



Halogen-free Ultra-low transmission loss Multi-layer circuit board materials

XPEDION 1

Laminate **R-5515**

Prepreg **R-5410**

ハロゲンフリー超低伝送損失多層基板材料

Applications 用途

Antenna(Automotive millimeter-wave radar, Base station), Etc.

アンテナ(車載ミリ波レーダ、基地局)など



Prepreg R-5410 enables multi-layer antenna constructions and improves the design flexibility of high-frequency circuit boards; especially suitable for millimeter-wave antennas.

This material achieves higher efficiency and lower loss, with the added benefit of reduced processing costs.

プリプレグ R-5410 は、アンテナ層の多層化、高周波基板の設計自由度向上に寄与します。

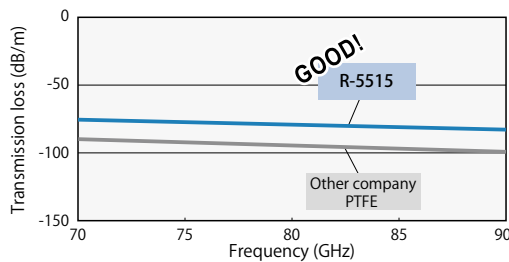
高周波アンテナの信号の高利得化と基板の加工コスト低減に貢献。

Dk 3.0 Df 0.002
@10GHz

Tg (DMA)
200°C

Reduce PCB process cost
(vs. PTFE material)

Frequency dependence by Transmission loss (70-90GHz) 伝送損失比較 (70-90GHz)

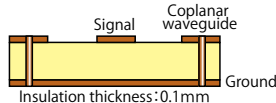


Transmission loss at 79GHz

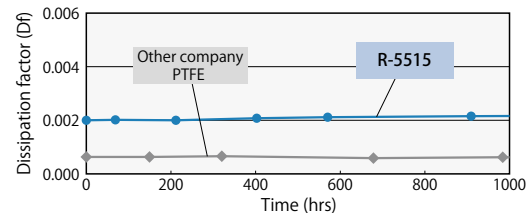
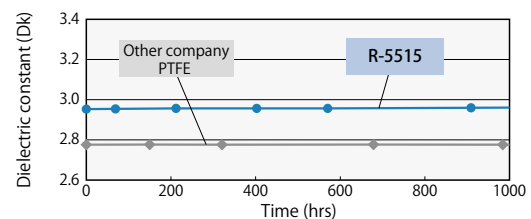
Material	Transmission loss (dB/m)	Dk (Design)
R-5515	79	3.09
Other company PTFE	96	3.01

Construction

Microstrip line



Long-term stability under High temperature (Dk, Df) 高温環境下における長期安定性 (Dk, Df)



- Measurement method : Cavity resonance method
- Aging Temperature : 125°C (without humidity control)
- Measurement frequency : 10GHz

General properties 一般特性

Item	Test method	Condition	Unit	Halogen-free R-5515	
Glass transition temp.(Tg)	DMA	A	°C	200 ^{*1}	
CTE z-axis	IPC-TM-650 2.4.24	A	ppm/°C	50	
				300	
T288(with copper)	IPC-TM-650 2.4.24.1	A	min	>120	
Thermal conductivity	Laser flash	A	W/m·K	0.35	
Dielectric constant(Dk)	Cavity resonance	C-24/23/50	-	3.0	
Dissipation factor(Df)				0.002	
Peel strength ^{*2}	1/2oz(18μm)	IPC-TM-650 2.4.8	A	kN/m	0.6 ^{*1}

The sample thickness is 0.5mm.

*1 The sample thickness is 0.13mm.

*2 H-VLP2 Copper

Please contact us about the thickness specification. 板厚仕様については、別途ご相談ください。
Our Halogen-free materials are based on JPCA-ES-01-2003 standard and others. 当社ハロゲンフリー材料は、JPCA-ES-01-2003などの定義によるものです。
The above data are typical values and not guaranteed values. 上記データは当社測定による代表値であり、保証値ではありません。

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High thermal conductivity Low transmission loss Halogen-free Multi-layer circuit board materials

高热伝導率・低伝送損失ハロゲンフリー多層基板材料

XPEDION T1

Laminate **R-5575**

Prepreg **R-5470**

Applications 用途

Power amplifier board (Base station for wireless communication, Small cell),
Antenna (Automotive millimeter-wave radar, Base station), Etc.

パワーアンプ基板（無線通信基地局、スモールセル）、
アンテナ（車載ミリ波レーダ、基地局）など



Automotive
オートモーティブ



Wireless
ワイヤレス通信

Leveraging multi-layer processability, low transmission loss, high thermal conductivity and Halogen-free, these materials are suitable for miniaturized and 5G small cell PCBs.

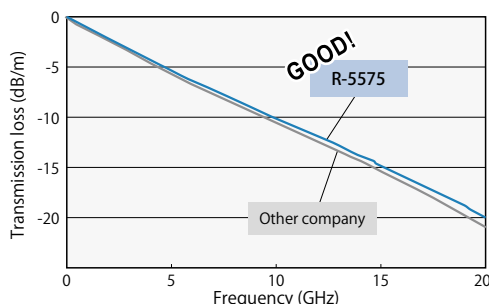
ハロゲンフリー、低伝送損失、高热伝導性を兼ね備え、多層成型性で“5G”における基地局の小型化や安定稼働に貢献

Dk 3.6 Df 0.005
@10GHz

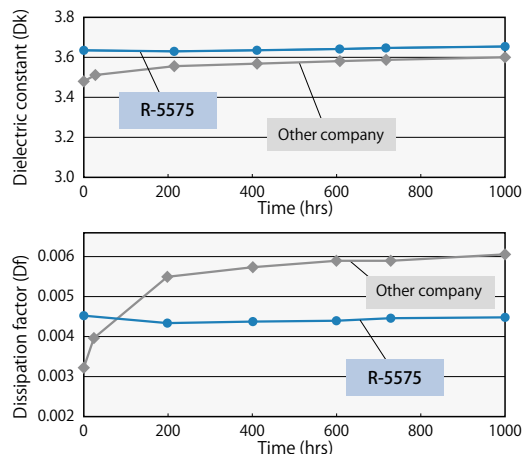
Thermal conductivity
0.60W/m·K

Tg (DMA)
245°C

Frequency dependence by Transmission loss 伝送損失比較



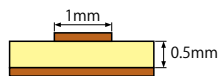
Long-term stability under High temperature (Dk, Df) 高温環境下における長期安定性 (Dk, Df)



- Measurement method : Balanced type circular disk resonance method
- Aging Temperature : 125°C (without humidity control)
- Measurement frequency : 18GHz

Construction

Microstrip line



Item	R-5575	Other company
Line length	1000mm	1000mm
Impedance	50±1Ω	50±1Ω
Copper thickness	18μm→ +20μm plating	18μm→ +20μm plating
Copper	RT	ST
Core	0.5mm	0.5mm

General properties 一般特性

Item	Test method	Condition	Unit	Halogen-free R-5575	Other company	
Glass transition temp.(Tg)	DMA	A	°C	245	Tg less	
CTE z-axis	$\alpha 1 / \alpha 2$	IPC-TM-650 2.4.24	ppm/°C	20/155	21/42	
T288(with copper)	IPC-TM-650 2.4.24.1	A	min	>120	>120	
Thermal conductivity	Laser flash	A	W/m·K	0.6	0.6	
Dielectric constant(Dk)	10GHz	Cavity resonance	—	3.6	3.5	
				Dissipation factor(Df)	0.005	0.004
Peel strength*	1oz(35μm)	IPC-TM-650 2.4.8	A	kN/m	0.80	0.58
Flammability	UL	C-48/23/50	—	94V-0(HF)	94V-0(Br)	

The sample thickness is 0.5mm.

* RT Copper

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Line-up
for
Network

Multi-layer circuit board materials for ICT infrastructure equipment

ICTインフラ機器向け多層基板材料

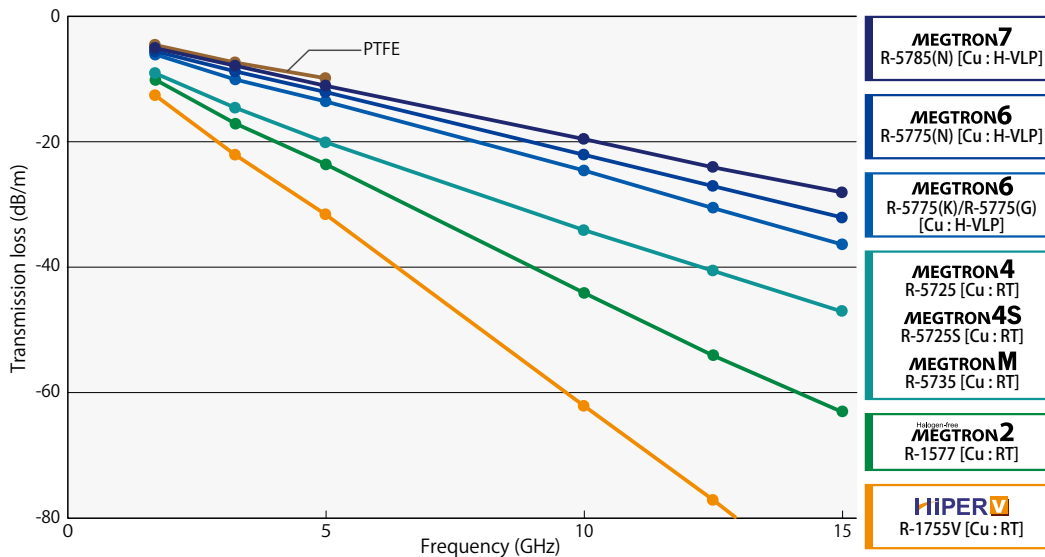
*ICT...Information and Communication Technology

Applications 用途

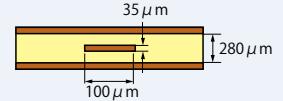
Server, Router, Switch, Supercomputer, Measuring instrument, Etc.
サーバ、ルータ、スイッチ、スーパーコンピュータ、半導体検査装置など

Multi-layer circuit board materials suitable to large capacity and high speed transmission of high frequency signal.
高周波信号などの大容量・高速伝送に対応する多層基板材料

Line-up ラインアップ



Construction



Core	0.13mm
Prepreg	0.06mm x 2ply
Line length	1m
Cu thickness	t=35 μm
Impedance	50Ω

General properties 一般特性

Item	Tg	CTE z-axis		T288 (with copper)	Dk	Df	Peel strength*1	
		a1	a2					
Test method	DSC	IPC-TM-650 2.4.24		IPC-TM-650 2.4.24.1	IPC-TM-650 2.5.5.9		IPC-TM-650 2.4.8	
Condition	A	A		A	C-24/23/50		A	
Unit	°C	ppm/°C		min	-		kN/m	
MEGTRON7	R-5785(N)	200	42	280	>120	3.4	0.001	0.8
	R-5785(GN)	200	42	280	>120	3.4	0.001	0.8
	R-5785(GE)	200	42	280	>120	3.6	0.002	0.8
Halogen-free MEGTRON6	R-5375(N)	250*2	39	200	>120	3.4	0.001	0.6
	R-5375(E)	250*2	39	200	>120	3.7	0.002	0.6
MEGTRON6	R-5775(N)	185	45	260	>120	3.4	0.002	0.8
	R-5775(K)/R-5775(G)	185	45	260	>120	3.7	0.002	0.8
MEGTRON4	R-5725	176	35	265	30	3.8	0.005	1.1
MEGTRON4S	R-5725S	200	32	250	50	3.8	0.005	1.3
MEGTRONM	R-5735	195	31	240	35	3.9	0.005	1.2
Halogen-free MEGTRON2	R-1577	170	34	200	25	4.1	0.010	1.3
HIPER V	R-1755V	173	44	255	20	4.4	0.016	1.5

The sample thickness of MEGTRON7, MEGTRON6 and Halogen-free MEGTRON6 is 0.75mm. The sample thickness of other part number is 0.8mm.

*1 MEGTRON7, MEGTRON6 is H-VLP copper. Halogen-free MEGTRON6 is H-VLP2 copper. MEGTRON4, MEGTRON4S, MEGTRON M is RT copper. MEGTRON2, HIPER V is ST copper.

*2 <Test method> DMA

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Ultra-low transmission loss Highly heat resistant Multi-layer circuit board materials

超低伝送損失・高耐熱多層基板材料

MEGTRON7

Laminate R-5785(N) R-5785(GN) R-5785(GE)
Prepreg R-5680(N) R-5680(GN) R-5680(GE)

Applications 用途

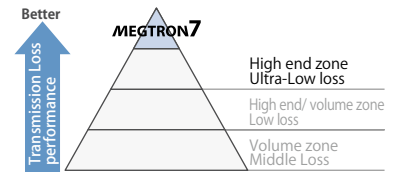
ICT infrastructure equipment, Supercomputer, Measuring instrument, Antenna(Base station, Automotive millimeter-wave radar), Etc.

ICT インフラ機器 (スーパーコンピュータ、計測用機器)、
アンテナ (基地局、車載ミリ波レーダ)、高周波用途など



Due to our industry leading low dielectric constant and dissipation factor, these materials are suitable for high-speed data transmission by servers and routers using high-layercount, large-size PCB designs.

業界最高クラスの低誘電率・低誘電正接により大容量・高速伝送に対応し、
大型高速サーバの性能向上に貢献。超高多層化・基板サイズの大型化にも対応

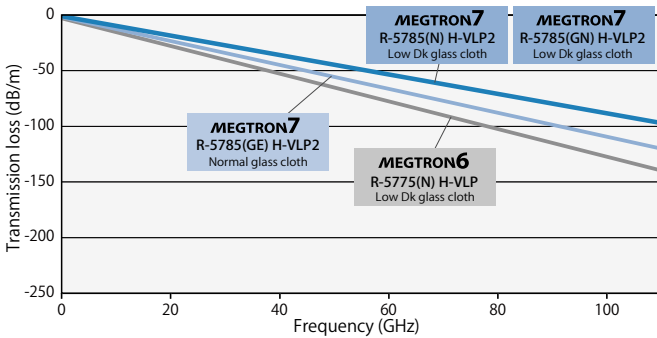


Dk 3.4 Df 0.002
@12GHz

Tg (DSC)
200°C

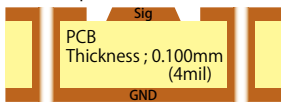
T288 (with copper)
>120min

Frequency dependence by Transmission loss 伝送損失比較



Construction

Microstrip line



Layer1 : Signal Line
(line width : 270 μm)
(Cu thickness : 24 μm)

Layer2 : GND Plane
(Cu thickness : 24 μm)

Measurement	2 port S-Parameter
Frequency	10MHz-110GHz
De-embedded	Multiline TRL method
Measurement line	adjust to 50Ω(Zo)

Heat resistance of High Multi-layered 高多層耐熱性

Result

Drill diameter	φ 0.3mm		
Wall to wall distance	0.4mm	0.5mm	0.6mm
R-5785(N) Low Dk glass cloth/H-VLP2	pass	pass	pass
R-5785(GN) Low Dk glass cloth/H-VLP2	pass	pass	pass

Condition

260°C reflow x 20times

Construction

32 Layers
Board thickness: 4.5mm



R-5785 (N)



R-5785 (GN)

General properties 一般特性

Item	Test method	Condition	Unit	MEGTRON7 R-5785(N) Low Dk glass cloth	MEGTRON7 R-5785(GN) Low Dk glass cloth	MEGTRON7 R-5785(GE) Normal glass cloth
Glass transition temp.(Tg)	DSC	A	°C	200	200	200
CTE z-axis	α1	IPC-TM-650 2.4.24	A	ppm/°C	42	42
					α2	280
T288(with copper)	IPC-TM-650 2.4.24.1	A	min	>120	>120	>120
Dielectric constant(Dk)	12GHz	Balanced-type circular disk resonator	C-24/23/50	-	3.4	3.4
Dissipation factor(Df)					0.002	0.002
Peel strength*	1oz(35 μm)	IPC-TM-650 2.4.8	A	kN/m	0.8	0.8

The sample thickness is 0.75mm.

* R-5785(GN), R-5785(GE): H-VLP2, R-5785(N): H-VLP Copper

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Ultra-low transmission loss Highly heat resistant Multi-layer circuit board materials

超低伝送損失・高耐熱多層基板材料

MEGTRON6

Laminate R-5775(N)* R-5775(K) R-5775(G)
Prepreg R-5670(N)* R-5670(K) R-5670(G)

*Low Dk glass cloth type

Applications 用途

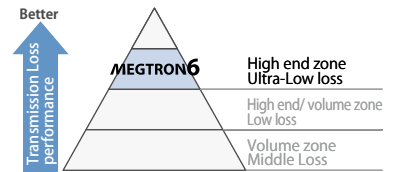
ICT infrastructure equipment, Supercomputer, Measuring instrument, Antenna(Base station, Automotive millimeter-wave radar), Etc.

ICT インフラ機器 (スーパーコンピュータ、計測用機器)、アンテナ (基地局、車載ミリ波レーダ)、高周波用途など



The industry standard for high speed, ultra-low loss PCB material. Excellent HDI and thermal performance.

超高性能サーバルータ向け材料のデファクトスタンダード。低伝送ロスを実現し、超高性能サーバルータの性能向上に貢献

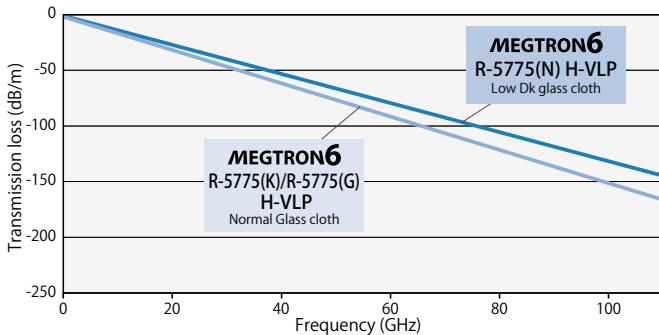


Dk 3.4 Df 0.004
@12GHz

Tg (DSC)
185°C

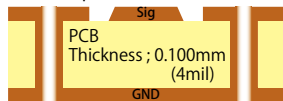
T288 (with copper)
>120min

Frequency dependence by Transmission loss 伝送損失比較



Construction

Microstrip line



Measurement	2 port S-Parameter
Frequency	10MHz-110GHz
De-embedded	Multiline TRL method
Measurement line	adjust to 50Ω(Zo)

Layer1 : Signal Line (line width : 270 μm) (Cu thickness : 24 μm)
Layer2 : GND Plane (Cu thickness : 24 μm)

Heat resistance of High Multi-layered 高多層耐熱性

Result

Drill diameter	φ 0.3mm	
Wall to wall distance	0.5mm	0.6mm
MEGTRON6 (Low Dk glass cloth)	pass	pass

Condition

260°C reflow x 10times

Construction

32 Layers
Board thickness: 4.5mm



General properties 一般特性

Item	Test method	Condition	Unit	MEGTRON6 R-5775(N) Low Dk glass cloth	MEGTRON6 R-5775(K)/R-5775(G) Normal glass cloth
Glass transition temp.(Tg)	DSC	A	°C	185	185
CTE z-axis	IPC-TM-650 2.4.24	A	ppm/°C	α1	45
				α2	260
T288(with copper)	IPC-TM-650 2.4.24.1	A	min	>120	>120
Dielectric constant(Dk)	Balanced-type circular disk resonator	C-24/23/50	-	12GHz	3.4
Dissipation factor(Df)				0.004	
Peel strength*	1oz(35 μm)	IPC-TM-650 2.4.8	A	kN/m	0.8

The sample thickness is 0.75mm.

* H-VLP Copper

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Halogen-free Ultra-low transmission loss Multi-layer circuit board materials

ハロゲンフリー超低伝送損失多層基板材料

Halogen-free
MEGTRON6
Laminate R-5375(N)* R-5375(E)
Prepreg R-5370(N)* R-5370(E)
*Low Dk glass cloth type

Applications 用途

ICT infrastructure equipment, High speed networking(High-end server/ router, Optical network, switch), High layer count PCB, Etc.

ICT インフラ機器、高速通信機器 (ハイエンドサーバ、ルータ、光ネットワーク、スイッチ)、高多層基板など



The industry standard high-speed, ultra-low loss material.

Transmission loss is between MEGTRON6 R-5775(K)/R-5775(G) and MEGTRON7 R-5785(N).

Excellent HDI and thermal performance.

超高性能サーバやルータ向けのデファクトスタンダード材料にハロゲンフリーを付与。

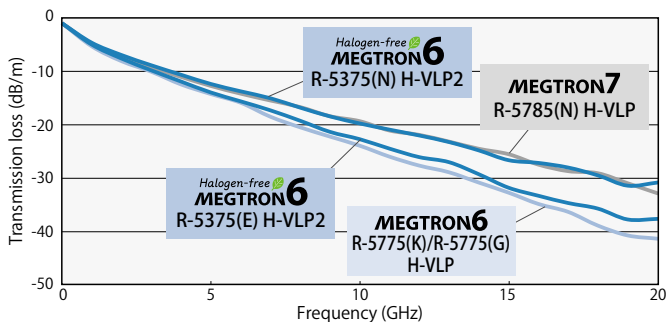
MEGTRON6 を超える低伝送ロスを実現し、超高性能サーバやルータの性能向上に貢献

Dk 3.4 Df 0.003
@ 12GHz

Tg (DMA)
250°C

T320 (with copper)
>120min.

Frequency dependence by Transmission loss 伝送損失比較



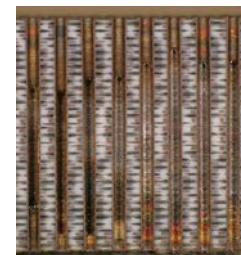
Heat resistance of High Multi-layered 高多層耐熱性

Result

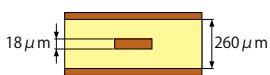
Drill diameter	φ 0.3mm	
Wall to wall distance	0.3mm	0.5mm
Halogen-free MEGTRON6 R-5375(E)	Pass	Pass

Condition
260°C reflow x 10times

Construction
32 Layers
Board thickness: 4.5mm



Construction



Line length	200mm, 100mm
Line width	125 μm
Impedance	50Ω
Inner Cu treatment	No-surface treatment
Core	0.13mm
Prepreg	#2116 56% x 1ply

General properties 一般特性

Item	Test method	Condition	Unit	Halogen-free MEGTRON6 R-5375(N) Low Dk glass cloth	Halogen-free MEGTRON6 R-5375(E) E glass cloth	MEGTRON6 R-5775(K)/R-5775(G) E glass cloth	
Glass transition temp.(Tg)	DMA (1Hz)	A	°C	250	250	210 ^{*1}	
Thermal expansion	TMA (Z direction)	50-260°C	%	1.7	1.7	2.9	
T288(with copper)	IPC-TM-650 2.4.24.1	A	min	>120	>120	>120	
T320(with copper)				>120	>120	50	
Dielectric constant(Dk)	12GHz	Balanced -type circular disk resonator	C-24/23/50	3.4	3.7	3.6	
Dissipation factor(Df)							0.003
Peel strength	1oz(35 μm)	IPC-TM-650 2.4.8	A	kN/m	0.6 ^{*2}	0.6 ^{*2}	0.8 ^{*3}

The sample thickness is 0.75mm.

*1 10Hz *2 H-VLP2 Copper *3 H-VLP Copper

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Low transmission loss Highly heat resistant Multi-layer circuit board materials

低伝送損失・高耐熱多層基板材料

MEGTRON4 MEGTRON4S MEGTRONM
Laminate **R-5725 R-5725S R-5735**
Prepreg **R-5620 R-5620S R-5630**

Applications 用途

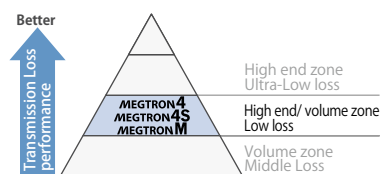
ICT infrastructure equipment, Supercomputer, Measuring instrument, Antenna, Etc.

ICT インフラ機器、スーパーコンピュータ、計測用機器、通信アンテナなど



Suitable for high-speed large-volume data transmission by servers and routers at high-end and volume designs.

大容量データの伝送速度の高速化に対応。
高多層や基板加工時のリフロー工程に対応した耐熱性を向上 (MEGTRON4S/MEGTRON M)

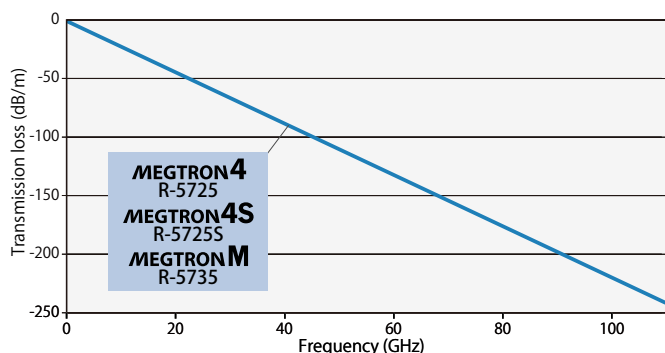


Dk 3.8 Df 0.007
@10GHz

Tg (DSC)
176°C

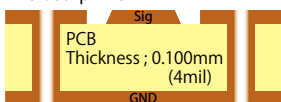
T288 (with copper)
30min

Frequency dependence by Transmission loss 伝送損失比較



Construction

Microstrip line



Layer1 : Signal Line
(line width : 270 μm)
(Cu thickness : 24 μm)

Layer2 : GND Plane
(Cu thickness : 24 μm)

Measurement	2 port S-Parameter
Frequency	10MHz-110GHz
De-embedded	Multiline TRL method
Measurement line	adjust to 50Ω (Zo)

Heat resistance of High Multi-layered 高多層耐熱性

Result

Drill diameter	φ0.3mm	
Wall to wall distance	0.6mm	0.7mm
MEGTRON4	pass	pass
MEGTRON4S	pass	pass
MEGTRONM	pass	pass

Condition

260°C reflow x 10times

Construction

28 Layers
Board thickness: 3.8mm



General properties 一般特性

Item	Test method	Condition	Unit	MEGTRON4 R-5725	MEGTRON4S R-5725S	MEGTRONM R-5735
Glass transition temp.(Tg)	DSC	A	°C	176	200	195
CTE z-axis	IPC-TM-650 2.4.24	A	ppm/°C	α1	35	31
				α2	265	240
T288(with copper)	IPC-TM-650 2.4.24.1	A	min	30	50	35
Dielectric constant(Dk)	10GHz	IPC-TM-650 2.5.5.5	C-24/23/50	-	3.8	3.9
Dissipation factor(Df)					0.007	0.007
Peel strength*	1oz(35 μm)	IPC-TM-650 2.4.8	A	kN/m	1.1	1.2

The sample thickness is 0.8mm.

* RT Copper

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Halogen-free Low transmission loss Highly heat resistant Multi-layer circuit board materials

ハロゲンフリー低伝送損失・高耐熱多層基板材料

Halogen-free
MEGTRON²
Halogen-free
MEGTRON²E

Laminate **R-1577 R-1577E**

Prepreg **R-1570 R-1570E**

Applications 用途

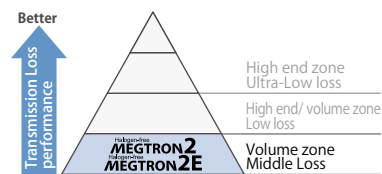
ICT infrastructure equipment, Measuring instrument, Etc.

ICT インフラ機器、計測機器など



Halogen-free High Tg material suitable for large volume high speed data transmission.

ハロゲン系難燃剤など含まない環境対応材で、ボリュームゾーンのサーバ・ルータなどの更なる高速化に対応

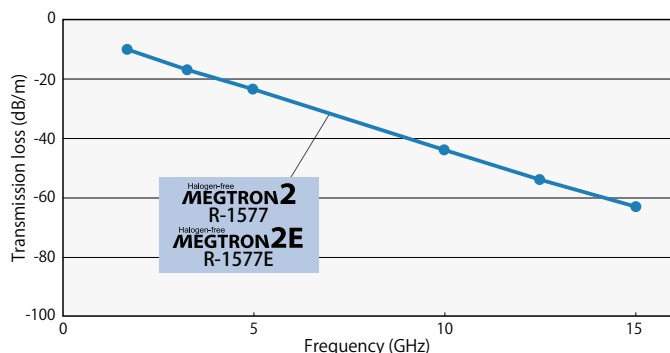


Dk 4.0 Df 0.013
@10GHz

Tg (DSC)
170°C

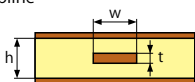
Halogen-free
Lead-free soldering

Frequency dependence by Transmission loss 伝送損失比較



Construction

Stripline



Trace width (w)	0.1mm
Trace thickness (t)	0.035mm
Dielectric thickness (h)	0.28mm
Core	0.13mm
Prepreg	0.06mm x 2ply
Line length	1m
Impedance	50Ω

Heat resistance of High Multi-layered 高多層耐熱性

Result

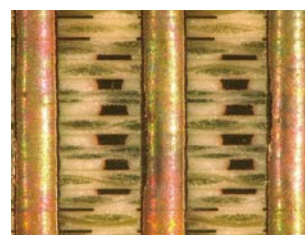
	φ 0.3mm		
	0.5mm	0.6mm	0.7mm
MEGTRON ²	pass	pass	pass
MEGTRON ² E	pass	pass	pass

Condition

260°C reflow x 10times

Construction

28 Layers
Board thickness: 3.8mm



General properties 一般特性

Item	Test method	Condition	Unit	MEGTRON ² R-1577	MEGTRON ² E R-1577E
Glass transition temp.(Tg)	DSC	A	°C	170	173
CTE z-axis	α 1	IPC-TM-650 2.4.24	A	ppm/°C	34
					α 2
T288(with copper)	IPC-TM-650 2.4.24.1	A	min	25	25
Dielectric constant(Dk)	10GHz	IPC-TM-650 2.5.5.5	C-24/23/50	-	4.0
Dissipation factor(Df)					0.013
Peel strength	1oz(35μm)	IPC-TM-650 2.4.8	A	kN/m	1.3

The sample thickness is 0.8mm.

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Highly heat resistant Low CTE Multi-layer circuit board materials <High-Tg type>

高耐熱・低熱膨張多層基板材料 <High-Tgタイプ>



Laminate **R-1755V**

Prepreg **R-1650V**

Applications 用途

ICT infrastructure equipment, Measuring instrument, Etc.

ICT インフラ機器、計測機器など



Good for hybrid board with MEGTRON series. Standard loss material.

スタンダード領域の伝送ロスを有しており、MEGTRON シリーズとのハイブリットが可能

Dk 4.4 Df 0.016
@1GHz

Tg (DSC)
173°C

T288 (with copper)
20min

■ IST (Interconnect Stress Test)

● Result

Sample No.	Reflow condition	HiPER V R-1755V
1	—	Over 1000 cycles OK
2	230°C x 3times	Over 1000 cycles OK
3	230°C x 6times	Over 1000 cycles OK
4	260°C x 3times	Over 1000 cycles OK
5	260°C x 6times	Over 1000 cycles OK

● Condition

Pretreatment	Reflow
	25°C (2min) ⇔ 150°C (3min)

● Construction

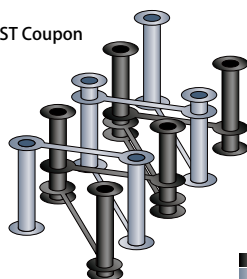
Board thickness	2.1mm
Number of layers	18 layers

* Failure is over 10% changes of resistance

What is IST ?

Carrying out temperature cycling experiments 25°C ⇔ 150°C by electric heating to the power unit. By detecting the occurrence of deficiencies in the sense unit, evaluating the number of cycles to failure occurrences.

IST Coupon



Power Sense

■ Solder heat resistance (float) はんだフロート耐熱性

● Result

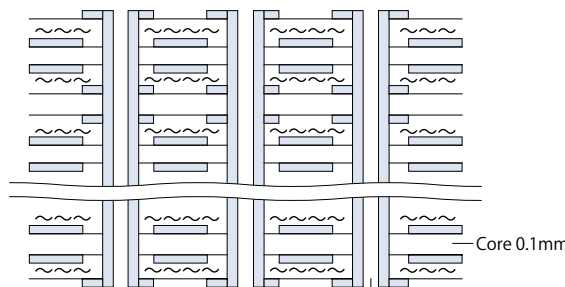
R-1755V : No abnormality of cross-sectional observation

● Condition

288°C 10sec. Solder float 6 cycles

● Construction

Board thickness	3.1mm
Layer count	24 layers
Drill diameter/Pitch	0.25 mm φ / 0.76mm



Prepreg #2116 53% 1ply

■ General properties 一般特性

Item	Test method	Condition	Unit	HiPER V R-1755V	
Glass transition temp.(Tg)	DSC	A	°C	173	
CTE z-axis	IPC-TM-650 2.4.24	A	ppm/°C	α 1	
				α 2	
T288(with copper)	IPC-TM-650 2.4.24.1	A	min	20	
Dielectric constant(Dk)	1GHz	IPC-TM-650 2.5.5.9	C-24/23/50	—	4.4
Dissipation factor(Df)					0.016
Peel strength	1oz(35 μm)	IPC-TM-650 2.4.8	A	kN/m	1.5

The sample thickness is 0.8mm.

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High performance Mass laminations (Shield board)

高性能内層回路入り多層基板材料(シールド板)

PreMulti

C-5870

Applications 用途

ICT infrastructure equipment, Antenna(Base station, Automotive millimeter-wave radar), Semiconductor test equipment, Automotive component, Etc.

ICT インフラ機器、アンテナ(基地局、車載ミリ波レーダ)、半導体検査装置、車載機器など



Providing high-quality shield board used high-performance circuit board material (MEGTRON6).
It's available to reduce the circuit forming process at customer and correspond to sequentially-laminated multilayer board.

高性能基板材料をシールド板にすることで高品質な製品を提供。

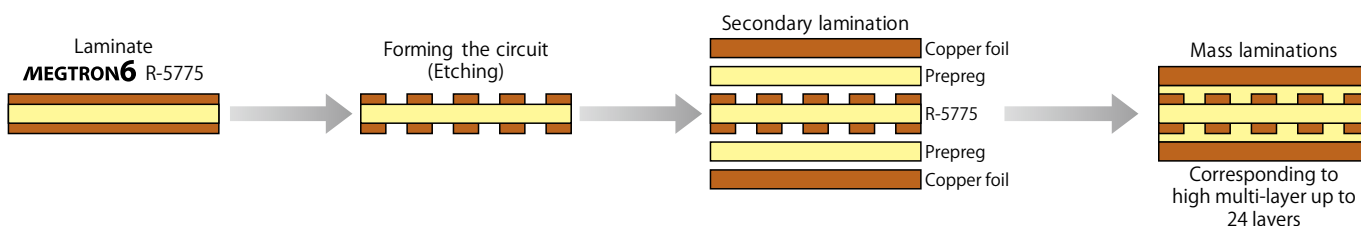
また、お客様の回路形成負荷低減や、全数層ずれ管理によるシーケンシャル基板にも対応可能

High performance
Mass laminations

High multi-layered
~24 layers

AOI inspection for all materials

What's Mass laminations? 内層回路入り多層基板材料とは?



Line-up ラインアップ

Item	Specification	
Thickness(Max.)	2.4mm + 10%	Please contact us regarding the specification of each material
Thickness(Min.)	0.4mm ± 10%	
Size	Each side:300~600mm	
Layer	4-24 Layer	

* Please contact us regarding more than 24 layers

Copper foil		Thickness(mm)			
Inner	RT	—	0.018	0.035	0.070
	H-VLP	0.012	0.018	0.035	—
Outside	ST	0.012	0.018	0.035	0.070
	H-VLP	0.012	0.018	0.035	—

Specification list 仕様一覧

Item	Specification
Dimensional tolerance between the reference mark	±0.15mm
Accuracy of the layer reach	0.15mm or less
Warpage	1% or less of the long side
Solder heat resistance Boiling for 2h 260°C solder Dip for 30 seconds	No abnormality

* If you have any inquiry or requirement, please contact us.

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Low CTE IC substrate materials Designed to Improve Reliability

低熱膨張・高実装信頼性半導体パッケージ基板材料

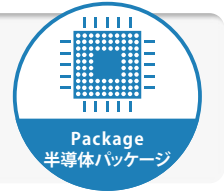
LEXCMGX

Laminate R-1515V (Low CTE glass cloth)

Laminate R-1515K (Normal glass cloth)

Applications 用途

IC substrate
FC-BGA (CPU, GPU, FPGA, ASIC, etc.)
半導体パッケージ基板 (CPU、GPU、FPGA、ASICなどのFC-BGAパッケージ)



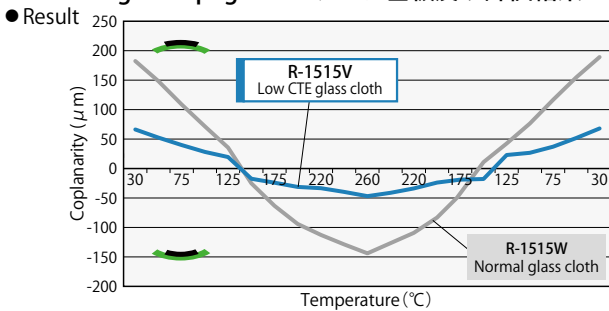
Low CTE reduces warping and addresses a critical challenge with the IC packaging process. Flexibility and buffering features through a stress relaxation technology improves the reliability of the assembly process. Offering excellent thickness tolerances. 低熱膨張性で反りを抑制し、IC チップの一次実装の不具合を低減、さらに樹脂の伸縮性と緩衝性を合わせ持つ応力緩和技術により二次実装の信頼性を向上させます。板厚精度に優れ、サブストレートとIC チップとの接合を安定化。

CTE x,y-axis 3-5ppm/°C
(Low CTE glass cloth)

Stress Relaxation

Good Thickness Variation

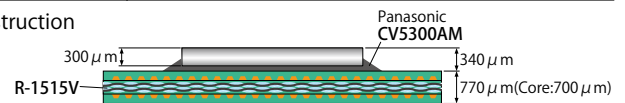
IC Package Warpage パッケージ基板反り評価結果



● Sample

Core Thickness	700 μm (12-12 μm)
Package size	35 x 35mm (Die size 15 x 15mm)

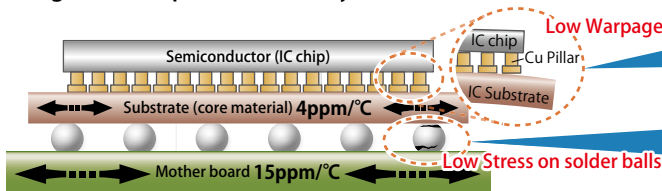
● PKG Construction



A wide range of Thickness Line-up 豊富な板厚をラインアップ

R-1515V (Low CTE glass cloth)	0.21~1.8mm
R-1515K (Normal glass cloth)	

Designed to Improve Reliability 高い実装信頼性



Low CTE

Low thermal expansion coefficient (CTE): close to that of silicon IC chips, which reduces warping and addresses a critical challenge with the IC chip packaging process.

Stress Relaxation

Combines flexibility and buffering features while retaining low thermal expansion properties through a stress relaxation technology, improving the reliability of the assembly process.

General properties 一般特性

Item	Test method	Condition	Unit	R-1515V Low CTE glass cloth	R-1515K Normal glass cloth	Conventional Normal glass cloth	
Glass transition temp.(Tg)	DMA*2	A	°C	260	260	260	
CTE x-axis	TMA*2	A	ppm/°C	3-5	7	8-10	
CTE y-axis				3-5	7	8-10	
Dielectric constant(Dk) ¹⁾	1GHz	IPC-TM-650 2.5.5.9	C-24/23/50	4.4	4.6	4.8	
Dissipation factor(Df) ¹⁾				0.016	0.015	0.015	
Elastic modulus ¹⁾	IPC-TM-650 2.4.4 ³⁾	25°C	GPa	30	27	33	
		250°C		14	12	21	
Peel strength	1/3oz(12μm)	IPC-TM-650 2.4.8	A	kN/m	0.6	0.6	0.9

The sample thickness is 100 μm. *1 700 μm *2 Measurement in tensile mode.

*3 The IPC standard determines the test sample size, methods and conditions, etc. but there is no formula for calculating the elastic modulus. Therefore, we quantified it according to JIS C 6481.

Our Halogen-free materials are based on JPCA-ES-01-2003 standard and others. 当社ハロゲンフリー材料は、JPCA-ES-01-2003などの定義によるものです。The above data are typical values and not guaranteed values. 上記データは当社測定による代表値であり、保証値ではありません。

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Ultra-low transmission loss Circuit board materials for IC substrate/ Module

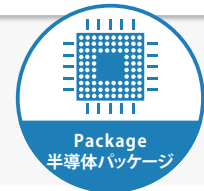
半導体パッケージ・モジュール基板向け超低損失材料

LEXCMGX

Laminate **R-G545L**(Low Dk glass cloth) **R-G545E**(Normal glass cloth)
Prepreg **R-G540L**(Low Dk glass cloth) **R-G540E**(Normal glass cloth)

Applications 用途

IC Package for base station application, Module part, Etc.
基地局向け半導体パッケージ基板、モジュール部分など



Excellent low-Dk/Df with low CTE property for the evolution of device.

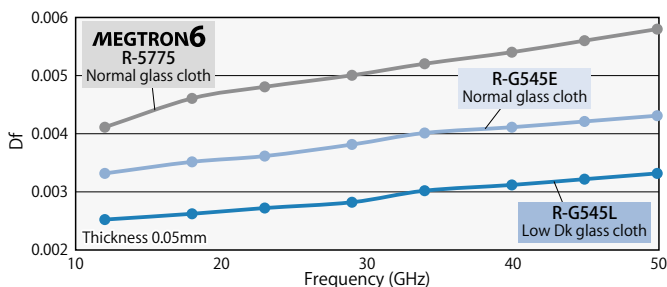
業界最高レベルの低 Dk/Df と低 CTE を両立し、デバイスの進化に貢献

Dk 3.5 Df 0.003
@12GHz

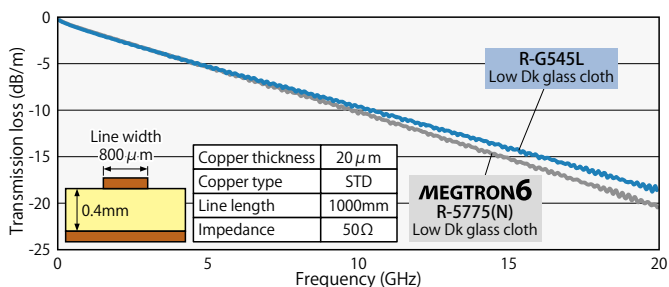
CTE x,y-axis 10ppm/°C
CTE z-axis 22ppm/°C

Tg (DMA)
230°C

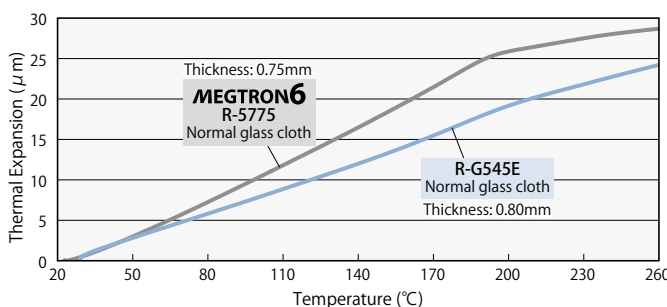
Df at Wide-frequency band 広周波帯域での誘電正接



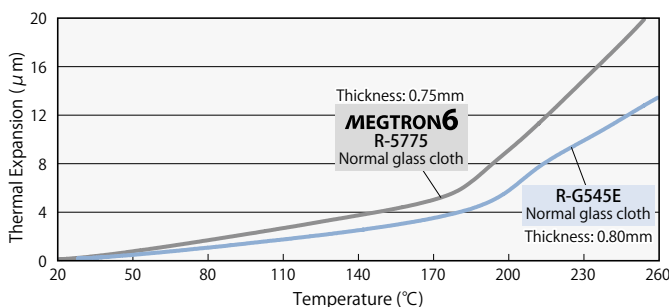
Frequency dependence by Transmission loss 伝送損失比較



TMAxy



TMAz



General properties 一般特性

Item	Test method	Condition	Unit	R-G545L Low Dk glass cloth	R-G545E Normal glass cloth
Glass transition temp.(Tg)	DMA*	A	°C	230	230
CTE x, y-axis	Internal method	A	ppm/°C	10	10
CTE z-axis				22	22
Dielectric constant(Dk)	Balanced type circular disk resonator	A	-	3.5	4.0
Dissipation factor(Df)				0.003	0.004
Water absorption	IPC-TM-650 2.6.2.1	D-24/23	%	0.06	0.06

The sample thickness is 0.1 mm.
*Measurement in tensile mode

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Low CTE Ultra-thin IC substrate materials

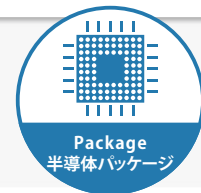
低熱膨張・極薄対応半導体パッケージ基板材料

LEXCMGX

Laminate R-G515S (Low CTE glass cloth) R-G515E (Normal glass cloth)
Prepreg R-G510S (Low CTE glass cloth) R-G510E (Normal glass cloth)

Applications 用途

IC substrate CSP (PoP-Bottom, Flip-Chip, Memory, Module, etc.)
半導体パッケージ基板 CSP (PoP-Bottom、Flip-Chip、Memory、Module など)



With an insulation layer thickness of 15 μm or less, these ultra-thin materials enable thin IC package designs. The low CTE property can reduce warpage and achieve a good reliability.

半導体パッケージの薄型化(絶縁層厚み15 μm以下)を実現する極薄サブストレート材料で、半導体に近い低熱膨張率を有し、熱膨張率の差によって発生する反りを抑制することで優れた実装信頼性を実現します。

CTE x,y-axis 4-6ppm/°C
(Low CTE glass cloth)

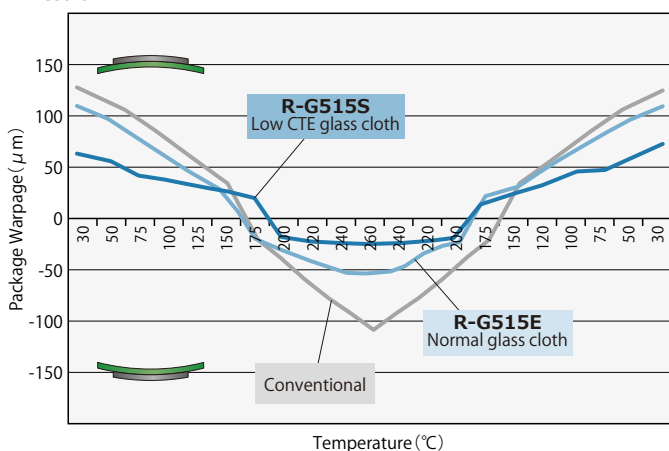
Low warpage

Ultra-thin
Excellent moldability

IC Package Warpage パッケージ基板反り評価結果

R-G515S, with low CTE glass cloth, reduces warpage to about half that of conventional Panasonic materials.

Result



PKG Construction

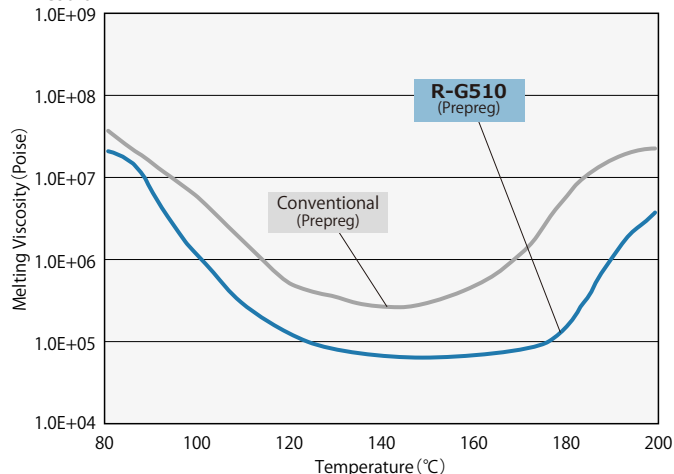


Package size	12.5 x 12.5mm
Die size	10 x 10 x 0.10mmt
CUF material	Panasonic CV5300AM
Substrate thickness	0.2mmt (2L Cu:12 μm)

Melting and Curling Behavior 溶融粘度挙動

R-G510 has a wider melting area and higher moldability than conventional Panasonic materials.

Result



General properties 一般特性

Item	Test method	Condition	Unit	LEXCMGX R-G515S Low CTE glass cloth	LEXCMGX R-G515E Normal glass cloth
Glass transition temp.(Tg)	DMA*1	A	°C	220-240	220-240
CTE x-axis	Internal method	A	ppm/°C	4-6	6-8
CTE y-axis				4-6	6-8
Young's modulus	ASTM D3039	25°C	GPa	23-28	22-27
Peel strength	1/3oz	IPC-TM-650 2.4.8	A	kN/m	0.7

The sample thickness is 0.1mm.

* DMA: Measurement in tensile mode

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High elasticity Low CTE Ultra-thin IC substrate materials

高弾性・低熱膨張・極薄対応半導体パッケージ基板材料

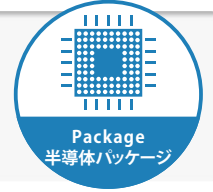
LEXCMGX

Laminate R-1515E

Prepreg R-1410E

Applications 用途

IC substrate
半導体パッケージ基板



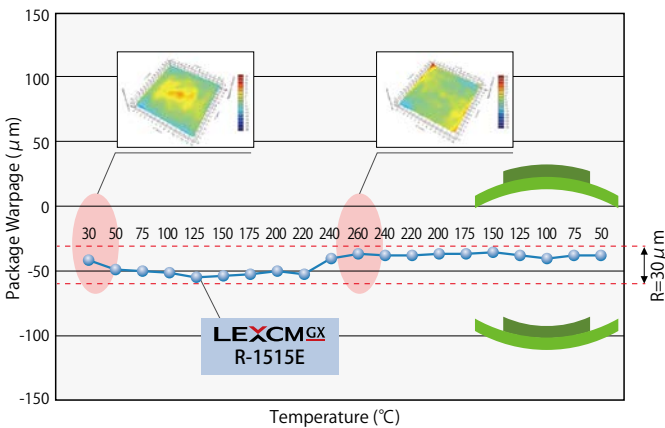
Contribute to thin IC package by ultra-thin material and decrease the substrate warpage by low CTE property.
極薄材料により半導体パッケージの薄型化や、熱膨張が低いためサブストレートの低反りを実現

Flexural modulus
25°C 33GPa

CTE x, y-axis
8-10ppm/°C

Tg (DMA)
270°C

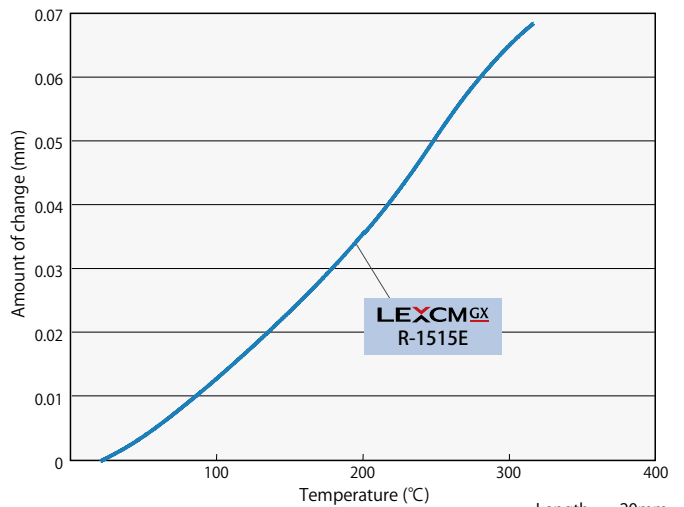
Package warpage(FBGA)
パッケージ基板反り評価結果(FBGA)



Construction

FBGA	14×14 mm
Chip size	10×10×0.15 mm
Substrate thickness	0.10 mm (Core 0.04mm)

Thermal expansion(x-axis) 熱膨張量(タテ方向)



Length : 20mm
Thickness : 0.1mm
Method : TMA

General properties 一般特性

Item	Test method	Condition	Unit	LEXCMGX R-1515E
Glass transition temp.(Tg)	DMA*2	A	°C	270
Thermal decomposition temp.(Td)	TGA	A	°C	390
CTE x-axis	α1	Internal method	ppm/°C	8-10
CTE y-axis				8-10
CTE z-axis*1	α1	IPC-TM-650 2.4.24	A	22
	α2			95
Flexural modulus*1	JIS C 6481	25°C	GPa	33
		250°C		18

The sample thickness is 0.1 mm.
*1 0.8mm *2 measurement in tensile mode

Our Halogen-free materials are based on JPCA-ES-01-2003 standard and others. 当社ハロゲンフリー材料は、JPCA-ES-01-2003 などの定義によるものです。The above data are typical values and not guaranteed values. 上記データは当社測定による代表値であり、保証値ではありません。

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Panasonic Electronic Materials Division launches a new product brand for the Semiconductor Device Materials business. The IC substrate materials' brand is transitioning from MEGTRON GX to LEXCM GX. パナソニック 電子材料事業部は、新たに半導体デバイス材料の製品ブランドを LEXCM(レクシム)としてスタートします。それに伴い、半導体パッケージ基板材料は MEGTRON GX から LEXCM GX へ変更いたします。

High elasticity Low CTE IC substrate materials

高弾性・低熱膨張半導体パッケージ基板材料

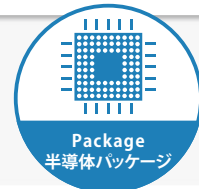
LEXCMGX

Laminate R-1515W

Prepreg R-1410W

Applications 用途

IC substrate
半導体パッケージ基板



Achieve more functionality (multi-pin and integrated circuit) the large-sized Package by excellent modulus and highly heat resistant property.

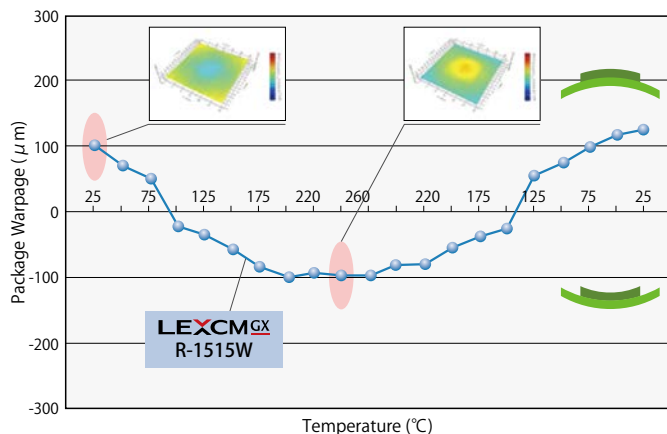
優れた弾性率と更なる耐熱性を付与し、多ピン化・伝送回路集積化に伴う大型パッケージの高機能化に貢献

Flexural modulus
25°C 35GPa

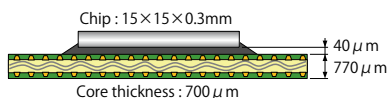
CTE x, y-axis
8-10ppm/°C

Tg (DMA)
250°C

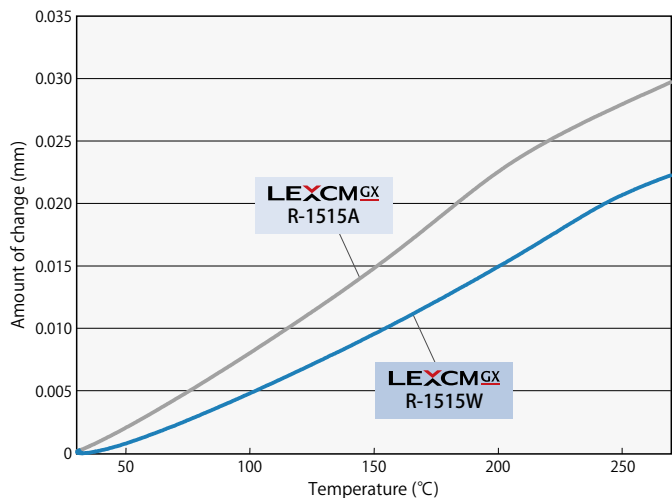
Package warpage パッケージ基板反り評価結果



Construction



Thermal expansion(x-axis) 熱膨張量(タテ方向)



Length : 10mm
Thickness : 0.8mm (8ply)
Method : TMA

General properties 一般特性

Item	Test method	Condition	Unit	LEXCMGX R-1515W
Glass transition temp.(Tg)	DMA*2	A	°C	250
Thermal decomposition temp.(Td)	TGA	A	°C	390
CTE x-axis	α 1	Internal method	ppm/°C	8-10
CTE y-axis				8-10
CTE z-axis	α 1	IPC-TM-650 2.4.24	A	22
	α 2			97
Flexural modulus*1	JIS C 6481	25°C	GPa	35
		250°C		21

The sample thickness is 0.1 mm.
*1 0.8mm *2 measurement in bending mode

Our Halogen-free materials are based on JPCA-ES-01-2003 standard and others. 当社ハロゲンフリー材料は、JPCA-ES-01-2003などの定義によるものです。The above data are typical values and not guaranteed values. 上記データは当社測定による代表値であり、保証値ではありません。

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Low CTE IC substrate materials

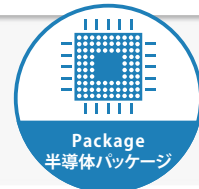
低熱膨張半導体パッケージ基板材料

LEXCMGX

Laminate **R-1515A**
Prepreg **R-1410A**

Applications 用途

IC substrate
半導体パッケージ基板



Achieve more functionality (multi-pin and integrated circuit) the large-sized Package by excellent modulus and highly heat resistant property.

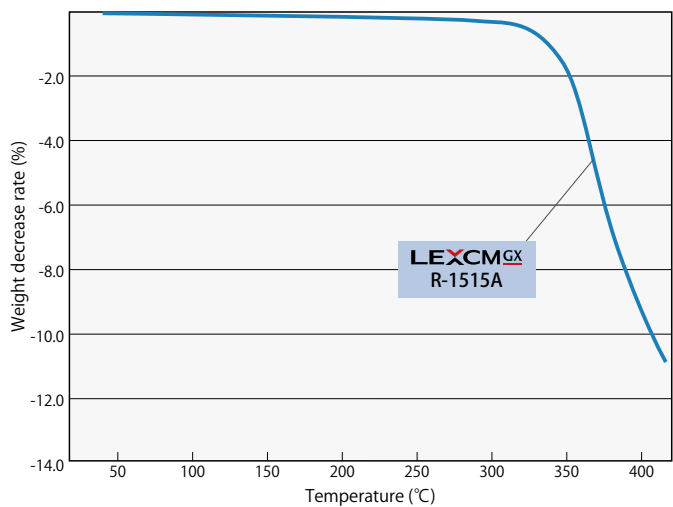
優れた弾性と耐熱性を有し、多ピン化・伝送回路集積化に伴う大型パッケージの高機能化に貢献

Flexural modulus
25°C 27GPa

CTE x, y-axis
11-13ppm/°C

Tg (DMA)
205°C

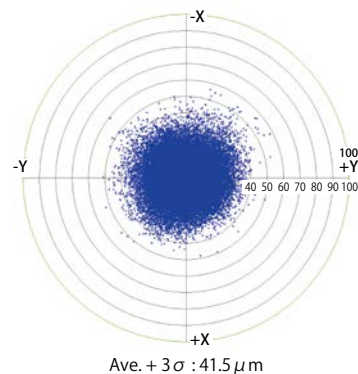
Heat resistance 耐熱性



Weight decrease @260°C

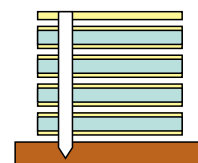
LEXCMGX R-1515A	0.2%
-----------------	------

Positioning accuracy 穴位置精度



Condition

Drill size	0.15mm φ
Flute length (ℓ)	3.0mm
Spindle speed	200krpm
Chip load	10 μm/rev
Hit count	20,000
Entry board	LE 800
Board thickness	0.4mm
Copper foil thickness	12/12 μm
Stack count	4



General properties 一般特性

Item	Test method	Condition	Unit	LEXCMGX R-1515A
Glass transition temp.(Tg)	DMA*2	A	°C	205
Thermal decomposition temp.(Td)	TGA	A	°C	390
CTE x-axis	α 1 Internal method	A	ppm/°C	11-13
CTE y-axis				11-13
Flexural modulus*1	JIS C 6481	25°C	GPa	27
		250°C		10

The sample thickness is 0.1 mm.
*1 0.8mm *2 measurement in bending mode

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Line-up
for
Automotive

Multi-layer circuit board materials for Automotive component

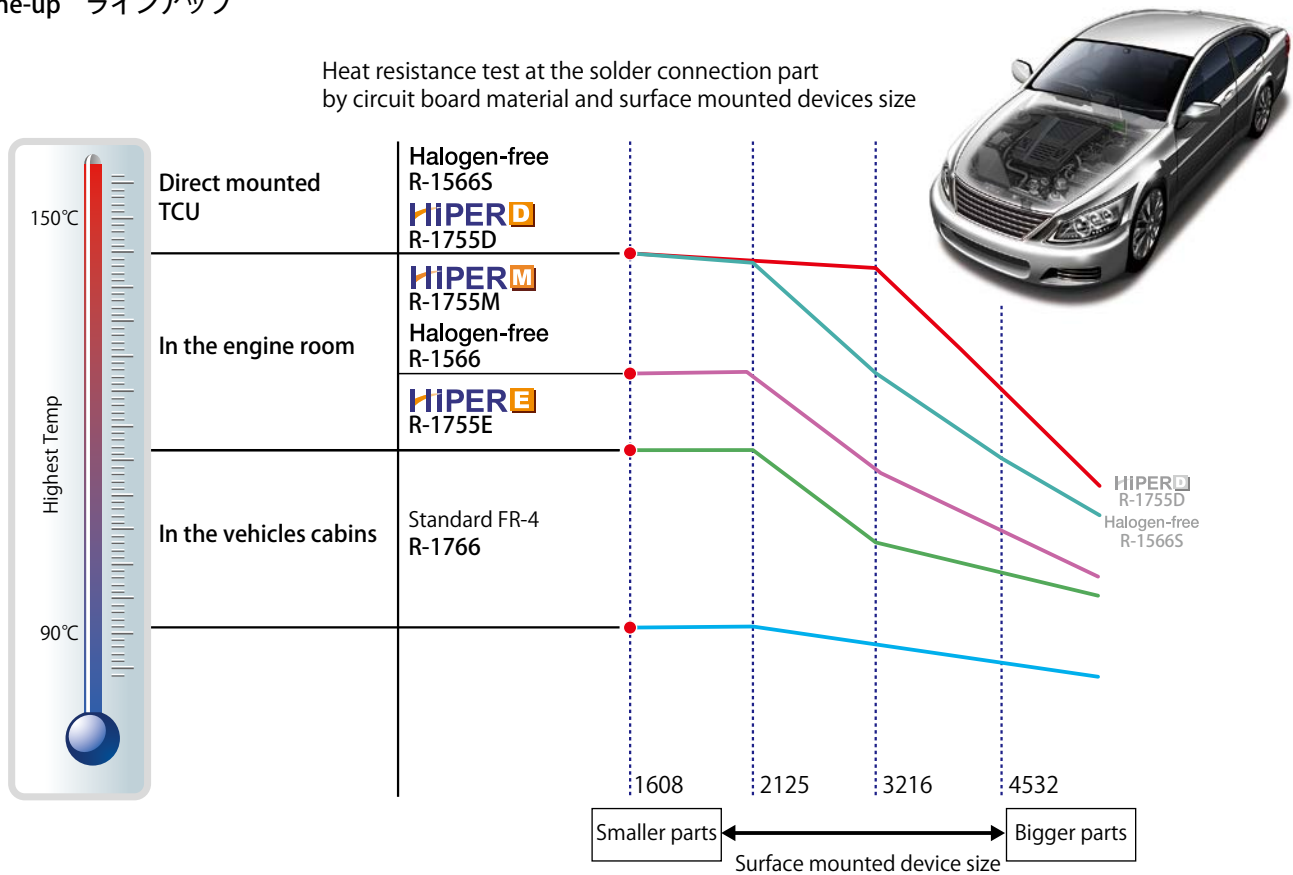
車載機器向け多層基板材料

Applications 用途

Automotive component(Direct mounted TCU, Power control ECU, Body control ECU), Etc.
車載機器 (エンジン直載 ECU, パワー系制御 ECU, ボディ系制御 ECU) など

Multi-layer circuit board materials with excellent highly heat resistant and high reliability.
高信頼性と高耐熱性に優れた多層基板材料

Line-up ラインアップ



General properties 一般特性

Item	Test method	Condition	Unit	Halogen-free R-1566S	HIAPER D R-1755D	HIAPER M R-1755M	Halogen-free R-1566	HIAPER E R-1755E	Standard FR-4 R-1766
Glass transition temp.(Tg)	DSC	A	°C	175	163	153	148	133	140
CTE x-axis	α 1	IPC-TM-650 2.4.24	A	ppm/°C	11-13	10-12	11-13	11-13	11-13
					13-15	12-14	13-15	13-15	13-15
CTE y-axis	α 1	IPC-TM-650 2.4.24	A	ppm/°C	40	43	40	40	42
					180	236	240	180	250
CTE z-axis	α 2	IPC-TM-650 2.4.24	A	ppm/°C	180	236	240	180	250
T288(with copper)	IPC-TM-650 2.4.24.1	A	min	10	15	18	3	25	1
Peel strength (1oz(35μm))	IPC-TM-650 2.4.8	A	kN/m	1.6	1.3	1.5	1.8	1.6	2.0

The sample thickness is 0.8mm.

Our Halogen-free materials are based on JPCA-ES-01-2003 standard and others. 当社ハロゲンフリー材料は、JPCA-ES-01-2003などの定義によるものです。The above data are typical values and not guaranteed values. 上記データは当社測定による代表値であり、保証値ではありません。

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Highly heat resistant Halogen-free Multi-layer circuit board materials

高耐熱ハロゲンフリー多層基板材料

Halogen-free

Laminate **R-1566S**
Prepreg **R-1551S**

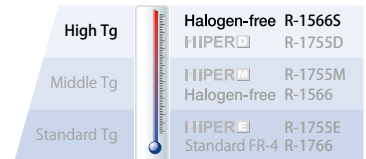
Applications 用途

Automotive ECU, Automotive module, HEV/EV power control unit, DC/DC converter board, Etc.
車載 ECU、車載モジュール、HEV/EV パワーコントロールユニット、DC/DC コンバータ用基板など



Added highly heat resistant and tracking resistance to automotive quality R-1566 to improve the reliability of ECU boards used under severe conditions.

従来の R-1566 より高耐熱性と耐トラッキング性を向上し、高温環境下で使用される ECU 用基板の信頼性に貢献



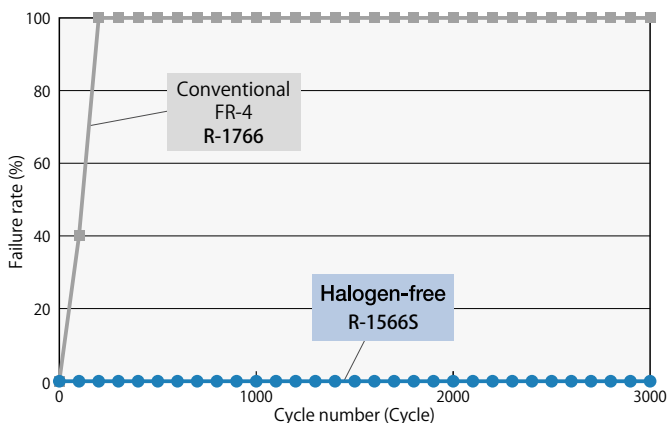
T_g (DSC)
175°C

T_d (TGA)
355°C

CTI ≥ 600V*

*actual value

Through-hole reliability スルーホール導通信頼性

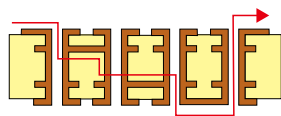


Condition

Cycle condition	-40°C (15min) ⇄ 160°C (15min)
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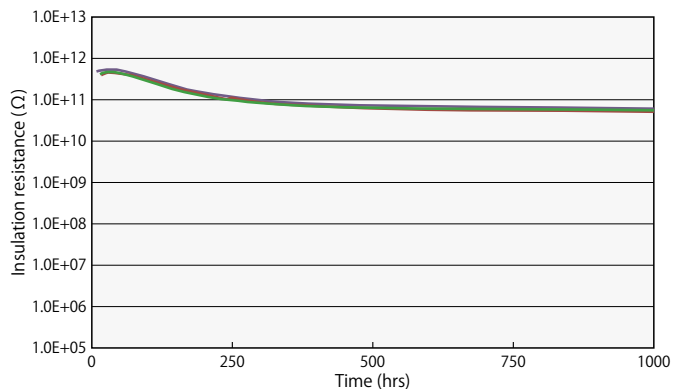
* Failure is over 10% changes of resistance
* 260°C Peak reflow x 3times as pretreatment

Construction



Insulation reliability 絶縁信頼性

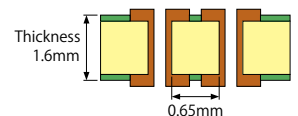
High voltage CAF evaluation



Condition

Pretreatment	260°C Peak reflow x 3times
Condition	85°C 85%RH DC 350V
Through-hole wall to wall distance	0.65mm

Construction



General properties 一般特性

Item	Test method	Condition	Unit	Halogen-free R-1566S	Conventional Halogen-free R-1566(W)
Glass transition temp.(T _g)	DSC	A	°C	175	148
	TMA			170	145
Thermal decomposition temp.(T _d)	TGA	A	°C	355	350
CTE z-axis	IPC-TM-650 2.4.24	A	ppm/°C	40	40
				180	180
T288(with copper)	IPC-TM-650 2.4.24.1	A	min	10	3
Peel strength	1oz(35 μm) IPC-TM-650 2.4.8	A	kN/m	1.6	1.8

The sample thickness is 0.8mm.

Our Halogen-free materials are based on JPCA-ES-01-2003 standard and others. 当社ハロゲンフリー材料は、JPCA-ES-01-2003 などの定義によるものです。The above data are typical values and not guaranteed values. 上記データは当社測定による代表値であり、保証値ではありません。

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Highly heat resistant Low CTE Multi-layer circuit board materials <High-Tg type>

高耐熱・低熱膨張多層基板材料 <High-Tgタイプ>



Laminate **R-1755D**

Prepreg **R-1650D**

Applications 用途

Automotive ECU, Etc.
車載 ECU など



Improved solder joint reliability by excellent connect reliability material.

Available for high voltage application by good to insulation reliability.

低温高温の温度サイクルでも接続信頼性に優れ、はんだ接続信頼性を向上。

絶縁信頼性に優れており、高電圧用途にも適用可

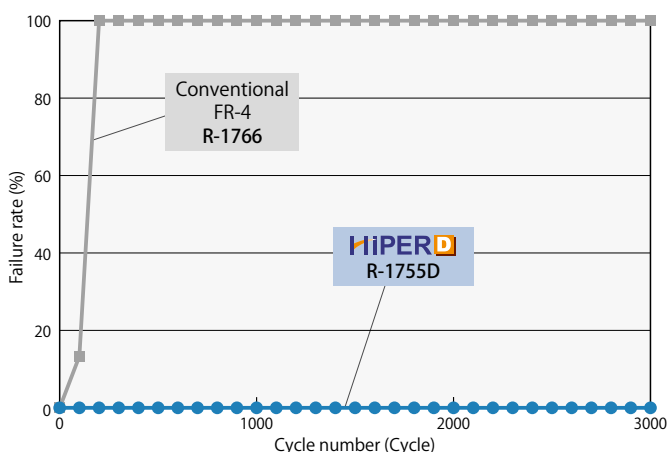
High Tg	Halogen-free R-1566S HiPERD R-1755D
Middle Tg	HiPERD R-1755M Halogen-free R-1566
Standard Tg	HiPERD R-1755E Standard FR-4 R-1766

T_g (DSC)
163°C

T_d (TGA)
345°C

CTE x-axis
10-12ppm/°C

Through-hole reliability スルーホール導通信頼性

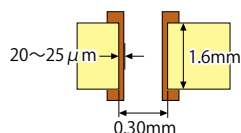


Condition

Cycle condition	-40°C (15min) ⇄ 150°C (15min)
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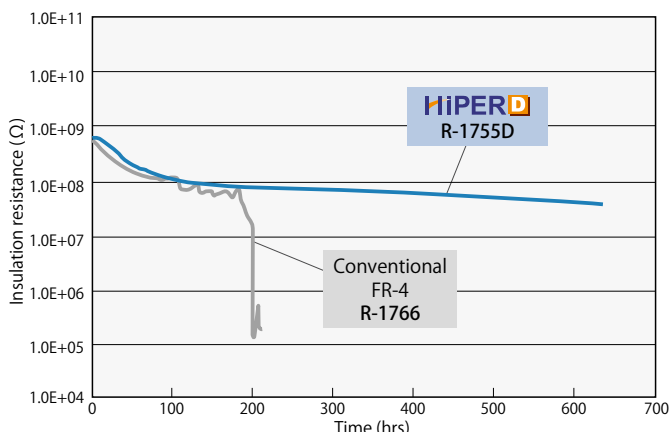
* Failure is over 10% changes of resistance

Construction



Insulation reliability 絶縁信頼性

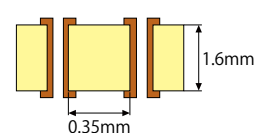
CAF evaluation



Condition

Board thickness	1.6mm
Condition	120°C 85%RH DC50V (HAST)
Through-hole wall to wall distance	0.35mm

Construction



General properties 一般特性

Item	Test method	Condition	Unit	HiPERD R-1755D	Conventional FR-4 R-1766
Glass transition temp.(T _g)	DSC	A	°C	163	140
Thermal decomposition temp.(T _d)	TGA	A	°C	345	315
CTE x-axis	IPC-TM-650 2.4.24	A	ppm/°C	10-12	11-13
CTE y-axis				12-14	13-15
T288(with copper)	IPC-TM-650 2.4.24.1	A	min	15	1
Peel strength	1oz(35 μm) IPC-TM-650 2.4.8	A	kN/m	1.3	2.0

The sample thickness is 0.8mm.

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Highly heat resistant Low CTE Multi-layer circuit board materials <Middle-Tg type>

高耐熱・低熱膨張多層基板材料 <Middle-Tgタイプ>

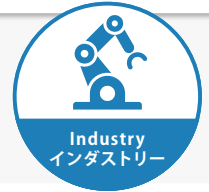


Laminate **R-1755M**

Prepreg **R-1650M**

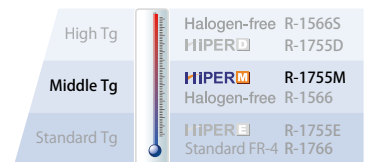
Applications 用途

Automotive component (ECU board), Photovoltaic (Inverter),
Electronic equipment requiring high reliability (using lead-free solder), Etc.
車載機器 (ECU 用基板)、太陽光発電、高信頼性が求められる電子機器
(鉛フリーはんだ使用) など



Improved connection reliability of circuit board for automotive by good CAF resistance.
Available for high voltage and industry application.

優れた耐CAF性により、車載用基板の接続信頼性を向上し更なる車の安全性に貢献。
高電圧用途・産業機器用途などにも対応

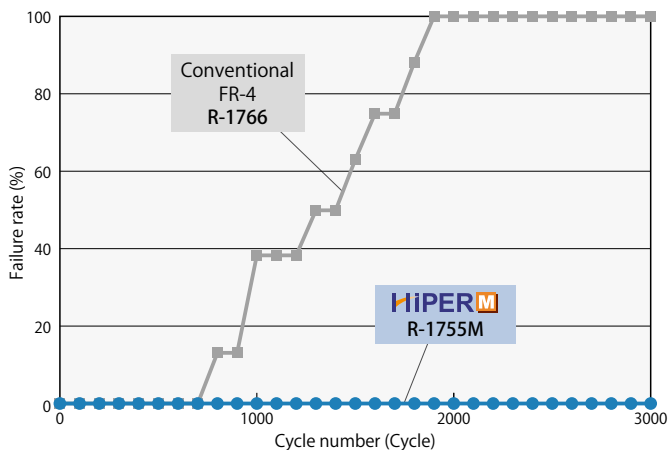


T_g (DSC)
153°C

T_d (TGA)
355°C

CTE z-axis
40ppm/°C

Through-hole reliability スルーホール導通信頼性

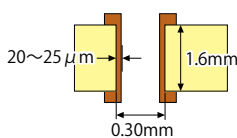


Condition

Cycle condition	-40°C (30min) ⇄ 125°C (30min)
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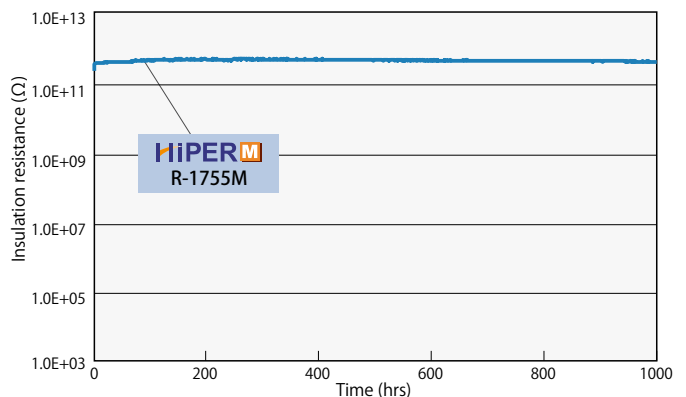
* Failure is over 10% changes of resistance

Construction



Insulation reliability 絶縁信頼性

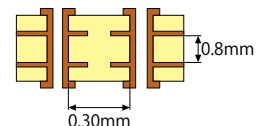
CAF evaluation



Condition

4-layers board	
Pretreatment	260°C Peak reflow x 3times
Condition	85°C 85%RH DC100V
Core	0.8 mm
Prepreg	#7628 x 1 ply
Through-hole wall to wall distance	0.30mm

Construction



General properties 一般特性

Item	Test method	Condition	Unit	HiPER M R-1755M	Conventional FR-4 R-1766
Glass transition temp.(T _g)	DSC	A	°C	153	140
Thermal decomposition temp.(T _d)	TGA	A	°C	355	315
CTE z-axis	IPC-TM-650 2.4.24	A	ppm/°C	α1	40
				α2	240
T288(with copper)	IPC-TM-650 2.4.24.1	A	min	18	1
Peel strength	1oz(35 μm) IPC-TM-650 2.4.8	A	kN/m	1.5	2.0

The sample thickness is 0.8mm.

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Halogen-free Multi-layer circuit board materials

ハロゲンフリー多層基板材料

Halogen-free

Laminate **R-1566** R-1566(W)*1 R-1566(WN)*2
Prepreg **R-1551** R-1551(W)*1 R-1551(WN)*2

*1 UV Shielding type *2 UV Shielding Heat resistance type

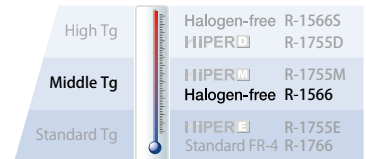
Applications 用途

Automotive component, Mobile phone, Amusement machine, Home appliance, Measuring instrument, Test equipment, Industry equipment (DC/DC converter) Etc.
車載機器、モバイル機器、携帯電話、アミューズメント機器、家電、計測機器、産業機器 (DC/DC コンバータ) など



Having many proven from car and mobile company with high reliability and halogen-free properties.

高い信頼性により車載機器やモバイル機器などに幅広く採用実績があり、環境への負荷を考慮したハロゲンフリー材料

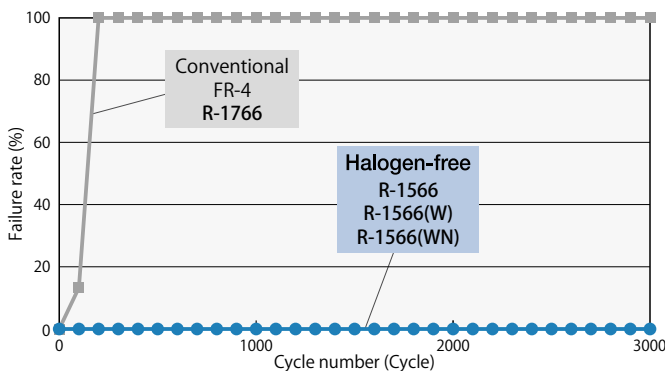


T_g (DSC)
148°C

T_d (TGA)
350°C

CTE z-axis
40ppm/°C

Through-hole reliability スルーホール導通信頼性

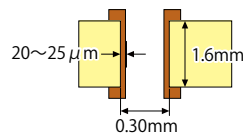


Condition

Cycle condition	-40°C (15min) ⇄ 150°C (15min)
-----------------	-------------------------------

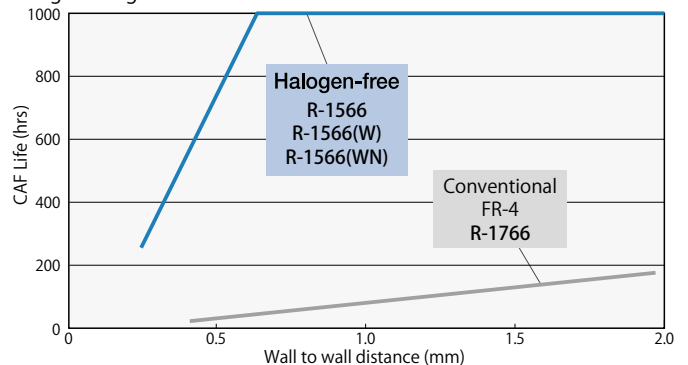
* Failure is over 10% changes of resistance

Construction



Insulation reliability 絶縁信頼性

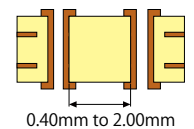
High voltage CAF evaluation



Condition

Pretreatment	260°C Peak reflow x 3times
Condition	85°C 85%RH DC1000V
Layer	4 layers
Core	1.1mm
Prepreg	#7628 1+1ply

Construction



General properties 一般特性

Item	Test method	Condition	Unit	Halogen-free R-1566 Standard type	Halogen-free R-1566(W) UV Shielding type	Halogen-free R-1566(WN) UV Shielding Heat resistance type	Conventional FR-4 R-1766
Glass transition temp.(T _g)	DSC	A	°C	148	148	148	140
Thermal decomposition temp.(T _d)	TGA	A	°C	350	350	355	315
CTE z-axis	IPC-TM-650 2.4.24	A	α1	40	40	40	65
			α2	180	180	180	270
T288(with copper)	IPC-TM-650 2.4.24.1	A	min	3	3	10	1
Peel strength	1oz(35 μm) IPC-TM-650 2.4.8	A	kN/m	1.8	1.8	1.8	2.0
Tracking resistance	IEC 60112	A	V	600>CTI≥400	600>CTI≥400	600>CTI≥400	250>CTI≥175

The sample thickness is 0.8mm.

Our Halogen-free materials are based on JPCA-ES-01-2003 standard and others. 当社ハロゲンフリー材料は、JPCA-ES-01-2003などの定義によるものです。The above data are typical values and not guaranteed values. 上記データは当社測定による代表値であり、保証値ではありません。

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Highly heat resistant Low CTE Multi-layer circuit board materials

高耐熱・低熱膨張多層基板材料



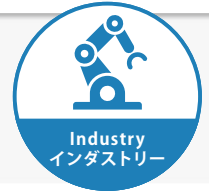
Laminate **R-1755E**

Prepreg **R-1650E**

Applications 用途

Automotive component (ECU board, GPS navigation system), Electric car, Industry, Appliance, Etc.

車載機器 (エンジン ECU、カーナビ)、電気自動車、産業機器、アプライアンスなど



Good highly heat resistant property as general materials apply to Automotive component in harsh environment, high voltage and Industry application.

汎用材でありながら耐熱性に優れており、高温環境の車載用途や高電圧用途、産業機器用途などに適用可能

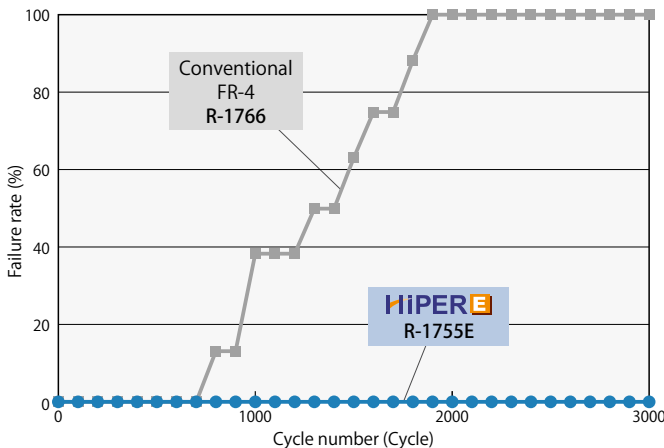
High Tg	Halogen-free R-1566S HiPER R-1755D
Middle Tg	HiPER R-1755M Halogen-free R-1566
Standard Tg	HiPER R-1755E Standard FR-4 R-1766

T_g (DSC)
133°C

T_d (TGA)
370°C

CTE z-axis
42ppm/°C

Through-hole reliability スルーホール導通信頼性

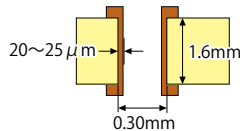


Condition

Cycle condition	-40°C (30min) ⇄ 125°C (30min)
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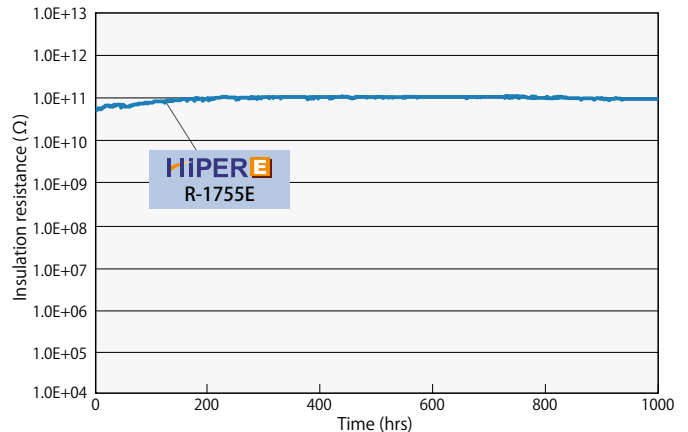
* Failure is over 10% changes of resistance

Construction



Insulation reliability 絶縁信頼性

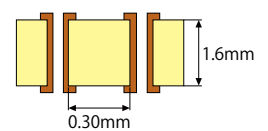
CAF evaluation



Condition

Board thickness	1.6mm
Condition	85°C 85%RH DC50V
Through-hole wall to wall distance	0.3mm

Construction



General properties 一般特性

Item	Test method	Condition	Unit	HiPER R-1755E	Conventional FR-4 R-1766
Glass transition temp.(T _g)	DSC	A	°C	133	140
Thermal decomposition temp.(T _d)	TGA	A	°C	370	315
CTE z-axis	IPC-TM-650 2.4.24	A	ppm/°C	α1	42
				α2	250
T288(with copper)	IPC-TM-650 2.4.24.1	A	min	25	1
Peel strength	1oz(35 μm) IPC-TM-650 2.4.8	A	kN/m	1.6	2.0

The sample thickness is 0.8mm.

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Circuit board materials for Mobile product

モバイル機器向け基板材料

Applications 用途

Smart phone(Mother board, Connection to PCB, Antenna, Alternative to micro-coaxial cable, Etc.)
Tablet PC, Module board, Etc.

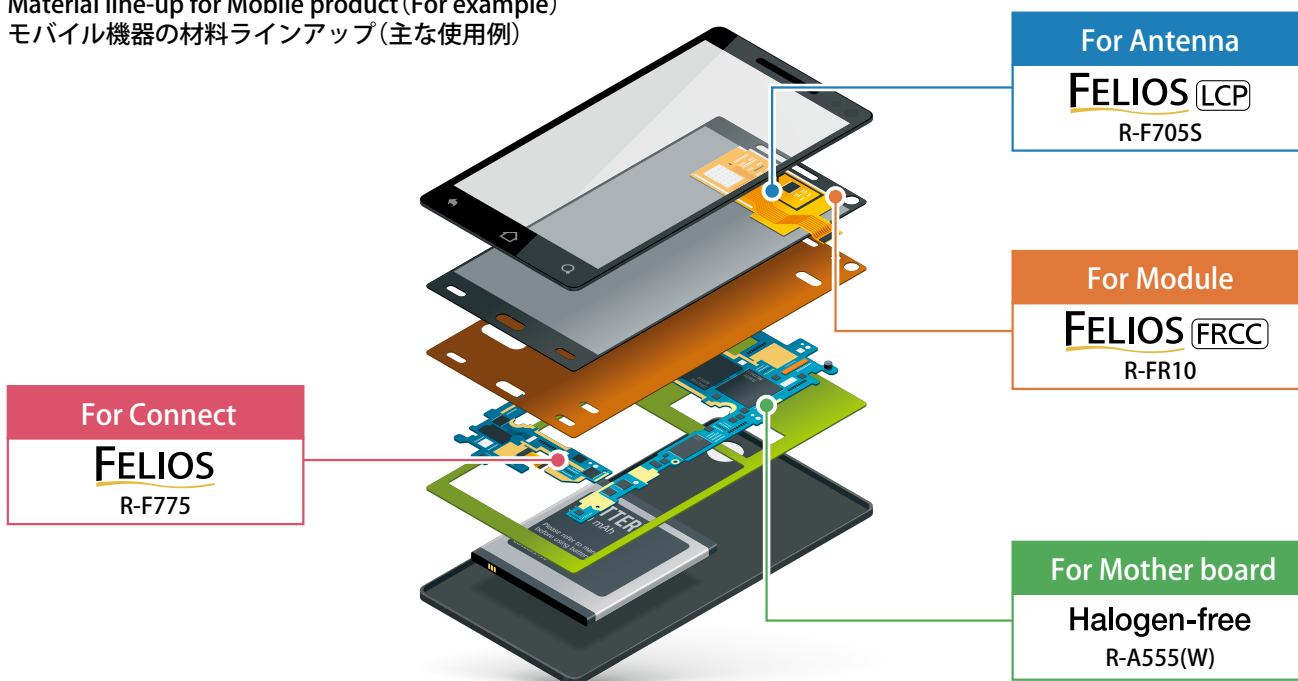
スマートフォン(マザーボード、基板コネクタ、アンテナ、同軸ケーブルの置換えなど)、
タブレットPC、モジュール基板など

Contributing more functionality, light weight and compact-sizing of mobile product.

スマートフォンなどのモバイル機器の更なる高機能化・軽量化・小型化に貢献

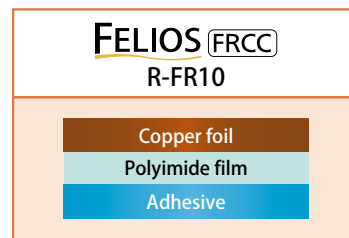
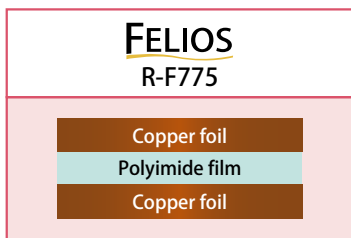
Material line-up for Mobile product (For example)

モバイル機器の材料ラインアップ(主な使用例)

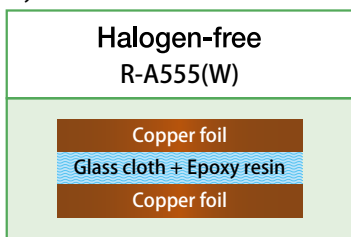


Layer structure 層構成

Flexible circuit board materials



Multi-layer circuit board materials



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Low Dk Highly heat resistant Halogen-free Multi-layer circuit board materials

低誘電率・高耐熱ハロゲンフリー多層基板材料

Halogen-free

Laminate **R-A555(W)**

Prepreg **R-A550(W)**

Applications 用途

Smartphone, Tablet PC, In-vehicle autonomous driving server, Etc.
スマートフォン、タブレット PC、車載自動運転サーバーなど



Good impedance matching at ultra-thin insulated layer with low Dk property.
Contribute to thinner and compact of mobile product.

極薄絶縁層のインピーダンス整合を容易にし、モバイル機器の更なる薄型化・小型化に貢献

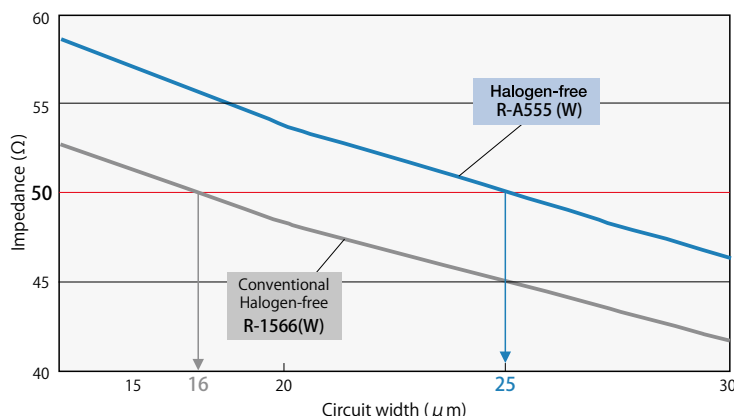
Dk 3.4*
@2GHz

CTE z-axis
41ppm/°C

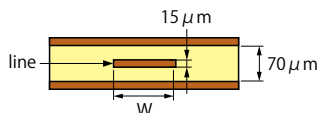
Tg (DMA)
200°C

*Resin content 70wt%

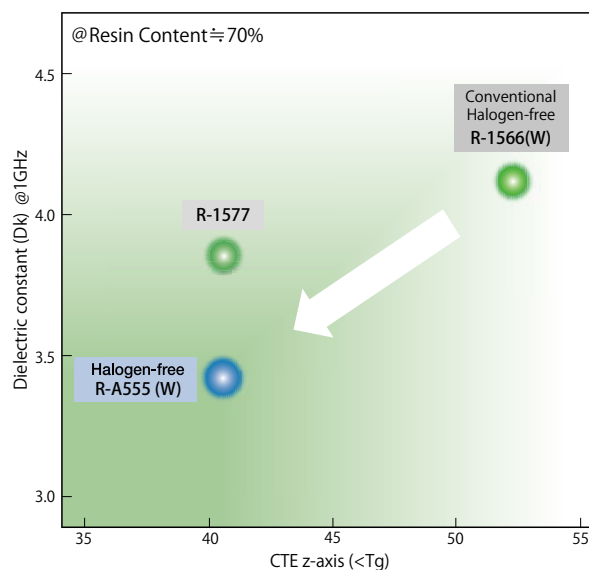
Impedance simulation (Strip Line) インピーダンスシミュレーション(ストリップライン)



Construction



Halogen-free material mapping ハロゲンフリー材料マッピング



General properties 一般特性

Item	Test method	Condition	Unit	Halogen-free R-A555(W)	Conventional Halogen-free R-1566(W)
Glass transition Temp.(Tg)	DMA	A	°C	200	170
CTE z-axis	IPC-TM-650 2.4.24	A	ppm/°C	α1	41
				α2	270
T288(with copper)	IPC-TM-650 2.4.24.1	A	min	>60	3
Dielectric constant(Dk)*	IPC-TM-650 2.5.5.5	C-24/23/50	-	2GHz	3.4
Dissipation factor(Df)*				0.010	
UL/ANSI grade	-	-	-	FR-4.1	FR-4.1

The sample thickness is 0.8mm.

* Resin content 70wt%

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Flexible circuit board materials LCP(Liquid Crystal Polymer) フレキシブル基板材料 LCP(液晶ポリマー)

FELIOS LCP
Double-sided R-F705S

Applications 用途

Avionics/Space applications, Smartphone(Antenna module), Laptop, Tablet PC, 4K/8K display(High-speed FPC cable), Automotive component, Etc.
航空・宇宙機器、スマートフォン(アンテナモジュール)、ノートPC・タブレットPC・4K/8Kディスプレイ(高速FPCケーブル)、車載機器など



Good high-frequency properties make this material suitable for high-speed large-volume data transmission by mobile devices. R-F705S may be used as a replacement of micro coaxial cable and millimeter-wave radar antenna.
優れた高周波特性により、モバイル機器の大容量・高速伝送に貢献、同軸ケーブル置換え。ミリ波レーダー用アンテナ基板に対応

Dk 2.9 Df 0.002
@14GHz

Water absorption
0.04%

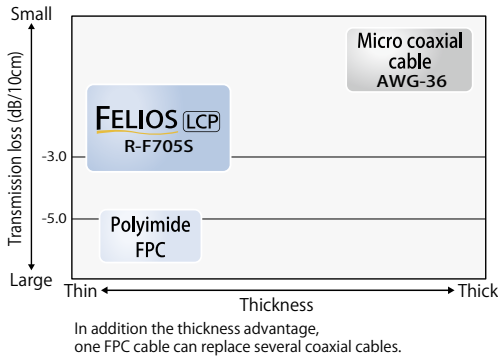
Peel strength
0.8N/mm

Line-up ラインアップ

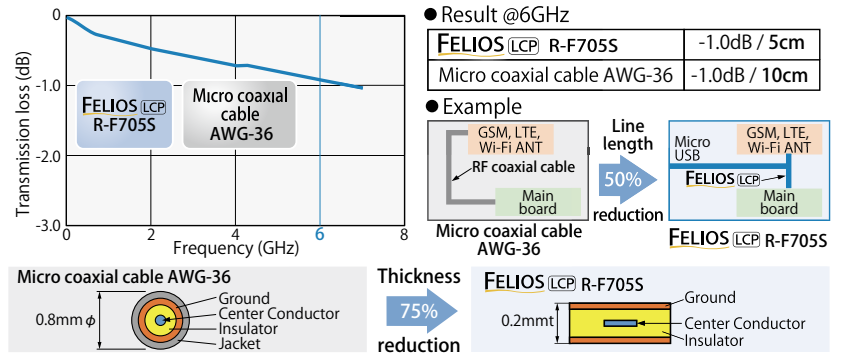
Roll-cut Type MAX 500mm(TD) Roll Type W=250mm, 500mm

Copper Foil Thickness		Film Thickness					Unit: mil (mm)
		1.0 (0.025)	2.0 (0.050)	3.0 (0.075)	4.0 (0.100)	5.0 (0.125)	
ED Copper Foil 電解銅箔	1/4oz (9μm)	●	●	●	●	●	●
	1/3oz (12μm)	●	●	●	●	●	●
	1/2oz (18μm)	●	●	●	●	●	●

Concept コンセプト



Frequency dependence by Transmission loss 伝送損失比較



General properties 一般特性

Item	Test method	Condition	Unit	FELIOS LCP R-F705S
Solder heat resistance	JIS C 6471	288°C solder float for 1min	—	No abnormality
Dk / Df	14GHz	BCDR*	—	2.9 / 0.002
Dk / Df	10GHz	Cavity resonance	—	3.3 / 0.002
Water absorption	Internal method	25°C 50h immersion	%	0.04
Peel strength	ED:18μm	IPC-TM-650 2.4.8	N/mm	0.8
Dimensional stability	IPC-TM-650 2.2.4	After etching	%	MD 0.008 / TD 0.007
		After E-0.5/150		MD 0.052 / TD 0.035
Flammability	UL	A + E-168/70	—	94VTM-0

The sample thickness is 0.1mm. * BCDR: Balanced-type circular disk resonance

ED (TP4S) 18-100-18

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Flexible circuit board materials Resin coated copper foil

フレキシブル基板材料 樹脂付銅箔

FELIOS FRCC
R-FR10

Applications 用途

Smartphone(Main/Sub board, Module board), Etc.
スマートフォン(メイン基板、サブ基板、モジュール基板)など



Possible to make board thinner and simplify the build-up process.
Contribute to thinner and smaller of mobile product and module.

薄型多層化、ビルドアップ工程の簡略化を可能とし、モバイル機器やモジュールの薄型化・小型化に貢献

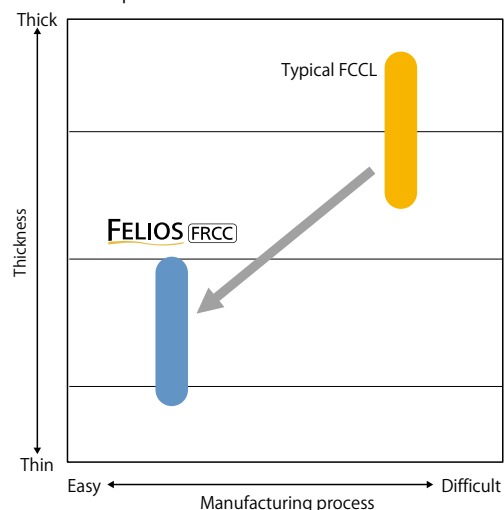
Thinned multi-layer

Simplify the build-up process

Good coplanarity

Concept コンセプト

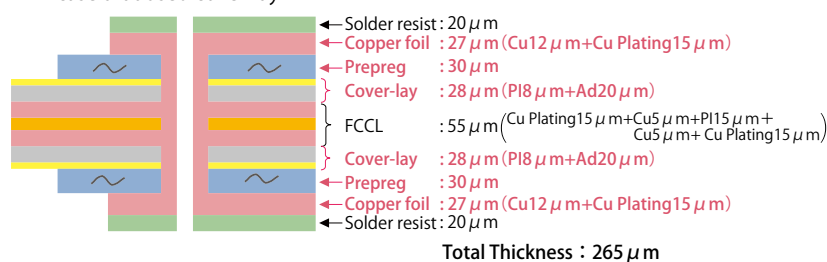
Thickness of 4 layer Rigid-Flex Board and
Manufacture process



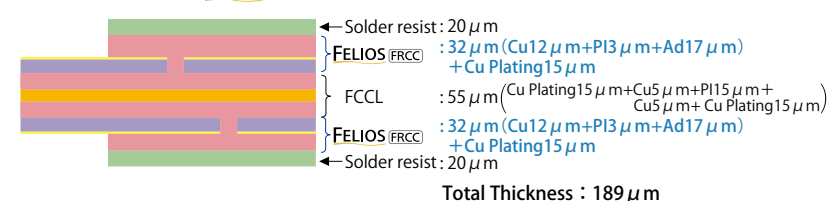
Thin multi-layer 薄型多層化

<Example> Multi-layer board 200 μm

● In case that used cover-layer



● In case that used FELIOS FRCC



General properties 一般特性

Item	Test method	Condition	Unit	FELIOS FRCC R-FR10	
Dielectric constant(Dk)	1GHz IPC-TM-650 2.5.5.9	A	-	3.0(Ad) / 3.3(PI)	
Dissipation factor(Df)				0.019(Ad) / 0.010(PI)	
Solder heat resistance	JIS C 6481	A	-	No abnormality	
		260°C solder float for 1 min.			
Peel strength	Copper:0.012mm(12 μm)	JIS C 6481	A	N/mm	0.8
Flammability	UL	A+E-168/70	-	-	94VTM-0 ^{*1}
Bending property	MIT ^{*2} method	0.5kg φ0.38, 175cpm, 135°	times	-	>150

The sample thickness is Copper12 μm, PI3 μm, Ad17 μm.
*1 Measured by R-FR10/R-F775 25 μm/R-FR10 construction
*2 Measured 18 μm ED copper on R-F775 25 μm covered by R-FR10 for both side

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Flexible circuit board materials

フレキシブル基板材料

FELIOS

Double-sided copper clad **R-F775**
Single-sided copper clad **R-F770**

Applications 用途

Consumer mobile products (Smartphone, tablet PC), Medical, Industrial, Avionics/Space applications, Etc.

モバイル機器 (スマートフォン、タブレット PC)、医療機器、産業機器、航空機器など



Felios adhesiveless flex materials are available in a wide-range of film and copper foil thicknesses to support all applications. Felios offers superior thermal resistance, dimensional stability and quality.

多彩な厚みのラインアップにより、モバイル機器を始め様々な用途に適用可能。また耐熱性や寸法安定性、品質にも優れる。

Superior Thermal Resistance

Wide Product Selection

High dimensional stability

Line-up ラインアップ

Available in various film and copper foil combinations. 様々なフィルム・銅箔の組合せに対応

Roll-cut Type MAX 610mm(MD) x 500mm(TD) Roll Type W=250mm, 500mm

Copper Foil Thickness		Film Thickness							Unit: mil (mm)
		0.5 (0.013)	1.0 (0.025)	2.0 (0.050)	3.0 (0.075)	4.0 (0.100)	5.0 (0.125)	6.0 (0.150)	
RA Copper Foil 圧延銅箔	1/4oz (9 μm)	●*1	●*1	●*1	-	-	-	●*1	
	1/3oz (12 μm)	●	●	●	●	●	-	-	
	1/2oz (18 μm)	●	●*2	●*2	●*2	●*2	●*2	●	
	1oz (35 μm)	●*1	●*2	●*2	●*2	●*2	●*2	●	
	2oz (70 μm)	-	●*2	●*2	●	●	●	-	
ED Copper Foil 電解銅箔	- (2 μm)	●	●	●	●	-	-	-	
	1/6oz (6 μm)	●	●	●	-	-	-	-	
	1/4oz (9 μm)	●	●	●	●	●	●	●	
	1/3oz (12 μm)	●	●	●	●	●	●	●	
	1/2oz (18 μm)	●	●	●	●	●	-	-	
	1oz (35 μm)	-	●	●	●	●	-	-	

*1 Special option *2 W=610mm is optional.

General properties 一般特性

Item	Test method	Condition	Unit	FELIOS R-F775	
Solder heat resistance	JIS C 6471	A	°C	>330	
		C-96/40/90		260	
Tensile modulus	ASTM D882	A	GPa	7.1	
Tensile strength	Internal method	A	MPa	542	
Peel strength	RA: 1/3oz(12 μm)	A	N/mm	1.35	
CTE	MD/TD	JIS R 3251	50~200°C	ppm/°C	17/19
	Z-axis			ppm/°C	101
Thermal conductivity	Laser flash	A	W/m·K	0.16	
Dimensional stability	IPC-TM-650	After etching MD direction	%	0.00±0.10	
		After etching TD direction		0.00±0.10	
Flammability	UL	A + E-168/70	-	94V-0	

The sample thickness is film 25 μm, copper foil 12 μm.

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High reliability Glass composite Circuit board materials

高信頼性ガラスコンポジット基板材料

Double-sided **R-1785**

Applications 用途

Automotive component, Power supply board, Power device module board, Infrastructure(Smart meter, IC tag), Etc.

車載機器、電源基板、パワーデバイスモジュール基板、インフラ関係(スマートメーター、電子タグ)など



Improved solder joint reliability compared with conventional CEM-3 which has already good to safety and long-time reliability property. Contribute to high reliability PCB for electric car.

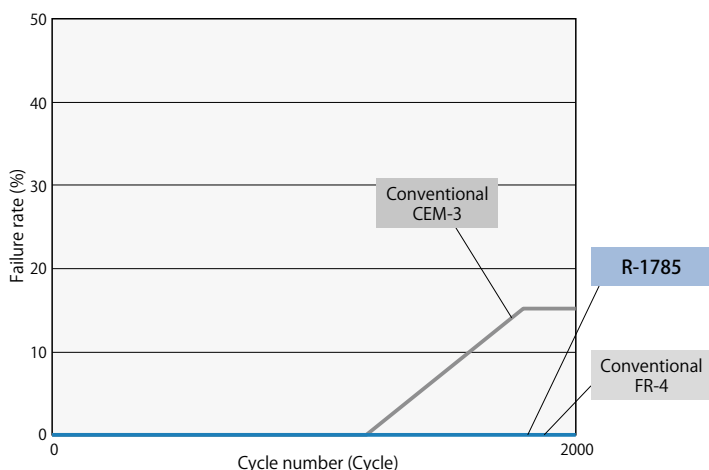
従来 CEM-3 の優れた安全性・長期絶縁信頼性の特性に加え、更に部品実装信頼性を向上。EV 向け車載基板の信頼性向上に貢献

CTE x,y-axis
20ppm/°C

Tg (TMA)
150°C

CTI ≥ 600V

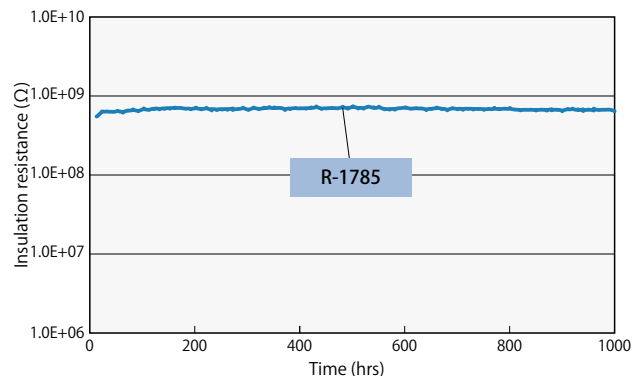
Solder joint reliability 部品実装信頼性



Cycle condition	-40°C ⇄ 80°C (30min) ⇄ (30min)
Mounted chip	3216
Thickness	1.6mm
Copper foil thickness	35/35 μm

Insulation reliability 絶縁信頼性

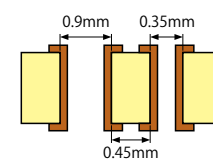
● CAF evaluation



● Condition

Condition	85°C 85%RH DC100V
Distance between THs	0.45mm
Drill diameter	φ 0.9, φ 0.35mm
Thickness	1.6mm
Method	Continuous measurement in the oven
PWB	Our test pattern Warp direction : 60holes Fill direction : 60holes

● Construction



General properties 一般特性

Item	Test method	Condition	Unit	R-1785	Conventional CEM-3	Conventional FR-4
Glass transition temp.(Tg)	TMA	Temp. rising rate: 10°C/min	°C	150	140	140
CTE x-axis	α 1 IPC-TM-650 2.4.24	TMA	ppm/°C	19 (15)	25 (20)	13
CTE y-axis				21 (17)	28 (23)	15
CTE z-axis	α 1/α 2 IPC-TM-650 2.4.24	TMA	ppm/°C	50/190	65/270	65/270
Tracking resistance	IEC 60112	A	V	CTI ≥ 600	CTI ≥ 600	250 > CTI ≥ 175
Accuracy of thickness(σ value)	—	A	mm	0.013	0.013	0.027

The sample thickness is 1.6mm.

The figure in parentheses is for the thickness of 0.8mm.

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