ORIENT DISPLAY

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SPECIFICATION
FOR
TFT MODULE

MODULE NO: AFU640480T-5.6-C256
REVISION NO: 00

Customer's Approval:

	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)	XJZ	2011-12-8
CHECKED BY	YHW	2011-12-8
APPROVED BY	HSH	2011-12-8

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DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
00	10-25-2009	First issue	

CONTENTS

1. Functions & Features

1.1. Format	: 640x480 Dots
1.2. LCD mode	: Normally White, Transmissive
1.3. Viewing direction	: 6 O'clock
1.4. Display color	: 256 colors
1.5. Operation temp	: -20~70℃
1.6. Storage temp	: -30~80℃
1.7. Power supply voltage (V_{DD})	: 3.3V
1.8. LED power voltage	: 5.0V
1.9. Backlight color	: White(LED)
1.10 LCM Contrast ratio	: 500:1
1.11 LCM Birghtness	: 200 nit(tye)
1.12.RoHS standard	

2. MECHANICAL SPECIFICATIONS

2.1. Module size	: 160.0mm(L)*109.0mm(W)*12.5 max mm (H)
2.2. Viewing area	: 115.0mm(L)*57.0mm(W)
2.3. Dot pitch	: 0.0588(W)*0.1764(H) mm
2.4. Weight	: Approx.

3. BLOCK DIAGRAM

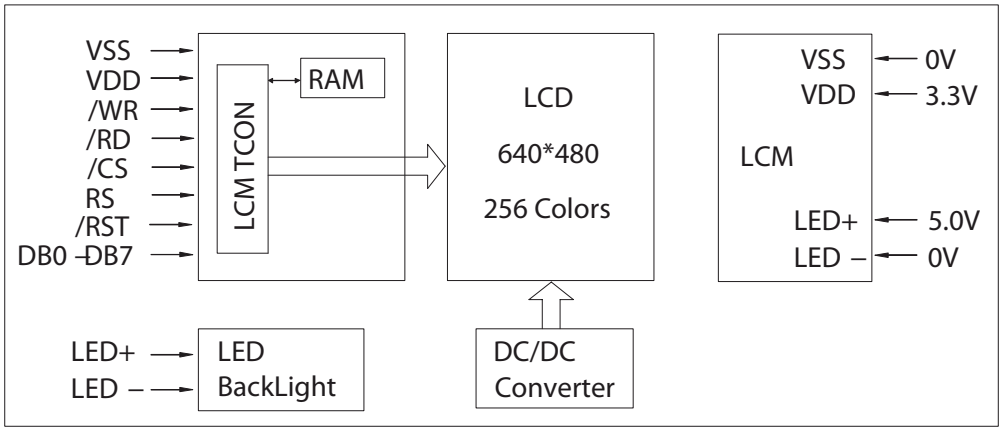


Figure 1. Block diagram

4. DIMENSIONAL OUTLINE

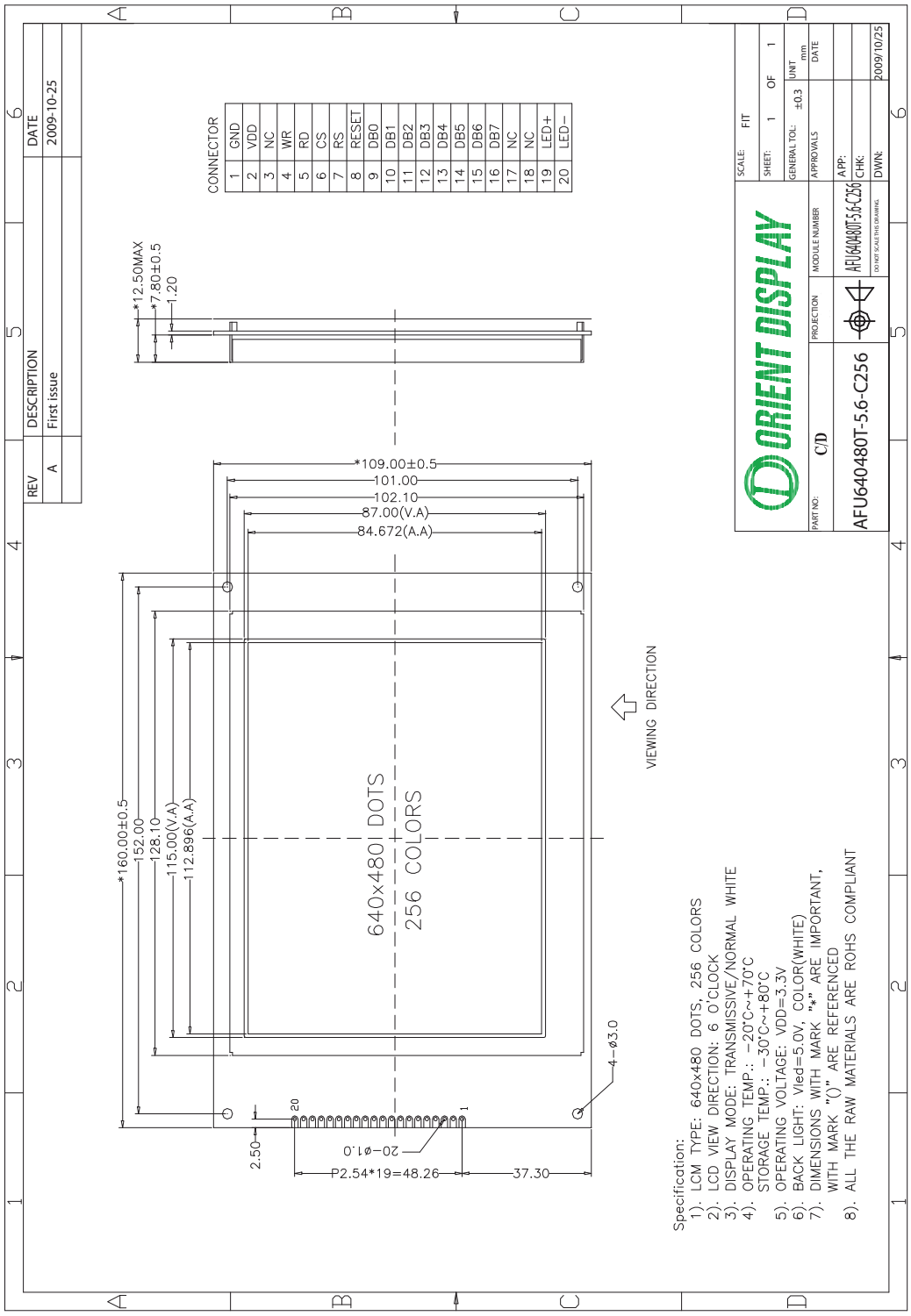


Figure 2. Dimensional outline

5. PIN DESCRIPTION

No.	Symbol	Function
1	VSS	GND
2	VDD	Logic supply voltage (+3.3V)
3	NC	No connection
4	/WR	Write signal
5	/RD	Read signal
6	/CS	Chip enable signal
7	RS	Register selection (H:Data register, L:Instruction register)
8	/RST	Reset signal (L)
9-16	DB0~DB7	Data bus line
17	NC	No connection
18	NC	No connection
19	LED+	Power supply for backlight(+5.0V)
20	LED-	Power supply for backlight(0V)

6. MAXIMUM ABSOUTE LIMIT

Item	Symbol	MIN	MAX	Unit
Supply Voltage for Logic	V_{DD}	-0.3	7.0	V
Input Voltage	Vin	-0.3	V_{DD}+0.3	V
Supply Current （Without Backllight）	I_{DD}(Ta = 25°C)		240	mA
Supply Current for Backlight	I_F(Ta = 25°C)	---	380	mA
Reverse Voltage for Backlight	V_R(Ta = 25°C)	---	5.5	V
Operating Temperature	Top	-20	70	℃
Storage Temperature	Tst	-30	80	℃

7. ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage for Logic	V_{DD}-V_{SS}	Ta = 25°C	3.1	3.3	3.5	V
Input High Voltage	V_{IH}	Ta = 25°C	08V $_{DD}$	---	V_{DD}	V
Input Low Voltage	V_{IL}	Ta = 25°C	0	---	02V $_{DD}$	V
Output High Voltage	V_{OH}	Ta = 25°C	08V $_{DD}$	---	V_{DD}	V
Output Low Voltage	V_{OL}		0	---	02V $_{DD}$	V
Supply Current （Without Backllight）	I_{DD}	Ta = 25°C	--	200	240	mA

8. BACKLIGHT CHARACTERISTICS

Ta = 25°C

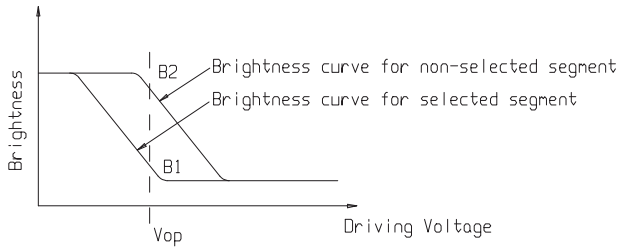
Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	Vled=5.0V	48	5.0	5.2	V
Reverse Current	IR	Vled=5.0V	---	160	380	mA
Luminous Intensity (With LCD dots off)	IV	Vled=5.0V	150	200	---	Cd/m^2
LED Backlight Color	White					

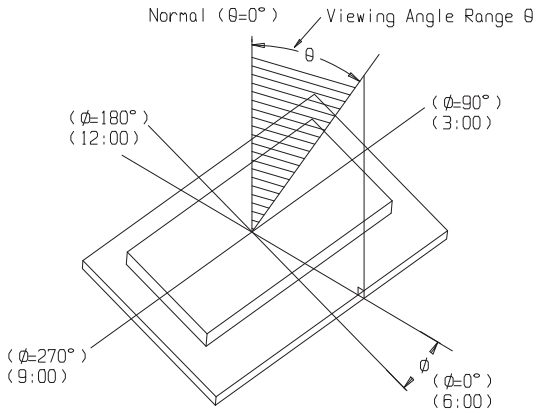
9. ELECTRO-OPTICAL CHARACTERISTICS

(VDD=3.3V,Vled=5.0V, Ta = 25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Viewing angle (CR ≥10)	θ_L	=180°(9 o'clock)	60	70	---	
	θ_R	=0°(3 o'clock)	60	70	---	degree
	θ_T	=90°(12 o'clock)	40	50	---	
	θ_B	=270°(6 o'clock)	60	70	---	
Response time	Ton	Normal θ= =0°	---	10	20	ms
	Toff		---	15	30	ms
Contrast ratio	Cr		450	500	---	---
Luminance	L1		150	200		Cd/m2

$$Cr=\frac{\text{Brightness of non-selected segment(B2)}}{\text{Brightness of selected segment(B1)}}$$





10. TIMING CHARACTERISTICS

10.1 Interface Timing

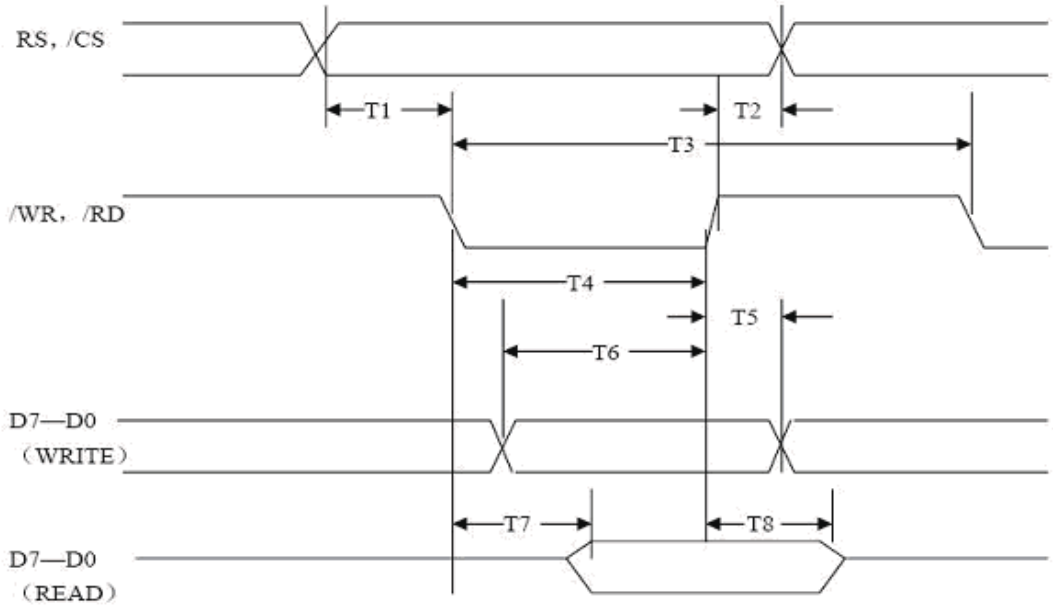


Figure 4. 8080 family Interface Timing

10.2 MCU Interface

Signal	Symbol	Parameter	VDD=3.1-3.5V		Unit	Condition
			Min	Max		
RS,/CS	T2	Address hold time	10	-	ns	CL=100pF
	T1	Address setup time	0	-	ns	
/WR,/RD	T3	System cycle time	350	-	ns	
	T4	Strobe pulsewidth	180	-	ns	
D0-D7	T5	Data hold time	80	-	ns	
	T6	Data setup time	120	-	ns	
	T7	/RD Access time	-	50	ns	
	T8	Output disable time	10	50	ns	

10.3 Power Sequence

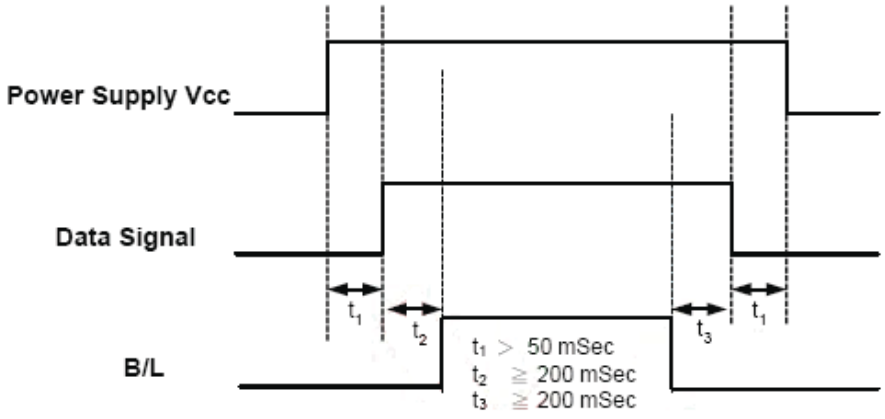


Figure 5. Power Sequence

11. CONTROL AND DISPLAY INSTRUCTION

11.1 Instruction

/CS	RS	/WR	/RD	DB0~DB7
H	H/L	H/L	H/L	Command non-active
L	L	L	H	Write display data
L	H	L	H	Write Address(X,Y) X_Address: 0~ 639 Y_Address: 0~480
L	L	H	L	Command non-active
L	H	H	L	Read display data

Example:

wcomd(0x00); wcomd(0x00); wcomd(0x00); wcomd(0x00); wdata(0xe0);

X-Address(H), X-Address(L), Y-Address(H), Y - Address(L),Display data

Continuum write display data, Address is increased by 1 automatically.

11.2 Display Data format(256 Colors)

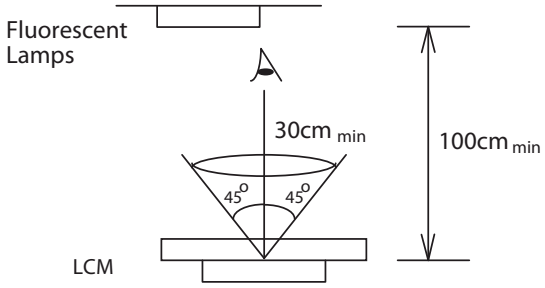
DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
R2	R1	R0	G2	G1	G0	B1	B0
MSB LSB RED (000~111)			MSB LSB GREEN(000~111)			MSB LSB BLUE(00~11)	

12.QUALITY SPECIFICATIONS

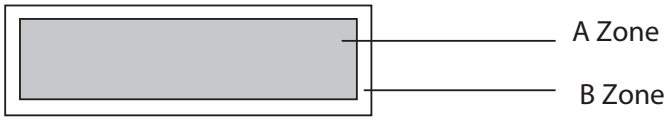
12.1 Standard of the product appearance test

Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps. Distance between LCM and fluorescent lamps should be 10cm or more. Distance between LCM and inspector eyes should be 30 cm or more.

Viewing direction for inspection is 45° from vertical against LCM.



Definition of zone:



A Zone: Active display area (minimum viewing area).
B Zone: Non-active display area (outside viewing area).

12.2 Specification of quality assurance

AQL inspection standard

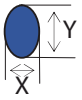
Sampling method: MIL-STD-105E, Level II, single sampling

Defect classification (Note: * is not including)

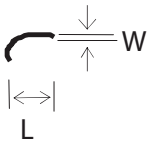
Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
		Back-light	1,8	
	Non-display	Flat cable or pin reverse	10	
		Wrong or missing component	11	
Minor	Display state	Background color deviation	2	1.0
		Black spot and dust	3	
		Line defect, Scratch	4	
		Rainbow	5	
		Chip	6	
		Pin hole	7	
	Polarizer	Protruded	12	
		Bubble and foreign material	3	
	Soldering	Poor connection	9	
	Wire	Poor connection	10	
	TAB	Position, Bonding strength	13	

Note on defect classification

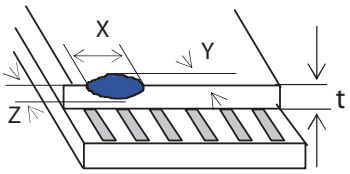
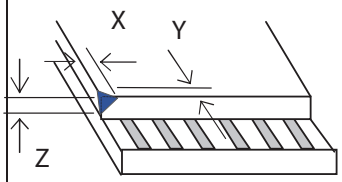
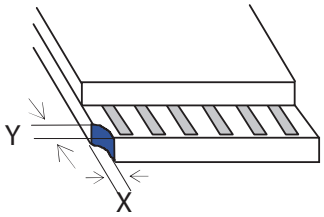
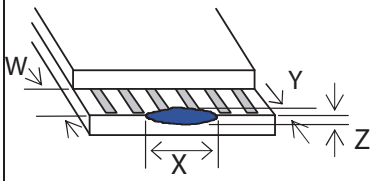
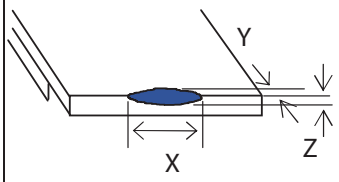
<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td rowspan="6">1</td><td>Short or open circuit</td><td rowspan="6">Not allow</td></tr>
<tr><td>LC leakage</td></tr>
<tr><td>Flickering</td></tr>
<tr><td>No display</td></tr>
<tr><td>Wrong viewing direction</td></tr>
<tr><td>Wrong Back-light</td></tr>
<tr><td rowspan="2">2</td><td>Contrast defect</td><td rowspan="2">Refer to approval sample</td></tr>
<tr><td>Background color deviation</td></tr>
<tr><td>3</td><td>Point defect,
Black spot, dust
(including Polarizer)

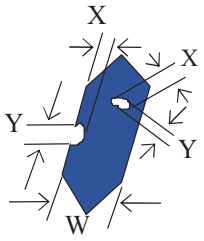
φ= (X+Y)/2</td><td> 

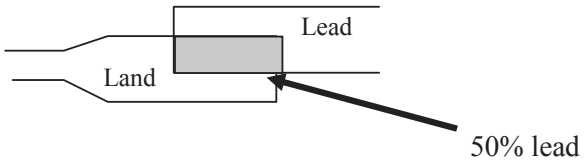
<table>
<tr><th>Point
Size</th><th>Acceptable Qty.</th></tr>
<tr><td>φ≤0.10</td><td>Disregard</td></tr>
<tr><td>0.10<φ≤0.20</td><td>3</td></tr>
<tr><td>0.20<φ≤0.25</td><td>2</td></tr>
<tr><td>0.25<φ≤0.30</td><td>1</td></tr>
<tr><td>φ>0.30</td><td>0</td></tr>
</table>
Unit： mm</td></tr>
<tr><td>4</td><td>Line defect,

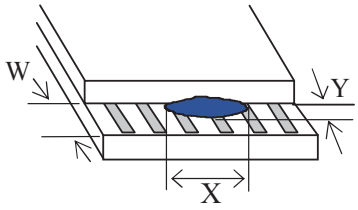
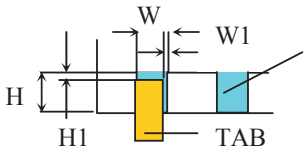
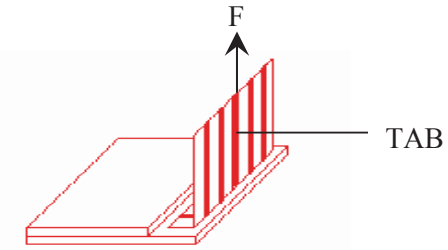
Scratch</td><td> 

<table>
<tr><th colspan="2">Line</th><th>Acceptable Qty.</th></tr>
<tr><td>L</td><td>W</td><td></td></tr>
<tr><td>---</td><td>0.015≥W</td><td>Disregard</td></tr>
<tr><td>5.0≥L</td><td>0.03 ≥W</td><td rowspan="2">2</td></tr>
<tr><td>5.0≥L</td><td>0.05 ≥W</td></tr>
<tr><td>5.0≥L</td><td>0.1 >W</td><td>1</td></tr>
<tr><td>---</td><td>0.05<W</td><td>Applied as point defect</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>5</td><td>Rainbow</td><td>Not more than two color changes across the viewing area.</td></tr>
</table>

No	Item	Criterion
6	Chip Remark: X: Length direction Y: Short direction Z: Thickness direction t: Glass thickness W: Terminal Width	 Acceptable criterion X: ⩽2 / Y: 0.5mm / Z: ⩽t/2  Acceptable criterion X: ⩽3 / Y: 0.5mm / Z: ⩽t  Acceptable criterion X: ⩽3 / Y: ⩽2 / Z: ⩽t shall not reach to ITO  Acceptable criterion X: Disregard / Y: ⩽0.2 / Z: ⩽t  Acceptable criterion X: ⩽5 / Y: ⩽2 / Z: ⩽t/3

<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td>7</td><td>Segment
pattern
W = Segment width
ϕ = (X+Y)/2</td><td>(1) Pin hole
ϕ < 0.10mm is acceptable.
 

<table>
<tr><th>Point Size</th><th>Acceptable Qty</th></tr>
<tr><td>ϕ≤1/4W</td><td>Disregard</td></tr>
<tr><td>1/4W< ϕ≤1/2W</td><td>1</td></tr>
<tr><td>ϕ>1/2W</td><td>0</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>8</td><td>Back-light</td><td>(1) The color of backlight should correspond its specification.
(2) Not allow flickering</td></tr>
<tr><td>9</td><td>Soldering</td><td>(1) Not allow heavy dirty and solder ball on PCB.
(The size of dirty refer to point and dust defect)
(2) Over 50% of lead should be soldered on Land.
 
</td></tr>
<tr><td>10</td><td>Wire</td><td>(1) Copper wire should not be rusted
(2) Not allow crack on copper wire connection.
(3) Not allow reversing the position of the flat cable.
(4) Not allow exposed copper wire inside the flat cable.</td></tr>
<tr><td>11*</td><td>PCB</td><td>(1) Not allow screw rust or damage.
(2) Not allow missing or wrong putting of component.</td></tr>
</table>

No	Item	Criterion
12	Protruded W: Terminal Width	 Acceptable criteria: Y ≤ 0.4
13	TAB	1. Position  W1≤1/3W H1≤1/3H 2 TAB bonding strength test  P (=F/TAB bonding width) ≥650gf/cm ,(speed rate: 1mm/min) 5pcs per SOA (shipment)
14	Total no. of acceptable Defect	A. Zone Maximum 2 minor non-conformities per one unit. Defect distance: each point to be separated over 10mm B. Zone It is acceptable when it is no trouble for quality and assembly in customer's end product.

12.3 Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	48	No abnormalities in functions and appearance
High temp. Operating	70°C	48	
Low temp. Storage	-30°C	48	
Low temp. Operating	-20°C	48	
Humidity	40°C/ 90%RH	48	
Temp. Cycle	-20°C<-- 25°C-->70°C (30 min<-- 5 min--> 30min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance ,etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature(20±8°C), normal humidity (below 45±20% RH), and in the area not exposed to direct sun light. The life time is not content the life time of the LED (for the life time of LED which decay only 50%,in the industry the experience value is 50000 hours, but there are not any experimentation data to support this). .

12.4 Precaution for using LCD/LCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.