



ELECTRONICS

APPROVAL

CUSTOMER : Inventech

DATE : March. 11. 2006

SAMSUNG TFT-LCD

MODEL NO. : LTE283QV-F01

Customer Approval

Any Modification of Spec is not allowed without SEC's permission.

Approved by : **D.H. KIM**

AMLCD Division Mobile Display Team

Samsung Electronics Co . , LTD.



Revision History

APPROVAL

Data	Rev. No.	Page	Summary
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General Description*** Description**

LTE283QV-F01 is a TMR 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 Back-light unit and a touch screen panel. The resolution of a 2.83" contains 320 x 240 pixels and can display up to 16,777,216 colors.

*** Features**

- TMR(Transmissive with micro reflective) type.
- 5 LED Back-light
- Line Inversion mode.
- Low Power Consumption.
- TSP sticking is possible product

*** Applications**

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

*** General Information**

Items	Specification	Unit	Note
Display area	57.6(H) x 43.2(V)	mm	-
Driver element	a-Si TFT active matrix	-	-
Display colors	16,777,216	colors	-
Number of pixels	320(H) x RGB x 240(V)	pixel	-
Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.180(H) x 0.180(V)	mm	-
Display mode	Normally Black	-	-
Viewing Direction	10:30	o'clock	-

*** Mechanical Information**

Item		Min.	Typ.	Max.	Unit	Note
Model size	Horizontal(H)	- 0.2	64.4	+ 0.2	mm	(1)
	Vertical(V)	- 0.2	56.5	+ 0.2	mm	
	Depth(D)	- 0.2	3.2	+ 0.2	mm	(1)
Weight		-	26	28	g	(1)

Note (1) FPC and Back-light unit are included.

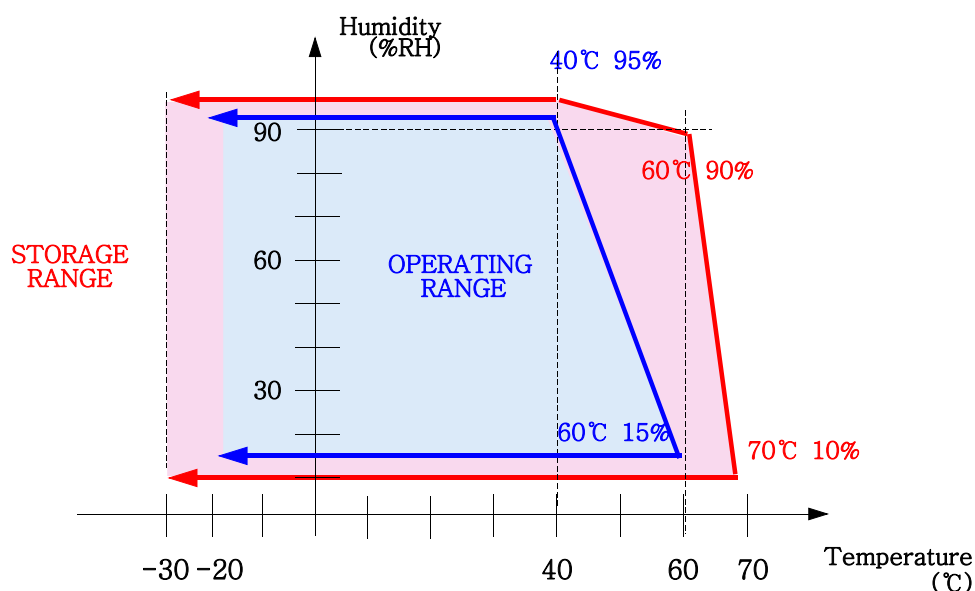
1. Absolute Maximum Ratings

1.1 Absolute Ratings of Environment

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T _{STG}	-30	70	°C	(1),(5)
Operating temperature (Ambient temperature)	T _{OPR}	-20	60	°C	(1),(2),(5)
Vibration (Non - operating)	V _{nop}	10	500	Hz	(3),(4)

Note (1) 90 % RH Max. (40 °C ≥ Ta)

Maximum wet-bulb temperature at 39 °C or less. (Ta > 40 °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)^{6CYC} 10min/Cycle, 3G_{pk,,} 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 = Room Temp, V_{ss}=GND=0V)**

Characteristics	Symbol	Min.	Max.	Unit	Note
Supply Voltage	V _{CC}	-0.3	5	V	-
Supply Voltage for Step-up	V _{DC}	-0.3	3.6	V	-

(2) Back-Light Unit**(Ta = Room Temp)**

Characteristics	Symbol	Min.	Max.	Unit	Note
Current	I _B	-	25	mA	(1)

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded.

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: BM-5A, BM-7, PR-650, EZ-Contrast

(Ta = Room Temp, V_{DC} = 2.8 V I_B = 18mA)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast ratio (Center point)		C/R	Φ=0 θ=0 Normal Viewing Angle B/L On	250	350	-	-	(4) BM-5A
Luminance of white (Center point)		YL		200	250	-	cd/m2	(5) BM-5A
White uniformity		Uw		70	-	-	%	(5) BM-5A
Response time	Rising:Tr	Tr+Tf		-	35	50	msec	(6) BM-7
	Falling:Tf							
Color chromaticity (CIE 1931)	White	Wx1		-0.05	0.310	+0.05	-	(7) PR-650
		Wy1			0.337			
	Red	Wx1		-0.05	0.591	+0.05	-	
		Wy1	0.359					
	Green	Wx1	-0.05	0.319	+0.05	-		
		Wy1		0.499				
	Blue	Wx1	-0.05	0.138	+0.05	-		
		Wy1		0.160				
Viewing angle	Hor.	θL1	C/R≥10 B/L On	65	80	-	Degrees	(8) Ez-Contrast
		θR1		65	80	-		
	Ver.	ΦH1		65	80	-		
		ΦL1		65	80	-		

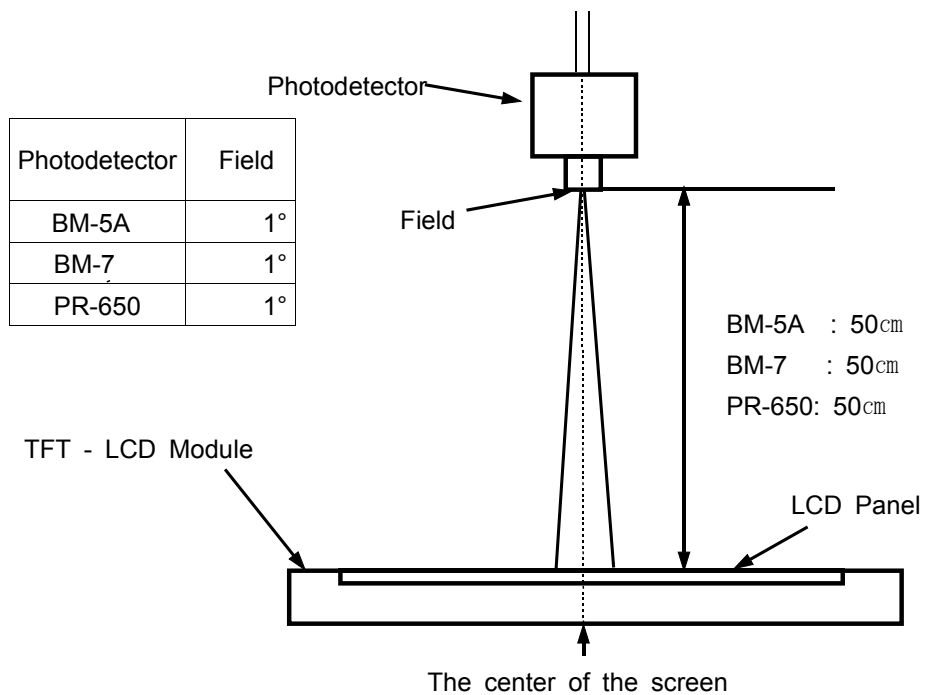
Note (1) The optical characteristics is measured with Back-light

(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 for the Transmissive Mode (Back-light On)

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.

- Back-light Current : 18mA
- Back-Light On condition



Note (4) Definition of Contrast Ratio (C/R) : Ratio of gray max (Gmax) & gray min (Gmin) at the center point of the panel. If Back-light 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

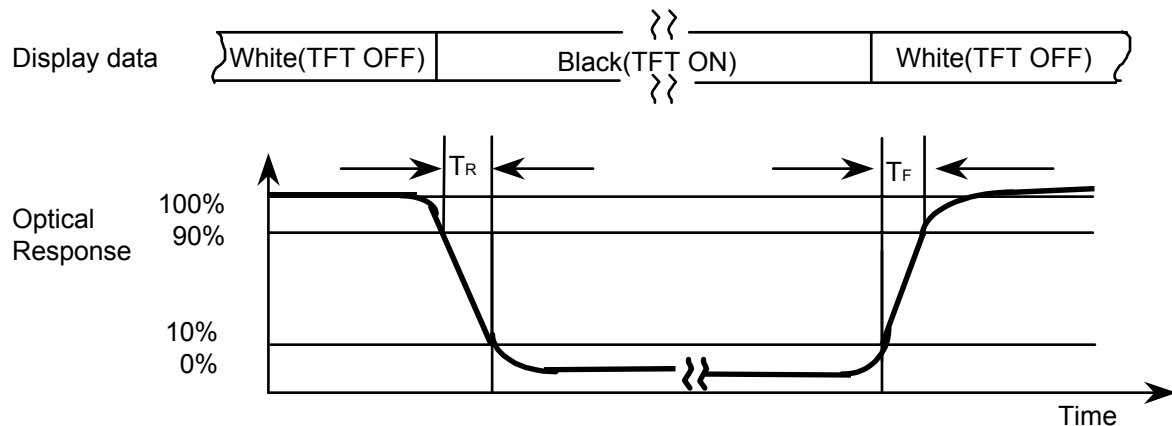
* Gmin : Luminance with all pixels black

Note (5) 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 Back-light that generates the reflected light source on LCD in the dark room.

※ Light Source(Chip type white LED : 5EA)

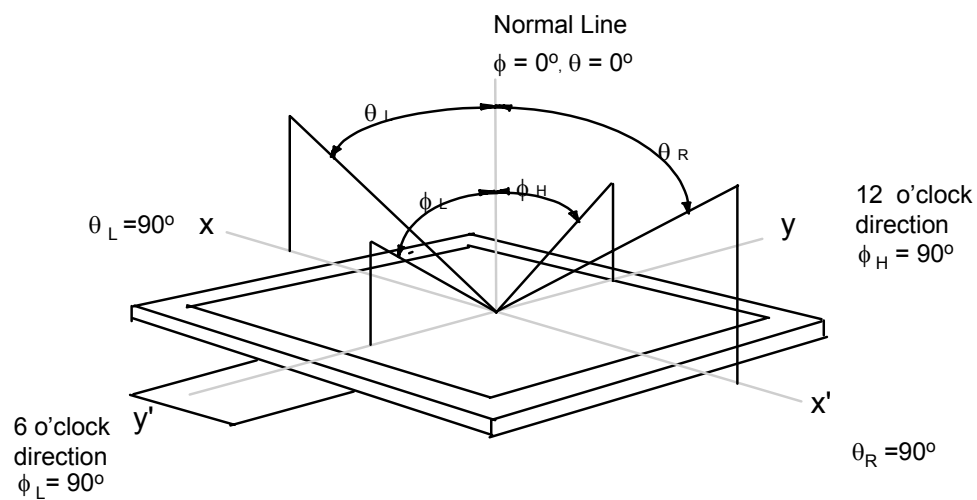
Note (6) Definition of Response time : Sum of T_r , T_f



Note (7) Definition of Color Chromaticity (CIE 1931)

Color coordinate of white & red, green, blue at center point.

Note (8) Definition of Viewing Angle : Viewing angle range ($CR \geq 10$)



3. Electrical Characteristics

3.1 TFT-LCD Module

(Input Voltage = 2.8V, Ta = Room Temp)

Characteristics		Symbol	MIN.	TYP.	MAX.	Unit	Note
Logic supply voltage		V_{DC}	2.5	2.8	3.3	V	(1),(3)
DC/DC supply voltage		V_{CC}	2.5	2.8	3.3	V	(1),(2),(3)
Dissipation Current	Full(White)	I_F	-	11.0	13.0	mA	(1),(3),(4)
Power Dissipation	White	PW	-	28.0	31.0	mW	(1),(3),(5)
	Blue	PB_{lue}	-	22.0	24.0	mW	
	Black	PB	-	19.0	21.0	mW	
	Vertical Stripe	PV	-	23.0	26.0	mW	

* To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the Chapter 7 power on/off Sequence

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

(2) If DC/DC supply voltage value is out of typical value, then must change Flowchart.

(3) $V_P = V_{CC} = V_{DC}$.

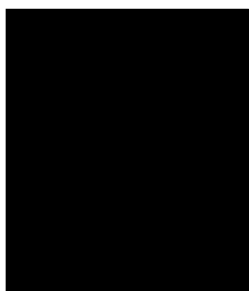
(4) $V_P = 2.8V$, Power supply current value of motion picture is high speed write mode.

(5) Power dissipation check pattern

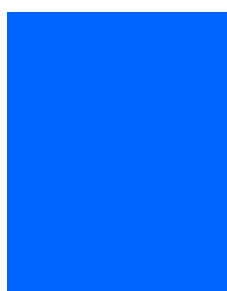
[White patten]



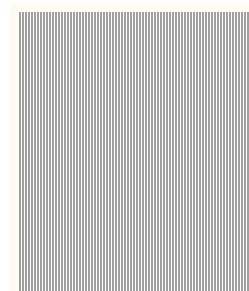
[Black patten]



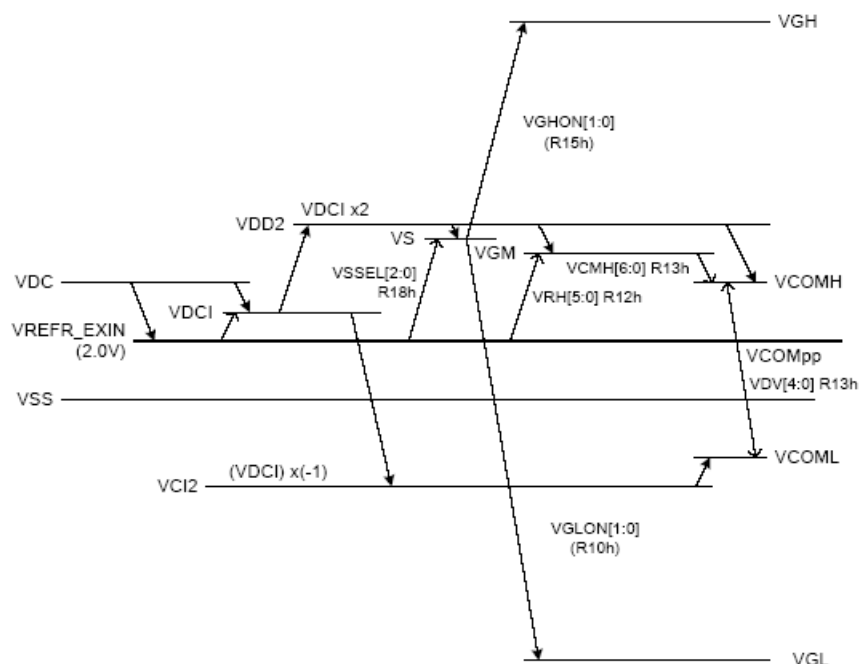
[Blue pattern]



[Vertical Stripe patten]



(5) Power Sequence



3.2 Back-Light Unit

The Back-light system is an edge-lighting type with 5 white LED(Light Emitting Diode)s. The characteristics of 5 white LEDs are shown in the following tables.

(Ta = Room Temp)

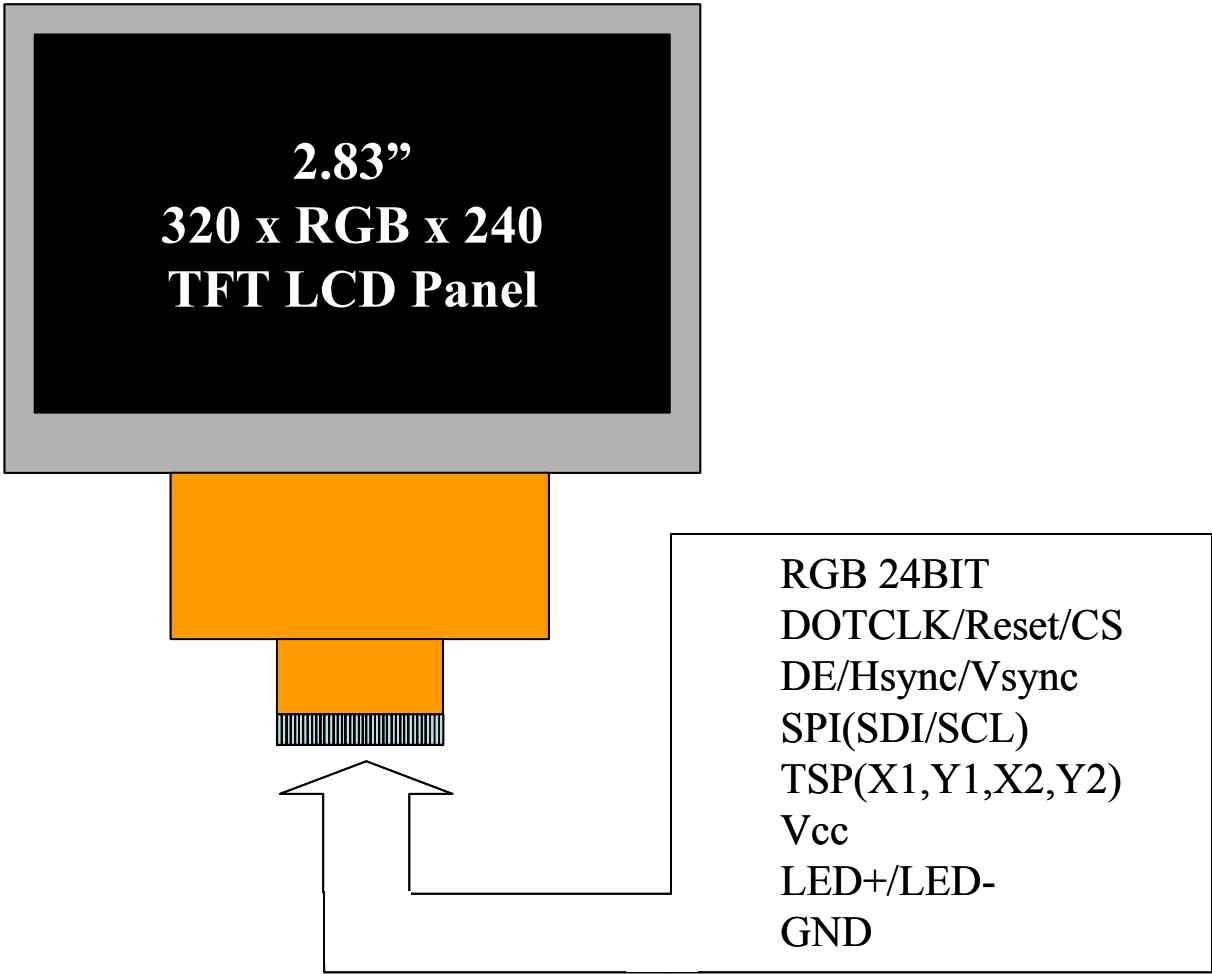
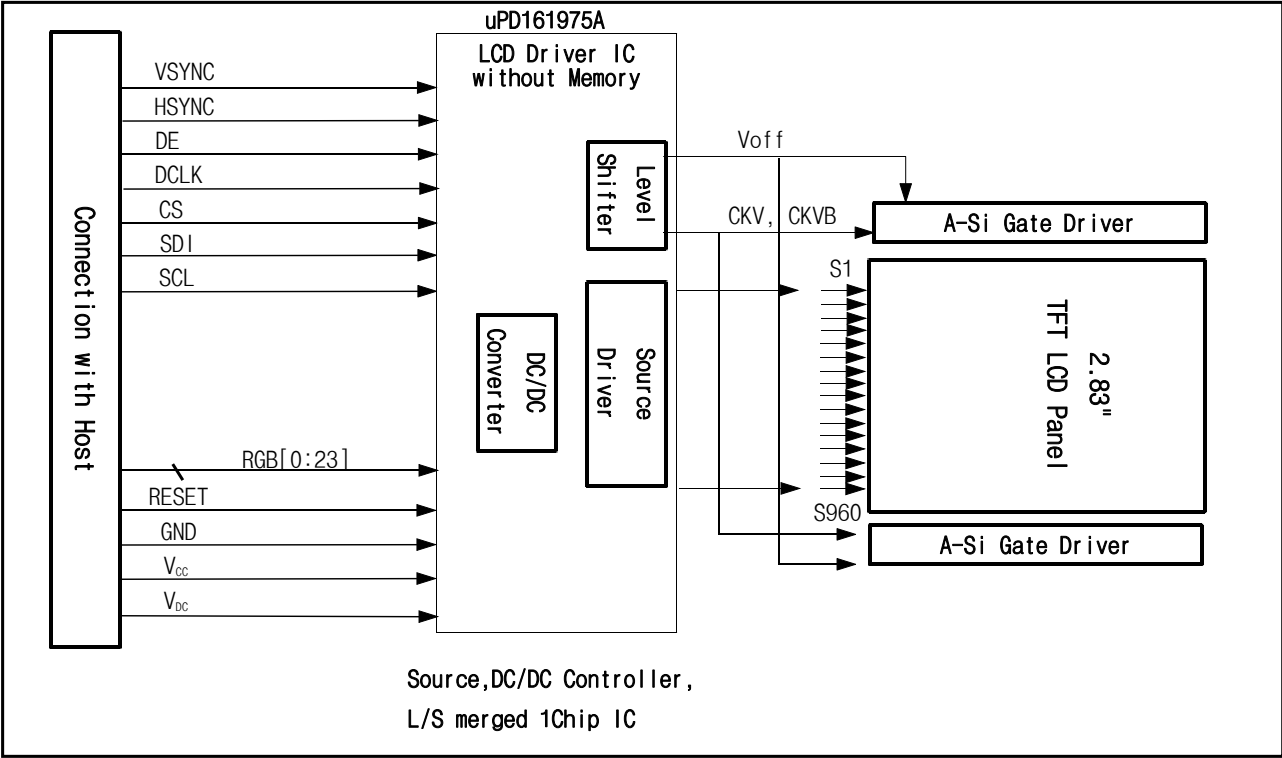
Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Current	I_B	-	18	25	mA	(1)
Power Consumption	P_{BL}	-	300	335	mW	(2)

Note (1) 5 white LEDs serial type.

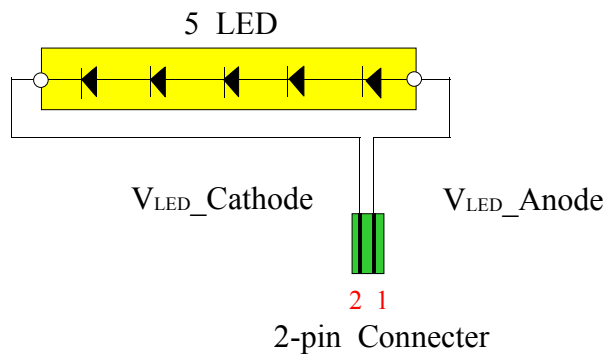
(2) Where $I_B = 18\text{mA}$, $V_B = 16.6\text{ V}$, $P_{BL} = V_B \times I_B$

4. Block Diagram

4.1 TFT-LCD Block Diagram



4.2 Back-light Unit



Pin No.	Symbol	I/O
1	LED_ANODE	Anode
2	LED_CATHODE	Cathode

5. Input Terminal Pin Assignment**5.1 TFT-LCD Module** (Mating Connector : 45PIN (Part Name:FH23-45S-0.3SHW, HIROSE))

Pin No	Symbol	Description	Remark
1	GND	Ground	
2	PD23	R7	(1)
3	PD22	R6	
4	PD21	R5	
5	PD20	R4	
6	PD19	R3	
7	PD18	R2	
8	PD17	R1	
9	PD16	R0	(1)
10	PD15	G7	(1)
11	PD14	G6	
12	PD13	G5	
13	PD12	G4	
14	PD11	G3	
15	PD10	G2	
16	PD9	G1	
17	PD8	G0	(1)
18	PD7	B7	(1)
19	PD6	B6	
20	PD5	B5	
21	PD4	B4	
22	PD3	B3	
23	PD2	B2	
24	PD1	B1	
25	PD0	B0	(1)
26	CS	Chip select	Low enable
27	SCL	Clock for SPI	(2)
28	SDI	Data for SPI	(2)
29	DOTCLK	Main Clock	
30	RESET	IC Reset	Low enable
31	VDD	Power supply	
32	VDD	Power supply	
33	HSYNC	Horizontal sync signal	High enable
34	VSYNC	Vertical sync signal	Low enable

Pin No	Symbol	Description	Remark
35	DE	Data enable	Low enable
36	GND	Ground	
37	X1	TSP : RIGHT	(3),(4)
38	Y1	TSP : BOTTOM	(3),(4)
39	X2	TSP : LEFT	(3),(4)
40	Y2	TSP : TOP	(3),(4)
41	LED-	LED CATHODE	
42	LED-	LED CATHODE	
43	LED+	LED ANODE	
44	LED+	LED ANODE	
45	GND	Ground	

Remark (1) LSB : B0, G0, R0

MSB : B7, G7, R7

(2) We need a "SPI" for initial power setting of driver IC including the power block

(3) X1 : Right, Y1 : Down, X2 : Left, Y2 : Top

(4) TSP sticking is possible product

5.2 Back-Light Unit (Connector : 2 pin FPC Solder type)

Pin No.	Symbol	Function
1	LED+	LED Anode
2	LED-	LED Cathode

5.3 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	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7			
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	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	0	0	0	0	1	1	1	1	1	1	1	1	1	-	
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	-	
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	
	MAGENT A	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	-	
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	-	
	WHITE	1	1	1	1	1	1	1	1	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	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	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	0	0	0	0	0	0	0	0	R2	
		:	:	:	:	:	:			:	:	:	:	:		:		:	:	:	:	:	:				R3~R252	
		:	:	:	:	:	:			:	:	:	:	:		:		:	:	:	:	:	:					
	↓ LIGHT	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R253
		0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R254
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R255
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	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	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G1	
		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2	
		:	:	:	:	:	:			:	:	:	:	:		:		:	:	:	:	:	:				G3~G252	
		:	:	:	:	:	:			:	:	:	:	:		:		:	:	:	:	:	:					
	↓ LIGHT	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	G253
		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	G254
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	G255
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	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	0	0	0	0	1	0	0	0	0	0	0	0	0	B1	
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	B2	
		:	:	:	:	:	:			:	:	:	:	:		:		:	:	:	:	:	:				B3~B252	
		:	:	:	:	:	:			:	:	:	:	:		:		:	:	:	:	:	:					
	↓ LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	B253
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	B254
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	B255

Note) Definition of Gray :

Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)

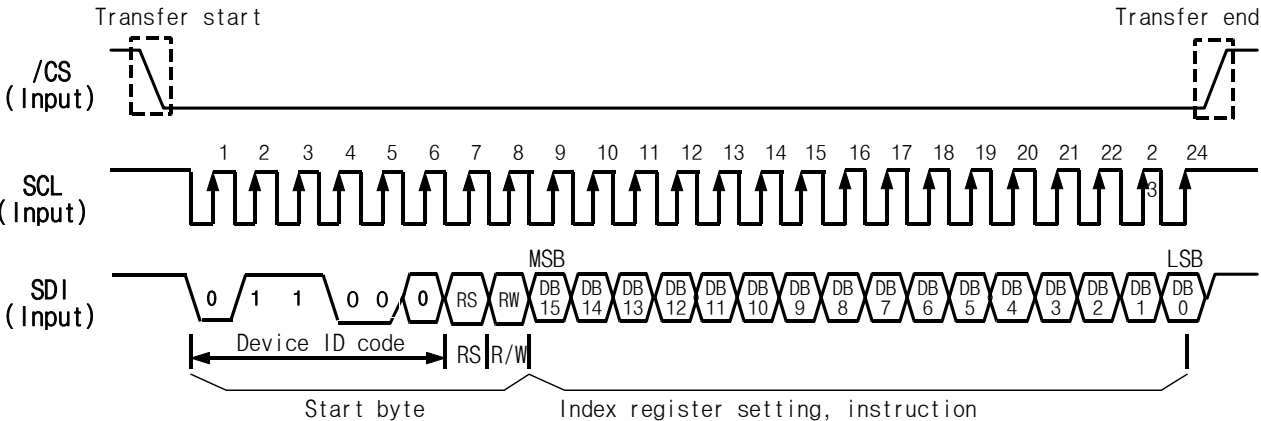
Input Signal : 0 = Low level voltage, 1 = High level voltage

※R7,G7,B7 : MSB R0,G0,B0 : LSB

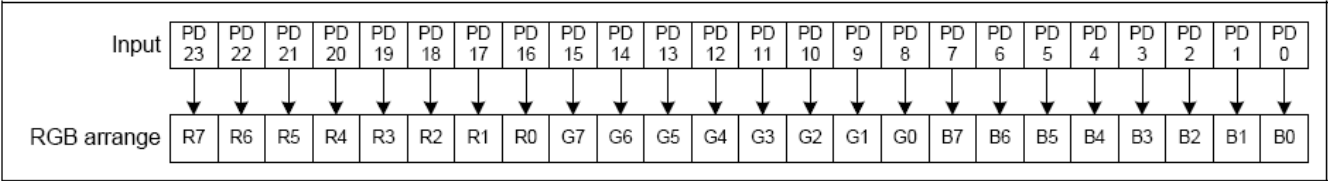
6. Interface Specifications.

6.1 Serial Peripheral interface

RS	R/W	Fucnction
0	0	Sets Index Register
0	1	Read Status
1	0	Writes Instruction
1	1	Reads Instruction

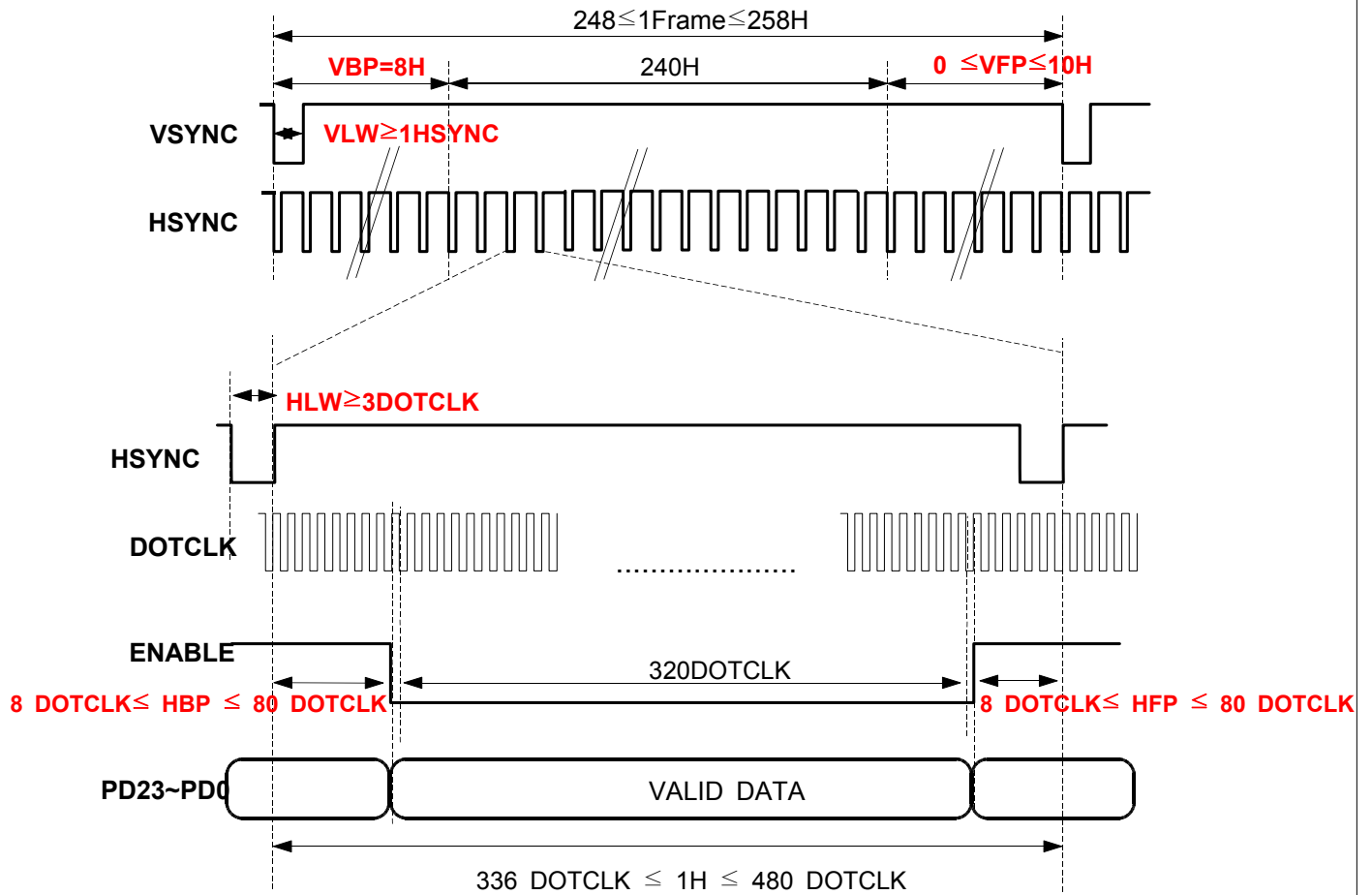


6.2 Data Format for 24bit RGB Interface



- The data format for pictures is parallel 24bit.

6.3 Input Signal Timing SPEC

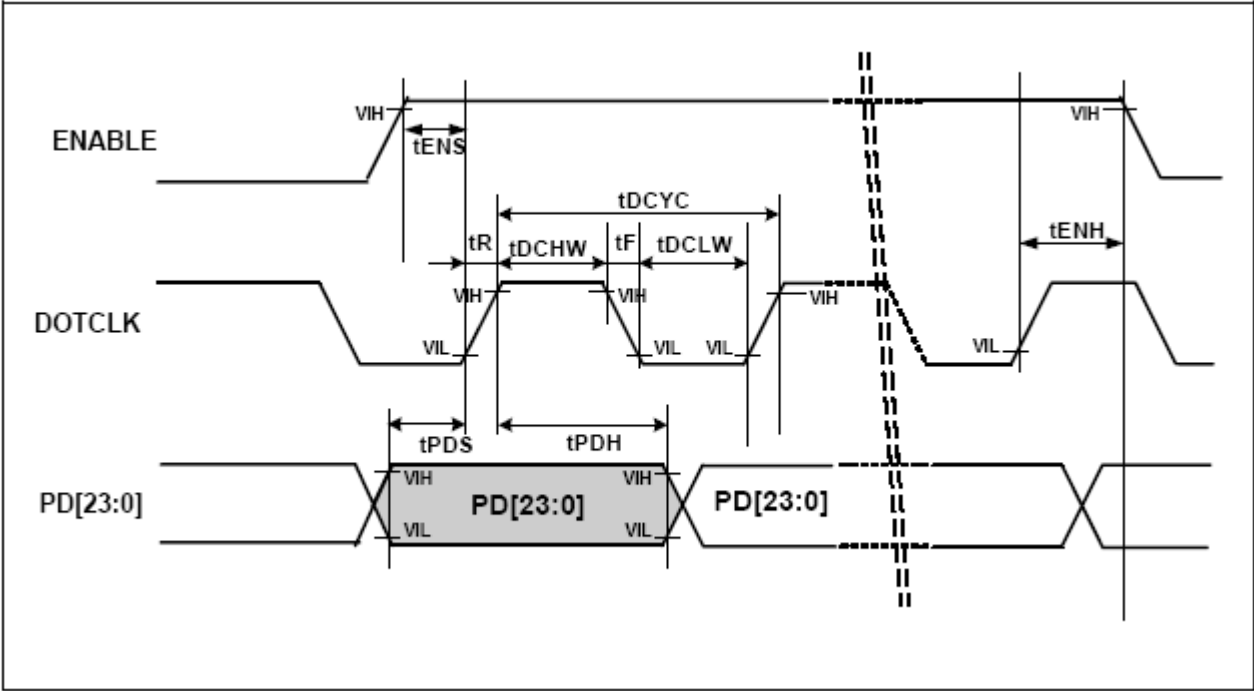


$$\begin{aligned}
 * \text{DOTCLK} &= \text{Frame} \times (240 + \text{VBP} + \text{VFP}) \times (320 + \text{HBP} + \text{HFP}) \\
 &= 60 \text{ Hz} \times 256 \times 336 \\
 &= 5.16\text{MHz}
 \end{aligned}$$

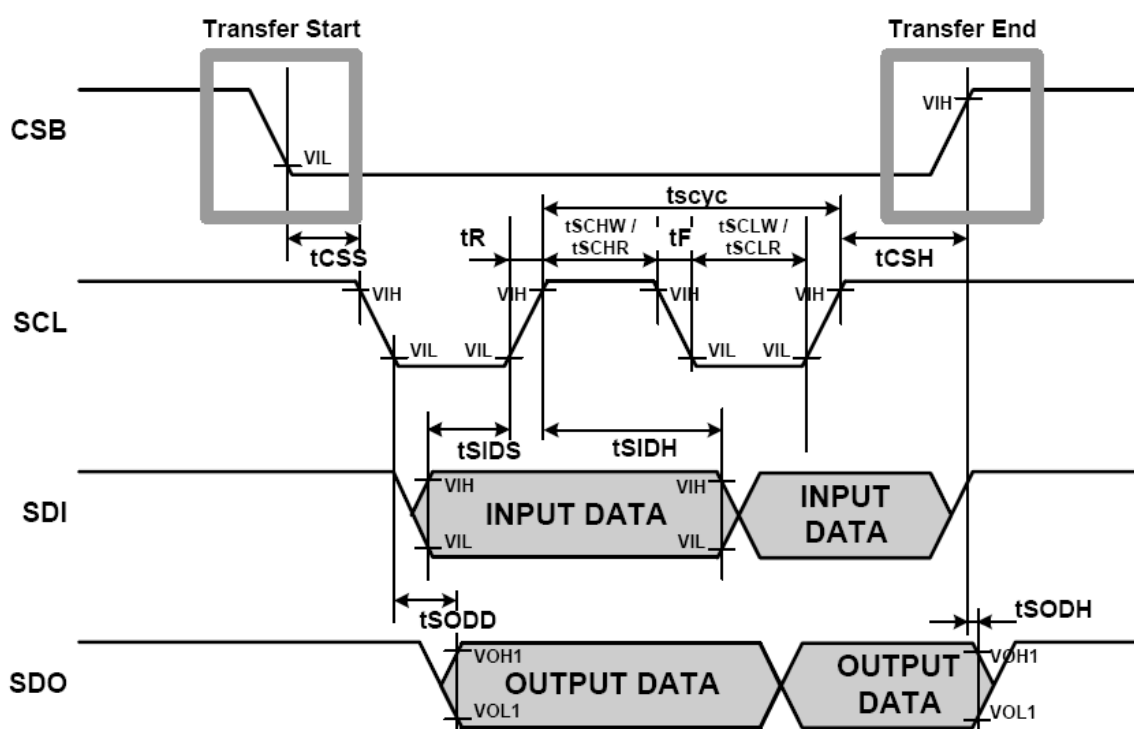
6.4 Input Timing Characteristics

(T_A = -40 to +85 °C)

Characteristic	Symbol	Min.	Max.	Unit
DOTCLK cycle time	tDCYC	(50)	-	ns
DOTCLK rise / fall time	tR, tF	-	(2)	
DOTCLK Pulse width high	tDCHW	(20)	-	
DOTCLK Pulse width low	tDCLW	(20)	-	
ENABLE setup time	tENS	(15)	-	
ENABLE hold time	tENH	(15)	-	
PD data setup time	tPDS	(15)	-	
PD data hold time	tPDH	(10)	-	



Characteristic	Symbol	Min.	Max.	Unit
Serial clock cycle time	t _{scyc}	250	-	ns
Serial clock rise / fall time	t _R , t _F	-	2	
Pulse width high for write	t _{SCHW}	40	-	
Pulse width high for read	t _{SCHR}	230	-	
Pulse width low for write	t _{SCLW}	60	-	
Pulse width low for read	t _{SCLR}	230	-	
Chip Select setup time	t _{CSS}	20	-	
Chip Select hold time	t _{CSH}	60	-	
Serial input data setup time	t _{SIDS}	30	-	
Serial input data hold time	t _{SIDH}	30	-	
Serial output data delay time	t _{SODD}	-	130	
Serial output data hold time	t _{SODH}	5	-	



7. Operating Sequence

7.1 Power On/ Off sequence

POWER ON

POWER ON

Wait 1ms

/ RESET

R07h = 0000

R12h = 0000

Wait 10ms

R11h = 0512

R12h = 0020

R13h = 1626

R14h = 0000

R15h = 03C5

R16h = 0000

R18h = 5505

R10h = 0004

Wait 100ms

R01h = 4000

R02h = 0300

R03h = 0000

R04h = 0000

R08h = 0004

R0Bh = 2320

R0Ch = 0200

R30h = 0606

R31h = 0807

R32h = 0506

R33h = 0404

R34h = 0304

R35h = 0404

R36h = 070F

R37h = 0202

R38h = 1F1B

R39h = 1F00

Wait 40ms

R07h = 0002

Wait 40ms

R07h = 0102

Wait 40ms

R07h = 0103

Wait 40ms

DISPLAY ON

POWER OFF

NORMAL DISPLAY

R0Bh = 2020

R07h = 0102

Wait 40ms

R07h = 0000

Wait 40ms

R11h = 0020

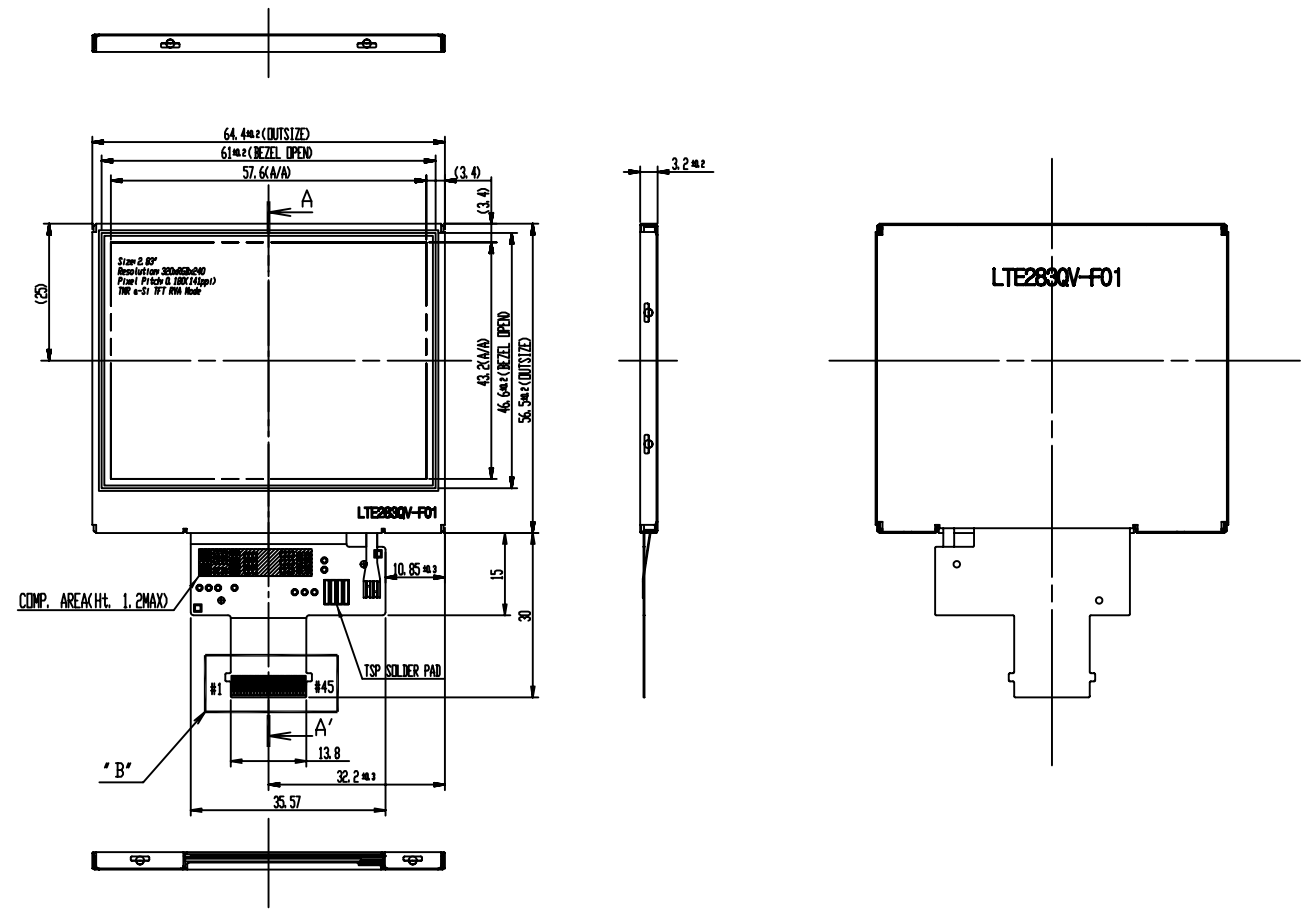
R10h = 0000

OFF

8. Outline Dimensions

8.1 Module Outline Dimensions (Total Assa'y)

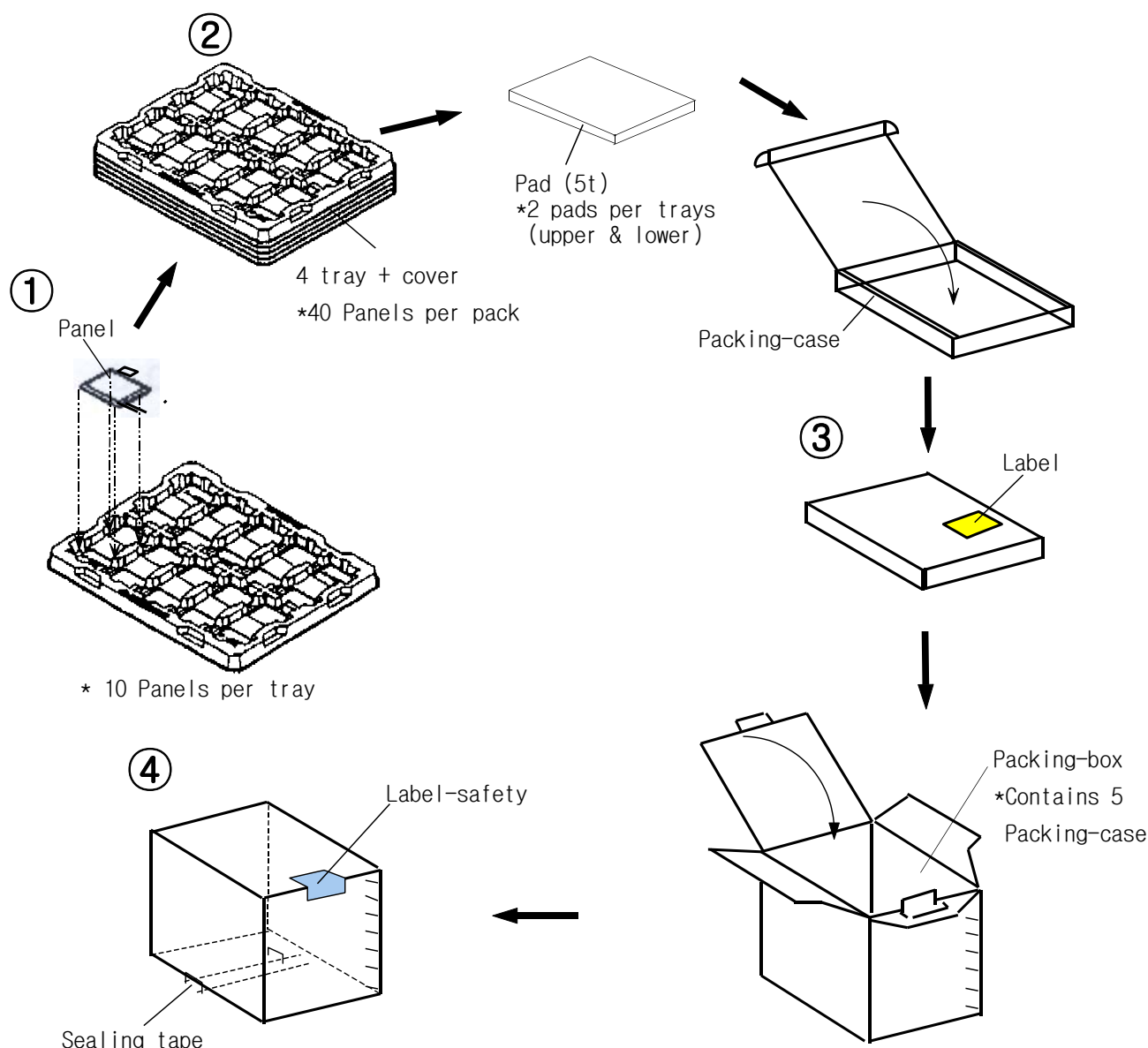
NO	PART NAME	CODE NO	SPECIFICATION	Q' TY	SPEC NO	REMARK
1	OUTLINE DIMENSION		LTE283QV-F01			



DETAIL 'B' (S: 3/1)

REVISION		GENERAL TOLERANCE														
		STEP	LEVEL 1	LEVEL 2	LEVEL 3	REV	DATE	DESCRIPTION OF REVISION				REASON		CHG'D BY		
						UNIT	mm	DRA' N BY	DES' D BY	CHK' D BY	APP' D BY	MODEL NAME	LTE283QV-F01			
		0 < X ≤ 4	±0.05	±0.1	±0.2	SCALE	1 / 1	T. J. KIM				Y. B. CHU	PART/SHEET NAME	OUTLINE DIMENSION	SHEET	1 / 1
		4 < X ≤ 16	±0.08	±0.15	±0.3	TOLERANCE	06 01.08				06 01.08					
		16 < X ≤ 64	±0.12	±0.25	±0.5	LEVEL 3	SAMSUNG ELECTRONICS				SPEC. NO	CODE NO.		VER.	000	
		64 < X ≤ 256	±0.25	±0.4	±0.8					SDS14924-000						

9. Packing



Note (1) Total : Case: Approx. 1.3 Kg

Box: Approx. 7 Kg

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

Box: 505(W) x 355(D) x 319(H)

(3) Pad Material : Polyethylene Foam T=3.0

(4) Resistance of tray surface : $10^3 \sim 10^6 \Omega$

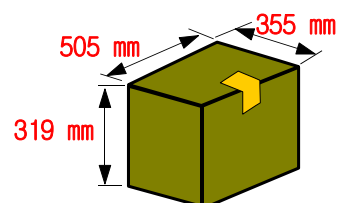
(5) ESD of tray surface : 20~100V

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

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

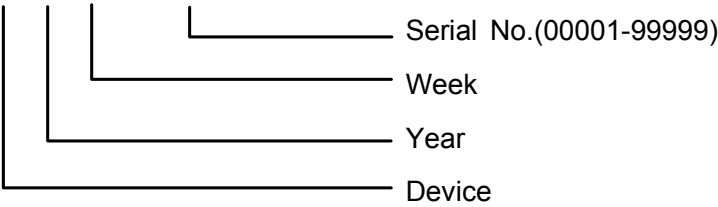
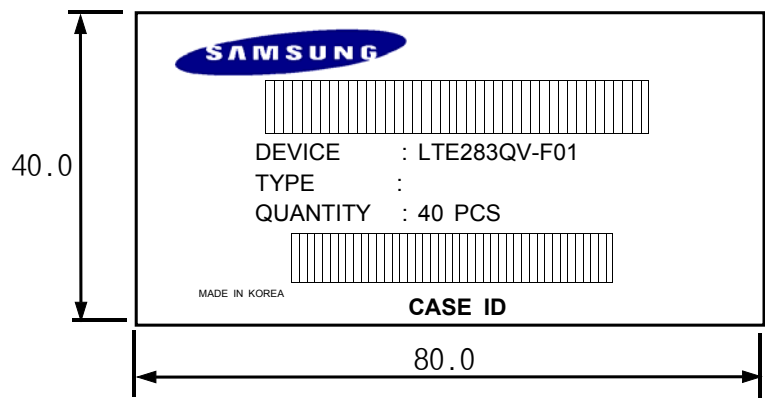
(8) Place 5 packing-case inside the packing-box.(Affix the label)

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



10. Marking & Others

(1) Packing case attach

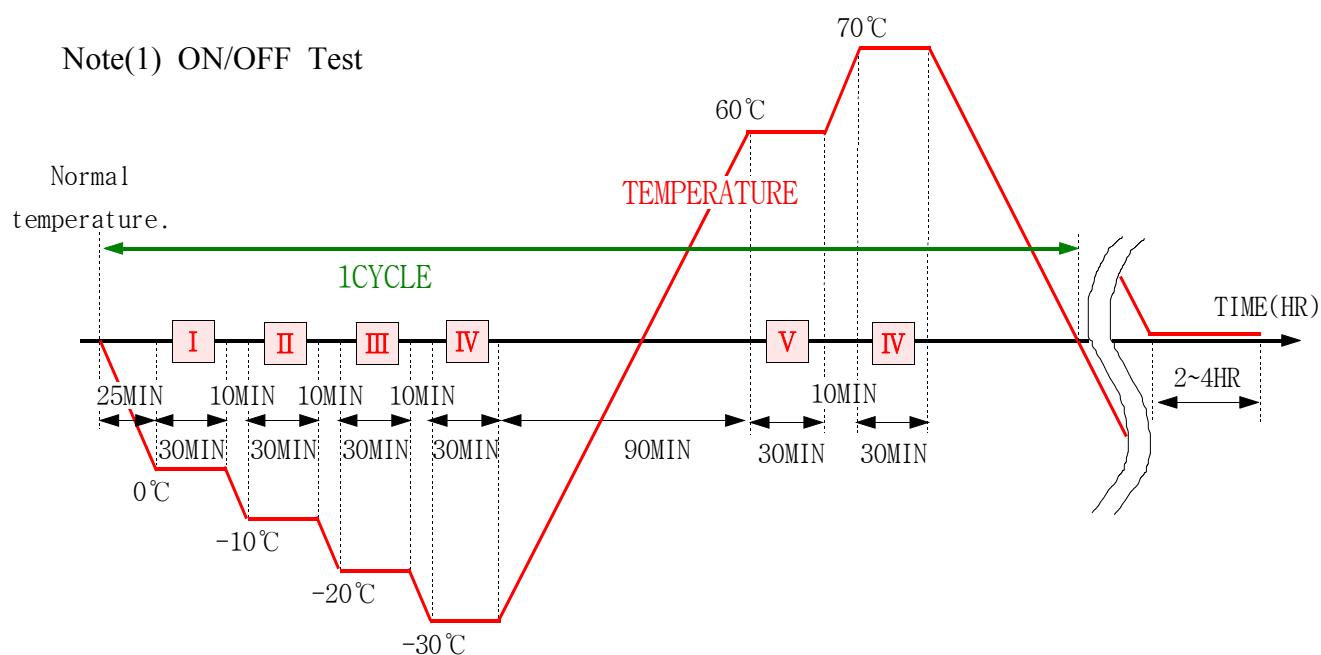


11. Reliability Test Condition

11.1 Condition

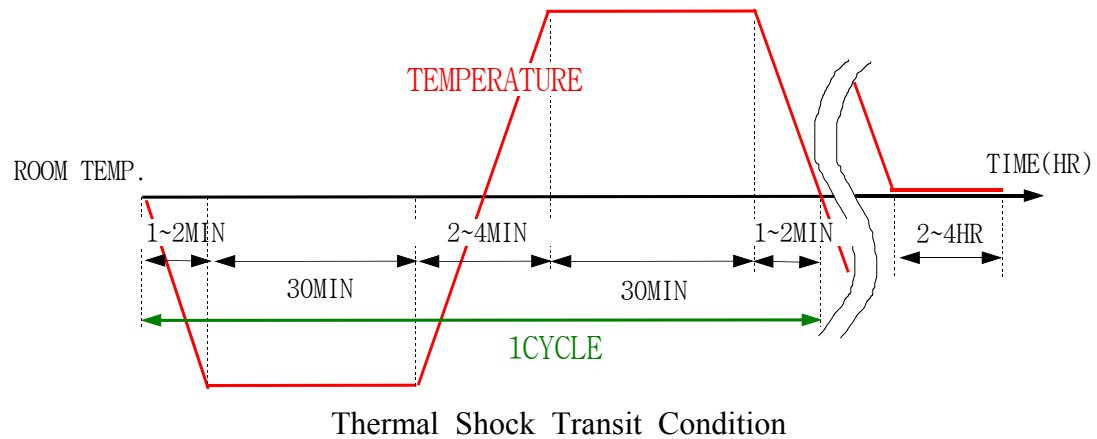
Item		Condition	Sample Size	Test Result
High Temperature Operating Life test		60℃, 240HR	10EA	Pass
Low Temperature Operating Life test		-20℃, 240HR	5EA	Pass
Thermal Humidity Bias		50℃, 90%RH, 240HR	10EA	Pass
High Temperature Storage test		70℃, 240HR	10EA	Pass
Low Temperature Storage test		-30℃, 240HR	5EA	Pass
Thermal Cycle (No operating test)		-30℃ ~ 70℃, 100cycle	10EA	Pass
Wet Humidity Temperature Storage test		60℃, 90%RH, 240HR	10EA	Pass
Power ON/OFF test		-30℃ ~ 70℃, 5cycle	5EA	Pass
ESD Test	Contact	±4kV, 150pF/330Ω	5EA	Pass
	Air	±8kV, 150pF/330Ω	5EA	Pass
	Pad	±2kV, 100pF/1500Ω	5EA	Pass
Box Vibration test		RANDOM NORMAL, 1HR/Y axis(Small box)	1Box	Pass
Bos Drop test		1Corner/3Edges/6Faces : 76cm(Medium box)	1Box	Pass

Note(1) ON/OFF Test



Temperature Cycle Transit Condition

Note(2) Storage



Note(3) Main-LCD, 5 times to every 4 corners of active area

11.2 Judgement

- > Main LCD should work under the normal condition.
- > After the temperature and humidity test, the luminance and CR(Contrast Ratio) should not be changed over 50% compared with those before the test.

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 Integrated Gate Circuit.
- (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

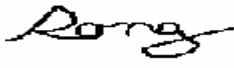
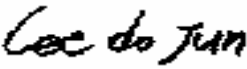

- (a) Do not connect, disconnect the module in the "Power On" condition.
- (b) Power supply should always be turned on/off by the item 7.1 "Power on/off sequence"

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.

Cosmetic Standards for Outgoing Inspection

(2.83"QVGA 240x320 TFT-LCD : LTE280QV-F01)

Document Control			
Document NO : COS_LTE283QV-F01_051117			
Customer (IAC)		Supplier (SAMSUNG Electronics)	
Approved by	Signature Here	Prepared by	
		Checked by	
		Approved by	

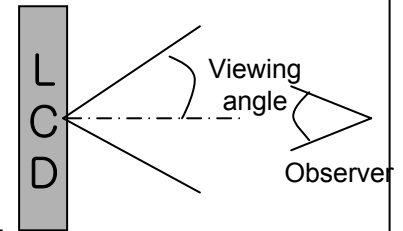
REVISION RECORD		
REV	REVISION ITEM	DATE
0	Engineering release	November 17 th , 2005

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Address : San 24 Nongseo-Ri, Giheung-Eup, Yongin-City, Gyeonggi-Do, Korea 449-711
Tel. 82-31-209-6134 Fax. 82-31-209-4867

1. Inspection Conditions:

- ✓ Viewing distance $30 \pm 5\text{cm}$
- ✓ Ambient illumination
 - . Operating Inspection $50 \sim 150\text{ Lux}$
 - . Appearance Inspection $1000 \sim 1500\text{ Lux}$
- ✓ Viewing angle Within 30 degrees left, right, up and down as the right picture shown .
- ✓ Ambient temperature $23 \pm 2\text{ }^{\circ}\text{C}$
- ✓ Display pattern 2.83" QVGA 240x320 - R, G, B, Black, White
- ✓ Inspection area Active area which is operating with pixels.



2. Inspection Criteria:

2-1. Visual Inspection

2-1-1 Definition of Visual defects

- ✓ Spot
Black/White spot appeared on the display which remain unchanged size.
- ✓ Line
Dark/Bright lines appeared on the display which remain unchanged in size.
- ✓ Polarizer Scratch
When the unit lights, visible scar or streak appear on the surface of polarizer.
- ✓ Polarizer Dent/Bubble
When the unit lights, visible carved mark or bubble on the surface of polarizer

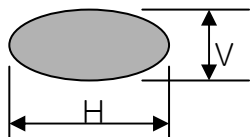
2-1-2 Visual Defect Criteria

Below judged criteria includes glasses, back light and polarizer defect.

Defect Mode	Acceptable Judgment Criteria	
Spot particles (Black or White)	Size D (mm)	Quantity (ea)
	$D \leq 0.1$	Disregard
	$0.1 < D \leq 0.2$	2
	$0.2 < D \leq 0.3$	1
Line particles (Black or White)	Width W(mm), Length L(mm)	Quantity (ea)
	$W \leq 0.03, L \leq 1.0$	Disregard
	$0.03 < W \leq 0.1, 1.0 < L \leq 3.0$	3
Polarizer Bubble / Dent	Size D (mm)	Quantity (ea)
	$D \leq 0.1$	Disregard
	$0.1 < D \leq 0.2$	2
	$0.2 < D \leq 0.3$	1
Polarizer scratch	Width W(mm), Length L(mm)	Quantity (ea)
	$W \leq 0.03, L \leq 1.0$	Disregard
	$0.03 < W \leq 0.1$	2
	$1.0 \leq L \leq 5$	
Maximum allowable defect type		4

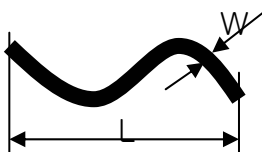
➤Remarks (How to measure?)

- Use inspection tools like a loupe or microscope if unsure of pass/fail criteria.
- Translucent edge is ignored in measuring the diameter of spot.



- Diameter of Spots and Bubbles

$$D = [\text{Vertical}(V) + \text{Horizontal}(H)] / 2$$



- Length and Width of Lines and Scratches

2-2. Pixel Inspection

2-2-1 Definition of Pixel defects

✓ Pixel

3 sub-pixels (R+G+B)



✓ DOT

1 sub-pixel (R or G or B /



or



or



)

✓ Bright/Dark Dot

A sub-pixel (R,G,B dot) stuck off/on (electrical)

Bright dots (black dots) shall be counted on a black pattern (a pure R,G,B and white pattern).

✓ Adjacent Dot

2 or 3 dots situated close to a neighboring dot. (R,G or G,B or B,R or R,G,B)

2-2-2 Dot Defect Criteria

Defect Mode	Acceptable Judgment Criteria	
	Dot Type	Quantity (ea)
Bright Dot	Random (Red or Blue or Green)	1
	2 or more adjacent dot defects	0
Dark Dot	Dark dot	2
	2 or more adjacent dot defects	1
Maximum allowable number of dot defect		3

- In case of adjacent dots, vertical direction is not permitted.

2-3. The other Inspections

2-3-1 Functional Defects

Below items are considered to be failure.

- ✓ Line Defect
One or more permanent horizontal or vertical lines on a white/black pattern.

- ✓ No Display
No pixels is active when power and valid data are applied to the display.

- ✓ No Back Light
No or weak light from the LED/CCFL when the backlight is activated.
(Measure brightness or uniformity if unsure of pass/fail criteria.)

- ✓ Gray Defect
Abnormal display of gray colored level on a specified R,G,B pattern.
(Measuring chromaticity if unsure of pass/fail criteria.)

- ✓ Noise
Wave on display due to electrical ripple or noise.

- ✓ Abnormal Display
Abnormal display excluding items mentioned above.

- If not issued from the customer site or not described above , SEC follows internal guide line.