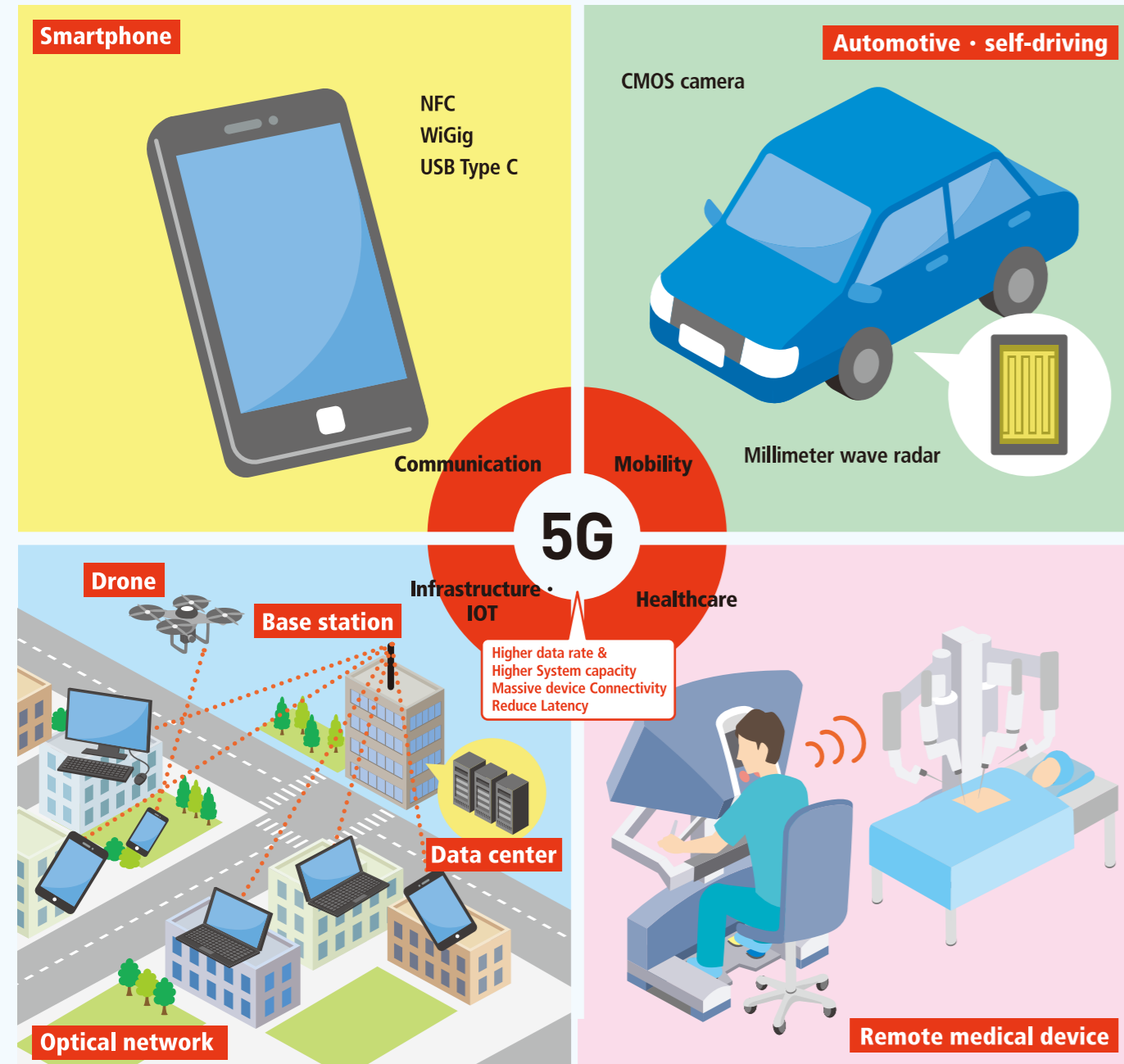


Standard materials

		Q series			F series		
		Qxx-02512	Qxx-05012	Qxx-10012	Fxx-02512	Fxx-05012	Fxx-10012
Dielectric Layer	Material	LCP Film "Vecstar™" CTQ			LCP Film "Vecstar™" CTF		
	Thickness	25μm	50μm	100μm	25μm	50μm	100μm
Copper Foil Layer	Material	ED Copper Foil			ED Copper Foil		
	Thickness	12μm			12μm		

Roll Width : 250mm or 520mm

Applications



Properties of dielectric layer (LCP Film "Vecstar™")

Property	Test condition	Unit	Q series	F series
Tensile strength	Kuraray method	MPa	180	190
Elongation	Kuraray method	%	30	40
Tensile modulus	Kuraray method	MPa	3,600	3,100
Melting temperature	Kuraray method (DSC)	°C	310	280
Coefficient of thermal expansion	Kuraray method (TMA)	ppm/°C	15	18
Breakdown voltage	IEC60243-1	kV/mm	200	200
Moisture absorption	Kuraray method (23°C, 50%R.H.)	%	0.04	0.04
Dielectric constant (Dk)	Fabry-Perot method (25°C, 28GHz, xy direction)	-	3.3	3.3
Dielectric dissipation factor (Df)		-	0.002	0.002
Chemical resistance	Kuraray method (HCl, 2mol/L, 23°C, 5min)	-	Pass	Pass
	Kuraray method (NaOH, 2mol/L, 23°C, 5min)	-	Pass	Pass
	Kuraray method (IPA, 23°C, 5min)	-	Pass	Pass

- The data in this brochure presents typical values that are not guaranteed. Feel free to contact the following department for more details.
- Before using the information and data, be sure to conduct a sufficient examination under your operating conditions and check if the performance meet your requirement.
- When using Kuraray's FCCL, please confirm the related law and regulations for your applications.
- Precautions should be taken in handling and storing. Please refer to the Safety Data Sheet (SDS) for further safety information.
- Kuraray's FCCL should not be applied for human body and food contact applications, including devices for medical and healthcare. Especially, Kuraray's FCCL should not be applied to any devices intended for implantation in the human body.
- The information contained herein could change without notice.

KURARAY CO., LTD.

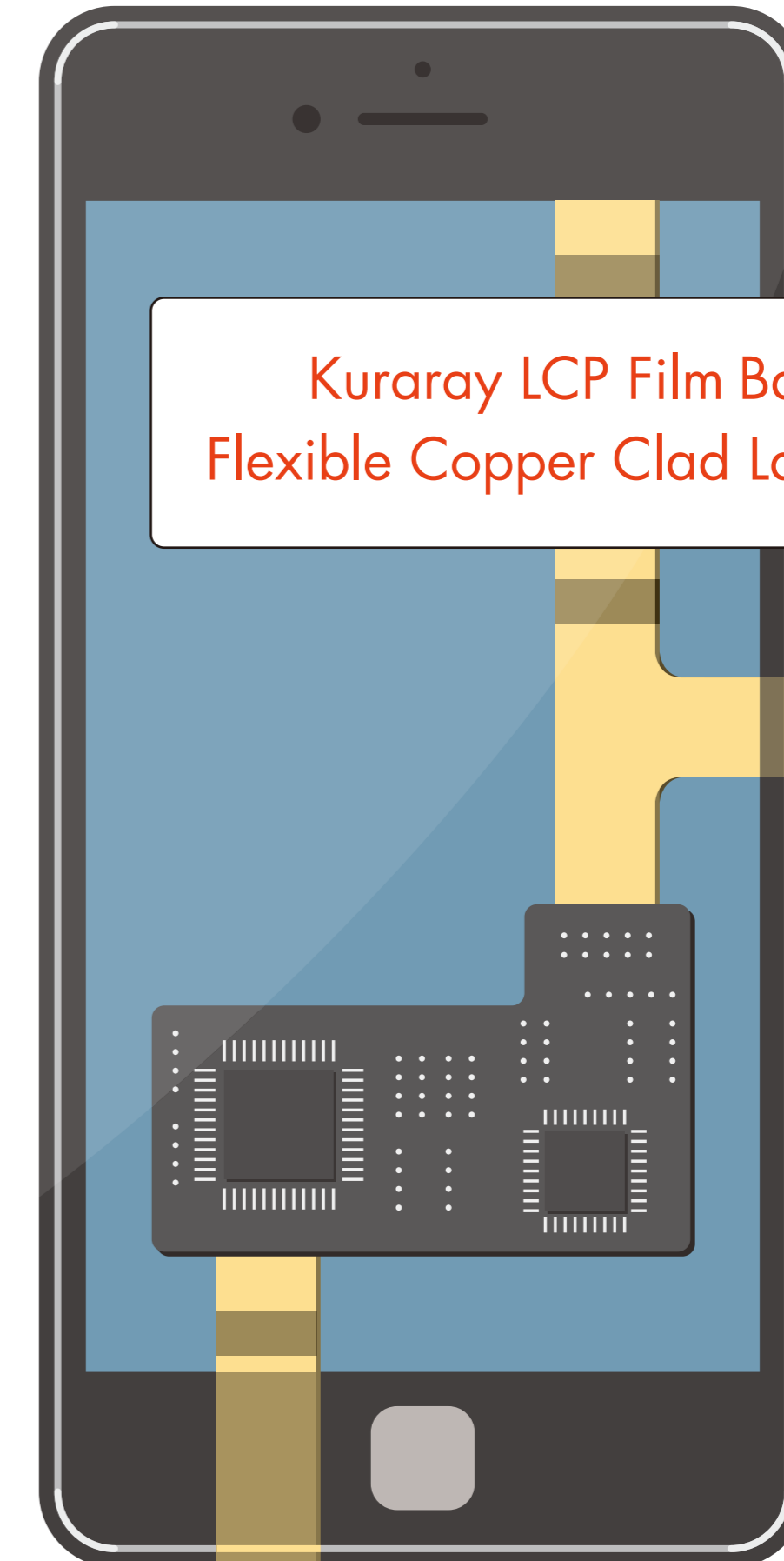
Vecstar Business Promotion Department, Research and Development Division
<https://www.kuraray.com/>

"Vecstar" is registered trademark or trademark of Kuraray Co., Ltd.

Date of revision : June ,2019

kuraray

Developing Materials

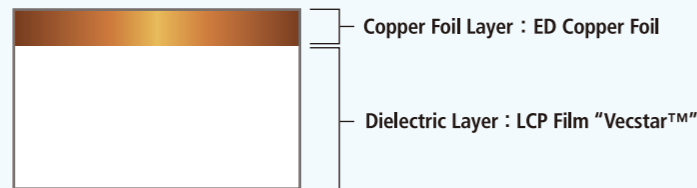


Kuraray LCP Film Based Flexible Copper Clad Laminates

Kuraray's FCCL is flexible copper clad laminates (FCCL) made of Kuraray's liquid crystal polymer (LCP) film "Vecstar™" developed by Kuraray's proprietary technology. It shows excellent electrical properties suitable for high speed transmission line and high frequency electric devices.



Structure Single Side Copper Clad Laminates



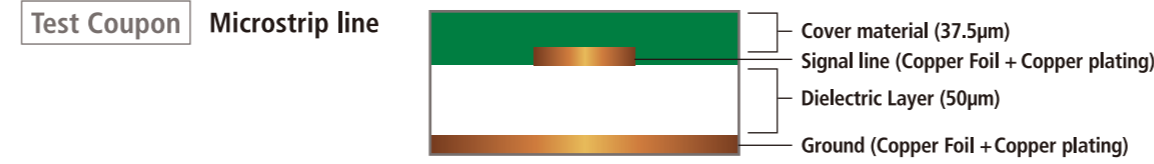
- Advantages**
- 1 | Excellent Dimensional stability
 - 2 | Excellent adhesion to low-profile copper foil
 - 3 | Excellent adhesion to other materials in multilayer stack up

Properties

Property	Test condition	Unit	Q series			F series
			Qxx-02512	Qxx-05012	Qxx-10012	Fxx-05012
Dimensional stability	Kuraray method	After Etching, MD	-0.02	0.00	0.01	0.00
		After Etching, TD	-0.01	0.00	0.00	0.01
		After Baking (150°C, 30min), MD	-0.04	-0.01	0.01	-0.02
		After Baking (150°C, 30min), TD	0.02	0.02	0.01	0.05
Peel strength	Kuraray method	90° peel	1.0			0.7
Flammability	—	UL94	VTM-0			VTM-0
Solder heat resistance	Kuraray method	Solder float at 288°C, 30sec	Pass			Pass *260°C, 30sec
		Solder float at 288°C, 30sec afetr C-96/40/90	Pass			Pass *260°C, 30sec
Volume resistance	JIS C6471	At normal temperature	>1.0×10 ¹⁶			>1.0×10 ¹⁶
		After moisture absorption C-96/40/90	>1.0×10 ¹⁶			>1.0×10 ¹⁶
Surface insulation resistance	JIS C6471	At normal temperature	>1.0×10 ¹²			>1.0×10 ¹²
		After moisture absorption C-96/40/90	>1.0×10 ¹²			>1.0×10 ¹²
Bending resistance	JIS C6471	Without coverlay	>9,600	>1,400	>140	>1,800

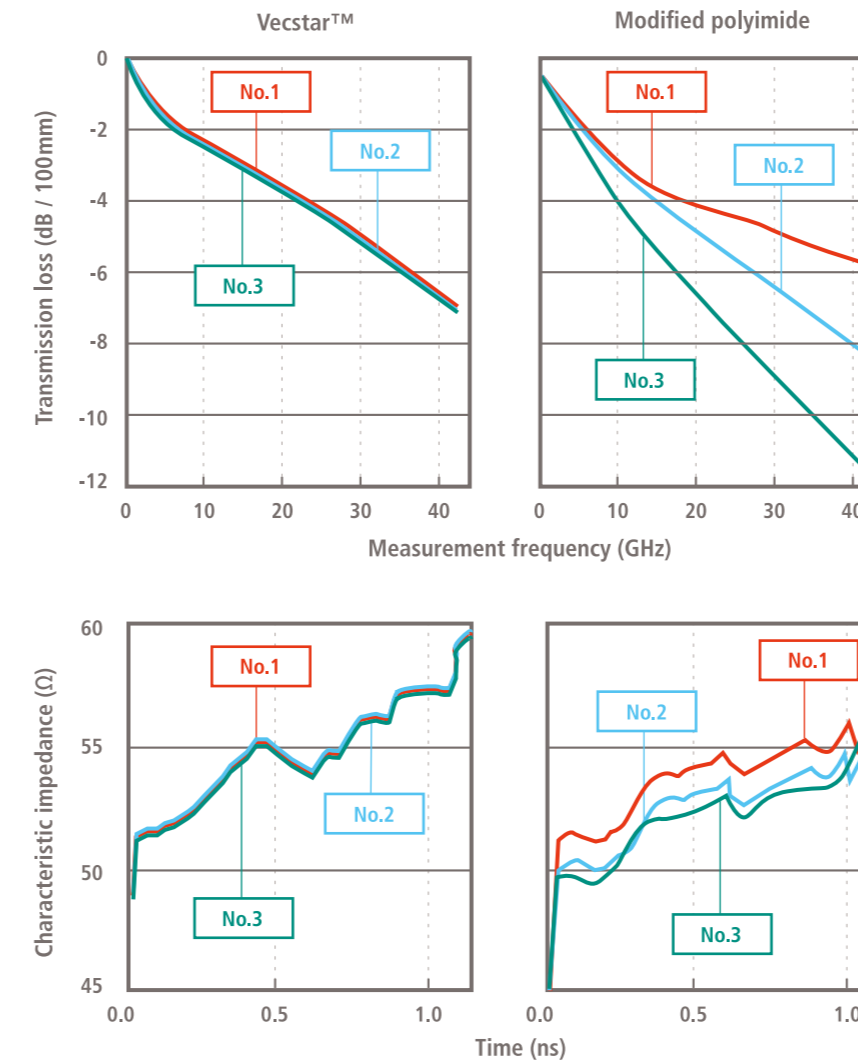
MD : Machine Direction, TD : Traverse Direction

Transmission

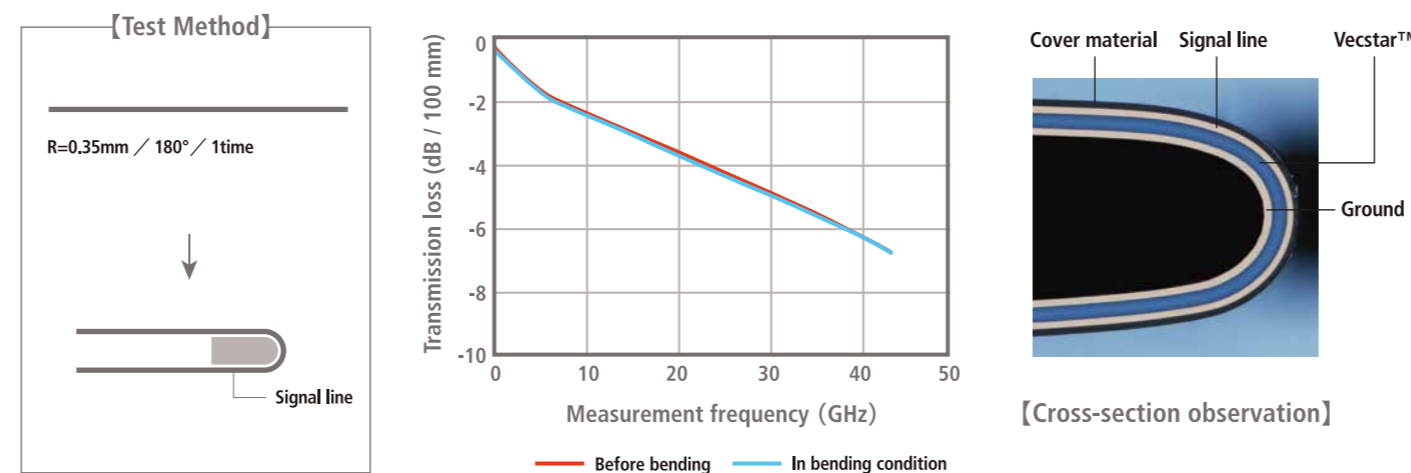


- "Vecstar™" is a low transmission loss material in high frequency range.
- Transmission loss and characteristic impedance are stable under high humidity condition.

No.	Pretreatment conditions
1	120°C / 24hrs
2	23°C / 50%R.H. / 48hrs
3	40°C / 90%R.H. / 48hrs

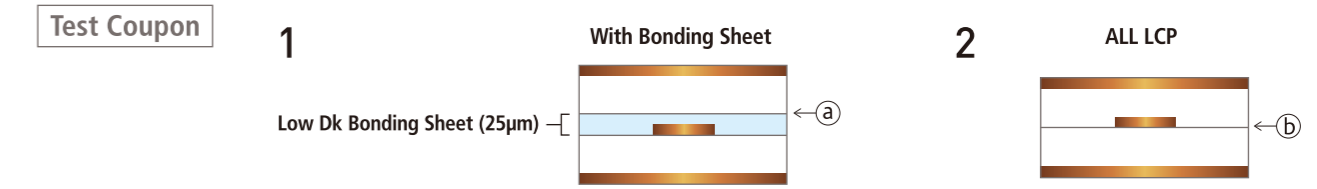


- Transmission loss is very stable in bending condition.



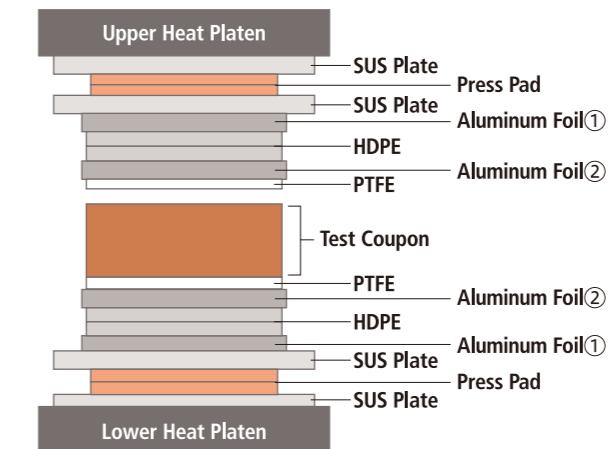
Lamination

- Kuraray's FCCL shows excellent peel strength and dimensional stability in both multilayer stack up with low Dk Bonding Sheet and ALL LCP multilayer stack up.



Lamination Top Temp. (°C)	Peel Strength (N/mm)	Peeling interface	Solder Float 288°C, 30sec	Dimensional Stability (%)						
				After Lamination		After Etching		After Baking		
				MD	TD	MD	TD	MD	TD	
No.1	180	≥0.8	(a)	Pass	0±0.1	0±0.1	0±0.1	0±0.1	0±0.1	0±0.1
No.2	300	≥0.8	(b)	Pass	0±0.1	0±0.1	0±0.1	0±0.1	0±0.1	0±0.1

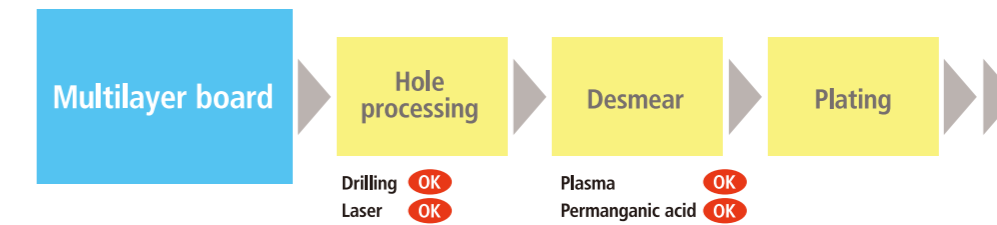
* Data using Qxx-05012 grade.



* Size of each accessories should be same for pressure uniformity.
* Number of HDPE film depends on the coupon thickness.

Accessories	Effect
SUS Plate	Pressure uniformity of heat platen
Press Pad	
SUS Plate	
Aluminum Foil ①	Release layer between HDPE and SUS
HDPE	Reducing resin flow
Aluminum Foil ②	Cancel the shrinkage of HDPE in cooling process
PTFE	Release film

Manufacturing process



- By choosing suitable pretreatment chemicals and conditions, it is possible to functionalize and improve the surface roughness of Via Hole for better adhesion.

[Cross-section observation of coupon]

	After plating	After hot-oiling reliability test
Condition A	OK	OK
Condition B	Open Failure	