SPECIFICATIONS

3.5-IN COLOR LCD TFT MODULE W/ TOUCH PANEL

CUSTOMER:	
CUSTOMER PART NO.	
AMP DISPLAY PART NO.	A M 3 2 0 2 4 0 L 2 T M Q W - T B 0 H
APPROVED BY:	
DATE:	

☐　　APPROVED FOR SPECIFICATIONS

☐　　APPROVED FOR SPECIFICATION AND PROTOTYPES

RECORD OF REVISION

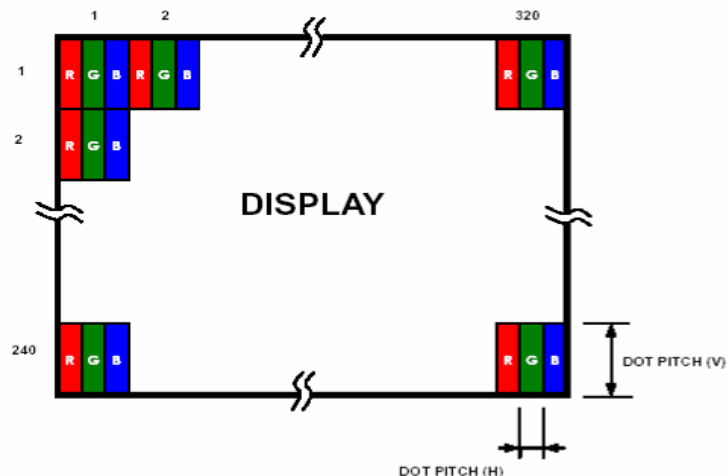| Revision Date	Page	Contents	Editor
2008/1/19		New Release	Norman
2008/6/12	--	Correct the company address	Edward
	4	Revise Functional Block Diagram	Edward
	11	Revise Description of Pin 11(SPDAT)	Edward
2008/6/23	8	Modify 7.1 DC Electrical characteristic of the LCD	Kasha
2008/7/16	6	Add the comment of SPI interface	Edward

1   General Description and Features

3.5 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) module. This module is composed of a 3.5" TFT-LCD panel, a driver circuit and backlight unit.
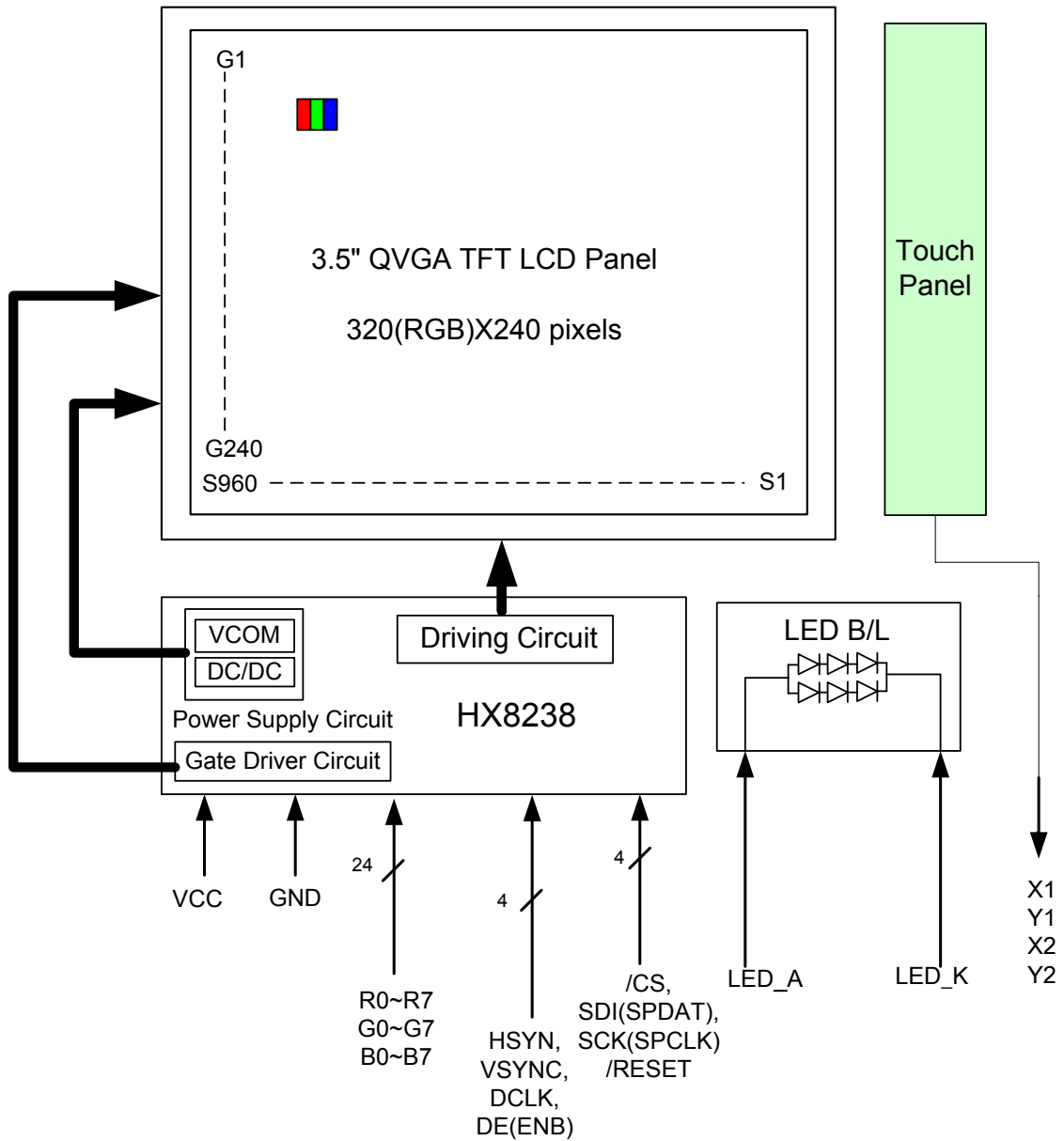
1.1 Construction: 3.5" a-Si color TFT-LCD, White LED Backlight and PCB, Touch Panel.

1.2 Resolution (pixel): 320(R.G.B) X240.

1.3 Number of the Colors: 16M colors (R, G, B 8 bit digital each).

1.4 LCD type: Transmissive Color TFT LCD (normally White).

1.5 View Angle: 6 o'clock.

1.6 24Bit RGB Interface.

1.7 Interface: 54 pin.

1.8 Power Supply Voltage: 3.3V single power input. Built-in power supply circuit.

1.9 LED Type Backlight.

1.10 With OTP function. (Loading initial code automatically).

2   Physical specifications

Item	Specifications	unit
Display Resolution	320(W) x 240(H)	dot
Active area	70.08 x 52.56	mm
Screen size	3.5(Diagonal)	inch
Dot pitch	0.073 (W) x 0.219 (H)	mm
Color configuration	R.G.B – stripe	
Overall Dimension	77.8(W) x 64.5(H) x3.2(T)	mm
Input interface	digital 24-bits RGB	
Surface Treatment	Anti - glare(AG)	
Backlight unit	White LED	
Display Mode	Normally White/Transmissive	

3 Functional Block Diagram

G1

3.5" QVGA TFT LCD Panel

320(RGB)X240 pixels

G240
S960 — — — — — — — — — — — — — — — S1

Touch
Panel

VCOM
DC/DC
Power Supply Circuit

Driving Circuit

HX8238

LED B/L

Gate Driver Circuit

VCC   GND

24

4

4

R0~R7
G0~G7
B0~B7

HSYN,
VSYNC,
DCLK,
DE(ENB)

/CS,
SDI(SPDAT),
SCK(SPCLK)
/RESET

LED_A   LED_K

X1
Y1
X2
Y2

4 Electrical Specifications

TFT LCD Panel FPC Descriptions

No.	Symbol	I/O	Description	Remark
1.	VBL-	I	Backlight LED Cathode.	
2.	VBL-	I	Backlight LED Cathode.	
3.	VBL+	I	Backlight LED Anode.	
4.	VBL+	I	Backlight LED Anode.	
5.	NC	-	No connection.	
6.	SDO	O	SPI Interface Data Out.	note
7.	NC	-	No connection.	
8.	/RESET	I	Hardware Reset Input, Low active.	
9.	/CS	I	Chip select pin of serial interface. - Leave it OPEN when not used.	
10.	SPCLK	I	SPI Interface Data Clock.	note
11.	SPDAT	I	SPI Interface Data.	note
12.	B0	I	Blue Data for Digital RGB Interface.	
13.	B1	I		
14.	B2	I		
15.	B3	I		
16.	B4	I		
17.	B5	I		
18.	B6	I		
19.	B7	I		
20.	G0	I	Green Data for Digital RGB Interface.	
21.	G1	I		
22.	G2	I		
23.	G3	I		
24.	G4	I		
25.	G5	I		
26.	G6	I		
27.	G7	I		
28.	R0	I	Red Data for Digital RGB Interface.	
29.	R1	I		
30.	R2	I		
31.	R3	I		
32.	R4	I		
33.	R5	I		
34.	R6	I		
35.	R7	I		
36.	HSYNC	I	Horizontal Sync Input.	
37.	VSYNC	I	Vertical Sync Input.	
38.	DCLK	I	Dot Data Clock.	
39.	NC	-	No connection.	
40.	NC	-	No connection.	
41.	VCC	-	Digital Power (3.3V).	

42.	VCC	-		
43.	NC	-	**No connection.**	
44.	NC	-		
45.	VGL	I	**For initial Code OTP Use (Keep NC).**	
46.	NC	-		
47.	VGH	I	**For initial Code OTP Use (Keep NC).**	
48.	NC	-	**No connection.**	
49.	NC	-		
50.	NC	-		
51.	NC	-		
52.	ENB	I	**Data Enable Input.**	
53.	GND	-	**Ground.**	
54.	GND	-		

Note : SPI interface only use for setting the initial code of IC HX8238.

5　Basic Display Color and Gray Scale

Color		Input Color Data																							
		Red (MSB → LSB)								Green (MSB → LSB)								Blue (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

6 Absolute Maximum Ratings

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

6.1 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 (1 LED Dice) :
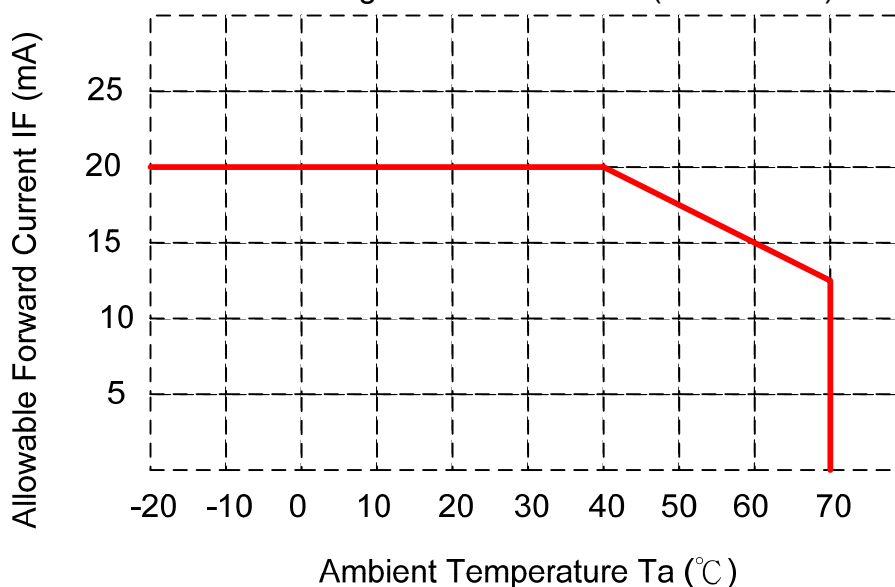
Note7 : This is panel surface temperature, not ambient temperature.

Note8 : When LCM be operated over than 40℃ , the life time of the LED back-light will be reduced.

6.2 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~R7, G0~G7, B0~B7

7 Electrical Characteristics

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	H Level	V_{IH}	0.7 VDD	-	VDD	V	Note 1
for logic	L Level	V_{IL}	0	-	0.3 VDD	V	
Power Supply current		IDD		14.78	--	mA	Note 2

Note1:Hsync, Vsync, DEN, DCLK, R0~R7, G0~G7, B0~B7

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

7.2 Electrical characteristic of LED Back-light

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
LED voltage	V_{AK}	9.6	-	11	V	I_{LED}=40mA,Ta=25℃
LED forward current	I_{LED}	--	40	-	mA	Ta=25℃
	I_{LED}	--	30	-	mA	Ta=60℃

LED_K   LED_A
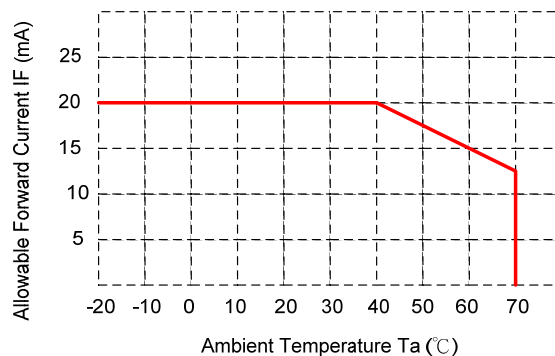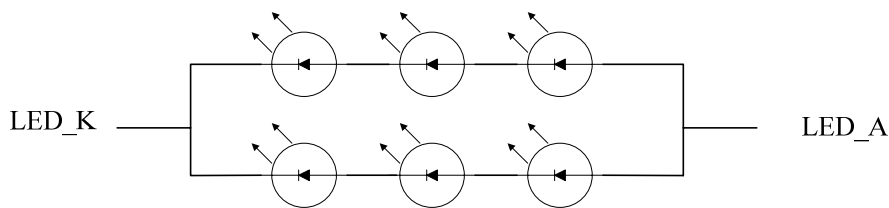
Life Time Curve/1 LED dice

8 AC Timing characteristic of the LCD
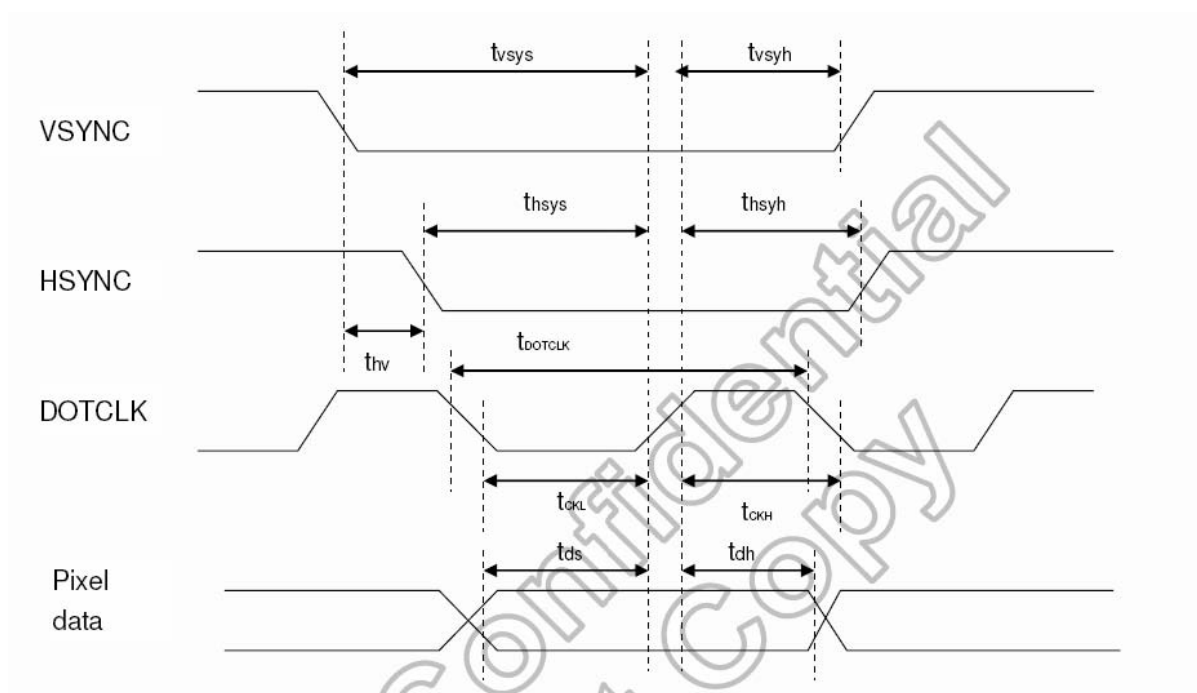
Pixel Timing

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) Horizontal Data Transaction Timing
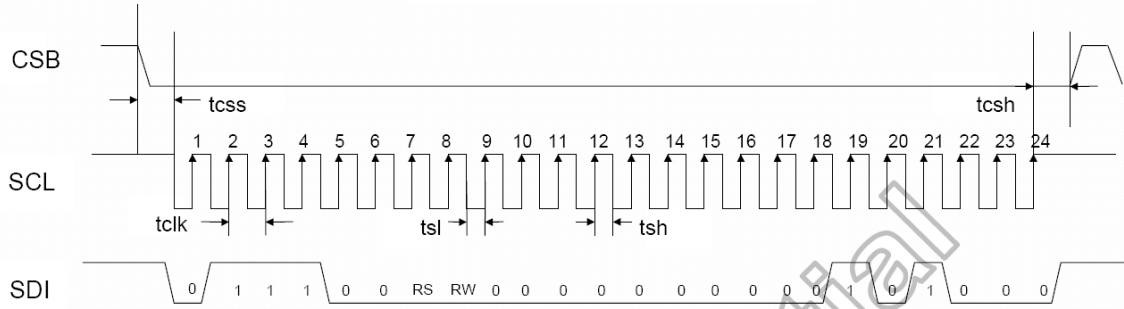
b) Vertical Data Transaction Timing
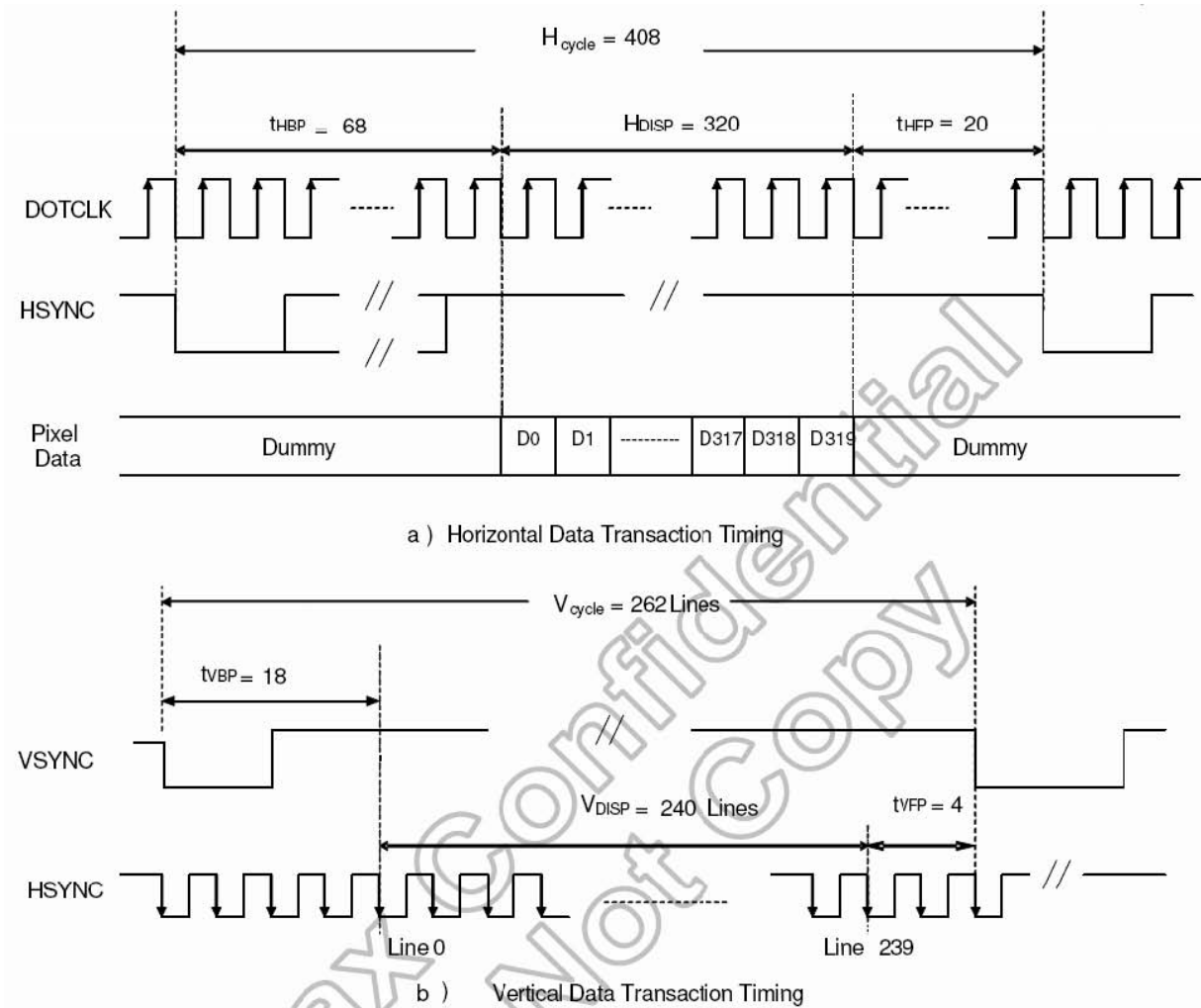
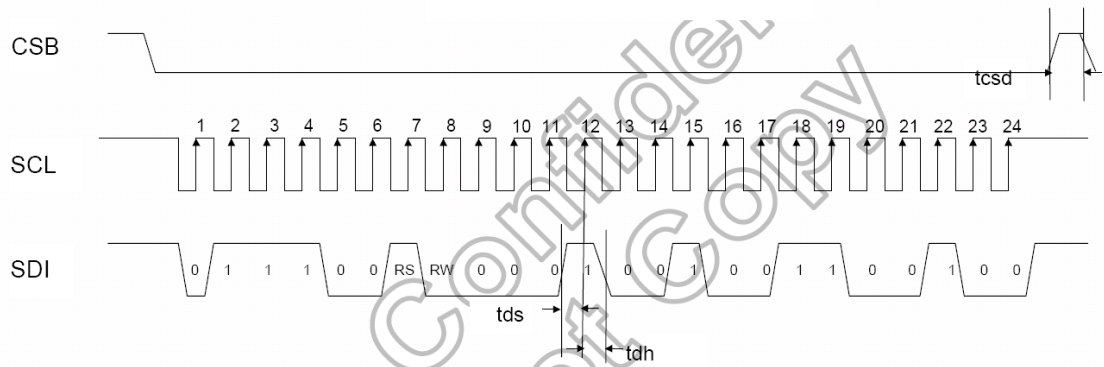(a) Data Transaction Timing in Parallel RGB (24 bit) Interface (SYNC Mode)
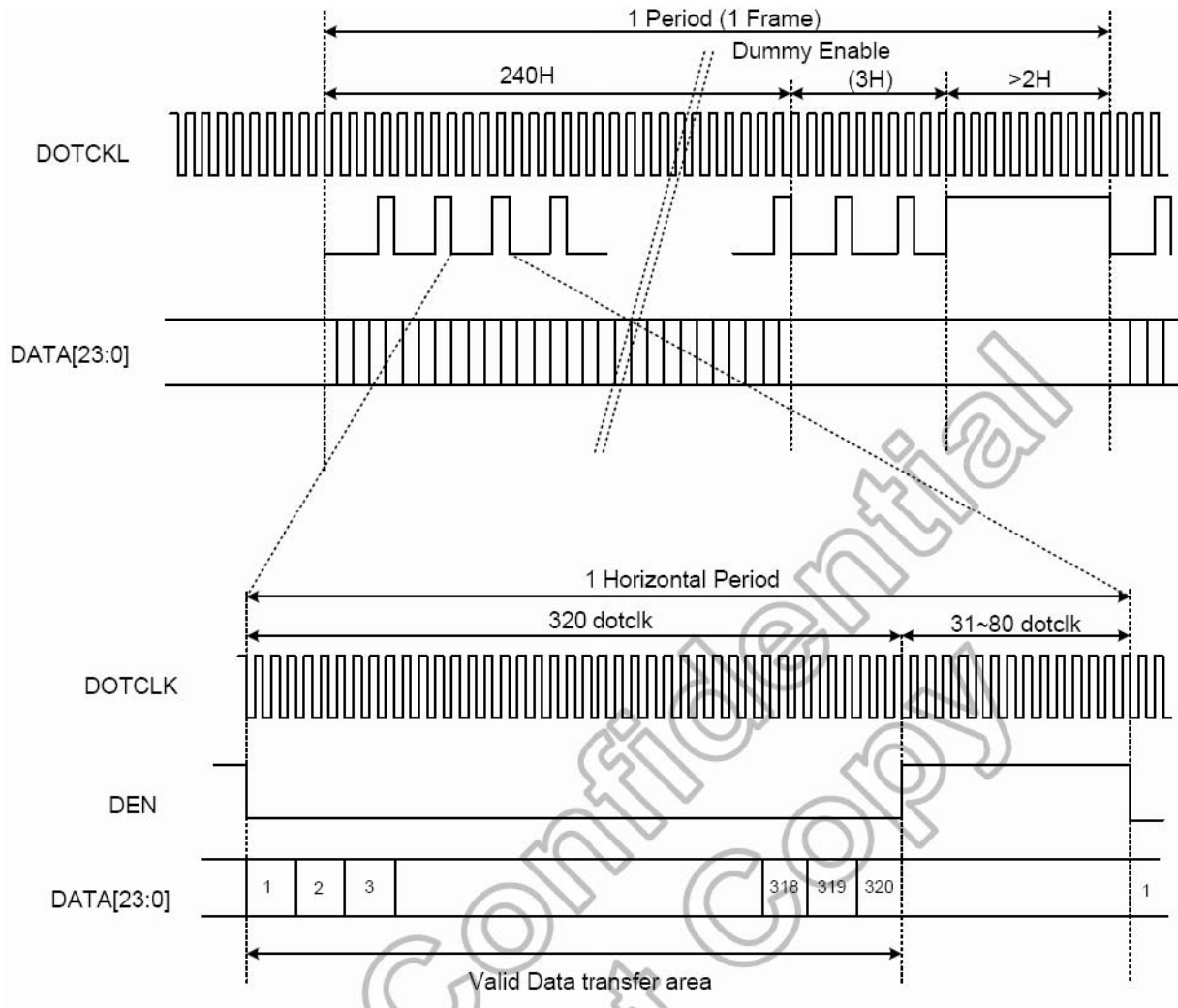
b) Data Transaction Timing in Parallel RGB (24 bit) Interface (DE Mode)

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
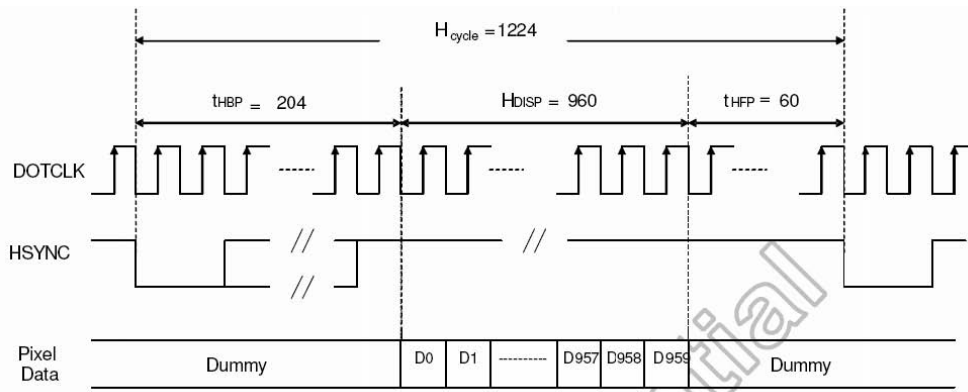
a) Horizontal Data Transaction Timing
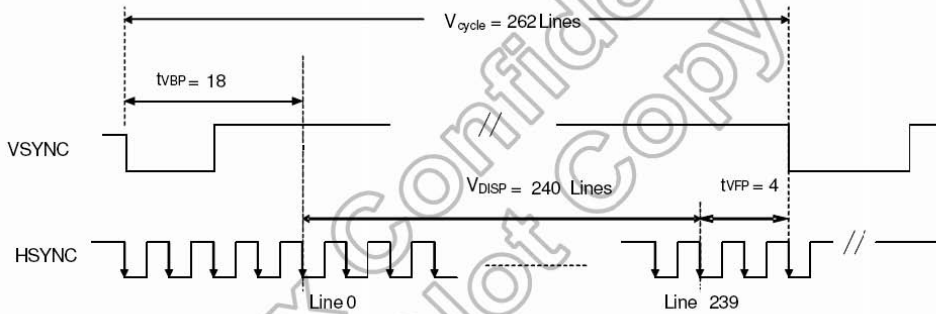
b) Vertical Data Transaction Timing

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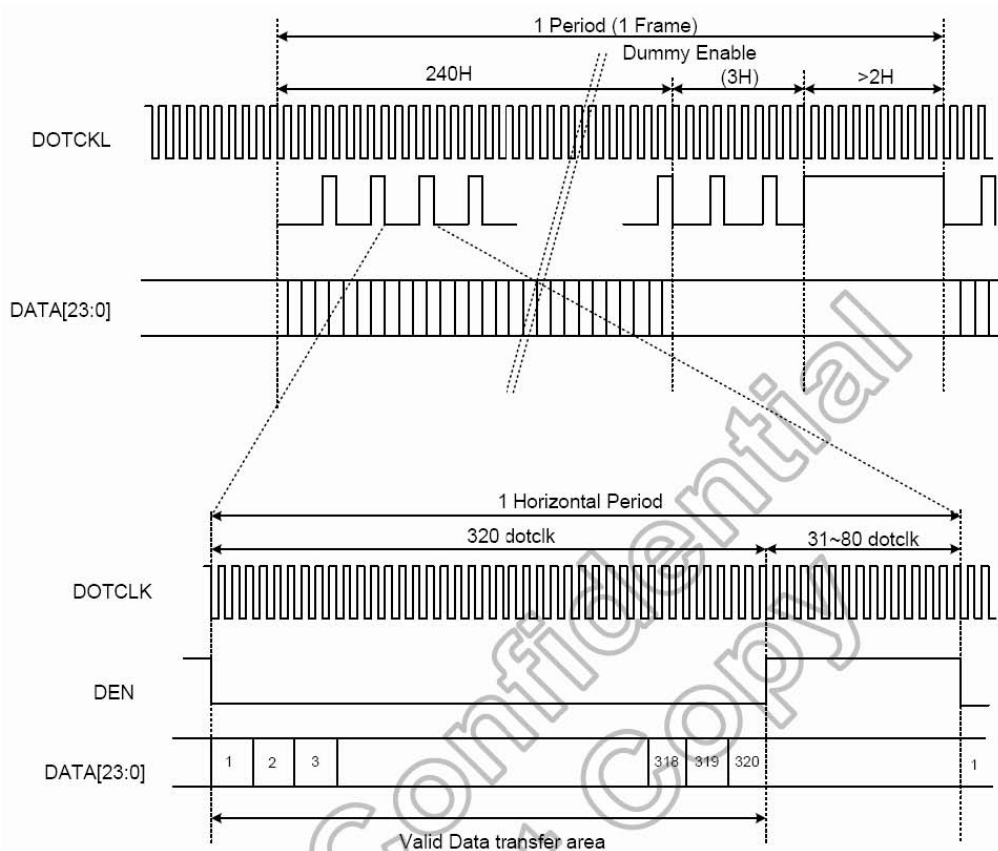
Data Transaction Timing in Serial RGB (8 bit) Interface (DE Mode)

●Write SPI

First Transmission (Register)

CSB

tcss   tcsh

SCL
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

tclk   tsl   tsh

SDI
0 1 1 1 0 0 RS RW 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0

Second Transmission (Data)

CSB

tcsd

SCL
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

SDI
0 1 1 1 0 0 RS RW 0 0 0 1 0 0 1 0 0 1 1 0 0 1 0 0

tds   tdh

Note: The example writes "0x1264h" to register R28h.
SPID connected to VSS.

●Read SPI

First Transmission (Register)

CSB

SCL
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

SDI
0 1 1 1 0 0 RS RW 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0

Second Transmission (Data)

CSB

SCL
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

SDI
0 1 1 1 0 0 RS RW

SDO
0 0 0 1 0 0 1 0 0 1 1 0 0 1 0 0
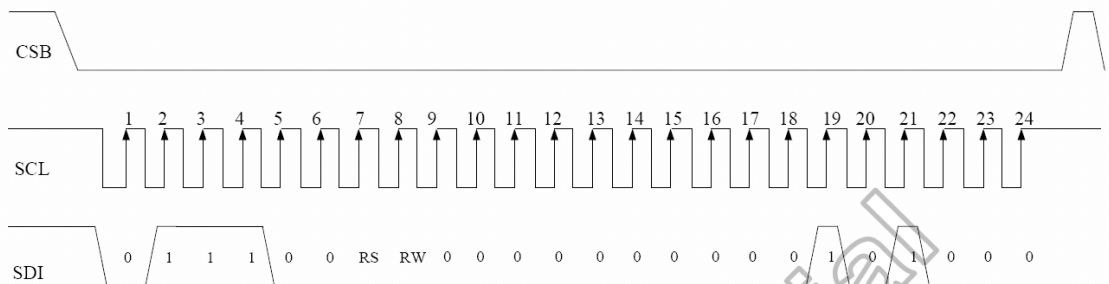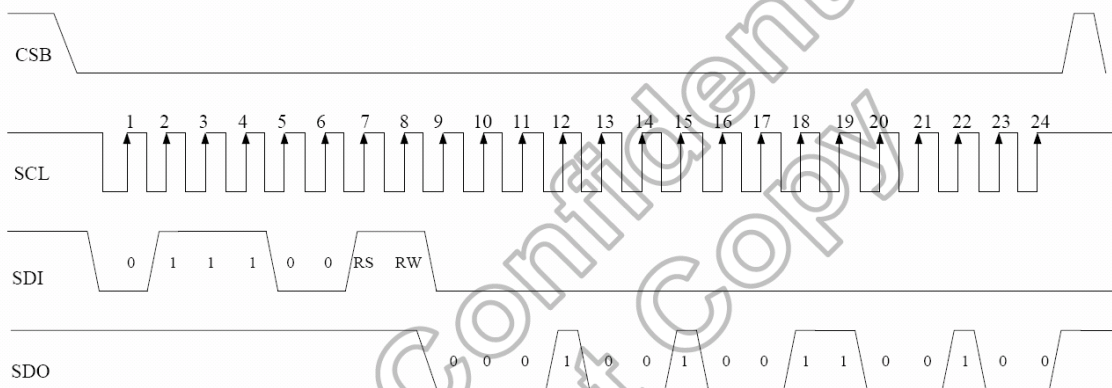
Note: The example Read "0x1264h" from register R28h.

Characteristics	Symbol	Min	Typ	Max	Unit
Serial Clock Frequency	fclk	-	-	20	MHz
Serial Clock Cycle Time	tclk	50	-	-	ns
Clock Low Width	tsl	25	-	-	ns
Clock High Width	tsh	25	-	-	ns
Chip Select Setup Time	tcss	0	-	-	ns
Chip Select Hold Time	tcsh	10	-	-	ns
Chip Select High Delay Time	tcsd	20	-	-	ns
Data Setup Time	tds	5	-	-	ns
Data Hold Time	tdh	10	-	-	ns

Table 14. 5 SPI Timing

9 Touch Screen Panel Specifications

9.1 Electronic characteristics

Item	Min.	Typ.	Max.	Unit	Note
Linearity			1.5	%	
Terminal Resistance	200		900	Ω	X(Film side)
	200		900	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.

9.2 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)

9.3 Touch Screen Panel

Parameter	Condition	Standard Value
Terminal Resistance	X Axis	200 ~ 900 Ω
	Y Axis	200 ~ 900 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
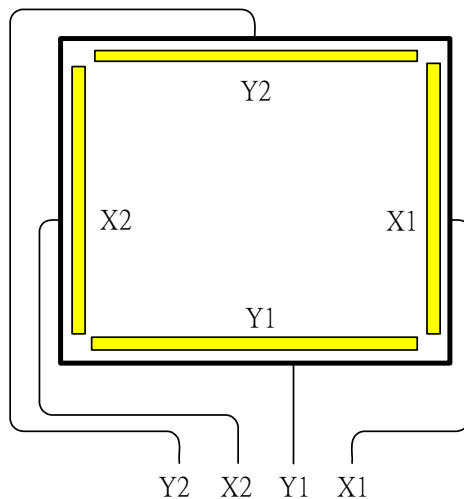
10 Optical specification

10.2   Optical characteristic of the LCD

Item		Symbol	Conditon	Min.	Typ.	Max.	Unit	Remark
Response Time		$T_r + T_f$	$\Theta = 0°$		50	80	ms	Note 1,2,3,5
Contrast ratio		CR	At optimized viewing angle	-	300	-		Note 1,2,4,5
Viewing Angle	Θ_{x+}		CR$\geqq$10	-	70	-	deg.	Note1,2, 5,6
	Θ_{x-}			-	70	-		
	Θ_{y+}			-	35	-		
	Θ_{y-}			-	55	-		
Brightness		Y_L	I_{LED}=20mA ,25℃	250	280	-	cd/m^2	Note 7
White chromaticity	XW		I_{LED}=20mA ,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.
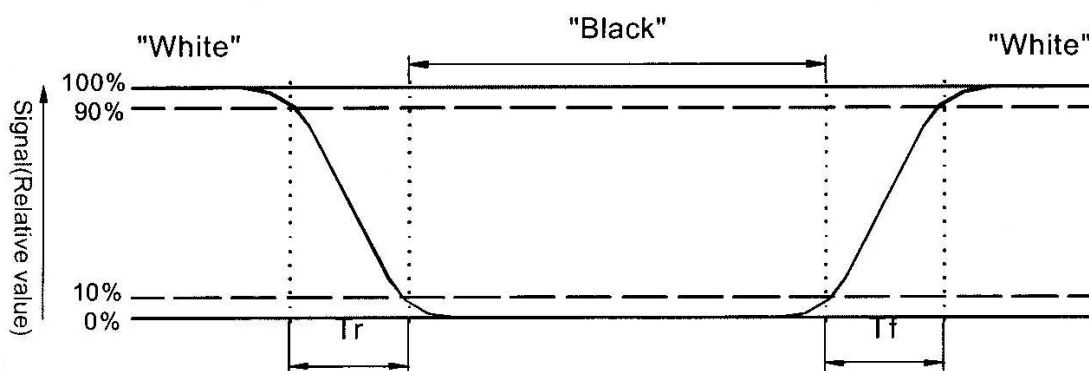
Note 4.Definition of contrast ratio:

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 $V_i = V_{i50} + 2.0V$

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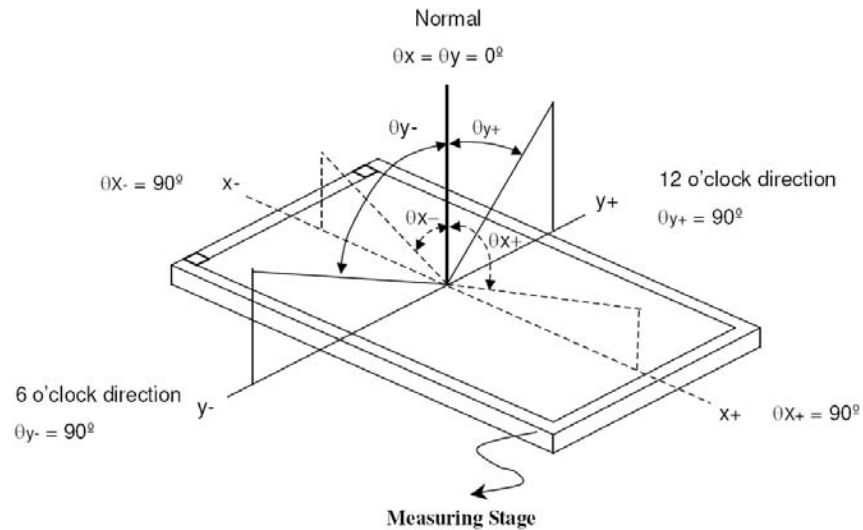
Note 7. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

LCD module — Ring light — Brightness gauge BM-7 (Topcon)

Glass fiber — Metal halide lamp

LED:OFF, LIGHT:ON

LCD — Optical Detector — Brightness gauge BM-7 (Topcon)

LED

LED:ON, LIGHT:OFF
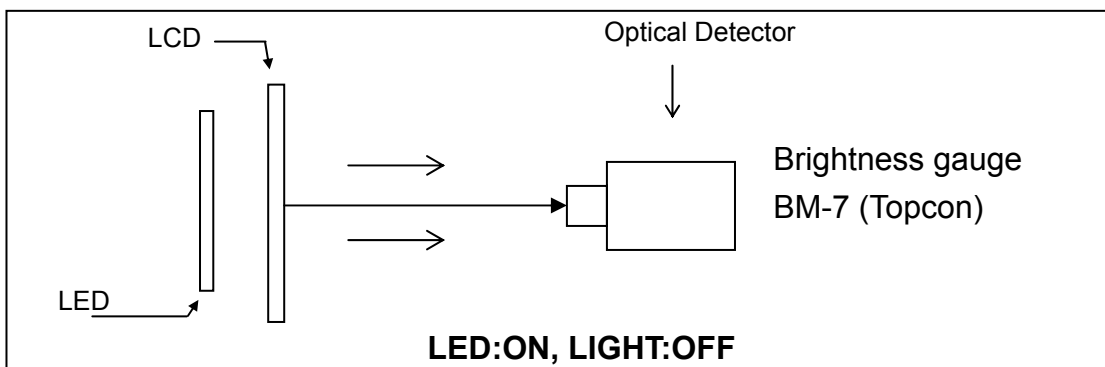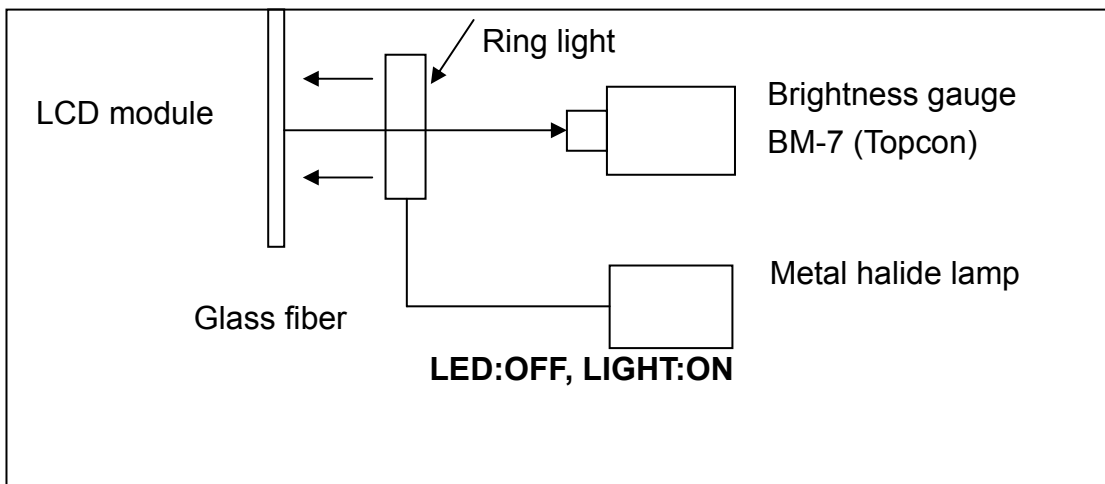
11 QUALITY AND RELIABILITY

11.1   TEST CONDITIONS

Tests should be conducted under the following conditions:
Ambient temperature: $25 \pm 5°C$
Humidity   : $60 \pm 25\%$ RH.

11.2   SAMPLING PLAN

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

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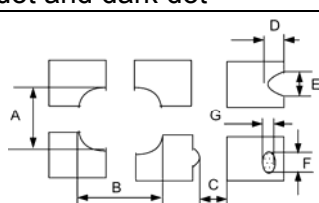
A major defect is defined as one that could cause failure to or materially reduce the usability of the unit for its intended purpose. A minor defect is one that does not materially reduce the usability of the unit for its intended purpose or is an infringement from established standards and has no significant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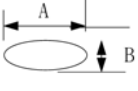
11.4   APPEARANCE

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.

ZONE A active area

ZONE B viewing area
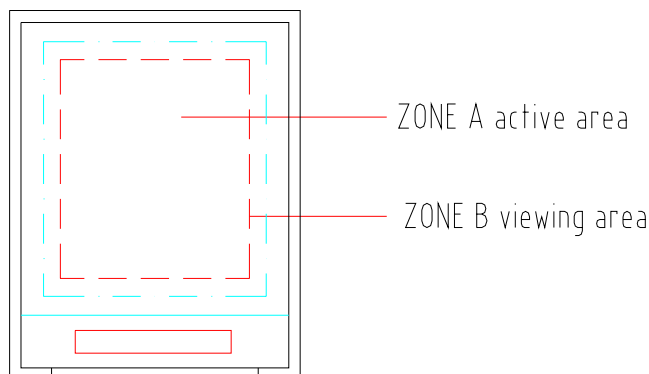
11.5 INSPECTION QUALITY CRITERIA

No.	Item	Criterion for defects	Defect type
1	Non display	No non display is allowed	Major
2	Irregular operation	No irregular operation is allowed	Major
3	Short	No short are allowed	Major
4	Open	Any segments or common patterns that don't activate are rejectable.	Major
5	Black/White spot	<table><tr><td>Size D (mm)</td><td>Acceptable number</td></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>	Minor
6	Black/White line	<table><tr><td>Length(mm)</td><td>Width (mm)</td><td>Acceptable number</td></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>	Minor
7	Back Light	1. No Lighting is rejectable 2. Flickering and abnormal lighting are rejectable	Major
8	dot defect	<table><tr><td>Bright dot</td><td>N ≦ 1</td></tr><tr><td>Dark dot</td><td>N ≦ 3</td></tr><tr><td>Total dot defect (Bright dot + Dark dot)</td><td>N ≦ 3</td></tr><tr><td>Minimum distance between dark dot and dark dot</td><td>L ≧ 5 mm</td></tr></table>	Minor
9	Display pattern	Unit:mm $\frac{A+B}{2} \le 0.30$ $0 < C$ $\frac{D+E}{2} \le 0.25$ $\frac{F+G}{2} \le 0.25$ Note: 1. Acceptable up to 3 damages 2. NG if there're to two or more pinholes per dot	Minor
10	Blemish & Foreign matters Size: $D = \frac{A+B}{2}$	<table><tr><td>Size D (mm)</td><td>Acceptable number</td></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>	Minor

11	Scratch on Polarizer	Width (mm)	Length (mm)	Acceptable number	Minor
		W≤0.03	Ignore	Ignore	
			L ≤ 2.0	Ignore	
		0.03<W≤0.05	L > 2.0	1	
			L > 1.0	1	
		0.05<W≤0.08	L ≤ 1.0	Ignore	
			Note (1)	Note(1)	
		0.08<W			
		Note(1) Regard as a blemish			

12	Bubble in polarizer	Size D (mm)	Acceptable number	Minor
		D ≤ 0.20	Ignore	
		0.20 < D ≤ 0.50	3	
		0.50 < D ≤ 0.80	2	
		0.80 < D	0	

13	Stains on LCD panel surface	Stains that cannot be removed even when wiped lightly with a soft cloth or similar cleaning too are rejectable.	Minor
14	Rust in Bezel	Rust which is visible in the bezel is rejectable.	Minor
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<φ≤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

11.6 RELIABILITY

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.

12 USE PRECAUTIONS

12.1 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.

12.2 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. $1M\Omega$ 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.

12.3　　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.
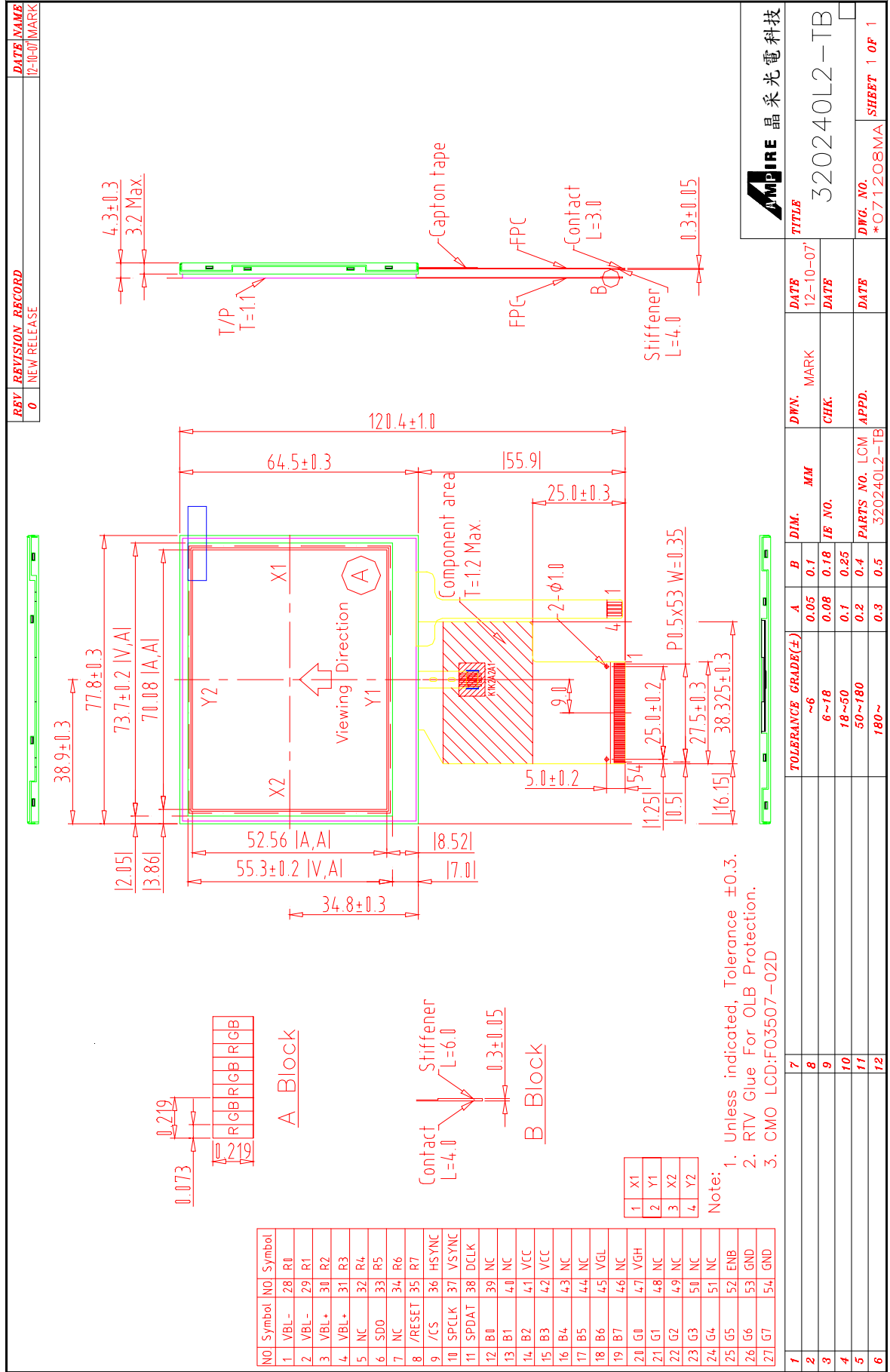3) Store the products as they are put in the boxes provided from us or in the same conditions as we recommend.

12.4　　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.

12.5   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.

3) AMIPRE will provide one year warrantee for all products and three months warrantee for all repairing products.

13 Mechanical Dimensions

(Mechanical drawing — AMPIRE 晶采光電科技, DWG. NO. *071208MA, PARTS NO. LCM 320240L2-TB, TITLE 320240L2-TB, SHEET 1 OF 1)

REV REVISION RECORD
0 NEW RELEASE

DATE NAME MARK
12-10-07

Dimensions and annotations shown:
- 120.4±1.0
- 64.5±0.3
- |55.9|
- 25.0±0.3
- 38.9±0.3
- 77.8±0.3
- 73.7±0.2 |V,A|
- 70.08 |A,A|
- 52.56 |A,A|
- 55.3±0.2 |V,A|
- 34.8±0.3
- |8.52|
- |7.0|
- |2.05|
- |3.86|
- 5.0±0.2
- 25.0±0.2
- 27.5±0.3
- 38.325±0.3
- 9.0
- |54|
- |1.25|
- 10.5
- |16.15|
- 2-Φ1.0
- P0.5x53 W=0.35
- X1, X2, Y1, Y2
- Viewing Direction
- Component area T=1.2 Max.
- KK3A2A1
- 4.3±0.3
- 3.2 Max.
- T/P T=1.1
- 0.3±0.05
- Capton tape
- FPC
- Contact L=3.0
- Stiffener L=4.0
- B
- 0.219, 0.073, 0.219
- RGB RGB RGB
- A Block
- Stiffener L=6.0
- Contact L=4.0
- 0.3±0.05
- B Block

Note:
1. Unless indicated, Tolerance ±0.3.
2. RTV Glue For OLB Protection.
3. CMO LCD:F03507-02D

TOLERANCE GRADE(±)

		A	B
7	~6	0.05	0.1
8	6~18	0.08	0.18
9	18~50	0.1	0.25
10	50~180	0.2	0.4
11	180~	0.3	0.5
12			

DIM. MM
DWN. MARK
CHK.
APPD.
DATE 12-10-07
DATE
DATE
IE NO.

NO	Symbol	NO	Symbol
1	VBL-	28	R0
2	VBL-	29	R1
3	VBL+	30	R2
4	VBL+	31	R3
5	NC	32	R4
6	SDO	33	R5
7	NC	34	R6
8	/RESET	35	R7
9	/CS	36	HSYNC
10	SPCLK	37	VSYNC
11	SPDAT	38	DCLK
12	B0	39	NC
13	B1	40	NC
14	B2	41	VCC
15	B3	42	VCC
16	B4	43	NC
17	B5	44	NC
18	B6	45	VGL
19	B7	46	NC
20	G0	47	VGH
21	G1	48	NC
22	G2	49	NC
23	G3	50	NC
24	G4	51	NC
25	G5	52	ENB
26	G6	53	GND
27	G7	54	GND

1	X1
2	Y1
3	X2
4	Y2