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Mechanical design



MODEL NO : ET020HV04-T

MODEL VERSION: 01

SPEC VERSION : 1.0

ISSUED DATE: 2021-05-11

☐ Preliminary Specification

☒ Final Product Specification

Customer : _____

Approved by	Notes

Youri Confirmation

Prepared by	Reviewed by	Approved by
John	Johnny	Wang

1. Introduction

1.1 Scope of application

This LCD module should be designed for mobile phone use.

LCD specification: Dots 240xRGBx320.

As to basic specification of the driver IC, refer to the IC (Orise:ST7789V2) specification and data book.

All material & processing of the LCD module should be Lead Free.

1.2 TFT features:

Structure: TFT PANNEL+IC +FPC+BL;

ALL O'CLOCK Type LCD

240 dot-segment and 320 dot-common outputs;

262K Color can be selected by software;

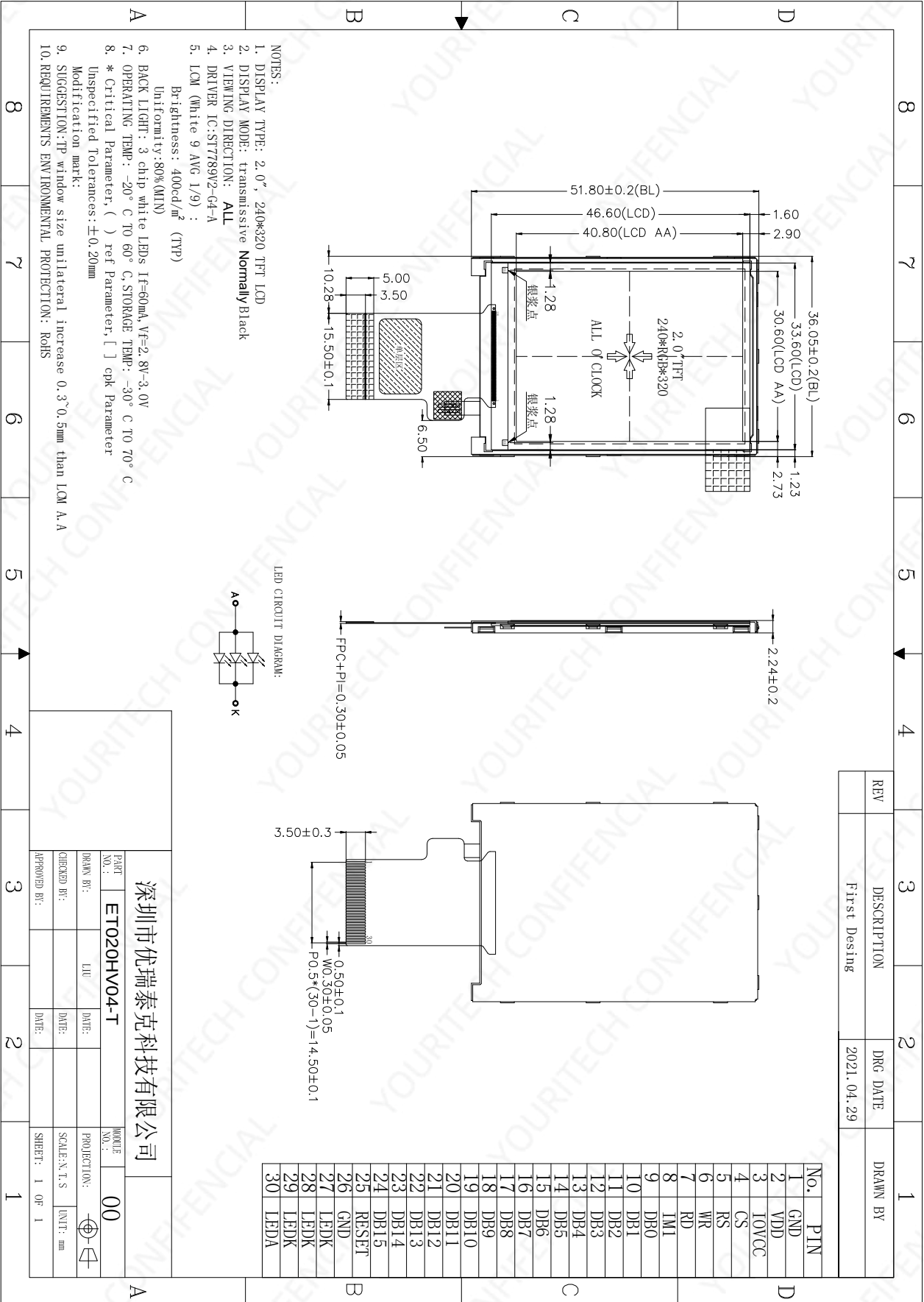
White LED back light;

8/16bit MCU interface

1.3 Applications:

2. LCM General specification

ITEM	Standard value	Unit
LCD Type	Normally Black	--
Drive element	TFT active matrix	--
Number of pixels	240*3RGB(H)X320(V)	Dots
Pixel arrangement	RGB stripe	--
Pixel Pitch (W*H)	0.1275(W)x 0.1275(H)	mm
Active area	30.60(W) x40.80(H)	mm
Module Size(W*H*T)	36.05(W) x51.80(H) x2.24(T)	mm
Viewing direction	ALL O'CLOCK	
TFT Driver IC	ST7789V2	-
TFT interface	8/16bit MCU interface	-
Approx. Weight	TBD	g



3.Absolute Maximum Rating

Characteristics	Symbol	Min.	Max.	Unit
LCM Operating Temperature	T _{OPR}	-20	+60	°C
LCM Storage Temperature	T _{STG}	-30	+70	°C
Humidity	RH	10	90	%

4.Electrical Characteristics

4.1 TFT DC Characteristics

(Ta=25±2°C)

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage 1	VDDIO	1.65	1.8	3.3	V	
Power Supply Voltage 2	VDD	2.6	2.8	3.3	V	
Power Supply Voltage 3	VDD3	-	-	-	V	
Power Supply for MTP	VPP	-	-	-	V	

6.4 Back-Light Unit Characeristics

The back-light system is an edge-lighting type with 3 white LEDs. The characteristics of the back-light are shown in the following tables.

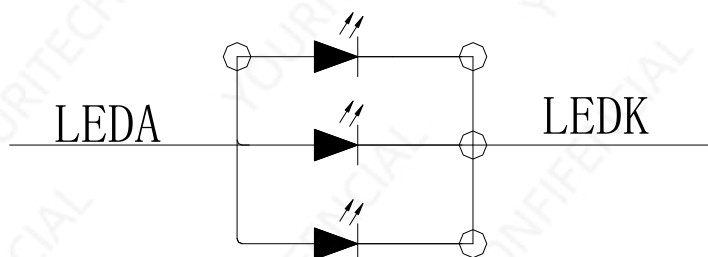
(Ta=25±2°C)

Characteristics	Symbol	Min.	Type	Max.	Unit	Notes
Forward Voltage	V _F	2.8	--	3.2	V	-
Forward current	I _F	--	60	-	mA	-
Luminance(With LCD)	L _v		400	--	cd/m ²	-
LED life time	N/A	----	30,000	--	Hr	Note 1

Note:

- (1) The “LED life time” is defined as the module brightness decrease to 50% of original brightness at I_L=20mA/LED. The LED life time could be decreased if operating I_L is larger than 25mA/LED.

Backlight circuit diagram shown in below:

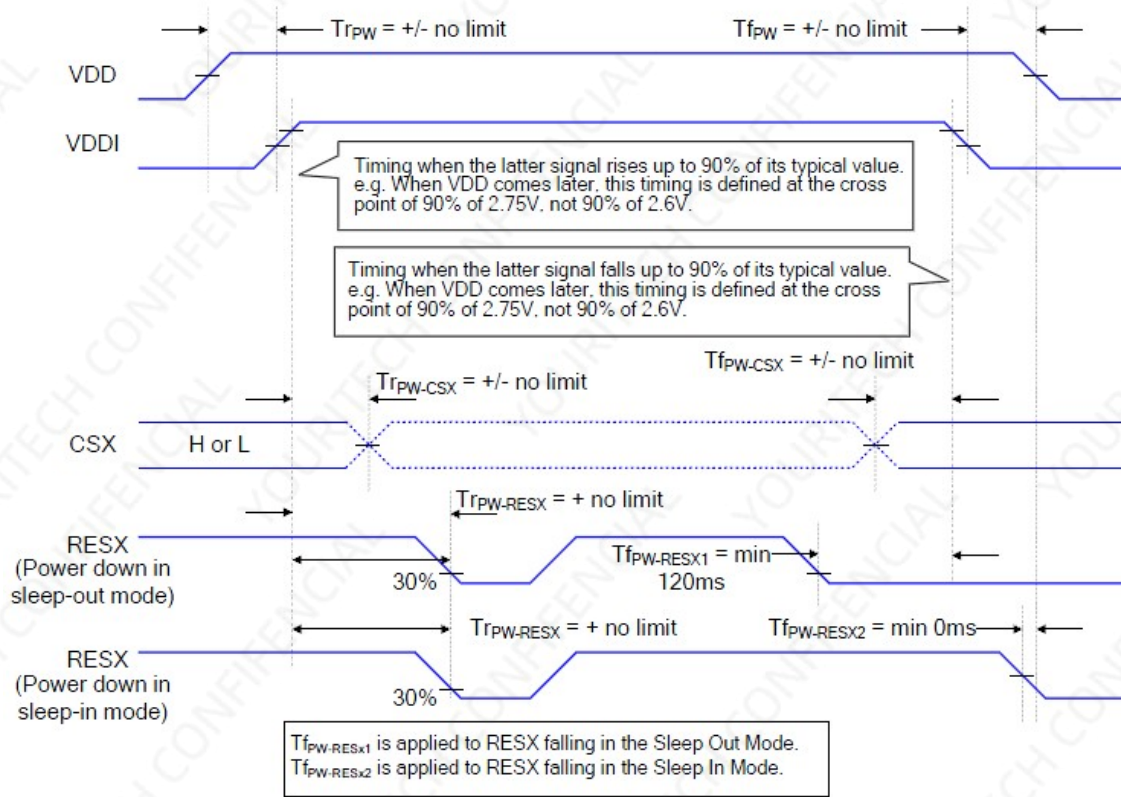


5. Module Function Description

Pin No.	Symbol	Functional	Notes
1	GND	Power Ground	
2	VDD	power supply for DC/DC circuit(2.8V)	
3	IOVCC	power supply for I/O circuit(1.8V)	
4	CS	Chip select signal input pin	
5	RS	Display data/command selection pin	
6	WR	Write enable in MCU parallel interface.	
7	RD	Read data at the rising edge.	
8	IM0	IM0=0: DB[7:0], 80-8bit parallel I/F; IM0=1: DB[15:0], 80-16bit parallel I/F;	
9~24	DB0~DB15	DB[15:0] are used as MCU parallel interface data bus.	
25	RESET	Reset signal input terminal. Active at 'L'.	
26	GND	Power Ground	
27	LEDK	Power supply for backlight cathode input terminal.	
28	LEDK	Power supply for backlight cathode input terminal.	
29	LEDK	Power supply for backlight cathode input terminal.	
30	LEDA	Power supply for backlight anode input terminal.	

6. Timing Characteristics

The power on/off sequence is illustrated below



The diagram illustrates the timing relationships for several control and data signals. The signals shown are CSX, D/CX, WRX, D[17:0] write, RDX, and D[17:0] read. The timing parameters are defined as follows:

- CSX:** T_{CHW} (Chip Select High Width), V_{IH} , V_{IL} , T_{CS} (Chip Select Setup), T_{CSH} (Chip Select Hold), T_{CSF} (Chip Select Fall Time).
- D/CX:** V_{IH} , V_{IL} , T_{AST} (Address Setup), T_{WC} (Write Command), T_{AHT} (Address Hold Time).
- WRX:** V_{IH} , V_{IL} , T_{WRL} (Write Enable Low Pulse Width), T_{WRH} (Write Enable High Pulse Width), T_{DST} (Data Setup), T_{DHT} (Data Hold Time).
- D[17:0] write:** V_{IH} , V_{IL} , T_{RCS}/T_{RCSFM} (Data Setup), T_{AHT} (Data Hold Time).
- RDX:** V_{IH} , V_{IL} , T_{AST} (Address Setup), T_{RC}/T_{RCFM} (Data Setup), T_{RDH}/T_{RDHFH} (Data Hold Time), T_{QDH} (Data Output Delay), T_{TRAT}/T_{TRATFM} (Data Output Setup), T_{RDI}/T_{RDIFM} (Data Output Setup).
- D[17:0] read:** V_{IH} , V_{IL} .

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25°C

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T_{DHT}	Data hold time	10		ns
T_{RAT}	Read access time (ID)		40	ns
T_{RATFM}	Read access time (FM)		340	ns
T_{ODH}	Output disable time	20	80	ns

Table 4 8080 Parallel Interface Characteristics

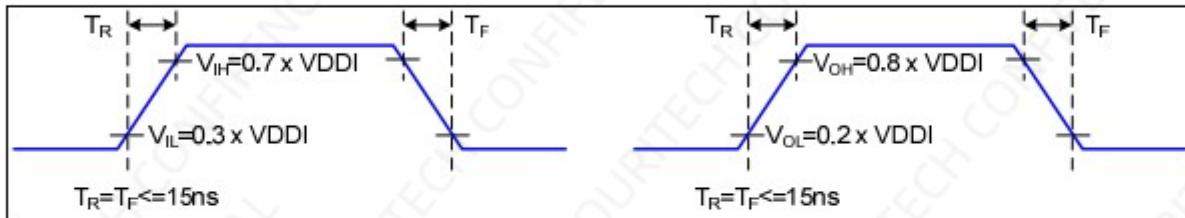


Figure 2 Rising and Falling Timing for I/O Signal

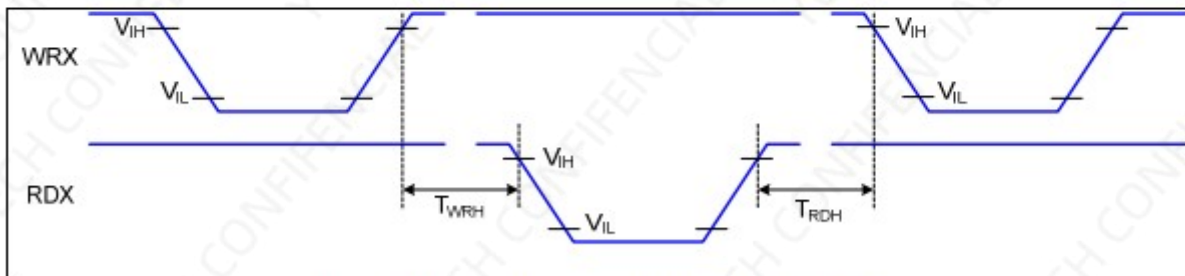


Figure 3 Write-to-Read and Read-to-Write Timing

Note: The rising time and falling time (T_R , T_F) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

Reset Timing:

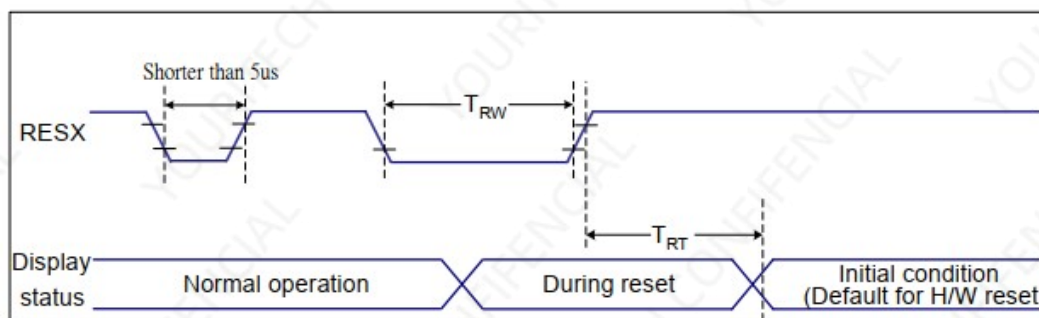


Figure 7 Reset Timing

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, $T_a=25^{\circ}\text{C}$

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5) 120 (Note 1, 6, 7)	ms

Table 9 Reset Timing

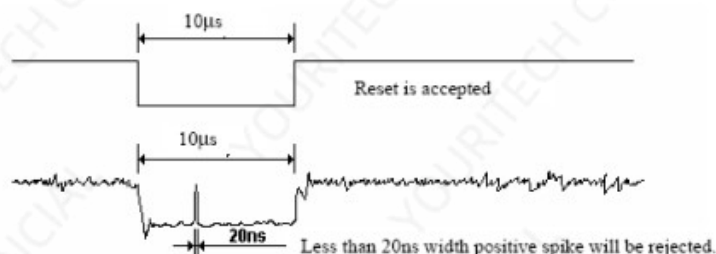
Notes:

1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (t_{RT}) within 5 ms after a rising edge of RESX.
2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset starts

3. During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode.) and then return to Default condition for Hardware Reset.

4. Spike Rejection also applies during a valid reset pulse as shown below:



5. When Reset applied during Sleep In Mode.
6. When Reset applied during Sleep Out Mode.
7. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

7.Optical Characteristics

Item	Symbol	Condition	Specification			Unit	Remark
			Min.	Typ.	Max.		
Response time	Tr+Tf	$\theta = 0^\circ$	-	30	40	ms	Note 1,5
Contrast ratio	CR	$\theta = 0^\circ$	640	800	-		Note 1,2,6
Viewing angle	Left (9 o'clock)	$CR \geq 10$	75	85	-	deg.	Note 1,2,6,7
	Right (3 o'clock)	$CR \geq 10$	75	85	-		
	Top (12 o'clock)	$CR \geq 10$	75	85	-		
	Bottom (6 o'clock)	$CR \geq 10$	75	85	-		
Color chromaticity (CF only with OC, light source is C light, CIE 1931)	Wx	$\theta = 0^\circ$	-0.015	0.307	+0.015		Note 1,3, 8
	Wy	$\theta = 0^\circ$	-0.015	0.344	+0.015		
Color Gamut (CF only with OC, light source is C light, CIE 1931)	%	CIE1931	54	60	-	%	Note 1,3, 8
Transmittance (with Polarizer)	Trans	$\theta = 0^\circ$	(3.8)	(4.5)	-	%	Note 1,2,4,8

Note 1: Ambient temperature = 25°C.

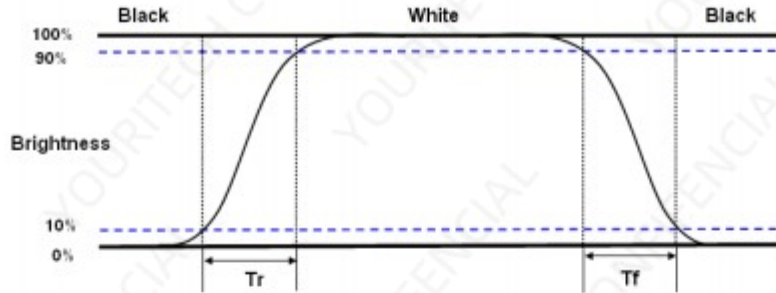
Note 2: To be measured with a viewing cone of 2° by Topcon luminance meter BM-5A.

Note 3: To be measured with Otsuta chromaticity meter LCF-2100M, CF only measure under C light.

Note 4: CTC Shipping status is cell without polarizer, Transmittance of specification is cell with polarizer.

Note 5: Definition of response time:

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time is the time between photo detector output intensity changed from 10% to 90%. And fall time is the time between photo detector output intensity changed from 90% to 10%.

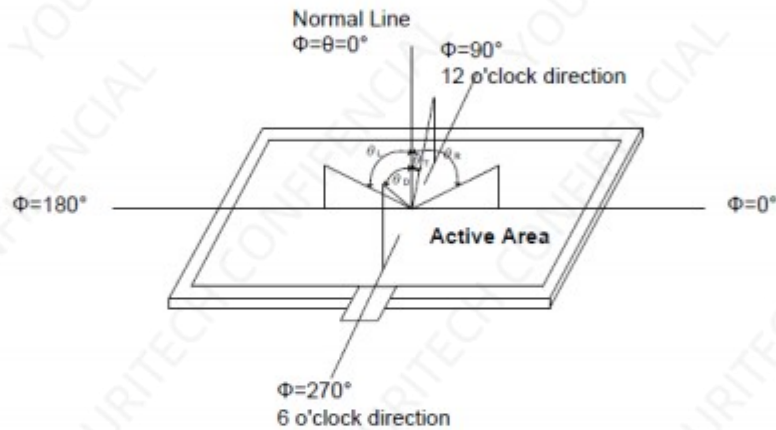


Note 6: Definition of contrast ratio:

Contrast ratio is calculated with the following formula:

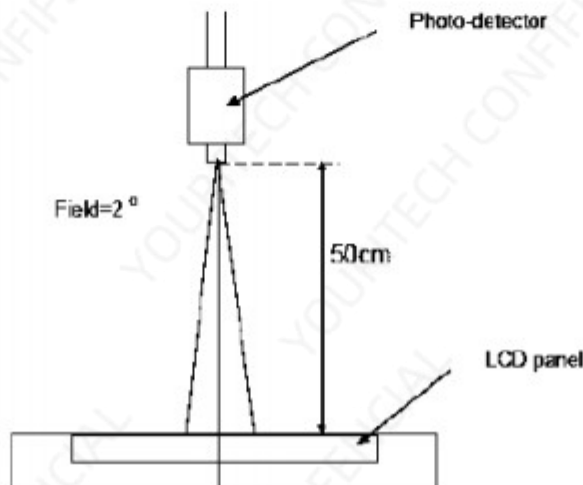
$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

Note 7: Definition of viewing angle:



Note 8: Optical characteristic measurement setup:

The LCD module should be stabilized at given temperature for 10 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 10 minutes in a windless room.



8. Reliability Test Item

No.	Test Item	Test Condition	Notes
1	High Temp. Storage	+70°C / 96H	1. Functional test is OK. Missing Segment, short, unclear segment non-display, display abnormally and liquid crystal leakage un-allowed. 2. No low temperature bubbles, end seal loose and fall, frame rainbow.
2	Low Temp. Storage	-30°C / 96H	
3	High Temp. Operating	+60°C / 96H	
4	Low Temp. Operating	-20°C / 96H	
5	High Temperature / Humidity storage	50°C x 90%RH / 96H	
6	Thermal and cold shock	Static state, -20°C (30min) ~ 60°C (30min), 50 cycles	

9. Packing Method----TBD

- END -