

DLC Display Co., Limited

德爾西顯示器有限公司



MODEL No: DLC2004AYYC-1

TEL: 86-755-86029824

FAX: 86-755-86029827

E-MAIL: sales@dlcdisplay.com

WEB: www.dlcdisplay.com



Record of Revision

Date	Revision No.	Summary
2009-9-20	1.0	Rev 1.0 was issued

1. Scope

The DLC2004AYYC-1 LCM unit consists of 20 characters x 4 lines LCD, composed of LCD panel, driver, PCB, metal-frame, zebras and LED backlight

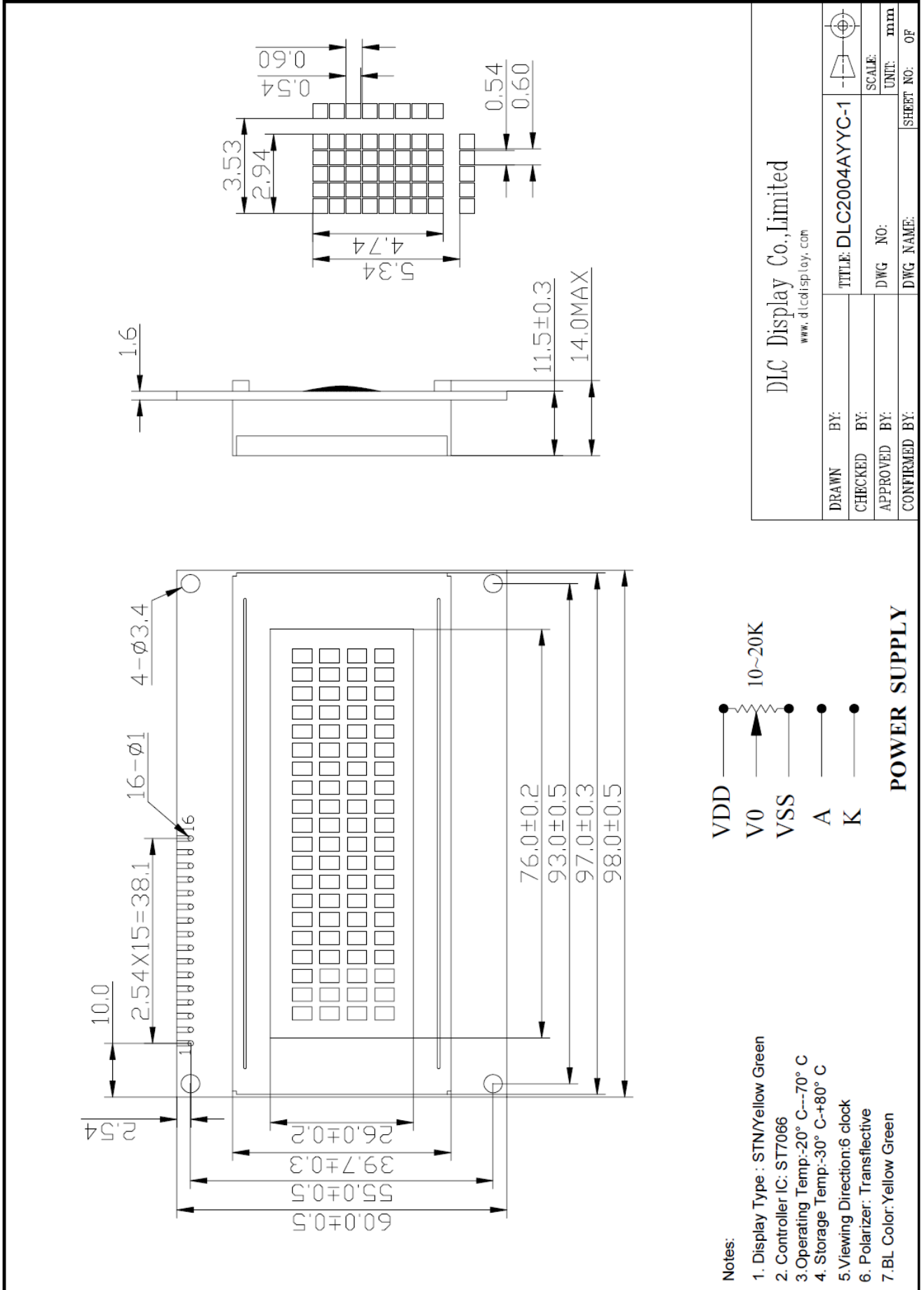
2. Application

Digital equipments which need display, instrumentation, remote control, electronic product.

3. General Information

Item	Contents	Unit
LCD Type	STN	
Polarizer Type	Transflective	
Viewing Direction	6:00	
Interface	8 bit parallel	
Number of Dots/ characters	20 characters x 4 lines	
Dot size (W×H)	0.54X0.54	mm
Dot Pitch (W×H)	0.60X0.60	mm
Viewing Area	76.0×26.0	mm
Outline Dimension (W x H x D)	98.0×60.0×14.0(MAX)	mm
LCD Controller & Driver	ST7066	
LCD Driving Method	1/16 Duty	
Backlight Type	LED	
Backlight Color	Yellow Green	
Operating Temperature	-20°C~+70°C	
Storage Temperature	-30°C~+80°C	

4. Outline Drawing



DLC Display Co., Limited www.dlcdisplay.com		TITLE: DLC2004AYYC-1	
DRAWN BY:	CHECKED BY:	DWG NO:	SCALE:
APPROVED BY:	CONFIRMED BY:	DWG NAME:	UNIT: mm
			SHEET NO: OF

5. Interface signals

Pin No.	Symbol	Function
1	VSS	Ground (0V)
2	VDD	Supply voltage for logic (+5V)
3	VO	Supply voltage for LCD
4	RS	Register select signal, H: Data; L: Instruction Code
5	R/W	Data read / write H: Read; L: Write
6	E	Enable signal
7	DB0	Data bus line
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
19	A	Supply voltage for backlight +5V
20	K	Supply voltage for backlight 0V

6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

Parameter	Symbol	MIN	MAX	Unit	Remark
Supply Voltage for Logic	VDD	-0.3	7.0	V	
Input Voltage for Logic	VIN	-0.3	VDD+0.3	V	

6.2. Environment Conditions

Item	Symbol	MIN	MAX	Unit	Remark
Operating Temperature	TOPR	-20	+70	°C	
Storage Temperature	TSTG	-30	+80	°C	

7. Electrical Specifications

7.1 Electrical characteristics

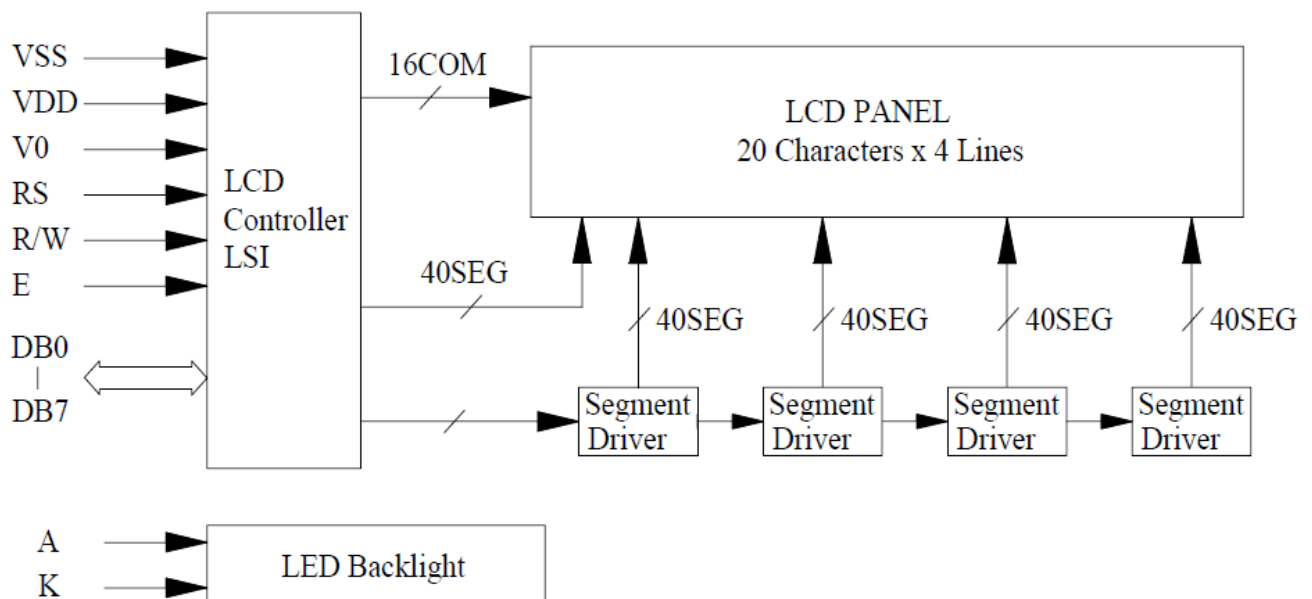
VSS=0V, Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Logic Supply Voltage	VDD	4.5	5.0	5.5	V	
Supply Current for Logic	IDD	1.0	1.6	2.2	mA	
Output Signal Voltage	VOH	2.4	--	VDD	V	
	VOL	0	--	0.4	V	
Input Signal Voltage	VIH	2.2	--	VDD	V	
	VIL	0	--	0.6	V	

7.2 Backlight

Item	Symbol	MIN	TYP	MAX	Unit	Remark
LED Current	I _{LED}	90	145	205	mA	
LED Voltage	V _{LED}	4.5	5.0	5.5	V	

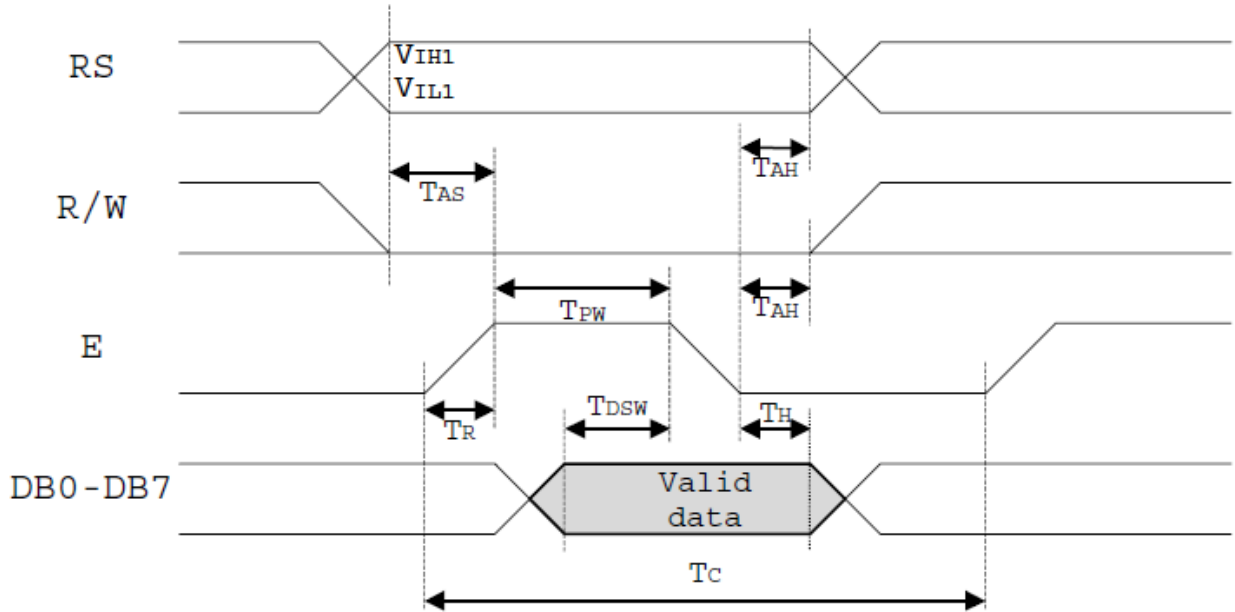
7.3 Schematic of LCD module system



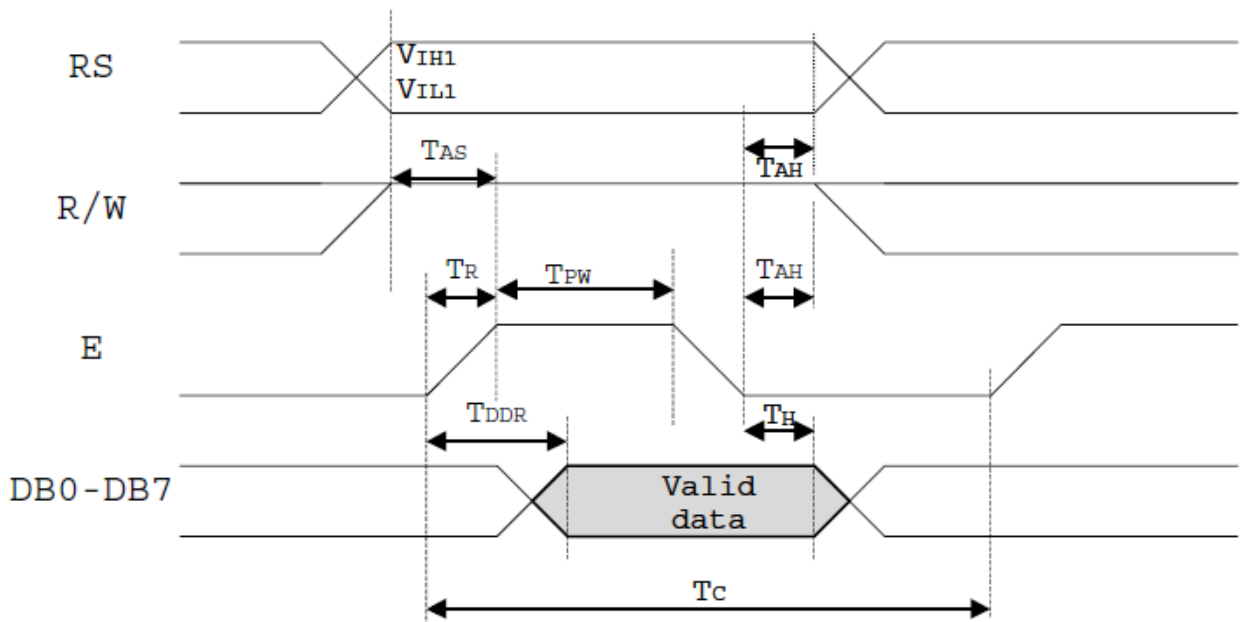
8. Command/AC Timing

8.1 Timing characteristics

8.1.1 Writing data from MPU to ST7066



8.1.2 Reading data from ST7066 to MPU



8.2 AC Characteristics (Ta=25°C, VCC=5.0V)

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
<i>Internal Clock Operation</i>						
f _{OSC}	OSC Frequency	R = 91KΩ	190	270	350	KHz
<i>External Clock Operation</i>						
f _{EX}	External Frequency	-	125	250	350	KHz
	Duty Cycle	-	45	50	55	%
T _R ,T _F	Rise/Fall Time	-	-	-	0.2	μs
<i>Write Mode (Writing data from MPU to ST7066)</i>						
T _C	Enable Cycle Time	Pin E	400	-	-	ns
T _{PW}	Enable Pulse Width	Pin E	150	-	-	ns
T _R ,T _F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T _{AS}	Address Setup Time	Pins: RS,RW,E	30	-	-	ns
T _{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T _{DSW}	Data Setup Time	Pins: DB0 - DB7	40	-	-	ns
T _H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns
<i>Read Mode (Reading Data from ST7066 to MPU)</i>						
T _C	Enable Cycle Time	Pin E	400	-	-	ns
T _{PW}	Enable Pulse Width	Pin E	150	-	-	ns
T _R ,T _F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T _{AS}	Address Setup Time	Pins: RS,RW,E	30	-	-	ns
T _{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T _{DDR}	Data Setup Time	Pins: DB0 - DB7	-	-	100	ns
T _H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns
<i>Interface Mode with LCD Driver(ST7065)</i>						
T _{CWH}	Clock Pulse with High	Pins: CL1, CL2	800	-	-	ns
T _{CWL}	Clock Pulse with Low	Pins: CL1, CL2	800	-	-	ns
T _{CST}	Clock Setup Time	Pins: CL1, CL2	500	-	-	ns
T _{SU}	Data Setup Time	Pin: D	300	-	-	ns
T _{DH}	Data Hold Time	Pin: D	300	-	-	ns
T _{DM}	M Delay Time	Pin: M	-1000	-	1000	ns

8.3 DISPLAY CONTROL INSTRUCTION

Instruction	Instruction Code										Description	Description Time (270KHZ)
	RS	RW	DB 7	DB 6	DB 5	DB 4	DB 3	DB 2	DB 1	DB 0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.52 ms
Return Home	0	0	0	0	0	0	0	0	0	1 x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52 ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	37 us
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1: entire display on C=1: cursor on B=1: cursor position on	37 us
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	37 us
Function Set	0	0	0	0	1	DL	N	F	x	x	DL: interface data is 8/4 bits NL: number of line is 2/1 F: font size is 5x11/5x8	37 us
Set CGRAM address	0	0	0	1	AC 5	AC 4	AC 3	AC 2	AC 1	AC 0	Set CGRAM address in address counter	37 us
Set DDRAM address	0	0	1	AC 6	AC 5	AC 4	AC 3	AC 2	AC 1	AC 0	Set DDRAM address in address counter	37 us
Read Busy flag and address	0	1	BF	AC 6	AC 5	AC 4	AC 3	AC 2	AC 1	AC 0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0 us
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	43 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	43 us

Note:

Be sure the ST7066 is not in the busy state (BF = 0) before sending an instruction from the MPU to the ST7066. If an instruction is sent without checking the busy flag, the time between the first instruction and next instruction will take much longer than the instruction time itself. Refer to Instruction Table for the list of each instruction execution time.

9. Optical Specification

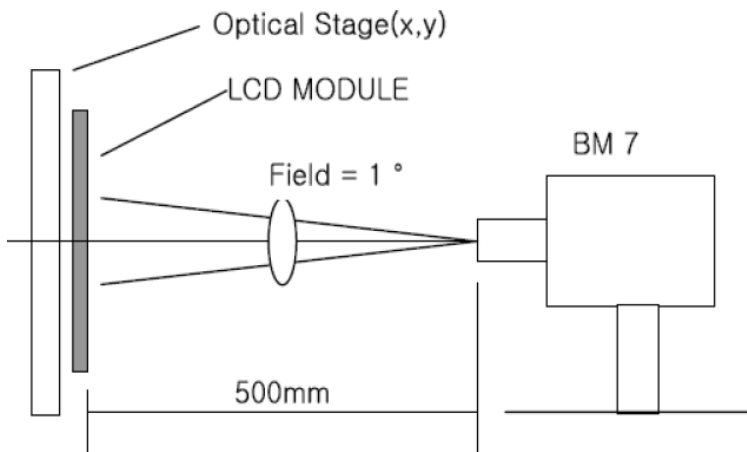
Ta=25°C

Item	Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio	CR	$\theta=0^\circ$	--	10.0	--		Note1 Note2
Response Time	Tr	25°C	-	--	200	ms	Note1 Note3
	Tf		-	--	250	ms	
View Angles	θT	$CR \geq 2$	-	35	-	Degree	Note 4
	θB		-	40	-		
	θL		-	30	-		
	θR		-	30	-		

Note 1: Definition of optical measurement system.

Temperature = 25°C(±3°C)

LED back-light: ON, Environment brightness < 150 lx

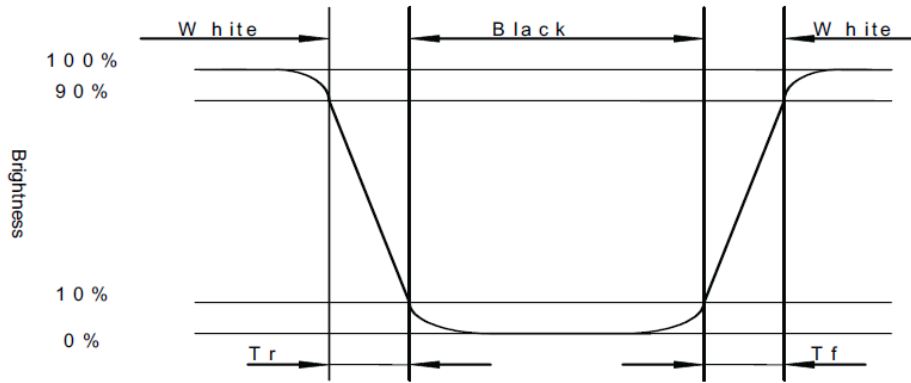


Note 2: Contrast ratio is defined as follow:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

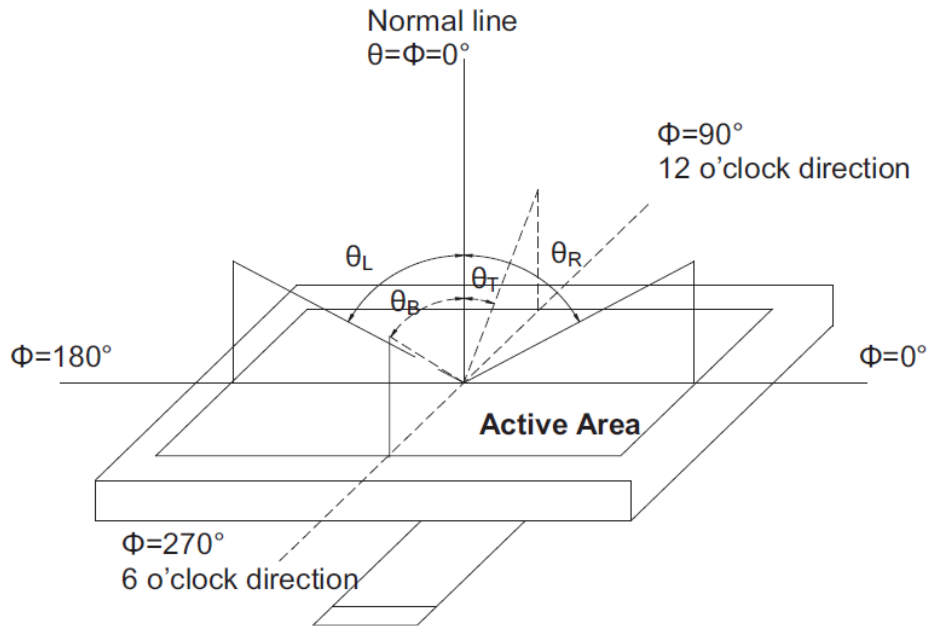
Note 3: Response time is defined as follow:

Response time is the time required for the display to transition from black to white (Rise Time, Tr) and from white to black (Decay Time, Tf).



Note 4: Viewing angle range is defined as follow:

Viewing angle is measured at the center point of the LCD.



10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ts=+70°C, 120hrs	Per table in below
2	Low Temp Operation	Ta=-20°C, 120hrs	Per table in below
3	High Temp Storage	Ta=+80°C, 120hrs	Per table in below
4	Low Temp Storage	Ta=-30°C, 120hrs	Per table in below
5	High Temp & High Humidity Storage	Ta=+60°C, 90% RH 120 hours	Per table in below (polarizer discoloration is excluded)
6	Thermal Shock (Non-operation)	-30°C 30 min~+80°C 30 min, Change time:5min, 10 Cycles	Per table in below
7	ESD (Operation)	C=150pF, R=330Ω · 5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times;	Per table in below
8	Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z.	Per table in below
9	Shock (Non-operation)	60G 6ms, ±X,±Y,±Z 3times, for each direction	Per table in below
10	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	Per table in below

INSPECTION	CRITERION(after test)
Appearance	No Crack on the FPC, on the LCD Panel
Alignment of LCD Panel	No Bubbles in the LCD Panel No other Defects of Alignment in Active area
Electrical current	Within device specifications
Function / Display	No Broken Circuit, No Short Circuit or No Black line No Other Defects of Display

11. Precautions for Use of LCD Modules

11.1 Safety

The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

11.2 Handling

- A. The LCD and touch panel is made of plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
- B. Do not handle the product by holding the flexible pattern portion in order to assure the reliability
- C. Transparency is an important factor for the touch panel. Please wear clear finger sacks, gloves and mask to protect the touch panel from finger print or stain and also hold the portion outside the view area when handling the touch panel.
- D. Provide a space so that the panel does not come into contact with other components.
- E. To protect the product from external force, put a covering lens (acrylic board or similar board) and keep an appropriate gap between them.
- F. Transparent electrodes may be disconnected if the panel is used under environmental conditions where dew condensation occurs.
- G. Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in IC malfunctions.
- H. To prevent such IC malfunctions, your design and mounting layout shall be done in the way that the IC is not exposed to light in actual use.

11.3 Static Electricity

- A. Ground soldering iron tips, tools and testers when they are in operation.
- B. Ground your body when handling the products.
- C. Power on the LCD module before applying the voltage to the input terminals.
- D. Do not apply voltage which exceeds the absolute maximum rating.
- E. Store the products in an anti-electrostatic bag or container.

11.4 Storage

- A. Store the products in a dark place at $+25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ with low humidity (40% RH to 60% RH). Don't expose to sunlight or fluorescent light.
- B. Storage in a clean environment, free from dust, active gas, and solvent.

11.5 Cleaning

- A. Do not wipe the touch panel with dry cloth, as it may cause scratch.
- B. Wipe off the stain on the product by using soft cloth moistened with ethanol. Do not allow ethanol to get in between the upper film and the bottom glass. It may cause peeling issue or defective operation. Do not use any organic solvent or detergent other than ethanol.

11.6 Cautions for installing and assembling

Bezel edge must be positioned in the area between the Active area and View area. The bezel may press the touch screen and cause activation if the edge touches the active area.

A gap of approximately 0.5mm is needed between the bezel and the top electrode. It may cause unexpected activation if the gap is too narrow. There is a tolerance of 0.2 to 0.3mm for the outside dimensions of the touch panel and tail. A gap must be made to absorb the tolerance in the case and connector.

