MOP-TFT480116-38A-BLH-TPR

Hardware Manual

Revision 1.0

Revision History

Revision	Date	Description	Author
1.0	May 26, 2017	Initial Release	Divino

Contents

1 General Information

No.	Item	Contents	Unit
1	Display Size(Diagonal)	3.8”	
2	LCD type	TN TFT	
3	Display Mode	Transmissive/ Normally White	
4	Resolution	480 RGB x 116	Pixels
5	View Direction	12 O’clock	
6	Gray Scale Inversion Direction	6 O’clock	
7	Module Outline	105.5(H) x 37.8 (V) x 4.2(T)	mm
8	Active Area	95.04(H) x 22.97(V)	mm
9	Pixel Pitch	198(H) x 198(V)	μm
10	Pixel Arrangement	Stripe	
11	Polarizer Surface Treatment	Anti-glare	
12	Display Colors	16M	
13	Interface	24-bit RGB interface	
14	Driver IC	ST7282	-
15	With or Without Touch Panel	With	
16	Operating Temperature	-20~70	°C
17	Storage Temperature	-30~80	°C
18	Weight	35	g

2 Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit
Supply Voltage	VCC	-0.3	4.6	V
Storage temperature	T_{STG}	-30	+80	°C
Operating temperature	T_{OP}	-20	+70	°C

***Note:** If Ta below 50ºC, the maximal humidity is 90%RH, if Ta over 50°C, absolute humidity should be less than 60%RH.
****Note:** The response time will be extremely slow when the operating temperature is around -10°C, and the back ground will become darker at high temperature operating.

3 Electrical Characteristics

DC Characteristics (at Ta=25°C)

Item		Symbol	Min	Typ	Max	Unit
Digital Interface Supply Voltage		VCC	3.0	3.3	3.6	V
Logic Low input voltage		V_{IL}	GND	-	0.3*VCC	V
Logic High input voltage		V_{IH}	0.7*VCC	-	VCC	V
Logic Low output voltage		V_{OL}	GND	-	GND+0.4	V
Logic High output voltage		V_{OH}	VCC-0.4	-	VCC	V
Current Consumption All Black	Logic Analog	$I_{cc}+I_{In}$	-	15	30	mA

4 Backlight Characteristics

(at Ta=25˚C,RH=60%)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V_F	Ta=25 °C, I_F=20mA/LED	17.4	19.2	19.8	V
Forward Current	I_F	Ta=25 °C, V_F=3.2V/LED	-	40	-	mA
Power dissipation	P_D		-	768	-	mW
Uniformity	Avg		80	-	-	%
Drive method	Constant current					
LED Configuration	12 White LEDs (6 LEDs in one string and 2 groups in parallel)					

5 Touch Panel Characteristics

5.1 Electrical Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Linearity	-3	-	3	%	Analog X and Y directions
Terminal resistance	1100	-	2600		X (Film side)
	10	-	250		Y (Glass side)
Insulation resistance	20	-	-	M	DC ≤10V
Voltage	-	-	10	V	DC
Chattering	-	-	10	ms	

***Note:** Do not operate it with a thing except a polyacetal pen (tip R0.8mm or less) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

5.2 Mechanical & Reliability Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Activation force	20	-	100	g	*Note
Durability-surface scratching	Write 20,000	-	-	Characters	*Note 2
Durability-surface pitting	1,000,000	-	-	Touches	*Note 3
Surface Hardness	3	-	-	H	

***Note 1:** Stylus pen Input: R0.8mm polyacetal pen or Finger

***Note 2:** Measurement for Surface area

- Force: 150-250gf
- Speed: 60mm/sec
- Stylus: R0.8 polyacetal pen or Finger

***Note 3:** Pit 1,000,000 times on the Film with a R3.75 silicon rubber.

- Force: 2.45N
- Speed: 3 times/sec

6 External Dimensions

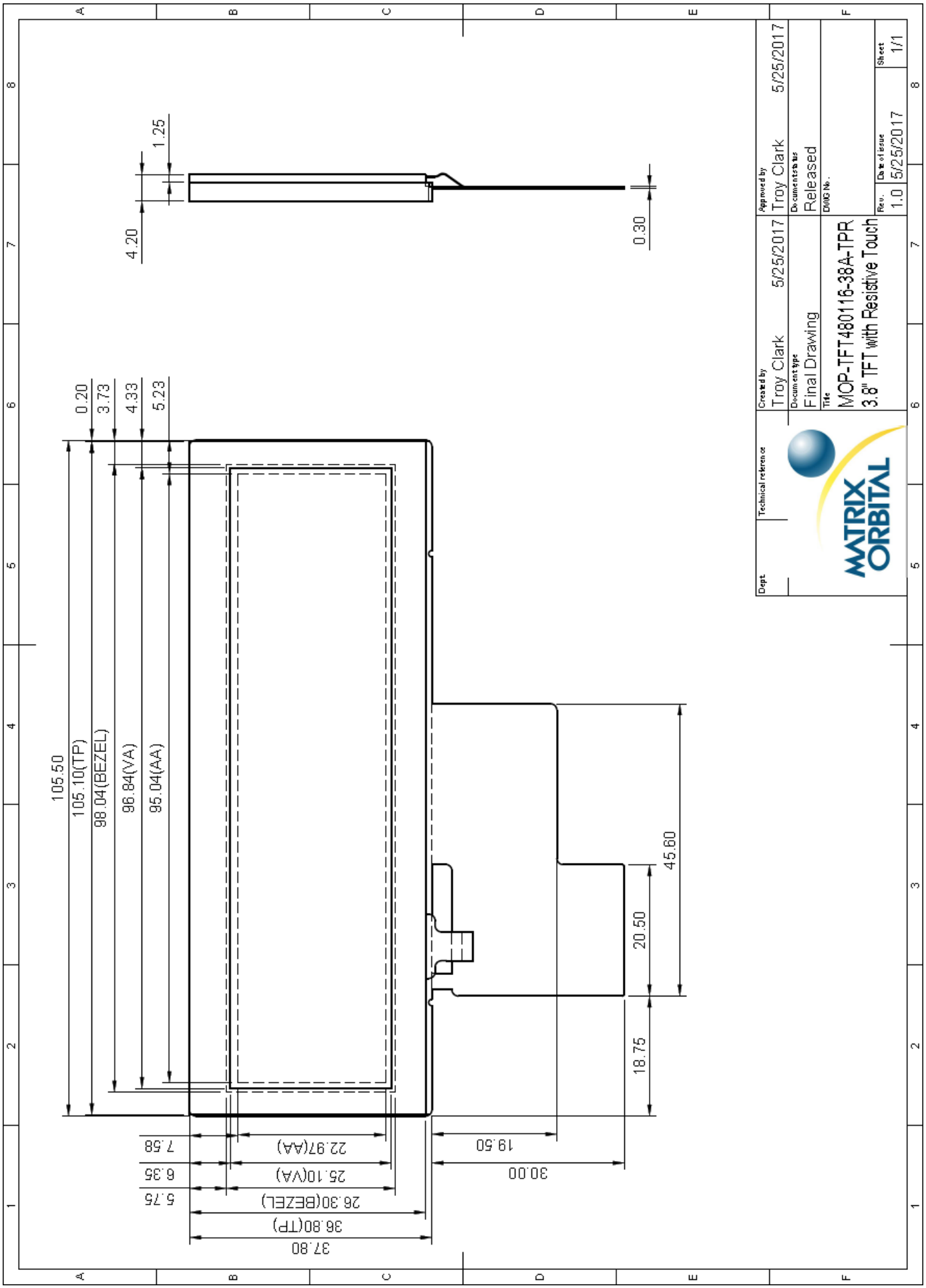


Figure 1: MOP-TFT480116-38A-BLH-TPR Drawing

7 Electro-Optical Characteristics

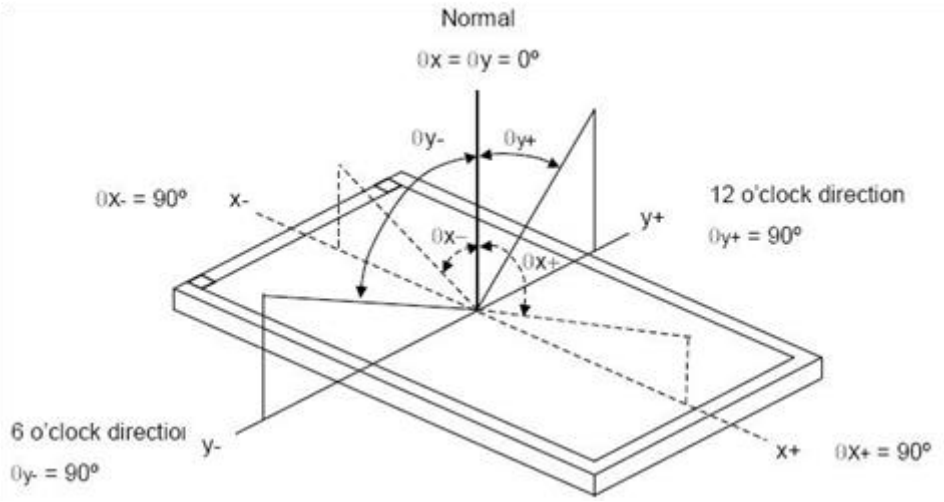


Figure 2: The definition of viewing angle

Item		Symbol	Condition	Specification			Unit
				Min	Typ	Max	
Luminance on TFT (I_f = 20mA/LED)		Lv	Normal viewing angle θx = φY = 0°	640	800	-	cd/m^2
Contrast Ratio		CR		300	500	-	
Response time		T_R+T_F		-	30	50	ms
Transmissive	Red	X_R		0.576	0.616	0.676	
		Y_R		0.309	0.359	0.409	
	Green	X_G		0.274	0.324	0.374	
		Y_G		0.558	0.608	0.658	
	Blue	X_B		0.099	0.149	0.199	
		Y_B		0.070	0.120	0.170	
	White	X_W		0.237	0.287	0.337	
		Y_W		0.292	0.342	0.392	
	Horizontal	θ_{X+}	Center CR≥10	-	60	-	Deg.
		θ_{X-}		-	60	-	
	Vertical	φ_{Y+}		-	50	-	
		φ_{Y-}		-	65	-	
NTSC Ratio(Gamut)				-	50	-	%

8 Interface Description

8.1 LCM Interface Description

Interface No.	Name	Description
1	LEDK	Backlight Cathode
2	LEDA	Backlight Anode
3	GND	Ground
4	VCC	Power source
5-12	Red(0-7)	Red data signal
13-20	Green(0-7)	Green data signal
21-28	Blue(0-7)	Blue data signal
29	GND	Ground
30	CLK	Clock signal to sample each data
31	DISP	Display on/off signal. DISP=”H” Display on; DISP=”L” Display off
32	HSYNC	Horizontal synchronizing signal
33	VSYNC	Vertical synchronizing signal
34	DEN	Input data eneable control
35	NC	No connection
36	GND	Ground
37	XR(NC)	Touch panel terminal
38	YD(NC)	Touch panel terminal
39	XL(NC)	Touch panel terminal
40	YU(NC)	Touch panel terminal

9 AC Characteristics

9.1 Pixel Timing

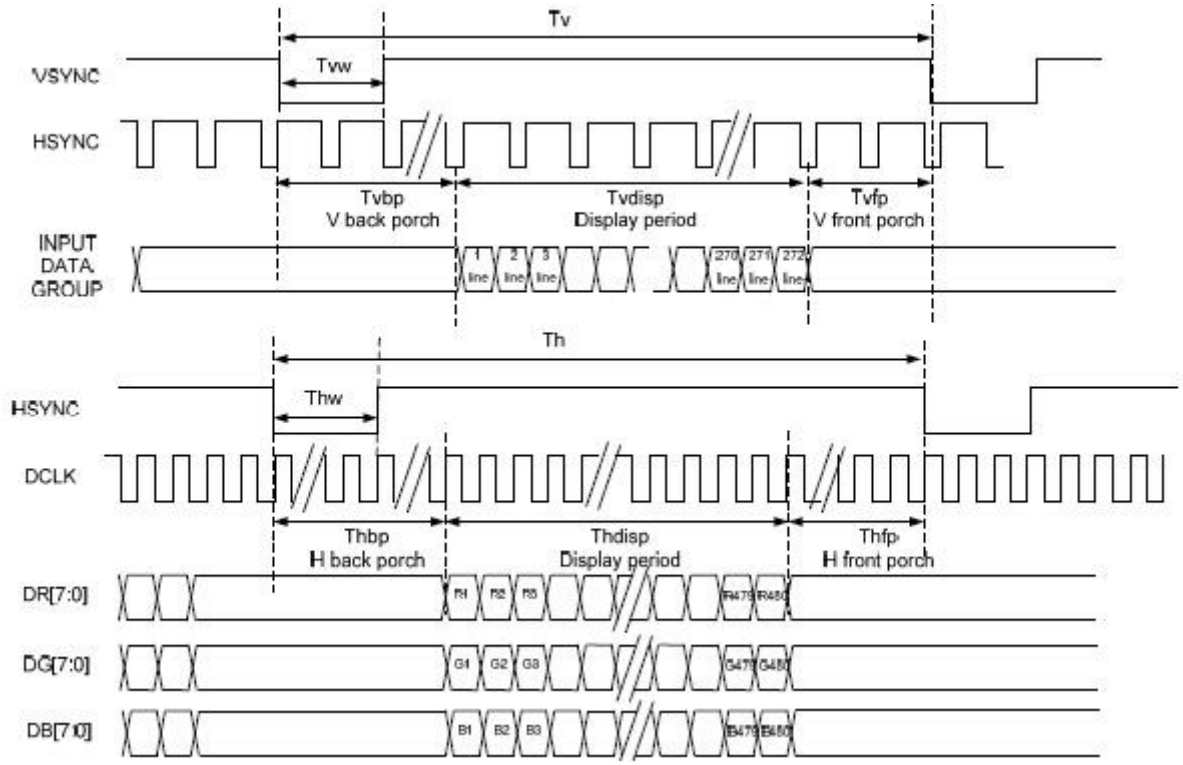


Figure 3:SYNC-DE Mode Timing Diagram

Characteristics		Symbol	Min.	Typ.	Max.	Unit
DOTCLK Frequency		Fclk	-	12	-	MHz
Hsync	Period Time	Th	-	524	-	DCLK
	Display Period	Thdisp	-	480	-	DCLK
	Back Porch	Thbp	-	43	-	DCLK
	Front Porch	Thfp	-	1	-	DCLK
	Pulse Width	Thw	-	2		DCLK
Vsync	Period Time	Tv	-	288	-	H
	Display Period	Tvdisp	-	272	-	H
	Back Porch	Tvbp	-	12	-	H
	Front Porch	Tvfp	-	4	-	H
	Pulse Width	Tvw	-	2	-	H

***Note:** The 1-156 gate lines must be sent back data

10 Power Sequence

10.1 Power Up Sequence

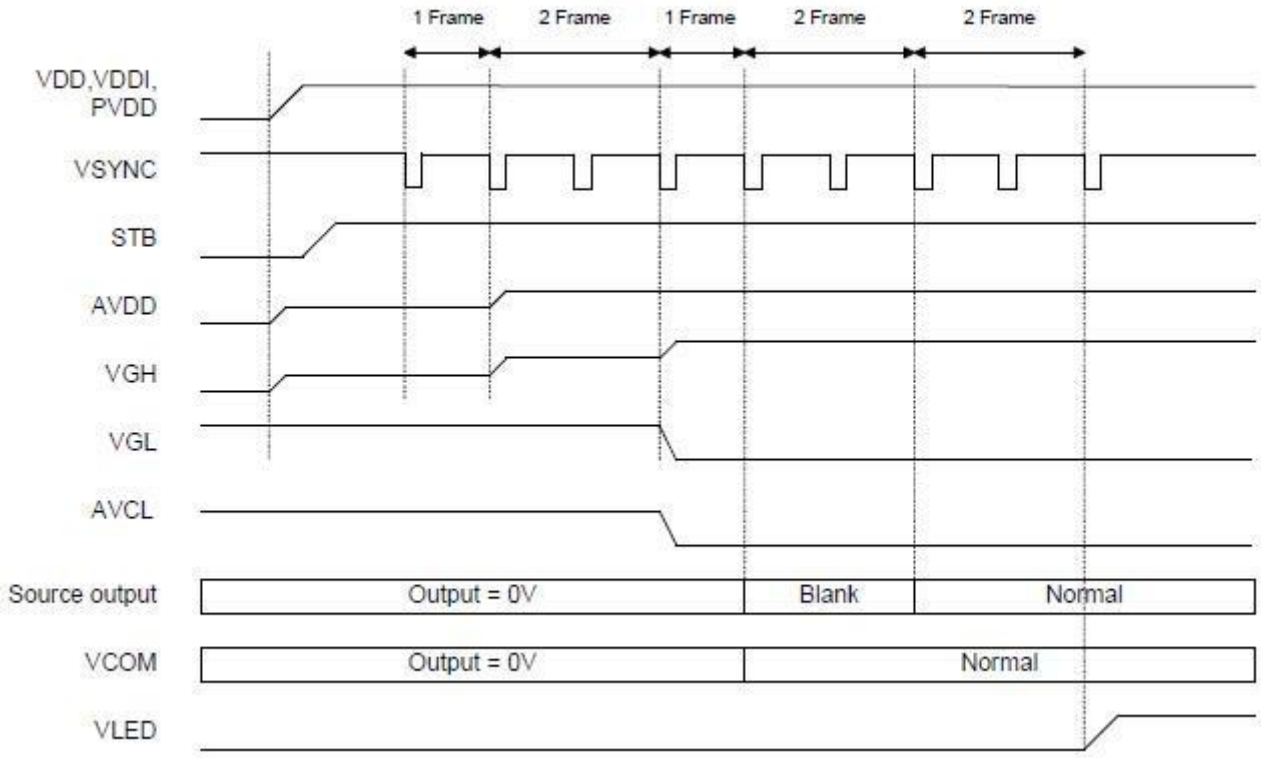


Figure 4: Power Up Sequence

10.2 Power Down Sequence

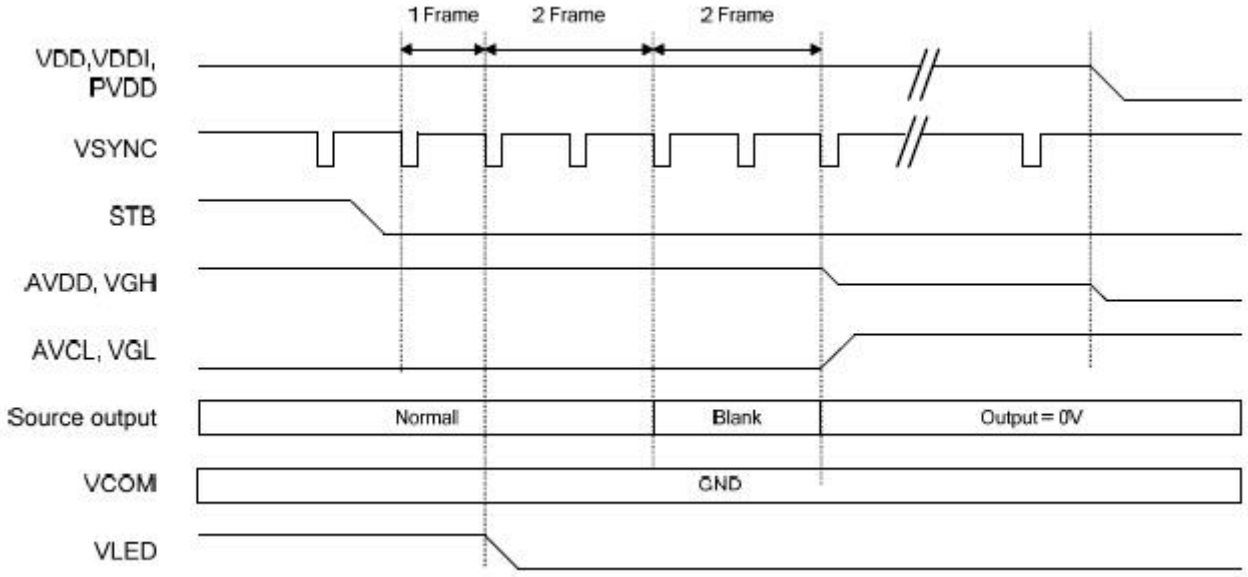


Figure 5: Power Down Sequence

11 Inspection Criterion

11.1 Description

This specification is made to be used as the standard acceptance/rejection criteria for the MOP-TFT480116-38A-BLH-TPR.

11.2 Sample plan

Sampling plan:
1999 and ANSI/ASQC Z1.4-1993
Single sampling, normal inspection
Visual inspection: AQL 1.5%
Electrical functional: AQL 0.65%

11.3 Inspection condition

- Viewing distance for cosmetic inspection is about 30±2 cm with bare eyes, and under a 1000~1500lux environment for visual inspection. All directions for inspecting the sample should be within 45°against perpendicular line. (Normal temperature 18~28°C and normal humidity 60±15%RH).

- During testing, the LCD is driven using the voltage level (Within ±0.5V of the typical value at 25°C.) that provides the most optical contrast

11.4 Definition of inspection zone in LCD

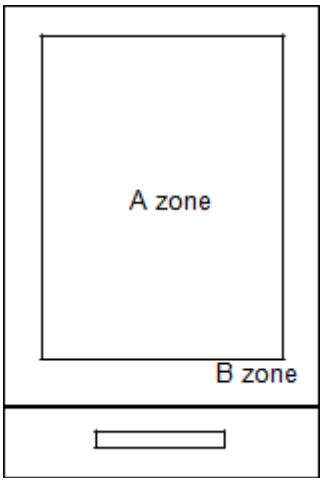


Figure 6: Inspection Zones in an LCD

Zone A: Active Area
Zone B: Viewing Area

11.5 Function Defect

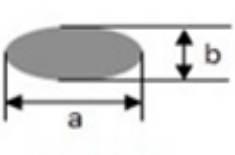
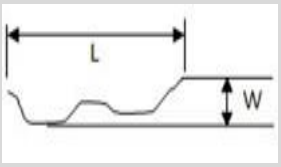
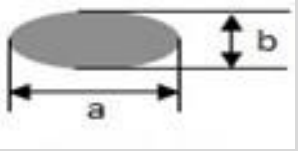
Items to be inspected	Inspection criterion	Classification of defects
All functional defects	1) No display 2) Display abnormally 3) Missing vertical, horizontal segment 4) Short circuit 5) Back-light no lighting, flickering and abnormal lighting. 6) obvious striation 7) Current beyond specification value	MA
Missing	Missing component	
Outline dimension	Overall outline dimension exceed the drawing is not allowed.	

11.6 LCD pixel defect (bad dot) (defect type: MI)

Checking item	Judgment criterion	Total
Bright dot	0	0
Dark dot	N≤2	N≤2
Total dot	N≤2	N≤2
Mura	Not visible through 5% ND filters	

***Note:** Bright dot caused by scratch and foreign object accords to item 1.

11.7 Dot and line defect (defect type: MI)

<table>
<tr><th rowspan="2">Checking item</th><th colspan="3">Judgment criterion</th><th rowspan="2">Figure</th></tr>
<tr><th colspan="2">Diameter(mm)\LCD Size</th><th>S ≤5.0 Inch</th></tr>
<tr><td rowspan="6">Dot defect</td><td colspan="2">D≤0.10</td><td>Allowed</td><td rowspan="6"> 
</td></tr>
<tr><td colspan="2">0.10<D≤0.15</td><td>2</td></tr>
<tr><td colspan="2">0.15<D≤0.25</td><td>1</td></tr>
<tr><td colspan="2">0.25<D</td><td>0</td></tr>
<tr><td colspan="2">Total</td><td>2</td></tr>
<tr><td colspan="3">Distance between 2 defects should be more than 3mm apart.</td></tr>
<tr><td rowspan="6">Line defect</td><td>Length(mm)</td><td>Width(mm)</td><td>Judgment criterion</td><td rowspan="6"> 
</td></tr>
<tr><td>---</td><td>W≤0.03</td><td>allowed</td></tr>
<tr><td>L≤2.5</td><td>0.03<W≤0.05</td><td>3</td></tr>
<tr><td>L≤2.5</td><td>0.05<W≤0.10</td><td>2</td></tr>
<tr><td>---</td><td>0.1<W</td><td>0</td></tr>
<tr><td colspan="2">Total</td><td>3</td></tr>
<tr><td colspan="4">Distance between 2 defects should more than 3mm apart.
Scratches not viewable through the back of the display are acceptable</td></tr>
<tr><td rowspan="5">Concave point and air bubble for polarizer</td><td colspan="2">Size(mm)</td><td>Judgment criterion</td><td rowspan="5"> 
</td></tr>
<tr><td colspan="2">D≤0.20</td><td>allowed</td></tr>
<tr><td colspan="2">0.20<D≤0.30</td><td>4</td></tr>
<tr><td colspan="2">0.30<D≤0.50</td><td>1</td></tr>
<tr><td colspan="2">D>0.50</td><td>None</td></tr>
</table>

12 Handling Precautions

12.1 Mounting method

Do not make extra holes in the display or modify its shape. When mounting the display, ensure that the display does not flex, bend or twist. Extreme care should be used when handling the LCD modules.

12.2 LCD Handling and Cleaning Precaution

To clean the display surface, it is recommended to wipe lightly using a soft cloth with either Isopropyl alcohol or Ethyl alcohol.
Do not wipe the display surface with dry or hard materials as it may damage the polarizer surface.
Do not use Water or Aromatics to clean the display.
Do not wipe ITO pad area with dry or hard materials that will damage the ITO patterns
Do not use Soldering flux, Chlorine(Cl), and Sulfur(S) on the pad or prevent it from being contaminated.
If the display is sent without applying a silicon coat on the pad, the ITO patterns could be damaged due to corrosion as time goes on.
If ITO corrosion occurs due to customer miss-handling, or if the customer applies materials such as Chlorine (Cl), Sulfur (S) to the display, the responsibility is placed the customer.

12.3 Static Charge Precaution

The LCD module uses CMOS LSI drivers, so we recommend that you:

- Connect any unused input terminal to VDD or VSS
- Do not input any signals before power is turned on
- Ground your body, work/assembly areas, and assembly equipment to protect against static electricity.

12.4 Packing

The module employs LCD elements and must be treated as such.

- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity

12.5 Precautions during Operation

- It is an indispensable condition to drive the LCD module within the specified voltage limits. Applying voltage higher than the limit will reduce the life span of the LCD.
- Using direct drive current should be avoided, as it will induce an electrochemical reaction causing undesirable deterioration.
- The LCD's response time will be delayed when operating at a temperature lower than the suggested operating range. When operating at a temperature higher than the suggested range, the LCD will be noticeably darker. The display will return to normal when it is brought back to the specified operation temperature.
- If the display area is pushed hard during operation, some font may be abnormally drawn but the LCD will return to normal after it is reset.
- Slight dew depositing on terminals can cause an electro-chemical reaction, damaging traces and resulting in an open circuit.

Usage under the maximum operating temperature, 50%Rh or less is required

12.6 Storage Recommendations

When storing the LCD for a prolonged period of time, the following recommendations will help prevent damage or deterioration

- Store the display in an ambient temperature range between 10°C to 30°C, and in a relative humidity of 45% to 75%.
- Do not leave the display exposed to sunlight or fluorescent light.
- Place the display in a polyethylene bag with the opening sealed.
- Ensure that nothing is making contact with the polarizer surface.
- It is recommended to store them in the same packaging that was provided upon purchase

12.7 Safety Precautions

In the case that the LCD glass has shattered, it is recommended to remove any glass pieces, wash off the liquid crystal using either acetone or ethanol, and proceed to burn any remaining display pieces.
If any liquid leaked out of a damaged glass cell, and comes in contact with your hands, please wash it off well with soap and water

13 Ordering

13.1 Part Numbering Scheme

Table 1: Parallel TFT Part Numbering Scheme

MOP	-	TFT	480	116	-	38	-	A	-	BLH	-	TPN
1		2	3	4		5		6		7		8

13.2 Options

Table 2: Parallel Part Options

#	Designator	Options
1	Product Line	MOP: Matrix Orbital Parallel Display
2	Screen Type	TFT: Graphic TFT
3	Display Columns	480: Four Hundred Eight Pixel Columns
4	Display Rows	116: One Hundred Sixteen Pixel Rows
5	Display Size	38: 3.8”
6	Display Form Factor	A: A Form Factor
7	Brightness Level	-BLS: Brightness < 300 Nit -BLM: 300 Nit < Brightness < 600 Nit -BLH: 600 Nit < Brightness < 1000 Nit -BLD: Brightness > 1000 Nit
8	Touch Panel Type	TPN: None TPR: Resistive TPC: Capacitive

14 Contact

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