SPECIFICATION
FOR
LCD Module
KD018C-1

MODULE:	**KD018C-1**
CUSTOMER:	

REV	DESCRIPTION	DATE
1.0	FIRST ISSUE	2010.04.08

STARTEK	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		

Revision History

Data	Rev. No.	Page	Summary
2010.04.08	V1.0	ALL	FIRST ISSUE

Contents

General Description

* 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 1.8'TFT-LCD contains 128x160 pixels, and can display up to 65K colors.

* Features

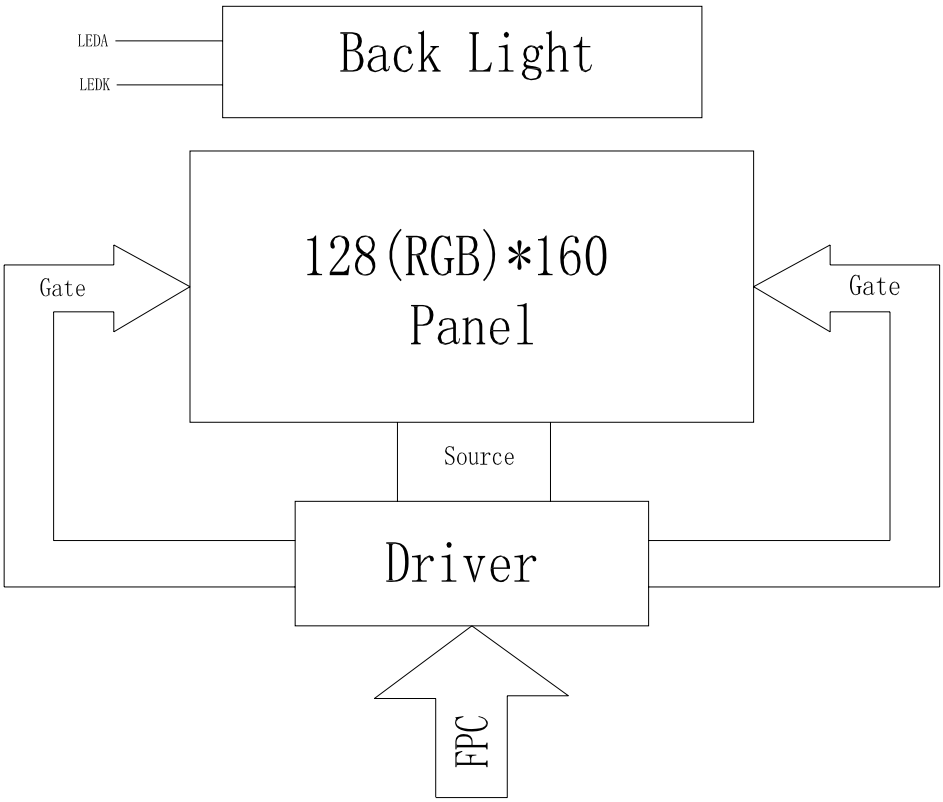
-Low Input Voltage: 3.3V(TYP)
-Display Colors of TFT LCD: 65Kcolors
- Interface: 16Bit MCU

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	28.02(H)*35.04(V) (1.77inch)	mm	-
Driver element	TFT active matrix	-	-
Display colors	65K	colors	-
Number of pixels	128(RGB)*160	dots	-
Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.219(H)*0.219(V)	mm	-
Viewing angle	12:00	o'clock	-
Controller IC	ILI9163V	-	-
Display mode	Transmissive/ Normally White	-	-
Operating temperature	-20～+70	℃	-
Storage temperature	-30～+80	℃	-

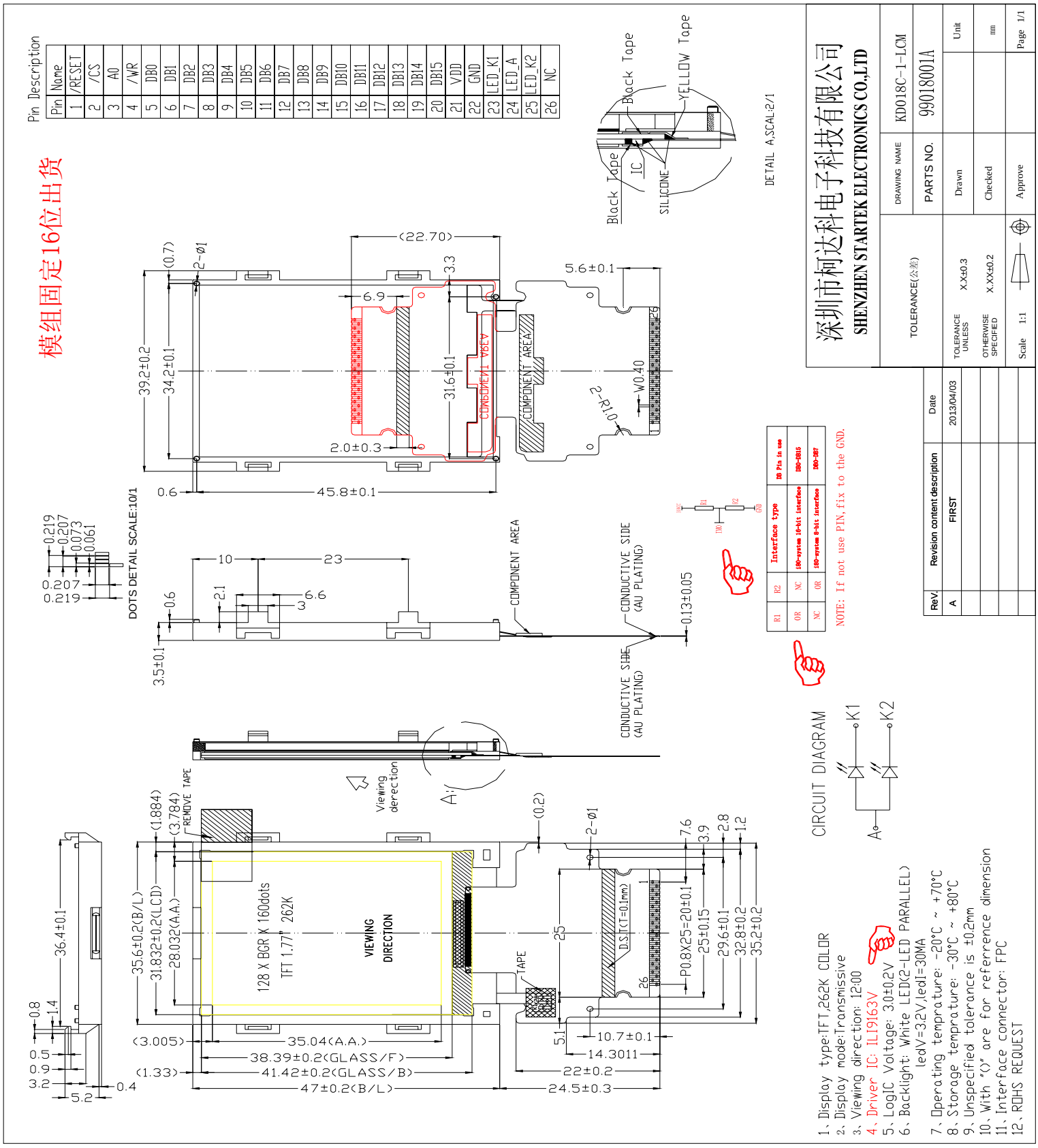
* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)		35.6		mm	-
	Vertical(V)		47.0		mm	-
	Depth(D)		3.6		mm	-
Weight			TBD		g	-

1. Block Diagram



2. Outline dimension



3. Input terminal Pin Assignment

NO.	SYMBOL	DISCRIPTION	I/O
1	RESET	This signal will reset the device and must b e applied to properly initialize the chip.	I
2	CS	Chip select input pin (“Low” enable).	I
3	RS/A0	Display data / Command selection . D/CX=’1’: Display data. D/CX=’0’: Command data.	I
4	WR	Write enable in parallel interface.	I
5-20	DB0-DB15	Data bus.	I
21	VDD	Supply voltage(3.3V).	P
22	GND	Ground.	P
23	LEDK1	Cathode pin OF backlight	P
24	LEDA	Anode pin of backlight	P
25	LEDK2	Cathode pin OF backlight	P
26	NC		

4. LCD Optical Characteristics

4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (without Polarizer)		T(%)	—	—	19.1	—	—	
Contrast Ratio		CR	Θ=0 Normal viewing angle	400	500	—	—	(1)(2)
Response time	Rising	T_R	—	—	2	4	msec	(1)(3)
	Falling	T_F	—	—	6	12		
Color gamut		S(%)			60		%	
Color chromaticity (CIE1931)	White	W_x		0.283	0.303	0.323		(1)(4) CF glass
		Wy		0.305	0.325	0.345		
	Red	Rx		0.606	0.626	0.646		
		Ry		0.314	0.334	0.354		
	Green	Gx		0.257	0.277	0.297		
		Gy		0.529	0.549	0.569		
	Blue	Bx		0.122	0.142	0.162		
		By		0.102	0.122	0.142		
Viewing angle	Hor.	Θ_L	CR>10	35	45	—		
		Θ_R		35	45	—		
	Ver.	Θ_U		35	45	—		
		Θ_D		10	20	—		
Optima View Direction		12 O'clock						(5)

4.2 Measuring Condition

■ Measuring surrounding : dark room

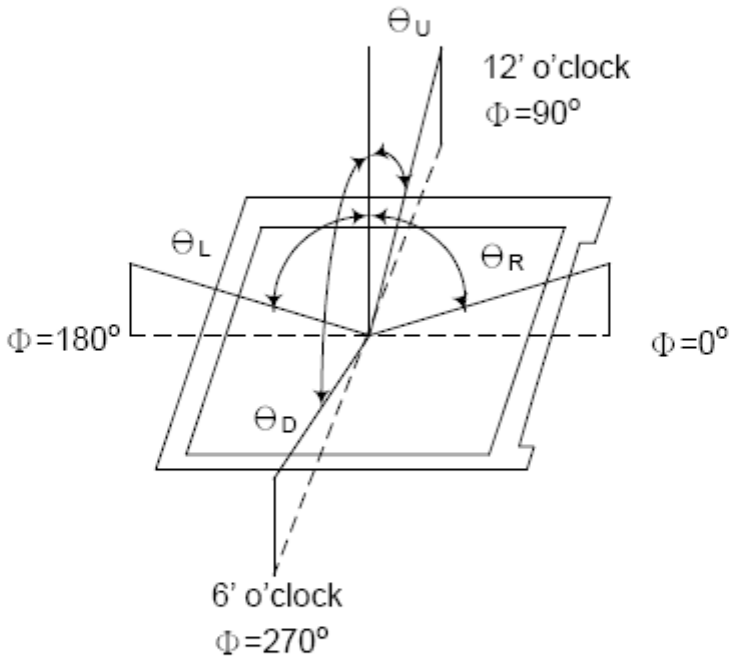
■ Ambient temperature : 25±2oC

■ 15min. warm-up time.

4.3 Measuring Equipment

■ FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

Note (1) Definition of Viewing Angle :



Note (2) Definition of Contrast Ratio(CR) :
measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

5. Electrical Characteristics

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

Characteristics	Symbol	Min.	Max.	Unit
Digital Supply Voltage	VDD	-0.3	4.8	**V**
Digital interface supple Voltage	VDDIO	-0.3	4.6	**V**
Operating temperature	T_{OP}	-20	+70	℃
Storage temperature	T_{ST}	-30	+80	℃

5.2 DC Electrical Characteristics

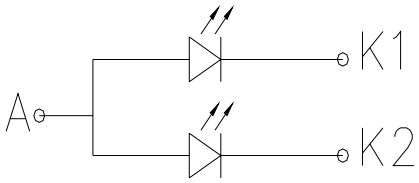
Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VDD	2.5	3..3	4.2	V	
Digital interface supple Voltage	VDDIO	1.65	3.3	4.2	V	
Normal mode Current consumption	IDD	--	1.5	--	mA	
Level input voltage	V_{IH}	0.7V_{DDIO}		VDDIO	V	
	V_{IL}	GND		0.3V_{DDIO}	V	
Level output voltage	V_{OH}	0.8VDDIO		VDDIO	V	
	V_{OL}	GND		0.2VDDIO	V	

5.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 2chips White LED

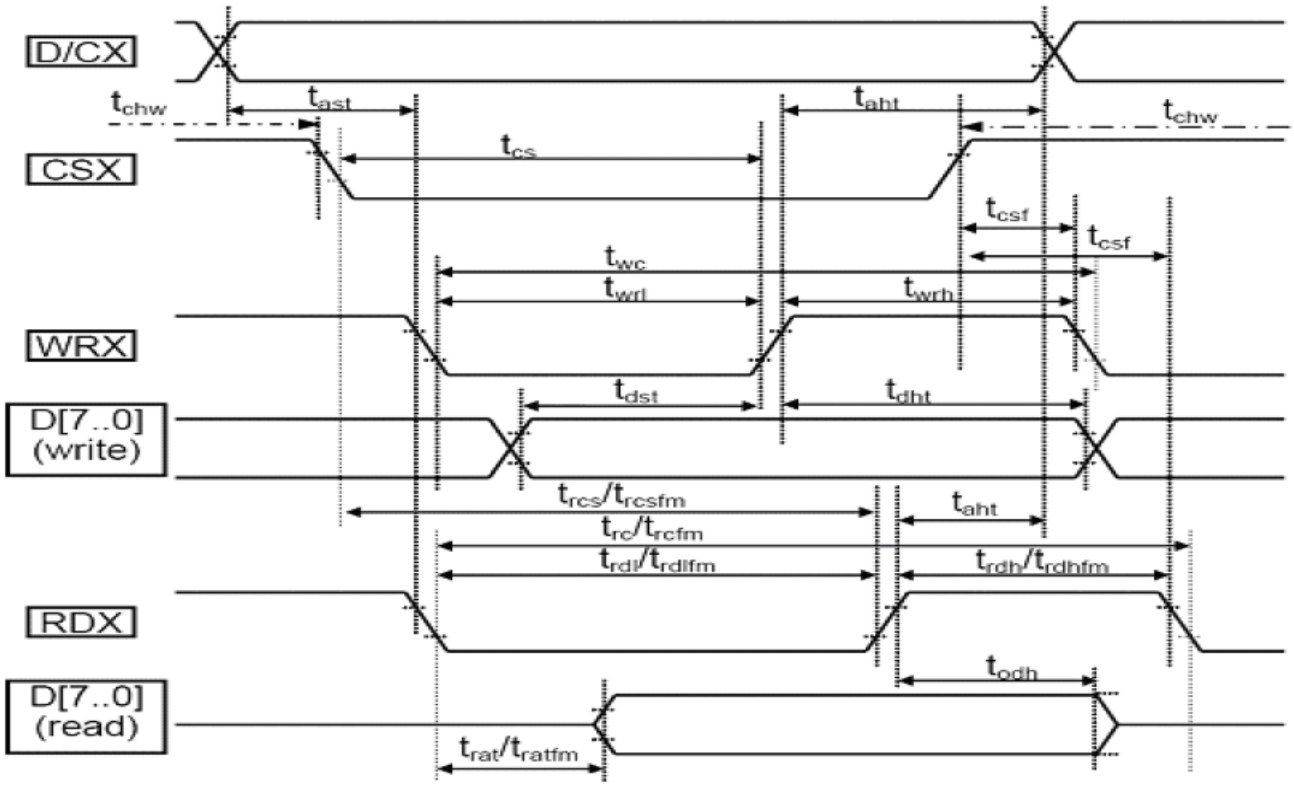
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I_F	30	40	--	mA	
Forward Voltage	V_F	--	3.2	--	V	
LCM Luminance	L_V	180	--	--	cd/m2	
Uniformity	AVg	80	--	--	%	

CIRCUIT DIAGRAM



6. AC Characteristic

6.1. Display Parallel 18/16/9/8-bit Interface Timing Characteristics (8080- system)



Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

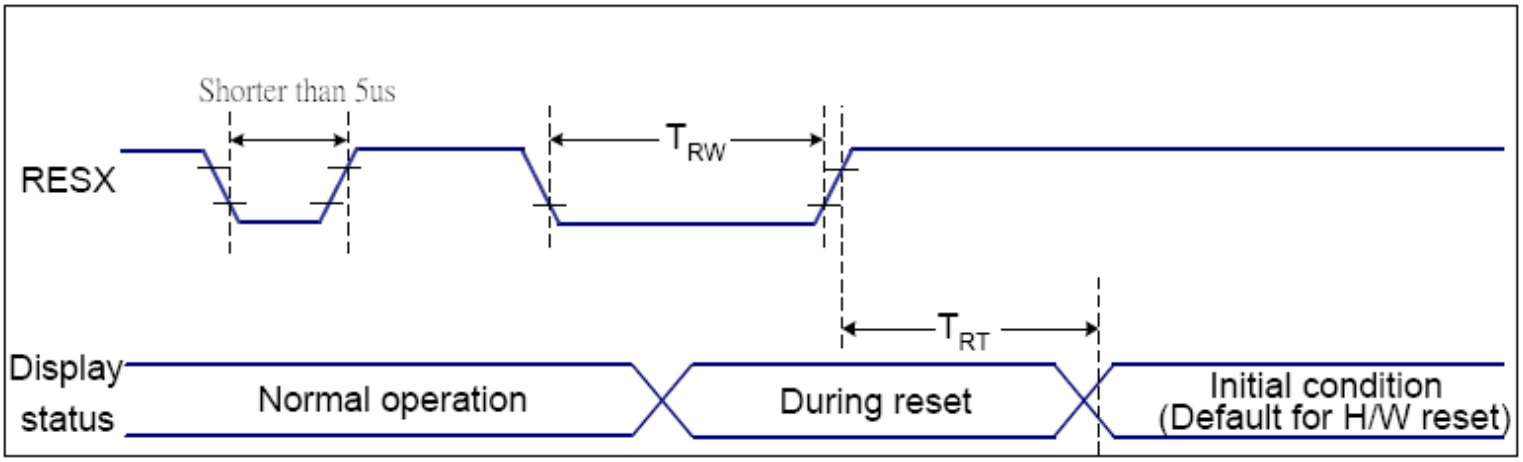
Signal	Symbol	Parameter	min	max	unit	description
D/CX	tast	Address setup time	0		ns	
	taht	Address hold time(Write/Read)	10		ns	
CSX	tchw	"S""H" Pulse Widtch	0		ns	
	tcs	Chip Select setup time (Write)	10		ns	
	trcs	Chip Select setup time (Read ID)	45		ns	
	trcsfm	Chip Select setup time (Read FM)	355		ns	
	tcsf	Chip Select Wait time(Write/read)	10		ns	
WRX	twc	Write cycle	66		ns	
	twrh	Controlpulse H duration	15		ns	
	twrl	Control pulse L duration	15		ns	
RDX	trc	Read cycle (ID)	160		ns	When read ID

	trdh	Control pulse H duration(ID)	90		ns	data
	trdl	Control pulse L duration(ID)	45		ns	
RDX	trcfm	Read cycle (FM)	450		ns	When read from frame memory
	trdhfm	Control pulse H duration (FM)	90		ns	
	trdlfm	Control pulse L duration (FM)	355		ns	
D[17..0]	tdst	Data setup time	10		ns	For maximum CL = 30pF For minimum CL = 8pF
	tdht	Data hold time	10		ns	
	trat	Read access time (ID)		40	ns	
	tratfm	Read access time (FM)		340	ns	
	todh	Output disable time	20	80	ns	

Note 1: VDDI 1.65 to 3.3V, VCI=2.6 to 3.3V, AGND=GND=0V, Ta=-30 to 70 °C (to +85°C no damage)

Note 2: This input signal rise time and fall time (tr, tf) is specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for input signals

6.2 Reset Timing Characteristics



VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 ~ 70 ℃

Related Pins	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:

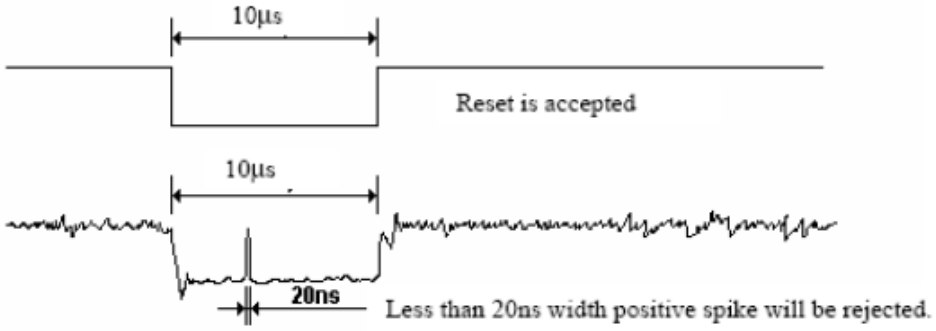
1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

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

3. During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode.) and then return to Default condition for Hardware Reset.

4. Spike Rejection also applies during a valid reset pulse as shown below:



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 RESX before sending commands. Also Sleep Out command cannot be sent for 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.

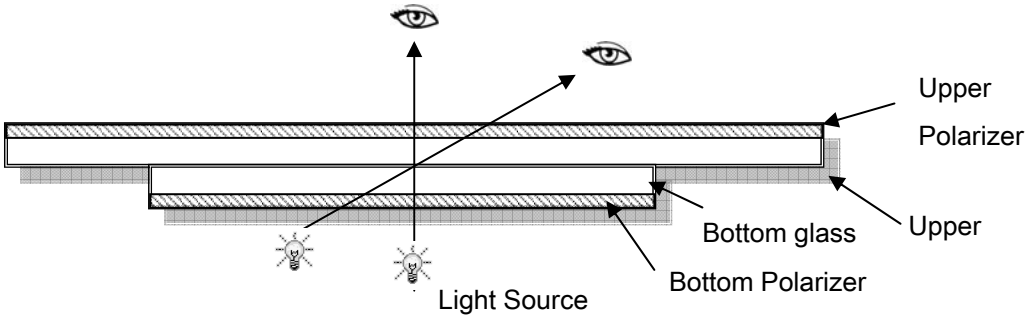
Temperature：25±5℃

Humidity： 65%±10%RH

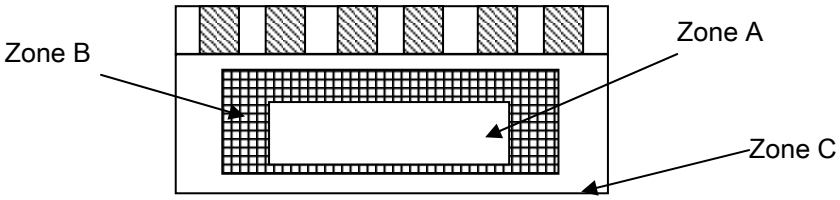
Viewing Angle：Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



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 .)

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:

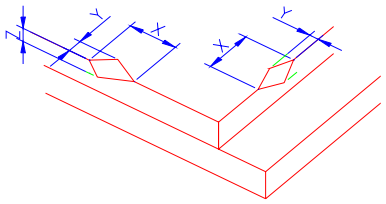
Major defect	Minor defect
0.65	1.5

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

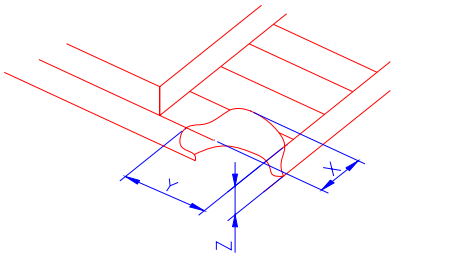
No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing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

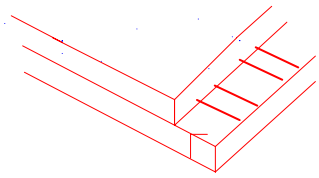
7

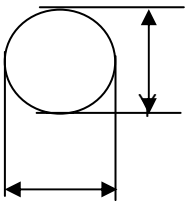
.1.4 Criteria (Visual)

Number	Items	Criteria(mm)
1.0 LCD Crack/Broken NOTE: X: Length Y: Width	(1) The edge of LCD broken	

X	Y	Z
≤3.0mm	<Inner border line of the seal	≤T

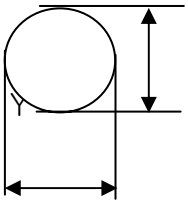
<table>
<tr><td rowspan="2">Z: Height
L: Length of ITO,
T: Height of LCD</td><td>(2)LCD corner broken</td><td> 

<table>
<tr><td>X</td><td>Y</td><td>Z</td></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>

<table>
<tr><th>Number</th><th>Items</th><th>Criteria (mm)</th></tr>
<tr><td>2.0</td><td>Spot defect
 
X
Φ=(X+Y)/2</td><td>① light dot (LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain)
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.10</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.10<Φ≤0.15</td><td colspan="2">3(distance≧10mm)</td></tr>
<tr><td>0.15<Φ≤0.2</td><td colspan="2">1</td></tr>
<tr><td>0.2<Φ</td><td colspan="2">0</td></tr>
</table>
②Dim spot (LCD/TP/Polarizer dim dot, light leakage、dark spot)
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></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">2(distance≧10mm)</td></tr>
<tr><td>0.2<Φ≤0.3</td><td colspan="2">1</td></tr>
<tr><td>Φ＞0.3</td><td colspan="2">0</td></tr>
</table>
③ Polarizer accidented spot
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.2<Φ≤0.5</td><td colspan="2">2(distance≧10mm)</td></tr>
<tr><td>Φ>0.5</td><td colspan="2">0</td></tr>
</table></td></tr>
<tr><td></td><td>Line defect (LCD/TP /Polarizer black/white line, scratch, stain)</td><td>
<table>
<tr><th rowspan="2">Width(mm)</th><th rowspan="2">Length(mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.03</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.03<W≤0.05</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.05<W≤0.08</td><td>L≤2.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr>
</table></td></tr>
</table>

Items	Criteria (mm)

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≤0.15	3(distance≧10mm)		
0.15<Φ≤0.2	1		
0.2<Φ	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
0.1<Φ≤0.2	2(distance≧10mm)		
0.2<Φ≤0.3	1		
Φ＞0.3	0		

③ Polarizer accidented spot

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

Line defect (LCD/TP /Polarizer black/white line, scratch, stain)

Width(mm)	Length(mm)	Acceptable Qty		
		A	B	C
Φ≤0.03	Ignore	Ignore		Ignore
0.03<W≤0.05	L≤3.0	N≤2		
0.05<W≤0.08	L≤2.0	N≤2		
0.08<W	Define as spot defect			

Polarizer Bubble

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.2<Φ≤0.4	2(distance≧10mm)		
0.4<Φ≤0.6	1		
0.6<Φ	0		

SMT

According to IPC-A-610C class II standard . Function defect and missing part are major defect ,the others are minor defect.

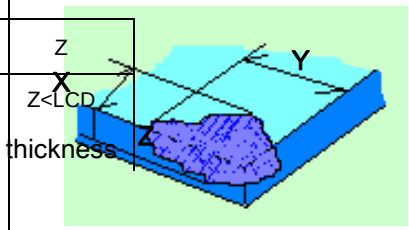
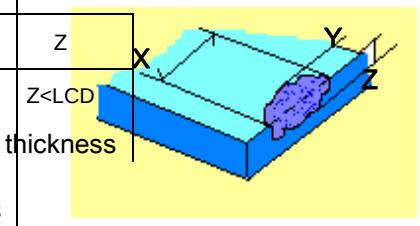
TP bubble/ accidented spot

Size Φ(mm)	Acceptable Qty		
	A	B	C
Φ≤0.1	Ignore		Ignore
0.1<Φ≤0.2	2		
0.2<Φ≤0.3	1		
0.3<Φ	0		

Assembly deflection

beyond the edge of backlight ≤0.15mm

<table>
<tr>
<td rowspan="3">5.0</td>
<td rowspan="3">TP
Related</td>
<td>Newton
Ring</td>
<td>Newton Ring area>1/3 TP area NG

Newton Ring area≤1/3 TP area OK</td>
<td> 
</td>
</tr>
<tr>
<td>TP corner broken
X：length
Y：width
Z：height</td>
<td><table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>X≤3.0mm</td><td>Y≤3.0mm</td><td>Z<LCD thickness</td></tr>
</table>
* Circuitry broken is not allowed.</td>
<td> 
</td>
</tr>
<tr>
<td>TP edge broken
X：length
Y：width
Z：height</td>
<td><table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>X≤6.0mm</td><td>Y≤2.0mm</td><td>Z<LCD thickness</td></tr>
</table>
* Circuitry broken is not allowed.</td>
<td> 
</td>
</tr>
</table>

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

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	60℃, 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	-
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

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.

10.Packing

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