

SAMSUNG

ELECTRONICS

Approval



TO

DATE : August 29, 2005

SAMSUNG TFT-LCD

MODEL NO.: LTN150P4-L03

NOTE : Extension code [-P] → LTN150P4-L03-**P**
Surface type [**Anti-Glare**]
Green product (Complied with RoHS request)

Any Modification of Spec is not allowed without SEC' permission

APPROVED BY :

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PREPARED BY : Technical Customer Service Team

SAMSUNG ELECTRONICS CO., LTD.



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Doc.No.	LTN150P4-L03-P	Rev.No	04-A02-G-050829	Page	1 / 29
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CONTENTS

Revision History	----- (3)
General Description	----- (4)
1. Absolute Maximum Ratings	----- (5)
1.1 Absolute Ratings of environment	
1.2 Electrical Absolute Ratings	
2. Optical Characteristics	----- (7)
3. Electrical Characteristics	----- (10)
3.1 TFT LCD Module	
3.2 Backlight Unit	
4. Block Diagram	----- (13)
4.1 TFT LCD Module	
4.2 Backlight Unit	
5. Input Terminal Pin Assignment	----- (14)
5.1 Input Signal & Power	
5.2 LVDS Interface	
5.3 Backlight Unit	
5.4 Timing Diagrams of LVDS For Transmitting	
5.5 Input Signals, Basic Display Colors and Gray Scale of Each Color.	
5.6 Pixel format	
6. Interface Timing	----- (20)
6.1 Timing Parameters(DE Mode)	
6.2 Timing Diagrams of interface Signal (DE Mode)	
6.3 Power ON/OFF Sequence	
7. Mechanical Outline Dimension	----- (22)
8. Packing	----- (23)
9. Markings & Others	----- (24)
10. General Precautions	----- (25)
11. EEDID	----- (27)

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REVISION HISTORY

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Date	Revision No.	Page	Summary
April 7, 2003	P00	ALL	. LTN150P4-L03 model specification was First issued.
April 16, 2003	A00	All 7	. The Approval specification of LTN150P4-L03 was First issued. . Fixed the Color Chromaticity
Jan. 20, 2005	A01	23 24 21	. Box code revision according to implementation of RoHS product. . Revision code change from N00 to P00 . Revision of power sequence based on VESA standard 0 < T1 < 10ms → 0.5ms < T1 < 10ms 400ms < T4 → 500ms < T4
Aug. 29 2005	A02	20	. Revision of timing parameter : Back porch, pulse width

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Doc.No.	LTN150P4-L03-P	Rev.No	04-A02-G-050829	Page	3 / 29
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GENERAL DESCRIPTION

DESCRIPTION

LTN150P4-L03 is a 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 panel, a driver circuit and a backlight system. The resolution of a 15.0" contains 1400 x 1050 pixels and can display up to 262,144 colors. 6 O'clock direction is the Optimum viewing angle.

FEATURES

- Thin and light weight
- High contrast ratio
- SXGA-Plus (1400x1050 pixels) resolution
- Low power consumption
- DE (Data enable) only mode.
- LVDS Interface with 2 pixel / clock (2 channel)
- Green product (complied with RoHS requirement)

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	304.5(H)X228.375(V) (15.0"diagonal)	mm	
Driver element	a-si TFT active matrix		
Display colors	262,144		
Number of pixel	1400 x 1050 (SXGA-Plus)	pixel	
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.2175(H) x 0.2175(V)	mm	
Display Mode	Normally white		
Surface treatment	HAZE 44, HARD-COATING 2H ARC150T		

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Doc.No.	LTN150P4-L03-P	Rev.No	04-A02-G-050829	Page	4 / 29
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Mechanical Information

ITEM		MIN.	TYP.	MAX.	NOTE
Module Size	Horizontal (H)	316.8	317.3	317.8	
	Vertical (V)	241.4	242.0	242.6	
	Depth (D)	-	-	6.5	
Weight			600g	615g	

Note (1) Depth of signal interface connector part.

1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Storage temperate	T_{STG}	-25	60	°C	(1)
Operating temperate (Temperature of glass surface)	T_{OPR}	0	50	°C	(1)
Shock (non-operating)	Snop	-	220	G	(2), (4)
Vibration (non-operating)	Vnop	-	1. 5	G	(3), (4)

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

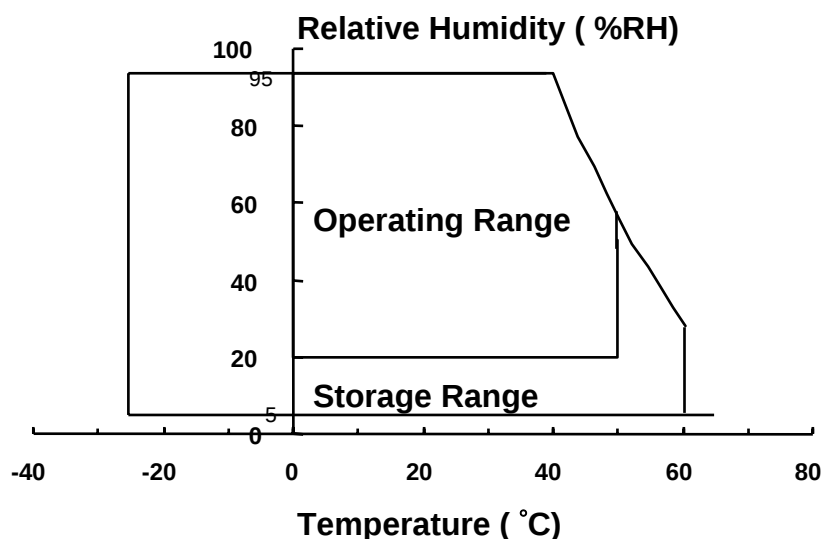
95 % RH Max. ($40^{\circ}\text{C} \geq T_a$)

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) 10 ~ 300 ~ 10 Hz, Sweep rate 10 min, 30 min 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.



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1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

(Vss = GND = 0 V)

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Power Supply Voltage	V _{CC}	V _{SS} -0.3	4.0	V	(1)
Logic Input Voltage	V _{IN}	V _{SS} -0.3	V _{CC} + 0.3	V	(1)

NOTE (1) Within Ta (25 ± 2 °C)

(2) BACK-LIGHT UNIT

Ta = 25 ± 2 °C

ITEM	SYMBOL	MIN.	MAX.	UNIT.	NOTE
Lamp current	I _L	2.0	7.0	mA _{RMS}	(1)
Lamp frequency	F _L	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.

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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).

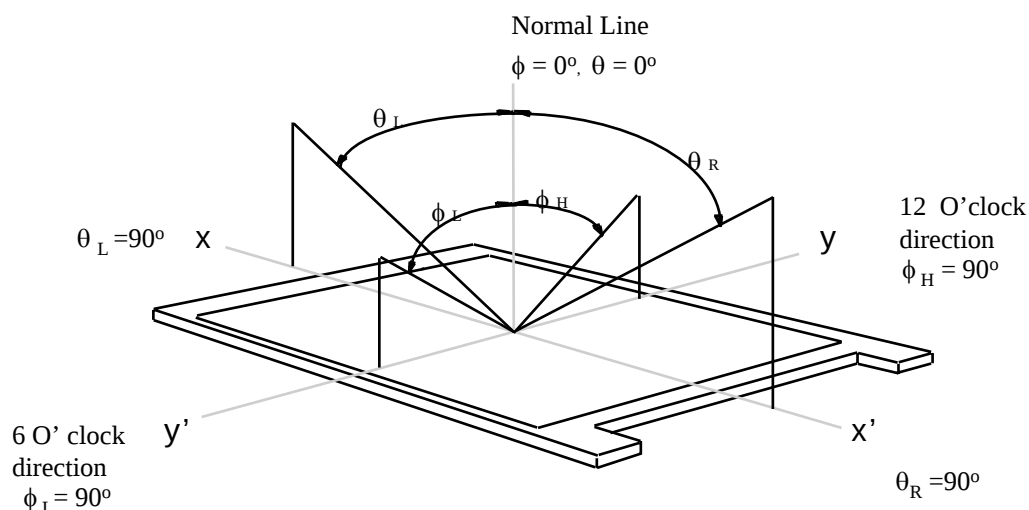
Measuring equipment : TOPCON BM-5A

* Ta = $25 \pm 2^{\circ}\text{C}$, VDD=3.3V, fv= 60Hz, fDCLK=54MHz, IL = 6.0 mA

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Contrast Ratio (5 Points)		CR	$\phi = 0,$ $\theta = 0$ Normal Viewing Angle	200	-	-		
Response Time at 25°C	Rising	T _R		-	10	20	msec	(1), (3)
	Falling	T _F		-	30	40		
Luminance of White (5points)		Y _L		120	150	-	cd/m ²	(1), (4)
Color Chromaticity (CIE)	Red	R _X		0.566	0.596	0.626		(1), (5)
		R _Y		0.318	0.348	0.378		
	Green	G _X		0.294	0.324	0.354		
		G _Y		0.517	0.547	0.577		
	Blue	B _X		0.122	0.152	0.182		
		B _Y		0.114	0.144	0.174		
	White	W _X		0.290	0.320	0.350		
		W _Y		0.305	0.335	0.365		
Viewing Angle	Hor.	θ_L	CR ≥10 (at center point)	40	45	-	Degrees	
		θ_R		40	45	-		
	Ver.	ϕ_H		15	20	-		
		ϕ_L		35	40	-		
13 Points White Variation		ΔL		-	1.75		(6)	

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Note 1) Definition of Viewing Angle :

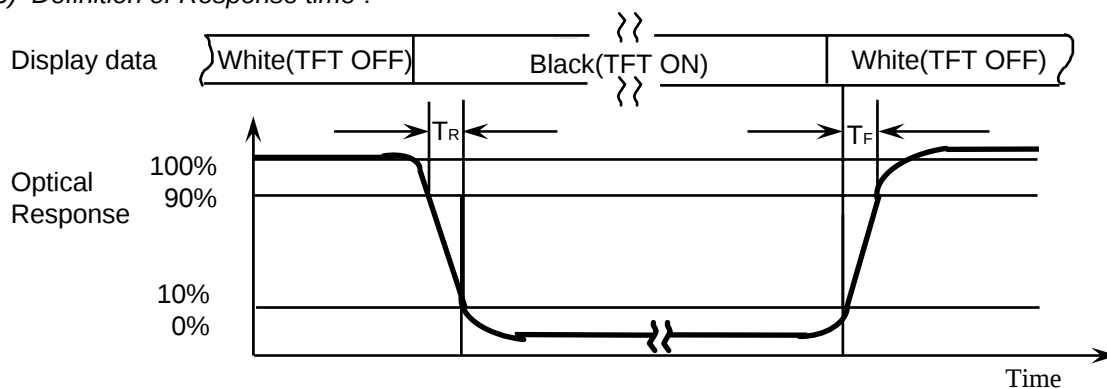


Note 2) Definition of Contrast Ratio (CR) :

$$CR = \frac{CR1 + CR2 + CR3 + CR4 + CR5}{5}$$

POINTS : (4), (5), (7), (9), (10) at 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.

Average Luminance of White ($Y_{L,AVE}$)

$$Y_{L,AVE} = \frac{Y_{L4} + Y_{L5} + Y_{L7} + Y_{L9} + Y_{L10}}{5}$$

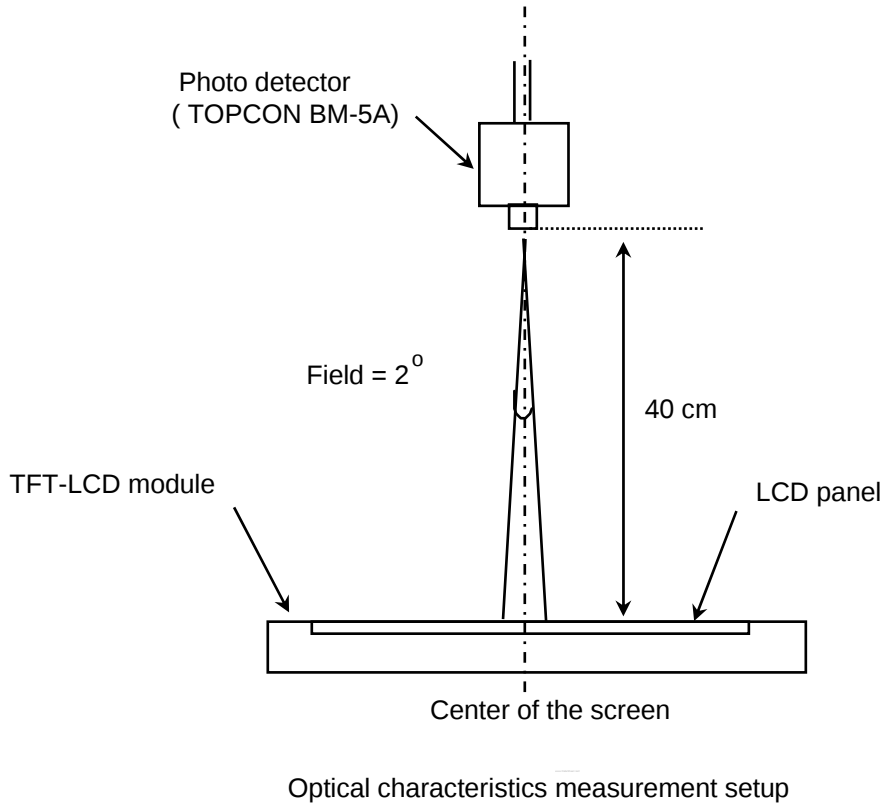
POINTS : (4), (5), (7), (9), (10) at FIGURE OF NOTE 6)

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Note 5) After stabilizing and leaving the panel alone at a given temperature for 30 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. 30 minutes after lighting the back-light. This should be measured in the center of screen.

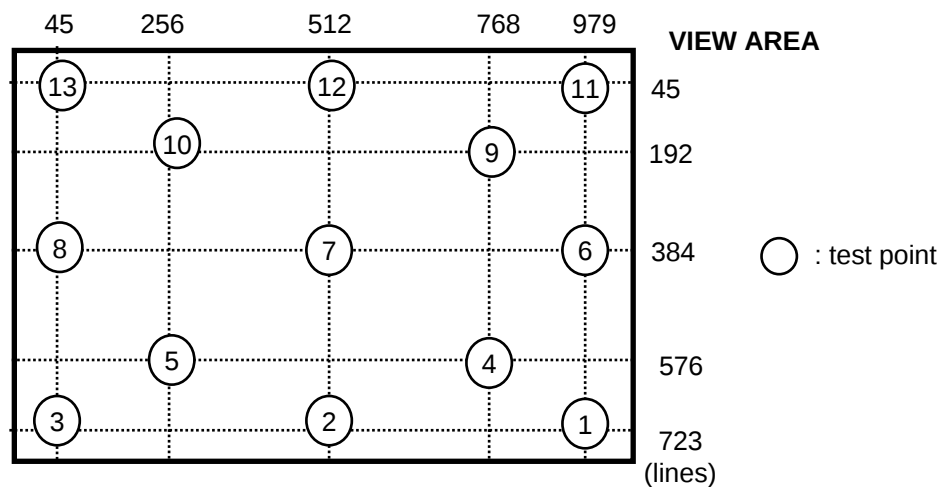
Lamp current : 6.0 mA

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



Note 6) Definition of 13 points white variation (δ_L) [① ~ ⑬]

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



3. ELECTRICAL CHARACTERISTICS

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3.1 TFT LCD MODULE

Ta=25 ± 2 °C

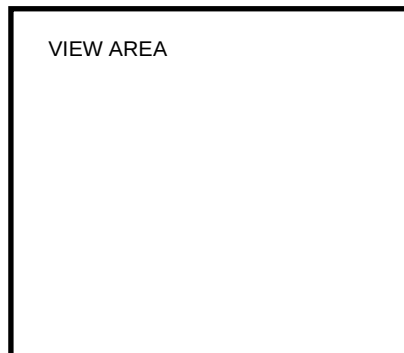
ITEM		SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Voltage of Power Supply		V _{DD}	3.0	3.3	3.6	V	
Differential Input Voltage for LVDS Receiver Threshold	High	V _{IH}	-	-	+100	mV	V _{CM} =+1.2V
	Low	V _{IL}	-100	-	-	mV	
Vsync Frequency		f _v	-	60	-	Hz	
Hsync Frequency		f _H	-	63.98	-	KHz	
Main Frequency		f _{DCLK}	53.57	54	54.43	MHz	
Rush Current		I _{RUSH}	-	-	1.5	A	(4)
Current of Power Supply	White	I _{DD}	-	425	-	mA	(2),(3)*a
	Mosaic		-	510	-	mA	(2),(3)*b
	Max Pattern		-	700	780	mA	(2),(3)*c

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

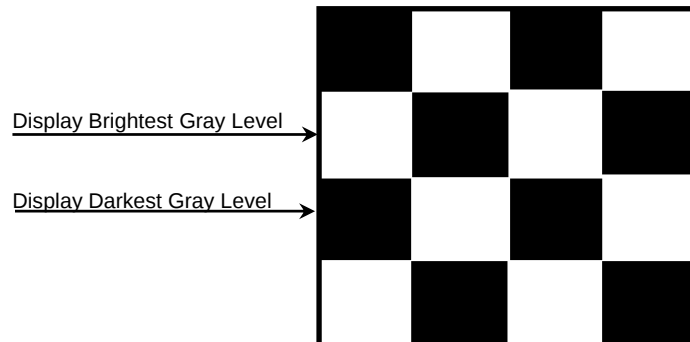
(2) f_v=60Hz, f_{DCLK} =54MHZ, V_{dd} = 3.3V , DC Current.

(3) Power dissipation pattern

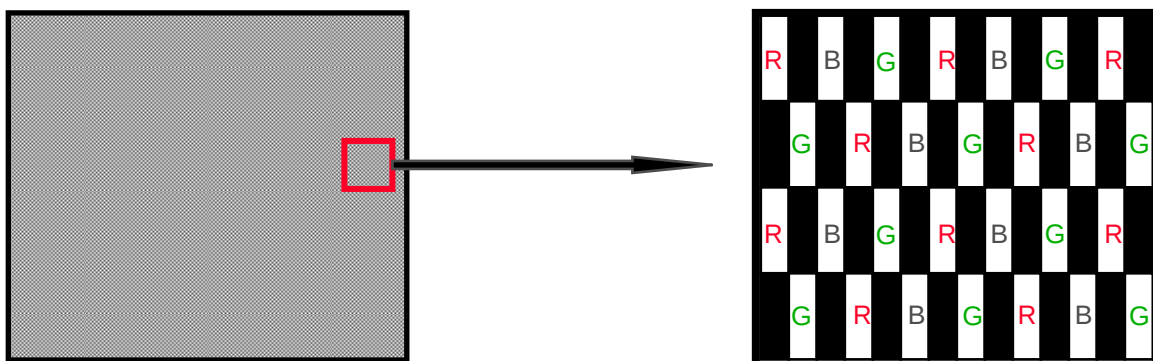
*a) White Pattern



*b) Mosaic Pattern

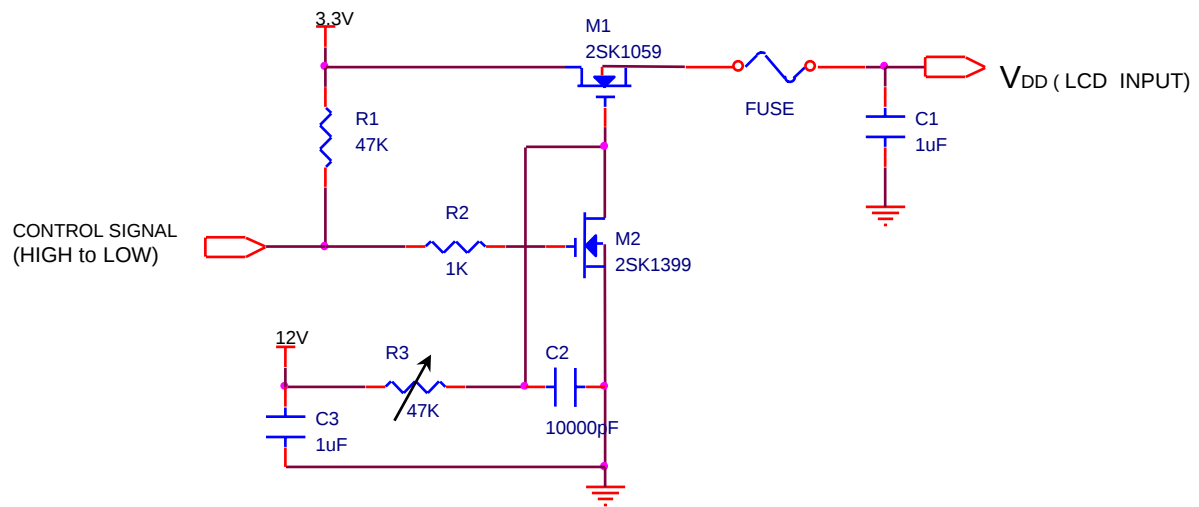


*c) 1dot Inversion Pattern (63/0 gray)

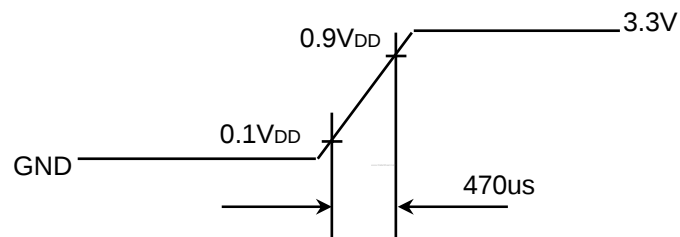


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4) Rush current measurement condition



V_{DD} rising time is 470us



3.2 BACK-LIGHT UNIT

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

INVERTER : SEM SIC130T

Ta=25 ± 2 °C

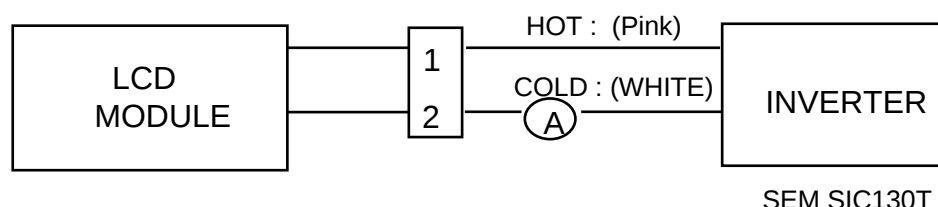
ITEM	SYMB	MIN	TYP	MAX	UNIT	NOTE
Lamp Current	I _L	3.0	6.0	6.5	mA _{rms}	(1)
Lamp Voltage	V _L	-	680	-	V _{rms}	I _L =6.0mA
Frequency	f _L	50	60	65	kHz	(2)
Power Consumption	P _L	-	4.0	-	W	(3)
Operating Life Time	H _r	10,000	-	-	Hour	(4)
Startup Voltage	V _s	-	-	1200 (25°C)	V _{rms}	(5)
				1450 (0 °C)		

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.



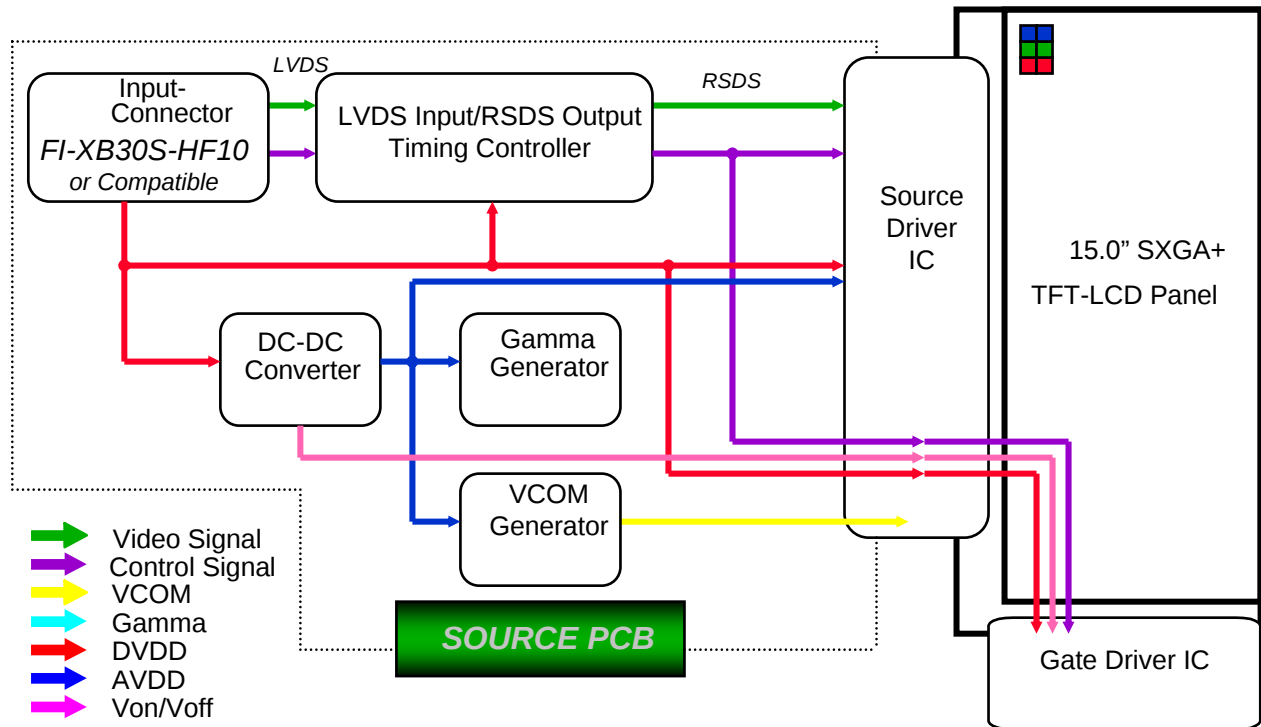
Switching Frequency : 50 ~ 65KHz

- (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 $I_L \times V_L$ to calculate.
- (4) Life time (Hr) of a lamp can be defined as the time in which it continues to operate under the condition $T_a = 25 \pm 2^\circ\text{C}$ and $I_L = 6.0 \text{ mA}_{\text{rms}}$ until one of the following event occurs.
1. When the brightness becomes 50% or lower than the original.
- (5) The voltage above this value should be applied to the lamp for more than 1 second to startup. Otherwise the lamp may not be turned on.

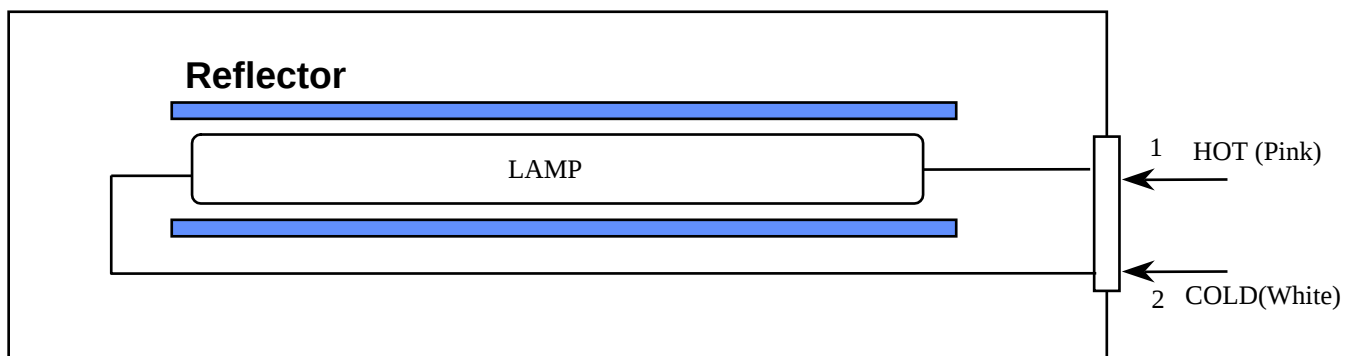
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4. BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 BACK-LIGHT UNIT



Note) The output of the inverter may change according to the material of the reflector.

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5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal & Power LVDS, Connector : (JAE, FI-XB30S-HF10)
Mating Connector :(JAE FI-X30M)

PIN NO	SYMBOL	FUNCTION	POLARITY	REMARK
1	Vss	Ground		
2	VDD	POWER SUPPLY +3.3V		
3	VDD	POWER SUPPLY +3.3V		
4	VEEDID	N/A (DDC 3.3V Power)		
5	NC	Reserved for supplier test point		
6	CLKEDID	N/A (DDC Clock)		
7	DATAEDID	N/A (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 B1-B5,Sync,DE)	Negative	
15	O_RxIN2+	LVDS Differential Data INPUT (Odd B1-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 B1-B5,Sync,DE)	Negative	
27	E_RxIN2+	LVDS Differential Data INPUT (Even B1-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

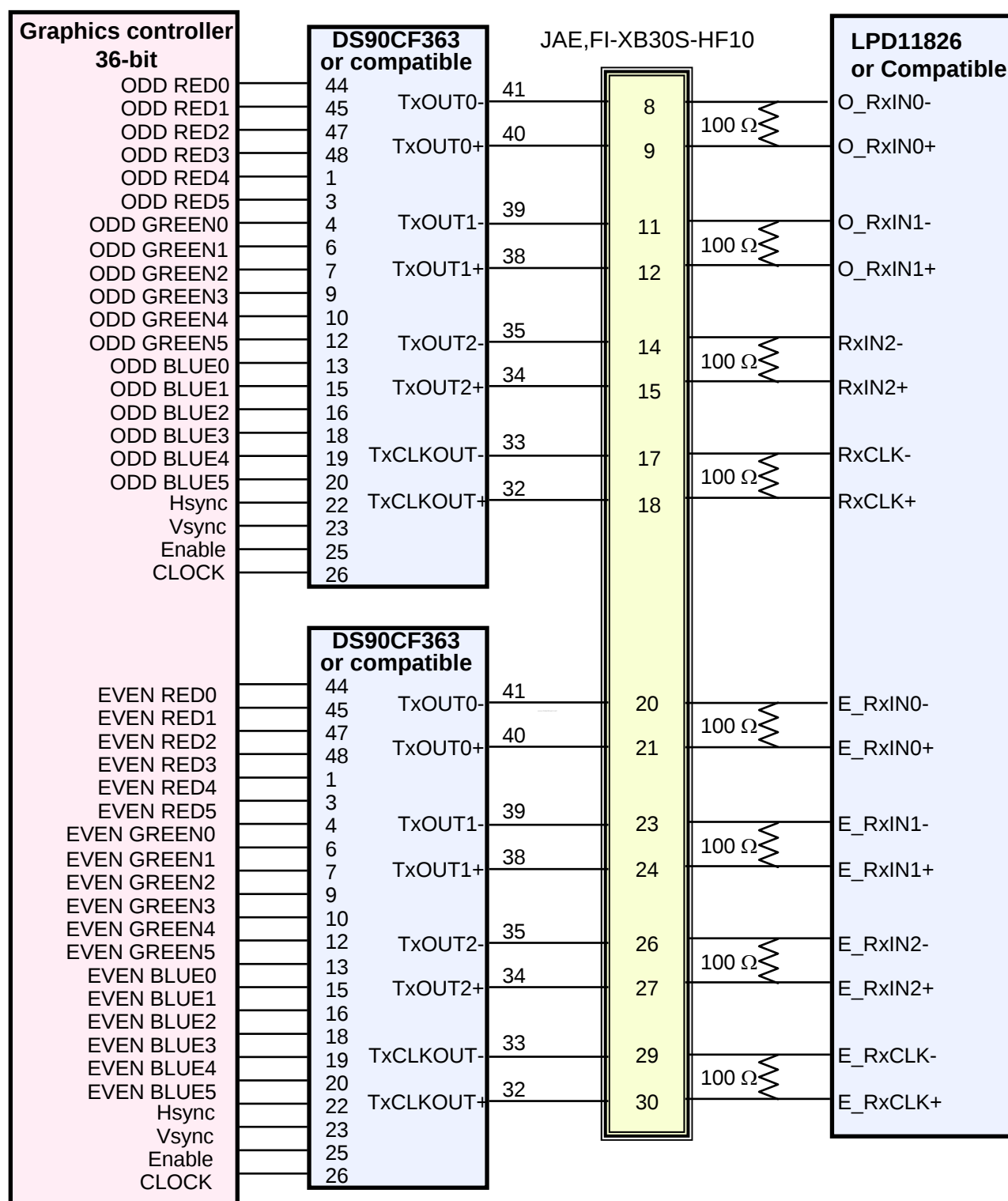
Pin No.	Name	RGB Signal	Pin No.	Name	RGB Signal
44	TxIN0	RO0	12	TxIN11	GO5
45	TxIN1	RO1	13	TxIN12	BO0
47	TxIN2	RO2	15	TxIN13	BO1
48	TxIN3	RO3	16	TxIN14	BO2
1	TxIN4	RO4	18	TxIN15	BO3
3	TxIN5	RO5	19	TxIN16	BO4
4	TxIN6	GO0	20	TxIN17	BO5
6	TxIN7	GO1	22	TxIN18	Hsync
7	TxIN8	GO2	23	TxIN19	Vsync
9	TxIN9	GO3	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	Hsync
7	TxIN8	GE2	23	TxIN19	Vsync
9	TxIN9	GE3	25	TxIN20	DE
10	TxIN10	GE4	26	TxCLK IN	Clock

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Flat Link Interface



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

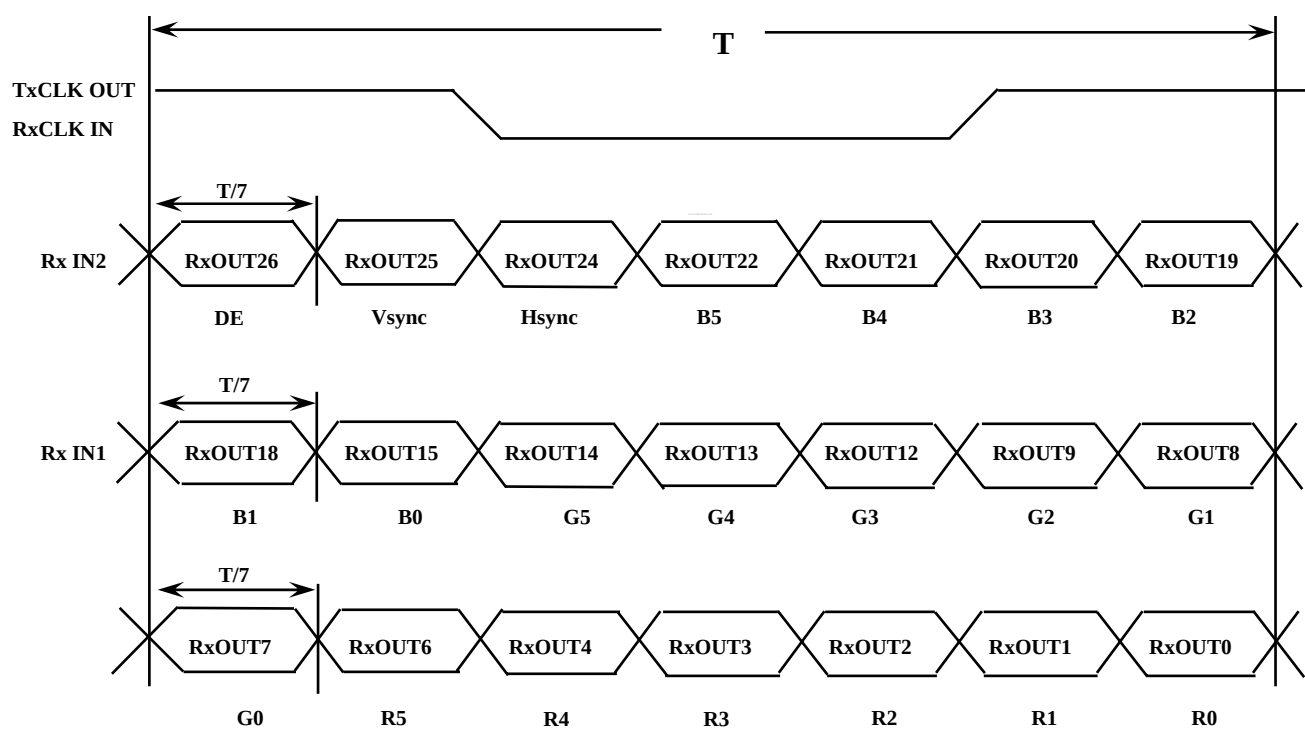
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5.3 BACK LIGHT UNIT

Connector : JST BHSR - 02VS -1

Pin NO.	Symbol	Color	Function
1	HOT	Pink	High Voltage
2	COLD	White	Ground

5.4 Timing Diagrams of LVDS For Transmission



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

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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	B5	
COLOR	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
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	↓ LIGHT	1	0	1	1	1	1	0	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	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
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	↓ LIGHT	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	G61
		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
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	↓ LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	B61
		0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	B62
	GREEN	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	B63

Note 1) Definition of gray :

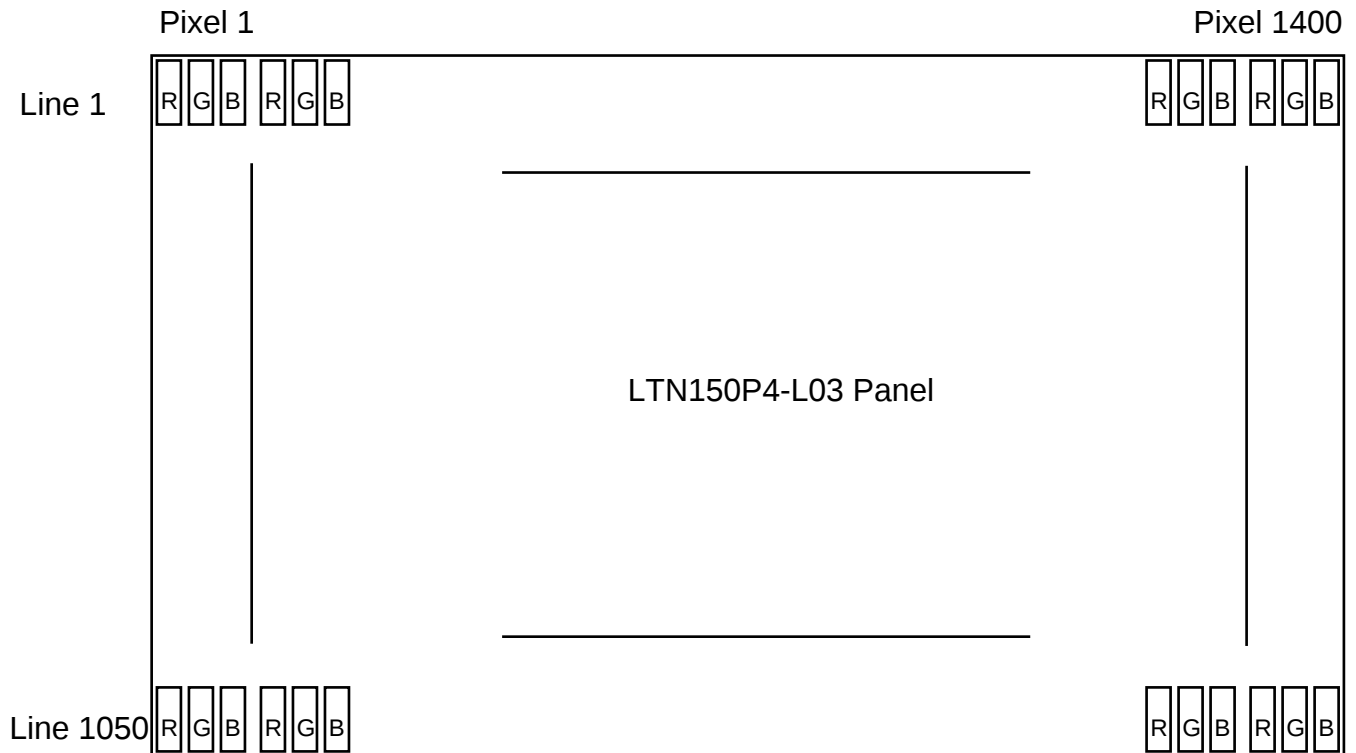
Rn: Red gray, Gn: Green gray, Bn: Blue gray (n=gray level)

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

SEC Secret

Doc.No.	LTN150P4-L03-P	Rev.No	04-A02-G-050829	Page	18 / 29
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5.6 Pixel Format in the display



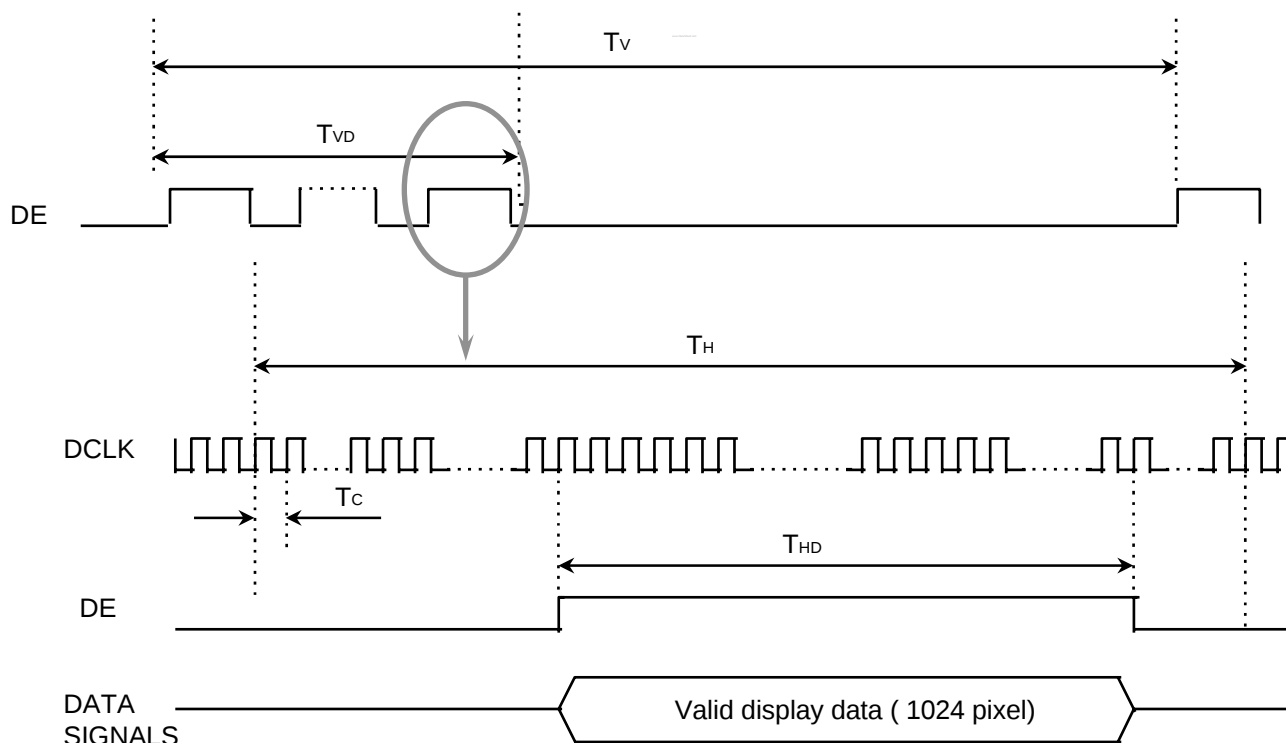
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6. INTERFACE TIMING

6.1 Timing Parameters

Signal	Item	Symbol	Min	Typ	Max	Unit	Note
Frame Frequency	Cycle	T_v	-	1066	-	Lines	
Vertical Active Display Term	Display Period	T_{VD}	-	1050	-	Lines	
One Line Scanning Time	Cycle	T_H	-	844	-	Clocks	
Horizontal Active Display Term	Display Period	T_{HD}	-	700	-	Clocks	
Vertical pulse width	Blanking period	VSPW	-	4	-	Lines	
Vertical back porch	Blanking period	Tvbp	-	15	-	Lines	
Horizontal pulse width	Blanking period	HSPW	-	56	-	Clocks	
Horizontal back porch	Blanking period	Thbp	-	120	-	Clocks	

6.2 Timing diagrams of interface signal

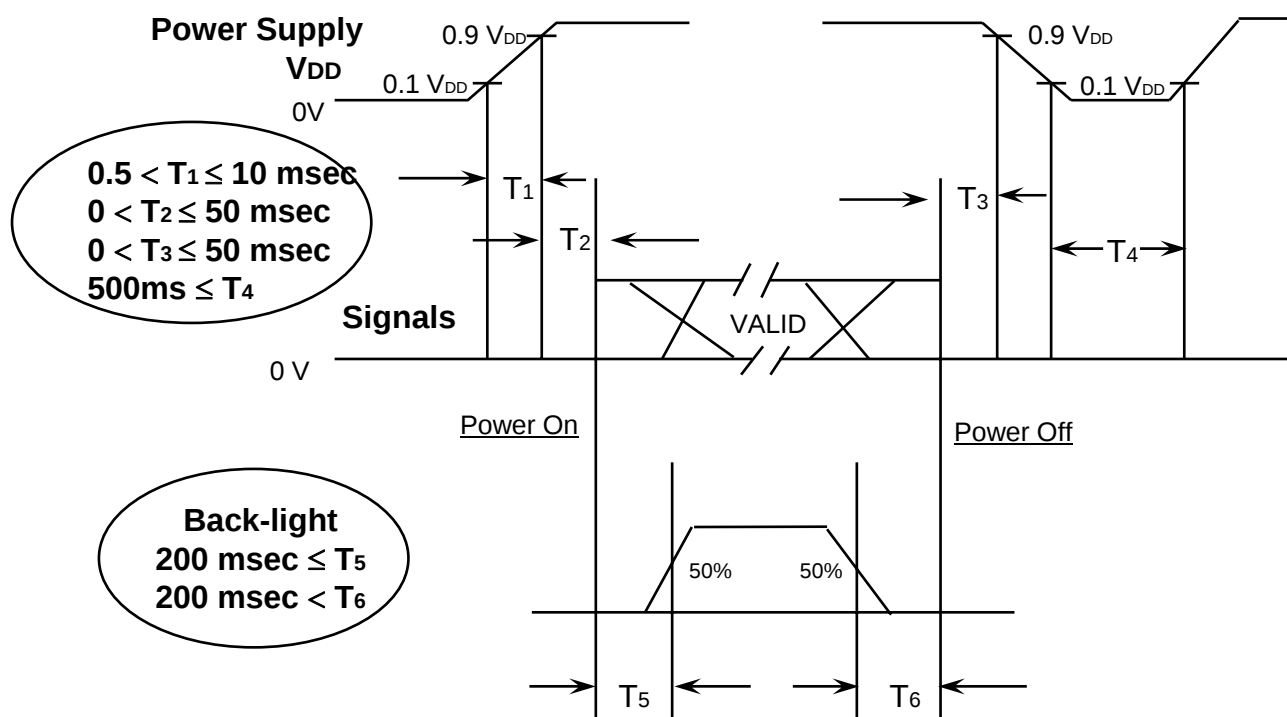


Note : All input condition(level&timing) for SN75LVDS88 are the same with those of LPD11826 or compatible.

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6.3 Power ON/OFF Sequence

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



Power ON/OFF Sequence

- 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 V_{DD}.
- (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become white.
- (3) In case of V_{DD} = 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.

SEC Secret

7. Mechanical Outline Dimension

Approval

[Refer to the next page]

SEC Secret

Doc.No.	LTN150P4-L03-P	Rev.No	04-A02-G-050829	Page	22 / 29
---------	----------------	--------	-----------------	------	---------

8. Packing

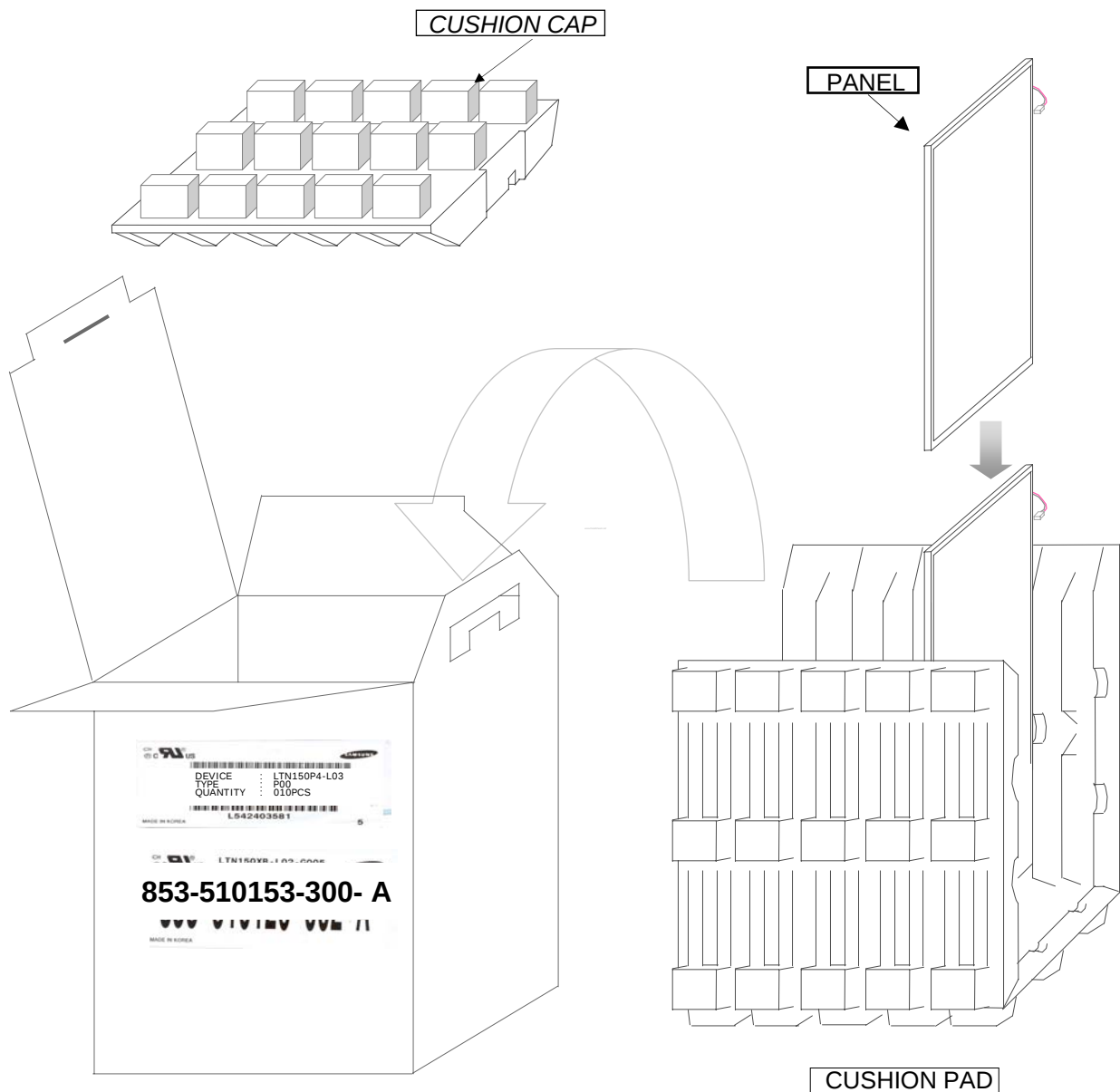
8.1 Packing

CARTON(Internal Package)

(1)Packing Form

Corrugated fiberoard box and corrugated cardboard as shock absorber

(2)Packing Method



Note (1)Total : Approx. 7.5Kg

(2)Acceptance number of piling : 10 sets

(3)Carton size : 325(W) X 260(D) X 420(H)

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(3)Packing Material

No.	Parts name	Quantity
1	Static electric protective sack	10
2	Cushion pad (Inner box) Included shock absorber	1set
3	Pictorial marking	2 pics
4	Carton	1 set

9. MARKINGS & OTHERS

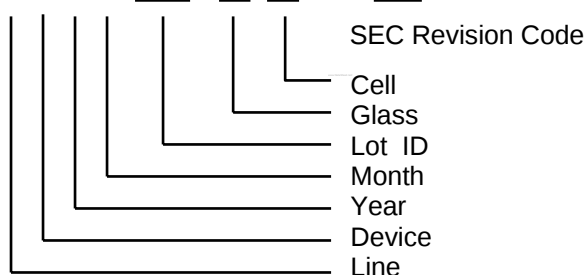
A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

(1)Parts number : LTN150P4-L03

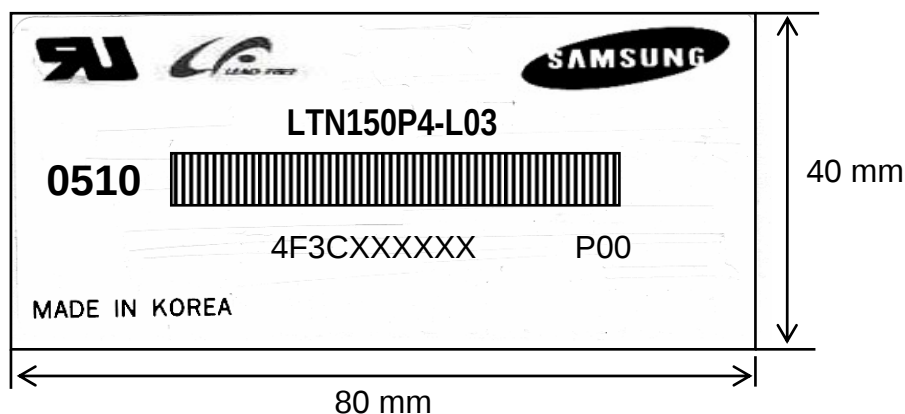
(2)Revision : One letter

(3)Control code : One letter

(4)Lot number : 4 F 3 C XXX XX X XXX



(5) Nameplate Indication



Parts name : LTN150P4 - L03

Lot number : 4F3CXXXXXX

Inspected work week : 0510(2005 year 10th week)

Product Revision Code : P00 (Meaning of RoHS product)

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10. GENERAL PRECAUTIONS

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 Keptone 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.

SEC Secret

Doc.No.	LTN150P4-L03-P	Rev.No	04-A02-G-050829	Page	25 / 29
----------------	----------------	---------------	-----------------	-------------	---------

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.

SEC Secret

Doc.No.	LTN150P4-L03-P	Rev.No	04-A02-G-050829	Page	26 / 29
----------------	----------------	---------------	-----------------	-------------	---------

11. EEDID

Approval

Address (HEX)	FUNCTION	Value HEX	BIN	DEC	ASCII or Data	Notes
00	Header	00	00000000	0		EDID Header
01		FF	11111111	255		
02		FF	11111111	255		
03		FF	11111111	255		
04		FF	11111111	255		
05		FF	11111111	255		
06		FF	11111111	255		
07		00	00000000	0		
08	ID Manufacturer Name	4C	01001100	76	S	3 character ID
09		A3	10100011	163	E C	"SEC"
0A	ID Product Code	00	00000000	0		
0B		00	00000000	0		
0C	32-bit serial no.	00	00000000	0		
0D		00	00000000	0		
0E		00	00000000	0		
0F		00	00000000	0		
10	Week of manufacture	00	00000000	0		
11	Year of manufacture	0E	00001110	14	2004	2004
12	EDID Structure Ver.	01	00000001	1	1	EDID Ver. 1.0
13	EDID revision #	03	00000011	3	3	EDID Rev. 3
14	Video input definition	80	10000000	128		
15	Max H image size	1F	00011111	31	31	30.5 cm(approx)
16	Max V image size	17	00010111	23	23	22.8 cm(approx)
17	Display Gamma	78	01111000	120	2.2	Gamma 2.2
18	Feature support	0A	00001010	10		
19	Red/green low bits	87	10000111	135		10000111
1A	Blue/white low bits	FE	11111110	254		11111110
1B	Red x/ high bits	94	10010100	148	0.580	Red x0.580= 1001010010
1C	Red y	57	01010111	87	0.340	Red y0.340= 0101011100
1D	Green x	4F	01001111	79	0.310	Green x0.310= 0100111101
1E	Green y	8C	10001100	140	0.550	Green y0.550= 1000110011
1F	Blue x	27	00100111	39	0.155	Blue x0.155= 0010011111
20	Blue y	27	00100111	39	0.155	Blue y0.155= 0010011111
21	White x	50	01010000	80	0.315	White x0.315= 0101000011
22	White y	54	01010100	84	0.330	White y0.330= 0101001010
23	Established timing 1	00	00000000	0		
24	Established timing 2	00	00000000	0		
25	Established timing 3	00	00000000	0		

SEC Secret

Doc.No.	LTN150P4-L03-P	Rev.No	04-A02-G-050829	Page	27 / 29
---------	----------------	--------	-----------------	------	---------

26	Standard timing #1	01	00000001	1		not used
27		01	00000001	1		
28	Standard timing #2	01	00000001	1		not used
29		01	00000001	1		
2A	Standard timing #3	01	00000001	1		not used
2B		01	00000001	1		
2C	Standard timing #4	01	00000001	1		not used
2D		01	00000001	1		
2E	Standard timing #5	01	00000001	1		not used
2F		01	00000001	1		
30	Standard timing #6	01	00000001	1		not used
31		01	00000001	1		
32	Standard timing #7	01	00000001	1		not used
33		01	00000001	1		
34	Standard timing #8	01	00000001	1		not used
35		01	00000001	1		
36	Detailed timing/monitor descriptor #1	30	00110000	48	108	Main clock= 108 MHz
37		2A	00101010	42		
38		78	01111000	120	1400	Hor active=700*2 pixels
39		20	00100000	32	288	Hor blanking=288 pixels
3A		51	01010001	81		4bit : 4bit
3B		1A	00011010	26	1050	Vertical active=1050 lines
3C		10	00010000	16	16	Vertical blanking=16 lines
3D		40	01000000	64		4bit : 4bit
3E		30	00110000	48	48	Hor sync. Offset=24 pixels
3F		70	01110000	112	112	H sync. Width=56 pixels
40		14	00010100	20	1 4	V sync. Offset=1 lines V sync. Width=4 lines
41		00	00000000	0		2bit : 2bit :2bit :2bit
42		31	00110001	49	305	H image size= 305 mm(approx)
43		E4	11100100	228	228	Vimage size = 228 mm(approx)
44		10	00010000	16		
45		00	00000000	0		No Horizontal Border
46		00	00000000	0		No Vertical Border
47		19	00011001	25		
48	Detailed timing/monitor descriptor #2	00	00000000	0		Manufacturer Specified (Timing)
49		00	00000000	0		
4A		00	00000000	0		
4B		00	00000000	0		
4C		00	00000000	0		
4D		00	00000000	0		Value=HSPWmin / 2
4E		00	00000000	0		Value=HSPWmax / 2
4F		00	00000000	0		Value=Thbpmin / 2
50		00	00000000	0		Value=Thbpmax / 2
51		00	00000000	0		Value=VSPWmin / 2
52		00	00000000	0		Value=VSPWmax / 2
53		00	00000000	0		Value=Tvbpmin / 2
54		00	00000000	0		Value=Tvbpmax / 2
55		00	00000000	0		Thpmin= value*2 + HA pixelclks
56		00	00000000	0		Thpmax= value*2 + HA pixelclks
57		00	00000000	0		Tvpmin= value*2 + VA lines
58		00	00000000	0		Tvpmax= value*2 + VA lines
59		00	00000000	0		Module revision

SEC Secret

5A	Detailed timing/monitor descriptor #3	00	00000000	0		ASCII Data String Tag
5B		00	00000000	0		
5C		00	00000000	0		
5D		FE	11111110	254		
5E		00	00000000	0		
5F		53	01010011	83	[S]	
60		41	01000001	65	[A]	
61		4D	01001101	77	[M]	
62		53	01010011	83	[S]	
63		55	01010101	85	[U]	
64		4E	01001110	78	[N]	
65		47	01000111	71	[G]	
66		0A	00001010	10	[N]	
67		20	00100000	32	[]	
68		20	00100000	32	[]	
69		20	00100000	32	[]	
6A		20	00100000	32	[]	
6B		20	00100000	32	[]	
6C	Detailed timing/monitor descriptor #4	00	00000000	0		Monitor Name Tag (ASCII)
6D		00	00000000	0		
6E		00	00000000	0		
6F		FE	11111110	254		
70		00	00000000	0		
71		4C	01001100	76	[L]	
72		54	01010100	84	[T]	
73		4E	01001110	78	[N]	
74		31	00110001	49	[1]	
75		35	00110101	53	[5]	
76		30	00110000	48	[0]	
77		50	01010000	80	[P]	
78		34	00110100	52	[4]	
79		2D	00101101	45	[=]	
7A		4C	01001100	76	[L]	
7B		30	00110000	48	[0]	
7C		33	00110011	51	[3]	
7D		0A	00001010	10	[N]	
7E	Extension Flag	00	00000000	0		
7F	Checksum	2F	00101111	47		

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