

APPROVAL

PART NO.	DESCRIPTION	REMARKS
HT4302L	LCD MODULE (480 x RGB x 272)	* ROHS compliant

CUSTOMER APPLICATION P/N	
APPROVED BY	
DATE	

PLEASE KINDLY FIND AND APPROVE THE SPECIFICATIONS INSERTED
HEREIN AND RETURN ONE COPY HERE OF WITH YOUR SIGNATURE OF APPROVAL.

PERPARED BY	CHECKED BY	CONFIRMED BY



HYES Optoelectronics, Inc.

2000 Wyatt Drive Suite 6
Santa Clara, CA 95054 USA

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1. BASIC SPECIFICATION

1.1 Mechanical specifications

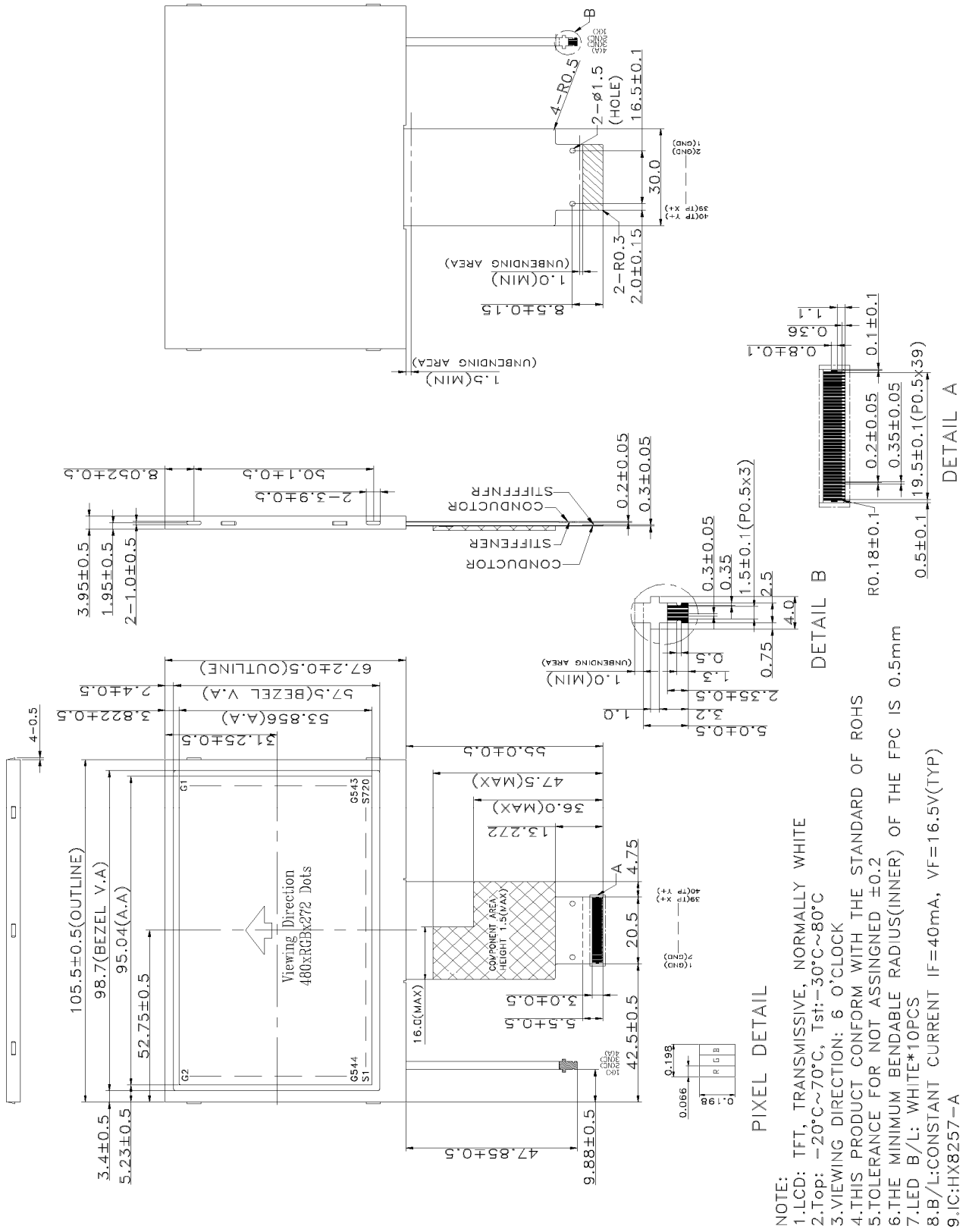
Items	Nominal Dimension	Unit
Active screen size	4.3" diagonal	-
Dot Matrix	480 x RGB x 272	Pixel
Module Size (W x H x T)	105.5 x 67.2 x 3.95	mm.
Active Area (W x H)	95.04 x 53.856	mm.
Pixel Size (W×H)	0.198 x 0.198	mm.
Color depth	16.7M	color
Interface	Parallel 24-bit RGB	-
Driving IC Package	COG	-
Module weight	55	g

1.2 Display specification

Display	Descriptions	Note
LCD Type	a-Si TFT	-
LCD Mode	TN / Normal white	-
Polarizer Mode	Transmissive	-
Polarizer Surface	Normal	-
Pixel arrangement	RGB-stripe	
Backlight Type	LED	-
Viewing Direction	6 O'clock Direction	-

* Color tone is slightly changed by temperature and driving voltage.

1.3 Outline dimension



- NOTE:
- LCD: TFT, TRANSMISSIVE, NORMALLY WHITE
 - Top: $-20^{\circ}\text{C} \sim 70^{\circ}\text{C}$, Tst: $-30^{\circ}\text{C} \sim 80^{\circ}\text{C}$
 - VIEWING DIRECTION: 6 O'CLOCK
 - THIS PRODUCT CONFORM WITH THE STANDARD OF ROHS
 - TOLERANCE FOR NOT ASSIGNED ± 0.2
 - THE MINIMUM BENDABLE RADIUS(INNER) OF THE FPC IS 0.5mm
 - LED B/L: WHITE*10PCS
 - B/L: CONSTANT CURRENT IF=40mA, VF=16.5V(TYP)
 - I.C:HX8257-A

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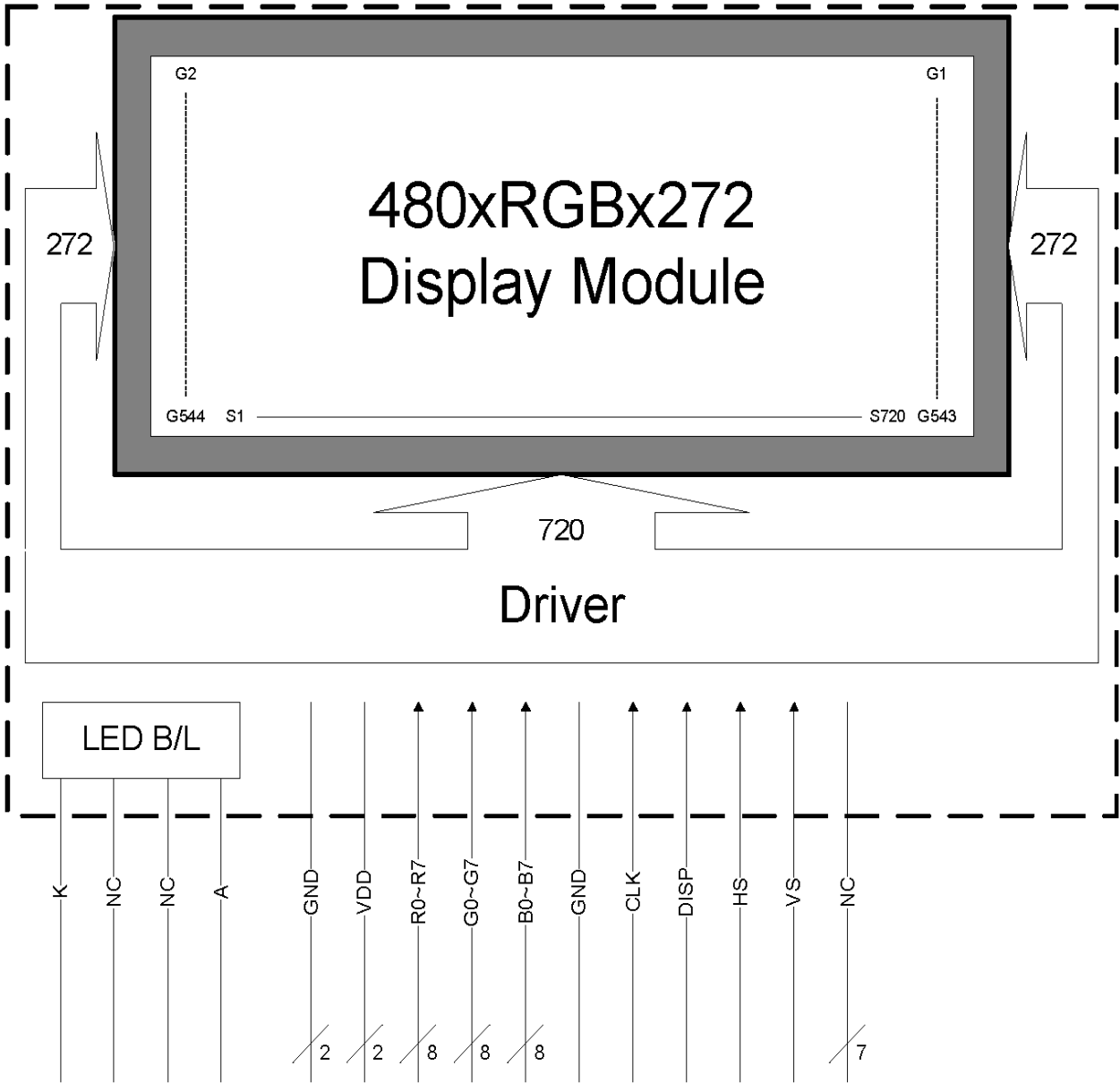
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1.4 Block diagram:



1.5 Interface pin :

Pin No.	Pin Symbol	I/O	Description
1 ~ 2	GND	P	Ground for logic. (0V)
3 ~ 4	VDD	P	Power supply. (+3.3V)
5 ~ 12	R0 ~ R7	I	Red data signal.
13 ~ 20	G0 ~ G7	I	Green data signal.
21 ~ 28	B0 ~ B7	I	Blue data signal.
29	GND	P	Ground for logic. (0V)
30	CLK	I	Clock signal for data latching and internal counter of the timing controller.
31	DISP	I	Display on/off mode control. Internally pulled high. (a) DISP=L, standby mode. (b) DISP=H, normal display mode.
32	HS	I	Horizontal sync input with negative polarity. Internally pull high.
33	VS	I	Vertical sync input with negative polarity. Internally pull high.
34 ~ 40	NC	-	No connect.

B/L interface pin :

Pin No.	Pin Symbol	I/O	Description
1	K	P	Ground pin for backlight.
2 ~ 3	NC	-	No connect.
4	A	P	Power supply input pin for backlight.

2. ELECTRICAL CHARACTERISTICS

2.1 Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit
Power supply voltage	VDD	-0.3	4.0	V
Operate temperature range	T _{OP}	-20	70	°C
Storage temperature range	T _{ST}	-30	80	°C

2.2 DC Characteristics

T_a = 25°C

Items	Symbol	Min.	Typ.	Max.	Unit	Condition
Supply voltage	VDD	3.0	3.3	3.6	V	-
Input Voltage	V _{IL}	0	-	0.3VDD	V	L level
	V _{IH}	0.7VDD	-	VDD	V	H level
Current consumption	I _{VDD}	-	-	25.5	mA	Note 1

*Note1 :

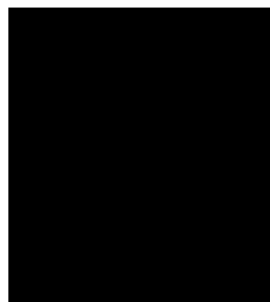
Measuring Condition:

Standard Value MAX.

T_a = 25°C

VDD - GND = 3.3V

Display Pattern = Check pattern



0 gray black pattern

2.2.1 Back-light Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	Unit	Test Condition	NOTE
Supply Current	I _f	-	40	-	mA	T _a =25°C	-
Supply Voltage	V _f	-	16.5	-	V	T _a =25°C	-
Half-Life Time	L _f	-	50000	-	hrs	T _a =25°C	1

Note 1 : The " Half-Life Time" is defined as the LED chip brightness decreases to 50% than original brightness, Based on T_a 25±2°C, 60±10% RH condition .

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2.3 AC Characteristics

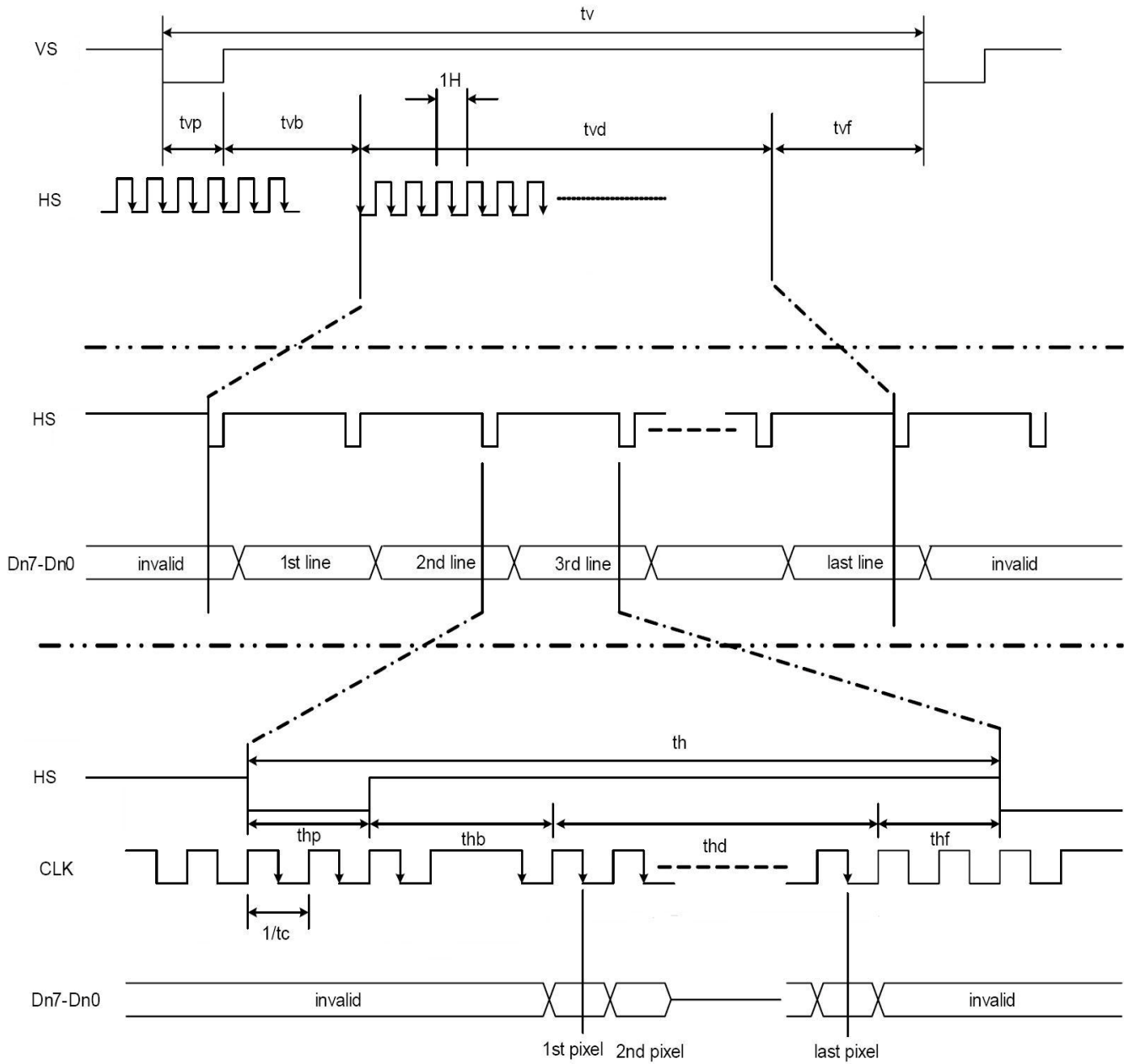
Parallel RGB Input Timing Requirement

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Clock cycle	$f_{CLK}^{(1)}$	-	9	15	MHz
Hsync cycle	1/th	-	17.14	-	KHz
Vsync cycle	1/tv	-	59.94	-	Hz
Horizontal Signal					
Horizontal cycle	th	525	525	605	CLK
Horizontal display period	thd	480	480	480	CLK
Horizontal front porch	thf	2	2	82	CLK
Horizontal pulse width	thp ⁽²⁾	2	41	41	CLK
Horizontal back porch	thb ⁽²⁾	2	2	41	CLK
Vertical Signal					
Vertical cycle	tv	285	286	399	H ⁽¹⁾
Vertical display period	tvd	272	272	272	H ⁽¹⁾
Vertical front porch	tvf	1	2	227	H ⁽¹⁾
Vertical pulse width	tvp ⁽²⁾	1	10	11	H ⁽¹⁾
Vertical back porch	tvb ⁽²⁾	1	2	11	H ⁽¹⁾

Note: (1) Unit: CLK=1/ f_{CLK} , H= th,

(2) It is necessary to keep $tv_p+tv_b=12$ and $th_p+th_b=43$ in sync mode. DE mode is unnecessary to keep it.

Interface Timing Chart



Parallel RGB Input timing

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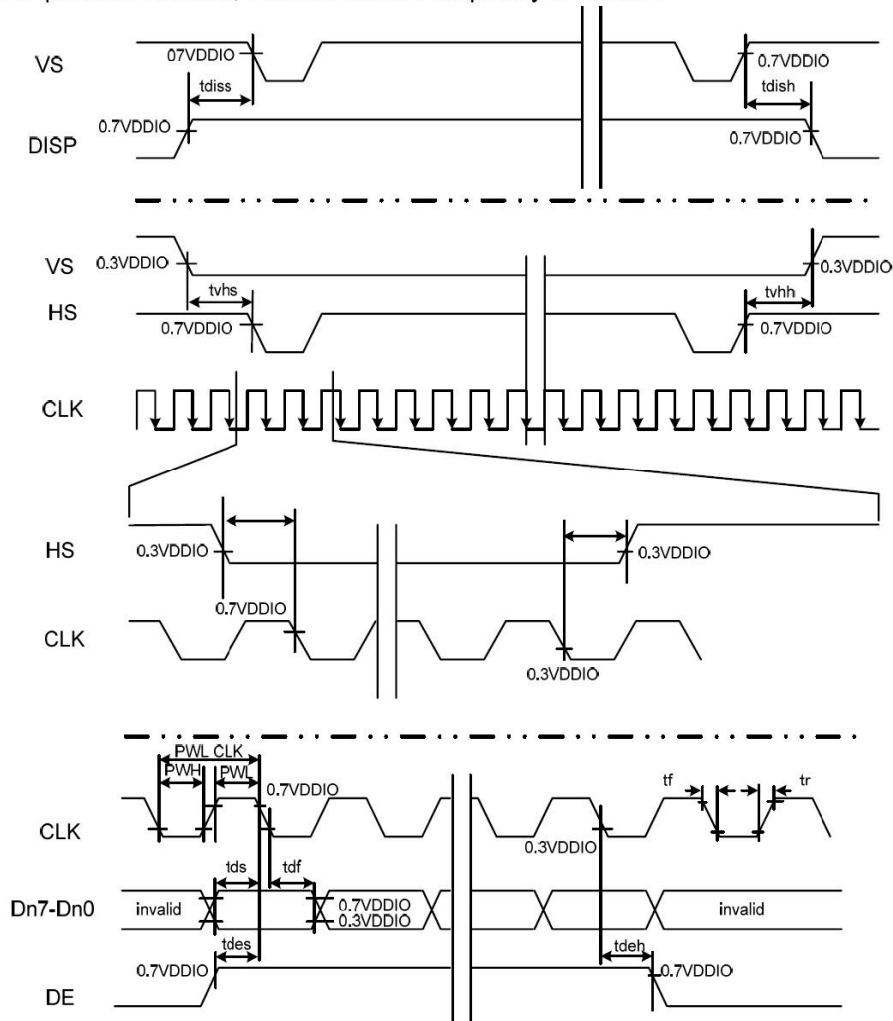
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Input Setup Timing Requirement

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DISP setup time	t_{diss}	10	-	-	ns
DISP hold time	t_{dish}	10	-	-	ns
Clock period	$PW_{CLK}^{(2)}$	66.7	-	-	ns
Clock pulse high period	$PWH^{(2)}$	26.7	-	-	ns
Clock pulse low period	$PWL^{(2)}$	26.7	-	-	ns
Hsync setup time	t_{hs}	10	-	-	ns
Hsync hold time	t_{hh}	10	-	-	ns
Data setup time	t_{ds}	10	-	-	ns
Data hold time	t_{dh}	10	-	-	ns
DE setup time	t_{des}	10	-	-	ns
DE hold time	t_{deh}	10	-	-	ns
Vsync setup time	t_{vhs}	10	-	-	ns
Vsync hold time	t_{vhh}	10	-	-	ns

Note: (1) t_r , t_f is defined 10% to 90% of signal amplitude.

(2) For parallel interface, maximum clock frequency is 15MHz.



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3. OPTICAL CHARACTERISTICS

3.1 Characteristics

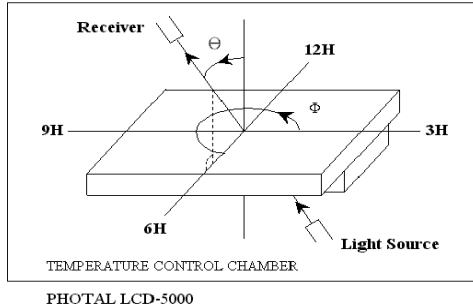
Electrical and Optical Characteristics

No.	Item	symbol / temp.	Min.	Typ.	Max.	Unit	Note		
1	Response Time	Tr	25 °C	-	5	-	ms	2	
		Tf	25 °C	-	15	-			
2	Viewing Angle	Hor.	Θ_{2+}	0°	-	45	-	degree	3
			Θ_{2-}	180°	-	45	-		
		Ver.	Θ_{1+}	270°	-	15	-		
			Θ_{1-}	90°	-	35	-		
3	Contrast Ratio	Cr	25 °C	-	500	-	-	4	
4	Red x-code	Rx	25 °C	0.56	0.61	0.66	-	5	
	Red y-code	Ry		0.31	0.36	0.41			
	Green x-code	Gx		0.28	0.33	0.38			
	Green y-code	Gy		0.53	0.58	0.63			
	Blue x-code	Bx		0.09	0.14	0.19			
	Blue y-code	By		0.07	0.12	0.17			
	White x-code	Wx		0.27	0.32	0.37			
	White y-code	Wy		0.30	0.35	0.40			
	Brightness	Y		400	500	-			cd/m ²
5	Brightness Uniformity		25 °C	80	-	-	%	6	

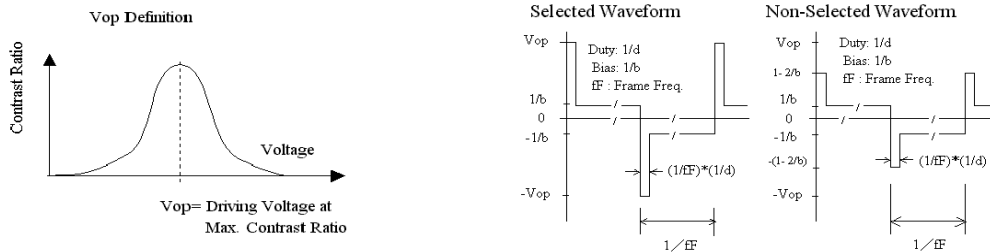
3.2 Definition of optical characteristics

Measurement condition :

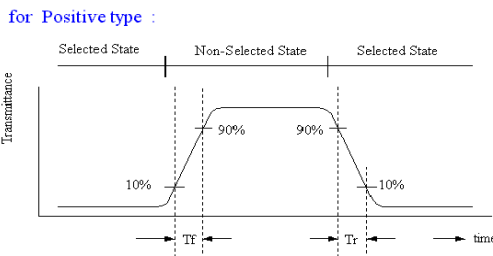
Transmissive and Transflective type



[Note 1] Definition of LCD Driving Vop and Waveform :

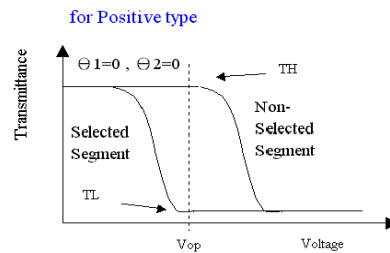
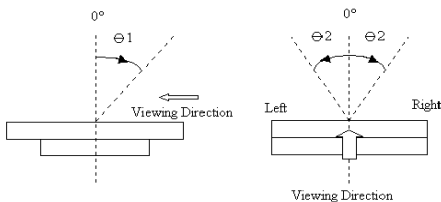


[Note 2] Definition of Response Time



[Note 3] Definition of Viewing Angle :

[Note 4] Definition of Contrast Ratio :



$$\text{Contrast Ratio} = \frac{TH}{TL}$$

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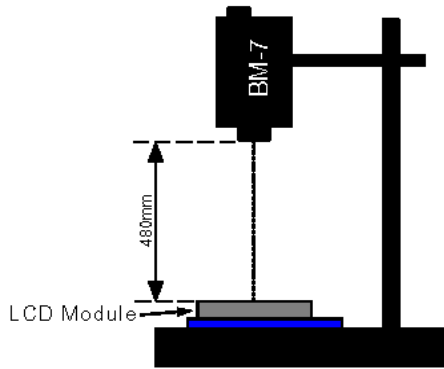
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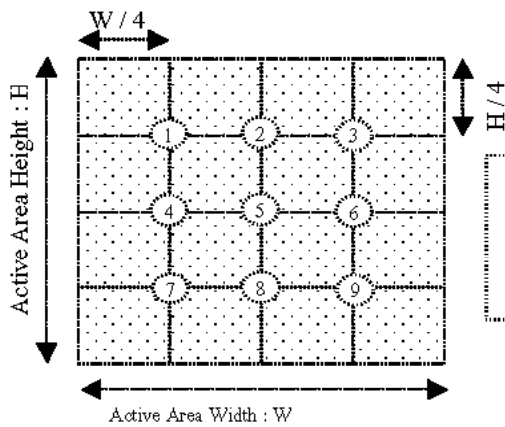
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[Note 5] Definition of measurement of Color Chromaticity and Brightness

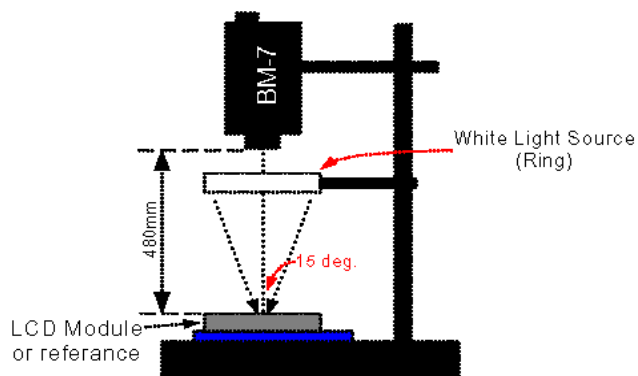


[Note 6] Definition of Brightness Uniformity



$$\text{Brightness Uniformity} = \frac{\text{Minimum Brightness of Point 1~9}}{\text{Maximum Brightness of Point 1~9}}$$

[Note 7] Definition of Measurement of Reflectance



4. RELIABILITY :

Item No	Items	Condition
1	High temperature operating	70 °C , 200 hours
2	Low temperature operating	-20 °C , 200 hours
3	High temperature storage	80 °C , 200 hours
4	Low temperature storage	-30 °C , 200 hours
5	High temperature & humidity storage	60°C, 90%RH, 100 hours
6	Thermal Shock storage	-30°C, 30min.<=> 80°C, 30min. 10 Cycles
7	Vibration test	10 => 55 =>10 => 55 => 10 Hz , within 1 minute Amplitude : 1.5mm. 15 minutes for each Direction (X,Y,Z)
8	Drop test	Packed, 100CM free fall, 6 sides, 1 corner, 3edges
9	Life time	50,000 hours 25°C , 70%RH below , specification condition driving

- * One single product test for only one item.
- * Judgment after test : keep in room temperature for more than 2 hours.
 - Current consumption < 2 times of initial value
 - Contrast > 1/2 initial value
 - Function : work normally

5. PRODUCT HANDLING AND APPLICATION

PRECAUTION FOR HANDLING LCM

- The LCD module contains a C-MOS LSI. People who operate the LCM should wear ESD protection equipment to prevent ESD hurt on products.
- Do not input any signal before power is turned on.
- Do not take LCM from its packaging bag until it is assembled.
- Peel off the LCM protective film slowly since static electricity may be generated.
- Pay attention to the humidity of the work shop, 50~60%RH is satisfactory.
- Use a non-leak iron for soldering LCM.
- Do not touch the display surface or connection terminals area with bare hands. Smudges on the display surface reduce the insulation between terminals.
- Cautions for soldering to LCM:
 Condition for soldering I/O terminals:
 Temperature at iron tip :280°C±10°C.
 Soldering time : 3~4sec./ terminals.
 Type of solder : Eutectic solder(rosin flux filled).

PRECAUTION IN USE OF LCD

- Do not contact or scratch the front surface and the contact pads of a LCD panel with hard materials such as metal or glass or with one's nail.
- To clean the surface, wipe it gently with soft cloth dampened by alcohol.
- Do not attempt to wipe off the contact pads.
- Keep LCD panels away from direct sunlight, also avoid them in high-temperature & high humidity environment for a long period.
- Do not drive LCD panels by DC voltage.
- Do not expose LCD panels to organic solvent.
- Liquid in LCD is hazardous substance. In case a contact with liquid crystal material is occurred, be sure to immediately wash such material away by soap and water.
- The polarizer is easily damaged and should be handled with special care. Don't press or rub it with hard objects.

PRECAUTION FOR STORING LCM

- To avoid degradation of the device, do not store the module under the conditions of direct sunlight, high temperature or high humidity. Keep the module in bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperature below 0°C)

USING ON MEDICAL CARE, SAFETY OR HAZARDOUS APPLICATION OR SYSTEM

- For the application in medical care, safety and hazardous products or systems, an authorization from **HYES** is required. **HYES** will not be responsible for any damage or loss which is caused by the products without any authorization given by **HYES**.
- This product is not allowed to be designed and used for military application and/or purpose.
- The delivery of this product to the countries and/or regions where embargoes are imposed by U.N. is prohibited.
- The application and delivery of this product must comply with Strategic High-Tech Commodities (SHTC) export control and the sales to the embargoed and/or sanctioned countries or regions are strictly prohibited.

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6. DATE CODE OF PRODUCTS

- Date code will be shown on each product :

- **Y MM DD - XXX**

Year Month Day - Production lots

- Example: 2 1 2 2 3 - 0 0 3 ==> Year 2002, Dec.,23rd , Batch no.03

MODEL NO: UM*

T.B.D. pcs / Tray

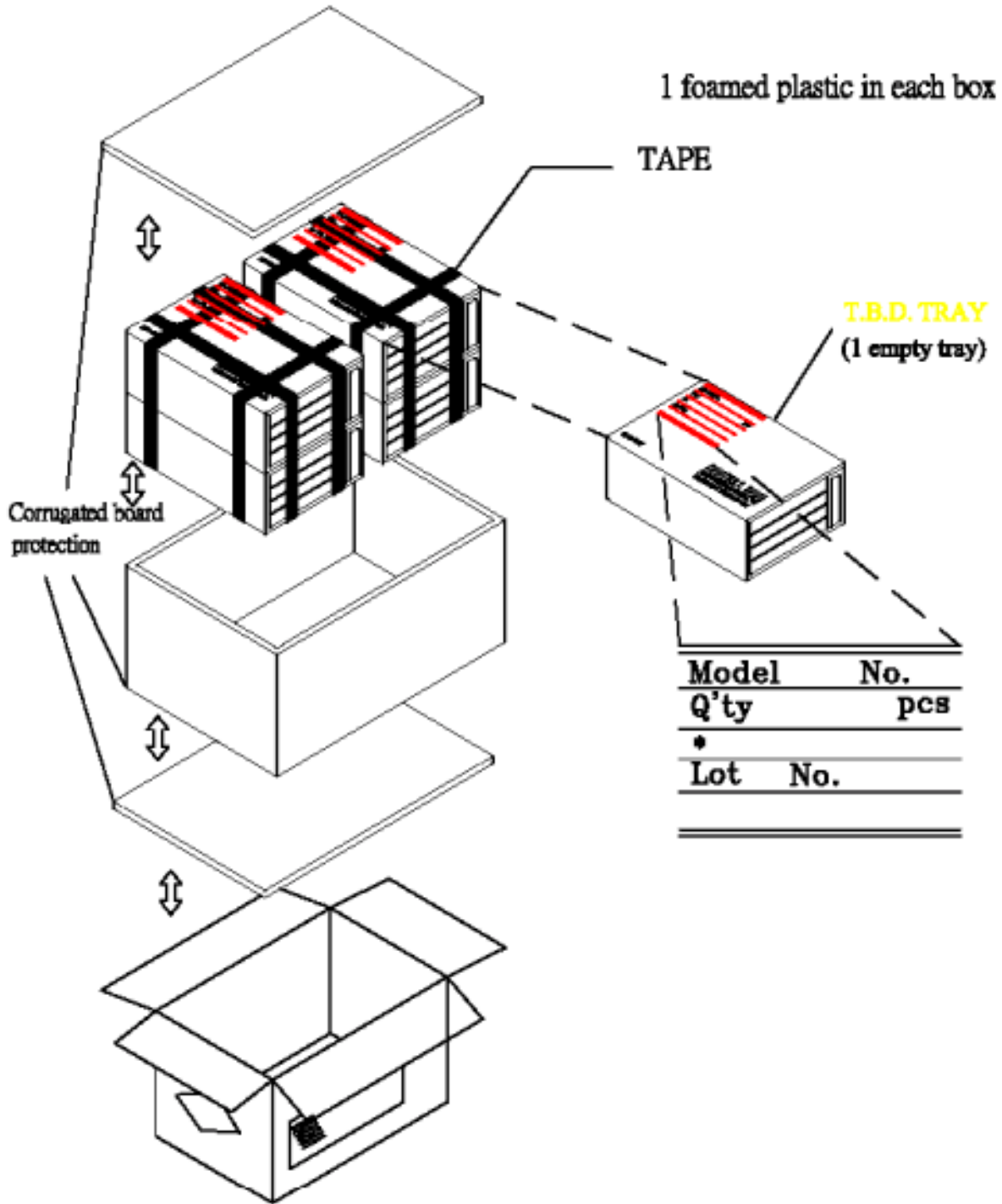
T.B.D. Tray / Box

T.B.D. Box / Carton

T.B.D. pcs / Carton

NOTE:

- (1) Be warned, the direction of the tray has to turn it by 180 degree before stack it up. Otherwise, it will be packager's responsibility!!
- (2) Safe Stack : 5 cartons only



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8. INSPECTION STANDARD

8.1. QUALITY :

THE QUALITY OF GOODS SUPPLIED TO PURCHASER SHALL COME UP TO THE FOLLOWING STANDARD.

8.1.1. THE METHOD OF PRESERVING GOODS

AFTER DELIVERY OF GOODS FROM **HYES** TO PURCHASER. PURCHASER SHALL CONTROL THE LCM AT -10 °C ~ 40 °C ,AND IT MIGHT BE DESIRABLE TO KEEP AT THE NORMAL ROOM TEMPERATURE AND HUMIDITY UNTIL INCOMING INSPECTION OR THROWING INTO PROCESS LINE.

8.1.2. INCOMING INSPECTION

(A) THE METHOD OF INSPECTION

IF PURCHASER MAKE AN INCOMING INSPECTION , A SAMPLING PLAN SHALL BE APPLIED ON THE CONDITION THAT QUALITY OF ONE DELIVERY SHALL BE REGARDED AS ONE LOT.

(B) THE STANDARD OF QUALITY

ISO-2859-1 (or MIL-STD-105D), LEVEL II SINGLE PLAN.

CLASS	AQL(%)
CRITICAL	0.4 %
MAJOR	0.65 %
MINOR	1.5 %
TOTAL	1.5 %

EVERY ITEM SHALL BE INSPECTED ACCORDING TO THE CLASS.

(C) MEASURE

IF AS THE RESULT OF ABOVE RECEIVING INSPECTION , A LOT OUT IS DISCOVERED. PURCHASER SHALL BE INFORM SELLER OF IT WITHIN SEVEN DAYS. BUT FIRST SHIPMENT WITHIN FOURTEEN DAYS.

8.1.3. WARRANTY POLICY

HYES WILL PROVIDE ONE-YEAR WARRANTY FOR THE PRODUCTS ONLY IF UNDER SPECIFICATION OPERATING CONDITIONS. **HYES** WILL REPLACE NEW PRODUCTS FOR THESE DEFECT PRODUCTS WHICH UNDER WARRANTY PERIOD AND BELONG TO THE RESPONSIBILITY OF **HYES**.

8.2. CHECKING CONDITION

8.2.1. CHECKING DIRECTION SHALL BE IN THE 45 DEGREE AREA TO FACE THE SAMPLE.

8.2.2. CHECKER SHALL SEE OVER 30 cm. WITH BARE EYES FAR FROM SAMPLE AND USING 2 PCS. OF 20W FLUORESCENT LAMP.

8.3. INSPECTION PLAN :

CLASS	ITEM	JUDGEMENT	CLASS
PACKING & INDICATE	1. OUTSIDE AND INSIDE PACKAGE	"MODEL NO." , "LOT NO." AND "QUANTITY" SHOULD INDICATE ON THE PACKAGE.	Minor
	2. MODEL MIXED AND QUANTITY	OTHER MODEL MIXED.....REJECTED QUANTITY SHORT OR OVER.....REJECTED	Critical
	3. PRODUCT INDICATION	"MODEL NO." SHOULD INDICATE ON THE PRODUCT	Major
ASSEMBLY	4. DIMENSION, LCD GLASS SCRATCH AND SCRIBE DEFECT.	ACCORDING TO SPECIFICATION OR DRAWING.	Major
APPEARANCE	5. VIEWING AREA	POLARIZER EDGE OR LCD'S SEALING LINE IS VISABLE IN THE VIEWING AREAREJECTED	Minor
	6. BLEMISH - BLACK SPOT - WHITE SPOT IN THE LCD AND LCD GLASS CRACKS	ACCORDING TO STANDARD OF VISUAL INSPECTION (INSIDE VIEWING AREA)	Minor
	7. BLEMISH - BLACK SPOT WHITE SPOT AND SCRTCH ON THE POLARIZER	ACCORDING TO STANDARD OF VISUAL INSPECTION (INSIDE VIEWING AREA)	Minor
	8. BUBBLE IN POLARIZER	ACCORDING TO STANDARD OF VISUAL INSPECTION (INSIDE VIEWING AREA)	Minor
	9. LCD'S RAINBOW COLOR	STRONG DEVIATION COLOR (OR NEWTON RING) OF LCD.....REJECTED. OR ACCORDING TO LIMITED SAMPLE (IF NEEDED, AND INSIDE VIEWING AREA)	Minor
ELECTRICAL	10. ELECTRICAL AND OPTICAL CHARACTERISTICS (CONTRAST - VOP - CHROMATICITY ... ETC)	ACCORDING TO SPECIFICATION OR DRAWING . (INSIDE VIEWING AREA)	Critical
	11. MISSING PATTERN	MISSING DOT - LINE - CHARACTERREJECTED	Critical
	12. SHORT CIRCUIT - WRONG PATTERN DISPLAY	NON DISPLAY - WRONG PATTERN DISPLAY - CURRENT CONSUMPTION OUT OF SPECIFICATION..... REJECTED	Critical
	13. PIN HOLE - PATTERN DEFORMITY	ACCORDING TO STANDARD OF VISUAL INSPECTION	Minor

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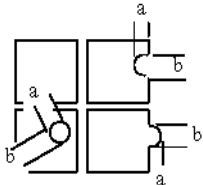


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8.4. STANDARD OF VISUAL INSPECTION

NO.	CLASS	ITEM	JUDGEMENT																									
8.4.1	MINOR	· BLEMISH · BLACK SPOT · WHITE SPOT IN THE LCD. · BLEMISH · BLACK SPOT · WHITE SPOT AND SCRATCH ON THE POLARIZER	(A) ROUND TYPE: unit : mm. <table border="1"> <thead> <tr> <th>DIAMETER (mm.)</th> <th>ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.1$</td> <td>DISREGARD</td> </tr> <tr> <td>$0.1 < \Phi \leq 0.2$</td> <td>2</td> </tr> <tr> <td>$0.2 < \Phi \leq 0.25$</td> <td>1</td> </tr> <tr> <td>$0.25 < \Phi$</td> <td>0</td> </tr> </tbody> </table> NOTE: $\Phi = (\text{LENGTH} + \text{WIDTH}) / 2$ (B) LINER TYPE: unit : mm. <table border="1"> <thead> <tr> <th>LENGTH</th> <th>WIDTH</th> <th>ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td>-----</td> <td>$W \leq 0.03$</td> <td>DISREGARD</td> </tr> <tr> <td>$L \leq 5.0$</td> <td>$0.03 < W \leq 0.05$</td> <td>3</td> </tr> <tr> <td>$L \leq 5.0$</td> <td>$0.05 < W \leq 0.07$</td> <td>1</td> </tr> <tr> <td>-----</td> <td>$0.07 < W$</td> <td>FOLLOW ROUND TYPE</td> </tr> </tbody> </table>	DIAMETER (mm.)	ACCEPTABLE Q'TY	$\Phi \leq 0.1$	DISREGARD	$0.1 < \Phi \leq 0.2$	2	$0.2 < \Phi \leq 0.25$	1	$0.25 < \Phi$	0	LENGTH	WIDTH	ACCEPTABLE Q'TY	-----	$W \leq 0.03$	DISREGARD	$L \leq 5.0$	$0.03 < W \leq 0.05$	3	$L \leq 5.0$	$0.05 < W \leq 0.07$	1	-----	$0.07 < W$	FOLLOW ROUND TYPE
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$L \leq 5.0$	$0.05 < W \leq 0.07$	1																										
-----	$0.07 < W$	FOLLOW ROUND TYPE																										
8.4.2	MINOR	BUBBLE IN POLARIZER	unit : mm. <table border="1"> <thead> <tr> <th>DIAMETER</th> <th>ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.15$</td> <td>DISREGARD</td> </tr> <tr> <td>$0.15 < \Phi \leq 0.5$</td> <td>2</td> </tr> <tr> <td>$0.5 < \Phi$</td> <td>0</td> </tr> </tbody> </table>	DIAMETER	ACCEPTABLE Q'TY	$\Phi \leq 0.15$	DISREGARD	$0.15 < \Phi \leq 0.5$	2	$0.5 < \Phi$	0																	
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8.4.3	MINOR	PIN HOLE · PATTERN DEFORMITY	unit : mm.  <table border="1"> <thead> <tr> <th>DIAMETER</th> <th>ACC. Q'TY</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.1$</td> <td>DISREGARD</td> </tr> <tr> <td>$0.1 < \Phi \leq 0.25$</td> <td>3</td> </tr> <tr> <td>$0.25 < \Phi$</td> <td>0</td> </tr> </tbody> </table> <p>$\Phi = (a+b)/2$</p>	DIAMETER	ACC. Q'TY	$\Phi \leq 0.1$	DISREGARD	$0.1 < \Phi \leq 0.25$	3	$0.25 < \Phi$	0																	
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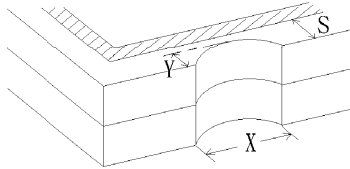
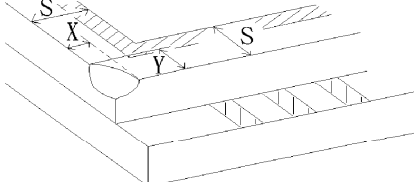
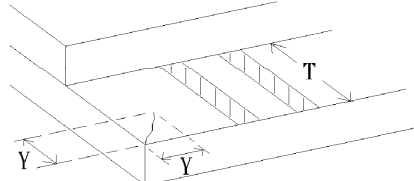
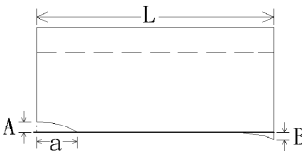
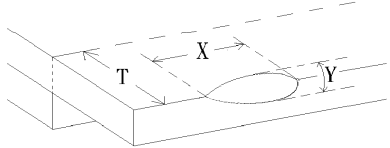
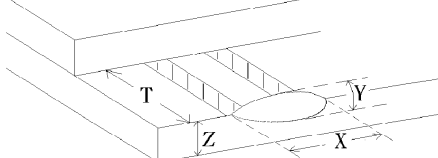
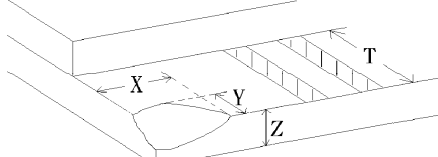
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NO.	CLASS	ITEM	JUDGEMENT
8.4.4	MINOR	CHIPPING	 $Y > S$ REJ.
8.4.5	MINOR	CHIPPING	 $X \text{ or } Y > S$ REJ.
8.4.6	MAJOR	GLASS CRACK	 $Y > (1/2) T$ REJ.
8.4.7	MAJOR	SCRIBE DEFECT	 <ol style="list-style-type: none"> $a > L/3$, $A > 1.5\text{mm}$. REJ. B : ACCORDING TO DIMENSION
8.4.8	MINOR	CHIPPING (ON THE TERMINAL AREA)	 $\Phi = (x+y)/2 > 2.5 \text{ mm}$ REJ.
8.4.9	MINOR	CHIPPING (ON THE TERMINAL SURFACE)	 $Y > (1/3) T$ REJ.
8.4.10	MINOR	CHIPPING	 $Y > T$ REJ.

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