

RECORDS OF REVISION

DATE	REVISED PAGE NO.	SUMMARY																																
AUG.26, 2016	1	2. MECHANICAL SPECIFICATIONS (3)MODULE SIZE : 235W→235.5W																																
	2	3.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS LED BACKLIGHT POWER DISSIPATION : MAX.=(3)→(4.096) LED BACKLIGHT FORWARD CURRENT : MAX.=(30)→(320) LED BACKLIGHT REVERSE VOLTAGE : MAX.=(5)→(13.6)																																
	3 , 4	4. ELECTRICAL CHARACTERISTICS <table><tr><th>PARAMETER</th><th>SYMBOL</th><th>CONDITION</th><th>MIN.</th><th>TYP.</th><th>MAX.</th><th>UNIT</th><th>REMARK</th></tr><tr><td>LED LIFE TIME</td><td>—</td><td>I_{LED}=20mA (PER. LED)</td><td>30K</td><td>—</td><td>—</td><td>HRS</td><td>NOTE(5) NOTE(6)</td></tr></table> <table><tr><th>PARAMETER</th><th>SYMBOL</th><th>CONDITION</th><th>MIN.</th><th>TYP.</th><th>MAX.</th><th>UNIT</th><th>REMARK</th></tr><tr><td>LED LIFE TIME</td><td>—</td><td>I_{LED}=120mA (PER. LED)</td><td>(50K)</td><td>—</td><td>—</td><td>HRS</td><td>NOTE(5) NOTE(6)</td></tr></table> MODIFY NOTE (3) 、(4)	PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK	LED LIFE TIME	—	I _{LED} =20mA (PER. LED)	30K	—	—	HRS	NOTE(5) NOTE(6)	PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK	LED LIFE TIME	—	I _{LED} =120mA (PER. LED)	(50K)	—	—	HRS	NOTE(5) NOTE(6)
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	LED LIFE TIME	—	I _{LED} =120mA (PER. LED)	(50K)	—	—	HRS	NOTE(5) NOTE(6)																										
8	6.1 OPTICAL CHARACTERISTICS THE BRIGHTNESS OF MODULE : MIN.=(350)→(400), TYP.=(400)→(500)																																	
9	MODIFY 6.2 THE TEST METHOD OF BRIGHTNESS AND UNIFORMITY																																	
10	7. OUTLINE DIMENSIONS MARK△: MODIFY MODULE DIMENSION & PCB TYPE																																	
AUG.29, 2016	2	3.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS AMBIENT TEMPERATURE: MIN.=-20°C→-30°C; MAX.=70°C→80°C																																
	23	12.4.1 STANDARD SPECIFICATIONS FOR RELIABILITY OF LCD MODULE NO.1 HIGH TEMPERATURE OPERATION: +70°C→+80°C NO.2 LOW TEMPERATURE OPERATION: -20°C→-30°C NO.6 THERMAL SHOCK: 																																
JAN.04, 2017	1	2. MECHANICAL SPECIFICATIONS (3)MODULE SIZE : 5.8D mm→9.3D (MAX.)																																
	4	4. ELECTRICAL CHARACTERISTICS MODIFY NOTE (4), (6)																																
	9	MODIFY 6.2 THE TEST METHOD OF BRIGHTNESS AND UNIFORMITY																																
	10	7. OUTLINE DIMENSIONS MARK△: MODIFY MODULE THICKNESS & B/L FPC, ADD PCB DIMENSION																																
OCT.05, 2017	2	3.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS LED BACKLIGHT POWER DISSIPATION : MAX.=(4.096)→10.65 LED BACKLIGHT FORWARD CURRENT : MAX.=(320)→600 LED BACKLIGHT REVERSE VOLTAGE : MAX.=(13.6)→6																																
	3	4. ELECTRICAL CHARACTERISTICS VDD CURRENT : TYP.=(200)→150, MAX.=(250)→190 POWER SUPPLY CURRENT FOR LED DRIVER : TYP.=(550)→880, MAX.=(650)→1100 LED LIFE TIME : MIN.=(50K)→50K																																
	5 , 6	5. TIMING CHARACTERISTICS REVISING THE ENTIRE PAGE																																

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NO.

SUMMARY

OCT.05, 2017

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6.1 OPTICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
VIEWING ANGLE	θ_{xz}	$CR \geq 10$	$\theta_x=0^\circ$	(60)	(70)	—	deg. NOTE (2) NOTE (3)
	θ_{yz}		$\theta_y=0^\circ$	(70)	(80)	—	
	θ_{zx}			(70)	(80)	—	
	θ_{zy}			(70)	(80)	—	
CONTRAST RATIO	CR	$\theta_x=0^\circ, \theta_y=0^\circ$	(400)	(500)	—	—	NOTE (3)
RESPONSE TIME	T_R (rise)+ T_F (fall)	$\theta_x=0^\circ, \theta_y=0^\circ$	—	(16)	(32)	msec	NOTE (4)
COLOR OF CIE COORDINATE	WHITE	$\theta_x=0^\circ, \theta_y=0^\circ$ NTSC : 45% VLED-VSS=5.0V	W_x	(0.25)	(0.30)	(0.35)	— NOTE (6)
			W_y	(0.32)	(0.37)	(0.42)	
	RED		R_x	(0.555)	(0.605)	(0.655)	
			R_y	(0.277)	(0.327)	(0.377)	
	GREEN		G_x	(0.236)	(0.286)	(0.336)	
			G_y	(0.476)	(0.526)	(0.576)	
	BLUE		B_x	(0.10)	(0.15)	(0.20)	
			B_y	(0.095)	(0.145)	(0.195)	
THE BRIGHTNESS OF MODULE	B	$\theta_x=0^\circ, \theta_y=0^\circ$ VLED-VSS=5.0V	(400)	(500)	—	cd/m ²	NOTE (5)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
VIEWING ANGLE	θ_{xz}	$CR \geq 10$	$\theta_x=0^\circ$	60	70	—	deg. NOTE (2) NOTE (3)
	θ_{yz}		$\theta_y=0^\circ$	70	80	—	
	θ_{zx}			70	80	—	
	θ_{zy}			70	80	—	
CONTRAST RATIO	CR	$\theta_x=0^\circ, \theta_y=0^\circ$	510	680	—	—	NOTE (3)
RESPONSE TIME	T_R (rise)+ T_F (fall)	$\theta_x=0^\circ, \theta_y=0^\circ$	—	16	32	msec	NOTE (4)
COLOR OF CIE COORDINATE	WHITE	$\theta_x=0^\circ, \theta_y=0^\circ$ NTSC : 45% VLED-VSS=5.0V	W_x	0.25	0.30	0.35	— NOTE (6)
			W_y	0.30	0.35	0.40	
	RED		R_x	0.54	0.59	0.64	
			R_y	0.31	0.36	0.41	
	GREEN		G_x	0.25	0.30	0.35	
			G_y	0.52	0.57	0.62	
	BLUE		B_x	0.10	0.15	0.20	
			B_y	0.07	0.12	0.17	
THE BRIGHTNESS OF MODULE	B	$\theta_x=0^\circ, \theta_y=0^\circ$ VLED-VSS=5.0V	400	500	—	cd/m ²	NOTE (5)

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11. POWER SUPPLY

DELETE 11.2 POWER 、 SIGNAL SEQUENCE

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1. GENERAL SPECIFICATIONS

1.1 DATA SHEETS FOR CONTROLLER/DRIVER

PLEASE REFER TO :

SITRONIX ST5651CB

SITRONIX ST5021

1.2 MATERIAL SAFETY DESCRIPTION

ASSEMBLIES SHALL COMPLY WITH EDT GREEN PRODUCT (GP) REQUIREMENTS, INCLUDING PROHIBITED MATERIALS/COMPONENTS CONTAINING LEAD, MERCURY, CADMIUM, HEXAVALENT CHROMIUM, POLYBROMINATED BIPHENYLS (PBB), POLYBROMINATED DIPHENYL ETHERS (PBDE), POLYCHLORINATED BIPHENYLS (PCB) CATEGORY, POLYCHLORINATED NAPHTHALENE (PCN) CATEGORY, POLYCHLORINATED TERPHENYLS (PCT) CATEGORY, CHLORINATED PARAFFINS (CP) CATEGORY, TRIBUTHYL TIN CATEGORY / TRIPHENYL TIN CATEGORY, ASBESTOS, SPECIFIC AZO COMPOUNDS, FORMALDEHYDE, POLYVINYL CHLORIDE (PVC) AND PVC BLENDS, OTHER BROMINATED ORGANIC COMPOUNDS AND OTHER CHLORINATED ORGANIC COMPOUNDS.

2. MECHANICAL SPECIFICATIONS

- (1) DISPLAY SIZE ----- 10.1 inch
- (2) NUMBER OF DOTS ----- 1024W * (RGB) * 600H DOTS
- (3) MODULE SIZE ----- 235.5W * 143H * 9.3D (MAX.) mm
- (4) VIEWING AREA ----- 225.4W * 128H mm
- (5) ACTIVE AREA ----- 222.72W * 125.28H mm
- (6) DOT SIZE ----- 0.0725W * 0.2088H mm
- (7) PIXEL SIZE ----- 0.2175W * 0.2088H mm
- (8) LCD TYPE ----- TFT , TRANSMISSIVE , ANTI-GLARE
- (9) COLOR ----- 16.7 M
- (10) VIEWING DIRECTION ----- 6 O'CLOCK (GRAY LEVEL INVERSION)
- (11) BACK LIGHT ----- LED , COLOR : WHITE
- (12) INTERFACE MODE ----- LVDS

3. ABSOLUTE MAXIMUM RATINGS

3.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
POWER SUPPLY VOLTAGE	VDD-VSS	-0.5	5.0	V	
LED BACKLIGHT POWER DISSIPATION	PD	—	10.65	W	
LED BACKLIGHT FORWARD CURRENT	IF	—	600	mA	
LED BACKLIGHT REVERSE VOLTAGE	VR	—	6	V	

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

3.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE		REMARK
	MIN.	MAX.	MIN.	MAX.	
AMBIENT TEMPERATURE	-30°C	80°C	-30°C	80°C	NOTE (1), (2)
HUMIDITY	NOTE (3)		NOTE (3)		WITHOUT CONDENSATION
VIBRATION	—	2.45 m/s ² (0.25 G)	—	11.76m/s ² (1.2 G)	10~55Hz X,Y,Z,EACH 2HRS
SHOCK	—	29.4 m/s ² (3 G)	—	490.0 m/s ² (50 G)	6 ms XYZ DIRECTIONS 3 TIMES 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 (96HRS MAX).

4. ELECTRICAL CHARACTERISTICS

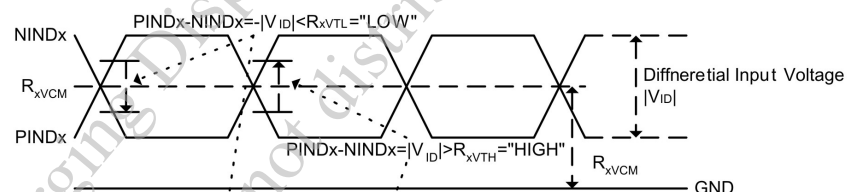
PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
LOGIC/LCD DRIVE VOLTAGE	VDD-VSS	—	3.0	3.3	3.6	V	
VDD CURRENT	IDD	—	—	150	190	mA	
POWER SUPPLY VOLTAGE FOR LED DRIVER	VLED-VSS	—	4.7	5.0	5.3	V	
POWER SUPPLY CURRENT FOR LED DRIVER	IVLED	VLED-VSS=5.0V	—	880	1100	mA	
DIFFERENTIAL INPUT HIGH THRESHOLD VOLTAGE	R _x VTH	R _x VCM=1.2V	—	—	0.1	V	
DIFFERENTIAL INPUT LOW THRESHOLD VOLTAGE	R _x VTL		-0.1	—	—	V	
INPUT VOLTAGE RANGE (SINGLED-END)	R _x VIN	—	0	—	2.4	V	
DIFFERENTIAL INPUT COMMON MODE VOLTAGE	R _x VCM	—	VID /2	—	2.4- VID /2	V	
DIFFERENTIAL INPUT VOLTAGE	VID	—	0.2	—	0.6	V	
DIFFERENTIAL INPUT LEAKAGE CURRENT	RVxliz	—	-10	—	+10	μA	
LVDS DIGITAL OPERATING CURRENT	I _{ddl} vs	Fclk=65MHz, VDD-VSS=3.3V	—	40	50	mA	
LVDS DIGITAL STANDBY CURRENT	I _{stl} vs	CLOCK & ALL FUNCTIONS ARE STOPPED	—	10	50	μA	
LED LIFE TIME	—	I _{LED} =120mA (PER. LED)	50K	—	—	HRS	NOTE(5) NOTE(6)

NOTE (1) : A. INPUT SIGNALS SHALL BE LOW OR HI-Z STATE WHEN VDD IS OFF.

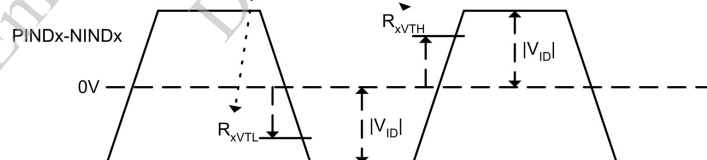
B. ALL ELECTRICAL CHARACTERISTICS FOR LVDS SIGNAL ARE DEFINED AND SHALL BE MEASURED AT THE INTERFACE CONNECTOR OF LCD.

NOTE (2) : LVDS INPUT CHARACTERISTICS ARE AS FOLLOW

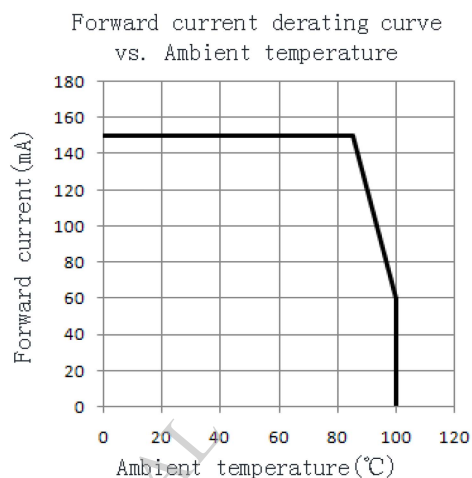
Single-end Signals



Differential Signal

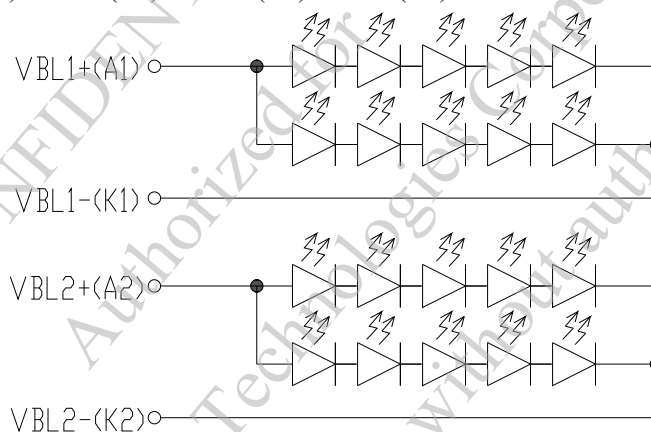


NOTE (3) : AMBIENT TEMP. VS. ALLOWABLE FORWARD CURRENT. (PER. LED)



NOTE (4) : INTERNAL CIRCUIT DIAGRAM OF BACKLIGHT

$$VF = VBL1 + (A1) - VBL1 - (K1) = VBL2 + (A2) - VBL2 - (K2)$$



NOTE (5) : CONDITIONS; $T_A = 25^\circ\text{C}$, CONTINUOUS LIGHTING

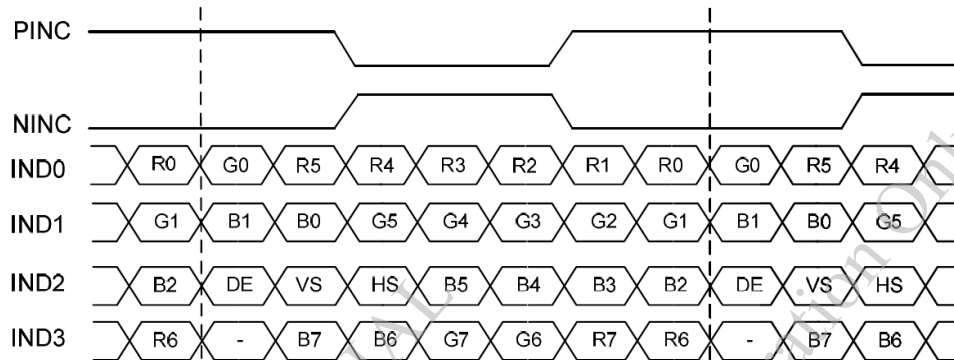
NOTE (6) : DEFINITIONS OF LIFE TIME

LCM LUMINANCE BECOMES HALF OF THE INITIAL VALUE.

5. TIMING CHARACTERISTICS

5.1 DATA INPUT FORMAT

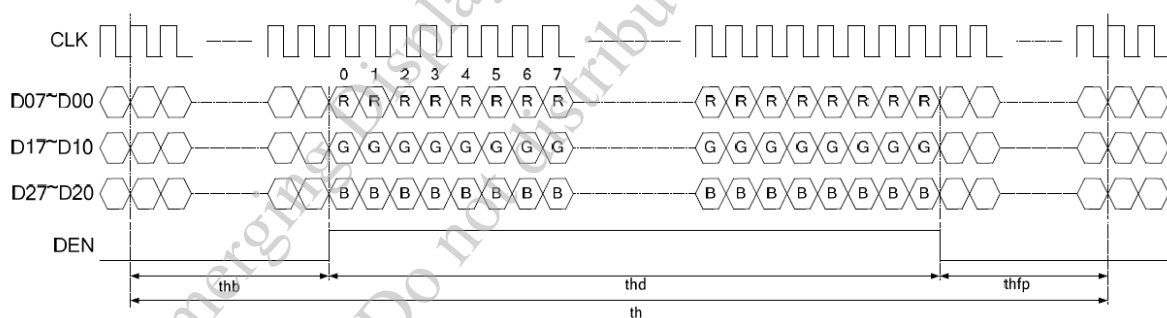
5.1.1 8 BIT LVDS INPUT(HSD="L")



5.2 TIMING TABLE

5.2.1 MODE = "H" : DE MODE

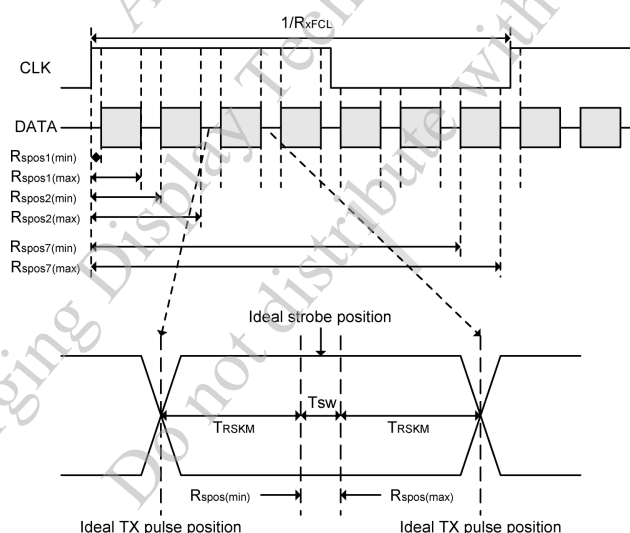
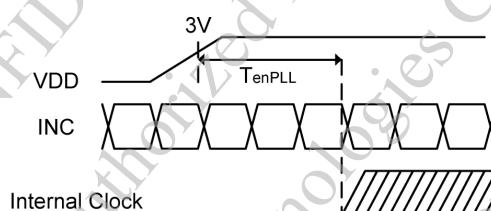
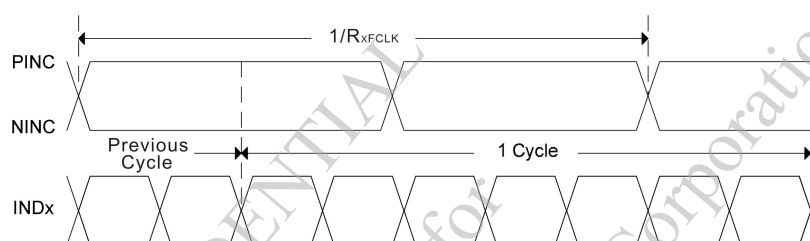
ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
CLKIN FREQUENCY@ FRAME RATE = 60Hz	fclk	40.8	51.2	67.2	MHz
HORIZONTAL DISPLAY AREA	thd	1024			CLKIN
1 HORIZONTAL LINE	th	1114	1344	1400	
HSD BLANKING	thb+thfp	90	320	376	
VERTICAL DISPLAY AREA	tvd	600			H
1 VERTICAL LINE	tv	610	635	800	
VSD BLANKING	tvb+tvfp	10	45	220	



5.3 AC ELECTRICAL CHARACTERISTICS

LVDS MODE

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITION
CLOCK FREQUENCY	R_{xFCLK}	20	—	71	MHz	
INPUT DATA SKEW MARGIN	T_{RSKM}	500	—	—	pS	$ V_{ID} = 400\text{mV}$ $R_{xVCM} = 1.2\text{V}$ $R_{xFCLK} = 71\text{ MHz}$
CLOCK HIGH TIME	T_{LVCH}	—	$4/(7 * R_{xFCLK})$	—	ns	
CLOCK LOW TIME	T_{LVCL}	—	$3/(7 * R_{xFCLK})$	—	ns	
PLL WAKE-UP TIME	T_{enPLL}		—	150	us	



T_{RSKM} : Receiver strobe margin
 R_{spos} : Receiver strobe position
 T_{sw} : Strobe width (internal data sampling window)

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

6. OPTICAL CHARACTERISTICS (NOTE1)

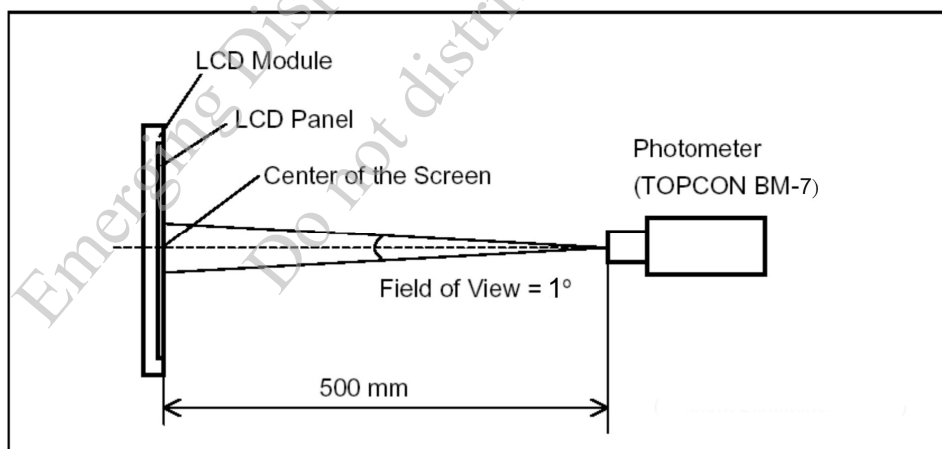
6.1 OPTICAL CHARACTERISTICS

Ta = 25 ± 2 °C

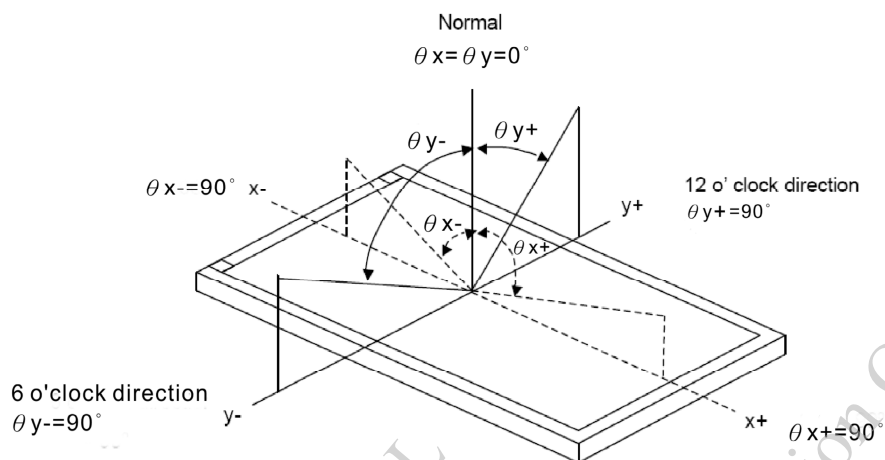
ITEM		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT	REMARK
VIEWING ANGLE		θ_{y+}	CR $\geq$ 10	$\theta_x=0^\circ$	60	70	—	deg.	NOTE (2) NOTE (3)
		θ_{y-}			70	80	—		
		θ_{x+}		$\theta_y=0^\circ$	70	80	—		
		θ_{x-}			70	80	—		
CONTRAST RATIO		CR	$\theta_x=0^\circ$, $\theta_y=0^\circ$		510	680	—		NOTE (3)
RESPONSE TIME		T _R (rise)+ T _F (fall)	$\theta_x=0^\circ$, $\theta_y=0^\circ$		—	16	32	msec	NOTE (4)
COLOR OF CIE COORDINATE	WHITE	W _x	$\theta_x=0^\circ$, $\theta_y=0^\circ$ NTSC : 45% VLED-VSS=5.0V		0.25	0.30	0.35	—	NOTE (6)
		W _y			0.30	0.35	0.40		
	RED	R _x			0.54	0.59	0.64	—	
		R _y			0.31	0.36	0.41		
	GREEN	G _x			0.25	0.30	0.35	—	
		G _y			0.52	0.57	0.62		
	BLUE	B _x			0.10	0.15	0.20	—	
		B _y			0.07	0.12	0.17		
THE BRIGHTNESS OF MODULE		B	$\theta_x=0^\circ$, $\theta_y=0^\circ$ VLED-VSS=5.0V		400	500	—	cd/m ²	NOTE (5)
THE UNIFORMITY OF MODULE		—			70	—	—	%	NOTE (5)

NOTE (1) : TEST EQUIPMENT SETUP :

AFTER STABILIZING AND LEAVING THE PANEL ALONE AT A GIVEN TEMPERATURE FOR 30 MINUTES, THE MEASUREMENT SHOULD BE EXECUTED. MEASUREMENT SHOULD BE EXECUTED IN A STABLE, WINDLESS, AND DARK ROOM. OPTICAL SPECIFICATIONS ARE MEASURED BY TOPCON BM-7 (FAST) WITH A VIEWING ANGLE OF 1° AT A DISTANCE OF 50cm AND NORMAL DIRECTION.



NOTE (2) : DEFINITION OF VIEWING ANGLE :

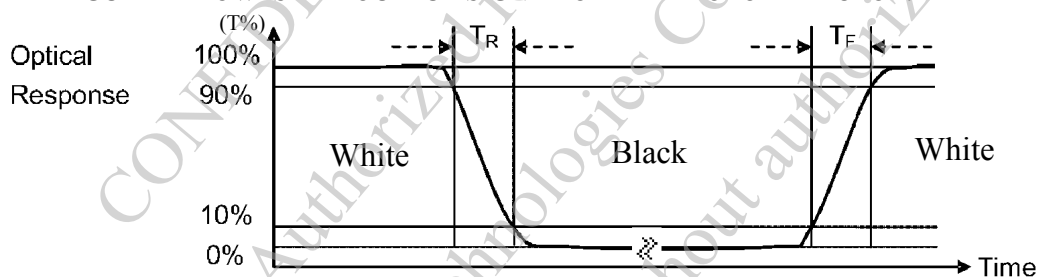


NOTE (3) : DEFINITION OF CONTRAST RATIO :

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

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

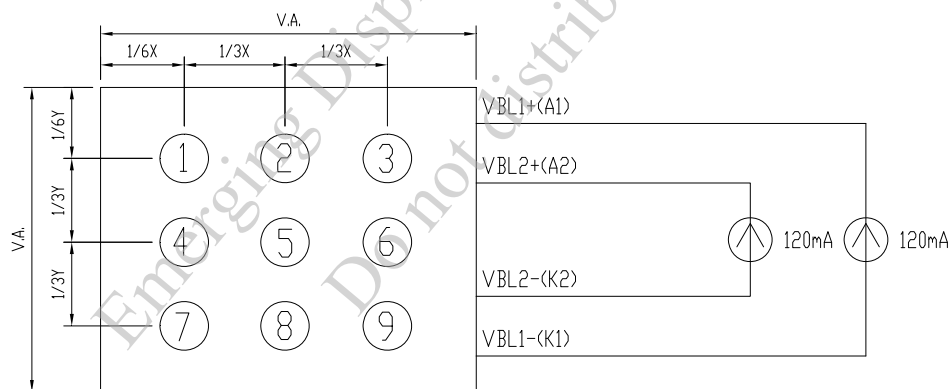
THE FIGURE BELOW IS THE OUTPUT SIGNAL OF THE PHOTO DETECTOR



NOTE (5) : BRIGHTNESS MEASURED WHEN LCD IS AT "WHITE STATE"

NOTE (6) : THE 100% TRANSMISSION IS DEFINED AS THE TRANSMISSION OF LCD PANEL WHEN ALL THE INPUT TERMINALS OF MODULE ARE ELECTRICALLY OPENED.

6.2 THE TEST METHOD OF BRIGHTNESS AND UNIFORMITY

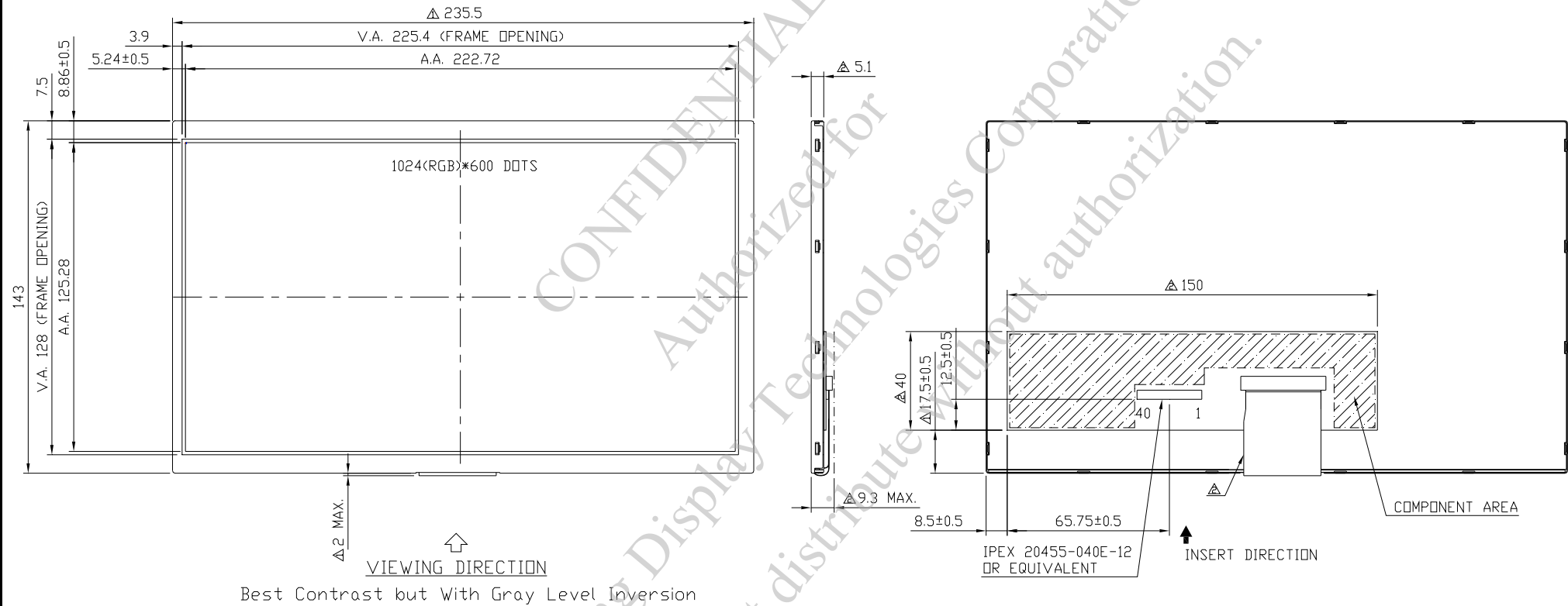


UNIT : mm

6.3 THE CALCULATING METHOD OF UNIFORMITY

$$\text{UNIFORMITY} = \left[1 - \frac{\text{MAXIMUM BRIGHTNESS} - \text{MINIMUM BRIGHTNESS}}{\text{AVERAGE BRIGHTNESS}} \right] \times 100\%$$

7. OUTLINE DIMENSIONS



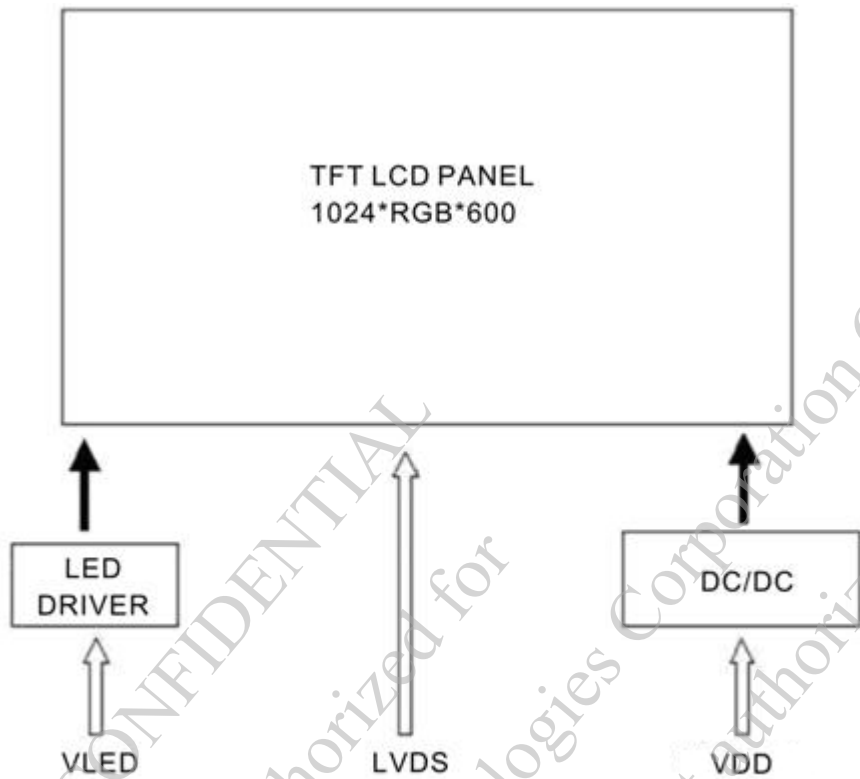
UNIT : mm

SCALE : NTS

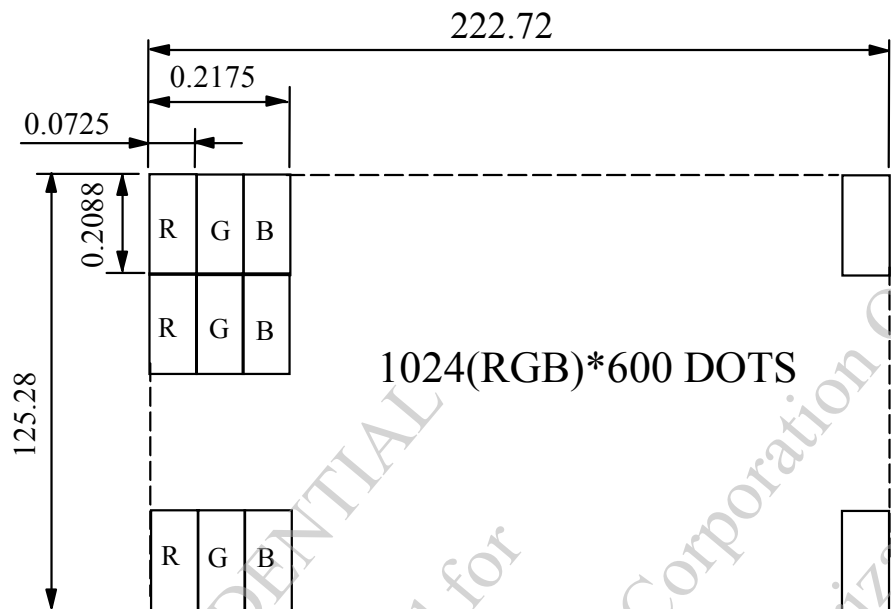
NOT SPECIFIED TOLERANCE IS ± 0.3

NOTE : MARK Δ MODIFY (NUMBER NOTE MODIFY VERSION)

8. BLOCK DIAGRAM



9. DETAIL DRAWING OF DOT MATRIX



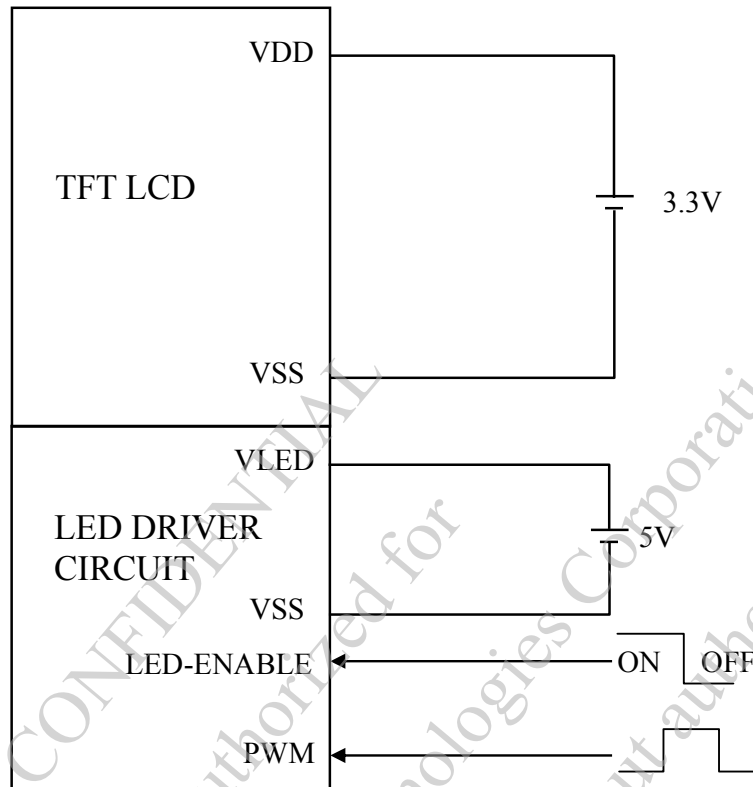
UNIT : mm
SCALE : NTS
NOT SPECIFIED TOLERANCE IS ± 0.1
DOTS MATRIX TOLERANCE IS ± 0.01

10. INTERFACE SIGNALS

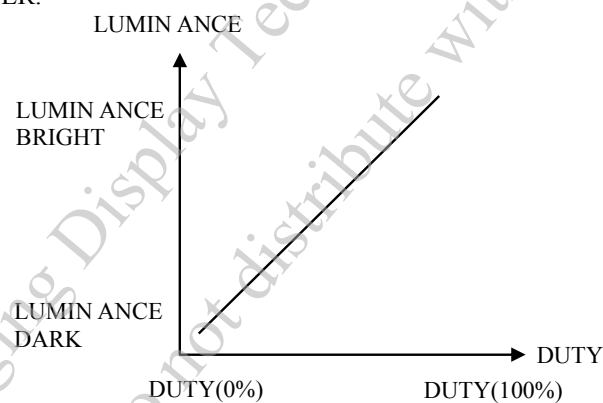
PIN NO.	SYMBOL	FUNCTION
1	NC	NON CONNECTION
2	VDD	POWER SUPPLY VOLTAGE
3	VDD	POWER SUPPLY VOLTAGE
4	NC	NON CONNECTION
5	NC	NON CONNECTION
6	NC	NON CONNECTION
7	NC	NON CONNECTION
8	IND0-	LVDS SIGNAL (-) — CHANNEL 0 (R0~R5,G0)
9	IND0+	LVDS SIGNAL (+) — CHANNEL 0 (R0~R5,G0)
10	VSS	GROUND
11	IND1-	LVDS SIGNAL (-) — 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-ENABLE	INTERNAL PULL UP TO +3.3V
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

11. POWER SUPPLY

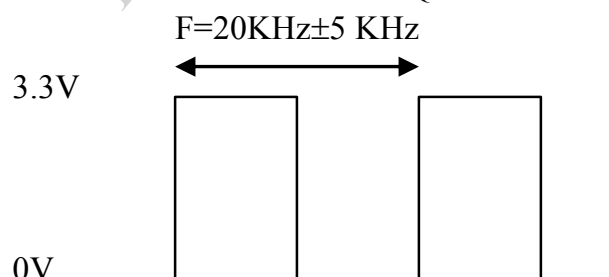
11.1 POWER SUPPLY FOR LCM



NOTE (1) : PWM ADJUST BRIGHTNESS TO CONTROL PIN, PULSE DUTY THE BIGGER THE BRIGHTER.



NOTE (2) : PWM SIGNAL=0~3.3V , OPERATION FREQUENCY : 20KHz±5KHz



12. INSPECTION CRITERION

12.1 APPLICATION

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

12.2 INSPECTION CONDITIONS

12.2.1 (1)OBSERVATION DISTANCE : $35\pm 5\text{cm}$

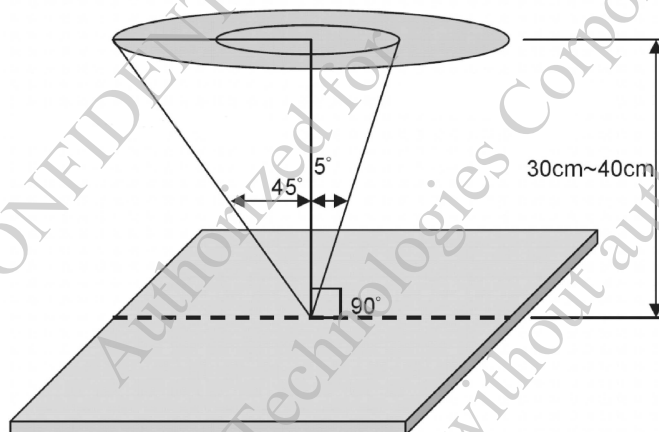
(2)VIEW ANGLE :

NON-OPERATION CONDITION : $\pm 5^\circ$

(PERPENDICULAR TO LCD PANEL SURFACE)

OPERATION CONDITION : $\pm 45^\circ$

(PERPENDICULAR TO LCD PANEL SURFACE)



12.2.2 ENVIRONMENT CONDITIONS :

AMBIENT TEMPERATURE		$20\pm 5^\circ\text{C}$
AMBIENT HUMIDITY		$65\pm 20\%\text{RH}$
AMBIENT ILLUMINATION	COSMETIC INSPECTION	MORE THAN 600Lux
	FUNCTIONAL INSPECTION	300~500 Lux

12.2.3 INSPECTION LOT

QUANTITY PER DELIVERY LOT FOR EACH MODEL

12.2.4 INSPECTION METHOD

A SAMPLING INSPECTION SHALL BE MADE ACCORDING TO THE FOLLOWING PROVISIONS TO JUDGE THE ACCEPTABILITY

(a)APPLICABLE STANDARD :

MIL-STD-105E

NORMAL INSPECTION, SINGLE SAMPLING

Level II

(b)AQL : MAJOR DEFECT : AQL 0.65

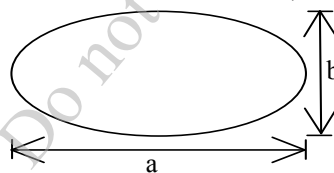
MINOR DEFECT : AQL 1.0

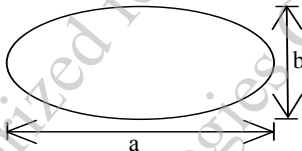
12.3 INSPECTION STANDARDS

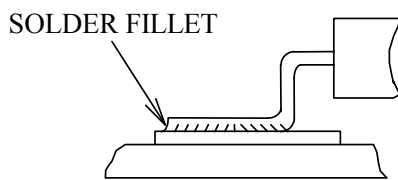
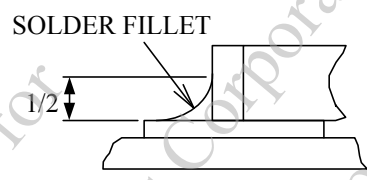
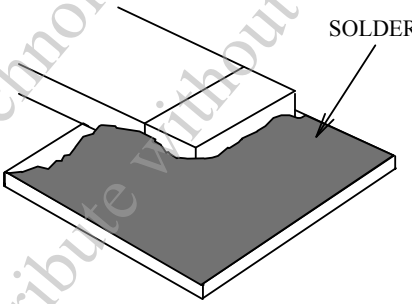
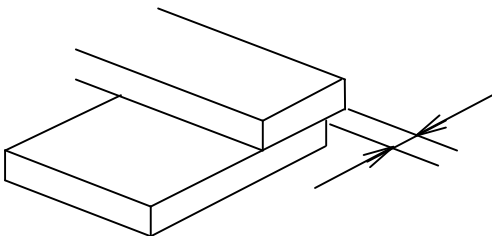
12.3.1 VISUAL DEFECTS CLASSIFICATION

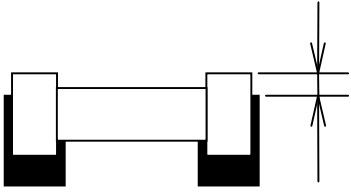
TYPE OF DEFECT	INSPECTION ITEM	DEFECT FEATURE	AQL
MAJOR DEFECT	1.DISPLAY ON	• DEFECT TO MISS SPECIFIED DISPLAY FUNCTION, FOR ALL AND SPECIFIED DOTS - EX: DISCONNECTION, SHORT CIRCUIT ETC	0.65
	2.BACKLIGHT	• NO LIGHT • FLICKERING AND OTHER ABNORMAL ILLUMINATION	
	3.DIMENSIONS	• SUBJECT TO INDIVIDUAL ACCEPTANCE SPECIFICATIONS	
MINOR DEFECT	1.DISPLAY ZONE	• BLACK/WHITE SPOT • BUBBLES ON POLARIZER • NEWTON RING • BLACK/WHITE LINE • 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	

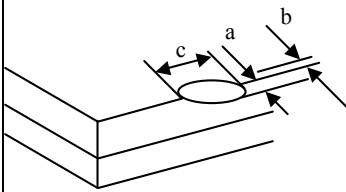
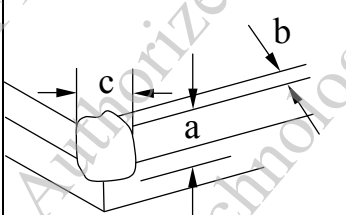
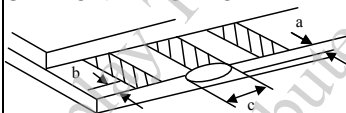
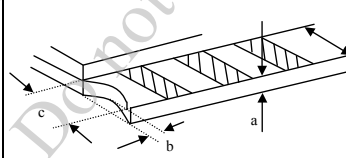
12.3.2 MODULE DEFECTS CLASSIFICATION

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) <table><tr><th>ITEMS</th><th>ACCEPTABLE COUNT</th></tr><tr><td>BRIGHT DOT</td><td>$N \leq 3$</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. 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	$N \leq 3$	DARK DOT	$N \leq 4$	TOTAL BRIGHT AND DARK DOTS	$N \leq 5$				
ITEMS	ACCEPTABLE COUNT													
BRIGHT DOT	$N \leq 3$													
DARK DOT	$N \leq 4$													
TOTAL BRIGHT AND DARK DOTS	$N \leq 5$													
4	FOREIGN BLACK/WHITE/ BRIGHT LINE/ SCRATCH OF VIEWING AREA	<table><tr><th>LENGTH : L</th><th>WIDTH : W</th><th>PERMISSIBLE NO.</th></tr><tr><td>$L \leq 1.0$</td><td>$W \leq 0.05$</td><td>IGNORE</td></tr><tr><td>$1.0 < L \leq 10$</td><td>$0.05 < W \leq 0.1$</td><td>4</td></tr><tr><td>$10 < L$</td><td>$0.1 < W$</td><td>NONE</td></tr></table> WIDTH : W mm, LENGTH : L mm	LENGTH : L	WIDTH : W	PERMISSIBLE NO.	$L \leq 1.0$	$W \leq 0.05$	IGNORE	$1.0 < L \leq 10$	$0.05 < W \leq 0.1$	4	$10 < L$	$0.1 < W$	NONE
LENGTH : L	WIDTH : W	PERMISSIBLE NO.												
$L \leq 1.0$	$W \leq 0.05$	IGNORE												
$1.0 < L \leq 10$	$0.05 < W \leq 0.1$	4												
$10 < L$	$0.1 < W$	NONE												
5	FOREIGN MATTER \ BLACK SPOTS \ WHITE SPOTS \ DENT (INCLUDING LIGHT LEAKAGE DUE TO POLARIZING PLATES PINHOLES, ETC.)	<table><tr><th>AVERAGE DIAMETER (mm): D</th><th>NUMBER OF PIECES PERMITTED</th></tr><tr><td>$D \leq 0.15$</td><td>IGNORE</td></tr><tr><td>$0.15 < D \leq 0.5$</td><td>4</td></tr><tr><td>$0.5 < D$</td><td>NONE</td></tr></table> NOTE : DIAMETER $D=(a+b)/2$ 	AVERAGE DIAMETER (mm): D	NUMBER OF PIECES PERMITTED	$D \leq 0.15$	IGNORE	$0.15 < D \leq 0.5$	4	$0.5 < D$	NONE				
AVERAGE DIAMETER (mm): D	NUMBER OF PIECES PERMITTED													
$D \leq 0.15$	IGNORE													
$0.15 < D \leq 0.5$	4													
$0.5 < D$	NONE													

NO.	ITEM	CRITERIA																				
6	BUBBLES OF POLARIZER /DIRT/CF FAIL /SURFACE STAINS	<table><tr><td></td><td>AVERAGE DIAMETER (mm) : D</td><td>NUMBER OF PIECES PERMITTED</td></tr><tr><td rowspan="3">BUBBLE ON THE POLARIZER</td><td>$D \leq 0.15$</td><td>LGNORE</td></tr><tr><td>$0.15 < D \leq 0.5$</td><td>$N \leq 4$</td></tr><tr><td>$0.5 < D$</td><td>NONE</td></tr><tr><td rowspan="2">SURFACE STAINS</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 rowspan="2">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></table>		AVERAGE DIAMETER (mm) : D	NUMBER OF PIECES PERMITTED	BUBBLE ON THE POLARIZER	$D \leq 0.15$	LGNORE	$0.15 < D \leq 0.5$	$N \leq 4$	$0.5 < D$	NONE	SURFACE STAINS	$D < 0.1$	IGNORE	$0.1 < D \leq 0.3$	$N \leq 3$	CF FAIL / SPOT	$D < 0.1$	IGNORE	$0.1 < D \leq 0.3$	$N \leq 3$
			AVERAGE DIAMETER (mm) : D	NUMBER OF PIECES PERMITTED																		
		BUBBLE ON THE POLARIZER	$D \leq 0.15$	LGNORE																		
			$0.15 < D \leq 0.5$	$N \leq 4$																		
			$0.5 < D$	NONE																		
		SURFACE STAINS	$D < 0.1$	IGNORE																		
			$0.1 < D \leq 0.3$	$N \leq 3$																		
		CF FAIL / SPOT	$D < 0.1$	IGNORE																		
			$0.1 < D \leq 0.3$	$N \leq 3$																		
		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																				
																						
7	LINE DEFECT ON DISPLAY	OBVIOUS VERTICAL OR HORIZONTAL LINE DEFECT IS NOT ALLOWED																				
8	MURA ON DISPLAY	IT'S OK IF MURA IS SLIGHT VISIBLE THROUGH 5% ND FILTER																				
9	UNEVEN COLOR SPREAD, COLORATION	(1)TO BE DETERMINED BASED UPON THE STANDARD SAMPLE.																				
10	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.																				
11	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.																				

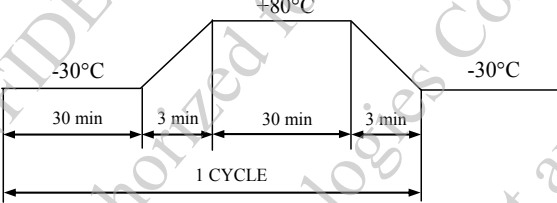
NO.	ITEM	CRITERIA
12	SOLDERING	(1) NO SOLDERING FOUND ON THE SPECIFIED PLACE (2) INSUFFICIENT SOLDER (a) LSI, IC A POOR WETTING OF SOLDER IS BETWEEN LOWER BEND OR "HEEL" OF LEAD AND PAD  (b) CHIP COMPONENT - SOLDER IS LESS THAN 50% OF SIDES AND FRONT FACE WETTING  - SOLDER WETS 3 SIDES OF TERMINAL, BUT LESS THAN 25% OF SIDES AND FRONT SURFACE AREA ARE COVERED  (3) PARTS ALIGNMENT (a) LSI, IC LEAD WIDTH IS MORE THAN 50% BEYOND PAD OUTLINE 

NO.	ITEM	CRITERIA
12	SOLDERING	(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.
13	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.
14	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 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.

NO.	ITEM	CRITERIA									
15	CRACKED GLASS	THE LCD WITH EXTENSIVE CRACK IS NOT ACCEPTABLE									
		GENERAL GLASS CHIP :  <table><tr><th>a</th><th>b</th><th>c</th></tr><tr><td>$\leq t/2$</td><td>< VIEWING AREA</td><td>$\leq 1/8X$</td></tr><tr><td>$t/2 > , \leq 2t$</td><td>$\leq W/2$</td><td>$\leq 1/8X$</td></tr></table> *W=DISTANCE BETWEEN SEALANT AREA AND LCD PANEL EDGE X = LCD SIDE LENGTH t = GLASS THICKNESS	a	b	c	$\leq t/2$	< VIEWING AREA	$\leq 1/8X$	$t/2 > , \leq 2t$	$\leq W/2$	$\leq 1/8X$
		a	b	c							
		$\leq t/2$	< VIEWING AREA	$\leq 1/8X$							
		$t/2 > , \leq 2t$	$\leq W/2$	$\leq 1/8X$							
CORNER PART :  <table><tr><th>a</th><th>b</th><th>c</th></tr><tr><td>$\leq t/2$</td><td>< VIEWING AREA</td><td>$\leq 1/8X$</td></tr><tr><td>$> t/2 , \leq 2t$</td><td>$\leq W/2$</td><td>$\leq 1/8X$</td></tr></table> *W=DISTANCE BETWEEN SEALANT AREA AND LCD PANEL EDGE X = LCD SIDE LENGTH t = GLASS THICKNESS	a	b	c	$\leq t/2$	< VIEWING AREA	$\leq 1/8X$	$> t/2 , \leq 2t$	$\leq W/2$	$\leq 1/8X$		
a	b	c									
$\leq t/2$	< VIEWING AREA	$\leq 1/8X$									
$> t/2 , \leq 2t$	$\leq W/2$	$\leq 1/8X$									
CHIP ON ELECTRODE PAD  <table><tr><th>a</th><th>b</th><th>c</th></tr><tr><td>$\leq t$</td><td>$\leq 0.5\text{mm}$</td><td>$\leq 1/8X$</td></tr></table> * X=LCD SIDE WIDTH t=GLASS THICKNESS	a	b	c	$\leq t$	$\leq 0.5\text{mm}$	$\leq 1/8X$					
a	b	c									
$\leq t$	$\leq 0.5\text{mm}$	$\leq 1/8X$									
 <table><tr><th>a</th><th>b</th><th>c</th></tr><tr><td>$\leq t$</td><td>$\leq 1/8X$</td><td>$\leq L$</td></tr></table> *X=LCD SIDE WIDTH t = GLASS THICKNESS L=ELECTRODE PAD LENGTH ①IF GLASS CHIPPING THE ITO TERMINAL, OVER 2/3 OF THE ITO MUST REMAIN AND BE, INSPECTED ACCORDING TO ELECTRODE TERMINAL SPECIFICATIONS ②IF THE PRODUCT WILL BE HEAT SEALED BY THE CUSTOMER, THE ALIGNMENT MARK MUST NOT BE DAMAGED	a	b	c	$\leq t$	$\leq 1/8X$	$\leq L$					
a	b	c									
$\leq t$	$\leq 1/8X$	$\leq L$									

12.4 RELIABILITY TEST

12.4.1 STANDARD SPECIFICATIONS FOR RELIABILITY OF LCD MODULE

NO.	ITEM	DESCRIPTION
1	HIGH TEMPERATURE OPERATION	THE SAMPLE SHOULD BE ALLOWED TO STAND AT +80°C FOR 240 HRS
2	LOW TEMPERATURE OPERATION	THE SAMPLE SHOULD BE ALLOWED TO STAND AT -30°C FOR 240 HRS
3	HIGH TEMPERATURE STORAGE	THE SAMPLE SHOULD BE ALLOWED TO STAND AT +80°C FOR 240 HRS
4	LOW TEMPERATURE 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 $\pm 12KV$ CONTACT DISCHARGE $\pm 8KV$ (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.

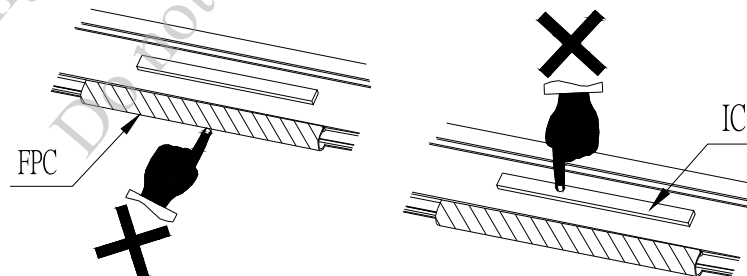
12.5 TESTING CONDITIONS AND INSPECTION CRITERIA

FOR THE FINAL TEST THE TESTING SAMPLE MUST BE STORED AT ROOM TEMPERATURE FOR 24 HOURS, AFTER THE TESTS LISTED IN TABLE 12.5, 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

12.6 OPERATION

- 12.6.1 DO NOT CONNECT OR DISCONNECT MODULES TO OR FROM THE MAIN SYSTEM WHILE POWER IS BEING SUPPLIED .
- 12.6.2 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.
- 12.6.3 ADJUST THE LC DRIVING VOLTAGE TO OBTAIN THE OPTIMUM CONTRAST .
- 12.6.4 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.
- 12.6.5 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!



12.7 NOTICE

- 12.7.1 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 .
- 12.7.2 DO NOT DISASSEMBLE . EDT SHALL NOT BE HELD RESPONSIBLE IF THE MODULE IS DISASSEMBLED AND UPON THE REASSEMBLY THE MODULE FAILED.
- 12.7.3 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.
- 12.7.4 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.
- 12.7.5 DON'T GIVE EXTERNAL SHOCK.
- 12.7.6 DON'T APPLY EXCESSIVE FORCE ON THE SURFACE.
- 12.7.7 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
- 12.7.8 DON'T OPERATE IT ABOVE THE ABSOLUTE MAXIMUM RATING.
- 12.7.9 STORAGE IN A CLEAN ENVIRONMENT, FREE FROM DUST, ACTIVE GAS, AND SOLVENT.
- 12.7.10 STORE WITHOUT ANY PHYSICAL LOAD.
- 12.7.11 REWIRING: NO MORE THAN 3 TIMES.