width/spacing, 1/4 ounce foil	.004/.004	.003/.003	.0025/.0025
Minimum designed line width/spacing, 3/8 ounce foil	.004/.004	.003/.003	.0025/.0025
Minimum designed line width/spacing, 1/2 ounce foil	.005/.0045	.004/.004	.003/.003
Minimum designed line width/spacing, 1 ounce foil	.005/.005	.0045/.0045	.004/.004
Minimum designed line width/spacing, 2 ounce foil	.006/.006	.0055/.0055	.0045/.0045
Minimum designed line width/spacing, 3 ounce foil	.0065/.0065	.006/.006	.005/.005



Santa Ana

Manufacturing Capabilities

Product Types: Rigid-flex, Flex, ATE, Semiconductor

Attribute	Standard	Advanced	Emerging
Plated External Layers			
Minimum designed line width/spacing, 1/4 ounce foil	.005/.005	.0045/.0045	.004/.004
Minimum designed line width/spacing, 3/8 ounce foil	.005/.005	.0045/.0045	.004/.004
Minimum designed line width/spacing, 1/2 ounce foil	.006/.006	.005/.005	.0045/.0045
Minimum designed line width/spacing, 1 ounce foil	.007/.007	.0065/.0065	.006/.006
Minimum designed line width/spacing, 2 ounce foil	.008/.008	.0075/.0075	N/A
Minimum designed line width/spacing, greater than 3 ounce foil	.012/.012	.010/.010	N/A
Copper fill to round feature spacing (donuts)	.003/.003	.0015/.0015	.001/.001
Flex Button Plate			
Flex PCB Button Plate: Pad + Drill, Button +Drill	Drill + 0.012, Drill + 0.004	Drill + 0.008, Drill + 0.004	Drill + 0.006, Drill + 0.003
Soldermask			
LDI solder mask minimum web width, green color	0.005	0.0045	0.004
LDI solder mask clearance	0.007	0.0065	0.006
Color options	Green	All	All
Legend			
Inkjet legend printing	Yes	Yes	Yes
Color options	White	All	All
Mechanical			
Board profile dimensional tolerance	0.01	0.008	0.005
Plated through hole diameter tolerance	0.003	0.003	0.002
Non-plated through hole diameter tolerance	0.003	0.002	0.001
Board flatness, warp and twist Per IPC-TM-650 2.4.22			
Impedance Testing			
Impedance controlled - single ended +/- %	10	8	5
Impedance controlled - edge coupled diff. +/- %	10	8	5
Impedance controlled - broad side diff. +/- %	10	8	5



Toronto

Manufacturing Capabilities

Product Types: Rigid, RF/Microwave, Thermal Management

Attribute	Standard	Advanced	Emerging
Lamination			
Layer count	2-24	24-30	30+
Minimum panel size	12 x 18		
Maximum panel size	18 x 24	21x24	
HDI layers	1-2	2-3	4
Sequential laminations	2-3	3	4+
Layer-to-layer registration	.005"	.003"	.002"
Minimum board thickness, single/double sided	.020"	.005"	.004"
Maximum board thickness	.200"	.220"	.240"
Minimum core thickness	.003"	.0025"	.002"
Minimum core thickness (BC, Kapton)	.002"	.001"	.00055"
Minimum prepreg fill	.003"	.002"	.001"
Drill			
Minimum drill diameter, mechanical drill	.0078"	.006"	.004"
Mechanical drill aspect ratio, unfilled	8:1	12:1	16:1
Mechanical drill aspect ratio, filled	8:1	12:1	>12:1
Drill to metal (rigid)	.010"	.008"	.006"
Drill to metal (flex)	.010"	.007"	.00525"
Drill Edge to Rigid Flex Transition	.100"	.075"	.050"
Antipad diameter over drill size	.020"+	.016"+	.012"
Minimum class 2 annular ring, mechanical drill	.005"	.004"	<.004"
Minimum class 3 annular ring, mechanical drill	.007"	.006"	<.006"
Minimum drill diameter, laser micro via	.006"	.004"	.003"
Microvia aspect ratio	.6:1	.7:1	.85:1
Microvia capture pad / hole	+.006"	+.005"	+.004"
Control depth drill tolerance	Keep back .010" +/- .005"	Keep back .005" +/- .002"	Keep back .004" +/- .002"
Back drill, diameter over primary drill	.008"	.007"	<.007"
Back drill anti-pad, diameter over primary drill	.016"	.014"	<.014"
Etch Features			
Min copper foil - Internal	1/2 oz	1/4 oz	1/4 oz
Max copper foil - Internal	3 oz	4 oz	4 oz
Min copper foil - External	3/8 oz	1/4 oz	1/4 oz
Max copper foil - External	3 oz	3 oz	3oz
Inner Layer Print and Etch			
Minimum designed line width/spacing, 1/4 ounce foil	Not Standard	.003/.0035	Not Standard
Minimum designed line width/spacing, 3/8 ounce foil	.004/.004	.003/.0035	Not Standard
Minimum designed line width/spacing, 1/2 ounce foil	.004"/.004"	.002"/.0025"	.002"/.0025"
Minimum designed line width/spacing, 1 ounce foil	.005/.005"	.004"/.004"	.0035"/.004"



Toronto

Manufacturing Capabilities

Product Types: Rigid, RF/Microwave, Thermal Management

Attribute	Standard	Advanced	Emerging
Minimum designed line width/spacing, 2 ounce foil	.006"/.006"	.005"/.006"	.0045"/.006"
Minimum designed line width/spacing, 3 ounce foil	.012/.012	.010/.012	.010/.012
Minimum designed line width/spacing, 4 ounce foil	.016/.016	.014/.016	.014/.016
Plated External Layers			
Minimum designed line width/spacing, 1/4 ounce foil	.004"/.004"	.003"/.0035"	.0025"/.003"
Minimum designed line width/spacing, 3/8 ounce foil	.004"/.0045"	.003"/.004"	.0025"/.0035"
Minimum designed line width/spacing, 1/2 ounce foil	.005"/.005"	.004"/.004"	.0035"/.004"
Minimum designed line width/spacing, 1 ounce foil	.006"/.006"	.005"/.005"	.0045"/.005"
Minimum designed line width/spacing, 2 ounce foil	.010"/.010"	.008"/.010"	.008"/.008"
Minimum designed line width/spacing, greater than 3 ounce foil			Requires engineering review
Copper fill to round feature spacing (donuts)	.006"	.005"	.005"
Flex Button Plate			
Flex PCB Button Plate: Pad + Drill, Button +Drill	Pad = DRL+ .016"/Button=DRL + .008"	Pad = DRL+ .014"/Button=DRL + .006"	Pad = DRL+ .012"/Button=DRL + .004"
Soldermask			
LDI solder mask minimum web width, green color	.004"	.0035"	.0035"
LDI solder mask clearance	.003"	.002"	.002"
Color options	Green	Red, Blue, Black, White	Red, Blue, Black, White
Legend			
Inkjet legend printing	White	White	White
Color options	Red, Blue, Black, White	Red, Blue, Black, White	Red, Blue,Black, White + Custom TBA
Mechanical			
Board profile dimensional tolerance	+/- .005"	+/- .003	<+/- .002"
Plated through hole diameter tolerance	+/- .003"	+/- .002"	<+/- .002"
Non-plated through hole diameter tolerance	+ .002"/- .001"	+/- .001"	<+/- .001"
Board flatness, warp and twist Per IPC-TM-650 2.4.22	<.75%	<.5% Balanced Construction	Unbalanced Constructions AABUS
Impedance Testing			
Impedance controlled - single ended +/- %	10%	7%	5%
Impedance controlled - edge couped diff. +/- %	10%	7%	5%
Impedance controlled - broad side diff. +/- %	10%	7%	5%
Thermal Management			
External Heatsinks	All designs to be reviewed by engineering		
Coin Technology- External Cavity Bonded			
Coin Technology- Embedded Designs			
Heavy Copper Plated Thermal Vias (2 mil)			