

# DMT043QQNTCMI-6A

## PRODUCT SPECIFICATION

Version 0.1  
Nov 22, 2022

TBD

<i>Customer's Approval</i>	
<u>Signature</u>	<u>Date</u>

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Approved by *Kenny Lin*

## Revision History

VERSION	DATE	DESCRIPTION	AUTHOR
0.1	Nov 22, 2022	Preliminary	Victoria Ho

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# 1. General Description

## 1.1 Introduction

This is a 4.3" size colour active matrix TFT LCD module that uses amorphous silicon TFT as a switching device. The display is normally black mode, transmissive, and featuring high contrast and excellent colour saturation. The resolution of the TFT-LCD is 480 x 272 and can display up to 16.7M colours. The display module supports 24-bit RGB interface.

## 1.2 Main Features

Item	Contents
Display Type	TFT LCD
Screen Size	4.3" Diagonal
Display Format	480 x RGB x 272 Dots
No. of Colour	16.7M
Overall Dimensions	119.04 (W) x 77.87 (H) x 4.94 (D) mm
Active Area	95.04 (W) x 53.856 (H) mm
Mode	Normally Black / Transmissive / IPS
Viewing Direction	All round
Interface	24-bit RGB
Driver IC	ST7283
Backlight Type	LED, White, 12 chips
Operating Temperature	-20°C ~ +70°C
Storage Temperature	-30°C ~ +80°C
ROHS	Compliant to RoHS 2.0

## 1.3 CTP Features

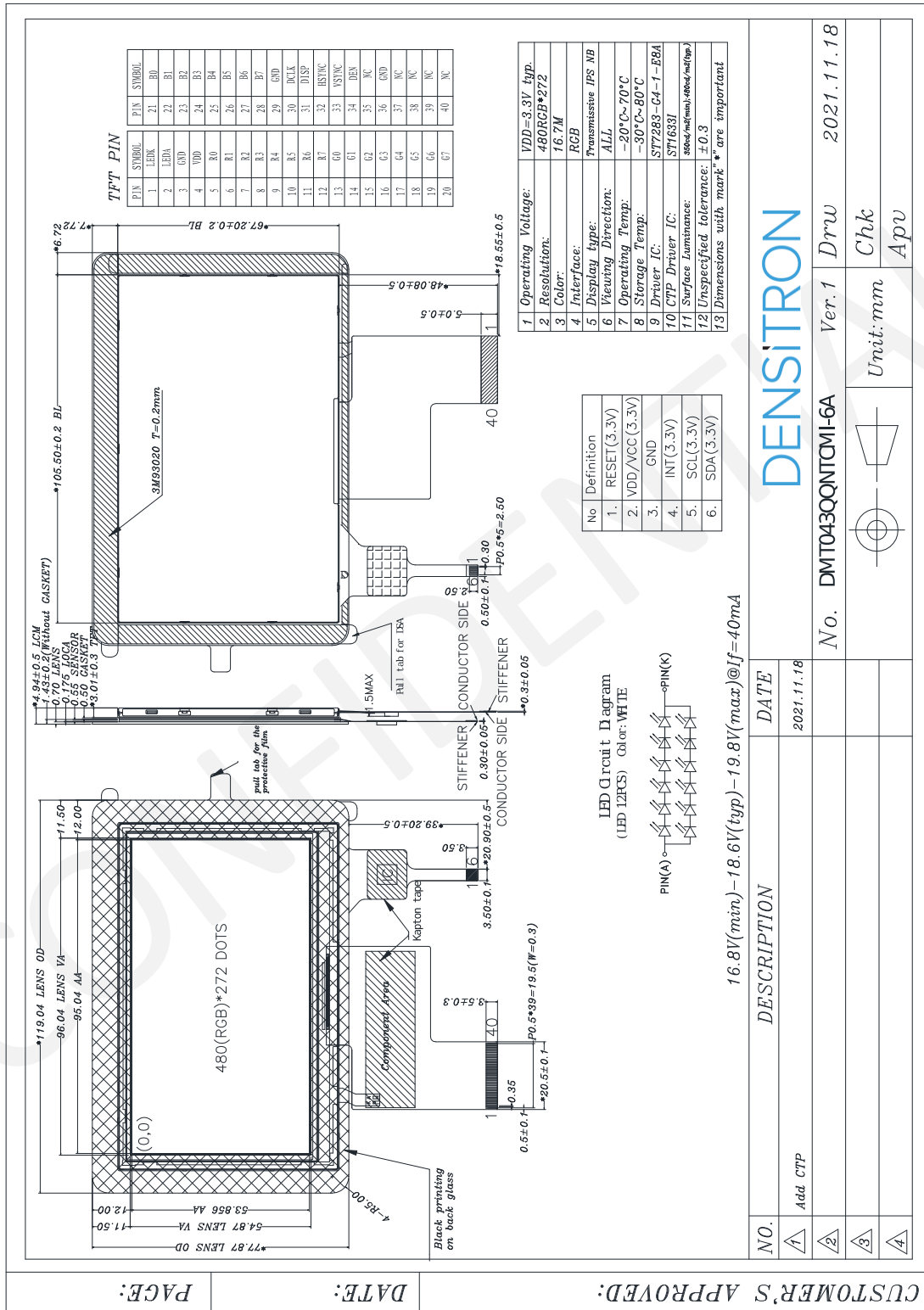
Item	Contents
CTP Technology	Mutual Capacitor
Input Method	Finger
Touch Point	5 Point
Positional Accuracy	2.5mm at 4 edges and 1.5mm at center
Cover Glass	Soda lime glass, chemically hardened
Hardness	6H
Optical Transmittance	87%
Touch Controller	ST1633i
Interface to Host	I <sup>2</sup> C
I <sup>2</sup> C Address	0X55
Connection Type	ZIF Connector

## 2. Mechanical Specification

### 2.1 Mechanical Characteristics

Item	Characteristic	Unit
Display Format	480 x RGB x 272	Dots
Overall Dimensions	119.04 (W) x 77.87 (H) x 4.94 (D)	mm
Active Area	95.04 (W) x 53.856 (H)	mm
Dot Pitch	0.198 x 0.198	mm
Weight	TBD	g
IC Controller/Driver	ST7283	

## 2.2 Mechanical Drawing





## 3. Electrical Specification

### 3.1 Absolute Maximum Ratings

AGND = GND = 0V, Ta = 25°C

Item	Symbol	Min	Max	Unit	Note
Power Voltage	VCC	-0.3	4.0	V	1
Operating Temperature	T <sub>OPR</sub>	-20	70	°C	-
Storage Temperature	T <sub>STG</sub>	-30	80	°C	-

**Note 1:** When this module is used beyond the above absolute maximum ratings, permanent breakage of the module may occur. For normal operations, it is desirable to use this module under the conditions according to Section 3.2 “Electrical Characteristics”, to avoid malfunctioning.

**Note 2:** Background colour changes slightly depending on ambient temperature. This phenomenon is reversible.

**Note 3:** Please refer to item of RELIABILITY.

### 3.2 Electrical Characteristics

#### 3.2.1 Recommended Operating Condition

AGND = GND = 0V, Ta = 25°C

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Power Voltage	VDD	-	3.0	3.3	3.6	V	-
Input Logic High Voltage	V <sub>ih</sub>	-	0.7 VDD	-	VDD	V	-
Input Logic Low Voltage	V <sub>il</sub>	-	GND	-	0.3 VDD	V	-

### 3.3 Interface Pin Assignment

#### 3.3.1 Pin Assignment

No.	Symbol	I/O	Function
1	LEDK	P	LED backlight cathode.
2	LEDA	P	LED backlight anode.
3	GND	P	Ground
4	VDD	P	Power supply for analog circuit
5	R0	I	RGB interface data input pins. 8-bit data bus display red data.
6	R1	I	
7	R2	I	
8	R3	I	
9	R4	I	
10	R5	I	
11	R6	I	
12	R7	I	
13	G0	I	RGB interface data input pins. 8-bit data bus display green data.
14	G1	I	
15	G2	I	
16	G3	I	
17	G4	I	
18	G5	I	
19	G6	I	
20	G7	I	
24	B0	I	RGB interface data input pins. 8-bit data bus display blue data.
22	B1	I	
23	B2	I	
24	B3	I	
25	B4	I	
26	B5	I	
27	B6	I	
28	B7	I	
29	GND	P	Ground
30	DCLK	I	Pixel clock input pin.

No.	Symbol	I/O	Function
31	DISP	I	DISP sets the display mode.
			DISP
			Function Description
			L Standby mode
			H Normal display mode
32	HSYNC	I	Horizontal sync input with negative polarity.
33	VSYNC	I	Vertical sync input with negative polarity.
34	DEN	I	Input data enable control. Display access is enabled when DEN is "H".
35	NC	-	No connection
36	GND	P	Ground
37	NC	-	No connection
38	NC	-	No connection
39	NC	-	No connection
40	NC	-	No connection

\*For further details, please refer to ST7283 data sheet.

### 3.3.2 CTP PIN Assignment

No.	Symbol	I/O	Function
1	RESET	I	3.3V
2	VDD/VCC	P	3.3V
3	GND	P	Ground.
4	INT	I	3.3V
5	SCL	I	3.3V
6	SDA	I	3.3V

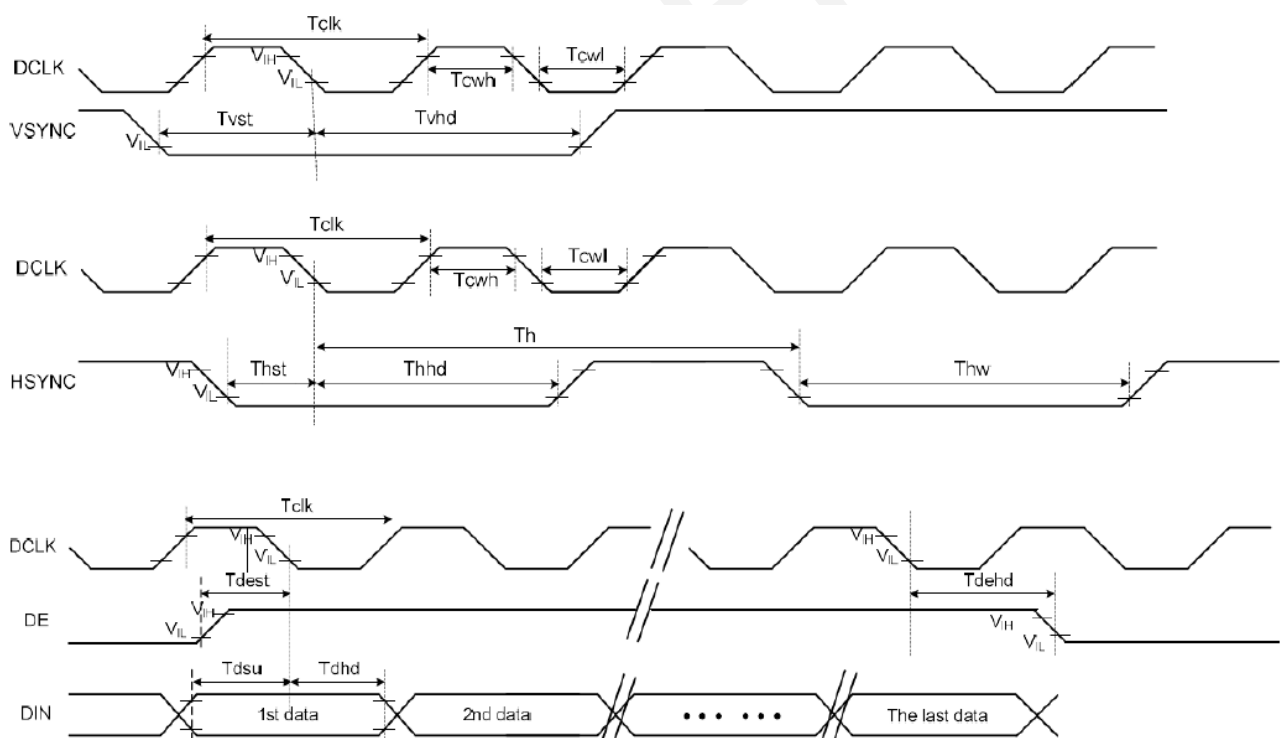
## 3.4 Timing Characteristics

### 3.4.1 AC Electrical Characteristics

#### System Operation AC Characteristics

Item	Symbol	Min	Typ.	Max	Unit	Note
VDD Power Source Slew Time	TPOR	-	-	20	ms	From 0V to 99% VDD
GRB Pulse Width	tRSTW	10	50	-	us	R=10Kohm, C=1μF
SD Output Stable Time	Tst	-	-	12	μs	Output settled within +20mV Loading = 6.8k+28.2pF
GD Output Rise and Fall Time	Tgst	-	-	6	μs	Output settled (5%~95%), Loading = 4.7k+29.8pF

#### System Bus Timing for RGB Interface



Item	Symbol	Min	Typ.	Max	Unit	Note
CLK Pulse Duty	Tcw	40	50	60	%	-
HSYNC Width	Thw	2	-	-	DCLK	-
HSYNC Period	Th	55	60	65	μs	-
VSYNC Setup Time	Tvst	12	-	-	ns	-
VSYNC Hold Time	Tvhd	12	-	-	ns	-
HSYNC Setup Time	Thst	12	-	-	ns	-
HSYNC Hold Time	Thhd	12	-	-	ns	-
Data Setup Time	Tdsu	12	-	-	ns	-
Data Hold Time	Tdhd	12	-	-	ns	-
DE Setup Time	Tdest	12	-	-	ns	-
DE Hold Time	Tdehd	12	-	-	ns	-

### 3.4.2 DC Electrical Characteristics

DC Electrical Characteristics (PVDD=VDD=VDDI= 3.3V, AGND= 0V, TA=25°C, Bare Chip)

#### Recommended Operating Range

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Supply Voltage	VDD	-	3.0	3.3	3.6	V	-
IO Supply Voltage	VDDI	-	1.65	-	3.6	V	-
Charge Pump Supply Voltage	PVDD	-	3.0	3.3	3.6	V	-

#### DC Characteristics for Digital Circuit

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Logic-High Input Voltage	Vih	-	0.7VDDI	-	VDDI	V	-
Logic-Low Input Voltage	Vil	-	DGND	-	0.3VDDI	V	-
Logic-High Output Voltage	Voh	-	VDDI-0.4	-	VDDI	V	-
Logic-Low Output Voltage	Vol	-	DGND	-	DGND+0.4	V	-

#### DC Characteristics for Analog Circuit

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Positive High-Voltage Power	VGH	-	13	15	16.5	V	No Load@ FR=60Hz
Negative High-Voltage Power	VGL	-	-7	-10	-11	V	
Output Voltage Deviation	Vod	-	-	±35	±45	mV	
Standby Current	Isc	-	-	-	50	μA	
Operation Current	Ioc	-	-	20	-	mA	

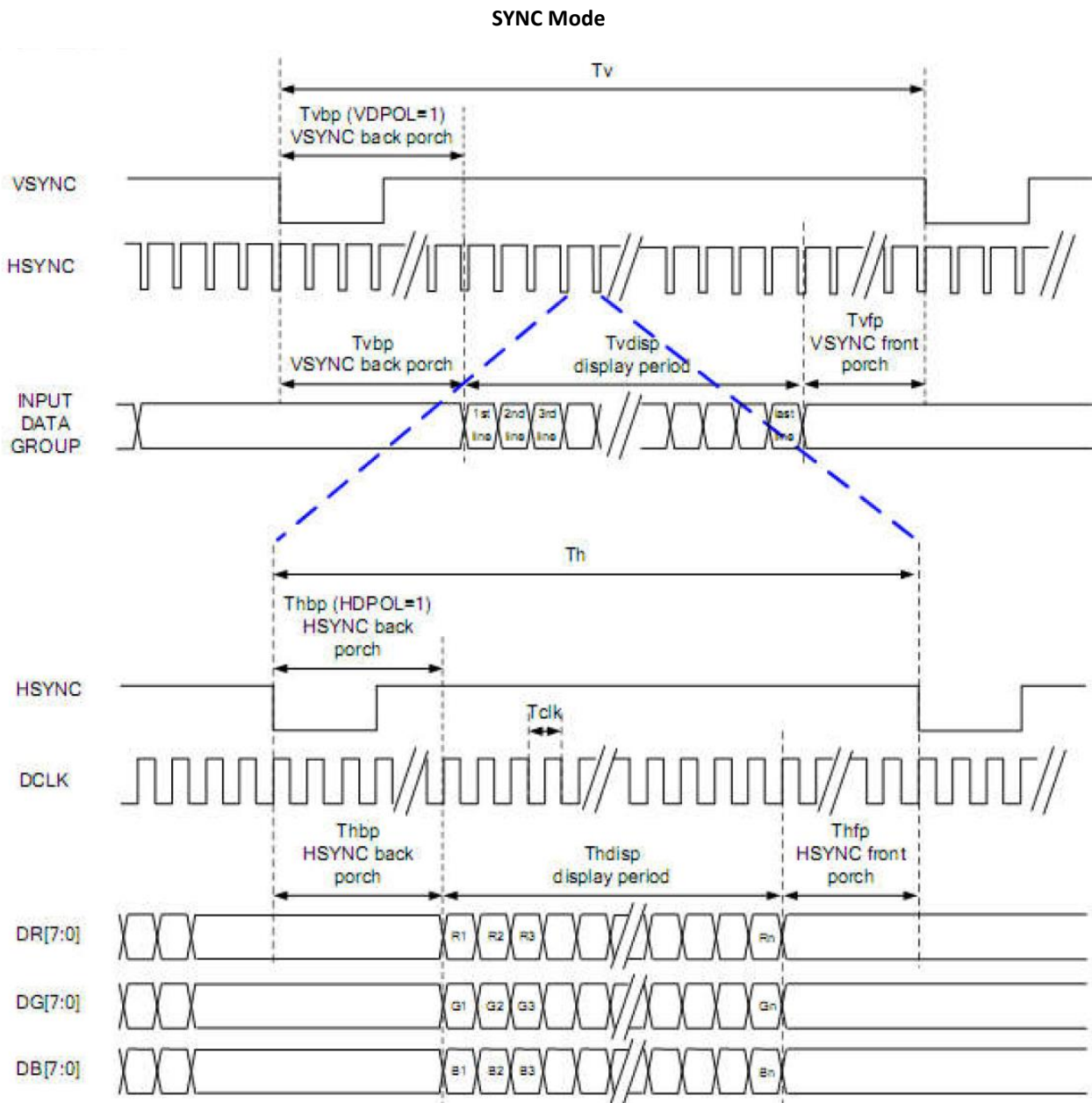
### 3.4.3 Timing

#### Parallel 24-bit RGB Timing Table

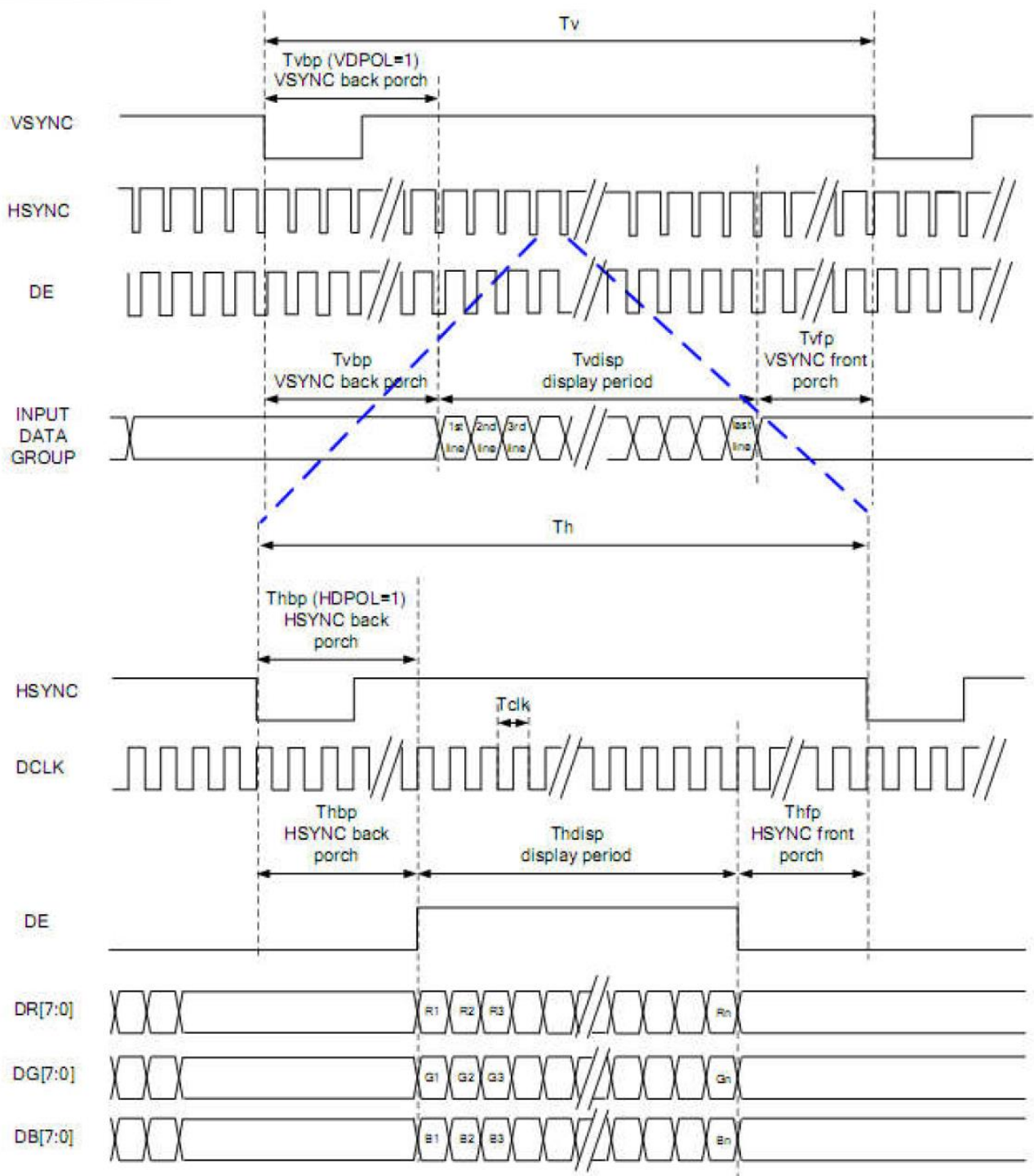
Parallel 24-bit RGB Input Timing (PVDD=VDD=VDDI=3.3V, AGND=0V, TA=25°C)

480RGB x 272 Resolution Timing Table							
Item		Symbol	Min	Typ.	Max	Unit	Remark
DCLK Frequency		Fclk	8	9	12	MHz	-
DCLK Period		Tclk	83	111	125	ns	-
HSYNC	Period Time	Th	485	531	598	DCLK	-
	Display Period	Thdisp	-	480	-	DCLK	-
	Back Porch	Thbp	3	43	43	DCLK	By H_BLANKING setting
	Front Porch	Thfp	2	8	75	DCLK	-
	Pulse Width	Thw	2	4	43	DCLK	-
VSYNC	Period Time	Tv	276	292	321	HSYNC	-
	Display Period	Tvdisp	-	272	-	HSYNC	-
	Back Porch	Tvbp	2	12	12	HSYNC	By V_BLANKING setting
	Front Porch	Tvfp	2	8	37	HSYNC	-
	Pulse Width	Tvw	2	4	12	HSYNC	-

**Note:** It is necessary to keep Tvbp=12 and Thbp=43 in sync mode. DE mode is unnecessary to keep it.

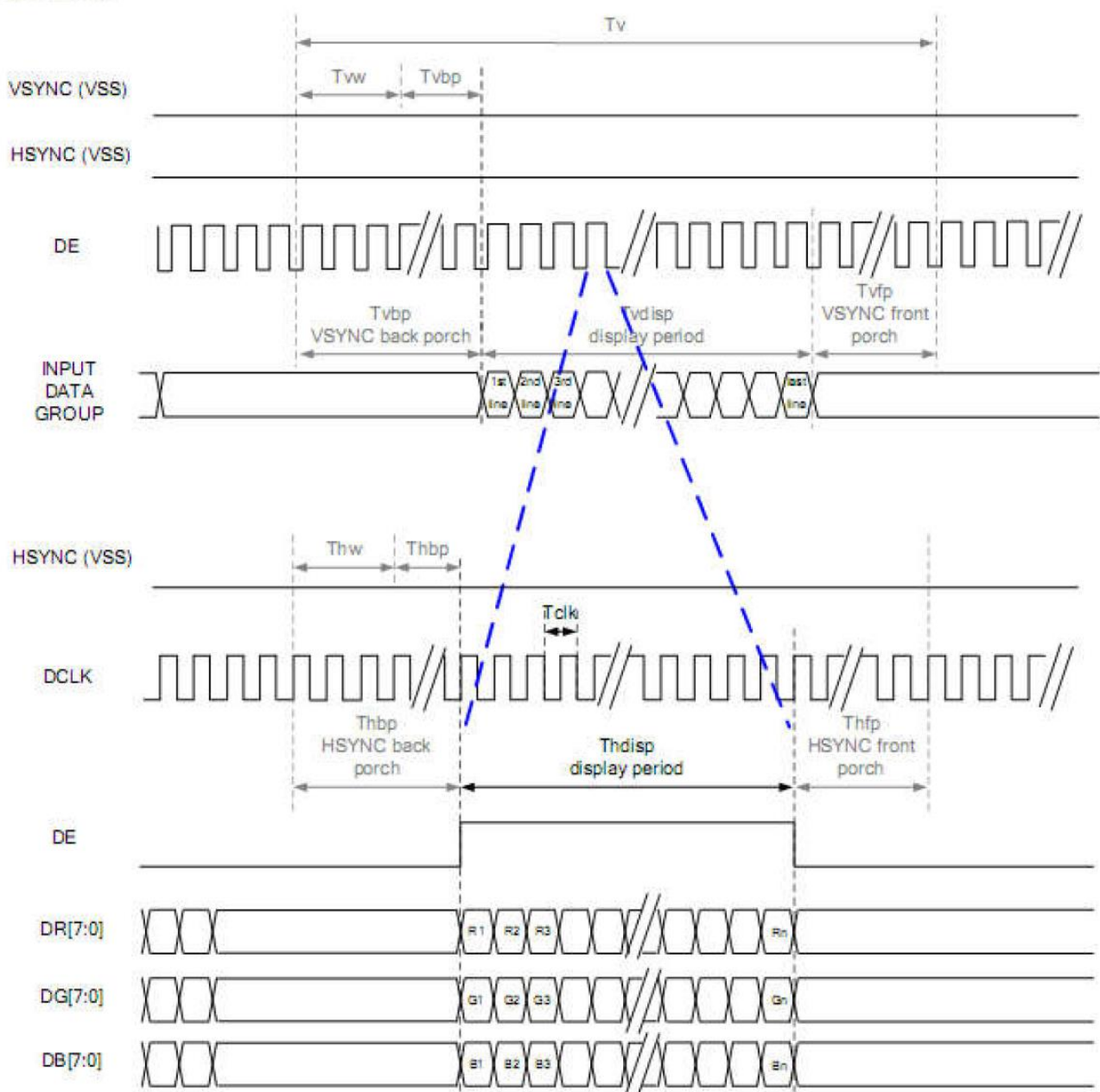


SYNC-DE Mode





DE Mode

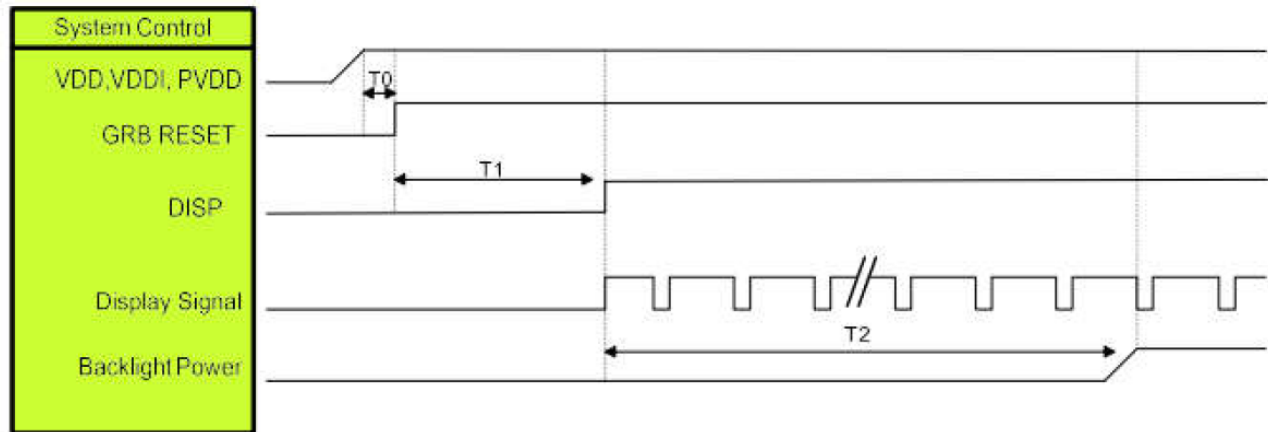


RGB Mode Selection Table	DCLK	HSYNC	VSYNC	DE
SYNC-DE Mode	Input	Input	Input	Input
SYNC Mode	Input	Input	Input	GND
DE Mode	Input	GND	GND	Input

**Note:** "Input" means these signals are driven by host side.

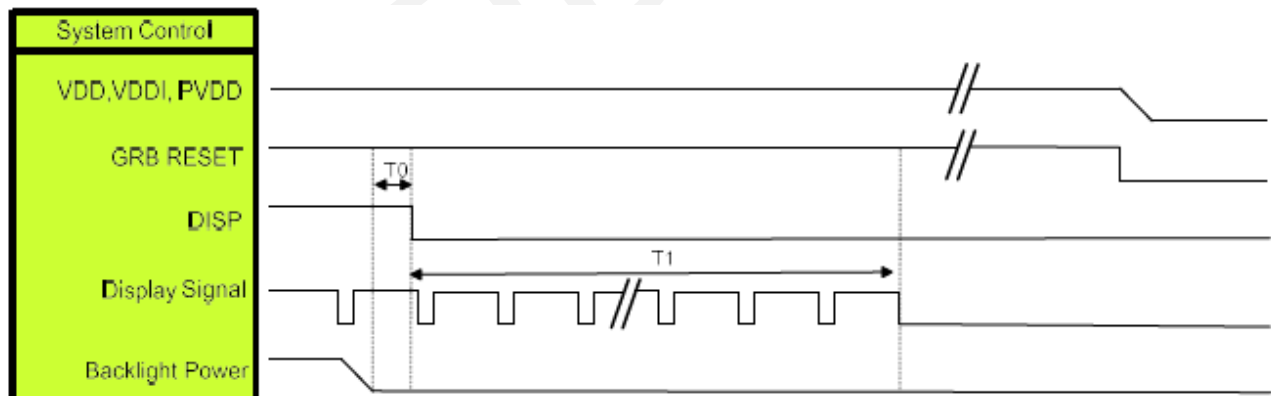
### 3.4.4 Power ON/OFF Sequence

#### Power On Sequence



Symbol	Description	Min	Unit
T0	System power stability to GRB RESET signal	0	ms
T1	GRB RESET= "High" to DISP= "High"	10	ms
T2	Display Signal output to Backlight Power on	250	ms

#### Power Off Sequence



Symbol	Description	Min	Unit
T0	Backlight Power off to DISP = "Low"	5	ms
T1	DISP = "Low" to IC internal voltage discharge complete	80	ms

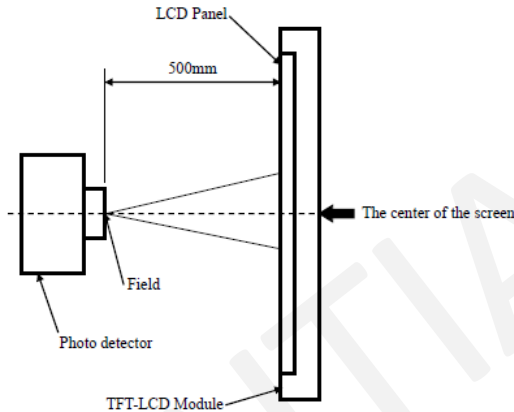
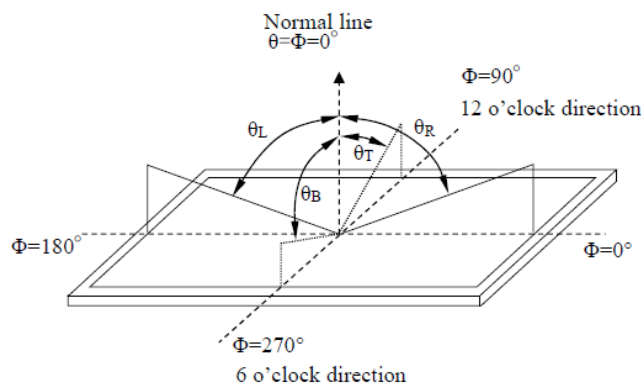
## 4. Optical Specification

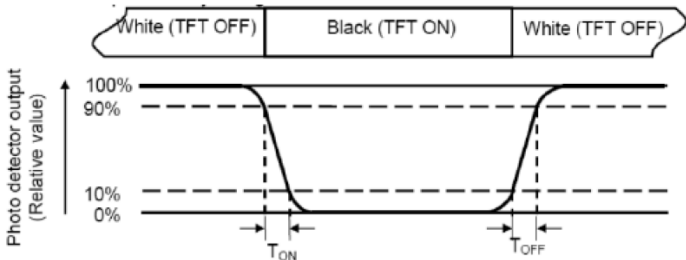
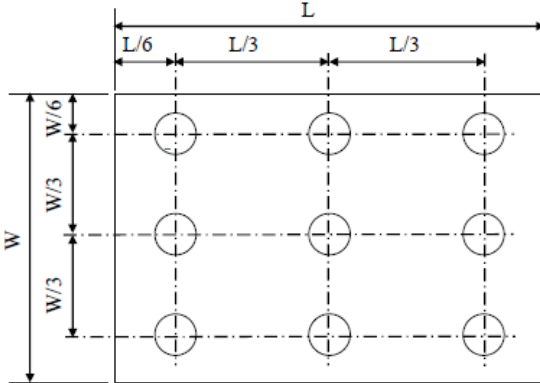
### 4.1 Optical Characteristics

Characteristics		Symbol	Conditions	Min	Typ.	Max	Unit	Note
Contrast Ratio		CR	$\theta = 0^{\circ}$	800	1000	-	-	1, 3
Response time		TR + TF	25°C	-	30	35	ms	1, 4
Viewing Angle	Left	$\theta_{x-}$	CR≥10	80	85	-	Degree	2
	Right	$\theta_{x+}$		80	85	-		
	Up	$\theta_{y+}$		80	85	-		
	Down	$\theta_{y-}$		80	85	-		
Colour Chromaticity	Red	Rx	$\theta = 0^{\circ}$	(0.563)	(0.603)	(0.643)	-	1, 5
		Ry		(0.267)	(0.307)	(0.347)		
	Green	Gx		(0.274)	(0.314)	(0.354)		
		Gy		(0.517)	(0.557)	(0.597)		
	Blue	Bx		(0.105)	(0.145)	(0.185)		
		By		(0.113)	(0.153)	(0.193)		
	White	Wx		(0.265)	(0.305)	(0.345)		
		Wy		(0.296)	(0.336)	(0.376)		
Uniformity		U	-	75	-	-	%	5
Luminance		L	I <sub>F</sub> = 40mA	350	480	-	cd/m <sup>2</sup>	1, 5

Test Conditions:

1.  $I_F = 40\text{ mA}$  (Backlight current),  $V_{DD} = 3.3\text{ V}$ , the ambient temperature is 25°C.
2. The test systems refer to Note 2.

Note	Item	Test method														
1	Definition of Optical Measurement System	<p>The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. ALL input terminals LCD panel must be ground when measuring the center area of the panel.</p>  <table border="1"> <thead> <tr> <th>Item</th><th>Photo detector</th><th>Field</th></tr> </thead> <tbody> <tr> <td>Contrast Ratio</td><td rowspan="3">CS1000</td><td rowspan="3">1°</td></tr> <tr> <td>Luminance</td></tr> <tr> <td>Lum Uniformity</td></tr> <tr> <td>Chromaticity</td><td>CS1000</td><td>-</td></tr> <tr> <td>Response Time</td><td>DMS703</td><td>-</td></tr> </tbody> </table>	Item	Photo detector	Field	Contrast Ratio	CS1000	1°	Luminance	Lum Uniformity	Chromaticity	CS1000	-	Response Time	DMS703	-
Item	Photo detector	Field														
Contrast Ratio	CS1000	1°														
Luminance																
Lum Uniformity																
Chromaticity	CS1000	-														
Response Time	DMS703	-														
2	Definition of Viewing Angle Range and Measurement System	<p>Viewing angle is measured at the center point of the LCD by CONOSCOPE (DMS703)</p> 														
3	Definition of Contrast Ratio (CR)	<p>Contrast ratio(CR)= <math>\frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}</math></p>														

Note	Item	Test method
		<p>“White state”: The state is that the LCD should drive by Vwhite.</p> <p>“Black state”: The state is that the LCD should drive by Vblack.</p> <p>Vwhite: To be determined</p> <p>Vblack: To be determined</p>
4	Definition of Response Time ( $T_R$ , $T_F$ )	<p>The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (<math>T_{ON}</math>) is the time between photo detector output intensity changed from 90% to 10%. And fall time (<math>T_{OFF}</math>) is the time between photo detector output intensity changed from 10% to 90%.</p> 
5	Definition of Color Chromaticity (CIE1931)	<p>Color coordinates measured at center point of LCD.</p> <p>Color coordinates are subject to actual measurement.</p> <p>If the data has a bracket, that means reference value of TFT panel or one sample of module, the values of module TBD.</p>
6	Definition of Luminance Uniformity	<p>Active area is divided into 9 measuring areas. Every measuring point is placed at the center of each measuring area.</p> <p>Luminance Uniformity (<math>U</math>) = <math>L_{min}/L_{max}</math></p> <p>L-----Active area length W-----Active area width</p>  <p>L max: The measured Maximum luminance of all measurement position.</p> <p>L min: The measured Minimum luminance of all measurement position.</p>

## 5. LED Backlight Specification

### 5.1 LED Backlight Characteristics

Ta = 25°C

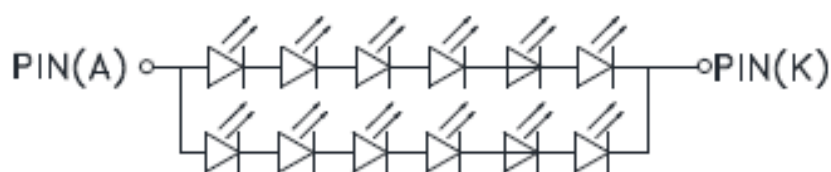
Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Forward Voltage	Vf	-	16.8	18.6	19.8	V	-
Forward Current	If	-	-	40	-	mA	-
Operating Lifetime	-	-	30000	-	-	Hours	-

**Note 1:** Ta means ambient temperature of TFT-LCD module.

**Note 2:** If the module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

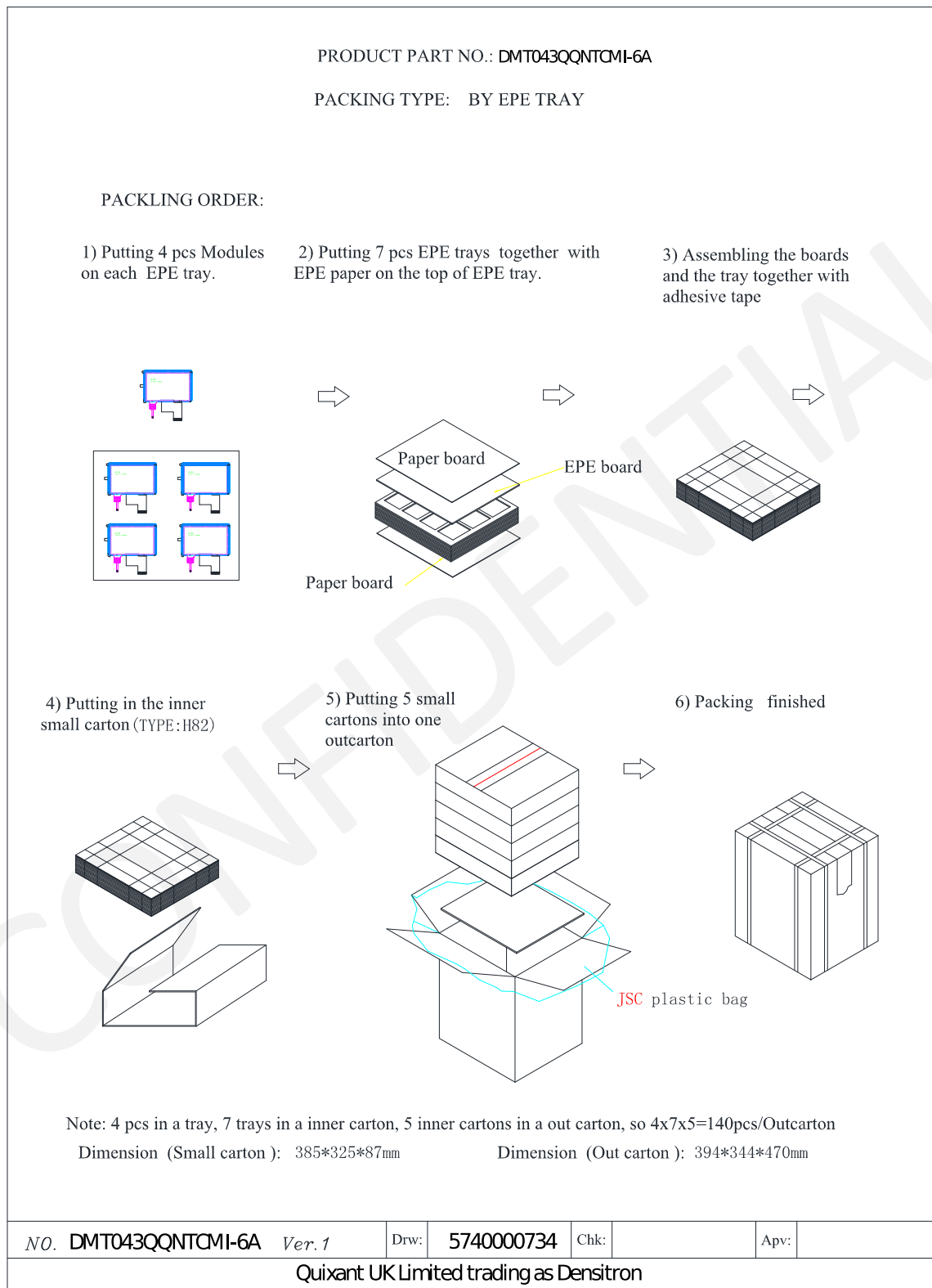
**Note 3:** Operating life means brightness goes down to 50% initial brightness. Minimum operating lifetime is estimated data.

### 5.2 INTERNAL CIRCUIT DIAGRAM



LED Circuit Diagram  
(LED 12 PCS) Color: WHITE

## 6. Packaging



## 7. Quality Assurance Specification

### 7.1 Conformity

The performance, function and reliability of the shipped products conform to the Product Specification.

### 7.2 Environment Required

Customer's test & measurement are required to be conducted under the following conditions:

Temperature:	$25 \pm 5^{\circ}\text{C}$
Humidity:	$65\% \pm 5\% \text{ RH}$
Illumination:	under 40W fluorescent light
Viewing distance:	$35 \pm 5\text{cm}$

Finger glove (or finger cover) must be worn by the inspector.

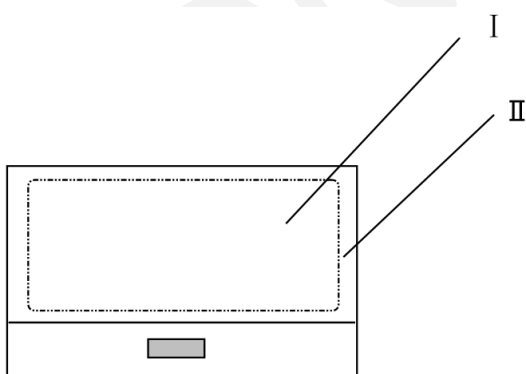
Inspection table or jig must be anti-electrostatic.

### 7.3 Delivery Assurance

#### 7.3.1 Delivery Inspection Standards

Class II, Normal Inspection, MIL-STD-105E

#### 7.3.2 Zone Definition



I area: viewing area

II area: outside viewing area



### 7.3.3 Criteria & Acceptable Quality Level

Partition	AQL	Definition
Major (MA)	0.65	1. Liquid crystal leakage 2. Wrong polarizer 3. Outside dimension 4. Bright dot, dark dot 5. Display abnormal 6. Class crack
Minor (MI)	1.0	1. Spot defect (including black spot, white spot, pinhole, foreign particle, bubbles, hurt) 2. Fragment 3. Line defect (including black line, white line, scratch) 4. Incision defect 5. Newton's ring 6. Other visual defects

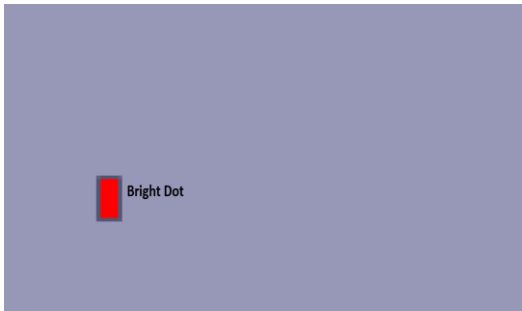
### 7.3.4 Packing Inspection

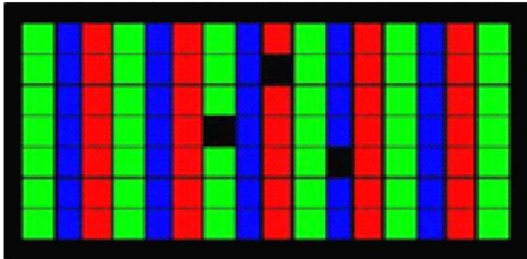
Standard of appearance test for I area: (unit: mm)

Note: Defect ignore for II area.

### 7.3.5 Criteria & Classification

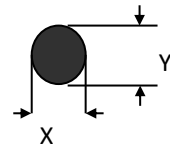
Bright/Dark Dots explain

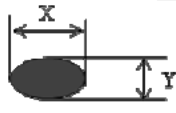
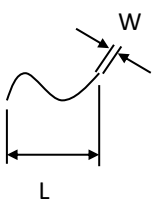
Item	Description	Definition
Bright Dot	Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern. 	The definition of dot: The size of a defective dot over 1/2 of single pixel dot is regarded as one defective dot.  <b>Note:</b> One pixel consists of 3 sub-pixels, including R, G, and B dot. (Sub-pixel = Dot)
Dark Dot	Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.	

Item	Description	Definition
		
Adjacent Dot	Adjacent two sub-pixel are defect (define two dot defect)	

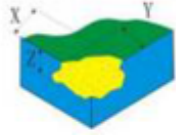
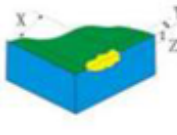
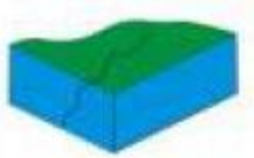
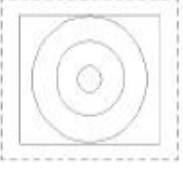

### Inspection standard

Units: mm

Class	Item	Criteria
Major	Bright / Dark Dot	1) $LCD \leq 4.3''$ Bright Dot: $N \leq 2$ Dark Dot: $N \leq 3$ Total: $N \leq 4$
		2) $4.3'' < LCD < 7''$ Bright Dot: $N \leq 3$ Dark Dot: $N \leq 4$ Total: $N \leq 6$
		3) $7'' \leq LCD \leq 12''$ Bright Dot: $N \leq 4$ Dark Dot: $N \leq 5$ Total: $N \leq 8$
		4) $LCD > 12''$ Bright Dot: $N \leq 5$ Dark dot: $N \leq 6$ Total: $N \leq 10$
		The distance between the two defect dots shall be greater than 5mm The distance between two defect dots above 7 inches shall be more than 10mm
		Note: Adjacent dot defect $N \leq 0$
Minor	Spot Defects (black and white spot, pinhole,	Round type: as per following drawing, $\varnothing = (X+Y)/2$ 
		1) $LCD \leq 4.3''$

Class	Item	Criteria	
	foreign matter, dent, backlight foreign matter)	$\Phi \leq 0.15$	Ignore
		$0.15 < \Phi \leq 0.30$	$N \leq 3$
		$0.3 < \Phi$	$N = 0$
		2) $4.3" < \text{LCD} < 7"$	
		$\Phi \leq 0.2$	Ignore
		$0.2 < \Phi \leq 0.5$	$N \leq 4$
		$0.5 < \Phi$	$N = 0$
		3) $7" \leq \text{LCD} \leq 12"$	
		$\Phi \leq 0.2$	Ignore
		$0.2 < \Phi \leq 0.5$	$N \leq 5$
		$0.5 < \Phi$	$N = 0$
		4) $\text{LCD} > 12"$	
		$\Phi \leq 0.2$	Ignore
		$0.2 < \Phi \leq 0.5$	$N \leq 6$
		$0.5 < \Phi$	$N = 0$
	Bubble	Bubble:  $D = (X + Y) / 2$	
		$\text{LCD} \leq 4.3"$	
		$\Phi \leq 0.2$	Ignore
		$0.2 < \Phi \leq 0.50$	$N \leq 3$
		$0.5 < \Phi$	$N = 0$
Minor	Line Defects (black and white line, backlight foreign matter etc.)	Line type: as per following drawing 	
		1) $\text{LCD} \leq 4.3"$	
		$W \leq 0.03$	Ignore
		$0.03 < W \leq 0.06$	$L \leq 5$ $N \leq 3$
		$0.06 < W$	$L > 5$ $N = 0$
		2) $4.3" < \text{LCD} < 7"$	
		$W \leq 0.03$	Ignore

Class	Item	Criteria		
		$0.03 < W \leq 0.1$	$L \leq 5$	$N \leq 4$
		$0.1 < W$	$L > 5$	$N = 0$
		1) $7'' \leq LCD \leq 12''$		
		$W \leq 0.03$	Ignore	
		$0.03 < W \leq 0.1$	$L \leq 5$	$N \leq 5$
		$0.1 < W$	$L > 5$	$N = 0$
		2) $LCD > 12''$		
		$W \leq 0.03$	Ignore	
		$0.03 < W \leq 0.1$	$L \leq 5$	$N \leq 6$
		$0.1 < W$	$L > 5$	$N = 0$
Minor	Scratch	1) $LCD \leq 4.3''$		
		$W \leq 0.03$	Ignore	
		$0.03 < W \leq 0.2$	$1.0 < L \leq 5.0$	$N \leq 3$
		$0.2 < W$	$L > 5$	$N = 0$
		2) $4.3'' < LCD < 7''$		
		$W \leq 0.03$	Ignore	
		$0.03 < W \leq 0.2$	$1.0 < L \leq 5.0$	$N \leq 4$
		$0.2 < W$	$L > 5$	$N = 0$
		3) $7'' \leq LCD \leq 12''$		
		$W \leq 0.03$	ignore	
		$0.03 < W \leq 0.2$	$1.0 < L \leq 5.0$	$N \leq 5$
		$0.2 < W$	$L > 5$	$N = 0$
		4) $LCD > 12''$		
		$W \leq 0.03$	Ignore	
		$0.03 < W \leq 0.2$	$1.0 < L \leq 5.0$	$N \leq 6$
		$0.2 < W$	$L > 5$	$N = 0$
Major	Display Abnormal	Not allowed		
Major	Outside Dimension	Accord with drawing		
Major	Glass Crack	Not allowed		
Major	Leak	Not allowed		

Class	Item	Criteria
Minor	Corner and Side Fragment	<div> <div> <p>Corner Fragment</p>  </div> <div> <p>Side Fragment</p>  </div> </div> <p>1. Corner fragment:  <math>X, Y \leq 1\text{mm}</math> <math>Z \leq T/2</math> allowed</p> <p>2. Side fragment:  <math>X \leq 2.0\text{mm}</math> <math>Y \leq 1\text{mm}</math> <math>Z \leq T/2</math> allowed</p>
Major	Crack	 <p>NG</p>
Minor	Newton's Ring (CTP or Cover Board)	<div>   </div> <p>Newton's ring <math>&lt; 1/9</math> area, after lightened, no influence on words and lines.</p>

## Touch Panel Inspection Standard

Class	Item	Phenomenon/Picture	Criteria	
Minor	Outside Dimension	-	Accord with Drawing	
Minor	Color Deviation	Difference of Ink Color	Obvious Deviation Compared with Samples	
Minor	Ink Pinhole		No any holes near VA side 3mm Out of VA: $D \leq 0.15\text{mm}$ $N \leq 1$ , no present in reflection condition.	
Minor	Ink Saw Tooth		$W \leq 0.15\text{mm}$ $N = 1$	
Minor	Ink Light Leakage		Width of light leakage at the edge area $\leq 0.15\text{mm}$	OK
			width of light leakage at the edge area $> 0.15\text{mm}$	NG
Minor	Cover Glass Profile	-	No ink, adhesive, oil stain, etc.	
Minor	IR (LED) dot/black-white dot		$\varphi \leq 0.2$	$N \leq 1$
			$0.15 < \varphi$	not allowed
Minor	IR (LED) dot black-white dot/different color		no present when use all viewing angle to determine at 35cm	allowed
Minor	Shooting Hole		$\varphi \leq 0.2$ 、 $N \leq 1$ $0.15 < \varphi$	not allowed
Minor	LOGO/ICON black-white dot		Diagram clear $\varphi \leq 0.2$ 、 $N \leq 1$	

Minor	FPC warped		OK	
Major	FPC broken, stained, oxidation		NG	
Minor	Stain	-	No evident fingerprint, oil print, gelatinoids, etc.	
Minor	Sponge	-	Presented in AA area	NG
Minor	Protection Foil	Finished Protection Foil	Protection foil Stain: In normal inspection condition, fingerprint, pen print and gelatinoids are presented.	NG
			Bubble≤5.0mm, or according to client's limited sample	
			Protection foil worn and warped	NG
			Scratch	
			W≤0.10mm	ignore
			0.10mm<W≤0.20mm	
			L≤30mm N≤4 d>15mm	OK
			L>30mm W>0.20mm	NG

## 7.4 Dealing with Customer Complaints

### 7.4.1 Non-conforming Analysis

Purchaser should supply Densitron with detailed data of non-conforming sample.

After accepting it, Densitron should complete the analysis in two weeks from receiving the sample.

If the analysis cannot be completed on time, Densitron must inform the purchaser.

### 7.4.2 Handling of Non-conforming Displays

If any non-conforming displays are found during customer acceptance inspection which Densitron is clearly responsible for, return them to Densitron.

Both Densitron and customer should analyse the reason and discuss the handling of non-conforming displays when the reason is not clear.

Equally, both sides should discuss and come to agreement for issues pertaining to modification of Densitron quality assurance standard.



## 8. Reliability Specification

### 8.1 Reliability Tests

Test Item	Test Condition	Evaluation and assessment
High Temperature Operation	70 ± 2°C, 240 hrs	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1. Air bubble in the LCD; 2. Sealleak; 3. Non-display; 4. missing segments; 5. Glass crack; 6. Current Idd is twice higher than initial value.
Low Temperature Operation	-20 ± 2°C, 240 hrs	
High Temperature Storage	80 ± 2°C, 240 hrs	
Low Temperature Storage	-30 ± 2°C, 240 hrs	
Temperature Cycle	-30°C ~ 25°C ~ 80°C × 10 cycles (30min.) (5min.) (30min.)	
Damp Proof Test	40°C ± 5°C × 90%RH, 240 hrs	
Vibration Test	Frequency : 10Hz~55Hz~10Hz Amplitude : 1.5mm, X · Y · Z direction for total 3hours (Packing condition)	
Dropping Test	Drop to the ground from 1m height, one time, every side of carton. (Packing condition)	
ESD test	Voltage: ±8KV R: 330Ω C: 150pF Air discharge, 10 time	
	Voltage: ±6KV R: 330Ω C: 150pF Contact discharge, 10 time	

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 judge as a good part.
5. Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.
6. Please use automatic switch menu (or roll menu) testing mode when test operating mode.

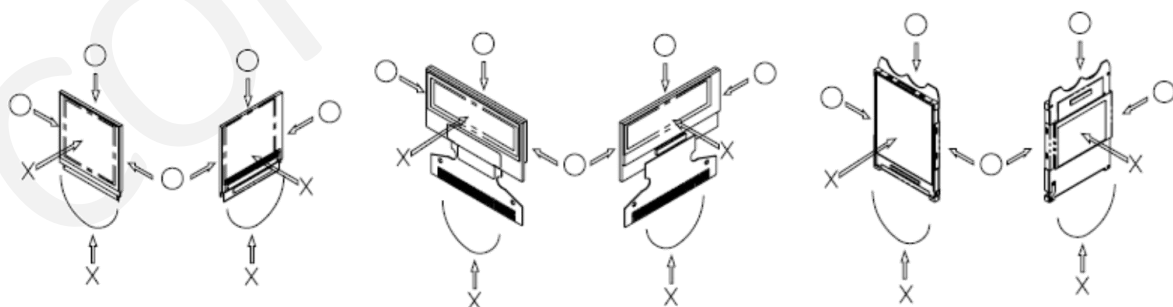
#### 8.1.1 Inspection Check Standard

After the completion of the described reliability test, the samples are to be left at room temperature for 4 hrs prior to conducting the inspection check at 25±5 °C, 65±5% RH.

## 9. Handling Precautions

### 9.1 Handling Precautions

- 1) Since the display panel is being made of glass, do not apply mechanical impacts such as dropping from a high position.
- 2) If the display panel is broken by some accident and the internal organic substance leaks out, be careful not to inhale nor lick the organic substance.
- 3) If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water
- 4) If pressure is applied to the display surface or its neighbourhood of the display module, the cell structure may be damaged and be careful not to apply pressure to these sections.
- 5) The polarizer covering the surface of the display module is soft and easily scratched. Please be careful when handling the display module.
- 6) When the surface of the polarizer of the display module has soil, clean the surface. It takes advantage of by using following adhesion tape.
  - a. Scotch Mending Tape No. 810 or an equivalent
  - b. Never try to breathe upon the soiled surface nor wipe the surface using cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy.
  - c. Also, pay attention that the following liquid and solvent may spoil the polarizer:
    - Water
    - Ketone
    - Aromatic Solvents
- 7) Hold the display module very carefully when placing it into the system housing. Do not apply excessive stress or pressure to display module. And, do not over bend the film with electrode pattern layouts. These stresses will



influence the display performance. Also, secure sufficient rigidity for the outer cases.

- 8) Do not apply stress to the LSI chips and the surrounding molded sections.
- 9) Do not disassemble nor modify the display module.
- 10) Do not apply input signals while the logic power is off.
- 11) Pay sufficient attention to the working environments when handing display modules to prevent occurrence of element breakage accidents by static electricity.

- a. Be sure to make human body grounding when handling display modules.
  - b. Be sure to ground tools to use or assembly such as soldering irons.
  - c. To suppress generation of static electricity, avoid carrying out assembly work under dry environments.
  - d. Protective film is being applied to the surface of the display panel of the display module. Be careful since static electricity may be generated when exfoliating the protective film.
- 12) Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. If the display module has been stored for a long period of time, residue adhesive material of the protection film may remain on the surface of the display panel after removed of the film. In such case, remove the residue material by the method introduced in the above Section 5).
- 13) If electric current is applied when the display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful to avoid the above.

## 9.2 Storage Precautions

- 1) When storing display modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps, etc. and, also, avoiding high temperature and high humidity environments or low temperature (less than 0°C) environments. (We recommend you to store these modules in the packaged state when they were shipped from Densitron) At that time, be careful not to let water drops adhere to the packages or bags nor let dewing occur with them.
- 2) If electric current is applied when water drops are adhering to the surface of the display module, when the display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful about the above.

## 9.3 Designing Precautions

- 1) The absolute maximum ratings are the ratings which cannot be exceeded for display module, and if these values are exceeded, panel damage may be happen.
- 2) To prevent occurrence of malfunctioning by noise, pay attention to satisfy the VIL and VIH specifications and, at the same time, to make the signal line cable as short as possible.
- 3) We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit (VDD). (Recommend value: 0.5A)
- 4) Pay sufficient attention to avoid occurrence of mutual noise interference with the neighbouring devices.
- 5) As for EMI, take necessary measures on the equipment side basically.
- 6) When fastening the display module, fasten the external plastic housing section.
- 7) If power supply to the display module is forcibly shut down by such errors as taking out the main battery while the display panel is in operation, we cannot guarantee the quality of this display module.

## 9.4 Operation Precautions

- 1) It is indispensable to drive the display within the specified voltage limit since excessive voltage shortens its life.
- 2) Direct current causes an electrochemical reaction with remarkable deterioration of the display quality. Give careful consideration to prevent direct current during ON/OFF timing and during operation.
- 3) Response time is extremely delayed at temperatures lower than the operating temperature range while, at high temperatures, displays become dark. However, this phenomenon is reversible and does not mean a malfunction or a display that has been permanently damaged.
- 4) To protect display modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the display modules.
  - a. Pins and electrodes
  - b. Pattern layouts such as the FPC
- 5) When the driver is being exposed (COG), semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if the driver is exposed to light, malfunctioning may occur.
  - a. Design the product and installation method so that the driver may be shielded from light in actual usage.
  - b. Design the product and installation method so that the driver may be shielded from light during the inspection processes.
- 6) Although the display module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may be changed. It therefore is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.
- 7) We recommend you to construct its software to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.

## 9.5 Other Precautions

- 1) Request the qualified companies to handle industrial wastes when disposing of the display modules. Or, when burning them, be sure to observe the environmental and hygienic laws and regulations.