# SPECIFICATION

## OF

## LIQUID  CRYSTAL  DISPLAY  MODULE

**CUSTOMER** : **URT-STD**

**Model  No.  :** **UMSH-9153MD-2T**

**Model version :** **0**

**Document Revision :** **1**

| CUSTOMER APPROVED SIGNATURE | | | |
|---|---|---|---|
|  |  |  |  |

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| Joe Wu | Ashin Chiu | Jenny Wang | Aug-18-2016 |
|---|---|---|---|
| APPROVED | CHECKED | PREPARED | Date |

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| Revision record | | | |
|---|---|---|---|
| Document Revision | Model No. Version No. | Description | Revision by |
| 0 | UMSH-9153MD-T Version No. 0 | | Peggy Ho Fong Jia Su 22-Jun-2016 |
| 1 | UMSH-9153MD-2T Version No. 0 | 1. Add the Capacitive touch panel 2. Modify the module number for    UMSH-9153MD-T to UMSH-9153MD-2T | Peggy Ho Fong Jia Su 18-Aug-2016 |

# CONTENTS:

# 1. BASIC SPECIFICATION

### 1.1 Mechanical specifications

| Items | Nominal Dimension | Unit |
|---|---|---|
| Active screen size | 4.3" diagonal | - |
| Dot Matrix | 480 x RGB x 272 | Pixel |
| Module Size (W x H x T) | 105.4 x 67.1 x 4.37 | mm. |
| Active Area (W x H) | 95.04 x 53.856 | mm. |
| Pixel Size ( W×H ) | 0.198 x 0.198 | mm. |
| Color depth | 16.7M | color |
| Interface | Parallel 24-bit RGB | - |
| Driving IC Package | COG | - |
| Module weight | 68±10% | g |

### 1.2 Display specification

| Display | Descriptions | Note |
|---|---|---|
| LCD Type | a-Si TFT | - |
| LCD Mode | TN / Normal white | - |
| Polarizer Mode | Transmissive | - |
| Polarizer Surface | ANTI-GLARE | - |
| 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.

# 1.3 Outline dimension
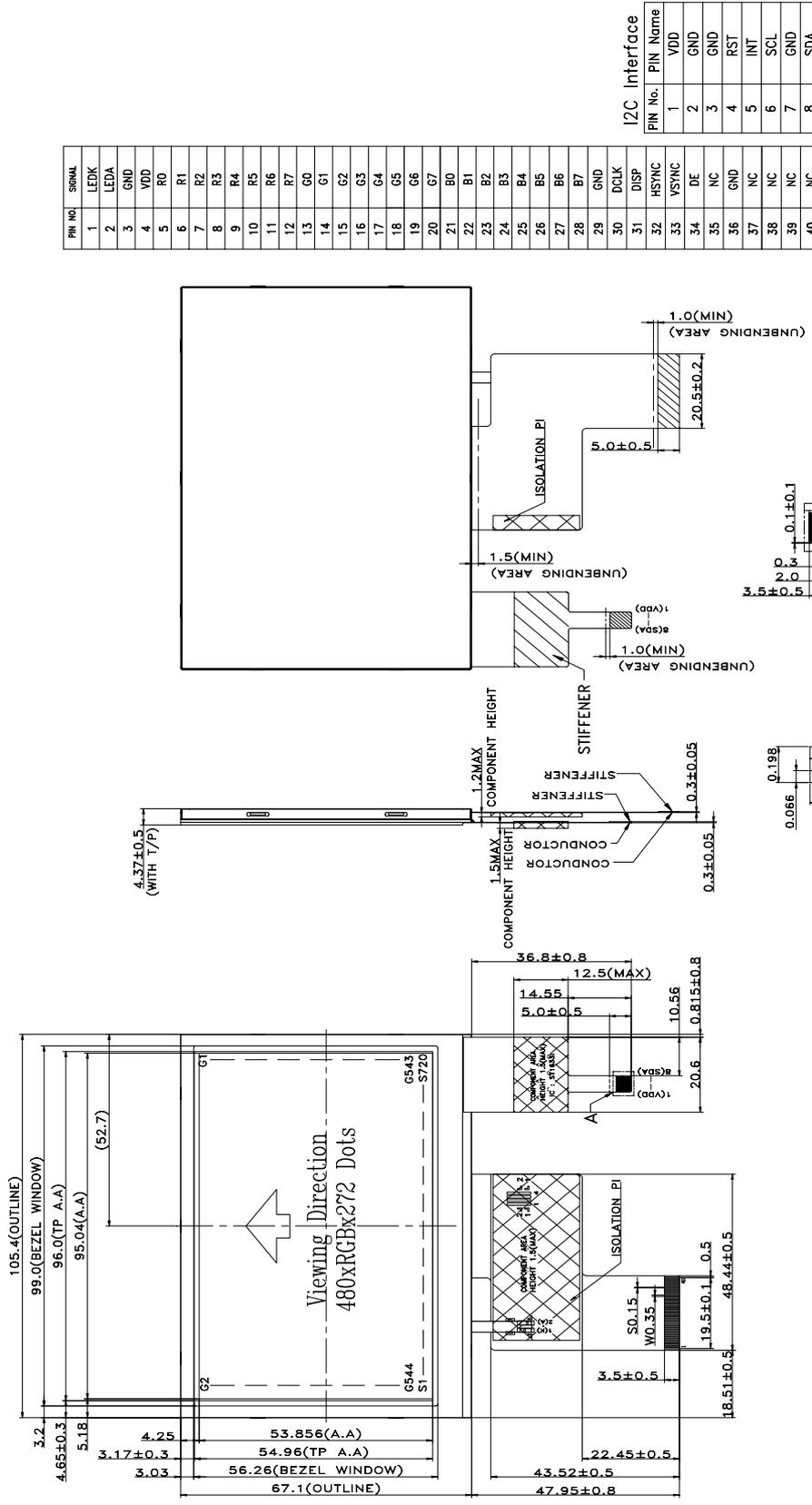
| PIN NO. | SIGNAL |
|---|---|
| 1 | LEDK |
| 2 | LEDA |
| 3 | GND |
| 4 | VDD |
| 5 | R0 |
| 6 | R1 |
| 7 | R2 |
| 8 | R3 |
| 9 | R4 |
| 10 | R5 |
| 11 | R6 |
| 12 | R7 |
| 13 | G0 |
| 14 | G1 |
| 15 | G2 |
| 16 | G3 |
| 17 | G4 |
| 18 | G5 |
| 19 | G6 |
| 20 | G7 |
| 21 | B0 |
| 22 | B1 |
| 23 | B2 |
| 24 | B3 |
| 25 | B4 |
| 26 | B5 |
| 27 | B6 |
| 28 | B7 |
| 29 | GND |
| 30 | DCLK |
| 31 | DISP |
| 32 | HSYNC |
| 33 | VSYNC |
| 34 | DE |
| 35 | NC |
| 36 | GND |
| 37 | NC |
| 38 | NC |
| 39 | NC |
| 40 | NC |

**I2C Interface**

| PIN No. | PIN Name |
|---|---|
| 1 | VDD |
| 2 | GND |
| 3 | GND |
| 4 | RST |
| 5 | INT |
| 6 | SCL |
| 7 | GND |
| 8 | SDA |

Viewing Direction
480xRGBx272 Dots

PIXEL DETAIL

DETAIL A

BACKLIGHT CIRCUIT DIAGRAM

NOTE:
1.LCD: TFT, TRANSMISSIVE, NORMALLY WHITE,ANTI-GLARE
2.Top: -20°C~70°C, Tst:-30°C~80°C
3.VIEWING DIRECTION: 6 O'CLOCK (GRAYSCALE INVERSION)
4.THIS PRODUCT CONFORM WITH THE STANDARD OF ROHS
5.TOLERANCE FOR NOT ASSINGNED ±0.2
6.THE MINIMUM BENDABLE RADIUS(INNER) OF THE FPC IS 1.0mm
7.LED B/L: WHITE*12PCS
8.B/L:CONSTANT CURRENT IF=40mA, VF=18.2V(TYP)
9.IC:HX8257-A
10.COMPONENT AREA AND SOLDER AREA CAN NOT BENDING
11.CTP IC:ST1633i
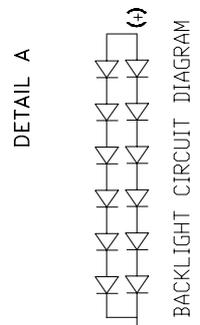
## 1.4 Block diagram:
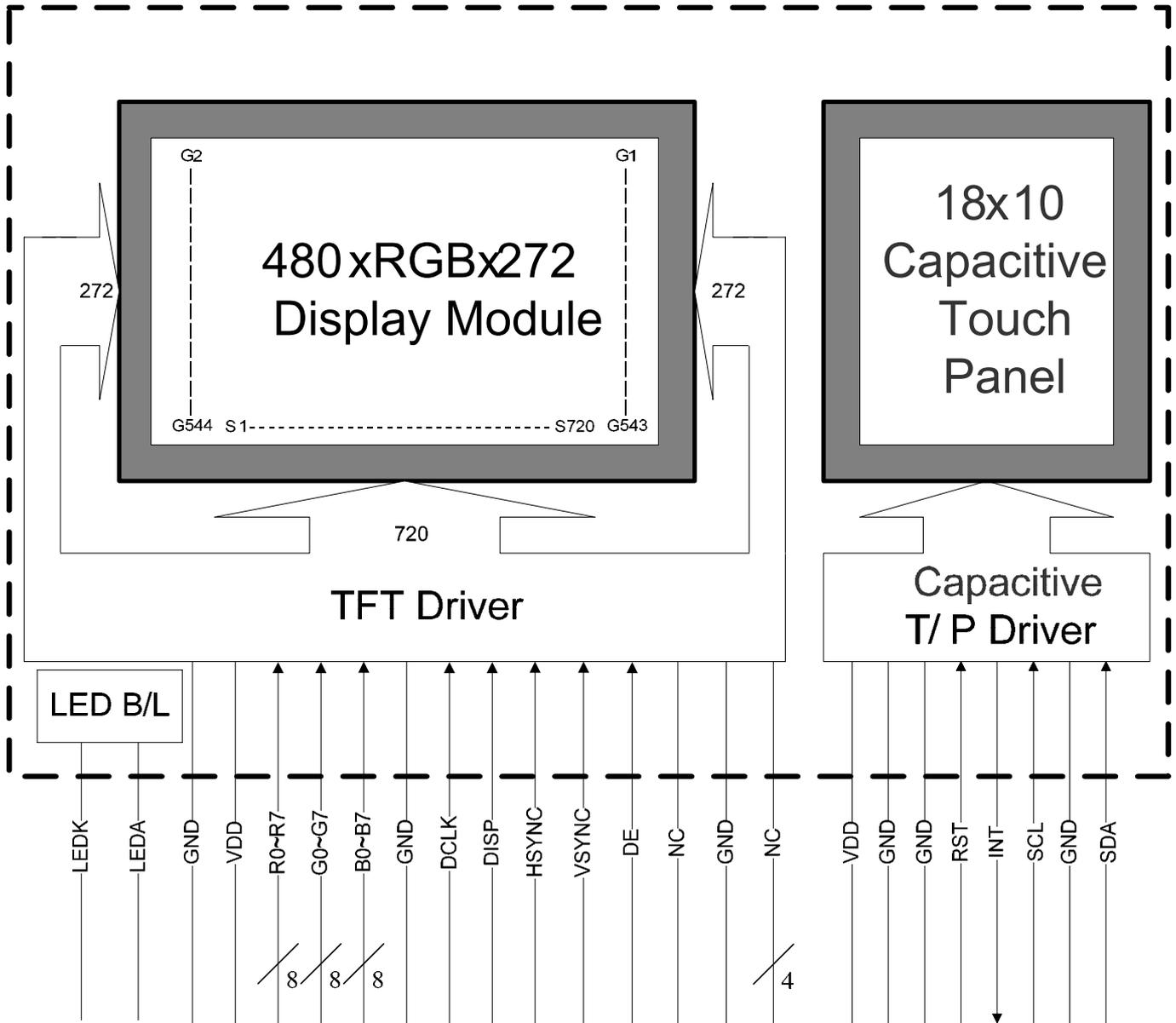
## 1.5 Interface Pin Connection :

| Pin No. | Pin Symbol | I/O | Description |
|---------|-----------|-----|-------------|
| 1 | LEDK | P | Power for LED backlight cathode. |
| 2 | LEDA | P | Power for LED backlight anode. |
| 3 | GND | P | Power Ground. |
| 4 | VDD | P | Power Voltage. |
| 5 ~ 12 | R0 ~ R7 | I | Red data signal. |
| 13 ~ 20 | G0 ~ G7 | I | Green data signal. |
| 21 ~ 28 | B0 ~ B7 | I | Blue data signal. |
| 29 | GND | P | Power Ground. |
| 30 | DCLK | I | Dot data clock. |
| 31 | DISP | I | Display on/off. |
| 32 | HSYNC | I | Horizontal sync signal. |
| 33 | VSYNC | I | Vertical sync signal. |
| 34 | DE | I | Data Enable. |
| 35 | NC | - | No connect. |
| 36 | GND | P | Power Ground. |
| 37~40 | NC | - | No connect. |

## Capacitive touch panel pin:

| Pin No. | Pin Symbol | I/O | Description |
|---------|-----------|-----|-------------|
| 1 | VDD | P | Power supply. (+3.3V) |
| 2 | GND | P | Ground for logic. (0V) |
| 3 | GND | P | Ground for logic. (0V) |
| 4 | RST | I | System reset signal input, active low and needs hold low for 5ms to take effect. |
| 5 | INT | O | Active low when data output from touch panel. |
| 6 | SCL | I | Serial clock. |
| 7 | GND | P | Ground for logic. (0V) |
| 8 | SDA | I/O | Serial data access. |

Note : SDA / SCL pins must connected to 4.7Kohm(Pull-up resistor) at host.

# 2. ELECTRICAL CHARACTERISTICS

## 2.1 Absolute Maximum Ratings

| Items | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|
| Power supply voltage | VDD(LCM) | -0.3 | 3.96 | V |
| | VDD(CTP) | -0.3 | 6.0 | |
| Operate temperature range | Top | -20 | 70 | ℃ |
| Storage temperature range | Tst | -30 | 80 | ℃ |

*Note1 :

The operating temperature is for product's functionality, please pay attention to human injury when using the product under extreme temperature.

## 2.2 DC Characteristics

$T_a = 25°C$

| Items | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| Supply voltage | $V_{DD}(LCM)$ | 3.0 | 3.3 | 3.6 | V | - |
| | $V_{DD}(CTP)$ | - | 3.3 | - | V | - |
| Input Voltage | $V_{IL}(LCM)$ | 0 | - | 0.3VDD | V | L level |
| | $V_{IL}(CTP)$ | 0 | - | 0.15VDD | V | L level |
| | $V_{IH}(LCM)$ | 0.7VDD | - | VDD | V | H level |
| | $V_{IH}(CTP)$ | 0.85VDD | - | VDD | V | H level |
| Current consumption | $I_{VDD}(LCM)$ | - | - | 40 | mA | Not 1 |
| | $I_{VDD}(CTP)$ | - | 15 | 30 | mA | - |

*Note1 :

Measuring Condition:

Standard Value MAX.

Ta = 25°C

VDD -GND = 3.3V

Display Pattern

0 gray black pattern

## 2.2.1 Back-light only Specification

| PARAMETER | SYMBOL | MIN | TYP | MA | nit | Test Condition | NOTE |
|---|---|---|---|---|---|---|---|
| Supply Current | If | - | 40 | - | mA | Ta=25°C | - |
| Supply Voltage | Vf | - | 18.2 | - | V | Ta=25°C | - |
| Half-Life Time | Lf | - | 50000 | - | hrs | Ta=25°C | 1 |

Note 1 : The "Half-Life Time" is defined as the LED chip brightness decreases to 50% than original brightness, Based on Ta 25±2°C,60±10% RH condition.

## 2.3 AC Characteristics

Parallel RGB Input Timing Requirement

| Parameter | Symbol | Sepc. | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Tpy. | Max. | |
| Clock cycle | $f_{CLK}$[1] | - | 9 | 15 | MHz |
| Hsync cycle | 1/th | - | 17.14 | - | KHz |
| Vsync cycle | 1/tv | - | 59.94 | - | Hz |
| Horizontal Signal | | | | | |
| Horizontal cycle | th | 525 | 525 | 605 | CLK |
| Horizontal display period | thd | 480 | 480 | 480 | CLK |
| Horizontal front porch | thf | 2 | 2 | 82 | CLK |
| Horizontal pulse width | thp[2] | 2 | 41 | 41 | CLK |
| Horizontal back porch | thb[2] | 2 | 2 | 41 | CLK |
| Vertical Signal | | | | | |
| Vertical cycle | tv | 285 | 286 | 399 | H[1] |
| Vertical display period | tvd | 272 | 272 | 272 | H[1] |
| Vertical front porch | tvf | 1 | 2 | 227 | H[1] |
| Vertical pulse width | tvp[2] | 1 | 10 | 11 | H[1] |
| Vertical back porch | tvb[2] | 1 | 2 | 11 | H[1] |

Note: (1) Unit: CLK=1/$f_{CLK}$ , H=th,

(2)It is necessary to keep tvp+tvb=12 and thp+thb=43 in sync mode.

# Interface Timing Chart
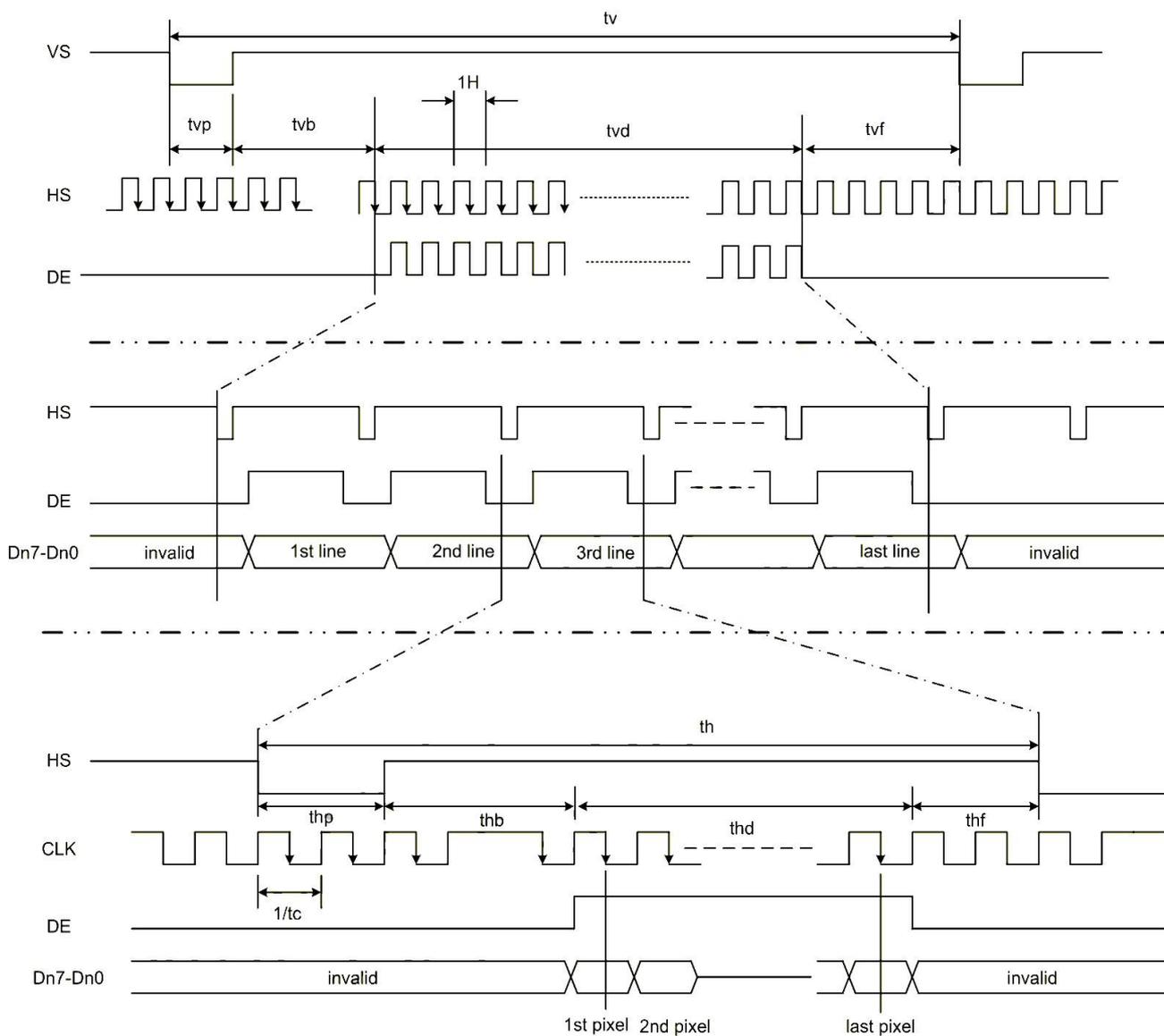
**Input Setup Timing Requirement**

| Parameter | Symbol | Spec. | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| DISP setup time | $t_{diss}$ | 10 | - | - | ns |
| DISP hold time | $t_{dish}$ | 10 | - | - | ns |
| Clock period | $PW_{CLK}{}^{(1)}$ | 66.7 | - | - | ns |
| Clock pulse high period | $PWH^{(1)}$ | 26.7 | - | - | ns |
| Clock pulse low period | $PWL^{(1)}$ | 26.7 | - | - | ns |
| Hsync setup time | $t_{hs}$ | 10 | - | - | ns |
| Hsync hold time | $t_{hh}$ | 10 | - | - | ns |
| Data setup time | $t_{ds}$ | 10 | - | - | ns |
| Data hold time | $t_{dh}$ | 10 | - | - | ns |
| DE setup time | $t_{des}$ | 10 | - | - | ns |
| DE hold time | $t_{deh}$ | 10 | - | - | ns |
| Vsync setup time | $t_{vhs}$ | 10 | - | - | ns |
| Vsync hold time | $t_{vhh}$ | 10 | - | - | ns |

Note: (1) For parallel interface, maximum clock frequency is 15MHz.

## Power Sequence Timing



$$t_1 > 50 \text{ mSec}$$
$$t_2 \geqq 200 \text{ mSec}$$
$$t_3 \geqq 200 \text{ mSec}$$
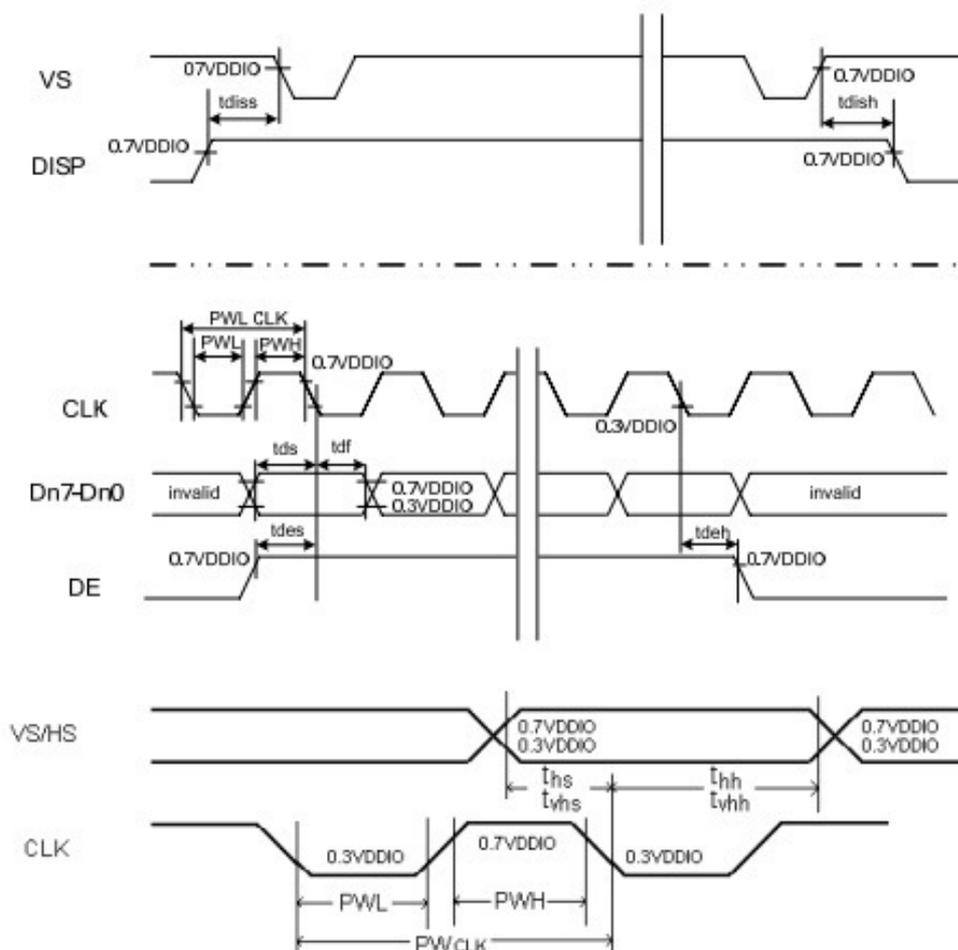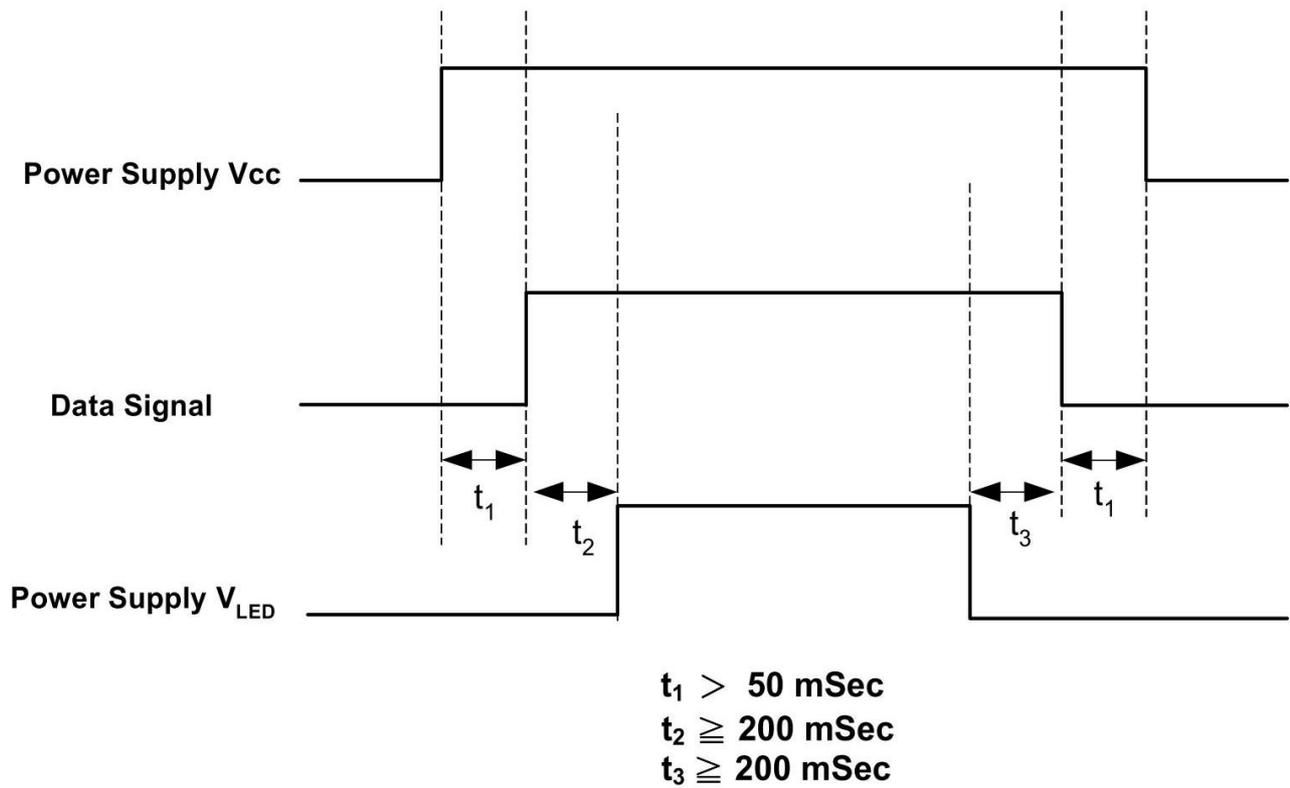
Note: Data Signal includes DCLK, HS, VS, R0~ R5, G0~ G5, B0~ B5.

## 2.4 Touch Panel AC Electrical Characteristics:



I2C Fast Mode Timing
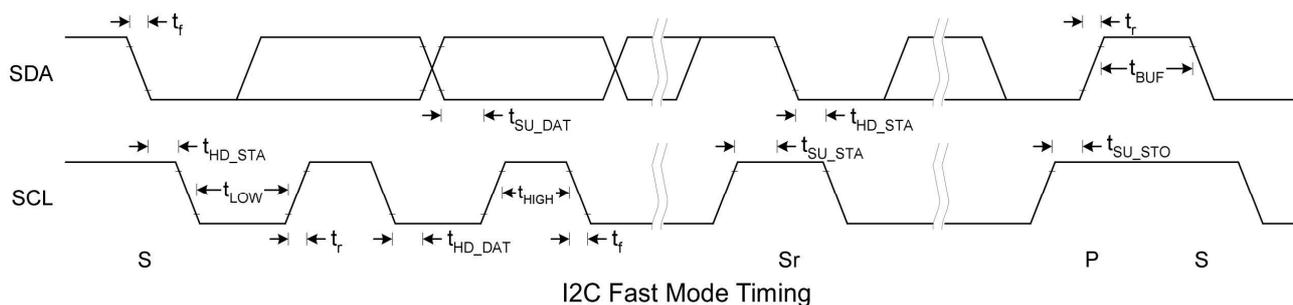
I2C Fast Mode Timing Characteristic

Conditions: VDD = 3.3V, GND = 0V, $T_A$ = 25°C

| Symbol | Parameter | Rating | | | Unit |
| --- | --- | --- | --- | --- | --- |
| | | Min. | Typ. | Max. | |
| $f_{SCL}$ | SCL clock frequency | 0 | - | 400 | kHz |
| $t_{LOW}$ | Low period of the SCL clock | 1.3 | - | - | us |
| $t_{HIGH}$ | High period of the SCL clock | 0.6 | - | - | us |
| $t_f$ | Signal falling time | - | - | 300 | ns |
| $t_r$ | Signal rising time | - | - | 300 | ns |
| $t_{SU\_STA}$ | Set up time for a repeated START condition | 0.6 | - | - | us |
| $t_{HD\_STA}$ | Hold time (repeated) START condition. After this period, the first clock pulse is generated | 0.6 | - | - | us |
| $t_{SU\_DAT}$ | Data set up time | 100 | - | - | ns |
| $t_{HD\_DAT}$ | Data hold time | 0 | - | 0.9 | us |
| $t_{SU\_STO}$ | Set up time for STOP condition | 0.6 | - | - | us |
| $t_{BUF}$ | Bus free time between a STOP and START condition | 1.3 | - | - | us |
| $C_b$ | Capacitive load for each bus line | - | - | 400 | pF |

# Touch Panel I2C Host Interface Protocol:

## I2C Slave Interface

Read



S: START
R/W̄: Read(high), Write(low)
A: Acknowledge(low)
P: STOP

SCL line held low until slave ready to receive or send data

Write



S: START
R/W̄: Read(high), Write(low)
A: Acknowledge(low)
P: STOP

SCL line held low until slave ready to receive or send data
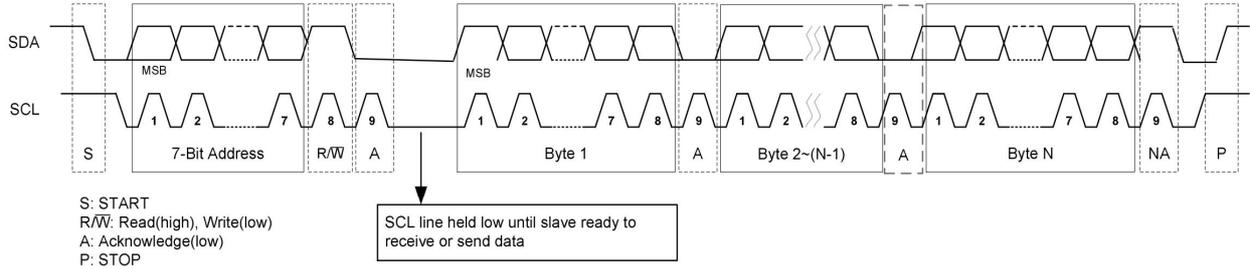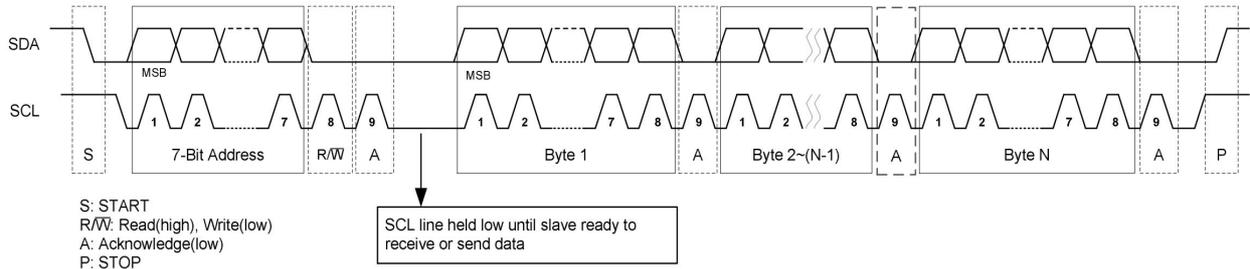
I2C Waveform

Note : I2C address is default to 0x55 (7-bits address)

## Touch Panel Register Read

For reading register value from I2C device, host has to tell I2C device the *Start Register Address* before reading corresponding register value.

| I2C Start | I2C Header (W) | Start Reg. Addr. (a) | I2C Stop | I2C Start | I2C Header (R) | Value of Reg(a) | Value of Reg(a+1) | ... | Value of Reg(a+n) | I2C Stop |
|---|---|---|---|---|---|---|---|---|---|---|

**Figure 1 - Register Read Format.**

Sitronix Touch IC I2C host interface protocol supports *Repeated Register Read*. That is, once the *Start Register Address* has been set by host, consequent I2C Read(R) transactions will directly read register values starting from the *Start Register Address* without setting address first, as shown in Figure 2.

| I2C Start | I2C Header (R) | Value of Reg(a) | Value of Reg(a+1) | ... | Value of Reg(a+n) | I2C Stop | I2C Start | I2C Header (R) | Value of Reg(a) | Value of Reg(a+1) | ... | Value of Reg(a+n) | I2C Stop |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**Figure 2 - Repeated Register Read.**

**Header Value(R) : 0xab**

## Touch Panel Register Write

For writing register to I2C device, host has to tell I2C device the Start Register Address in each I2C Register Write transaction. Register values to the I2C device will be written to the address starting from the Start Register Address described in Register Write I2C transaction as shown in Figure 3.

| I2C Start | I2C Header (W) | Start Reg. Addr. (a) | Value to Reg(a) | Value to Reg(a+1) | ... | Value to Reg(a+n) | I2C Stop |
|---|---|---|---|---|---|---|---|
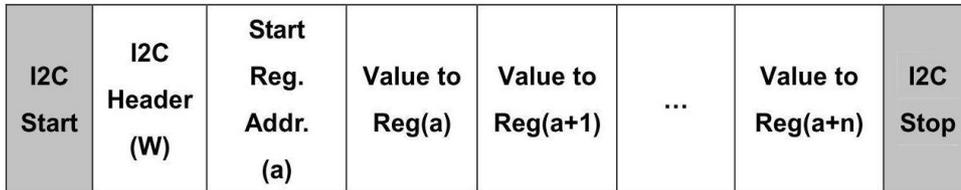
**Figure 3 - Register Write Format.**

### Header Value(W) : 0xaa

## Touch Panel I2C Electrical Waveform
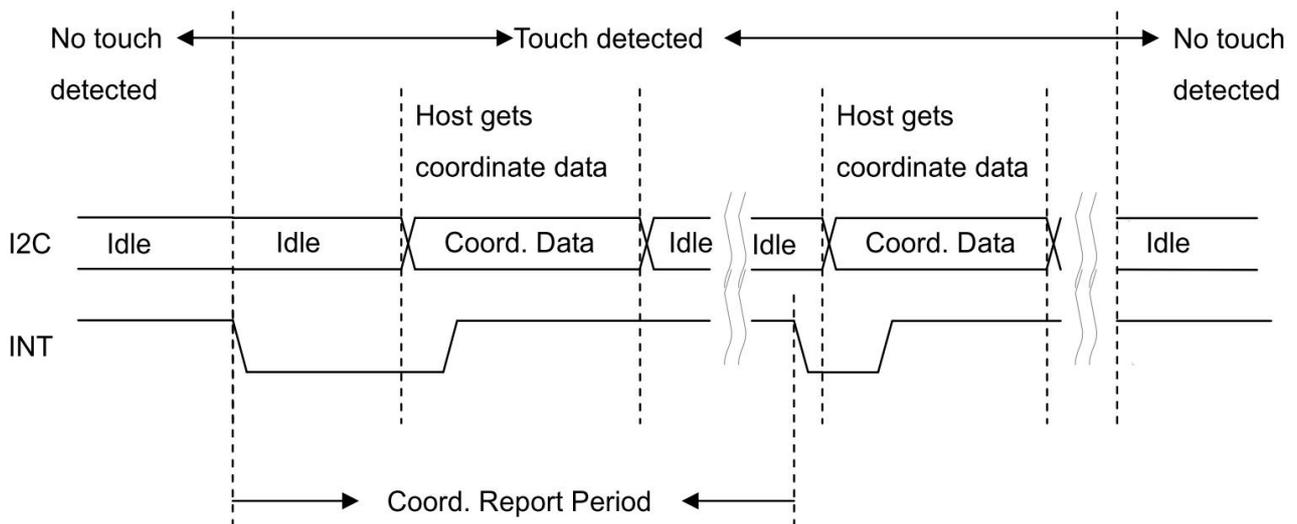
## Touch Panel Registers

Sitronix Touch IC provides a register set for host to configure device attributes and retrieve information about Device Control , XY Coordinates through device host interface. Host interface registers are listed below.

| Reg. Addr. | Name | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Host Interface Registers ( Report Page ) | | | | |
| 0x00 | Firmware Version | Version (RO) | | | | | | | |
| 0x01 | Status Reg. | Error Code (RO) | | | | Device Status (RO) | | | |
| 0x02 | Device Control Reg. | Reserved | | | | Reserved | Reserved | Power Down (R/W) | Reset (R/W) |
| 0x03 | Timeout to Idle Register | Timeout to Idle ( Sec ) (R/W) | | | | | | | |
| 0x04 | XY Resolution (High Byte) | Reserved | X_Res_H (RO) | | | Reserved | Y_Res_H (RO) | | |
| 0x05 | X Resolution (High Byte) | X_Res_L (RO) | | | | | | | |
| 0x06 | Y Resolution (High Byte) | Y_Res_L (RO) | | | | | | | |
| 0x07 ~ 0x11 | ------ | Reserved | | | | | | | |
| 0x12 | XY0 Coord. ( High Byte ) | Valid 0 ( RO) | X0_H(RO) | | | Reserved | Y0_H (RO) | | |
| 0x13 | X0 Coord. ( Low Byte ) | X0_L(RO) | | | | | | | |
| 0x14 | Y0 Coord. ( Low Byte ) | Y0_L(RO) | | | | | | | |
| 0x15 | | Reserved | | | | | | | |
| 0x16 | XY1 Coord. ( High Byte ) | Valid 1 ( RO) | X1_H(RO) | | | Reserved | Y1_H (RO) | | |
| 0x17 | X1 Coord. ( Low Byte ) | X1_L(RO) | | | | | | | |
| 0x18 | Y1 Coord. ( Low Byte ) | Y1_L(RO) | | | | | | | |
| 0x19 | | Reserved | | | | | | | |
| 0x1A | XY2 Coord. ( High Byte ) | Valid 2 ( RO) | X2_H(RO) | | | Reserved | Y2_H (RO) | | |
| 0x1B | X2 Coord. ( Low Byte ) | X2_L(RO) | | | | | | | |
| 0x1C | Y2 Coord. ( Low Byte ) | Y2_L(RO) | | | | | | | |
| 0x1D | | Reserved | | | | | | | |
| 0x1E | XY3 Coord. ( High Byte ) | Valid 3 ( RO) | X3_H(RO) | | | Reserved | Y3_H (RO) | | |
| 0x1F | X3 Coord. ( Low Byte ) | X3_L(RO) | | | | | | | |
| 0x20 | Y3 Coord. ( Low Byte ) | Y3_L(RO) | | | | | | | |
| 0x21 | | Reserved | | | | | | | |
| 0x22 | XY4 Coord. ( High Byte ) | Valid 4 ( RO) | X4_H(RO) | | | Reserved | Y4_H (RO) | | |
| 0x23 | X4 Coord. ( Low Byte ) | X4_L(RO) | | | | | | | |
| 0x24 | Y4 Coord. ( Low Byte ) | Y4_L(RO) | | | | | | | |

## Firmware Version Register

| Reg. Addr. | Name | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0x00 | Firmware Version | Version (RO) | | | | | | | |

Firmware Version Register provides version information about current firmware. Host application can support version control in firmware upgrade function by reading Firmware Version Register and comparing with the version of new firmware binary.

## Status Register

| Reg. Addr. | Name | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0x01 | Status Reg. | Error Code (RO) | | | | Device Status (RO) | | | |

Status Register shows current status of the device to host, including Device Status and Error Code. Init status represents that the device is in Init state and not ready for host access. Host has to wait for the device to change into Normal state before accessing registers other than Status Register. If Device Status shows Error, the Error Code field in the Status Register gives reason of the error.

| Device Status | |
|---|---|
| 0x0 | Normal |
| 0x1 | Init |
| 0x2 | Error |
| 0x3 | Auto Tuning |
| 0x4 | Idle |
| 0x5 | Power Down |
| 0x6 | Boot ROM |
| 0x7 | Waiting to execute Sub-AP |
| 0x8 … 0xF | Reserved |

| Error Code | |
|---|---|
| 0x0 | No Error |
| 0x1 | Invalid Address |
| 0x2 | Invalid Value |
| 0x3 | Invalid Platform |
| 0x4 | Dev Not Found |
| 0x5 | Stack Overflow |
| 0x6 | Invalid Firmware Parameter Table |
| 0x7 | Invalid Secondary Touch Firmware |
| 0x8 … 0xF | Reserved |

## Device Control Register

| Reg. Addr. | Name | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0x02 | Device Control Reg. | Reserved | | | | Reserved | Reserved | Power Down (R/W) | Reset (R/W) |

Device Control Register provides device control bits for host to reset the device , power down the device.

When host sets Power Down bit, touch sensor controller will enter power down mode. Host can clear Power Down bit to wake up the controller.

## Timeout to Idle Register

| Reg Addr. | Name | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0x03 | Timeout to Idle Register | Timeout to Idle ( Sec ) (R/W) | | | | | | | |

Timeout to Idle Register provides timeout control to entering Idle Mode for host.

The touch controller will enter Idle Mode after the number of seconds specified in Timeout to Idle Register if there is no touch detected in this period.

Set the field to 0xFF will disable Idle Mode. Set the field to 0 will entering Idle Mode immediately.

The default value of Timeout to Idle Register is set to 0x08 for 8 seconds to Idle Mode.

## XY Resolution Registers

| Reg Addr. | Name | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0x04 | XY Resolution (High Byte) | Reserved | X_Res_H (RO) | | | Reserved | Y_Res_H (RO) | | |
| 0x05 | X Resolution (High Byte) | X_Res_L (RO) | | | | | | | |
| 0x06 | Y Resolution (High Byte) | Y_Res_L (RO) | | | | | | | |

XY Resolution Registers represents resolution of X and Y coordinates of the touch screen.

## XY Coordinate Registers

| Reg Addr. | Name | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0x12 | XY0 Coord ( High Byte ) | Valid 0 ( RO ) | X0_H(RO) | | | Reserved | Y0_H (RO) | | |
| 0x13 | X0 Coord ( Low Byte ) | X0_L(RO) | | | | | | | |
| 0x14 | Y0 Coord ( Low Byte ) | Y0_L(RO) | | | | | | | |
| 0x15 | | Reserved | | | | | | | |
| 0x16 ~ 0x21 | … | … | | | | | | | |
| 0x22 | XY4 Coord ( High Byte ) | Valid 4 ( RO ) | X4_H(RO) | | | Reserved | Y4_H (RO) | | |
| 0x23 | X4 Coord ( Low Byte ) | X4_L(RO) | | | | | | | |
| 0x24 | Y4 Coord ( Low Byte ) | Y4_L(RO) | | | | | | | |

XY Coordinate Registers represent the XY coordinates for each touch point ID.

Valid bit field tells that this point ID is valid and the XY information represents a real touch point on touch sensor.

# 3. OPTICAL CHARACTERISTICS

## 3.1  Characteristics

Electrical and Optical Characteristics

| No. | Item | | | symbol / temp. | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Response Time | | | Tr | 25 ℃ | 5 | 7 | - | ms | 2 |
| | | | | Tf | 25 ℃ | 20 | 28 | - | | |
| 2 | Viewing Angle | Hor. | Cr≧10 | $\theta_{2+}$ | Φ = 0° | 60 | 80 | - | degree | 3 |
| | | | | $\theta_{2-}$ | Φ = 180° | 60 | 80 | - | | |
| | | Ver. | | $\theta_{1+}$ | Φ = 270° | 60 | 80 | - | | |
| | | | | $\theta_{1-}$ | Φ = 90° | 45 | 80 | - | | |
| 3 | Contrast Ratio | | | Cr | 25 ℃ | 400 | 500 | - | - | 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 | | 0.30 | 0.35 | 0.40 | | |
| | Green y-code | | | Gy | | 0.53 | 0.58 | 0.63 | | |
| | Blue x-code | | | Bx | | 0.10 | 0.15 | 0.20 | | |
| | Blue y-code | | | By | | 0.05 | 0.10 | 0.15 | | |
| | White x-code | | | Wx | | 0.25 | 0.30 | 0.35 | | |
| | White y-code | | | Wy | | 0.28 | 0.33 | 0.38 | | |
| | Brightness | | | Y | | 350 | 450 | - | $cd/m^2$ | |
| 5 | Brightness Uniformity | | | | 25 ℃ | 80 | - | - | % | 6 |

# 3.2 Definition of optical characteristics

**Measurement condition :**

Transmissive and Transflective type

Receiver
Θ
12H
9H
3H
Φ
6H
Light Source
TEMPERATURE CONTROL CHAMBER

PHOTAL LCD-5000
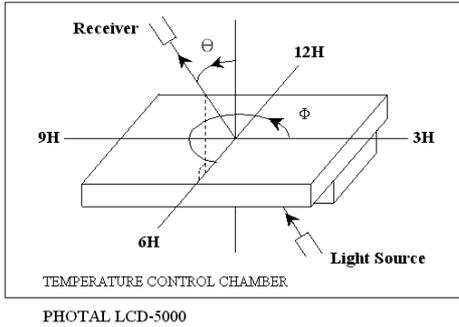
**[Note 1]  Definition of LCD Driving Vop and Waveform :**

Vop Definition

Contrast Ratio

Voltage

Vop= Driving Voltage at
Max. Contrast Ratio

Selected Waveform

Vop
Duty: 1/d
Bias: 1/b
fF : Frame Freq.
1/b
0
-1/b
(1/fF)*(1/d)
-Vop
1／fF

Non-Selected Waveform

Vop
Duty: 1/d
Bias: 1/b
fF : Frame Freq.
1- 2/b
1/b
0
-1/b
-(1- 2/b)
(1/fF)*(1/d)
-Vop
1／fF
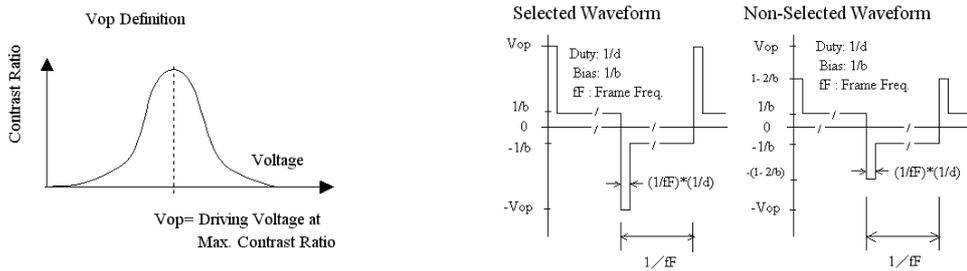
**[Note 2]  Definition of Response Time**

for  Positive type  :

Selected State
Non-Selected State
Selected State

Transmittance

90%    90%

10%    10%

Tf    Tr    time
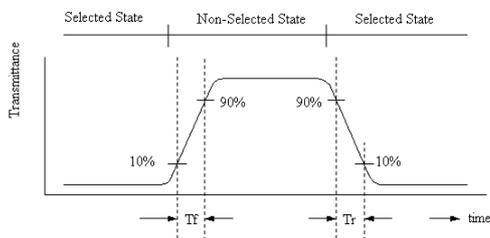
**[Note 3]  Definition of Viewing Angle :**         **[Note 4]  Definition of Contrast Ratio :**

0°
Θ1-   Θ1+
Viewing Direction

0°
Θ2-   Θ2+
Left    Right
Viewing Direction

for Positive type

Transmittance

Θ1=0 , Θ2=0
TH
Non-Selected Segment
Selected Segment
TL
Vop    Voltage
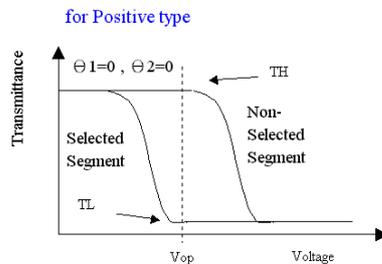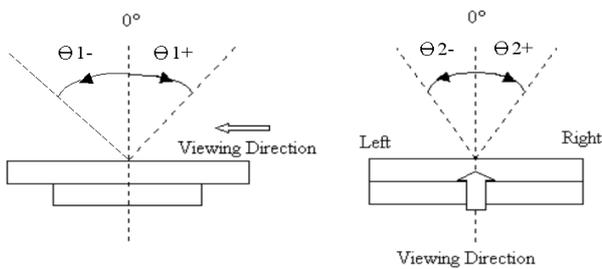
$$\text{Contrast Ratio} \; = \; \frac{TH}{TL}$$

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

BM-7

500mm

LCD Module
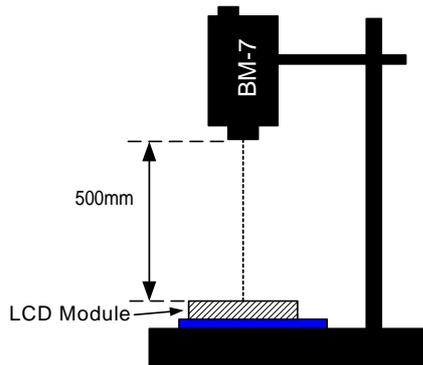
**[Note 6] Definition of Brightness Uniformity**

W / 4

H / 4

Active Area Height : H

① ② ③

④ ⑤ ⑥

⑦ ⑧ ⑨

Active Area Width : W
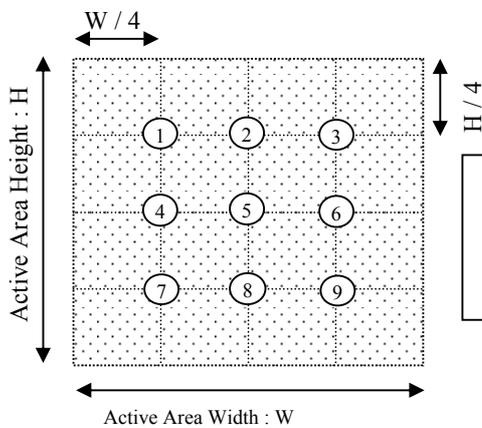
$$\text{Brightness Uniformity} = \frac{\text{Minimum Brightness of Point 1~9}}{\text{Maximum Brightness of Point 1~9}}$$

**[Note 7] Definition of Measurement of Reflectance**

BM-7

White Light Source
(Ring)

500mm

15 deg.

LCD Module
or referance
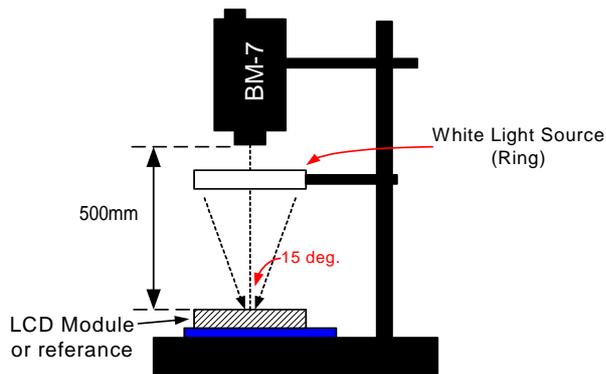
## 4. RELIABILITY :

| 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 , 60%RH , 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.

Note 3 : Please change the display picture (autorun) during operating mode.  Avoid displaying static images
   * One single product test for only one item.
   * 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

# 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 LCM

Do not contact or scratch the front surface and the contact pads of a LCM 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 LCM away from direct sunlight , also avoid them in high-temperature & high
humidity environment for a long period.

Do not drive LCM by DC voltage.

Do not expose LCM to organic solvent.

Liquid in LCM 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 AND USE OF 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　)

Never use the LCD , LCM under 45 Hz , the liquid crystal will decomposition and cause permently
damage on display !!

## 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.

## 6. DATE CODE OF PRODUCTS

Date code will be shown on each product :

**<u>YY</u> <u>MM</u> <u>DD</u> - <u>XXXX</u>**

Year  Month  Day - Serial No.

Example: 141108 - 0003 ==> Year 2014, 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.

## 7. PACKING

Instruction of lot number:

LOT NO. : 0 0 0 8 3 5 2 5 (EX)

| | |
|---|---|
| Date | 01—1 st<br>02—2 nd<br>\|    \|<br>31—31 th |
| Week | 1 ———— 7 |
| Week of Month | 1 ———— 5 |
| Month | 01—January<br>02—February<br>\|    \|<br>12—December |
| Year | 00—2000<br>01—2001 |

Lable of carton:



Carton Box

```
MODEL:XXXX—XXXXXX—XX
Q'TY:      PCS
LOT    NO.                          ↑
N.W.      KGS.                      UP
G.W.      KGS.
UNITED  RADIANT  TECHNOLOGY  CORP.
光聯科技股份有限公司
```
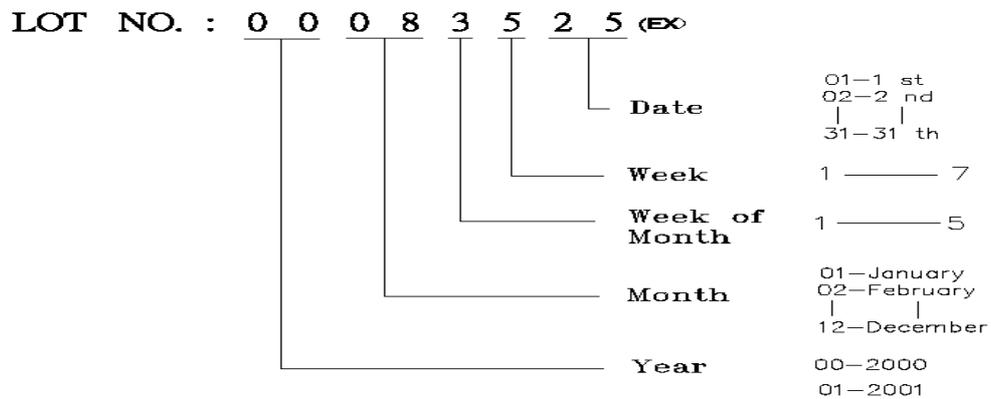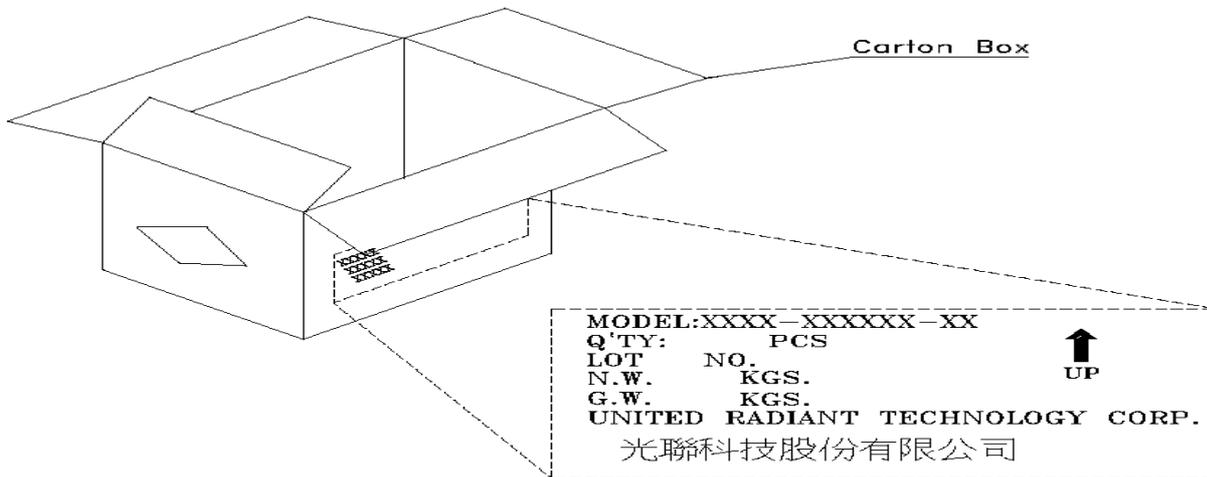
Packing tray must be stacked with alternated direction to each others.
To tacks packing trays in same direction will cause product damaged.



Not Allowed

OK

Not Allowed

OK
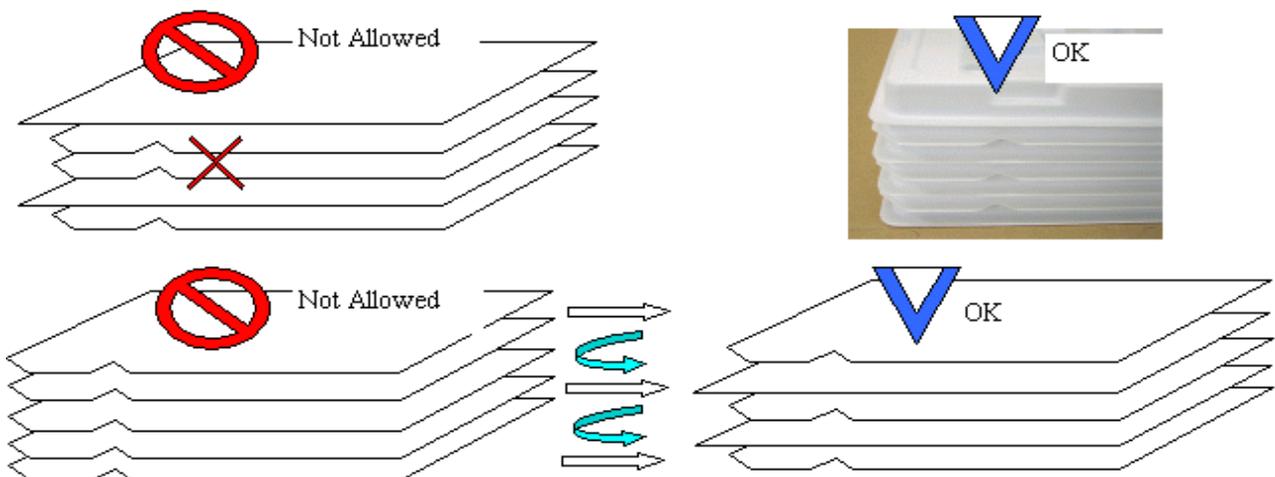
MODEL NO: UM*

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

1 foamed plastic in each box

TAPE

T.B.D. TRAY
(1 empty tray)

Corrugated board
protection

| Model | | No. | |
|---|---|---|---|
| Q'ty | | | pcs |
| * | | | |
| Lot | No. | (U.R.T. DATE CODE) | |
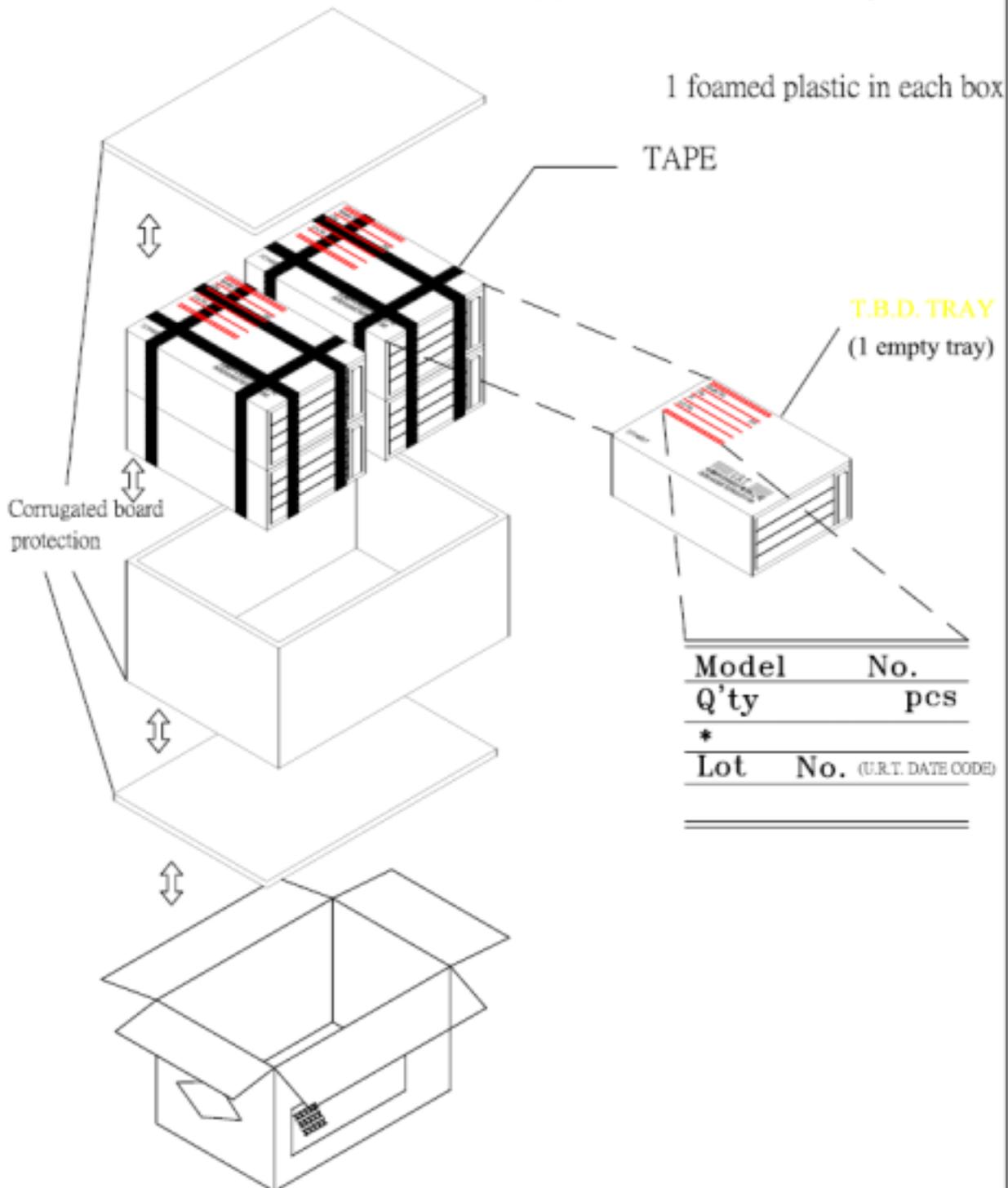
# 8. INSPECTION STANDARD

## 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    TO 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                (B) LINEAR TYPE:

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     SINGLE  PLAN.

| CLASS | AQL(%) |
|----------|---------|
| CRITICAL | 0.4   % |
| MAJOR | 0.65  % |
| MINOR | 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.

## 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 | (B) LINEAR TYPE: 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 |

## 8.4. STANDARD OF VISUAL INSPECTION

| NO. | CLASS | ITEM | JUDGEMENT |
|---|---|---|---|
| 8.4.1 | MINOR | BLACK AND WHITE SPOT FOREIGN MATERIEL DUST IN THE CELL BLEMISH SCRATCH | (A) ROUND TYPE: unit : mm. <br><br> (see table A below) <br><br> NOTE: $\Phi$=(LENGTH+WIDTH)/2 <br><br> (B) LINEAR TYPE: unit : mm. <br><br> (see table B below) |
| 8.4.2 | MINOR | BUBBLE IN POLARIZER DENT ON POLARIZER | unit : mm. <br><br> (see table below) |
| 8.4.3 | MINOR | Dot Defect | (see tables and notes below) |

**(A) ROUND TYPE:**     unit : mm.

| DIAMETER (mm.) | ACCEPTABLE Q'TY |
|---|---|
| $\Phi \leqq 0.1$ | DISREGARD |
| $0.1 < \Phi \leqq 0.25$ | 3 (Distance>5mm) |
| $0.25 < \Phi$ | 0 |

NOTE: $\Phi$=(LENGTH+WIDTH)/2

**(B) LINEAR TYPE:**     unit : mm.

| LENGTH | WIDTH | ACCEPTABLE Q'TY |
|---|---|---|
| ------ | $W \leqq 0.03$ | DISREGARD |
| $L \leqq 5.0$ | $0.03 < W \leqq 0.07$ | 3 (Distance>5mm) |
| ------ | $0.07 < W$ | FOLLOW ROUND TYPE |

    unit : mm.

| DIAMETER | ACCEPTABLE Q'TY |
|---|---|
| $\Phi \leqq 0.2$ | DISREGARD |
| $0.2 < \Phi \leqq 0.5$ | 2 (Distance>5mm) |
| $0.5 < \Phi$ | 0 |

| Items | ACC. Q'TY |
|---|---|
| Bright dot | $N \leqq 4$ (Distance>5mm) |
| Dark dot | $N \leqq 4$ (Distance>5mm) |

Pixel Define :
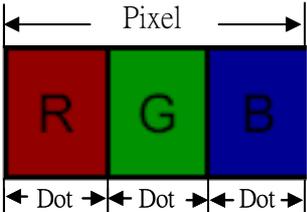


Note 1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.

Note 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

Note 3: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green ,blue pattern.

## 8.5 INSPECTION STANDARD OF TOUCH PANEL
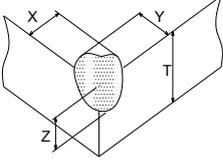
| NO. | CLASS | ITEMS | | JUDGEMENT | | |
|---|---|---|---|---|---|---|
| 8.5.1 | MAJOR | Touch Panel Crack | | | | Reject |
| 8.5.2 | MINOR | Touch Panel Chipping | Corner | Not CNC Products | X≦2mm, Y≦2mm, Z＜1/2T | Accept |
| | | | | CNC Products | For CNC Outline Dimension | Accept |
| | | | Edge | Not CNC Products | X≦3mm, Y≦3mm, Z＜1/2T | Accept |
| | | | | CNC Products | For CNC Outline Dimension | Accept |
| 8.5.3 | MINOR | Scratch Dust and Foreign Material (Linear Type) | | W≦0.05, L≦10mm | | Accept |
| | | | | 0.05mm＜W≦0.07mm；L≦5.0mm Distance between seratch＞5.0mm | | Accept 3 ea Max. |
| | | | | W＞0.07mm | | Reject |
| 8.5.4 | MINOR | Scratch Dust and Foreign Material (Round Type：Φ=(Length+Width)/2) | | Φ≦0.15mm | | Accept |
| | | | | 0.15mm＜Φ≦0.25mm Distance between seratch＞5.0mm | | Accept 5 ea Max. |
| | | | | Φ＞0.25mm | | Reject |
| 8.5.5 | MINOR | Touch Panel Dent / Fish Eyes (Φ=(Length+Width)/2) | | Φ≦0.35mm | | Accept |
| | | | | 0.35mm＜Φ≦1.0mm Distance＞5.0mm | | Accept 3 ea Max. |
| | | | | Φ＞1.0mm | | Reject |
| 8.5.6 | MINOR | Touch Panel Air Bubble (Φ=(Length+Width)/2) | | Φ≦0.15mm | | Accept |
| | | | | 0.15mm＜Φ≦0.25mm Distance between bubbles＞5.0mm | | Accept 3 ea Max. |
| | | | | Φ＞0.25mm | | Reject |
| 8.5.7 | MINOR | Touch Panel Printing area Scratch | | W≦0.03, L≦10mm | | Accept |
| | | | | 0.03mm＜W≦0.05mm, L≦5mm | | Accept 3 ea Max. |
| | | | | W＞0.05mm or L＞5mm ( W>0.05 Follow 8.5.4 Round type ) | | Reject |
| 8.5.8 | MINOR | Touch Panel White Haze Mark / Dust | | Can not be removed | | Reject |