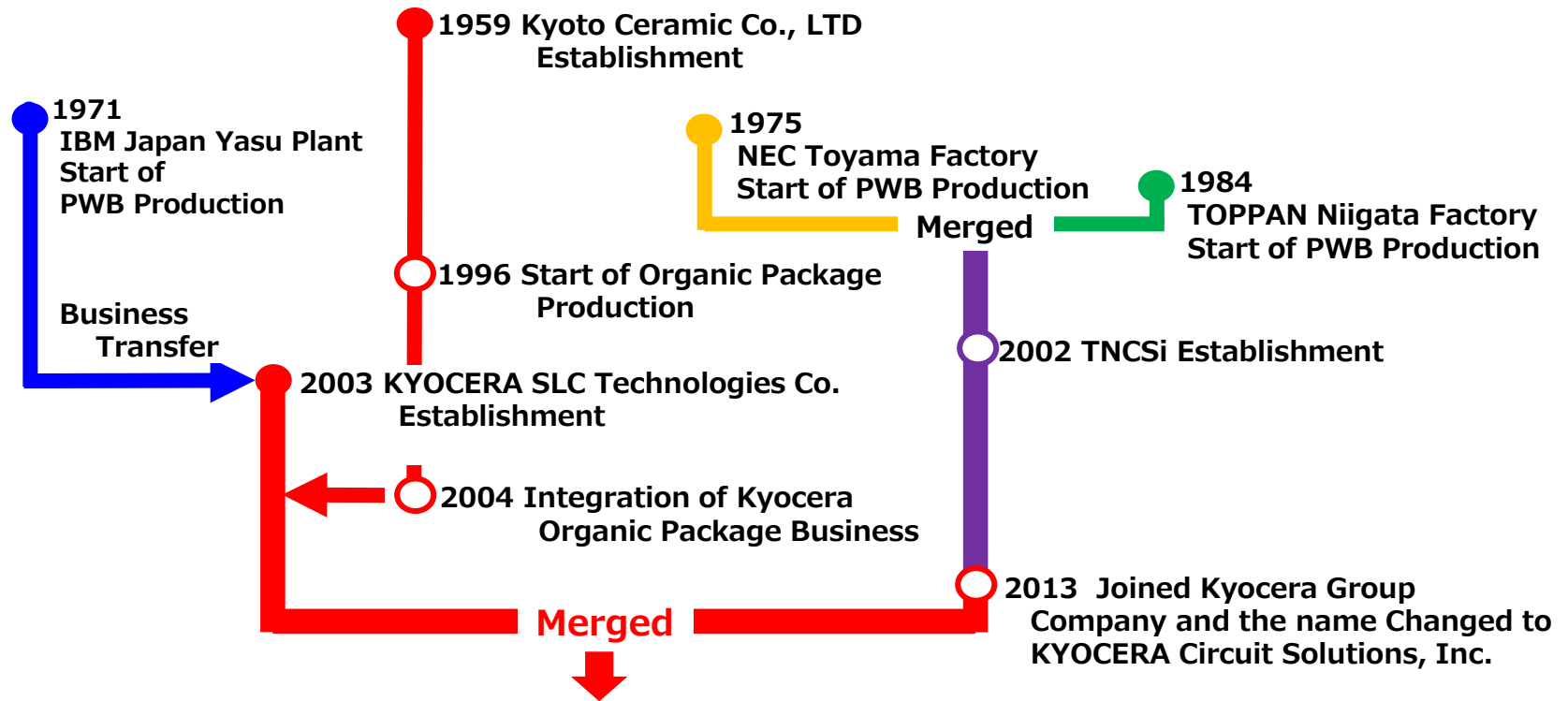


KYOCERA PWB Introduction

June 2016

History of Kyocera Organic Package and PWB



October 2014 Company name was changed from KYOCERA SLC Technologies Co. to **KYOCERA Circuit Solutions, Inc. (KCS)**

Aiming to further expand its business, Kyocera Circuit Solutions, Inc. has been incorporated into Kyocera Corporation as of April 1, 2016.

Japan Network



Toyama Nyuzen Plant
Product : Printed Wiring Boards



Niigata Shibata Plant
Product : Printed Wiring Boards



Kyoto Ayabe Plant
Product : Organic Packages



Tokyo Office / Design Center



Kagoshima Sendai Plant
Product : Organic Packages

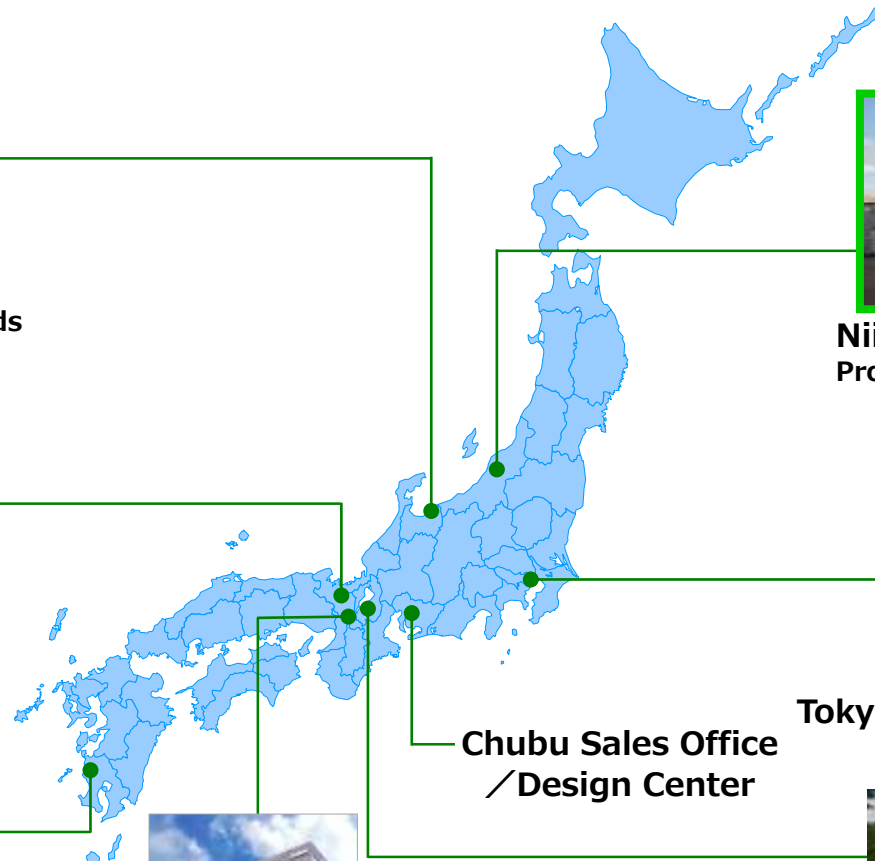


Kyoto Headquarters

Chubu Sales Office / Design Center



Shiga Yasu Office (R&D)



All site are ISO9001 and ISO14001 certified

【Niigata Shibata Plant】

Location : Shibata, Niigata prefecture, JAPAN

Land area : 100,000m²

Building area : 32,000m²

Employees : 320

Production item : PWB



(1) MLB

(2) High-MLB (Up to 50 Layers)

(3) Build-up

Capacity : MLB 30km²/Month

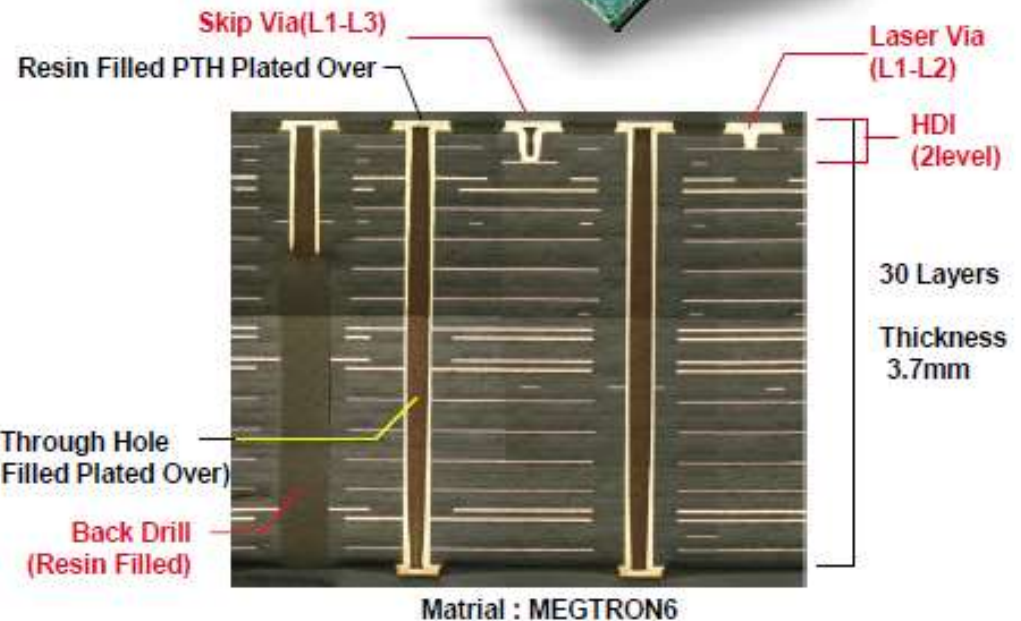
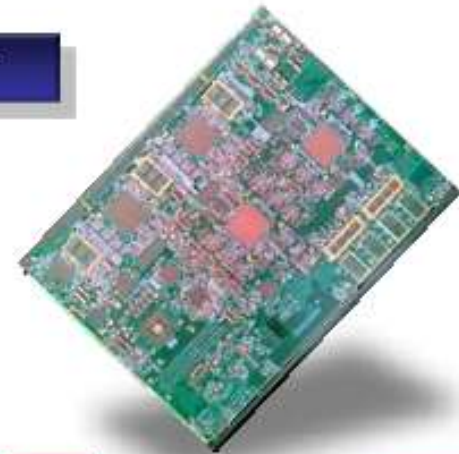
: Build-up PWB 8km²/Month

※ Certified 『ISO 9001』 , 『ISO 14001』

High Layer HDI with Back Drill

Layer Count	30 Layers
Layer Construction	2 HDI + 26L + 2 HDI Skip Via + Resin filled plated over
Board Thickness	3.7mm
Material	Panasonic MEGTRON6
Board Size	546 x 457mm
Drill Hole Size	dia. 0.25mm
Finished Hole Size	dia. 0.20mm
Aspect Ratio	18.5
Back Drill Size	dia. 0.45mm
Stub Control	0.254+/-0.203mm
Laser Via	Normal : dia. 0.110mm Skip Via : dia. 0.250mm
Line / Space	Inner : 100um/140um Outer : 230um/135um
Surface Finish	OSP + Selective electric Ni/Au
Impedance Control	Single : 50+/-5 ohm Differential : 100+/-10 ohm

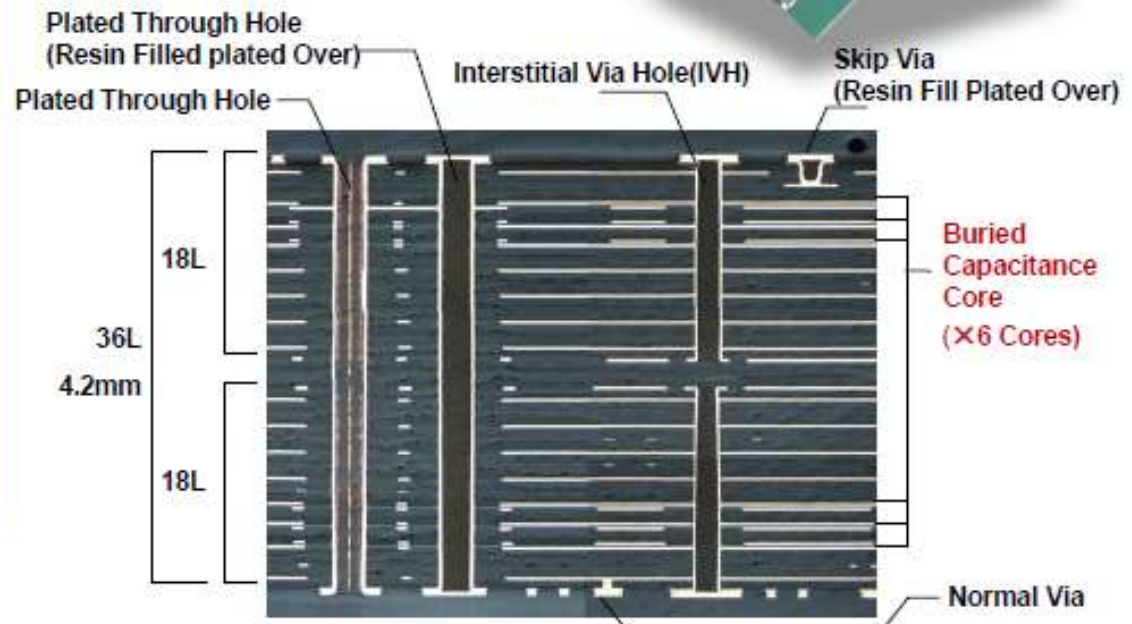
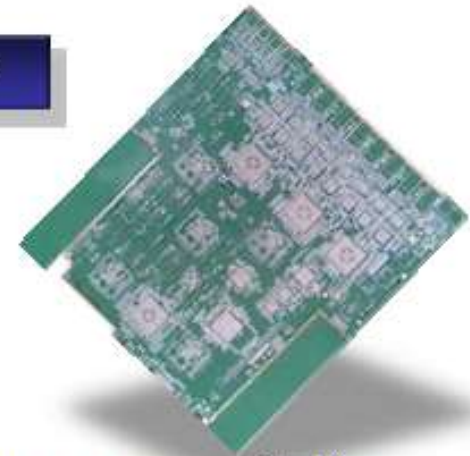
Application : High End Router



Sequential Lamination with HDI

Layer Count	36 Layers
Layer Construction	2HDI+L16+L16+2HDI
Board Thickness	4.2mm
Material	Panasonic MEGTRON6
Buried Capacitance	Orc-Mitsui BC24 x6Core
Board Size	430 x 500mm
Drill Hole Size	dia. 0.35mm
Finished Hole Size	dia. 0.30mm
Aspect Ratio	14
IVH Drill Hole Size	dia. 0.25mm
Laser Drill Size	Normal Via : dia. 0.1mm Skip Via : dia. 0.25mm
Line / Space	Inner : 80um / 100um Outer : 120um / 100um
Surface Finish	Immersion Ag
Impedance Control	Single : 50+/-5 ohm Differential : 100+/-10 ohm

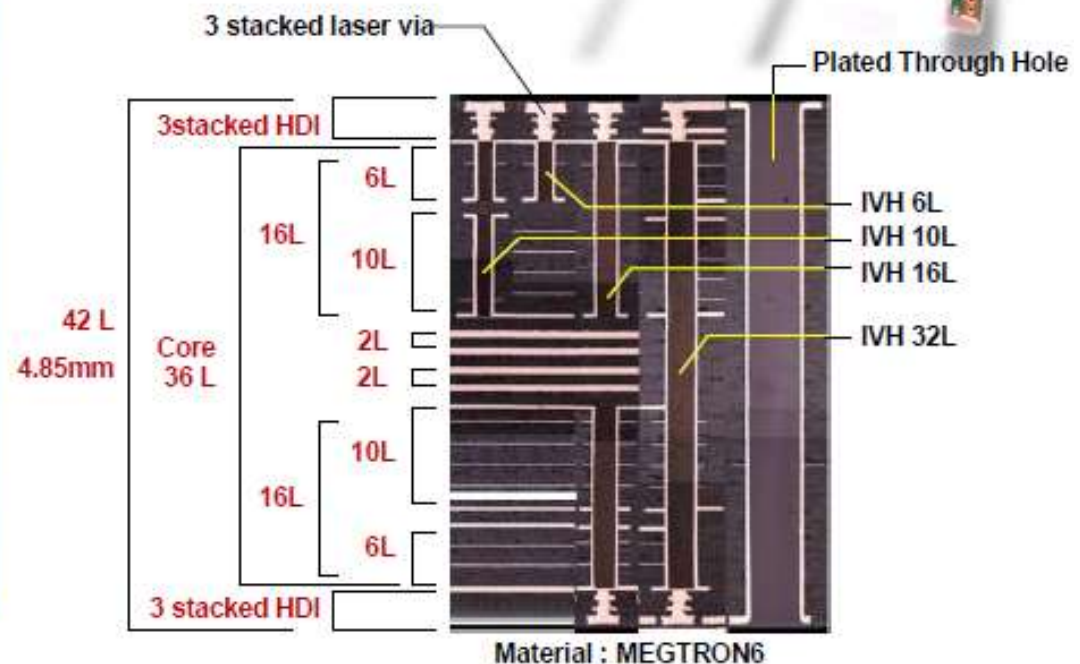
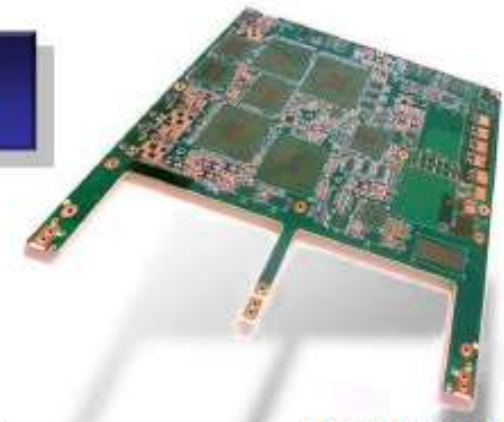
Application: High End Server



Sequential Lamination + 3 stacked HDI

Layer Count	42 Layer
Layer Construction	Sequential Lamination(x7) +3Stacked HDI 3xHDI+(L16(=L6+L10)+L2 +L2+L16(=L10+L6))+3xHDI
Board Thickness	4.85mm
Material	Panasonic MEGTRON6
Board Size	265 x 287mm
Drill Hole Size	dia. 0.35mm
Finished Hole Size	dia. 0.30mm
Aspect Ratio	16.2
IVH Drill Size	dia. 0.20mm (6L IVH Core) dia. 0.25mm (10L IVH Core) dia. 0.30mm (16L IVH Core) dia. (32L IVH Core)
Laser Via Size	Stacked Via : dia. 0.125mm
L/S	Inner : 80 / 80um Outer : 150 / 150um
Surface Finish	OSP
Impedance Control	Single : 50+/-5 ohm Deferential : 100 +/-10 ohm

Application :
Optical Transmission System



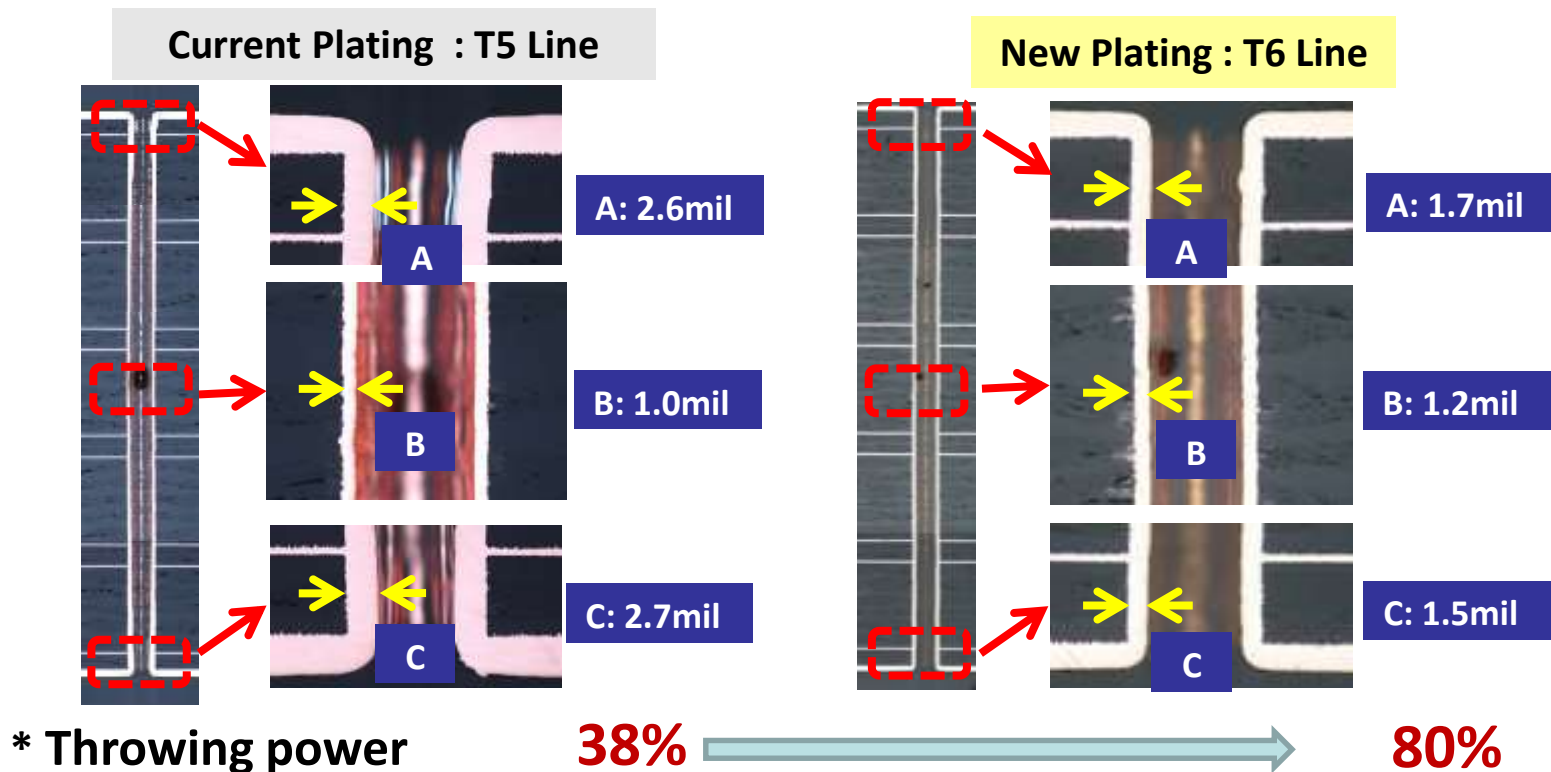
New Plating line Installation

1) Boards plating requirement

- Copper plating thickness shall meet the requirement of IPC-6011 Class2 in IPC-6012.

2) Compare to Current T5 line capability with New Plating T6 line

- ETV ; Board Thickness:254mil, Min. DHS:11.8mil, Aspect Ratio:21.5



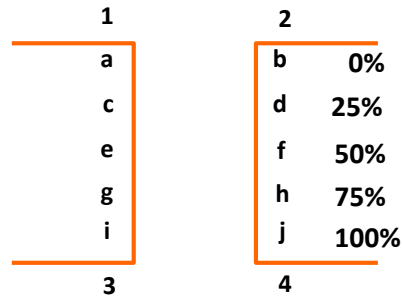
Evaluation Result

ETV specification

Board Thickness	254mil
Min. DHS	11.8mil
Aspect Ratio	21.5

KC measured plating thickness at 11.8mil DHS.

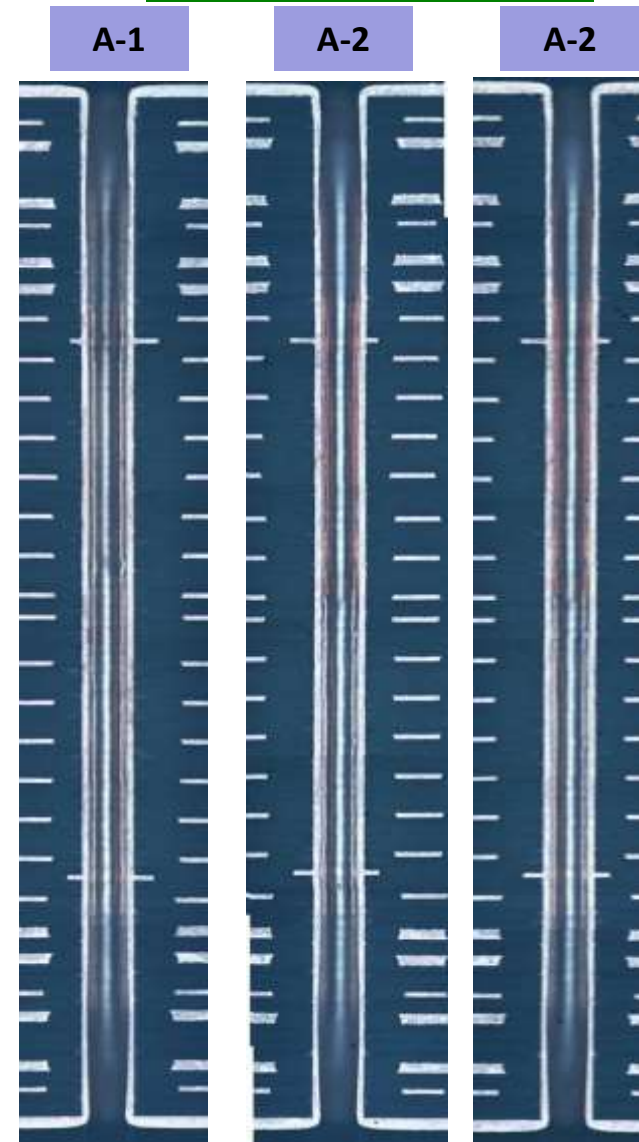
T/H plating thickness measurement points are below



Measurement Results

DHS 11.8mil			A-1		A-2		A-3		Unit:um				
			1	2	1	2	1	2	Ave.	Max.	Min.	R	σ
Plating Thickness	0% 100%	a	32.0	33.4	43.0	45.6	37.8	36.4	37.52	45.6	32.0	13.6	3.87
		b	32.6	34.4	40.4	40.6	36.6	36.4					
		i	36.4	34.0	37.2	35.8	41.4	41.8					
		j	32.2	32.8	37.6	37.4	41.6	43.0					
	25% 75%	c	38.0	37.4	38.2	38.4	35.4	34.8	36.88	38.8	34.6	4.2	1.24
		d	37.0	38.0	37.6	38.8	34.6	35.6					
		g	37.6	37.2	37.4	37.0	35.2	36.0					
		h	38.6	36.4	37.8	36.6	35.8	35.8					
50%	e	36.4	36.4	37.4	37.8	34.4	35.2	36.55	38.0	34.4	3.6	1.26	
	f	36.0	38.0	37.8	38.0	35.0	36.2						
Surface Conductor Width		1	53.4	50.0	66.0	62.0	57.0	56.6	57.07	66.0	49.8	16.2	4.89
		2	49.8	50.6	60.6	60.4	59.8	59.2					
		3	55.2	55.4	51.6	54.2	63.6	61.6					
		4	54.0	51.6	54.2	55.0	64.0	63.8					
Throwing Power			109%	111%	95%	95%	88%	91%	98.0%	-	-	-	-

Cross section



New Plating Line and Schedule

Front side



Horizontal conveyor for drying



In evaluation



Schedule

	May	Jun.	Jul.	Aug.
Internal Evaluation	Reliability Evaluation			
Internal PCN approval		✗ ★		
Release		➔		

【Toyama Nyuzen Plant】

Location : Nyuzen, Toyama prefecture, JAPAN

Land area : 33,000m²

Building area : 32,000m²

Employees : 300

Production item : PWB

(1) Build-up

(2) MLB

(3) High-MLB

Capacity : MLB 10Km² / Month

: Build-up PWB 25Km² / Month



※ Certified 『ISO 9001』 , 『ISO 14001』

6 Layer Substrate with Separate Through Holes

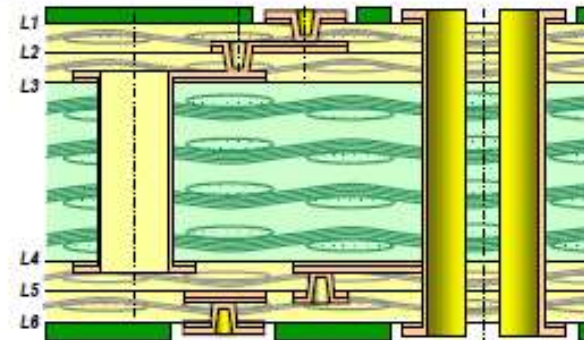
Wireless, TV tuner module for automotive

Thickness: 880 μ m

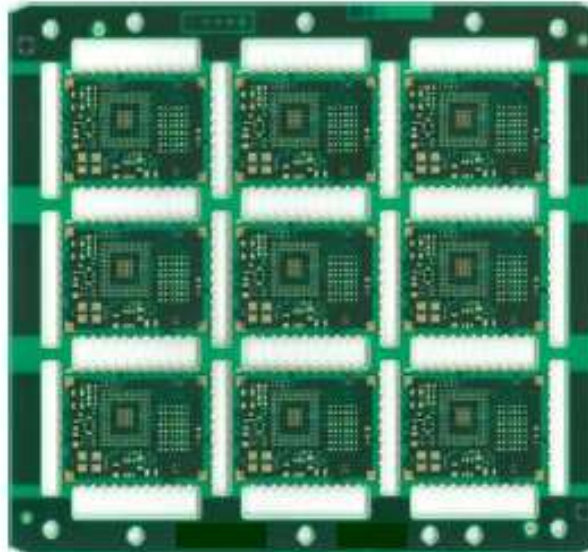
Layers : 4 Layer (1-2-1), 6 Layer (2-2-2)

Via Diameter: 100 μ m

Material: MCL-E-679F (High Tg, High stiff FR-4)

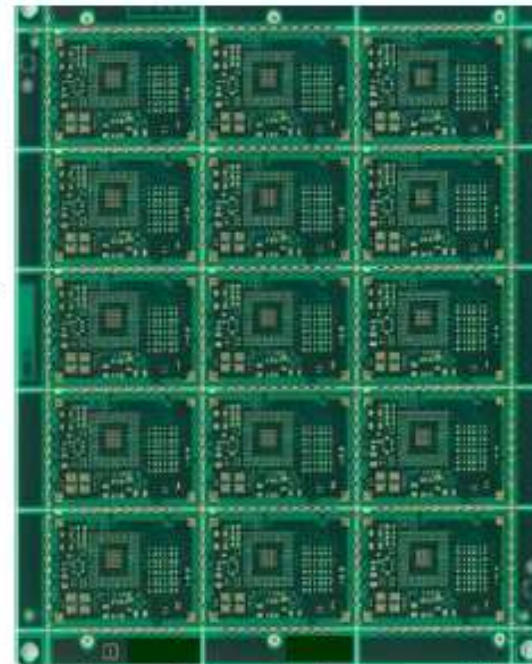


Dielectric	Conductor
25	35
60	30
60	30
400	30
60	30
60	30
25	35
Total	880



Current production

Strip: 89 x 74 mm
Piece : 23x16 mm



Latest Products

Strip: 79 x 90.6 mm
Piece : 23x16 mm

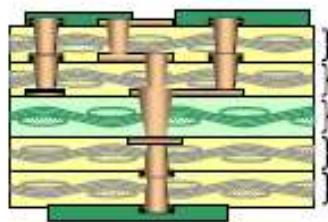
Number of the pieces
166.7%

Thin 6 Layer Substrate

Application: Wireless LAN module
Thickness : 255 μ m, 6 Layer(2-2-2), Via Pitch: 200 μ m Via and Land Diameter: 75 μ m on 110 μ m
Material: High modulus & Low CTE, Volume Production since 2014

Strip Size: 120 x 100 mm

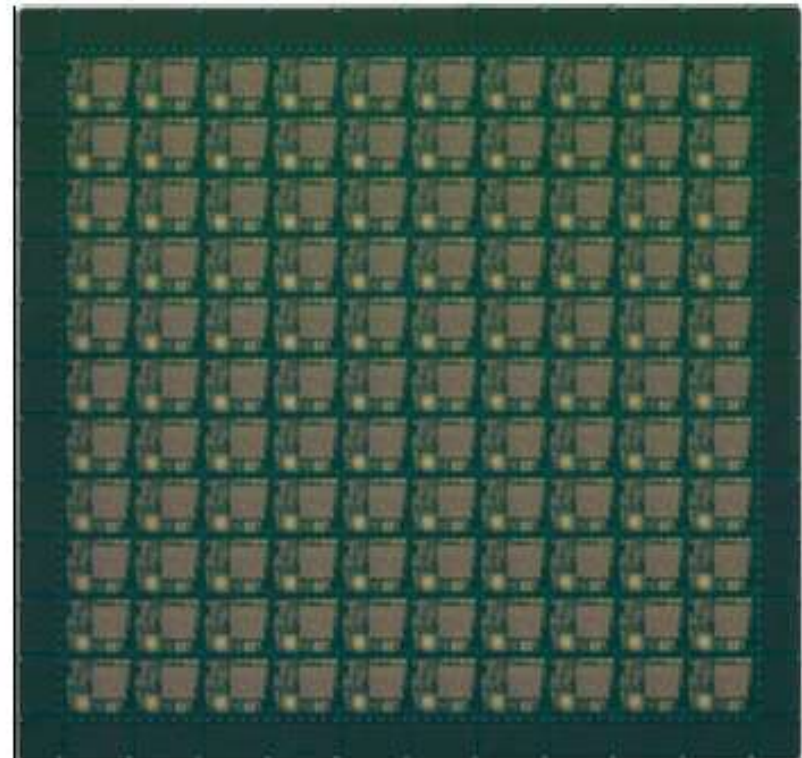
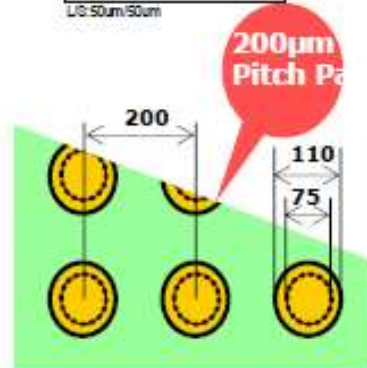
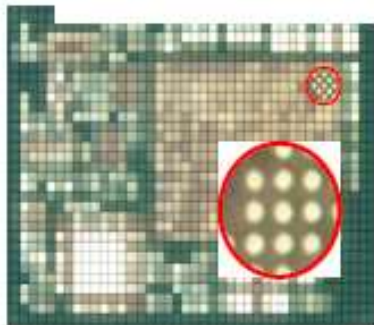
Piece Size: 10 x 8mm
 Layer Structure (Full stack)



Max:280 μ m

		Designed Value (Thickness)			
		Dielectric		Conductor	
		Nom.	Tolerance	Nom.	Tolerance
SR	1L	18 μ m	$\pm 7\mu$ m	14 μ m	$\pm 7\mu$ m
1L-2L	2L	27 μ m	$\pm 7\mu$ m	13 μ m	$\pm 6\mu$ m
2L-3L	3L	26 μ m	$\pm 7\mu$ m	12 μ m	$\pm 6\mu$ m
3L-4L	4L	38 μ m	$\pm 7\mu$ m	12 μ m	$\pm 6\mu$ m
4L-5L	5L	26 μ m	$\pm 7\mu$ m	13 μ m	$\pm 6\mu$ m
5L-6L	6L	24 μ m	$\pm 7\mu$ m	14 μ m	$\pm 7\mu$ m
SR		18 μ m	$\pm 7\mu$ m		

Nominal : 255 μ m
 L/S: 50 μ m/50 μ m



Thin 8 Layer Substrate

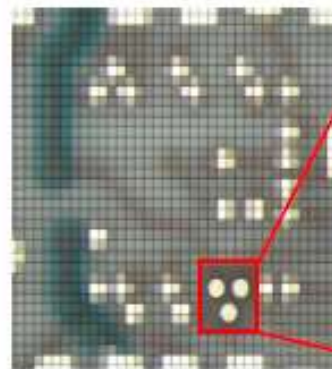
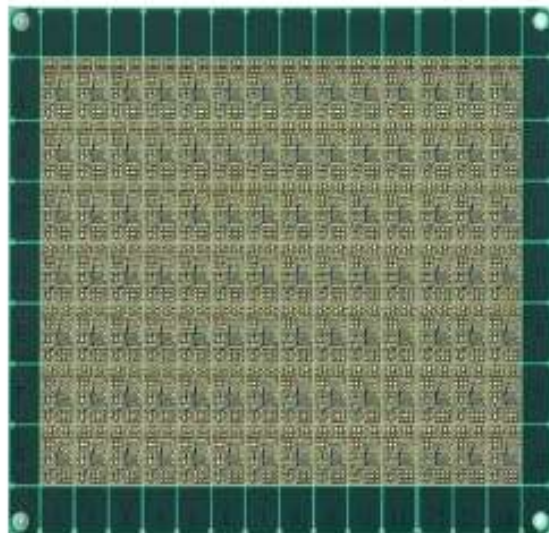
Application: RF module

Thickness :415 μ m, 8 Layer(3-2-3), Via Pitch: 150 μ m, Via and Land Diameter: 60 μ m on 90 μ m

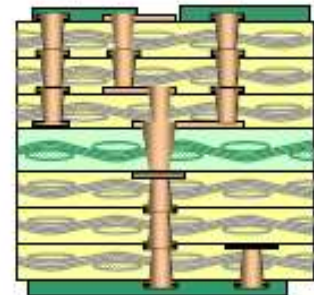
Material:MCL-E-679FG, Volume Production since 2014

Strip Size: 80 x 70 mm

Piece Size:5 x 8 mm



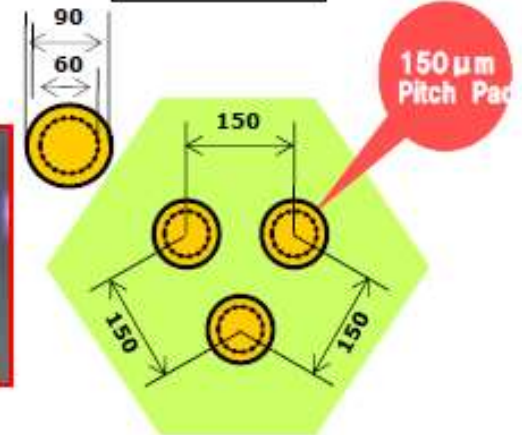
Layer Structure (Full stack)



		Dielectric		Conductor	
		Norm.	Tolerance	Norm.	Tolerance
DR	1L	15 μ m	-	17 μ m	$\pm 10\mu$ m
1L-2L	2L	30 μ m	-	15 μ m	$\pm 10\mu$ m
2L-3L	3L	40 μ m	-	15 μ m	$\pm 10\mu$ m
3L-4L	4L	40 μ m	-	15 μ m	$\pm 10\mu$ m
4L-5L	5L	40 μ m	-	15 μ m	$\pm 10\mu$ m
5L-6L	6L	40 μ m	-	15 μ m	$\pm 10\mu$ m
6L-7L	7L	40 μ m	-	15 μ m	$\pm 10\mu$ m
7L-8L	8L	30 μ m	-	15 μ m	$\pm 10\mu$ m
DR		15 μ m	-	17 μ m	$\pm 10\mu$ m

Max:450 μ m

Normal: 414 μ m



(unit : um)

	MP	Prototype	2016	2017
CSP Pitch	150	150	130	130
Line and Space	50/50	40/40	30/30	30/30
Pad Dai./Via Dia (outer layer)	90/60	90/60	90/60	80/55
Land Dia/Via Dia (inner layer)	100/60	100/60	100/60	100/55
SRO/Pad Dia (SMD)	90/140	80/110	80/110	80/100
SRO/Pad Dia (n-SMD)	160/110	120/90	120/90	100/80
SM Registration	±25	±15	±15	±10

Production Prototype Under dev.

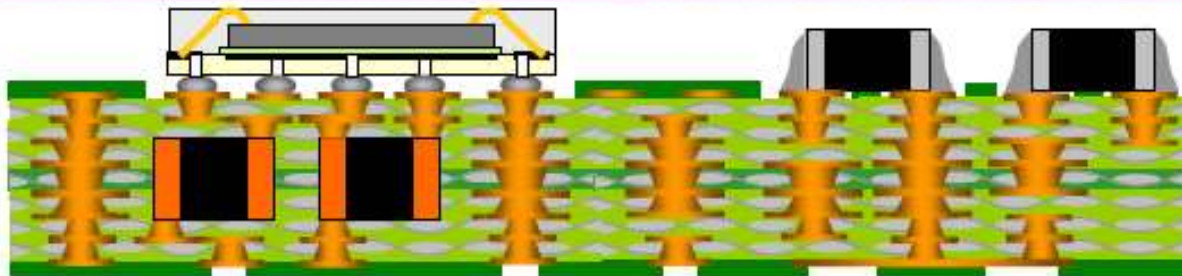
(unit :mm)

	MP	Prototype	2016	2017
Min. Thickness (1-2-1)	Typ. 0.18	Typ. 0.155	Typ. 0.175	Typ. 0.155
Min. Thickness (2-2-2)	Typ. 0.255	Typ. 0.225	Typ. 0.250	Typ. 0.225
Core Thickness	Min. 0.04	Min. 0.030	Min. 0.04	Min. 0.030
Dielectric Thickness	Min. 0.023	Min. 0.0225	Min. 0.0225	Min. 0.020
Material	679FG,679F 700G,832NS	705G,R5725	HL972LD,770G,777G, CS3305A,832NSF,R5775	
Solder Resist	PSR-4000 SP-19、AM02 PSR-4000 AUS308、AUS320			DFR-800 AUS410
Surface finish	ENIG、ENEPIG、OSP ENIG + Electrolytic Ni-Au			SOP
	Production	Prototype	Under dev.	

Material		FR-4	R-1566 Panasonic	E-75G Hitachi	E-679F Hitachi	E-679FG Hitachi	E-700G Hitachi	832NS Mitsubishi	E-705G Hitachi	HE-679G Hitachi	LZ-71G Hitachi	R5725 Panasonic	R-F705 Panasonic	
Environmental		-	Hargen Free	-	Hargen Free	Hargen Free	Hargen Free	Hargen Free	Hargen Free	Hargen Free	Hargen Free	-	Hargen Free	
Mechanical	Tg (TMA)	125 degC	145 degC	165 degC	165 degC	170 degC	260 degC	230 degC	260 degC	185 degC	170 degC	170 degC	300 degC	
	CTE(Z)	<Tg	60ppm	40ppm	35ppm	25ppm	28ppm	20ppm	13ppm	13ppm	40ppm	45ppm	35ppm	-
		>Tg	250ppm	180ppm	210ppm	145ppm	155ppm	105ppm	80ppm	80ppm	205ppm	295ppm	265ppm	-
Electrical	Dk (1GHz)	4.3	4.8	4.5	4.6	4.8	4.7	4.4	4.3	4.0	3.6	3.8	3.0 (10GHz)	
	Df (1GHz)	0.020	0.010	0.015	0.014	0.015	0.010	0.006	0.008	0.009	0.006	0.005	0.0016 (10GHz)	
UL		0	0	0	0	0	X	X	X	0	X	~2015	X	
Application		Mobile product 		Auto motive 		Medical Module component 			High frequency 					
Requirement		Normal		High Tg, Low CTE, Stiffness, Low warpage						Low Dk, Df				

Embedded Passive Components PWB

[Laser via connection for high reliability and Any Layer construction for high density Interconnects]



- ① Thinner: No base plate
- ② High density design without PTH or IVH
- ③ Highly reliable secondary assembly by laser via connection

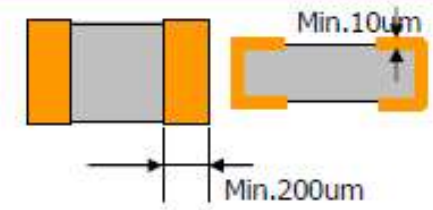
Cross section of PWB with embedded Components



Over view of embedded components (Recommend: Components to be supplied by customer)

- Components value**
- Component size**
- Required spec.**

- Resistance : $1\Omega \sim 10M\Omega$
- Capacitor : $0.2pF \sim 220nF$
- Components Height: $0.15mm \sim 0.33mm$
- Components Size : 1005,0603(metric)
0402,0201(inch)
- Terminal spec. (std.) : Copper terminal,



Copper thickness $\geq 10\mu m$
Terminal width $\geq 200\mu m$

Embedded Active Component PWB

Characteristic

[Phase 1. Copper post + via]

- Total production: 1.5M pcs

Volume production

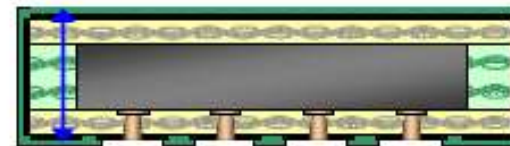


2-3-2



[Phase 2. Base plate less]

- Total thickness : Thinner



Thickness: 0.38 (±0.04)mm 1-(2)-1

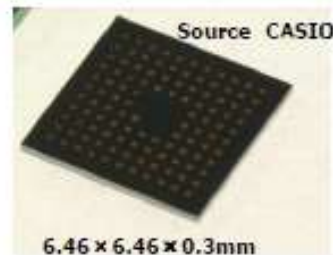
Sample

Designed Value (Thickness)	
Dielectric	Conductor
L1: 25μm	25μm
L2: 40μm	0μm
200μm	8μm
L3: 32μm	25μm
L4: 25μm	
Nominal : 380μm	



Embedded Active Die (WLP)

- Size : 6.46x6.46mm
- Thickness : 300 μm
- Pad pitch : 500 μm
- Pad dia : 250 μm
- Pad count : 112



- Size : 2.74x2.28mm
- Thickness : 200 μm
- Pad pitch : 400 μm
- Pad dia : 200 μm
- Pad count : 30



2.74 x 2.28 x 0.2mm

Thank You