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Specification

TFT-LCD module

Module(型号):	QT109H2405
Customer（客户）:	
Customer P/N（户型号）:	

Approved by（批准）:	
Qualified（合格）:	Unqualified（不合格）:

PREPARED	CHECKED	APPROVED

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REV NO	REV DATE	CONTENTS	REMARKS
A0	2020-11-13	First Release	

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1.0 General Specifications

QT109H2405 is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver IC, FPC and a back light unit. The module display area contains240X240pixels and can display up to 262K colors. This product accords with RoHS environmental criterion.

Item	Contents	Unit
LCD Type	TFT TRANSMISSIVE	/
Viewing direction	ALL	O' Clock
Module outline (W x H x D)	30.59 X33.0X1.60	mm
Active area (WxH)	27.79X27.79	mm
Number of Dots	240(RGB) x240	/
Driver IC	GC9A01	/
Colors	262K	/
Backlight Type	2LED	/
Interface Type	4 wire 1lane SPI	/
Input voltage	2.8	V

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2.0 ABSOLUTE MAXIMUM RATINGS

Parameter	*Symbol*	*Min*	*Max*	*Unit*
Supply voltage for logic	Vcc1,Vcc2	*-0.3*	*4.6*	**V**
Input voltage	Vin	*-0.3*	*VCC+ 0.3*	**V**
Operating temperatur	Top	*-10*	*60*	℃
Storage temperature	Tst	*-20*	*70*	℃
Humidity	RH	*--*	*90%(Max60C)*	RH

3.0 ELECTRICAL CHARACTERISTICS

Parameter	*Symbol*	*Min*	*Typ*	*Max*	*Unit*
Supply voltage for logic	Vcc -Vss	*2.8*	*3.0*	*3.2*	V
Input Current	Idd	*--*	*10*	*--*	mA
Input voltage ' H ' level	Vih	*0.7Vdd*	*--*	*Vdd*	V
Input voltage ' L ' level	Vil	*-Vss*	*--*	*0.2 Vdd*	V
Output voltage ' H ' level	Voh	*0.8 Vcc*	*--*	*Vcc*	V
Output voltage ' L ' level	Vol	*-Vss*	*--*	*0.2 Vcc*	V

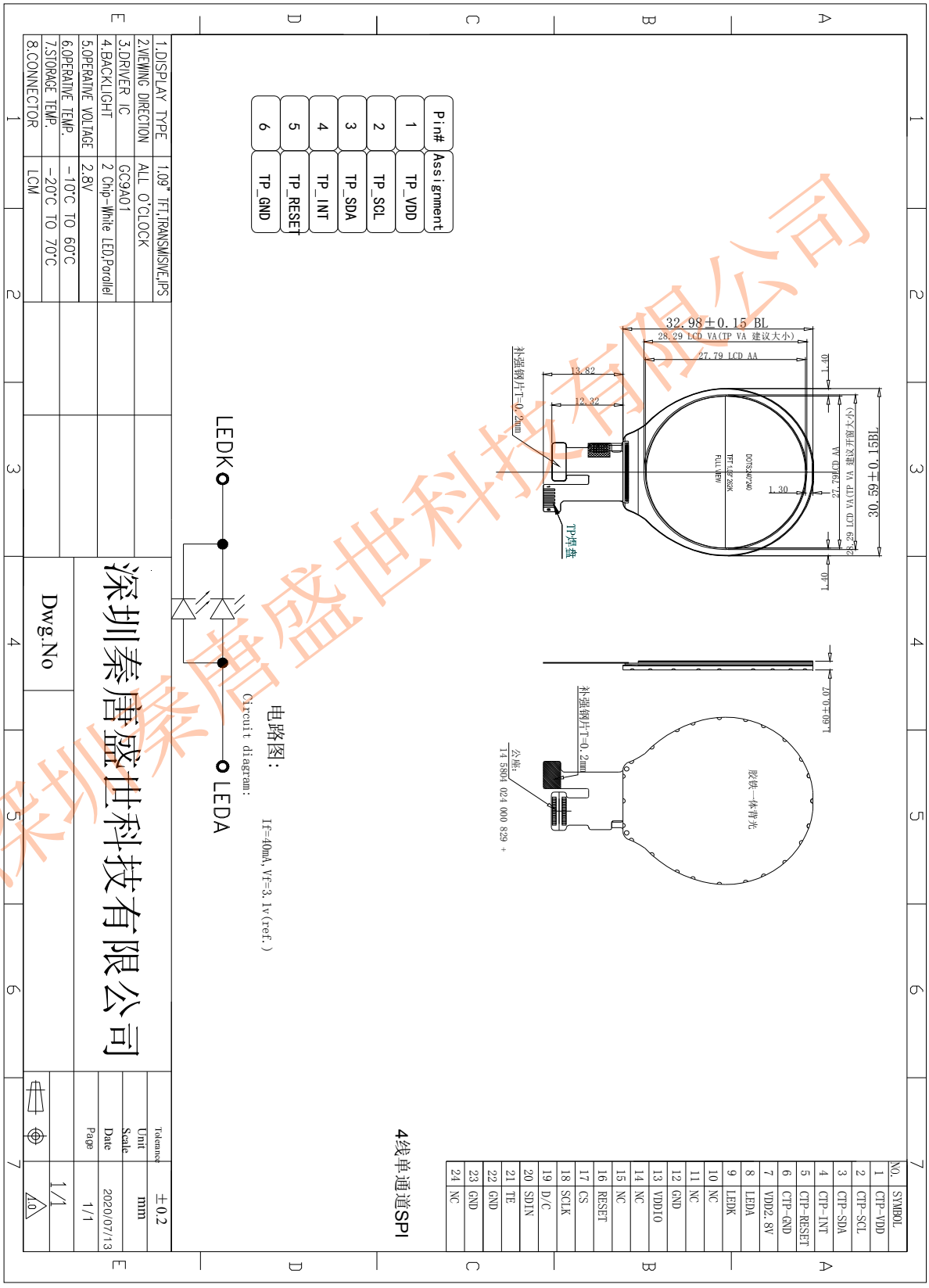
4.0 BACKLIGHT CHARACTERISTICS

Item	*Symbol*	*Min*	*Typ*	*Max*	*Unit*	*Condition*
Forward voltage	***Vf***	*2.8*	*3.1*	*3.2*	**V**	**--**
LCM Luminance	***Lv***	*---*	*200*	*---*	**cd/m2**	***If=40mA***
Number of LED	**--**	*2*			**Piece**	**--**
Connection mode	***P***	*Parallel*			**--**	**--**

Using condition: constant current driving method If= 40mA(+/-10%)

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5.0 DIMENSIONAL DRAWING



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6.0 INTERFACE PIN CONNECTIONS

Pin.No	Symbol	Function
1-6	CTP_PINS	Connect CTP.
7	VDD28	Power supply (+2.8V) for logic circuit.
8	LEDA	Back light power supply positive.
9	LEDK	Back light power supply negative.
10~11	NC	Don't need to connect.
12	GND	Power Ground
13~14	VDDIO	Power supply (+1.8V/+2.8V) IO circuit.
15	GND	Power Ground
16	RESET	Reset control signal
17	CS	Chip select signal (low active).
18	D/C	Serial communication clock line (SCLK).
19	WR	Data or command select pin (RS).
20	SDIN	Serial communication data line.
21	TE	Tear effect.
22~23	GND	Power Ground
24	NC	Don't need to connect.

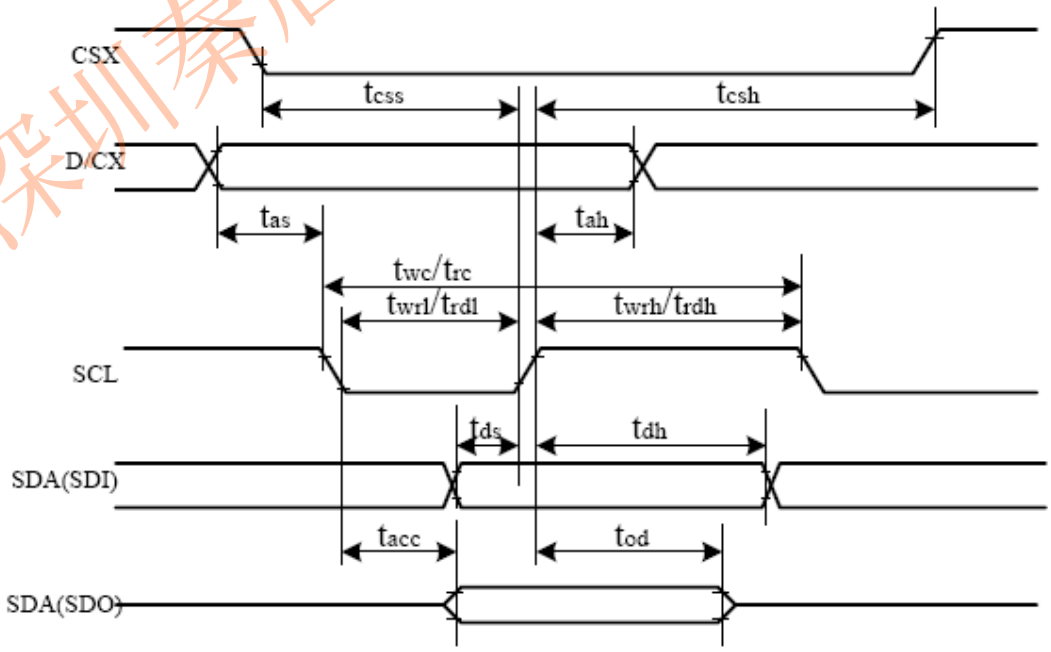
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6. 1 TIMING CHARACTERISTICS

6.1.1

Display Serial Interface Timing Characteristics (4-line SPI system)

Signal	Symbol	Parameter	min	max	Unit	Description
CSX	tcss	Chip select time (Write)	20	-	ns	
	tcsh	Chip select hold time (Read)	40	-	ns	
SCL	twc	Serial Clock Cycle (Write)	10	-	ns	
	twrh	SCL "H" Pulse Width (Write)	5	-	ns	
	twrl	SCL "L" Pulse Width (Write)	5	-	ns	
	trc	Serial Clock Cycle (Read)	150	-	ns	
	trdh	SCL "H" Pulse Width (Read)	60	-	ns	
	trdl	SCL "L" Pulse Width (Read)	60	-	ns	
D/CX	tas	D/CX setup time	10	-	ns	
	tah	D/CX hold time (Write/Read)	10	-	ns	
SDA/SDI (Input)	tds	Data setup time (Write)	5	-	ns	
	tdh	Data hold time (Write)	5	-	ns	
SDA/SD0 (Output)	tacc	Access time (Read)	10	-	ns	



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6.2. **Reset Input Timing**

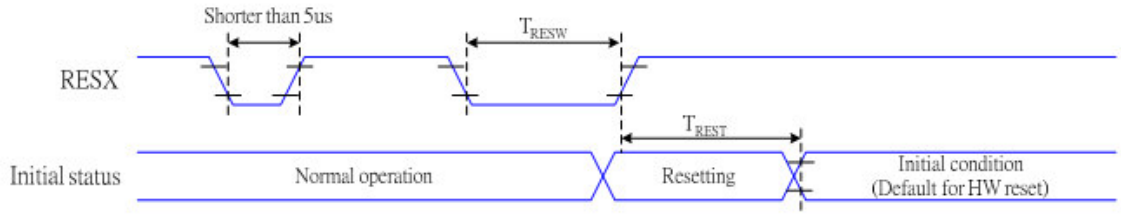


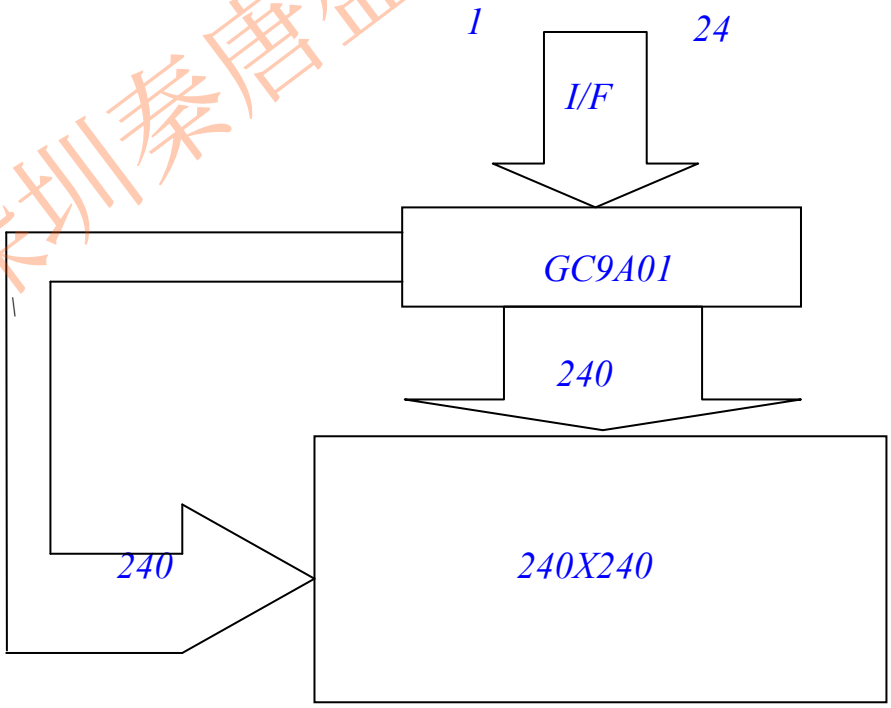
Table 9.16.1 Reset timing

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	tRESW	Reset pulse duration	10	-	us
	tREST	Reset cancel	-	5	ms
				120	ms

Notes:
1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from EEPROM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) 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

6.3 BLOCK DIAGRAM OF LCM

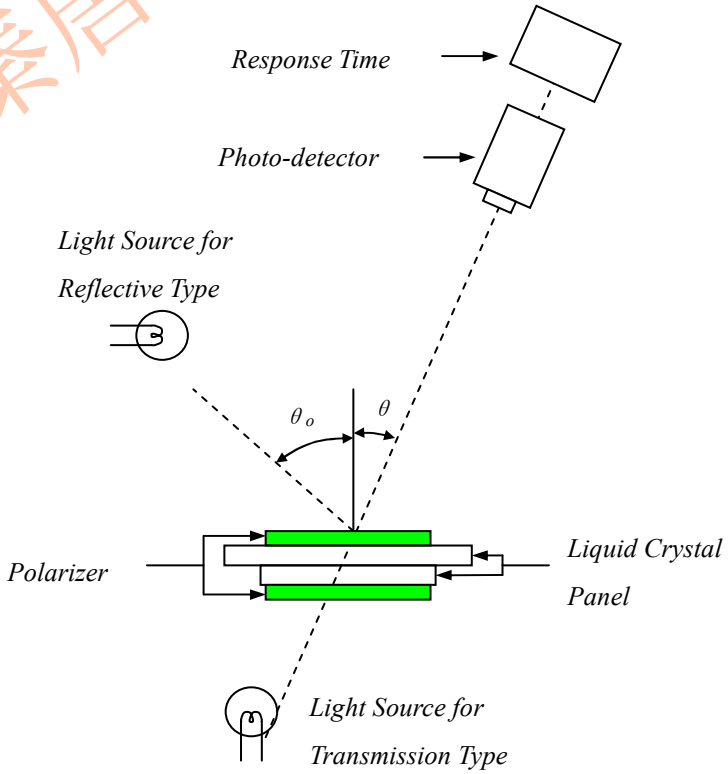


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7. ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Temp	Min	Typ	Max	Units	Note
Operating Volt.	V_{LCD}	$\theta = \psi = 0$	-10 ℃	----	----	----	V	8.1
			25 ℃	----	5.0	----		
			60 ℃	----	----	----		
Response Time	Rise Time (Tr)	$\theta = \psi = 0$	-10 ℃	----	----	----	msec	8.2
	Decay Time (Td)			----	----	----		
	Rise Time (Tr)		25 ℃	35	----	70		
	Decay Time (Td)			35	----	70		
	Rise Time (Tr)		60 ℃	----	----	----		
	Decay Time (Td)			----	----	----		
Viewing Angle Range	θ	$\psi = 0°$	25 ℃	----	----	80	Deg	8.3 CR≧2
		$\psi = 90°$		----	----	80		
		$\psi = 180°$		----	----	80		
		$\psi = 270°$		----	----	80		
Contrast Ratio	Cr	$\theta = \psi = 0$	25 ℃	300	500	----	---	8.4

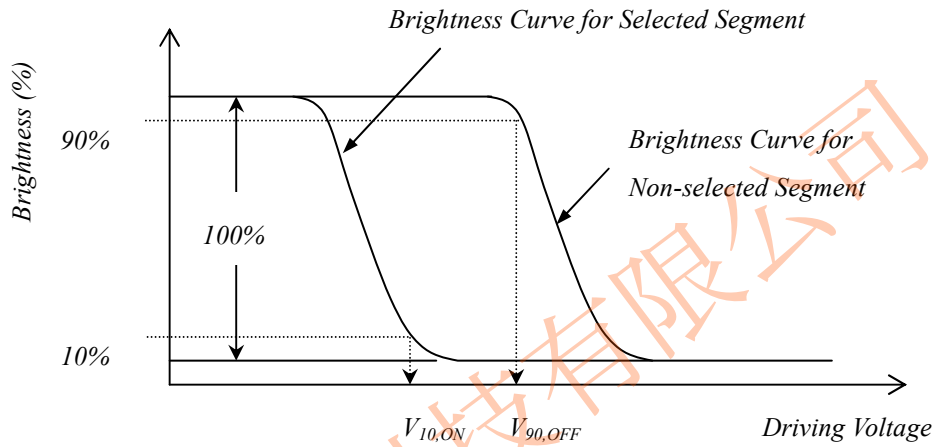
7. 1 ELECTRO-OPTICAL CHARACTERISTICS TEST METHOD



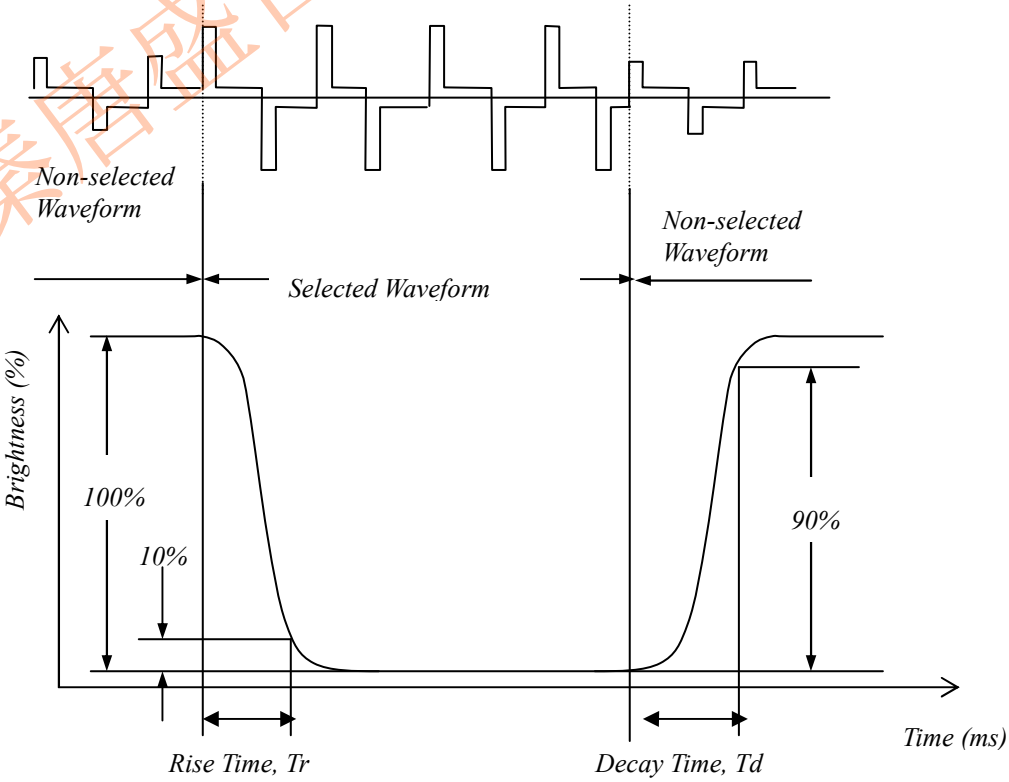
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7.2 DEFINITION OF OPERATING VOLTAGE, VOP

$Vop = (V_{10,ON} + V_{90,OFF})/2$

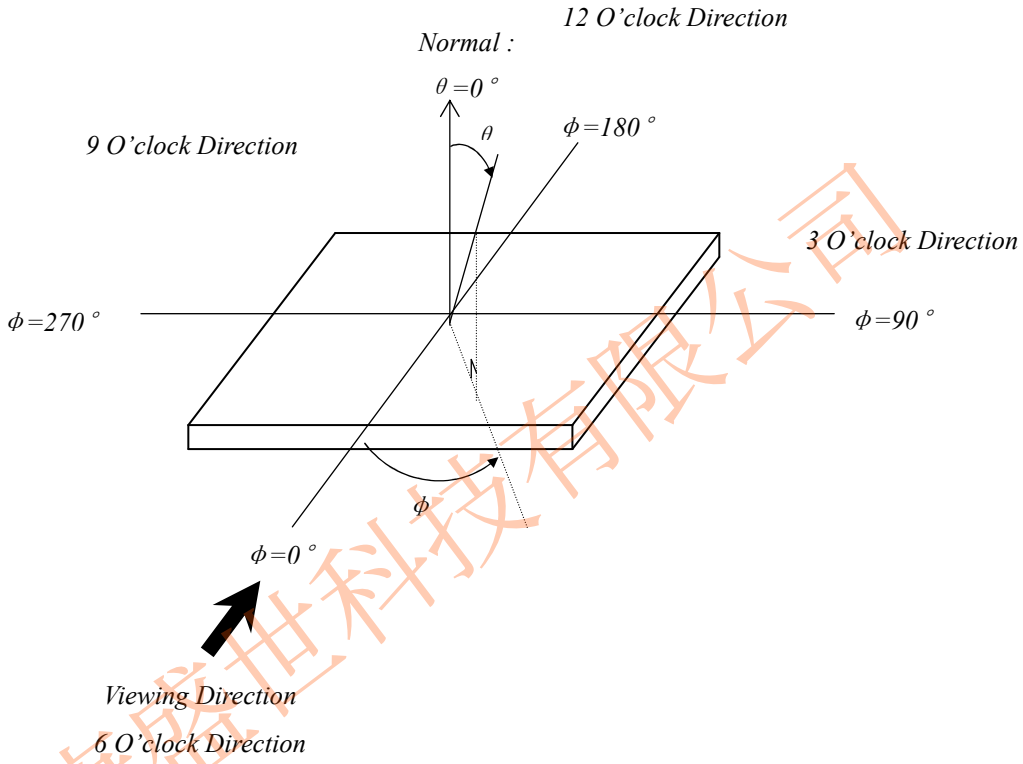


7.3 DEFINITION OF OPTICAL RESPONSE TIME



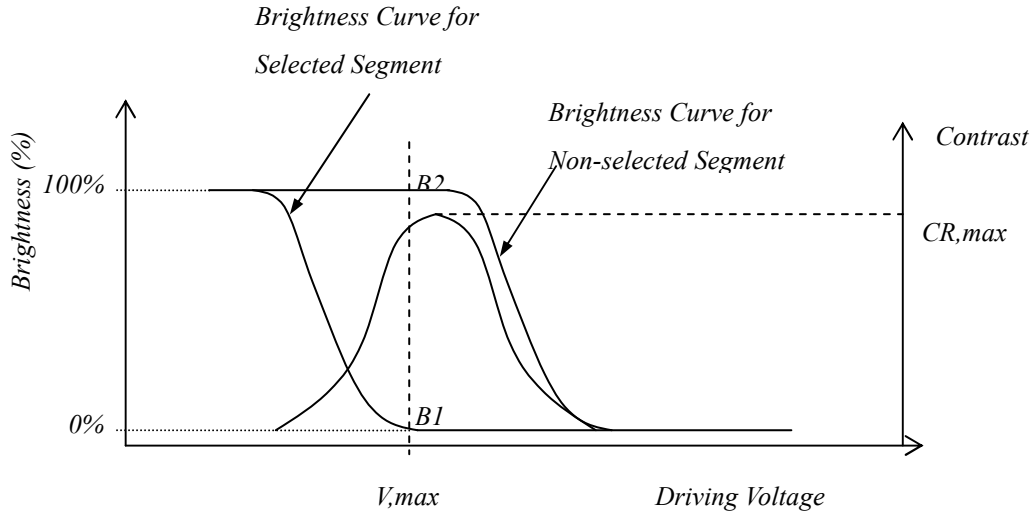
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7.4 DEFINITION OF VIEWING ANGLE Θ AND



7.5 DEFINITION OF CONTRAST RATIO, CR

$$CR = \frac{\text{Brightness of Non-selected Segment (B2)}}{\text{Brightness of Selected Segment (B1)}}$$



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8.*INSPECTION CRITERIA*

8.1*Inspection Conditions*

8.1.1Environmental conditions

The environmental conditions for inspection shall be as follows

Room temperature: 20±3°C

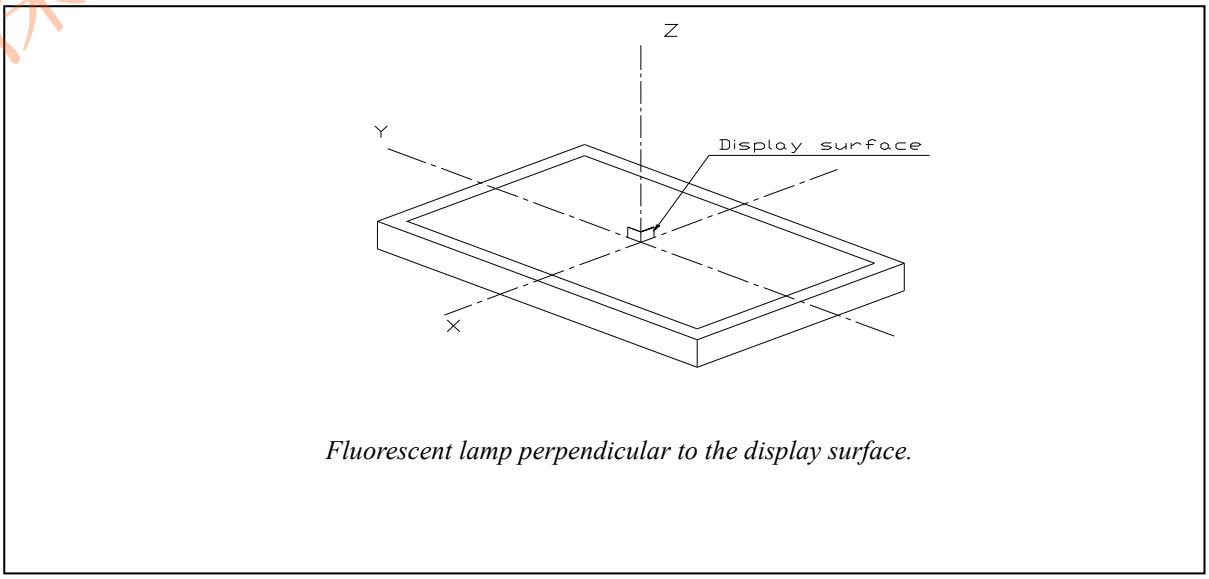
Humidity: 65±20%RH

8.1.2 The external visual inspection

With a single 20-watt fluorescent lamp as the light source, the inspection was in the distance of 30cm or more from the LCD to the inspector's eyes .

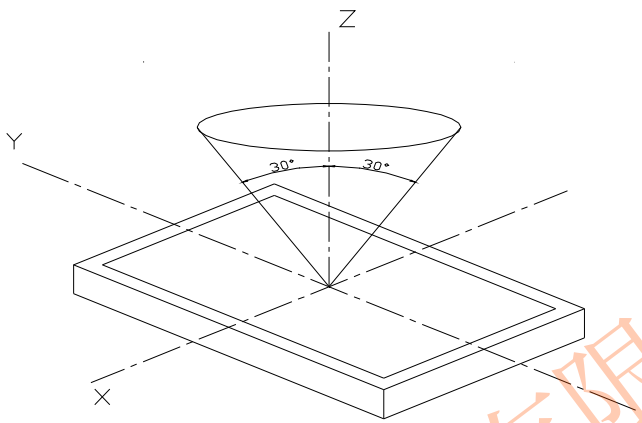
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8.2 LIGHT METHOD



Fluorescent lamp perpendicular to the display surface.

Inspection distance and angle



Inspection should be performed within angle Φ(Φis usually 30°) from Z axis to each X and Y.

Inspection distance in any direction within Φmust be kept 30±5cm from the display surface.

8.3 Classification of defects

8.3.1*Major defect*

A major defect refers to a defect that may substantially degrade usability for product applications.

8.3.2 Minor defect

A minor defect refers to a defect which is not considered to be able substantially degrade the product application or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation.

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9. RELIABILITY

9.1 MTBF

The LCD module shall be designed to meet a minimum MTBF value of 50000 hours with normal. (25°C in the room without sunlight)

9.2 TESTS

NO.	Test Item	Test condition	Criterion
1	High Temperature Storage	70℃±2℃ 96H Restore 2H at 25℃ Power off	Aftertesting,cosmetic and electrical defects should not happen.
2	Low Temperature Storage	-20℃±2℃ 96H Restore 2H at 25℃ Power off	
3	High Temperature Operation	60℃±2℃ 96H Restore 2H at 25℃ Power on	
4	Low Temperature Operation	-10℃±2℃ 96H Restore 4H at 25℃ Power on	
5	High Temperature & Humidity Operation	60℃±2℃ 90%RH 96H Power on	
6	Temperature Cycle	-20℃←→25℃←→70℃ 30min 5min 30min after 10cycle, Restore 2H at 25℃ Power off	
7	Vibration Test	10Hz~150Hz, 100m/s2, 120min	
8	Shock Test	Half-sinewave,300m/s2,11ms	
9	Drop Test(package state)	800mm, concrete floor,1corner, 3edges, 6 sides each time	1.After testing, cosmetic and electrical defects should not happen. 2.the product should remain at initial place 3.Product uncovered or package broken is not permitted.

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10. PRECAUTIONS FOR USING LCD MODULE

10.1 handing precautions

(1) *The display panel is made of glass. Do not subject it to a mechanical shock or impact by dropping it.*

(2) *If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.*

(3) *Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.*

(4) *The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.*

(5) *If the display surface becomes contaminated,breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten a cloth with one of the following solvents:*

- *Isopropyl alcohol*
- *Ethyl alcohol*

(6) *Solvents other than those above mentioned may damage the polarizer.*
Especially, do not use the following:

- *Water*
- *Ketone*
- *Aromatic solvents*

(7) *Extra care to minimize corrosion of the electrode. Water droplets, moisture condensation or a current flow in a high-humidity environment accelerates corrosion of the electrode.*

(8) *Install the LCD Module by using the mounting holes. When mounting the LCD Module, make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.*

(9) *Do not attempt to disassemble or process the LCD Module.*

(10) *NC terminal should be open. Do not connect anything.*

(11) *If the logic circuit power is off, do not apply the input signals.*

(12) *To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.*

- *Be sure to ground the body when handling he LCD Module.*
- *Tools required for assembling, such as soldering irons, must be properly grounded.*
- *To reduce the amount of static electricity generated, do not conduct assembling and other*

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work under dry conditions.

-The LCD Module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

10.2 STORAGE PRECAUTIONS

When storing The LCD Module, avoid exposure to direct sunlight of fluorescent lamps. Keep the modules in bags (avoid high temperature/ high humidity and low temperatures below 0℃). Whenever possible, the LCD Module should be stored in the same conditions in which they were shipped from our company.

10.3 OTHERS

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD Module have been operating for a long time showing the same display patterns the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be recovered by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD Module resulting from destruction caused by static electricity etc. exercise care to avoid holding the following sections when handling the modules.

- Exposed area of the printed circuit board.

- Terminal electrode sections.

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