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ELECTRONICS

LEAD-FREE

TO　　　:

DATE　　: Nov. 22, 2010

SAMSUNG TFT-LCD

MODEL NO. : LTN156AT15-Cxx

NOTE : Extension code [- Cxx 　]
　　　　　 → LTN156AT15-Cxx
　　　　Surface type [**Glare**]

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

Application engineering part, Mobile Division
Samsung Electronics Co., Ltd.

wise view™

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Date	Revision No.	Page	Summary
Nov.22	A00	All	The approval specification of LTN156AT15-Cxx was issued first.

GENERAL DESCRIPTION

DESCRIPTION

LTN156AT15 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 15.6" contains 1366 x 768 pixels and can display up to 262,144 colors. 6 O'clock direction is the optimum viewing angle.

FEATURES

- High contrast ratio
- HD(1366 x 768 pixels) resolution
- Low power consumption
- Fast Response
- LED Back Light with embedded LED Driver
- DE (Data enable) only mode
- 3.3V LVDS Interface
- Onboard EEDID chip

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	344.232 (H) x 193.536 (V) (15.6"diagonal)	mm	
Driver element	a-Si TFT active matrix		
Display colors	262,144		
Number of pixel	1366 * 768	pixel	
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.252 (H) x 0.252 (V) (TYP.)	mm	
Display Mode	Normally white		
Surface treatment	Haze 0, Hardness 3H		Glare

Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal (H)	358.8	359.3	359.8	mm	
	Vertical (V)	208.95	209.45	209.95	mm	
	Depth (D)	-	-	4.0	mm	(1)
Weight		-	405	420	g	

Note (1) Measurement condition of outline dimension
. Equipment : Bernier 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)
Operating temperate (Temperature of glass surface)	TOPR	0	50	°C	(1)
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. ($40\,°C \geq Ta$)
Maximum wet - bulb temperature at 39 ^{O}C or less. ($Ta > 40\,°C$) No condensation

Relative Humidity (%RH)

(40,90)

Operating Range

(50,50.4)

(60,27.7)

Storage Range

Temperature (^{O}C)
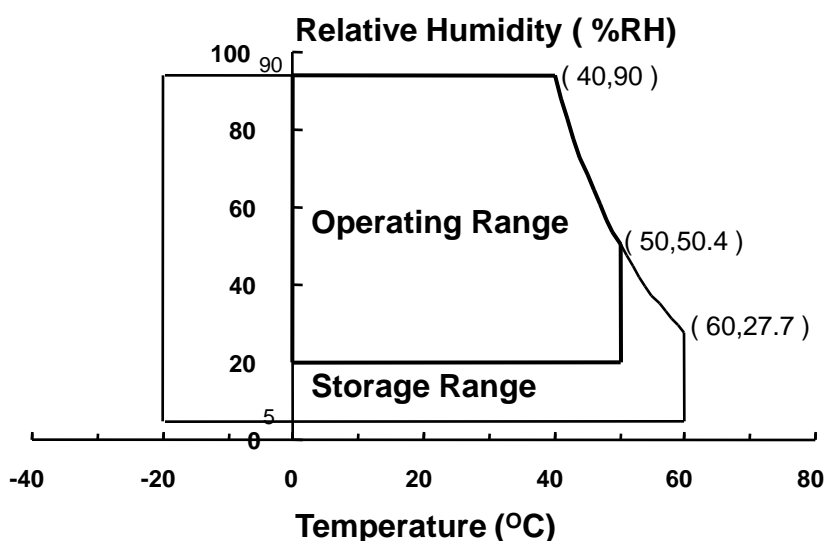
(2) 2ms, half sine wave, one time for $\pm X, \pm Y, \pm Z$.
(3) 5 - 500 Hz, random vibration, 30min for X, Y, Z.
(4) At testing Vibration and Shock, the fixture in holding the Module to be tested have to be hard and rigid enough so that the Module would not be twisted or bent by the fixture.

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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 Ta (25 $\pm$ 2 $^\circ$C)
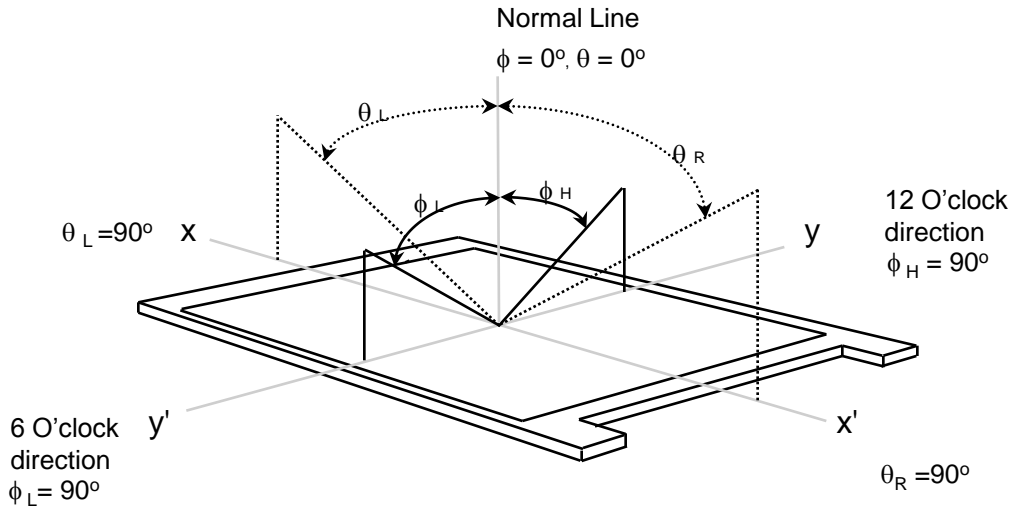
2. OPTICAL CHARACTERISTICS

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 SR-3

$*$ Ta = 25 $\pm$ 2 °C, V_{DD}=3.3V, fv= 60Hz, f_{DCLK} = 72.33MHz, IF = 100% duty

Item		Symbol	Condition	Min.	Typ.	Max	Unit	Note
Contrast Ratio (5 Points)		CR		300	500	-	-	(1), (2), (5)
Response Time at Ta (Rising + Falling)		T_{RT}		-	16	25	msec	(1), (3)
Average Luminance of White (5 Points)		$Y_{L,AVE}$		190	220	-	cd/m^2	IF=100% duty (1), (4)
Color Chromaticity (CIE)	Red	R_X	Normal Viewing Angle ϕ = 0 θ = 0	-0.03	0.615	+0.03	-	(1), (5) SR-3
		R_Y			0.355			
	Green	G_X			0.355			
		G_Y			0.610			
	Blue	B_X			0.150			
		B_Y			0.100			
	White	W_X			0.313			
		W_Y			0.329			
Viewing Angle	Hor.	θ_L	CR $\geq$ 10 At center	40	45	-	Degrees	(1), (5) SR-3
		θ_H		40	45	-		
	Ver.	ϕ_H		15	15	-		
		ϕ_L		30	30	-		
Color Gamut		CG		-	60	-	%	
13 Points White Variation		δ_L		-	-	1.7	-	(6)

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Note 1) Definition of Viewing Angle : Viewing angle range(10 ≤ C/R)

Normal Line
$\phi = 0°, \theta = 0°$

θ_L

θ_R

ϕ_L ϕ_H

$\theta_L = 90°$ x

12 O'clock direction
$\phi_H = 90°$

y

6 O'clock direction
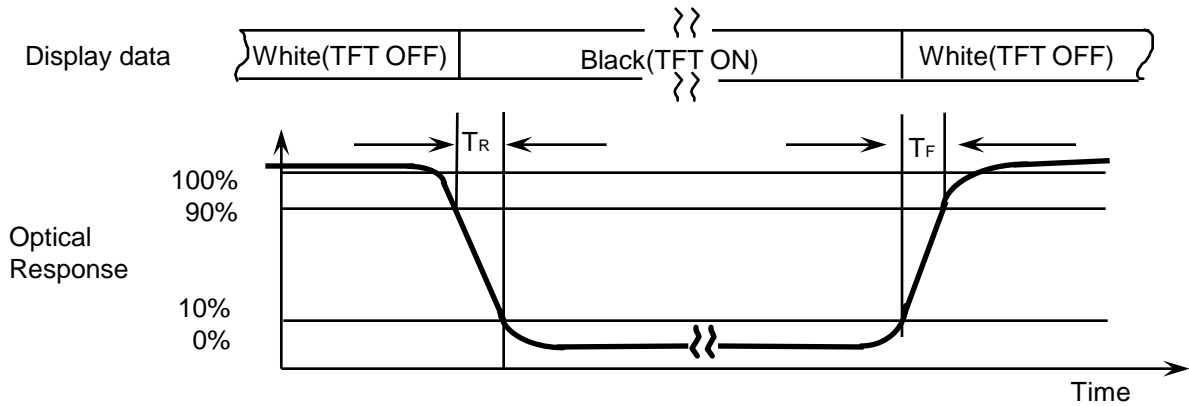$\phi_L = 90°$ y'

x'

$\theta_R = 90°$

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 :

Display data   White(TFT OFF)   Black(TFT ON)   White(TFT OFF)

T_R T_F

Optical Response

100%
90%

10%
0%

Time

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

256   512   768

VIEW AREA

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

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

⑩   ⑨   150

⑦   300

⑤   ④   450
(lines)

◯ : test point
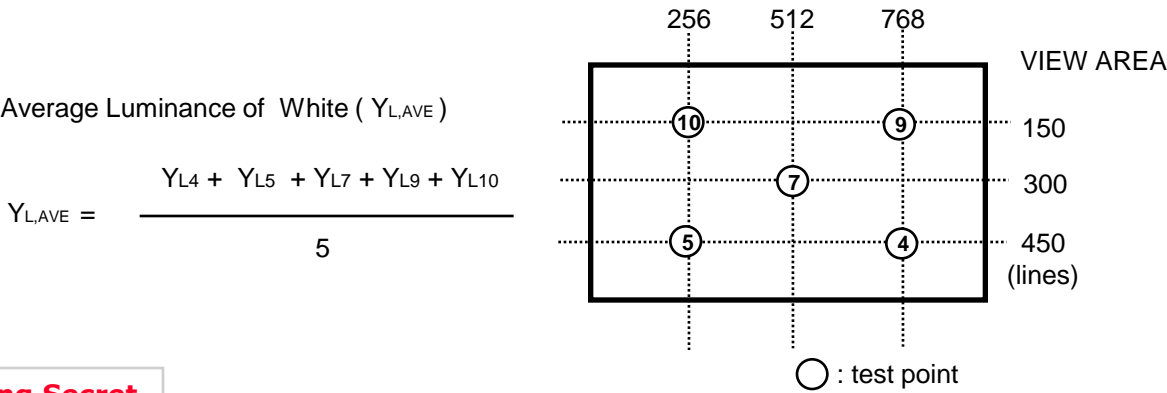
Note 5) After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless,and dark room. 30 min after lighting the backlight. This should be measured in the center of screen.
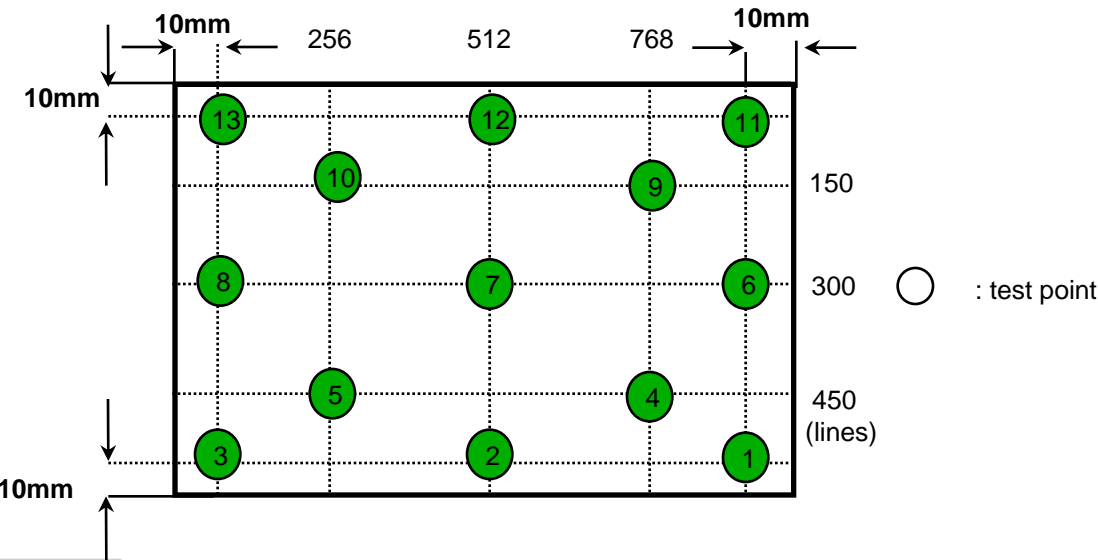IF current : 27mA
Environment condition : Ta = 25 $\pm$ 2 $^{\circ}$C

Photo-detector
(TOPCON SR-3)

Field = 2°

50 cm

TFT-LCD module

LCD panel

Center of the screen

[Optical characteristics measurement setup]
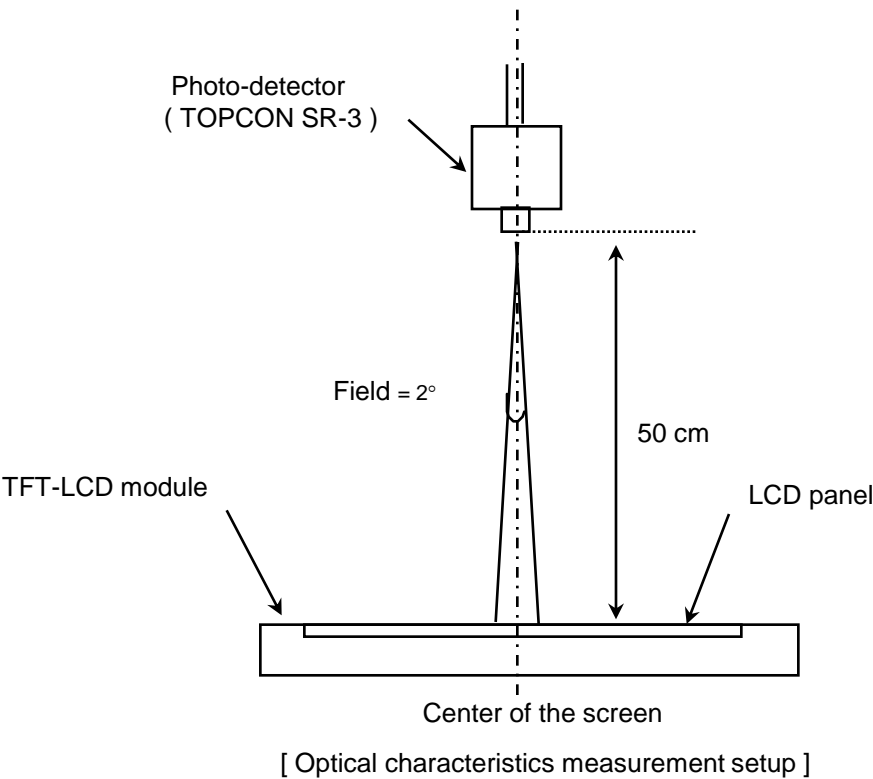
Note 6) Definition of 13 points white variation (δ L), CR variation(Cver) [(1) ~ (13)]

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

10mm   256   512   768   **10mm**

10mm

13   12   11

10   9   150

8   7   6   300   ◯   : test point

5   4   450
(lines)

3   2   1

10mm

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3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Ta= $25 \pm 2°C$

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		fv	-	60	-	Hz	
Main Frequency		f_{DCLK}	-	72.33	-	MHz	-
Rush Current		I_{RUSH}	-	-	1.5	A	(4)
Current of Power Supply	White	I_{DD}	-	200	-	mA	(2),(3)*a
	Mosaic		-	220	-	mA	(2),(3)*b
	V. stripe		-	350	-	mA	(2),(3)*c

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

　　　 (2) fv = 60Hz, f_{DCLK} = 72.33MHZ, V_{DD} = 3.3V , DC Current.
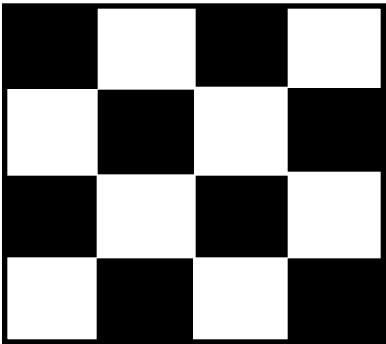
　　　 (3) Power dissipation pattern
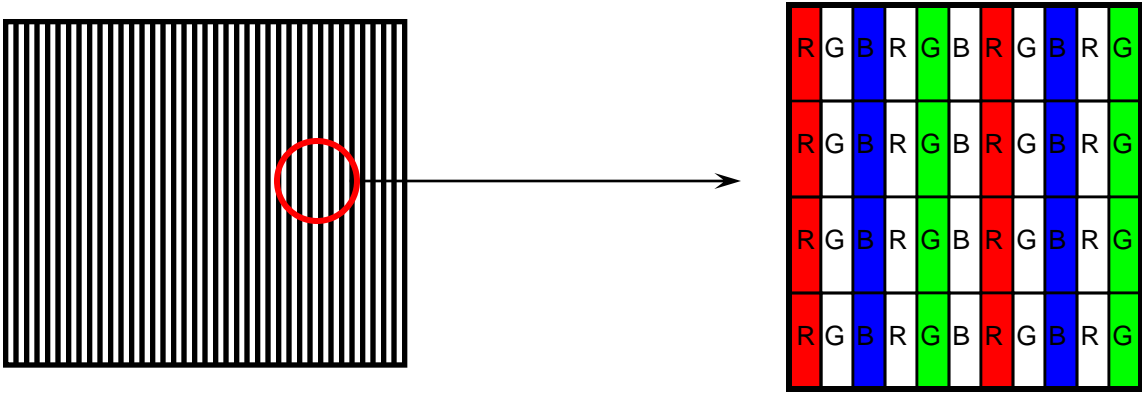
*a) White Pattern

VIEW AREA
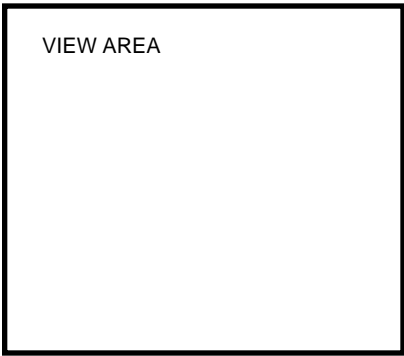
Display Brightest Gray Level →
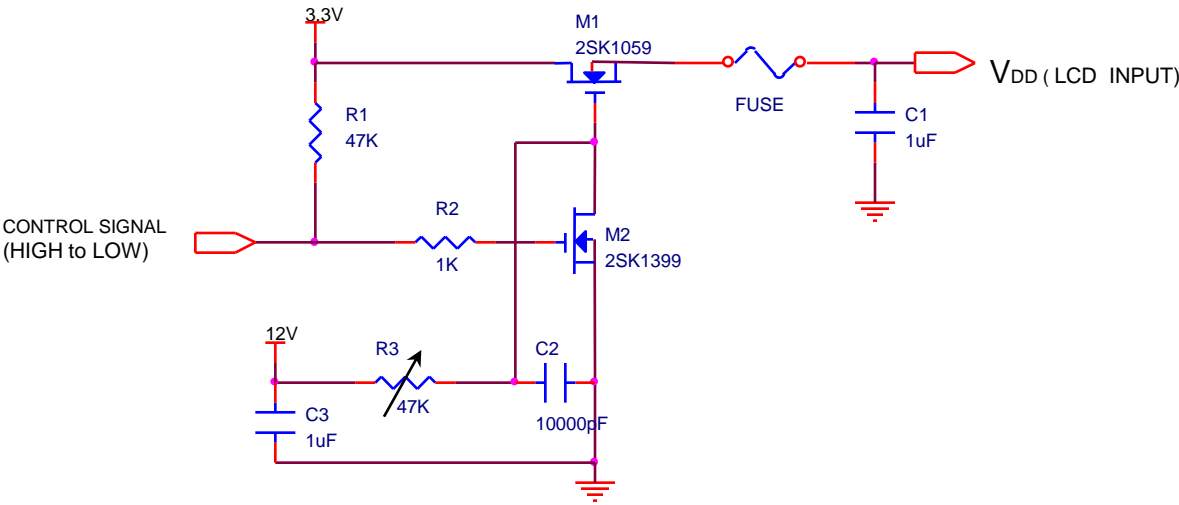
Display Darkest Gray Level →

*b) Mosaic Pattern

*c) 1dot Vertical stripe pattern

4) Rush current measurement condition

V$_{DD}$ rising time is 470us

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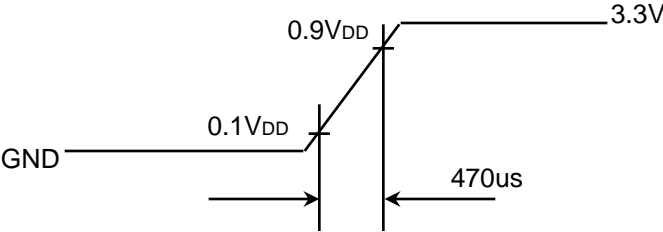
3.2 LED Driver

- On board LED Driver

Ta= 25 $\pm$ 2 ℃

Item-	Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage	V_{in}	6	12	24	V	-
Input Current	I	-	108	-	mA	-
PWM Control Duty Ratio	D	10	-	100	%	-
External PWM Dimming Control Frequency (BLIM)	F_{BLIM}		1	10	kHz	
Operating Life Time	Hr	10,000	-	-	Hour	

Note (1) Life time (Hr) of LEDs can be defined as the time in which it continues to operate under the
condition Ta= 25 $\pm$ 2 ℃ and IF = 27 mArms until one of the following event occurs.
1. When the brightness becomes 50% or lower than the original.

3.3 BACK-LIGHT UNIT

Ta= 25 $\pm$ 2 ℃

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Forward Current	IF	-	27	-	mA	
LED Forward Voltage	VF	3.0	3.2	3.4	V	
LED Array Voltage	VP	-	28.8	-	V	VF X 9 LEDs
Power Consumption	P	-	-	3.95	W	IF X VF X 36 LEDs @ 220 nit

4. BLOCK DIAGRAM

4.1 TFT LCD Module
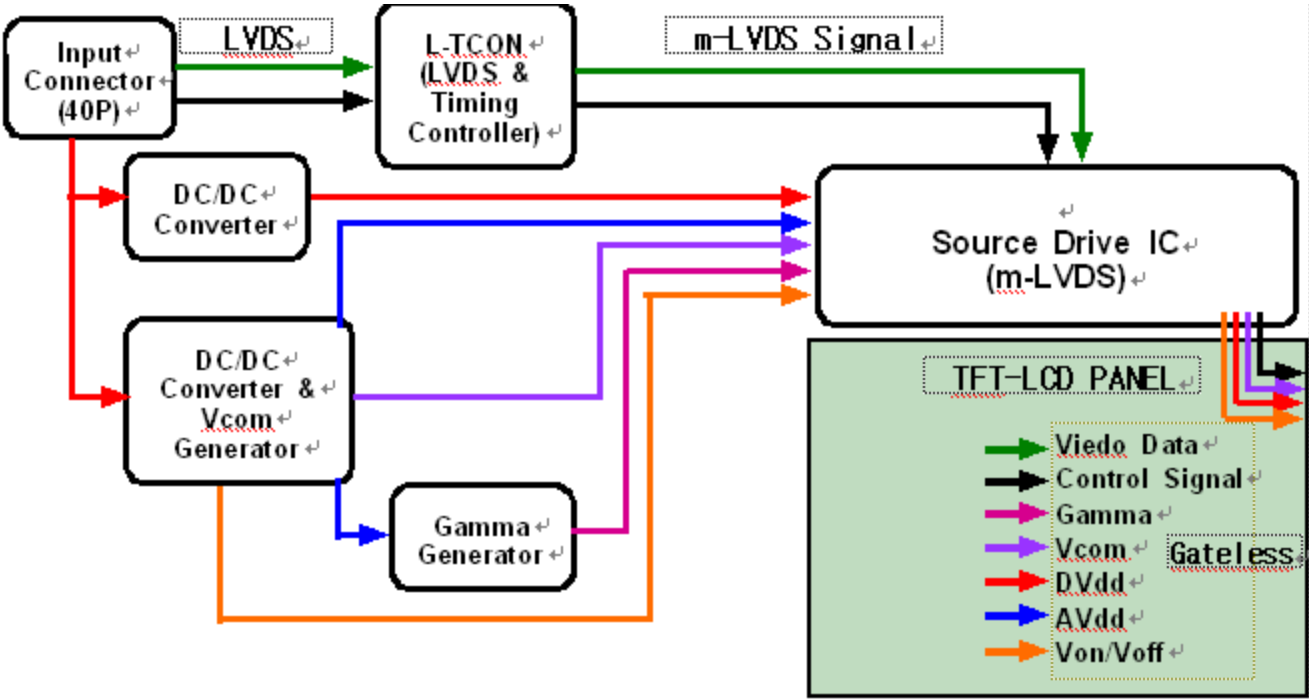
4.2 LED placement structure

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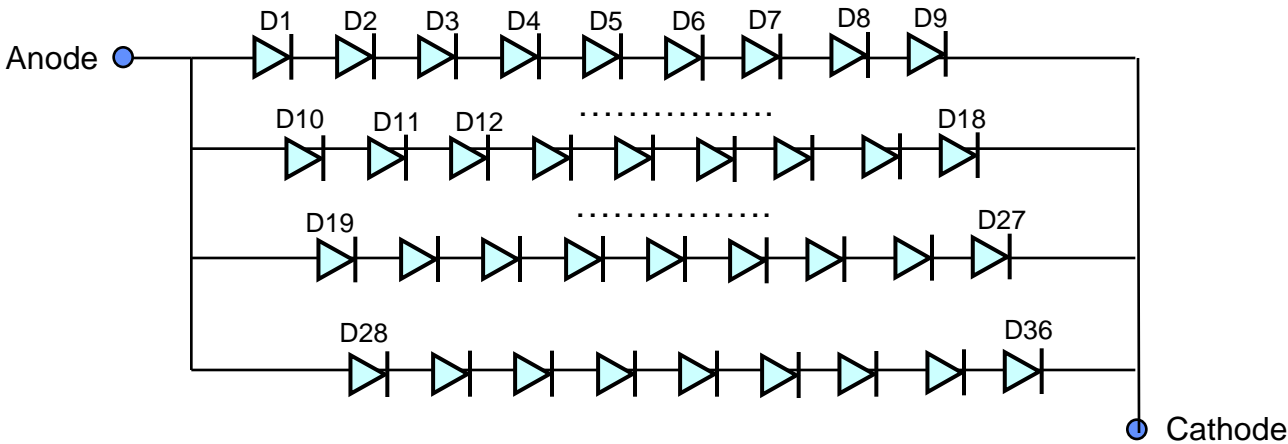
5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal & Power (LVDS, Connector : I-PEX 20455-040E-## or equivalent)

No.	Symbol	Function	Polarity	Remarks
1	NU	NOT USED		
2	VDD	Power (Vdd = 3.3V)		
3	VDD	Power (Vdd = 3.3V)		
4	VCC EDID	VCC_EDID		
5	WPN	WPN		
6	SCL	CLOCK FOR EDID		
7	SDA	DATA FOR EDID		
8	O_RXIN0-	LVDS 0th Signal Negative(Odd)	Negative	
9	O_RXIN0+	LVDS 0th Signal Positive(Odd)	Positive	
10	GND	Ground		
11	O_RXIN1-	LVDS 1st Signal Negative(Odd)	Negative	
12	O_RXIN1+	LVDS 1st Signal Positive(Odd)	Positive	
13	GND	Ground		
14	O_RXIN2-	LVDS 2nd Signal Negative(Odd)	Negative	
15	O_RXIN2+	LVDS 2nd Signal Positive(Odd)	Positive	
16	GND	Ground		
17	O_RXCLKIN-	LVDS Clock Signal Negative(Odd)	Negative	
18	O_RXCLKIN+	LVDS Clock Signal Positive(Odd)	Positive	
19	NC	NOT CONNECT		
20	NC	NOT CONNECT		
21	NC	NOT CONNECT		
22	GND	Ground		
23	NC	NOT CONNECT		
24	NC	NOT CONNECT		
25	GND	Ground		
26	NC	NOT CONNECT		
27	NC	NOT CONNECT		
28	GND	Ground		
29	NC	NOT CONNECT		
30	NC	NOT CONNECT		

No.	Symbol	Function	Polarity	Remarks
31	GND	Ground		
32	GND	Ground		
33	GND	Ground		
34	NU	NOT USED		
35	PWM	PWM		
36	BLEN	BL ENABLED		
37	NC	NOT CONNECT		
38	VBL	B/L VCC		
39	VBL	B/L VCC		
40	VBL	B/L VCC		

5.2 LVDS Interface

5.2.1 LVDS DC Input

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
LVDS Differential Voltage	|VID|	100	–	200	mV	
Input Common Mode Voltage	V_{CM}	0.4	1.2	1.8	V	
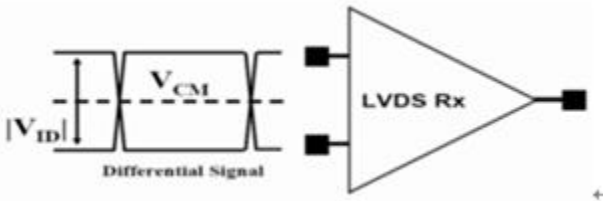
5.2.1 LVDS AC Input

ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
LVDS RX Skew(Strobe) Right Margin	90MHz	T_{RSRM}	–	–	300	ps	(1),(2)
	65MHz		–	–	400	ps	(1),(2)
LVDS RX Skew(Strobe) Left Margin	90MHz	T_{RSLM}	−300	–	–	ps	(1),(2)
	65MHz		−400	–	–	ps	(1),(2)
SSC Modulation Rate			–	–	± 3	%	(3)
SSC Modulation Frequency			–	–	300	KHz	(3)

Note (1) : LVDS Receiver Skew (Strobe) Margin
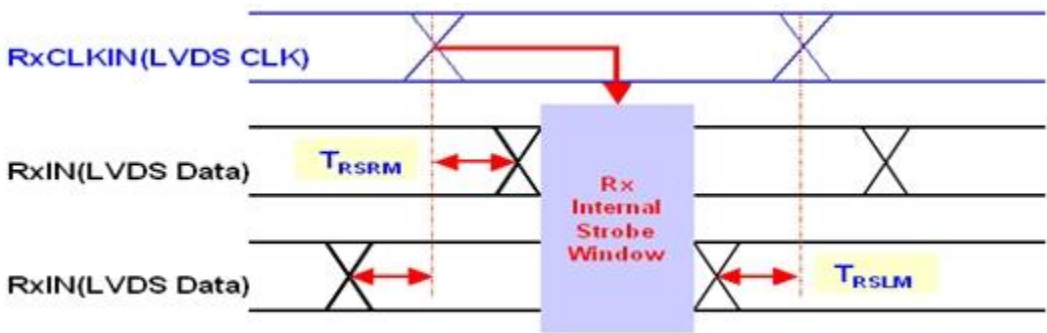
Note (2) : Ideal Strove Positions for LVDS Input
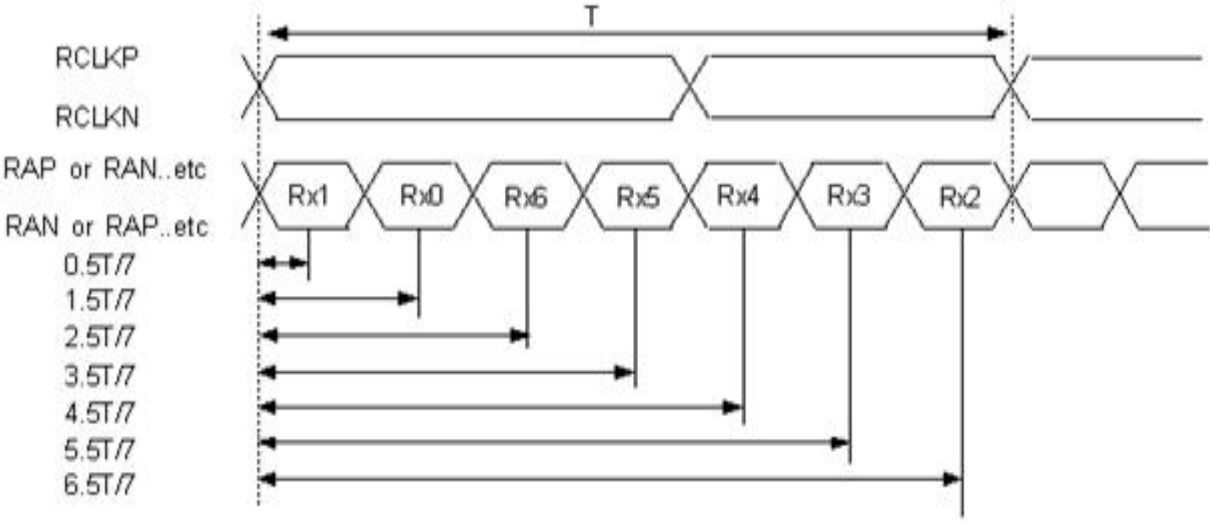
Note (3) : SSC (Spread Spectrum Clock)

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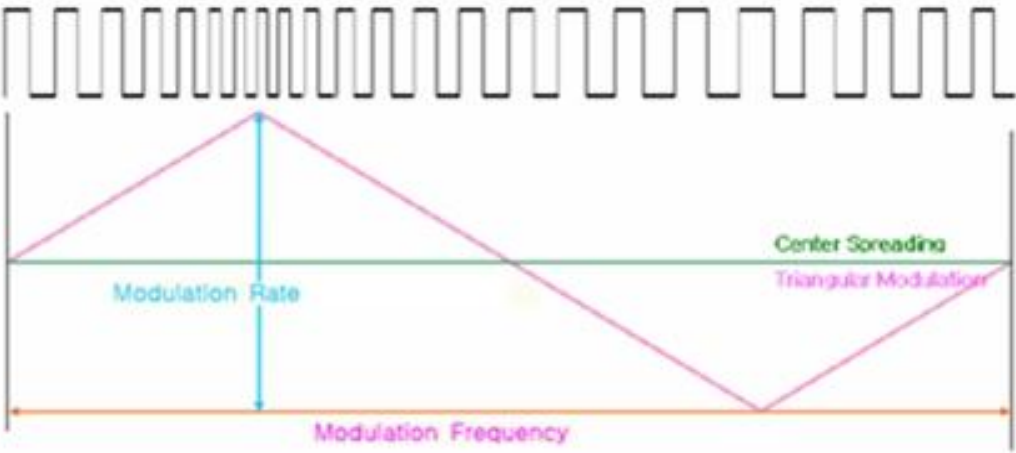
5.3 Timing Diagrams of LVDS For Transmission

LVDS Receiver : Integrated T-CON

T

TxCLK OUT
RxCLK IN

T/7

Rx IN2

| RxOUT20 | RxOUT19 | RxOUT18 | RxOUT17 | RxOUT16 | RxOUT15 | RxOUT14 |
| DE | Vsync | Hsync | B5 | B4 | B3 | B2 |

Rx IN1

| RxOUT13 | RxOUT12 | RxOUT11 | RxOUT10 | RxOUT9 | RxOUT8 | RxOUT7 |
| B1 | B0 | G5 | G4 | G3 | G2 | G1 |

RxIN0

| RxOUT6 | RxOUT5 | RxOUT4 | RxOUT3 | RxOUT2 | RxOUT1 | RxOUT0 |
| G0 | R5 | R4 | R3 | R2 | R1 | R0 |

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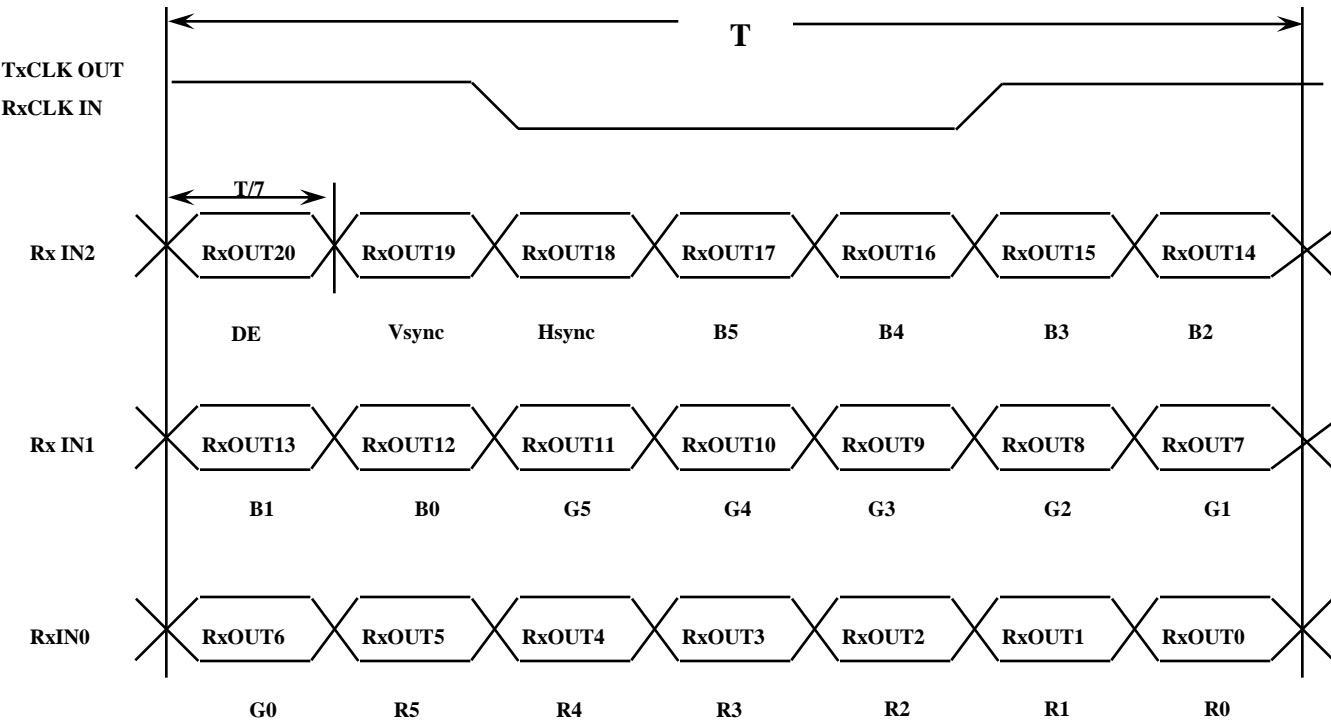
5.4 Input Signals, Basic Display Colors and Gray Scale of Each Color

| 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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5.5 Pixel Format in the display

	1		1366

Line 1   R G B   R G B   R G B   R G B

LTN156AT15Panel

Line 768   R G B   R G B   R G B   R G B
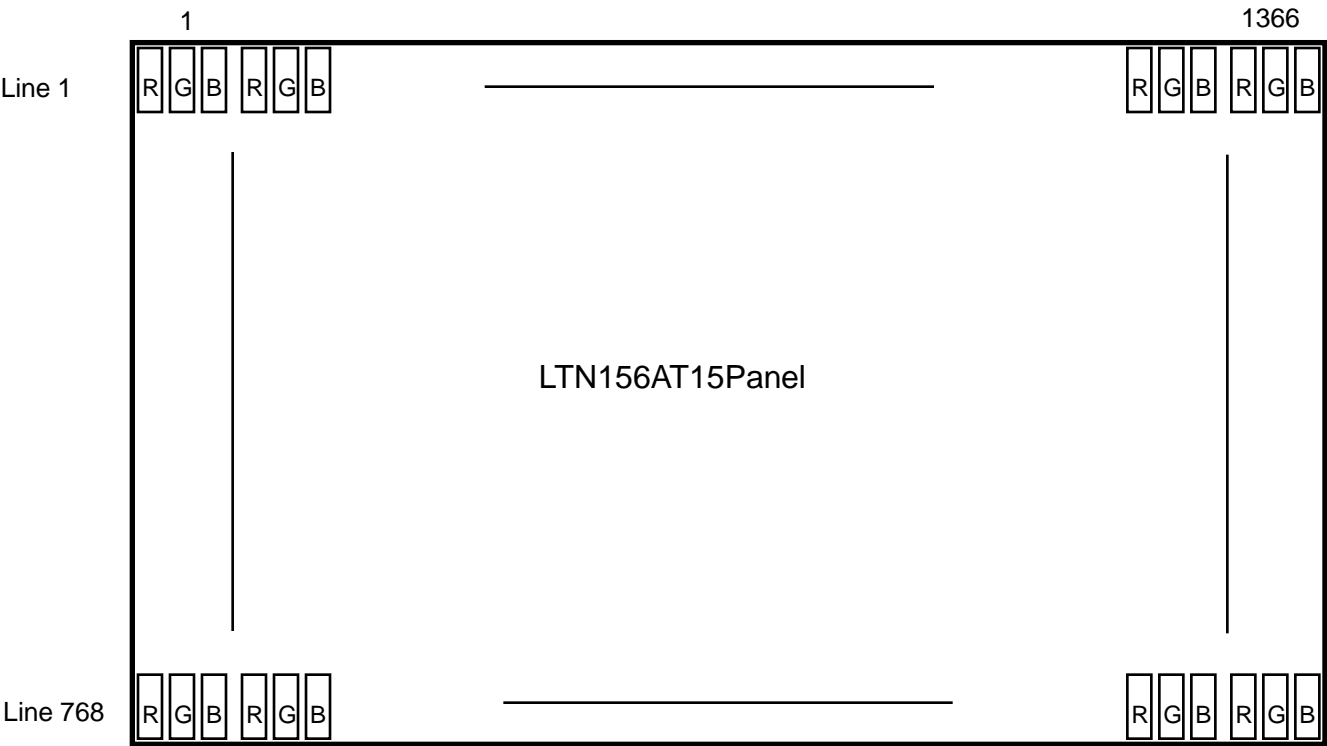
6. INTERFACE TIMING

6.1 Timing Parameters

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frame Frequency	Cycle	TV	773	790	810	Lines	
Vertical Active Display Term	Display Period	TVD	-	768	-	Lines	
One Line Scanning Time	Cycle	TH	1426	1526	1726	Clocks	
Horizontal Active Display Term	Display Period	THD	-	1366	-	Clocks	

6.2 Timing diagrams of interface signal

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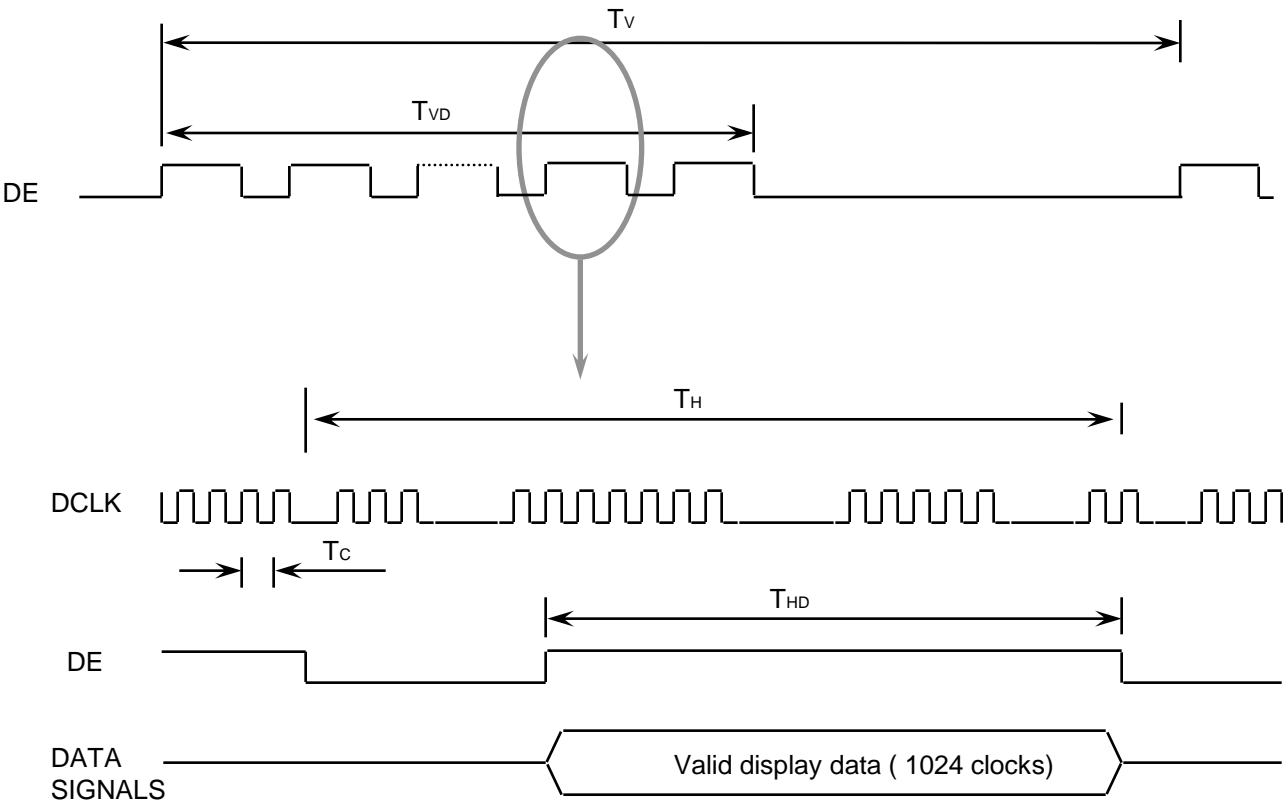
6.3 Power ON/OFF Sequence

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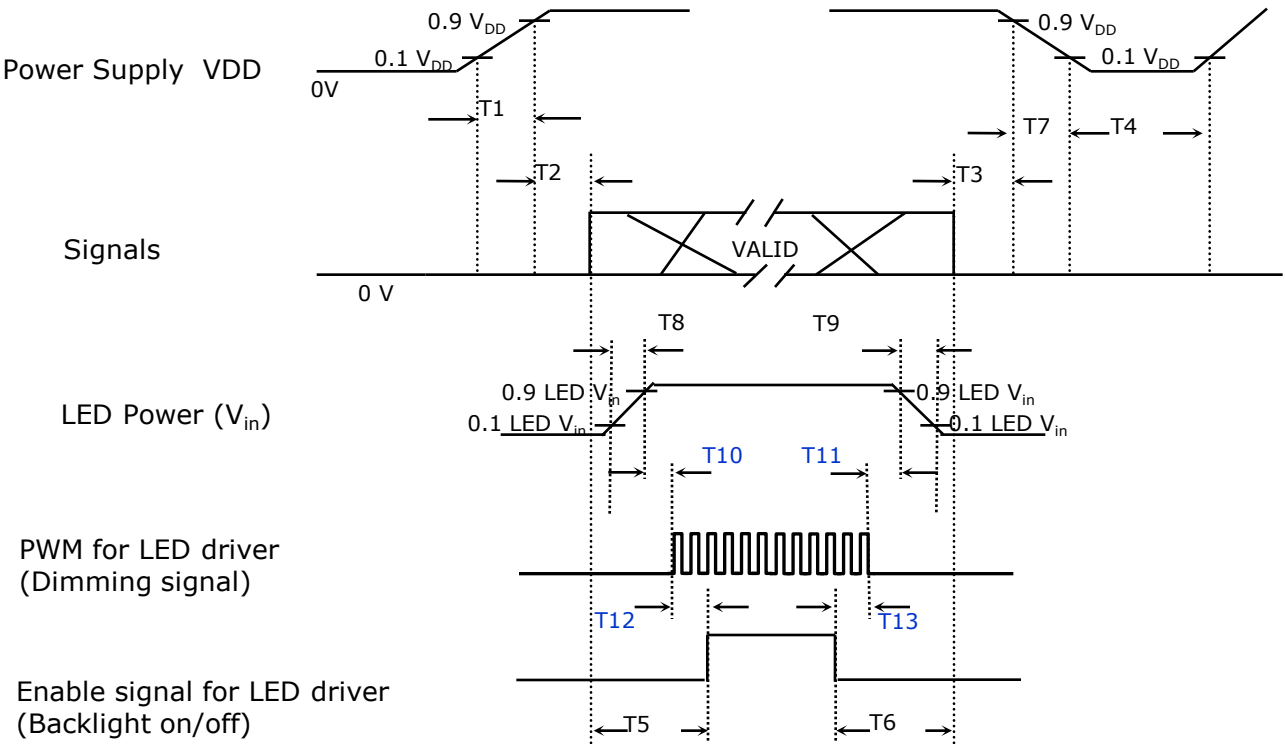
Power ON/OFF Sequence

Timing (ms)	Remarks
$0.5 < T1 \leq 10$	V_{DD} rising time from 10% to 90%
$0 < T2 \leq 50$	Delay from V_{DD} to valid data at power ON
$0 < T3 \leq 50$	Delay from valid data OFF to V_{DD} OFF at power Off
$500 \leq T4$	V_{DD} OFF time for Windows restart
$200 \leq T5$	Delay from valid data to B/L enable at power ON
$200 \leq T6$	Delay from valid data off to B/L disable at power Off
$0 < T7 \leq 10$	V_{DD} falling time from 90% to 10%
$0.5 < T8 \leq 10$	LED V_{in} rising time from 10% to 90%
$0.5 < T9 \leq 10$	LED V_{in} falling time from 90% to 10%
$0 \leq T10$	Delay from LED driver Vin rising time 90% to PWM ON
$0 \leq T11$	Delay from PWM Off to LED driver Vin falling time 10%, Must Keep rule
$0 \leq T12$	Delay from PWM ON to B/L Enable ON, Must Keep rule
$0 \leq T13$	Delay from B/L Enable Off to PWM Off

Power Sequence & Timing Parameters
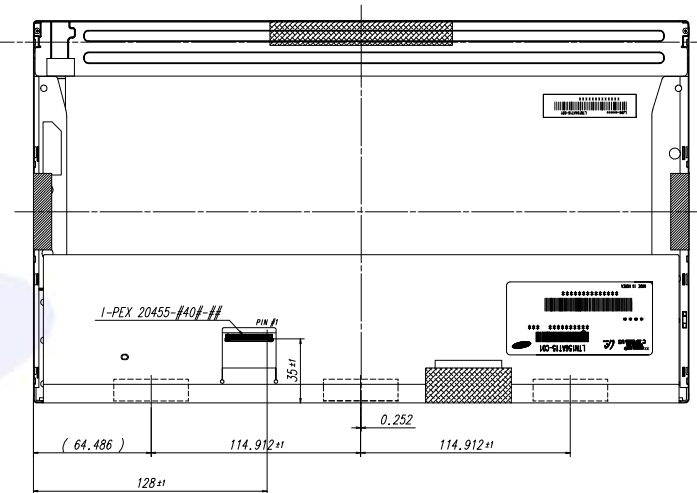
Samsung Secret

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 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 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.

7. Mechanical Outline Dimension

Refer to the next page

(179.65)

(1.782)
(6.2)

11.9±0.3

66.9±0.3

118.8±0.3

185.7±0.3

92.85±0.3 [ACTIVE CENTER TO USER HOLE]

(104.75)

ACTIVE CENTER

193.536 [ACTIVE AREA]
197.1 [BEZEL OPENING AREA]
209.5±0.5 [OUTLINE]

(2.284)
(7.534)
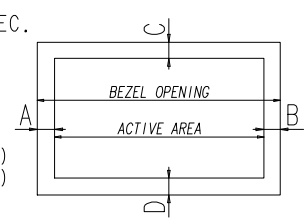
(2.284)
(7.534)

DP=2.5MAX SCREW PENETRATION

4-3.1±0.3

5.5 MAX [MODULE THICKNESS]

(1.782)
(7.982)

344.232 [ACTIVE AREA]
348.8 [BEZEL OPENING AREA]
359.3±0.5 [OUTLINE]

I-PEX 20455-#40#-##

PIN #1

35±1

O

(64.486)

0.252

114.912±1

114.912±1

128±1

LTN156AT15-C01

3.1±0.3

5.5MAX

SCREW HOLE DEPTH 2.5 Min

<USER HOLE SCREW HOLE DEPTH>

BM SHIFT SPEC.

C

A   BEZEL OPENING   B

ACTIVE AREA

D

IA-BI < 1.0 (mm)
IC-DI < 1.0 (mm)
IBMI ≥ 1.0 (mm)

* NOTE
1. SIGNAL INTERFACE CONNECTOR TO BE SPECIFIED AS BELOW.
   -. MAKER : I-PEX(Not accecpt compotable connector basically)
   -. INPUT CONNECTOR : I-PEX 20455-040E-12
2. LED CONNECTOR FOR BACKLIGHT TO BE SPECIFIED AS BELOW.
   -. MAKER : UJU Electronics
   -. PART NO : 51441-1041
3. CALIFERS MEASURING FORCE : 750 ± 250 gfcm
4. MAXIMUM SCREW TORQUE : MAX 2.5 Kgf-cm(5TIMES)
5. WEIGHT : 465 g MAX
6. IN ORDER TO AVOID IC DAMAGE, IT IS NOT ALLOW
   THAT OVERLAPPING OF CABLES OR ANTENNAS, CAMERA, WLAN,
   WWAN, OVER THESE COF LOCATIONS.

REV | DATE | DESCRIPTION OF REVISION | DRA'N BY | DES'D BY | CHK'D BY | APP'D BY | REASON | CHK'D BY

UNIT mm | DRA'N BY | DES'D BY | CHK'D BY | APP'D BY | MODEL NAME | LTN156AT15-C01
SCALE 1/1
GENERAL TOLERANCE | W.C.LEE
± 0.5 | 2010.04.28
SPEC. NO. | PART/SHEET NAME | OUTLINE DIMENSION | SHEET 1/1
SAMSUNG ELECTRONICS | CODE NO. | - | VER. 000

이원철07011703개발1그룹(LCD)12925053 20100428171045

233011272441978

8. PACKING

1. CARTON(Internal Package)

   (1) Packing Form
      Paper box type : Paper type is more eco-friendly than EPS and plastic
      EPP box type : This type is for direct shipping

   (2) Packing Method

      Paper box type

Panel:2ea/slit

      EPP box type

Panel:2ea/slit
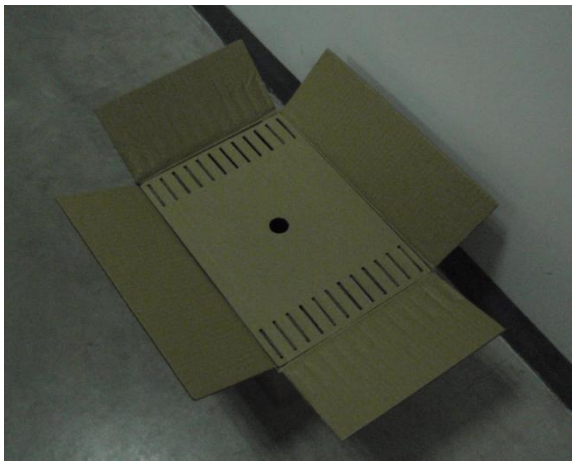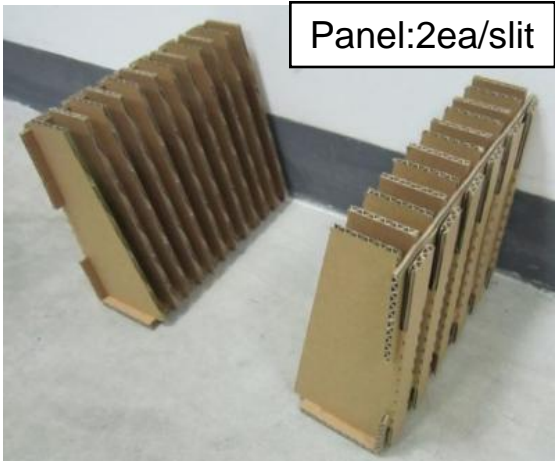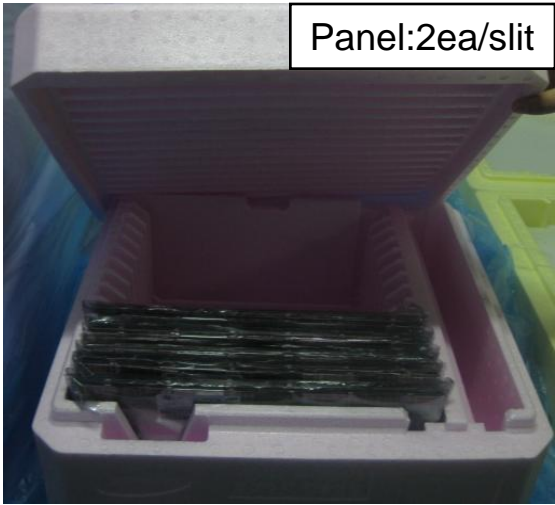
 Note : Paper Box
  1)Total Weight : Approximately 12.5 kg
  2) Acceptance number of piling : 22sets
  3) Carton size :   283(W) × 401(L) × 253(H)

 EPP Box
  1)Total Weight : Approximately 16 kg
  2) Acceptance number of piling : 30 sets
  3) Carton size : 501(W) × 509(L) × 280(H)

(3)Packing Material

No	Part name	Quantity (EPP)	Quantity (PAPER)
1	Static electric protective sack	30	22
2	Packing case (Inner box) included shock absorber	1 set	1 set
3	Pictorial marking	2 pcs	2 pcs
4	Carton	1 set	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 : LTN156AT15
(2)Revision code : 3 letters
(3)Lot number : X X X X XXX XX X **Cxx**

- SEC Revision Code
- Panel number
- Cell ID
- Lot ID
- Month
- Year
- Product Code
- Line

(5) Nameplate Indication

LTN156AT15

1029

XXXXXXXXXX **Cxx**

MADE IN CHINA

40 mm

80 mm
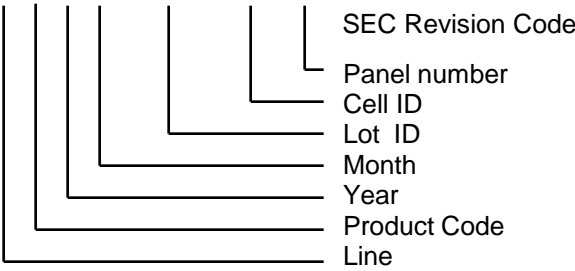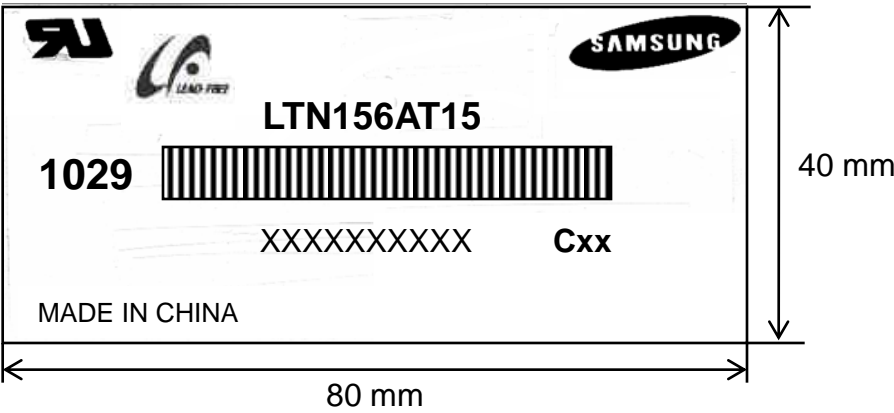
Parts name   : LTN156AT15
Lot number   : XXXXXXXXXX
Inspected work week   : 1029(2010 year, 29nd week)

High voltage caution label

⚡	HIGH VOLTAGE CAUTION RISK OF ELECTRIC SHOCK DISCONNECT THE ELECTRIC POWER BEFORE SERVICE	THIS COVER CONTAINS FLUORESCENT LAMP. PLEASE FOLLOW LOCAL ORDINANCES OR REGULATIONS FOR ITS DISPOSAL

10mm High voltage caution

70mm
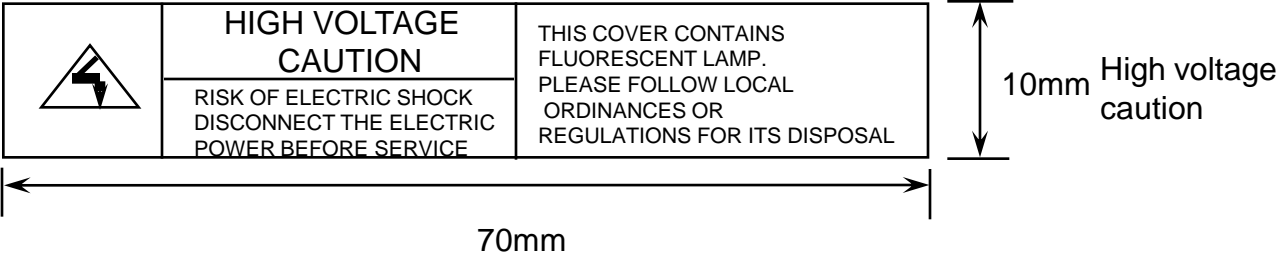
(6) Packing small box attach

SAMSUNG
ELECTRONICS

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DEVICE   : LTN156AT15
TYPE   : Cxx
QUANTITY   : 30 PCS

‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖

CO6040001

10. GENERAL PRECAUTIONS

Approval
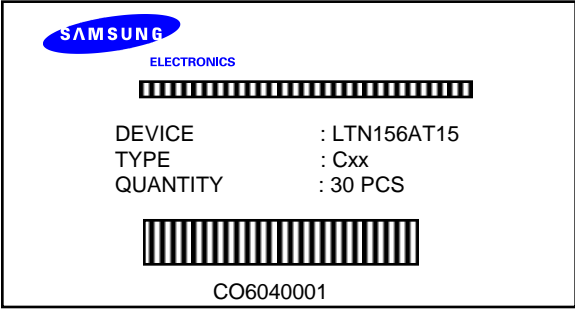
1. Handling

(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 back-light.

(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 back-light connector and its inverter power supply shall be a
minimized length and be connected directly . The longer cable between the back-light
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.

11. EDID

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
					E	
09		A3	10100011	163	C	"SEC"
0A	ID Product Code	41	01000001	65	[A]	
0B		54	01010100	84	[T]	
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	14	00010100	20	2010	2010
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	22	00100010	34	34	34 cm(approx)
16	Max V image size	13	00010011	19	19	19 cm(approx)
17	Display Gamma	78	01111000	120	2.2	Gamma 2.2
18	Feature support	0A	00001010	10		
19	Red/green low bits	8D	10001101	141		01000010
1A	Blue/white low bits	A5	10100101	165		11010101
1B	Red x/ high bits	9D	10011101	157	0.615	Red x 0.587= 10011000
1C	Red y	5B	01011011	91	0.355	Red y 0.344= 01010111
1D	Green x	55	01010101	85	0.335	Green x 0.320= 01010010
1E	Green y	9C	10011100	156	0.610	Green y 0.541= 10001100
1F	Blue x	26	00100110	38	0.150	Blue x 0.155= 00100111
20	Blue y	19	00011001	25	0.100	Blue y 0.130= 00100001
21	White x	50	01010000	80	0.313	White x 0.313= 01010000
22	White y	54	01010100	84	0.329	White y 0.329= 01010100
23	Established timing 1	00	00000000	0		601.088
24	Established timing 2	00	00000000	0		
25	Established timing 3	00	00000000	0		
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		

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Addr	Description	Hex	Binary	Dec	Value	Note
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		84	10000100	132	70.44	Main clock
37		1B	00011011	27		
38		56	01010110	86	1366	Hor active
39		78	01111000	120	120	Hor blanking
3A		50	01010000	80		4bit : 4bit
3B		00	00000000	0	768	Vertcal active
3C		16	00010110	22	22	Vertical blanking
3D		30	00110000	48		4bit : 4bit
3E		30	00110000	48	48	Hor sync. Offset
3F	Detailed timing/monitor	20	00100000	32	32	H sync. Width
40	descriptor #1	25	00100101	37	2 / 5	V sync. Offset / V sync. Width
41		00	00000000	0		2bit : 2bit :2bit :2bit
42		58	01011000	88	344	H image size
43		C2	11000010	194	194	V image size
44		10	00010000	16		
45		00	00000000	0		No Horizontal Border
46		00	00000000	0		No Vertical Border
47		19	00011001	25		
48		00	00000000	0		
49		00	00000000	0		
4A		00	00000000	0		Manufacturer Specified (Timing)
4B		0F	00001111	15		
4C		00	00000000	0		
4D		00	00000000	0		**Value**=HSPWmin / 2
4E		00	00000000	0		**Value**=HSPWmax / 2
4F	Detailed timing/monitor	00	00000000	0		**Value**=Thbpmin /2
50	descriptor #2	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		23	00100011	35		Thpmin=**value***2 + HA pixelclks
56		87	10000111	135		Thpmax=**value***2 + HA pixelclks
57		02	00000010	2		Tvpmin=**value***2 + VA lines
58		64	01100100	100		Tvpmax=**value***2 + VA lines
59		01	00000001	1		Module revision

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Address	Field	Hex	Binary	Dec	ASCII	Description
5A		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	Detailed timing/monitor	4D	01001101	77	[M]	
62	descriptor #3	53	01010011	83	[S]	
63		55	01010101	85	[U]	
64		4E	01001110	78	[N]	
65		47	01000111	71	[G]	
66		0A	00001010	10	[^]	
67		20	00100000	32	[ ]	
68		20	00100000	32	[ ]	
69		20	00100000	32	[ ]	
6A		20	00100000	32	[ ]	
6B		20	00100000	32	[ ]	
6C		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	Detailed timing/monitor	4E	01001110	78	[N]	
74	descriptor #4	31	00110001	49	[1]	
75		35	00110101	53	[5]	
76		36	00110110	54	[6]	
77		41	01000001	65	[A]	
78		54	01010100	84	[T]	
79		31	00110001	49	[1]	
7A		35	00110101	53	[5]	
7B		43	01000011	67	[C]	
7C		30	00110000	48	[0]	
7D		31	00110001	49	[1]	
7E	Extension Flag	00	00000000	0		
7F	Checksum	5D	01011101	93		