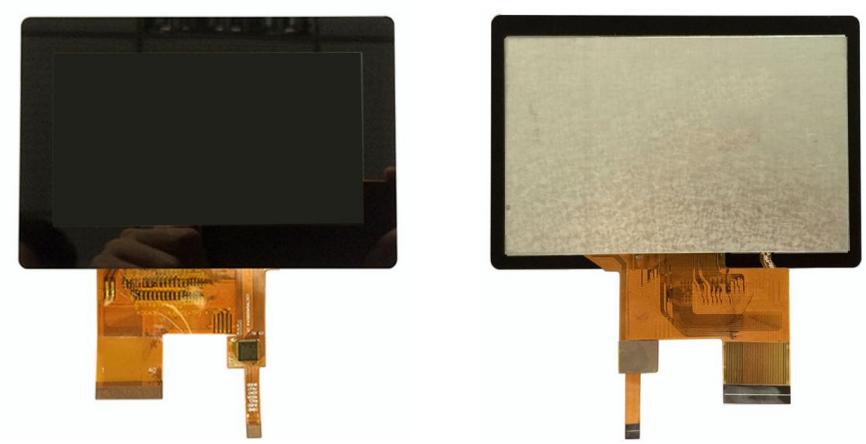
DMT043QQHTCMI-1C

PRODUCT SPECIFICATION

Version 0.1
May 23, 2023



Customer's Approval	
Signature	*Date*

Prepared by *Joyce Huang*
Approved by *Eric Wan*

Revision History

VERSION	DATE	DESCRIPTION	AUTHOR
0.1	May 23, 2023	Preliminary	Joyce Huang

Legal Notice

Table of Contents

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 and all-round view. 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 65K/262K/16.7M colours.

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	65K/262K/16.7M
Overall Dimensions	115.4 (W) x 79.15 (H) x 4.8 (D) mm
Active Area	95.04 (W) x 53.86 (H) mm
Mode	Normally Black / Transmissive / IPS
Surface Treatment	Anti-Glare (3H)
Viewing Direction	All round
Interface	24/8 bit RGB
Driver IC	SC7283
Backlight Type	LED, White, 10 chips
Operating Temperature	-30°C ~ +85°C
Storage Temperature	-40°C ~ +90°C
ROHS	Compliant to RoHS 2.0

1.3 CTP Features

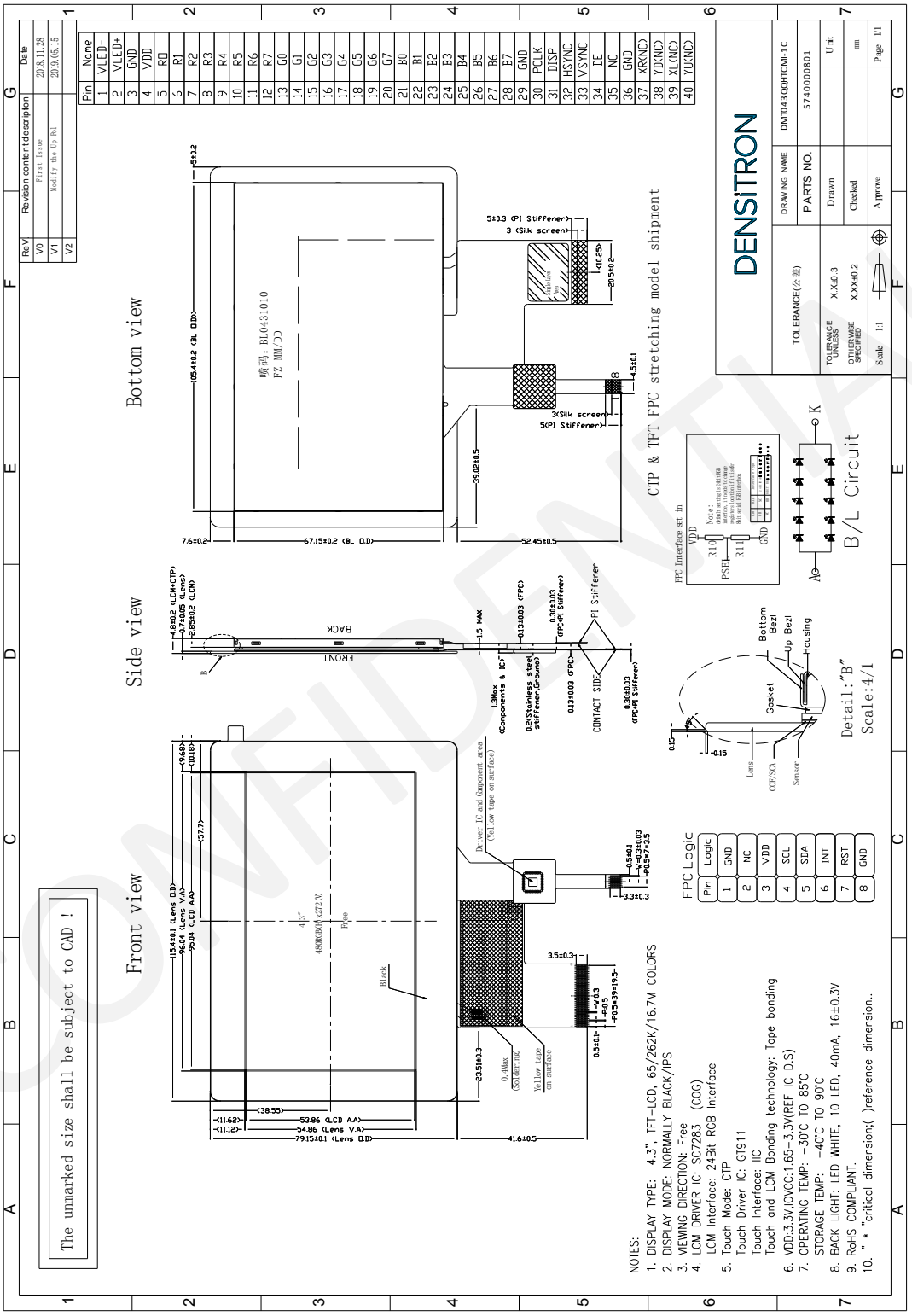
Item	Contents
Structure	G+G
Touch Interface	I2C
Slave Address	0x5D(7bit) or 0x14(7bit)
Touch Driver IC	GT911
Touch Mode	Five points and Gestures
Bonding Type	Tape Bonding

2. Mechanical Specification

2.1 Mechanical Characteristics

Item	Characteristic	Unit
Display Format	480 x RGB x 272	Dots
Overall Dimensions	115.4 (W) x 79.15 (H) x 4.8 (D)	mm
Active Area	95.04 (W) x 53.86 (H)	mm
Dot Pitch	0.198 (W) x 0.198 (H)	mm
Weight	TBD	g
IC Controller/Driver	SC7283	

2.2 Mechanical Drawing



3. Electrical Specification

3.1 Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Note
Digital Supply Voltage	VDD	-0.3	4.6	V	1
Operating Temperature	T_{OP}	-30	+85	°C	-
Storage Temperature	T_{ST}	-40	+90	°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

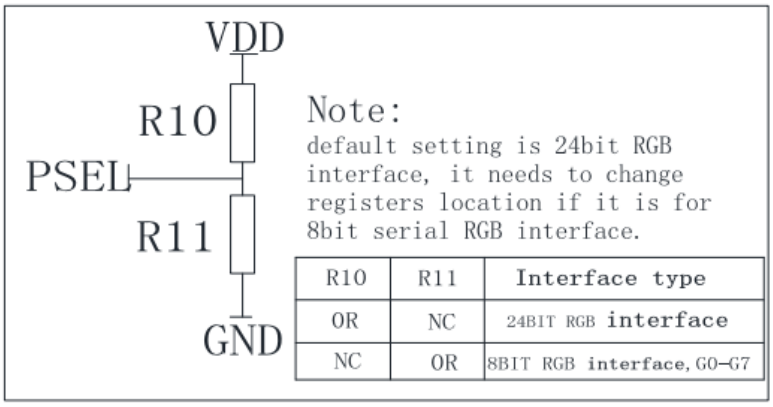
Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Digital Supply Voltage	VDD	-	3.0	3.3	3.6	V	-
Normal Mode Current	IDD	-	-	23	-	mA	-
Level Input Voltage	V_{IH}	-	0.7VDD	-	-	VDD	-
	V_{IL}	-	GND	-	0.3VDD	V	-
Level Output Voltage	V_{OH}	-	VDD-0.4	-	-	V	-
	V_{OL}	-	GND	-	GND+0.4	V	-

3.3 Interface Pin Assignment

3.3.1 TFT Pin Assignment

No.	Symbol	I/O	Function
1	LEDK	P	Cathode pin of backlight
2	LEDA	P	Anode pin of backlight
3	GND	P	Ground
4	VDD	P	Supply voltage (3.3V).
5-12	R0-R7	I	8-bit digital Red data input
13-20	G0-G7	I	8-bit digital Green data input. Serial 8-bit RGB interface and input through DG[7:0].
21-28	B0-B7	I	8-bit digital Blue data input
29	GND	P	Ground
30	PCLK	I	Clock signal; latching data at the falling edge
31	DISP	I	Display control / standby mode selection. DISP = “Low” : Standby; (Default) DISP = “High” : Normal display
32	HSYNC	I	Horizontal sync signal; negative polarity
33	VSYNC	I	Vertical sync signal; negative polarity
34	DE	I	Data input enable. Active High to enable the data input When not used in SYNC mode, user should connect it to “Low”.
35	NC	-	-
36	GND	P	Ground
37	XR (NC)	A/D	Touch panel Right Glass Terminal
38	YD (NC)	A/D	Touch panel Bottom Film Terminal
39	XL (NC)	A/D	Touch panel Left Glass Terminal
40	YU (NC)	A/D	Touch panel Top Film Terminal

FPC Interface set in

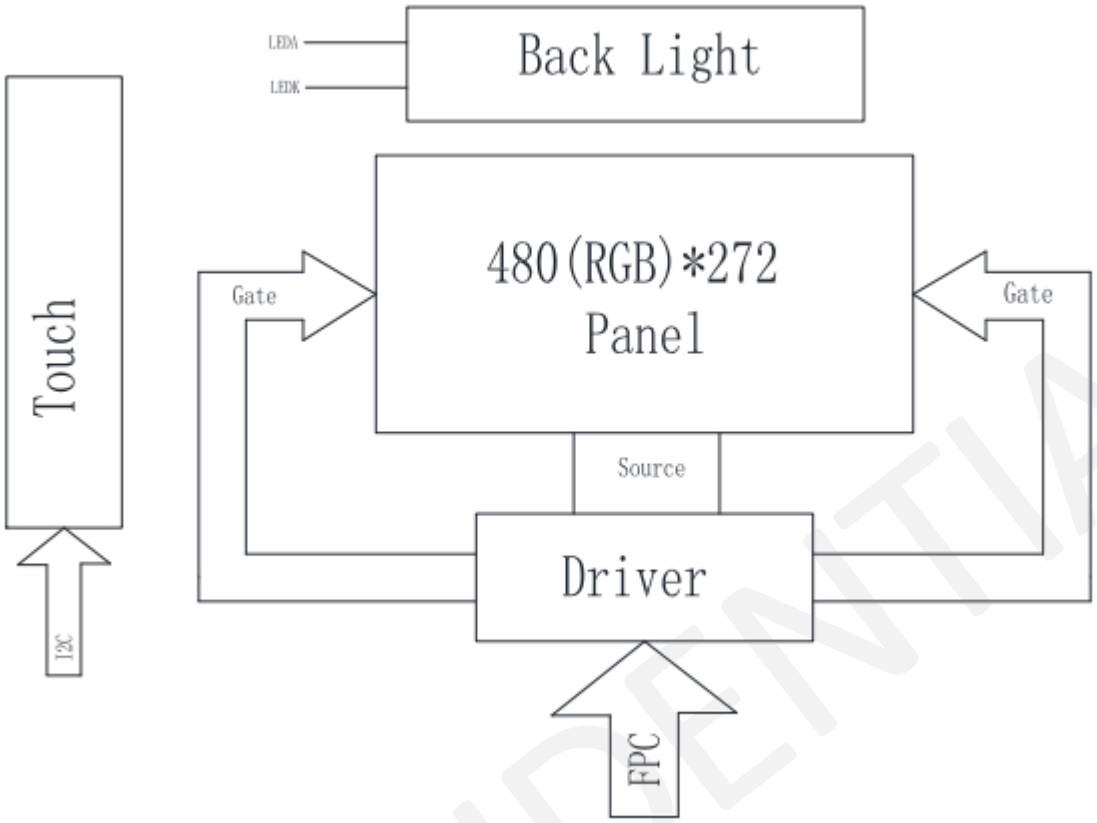


R10	R11	Interface type
OR	NC	24BIT RGB interface
NC	OR	8BIT RGB interface, G0-G7

3.3.2 CTP Pin Assignment

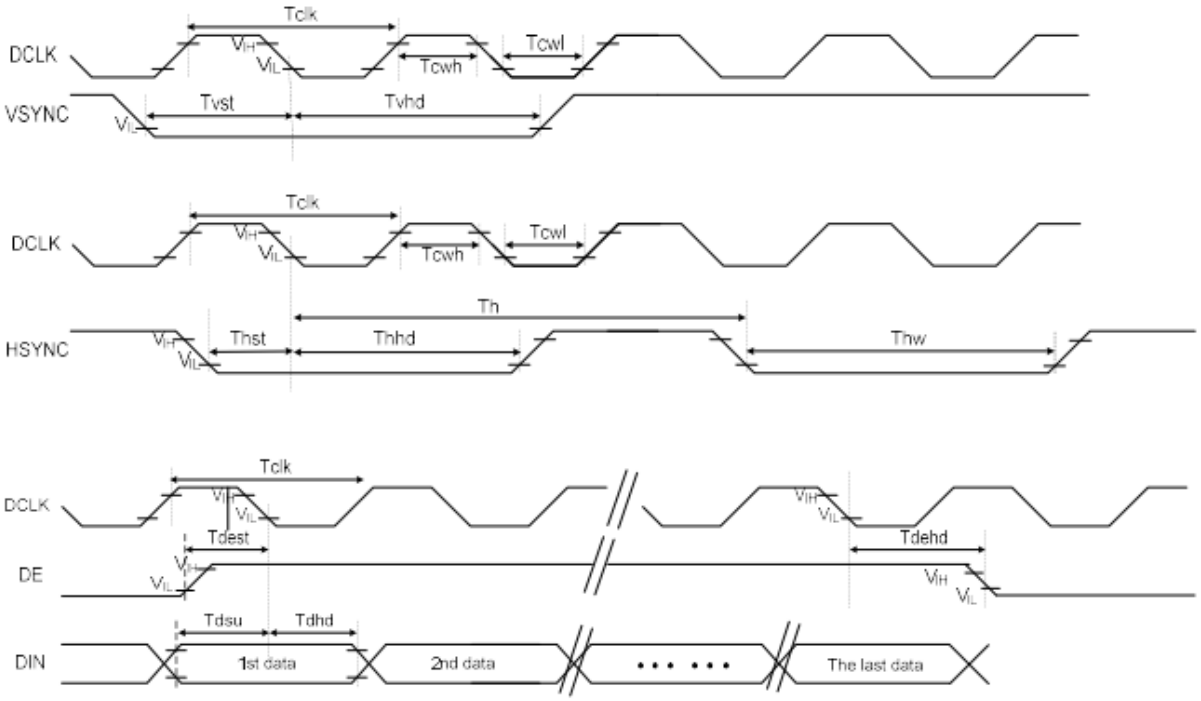
No.	Symbol	I/O	Function
1	GND	P	Ground
2	NC	-	No connection
3	VDD	P	Supply voltage
4	SCL	I	I2C clock input
5	SDA	I	I2C data input and output
6	INT	I	External interrupt to the host
7	RST	I	External Reset, Low is active
8	GND	P	Ground

3.4 Block Diagram



3.5 Timing Characteristics

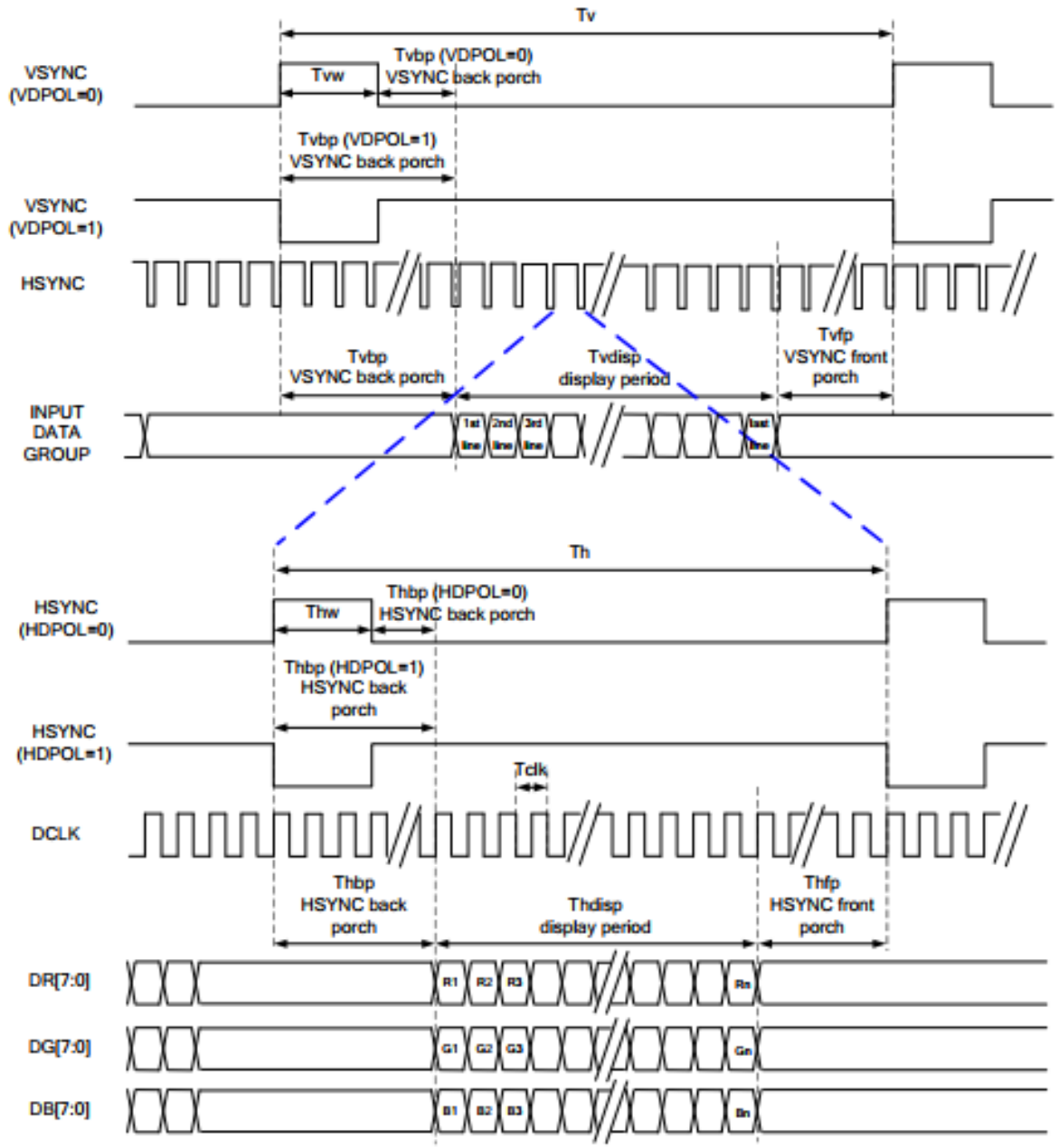
3.5.1 System Bus Timing for RGB Interface



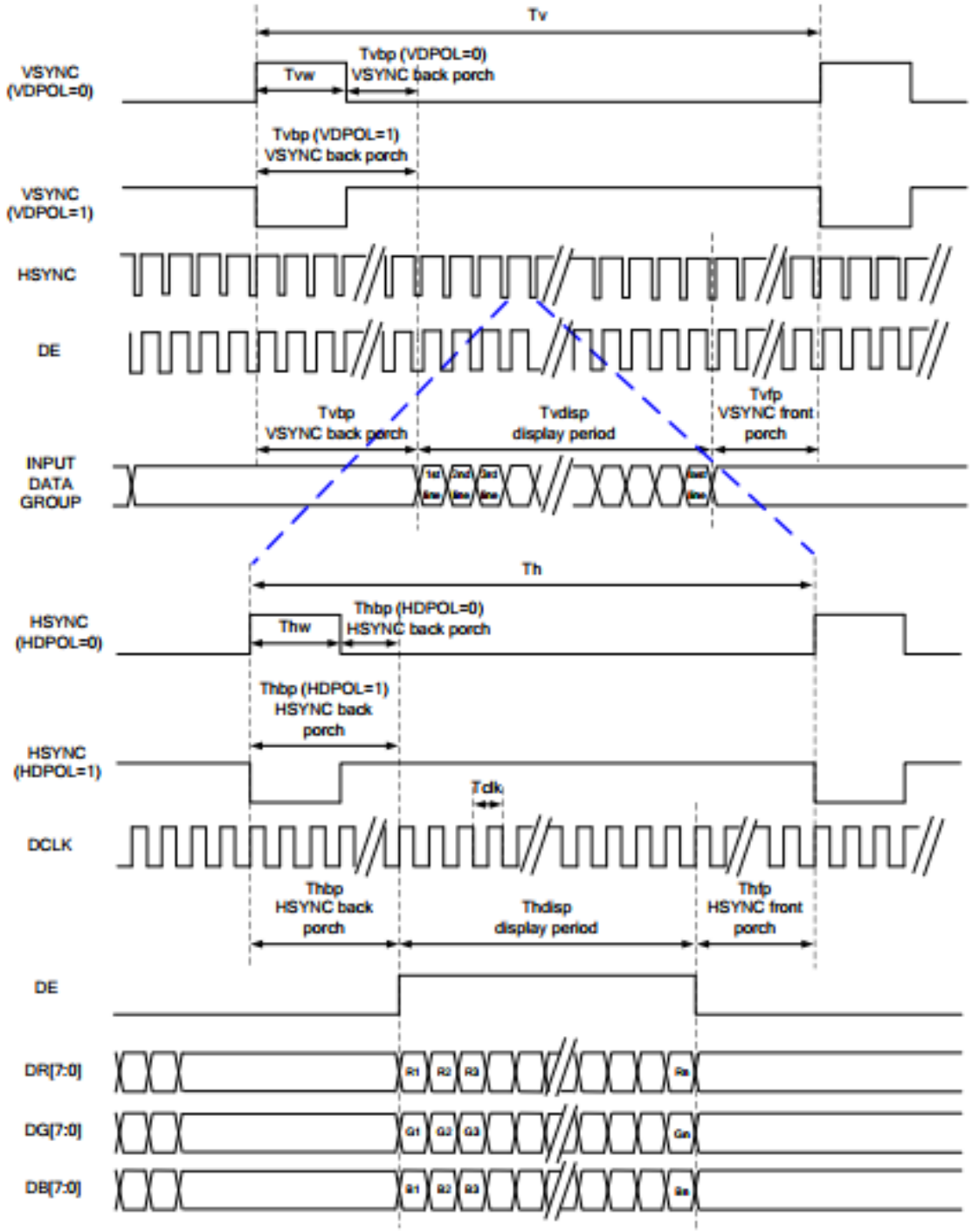
Item	Symbol	Min	Typ.	Max	Unit
CLK Pulse Duty	Tcw	40	50	60	%
HSYNC Width	Thw	2	-	-	DCLK
HSYNC Period	Th	55	60	65	us
VSYNC Setup Time	Tvst	12	-	-	ns
VSYNC Hold Time	Tvhd	12	-	-	ns
HSYNC Setup Time	Thst	12	-	-	ns
HSYNC Hold Time	Thhd	12	-	-	ns
Data Setup Time	Tdsu	12	-	-	ns
Data Hold Time	Tdhd	12	-	-	ns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

3.5.2 RGB Interface

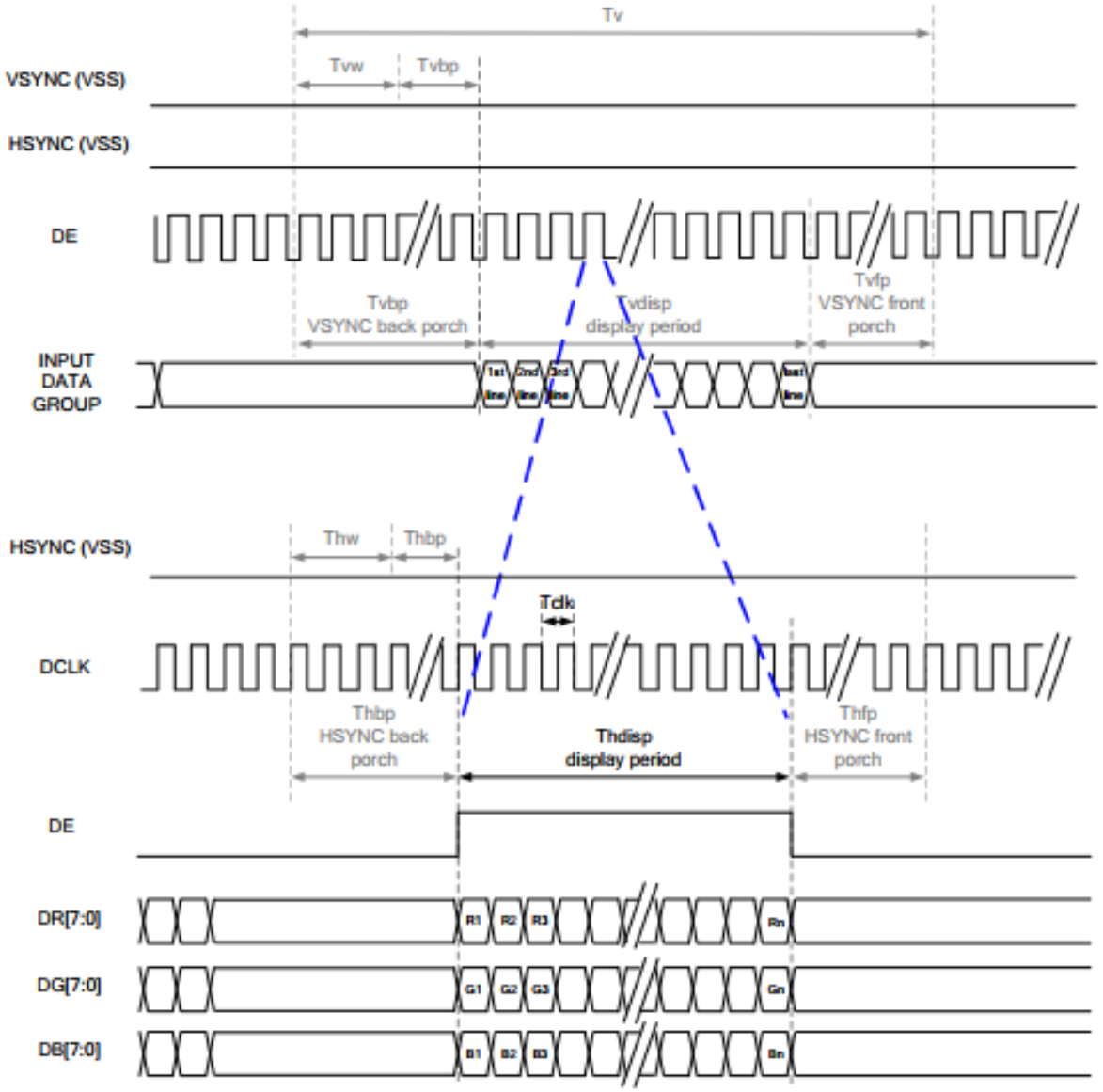
3.5.2.1 SYNC Mode



3.5.2.2 SYNC-DE Mode



3.5.2.3 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

3.5.3 RGB Input Timing Table

3.5.3.1 Parallel 24-bit RGB Timing Table

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

Item		Symbol	Min	Typ.	Max	Unit	Condition
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.

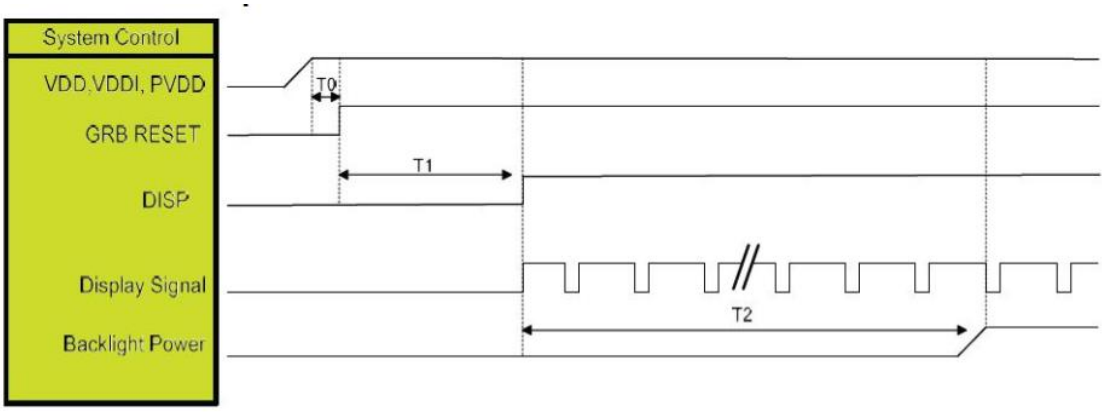
3.5.3.2 Series 8-bit RGB Timing Table

Serial 8-bit RGB Input Timing (PVDD=VDD=VDDI= 3.3V, AGND= 0V, TA=25℃)

Item		Symbol	Min	Typ.	Max	Unit	Condition
DCLK Frequency		Fclk	24	27	30	MHz	-
DCLK Period		Tclk	33	37	42	ns	-
HSYNC	Period Time	Th	1445	1491	1558	DCLK	-
	Display Period	Thdisp	-	1440	-	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	-

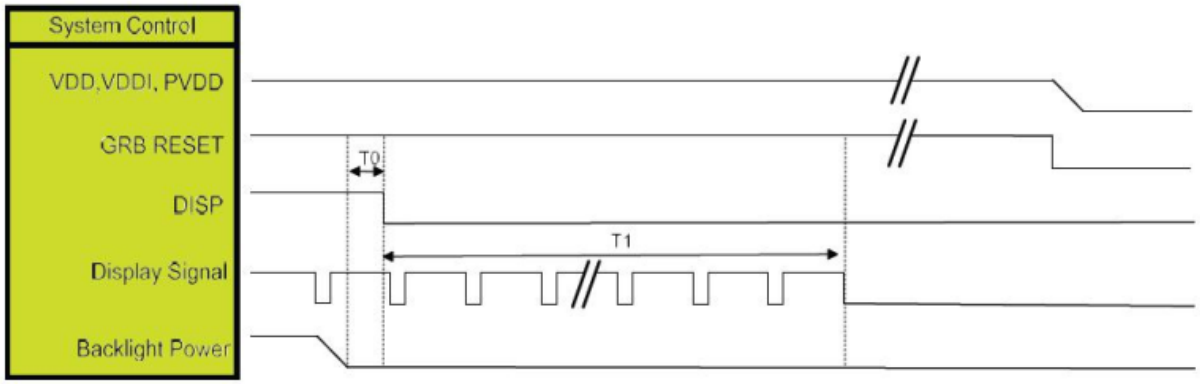
3.5.4 Power On/Off Sequence

3.5.4.1 Power On Sequence



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

3.5.4.2 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. Electrical Specification Touch

4.1 Electrical Characteristics

4.1.1 Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Note
Power Supply Voltage	VDD	2.66	3.47	V	-
Operating Temperature	T_{OP}	-30	+85	℃	-
Storage Temperature	T_{ST}	-40	+90	℃	-

4.1.2 DC Electrical Characteristics (Ta=25℃)

(Ambient temperature: 25℃, VDD=2.8V, VDDIO=1.8V or VDDIO=VDD)

Item	Min	Typ.	Max	Unit	Note
Power Supply Voltage/VDD	2.66	3.3	3.47	V	-
Normal mode operating current	-	8	14.5	mA	-
Green mode operating current	-	3.3	-	mA	-
Sleep mode operating current	70	-	120	uA	-
Doze mode operating current	-	0.78	-	mA	-
Digital Input low voltage/VIL	-0.3	-	0.25*VDD	V	-
Digital Input high voltage/VIH	0.75*VDD	-	VDD+0.3	V	-
Digital Output low voltage/VOL	-	-	0.15*VDD	V	-
Digital Output high voltage/VOH	0.85*VDD	-	-	V	-

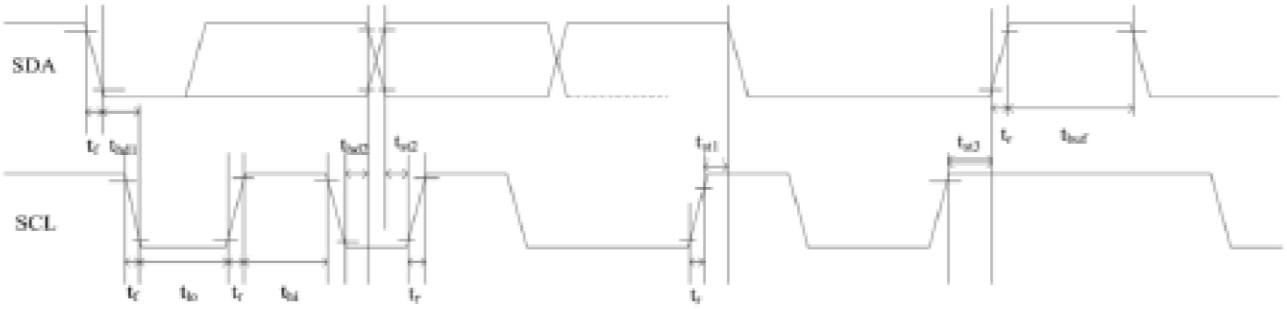
4.1.3 AC Characteristics

(Ambient temperature:25℃, AVDD=2.8V, VDDIO=1.8V)

Item	Min	Typ.	Max	Unit	Note
OSC oscillation frequency	59	60	61	MHZ	-
I/O output rise time, low to high	-	14	-	ns	-
I/O output rfall time, high to low	-	14	-	ns	-

4.1.4 I²C Timing

GT911 provides a standard I2C interface for SCL and SDA to communicate with the host. GT911 always serves as slave device in the system with all communication being initialized by the host. It is strongly recommended that transmission rate be kept at or below 400Kbps. The I2C timing is shown below:



Test Condition 1: 1.8V host interface voltage, 400Kbps transmission rate, 2K pull-up resistor.

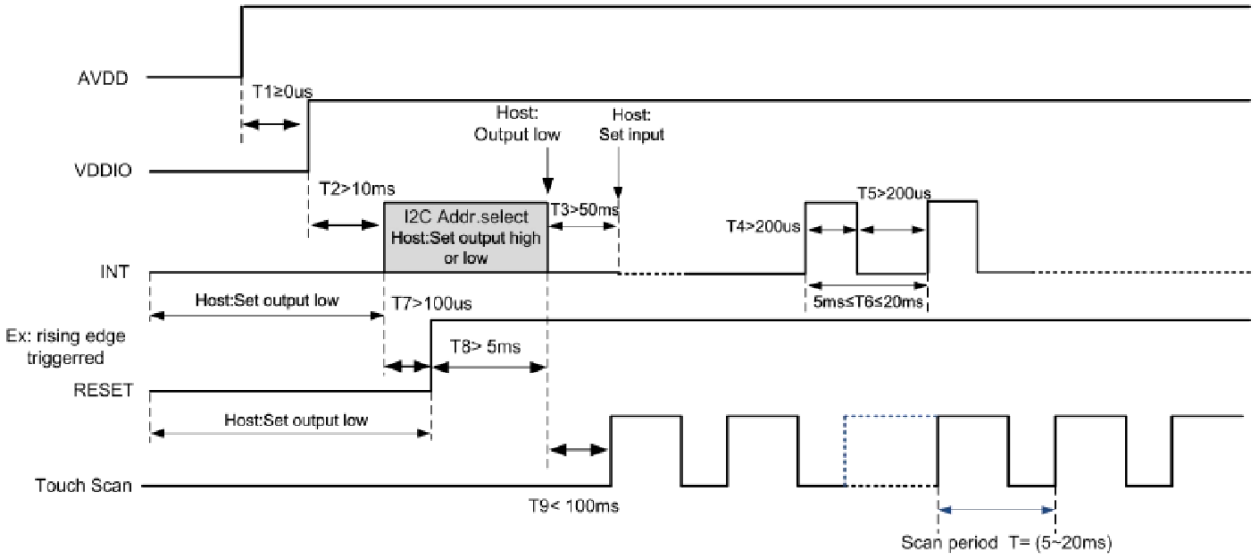
Item	Symbol	Min	Typ.	Max	Unit
SCL Low Period	tlo	1.3	-	-	us
SCL High Period	thi	0.6	-	-	us
SCL Setup Time for Start Condition	tst1	0.6	-	-	us
SCL Setup Time for Stop Condition	tst3	0.6	-	-	us
SCL Hold Time for Start Condition	thd1	0.6	-	-	us
SDA Setup Time	tst2	0.1	-	-	us
SDA Hold Time	thd2	0	-	-	us

Test Condition 2: 3.3V host interface voltage, 400Kbps transmission rate, 2K pull-up resistor.

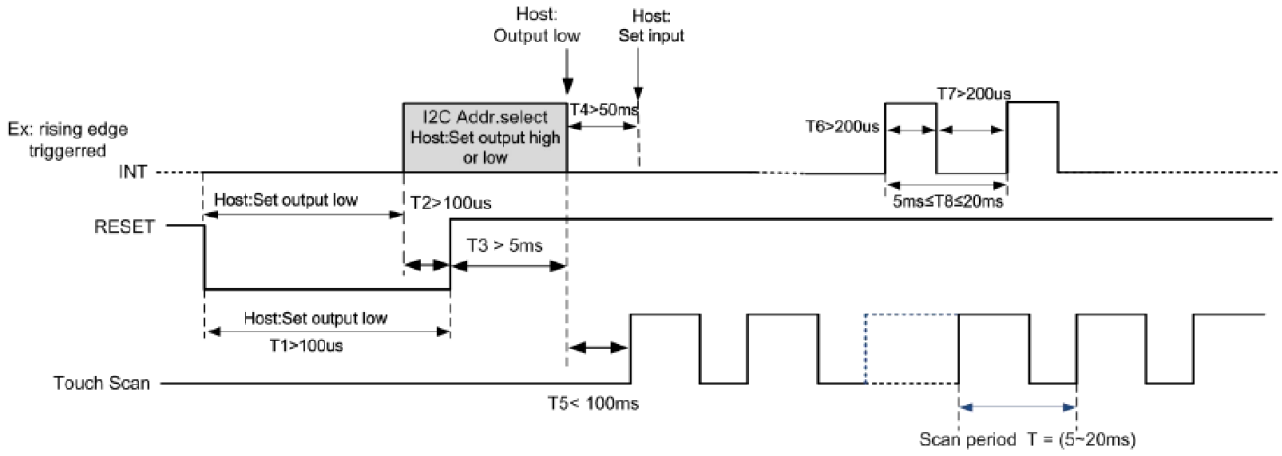
Item	Symbol	Min	Typ.	Max	Unit
SCL Low Period	tlo	1.3	-	-	us
SCL High Period	thi	0.6	-	-	us
SCL Setup Time for Start Condition	tst1	0.6	-	-	us
SCL Setup Time for Stop Condition	tst3	0.6	-	-	us
SCL Hold Time for Start Condition	thd1	0.6	-	-	us
SDA Setup Time	tst2	0.1	-	-	us
SDA Hold Time	thd2	0	-	-	us

GT911 supports two I^2C slave addresses: 0xBA/0xBB and 0x28/0x29. The host can select the address by changing the status of Reset and INT pins during the power-on initialization phase. See the diagram below for configuration methods and timings:

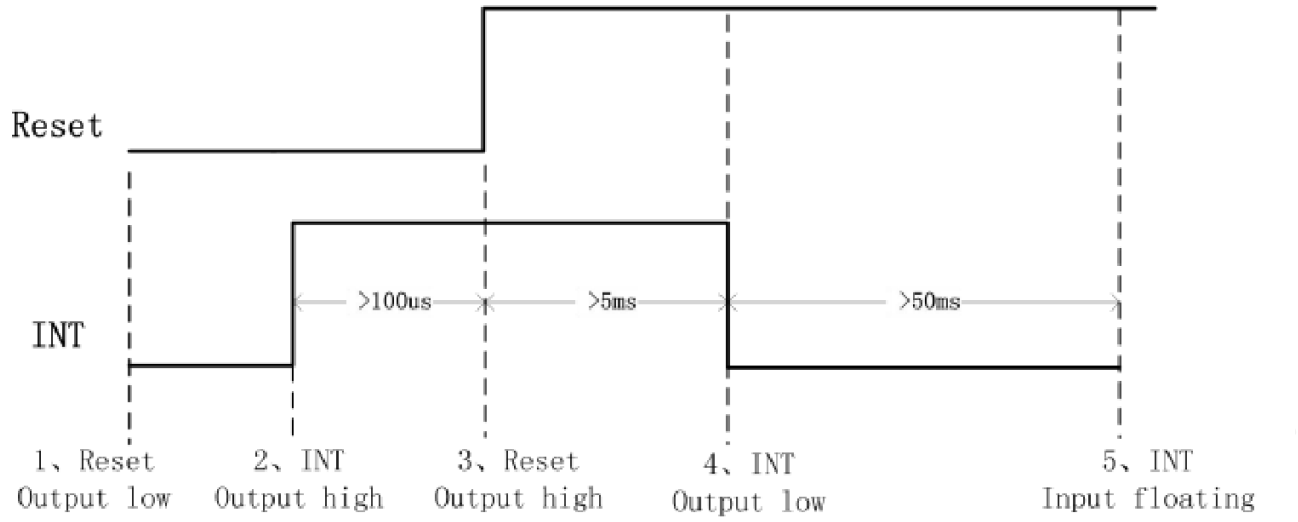
Power on Timing:



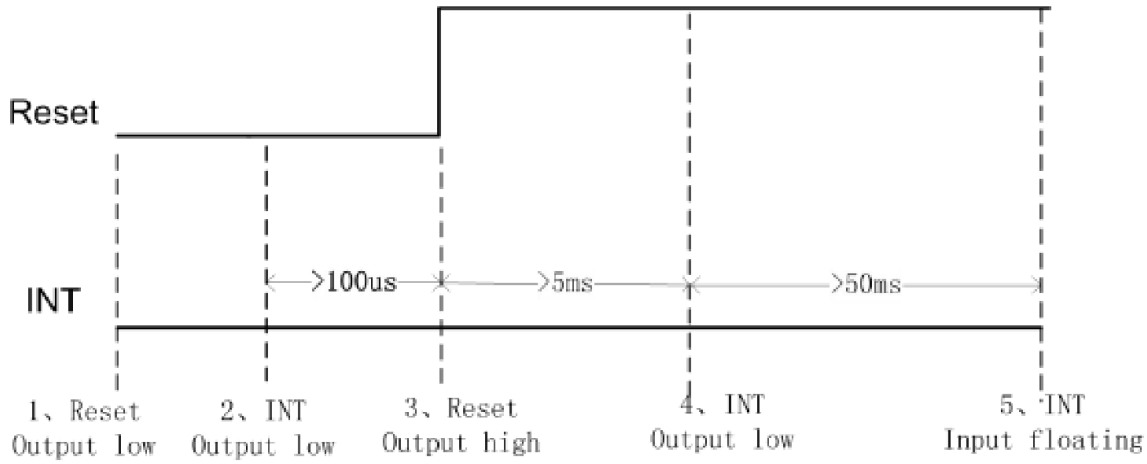
Timing for host resetting GT911:



Timing for setting slave address to x28/0x29:



Timing for setting slave address to 0xBA/0xBB:



a) Data Transmission

(For example device address is 0xBA/0xBB)

Communication is always initiated by the host. Valid Start condition is signaled by pulling SDA line from “high” to “low” when SCL line is “high”. Data flow or address is transmitted after the Start condition.

All slave devices connected to I2C bus should detect the 8-bit address issued after Start condition and send the correct ACK. After receiving matching address, GT911 acknowledges by configuring SDA line as output port and pulling SDA line low during the ninth SCL cycle. When receiving unmatched address, namely, not 0XBA or 0XBB, GT911 will stay in an idle state.

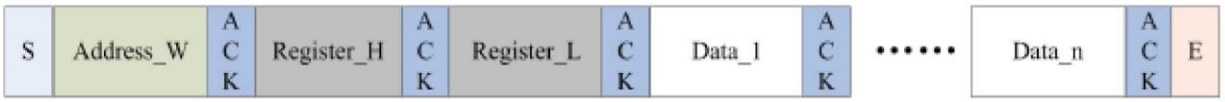
For data bytes on SDA, each of 9 serial bits will be sent on nine SCL cycles. Each data byte consists of 8 valid data bits and one ACK or NACK bit sent by the recipient. The data transmission is valid when SCL line is “high”. When

communication is completed, the host will issue the STOP condition. Stop condition implies the transition of SDA line from “low” to “high” when SCL line is “high”.

b) Writing Data to GT911

(For example device address is 0xBA/0xBB)

Timing for Write Operation



The diagram above displays the timing sequence of the host writing data onto GT911. First, the host issues a Start condition. Then, the host sends 0XBA (address bits and R/W bit; R/W bit as 0 indicates Write operation) to the slave device.

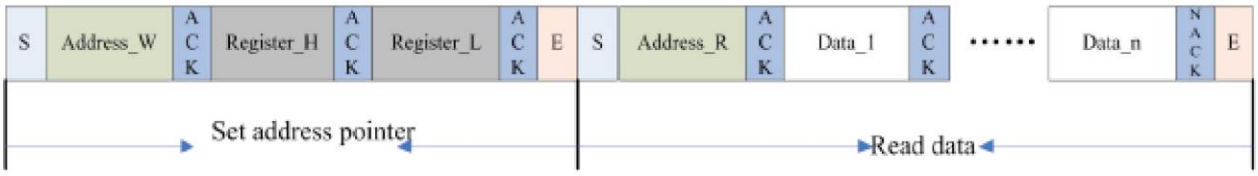
After receiving ACK, the host sends the 16-bit register address (where writing starts) and the 8-bit data bytes (to be written onto the register).

The location of the register address pointer will automatically add 1 after every Write Operation. Therefore, when the host needs to perform Write Operations on a group of registers of continuous addresses, it is able to write continuously. The Write Operation is terminated when the host issues the Stop condition.

c) Reading Data from GT911

(For example device address is 0xBA/0xBB)

Timing for Read Operation



The diagram above is the timing sequence of the host reading data from GT911. First, the host issues a Start condition and sends 0XBA (address bits and R/W bit; R/W bit as 0 indicates Write operation) to the slave device. After receiving ACK, the host sends the 16-bit register address (where reading starts) to the slave device. Then the host sets register addresses which need to be read.

Also after receiving ACK, the host issues the Start condition once again and sends 0XBB (Read Operation). After receiving ACK, the host starts to read data.

GT911 also supports continuous Read Operation and, by default, reads data continuously. Whenever receiving a byte of data, the host sends an ACK signal indicating successful reception. After receiving the last byte of data, the host sends a NACK signal followed by a STOP condition which terminates communication.

5. Optical Specification

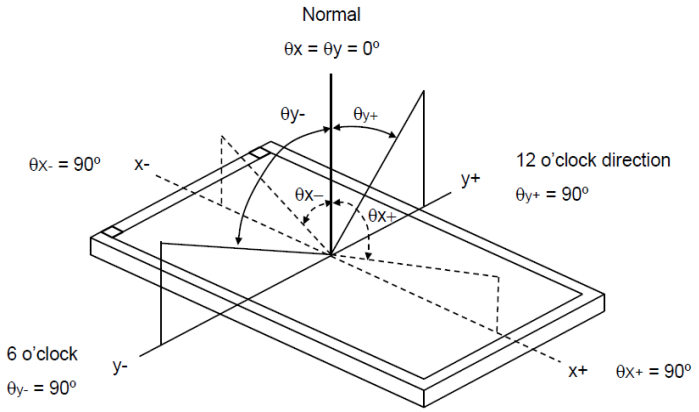
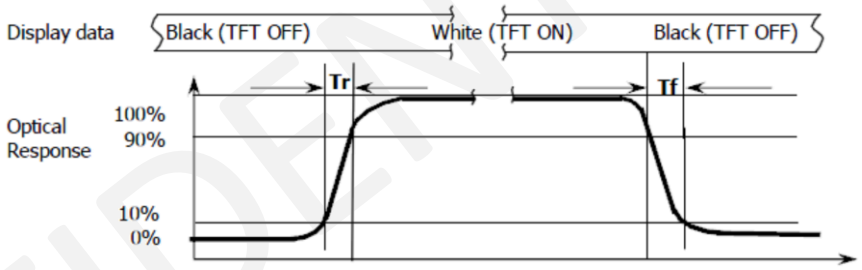
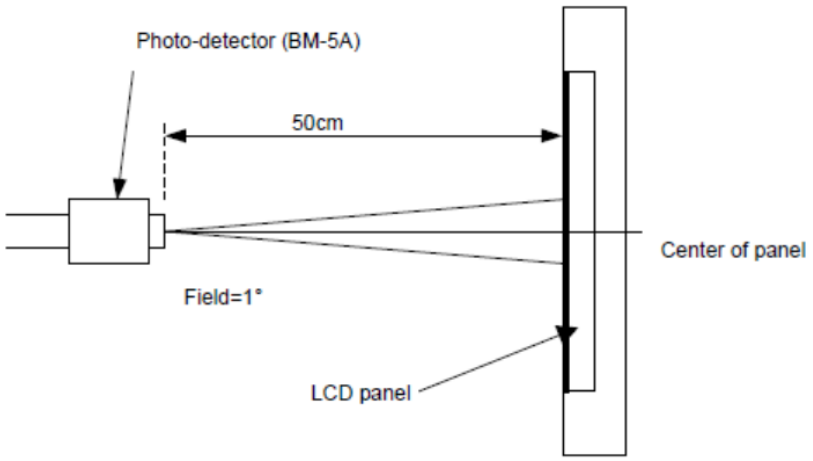
5.1 Optical Characteristics

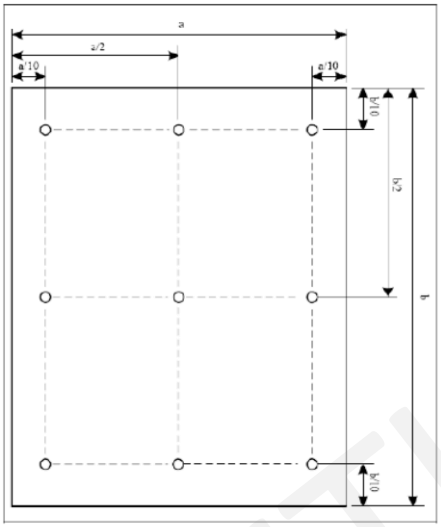
Characteristics		Symbol	Conditions	Min	Typ.	Max	Unit	Note
Contrast Ratio		CR	θ = 0° Normal viewing angle	640	800	-	-	1, 2
Response time		TR + TF		-	30	40	msec	1, 3
Color Gamut		S (%)		40	45	-	%	C-light
Viewing Angle	Left	θ_x-	CR>10	70	80	-	-	1, 4
	Right	θ_x+		70	80	-		
	Up	θ_Y+		70	80	-		
	Down	θ_Y-		70	80	-		
Colour Chromaticity	Red	Rx	θ = 0° Normal viewing angle	0.5567	0.5967	0.6367	-	CA-310
		Ry		0.3211	0.3611	0.4011		
	Green	Gx		0.3223	0.3623	0.4023		
		Gy		0.5070	0.5470	0.5870		
	Blue	Bx		0.1095	0.1495	0.1895		
		By		0.0752	0.1152	0.1552		
	White	Wx		0.2813	0.3213	0.3613		
		Wy		0.3126	0.3526	0.3926		
Luminance		Lv	I_F= 40 mA	750	800	-	cd/m^2	5
Uniformity		AVg	45	80	-	-	%	C-light

*The data comes from the LCD specification.

Measuring Condition = in dark room, at ambient temperature 25±2°C, for 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	Item	Test method
1	Definition of Viewing Angle	
2	Definition of Contrast Ratio (CR)	Measured at the center point of panel $\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is at "white state"}}{\text{Luminance measured when LCD is at "black state"}}$
3	Definition of Response Time	
4	Definition of Optical Measurement Setup	

Note	Item	Test method
5	Definition of Luminance Uniformity	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. LED Backlight Specification

6.1 LED Backlight Characteristics

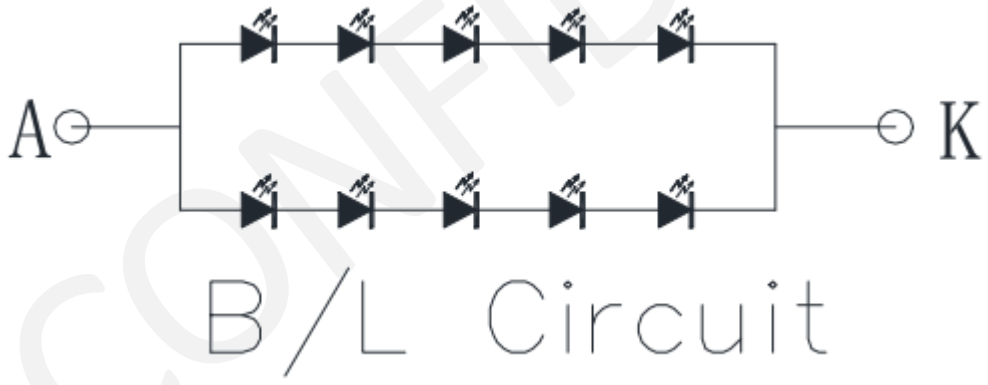
The back-light system is edge-lighting type with 10 chips LED.

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Forward Current	IF	-	35	40	-	mA	-
Forward Voltage	V_F	I_F=40mA	-	16.0	-	V	-
LED Lifetime	Hr	50000	-	-	-	Hour	1, 2

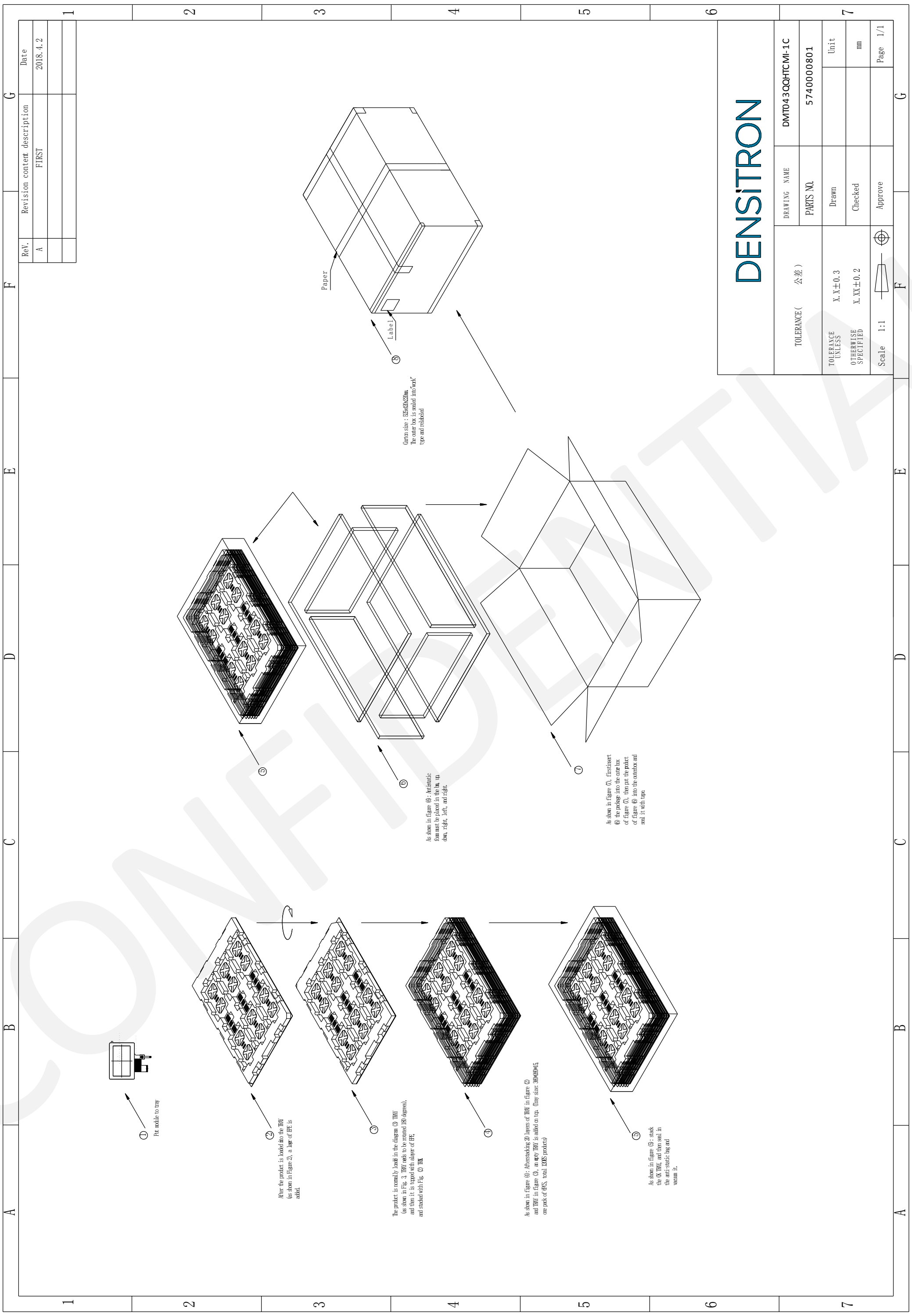
Note 1: LED lifetime (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3℃, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note 2: The "LED lifetime" is defined as the module brightness decreases to 50% original brightness at Ta=25℃ and IL=40mA. The LED lifetime could be decreased if operating IL is larger than 40mA. The constant current driving method is suggested.

6.2 Internal Circuit Diagram



7. Packaging



8. Quality Assurance Specification

8.1 Conformity

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

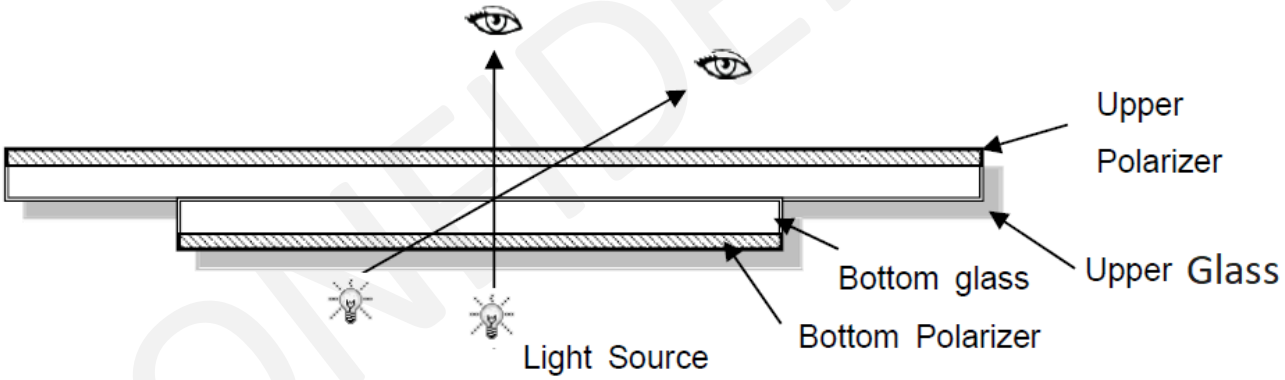
8.2 Environment Required

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

Temperature:	25±5℃
Humidity:	65% ± 10% RH
Viewing Angle:	Normal Viewing Angle
Illumination:	Single fluorescent lamp (300 to 700 Lux)
Viewing distance:	30 - 50cm

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

Inspection table or jig must be anti-electrostatic.

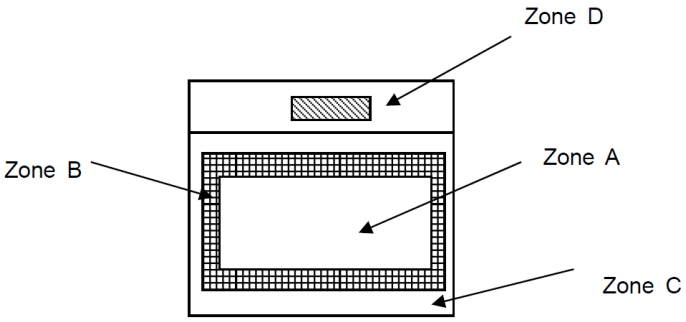


8.3 Delivery Assurance

8.3.1 Delivery Inspection Standards

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

8.3.2 Zone 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) Area which cannot be seen after assembly by customer.

Zone D: IC Bonding Area

Note: Generally, visual defects in Zone C can be ignored when it doesn't affect product function or appearance after assembly by customer

8.3.3 Criteria & Acceptable Quality Level

Partition	AQL	Definition
Major	0.65	Defects in Pattern Check (Display On)
Minor	1.5	Defects in Cosmetic Check (Display Off)

LCD: Liquid Crystal Display, LCM: Liquid Crystal Module, CTP: Capacitive Touch Panel

No.	Items	Criteria	Classification of defects
1	Functional defects	(1) No display, Open or miss line (2) Display abnormally, Short (3) Backlight no lighting, abnormal lighting. (4) TP no function	Major
2	Missing	Missing component.	
3	Outline Dimension	Overall outline dimension beyond the drawing or deformation is not allowed.	
4	Color Tone	To judge color unevenness, please refer to limit sample.	Minor
5	Spot/ Line Defect	Light dot, dim spot, polarizer air bubble Polarizer accidented spot, etc.	
6	Soldering Appearance	Good soldering, peeling off is not allowed.	
7	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

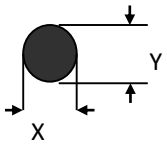
Note:

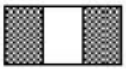
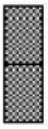
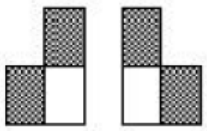
a) Light dot: Dots appearing bright and unchanged in size in which LCD panel is displaying under black pattern.

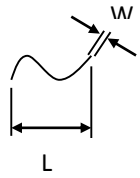
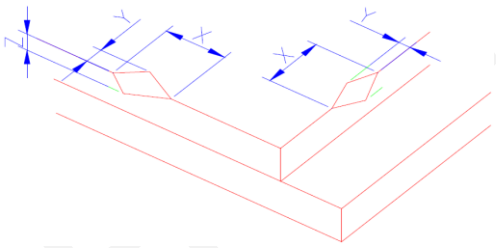
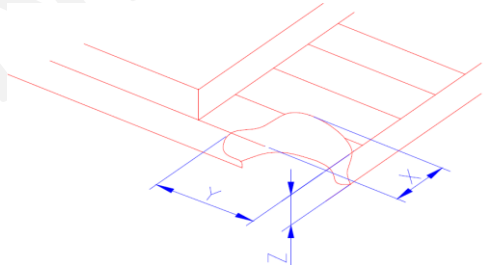
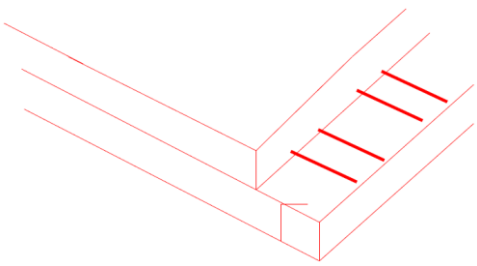
b) Dim dot: Dots appearing dark and unchanged in size in which LCD panel is displaying under pure red, green, or blue picture.

8.3.4 Criteria & Classification

Units: mm

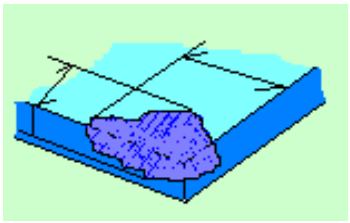
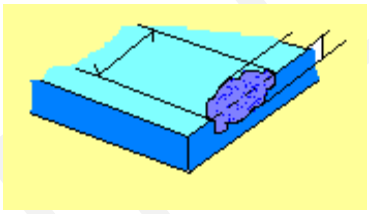
<table>
<tr><th>Class</th><th>Item</th><th colspan="4">Criteria</th></tr>
<tr><td rowspan="24">Minor</td><td rowspan="24">Spot Defect</td><td colspan="4">Round type: as per following drawing, ∅ = (X+Y)/2  </td></tr>
<tr><td colspan="4">1) Light Dot (Black/white spot, pinhole, stain)</td></tr>
<tr><td rowspan="2">Size\Zone</td><td colspan="3">Acceptable Quantity</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>∅≤0.10</td><td>Ignore</td><td rowspan="4" colspan="2">Ignore</td></tr>
<tr><td>0.10<∅≤0.25</td><td>4 (distance ≧ 10mm)</td></tr>
<tr><td>0.25<∅≤0.35</td><td>3</td></tr>
<tr><td>0.35<∅</td><td>0</td></tr>
<tr><td colspan="4">2) Dim Spot (Light leakage, dent, dark spot)</td></tr>
<tr><td rowspan="2">Size\Zone</td><td colspan="3">Acceptable Quantity</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>∅≤0.1</td><td>Ignore</td><td rowspan="4" colspan="2">Ignore</td></tr>
<tr><td>0.10<∅≤0.25</td><td>4 (distance ≧ 10mm)</td></tr>
<tr><td>0.25<∅≤0.35</td><td>3</td></tr>
<tr><td>0.35<∅</td><td>0</td></tr>
<tr><td colspan="4">3) Polarizer Accidented Spot</td></tr>
<tr><td rowspan="2">Size\Zone</td><td colspan="3">Acceptable Quantity</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>∅≤0.2</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.2<∅≤0.5</td><td colspan="2">3 (distance ≧ 10mm)</td></tr>
<tr><td>0.5<∅</td><td colspan="2">0</td></tr>
<tr><td colspan="4">4) Pixel Bad Points</td></tr>
<tr><td>Item</td><td>Zone A</td><td colspan="2">Acceptable Quantity</td></tr>
<tr><td rowspan="3">Bright Dot</td><td>Random</td><td colspan="2">N≤2</td></tr>
<tr><td>2 dots adjacent</td><td colspan="2">N≤0</td></tr>
<tr><td>3 dots adjacent</td><td colspan="2">N≤0</td></tr>
<tr><td rowspan="2">Dark Dots</td><td>Random</td><td colspan="2">N≤2</td></tr>
<tr><td>2 dots adjacent</td><td colspan="2">N≤0</td></tr>
</table>

<table>
<tr><th>Class</th><th>Item</th><th colspan="3">Criteria</th></tr>
<tr><td rowspan="6"></td><td rowspan="6"></td><td></td><td>3 dots adjacent</td><td>N≤0</td></tr>
<tr><td>Distance</td><td>1. Minimum distance between Bright dots.
2. Minimum distance between dark dots
3. Minimum distance between dark and bright dots.</td><td>5mm</td></tr>
<tr><td colspan="2">Total quantity of bright and dark dots</td><td>N≤4</td></tr>
<tr><td colspan="3">Note
A) Bright dot: Dots appearing bright and unchanged in size in which LCD panel is displaying under black pattern.
B) Dark dot: Dots appearing 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
 
2 dot adjacent
 
2 dot adjacent
 
2 dot adjacent (vertical)
 
2 dot adjacent (slant)</td></tr>
<tr><td colspan="3">5) Polarizer Bubble</td></tr>
<tr><td rowspan="2">Size\Zone</td><td colspan="3">Acceptable Quantity</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>∅≤0.2</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.2<∅≤0.4</td><td colspan="2">4 (distance ≧ 10mm)</td></tr>
<tr><td>0.4<∅≤0.5</td><td colspan="2">3</td></tr>
<tr><td>0.5<∅</td><td colspan="2">0</td></tr>
</table>

<table>
<tr><th>Class</th><th>Item</th><th colspan="5">Criteria</th></tr>
<tr><td rowspan="6">Minor</td><td rowspan="6">Line Defect (LCD/ Polarizer backlight black/white line, scratch, stain)</td><td colspan="5">Line type: as per following drawing
 
</td></tr>
<tr><td rowspan="2">Width (mm)</td><td rowspan="2">Length (mm)</td><td colspan="3">Acceptable quantity</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>W≤0.05</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.05<W≤0.06</td><td>L ≤ 5.0</td><td colspan="2">N ≤ 3</td></tr>
<tr><td>0.06<W≤0.08</td><td>L ≤ 4.0</td><td colspan="2">N ≤ 2</td></tr>
<tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr>
<tr><td>Minor</td><td>LCD Crack/Broken</td><td colspan="5">Symbols:
N: Count, X: Length, Y: Width, Z: Height, L: Length of ITO, T: Height of LCD
1) The edge of LCD broken: X≦3.0mm; Y<Inner border line of the seal; Z≦T
 
2) LCD corner broken: X≦3.0mm; Y≦L; Z≦T
  </td></tr>
<tr><td>Major</td><td>LCD Crack</td><td colspan="5">The LCD with extensive crack is not acceptable.
  </td></tr>
</table>

Class	Item	Criteria
Major	Electronic Components SMT	Missing parts, solderless connection, cold solder joint, mismatch, or the positive and negative polarity opposite is not allowed.
Minor	Display Color & Brightness	1) Color: Measuring the colour coordinates in accordance with the datasheet or samples. 2) Brightness: Measuring the brightness of white screen in accordance with the datasheet or samples.
Minor	LCD Mura / Waving / Hot spot	By 5% ND filter invisible.

<table>
<tr><th>Class</th><th>Item</th><th colspan="5">Criteria</th></tr>
<tr><td rowspan="30">Minor</td><td rowspan="30">CTP Related</td><td colspan="5">1) CTP Cover sensor accidented black/white spot</td></tr>
<tr><td rowspan="2">Size (mm)</td><td colspan="4">Acceptable Quantity</td></tr>
<tr><td>A</td><td colspan="2">B</td><td>C</td></tr>
<tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.1<Φ≤0.25</td><td colspan="2">4（distance≧ 10mm）</td></tr>
<tr><td>0.25<Φ≤0.35</td><td colspan="2">3</td></tr>
<tr><td>Φ＞0.35</td><td colspan="2">0</td></tr>
<tr><td colspan="5">2) CTP Cover Scratch</td></tr>
<tr><td rowspan="2">Width (mm)</td><td rowspan="2">Ignore (mm)</td><td colspan="3">Acceptable Quantity</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.05</td><td>Ignore</td><td colspan="3">Ignore</td></tr>
<tr><td>0.05<Φ≤0.06</td><td>L≤4.0</td><td colspan="3">N≤3</td></tr>
<tr><td>0.06<Φ≤0.08</td><td>L≤3.0</td><td colspan="3">N≤2</td></tr>
<tr><td>0.08<Φ</td><td colspan="4">Define as spot defect</td></tr>
<tr><td colspan="5">3) CTP Cover Pinhole/Lack of Ink</td></tr>
<tr><td rowspan="2">Size (mm) / Zone</td><td colspan="4">Acceptable Quantity</td></tr>
<tr><td colspan="4">C</td></tr>
<tr><td>Φ≤0.2</td><td colspan="4">Ignore</td></tr>
<tr><td>0.2<Φ≤0.3</td><td colspan="4">4 (distance≧ 10mm)</td></tr>
<tr><td>0.3<Φ≤0.4</td><td colspan="4">3</td></tr>
<tr><td>Φ>0.4</td><td colspan="4">0</td></tr>
<tr><td colspan="5">4) CTP Bonding Bubble/Accidented Spot</td></tr>
<tr><td rowspan="2">Size Φ (mm)</td><td colspan="4">Acceptable Quantity</td></tr>
<tr><td colspan="2">A</td><td colspan="2">B</td></tr>
<tr><td>Φ≤0.1</td><td colspan="4">Ignore</td></tr>
<tr><td>0.1<Φ≤0.2</td><td colspan="4">3 (distance≧ 10mm）</td></tr>
<tr><td>0.2<Φ≤0.25</td><td colspan="4">2</td></tr>
<tr><td>Φ>0.25</td><td colspan="4">0</td></tr>
<tr><td colspan="5">5) Assembly deflection: beyond the edge of backlight ≤0.2mm</td></tr>
<tr><td colspan="5">6) TP cover broken
X：length, Y：width, Z：height</td></tr>
</table>

<table>
<tr><th>Class</th><th>Item</th><th colspan="2">Criteria</th></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td>
<table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>X≤0.5mm</td><td>Y≤0.5mm</td><td>Z<cover thickness</td></tr>
</table>
Circuitry broken is not allowed.
</td><td>  </td></tr>
<tr><td colspan="2">7) TP Cover Broken
X：length, Y：width, Z：height</td></tr>
<tr><td>
<table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>X≤0.3mm</td><td>Y≤0.3mm</td><td>Z<cover thickness</td></tr>
</table>
Circuitry broken is not allowed.
</td><td>  </td></tr>
</table>

Criteria (functional items)

No.	Item	Criteria
1	No display	Not allowed
2	Missing segment	
3	Short circuit	
4	Backlight no lighting	

8.4 Dealing with Customer Complaints

8.4.1 Non-conforming Analysis

Purchaser should supply Densitron with detailed data of non-conforming sample.
After accepting it, Densitron should complete the analysis in reasonable time and update the status to the purchaser.

8.4.2 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.

9. Reliability Specification

9.1 Reliability Tests

Item	Condition	Inspection After Test
High Temperature Operation	85℃,96 hrs	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 cracks; 5.Current IDD is twice higher than initial value
Low Temperature Operation	-30℃, 96 hrs	
High Temperature Storage	90℃,96 hrs	
Low Temperature Storage	-40℃, 96 hrs	
High Temperature and High Humidity	+60℃, 90% RH ,96 hours	
Thermal Shock (Non-operation)	-10℃, 30 min ↔ +60℃, 30 min Change time: 5min 20CYC.	
ESD Test	C=150pF, R=330Ω, 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 cm (MEDIUM BOX)	
Stock Test (Non-Operating)	50G,20ms,Half-sine wave,(± X,± Y,± Z)	
Vibration Test (Non-Operating)	Sine wave: 6.8G, 10~400Hz, 280mins/axis, 0.6oct/min Random: 3.3Grms, 5~500Hz, 30mins/axis	

Note 1: The test samples should be applied to only one test item.

Note 2: Sample size for each test item is 5~10 pieces.

Note 3: For Damp Proof Test, Pure water (Resistance＞10MΩ) should be used.

Note 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.

Note 5: Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

Note 6: The color fading mura of polarizing filter can be ignored.

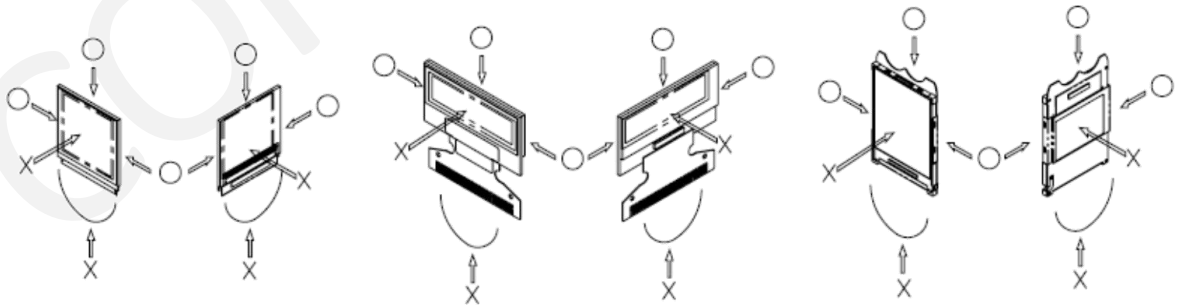
9.1.1 Inspection Check Standard

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±10% RH.

10. Handling Precautions

10.1 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.

10.2 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.

10.3 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.

10.4 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.

10.5 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.