Product Specification

CUSTOMER	LENOVO
DATE OF ISSUE	2012.05.30

MODEL NO.	LTN133AT28
EXTENSION CODE	-L01

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REVISION HISTORY

Date.	Rev.No.	Page	Revision Description
05/30/12	V00		Initial Release

1. GENERAL DESCRIPTION

DESCRIPTION

The LTN133AT28-L01 uses a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFTs as switching components. This model is composed of a TFT LCD panel, a driver circuit, and a backlight unit. This 13.3" model has a resolution of 1366 x 768 pixels and can display up to 262,144 colors.

FEATURES

High contrast ratio
HD(1366 x 768 pixels) resolution
Low power consumption
Fast Response
LED back light with an embedded LED driver
DE (Data enable) only mode
3.3V LVDS Interface
Onboard EEDID chip

APPLICATIONS

Notebook PC
If the intent to use this product is for other purpose, please contact Samsung Display.

GENERAL INFORMATION

Item	Specification	Unit	Note
Display area	293.42 (H) x 164.97 (V) (13.3"diagonal)	mm	
Driver Element	a-Si TFT active matrix		
Display colors	262,144 (6bit)		
Number of pixel	1366 * 768 (HD)	Pixel	16:9
Pixel Arrangement	RGB vertical stripe		
Pixel pitch	0.2148 (H) x 0.2148 (V) (TYP.)	mm	
Display Mode	Normally white, TN mode		
Thickness of glass	0.5	mm	
Surface treatment	Haze 0%, Hardness 2H		Glare
Environmental safe regulation	Pb Free, Halogen Free		

MECHANICAL INFORMATION

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	313.6	314.1	314.6	mm	with flange
		305.8	306.3	306.8	mm	w/o flange
	Vertical (V)	188.2	188.7	189.2	mm	with PCB
		177.2	177.7	178.2	mm	w/o PCB
	Depth (D)	-	3.4	3.6	mm	(1)
Weight		-	273	290	g	

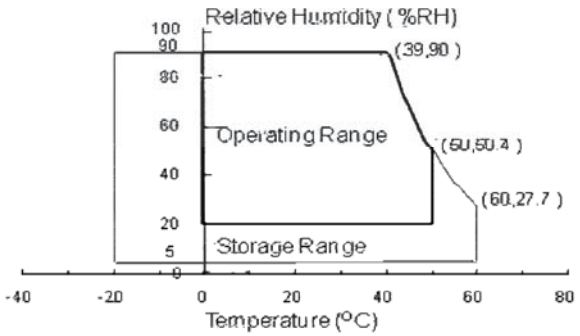
NOTE (1) Measuring method for thickness
Force to be applied for measurement (Body Part) : The 200gf when using the height gauge.
Force to be applied for measurement (COF Part) : The 50gf when using the height gauge.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ENVIRONMENTAL ABSOLTE RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Storage temperate	TSTG	-20	60	°C	(1)
Operating temperature (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) The range of temperature and relative humidity are shown in the graph below 90% RH Max. . (39℃ ≥ Ta) If the temperature is higher than 40 ℃, the maximum temperature of wet–bulb shall be less than 39℃. No condensation



(2) Vibrate ±X, ±Y, and ± Z axis in the shape of the half sine wave one time for 2ms .
(3) Vibrate the X, Y, and Z randomly within a 5 - 500 Hz range for 30min.
(4) When testing a vibration and a shock, the fixture, which holds the module to be tested shall be hard and rigid in order for the the module not to be twisted or bent by the fixture.

2.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

V_{LCD_VCC} =3.3V, V_{SS} = GND = 0V

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{LCD_VCC}	V_{SS} - 0.3	4.0	V	(1),(2)
LVDS Input Voltage	V_{LVDS}	V_{SS} - 0.3	2.0		

Note (1) Within Ta (25 ± 2 °C)
(2) Permanent damage to the device may occur if exceed maximum values.

(2) BACKLIGHT UNIT

VSS = GND = 0V

Item	Symbol	Min.	Max.	Unit	Note
BLU Supply Voltage	V_{BL_PWR}	V_{SS} - 0.3	26.5	V	(1), (2)
BLU Supply Current	I_{BL_PWR}	-	0.9	A	(1), (2) Vin=12V Duty 100%

Note (1) Within Ta (25 ± 2 °C)
(2) Permanent damage to the device may occur if exceed maximum values

2.3 THE OTHERS

(1) STATIC ELECTRICITY PRESSURE RESISTANCE

Item	Test Conditions	Remark
CONTACT DISCHARGE	150pF, 330Ω, ± 8kV, 200points, 1 time/point	Operating
AIR DISCHARGE	150pF, 330Ω, ± 15kV, 200points, 1 time/point	Operating

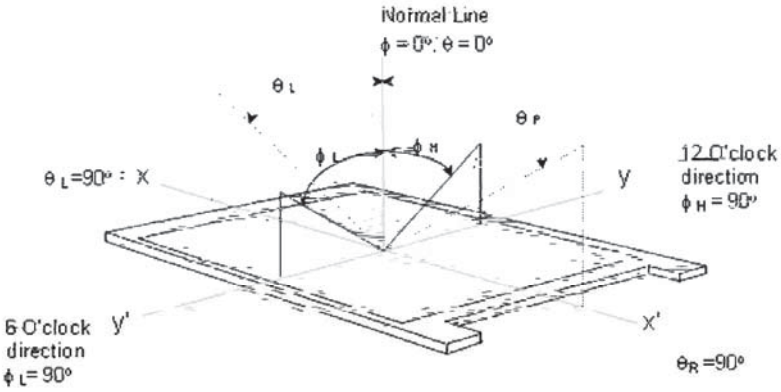
3. OPTICAL CHARACTERISTICS

The following items are measured under the stable conditions.* The optical characteristics should be measured in the dark room or the equivalent environment by the methods shown in the Note (5).
Measuring equipment : TOPCON SR-3

Ta = 25 ± 2 °C, V_{LCD_VCC} =3.3V, fv= 60Hz, fDCLK = 69.71MHz, IF = 100% duty

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	Normal Viewing Angle $\phi = 0$ $\theta = 0$	500	700	-	-	(1),(2),(5)
Response time (Rising + Falling)		T_{RT}		-	16	25	msec	(1),(3)
Average Luminance of White (5 Points)		$Y_{L,AVE}$		170	200	-	cd/m^2	IF=100% Duty (1),(4)
Cross Modulation		DSHA		-	1.0	2.0	%	(7)
Color Chromaticity (CIE)	Red	R_X		-0.03	0.576	+0.03		(1),(5)
		R_Y			0.347			
	Green	G_X			0.337			
		G_Y			0.552			
	Blue	B_X			0.162			
		B_Y			0.122			
	White	W_X			0.313			
		W_Y			0.329			
Viewing Angle	Hor.	θ_L	CR ≥ 10 At center	30	45	-	Degrees	(1),(5)
		θ_H		30	45	-		
	Ver.	ϕ_H		10	20	-		
		ϕ_L		20	30	-		
Color Gamut		CG		41	45	-	%	
White variation (13P)		δ_L		-	1.54	1.7		(6)

Note (1) The definition of viewing angle : The range of viewing angle (10 ≤ C/R)

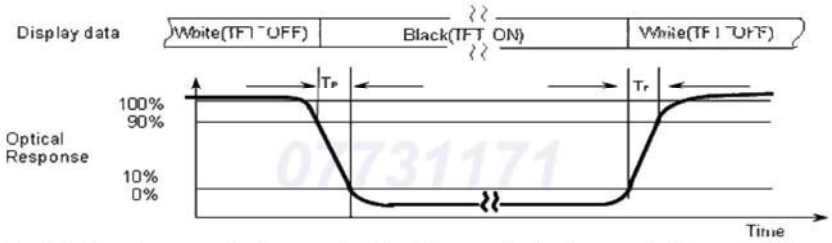


Note (2) The definition of contrast ratio (CR) : The ratio of max. gray and min gray at 5 points (4, 5, 7, 9, and10)

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

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

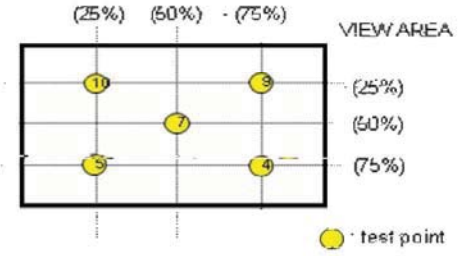
Note (3) The definition of Response time : Subtotal of the time, during which the transmission changes from 10% to 90% when the TFT turns on and off.



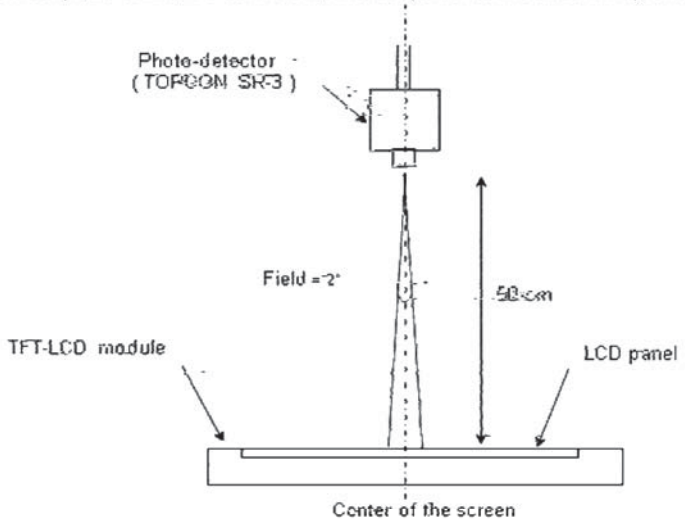
Note (4) The definition of average luminance of white : Measure the luminance of white at 5 points.

Average luminance of White ($Y_{L5,E}$)

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



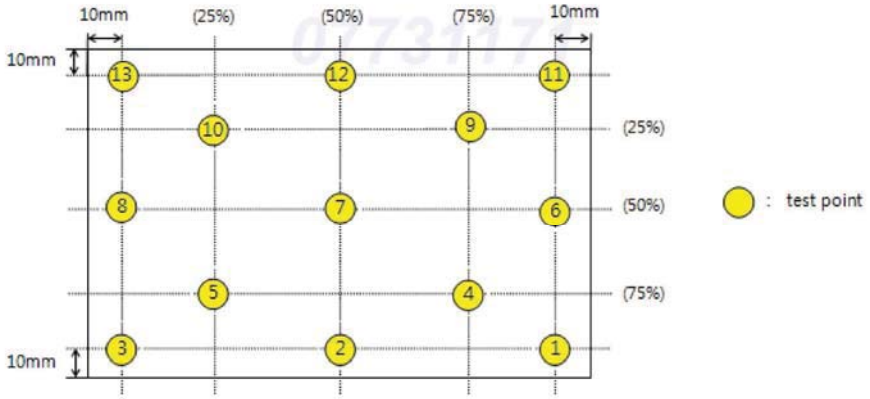
Note (5) Measure the panel, which is left for 30 min. at the normal temp. after leaving it for 30 min with turning the back light on at the rating. The measurement should be executed under the condition including the ambient temp., 25℃±2℃, the dark room, windless(removed the direct wind), and no vibration.



[Optical characteristics measurement setup]

Note (6) The definition of white variation at 13 points (δ L)

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



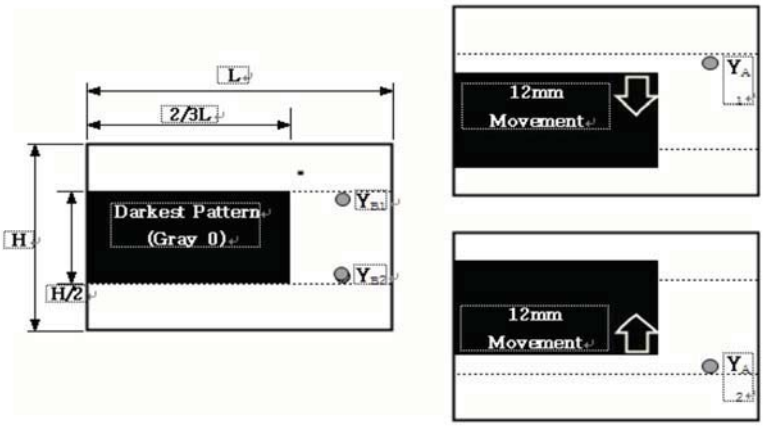
Note (7) The definition of crosstalk (Cross modulation)
: The phenomenon, which the contrast ratio is decreased by the interference of signal between pixels

Crosstalk Calculation Method

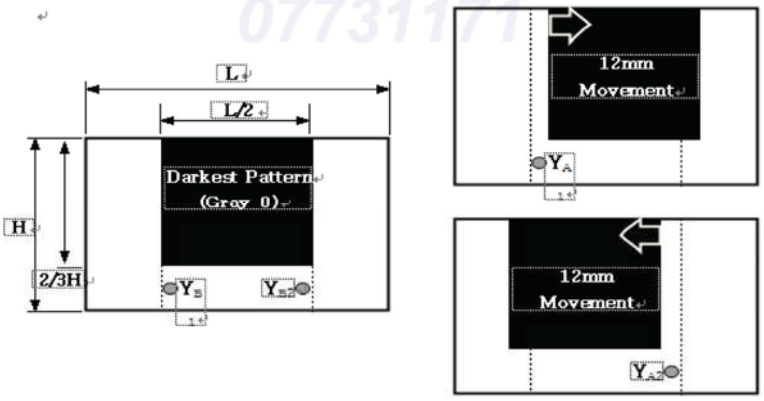
$$\text{Crosstalk Modulation Ratio}(D_{SHA}) = \frac{|Y_A - Y_B|}{Y_A} \times 100\ (\%)$$

Where
Y_A, Y_B = Measured under the 2° viewing angle (Measured area: ψ12 ㎜)
The rectangle area, which excludes the black-colored rectangle includes the range, which is from 1 gray to 63 gray.

1) The method of measurement for horizontal-crosstalk

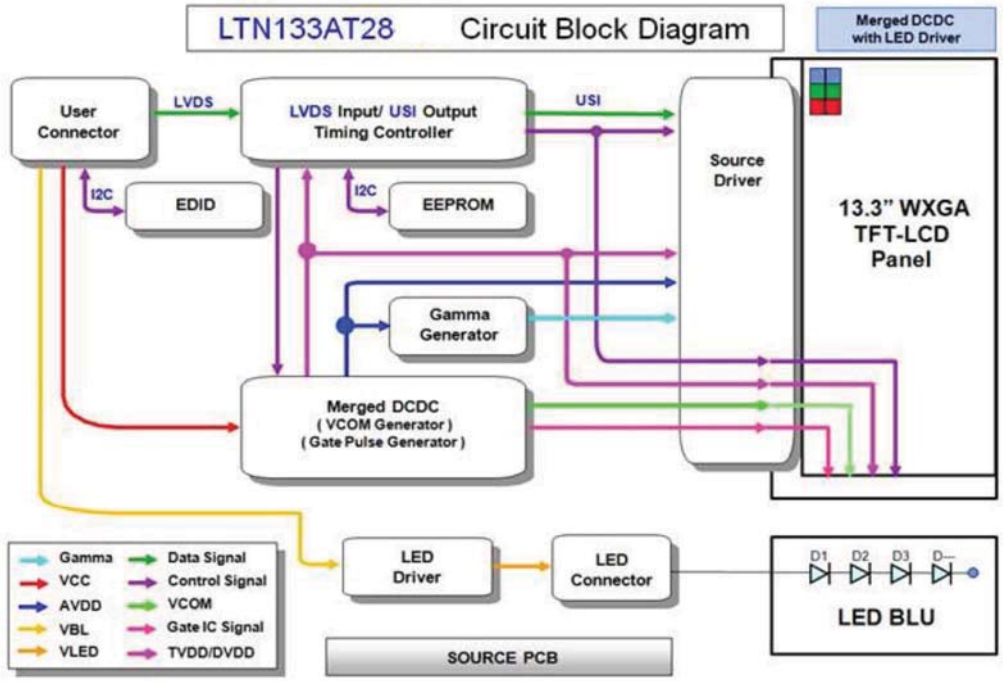


2) The method of measurement for vertical-crosstalk



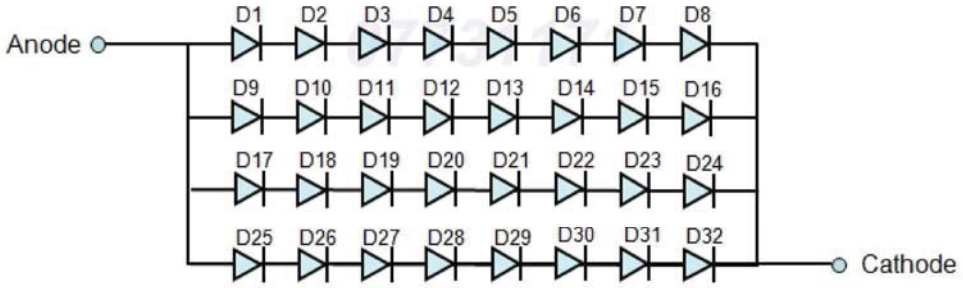
4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 THE STRUCTURE OF LED PLACEMENT

(4 channels x 8ea = 32ea)



5. ELECTRICAL CHARACTERISTICS

5.1 TFT LCD MODULE

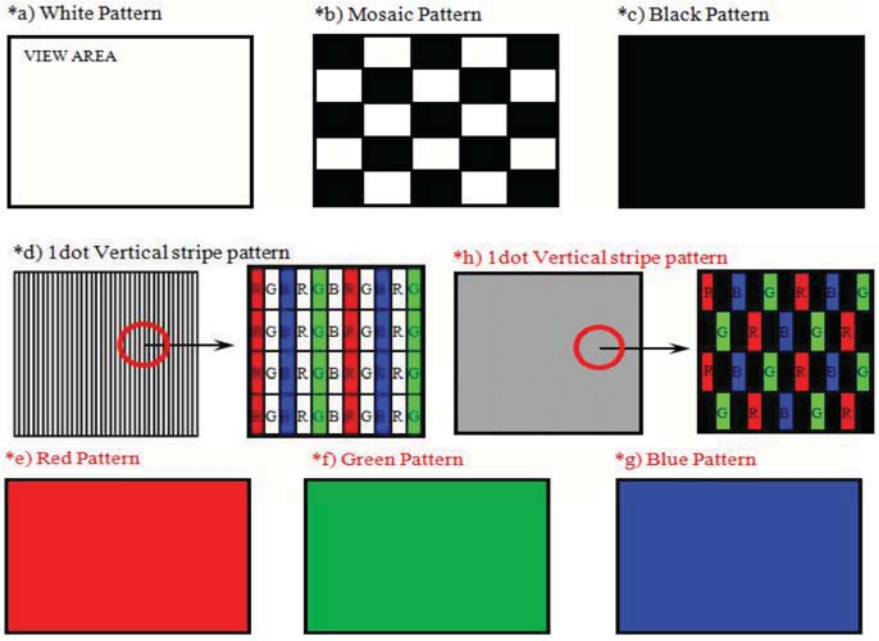
* Ta = 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note

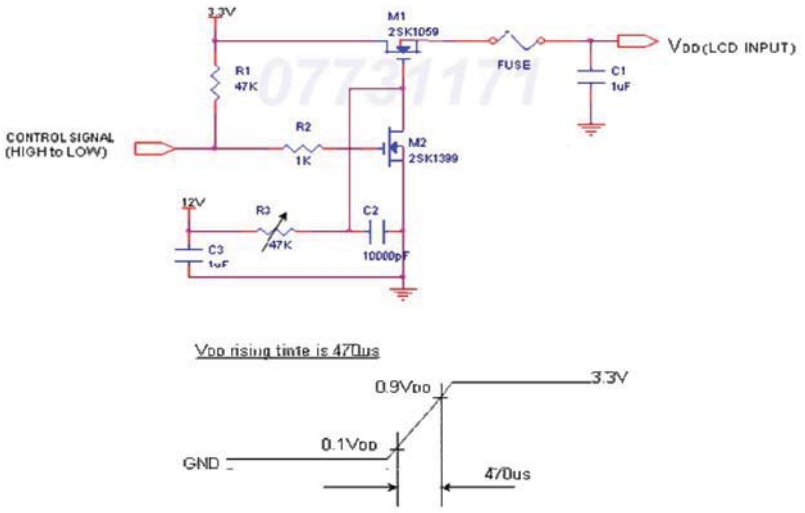
Power Supply Voltage		VLCD_VCC	3.0	3.3	3.6	V	
T-CON TTL Input Voltage	High	VTH	0.7 V_{LCD_VCC}	-	-	V	(1)
	Low	VTL	-	-	0.3 V_{LCD_VCC}	V	
Threshold voltage for differential input at LVDS receiver	High	VIH	-	-	+100	mV	VCM = +1.2V
	Low	VIL	-100	-	-	mV	
Vsync	60Hz	fv	-	60	-	Hz	
	50Hz	fv	-	50	-	Hz	(3)
	40Hz	fv	-	40	-	Hz	
Hsync	60Hz	fh	46.38	47.04	48.60	kHz	
Main Frequency	60Hz	fDCLK	66.14	69.71	83.88	MHz	
	50Hz	fDCLK	-	58.09	-	MHz	(3)
	40Hz	fDCLK	-	46.48	-	MHz	
Rush Current		IRUSH	-	-	1.5	A	(6)
Input Current	White	I_{LCD_VCC}	-	242	265	mA	(2), (5)
	Mosaic	I_{LCD_VCC}	-	276	303	mA	
	Black	I_{LCD_VCC}	-	230	253	mA	
	V.Stripe	I_{LCD_VCC}	-	370	400	mA	
	Red	I_{LCD_VCC}	-	310	340	mA	(2), (5)
	Green	I_{LCD_VCC}	-	310	340	mA	
	Blue	I_{LCD_VCC}	-	270	300	mA	
	1Dot	I_{LCD_VCC}	-	320	352	mA	(5)
EDID Input Voltage		V_{EDID}	3.0	3.3	3.6	V	
EDID Input Current		I_{EDID}	-	-	5	mA	
Skew		PS	-400	-	400	Ps	(2)

Note (1) The data pins for display and signal pins for timing should be connected.(GND= 0V)
(2) fV = 60Hz, fDCLK = 69.71 MHZ, V_{LCD_VCC} = 3.3V , DC Current.
(3) In the case of 40Hz & 50Hz, FOS, Flicker & Brightness are not guaranteed, because their level might be different from 60Hz operation.

Note (5) The dissipation pattern for power



Note (6) The condition for measurement for rush current



5.2 BACK LIGHT UNIT

Ta = 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Forward Current	IF	-	19.2	-	mA	
LED Forward Voltage	VF	3.0	3.2	3.4	V	IF = 20mA
LED Array Voltage	VP	-	25.6	-	V	VF * LED Counts
LED Power Consumption	P	-	2.27	2.5	W	
LED Life time	Hr	12,000	-	-	Hours	(1)
LED Counts	Q	-	32	-	EA	

Note (1) The life time (Hr) of LEDs can be defined as the time during which it continues to operate under the condition, which the Ta is 25 ± 2 °C and IF= 19.2 mArms until the one of the following events occurs when the brightness becomes 50% or lower than the original..

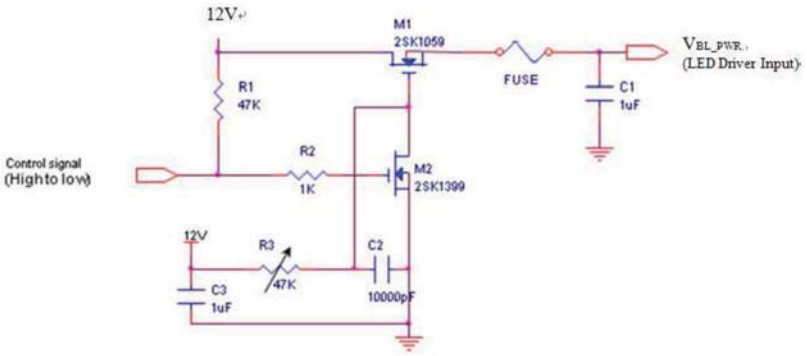
5.3 LED DRIVER

The manufacturer of LED driver: Richtek RT8510

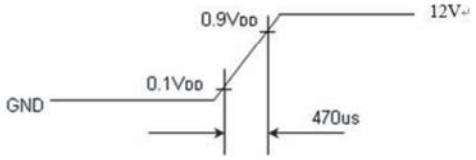
Ta= 25 ± 2 °C

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage		V_{BL_PWR}	7	12	20	V	
Input Current		I_{BL_PWR}	-	189	208	mA	Vin=12V Duty 100%
PWM duty Ratio		$D_{BL\_PWM\_DIM}$	0.2	-	100	%	PWM : 120Hz~500Hz
			0.4	-	100		PWM : 500Hz~1kHz
			0.8	-	100		PWM : 1kHz~2kHz
			1.5	-	100		PWM : 2kHz~5kHz
			3	-	100		PWM : 5kHz~10kHz
			10	-	100		PWM : 10kHz~30kHz
External PWM Frequency		$F_{BL\_PWM\_DIM}$	0.12	1	30	kHz	
In-Rush Current		$I_{RUSH\_BL\_PWR}$	-	-	1.5	A	(1)
EN Control Level	High	V_{BL_ENABLE}	2.0	-	5.0	V	
	Low		0.0	-	0.8	V	
PWM Control Level	HIgh	$V_{BL\_PWM\_DIM}$	2.0	-	5.0	V	
	Low		0.0	-	0.8	V	
V_{BL_PWR} @ LED Driver On		V_{BL_PWR}	7	-	20	V	
V_{BL_PWR} @ LED Driver Off		V_{BL_PWR}	0	-	2	V	
Operating frequency		F_O	0.8	1.0	1.2	kHz	
Efficiency		η	-	87	-	%	

Note (1) Rush current measurement condition



The V_{BL_PWR} rising time is 470us.



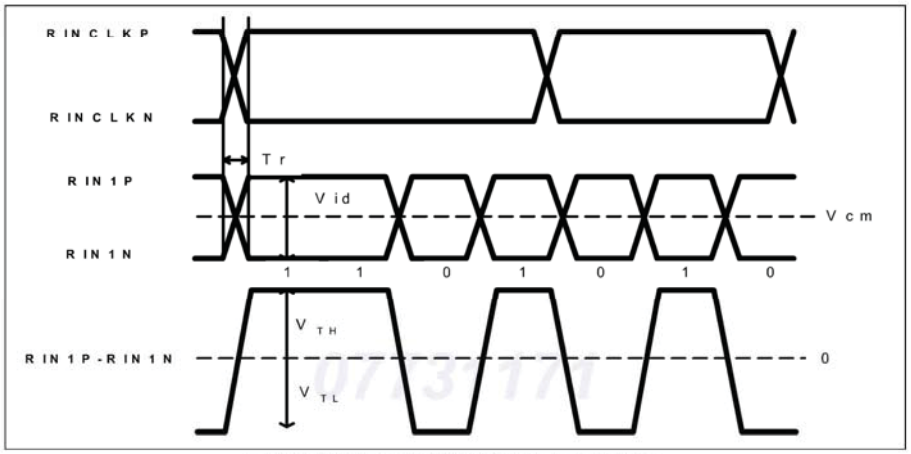
5.4 LVDS INTERFACE

5.4.1 LVDS DC Specifications

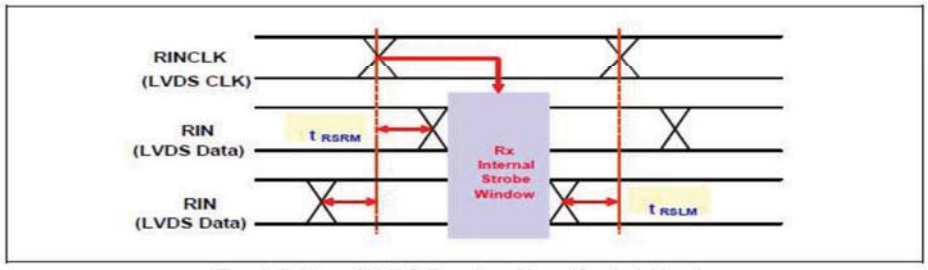
Characteristics	Symbol	Min.	Typ.	Max.	Unit	Conditions
Differential input high threshold voltage	V_{TH}	-	-	+100	mV	V_{CM} = 1.2V
Differential input low threshold voltage	V_{TL}	-100	-	-	mV	
Differential input voltage	$\|V_{ID}\|$	200	400	600	mV	
Common mode voltage	V_{CM}	0.3.	1.2	1.7	V	$\|V_{ID}\|$= 100mV

5.4.2 LVDS AC Specifications

Characteristics		Symbol	Min.	Typ.	Max.	Unit	Remarks
ROUTCLK frequency		fRCP	66.14	69.71	83.88	Mhz	
LVDS RX Skew (Strobe) Right Margin	85MHz	T_{RSRM}	-	-	400	ps	
	50MHz		-	-	700	ps	
LVDS RX Skew (Strobe) Left Margin	85MHz	T_{RSLM}	-400	-	-	ps	
	50MHz		-700	-	-	ps	



< The definition of LVDS DC characteristics >

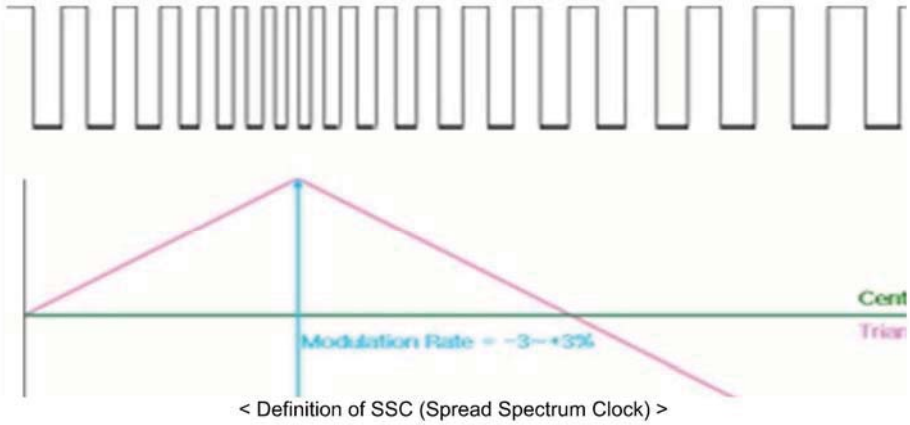


< The definition of LVDS Receiver Skew (Strobe) Margin >

5.4.3 LVDS SSC Specification

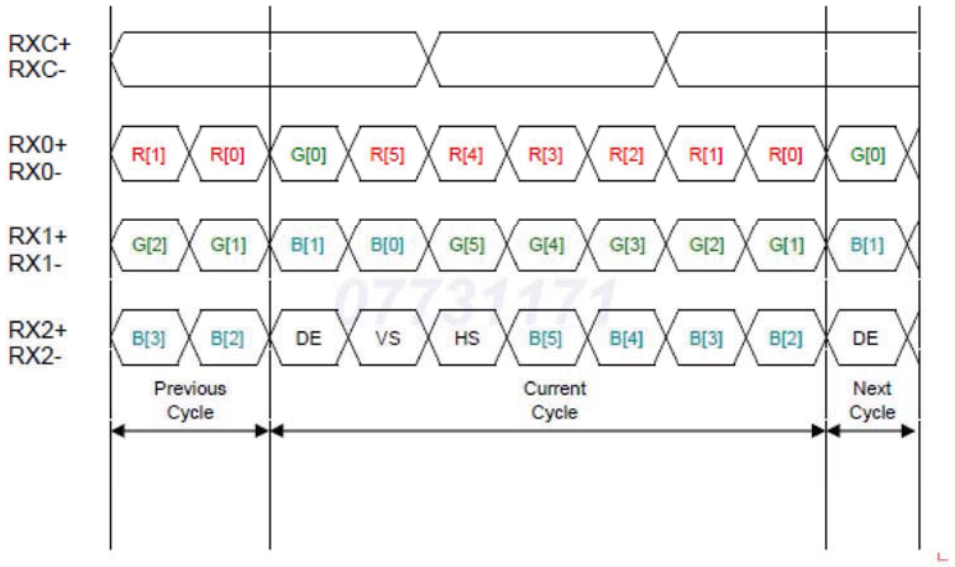
Characteristics	Symbol	Min.	Typ.	Max.	Unit	Remarks
Modulation Rate	Fmr	-3	0	+3	%	

Modulation Frequency	Fmf	30	-	300	kHz	@ MAINCLK = 69.71MHz



< Definition of SSC (Spread Spectrum Clock) >

5.4.4 Timing diagrams of LVDS transmission



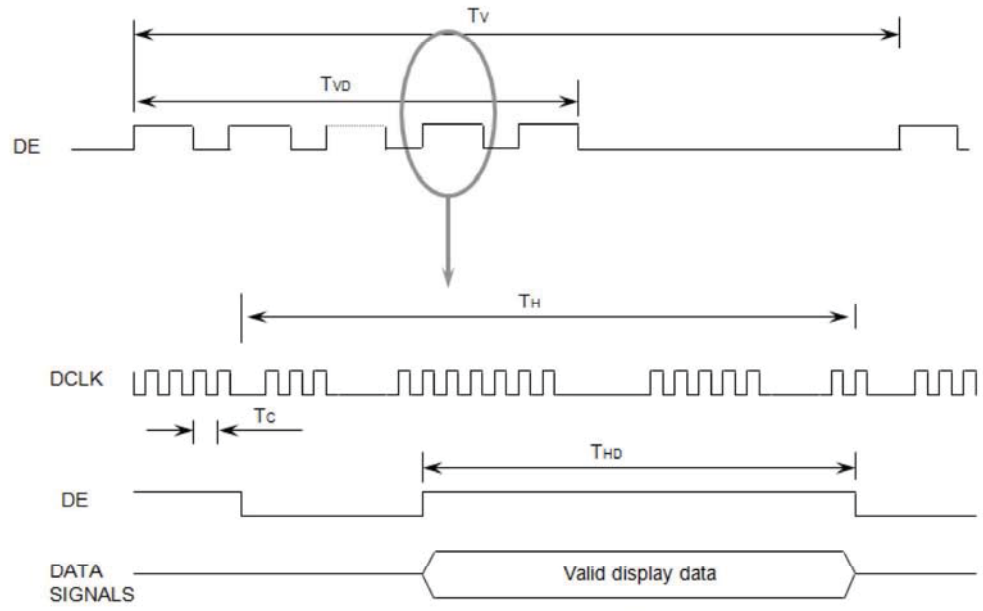
5.5 INTERFACE TIMING

5.5.1 TIMING PARAMETERS

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note

Frame Frequency	Cycle	T_V	773	784	810	Lines	
Vertical active in the display term	Display Period	T_{VD}	-	768	-	Lines	
Scanning time in one line	Cycle	T_H	1426	1482	1726	Clocks	
Horizontal active in the display term	Display Period	T_{HD}	-	1366	-	Clocks	

5.5.2 TIMING DIAGRAMS OF INTERFACE SIGNAL



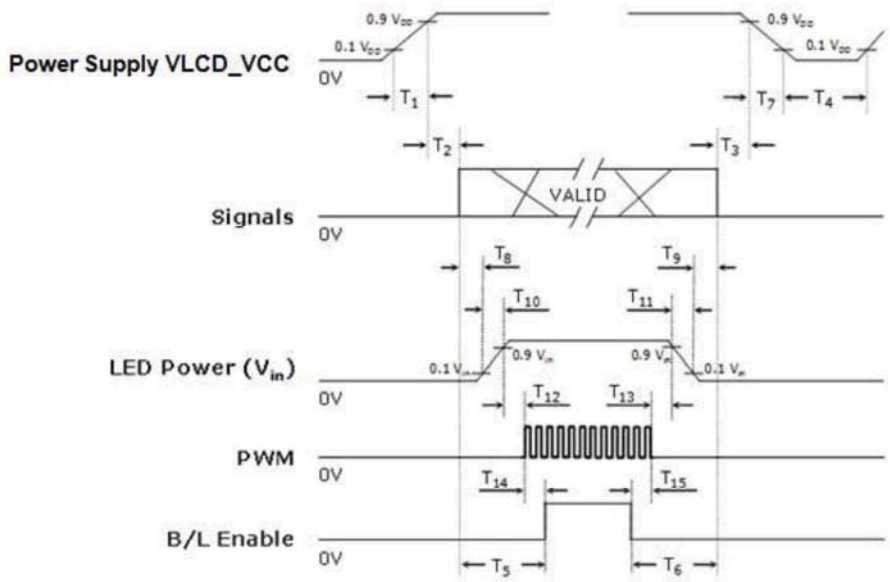
5.6 INPUT COLOR DATA MAPPING

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

5.7 POWER ON/OFF SEQUENCE

To prevent the product from being latched up or the DC in the LCD module from starting an operation, the order to turn the power on and off should be changed to the order as shown in the diagram below.



Timing (ms)	Remarks
$0.5 < T_1 \leq 10$	VLCD_VCC rising time from 10% to 90%
$0 < T_2 \leq 50$	Interval from VLCD_VCC to valid data at power ON
$0 < T_3 \leq 50$	Interval from valid data OFF to VLCD_VCC OFF at power Off
$500 \leq T_4$	VLCD_VCC OFF time for Windows restart
$200 \leq T_5$	Interval from valid data to B/L enable at power ON
$200 \leq T_6$	Interval from valid data off to B/L disable at power Off
$0 < T_7 \leq 10$	VLCD_VCC falling time from 90% to 10%
$10 < T_8$	Interval from valid data on to LED driver Vin rising time 10%
$10 < T_9$	Interval from LED driver Vin falling time 10% to valid data Off
$0.5 < T_{10} \leq 10$	LED V_{in} rising time from 10% to 90%
$0.5 < T_{11} \leq 10$	LED V_{in} falling time from 90% to 10%
$0 < T_{12}$	Interval from LED driver Vin rising time 90% to PWM ON
$0 < T_{13}$	Interval from PWM Off to LED driver Vin falling time 10%
$0 \leq T_{14}$	Interval from PWM ON to B/L Enable ON
$0 \leq T_{15}$	Interval from B/L Enable Off to PWM Off

The backlight may be flashed if the interface signal remains floated when the above-mentioned signal becomes invalid.

Note (1) The power voltage from system shall be supplied to the input pin of LCD constantly.
(2) Enable the voltage to the LED within the range, which the LCD is operated. The screen becomes white when turning the back-light on before the LCD is operated or turning the LCD off before turning

the back-light off. Operation or the LCD turns off before the back-light turns off, the display may momentarily become white.

(3) Don't leave the system at a high impedance state, which the interface signal is out for a long time after the Vcc is enabled.

(4) The T4 should be measured the module is fully discharged.

(5) The interface signal shall not maintain the high impedance when the power is on.

5.8 INPUT TERMINAL PIN ASSIGNMENT

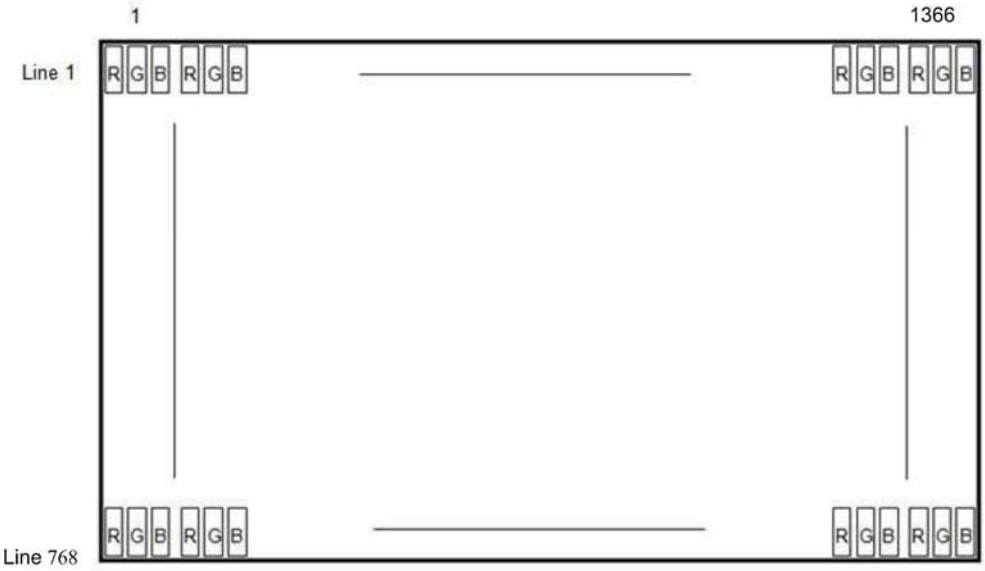
5.8.1 INPUT SIGNAL & POWER

(LVDS, Connector : 20455-040E-0 , I-PEX or the equipment with the equivalent capability)

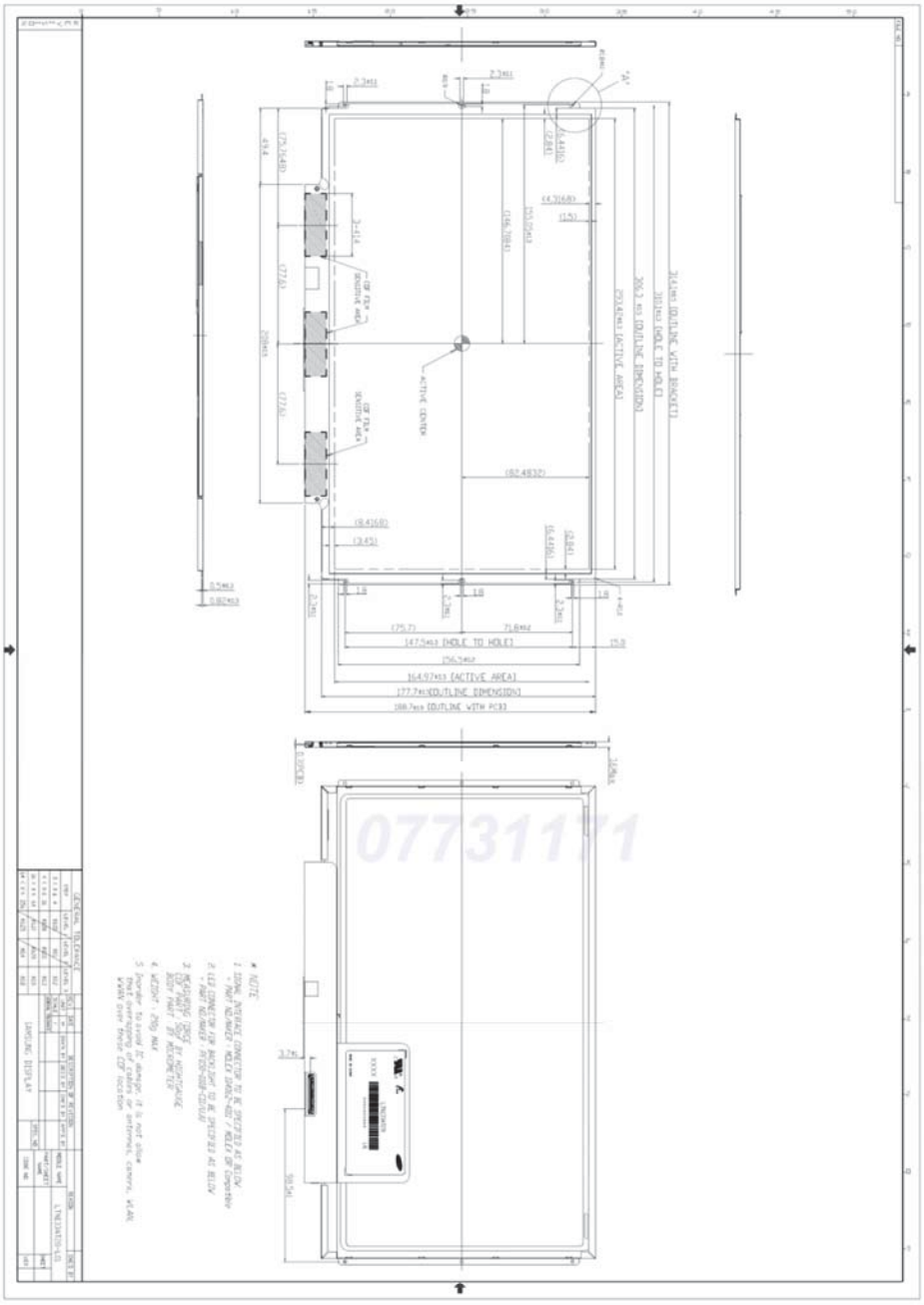
Pin	Symbol	Function
1	NC	Hot Plug Detect or No connection (optional)
2	LCD_VCC	LCD logic and driver IC Power(3.3V typ.)
3	LCD_VCC	LCD logic and driver IC Power(3.3V typ.)
4	VCC_EDID	DDC power
5	NC (WPN)	Reserved for the use by LCD manufacturer (WPN)

6	CLK_EDID	DDC clock
7	DAT_EDID	DDC data
8	RX0-	Negative LVDS differential data input for pixel
9	RX0+	Positive LVDS differential data input for pixel
10	H_GND	High speed ground
11	RX1-	Negative LVDS differential data input for pixel
12	RX1+	Positive LVDS differential data input for pixel
13	H_GND	High speed ground
14	RX2-	Negative LVDS differential data input for pixel
15	RX2+	Positive LVDS differential data input for pixel
16	H_GND	High speed ground
17	RXC-	Negative LVDS differential clock input for pixel
18	RXC+	Positive LVDS differential clock input for pixel
19	LCD_GND	LCD logic and driver IC Ground
20	NC	No connection
21	NC	No connection
22	LCD_GND	LCD logic and driver IC Ground
23	NC	No connection
24	NC	No connection
25	LCD_GND	LCD logic and driver IC Ground
26	NC	No connection
27	NC	No connection
28	LCD_GND	LCD logic and driver IC Ground
29	NC	No connection
30	NC	No connection
31	BL_GND	Backlight ground
32	BL_GND	Backlight ground
33	BL_GND	Backlight ground
34	NC	Hot Plug Detect or No connection (optional)
35	BL_PWM_DIM	Signal input for the system PWM for dimming
36	BL_ENABLE	Backlight on/off
37	NC	APS on/off or No connection (optional)
38	BL_PWR	Backlight power
39	BL_PWR	Backlight power
40	BL_PWR	Backlight power

6. PIXEL FORMAT



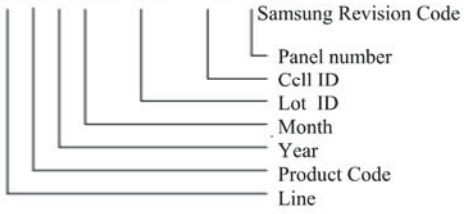
7. OUTLINE DIMENSION



8. MARKING

A nameplate is affixed to the specified location on each product.

(1)Parts number : LTN133AT28
(2)Revision code : 3 letters
(3)Lot number : X X X X XXX XX X L01



9. GENERAL PRECAUTIONS

9.1 STORAGE

We highly recommend to comply with the criteria in the table below.

ITEM	Unit	Min.	Max.
Storage Temperature	(℃)	5	40
Storage Humidity	(%rH)	35	75
Storage Life	12 months		
Storage Condition	- The storage room should be equipped with a good ventilation facility, which has a temperature controlling system. - Products should be placed on the pallet, which is away from the wall not on the floor. - Prevent products from being exposed to the direct sunlight, moisture, and water.; Be cautious not to pile the products up. - Avoid storing products in the environment, which other hazardous material is placed. - If products are delivered or kept in the storage facility more than 3 months,we recommend you to leave products under the condition including a 20℃ temperature and a humidity of 50% for 24 hours. - If you store semi-manufactured products for more than 3 months, bake the products under the condition including the 50℃ temp. and the 10% humidity for 24hrs after being used.		

10. APPENDIX

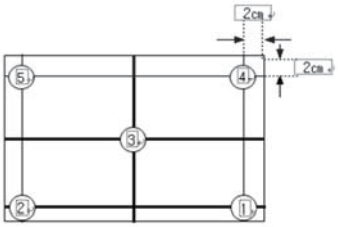
Only Internal

[OPTICAL CHARACTERISTICS]

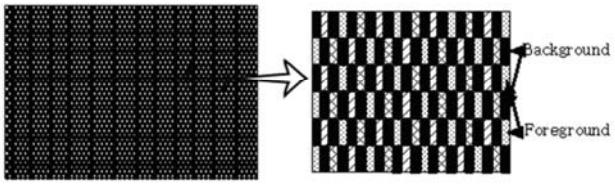
The following items are measured under the stable conditions.* The optical characteristics should be measured in the dark room or the equivalent environment by the methods shown in the Note (5).
Measuring equipment : TOPCON SR-3
Ta = 25 ± 2 °C, V_{LCD_VCC} F=3.3V, fv= 60Hz, fDCLK = 69.71MHz, IF = 100% duty

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Flicker	F		-	3.2	5.2		(8)

Note (8) The definition of flicker : The phenomenon, which the pixel on the screen of LCD panel blinks.
1) Calculate the figure with observing the standard for the measurement for the flicker.
2) Measurement point



3) Pattern to measure the flicker : Inverting driving of DOT



[LED DRIVER]

The manufacturer of LED driver: Richtek RT8510 Ta= 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
OVP driving Voltage	V_{OVP}	-	-	42	V	

[ELECTRICAL CHARACTERISTICS]

TFT LCD MODULE

* Ta = 25 ± 2 °C

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage Ripple	Active Period	$V_{LCD\_VCC\_RIPPLE}$	-	-	0.05 * V_{LCD_VCC}	V	(1)

Note (1) fV = 60Hz, fDCLK = 69.71MHz, V_{LCD_VCC} = 3.3V, Sub Dot Pattern