Display Elektronik GmbH

DATA SHEET

TFT MODULE

DEM 240400A TTH-PW

2,8“ transfl. TFT

18.10.2024

Revision History

Date	Rev. No.	Page	Summary
18.10.2024	0	ALL	FIRST ISSUE

Contents

* Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silico n TFT as a switching device. This module is composed of a transflective type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 2.8'TFT-LCD contains 240x400 pixels, and can display up to 65K/262K colors.

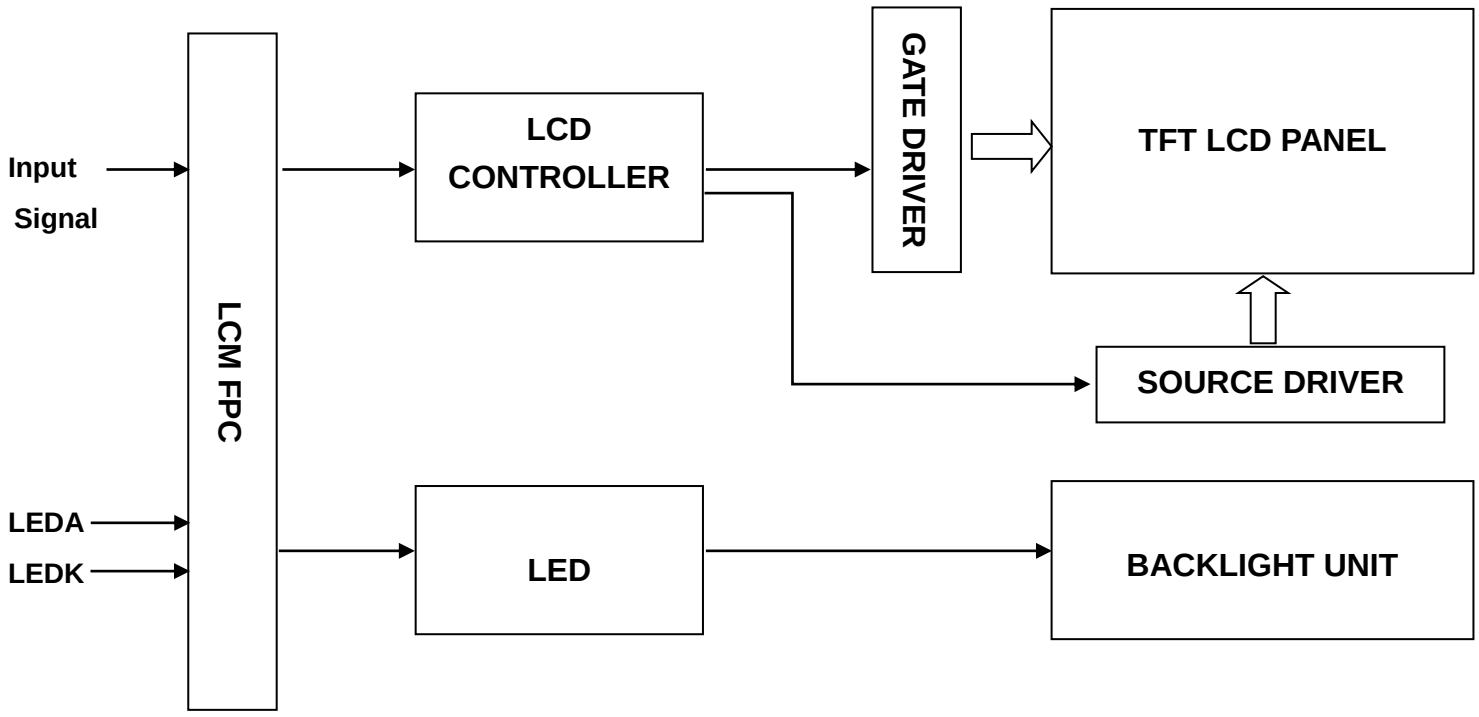
* Features

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	36.72(H)*61.2（V） (2.8 inch)	mm	-
Driver element	TFT active matrix	-	-
Display colors	65K/262K	colors	-
Number of pixels	240(RGB)*400	dots	-
Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.153(H)*0.153(V)	mm	-
Viewing angle	5:00	o'clock	-
Controller IC	ILI9327	-	-
LCM Interface	8/9/16/18Bit MCU 3/4SPI+16/18Bit RGB 3-line/4-line Serial		
Display mode	transflective/ Normally White	-	-
Operating temperature	-20～+70	℃	-
Storage temperature	-30～+80	℃	-

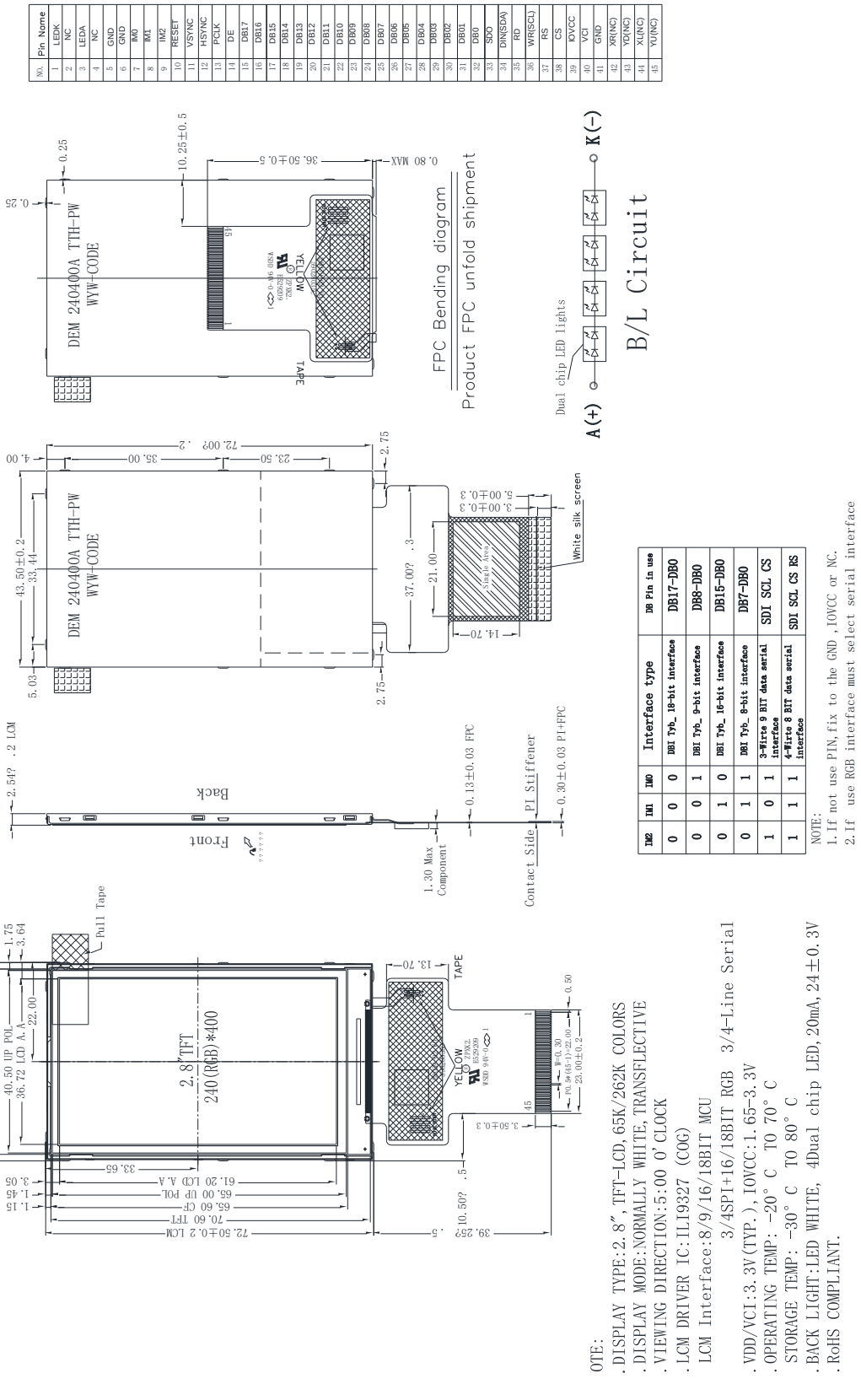
* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)		44		mm	-
	Vertical(V)		72.5		mm	-
	Depth(D)		2.54		mm	-
Weight			TBD		g	-

1. Block Diagram



2. Outline dimension



NO.	Pin Name
1	LEDK
2	NC
3	LEDA
4	NC
5	GND
6	GND
7	IM0
8	IM1
9	IM2
10	RESET
11	VSYNC
12	HSYNC
13	PCLK
14	DE
15	DB17
16	DB16
17	DB15
18	DB14
19	DB13
20	DB12
21	DB11
22	DB10
23	DB09
24	DB08
25	DB07
26	DB06
27	DB05
28	DB04
29	DB03
30	DB02
31	DB01
32	DB00
33	SDO
34	DIN(SDA)
35	RD
36	WR(SCL)
37	RS
38	CS
39	IOVCC
40	VCI
41	GND
42	XR(NC)
43	YD(NC)
44	XL(NC)
45	YU(NC)

IM2	IM1	IM0	Interface type	DB Pin in use
0	0	0	DBI TyB_ 18-bit interface	DB17-DB0
0	0	1	DBI TyB_ 9-bit interface	DB8-DB0
0	1	0	DBI TyB_ 16-bit interface	DB15-DB0
0	1	1	DBI TyB_ 8-bit interface	DB7-DB0
1	0	1	3-Wire 9 BIT data serial interface	SDI SCL CS
1	1	1	4-Wire 8 BIT data serial interface	SDI SCL CS RS

NOTE:
1. If not use PIN, fix to the GND , IOVCC or NC.
2. If use RGB interface must select serial interface

OTE:
. DISPLAY TYPE: 2.8", TFT-LCD, 65K/262K COLORS
. DISPLAY MODE: NORMALLY WHITE, TRANSFLECTIVE
. VIEWING DIRECTION: 5:00 O'CLOCK
. LCM DRIVER IC: ILI9327 (COG)
. LCM Interface: 8/9/16/18BIT MCU
3/4SPI+16/18BIT RGB 3/4-Line Serial
. VDD/VCI: 3.3V(TYP.), IOVCC: 1.65~3.3V
. OPERATING TEMP: -20° C TO 70° C
STORAGE TEMP: -30° C TO 80° C
. BACK LIGHT: LED WHITE, 4Dual chip LED, 20mA, 24±0.3V
. RoHS COMPLIANT.

3. Input terminal Pin Assignment

NO.	SYMBOL	DISCRIPTION	I/O
1	LEDK	Cathode pin OF backlight	P
2	NC	--	--
3	LEDA	Anode pin of backlight	P
4	NC	--	--
5	GND	Ground.	P
6	GND	Ground.	P
7	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
8	IM1		I
9	IM2		I
10	RESET	This signal will reset the device and must be applied to properly initialize the chip. Signal is low active	I
11	VSYNC	Frame synchronizing signal for RGB interface operation. fix this pin at IOVCC or GND when not in use.	I
12	HSYNC	Line synchronizing signal for RGB interface operation. fix this pin at IOVCC or GND when not in use	I
13	PLCK	Dot clock signal for RGB interface operation Fix this pin at IOVCC or GND when not in use.	I
14	DE	Data enable signal for RGB interface operation. fix this pin at IOVCC or GND when not in use.	I
15-32	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
33	SDO	Serial data output pin in serial bus system interface. If not used, please open this pin.	O
34	DIN(SDA)	Serial data input pin and used for the DBI type C mode. If not used, please connect this pin to ground.	I
35	RD	Read control pin for the DBI interface. If not used, please connect this pin to IOVCC or GND.	I
36	WR(SCL)	Write control pin for the DBI interface. When the DBI type C is selected,this pin is used as serial clock pin. If not used, please connect this pin to IOVCC or GND.	I
37	RS	Display data / Command selection pin	I

		D/CX='1': Display data. D/CX='0': Command data. If not used, please fix this pin at GND level.	
38	CS	Chip select input pin ("Low" enable). When it is not used, please fix this pin at IOVCC or GND.	I
39	IOVCC	Supply voltage for IO(1.65-3.3V)	P
40	VCI	Supply voltage(3.3V).	P
41	GND	Ground.	P
42	XR(NC)	--	--
43	YD(NC)	--	--
44	XL(NC)	--	--
45	YU(NC)	--	--

4. LCD Optical Characteristics

4.1 Transmissive mode

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Transmittance(With Polarizer)		T%	--	0.85	1	--	%	
Contrast Ratio		CR	Θ=0 Normal viewing angle	60	--	--		(1)(2)
Response time	Rising	$T_{R+}T_F$		--	30		msec	(1)(3)
	Falling							
Color Gamut		S(%)		23	28	--	%	
Color Filter Chromacicity	White	W_X		0.2321	0.2721	0.3121		(1) (4) CA-310
		W_Y		0.2557	0.2957	0.3357		
	Red	R_X		0.4166	0.4566	04966		
		R_Y		0.2616	0.3016	0.3416		
	Green	G_X		0.2765	0.3165	0.3565		
		G_Y		0.4780	0.5180	0.5580		
	Blue	B_X		0.1224	0.1624	0.2024		
		B_Y		0.0770	0.1170	0.1570		
Viewing angle	Hor.	$Θ_L$	CR≥10	--	30	--		(1)(4)
		$Θ_R$		--	30	--		
	Ver.	$Θ_U$		--	40	--		
		$Θ_D$		--	30	--		
Option View Direction		5:00						

4.2 Reflective mode (Not driving the back light condition)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Reflection Ratio (With Polarizer)		R ($\theta = \phi = 0°$)	--	5.5	7	--	%	
Reflective Contrast Ratio		CR($\theta = 0°$)	--	11	--	--		(1)(2)
Color Gamut		S(%)	--	--	5.73	--	%	(1)(3)
Viewing angle	Hor.	ΘL	CR≥ 5	--	30	--		(1)(4)
		ΘR		--	35	--		
	Ver.	ΘU		--	30	--		
		ΘD		--	35	--		

*The data comes from the LCD specification.

Measuring Condition

Measuring surrounding : dark room

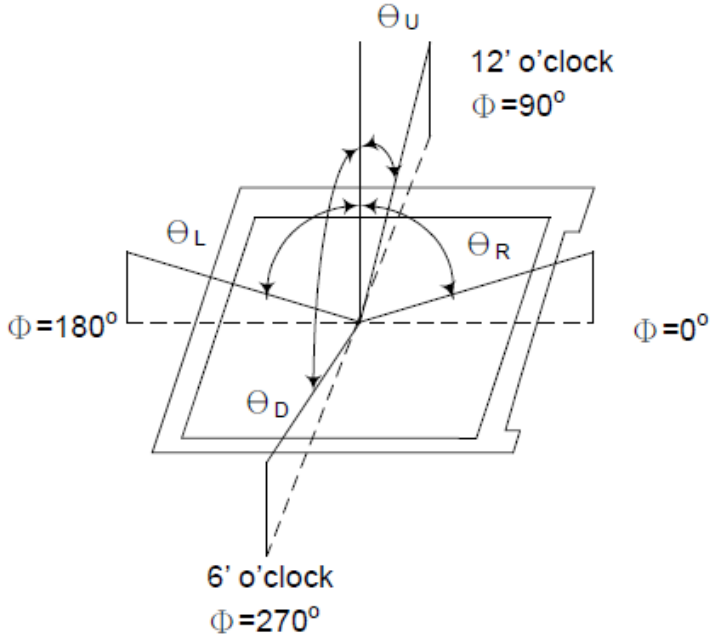
Ambient temperature : 25±2oC

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.

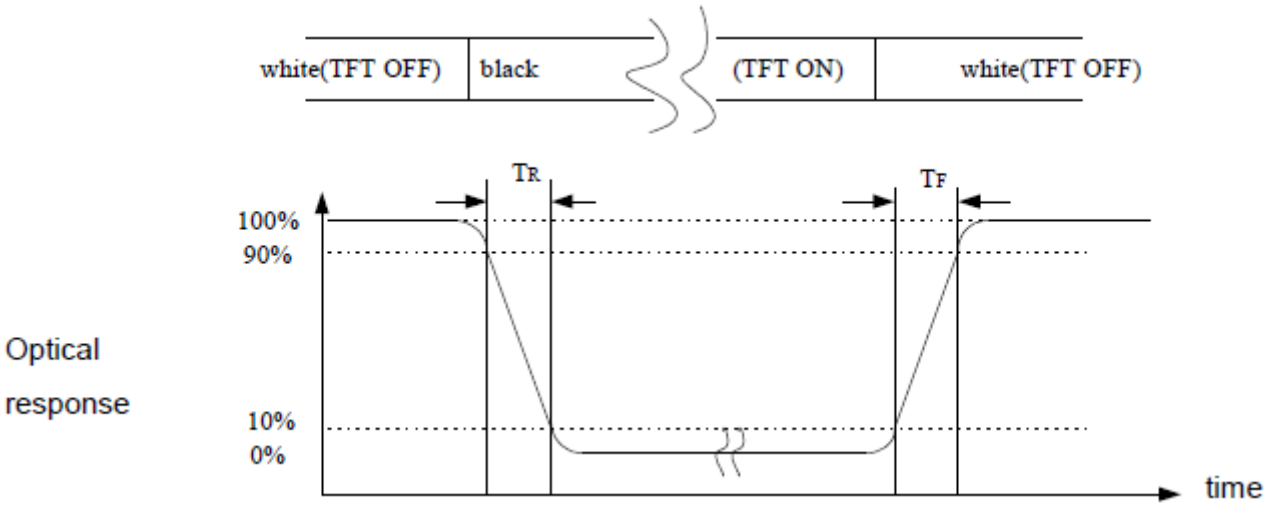
Note (1): Definition of Viewing Angle :



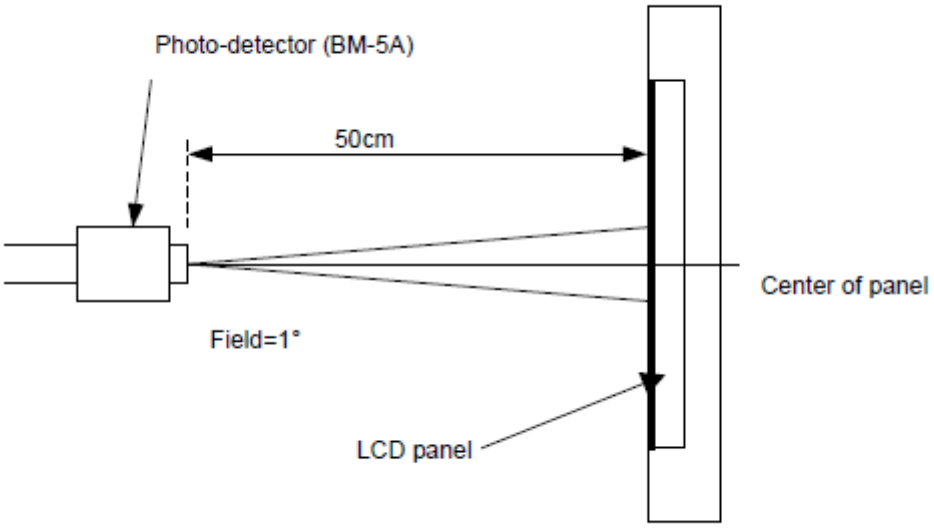
Note (2): Definition of Contrast Ratio(CR) :measured at the center point of panel

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

Note (3): Response Time



Note (4): Definition of optical measurement setup



5. Electrical Characteristics

5.1 Absolute Maximum Rating (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	3.6	V	
Digital interface supple Voltage	IOVCC	1.65	1.8	3.6	V	
Normal mode Current consumption	IDD	--	6	12	mA	
Level input voltage	V_{IH}	0.7IOVCC		IOVCC	V	
	V_{IL}	GND		0.3IOVCC	V	
Level output voltage	V_{OH}	0.8IOVCC		IOVCC	V	
	V_{OL}	GND		0.2IOVCC	V	

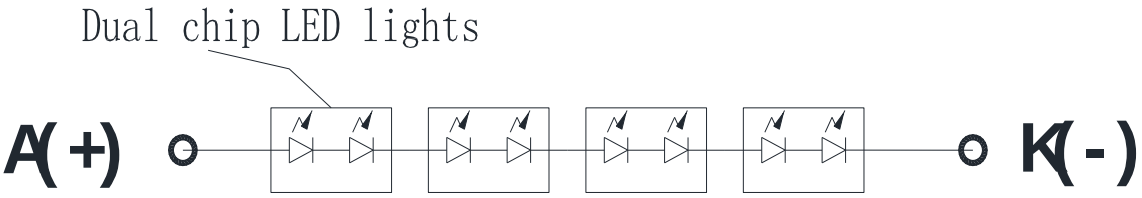
5.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 4 Dual chips White LED

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I_F	15	20	--	mA	
Forward Voltage	V_F	--	24	--	V	
LCM Luminance	L_V	100	120	--	cd/m2	Note3
LED life time	Hr	30000	--	--	Hour	Note1,2
Uniformity	AVg	80	--	--	%	Note3

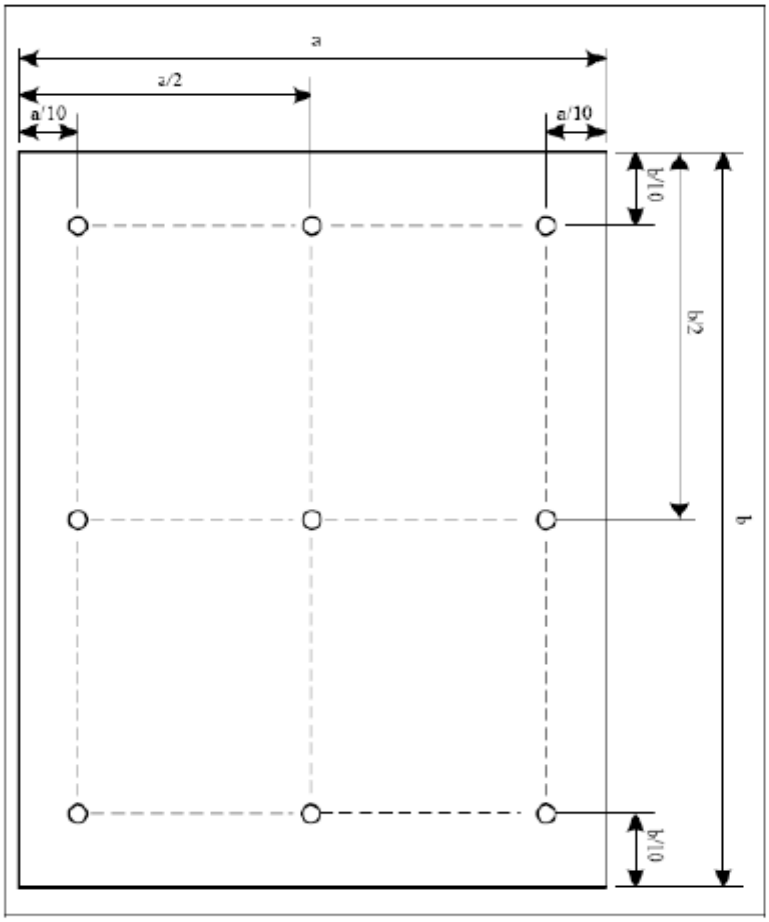
Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 ℃, typical IL value indicated in the above table until the brightness becomes less than 50%.

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.



B/L Circuit

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

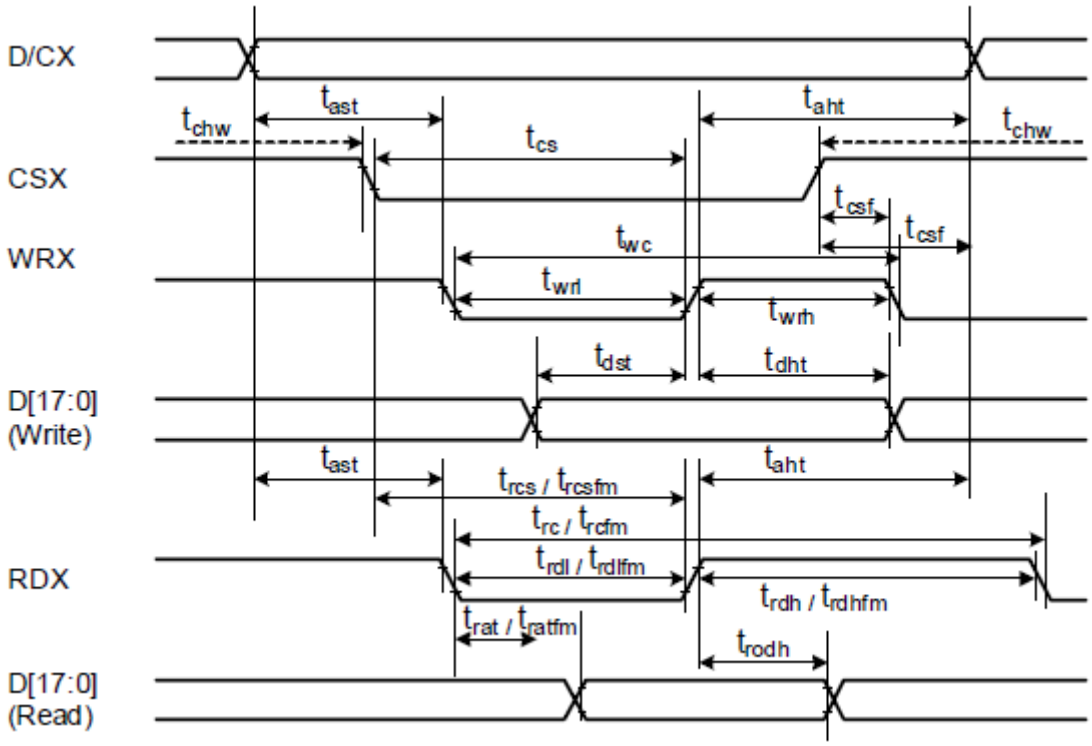


$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

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

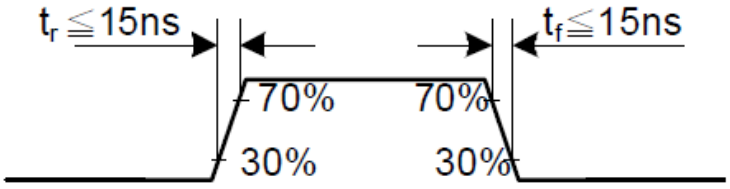
6. AC Characteristic

6.1 DBI Type B (18/16/9/8 bit) Interface Timing Characteristics

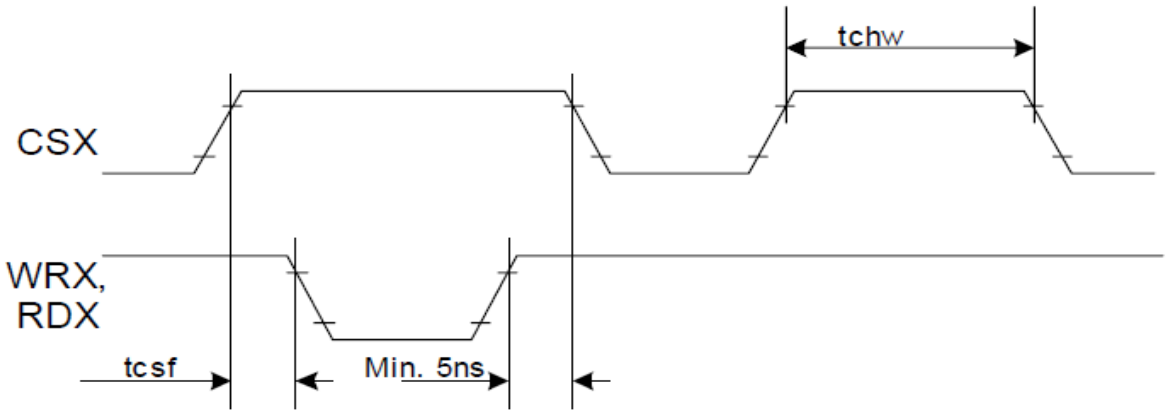


Signal	Symbol	Parameter	min	max	Unit	Description
D/CX	tast	Address setup time	0	-	ns	
	taht	Address hold time (Write/Read)	10	-	ns	
CSX	tchw	CSX "H" Pulse Width	0	-	ns	
	tcs	Chip Select setup time (Write)	20	-	ns	
	trcs	Chip Select setup time (Read ID)	45	-	ns	
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	
	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	twc	Write cycle	80	-	ns	
	twrh	Write Control pulse H duration	25	-	ns	
	twrl	Write Control pulse L duration	25	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control pulse H duration (ID)	90	-	ns	
	trdl	Read Control pulse L duration (ID)	45	-	ns	
RDX (FM)	trcfm	Read cycle (FM)	450	-	ns	
	trdhfm	Read Control pulse H duration (FM)	90	-	ns	
	trdlfm	Read Control pulse L duration (FM)	355	-	ns	
DB[17:0], DB[15:0], DB[8:0], DB[7:0]	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	-	ns	

Note: Ta = -30 to 70 °C, VDDI=1.65V to 3.3V, VDD=2.5V to 3.0V, DGND=0V

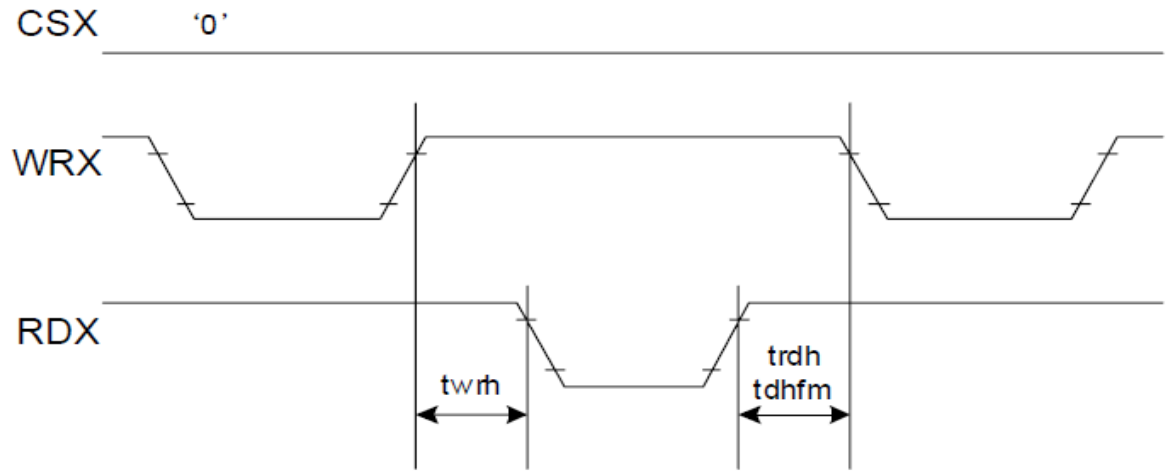


CSX timings:



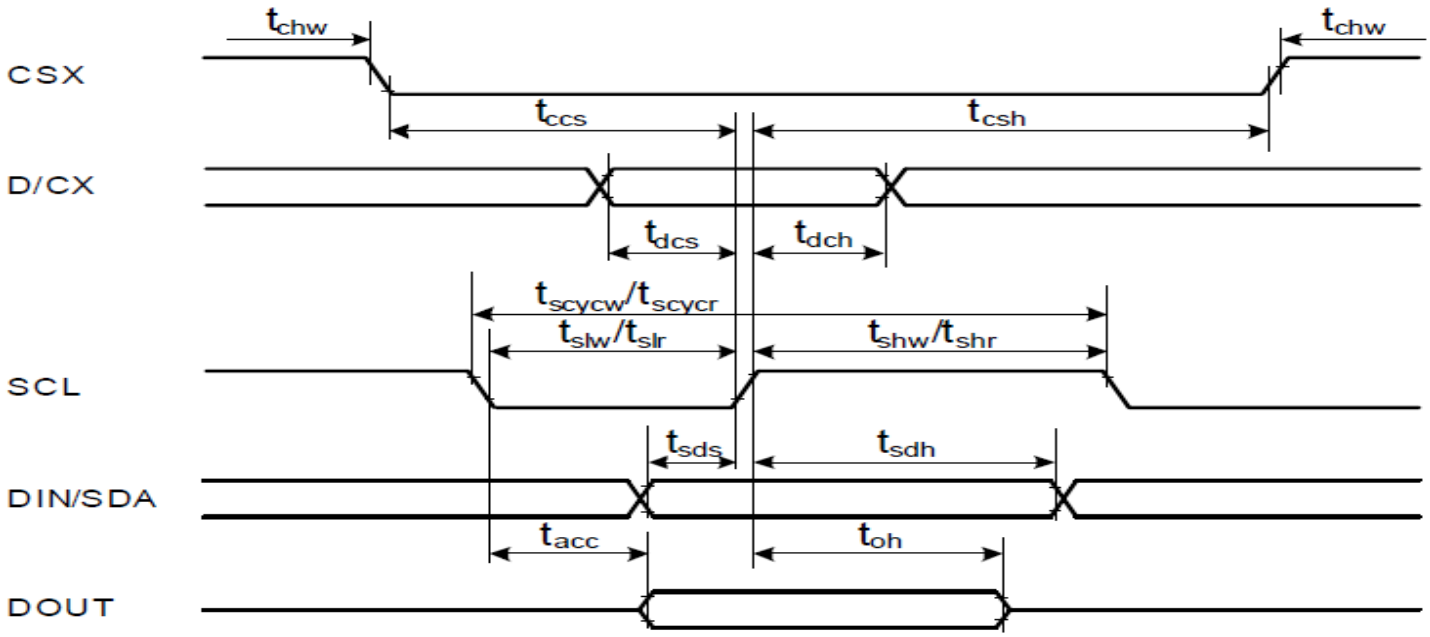
Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

Write to read or read to write timings:



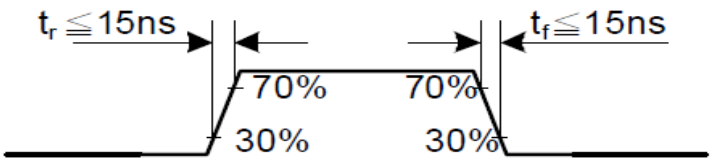
Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

6.2 DBI Type C (SPI) Interface Timing Characteristics

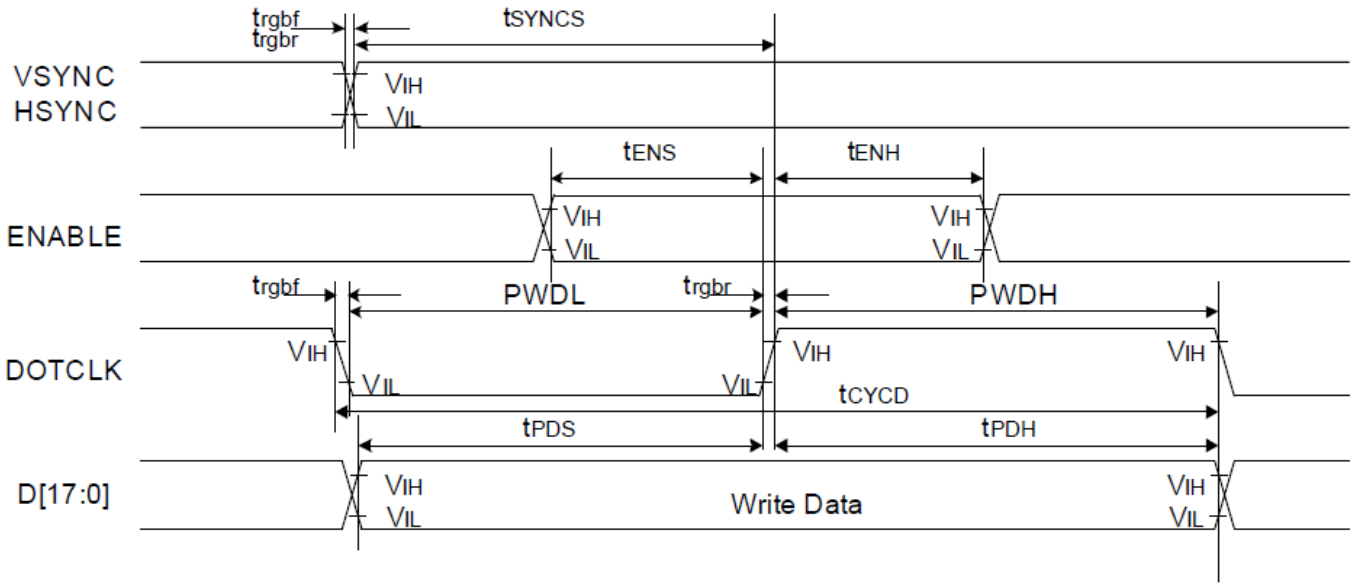


Signal	Symbol	Parameter	min	max	Unit	Description
CSX	tcss	CSX-SCL time (Write)	15	-	ns	
	tcsh	CSX-SCL time (Write)	15	-	ns	
	tcss	CSX-SCL time (Read)	60	-	ns	
	tcsh	CSX-SCL time (Read)	60	-	ns	
	tchw	CSX “H” pulse time	40	-	ns	
SCL	tscycw	Serial clock cycle (Write)	60	-	ns	
	tshw	SCL “H” pulse width (Write)	15	-	ns	
	tslw	SCL “L” pulse width (Write)	15	-	ns	
	tscycr	Serial clock cycle (Read GRAM)	300	-	ns	
	tshr	SCL “H” pulse width (Read GRAM)	110	-	ns	
	tslr	SCL “L” pulse width (Read GRAM)	110	-	ns	
	tscycr	Serial clock cycle (Read ID)	150	-	ns	
	tshr	SCL “H” pulse width (Read GRAM)	54	-	ns	
	tslr	SCL “L” pulse width (Read GRAM)	54	-	ns	
D/CX	tdcs	D/CX setup time	7	-	ns	
	tdch	D/CX hold time	7	-	ns	
SDA (Input) (Output)	tacc	Access time	10	50	ns	For maximum CL=30pF For minimum CL=8pF
	toh	Output disable time	15	50	ns	
	tsds	Data setup time	7	-		
	tsdh	Data hold time	7	-		

Note: Ta = -30 to 70 °C, VDDI=1.65V to 3.3V, VDD=2.5V to 3.0V, AGND=DGND=0V



6.3 RGB Interface Timing Characteristics



Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC / HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
ENABLE	t_{ENS}	ENABLE setup time	15	-	ns	
	t_{ENH}	ENABLE hold time	15	-	ns	
D[17:0]	t_{POS}	Data setup time	15	-	ns	
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level period	15	-	ns	
	PWDL	DOTCLK low-level period	15	-	ns	
	t_{CYCD}	DOTCLK cycle time	100	-	ns	
	t_{rgbr} , t_{rgbf}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	
VSYNC / HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	6-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
ENABLE	t_{ENS}	ENABLE setup time	15	-	ns	
	t_{ENH}	ENABLE hold time	15	-	ns	
D[17:0]	t_{POS}	Data setup time	15	-	ns	
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level pulse period	15	-	ns	
	PWDL	DOTCLK low-level pulse period	15	-	ns	
	t_{CYCD}	DOTCLK cycle time	100	-	ns	
	t_{rgbr} , t_{rgbf}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	

6.4 Reset Timing Characteristics

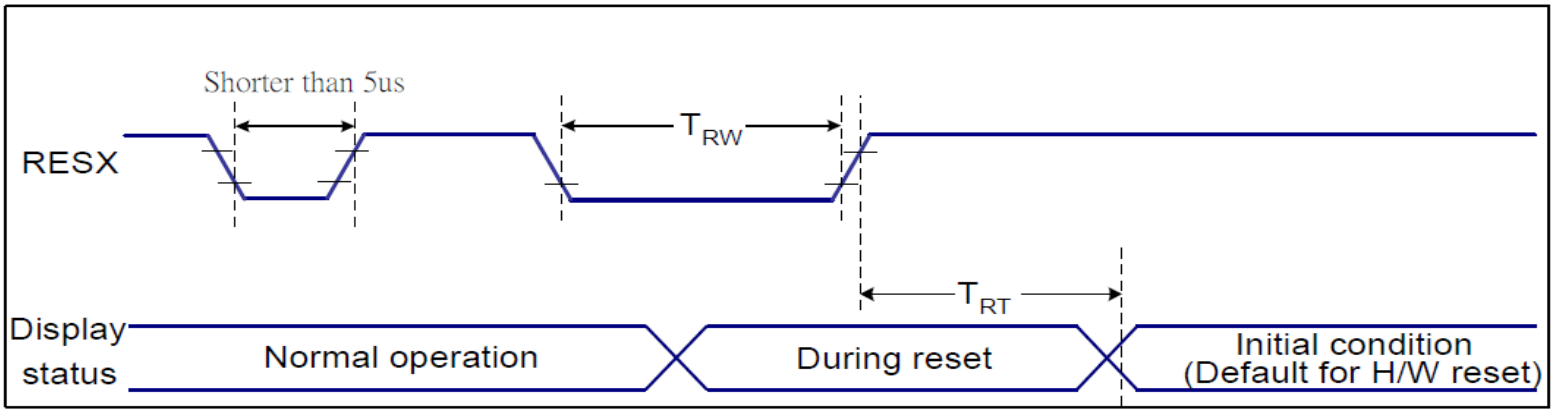


Figure 7 Reset Timing

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

Table 8 Reset Timing

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:

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.

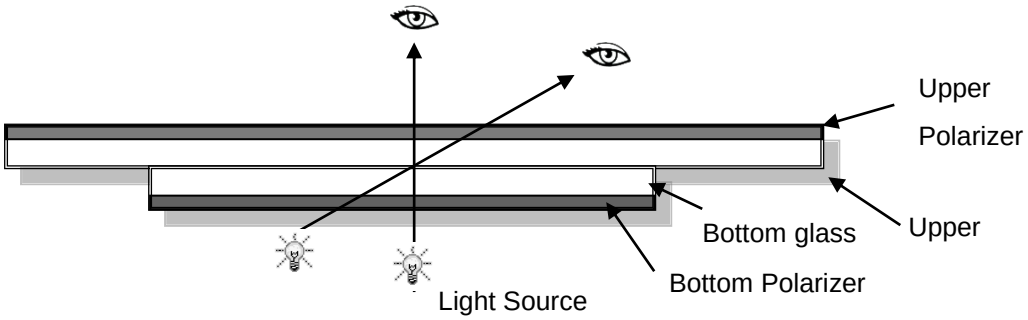
Temperature : 25±5℃

Humidity : 65%±10%RH

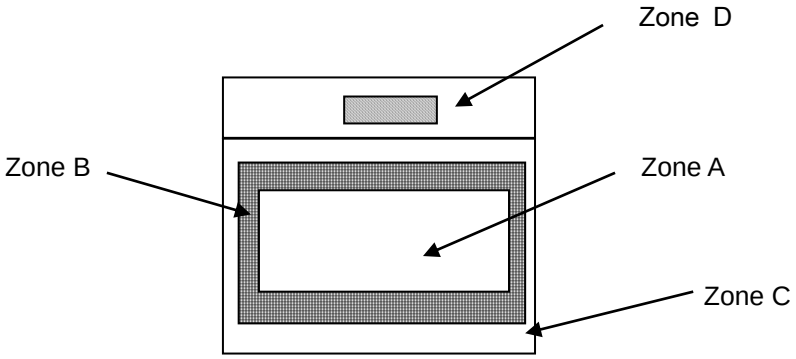
Viewing Angle : Normal viewing Angle.

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

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

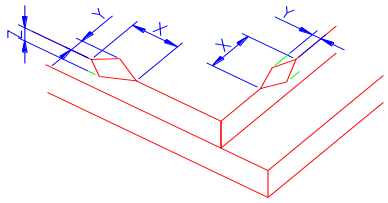
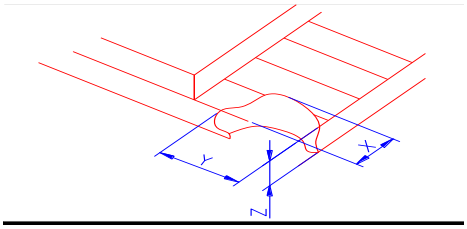
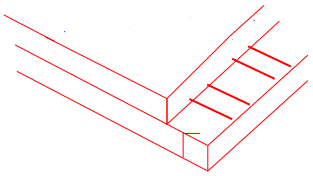
LCD: Liquid Crystal Display , LCM: Liquid Crystal Module,

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.	

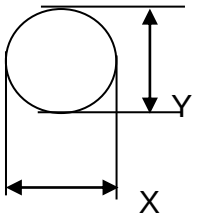
Note1: a) Light dot：Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

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:

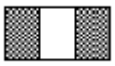
A) Bright dot：Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

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

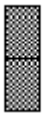
C) 2 dot adjacent = 1 pair = 2 dots

Picture:

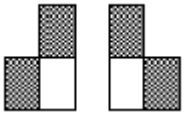
2 dot adjacent



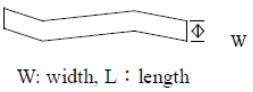
2 dot adjacent



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

Remark:

Item	Condition	Inspection after test
High Temperature Operating	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 Operating	-20°C, 96HR	
High Temperature Storage	80°C, 96HR	
Low Temperature Storage	-30°C, 96HR	
High Temperature & High Humidity Operating	+60°C, 90% RH ,96 hours.	
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℃~35℃, 30%~60%).	
Vibration (Non-operation)	Frequency range:10~55Hz, 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)	

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.
(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.