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TFT | CHARACTER | UWVD | FSC | SEGMENT | CUSTOM | REPLACEMENT

TFT Display Module

Part Number

E35RA-FW280-CA

Overview:

- o.p-inch TFT (тс.упх6о¢уп ҮҮ)
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- мскмукнпπŌƛű wD . ǇƴűŜǋŦl·ŎŜ
- ² ƛŘŜ ¢ŜYǈ
- White LED back-light
- Transmissive
- / l·ǈl·ŎƛűƛØŜ ¢ƻdzŎK t l·ƴŜf
- нy0 NITS
- Controllerǎ: l · унoу5Ʃ C¢cooD
- RoHS Compliant

Description

This is a color active matrix TFT (Thin Film Transistor) LCD (Liquid Crystal Display) that uses amorphous silicon TFT as a switching device. This model is composed of a transmissive type TFT-LCD Panel, driver circuit and a backlight unit. The resolution of the 3.5" TFT-LCD contains 320(RGB)x240 pixels and can display up to 16.7M colors.

TFT Features

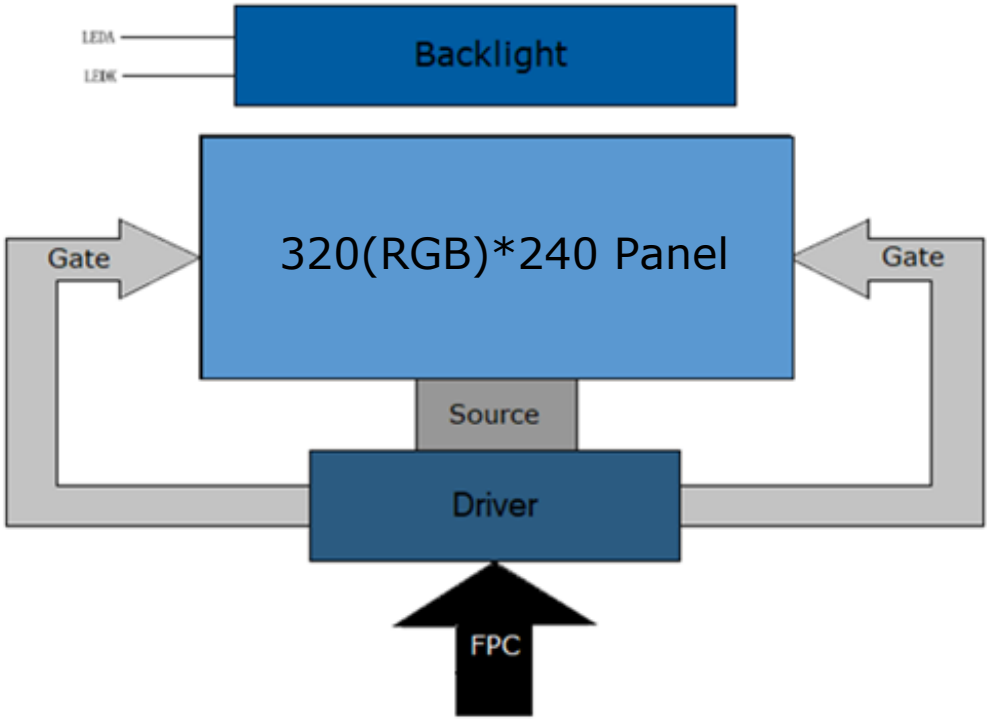
Low Input Voltage: 3.3V
Display Colors: 16.7M colors
TFT Interfaces: 16/18/24-bit RGB
CTP Interface: I2C

General Information Items	Specification	Unit	Note
	Main Panel		
TFT Display area (AA)	70.08 (H) x 52.56 (V) (3.5 inch)	mm	-
CTP View Area	70.68 (H)*53.16 (V)	mm	-
Driver element	TFT active matrix	-	-
Display colors	16.7M	colors	-
Number of pixels	320(RGB)x240	dots	-
TFT Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.066 (H) x 0.198 (V)	mm	-
Viewing angle	12:00	o'clock	-
TFT Controller IC	HX8238D	-	-
CTP Driver IC	FT6336G		
LCM Interface	16/18/14-bit RGB	-	-
Display mode	Transmissive/ Normally White	-	-
Touch Mode	Single Point and Gestures		
Operating temperature	-20～+70	℃	-
Storage temperature	-30～+80	℃	-

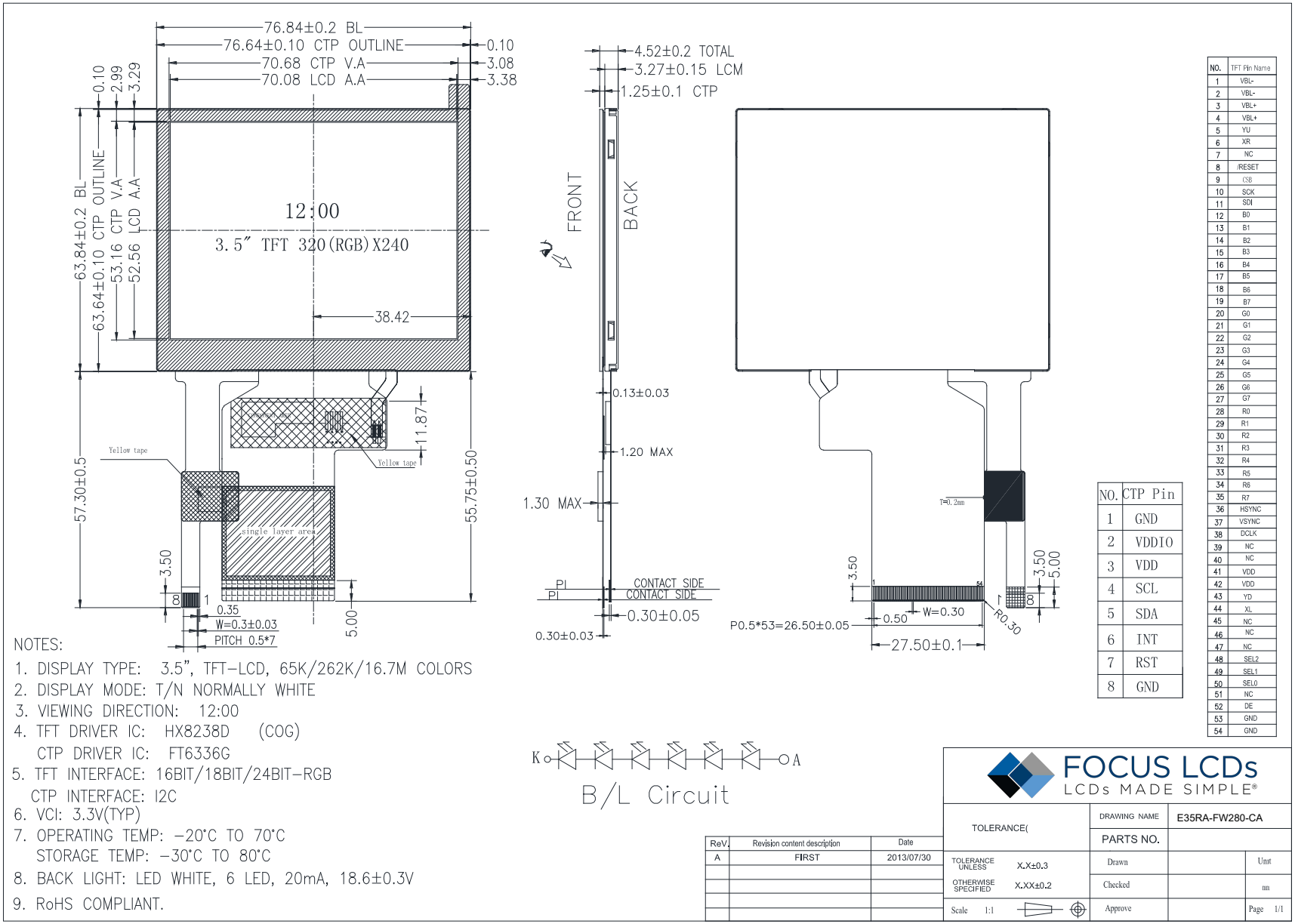
Mechanical Information

Item		Min	Typ.	Max	Unit	Note
Module size	Height (H)		76.84		mm	-
	Vertical (V)		63.84		mm	-
	Depth (D)		4.52		mm	-

1. Block Diagram



2. Outline Dimensions



NO.	CTP Pin
1	GND
2	VDDIO
3	VDD
4	SCL
5	SDA
6	INT
7	RST
8	GND

NO.	TFT Pin Name
1	VBL-
2	VBL-
3	VBL+
4	VBL+
5	YU
6	XR
7	NC
8	/RESET
9	CSB
10	SCK
11	SDI
12	B0
13	B1
14	B2
15	B3
16	B4
17	B5
18	B6
19	B7
20	G0
21	G1
22	G2
23	G3
24	G4
25	G5
26	G6
27	G7
28	R0
29	R1
30	R2
31	R3
32	R4
33	R5
34	R6
35	R7
36	HSYNC
37	VSYNC
38	DCLK
39	NC
40	NC
41	VDD
42	VDD
43	YD
44	XL
45	NC
46	NC
47	NC
48	SEL2
49	SEL1
50	SEL0
51	NC
52	DE
53	GND
54	GND

NOTES:

1. DISPLAY TYPE: 3.5", TFT-LCD, 65K/262K/16.7M COLORS
2. DISPLAY MODE: T/N NORMALLY WHITE
3. VIEWING DIRECTION: 12:00
4. TFT DRIVER IC: HX8238D (COG)
   CTP DRIVER IC: FT6336G
5. TFT INTERFACE: 16BIT/18BIT/24BIT-RGB
   CTP INTERFACE: I2C
6. VCI: 3.3V(TYP)
7. OPERATING TEMP: -20°C TO 70°C
   STORAGE TEMP: -30°C TO 80°C
8. BACK LIGHT: LED WHITE, 6 LED, 20mA, 18.6±0.3V
9. RoHS COMPLIANT.

B/L Circuit

ReV.	Revision content description	Date
A	FIRST	2013/07/30

FOCUS LCDs
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TOLERANCE(		DRAWING NAME	E35RA-FW280-CA
		PARTS NO.	
TOLERANCE UNLESS OTHERWISE SPECIFIED	X.X±0.3 X.XX±0.2	Drawn	Unit
		Checked	mm
Scale 1:1		Approve	Page 1/1

3. Input Terminal Pin Assignment

3.1 TFT

NO.	Symbol	Description	I/O
1	BLK	Cathode pin of the backlight	P
2	BLK	Cathode pin of the backlight	P
3	BLA	Anode pin of the backlight	P
4	BLA	Anode pin of the backlight	P
5	YU(NC)	Touch panel top film terminal	
6	XR(NC)	Touch panel right glass terminal	
7	NC		
8	RESET	System reset pin. Internal pull high. Connect to VDDIO when not used.	I
9	CSB	Chip select pin of serial interface. Internal pull high. Leave pin open when not used.	I
10	SCK	Clock pin of serial interface. Internal pull high. Leave open when not used.	I
11	SDI	Data input pin of serial interface. Internal pull high. Leave open when not used.	I
12-19	B0-B7	Blue data input	I
20-27	G0-G7	Green data input	I
28-35	R0-R7	Red data input	I
36	HSYNC	Horizontal sync input. Negative polarity.	I
37	VSYNC	Vertical sync input. Negative polarity.	I
38	DCLK	Clock signal. Latching data at the rising edge.	I
39	NC		
40	NC		
41	VDD	Supply voltage (3.3V)	P
42	VDD	Supply voltage (3.3V)	P
43	YD(NC)	Touch panel bottom film terminal	
44	XL(NC)	Touch panel left glass terminal	
45-47	NC		
48	SEL2	Input pin to select input interface mode	I
49	SEL1	Input pin to select input interface mode	I
50	SEL0	Input pin to select input interface mode	I
51	NC		
52	DE	Data input enable. Active high to enable the data input bus under DE mode. If using SYNC mode leave open.	I
53	GND	Ground	P
54	GND	Ground	P

3.2 CTP

NO.	Symbol	Description	I/O
1	GND	Ground	P
2	VDDIO	I/O power supply voltage	P
3	VDD	Supply voltage	P
4	SCL	I2C clock input	I
5	SDA	I2C data input and output	I/O
6	INT	External interrupt to the host	I
7	RST	External reset. Low is active	I
8	GND	Ground	O

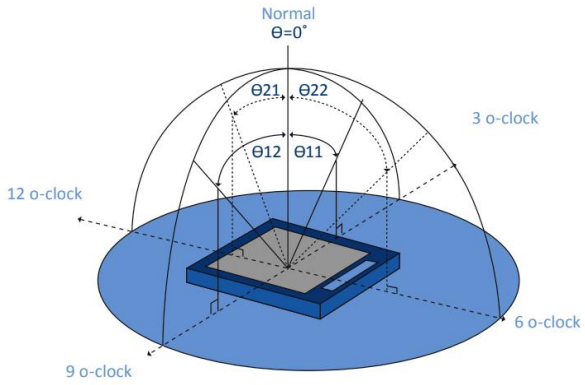
4. LCD Optical Characteristics

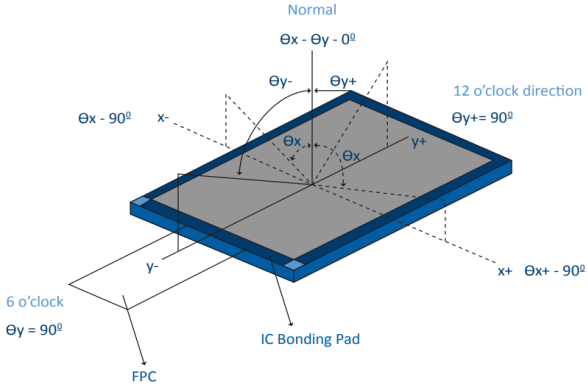
4.1 Optical Specifications

Item		Symbol	Condition	Min	Typ.	Max	Unit	Note
Transmittance		T%		--	7.4	--	%	(3)
Contrast Ratio		CR	θ=0 Normal viewing angle	200	300	--	%	(2)
Response Time	Rising	TR		--	15	30	ms	(4)
	Falling	TF		--	35	50		
Color Filter Chromaticity	White	W_X		0.282	0.312	0.342		(5)(6)
		W_Y		0.319	0.349	0.379		
	Red	R_X		0.609	0.639	0.669		
		R_Y		0.314	0.344	0.374		
	Green	G_X		0264	0.294	0.324		
		G_Y		0.557	0.587	0.617		
	Blue	B_X		0.102	0.132	0.162		
		B_Y		0.106	0.136	0.166		
Viewing Angle	Hor.	ΘL	CR≥10	--	45	--	degree	(1)(6)
		ΘR		--	45	--		
	Ver.	ΘT		--	15	--		
		ΘB		--	35	--		
Option View Direction		ALL						(1)

Optical Specification Reference Notes:

(1) Definition of Viewing Angle: The viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3,9 o'clock direction and the vertical or 6,12 o'clock direction with respect to the optical axis which is normal to the LCD surface.



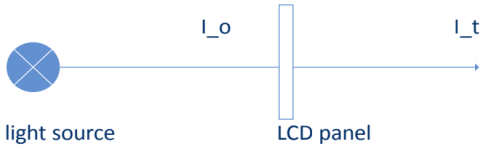


(2) Definition of Contrast Ratio (Cr): measured at the center point of panel. The contrast ratio (Cr) measured on a module, is the ratio between the luminance (Lw) in a full white area (R=G=B=1) and the luminance (Ld) in a dark area (R=G=B=0).

$$Cr = \frac{Lw}{Ld}$$

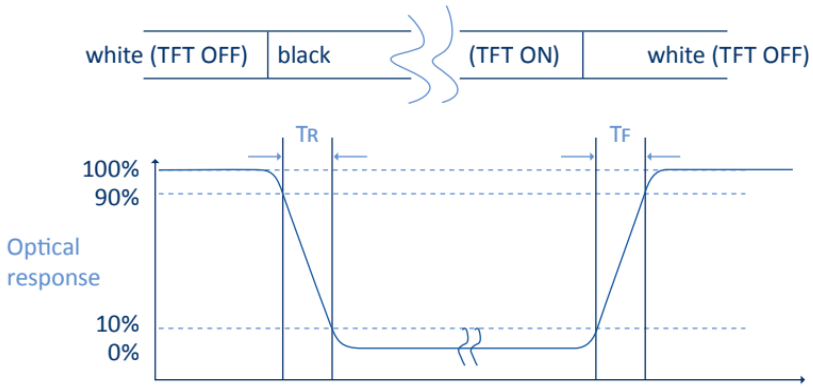
(3) Definition of transmittance (T%): The transmittance of the panel including the polarizers is measured with electrical driving. The equation for transmittance Tr is:

$$Tr = \frac{It}{Io} \; x \; 100\%$$



Io = the brightness of the light source.
It = the brightness after panel transmission

(4) Definition of Response Time (Tr, Tf): The rise time 'Tr' is defined as the time for luminance to change from 90% to 10% as a result of a change of the electrical condition. The fall time 'Tf' is defined as the time for luminance to change from 10% to 90% as a result of a change of the electrical condition.



(5) Definition of Color Gamut:
Measuring machine CFT-01. NTSC's Primaries: R(x,y,Y),G(x,y,Y), B(x,y,Y). FPM520 of Westar Display Technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.The color chromaticity shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

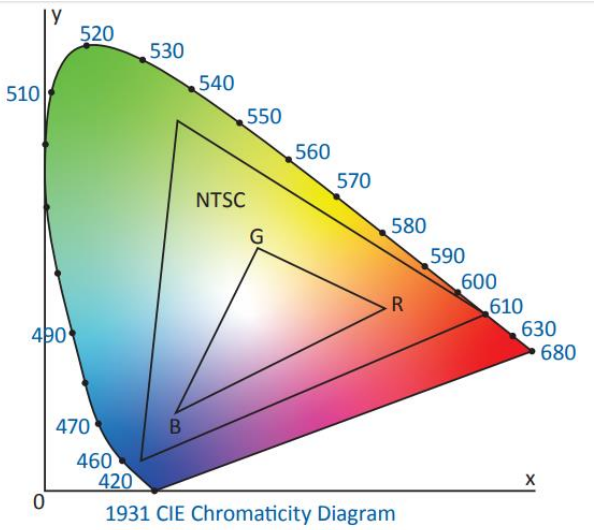
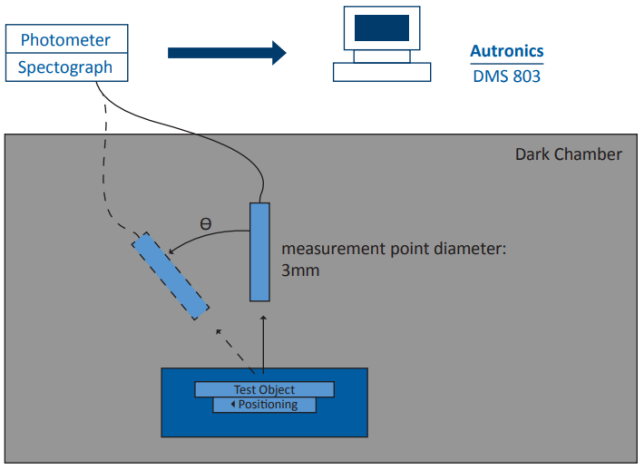


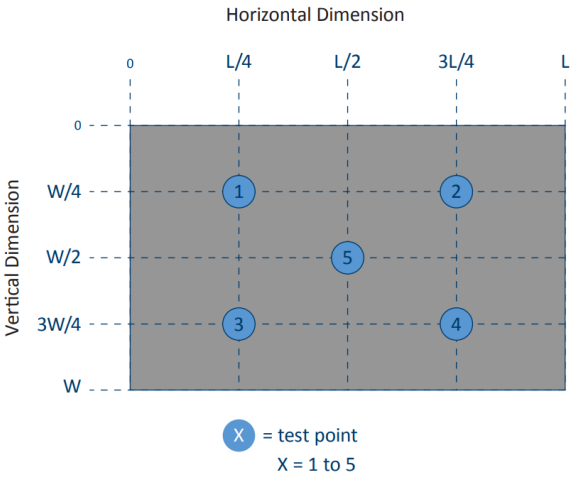
Fig. 1931 CIE chromacity diagram

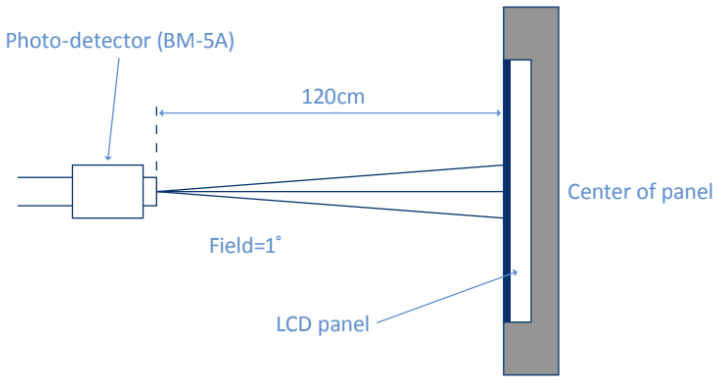
Color gamut: $S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$

(6) Definition of Optical Measurement Setup:

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 20 minutes.







5. TFT Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25 ˚C, VSS=0V)

Characteristics	Symbol	Min	Max	Unit
Digital Supply Voltage	VDD	-0.3	2.7	V
Digital Interface Supply Voltage	IOVCC	-0.3	4.0	V
Operating Temperature	TOP	-20	+70	℃
Storage Temperature	TST	-30	+80	℃

NOTE: If the absolute maximum rating of the above parameters is exceeded, even momentarily, the quality of the product may be degraded. Absolute maximum ratings specify the values which the product may be physically damaged if exceeded. Be sure to use the product within the range of the absolute maximum ratings.

5.2 DC Electrical Characteristics

Characteristics	Symbol	Min	Typ.	Max	Unit	Note
Digital Supply Voltage	VCI/VDD	1.6	--	2.5	V	
Digital Interface Supply Voltage	IOVCC	1.6	--	3.6	V	
Normal Mode Current Consumption	IDD	--	8	--	mA	VCC=2.8V
Level Input Voltage	VIH	0.8VDDIO	--	VDDIO	V	
	VIL	GND	--	0.2VDDIO	V	
Level Output Voltage	VOH	0.9VDDIO	--	VDD	V	
	VOL	GND	--	0.1VDDIO	V	

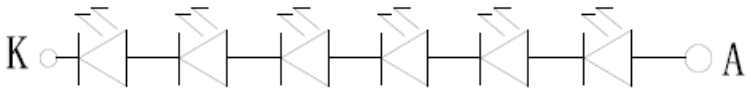
5.3 LED Backlight Characteristics

The backlight system is edge lighting type with 6 chips LED.

Item	Symbol	Min	Typ.	Max	Unit	Note
Forward Current	I_F	15	20	--	mA	
Forward Voltage	V_F	--	19.2	--	V	
LCM Luminance	LV	280	--	--	cd/m2	Note 3
LED lifetime	Hr	50000	--	--	hour	Note1 & 2
Uniformity	AVg	80	--	--	%	Note 3

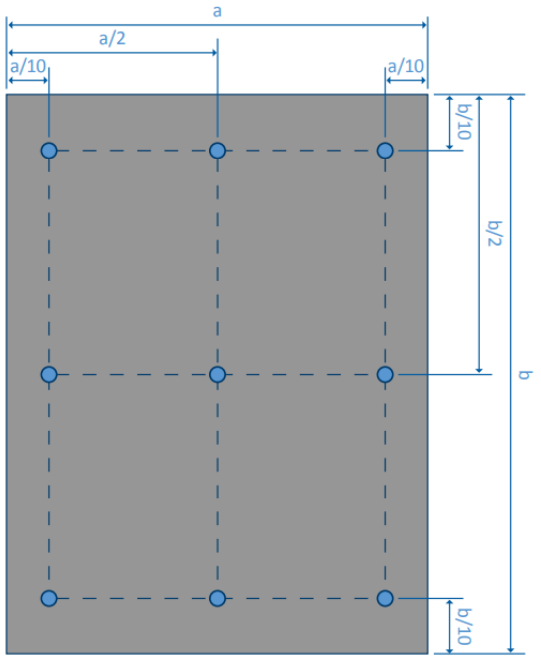
Note 1: LED lifetime (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25 ±3 ℃, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note 2: The "LED lifetime" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL = 20mA



Backlight LED Circuit

Note 3: Luminance Uniformity of these 9 points is defined as below:



$$\text{Luminance} = \frac{\text{(Total Luminance of 9 points)}}{9}$$

$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points(1-9)}}{\text{maximum luminance in 9 points(1-9)}}$$

6. AC Characteristic

6.1 Display Parallel RGB Interface Timing Characteristics

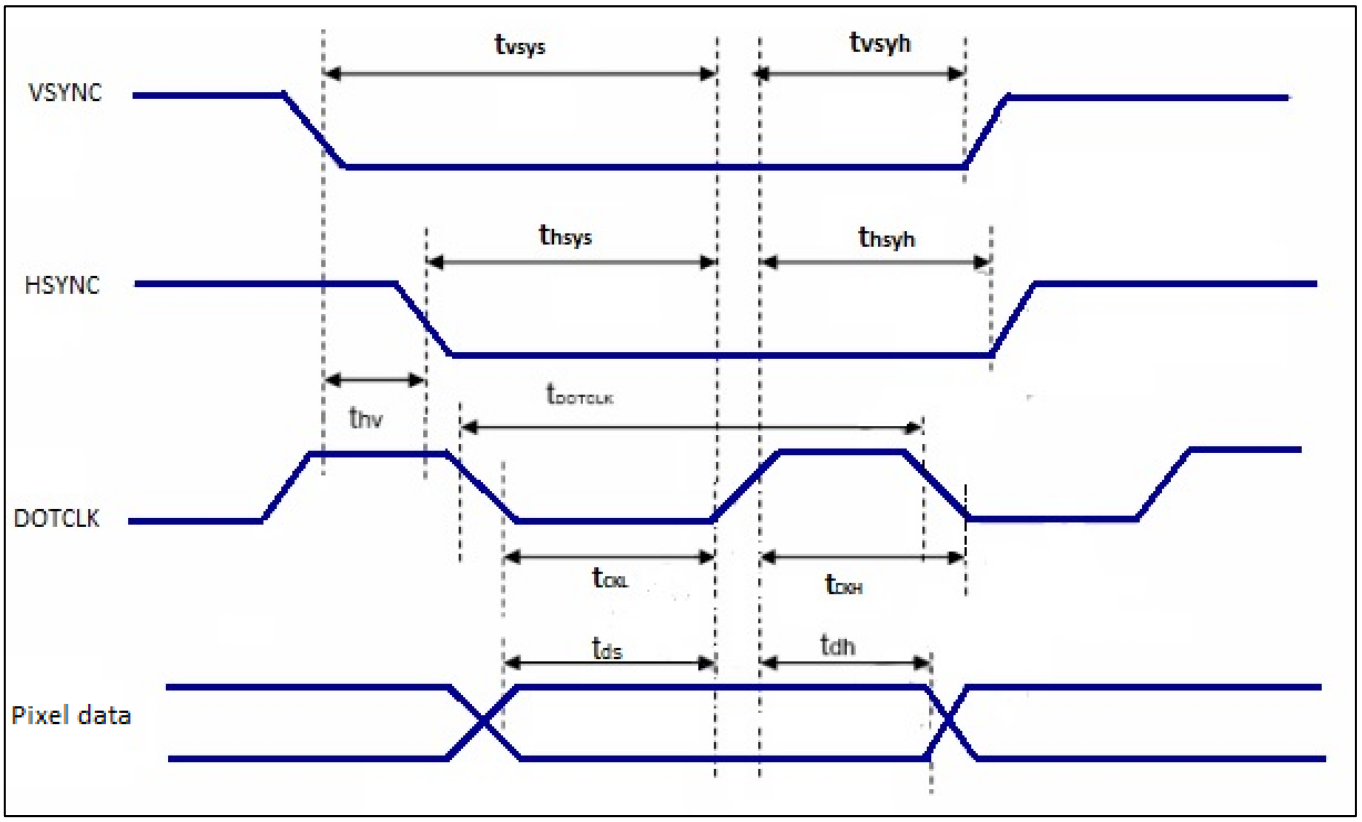


Figure 6.1: Parallel RGB Interface Timing Diagram

Characteristics	Symbol	Min		Typ.		Max		Unit
		24bit	8bit	24bit	8bit	24bit	8bit	
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	1	-	-	240	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	10	-	-	-		ns

Table 6.1: Parallel RGB Interface Timing Characteristics

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

6.2 Clock and Data Input Waveforms

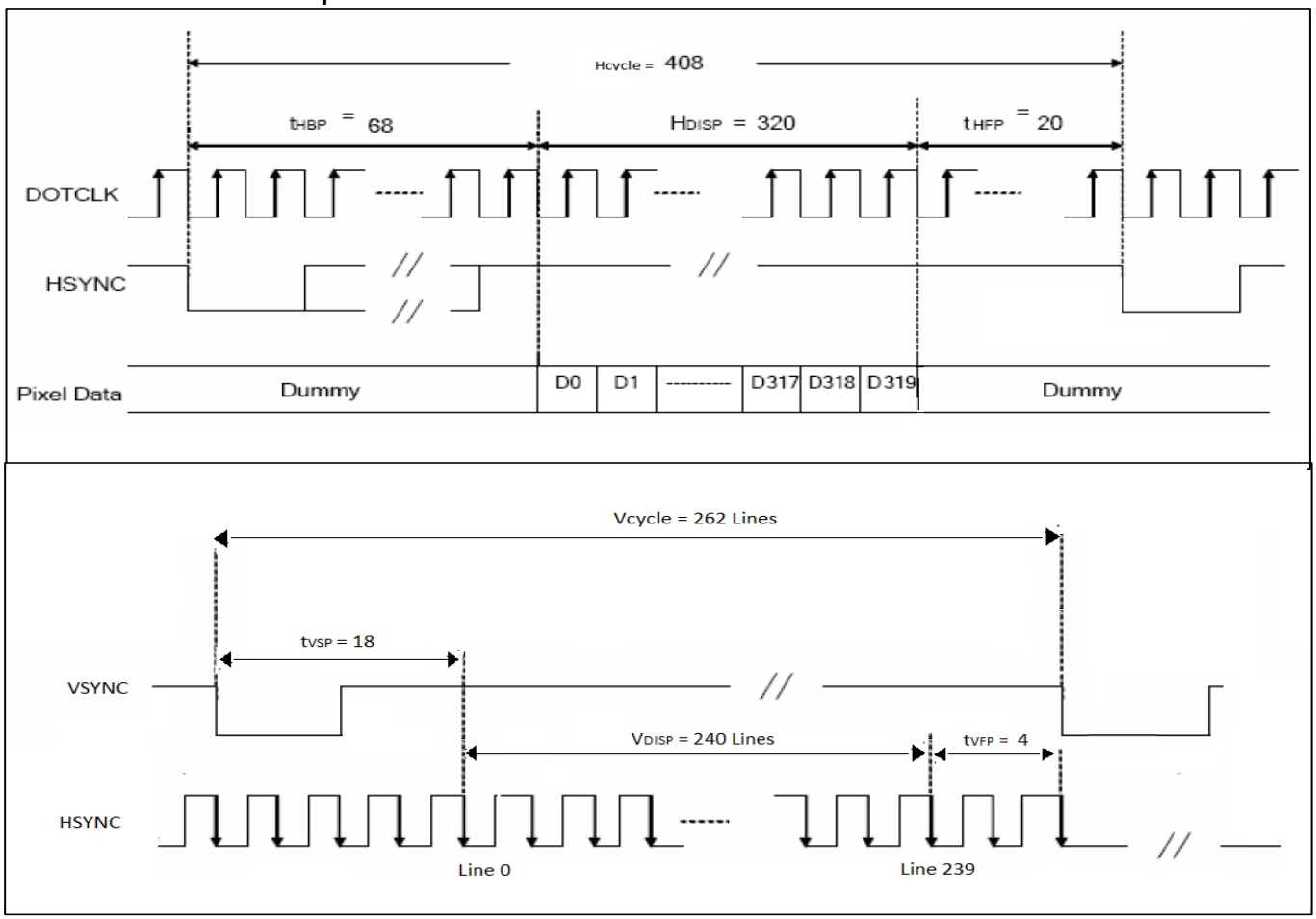


Figure 6.2: Vertical and Horizontal Data Transaction Timing Diagram

Characteristics		Symbol	Min		Typ.		Max		Unit
			24bit	8bit	24bit	8bit	24bit	8bit	
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 Blacking Period		tVBP+tVFP	-	-	22		-	-	Lines
Vertical Display Area	NTSC	VDISP	-	-	240		-	-	Lines
	PAL				280(PALM=0)				
	PAL				288(PALM=1)				
Vertical Cycle	NTSC	Vcycle	-	-	262		350		Lines
	PAL				313				

Table 6.2: Vertical and Horizontal Timing Characteristics

6.3 Reset Timing

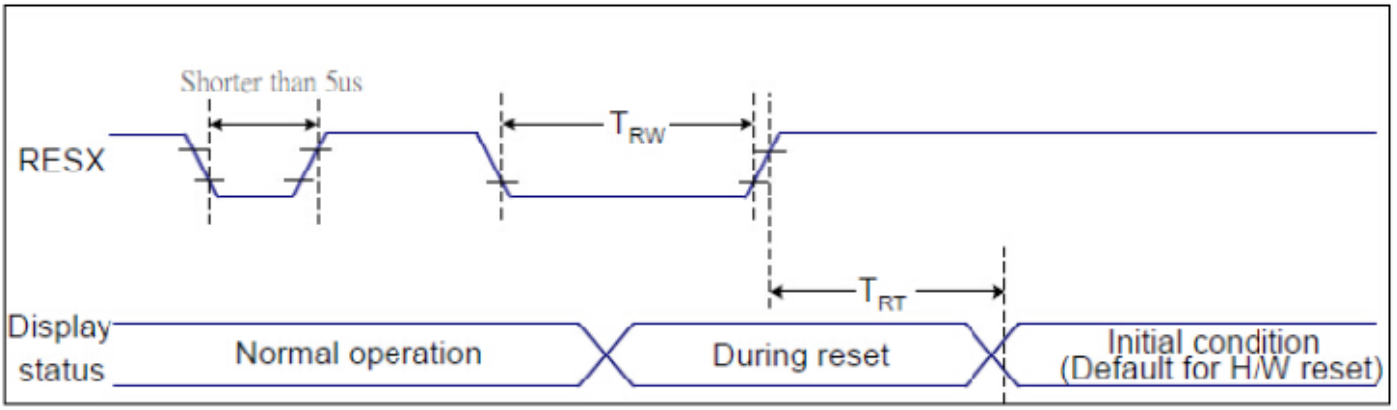


Figure 6.3: Reset Timing Diagram

Related Pins	Symbol	Parameter	Min	Max	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1,5)	ms
				120 (Note 1, 6, 7)	ms

Notes:

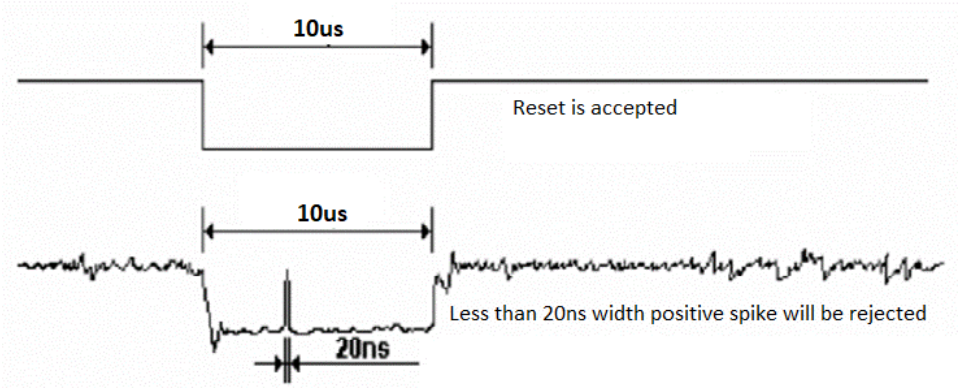
1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5ms after a rising edge of RESX.

2. Spike due to an electrostatic discharge on RESX line does not because irregular system reset according to the table below:

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9 us	Reset starts

3. During the resetting period, the display will be blanked (the display is entering blanking sequence, which maximum time is 120ms, when reset starts in Sleep Out mode. The display remains the blank state in Sleep in mode) and then return to Default condition for Hardware Reset.

4. Spike Rejection also applies during a valid reset pulse as shown below:



5. When Reset applied during Sleep In Mode.
6. When Reset applied during Sleep Out Mode.
7. It is necessary to wait 5ms after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120ms.

7. CTP Specification

7.1 Electrical Characteristics

7.1.1 Absolute Maximum Rating

Item	Symbol	Min	Max	Unit	Note
Power Supply Voltage	VDD	-0.3	3.6	V	1
I/O Digital Voltage	VDDIO	1.8	3.6	V	1
Operating Temperature	T	-20	+70	℃	-
Storage Temperature	T_{ST}	-30	+80	℃	-

Note: If used beyond the absolute maximum ratings, FT6336 may permanently damage. It is strongly recommended that the device be used within the electrical characteristics in normal operations. If exposed to the condition not within the electrical characteristics, it may affect the reliability of the device.

7.1.2 DC Electrical Characteristics (Ta=25℃)

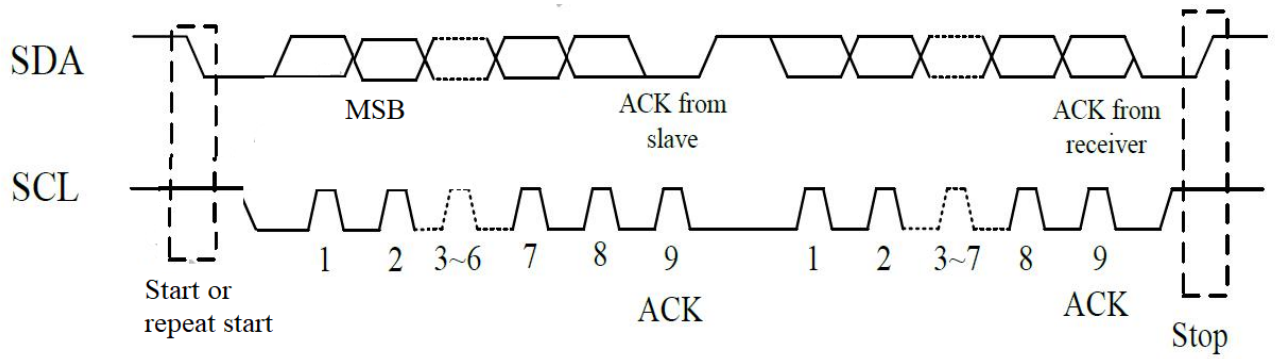
Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Digital supply voltage	VDD		2.8	3.3	3.6	V	
I/O Digital supply voltage	VDDIO		1.8	3.3	3.6	V	
Normal operation mode current consumption	I_{OPr}	VDD=2.8V Ta=25℃ MCLK= 17.5M Hz		4		mA	
Monitor mode current consumption	I_{mon}			1.5		mA	
Sleep mode current consumption	I_{sip}			50		uA	
Level input voltage	V_{IH}		0.7VDDIO		VDDIO	V	
	V_{IL}		-0.3		0.3VDDIO	V	
Level output voltage	V_{OH}	I_{OH}=-0.1mA	0.7VDDIO			V	
	V_{OL}	I_{OL}=0.1mA			0.3VDDIO	V	

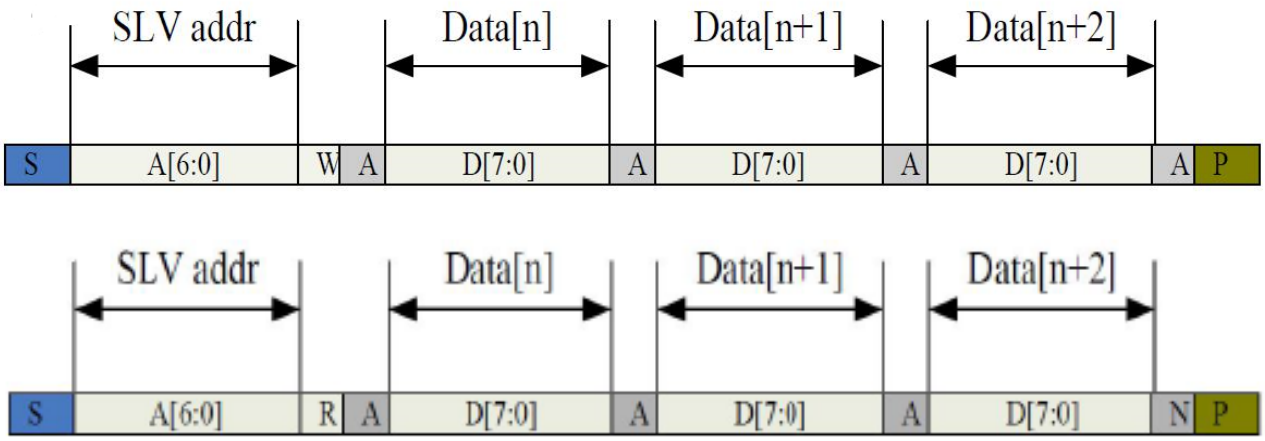
7.1.3 AC Characteristics

Item	Symbol	Test Condition	Min	Typ.	Max	Unit	Note
OSC clock 1	fosc1	VDDA=2.8V; Ta=25℃	34.65	35	35.35	MHz	
Sensor acceptable clock	ftx	VDDA=2.8V; Ta=25℃	0	100	300	kHz	
Sensor output rise time	Ttxr	VDDA=2.8V; Ta=25℃	-	100	-	Ns	
Sensor output fall time	Ttxf	VDDA=2.8V; Ta=25℃	-	80	-	Ns	
Sensor input voltage	Trxi	VDDA=2.8V; Ta=25℃	-	5	-	V	

7.1.4 I2C Interface

The I2C is always configured in the slave mode. The data transfer format is shown below.





The following table lists the meanings of the mnemonics used in the above figures.

Mnemonics	Description
S	I2C start or I2C restart
A [6:0]	Slave address
R/W	Read/Write bit, '1' for read, '0' for write
A(N)	ACK(NACK)
P	Stop: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet)

I2C Interface Timing Characteristics

Parameter	Min	Max	Unit
SCL frequency	10	400	kHz
Bus free time between a stop and start condition	4.7	-	us
Hold time (repeated) start condition	4.0	-	us
Data setup time	250	-	us
Setup time for a repeated start condition	4.7	-	us
Setup time for stop condition	4.0	-	us

8. Cautions and Handling Precautions

8.1 Handling and Operating the Module

1. When the module is assembled, it should be attached to the system firmly. Do not warp or twist the module during assembly work.
2. Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
3. Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
4. Do not allow drops of water or chemicals to remain on the display surface. If you have the droplets for a long time, staining and discoloration may occur.
5. If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
6. The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
7. 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.
8. Protect the module from static; it may cause damage to the CMOS ICs.
9. Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
10. Do not disassemble the module.
11. Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
12. Pins of I/F connector shall not be touched directly with bare hands.
13. Do not connect, disconnect the module in the “Power ON” condition.
14. Power supply should always be turned on/off by the item Power On Sequence & Power Off Sequence

8.2 Storage and Transportation.

1. 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 ℃ and relative humidity of less than 70%
2. Do not store the TFT-LCD module in direct sunlight.
3. The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
4. It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module. In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.
5. This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.