Microtips TECHNOLOGY

Model No: 13-156HIEB0GA1-S

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RECORD OF REVISION

Version	Revised Date	Page	Content
V1.0	2019/07/03	--	First Issued
V1.1	2019/10/31	5	MECHANICAL SPECIFICATION

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1. GENERAL DESCRIPTION

1.1 Description

The specifications is model 13-156HIEB0GA1-S is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit, a back light system. This TFT LCD has a 15.6 (16:9) inch diagonally measured active display area with FHD (1920 horizontal by 1080 vertical pixels) resolution.

1.2 Features:

No.	Item	Specification	Unit
1	Panel Size	15.6”	Inch
2	Number of Pixels	1920 (W) x RGB x 1080 (H)	Pixels
3	Active Area	344.16 (W) × 193.59 (H)	mm
4	Pixel Pitch	0.17925 (W) x 0.17925 (H)	mm
5	Outline Dimension	360.0 (W) × 222.24 (H) × 17.3 (T)	mm
6	Number of Colors	262K	- -
7	Display Mode	Normally Black	- -
8	View Direction	Free direction	- -
9	Display Format	RGB vertical stripe	- -
10	Surface Treatment	Anti-Glare (3H)	- -
11	Contrast Ratio	1000 (Typ.)	- -
12	Luminance (cd/m^2)	1000 (Typ.)	cd/m2
13	Interface	LVDS 8-bits Interface	- -
14	Backlight	White LED	- -
15	Operation Temperature	-30 ~ 80	°C
16	Storage Temperature	-30 ~ 80	°C
17	Weight	TBD	g

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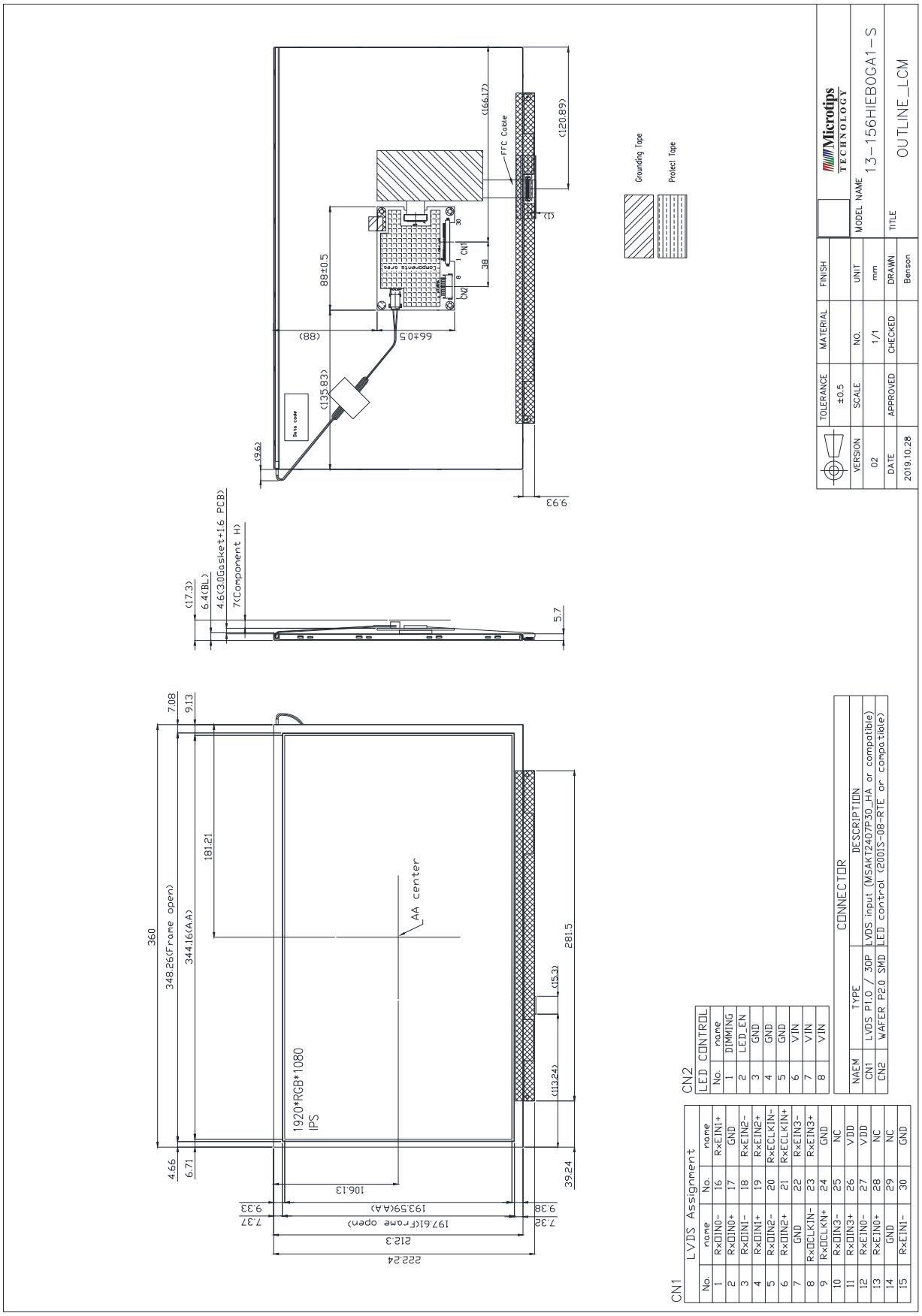
2. MECHANICAL SPECIFICATION



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3. PIN DESCRIPTION

3.1 LVDS 8-bits Interface (CN1) [MSAKT2407P30HA or compatible]

Pin	Symbol	I/O	Function	Note
1	RxOIN0-	I	Negative LVDS differential data input (Odd data).	
2	RxOIN0+	I	Positive LVDS differential data input (Odd data).	
3	RxOIN1-	I	Negative LVDS differential data input (Odd data).	
4	RxOIN1+	I	Positive LVDS differential data input (Odd data).	
5	RxOIN2-	I	Negative LVDS differential data input (Odd data).	
6	RxOIN2+	I	Positive LVDS differential data input (Odd data).	
7	GND	P	Ground.	
8	RxOCLKIN-	I	Negative LVDS differential data input (Odd clock).	
9	RxOCLKIN+	I	Positive LVDS differential data input (Odd clock).	
10	RxOIN3-	I	Negative LVDS differential data input (Odd data).	
11	RxOIN3+	I	Positive LVDS differential data input (Odd data).	
12	RxEIN0-	I	Negative LVDS differential data input (Even data).	
13	RxEIN0+	I	Positive LVDS differential data input (Even data).	
14	GND	P	Ground.	
15	RxEIN1-	I	Negative LVDS differential data input (Even data).	
16	RxEIN1+	I	Positive LVDS differential data input (Even data).	
17	GND	P	Ground.	
18	RxEIN2-	I	Negative LVDS differential data input (Even data).	
19	RxEIN2+	I	Positive LVDS differential data input (Even data).	
20	RxECLKIN-	I	Negative LVDS differential data input (Even clock).	
21	RxECLKIN+	I	Positive LVDS differential data input (Even clock).	
22	RxEIN3-	I	Negative LVDS differential data input (Even data).	
23	RxEIN3+	I	Positive LVDS differential data input (Even data).	
24	GND	P	Ground.	
25	NC	-	Keep the NC pin open.	
26	VDD	P	Power +3.3V	
27	VDD	P	Power +3.3V	
28	NC	-	Keep the NC pin open.	
29	NC	-	Keep the NC pin open.	
30	GND	P	Ground.	

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3.2 LED CONTROL(CN2) [WAFER P2.0mm:2001S-08-RTE or compatible]

Pin	Symbol	I/O	Function	Note
1	DIMMING	I	Backlight Adjust	
2	LED_EN	I	Enable pin	
3	GND	P	Converter ground	Ground
4	GND	P	Converter ground	Ground
5	GND	P	Converter ground	Ground
6	VIN	P	Converter input voltage	12V
7	VIN	P	Converter input voltage	12V
8	VIN	P	Converter input voltage	12V

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4. ABSOLUTE MAXIMUM RATINGS

4.1 Electrical Absolute Rating

4.1.1 TFT LCD Module

Item	Symbol	Values		Unit	Note
		Min	Max.		
Power supply voltage	VDD	-0.3	4.0	V	
BL input voltage	VIN	-0.3	20.0	V	

4.2 Environment Absolute Rating

Item	Symbol	Values			Unit	Note
		Min	Typ	Max.		
Operating Temperature	Topa	-30	-	80	°C	
Storage Temperature	Tstg	-30	-	80	°C	

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5. ELECTRICAL CHARACTERISTICS

5.1 TFT LCD Module

Item	Symbol	Values			Unit	Note
		Min	Typ.	Max.		
Supply Voltage	VDD	3.0	3.3	3.6	V	
Supply Current	IDD	-	355	380	mA	

5.2 Backlight Unit(LED CONTROL)

Item	Symbol	Values			Unit	Note
		Min	Typ.	Max.		
Supply Voltage	VIN	11	12	20	V	
PWM frequency		100	-	10K	Hz	
PWM Duty		17	-	100	%	<17%=OFF
PWM Dimming Voltage	$V_{DIMMING-IH}$	2	3.3	8	V	
	$V_{DIMMING-IL}$	-	-	0.3	V	
LED Enable Control Voltage	V_{LED_EN-IH}	2	3.3	12	V	
	V_{LED_EN-IL}	-	-	0.5	V	
Supply Current	ICC(12V)	-	1200	1300	mA	
LED life time		-	50000	-	Hr	(1)

Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25℃ 60% RH.

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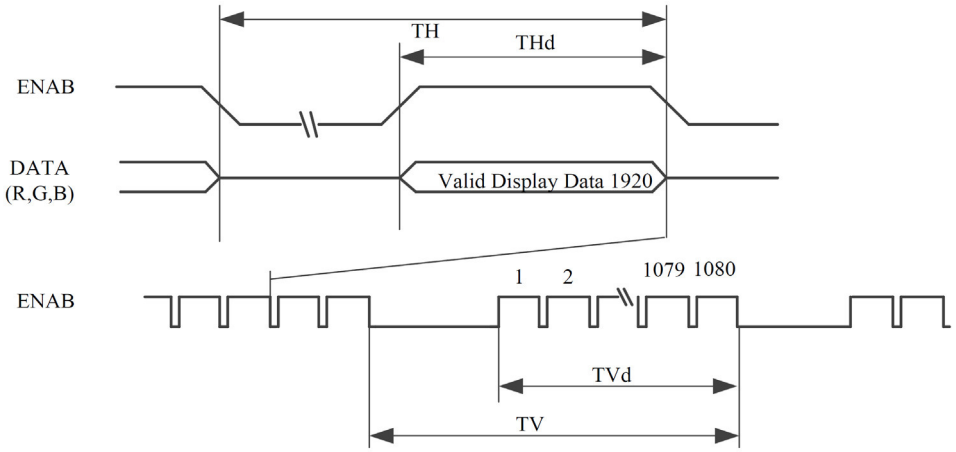
6. INTERFACE SPECIFICATIONS

6.1 Timing

Signal	Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	CLK frequency	1/Tc	132.5	139.77	150.0	MHz	*1
Data enable signal	Horizontal period	T_H	2002	2080	2400	Tc	
	Horizontal period (High)	T_{HD}	-	1920	-	Tc	
	Vertical Period	T_V	1103	1120	1200	T_H	
	Vertical Period (High)	T_{VD}	-	1080	-	T_H	

Note 1: In case of using the long vertical period, the deterioration of display quality, flicker, etc, may occur.



6.2 Input data signals and display position on the screen

Display position of input data(V·H)

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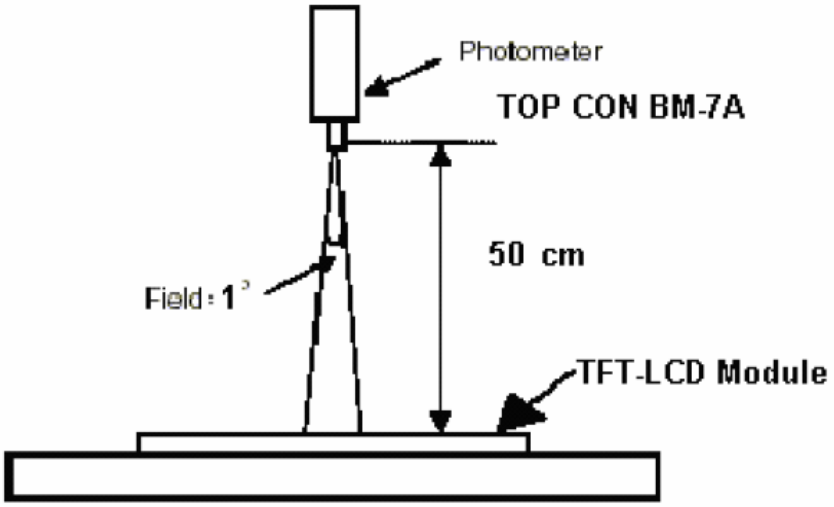
7. OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Brightness		--	Note1, Note 3, ($\theta = 0^\circ$, Normal Viewing Angle)	800	1000	--	cd/m2
Uniformity		B-uni		--	70	--	%
Contrast Ratio		CR		700	1000	--	--
Response Time		Tr + Tf		--	25	35	ms
Color Chromaticity	White	Wx		0.247	0.297	0.347	--
		Wy		0.287	0.337	0.387	--
	Red	Rx		0.542	0.592	0.642	
		Ry		0.310	0.360	0.410	
	Green	Gx		0.292	0.342	0.392	
		Gy		0.507	0.557	0.607	
	Blue	Bx		0.108	0.158	0.208	
		By		0.059	0.109	0.159	
View angle	Horizontal	θ x+	Center CR≥10	80	85	--	
		θ x-		80	85	--	
	Vertical	θ Y+		80	85	--	
		θ Y-		80	85	--	

Note：The following optical specifications shall be measured in a darkroom or equivalent state(ambient luminance ≤1 lux, and at room temperature). The operation temperature is 25°C±2°C. The measurement method is shown in Note1.

Note 1: The method of optical measurement:



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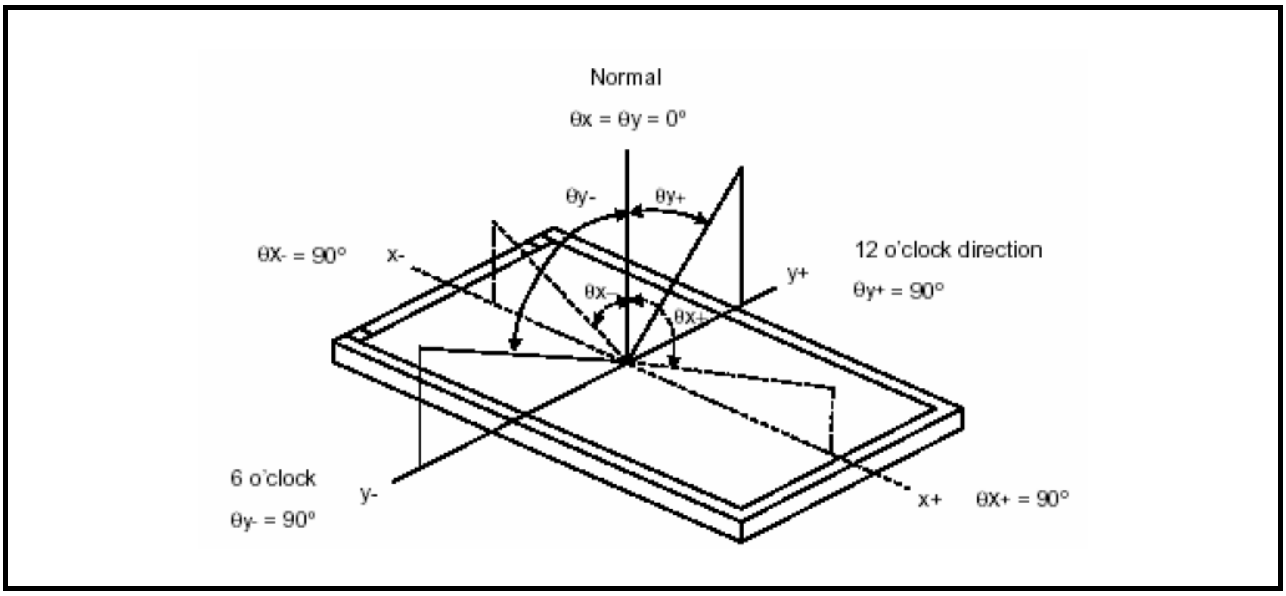
Note 2: Measured at the center area of the panel and at the viewing angle of the θ x= θ y =0°

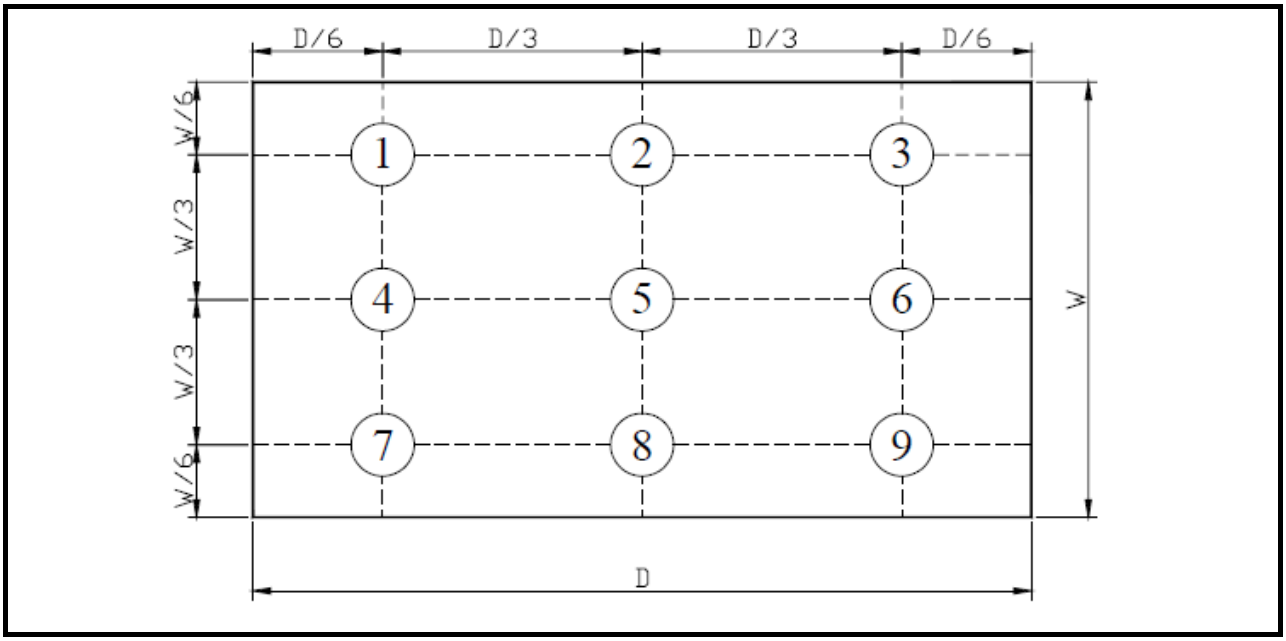
Note 3: Definition of Contrast Ratio (CR):

CR = Luminance with all pixels in white state ÷ Luminance with all pixels in Black state

Note 4: Definition of Viewing Angle:



Note 5: Definition of Brightness Uniformity (B-uni):



B-uni ＝(Minimum luminance of 9 points÷Maximum luminance of 9points)X100%

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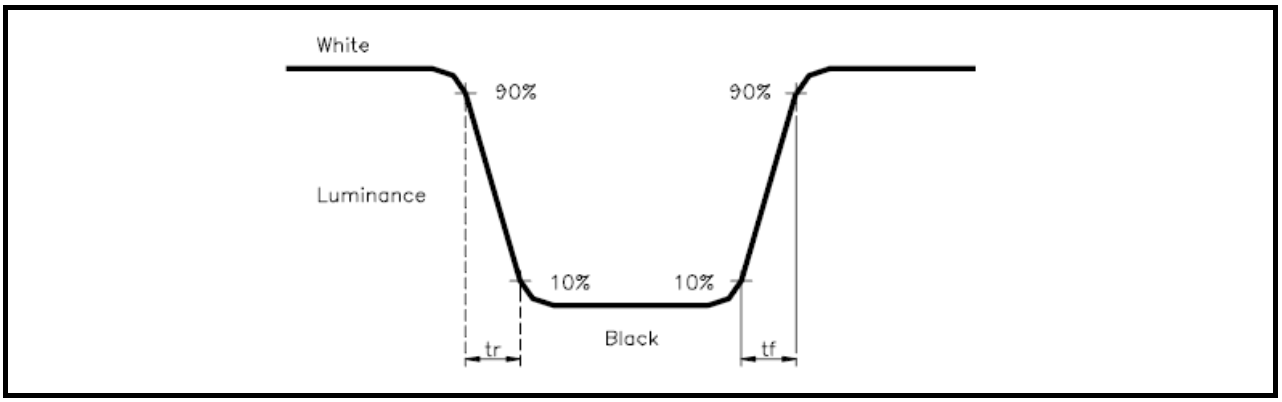
Note 6: Definition of Response Time:
The Response Time is set initially by defining the “Rising Time (Tr)” and the “Falling Time (Tf)” respectively. Tr and Tf are defined as following figure



Note 7: Definition of Chromaticity:
The color coordinates (Wx,Wy),(Rx,Ry),(Gx,Gy),and (Bx,By) are obtained with all pixels in the viewing field at white, red, green, and blue states, respectively.

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8. RELIABILITY

8.1 Test Condition

8.1.1 Temperature and Humidity(Ambient Temperature)

Temperature : 25 ± 5°C

Humidity : 65 ± 5%

8.1.2 Operation

Unless specified otherwise, test will be conducted under function state.

8.1.3 Container

Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

8.1.4 Test Frequency

In case of related to deterioration such as shock test. It will be conducted only once.

8.2 TESTS

No.	ITEM	CONDITION CRITERION
1	High Temperature Storage	80°C, 240 hrs
2	Low Temperature Storage	-30°C, 240 hrs
3	High Temperature Operating	80°C, 240 hrs
4	Low Temperature Operating	-30°C, 240 hrs
5	High Temperature/Humidity	40°C, 90%RH,300 hrs
6	Temperature Shock Non-Operating	-30°C ←→ 80°C (0.5hr each), 50 cycles
7	Vibration Test Non-Operating	Frequency:0 ~ 55 Hz Amplitude:1.5 mm Sweep Time:11min Test Period:6 Cycles for each Direction of X,Y,Z
8	Electro-static Discharge	Contact Discharge: ±8 KV, 150pF(330Ω) 1sec,8Points, 25times/point Air Discharge: ±15 KV, 150pF(330Ω) 1sec, 8Points,25times/point

Note1: The test sample have recovery time for 24 hours at room temperature before the function check. In the standard conditions, there is no any touch panel function NG issue occurred.

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8.3 JUDGMENT STANDARD

The judgment of the above test should be made as follow:

Pass: Normal display image with no obvious non-uniformity and no line defect. Partial transformation of the module parts should be ignored.

Fail: No display image, obvious non-uniformity, or line defects.

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8.4 INCOMING INSPECTION STANDARDS

<table>
<tr><th>No.</th><th>Parameter</th><th>Criteria</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Operating</td><td>
Display function: No Display malfunction (Major)
Contrast ratio (Black, White):
Does not meet specified range in the spec. (Major) (Note:3)
Line Defect: No obvious Vertical and Horizontal line defect in bright, dark and colored. (Major) (Note:1)
Point Defect : Active area ≤ 5 dots (Minor) (Note:1)
<table>
<tr><th rowspan="2">Item</th><th>Acceptable number</th><th rowspan="2">Total</th></tr>
<tr><th>Active Area</th></tr>
<tr><td>Bright</td><td>5</td><td rowspan="2">8</td></tr>
<tr><td>Dark</td><td>5</td></tr>
</table>
</td></tr>
<tr><td>
Non-uniformity: Visible through 5%ND filter. (Minor)
Foreign material in Black or White spots shape (W>1/4L)
<table>
<tr><th>Zone / Dimension</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>D> 0.5</td><td>0</td><td rowspan="3">Minor</td><td rowspan="3">1.5</td></tr>
<tr><td>0.3 < D ≤ 0.5</td><td>5</td></tr>
<tr><td>D ≤ 0.3</td><td>*</td></tr>
</table>
D = (Long + Short) / 2 ＊: Disregard
Foreign Material in Line or spiral shape (W≤1/4L) (Note: 4)
<table>
<tr><th>L (mm) / Zone W(mm)</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>L >5</td><td>W>0.1</td><td>0</td><td rowspan="3">Minor</td><td rowspan="3">1.5</td></tr>
<tr><td>0.5 < L ≤ 5</td><td>0.03 < W≤0.1</td><td>5</td></tr>
<tr><td>L ≤0.5</td><td>W≤0.03</td><td>*</td></tr>
</table>
L : Length W : Width ＊: Disregard
</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">External Inspection (non-operating)</td><td>
Dimension: Outline (Major)
Bezel appearance: uneven (Minor)
Scratch on the polarize: (Note:2)
<table>
<tr><th>L (mm) / Zone W(mm)</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>--</td><td>W>0.1</td><td>0</td><td rowspan="2">Minor</td><td rowspan="2">1.5</td></tr>
<tr><td>L ≤ 3</td><td>W≤0.1</td><td>3</td></tr>
</table>
L : Length W : Width ＊: Disregard
</td></tr>
<tr><td>
Dent or bubble on the polarize (Note:2)
<table>
<tr><th>Zone / Dimension</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>D≤0.3</td><td>*</td><td rowspan="2">Minor</td><td rowspan="2">1.5</td></tr>
<tr><td>D≤0.5</td><td>5</td></tr>
</table>
D = (Long + Short) / 2 ＊: Disregard
</td></tr>
</table>

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Class of defects	**Major**	AQL 0.65%	**Definition** It is a defect that is likely to result in failure or to reduce materially the usability of the product for the intended function.
	Minor	AQL 1.5%	It is a defect that will not result in functioning problem with deviation classified.

Note1:

(a)Bright point defect is defined as point defect of R,G,B with area >1/2 pixel respectively

(b)Dark point defect is defined as visible in full white pattern.

(c)Definition of distribution of point defect is as follows:

-minimum separation between dark point defects should be larger than 5mm.

-minimum separation between bright point defects should be larger than 5mm.

(d)Definition of joined bright point defect and joined dark point defect are as follows:

-Two joined bright point defects: ≦ 2

-Three joined bright point defects: ≦ 1

-Two joined dark point defects: ≦ 2

-Three joined dark point defects: ≦ 1

-Four or more joined bright point defects must be nil.

-Four or more joined dark point defects must be nil.

-Coupling of one dark and one bright point in junction is counted as one dark and bright spot with 2 pair maximum.

-Two Joined dark point is counted as two dark points with 2 pair maximum.

-Flashing dot is counted as a Black dot.

Note2: The external inspection should be conducted at the distance 30± 5cm between the eyes of inspector and the panel.

Note3: Luminance measurement for contrast ratio is at the distance 50± 5cm between the detective head and the panel with ambient luminance less than 1 lux. Contrast ratio is obtained at optimum view angle.

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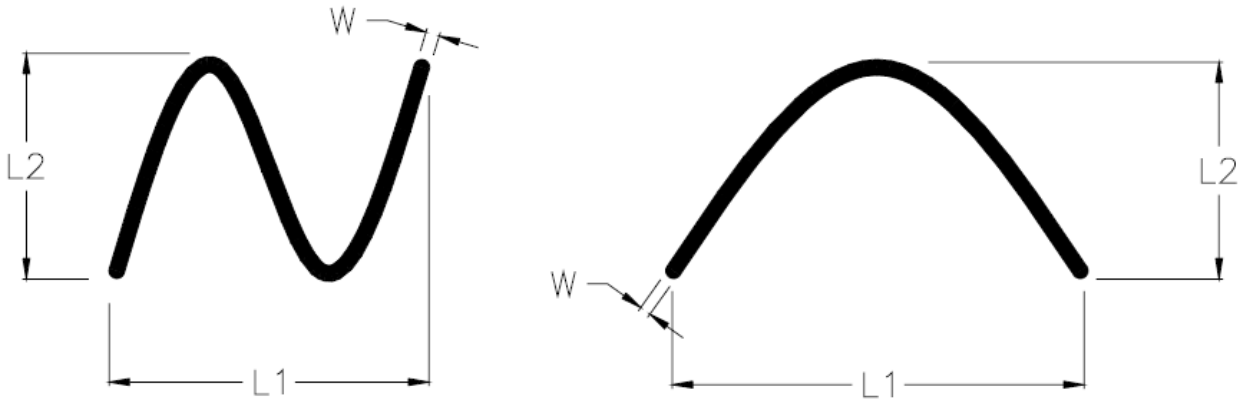
Note4: W-Width in mm , L-length of Max.(L1,L2) in mm.



8.5 Sampling Condition

Unless otherwise agree in written, the sampling inspection shall be applied to the incoming inspection of customer.

Lot size: Quantity of shipment lot per model.

Sampling type: normal inspection, single sampling

Sampling table: MIL-STD-105E

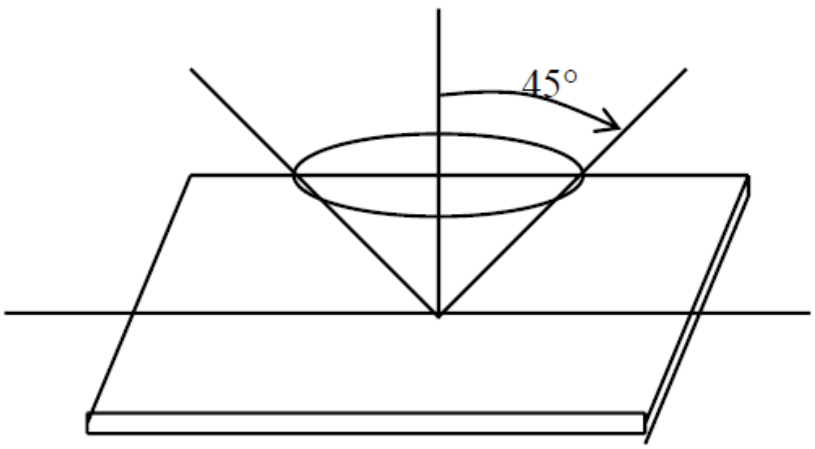
Inspection level: Level II

8.6 Inspection conditions

The LCD shall be inspected under 40W white fluorescent light.

$\theta \leq 45^{\circ}$ inspection under non-operating condition.

$\theta \leq 5^{\circ}$ inspection under operating condition



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9. PRECAUTION RELATING PRODUCT HANDLING

9.1 SAFETY

9.1.1 If the LCD panel breaks , be careful not to get the liquid crystal to touch your skin.

9.1.2 If the liquid crystal touches your skin or clothes , please wash it off immediately by using soap and water.

9.2 HANDLING

9.2.1 Avoid any strong mechanical shock which can break the glass.

9.2.2 Avoid static electricity which can damage the CMOS LSI—When working with the module, be sure to ground your body and any electrical equipment you may be using.

9.2.3 Do not remove the panel or frame from the module.

9.2.4 The polarizing plate of the display is very fragile. So , please handle it very carefully, Do not touch, push or rub the exposed polarizing with anything harder than an HB pencil lead (glass , tweezers , etc.)

9.2.5 Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.

9.2.6 Do not touch the display area with bare hands , this will stain the display area.

9.2.7 Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.

9.2.8 To control temperature and time of soldering is 280 ± 10°C and 3-5 sec.

9.2.9 To avoid liquid (include organic solvent) stained on LCM.

9.3 STORAGE

9.3.1 Store the panel or module in a dark place where the temperature is 25°C ± 5°C and the humidity is below 65% RH.

9.3.2 Do not place the module near organics solvents or corrosive gases.

9.3.3 Do not crush, shake, or jolt the module.

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