SAMSUNG ELECTRONICS

Product Information

ISSUE DATE : 03-03-14
MODEL : LTS500Q1-GF3

Note : This product information is subjet to change without any notice.

PREPARED BY : AMLCD Mobile Application Engineering Group

Samsung Electronics Co . , LTD.

wise view™ SAMSUNG TFT-LCD

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General Description

*** Description**

LTS500Q1-GF3 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching devices. Customer can use the high quality display. This model is composed of a TFT-LCD Module(TFT-LCD panel, back-light system). The resolution of a 5.0" contains 320 x 240 pixels and can display Analog RGB colors.

*** Features**

- Thin and light weight
- High Luminance, high contrast ratio
- NTSC Analog Interface

*** Applications**

- Display terminal for AV Units(DVD, VTR, CNS)
- Portable LCD TV

*** General Information**

Items	Specification	Unit	Note
Display area	101.76(H) x 76.36(V) (5.0" Diagonal)	mm	
Driver element	a-Si TFT active matrix		
Number of pixels	320(H) x 240(V) (QVGA)	pixel	
Pixel arrangement	RGB vertical stripe		
Dot pitch	0.106(H) x 0.318(V)	mm	Dot
Display mode	Normally White		
Viewing Direction	6:00	o'clock	

*** Mechanical Information**

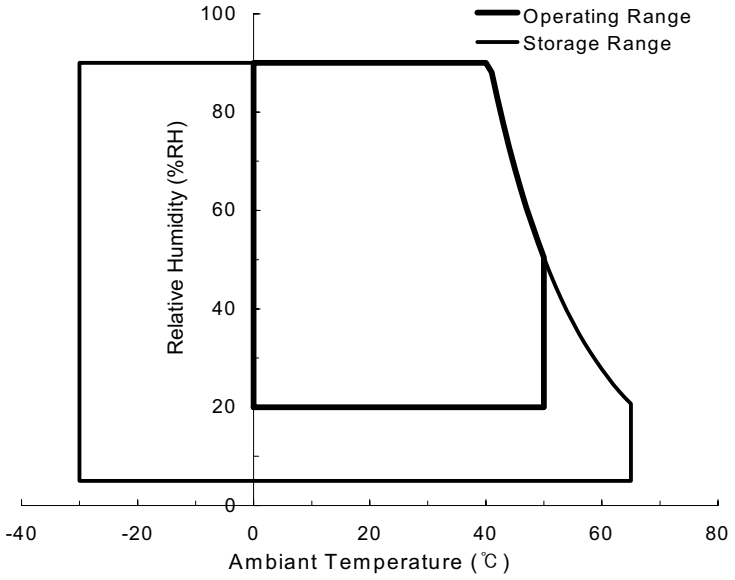
Item		Min.	Typ.	Max.	Unit	Note
Size	Horizontal	12.9.9	130.4	130.9	mm	
	Vertical	93.4	93.9	94.4		
	Depth	6.6	7.1	7.6		
Weight		-	-	108	g	

1. Absolute Maximum Ratings

1.1 Absolute Ratings of Environment

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T_{STG}	-25	60	℃	(1)
Operating temperature (Ambient temperature)	T_{OPR}	0	50	℃	(1)

Note (1) Temperature and relative humidity range are shown in the figure below.
95 % RH Max. (40 °C > Ta)
Maximum wet - bulb temperature at 39 C or less. (Ta > 40°C) No condensation.



1.2 Electrical Absolute Ratings

(1) TFT-LCD Monitor (Ta=25±2°C, V_{gg}=GND=0V)

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Input Voltage 1	VDD1	-0.3	7.0	V	(1)
Input Voltage 2	VDD2	-0.3	7.0	V	(1)
Input Voltage 3	Von	-0.3	44	V	(1)
Input Voltage 4	Voff	Von-44	VDD1+0.3	V	(1)
Common Voltage	VCOM	-2.0	+6.0	V	(1)

Note (1) Within operating temperature.

(2) Back-Light Unit

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Lamp Current	I_L	2.0	6.0	mA_{rms}	(1)
Lamp frequency	f_L	40	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.

- Measuring equipment: BM-5A, PR-650.

(V_{DD1}=3V, V_{DD2}=5V, f_V=60Hz, f_H=15.734kHz, Ta = 25 ± 2°C)

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Contrast Ratio		CR	ϕ =0 θ =0 Viewing Normal Angle	200	-	-		BM-5A (4)-①
Response time at 25 ℃	Rising	T_R		-	-	10	ms	BM-5A (5)
	Falling	T_F		-	-	40		
Luminance		Y_L		-	450	-		BM-5A (4)-②
Color Chromaticity (CIE 1931)	Red	R_X		0.555	0.580	0.605		PR-650 (6)
		R_Y		0.315	0.340	0.365		
	Green	G_X		0.283	0.308	0.333		
		G_Y		0.512	0.537	0.562		
	Blue	B_X		0.128	0.153	0.178		
		B_Y		0.099	0.124	0.149		
	White	W_X		0.285	0.310	0.335		
		W_Y		0.295	0.320	0.345		
Viewing Angle	Hor.	θ_L	CR≥ 10	-	45	-	Degrees	BM-5A (7)
		θ_R		-	45	-		
	Ver.	ϕ_H		-	30	-		
		ϕ_L		-	10	-		

Note (1) The optical characteristics is measured with Back-light.

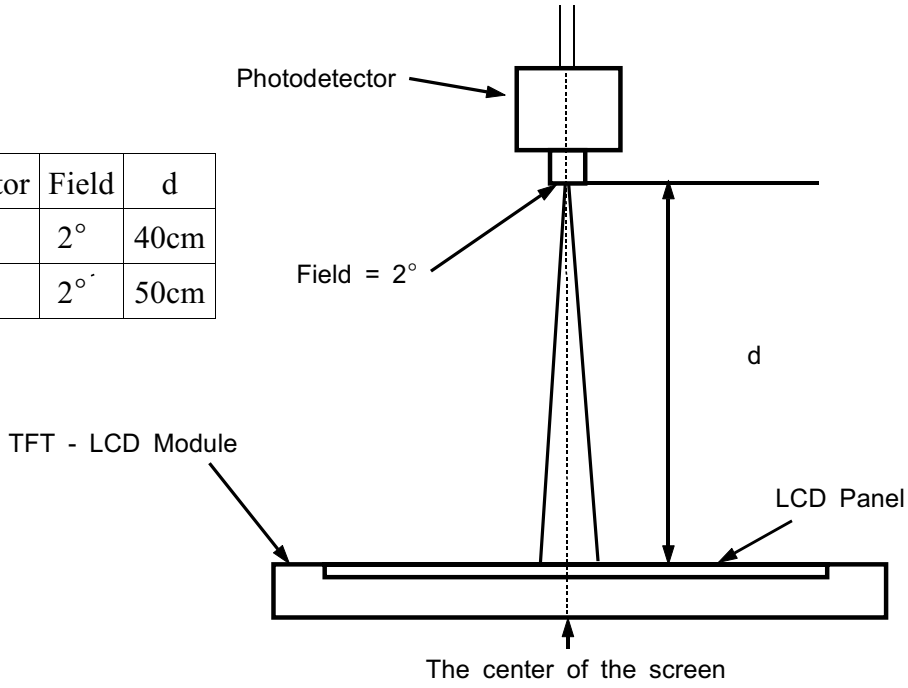
(2) If product is exposed to high temperatures for extended time, there is a possibility of the polarizer film damage which could degrade the optical characteristics.

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 back-light. This should be measured in the center of screen..

- Environment condition : Ta = 25 ± 2 °C

Photodetector	Field	d
BM-5A	2°	40cm
PR-650	2°´	50cm



Note (4) Definition of Contrast Ratio, Luminance.

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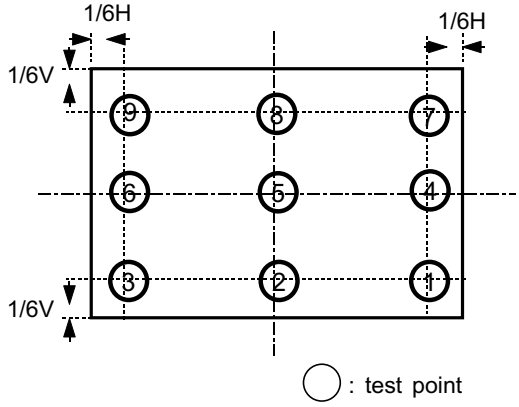
ACTIVE AREA (H:101.76mm/ V:76.36mm)



① Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax), gray min (Gmin) at 9 points.

$$C/R = \frac{Gmax}{Gmin}$$

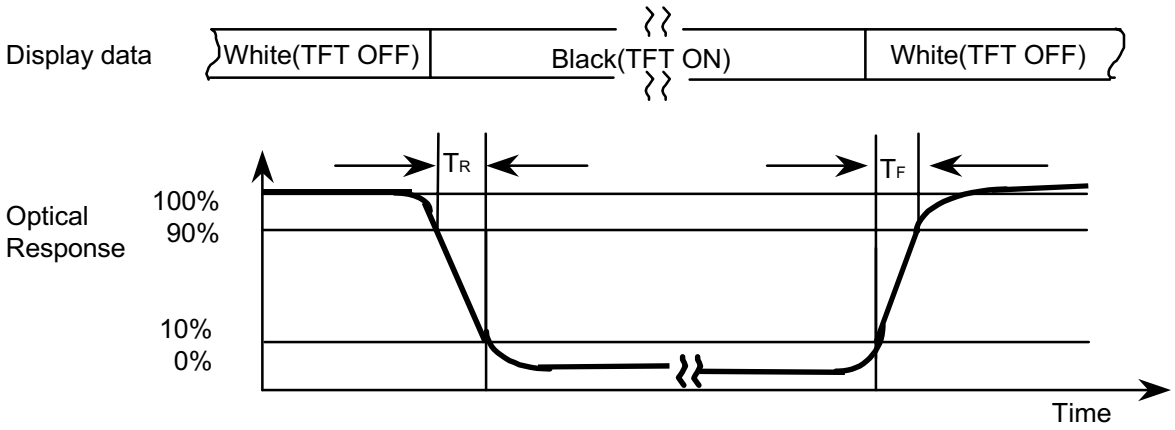
* Gmax : Luminance with all pixels white

* Gmin : Luminance with all pixels black

② Definition of Average Luminance of White : measure the luminance of white at 9 points.

③ Definition of White Variation(δ w) : measure the Variation at 9 points.

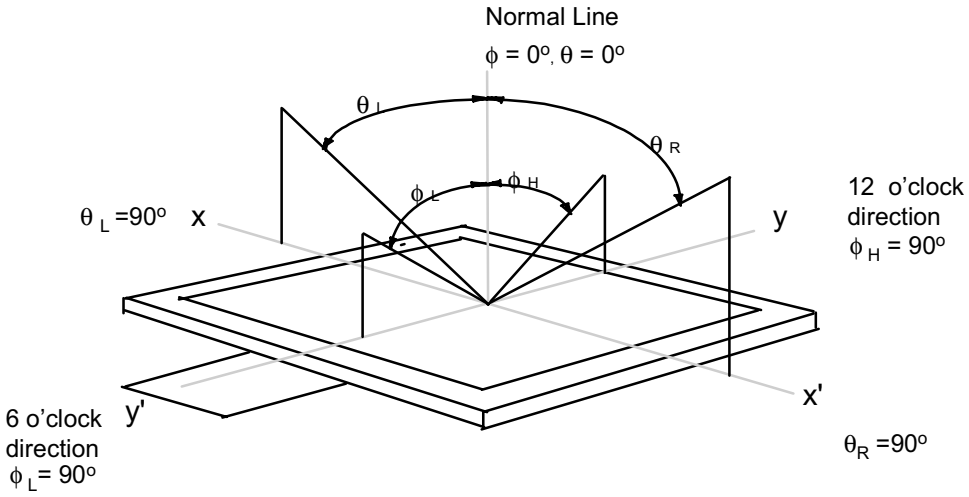
Note (5) Definition of Response time : Sum of Tr, Tf.



Note (6) Definition of Color Chromaticity (CIE 1931), (Back-light: On) :

Color coordinate of white at center point.

Note (7) Definition of Viewing Angle : Viewing angle range (CR≥ 2)



3. Electrical Characteristics

3.1 TFT-LCD Module

(Ta = 25 ± 2°C)

Characteristics		Symbol	MIN.	TYP.	MAX.	Unit	Note
Input Voltage 1		VDD1	2.85	3.0	3.3	V	
Input Voltage 2		VDD2	4.75	5.0	5.25	V	
Input Voltage 3		Von	20	21	22	V	
Input Voltage 4		Voff	-11	-10	-9	V	
Common Voltage (VCOMS, VCOMG)		Center	1.5	2.1	2.5	V	
		AC	4.0	4.8	6.0	Vp-p	
		Frequency	-	7.87	-	kHz	
Rin/Gin/Bin		Black-Black	0.3	0.7/4.3	VDD2-0.3	V	
		White-White	0.3	4.0/1.0	VDD2-0.3	V	
Input Voltage Level		High Level	0.8VDD1	-	VDD1		(3)
		Low Level	0	-	0.2VDD1		(3)
		VBS	1.0	-	3.0		
CPH1, 2, 3		Frequency	-	6.39	-	MHz	
STV		Frequency	-	60	-	Hz	
CPV, OEV, OE		Frequency	-	15.734	-	kHz	
Power Dissipation	White	P_W	-	276	360	mW	(1),(2)
	Black	P_B	-	300	400	mW	

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

- Power On : VDD1 → VDD2 → V_{OFF} → V_{ON} → Data
- Power Off : Data → V_{ON} → V_{OFF} → VDD2 → VDD1

Note (1) Condition : TFT-LCD module only with typ. electrical characteristics
(2) Maximum Power dissipation check pattern : Black pattern.
(3) CPV, OEV, STV, OE, MOD, CPH1, CPH2, CPH3

3.2 Back-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.

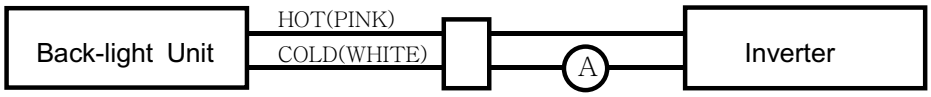
(Ta=25 ± 2°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp current	I_L	2.0	3.5	6.0	mArms	(1)
Lamp voltage	V_L	-	690	-	Vrms	(1)
Lamp frequency	f_L	40	-	80	kHz	(2)
Operating life time	Hr	10,000	-	-	Hour	(3)

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 Back-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 Back-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.

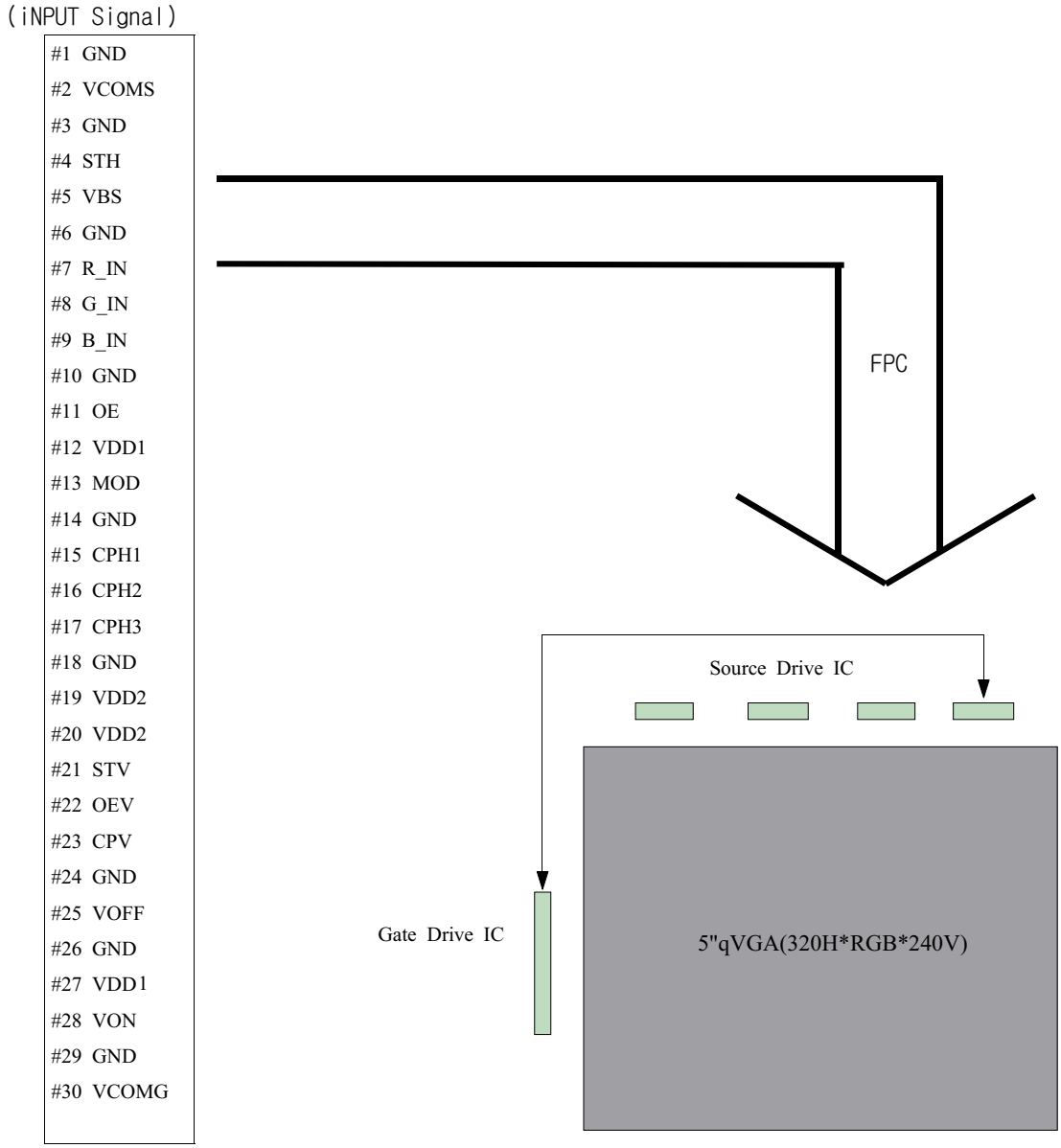


(2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency shall be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

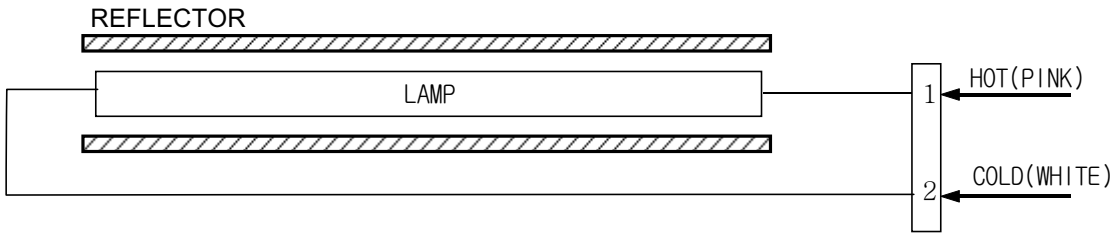
(3) Life time (Hr) of a lamp is defined as the time in which it continues to operate under the condition of Ta=25±2°C and I_L=3.5mArms for a lamp until the brightness becomes 50% or lower than it's original value.

4. Block Diagram

4.1 TFT-LCD Module



4.2 Back-light Unit



5. Input Terminal Pin Assignment

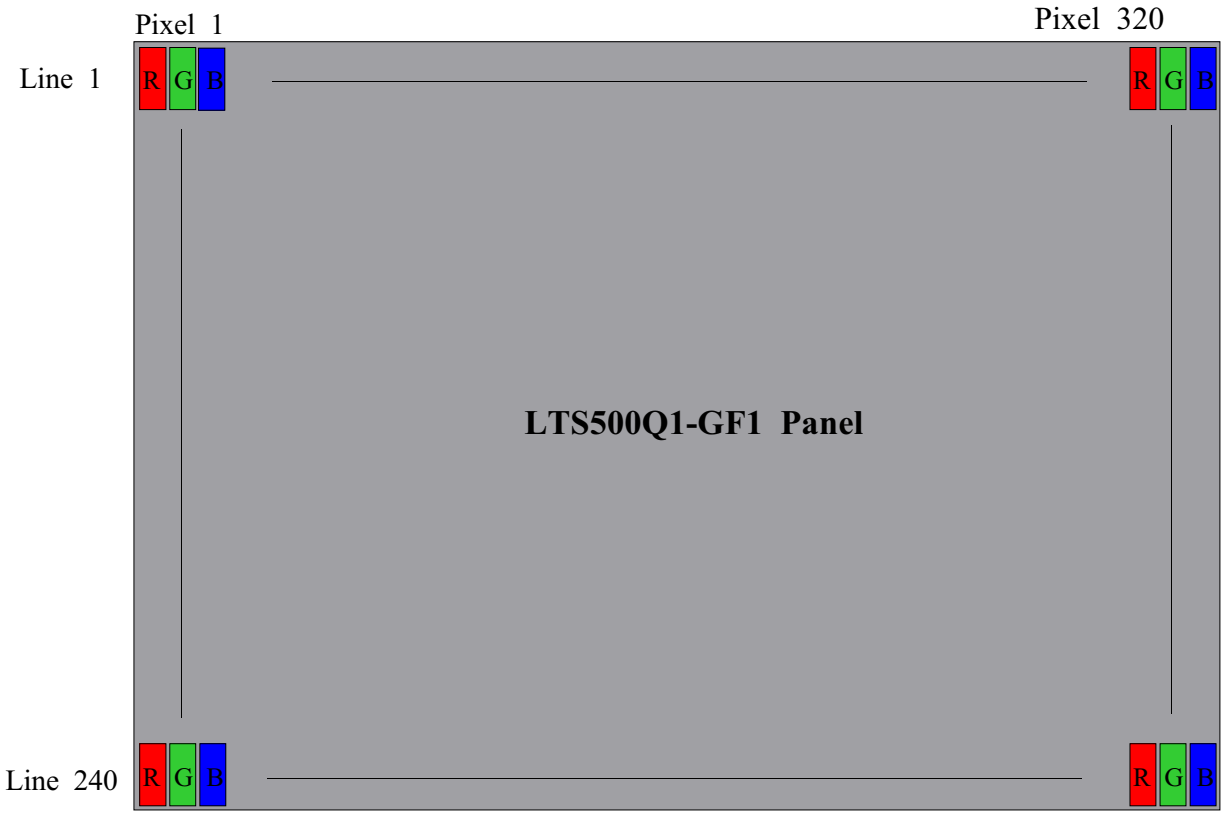
5.1 TFT-LCD Module (Connector : 30Pin FPC type ↔ UJU 2924A-3003R)

Pin No	Symbol	Description	Remark
1	GND	Ground	-
2	VCOMS	Common Voltage Drive signal(Source Part)	-
3	GND	Ground	-
4	STH	Source Data sampling Start Pulse	-
5	VBS	Source Drive IC output Buffer Control Voltage	-
6	GND	Ground	-
7	RIN	Analog Red Data Input	-
8	GIN	Analog Green Data Input	-
9	BIN	Analog Blue Data Input	-
10	GND	Ground	-
11	OE	Output Enalble Signal	-
12	VDD1	Input Voltage 1(+3.0V)	-
13	MOD	CPH1,2,3 Smpling Mode selection Terminal (High:Simultaneous Sampling / Low:Progressive sampling)	-
14	GND	Ground	-
15	CPH1	Source IC Clock1	-
16	CPH2	Source IC Clock2	-
17	CPH3	Source IC Clock3	-
18	GND	Ground	-
19	VDD2	Input Voltage 2(+5.0V)	-
20	VDD2	Input Voltage 2(+5.0V)	-
21	STV	Gate IC Start Pulse	-
22	OEV	GATE IC Output Enable Signal	-
23	CPV	Gate IC Clock	-
24	GND	Ground	-
25	VOFF	Gate IC Output Pulse Low Vlotage	-
26	GND	Gound	-
27	VDD1	Input Voltage 1(+3.0V)	-
28	VON	Gate IC Output Pulse High Vlotage	-
29	GND	Ground	-
30	VCOMG	Common Voltage Drive signal(Gate Part)	-

5.2 Back-Light Unit (Connector : BHSR-02VS-1 ↔ JST SM02B-BHSS-1-TB)

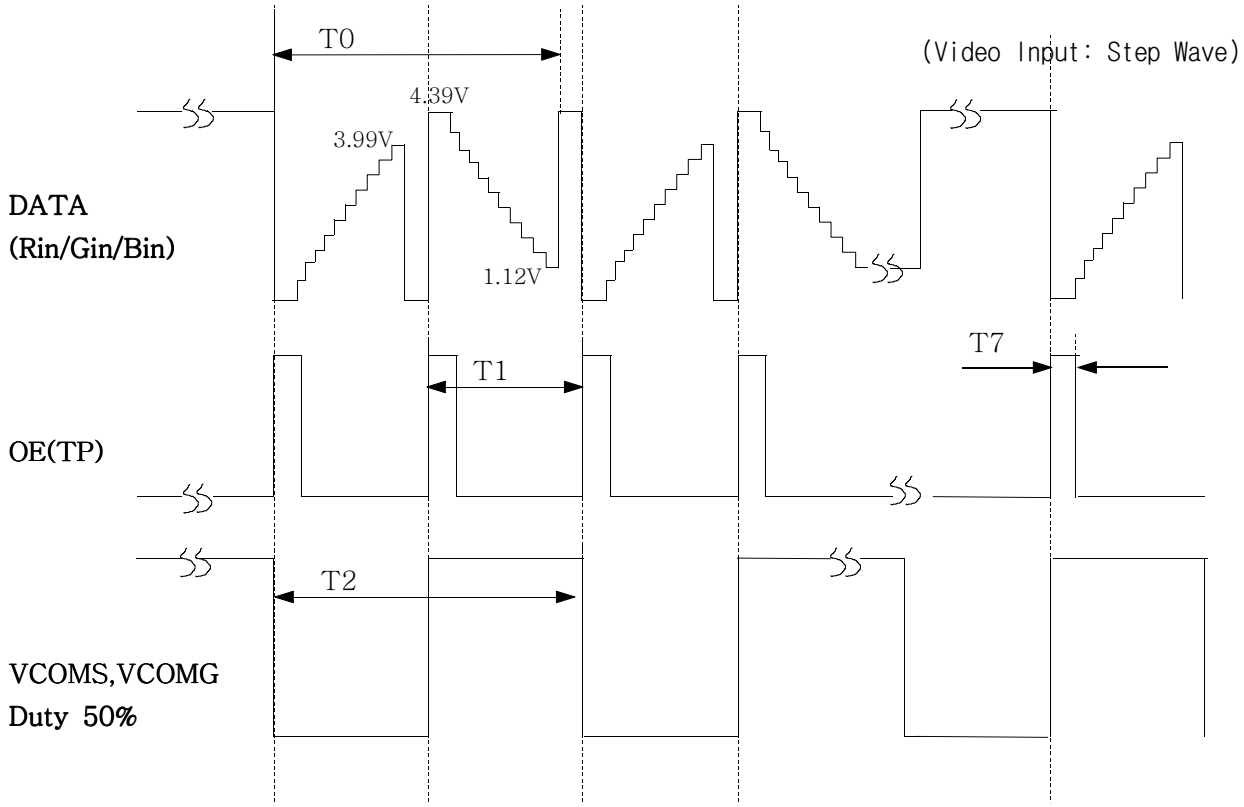
Pin No.	Symbol	Color	Function
1	HOT	PINK	High voltage
2	COLD	WHITE	Low voltage

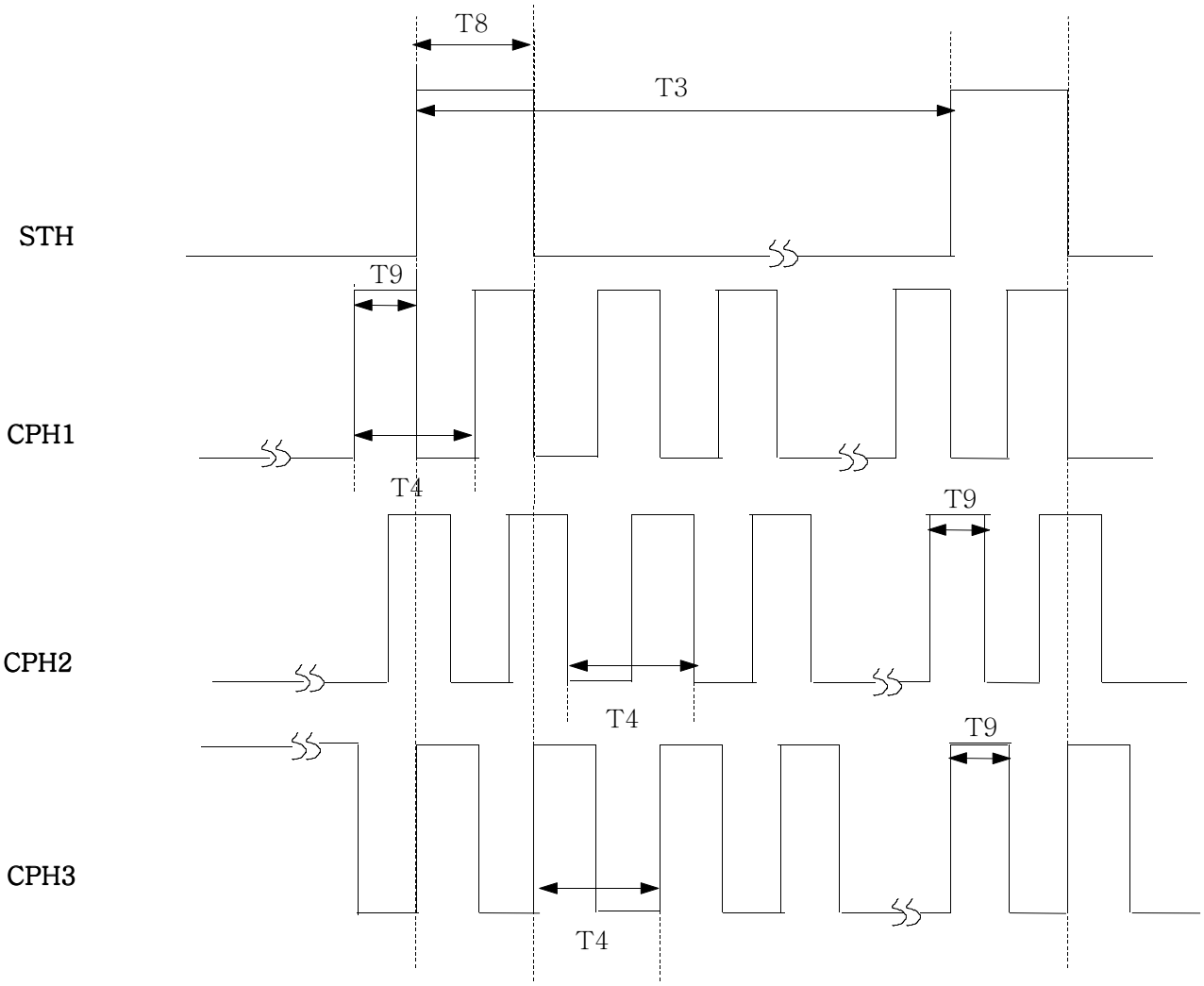
6. Pixel Format

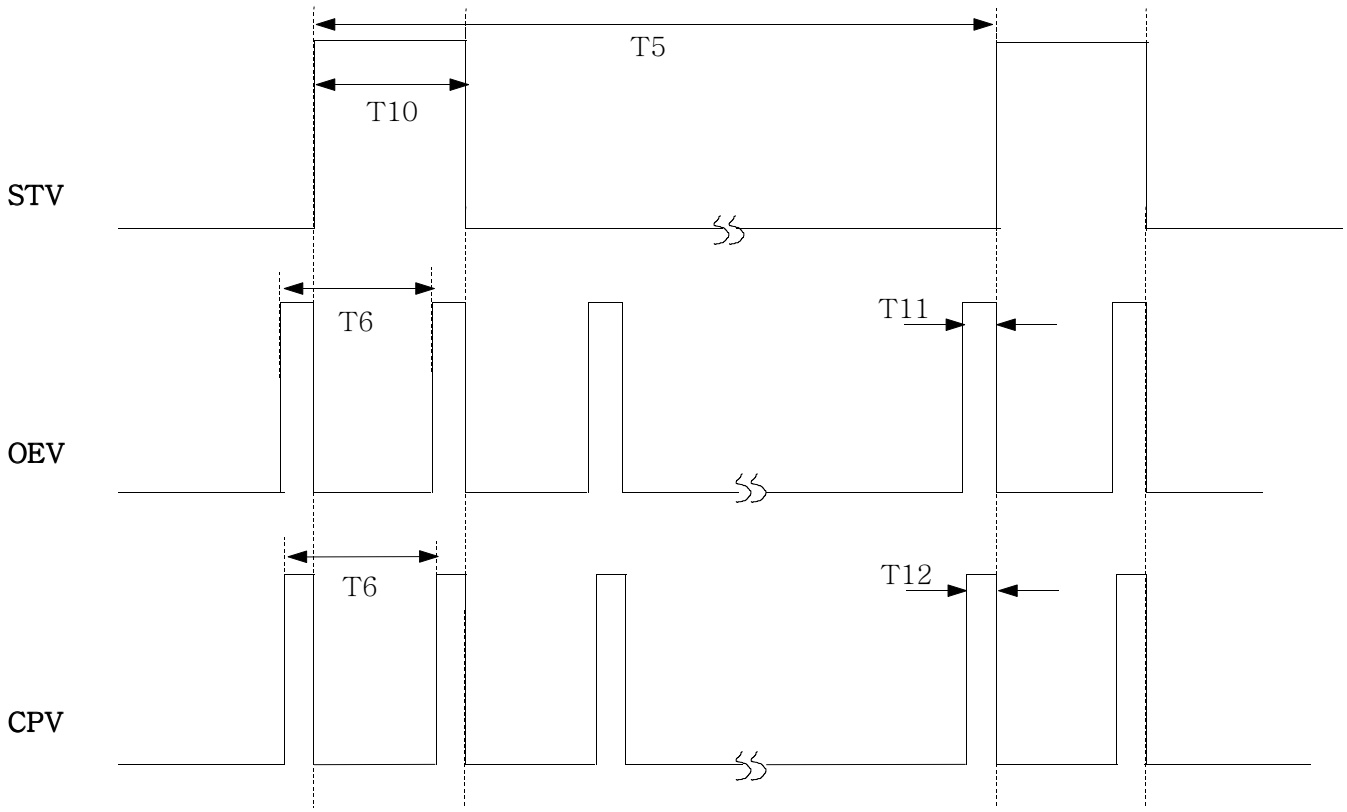


7. Interface Timing

7.1 Timing Diagrams of Interface Signal




T8
T3
STH
T9
CPH1
T4
T9
CPH2
T4
T9
CPH3
T4



INTERVAL	MIN.	TYP.	MAX.	Unit
T0	-	7.867	-	kHz
T1	-	15.734	-	kHz
T2	-	7.867	-	kHz
T3	-	15.734	-	kHz
T4	-	6.35	-	MHz
T5	-	60	-	Hz
T6	-	15.734	-	kHz
T7	-	8.4	-	us
T8	-	160	-	ns
T9	-	80	-	ns
T10	-	63	-	us
T11	-	10	-	us
T12	-	8	-	us

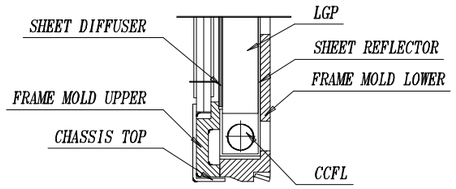
8. Outline Dimensions

8.1 Module Outline Dimensions

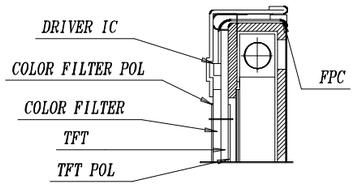
- Refer to the Next Page.

FILE NO.	

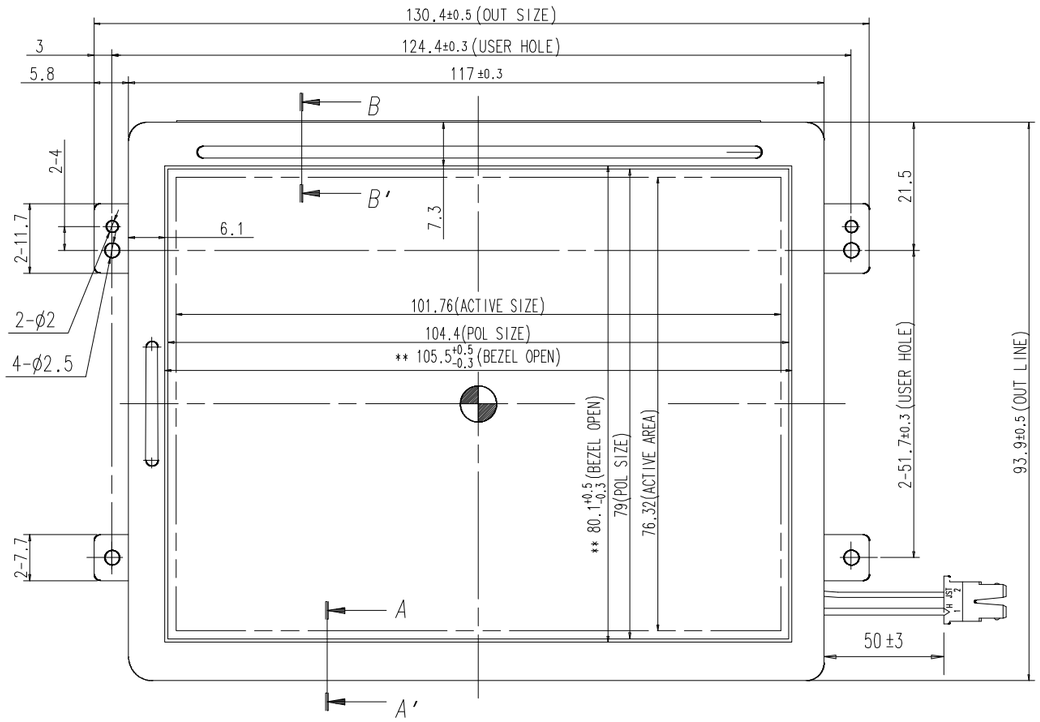
NO	PART NAME	CODE NO	SPECIFICATION	Q'TY	WEIGHT FINISH	WEIGHT MATERIAL	UNFOLDED DIM. OF. MATERIAL	REMARK
1	OUTLINE DIMENSION		LTS500Q1-GF3					

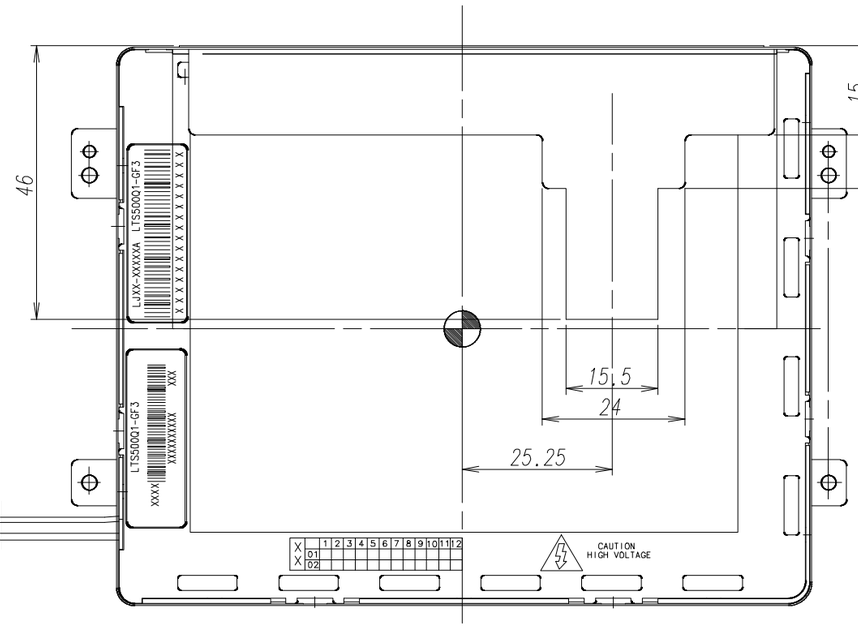


SECTION A-A' (S=2/1)



SECTION B-B' (S=2/1)





* NOTE

CCFT LAMP CONN. SPECIFICATION.

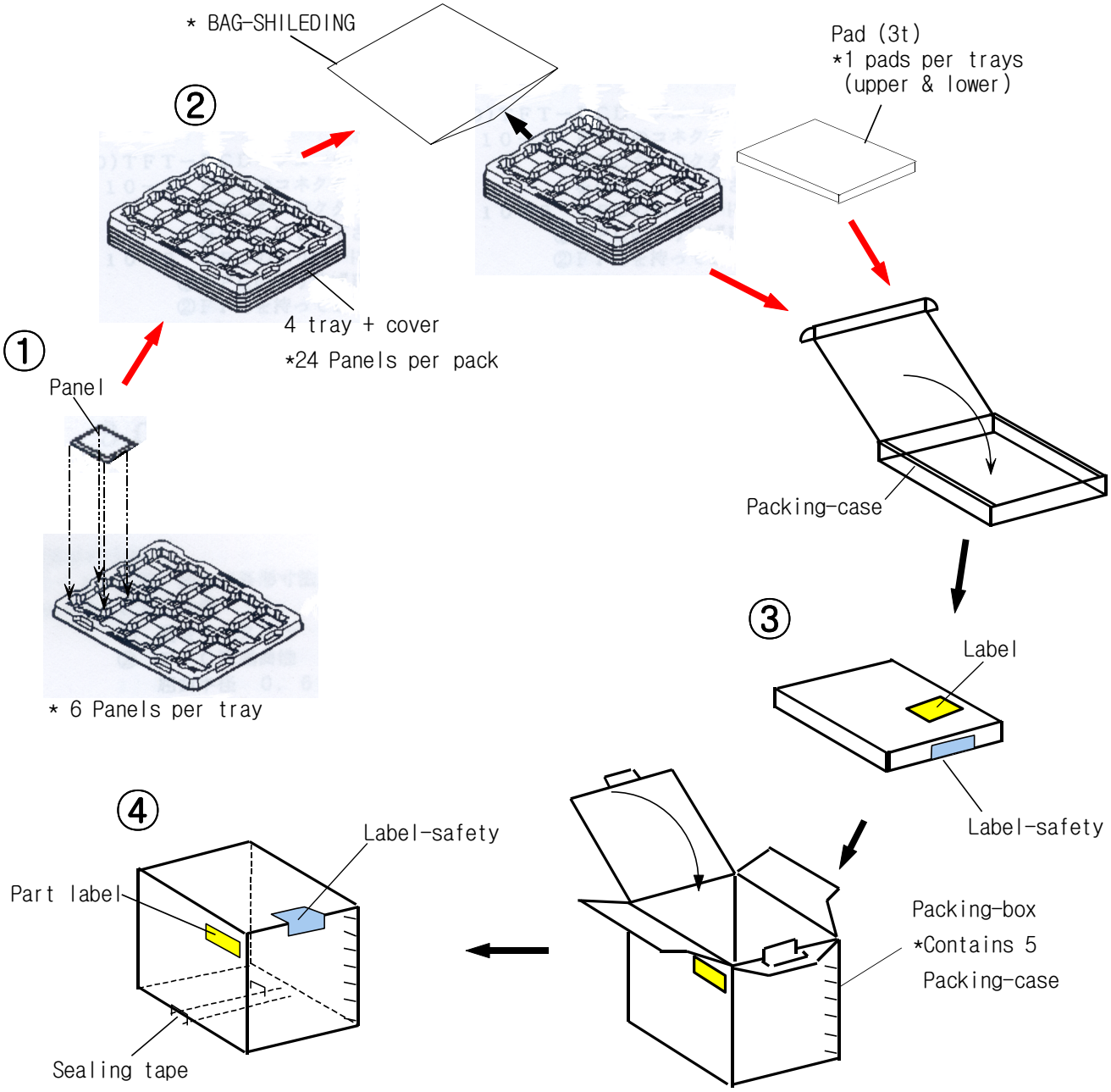
- MAKER : JST
- PART NO : BHSR-02VS-1

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

REV	DATE	DESCRIPTION OF REVISION				REASON	CHK'D BY
UNIT	mm	DRA'N BY	DES'D BY	CHK'D BY	APP'D BY	MODEL NAME	LTS500Q1-GF3
SCALE	1/1	S.J.LEE		J.G.LEE	Y.B.CHU		
TOLERANCE LEVEL3		01.08.14		--.--.--	--.--.--	PART NAME	OUTLINE DIMENSION — SHEET 3/3
SAMSUNG ELECTRONICS					SPEC. NO -------	CODE NO.	VER. 00

REVISION

9. PACKING



Note (1) Total : Case: Approx. 3.2Kg
Box: Approx. 17Kg

(2) Size : Case: 490(W) x 342(D) x 58(H)
Box: 505(W) x 355(D) x 319(H)

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

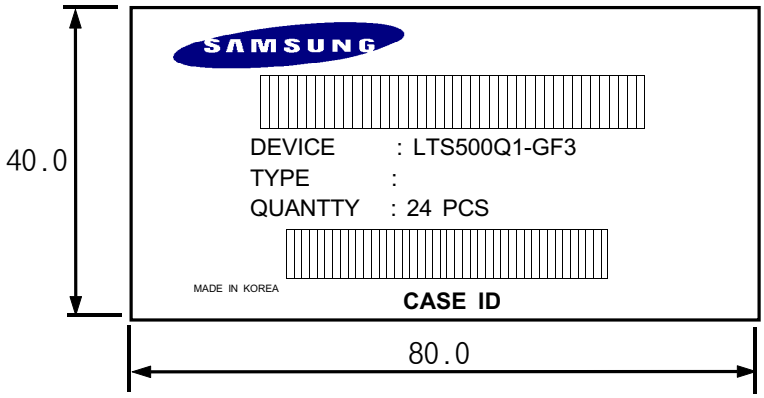
(4) Place 4 tray and cover(empty tray) and pads inside the packing-case.

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

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

10. MARKING & OTHERS

(1) Packing case attach



CASE ID : V 00 00 00001

- Serial No.(00001-99999)
- Week
- Year
- Device

11. General Precautions

11.1 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.

11.2 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.

11.3 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"

11.4 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.