Display Future Ltd
www.displayfuture.com

# LCD MODULE SPECIFICATION

## Model: DF-SSC0500---M1

**This module uses ROHS materials**

**For customer acceptance**

| | | |
|---|---|---|
| Customer | | date |
| Approved | | |
| Comments | | |

| | | |
|---|---|---|
| The standard product specification may change without prior notice in order to improve performance or quality. Please contact Display Future Ltd for updated specification and product status before design for the standard product or release of the order. | Revision | 1.0 |
| | Engineering | |
| | Date | 2018/01/4 |
| | Our Reference | |

## REVISION RECORD

| REV NO. | REV DATE | CONTENTS | REMARKS |
|---|---|---|---|
| 1.0 | 2018-01-4 | Initial Release | |
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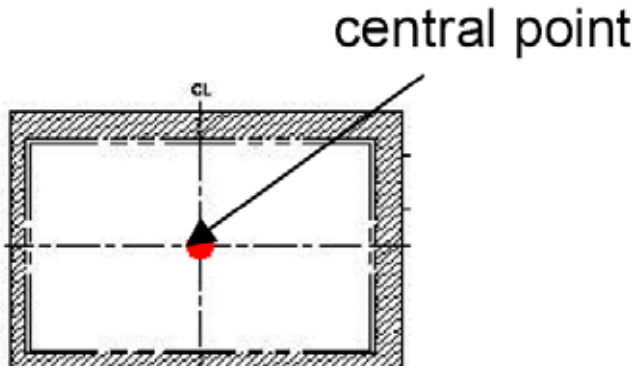
## 3. GENERAL SPECIFICATIONS

Composition: 5”inch Capacitive Touch Panel (CTP).
Interface: $I^2C$ for the CTP.

| Item | Specification | Unit |
|---|---|---|
| Type | Transparent type projected capacitive touch panel | |
| Input mode | Human’s finger | |
| Finger | 2 | |
| Outline Dimension | 142(W) x 94(H) x 2.35(D) | mm |
| Active area | 108.8(W) × 65.6(H) | mm |
| Transparency | ≧85 | % |
| Haze | ≦1.0 | % |
| Point hitting life time | T.B.D | Note 1 |
| Weight | T.B.D | g |
| Our components and processes are compliant to RoHS standard | | |

Note 1: Use 8 mm diameter silicon rubber/force 3N to knock on central point twice per second (no-operating), function pass after test.




## 4. ELECTRICAL CHARACTERISTICS

Ta= 25°C

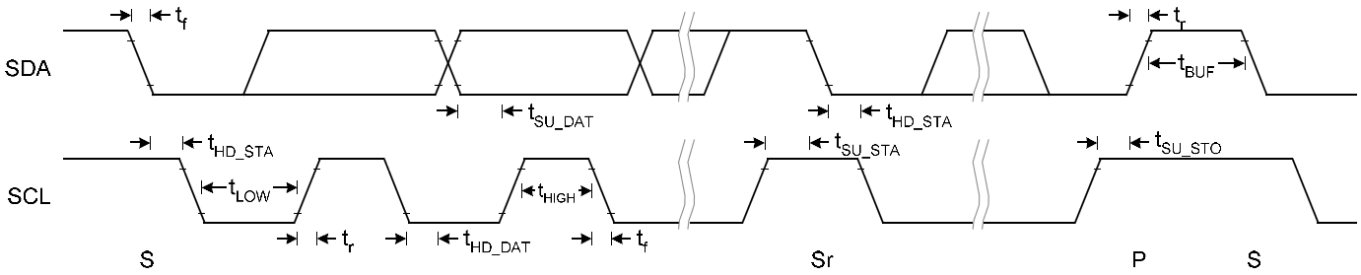
| Parameter | Symbol | MIN. | Typ. | MAX. | Unit | Remark |
|---|---|---|---|---|---|---|
| Power Supply voltage | Vcc | 3.0 | 3.3 | 3.6 | V | |
| Power Supply Current | $I_{DD}$ | -- | TBD | -- | mA | $V_{cc}$ =3.3V |
| “H” level logical input voltage | $V_{IH}$ | 1.9 | -- | Vcc | V | |
| “L” level logical input voltage | $V_{IL}$ | 0 | -- | 1.3 | V | |

## 5. Pin Connections

| No. | Name | I/O | Description |
|---|---|---|---|
| 1 | $V_{CC}$ | - | Power; $V_{CC}$=3.3V(typ.) |
| 2 | SCL | I | $I^2C$ Clock |
| 3 | SDA | I/O | $I^2C$ Data |
| 4 | /TP_INT | O | Active low when data output from touch panel |
| 5 | /TP_RST | I | CTP reset input pin, active low. |
| 6 | GND | - | Ground |

## 6. Interface and Data Format (Slave address is 0x55H)

Communication protocol: $I^2C$




**I2C Fast Mode Timing**

| 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 |

**I2C Fast Mode Timing Characteristic**

### 6.1 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.**

The 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.**

### 6.2 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 of Reg(a) | Value of Reg(a+1) | … | Value of Reg(a+n) | I²C Stop |
|---|---|---|---|---|---|---|---|

Figure 3.

## 7. REPORT PAGE REGISTERS

The provides a register set for host to configure device attributes and retrieve information about fingers, proximity, gestures or raw data through device host interface. Host interface registers are listed below.

| Host Interface Registers (Report Page) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Reg. Addr. | Name | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| 0x00 | Firmware Version | Version (RO) | | | | | | | |
| 0x01 | Status Reg. | Error Code (RO) | | | | Device Status (RO) | | | |
| 0x02 | Device Control Reg. | Auto Tune (RW | Flash Update Disable (RW) | Reserved | | Gest. Enable (RW) | Proximity Enable (RW) | Power Down (RW) | Power Down (RW) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0x03 | Timeout to Idle Reg. | Timeout to Idle (sec.) (RW) | | | | | |
| 0x04 | XY Resolution (High Byte) | X _ Res _ H (RW) | | | Y _ Res _ H (RW) | | |
| 0x05 | X Resolution (Low Byte) | X _ Res _ L (RW) | | | | | |
| 0x06 | Y Resolution (Low Byte) | Y _ Res _ L (RW) | | | | | |
| 0x07 | Max Drift Threshold | Max Drift Threshold (RW) | | | | | |
| 0x08 | Touch Threshold (High Byte) | Touch _ TH _ H (RW) | | | | | |
| 0x09 | Touch Threshold (Low Byte) | Touch _ TH _ L (RW) | | | | | |
| 0x0A | Noise Threshold | Noise _ TH (RW) | | | | | |
| 0x0B | Key Threshold | Key _ TH (RW) | | | | | |
| 0x0C | Firmware Revision 3 | FW_Rev_3 | | | | | |
| 0x0D | Firmware Revision 2 | FW_Rev_2 | | | | | |
| 0x0E | Firmware Revision 1 | FW_Rev_1 | | | | | |
| 0x0F | Firmware Revision 0 | FW_Rev_0 | | | | | |
| 0x10 | Fingers / Gesture | Gesture Code (RO) | | | Fingers (RO) | | |
| 0x11 | Keys Reg. | Keys (RO) | | | | | |
| 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 | XY1 Coord. (High | Valid 1 (RO) | X1_H (RO) | | Reserved | Y1_H (RO) | |

| | Byte) | | | | |
|---|---|---|---|---|---|
| 0x16 | X1 Coord. (Low Byte) | X1_L (RO) | | | |
| 0x17 | Y1 Coord. (Low Byte) | Y1_L (RO) | | | |
| 0x18 | Z0 Coord. | Z0 (RO) | | | |
| 0x19 | Z1 Coord. | Z1 (RO) | | | |
| 0x1A … 0x3F | … | *Reserved* | | | |
| 0x40 | Data [0] (High Byte) | Data _ H [0] | | | |
| 0x41 | Data [0] (Low Byte) | Data _ L [0] | | | |
| 0x42 | Data [1] (High Byte) | Data _ H [1] | | | |
| 0x43 | Data [1] (Low Byte) | Data _ L [1] | | | |
| 0x44 | Data [2] (High Byte) | Data _ H [2] | | | |
| 0x45 | Data [2] (Low Byte) | Data _ L [2] | | | |
| … | … | … | | | |
| 0x7E | Raw Data[31] (High Byte) | Data _ H [31] | | | |
| 0x7F | Raw Data [31] (Low Byte) | Data _ L [31] | | | |
| 0x80 … 0xFE | … | Reserved | | | |
| 0xFF | Page Reg. | Page Number (RW) | | | |

### 7.1 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.

### 7.2 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.

| Error Code | |
|---|---|
| **0x0** | **No Error** |
| **0x1** | **Invalid Address** |
| **0x2** | **Invalid Value** |
| **0x3** | **Invalid Platform** |
| **0x4 … 0xF** | **Reserved** |

| Device Status | |
|---|---|
| **0x0** | **Normal** |
| **0x1** | **Init** |
| **0x2** | **Error** |
| **0x3** | **Auto Tuning** |
| **0x4** | **Idle** |
| **0x5** | **Power Down** |
| **0x6 … 0xF** | **Reserved** |

### 7.3 Device Control Register

| Reg. Addr. | Name | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0x02 | Firmware Version | Auto Tune (RW) | Flash Update Disable (RW) | Reserved | | Gest. Enable (RW) | Proximity Enable (RW) | Power Down (RW) | Reset (RW) |

Device Control Register provides device control bits for host to reset the device, power down the device, enable/disable proximity detection, enable/disable gestures or data mode. Power Down state will be updated to Device Status field of Status Register, 0x01, after setting/clearing Power Down bit. Set Data Mode to 0x1 for Raw Data mode. Set Data Mode to 0x02 for Delta mode. Set Auto Tune to 0x1 will enable Auto Tune. Set Flash Update Disable to 0x00 will write the Auto Tune's result to flash.

### 7.4 Proximity Enable and 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 Reg. | Timeout to Idle (sec.) (RW) | | | | | | | |

Timeout to Idle Register provides timeout control to enter 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 this field to 0xFF will disable Idle Mode. Set this field to 0 will entering Idle Mode immediately. Idle state will be updated to Device Status field of Status Register, 0x01, after entering Idle Mode automatically. The default value of Timeout to Idle Register is set to 0x08 for 8 seconds to Idle Mode.

### 7.5 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) | X _ Res _ H (RW) | | | | Y _ Res _ H (RW) | | | |
| 0x05 | X Resolution (Low Byte) | X _ Res _ L (RW) | | | | | | | |
| 0x06 | Y Resolution (Low Byte) | Y _ Res _ L (RW) | | | | | | | |

XY Resolution Registers represents resolution of X and Y coordinates of the touch screen. Host can change XY Resolution at run time by updating new resolution to these registers.

### 7.6 Threshold Setting

| Reg. Addr. | Name | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0x07 | Max Drift Threshold | Max Drift Threshold (RW) | | | | | | | |
| 0x08 | Touch Threshold (High Byte) | Touch _ TH _ H (RW) | | | | | | | |
| 0x09 | Touch Threshold (Low Byte) | Touch _ TH _ L (RW) | | | | | | | |
| 0x0A | Noise Threshold | Noise _ TH (RW) | | | | | | | |
| 0x0B | Key Threshold | Key _ TH (RW) | | | | | | | |

Max Drift Threshold field defines the largest allowable drift in reported coordinates before issuing a new interrupt. Setting this field to 0 will disable Max Drift Threshold function. The default setting is 0.
Touch Threshold, Noise Threshold and Key Threshold define threshold of touch event detecting for Touch, Noise and Key sensors.

### 7.7 Firmware Revision Registers

| Reg. Addr. | Name | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0x0C | Firmware Revision 3 | FW_Rev_3 | | | | | | | |
| 0x0D | Firmware Revision 2 | FW_Rev_2 | | | | | | | |
| 0x0E | Firmware Revision 1 | FW_Rev_1 | | | | | | | |
| 0x0F | Firmware Revision 0 | FW_Rev_0 | | | | | | | |

Firmware Revision Registers provide revision information about current firmware.

### 7.8 Fingers and Gesture Register

| Reg. Addr. | Name | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0x10 | Fingers / Gesture | Gesture Code (RO) | | | | Fingers (RO) | | | |

Fingers field represents number of fingers detected by touch controller. The coordinates of each finger detected are represents in X Coordinate and Y Coordinate fields. Gesture Register tells host which gesture is detected by the controller. Gesture Codes for each gesture are listed below.

| Device Status | |
|---|---|
| **0x0** | **No Detected** |
| **0x1** | **Single Touch Tap** |
| **0x2** | **Single Touch Double Tap** |
| **0x3** | **Single Touch Slide Up** |
| **0x4** | **Single Touch Slide Down** |
| **0x5** | **Single Touch Slide Left** |
| **0x6** | **Single Touch Slide Right** |
| **0x7** | **Two Finger Slide Up** |
| **0x8** | **Two Finger Slide Down** |
| **0x9** | **Two Finger Slide Left** |
| **0xA** | **Two Finger Slide Right** |
| **0x0B** | **Pinch In (Zoom In)** |
| **0x0C** | **Pinch Out (Zoom Out)** |
| **0x0D** | **Rotate CW (CCW, for Top Down Mapping)** |
| **0x0E** | **Rotate CCW (CW, for Top Down Mapping)** |
| **0x0F** | **Object Approaching** |
| **0x10** | **Object Leaving** |
| **0x11 … 0x1F** | **Reserved** |

### 7.9 Keys Register

| Reg. Addr. | Name | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0x11 | Keys | Keys (RO) | | | | | | | |

Key field represents which key is pressed or released. Each bit in the Key field represents the pressed or released state of one key. If the bit is set, it means that the corresponding key is pressed. Otherwise, the key is released.

### 7.10 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) | | | | | | | |

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.
Z Coordinate Register indicates the touch strength of corresponding touch point ID.

### 7.11 Z Coordinate Registers

| Reg. Addr. | Name | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0x18 | Z0 Coord. | Z0 (RO) | | | | | | | |
| 0x19 | Z1 Coord. | Z1 (RO) | | | | | | | |

Z Coordinate Register indicates the touch strength of corresponding touch point ID. Z0 represents touch strength of point ID 0 and Z1 represents touch strength of point ID 1.

### 7.12 Data Registers

| Reg. Addr. | Name | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0x40 | Data [0] (High Byte) | Data _ H [0] | | | | | | | |
| 0x41 | Data [0] (Low Byte) | Data _ L [0] | | | | | | | |
| 0x42 | Data [1] (High Byte) | Data _ H [1] | | | | | | | |
| 0x43 | Data [1] (Low Byte) | Data _ L [1] | | | | | | | |
| 0x44 | Data [2] (High Byte) | Data _ H [2] | | | | | | | |
| 0x45 | Data [2] (Low Byte) | Data _ L [2] | | | | | | | |
| … | … | … | | | | | | | |
| 0x7E | Raw Data[31] (High Byte) | Data _ H [31] | | | | | | | |
| 0x7F | Raw Data [31] (Low Byte) | Data _ L [31] | | | | | | | |

Data Registers provide raw or delta data detected by touch sensor controller. If Data Mode of Device Control Register (0x02) is set to Raw Mode, Data Registers represent raw data. If Data Mode is set to Delta Mode, Data Registers represent delta data. Data Registers will be updated for each scan frame when in raw or delta mode. Otherwise, Raw Data Registers will not be updated.

### 7.13 Page Register

| Reg. Addr. | Name | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0xFF | Page Reg. | Page Number (RW) | | | | | | | |

Page Register provides changing page of Host Interface Register.
Default page is Report Page.

| Page Number | Description |
|---|---|
| **0x00** | **Report Page** |
| **0x01** | **Auto Tune Page** |

## 8. SAMPLE CODES

### 8.1 Data Structures and APIs

```
typedef struct
{
	u8 y_h: 3,
	reserved: 1,
	x_h: 3,
	valid: 1;
	u8 x_l;
	u8 y_l;
}
xy_data_t;
typedef struct
{
	u8 fingers: 3,
	gesture: 5;
	u8 keys;
	xy_data_t xy_data[2];
}
stx_report_data_t;
// I2C Master sends count bytes data stored in buf to I2C Slave.
// I2C package: | S | I2C Addr | W | Data (buf) | P |
extern int i2c_master_send(const char *buf, int count);
// I2C Master reads count bytes data to buf from I2C Slave.
// I2C package: | S | I2C Addr | R | Data (buf) | Nak | P |
extern int i2c_master_recv(char *buf, int count);
```

### 8.2 Get Version

```
static int get_fw_version(u32 *ver)
{
	u8 buf[1];
	int ret = 0;
	buf[0] = 0x0; // Set Reg. address to 0x0 for reading FW Version.
		if (ret = i2c_master_send(buf, 1))
			goto err;
		if (ret = I2c_master_recv(buf, 1)) // Read 1 byte FW Version from Reg. 0x0 set previously.
			goto err;
			*ver = (u32) buf[0]; // Return FW Version.
			buf[0] = 0x10; // Set Reg. address back to 0x10 for Coordinates.
		if (i2c_master_send(buf, 1))
			goto err;
			err:
			return ret;
}
```

### 8.3 Set Power Down (PD)

```
static int set_power_down()
{
	u8 buf[2];
	int ret = 0;
	buf[0] = 0x2;	// Set Reg. address to 0x2 for Device Control Reg.
	buf[1] = 0xA;	// Keep Gesture bit and set PD bit to enter Power Down.
		if (ret = i2c_master_send(buf, 2))
			goto err;
			err:
			return ret;
}
```

### 8.4 Set XY Resolution

```
static int set_power_down()
{
	u8 buf[2];
	int ret = 0;
	buf[0] = 0x2; // Set Reg. address to 0x2 for Device Control Reg.
	buf[1] = 0xA; // Keep Gesture bit and set PD bit to enter Power Down.
		if (ret = i2c_master_send(buf, 2))
			goto err;
			buf[0] = 0x10; // Set Reg. address back to 0x10 for Coordinates.
		if (i2c_master_send(buf, 1))
		goto err;
		err:
		return ret;
}
```

### 8.5 Read XY Coordinates

The function, get_coordinates(), reads XY Coordinate registers from I2C Slave, extracts XY information from data buffer and returns to upper layer. This function shall be called from ISR each time when host receives and INT from device.

```
static int get_coordinates(u8 *count, u32 *x0, u32 *y0, u32 *x1, u32 *y1)
{
	u8 buf[8];
	stx_report_data_t *pdata;
	int ret = 0;
	*count = 0; // Set point detected count to 0.
	if (i2c_master_recv(buf, 8)) // Read Coordinates from default Reg. address 0x10.
		goto err;
		pdata = (stx_report_data_t *) buf;
	if (pdata->fingers)
	{
		if (pdata->xy_data[0].valid)
	{
		*x0 = pdata->xy_data[0].x_h << 8 | pdata->xy_data[0].x_l;
		*y0 = pdata->xy_data[0].y_h << 8 | pdata->xy_data[0].y_l;
		(*count)++;
}
	if (pdata->xy_data[1].valid)
	{
		*x1 = pdata->xy_data[1].x_h << 8 | pdata->xy_data[1].x_l;
		*y1 = pdata->xy_data[1].y_h << 8 | pdata->xy_data[1].y_l;
		(*count)++;
	}
}
err:
return ret;
}
```

### 8.6 Set XY Resolution

```
static int set_resolution(u16 x_res, u16 y_res)
{
	u8 buf[4];
	int ret = 0;
	buf[0] = 0x4; // Set Reg. address to 0x4 for XY Resolution Registers.
	buf[1] = ((x_res & 0xF00) >> 4) | ((y_res & 0xF00) >> 8); // Set X_Res_H and Y_Res_H.
	buf[2] = x_res & 0xFF; // Set X_Res_L.
	buf[3] = y_res & 0xFF; // Set Y_Res_L.
	if (ret = i2c_master_send(buf, 4))
		goto err;
		buf[0] = 0x10; // Set Reg. address back to 0x10 for Coordinates.
	if (i2c_master_send(buf, 1))
		goto err;
		err:
		return ret;
}
```

## 9. QUALITY ASSURANCE

### 9.1 Test Condition

9.1.1 Temperature and Humidity(Ambient Temperature)

Temperature : 25 ± 5°C

Humidity : 65 ± 5%

9.1.2 Operation

Unless specified otherwise, test will be conducted under function state.

9.1.3 Container

Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

9.1.4 Test Frequency

In case of related to deterioration such as shock test. It will be conducted only once.

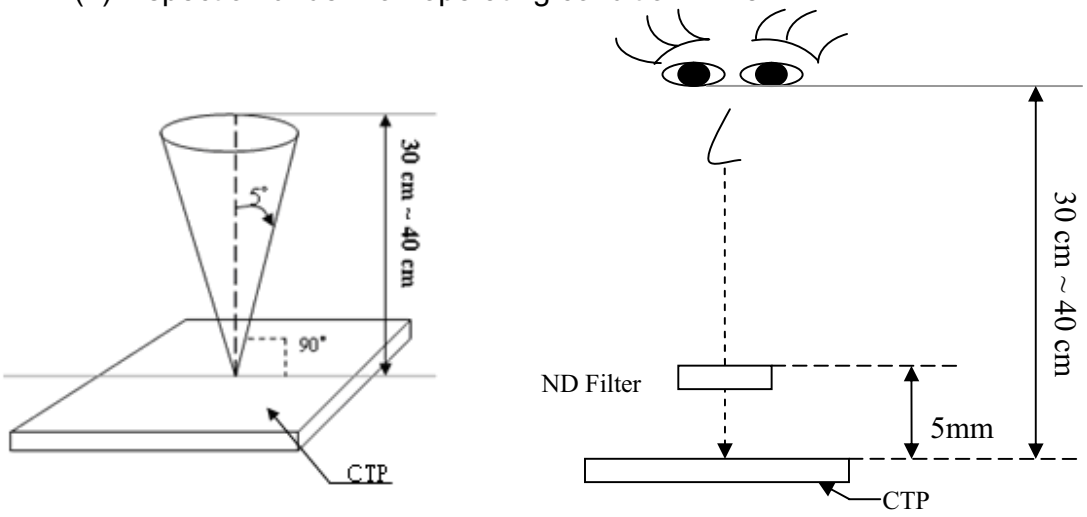
9.1.5 Test Method

| No. | Item | Test Conditions | Remark |
|---|---|---|---|
| 1 | High Temperature Storage | Ta = 80 ℃ 240 hrs | IEC68-2-2 |
| 2 | Low Temperature Storage | Ta = -30℃ 240hrs | IEC68-2-1 |
| 3 | High Temperature Operation | Ta = 70℃ 240hrs | IEC68-2-2 |
| 4 | Low Temperature Operation | Ta = -20℃ 240hrs | IEC68-2-1 |
| 5 | Operate at High Temperature and Humidity | +60℃ , 90%RH 240 hrs | IEC68-2-3 |
| 6 | Thermal Cycling Test (non operation) | -30℃(30 min) → + 80℃(30 min), 200 cycles | IEC68-2-14 |
| 7 | Vibration Test(with carton) | Random Vibration :<br>0.015G^2/Hz from 5-200HZ, -6dB/Octave from 200-400HZ<br>2 hours for each direction of X. Y. Z. | IEC68-2-6 |
| 8 | Drop Test(with carton) | Height:60 cm<br>1 corner, 3 edges, 6 surfaces | JIS Z0202 |
| 9 | Electro Static Discharge | ± 200V, 200Pf(0Ω) 1 time/each terminal | IEC-61000-4-2 |

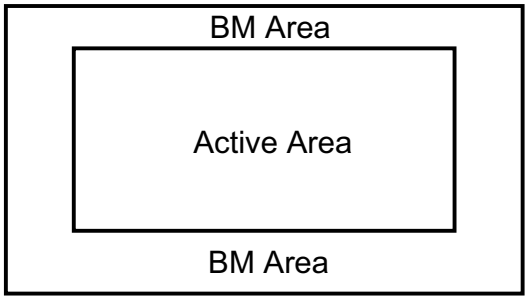
## 10. Appearance Specification

### 10.1Inspection and Environment conditions

10.1.1 Temperature: 25± 5℃
10.1.2 Humidity: 55 ± 10% RH
10.1.3 Light source: Fluorescent Light
10.1.4 Inspection: Viewing distance: 35±5cm
10.1.5 Ambient Illumination:
(1) Cosmetic Inspection: 500 ~ 800 lux
(2) Functional Inspection: 400 ~ 600 lux
10.1.6 Inspection View angle:
(1) Inspection under operating condition: ±5°
(2) Inspection under non-operating condition: ± 45°



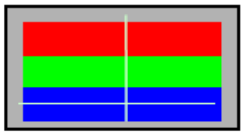
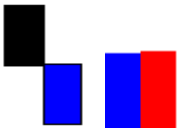
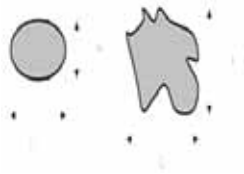
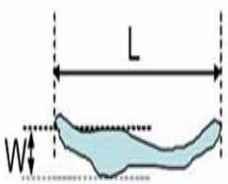

### 10.2 Definition of applicable Zones

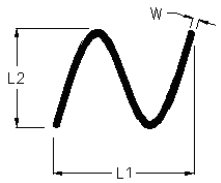


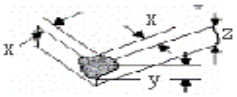
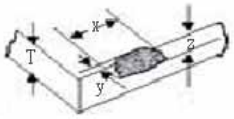

### 10.3 Judgment standard

The Judgment of the above test should be made after exposure in room temperature for two hours as follow:
Pass: Normal display image with no obvious non-uniformity and no line defect. Partial transformation of the module parts should be ignored.
Fail: No display image, obvious non-uniformity, or line defect.

### 10.4 Cosmetic Specification and Inspection Items

<table>
<tr><th>Inspection Item</th><th>Inspection Criteria</th><th>Illustration</th></tr>
<tr><td>Display function</td><td>No Display malfunction</td><td>  </td></tr>
<tr><td>Contrast ratio</td><td>Does not meet specified range in the spec.</td><td>(Major) (Note:2)</td></tr>
<tr><td>Line Defect</td><td>No obvious Vertical and Horizontal line defect in black and White.</td><td>  </td></tr>
<tr><td>Point Defect</td><td>
<table>
<tr><th rowspan="2">Item</th><th>Acceptable number</th><th rowspan="2">Total</th></tr>
<tr><th>Active Area</th></tr>
<tr><td>Bright</td><td>2</td><td rowspan="2">5</td></tr>
<tr><td>Dark</td><td>4</td></tr>
<tr><td>Two adjacent dot</td><td>2</td><td>2</td></tr>
</table>
</td><td>One Dot<br>  <br>Two adjacent dot<br>  </td></tr>
<tr><td>Foreign material (Black or White spots shape)</td><td>
<table>
<tr><th>Zone / Dimension</th><th>Acceptable number</th><th>Class of Defects</th></tr>
<tr><td>D> 0.5mm</td><td>0</td><td rowspan="3">Minor</td></tr>
<tr><td>0.3mm<D≦0.5 mm</td><td>5</td></tr>
<tr><td>D≦ 0.3mm</td><td>*</td></tr>
</table>
</td><td>  <br>D= (L + W) / 2</td></tr>
<tr><td>Foreign Material ( Line shape)</td><td>
<table>
<tr><th>Zone / Dimension</th><th>Acceptable number</th><th>Class of Defects</th></tr>
<tr><td>W> 0.1mm or L >5mm</td><td>0</td><td rowspan="3">Minor</td></tr>
<tr><td>0.05 mm<W≦0.1 mm<br>L ≦5mm</td><td>5</td></tr>
<tr><td>W≦ 0.05mm</td><td>*</td></tr>
</table>
</td><td>  <br>L : Long W : Width</td></tr>
<tr><td>Non-uniformity</td><td>Visible through 5 %ND filter White, R, G, B and gray 50% pattern.</td><td>(Minor)</td></tr>
<tr><td>Dimension</td><td>Outline</td><td>(Major)</td></tr>
<tr><td>Bezel appearance</td><td>uneven</td><td>(Minor)</td></tr>
</table>

<table>
<tr>
<td>Scratch on the Touch panel</td>
<td>
<table>
<tr><th>Zone / Dimension</th><th>Acceptable number</th><th>Class of Defects</th></tr>
<tr><td>W>0.1mm or L>5mm</td><td>0</td><td rowspan="2">Minor</td></tr>
<tr><td>W≦0.1 mm L≦5mm</td><td>5</td></tr>
</table>
</td>
<td> 
</td>
</tr>
<tr>
<td>Dent on the Touch panel</td>
<td>
<table>
<tr><th>Zone / Dimension</th><th>Acceptable number</th><th>Class of Defects</th></tr>
<tr><td>D> 0.5 mm</td><td>0</td><td rowspan="2">Minor</td></tr>
<tr><td>0.3mm ≦D≦ 0.5 mm</td><td>5</td></tr>
</table>
</td>
<td> 

D= (L + W) / 2</td>
</tr>
<tr>
<td>Polarizer flaw or leak out resin</td>
<td>Defect is defined as the active area.</td>
<td></td>
</tr>
<tr>
<td>Corner Chipping</td>
<td>X<3 mm, Y<3 mm, Z< Glass thickness</td>
<td> 
</td>
</tr>
<tr>
<td>Edge Chipping</td>
<td>X<3 mm, Y<3 mm, Z< Glass thickness</td>
<td> 
</td>
</tr>
<tr>
<td>Crack</td>
<td>reject</td>
<td>  </td>
</tr>
</table>

**10.5 Sampling Condition**

Unless otherwise agree in written, the sampling inspection shall be applied to the incoming inspection of customer.
Lot size: Quantity of shipment lot per model.
Sampling type: normal inspection, single sampling
Sampling table: MIL-STD-105E
Inspection level: Level II

| | Definition | | |
|---|---|---|---|
| Class of defects | Major | AQL 0.65% | It is a defect that is likely to result in failure or to reduce materially the usability of the product for the intended function. |
| | Minor | AQL 1.5% | It is a defect that will not result in functioning problem with deviation classified. |

Note:1.(a)Bright point defect is defined as point defect of R,G,B with area >1/2 dot pectively

(b)Dark point defect is defined as visible in full white pattern.

(c)Definition of distribution of point defect is as follows:

-minumum separation between dark point defects should be larger than 5mm.

-minumum separation between bright point defects should be larger than 5mm.

(d)Definition of joined bright point defect and joined dark point defect are as follows:

- Three or more joined bright point defects must be nil.
- Three joined dark point defects must be nil.
- Two Joined dark point is counted as two dark points with 2 pair maximum.

(e) Line defect is defined as visible by using 5 % ND filter.

## 11. PRECAUTIONS IN USE CTP

1. ASSEMBLY PRECAUTIONS
   (1) Since Touch Panel is consist of glass, please be careful your hands to be injured during handing. You must wear gloves during handing.
   (2) Do not touch, push or rub the exposed touch panel, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
   (3) Do not stack the touch panels together. Do not put heavy objects on touch panel.
   (4) Please do not take a CTP to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.
   (5) Please excessive force or strain to the panel or tail is prohibited, Do not lift touch panel by cable(FPC).
   (6) Use clean sacks or glove to prevent fingerprints and/or stains left on the panel. Extra attention and carefulness should be taken while handling the glass edge.
   (7) Please pay attention for the matters stated below at mounting design of touch panel enclosure.
   Enclosure support to fix touch panel must be out of active area.(do not design enclosure presses the active area to protect from miss put)
2. OPERATING PRECAUTIONS
   (1) Please be sure to turn off the power supply before connecting and disconnecting signal input cable.
   (2) Please do not change variable resistance settings in CTP. They are adjusted to the most suitable value. If they are changed, it might happen CTP does not satisfy the characteristics specification
   (3) Be careful for condensation at sudden temperature change. Condensation makes damage to sensor or electrical contacted parts.
   (4) CTP has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
   (5) Touch the panel with your finger or stylus only to assure normal operation. Any sharp edged or hard objects are prohibited.
   (6) Operate the panel in a steady environment. Abrupt variation on temperature and humidity may cause malfunction of the panel.
3. ELECTROSTATIC DISCHARGE CONTROL
   (1) The operator should be grounded whenever he/she comes into contact with the CTP. Never touch any of the conductive parts such the copper leads on the FPC and the interface terminals with any parts of the human body.
   (2) The CTP should be kept in antistatic bags or other containers resistant to static for storage.
   (3) Only properly grounded soldering irons should be used.
   (4) If an electric screwdriver is used, it should be well grounded and shielded from commentator sparks.
   (5) The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended
   (6) Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.
5. STORAGE PRECAUTIONS
   (1) When you store touch panel for a long time, it is recommended to keep the temperature between 0°C-40°C without the exposure of sunlight and to keep the humidity less than 90%RH.
   (2) Please do not leave touch panel in the environment of high humidity and high temperature such as 60°C 90%RH
   (3) Please do not leave touch panel in the environment of low temperature; below -20°C.
6. OTHERS
   For the packaging box, please pay attention to the followings:
   a. Please do not pile them up more than 5 boxes. (They are not designed so.) And please do not turn over.
   b. Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
   c. Packing box and inner case for CTP are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)
7. LIMITED WARRANTY
   Unless otherwise agreed between Display Future and customer, Display Future will replace or repair any of its CTP which is found to be defective electrically and visually when inspected in accordance with Display Future acceptance standards, for a period on one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Display Future is limited to repair and/or replacement on the terms set forth above. Display Future will not responsible for any subsequent or consequential events.

## 12. OUTLINE DRAWING