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

XPEDION 1
Laminate **R-5515**
Prepreg **R-5410**

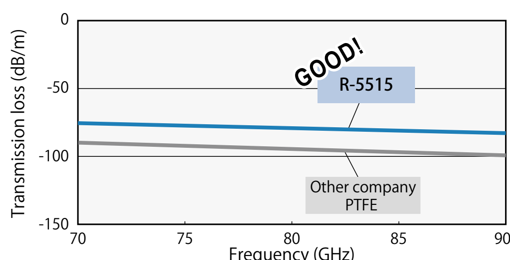
Applications 用途

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℃** | **Reduce PCB process cost (vs. PTFE material)**

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

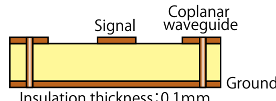


● Transmission loss at 79GHz

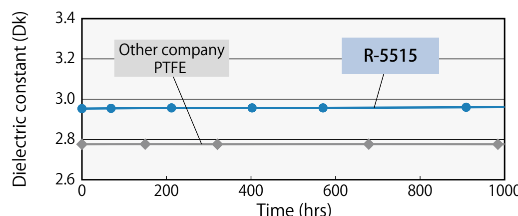
Material	Transmission loss (dB/m)	Dk (Design)
R-5515	79	3.09
Other company PTFE	96	3.01

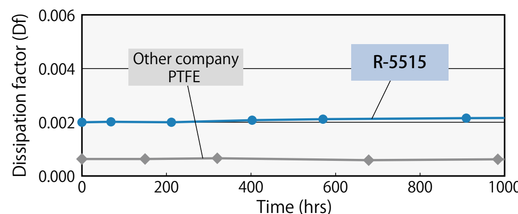
● Construction

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℃(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	℃	200[*1]
CTE z-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	50
	α2				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)	10GHz	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。
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High thermal conductivity Low transmission loss Halogen-free Multi-layer circuit board materials

高熱伝導率・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.

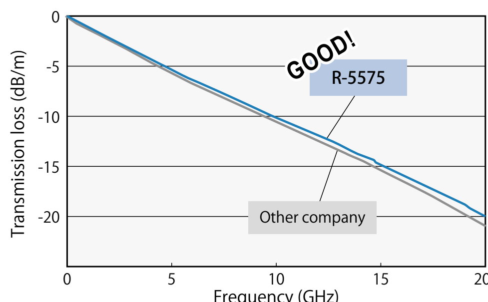
パワーアンプ基板（無線通信基地局、スモールセル）、
アンテナ（車載ミリ波レーダ、基地局）など

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、高熱伝導性を兼ね備え、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

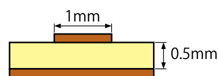
Dk 3.6 Df 0.005 @10GHz	Thermal conductivity 0.60W/m·K	Tg (DMA) 245℃

Frequency dependence by Transmission loss
伝送損失比較



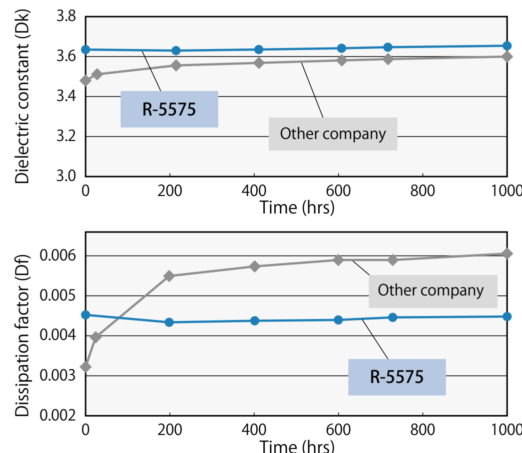
● Construction

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

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℃(without humidity control)
● Measurement frequency : 18GHz

General properties 一般特性

Item		Test method	Condition	Unit	Halogen-free R-5575	Other company
Glass transition temp.(Tg)		DMA	A	℃	245	Tg less
CTE z-axis	α1/α2	IPC-TM-650 2.4.24	A	ppm/℃	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	C-24/23/50	—	3.6	3.5
Dissipation factor(Df)	10GHz	Cavity resonance	C-24/23/50	—	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

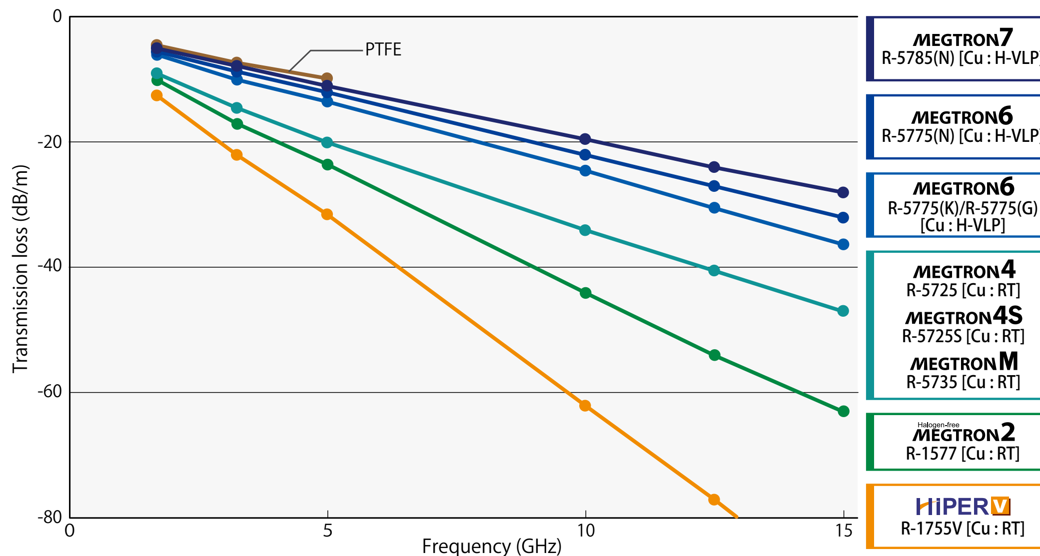
*ICT…Information and Communication Technology

Applications 用途

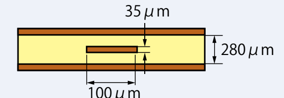
Server, Router, Switch, Supercomputer, Measuring instrument, Etc.
サーバ、ルータ、スイッチ、スーパーコンピュータ、半導体検査装置など

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
			α1	α2		1GHz		1oz(35 μm)
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		℃	ppm/℃		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
MEGTRON M	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)**

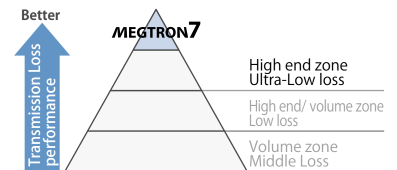
Applications 用途

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

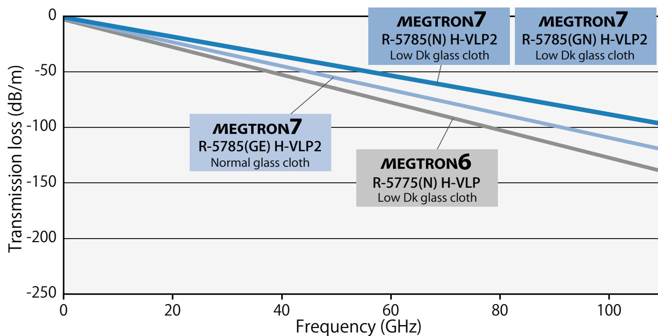
Due to our industry leading low dielectric constant and dissipation factor, these materials are suitable for high-speed data transmission by servers and routers using high-layercount, large-size PCB designs.

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

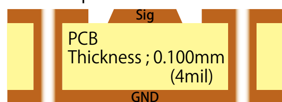


Dk 3.4 Df 0.002 @12GHz | **Tg (DSC) 200℃** | **T288 (with copper) >120min**

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	ϕ0.3mm		
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℃ 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	℃	200	200	200
CTE z-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	42	42	42
	α2				280	280	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	3.6
Dissipation factor(Df)					0.002	0.002	0.003
Peel strength*	1oz(35 μm)	IPC-TM-650 2.4.8	A	kN/m	0.8	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

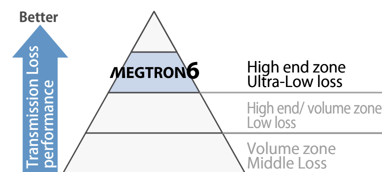
MEGTRON6

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

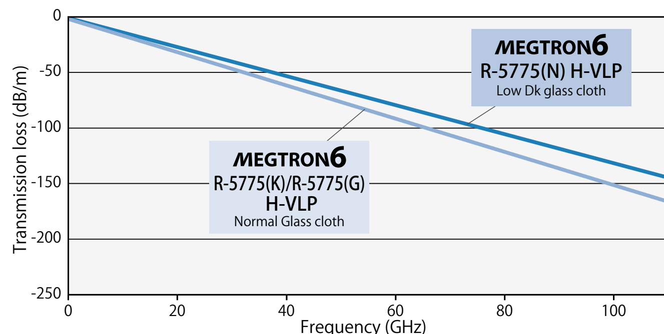
ICT infrastructure equipment, Supercomputer, Measuring instrument, Antenna(Base station, Automotive millimeter-wave radar), Etc.
ICT インフラ機器 (スーパーコンピュータ、計測用機器)、
アンテナ (基地局、車載ミリ波レーダ)、高周波用途など

The industry standard for high speed, ultra-low loss PCB material.
Excellent HDI and thermal performance.
超高性能サーバや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、超高性能サーバやルータの性能向上に貢献

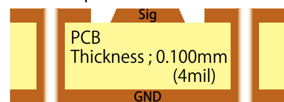


Dk 3.4 Df 0.004 @12GHz | **Tg (DSC) 185℃** | **T288 (with copper) >120min**

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	φ0.3mm	
Wall to wall distance	0.5mm	0.6mm
MEGTRON6 (Low Dk glass cloth)	pass	pass

● Condition
260℃ 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	℃	185	185
CTE z-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	45	45
	α2				260	260
T288(with copper)		IPC-TM-650 2.4.24.1	A	min	>120	>120
Dielectric constant(Dk)	12GHz	Balanced-type circular disk resonator	C-24/23/50	—	3.4	3.6
Dissipation factor(Df)					0.004	0.004
Peel strength*	1oz(35 μm)	IPC-TM-650 2.4.8	A	kN/m	0.8	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.

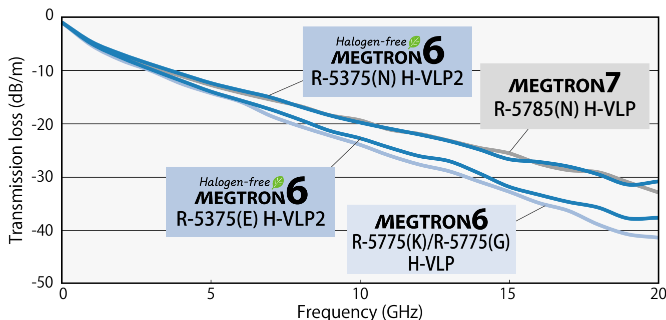
ICT インフラ機器、高速通信機器 (ハイエンドサーバ、ルータ、光ネットワーク、スイッチ)、高多層基板など

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.

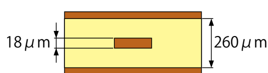
超高性能サーバやルータ向けのデファクトスタンダード材料にハロゲンフリーを付与。
MEGTRON6 を超える低伝送ロスを実現し、超高性能サーバやルータの性能向上に貢献

Dk 3.4 Df 0.003 @12GHz	Tg (DMA) 250℃	T320 (with copper) >120min.

Frequency dependence by Transmission loss 伝送損失比較



● Construction



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

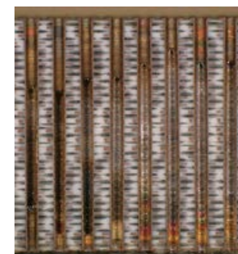
Heat resistance of High Multi-layered 高多層耐熱性

● Result

Drill diameter	φ0.3mm	
Wall to wall distance	0.3mm	0.5mm
Halogen-free MEGTRON6 R-5375(E)	Pass	Pass

● Condition
260℃ reflow x 10times

● Construction
32 Layers
Board thickness: 4.5mm



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	℃	250	250	210[*1]
Thermal expansion		TMA (Z direction)	50-260℃	%	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	0.004	0.004
Peel strength	1oz(35μm)	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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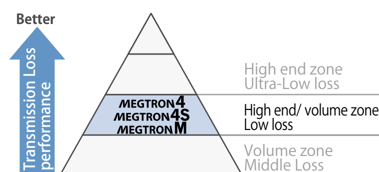
Low transmission loss Highly heat resistant Multi-layer circuit board materials
低伝送損失・高耐熱多層基板材料

MEGTRON4 MEGTRON4S MEGTRON M
Laminate R-5725 R-5725S R-5735
Prepreg R-5620 R-5620S R-5630

Applications 用途

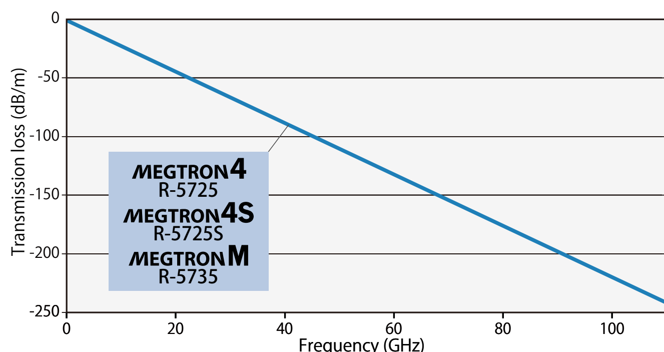
ICT infrastructure equipment, Supercomputer, Measuring instrument, Antenna, Etc.
ICT インフラ機器、スーパーコンピュータ、計測用機器、通信アンテナなど

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)

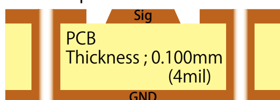


Dk 3.8 Df 0.007 @10GHz	Tg (DSC) 176℃	T288 (with copper) 30min

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	φ0.3mm	
Wall to wall distance	0.6mm	0.7mm
MEGTRON4	pass	pass
MEGTRON4S	pass	pass
MEGTRON M	pass	pass

●Condition
260℃ 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	MEGTRON M R-5735
Glass transition temp.(Tg)		DSC	A	℃	176	200	195
CTE z-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	35	32	31
	α2				265	250	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	3.8	3.9
Dissipation factor(Df)					0.007	0.007	0.007
Peel strength*	1oz(35 μm)	IPC-TM-650 2.4.8	A	kN/m	1.1	1.3	1.2

The sample thickness is 0.8mm.
* RT Copper

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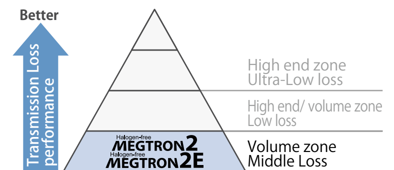
Halogen-free Low transmission loss Highly heat resistant Multi-layer circuit board materials
ハロゲンフリー低伝送損失・高耐熱多層基板材料

Halogen-free MEGTRON 2
Halogen-free MEGTRON 2E
Laminate R-1577 R-1577E
Prepreg R-1570 R-1570E

Applications 用途

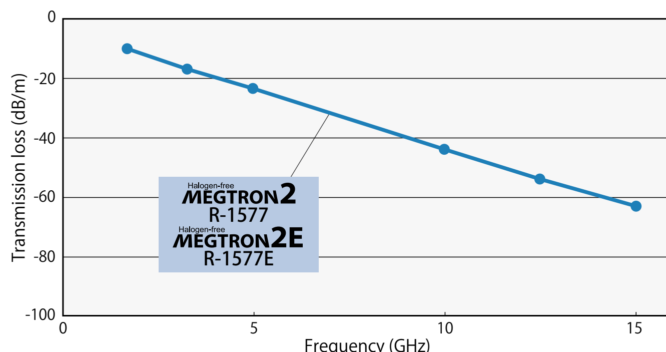
ICT infrastructure equipment, Measuring instrument, Etc.
ICT インフラ機器、計測機器など

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



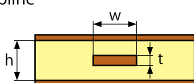
Dk 4.0 Df 0.013 @10GHz | **Tg (DSC) 170℃** | **Halogen-free Lead-free soldering**

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

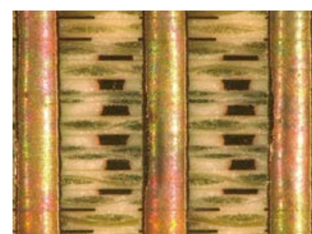
Drill diameter	φ0.3mm		
Wall to wall distance	0.5mm	0.6mm	0.7mm
Halogen-free MEGTRON 2	pass	pass	pass
Halogen-free MEGTRON 2E	pass	pass	pass

● Condition

260℃ reflow x 10times

● Construction

28 Layers
Board thickness: 3.8mm



General properties 一般特性

Item		Test method	Condition	Unit	Halogen-free MEGTRON 2 R-1577	Halogen-free MEGTRON 2E R-1577E
Glass transition temp.(Tg)		DSC	A	℃	170	173
CTE z-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	34	35
	α2				200	210
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	4.1
Dissipation factor(Df)					0.013	0.013
Peel strength	1oz(35 μm)	IPC-TM-650 2.4.8	A	kN/m	1.3	1.3

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。
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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>

HIPER V
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℃	T288 (with copper) 20min

IST (Interconnect Stress Test)

● Result

Sample No.	Reflow condition	HIPER V R-1755V
1	–	Over 1000 cycles OK
2	230℃ x 3times	Over 1000 cycles OK
3	230℃ x 6times	Over 1000 cycles OK
4	260℃ x 3times	Over 1000 cycles OK
5	260℃ x 6times	Over 1000 cycles OK

● Condition

Pretreatment	Reflow
Cycle condition	25℃ (2min) ⇔ 150℃ (3min)

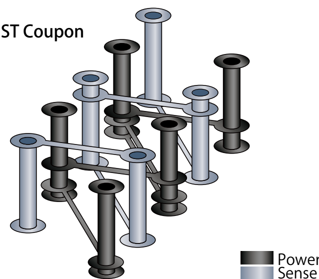
* Failure is over 10% changes of resistance

● Construction

Board thickness	2.1mm
Number of layers	18 layers

What is IST ?

Carrying out temperature cycling experiments 25℃ ⇔ 150℃ 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.



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

● Result

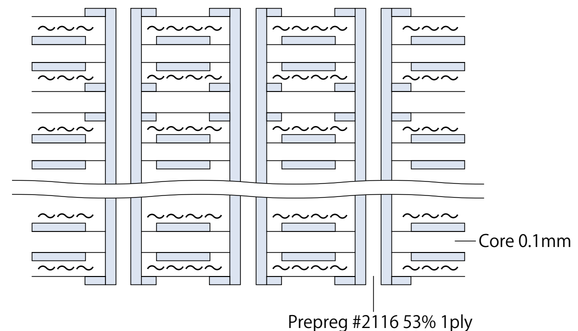
R-1755V : No abnormality of cross-sectional observation

● Condition

288℃ 10sec. Solder float 6 cycles

● Construction

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



General properties 一般特性

Item		Test method	Condition	Unit	HIPER V R-1755V
Glass transition temp.(Tg)		DSC	A	℃	173
CTE z-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	44
	α2				255
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(35μm)	IPC-TM-650 2.4.8	A	kN/m	1.5

The sample thickness is 0.8mm.

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Low CTE IC substrate materials Designed to Improve Reliability

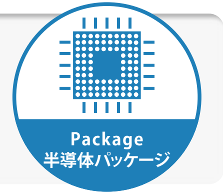
低熱膨張・高実装信頼性半導体パッケージ基板材料

LEXCM GX

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）

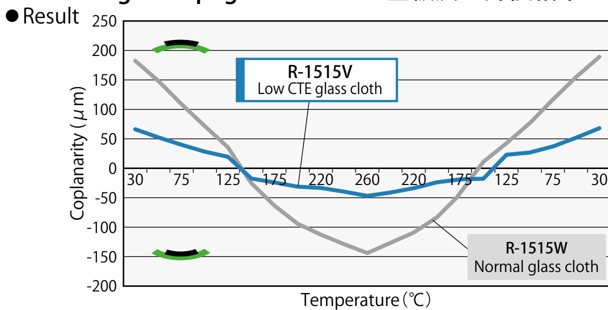


Low CTE reduces warping and addresses a critical challenge with the IC packaging process. Flexibility and buffering features through a stress relaxation technology improves the reliability of the assembly process. Offering excellent thickness tolerances.
低熱膨張性で反りを抑制し、IC チップの一次実装の不具合を低減、さらに樹脂の伸縮性と緩衝性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/℃ (Low CTE glass cloth) | **Stress Relaxation** | **Good Thickness Variation**

IC Pakage Warpage パッケージ基板反り評価結果

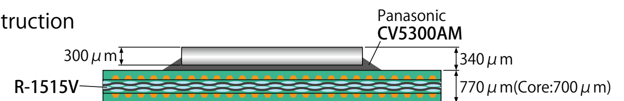
● Result



● Sample

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

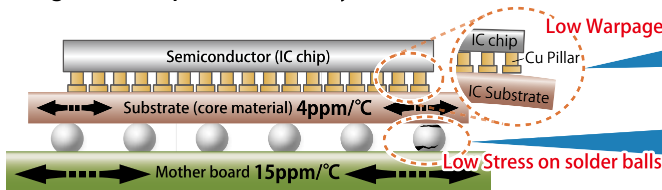
● PKG Construction



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

Product	Thickness
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	℃	260	260	260
CTE x-axis	α1	TMA*2	A	ppm/℃	3-5	7	8-10
CTE y-axis	α1	TMA*2	A	ppm/℃	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	1GHz	IPC-TM-650 2.5.5.9	C-24/23/50	―	0.016	0.015	0.015
Elastic modulus*1		IPC-TM-650 2.4.4*3	25℃	GPa	30	27	33
Elastic modulus*1		IPC-TM-650 2.4.4*3	250℃	GPa	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 100μm. *1 700μm *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.

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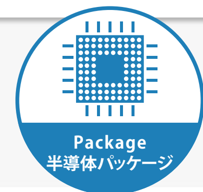
Ultra-low transmission loss Circuit board materials for IC substrate/ Module
半導体パッケージ・モジュール基板向け超低損失材料

LEXCM GX

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



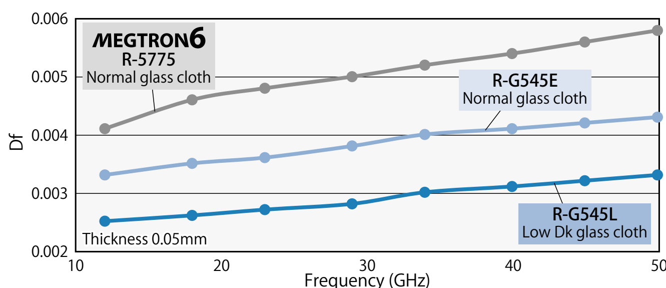
Excellent low-Dk/Df with low CTE property for the evolution of device.
業界最高レベルの低 Dk/Df と低 CTE を両立し、デバイスの進化に貢献

Dk 3.5 Df 0.003 @12GHz

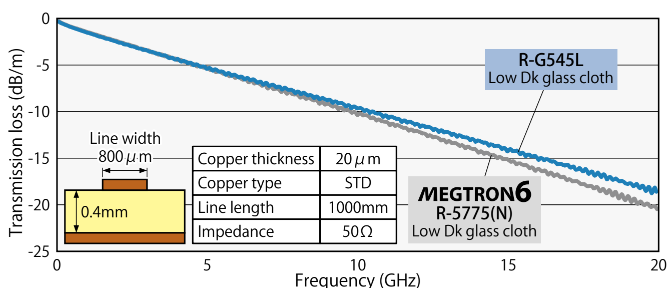
CTE x,y-axis 10ppm/℃ CTE z-axis 22ppm/℃

Tg (DMA) 230℃

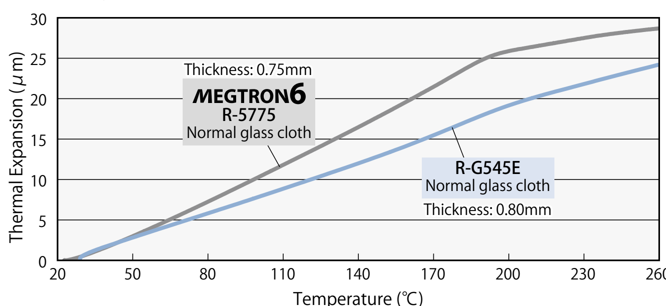
Df at Wide-frequency band 広周波帯域での誘電正接



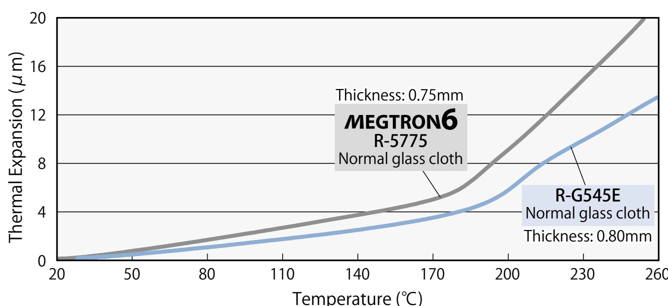
Frequency dependence by Transmission loss 伝送損失比較



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	℃	230	230
CTE x, y-axis	α1	Internal method	A	ppm/℃	10	10
CTE z-axis		IPC-TM-650 2.4.24			22	22
Dielectric constant(Dk)	12GHz	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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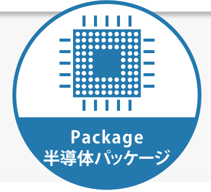
Low CTE Ultra-thin IC substrate materials
低熱膨張・極薄対応半導体パッケージ基板材料

LEXCM GX

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)



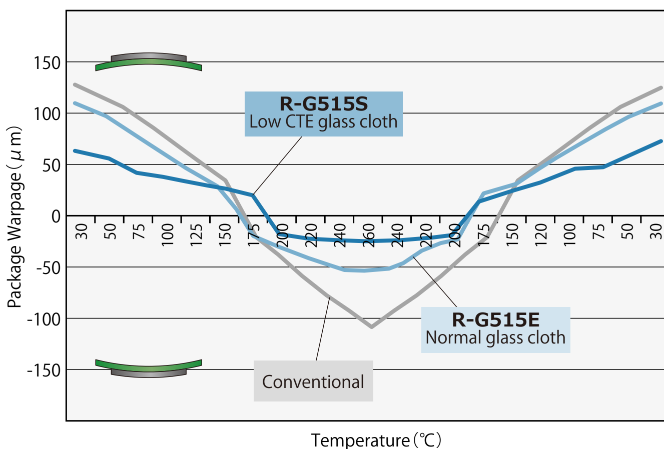
With an insulation layer thickness of 15 μm or less, these ultra-thin materials enable thin IC package designs.
The low CTE property can reduce warpage and achieve a good reliability.
半導体パッケージの薄型化(絶縁層厚み15μm以下)を実現する極薄サブストレート材料で、半導体に近い低熱膨張率を有し、熱膨張率の差によって発生する反りを抑制することで優れた実装信頼性を実現します。

CTE x,y-axis 4-6ppm/℃ (Low CTE glass cloth)	Low warpage	Ultra-thin Excellent moldability

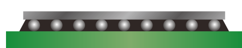
IC Package Warpage パッケージ基板反り評価結果

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

● Result



● PKG Construction

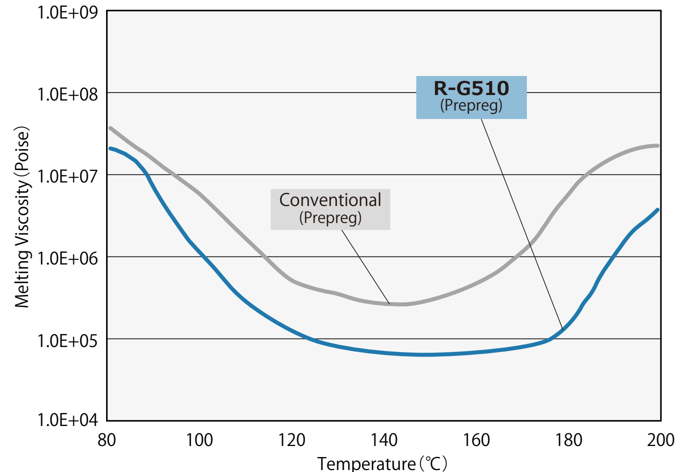


Package size	12.5 x 12.5mm
Die size	10 x 10 x 0.10mmt
CUF material	Panasonic CV5300AM
Substrate thickness	0.2mmt (2L Cu:12μm)

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	LEXCM GX R-G515S Low CTE glass cloth	LEXCM GX R-G515E Normal glass cloth
Glass transition temp.(Tg)		DMA*1	A	℃	220-240	220-240
CTE x-axis	α1	Internal method	A	ppm/℃	4-6	6-8
CTE y-axis	α1	Internal method	A	ppm/℃	4-6	6-8
Young's modulus		ASTM D3039	25℃	GPa	23-28	22-27
Peel strength	1/3oz	IPC-TM-650 2.4.8	A	kN/m	0.7	0.7

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

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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。

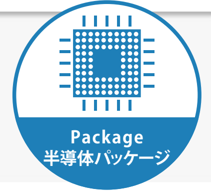
High elasticity Low CTE Ultra-thin IC substrate materials

高弾性・低熱膨張・極薄対応半導体パッケージ基板材料

LEXCM GX
Laminate **R-1515E**
Prepreg **R-1410E**

Applications 用途

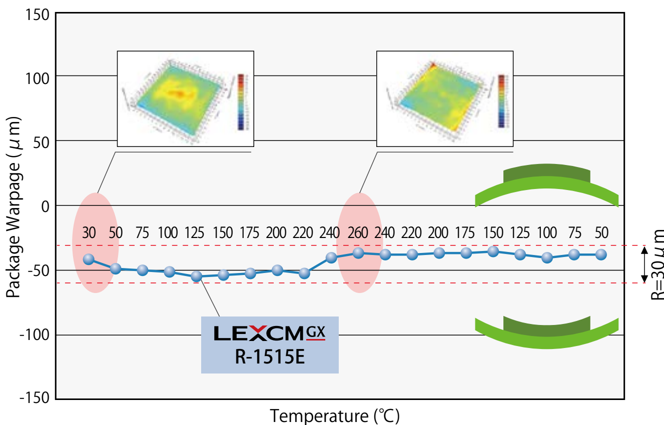
IC substrate
半導体パッケージ基板



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℃ 33GPa	CTE x, y-axis 8-10ppm/℃	Tg (DMA) 270℃

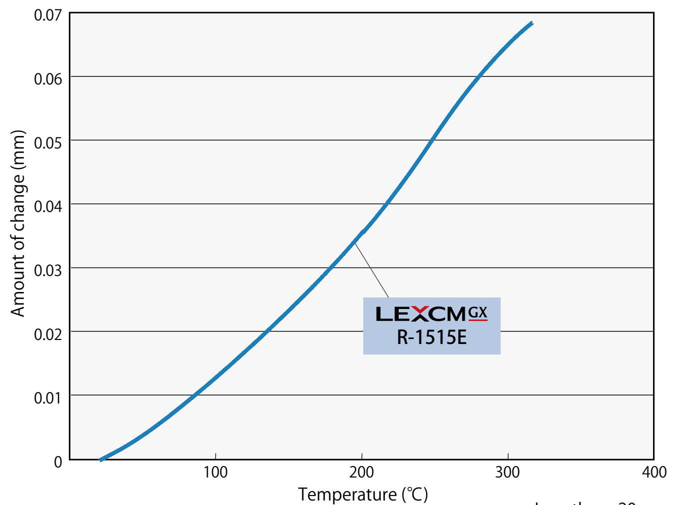
Package warpage(FBGA) パッケージ基板反り評価結果(FBGA)



● 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	LEXCM GX R-1515E
Glass transition temp.(Tg)		DMA[*2]	A	℃	270
Thermal decomposition temp.(Td)		TGA	A	℃	390
CTE x-axis	α1	Internal method	A	ppm/℃	8-10
CTE y-axis	α1	Internal method	A	ppm/℃	8-10
CTE z-axis[*1]	α1	IPC-TM-650 2.4.24	A	ppm/℃	22
	α2				95
Flexural modulus[*1]		JIS C 6481	25℃	GPa	33
			250℃		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。
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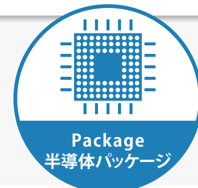
High elasticity Low CTE IC substrate materials

高弾性・低熱膨張半導体パッケージ基板材料

LEXCM GX
Laminate **R-1515W**
Prepreg **R-1410W**

Applications 用途

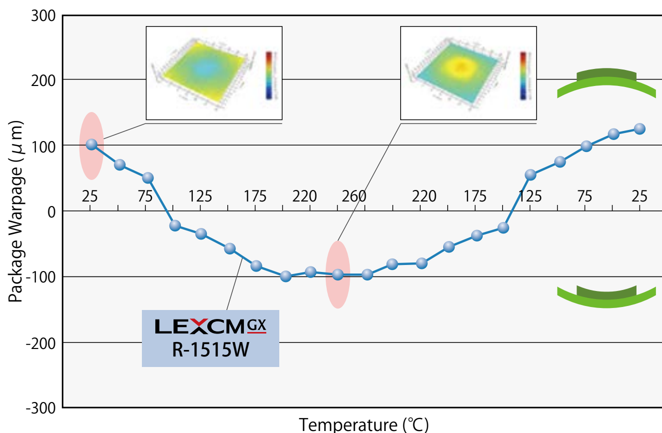
IC substrate
半導体パッケージ基板



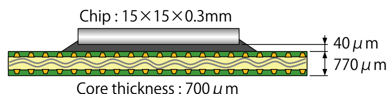
Achieve more functionality (multi-pin and integrated circuit) the large-sized Package by excellent modulus and highly heat resistant property.
優れた弾性率と更なる耐熱性を付与し、多ピン化・伝送回路集積化に伴う大型パッケージの高機能化に貢献

Flexural modulus 25℃ 35GPa	CTE x, y-axis 8-10ppm/℃	Tg (DMA) 250℃

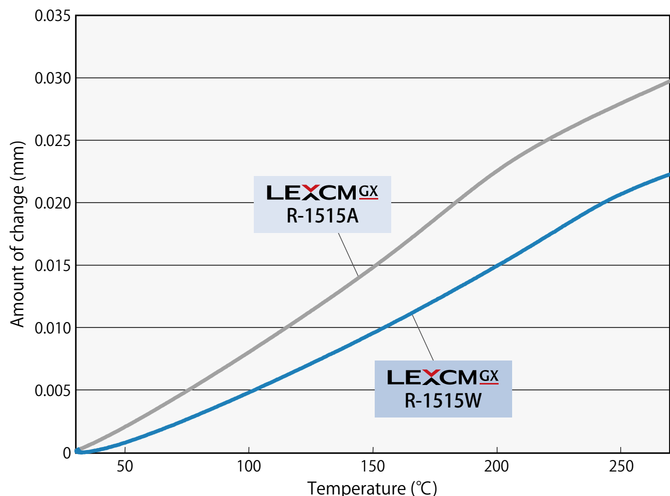
Package warpage パッケージ基板反り評価結果



● 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	LEXCM GX R-1515W
Glass transition temp.(Tg)		DMA*2	A	℃	250
Thermal decomposition temp.(Td)		TGA	A	℃	390
CTE x-axis	α1	Internal method	A	ppm/℃	8-10
CTE y-axis	α1	Internal method	A	ppm/℃	8-10
CTE z-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	22
CTE z-axis	α2	IPC-TM-650 2.4.24	A	ppm/℃	97
Flexural modulus*1		JIS C 6481	25℃	GPa	35
Flexural modulus*1		JIS C 6481	250℃	GPa	21

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

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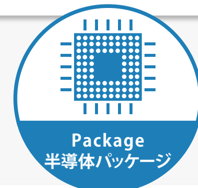
Low CTE
IC substrate materials
低熱膨張半導体パッケージ基板材料

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

Applications 用途

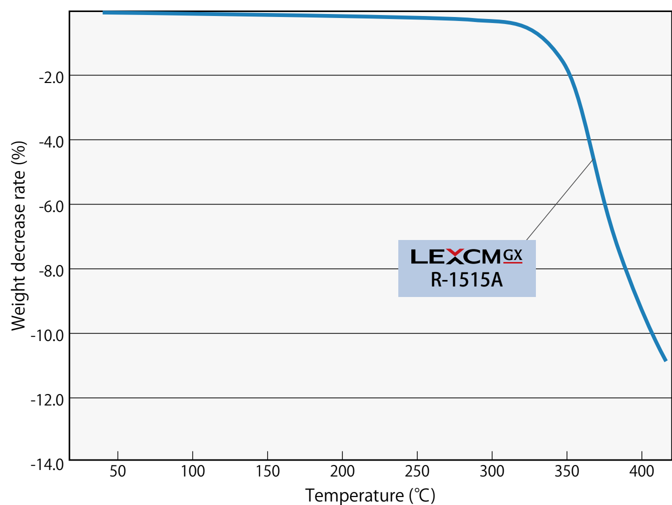
IC substrate
半導体パッケージ基板



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℃ 27GPa	CTE x, y-axis 11-13ppm/℃	Tg (DMA) 205℃

Heat resistance 耐熱性

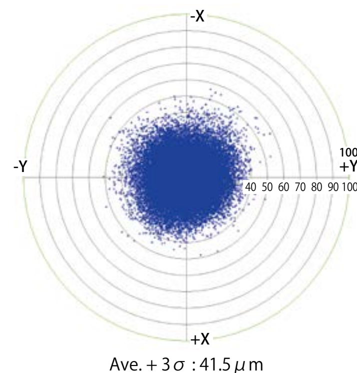


Method : TGA

Weight decrease @260℃

LEXCM GX R-1515A	0.2%

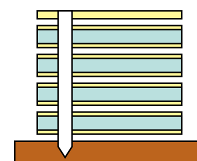
Positioning accuracy 穴位置精度



Ave.＋3σ：41.5μm

●Condition

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



General properties 一般特性

Item		Test method	Condition	Unit	LEXCM GX R-1515A
Glass transition temp.(Tg)		DMA*2	A	℃	205
Thermal decomposition temp.(Td)		TGA	A	℃	390
CTE x-axis	α1	Internal method	A	ppm/℃	11-13
CTE y-axis	α1	Internal method	A	ppm/℃	11-13
Flexural modulus*1		JIS C 6481	25℃	GPa	27
			250℃		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.

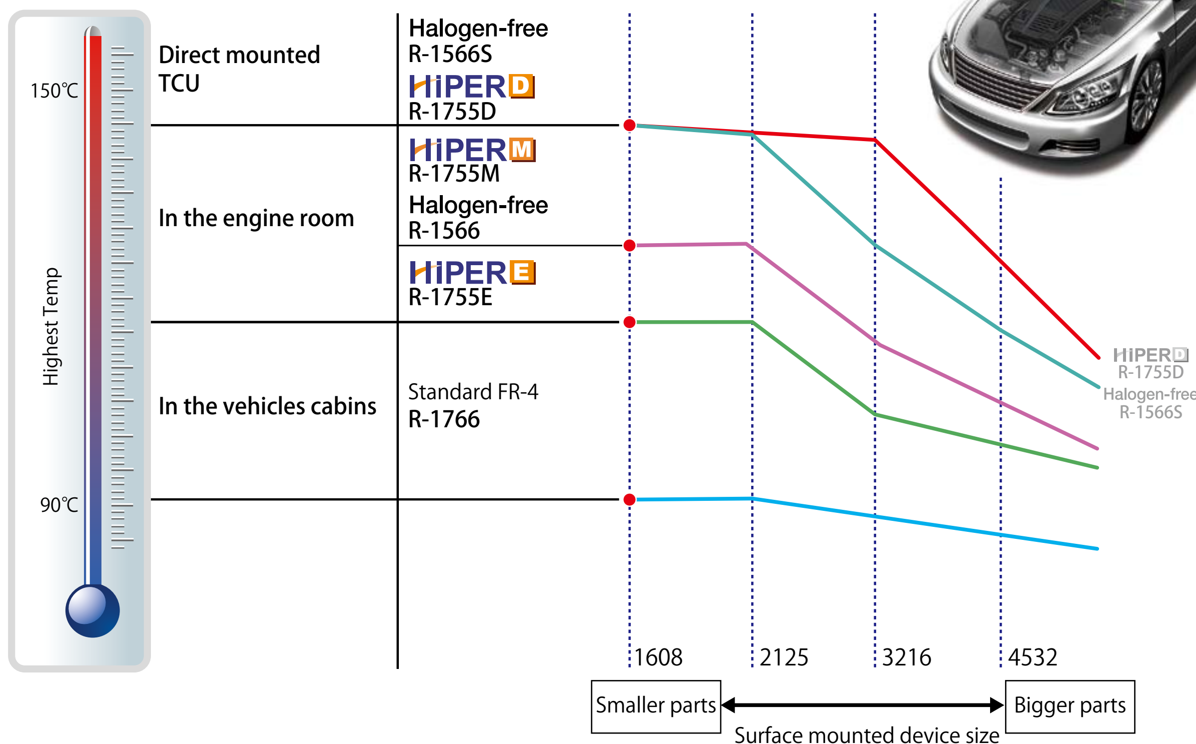
車載機器 (エンジン直載 ECU, パワー系制御 ECU, ボディ系制御 ECU) など

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

Heat resistance test at the solder connection part
by circuit board material and surface mounted devices size



General properties　一般特性

Item		Test method	Condition	Unit	Halogen-free R-1566S	HIPER D R-1755D	HIPER M R-1755M	Halogen-free R-1566	HIPER E R-1755E	Standard FR-4 R-1766
Glass transition temp.(Tg)		DSC	A	℃	175	163	153	148	133	140
CTE x-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	11-13	10-12	11-13	11-13	11-13	11-13
CTE y-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	13-15	12-14	13-15	13-15	13-15	13-15
CTE z-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	40	43	40	40	42	65
	α2				180	236	240	180	250	270
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。
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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

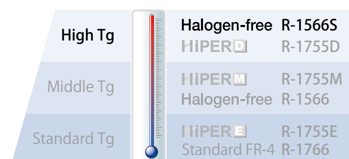
Halogen-free

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

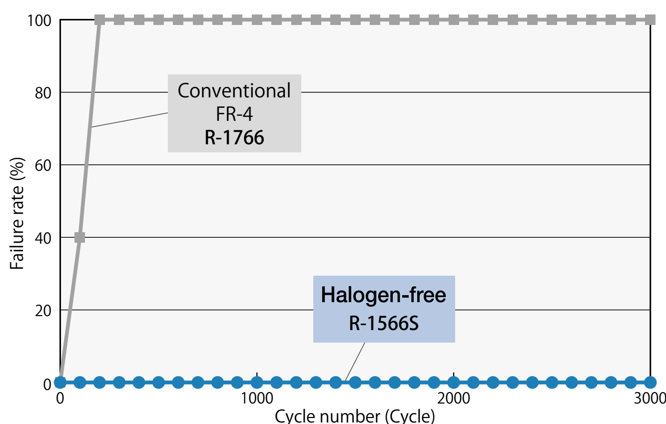
Added highly heat resistant and tracking resistance to automotive quality R-1566 to improve the reliability of ECU boards used under severe conditions.
従来の R-1566 より高耐熱性と耐トラッキング性を向上し、高温環境下で使用される ECU 用基板の信頼性に貢献



Tg (DSC)	Td (TGA)	CTI≧600V*
175℃	355℃	

*actual value

Through-hole reliability　スルーホール導通信頼性

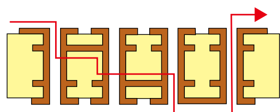


●Condition

Cycle condition	-40℃ (15min) ⇔ 160℃ (15min)

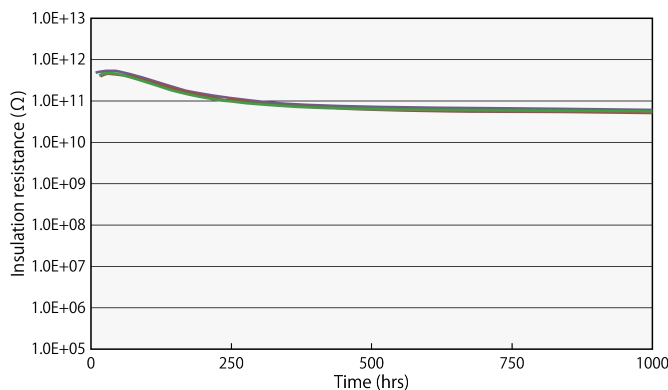
* Failure is over 10% changes of resistance
* 260℃ Peak reflow x 3times as pretreatment

●Construction



Insulation reliability　絶縁信頼性

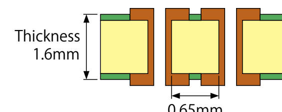
●High voltage CAF evaluation



●Condition

Pretreatment	260℃ Peak reflow x 3times
Condition	85℃ 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.(Tg)		DSC	A	℃	175	148
		TMA			170	145
Thermal decomposition temp.(Td)		TGA	A	℃	355	350
CTE z-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	40	40
	α2				180	180
T288(with copper)		IPC-TM-650 2.4.24.1	A	min	10	3
Peel strength	1oz(35μm)	IPC-TM-650 2.4.8	A	kN/m	1.6	1.8

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-1755D**
Prepreg **R-1650D**

Applications 用途

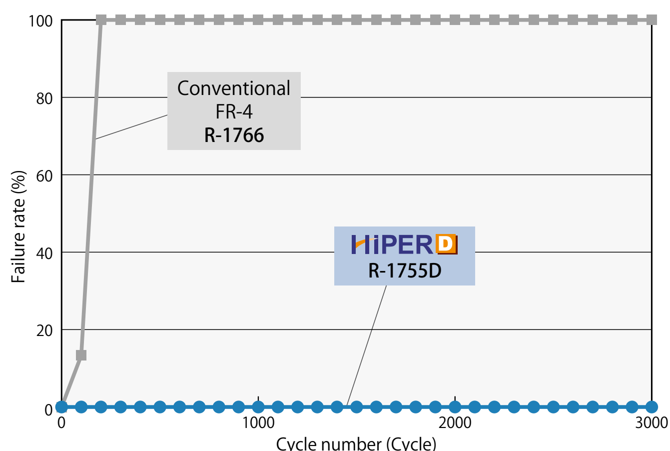
Automotive ECU, Etc.
車載 ECU など

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

Tg (DSC)	Td (TGA)	CTE x-axis
163℃	345℃	10-12ppm/℃

Through-hole reliability スルーホール導通信頼性

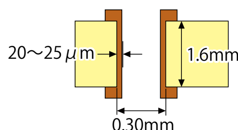


●Condition

Cycle condition	-40℃ (15min) ⇔ 150℃ (15min)

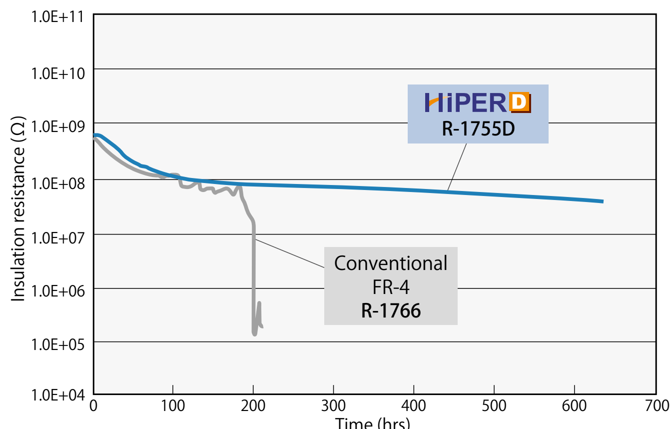
* Failure is over 10% changes of resistance

●Construction



Insulation reliability 絶縁信頼性

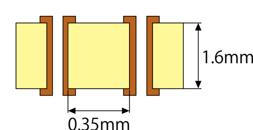
●CAF evaluation



●Condition

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

●Construction



General properties 一般特性

Item		Test method	Condition	Unit	HIPER D R-1755D	Conventional FR-4 R-1766
Glass transition temp.(Tg)		DSC	A	℃	163	140
Thermal decomposition temp.(Td)		TGA	A	℃	345	315
CTE x-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	10-12	11-13
CTE y-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	12-14	13-15
T288(with copper)		IPC-TM-650 2.4.24.1	A	min	15	1
Peel strength	1oz(35μm)	IPC-TM-650 2.4.8	A	kN/m	1.3	2.0

The sample thickness is 0.8mm.

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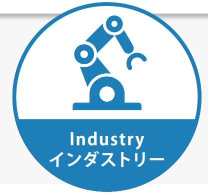
Highly heat resistant Low CTE Multi-layer circuit board materials <Middle-Tg type>

高耐熱・低熱膨張多層基板材料 <Middle-Tgタイプ>

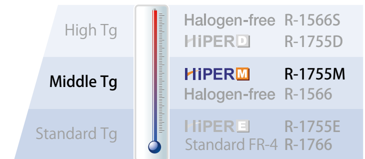
Laminate **R-1755M**
Prepreg **R-1650M**

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

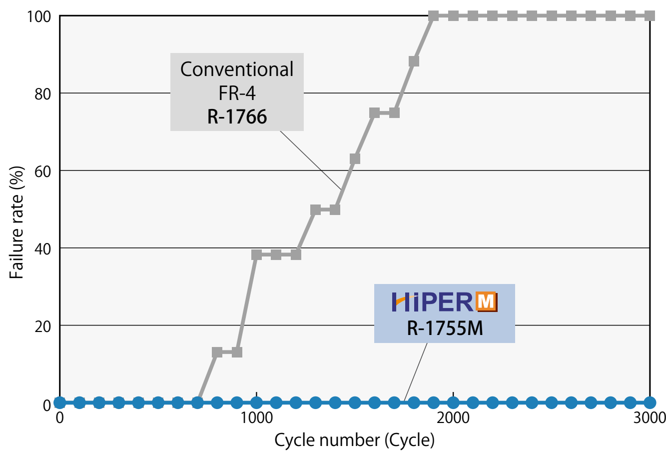


Improved connection reliability of circuit board for automotive by good CAF resistance.
Available for high voltage and industry application.
優れた耐 CAF 性により、車載用基板の接続信頼性を向上し更なる車の安全性に貢献。
高電圧用途・産業機器用途などにも対応



Tg (DSC)	Td (TGA)	CTE z-axis
153℃	355℃	40ppm/℃

Through-hole reliability スルーホール導通信頼性

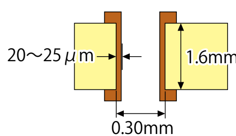


● Condition

Cycle condition	-40℃ (30min) ⇔ 125℃ (30min)

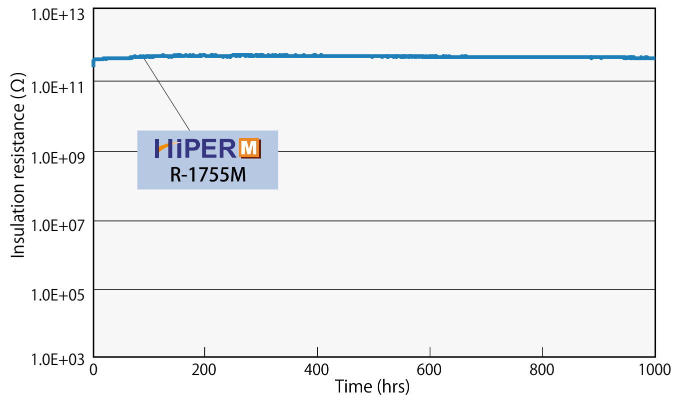
* Failure is over 10% changes of resistance

● Construction



Insulation reliability 絶縁信頼性

● CAF evaluation

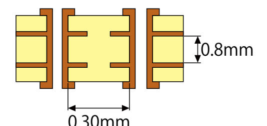


● Condition

4-layers board

Pretreatment	260℃ Peak reflow x 3times
Condition	85℃ 85%RH DC100V
Core	0.8 mm
Prepreg	#7628 x 1ply
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.(Tg)		DSC	A	℃	153	140
Thermal decomposition temp.(Td)		TGA	A	℃	355	315
CTE z-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	40	65
	α2				240	270
T288(with copper)		IPC-TM-650 2.4.24.1	A	min	18	1
Peel strength	1oz(35μm)	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

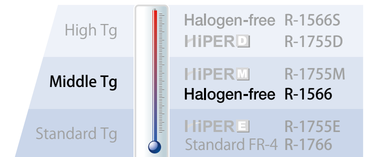
Applications 用途

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

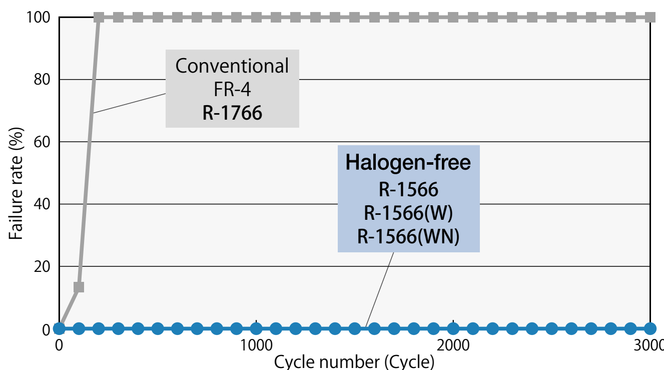
Having many proven from car and mobile company with high reliability and halogen-free properties.

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



Tg (DSC)	Td (TGA)	CTE z-axis
148℃	350℃	40ppm/℃

Through-hole reliability スルーホール導通信頼性

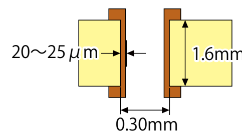


● Condition

Cycle condition	-40℃ (15min) ⇔ 150℃ (15min)

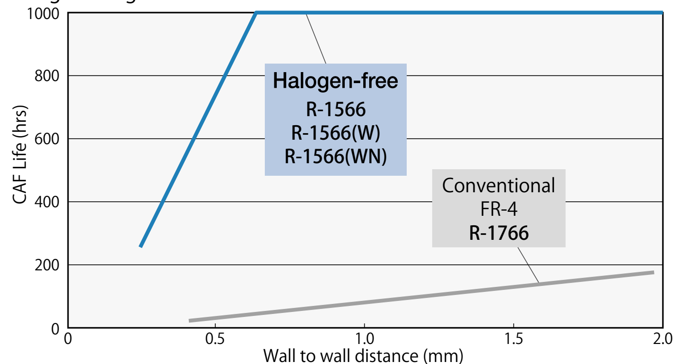
* Failure is over 10% changes of resistance

● Construction



Insulation reliability 絶縁信頼性

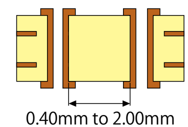
● High voltage CAF evaluation



● Condition

Pretreatment	260℃ Peak reflow x 3times
Condition	85℃ 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.(Tg)		DSC	A	℃	148	148	148	140
Thermal decomposition temp.(Td)		TGA	A	℃	350	350	355	315
CTE z-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	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(35μm)	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。
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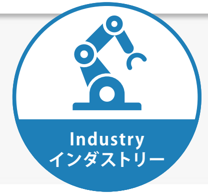
Highly heat resistant Low CTE Multi-layer circuit board materials

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

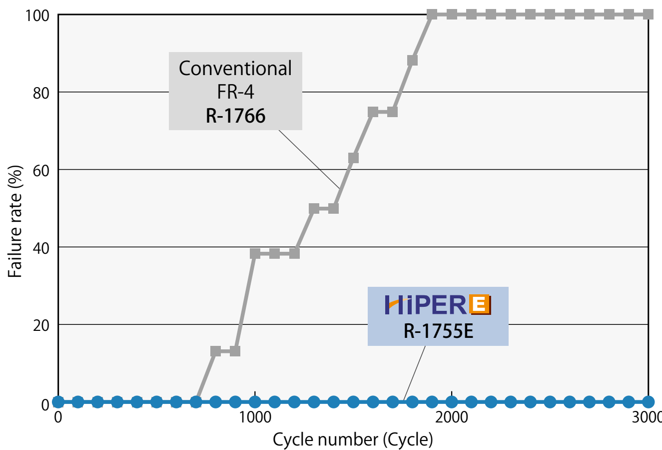


Good highly heat resistant property as general materials apply to Automotive component in harsh environment, high voltage and Industry application.
汎用材でありながら耐熱性に優れており、高温環境の車載用途や高電圧用途、産業機器用途などに適用可能

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

Tg (DSC)	Td (TGA)	CTE z-axis
133℃	370℃	42ppm/℃

Through-hole reliability　スルーホール導通信頼性

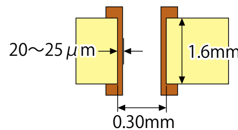


●Condition

Cycle condition	-40℃ (30min) ⇔ 125℃ (30min)

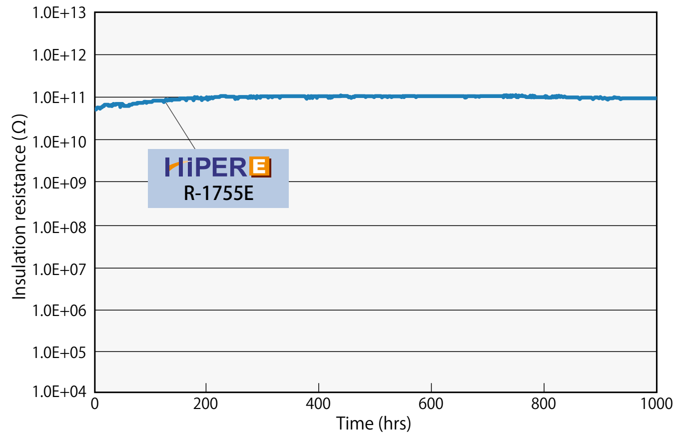
* Failure is over 10% changes of resistance

●Construction



Insulation reliability　絶縁信頼性

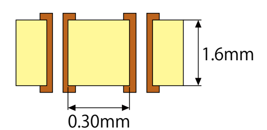
●CAF evaluation



●Condition

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

●Construction



General properties　一般特性

Item		Test method	Condition	Unit	HIPER E R-1755E	Conventional FR-4 R-1766
Glass transition temp.(Tg)		DSC	A	℃	133	140
Thermal decomposition temp.(Td)		TGA	A	℃	370	315
CTE z-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	42	65
	α2				250	270
T288(with copper)		IPC-TM-650 2.4.24.1	A	min	25	1
Peel strength	1oz(35μm)	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

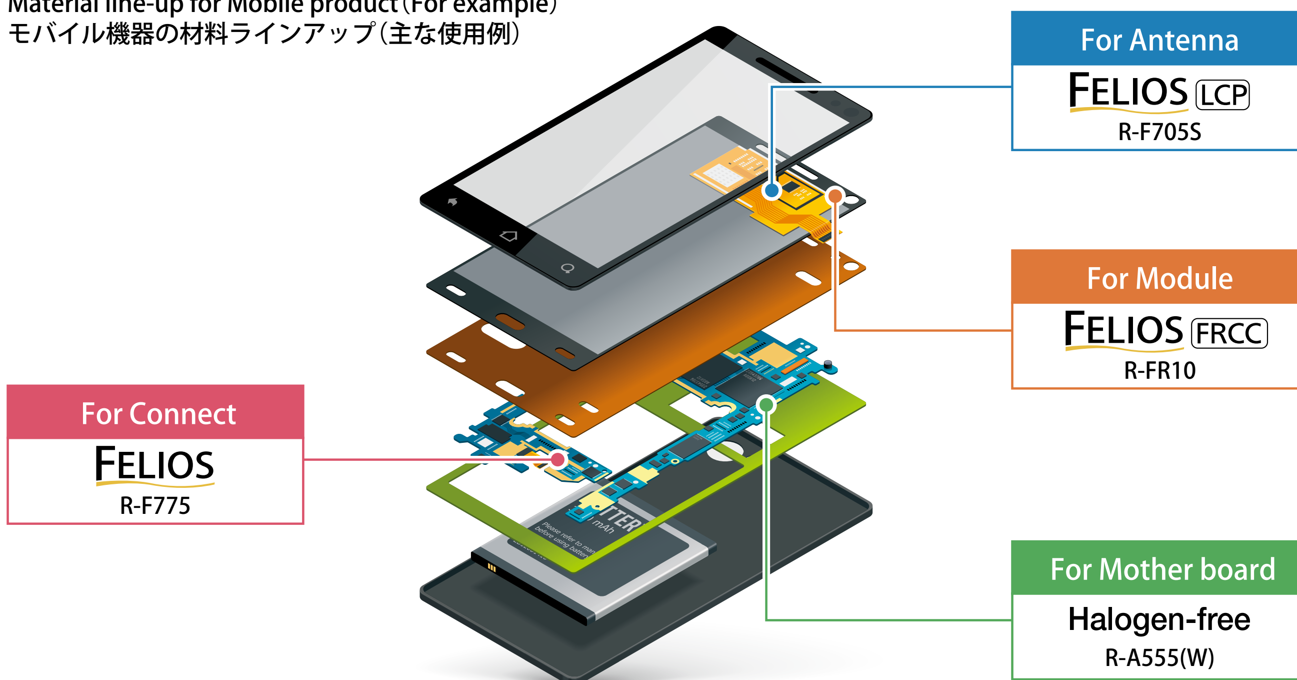
Applications　用途

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、基板コネクト、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

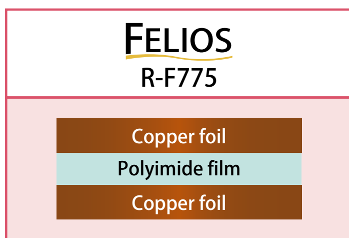
Contributing more functionality, light weight and compact-sizing of mobile product.
スマートフォンなどのモバイル機器の更なる高機能化・軽量化・小型化に貢献

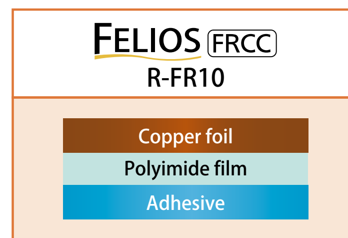
■ Material line-up for Mobile product (For example)
モバイル機器の材料ラインアップ（主な使用例）



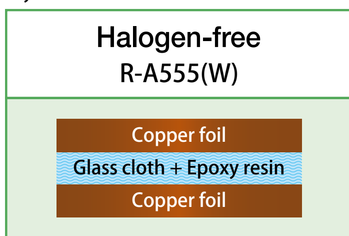
■ Layer structure　層構成

● Flexible circuit board materials





● Multi-layer circuit board materials



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。

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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

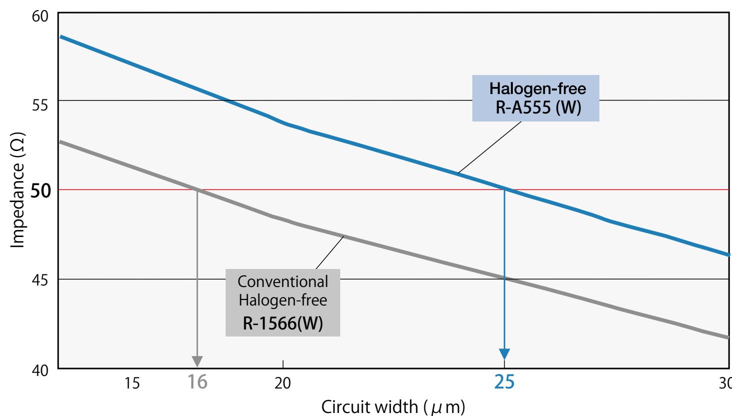
Smartphone, Tablet PC, In-vehicle autonomous driving server, Etc.
スマートフォン、タブレット PC、車載自動運転サーバーなど

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

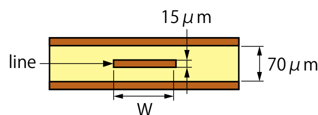
Dk 3.4* @2GHz | **CTE z-axis 41ppm/℃** | **Tg (DMA) 200℃**

*Resin content 70wt%

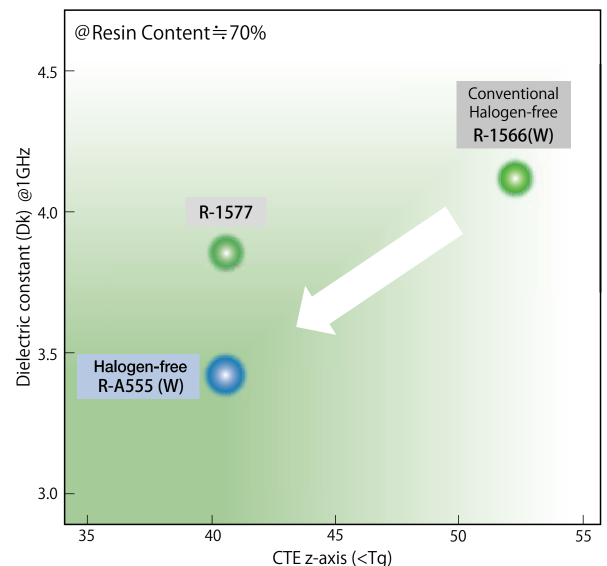
Impedance simulation (Strip Line)
インピーダンスシミュレーション（ストリップライン）



● 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	℃	200	170
CTE z-axis	α1	IPC-TM-650 2.4.24	A	ppm/℃	41	52
	α2				270	300
T288(with copper)		IPC-TM-650 2.4.24.1	A	min	>60	3
Dielectric constant(Dk)*	2GHz	IPC-TM-650 2.5.5.5	C-24/23/50	—	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**

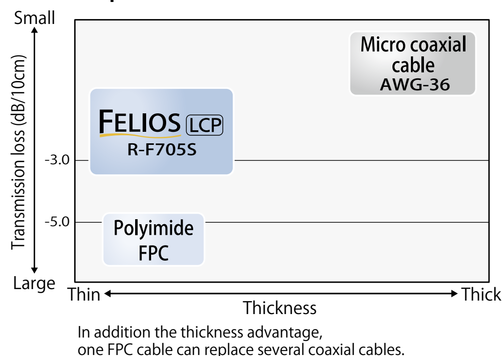
Line-up ラインアップ

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

Unit: mil (mm)

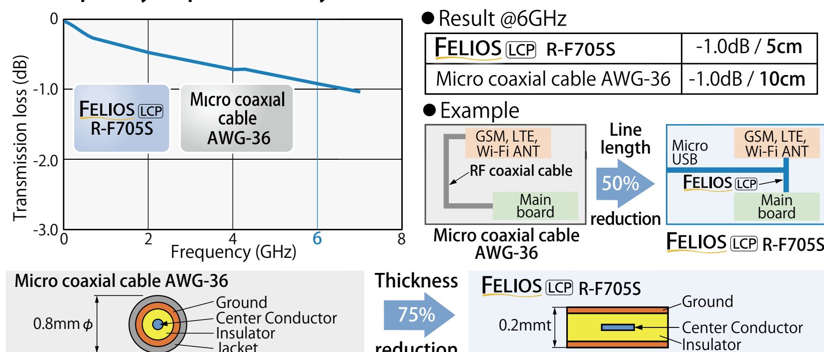
Copper Foil Thickness		Film Thickness 1.0 (0.025)	2.0 (0.050)	3.0 (0.075)	4.0 (0.100)	5.0 (0.125)	6.0 (0.150)
ED Copper Foil 電解銅箔	1/4oz (9μm)	●	●	●	●	●	●
	1/3oz (12μm)	●	●	●	●	●	●
	1/2oz (18μm)	●	●	●	●	●	●

Concept コンセプト



In addition the thickness advantage, one FPC cable can replace several coaxial cables.

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℃ solder float for 1min	—	No abnormality
Dk / Df	14GHz	BCDR*	A	—	2.9 / 0.002
Dk / Df	10GHz	Cavity resonance	A		3.3 / 0.002
Water absorption		Internal method	25℃ 50h immersion	%	0.04
Peel strength	ED:18μm	IPC-TM-650 2.4.8	A	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

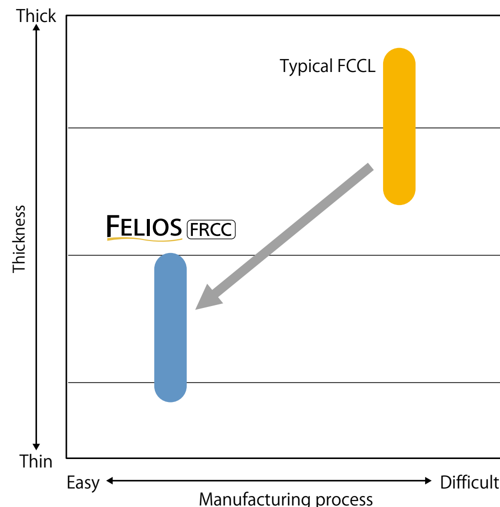
Smartphone(Main/Sub board, Module board), Etc.
スマートフォン (メイン基板、サブ基板、モジュール基板) など

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

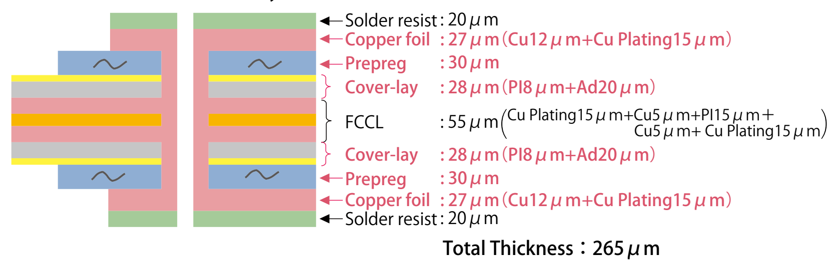
Thickness of 4 layer Rigid-Flex Board and Manufacture process



Thin multi-layer　薄型多層化

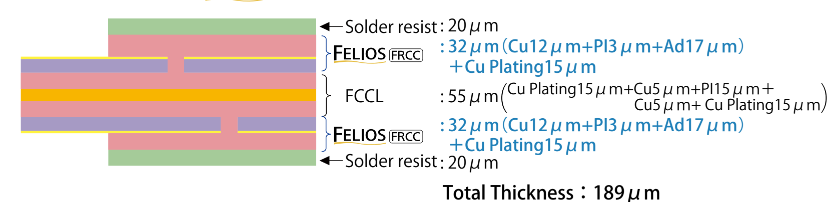
<Example> Multi-layer board 200μm

● In case that used cover-lay



Total Thickness：265μm

● In case that used FELIOS FRCC



Total Thickness：189μm

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℃ solder float for 1min.		
Peel strength	Copper:0.012mm(12μm)	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 Copper12μm, PI3μm, Ad17μm.
*1 Measured by R-FR10/R-F775 25μm/R-FR10 construction
*2 Measured 18μm ED copper on R-F775 25μm 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 (9μm)	●*1	●*1	●*1	-	-	-	●*1
	1/3oz (12μm)	●	●	●	●	●	-	-
	1/2oz (18μm)	●	●*2	●*2	●*2	●*2	●*2	●
	1oz (35μm)	●*1	●*2	●*2	●*2	●*2	●*2	●
	2oz (70μm)	-	●*2	●*2	●	●	●	-
ED Copper Foil 電解銅箔	- (2μm)	●	●	●	●	-	-	-
	1/6oz (6μm)	●	●	●	-	-	-	-
	1/4oz (9μm)	●	●	●	●	●	●	●
	1/3oz (12μm)	●	●	●	●	●	●	●
	1/2oz (18μm)	●	●	●	●	●	-	-
	1oz (35μm)	-	●	●	●	●	-	-

*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	℃	>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(12μm)	JIS C 6471	A	N/mm	1.35
CTE	MD/TD	JIS R 3251	50〜200℃	ppm/℃	17/19
	Z-axis			ppm/℃	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 25μm, copper foil 12μm.

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 reliability Glass composite Circuit board materials

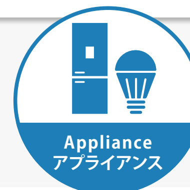
高信頼性ガラスコンポジット基板材料

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

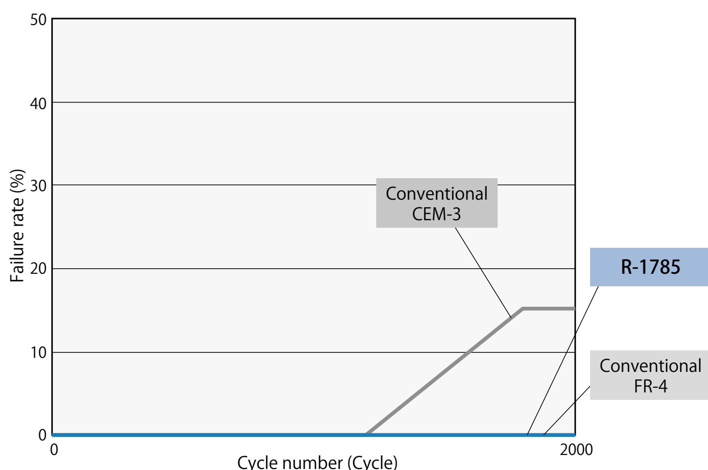


Improved solder joint reliability compared with conventional CEM-3 which has already good to safety and long-time reliability property. Contribute to high reliability PCB for electric car.

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/℃	Tg (TMA) 150℃	CTI≧600V

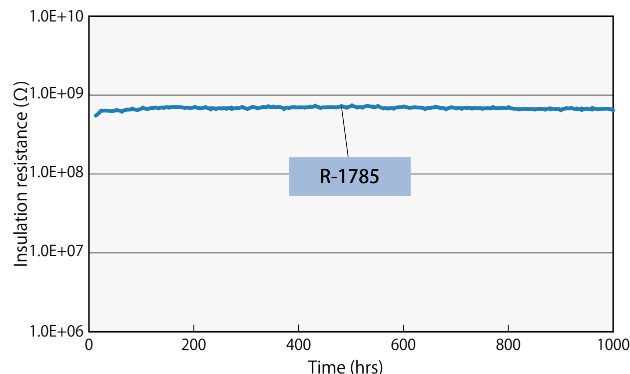
Solder joint reliability 部品実装信頼性



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

Insulation reliability 絶縁信頼性

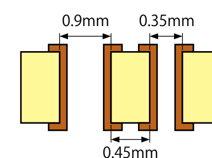
● CAF evaluation



● Condition

Condition	85℃ 85%RH DC100V
Distance between THs	0.45mm
Drill diameter	φ0.9, φ0.35mm
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℃/min	℃	150	140	140
CTE x-axis	α1	IPC-TM-650 2.4.24	TMA	ppm/℃	19 (15)	25 (20)	13
CTE y-axis					21 (17)	28 (23)	15
CTE z-axis	α1/α2	IPC-TM-650 2.4.24	TMA	ppm/℃	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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