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EMERGING DISPLAY

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TECHNOLOGIES CORPORATION

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VERSION : 1

CUSTOMER

ACCEPTANCE

SPECIFICATIONS

MODEL NO.:

ET035009DH6

(RoHS)

FOR MESSRS :

CUSTOMER'S APPROVAL

DATE :

BY :

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SUMMARY

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1. GENERAL SPECIFICATIONS

1.1 APPLICATION NOTES FOR CONTROLLER/DRIVER PLEASE REFER TO :

H X 8 2 3 8 - A

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)

2. MECHANICAL SPECIFICATIONS

(1) DISPLAY SIZE (inch)	-----	3.5"
(2) NUMBER OF DOTS	-----	320W * (RGB) * 240H DOTS
(3) MODULE SIZE	-----	76.8W * 63.8H * 4.4(D) mm (WITHOUT FPC)
(4) EFFECTIVE AREA	-----	72.2W*54.76H mm (T/P)
(5) ACTIVE AREA	-----	70.08W * 52.56H mm (LCD) 70.8W * 53.26H mm (T/P)
(6) DOT SIZE	-----	0.073W * 0.219H mm
(7) PIXEL SIZE	-----	0.219W * 0.219H mm
(8) LCD TYPE	-----	TFT , TRANSMISSIVE
(9) COLOR	-----	262K (24BIT)
(10) VIEWING DIRECTION	-----	6 O'CLOCK
(11) BACK LIGHT	-----	LED , COLOR : WHITE

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3. ABSOLUTE MAXIMUM RATINGS

3.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS.

PARAMETER	SYMBOL	MIN.	MAX.	UNIT	REMARK
POWER VOLTAGE	VDD	VSS-0.3	5.0	V	—
	VCC	-0.3	4.0	V	—
POWER DISSIPATION	PD	—	540	mW	—
FORWARD CURRENT	IF	—	25	mA	—
REVERSE VOLTAGE	VR	—	30	V	—

3.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS.

I T E M	OPERATING		STORAGE		REMARK
	MIN.	MAX.	MIN.	MAX.	
AMBIENT TEMPERATURE	-10°C	60°C	-20°C	70°C	NOTE (1), (2)
HUMIDITY	NOTE (3)		NOTE (3)		WITHOUT CONDENSATION
VIBRATION	—	2.45m/s ² (0.25G)	—	11.76m/s ² (1.2G)	5~20Hz, 1HR 20~500Hz(20Hz), 1HR 20~500Hz(500Hz), 1HR X,Y,Z,TOTAL 3HR
SHOCK	—	29.4m/s ² (3G)	—	490m/s ² (50G)	10 m SECONDS XYZ DIRECTIONS 1 TIME EACH
CORROSIVE GAS	NOT ACCEPTABLE		NOT ACCEPTABLE		

NOTE (1) : Ta AT -20°C : 48HR MAX.

70°C : 168HR 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).

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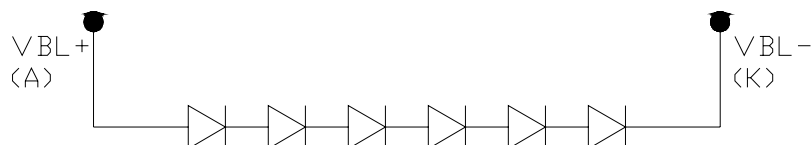
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4. ELECTRICAL CHARACTERISTICS

Ta = 25 °C

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
DIGITAL POWER SUPPLY	VCC	—	2.5	3.3	3.6	V	
ANALOG POWER SUPPLY	VDD	—	2.5	3.3	3.6	V	
DIGITAL OPERATING CURRENT	ICC	—	—	(1)	(2)	mA	
ANALOG OPERATING CURRENT	IDD	—	—	(10)	(15)	mA	
LOGIC HIGH OUTPUT VOLTAGE	VOH	IOUT=-100μA	0.9*VCC	—	VCC	V	
LOGIC LOW OUTPUT VOLTAGE	VOL	IOUT=100μA	0	—	0.1*VCC	V	
LOGIC HIGH INPUT VOLTAGE	VIH	H LEVEL	0.8*VCC	—	VCC	V	
LOGIC LOW INPUT VOLTAGE	VIL	L LEVEL	0	—	0.2*VCC	V	
FORWARD VOLTAGE	VF	IF=20mA	19.2	20.4	21.6	V	NOET(1)
LED LIFE TIME		—	30k	40k	—	hr	

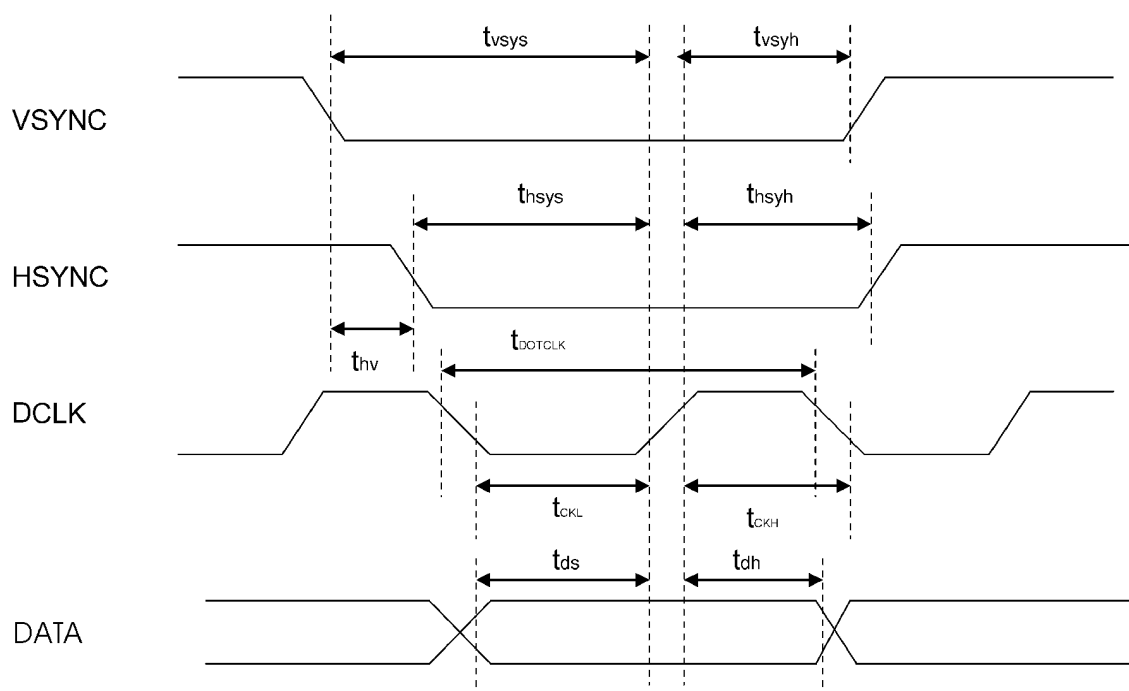
NOET(1) : INTERNAL CIRCUIT DIAGRAM OF BACKLIGHT



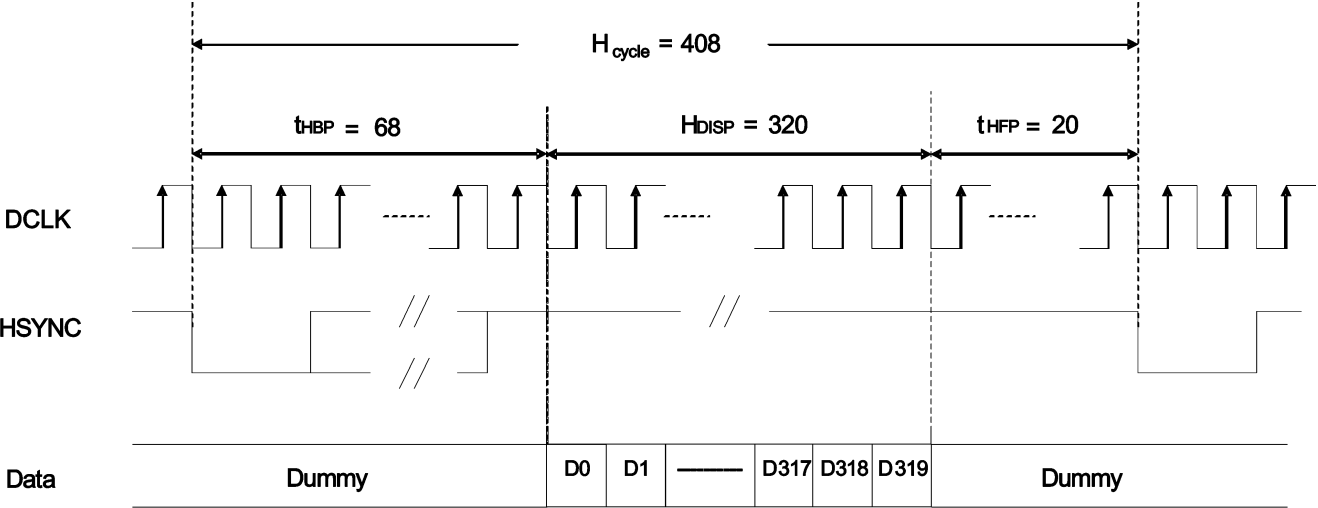
5. TIMING CHART

5.1 DIGITAL PARALLEL RGB INTERFACE

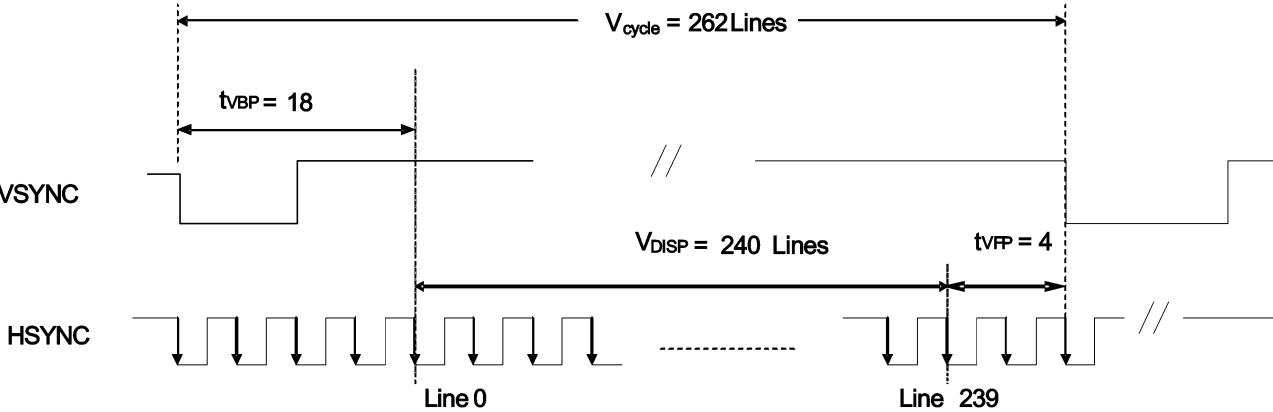
CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNIT
DCLK FREQUENCY	fDCLK	—	6.5	10	MHz
DCLK PERIOD	tDCLK	100	154	—	ns
VERTICAL SYNC SETUP TIME	tvsys	20	—	—	ns
VERTICAL SYNC HOLD TIME	tvsyh	20	—	—	ns
HORIZONTAL SYNC SETUP TIME	thsys	20	—	—	ns
HORIZONTAL SYNC HOLD TIME	thsyh	20	—	—	ns
PHASE DIFFERENCE OF SYNC SIGNAL FALLING EDGE	thv	1	—	240	tDCLK
DCLK LOW PERIOD	tCKL	50	—	—	ns
DCLK HIGH PERIOD	tCKH	50	—	—	ns
DATA SETUP TIME	tds	12	—	—	ns
DATA HOLD TIME	tdh	12	—	—	ns
RESET PULSE WIDTH	tRES	10	—	—	μs



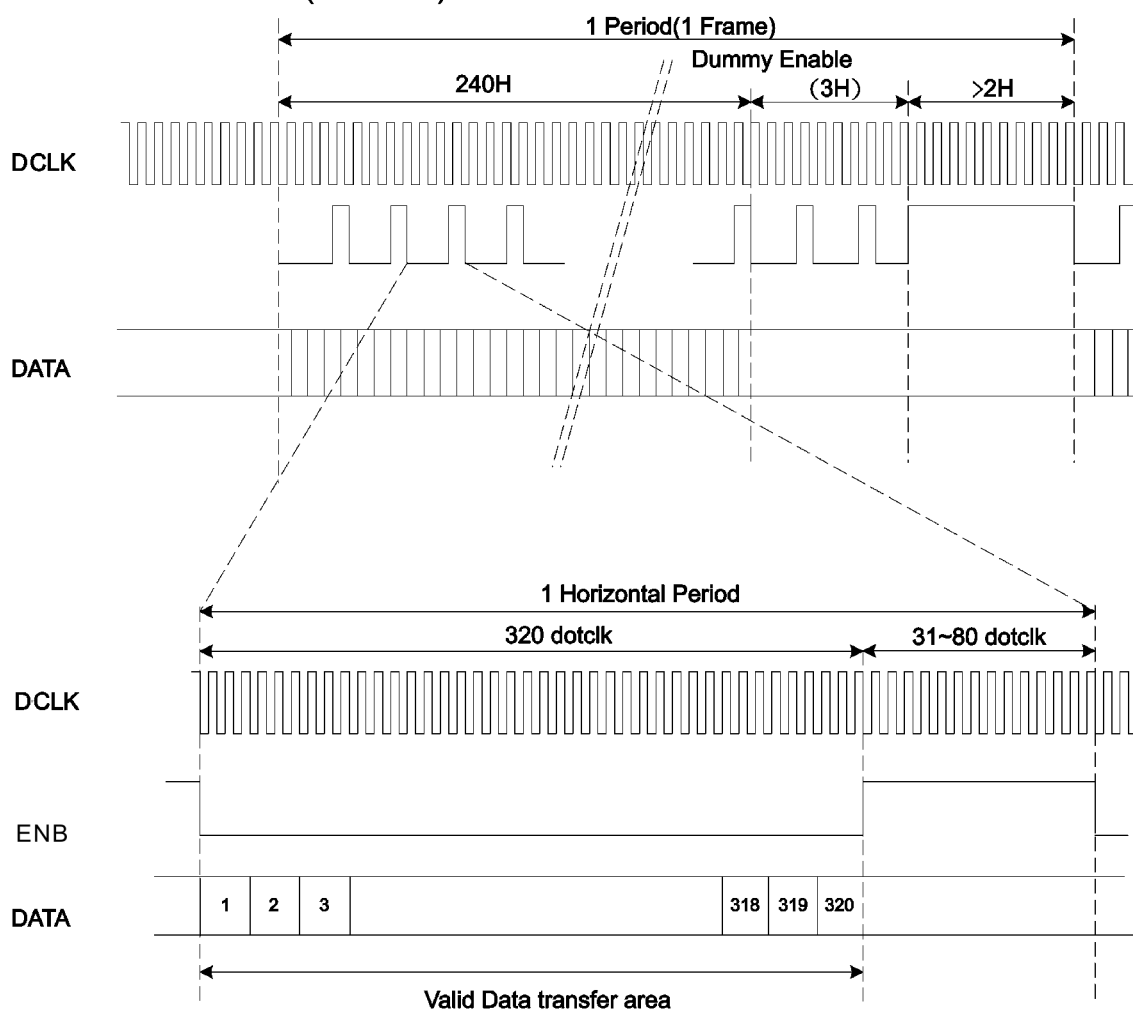
5.2 PARALLEL RGB INTERFACE (SYNC MODE)



a) Horizontal Data Transaction Timing



b) Vertical Data Transaction Timing

Parallel RGB Interface (DE Mode)


CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	
DCLK FREQUENCY	fDCLK	—	6.5	10	MHz
DCLK PERIOD	tDCLK	100	154	—	ns
HORIZONTAL FREQUENCY (LINE)	fH	—	14.9	22.35	KHz
VERTICAL FREQUENCY (REFRESH)	fV	—	60	90	Hz
HORIZONTAL BACK PORCH	tHBP	—	68	—	tDCLK
HORIZONTAL FRONT PORCH	tHFP	—	20	—	tDCLK
HORIZONTAL DATA START POINT	tHBP	—	68	—	tDCLK
HORIZONTAL BLANKING PERIOD	tHBP + tHFP	—	88	—	tDCLK
HORIZONTAL DISPLAY AREA	HDISP	—	320	—	tDCLK
HORIZONTAL CYCLE	Hcycle	—	408	450	tDCLK
VERTICAL BACK PORCH	tVBP	—	18	—	Lines
VERTICAL FRONT PORCH	tVFP	—	4	—	Lines
VERTICAL DATA START POINT	tVBP	—	18	—	Lines
VERTICAL BLANKING PERIOD	tVBP + tVFP	—	22	—	Lines
VERTICAL DISPLAY AREA	NTSC	VDISP	—	240	Lines
	PAL		—	280(PALM=0)	
	PAL		—	280(PALM=1)	
VERTICAL CYCLE	NTSC	Vcycle	—	262	Lines
	PAL		—	313	

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6 . OPTICAL CHARACTERISTICS (NOTE1)

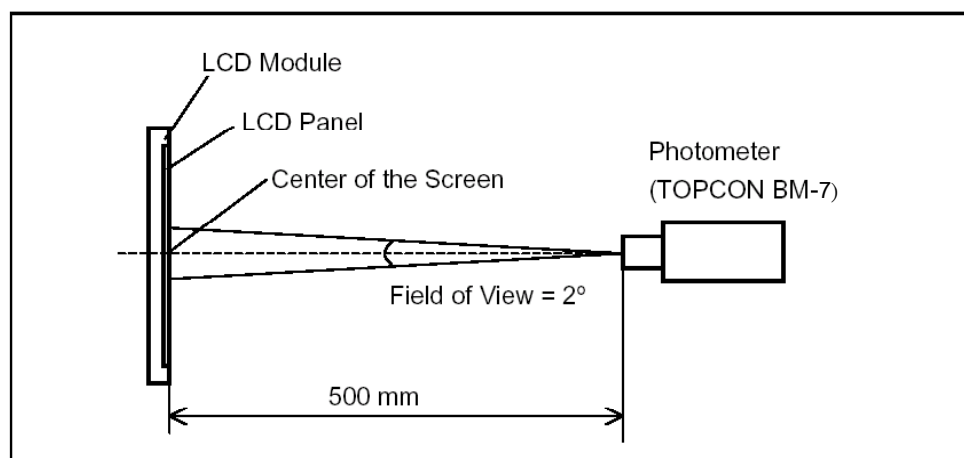
6.1 OPTICAL CHARACTERISTICS

 $T_a = 25 \pm 2^\circ\text{C}$

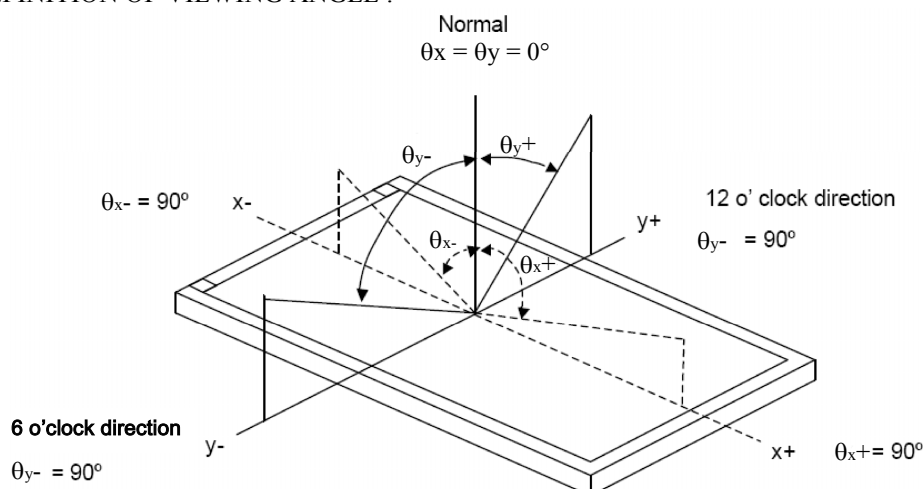
I T E M		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT	REMARK
VIEWING ANGLE		θ_{y+}	$CR \geq 10$	$\theta_x=0^\circ$	(50)	(55)	—	deg.	(2) , (3)
		θ_{y-}			(70)	(75)	—		
		θ_{x+}		$\theta_y=0^\circ$	(70)	(75)	—		
		θ_{x-}			(70)	(75)	—		
CONTRAST RATIO		CR	$\theta_x=0^\circ$, $\theta_y=0^\circ$		(300)	(400)	—	—	(3)
RESPONSE TIME		tr(rise)	$\theta_x=0^\circ$, $\theta_y=0^\circ$		—	15	20	msec	(4)
		tf(fall)			—	35	50		
THE BRIGHTNESS OF MODULE		B	$\theta_x=0^\circ$, $\theta_y=0^\circ$ IF=20mA		(300)	(400)	—	cd/m ²	(5)
COLOR OF CIE COORDINATE	WHITE	X	$\theta_x=0^\circ$, $\theta_y=0^\circ$ IF=20mA NTSC : (60)%		(0.236)	(0.286)	(0.336)	—	(6)
		Y			(0.261)	(0.311)	(0.361)		
	RED	X			(0.562)	(0.612)	(0.662)	—	
		Y			(0.305)	(0.355)	(0.405)		
	GREEN	X			(0.262)	(0.312)	(0.362)	—	
		Y			(0.533)	(0.583)	(0.633)		
	BLUE	X			(0.090)	(0.140)	(0.190)	—	
		Y			(0.020)	(0.070)	(0.120)		
THE UNIFORMITY OF BRIGHTNESS		—	—		(70)	—	—	%	—

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 2° AT A DISTANCE OF 50cm AND NORMAL DIRECTION.



NOTE (2) : DEFINITION OF VIEWING ANGLE :

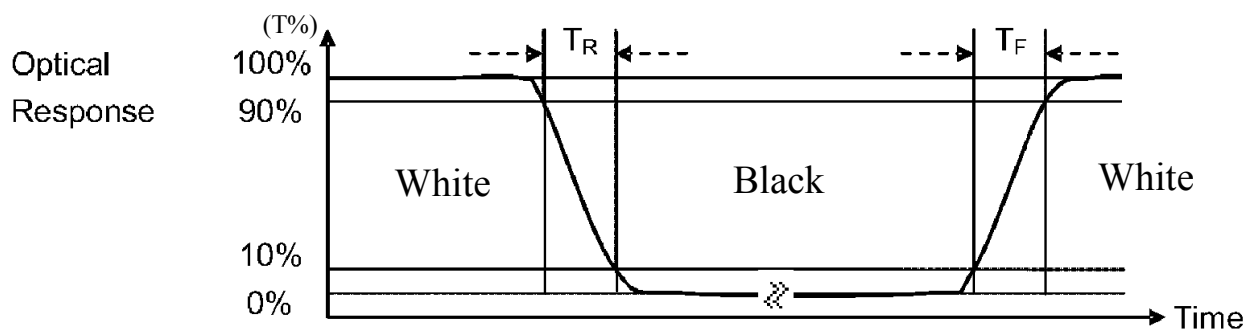


NOTE (3) : DEFINITION OF CONTRAST RATIO :

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

NOTE (4) : DEFINITION OF RESPONSE TIME : TR AND TF

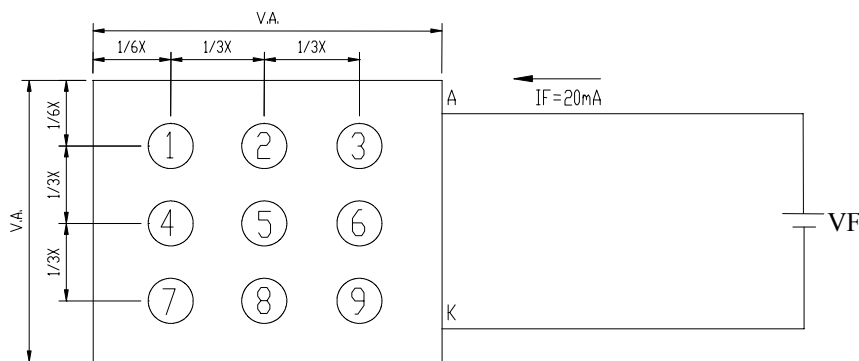
THE FIGURE BVELOW IS THE OUTPUT SIGNAL OF THE PHOTO DETECTOR.



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

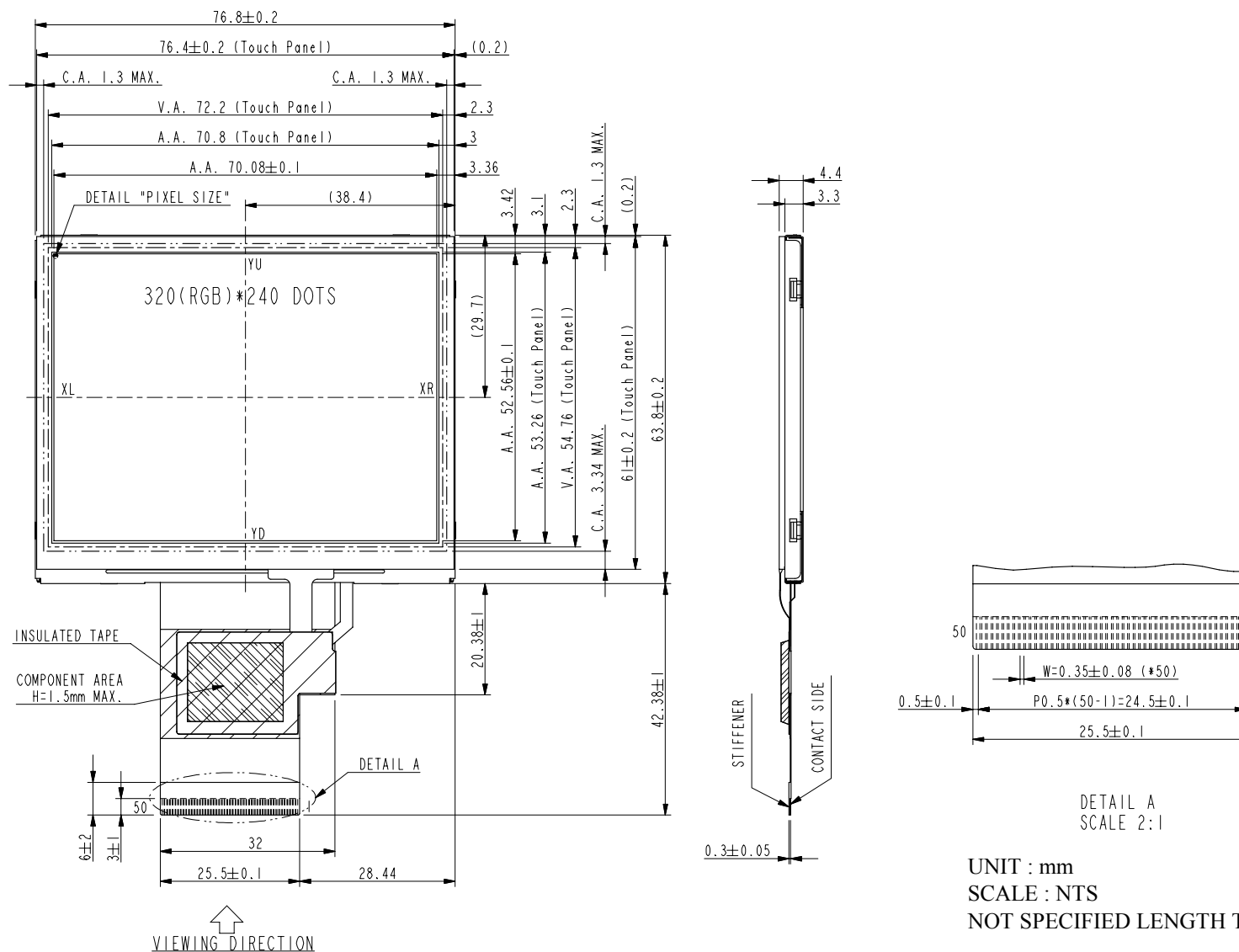


UNIT : mm

6.3 THE CALCULATING METHOD OF UNIFORMITY

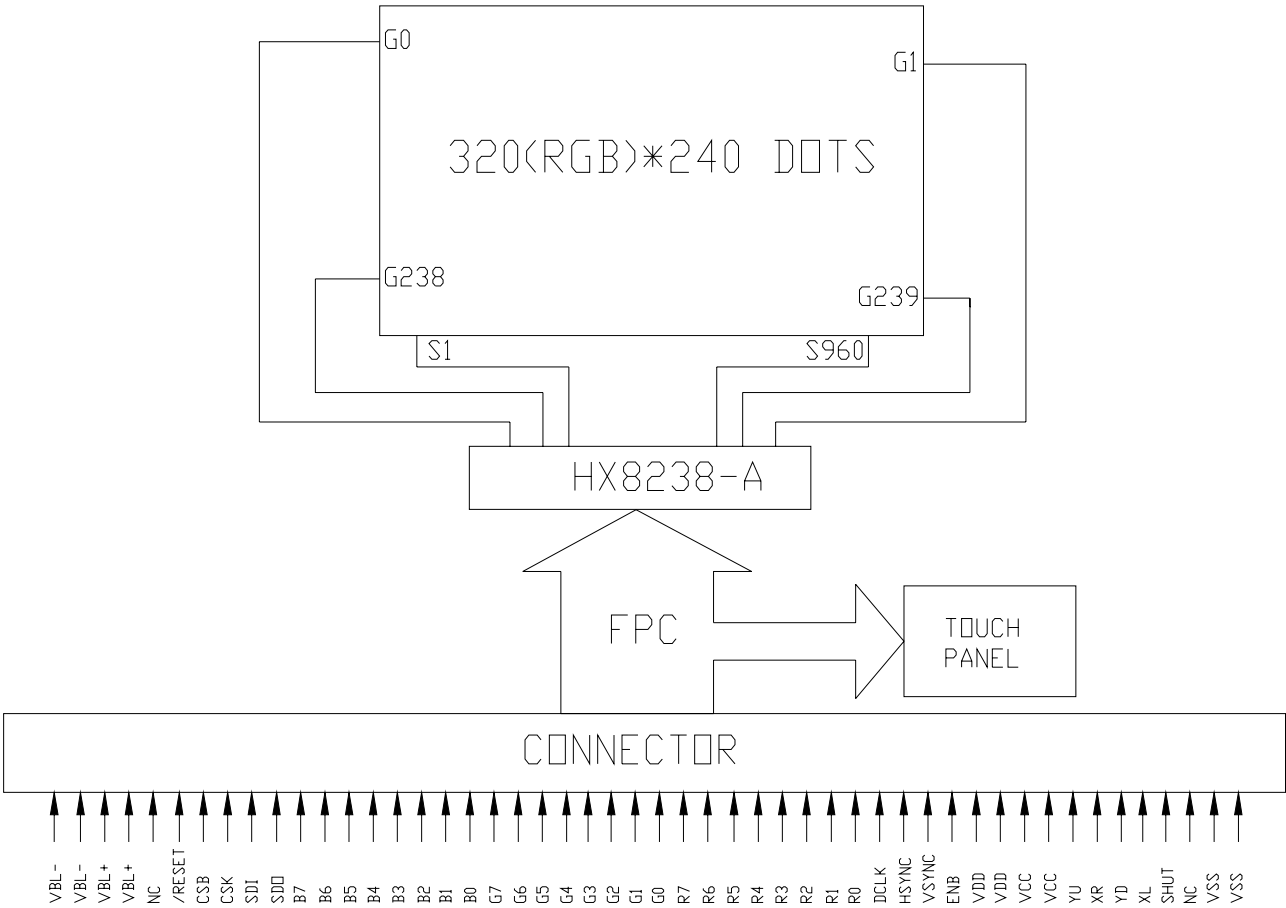
$$\text{UNIFORMITY} : \left[1 - \frac{\text{MAXIMUN BRIGHTNESS} - \text{MINIMUN BRIGHTNESS}}{\text{AVERAGE BRIGHTNESS}} \right] \times 100\%$$

7. OUTLINE DIMENSIONS



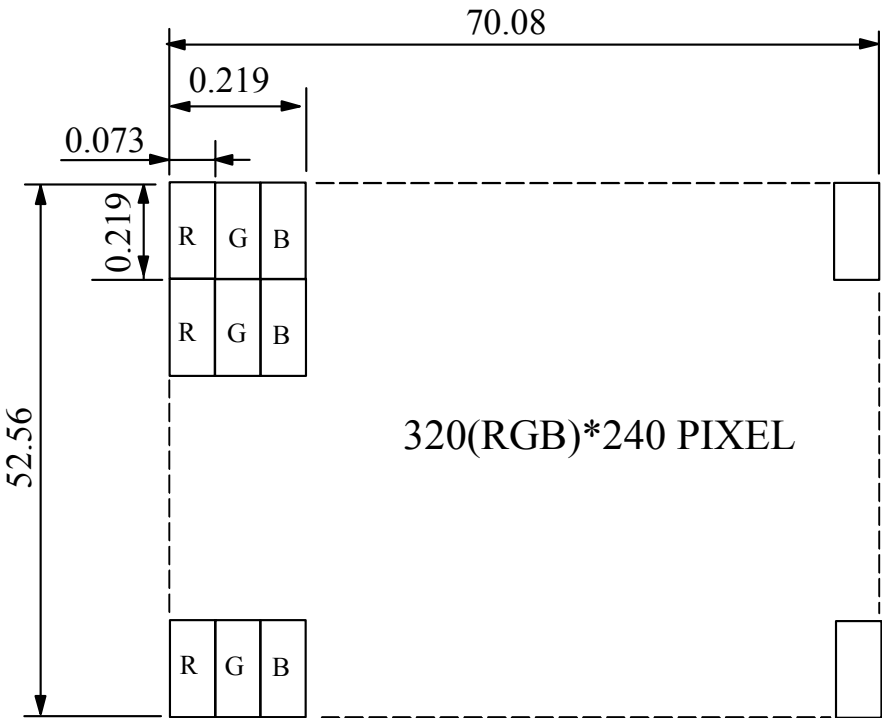
UNIT : mm
SCALE : NTS
NOT SPECIFIED LENGTH TOLERANCE IS ± 0.5

8. BLOCK DIMENSION



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9. DETAIL DRAWING OF DOT MATRIX



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

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10. INTERFACE SIGNALS

PIN NO	SYMBOL	I/O	FUNCTION
1	VBL-	P	BACKLIGHT LED GROUND (K)
2	VBL-	P	BACKLIGHT LED GROUND (K)
3	VBL+	P	BACKLIGHT LED POWER (A)
4	VBL+	P	BACKLIGHT LED POWER (A)
5	NC	—	NOT USE
6	/RESET	I	HARDWARE RESET
7	CSB	I	SPI INTERFACE CHIP SELECT BAR
8	SCK	I	SPI INTERFACE DATA CLOCK
9	SDI	I	SPI INTERFACE DATA (INPUT)
10	SDO	O	SPI INTERFACE DATA(OUTPUT)
11	B7	I	BLUE DATA BIT 7
12	B6	I	BLUE DATA BIT 6
13	B5	I	BLUE DATA BIT 5
14	B4	I	BLUE DATA BIT 4
15	B3	I	BLUE DATA BIT 3
16	B2	I	BLUE DATA BIT 2
17	B1	I	BLUE DATA BIT 1
18	B0	I	BLUE DATA BIT 0
19	G7	I	GREEN DATA BIT 7
20	G6	I	GREEN DATA BIT 6
21	G5	I	GREEN DATA BIT 5
22	G4	I	GREEN DATA BIT 4
23	G3	I	GREEN DATA BIT 3
24	G2	I	GREEN DATA BIT 2
25	G1	I	GREEN DATA BIT 1
26	G0	I	GREEN DATA BIT 0
27	R7	I	RED DATA BIT 7
28	R6	I	RED DATA BIT 6
29	R5	I	RED DATA BIT 5
30	R4	I	RED DATA BIT 4
31	R3	I	RED DATA BIT 3
32	R2	I	RED DATA BIT 2
33	R1	I	RED DATA BIT 1
34	R0	I	RED DATA BIT 0

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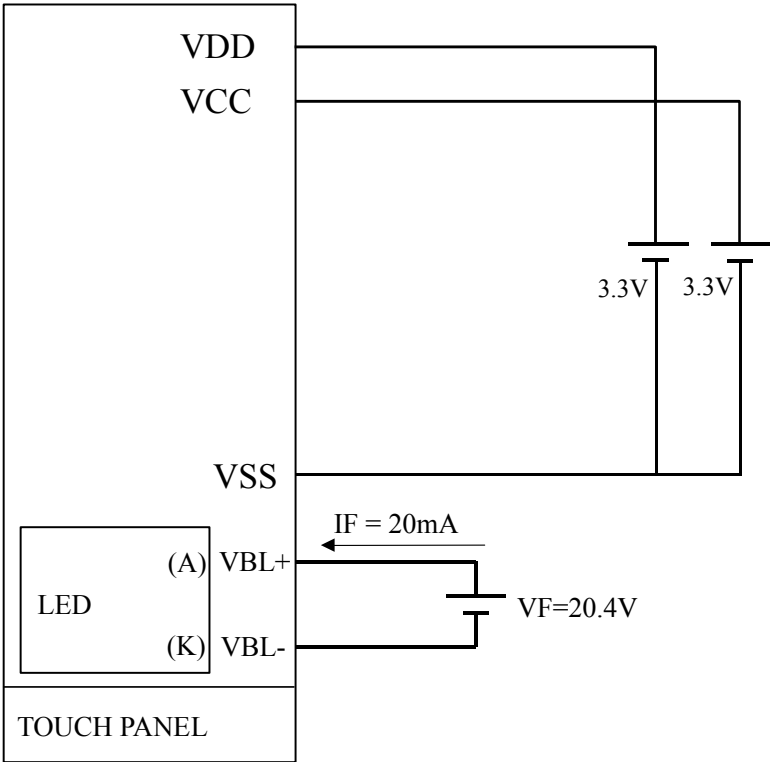
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PIN NO	SYMBOL	I/O	FUNCTION	
35	DCLK	I	DOT DATA COLCK	
36	HSYNC	I	HORIZONTAL SYNC INPUT	
37	VSYNC	I	VERTICAL SYNC INPUT	
38	ENB	I	DATA ENABLE INPUT	
39	VDD	P	ANALOG POWER	
40	VDD	P	ANALOG POWER	
41	VCC	P	DIGITAL POWER	
42	VCC	P	DIGITAL POWER	
43	YU	I	TOP PANEL	TOUCH PANEL INTERFACE SIGNALS
44	XR	I	RIGHT PANEL	
45	YD	I	BOTTOM PANEL	
46	XL	I	LEFT PANEL	
47	SHUT	I	DISPLAY SHUT DOWN PIN TO PUT THE DRIVER INTO SLEEP MODE. CONNECT TO VCC FOR SLEEP MODE. CONNECT TO VSS FOR NORMAL OPERATING MODE.	
48	NC	—	NOT USE	
49	VSS	P	GROUND	
50	VSS	P	GROUND	

1 1 . POWER SUPPLY

1 1 .1 POWER SUPPLY FOR LCM



12. TOUCH PANEL SPECIFICATION

12.1 ELECTRICAL CHARACTERISTICS Ta = 25°C

ITEM	CONDITION	SPEC.	UNIT
LINEARITY	—	1.5	%
TERMINAL RESISTANCE	X AXIS	200 ~ 900	Ω
	Y AXIS	200 ~ 900	
INSULATION RESISTANCE	DC25V	20	M Ω

12.2 ABSOLUTE MAXIMUM RATINGS :

ITEM	MIN.	TYP.	MAX.
OPERATING TEMPERATURE (Top)	-10°C	—	60°C
STORAGE TEMPERATURE (Tst)	-20°C	—	+70°C
INPUT VOLTAGE (V)	—	5	—

12.3 PRECAUTIONS IN USE OF TOUCH PANEL

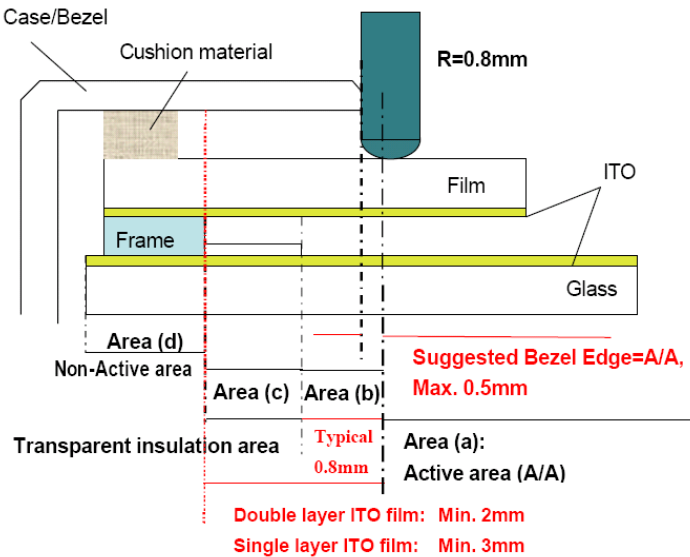
12.3.1 PURPOSE :

IN ORDER TO PREVENT ACCIDENTAL USE AND PERFORMANCE DETERIORATION, PLEASE KEEP THE FOLLOWING PRECAUTIONS AND INHIBITED POINTS.

12.3.2 ITEM AND ILLUSTRATION :

(1) STRUCTURE, AREA DEFINITION

THE STRUCTURE AND THE PERFORMANCE GUARANTEED AREA OF THIS TOUCH PANEL ARE DEFINED BELOW :



THE ABOVE FIGURE IS OUR DESIGN RULE OF TOUCH PANEL.
IF IT CANNOT MEET YOUR REQUIREMENT, PLEASE CONTACT WITH OUR ENGINEERS FOR FURTHER DISCUSSION.

ABOVE FIGURE ILLUSTRATES THE RECOMMENDED BEZEL AND CUSHION DESIGN. IN ORDER TO PREVENT UNUSUAL PERFORMANCE DEGRADATION AND MALFUNCTION OF A TOUCH PANEL, PLEASE CARRY OUT THE SET CASE DESIGNING AND A TOUCH PANEL ASSEMBLING METHOD AFTER SURELY CONSIDERING THE DEFINITION OF EACH AREA ILLUSTRATED IN ABOVE FIGURE.

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AREA(a) : ACTIVE AREA

THE ACTIVE AREA IS GUARANTEED THE POSITION DATA DETECTABLE PRECISION, OPERATION FORCE AND OTHER OPERATIONS. IT IS STRONGLY RECOMMENDED TO PLACE THE OPERATION BUTTON OR MENU KEYS WITHIN THE ACTIVE AREA. DUE TO STRUCTURE, THE ACTIVE AREA IS LESS DURABLE AT THE EDGE OR CLOSE TO THE EDGE.

AREA(b) : OPERATION NON-GUARANTEED AREA

THIS AREA DOES NOT GUARANTEE A TOUCH PANEL OPERATION AND ITS FUNCTION. WHEN THIS AREA IS PRESSED, TOUCH PANEL SHOWS DEGRADATION OF ITS PERFORMANCE AND DURABILITY SUCH AS A PEN SLIDING DURABILITY BECOMES ABOUT ONE-TENTH COMPARED WITH THE ACTIVE AREA (AREA-(A) AS GUARANTEED AREA) AND ITS OPERATION FORCE REQUIRES ABOUT DOUBLE. ABOUT 0.5 MM OUTSIDE FROM A BOUNDARY OF THE ACTIVE AREA CORRESPONDS TO THIS AREA.

AREA(c) : PRESSING PROHIBITION AREA

THE AREA WHICH FORBIDS PRESSING, BECAUSE AN EXCESSIVE LOAD IS APPLIED TO A TRANSPARENT ELECTRODE (ITO) AND A SERIOUS DAMAGE IS GIVEN TO A TOUCH PANEL FUNCTION BY PRESSING.

AREA(d) : NON-ACTIVE AREA

THE AREA DOES NOT ACTIVATE EVEN IF PRESSED.

(2) CAUTIONS FOR INSTALLING AND ASSEMBLING

(i) DO NOT GIVE EXCESSIVE STRAIN TO THE PRODUCT.

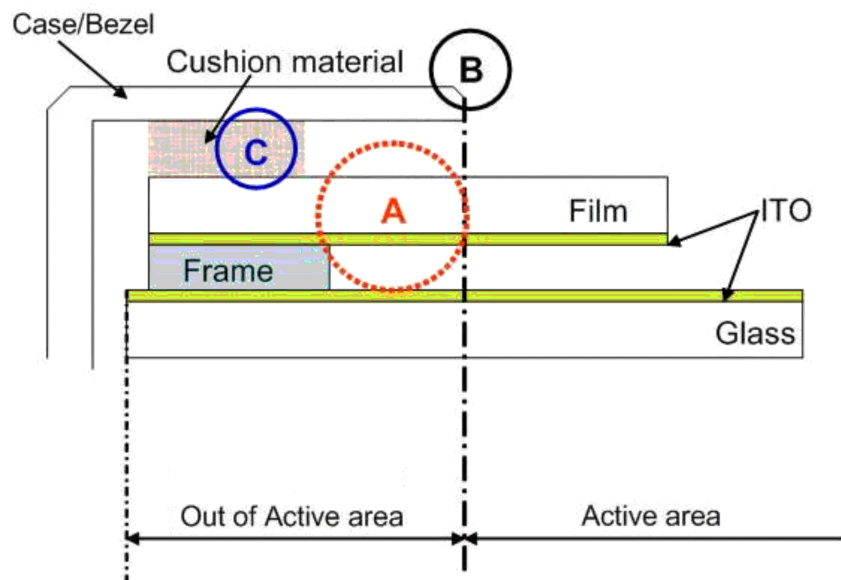
(ii) FLEXIBLE PATTERN CABLE IS CONNECTED TO THE BODY BY THERMAL PRESSURE METHOD. SO, DO NOT APPLY EXCESSIVE FORCES TO THE FLEXIBLE PATTERN. DO NOT ADD AN EXCESSIVE FORCE TO A FPC(FLEX TAIL) THAT MAKES PEELING OFF OF THE FPC FROM THE PRODUCT. DO NOT FIX, ADHERE OR MOUNT ANY ADDITIONAL GOODS ON THE FPC SUCH AS ADDITIONAL FILM/PLATE ON THE FPC, BECAUSE SUCH ADDITIONAL GOODS WILL APPLY A STRESS AT THE FPC BONDING AREA. IT MAY AFFECT THE CONDUCTIVITY OF FPC WITH TOUCH PANEL.

(iii) IN ORDER NOT TO APPLY LOAD ON THE DISPLAY, PROVIDE A CLEARANCE OF AT LEAST 0.3MM BETWEEN THE PRODUCT AND DISPLAY.

(iv) WE RECOMMEND THE DESIGN OF A CASE OR BEZEL SHOULD COVERS THE BOUNDARY OF THE ACTIVE AREA INSIDE IN ORDER TO PREVENT AN OPERATION AT OUTSIDE OF THE ACTIVE AREA WHICH CAN NOT GUARANTEE THE FUNCTION OR DURABILITY (REFER TO ITEM 5.1.2. STRUCTURE, AREA DEFINITION).

BEZEL'S EDGE PART MAY GUIDE THE PEN SLIDING ON THE SAME POSITION REPEATEDLY. IF THE BEZEL IS PLACED OUTSIDE OF THE ACTIVE AREA, IT MAY CAUSE THE DAMAGE OF THE ITO FILM.

- (v) PRESSING INSIDE OF BOUNDARY OF THE FRAME(PART (A) AS SHOWN IN BELOW) MAY CAUSES FAULT OPERATION, SO PLEASE DESIGN TO AVOID PRESSING OF TOUCH PANEL AT PART (A) SUCH AS HAVING GASKET/CUSHION AT PART (C). PARTICULARLY THE AREA (B) SHALL BE FREE FROM BURR. THE GASKET/CUSHION MATERIAL AT THE PART (C) SHOULD NOT BE EXCEEDED TO INSIDE OF THE BOUNDARY OF THE FRAME.



- (vi) TO PREVENT GIVING DISTORTION TO THE FILM OF THE PRODUCT AND PEELING OFF OF THE FILM FROM THE PRODUCT, DO NOT FIX THE FILM AND A SET CASE OR A SHOCK ABSORBING MATERIAL ADHERED TO A SET CASE BY ADHESION.
- (vii) WIPE OFF THE STAIN ON THE PRODUCT BY USING SOFT CLOTH MOISTENED WITH ETHANOL. TAKE CARE NOT TO ALLOW ETHANOL TO SOAK INTO THE JOINT OF UPPER FILM AND BOTTOM GLASS. IT MAY OTHERWISE CAUSE PEELING OR DEFECTIVE OPERATION. DO NOT USE ANY ORGANIC SOLVENT OR DETERGENT OTHER THAN ETHANOL.
- (viii) THE CORNERS OF THE PRODUCT ARE NOT CHAMFERED AND ARE SHARP. WHEN POSITIONING AND FIXING THE PRODUCT ON THE CASE, PROVIDE A ROUND PART ON THE CORNER OF THE CASE SO AS NOT TO APPLY LOAD ON THE CORNER OF THE TRANSPARENT TOUCH PANEL.
- (ix) DO NOT PRESS THE FILM OF THE PRODUCT WHEN THIS PRODUCT IS BUILT INTO A SET.

(3) CAUTIONS FOR OPERATION

- (i) OPERATE IT WITH A POLYACETAL PEN (TIP R0.8 OR OVER) OR A BELLY OF A FINGER WITHOUT APPLYING EXCESSIVE LOAD. NEVER USE ANY MECHANICAL PENCILS, BALL POINT PENS AND HARD FINGERTIPS WHOSE TIP IS HARD FOR INPUT, OTHERWISE MALFUNCTIONS MAY RESULT.

- (ii) THE INPUT POSITION MAY BE FLUCTUATED A LITTLE THROUGH LONG-TIME USE. IT IS DESIRABLE TO PROVIDE A ZERO-ADJUSTMENT FUNCTION BY USING A CIRCUIT AND SOFTWARE.
- (iii) OPERATION AT THE OUT OF ACTIVE AREA IS OUT OF OUR GUARANTEE. IT CAUSES A SERIOUS DAMAGE OF A TRANSPARENT ELECTRODE. DO NOT OPERATE AT THE OUT OF ACTIVE AREA.
- (iv) IN CASE OF CLEANING THE PART OF THE CASE BOUNDARY OF ACCOMPLISHED SET, USE A SOFT CLOTH WITH A FINGER BERRY OR A COTTON BUD. DO NOT CLEAN WITH A THING OTHER THAN THE FINGER SUCH AS HARD OR SHARP EDGES LIKE A FINGER NAIL ETC. ON THE CLOTH, BECAUSE IT CAUSE TRANSPARENT CONDUCTIVE FILM CRACKS. PLEASE ADVISE THIS PROHIBITION TO YOUR LAST CUSTOMERS.

12.4 DURABILITY

12.4.1 STYLUS HITTING :

ONE MILLION TIMES OR OVER
 NO DAMAGE ON FILM SURFACE
 PEN : R8 mm SILICON RUBBER
 LOAD : 250g
 FREQUENCY : 240 times/min
 MEASUREMENT POSITION:
 1 POINT OF TOUCH PANEL ACTIVE AREA
 REPEATED : OVER 1,000,000 TIMES

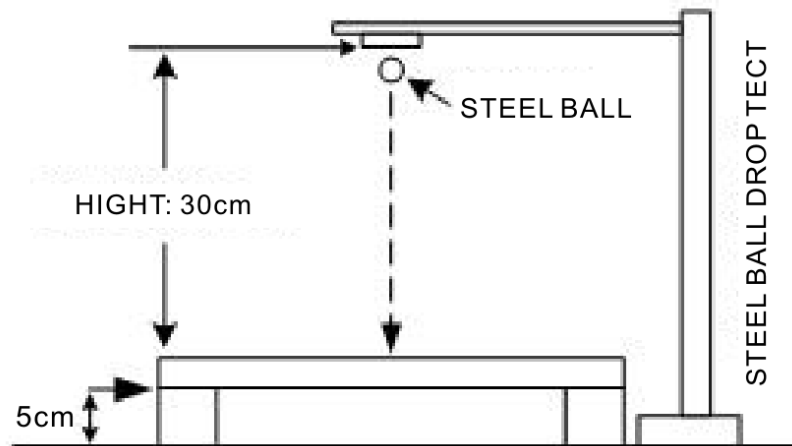
12.4.2 PEN TOUCH SLIDING DURABILITY :

100,000 TIMES OR OVER
 WRITING WITH R0.8mm PLASTIC STYLUS PEN; WRITING FORCE 150g
 IN ACTIVE AREA.
 SPEED IS 60mm/sec.

12.5 STEEL BALL DROP TEST

BY USING F9mm STEEL BALL FROM THE HEIGHT OF 30cm AND FALLING ON TOUCH PANEL SURFACE, MUST PASS BELOW CONDITIONS :

APPEARANCE : THE APPEARANCE WITHOUT ANY CHANGE, INCLUDING THE PANEL BROKEN.



12.6 APPEARANCE INSPECTION

PURPOSE :

TO ESTABLISH APPEARANCE STANDARD AND MAINTAIN PRODUCT QUALITY .

SCOPE :

TOUCH PANEL VIEW AREA WITHIN TOUCH PANEL .

12.6.1 RULE :

INSPECTION CONDITION

(A) ENVIRONMENTAL LUMINANCE : 500 LUX .

(B) DISTANCE BETWEEN HUMAN EYES AND PANEL : 30 CM

(PANEL MUST BE TESTED UNDER LIGHT TRANSPARENT) .

(C) VISUAL ANGEL : $> 60^\circ$.

(D) LIGHT SOURCE : FLUORESCENT LIGHT SOURCE .

12.6.2 JUDGE CRITERION :

JUDGEMENT UNDER ABOVE MENTIONED CRITERION (PANEL MUST BE TESTED UNDER LIGHT TRANSPARENT),

TESTING GOODS DEFECT CAN BE VISIBLE WITHIN 10 SECONDS, WHICH WILL BE JUDGED AS MAJOR DEFECTS .

SAMPLING STANDARD :

THE SAMPLING STANDARD WILL BE CONFIRMED BY BOTH OF EDT AND CUSTOMER.

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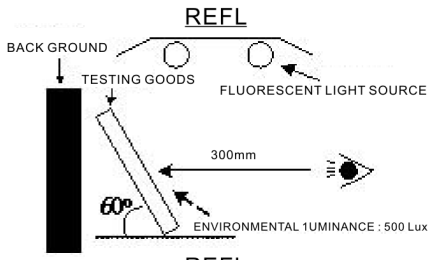
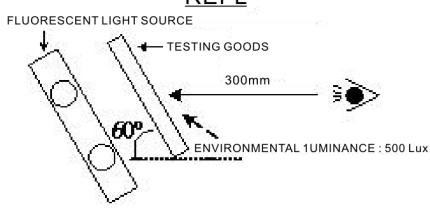
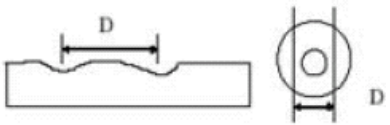
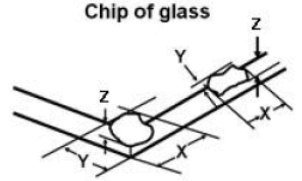
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INSPECTION ITEMS	SEPC.		JUDGE CRITERION	OPERATION GUIDELINE
SCRATCH	$W \leq 0.1\text{mm} \ \& \ L \leq 10\text{mm}$		ACCEPTABLE	
	$W > 0.1\text{mm} \ \text{or} \ L > 10\text{mm}$		NOT ACCEPTABLE	
LINEAR FOREIGN OBJECT	$W \leq 0.1\text{mm} \ \& \ L \leq 5\text{mm}$		ACCEPTABLE	
	$W > 0.1\text{mm} \ \text{or} \ L > 5\text{mm}$		NOT ACCEPTABLE	
GRANULAR FOREIGN OBJECT	$D \leq 0.3\text{mm}$		ACCEPTABLE	
	$D > 0.3\text{mm}$		NOT ACCEPTABLE	
PET BUBBLES	$D \leq 0.6\text{mm}$		ACCEPTABLE	
	$D > 0.6\text{mm}$		NOT ACCEPTABLE	
CHIP ON GLASS	CORNER	$X \leq 3\text{mm} \ 、$ $Y \leq 3\text{mm} \ 、 Z < t$ ($t = \text{thickness}$)	ACCEPTABLE	
	EDGE	$W \leq 3\text{mm} \ 、$ $Y \leq 3\text{mm} \ 、 Z < t$		

13 . SPECIFICATION OF AUDACITY ASSURANCE

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

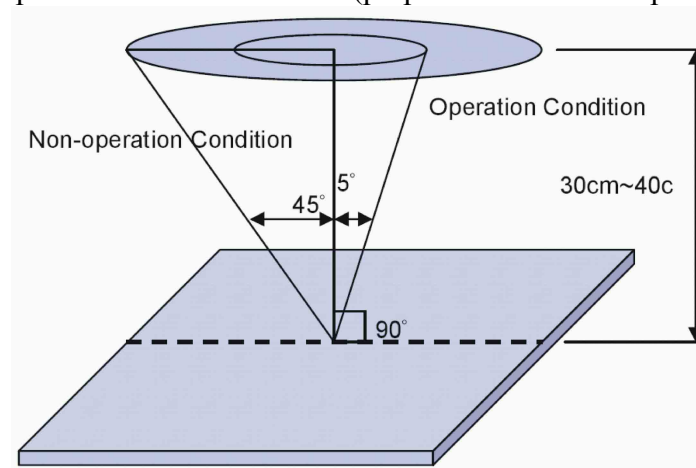
13.2 INSPECTION CONDITIONS

13.2.1 (1)Observation Distance : 35cm±5cm

(2)View Angle :

Non-operation Condition : $\pm 5^\circ$ (perpendicular to LCD panel surface)

Operation Condition : $\pm 45^\circ$ (perpendicular to LCD panel surface)



13.2.2 Environment Conditions :

Ambient Temperature		20°C~25°C
Ambient Humidity		65±20%RH
Ambient Illumination	Cosmetic Inspection	More than 600Lux
	Functional Inspection	300~500 Lux

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 : MIL-STD-105E

Normal inspection , single sampling

Level II

(b)AQL : Major defect : AQL 0.65%

Minor defect : AQL 1.0%

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13.3 INSPECTION STANDARDS

13.3.1 VISUAL DEFECTS CLASSIFICATION

TYPE OF DEFECT	INSPECTION ITEM	DEFECT FEATURE	AQL
MAJOR DEFECT	1.DISPLAY ON	<ul style="list-style-type: none"> • DEFECT TO MISS SPECIFIED DISPLAY FUNCTION, FOR ALL AND SPECIFIED DOTS EX: DISCONNECTION, SHORT CIRCUIT ETC 	0.65
	2.BACKLIGHT	<ul style="list-style-type: none"> • NO LIGHT • FLICKERING AND OTHER ABNORMAL ILLUMINATION 	
	3.DIMENSIONS	<ul style="list-style-type: none"> • SUBJECT TO INDIVIDUAL ACCEPTANCE SPECIFICATIONS 	
MINOR DEFECT	1.DISPLAY ZONE	<ul style="list-style-type: none"> • BLACK/WHITE SPOT • BUBBLES ON POLARIZER • NEWTON RING • BLACK/WHITE LINE • SCRATCH • CONTAMINATION • LEVER COLOR SPREED 	1.0
	2.BEZEL ZONE	<ul style="list-style-type: none"> • STAINS • SCRATCHES • FOREIGN MATTER 	
	3.SOLDERING	<ul style="list-style-type: none"> • INSUFFICIENT SOLDER • SOLDERED IN INCORRECT POSITION • CONVEX SOLDERING SPOT • SOLDER BALLS • SOLDER SCRAPS 	
	4.DISPLAY ON (ALL ON)	<ul style="list-style-type: none"> • LIGHT LINE 	

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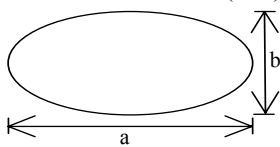
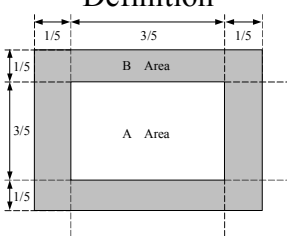
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13.3.2 MODULE DEFECTS CALSSIFICATION

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.	BLACK SPOTS, FOREIGN MATTER, AND WHITE SPOTS (INCLUDING LIGHT LEAKAGE DUE TO POLARIZING PLATES PINHOLES, ETC.)	<div>(1) SPOTS<table border="1"><thead><tr><th>AVERAGE DIAMETER (mm): D</th><th>NUMBER OF PIECES PERMITTED</th><th>MINIMUM SPACE</th></tr></thead><tbody><tr><td>D≤0.2</td><td>IGNORE</td><td>—</td></tr><tr><td>0.2<D≤0.4</td><td>5</td><td>10 mm</td></tr><tr><td>0.4<D</td><td>0</td><td></td></tr></tbody></table><p>NUMBER OF TOTAL PIECES IS TO BE SET WITHIN 5 PIECES.</p><p>NOTE : THAT WHEN THERE ARE 2 PIECES OR MORE, THEY ARE NOT TO BE CONSIDERED AS CONCENTRATED.</p></div> <div>(2) BLURRY SPOTS (WHEN FULLY POWERED-ON)<table border="1"><thead><tr><th>AVERAGE DIAMETER (mm): D</th><th>NUMBER OF PIECES PERMITTED</th></tr></thead><tbody><tr><td>D≤0.3</td><td>IGNORE</td></tr><tr><td>0.3<D≤0.75</td><td>5</td></tr><tr><td>0.75<D</td><td>0</td></tr></tbody></table><p>Note : Diameter D=(a+b)/2</p><p>NUMBER OF TOTAL PIECES IS TO BE SET WITHIN 5 PIECES.</p><p>NOTE : THAT WHEN THERE ARE 2 PIECES OR MORE, THEY ARE NOT TO BE CONSIDERED AS CONCENTRATED.</p></div>			AVERAGE DIAMETER (mm): D	NUMBER OF PIECES PERMITTED	MINIMUM SPACE	D≤0.2	IGNORE	—	0.2<D≤0.4	5	10 mm	0.4<D	0		AVERAGE DIAMETER (mm): D	NUMBER OF PIECES PERMITTED	D≤0.3	IGNORE	0.3<D≤0.75	5	0.75<D	0
AVERAGE DIAMETER (mm): D	NUMBER OF PIECES PERMITTED	MINIMUM SPACE																						
D≤0.2	IGNORE	—																						
0.2<D≤0.4	5	10 mm																						
0.4<D	0																							
AVERAGE DIAMETER (mm): D	NUMBER OF PIECES PERMITTED																							
D≤0.3	IGNORE																							
0.3<D≤0.75	5																							
0.75<D	0																							
4.	BLACK LINE WHITE LINE NON-DISPLAY	(1)THE BLACK LINE, WHITE LINE ARE WITHIN THE VIEWING AREA. IT IS NOT ALLOW.																						
5	BLACK LINE WHITE LINE ON-DISPLAY	<div>(1) THE FOLLOWING BLACK LINE , WHITE LINE ARE WITHIN THE VIEWING AREA. WIDTH :Wmm , LENGH :Lmm<table border="1"><thead><tr><th>LENGTH : L</th><th>WIDTH : W</th><th>PERMISSIBLE NO.</th></tr></thead><tbody><tr><td>L ≤ 0.5</td><td>W ≤ 0.1</td><td>IGNORE</td></tr><tr><td>0.5 < L ≤ 2.5</td><td>0.1 < W ≤ 0.3</td><td>4</td></tr><tr><td>2.5 < L</td><td>0.3 ≤ W</td><td>NONE</td></tr></tbody></table></div>			LENGTH : L	WIDTH : W	PERMISSIBLE NO.	L ≤ 0.5	W ≤ 0.1	IGNORE	0.5 < L ≤ 2.5	0.1 < W ≤ 0.3	4	2.5 < L	0.3 ≤ W	NONE								
LENGTH : L	WIDTH : W	PERMISSIBLE NO.																						
L ≤ 0.5	W ≤ 0.1	IGNORE																						
0.5 < L ≤ 2.5	0.1 < W ≤ 0.3	4																						
2.5 < L	0.3 ≤ W	NONE																						
6.	SCRATCHES AND DENT ON GLASS POLARIZER	(1) PLS REFER TO THE ABOVE NO.3 AND 4 TO DETERMINE SCRATCHES AND DENT ON POLARIZER OR GLASS																						
7.	DOT DEFECT ON DISPLAY	<div>Judgment Criteria<table border="1"><thead><tr><th>Area</th><th>Bright Dot</th><th>Dark Dot</th><th>Total</th></tr></thead><tbody><tr><td>A</td><td>3</td><td>3</td><td>4</td></tr><tr><td>B</td><td>5</td><td>5</td><td>5</td></tr></tbody></table></div> <div>(1)It is defined as Point Defect if defect area>0.5dot (2)It is ignored if defect area≤0.5dot (3)Weak point defect will be defined as Bright Dot if it can be observed through ND filter 6% (4)The distance between 2 dot defect≥5mm (5)Not Allowed Joint point defect</div>	Area	Bright Dot	Dark Dot	Total	A	3	3	4	B	5	5	5	<div>Note : A/B Area Definition</div> 									
Area	Bright Dot	Dark Dot	Total																					
A	3	3	4																					
B	5	5	5																					

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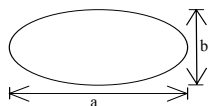
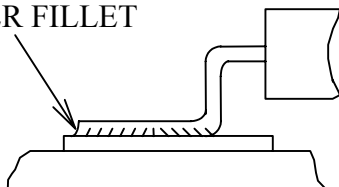
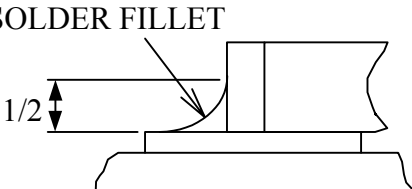
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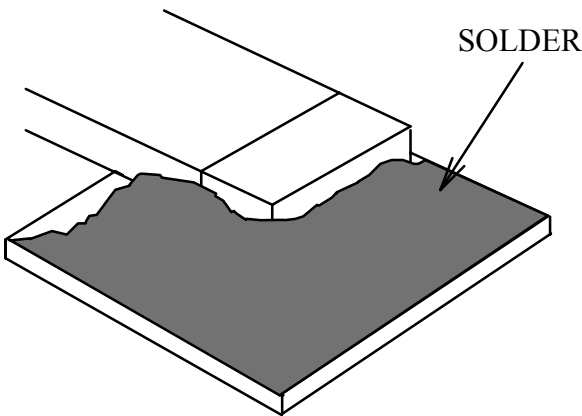
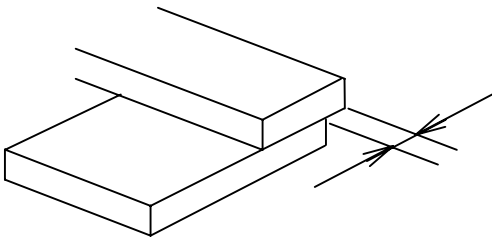
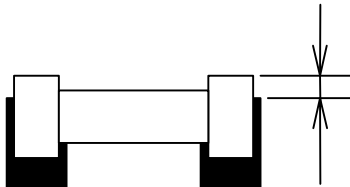
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NO.	ITEM	CRITERIA	
8	LINE DEFECT ON DISPLAY	OBVIOUS VERTICAL OR HORIZONTAL LINE DEFECT IS NOT ALLOW	
9	MURA ON DISPLAY	IT'S OK IF MURA IS SLIGHT VISIBLE THROUNG 6% ND FILTER	
10	CF FAIL/SPOT ON DISPLAY	(1)THE FOLLOWING CF FAIL , SPOT ARE WITHIN THE VIEWING AREA	
		SIZE D	PERMISSIBLE NO.
		$D \leq 0.15\text{mm}$	IGNORED
		$0.15\text{mm} < D \leq 0.2\text{mm}$	$N \leq 2$
		$D > 0.2\text{mm}$	NOT ALLOWED
		<div>Note : Diameter $D=(a+b)/2$ </div>	
11	UNEVEN COLOR SPREAD , COLORATION	(1)TO BE DETERMINED BASED UPON THE STANDARD SAMPLE.	
12	BEZEL APPEARANCE	(1)BEZEL MAY NOT HAVE RUST, E DEFORMED OR HAVE FINGER PRINTS STAINS OF OTHER CONTAMINATION. (2)BEZEL MUST COMPLY WITH JOB SPECIFICATIONS.	
13	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	
			

NO.	ITEM	CRITERIA
13.	SOLDERING	<ul style="list-style-type: none">SOLDER WETS 3 SIDES OF TERMINAL, BUT LESS THAN 25% OF SIDES AND FRONT SURFACE AREA ARE COVERED  <p>(3)PARTS ALIGMENT</p> <p>(a)LSI, IC LEAD WIDTH IS MORE THAN 50% BEYOND PAD OUTLINE</p>  <p>(b)CHIP COMPONENT COMPONENT IS OFF CENTER, AND MORE THAN 50% OF THE LEADS IS OFF THE PAD OUTLINE</p> 

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NO.	ITEM	CRITERIA
13.	SOLDERING	(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.
14.	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.
15.	GENERAL APPEARANCE	(1)NO OXIDATION,CONTAMINATION, URVES 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.

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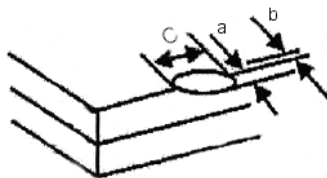
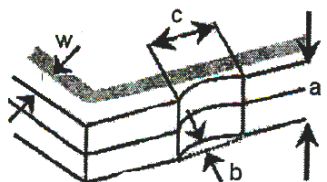
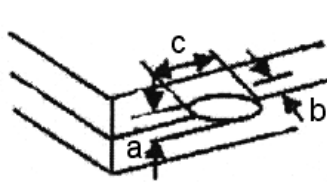
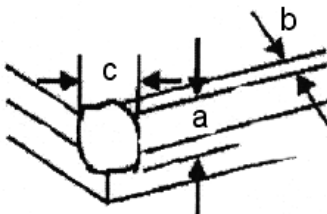
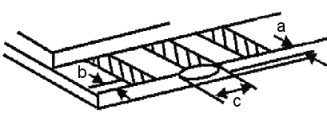
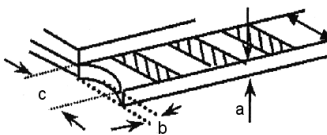
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NO.	ITEM	CRITERIA														
16.	CRACKED GLASS	THE LCD WITH EXTENSIVE CRACK IS NOT ACCEPTABLE														
		General glass chip :		<table><tr><td>a</td><td>b</td><td>c</td></tr><tr><td>$\leq t/2$</td><td>< VIEWING AREA</td><td>$\leq 1/8X$</td></tr><tr><td>$t/2 > , \leq 2t$</td><td>$\leq W/2$</td><td>$\leq 1/8X$</td></tr></table>	a	b	c	$\leq t/2$	< VIEWING AREA	$\leq 1/8X$	$t/2 > , \leq 2t$	$\leq W/2$	$\leq 1/8X$	<p>*W=DISTANCE BETWEEN SEALANT AREA AND LCD PANEL EDGE X = LCD SIDE LENGTH t = GLASS THICKNESS</p>		
		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><td>a</td><td>b</td><td>c</td></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>	a	b	c	$\leq t/2$	< VIEWING AREA	$\leq 1/8X$	$> t/2 , \leq 2t$	$\leq W/2$	$\leq 1/8X$	<p>*W=DISTANCE BETWEEN SEALANT AREA AND LCD PANEL EDGE X=LCD SIDE LENGTH t=GLASS THICKNESS</p>		
		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><td>a</td><td>b</td><td>c</td></tr><tr><td>$\leq t$</td><td>$\leq 0.5\text{mm}$</td><td>$\leq 1/8X$</td></tr></table>	a	b	c	$\leq t$	$\leq 0.5\text{mm}$	$\leq 1/8X$	<p>* X=LCD SIDE WIDTH t=GLASS THICKNESS</p> <table><tr><td>a</td><td>b</td><td>c</td></tr><tr><td>$\leq t$</td><td>$\leq 1/8X$</td><td>$\leq L$</td></tr></table> <p>*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</p>		a	b	c	$\leq t$	$\leq 1/8X$	$\leq L$
a	b	c														
$\leq t$	$\leq 0.5\text{mm}$	$\leq 1/8X$														
a	b	c														
$\leq t$	$\leq 1/8X$	$\leq L$														
																
																

13.4 RELIABILITY TEST

13.4.1 STANDARD SPECIFICATIONS FOR RELIABILITY OF LCD MODULE

NO	ITEM	DESCRIPTION
1	High temperature operation	The sample should be allowed to stand at +60°C for 240 hrs
2	Low temperature operation	The sample should be allowed to stand at -10°C for 240 hrs
3	High temperature storage	The sample should be allowed to stand at +70°C for 240 hrs
4	Low temperature storage	The sample should be allowed to stand at -20°C for 240 hrs
5	High temp / humidity test	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 200 cycles of operation: -25°C for 30 minutes ~ +70°C for 30 minutes
7	ESD (Electrostatic Discharge)	AIR DISCHARGE $\pm 4KV$ CONTACT DISCHARGE $\pm 2KV$

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.

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13.5 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

13.6 OPERATION

- 13.6.1 Do not connect or disconnect modules to or from the main system while power is being supplied .
- 13.6.2 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 .
- 13.6.3 Adjust the LC driving voltage to obtain the optimum contrast .
- 13.6.4 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 .

13.7 NOTICE

- 13.7.1 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 .
- 13.7.2 Do not disassemble . EDT shall not be held responsible if the module is disassembled and upon the reassembly the module failed .
- 13.7.3 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 .
- 13.7.4 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 .
- 13.7.5 Don't give external shock.
- 13.7.6 Don't apply excessive force on the surface.
- 13.7.7 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.
- 13.7.8 Don't operate it above the absolute maximum rating.
- 13.7.9 Storage in a clean environment, free from dust, active gas, and solvent.
- 13.7.10 Store without any physical load.
- 13.7.11 Rewiring: no more than 3 times .