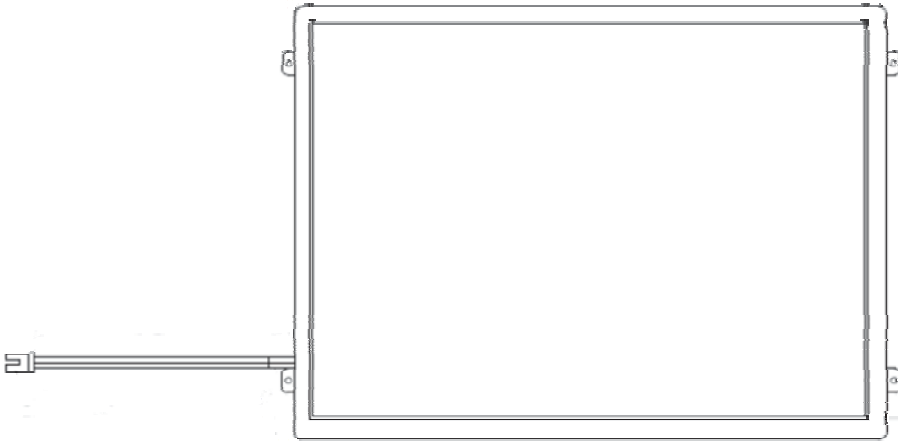




PRODUCT SPECIFICATION

HDA1040X-A

10.4", TFT XGA (1024X768) COLOR
LCD DISPLAY MODULE



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1. OVERVIEW

HDA1040X-A is 10.4" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, a driving circuit, and a LED backlight. This 10.4" TFT LCD module has a high resolution image that is composed of 1024×768 pixel elements in a stripe arrangement displayed by 6 bit R.G.B signal input.

General specification are summarized in the following table:

Item	Specifications	unit
Panel Size	10.4 (panel Diagonal)	inch
Display Area	211.2 (W) x 158.4(H)	mm
Number of Pixels	1024(H) x 3(RGB) x 768(V)	-
Overall dimension	236.0(W)x174.3x7.4(D)(with PWB & components)	mm
Color configuration	R.G.B -stripe	-
Display Mode	Normally white	mm
Number of colors	262,144	colors
Brightness	400	cd/m ²
Backlight Unit	LED	
Electrical Interface	LVDS 6 bits	
Weight	390	g
Surface Treatment	Anti-Glare, Hardness 3H	

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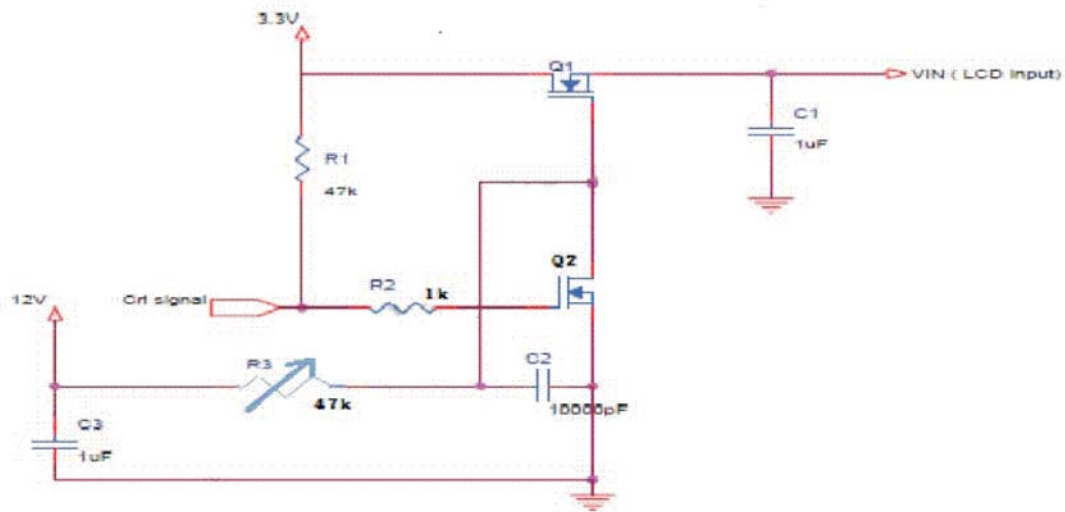
DATE:
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2. ABSOLUTE MAXIMUM RATINGS

The following are maximum values which, if exceeded, may cause faulty operation or damage to the unit.

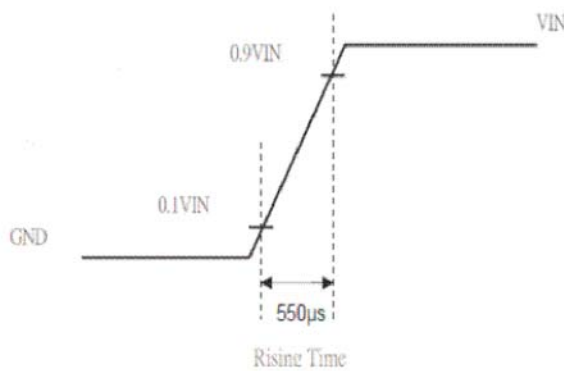
ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Power Supply Voltage	V _{cc}	-0.3	4.0	V	
LED Supply Voltage	V _{LED}		10.65	V	
ICC Rush Current	IRUSH	-	1	A	(Note 2)
Operation Temperature	T _{op}	-20	70	°C	(Note 1)
Storage Temperature	T _{stg}	-30	80	°C	(Note 1)

(Note1) If users use the product out off the environment operation range (temperature



Control signal : High(+3.3V) → Low(GND)

Supply Voltage of rising time should be from R3 and C2 tune to 550 us.



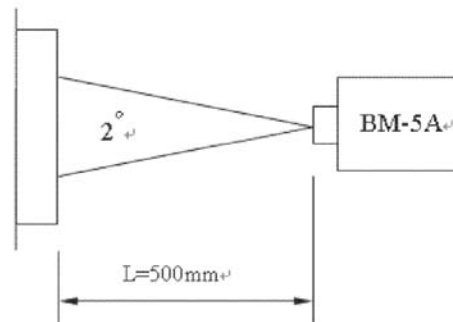
3. OPTICAL CHARACTERISTICS

Ta = 25°C, Vcc = 3.3V

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE	
Contrast Ratio	CR	Point-5	400	500	-	-	*1)*2)*3)	
Luminance*)	Lw	Point-5	360	400	-	cd/m2	*1)*3)	
Luminance Uniformity	ΔL		75	80		%	*1)*3)	
Response Time (Whit-Black)	Tr+Tf	Point-5		25	30	ms	*1)*3)*5)	
Viewing Angle	Horizontal	Ψ	CR ≥ 10	140	-	°	*1)*2)*4)	
	Vertical	θ		Point-5	120	-	°	*1)*2)*4)
NTSC				(50)		%		
Color Coordinate	White	Wx	Ψ = θ = 0° Point-5	0.273	0.313	0.353	-	*1)*3)
		Wy		0.289	0.329	0.369		
	Red	Rx			TBD			
		Ry						
	Green	Gx			TBD			
		Gy						
	Blue	Bx			TBD			
		By						

NOTE :

*1) Measure condition : 25°C ± 2°C, 60 ± 10% RH, under 10 Lux in the dark room. BM-5A (TOPCON), viewing angle 2°, Vadj = 3.3V, Duty 100% or IL = 260mA, After 10 minutes operation



*2) Definition of contrast ratio :

Contrast Ratio (CR) = (White) Luminance of ON ÷ (Black) Luminance of OFF

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- 3) Definition of luminance : Measure white luminance on the point 5 as figure 3-3
 Definition of Luminance Uniformity: Measure white luminance on the point1~9 as figure3-3

$$\Delta L = [L(\text{MIN})/L(\text{MAX})] \times 100$$

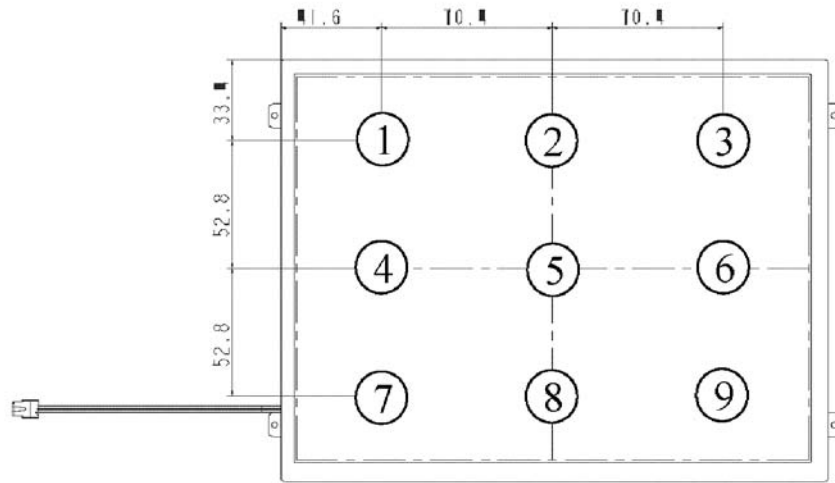


Fig 3-3 Measuring point

- *4) Definition of Viewing Angle(ϕ, z), refer to Fig 3-4 as below:
 These items are measured by EZ-CONTRAST (ELDIM) in the dark room. (no ambient light).

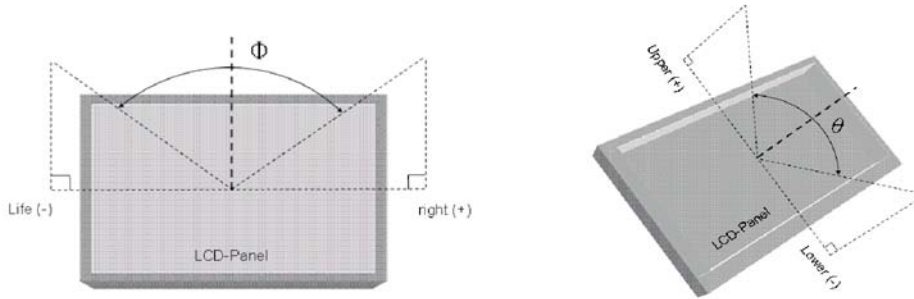


Fig 3-4 Definition of Viewing Angle

- *5) Definition of Response Time.(White-Black)

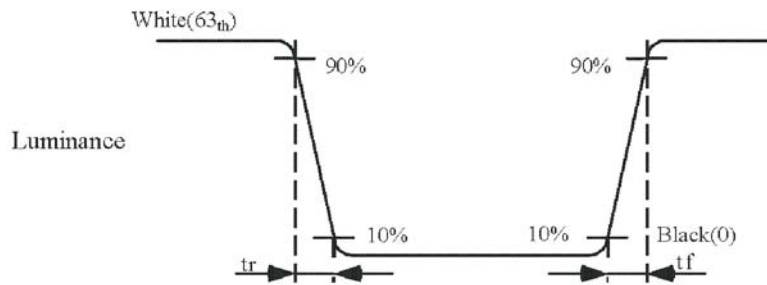


Fig 3-5 Definition of Response Time(White-Black)

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4. ELECTRICAL CHARACTERISTICS

4.1 TFT LCD Power Voltage

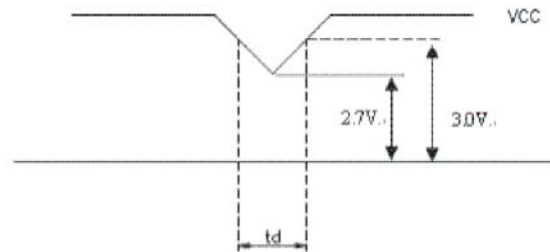
Ta=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE	
Power Supply Voltage For LCD	V _{CC}	3.0	3.3	3.6	V	(Note 1)	
Logic Input Voltage (LVDS:IN+,IN-)	Common Mode Voltage	V _{CM}	1.08	1.2	1.32	V	(Note 2)
	Differential Input Voltage	V _{ID}	250	350	450	mV	(Note 2)
	Threshold Voltage(high)	V _{TH}	-	-	100	mV	(Note 2)
	Threshold Voltage(low)	V _{TL}	-100	-	-	mV	(Note 2)

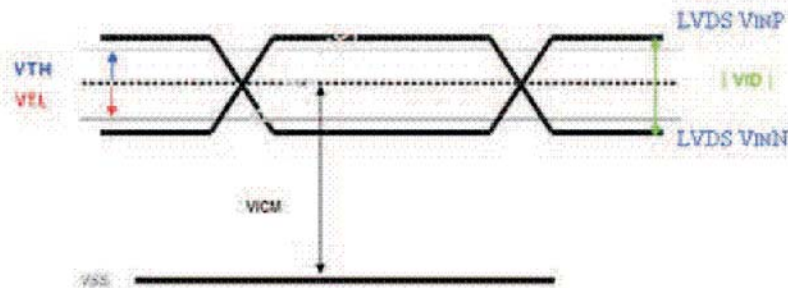
Remarks :

(Note1) VCC –dip condition:

- 1) When $2.7\text{V} \leq V_{CC} < 3.0\text{V}$, $t_d \leq 10\text{ms}$.
- 2) $V_{CC} > 3.0\text{V}$, VCC-dip condition should be same as VCC-turn-on condition.



(Note 2) LVDS signal



4.2 TFT-LCD Current Consumption

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
LCD Power Current	I_{CC}	--	450	500	mA	(Note 1)

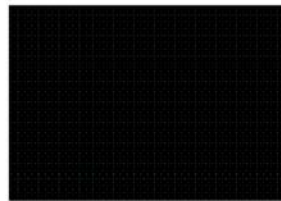
(Note1) (Frame rate = 60 Hz)

Typical: Under 64 gray pattern @ $V_{CC} = 3.3\text{ V}$

Maximum: Under black pattern @ $V_{CC} = 3.0\text{ V}$

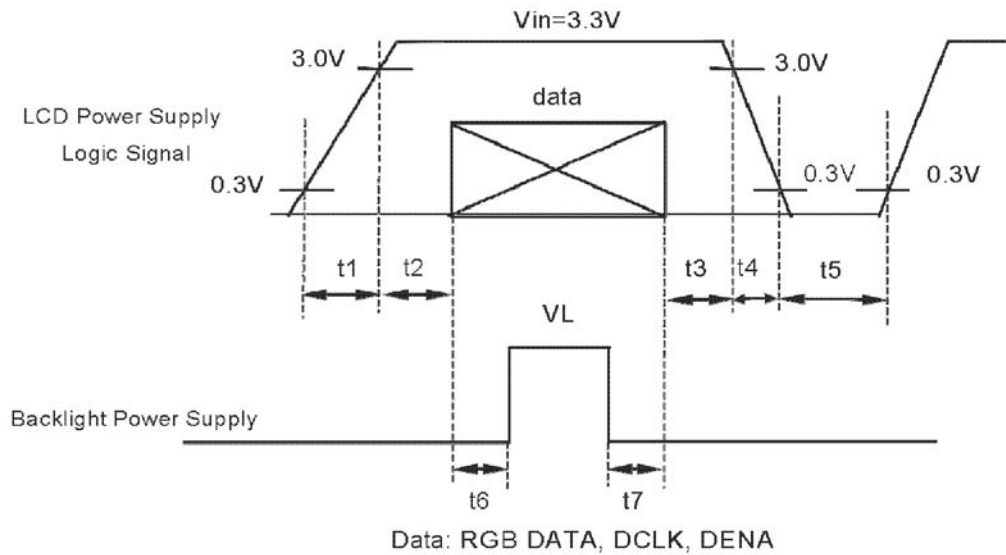


(a) 64 Gray Pattern



(b) Black Pattern

4.3 Power Signal sequence



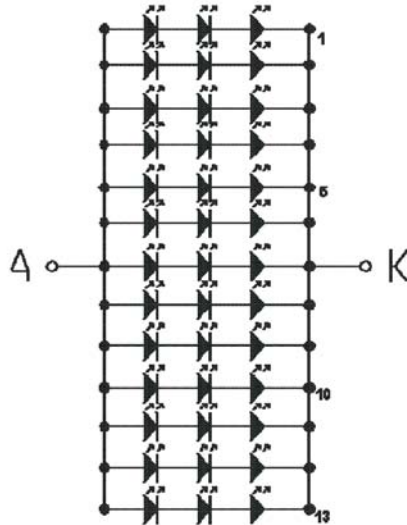
$$\begin{aligned}
 0.5 < t1 &\leq 10\text{ms} & 200\text{ms} &\leq t5 \\
 0 < t2 &\leq 50\text{ms} & 200\text{ms} &\leq t6 \\
 0 < t3 &\leq 50\text{ms} & 200\text{ms} &\leq t7 \\
 0 < t4 &\leq 10\text{ms} & &
 \end{aligned}$$

5. BACKLIGHT DRIVING CIRCUIT:

IT	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	REMARK
LED current	I L	Ta=25°C (20mA/serise)	--	260	--	mA	Note 1,2
LED voltage	V L	Ta=25°C (20mA/serise)	8.85	9.6	10.8	V	Note 1,2
Power consumption	W L	Ta=25°C (20mA/serise)	--	2496	--	mW	Note 1,2
LED Lifetime	-	Ta=25°C IF=20mA	30000	-	-	Hr	Note 3,4,5

Remarks :

*1) LED Circuit Diagram:



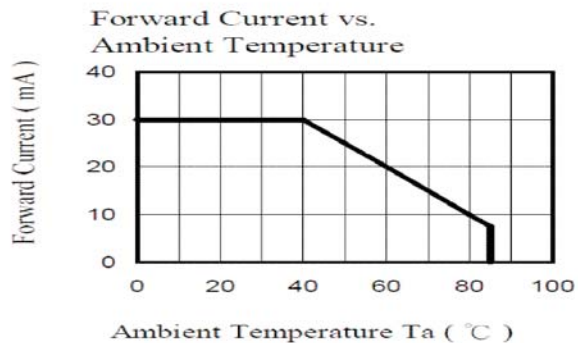
*2) A : Anode(+), K : Cathode(-)

*3) Suggestion: Using the constant current control to avoid the leakage light and brightness quality issue.

*4) DEFINITION OF LED LIFETIME : LUMINANCE < INITIAL LUMINANCE 50%

*5) If Conditions : Pulse Width \leq 10msec, Duty \leq 1/10 °

One of Every LED must be satisfied as below figure.



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6. INTERFACE CONNECTION

LCD connector (30pin) : STARCONN, P/N : MSBK2407P30D or other of the same class

Pin No.	SYMBOL	FUNCTION
1	GND	Ground
2	Vcc	+3.3V Power
3	Vcc	+3.3V Power
4	NC	NC
5	NC	NC
6	NC	NC
7	GND	GND
8	RXIN0-	LVDS Signal(-)—channel 0
9	RXIN0+	LVDS Signal(+)—channel 0
10	GND	Ground
11	RXIN1-	LVDS Signal(-)—channel 1
12	RXIN1+	LVDS Signal(+)—channel 1
13	GND	Ground
14	RXIN2-	LVDS Signal(-)—channel 2
15	RXIN2+	LVDS Signal(+)—channel 2
16	GND	Ground
17	RXCLKIN-	LVDS Clock Signal(-)
18	RXCLKIN+	LVDS Clock Signal(+)
19	GND	Ground
20	NC	NC
21	NC	NC
22	GND	Ground
23	GND	Ground
24	NC	NC
25	NC	NC
26	NC	NC
27	NC	NC
28	NC	NC
29	NC	NC
30	NC	NC

Note)

- 1) GND Pin must be connected to ground. Don't be floating.
- 2) NC Pin must be floating.

Back Light Connector:

Pin No	Symbol	Function	Wire Color
1	LEDA	LED driving anode (high voltage)	Red
2	LEDK	LED driving cathode (low voltage)	Whit

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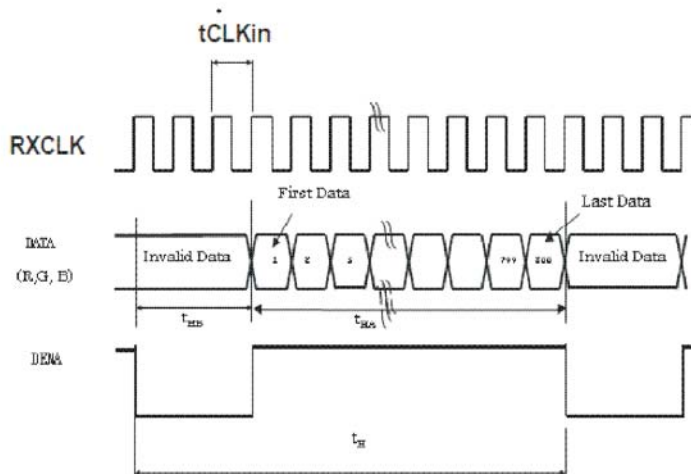
7. INPUT SIGNAL(DE ONLY MODE)

7.1 Timing Specification

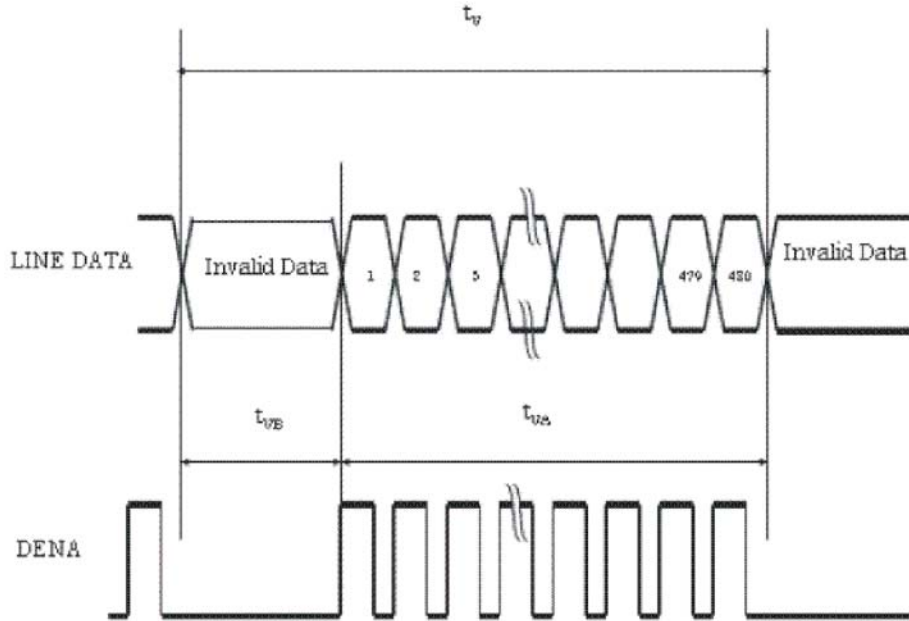
ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	
LVDS Input Signal Sequence	CLK Frequency	fCLKin	51	65	71	MHZ	
LCD Input Timing	Horizontal	Horizontal Period	t _H	1160	1344	1350	tCLK
		Horizontal Valid	t _{HA}	1024		tCLK	
		Horizontal Blank	t _{HB}	136	320	326	tCLK
	Vertical	Frame	fV	55	60	65	Hz
		Vertical Period	t _V	790	806	810	t _H
		Vertical Valid	t _{VA}	768		t _H	
		Vertical Blank	t _{VB}	22	38	42	t _H

7.2 Timing sequence (Timing chart)

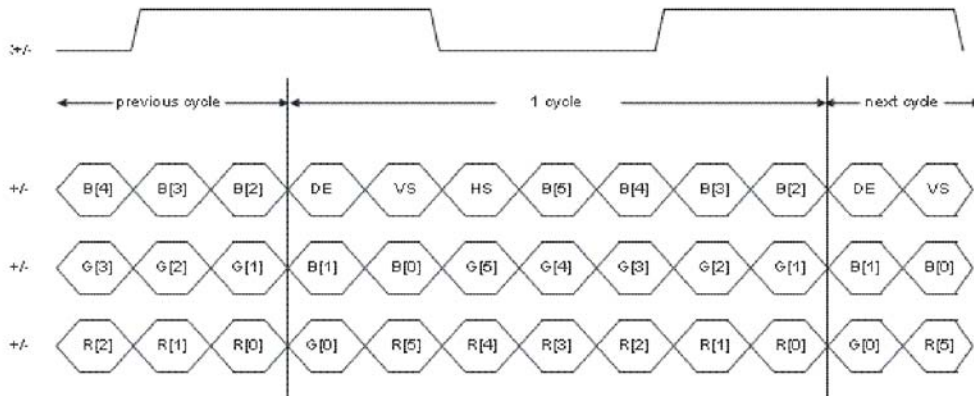
7.2.1 Horizontal Timing Sequence



7.2.2 Vertical Timing Sequence



7.2.3 LVDS Input Data mapping



7.3 Color data assignment

COLOR	INPUT DATA	R DATA						G DATA						B DATA					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
		MSB					LSB	MSB					LSB	MSB					LSB
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	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
RED	RED(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	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
GREEN	GREEN(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	1	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	GREEN(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
GREEN(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	
BLUE	BLUE(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	1
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	

(Note1) Definition of Gray Scale

color(n) : (n) means the level of gray scale, the larger (n) means the brighter level.

(Note2) Data:1-High, 0-Low

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8. QUALITY AND RELIABILITY

8.1 TEST CONDITIONS

Tests should be conducted under the following conditions : Ambient temperature : $25 \pm 5^{\circ}\text{C}$
Humidity : $60 \pm 25\% \text{ RH}$.

8.2 SAMPLING PLAN

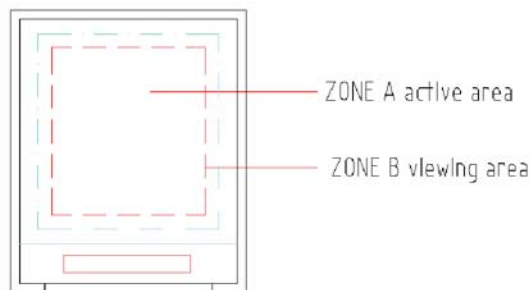
Sampling method shall be in accordance with MIL-STD-105E , level II, normal single sampling plan .

8.3 ACCEPTABLE QUALITY LEVEL

A major defect is defined as one that could cause failure to or materially reduce the usability of the unit for its intended purpose. A minor defect is one that does not materially reduce the usability of the unit for its intended purpose or is an infringement from established standards and has no significant bearing on its effective use or operation.

8.4 APPEARANCE

An appearance test should be conducted by human sight at approximately 30 cm distance from the LCD module under florescent light. The inspection area of LCD panel shall be within the range of following limits.



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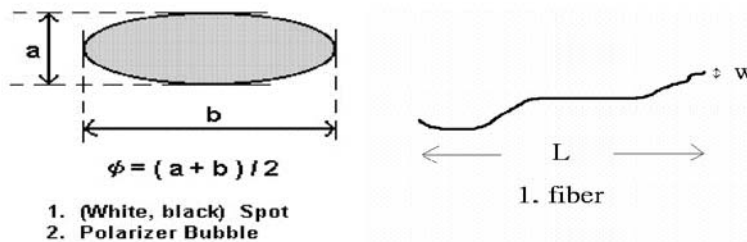
8.5 INCOMING INSPECTION STANDARD FOR TFT-LCD PANEL

DEFECT TYPE			LIMIT			Note		
VISUAL DEFECT	INTERNAL	SPOT	$\phi < 0.15\text{mm}$	Ignore		Note1		
			$0.15\text{mm} \leq \phi \leq 0.5\text{mm}$	$N \leq 4$				
			$0.5\text{mm} < \phi$	$N=0$				
		FIBER	$0.03\text{mm} < W \leq 0.1\text{mm}, L \leq 5\text{mm}$	$N \leq 3$		Note1		
			$1.0\text{mm} < W, 1.5\text{mm} < L$	$N=0$				
		POLARIZER BUBBLE	$\phi < 0.15\text{mm}$	Ignore		Note1		
			$0.15\text{mm} \leq \phi \leq 0.5\text{mm}$	$N \leq 2$				
			$0.5\text{mm} < \phi$	$N=0$				
		Mura	It' OK if mura is slight visible through 6%ND filter					
		ELECTRICAL DEFECT	BRIGHT DOT	A Grade			B Grade	
C Area	O Area			Total	C Area	O Area	Total	Note3
$N \leq 0$	$N \leq 2$			$N \leq 2$	$N \leq 2$	$N \leq 3$	$N \leq 5$	Note2
DARK DOT	$N \leq 2$		$N \leq 3$	$N \leq 3$	$N \leq 3$	$N \leq 5$	$N \leq 8$	
TOTAL DOT	$N \leq 4$			$N \leq 5$	$N \leq 6$	$N \leq 8$	Note2	
TWO ADJACENT DOT	$N \leq 0$		$N \leq 1$ pair	$N \leq 1$ pair	$N \leq 1$ pair	$N \leq 1$ pair	$N \leq 1$ pair	Note4
THREE OR MORE ADJACENT DOT	NOT ALLOWED							
LINE DEFECT	NOT ALLOWED							

(1) One pixel consists of 3 sub-pixels, including R,G, and B dot.(Sub-pixel = Dot)

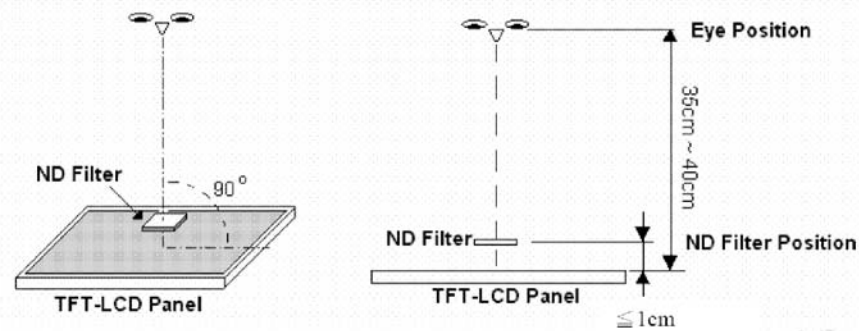
(2) LITTLE BRIGHT DOT ACCEPTABLE UNDER 6 % ND-Filter

[Note1] W : Width[mm], L : Length[mm], N : Number, ϕ : Average Diameter

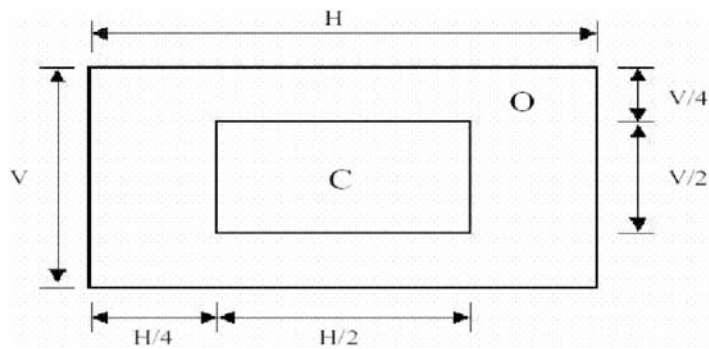


[Note2] Bright dot is defined through 6% transmission ND Filter as following.

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[Note3]

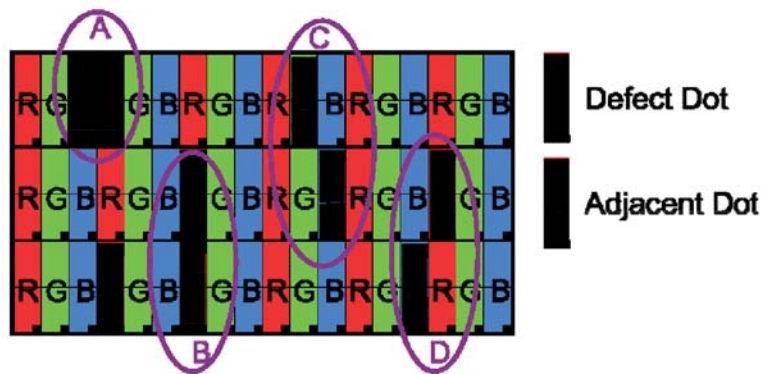


C Area: Center of display area

O Area: Outer of display area

[Note4]

Judge defect dot and adjacent dot as following. Allow below (as A, B, C and D status) adjacent defect dots, including bright and dark adjacent dot. And they will be counted 2 defect dots in total quantity.



(1) The defects that are not defined above and considered to be problem shall be reviewed and discussed by both parties.

(2) Defects on the Black Matrix, out of Display area, are not considered as a defect or counted.

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8.6 Reliability Test

Test Item	Test Conditions	Note
High Temperature Operation	70±3°C , t=96 hrs	
Low Temperature Operation	-20±3°C , t=96 hrs	
High Temperature Storage	80±3°C , t=96 hrs	1,2
Low Temperature Storage	-30±3°C , t=96 hrs	1,2
Thermal Shock Test	-20°C ~ 25°C ~ 70°C 30 m in. 5 min. 30 min. (1 cycle) Total 5 cycle	1,2
Humidity Test	60 °C, Humidity 90%, 96 hrs	1,2
Vibration Test (Packing)	Sweep frequency : 10 ~ 55 ~ 10 Hz/1min Amplitude : 0.75mm Test direction : X.Y.Z/3 axis Duration : 30min/each axis	2

Note 1 : Condensation of water is not permitted on the module.

Note 2 : The module should be inspected after 1 hour storage in normal conditions
(15-35°C , 45-65%RH).

Definitions of life end point :

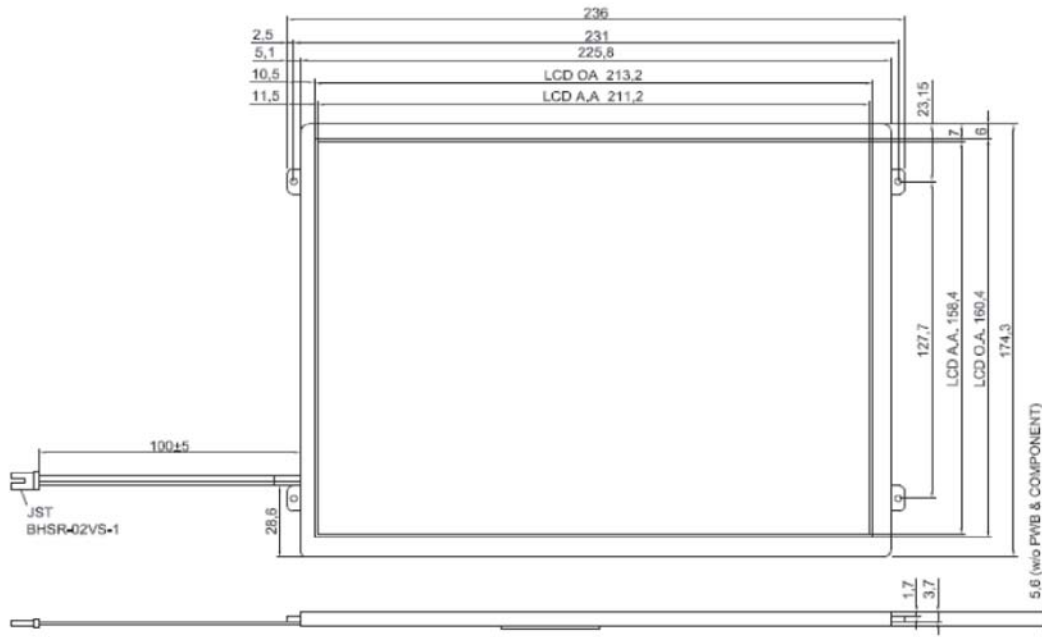
- Current drain should be smaller than the specific value.
- Function of the module should be maintained.
- Appearance and display quality should not have degraded noticeably.
- Contrast ratio should be greater than 50% of the initial value.

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10. MECHANICAL DIMENSION

10.1 Front Side

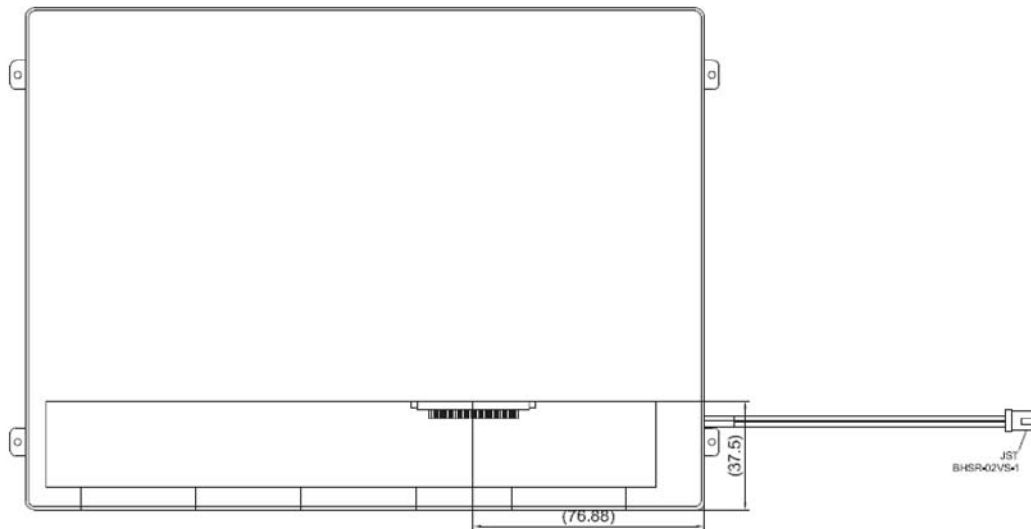
[Unit : mm]



[Note] : Tolerance is $\pm 0.3\text{mm}$ unless noted

10.2 Rear Side

[Unit : mm]



[Note] : Tolerance is $\pm 0.3\text{mm}$ unless not noted

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