SAMSUNG **ELECTRONICS**

LEAD-FREE

TO : General

DATE : Oct. 28 , 2010

SAMSUNG TFT-LCD

MODEL NO. : LTN097XL01-H01

NOTE : Extension code [-H01]
→ LTN097XL01-H01
Surface type [**Glare**]

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

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wise view™

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Oct. 28, 2010	P00	All	The Preliminary specification of LTN097XL01-H01 model was issued first.

GENERAL DESCRIPTION

DESCRIPTION

LTN097XL01 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 9.7" contains 1024 x 768 pixels and can display up to 262,144 colors. 6 O'clock direction is the optimum viewing angle.

FEATURES

- High contrast ratio
- XGA (1024 x 768 pixels) resolution
- Low power consumption
- DE (Data enable) only mode
- 3.3V LVDS Interface
- Onboard EEDID chip
- Green product (RoHS compliant)

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	196.608(H) x 147.456(V) (9.7" diagonal)	mm	
Driver element	a-Si TFT active matrix		
Display colors	262,144		
Number of pixel	1024 X 768	pixel	
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.192 (H) X 0.192 (V) typ	mm	
Display Mode	Normally black (PLS mode)		
Surface treatment	Haze 0, Hard-Coating 3H		

Mechanical Information

| Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal (H)	210.12	210.42	210.72	mm	
	Vertical (V)	166.12	166.42	167.72	mm	
	Depth (D)	-	-	3.55 / 5.85	mm	(1)
Weight		-	-	170	g	

Note (1) Measurement condition of outline dimension
. Equipment : Bernier Calipers
. Push Force : 500 $\pm$ 250 g ·f

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 °C or less. (Ta $>$ 40 °C) No condensation
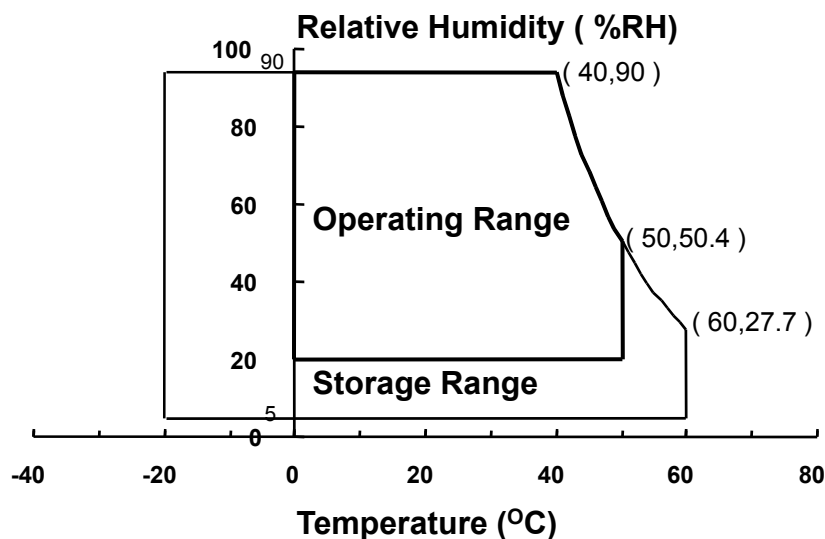
(2) 2ms, half sine wave, one time for $\pm$X, $\pm$Y, $\pm$ Z.
(3) 5 - 500 Hz, random vibration, 30min for X, Y, Z.
(4) At testing Vibration and Shock, the fixture in holding the Module to be tested have to be hard and rigid enough so that the Module would not be twisted or bent by the fixture.

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 °C)
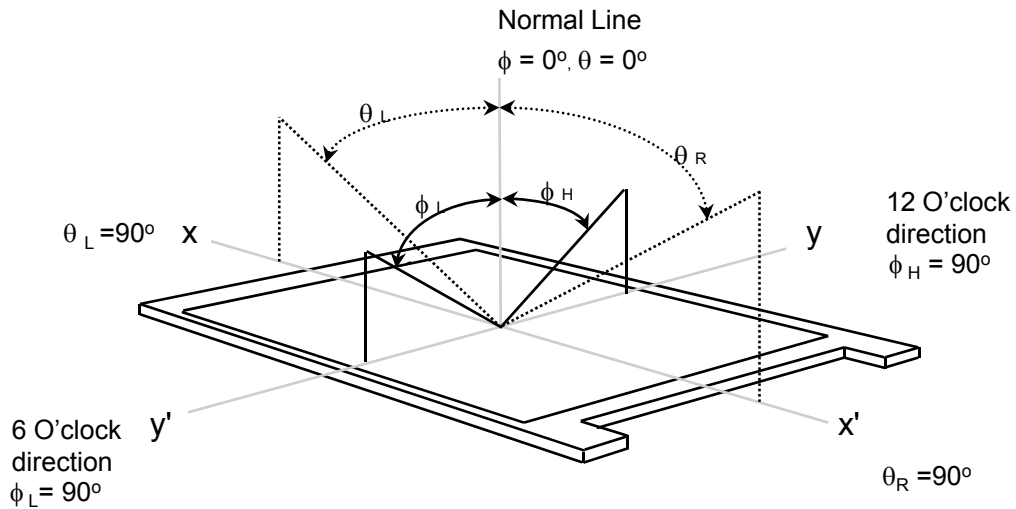
2. OPTICAL CHARACTERISTICS

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 ± 2 °C, V_{DD}=3.3V,   fv= 60Hz, f_{DCLK} = 100MHz, IF = (23 mA)

Item		Symbol	Condition	Min.	Typ.	Max	Unit	Note
Contrast Ratio (5 Points)		CR	Normal Viewing Angle $\phi = 0$ $\theta = 0$	-	600	-	-	(1), (2), (5)
Response Time at Ta (Rising + Falling)		T_{RT}		-	30	(35)	msec	(1), (3)
Average Luminance of White (5 Points)		$Y_{L,AVE}$		255	300	-	cd/m²	IF=(23mA) (1), (4)
Color Chromaticity (CIE)	Red	R_X			TBD		-	(1), (5) SR-3
		R_Y			TBD			
	Green	G_X			TBD			
		G_Y			TBD			
	Blue	B_X			TBD			
		B_Y			TBD			
	White	W_X		0.283	0.313	0.343		
		W_Y		0.299	0.329	0.359		
Viewing Angle	Hor.	θ_L	CR $\geq$ 10 At center	80	-	-	Degrees	(1), (5) SR-3
		θ_R		80	-	-		
	Ver.	ϕ_H		80	-	-		
		ϕ_L		80	-	-		
13 Points White Variation		δ_L		-	1.4	(1.6)	-	(6)

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

Normal Line
$\phi = 0^o, \theta = 0^o$

θ_L

θ_R

ϕ_L ϕ_H

$\theta_L = 90^o$ x

y

12 O'clock direction
$\phi_H = 90^o$

6 O'clock direction
$\phi_L = 90^o$ y'

x'

$\theta_R = 90^o$

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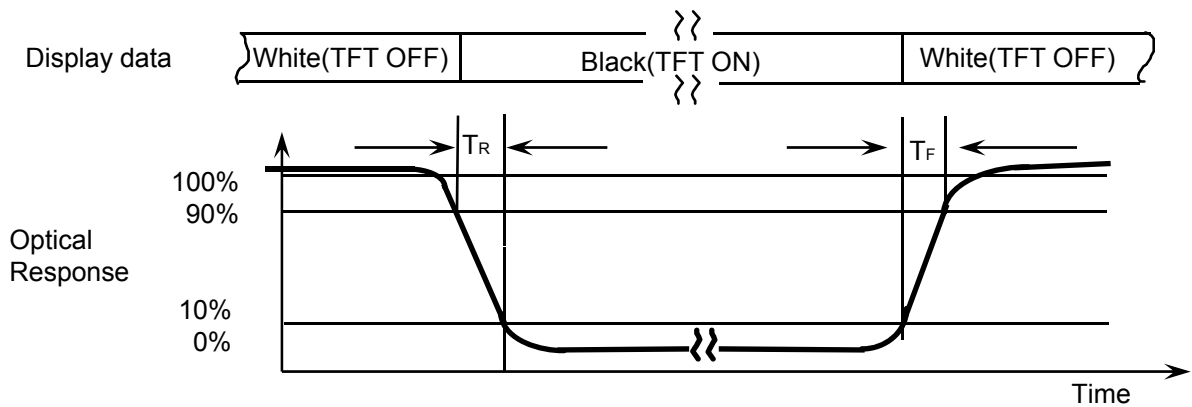
Note 4) Definition of Average Luminance of White : measure the luminance of white at 5 points.

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

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

320   640   960

VIEW AREA

⑩   ⑨   200

⑦   400

⑤   ④   600
(lines)
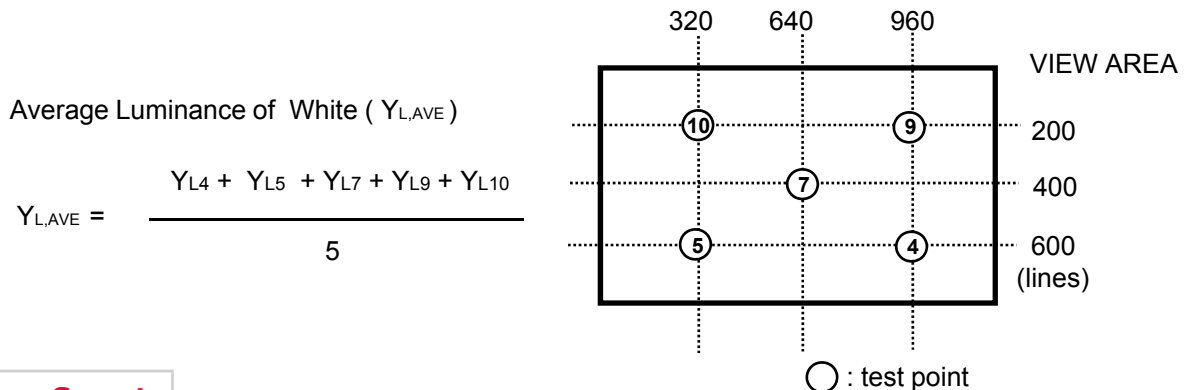
◯ : test point

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 : 17.0mA
Environment condition : Ta = 25 ± 2 °C

Photo-detector
(TOPCON SR-3)
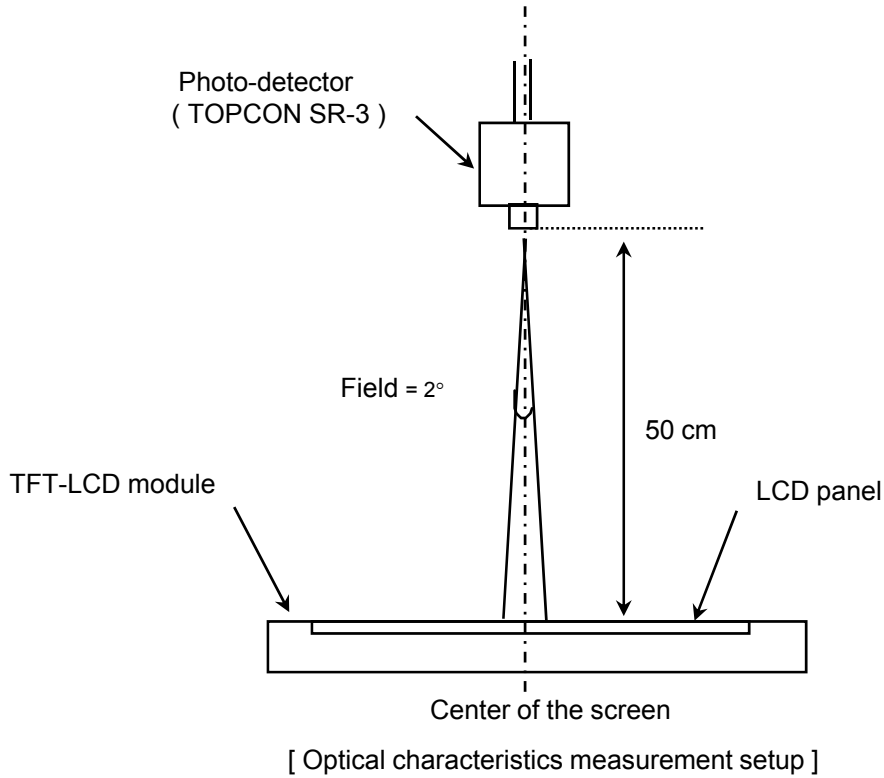
Field = 2°

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(C_{VER}) [① ~ ⑬]

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

10mm **10mm**

320   640   960

10mm

⑬   ⑫   ⑪

⑩   ⑨   200

⑧   ⑦   ⑥   400   ◯ : test point

⑤   ④   600
(lines)

③   ②   ①

10mm

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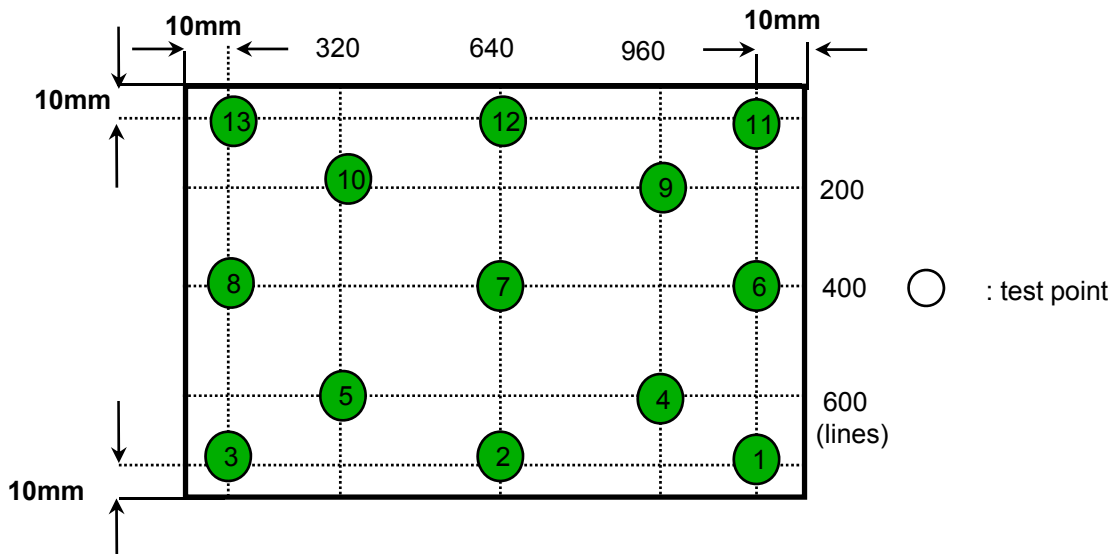
3. ELECTRICAL CHARACTERISTICS

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	
Hsync Frequency		f_H	-	48	-	KHz	
Main Frequency		f_{DCLK}	-	100	-	MHz	
Rush Current		I_{RUSH}	-	-	1.5	A	(4)
Current of Power Supply	White	I_{DD}	-	(TBD)	-	mA	(2),(3)*a
	Mosaic		-	242	273	mA	(2),(3)*b
	V. stripe		-	(TBD)	-	mA	(2),(3)*c

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

(2) fv = 60Hz, f_{DCLK} = 100MHZ, V_{DD} = 3.3V , DC Current.

(3) Power dissipation pattern

*a) White Pattern

*b) Mosaic Pattern

VIEW AREA

Display Brightest Gray Level

Display Darkest Gray Level
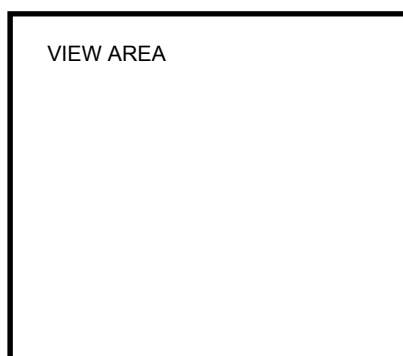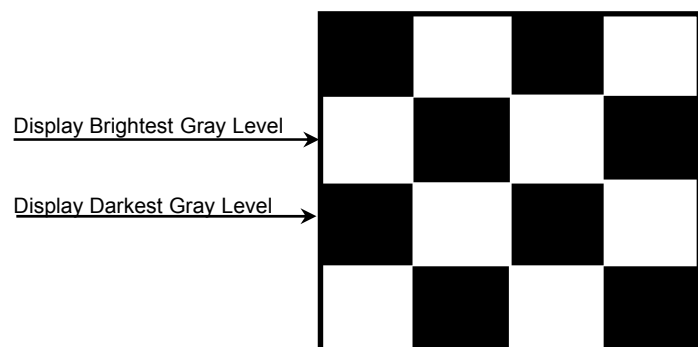
*c) 1dot Vertical stripe pattern
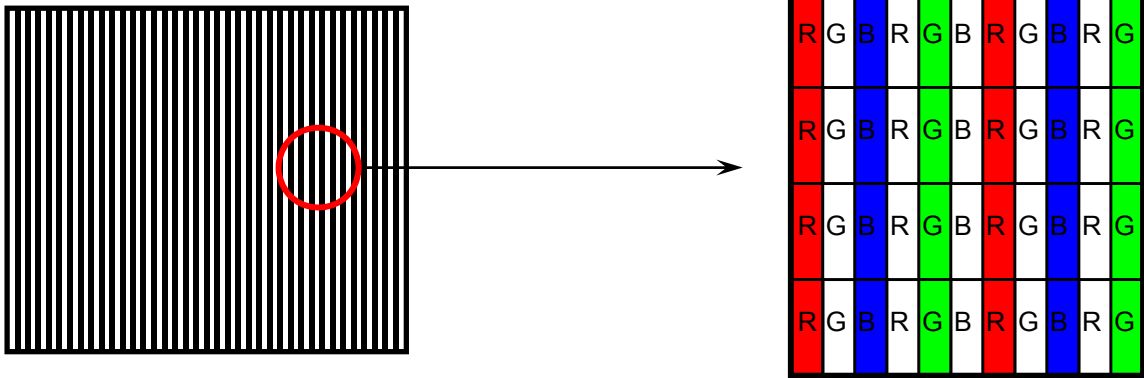
4) Rush current measurement condition

3.3V

M1
2SK1059

FUSE

V$_{DD}$ (LCD INPUT)

R1
47K

C1
1uF

CONTROL SIGNAL
(HIGH to LOW)

R2
1K

M2
2SK1399

12V

R3
47K

C2
10000pF

C3
1uF
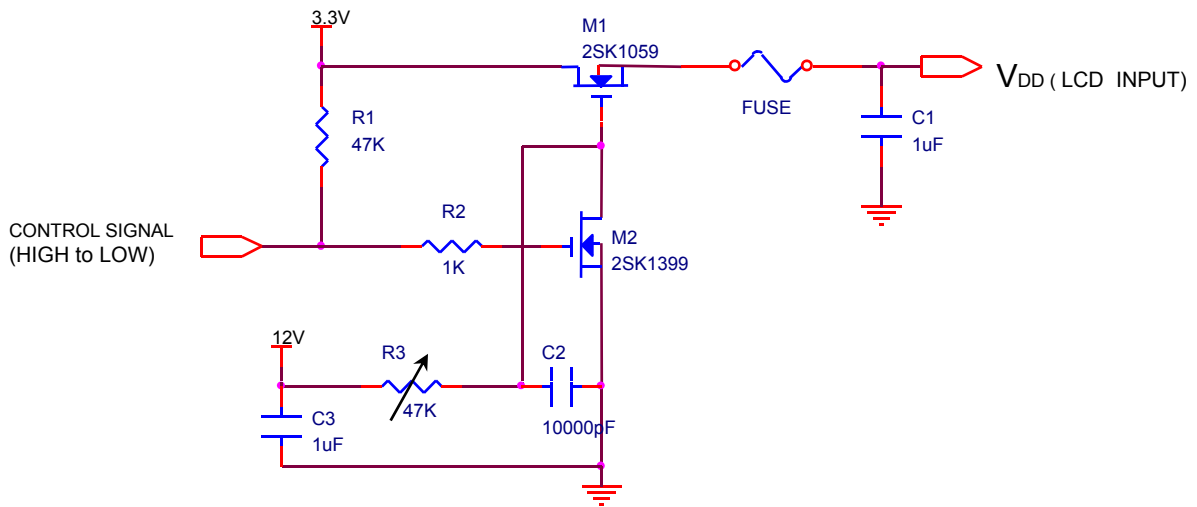
V$_{DD}$ rising time is 470us

0.9V$_{DD}$

3.3V

0.1V$_{DD}$

GND

470us
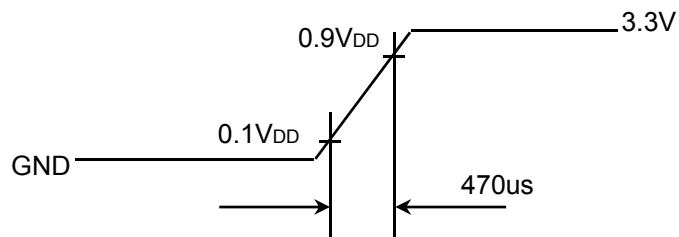
3.2 BACK-LIGHT UNIT

Ta= 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Forward Current	IF	-	(23)	-	mA	
LED Forward Voltage	VF	-	3.2	-	V	
LED Array Voltage	VP	-	TBD	-	V	VF X (TBD LEDs)
Power Consumption	P	-	-	2.3	W	IF X VF X (28)LEDs
Operating Life Time	Hr	10,000	-	-	Hour	(1)

Note (1) Life time (Hr) of LEDs can be defined as the time in which it continues to operate under the
condition Ta= 25 ± 2 °C and IF = 21.3 mA until one of the following event occurs.
1. When the brightness becomes 50% or lower than the original.

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4. BLOCK DIAGRAM

4.1 TFT LCD Module

I²C bus

EDID EEPROM

Input-Connector
I-PEX 20474-X30X-XX
or Compatible

LVDS

LVDS Input/RVDS Output Timing Controller

RVDS

DC-DC Converter

Gamma Generator

VCOM Generator

Source Driver IC

9.7" XGA TFT-LCD Panel

Gate Driver IC

SOURCE PCB

→	Video Signal
→	Control Signal
→	VCOM
→	DVDD
→	AVDD
→	Von/Voff
→	Gamma
→	Feedback
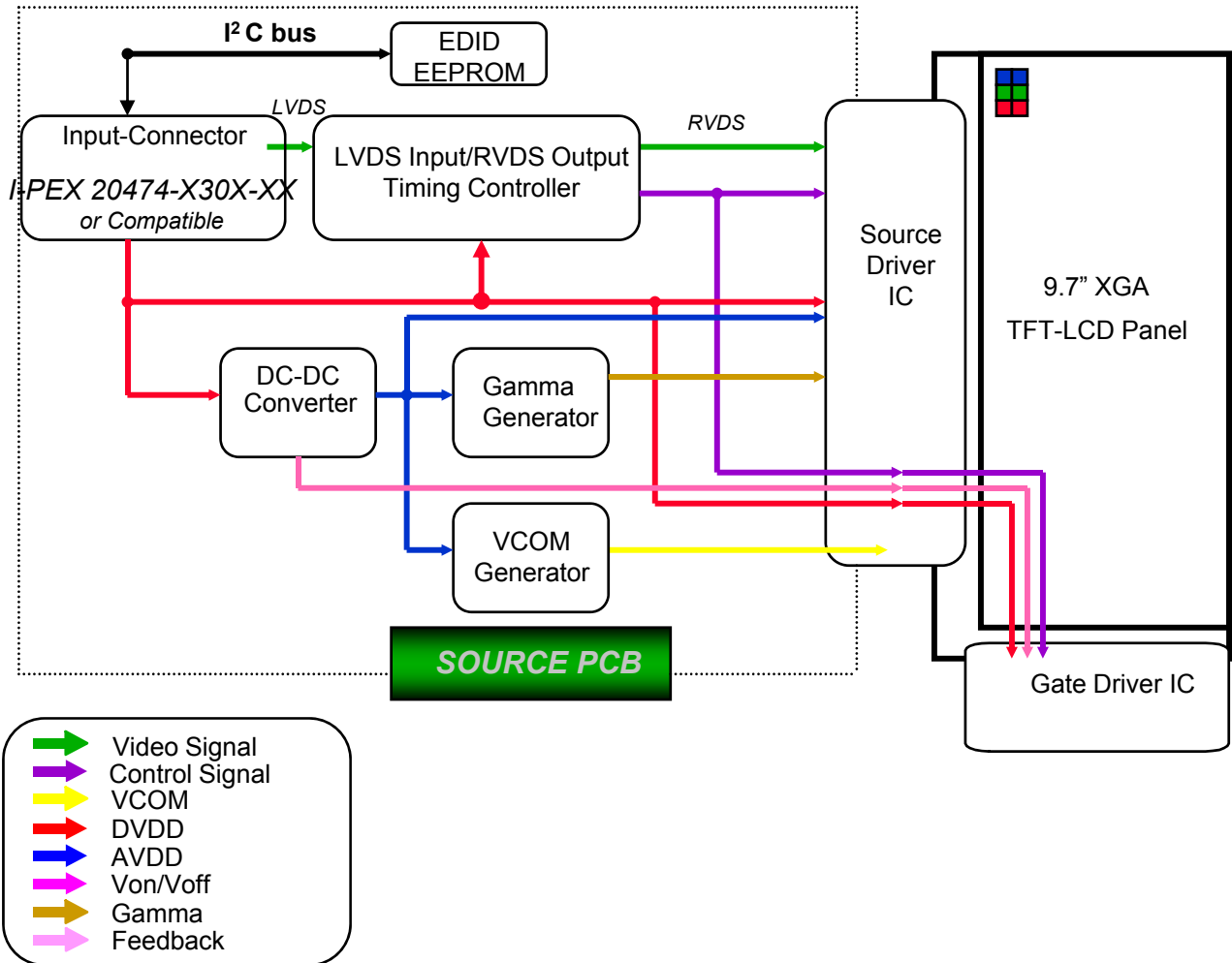
5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal & Power (LVDS, Connector : *20474-X30X-XX* by I-PEX or equivalent)

No.	Symbol	Function	Polarity	Remarks
1	GND	Ground		
2	VCC	Power Supply, 3.3V Typ.		
3	VCC	Power Supply, 3.3V Typ.		
4	V EEDID	DDC 3.3V power		
5	GSP	GSP		
6	Clk EEDID	DDC Clock		
7	DATA EEDID	DDC Data		
8	$R_{IN}0-$	Negative LVDS differential data input	Negative	
9	$R_{IN}0+$	Positive LVDS differential data input	Positive	
10	GND	Ground		
11	$R_{IN}1-$	Negative LVDS differential data input	Negative	
12	$R_{IN}1+$	Positive LVDS differential data input	Positive	
13	GND	Ground		
14	$R_{IN}2-$	Negative LVDS differential data input	Negative	
15	$R_{IN}2+$	Positive LVDS differential data input	Positive	
16	GND	Ground		
17	CLKIN−	Negative LVDS differential clock input	Negative	
18	CLKIN+	Positive LVDS differential clock input	Positive	
19	GND	Ground		
20	NC	No Connection		
21	Vdc	LED Anode (Positive)		
22	Vdc	LED Anode (Positive)		
23	NC	No Connection		
24	Vdc1	LED Cathode (Negative)		
25	Vdc2	LED Cathode (Negative)		
26	Vdc3	LED Cathode (Negative)		
27	Vdc4	LED Cathode (Negative)		
28	Vdc5	LED Cathode (Negative)		
29	Vdc6	LED Cathode (Negative)		
30	NC	No Connection		

When single LVDS input, even differential data pin put NC

5.2 LVDS Interface : Transmitter DS90CF363 or Compatible

Pin No.	Name	RGB Signal	Pin No.	Name	RGB Signal
51	TxIN0	R0	14	TxIN14	G5
52	TxIN1	R1	15	TxIN15	B0
54	TxIN2	R2	19	TxIN18	B1
55	TxIN3	R3	20	TxIN19	B2
56	TxIN4	R4	22	TxIN20	B3
3	TxIN6	R5	23	TxIN21	B4
4	TxIN7	G0	24	TxIN22	B5
6	TxIN8	G1	27	TxIN24	Hsync
7	TxIN9	G2	28	TxIN25	Vsync
11	TxIN12	G3	30	TxIN26	DE
12	TxIN13	G4	31	TxCLKIN	Clock

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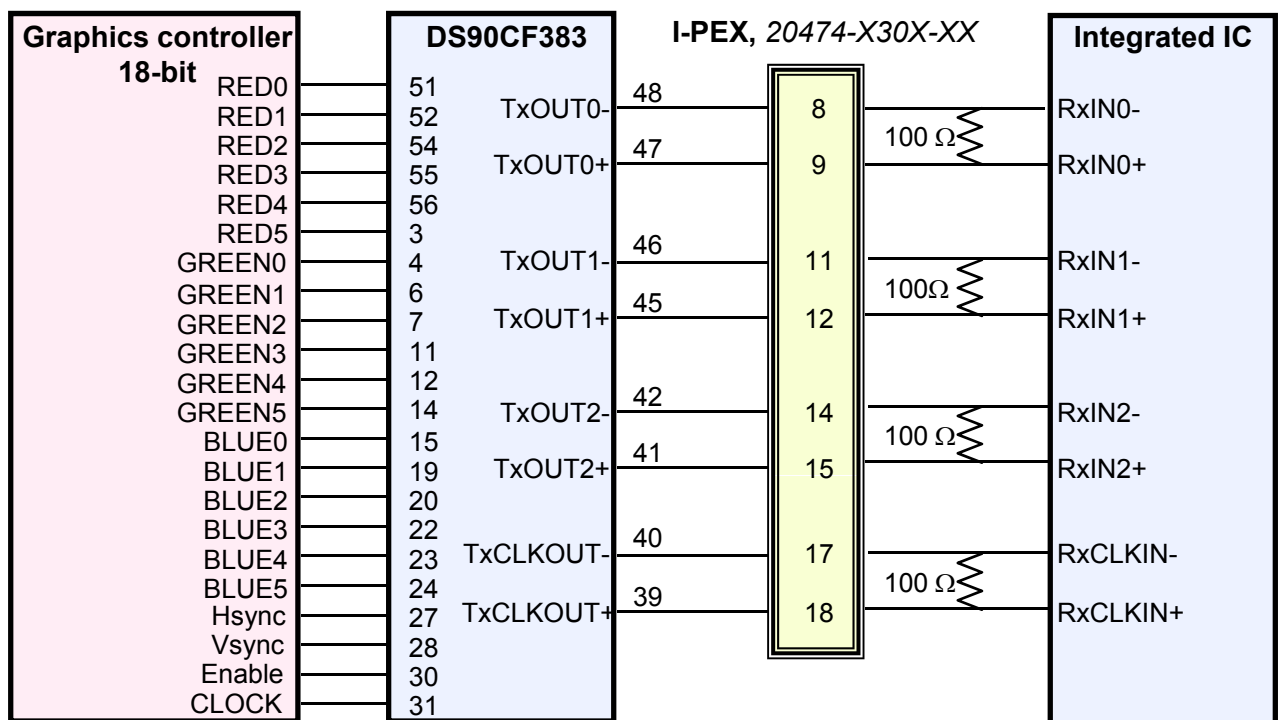
Note : The LCD Module uses a 100ohm resistor between positive and negative lines of each receiver input.

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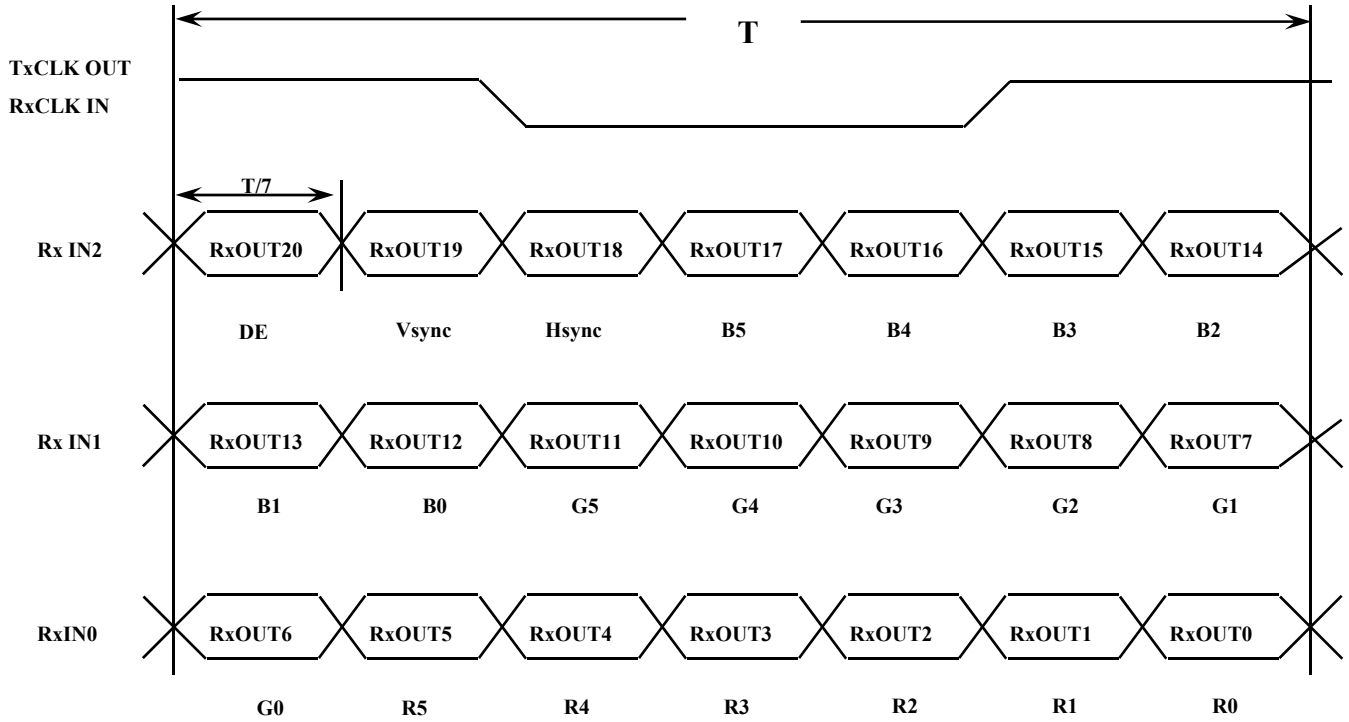
5.4 Input Signals, Basic Display Colors and Gray Scale of Each Color

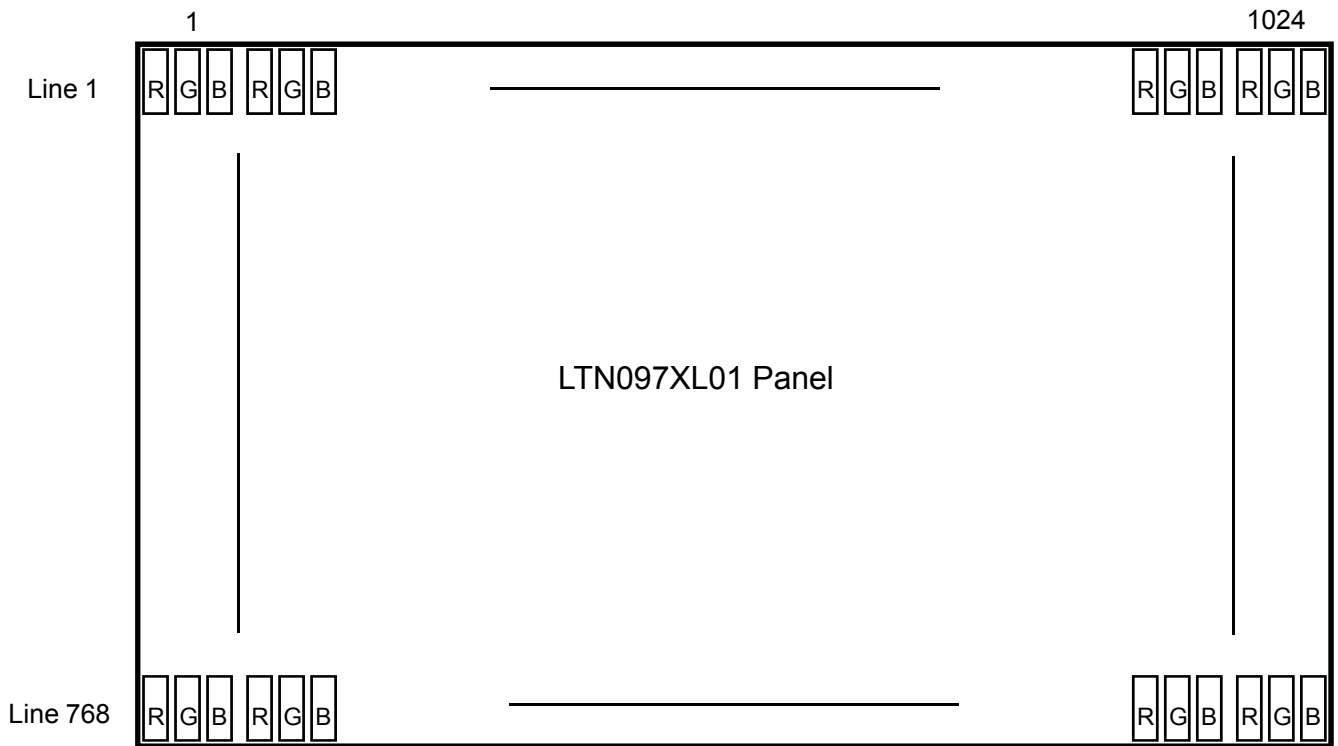| Color	Display	Data Signal																		Gray Scale Level
		Red						Green						Blue						
		R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	45	B5	
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	-
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	-
	Cyan	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
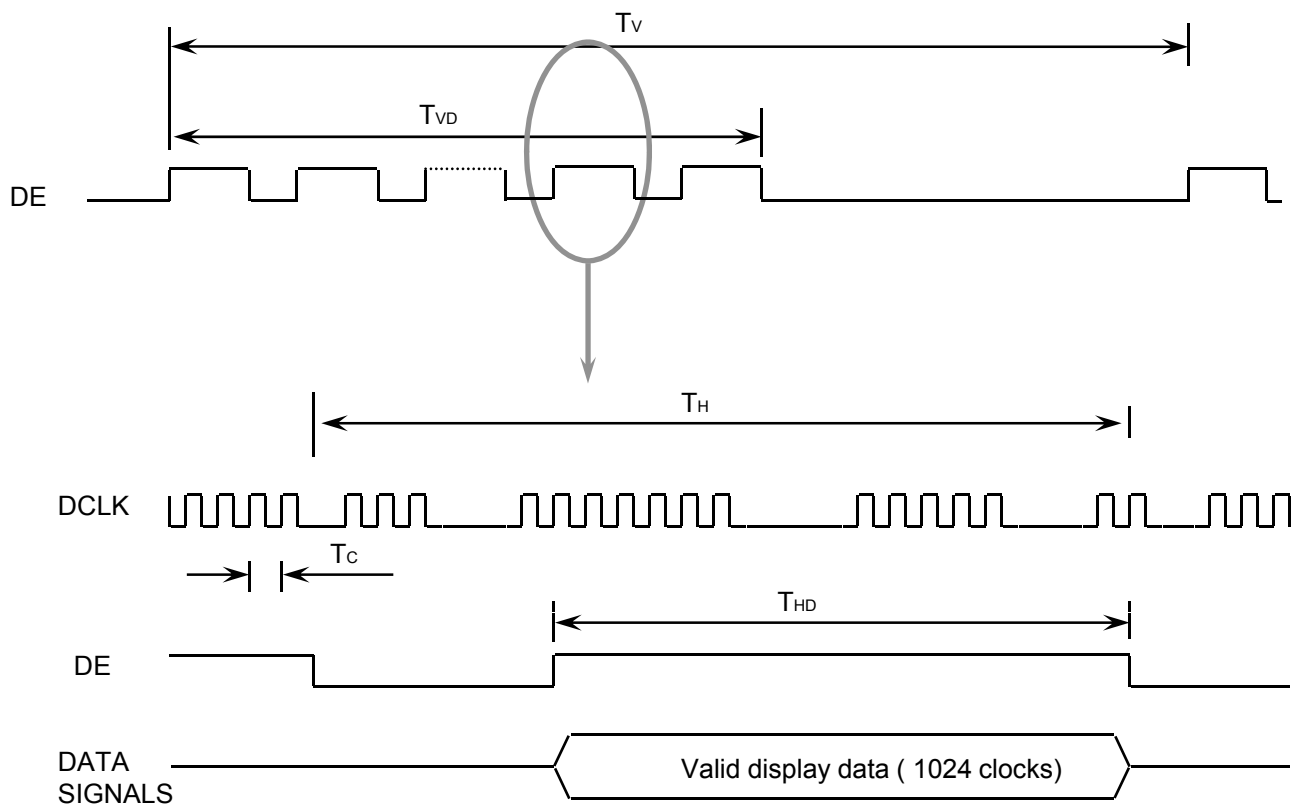
5.5 Pixel Format in the display

1   1024

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

LTN097XL01 Panel

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	772	800	812	Lines	
Vertical Active Display Term	Display Period	TVD	-	768	-	Lines	
One Line Scanning Time	Cycle	TH	-	2084	-	Clocks	
Horizontal Active Display Term	Display Period	THD	-	1024	-	Clocks	

6.2 Timing diagrams of interface signal

T_V

T_{VD}

DE

T_H

DCLK

T_C

T_{HD}

DE

DATA SIGNALS   Valid display data (1024 clocks)

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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 Supply V_{DD}

$0.9\ V_{DD}$ $0.9\ V_{DD}$
$0.1\ V_{DD}$ $0.1\ V_{DD}$
0V

$0.15 < T_1 \leq 10$ msec
$0 < T_2 \leq 50$ msec
$0 < T_3 \leq 50$ msec
500 msec $\leq T_4$

T_1 T_3
T_2 T_4

Signals   VALID

0 V

Power On   Power Off

Back-light
200 msec $\leq T_5$
200 msec $\leq T_6$

50%   50%

T_5 T_6
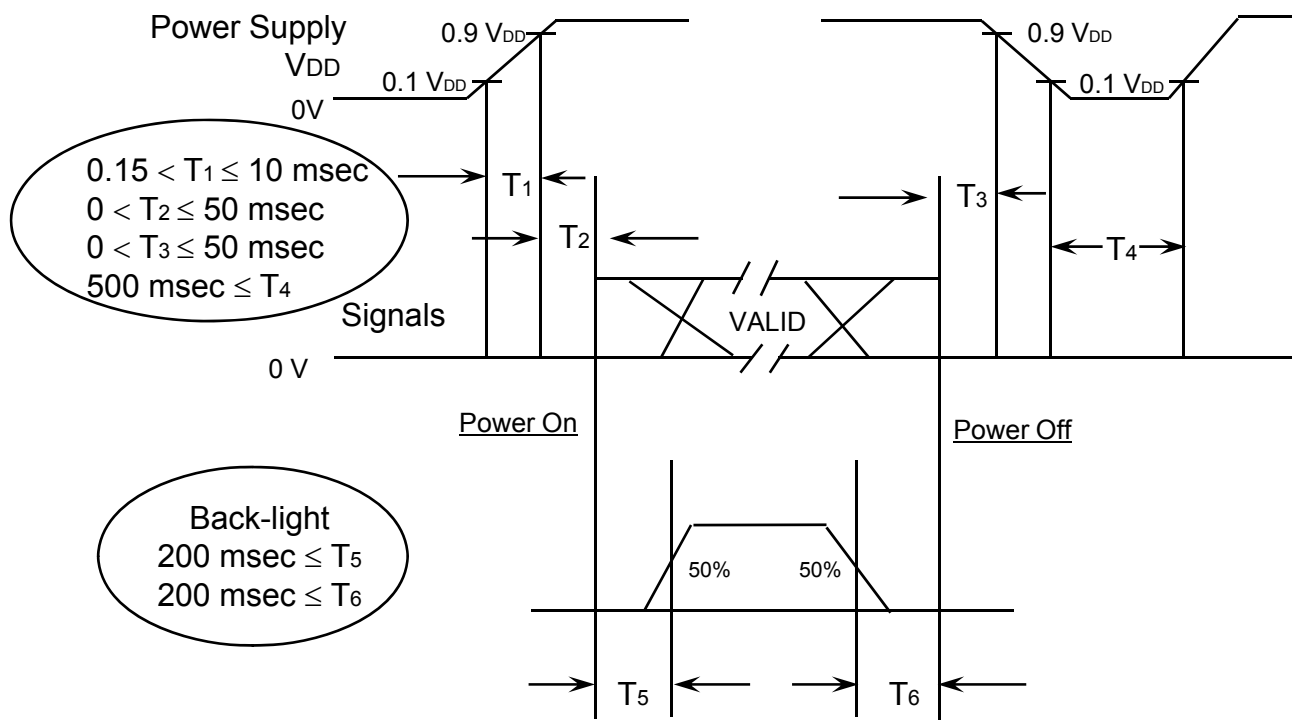
Power ON/OFF Sequence

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 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

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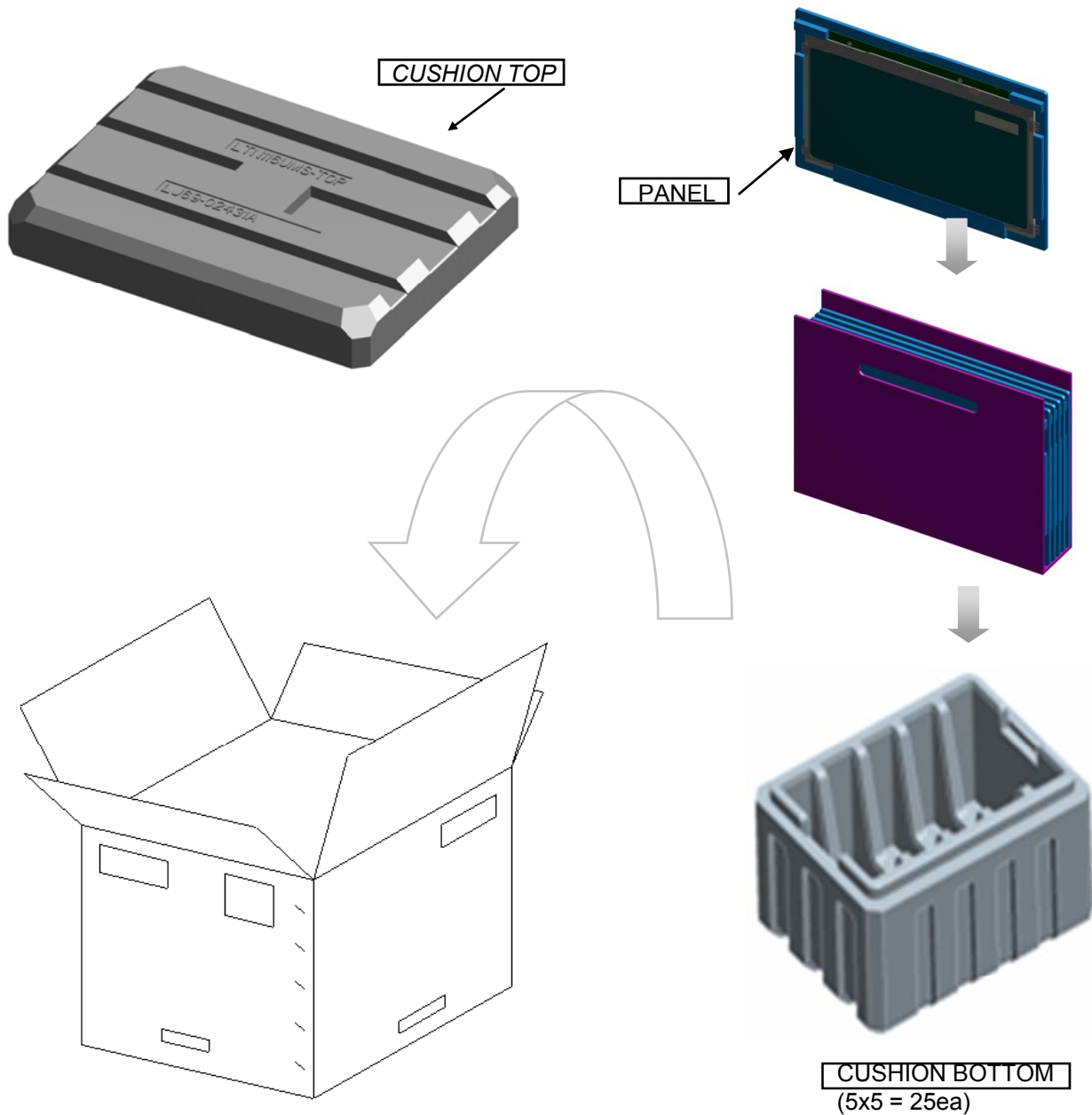*This page will be replaced with the outline drawing after producing PDF file.*

8. PACKING

1. CARTON(Internal Package)

(1) Packing Form
Corrugated Cardboard box and Corrupad form as shock absorber

(2) Packing Method

CUSHION TOP

LTN097XL-TOP

LJ63-02431A

PANEL

CUSHION BOTTOM
(5x5 = 25ea)

* Each panel was packed with shielding bag

(3)Packing Material

No	Part name	Quantity
1	Static electric protective sack	(25)
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.
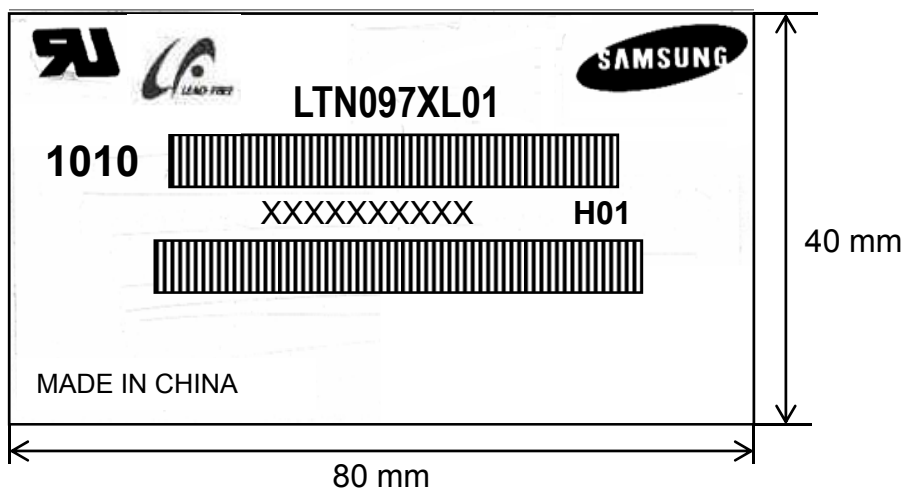
(1)Parts number : LTN097XL01
(2)Revision code : 3 letters
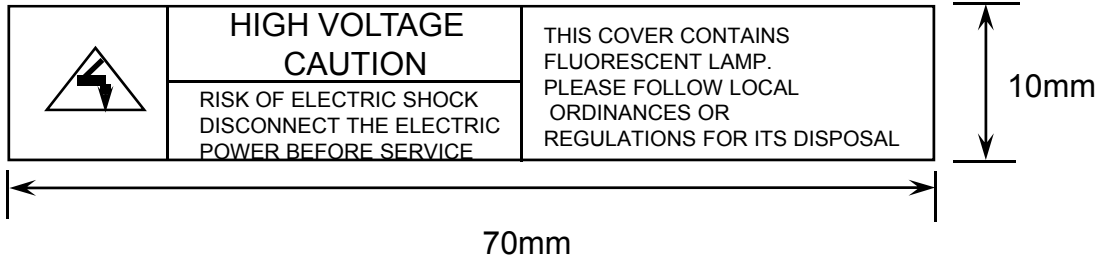(3)Lot number   : X X X X XXX XX X   **H01**

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

(4) Nameplate Indication

LTN097XL01
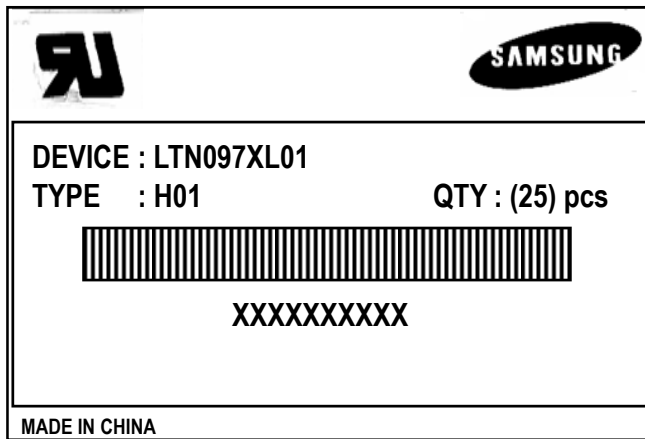1010 XXXXXXXXXX **H01**
MADE IN CHINA
40 mm
80 mm
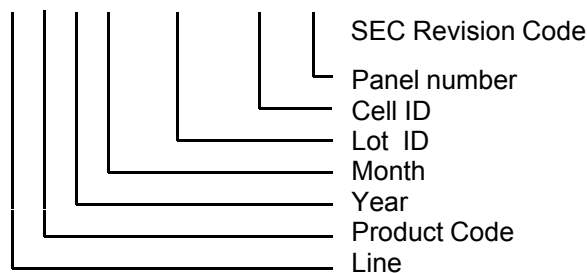
Parts name   : LTN097XL01
Lot number   : XXXXXXXXX
Inspected work week : 10 (2010 year 10th week)
Product Revision Code : **H01**

(5) High voltage caution notice

| ⚡ | 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

↔ 70mm

(6) Packing small box attach


```
UL                              SAMSUNG

DEVICE : LTN097XL01
TYPE   : H01              QTY : (25) pcs

        ||||||||||||||||||||||||||
             XXXXXXXXXX


MADE IN CHINA
```

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

wise view™

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 LED 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.

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 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.