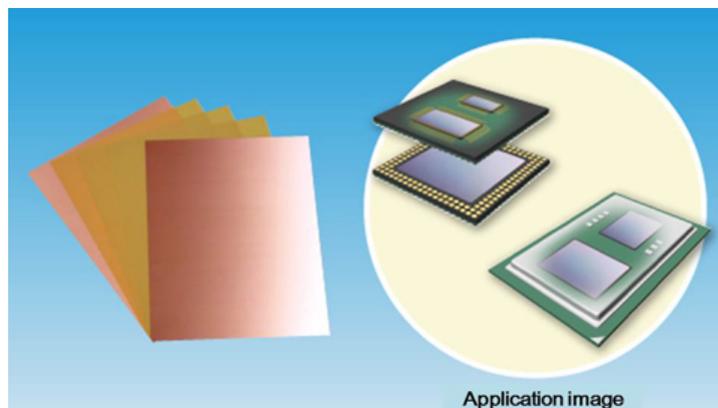


May 29, 2018

## Panasonic Develops an Ultra-low Transmission Loss Circuit Board Material for Semiconductor Packages and Modules

Panasonic's ultra-low transmission loss circuit board material for semiconductor packages and modules allows the stable operation of semiconductor devices that process enormous data at high speed.



**Ultra-low transmission loss circuit board material for semiconductor packages and modules**  
 Laminate R-G545L/R-G545E, Prepreg R-G540L/R-G540E  
 (May 2018, Panasonic)

**Osaka, Japan** - Panasonic Corporation has developed an ultra-low transmission loss circuit board material (Product No. Laminate R-G545L/R-G545E, Prepreg R-G540L/R-G540E) that is suitable for use in semiconductor packages and modules. The company will start mass-producing the material from June 2018. The newly developed material allows the stable operation of semiconductor devices that process enormous data at a high speed.

Due to the expansion of IoT (Internet of Things) network and the launch of the fifth-generation (5G) mobile communications system scheduled to be implemented in 2020. It is expected that the data communication will become further larger in volume and faster. This circumstance has created a demand for circuit board materials used in semiconductor packages and modules that need to be adapted for high-speed/large-capacity data communication applications. From its original resin design technology, the company has developed the circuit board material with ultra-low transmission loss for semiconductor packages and modules. The material offers the lowest transmission loss among the other materials used in the industry\*1.

Panasonic's new ultra-low transmission loss circuit board material has the following features:

1. The lowest transmission loss in the industry\*1 that allows semiconductor devices to operate steadily
  - Transmission loss: -18.7 dB/m. Panasonic's conventional product\*2: -20.6 dB/m (@20 GHz)
2. Excellent environmental durability that allows semiconductor devices to operate over a long period
  - Stable electrical characteristics under a high-temperature/high-humidity conditions
 When the developed material and a conventional product are left in an environment at 130°C with a relative humidity of

85% for 800 hours:

Variation in [dissipation factor](#)[1]: 0.0024. Panasonic's conventional product\*2: 0.0033

3. Less warpage which contributes to an improvement in circuit board manufacturing yield

• Warpage: 310  $\mu\text{m}^3$ . Panasonic's conventional product\*4: 410  $\mu\text{m}$

## Notes:

\*1 As a resin circuit board material for semiconductor packages and modules, the developed material offers the lowest transmission loss in the industry as of May 29, 2018 (Panasonic data).

\*2 Panasonic's conventional product: High-heat-resistant multilayer circuit board material with ultra-low transmission loss MEGTRON6 (Product No. R-5775 (N))

\*3 Variation in the material's warpage when its temperature is raised from 20°C to 260°C (measured by Panasonic's measuring method)

\*4 Panasonic's conventional product: Low thermal expansion circuit board material for semiconductor packages MEGTRONGX (Product No. R-1515A)

## Suitable applications:

Semiconductor package circuit board, module circuit board, etc., for use in communication base stations and various terminals

## Note:

This product will be exhibited at ECTC 2018 scheduled to be held at the Sheraton San Diego Hotel & Marina, United States, from May 29 to June 1, 2018 and at the JPCA Show 2018 scheduled to be held at Tokyo Big Sight from June 6 to 8, 2018.

## [Product Features]

1. The lowest transmission loss in the industry that allows semiconductor devices to operate steadily

There is the trade-off between the dissipation factor, [dielectric constant](#) [2], and [coefficient of thermal expansion \(CTE\)](#) [3] of conventional circuit board materials. This makes it difficult to achieve a circuit board material with a low CTE that is optimal for high-speed/large-capacity data communication. Panasonic's new circuit board material, which has been developed using the company's original resin design technology, offers a reduced CTE and lower dissipation factor and dielectric constant as well. It has achieved the lowest transmission loss in the industry, suppressing signal loss and allowing the stable operation of semiconductor devices that process a large volume of data at high speed.

2. Excellent environmental durability that allows semiconductor devices to operate over a long period

Conventional circuit board materials have a problem in which their resin components decompose under high-temperature/high-humidity conditions and electrical characteristics are deteriorated by absorbed moisture. Thanks to the original resin design technology, the new circuit board material has obtained excellent environmental durability, showing high resistance to heat and humidity. This allows the circuit board material to retain stable electrical characteristics under a high-temperature/high-humidity outdoor environment and even in cases where the semiconductor device generates heat. The product thus allows semiconductor devices to operate steadily for a long period. It is capable of suppressing a variation in dissipation factor more effectively than MEGTRON6, one of the company's conventional products, which has a fine performance record in applications for high-end network equipment, etc.

3. Less warping that contributes to an improvement in circuit board manufacturing yield

Equipping base stations and terminals with higher functionalities have led to an increase in the size of semiconductor devices and in the number of devices incorporated in base stations and terminals. This has created a trend in manufacturing larger package circuit boards and module circuit boards. This trend, however, poses the problem of a lower manufacturing yield due to the warpage of circuit board materials. The new circuit board material offers low dissipation factor and dielectric constant and yet retains low CTE as well, thus managing to suppress its warpage. Therefore, it contributes to an improvement in circuit board manufacturing yield.

## [General properties]

Item		Test method	Unit	R-G545L Low Dk glass cloth	R-G545E Normal glass cloth
Glass transition temp. (Tg)		DMA*	°C	230	230
CTE x, y-axis	$\alpha$ 1	IPC-TM-650 2.4.41	ppm/°C	10	10
CTE z-axis		IPC-TM-650 2.4.24		22	22
Dielectric constant (Dk)	12GHz	Cavity resonance method	-	3.5	4.0
Dissipation factor (Df)				0.0026	0.0040
Water absorption		IPC-TM-650 2.6.2.1	%	0.06	0.06
Peel strength	1/3oz(12 $\mu$ m)	IPC	kN/m	0.6	0.6

The sample thickness is 0.1mm

\* DMA: Measurement in tensile mode

The above data is actual values and not guaranteed values.

## [Term Descriptions]

### [1] Dissipation factor

This term refers to the amount of electric energy that is lost when an insulating material releases its accumulated electric energy. The smaller dissipation factor therefore means more efficient release of accumulated energy, in which case the transmission loss of electric signals becomes smaller.

### [2] Dielectric constant

The dielectric constant of an insulating material indicates how easily it polarizes when external charges are applied thereto. Each material has its inherent dielectric constant value. Because a material that easily polarizes tends to accumulate more electric charges, a material that is difficult to polarize (small dielectric constant) is advantageous for the purpose of creating an efficient current flow.

### [3] Coefficient of thermal expansion (CTE)

This coefficient represents a rate at which the length of a material increases with a unit temperature rise when the temperature of the material is changed under a constant pressure. CTE is one of important characteristics of a circuit board material. It affects the way the circuit board material warpages.

## About Panasonic

Panasonic Corporation is a worldwide leader in the development of diverse electronics technologies and solutions for customers in the consumer electronics, housing, automotive, and B2B businesses. Celebrating its 100<sup>th</sup> anniversary in 2018, the company has expanded globally and now operates 591 subsidiaries and 88 associated companies worldwide, recording consolidated net sales of 7.982 trillion yen for the year ended March 31, 2018. Committed to pursuing new value through innovation across divisional lines, the company uses its technologies to create a better life and a better world for its customers. To learn more about Panasonic:

<http://www.panasonic.com/global>

### Media Contact:

#### Global Communications Department

Panasonic Corporation

Tel: +81-(0)3-3574-5664

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