CUSTOMER' S APPROVAL SPECIFICATIONS

MODEL: CH050DLDT-CT3

(Complied with RoHS)

ISSUE:MAY.25.2013

Spec Condition preliminary

CUSTOMER	CHEFREE		
APPROVAL	APPROVAL	CHECKER	PREPARE
.	ch lee	kevin	Zoe

2.RECORD OF REVISION

REV	DATE	PAGE	SUMMARY
0.1	2013.05.25	ALL	Preliminary specification was first issued.

3.MECHANICAL SPECIFICATIONS

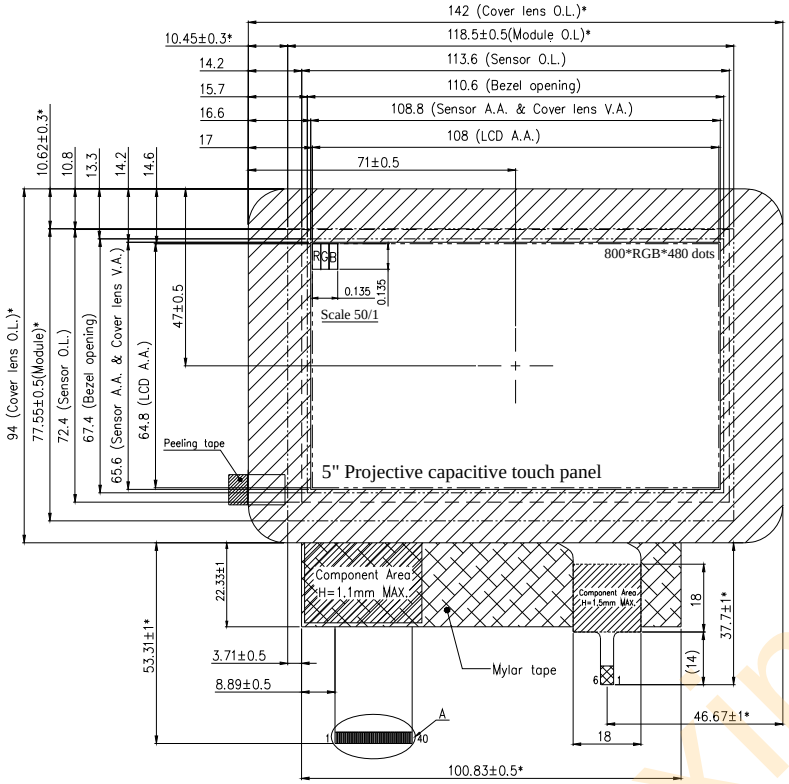
(1)	Number Of Dots (Dots)	800 (R.G.B) X 480
(2)	Module Size(mm)	142(H) X 92(V) X 6.25(D)
(3)	Active Area(mm)	108.0(H) X 64.8(V)
(4)	Pixel Pitch(mm)	0.135(H) X 0.135(V)
(5)	LCD Model	TFT , Transmissive , Normally/white
(6)	Polarizer Model	Glare
(7)	LED Backlight Color	White
(8)	Viewing Direction	6 O'clock
(9)	Gray Scale Inversion Direction	12 O'clock
(10)	Color Configuration	R.G.B Vertical Stripe
(11)	CTP Touch Method	Fingers Multi Touch
(12)	Weight(g)	TBD

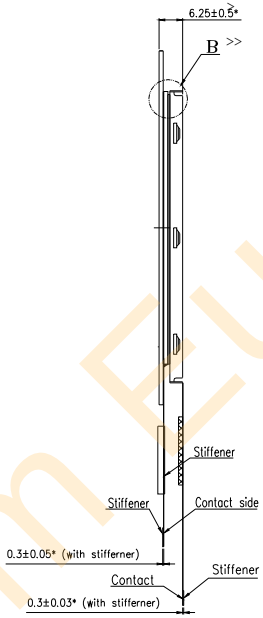
**Viewing direction for best image quality is different from TFT definition, there is the 180 degrees shift.

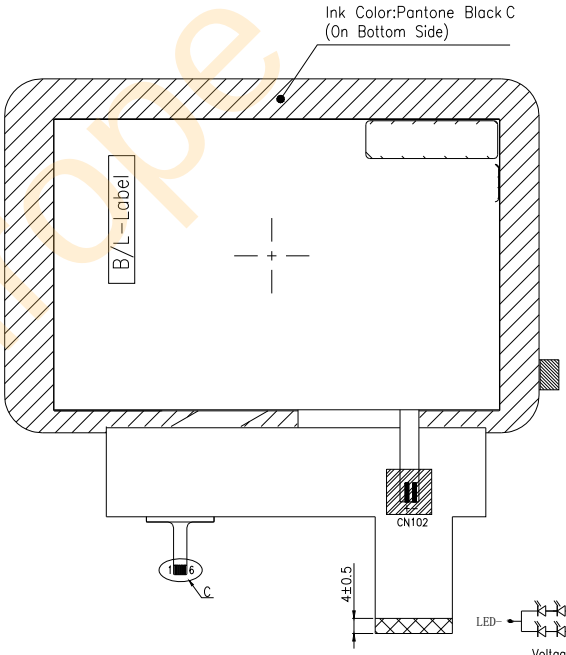
文件題目	圖號	頁	次頁
發行日	舊版日	登入號碼	機密等級

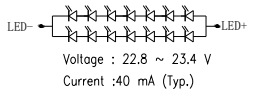
8樣式 QT3-RD-E-0004-003

No.	修定區塊	修 訂 內 容	作 成	修訂日期
		新版	Bella	

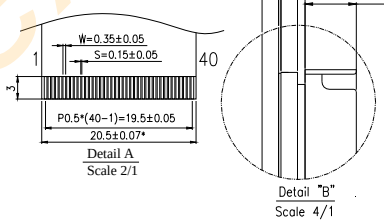


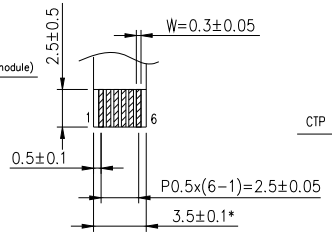






backlight circuit





Note:

1. For RoHS.
2. IC : Sitronix ST1332.
3. LCM Match connector: HIROSE FH19SC-40S-0.5SH or equivalent.
4. CTP Match connector : HIROSE FH34SJ-6S-0.5SH or equivalent.
5. Tolerance is ±0.3 unless otherwise noted.
6. Center brightness : 250 cd/m^2 (Min.); 320 cd/m^2 (Typ.)
7. Uniformity : 70% min.
8. * is important dimension.

CTP	Pin FUNCTIONS (I2C)
1	Vcc
2	SCL
3	SDA
4	TP_INT
5	TP_RST
6	GND

LCM	PIN	FUNCTIONS					
1	VLED-	11	R6	21	B0	31	DISP
2	VLED+	12	R7	22	B1	32	Hsync
3	GND	13	G0	23	B2	33	Vsync
4	VDD	14	G1	24	B3	34	DE
5	R0	15	G2	25	B4	35	NC
6	R1	16	G3	26	B5	36	GND
7	R2	17	G4	27	B6	37	NC
8	R3	18	G5	28	B7	38	NC
9	R4	19	G6	29	DGND	39	NC
10	R5	20	G7	30	DCLK	40	NC

備考		單位: mm	投影法:	比例尺: 1:1
入庫	製圖	名稱:		圖號
	審查			
	承認			

5. INTERFACE PIN CONNECTION

5.1 LCM PANEL DRIVING SECTION

FPC recommended connector：HIROSE FH19SC-40S-0.5SH or Compatible

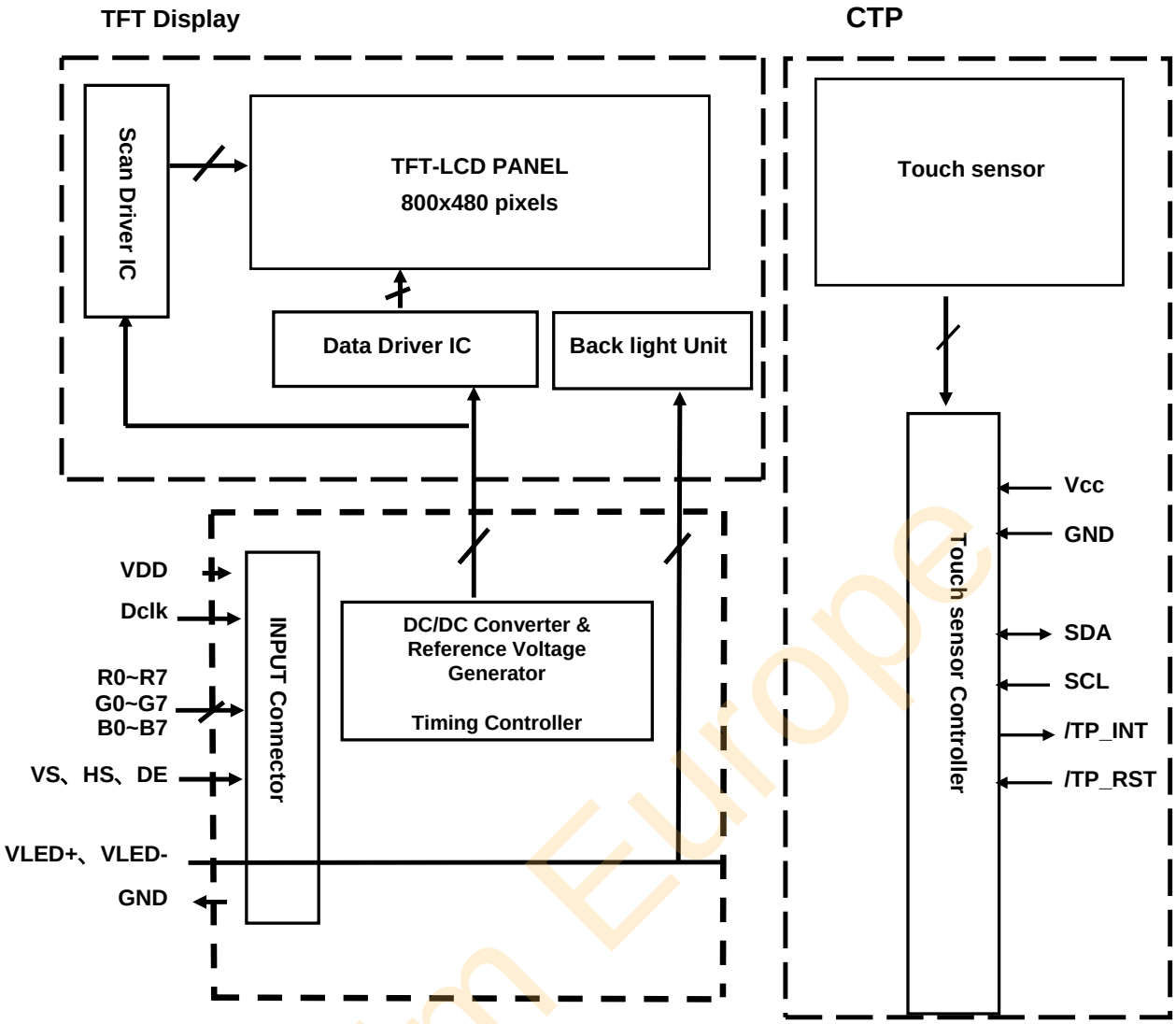
PIN No.	SYMBOL	FUNCTION	REMARK
1	V_{LED-}	Power for LED backlight cathode	
2	V_{LED+}	Power for LED backlight anode	
3	GND	Power ground	
4	V_{DD}	Power voltage	
5	R0	Red data(LSB)	
6	R1	Red data	
7	R2	Red data	
8	R3	Red data	
9	R4	Red data	
10	R5	Red data	
11	R6	Red data	
12	R7	Red data(MSB)	
13	G0	Green data(LSB)	
14	G1	Green data	
15	G2	Green data	
16	G3	Green data	
17	G4	Green data	
18	G5	Green data	
19	G6	Green data	
20	G7	Green data(MSB)	
21	B0	Blue data(LSB)	
22	B1	Blue data	
23	B2	Blue data	
24	B3	Blue data	
25	B4	Blue data	
26	B5	Blue data	
27	B6	Blue data	
28	B7	Blue data(MSB)	
29	GND	Power ground	
30	CLK	Pixel clock	
31	DISP	Display on/off	
32	HSYNC	Horizontal sync signal	
33	VSYNC	Vertical sync signal	
34	DE	Data Enable	
35	NC	No connection	
36	GND	Power ground	
37	NC	No connection	
38	NC	No connection	
39	NC	No connection	
40	NC	No connection	

5.2 CTP PANEL DRIVING SECTION

FPC recommended connector：HIROSE FH34SJ-6S-0.5SH or Compatible

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

6. BLOCK DIAGRAM



7. ABSOLUTE MAXIMUM RATINGS

7.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS (GND=0V)

ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
Power Supply Voltage	V_{DD}	-0.5	5.0	V	
Input signal Voltage	Logic input	-0.3	VDD+0.3		
CTP Power Supply Voltage	Vcc	2.4	3.6		

7.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE		COMMENT
	MIN	MAX	MIN	MAX	
Ambient Temperature(℃)	-20	70	-30	80	Note 1,2,3
Humidity(% RH)	-	90	-	90	Note 4

Note 1 : The response time will become lower when operated at low temperature.
Note 2 : Background color changes slightly depending on ambient temperature.
Note 3 : Operation Ta=70℃ & -20℃ ≦ 240Hrs.
Note 4 : Storage Ta=60℃ & H=90% ≦ 240Hrs.

8. ELECTRICAL CHARACTERISTICS

8.1 LCM ELECTRICAL CHARACTERISTICS

Ta=25℃

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Power Supply Voltage	V_{DD}	3.0	3.3	3.6	V	-
Power Supply Current	I_{DD}		--	220	mA	V_{DD}=3.3V
"H" level logical input voltage	V_{IH}	0.7*V_{DD}	--	V_{DD}	V	Note 1
"L" level logical input voltage	V_{IL}	0	--	0.3*V_{DD}	V	

Note 1:CLK,DE,R0~R7,G0~G7,B0~B7.

8.2 LED BACKLIGHT UNITS

Ta=25℃

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
LED Voltage	V_{LED}	--	23.1	--	V	Note 1
LED Current	I_{LED}	--	40	--	mA	
LED Life Time	-	10,000	--	--	Hr	Note 2

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25℃ and I_{LED} =40mA.

Note 2: The "LED Life Time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and I_{LED} =40mA. The LED lifetime could be decreased if operating I_{LED} is larger than 40mA

8.3 CTP ELECTRICAL CHARACTERISTICS

Ta=25℃

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
CTP Supply Voltage	Vcc	-	3.3	-	V	

9.OPTICAL CHARACTERISTICS

9.1 OPTICAL CHARACTERISTICS OF LCM PANEL

Ta=25℃

ITEM		SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	REMARK
Contrast Ratio		CR	Viewing Normal Angle ΘX=ΘY =0°	480	600	-		Note (1)
Response Time		TR		-	2	4	ms	Note (2)
		TF		-	6	12	ms	
Chromaticity	White	x		(0.26)	(0.31)	(0.36)	-	Note (4)
		y		(0.28)	(0.33)	(0.38)	-	
Viewing Angle		ΘX+	Viewing Normal Angle ΘX=ΘY =0° CR≧10	65	75	-	Deg.	Note (3)
		ΘX-		65	75	-		
		ΘY+		50	60	-		
		ΘY-		60	70	-		
Brightness		L	I_{LED}=40mA	(250)	(320)	-	cd/m2	Note(5)
Uniformity		YU		70	75	-	%	

*Note (1) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

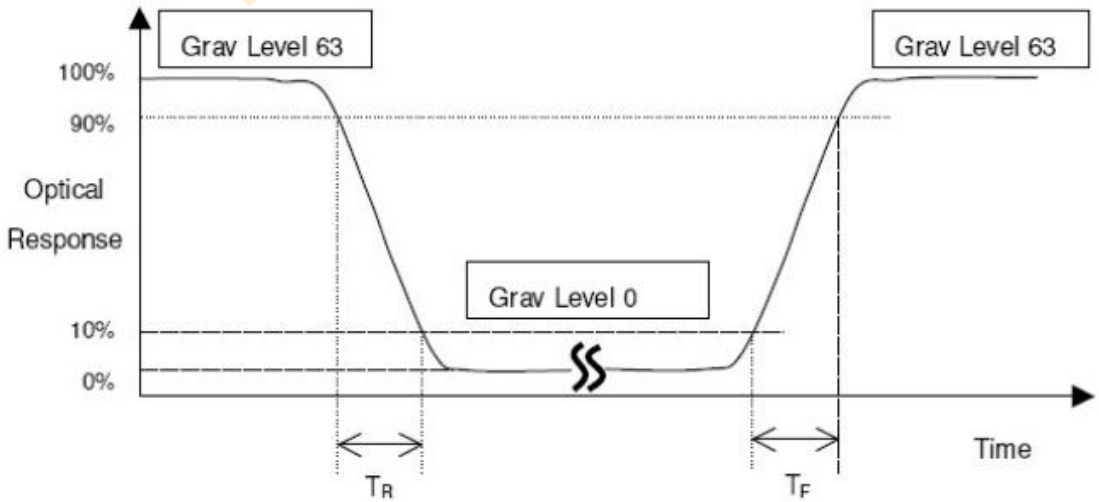
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

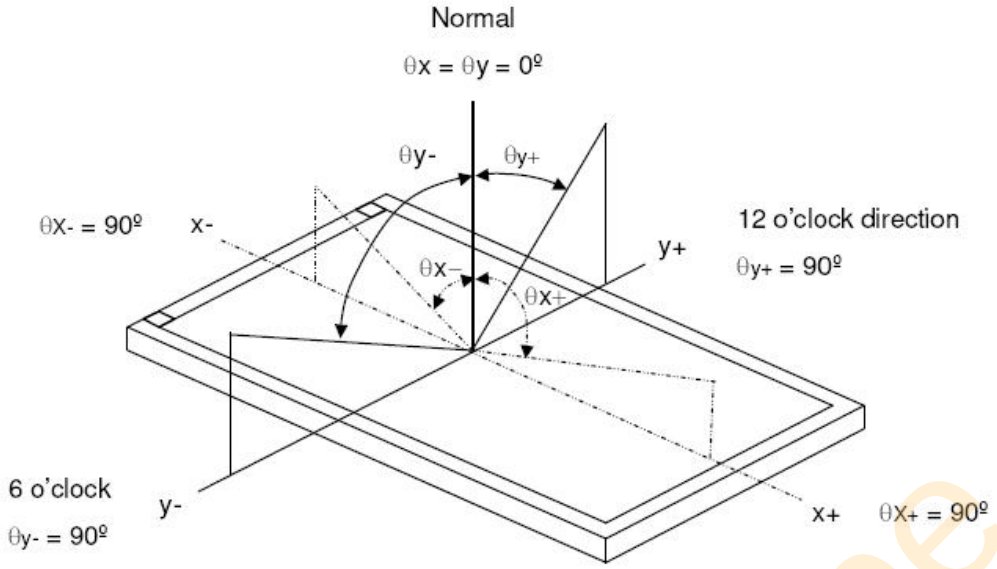
CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

*Note (2) Definition of Response Time (T_R, T_F):

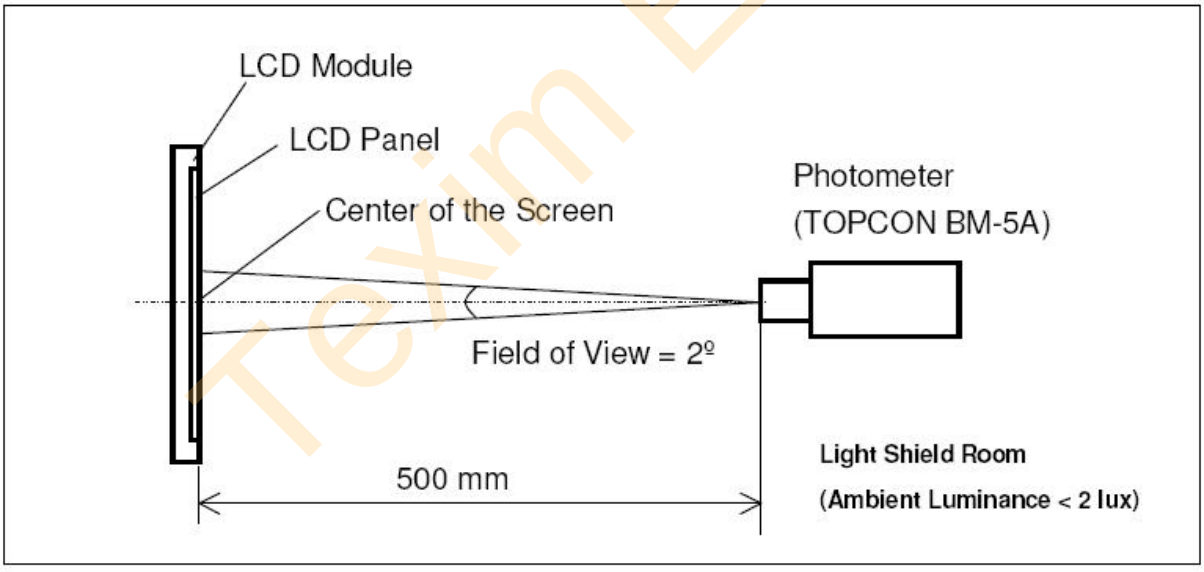


*Note(3) Definition of Viewing Angle

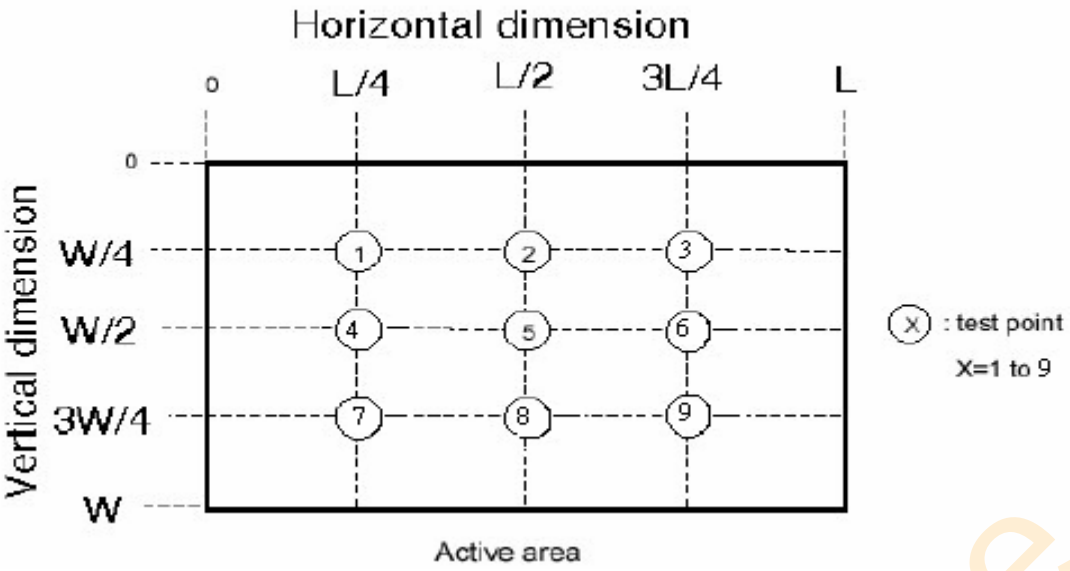


*Note (4) Measurement Set-Up:

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



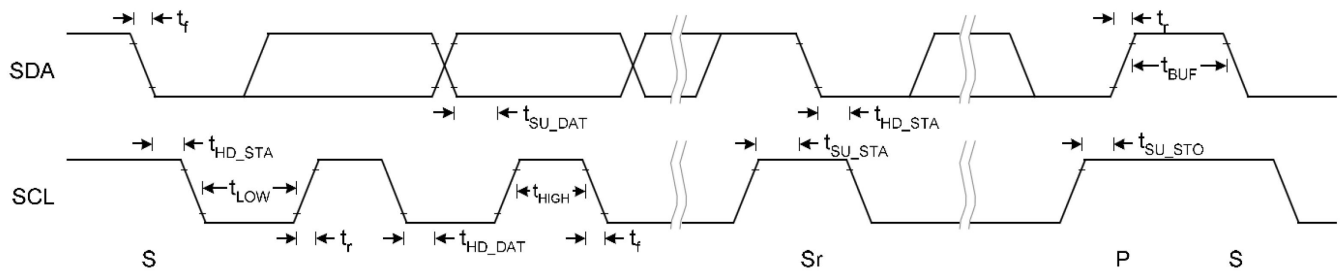
*Note (5)



$$\left(1-\frac{\text{MAX Luminance} - \text{Average Luminance}}{\text{Average Luminance}}\right) \times 100\% \geqq 70\%$$

10. TOUCH PANEL SPECIFICATIONS

10.1 I^2C 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

10.2 REGISTER READ

10.2.1 REGISTER READ FORMAT

For reading register value from I^2C device, host has to tell I^2C device the Start Register Address before reading corresponding register value.

I^2C Start	I^2C Header (W)	Start Reg. Addr. (a)	I^2C Stop	I^2C Start	I^2C Header (R)	Value of Reg(a)	Value of Reg(a+1)	……..	Value of Reg(a+n)	I^2C Stop

10.2.2 REPEATED REGISTER READ

The I^2C 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.

I^2C Start	I^2C Header (R)	Value of Reg(a)	Value of Reg(a+1)	…	Value of Reg(a+n)	I^2C Stop	I^2C Start	I^2C Header (R)	Value of Reg(a)	Value of Reg(a+1)	…	Value of Reg(a+n)	I^2C Stop

10.2.3 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.

I^2C Start	I^2C Header (W)	Start Reg. Addr. (a)	Value of Reg(a)	Value of Reg(a+1)	……..	Value of Reg(a+n)	I^2C Stop

10.3 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	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0x00	Firmware	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(R0)		Fingers(R0)	
0x11	Keys Reg.	Keys(R0)			
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 Byte)	Valid 1 (RO)	X1_H(RO)	Reserved	Y1_H(RO)
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)			

10.4 FIRWARE VERSION REGISTER

Reg. Addr.	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0x00	Firmware	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.

10.5 STATUS REGISTER

Reg. Addr.	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
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

10.6 DEVICE CONTROL REGISTER

Reg. Addr.	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0x02	Device Control Reg.	Auto Tune (RW)	Flash Update Disable (RW)	Reserved		Gest. Enable (RW)	Proximity Enable (RW)	Power Down (RW)	Power Down (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.

10.7 PROXIMITY ENABLE AND TIMEOUT TO IDLE REGISTER

Reg. Addr.	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
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.

10.8 XY RESOLUTION REGISTERS

Reg. Addr.	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
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.

10.9 THRESHOLD SETTING

Reg. Addr.	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
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.

10.10 FIRMWARE REVISION REGISTERS

Reg. Addr.	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
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.

10.11 FINGERS AND GESTURE REGISTER

Reg. Addr.	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
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
0xB	Pinch In(Zoom In)
0xC	Pinch Out(Zoom Out)
0xD	Rotate CW(CCW, for Top Down Mapping)
0xE	Rotate CCW(CW, for Top Down Mapping)
0xF	Object Approaching
0x10	Object Leaving
0x11 … 0x1F	Reserved

10.12 KEYS REGISTER

Reg. Addr.	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0x11	Keys Reg.	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.

10.13 XY COORDINATE REGISTERS

Reg. Addr.	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
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.

10.14 Z COORDINATE REGISTERS

Reg. Addr.	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
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.

10.15 DATA REGISTERS

Reg. Addr.	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
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.

10.16 PAGE REGISTER

Reg. Addr.	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0xFF	Page Reg.	Page Number(RW)							

Page Register provides changing page of Host Interface Register.

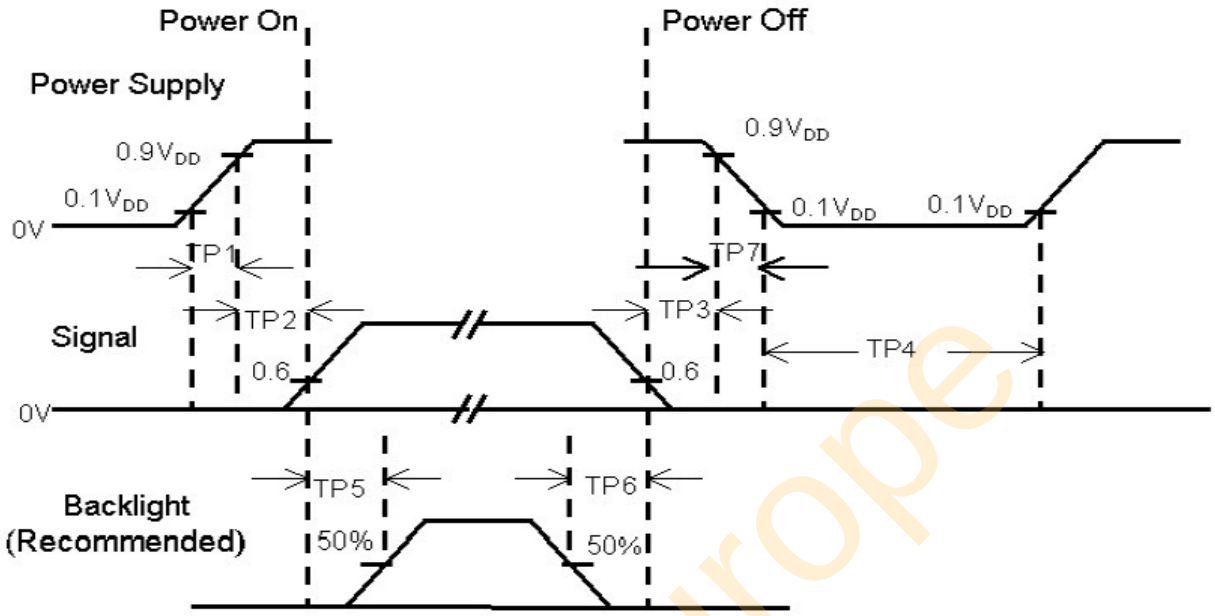
Default page is Report Page.

Page Number	Description
0x00	Report Page
0x01	AutoTune Page

11. LCM TIMING CHARACTERISTICS

11.1 POWER SIGNALSEQUENCE

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the diagram below.



Item	Min.	Typ.	Max.	Unit	Remark
TP1	0.5	--	10	msec	
TP2	0	--	50	msec	
TP3	0	--	50	msec	
TP4	1000	--	--	msec	
TP5	200	--	--	msec	
TP6	200	--	--	msec	
TP7	0.5	--	10	msec	

Note:

(1) The supply voltage of the external system for the module input should be the same as the definition of VDD.

(2) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.

(3) In case of VDD = off level, please keep the level of input signal on the low or keep a high impedance.

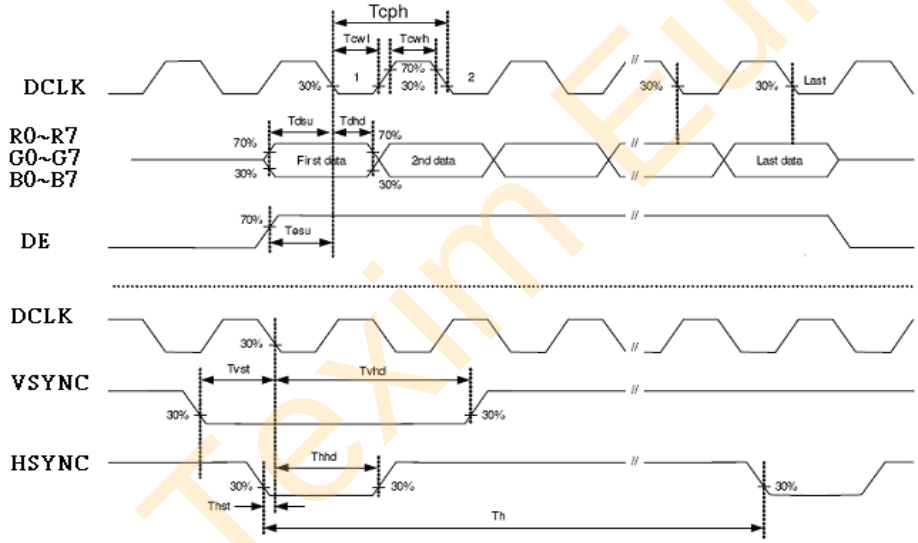
(4) TP4 should be measured after the module has been fully discharged between power off and on period.

(5) Interface signal shall not be kept at high impedance when the power is on.

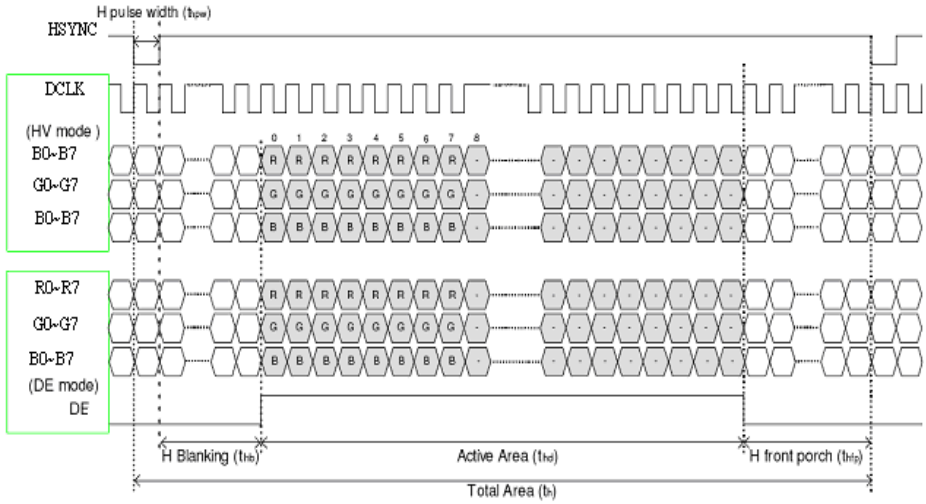
11.2 AC TIMING CHARATERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK cycle time	Tclk	25			ns	
DCLK frequency	fclk		33	40	MHz	
DCLK pulse duty	Tcwh	40	50	60	%	
VSYNC setup time	Tvst	8			ns	
VSYNC hold time	Tvhd	8			ns	
HSYNC setup time	Thst	8			ns	
HSYNC hold time	Thhd	8			ns	
Data setup time	Tdasu	8			ns	
Data hold time	Tdahd	8			ns	
DE setup time	Tdesu	8			ns	
DE hold time	Tdehd	8			ns	
Horizontal display area	Thd		800		Tcph	
HSYNC period time	Th		928		Tcph	
HSYNC width	Thwh	1	48		Tcph	
HSYNC back porch	Thbp		40		Tcph	
HSYNC front porch	Thfp		40		Tcph	
Vertical display area	Tvd		480		th	
VSYNC period time	Tv		525		th	
VSYNC width	Tvwh		3		th	
VSYNC back porch	Tvbp		29		th	
VSYNC front porch	Tvfp		13		th	

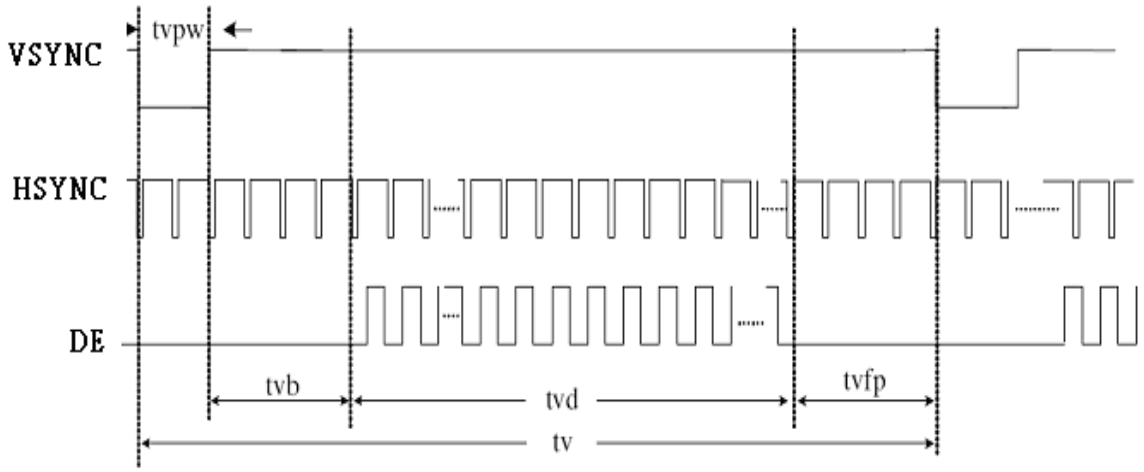
Timing Diagram of Interface Signal



Sampling clock timing



Horizontal display timing range



12. RELIABILITY TEST

NO	ITEM	CONDITION	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	1 Random: 1.04Grrms,5~500HZ, X/Y/X 30min/each direction 2 Sine: Freq. Range:8~33.3Hz Stoke:1.3mm Sweep:2.9G,33.3~400Hz X/Z:2hr,Y:4hr cyc:15min	IEC68-2-6
8	Drop Test(with carton)	Height:60 cm 1 corner, 3 edges, 6 surfaces	JIS Z0202
9	Electro Static Discharge	± 200V, 200Pf(0Ω) 1 time/each terminal	IEC-61000-4-2

13. PRECAUTIONS IN USE LCM

13.1 LIQUID CRYSTAL DISPLAY(LCD)

LCD is made up of glass, organic sealant, organic fluid, and polymer based polarizers. The following precautions should be taken when handing,

(1).Keep the temperature within range of use and storage.

Excessive temperature and humidity could cause polarization degradation, polarizer peel off or bubble.

(2).Do not contact the exposed polarizers with anything harder than and HB pencil lead. To clean dust off the display surface, wipe gently with cotton, chamois or other soft material soaked in petroleum benzin.

(3).Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or color fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.

(4).Glass can be easily chipped or cracked from rough handling, especially at corners and edges.

(5).Do not drive LCD with DC voltage.

13.2 LIQUID CRYSTAL DISPLAY MODULES

13.2.1 MECHANICAL CONSIDERATIONS

LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modifications. The following should be noted.

(1). Do not tamper in any way with the tabs on the metal frame.

(2). Do not modify the PCB by drilling extra holes, changing its outline, moving its components or modifying its pattern.

(3). Do not touch the elastomer connector, especially insert an backlight panel(for example, EL).

(4). When mounting a LCM make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.

(5). Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

13.2.2 STATIC ELECTRICITY

LCM contains CMOS LSI's and the same precaution for such devices should apply, namely.

(1). The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.

(2). The modules 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 commutator 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.

13.2.3 SOLDERING

(1). Solder only to the I/O terminals.

(2). Use only soldering irons with proper grounding and no leakage.

(3). Soldering temperature : 280˚C ± 10˚C

(4). Soldering time: 3 to 4 sec.

(5). Use eutectic solder with resin flux fill.

(6). If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed after wards.

13.2.4 OPERATION

(1). The viewing angle can be adjusted by varying the LCD driving voltage V0.

(2). Driving voltage should be kept within specified range; excess voltage shortens display life.

(3). Response time increases with decrease in temperature.

(4). Display may turn black or dark blue at temperatures above its operational range; this is (however not pressing on the viewing area) may cause the segments to appear “fractured”.

(5). Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear “fractured”.

13.2.5 STORAGE

If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

13.2.6 LIMITED WARRANTY

Unless otherwise agreed between Chefree and customer, Chefree will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with Chefree acceptance standards, for a period on one year from data of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Chefree is limited to repair and /or replacement on the terms set forth above. Chefree will not responsible for any subsequent or consequential events.

Appendix : Inspection condition

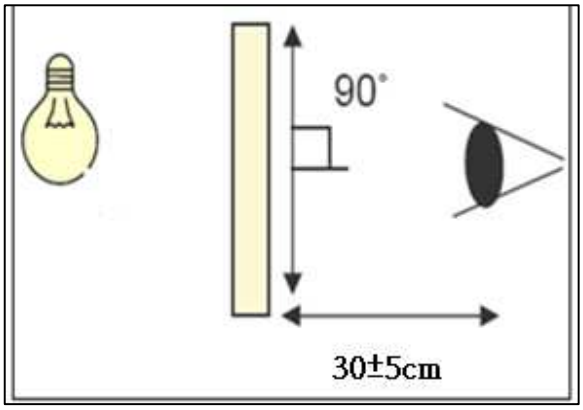
1 Inspection conditions

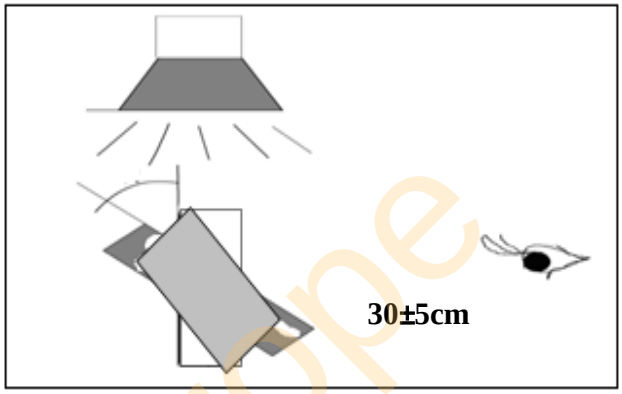
1.2.1.1 Inspection Distance : 30 ± 5 cm

1.2.1.2 View Angle :

(1) Inspection that light pervious to the product: 90±15°

(2) Inspection that light reflects on the product: 90±15°



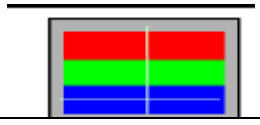


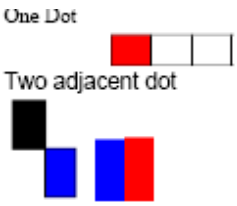
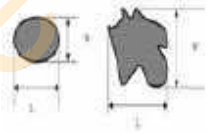
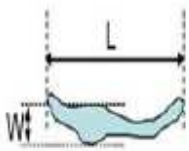
1.2.2 Environment conditions :

Ambient Temperature :	25±5℃
Ambient Humidity :	30~75%RH
Ambient Illumination	600~800 lux

1.3 Inspection Parameters

Appearance inspection standard (D: diameter, L: length; W: width, Z: height, T: glass thickness)

Inspection item	Inspection standard	Description
No image	Prohibited	
Image abnormal	Prohibited	
Bright line	Prohibited	
Thin line	It is acceptable that the defect can not be seen with 10% ND filter.	
Mura	It is acceptable that the defect can not be seen with 5% ND filter.	

<table>
<tr><td>Dot</td><td>
<table>
<tr><th rowspan="2">Item</th><th>Acceptable</th><th rowspan="2">Total</th></tr>
<tr><th>Visible area</th></tr>
<tr><td>Bright dot</td><td>2</td><td rowspan="2">5</td></tr>
<tr><td>Dark dot</td><td>4</td></tr>
<tr><td>Bright adjacent dots</td><td>1</td><td>1</td></tr>
<tr><td>Dark adjacent dots</td><td>2</td><td>2</td></tr>
<tr><td>Adjacent dots with a bright dot and a dark dot</td><td>2</td><td>2</td></tr>
</table>
</td><td> 
</td></tr>
<tr><td>Foreign material in dot shape</td><td>
<table>
<tr><th>SPEC (unit: mm)</th><th>Acceptable</th></tr>
<tr><td>D ≦ 0.5</td><td>Ignored</td></tr>
<tr><td>0.5<D ≦ 0.8, distance>5</td><td>n ≦ 5</td></tr>
<tr><td>D > 0.8</td><td>0</td></tr>
</table>
</td><td> 
</td></tr>
<tr><td>Foreign material in line shape</td><td>
<table>
<tr><th>SPEC</th><th>Acceptable</th></tr>
<tr><td>W ≦ 0.05 and L ≦ 10</td><td>Ignored</td></tr>
<tr><td>0.05<W ≦ 0.1, L ≦ 10, distance >5</td><td>n ≦ 5</td></tr>
<tr><td>W>0.1 or L>10</td><td>0</td></tr>
</table>
</td><td> 
</td></tr>
<tr><td>Contamination</td><td>It is acceptable if the dirt can be wiped.</td><td></td></tr>
<tr><td>Inspection item</td><td>SPEC</td><td>Description</td></tr>
<tr><td>Scratch</td><td>
<table>
<tr><th>SPEC</th><th>Acceptable</th></tr>
<tr><td>W ≦ 0.05 and L ≦ 10</td><td>Ignored</td></tr>
<tr><td>0.05<W ≦ 0.08, L ≦ 10, distance >5</td><td>n ≦ 5</td></tr>
<tr><td>0.08<W ≦ 0.1, L ≦ 10, distance >5</td><td>n ≦ 3</td></tr>
<tr><td>W>0.1 or L>10</td><td>0</td></tr>
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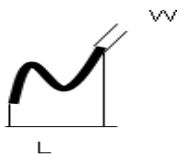
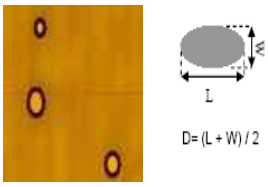
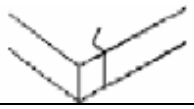
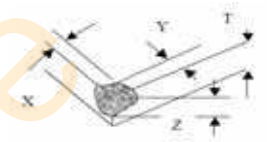
</td><td> 
</td></tr>
</table>

<table>
<tr><td>Bubble</td><td><table><tr><td>SPEC (unit: mm)</td><td>Acceptable</td></tr><tr><td>D ≦ 0.3</td><td>Ignored</td></tr><tr><td>Non visible area</td><td>Ignored</td></tr><tr><td>0.3<D ≦ 0.5, distance >5</td><td>n ≦ 5</td></tr><tr><td>D > 0.5</td><td>0</td></tr></table></td><td>  </td></tr>
<tr><td>Cover & Sensor Crack</td><td>Prohibited</td><td>  </td></tr>
<tr><td>Cover angle missing</td><td><table><tr><td>SPEC (unit: mm)</td><td>Acceptable</td></tr><tr><td>Side/Bottom</td><td>Ignored</td></tr><tr><td>It is prohibited if the defect appears on the front.</td><td>0</td></tr></table></td><td>  </td></tr>
<tr><td>Cover edge break</td><td><table><tr><td>SPEC (unit: mm)</td><td>Acceptable</td></tr><tr><td>X ≦ 3.0, Y ≦ 3.0, Z ≦ T</td><td>Ignored</td></tr><tr><td>X>3.0, Y>3.0, Z > T</td><td>0</td></tr></table></td><td>  </td></tr>
<tr><td>Inspection item</td><td>SPEC</td><td>Description</td></tr>
<tr><td>Ink</td><td><table><tr><td>SPEC (unit: mm)</td><td>Acceptable</td></tr><tr><td>word unclear, inverted, mistake, break line</td><td>0</td></tr></table></td><td></td></tr>
<tr><td>Bubble under protection film</td><td><table><tr><td>SPEC (unit: mm)</td><td>Acceptable</td></tr><tr><td>NA</td><td></td></tr></table></td><td></td></tr>
<tr><td>Function</td><td>Prohibited</td><td></td></tr>
</table>

1.4 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

Class of defects	Definition		
	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.