SPECIFICATION
FOR
LCM Module
KD043WVFBD020

MODULE:	KD043WVFBD020
CUSTOMER:	

REV	DESCRIPTION	DATE
1.0	FIRST ISSUE	2017.05.15

STARTEK	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		

ISO9001:2008
ISO/TS16949 2009

Revision History

Date	Rev. No.	Page	Summary
2017.05.15	V1.0	ALL	FIRST ISSUE

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Contents

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* Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 4.3'TFT-LCD contains 480x800 pixels, and can display up to 65K/262K colors.

* Features

-Low Input Voltage: 3.3V(TYP)
-Display Colors of TFT LCD: 65K/262K colors
-Interface: 8/16-bits MCU interface.

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	56.16(H)*93.6(V) (4.3inch)	mm	-
Driver element	TFT active matrix	-	-
Display colors	65K/262K	colors	-
Number of pixels	480(RGB)*800	dots	-
TFT Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.117(H)*0.117(V)	mm	-
Viewing angle	ALL	o'clock	-
Controller IC	ILI9806	-	-
Display mode	Transmissive/Normally Black	-	-
Operating temperature	-20～+70	℃	-
Storage temperature	-30～+80	℃	-

* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)		62.66		mm	-
	Vertical(V)		105.95		mm	-
	Depth(D)		2.25		mm	-
Weight			--		g	-

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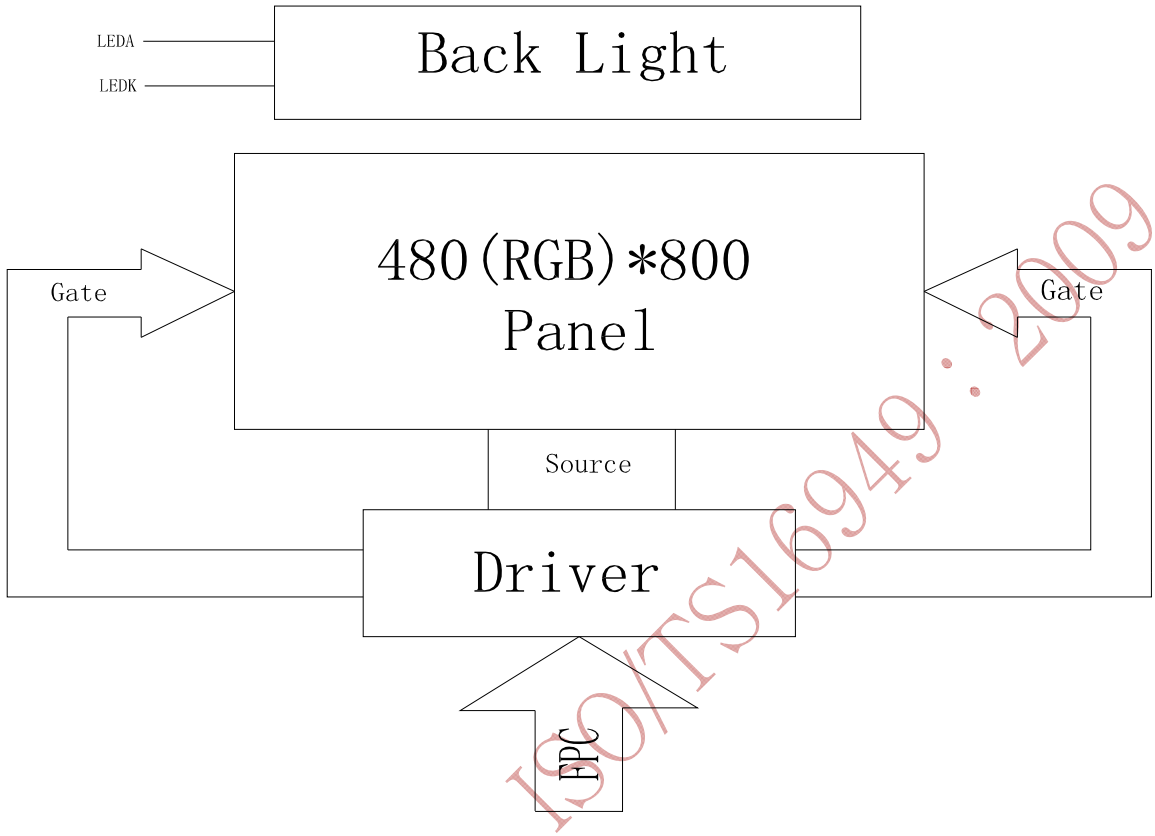
1. Block Diagram



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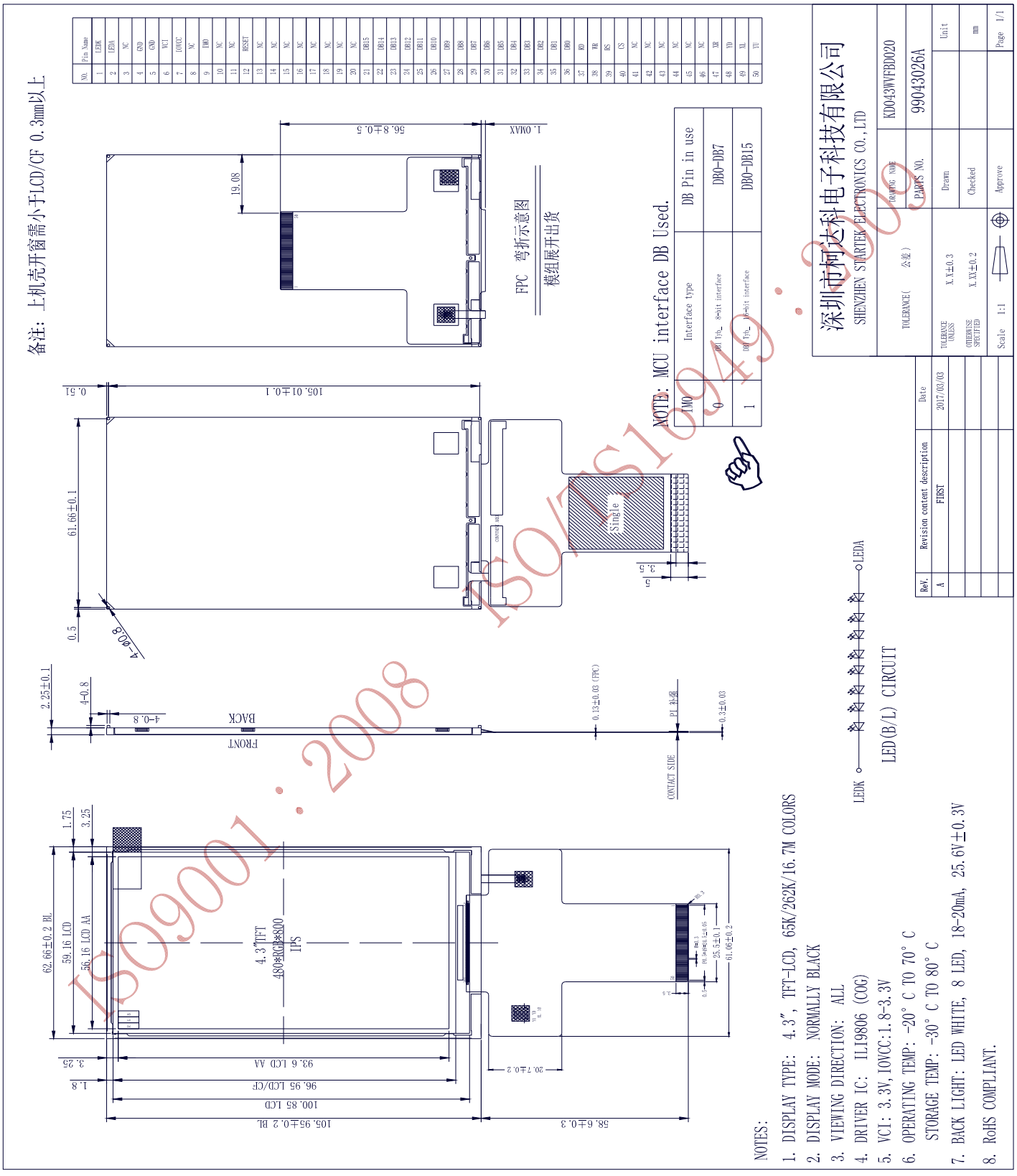
2. Outline dimension



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3. Input terminal Pin Assignment

NO.	SYMBOL	DISCRIPTION	I/O
1	LEDK	Cathode pin of backlight.	P
2	LEDA	Anode pin of backlight.	P
3	NC		
4	GND	Ground.	
5	GND	Ground.	P
6	VCI	Supply voltage (3.3V).	P
7	IOVCC	I/O power supply voltage.	P
8	NC		P
9	IM0	IM0 / Interface type / DB Pin in use 0 / DBI Tyb_ 8-bit interface / DB0-DB7 1 / DBI Tyb_ 16-bit interface / DB0-DB15	I
10	NC		
11	NC		
12	RESET	Reset pin. Setting either pin low initializes the LSI. Must be reset after power is supplied.	I
13-20	NC		I
21-36	DB15-DB0	16-bit parallel bi-directional data bus for MCU system interface mode .Fix to GND level when not in use	I/O
37	RD	- Serves as a read signal and read data at the rising edge. Fix to VDDI or VSSI level when not in use.	I
38	WR	- The DBI Type B system (WRX): Serves as a write signal and writes data at the rising edge. Fix to VDDI or VSSI level when not in use.	I
39	RS	- The DBI Type B interface (DCX): The signal for command or parameter select. Low: Command High: Parameter Fix to VDDI or VSSI level when not in use.	I
40	CS	- A chip select signal. Low: the chip is selected and accessible High: the chip is not selected and not accessible Fix to VDDI or VSSI level when not in use.	I

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41-46	NC		
47	XR	Touch panel Right Glass Terminal	A/D
48	YD	Touch panel Bottom Film Terminal	A/D
49	XL	Touch panel LIFT Glass Terminal	A/D
50	YU	Touch panel Top Film Terminal	A/D

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4. LCD Optical Characteristics

4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	Θ=0 Normal viewing angle	700	800	--		(3)
Response time	Rising	$T_{R+}T_F$		--	30	45	msec	(2)
	Falling			--				
Color gamut		S(%)		--	70	--	%	C-light
Color Filter Chromacicity	White	W_X		0.285	0.325	0.365	-	
		W_Y		0.326	0.366	0.386		
	Red	R_X		0.616	0.636	0.656		
		R_Y		0.317	0.337	0.357		
	Green	G_X		0.300	0.320	0.340		
		G_Y		0.587	0.607	0.627		
	Blue	B_X		0.127	0.147	0.167		
		B_Y		0.033	0.053	0.073		
Viewing angle	Hor.	Θ_L	CR>10	--	80	--	-	(1)(4) Measuring with Polarizer, Reference Only
		Θ_R		--	80	--		
	Ver.	Θ_U		--	80	--		
		Θ_D		--	80	--		
Option View Direction		Free						

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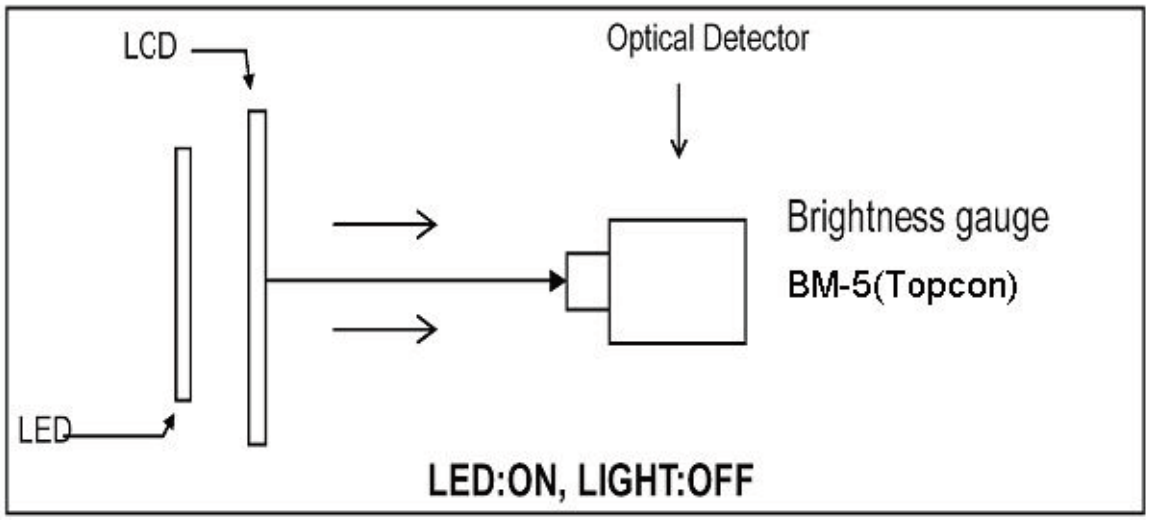
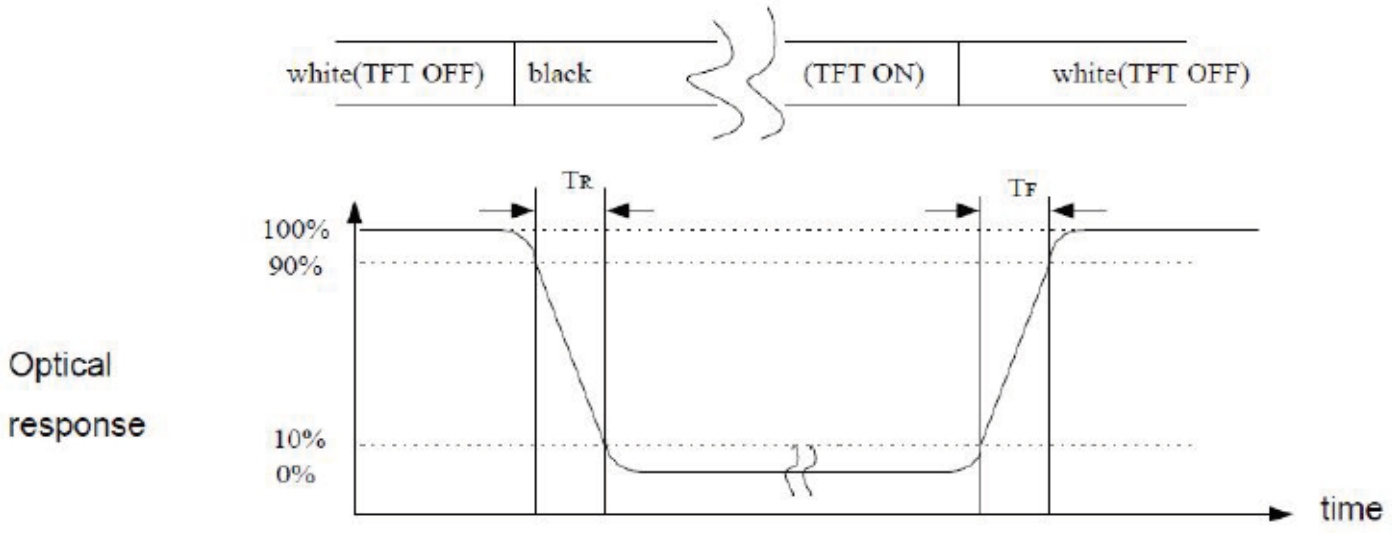
NOTE 1 :Test equipment setup

After stabilizing and leaving the panel alone at a given temperature for 30 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-5A with a viewing angle of 2° at a distance of 50cm and normal direction.



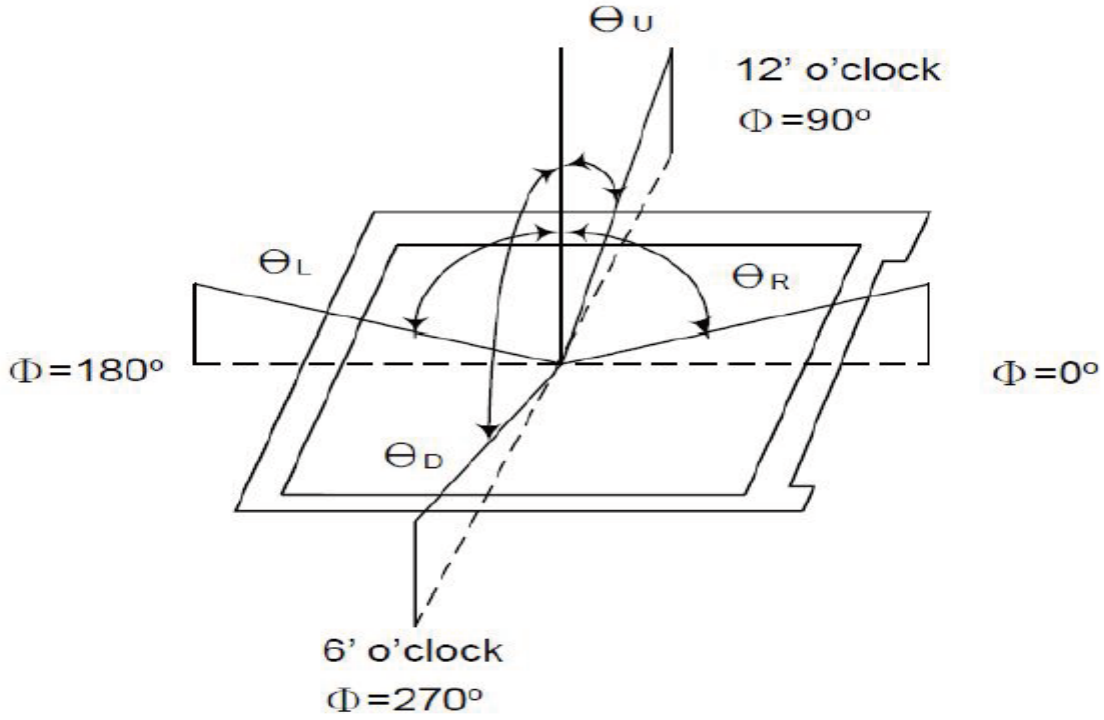
NOTE 2: Response Time



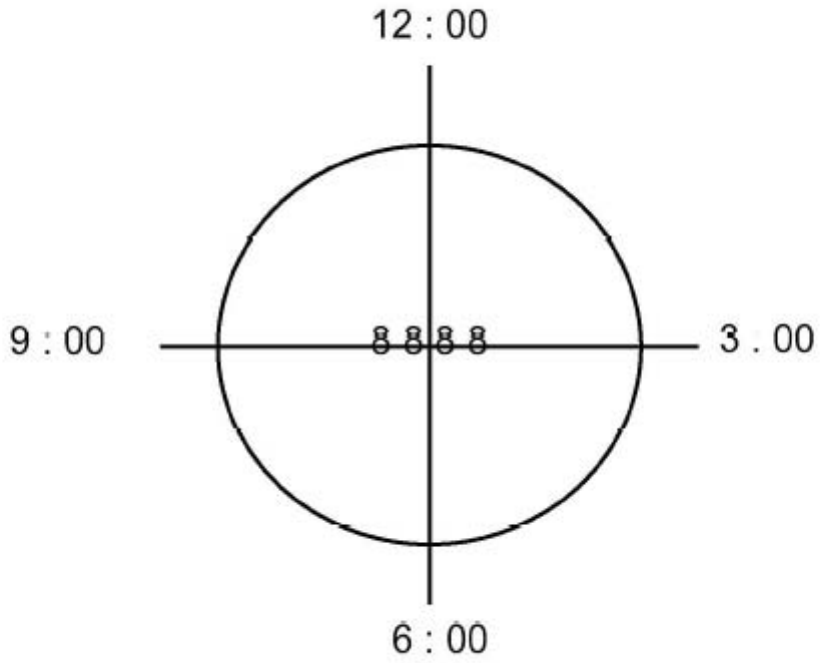
NOTE 3: Definition of contrast ratio:

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is at “white state”}}{\text{Luminance measured when LCD is at “black state”}}$$

NOTE 4 : Φ、θ Definition



NOTE 5: Visual angle direction priority



5. TFT Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

Characteristics	Symbol	Min.	Max.	Unit
Digital Supply Voltage	VCI	-0.3	4.6	V
Digital interface supple Voltage	IOVCC	-0.3	4.6	V
Operating temperature	T_{OP}	-20	+70	℃
Storage temperature	T_{ST}	-30	+80	℃

NOTE: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VCI	2.5	2.8/3.3	3.6	V	--
Digital interface supple Voltage	IOVCC	1.65	1.8	3.3	V	--
Normal mode Current consumption	IDD	--	30	--	mA	--
Level input voltage	V_{IH}	0.7 IOVCC	--	IOVCC	V	--
	V_{IL}	-0.3	--	0.3 IOVCC	V	--
Level output voltage	V_{OH}	0.8* IOVCC	--	IOVCC	V	--
	V_{OL}	GND	--	0.2 IOVCC	V	--

5.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 8 chips White LED

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I_F	15	20	--	mA	--
Forward Voltage	V_F	--	25.6	--	V	--
LCM Luminance	L_V	450	500	--	cd/m2	Note3
LED life time	Hr	50000			Hour	Note1,2
Uniformity	AVg	80	--	--	%	Note3

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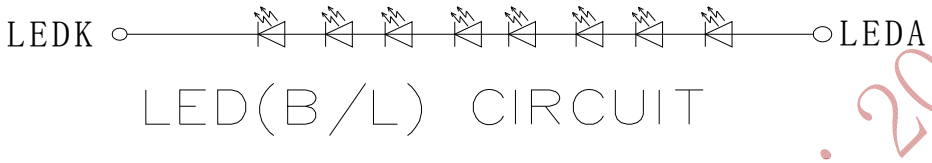
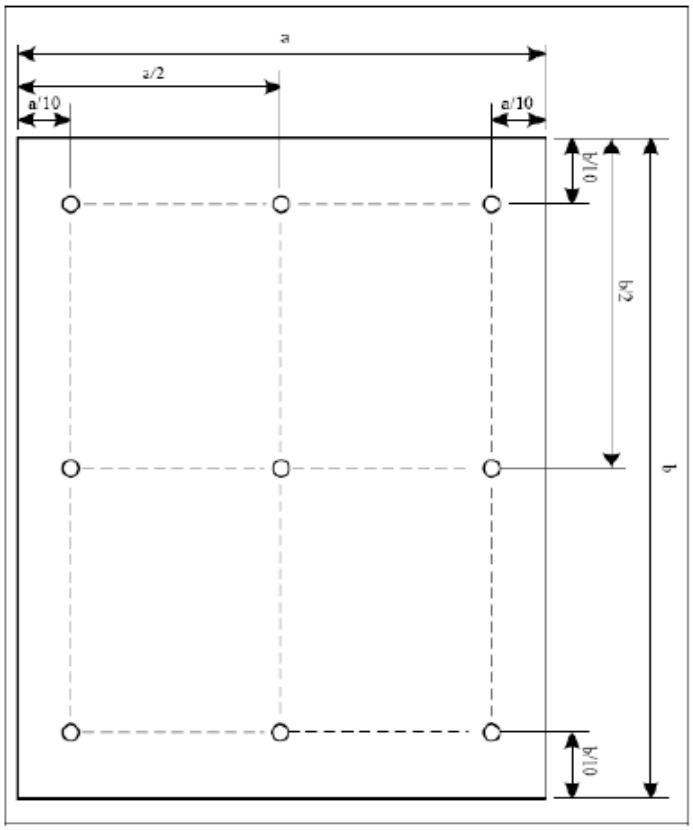
Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 ℃, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL=20mA. The LED lifetime could be decreased if operating IL is larger than 20mA. The constant current driving method is suggested.



LED(B/L) CIRCUIT

NOTE 3：Luminance Uniformity of these 9 points is defined as below:

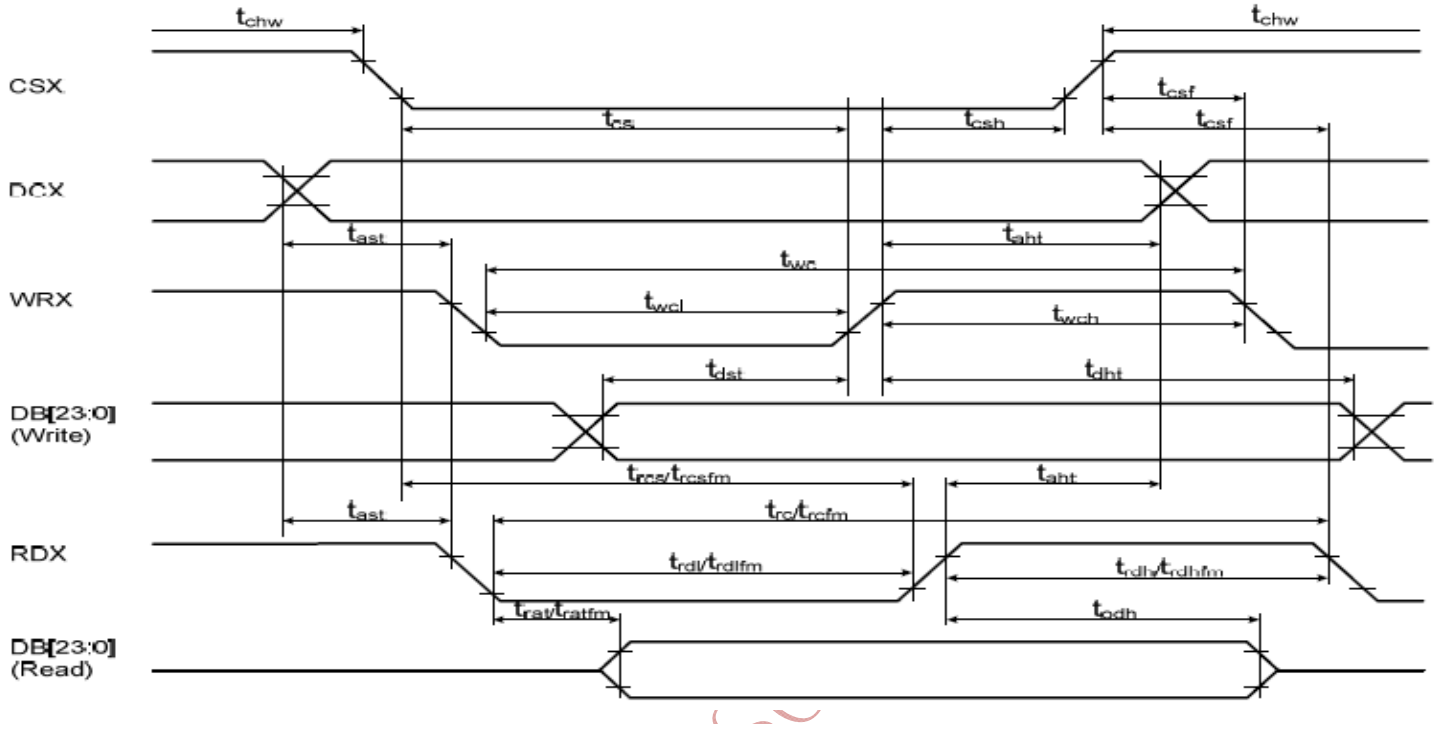


$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$

6. TFT AC Characteristic

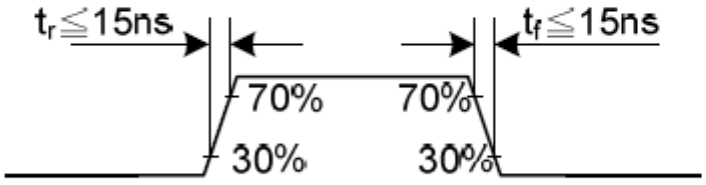
6.1 Display Parallel 8/16-bit Interface Timing Characteristics (8080 system)



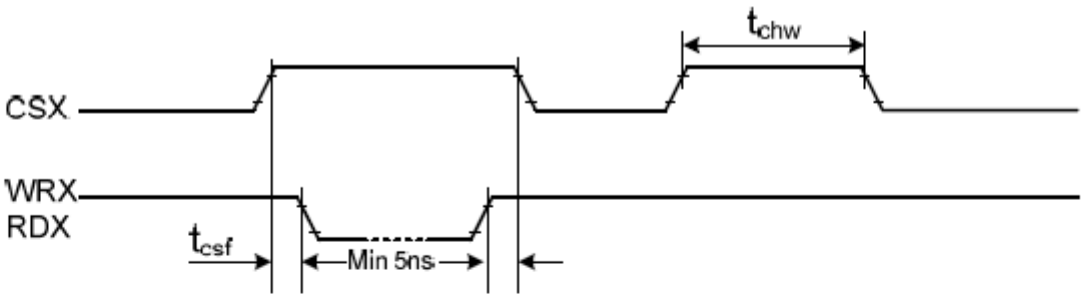
Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	-
	taht	Address hold time (Write/Read)	10	-	ns	-
CSX	tchw	CSX "H" pulse width	0	-	ns	-
	tcs	Chip Select setup time (Write)	10	-	ns	-
	trcs	Chip Select setup time (Read ID)	45	-	ns	-
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	-
	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	-
WRX	twc	Write cycle	30	-	ns	-
	twrh	Write Control pulse H duration	10	-	ns	-
	twrl	Write Control pulse L duration	10	-	ns	-
RDX (FM)	trcfm	Read Cycle (FM)	450	-	ns	When read from the Frame Memory
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	When read ID data
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
DB[17:0], DB[15:0], DB[8:0] DB[7:0]	tdst	Write data setup time	10	-	ns	CL = 30pF (maximum) CL = 8pF (minimum)
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trodh	Read output disable time	20	80	ns	

Notes:

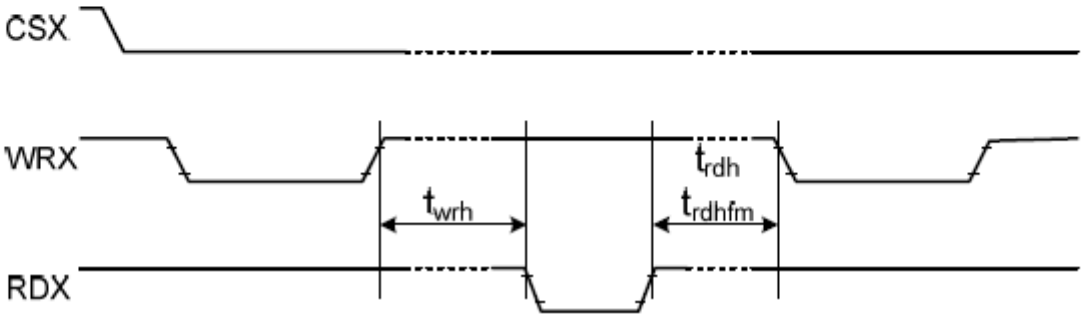
1. Ta = -30 to 70°C, VDDI = 1.65V to 3.3V, VDDA = 2.6V to 4.8V, VSSAM = GND= 0V
2. Logic high and low levels are specified as 30% and 70% of VDDI for input signals.
3. Input signal rising and falling time:



4. The CSX timing:



5. The Write-to-Read or the Read-to-Write timing:



6.2 Reset input timing

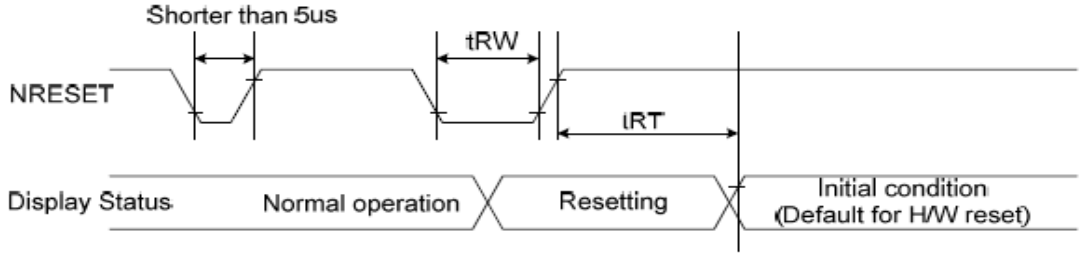


Figure 182: Reset Timing

Table 46: Reset Timing

Signal	Symbol	Parameter	Min	Max	Unit
RESX	tRW	Reset pulse duration	10		us
	tRT	Reset cancel		5 (note 1,5)	ms
				120 (note 1,6,7)	ms

Notes:

1. The reset cancel also includes the required time for loading ID bytes, VCOM setting and other settings from the EEPROM to registers. After a rising edge of RESX, this loading is done within 5 ms after the H/W reset cancel (tRT).
2. A spike due to an electrostatic discharge on the RESX line does not cause irregular system reset, according to the Table 47.

Table 47: Reset Description

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 (When Reset starts in the Sleep Out mode, the display will enter the blanking sequence in at least 120 ms. The display remains blank in the Sleep In mode.), and then return to the default condition for the Hardware Reset.
4. Spike Rejection can also be applied during a valid reset pulse as shown below:

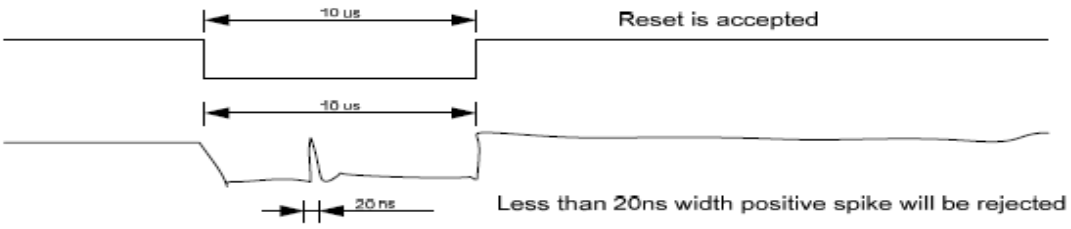


Figure 183: Positive Noise Pulse during Reset Low

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 the RESX before sending commands. Moreover, the Sleep Out command cannot be sent in 120msec.

7. LCD Module Out-Going Quality Level

7.1 VISUAL & FUNCTION INSPECTION STANDARD

7.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

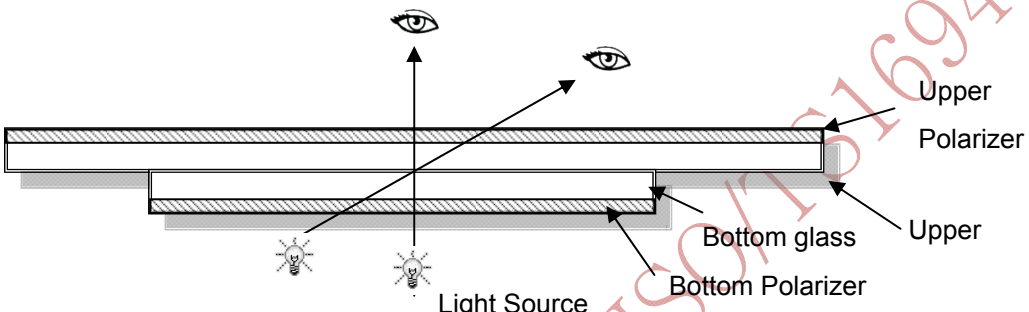
Temperature : 25±5℃

Humidity : 65%±10%RH

Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



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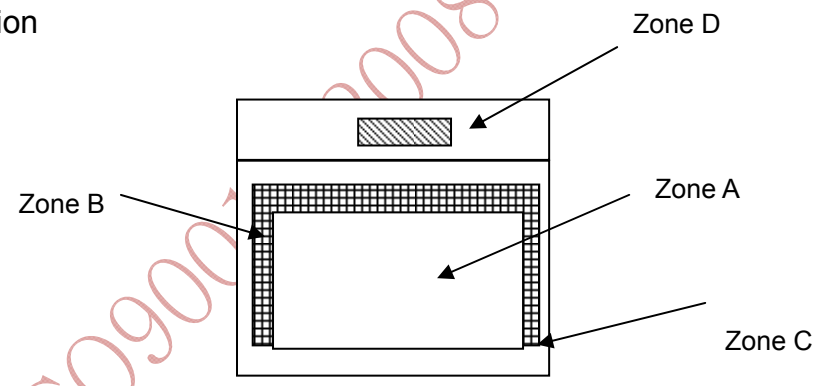
7.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Zone D : IC Bonding Area

Note:

As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer

7.1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class Ⅱ

AQL:

Major defect	Minor defect
0.65	1.5

LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot Line defect	Light dot, Dim spot,Polarizer Bubble ; Polarizer accidented spot.	
6	Soldering appearance	Good soldering , Peeling off is not allowed.	
7	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

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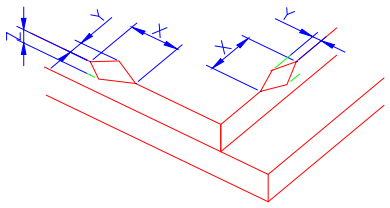
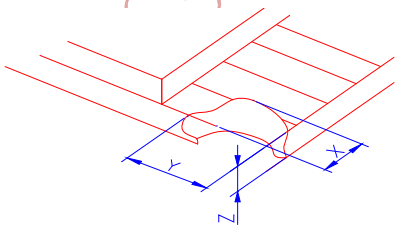
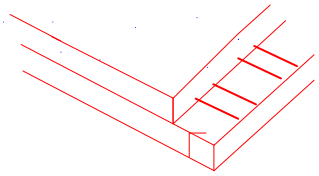
7.1.4 Criteria (Visual)

<table>
<tr><th>Number</th><th>Items</th><th>Criteria(mm)</th></tr>
<tr><td rowspan="3">1.0 LCD Crack/Broken
NOTE:
X: Length
Y: Width
Z: Height
L: Length of ITO,
T: Height of LCD</td><td>(1) The edge of LCD broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></table></td></tr>
<tr><td>(2)LCD corner broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table></td></tr>
<tr><td>(3) LCD crack</td><td> 
Crack
Not allowed</td></tr>
</table>

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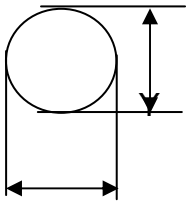
2.0

Spot defect



X

Φ=(X+Y)/2

① light dot（LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain）

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.10	Ignore		Ignore
0.10<Φ≤0.25	3(distance≧10mm)		
0.25<Φ≤0.3	2		
Φ>0.35	0		

②Dim spot（LCD/TP/Polarizer dim dot, light leakage、dark spot）

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.1	Ignore		Ignore
0.10<Φ≤0.25	3(distance≧10mm)		
0.25<Φ≤0.3	2		
Φ>0.35	0		

③ Polarizer accidented spot

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.3<Φ≤0.5	2(distance≧10mm)		
Φ>0.5	0		

④Pixel bad points（light dot，Dim dot, color dot）

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.1	Ignore		Ignore
0.15<Φ≤0.25	2(distance≧10mm)		
Φ>0.3	0		

⑤ Polarizer Bubble

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.3<Φ≤0.4	3(distance≧10mm)		
0.4<Φ≤0.5	2		
Φ>0.5	0		

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<table>
<tr><td>3.0</td><td>Line defect (LCD/TP /Polarizer backlight black/white line, scratch, stain)</td><td>
<table>
<tr><td rowspan="2">Width(mm)</td><td rowspan="2">Length(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.05</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.05<W≤0.06</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.07<W≤0.08</td><td>L≤2.0</td><td colspan="2">N≤1</td></tr>
<tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr>
</table>
</td></tr>
<tr><td>4.0</td><td>Electronic Components SMT</td><td>Not allow missing parts，solderless connection，cold solder joint，mis match，The positive and negative polarity opposite</td></tr>
<tr><td>5.0</td><td>Display color& Brightness</td><td>1. Color：Measuring the color coordinates, The measurement standard according to the datasheet or samples.
2. Brightness：Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples.</td></tr>
<tr><td>6.0</td><td>RTP Related</td><td>TP film bubble/ accidented spot</td><td>
<table>
<tr><td rowspan="2">Size Φ(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.1<Φ≤0.2</td><td colspan="2">3（distance≧10mm）</td></tr>
<tr><td>0.25<Φ≤0.3</td><td colspan="2">2</td></tr>
<tr><td>Φ>0.35</td><td colspan="2">0</td></tr>
</table>
</td></tr>
<tr><td></td><td></td><td>TP film scratch</td><td>
<table>
<tr><td rowspan="2">Width(mm)</td><td rowspan="2">Length(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.05</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.05<W≤0.06</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.07<W≤0.08</td><td>L≤2.0</td><td colspan="2">N≤1</td></tr>
<tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr>
</table>
</td></tr>
<tr><td></td><td></td><td>Assembly</td><td>beyond the edge of backlight ≤0.2mm</td></tr>
</table>

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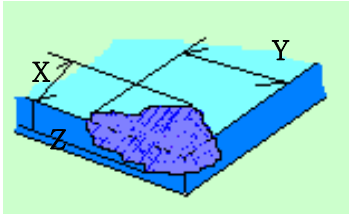
		deflection		
		Bulge (undulation included)	The ITO film plumped below 0.40mm, it's ok.  	
		Newton Ring	Newton Ring area>1/3 TP area NG Newton Ring area≤1/3 TP area OK	  
		TP corner broken X：length Y：width Z：height	X: X≤3mm; Y: Y≤3mm; Z: Z<COVER thickness * *Circuitry broken is not allowed.	

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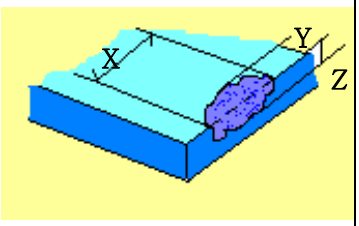
		TP edge broken X：length Y：width Z：height	<table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>X≤4mm</td><td>Y≤2mm</td><td>Z<COVER thickness</td></tr></table>* Circuitry broken is not allowed.	

Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	TP no function	Not allowed

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8. Reliability Test Result

8.1 Condition

Item	Condition	Sample Size	Test Result	Note
Low Temperature Operating Life test	-20℃, 96HR	3ea	pass	-
Thermal Humidity Operating Life test	70℃90%RH, 96HR	3ea	pass	-
Temperature Cycle ON/OFF test	-20℃ ↔ 70℃, ON/OFF, 20CYC	3ea	pass	(1)
High Temperature Storage test	80℃, 96HR	3ea	pass	-
Low Temperature Storage test	－30℃, 96HR	3ea	pass	-
ESD test	150pF, 330Ω , ±6KV(Contact)/± 8KV(Air), 5 points/panel, 10 times/point	3ea	pass	
Thermal Shock Resistance	The sample should be allowed to stand the following 5 cycles of operation: TSTL for 30 minutes -> normal temperature for 5 minutes -> TSTH for 30 minutes -> normal temperature for 5 minutes, as one cycle, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours	3ea	pass	
Box Drop Test	1 Corner 3 Edges 6 faces, 66㎝(MEDIUM BOX)	1box	pass	-

Note (1) ON Time over 10 seconds, OFF Time under 10 seconds

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9. Cautions and Handling Precautions

9.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.
Do not warp or twist the module during assembly work.
(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
(4) Do not allow drops of water or chemicals to remain on the display surface.
If you have the droplets for a long time, staining and discoloration may occur.
(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.
Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
(7) 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.
(8) Protect the module from static; it may cause damage to the CMOS ICs.
(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
(10) Do not disassemble the module.
(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
(12) Pins of I/F connector shall not be touched directly with bare hands.
(13) Do not connect, disconnect the module in the “Power ON” condition.
(14) Power supply should always be turned on/off by the item 6.1 Power On Sequence &6.2 Power Off Sequence

9.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 ℃ and relative humidity of less than 70%
(2) Do not store the TFT-LCD module in direct sunlight.
(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.
In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.
(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed

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10. Packing

----TBD----------

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