

LCD Module

Product Specification

☐ : APPROVAL FOR SPECIFICATION

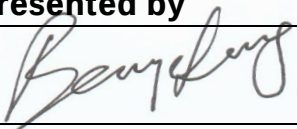
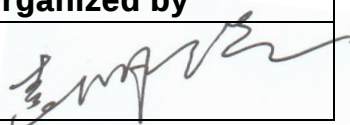
For Customer : _____ ☐ : APPROVAL FOR SAMPLE

Module No. : TST035A02-V1

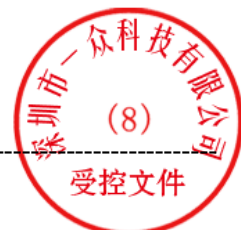
For Customer's Acceptance :

Approved by	Comment

Team Source Display :

Presented by	Reviewed by	Organized by
		

This module uses ROHS material



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1. General Description

* Description

TST035A02-V1 is a transmissive type's TFT (Thin Film Transistor) active matrix color liquid crystal display (LCD) comprising an amorphous silicon TFT attached to each signal electrode. This model is consisting of TFT-LCD module, a driver circuit and a back-light unit. The resolution of a 3.5" contains 320×240 pixels and can display up to 16.7M colors.

* Features

- Transmissive type and back-light with six LEDs (Light Emitting Diodes)
- Support digital 24-bits parallel RGB interface
- Serial Peripheral Interface(SPI)
- Source and Gate Driver IC: HX8238
- Line inversion driving scheme.
- Polarizer without Hard Coat
- Image Reversion : Up/Down and Left/Right

* Applications

Designed for camcorder, digital camera application and other electronic products which require high quality flat panel displays.

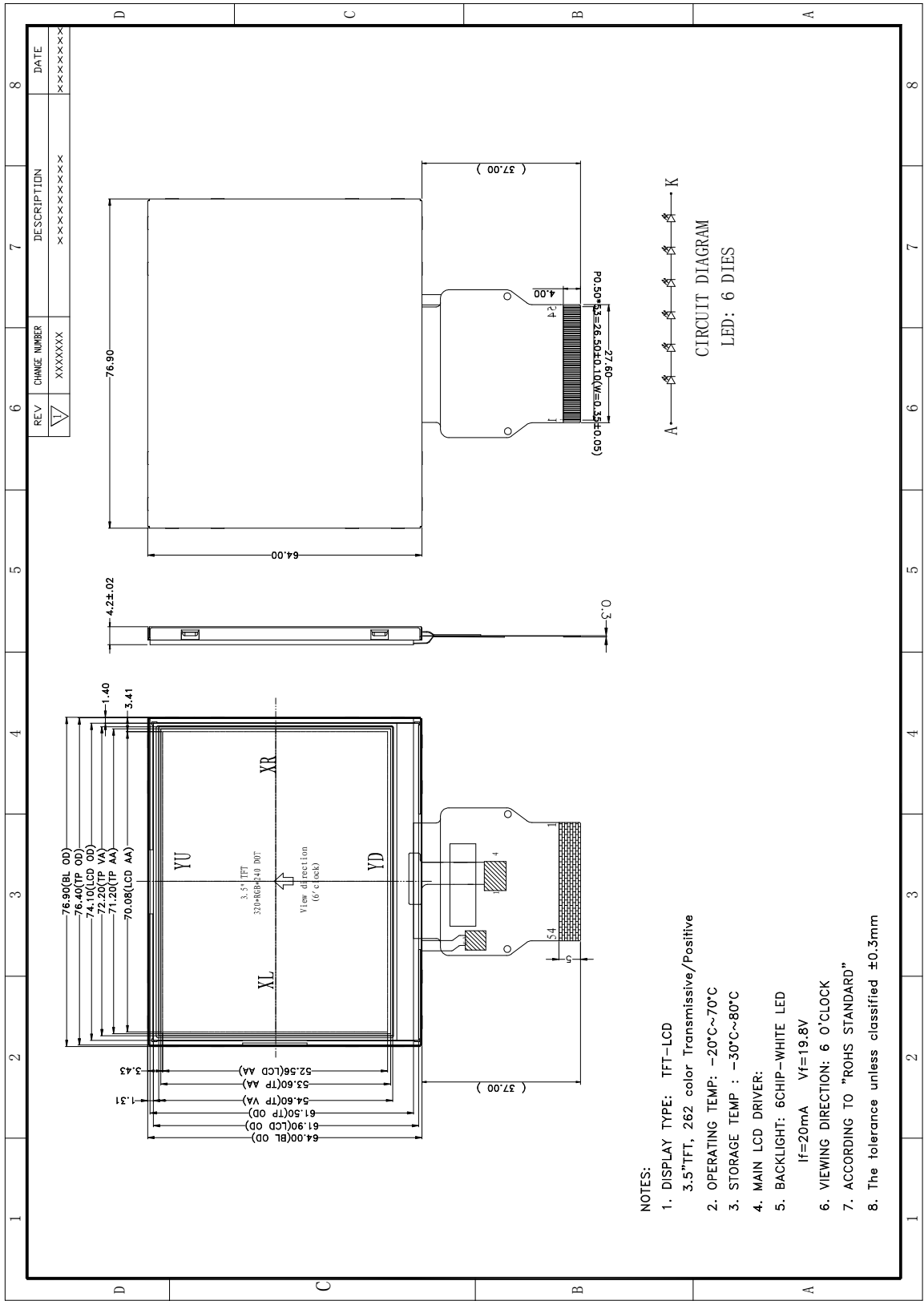
* General Information

Items	Main-Panel	Unit
LCD type	3.5" TFT-LCD	
Active Area	70.08(H)*52.56(V)	mm
LCD type	Transmissive type	
Driving IC	HX8238	
Display Color	16.7M	color
Number of Pixel	320(H)*RGB*240(V)	pixel
Dot Pitch	0.219(H)*0.219(V)	mm
Display mode	Normally White	
Viewing direction	6	o'clock

*** Mechanical Information**

Items		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	76.7	76.9	77.1	mm	
	Vertical(V)	63.7	63.9	64.1	mm	
	Depth(D)	-	-	3.35	mm	
Weight		-	22.0	-	g	

Figure 1: Outline Drawing



3. Absolute Maximum Ratings

3.1. Absolute Ratings of Environment

Item	Symbol	Value	Unit	Note
Operating temperature	T _{opr}	-20 to 70	°C	
Storage temperature	T _{stg}	-30 to 80	°C	

T_a = 25 ± 2°C

3.2. Electrical Absolute Ratings

3-2-1 TFT-LCD Module

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power Voltage	V _{CC}	GND=0	2.5	3.6	V	(1)
Input Signal Voltage	V _{in}	GND=0	2.5	3.6	V	
Logic Output Voltage	V _{out}	GND=0	-	5	V	

T_a = 25 ± 2°C

Note:

(1) Device is subject to be damaged if stresses beyond those absolute maximum ratings.

3-2-2 Back-Light Unit

Item	Symbol	Min.	Max.	Unit	Note
Current	I _F	-	20	mA	(1)

Note:

(1) One LED current maximum absolute ratings.

4. LCM Optical Characteristics

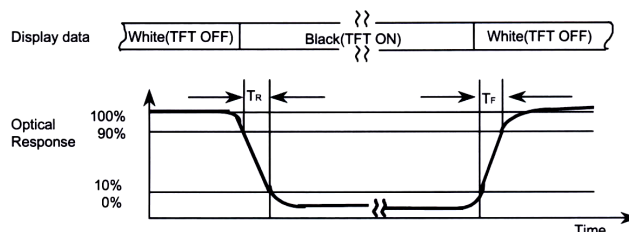
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast ratio (center point)		CR	$\theta = 0$ $\phi = 0$ (Normal Viewing Angle) B / L on	-	300	-	-	(1) BM-7f
Luminance of white (Center point)		YL		200	250	-	cd / m ²	(4)BM-7f
Uniformity of luminance		-		80	-	-	%	(4)BM-7f
Response time		T _R		-	15	-	ms	(2)
		T _F		-	35	-	ms	
Color chromaticity (CIE 1931)	White	W _x		0.280	0.310	0.340	-	(4) BM-7f
		W _y		0.270	0.300	0.330		
	Red	R _x		0.588	0.638	0.688		
		R _y		0.298	0.348	0.398		
	Green	G _x		0.268	0.318	0.368		
		G _y		0.562	0.612	0.662		
	Blue	B _x		0.092	0.142	0.192		
		B _y		0.048	0.098	0.148		
Viewing angle	Hor.	θ L	CR ≥ 10 B / L on	-	70	-	Degrees	(3)
		θ R		-	70	-		
	Ver	ϕ H		-	50	-		
		ϕ L		-	60	-		

T_a = 25 ± 2°C

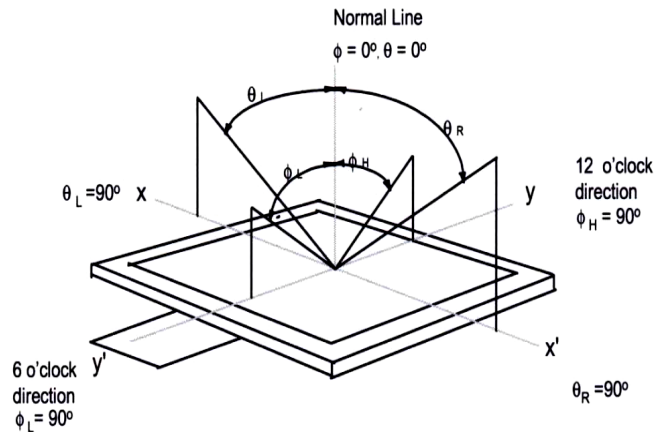
Note (1) Contrast ratio is defined as follows

$$CR = \frac{\text{Luminance (brightness) all pixels "White" }}{\text{Luminance (brightness) all pixels "dark" }}$$

(2) Response time is defined as follows

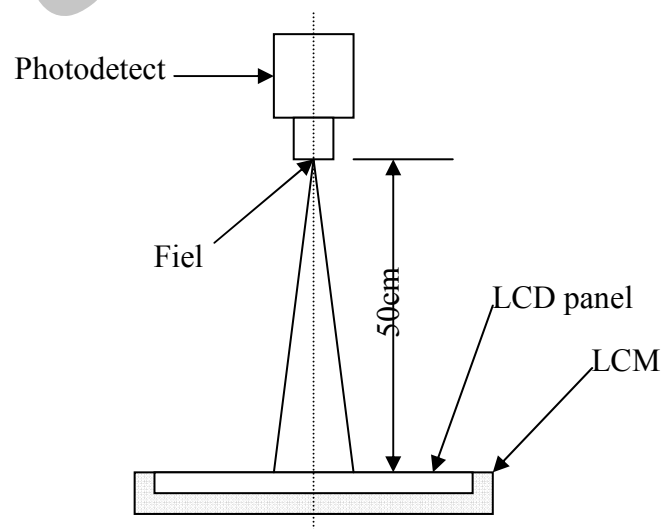


(3) Definition of Viewing Angle



(4) Optical measurement equipment setup

- Measurement should be executed in a stable, windless, and dark room. After lighting the backlight for 30mins.
- Environment condition : Common air conditioner cleanness · Ta=23±5℃ · Humidity=60±15%
- Distance : 50cm
- Photodetector : BM-7f (Field 1°)



5. Electrical Characteristics

5.1. TFT-LCD Module Operating conditions :

Items	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Voltage	V_{CC}	2.5	3.3	3.6	V	
Low level input voltage	V_{IL}	0	-	$0.2 V_{CC}$	V	
High level input voltage	V_{IH}	$0.8 V_{CC}$	-	V_{CC}	V	
Analog operating current	I_{CC}	-	TBD	-	mA	Note (1)

$T_a = 25 \pm 2^\circ\text{C}$

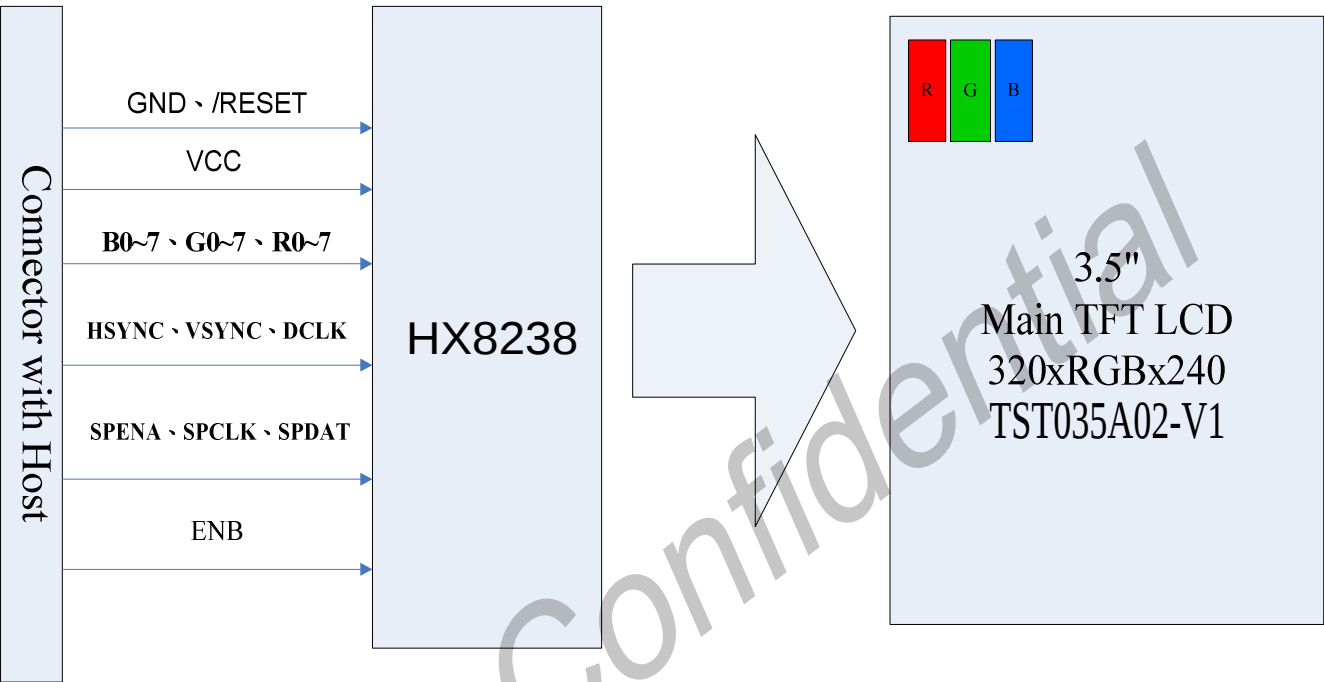
Note (1) DOTCLK=6.5MHZ

5.2. Back-Light unit

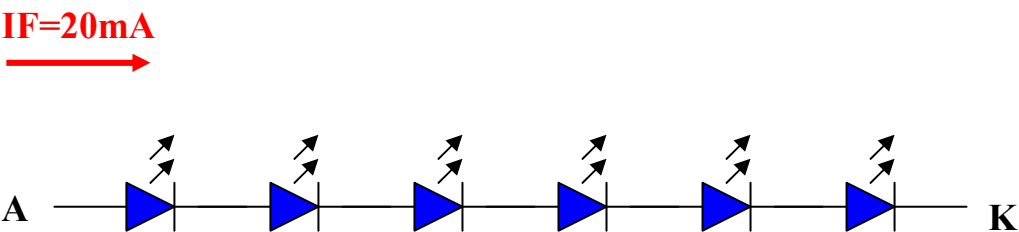
Back-Light Unit Electrical Characteristics ($T_a = 25 \pm 2^\circ\text{C}$)

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward Voltage	V_F	-	19.2	-	V	$I_F = 20\text{mA}$
Power Consumption	P_{WF}	-	384	-	mW	-

6. Block Diagram



6.1. Back light unit

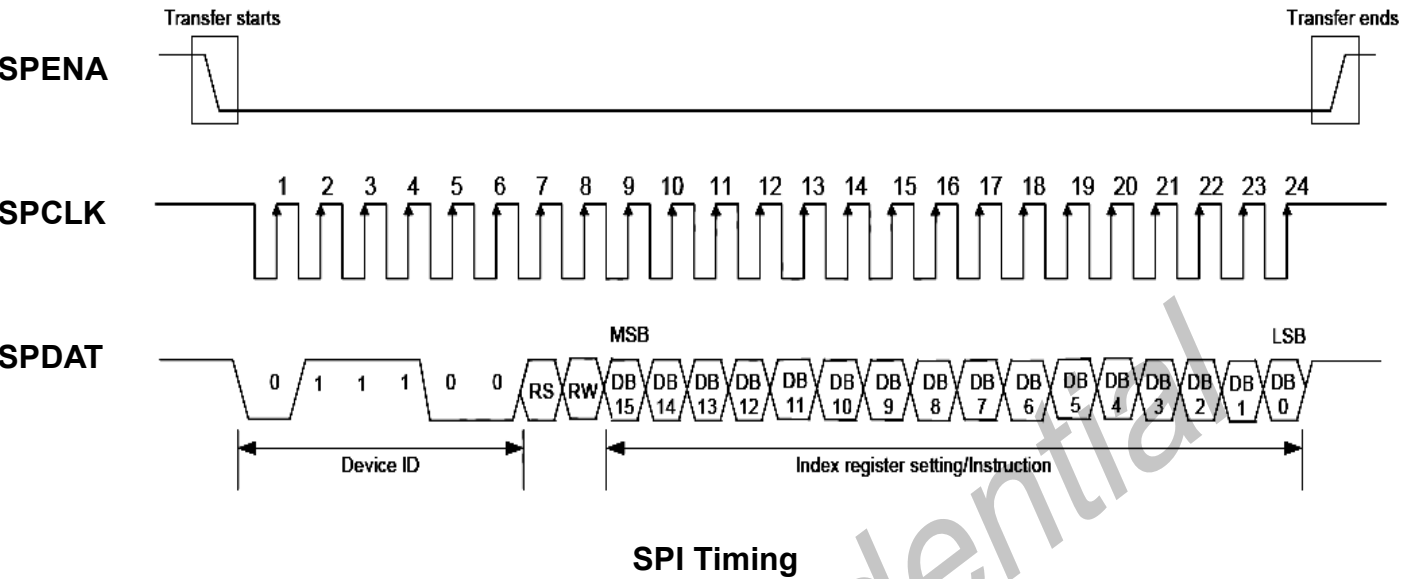


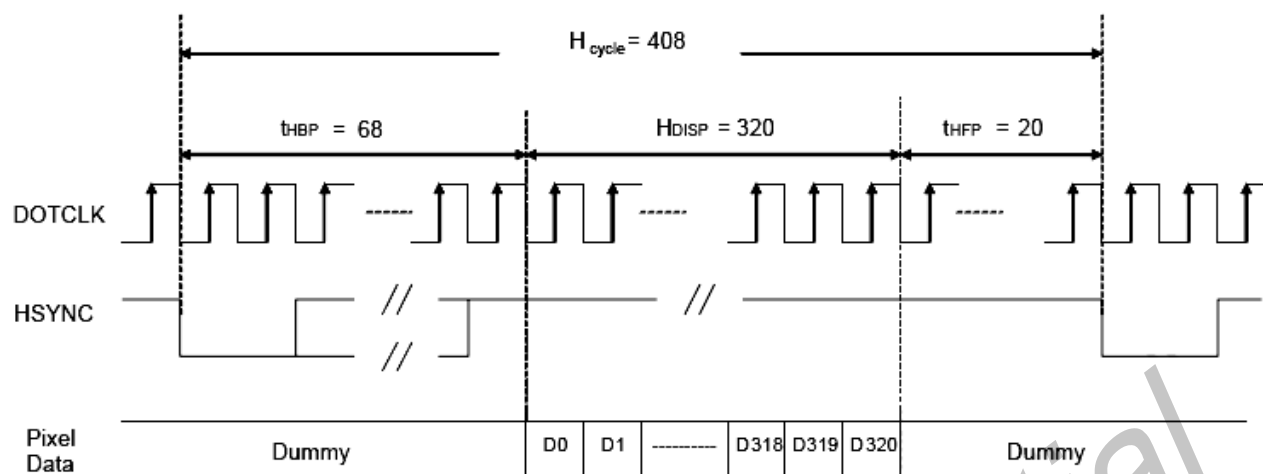
7. Input Terminal Pin Assignment

NO	pin name	Description	I/O
1	VBL-	LED_Cathode	P
2	VBL-	LED_Cathode	P
3	VBL+	LED_Anode	P
4	VBL+	LED_Anode	P
5	NC	No connection	-
6	/RESET	RESET Signal	I
7	NC	No connection	-
8	Y1(YU)	NC	-
9	X1(XR)	NC	-
10	Y2(YD)	NC	-
11	X2(XL)	NC	-
12	B0	Blue Data (LSB)	I/O
13	B1	Blue Data	I/O
14	B2	Blue Data	I/O
15	B3	Blue Data	I/O
16	B4	Blue Data	I/O
17	B5	Blue Data	I/O
18	B6	Blue Data	I/O
19	B7	Blue Data (MSB)	I/O
20	G0	Green Data (LSB)	I/O
21	G1	Green Data	I/O
22	G2	Green Data	I/O
23	G3	Green Data	I/O
24	G4	Green Data	I/O
25	G5	Green Data	I/O
26	G6	Green Data	I/O
27	G7	Green Data (MSB)	I/O
28	R0	Red Data (LSB)	I/O
29	R1	Red Data	I/O
30	R2	Red Data	I/O
31	R3	Red Data	I/O
32	R4	Red Data	I/O

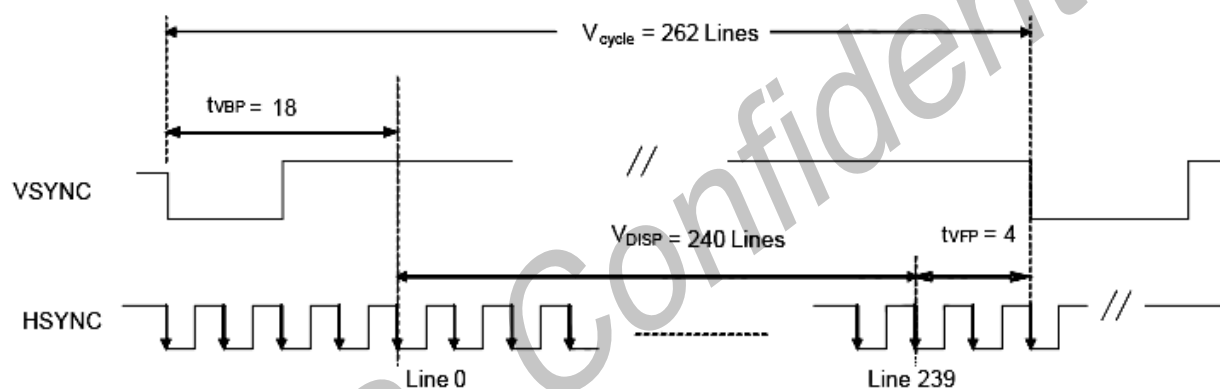
33	R5	Red Data	I/O
34	R6	Red Data	I/O
35	R7	Red Data (MSB)	I/O
36	HSYNC	Horizontal Synchronous Signal	I
37	VSYNC	Vertical Synchronous Signal	I
38	DCLK	Data Clock	I
39	NC	No connection	-
40	NC	No connection	-
41	VCC	Digital Voltage(2.5~3.6V)	P
42	VCC	Digital Voltage(2.5~3.6V)	P
43	SPENA	Chip Select for Serial port use	I
44	NC	No connection	-
45	NC	No connection	-
46	NC	No connection	-
47	NC	No connection	-
48	GND	GROUND	P
49	SPCLK	Serial port Clock.	I
50	SPDAT	Serial port Data input/output.	I/O
51	NC	No connection	-
52	ENB	Data enable signal	I
53	GND	GROUND	P
54	GND	GROUND	P

8. Serial Interface





a) Horizontal Data Transaction Timing



b) Vertical Data Transaction Timing

Data transaction timing in parallel RGB (24 bit) interface (SYNC 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	VDISP	-	-	240	-	-	-	Lines
Vertical Cycle	Vcycle	-	-	262	-	350	-	Lines

9. Reliability

Contents of Reliability Tests

Item		Purpose	Conditions	Criterion
Environment Stress	High Temperature Storage	To check the product capability after long time high temperature environment stress.	Ta = 70 ± 2°C 240 hours	Brightness should be within 70% of initial value Operational function is work
	High Temperature / Humidity Storage	To check the product capability after long time high temperature & high humidity environment stress.	Ta = 60 ± 2°C RH = 90 ± 2% 240 hours	
	Thermal Shock	To check the product capability after rapidly stress of different high/low temperature environment change.	-20°C /30 mins ⇔ 20°C /5 mins ⇔ 70°C /30 mins , 10 Cycles	

11. General Precautions

11.1. Handling

- (a) When the module is assembled, it should be attached to the system firmly. Be careful not to twist and bend the module.
- (b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
- (c) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.
- (d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.
- (e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (f) The desirable cleaners are water, Isopropyl Alcohol or Hexane.
- (g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.
- (h) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (i) Do not disassemble the module.
- (j) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

11.2. Storage

- (a) Do not leave the Panel in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35°C and relative humidity of less than 70%.
- (b) Do not store the TFT-LCD module in direct sunlight.
- (c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

11.3. Others

- (a) When in operations, do not connect; disconnect the module in the “Power on” condition.
- (b) The liquid crystal is deteriorated by ultraviolet; do not leave it in direct sunlight and strong ultraviolet ray for hours.
- (c) Avoid condensation of water. It may result in improper operation or disconnection of electrode.
- (d) Do not exceed the absolute maximum rating value. Otherwise the panel may be damaged.
- (e) If the panel displays the same pattern continuously for a long period of time, it can be the situation when the image “Stick” to the screen.
- (f) The max temperature / continuous time of FPC soldering are 320°C / 5 seconds.