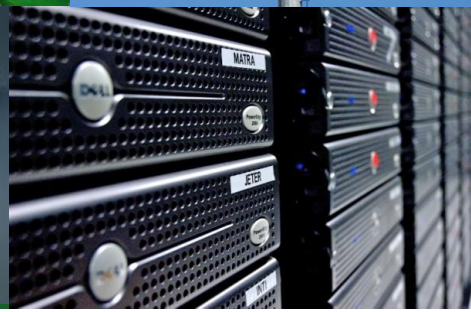
Halogenated Material

Very & Ultra Low Loss

100G/ 200G/ 400G Application

Innovation
Globalization
Diversification

High Speed Material EM-891/EM-891K General Introduction



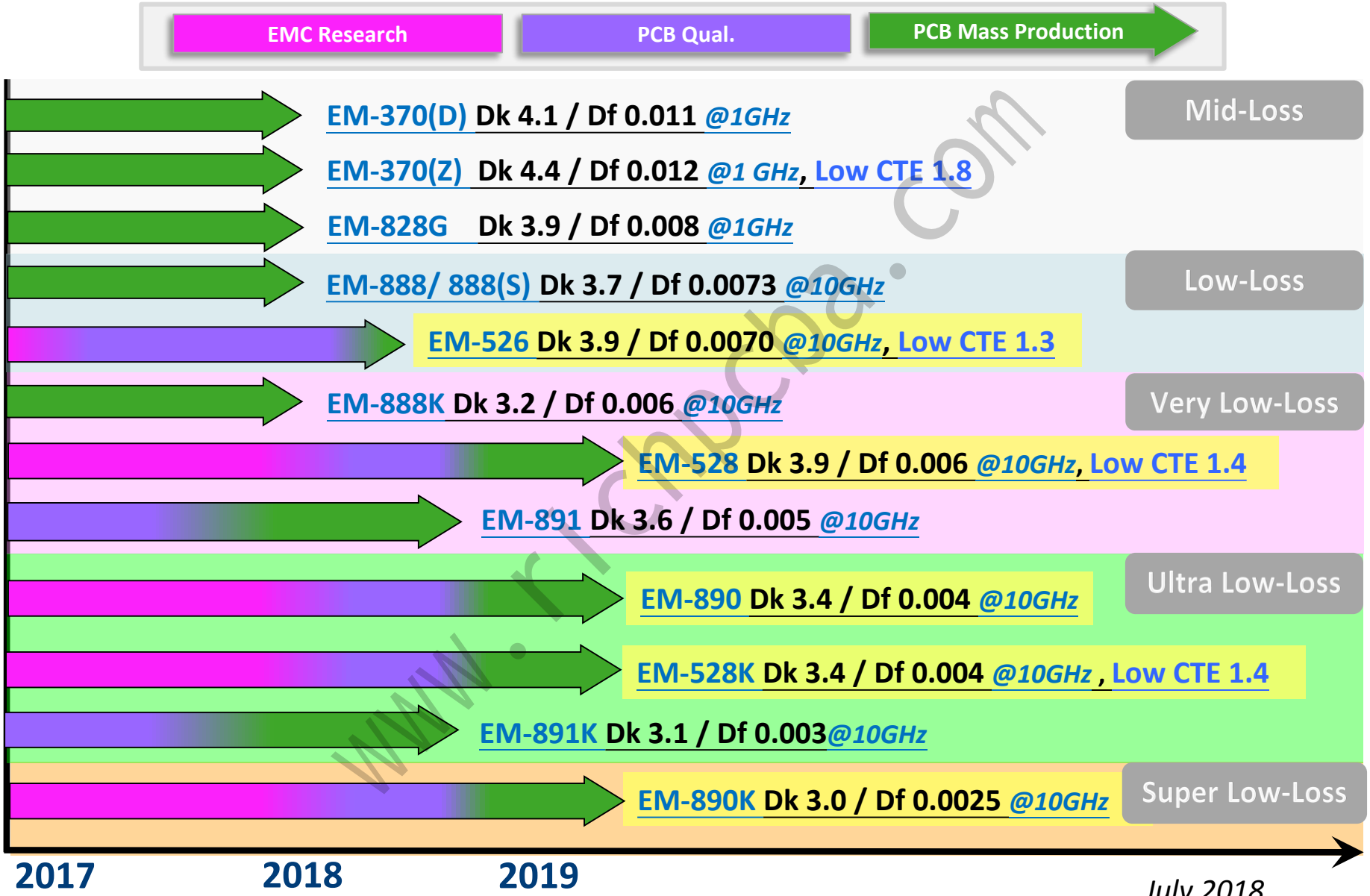
EMC

Rev. 20180907

Agenda

- Product Roadmap –High Speed Application
- Material Features
- Material Property Comparison
- Electrical Performance
- Reliability Performance

Product Roadmap- High Speed Application



* Except for EM-891 & EM-891K, all materials above are halogen free materials.

**The material Dk/Df data are measured by RC50% sample.

July 2018

Product Benchmarking

Halogen Free Halogenated

Df Scope by Cisco S3 (@10 GHz)		Df Scope by IBM SPP (@ 1 GHz)		Tg	Benchmark Materials	EMC Proposed Materials	Sample Status	Production Site
>/= 0.020	High Loss	0.020~ 0.023	Standard Loss	150	IS-400/ IT-158	**EM-825**	OK	TWN+KS+ZS
				170	370 HR	**EM-827**	OK	TWN+KS+ZS
0.015~ 0.020	Standard Loss	0.015~ 0.020	Upper Mid Loss	150	**R-1566**	**EM-285** **EM-370(5)**	OK	TWN+KS+ZS
					R-1555	**EM-355(D)**		
				170	**MCL-E-679FG** **Megtron2** **TU-862HF**	**EM-370(Z)** **EM-370(D)**	OK	TWN+KS+ZS
0.010~ 0.015	Mid. Loss	0.012~ 0.015	Lower Mid Loss	170	**RA-555W** IS-415	**EM-390** **EM-828G**	OK	TWN+KS+ZS
		0.008~ 0.012	Low Loss		408HR/ I-Speed N-13 EP TU-872 SLK Megtron4	**EM-888** **EM-888(S)** **EM-526**	OK	TWN+KS+ZS
0.005~ 0.010	Low Loss	0.004~ 0.008	Very Low Loss	170	Megtron6/ I-Tera **TU-883** **LW-900** D(V)/ M-7	**EM-888K** **EM-528** **EM-891**	OK	TWN+KS+ZS
~0.005	Ultra Low Loss	~0.004	Ultra Low Loss	170	**LW-910** TU-933 Tachyon 100G M-7N/ D(V)N	**EM-528K** **EM-890** **EM-891K**	OK	TWN+KS+ZS
~0.003	NA	~0.0025	NA	170	**DJN**	**EM-890K**	OK	TWN+KS+ZS

Agenda

- Product Roadmap –High Speed Application
- **Material Features**
- **Material Property Comparison**
- Electrical Performance
- Reliability Performance

EM-891/891K Material Features

Halogenated Material → *Very & Ultra Low Loss* → *100G/ 200G/ 400G Application*

➢ Electrical Features:

- ✓ EM-891K is made of *low Dk/Df glass fabric*
- ✓ Flat Dk and Df with various temperature and frequency ranges.

➢ Reliability Performance:

- ✓ Lead Free soldering compatible: *LF-260 10X with 0.6mm BGA pitch design*
- ✓ Ideal for *multi-lamination & Hybrid design (Low cost solution)*
- ✓ Extreme thermal robustness with *IST over 2,500 cycles (Hole pitch 1.0mm)*
  1,000 cycles (Hole pitch 0.8mm)

Developing for 100G/ 400G Super Computer, back plane, 100G/ 200G/ 400G switch & router, 5G telecom and RF applications

Material Property Comparison

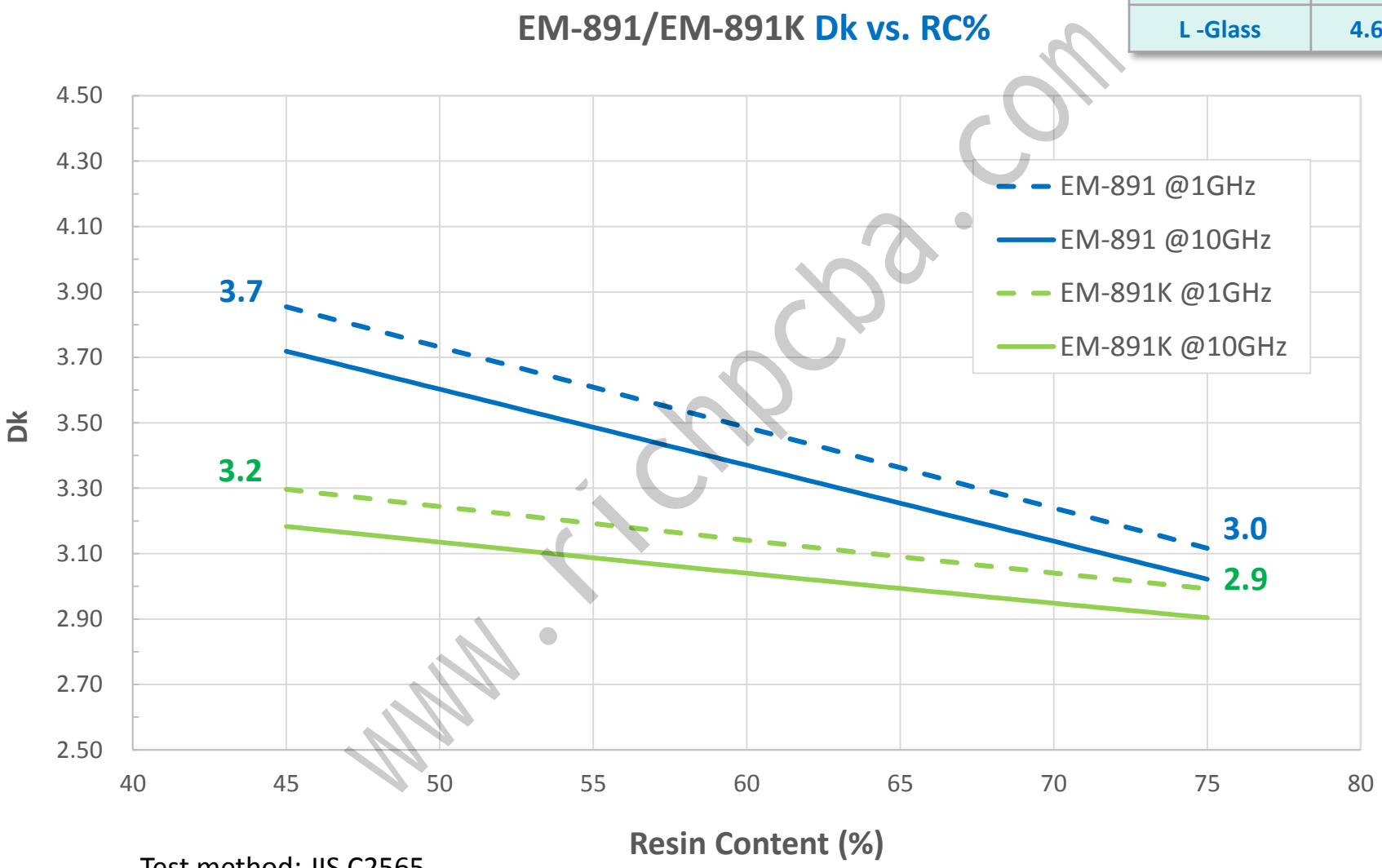
Property		Test Condition	Unit	Halogenated Material			
				E-Glass		Low-Dk Glass	
				X-6	EM-891	X-7	EM-891K
Thermal	Tg	TMA	℃	175	170	190	170
		DMA		205	205	210	205
	Td	TGA	℃	400	400	400	400
	CTE Z-Axis	Alpha 1, TMA	ppm/°C	40~45	40~45	40~45	40~45
		Alpha 2, TMA		210~230	180~200	230~250	180~200
		50~260°C, TMA	%	2.3	2.2	2.3	2.2
Electrical	Dk (RC50%)	10 GHz	--	3.6	3.6	3.4	3.1
	Df (RC50%)	10 GHz	--	0.0061	0.0053	0.0048	0.0032
Physical	Peel Strength (HVLP, 1 oz)	As Received	lb/in	4.0	4.5	4.0	4.5
		After thermal stress	lb/in	4.0	4.5	4.0	4.5

Agenda

- Product Roadmap –High Speed Application
- Material Features
- Material Property Comparison
- **Electrical Performance**
- Reliability Performance

EM-891/EM-891K Dk vs. RC%

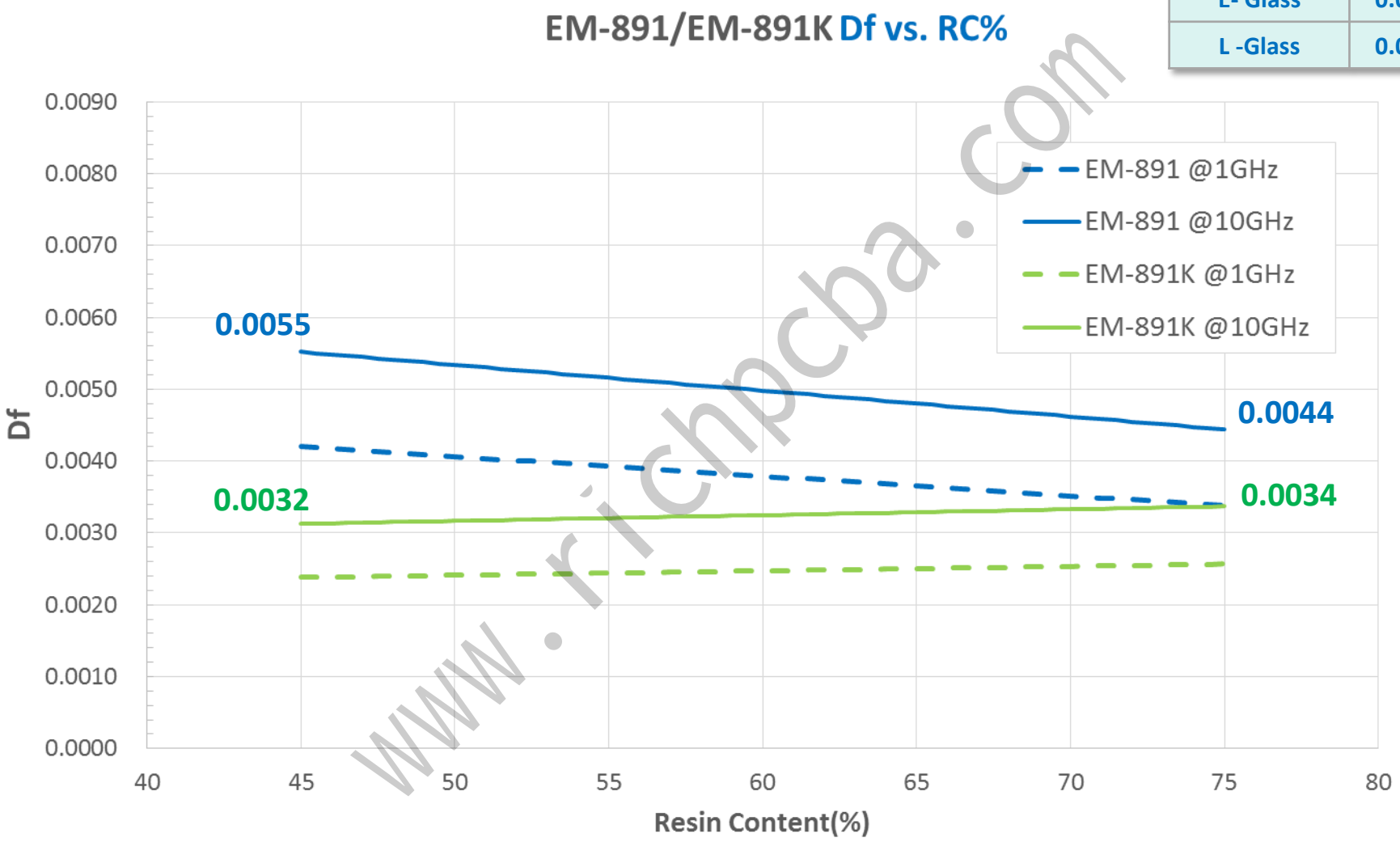
Dk (Ref.)	10 GHz
Pure EM-891	2.70
E- Glass	6.20
L -Glass	4.60



Test method: JIS C2565

EM-891/EM-891K Df vs. RC%

Df (ref.)	10 GHz
Pure EM-891	0.0036
E- Glass	0.0070
L -Glass	0.0033



Test method: JIS C2565

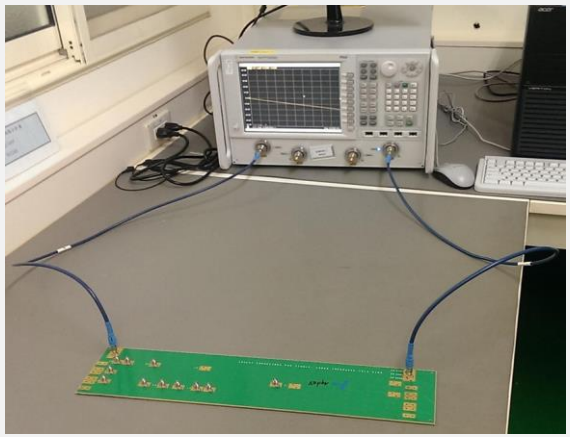
[Cisco S3] S21 Test Plan

PCB Construction
(6 Layer 1oz)

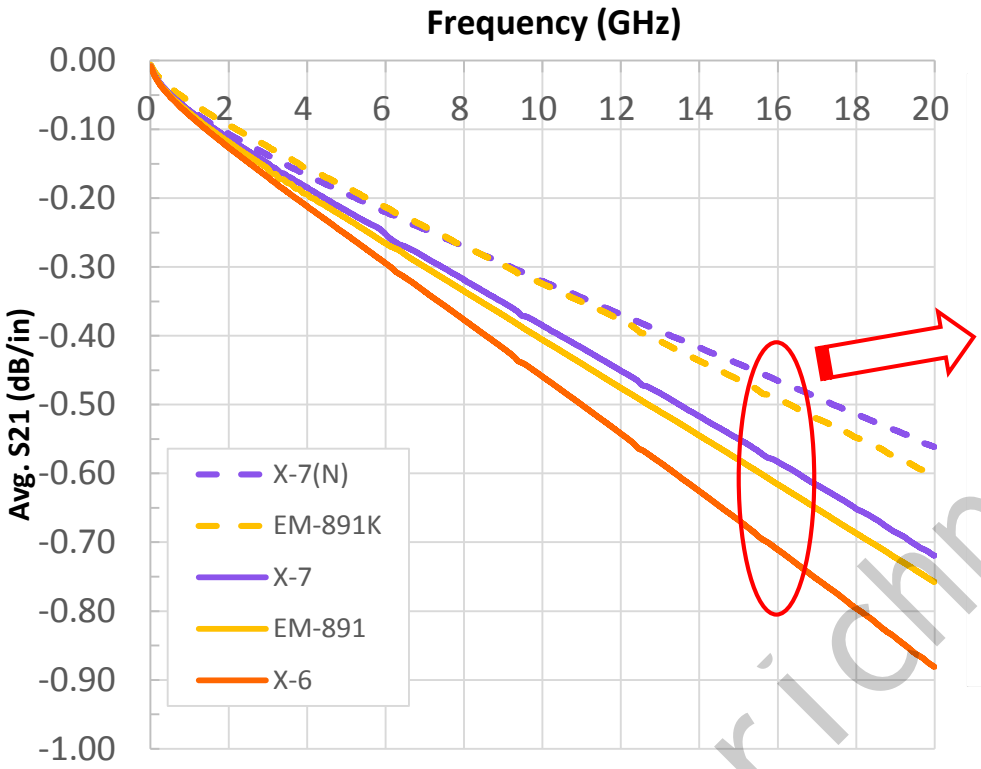
L1	Hoz Copper foil
PP	2116 RC 50~55%x2
L2/3	10mil 1/1 2116x2
PP	7629 RC45%x5
L4/5	10mil 1/1 2116x2
PP	2116 RC 50~55%x2
L6	Hoz Copper foil

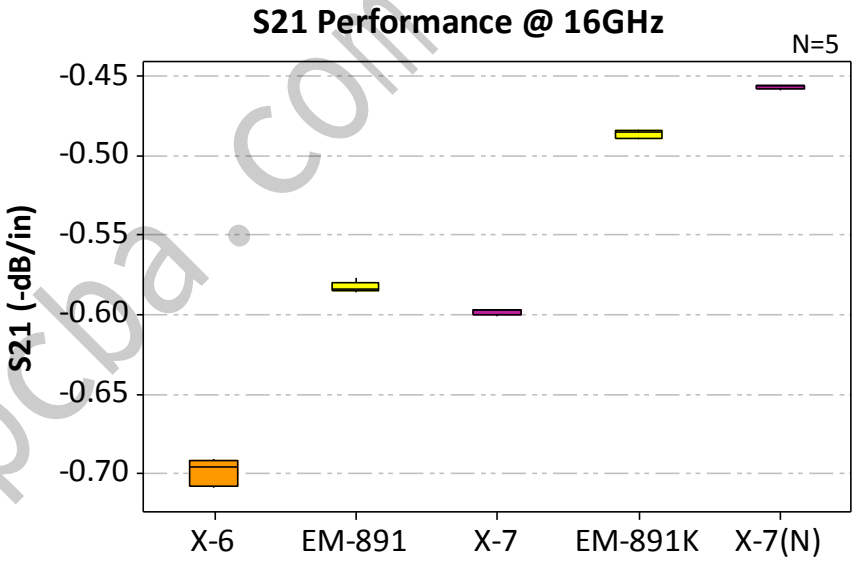
PCB thickness: 80mil

- **Test Material:**
  - EM-891 + HVLP
  - EM-891K + HVLP
  - X-6 + HVLP
  - X-7 + HVLP
  - X-7(N) + HVLP
- **Test Pattern Design:**
  - Impedance: 50Ω (Single-End)
  - Line length: 16 inch
  - Line width: 8mil (L2)



[Cisco S3] Insertion loss S21 Data up to 20GHz





Material	X-6	EM-891	X-7	EM-891K	X-7(N)
8	-0.38	-0.33	-0.33	-0.27	-0.27
12.89	-0.59	-0.51	-0.49	-0.4	-0.39
14	-0.63	-0.54	-0.53	-0.44	-0.42
16	-0.71	-0.62	-0.60	-0.49	-0.47
Benchmark @16GHz	+15%	1	-3%	-21%	-24%

[Cisco S3] S21 Test by Thermal Impact

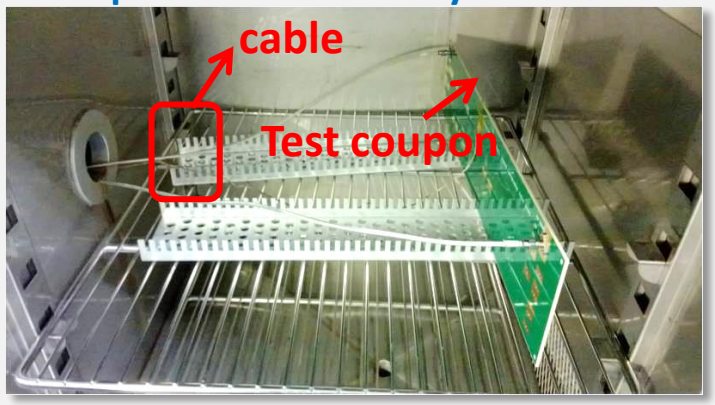
PCB Construction
(6 Layer 1oz)

L1	Hoz Copper foil
PP	2116 RC 50~55%x2
L2/3	10mil 1/1 2116x2
PP	7629 RC45%x5
L4/5	10mil 1/1 2116x2
PP	2116 RC 50~55%x2
L6	Hoz Copper foil

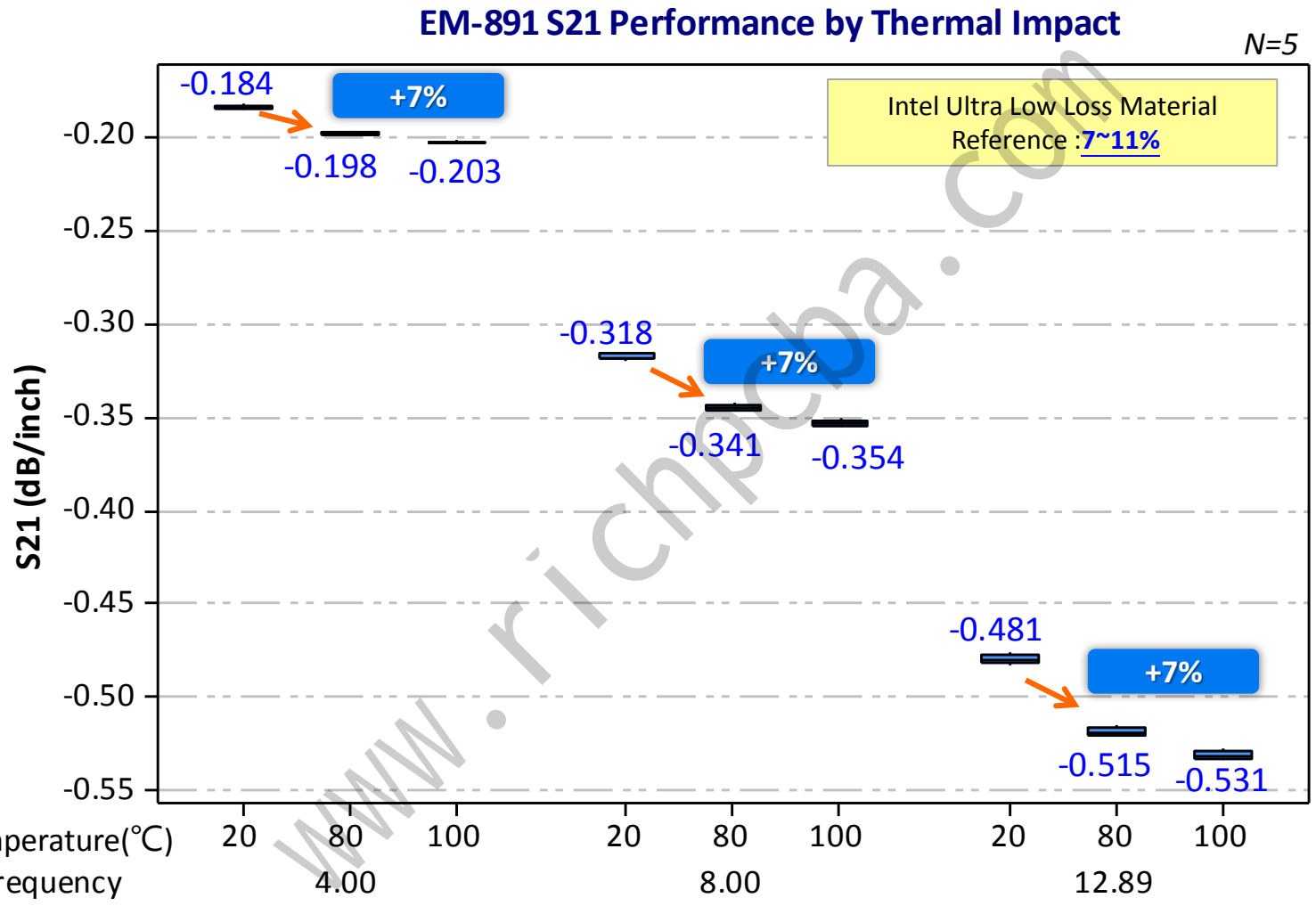
PCB thickness: 80mil

- **Test Material:**
  - EM-891 + HVLP
- **Test Temperature:**
  - 20℃ @50%R.H.
  - 80℃ @50%R.H.
  - 100℃ @No humidity
- **Test Pattern Design:**
  - Impedance: 50Ω
  - Line width: 8mil (L2)

Programmable
Temperature& Humidity Chamber



[Cisco S3] S21 Test Results by Thermal Impact



Comment:

✓ Around **7%** increased loss from 20 to 80 ℃ @ 4 to 12.89 GHz.

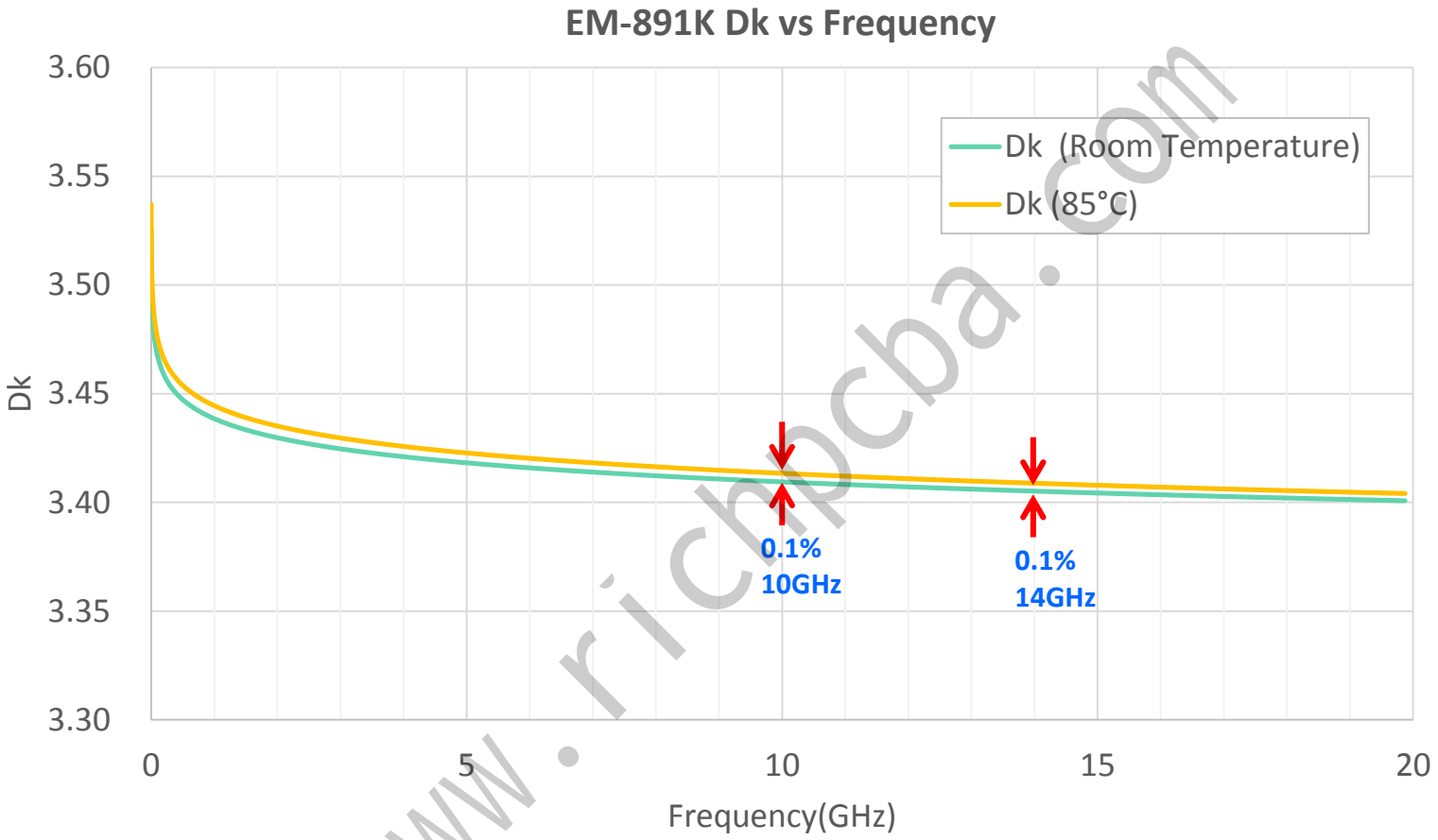
[Cisco S3] Customer's DkDf Extraction

Material	Copper Foil	Brown Oxide	Dk@10GHz	Df@10GHz
EM-891K	HVLP2	Horizontal Oxide	3.12	0.00369
XX-7409DV(N)	ANP	Horizontal Oxide	3.38	0.00370

Comment:

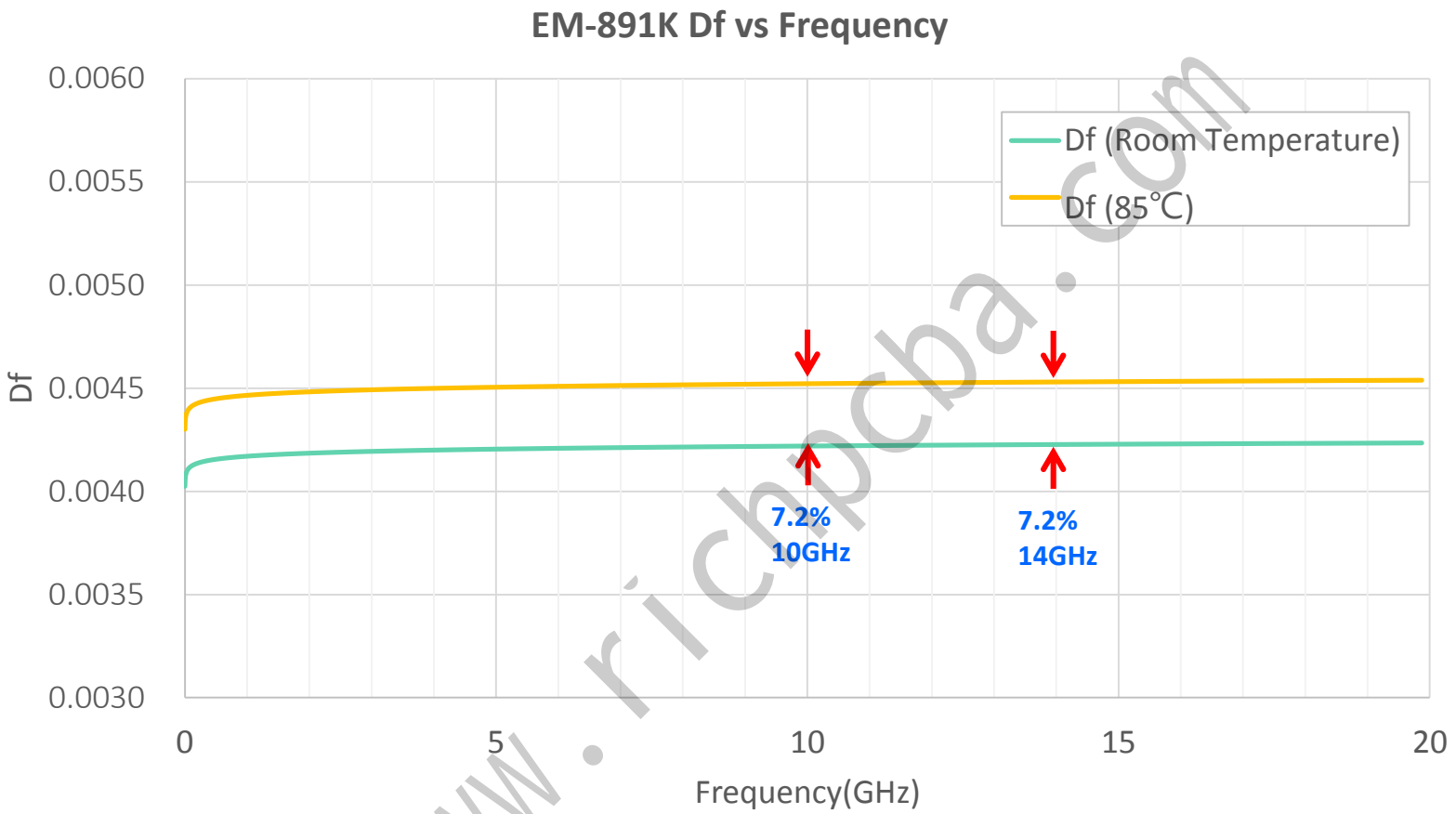
✓ The DkDf performance of EM-891K is equivalent to XX-7409DV(N) from customer's extraction.

EM-891K (HVLP) Dk Variation at High Temperature



Frequency	Dk @ Room Temperature	Dk @ 85°C	Variation (%)
10 GHz	3.409	3.413	0.1%
14 GHz	3.405	3.409	0.1%

EM-891K (HVLP) Df Variation at High Temperature

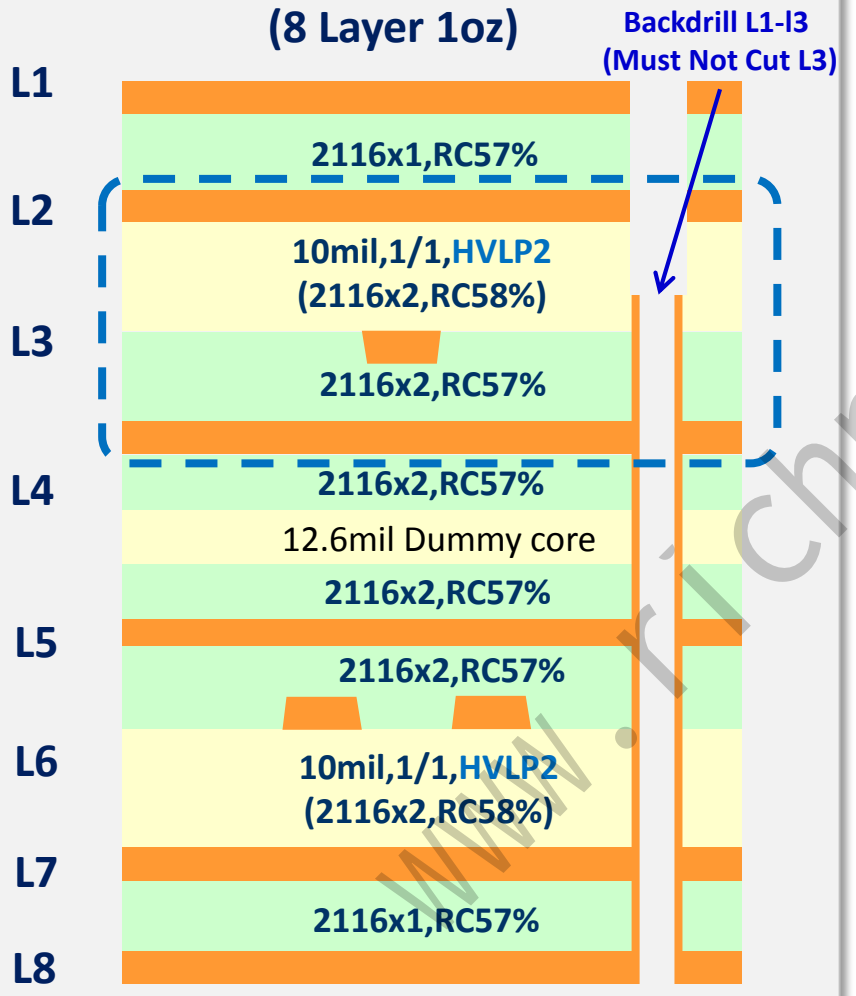


Frequency	Df @ Room Temperature	Df @ 85°C	Variation (%)
10 GHz	0.00422	0.00452	7.2%
14 GHz	0.00423	0.00453	7.2%

[Cisco S3] EM-891K+ HVLP2 Cisco 8L S21 SI Test

PCB Construction

(8 Layer 1oz)



PCB thickness: 91mil

Insertion Loss Test

- **Test equipment :** Keysight N5224A
- **Test Frequency:** up to 40GHz
- **Test Sample:**

✓ Line length 16”, **Single ended**
✓ Impedance Control: 50 ohms
✓ Design Line Width: 9.0 mil
✓ With backdrill L1-L3

Measurement Flow

(1) TRL Calibration
(2) S Parameter Measurement

S21 SI Results

Layer	Line Width (mil)	S21 Insertion Loss (dB/in)		
		14GHz	28GHz	40GHz
L3	9	-0.43	-0.81	-1.16

[Intel Delta-L] SDD21 Test for Server Platform

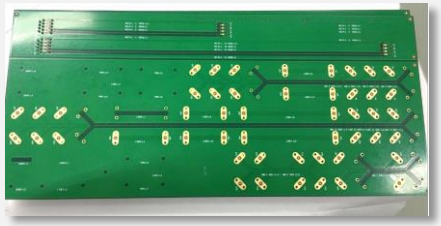
PCB Construction

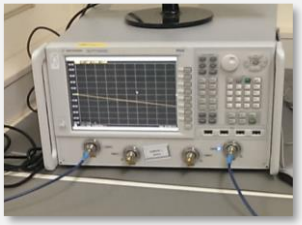
(12 Layer 1oz)

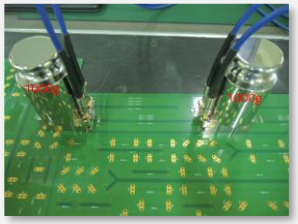
L1	Hoz Copper foil (HTE) +Plating	Thickness
	1078 x1	3.2
L2/3	3mil 1/1 1078x1	3
	2116 x2	9.5
L4/5	4mil 1/1 3313x1	4
	2116 x1	4.8
L6/7	12mil 1/1 3313x3	12
	1078 x2	6.2
L8/9	5mil 1/1 2116x1	5
	2116 x1	4.8
L10/11	4mil 1/1 3313x1	4
	1078 x1	3.2
L12	Hoz Copper foil (HTE) +Plating	

PCB thickness: 77mil

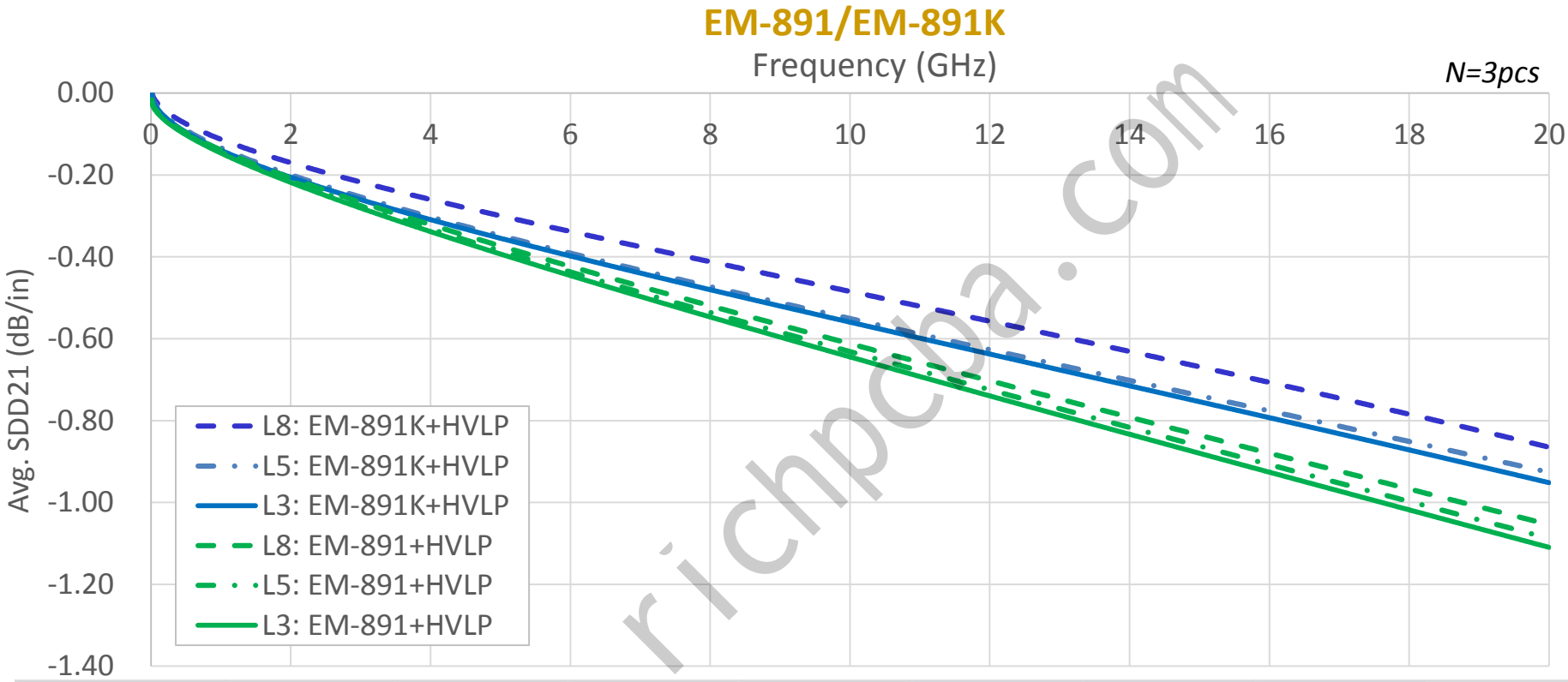
- **Test Material:**
  - EM-891 + RTF/HVLP
  - EM-891K + HVLP
  - X-6 + HVLP
- **Test Pattern Design:**
  - Impedance: 85Ω (Differential)
  - Line length: 5/10 inch
  - Line width /space :
    - L3 4.8 /6.7 mil
    - L5 5.0 /6.25 mil
    - L8 6.25 /6.5 mil





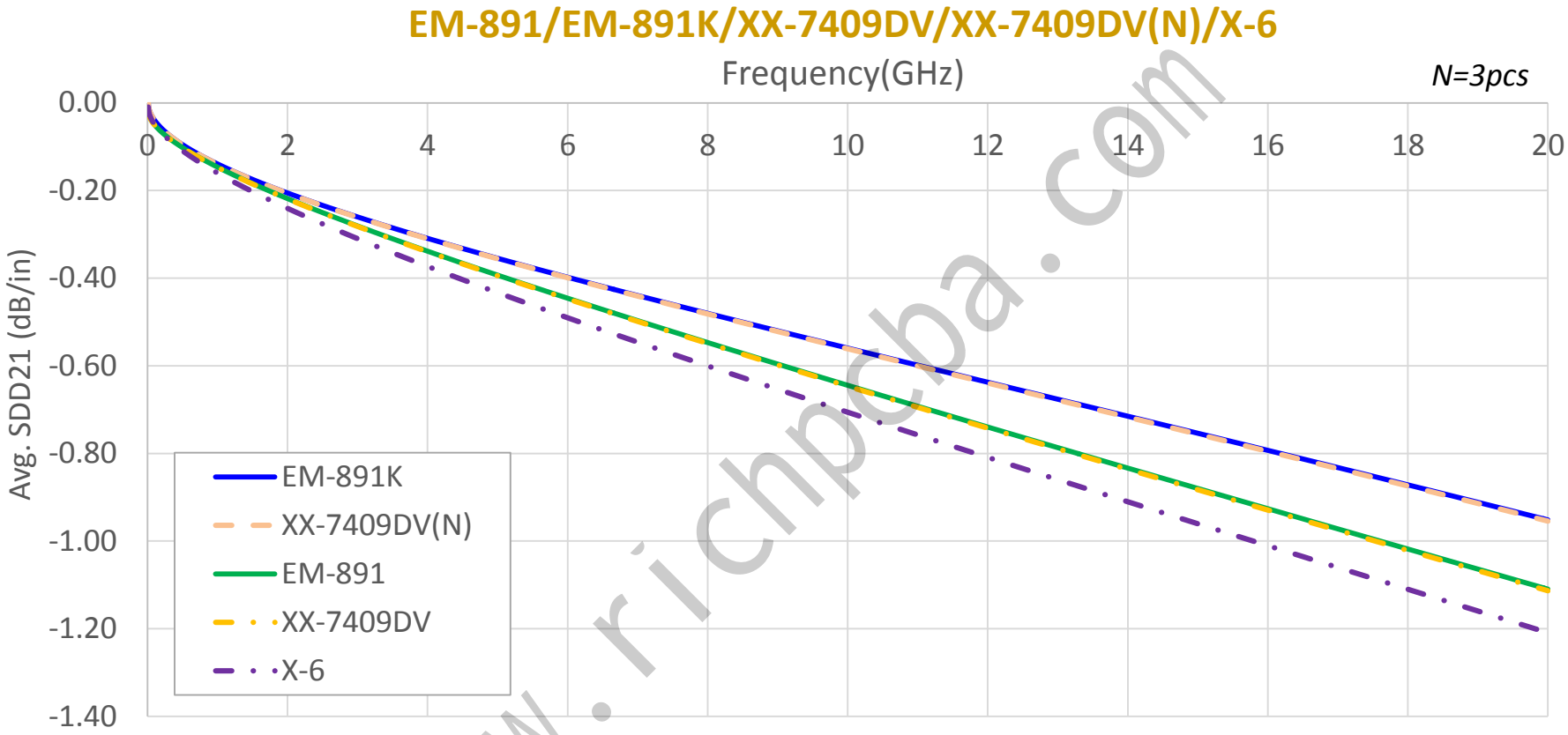


[Intel Delta-L] SDD21 Performance for Server Platform



Material	Cu Foil	Layer	W/S (mil)	4 GHz	8 GHz	12.89 GHz	14 GHz	16 GHz
EM-891K	HVLP	L8	6.25/6.5	-0.26	-0.41	-0.59	-0.63	-0.71
		L5	5.0/6.25	-0.30	-0.47	-0.66	-0.70	-0.78
		L3	4.8/6.7	-0.31	-0.48	-0.67	-0.72	-0.79
EM-891	HVLP	L8	6.25/6.5	-0.32	-0.52	-0.74	-0.79	-0.88
		L5	5.0/6.25	-0.33	-0.54	-0.77	-0.82	-0.91
		L3	4.8/6.7	-0.34	-0.55	-0.78	-0.83	-0.93

[Intel Delta-L] SDD21 Performance for Server Platform

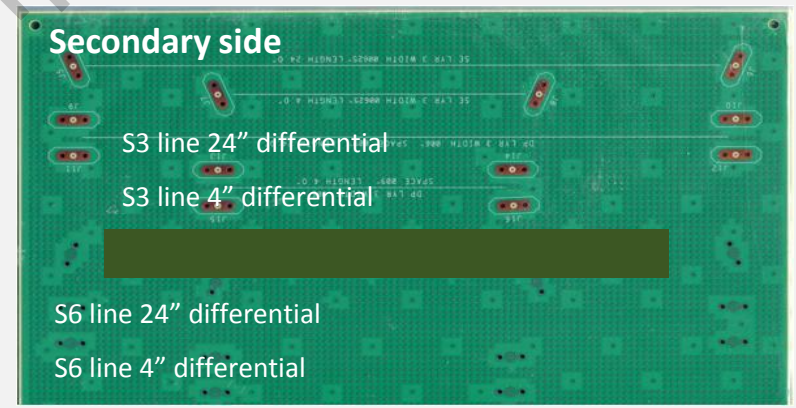


Material	Cu Foil	Layer	W/S (mil)	4 GHz	8 GHz	12.89 GHz	14 GHz	16 GHz
EM-891K	HVLP	L3	4.8/6.7	-0.309	-0.480	-0.672	-0.715	-0.793
XX-7409DV(N)				-0.310	-0.482	-0.674	-0.717	-0.795
EM-891				-0.338	-0.545	-0.782	-0.833	-0.926
XX-7409DV				-0.339	-0.549	-0.784	-0.836	-0.929
X-6				-0.373	-0.600	-0.854	-0.910	-1.011

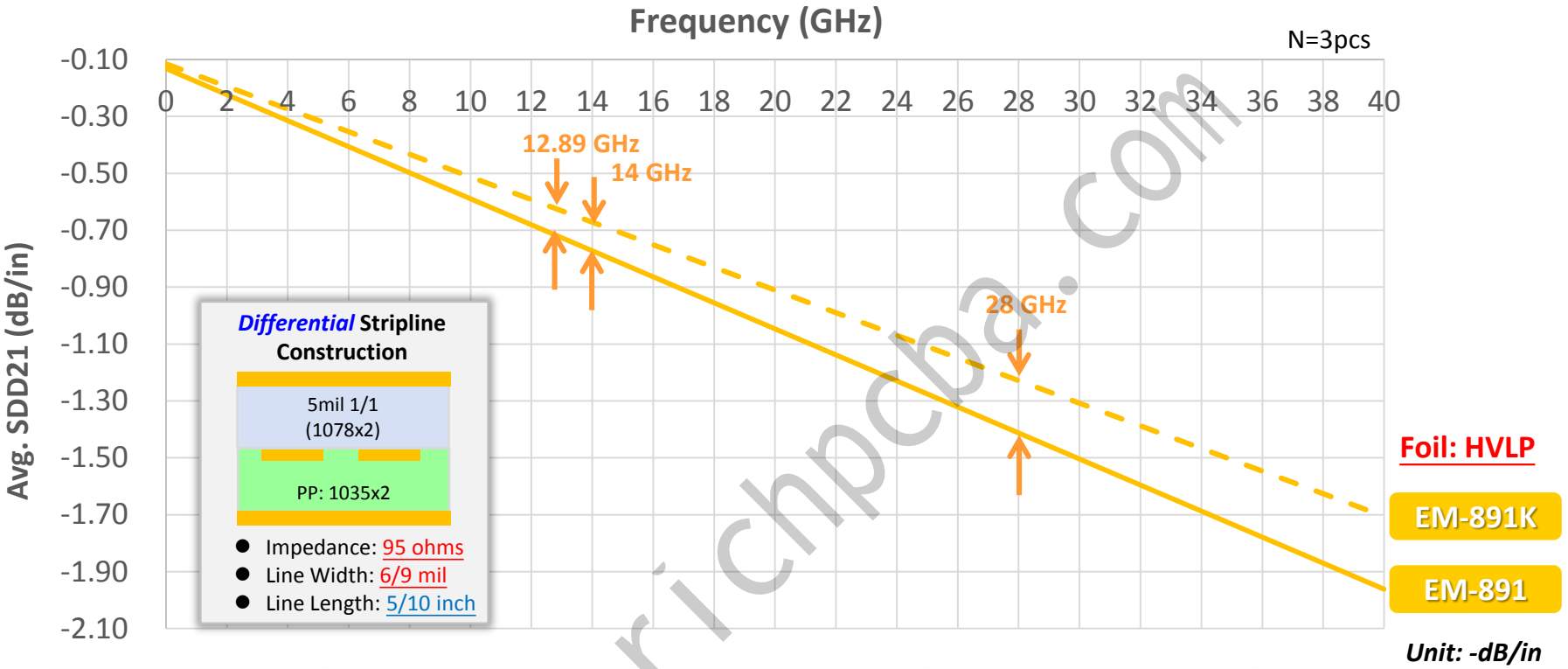
[Intel Delta-L] SDD21 Test for 100/400G Ethernet

Layers	EM-891/EM-891K HVLP
L1	Hoz Cu Foil
	1078 RC 65%x3
L2/3	5mil 1/1 HVLP 1078 RC57% x2
L3	1035 RC75%x2
L4/5	10mil 1/1 HVLP 2116 RC55%x2
	1078 RC 65%x2
L6/7	8mil1/1 HVLP 3313 RC56%x2
	1078 RC 65%x3
L8	Hoz Cu Foil

- **Test Material:**
  - EM-891 + HVLP
  - EM-891K + HVLP
- **Test Pattern Design:**
  - Impedance: 95Ω (Differential)
  - Line length: 4/24 inch
  - Line width /space :
    L3 : 6/9 mil



[Intel Delta-L] SDD21 Performance for 100/400G Ethernet



Application	Copper Foil	Frequency (GHz)	EM-891	EM-891K
100G (NRZ) 25 Gbps x4	**HVLP**	**12.89**	-0.72	-0.63
400G (PAM4) 56 Gbps x8	**HVLP**	**14**	-0.77	-0.67
800G (PAM4) 112 Gbps x8	**HVLP**	**28**	-1.41	-1.23

Agenda

- Product Roadmap –High Speed Application
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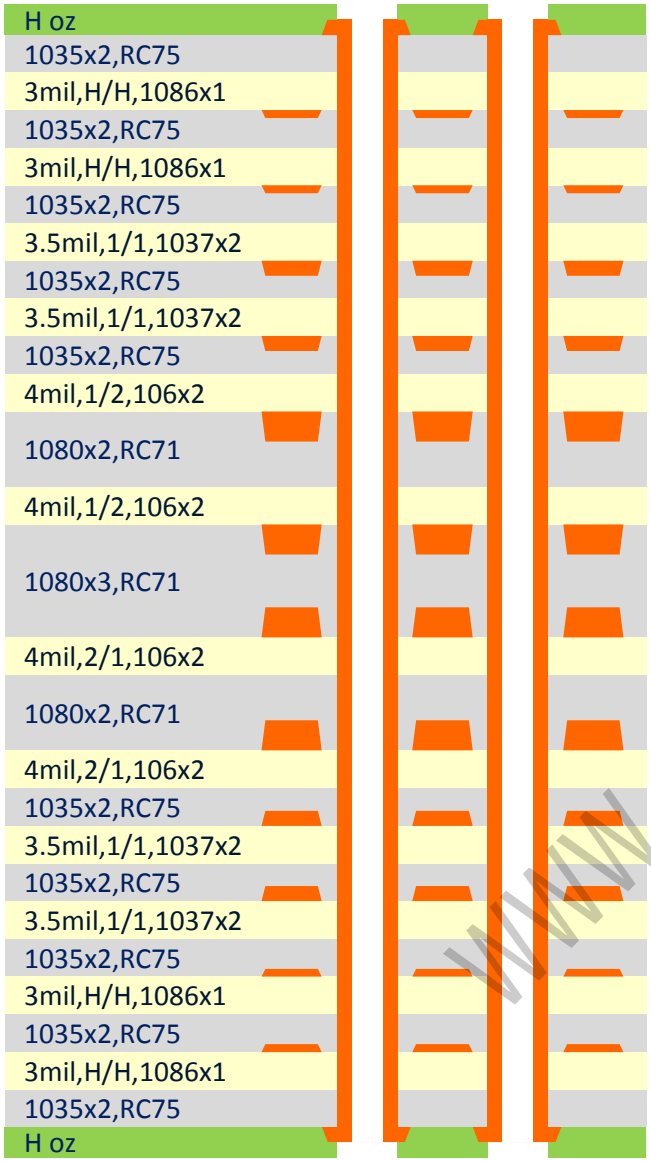
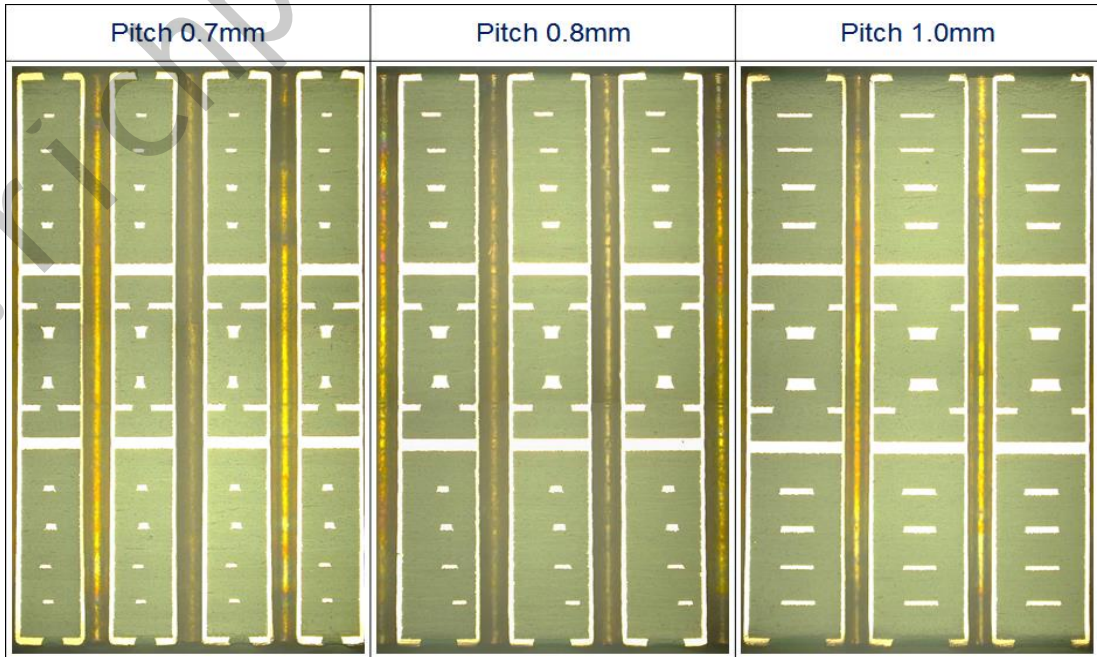
- Material Property Comparison
- Electrical Performance
- **Reliability Performance**

EM-891 26L IR Reflow Test Result



- **Test Vehicle Attribute:**
- Layer Count: 26 ,t130 mil
- Finished Hole Size: 8 mil
- Hole-To-Hole Pitch: **min. 0.7mm**
- Max. Copper Weight: 4L 2oz inside

- **Test Condition & Result:**
  - Precondition: **IR reflow 260 ℃ X10**
  - Result: with no abnormality



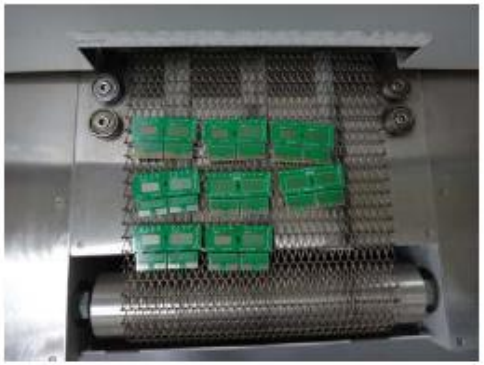
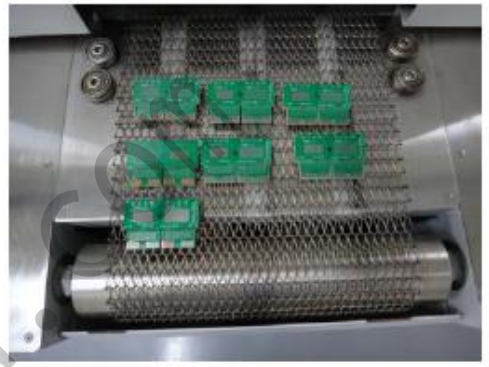
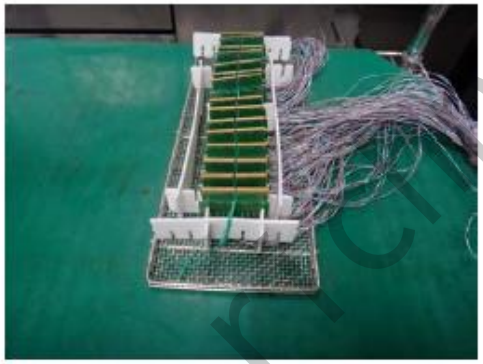
EM-891 32L IR Reflow/CAF Test Result

Layers	EM-891
L1	Copper foil
	1078 RC 67% x1
L2/3	2 mil 1/1 1035*1
	1035 RC71% x2
L4/5	3 mil H/H 1086*1
	1035 RC71% x2
L6/7	3 mil H/H 1086*1
	1035 RC71% x2
L8/9	2.5 mil H/H 1078*1
	1035 RC71% x2
L10/11	2.5 mil H/H 1078*1
	1035 RC71% x2
L12/13	3 mil H/H 1086*1
	1035 RC71% x2
L14/15	3 mil 1/2 1086*1
	1035 RC75%*3
L16/17	6 mil 2/2 1086x2
	1035 RC75% x3
L18/19	3 mil 2/1 1086*1
	1035 RC71% x2
L20/21	3 mil H/H 1086*1
	1035 RC71% x2
L22/L23	2.5 mil H/H 1078*1
	1035 RC71% x2
L24/L25	2.5 mil H/H 1078*1
	1035 RC71% x2
L26/L27	3 mil H/H 1086*1
	1035 RC71% x2
L28/L29	3 mil H/H 1086*1
	1035 RC71% x2
L30/L31	2mil 1/1 1035*1
	1078 67%
L32	Copper Foil

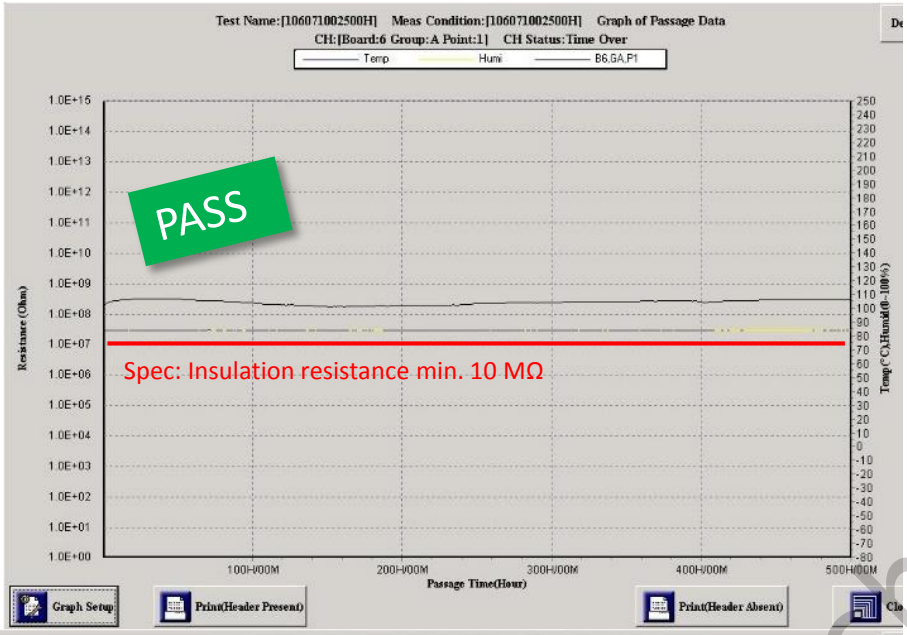
- **Test Vehicle Attribute:**
  - Layer Count: 32, t145 mil
  - Finished Hole Size: 8 mil
  - Hole-To-Hole Pitch: **min. 0.8mm**
  - Max. Copper Weight: 4L 2oz inside
- **Other Reliability Test Result:**
  - Precondition: IR reflow **260 ℃ 10X**
  - CAF 50V DC/ 65 ℃/ 85% RH, 596 hours Passed

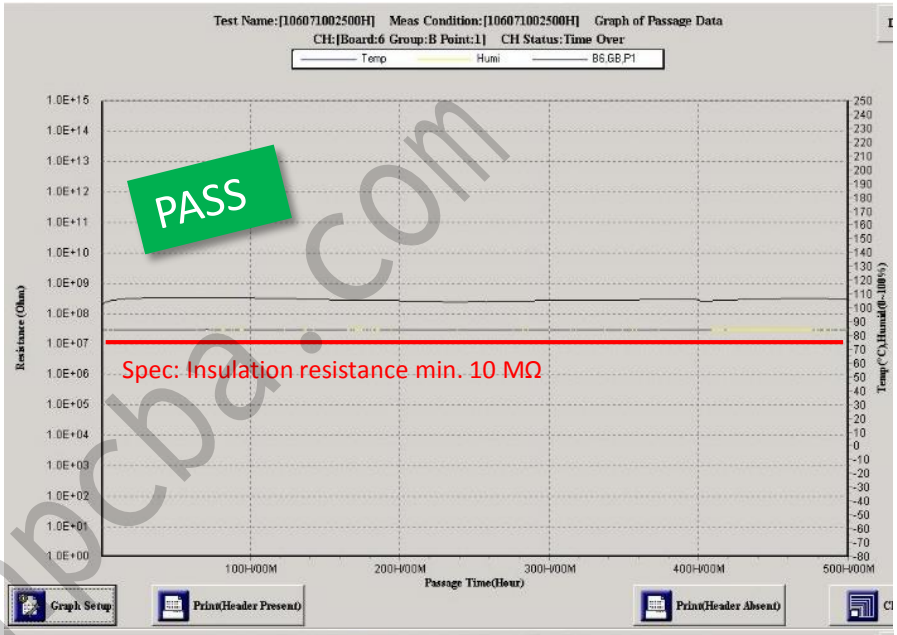
Pattern no	Pitch	Drill Size	IR Reflow 260℃ X10 Test Result
1	1.0mm	0.25mm	Pass
2	0.8mm	0.25mm	Pass
3	0.8mm	0.20mm	Pass
4	0.65mm	6mil uVia	Pass

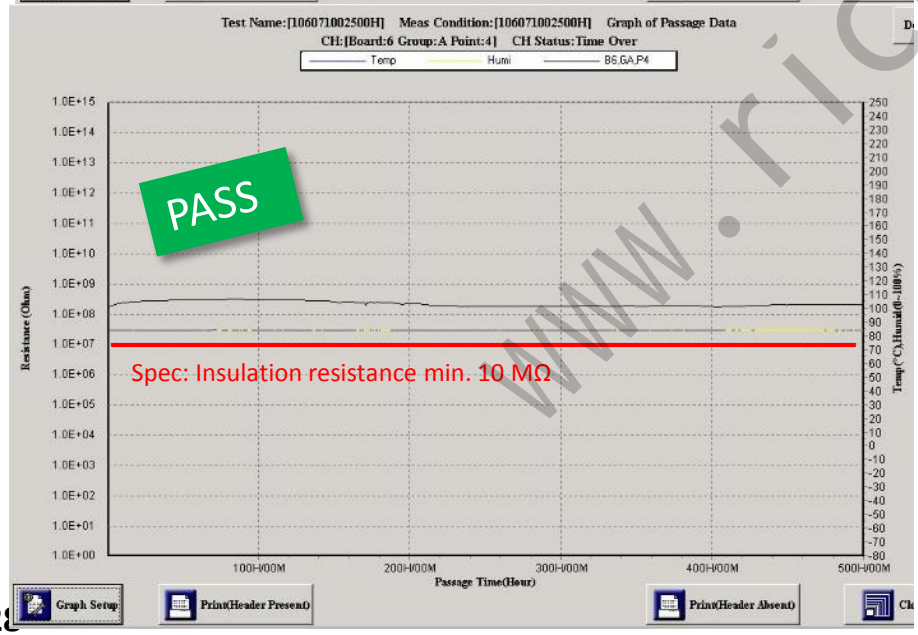
EM-891 32L CAF Test Procedure

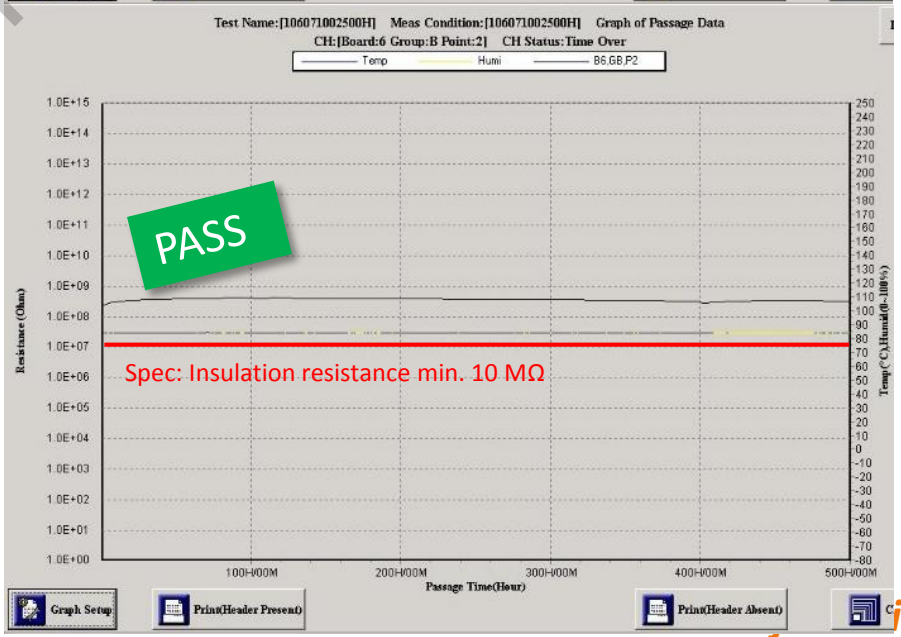
Reflow		Reflow	
Pre-test		Point	
Set-up		Post-test	

EM-891 32L CAF Test Result







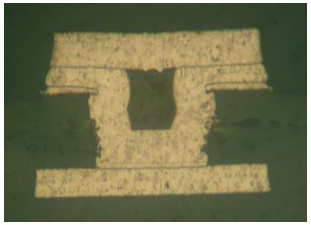


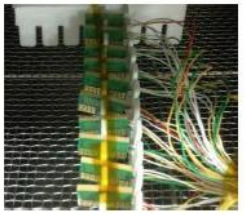
EM-891 32L IR Reflow& ATC Test Result

L1	Copper foil
	1078 RC 67% x1
L2/3	2 mil 1/1 1035*1
	1035 RC71% x2
L4/5	3 mil H/H 1086*1
	3313 RC57% x1
L6/7	3 mil H/H 1086*1
	3313 RC57% x2
L8/9	3 mil H/H 1086*1
	3313 RC57% x1
L10/11	3 mil H/H 1086*1
	3313 RC57% x1
L12/13	3 mil H/H 1086*1
	1035 RC71% x2
L14/15	4 mil 1/2 33136*1
	1078 RC67%*2
L16/17	8 mil 2/2 3313*2
	1078 RC67% x2
L18/19	4mil 2/1 3313*1
	3313 RC57% x1
L20/21	3 mil H/H 1086*1
	3313 R57% x1
L22/L23	3 mil H/H 1086*1
	3313 RC57% x1
L24/L25	3 mil H/H 1086*1
	3313 RC57% x1
L26/L27	3 mil H/H 1086*1
	3313 RC57% x1
L28/L29	3 mil H/H 1086*1
	1035 RC71% x2
L30/L31	2mil 1/1 1035*1
	1078 67%
L32	Copper Foil

- **Test Vehicle Attribute:**
  - Layer Count: 32, t145 mil
  - Finished Hole Size: 8 mil
  - Hole-To-Hole Pitch: **min. 0.8mm**
  - Max. Copper Weight: 4L 2oz inside
- **Other Reliability Test Result:**
  - Precondition: IR reflow **260 ℃X10**
  - ATC -35 ℃ to 125 ℃ (15-5-15 min), 400 cycles Passed

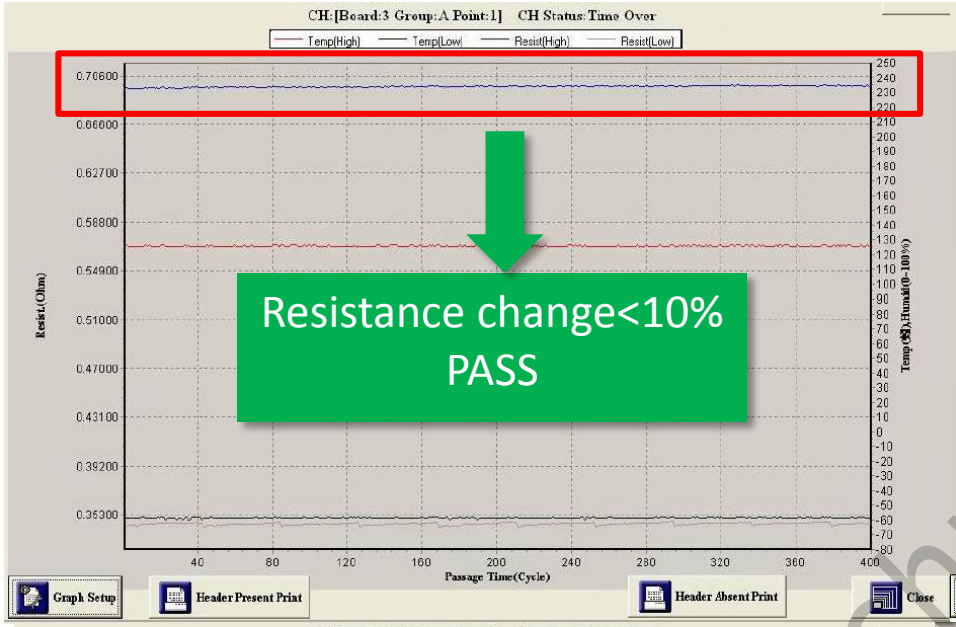
Pattern no	Pitch	Drill Size	IR Reflow 260℃ X10 Test Result
1	1.0mm	0.25mm	Pass
2	0.8mm	0.25mm	Pass
3	0.8mm	0.20mm	Pass
4	0.65mm	6mil uVia	Pass

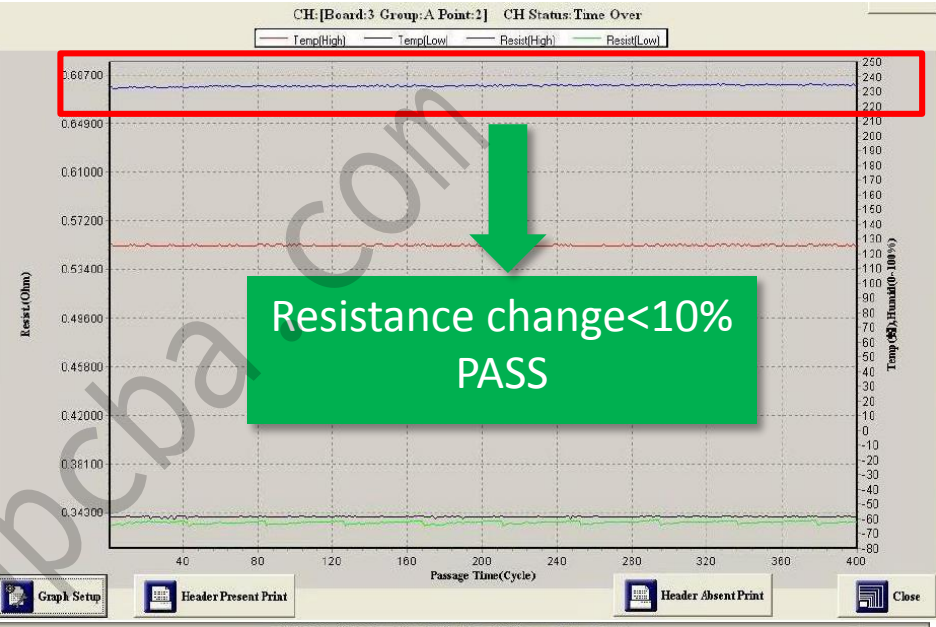


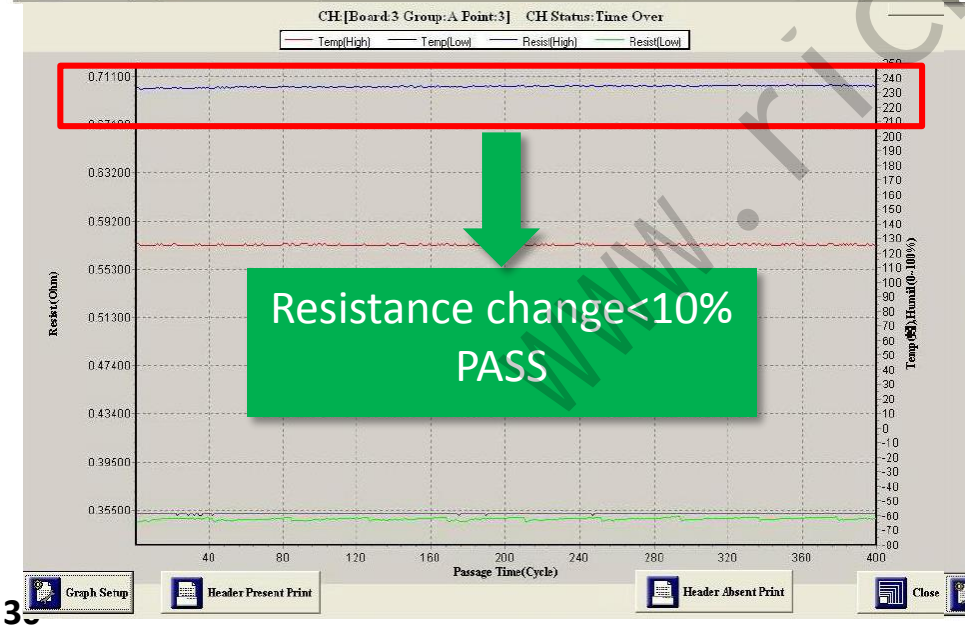


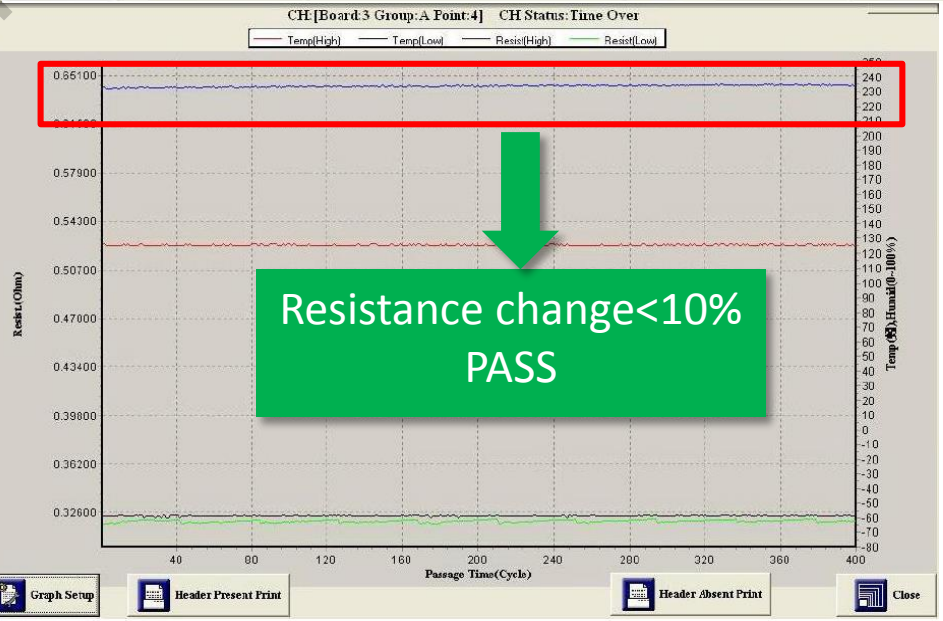
ATC Test

EM-891 32L ATC Test Results







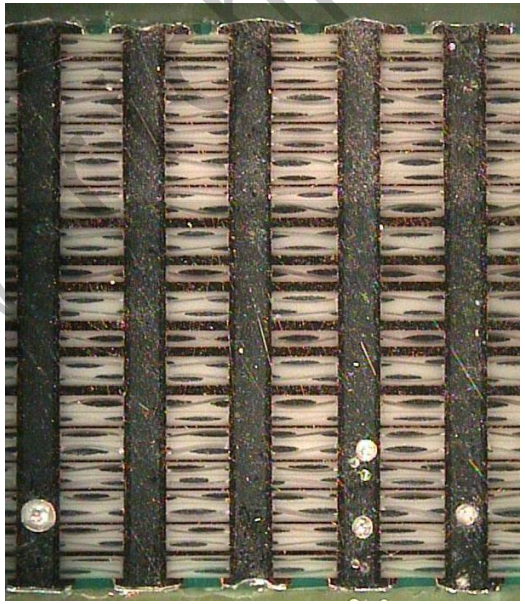


EM-891 30L IST Test Result

L1	Copper foil
	1078 RC 67% x1
L2/3	2 mil 1/1 1035*1
	1078 RC 67% x1
L4/5	3 mil H/H 1086*1
	3313 RC59% x1
L6/7	3 mil H/H 1086*1
	1086 RC65% x1
L8/9	3 mil H/H 1086*1
	3313 RC59% x1
L10/11	3 mil H/H 1086*1
	1078 RC67% x1
L12/13	4 mil 1/2 3313*1
	1078 RC67%*2
L14/15	4 mil 2/2 3313*1
	1078 RC67% x2
L16/17	4mil 2/2 3313*1
	1078 RC65% x2
L18/19	4 mil 2/1 3313*1
	1078 R67% x1
L20/L21	3 mil H/H 1086*1
	3313 RC59% x1
L22/L23	3 mil H/H 1086*1
	1086 RC65% x1
L24/L25	3 mil H/H 1086*1
	3313 RC59% x1
L26/L27	3 mil H/H 1086*1
	1078 RC 67% x1
L28/L29	2mil 1/1 1035*1
	1078 67%
L30	Copper Foil

- **Test Vehicle Attribute:**
  - Layer Count: 30, t3.8mm (150 mil)
  - Finished Hole Size: 0.20mm (Drill Size 0.25 mm)
  - Hole Pitch: Min.**0.70mm**
  - Max. Copper Weight: 6L x2oz inside
- **Test Condition & Result:**
  - IR reflow **260 ℃ X5** with no abnormality
  - Solder float: 288°C 6X passed **(Pitch: 0.7mm)**
  - IST: R.T. to **150 ℃, 1000 cycles** passed **(Pitch: 0.8mm)**

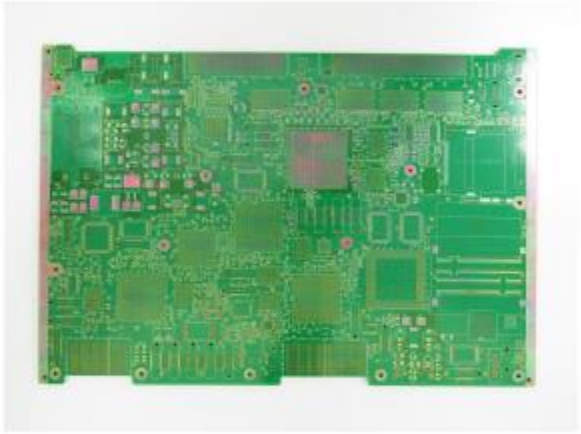
  Criteria: Resistance change<10%

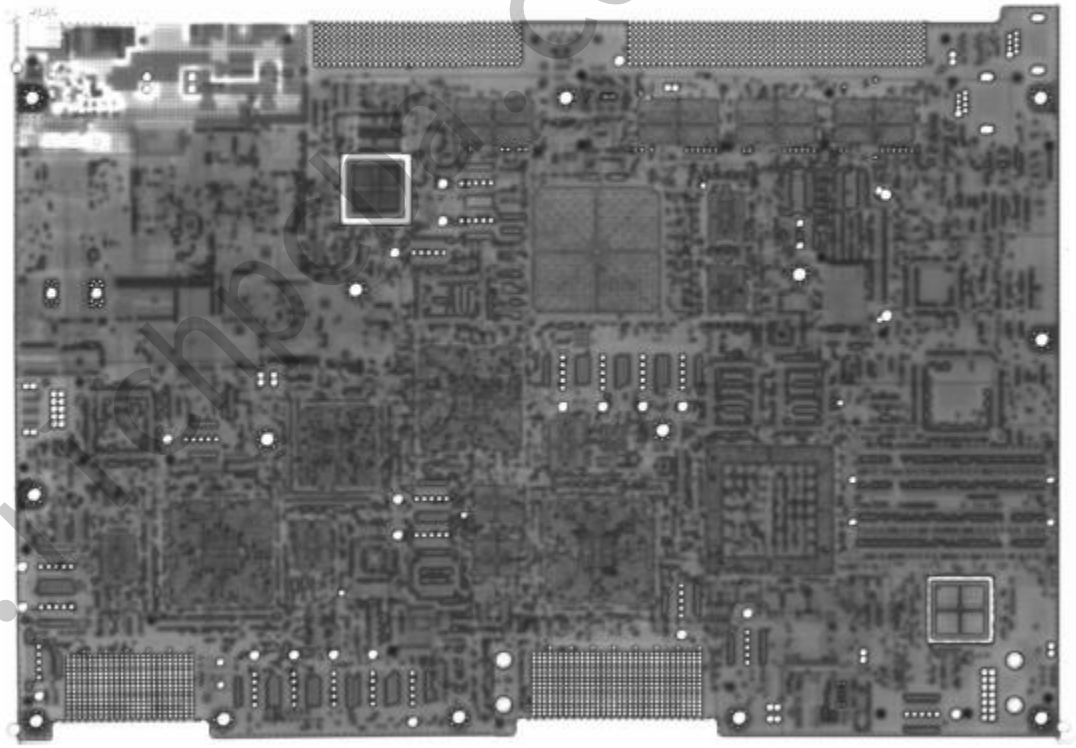


0.7mm Pitch X-section (Solder Float)

C-SAM Inspection Data

#1(00016PB-06 EM891)

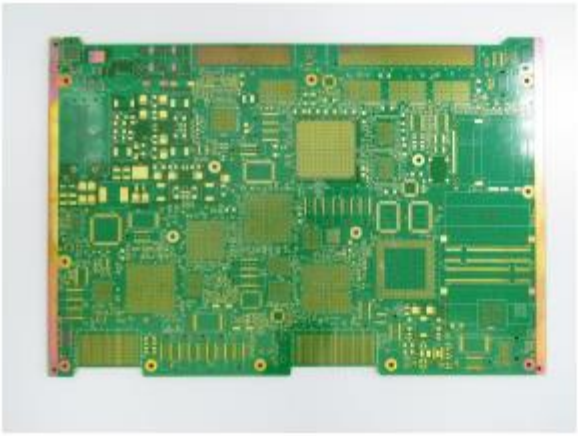


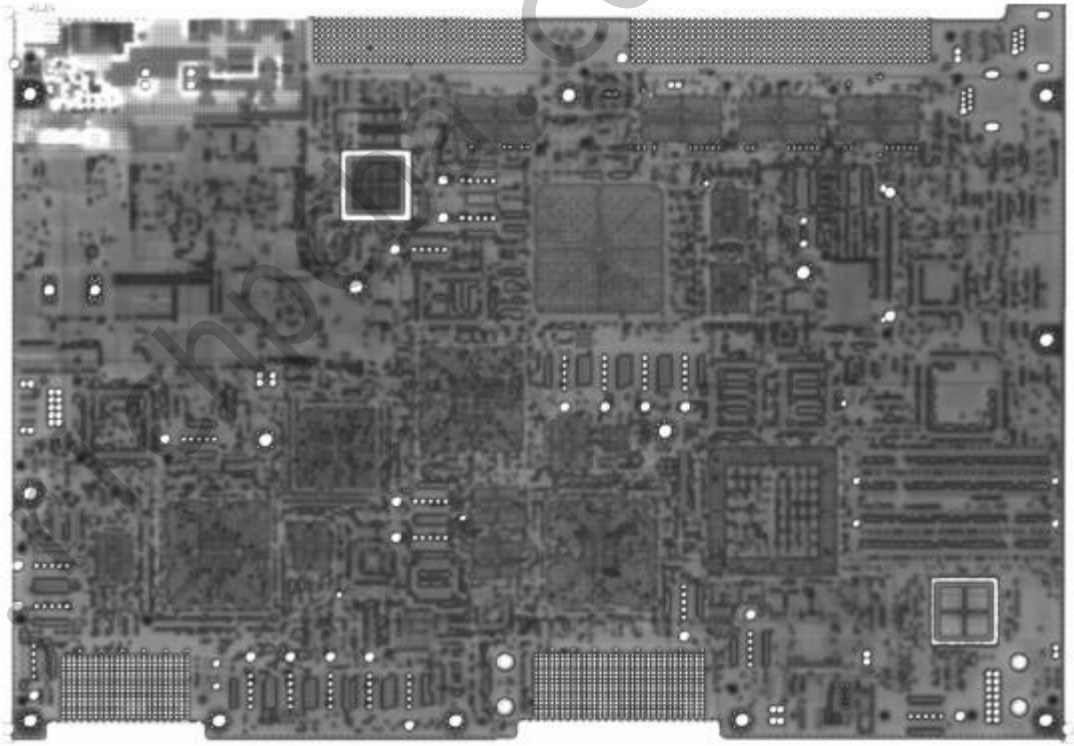


No delamination was found .

C-SAM Inspection Data

#2(00016PB-06 EM891)





No delamination was found .

EM-891 28L (14+14) IR Reflow Test Result

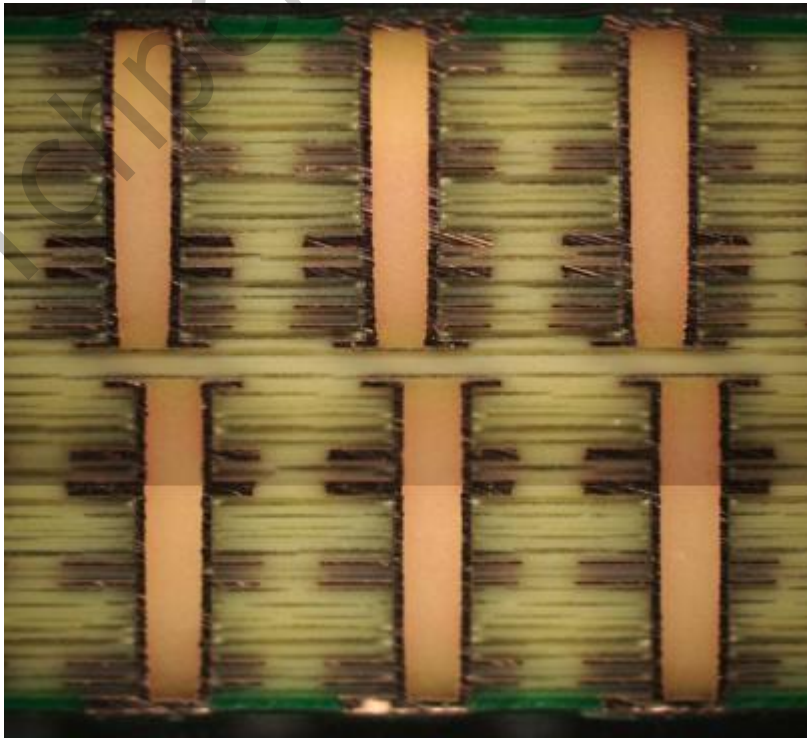
L1	Copper Foil
	1035×2 RC71%
L2/3	2mil 1/1
	1035×2 RC71%
L4/5	2mil H/H
	1035×2 RC71%
L6/7	2mil H/H
	1035×2 RC71%
L8/9	2mil H/H
	1035×2 RC71%
L10/11	2mil H/H
	1035×2 RC71%
L12/13	2mil H/H
	1035×2 RC71%
L14	H oz Copper
	1080×2 RC69%
L15	H oz Copper
	1035×2 RC71%
L16/17	2mil H/H
	1035×2 RC71%
L18/19	2mil H/H
	1035×2 RC71%
L20/21	2mil H/H
	1035×2 RC71%
L22/23	2mil H/H
	1035×2 RC71%
L24/L25	2mil H/H
	1035×2 RC71%
L26/27	2mil H/H
	1035×2 RC71%
L28	Copper foil

Test Vehicle Attribute:

- Layer Count: 28 (14+14)
- Board Thickness: 3.0mm (118 mil)
- Finished Hole Size: 8 mil (Drill size: 0.25mm)
- Min. Hole-To-Hole Pitch: **0.6 mm**

Test Condition & Result:

- IR reflow **260 ℃ 5X** with no abnormality



EM-891 20L HDPUG Test Result

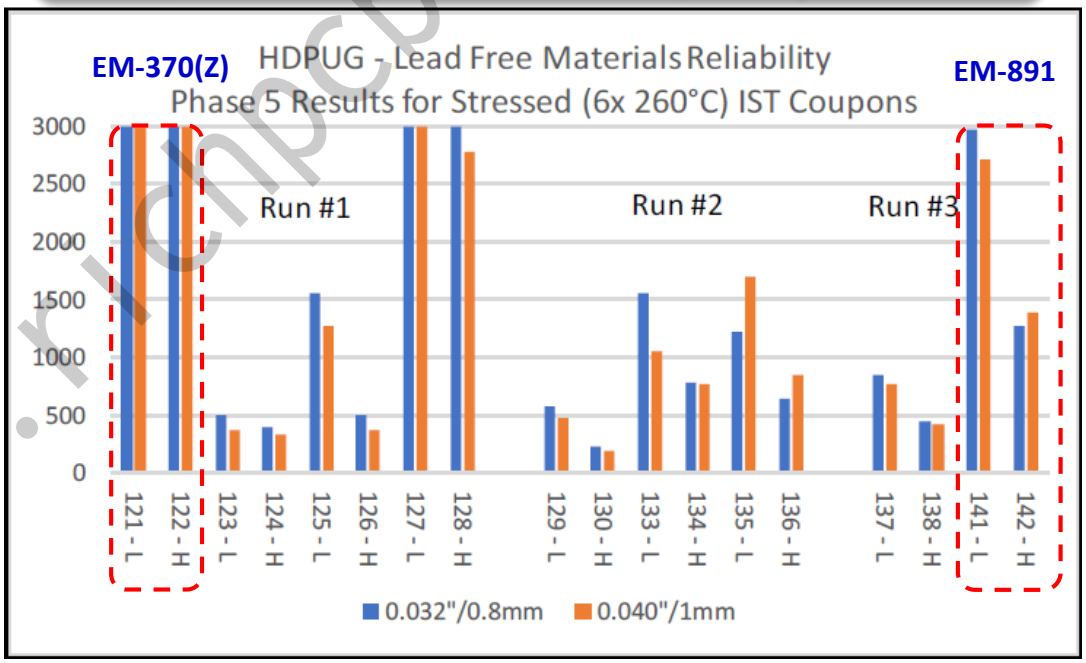
	Low Resin	High Resin
L1	Hoz+Plating	Hoz+Plating
	1086×1 RC65%	1086×1 RC69%
L2/3	5mil 1/1 (2116x1)	4.2mil 1/1 (106x2)
	1086×2 RC65%	1086×2 RC69%
L4/5	5mil 1/1 (2116x1)	4.2mil 1/1 (106x2)
	1086×2 RC65%	1086×2 RC69%
L6/7	5mil 1/1 (2116x1)	4.2mil 1/1 (106x2)
	1086×2 RC65%	1086×2 RC69%
L8/9	5mil 1/1 (2116x1)	4.2mil 1/1 (106x2)
	1086×2 RC65%	1086×2 RC69%
L10/11	5mil 1/1 (2116x1)	4.2mil 1/1 (106x2)
	1086×2 RC65%	1086×2 RC69%
L12/13	5mil 1/1 (2116x1)	4.2mil 1/1 (106x2)
	1086×2 RC65%	1086×2 RC69%
L14/15	5mil 1/1 (2116x1)	4.2mil 1/1 (106x2)
	1086×2 RC65%	1086×2 RC69%
L16/17	5mil 1/1 (2116x1)	4.2mil 1/1 (106x2)
	1086×2 RC65%	1086×2 RC69%
L18/19	5mil 1/1 (2116x1)	4.2mil 1/1 (106x2)
	1086×1 RC65%	1086×1 RC69%
L20	Hoz+Plating	Hoz+Plating

Test Vehicle Attribute:

- Layer Count: 20
- Board Thickness: 3.0mm (118 mil)
- Finished Hole Size: 8 mil (Drill size: 0.25mm)
- Min. Hole-To-Hole Pitch: **0.8 mm**

Test Condition & Result:

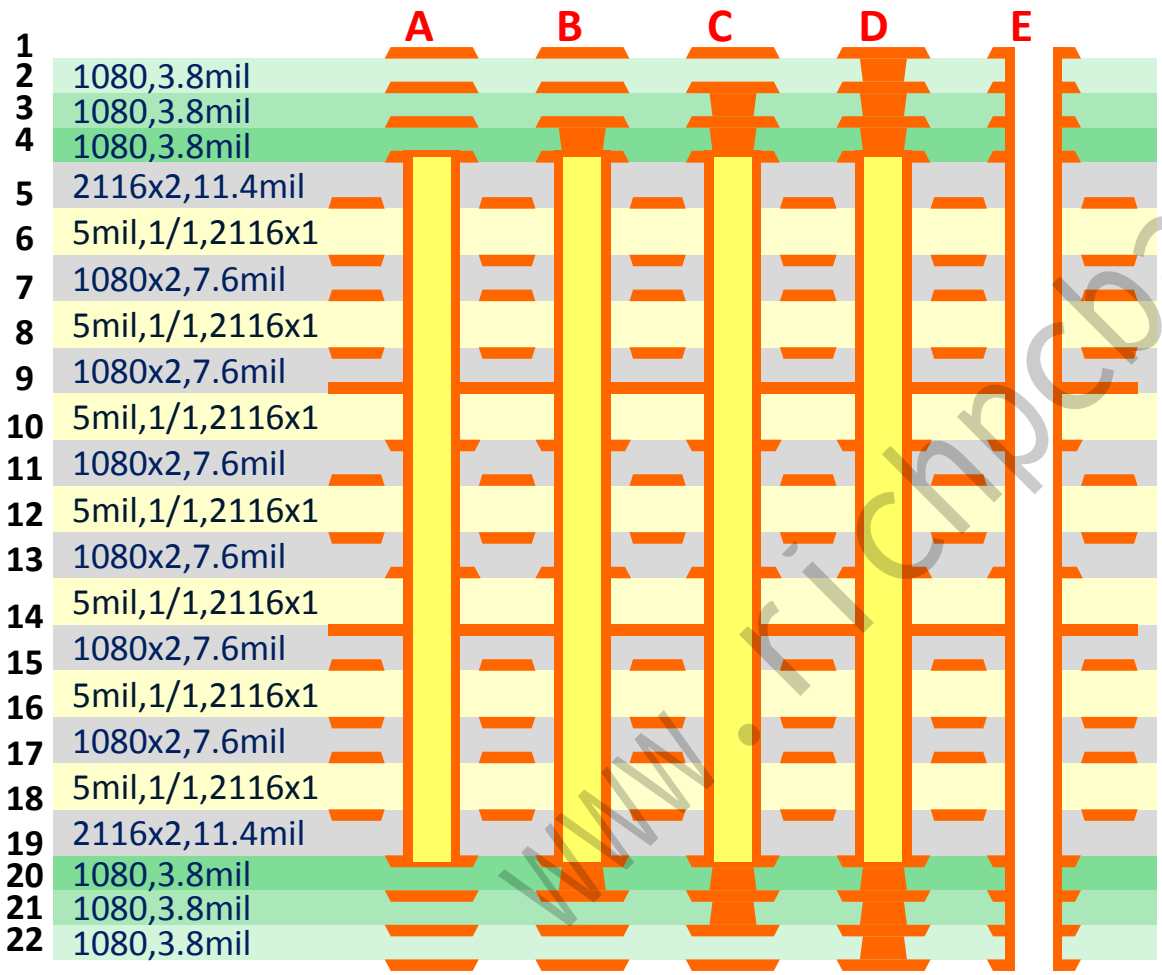
- IR reflow **260 ℃ 6X** with no abnormality
- IST, **Room temperature ~ 150°C ,1000cycles**



Material Type	Material Code	Resin Content	0.032"/0.8mm Grid Size						
			1	2	3	4	5	6	Mean
EM-891	141	Low	3000	3000	3000	2832	3000	3000	2972
EM-891	142	High	1294	1298	1217	1274	1457	1112	1275

EM-891 Multi-lamination Performance

Stack-up and Pattern Design



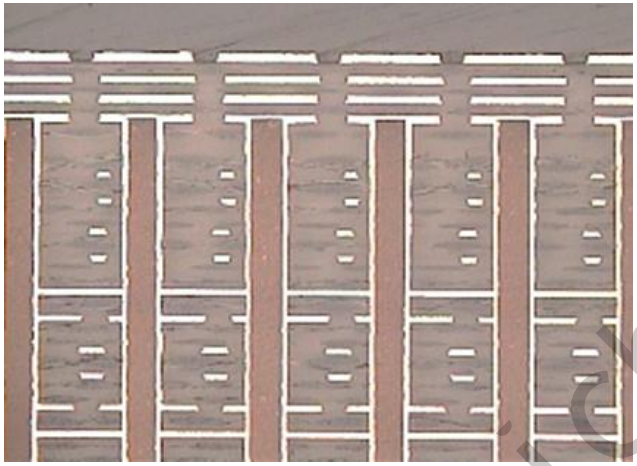
Test Vehicle Attribute

- Layer Count: 22 (3+16+3)
- Board thickness: 118 mil (3.0mm)
- PTH DHS: 10 mil
- Laser Drill size: 6 mil
- Hole-To-Hole Pitch: min. 0.7mm

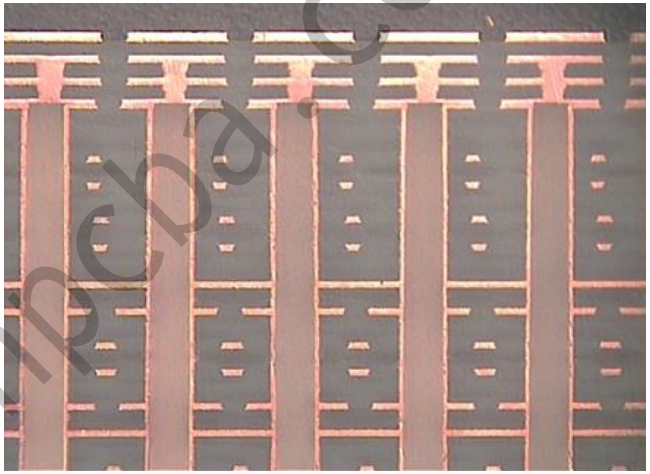
EM-891 Multi-lamination Performance

Test Condition:
IR reflow 260 °C x10
Test Result: No abnormality was found

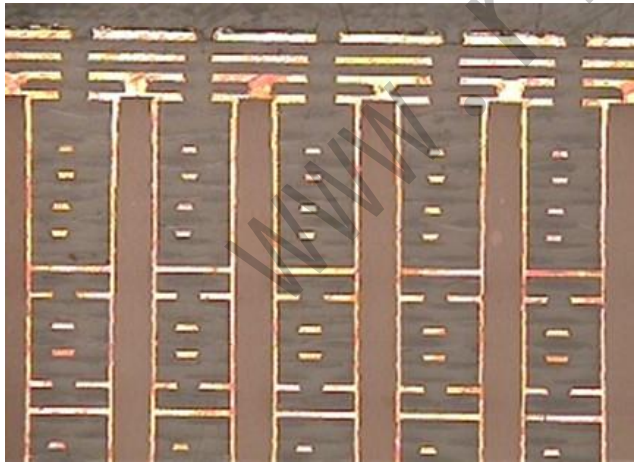
Type A Pattern



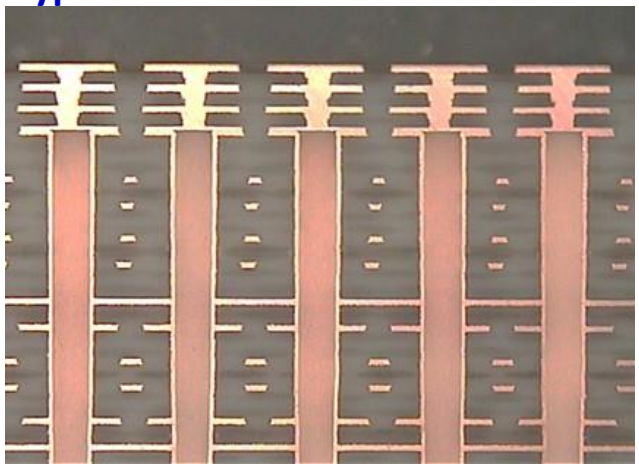
Type C Pattern



Type B Pattern



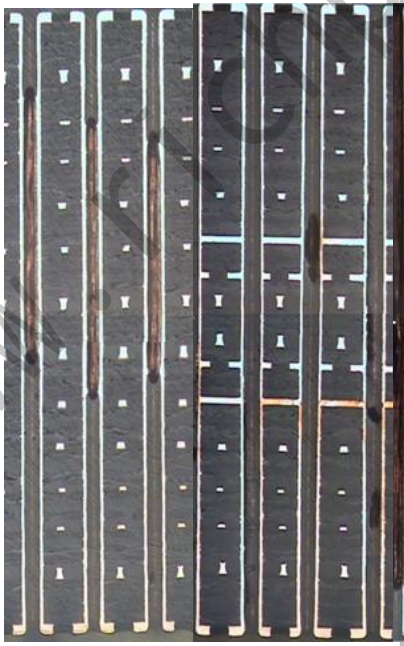
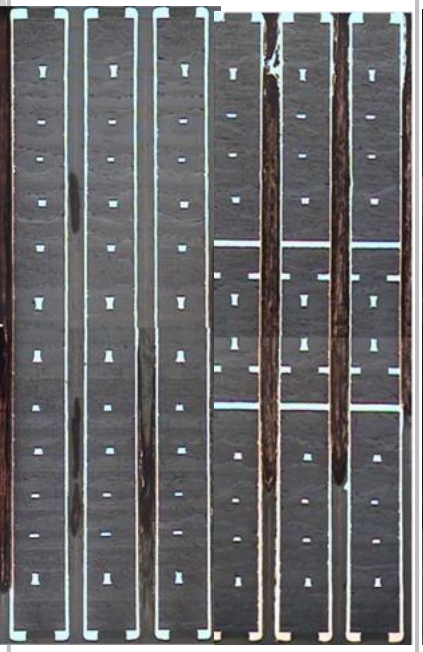
Type D Pattern



Hybrid Application :EM-891+EM-827 26L Test

Layers	EM-891+EM-827
L1	Copper foil
	EM-827 1080 RC 66%x1
L2/3	EM-827 4 mil 2/2
	EM-827 1080 RC 66%x1
L4/5	EM-827 3 mil H/H
	EM-827 2116 RC 66%x1
L6/7	EM-827 4 mil H/H
	EM-827 2116 RC 66%x1
L8/9	EM-827 4 mil 1/1
	EM-827 2116 RC 66%x1
L10/11	EM-827 4 mil 1/1
	EM-827 1080 RC 66%x2
L12/13	EM-827 4 mil 1/2
	EM-891 1080 RC 69%x2
L14/15	EM-827 4 mil 2/1
	EM-827 1080 RC 66%x2
L16/17	EM-891 4 mil 1/1
	EM-827 2116 RC 57%x1
L18/19	EM-891 4 mil 1/1
	EM-891 2116 RC 57%x1
L20/21	EM-891 4 mil 1/1
	EM-891 2116 RC 57%x1
L22/23	EM-891 3 mil H/H
	EM-891 1080 RC 69%x2
L24/25	EM-891 4 mil 2/2
	EM-827 1080 RC 66%x2
L26	Copper Foil

- **Test Vehicle Attribute:**
  - Layer Count: 26, t140 mil
  - Finished Hole Size: 8 mil
  - Hole-To-Hole Pitch: **min. 0.7mm**
  - Max. Copper Weight: 6L 2oz inside
- **Test Condition & Result:**
  - Precondition: **IR reflow 260 ℃X10**
  - with no abnormality

0.7mm	0.8mm	1.0mm
		

EM-891 Plus EM-827 Hybrid 36L Test

L1	Cooper Foil
	EM-827 1080 RC 68% x2
L2/3	EM-827 3.5 mil 1/2 1037*2
	EM-827 1080 RC68% x3
L4/5	EM-827 3.5 mil 2/1 1037*2
	EM-891 1035 RC71% x2
L6/7	EM-891 4 mil 1/1 1035*2
	EM-891 1035 RC71% x2
L8/9	EM-891 4 mil 1/1 1035*2
	EM-891 1035 RC71% x2
L10/11	EM-891 4 mil 1/1 1035*2
	EM-891 1035 RC71% x2
L12/13	EM-891 4 mil 1/1 1035*2
	EM-891 1035 RC71% x2
L14/15	EM-891 4 mil 1/1 1035*2
	EM-891 1035 RC71% x2
L16/17	EM-891 4 mil 1/1 1035*2
	EM-827 1080 RC68% x3
L18/19	EM-827 3.5 mil 2/2 1037*2
	EM-827 1080 RC68% x3
L20/21	EM-891 4 mil 1/1 1035*2
	EM-891 1035 RC71% x2
L22/L23	EM-891 4 mil 1/1 1035*2
	EM-891 1035 RC71% x2
L24/L25	EM-891 4 mil 1/1 1035*2
	EM-891 1035 RC71% x2
L26/L27	EM-891 4 mil 1/1 1035*2
	EM-891 1035 RC71% x2
L28/L29	EM-891 4 mil 1/1 1035*2
	EM-891 1035 RC71% x2
L30/L31	EM-891 4 mil 1/1 1035*2
	EM-891 1035 RC71% x2
L32/L33	EM-827 3.5 mil 1/2 1037*2
	EM-827 1080 RC68% x3
L34/L35	EM-827 3.5 mil 2/1 1037*2
	EM-827 106 RC72% x2
L36	Copper Foil

Test Vehicle Attribute:

- Layer Count: 36
- Board Thickness: 205 mil
- Finished Hole Size: 8 mil (Drill Size 0.25 mm)
- Hole-To-Hole Pitch: **0.7mm minimum**
- Max. Copper Weight: **6L 2oz** inside

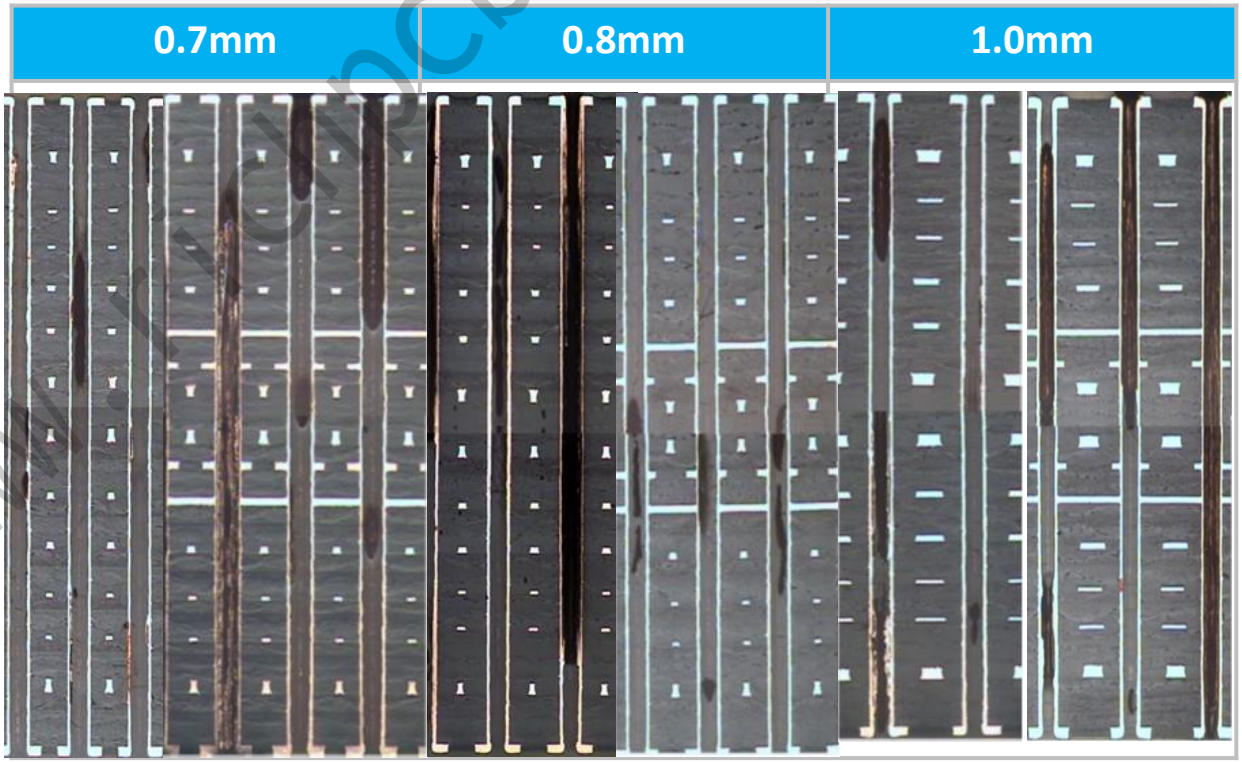
Test Condition & Result:

- IR reflow 260°C 5X with no abnormality
- Solder float 288 °C 6X with no abnormality

Hybrid Application :EM-891+EM-370(D) 26L Test

Layers	EM-891+EM-370(D)
L1	Copper foil
	EM-370(D) 1080 RC 66%x1
L2/3	EM-370(D) 4 mil 2/2
	EM-370(D) 1080 RC 66%x1
L4/5	EM-370(D) 3 mil H/H
	EM-370(D) 2116 RC 66%x1
L6/7	EM-370(D) 4 mil H/H
	EM-370(D) 2116 RC 66%x1
L8/9	EM-370(D) 4 mil 1/1
	EM-370(D) 2116 RC 66%x1
L10/11	EM-370(D) 4 mil 1/1
	EM-370(D) 1080 RC 66%x2
L12/13	EM-370(D) 4 mil 1/2
	EM-891 1080 RC 69%x2
L14/15	EM-370(D) 4 mil 2/1
	EM-370(D) 1080 RC 66%x2
L16/17	EM-891 4 mil 1/1
	EM-370(D) 2116 RC 57%x1
L18/19	EM-891 4 mil 1/1
	EM-891 2116 RC 57%x1
L20/21	EM-891 4 mil 1/1
	EM-891 2116 RC 57%x1
L22/23	EM-891 3 mil H/H
	EM-891 1080 RC 69%x2
L24/25	EM-891 4 mil 2/2
	EM-370(D) 1080 RC 66%x2
L26	Copper Foil

- **Test Vehicle Attribute:**
  - Layer Count: 26, t140 mil
  - Finished Hole Size: 8 mil
  - Hole-To-Hole Pitch: **min. 0.7mm**
  - Max. Copper Weight: 6L 2oz inside
- **Test Condition & Result:**
  - Precondition: **IR reflow 260 ℃X10**
  - with no abnormality



Q&A

THANK YOU.