SPECIFICATION

OF

LIQUID CRYSTAL DISPLAY MODULE

UNITED RADIANT TECHNOLOGY CORP. 光聯科技
Sep-25-2015
品管部 QC DEPT.

CUSTOMER : URT-STD

Model No. : UMSH-8247MD-15T(REV1)

Model version : 0

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CUSTOMER APPROVED SIGNATURE			

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Revision record

Document Revision	Model No. Version No.	Description	Revision by
0	UMSH-8247MD-T (UFNH-K080EY-1FT) Version No. 0		Albert Lin Nick Liu
1	UMSH-8247MD-1T (UFNH-K080EY-1FT) Version No. 0	1. Remove the MPU board. 2. Modify the module number from UMSH-8247MD-T to UMSH-8247MD-1T.	Albert Lin Nick Liu 03-Mar-2009
2	UMSH-8247MD-1T (UFNH-K080EY-1FT) Version No. 1	Modify the ADJ pin from low level to high level.	Albert Lin Nick Liu 03-Apr-2009
3	UMSH-8247MD-1T (UFNH-K080EY-1FT) Version No. 2	Modify the AC Characteristics (page 9, 10, 11 and 12).	Albert Lin Nick Liu 19-Nov-2012
4	UMSH-8247MD-1T(REV2) (UFNH-K080EY-6FT) Version No.0	1. Modify PCB. 2. Modify module number from UMSH-8247MD-1T to UMSH-8247MD-1T(REV2).	H.F. Kuo Danny Jhuaung 27-Apr-2015
5	UMSH-8247MD-15T(REV1) (UFNH-K080EY-6FT) Version No.0	1. Modify TP IC. 2. Modify module number from UMSH-8247MD-1T(REV2) to UMSH-8247MD-15T(REV1).	H.F. Kuo Ted Chen 25-Sep-2015

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1. BASIC SPECIFICATION

1.1 Mechanical specifications

Items	Nominal Dimension	Unit
Active screen size	5.7” diagonal	-
Dot Matrix	640 x RGB x 480	Pixel
Module Size (W x H x T)	127.0 x 98.43 x 8.96	mm.
Active Area (W x H)	115.2 x 86.4	mm.
Pixel Size (WxH)	0.18 x 0.18	mm.
Color depth	262K	color
Interface	Parallel 18-bit RGB	-
Driving IC Package	COG	-
Module weight	TBD	g

1.2 Display specification

Display	Descriptions	Note
LCD Type	a-Si TFT	-
LCD Mode	TN / Normal white	-
Polarizer Mode	Transmissive	-
Polarizer Surface	Normal	-
Pixel arrangement	RGB-stripe	-
Backlight Type	LED	-
Viewing Direction(Gray inversion)	6 O'clock Direction	1

Color tone is slightly changed by temperature and driving voltage.

Note 1 : The viewing direction defined in this specification is according to the rubbing direction of its TFT surface treatment by the TFT glass manufacturer. The grayscale inversion is at this direction as well. However, the optimal viewing direction for human view is normally where the color does NOT change to grayscale inversion, and this would be the opposite site of the specified viewing direction in this specification. In any case we advise customers to judge by themselves, and be aware of this phenomenon.

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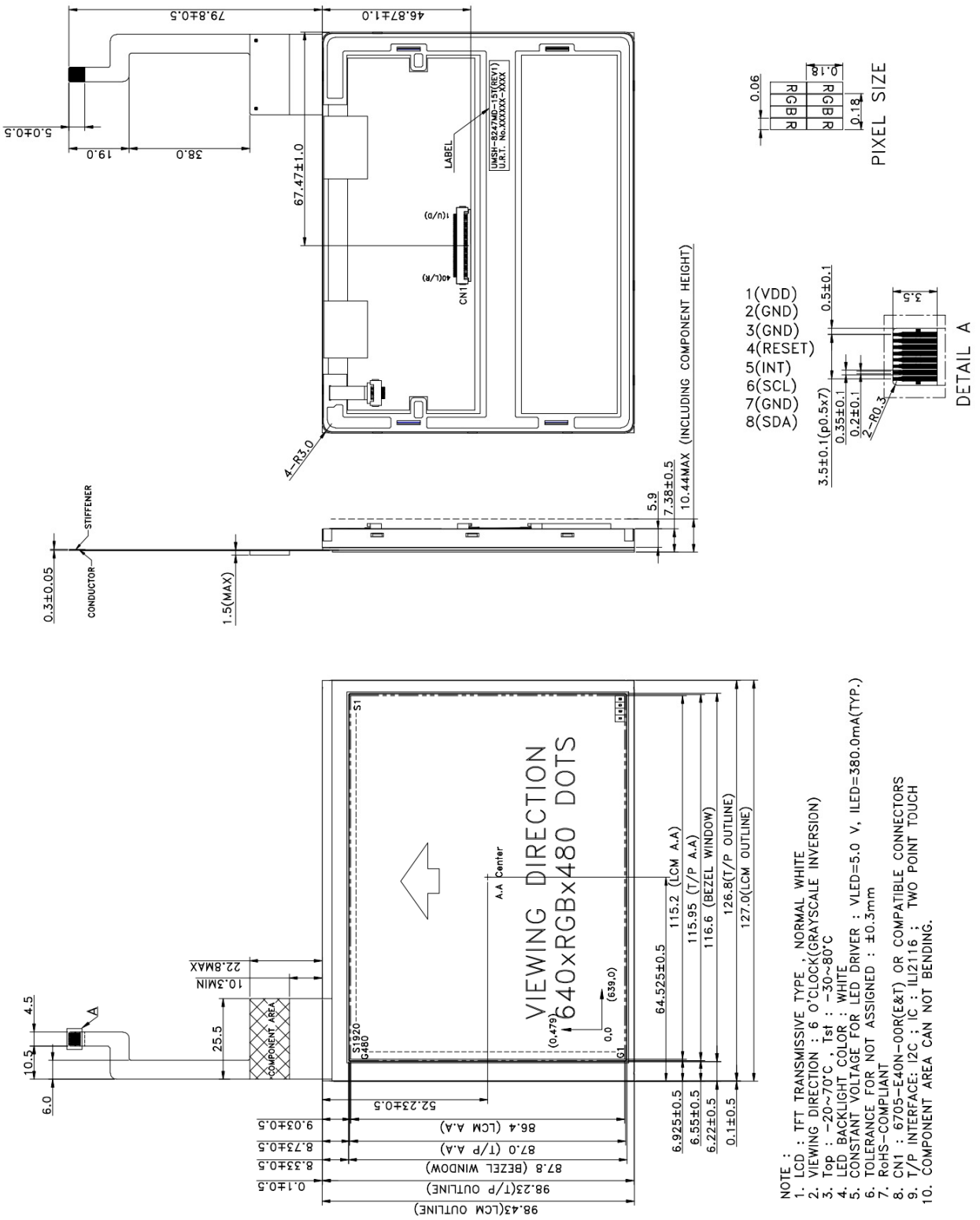
1.3 Outline dimension



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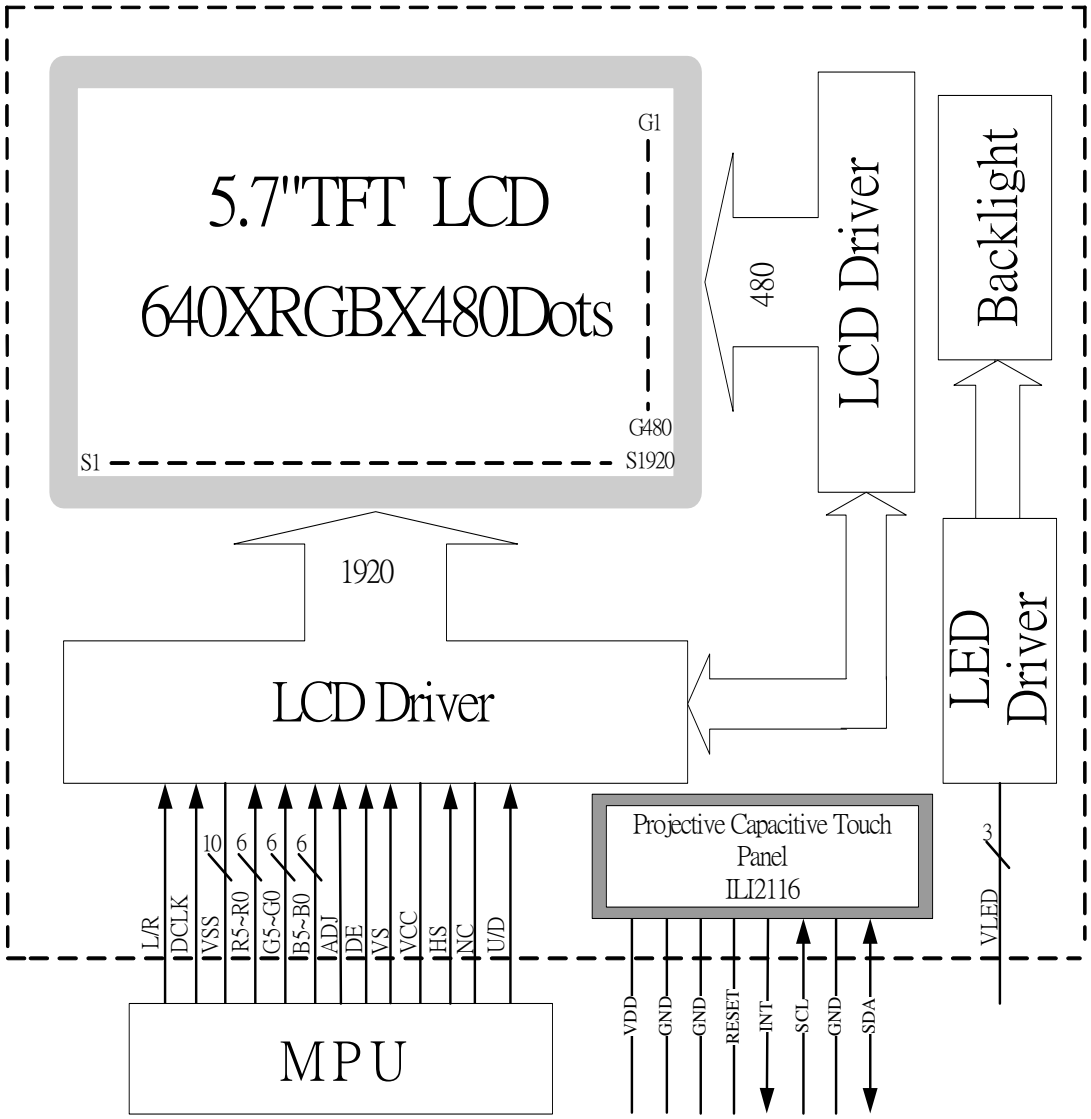
1.4 Block diagram:



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1.5 Interface Pin Connection:

21	G5	I	Green data input (MSB)
22、23	G4、G3	I	Green data input
24	VSS	P	Power ground
25、26	G2、G1	I	Green data input
27	G0	I	Green data input (LSB)
28	VSS	P	Power ground

Pin No.	Pin Symbol	I/O	Description
29	R5	I	Red data input (MSB)
30、31	R4、R3	I	Red data input
32	VSS	P	Power ground
33、34	R2、R1	I	Red data input
35	R0	I	Red data input (LSB)
36~37	VSS	P	Power ground
38	DCLK	I	Clock signals.
39	VSS	P	Power ground
40	L/R	I	Left or Right Display Control

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2. ELECTRICAL CHARACTERISTICS

2.1 Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit
Power supply voltage	VCC	-0.3	7.0	V
Input voltage	Vin	-0.3	VCC+0.3	V
Operate temperature range	TOP	-20	70	℃
Storage temperature range	TST	-30	80	℃

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2.2 DC Characteristics

2.2.1 Back-light Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	Unit	Test Condition	NOTE
Supply Current	I_{LED}	-	380	760	mA	Ta=25℃	-
Supply Voltage	V_{LED}	-	5	-	V	Ta=25℃	-
Half-Life Time	Lf	-	50000	-	hrs	Ta=25℃ 60 RH%	1

Note 1 : The " Half-Life Time "is defined as the module brightness decrease to 50% original brightness.

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2.3 AC Characteristics ：

2.3.1 AC Electrical Characteristics：

PARAMETER	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
HS setup time	T_{hst}	10	-	-	ns
HS hold time	T_{hhd}	10	-	-	ns
VS setup time	T_{vst}	10	-	-	ns
VS hold time	T_{vhd}	10	-	-	ns
Data setup time	T_{dsu}	10	-	-	ns
Data hold time	T_{dhd}	10	-	-	ns
DEN setup time	T_{esu}	10	-	-	ns
VS falling to HS falling time on odd field @ RGB mode	T_{HV_O}	-4	0	+4	T_{CPH}
VS falling to HS falling time on even field @ RGB mode	T_{HV_E}	0.4	0.5	0.6	T_H
Source output settling time	T_{ST}	-	12	20	μs
Source output loading R	R_{SL}	-	2	-	K ohm
Source output loading C	C_{SL}	-	60	-	pF
POL output delay time	T_{DP}	-	-	40	ns

2.3.2 Digital Parallel RGB interface (1920x480 resolution)：

PARAMETER	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
CLK frequency	F_{CPH}	-	25.175	-	MHz
CLK period	T_{CPH}	-	39.7	-	ns
CLK pulse duty	T_{CWH}	40	50	60	%
HS period	T_H	-	800	-	T_{CPH}
HS pulse width	T_{WH}	5	30	-	T_{CPH}
HS-first horizontal data time	T_{HS}	112	144	175	T_{CPH}
DEN pulse width	T_{EP}	-	640	-	T_{CPH}
VS pulse width	T_{WV}	1	3	5	T_H
VS-DEN time	T_{STV}	-	35	-	T_H
VS period	T_V	-	525	-	T_H

Note: When SYNC mode is used, 1st data start from 144th CLK after HS falling (when STHD[5:0]=00000)

PARAMETER	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
OEV pulse width	T_{OEV}	-	100	-	T_{CPH}
CKV pulse width	T_{CKV}	-	96	-	T_{CPH}
HS-CKV time	T_1	-	52	-	T_{CPH}
HS-OEV time	T_2	-	8	-	T_{CPH}
HS-POL time	T_3	-	72	-	T_{CPH}
STV setup time	T_{SUV}	-	46	-	T_{CPH}
STV pulse width	T_{WSTV}	-	1	-	T_H

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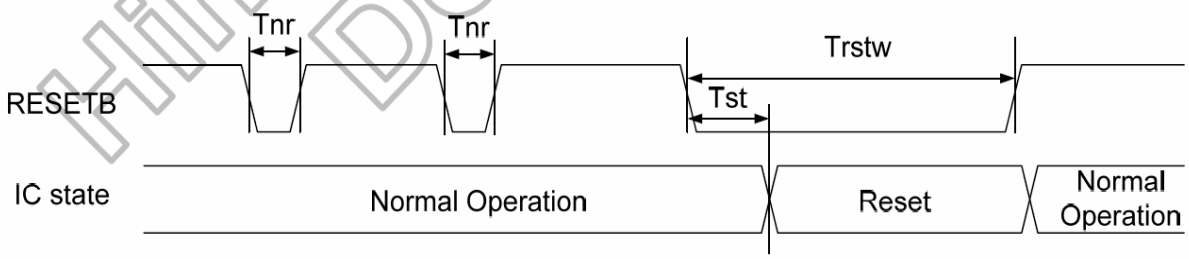
2.3.3 Hardware reset timing ：

PARAMETER	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
RESETB low pulse width	T_{rstw}	10	-	-	μs
Negative noise pulse width	T_{nr}		-	2	μs
Reset start time	T_{st}	2	-		μs



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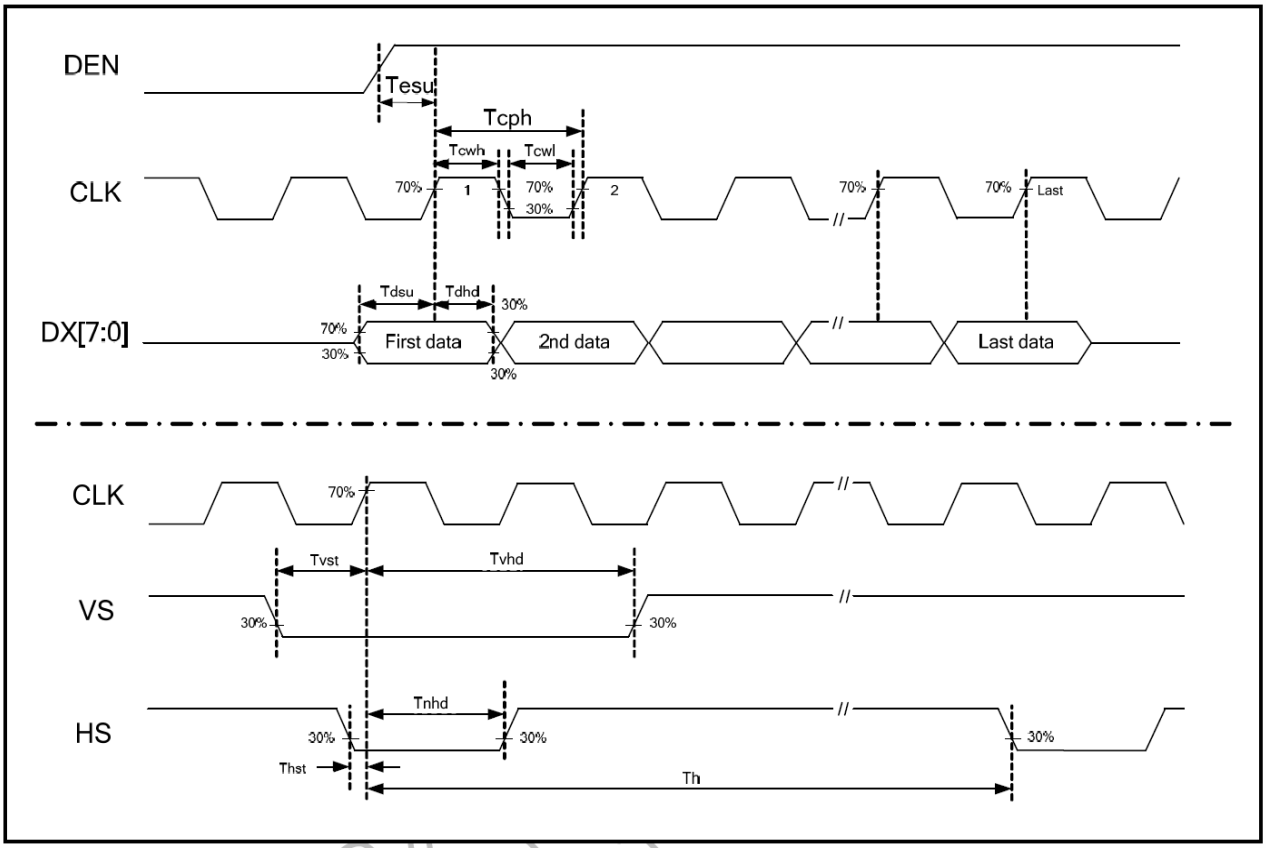
2.3.4 Interface Timing Chart:



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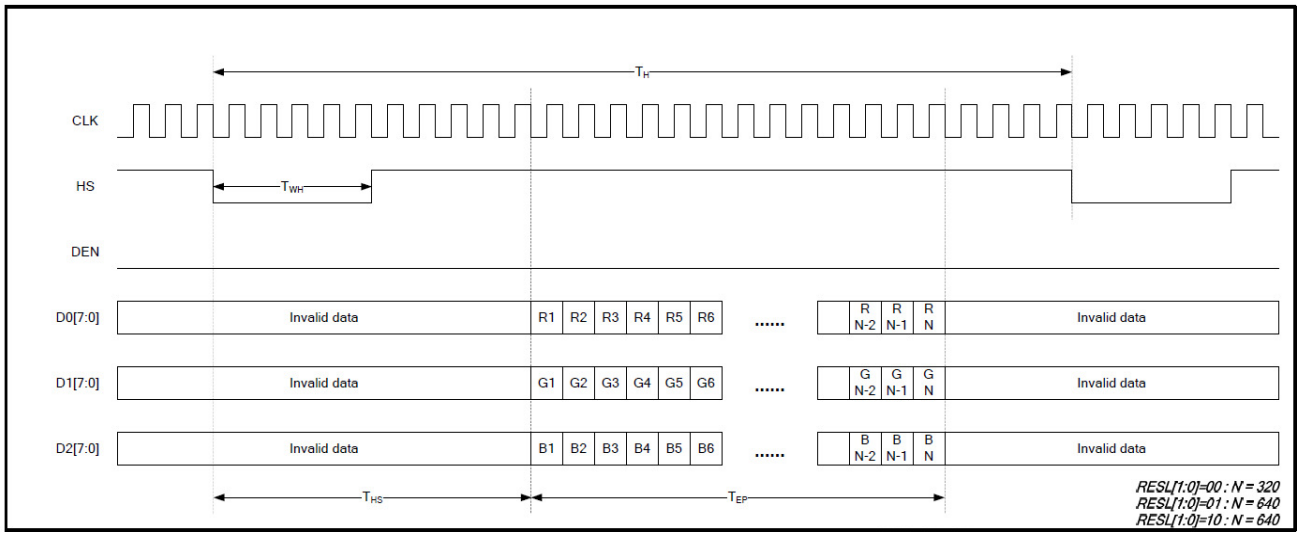
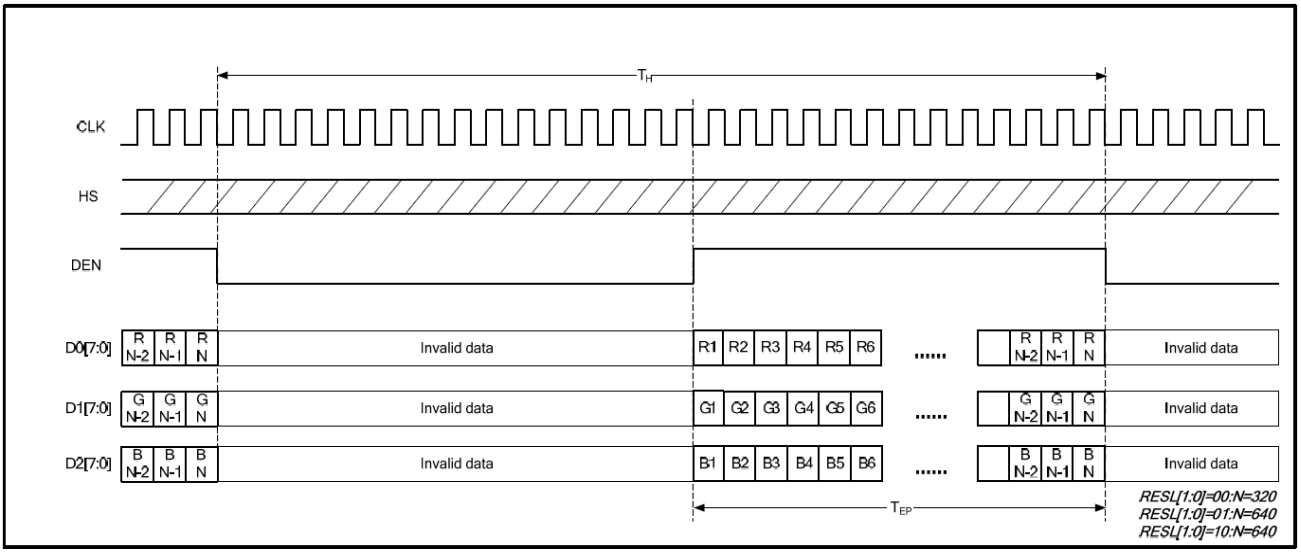
2.3.5 Data input format for RGB Mode:

Parallel RGB SYNC Mode Horizontal Data Format：



Parallel RGB DE Mode Horizontal Data Format：



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2.4 Touch Panel Basic Specification:

2.4.1 Mechanical Specifications

Items	Nominal Dimension	Unit
Touch Panel Size	5.7"	inch
Module Size (WxH)	117.6±0.3 x 88.8 ±0.3	mm
Active Area (WxH)	115.95 ± 0.3 x 87.0 ± 0.3	mm
Thickness	1.5±0.2 (without protective film)	mm

2.4.2 Touch Panel Specifications

Display	Descriptions	Note
Type	Projective Capacitive Touch Panel	
Structure	ITO Glass : T = 0.7mm	
Surface Hardness	≧ 7H	7H pencil , pressure 500g/45 degree (JIS-K5600)
Input mode	Finger	-
Connector Type	FPC	-
Resolution	640 *480	-

2.4.3 Mechanical Characteristics:

Items	Descriptions	Note
FPC Strength (Vertical)	Strength ≧ 600g/cm	-
FPC Bending	Min. 10 times for each side	Normal performance after Bending 90° test, no damage on FPC

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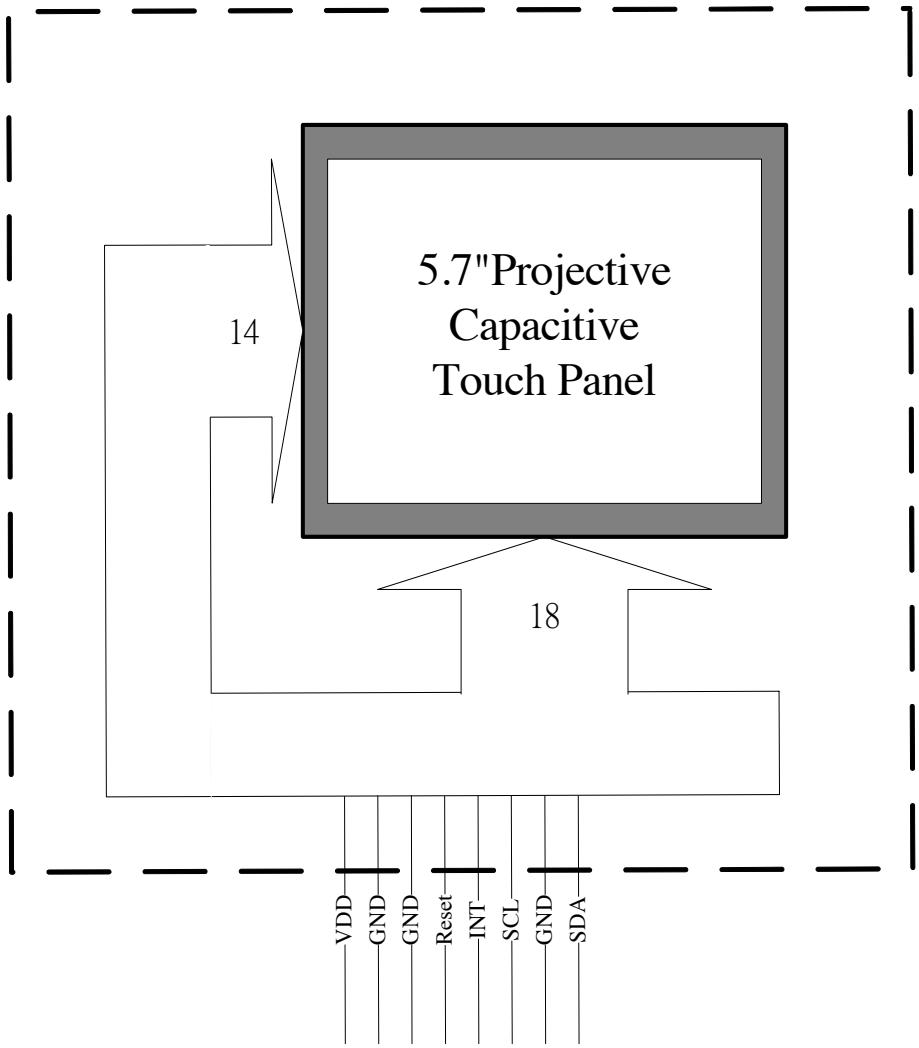
2.4.4 Block Diagram:



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2.4.5 Interface Pin Definition:

Capacitive Touch Panel interface pin:

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2.5 Electrical Characteristics

2.5.1 Absolute Maximum Ratings:

Items	Symbol	Min.	Max.	Unit
Supply voltage	VDD	-0.3	4	V
Operating temperature range	TOP	-20	70	℃
Storage temperature range	TST	-30	80	℃

2.5.2 DC Characteristics:

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2.5.3 Power up Sequence and Reset timing Requirement:

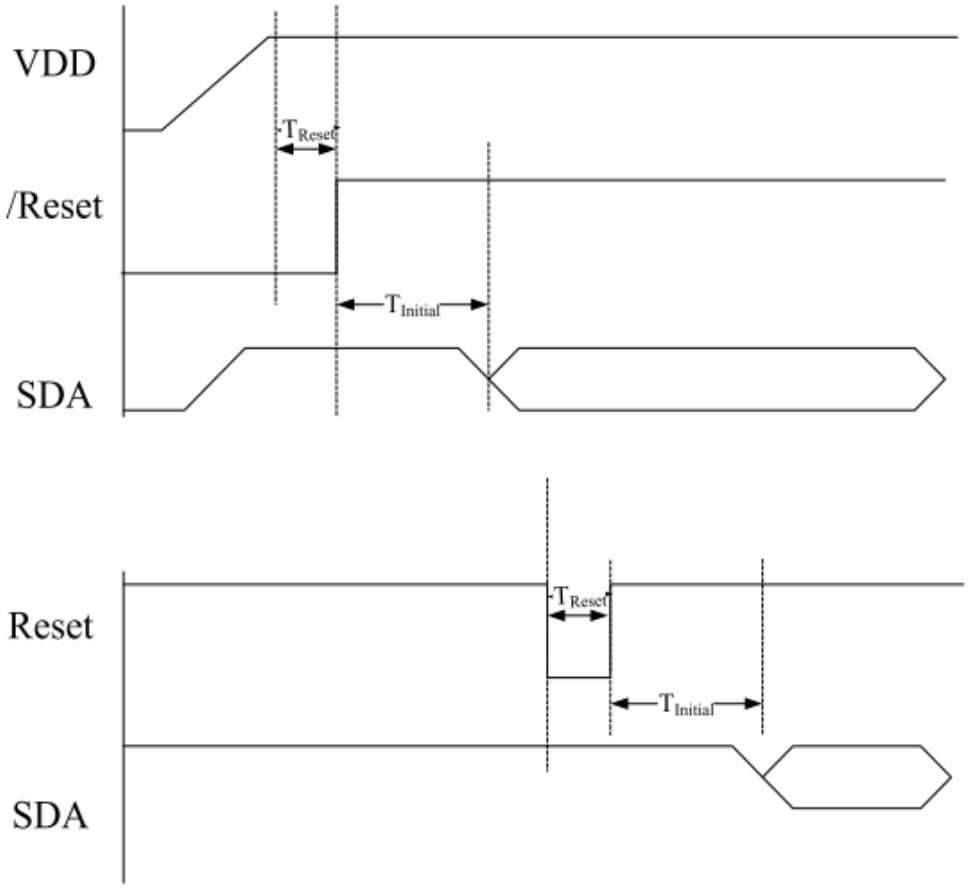

Fig 1: Power Up Sequence and Reset Diagram

Symbol	Parameter	MIN.	MAX.	Unit
$T_{Initial}$	After powering-on or resetting the device, the device needs I_{nitial} time to configure the system.	100	-	ms
T_{Reset}	/Reset pin low hold time	50	-	μs

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2.5.4 AC Characteristics:

I²C Timing

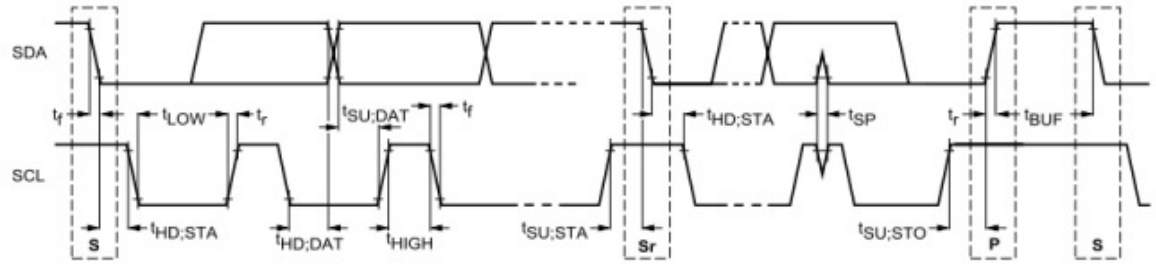

Fig 2: The timing of I²C Interface

Characteristics of the SDA and SCL bus lines

Symbol	Parameter	Standard mode			Fast Mode		
		Min	Max	Unit	Min	Max	Unit
f_{SCL}	SCL clock frequency	0	100	kHz	0	400	kHz
$t_{HD;STA}$	Hold time (repeated) START condition. After this period, the first clock pulse is generated	4.0	–	μs	0.6	–	μs
t_{LOW}	LOW period of the SCL clock	4.7	–	μs	1.3	–	μs
t_{HIGH}	HIGH period of the SCL clock	4.0	–	μs	0.6	–	μs
$t_{SU;STA}$	Set-up time for a repeated START condition	4.7	–	μs	0.6	–	μs
$t_{HD;DAT}$	Data hold time	5.0	–	μs	0	0.9	μs
$t_{SU;DAT}$	Data set-up time	250	–	ns	100	–	ns
t_r	Rise time of both SDA and SCL signals	–	1000	ns	–	300	ns
t_f	Fall time of both SDA and SCL signals	–	300	ns	–	300	ns
$t_{SU;STO}$	Set-up time for STOP condition	4.0	–	μs	0.6	–	μs
t_{BUF}	Bus free time between a STOP and START condition	4.7	–	μs	1.3	–	μs

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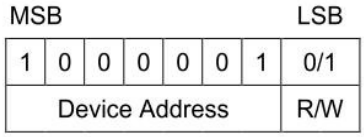
2.6 I2C Interface Data Structure

2.6.1 Device Address

The device addresses are 7-binary bits long and are conventionally expressed as 4 bits followed by 3 bits followed by the letter 'b', 1000 001b. These addresses occupy the high seven bits of an eight-bit field on the bus.



7-bit Device Address: 0x41

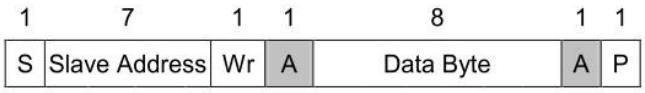
8-bit Device Read Address:0x83

8-bit Device Write Address:0x82

Fig 3: I^2C Device Address

2.6.2 Data Transfer

Data is transferred over the I^2C bus with 8-bit address and 8-bit data. The related protocol and timing diagrams are shown as below.



S	Start Condition
Sr	Repeated Start Condition
Rd	Read (bit value of 1)
Wr	Write (bit value of 0)
A	Acknowledge (this bit position may be '0' for an ACK or '1' for a NACK)
P	Stop Condition
	Master-to-Slave
	Slave-to-Master
---	Continue

Fig 4: Generic Transaction Diagram

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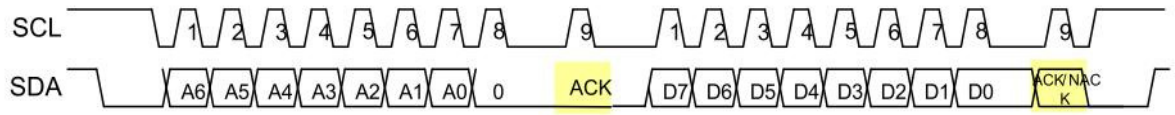
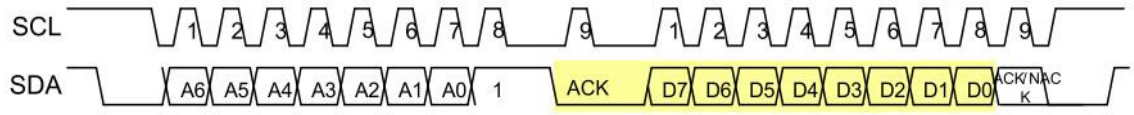
I2C Write timing



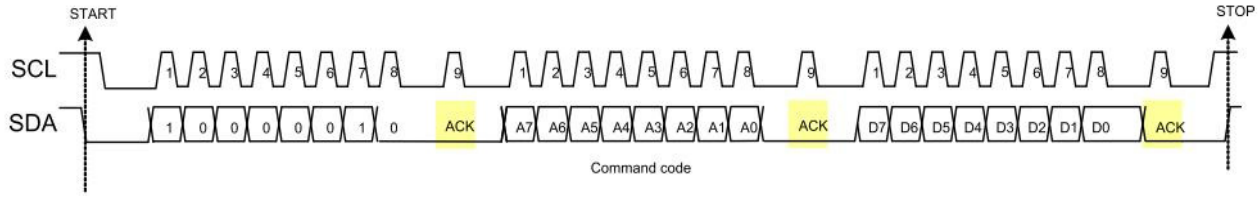
=> slave to master

I2C Read timing



=> slave to master

Byte Write



S	Slave Address	Wr	A	Command Code	A	Data Byte	A	P

Fig 5: Byte Write

Byte Read

c

S	Slave Address	Wr	A	Command Code	A	Sr	Slave Address	Rd	A	Data Byte	A	P

Fig 6: Byte Read

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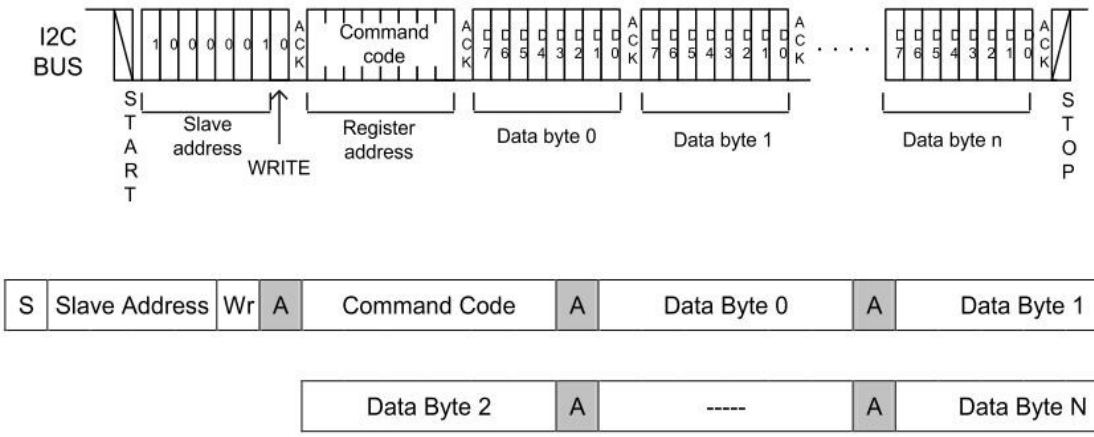
Multi-Byte Write

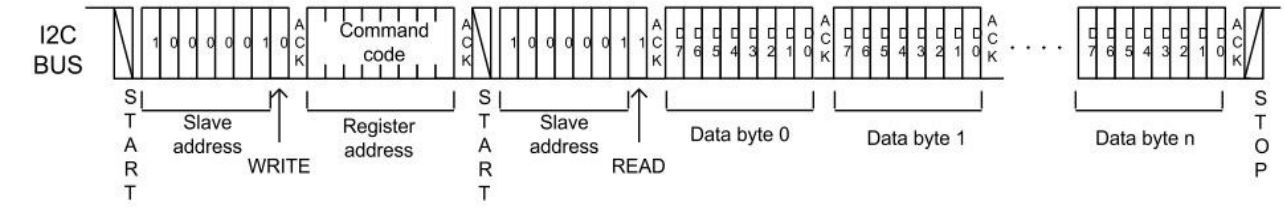


S	Slave Address	Wr	A	Command Code	A	Data Byte 0	A	Data Byte 1	A

Data Byte 2	A	-----	A	Data Byte N	A	P

Fig 7: Multi-Byte Write

Multi-Byte Read



S	Slave Address	Wr	A	Command Code	A	Sr	Slave Address	Rd	A	Data Byte 0	A

Data Byte 1	A	-----	A	Data Byte N	A	P

Fig 8: Multi-Byte Read

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2.7 Communication Protocol

2.7.1 Interrupt Pin (/INT) Control

ILI Touch device uses interrupt pin to signal the host when detecting touch events on the sensor. When a finger touches on the sensor surface, the $\overline{INT}$ pin will be pull low. ILI Touch device supports two different type control method.

Method 1: The $\overline{INT}$ will continue to be low until the finger leaves the sensor surface.

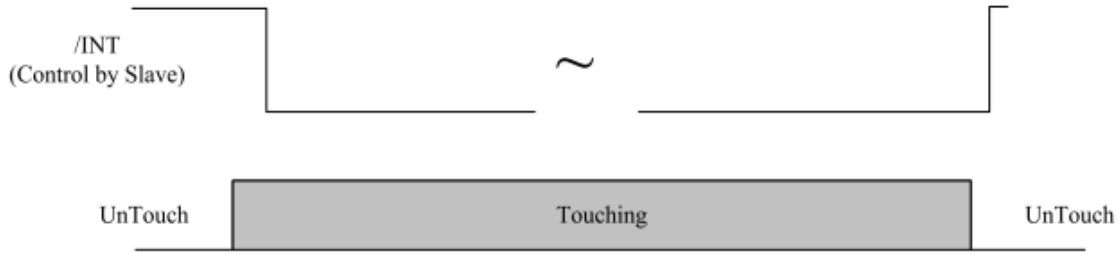

Fig 9: Method 1: $\overline{INT}$ Pin Control Diagram (Finger Touch)

Method 2: The $\overline{INT}$ will continue to be pull low until host read 0x10 command.

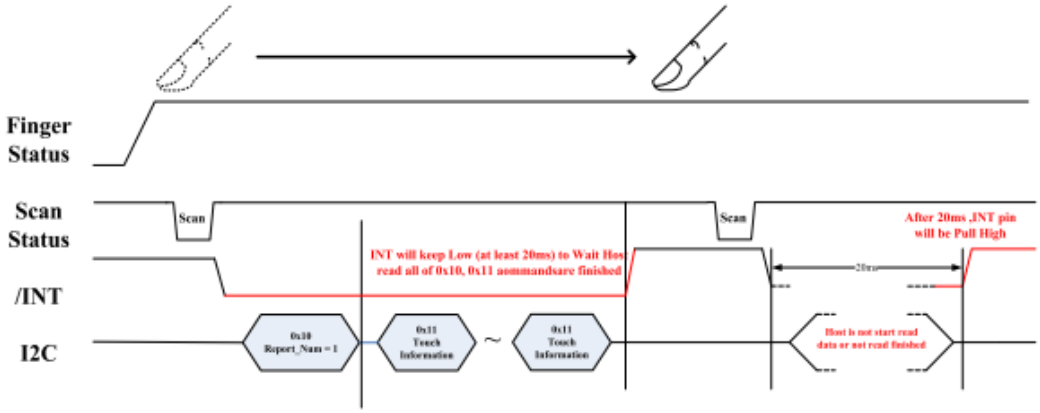

Fig 10: Method 2: $\overline{INT}$ Pin Control Diagram (Finger Touch)

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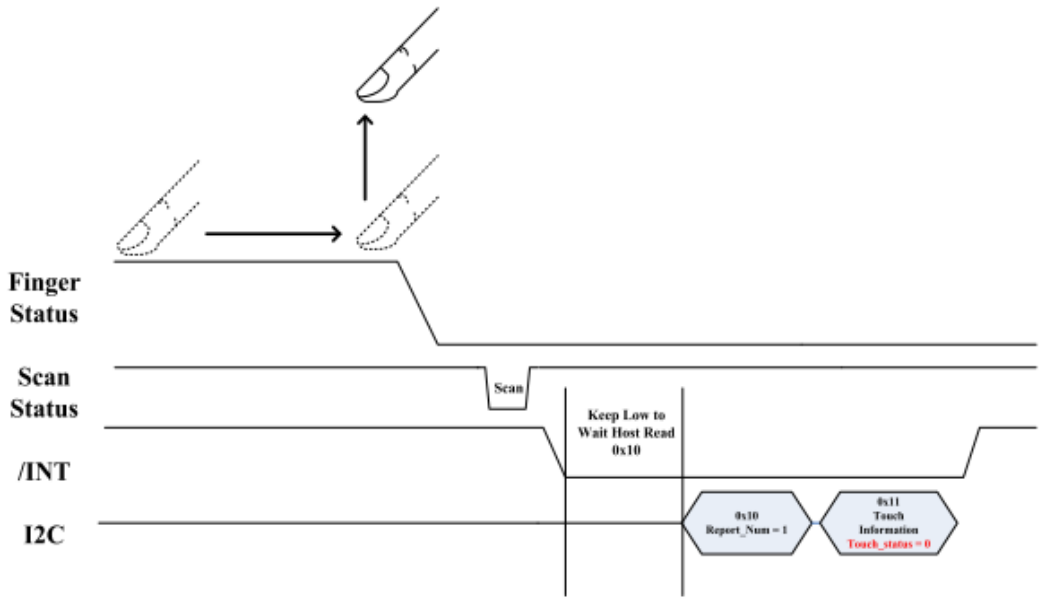

Fig 11: Method 2: $\overline{\text{INT}}$ Pin Control Diagram (Finger Release)

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2.7.2 General Command Description

2.7.2.1 Protocol V2.X Command List

CMD Code	Name	Set /Get	b7	b6	b5	b4	b3	b2	b1	b0
0x10	Touch Reported Number	Get	The numbers of the touch information report							
0x11	Touch Information Report	Get	Touch _ status	0	Reported_ID					
			X Position (bit 15:8) of the finger							
			X Position (bit 7:0) of the finger)							
			Y Position (bit 15:8) of the finger							
			Y Position (bit 7:0) of the finger							
0x11	Touch Key Report	Get	Touch _ status	1	Reported_ID					
			Touch Key ID							
			0x00							
			0xFF							
			0xFF							
0x11	Scrolling Bar Report	Get	Touch _ status	1	Reported_ID					
			Scrolling Bar ID							
			0x01							
			Scrolling Bar Position (bit 7:0) of the finger touched							
			Scrolling Bar Position (bit 15:8) of the finger touched							
0x20	Panel information	Get	The maximum X coordinate (bit 7:0)							
			The maximum X coordinate (bit 15:8)							
			The maximum Y coordinate (bit 7:0)							
			The maximum Y coordinate (bit 15:8)							
			The channel numbers of X direction							
			The channel numbers of Y direction							
			The maximum report points							
			The channel numbers of TouchKey / Scrolling Bar							
			For Touch Key Application (Maximum supports 31 Touch Key)							

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			Byte 8 : The Touch Key number (<32) Byte 9: 0xFF For Scrolling Bar Application Byte 8: The maximum Scrolling Bar coordinate (bit 7:0) Byte 9: The maximum Scrolling Bar coordinate (bit 15:8)
0x30	Enter Sleep Mode	Set	--
0x40	Firmware Version	Get	Major firmware version
			Minor firmware version
			Release firmware version
0x42	Protocol Version	Get	Major protocol version : 0x02
			Minor protocol version : XX

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2.7.2.2 Protocol V2.X Data Format

Read Touch Reported Number (0x10)

The Host sends I²C **"Multi-Byte Read"** format with command code **"0x10"** to read touch reported number. The touch device responds data with the following data format.

Touch Reported Number Data Format									
Byte	**Name of Bytes**	**Description**	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Report_Num	Touch reported number	The numbers of the touch information report							

Read Touch Information Report (0x11)

The Host sends I²C **"Multi-Byte Read"** format with command code **"0x11"** to read Touch Information Report. This command format includes touch points information. The touch device responds data with the following data format.

Touch Information Report Data Format										
Byte	**Name of Bytes**	**Description**	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Status	Touch Information Status	Touch_status	0	Reported_ID					
1	X_High	X direction coordinate of the finger	X Position (bit 15:8) of the finger							
2	X_Low		X Position (bit 7:0) of the finger)							
3	Y_High	Y direction coordinate of the finger	Y Position (bit 15:8) of the finger							
4	Y_Low		Y Position (bit 7:0) of the finger							

Touch_status:

1 = touch

0 = un-touch

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Read Touch Key Report (0x11)

The Host sends I²C **"Multi-Byte Read"** format with command code **"0x11"** to read Touch Key Report. This command format includes touch key information. The touch device responds data with the following data format.

Touch Key Report Data Format									
Byte	**Name of Bytes**	**Description**	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Status	Touch Information Status	Touch_ status	1	Reported_ID					
1	TouchKey_ID	Touch Key ID	Touch Key ID							
2	TouchKey_ScrollingBar	TouchKey or Scrolling Bar Report	0x00							
3	Reserved	--	0xFF							
4	Reserved	--	0xFF							

Touch_status:

1 = touch

0 = un-touch

Read Scrolling Bar Report (0x11)

The Host sends I²C **"Multi-Byte Read"** format with command code **"0x11"** to read Scrolling Bar Report. This command format includes Scrolling Bar information. The touch device responds data with the following data format.

Scrolling Bar Report Data Format									
Byte	**Name of Bytes**	**Description**	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Status	Touch Information Status	Touch_ status	1	Reported_ID					
1	ScrollingBar_ID	Scrolling Bar ID	Scrolling Bar ID							
2	TouchKey_ScrollingBar	TouchKey or Scrolling Bar Report	0x01							
3	ScrollingBar_Low	Scrolling Bar Coordinate	Scrolling Bar Position (bit 7:0) of the finger touched							
4	ScrollingBar_High		Scrolling Bar Position (bit 15:8) of the finger touched							

Touch_status:

1 = touch

0 = un-touch

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Read Panel information (0x20)

The Host sends I²C **"Multi-Byte Read"** format with command code **"0x20"** to read touch panel information.

The touch device responds data with the following data format.

Panel Information Data Format										
Byte	**Name of Bytes**	**Description**	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Xmax_Low	The maximum report value	The maximum X coordinate (bit 7:0)							
1	Xmax_High		The maximum X coordinate (bit 15:8)							
2	Ymax_Low	The maximum report value of Y coordinate	The maximum Y coordinate (bit 7:0)							
3	Ymax_High		The maximum Y coordinate (bit 15:8)							
4	Xchannel_Num	Channel numbers	The channel numbers of X direction							
5	Ychannel_Num		The channel numbers of Y direction							
6	Max_Point	The maximum report points	The maximum report points							
7	TouchKey_ScrollingBar_Channel_Num	Touch Key or Scrolling Bar Channel Numbers	The channel numbers of TouchKey / Scrolling Bar							
8	ToucKey_Num ScrollingBar_Low	Touch Key or Scrolling Bar Information	For Touch Key Application (Maximum supports 31 Touch Key) Byte 8 : The Touch Key number (<32) Byte 9: 0xFF For Scrolling Bar Application Byte 8: The maximum Scrolling Bar coordinate (bit 7:0) Byte 9: The maximum Scrolling Bar coordinate (bit 15:8)							
9	ScrollingBar_ High									

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Enter Sleep Mode (0x30)

The Host sends I²C **"Byte Write"** format with command code **"0x30"** to touch device.
After the touch device receives this command, the touch panel will do MCU sleep for power saving.
More detail, PLZ reference 4.2.3 Sleep Mode: Mode Control.

Read Firmware Version (0x40)

The Host sends I²C **"Multi-Byte Read"** format with command code **"0x40"** to read touch device firmware version. The touch device responds data with following data format.

Firmware Version Data Format									
Byte	**Name of Bytes**	**Description**	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	FW_Ver_0	Firmware Version V X.X.X	FW_Ver_0.FW_Ver_1.FW_Ver_2							
1	FW_Ver_1									
2	FW_Ver_2									

Read Protocol Version (0x42)

The Host sends I²C **"Multi-Byte Read"** format with command code **"0x42"** to read touch device protocol version. The touch device responds data with following data format.

Firmware Version Data Format									
Byte	**Name of Bytes**	**Description**	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Protocol_Ver_0	Protocol Version V 2.X	Major protocol version : 0x02							
1	Protocol_Ver_1		Minor protocol version: XX							

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2.7.2.3 PSleep Mode : Mode Control

Entry Sleep mode

After the touch device receives this command (0x30), the touch device will enter the Sleep mode.

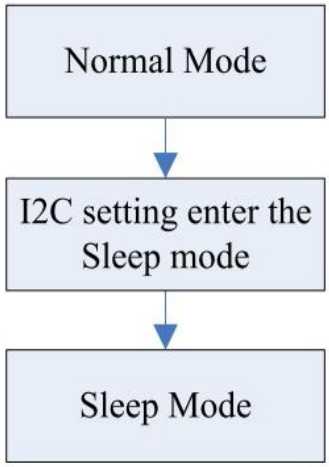

Fig 12: Entry Sleep mode Flowchart

Exit Sleep mode

After the touch device receives the **/Reset pin low and hold a period,** the touch device will exit the Sleep mode.

About the Reset timing Requirement reference Fig 1. Power Up Sequence and Reset Diagram

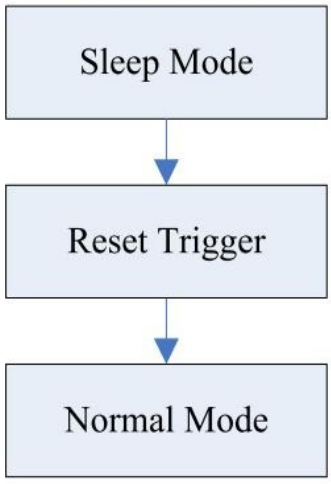

Fig 13: Exit Sleep mode Flowchart

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2.7.2.4 Idle Mode: Mode Control

If no touch and the non-active time over the entry idle time, the chip enter Idle mode.

Entry Idle Mode

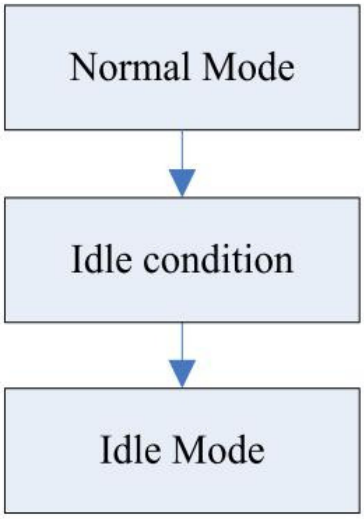

Fig 14: Entry Idle mode Flowchart

Exit Idle Mode

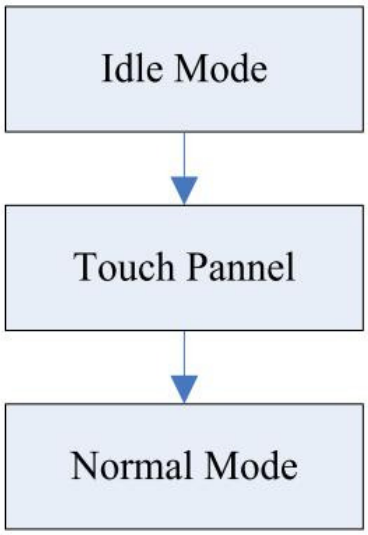

Fig 15: Exit Idle mode Flowchart

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2.7.2.5 Touch Key / Points Reporting

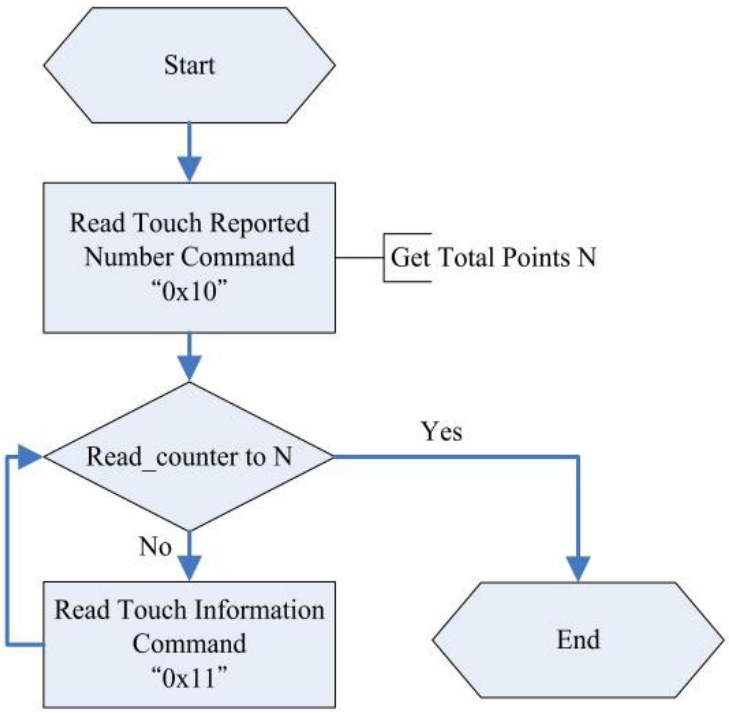

Fig 16: Read Touch Key / Points Data Flow Chart

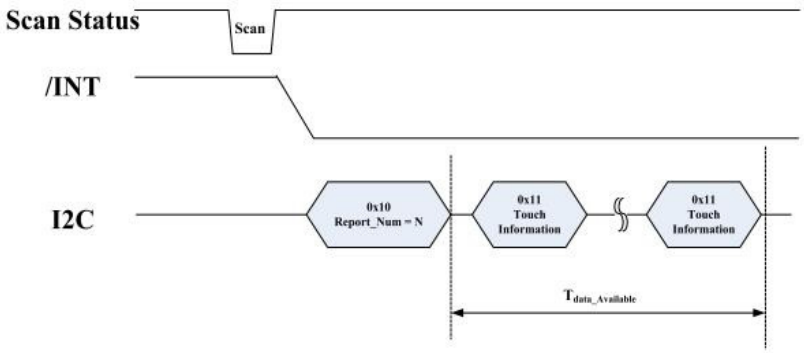

Fig 17: Touch Key / Points Reporting Timing Diagram

Symbol	Parameter	MIN.	MAX.	Unit
$T_{data_Available}$	0x10 data available time. TP will latch buffer for at least $T_{data_Available.}$ Ms	5	--	ms

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Standard Process (For Example 3 Points)

Command	Return Value
0x10	0x03
0x11	0x81,X_{High},X_{low},Y_{High},Y_{Low}
0x11	0x82,X_{High},X_{low},Y_{High},Y_{Low}
0x11	0x83,X_{High},X_{low},Y_{High},Y_{Low}
0x10	0x03
0x11	0x81,X_{High},X_{low},Y_{High},Y_{Low}
0x11	0x82,X_{High},X_{low},Y_{High},Y_{Low}
0x11	0x83,X_{High},X_{low},Y_{High},Y_{Low}

Standard Process (For Example 1 Touch Key)

Command	Return Value
0x10	0x01
0x11	0xC1,0x01,0X00,0xFF,0xFF
0x10	0x01
0x11	0x41,0x01,0X00,0xFF,0xFF

Touch Release Event (For Example 3 Points → 2 Points)

Command	Return Value
0x10	0x03
0x11	0x81,X_{High},X_{low},Y_{High},Y_{Low}
0x11	0x82,X_{High},X_{low},Y_{High},Y_{Low}
0x11	0x83,X_{High},X_{low},Y_{High},Y_{Low}
0x10	0x03
0x11	0x81,X_{High},X_{low},Y_{High},Y_{Low}
0x11	0x02,X_{High},X_{low},Y_{High},Y_{Low}
0x11	0x83,X_{High},X_{low},Y_{High},Y_{Low}

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2.8 Optical Characteristics

Items	Descriptions	Note
Transmittance	Type : 85%	-

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3. OPTICAL CHARACTERISTICS

3.1 Characteristics

Electrical and Optical Characteristics

No.	Item			symbol	/ temp.	Min.	Typ.	Max.	Unit	Note
1	Response Time			Tr	25 ℃	-	15	-	ms	2
				Tf	25 ℃	-	35	-		
2	Viewing Angle	Hor.	Cr.≧10	Θ_{2+}	0°	60	75	-	degree	3
				Θ_{2-}	180°	60	75	-		
		Ver.		Θ_{1+}	270°	45	50	-		
				Θ_{1-}	90°	60	75	-		
3	Contrast Ratio			Cr	25 ℃	400	600	-	-	4
4	Red x-code			Rx	25 ℃	0.56	0.61	0.66	-	5
	Red y-code			Ry		0.31	0.36	0.41		
	Green x-code			Gx		0.29	0.34	0.39		
	Green y-code			Gy		0.53	0.58	0.63		
	Blue x-code			Bx		0.09	0.14	0.19		
	Blue y-code			By		0.07	0.12	0.17		
	White x-code			Wx		0.28	0.33	0.38		
	White y-code			Wy		0.31	0.36	0.41		
	Brightness			Y		400	600	-	cd/m^2	
5	Brightness Uniformity				25 ℃	80	-	-	%	6

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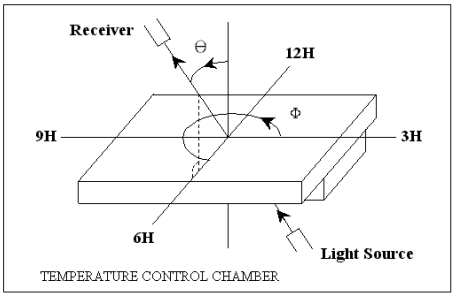
3.2 Definition of optical characteristics

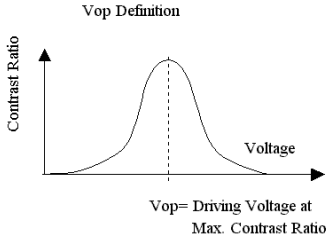
Measurement condition :

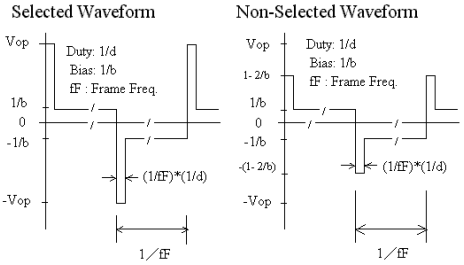
Transmissive and Transflective type



PHOTAL LCD-5000

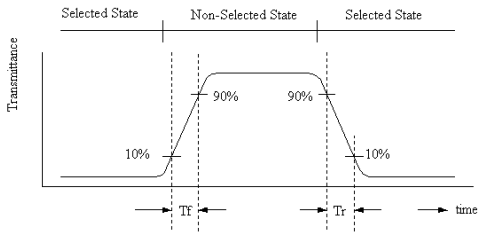
[Note 1] Definition of LCD Driving Vop and Waveform :



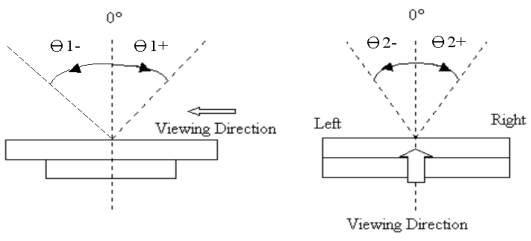


[Note 2] Definition of Response Time

for Positive type :

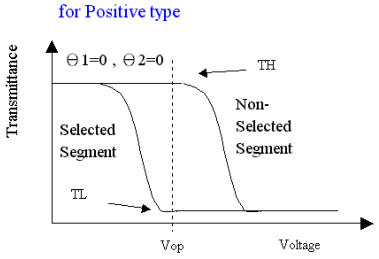


[Note 3] Definition of Viewing Angle :



[Note 4] Definition of Contrast Ratio :

for Positive type



$$\text{Contrast Ratio} = \frac{TH}{TL}$$

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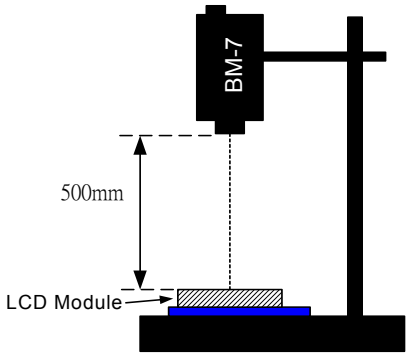
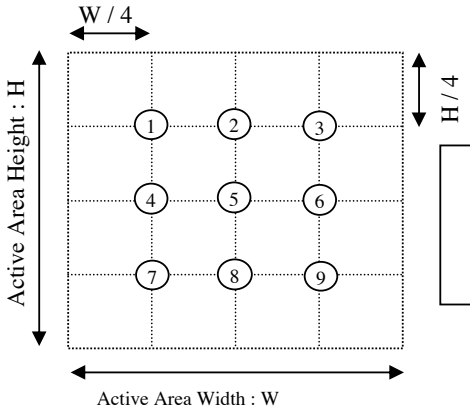
[Note 5] Definition of measurement of Color Chromaticity and Brightness

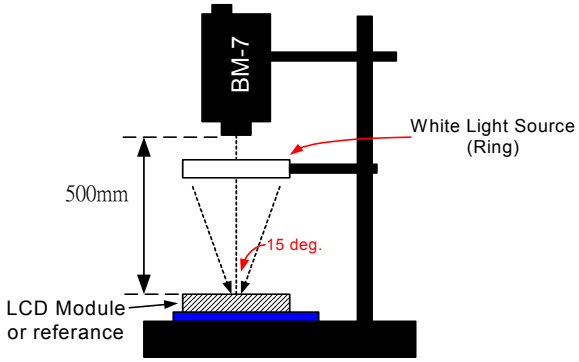


[Note 6] Definition of Brightness Uniformity



$$\text{Brightness Uniformity} = \frac{\text{Minimum Brightness of Point 1~9}}{\text{Maximum Brightness of Point 1~9}}$$

[Note 7] Definition of Measurement of Reflectance



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4. RELIABILITY :

Item No	Items	Condition	Note
1	High temperature operating	70 ℃ , 200 hours	1
2	Low temperature operating	-20 ℃ , 200 hours	1
3	High temperature storage	80 ℃ , 200 hours	1
4	Low temperature storage	-30 ℃ , 200 hours	1
5	High temperature & humidity storage	60℃, 90%RH, 100 hours	2
6	Thermal Shock storage	-30℃, 30min.<=> 80℃, 30min. 10 Cycles	1
7	Vibration test	10 => 55 =>10 => 55 => 10 Hz , within 1 minute Amplitude : 1.5mm. 15 minutes for each Direction (X,Y,Z)	
8	Drop test	Packed, 100CM free fall, 6 sides, 1 corner, 3edges	
9	Life time	50,000 hours 25℃ , 70%RH below , specification condition driving	

Note 1：The product move into the room temperature for at least 2 hours with no condensation.

Note 2：The product move into the room temperature for at least 24 hours with no condensation.

* One single product test for only one item.

* Judgment after test : keep in room temperature for more than 2 hours.

- Current consumption < 2 times of initial value
- Contrast > 1/2 initial value
- Function : work normally

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5. PRODUCT HANDLING AND APPLICATION

☐ PRECAUTION FOR HANDLING LCM

- The LCD module contains a C-MOS LSI. People who operate the LCM should wear ESD protection eguipement to prevent ESD hurt on products.
- Do not input any signal before power is turned on.
- Do not take LCM from its packaging bag until it is assembled.
- Peel off the LCM protective film slowly since static electricity may be generated.
- Pay attention to the humidity of the work shop, 50~60%RH is satisfactory.
- Use a non-leak iron for soldering LCM.
- Do not touch the display surface or connection terminals area with bare hands.Smudges on the display surface reduce the insulation between terminals.
- Cautions for soldering to LCM:

  Condition for soldering I/O terminals:
  Temperature at iron tip :350℃±15℃.
  Soldering time : 3~4sec./ terminals.
  Type of solder : Eutectic solder(rosin flux filled).

☐ PRECAUTION IN USE OF LCD

- Do not contact or scratch the front surface and the contact pads of a LCD panel with hard materials such as metal or glass or with one's nail.
- To clean the surface , wipe it gently with soft cloth dampened by alcohol.
- Do not attempt to wiped off the contact pads.
- Keep LCD panels away from direct sunlight , also avoid them in high-temperature & high humidity environment for a long period.
- Do not drive LCD panels by DC voltage.
- Do not expose LCD panels to organic solvent.
- Liquid in LCD is hazardous substance. In case a contact with liquid crystal material is occured, be sure to immediately wash such material away by soap and water.
- The polarizer is easily damaged and should be handle with special care. Don't press or rub it with hard objects.

☐ PRECAUTION FOR STORING LCM

- To avoid degradation of the device , do not store the module under the conditions of direct sunlight , high temperature or high humidity . Keep the module in bags designed to prevent static electricity charging under low temperature / normal humidity conditions(avoid high temperature / high humidity and low temperature below 0℃)

☐ USING ON MEDICAL CARE , SAFETY OR HAZARDOUS APPLICATION OR SYSTEM

- For the application in medical care, safety and hazardous prodcuts or systems, an authorization from URT is required. URT will not responsible for any damage or loss which caused by the products without any authorization given by URT.
- This product is not allowed to be designed and used for military application and/or purpose.
- The delivery of this product to the countries and/or regions where the embargoes are imposed by U.N. is prohibited.
- The application and delivery of this product must comply with Startegic High-Tech Commodities (SHTC) export control and the sales to the embargoed and/or sanctioned countries or regions are strictly prohibited.

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6. DATE CODE OF PRODUCTS

- Date code will be shown on each product :

- **YY MM DD - XXXX**

  Year Month Day - Serial No.

- Example: 121108 - 0 0 0 3 ==> Year 2012, November,8th , Serial No.0003

Note ： The lot no. attached on the packing box will be used for tracking once the part is too small to print the date code.

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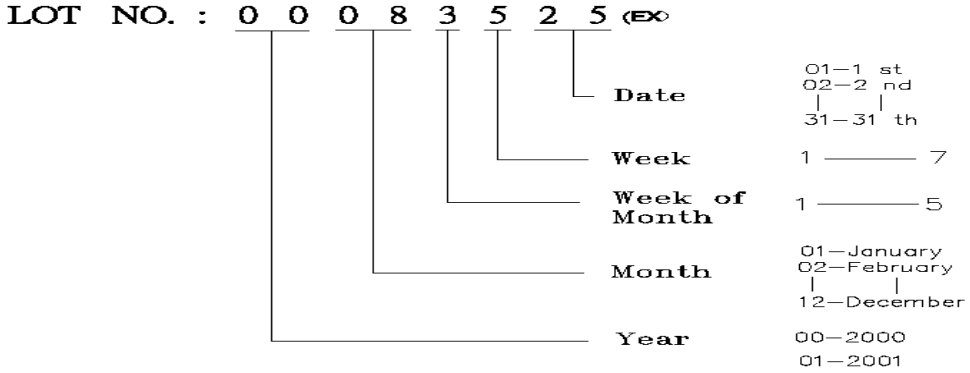
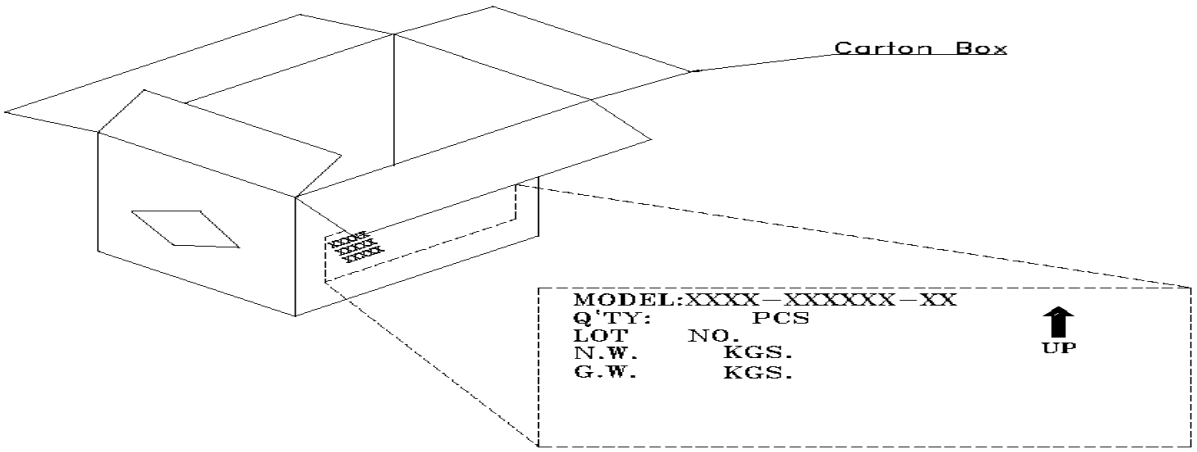
7. PACKING

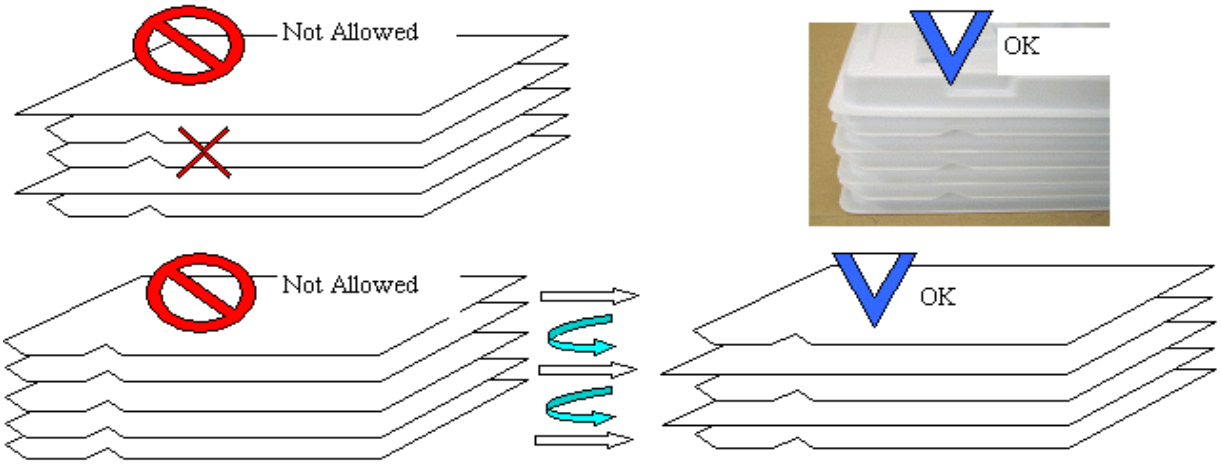
Instruction of lot number:



Lable of carton:



Packing tray must be stacked with alternated direction to each others.
To tacks packing trays in same direction will cause product damaged.



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MODEL NO: UM*

T.B.D. pcs / Tray

T.B.D. Tray / Box

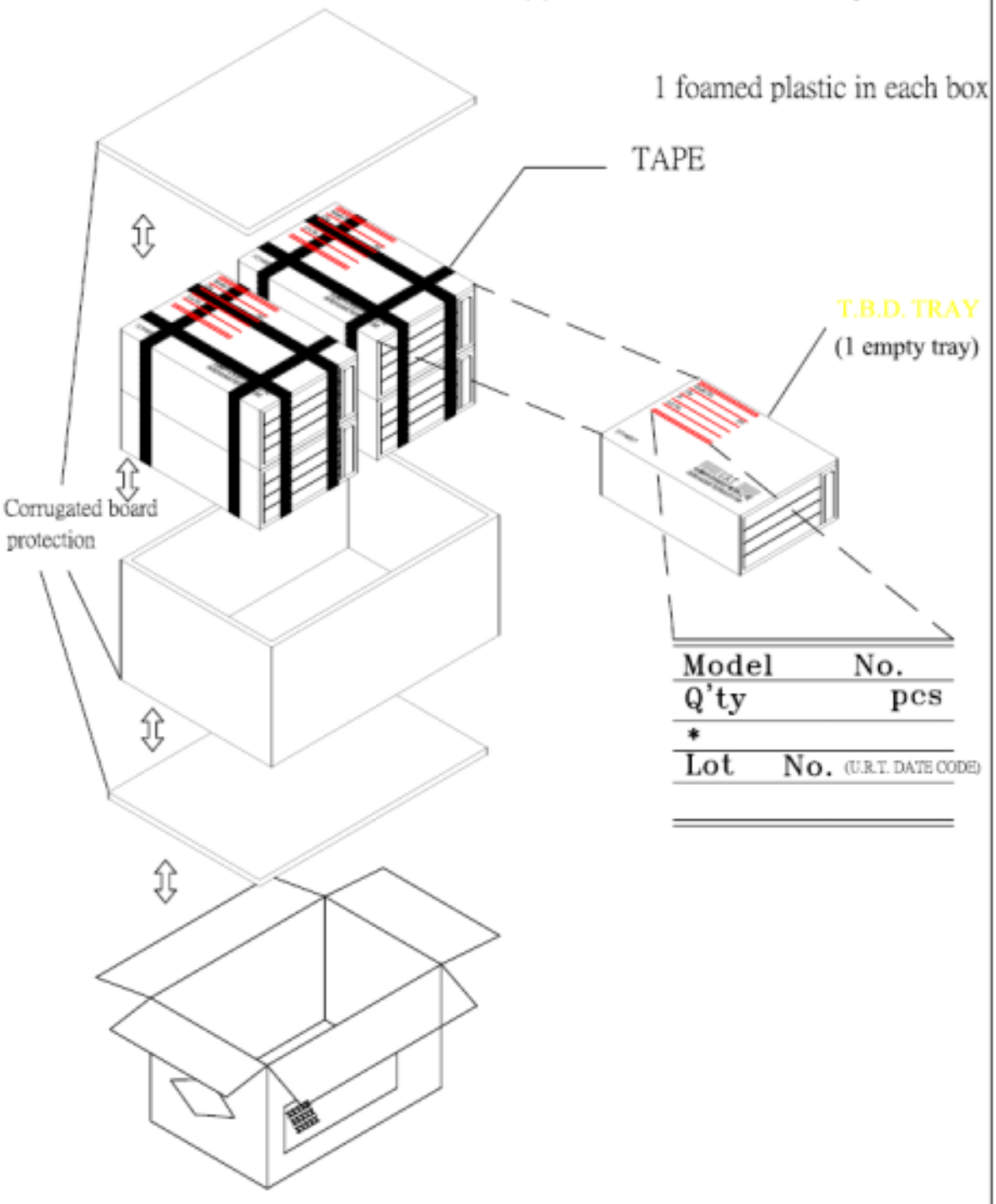
T.B.D. Box / Carton

T.B.D. pcs / Carton

NOTE:

(1)Be warned ,the direction of the tray has to turn it by 180 degree before stack it up.Otherwise, it will be packager's responsibility!!

(2)Safe Stack : 5 cartons only



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8. INSPECTION STANDARD

8.1. QUALITY :

THE QUALITY OF GOODS SUPPLIED TO PURCHASER SHALL COME UP TO THE FOLLOWING STANDARD.

8.1.1. THE METHOD OF PRESERVING GOODS

AFTER DELIVERY OF GOODS FROM U.R.T. TO PURCHASER. PURCHASER SHALL CONTROL THE LCM AT -10 ℃ 40 ℃ ,AND IT MIGHT BE DESIRABLE TO KEEP AT THE NORMAL ROOM TEMPERATURE AND HUMIDITY UNTIL INCOMING INSPECTION OR THROWING INTO PROCESS LINE.

8.1.2. INCOMING INSPECTION

(A) THE METHOD OF INSPECTION

IF PURCHASER MAKE AN INCOMING INSPECTION , A SAMPLING PLAN SHALL BE APPLIED ON THE CONDITION THAT QUALITY OF ONE DELIVERY SHALL BE REGARDED AS ONE LOT.

(B) THE STANDARD OF QUALITY

ISO-2859-1 (SAME AS MIL-STD-105E) , LEVEL Ⅱ SINGLE PLAN.

CLASS	AQL(%)
CRITICAL	0.4 %
MAJOR	0.65 %
MINOR	1.5 %
TOTAL	1.5 %

EVERY ITEM SHALL BE INSPECTED ACCORDING TO THE CLASS.

(C) MEASURE

IF AS THE RESULT OF ABOVE RECEIVING INSPECTION , A LOT OUT IS DISCOVERED. PURCHASER SHALL BE INFORM SELLER OF IT WITHIN SEVEN DAYS. BUT FIRST SHIPMENT WITHIN FOURTEEN DAYS.

8.1.3. WARRANTY POLICY

U.R.T. WILL PROVIDE ONE-YEAR WARRANTY FOR THE PRODUCTS ONLY IF UNDER SPECIFICATION OPERATING CONDITIONS. U.R.T. WILL REPLACE NEW PRODUCTS FOR THESE DEFECT PRODUCTS WHICH UNDER WARRANTY PERIOD AND BELONG TO THE RESPONSIBILITY OF U.R.T.

8.2. CHECKING CONDITION

8.2.1. CHECKING DIRECTION SHALL BE IN THE 45 DEGREE AREA FROM VIEWING DIRECTION.

8.2.2. CHECKER SHALL SEE OVER 300±25 mm. WITH BARE EYES FAR FROM SAMPLE AND USING 2 PCS. OF 20W FLUORESCENT LAMP.

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8.3. INSPECTION PLAN :

CLASS	ITEM	JUDGEMENT	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	NON DISPLAY、WRONG PATTERN DISPLAY、CURRENT CONSUMPTION OUT OF SPECIFICATION..... REJECTED	Critical
	13. PIN HOLE、PATTERN DEFORMITY	ACCORDING TO STANDARD OF VISUAL INSPECTION	Minor

Note: If Viewing Area (VA) have the same dimension with Active Area(AA), then only Active Area will be defined in the drawing , use the AA as VA for inspection judgement

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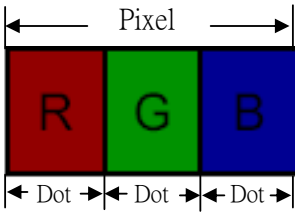
8.4. STANDARD OF VISUAL INSPECTION

<table>
<tr><th>NO.</th><th>CLASS</th><th>ITEM</th><th>JUDGEMENT</th></tr>
<tr><td>8.4.1</td><td>MINOR</td><td>BLACK AND WHITE SPOT
FOREIGN MATERIEL
DUST IN THE CELL
BLEMISH
SCRATCH</td><td>(A) ROUND TYPE: unit : mm.
<table>
<tr><th>DIAMETER (mm.)</th><th>ACCEPTABLE Q'TY</th></tr>
<tr><td>Φ ≦ 0.1</td><td>DISREGARD</td></tr>
<tr><td>0.1 < Φ ≦ 0.25</td><td>3 (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</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 ≦0.07</td><td>3 (Distance>5mm)</td></tr>
<tr><td>------</td><td>0.07 < W</td><td>FOLLOW ROUND TYPE</td></tr>
</table></td></tr>
<tr><td>8.4.2</td><td>MINOR</td><td>BUBBLE IN POLARIZER
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>8.4.3</td><td>MINOR</td><td>Dot Defect</td><td>
<table>
<tr><th>Items</th><th>ACC. Q'TY</th></tr>
<tr><td>Bright dot</td><td>N≦ 4 (Distance>5mm)</td></tr>
<tr><td>Dark dot</td><td>N≦ 4 (Distance>5mm)</td></tr>
</table>
Pixel Define
 

Not 1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.
Not 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.
Not 3: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green ,blue pattern.</td></tr>
</table>

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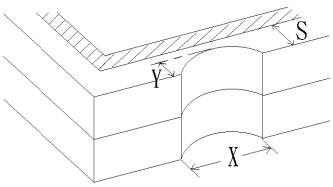
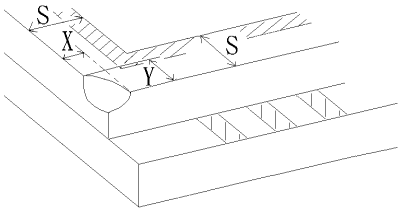
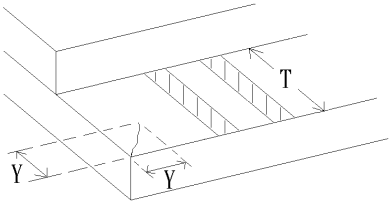
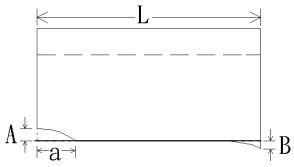
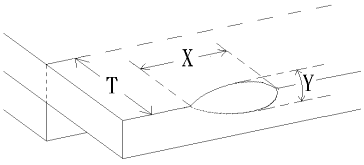
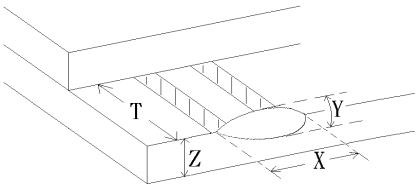
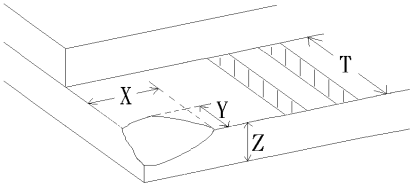
NO.	CLASS	ITEM	JUDGEMENT
8.4.4	MINOR	CHIPPING	 Y > S REJ.
8.4.5	MINOR	CHIPPING	 X or Y > S REJ.
8.4.6	MAJOR	GLASS CRACK	 Y > (1/2) T REJ.
8.4.7	MAJOR	SCRIBE DEFECT	 1. a> L/3 , A>1.5mm. REJ. 2. B : ACCORDING TO DIMENSION
8.4.8	MINOR	CHIPPING (ON THE TERMINAL AREA)	 Φ= (x+y)/2 > 2.5 mm REJ.
8.4.9	MINOR	CHIPPING (ON THE TERMINAL SURFACE)	 Y > (1/3) T REJ.
8.4.10	MINOR	CHIPPING	 Y > T REJ.

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