

รายการอ้างอิง

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ภาคผนวก

ภาคผนวก ก
แสดงตารางของ FR-1

DS-1107A (ANSI : FR-1) HIGH C.T.I

FEATURES

- High C.T.I Value (over 600V)
- Excellent heat and humidity resistance
- Good dimensional stability
- Excellent punching processability
- Recommendable for high density circuits

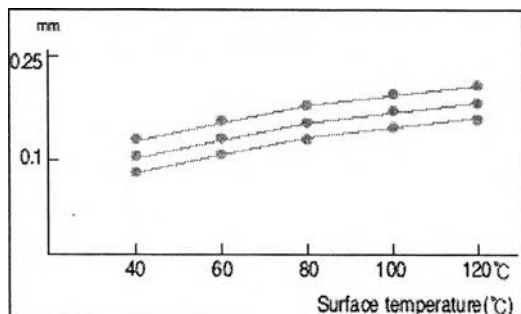
INTERNATIONAL STANDARD RECOGNITION

- UL : E103670
- CSA : LS-93237
- BSI : 6741
- VDE : VDE-Reg-Nr. 4158
- JET : V-0034

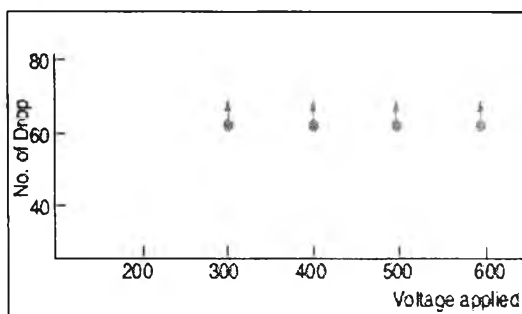
APPLICATIONS

Color TV, Monitor, VCR, CDP, Radio, Component, stereo, etc.,

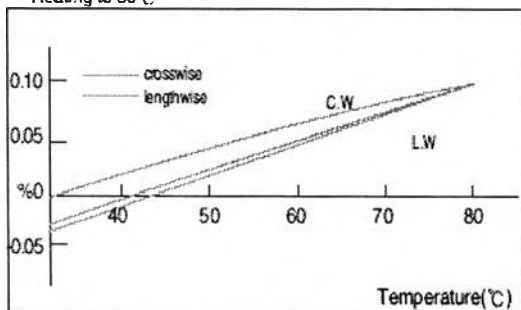
■ Punching hole shrinkage



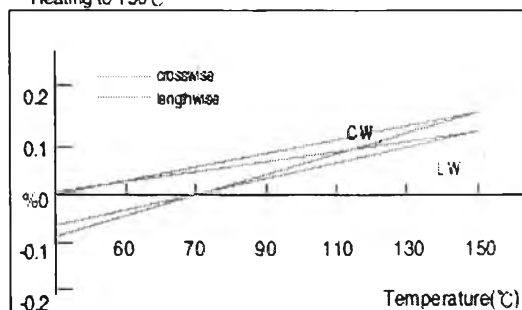
■ Anti-Tracking (IEC Method)



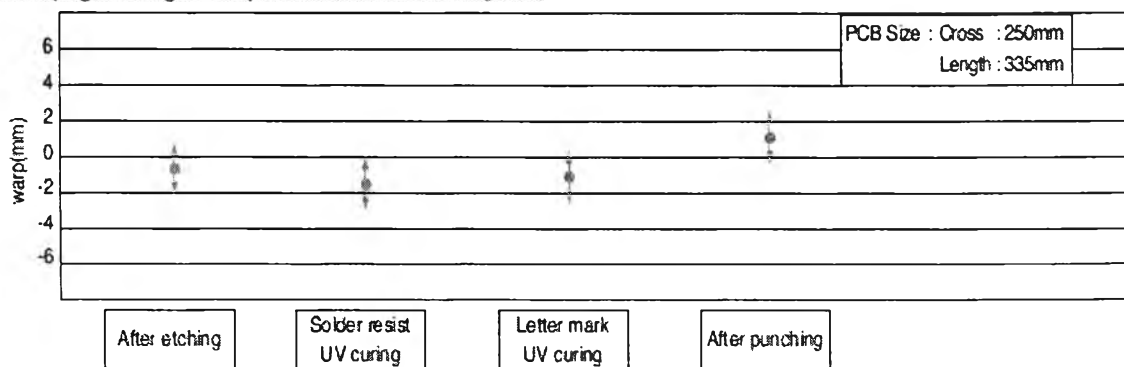
■ Thermal expansion and shrinkage Heating to 80°C



■ Thermal expansion and shrinkage Heating to 150°C



■ Warpage through PCB process (thickness 1.6mm single side)



GENERAL PROPERTIES

			Designation	DS-1107A	
			ANSI Grade	FR-1	
Test Item	Unit	Treatment Condition	Property Data		
			Standard Value	Guaranteed Value	
Flammability	sec	UL 94	avg : 3.0 max : 8.0	avg : 5.0 max : 10.0	
Insulation Resistance	ohm	C-96/20/85 C-96/20/65+D-2/100	$5 \times 10^1 - 5 \times 10^2$ $3 \times 10^1 - 8 \times 10^1$	above 1×10^1 above 1×10^1	
Volume Resistivity	ohm-cm	C-96/20/65 C-96/20/65+C-96/40/90	$1 \times 10^3 - 1 \times 10^4$ $5 \times 10^2 - 5 \times 10^3$	above 5×10^1 above 5×10^1	
Surface Resistance	Adhesive Surface	ohm	C-96/20/65 C-96/20/65+C-96/40/90	$5 \times 10^1 - 5 \times 10^2$ $1 \times 10^1 - 1 \times 10^1$	above 1×10^1 above 5×10^1
	Laminate Surface	ohm	C-96/20/65 C-96/20/65+C-96/40/90	$1 \times 10^1 - 1 \times 10^2$ $5 \times 10^1 - 5 \times 10^1$	above 1×10^1 above 1×10^1
Dielectric Constant (1 MHz)	-	C-96/20/65 C-96/20/65+D-48/50	4.0 - 5.0 4.5 - 5.5	less than 5.5 less than 6.0	
Dissipation Factor (1 MHz)	-	C-96/20/65 C-96/20/65+D-48/50	0.020 - 0.030 0.025 - 0.035	less than 0.050 less than 0.060	
Comparative Tracking Index	volt	IEC Method	600	above 600	
Solder Float(260 °C)	sec	A	35 - 45	above 15	
Peel Strength	Cu.Foil 1 oz (0.035mm)	kg/cm	A	1.8 - 2.3	above 1.42
			S	1.8 - 2.3	above 1.42
Flexural Strength(LW)(CW)	kg/mm ²	A	15 - 18 13 - 16	above 8.16 above 8.16	
Water absorption	%	E-24/50+D-24/23	0.7 - 0.9	less than 1.2	
Trichloroethylene Resistance	-	Immersion in boiling Trichloroethylene (For 2 minutes)	No abnormality	No abnormality	
Punching Processability		A	Suitable Temperature 50 °C - 70 °C		

Specimen Thickness : 1.6mm

PURCHASING INFORMATION

- Copper foil : 1 oz/ft²(0.035 mm) copper foil as standard
- Thickness : 0.6mm to 3.2mm

Standard Size	Tolerance(mm)
1,020 × 1,020mm (40" × 40")	+3
1,020 × 1,220mm (40" × 48")	-0
1,070 × 1,160mm (42" × 45.6")	

※ Other sheet size and thickness could be available upon request.

■ Punching hole shrinkage

■ Anti-tracking(IEC Method)

Electrode distance: 4mm 0.1% NH₄Cl

ภาคผนวก ข
แสดงตารางของ FR-4

DS-7405 (ANSI : F R-4)

FEATURES

- Good dimensional stability.
- Soldering reliability has been bettered
- Good electrical properties
- High density automatic mounting can be carried out

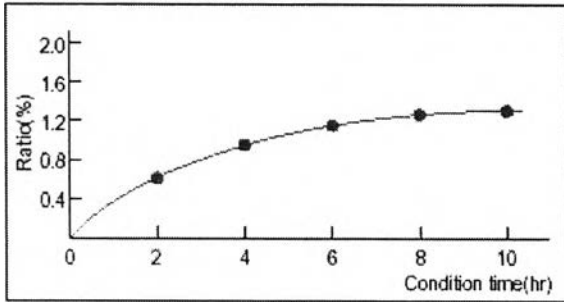
INTERNATIONAL STANDARD RECOGNITION

- UL : E103670
- CSA : LS-93237
- BSI : 6741
- VDE : VDE-Reg-Nr. 4945

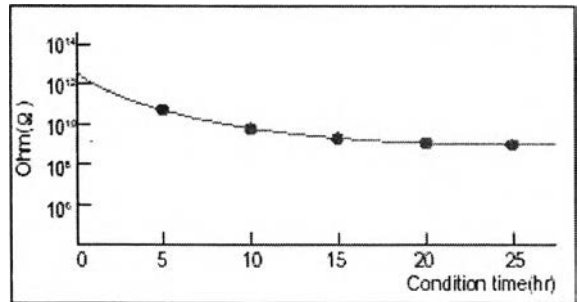
APPLICATIONS

Computer, Instrumentation, VCR, Television, Electronic Toy, etc..

Water absorption at pressure cooker

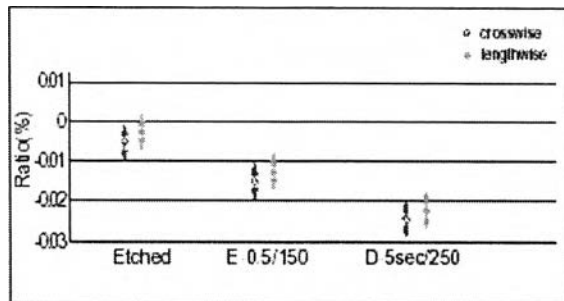


Insulation resistance at pressure cooker



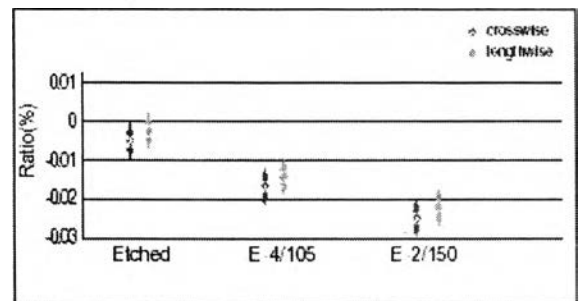
Dimensional stability

PCB process (size 360 X 310 mm span 310 X 254 mm)

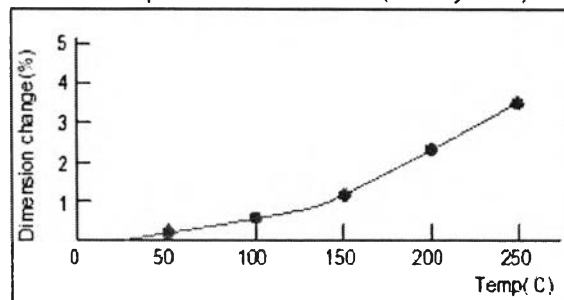


Dimensional stability

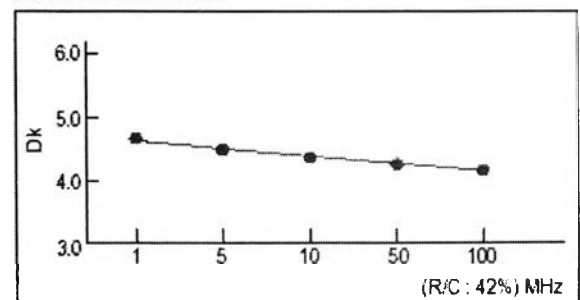
Test method (IPC TM.650 2.4.39)



Thermal expansion of Z-direction (Test by TMA)



Dielectric constant



GENERAL PROPERTIES

		Designation		DS-7405	
		ANSI Grade		FR-4	
Test Item	Unit	Treatment Condition	Property Data		
			Standard Value	Guaranteed Value	
Tg	°C	DSC	135	above 130	
		TMA	135	above 130	
		DMA	165	above 160	
CTE x-axis y-axis z-axis	ppm/°C	Ambient to Tg	18	less than 20	
			13	less than 15	
			55	less than 60	
Flammability	-	UL-94	V-0	V-0	
Insulation Resistance	ohm	C-96/20/65	$1 \times 10^{12} - 1 \times 10^{13}$	above 5×10^{11}	
		C-96/20/65+D-2/100	$1 \times 10^{13} - 1 \times 10^{14}$	above 1×10^9	
Volume Resistivity	ohm-cm	C-96/20/65	$1 \times 10^{14} - 1 \times 10^{15}$	above 1×10^{13}	
		C-96/20/65+C-96/40/90	$5 \times 10^{13} - 5 \times 10^{14}$	above 5×10^{12}	
Surface Resistance	ohm	C-96/20/65	$5 \times 10^{13} - 5 \times 10^{14}$	above 1×10^{12}	
		C-96/20/65+C-96/40/90	$1 \times 10^{12} - 1 \times 10^{13}$	above 1×10^{11}	
Arc Resistance	min.seconds		110	above 60	
Dielectric Constant (1 MHz)	-	C-96/20/65	4.5 - 4.8	less than 5.5	
		C-96/20/65+D-48/50	4.6 - 5.2	less than 5.8	
Dissipation Factor (1 MHz)	-	C-96/20/65	0.015 - 0.020	less than 0.035	
		C-96/20/65+D-48/50	0.018 - 0.023	less than 0.045	
Comparative Tracking Index	volt	IEC Method	-	-	
Solder Float(260 °C)	sec	A	above 180	above 120	
Peel Strength	Cu.foil 1 oz (0.035mm)	kgf/cm	A	1.8 - 2.2	
Flexural Strength	kgf/mm ²	A	40 - 50	above 32.7	
Water Absorption	%	E-24/50+D-24/23	0.10 - 0.15	less than 0.25	

Specimen Thickness : 1.6mm

PURCHASING INFORMATION

- Copper foil : 0.5 oz/ft²(0.018 mm), 1 oz/ft²(0.035 mm), 2 oz/ft²(0.070 mm) available.
- Thickness : 0.2mm to 3.2mm

Standard Size		Tolerance(mm)
1,020 X 1,220mm (40" X 48")	915 X 1,220mm (36" X 48")	+3
1,070 X 1,220mm (42" X 48")	970 X 1,220mm (38" X 48")	-0

* Other sheet size and thickness could be available upon request.

ประวัติผู้เขียนวิทยานิพนธ์

นายนิคม กุญชรศิลป์ เกิดวันที่ 1 กรกฎาคม พ.ศ. 2512 ที่จังหวัดสระบุรี สำเร็จการศึกษา
ระดับปริญญาวิศวกรรมศาสตรบัณฑิต สาขาวิชาวิศวกรรมไฟฟ้า จากสถาบันเทคโนโลยีราชมงคล เมื่อ
ปี พ.ศ. 2538 และได้เข้าศึกษาต่อในหลักสูตรวิศวกรรมศาสตรมหาบัณฑิต สาขาวิชาวิศวกรรมไฟฟ้า
(เครื่องมือวัดคุมทางอุตสาหกรรม) ที่จุฬาลงกรณ์มหาวิทยาลัย เมื่อปี พ.ศ. 2544

