



# MOP-TFT480116-38G-BLH-TPC

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Hardware Manual

Revision 1.1

## Revision History

Revision	Date	Description	Author
1.1	March 29, 2018	Updated Naming Convention	Divino
1.0	February 21, 2018	Initial Release	Divino



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## 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 <sub>STG</sub>	-30	+80	°C
Operating temperature	T <sub>OP</sub>	-20	+70	°C

**\*Note:** If Ta below 50°C, 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 <sub>IL</sub>	GND	-	0.3*VCC	V	
Logic High input voltage	V <sub>IH</sub>	0.7*VCC	-	VCC	V	
Logic Low output voltage	V <sub>OL</sub>	GND	-	GND+0.4	V	
Logic High output voltage	V <sub>OH</sub>	VCC-0.4	-	VCC	V	
Current Consumption All Black	Logic	I <sub>CC</sub> +I <sub>IN</sub>	-	15	30	mA
	Analog					



## 4 Backlight Characteristics

(at Ta=25 °C, RH=60%)

Item	Symbol	Condition	Min	Typ.	Max.	Unit
Forward Voltage	V <sub>F</sub>	Ta=25 °C, I <sub>F</sub> =20mA/LED	17.4	19.2	19.8	V
Forward Current	I <sub>F</sub>	Ta=25 °C, V <sub>F</sub> =3.2V/LED	-	40	-	mA
Power dissipation	P <sub>D</sub>		-	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

(at Ta=25 °C)

Item	Description
IC solution on TP Model	GT911*
Touch Count Max	5 point
Display Resolution	480*116
Interface Type	I2C
Maximum Clock Speed	400Kbps
Interrupt Signal	Active Low
Default Origin	Upper Left Corner
Default I2C Address (Write/Read)	0xBA/0xBB

Parameter	Min.	Typ.	Max.	Unit
Power Voltage (VDD)	2.8	---	3.3	V
Signal Voltage	1.8	3.3	3.6	V
Signal HIGH	0.7*VDD	---	VDD	V
Signal LOW	0	---	0.3*VDD	V
Supply Current (Operation)	---	6.0	---	mA

\*Note: For more information, see the GT911 datasheet



# 6 External Dimensions

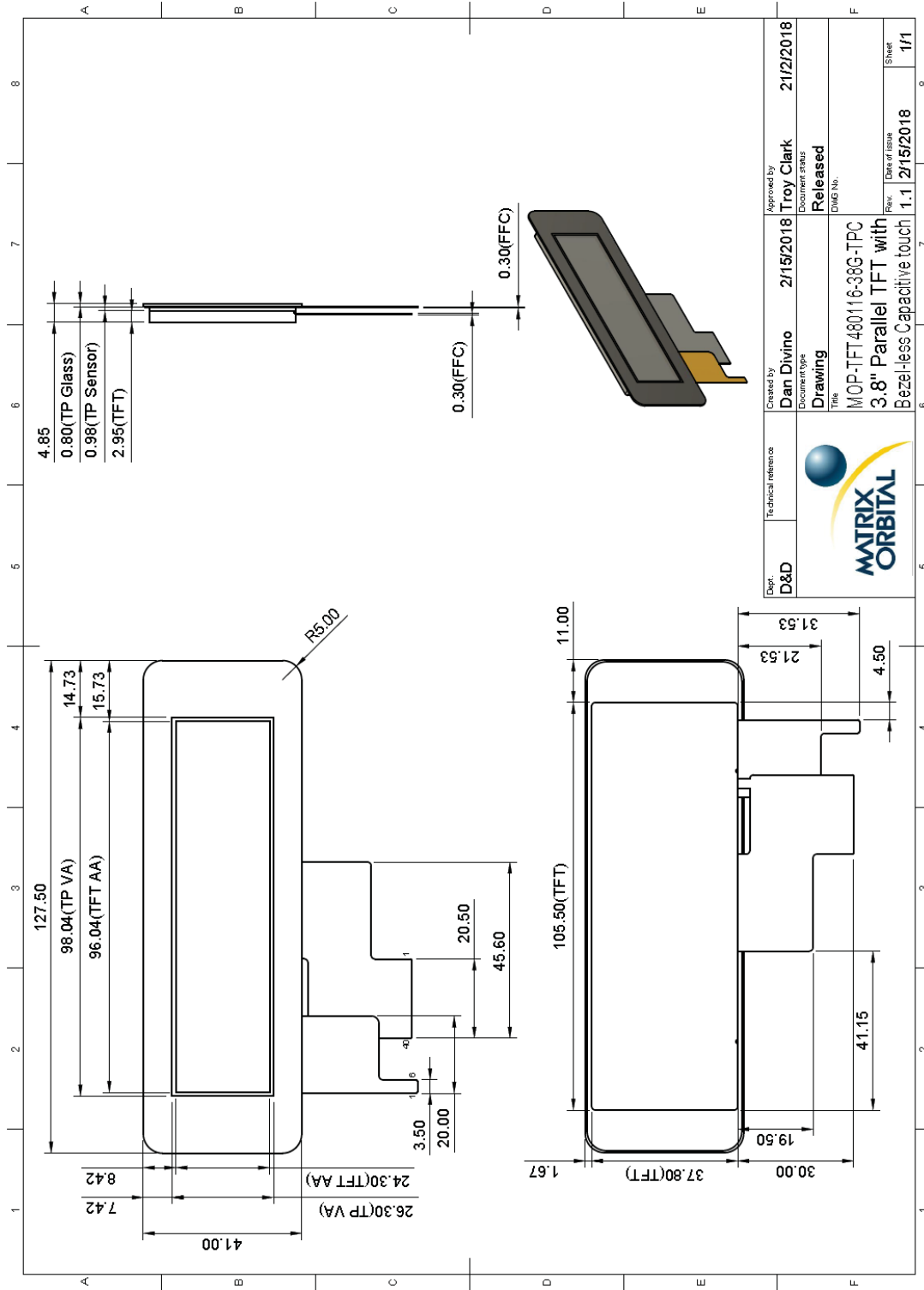


Figure 1: MOP-TFT480116-38G-BLH-TPC Drawing



## 7 Electro-Optical Characteristics

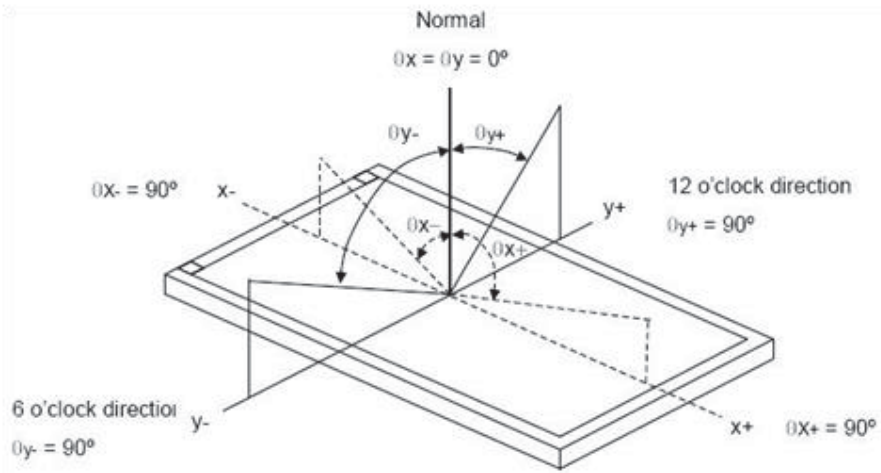


Figure 2: The definition of viewing angle

Item	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
Luminance on TFT ( $I_f = 20\text{mA/LED}$ )	Lv	Normal viewing angle $\theta_x = \theta_y = 0^\circ$	640	800	-	cd/m <sup>2</sup>
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	$\theta_{x+}$	-	60	-	Deg.
		$\theta_{x-}$	-	60	-	
	Vertical	$\phi_{y+}$	-	50	-	
		$\phi_{y-}$	-	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 enable control
35	NC	No connection
36	GND	Ground
37	XR(NC)	No Connect
38	YD(NC)	No Connect
39	XL(NC)	No Connect
40	YU(NC)	No Connect

### 8.2 CTB Interface Description

Interface No.	Name	I/O Pin Connections	Description
1	RST*	I	Reset (Active Low)
2	INT*	O	State change interrupt (Active Low)
3	GND	P	Ground
4	SDA**	I/O	Serial interface data
5	SCL**	I	Serial interface clock
6	VDD	P	Power supply of CTP

\*Note: Pull up resistors of 10K ohms to VDD are recommended for RST and INT.

\*\*Note: Pull up resistors of 1K-10K ohms to VDD are required for SCL and SDA.





# 9 AC Characteristics

## 9.1 Pixel Timing

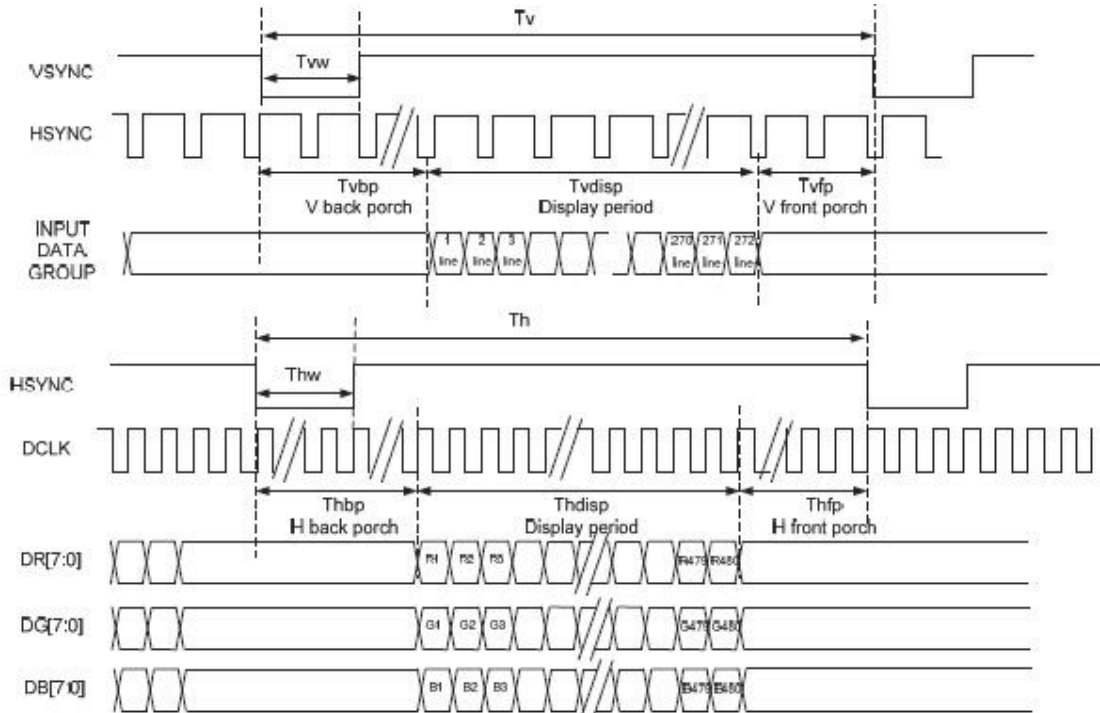


Figure 3: SYNC-DE Mode Timing Diagram

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

## 9.2 Touch Panel Timing

Table 1: Write Operation

Start	Address (Write)	ACK	Register (H)*	ACK	Register (L)*	ACK	Data (1)	ACK	...	Data (n)	ACK	End
-------	-----------------	-----	---------------	-----	---------------	-----	----------	-----	-----	----------	-----	-----

Table 2: Read Operation

Start	A (Write)	ACK	R (H)	ACK	R (L)	ACK	End	Start	A (Read)	ACK	D (1)	ACK	...	D (n)	ACK	End
-------	-----------	-----	-------	-----	-------	-----	-----	-------	----------	-----	-------	-----	-----	-------	-----	-----

\*Note: For a complete list of registers and additional information, see the GT911 datasheet.



# 10 Power Sequence

## 10.1 Power Up Sequence

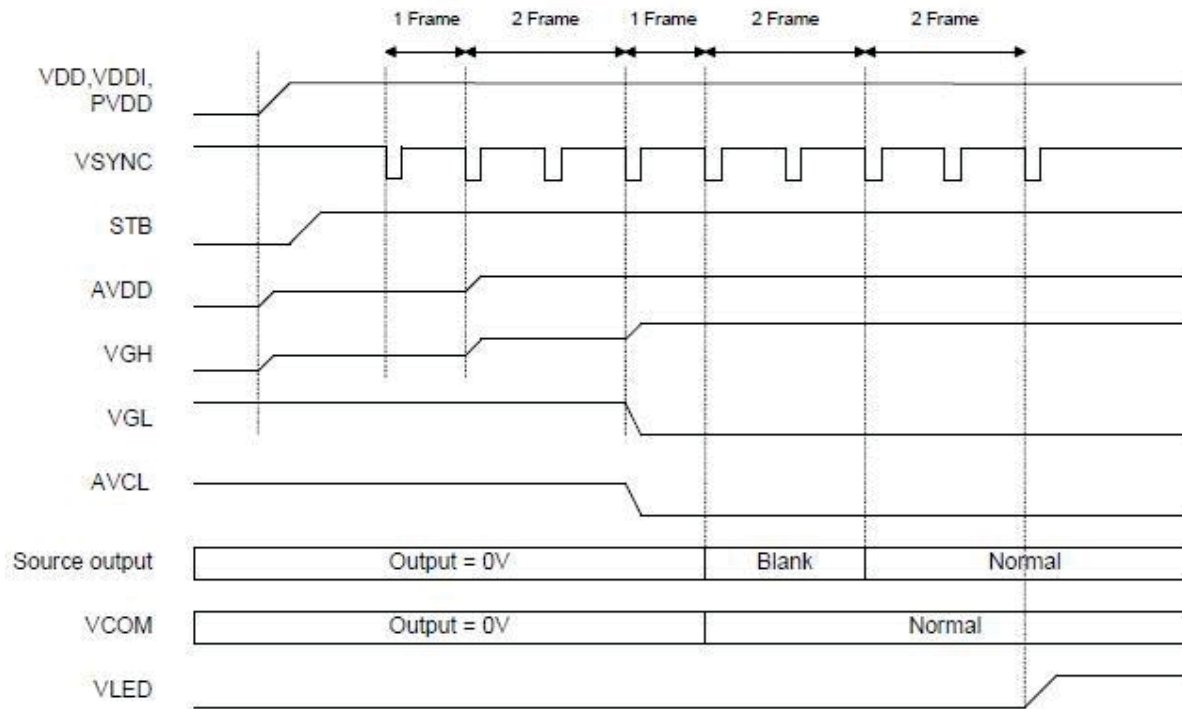


Figure 4: Power Up Sequence

## 10.2 Power Down Sequence

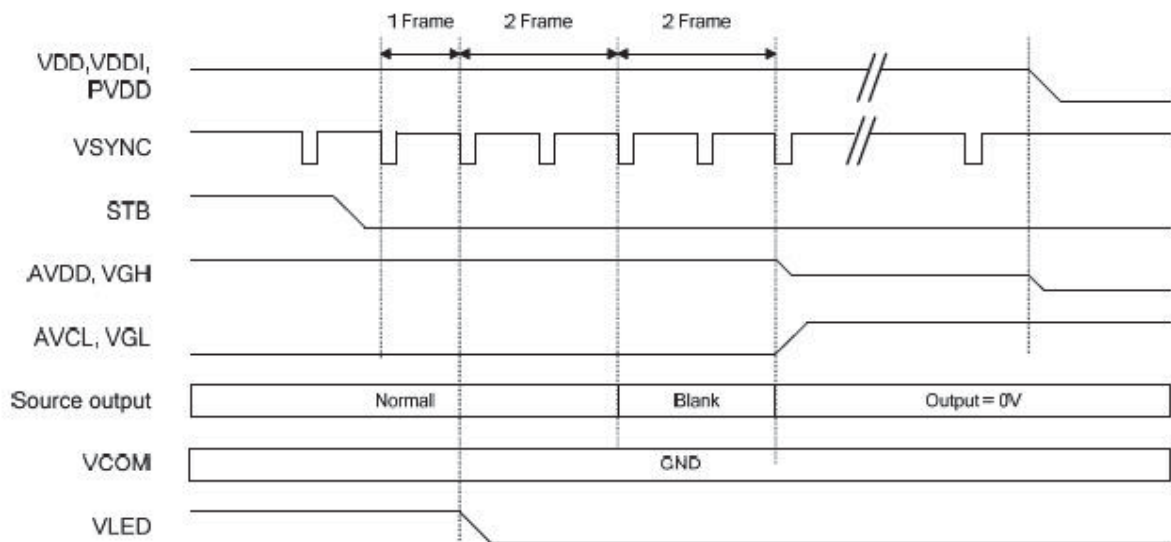


Figure 5: Power Down Sequence



# 11 Inspection Criterion

## 11.1 Description

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

## 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  $30\pm 2$  cm with bare eyes, and under a 1000~1500lux environment for visual inspection. All directions for inspecting the sample should be within  $45^\circ$  against perpendicular line. (Normal temperature  $18\sim 28^\circ\text{C}$  and normal humidity  $60\pm 15\%\text{RH}$ ).
- During testing, the LCD is driven using the voltage level (Within  $\pm 0.5\text{V}$  of the typical value at  $25^\circ\text{C}$ .) that provides the most optical contrast

## 11.4 Definition of inspection zone in LCD

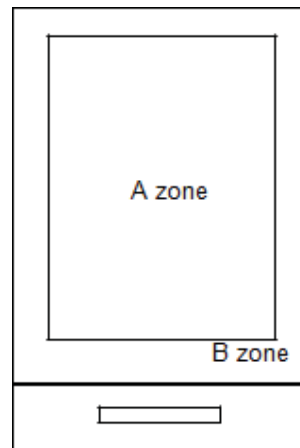


Figure 6: Inspection Zones in an LCD

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.	

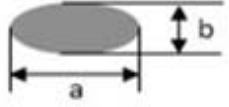
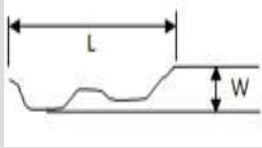
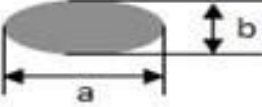


## 11.6 LCD pixel defect (bad dot) (defect type: MI)

Checking item	Judgment criterion	Total
Bright dot	0	0
Dark dot	$N \leq 2$	$N \leq 2$
Total dot	$N \leq 2$	$N \leq 2$
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)

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



## 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 3: Parallel TFT Part Numbering Scheme

MOP	TFT	480	116	38	G	BLH	CTB
1	2	3	4	5	6	7	8

### 13.2 Options

Table 4: 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	G: G 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 CTB: Bezel-less Capacitive

## 14 Contact

### Sales

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