

# Halogen-free CEM-3

(Double-sided copper-clad)

R-1586

(Single-sided copper-clad)

R-1581

Epoxy resin copper-clad laminate using glass fabric and nonwoven glass fabric as base materials

## ■Features

- 94V-0 has been achieved without using halogen compound and antimony in the UL flame resistance test.
- Excellent in tracking resistance (CTI value: 600).
- Excellent in thickness accuracy.  
Variations in board thickness are  $\pm 0.05$  mm. This thickness accuracy is equal to that of New CEM-3 R-1786.
- Excellent in high frequency characteristics.  
Small dissipation factor and thickness variations can realize designed performance.

- Provides dimensional stability equivalent to that of glass epoxy (FR-4).
- Reduces CO<sub>2</sub> emission amount in our manufacturing process to one-quarter by means of our unique manufacturing process.  
(Compared with our conventional FR-4)

## ■Applications

- Liquid crystal television, PDP, PC peripheral equipment, air conditioner, plumbing equipment, power supply board, tuner, amusement machine, etc.

## ■Specifications (Assured values)

Standard size (Warp × Fill)	Nominal thickness		Thickness tolerance				Warpage, Twist	
			R-1586		R-1581		Single-sided	Double-sided
			Copper foil 0.018mm	Copper foil 0.035mm	Copper foil 0.018mm	Copper foil 0.035mm		
1,020 <sup>+3</sup> / <sub>-0</sub> × 1,020 <sup>+5</sup> / <sub>-0</sub> mm 1,220 <sup>+3</sup> / <sub>-0</sub> × 1,020 <sup>+5</sup> / <sub>-0</sub> mm	1.0mm	Including copper foil thickness.	1.00 ± 0.08mm	1.04 ± 0.08mm	0.99 ± 0.08mm	1.01 ± 0.08mm	≤ 9.0%	≤ 2.5%
	1.2mm		1.15 ± 0.05mm	1.19 ± 0.05mm	1.14 ± 0.05mm	1.16 ± 0.05mm	≤ 7.0%	≤ 2.5%
	1.6mm		1.52 ± 0.05mm	1.56 ± 0.05mm	1.51 ± 0.05mm	1.53 ± 0.05mm	≤ 6.0%	≤ 2.0%

Note : When thickness is measured at 10 positions according to Section 5.3.3 in JIS C6481, thicknesses of at least 9 positions are within the tolerance range specified above. Thickness out of the tolerance range is within 125% of the above tolerance.

Note : For detail dimensions, please confer with us separately.

## ■General Properties

Test item	Unit	Treatment conditions	R-1586	
			Actual value	Guaranteed value
Volume resistivity	M Ω · m	C-96/20/65	1 × 10 <sup>9</sup>	≥ 1 × 10 <sup>6</sup>
		C-96/20/65+C-96/40/90	5 × 10 <sup>7</sup>	≥ 1 × 10 <sup>5</sup>
Surface resistance	M Ω	C-96/20/65	3 × 10 <sup>9</sup>	≥ 1 × 10 <sup>6</sup>
		C-96/20/65+C-96/40/90	1 × 10 <sup>9</sup>	≥ 1 × 10 <sup>5</sup>
Insulation resistance	M Ω	C-96/20/65	5 × 10 <sup>9</sup>	≥ 1 × 10 <sup>6</sup>
		C-96/20/65+D-2/100	1 × 10 <sup>7</sup>	≥ 1 × 10 <sup>4</sup>
Dielectric constant (1MHz)	—	C-96/20/65	4.6	≤ 5.5
		C-96/20/65+D-24/23	4.6	≤ 5.8
Dissipation factor (1MHz)	—	C-96/20/65	0.016	≤ 0.030
		C-96/20/65+D-24/23	0.016	≤ 0.035
Solder heat resistance (260°C)	second	A	≥ 120	≥ 60
Peel strength	Copper foil : 0.018mm (18 μm)	A	1.42	≥ 1.00
		S <sub>4</sub>	1.42	≥ 1.00
	Copper foil : 0.035mm (35 μm)	A	1.70	≥ 1.40
		S <sub>4</sub>	1.70	≥ 1.40
Heat resistance	—	A	230°C60minutes No blister	200°C60minutes No blister
Flexural strength (crosswise direction)	N/mm <sup>2</sup>	A	270	≥ 225
Water absorption	%	E-24/50+D-24/23	0.09	≤ 0.25
Flammability (UL method)	—	A and E-168/70	94V-0	94V-0
Alkali resistance	—	Immersion (3 minutes)	no abnormality	no abnormality
Punching workability	—	A	Suitable temperature:25°C	—

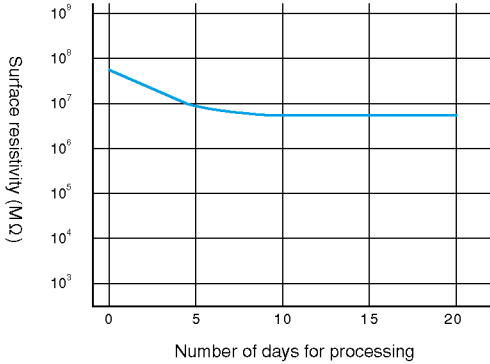
Note : Test piece thickness is 1.6 mm.

Note : The above tests are in accordance with JIS C6481. However, flame resistance is tested in accordance with UL94, and punching workability is in accordance with our company's testing method.

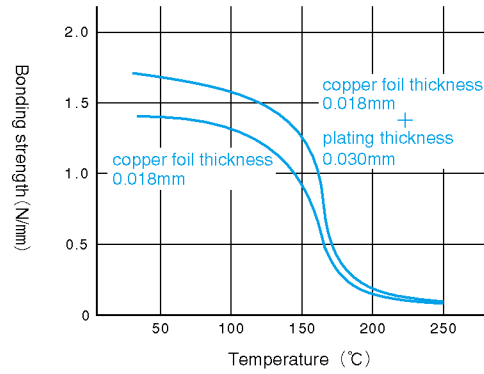
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**Characteristic graph (reference value)**

**Time-dependent change of surface resistance (40°C、90%RH processing)**  
 (Comb pattern circuit width : 0.64mm、Circuit interval : 1.3mm)

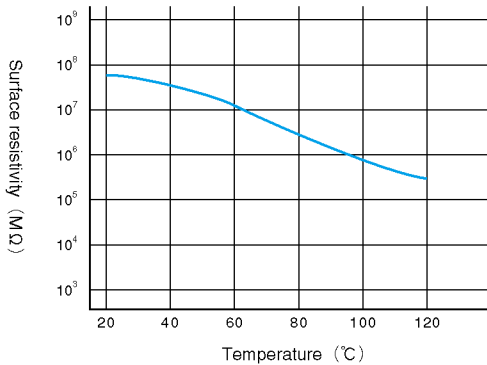


**Peel strength of copper foil**



**Temperature characteristic of surface resistance**

(Comb pattern circuit width : 0.64mm、Circuit interval : 1.3mm)

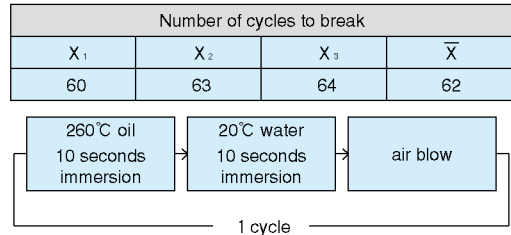


**Through hole reliability**

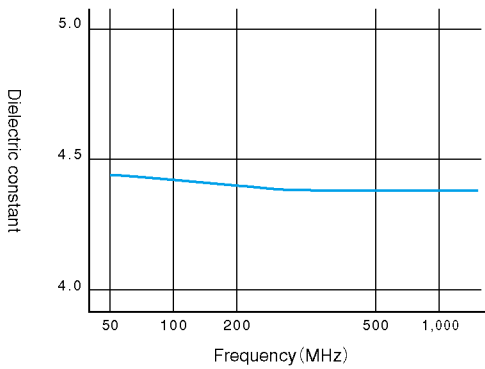
● Test condition

Create test pieces by applying copper through hole processing on test patterns, give the following thermal shocks, and measure the number of cycles until disconnection occurs.

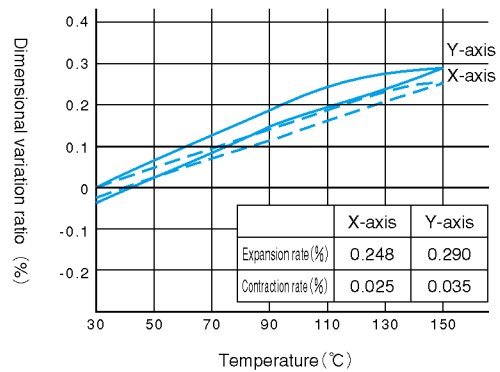
● Example



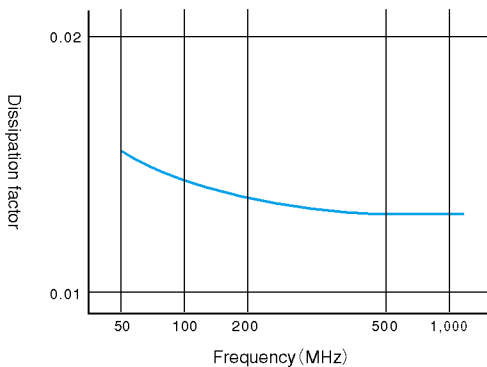
**Frequency characteristic of dielectric constant (IPC TM-650 2.5.5.9)**



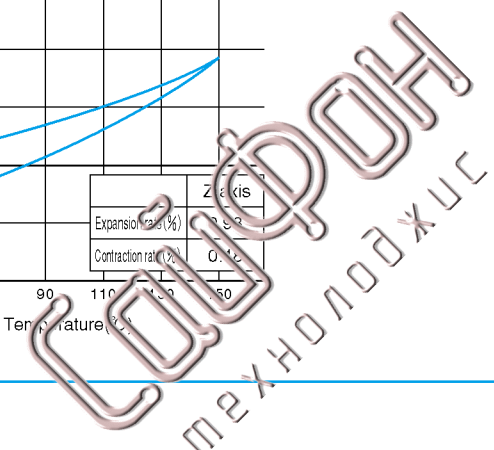
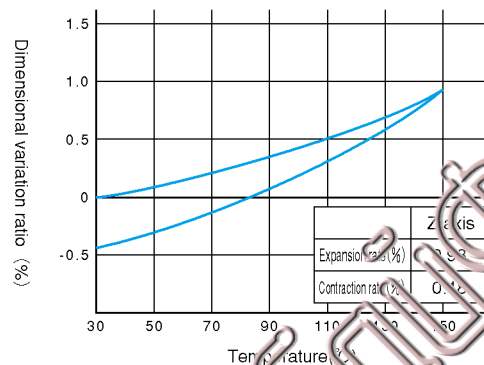
**Thermal expansion and contraction rates (Dilatometer method) (150°C scale)**



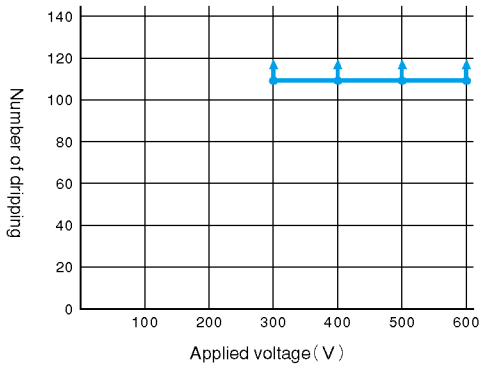
**Frequency characteristic of dissipation factor (IPC TM-650 2.5.5.9)**



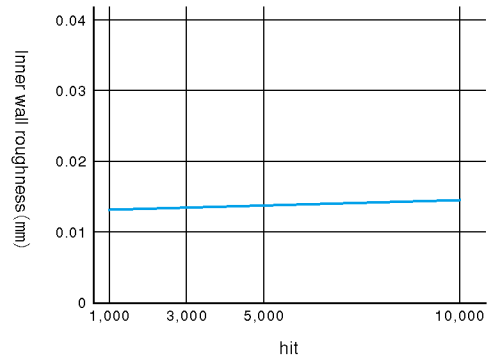
**Thermal expansion and contraction rates (TMA method) (150°C scale)**



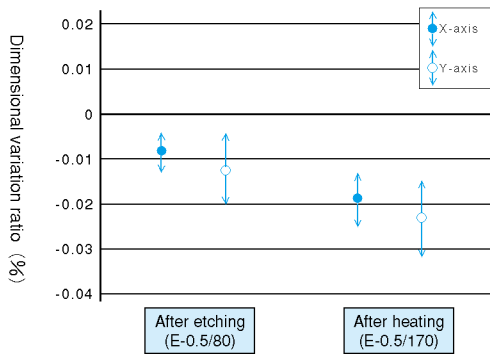
■ Tracking resistance (IEC method) (0.1% NH<sub>4</sub>Cl)  
(Electrode (platinum) interval)



■ Inner wall roughness (60,000rpm 0.05mm/rev 3 ply)



■ Dimensional variation ratio (plate thickness 1.6mm copper foil thickness 0.018mm)  
Size : 305mm(X-axis)×280mm(Y-axis)/Span : 270mm(X-axis), 260mm(Y-axis)

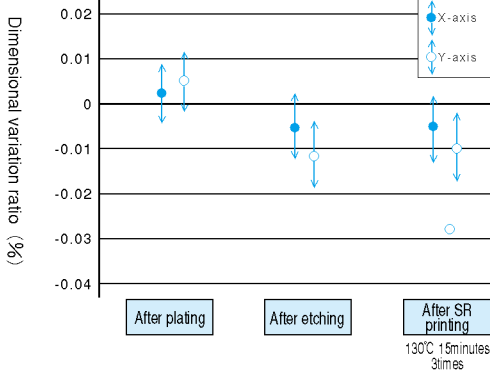


■ Punching characteristic (Punching temperature 25°C)

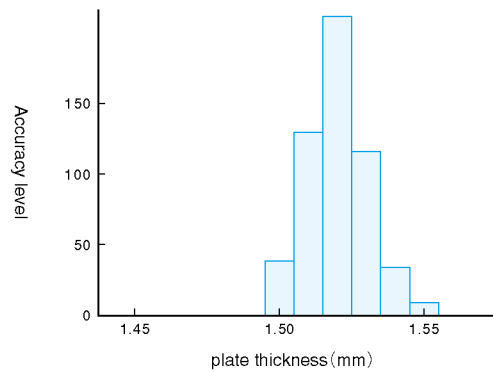
Maximum dynamic shearing stress N/mm <sup>2</sup>	Maximum dynamic pull-out stress N/mm <sup>2</sup>
161.7	46.1

※ Punching temperature is equal to the board's surface temperature.

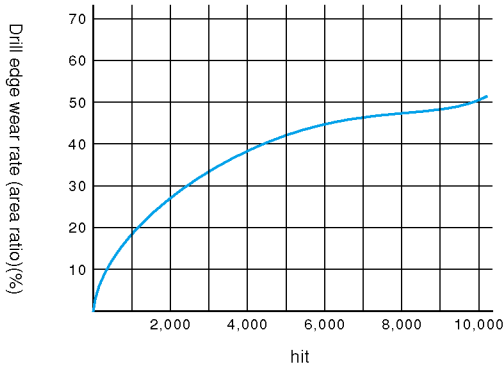
■ Dimensional variation ratio (Processing steps plate thickness 1.6mm copper foil thickness 0.018mm)  
Size : 305mm(X-axis)×280mm(Y-axis)/Span : 270mm(X-axis), 260mm(Y-axis)



■ thickness accuracy (plate thickness 1.6mm copper foil thickness 0.018mm)  
( $\bar{x}$  = 1.52mm R = 0.053mm  $\sqrt{v}$  = 0.014mm)



■ Drill wear resistance (Drill  $\phi$ 0.6mm U.C35 Number of rotations 60,000rpm  
Feed rate 0.035mm/rev Entry boards : Aluminum(0.15mm)  
Backup board : Bakelite plate thickness : 1.6mm Copper foil 0.018mm 3 ply)



■ Hole diameter contraction after punching (Punching temperature : 25°C R-1581)

