CUSTOMER   ACCEPTANCE   SPECIFICATIONS

MODEL   NO. :

E T M L 1 2 1 0 2 5 L D Y A
(RoHS)

FOR   MESSRS :

_____

CUSTOMER'S APPROVAL

DATE :

_____

BY :

_____

02101300-01-02

RECORDS OF REVISION	DOC . FIRST ISSUE
	MAR.30, 2023
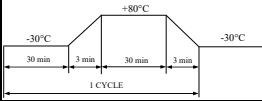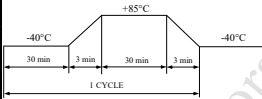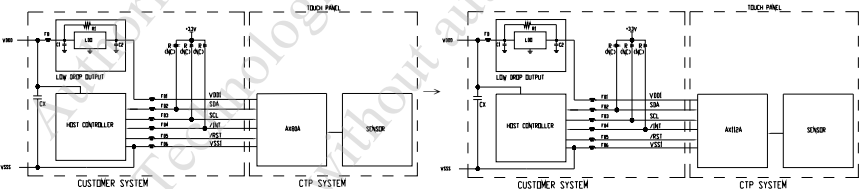
DATE	REVISED PAGE NO.	SUMMARY
MAY.09, 2023	3	3.3 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS ITEM:AMBIENT TEMPERATURE, STORAGE: MIN.= -30°C→-40°C
	25	14.1 STANDARD SPECIFICATIONS FOR RELIABILITY OF LCD MODULE
AUG.08, 2023	1	2.1 LCD MODULE MECHANICAL SPECIFICATIONS (8) LCD TYPE : TFT , IPS , TRANSMISSIVE , NORMALLY BLACK , ANTI-GLARE→TFT , IPS , TRANSMISSIVE , NORMALLY BLACK
	13	8.2 CTP MODULE
	22	13.3.2 MODULE DEFECTS CLASSIFICATION NO.5 ITEM : BLACK/WHITE SPOT/DENT CIRCULAR TYPE, SIZE D : D>5→D>0.5

02101300-01-02

T A B L E   O F   C O N T E N T S

1. GENERAL SPECIFICATIONS

1.1 APPLICATION NOTES FOR CAPACITIVE TOUCH PANEL CONTROLLER/DRIVER
PLEASE REFER TO：

TOUCHNETIX AX112A

1.2 MATERIAL SAFETY DESCRIPTION
ASSEMBLIES SHALL COMPLY WITH EUROPEAN ROHS REQUIREMENTS,
INCLUDING PROHIBITED MATERIALS/COMPONENTS CONTAINING LEAD,
MERCURY, CADMIUM, HEXAVALENT CHROMIUM, POLYBROMINATED
BIPHENYLS (PBB) AND POLYBROMINATED
DIPHENYL ETHERS (PBDE), BIS(2-ETHYLHEXYL) PHTHALATE (DEHP), BUTYL
BENZYL PHTHALATE (BBP), DIBUTYL PHTHALATE (DBP), DIISOBUTYL
PHTHALATE (DIBP).

2. MECHANICAL SPECIFICATIONS

2.1 LCD MODULE MECHANICAL SPECIFICATIONS

(1) DISPLAY SIZE -------------------------------------- 12.1 inch
(2) NUMBER OF DOTS -------------------------------- 1280(BGR)W * 800H DOTS
(3) MODULE SIZE -- 283W * 185.1H *15.5D(MAX.) mm
(4) VIEWING AREA --------------------------------- 263.52W * 165.6H mm
(5) ACTIVE AREA --- 261.12W * 163.2H mm
(6) DOT SIZE --- 0.068W * 0.204H mm
(7) PIXEL SIZE --- 0.204W * 0.204H mm
(8) LCD TYPE --- TFT , IPS , TRANSMISSIVE ,
                                                             NORMALLY BLACK
(9) COLOR --- 16.7M
(10) VIEWING DIRECTION ---------------------------- SUPER WIDE VIEW
(11) BACK LIGHT -- LED , COLOR : WHITE
(12) INTERFACE MODE -------------------------------- LVDS (8 BIT)
(13) WEIGHT --- TBD

2.2 CAPACITIVE TOUCH PANEL MECHANICAL SPECIFICATIONS

(1) TOUCH PANEL SIZE ------------------- 12.1 inch

(2) OUTER DIMENSION ------------------- 281W * 183.1H * 2.0D mm

(WITHOUT FPC)

(3) ACTIVE AREA ----------------------- 263.12W * 165.2H mm

(4) INPUT TYPE -------------------------- MULTI TOUCH

(5) NUMBER OF TOUCH SENSOR -------- 48*30 SENSORS

(6) RESOLUTION ------------------------- 65536*65536

(7) INTERFACE MODE --------------------- I2C

02101300-01-02

3. ABSOLUTE MAXIMUM RATINGS

3.1 LCD MODULE ELECTRICAL ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
POWER SUPPLY VOLTAGE	VDD-VSS	-0.3	5.0	V	—
POWER SUPPLY VOLTAGE FOR LED DRIVER	VBL+-VBL-	-0.3	27	V	—

NOTE (1)：LCM SHOULD BE GROUND DURING LCM HANDLING.

3.2 CAPACITIVE TOUCH PANEL ELECTRICAL ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
POWER SUPPLY VOLTAGE	VDD1-VSS1	-0.3	4	V	

3.3 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING MIN.	OPERATING MAX.	STORAGE MIN.	STORAGE MAX.	REMARK
AMBIENT TEMPERATURE	-30°C	85°C	-40°C	85°C	NOTE (1) , (2) , (3) , (4)
HUMIDITY	NOTE (3)		NOTE (3)		WITHOUT CONDENSATION
VIBRATION	—	2.45 m/s² (0.25 G)	—	11.76 m/s² (1.2 G)	10~100 Hz XYZ DIRECTIONS 1 HR EACH
SHOCK	—	29.4 m/s² (3 G)	—	490 m/s² (50 G)	10 ms XYZ DIRECTIONS 1 TIME EACH
CORROSIVE GAS	NOT ACCEPTABLE		NOT ACCEPTABLE		

NOTE (1)：THE ABSOLUTE MAXIMUM RATINGS OF THIS PRODUCT SHOULD NOT BE EXCEEDED AT ANY TIME. IF THESE RATINGS ARE EXCEEDED, THE PRODUCT'S PERFORMANCE IS NOT GUARANTEED AND THE PRODUCT MAY EXPERIENCE PERMANENT DAMAGE.
NOTE (2)：BACKGROUND COLOR CHANGES SLIGHTLY DEPENDING ON AMBIENT TEMPERATURE THIS PHENOMENON IS REVERSIBLE.
NOTE (3)：Ta ≤ 60°C：90%RH MAX. (96HRS MAX.)
Ta > 60°C：ABSOLUTE HUMIDITY MUST BE LOWER THAN THE HUMIDITY OF 90%RH AT 60°C. (96HRS MAX.)
NOTE (4)：WHEN THE LCD MODULE IS OPERATED AT A HIGHER AMBIENT TEMPERATURE THAN 60°C, THE PWM DUTY CYCLE OF THE LED BACKLIGHT SHOULD BE ADJUSTED TO BE LESS THAN (TBD)%. IF THE MODULE IS OPERATED AT A HIGHER DUTY CYCLE THAN (TBD)%, THEN THERE IS A POSSIBILITY OF DISTORTION AND IRREGULARITY OF THE PICTURE DUE TO LIQUID CRYSTAL BEHAVIOR.

4. ELECTRICAL CHARACTERISTICS

### 4.1 LCD MODULE ELECTRICAL CHARACTERISTICS

Ta = 25 °C

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
POWER SUPPLY VOLTAGE	VDD-VSS	—	(3.15)	(3.30)	(3.45)	V	
LOGIC HIGH INPUT VOLTAGE	VIH	—	0.8*VDD	—	VDD	V	
LOGIC LOW INPUT VOLTAGE	VIL	—	0	—	VDD*0.2	V	
PERMISSIVE POWER SUPPLY INPUT RIPPLE	VDDrp	VDD-VSS = 3.30V	—	—	100	mV_{P-p}	
INRUSH CURRENT	IRUSH	—	—	—	2.0	A	NOTE (6)
POWER SUPPLY CURRENT	IDD	VDD-VSS = 3.30V	—	(150)	(250)	mA	NOTE (1)
POWER SUPPLY VOLTAGE FOR LED DRIVER	VBL+-VBL-	—	(10.8)	(12.0)	(13.2)	V	NOTE (2)
LOGIC HIGH INPUT VOLTAGE FOR BL_EN, BL_PWM	VIH	—	1.6	—	—	V	
LOGIC LOW INPUT VOLTAGE FOR BL_EN, BL_PWM	VIL	—	—	—	0.8	V	
POWER SUPPLY CURRENT FOR LED DRIVER	IBL	VBL+-VBL- =12.0V LED B/L=ON PWM=100%	—	(1.8)	(3.0)	A	
LED LIFE TIME	—	IF=68mA (PER LED)	50000	—	—	HRS	NOTE (4) NOTE (5)

NOTE (1) : THE DISPLAY PATTERN IS ALL "WHITE".
NOTE (2) : INTERNAL CIRCUIT DIAGRAM OF BACKLIGHT.
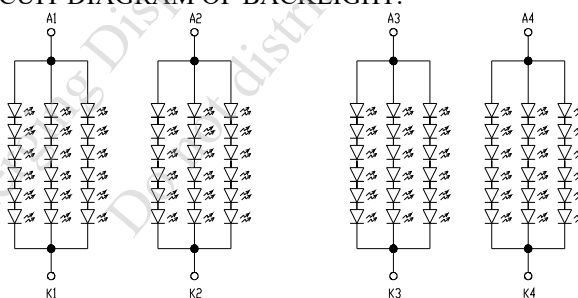
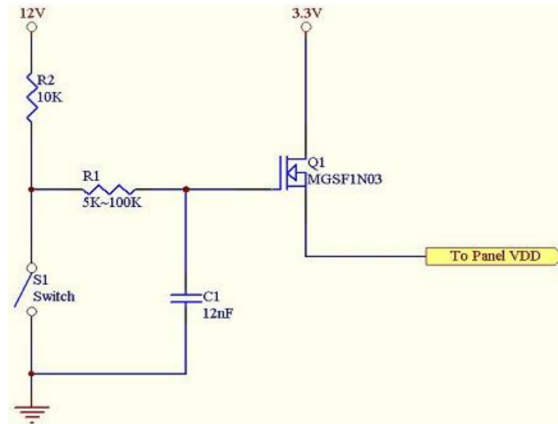NOTE (3) : AMBIENT TEMP. VS. ALLOWABLE FORWARD CURRENT. (PER LED)
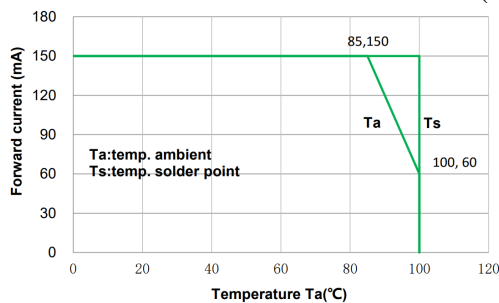
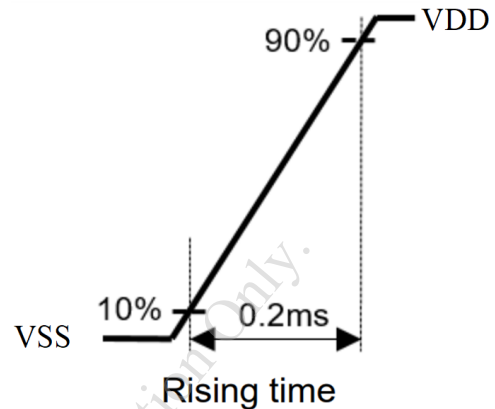NOTE (4)：CONDITIONS; Ta=25 °C, CONTINUOUS LIGHTING

NOTE (5)：DEFINITIONS OF LIFE TIME：
LCM LUMINANCE BECOMES HALF OF THE INITIAL VALUE.
NOTE (6)：INRUSH CURRENT TEST CIRCUIT AND RISING TIME SETTING (POWER ON)

Test circuit

Rising time

VDD-DIP CONDITION :
WHEN VDD>2.6V OR VDD>3.0V AND 10ms>td, THIS PRODUCT SHOULD WORK NORMALLY.
IT SHOULD BE RETURNED NORMALLY AFTER VDD RETURN TO MORE THAN 2.6V EVEN
IF VDD DROPS 2.6V AND OPERATION STOPS.
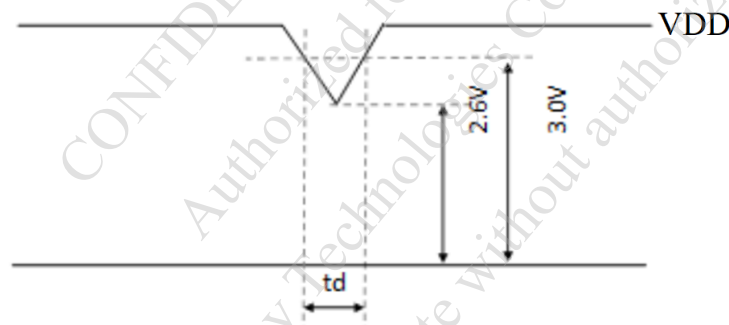
4.2 CAPACITIVE TOUCH PANEL ELECTRICAL CHARACTERISTICS

Ta = 25 ℃

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
POWER SUPPLY FOR DRIVER	VDD1-VSS1	—	3.15	3.30	3.45	V
LOGIC HIGH INPUT VOLTAGE	VIH	—	2	—	VDD1	V
LOGIC LOW INPUT VOLTAGE	VIL	—	-0.3	—	0.8	V
LOGIC HIGH OUTPUT VOLTAGE	VOH	—	2.4	—	—	V
LOGIC LOW OUTPUT VOLTAGE	VOL	—	—	—	0.4	V
POWER SUPPLY CURRENT	IDD1	VDD1-VSS1 =3.30V	—	(250)	(300)	mA

02101300-01-02

5. TIMING CHARACTERISTICS

5.1 SWITCHING CHARACTERISTISS FOR LVDS RECEIVER

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
DIFFERENTIAL INPUT HIGH THRESHOLD	V_{TH}	—	—	—	200	mV
DIFFERENTIAL INPUT LOW THRESHOLD	V_{TL}	—	-200	—	—	mV
DIFFERENTIAL INPUT COMMON MODE VOLTAGE	V_{CM}	—	1.0	1.2	1.7-|VID|/ 2	V
INPUT LEAKAGE CURRENT	I_{IN}	RX+/-, RXC+/-	-1.0	—	10	uA
DIFFERENTIAL INPUT VOLTAGE	$|V_{ID}|$	—	200	—	600	mV
1 DATA BIT TIME	UI	—	—	1/7	—	T_{LVCLK}
POSITION 1	T_{POS1}	—	-0.25	0	0.25	UI
POSITION 0	T_{POS0}	—	0.75	1	1.25	UI
POSITION 6	T_{POS6}	—	1.75	2	2.25	UI
POSITION 5	T_{POS5}	—	2.75	3	3.25	UI
POSITION 4	T_{POS4}	—	3.75	4	4.25	UI
POSITION 3	T_{POS3}	—	4.75	5	5.25	UI
POSITION 2	T_{POS2}	—	5.75	6	6.25	UI
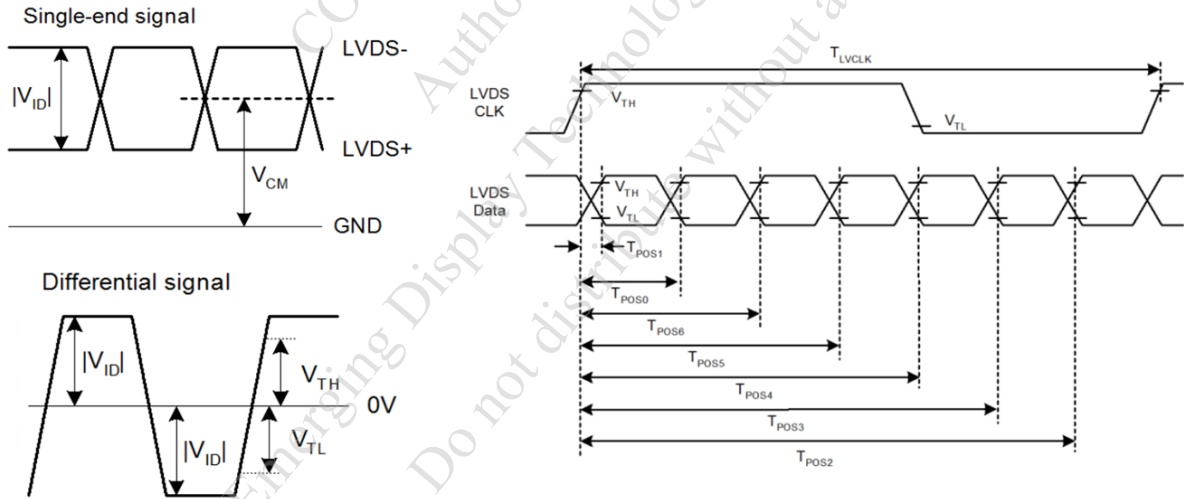
5.2 BIT LVDS INPUT
8-BIT LVDS FROMAT(VESA)

02101300-01-02
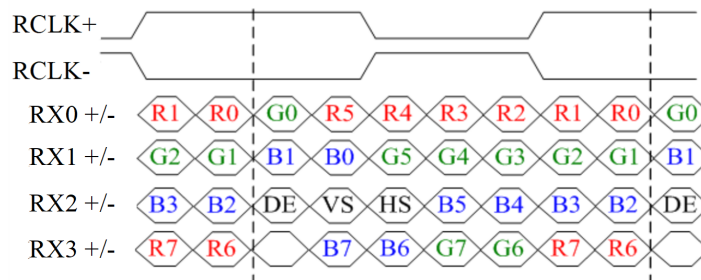
5.3 INTERFACE TIMING (DE MODE ONLY)

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
FRAME RATE	—		60		Hz
HORIZONTAL DISPLAY TIME	tHA		1280		clock
HORIZONTAL BLANKING TIME	tHB	70	80	90	clock
HORIZONTAL TOTAL TIME	tH	1350	1360	1370	clock
VERTICAL DISPLAY TIME	tVA		800		line
VERTICAL BLANKING TIME	tVB	15	30	45	line
VERTICAL TOTAL TIME	tV	815	830	845	line
CLOCK RATE	$1/T_{CLOCK}$	66.015	67.728	69.459	MHz
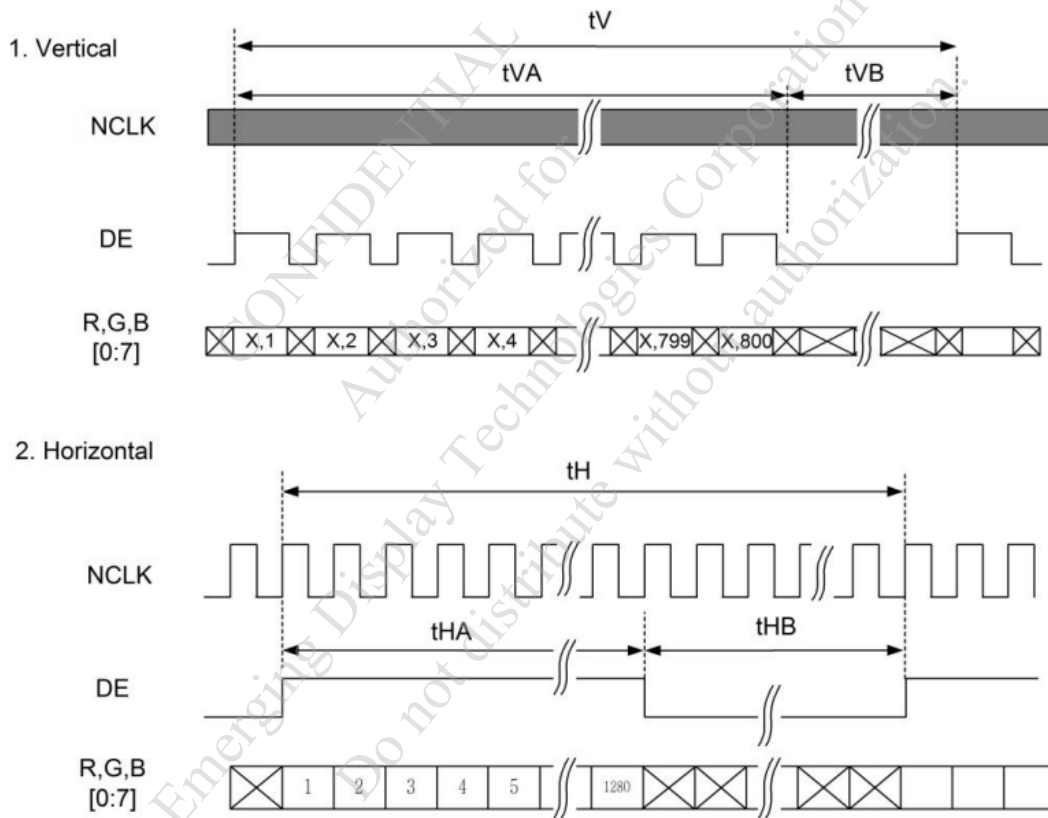
NOTE (1) : ALL TIMING PARAMETERS SHOULD BE CONSTANT IN EACH FRAME.

02101300-01-02

5.4   POWER ON / OFF SEQUENCE

POWER ON

POWER OFF

02101300-01-02
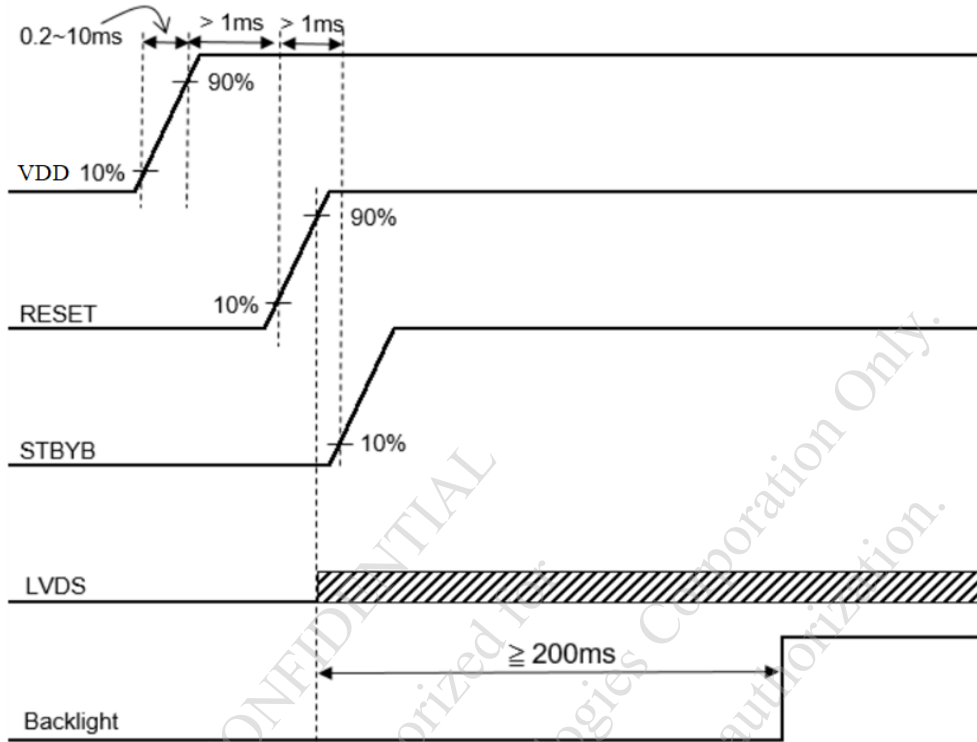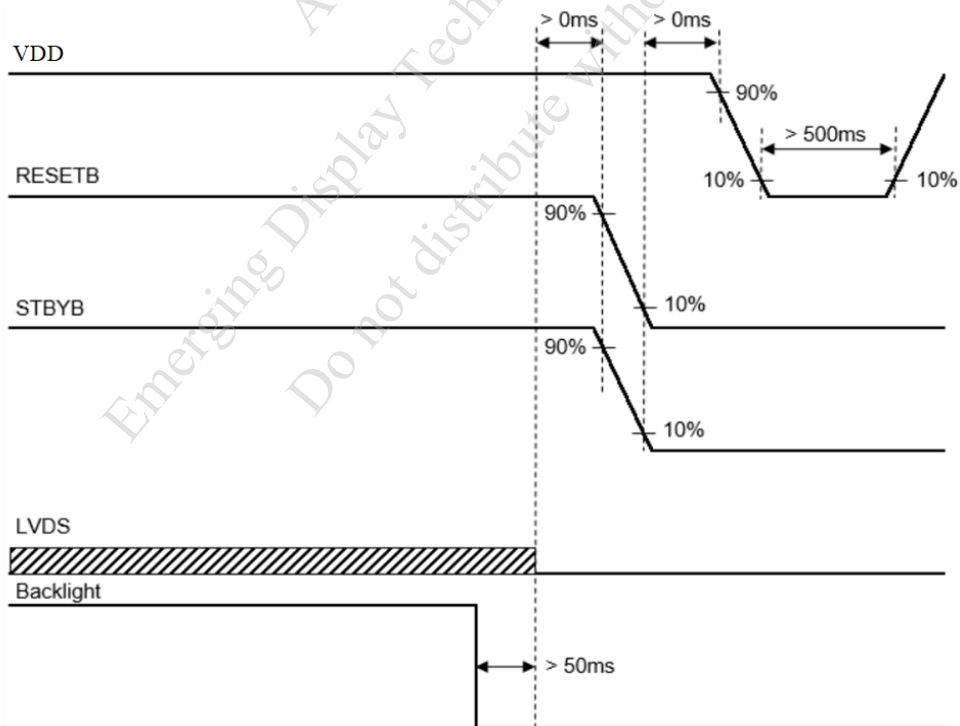
5.5 TOUCH PANEL TIMING

5.5.1 IC2 INTERFACE TIMING CHARACTERISTICS
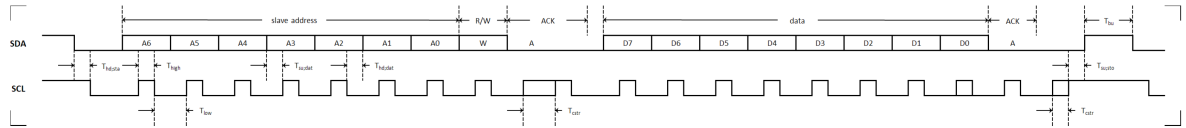
ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
START BIT HOLD TIME	Thd;sta	600	—	ns	
CLOCK HIGH PERIOD	Thigh	600	—	ns	
CLOCK LOW PERIOD	Tlow	1300	—	ns	
DATA SETUP TIME	Tsu;dat	100	—	ns	
DATA HOLD TIME	Thd;dat	0	—	ns	
MAXIMUM CLOCK STRETCH BY SLAVE	Tcstr	—	5	us	
STOP BIT SETUP TIME	Tsu;sto	600	—	ns	
BUS FREE TIME BETWEEN STOP AND START	Tbu	1300	—	ns	

6. OPTICAL CHARACTERISTICS

6.1 OPTICAL CHARACTERISTICS

Ta = 25 ± 2 °C

ITEM		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT	REMARK
VIEWING ANGLE		θ_{y+}	CR ≥ 10	$\theta_x=0°$	80	88	—	deg.	NOTE (2) NOTE (3)
		θ_{y-}			80	88	—		
		θ_{x+}		$\theta_y=0°$	80	88	—		
		θ_{x-}			80	88	—		
CONTRAST RATIO (CENTER)		CR	$\theta x=0°$, $\theta y=0°$		(800)	(1000)	—	—	NOTE (3)
RESPONSE TIME		TR+TF			—	—	30	msec	NOTE (4)
COLOR CHROMATICITY (CENTER)	WHITE	Wx	$\theta x=0°$, $\theta y=0°$ VDD-VSS=3.30V VBL+-VBL-=12V LED B/L=ON PWM=100%		(0.26)	(0.31)	(0.36)	—	NOTE (5)
		Wy			(0.30)	(0.35)	(0.40)		
	RED	Rx			(0.60)	(0.65)	(0.70)	—	
		Ry			(0.30)	(0.35)	(0.40)		
	GREEN	Gx			(0.28)	(0.33)	(0.38)	—	
		Gy			(0.57)	(0.62)	(0.67)		
	BLUE	Bx			(0.09)	(0.14)	(0.19)	—	
		By			(0.06)	(0.11)	(0.16)		
THE BRIGHTNESS OF MODULE (CENTER)		B			(1250)	(1350)	—	cd/m^2	NOTE (6)
THE UNIFORMITY OF MODULE		—			70	—	—	%	NOTE (7)

NOTE (1)：TEST CONDITION：

AFTER STABILIZING AND LEAVING THE PANEL ALONE AT A GIVEN TEMPERATURE FOR 30 MINUTES. MEASUREMENT SHOULD BE EXECUTED IN A STABLE, WINDLESS, AND DARK ROOM.
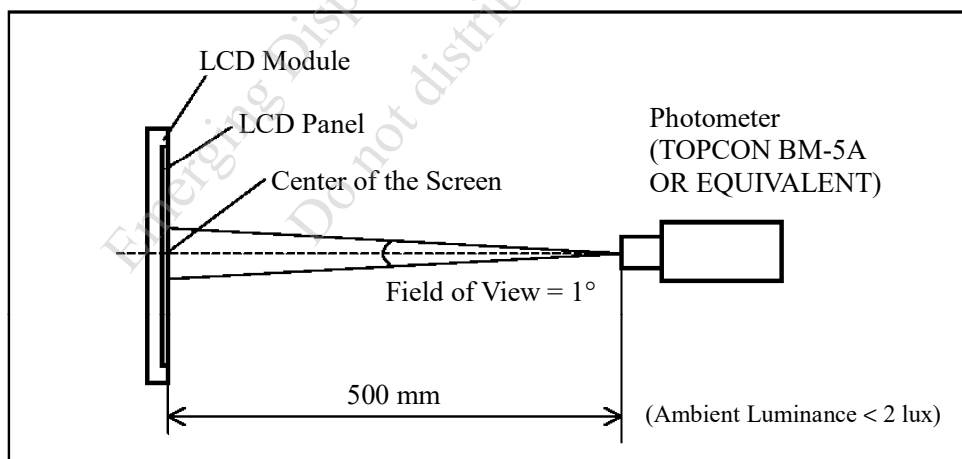
NOTE（2）：DEFINITION OF VIEWING ANGLE :

Normal
$\theta x = \theta y = 0°$

$\theta y-$ $\theta y+$

$\theta x-=90°$ x-

12 o' clock direction
$\theta y-=90°$

y+

$\theta x-$

$\theta x+$

6 o'clock direction
$\theta y-=90°$ y-

x+
$\theta x+=90°$
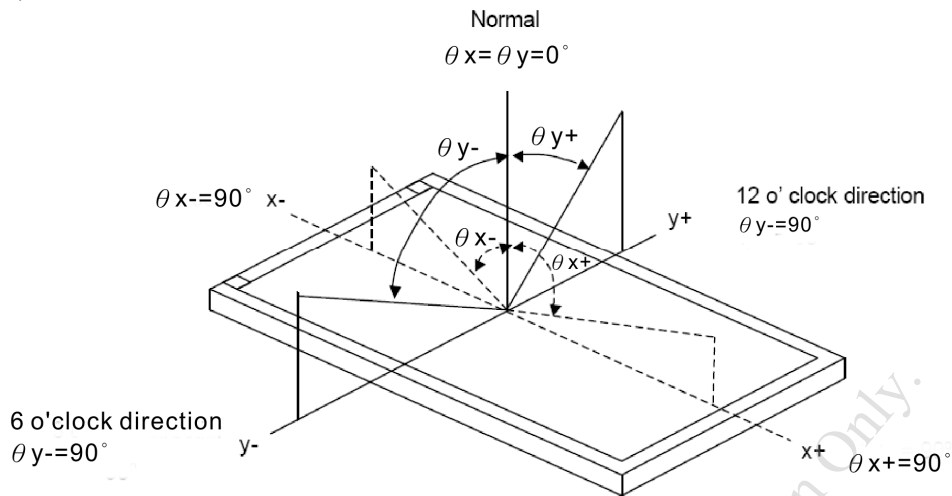
NOTE（3）：DEFINITION OF CONTRAST RATIO (CR) :
MEASURED AT THE CENTER POINT OF MODULE

$$CONTRAST \quad RATIO(CR) = \frac{BRIGHTNESS\ MEASURED\ WHEN\ LCD\ IS\ AT\ "WHITE\ STATE"}{BRIGHTNESS\ MEASURED\ WHEN\ LCD\ IS\ AT\ "BLACK\ STATE"}$$

NOTE（4）：DEFINITION OF RESPONSE TIME : T_r AND T_f
THE FIGURE BELOW IS THE OUTPUT SIGNAL OF THE PHOTO DETECTOR.

100%
90%

10%

T_r T_f
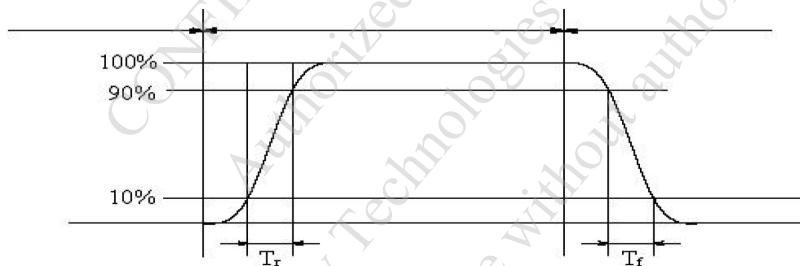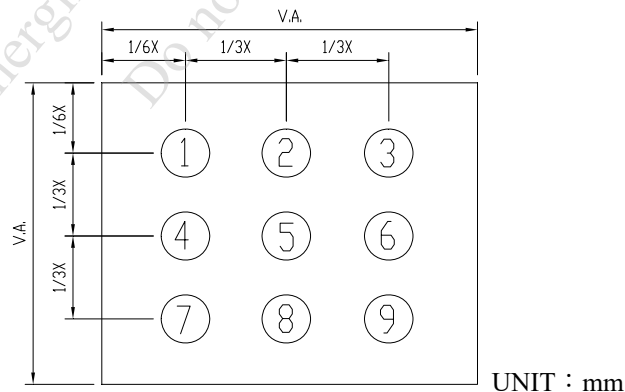
NOTE（5）：DEFINITION OF COLOR CHROMATICITY
(a)100% RGB PIXEL DATA TRANSMISSION WHEN ALL THE INPUT TERMINALS OF
MODULE ARE ELECTRICALLY POWERED ON.
(b)MEASURED AT THE CENTER POINT OF MODULE
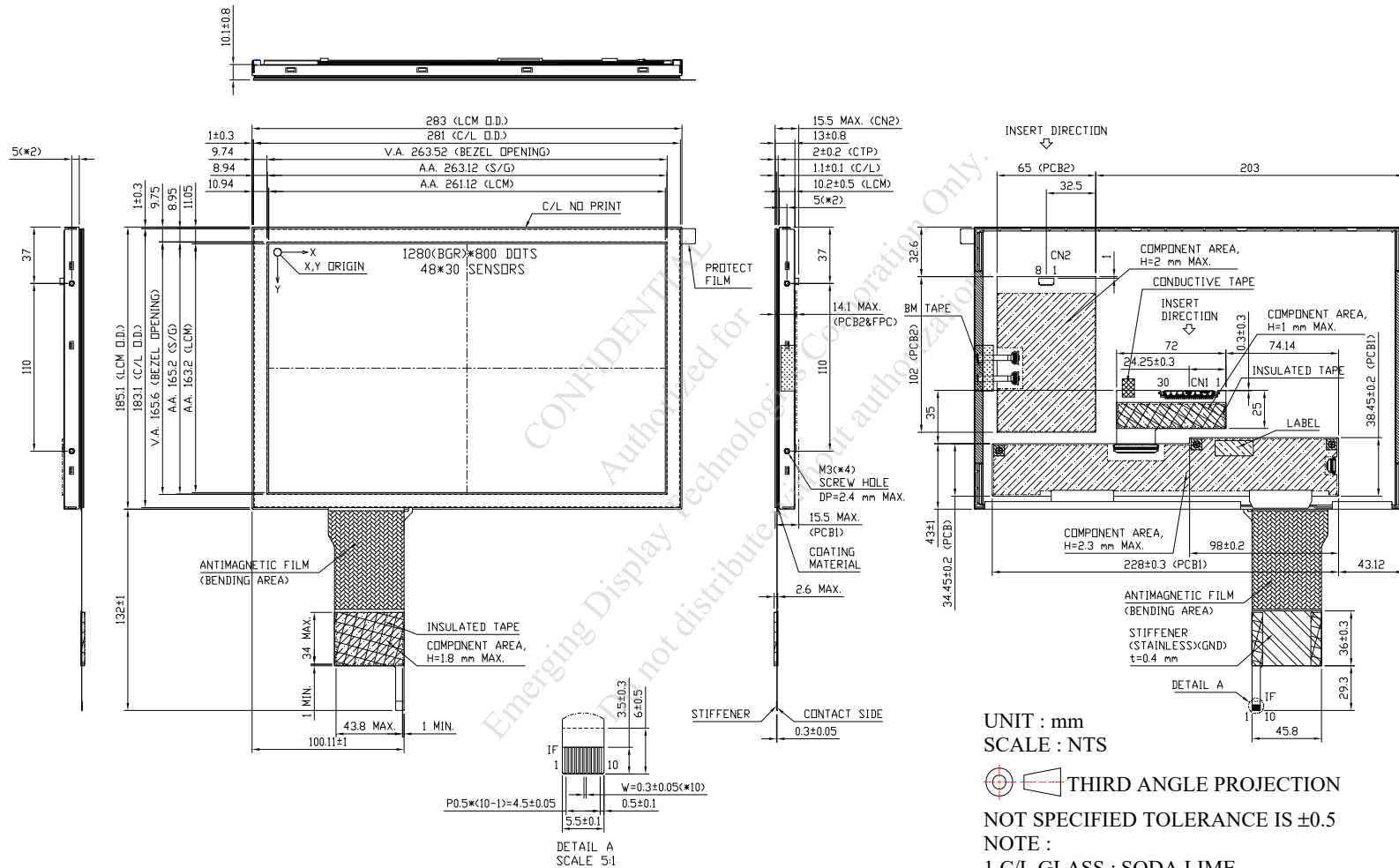NOTE（6）：MEASURED THE BRIGHTNESS OF WHITE STATE AT CENTER POINT.
NOTE（7）：(a)DEFINITION OF BRIGHTNESS UNIFORMITY

V.A.

1/6X   1/3X   1/3X

1/6X
1/3X
1/3X

V.A.

① ② ③
④ ⑤ ⑥
⑦ ⑧ ⑨

UNIT：mm

(b)THE BRIGHTNESS UNIFORMITY CALCULATING METHOD

$$UNIFORMITY : \frac{MINIMUM\ BRIGHTNESS}{MAXIMUM\ BRIGHTNESS} *100\%$$

02101300-01-02

7. OUTLINE DIMENSIONS

UNIT : mm
SCALE : NTS

⊚ ⊏ THIRD ANGLE PROJECTION

NOT SPECIFIED TOLERANCE IS ±0.5
NOTE :
1.C/L GLASS : SODA LIME
2.CN1 : STM MSBKT2407P30HB OR EQUIVALENT.
3.CN2 : JST SM08B-SRSS-TB OR EQUIVALENT.
4.FPC BENDING RADIUS SHOULD BE MORE THAN 1.0 mm.
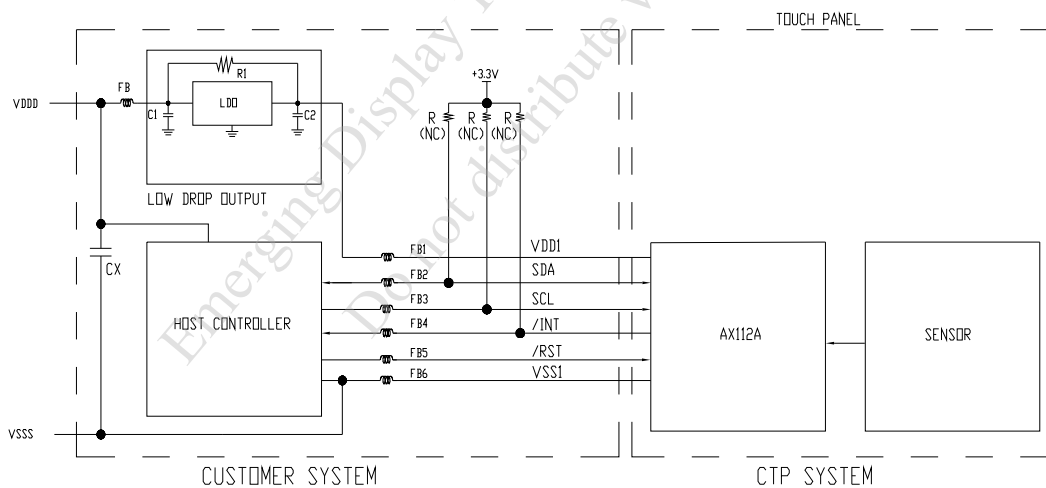
02101300-01-02

8. BLOCK DIAGRAM
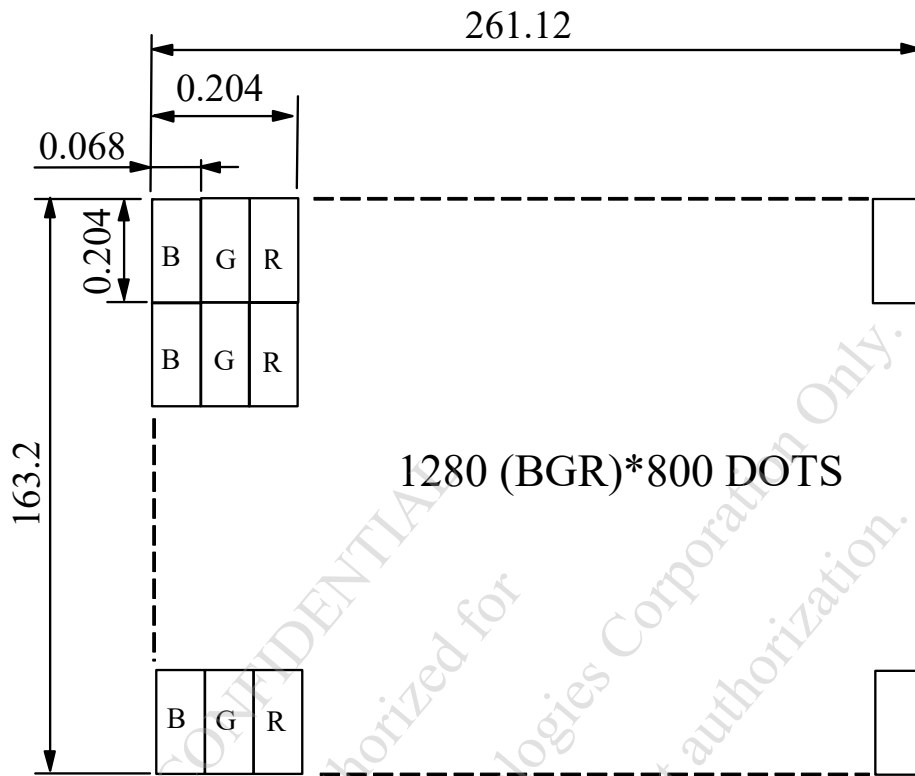
8.1 LCD MODULE
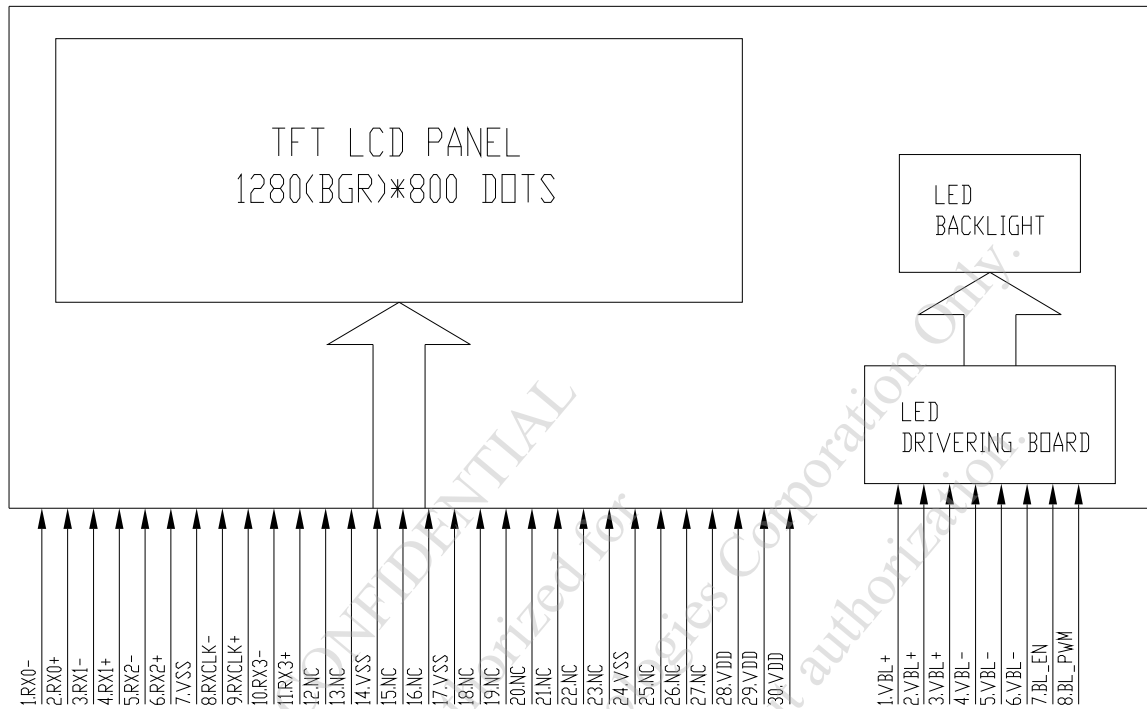
8.2 CTP MODULE

NOTE (1)：THE STANDARD IIC COMMUNICATION INTERFACE, SUPREME SCL CLOCK
IS 400 KHZ, SLAVE ADDRESS CAN BE SET UP, SUPPORTS VDD1 LEVEL
POWER, NEEDS PULL HIGH RESISTANCE AND THE PULL HIGH RESISTORS
ARE BUILT-IN FPCA.FOR CUSTOMER SYSTEM CAN BE RESEVRED THE PULL
HIGH.

NOTE (2)：POWER SUPPLY SHALL BE CLEAN AND NOISE FREE. ADDITIONAL
FILTERING OR A SEPARATE LDO (LOW DROP OUT) REGULATOR CAN BE
REQUIRED. C1 AND C2 CAPACITORS RECOMMENDATION：4.7μF OR 10 μF

E M E R G I N G   D I S P L A Y
TECHNOLOGIES CORPORATION

MODEL NO .
E T M L 1 2 1 0 2 5 L D Y A

VERSION
3

PAGE
14

9. DETAIL DRAWING OF DOT MATRIX

261.12

0.204

0.068

0.204

163.2

| B | G | R |
| B | G | R |

| B | G | R |

1280 (BGR)*800 DOTS

UNIT : mm
SCALE : NTS
NOT SPECIFIED TOLERANCE IS ± 0.1
DOTS MATRIX TOLERANCE IS ± 0.01

02101300-01-02

E M E R G I N G   D I S P L A Y
TECHNOLOGIES CORPORATION

MODEL NO.
E T M L 1 2 1 0 2 5 L D Y A

VERSION
3

PAGE
15

10. INTERFACE SIGNALS

10.1 CN1

PIN NO.	SYMBOL	FUNCTION
1	RX0-	NEGATIVE TRANSMISSION DATA OF PIXEL0
2	RX0+	POSITIVE TRANSMISSION DATA OF PIXEL0
3	RX1-	NEGATIVE TRANSMISSION DATA OF PIXEL1
4	RX1+	POSITIVE TRANSMISSION DATA OF PIXEL1
5	RX2-	NEGATIVE TRANSMISSION DATA OF PIXEL2
6	RX2+	POSITIVE TRANSMISSION DATA OF PIXEL2
7	VSS	GROUND
8	RXCLK-	NEGATIVE OF CLOCK
9	RXCLK+	POSITIVE OF CLOCK
10	RX3-	NEGATIVE TRANSMISSION DATA OF PIXEL3
11	RX3+	POSITIVE TRANSMISSION DATA OF PIXEL3
12	NC	NON CONNECTION
13	NC	NON CONNECTION
14	VSS	GROUND
15	NC	NON CONNECTION
16	NC	NON CONNECTION
17	VSS	GROUND
18	NC	NON CONNECTION
19	NC	NON CONNECTION
20	NC	NON CONNECTION
21	NC	NON CONNECTION
22	NC	NON CONNECTION
23	NC	NON CONNECTION
24	VSS	GROUND
25	NC	NON CONNECTION
26	NC	NON CONNECTION
27	NC	NON CONNECTION
28	VDD	POWER SUPPLY VOLTAGE
29	VDD	POWER SUPPLY VOLTAGE
30	VDD	POWER SUPPLY VOLTAGE

### 10.2 CN2

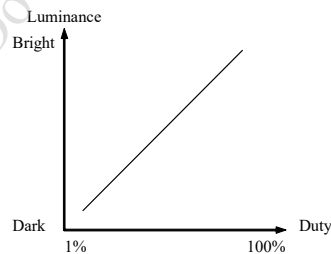| PIN NO.	SYMBOL	FUNCTION
1	VBL+	POWER SUPPLY VOLTAGE FOR LED DRIVER(+)
2	VBL+	POWER SUPPLY VOLTAGE FOR LED DRIVER(+)
3	VBL+	POWER SUPPLY VOLTAGE FOR LED DRIVER(+)
4	VBL-	POWER SUPPLY VOLTAGE FOR LED DRIVER(-)
5	VBL-	POWER SUPPLY VOLTAGE FOR LED DRIVER(-)
6	VBL-	POWER SUPPLY VOLTAGE FOR LED DRIVER(-)
7	BL_EN	BACKLIGHT LED ON/OFF CONTROL
8	BL_PWM	BACKLIGHT LED BRIGHTNESS CONTROL

02101300-01-02

10.2 IF

PIN NO.	SYMBOL	FUNCTION
1	VDD1	POWER SUPPLY VOLTAGE
2	/RST	EXTERNAL RESET
3	INT	EXTERNAL INTERRUPT TO THE HOST
4	SDA	I2C DATA INPUT AND OUTPUT
5	SCL	I2C CLOCK INPUT
6	VSS1	GROUND
7	VSS1	GROUND
8	NC	NON CONNECTION
9	NC	NON CONNECTION
10	NC	NON CONNECTION

11. POWER SUPPLY

11.1 POWER SUPPLY FOR LCM
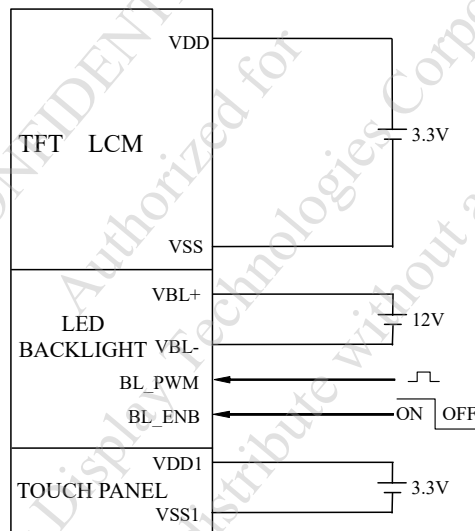
NOTE (1)：ADJUST THE PWM SIGNAL IN ORDER TO CONTROL LED BACKLIGHT'S BRIGHTNESS. THE HIGHER THE DUTY CYCLE, THE HIGHER THE BRIGHTNESS

NOTE (2)：PWM SIGNAL OPERATION FREQUENCY IS 100~2000Hz AND DIMMING DUTY.

PWM Dimming Frequency[Hz]	Dimming Duty Min[%]	Max[%]
100 < F_DIM < 200	0.1	100
200 < F_DIM <500	0.4	100
500 < F_DIM < 1K	0.8	100
1K < F_DIM < 2K	1.5	100

02101300-01-02
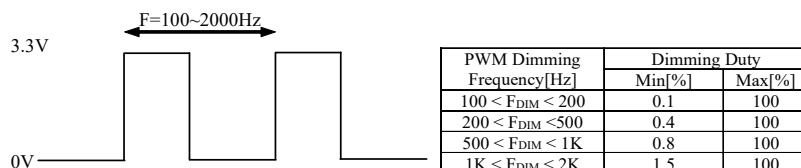
12. CAPACITIVE TOUCH PANEL SPECIFICATION

12.1 OPTICAL CHARACTERISTICS

ITEM	CONDITION	MIN.	TYP.	MAX.	UNIT
TRANSPARENCY NOTE（1）	Ta = 25°C λ=550 nm	(85)	—	—	%

NOTE（1）: OPTICAL MEASUREMENT SHOULD BE EXECUTED AFTER PANEL IS SECURED.
MEASUREMENT PROCESS SHOULD BE EXECUTED IN A STABLE, WINDLESS, AND DARK ROOM.
OPTICAL SPECIFICATIONS SHOULD BE MEASURED BY SPECTROPHOTOMETER.

12.2 HARDNESS

ITEM	DESCRIPTION
SURFACE HARDNESS	(7)H (MIN.)

12.3 DURABILITY

USING STEEL BALL AND FALLING ON TOUCH PANEL SURFACE, FROM THE HEIGHT MUST PASS BELOW CONDITIONS：

ITEM	CONDITION	INSPECTION METHOD	DESCRIPTION
STEEL BALL DROP TEST	WEIGHT：67g HEIGHT OF FALL：30 cm	VISUAL INSPECTION	SIGN OF FRACTURE OR DAMAGE IS NOT ACCEPTABLE 3 TIME/ 1 POINTS, 25°C (CENTER POINT)

02101300-01-02
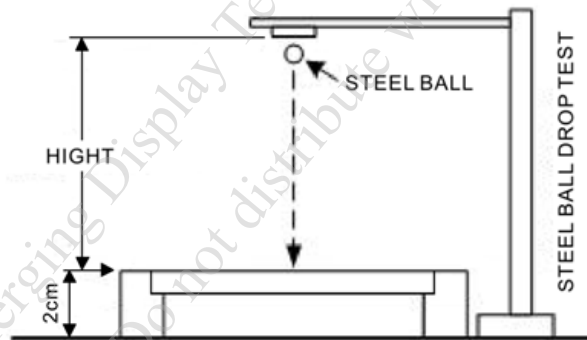
12.4 I2C BUS PROTOCOL

IN THE FOLLOWING DIAGRAMS ADDR IS THE 7-BIT I2C BUS ADDRESS, START/STOP ARE THE NORMAL BUS START AND STOP CONDITIONS RESPECTIVELY, WR DENOTES THAT THE 8TH BIT OF THE ADDRESS BYTE IS CLEAR TO REQUEST A WRITE TRANSFER WHEREAS RD DENOTES THAT IT IS SET TO REQUEST A READ TRANSFER. THE DEVICE WILL APPLY A CLOCK STRETCH WHEN IT NEEDS TO DECODE OR PREPARE DATA BETWEEN THE VARIOUS PHASES.

12.4.1 DATA FROM DEVICE TO HOST (READ)
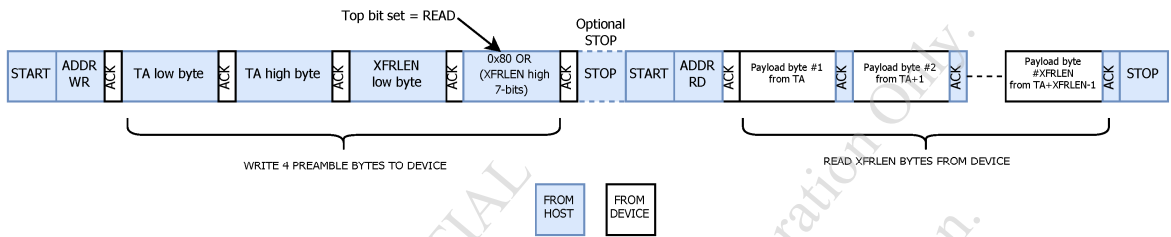
I2C READ TRANSFER

12.4.2 DATA FROM HOST TO DEVICE (WRITE)
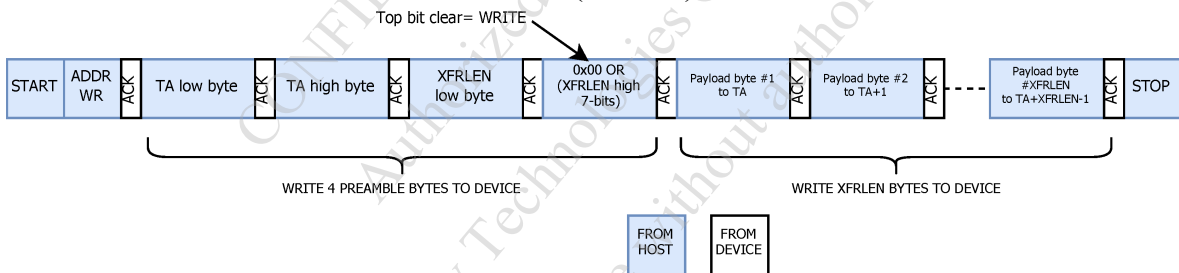
I2C WRITE TRANSFER

SLAVE I2C ADDRESS=0x66

13. INSPECTION CRITERIA

13.1 APPLICATION
THIS INSPECTION STANDARD IS TO BE APPLIED TO THE LCD MODULE
DELIVERED FROM EMERGING DISPLAY TECHNOLOGIES CORP.(E.D.T) TO
CUSTOMERS

13.2 INSPECTION CONDITIONS

13.2.1 (1)OBSERVATION DISTANCE：45±5cm
(2)VIEWING ANGLE：±45°
±45° (FOR SECTION WITHIN VIEWING AREA), REFER TO FIG.A
90° (FOR SECTION OUTSIDE OF VIEWING AREA), REF TO FIG.B
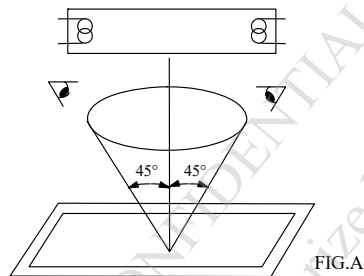PERPENDICULAR TO MODULE SURFACE
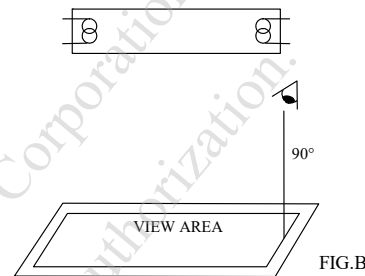
VIEWING ANGLE SHOULD BE SMALLER THAN 45°

FIG.A

FIG.B

THE INSPECTION CRITERIA IS ACCORDING TO LINE OF SIGHT. INSPECTION SHALL
BE MADE WITHIN THE HALF SECTION OF THE VIEWING CONE GENERATED BY LINE
SEGMENT OF 45° WITH RESPECT TO THE VERTICAL AXIS FROM CENTER VERTEX
OF LCD, THE FLUORESCENT LAMP AND THE CONE AXIS MUST BE PERPENDICULAR
TO THE LCD SURFACE.

IF THE DEFECTS ARE OUTSIDE OF VIEWING AREA, IT SHALL BE INSPECTED BY 90°
WITH RESPECT TO THE VERTICAL AXIS FROM EDGE OF VIEWING AREA.

13.2.2 ENVIRONMENT CONDITIONS：

AMBIENT TEMPERATURE		25±5°C
AMBIENT HUMIDITY		65 ± 20%RH
AMBIENT ILLUMINATION	COSMETIC INSPECTION	600~800 lux
	FUNCTIONAL INSPECTION	300~500 lux
INSPECTION TIME		15 secs

13.2.3 INSPECTION LOT
QUANTITY PER DELIVERY LOT FOR EACH MODEL

13.2.4 INSPECTION METHOD
A SAMPLING INSPECTION SHALL BE MADE ACCORDING TO THE
FOLLOWING PROVISIONS TO JUDGE THE ACCEPTABILITY
(a)APPLICABLE STANDARD：
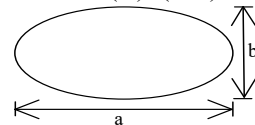ANSI/ ASQ Z1.4 NORMAL INSPECTION LEVEL II
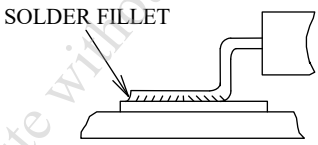(b)AQL：MAJOR DEFECT：AQL 0.65
MINOR DEFECT：AQL 1.0
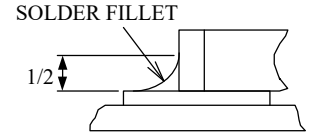
02101300-01-02

13.3 INSPECTION STANDARDS
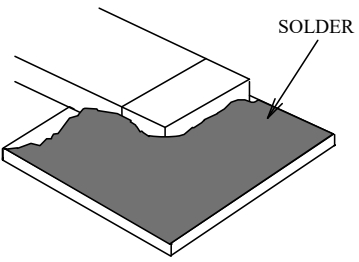
13.3.1 VISUAL DEFECTS CLASSIFICATION
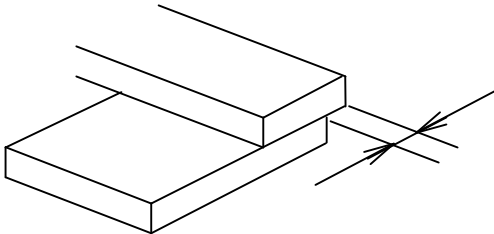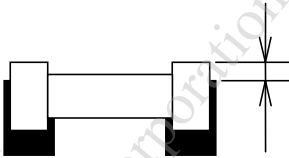
TYPE OF DEFECT	INSPECTION ITEM	DEFECT FEATURE	AQL
MAJOR DEFECT	1.DISPLAY ON	• DEFECT TO MISS SPECIFIED DISPLAY FUNCTION, FOR ALL AND SPECIFIED DOTS EX: DISCONNECTION, SHORT CIRCUIT ETC	0.65
	2.CTP FUNCTION	• NO FUNCTION • BROKEN LINE • FALSE TOUCH	
	3.BACKLIGHT	• NO LIGHT • FLICKERING AND OTHER ABNORMAL ILLUMINATION	
	4.DIMENSIONS	• SUBJECT TO INDIVIDUAL ACCEPTANCE SPECIFICATIONS	
MINOR DEFECT	1.DISPLAY ZONE	• BLACK/WHITE SPOT • BUBBLES ON POLARIZER • NEWTON RING • BLACK/WHITE LINE • SCRATCH • CONTAMINATION • LEVER COLOR SPREAD	1.0
	2.BEZEL ZONE	• STAINS • SCRATCHES • FOREIGN MATTER	
	3.SOLDERING	• INSUFFICIENT SOLDER • SOLDERED IN INCORRECT POSITION • CONVEX SOLDERING SPOT • SOLDER BALLS • SOLDER SCRAPS	
	4.DISPLAY ON (ALL ON)	• LIGHT LINE	

02101300-01-02

13.3.2 MODULE DEFECTS CLASSIFICATION

NO.	ITEM	CRITERIA
1	DISPLAY ON INSPECTION	1. INCORRECT PATTERN 2. MISSING SEGMENT 3. DIM SEGMENT 4. OPERATING VOLTAGE BEYOND SPEC
2	OVERALL DIMENSIONS	1. OVERALL DIMENSION BEYOND SPEC
3	DOT DEFECT	1. INSPECTION PATTERN: FULL WHITE, FULL BLACK, RED, GREEN AND BLUE SCREENS. 2.

ITEMS	ACCEPTABLE COUNT
BRIGHT DOT	N ≤ 1
DARK DOT	N ≤ 4
TOTAL BRIGHT AND DARK DOTS	N ≤ 4

NOTE：
(1)THE DEFINITION OF DOT：
   THE SIZE OF A DEFECTIVE DOT OVER 1/2 OF WHOLE DOT IS REGARDED AS ONE DEFECTIVE DOT.
(2)BRIGHT DOT：
   DOTS APPEAR BRIGHT AND UNCHANGED IN SIZE IN WHICH LCD PANEL IS DISPLAYING UNDER BLACK PATTERN.
   THE BRIGHT DOT DEFECT MUST BE VISIBLE THROUGH 5% ND FILTER.
(3)DARK DOT：
   DOTS APPEAR DARK AND UNCHANGED IN SIZE IN WHICH LCD PANEL IS DISPLAYING UNDER PURE RED, GREEN, BLUE PICTURE.

	AVERAGE DIAMETER (mm)：D	NUMBER OF PIECES PERMITTED
BUBBLE ON THE POLARIZER	D ≤ 0.25	IGNORE
	0.25 < D ≤ 0.5	5
	D > 0.5	0
POLARIZER SCRATCH	W < 0.05	IGNORE
	0.05 < W ≤ 0.2, 1.0 < L ≤ 5	4
	W > 0.2 ,L >5	0
CF FAIL / SPOT	D < 0.25	IGNORE
	0.25 < D ≤ 0.5	4
	D > 0.5	0

4. BUBBLES ON POLARIZER /SURFACE STAINS /DIRT/CF FAIL/SPOT

NOTE : (1)POLARIZER BUBBLE IS DEFINED AS THE BUBBLE APPEARS ON ACTIVE DISPLAY AREA. THE DEFECT OF POLARIZER BUBBLE SHALL BE IGNORED IF THE POLARIZER BUBBLE APPEARS ON THE OUTSIDE OF ACTIVE DISPLAY AREA.
(2)THE EXTRANEOUS SUBSTANCE IS DEFINED AS IT CAN BE OBSERVED WHEN THE MODULE IS POWER ON.
(3)THE DEFINITION OF AVERAGE DIAMETER, D IS DEFINED AS FOLLOWING.
   AVERAGE DIAMETER (D)=(a+b)/2

NO.	ITEM	CRITERIA		
5	BLACK/WHITE SPOT/DENT CIRCULAR TYPE	THE FOLLOWING BLACK/WHITE SPOT ARE WITHIN THE VIEWING AREA. AVERAGE DIAMETER：D (mm) <table><tr><td>SIZE D</td><td>PERMISSIBLE NO.</td></tr><tr><td>D≤0.2</td><td>IGNORE</td></tr><tr><td>0.2<D≤0.3</td><td>5</td></tr><tr><td>0.3<D≤0.5</td><td>5</td></tr><tr><td>D>0.5</td><td>0</td></tr></table>NOTE (1)：THE DISTANCE BETWEEN DEFECTS SHOULD BE MORE THAN 10mm APART.		
6	SCRATCH	THE FOLLOWING SCRATCH IS WITHIN THE VIEWING AREA. WIDTH：W (mm) , LENGTH : L (mm) <table><tr><td>SIZE W & L</td><td>PERMISSIBLE NO.</td></tr><tr><td>W≤0.07</td><td>IGNORE</td></tr><tr><td>0.07≤W≤0.1, L≤8</td><td>4</td></tr><tr><td>0.07≤W≤0.1, 8<L≤10</td><td>3</td></tr><tr><td>W>0.1</td><td>0</td></tr></table>NOTE (1)：THE DISTANCE BETWEEN DEFECTS SHOULD BE MORE THAN 10mm APART.		
7	BLACK / WHITE LINE LINEAR TYPE / FOREIGN FIBER	THE FOLLOWING BLACK LINE, WHITE LINE IS WITHIN THE VIEWING AREA. WIDTH：W (mm) , LENGTH : L (mm) <table><tr><td>SIZE W & L</td><td>PERMISSIBLE NO.</td></tr><tr><td>W≤0.07</td><td>IGNORE</td></tr><tr><td>0.07≤W≤0.1, L≤8</td><td>4</td></tr><tr><td>0.07≤W≤0.1, 8<L≤10</td><td>3</td></tr><tr><td>W>0.1</td><td>0</td></tr></table>NOTE (1)：THE DISTANCE BETWEEN DEFECTS SHOULD BE MORE THAN 10mm APART.		
8	BUBBLE / DENT FOR OPTICAL BONDING	BUBBLES WITHIN VIEWING AREA. AVERAGE DIAMETER：D (mm) <table><tr><td>SIZE D</td><td>PERMISSIBLE NO.</td></tr><tr><td>D≤0.2</td><td>IGNORE</td></tr><tr><td>0.2<D≤0.3</td><td>3</td></tr><tr><td>0.3<D≤0.5</td><td>2</td></tr><tr><td>D>0.5</td><td>0</td></tr></table>NOTE (1)：THE DISTANCE BETWEEN DEFECTS SHOULD BE MORE THAN 10mm APART.		
9	PIN HOLE	PIN HOLE WITHIN INK AREA. AVERAGE DIAMETER：D (mm) <table><tr><td>SIZE D</td><td>PERMISSIBLE NO.</td></tr><tr><td>D≤0.1</td><td>IGNORE</td></tr><tr><td>0.1<D≤0.2</td><td>5</td></tr><tr><td>0.2<D≤0.3</td><td>2</td></tr><tr><td>D>0.3</td><td>0</td></tr></table>NOTE (1)：THE DISTANCE BETWEEN DEFECTS SHOULD BE MORE THAN 10mm APART.		
10	CHIPPING	<table><tr><td>CORNER</td><td>X ≤ 3mm、Y ≤ 3mm、Z < t (t : THICKNESS)</td></tr><tr><td>EDGE</td><td>X ≤ 6mm , Y ≤ 1mm , Z < t (t : THICKNESS)</td></tr></table>		Chip of glass
11	CRACKED GLASS	NOT ACCEPTABLE		

02101300-01-02

NO.	ITEM	CRITERIA
12	LINE DEFECT ON DISPLAY	OBVIOUS VERTICAL OR HORIZONTAL LINE DEFECT IS NOT ALLOWED
13	MURA ON DISPLAY	IT'S OK IF MURA IS SLIGHT VISIBLE THROUGH 5% ND FILTER
14	UNEVEN COLOR SPREAD, COLORATION	TO BE DETERMINED BASED UPON THE LIMITED SAMPLE.
15	BEZEL APPEARANCE	(1)BEZEL MAY NOT HAVE RUST, BE DEFORMED OR HAVE FINGER PRINTS STAINS OF OTHER CONTAMINATION. (2)BEZEL MUST COMPLY WITH JOB SPECIFICATIONS.
16	PCB	(1)THERE MAY NOT BE MORE THAN 2mm OF SEALANT OUTSIDE THE SEAL AREA ON THE PCB, AND THERE SHOULD BE NO MORE THAN THREE PLACES. (2)NO OXIDATION OR CONTAMINATION PCB TERMINALS. (3)PARTS ON PCB MUST BE THE SAME AS ON THE PRODUCTION CHARACTERISTIC CHART. THERE SHOULD BE NO WRONG PARTS, MISSING PARTS OR EXCESS PARTS. (4)THE JUMPER ON THE PCB SHOULD CONFORM TO THE PRODUCT CHARACTERISTIC CHART. (5)IF SOLDER GETS ON BEZEL TAB PADS, LED PAD, ZEBRA PAD OR SCREW HOLD PAD; MAKE SURE IT IS SMOOTHED DOWN.
17	SOLDERING	(1)NO SOLDERING FOUND ON THE SPECIFIED PLACE (2)INSUFFICIENT SOLDER 　(a)LSI, IC 　　A POOR WETTING OF SOLDER IS BETWEEN LOWER BEND OR "HEEL" OF LEAD AND PAD SOLDER FILLET 　(b)CHIP COMPONENT 　　· SOLDER IS LESS THAN 50% OF SIDES AND FRONT FACE WETTING SOLDER FILLET 1/2 　　· SOLDER WETS 3 SIDES OF TERMINAL, BUT LESS THAN 25% OF SIDES AND FRONT SURFACE AREA ARE COVERED SOLDER

NO.	ITEM	CRITERIA

17	SOLDERING	(3)PARTS ALIGNMENT
		  (a)LSI, IC
		    LEAD WIDTH IS MORE THAN 50% BEYOND PAD OUTLINE
		
		  (b)CHIP COMPONENT
		    COMPONENT IS OFF CENTER, AND MORE THAN 50% OF THE LEADS IS OFF THE PAD OUTLINE
		
		(4)NO UNMELTED SOLDER PASTE MAY BE PRESENT ON THE PCB.
		(5)NO COLD SOLDER JOINTS, MISSING SOLDER CONNECTIONS, OXIDATION OR ICICLE.
		(6)NO RESIDUE OR SOLDER BALLS ON PCB.
		(7)NO SHORT CIRCUITS IN COMPONENTS ON PCB.

18	BACKLIGHT	(1)NO LIGHT (2)FLICKERING AND OTHER ABNORMAL ILLUMINATION (3)SPOTS OR SCRATCHES THAT APPEAR WHEN LIT MUST BE JUDGED USING LCD SPOT, LINES AND CONTAMINATION STANDARDS. (4)BACKLIGHT DOESN'T LIGHT OR COLOR IS WRONG.
19	GENERAL APPEARANCE	(1)NO OXIDATION, CONTAMINATION, CURVES OR, BENDS ON INTERFACE PIN (OLB) OF TCP. (2)NO CRACKS ON INTERFACE PIN (OLB) OF TCP. (3)NO CONTAMINATION, SOLDER RESIDUE OR SOLDER BALLS ON PRODUCT. (4)THE IC ON THE TCP MAY NOT BE DAMAGED, CIRCUITS. (5)THE UPPERMOST EDGE OF THE PROTECTIVE STRIP ON THE INTERFACE PIN MUST BE PRESENT OR LOOK AS IF IT CAUSE THE INTERFACE PIN TO SEVER. (6)THE RESIDUAL ROSIN OR TIN OIL OF SOLDERING (COMPONENT OR CHIP COMPONENT) IS NOT BURNED INTO BROWN OR BLACK COLOR. (7)SEALANT ON TOP OF THE ITO CIRCUIT HAS NOT HARDENED. (8)PIN TYPE MUST MATCH TYPE IN SPECIFICATION SHEET. (9)LCD PIN LOOSE OR MISSING PINS. (10)PRODUCT PACKAGING MUST BE THE SAME AS SPECIFIED ON PACKAGING SPECIFICATION SHEET. (11)PRODUCT DIMENSION AND STRUCTURE MUST CONFORM TO PRODUCT SPECIFICATION SHEET. (12)THE APPEARANCE OF HEAT SEAL SHOULD NOT ADMIT ANY DIRT AND BREAK.

14. RELIABILITY TEST

14.1 STANDARD SPECIFICATIONS FOR RELIABILITY OF LCD MODULE

NO.	ITEM	DESCRIPTION
1	HIGH TEMPERATURE TEST (OPERATION)	THE SAMPLE SHOULD BE ALLOWED TO STAND AT +85°C FOR 240 HRS
2	LOW TEMPERATURE TEST (OPERATION)	THE SAMPLE SHOULD BE ALLOWED TO STAND AT -30°C FOR 240 HRS
3	HIGH TEMPERATURE TEST (STORAGE)	THE SAMPLE SHOULD BE ALLOWED TO STAND AT +85°C FOR 240 HRS
4	LOW TEMPERATURE TEST (STORAGE)	THE SAMPLE SHOULD BE ALLOWED TO STAND AT -40°C FOR 240 HRS
5	HIGH TEMPERATURE /HUMIDITY TEST TEST (STORAGE)	THE SAMPLE SHOULD BE ALLOWED TO STAND AT 60°C, 90% RH 240 HRS
6	THERMAL SHOCK (NOT OPERATED)	THE SAMPLE SHOULD BE ALLOWED TO STAND THE FOLLOWING 10 CYCLES OF OPERATION: +85°C -40°C ... -40°C 30 min / 3 min / 30 min / 3 min 1 CYCLE
7	ESD (ELECTROSTATIC DISCHARGE) (NOT OPERATED)	AIR DISCHARGE ± 12KV CONTACT DISCHARGE ± 8KV (ACCORDING TO IEC-61000-4-2)

NOTE (1)：THE TEST SAMPLES HAVE RECOVERY TIME FOR 2 HOURS AT ROOM
TEMPERATURE BEFORE THE FUNCTION CHECK. IN THE STANDARD
CONDITIONS, THERE IS NO DISPLAY FUNCTION NG ISSUE OCCURRED.

NOTE (2)：WHEN THE LCD MODULE IS OPERATED AT A HIGHER AMBIENT TEMPERATURE THAN
60°C, THE PWM DUTY CYCLE OF THE LED BACKLIGHT SHOULD BE ADJUSTED TO BE
LESS THAN (TBD)%. IF THE MODULE IS OPERATED AT A HIGHER DUTY CYCLE THAN
(TBD)%,THEN THERE IS A POSSIBILITY OF DISTORTION AND IRREGULARITY OF THE
PICTURE DUE TO LIQUID CRYSTAL BEHAVIOR.

NOTE (3)：TESTING CONDITIONS AND INSPECTION CRITERIA

NO.	ITEM	TEST MODEL	INSPECTION CRITERIA
1	CURRENT CONSUMPTION	REFER TO SPECIFICATION	THE CURRENT CONSUMPTION SHOULD CONFORM TO THE PRODUCT SPECIFICATION.
2	CONTRAST	REFER TO SPECIFICATION	AFTER THE TESTS HAVE BEEN EXECUTED, THE CONTRAST MUST BE LARGER THAN HALF OF ITS INITIAL VALUE PRIOR TO THE TESTS.
3	APPEARANCE	VISUAL INSPECTION	DEFECT FREE

15. CAUTION

15.1 OPERATION

15.1.1   DO NOT CONNECT OR DISCONNECT MODULES TO OR FROM THE MAIN SYSTEM WHILE POWER IS BEING SUPPLIED .

15.1.2   USE THE MODULE WITHIN SPECIFIED TEMPERATURE ; LOWER TEMPERATURE CAUSES THE RETARDATION OF BLINKING SPEED OF THE DISPLAY ; HIGHER TEMPERATURE MAKES OVERALL DISPLAY DISCOLOR . WHEN THE TEMPERATURE RETURNS TO NORMALITY, THE DISPLAY WILL OPERATE NORMALLY.

15.1.3   ADJUST THE LC DRIVING VOLTAGE TO OBTAIN THE OPTIMUM CONTRAST .

15.1.4   POWER ON SEQUENCE INPUT SIGNALS SHOULD NOT BE SUPPLIED TO LCD MODULE BEFORE POWER SUPPLY VOLTAGE IS APPLIED AND REACHES THE SPECIFIED VALUE.
IF ABOVE SEQUENCE IS NOT FOLLOWED , CMOS LSIS OF LCD MODULES MAY BE DAMAGED DUE TO LATCH - UP PROBLEM.

15.1.5   NOT ALLOWED TO INFLICT ANY EXTERNAL STRESS AND TO CAUSE ANY MECHANICAL INTERFERENCE ON THE BENDING AREA OF FPC DURING THE TAIL BENDING BACKWARDS!
DO NOT STRESS FPC AND IC ON THE MODULE!
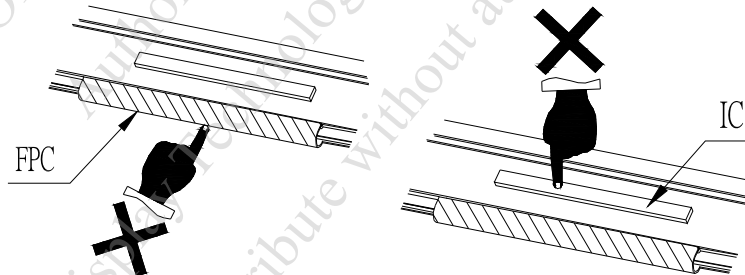
15.2 HANDLING

15.2.1 USE A GROUNDED SOLDERING IRON WHEN SOLDERING CONNECTOR I/O TERMINALS . FOR SOLDERING OR REPAIRING, TAKE PRECAUTION AGAINST THE TEMPERATURE OF THE SOLDERING IRON AND THE SOLDERING TIME TO PREVENT PEELING OFF THE THROUGH-HOLE-PAD.

15.2.2 DO NOT DISASSEMBLE . EDT SHALL NOT BE HELD RESPONSIBLE IF THE MODULE IS DISASSEMBLED AND UPON THE REASSEMBLY THE MODULE FAILED.

15.2.3 DO NOT CHARGE STATIC ELECTRICITY, AS THE CIRCUIT OF THIS MODULE CONTAINS CMOS LSIS. A WORKMAN'S BODY SHOULD ALWAYS BE STATIC-PROTECTED BY USE OF AN ESD STRAP. WORKING CLOTHES FOR SUCH PERSONNEL SHOULD BE OF STATIC-PROTECTED MATERIAL.

15.2.4 ALWAYS GROUND THE ELECTRICALLY-POWERED DRIVER BEFORE USING IT TO INSTALL THE LCD MODULE. WHILE CLEANING THE WORK STATION BY VACUUM CLEANER, DO NOT BRING THE SUCKING MOUTH NEAR THE MODULE ; STATIC ELECTRICITY OF THE ELECTRICALLY-POWERED DRIVER OR THE VACUUM CLEANER MAY DESTROY THE MODULE.

15.2.5 DON'T GIVE EXTERNAL SHOCK.

15.2.6 DON'T APPLY EXCESSIVE FORCE ON THE SURFACE.

15.2.7 LIQUID IN LCD IS HAZARDOUS SUBSTANCE. MUST NOT LICK AND SWALLOW.
WHEN THE LIQUID IS ATTACH TO YOUR, SKIN, CLOTH ETC. WASH IT OUT THOROUGHLY AND IMMEDIATELY.

15.2.8 DON'T OPERATE IT ABOVE THE ABSOLUTE MAXIMUM RATING.

15.2.9 STORAGE IN A CLEAN ENVIRONMENT, FREE FROM DUST, ACTIVE GAS, AND SOLVENT.

15.2.10   STORE WITHOUT ANY PHYSICAL LOAD.

15.2.11   REWIRING: NO MORE THAN 3 TIMES.