Display Elektronik GmbH

DATA SHEET

TFT MODULE

DEM 240240D VMH-PW

1,3“ Round TFT

Product Specification

Version: 0

16.01.2025

Revision History

Date	Rev. No.	Page	Summary
16.01.2025	0	ALL	FIRST ISSUE

Contents

* 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 module is composed of a Transmissive type TFT-LCD Panel, driver circuit, Backlight unit. The resolution of a 1.28 " TFT-LCD contains 240x240 pixels, and can display up to 65K/262K colors.

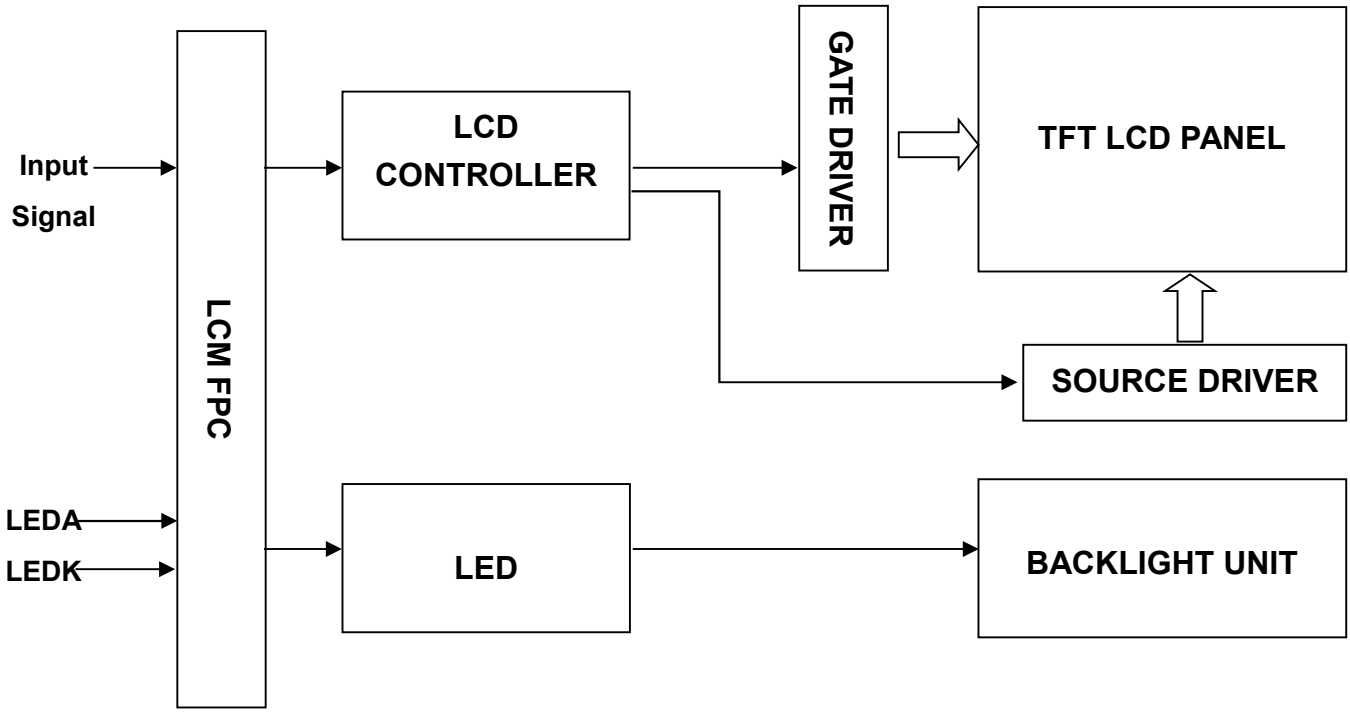
* Features

General Information Items	Specification	Unit	Note
	Main Panel		
Display Area(AA)	32.40 x 32.40 (1.28 Inch)	mm	-
Driver Element	TFT Active Matrix	-	-
Display Colors	65k / 262k	colors	-
Number of Pixels	240 x RGB x 240	dots	-
Pixel Arrangement	RGB Vertical Stripe	-	-
Pixel Pitch	0.135 x 0.135	mm	-
Viewing Angle	ALL	o'clock	-
Controller IC	GC9A01 (Galaxycore)	-	-
LCM Interface	8/9/16/18-Bit MCU 3/4SPI 16/18 Bit RGB 3/4 SERIAL	-	-
Display Mode	IPS, Transmissive / Normally Black	-	-
Operating Temperature	-20 to +70	°C	-
Storage Temperature	-30 to +80	°C	-

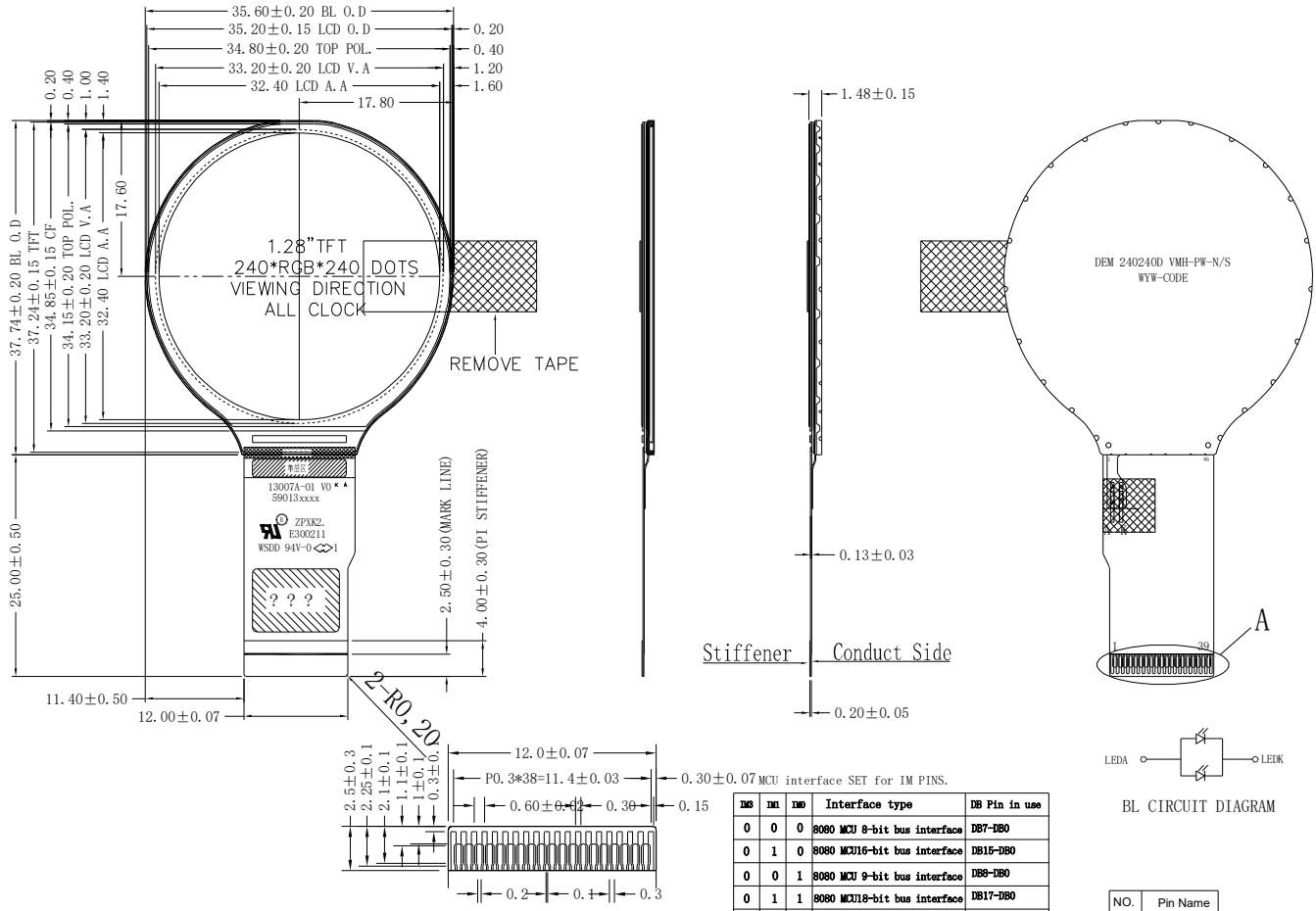
Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	-	35.6	-	mm	-
	Vertical(V)	-	37.74	-	mm	-
	Depth(D)	-	1.48	-	mm	-
Weight		-	3	-	g	-

1. Block Diagram



2. Outline Dimension



Detail A 2:1
FH26-39S-0.3SHW

BL CIRCUIT DIAGRAM

MCU interface SET for IM PINS.

IM3	IM1	IM0	Interface type	DB Pin in use
0	0	0	8080 MCU 8-bit bus interface	DB7-DB0
0	1	0	8080 MCU16-bit bus interface	DB15-DB0
0	0	1	8080 MCU 9-bit bus interface	DB8-DB0
0	1	1	8080 MCU18-bit bus interface	DB17-DB0
1	0	1	3-wire 9-bit data serial	SDA:In/Out
			2 data line serial	SDA:In/Out,DCX:In
1	1	1	4-wire 8-bit data serial	SDA:In/Out

NOTE:
1. Input Pin if not use, please connect to GND.
   Output Pin if not use, please empty.
2. If use RGB interface must select serial interface.

NOTES:
1. DISPLAY TYPE: 1.28", TFT-LCD,262K COLORS
2. DISPLAY MODE: NORMALLY BLACK,IPS
3. VIEWING DIRECTION: ALL
4. LCM DRIVER IC: GC9A01(COG)
5. LCM Interface: 3/4serial,8/9/16/18bit MCU,3/4SPI+16/18BIT RGB
6. VDD/VCI: 2.5~3.3V; LCM IOVCC:1.65~3.3V
7. OPERATING TEMP: -20°C TO 70°C
   STORAGE TEMP: -30°C TO 80°C
8. BACK LIGHT: LED WHITE, 2 LED, 40mA, 2.8~3.2V
9. RoHS and REACH COMPLIANT.

Note: The opening of top case must less than LCD POL 0.3mm at least,the LCD V.A is the Recommended opening of Lens.

NO.	Pin Name
1	LEDA
2	LEDK
3	GND
4	GND
5	VCC
6	IOVCC
7	RESET
8	WR(SPI-RS)
9	CS
10	RS(SPI-SCL)
11	RD
12	PCLK
13	DE
14	VSYNC
15	HSYNC
16	TE
17	SDO
18	SDA
19	DB17
20	DB16
21	DB15
22	DB14
23	DB13
24	DB12
25	DB11
26	DB10
27	DB09
28	DB08
29	DB07
30	DB06
31	DB05
32	DB04
33	DB03
34	DB02
35	DB01
36	DB0
37	IM0
38	IM1
39	IM3

3. Input Terminal Pin Assignment

NO.	SYMBOL	DISCRIPTION	I/O
1	LED(A)	Anode pin of backlight	P
2	LED(K)	Cathode pin of backlight	P
3	GND	Ground.	P
4	GND	Ground.	P
5	VCC	Supply voltage (2.5-3.3V).	P
6	IOVCC	Supply voltage (1.65-3.3V).	P
7	RESET	This signal will reset the device and must be applied to properly initialize the chip.	I
8	WR(SPI-RS)	- Write enable in MCU parallel interface. - Display data/command selection pin in 4-line serial interface. - Second Data lane in 2 data lane serial interface. - If not used, please fix this pin at IOVCC or GND.	I
9	CS	Chip select input pin (“Low” enable). Fix this pin at IOVCC or GND when not in use.	I
10	RS(SPI-SCL)	- Display data/command selection pin in parallel interface. - This pin is used to be serial interface clock. DC=’1’: display data or parameter. DC=’0’: command data. - If not used, please fix this pin at IOVCC or GND.	I
11	RD	Serves as a read signal and MCU read data at the rising edge. Fix this pin at IOVCC or GND when not in use.	I
12	PCLK	Dot clock signal for RGB interface operation. Fix this pin at IOVCC or GND when not in use.	I
13	DE	Data enable signal for RGB interface operation. fix this pin at IOVCC or GND when not in use.	I
14	VSYNC	Frame synchronizing signal for RGB interface operation. fix this pin at IOVCC or GND when not in use.	I
15	HSYNC	Line synchronizing signal for RGB interface operation. fix this pin at IOVCC or GND when not in use.	I

16	TE	Tearing effect output pin to synchronize MPU to frame writing, activated by S/W command. When this pin is not activated, this pin is low. If not used, open this pin.	I
17	SDO	The data is output on the falling edge of the SCL signal. If not used, let this pin open.	O
18	SDA	The data is latched on the rising edge of the SCL signal. If not used, please fix this pin at IOVCC or DGND level	I/O
19-36	DB17-DB0	18-bit parallel bi-directional data bus for MCU system and RGB interface mode . Fix to GND level when not in use	I/O
37	IM0	MPU Parallel interface bus and serial interface select If use RGB Interface must select serial interface. Fix this pin at IOVCC and GND.	I
38	IM1		
39	IM3		

MCU interface SET for IM PINS.

IM3	IM1	IM0	Interface type	DB Pin in use
0	0	0	8080 MCU 8-bit bus interface	DB7-DB0
0	1	0	8080 MCU16-bit bus interface	DB15-DB0
0	0	1	8080 MCU 9-bit bus interface	DB8-DB0
0	1	1	8080 MCU18-bit bus interface	DB17-DB0
1	0	1	3-wire 9-bit data serial interface	SDA:In/Out
			2 data line serial interface	SDA:In/Out,DCX:In
1	1	1	4-wire 8-bit data serial interface	SDA:In/Out

NOTE:

1. Input Pin if not use,please connect to GND.
   Output Pin if not use,please empty.
2. If use RGB interface must select serial interface.

4. LCD Optical Characteristics

4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	Θ=0 Normal Viewing Angle	500	700	--		(1)(2)
Response Time	Rising	$T_{R+}T_F$		--	30	35	msec	(1)(3)
	Falling							
Color Gamut		S(%)		58	63.8	--	%	*
Color Filter Chromacicity	White	W_X		-0.04	0.264	+0.04		(1)(4) CA-310
		W_Y			0.295			
	Red	R_X			0.623			
		R_Y			0.335			
	Green	G_X			0.294			
		G_Y			0.571			
	Blue	B_X			0.148			
		B_Y			0.062			
Viewing Angle	Hor.	ΘL	CR>10	80	85	--		(1)(4)
		ΘR		80	85	--		
	Ver.	ΘU		80	85	--		
		ΘD		80	85	--		
Option View Direction		ALL						

*The data comes from the LCD specification.

Measuring Condition

Measuring Surrounding: Dark Room

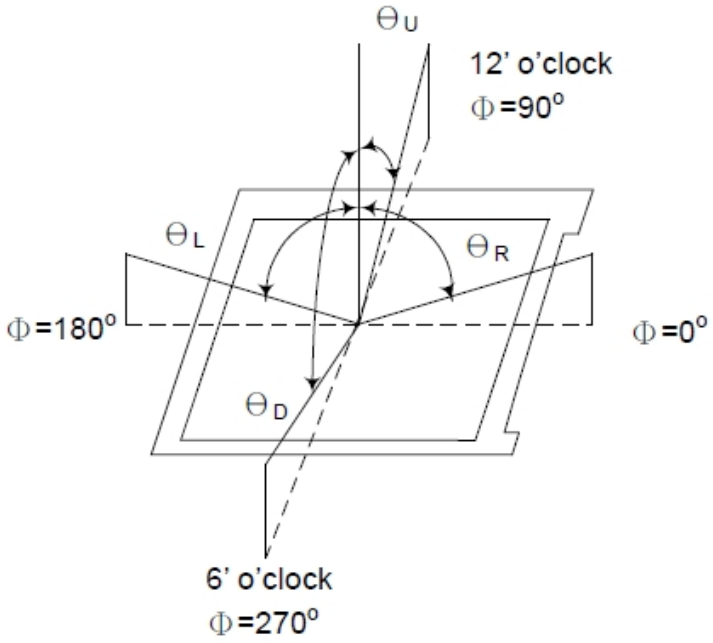
Ambient Temperature: 25°C ± 2°C

15min. warm-up time.

Measuring Equipment

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

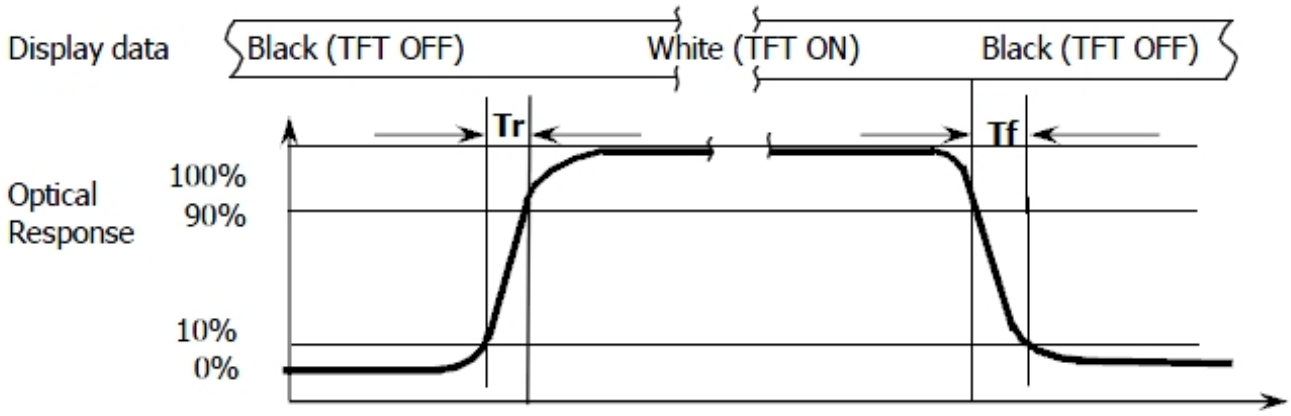
Note (1): Definition of Viewing Angle :



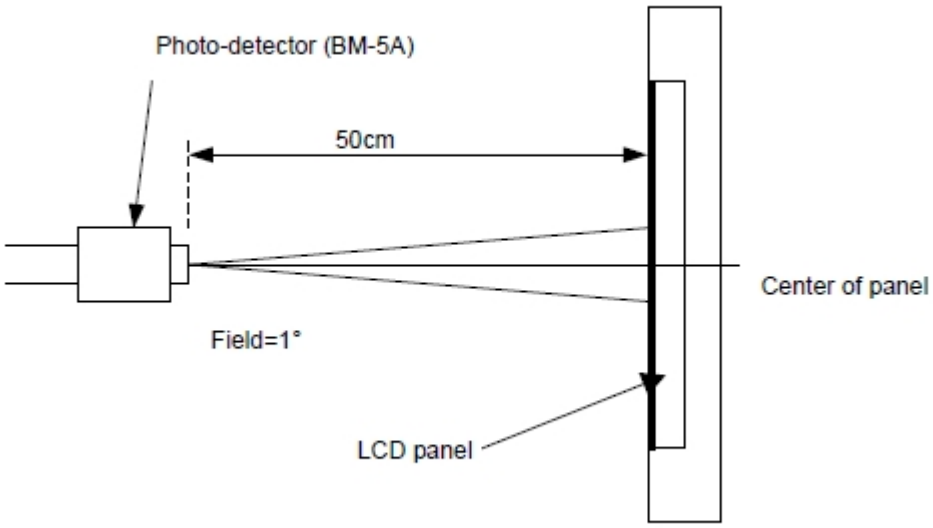
Note (2): Definition of Contrast Ratio(CR) :measured at the center point of panel

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

Note (3): Response Time



Note (4): Definition of optical measurement setup



5. Electrical Characteristics

5.1 Absolute Maximum Rating

Characteristics	Symbol	Min.	Max.	Unit	Note
Digital Supply Voltage	VCC/VCI	-0.3	4.6	V	Note1
Digital Interface Supply Voltage	IOVCC	-0.3	4.6	V	-
Operating Temperature	T_{OP}	-20	+70	°C	-
Storage Temperature	T_{ST}	-30	+80	°C	-

NOTE1: 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
Digital Supply Voltage	VCC/VCI	2.5	2.8	3.3	V
Digital Interface Supply Voltage	IOVCC	1.65	2.8	3.3	V
Normal Mode Current Consumption	IDD	--	6	12	mA
Level Input Voltage	V_{IH}	0.7*IOVCC	--	IOVCC	V
	V_{IL}	GND	--	0.3*IOVCC	V
Level Output Voltage	V_{OH}	0.8*IOVCC	--	IOVCC	V
	V_{OL}	GND	--	0.2*IOVCC	V

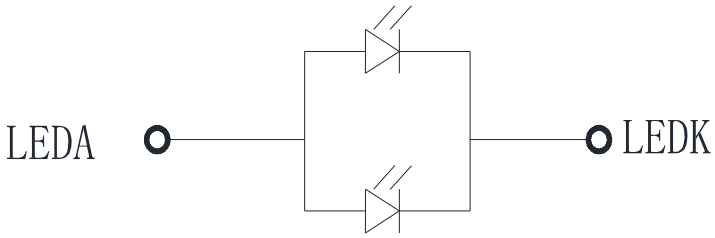
5.3 LED Backlight Characteristics

The Backlight system is edge-lighting type with 2 chips LED

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I_F	--	40	--	mA	-
Forward Voltage	V_F	2.8	3.0	3.2	V	-
LCM Luminance	LV	430	500	--	cd/m2	IF=40mA
LED Lifetime	Hr	50000	--	--	Hour	Note1,2
Uniformity	Avg	80	--	--	%	Note3

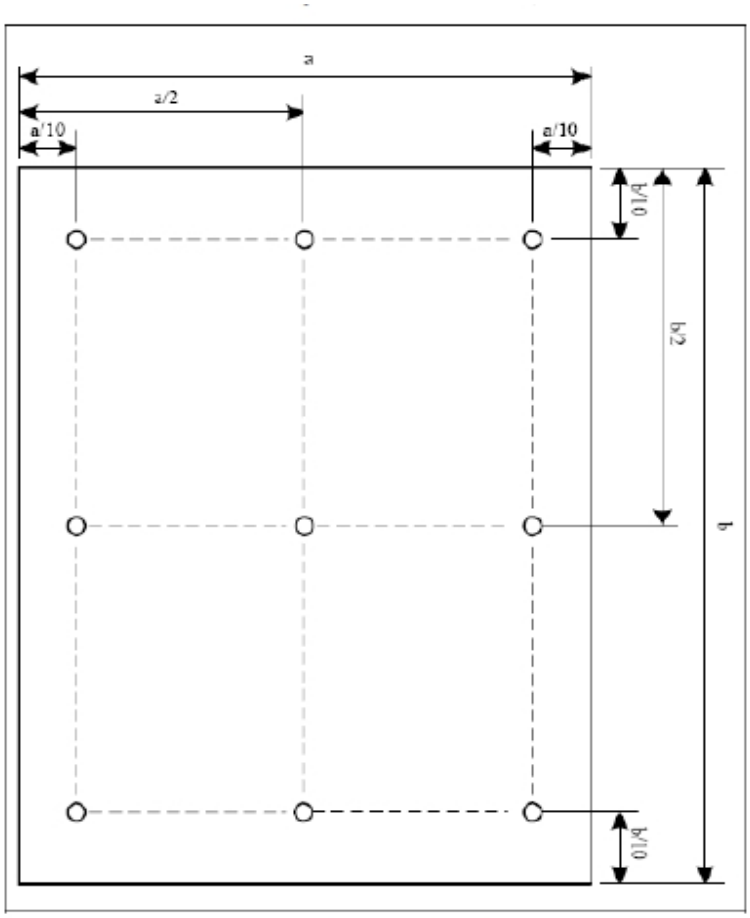
Note1: LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25°C ± 3°C, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25°C and IL=40mA. The LED lifetime could be decreased if operating IL is larger than 40mA. The constant current driving method is suggested.



BL CIRCUIT DIAGRAM

Note (3) Luminance Uniformity of these 9 points is defined as below:

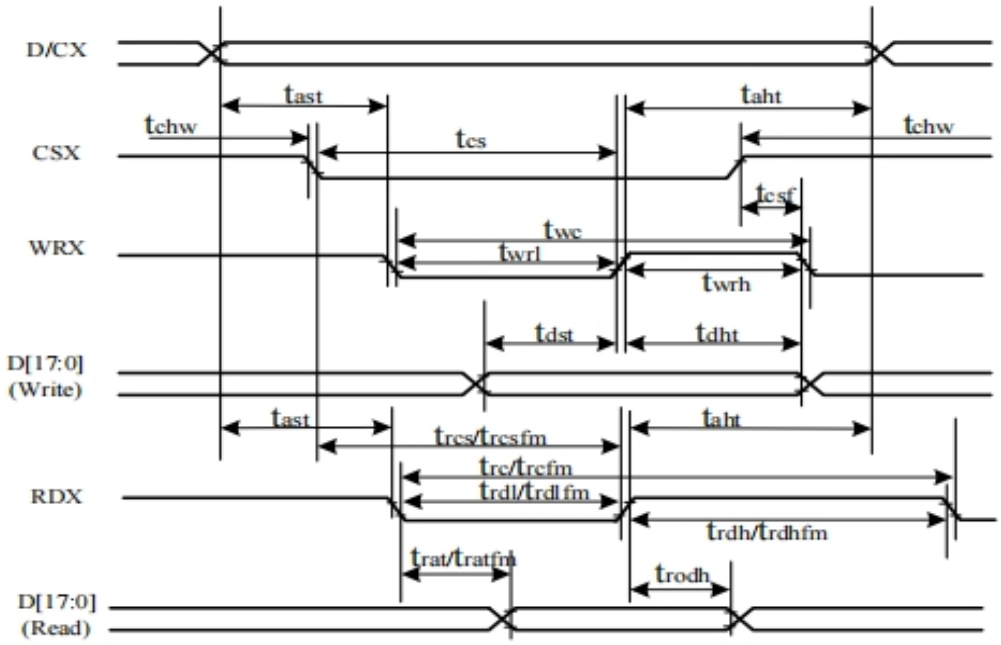


$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

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

6. AC Characteristic

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

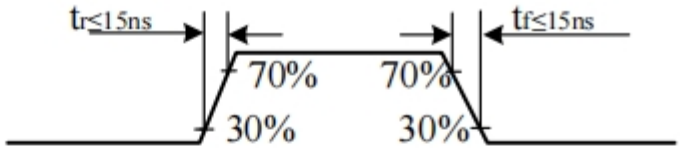


Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	
	taht	Address hold time(Write/Read)	0	-	ns	
CSX	tchw	CSX "H" pulse width	0	-	ns	
	tcs	Chip Select setup time(Write)	15	-	ns	
	trcs	Chip Select setup time(Read ID)	45	-	ns	
	trcsfm	Chip Select setup time(Read FM)	355	-	ns	
	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	twc	Write Cycle	66	-	ns	
	twrh	Write Control pulse H duration	15	-	ns	
	twrl	Write Control pulse L duration	15	-	ns	
RDX(FM)	trcfm	Read Cycle (FM)	380	-	ns	
	trdhfm	Read Control H duration(FM)	180	-	ns	
	trdlfm	Read Control L duration(FM)	200	-	ns	
RDX(ID)	trc	Read Cycle (ID)	160	-	ns	
	trdh	Read Control H pulse duration	90	-	ns	
	trdl	Read Control L pulse duration	70	-	ns	
D[17:0], D[15:0],	tdst	Write data setup time	10	-	ns	For maximum CL=30pF
	tdht	Write data hold time	10	-	ns	

D[8:0], D[7:0]	trat	Read access time	-	40	ns	For minimum CL=8pF
	tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

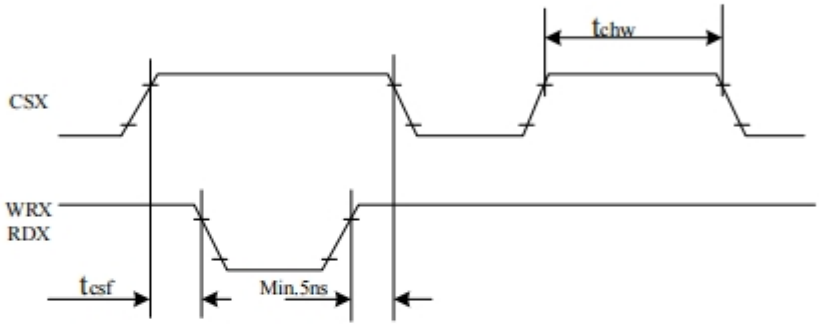
Note: Ta = -30 to 70 °C, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, VSS=0V

Figure91.



CSX timings :

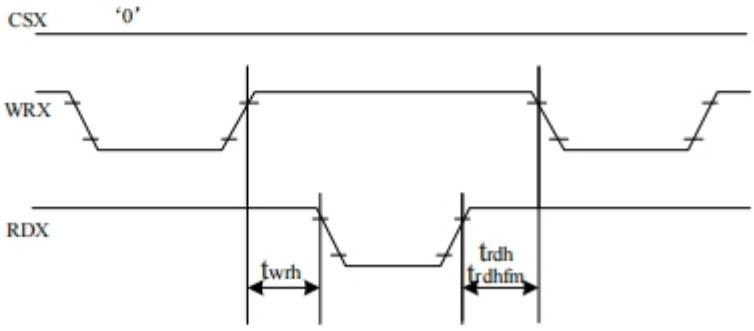
Figure92.



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

Write to read or read to write timings:

Figure92.



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

6.2 Display Serial Interface Timing Characteristics (3-line SPI system)

Figure97.

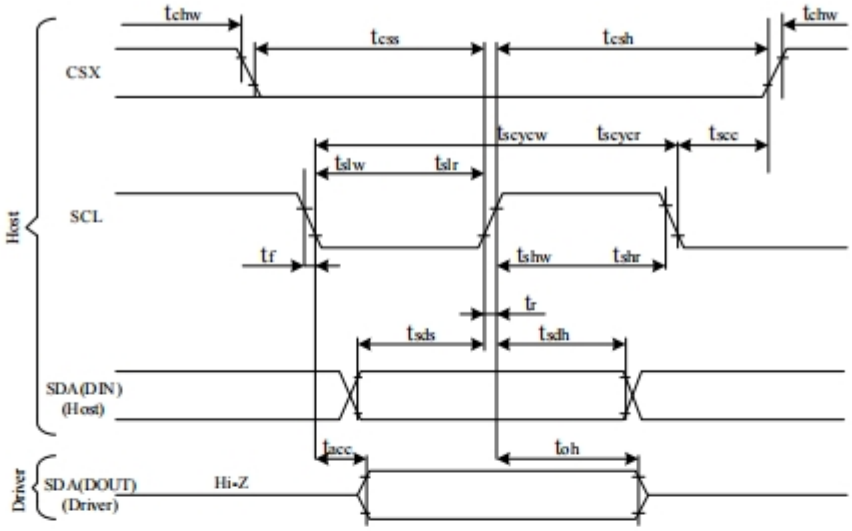
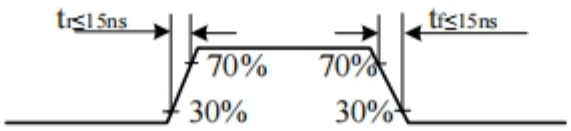


Table47.

Signal	Symbol	Parameter	min	max	Unit	Description
SCL	tscycw	Serial Clock Cycle (Write)	10	-	ns	
	tshw	SCL "H" Pulse Width (Write)	5	-	ns	
	tslw	SCL "L" Pulse Width (Write)	5	-	ns	
	tscycr	Serial Clock Cycle (Read)	150	-	ns	
	tshr	SCL "H" Pulse Width (Read)	60	-	ns	
	tslr	SCL "L" Pulse Width (Read)	60	-	ns	
SDA/SDI (Input)	tsds	Data setup time (Write)	5	-	ns	
	tsdh	Data hold time (Write)	5	-	ns	
SDA/SD0(Outp)	tacc	Access time (Read)	10	-	ns	
CSX	tscc	SCL-CSX	10	-	ns	
	tchw	CSX "H" Pulse Width	10	-	ns	
	tcss	CSX-SCL Time	20	-	ns	
	tcsh		40	-	ns	

Note: Ta = 25 °C, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, VSSA=VSSC=0V

Figure98.



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

Figure98.

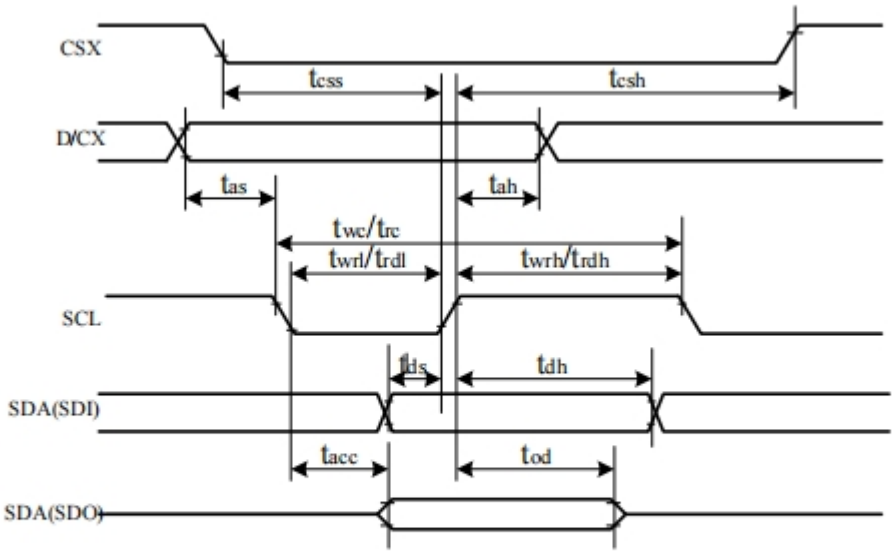
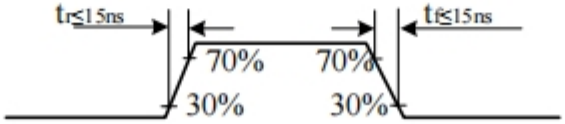


Table48.

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	

Note: Ta = 25 °C, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, AGND=VSS=0V

Figure99.



6.4 Parallel 18/16/6-bit RGB Interface Timing Characteristics

Figure100.

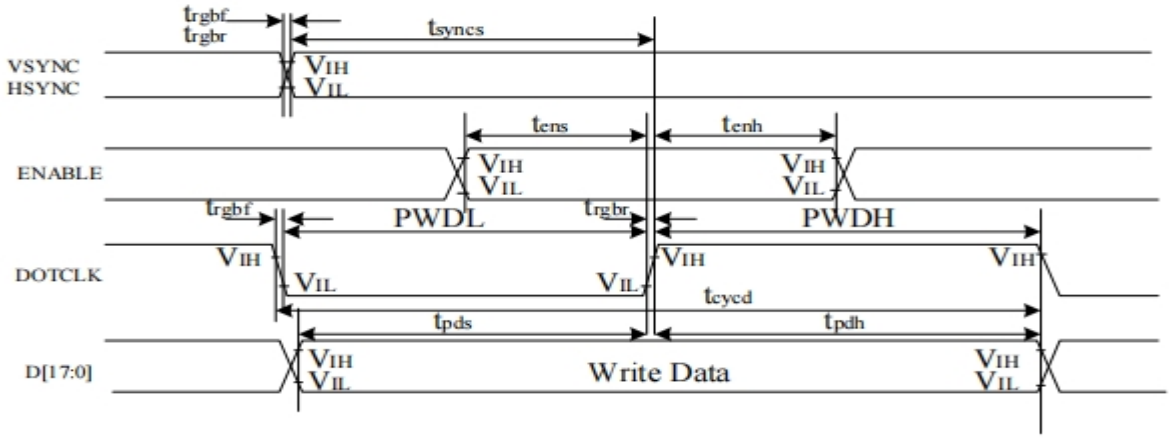
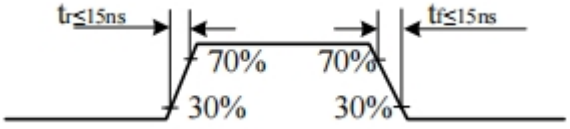


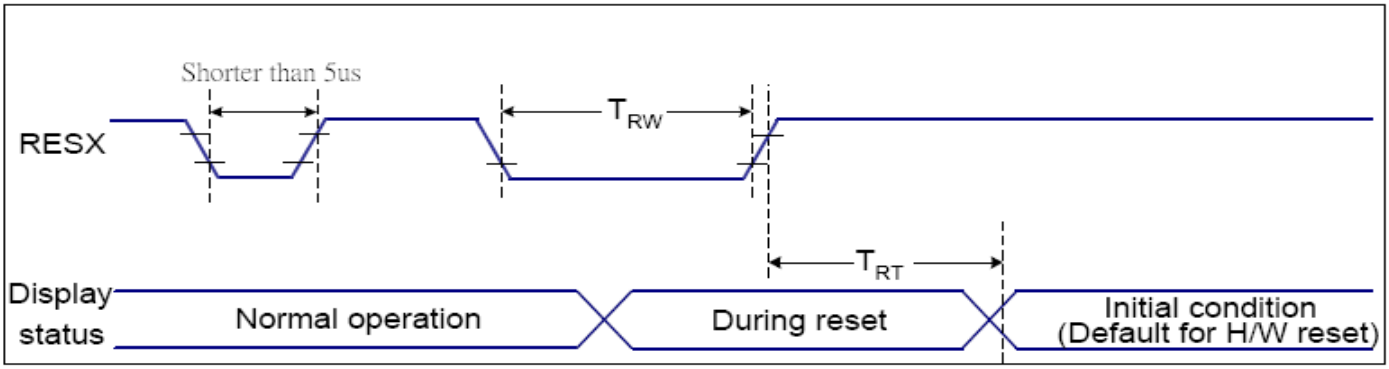
Table49.

Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC/HSYNC	tsyncs	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode
	tsynch	VSYNC/HSYNC hold time	15	-	ns	
DE	tens	DE setup time	15	-	ns	
	tenh	DE hold time	15	-	ns	
D[17:0]	tpos	Data setup time	15	-	ns	
	tpdh	Date hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level period	15	-	ns	
	PWDL	DOTCLK low-level period	15	-	ns	
	tcycd	DOTCLK cycle time	100	-	ns	
	trgbr,trgbf	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	
VSYNC/HSYNC	tsyncs	VSYNC/HSYNC setup time	15	-	ns	6-bit bus RGB interface mode
	tsynch	VSYNC/HSYNC hold time	15	-	ns	
DE	tens	DE setup time	15	-	ns	
	tenh	DE hold time	15	-	ns	
D[17:0]	tpos	Data setup time	15	-	ns	
	tpdh	Date hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level pulse period	15	-	ns	
	PWDL	DOTCLK low-level pulse period	15	-	ns	
	tcycd	DOTCLK cycle time	100	-	ns	
	trgbr,trgbf	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	

Note: Ta = -30 to 70 °C, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, AGND=VSS=0V



6.4 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:

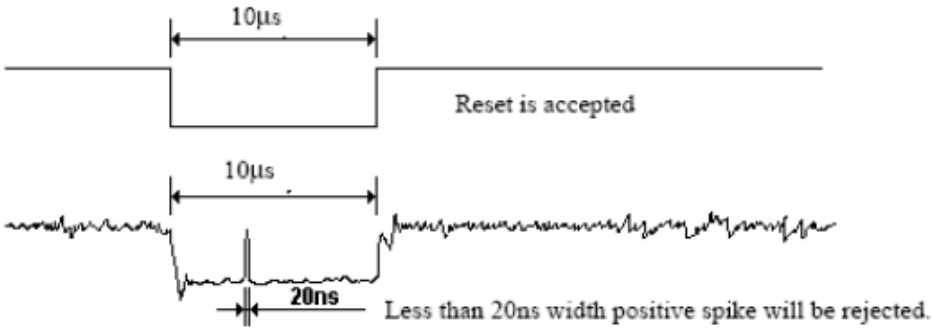
1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

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.

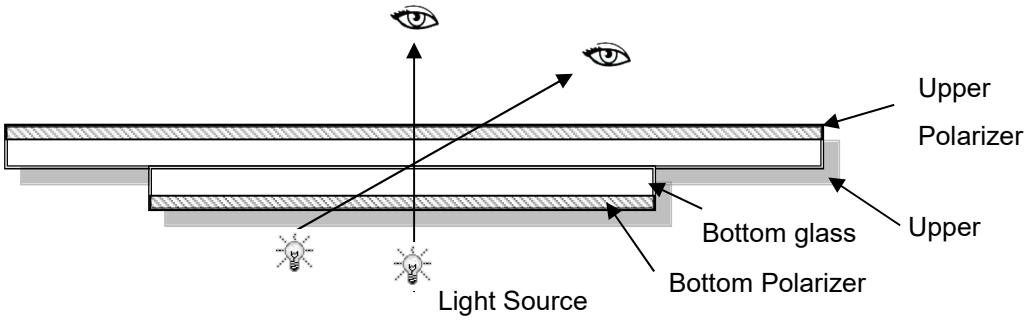
Temperature: 25°C±5°C

Humidity: 65%±10%RH

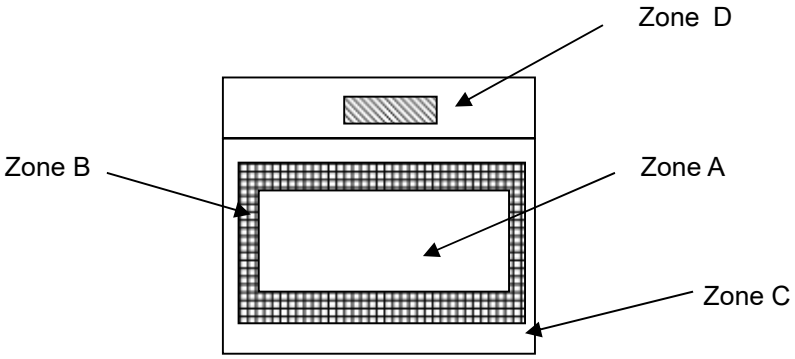
Viewing Angle: Normal Viewing Angle.

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

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 2828-2012 ; , normal inspection, Class Ⅱ

AQL:

Major defect	Minor defect
0.65	1.5

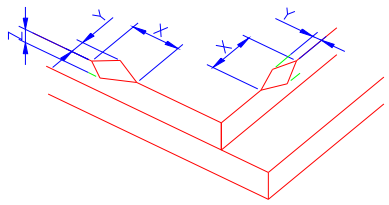
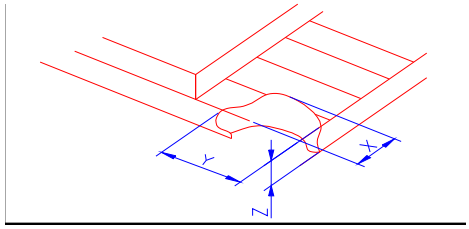
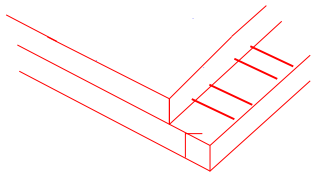
LCD: Liquid Crystal Display , LCM: Liquid Crystal Module,

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. etc…	Major
2	Missing	Missing components and etc…	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed,deformation and etc…	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot/Line defect	Light dot,Dim spot,(Note1) Polarizer Air Bubble, Polarizer accidented spot and etc.	
6	Soldering appearance	Good soldering , Peeling off is not allowed and etc.	
7	LCD/Polarizer	Black/White spot/line, scratch, crack, etc.	

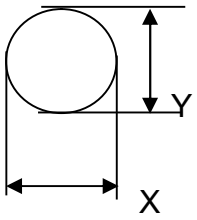
Note1: a) Light dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

b) Dim dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

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>

2.0 Spot defect



Φ=(X+Y)/2

① light dot（ black/white spot , pinhole, stain，etc.）

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.15	Ignore	Ignore	
0.15<Φ≤0.25	3(distance≧6mm)		
0.25<Φ≤0.4	2(distance≧6mm)		
Φ>0.4	0		

② Dim spot（light leakage、dent、dark spot，etc）

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.15	Ignore	Ignore	
0.15<Φ≤0.25	3(distance≧6mm)		
0.25<Φ≤0.4	2(distance≧6mm)		
Φ>0.4	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≧6mm)		
Φ>0.5	0		

④Polarizer Bubble

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.2<Φ≤0.4	3(distance≧6mm)		
Φ>0.4	0		

3.0 LCD Pixel defect

Pixel bad points

Item	Zone A	Acceptable Qty
Bright dot	Random	N≤2
	2 dots adjacent	N≤0
	3 dots adjacent	N≤0
Dark dot	Random	N≤2
	2 dots adjacent	N≤0
	3 dots adjacent	N≤0
Distance	1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot.	5mm
Total bright and dark dot		N≤4

Note:

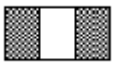
A) Bright dot：Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

B) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

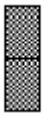
C) 2 dot adjacent = 1 pair = 2 dots

Picture:

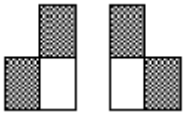
2 dot adjacent



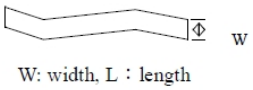
2 dot adjacent



2 dot adjacent (vertical)



2 dot adjacent (slant)

<table>
<tr>
<td>4.0</td>
<td>Line defect (LCD /Polarizer backlight black/white line, scratch, stain)
 

N：Count</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≤0.04</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.04<W≤0.05</td><td>L≤2.0</td><td colspan="2">N≤1</td></tr>
<tr><td>W>0.05</td><td colspan="4">Define as spot defect</td></tr>
</table>
</td>
</tr>
<tr>
<td>5.0</td>
<td>Electronic Components SMT.</td>
<td>Not allow missing parts，solderless connection，cold solder joint，mismatch，The positive and negative polarity opposite</td>
</tr>
<tr>
<td>6.0</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>7.0</td>
<td>LCD Mura/Waving/ Hot spot</td>
<td>Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary.</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

8. Reliability Test Result

Item	Condition	Inspection after test
High Temperature	+70°C, 96h	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value.
Low Temperature	-20°C, 96h	
High Temperature Storage	+80°C, 96h	
Low Temperature Storage	-30°C, 96h	
High Temperature & High Humidity Operating	+60°C, 90% RH, 96h	
Thermal Shock (Non-operation)	-10°C,30 min ↔ +60°C, 30 min, Change time: 5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±8kV, 5times; Contact:±6kV, 5 times; (Environment: 15°C~35°C, 30%~60%)	
Vibration (Non-operation)	Frequency range: 10Hz~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition).	
Box Drop Test	1 Corner 3 Edges 6 faces,80㎝(MEDIUM BOX)	

Remark:

1. The test samples should be applied to only one test item.
2. Sample size for each test item is 5~10pcs.
3. For Damp Proof Test, Pure water (Resistance > 10MΩ) should be used.
4. In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
5. Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.
6. The color fading mura of polarizing filter should not care.

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.

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°C to 35°C 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.