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ELECTRONICS

Approval



TO :

DATE : May. 15. 2008

SAMSUNG TFT-LCD

MODEL NO. : LTN154CT02-0

NOTE : Extension code [-0]
→ LTN154CT02-0
Surface type [Anti-Glare]

The information described in this SPEC is preliminary and can be changed without prior notice

APPROVED BY :

K. H. Shin

PREPARED BY :

Application Engineering Part (Mobile)

SAMSUNG ELECTRONICS CO., LTD.

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REVISION HISTORY

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Date	Revision No.	Page	Summary
Oct. 19. 2007	P00	All	LTN154CT02-0 model Preliminary spec was issued first.
Jan. 25. 2008	P01	26	Panel Rev. Code scheme was added
Mar. 31. 2008	P02	7	Color coordinate of R, G, B were updated
May. 15. 2008	A00	All	Approval spec was issued
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GENERAL DESCRIPTION

DESCRIPTION

LTN154CT02-0 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as switching devices. This model is composed of a TFT LCD panel, a driver circuit and a backlight unit. The resolution of a 15.4" contains 1920 x 1200 pixels and can display up to 262,144 colors. 6 O'clock direction is the optimum viewing angle.

FEATURES

- High contrast ratio, high aperture structure
- 1920 x 1200 pixels resolution (16:10)
- High Color Gamut (Typical 72%)
- Low power consumption
- Fast Response
- 2 CCFL(Y-stack)
- DE(Data enable) only mode
- 3.3V LVDS Interface
- Onboard EEDID chip
- RoHS Compliance
- Windows Vista Premium Logo compliance

APPLICATIONS

- Notebook PC
- If the usage of this product is not for PC application, but for others, please contact SEC

GENERAL INFORMATION

Item	Specification	Unit	Note
Display area	331.2(H) x 207.0(V) (15.4" diagonal)	mm	
Driver element	a-Si TFT active matrix		
Display colors	262,144		
Number of pixel	1920 x 1200 (WUXGA)	pixel	16 : 10
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.1725(H) x 0.1725(V)	mm	
Display Mode	Normally white		
Surface treatment	Haze 40, Hardness 3H		Anti-glare

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Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal (H)	343.5	344.0	344.5	mm	(1)
	Vertical (V)	224.5	225.0	225.5	mm	
	Depth (D)	-	-	7.0	mm	
Weight		-	-	650	g	

Note (1) Measurement condition of outline dimension

- . Equipment : Vernier Calipers
- . Push Force : 500g · f (minimum)

1. ABSOLUTE MAXIMUM RATINGS

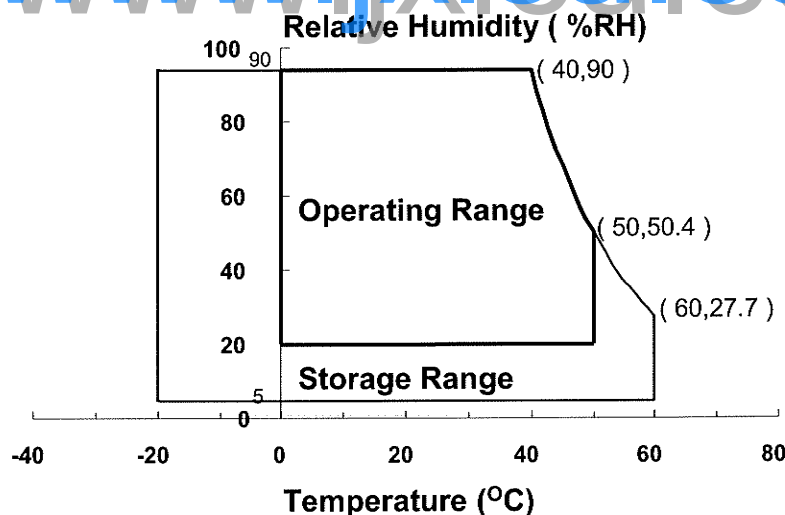
1.1 ENVIRONMENTAL ABSOLUTE RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Storage temperate	TSTG	-20	60	°C	(1),(5)
Operating temperate (Temperature of glass surface)	TOPR	0	50	°C	(1),(5)
Shock (non-operating)	Snop	-	240	G	(2),(4)
Vibration (non-operating)	Vnop	-	2.41	G	(3),(4)

Note (1) Temperature and relative humidity range are shown in the figure below.

95 % RH Max. ($40^{\circ}\text{C} \geq T_a$)

Maximum wet-bulb temperature at 39°C or less. ($T_a > 40^{\circ}\text{C}$) No condensation



- (2) 2ms, half sine wave, one time for $\pm X, \pm Y, \pm Z$.
- (3) 5 - 500 Hz, random vibration, 30min for X, Y, Z.
- (4) At testing Vibration and Shock, 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 used for extended time excessively or exposed to high temperatures for extended time, there is a possibility of wide viewing angle film damage which could affect visual characteristics.

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1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

 $V_{DD} = 3.3V$, $V_{SS} = GND = 0V$

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	$V_{DD} - 0.3$	$V_{DD} + 0.3$	V	(1)
Logic Input Voltage	V_{IN}	$V_{DD} - 0.3$	$V_{DD} + 0.3$	V	(1)

Note (1) Within T_a ($25 \pm 2^\circ C$)

(2) BACK-LIGHT UNIT

 $T_a = 25 \pm 2^\circ C$

Item	Symbol	Min.	Max.	Unit	Note
Lamp Current	I_L	2.0	7.0	mAmps	(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.

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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 (5).
Measuring equipment : TOPCON BM-5A and PR-650

* Ta = 25 ± 2 °C, VDD=3.3V, fV= 60Hz, fDCLK = 82.1MHz, IL = 6.0 mA

Item		Symbol	Condition	Min.	Typ.	Max	Unit	Note
Contrast Ratio (5 Points)		CR	Normal Viewing Angle $\phi = 0$ $\theta = 0$	400	500	-	-	(1), (2), (5)
Response Time at Ta (Rising + Falling)		T _{RT}		-	16	20	msec	(1), (3)
Average Luminance of White (5 Points)		Y _{L,AVE}		290	340	-	cd/m ²	I _L =6.0mA (1), (4)
Color Chromaticity (CIE)	Red	R _X		0.630	0.650	0.670	-	(1), (5) PR-650
		R _Y		0.315	0.335	0.355		
	Green	G _X		0.270	0.290	0.310		
		G _Y		0.585	0.605	0.625		
	Blue	B _X		0.125	0.145	0.165		
		B _Y		0.055	0.075	0.095		
	White	W _X		0.293	0.313	0.333		
		W _Y	0.309	0.329	0.349			
Viewing Angle	Hor.	θ_L	CR ≥ 10	55	-	-	Degrees	(1), (5) BM-5A
		θ_H		55	-	-		
	Ver.	ϕ_H		45	-	-		
		ϕ_L		45	-	-		
Color Gamut				-	72	-	%	
13 Points White Variation		δ_L		-	-	1.7	-	(6)

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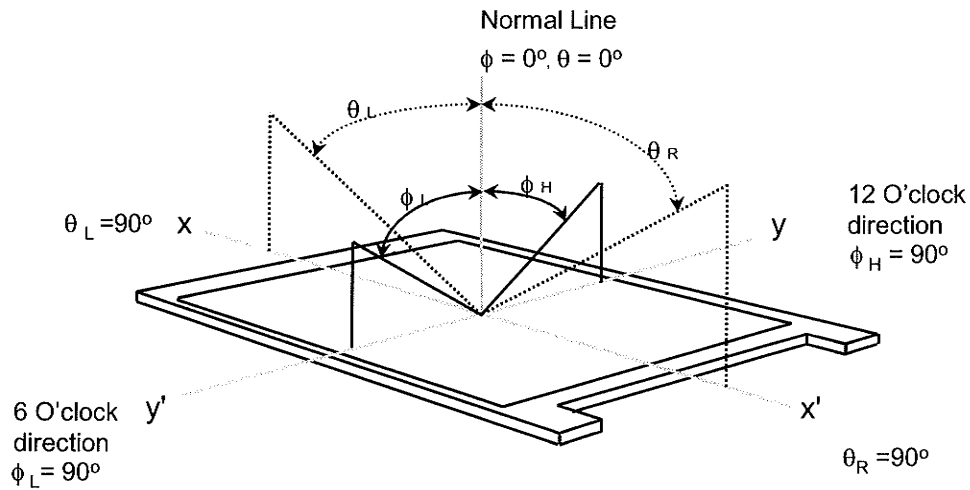
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Note 1) Definition of Viewing Angle : Viewing angle range($10 \leq C/R$)

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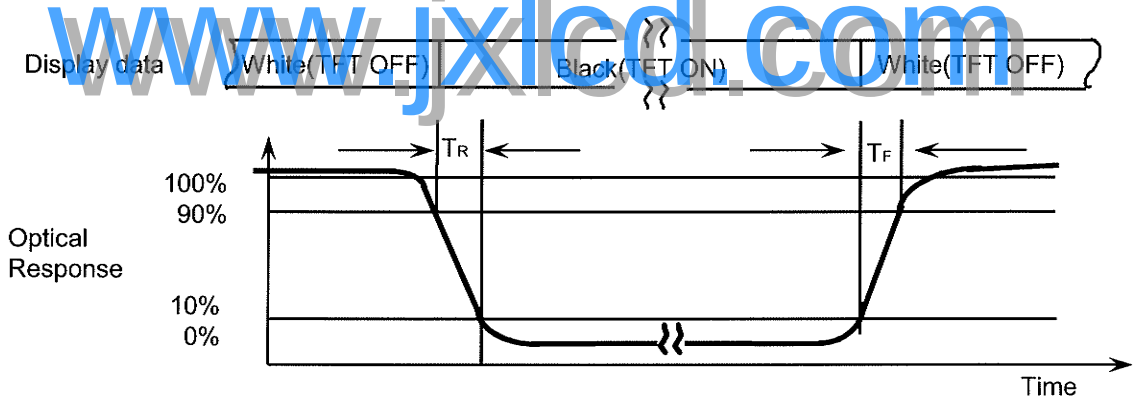


Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax), gray min (Gmin) at 5 points(4, 5, 7, 9, 10)

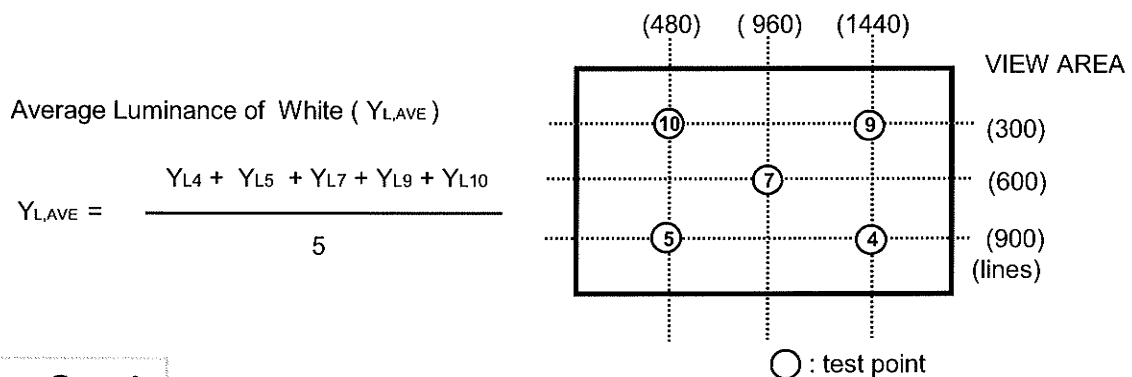
$$CR = \frac{CR(4) + CR(5) + CR(7) + CR(9) + CR(10)}{5}$$

Points : (4), (5), (7), (9), (10) at the figure of Note (6).

Note 3) Definition of Response time :



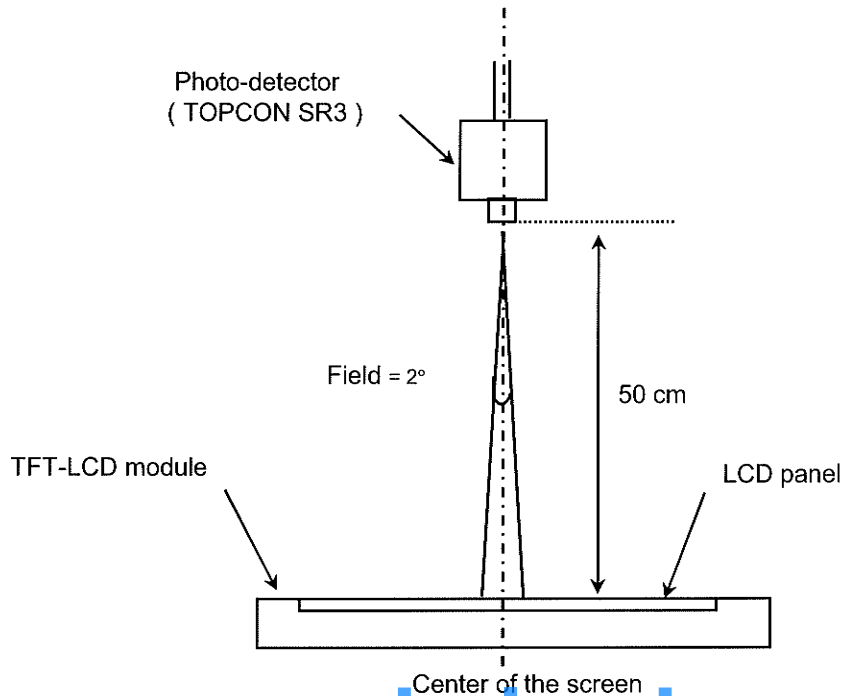
Note 4) Definition of Average Luminance of White : measure the luminance of white at 5 points.



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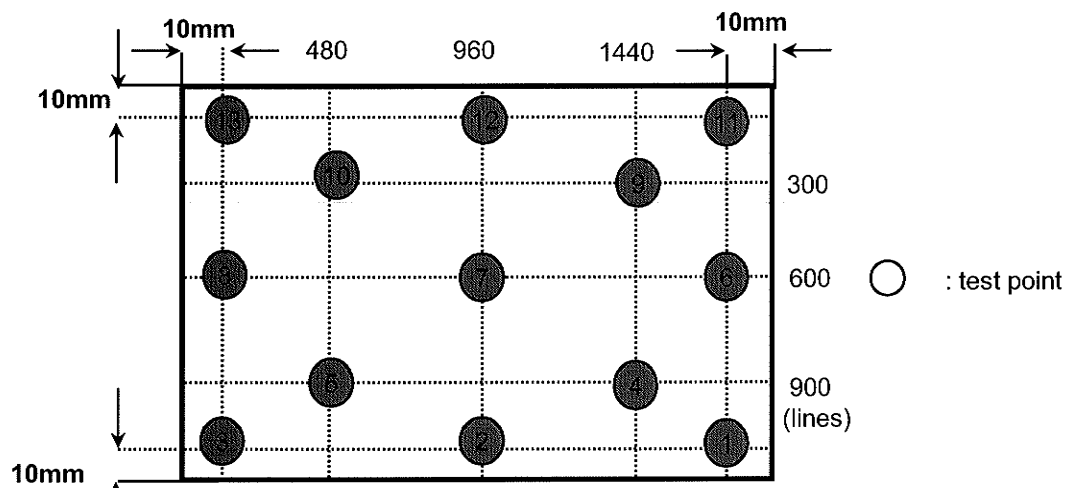
Note 5) After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. 30 min after lighting the backlight. This should be measured in the center of screen.
 Lamp current : 6.0mA (Inverter : SIC-130T)
 Environment condition : $T_a = 25 \pm 2 \text{ } ^\circ\text{C}$



[Optical characteristics measurement setup]

Note 6) Definition of 13 points white variation (δL), CR variation (C_{VER}) [① ~ ⑬]

$$\delta L = \frac{\text{Maximum luminance of 13 points}}{\text{Minimum luminance of 13 points}}$$



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3. ELECTRICAL CHARACTERISTICS

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3.1 TFT LCD MODULE

Ta= 25 ± 2°C

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V _{DD}	3.0	3.3	3.6	V	
Differential Input Voltage for LVDS Receiver Threshold	High	V _{IH}	-	-	+100	mV	V _{CM} = +1.2V
	Low	V _{IL}	-100	-	-	mV	
Vsync Frequency		f _v	-	60	-	Hz	
Hsync Frequency		f _H	-	73	-	KHz	
Main Frequency		f _{DCLK}	-	83.9	-	MHz	2CH
Rush Current		I _{RUSH}	-	-	1.5	A	(4)
Current of Power Supply	White	I _{DD}	-	500	-	mA	(2),(3)*a
	Mosaic		-	550	-	mA	(2),(3)*b
	V. stripe		-	720	820	mA	(2),(3)*c

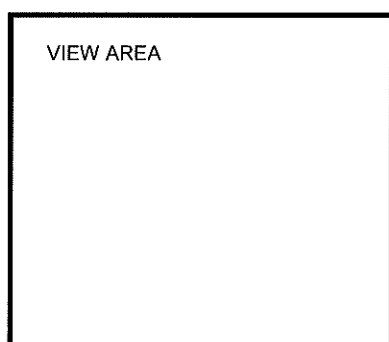
Note (1) Display data pins and timing signal pins should be connected.(GND = 0V)

(2) f_v = 60HZ, f_{DCLK} = 82.1MHZ, V_{DD} = 3.3V, DC Current.

(3) Power dissipation pattern

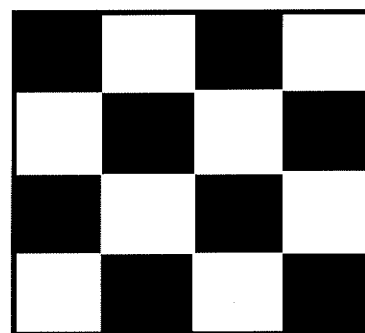
*a) White Pattern

*b) Mosaic Pattern



Display Brightest Gray Level →

Display Darkest Gray Level →



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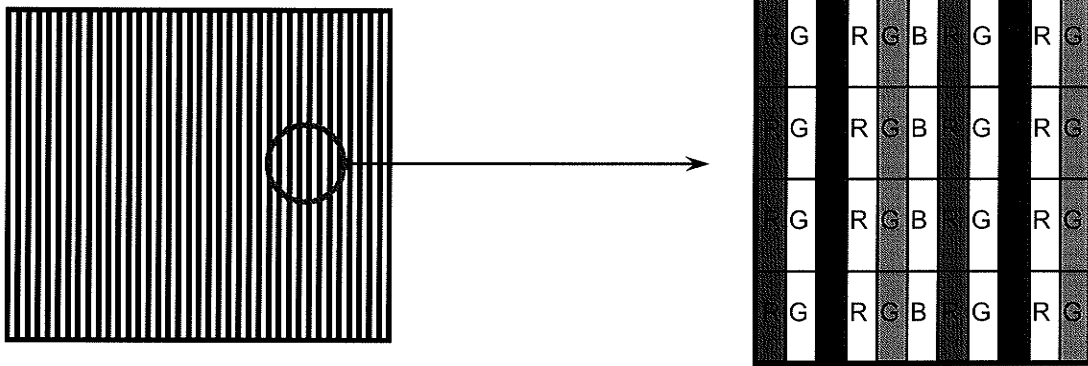
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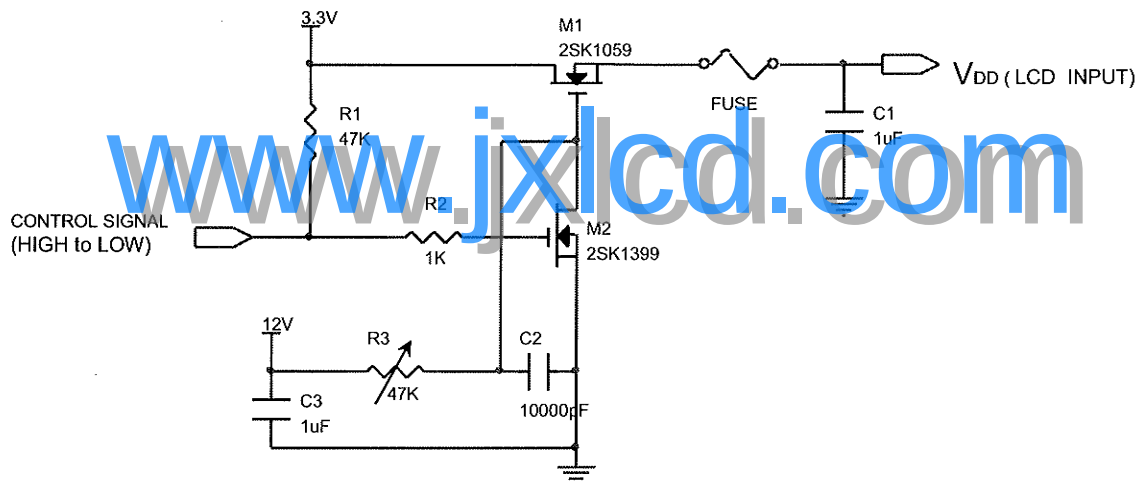
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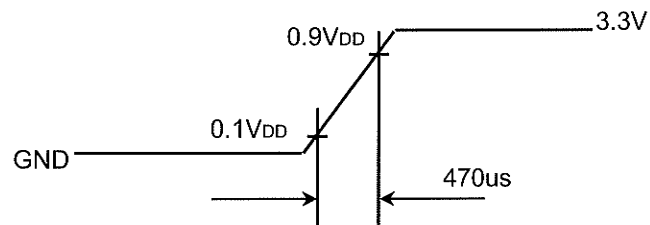
*c) 1dot Vertical stripe pattern



4) Rush current measurement condition



V_{DD} rising time is 470us



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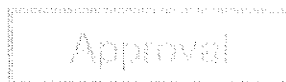
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3.2 BACK-LIGHT UNIT



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

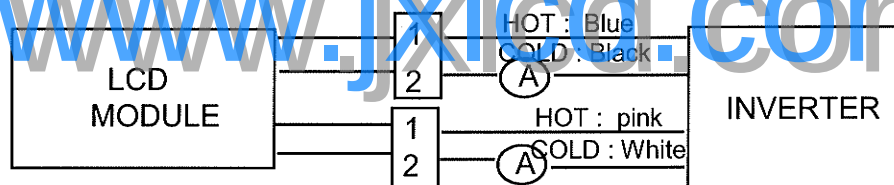
Ta= 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp Current	I _L	4.0	6.0	7.0	mArms	(1)
Lamp Voltage	V _L	-	750	-	Vrms	I _L = 6.0mA
Frequency	f _L	40	60	65	KHz	(2)
Power Consumption	P _L	-	4.5		W	(3) I _L = 6.0mA
Operating Life Time	Hr	15,000	-	-	Hour	(4)
Startup Voltage	V _s	-	-	1180	Vrms	25°C, (5)
				1415	Vrms	0°C, (5)

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 backlight, 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 backlight and the inverter(miss lighting, flicker, etc.) 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 a 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 should be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

(3) Refer to I_L × V_L to calculate.

(4) Life time (Hr) of a lamp can be defined as the time in which it continues to operate under the condition Ta= 25 ± 2 °C and I_L = 6.0 mArms until one of the following event occurs.

1. When the brightness becomes 50% or lower than the original.
2. When the Effective ignition length becomes 80% or lower than the original value.
(Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)

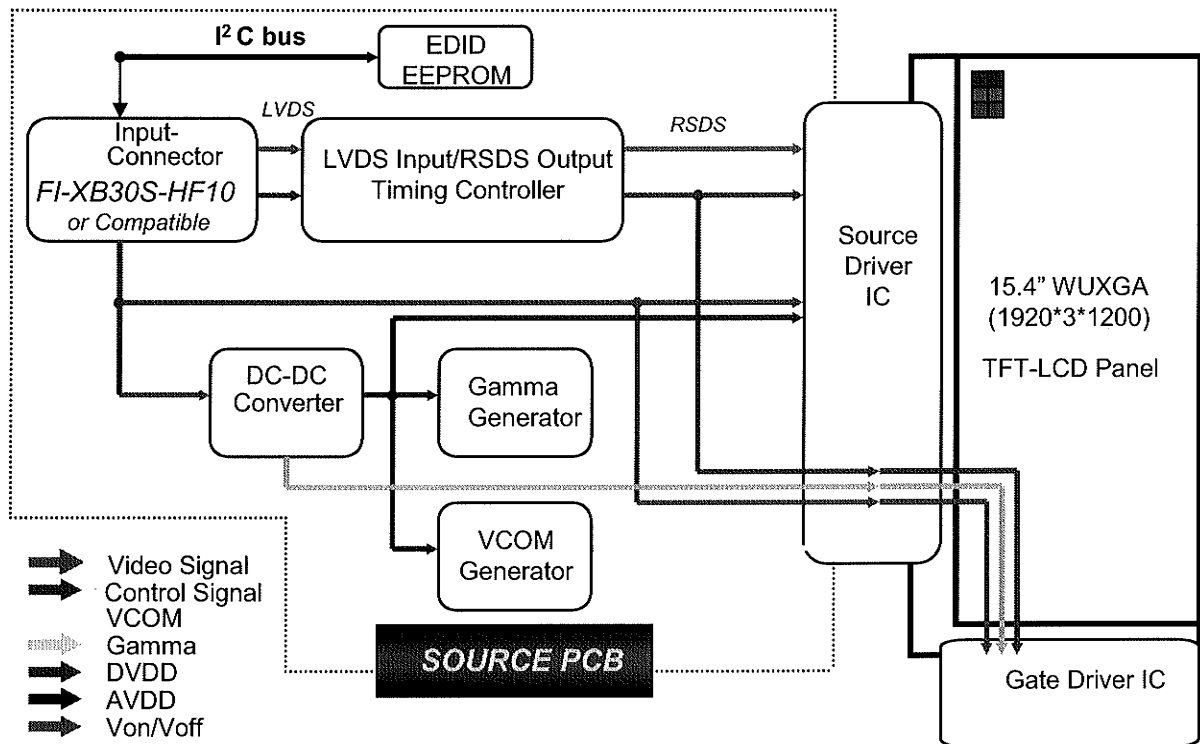
(5) The inverter open voltage - this voltage should be measured after ballast capacitor- have to be larger than the lamp startup voltage, otherwise backlight may has blinking for a moment after turns on or not be turned on.
If an inverter has shutdown function it should keep its open voltage for longer than 1 second even if lamp connector open.

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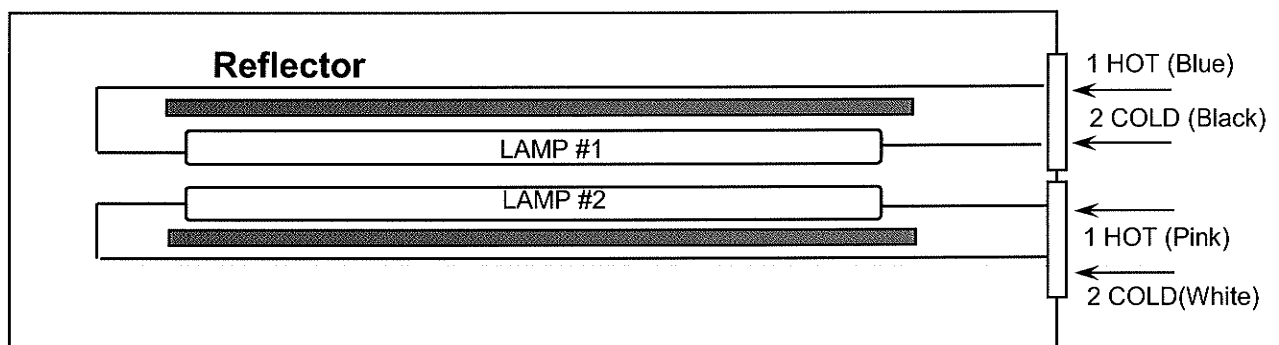
4. BLOCK DIAGRAM

4.1 TFT LCD Module



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4.2 BACK-LIGHT UNIT



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5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal & Power (LVDS, Connector : JAE FI-XB30SRL-HF11 or compatible)
Mating Connector : JAE FI-X30Sx or compatible)

No.	Symbol	Function	Polarity	Remarks
1	VSS	Ground		
2	VDD	POWER SUPPLY +3.3V		
3	VDD	POWER SUPPLY +3.3V		
4	VEEDID	DDC 3.3V Power		
5	NC	No Connection		
6	CLKEDID	DDC Clock		
7	DATAEDID	DDC data		
8	O_RxIN0-	LVDS Differential Data INPUT (Odd R0-R5,G0)	Negative	
9	O_RxIN0+	LVDS Differential Data INPUT (Odd R0-R5,G0)	Positive	
10	GND	Ground		
11	O_RxIN1-	LVDS Differential Data INPUT (Odd G1-G5,B0-B1)	Negative	
12	O_RxIN1+	LVDS Differential Data INPUT (Odd G1-G5,B0-B1)	Positive	
13	GND	Ground		
14	O_RxIN2-	LVDS Differential Data INPUT (Odd B2-B5,Sync,DE)	Negative	
15	O_RxIN2+	LVDS Differential Data INPUT (Odd B2-B5,Sync,DE)	Positive	
16	GND	Ground		
17	O_RxCLK-	LVDS Differential Data INPUT (Odd Clock)	Negative	
18	O_RxCLK+	LVDS Differential Data INPUT (Odd Clock)	Positive	
19	GND	Ground		
20	E_RxIN0-	LVDS Differential Data INPUT (Even R0-R5,G0)	Negative	
21	E_RxIN0+	LVDS Differential Data INPUT (Even R0-R5,G0)	Positive	
22	GND	Ground		
23	E_RxIN1-	LVDS Differential Data INPUT (Even G1-G5,B0-B1)	Negative	
24	E_RxIN1+	LVDS Differential Data INPUT (Even G1-G5,B0-B1)	Positive	
25	GND	Ground		
26	E_RxIN2-	LVDS Differential Data INPUT (Even B2-B5,Sync,DE)	Negative	
27	E_RxIN2+	LVDS Differential Data INPUT (Even B2-B5,Sync,DE)	Positive	
28	GND	Ground		
29	E_RxCLK-	LVDS Differential Data INPUT (Even Clock)	Negative	
30	E_RxCLK+	LVDS Differential Data INPUT (Even Clock)	Positive	

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5.2 LVDS Interface : Transmitter DS90CF363 or Compatible

LVDS for Odd pixel

Pin No.	Name	RGB Signal	Pin No.	Name	RGB Signal
44	TxIN0	RO0	12	TxIN11	GO5
45	TxIN1	RO1	13	TxIN12	BO0
47	TxIN2	RO2	15	TxIN13	BO1
48	TxIN3	RO3	16	TxIN14	BO2
1	TxIN4	RO4	18	TxIN15	BO3
3	TxIN5	RO5	19	TxIN16	BO4
4	TxIN6	GO0	20	TxIN17	BO5
6	TxIN7	GO1	22	TxIN18	Hsync
7	TxIN8	GO2	23	TxIN19	Vsync
9	TxIN9	GO3	25	TxIN20	DE
10	TxIN10	GO4	26	TxCLK IN	Clock

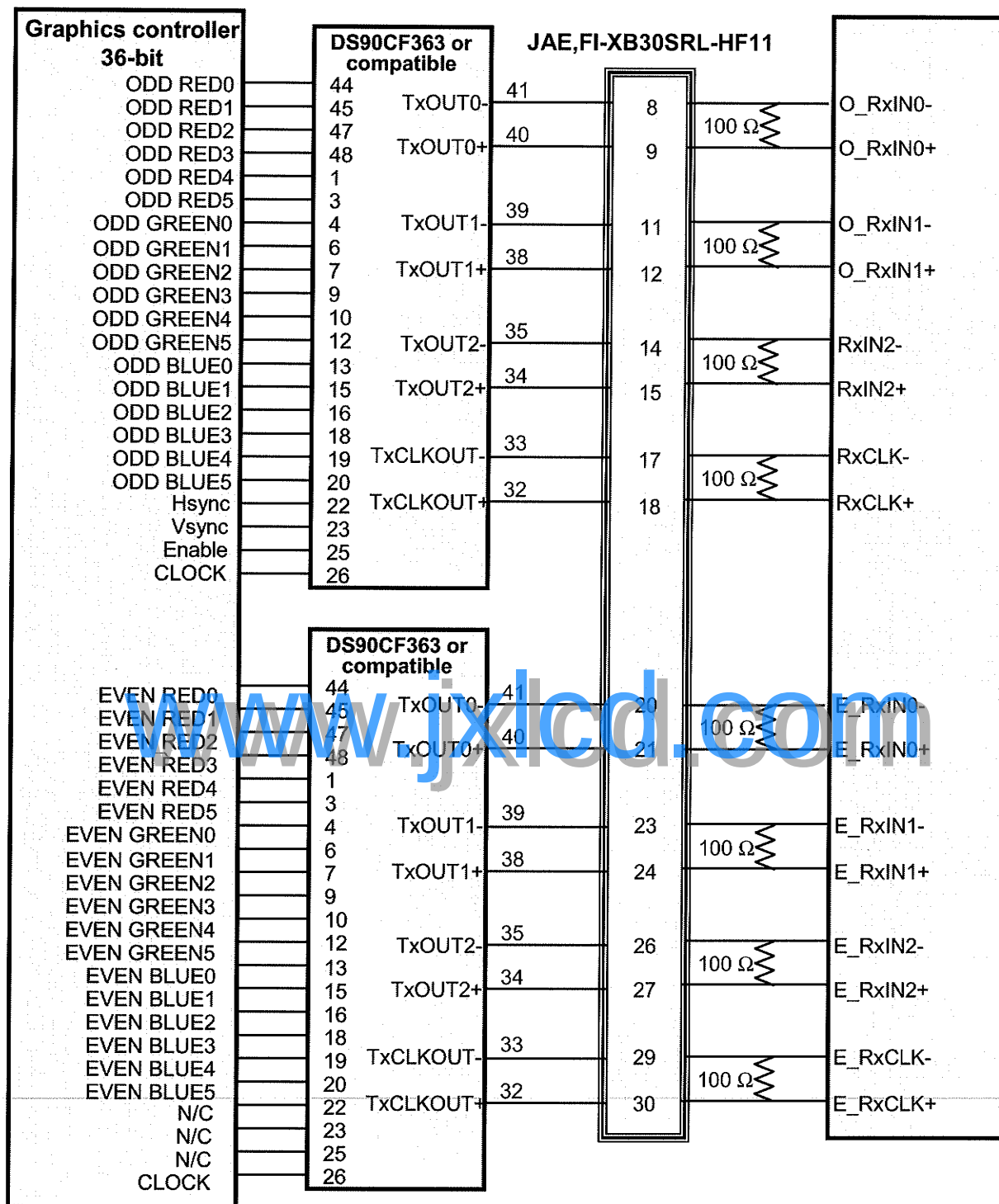
LVDS for Even pixel

Pin No.	Name	RGB Signal	Pin No.	Name	RGB Signal
44	TxIN0	RE0	12	TxIN11	GE5
45	TxIN1	RE1	13	TxIN12	BE0
47	TxIN2	RE2	15	TxIN13	BE1
48	TxIN3	RE3	16	TxIN14	BE2
1	TxIN4	RE4	18	TxIN15	BE3
3	TxIN5	RE5	19	TxIN16	BE4
4	TxIN6	GE0	20	TxIN17	BE5
6	TxIN7	GE1	22	TxIN18	N/C
7	TxIN8	GE2	23	TxIN19	N/C
9	TxIN9	GE3	25	TxIN20	N/C
10	TxIN10	GE4	26	TxCLK IN	Clock

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LVDS Interface



Note : The LCD Module uses a 100ohm resistor between positive and negative lines of each receiver input.

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5.3 BACK LIGHT UNIT

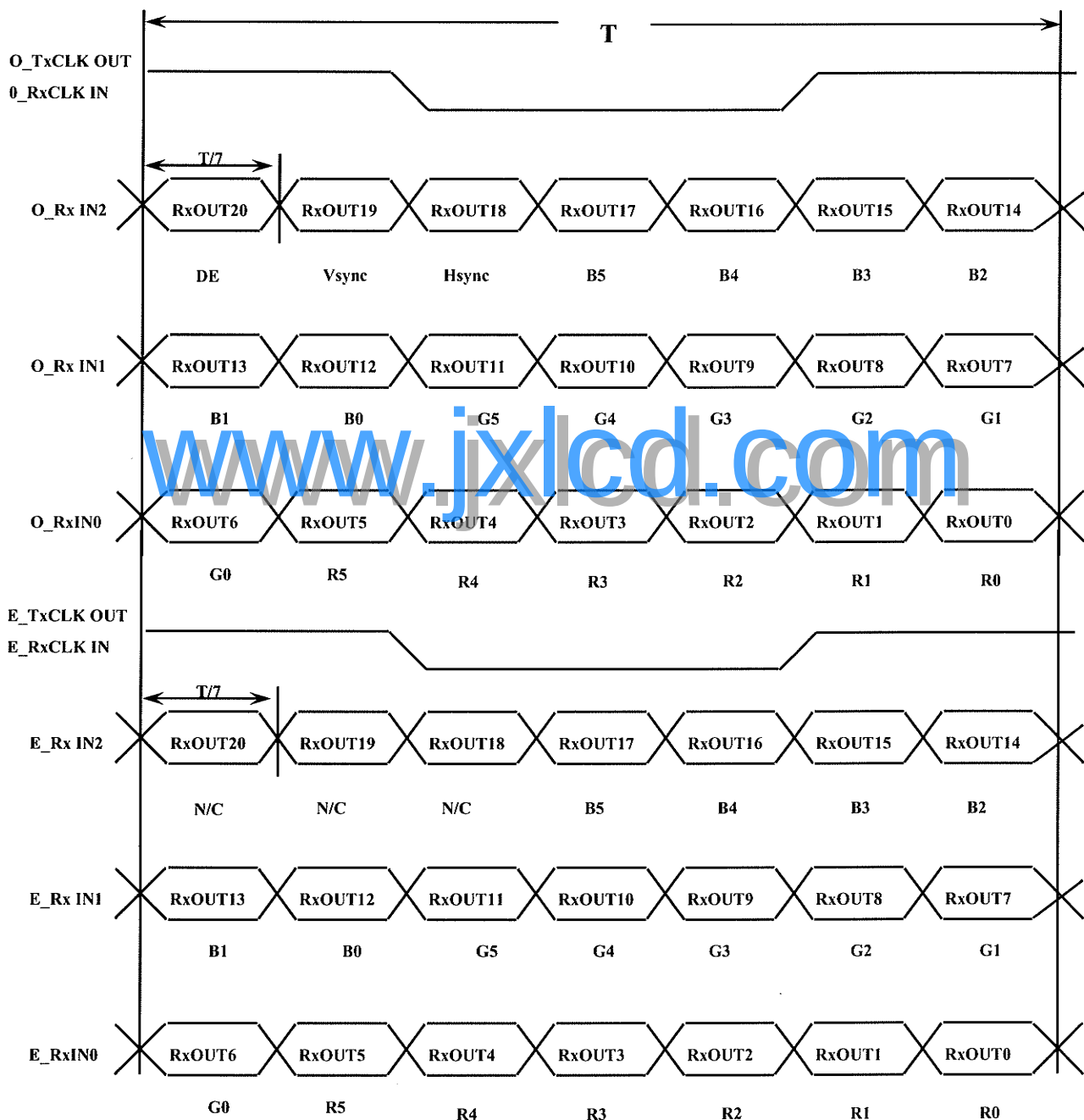
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Connector : JST BHSR - 02VS -1
Mating Connector : SM02B-BHSS-1(JST)

Pin NO.	Symbol	Color	Function
1	HOT	Pink / Blue	High Voltage
2	COLD	White / Black	Low Voltage

5.4 Timing Diagrams of LVDS For Transmission

LVDS Receiver : Integrated T-CON



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5.5 Input Signals, Basic Display Colors and Gray Scale of Each Color

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	45	B5	
Basic Colors	Black	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	1	1	1	1	1	1	-
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	-
	Cyan	0	0	0	0	0	0	1	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	0	-
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	-
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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	-
Gray Scale Of Red	Black	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	R1
	↑	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R61
	Light	0	1	1	1	1	1	0	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	0	R63
Gray Scale Of Green	Black	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	1	0	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	0	G2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~G60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	G61
	Light	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	G62
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	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	0	B0
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	B1
	↑	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	B2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	B61
	Light	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	B62
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	B63

Note 1) Definition of gray :

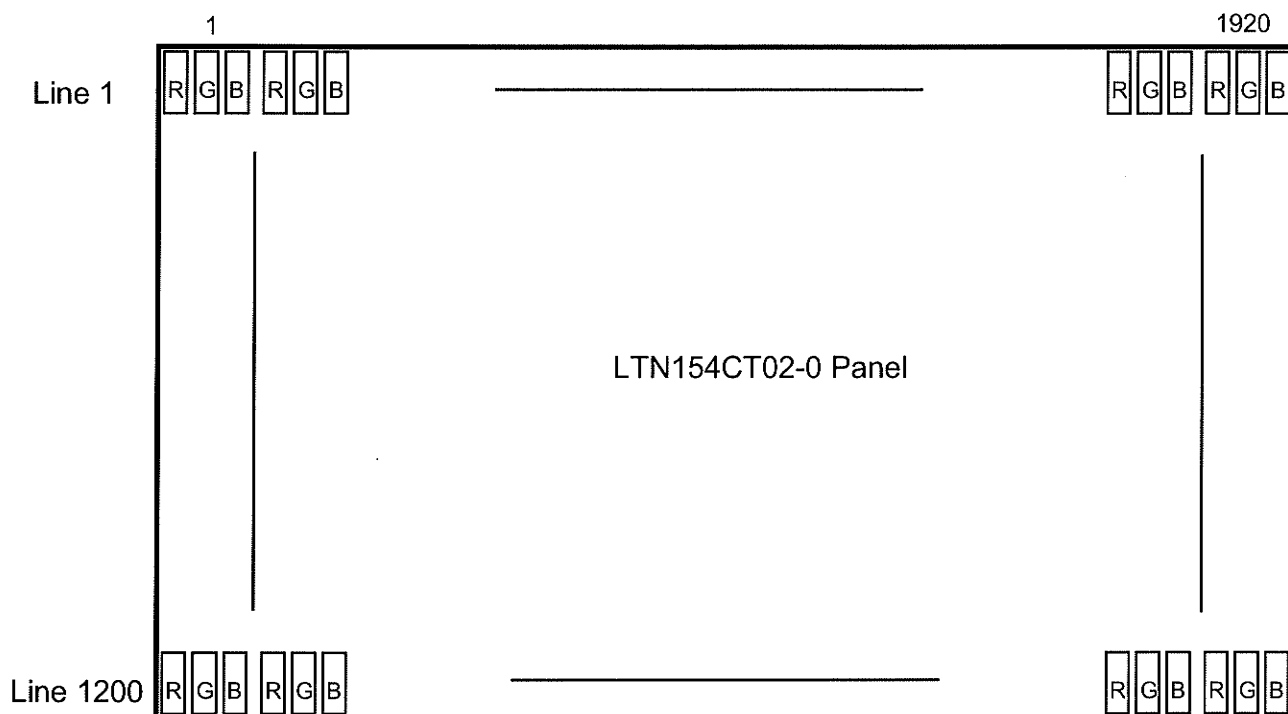
Rn: Red gray, Gn: Green gray, Bn: Blue gray (n=gray level)

Note 2) Input signal: 0 =Low level voltage, 1=High level voltage

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5.6 Pixel Format in the display



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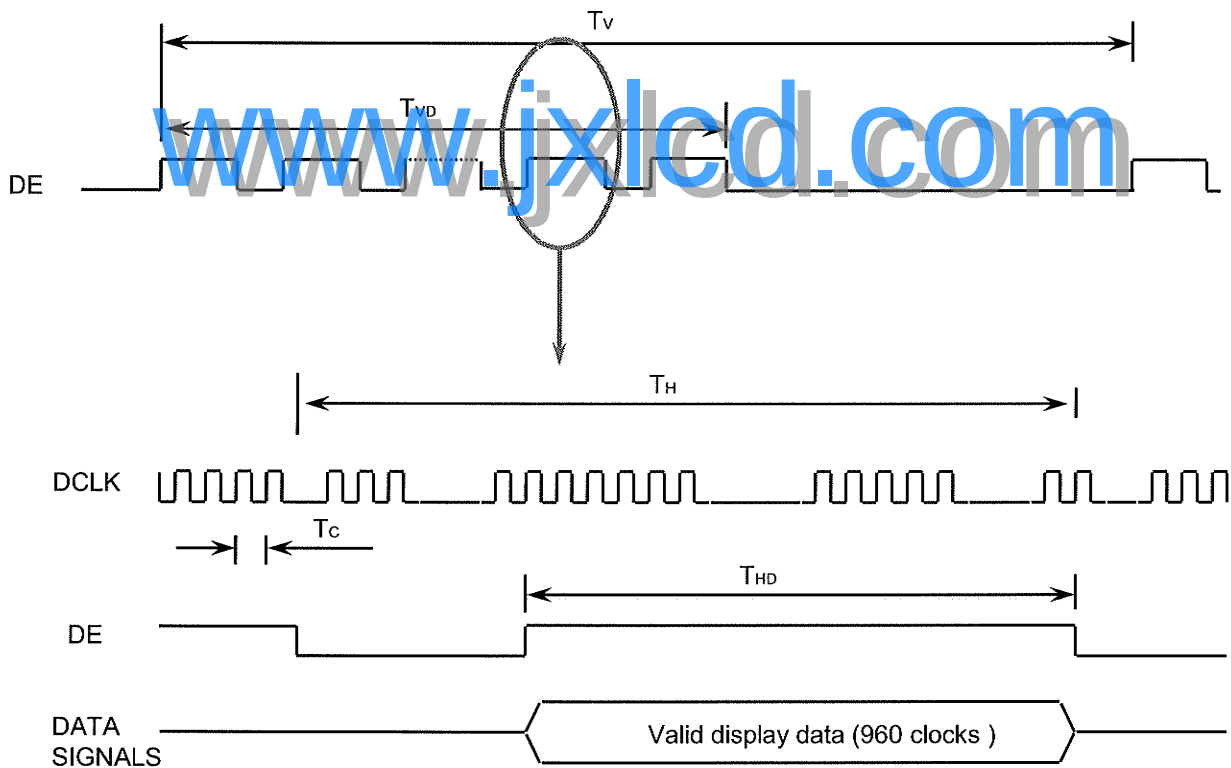
6. INTERFACE TIMING

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6.1 Timing Parameters

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frame Frequency	Cycle	TV	1204	1250	1400	Lines	
Vertical Active Display Term	Display Period	TVD	-	1200	-	Lines	
One Line Scanning Time	Cycle	TH	1030	1080	1170	Clocks	
Horizontal Active Display Term	Display Period	THD	-	960	-	Clocks	

6.2 Timing diagrams of interface signal



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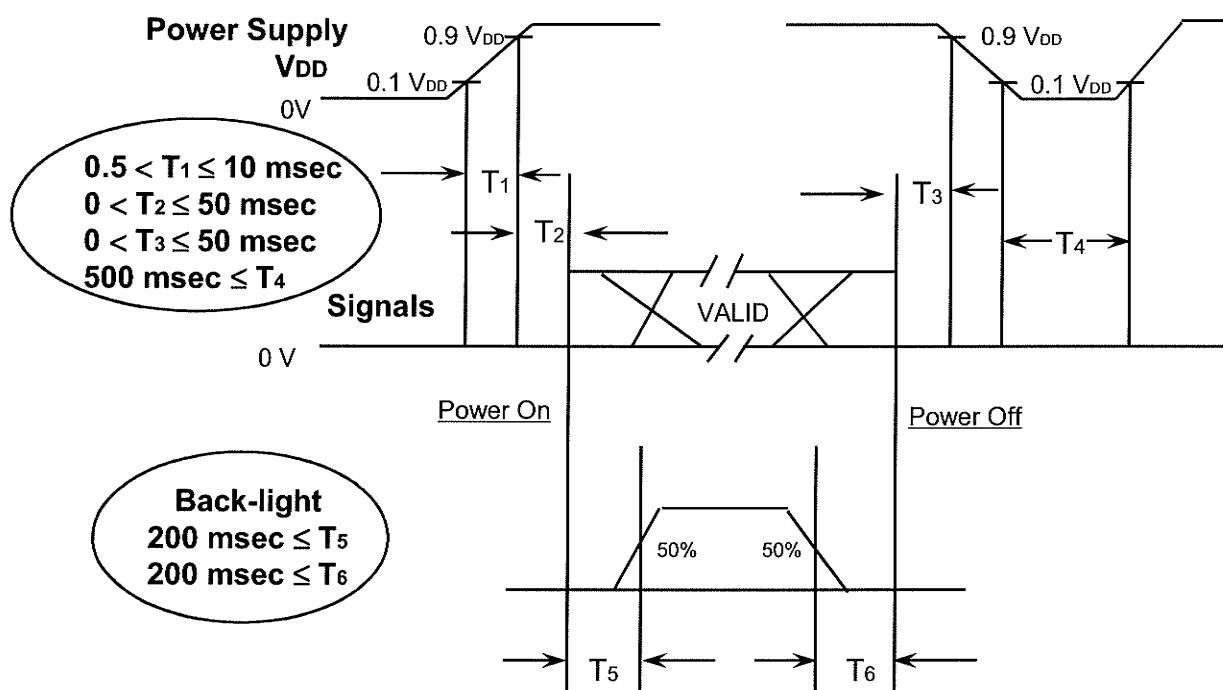
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6.3 Power ON/OFF Sequence

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



Power ON/OFF Sequence

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- T1 : Vdd rising time from 10% to 90%
- T2 : The time from Vdd to valid data at power ON.
- T3 : The time from valid data off to Vdd off at power Off.
- T4 : Vdd off time for Windows restart
- T5 : The time from valid data to B/L enable at power ON.
- T6 : The time from valid data off to B/L disable at power Off.

NOTE.

- (1) The supply voltage of the external system for the module input should be the same as the definition of VDD.
- (2) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.
- (3) In case of VDD = off level, please keep the level of input signals on the low or keep a high impedance.
- (4) T4 should be measured after the module has been fully discharged between power off and on period.
- (5) Interface signal shall not be kept at high impedance when the power is on.

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7. Mechanical Outline Dimension

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[Refer to the next page]

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8. PACKING

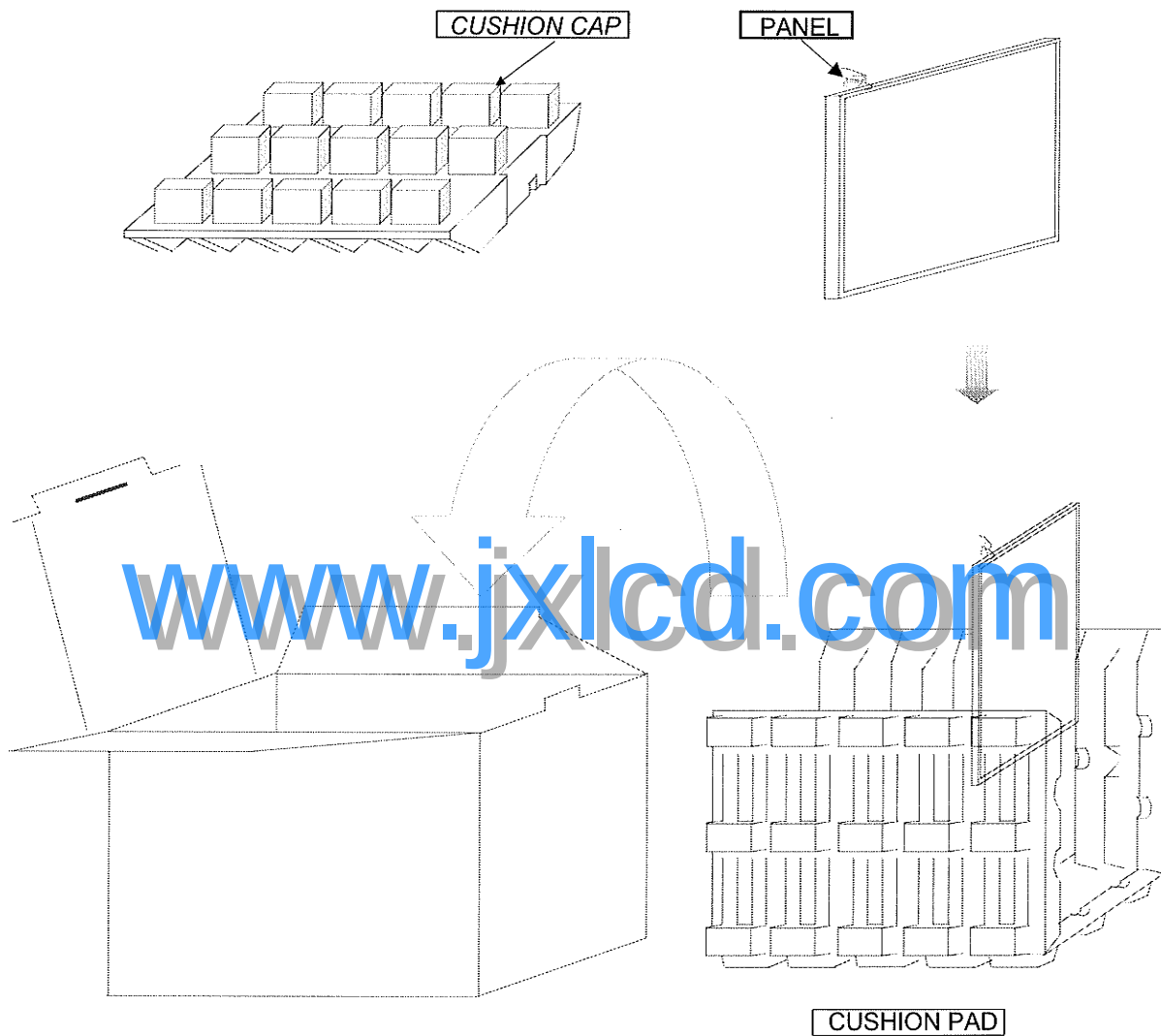
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1. CARTON(Internal Package)

(1) Packing Form

Corrugated Cardboard box and Corrupad form as shock absorber

(2) Packing Method



- Note 1) Total Weight : Approximately 10 kg
2) Acceptance number of piling : 10 sets
3) Carton size : 376(W) X 326(D) X 404(H)

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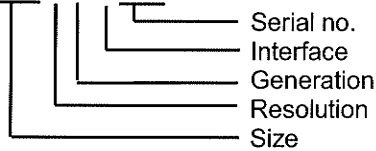
(3)Packing Material

No	Part name	Quantity
1	Static electric protective sack	10 pcs
2	Packing case (Inner box) included shock absorber	1 set
3	Pictorial marking	2 pcs
4	Carton	1 set

9. MARKINGS & OTHERS

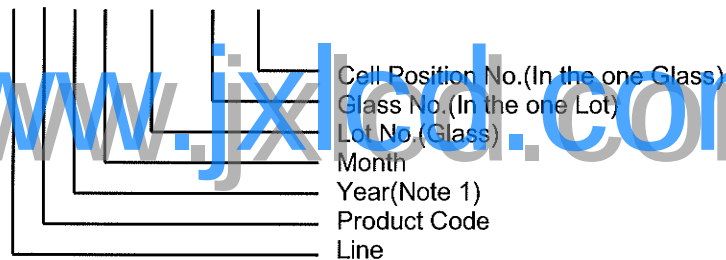
A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

(1) Parts number : LTNXXXXX-XXX



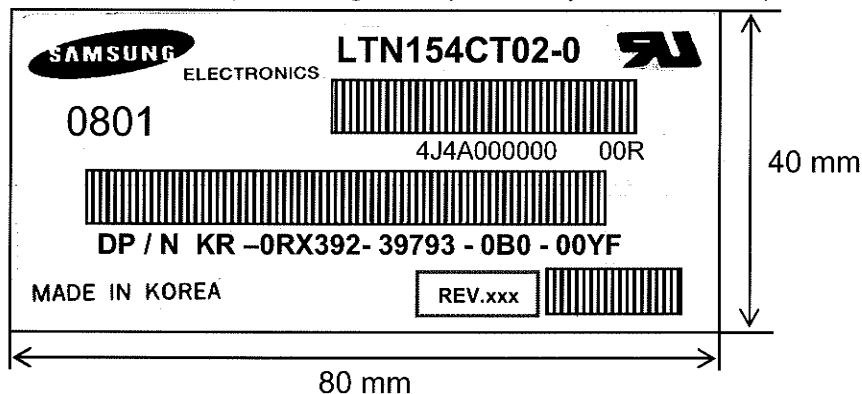
(2) Revision : Three letters

(3) Lot number : X Y 4 A XXX XX X



NOTE 1). This code indicating year is omitted in the products of KIHENG site.

(4) Nameplate Indication (Following example is only for reference)



Parts name : LTN154CT02-0

Lot number : 4J4A000000

Inspected work week : 0801

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DP/N : Dell Part Number ("0RX392" is for 154CT02-0)

REV.xxx : Product Revision Code (Refer to the next page)

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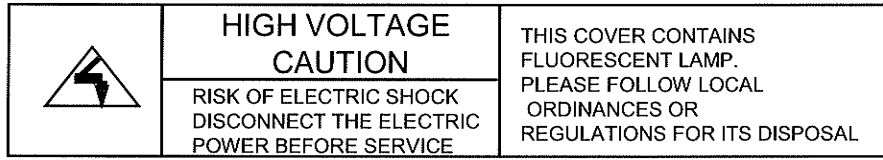
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This HIGH VOLTAGE CAUTION is carved in mold frame



10mm High voltage caution

70mm

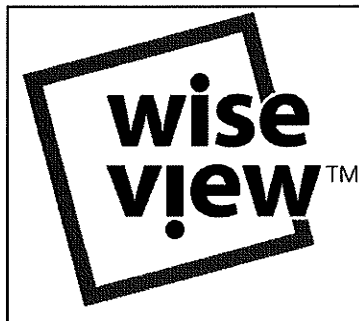
※ Panel revision code scheme (Refer to the Red box on the label)

Build Name(s)	Revision Code(s)
SST (WS)	X00, X01, X02, ... X09
PT (ES)	X10, X11, X12, ... X19
ST (CS)	X20, X21, X23, ... X29
XB (MP)	A00, A01, A02, ... A99

(6) Packing small box attach (Following example is only for reference)

SAMSUNG Elec CHEONAN CITY, CHUNGCHONGNAM-DO KOREA		LTNXXXXXXXX-XXX		0XXXXX : DELL P/N	
DP/N 0XXXXX				REV. xxx	
Box Qty 10		C/O-KR		Vendor ID/Loc : 21320/39792	
				Vendor Id/Loc: 39792/39792	

(7) Packing box Marking : Samsung TFT-LCD Brand Name



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10. GENERAL PRECAUTIONS

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1. Handling

- (a) When the module is assembled, It should be attached to the system firmly using every mounting holes. Be careful not to twist and bend the modules.
- (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 CCFT backlight.
- (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(Isoprophyl 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 C-MOS Gate Array IC.
- (i) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (j) Do not disassemble the module.
- (k) Do not pull or fold the lamp wire.
- (l) Do not adjust the variable resistor which is located on the back side.
- (m) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (n) Pins of I/F connector shall not be touched directly with bare hands.

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2. STORAGE

- (a) Do not leave the module 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.

3. OPERATION

- (a) Do not connect, disconnect the module in the "Power On" condition.
- (b) Power supply should always be turned on/off by following item 6.3
"Power on/off sequence".
- (c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- (d) The cable between the backlight connector and its inverter power supply shall be a minimized length and be connected directly. The longer cable between the backlight and the inverter may cause lower luminance of lamp(CCFT) and may require higher startup voltage(Vs).
- (e) The standard limited warranty is only applicable when the module is used for general notebook applications. If used for purposes other than as specified, SEC is not to be held reliable for the defective operations. It is strongly recommended to contact SEC to find out fitness for a particular purpose.

4. OTHERS

- (a) Ultra-violet ray filter is necessary for outdoor operation.
- (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, so on)
Otherwise the module may be damaged.
- (d) If the module 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 module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

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	Byte (hex)	Field Name and Comments	Value (hex)	Value (binary)
Header	0	Header	00	00000000
	1	Header	FF	11111111
	2	Header	FF	11111111
	3	Header	FF	11111111
	4	Header	FF	11111111
	5	Header	FF	11111111
	6	Header	FF	11111111
	7	Header	00	00000000
Vendor / Product EDID Version	8	EISA manufacture code = 3 Character ID	4C	01001100
	9	EISA manufacture code (Compressed ASCII)	A3	10100011
	0A	Panel Supplier Reserved - Product Code	43	01000011
	0B	Panel Supplier Reserved - Product Code	54	01010100
	0C	LCD module Serial No - Preferred but Optional ("0" if not used)	00	00000000
	0D	LCD module Serial No - Preferred but Optional ("0" if not used)	00	00000000
	0E	LCD module Serial No - Preferred but Optional ("0" if not used)	00	00000000
	0F	LCD module Serial No - Preferred but Optional ("0" if not used)	00	00000000
	10	Week of manufacture	00	00000000
	11	Year of manufacture	12	00010010
Display Parameters	12	EDID structure version # = 1	01	00000001
	13	EDID revision # = 3	03	00000011
	14	Video I/P definition = Digital I/P	90	10010000
	15	Max H image size = (Rounded to cm)	21	00100001
Panel Color Coordinates	16	Max V image size = (Rounded to cm)	15	00010101
	17	Display gamma = (gamma × 100) - 100 = Example: (2.2 × 100) - 100 = 120	78	01111000
	18	Feature support (no DPMS, Active off, RGB, timing BLK 1)	0A	00001010
	19	Red/Green Low bit (RxRy/GxGy)	87	10000111
	1A	Blue/White Low bit (BxBY/WxWy)	F5	11110101
	1B	Red X Rx = 0.xxx	94	10010100
	1C	Red Y Ry = 0.xxx	57	01010111
	1D	Green X Gx = 0.xxx	4F	01001111
	1E	Green Y Gy = 0.xxx	8C	10001100
	1F	Blue X Bx = 0.xxx	27	00100111
Established Timings	20	Blue Y By = 0.xxx	27	00100111
	21	White X Wx = 0.xxx	50	01010000
	22	White Y Wy = 0.xxx	54	01010100
	23	Established timings 1 (00h if not used)	00	00000000
	24	Established timings 2 (00h if not used)	00	00000000
	25	Manufacturer's timings (00h if not used)	00	00000000

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Standard Timing ID

26	Standard timing ID1 (01h if not used)	01	00000001
27	Standard timing ID1 (01h if not used)	01	00000001
28	Standard timing ID2 (01h if not used)	01	00000001
29	Standard timing ID2 (01h if not used)	01	00000001
2A	Standard timing ID3 (01h if not used)	01	00000001
2B	Standard timing ID3 (01h if not used)	01	00000001
2C	Standard timing ID4 (01h if not used)	01	00000001
2D	Standard timing ID4 (01h if not used)	01	00000001
2E	Standard timing ID5 (01h if not used)	01	00000001
2F	Standard timing ID5 (01h if not used)	01	00000001
30	Standard timing ID6 (01h if not used)	01	00000001
31	Standard timing ID6 (01h if not used)	01	00000001
32	Standard timing ID7 (01h if not used)	01	00000001
33	Standard timing ID7 (01h if not used)	01	00000001
34	Standard timing ID8 (01h if not used)	01	00000001
35	Standard timing ID8 (01h if not used)	01	00000001

Timing Descriptor #1

36	Pixel Clock/10,000 (LSB)	24	00100100
37	Pixel Clock/10,000 (MSB)	40	01000000
38	Horizontal Active = xxx pixels (lower 8 bits)	80	10000000
39	Horizontal Blanking (Thbp) = xxx pixels (lower 8 bits)	28	00101000
3A	Horizontal Active/Horizontal blanking (Thbp) (upper 4:4 bits)	71	01110001
3B	Vertical Active = xxx lines	B0	10110000
3C	Vertical Blanking (Tvbp) = xxx lines (DE Blanking typ. for DE only panels)	23	00100011
3D	Vertical Active : Vertical Blanking (Tvbp) (upper 4:4 bits)	40	01000000
3E	Horizontal Sync, Offset (Thfp) = xxx pixels	64	01100100
3F	Horizontal Sync, Pulse Width = xxx pixels	20	00100000
40	Vertical Sync, Offset (Tvfp) = xx lines Sync Width = xx lines	26	00100110
41	Horizontal Vertical Sync Offset/Width upper 2 bits	00	00000000
42	Horizontal Image Size = xxx mm	4B	01001011
43	Vertical image Size = xxx mm	CF	11001111
44	Horizontal Image Size / Vertical image size	10	00010000
45	Horizontal Border = 0 (Zero for Notebook LCD)	00	00000000
46	Vertical Border = 0 (Zero for Notebook LCD)	00	00000000

47	Bit[7] 0: Non-interlace, 1: Interlace Bit[6:5] 00: Normal display, no stereo, XX: See table xx for definition Bit[4:3] 00: Analog composite, 01: Bipolar analog composite, 10: Digital composite, 11: Digital separate Bit[2:1] :The interpretation of bits 2 and 1 is dependent on the decode of bits 4 and 3 - see Table 3.18 Bit[0] :See Table VESA EDID spec for definition Referenced Default = 1Ah	1A	00011010
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Timing Descriptor #2

48	Pixel Clock/10,000 (LSB)	C3	11000011
49	Pixel Clock/10,000 (MSB)	2A	00101010
4A	Horizontal Active = xxx pixels (lower 8 bits)	80	10000000
4B	Horizontal Blanking (Thbp) = xxx pixels (lower 8 bits)	28	00101000
4C	Horizontal Active/Horizontal blanking (Thbp) (upper 4:4 bits)	71	01110001
4D	Vertical Active = xxx lines	B0	10110000
4E	Vertical Blanking (Tvbp) = xxx lines (DE Blanking typ. for DE only panels)	23	00100011
4F	Vertical Active : Vertical Blanking (Tvbp) (upper 4:4 bits)	40	01000000
50	Horizontal Sync, Offset (Thfp) = xxx pixels	64	01100100
51	Horizontal Sync, Pulse Width = xxx pixels	20	00100000
52	Vertical Sync, Offset (Tvfp) = xx lines Sync Width = xx lines	26	00100110
53	Horizontal Vertical Sync Offset/Width upper 2 bits	00	00000000
54	Horizontal Image Size = xxx mm	4B	01001011
55	Vertical image Size = xxx mm	CF	11001111
56	Horizontal Image Size / Vertical image size	10	00010000
57	Horizontal Border = 0 (Zero for Notebook LCD)	00	00000000
58	Vertical Border = 0 (Zero for Notebook LCD)	00	00000000

59	Bit[7] 0: Non-interlace, 1: Interlace Bit[6:5] 00: Normal display, no stereo, XX: See table xx for definition Bit[4:3] 00: Analog composite, 01: Bipolar analog composite, 10: Digital composite, 11: Digital separate Bit[2:1] :The interpretation of bits 2 and 1 is dependent on the decode of bits 4 and 3 - see Table 3.18. Bit[0] :See Table VESA EDID spec for definition Referenced Default = 1Ah	1A	00011010
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Timing Descriptor #3 Dell specific information	5A	Flag	00	00000000
	5B	Flag	00	00000000
	5C	Flag	00	00000000
	5D	Data Type Tag: Alphanumeric Data String (ASCII)	FE	11111110
	5E	Flag	00	00000000
	5F	Dell P/N 1 st Character	52	01010010
	60	Dell P/N 2 nd Character	58	01011000
	61	Dell P/N 3 rd Character	33	00110011
	62	Dell P/N 4 th Character	39	00111001
	63	Dell P/N 5 th Character	32	00110010
Timing Descriptor #4	64	LCD Supplier EEDID Revision # Bit[7] : 0=X, 1=A Bit[6:0] : 00, 01, 02... for SST 10, 11, 12... for PT 20, 21, 22... for ST 00, 01, 02... for X-Build (if Bit[7]=1)	80	10000000
	65	Manufacturer P/N	31	00110001
	66	Manufacturer P/N	35	00110101
	67	Manufacturer P/N	34	00110100
	68	Manufacturer P/N	43	01000011
	69	Manufacturer P/N	54	01010100
	6A	Manufacturer P/N	0A	00001010
	6B	Manufacturer P/N (If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
	6C	Flag	00	00000000
	6D	Flag	00	00000000
	6E	Flag	00	00000000
	6F	Data Type Tag: Manufacturer Specified Data 00	FE	11111110
	70	Flag	00	00000000
	71	SMBUS Value = XX nits	00	00000000
	72	SMBUS Value = XX nits	00	00000000
	73	SMBUS Value = XX nits	00	00000000
	74	SMBUS Value = XX nits	00	00000000
	75	SMBUS Value = XX nits	00	00000000
	76	SMBUS Value = XXX nits	00	00000000
	77	SMBUS Value = XXX nits	00	00000000
	78	SMBUS Value = max nits (Typically = 00h, XXX nits)	00	00000000
Checksum	79	Bit[7:3] Reserved Bit[2] 0: No RTC support, 1: RTC support Bit[1:0] 00: reserved, 01: single LVDS, 10: dual LVDS, 11: reserved 01h single channel LVDS, no RTC support 02h dual channel LVDS, no RTC support 05h single channel LVDS, with RTC support 06h dual channel LVDS, with RTC support	02	00000010
	7A	BIST Enable: Yes = '01' No = '00'	01	00000001
	7B	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	0A	00001010
	7C	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
	7D	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
	7E	Extension flag (# of optional 128 EDID extension blocks to follow, Typ = 0)	00	00000000
	7F	Checksum (The 1-byte sum of all 128 bytes in this EDID block shall = 0)	ED	11101101

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