



ELECTRONICS

# Product Information

**ISSUE DATE : 02-04-08**

**MODEL : LTS350Q1-PD1**

**Note : This product information is subject to change after 3 months of issue date.**

**PREPARED BY : AMLCD Technical Customer Service Team**

**Samsung Electronics Co . , LTD.**

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## Revision History

Data	Rev. No.	Page	Summary
Jun.30. 2001	000		Rev.000 was issued.
Jan.03. 2002	001		Rev.001 was issued.
Jan.25. 2002	002		Rev.002 was issued.
Apr.08. 2002	003		Rev.003 was issued.

## General Description

### \* Description

LTS350Q1-PD1 is a reflective type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching devices. This model is composed of a TFT-LCD module(TFT-LCD panel, driver ICs and FPC), a front-light unit and a touch panel. The resolution of a 3.5" contains 240 x 320 pixels and can display up to 260K colors.

### \* Features

- Reflective type.
- Front light with CCFL and touch panel included.
- MTN(Mixed Twisted Nematic) mode.
- Line inversion mode.
- Low Power consumption.

### \* Applications

- Display terminals for PDA application products.
- Smart phone / Game machine / Camcoder.

### \* General Information

Items	Specification	Unit	Note
Display area	53.64(H) x 71.52(V)	mm	-
Driver element	a-Si TFT active matrix	-	-
Display colors	262,144	colors	-
Number of pixels	240(H) x 320(V)	pixel	-
Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.2235(H) x 0.2235(V)	mm	-
Display mode	Normally White	-	-
Viewing Direction	6:00	o'clock	-
Surface treatment	Anti-Glare (Haze 12%), Anti-Reflection	-	-

### \* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Model size	Horizontal(H)	69.75	70.0	70.25	mm	(1)
	Vertical(V)	90.45	90.7	90.95	mm	(1),(2)
	Depth(D)	4.65	4.90	5.15	mm	(1)
Weight		-	50	55	g	(1)

Note (1) Touch panel and front light unit are included.

(2) FPC is not included. (Refer to the Outline Dimension in the page 26 for further information.)

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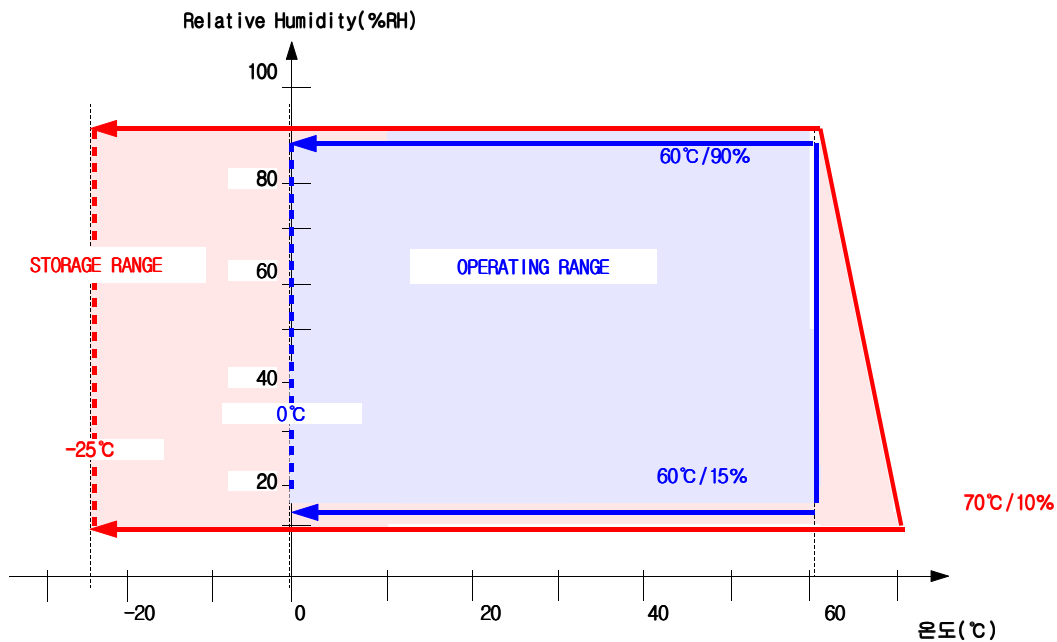
# 1. Absolute Maximum Ratings

## 1.1 Absolute Ratings of Environment

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T <sub>STG</sub>	-25	70	°C	(1),(5)
Operating temperature (Ambient temperature)	T <sub>OPR</sub>	0	60	°C	(1),(2),(5)
Vibration ( Non - operating )	V <sub>nop</sub>	10	500	Hz	(3),(4)

Note (1) 90 % RH Max. ( 60 °C ≥ Ta )

Maximum wet-bulb temperature at 59 °C or less. (Ta > 60 °C) No condensation.



(2) In case of below 0° , the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one.

Level of retardation depends on temperature, because of LC's characteristics.

(3) (10 ⇔ 500Hz)<sup>6CYC</sup> 10min/Cycle, 3G<sub>pk,,</sub> for each X, Y, Z axis.

(4) At testing vibration, the fixture in holding the module to be tested have to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

(5) If product is exposed to high temperatures for extended time, there is a possibility of the polarizer film damage which could degrade the optical characteristics.

## 1.2 Electrical Absolute Ratings

### (1) TFT-LCD Module

(Ta = 25 ± 2°C, V<sub>gg</sub>=GND=0V)

Characteristics	Symbol	Min.	Max.	Unit	Note
Power supply(analog, digital)	V <sub>DD</sub>	-0.3	6.5	V	-
Power supply(gate on)	V <sub>ON</sub>	-0.3	44	V	-
Power supply(gate off)	V <sub>OFF</sub>	V <sub>ON</sub> -44	0.3	V	-
Common Voltage	V <sub>COM</sub>	-1.5	5.5	V	AC
Input voltage	V <sub>I</sub>	-0.3	V <sub>DD</sub> +0.3	V	-

### (2) Front-Light Unit

(Ta = 25 ± 2°C)

Item	Symbol	Min.	Max.	Unit.	Note
Lamp current	I <sub>L</sub>	1.0	4.0	mArms	(1)
Lamp frequency	F <sub>L</sub>	50	80	kHz	(1)

Note (1) Permanent damage to the device may occur if maximum values are exceeded.  
Functional operation should be restricted to the conditions described under normal operating conditions.

## 2. Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (3).

Measuring equipment: LCD-7000, BM-5A

(Ta = 25 ± 2°C)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Reflectance	Ver.	Rf		8	12	-	%	(4) LCD-7000	
Contrast ratio	F/L Off	C/R		10	15	-		(5) LCD-7000	
	F/L On			4	5	-		(5) BM-5A	
Luminance of white	F/L On	YL		25	30	-	cd/m2	(6) BM-5A	
Response time	Rising:Tr	Tr+Tf		-	40	45	msec	(8) BM-5A	
	Falling:Tf								
Color chromaticity (CIE 1931)	White F/L Off	Wx1		0.30	0.32	0.34		(9) LCD-7000	
		Wy1		0.35	0.37	0.39			
	White F/L On	Wx2		0.31	0.33	0.35		(10) BM-5A	
		Wy2		0.30	0.32	0.34			
Viewing angle	F/L Off	Hor.	$\theta L + \theta R$	CR $\geq$ 2	80	100	-	Degrees	(11) LCD-7000
		Ver.	$\phi H + \phi L$		80	100	-		
	F/L On	Hor.	$\theta L + \theta R$		70	80	-		(11) BM-5A
		Ver.	$\phi H + \phi L$		70	80	-		
Crosstalk	F/L On			-	5	-	%	(12) BM-5A	
Uniformity	F/L On			-	50	-	%	(7) BM-5A	

\* Optical Characteristics can be changed without special notice

Note (1) The optical characteristics is measured with front-light and touch panel.

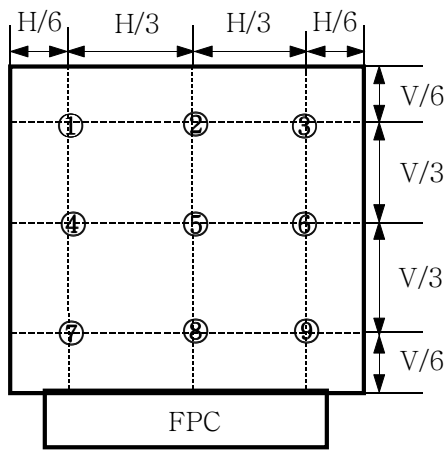
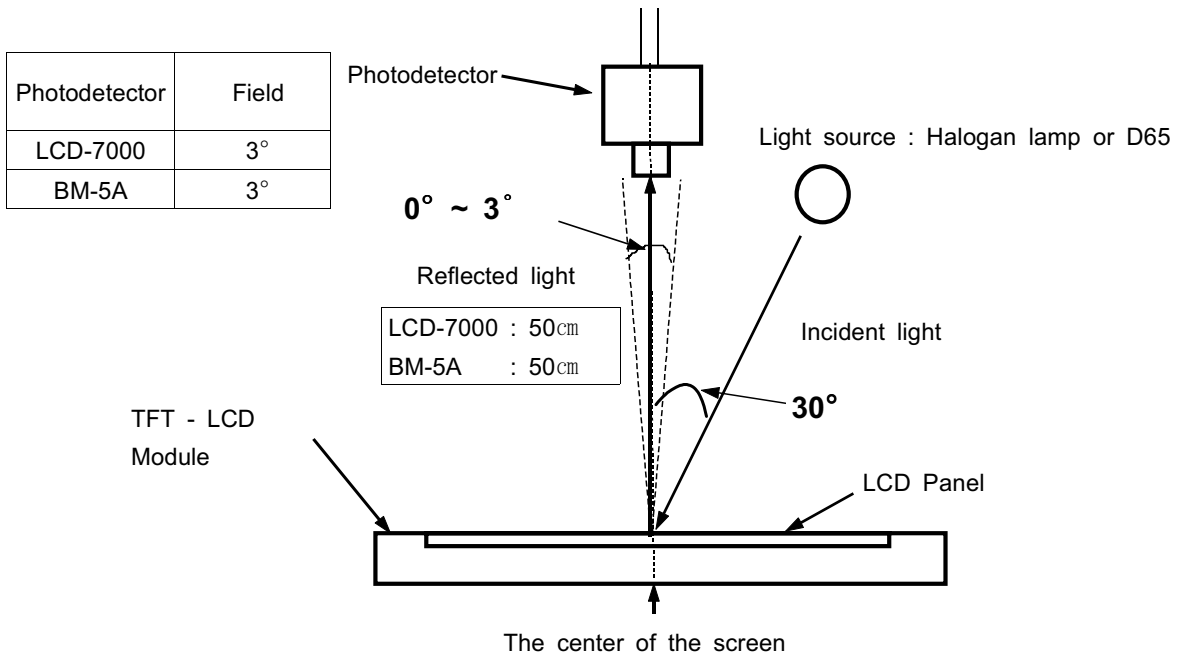
(2) If product is exposed to high temperatures for extended time, there is a possibility of the polarizer film damage which could degrade the optical characteristics.



Note (3) Test Equipment Setup

After stabilizing and leaving the panel alone at a given temperature for 30 min, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. 30 min after lighting the Front-light or reference light source. The reflected light intensity should be measured in the center of screen. The incident angle of the light source is  $30^\circ$  to the normal direction where the photodetector is positioned.

Environment condition :  $T_a = 25 \pm 2 \text{ }^\circ\text{C}$



The spot locations for luminance measurement

Note (4) Definition of Reflectance : The reflectance is relative quantity to the standard white BaSO<sub>4</sub> or MgO plate that the reflectance of the standard white plate is the 100%.

$$\text{Reflectance} = \frac{\frac{\text{Intensity of the reflected light on LCD}}{\text{Intensity of the incident light on BaSO}_4 \text{ plate}}}{\frac{\text{Intensity of the reflected light on BaSO}_4 \text{ plate}}{\text{Intensity of the incident light on BaSO}_4 \text{ plate}}} \times 100\%$$

Note (5) Definition of Contrast Ratio (C/R) : Ratio of gray max (Gmax) & gray min (Gmin) at the center point of the panel. If frontlight is on state, it is the light source and the BM-5A will be used to measure.

$$C/R = \frac{G_{\max}}{G_{\min}}$$

\* Gmax : Luminance with all pixels white  
\* Gmin : Luminance with all pixels black

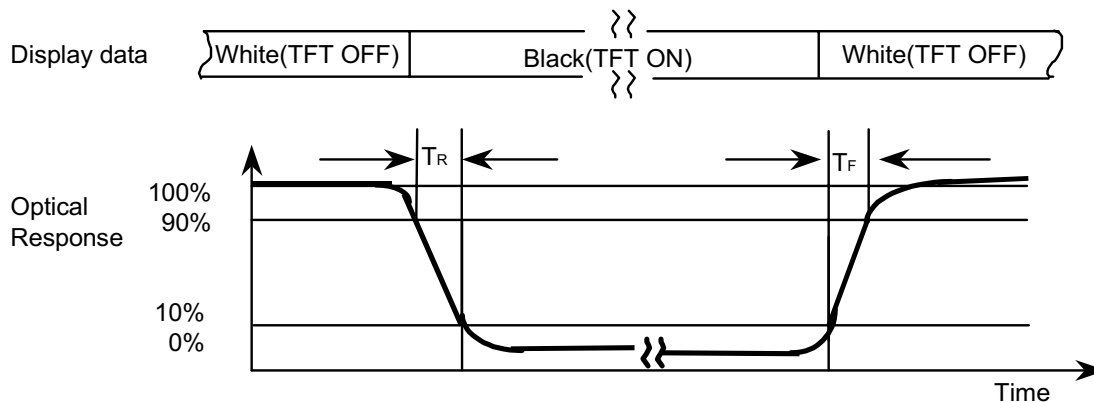
Note (6) Definition of Luminance of White : Luminance of white at center point. In this case, the incident light is not from the light source but from the front-light that generates the reflected light source on LCD in the dark room.

Note (7) Definition of Uniformity :

$$B_{uni} = 100 * \frac{B_{\min}}{B_{\max}}$$

Bmax : Maximum brightness  
Bmin : Minimum brightness

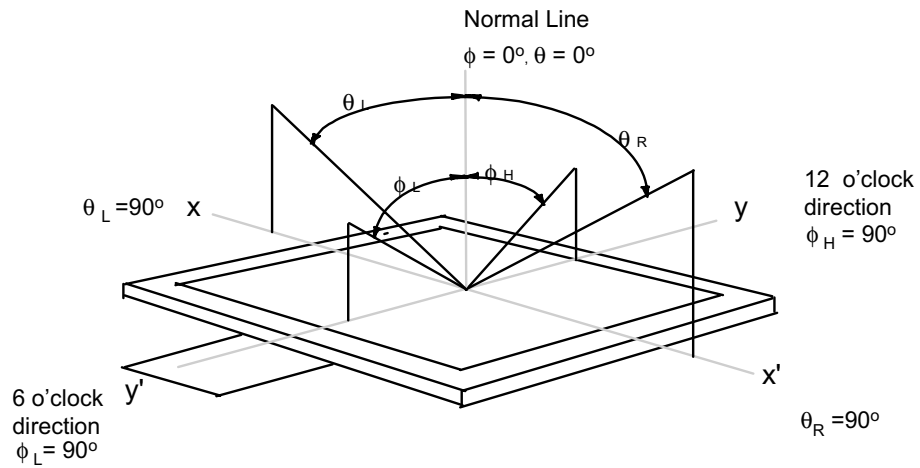
Note (8) Definition of Response time : Sum of Tr ,Tf



Note (9) Definition of Color Chromaticity (CIE 1931), (Front light:Off)  
Color coordinate of white at center point.  
It should be measured at vertical direction on front light off state  
\* Light Source : D65. (Front light:Off.)

Note (10) Definition of Color Chromaticity (CIE 1931), (Front light:On)  
 Color coordinate of white at center point.

Note (11) Definition of Viewing Angle : Viewing angle range ( $CR \geq 2$ )

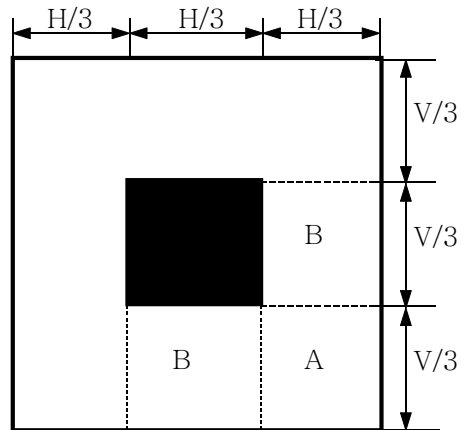


Note (12) Definition of Cross-talk level

$$C/T = \frac{|Y_A - Y_B|}{Y_A} \times 100\%$$

\*  $Y_A$  : Luminance of A area ( $\text{Cd}/\text{m}^2$  )

\*  $Y_B$  : Luminance of B area ( $\text{Cd}/\text{m}^2$  )



When this panel displays a black window pattern, the luminance of B area is effected from black window. The Luminance of B area is different from the Luminance of A area. This pattern for measurement has a black window on the background of middle-gray.

### 3. Electrical Characteristics

#### 3.1 TFT-LCD Module

Ta = 25 ± 2°C

Characteristics		Symbol	MIN.	TYP.	MAX.	Unit	Note
Digital supply voltage		DV <sub>DD</sub>	3.0	3.3	3.6	V	
Analog supply voltage		AV <sub>DD</sub>	4.5	4.7	5.0	V	
Gate On voltage		V <sub>ON</sub>	16	18	20	V	
Gate Off voltage		V <sub>OFF</sub>	-13	-10	-8	V	
Common voltage		V <sub>COMH(Vpp)</sub>	-	4.5	-	V	
Digital supply current		I <sub>DVDD</sub>	-	0.3	1.3	mA	
Analog supply current		I <sub>AVDD</sub>	-	5.0	8.5	mA	
Gate supply current		I <sub>VON/VOFF</sub>	-	-	0.6	mA	
Input voltage	Source driver (High)	V <sub>IHS</sub>	0.8DV <sub>DD</sub>	-	DV <sub>DD</sub>	V	
	Source driver (Low)	V <sub>ILS</sub>	GND	-	0.2DV <sub>DD</sub>	V	
	Gate driver (High)	V <sub>IHG</sub>	0.8 x 1.65	-	DV <sub>DD</sub>	V	
	Gate driver (Low)	V <sub>ILG</sub>	GND	-	0.2 x 1.65	V	
Power Dissipation	White	P <sub>W</sub>	-	(15)	25	mW	(1),(2)
	Black	P <sub>B</sub>	-	(20)	30	mW	
	Vertical	P <sub>V</sub>	-	(20)	30	mW	

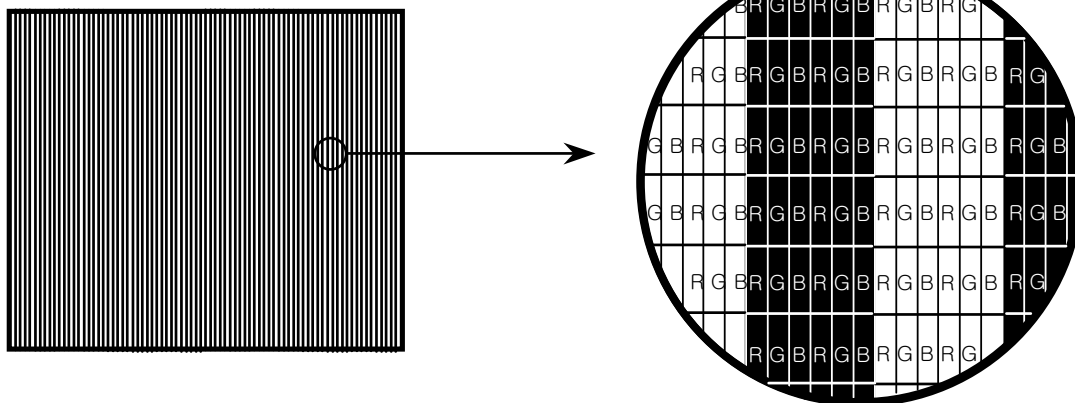
\* To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as below.

- Power On : DV<sub>DD</sub> → AV<sub>DD</sub> → V<sub>OFF</sub> → V<sub>ON</sub> → Data
- Power Off : Data → V<sub>ON</sub> → V<sub>OFF</sub> → AV<sub>DD</sub> → DV<sub>DD</sub>

Note (1) Condition : TFT-LCD module only with typ. electrical characteristics

(2) Power dissipation check pattern

▶ 2line Vertical stripe pattern



### 3.2 Front-Light Unit

The back-light system is an edge-lighting type with a single CCFL(Cold Cathode Fluorescent Lamp). The characteristics of a single lamp are shown in the following tables.

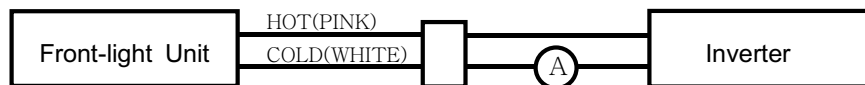
(Ta=25 ± 2°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp current	I <sub>L</sub>	1.0	1.5	4.0	mArms	(1)
Lamp voltage	V <sub>L</sub>	-	330	-	Vrms	(1)
Lamp frequency	f <sub>L</sub>	50	-	80	kHz	(2)
Operating life time	Hr	10,000	-	-	Hour	(3)
Power Consumption	P <sub>L</sub>	316	495	984	mW	(4)
Start up voltage	Vs	-	-	0°C:600	Vrms	(5)
				25°C:450		

**Note) The waveform of the inverter output voltage must be area symmetric and the design of the inverter must have specifications for the modularized lamp.**

The performance of the front-light, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter. When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the front-light and the inverter never occur. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

Note (1) Lamp current is measured with high frequency current meter as shown below.



- (2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency shall be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.
- (3) Life time (Hr) of a lamp is defined as the time in which it continues to operate under the condition of Ta=25±2°C and I<sub>L</sub>=3.0mArms for a lamp until the brightness becomes 50% or lower than it's original value.
- (4) Refer to I<sub>L</sub> x V<sub>L</sub> to calculate.
- (5) If an inverter has shutdown function, it should keep its output for more than 1 second even if the lamp connector open. Otherwise the lamp may not to be turned on.

## 4. Touch Panel Specifications

### 4-1. Electrical Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Linearity	-1.5	-	1.5	%	Analog X and Y directions
Terminal resistance	150	340	630	$\Omega$	X(Glass side)
	180	360	720	$\Omega$	Y(Film side)
Insulation resistance	20	-	-	M $\Omega$	DC 25V
Voltage	-	5	7	V	DC
Bouncing	-	-	10	ms	10ms or less at On/Off
Transparency	-	83	-	%	No anti-glare

Caution (1) : Do not operate it with a thing except a polyacetal pen(tip R0.8mm or less) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

### 4-2. Mechanical & Reliability Characteristics

Item	Min.	Typ.	Max.	Unit	Note
ITO glass	-	-	0.7	mm	Glass substrate material option
ITO film	-	-	180	$\mu$ m	No anti-glare
Activation force	-	-	0.8	N	(1)
Durability-surface scratching	Write 300,000	-	-	times	(2)
Durability-surface hitting	1,000,000	-	-	touches	(3)
Surface hardness	3	-	-	H	JIS K5400

Note (1) 0.8N or less (Tip R0.8mm polyacetal pen or Tip R3.75mm, hardness 10 $\circ$  to 20 $\circ$  , silicone rubber operation)

(2) Test Conditions

- Sliding Pen : Tip R0.8mm, Polyacetal pen
- Load : 2.45 N
- Sliding speed : 60 mm/s

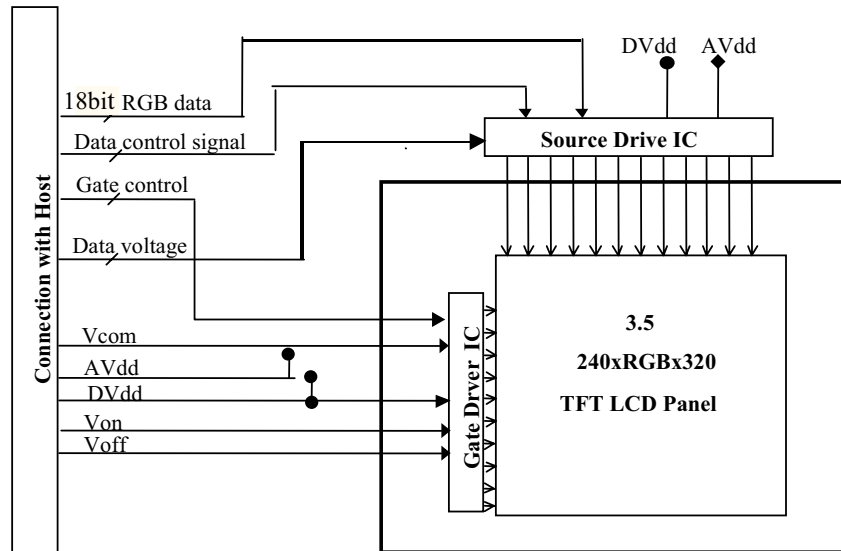
(3) Test Conditions :

- Hitting pad : Tip R3.75mm, Hardness 10 $\circ$  to 20 $\circ$  , Silicone rubber
- Load : 2.45 N
- Hitting speed : Twice/s

**Refer to the Appendix 1: Touch Panel Specifications.**

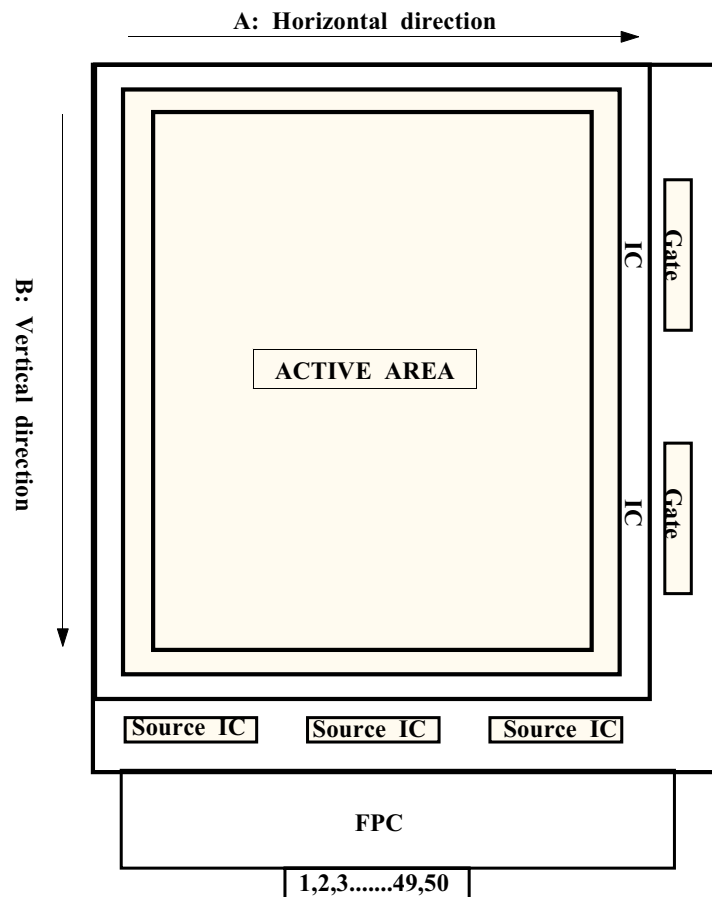
## 5. Block Diagram

### 5.1 TFT-LCD Module



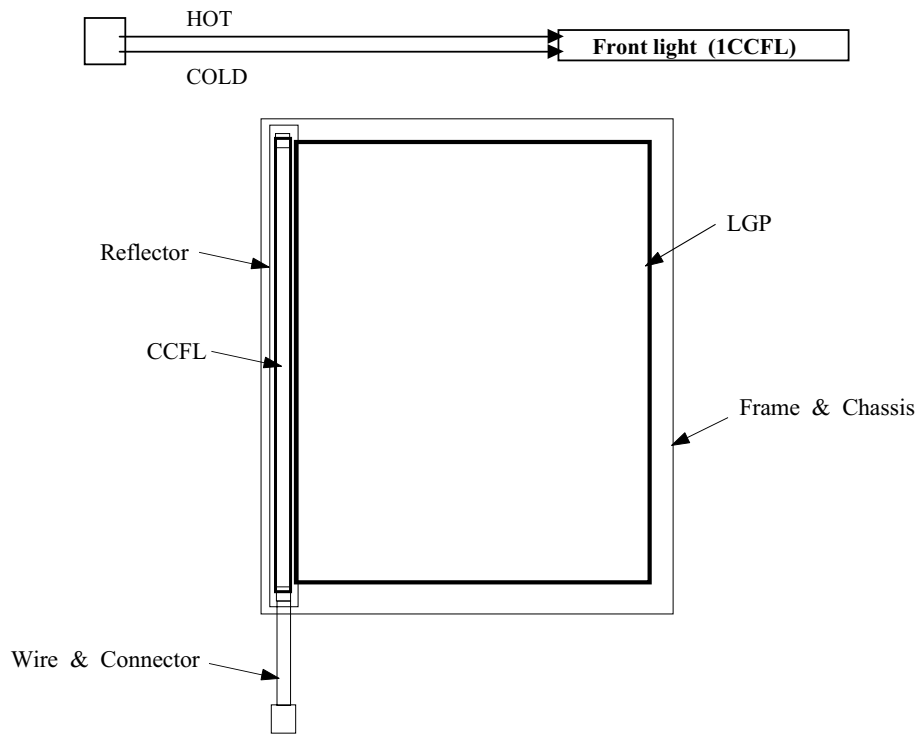
The scanning direction for the horizontal period and the vertical period are A and B respectively as shown below.

The scanning directions are from a front view.

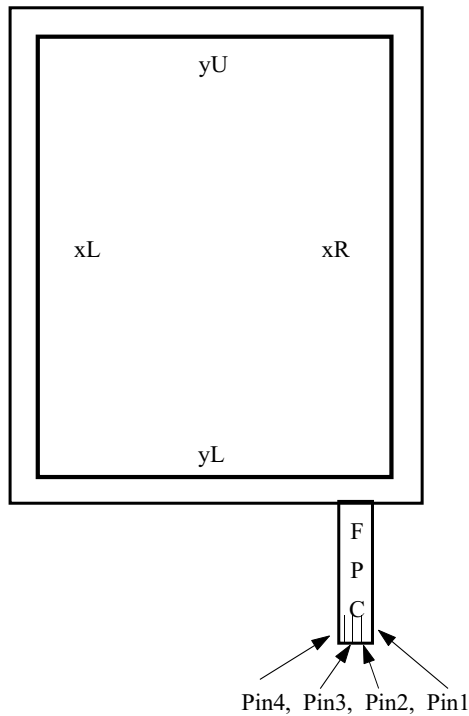




## 5.2 Front Light Unit



## 5.3 Touch Panel



Pin No.	Symbol	I/O
1	xR	X_Right
2	xL	X_Left
3	yL	Y_Bottom
4	yU	Y_Up

## 6. Input Terminal Pin Assignment

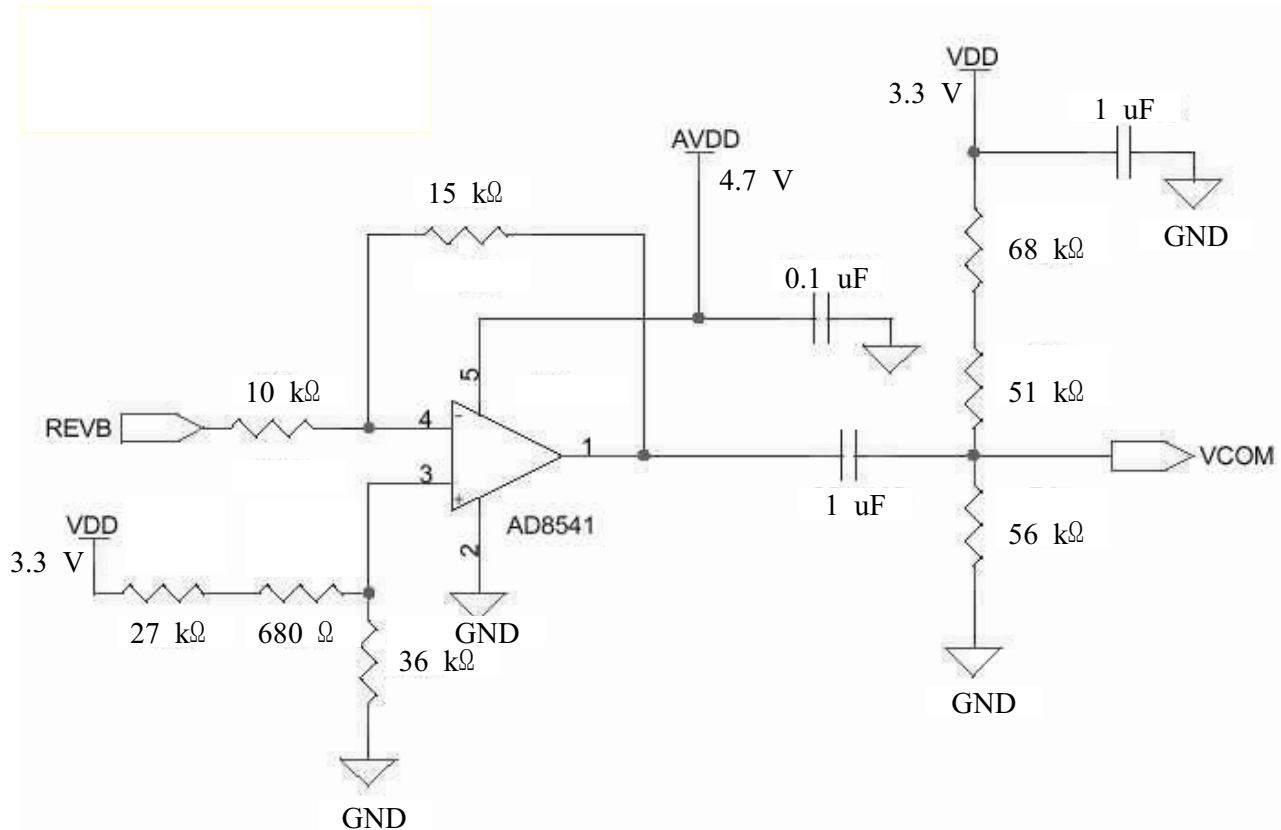
### 6.1 TFT-LCD Module (Connector : 50Pin FPC type ↔ Hirose FH12-50S-0.5SH )

Pin No	Symbol	Description	Remark
1	AV <sub>DD</sub>	Power Supply	-
2	AV <sub>DD</sub>	Power Supply	-
3	STH	Horizontal Start Pulse	-
4	R0	Red Pixel Data (LSB)	-
5	R1	Red Pixel Data	-
6	R2	Red Pixel Data	-
7	R3	Red Pixel Data	-
8	R4	Red Pixel Data	-
9	R5	Red Pixel Data (MSB)	-
10	G0	Green Pixel Data (LSB)	-
11	G1	Green Pixel Data	-
12	G2	Green Pixel Data	-
13	G3	Green Pixel Data	-
14	G4	Green Pixel Data	-
15	G5	Green Pixel Data (MSB)	-
16	V <sub>REF0</sub>	Gray Scale Voltage0	(2)
17	V <sub>REF1</sub>	Gray Scale Voltage1	
18	V <sub>REF2</sub>	Gray Scale Voltage2	
19	V <sub>REF3</sub>	Gray Scale Voltage3	
20	V <sub>REF4</sub>	Gray Scale Voltage4	
21	V <sub>REF5</sub>	Gray Scale Voltage5	
22	V <sub>REF6</sub>	Gray Scale Voltage6	
23	V <sub>REF7</sub>	Gray Scale Voltage7	
24	V <sub>REF8</sub>	Gray Scale Voltage8	
25	V <sub>REF9</sub>	Gray Scale Voltage9	
26	V <sub>REF10</sub>	Gray Scale Voltage10	
27	DV <sub>DD</sub>	Power Supply	-
28	TP	Source Driver Data Load Pulse	-
29	V <sub>SS</sub>	Ground	-
30	INV	Digital Data Inversion	(2)
31	HCLK	Horizontal Sampling Clock	-
32	B0	Blue Pixel Data (LSB)	-
33	B1	Blue Pixel Data	-
34	B2	Blue Pixel Data	-

Pin No	Symbol	Description	Remark
35	B3	Blue Pixel Data	-
36	B4	Blue Pixel Data	-
37	B5	Blue Pixel Data (MSB)	-
38	V <sub>SS</sub>	Ground	-
39	V <sub>SS</sub>	Ground	-
40	V <sub>COM</sub>	Common Voltage	(1)
41	V <sub>COM</sub>	Common Voltage	
42	V <sub>ON</sub>	Power Supply (Gate ON)	-
43	V <sub>OFF</sub>	Power Supply (Gate OFF)	-
44	V <sub>SS</sub>	Ground	-
45	V <sub>SS</sub>	Ground	-
46	CPV	Vertical Shift Clock	-
47	DV <sub>DD</sub>	Power Supply	-
48	V <sub>OFF</sub>	Power Supply (Gate OFF)	-
49	V <sub>ON</sub>	Power Supply (Gate ON)	-
50	STV	Vertical Start Pulse	-

Note (1) Recommended Vcom generator circuit

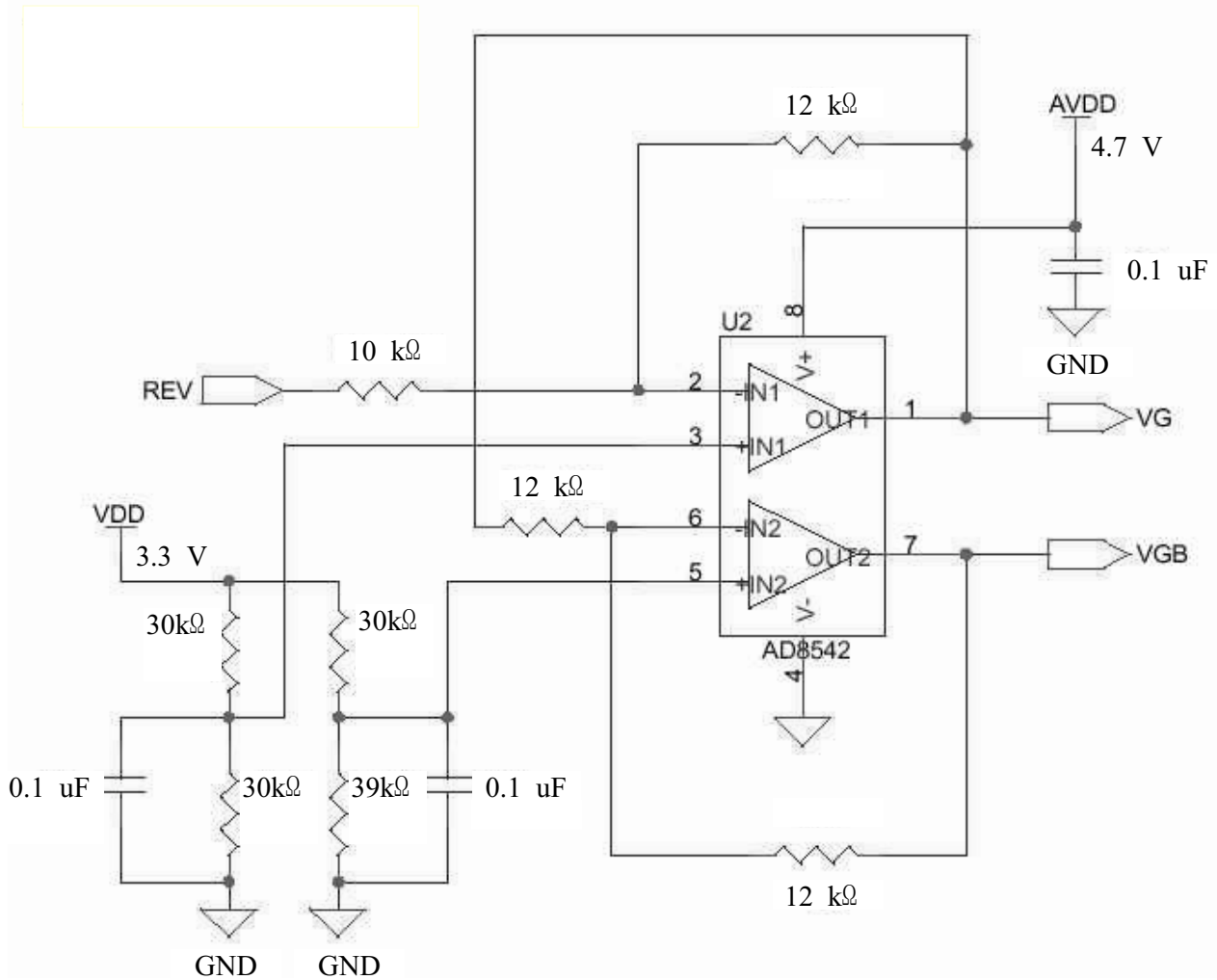
REV, REVB : Timing control IC output signal

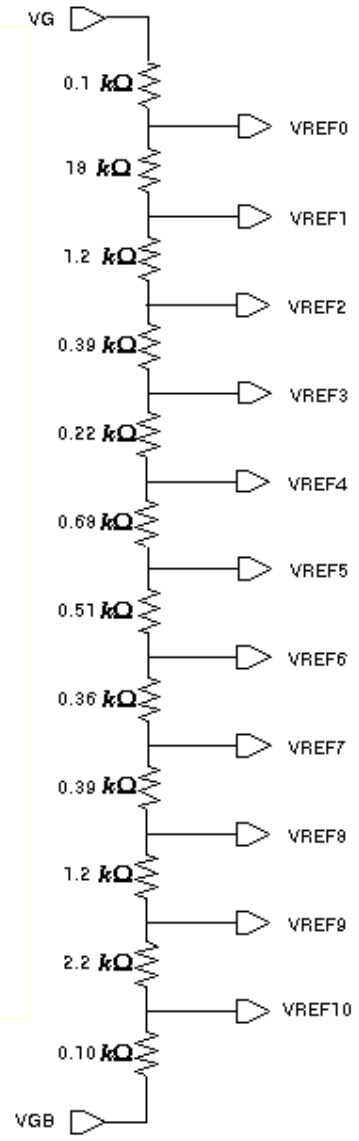
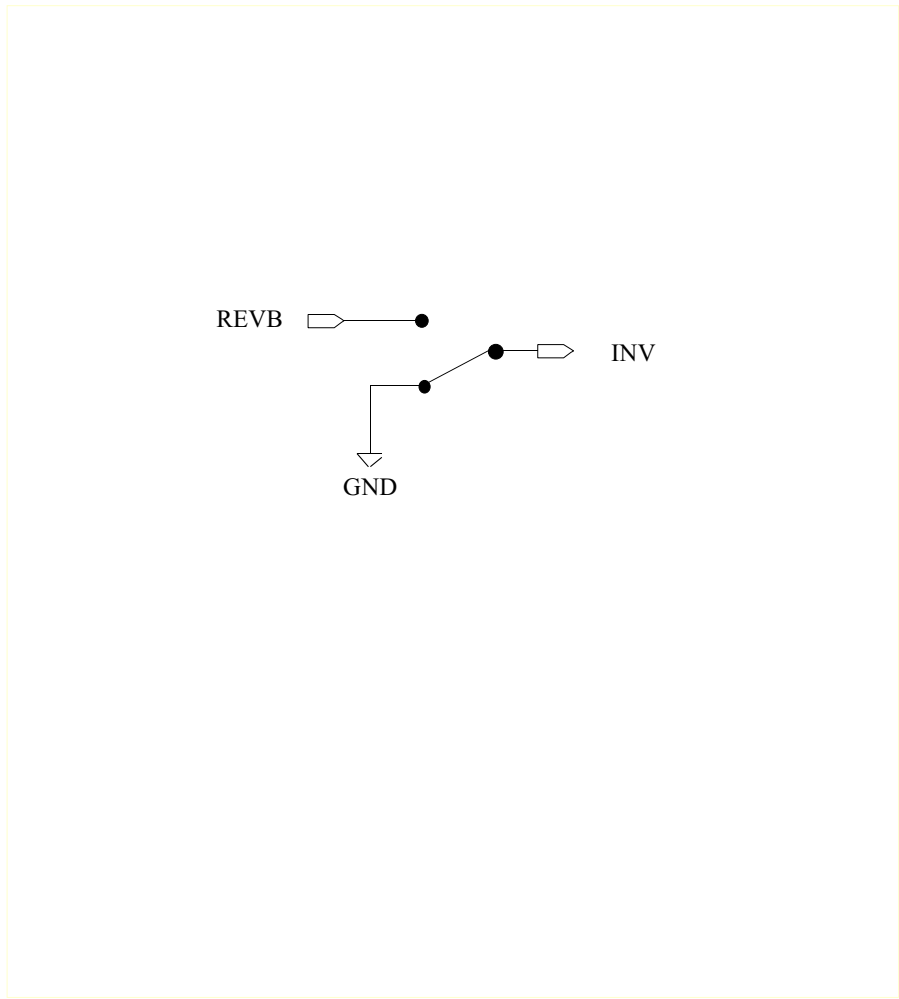


Note (2) Recommended INV signal& gray scale voltage generator circuits  
Recommended circuits could not be optimal circuits and could be modified by user.

\* Recommended Circuit

- Gamma Voltage Generator Circuit.
- REV, REVB : Timing control IC output signal





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**6.2 Front-Light Unit** ( Connector : BHSR-02VS-1 ↔ JST SM02B-BHSS-1-TB )

Pin No.	Symbol	Color	Function
1	HOT	PINK	High voltage
2	COLD	WHITE	Low voltage

**6.3 Touch Panel** ( Connector : 4Pin FPC type ↔ Hirose FH12-10(4)SA-1SH )

Pin No.	Symbol	I/O	Function
1	xR	X_Right	X axis position - differential analog
2	xL	X_Left	X axis position - differential analog
3	yL	Y_Bottom	Y axis position - differential analog
4	yU	Y_Up	Y axis position - differential analog

## 6.4 Input Signal, Basic Display Colors and Gray Scale of Each Colors

COLOR	DISPLAY	DATA SIGNAL															GRAY SCALE LEVEL		
		RED					GREEN					BLUE							
		R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2		B3	B4
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	-
	RED	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	-
	MAGENTA	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	-
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	-
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
GRAY SCALE OF RED	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	DARK ↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	LIGHT ↓	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	R61
		0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	R62
RED	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	R63	
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	DARK ↑	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	G1
		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	G2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~G60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	LIGHT ↓	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	G61
		0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	G62
GREEN	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	G63	
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	DARK ↑	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	B1
		0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	B2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	LIGHT ↓	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	B61
		0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	B62
BLUE	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	B63	

Note) Definition of Gray :

R<sub>n</sub> : Red Gray, G<sub>n</sub> : Green Gray, B<sub>n</sub> : Blue Gray (n = Gray level)

Input Signal : 0 = Low level voltage, 1 = High level voltage

※R5,G5,B5:MSB R0,G0,B0:LSB

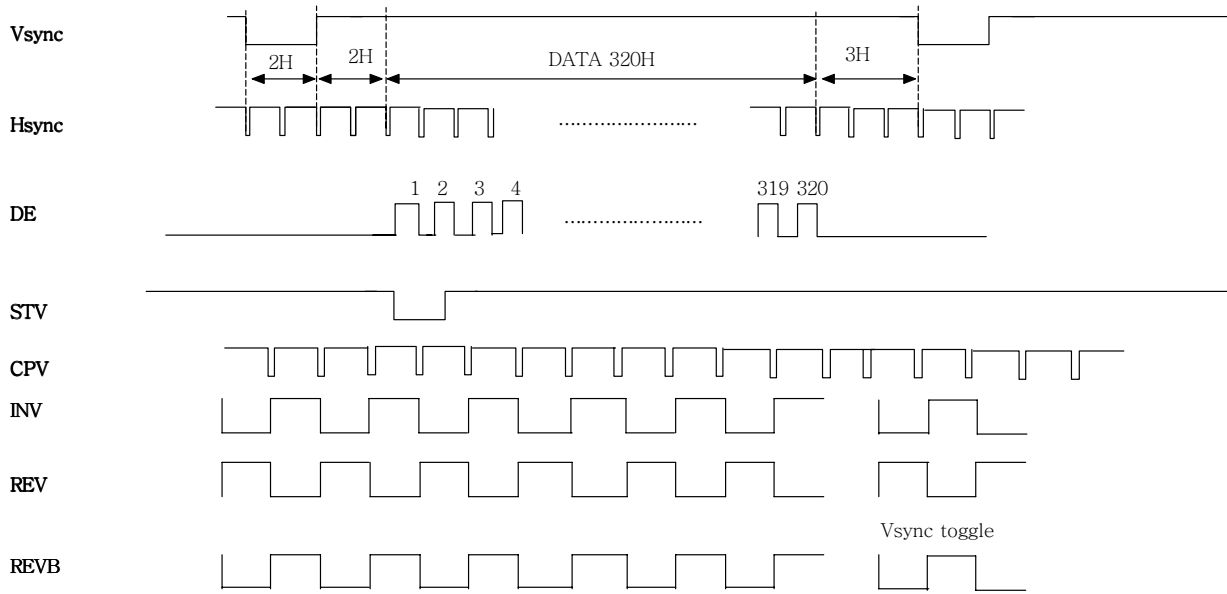
## 7. Interface Timing

### 7.1 Timing Parameters of TFT-LCD Module Input Signals

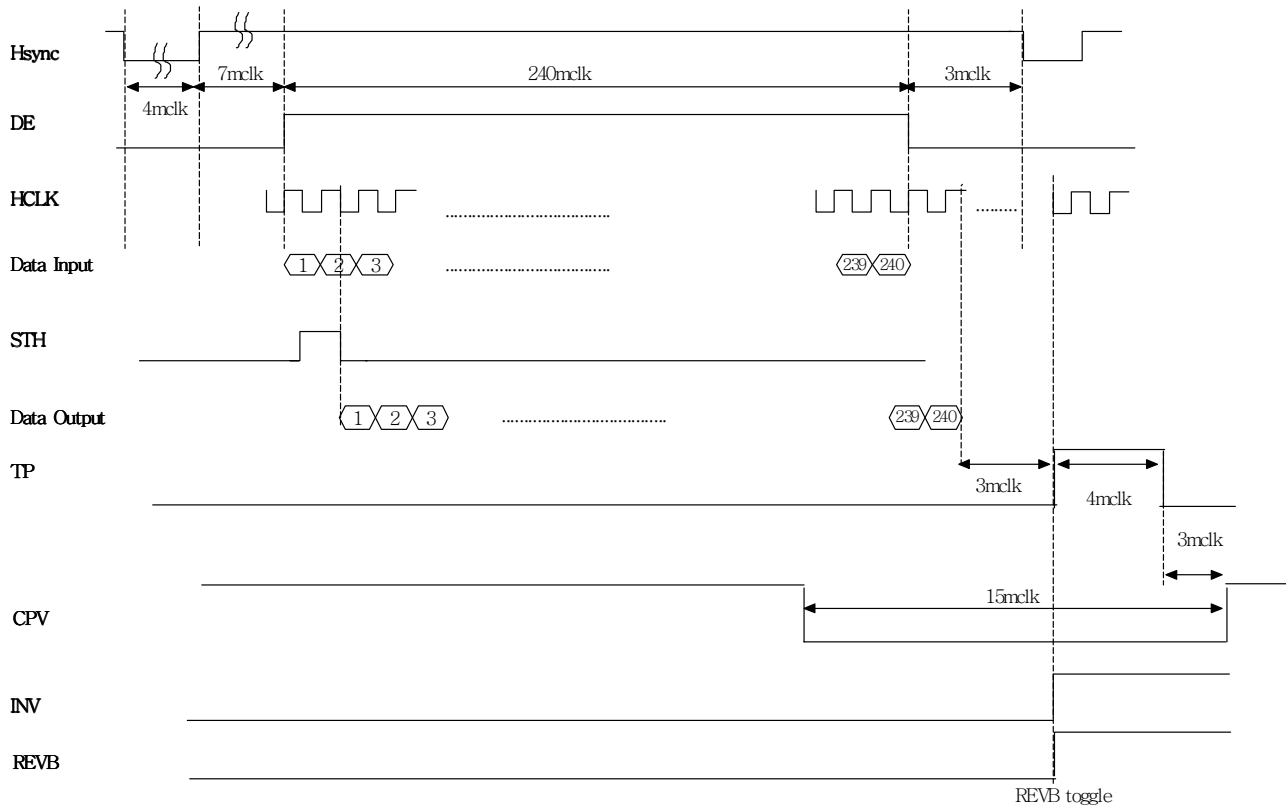
ITEM	Symbol	MIN.	TYP.	MAX.	Unit
HCLK frequency	$1/t_{\text{HCLK}}$	-	5.0	-	MHz
HCLK pulse low width	$t_{\text{WL1}}$	$0.5t_{\text{HCLK}}$	-	-	-
HCLK pulse high width	$t_{\text{WH1}}$	$0.5t_{\text{HCLK}}$	-	-	-
STH setup time	$t_{\text{ST1}}$	15	-	-	ns
STH hold time	$t_{\text{HD1}}$	15	-	-	ns
TP setup time	$t_{\text{ST2}}$	15	-	-	ns
TP hold time	$t_{\text{HD2}}$	15	-	-	ns
INV setup time	$t_{\text{ST3}}$	15	-	-	ns
INV hold time	$t_{\text{HD3}}$	15	-	-	ns
STV setup time	$t_{\text{ST4}}$	100	-	-	ns
STV hold time	$t_{\text{HD4}}$	300	-	-	ns
CPV cycle	$t_{\text{CPV}}$	2	-	-	$\mu\text{s}$
CPV pulse low width	$t_{\text{WL2}}$	500	-	-	ns
CPV pulse high width	$t_{\text{WL2}}$	500	-	-	ns



## 7.2 Timing Diagrams of Interface Signal



**Vertical Timing Chart**



**Horizontal Timing Chart**

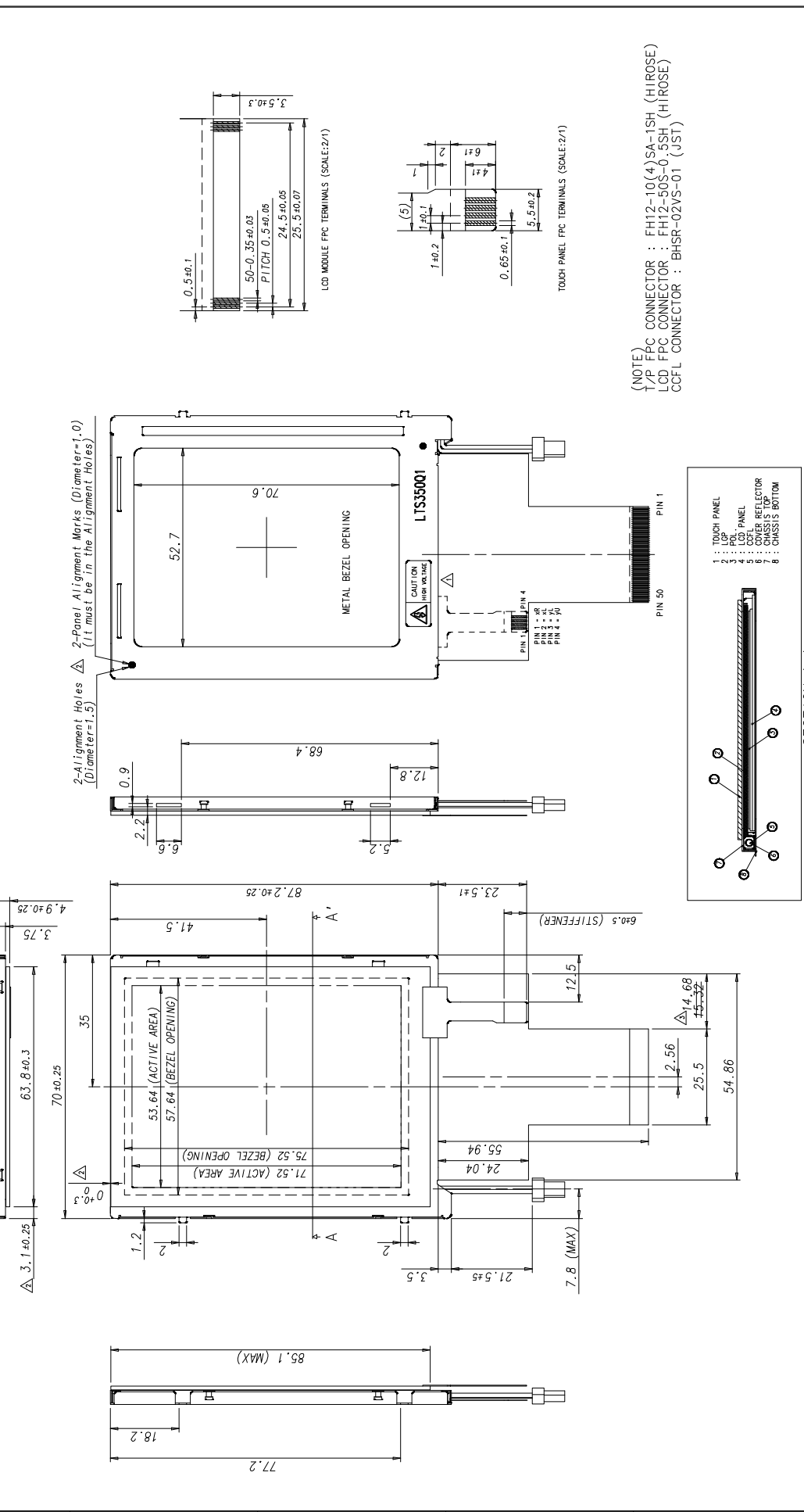
- Note (1) Vsync, Hsync, DE, Data Input : Timing control IC input signals  
 REV, REVb : Timing control IC output signals  
 INV : TFT-LCD module input signal  
 Others : Timing control IC output and TFT-LCD module input signals
- (2) To operate our panel correctly, CPV\_SEL should be Low(Ground)

## **8. Outline Dimensions**

### **8-1. Module Outline Dimensions (Total Assa'y)**

**- Refer to the Next Page.**

FILE NO.	A	B	C	D	E	F	G	H	I
1									
	NO	PART NAME	CODE NO	SPECIFICATION	Q'TY	WEIGHT	UNFOLDED DIM. OF MATERIAL	REMARK	
	1	OUTLINE DRAWING							



GENERAL TOLERANCE		SECTION A-A'		
STEP	LEVEL 1	LEVEL 2	LEVEL 3	REV
0 < X ≤ 4	±0.05	±0.1	±0.2	1
4 < X ≤ 16	±0.08	±0.15	±0.3	2
16 < X ≤ 64	±0.12	±0.25	±0.5	
64 < X ≤ 256	±0.25	±0.4	±0.8	

REV DATE		DESCRIPTION OF REVISION		CHK'D BY	J.B.KIM
2	02.01.09	Changed Panel FPC Dimension			
REV DATE		DESCRIPTION OF REVISION		CHK'D BY	J.B.KIM
REV DATE		DESCRIPTION OF REVISION		CHK'D BY	J.B.KIM

REV DATE		DESCRIPTION OF REVISION		CHK'D BY	J.B.KIM
REV DATE		DESCRIPTION OF REVISION		CHK'D BY	J.B.KIM

REV	DATE	DESCRIPTION OF REVISION	CHK'D BY	J.B.KIM
1	01.08.28	Added Caution Mark.		
		Added Alignment Spec.		

REASON	CHK'D BY
	J.B.KIM

MODEL NAME	LTS35001-PD1
PART/SHEET NAME	OUTLINE DRAWING
SHEET	1/1
CODE NO.	
SPEC. NO	S050524-002

**8-2. FLU Outline Dimensions**

**- Refer to the Next Page.**

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NO	PART NAME	CODE NO	SPECIFICATION	Q.TY	REMARK
1	ASSY-F/L	LJ96-00496A	D1.8.L86.0.2PIN.LTS35001	1	SDS07567
2	ASSY-LAMP	LJ91-00352A	D1.8.L86.0.2PIN.LTS35001	1	SDS05214
1	LGP	LJ61-00580A	ZENONOR_AR_COAT.LTS35001	1	SDS05220
1	LGP	LJ61-00712A	ZENONOR_AR_COAT.LTS35001	1	SDS07700
3	ASSY-CHASSIS, TOP	LJ97-00134A	SUS301.0.3T.LTS35001	1	SDS05222
4	LABEL-CODE(F/L)	LJ68-00058A	PET.WHT.LTS35001	1	SDS05228
5	RUBBER	-	BLK,L82,W2.8,D1.2	1	-
6	RUBBER	-	BLK,L59,W2.0,D1.2	1	-

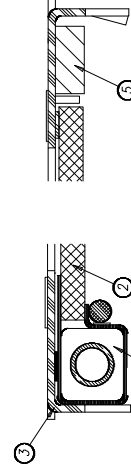
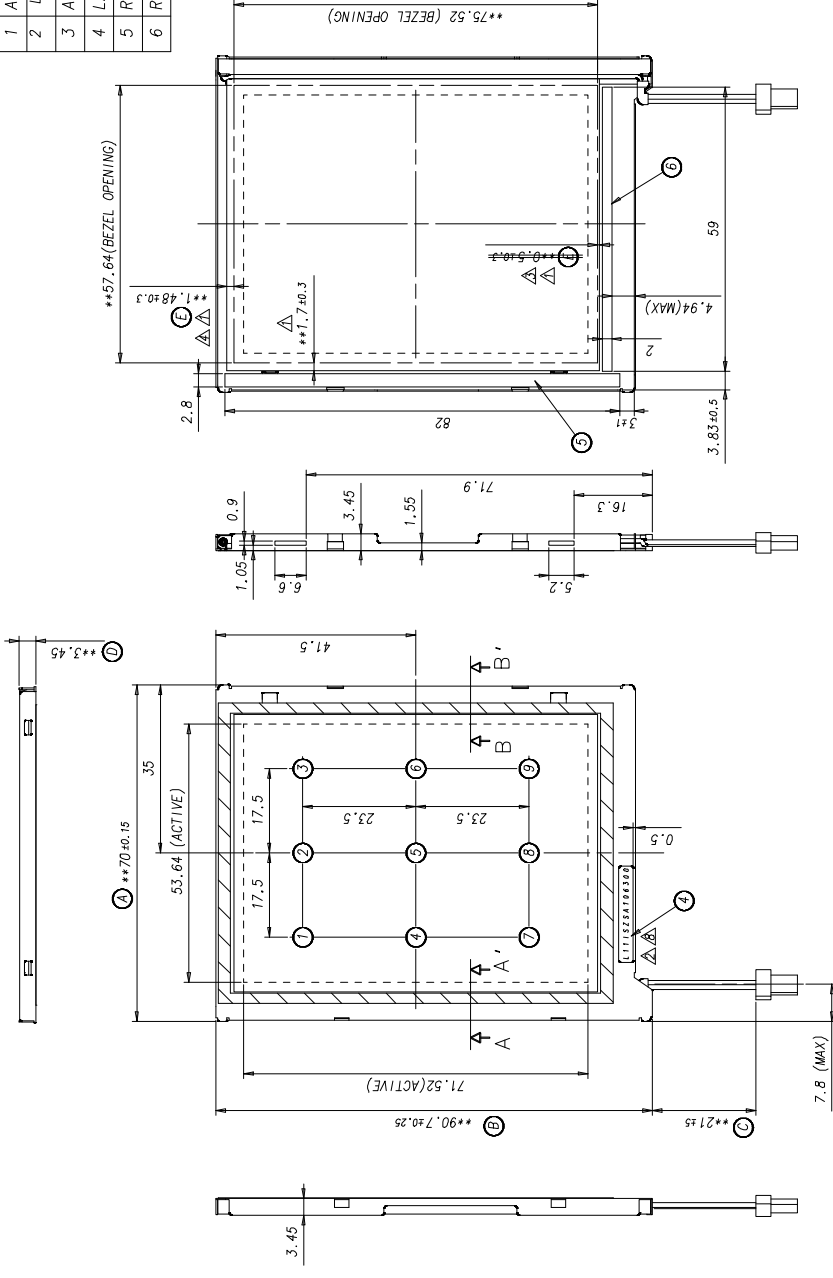
1. LABEL-CODE(F/L) SPEC.  
 L X X X X S A X X X X X X X X X  
 7 2      3      4 5 6 7      8 9      [ L 1 1 1 1 S Z S A 1 0 6 3 0 0 ]

1. F/L MAKER CODE  $\Delta$  L : ELITECOM  
 2. CCL MAKER CODE  $\Delta$  1 : KUMHO  
 2 : WEST  
 3. CCL LOT NO.  $\Delta$   
 4. LGP MAKER CODE  $\Delta$  S : SAMSUNG TECHWIN  
 N : MANULCO  
 5. LGP CAVITY CAVITY 1 : A  $\Delta$   
 CAVITY 2 : B  
 6. YEAR CODE  
 7. MONTHLY CODE  
 8. DATE CODE  
 9. REVISION NO.  $\Delta$

2. INSPECTION POINTS : (A) ~ (L)  
 3. BRIGHTNESS MEASURE POINTS : (1) ~ (9)  
 4. \*\* IS VERY IMPORTANT DIMENSION.  
 5. F/L UNIT SPECIFICATION

SPEC. ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Brightness	Br	25	30	-	cd/m <sup>2</sup>	CENTER POINT
Coordinates of Chromaticity	Wx Wy	- -	0.310 0.340	-	-	±0.02
Lamp Voltage	V <sub>L</sub>	-	(300)	-	Vrms	Frequency : 60 kHz (TYP.)
Lamp Current	I <sub>L</sub>	-	1.5	4	mA <sub>RMS</sub>	-
Power Consumption	P <sub>L</sub>	-	450	-	mW	-
Uniformity	F <sub>u</sub>	60	-	-	%	(Min,Max.)x100

<NOTE> Brightness measurement must be done on the reference reflective LCD panel  
 - BM7 Field : 1°, 25 ± 2°C  
 Δ 6. F/L UNIT WEIGHT : 1342g  
 Δ 7. HIGH VOLTAGE TEST SPEC  
 - VOLTAGE : AC 1.0KV(RMS)  
 - CUTOFF CURRENT : 0.4mA  
 - DURATION TIME : 1 sec



REV	DATE	DESCRIPTION OF REVISION	CHK'D BY	Realization of Dimensions			REASON	CHK'D BY
				MODEL NAME	PART/SHEET NAME	CODE NO.		
5	01.12.26	Changed Label (Changed F/L Maker Code)	J.B.KIM	LTS35001-PD1				
4	01.11.28	Added Part(LGP for common use)	J.B.KIM	ASSY-F/L				
3	01.11.16	Changed Label (Added Revision No.)	J.B.KIM					
3	01.11.16	Added Spec (Weight Spec & High Voltage Test Spec)	J.B.KIM					
3	01.11.16	Delete Dimension, Changed Inspection Point	J.B.KIM					
2	01.11.02	Changed Label (Added CCL Lot No. & LGP Cavity)	J.B.KIM					
REV	DATE	DESCRIPTION OF REVISION	CHK'D BY	SAMSUNG ELECTRONICS		SDS07567-005	VER. : 005	

SECTION A-A' (S=5:1)

SECTION B-B' (S=5:1)

General Tolerance

STEP	LEVEL 1	LEVEL 2	LEVEL 3
0 < X ≤ 4	±0.05	±0.1	±0.2
4 < X ≤ 16	±0.08	±0.15	±0.3
16 < X ≤ 64	±0.12	±0.25	±0.5
64 < X ≤ 256	±0.25	±0.4	±0.8

Changed Tolerances (3 Points)

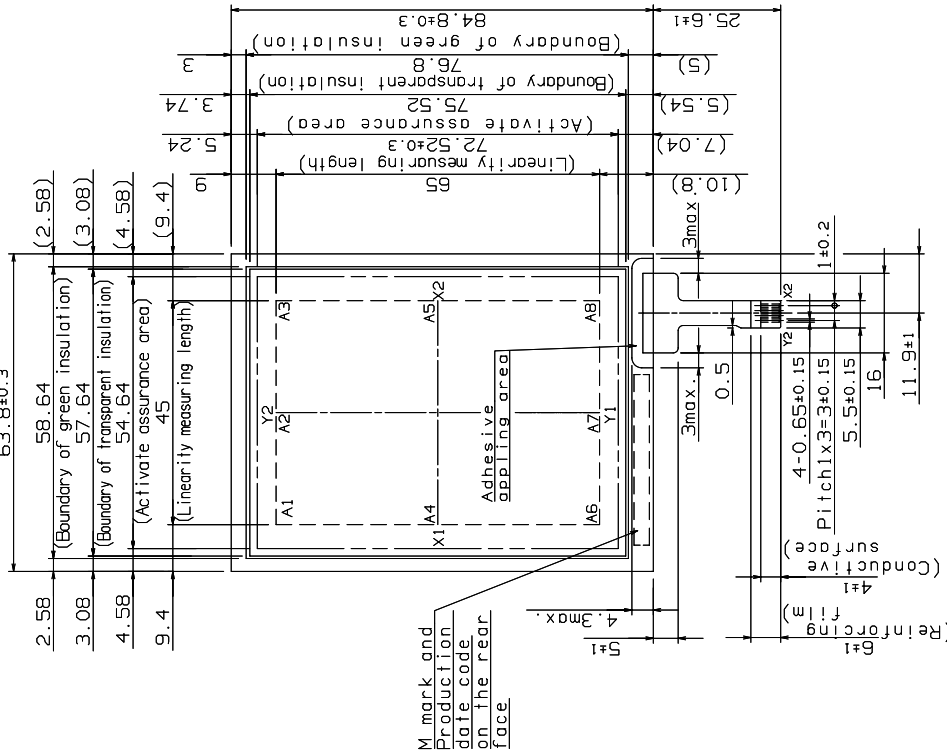
REV	DATE	DESCRIPTION OF REVISION	CHK'D BY
1	01.09.18	Changed Tolerances (3 Points)	J.B.KIM

**8-3. Touch Panel Outline Dimensions**

**- Refer to the Next Page.**

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Seeing the operative surface



Note: Our transparent touch panel forms all of wiring patterns except for FPC part on the side of the glass.  
 PEN 0 151 153 154 250 254  
 PEN 2 3 60 130 150 155 SCL1 Electromechanical Components Business Unit Custom Components Company △ Matsushita Electronic Components Co.,Ltd.

Commercial tolerance	Sym.	Date	Revision	Signed	Checked
±0.5	△				

**Specification**

Subject to Specification 151-EMU601A2SA00 for EMU60 type individual except for the following items.  
 Packing specification: The standard quantity per packing case shall be 200 pcs.

Items	Specification	Remarks
9 Electric characteristics	9-1 Terminal resistance X: 150Ω ~ 630Ω (typical: 340Ω) Y: 180Ω ~ 720Ω (typical: 360Ω)	X: Glass Y: Film
9-2 Linearity	X: ± 1.5 % max. Y: ± 1.5 % max. Linearity(X) = $\frac{EV - SV}{\Delta V} \times 100$ SV: Voltage of Starting Points (X axis: A1, A4, A6, Y axis: A1, A2, A3) EV: Voltage of Ending Points (X axis: A3, A5, A8, Y axis: A6, A7, A8) Measuring line X axis: A1, A5, A6, A7, A8 Y axis: A1, A6, A2, A7, A3, A8	(Measuring method) ΔV: the difference between the ideal voltage and measured voltage on the each measuring line.
10 Optical characteristics	Effective potential ratio X: 55 % min. Y: 60 % min.	Percentage divided the value of the electric potential at the both ends in the Linearity measuring length by the value of the apply voltage. (The points at the both X: A1A3, A4A5, A6A8 ends to be measured) Y: A1A6, A2A7, A3A8
	10-1 Total light transparency	Visible Radiation Haze 2%(typ.)
	Product weight	11 g ± 3g

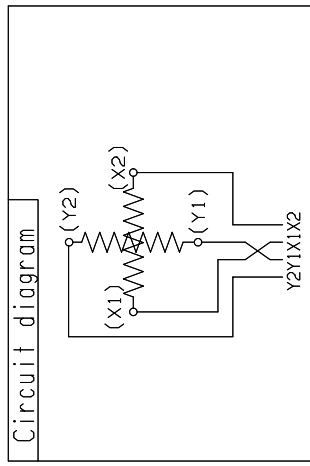
Production Date Code indicating method

Line No.  1st-10th  11th-20th  21th-31th

Production line  Allow one character space

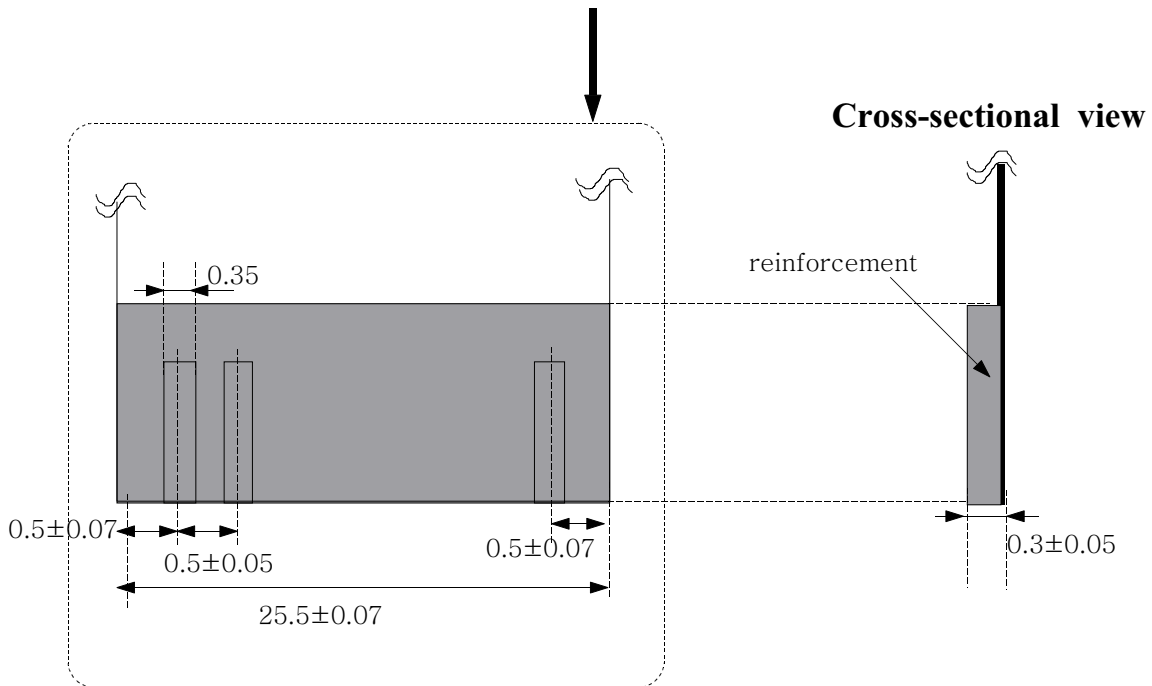
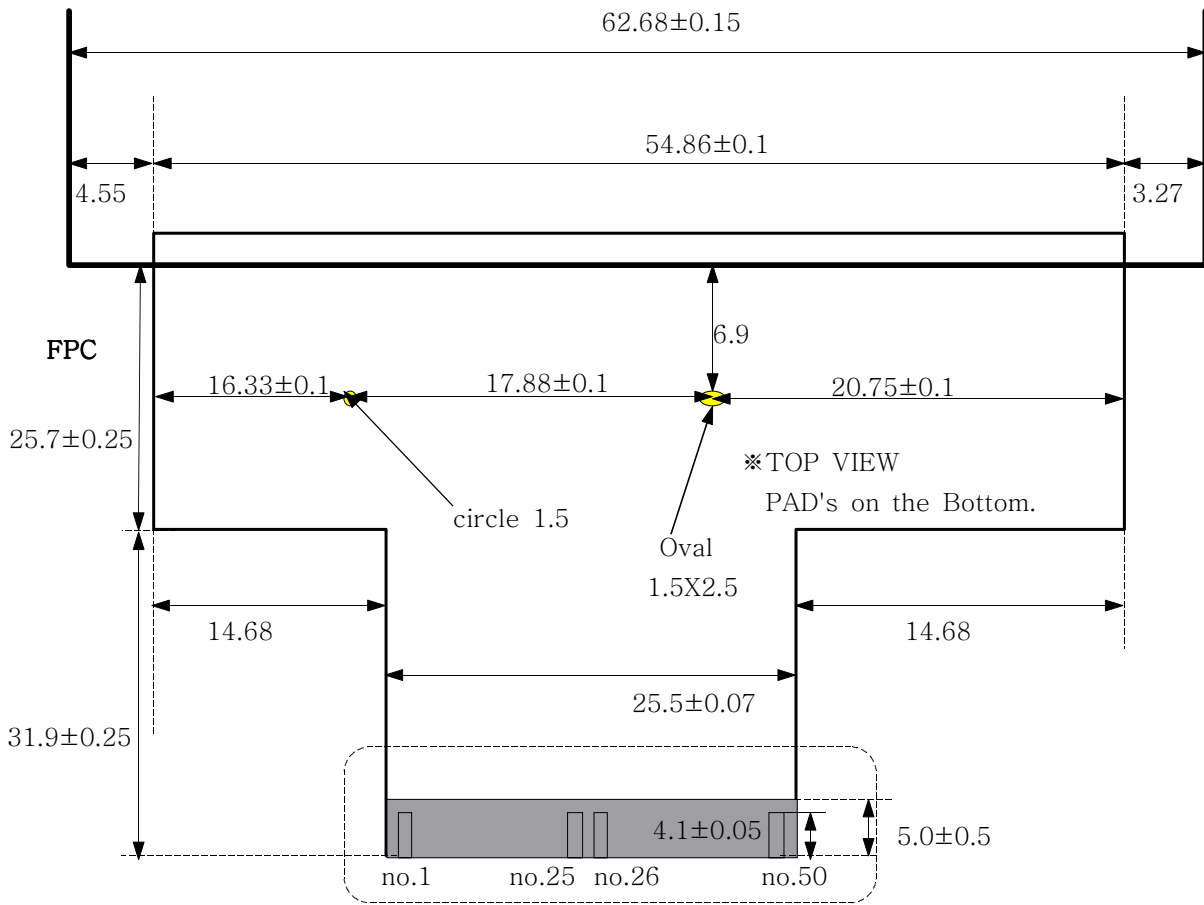
Production month  JAN.  FEB.  MAR.  APR.  MAY.  JUN.  JUL.  AUG.  SEP.  OCT.  NOV.  DEC.

Production year  2000  2001  2002



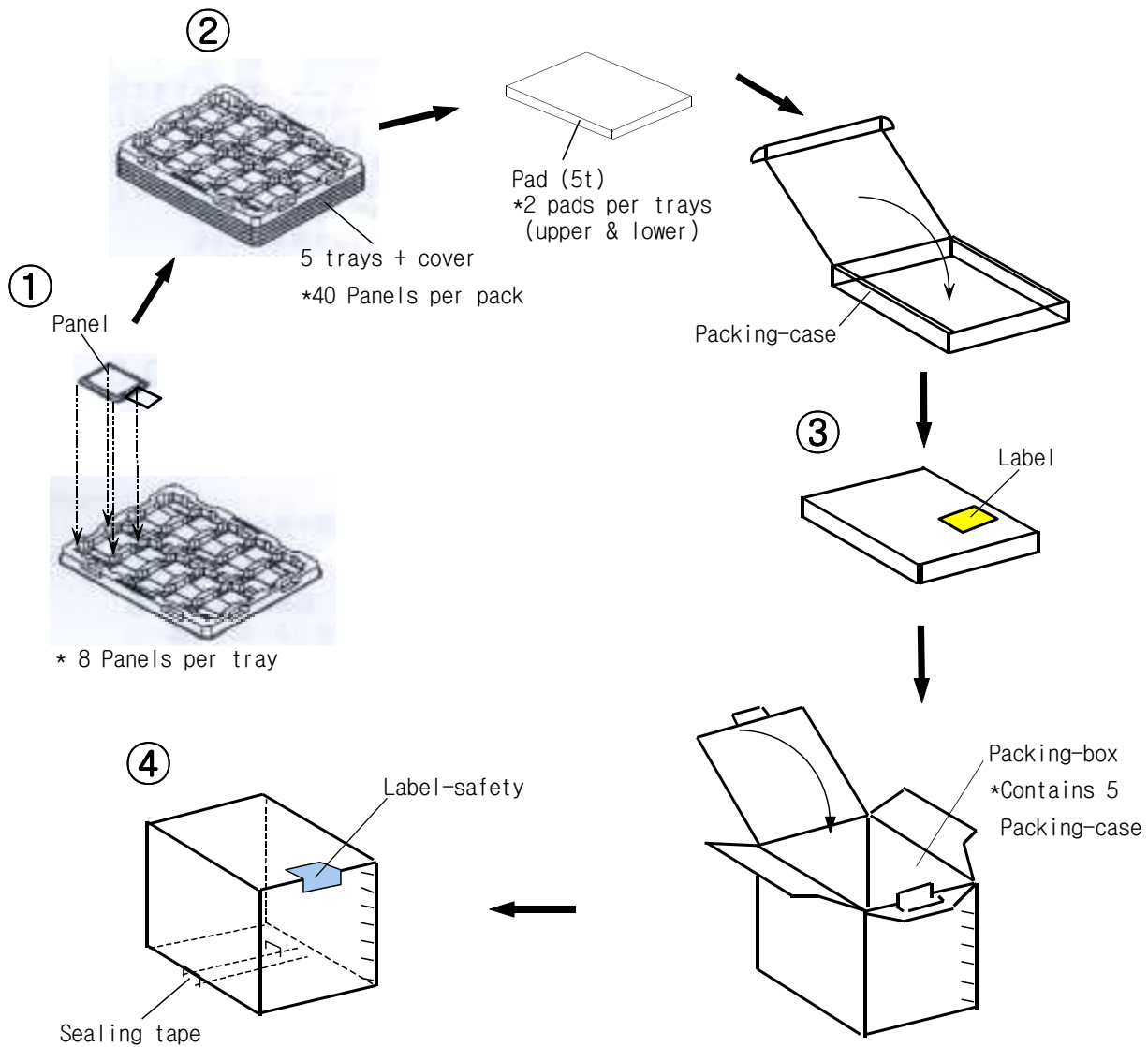
4	Flexible pattern	Polyester film 25μ	—	Cu-Sn/Pb type	Printing layer
3	Adhesive	—	—	—	—
2	Glass circuit board	Glass t=0.7	—	—	—
1	Film circuit board	Polyester film t=0.18	—	Clear type	—
Sym.	Item or Code No.	Material & Size	Material	Process	Remarks
Estm. Date	Oct. 26, 2001				Specification Customer SAMSUNG
Enfo. Date	Oct. 26, 2001				Name Transparent touch panel
Scale	Des. Signed	Drawn	Traced	Checked	Enacted
	K. Okamoto	K. Okamoto	K. Wate		
	Oct. 26, 2001	Oct. 26, 2001	Oct. 26, 2001		
					Part No. EMU601A2SA00
					Drawing No. 151-EMU-601A2SA00 (R)

## 9. FPC Outline Dimension





## 10. PACKING :



Note (1) Total : Case: Approx. 3.5Kg

Box: Approx. 18Kg

(2) Size : Case: 490(W) x 342(D) x 58(H)

Box: 505(W) x 355(D) x 300(H)

(3) Place the panels in the tray facing the direction shown in the figure.

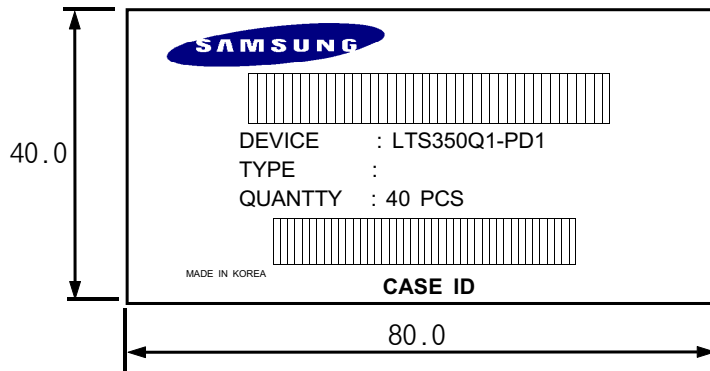
(4) Place 5 tray and cover(empty tray) and pads inside the packing-case.

(5) Place 5 packing-case inside the packing-box.(Affix the label)

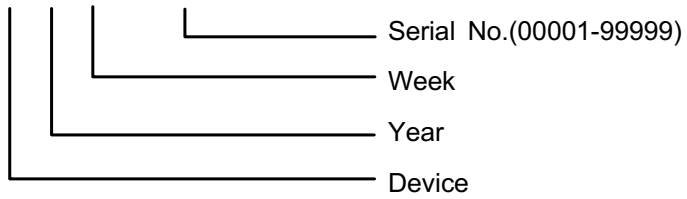
(6) Seal the packing-box. Affix the label-safety.

# 11. MARKING & OTHERS :

(1) Packing case attach



CASE ID : V 00 00 00001



## 12. General Precautions

### 12.1 Handling

- (a) When the module is assembled, it should be attached to the system firmly. Be careful not to twist and bend the module.
- (b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
- (c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.
- (d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.
- (e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (f) The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane. Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth . In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.
- (h) Protect the module from static , it may cause damage to the CMOS Gate Array IC.
- (i) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (j) Do not disassemble the module.
- (k) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (l) Pins of I/F connector shall not be touched directly with bare hands.

## 12.2 Storage

- (a) Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35° C and relative humidity of less than 70%.
- (b) Do not store the TFT-LCD module in direct sunlight.
- (c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

## 12.3 Operation

- (a) Do not connect, disconnect the module in the "Power On" condition.
- (b) Power supply should always be turned on/off by the item 3.1 "Power on/off sequence"

## 12.4 Others

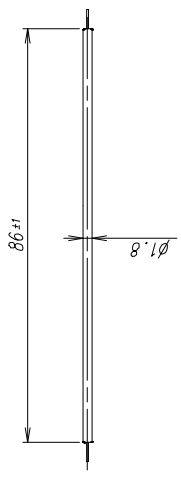
- (a) The liquid-crystal is deteriorated by ultraviolet rays. Do not leave it in direct sunlight and strong ultraviolet rays for many hours.
- (b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.
- (c) Do not exceed the absolute maximum rating value. ( the supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on)  
Otherwise the panel may be damaged.
- (d) If the panel displays the same pattern continuously for a long period of time, it can be the situation when the image "Sticks" to the screen.
- (e) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

# Appendix 1

## CCFL Specifications

- Refer to the Next Page

NO	PART NAME	CODE NO	SPECIFICATION	Q'TY	WEIGHT FINISH MATERIAL	UNFOLDED DIM. OF MATERIAL	REMARK
1	LAMP-CCFL	LJ47-00139A	D1, B, L86, 0, LTS350Q1	1			



<LAMP SPECIFICATION>  
1. Initial Characteristics

NO	Items	Code	Unit	Requirement			REMARKS	NO	Items	Code	Unit	Requirement			REMARKS
				MIN	TYP	MAX						MIN	TYP	MAX	
1	Lamp Current	I <sub>c</sub>	mAms	1.0	2.0	4.0		10	Luminescence Stabilization Time	T <sub>s</sub>	min	-	3		
2	Lamp Voltage	V <sub>k</sub>	Vrms	350 ± 25 Vrms (at : 1mA)				11	Life Time		Hr	25°C	10000	-	at 4.0 mA
				325 ± 23 Vrms (at : 2mA)											
				310 ± 22 Vrms (at : 3mA)											
3	Start up Voltage	E <sub>s</sub>	Vrms	25°C	-	-		12	Surface Temperature	T <sub>s</sub>	deg	Center(°C)	Hot(°C)	Cold(°C)	
				0°C	-	-						at:1mA	45	50	50
					-	-						at:2mA	50	65	65
4	Luminance	B	cd/m <sup>2</sup>	7000 ± 910cd/m <sup>2</sup> (at : 1mA)				13	Phosphor Separation	A	No permission	B : Up to IEA	D : Don't care		
				18000 ± 2350 cd/m <sup>2</sup> (at : 2mA)											
				30600 ± 3965 cd/m <sup>2</sup> (at : 3mA)											
5	Effective Emission Length	L <sub>e</sub>	mm	72	-	-		14	Hg Amount (mg)	Min	Typ	Max	Electrode Type	Electrode Length	No. of Partial Pressure Ratio
6	Chromaticity	X		0.305 ± 0.01											
		Y		0.304 ± 0.01											
7	Chromaticity Uniformity	ΔE <sub>uv</sub>		-	-	0.015									
8	Lighting Frequency	f <sub>r</sub>	kHz	(50)		(80)									
9	Light Spectrum		mm	Red				14	Gas Pressure (Pa)	W	(11970)				
				Green	(545)										
				Blue	(440)										

Notice) To reference drawing Specification for initial characteristics. All measured characteristics are referred to WEST measuring standards.

GENERAL TOLERANCE				DESCRIPTION OF REVISION				REASON		CHK'D BY	
STEP	LEVEL 1	LEVEL 2	LEVEL 3	REV	DATE	DRAWN BY	DESIGNED BY	CHK'D BY	APP'D BY	MODEL NAME	SHEET
0 < X ≤ 4	±0.05	±0.1	±0.2			J.B.KIM	K.H.KHO	I.S.LEE		LTS350Q1-PD1	
4 < X ≤ 16	±0.08	±0.15	±0.3			2007.09.14	2007.09.18	2007.09.18		LAMP-CCFL	1/1
16 < X ≤ 64	±0.12	±0.25	±0.5			SAMSUNG ELECTRONICS		SPEC. NO			
64 < X ≤ 256	±0.25	±0.4	±0.8							LJ47-00139A	VER. 000

# Appendix 2

## Touch Panel Specifications

- Refer to the Next Page

Classification " j { °		Product specification for information yY yY yY 7 yY {		Standard No. (R) G ± j ± 151-EMU-601A2SA00 9-1		
Item £	Specification 7		Remarks			
1.Product name Code No a... ° z... j	Transparent touch panel EMU601A2SA » z % "					
2.Scope & ; c	This specification applies to EMU601A2 analog type pen or finger input transparent touch panels.(Those mentioned in the individual specification shall be given priority.) \ w 7 { x z EMU601A2 ç x f » z % " t & ; b { ç ' ' z x 7 { t G L ' o K w x z \ ' o & ; b £					
3.Application ; M	The products are film / glass type transparent touch panels used as the input devices for general electric appliances and OA equipment. \ w a... x z ' ? > a... t   OA ; + w q ' o ; b ¢ » z % " p K {					
4.Manufacturer a i	Administration, Sales and Engineering: Electromechanical Components Division. Matsushita Electronic Components Co., Ltd. Address:1006, Oaza Kadoma, Kadoma City, Osaka Pref. Manufacturing: Electromechanical Components Division. Matsushita Electronic Components Co., Ltd.or Qingdao Matsushita Electronic Components çFree Trade Zone £Co., Ltd. Address:1006, Oaza Kadoma, Kadoma City, Osaka Pref.or / f t h a ç h a - k , 8 ; 18 ± 1 ± g f < ? ... ç £ t O G U , ç G " 1006 j a z f < ? ... ç £ ç x h a f < ? ... ç - k £ v q t O G U , ç G " 1006 j ç x / f t h a ç h a - k , 8 ; 18 ± 1 ±					
5-1 Operating Temperature and humidity ; 9 £ S c	-10 ~ 60 ~ 20%RH 90%RH yY ' z 40 ~ 60 ~ x 0 £ S U 40 ~ 90 , RH p < Except for dew gathering. ' ' A - x X {					
5-2 Storage Temperature and humidity - 9 £ S c	-20 ~ 70 ~ 20%RH 90%RH yY ' z 40 ~ 70 ~ x 0 £ S U 40 ~ 90 , RH p < yYyY 60 ~ 70 ~ x 240h < yExcept for dew gathering. y ' ' A - x X {					
6.Shape and dimensions z G O	As specified in individual drawings x \$ t {					
7.Rating ¤	DC Vmax } yY ç Vtyp. £					
8.Mechanical characteristics ; \$ Q						
8-1 Operation force ^	0.8N or less (Tip R0.8mm polyacetal pen y or y Tip R3.75mm,hardness 10 ^ to 20 ^ , silicone rubber operation.) 0.8N < ç z R0.8mm • » h x z z R3.75mm z S 10 ^ 20 ^ z ‡ fl ^ £					
8-2 Impact resistance 1 z 8 Q	No damage when 9mm steel ball is dropped on the surface from 0.3m height at 1 time. 9 w 0.3m w ^ T s X < ^ d o s V \ q {					
Remarks/Revision ~						
Date issued M Oct,26,2001	Electromechanical Components Business Unit		Approval M V	Check g y	Check U,,	Signature r p
Date enforced " Oct,26,2001	. ; ~ ... ~ . : ç ~		T.Yagasaki	T.Yagasaki	H,Komiya	K,Okamoto

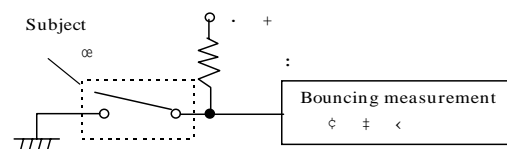
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Classification " j { °		Product specification for information Y Y Y Y 7 Y Y {			Standard No. (R) G i j j 151-EMU-601A2SA00 9-2	
Item L	Specification 7			Remarks		
8-3 Static load resistance 1 i Y O S S	After 45N load is applied to the center area (2500mm ) of the transparent touch panel, the requirements in 8-1 and 9 shall be satisfied. » z % " w / 2500mm 45N w Y O p 30s C Q h z 8-1 z H 9 < b \ q { 					
8-4 Surface hardness fl S	H or over. (JIS K5400, Pressure 1N,45 ^.) H " { (JISK5400 j , ! y 1N,45 ^)					
8-5 Flexible pattern heat seal peeling strength SS	0.15N/mm(peeling upward by 90 ^.) 0.15N/mm ( " M † 90 ^ # m )					
8-6 Flexible pattern bending resistance R Q	Bending 3 times or more by bending radius R1 mm. The requirements in 9-1 shall be satisfied. ' R R1mm p ' s : 3 s " { H 9-1 < b \ q {					
8-7 Flexible pattern insert/pull out resistance H Q	20 times at least. The requirements in 9-1 shall be satisfied. Type of connector : Japan Molex 5597- CPB(1.25mm pitch) 52030- 10(1.0mm pitch) (Insert/pull-out conditions) One test cycle: Connector unlock Flexible pattern insert Connector lock Connector unlock Flexible pattern pull-out Connector lock 20 s " { H 9-1 < b \ q { fl « » □ : E z « 5597- CPB(1.25mm pitch) 52030- 10(1.0mm pitch) ( H E ) 1 s q b {			depend on the number of keys.  x ^ : t {		
8-8 Vibration resistance(product) 1 Q ( a ...)	In operation : No faulty operation when sweep vibration of 2m/s <sup>2</sup> ,10Hz ~ 55Hz (1min) is given for 30min each in the directions of X, Y, Z. Not in operation : The requirements in 8-1 and 9 shall be satisfied after sweep vibration of 20m/s <sup>2</sup> ,10Hz ~ 55Hz(1min) is given for 30min each in the directions of X, Y, Z. ^ 2m/s <sup>2</sup> z 10Hz ~ 55Hz * 8 1min w X,Y,Z w < M † t 30min ) Q o z j ^ \ s M \ q { ^ 20m/s <sup>2</sup> z 10Hz ~ 55Hz * 8 1min w z X,Y,Z w < M † t 30min ) Q h z H 8-1 z H 9 < b \ q {					
8-9 Package drop A X <	No damage to the product. (1 corner edge, 2 ridges, 4 surfaces, drop from 0.5m height: 0.65m for the bottom) a ... t s V \ q { (1 fl z 2 z 4 z 0.5m X < z ' ' x 0.65m X <)					
Remarks/Revision ~						
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					151-EMU-601A2SA00	
Item		Specification			9-3	
9.Electric characteristics					Remarks	
9-1 Terminal resistance	z -	As specified in individual drawings.				
9-2 Linearity	¢ Q	As specified in individual drawings.				
9-3 Bouncing	¢ ± <	<p>10ms or less at ON; 10ms or less at OFF.            Tip R3.75mm, hardness 10 ^ 20 ^, silicone rubber 4.5N operation : 400mm/s.            ON 10ms &lt; z OFF 10ms &lt; {            z R3.75mm s 10 ^ 20 ^ † fl 4.5N ^ : ' d S 400mm/ B</p> <p>Subject</p> 				
9-4 Insulation resistance	-	20 M or over (DC25V) 20 M " (DC25V)				
10.Optical characteristics						
« ¶ \$ Q						
10-1 Light transparency	« ¢ ap	As specified in individual drawings.				
10-2 Newton's ring	~ 31	<p>No remarkable Newton's ring in practical use.            Visual inspection shall be done at a distance of 0.3m } between eyes and a product at an angles of 60 ^ to the surface of the product under a ceiling fluorescent light (40W,natural color).            ; " J w K ' E ~ &lt; w s V \ q {            1 " , « n ¢ 40W z £ ; ` z £ q a ... w m 0.3m            K Z z a ... t 0 ' o 60 ^ w f l S p £ , U * {</p>				
11.Reliability						
T Q						
11-1 Humidity resistance	1 ¢ Q	<p>The requirements in 8-1, 9 and 10 shall be satisfied after exposing at 60 ~ , 90%RH for 240h (after dehumidifying in the chamber (60 ~ and 50%RH max.)) and at normal temperature and humidity for 24h.            60 ~ z 90 , RH w " t 240h L z 60 ~ z 50 , RH &lt; w Z A - «            ¢ S p " ¢ ' o T z 9 ¢ t z ' o 24h L ' z H 8-1 z H 9 z H 10 &lt; b \ ¢</p>			Except for dew gathering	
11-2 Heat resistance	1 Q	<p>The requirements in 8-1, 9 and 10 shall be satisfied after exposing at 70 ~ for 240h and at normal temperature and humidity for 24 h.            70 ~ z 240h L z 9 ¢ t 24h L ' z H 8-1 z H 9 z H 10 &lt; b \ q {</p>				
11-3 Cold resistance	1 Q	<p>The requirements in 8-1, 9 and 10 shall be satisfied after exposing at -40 ~ for 240h and at normal temperature and humidity for 24h.            -40 ~ z 240h L z 9 ¢ t 24h L ' z H 8-1 z H 9 z H 10 &lt; b \ q {</p>			Except for dew gathering	
Remarks/Revision ~						
Date issued M		Electromechanical		Approval M V	Check g y	Check U „
Oct,26,2001		Components Business Unit				
Date enforced "		. ; ~ ... ~		T.Yagasaki	T.Yagasaki	H,Komiya
Oct,26,2001		. . ¢ ~				K,Okamoto

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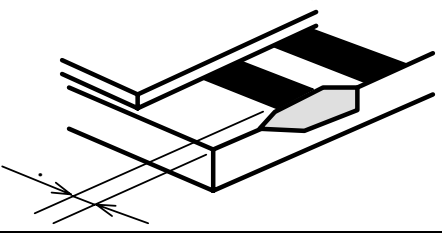
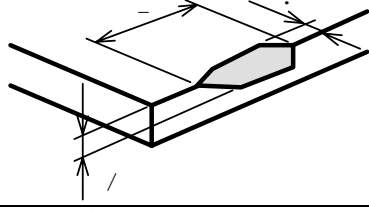
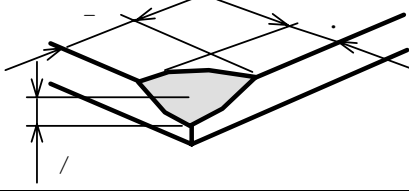
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Item ㄨ		Specification 7			Remarks		
11-4 Thermal shock ㄨ 8		The requirements in 8-1, 9 and 10 shall be satisfied after exposing under the conditions of -10 °(1h) ±60 °(1h) by 20 cycles (taking out at 60 °) and at normal temperature and humidity for 24h. -10 ° ± 1h ± 60 ° ± 1h 1 - « q `h E / t 20 - « L z 9 E t 24h L `z H 8-1 z H 9 z H 10 < b \ q {			Except for dew gathering Z A - «		
11-5 Hitting durability ' d l q Q		One million times minimum. The requirements in 9 shall be satisfied. The surface shall be free from damage. (Test conditions) Hitting pad : Tip R3.75mm Hardness 10 ^ to 20 ^ . Silicone rubber. Load : 2.45N Hitting speed : Twice/s. Electric load : None 100 " s ~ { H 9 < b \ q { ' ¶ U m T s M \ q { φ ... g E £ ' d " z ~ : z R3.75mm S 10 ^ 20 ^ † fl Y O : 2.45N ' d S : 2 s / s > Y : s `					
11-6 Pen sliding durability F l q Q		300,000 times minimum. The requirements in 9 shall be satisfied. The surface shall be free from damage. (Test conditions) Sliding pen : Tip R0.8mm Polyacetal pen Load : 2.45N Sliding speed: 60mm/s Electric load : None 30 " s ~ { H 9 < b \ q { ' ¶ U m T s M \ q { φ ... g E £ F : z R0.8mm • » Y O : 2.45N F S : 60mm/s > Y : s `					
12. Appearance limit standard v S , j							
12-1 Scope & ; c		This standard applies to the view area (inside of transparent insulation). For the area outside the view area, it shall be regarded acceptable provided that there is no possibility of causing influences to the performance. However, the Item 12-4 Chip and Crack applies to the whole part of the product. \ w , j x z ~ E / " ( E . ~ ¥ w " ) t & ; b { ~ E / t m M o x z Q t G V X E , " t b D Q w s M v ... q b { ` ` z 12-4 = Z t m M o x a ... ¶ . t & ; b {					
Remarks/Revision ~							
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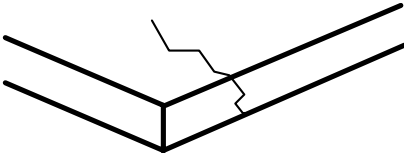
Item	Specification	Judgment																								
12-2 Dot-like foreign matter : œ	A:d %0.1 B:0.1 »d %0.2 C: 0.2 »d %0.3 D:d ...0.3 d(mm): average diameter =(Long dia. + short dia.)/2  A:d %0.1 B:0.1 »d %0.2 C: 0.2 »d %0.3 D:d ...0.3 d(mm): =( · y )/2	A: Ignored B: 2 yor less C: 1 yor less D: Zero  A: ` " B:2 x < C:1 x < D:0 x																								
12-3 Linear foreign matter ç œ	A:L » .0 and W »0.0 B: 2.0 %L or 0.02 %W L(mm) : overall length, W(mm): width A:L »2.0 T m W »0.02 B:2.0 % ! ç x 0.02 %W L(mm): ¶ z W(mm):	A: Ignored B: Zero  A: ` " B:0 x																								
12-4 Chip and crack = Z q .	(1)Chip reaching bottom glass pattern < « " » t T T = Z {    (2)General chip X: width direction to ridge line. Y: length direction to ridge line. Z: thickness direction to ridge line. t: bottom glass thickness. ` = Z X x a ç ç t 0 ` ° M † Y x a ç ç t 0 ` M † Z x a ç ç t 0 ` X M † t x < «    (3)Corner chip t: bottom glass thickness fl ~ = Z t x < «  	Y %1mm Y %1mm q b {  <table border="1" data-bbox="1079 1060 1477 1186"> <thead> <tr> <th>X(mm)</th> <th>Y(mm)</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>% 3.0</td> <td>%3.0</td> <td>%2/3t</td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table>  <table border="1" data-bbox="1079 1438 1477 1533"> <thead> <tr> <th>X(mm)</th> <th>Y(mm)</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>% 3.0</td> <td>%3.0</td> <td>%2/3t</td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table>	X(mm)	Y(mm)	Z	% 3.0	%3.0	%2/3t							X(mm)	Y(mm)	Z	% 3.0	%3.0	%2/3t						
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Classification " j { °		Product specification for information yY yY yY7yY{		Standard No. (R) G±j± 151-EMU-601A2SA00 9-6	
Item L	Specification 7	Judgment Q " 0			
12-4 Chip and crack = Z q . ~	(4)Bad crack (possibly expanding) QwK . ~ { 	All shall be rejected. ¶ o ~ qb {			
12-5 Scratch ' ¶	A:L<3 and W »0.05 B: 3 %L or 0.05 %W L(mm): overall length W(mm): width  A:L<3 Tm W »0.05 B: 3 %L ç x 0.05 %W L(mm): ¶ W(mm):	A: Ignored B: Zero  A: ` " B: 0 x			
12-6 Fish eye ' z > P	A:D %0.2 B: 0.2 »D %0.4 C:D ..0.4 D(mm): average diameter =(Long dia. + short dia.)/2  A:D %0.2 B: 0.2 »D %0.4 C:D ..0.4 D(mm): =( . y )/2	A: Ignored B: 2 or less C: Zero  A: ` " B: 2 x < C: 0 x			
12-7 Stain Upper electrode slack Film break z " ? ^ ¶ ¶	Not excessive L q h u \ q				
12-8 Others f w	This specification is considered as basic on transparent touch panels, but details are subject to discussion upon individual customer requirement. 7 p w E ; , qb UzY [ \ ah ø x M ^ b {				
13. Precautions for use ; ~ w « ~	In order to prevent accidental use and performance deterioration, please keep the following precautions and inhibited points. ] ; t M ` o x z ~ ¶ ~ Q ... = s w w > w h z < t G ` b « ~ t m M o w ] q - > ~ w k S & M ` b {				
13-1 Cautions for storage - t b « ~	Store the products at the temperature and humidity mentioned in the specification in a state of package with care not to expose the products to the direct sunlight or stresses. - x 7 { t > h 9 E S " p z a ... t ø « z C Q s M O A 6 w l o < ^ M {				
13-2 Cautions for unpacking t b « ~	Check the vertical direction before unpacking. ~ < M † < ` o ` o < ^ M {				
13-3 Cautions for handling { M t b « ~	Transparency is an important factor for the transparent touch panel. So, please wear clean finger sacks, gloves and mask to protect the products from fingerprint or stain, and also hold the portion outside the view area when handling the panel. » ç % " x Q U O A s ; q s l o M b w p z a ... t f z U ' f ` s M O z Z s f - ç « z > « s f ; ` z ~ E / l o S { M < ^ M { The glass edges are not chamfered. So, use finger sacks or gloves to avoid injuries by sharp edges when handling the panel. ¶ x ^ o S d { b s U K b w p f - ç « > c ; w " z { M t x F ] « < ^ M {				
Remarks/Revision ~					
Date issued M Oct,26,2001	Electromechanical Components Business Unit	Approval M V	Check g y	Check U „	Signature r p
Date enforced " Oct,26,2001	~ ; ~ ~ . ; ~	T.Yagasaki	T.Yagasaki	H.Komiya	K.Okamoto

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		151-EMU-601A2SA00 9-7

Item	Specification
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†Inhibition †  
 ~Do not handle the transparent touch panel by holding the flexible pattern portion in order to assure the reliability.  
 ~Do not put one product on the other. It may otherwise cause the product to be scratched.  
 ~Do not put a heavy, hard or sharp object on the transparent touch panel.  
 †->~ †  
 ~ TQ<-wh " z%" w L'† "» ,lo { s  
 Mp<^M{  
 ~a...t'¶ mZ " UK h zOv Vx`sMp<^M{  
 ~ »z%" w"tO æ Mæz bsæ TsMp<^M{

13-4 Cautions for installing and assembling  
 z ° q " w « ~

Do not give excessive strain to the transparent touch panel.  
 »z%" t`gsE )QsM Ot`o<^M{  
 Flexible pattern cable is connected to the body by heat-seal (thermal pressure) method. So, do not apply excessive forces to the flexible pattern.  
 »z%" w L'† "» x yEt Aφ^ oM bw  
 pz L'† "» it`gs UC sM Ot`o<^M{  
 In order not to apply load on the display, provide a clearance of at least 0.3mm between touch panel and display.  
 »z%" q^ E w xOv »z%" ^ wh  
 `z ' φE 0.3mm 0.7mm E Z Ot`o^ E t  
 YsTT sM7t `Z \qU• `Mpb{  
 Pressing the boundary area (around A of the sketch shown below) of adhesive and transparent resist may cause faulty operation.  
 So, design its structure impossible to press the area around A by using a case, etc. Particularly the area B shall be free from burr, etc.  
 It is recommended to provide a buffer material at clearance C.  
 E£N E• ~w¥ φ<\$ A`z^E / "E !^Q qi  
 ^b " UK bwpz ' C t zP Z s `o A` φ`  
 E / z ^ / E !^Q \qwZRSM` t`o<^M{  
 t B tx swsM Ot`o<^M{  
 φz> zU ^ / p sM Ot -<^M{

Case > A Transparent electrode ? ^  
 Film  
 D  
 Adhesive E£N Transparent resist E• ~  
 Glass ▫

Respective transparent electrodes for film and glass do not perform pattern etching. Therefore, design the construction not to touch conductive material on the end part D.  
 t | ▫ w ? ^ x " » / z% < ^ oM d wpzz D  
 t ?QP U»z% `sM O - `o<^M{  
 †Inhibition †  
 To avoid giving strain to Film, do not bond the upper Film board to the case or the buffer.  
 †->~ †  
 wE Z h , Xq > φx > t E ^ h  
 zPsw E{ `sMp<^M{

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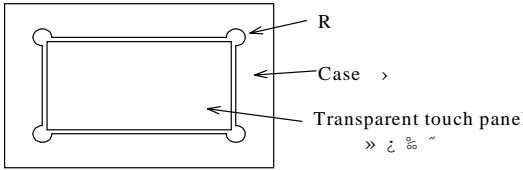
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Date enforced " Oct,26,2001	~ ; ~ ... z ~	T.Yagasaki	T.Yagasaki	H.Komiya	K.Okamoto

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Item ㄤ	Specification 7
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	<p>In case of the transparent touch panel is provided with an air groove, please design the surrounding structure not to store any liquid nor any fine particles.</p> <p>»¿%“ t &gt; ZoK øxz\w' t æ .U• sM&gt; ~ q`o&lt;^M{</p> <p>Wipe off the stain on the transparent touch panel by using soft cloth moistened with ethanol. Take care not to allow ethanol to soak into the joint of upper Film and bottom glass. It may otherwise cause peeling or defective operation.</p> <p>»¿%“ wfl w xz/&gt;° ' dhJ TM"sp V lo&lt;^M{ ``z/&gt;° U π 7 ød t' \ b q#U z ^~ wj...qs bwp]« &lt;^M{</p> <p>†Inhibition † Do not use any organic solvent or detergent other than ethanol.</p> <p>†-&gt;~ † &lt;&gt;° w ;9N Nx ;`sMp&lt;^M{</p> <p>The corners of the transparent touch panel are not chamfered and are sharp-edged. When positioning and fixing the transparent touch panel on the case, provide a R part on the corner of the case so as not to apply load on the corner of the transparent touch panel.</p> <p>»¿%“ wfl ~ x ^ oS c bs UK bw pz »¿%“ &gt; p &gt; z{ ^ øx&lt;\$w Ot &gt; wfl ~ t' Z s `o »¿%“ wfl ~ t YUTT sM Ot`o&lt;^M{</p> 
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13-5 Cautions for operation ^~w« ~	<p>Operate it with a polyacetal pen (tip R0.8mm or over) or a finger without applying excessive load.</p> <p>^x z R0.8mm "w •» zçxfp Mz`gsYO TZ sMp&lt;^M{</p> <p>†Inhibition † Do not operate it with a thing except a poyacetal pen (tip R0.8mm or less) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.</p> <p>†-&gt;~ † "G z R0.8mm &lt;w •» zçxf wæz t z sMow sw zw Mæ zw bs wp ^`sMp&lt;^M{</p> <p>The input position may be fluctuated a little through long-time use. It is desirable to provide a zero-adjustment function by using a circuit and software.</p> <p>] ;^ qz Uc \qUK b{s^t „ ~ç£ pw 4Y; ZoMhiX OtS&amp;MMh` b{</p> <p>Use ethanol to remove stain from the touch panel surface. If ethanol soaks into the joint of upper film and bottom glass, it may cause peeling and defective operation.</p> <p>»¿%“ fl w sw tmMoxz/&gt;° %p V lo&lt;^ M{ ``z/&gt;° U π 7 ød t' \ bq#U z ^~ wj...qs bwp]« &lt;^M{</p> <p>†Inhibition † Do not use alkaline detergents including glass cleaner, manicure remover (toluene), benzine or other organic solvents.</p> <p>†-&gt;~ † &lt;&gt;° w ;9Nx ;`sMp&lt;^M{ çπ « ~ sw \$ Nz `E çzsbæ</p>
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Item ㄥ		Specification 7				
13-6 Application notes for circuit condition s ~ E t b « ~		<p>Use for set</p> <p>Although full care is taken to ensure product quality, failure modes such as degradation, short circuits, or open circuits might be caused. Therefore, to design a product set, study the affects of any single failure of the panel in advance and consider fail-safe design to secure the safety of the system.</p> <p>• z ~ w ] ; t K h l o { p a ... w ... t x " ¶ m X ' o S b U z u z # , s r w , - q ' o Q ... = z † ^ ~ z f s U C \ b " U K b { ' h U l o • z ~ w - t M ' o x z ... w o , t 0 ' • z ~ q ' o r o s T ? ~ † t ] U   M h i V z † ' q ' o ¶ \$ h £ ~ • - w G t M z ¶ Q w &lt; - S &amp; M ' b {</p>				
13-7 Other cautions f w w « ~		<p>Please note that dew gathering in the panel due to abrupt temperature or humidity change, etc. may cause deterioration of the performance.</p> <p>x 9 s 9 E S ! = s t " " w A - C \ x Q ... = w j ... q s b p F ] &lt; &lt; ^ M {</p> <p>The glass of transparent touch panels may break due to a set's drop or overload on the panels. (It is difficult to avoid the break by nature.) Besides, the broken glass may cause injuries. Therefore, take care not to break the glass of transparent touch panels when handling the set, and add the following notes to the product operation manual and the product itself to avoid injuries by the broken glass.</p> <p>1) When handling the product, take care not to break the transparent touch panel.</p> <p>2) In case the transparent touch panel is broken, do not touch the panel bare-handed to prevent injuries, and contact a service center immediately.</p> <p>• z ~ w X &lt; z » z % " w a Y O s t » z % " w a ' U C \ b " U K b { φ \ \$ t w Y \ q x p b { £ h z \ w ' h a t l o x f X " U K b { H l o z » z % " w a U ' s M O t { M t « ' o M h i X q q t z ' h a t x f ' s M O t H a ... w { M { q a ... . t &lt; G " 0 w / f l S &amp; M ' b { £ » z % " U ' s M O t { l o X i ^ M { £ » z % " U ' h ø z x f b " U K h z a ... t p c z H - ~ • » " W ' o &lt; ^ M {</p>				
14. Handling of product specification for information 7 { w { M		<p>This specification shall guarantee the quality of the panel alone. For actual use, be sure to check and evaluate the product set with the panel installed in your equipment.</p> <p>7 { x z o . p w ... - ' b w p b { } ; t M ' o x z a ... t ' Z ^ h 6 p c &lt; z A ' o &lt; ^ M {</p> <p>After evaluation, please put your approval stamp on our submitted specification and return us two copies of the specification.</p> <p>In case the copies are not returned to us even 3 months after the issued date described in the specification, we will regard that you have approved the contents of the specification.</p> <p>] &lt; z 7 { t ! " " w " z 2 ] &amp; k &lt; ^ M { 7 { f l • t G L w C 3 D &amp; a ' o ] &amp; k Z s M ø x z 7 { w " 0 M h i Z h w q ^ d o V b w p z S ' X r &amp; M b {</p> <p>Any change of the specification is subject to discussion prior to the actual changes.</p> <p>7 { w " 0 w ! , t m M o x z q ~ † ^ w " " ^ d o V b {</p>				
Remarks/Revision ~						
Date issued M Oct,26,2001		Electromechanical Components Business Unit		Approval M V	Check gy	Check U,,
Date enforced " Oct,26,2001		; ~ ... ~ . : z ~		T.Yagasaki	T.Yagasaki	H.Komiya
						Signature rp K.Okamoto

Custom Components Company Matsushita Electronic Components Co., Ltd

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# Appendix 3

## Timing Control IC Specifications

- Refer to the Next Page

**(Preliminary)**

**(Rev. 1)**

**3.5" Reflective Type a-si TFT LCD**

**Timing Controller Spec.**

**(240 x 320 , Portrait Type)**

**(for ASIC by SEC)**

**ISSUE DATE : Dec. 11. 2001**

**MODEL :**

Produced by : Ho-suk Maeng

Approved by : Hyong-gon Lee

**Samsung Electronics Co . , LTD.**

## 1. General Description

Timing control IC for QVGA(240x320) portrait LCD Panel.

## 2. Feature

- Resolution : 240(horizontal) x RGB x 320(vertical)
- Voltage : 3.3V
- 6bit x RGB DATA
- DE mode / Sync mode
- CPV pulse low width selection

## 3. Pin Description

PIN	DIRECTION	PIN #	FUNCTION AND APPLICATION
MCLK	I	1	Main Clock
GND1		2	Ground
DE	I	3	DE signal input
VSYNC	I	4	Vertical sync
HSYNC	I	5	Horizontal sync
R0_I	I	6	Red 0 bit data input (LSB)
R1_I	I	7	Red 1 bit data input
R2_I	I	8	Red 2 bit data input
R3_I	I	9	Red 3 bit data input
R4_I	I	10	Red 4 bit data input
R5_I	I	11	Red 5 bit data input (MSB)
VDD1		12	Power(3.3V)
G0_I	I	13	Green 0 bit data input (LSB)
G1_I	I	14	Green 1 bit data input
G2_I	I	15	Green 2 bit data input
GND2		16	Ground
G3_I	I	17	Green 3 bit data input
G4_I	I	18	Green 4 bit data input
G5_I	I	19	Green 5 bit data input (MSB)
GND3		20	Ground
B0_I	I	21	Blue 0 bit data input (LSB)
B1_I	I	22	Blue 1 bit data input
B2_I	I	23	Blue 2 bit data input
B3_I	I	24	Blue 3 bit data input
B4_I	I	25	Blue 4 bit data input
B5_I	I	26	Blue 5 bit data input (MSB)
GND4		27	Ground
OE	O	28	Gate Output Enable
CPV	O	29	Clock Pulse(vertical)
VDD2		30	Power(3.3V)
STV	O	31	Start Pulse (vertical)
STH	O	32	Start Pulse (horizontal)

PIN	DIRECTION	PIN #	FUNCTION AND APPLICATION
REV	O	33	Polarity Signal
REVB	O	34	Polarity Signal
TP	O	35	Data Load Signal
GND5		36	Ground
R5	O	37	Red 5 bit data output (MSB)
R4	O	38	Red 4 bit data output
R3	O	39	Red 3 bit data output
R2	O	40	Red 2 bit data output
R1	O	41	Red 1 bit data output
R0	O	42	Red 0 bit data output (LSB)
VDD3		43	Power(3.3V)
G5	O	44	Green 5 bit data output (MSB)
G4	O	45	Green 4 bit data output
G3	O	46	Green 3 bit data output
G2	O	47	Green 2 bit data output
GND6		48	Ground
G1	O	49	Green 1 bit data output
G0	O	50	Green 0 bit data output (LSB)
GND7		51	Ground
B5	O	52	Blue 5 bit data output (MSB)
B4	O	53	Blue 4 bit data output
B3	O	54	Blue 3 bit data output
B2	O	55	Blue 2 bit data output
B1	O	56	Blue 1 bit data output
B0	O	57	Blue 0 bit data output (LSB)
VDD4		58	Power(3.3V)
HCLK	O	59	Clock Pulse (horizontal)
CPV_SEL	I	60	CPV_SEL Should be low.(ground)
MODE_SEL	I	61	DE/Sync mode select "1" DE mode "0" Sync mode
RE_SEL	I	62	Resolution select "1" 240X320 "0" 320X240
RST	I	63	Reset
TEST	I	64	TEST

#### 4. Absolute Maximum Rating

Characteristics	Symbol	Ratings	Unit
DC Supply Voltage	$V_{DD}$	-0.3 to +4.6	V
DC Input Voltage	$V_{IN}$	-0.3 to $V_{DD}+0.3$	V
DC Input Current	$I_{IN}$	$\pm 10$	mA
Storage Temperature	$T_{STG}$	-40 to 125	°C

#### 5. Recommended Operating Conditions

Characteristics	Symbol	Ratings	Unit
DC Supply Voltage	$V_{DD}$	2.7 to 3.6	V
Operating Temperature	$T_A$	0 to 70	°C

#### 6. Electrical Characteristics

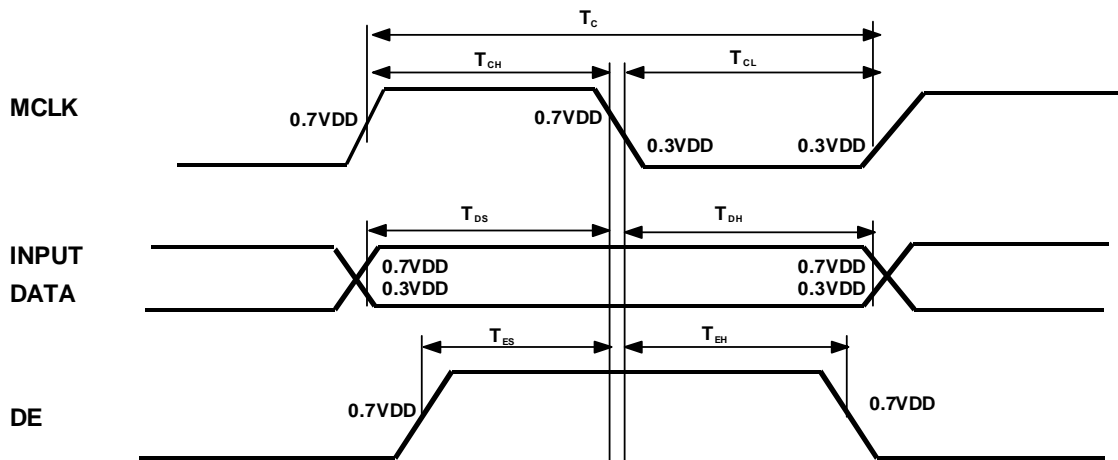
1) DC ELECTRICAL CHARACTERISTICS ( $V_{DD}=3.3\pm 10\%(V)$ ,  $T_A=0$  to  $70^\circ C$ )

Characteristics	Symbol	Test Condition		Min	Typ	Max	Unit
Input High Current	$I_{IH}$	$V_{IN}=V_{DD}$	Normal	-10		10	uA
Input with pull-down				10		200	
Input Low Current	$I_{IL}$	$V_{IN}=V_{SS}$	Normal	-10		10	uA
Input with pull-up				-200		-10	
Input High Voltage	$V_{IH1}$	CMOS		$0.7V_{DD}$			V
Input Low Voltage	$V_{IL1}$	CMOS				$0.3 V_{DD}$	V
Output High Voltage	$V_{OH}$	1mA buffer, $I_{OH}=-1mA$		2.4	-	-	V
		2mA buffer, $I_{OH}=-2mA$		2.4	-	-	
Output Low Voltage	$V_{OL}$	1mA buffer, $I_{OL}=1mA$		-	-	0.4	v
		2mA buffer, $I_{OL}=2mA$		-	-	0.4	

- HCLK : 2mA buffer , Others : 1mA buffer
- Output Load : HCLK : 45pF, Others : 35pF

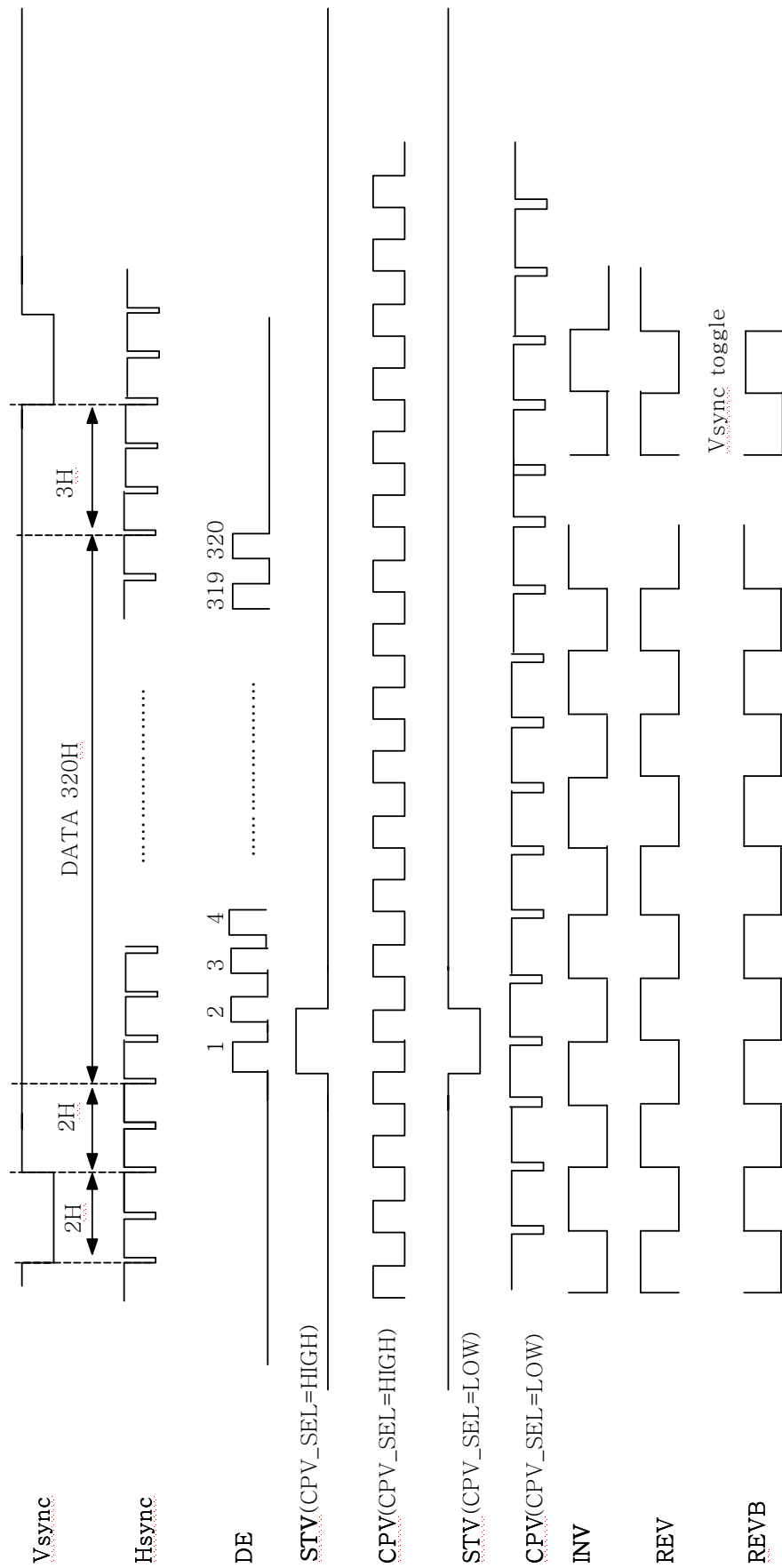
2) AC ELECTRICAL CHARACTERISTICS

Signal	Item	Condition	Symbol	Min.	Typ.	Max.	Unit
MCLK	Frequency	Dual scan In	$1/T_C$	-	5.0	15	Mhz
	High level width	-	$T_{CH}$	3	-	-	ns
	Low level width	-	$T_{CL}$	3	-	-	ns
INPUT DATA	Setup time	-	$T_{DS}$	3	-	-	ns
	Hold time	-	$T_{DH}$	3	-	-	ns
DEI	Setup time	-	$T_{ES}$	3	-	-	ns
	Hold time	-	$T_{EH}$	3	-	-	ns

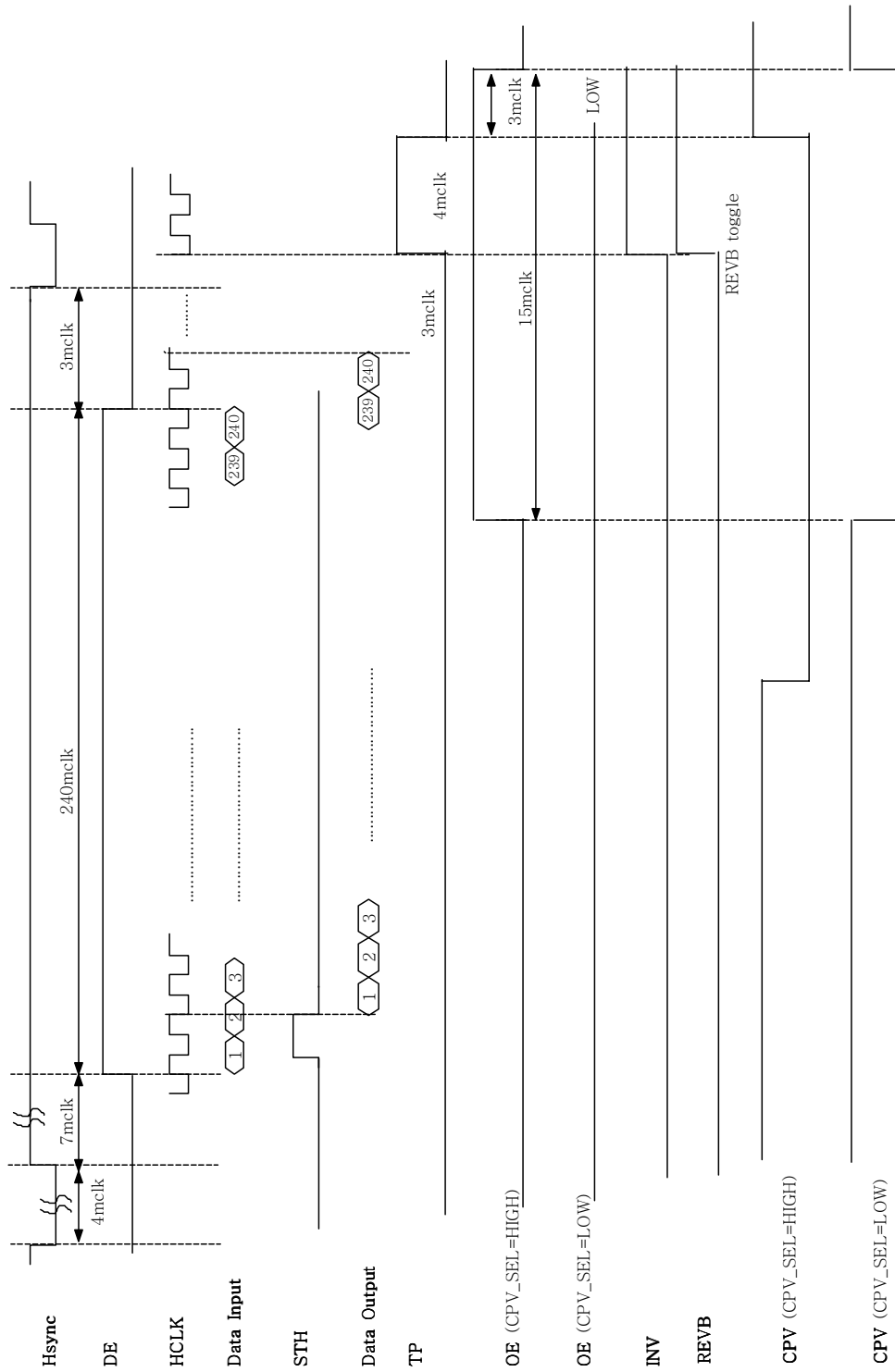


3) INPUT TIMING SPEC

	<b>Item</b>	<b>Description</b>	<b>Condition</b>	<b>Min.</b>	<b>Typ.</b>	<b>Max.</b>	<b>Unit</b>
FRAME	$T_{V\_TOTAL}$	V total line number	-		327		H
	$T_{V\_SYNC} + T_{V\_BP}$	From sync to data	Sync mode	-	4	-	H
	$T_{V\_DATA}$	Data duration	-	-	320	-	H
LINE	$T_{H\_TOTAL}$	H total pixel number	-		254		mclk
	$T_{H\_SYNC} + T_{H\_BP}$	From sync to data	Sync mode	-	11	-	mclk
	$T_{H\_DATA}$	Data duration	-	-	240	-	mclk



**Fig.1 VERTICAL TIMING CHART (RE\_SEL = HIGH)**



**Fig.2 HORIZONTAL TIMING CHART ( RE\_SEL = HIGH)**



## 7.Package

64LQFP 1010

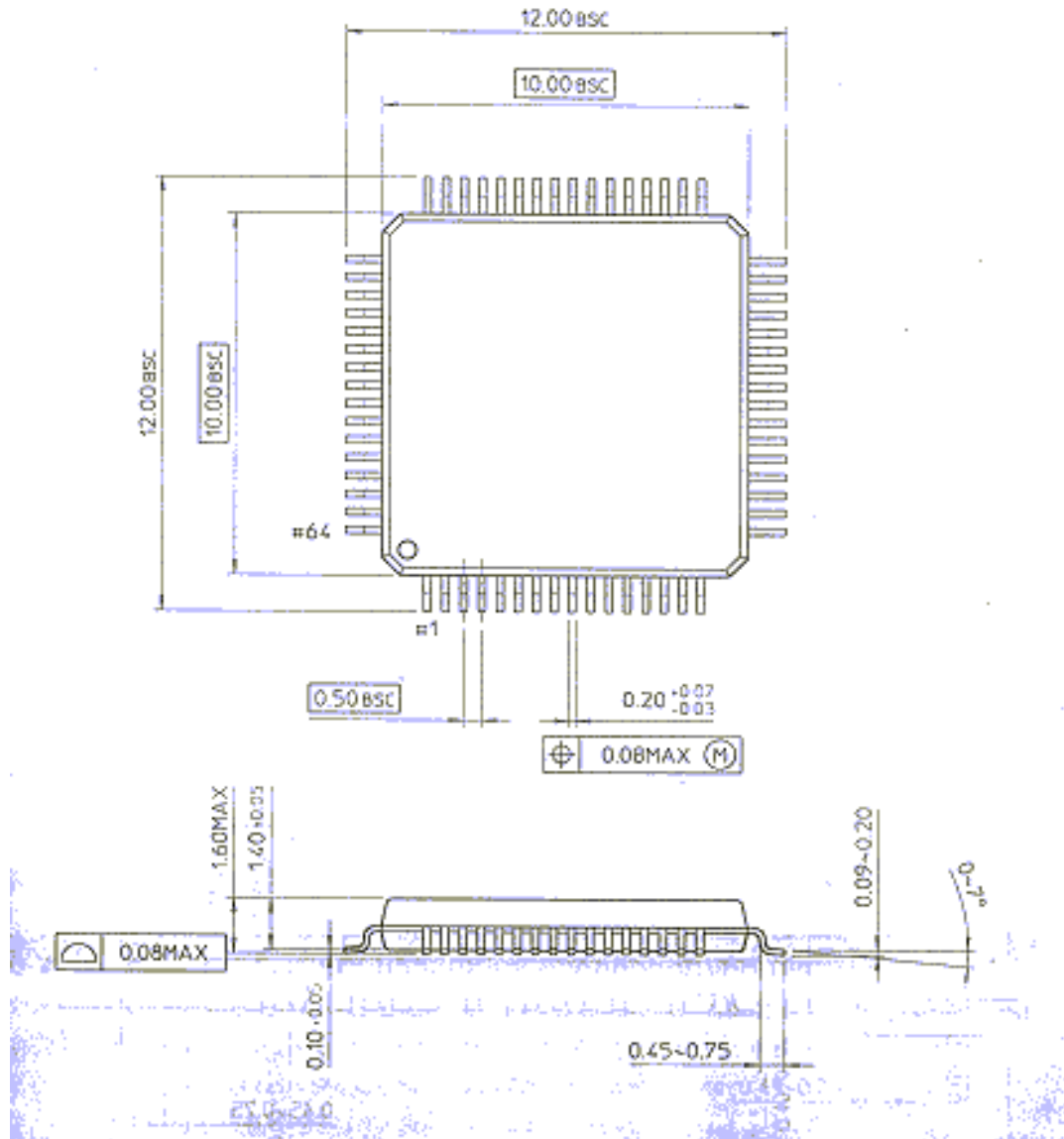


Fig.3 Dimension

### Revision ITEM

<b>ITEM</b>	<b>Rev.1</b>	<b>Rev.0</b>	<b>Page</b>
OE_SEL => CPV_SEL	CPV_SEL Should be low. OE should be low. (Ground)	OE pulse width selection	Page 2,3
Gate Clock name	CPV	CKV	Page 2
Output buffer size	HCLK : 2mA buffer Others : 1mA buffer	HCLK : 4mA buffer Others : 2mA buffer	Page 4
Output Load	HCLK : 45pF Others : 35pF	75 pF	Page 4
MCLK	Typ. = 5.0 Mhz	Typ. = 6.3 Mhz	Page 4
V total line	327	350	Page 5
From Vsync to data	4	23	Page 5
H total pixel	254	300	Page 5
From Hsync to data	11	54	Page 5
Vertical timing chart	Fig.1	Fig.1	Page 6
Horizontal Timing chart	Fig.2	Fig.2	Page 7