晶采光電科技股份有限公司
AMPIRE CO., LTD.

SPECIFICATIONS FOR LCD MODULE

CUSTOMER	
CUSTOMER PART NO.	
AMPIRE PART NO.	AM320240L6TMQW-TB0H
APPROVED BY	
DATE	

☑Approved For Specifications
☐ Approved For Specifications & Sample

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RECORD OF REVISION

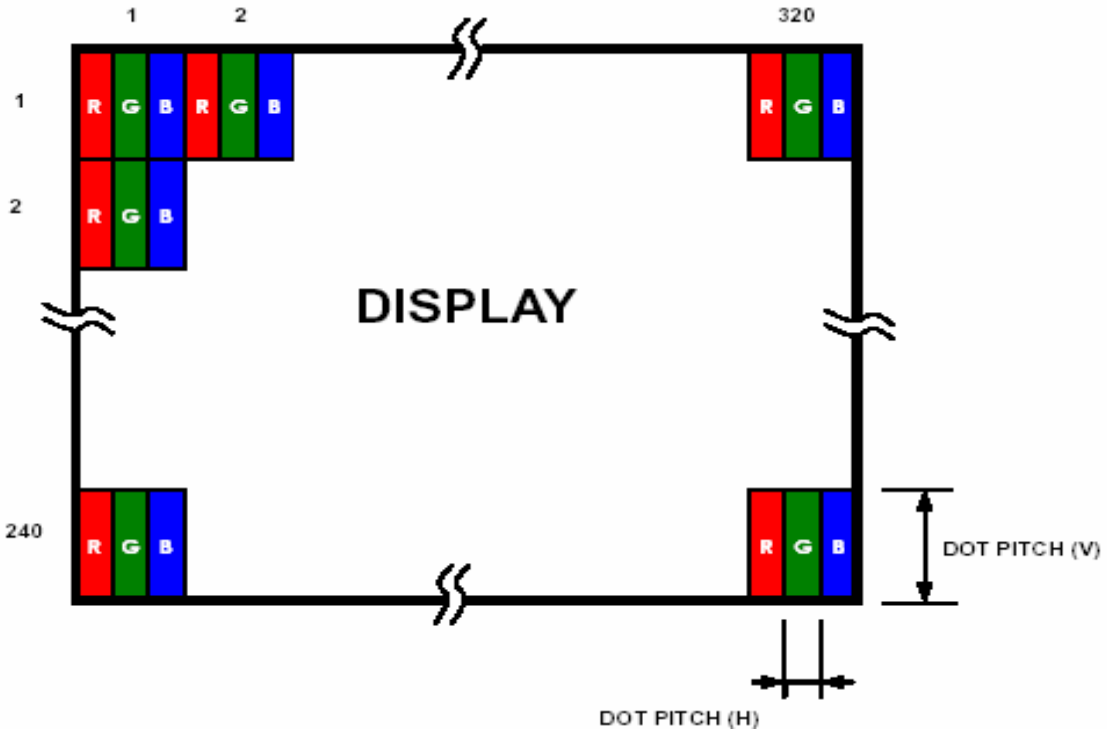
Revision Date	Page	Contents	Editor
2007/10/11	---	New Release	**Norman**

1 General Description and Features

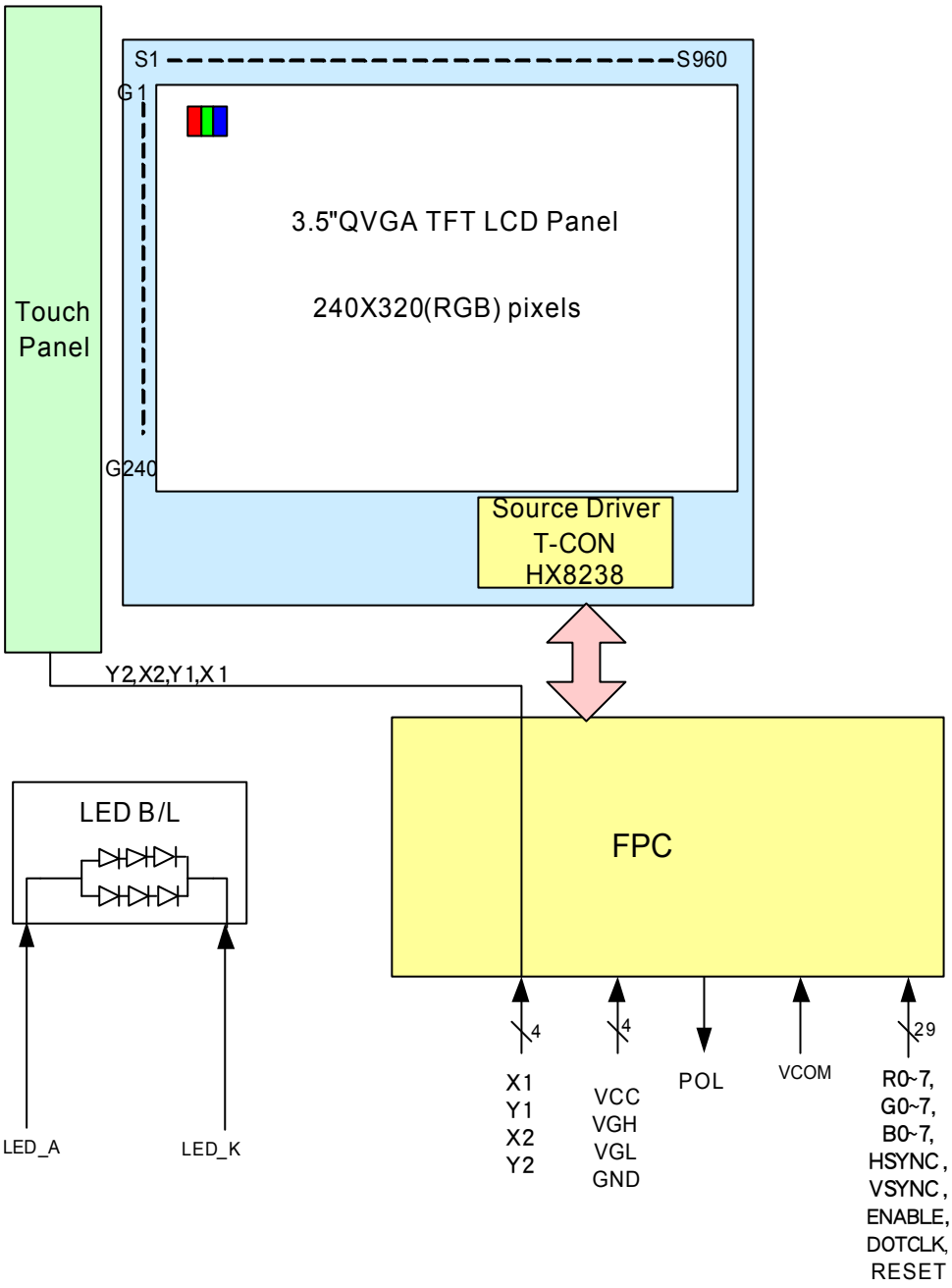
AM-320240L6TMQW-TB0H is a transmissive type color active matrix liquid crystal display (LCD) which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT LCD panel, driver ICs, FPC, Touch panel and a backlight unit. The following table described the features of AM-320240L6TMQW-TB0H.

2 Physical specifications

Item	Specifications	unit
Display Resolution	240(W) x320(H)	dot
Active area	52.56 (W) x 70.08 (H)	mm
Screen size	3.5(Diagonal)	inch
Dot pitch	0.219 (W) x 0.073 (H)	mm
Color configuration	R.G.B – stripe	
Overall Dimension	117.4W) x 77.8(H)x 4.3(D)	mm
Input interface	Digital 24-bits RGB	
Surface Treatment	Anti-glare(AG)	
Backlight unit	White LED	
Viewing Direction	6 O'CLOCK	
Display Mode	Normally White/Transmissive	



2.1 Functional Block Diagram



Electrical Specifications

2.2 TFT LCD Panel FPC Descriptions

No.	Symbol	I/O	Functions	Remark
1	LED-	-	LED Power Supply(-)	
2	LED-	-	LED Power Supply(-)	
3	LED+	-	LED Power Supply(+)	
4	LED+	-	LED Power Supply(+)	
5	GND	P	Ground	
6	X1	O	T/P terminal(X-Right)	
7	Y1	O	T/P terminal(Y-Lower)	
8	X2	O	T/P terminal(X-Left)	
9	Y2	O	T/P terminal(Y-Upper)	
10	GND	P	Ground	
11	NC	-	No Connection	
12	SDO	O	Serial Data Output	
13	POL	O	Polarity Signal Connect to Vcom driving circuit	
14	RESET	I	Reset	
15	/CS	I	Chip select pin of serial interface. Leave it OPEN when not used	
16	SCK	I	Clock pin of serial interface	
17	SDI	I	Serial Data Input	
18	DATA0	I	Data Blue 0(LSB)	
19	DATA1	I	Data Blue 1	
20	DATA2	I	Data Blue 2	
21	DATA3	I	Data Blue 3	
22	DATA4	I	Data Blue 4	
23	DATA5	I	Data Blue 5	
24	DATA6	I	Data Blue 6	
25	DATA7	I	Data Blue 7(MSB)	
26	DATA8	I	Data Green 0 (LSB)	
27	DATA9	I	Data Green 1	
28	DATA10	I	Data Green 2	
29	DATA11	I	Data Green 3	
30	DATA12	I	Data Green 4	
31	DATA13	I	Data Green 5	
32	DATA14	I	Data Green 6	
33	DATA15	I	Data Green 7(MSB)	
34	DATA16	I	Data Red 0 (LSB)	
35	DATA17	I	Data Red 1	
36	DATA18	I	Data Red 2	
37	DATA19	I	Data Red 3	
38	DATA20	I	Data Red 4	

39	DATA21	I	Data Red 5	
40	DATA22	I	Data Red 6	
41	DATA23	I	Data Red 7 (MSB)	
42	HSYNC	I	Horizontal Synchronization	
43	VSYNC	I	Vertical Synchronization	
44	DOTCLK	I	Clock signal	
45	NC	-	No connection	
46	NC	-	No connection	
47	VCC	P	Power supply for Logic	+3.3V
48	VCC	P	Power supply for Logic	+3.3V
49	NC	-	No Connection	
50	VGL	I	Gate OFF Power	
51	VGL	I	Gate OFF Power	
52	NC	-	No Connection	
53	VGH	I	Gate ON Power	
54	NC	-	No Connection	
55	NC	-	No Connection	
56	VCOM	I	Driving Input	
57	VCOM	I	Driving Input	
58	ENABLE	I	Data enable	
59	GND	P	Ground	
60	GND	P	Ground	

2.3 Basic Display Color and Gray Scale

Color		Input Color Data																							
		Red								Green								Blue							
		MSB							LSB	MSB							LSB	MSB							LSB
		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 Colors	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(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(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(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
	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	Red(0) Dark	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(253)	1	1	1	1	1	1	0	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) Bright	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	Green(0) Dark	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(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	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)Bright	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	Blue(0) Dark	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(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	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) Bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

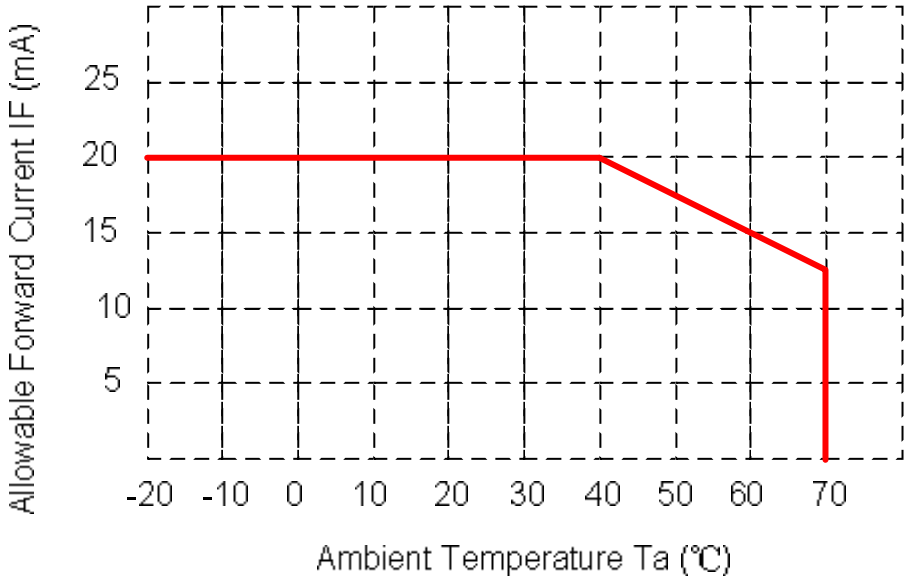
2.4 Absolute Maximum Ratings

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

2.5 Environmental Absolute max. ratings

Item	OPERATING		STORAGE		Remark
	MIN	MAX	MIN	MAX	
Temperature	-20	70	-30	80	Note2,3,4,5,6,7,8
Humidity	Note1		Note1		
Corrosive Gas	Not Acceptable		Not Acceptable		

Note1 : Ta <= 40℃ : 85% RH max
Ta > 40℃ : Absolute humidity must be lower than the humidity of 85%RH at 40℃
Note2 : For storage condition Ta at -30℃ < 48h , at 80℃ < 100h
For operating condition Ta at -20℃ < 100h
Note3 : Background color changes slightly depending on ambient temperature. This phenomenon is reversible.
Note4 : The response time will be slower at low temperature.
Note5 : Only operation is guarantied at operating temperature. Contrast , response time, another display quality are evaluated at +25℃
Note6 : When LCM is operated over 40℃ ambient temperature, the I_{LED} of the LED back-light should be follow :



Note7 : This is panel surface temperature, not ambient temperature.
Note8 : When LCM be operated over than 40℃ , the life time of the LED back-light will be reduced.

2.6 Electrical Absolute max. ratings

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power voltage	VDD	VSS=0	-0.3	6.0	V	
Input voltege	V_{in}		-0.3	VDD+0.3	V	Note 1

Note1:Hsync, Vsync, DEN, DCLK, R0~R5, G0~G5, B0~B5

2.7 Electrical Characteristics

2.7.1 DC Electrical characteristic of the LCD

Typical operting conditions (VSS=0V)

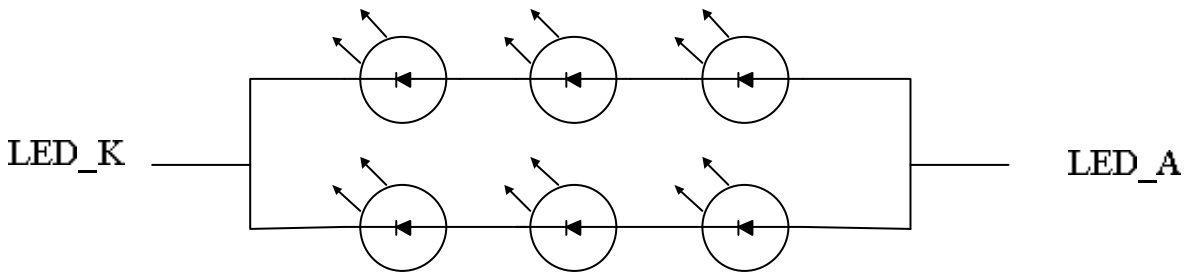
Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply		VDD	3.0	3.3	3.6	V	
Input Voltage for logic	H Level	V_{IH}	0.7 VDD	-	VDD	V	Note 1
	L Level	V_{IL}	0	-	0.3 VDD	V	
Power Supply current		IDD		(T.B.D)	--	mA	Note 2

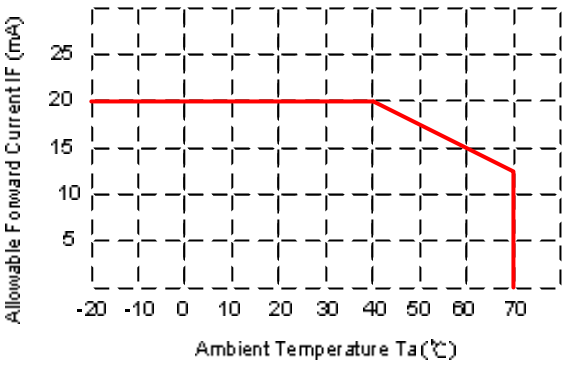
Note1: Hsync, Vsync, DEN, DCLK, R0~R5, G0~G5, B0~B5

Note2: fv =60Hz , Ta=25℃ , Display pattern : All Black

2.7.2 Backlight Unit

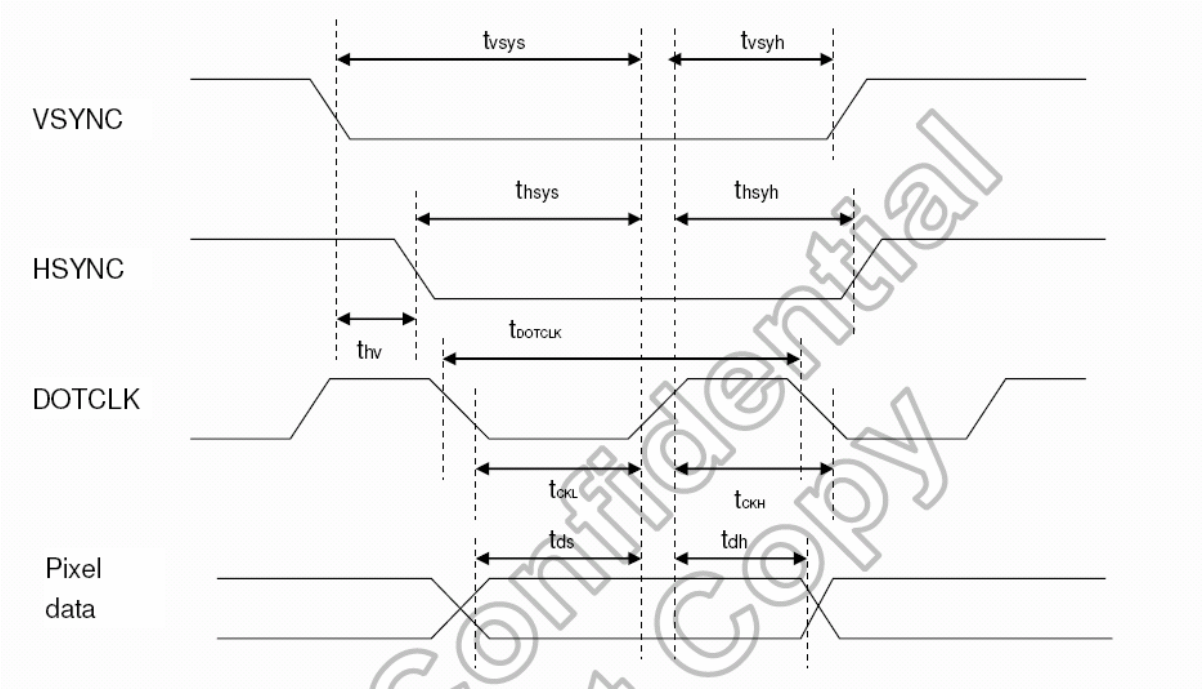
Paramenter	Symbol	Min.	Typ.	Max.	Unit	Condition
LED voltage	V_{AK}	--	9.9	11	V	I_{LED}=40mA,Ta=25℃
LED forward current	I_{LED}	--	40	-	mA	Ta=25℃
	I_{LED}	--	30	-	mA	Ta=60℃





Life Time Curve/1 LED dice

2.8 AC Timing

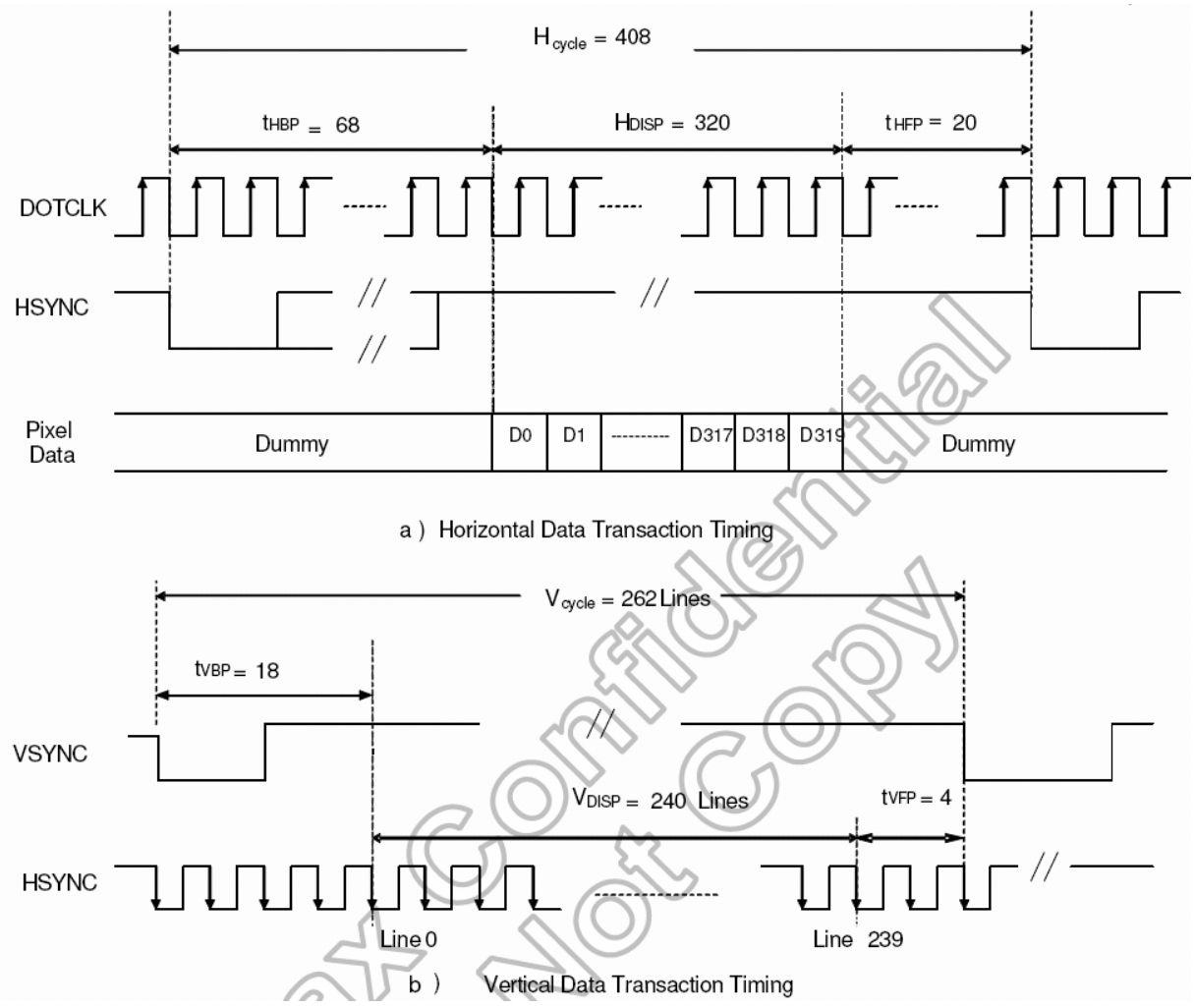


Pixel Timing

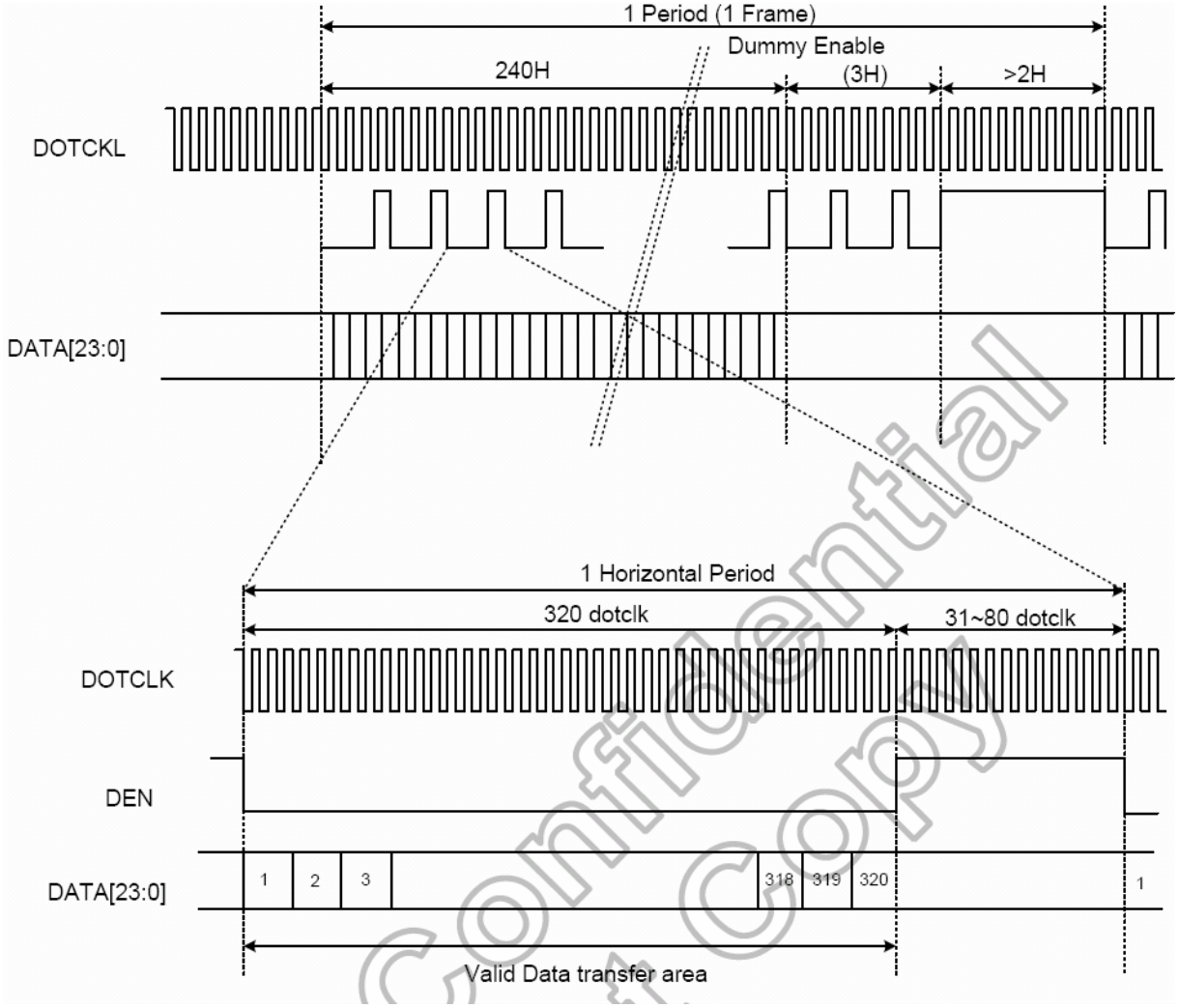
Characteristics	Symbol	Min		Typ		Max		Unit
		24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency	fDOTCLK	-		6.5	19.5	10	30	MHz
DOTCLK Period	tDOTCLK	100	33.3	154	51.3	-		ns
Vertical Sync Setup Time	tvsys	20	10	-		-		ns
Vertical Sync Hold Time	tvsyh	20	10	-		-		ns
Horizontal Sync Setup Time	thsys	20	10	-		-		ns
Horizontal Sync Hold Time	thsyh	20	10	-		-		ns
Phase difference of Sync Signal Falling Edge	thv	1		-		240		tDOTCLK
DOTCLK Low Period	tCKL	50	15	-		-		ns
DOTCLK High Period	tCKH	50	15	-		-		ns
Data Setup Time	tds	12	10	-		-		ns
Data hold Time	tdh	12	10	-		-		ns
Reset pulse width	tRES	10		-		-		us

Note: External clock source must be provided to DOTCLK pin of HX8238-A. The driver will not operate if absent of the clocking signal.

Pixel Timing Table



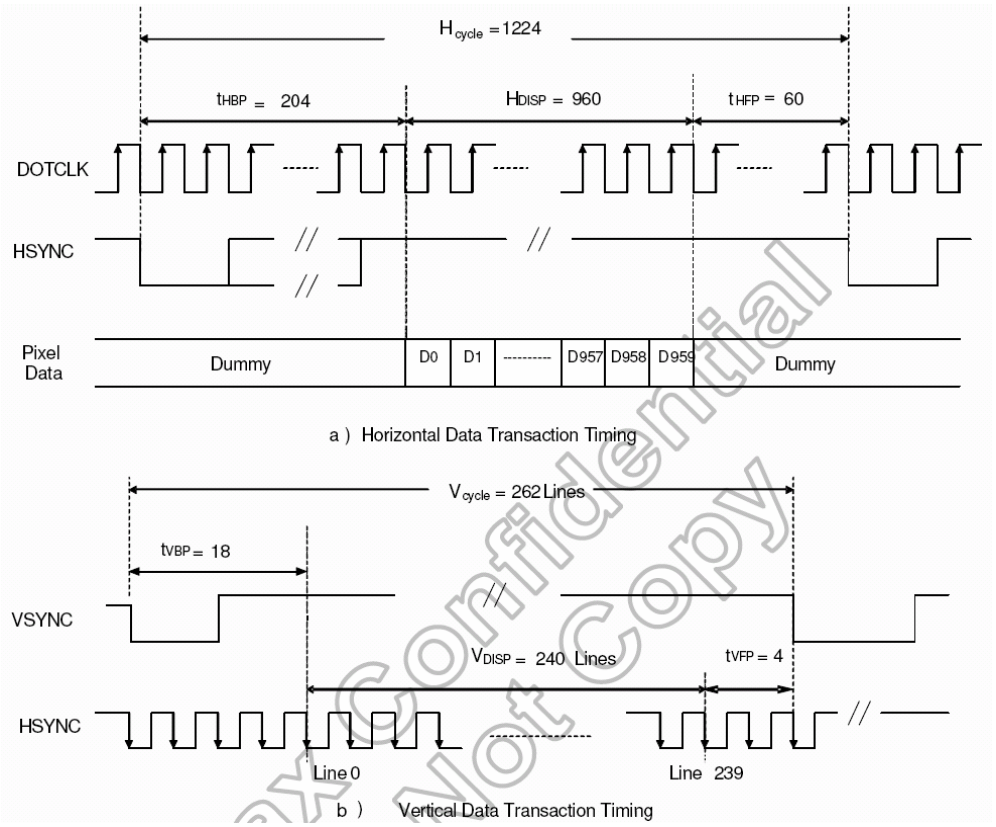
(a) Data Transaction Timing in Parallel RGB (24 bit) Interface (SYNC Mode)



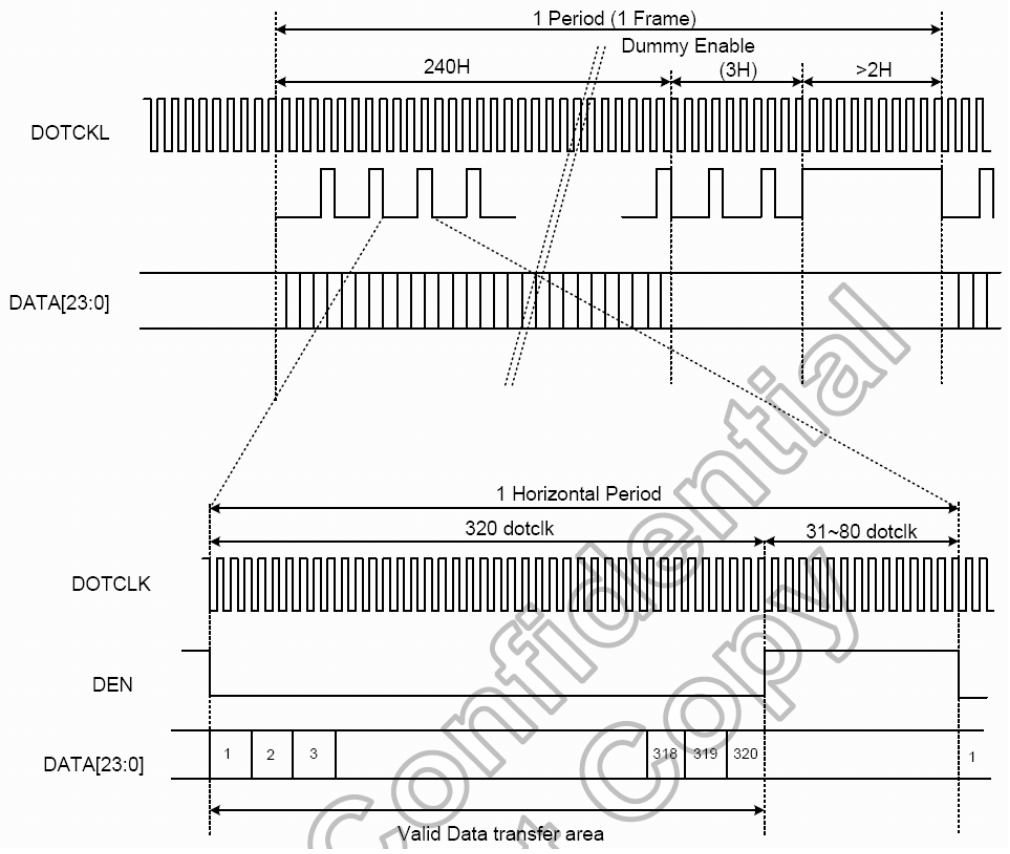
b) Data Transaction Timing in Parallel RGB (24 bit) Interface (DE Mode)

Characteristics		Symbol	Min		Typ		Max		Unit
			24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency		fDOTCLK	-	-	6.5	19.5	10	30	MHz
DOTCLK Period		tDOTCLK	100	33.3	154	51.3	-	-	ns
Horizontal Frequency (Line)		fH	-		14.9		22.35		KHz
Vertical Frequency (Refresh)		fV	-		60		90		Hz
Horizontal Back Porch		tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Front Porch		tHFP	-	-	20	60	-	-	tDOTCLK
Horizontal Data Start Point		tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Blanking Period		tHBP + tHFP	-	-	88	264	-	-	tDOTCLK
Horizontal Display Area		HDISP	-	-	320	960	-	-	tDOTCLK
Horizontal Cycle		Hcycle	-	-	408	1224	450	1350	tDOTCLK
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)				
					288(PALM=1)				
Vertical Cycle	NTSC	Vcycle	-		262		350		Lines
	PAL				313				

Data Transaction Timing in Normal Operating Mode



Data Transaction Timing in Serial RGB (8 bit) Interface (SYNC Mode)



Data Transaction Timing in Serial RGB (8 bit) Interface (DE Mode)

Touch Screen Panel Specifications

2.9 Electronic characteristics

Item	Min.	Typ.	Max.	Unit	Note
Linearity			1.5	%	
Terminal Resistance	200			Ω	X(Film side)
	200			Ω	Y(Film side)
Insulation resistance	20			MΩ	DC25V
Voltage			5	V	DC
Chattering			10	ms	ON/OFF
Transparency		80		%	Non-glare

Note:

Do not operate it with a thing except a polyacetal pen(tip R0.8mm or less) or a finger especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

2.10 Mechanical & Reliability Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Activation force			100	G	(1)
Durability-surface scratching	Write 100,000			Characters	(2)
Durability-surface pitting	1,000,000			Touches	(3)
Surface hardness	3			H	JIS K5400,ASTM D3363

Note:

1.Stylus pen Input:R0.8mm polyacetal pen or Finger

2.Measurement for Surface area

-1,000,000 times or over

-Writing with R0.8mm plastic stylus pen; writing force 150g in active area.

-Speed is 60mm/sec

3.1,000,000,tines or over(No damage on film surface)

2.11 Touch Screen Panel

Parameter	Condition	Standard Value
Terminal Resistance	X Axis	160 ~ 680 Ω
	Y Axis	160 ~ 640 Ω
Insulating Resistance	DC 25 V	More than 20MΩ
Linearity	--	±1.5 %
Notes life by Pen	Note a	100,000 times(min)
Input life by finger	Note b	1,000,000 times (min)

Note A .

Hitting pad：Tip R8 mm Silicone rudder, & Tip R0.8 mm stylus pen(POM).

Hitting speed：2 times / sec.

Electric load：None.

Note B .

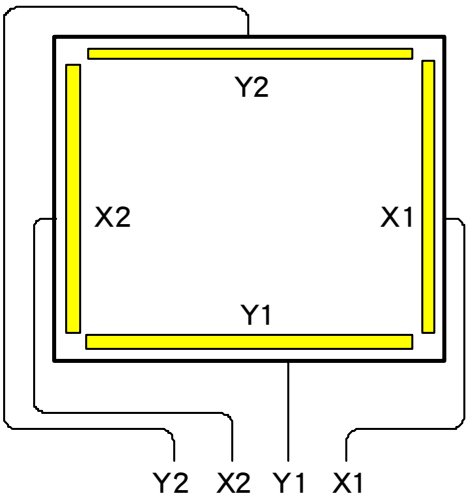
Hitting pad：Tip R0.8 mm stylus pen(POM).

Sliding speed：150mm / sec.

Sliding length：25mm.

Electric load：None.

Pin No.	Symbol	I/O	Function
1	X1	Right	Right electrode – differential analog
2	Y1	Bottom	Bottom electrode – differential analog
3	X2	Left	Left electrode – differential analog
4	Y2	Top	Top electrode – differential analog



3 Optical Specifications

3.1 Optical characteristic of the LCD

Item		Symbol	Conditon	Min.	Typ.	Max.	Unit	Remark
Response Time		T_r+T_f	Θ=0°		50	80	ms	Note 1,2,3,5
Contrast ratio		CR	At optimized viewing angle	-	300	-		Note 1,2,4,5
Viewing Angle		CR≧ 10	- - - -	45 45 15 35	- - - -	deg.	deg.	Note1,2, 5,6
Brightness		Y_L	I_{LED}=40mA ,25℃	--	235	-	cd/m^2	Note 7
White chromaticity		Xw	I_{LED}=40mA ,25℃	0.26	-	0.34		
		Yw		0.27	-	0.35		

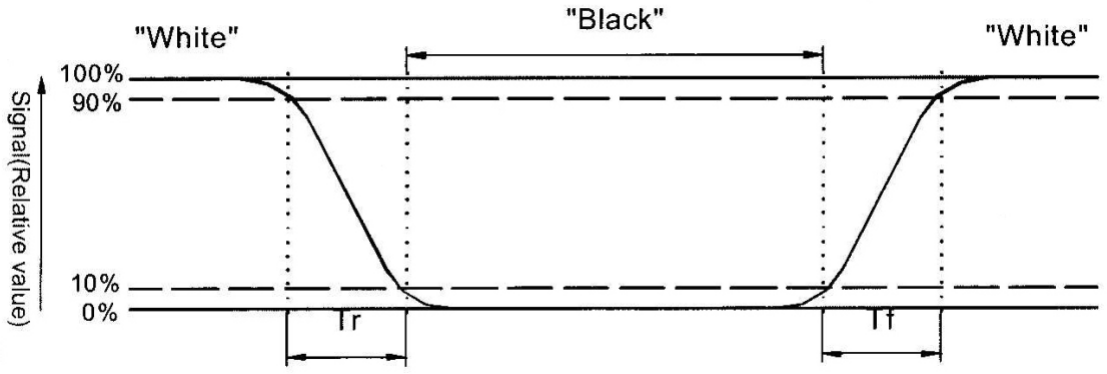
( )For reference only. These data should be update according the prototype.

Note 1: Note 1:Ambient temperature=25℃,and lamp current I_{LED}=20mA.To be measured in the dark room.

Note 2:To be measured on the center area of panel with a viewing cone of 1°by Topcon luminance meter BM-7,after 10 minutes operation.

Note 3.Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “black“ to “white”(falling time) and from”white” to “black” (rising time),respectively.The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



Note 4.Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector Output when LCD is at "Black" state}}$$

Note 5:White $V_i = V_{i50} + 1.5V$

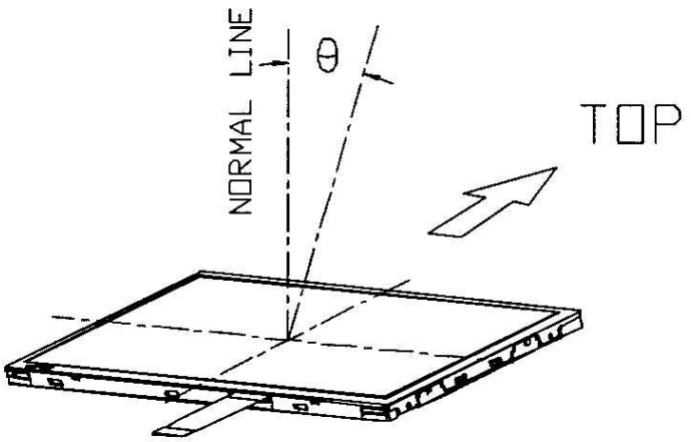
Black $V_i = V_{i50} + 2.0V$

"$\pm$" means that the analog input signal swings in phase with V_{COM} signal.

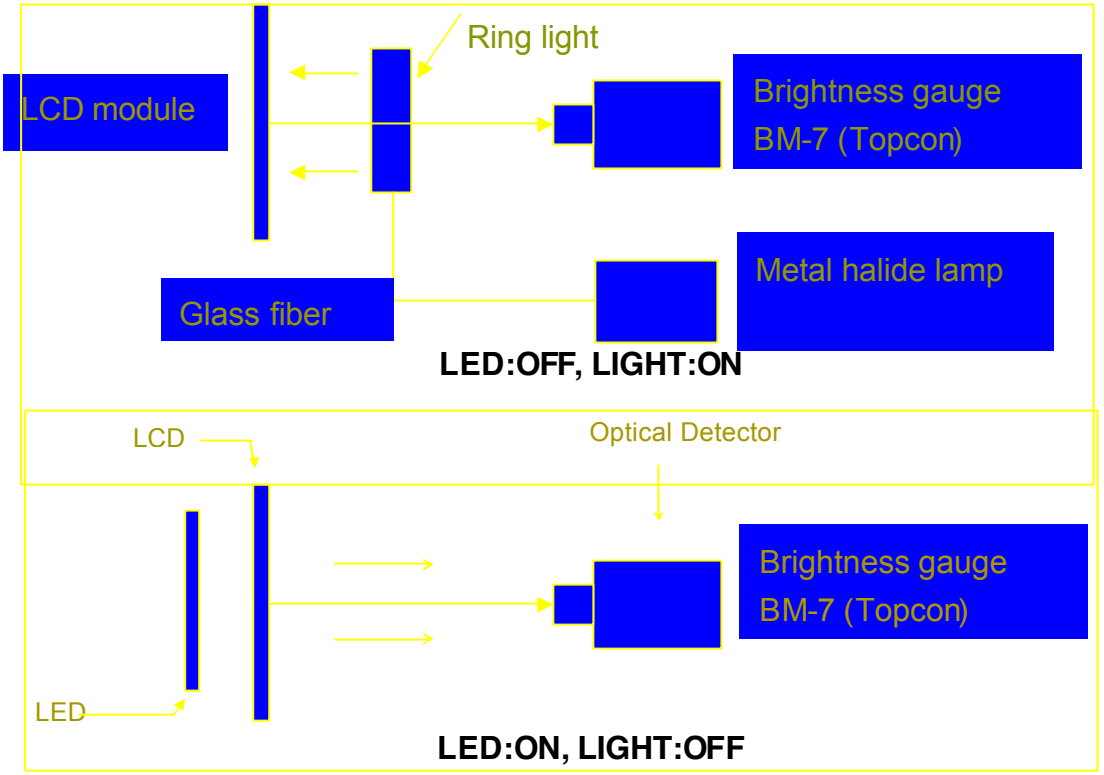
"$\mp$" means that the analog input signal swings out of phase with V_{COM} signal.

V_{i50} : The analog input voltage when transmission is 50%.The 100% Transmission is defined as the transmission of LCD panel when all the Input terminals of module are electrically opened.

Note 6.Definition of viewing angle, Refer to figure as below.



Note 7.Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.



4 QUALITY AND RELIABILITY

4.1 TEST CONDITIONS

Tests should be conducted under the following conditions:

Ambient temperature: 25 ± 5°C

Humidity : 60 ± 25% RH.

4.2 SAMPLING PLAN

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

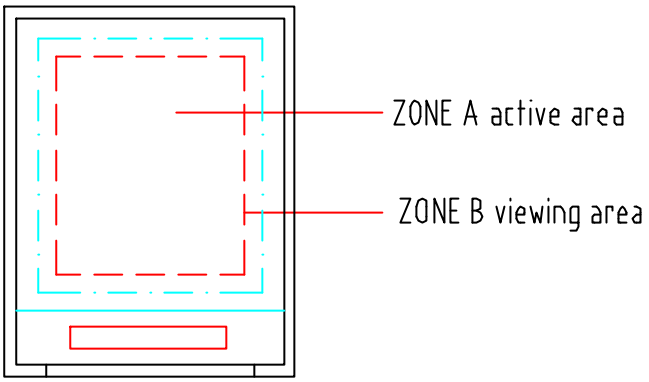
4.3 ACCEPTABLE QUALITY LEVEL

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.

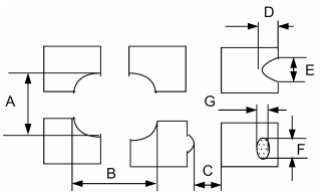
4.4 APPEARANCE

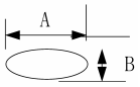
An appearance test should be conducted by human sight at approximately 30 cm distance from the LCD module under fluorescent light. The inspection area of LCD panel shall be within the range of following limits.



6. Inspection quality criteria

<table>
<tr><th>No.</th><th>Item</th><th>Criterion for defects</th><th>Defect type</th></tr>
<tr><td>1</td><td>Non display</td><td>No non display is allowed</td><td>Major</td></tr>
<tr><td>2</td><td>Irregular operation</td><td>No irregular operation is allowed</td><td>Major</td></tr>
<tr><td>3</td><td>Short</td><td>No short are allowed</td><td>Major</td></tr>
<tr><td>4</td><td>Open</td><td>Any segments or common patterns that don’ t activate are rejectable.</td><td>Major</td></tr>
<tr><td>5</td><td>Black/White spot</td><td><table><tr><th>Size D (mm)</th><th>Acceptable number</th></tr><tr><td>D ≤ 0.15</td><td>Ignore</td></tr><tr><td>0.15 < D ≤ 0.20</td><td>3</td></tr><tr><td>0.20 < D ≤ 0.30</td><td>2</td></tr><tr><td>0.30 < D</td><td>0</td></tr></table></td><td>Minor</td></tr>
<tr><td>6</td><td>Black/White line</td><td><table><tr><th>Length(mm)</th><th>Width (mm)</th><th>Acceptable number</th></tr><tr><td>10 < L</td><td>0.03 < W ≤ 0.04</td><td>5</td></tr><tr><td>5.0 < L ≤ 10</td><td>0.04 < W ≤ 0.06</td><td>3</td></tr><tr><td>1.0 < L ≤ 5.0</td><td>0.06 < W ≤ 0.07</td><td>2</td></tr><tr><td>L ≤ 1.0</td><td>0.07 < W ≤ 0.09</td><td>1</td></tr></table></td><td>Minor</td></tr>
</table>

<table>
<tr><td>7</td><td>Back Light</td><td colspan="2">1. No Lighting is rejectable
2. Flickering and abnormal lighting are rejectable</td><td>Major</td></tr>
<tr><td rowspan="4">8</td><td rowspan="4">dot defect</td><td>Bright dot</td><td>N≦3</td><td rowspan="4">Minor</td></tr>
<tr><td>Dark dot</td><td>N≦4</td></tr>
<tr><td>Total dot defect
(Bright dot + Dark dot)</td><td>N≦5</td></tr>
<tr><td>Minimum distance between dark dot and dark dot</td><td>L≧0.5 mm</td></tr>
<tr><td>9</td><td>Display pattern</td><td colspan="2"> 

Unit:mm
<table><tr><td>$\frac{A+B}{2} \le 0.30$</td><td>0 < C</td><td>$\frac{D+E}{2} \le 0.25$</td><td>$\frac{F+G}{2} \le 0.25$</td></tr></table>
Note: 1. Acceptable up to 3 damages
2. NG if there’ re to two or more pinholes per dot</td><td>Minor</td></tr>
<tr><td>10</td><td>Blemish & Foreign matters
Size:
$D = \frac{A+B}{2}$</td><td colspan="2"><table><tr><th>Size D (mm)</th><th>Acceptable number</th></tr><tr><td>D ≤ 0.15</td><td>Ignore</td></tr><tr><td>0.15 < D ≤ 0.20</td><td>3</td></tr><tr><td>0.20 < D ≤ 0.30</td><td>2</td></tr><tr><td>0.30 < D</td><td>0</td></tr></table></td><td>Minor</td></tr>
<tr><td>11</td><td>Scratch on Polarizer
 
</td><td colspan="2"><table><tr><th>Width (mm)</th><th>Length (mm)</th><th>Acceptable number</th></tr><tr><td>W≤0.0
3</td><td>Ignore
L ≤ 2.0</td><td>Ignore
Ignore</td></tr><tr><td>0.03<W≤0.05</td><td>L > 2.0
L > 1.0</td><td>1
1</td></tr><tr><td>0.05<W≤0.08</td><td>L ≤ 1.0</td><td>Ignore</td></tr><tr><td>0.08<W</td><td>Note (1)</td><td>Note(1)</td></tr></table>
Note(1) Regard as a blemish</td><td>Minor</td></tr>
<tr><td>12</td><td>Bubble in polarizer</td><td colspan="2"><table><tr><th>Size D (mm)</th><th>Acceptable number</th></tr><tr><td>D ≤ 0.20</td><td>Ignore</td></tr><tr><td>0.20 < D ≤ 0.50</td><td>3</td></tr><tr><td>0.50 < D ≤ 0.80</td><td>2</td></tr><tr><td>0.80 < D</td><td>0</td></tr></table></td><td>Minor</td></tr>
<tr><td>13</td><td>Stains on LCD panel surface</td><td colspan="2">Stains that cannot be removed even when wiped lightly with a soft cloth or similar cleaning too are rejectable.</td><td>Minor</td></tr>
<tr><td>14</td><td>Rust in Bezel</td><td colspan="2">Rust which is visible in the bezel is rejectable.</td><td>Minor</td></tr>
</table>

15	Defect of land surface contact (poor soldering)	Evident crevices which is visible are rejectable.	Minor
16	Parts mounting	1. Failure to mount parts 2. Parts not in the specifications are mounted 3. Polarity, for example, is reversed	Major Major Major
17	Parts alignment	1. LSI, IC lead width is more than 50% beyond pad outline. 2. Chip component is off center and more than 50% of the leads is off the pad outline.	Minor Minor
18	Conductive foreign matter (Solder ball, Solder chips)	1. 0.45< ϕ ,N≧1 2. 0.30< $\phi \leq$ 0.45 ,N≧1 ϕ :Average diameter of solder ball (unit: mm) 3. 0.50<L ,N≧1 L: Average length of solder chip (unit: mm)	Major Minor Minor
19	Faulty PCB correction	1. Due to PCB copper foil pattern burnout, the pattern is connected, using a jumper wire for repair; 2 or more places are corrected per PCB. 2. Short circuited part is cut, and no resist coating has been performed.	Minor Minor

7. Reliability Test Items

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
Humidity Test	40°C , Humidity 90%, 96 hrs	1,2
Thermal Shock Test	-30°C ~ 25°C ~ 80°C 30 min. 5 min. 30 min. (1 cycle) Total 5 cycle	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
Static Electricity	150pF 330 ohm ±8kV, 10times air discharge	

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.

8 USE PRECAUTIONS

8.1 Handling precautions

1) The polarizing plate may break easily so be careful when handling it. Do not touch, press or rub it with a hard-material tool like tweezers.
2) Do not touch the polarizing plate surface with bare hands so as not to make it dirty. If the surface or other related part of the polarizing plate is dirty, soak a soft cotton cloth or chamois leather in benzine and wipe off with it. Do not use chemical liquids such as acetone, toluene and isopropyl alcohol. Failure to do so may bring chemical reaction phenomena and deteriorations.
3) Remove any spit or water immediately. If it is left for hours, the suffered part may deform or decolorize.
4) If the LCD element breaks and any LC stuff leaks, do not suck or lick it. Also if LC stuff is stuck on your skin or clothing, wash thoroughly with soap and water immediately.

8.2 Installing precautions

1) To prevent breaking by static electricity from the human body and clothing, earth the human body properly using the high resistance and discharge static electricity during the operation. In this case, however, the resistance value should be approx. 1MO and the resistance should be placed near the human body rather than the ground surface. When the indoor space is dry, static electricity may occur easily so be careful. We recommend the indoor space should be kept with humidity of 60% or more. When a soldering iron or other similar tool is used for assembly, be sure to earth it.
2) When installing the module and ICs, do not bend or twist them. Failure to do so may crack LC element and cause circuit failure.
3) To protect LC element, especially polarizing plate, use a transparent protective plate (e.g., acrylic plate, glass etc) for the product case.
4) Do not use an adhesive like a both-side adhesive tape to make LCD surface (polarizing plate) and product case stick together. Failure to do so may cause the polarizing plate to peel off.

8.3 Storage precautions

1) Avoid a high temperature and humidity area. Keep the temperature between 0°C and 35°C and also the humidity under 60%.
2) Choose the dark spaces where the product is not exposed to direct sunlight or fluorescent light.
3) Store the products as they are put in the boxes provided from us or in the same conditions as we recommend.

8.4 Operating precautions

1) Do not boost the applied drive voltage abnormally. Failure to do so may break ICs. When applying power voltage, check the electrical features beforehand and be careful. Always turn off the power to the LC module controller before removing or inserting the LC module input connector. If the input connector is removed or inserted while the power is turned on, the LC module internal circuit may break.
2) The display response may be late if the operating temperature is under the normal standard, and the display may be out of order if it is above the normal standard. But this is not a failure; this will be restored if it is within the normal standard.
3) The LCD contrast varies depending on the visual angle, ambient temperature, power voltage etc. Obtain the optimum contrast by adjusting the LC dive voltage.
4) When carrying out the test, do not take the module out of the low-temperature space suddenly. Failure to do so will cause the module condensing, leading to malfunctions.
5) Make certain that each signal noise level is within the standard (L level: 0.2Vdd or less and H level: 0.8Vdd or more) even if the module has functioned properly. If it is beyond the standard, the module may often malfunction. In addition, always connect the module when making noise level measurements.
6) The CMOS ICs are incorporated in the module and the pull-up and pull-down function is not adopted for the input so avoid putting the input signal open while the power is ON.
7) The characteristic of the semiconductor element changes when it is exposed to light emissions, therefore ICs on the LCD may malfunction if they receive light emissions. To prevent these malfunctions, design and assemble ICs so that they are shielded from light emissions.

8) Crosstalk occurs because of characteristics of the LCD. In general, crosstalk occurs when the regularized display is maintained. Also, crosstalk is affected by the LC drive voltage. Design the contents of the display, considering crosstalk.

8.5 Other

1) Do not disassemble or take the LC module into pieces. The LC modules once disassembled or taken into pieces are not the guarantee articles.
2) The residual image may exist if the same display pattern is shown for hours. This residual image, however, disappears when another display pattern is shown or the drive is interrupted and left for a while. But this is not a problem on reliability.

9. Mechanical Dimensions