Shenzhen Leadtek Electronics Co.,Ltd

PRODUCT SPECIFICATION

TFT-LCD MODULE

Module No：LTK018QQ12HYL-V0

☑ Preliminary Specification

☐ Approval Specification

Designed by	Checked by	Approved by
		

Final Approval by Customer

Approved by	Comment
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※The specification of “TBD” should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.

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Revision History

Version	Contents	Date	Note
V0	Original	2022.04.15	

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2 GENERAL INFORMATION

Item	Specification	Unit
Panel size	1.77	inch
Display Mode	Normally White	--
Resolution	128(RGB)x160	Pixel
Pixel per inch	116	-
Viewing direction(Gray inversion)	12 O'clock	-
Module outline dimension	34.30(H)* 44.76 (V)*2.45(D)	mm
LCD Panel Active Area	28.03 (H)* 35.04(V)	mm
Touch Panel Active Area	/	mm
Colors	262K	-
Driver IC	ST7735S	-
Interface Type	4-line Serial Interface	--
Backlight Type	White LED	--

3 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit	Note
Power Supply voltage 1	VCC~GND	-0.3	+3.7	V	-
Power Supply voltage 2	IOVCC~GND	-0.3	+3.7	V	-
Logic Input Voltage Range	V_{IN}	-0.3	IOVCC+0.3	V	-
Logic Output Voltage Range	V_O	-0.3	IOVCC+0.3	V	-
Operating temperature	Topr	-20	+60	℃	-
Storage temperature	Tstg	-30	+70	℃	-

* The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

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4 DC ELECTRICAL CHARACTERISTICS

4.1 Driving TFT LCD Panel

AGND = GND = 0V, Ta = 25℃

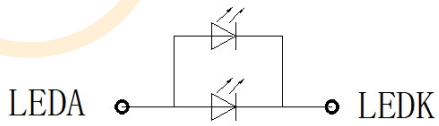
Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage for analog circuit	VCC	2.5	2.8	3.7	V
Supply voltage for logic circuit	IOVCC	1.65	1.8	3.7	V
Input voltage 'H'level	V_{IH}	0.7*IOVCC	—	IOVCC	V
Input voltage 'L'level	V_{IL}	0	—	0.3*IOVCC	V
Output voltage 'H'level	V_{OH}	0.8*IOVCC	—	IOVCC	V
Output voltage 'L'level	V_{OL}	0	—	0.2*IOVCC	V

4.2 Backlight Characteristics

Ta = 25℃

Item	Symbol	Min	Typ	Max	Unit	Condition
Forward voltage	Vf	3.0	3.2	3.4	V	If=40 mA
Luminance	LV	360	400	—	cd/㎡	
Number of LED	-	1X2			Piece	-
Connection mode	S/P	1Serial/2Parallel			-	-

Using condition: constant current driving method If= 20×2mA (+/-10%)



背光电路图（CIRCUIT DIAGRAM）

5 TIMING CHARACTERISTICS

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5.1 Serial Interface Characteristics (4-line Serial)

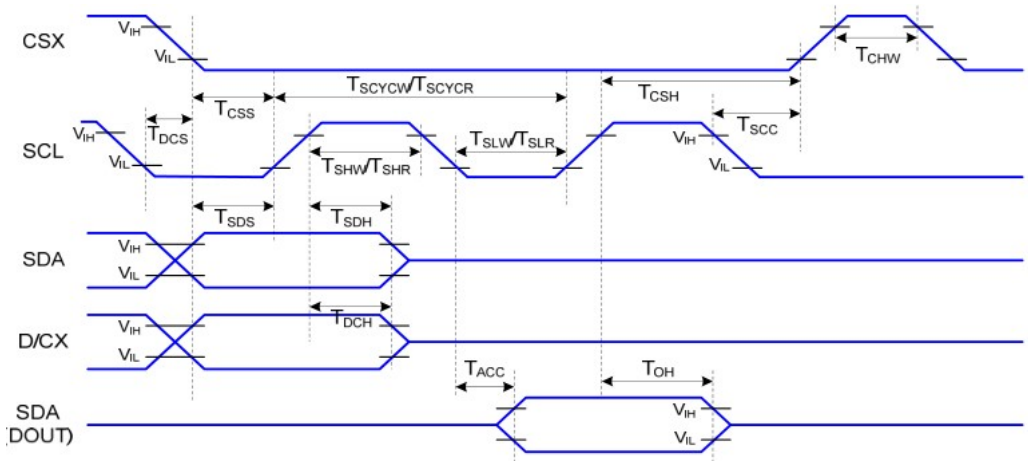

Figure5.1.1 4-line Serial Interface Timing

Ta=25℃, IOVCC=1.65~3.7V, VCC=2.5~3.7V

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	TCSS	Chip select setup time(write)	45	-	ns	
	TCSH	Chip select hold time(write)	45	-	ns	
	TCSS	Chip select setup time(read)	60	-	ns	
	TSCC	Chip Select hold time(read)	65	-	ns	
	TCHW	Chip Select 'H' pulse width	40	-	ns	
SCL	TSCYCW	Serial clock cycle(write)	66	-	ns	Write Command & Data Ram
	TSHW	SCL 'H' pulse width(write)	15	-	ns	
	TSLW	SCL 'L' pulse width(write)	15	-	ns	
	TSCYCR	Serial clock cycle(read)	150	-	ns	Read Command & Data Ram
	TSHR	SCL 'H' pulse width(read)	60	-	ns	
	TSLR	SCL 'L' pulse width(read)	60	-	ns	
D/CX	TDCS	D/CX setup time	10	-	ns	
	TDCH	D/CS hold time	10	-	ns	
SDA (DIN) (DOUT)	TSDS	Data setup time	10	-	ns	For maximun CL=30pF For minimum CL=8pF
	TSDH	Data hold time	10	-	ns	
	TACC	Access time	10	50	ns	
	TOH	Output disable time	15	50	ns	

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

Table 7 4-line Serial Interface Characteristics

5.2 Reset Timing Characteristics

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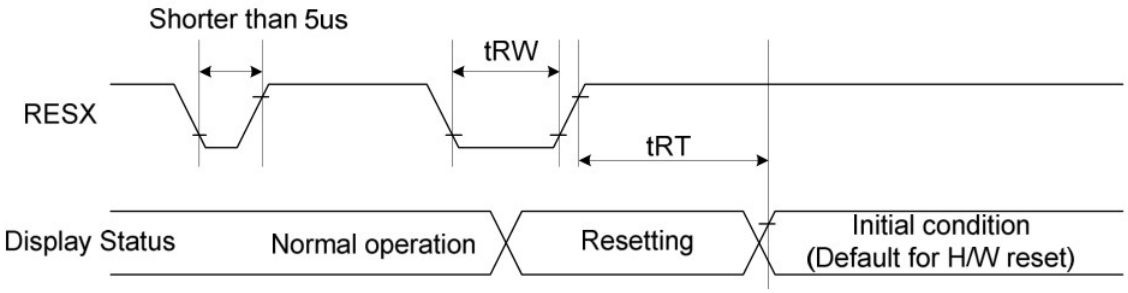


Signal	Symbol	Parameter	Min	Max	Unit	Description
RESX	tRW	Reset pulse duration	10	-	us	-
	tRT	Reset cancel	-	5	ms	Note 1,5
			-	120	ms	Note 1,6,7

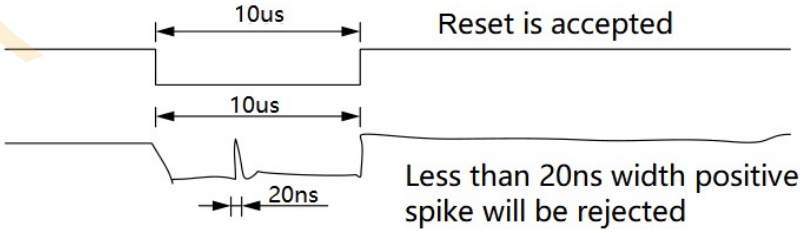
Note:

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. According to the Table 40, a spike due to an electrostatic discharge on the RESX line does not cause irregular system reset.

Table 5.2.2: Reset Description

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

3. During the Reset 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 the blank state 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:



Positive Noise Pulse during Reset Low

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

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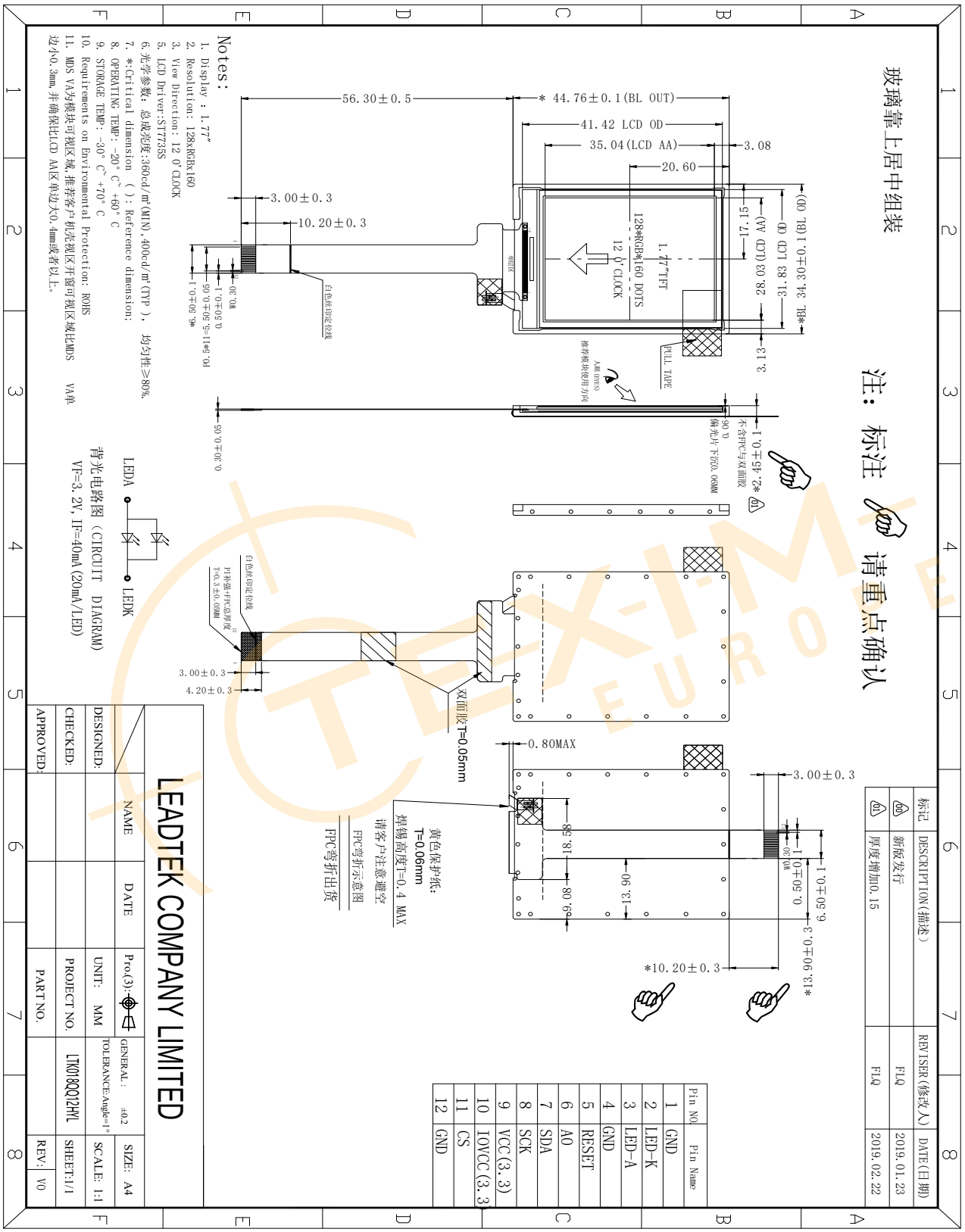
6 EXTERNAL DIMENSIONS



Pin NO.	Pin Name
1	GND
2	LED-K
3	LED-A
4	GND
5	RESET
6	A0
7	SDA
8	SCK
9	VCC(3.3)
10	IOVCC(3.3)
11	CS
12	GND

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7 INTERFACE SIGNAL

Pin No.	Symbol	Description
1	GND	Power ground
2	LEDK	LED backlight cathode.
3	LEDA	LED backlight anode.
4	GND	Power ground
5	RESET	Reset signal(low active)
6	A0(DC/X)	Data or command select pin
7	SDA	SPI interface input/output pin.
8	SCK	Servers as SCL (Serial Clock)
9	VCC(3.3)	Power supply for the analog power.
10	IOVCC(3.3)	Power supply for the logic power and I/O circuit.
11	CS	Chip select pin
12	GND	Power ground

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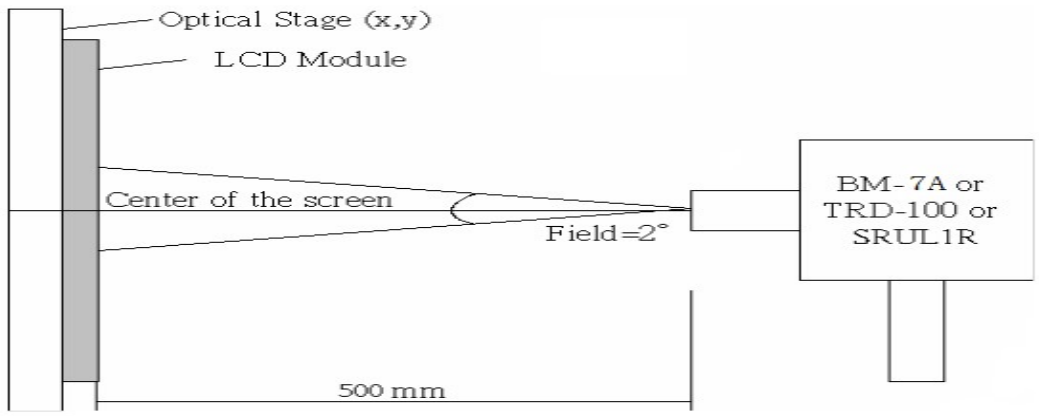
8 ELECTRO-OPTICAL CHARACTERISTICS

Item		Symbol		Condition	Min	Typ	Max	Unit	Note
Transmittance (w/o DBEF)		T%		θ=0° Ta=25℃	-	5.0	-	%	1
Contrast ratio		Cr			--	500	-	-	3
Response time		Ton+Toff			-	25	35	ms	4
Surface Luminance		LV			360	400	-	cd/㎡	2
Viewing angle range		Hor	Θ_{X+}	Center CR>10	-	45	-	deg	5
			Θ_{X-}		-	45	-	deg	
		Ver	Θ_{Y+}		-	45	-	deg	
			Θ_{Y-}		-	20	-	deg	
CIE(x,y) chromaticity	Red	x		Viewing normal angle Θx=θy=0° Ta=25℃	0.591	0.621	0.651	-	6
		y			0.302	0.332	0.362	-	
	Green	x			0.264	0.294	0.324	-	
		y			0.547	0.577	0.607	-	
	Blue	x			0.111	0.141	0.171	-	
		y			0.127	0.157	0.187	-	
	White	x			0.25	0.28	0.31	-	
		y			0.27	0.30	0.33	-	

Note 1.Ambient condition：25℃±2℃，60±10%RH，under 10 Lunx in the darkroom。
Note 2.Measure device：BM-7A (TOPCON)，viewing cone=2°
Lv = Average Surface Luminance with all white pixels (P1,P2,P3,P4,P5)



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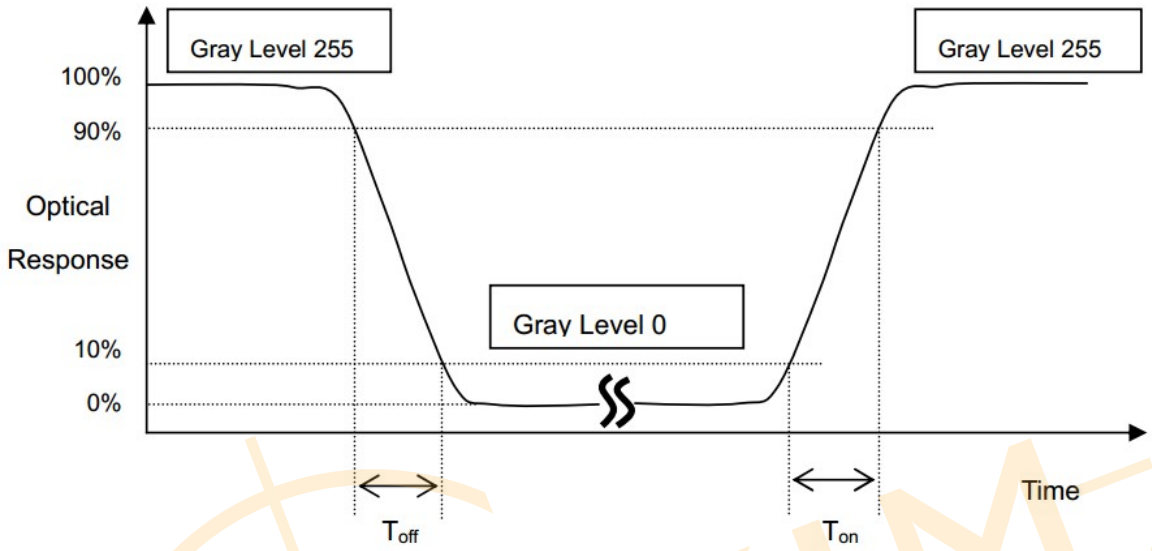
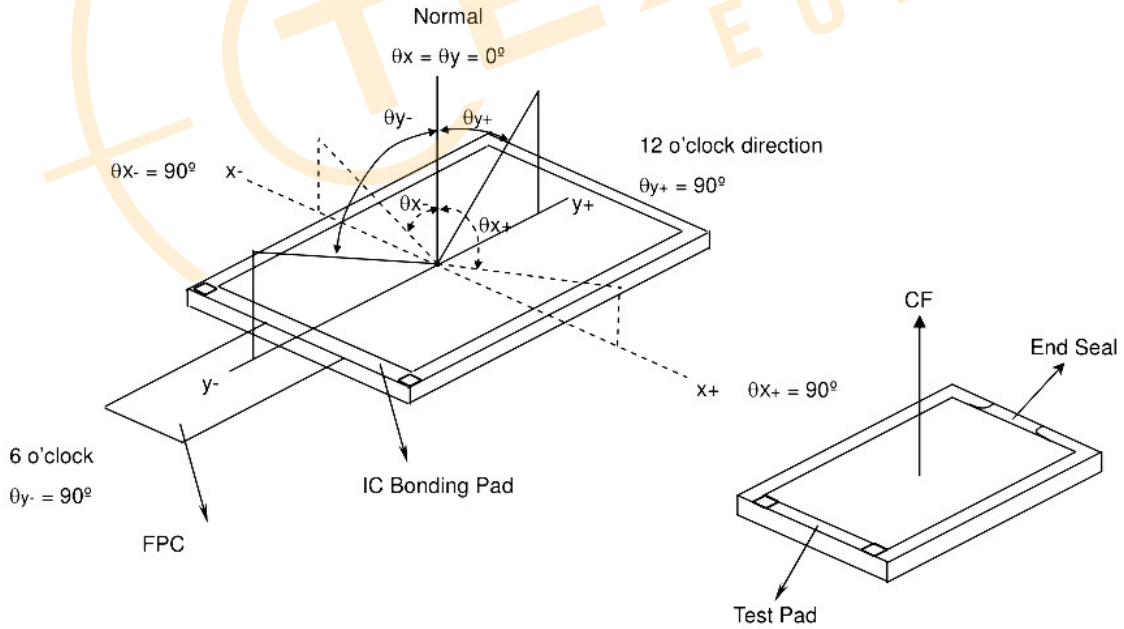
Note 3. Definition of Contrast Ratio：

$$CR = \frac{\text{Average Surface Luminance with all black pixels (P1,P2,P3,P4,P5)}}{\text{Average Surface Luminance with all white pixels (P1,P2,P3,P4,P5)}}$$

Note 4. Definition of Response Time (Ton, Toff), The response time is defined as the time interval between the 10% and 90% amplitudes.



Note 5. Definition of view angle(θ，ψ)：



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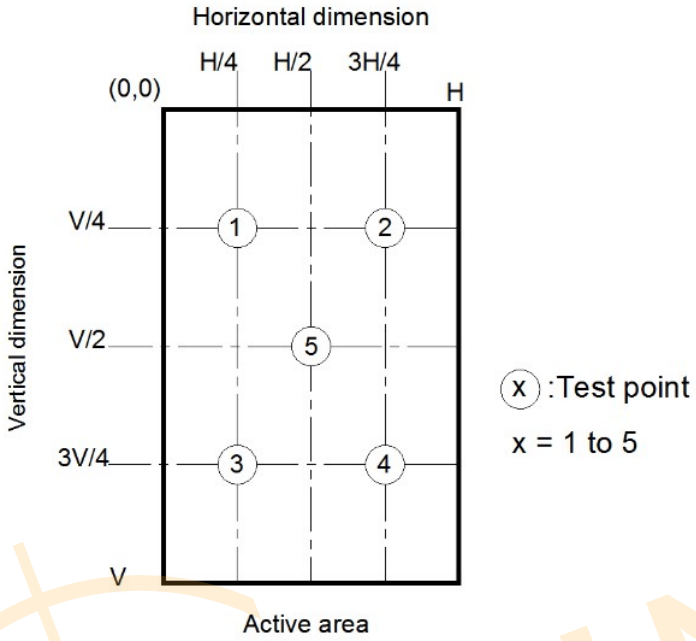
Note 6. The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room. Measouring method for Contrast ratio, surface luminance, Luminance uniformity,CIE(x,y) chromaticity.



Light spot size ⌀=7mm, 500mm distance from the LCD surface to detector lens measurement instrument is TOPCON's luminance meter BM-7A

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9 RELIABILITY TEST

Reliability test conditions (Polarizer characteristics null)

No.	Items	Condition	Inspection after test
1	High Temperature Storage	T = 70℃±2℃ for 48 hr	Inspection after 4 hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD 2.Sealleak; 3.Non-display; 4.missing segments; 5.Glass crack; 6.Current Idd is twice higher than initial value.
2	Low Temperature Storage	T = -30℃±2℃ for 48 hr	
3	High Temperature Operating	T = 60℃±2℃ for 48 hr	
4	Low Temperature Operating	T = -20℃±2℃ for 48 hr (But no condensation of dew)	
5	High Temp. and High Humidity Operating	T = 50℃±5℃ /90% for 48 hr (But no condensation dew)	
6	Thermal Shock	-30±2℃~25~70±2℃×10cycles (30min.) (5min.) (30min.)	
7	Dropping test (non-operation)	Drop to the ground from 76cm height, one time, every side of carton. (Packing condition)	
8	Packing Vibration (non-operation)	Frequency：10Hz~55Hz~10Hz Amplitude：1.0mm, X，Y，Z direction for total 3hours (Packing condition)	
9	ESD	Voltage:±6KV R: 330Ω C: 150pF Air discharge, 10time	

Note:

(1)The test samples should be applied to only one test item.

(2)Sample size for each test item is 5~10pcs.

(3)In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
Using ionizer(an antistatic blower) is recommended at working area in order to reduce electro-static voltage.
When removing protection film from LCM panel, peel off the tag slowly (recommended more than one second) while blowing with ionizer toward the peeling face to minimize ESD which may damage electrical circuit.

(4) Please use automatic switch testing mode when test operating mode.

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10 INSPECTION CRITERION

This specification is made to be used as the standard acceptance/rejection criteria for Normal LCM Product.

1 Sample plan

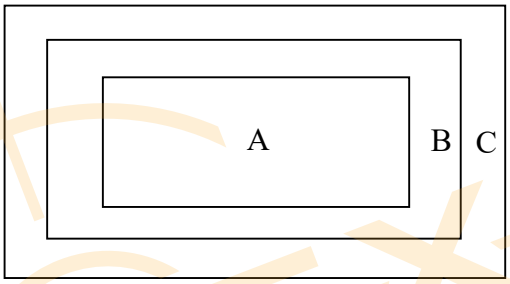
Sampling plan according to GB/T2828.1-2003/ISO 2859-1：1999 and ANSI/ASQC Z1.4-1993,normal level 2 and based on:

Major defect: AQL 0.65
Minor defect: AQL 1.0

2. Inspection condition

Viewing distance for cosmetic inspection is about 30cm with bare eyes, and under an environment of 20~40W light intensity, all directions for inspecting the sample should be within 45° against perpendicular line. (Normal temperature 20~25°C and normal humidity 60±15%RH).

3. Definition of inspection zone in LCD.



Zone A: character/Digit area

Zone B: viewing area except Zone A (Zone A + Zone B=minimum Viewing area)

Zone C: Outside viewing area (invisible area after assembly in customer's product)

Fig.1 Inspection zones in an LCD.

Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer's product.

4.Standards of inspection items

4.1 Major Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
4.1.1	All functional defects	1.No display	Major
		2.Display abnormally	
		3.Missing vertical，horizontal segment	
		4.Short circuit	

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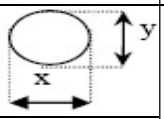
		5. Back-light no lighting, flickering and abnormal lighting.	
4.1.2	Missing	Missing component	
4.1.3	Outline dimension	Overall outline dimension beyond the drawing is not allowed.	
4.1.4	linearity	No more than 1.5%	

4.2 Cosmetic Defect

<table>
<tr><th>Item No</th><th>Items to be inspected</th><th>Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td rowspan="3">4.2.1</td><td>Clear Spots Black and white Spot defect Pinhole, Foreign Particle, polarizer Dirt</td><td>For dark/white spot, sizeΦis defined as Φ=(x + y)/2 
1
<table>
<tr><td rowspan="2">Zone
Size(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.15</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.15＜Φ≤0.20</td><td colspan="2">2</td></tr>
<tr><td>0.20＜Φ≤0.30</td><td colspan="2">1</td></tr>
<tr><td>Φ＞0.30</td><td colspan="2">0</td></tr>
</table></td><td>Minor</td></tr>
<tr><td>Clear Spots TP Dirt</td><td>2
<table>
<tr><td rowspan="2">Zone
Size(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.15</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.15＜Φ≤0.20</td><td colspan="2">2</td></tr>
<tr><td>0.20＜Φ≤0.30</td><td colspan="2">1</td></tr>
<tr><td>Φ＞0.30</td><td colspan="2">0</td></tr>
</table></td><td>Minor</td></tr>
<tr><td>Dim Spots Circle shaped and dim edged defects</td><td>3
<table>
<tr><td rowspan="2">Zone
Size(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="2">Ignore</td></tr>
<tr><td>0.20＜Φ≤0.40</td><td colspan="2">2</td></tr>
</table></td><td>Minor</td></tr>
</table>

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		0.40＜Φ≤0.60	1		
		Φ＞0.60	0		

Item No	Items to be inspected	Inspection Standard					Classification of defects
4.2.2	Line defect Black line, White line, Foreign material on polarizer	Size(mm)		Acceptable Qty			Minor
		L(Length)	W(Width)	Zone			
				A	B	C	
		Ignore	W≤0.05	Ignore		Ignore	
		L ≤5.0	0.05＜W≤0.08	2			
			W＞0.08	0			
	Foreign material on TP film	The line can be seen after mobile phone in the operating condition:					Minor
		Size(mm)		Acceptable Qty			
		L(Length)	W(Width)	Zone			
				A	B	C	
		Ignore	W≤0.05	Ignore		Ignore	
		L ≤5.0	0.05＜W≤0.08	3			
			W＞0.08	0			
4.2.3	Dim line defect Polarizer scratch TP film scratch	If the scratch can be seen after mobile phone cover assembling or in the operating condition, judge by the line defect of 4.2.2. If the scratch can be seen only in non-operating condition or some special angle, judge by the following.					Minor
		Size(mm)		Acceptable Qty			
		L(Length)	W(Width)	Zone			
				A	B	C	
		Ignore	W≤0.03	Ignore		Ignore	
		5.0＜ L≤10.0	0.03＜W≤0.05	2			
		L≤5.0	0.05＜W≤0.08	1			
			W＞0.08	0			
4.2.4	Polarize Air bubble	Air bubbles between glass & polarizer					Minor
		Zone / Size(mm)		Acceptable Qty			
				A	B	C	
		Φ≤0.20		Ignore		Ignore	

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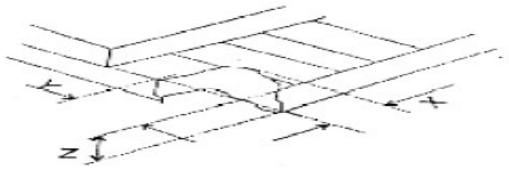
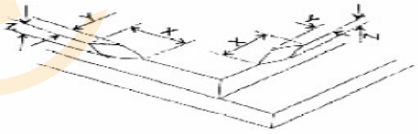
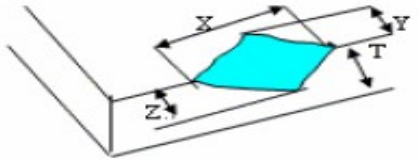
		0.20＜Φ≤0.3	2		
		Φ＞0.30	0		

<table>
<tr><th>Item No</th><th>Items to be inspected</th><th>Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td rowspan="11">4.35</td><td rowspan="11">Glass defect</td><td>(i) Chips on corner
A:LCD Glass defect
  </td><td rowspan="11">Minor</td></tr>
<tr><td><table>
<tr><td>X(mm)</td><td>Y(mm)</td><td>Z(mm)</td></tr>
<tr><td>≤3.0</td><td>≤3.0</td><td>Disregard</td></tr>
</table></td></tr>
<tr><td>Notes: S=contact pad length
Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.
B:TP Glass defect
  </td></tr>
<tr><td><table>
<tr><td>X(mm)</td><td>Y(mm)</td><td>Z(mm)</td></tr>
<tr><td>≤3.0</td><td>≤3.0</td><td>Disregard</td></tr>
</table></td></tr>
<tr><td>(ii)Usual surface cracks
A:LCD Glass defect
  </td></tr>
<tr><td><table>
<tr><td>X(mm)</td><td>Y(mm)</td><td>Z(mm)</td></tr>
<tr><td>≤3.0</td><td><Inner border line of the seal</td><td>Disregard</td></tr>
</table></td></tr>
<tr><td>B:TP Glass defect
  </td></tr>
<tr><td><table>
<tr><td>X(mm)</td><td>Y(mm)</td><td>Z(mm)</td></tr>
<tr><td>≤6.0</td><td>＜2.0</td><td>Disregard</td></tr>
</table></td></tr>
<tr><td>(iii) Crack
Cracks tend to break are not allowed.</td></tr>
</table>

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		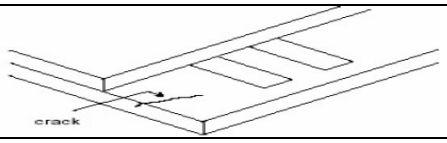	

11 PRECAUTIONS FOR USE OF LCD MODULES

1. Handling Precautions

(1) The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

(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. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(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 cloth with one of the following solvents

- Isopropyl alcohol
- Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

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

- Water
- Ketone
- Aromatic solvents

Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.

(7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

(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.

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(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) Electro-Static Discharge Control，Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential. Be sure to ground the body when handling the LCD modules.
- Tools required for assembling, such as soldering irons, must be properly grounded. Make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.
- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential
- 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

(13)Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- Do not alter, modify or change the shape of the tab on the metal frame.
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist LCM.

2. Storage precautions

2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0℃ ～ 40℃ Relatively humidity: ≤80%

2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

2.4 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

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