Microtips TECHNOLOGY

Model No: AWK-480800T43PC04

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Revision Record

Rev No.	Rev Date	Contents	Note
A	2019/06/20	New issue.	

Table of Contents

1. Scope

This specification defines general provisions as well as inspection standards for TFT module supplied by Microtips Technology.
If the event of unforeseen problem or unspecified items may occur, naturally shall negotiate and agree to solution

2. General Information

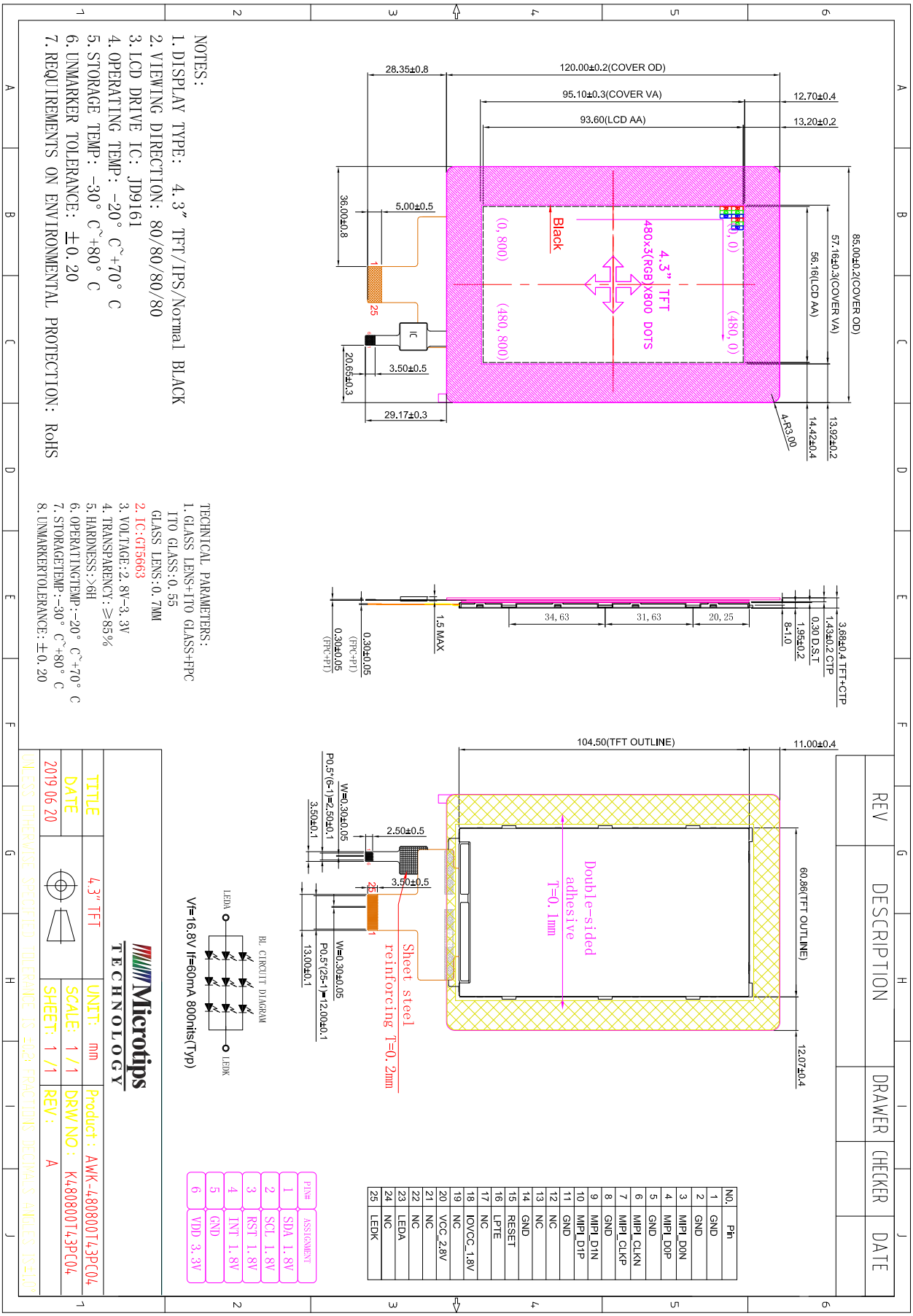
LCM

Item	Standard Values	Units
LCD type	4.3”TFT	--
Dot arrangement	480(RGB)×800	dots
Color filter array	RGB vertical stripe	--
Display mode	IPS / Transmission / Normally Black	-
Gray Scale Inversion Direction	80/80/80/80 deg(U/D/L/R @ C/R>10)	--
Eyes Viewing Direction	ALL	
Driver IC	JD9161	--
Module size	85(W)×120(H)×3.68(T)	mm
Active area	56.16(W)×93.60(H)	mm
Dot pitch	0.117(W)×0.117(H)	mm
Interface	MIPI interface	--
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Back Light	9 White LEDS	--

CTP

ITEM	STANDARD VALUES	UNITS
CTP type	Glass + Glass + FPC	--
CTP Driver IC	GT5663	--
Surface hardness	6H	--
Transmittance	≥85%	--
Operation Voltage	2.8V-3.3 V	--
CTP size	85(W)×120 (H)×1.43(T)	mm
LENS Viewing area	57.16(W)×94.70(H)	mm
CTP Interface	I²C	-
Operating temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C
Pointing Stick	5	-

3. External Dimensions



4. Interface Description

LCM

Pin	Pin Name	Description
1	GND	Power ground
2	GND	Power ground
3	MIPI_D0N	MIPI DSI differential data pair
4	MIPI_D0P	MIPI DSI differential data pair
5	GND	Power ground
6	MIPI_CLKN	MIPI DSI differential clock pair
7	MIPI_CLKP	MIPI DSI differential clock pair
8	GND	Power ground
9	MIPI_D1N	MIPI DSI differential data pair
10	MIPI_D1P	MIPI DSI differential data pair
11	GND	Power ground
12	NC	No connection
13	NC	No connection
14	GND	Power ground
15	RESET	Reset input pin
16	LPTE	TE Signal
17	NC	No connection
18	IOVCC_1.8V	Logic Supply Voltage
19	NC	No connection
20	VCC_2.8V	Analog Supply Voltage
21	NC	No connection
22	NC	No connection
23	LEDA	LED backlight (Anode).
24	NC	No connection
25	LEDK	LED backlight (Cathode).

CTP

PIN NO.	PIN NAME	
1	SDA 1.8V	CTP I^2C_data
2	SCL 1.8V	CTP I^2C_clock.
3	RST 1.8V	CTP reset pin. Active low to enter reset state.
4	INT 1.8V	CTP interruption signal.
5	GND	CTP Power ground
6	VDD 3.3V	CTP Digital Power.

5. Absolute Maximum Ratings

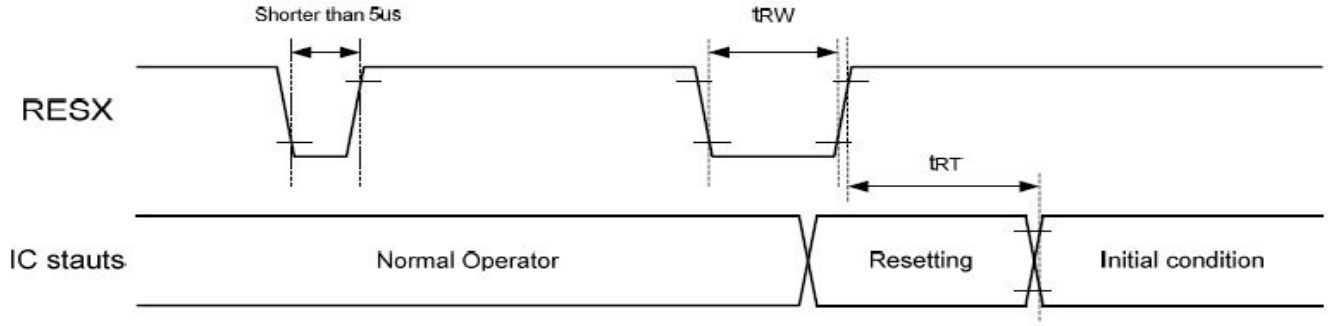
Item	Symbol	Min.	Max.	Unit
Logic Supply Voltage	IOVCC	-0.3	3.6	V
Analog Supply Voltage	VCC	-0.3	5.5	V
CTP Supply Voltage	VDD	2.66	3.47	V
Input Voltage	Vin	-0.3	IOVCC+0.3	V
Operating Temperature	TOP	-20	70	°C
Storage Temperature	TST	-30	80	°C
Storage Humidity	HD	20	90	%RH

6. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Logic Supply Voltage	IOVCC	1.65	1.8/2.8	3.3	V	-
Analog Supply Voltage	VCC	2.5	2.8	4.8	V	-
Analog Supply Current	IVCC	TBD	TBD	TBD	mA	-
CTP Supply Voltage	VDD	2.8	-	3.3	V	-
Input High Voltage	V_{IH}	0.7IOVCC	-	IOVCC	V	-
Input Low Voltage	V_{IL}	GND	-	0.3IOVCC	V	-
Output High Voltage	V_{OH}	0.8IOVCC	-	IOVCC	V	-
Output Low Voltage	V_{OL}	GND	-	0.2IOVCC	V	-
I/O Leak Current	ILI	-1	-	1	uA	-

7. Timing Characteristics

7.1 Reset Timing Characteristics



Reset input timings

Symbol	Parameter	Related pins	Min.	Max.	Unit
t_{RW}	Reset pulse width(2)	RESX	10	-	µs
t_{RT}	Reset complete time(3)	-	-	5 (Note 5)	ms
		-	-	120 (Note 6, 7)	ms

Note: (1) The reset complete time also required time for loading ID bytes from OTP to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

(2) Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below.

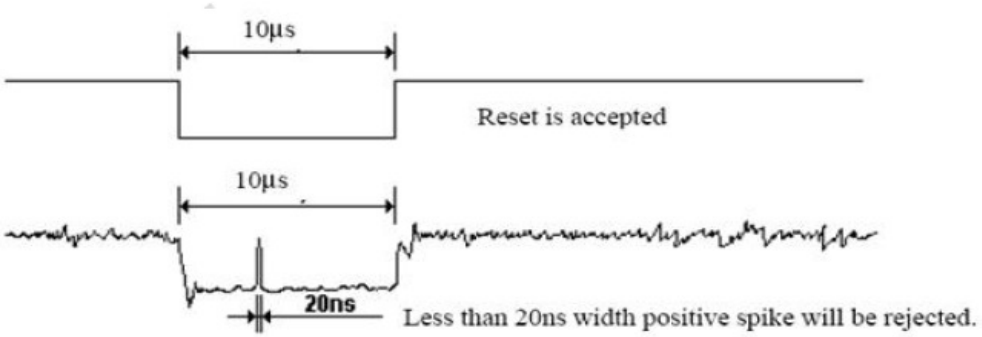
RESX Pulse	Action
Shorter than 5 µs	Reset Rejected
Longer than 10 µs	Reset
Between 5 µs and 10 µs	Reset Start

(3) During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode) and then returns to Default condition for H/W reset.

(4) Spike Rejection also applies during a valid reset pulse as shown below:

(3) During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode) and then returns to Default condition for H/W reset.

(4) Spike Rejection also applies during a valid reset pulse as shown below:



(5) When Reset is applied during Sleep In Mode.

(6) When Reset is applied during Sleep Out Mode.

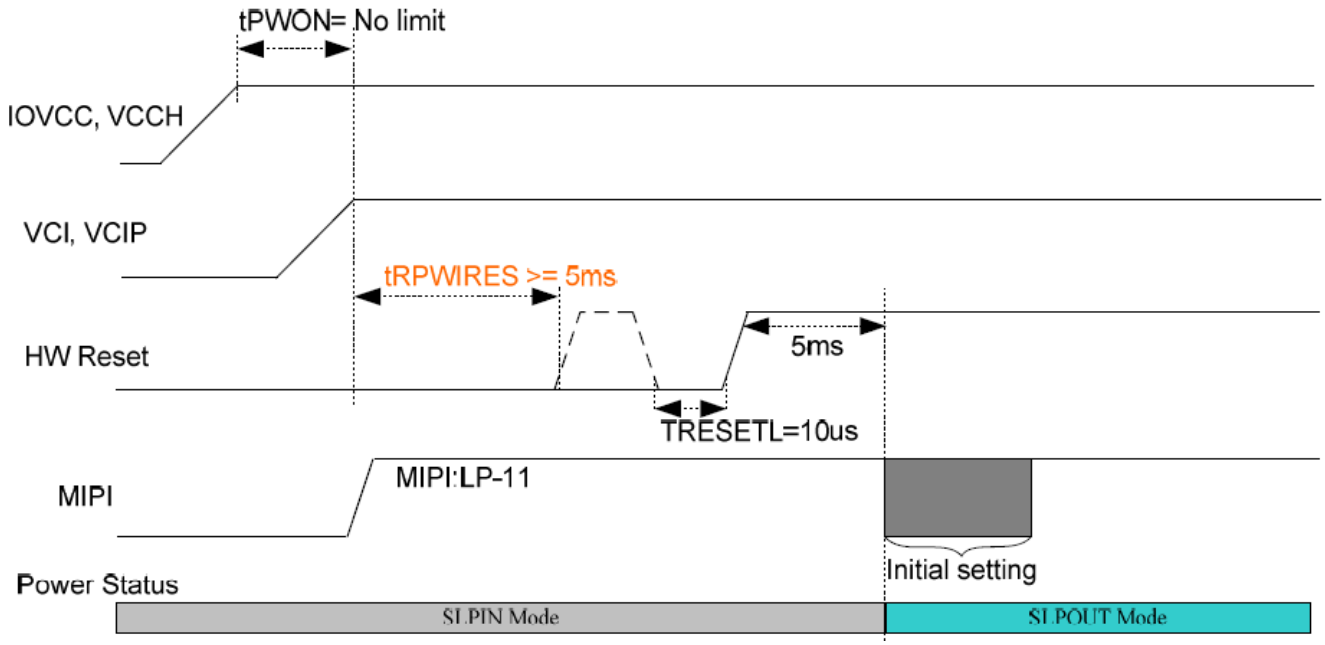
(7) It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

7.2 Power on/off sequence

Power on sequence for differential power mode

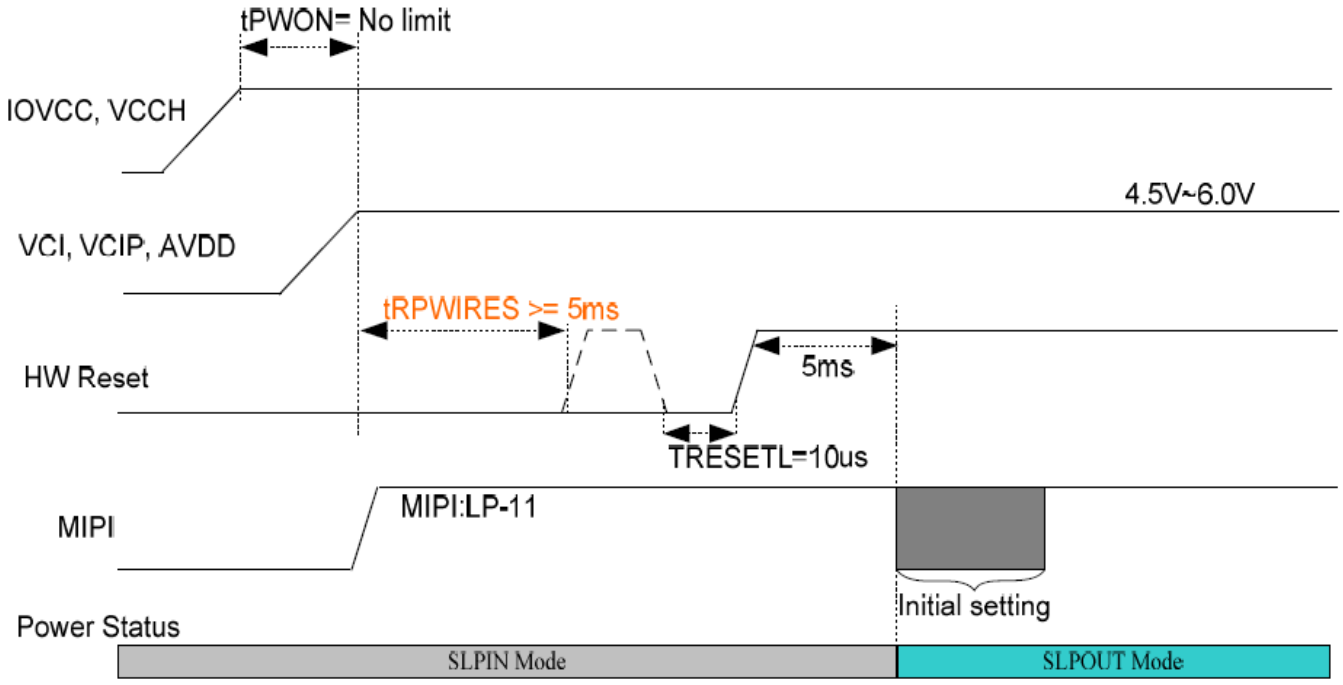
BOOSTM [1:0]=00 (Internal DC/DC power mode : PFM, Charge Pump, JD5001)

IOVCC=VCCH=1.65V ~ 3.6V, VCI=VCIP=2.5V ~ 4.8V.



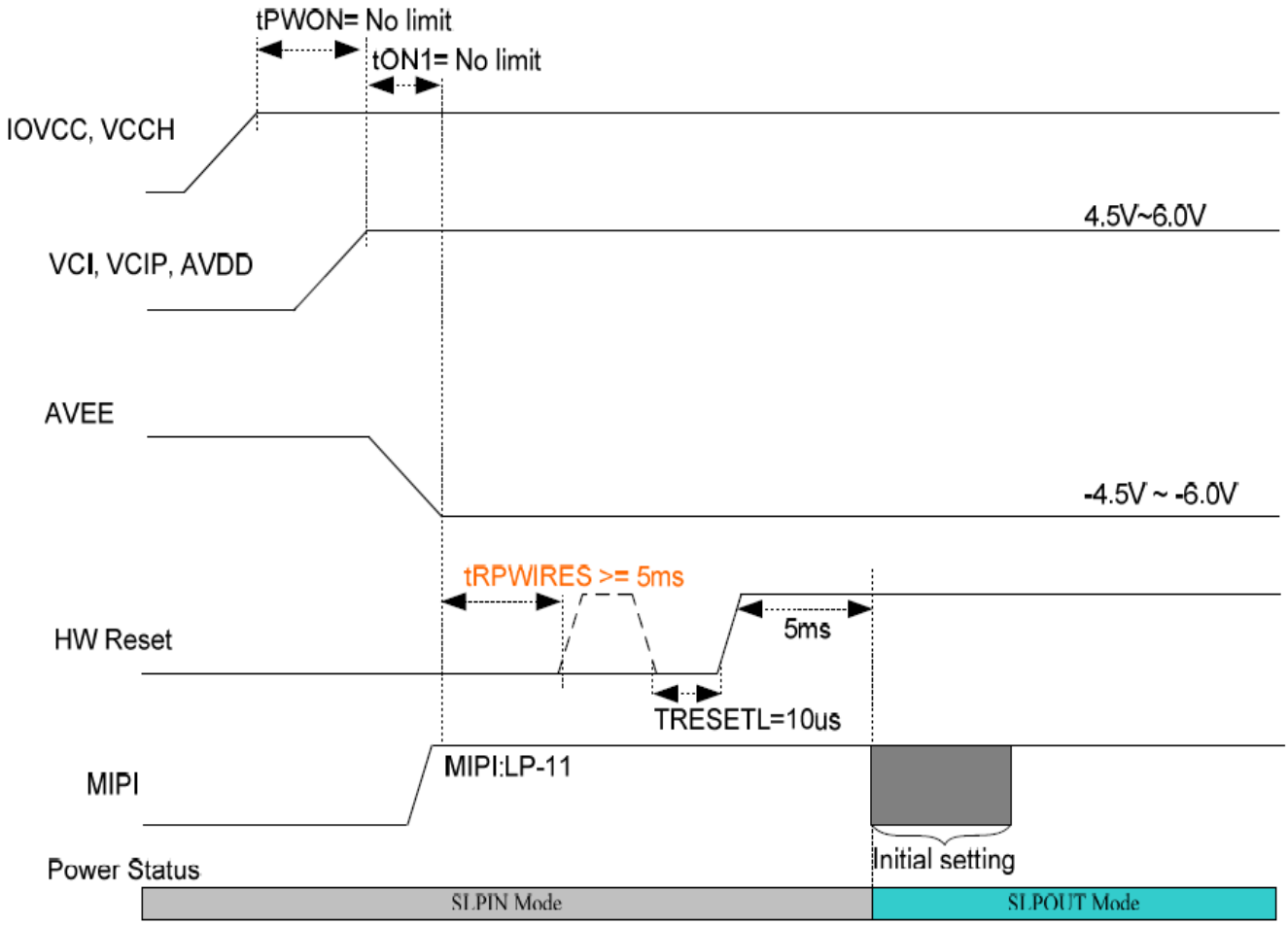
BOOSTM [1:0]=01 (External AVDD power, Internal AVEE power)

IOVCC=VCCH=1.65V ~ 3.6V, AVDD=VCI=VCIP=4.5V ~ 6.0V



BOOSTM [1:0]=11 (External AVDD/AVEE Power)

IOVCC=VCCH=1.65V ~ 3.6V, AVDD=VCI=VCIP=4.5V ~ 6.0V, AVEE=-4.5V ~ -6.0V



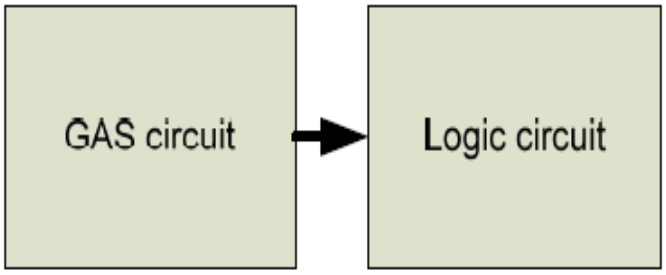
Note: tON1: The space time between VCI/VCIP/AVDD Power On and AVEE Power On.

Uncontrolled power off

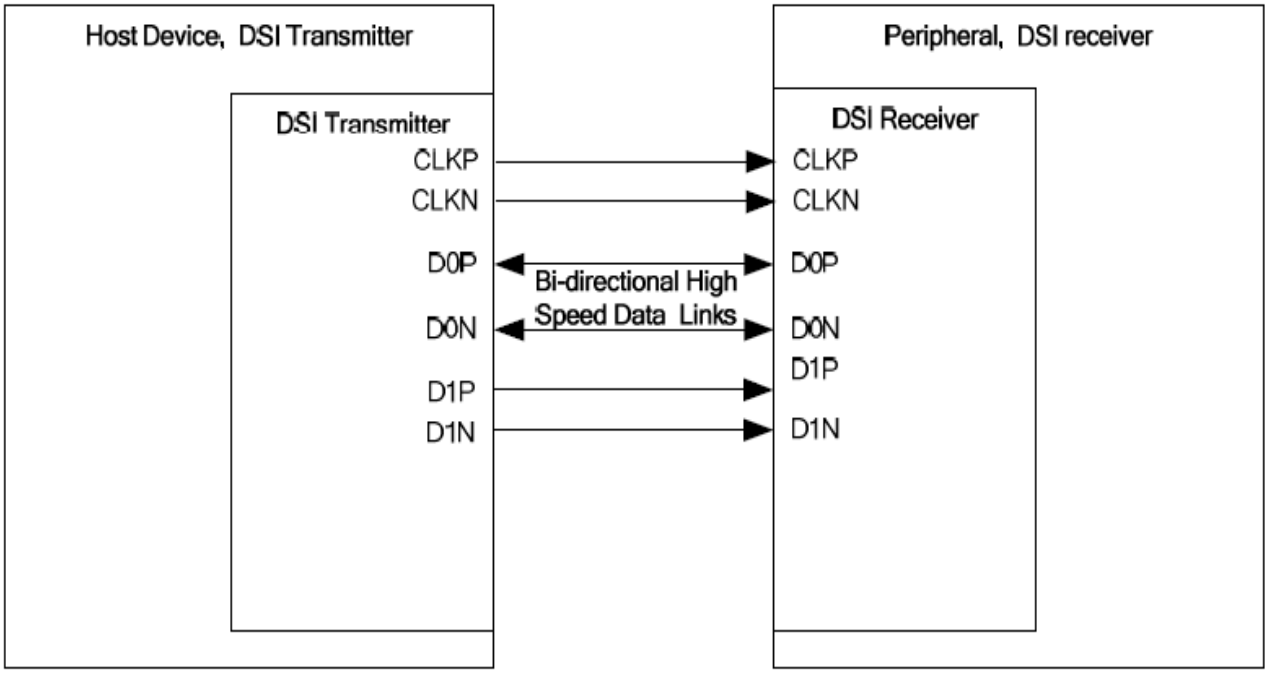
The uncontrolled power off means a situation when e.g. there is removed a battery without the controlled power off sequence. The display module must meet following requirements:

There cannot be any damages for the display module or the display module cannot cause any damages for the host or lines of the interface.

There cannot be any abnormal visible effects (= display must be blank) with in 1 second on the display and remains blank until “Power On Sequence” powers it up

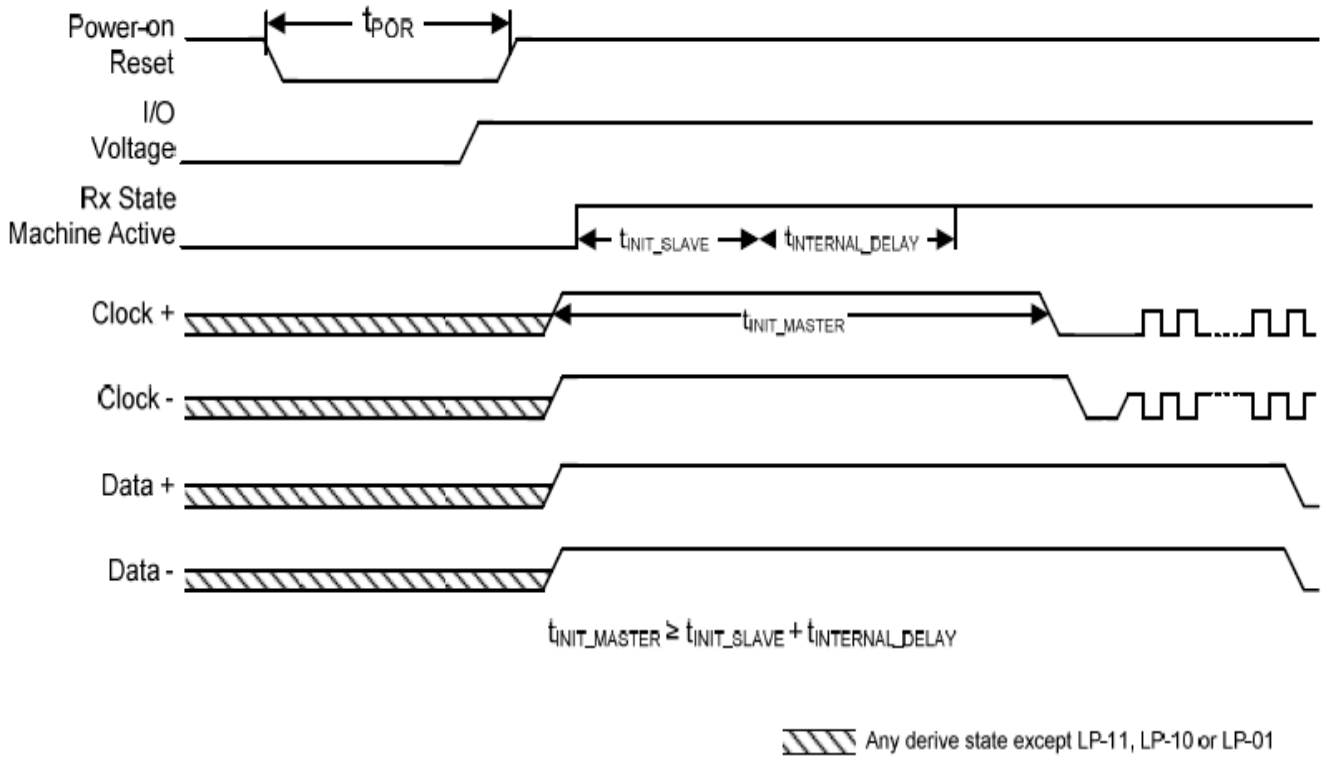


7.3 MIPI interface



DSI transmitter and receiver interface

Power-up Sequence Example

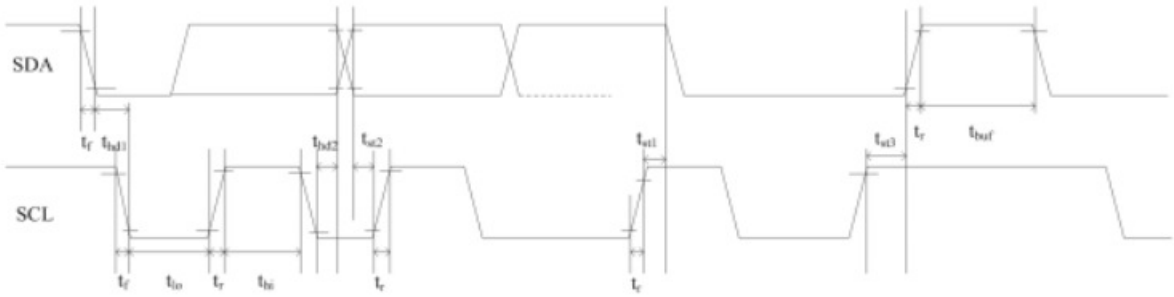


Peripheral Power-Up Sequencing Example

7.4 CTP Timing

I²C Timing

GT5663 provides a standard I²C interface for SCL and SDA to communicate with the host. GT5663 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 diagram below illustrates the I²C timing sequence:



Test condition 1: 1.8V host interface voltage, 400Kbps transmission rate, 2KΩ pull-up resistor

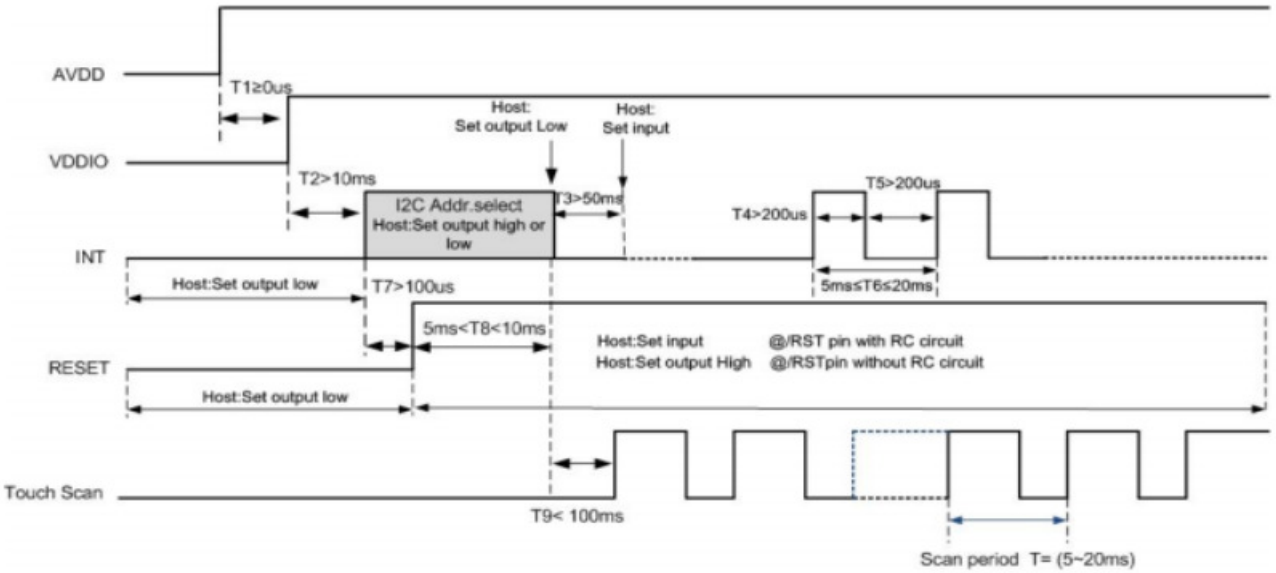
Parameter	Symbol	Min.	Max.	Unit
SCL low period	t_{lo}	1.3	-	us
SCL high period	t_{hi}	0.6	-	us
SCL setup time for START condition	t_{st1}	0.6	-	us
SCL setup time for STOP condition	t_{st3}	0.6	-	us
SCL hold time for START condition	t_{hd1}	0.6	-	us
SDA setup time	t_{st2}	0.1	-	us
SDA hold time	t_{hd2}	0	-	us

Test condition 2: 3.3V host interface voltage, 400Kbps transmission rate, 2KΩ pull-up resistor

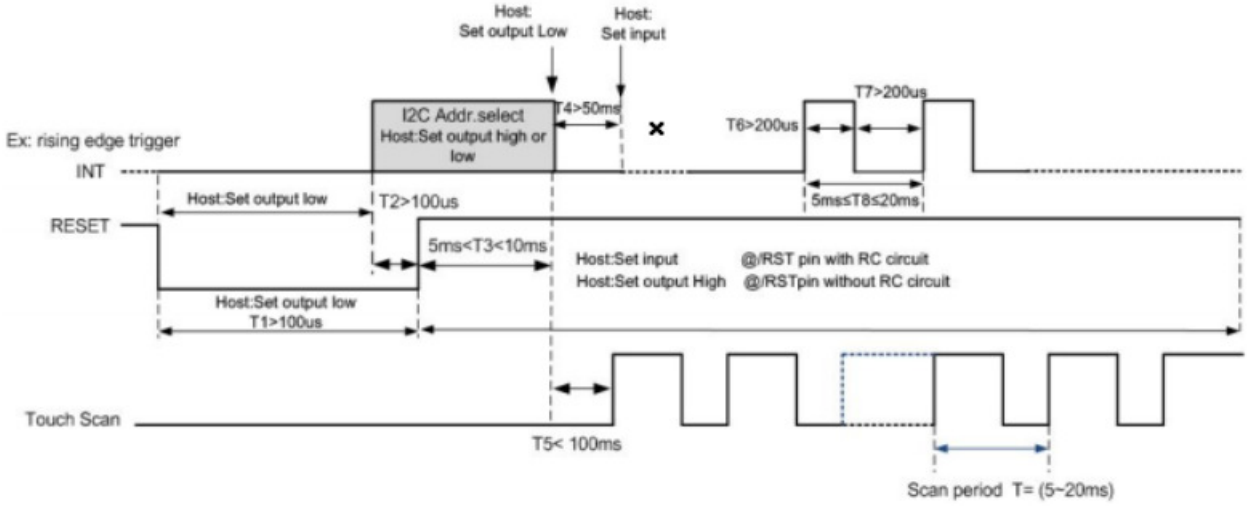
Parameter	Symbol	Min.	Max.	Unit
SCL low period	t_{lo}	1.3	-	us
SCL high period	t_{hi}	0.6	-	us
SCL setup time for START condition	t_{st1}	0.6	-	us
SCL setup time for STOP condition	t_{st3}	0.6	-	us
SCL hold time for START condition	t_{hd1}	0.6	-	us
SDA setup time	t_{st2}	0.1	-	us
SDA hold time	t_{hd2}	0	-	us

GT5663 supports two I²C slave addresses: 0xBA/0xBB and 0x28/0x29. The host can select the address by controlling the Reset and INT pins during power-on initialization. See the diagram below for detailed timings:

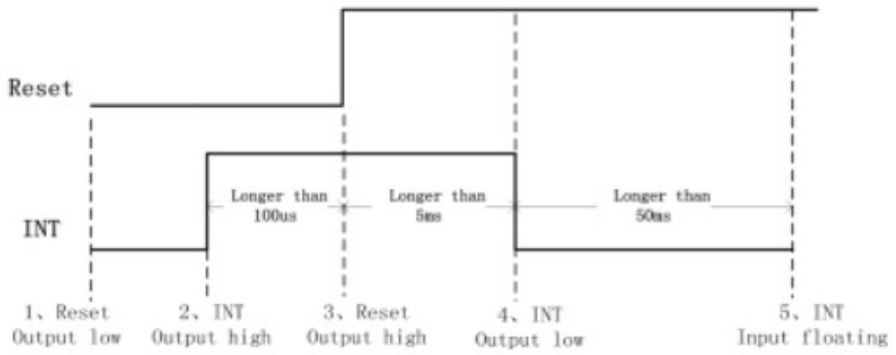
Power-on Timing:



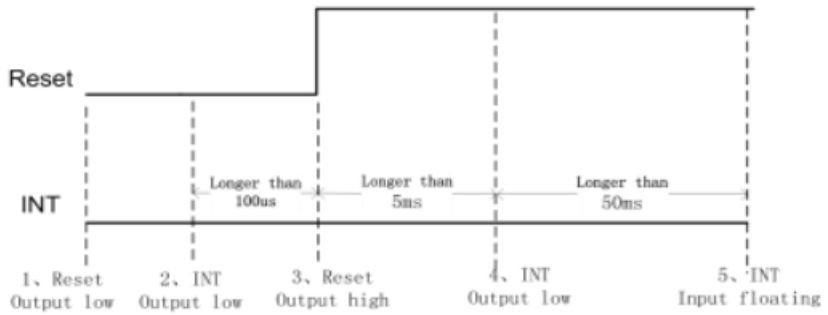
Timing for host resetting GT5663:



Timing for setting slave address to 0x28/0x29:



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



a) Data Transmission

(For example：slave 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 I^2C bus should detect the 8-bit address issued after Start condition and send the correct ACK. After receiving matching address, GT5663 acknowledges by configuring SDA line as output port and pulling SDA line low during the ninth SCL cycle. When receiving mismatched address, namely, not 0XBA or 0XBB, GT5663 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 which implies the transition of SDA line from low to high when SCL line is high.

b) Writing Data to GT5663

(For example：slave address is 0xBA/0xBB)

Timing for Write Operation

The diagram above displays the timing sequence of the host writing data onto GT5663. 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 consecutive addresses, it is able to write continuously. The Write Operation is terminated when the host issues the Stop condition.

c) Reading Data from GT5663

(For example：slave address is 0xBA/0xBB)

Timing for Read Operation

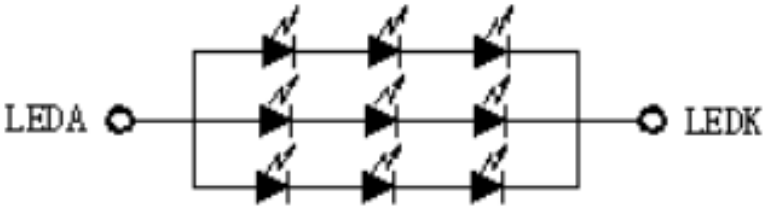
The diagram above is the timing sequence of the host reading data from GT5663. First, the host issues a Start condition and sends 0XBA (address bits and R/W bit; R/W bit as 0 indicates Write operation) to the slave device.

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.

GT5663 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.

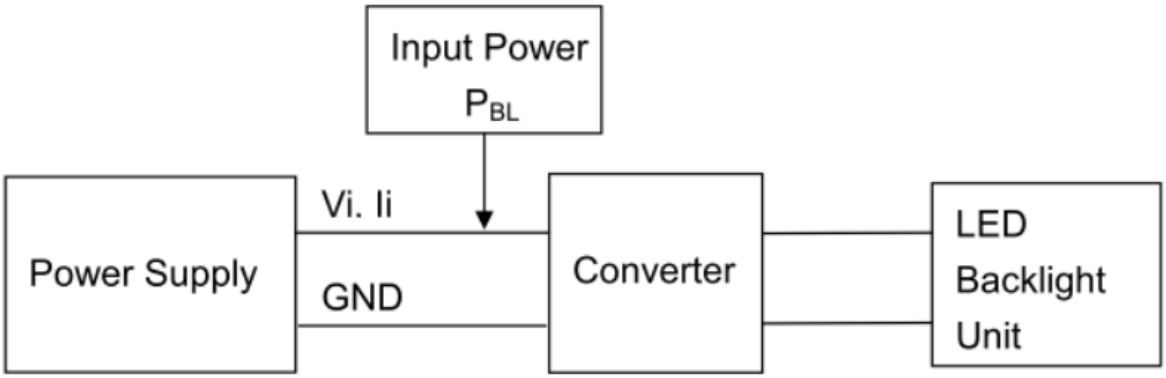
8. Backlight Characteristic



Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	15.6	16.8	18	V	If=60mA
Supply Current	If	-	60	-	mA	-
Life Time	-	20000	(30000)	-	Hr	If=60mA
Backlight Color	White					

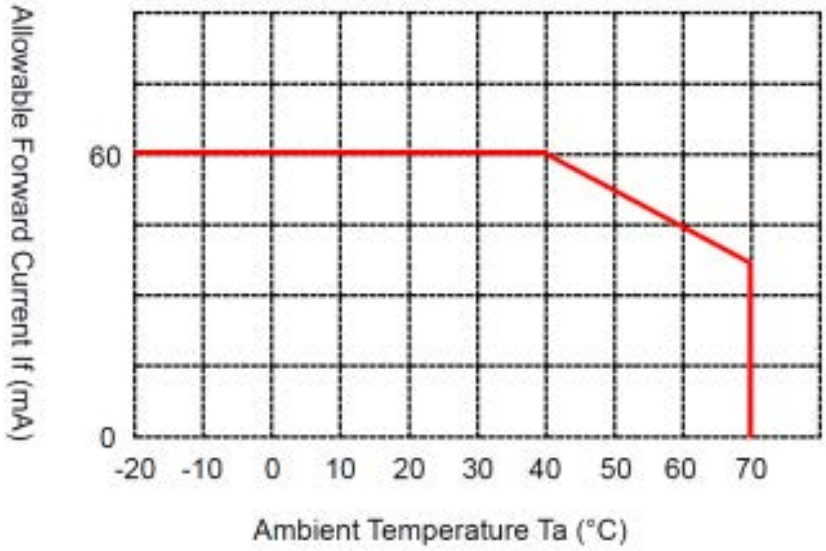
Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25℃ and If = 60mA.

Note 2: LED current is measured by utilizing a high frequency current meter as shown below:



Note 3: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and If = 60mA. The LED lifetime could be decreased if operating If is larger than 60mA.

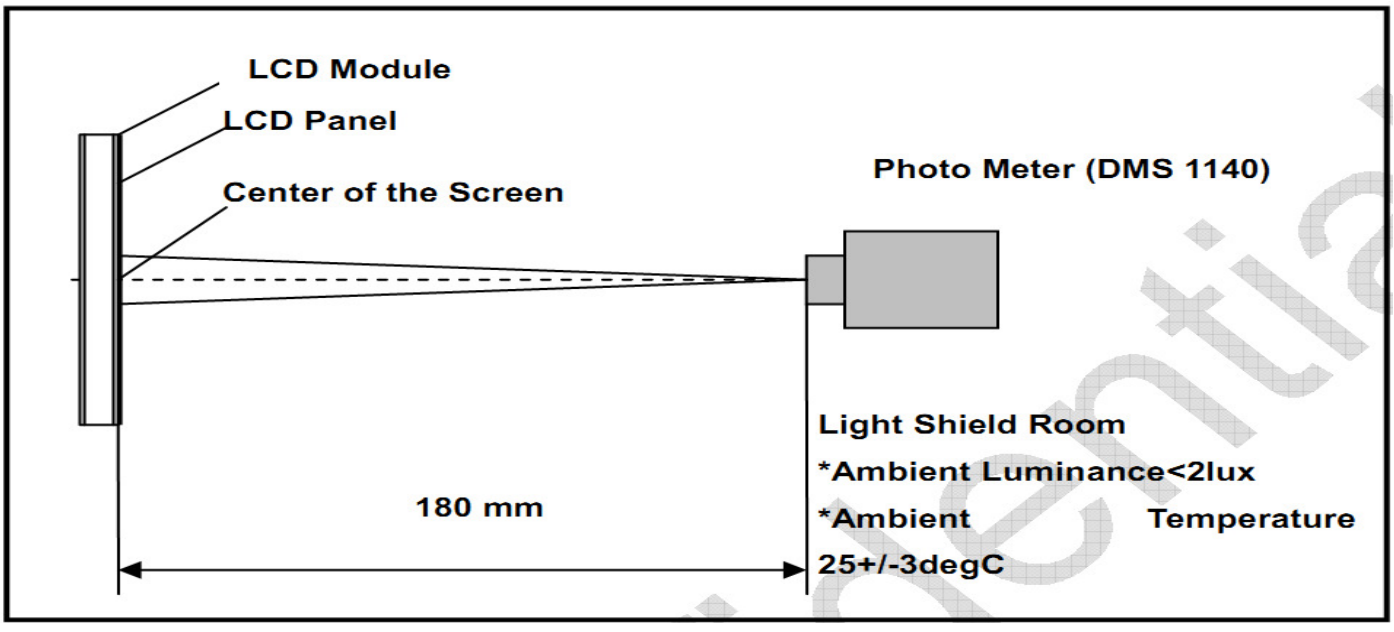
Note 4: LED light bar circuit:



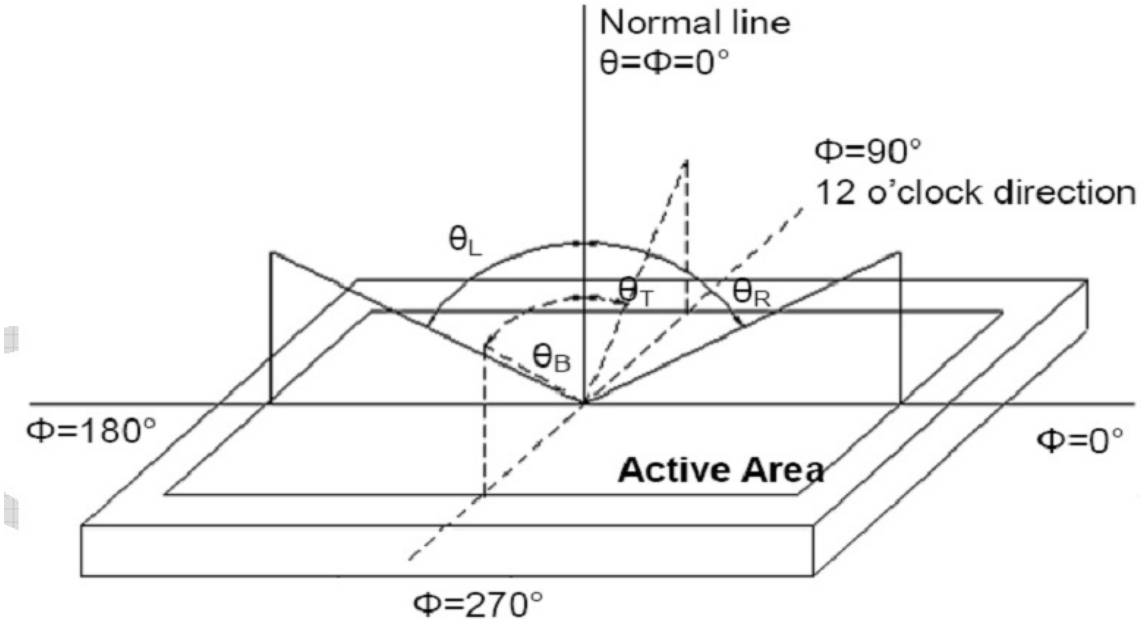
9. Optical Characteristics

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR>10)	Horizontal	θ_L	70	80	-	degree	(1),(2),(6)
		θ_R	70	80	-		
	Vertical	θ_T	70	80	-		
		θ_B	70	80	-		
Luminous Intensity for LCM	-		700	800	-	cd/m2	If=60mA
Uniformity for LCM	-		80	-	-	%	If=60mA
Contrast Ratio	Center		650	800	-	-	(1),(3),(6)
Response Time	Rising + Falling		35		40	ms	(1),(4),(6)
CF Color Chromaticity (CIE1931)	White x		TBD	TBD	TBD	-	(1), (6)
	White y		TBD	TBD	TBD	-	
	Red x		TBD	TBD	TBD	-	
	Red y		TBD	TBD	TBD	-	
	Green x		TBD	TBD	TBD	-	
	Green y		TBD	TBD	TBD	-	
	Blue x		TBD	TBD	TBD	-	
	Blue y		TBD	TBD	TBD	-	

Note (1) Measurement Setup: The LCD module should be stabilized at given temp. 25°C for 15 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 15 minutes in a windless room.



Note (2) Definition of Viewing Angle



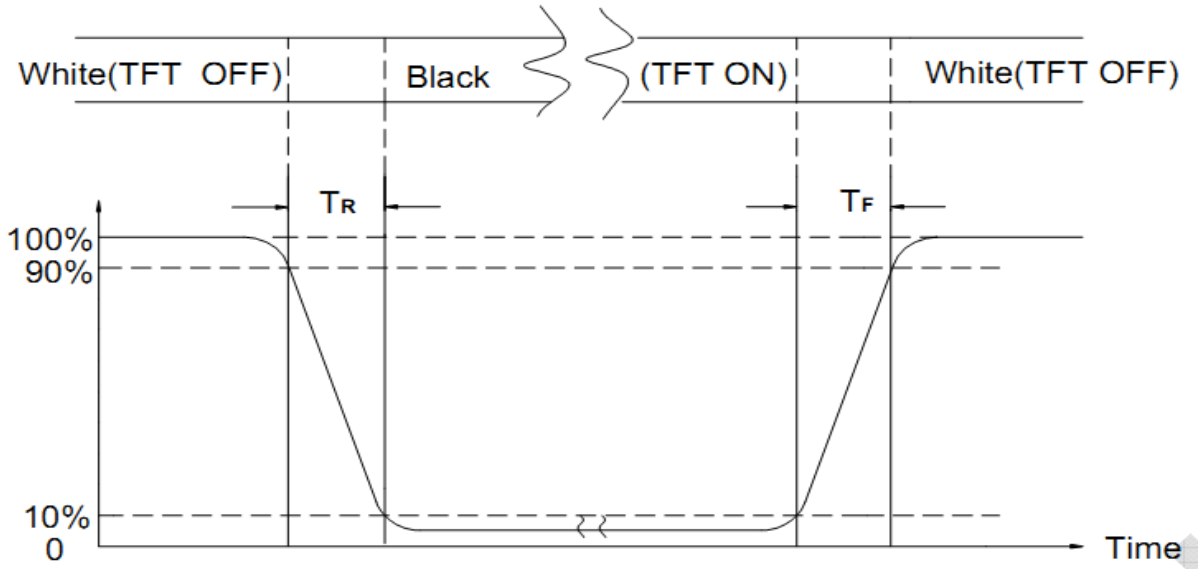
Note (3) Definition of Contrast Ratio (CR)

The contrast ratio can be calculated by the following expression

Contrast Ratio (CR) = L63 / L0

L63: Luminance of gray level 63, L0: Luminance of gray level 0

Note (4) Definition of response time



Note (5) Definition of Transmittance (Module is without signal input)

Transmittance = Center Luminance of LCD / Center Luminance of Back Light x 100%

Note (6) Definition of color chromaticity (CIE1931)

Color coordinates measured at the center point of LCD

10. Reliability Test Conditions and Methods

NO.	TEST ITEMS	TEST CONDITION	INSPECTION AFTER TEST
①	High Temperature Storage	80°C±2°C×96Hours	Inspection after 2~4hours storage at room temperature, the samples should be free from defects: 1, Air bubble in the LCD. 2, Seal leak. 3, Non-display. 4, Missing segments. 5, Glass crack. 6, Current IDD is twice higher than initial value. 7, The surface shall be free from damage. 8, The electric characteristic requirements shall be satisfied.
②	Low Temperature Storage	-30°C±2°C×96Hours	
③	High Temperature Operating	70°C±2°C×96Hours	
④	Low Temperature Operating	-20°C±2°C×96Hours	
⑤	Temperature Cycle(Storage)	-20°C ⟺ 25°C ⟺ 70°C (30min) (5min) (30min) 1cycle Total 10cycle	
⑥	Damp Proof Test (Storage)	50°C±5°C×90%RH×96Hours	
⑦	Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5mm X,Y,Z direction for total 3hours (packing condition test will be tested by a carton)	
⑧	Drooping Test	Drop to the ground from 1M height one time every side of carton. (packing condition test will be tested by a carton)	
⑨	ESD Test	Voltage:±8KV,R:330Ω,C:150PF,Air Mode,10times	

REMARK:
1, The Test samples should be applied to only one test item.
2, Sample side 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, EL evaluation should be accepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
6, Failure Judgment Criterion: Basic Specification Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

11. Inspection Standard

11.1 Scope

Specifications contain

11.1.1 Display Quality Evaluation

11.1.2 Mechanics Specification

11.2 Sampling Plan

Unless there is other agreement, the sampling plan for incoming inspection shall follow MIL-STD-105E.

11.2.1 Lot size: Quantity per shipment as one lot (different model as different lot).

11.2.2 Sampling type: Normal inspection, single sampling.

11.2.3 Sampling level: Level II.

11.2.4 AQL: Acceptable Quality Level

Major defect: AQL=0.65

Minor defect: AQL=1.5

11.3 Panel Inspection Condition

11.3.1 Environment:
Room Temperature: 25±5°C.

Humidity: 65±5% RH.

Illumination: 300 ~ 700 Lux.

11.3.2 Inspection Distance:

35±5 cm

11.3.3 Inspection Angle:

The vision of inspector should be perpendicular to the surface of the Module.

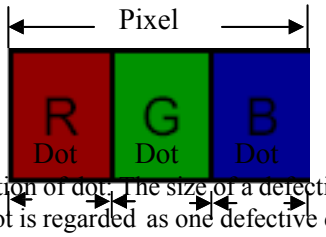
11.3.4 Inspection time：

Perceptibility Test Time: 20 seconds max.

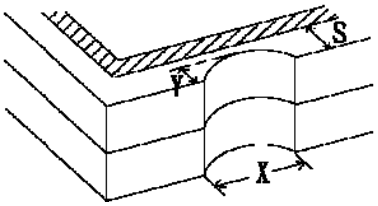
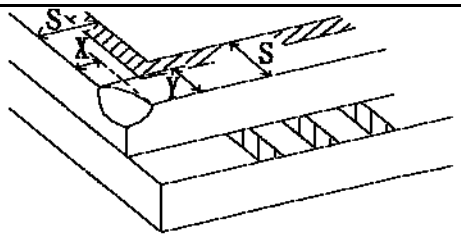
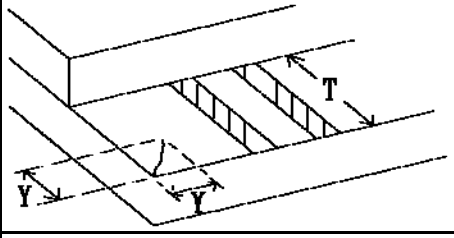
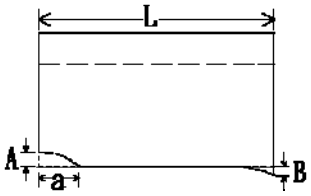
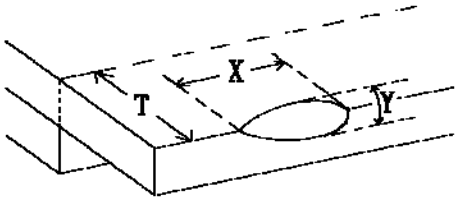
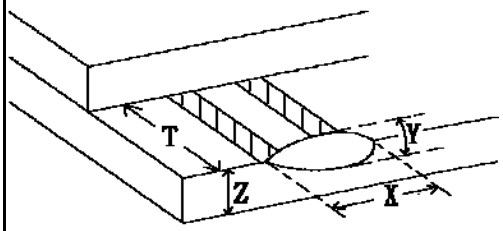
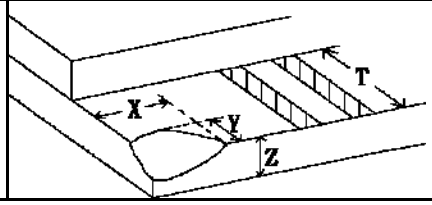
11.4 Inspection Plan

Class	Item	Judgment	Class
Packing & Indicate	1. Outside and inside package.	"MODEL NO.", "LOT NO." and "QUANTITY" should indicate on the package.	Minor
	2. Model mixed and quantity.	Other model mixed.....Rejected. Quantity short or over.....Rejected.	Critical
	3. Product indication.	"MODEL NO." should indicate on the product.	Major
Assembly	4. Dimension, LCD glass scratch and scribe defect.	According to specification or drawing.	Major
Appearance	5. Viewing area.	Polarizer edge or LCD's sealing line is visable in the viewing area…….Rejected.	Minor
	6. Blemish, black spot, white spot in the LCD and LCD glass cracks.	According to standard of visual inspection.(inside viewing area)	Minor
	7. Blemish, black spot, white spot and scratch on the polarizer.	According to standard of visual inspection.(inside viewing area)	Minor
	8. Bubble in polarizer.	According to standard of visual inspection.(inside viewing area)	Minor
	9. LCD's rainbow color.	Strong deviation color (or newton ring) of LCD…….....Rejected. Or according to limited sample.(if needed, and inside viewing area)	Minor
Electrical	10. Electrical and optical characteristics.(contrast Vop chromaticity….etc)	According to specification or drawing.(inside viewing area)	Critical
	11. Missing line.	Missing dot line character……..Rejected.	Critical
	12.Short circuit. Wrong pattern display.	No display, wrong pattern display, current consumption. Out of specification.....Rejected.	Critical
	13. Dot defect.(for color and TFT)	According to standard of visual Inspection.	Minor

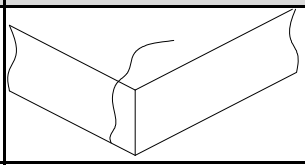
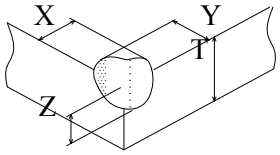
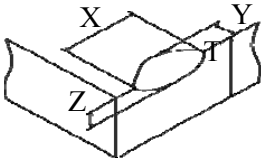
11.5 Standard Of Visual Inspection

<table>
<tr><th>NO.</th><th>CLASS</th><th>ITEM</th><th>JUDGMENT</th></tr>
<tr><td>11.5.1</td><td>Minor</td><td>Black and white spot.
Foreign materiel.
Dust.
Blemish.
Scratch.</td><td>(A) Round type: Unit: mm
<table>
<tr><th>Diameter (mm.)</th><th>Acceptable Q'ty</th></tr>
<tr><td>Φ≦0.2</td><td>Disregard</td></tr>
<tr><td>0.2 < Φ≦0.25</td><td>1(Distance>5mm)</td></tr>
<tr><td>0.25 < Φ</td><td>0</td></tr>
</table>
Note: Φ = (length+width)/2
(B) Linear type: Unit: mm
<table>
<tr><th>Length</th><th>Width (mm.)</th><th>Acceptable Q'ty</th></tr>
<tr><td>--</td><td>W≦0.03</td><td>Disregard</td></tr>
<tr><td>L≦5.0</td><td>0.03 < W≦0.05</td><td>2(Distance>5mm)</td></tr>
<tr><td>--</td><td>0.05 < W</td><td>FOLLOW ROUND TYPE</td></tr>
</table></td></tr>
<tr><td>11.5.2</td><td>Minor</td><td>Dent on polarizer.</td><td>Unit: mm.
<table>
<tr><th>Diameter</th><th>Acceptable Q'ty</th></tr>
<tr><td>Φ≦0.2</td><td>Disregard</td></tr>
<tr><td>0.2 < Φ≦0.5</td><td>2(Distance>5mm)</td></tr>
<tr><td>0.5 < Φ</td><td>0</td></tr>
</table></td></tr>
<tr><td>11.5.3</td><td>Minor</td><td>Bubble in polarizer.</td><td>Unit: mm.
<table>
<tr><th>Diameter</th><th>Acceptable Q'ty</th></tr>
<tr><td>Φ≦0.2</td><td>Disregard</td></tr>
<tr><td>0.2 < Φ≦0.5</td><td>2(Distance>5mm)</td></tr>
<tr><td>0.5 < Φ</td><td>0</td></tr>
</table></td></tr>
<tr><td>11.5.4</td><td>Minor</td><td>Dot defect</td><td>
<table>
<tr><th>Items</th><th>Acceptable Q'ty</th></tr>
<tr><td>Bright dot</td><td>N ≦1</td></tr>
<tr><td>Dark dot</td><td>N ≦1</td></tr>
<tr><td>Total dot</td><td>N ≦2</td></tr>
</table>
Pixel define :
 

Note1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.
Note 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.
Note 3: The bright dot defect must be visible through 2% ND filter
Note 4: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.</td></tr>
</table>

No.	Class	Item	Judgment
11.5.5	Minor	LCD glass chipping.	 Y>S Reject
11.5.6	Minor	LCD glass chipping.	 X or Y>S Reject
11.5.7	Major	LCD glass crack.	 Y>(1/2) T Reject
11.5.8	Major	LCD glass scribe defect.	 1. a>L/3, A>1.5mm Reject 2. B : According to dimension
11.5.9	Minor	LCD glass chipping. (on the terminal area)	 Φ = (x+y)/2>2.5mm Reject
11.5.10	Minor	LCD glass chipping. (on the terminal surface)	 Y>(1/3)T Reject
11.5.11	Minor	LCD glass chipping.	 Y>T Reject

11.6. Inspection Standard Of Touch Panel

No.	Class	Items		Judgment	
11.6.1	Major	Touch panel crack.			Reject
11.6.2	Minor	Touch panel chipping.	Corner.		
			Edge.		
11.6.3	Minor	Scratch. Dust and foreign materiel. (linear type)		W≦0.03	Accept
				0.03mm<W≦0.07mm, L≦5.0mm (Distance>5mm)	Accept 2 ea Max.
				W>0.07mm	Reject
11.6.4	Minor	Scratch. Dust and foreign materiel (round type: φ = (length+width)/2)		Φ≦0.2mm	Accept
				0.2mm＜Φ≦0.25mm (Distance>5mm)	Accept 1 ea Max.
				Φ＞0.25mm	Reject
11.6.5	Minor	Touch panel dent / fish eyes.		Φ≦0.2mm	Accept
				0.2mm＜Φ≦0.5mm (Distance>5mm)	Accept 2 ea Max.
				Φ＞0.5mm	Reject
11.6.6	Minor	Touch panel air bubble.		Φ≦0.2mm	Accept
				0.2mm＜Φ≦0.5mm (Distance>5mm)	Accept 2 ea Max.
				Φ＞0.5mm	Reject
11.6.7	Minor	Touch panel printing area scratch.		W≦0.03mm	Accept
				0.03mm＜W≦0.05mm, L≦5.0mm (Distance>5mm)	Accept 2 ea Max.
				W＞0.05 (W>0.05 follow 11.6.4 round type)	Reject
11.6.8	Minor	Touch panel white haze mark / dust.		Can not be removed	Reject

12. Handling Precautions

12.1 Mounting Method

The LCD panel of Microtips TFT module consists of two thin glass plates with polarizes which easily be damaged. And since the module in so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

12.2 Caution of LCD Handling And Cleaning

When cleaning the display surface, Use soft cloth with solvent [Recommended below] and wipe lightly

- Isopropyl alcohol
- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux
- Chlorine (Cl) , Sulfur (S)

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happen by miss-handling or using some materials such as Chlorine (CI), Sulfur (S) from customer, Responsibility is on customer.

12.3 Caution Against Static Charge

The LCD module use C-MOS LSI drivers, so we recommended that you:

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

12.4 Packing

- 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 Caution for operation

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life.
- An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- Response time will be extremely delayed at lower temperature then the operating temperature range and on the other hand at higher temperature LCD's how dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.

- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- Slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.
  Usage under the maximum operating temperature, 50%Rh or less is required.

12.6 Storing

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by the anything else.
  [It is recommended to store them as they have been contained in the inner container at the time of delivery from us

12.7 Safety

- It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water

13. Precaution for Use

13.1

A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

13.2

On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this specification
- When a new problem is arisen which is not specified in this specifications
- When an inspection specifications change or operating condition change in customer is reported to MicrotipsTFT , and some problem is arisen in this specification due to the change
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

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