

CHENG UEI PRECISION INDUSTRY CO., LTD.

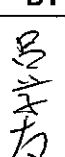



PRODUCT SPECIFICATION

RoHS

3.5" TFT LCD MODULE MODEL: FL350QVR02-B1

- < ◇ > Preliminary Specification
- < ◆ > Engineering Specification
- < ◇ > Approval Specification

CUSTOMER'S APPROVAL	
CUSTOMER :	
SIGNATURE:	DATE:

APPROVED BY	PM REVIEWD	PREPARED By
 4/23/08	 4/23/08	  4/23/08

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* This specification is subject to change without notice. Please contact Foxlink or it's representative before designing your product based on this specification.

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1. General Description

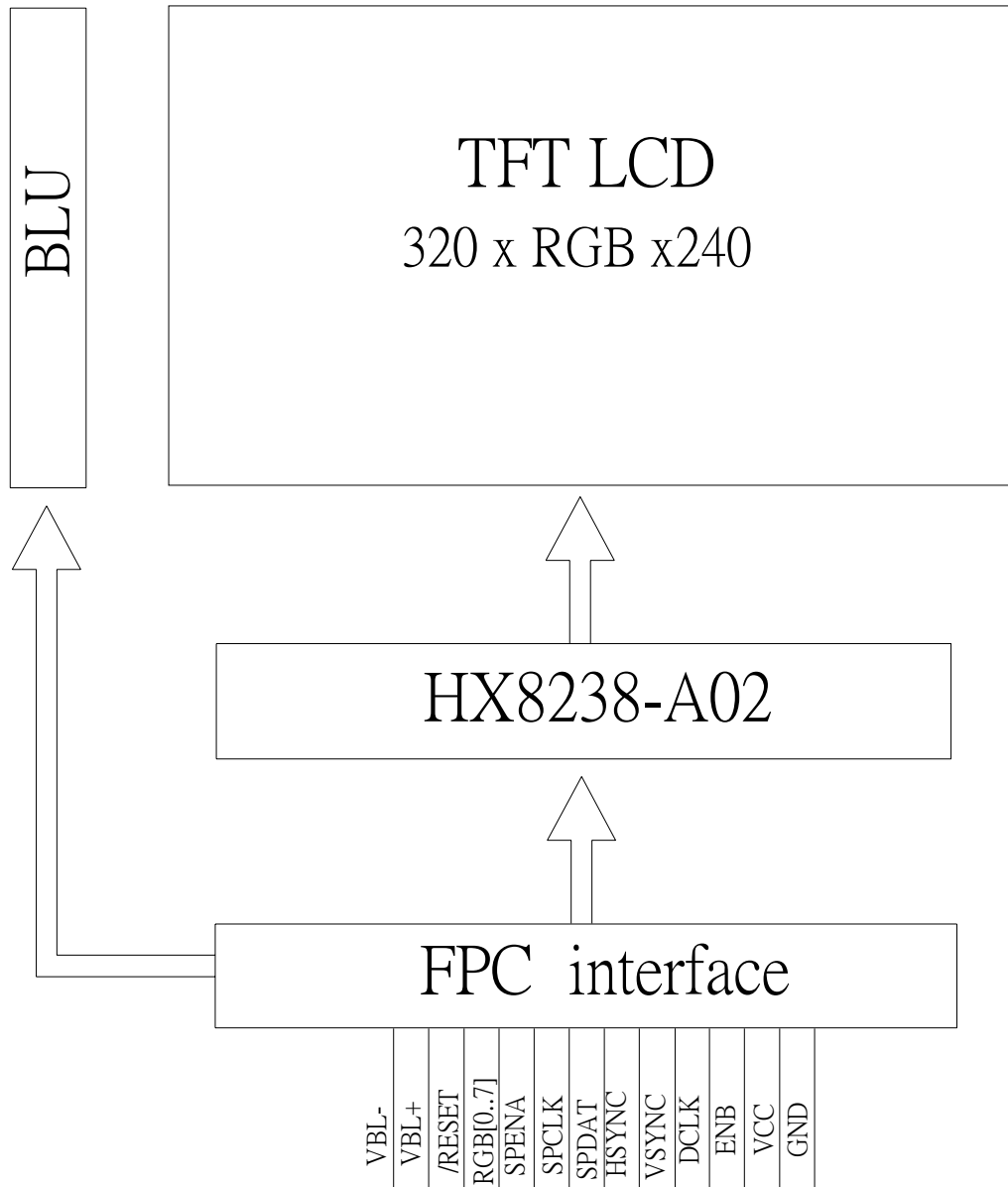
1.1 Description

The specifications 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 and a backlight unit. The following table described the features of FL350QVR02-B1.

1.2 Features:

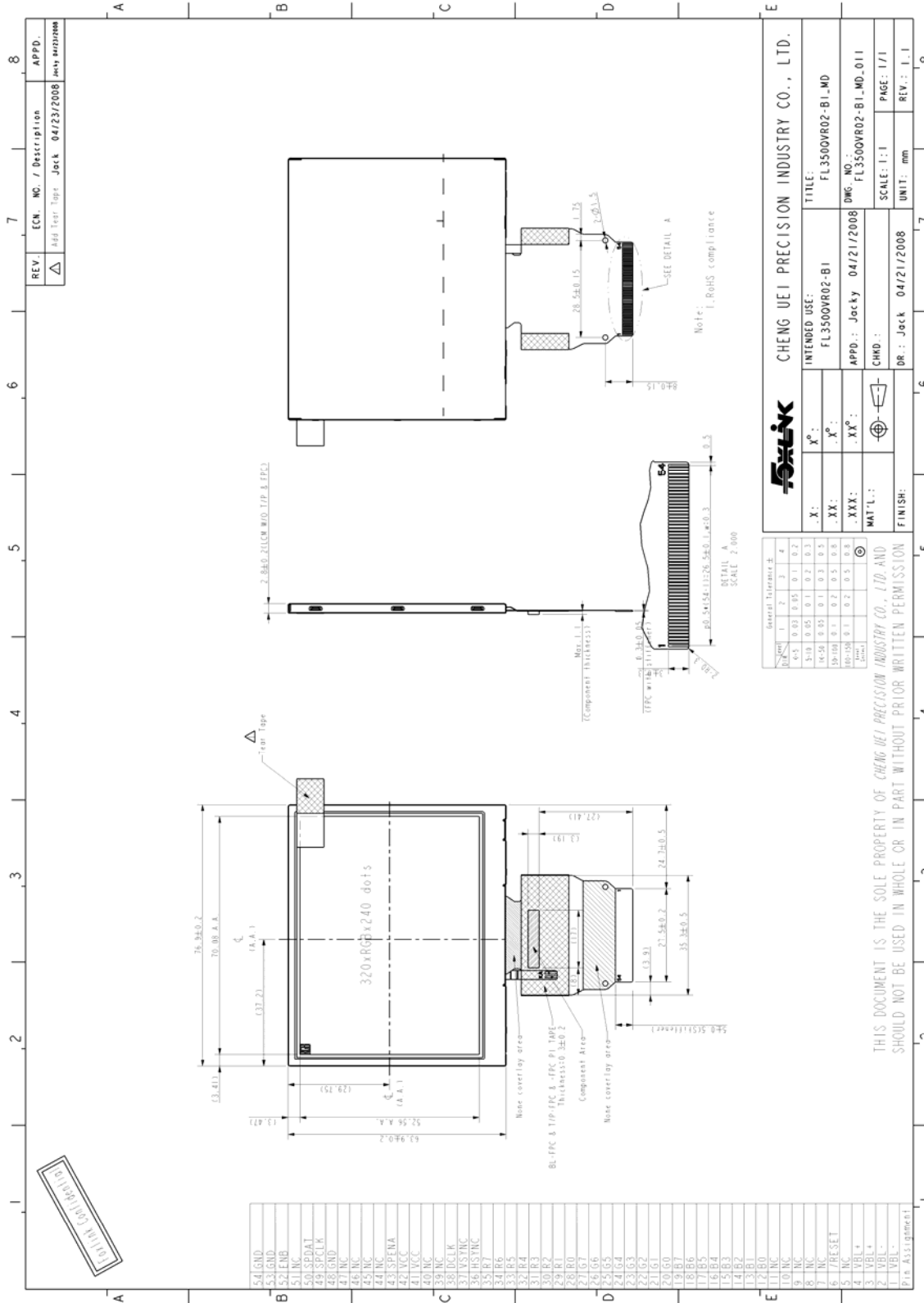
No.	Item	Specification	Unit
1	Panel Size	3.5	inch
2	Number of Pixels	320(H)×RGB×240(V)	Pixels
3	Active Area	70.08(H)×52.56(V)	mm
4	Pixel Pitch	0.219(H) x0.219 (V)	mm
5	Outline Dimension	76.9(H) x 63.9(V) x 2.8(D)	mm
6	Number of Colors	262K	-
7	Pixel Arrangement	RGB Vertical Stripe	-
8	Display Mode	Normally White TN / Transmissive	-
9	Brightness (LED I _f =20mA)	380 (Typ.) 330(Min.)	cd/m ²
10	Contrast Ratio	250 :1 (Typ.)	-
11	Chromaticity (White, x / y)	0.31/ 0.33 (Typ.)	
12	Uniformity	80% (Typ.)	
13	Response time (Tr+Tf)	50 (Typ.)	ms
14	Viewing Direction	6 o'clock	-
15	Input Interface	RGB interface	-
16	Viewing Angle (U/D/L/R)	50/55/60/60	degree
17	Backlight unit	LED * 6	-
18	Driver IC	HX8238-A02	
19	Weight	(29)	g

2. Functional Block Diagram



3. Mechanical Specification

3.1 Mechanical Dimension



4. Pin Description

4.1 Interface Pin Description

No.	Symbol	I/O	Function	Remark
1	VBL-	P	LED_Cathode	
2	VBL-	P	LED_Cathode	
3	VBL+	P	LED_Anode	
4	VBL+	P	LED_Anode	
5	NC	-	NC	
6	/RESET	I	Reset	
7	NC	-	NC	
8	NC	-	NC	
9	NC	-	NC	
10	NC	-	NC	
11	NC	-	NC	
12	B0	I	Blue signal data bus(LSB)	
13	B1	I	Blue signal data bus	
14	B2	I	Blue signal data bus	
15	B3	I	Blue signal data bus	
16	B4	I	Blue signal data bus	
17	B5	I	Blue signal data bus	
18	B6	I	Blue signal data bus	
19	B7	I	Blue signal data bus(MSB)	
20	G0	I	Green signal data bus(LSB)	
21	G1	I	Green signal data bus	
22	G2	I	Green signal data bus	
23	G3	I	Green signal data bus	
24	G4	I	Green signal data bus	
25	G5	I	Green signal data bus	
26	G6	I	Green signal data bus	
27	G7	I	Green signal data bus(MSB)	
28	R0	I	Red signal data bus(LSB)	
29	R1	I	Red signal data bus	
30	R2	I	Red signal data bus	
31	R3	I	Red signal data bus	
32	R4	I	Red signal data bus	
33	R5	I	Red signal data bus	
34	R6	I	Red signal data bus	
35	R7	I	Red signal data bus(MSB)	
36	HSYNC	I	Horizontal Synchronous Signal	
37	VSYNC	I	Vertical Synchronous Signal	
38	DCLK	I	Data Clock	
39	NC	-	NC	
40	NC	-	NC	
41	VCC	P	Power Supply	

42	VCC	P	Power Supply	
43	SPENA	I	Chip select pin of serial interface	
44	NC	-	NC	
45	NC	-	NC	
46	NC	-	NC	
47	NC	-	NC	
48	GND	P	Ground	
49	SPCLK	I	Clock pin of serial interface	
50	SPDAT	I	Data input pin in serial interface	
51	NC	-	NC	
52	ENB	I	Data Enabling Signal	
53	GND	P	Ground	
54	GND	P	Ground	

5. Electrical Characteristics

5.1 Absolute Maximum Ratings

5.1.1 Electronic Absolute Maximum Ratings

Item	Symbol	Values		Unit	Remark
		Min	Max.		
Power Supply Voltages	VCC	-0.3	+4	V	GND=0
	V _{GH-VGL}	-0.3	+25	V	GND=0
Input signal voltage	V _i	-0.3	VCC+0.3	V	
LED Reverse Voltage	V _r	-	5	V	ONE LED
LED Forward Current	I _F	-	35	mA	ONE LED
LED Power Dissipation	P _d	-	126	mW	ONE LED
Storage Temperature	T _{ST}	-30	80	°C	
Operating Temperature (Ambient Temperture)	T _{opa}	-20	70	°C	

5.2 DC Electrical Characteristics

5.2.1 LCD DC Characteristics

Typical Operating Conditions (Ta=25°C)

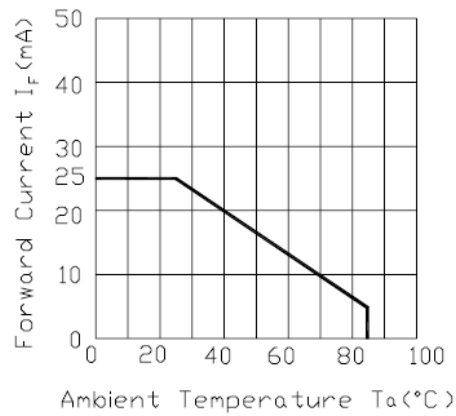
Item	Symbol	Values			Unit	Remark
		Min	Typ	Max.		
Operating voltage	VCC	-	3.3	-	V	
Input high voltage	V _{IH}	0.8*VCC	-	VCC	V	
Input low voltage	V _{IL}	0	-	0.2*VCC	V	
Output high voltage	V _{OH}	0.9*VCC	-	VCC	V	
Output low voltage	V _{OL}	0	-	0.1*VCC	V	
Current Consumption	I _{CC-Black}	-	7.2	10.8	mA	
Power Consumption	P _{LCD}	-	23.76	35.64	mW	

5.2.2 Backlight Unit (VSS=0V)

Item	Symbol	Values			Unit	Remark
		Min	Typ	Max.		
LED Voltage	V_L	-	19.8	-	V	LED*6
LED Current	I_f	-	20	-	mA	LED*6
Power Consumption	P_{LED}	-	396	-	mW	LED*6

5.2.3 LED Forward Current

Forward Current Derating Curve

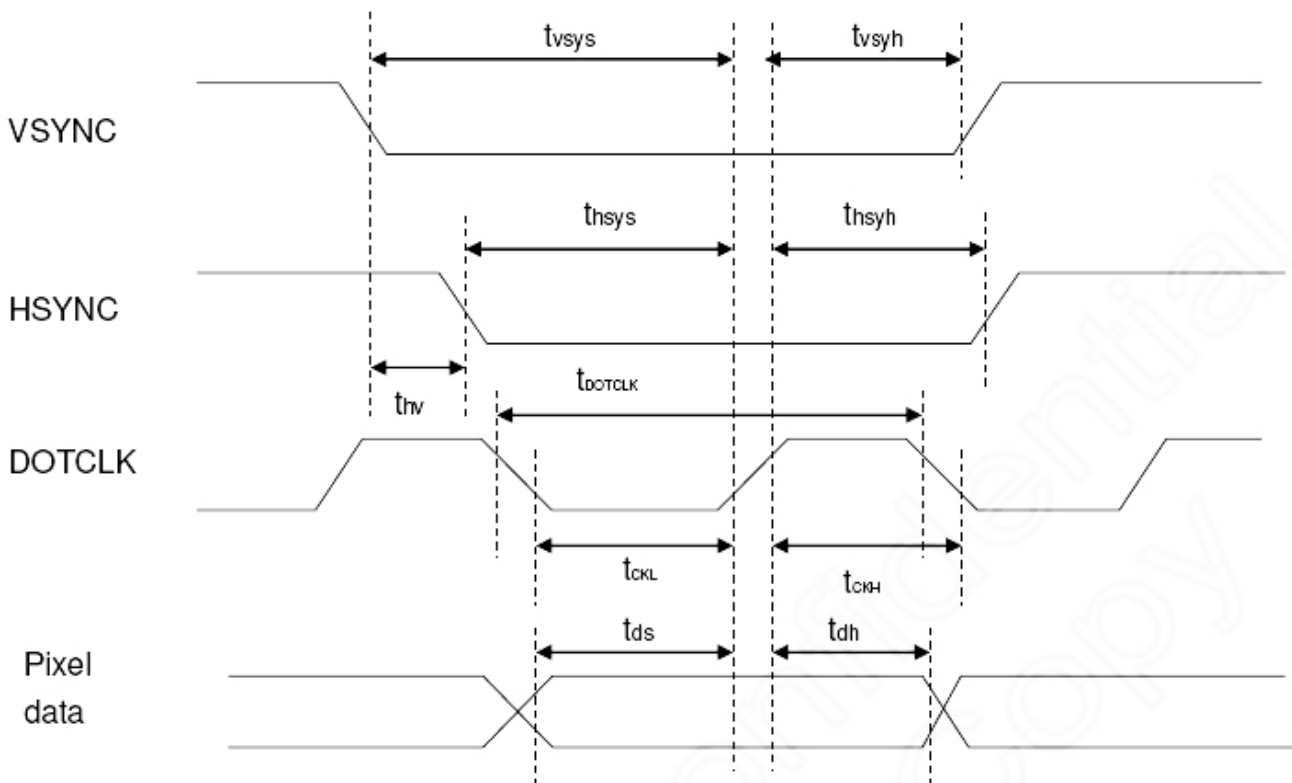


5.3 AC Electrical Characteristics

5.3.1 Pixel Timing Characteristics

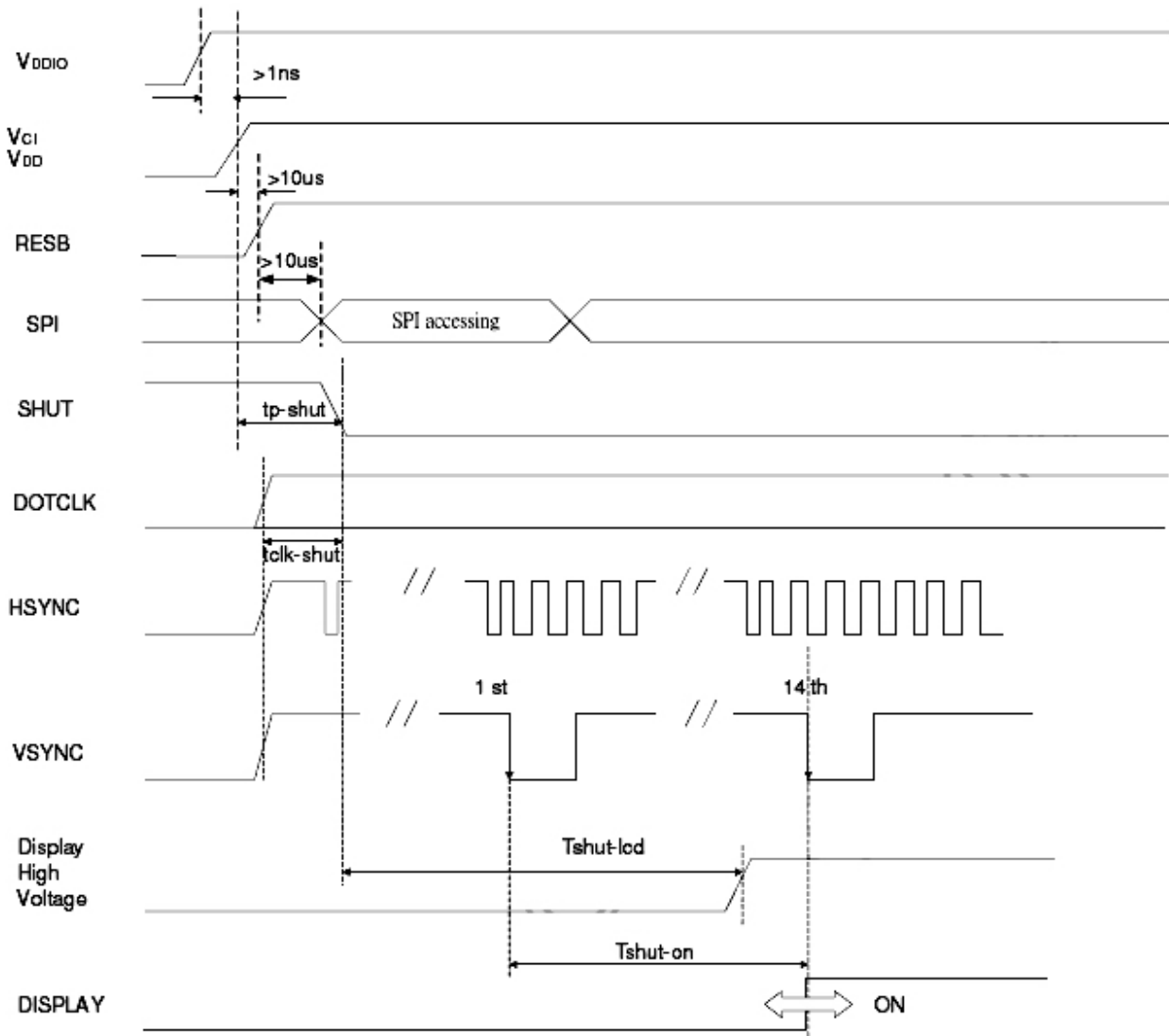
(VDD = 2.5~3.6V)

Characteristics	Symbol	Values			Unit	Remark
		Min	Typ	Max.		
DOTCLK Frequency	fDOTCLK	-	6.5	10	MHz	
DOTCLK Period	tDOTCLK	100	154	-	ns	
Vertical Sync Setup Time	tvsys	20	-	-	ns	
Vertical Sync Hold Time	tvsyh	20	-	-	ns	
Horizontal Sync Setup Time	thsys	20	-	-	ns	
Horizontal Sync Hold Time	thsyh	20	-	-	ns	
Phase difference of Sync Signal Falling Edge	thv	1	-	240	tDOTCLK	
DOTCLK Low Period	tCKL	50	-	-	ns	
DOTCLK High Period	tCKH	50	-	-	ns	
Data Setup Time	tds	12	-	-	ns	
Data Hold Time	tdh	12	-	-	ns	
Reset Pulse Width	tRES	10	-	-	us	



Pixel timing

5.4 Power Up Sequence



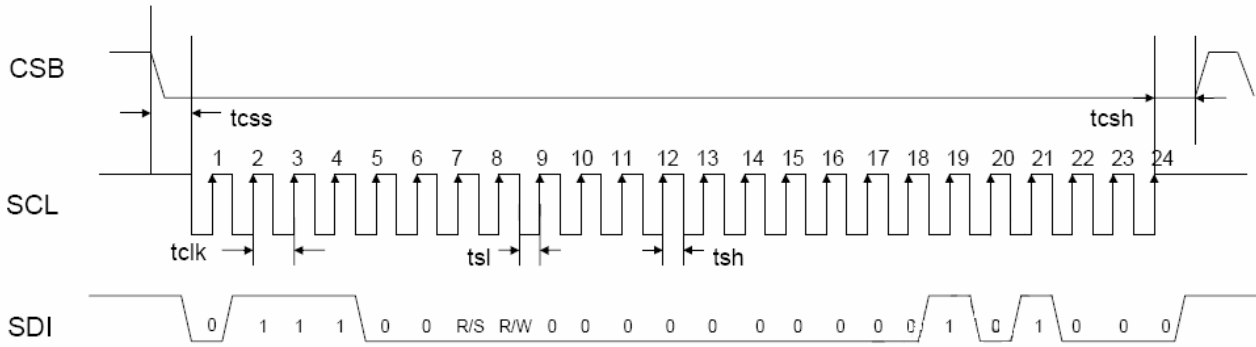
VDDIO = VDD0 = VCI = VDD ,

SHUT => Connect to VSS for normal operating mode

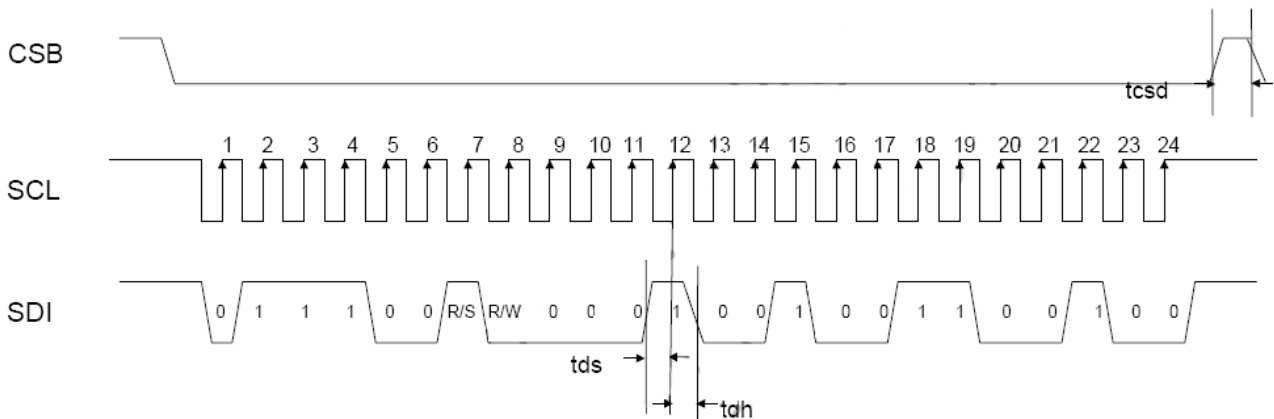
Characteristics	Symbol	Min	Typ	Max	Units
VDD / VDDIO on to falling edge of SHUT	$t_{p\text{-shut}}$	1	-	-	us
DOTCLK	$t_{\text{clk-shut}}$	1	-	-	clk
Falling edge of SHUT to LCD power on	$t_{\text{shut-lcd}}$	-	-	128	ms
Falling edge of SHUT to display start	$t_{\text{shut-on}}$	-	-	14	frame
- 1 line: 408 clk - 1 frame: 262 line - DOTCLK = 6.5MHz		-	166	232.4	ms

5.5 SPI interface timing diagram & transaction example

First Transmission (Register)



Second Transmission (Data)



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
Clock Rising Time	trs	-	-	30	ns
Clock Falling Time	tfl	-	-	30	ns
Chip Select Setup Time	tcss	0	-	-	ns
Chip Select Hold Time	tcsd	10	-	-	ns
Chip Select High Delay Time	tcdh	20	-	-	ns
Data Setup Time	tds	5	-	-	ns
Data Hold Time	tdh	10	-	-	ns

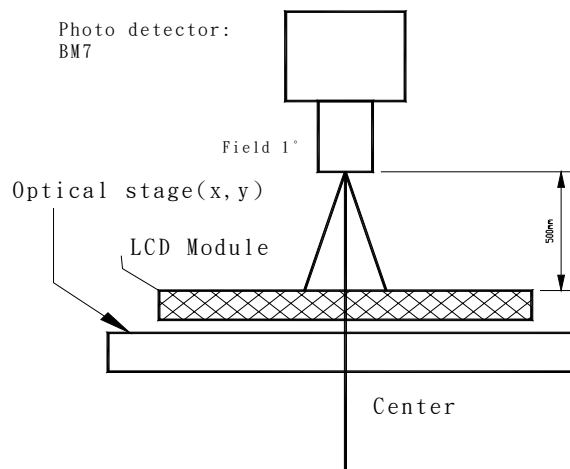
6. Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note.1.

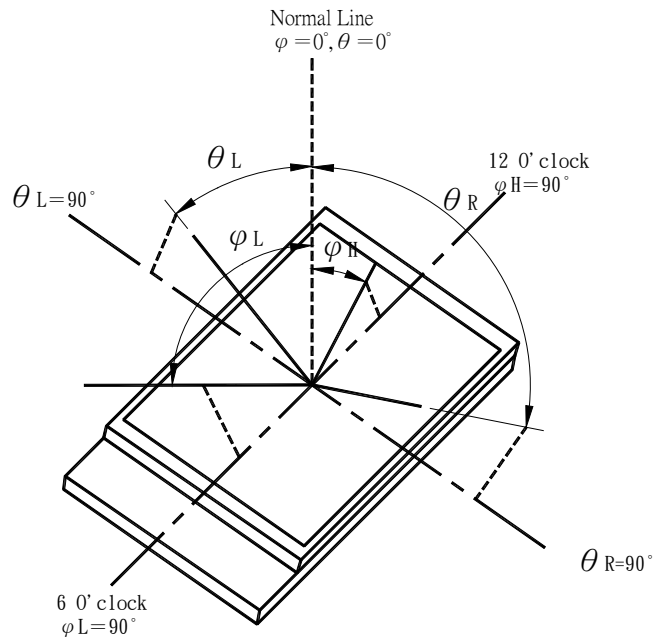
6.1 Main LCD Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	
Viewing Angle	Top	ΦH	$CR \geq 10$	-	50	-	degree	Note.2
	Bottom	ΦL		-	55	-		
	Left	ΘL		-	60	-		
	Right	ΘR		-	60	-		
Response time(T_r+T_f)		$\Theta=0$	-	50	-	ms	Note.3	
Brightness		Center	330	380	-	cd/m^2		
Contrast Ratio		CR	At optimized viewing angle		-	250	-	Note.4
Color Chromaticity	White	X_w	Viewing normal angle $\Phi, \Theta=0$	(0.26)	(0.31)	(0.36)	-	Note.5
		Y_w		(0.28)	(0.33)	(0.38)		
	Red	X_R		(0.57)	(0.62)	(0.67)	-	-
		Y_R		(0.32)	(0.37)	(0.42)		
	Green	X_G		(0.28)	(0.33)	(0.38)	-	-
		Y_G		(0.54)	(0.59)	(0.64)		
	Blue	X_B		(0.09)	(0.14)	(0.19)	-	-
		Y_B		(0.04)	(0.09)	(0.14)		

Note.1: After stabilizing and leaving the panel alone at a given temperature for 30 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7 with a viewing angle of 1° at a distance of 50cm and normal direction.

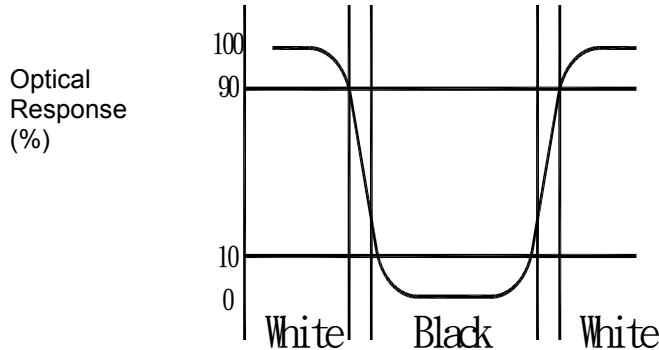


Note.2: Definition of Viewing Angle: Refer to figure as below:



Note.3: Definition of Response Time: TR and TF

The figure below is the output signal of the photo detector.



Note.4: Definition of Contrast Ratio (CR)

Ratio of gray max (G max)& gray min(G min)

Contrast ratio (CR) =(G max) / (G min)

(G max)=luminance with all pixel white

(G min)=luminance with all pixel black

Note.5: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

7. Reliability

8. Cosmetic Criteria of LCD Screen

9. Package

10. Precautions for Use

10.1 Safety

- (1) Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.
- (2) If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
- (3) If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

10.2 Storage Conditions

- (1) Store the panel or module in a dark place where the temperature is $23\pm 5^{\circ}\text{C}$ and the humidity is below $50\pm 20\% \text{RH}$.
- (2) Store in anti-static electricity container.
- (3) Store in clean environment, free from dust, active gas, and solvent.
- (4) Do not place the module near organics solvents or corrosive gases.
- (5) Do not crush, shake, or jolt the module.

10.3 Handling Precautions

- (1) Avoid static electricity which can damage the CMOS LSI.
- (2) The polarizing plate of the display is very fragile. So, please handle it very carefully.
- (3) Do not give external shock.
- (4) Do not apply excessive force on the surface.
- (5) Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- (6) Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
- (7) Do not operate it above the absolute maximum rating.
- (8) Do not remove the panel or frame from the module.

10.4 Warranty

The period is within twelve months since the date of shipping out under normal using and storage conditions.