Panasonic Manufacturing Ayuthaya Co., Ltd
Rojana Industrial Park 1/69 Moo 5 Rojana Road ,
Tambol Kanham Amphur U-thai Ayuthaya , Thailand 13210
Tel : (66-35) 330-864~ 66 Fax : (66-35) 330-867~68

Certificate No. 403378

Certificate No. 402978

ATTN : MICROLINE CIRCUIT CO.,LTD.

SPECIFICATION APPROVAL SHEET

TITLE :	PAPER PHENOL RESIN COPPER CLAD LAMINATE
ANSI GRADE :	FR-1
PRODUCT MODEL :	R - 8700 K,
SHEET THICKNESS :	0.8, 1.0 , 1.2 , 1.6 mm.
COPPER FOIL THICNESS	35 µm.
DIMENSION	1020 x 1020 , 1220 x 1020 mm.

SIGNATURE OF APPROVAL

FOR RETURN

DATE .....

Panasonic Manufacturing Ayuthaya Co., Ltd.

MARKETING DEPARTMENT

Mr.Hiroshi Koyama

PRODUCTION DEPARTMENT

Mr.Anuchar Janguna

DIRECTOR

Mr.Kanji Kurata

QUALITY ASSURANCE DEPARTMENT

Mr.Pitak Aunnankart

DATE : _____

LIST NO.	

1. APPLICATION

This Specification Approval document contains the stipulation of the Paper Phenolic Copper Clad Laminates, such as the Copper Foil dimension, the product appearance, the special standards, the product displays and the packaging.

Note : The general properties and other requirment are same as model R-8700. Only appearance specification was defered.

PRODUCT CERTIFICATION

STANDARD	FILE NO.
1) UL / CSA	E 81336
2) BSI	6369
3) JQA	KL6530342
4) JET	V-0055

2.COPPER FOIL

Copper Foil must be electrolysis copper of 99.8 % purity or greater

Table 1 Thickness and tolerances for Copper Foil (Units:mm)

Nominal thickness	Weight (g/m^2)	Tolerance # (mm)
35 μm (1 ounce)	305±30	+0.010 -0.005

@ Reference ···This Thickness is mesured by outside micrometer

3. DIMENSION

Dimensions and dimension tolerances are as shown in table 2

Table 2 : The standard dimension of direction and tolerances

(Unit : mm)

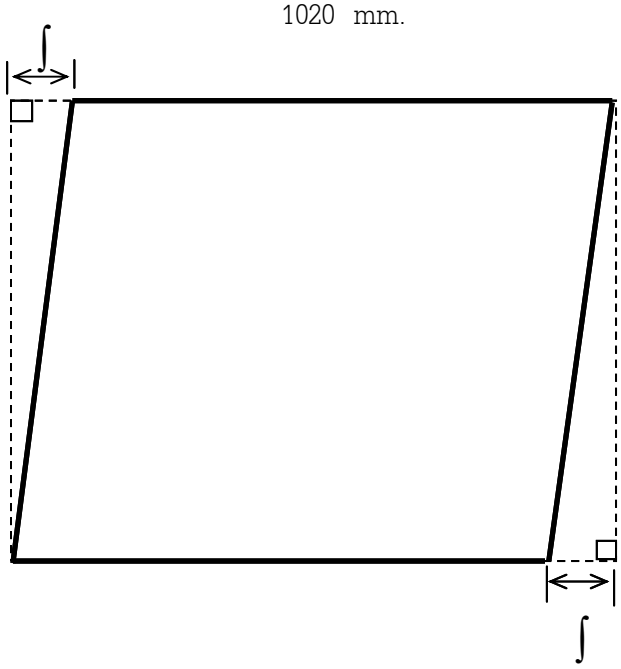
Dimension Directions (Length x Width)	Dimension Tolerances (Length x Width)
1) 1,020x1,020 (N)	+ 2
2) 1,220x1,020 (T)	- 2

4. SQUARENESS

Using a chosen side as the base,measure the side as shown in Figure 1 .Next , make one of the sides the base and measure again,using ∫ as the criterion for squareness.

J

1020 mm.



1020 or 1220 mm.

Figure 1 Squareness

∫ mm/Specified length ≤ 2 mm / MEW Standard length

5.APPERANCE

Consider the product appearance, which are the standard quality Copper Clad Laminates being.

It will be illustrated as Table 3

AREA SIDE	ITEMS	APPEARANCE STANDARDS
Copper foil Surface	PIN HOLES	Pin hole with resin through out the copper surface but can not see the laminate could be accept.
	DENTS	size < 1.0 mm^2 allow on Cu surface 1 m2 totally ≤ 50 points size 1.0~1.5 mm^2 allow on Cu surface 1 m2 totally ≤ 30 points size 1.5~5.0 mm^2 allow on Cu surface 1 m2 totally ≤ 10 points
	RUSTY	- Color is not black or dark brown size not over 2.0~5.0 mm^2 totally ≤ 30 point / 1m^2. - Color is black or dark brown size not over 20x100 mm totally ≤ 3 point / 1m^2.
	BLISTERS, WRINKLES	(1) Size less than 5 mm^2 toally < 3 points/1 m^2
	SCRATCHES	(1) Width size is not over 1.0 mm. , the length not over 50 cm. and the laminate must be not seen.
	Surface Unevenness	(1) There must be no unevenness thickness greater than 0.1 mm form other area. And in visual observation , there must be no such unevenness as is detectable by touch (with hand)

AREA SIDE	ITEMS	APPEARANCE STANDARDS
ETCHING SURFACE	Foreign matter, Scratches, Copper Fillings, Color Irregularities and graze	(1) There must be no such one as is actually hurtful (residual copper, copper fillings, scratches, and color irregularities;(resin irregularities.)) (2) At the four corner portions,there must be no more than one graze within the radius 50 mm from each corner,
Laminate Surface	Foreign matter, Burring	(1) There must be no more than 20 pieces of foreign matter of surface area of 1.0 through 3.0 mm^2 (2) As to the foreign matter of is not different color from the product ,all size are around on laminate.
	Scratches.	(1) - Depth not over 0.1 mm, width not over 0.5 mm, Length is not control but not less than 5 lines
	Cracks Non uniformity	(1) Not allowed

Note: 1) Measurements of the size of dents and foreign matter are based on the impurities . Measurement table produced by The Ministry of Finance's Printing office.

2) The standards for laminates are to be applied to single-faced boards.

6. GENERAL PROPERTIES

ITEM		UNIT	TREATMENT CONDITIONS	STANDARD VALUE
SOLDER HEAT RESISTANCE	THICKNESS 1.6 mm.	SECONDS	A + S - 260 °C	5 OR GREATER 10 OR GREATER
HEAT RESISTANCE		°C	A + E - 0.5 / 190	NO PEELING OR BLISTERING
PEEL STRENGTH	COPPER FOIL0.035 mm.	N / cm.	A and S 2	14.7 OR GREATER
VOLUME RESISTIVELY	ADHESIVE SURFACE	Ω.cm.	C-96/20/65	$5X10^{12}$ OR GEATER
			C-96/20/65 + C-96/40/90	$5X10^{11}$ OR GRATER
SURFACE RESISTANCE	ADHESIVE SURFACE	Ω	C-96/20/65	$1X10^{11}$ OR GREATER
			C-96/20/65+C-96/40/90	$1X10^{10}$ OR GREATER
	LAMINATE SURFACE	Ω	C-96/20/65	$1X10^{10}$ OR GREATER
			C-96/20/65+D2/100	$1X10^{8}$ OR GREATER
INSULATION RESISTANCE		Ω	C-96/20/65	$1X10^{11}$ OR GREATER
			C-96/20/65+D-2/100	$1X10^{8}$ OR GREATER
DIELECTRIC CONSTANT (1 MHz)	ADHESIVE SURFACE	-	C-96/20/65	5.0 OR LESS
			C-96/20/65 + D-24/23	5.3 OR LESS
DISSIPATION FACTOR (1 MHz)	ADHESIVE SURFACE	-	C-96/20/65	0 .045 OR LESS
			C-96/20/65+D-24/23	0.055 OR LESS
ALKALINE RESISTANCE		-	A	NO GREAT CHANGE IN APPEARANCE AFTER BEING IMMERSED IN 3 % OF SODIUM HYDROXIDE (Naoh3%) 40 °C FOR 3 MINUTES
WATER ABSORPTION		%	E-24/50+D-24/23	SHOWN IN TABLE
FLEXURAL STRENGTH(CROSSWISE DIRECTION		$N/mm.^2$	A	98 OR GREATER
FLAME RESISTANCE		SECONDS	A AND E - 168 / 70	$\bar{X}$ < 5 OR LESS MAX < 10 OR LESS

JIS C - 6481 is testing method , UL 94 is flame resistance testing

TABLE :WATER ABSORPTION UNIT : Wt %

Item	Unit				1.6 mm.
Water Absorption	%				1.2 or less

7. THICKNESS AND THICKNESS TOLERANCES

THICKNESS TOLERANCES

Nominal Thickness (mm.)				1.6 mm.
Thickness (mm.)				1.6 ± 0.14

Note: 1)

When measuring 10 locations in accordance with JIS C-6481 5.3.3, Nine of locations must be within the range of the tolerances recorded above .Measurements outside the rang of the tolerances must be within 125 % of the tolerances above.

8. WARPING/ TWISTING

Normal warping and twisting rates are illustrated in Table 7

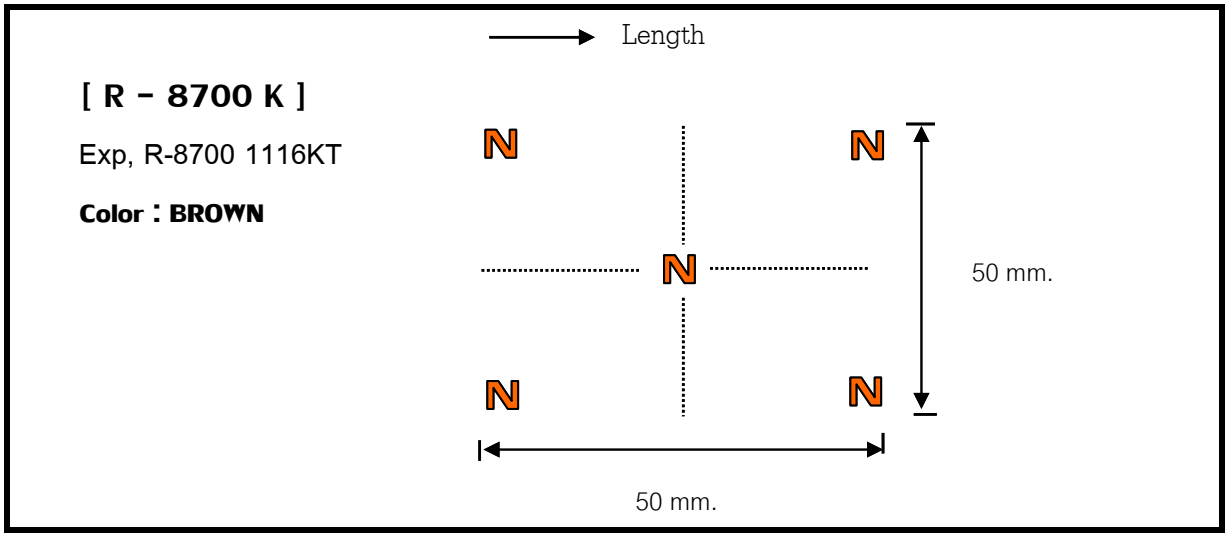
Testing is done in accordance with JIS C - 6481.

Table 5 UNIT : %

Nominal Thickness (mm.)				1.6 mm.
Warping and Twisting Rates				2.0 or less

9. N-MARK DISPLAY

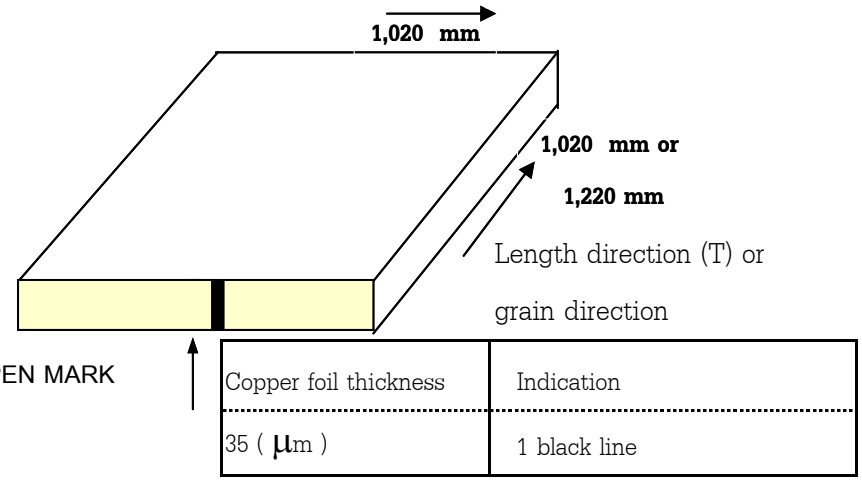
As a general rule , the N -Mark is displayed on the laminate surface of thr single sided Copper Clad Laminate, as shown below. As a general rule of double sided , the N-Mark is not displayed on the surface the Laminate .



10.PRODUCT INFORMATION

1) Product name
2) The thickness (including copper foil)
3) The manufacture lot number
4) The number of units
5) The manufacturer name
6) The fiber direction
7) The dimension

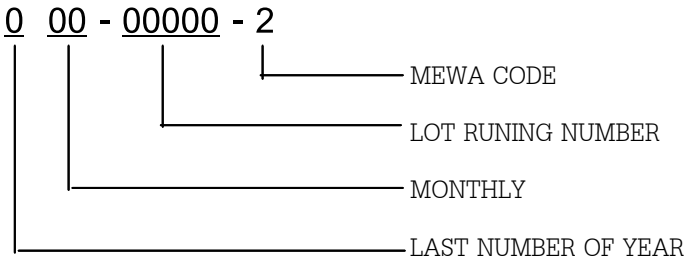
*Note: See the detailed as below Figure.



Copper foil thickness	Indication
35 (μm)	1 black line

11.PACKAGING

The packing is focused on the product protection. To prevent the damage during transportation, the storage and the movement ,it will be put on the protect board. From the above topic (Product Information) it will be illustrated on the packaging as below



12.SAFETY PRECAUTIONS

1) For flame resistance R-8700 have self - flash reducing properties according to the standard UL class 94V-0.However ,if they are exposed to ignition sources or ignition temperature , they will burn.

2) If you inhale or touch the plastic powder produced during machining (drilling, punching and cutting) it may be caus an irritation to throat, skin or eyes and may damage your health.
Therefore,it is necessary to install dust collectors in your workplace.
In areas where dust is produced,wear a dust mark ,protective goggles and gloves when necessary.

3) Offensive odors(phenol ,etc) may arise due to heat .Secure complete exhaust and ventilation, otherwise you may suffer headache or nausea.

4) Dispose of laminated boards according to specified methods as industrial refuse.Avoid burning them or disposing of them in soil or water without appronal.

- ((When selection new materials or changing the conditions ,consult with our sales offices indicating clear applications of this product and the condition of use))

1).DESIGNING PRINTED-CIRCUIT BOARDS

1) Although the rated temperature has been authorized by the UL,printed circuit boards any become discolored due to heat during use.Although it is rare,printed circuit boards may burn .Therefore ,design the board so that they may be exposed to as little heat as possible.

2) Printed-circuit board sometime catch fire during use due to tracking destruction caused by water leaks from components. Design should take this possibility into account.

3) For the conductors positioned adjacent to sewn edges,wire them more than 1 mm apart from each other,taking into account the board breakage that may occur when the sewn edges are folded and removed .Similarly , when positioning part mounting holeds ,arrange adjscent holes to be further from each other than the thickness(t mm) of the printed - circuit board used

2) HANDLING

1) Avoid touching the copper foil surface with a bare hands.If the copper foil is touched with bare hands, the contact area will become discolored or corroded .Wear clean gloves when handing the CCL.

2) Avoid bringing the copper foil surface in to contact with a corner of the CCL to prevent scratches.

If any corners of the CCL touches the copper foil,the resin in the CCL might adhere to the surface and since it cannot be moved during the surface cleaning and conditioning process, it may cause some copper to remain after etching.

3) When using a forklift to handle CCL packages or restock them on a pallet, avoid contact with the fork or with nails sticking out from the pallets to prevent cracks and scratches.Use utmost care to carry out these operations.

4) When handing CCL packages or reload them on a pallet, please use care to avoid bringing them into contact with cach other to prevent scratches.

15.STORAGE

1) Avoid direct sunlight.Store the boards indoor area at normal temperature and humidity.

2) Keep away from water or high temperature and humidity.

3) Avoid storing CCLs in the bent position or lean against a wall. Place them on a level surface to prevent camber and twisting.

4) Unpacked CCL should be used immediately; otherwise , they should be packed again If they are stored unpacked, they may absorb moisture,causing their performance to deteriorate oxidation of the copper foil.

16.FABRICATION

1) We rcommendation, You should cut along the longitudinal direction or the Printed-Circuit Boards follow the vertical direction of Copper Clad Laminates.

2) Before applying through-hole plating and gold plating ,examine the conditions thoroughly.

3) Avoid using CCL under pulsing conditions .They have limited resistance to acids, alkaline solutions and organic solvents such as cleaning solutions ,plating solutions ,and resist- removing solutions.If they are brought into contact with such solutions ,they might become discolored or their performance may deteriorate if any such solution come in contact with them clean them carefully to avoid reduction in ink adhesion and insulation resistance.

4) Laminates may cause dimensional changes or distortion when influenced by thermal conditions . This trend is particularly marked for laminates thinner than 1.6 mm. Examine before hand the condition applied to laminates in each process.

5) Pattern and metal mold design should take into account the characteristic of the CCL. The punching process should be performed at an appropriate temperature under full temperature control.

6) Avoid making scratches during the punching process scratches may lower the solder heat resistance.

7) Stress concentration may arise depending on the circuit configuration as result cracks may arise take sufficient care when designing printed circuit boards.

8) If the difference in quantity of residual; copper between the inside and outside of board during pattern molding applied to both sides of boards is large distortion may arise.When designing printed-circuit boards,try to minimize the above difference.

17. CAUTIONS REGARDING EXPERIMENTS

1) If excessive or one-sided force is supplied during screw tightening and caulking laminated may invite internal destruction, which causes blistering of boards or copper foil during soldering.Set up conditions to prevent any damage from occurring inside boards. It is recommended thas gas discharge holes be prepared near screw lightening and caulking positions.

2) If CCL area soldered at too high a temperature (in the process of dipping float reflow or manual soldering) the substrate and copper foil may swell check conditions in advance check and carry out careful temp and time control condition might need to be changed depending on the board thickness or pwb size.

3) The performance of the CCL might change during long time storage of PWBs.

4) If stress is applied to the boards during heating quality deterioration may occur.

The above said precautions are describe in our manual read through the manuals before use without fail.

18 QUALITY ASSURANCE

Individual transactions along this product should be carried out in accordance with the conditions specified in contracts and catalogues as well as the following general conditions.

(1) Guarantee period

Unless other wise specified by separate agreement between your company and our company the product will be guaranteed for one year after delivery to the location you specify.

(2) Scope of guarantee

Should specific any problem for which we (or distributor)are responsible occur in the product during the guarantee period and any damage be cause of the problem we will assure responsibility only the connect problem we will assume responsibility to the correct problem and replaced defective parts immediately at our cost .

THE ABOVE RULES DOES NOT APPLY IN ANY OF THE FOLLOWING CASES :

1) The problem has been caused due to inappropriate use not indicated in this specification.

2) The problem has been caused due to modifications made in performance and / or specifications after delivery and in which we were not involved.

3) The problem has been caused due to the inherent characteristics of materials or to aging such as natural corrosion change and discoloration

4) The problem has been caused due to a phenomenon which could not have been prevented using practical technology available at the time of the execution or the contract.

5) You failed to report the problem immediately after its occurrence.

6) The problem has been caused intentionally by any person other than ourselves or is due to a mistake made by such person.

7) The problem has been caused due to use, storage and transportation under environmental conditions (including temperature humidity and atmosphere) not normally expected for the product.

8) The damage is caused due to a special combination designed by your company of the product and product of manufacturers other than ourselves.

9) The problem has been caused due to a natural disaster such as earthquake, flood, and fire,

or due to force major.

10) Other nonconformities That fall outside of our responsibility.

19) NOTICE OF MODIFICATION

We will send you advance notice of any modification regarding these specifications and obtain your approval of such modification.

20) Discussions

Between the two companies shall be held any other problem or the need for any change arise.

21) VALIDITY OF THESE SPECIFICATIONS

In principle , these specifications shall be valid for one year from the date of the agreement is concluded , or from the date which buyer have received these specifications unless any change in the contract conditions are requested from one party to the others in writing within the validity,
the validity of these specifications shall be automatically extended for one year
and also the thereafter.

22) **RECORD**

NUMBER	DATE	MODIFICATIONS		REASON FOR MODIFICATION
		PREVIOUS	NEW	