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KEVIN KUO		ISSUE : SEP.15, 2020
APPROVED BY:		TOTAL PAGE : 26
CHRIS WU		VERSION : 4
CUSTOMER ACCEPTANCE SPECIFICATIONS		
MODEL NO. : ETML070016NDRA (RoHS) FOR MESSRS :		

CUSTOMER'S APPROVAL

DATE :

BY :

RECORDS OF REVISION

DOC . FIRST ISSUE

APR.11, 2019

DATE

REVISED
PAGE
NO.

SUMMARY

APR.16, 2019

11

7. OUTLINE DIMENSIONS

MARK Δ : MODIFY CTP FPC PIN NO.

OCT.04, 2019

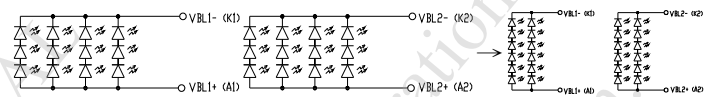
4

4.1 TFT MODULE ELECTRICAL CHARACTERISTICS

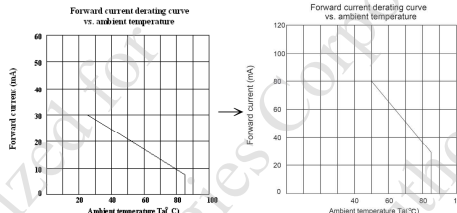
PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
POWER SUPPLY VOLTAGE FOR LED DRIVER	VLED-VSS	—	4.7	5	5.3	V	

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
POWER SUPPLY VOLTAGE FOR LED DRIVER	VLED-VSS	—	9	12	15	V	

NOTE (2) :



NOTE (3) :



4.2 CAPACITIVE TOUCH PANEL ELECTRICAL CHARACTERISTICS

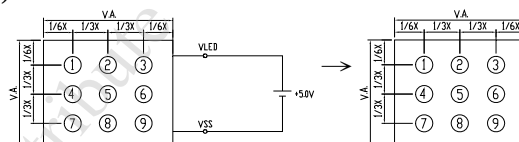
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
POWER SUPPLY CURRENT CONSUMPTION FOR OPERATION	ICC	VCC-GND =5.0V	—	(100)	(130)	mA

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
POWER SUPPLY CURRENT CONSUMPTION FOR OPERATION	ICC	VCC-GND =5.0V	—	100	130	mA

10

6.1 OPTICAL SPECIFICATIONS

NOTE (7) : (a) DEFINITION OF BRIGHTNESS UNIFORMITY



12

8.1 TFT

PIN NO:36.NC → 36.LED_EN

14

10.1 TFT MODULE INTERFACE

PIN NO.	SYMBOL	FUNCTION
36	NC	NON CONNECTION

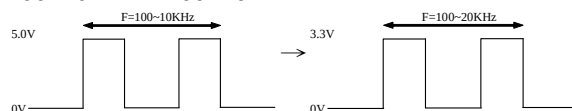
PIN NO.	SYMBOL	FUNCTION
36	LED_EN	LED ENABLE PIN

16

11.1 POWER SUPPLY FOR LCM

LED BACKLIGHT: ADD LED_EN

NOTE (2) : 100~10KHz → 100~20KHz



SEP.15, 2020

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11.1 POWER SUPPLY FOR LCM

NOTE (2) : PWM SIGNAL OPERATION FREQUENCY IS 100~20KHz → THE OPERATION FREQUENCY OF PWM SIGNAL IS 100~20KHz

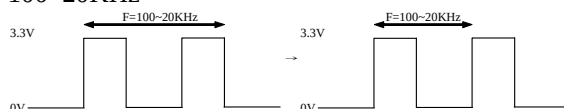


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1. GENERAL SPECIFICATIONS

1.1 DATA SHEETS FOR CONTROLLER/DRIVER

PLEASE REFER TO :

SITRONIX ST5651CB

SITRONIX ST5021CA

1.2 APPLICATION NOTES FOR CAPACITIVE TOUCH PANEL CONTROLLER/DRIVER

PLEASE REFER TO :

ILITEK ILI2511

1.3 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 ----- 7 inch
- (2) NUMBER OF DOTS ----- 1024W * (RGB) * 600H DOTS
- (3) MODULE SIZE ----- 166.2W * 100.3H * 11.0D (MAX.) mm
(NOT INCLUDED FPC & PROTECT FILM)
- (4) VIEWING AREA ----- 155.6W * 87.9H mm
- (5) ACTIVE AREA ----- 154.2144W * 85.92H mm
- (6) DOT SIZE ----- 0.0502W * 0.1432H mm
- (7) PIXEL SIZE ----- 0.1506W * 0.1432H mm
- (8) LCD TYPE ----- TFT , TRANSMISSIVE ,
NORMALLY BLACK, ANTI-GLARE
- (9) COLOR ----- 16.7M
- (10) VIEWING DIRECTION ----- SUPER WIDE VIEW
- (11) BACK LIGHT ----- LED , COLOR : WHITE
- (12) INTERFACE MODE ----- LVDS

2.2 CAPACITIVE TOUCH PANEL MECHANICAL SPECIFICATIONS

- (1) TOUCH PANEL SIZE ----- 7 inch
- (2) OUTER DIMENSION ----- 163.7W * 100.3H * 1.3D mm
(NOT INCLUDED FPC)
- (3) VIEWING AREA ----- 156.6W * 92.01H mm
- (4) ACTIVE AREA ----- 155.6W * 91.01H mm
- (5) INPUT TYPE ----- MULTI-TOUCH
- (6) NUMBER OF TOUCH SENSOR ----- 28*16 SENSORS
- (7) INTERFACE MODE ----- USB
- (8) RESOLUTION ----- 16384*9600

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3. ABSOLUTE MAXIMUM RATINGS

3.1 LCD MODULE ELECTRICAL ABSOLUTE MAXIMUM RATINGS

NOTE (1)

ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
POWER SUPPLY VOLTAGE	VDD	-0.5	6.5	V	
INPUT VOLTAGE	VIN	- 0.3	VDD+0.3	V	

3.2 CAPACITIVE TOUCH PANEL ELECTRICAL ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
POWER SUPPLY VOLTAGE	VCC	-0.3	6	V	

3.3 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE		REMARK
	MIN.	MAX.	MIN.	MAX.	
AMBIENT TEMPERATURE	-20°C	70°C	-30°C	80°C	NOTE (1) , (2)
HUMIDITY	NOTE (3)		NOTE (3)		WITHOUT CONDENSATION
VIBRATION	—	2.45 m/s ² (0.25 G)	—	4.9 m/s ² (0.5 G)	10~55Hz , X,Y,Z EACH 2HRS
SHOCK	—	29.4 m/s ² (3 G)	—	490 m/s ² (50 G)	10 ms XYZ DIRECTIONS 1 TIME EACH
CORROSIVE GAS	NOT ACCEPTABLE		NOT ACCEPTABLE		

NOTE (1) : Ta AT -30°C : WILL BE 48HRS MAX.

80°C : WILL BE 48HRS MAX.

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 (48HRS MAX).

4. ELECTRICAL CHARACTERISTICS

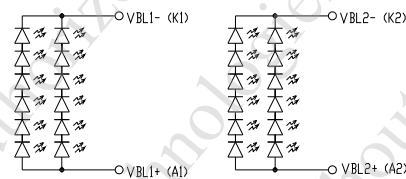
4.1 TFT MODULE ELECTRICAL CHARACTERISTICS

Ta = 25 °C

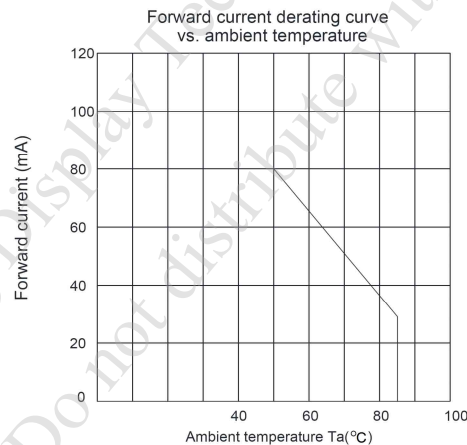
PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
POWER SUPPLY VOLTAGE	VDD-VSS	—	3.15	3.3	3.45	V	
POWER SUPPLY VOLTAGE FOR LED DRIVER	VLED-VSS	—	9	12	15	V	
LOW LEVEL INPUT VOLTAGE	VIL	—	0	—	0.3*VDD	V	NOTE (1)
HIGH LEVEL INPUT VOLTAGE	VIH	—	0.7*VDD	—	VDD	V	NOTE (1)
POWER SUPPLY CURRENT	IDD	VDD-VSS=3.3V	—	130	160	mA	NOTE (2)
POWER SUPPLY CURRENT FOR LED DRIVER	ILED	VLED-VSS=12V LED B/L=ON	—	420	510	mA	
LED LIFE TIME	—	IF=50mA PER LED	50K	—	—	hrs	NOTE (4) NOTE (5)

NOTE (1) : THE DISPLAY PATTERN IS ALL “BLACK”.

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 FAILURE

LCD LUMINANCE BECOMES HALF OF THE INITIAL VALUE.

4.2 CAPACITIVE TOUCH PANEL ELECTRICAL CHARACTERISTICS

Ta = 25 °C

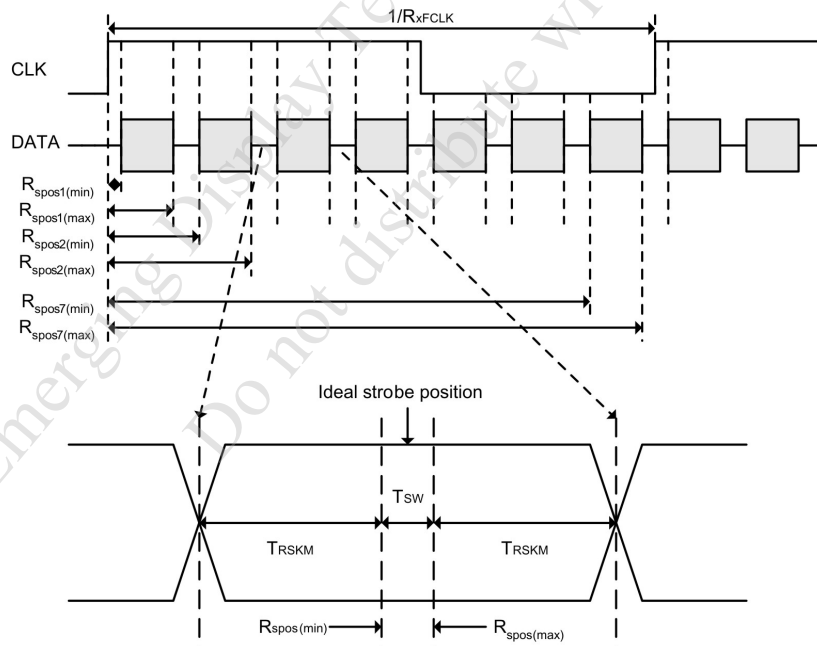
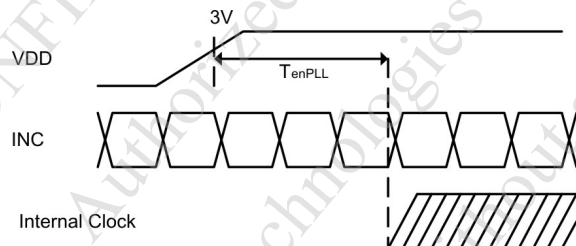
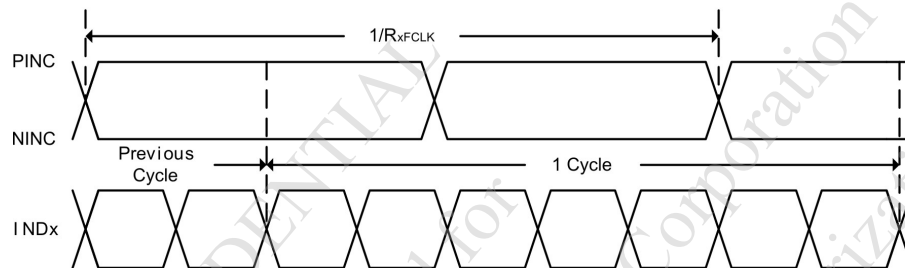
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
POWER SUPPLY FOR DRIVER	VCC	—	4.75	5.0	5.25	V
POWER SUPPLY CURRENT CONSUMPTION FOR OPERATION	ICC	VCC-GND =5.0V	—	100	130	mA

5. TIMING CHARACTERISTICS

5.1 FOR TFT MODULE

5.1.1 AC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
CLOCK FREQUENCY	R_{xCLK}	—	20	—	71	MHz
INPUT DATA SKEW MARGIN	TR_{SKM}	$ V_{ID} = 400mV$ $R_{xVCM} = 1.2V$ $R_{xCLK} = 71 MHz$	500	—	—	pS
CLOCK HIGH TIME	TL_{VCH}	—	—	$4/(7 * R_{xCLK})$	—	ns
CLOCK LOW TIME	TL_{VCL}	—	—	$3/(7 * R_{xCLK})$	—	ns
PLL WAKE-UP TIME	T_{enPLL}	—	—	—	150	μs



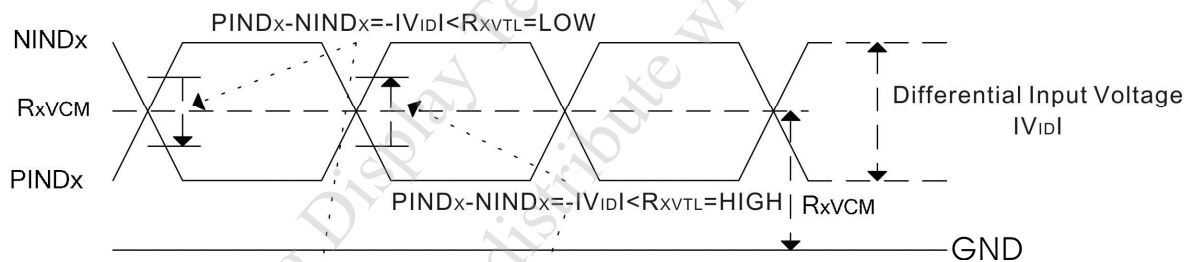
TR_{SKM} : RECEIVER STROBE MARGIN
 RS_{POS} : RECEIVER STROBE POSITION
 TSW : STROBE WIDTH (INTERNAL DATA SAMPLING WINDOW)

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
MODULATION FREQUENCY	SSCMF	—	23	—	93	KHz
MODULATION RATE	SSCMR	LVDS clock = 71MHz CENTER SPREAD	—	—	±3	%

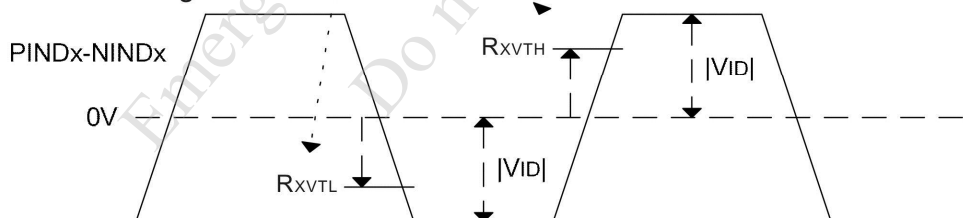
5.1.2 DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
DIFFERENTIAL INPUT HIGH THRESHOLD VOLTAGE	R_{xvth}	—	—	+0.1	V	$R_{xvcm}=1.2V$
DIFFERENTIAL INPUT LOW THRESHOLD VOLTAGE	R_{xvtl}	-0.1	—		V	
INPUT VOLTAGE RANGE (SINGLED-END)	R_{xvin}	0	—	2.4	V	
DIFFERENTIAL INPUT COMMON MODE VOLTAGE	R_{xvcm}	$ V_{ID} /2$	—	$2.4- V_{ID} /2$	V	
DIFFERENTIAL VOLTAGE	$ V_{ID} $	0.2	—	0.6	V	
DIFFERENTIAL INPUT LEAKAGE CURRENT	R_{Vxliz}	-10	—	+10	μA	
LVDS DIGITAL OPERATING CURRENT	LDDLVDs	—	40	50	mA	FCLK=65MHz VDD=3.3V
LVDS DIGITAL STAND-BY CURRENT	LSTLVDS	—	10	50	μA	CLOCK & ALL FUNCTIONS ARE STOPPED

Single end signals



Differential signals



5.1.3 TIMING

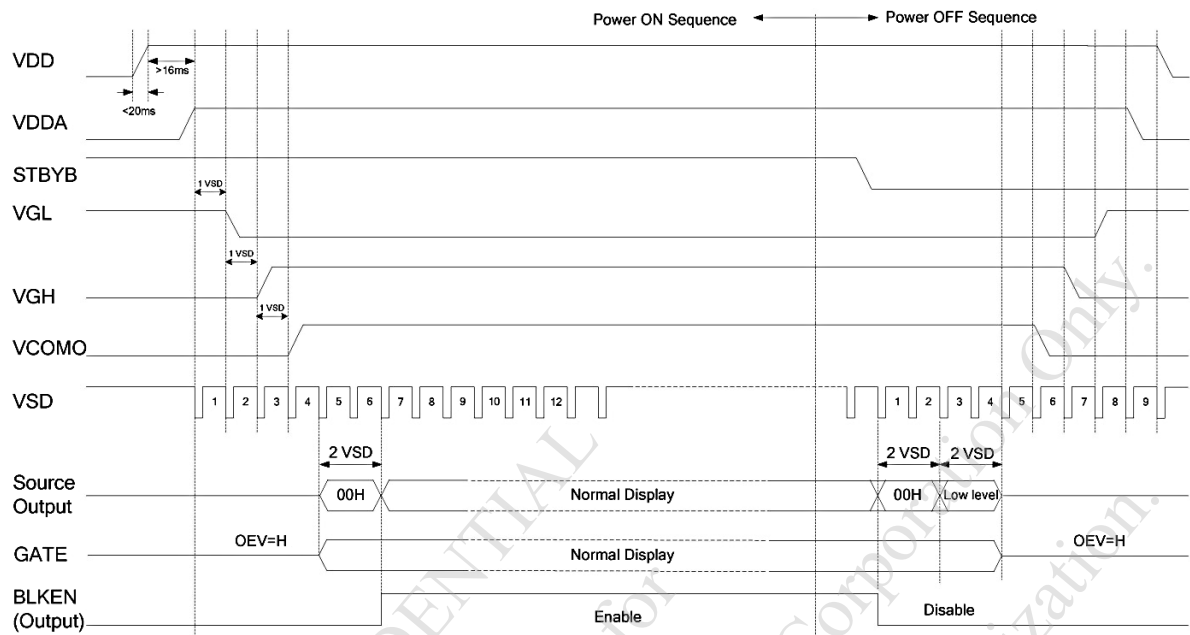
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
CLOCK FREQUENCY	fclk	40.8	51.2	67.2	MHz	FRAME RATE=60Hz
HORIZONTAL DISPLAY AREA	thd	1024			DCLK	
HS PERIOD TIME	th	1114	1344	1400	DCLK	
HS BLANKING	thb	90	320	376	DCLK	
VERTICAL DISPLAY AREA	tvd	600			H	
VS PERIOD TIME	tv	610	635	800	H	
VS BLANKING	tvd +tvfp	10	35	200	H	

DATA INPUT FORMAT

8-BIT LVDS INPUT



5.1.4 POWER ON/OFF SEQUENCE FOR LCD MODULE



6. OPTICAL CHARACTERISTICS

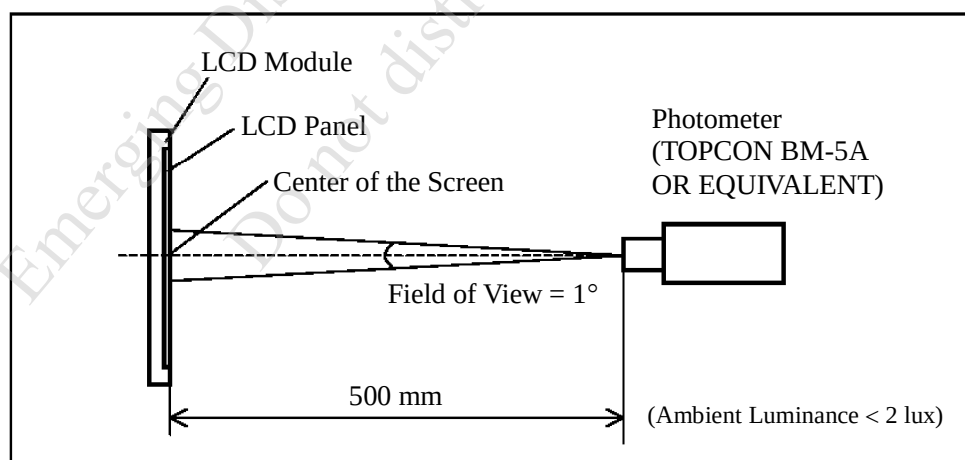
6.1 OPTICAL SPECIFICATIONS

Ta = 25 ± 2 °C

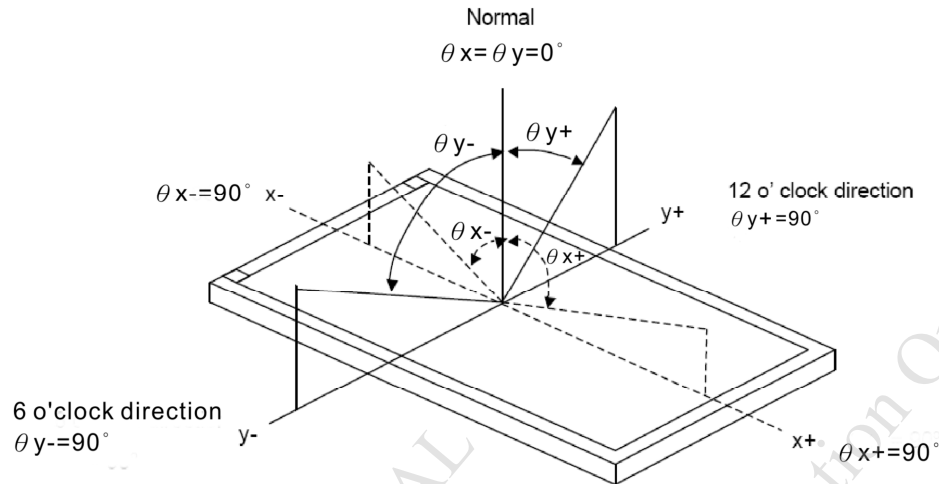
ITEM		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT	REMARK
VIEWING ANGLE		θ_{y+}	CR ≥ 10	$\theta_x=0^\circ$	80	85	—	deg.	NOTE (2)
		θ_{y-}			80	85	—		
		θ_{x+}		$\theta_y=0^\circ$	80	85	—		
		θ_{x-}			80	85	—		
CONTRAST RATIO (CENTER)		CR	$\theta_x=0^\circ$, $\theta_y=0^\circ$		600	800	—	—	NOTE (3)
RESPONSE TIME		T _R (rise)	$\theta_x=0^\circ$, $\theta_y=0^\circ$		—	13	20	msec	NOTE (4)
		T _F (fall)			—	15	25		
COLOR CHROMATICITY (CENTER)	WHITE	W _x	$\theta_x=0^\circ$, $\theta_y=0^\circ$ VDD-VSS=3.3V VLED-VSS=12V NTSC : 47 %		0.26	0.31	0.36	—	NOTE (5)
		W _y			0.28	0.33	0.38		
	RED	R _x			0.53	0.58	0.63		
		R _y			0.31	0.36	0.41		
	GREEN	G _x			0.30	0.35	0.40		
		G _y			0.53	0.58	0.63		
	BLUE	B _x			0.11	0.16	0.21		
		B _y			0.06	0.11	0.16		
THE BRIGHTNESS OF MODULE (CENTER)		L			680	850	—	cd/m ²	NOTE (6)
THE UNIFORMITY OF MODULE		—			70	75	—	%	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 :



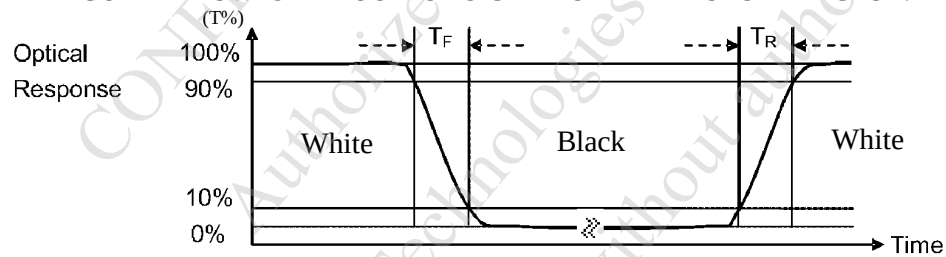
NOTE (3) : DEFINITION OF CONTRAST RATIO (CR) :

MEASURED AT THE CENTER POINT OF MODULE

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

NOTE (4) : DEFINITION OF RESPONSE TIME : T_R AND T_F

THE FIGURE BELOW IS THE OUTPUT SIGNAL OF THE PHOTO DETECTOR.



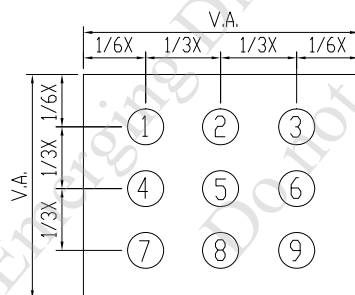
NOTE (5) : DEFINITION OF COLOR CHROMATICITY

(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

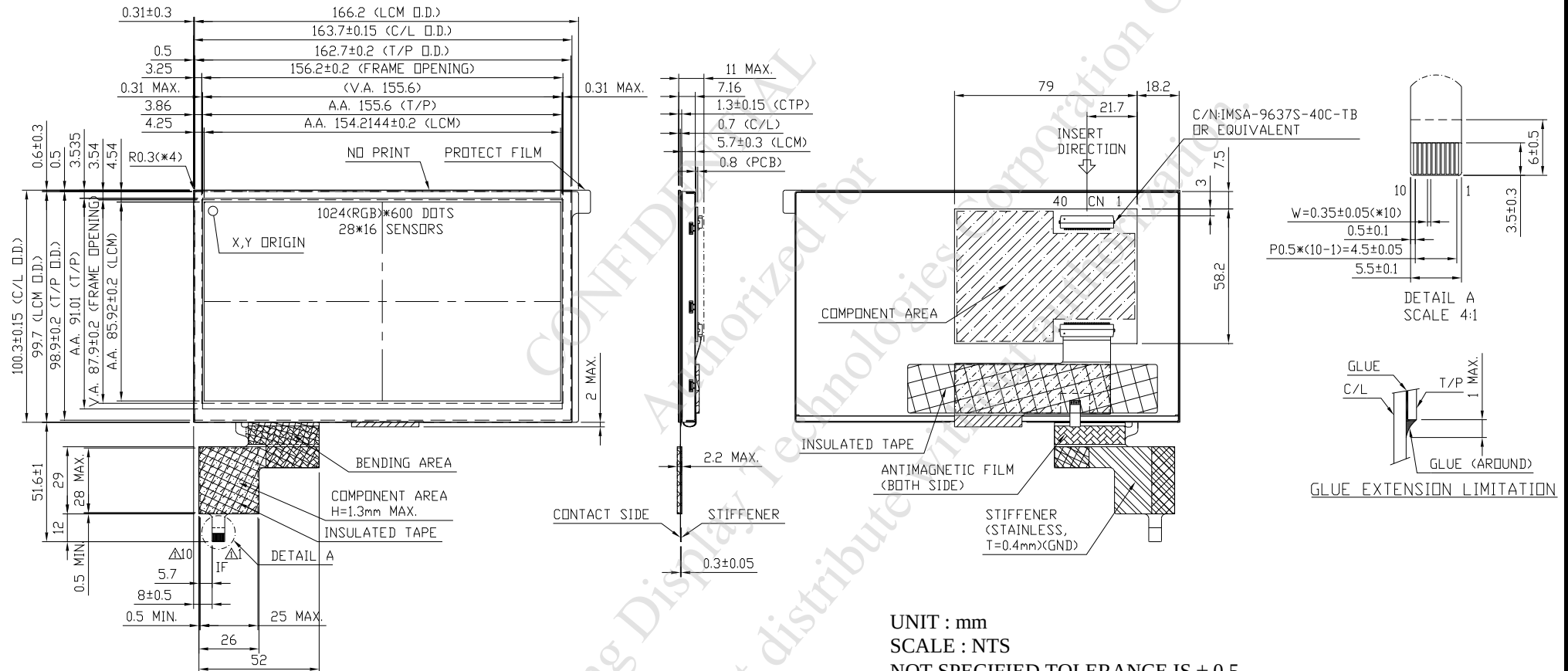


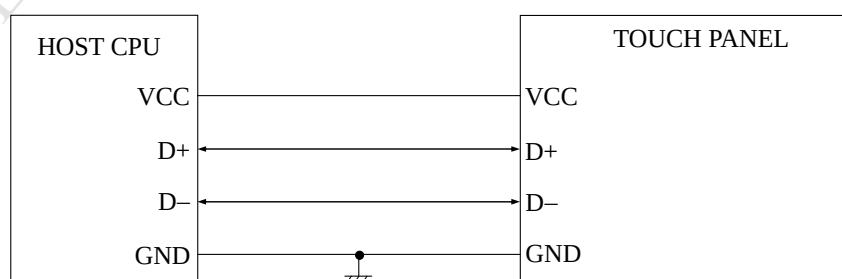
UNIT : mm

(b) THE BRIGHTNESS UNIFORMITY CALCULATING METHOD

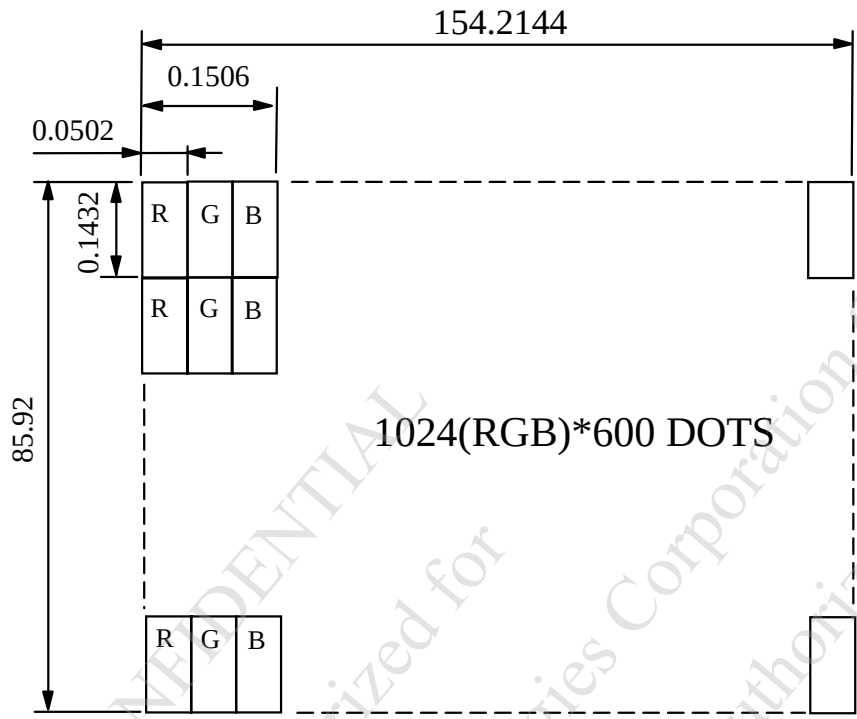
$$\text{UNIFORMITY} : \frac{\text{MINIMUM BRIGHTNESS}}{\text{MAXIMUM BRIGHTNESS}} \times 100\%$$

7. OUTLINE DIMENSIONS





9. DETAIL DRAWING OF DOT MATRIX



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

10. INTERFACE SIGNALS

10.1 TFT MODULE INTERFACE

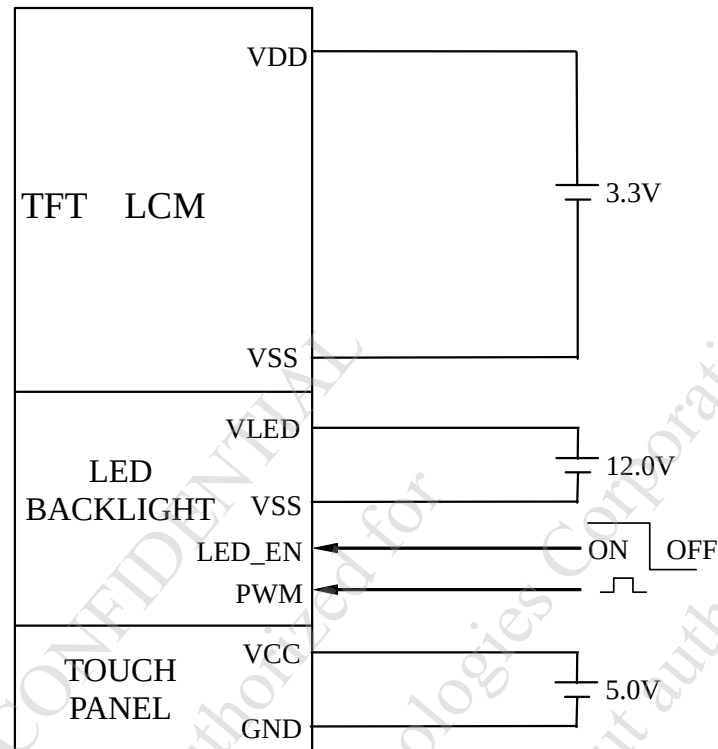
PIN NO.	SYMBOL	FUNCTION
1	NC	NON CONNECTION
2	VDD	POWER SUPPLY VOLTAGE
3	VDD	POWER SUPPLY VOLTAGE
4	NC	NON CONNECTION
5	NC	NON CONNECTION
6	NC	NON CONNECTION
7	NC	NON CONNECTION
8	IND0-	LVDS SIGNAL (-) — CHANNEL 0 (R0~R5,G0)
9	IND0+	LVDS SIGNAL (+) — CHANNEL 0 (R0~R5,G0)
10	VSS	GROUND
11	IND1-	LVDS SIGNAL (-) — CHANNEL 1 (G1~G5,B0~B1)
12	IND1+	LVDS SIGNAL (+) — CHANNEL 1 (G1~G5,B0~B1)
13	VSS	GROUND
14	IND2-	LVDS SIGNAL (-) — CHANNEL 2 (B2~B5,VS,HS,DE)
15	IND2+	LVDS SIGNAL (+) — CHANNEL 2 (B2~B5,VS,HS,DE)
16	VSS	GROUND
17	NINC	LVDS CLOCK SIGNAL (-)
18	PINC	LVDS CLOCK SIGNAL (+)
19	VSS	GROUND
20	IND3-	LVDS SIGNAL (-) — CHANNEL 3 (R6,R7,G6,G7,B6,B7)
21	IND3+	LVDS SIGNAL (+) — CHANNEL 3 (R6,R7,G6,G7,B6,B7)
22	VSS	GROUND
23	NC	NON CONNECTION
24	NC	NON CONNECTION
25	VSS	GROUND
26	NC	NON CONNECTION
27	NC	NON CONNECTION
28	VSS	GROUND
29	NC	NON CONNECTION
30	NC	NON CONNECTION
31	VSS	GROUND
32	VSS	GROUND
33	VSS	GROUND
34	NC	NON CONNECTION
35	PWM	ADJUST FOR LED BRIGHTNESS
36	LED_EN	LED ENABLE PIN
37	NC	NON CONNECTION
38	VLED	POWER SUPPLY VOLTAGE FOR LED BACKLIGHT
39	VLED	POWER SUPPLY VOLTAGE FOR LED BACKLIGHT
40	VLED	POWER SUPPLY VOLTAGE FOR LED BACKLIGHT

10.2 CTP MODULE INTERFACE

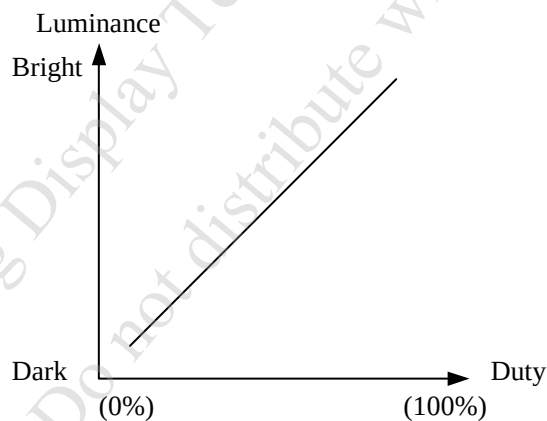
PIN NO.	SYMBOL	FUNCTION
1	NC	THE PIN WAS RESERVED FOR I2C GND
2	NC	THE PIN WAS RESERVED FOR I2C /RST
3	NC	THE PIN WAS RESERVED FOR I2C /INT
4	NC	THE PIN WAS RESERVED FOR I2C SCL
5	NC	THE PIN WAS RESERVED FOR I2C SDA
6	NC	THE PIN WAS RESERVED FOR I2C VCC(+3.3V)
7	VCC	POWER SUPPLY VOLTAGE(+5V)
8	D-	USB D-
9	D+	USB D+
10	GND	GROUND

11. POWER SUPPLY

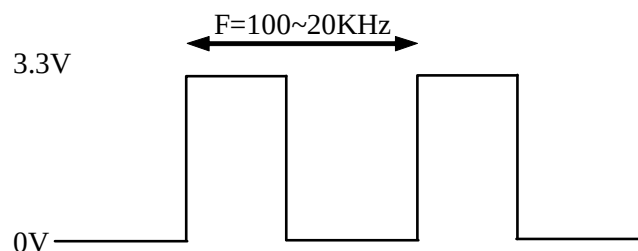
11.1 POWER SUPPLY FOR LCM



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) : THE OPERATION FREQUENCY OF PWM SIGNAL IS 100~20KHz.



12. CAPACITIVE TOUCH PANEL SPECIFICATION

12.1 OPTICAL CHARACTERISTICS

ITEM	CONDITION	MIN.	TYP.	MAX.	UNIT
TRANSPARENCY NOTE (1)	Ta = 25°C $\lambda = 550\text{nm}$	(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.

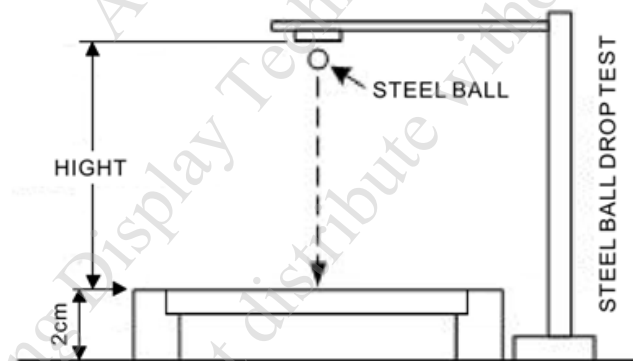
12.2 HARDNESS

ITEM	DESCRIPTION
SURFACE HARDNESS	7H (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)



13. INSPECTION CRITERION

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 ± 5 cm

(2)VIEWING ANGLE : $\pm 15^\circ$

$\pm 15^\circ$ (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 15°

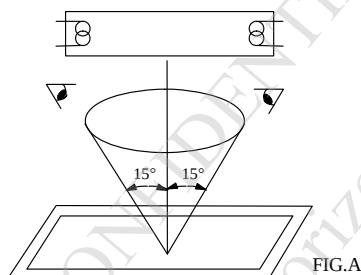


FIG.A

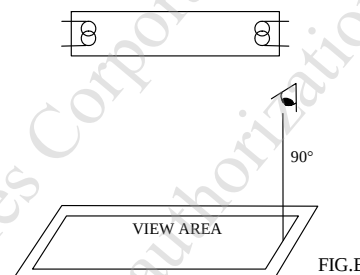


FIG.B

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 15° WITH RESPECTS 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 RESPECTS TO THE VERTICAL AXIS FROM EDGE OF VIEWING AREA.

13.2.2 ENVIRONMENT CONDITIONS :

AMBIENT TEMPERATURE		$25 \pm 5^\circ\text{C}$
AMBIENT HUMIDITY		$65 \pm 20\%\text{RH}$
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 A SAMPLING INSPECTION SHALL BE MADE ACCORDING TO THE FOLLOWING PROVISIONS TO JUDGE THE ACCEPTABILITY

(a)APPLICABLE STANDARD :

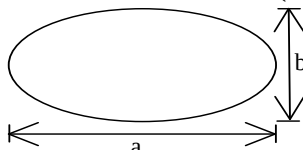
ANSI/ ASQ Z1.4 NORMAL INSPECTION LEVEL II

(b)AQL : MAJOR DEFECT : AQL 0.65

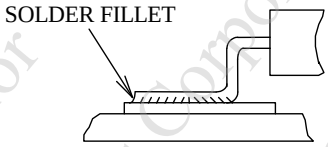
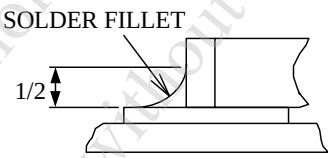
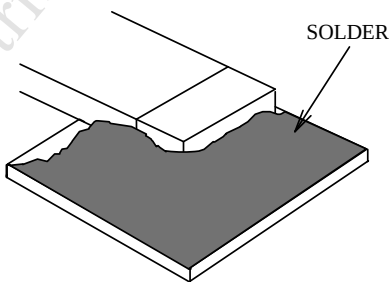
MINOR DEFECT : AQL 1.0

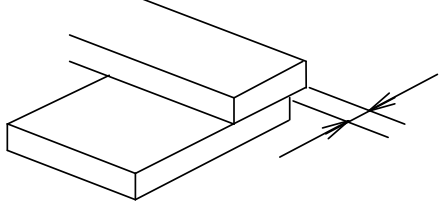
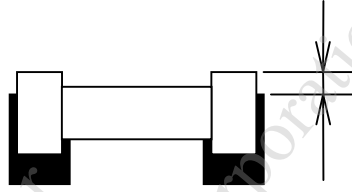
13.3 DEFECTS CLASSIFICATION

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 (VIEWING AREA)	• BLACK/WHITE SPOT / CIRCULAR TYPE • BUBBLES ON POLARIZER • NEWTON RING • BLACK/WHITE LINE / LINEAR TYPE • SCRATCH • CONTAMINATION • UNEVEN 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	

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.<table><tr><th>ITEMS</th><th>ACCEPTABLE COUNT</th></tr><tr><td>BRIGHT DOT</td><td>$N \leq 1$</td></tr><tr><td>DARK DOT</td><td>$N \leq 4$</td></tr><tr><td>TOTAL BRIGHT AND DARK DOTS</td><td>$N \leq 5$</td></tr></table> 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 2% ND FILTER. (3)DARK DOT : DOTS APPEAR DARK AND UNCHANGED IN SIZE IN WHICH LCD PANEL IS DISPLAYING UNDER PURE RED, GREEN, BLUE PICTURE.	ITEMS	ACCEPTABLE COUNT	BRIGHT DOT	$N \leq 1$	DARK DOT	$N \leq 4$	TOTAL BRIGHT AND DARK DOTS	$N \leq 5$																
ITEMS	ACCEPTABLE COUNT																									
BRIGHT DOT	$N \leq 1$																									
DARK DOT	$N \leq 4$																									
TOTAL BRIGHT AND DARK DOTS	$N \leq 5$																									
4	BUBBLES ON POLARIZER /SURFACE STAINS /DIRT/CF FAIL/SPOT	<table><tr><td></td><td>AVERAGE DIAMETER (mm) : D</td><td>PERMISSIBLE NO.</td></tr><tr><td rowspan="3">BUBBLE ON POLARIZER</td><td>$D \leq 0.25$</td><td>IGNORE</td></tr><tr><td>$0.25 < D \leq 0.5$</td><td>$N \leq 5$</td></tr><tr><td>$0.5 < D$</td><td>0</td></tr><tr><td rowspan="3">SURFACE STAINS / DIRT ON POLARIZER</td><td>$D < 0.1$</td><td>IGNORE</td></tr><tr><td>$0.1 < D \leq 0.3$</td><td>$N \leq 3$</td></tr><tr><td>$0.3 < D$</td><td>0</td></tr><tr><td rowspan="3">CF FAIL / SPOT</td><td>$D < 0.1$</td><td>IGNORE</td></tr><tr><td>$0.1 < D \leq 0.3$</td><td>$N \leq 3$</td></tr><tr><td>$0.3 < D$</td><td>0</td></tr></table> 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 EXTRANEIOUS 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 		AVERAGE DIAMETER (mm) : D	PERMISSIBLE NO.	BUBBLE ON POLARIZER	$D \leq 0.25$	IGNORE	$0.25 < D \leq 0.5$	$N \leq 5$	$0.5 < D$	0	SURFACE STAINS / DIRT ON POLARIZER	$D < 0.1$	IGNORE	$0.1 < D \leq 0.3$	$N \leq 3$	$0.3 < D$	0	CF FAIL / SPOT	$D < 0.1$	IGNORE	$0.1 < D \leq 0.3$	$N \leq 3$	$0.3 < D$	0
	AVERAGE DIAMETER (mm) : D	PERMISSIBLE NO.																								
BUBBLE ON POLARIZER	$D \leq 0.25$	IGNORE																								
	$0.25 < D \leq 0.5$	$N \leq 5$																								
	$0.5 < D$	0																								
SURFACE STAINS / DIRT ON POLARIZER	$D < 0.1$	IGNORE																								
	$0.1 < D \leq 0.3$	$N \leq 3$																								
	$0.3 < D$	0																								
CF FAIL / SPOT	$D < 0.1$	IGNORE																								
	$0.1 < D \leq 0.3$	$N \leq 3$																								
	$0.3 < D$	0																								

NO.	ITEM	CRITERIA											
5	BLACK/WHITE SPOT CIRCULAR TYPE	THE FOLLOWING BLACK/WHITE SPOT ARE WITHIN THE VIEWING AREA. AVERAGE DIAMETER : D (mm) <table><tr><th>SIZE D</th><th>PERMISSIBLE NO.</th></tr><tr><td>D≤0.1</td><td>IGNORE</td></tr><tr><td>0.1<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.	SIZE D	PERMISSIBLE NO.	D≤0.1	IGNORE	0.1<D≤0.3	5	0.3<D≤0.5	5	D>0.5	0	
SIZE D	PERMISSIBLE NO.												
D≤0.1	IGNORE												
0.1<D≤0.3	5												
0.3<D≤0.5	5												
D>0.5	0												
6	SCRATCH	THE FOLLOWING SCRATCH IS WITHIN THE VIEWING AREA. WIDTH : W (mm) , LENGTH : L (mm) <table><tr><th>SIZE W & L</th><th>PERMISSIBLE NO.</th></tr><tr><td>W≤0.05</td><td>IGNORE</td></tr><tr><td>0.05<W≤0.08, L≤8</td><td>3</td></tr><tr><td>0.08<W≤0.1, L≤5</td><td>2</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.	SIZE W & L	PERMISSIBLE NO.	W≤0.05	IGNORE	0.05<W≤0.08, L≤8	3	0.08<W≤0.1, L≤5	2	W>0.1	0	
SIZE W & L	PERMISSIBLE NO.												
W≤0.05	IGNORE												
0.05<W≤0.08, L≤8	3												
0.08<W≤0.1, L≤5	2												
W>0.1	0												
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><th>SIZE W & L</th><th>PERMISSIBLE NO.</th></tr><tr><td>W≤0.05</td><td>IGNORE</td></tr><tr><td>0.05<W≤0.08, L≤8</td><td>3</td></tr><tr><td>0.08<W≤0.1, L≤5</td><td>2</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.	SIZE W & L	PERMISSIBLE NO.	W≤0.05	IGNORE	0.05<W≤0.08, L≤8	3	0.08<W≤0.1, L≤5	2	W>0.1	0	
SIZE W & L	PERMISSIBLE NO.												
W≤0.05	IGNORE												
0.05<W≤0.08, L≤8	3												
0.08<W≤0.1, L≤5	2												
W>0.1	0												
8	BUBBLE / DENT FOR OPTICAL BONDING	BUBBLES WITHIN VIEWING AREA. AVERAGE DIAMETER : D (mm) <table><tr><th>SIZE D</th><th>PERMISSIBLE NO.</th></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>1</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.	SIZE D	PERMISSIBLE NO.	D≤0.2	IGNORE	0.2<D≤0.3	3	0.3<D≤0.5	1	D>0.5	0	
SIZE D	PERMISSIBLE NO.												
D≤0.2	IGNORE												
0.2<D≤0.3	3												
0.3<D≤0.5	1												
D>0.5	0												
9	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>	CORNER	X ≤ 3mm 、 Y ≤ 3mm 、 Z ≤ t (t : THICKNESS)	EDGE	X ≤ 6mm , Y ≤ 1mm , Z < t (t : THICKNESS)							
CORNER	X ≤ 3mm 、 Y ≤ 3mm 、 Z ≤ t (t : THICKNESS)												
EDGE	X ≤ 6mm , Y ≤ 1mm , Z < t (t : THICKNESS)												
10	CRACKED GLASS	NOT ACCEPTABLE											
11	LINE DEFECT ON DISPLAY	OBVIOUS VERTICAL OR HORIZONTAL LINE DEFECT IS NOT ALLOWED.											
12	MURA ON DISPLAY	IT'S ACCEPTABLE, IF MURA IS SLIGHT VISIBLE THROUGH 5% ND FILTER.											
13	UNEVEN COLOR SPREAD, COLORATION	TO BE DETERMINED BASED UPON THE LIMITED SAMPLE.											
14	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.											

NO.	ITEM	CRITERIA
15	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 ON 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.
16	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  (b)CHIP COMPONENT · SOLDER IS LESS THAN 50% OF SIDES AND FRONT FACE WETTING  · SOLDER WETS 3 SIDES OF TERMINAL, BUT LESS THAN 25% OF SIDES AND FRONT SURFACE AREA ARE COVERED 

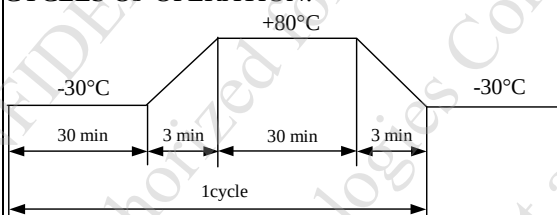
NO.	ITEM	CRITERIA
16	SOLDERING	3. PARTS ALIGNMENT (a)LSI, IC LEAD WIDTH IS MORE THAN 50% BEYOND PAD OUTLINE  (b)CHIP COMPONENT COMPONENT IS OFF CENTER, AND MORE THAN 50% OF THE LEADS IS OFF THE PAD OUTLINE  4. NO UNMELTED SOLDER PASTE MAY BE PRESENT ON THE PCB. 5. NO COLD SOLDER JOINTS, MISSING SOLDER CONNECTIONS, OXIDATION OR ICICLE. 6. NO RESIDUE OR SOLDER BALLS ON PCB. 7. NO SHORT CIRCUITS IN COMPONENTS ON PCB.
17	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.
18	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.

NOTE :

- 1.FOR ANY SPOTS OR LINES, WHICH ARE NOT OBSERVED UNDER APPROPRIATE PANEL OPERATING CONDITION ARE DEEMED ACCEPTABLE.
- 2.THE FOREIGN MATERIALS THAT CAN BE BLOWN OUT BY AIR AND REMOVED BY WET CLEANING ARE NOT REGARDED AS DEFECTS.

14. RELIABILITY TEST

14.1 STANDARD SPECIFICATIONS FOR RELIABILITY OF LCD MODULE

NO.	ITEM	DESCRIPTION
1	HIGH TEMPERATURE OPERATION	THE SAMPLE SHOULD BE ALLOWED TO STAND AT +70°C FOR 240 HRS
2	LOW TEMPERATURE OPERATION	THE SAMPLE SHOULD BE ALLOWED TO STAND AT -20°C FOR 240 HRS
3	HIGH TEMPERATURE STORAGE	THE SAMPLE SHOULD BE ALLOWED TO STAND AT +80°C FOR 240 HRS
4	LOW TEMP STORAGE	THE SAMPLE SHOULD BE ALLOWED TO STAND AT -30°C FOR 240 HRS
5	HIGH TEMPERATURE /HUMIDITY 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: 
7	ESD (ELECTROSTATIC DISCHARGE) (NOT OPERATED)	AIR DISCHARGE $\pm 12\text{KV}$ CONTACT DISCHARGE $\pm 8\text{KV}$ (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 FAILURE 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 60%. 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.

14.2 TESTING CONDITIONS AND INSPECTION CRITERIA

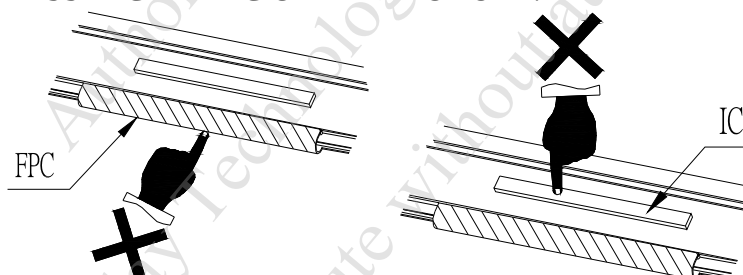
FOR THE FINAL TEST THE TESTING SAMPLE MUST BE STORED AT ROOM TEMPERATURE FOR 24 HOURS, AFTER THE TESTS LISTED IN TABLE 14.1, STANDARD SPECIFICATIONS FOR RELIABILITY HAVE BEEN EXECUTED IN ORDER TO ENSURE STABILITY.

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 CRISTAL 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.