



Microtips

TECHNOLOGY

Model No: 13-070WIEC0GA0-S

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RECORD OF REVISION

Version	Revised Date	Page	Content
V0.1	2018/11/09	--	Preliminary SPEC
V1.0	2019/04/23		First issue
V1.1	2020/03/24	5	Update PCB Size 47.5mm → 49mm

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1. GENERAL DESCRIPTION

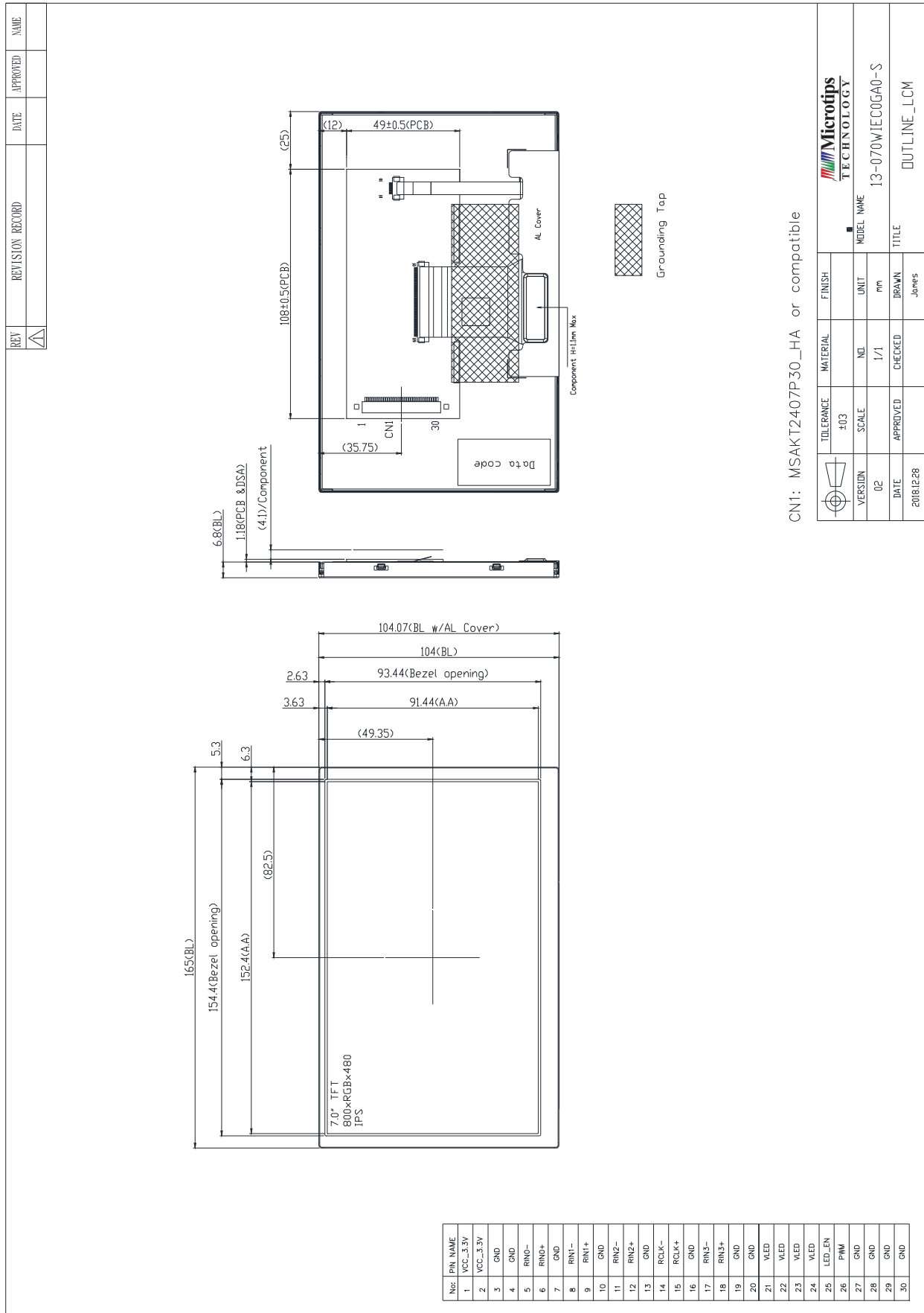
1.1 Description

The specification is model 13-070WIEC0GA0-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 backlight system. This TFT LCD has a 7.0 (15:9) inch diagonally measured active display area with WVGA (800 horizontal by 480 vertical pixels) resolution.

1.2 Features:

No.	Item	Specification	Unit
1	Panel Size	7.0"	Inch
2	Number of Pixels	800 (H) x RGB x 480 (V)	Pixels
3	Active Area	152.4 (H) x 91.44 (V)	mm
4	Pixel Pitch	0.1905 (H) x 0.1905 (V)	mm
5	Outline Dimension	165 (H) x 104.07 (V) x 6.8 (T)	mm
6	Number of Colors	16.7M	- -
7	Display Mode	IPS / Normally Black / Transmissive	- -
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/m ²
13	Interface	LVDS 8 bit Interface	- -
14	Backlight	White LED	- -
15	Operation Temperature	-40 ~ 80	°C
16	Storage Temperature	-40 ~ 80	°C
17	Weight	(TBD)	g

2. MECHANICAL SPECIFICATION



3. PIN DESCRIPTION

3.1 TFT LCD Module (Connector Part No: MSAKT2407P30_HA or equivalent)

Pin No.	Symbol	I/O	Function	Note
1	VCC	P	Power Supply Logic voltage +3.3V	
2	VCC	P	Power Supply Logic voltage +3.3V	
3	GND	P	Ground	
4	GND	P	Ground	
5	RIN0-	I	Negative LVDS differential data input	
6	RIN0+	I	Positive LVDS differential data input	
7	GND	P	Ground	
8	RIN1-	I	Negative LVDS differential data input	
9	RIN1+	I	Positive LVDS differential data input	
10	GND	P	Ground	
11	RIN2-	I	Negative LVDS differential data input	
12	RIN2+	I	Positive LVDS differential data input	
13	GND	P	Ground	
14	RCLK-	I	Negative LVDS differential clock input	
15	RCLK+	I	Positive LVDS differential clock input	
16	GND	P	Ground	
17	RIN3-	I	Negative LVDS differential data input	
18	RIN3+	I	Positive LVDS differential data input	
19	GND	P	Ground	
20	GND	P	Ground	
21	VLED	P	Power Supply LED voltage	
22	VLED	P	Power Supply LED voltage	
23	VLED	P	Power Supply LED voltage	
24	VLED	P	Power Supply LED voltage	
25	LED_EN	I	Backlight Enable signal	
26	PWM	I	Backlight Dimming control	
27	GND	P	Ground	
28	GND	P	Ground	
29	GND	P	Ground	
30	GND	P	Ground	

4. ABSOLUTE MAXIMUM RATINGS

4.1 Electrical Absolute Rating

4.1.1 TFT LCD Module

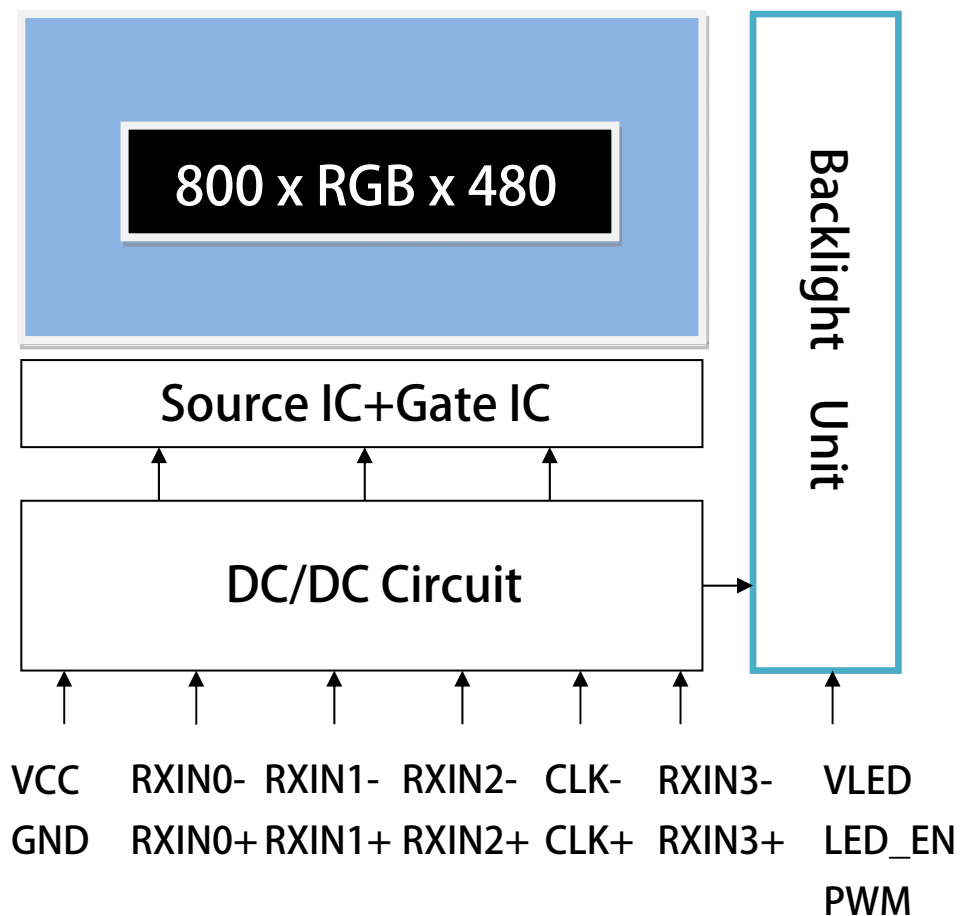
Item	Symbol	Values		Unit	Note
		Min	Max.		
Power supply voltage	VCC	-0.3	4.0	V	
	VLED	5	13	V	

4.1.2 Environment Absolute Rating

Item	Symbol	Values			Unit	Note
		Min	Typ	Max.		
Operating Temperature	Topa	-40		80	°C	Ambient temperature
Storage Temperature	Tstg	-40		80	°C	

5. BLOCK DIAGRAM

5.1 TFT LCD Module



6. Relationship Between Displayed Color and Input

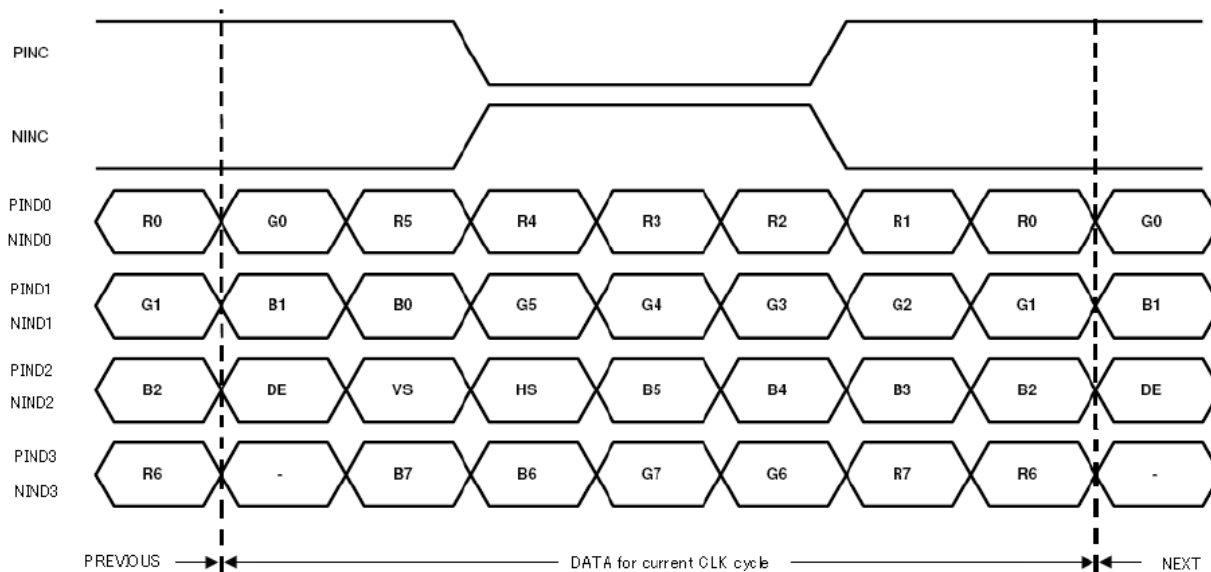
6.1 8 bit

	Color & Gray Scale	Data Signal																							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(127)	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(127)	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(127)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

0 : Low level voltage, 1 :High level voltage

Each basic color can be displayed in 256 gray scales from 8 bit data signals. With the combination of total 24 bit data signals, the 16,777,216-color display can be achieved on the screen.

6.2 LVDS Mapping

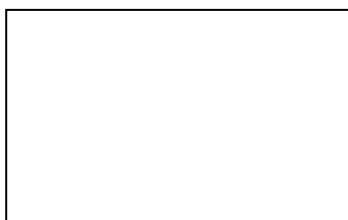


7. ELECTRICAL CHARACTERISTICS

7.1 TFT LCD Module

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Supply Voltage	VCC	3.0	3.3	3.6	V	
	VLED	11	12	13	V	
	VRF	-	-	100	mV p-p	Ripple voltage
Differential Input High Threshold	VTH	-	-	+100	mV	Vcm=+1.2V
Differential Input Low Threshold	VTL	-100	-	-	mV	Vcm=+1.2V
Magnitude differential Input Voltage	VID	100	-	600	mV	
Common Mode Voltage	Vcm	0.7	1.2	1.6	V	
Common Mode Voltage Offset	ΔV_{cm}	-	-	50	mV	Vcm=+1.2V
Supply Current	ICC	-	200	250	mA	VCC=3.3V
	IDD	-	360	450	mA	VLED=12V
PWM frequency	PWM	100	-	8K	Hz	
PWM input voltage	VIH	1.6	-	-	V	
	VIL	-	-	0.8	V	
LED_EN input voltage	VIH	1.6	-	-	V	
	VIL	-	-	0.8	V	
LED life time		30000	-	-	Hr	(2)

Note (1): frame =60Hz, Ta=25°C, Display pattern: White pattern

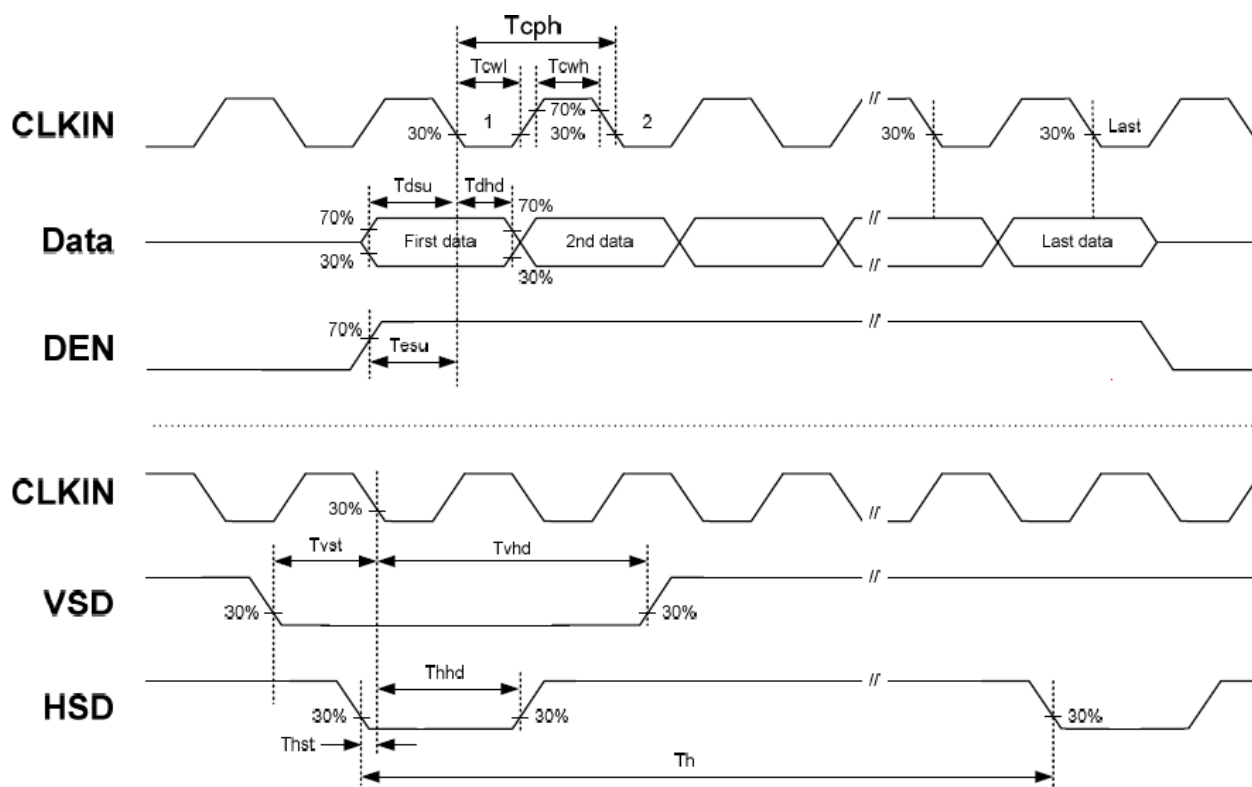


Note (2): The “LED life time” is defined as the module brightness decrease to 50% Original brightness that the ambient temperature is 25°C 60% RH.

7.2 INTERFACE SPECIFICATIONS

7.2.1 AC Timing characteristics

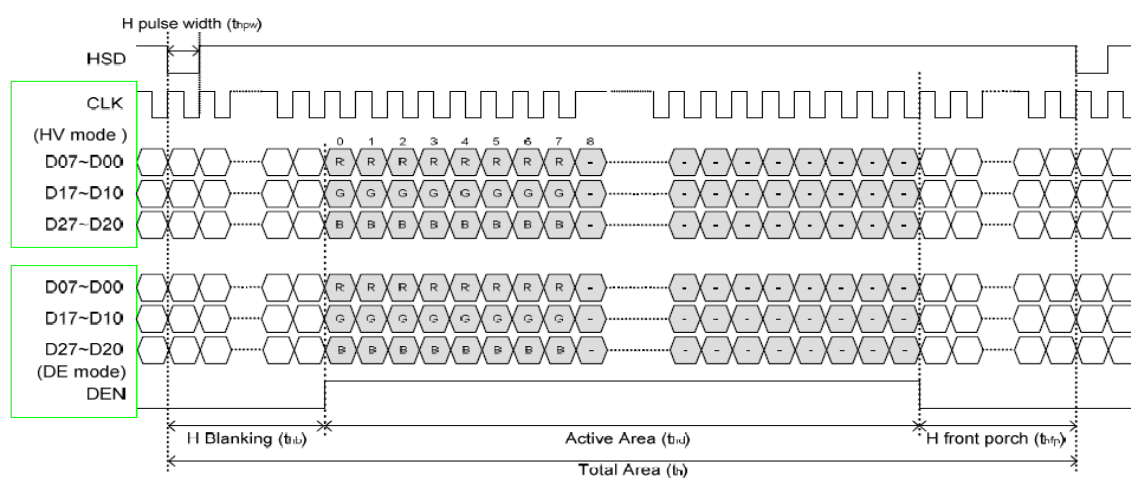
Signal	Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
HSYNC	HS setup time	Thst	8	-	-	ns	
	HS hold time	Thhd	8	-	-	ns	
VSYNC	VS setup time	Tvst	8	-	-	ns	
	VS hold time	Tvhd	8	-	-	ns	
Data	Data setup time	Tdsu	8	-	-	ns	
	Data hold time	Tdhd	8	-	-	ns	
DE	DEN setup time	Tvpw	8	-	-	ns	
	DEN hold time	Tvb	8	-	-	ns	



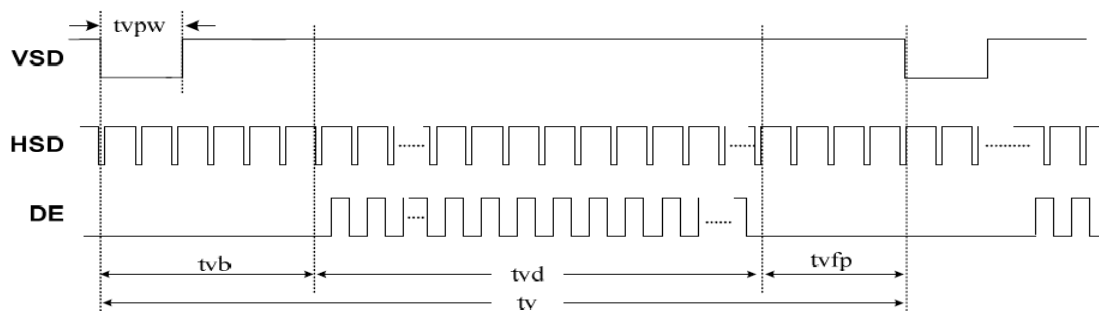
7.2.2 Timing Table

Signal	Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
DCLK	CLK frequency	Fclk	28	30	32	MHz	
	CLK period	Tcph	20	-	220	ns	
	CLK pulse duty	Tcwh	35	50	65	%	
HSYNC	Horizontal Line	Th	899	902	915	CLK	
	HS Display Area	Thd	-	800	-	CLK	
	HS Pulse Width	Thpw	5	10	15	CLK	
	HS Back Porch	Thb	-	32	-	CLK	
	HS Front Porch	Thfp	52	60	68	CLK	
DE	DE Mode Blanking	Th-Thd	85	256	400	CLK	
VSYNC	VS Display Area	Tvd	-	480	-	th	
	VS Period Time	Tv	546	555	564	th	
	VS Pulse Width	Tvpw	6	10	14	th	
	VS Back Porch	Tvb	-	5	-	th	
	VS Front Porch	Tvfp	55	60	65	th	

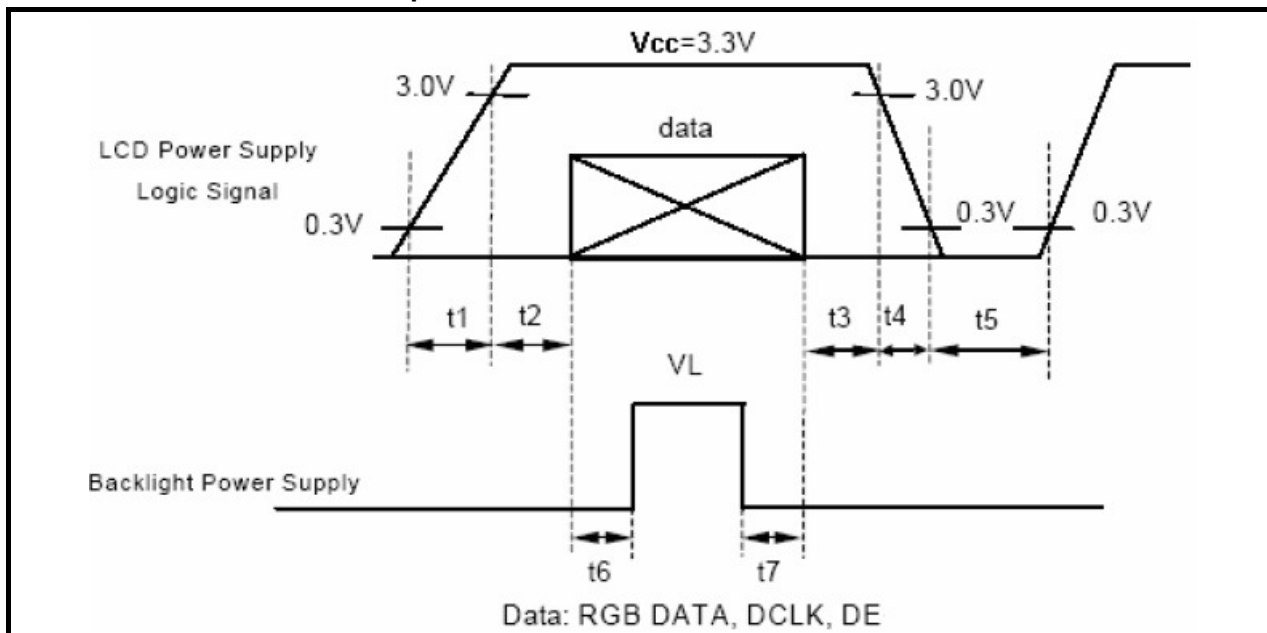
Horizontal input timing



Vertical input timing



7.3 Power On / Off Sequence



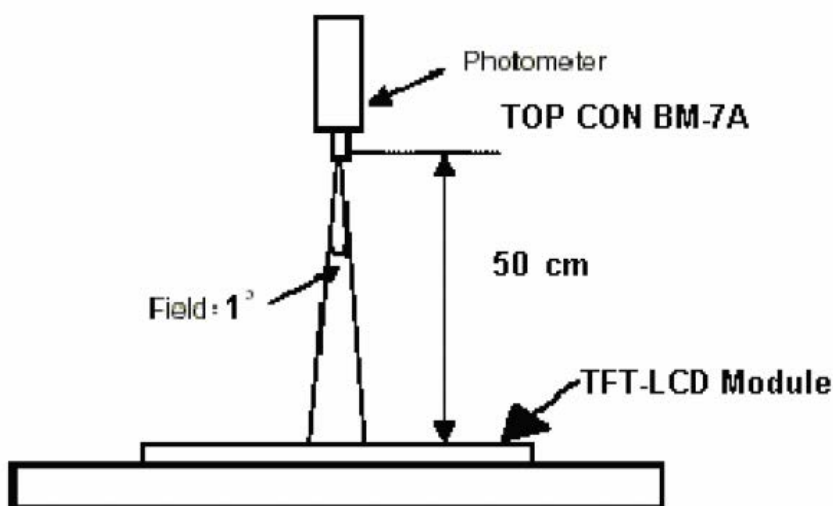
$$\begin{aligned}
 t_1 &\leq 20\text{ms} \mid 1 \text{ sec} \leq t_5 \\
 120\text{ms} &\leq t_2 \mid 32\text{ms} \leq t_6 \\
 100\text{ms} &\leq t_3 \mid 32\text{ms} \leq t_7 \\
 0 &< t_4 \leq 10\text{ms}
 \end{aligned}$$

8. OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Brightness	--	Note1, Note 3, ($\theta = 0^\circ$; Normal Viewing Angle)	750	1000	--	cd/m ²
Uniformity	B-uni		70	80	-	%
Contrast Ratio	CR		700	1000	--	--
Response Time	Tr+Tf		-	30	40	ms
Color Chromaticity	White	Wx	0.260	0.310	0.360	--
		Wy	0.280	0.330	0.380	--
View angle	Horizontal	$\theta x+$	80	85	--	
		$\theta x-$	80	85	--	
	Vertical	$\theta Y+$	80	85	--	
		$\theta Y-$	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 $25^\circ\text{C} \pm 2^\circ\text{C}$. The measurement method is shown in Note1.

Note 1: The method of optical measurement:

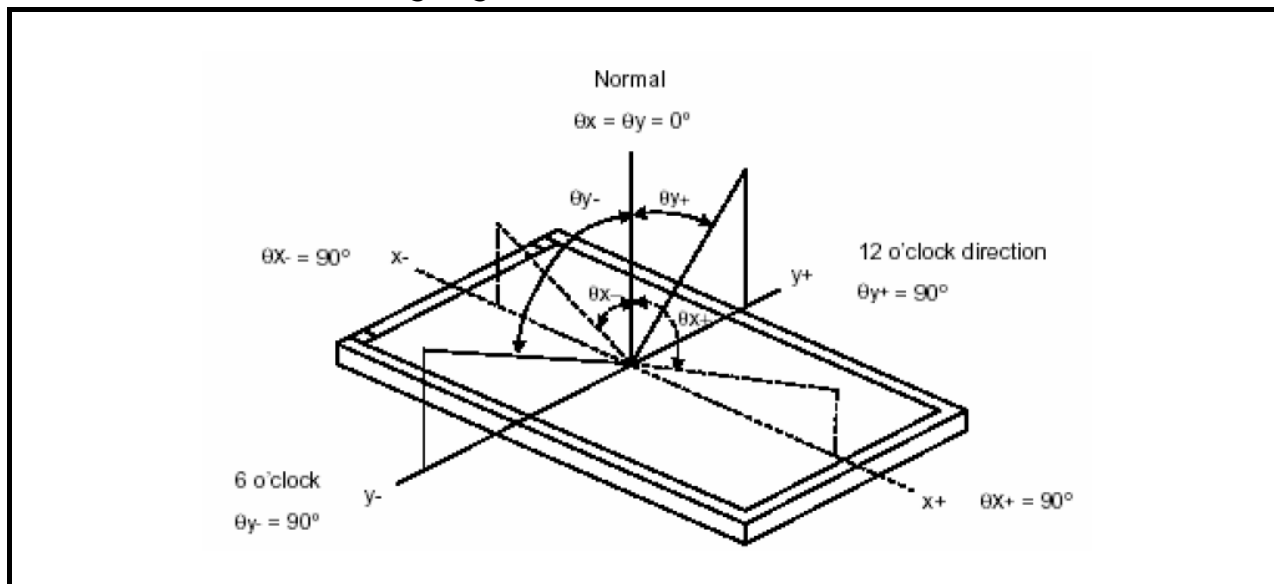


Note 2: Measured at the center area of the panel and at the viewing angle of the $\theta x = \theta y = 0^\circ$

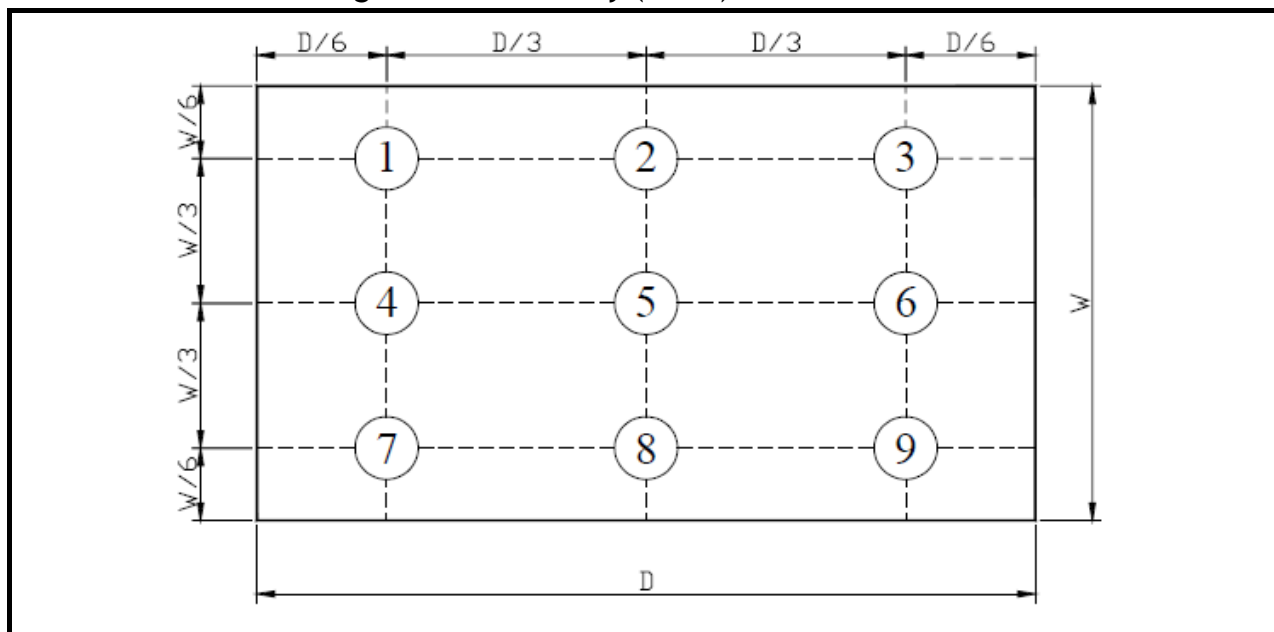
Note 3: Definition of Contrast Ratio (CR):

CR = Luminance with all pixels in white state $\div$ Luminance with all pixels in Black state

Note 4: Definition of Viewing Angle:



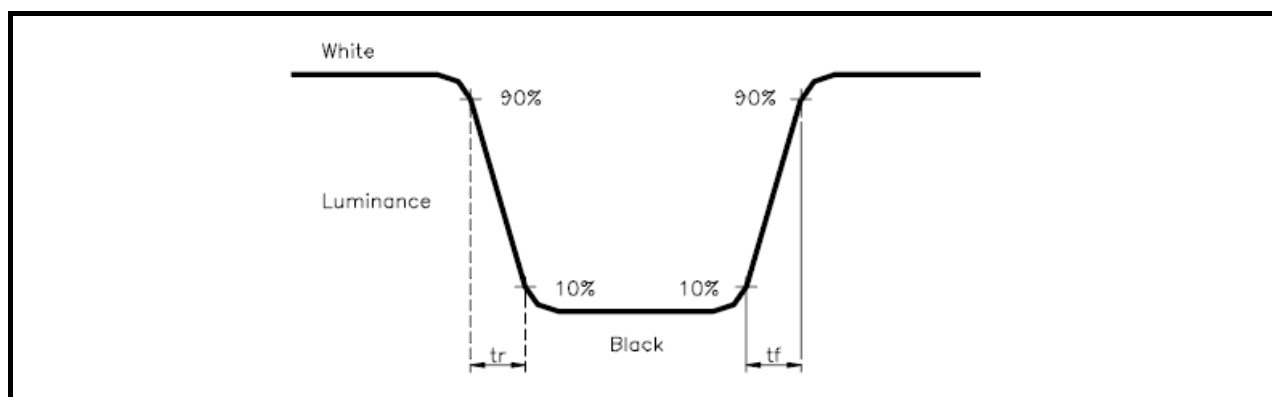
Note 5: Definition of Brightness Uniformity (B-uni):



$$B\text{-uni} = (\text{Minimum luminance of 9 points} \div \text{Maximum luminance of 9 points}) \times 100\%$$

Note 6: Definition of Response Time:

The Response Time is set initially by defining the “Rising Time (T_r)” and the “Falling Time (T_f)” respectively. T_r and T_f are defined as following figure



Note 7: Definition of Chromaticity:

The color coordinates (W_x, W_y), (R_x, R_y), (G_x, G_y), and (B_x, B_y) are obtained with all pixels in the viewing field at white, red, green, and blue states, respectively.

9. RELIABILITY

9.1 Test Condition

9.1.1 Temperature and Humidity(Ambient Temperature)

Temperature : $25 \pm 5^{\circ}\text{C}$

Humidity : $65 \pm 5\%$

9.1.2 Operation

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

9.1.3 Container

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

9.1.4 Test Frequency

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

9.2 TESTS

No.	ITEM	CONDITION CRITERION
1	High Temperature Storage	80°C, 240 hrs
2	Low Temperature Storage	-40°C, 240 hrs
3	High Temperature Operating	80°C, 240 hrs
4	Low Temperature Operating	-40°C, 240 hrs
5	High Temperature/Humidity Non-Operating	60°C, 90%RH, 240 hrs
6	Temperature Shock Non-Operating	-40°C $\longleftrightarrow$ 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 Non-Operating	$\pm 200\text{V}$, 200pF(0_) 1 time/each termina

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.

9.3 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.

9.4 INCOMING INSPECTION STANDARDS

No.	Parameter	Criteria												
1	Operating	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>2</td><td rowspan="2">5</td></tr><tr><td>Dark</td><td>4</td></tr></table>	Item	Acceptable number	Total	Active Area	Bright	2	5	Dark	4			
		Item		Acceptable number		Total								
			Active Area											
		Bright	2	5										
		Dark	4											
		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 rowspan="4">Class Of Defects</th><th rowspan="4">AQL Level</th></tr><tr><td>$D>0.5$</td><td>0</td></tr><tr><td>$0.3 < D \leq 0.5$</td><td>5</td></tr><tr><td>$D \leq 0.3$</td><td>*</td></tr></table>	Zone Dimension	Acceptable number	Class Of Defects	AQL Level	$D>0.5$	0	$0.3 < D \leq 0.5$	5	$D \leq 0.3$	*				
Zone Dimension	Acceptable number	Class Of Defects			AQL Level									
$D>0.5$	0													
$0.3 < D \leq 0.5$	5													
$D \leq 0.3$	*													
$D = (\text{Long} + \text{Short}) / 2$ * : Disregard														
Foreign Material in Line or spiral shape ($W \leq 1/4L$) (Note: 4)														
<table><tr><th>L (mm)</th><th>Zone W(mm)</th><th>Acceptable number</th><th rowspan="4">Class Of Defects</th><th rowspan="4">AQL Level</th></tr><tr><td>$L > 5$</td><td>$W > 0.1$</td><td>0</td></tr><tr><td>$0.5 < L \leq 5$</td><td>$0.03 < W \leq 0.1$</td><td>5</td></tr><tr><td>$L \leq 0.5$</td><td>$W \leq 0.03$</td><td>*</td></tr></table>	L (mm)	Zone W(mm)	Acceptable number	Class Of Defects	AQL Level	$L > 5$	$W > 0.1$	0	$0.5 < L \leq 5$	$0.03 < W \leq 0.1$	5	$L \leq 0.5$	$W \leq 0.03$	*
L (mm)	Zone W(mm)	Acceptable number	Class Of Defects			AQL Level								
$L > 5$	$W > 0.1$	0												
$0.5 < L \leq 5$	$0.03 < W \leq 0.1$	5												
$L \leq 0.5$	$W \leq 0.03$	*												
L : Length W : Width * : Disregard														
2	External Inspection (non-operating)	Dimension: Outline (Major)												
		Bezel appearance: uneven (Minor)												
		Scratch on the polarize: (Note:2)												
		<table><tr><th>L (mm)</th><th>Zone W(mm)</th><th>Acceptable number</th><th rowspan="3">Class Of Defects</th><th rowspan="3">AQL Level</th></tr><tr><td>--</td><td>$W > 0.1$</td><td>0</td></tr><tr><td>$L \leq 3$</td><td>$W \leq 0.1$</td><td>3</td></tr></table>	L (mm)	Zone W(mm)	Acceptable number	Class Of Defects	AQL Level	--	$W > 0.1$	0	$L \leq 3$	$W \leq 0.1$	3	
		L (mm)	Zone W(mm)	Acceptable number	Class Of Defects			AQL Level						
		--	$W > 0.1$	0										
		$L \leq 3$	$W \leq 0.1$	3										
		L : Length W : Width * : Disregard												
		Dent or bubble on the polarize (Note:2)												
		<table><tr><th>Zone Dimension</th><th>Acceptable number</th><th rowspan="3">Class Of Defects</th><th rowspan="3">AQL Level</th></tr><tr><td>$D \leq 0.3$</td><td>*</td></tr><tr><td>$D \leq 0.5$</td><td>3</td></tr></table>	Zone Dimension	Acceptable number	Class Of Defects	AQL Level	$D \leq 0.3$	*	$D \leq 0.5$	3				
Zone Dimension	Acceptable number	Class Of Defects	AQL Level											
$D \leq 0.3$	*													
$D \leq 0.5$	3													
$D = (\text{Long} + \text{Short}) / 2$ * : Disregard														

Class of defects	Major	AQL 0.65%	Definition
	Minor	AQL 1.5%	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.
			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.

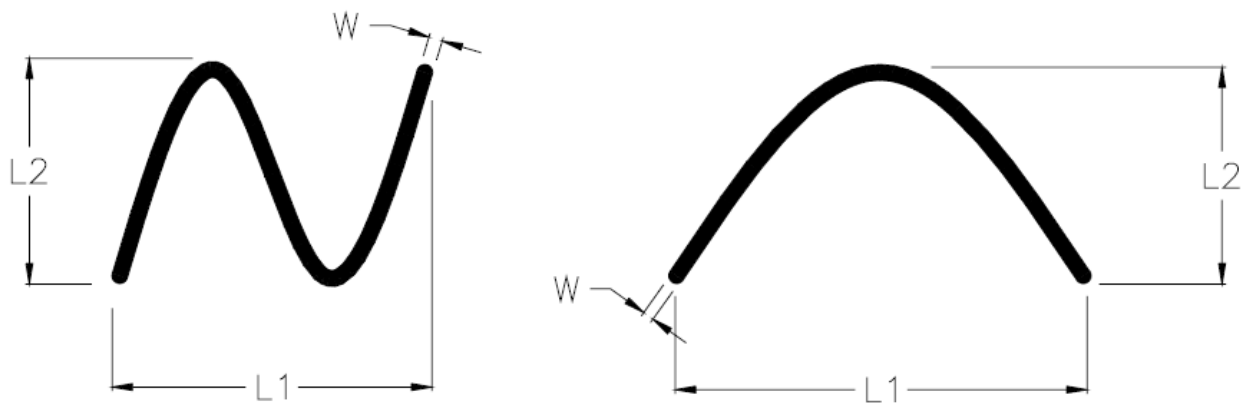
(d) Definition of joined bright point defect and joined dark point defect are as follows:

- Two or more joined bright point defects must be nil.
- Three 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 1 pair maximum.
- Two Joined dark point is counted as two dark points with 2 pair maximum.

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

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

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



9.5 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

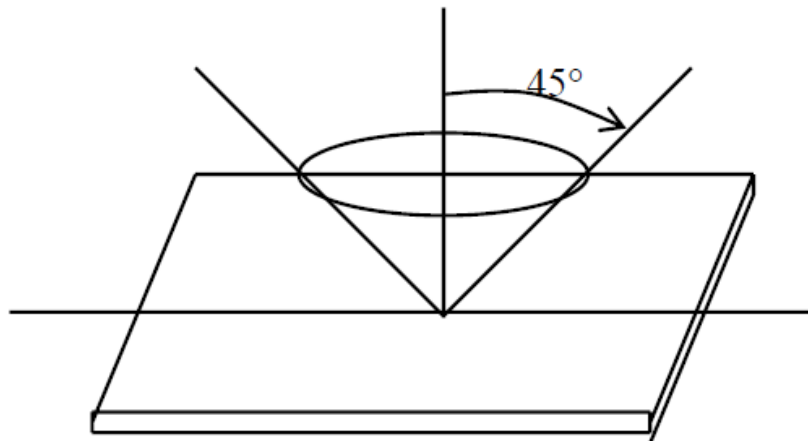
Inspection level: Level II

9.6 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



10. PRECAUTION RELATING PRODUCT HANDLING

10.1 SAFETY

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

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

10.2 HANDLING

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

10.2.2 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.

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

10.2.4 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.)

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

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

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

10.2.8 To control temperature and time of soldering is $280 \pm 10^{\circ}\text{C}$ and 3-5 sec.

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

10.3 STORAGE

10.3.1 Store the panel or module in a dark place where the temperature is $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ and the humidity is below 65% RH.

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

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

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