



## RVT3.5A320240CNWC36

### LCD TFT Datasheet

Rev.1.3  
2015-08-05

ITEM	CONTENTS	UNIT
LCD Type	TFT/Transmissive/Normally white	/
Size	3.5	Inch
Viewing Direction	12:00 (without image inversion)	O' Clock
Gray Scale Inversion Direction	6:00	O' Clock
LCM (W × H × D )	76.90 × 63.90 × 7.88	mm <sup>3</sup>
Active Area (W × H)	70.08 × 52.56	mm <sup>2</sup>
Dot Pitch (W × H)	0.73 × 0.219	mm <sup>2</sup>
Number Of Dots	320 (RGB) × 240	/
Controller IC	SSD1963	/
Backlight Type	6 LEDs	/
Surface Luminance	480	cd/m <sup>2</sup>
Interface Type	Parallel 8/16b	/
Color Depth	262k	/
Pixel Arrangement	RGB Vertical Stripe	/
Surface Treatment	Clear	/
Input Voltage	3.3	V
With/Without TSP	Projected Capacitive Touch Panel	/
Weight	56	g

**Note 1:** RoHS compliant

**Note 2:** LCM weight tolerance: ± 5%.

## REVISION RECORD

REVNO.	REVDATE	CONTENTS	REMARKS
1.0	2014-10-27	Initial Release	
1.1	2015-01-30	Update surface luminance, update LED lifetime, update response time, update absolute maximum supply voltage	
1.2	2015-06-12	Update surface treatment information, update interface type	
1.3	2015-08-05	Add pin numbering in the mechanical drawing	

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## 1. MODULE CLASSIFICATION INFORMATION

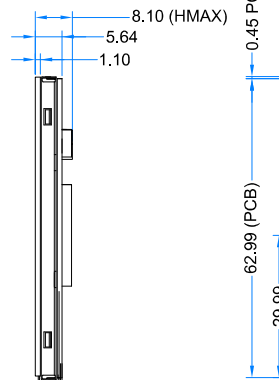
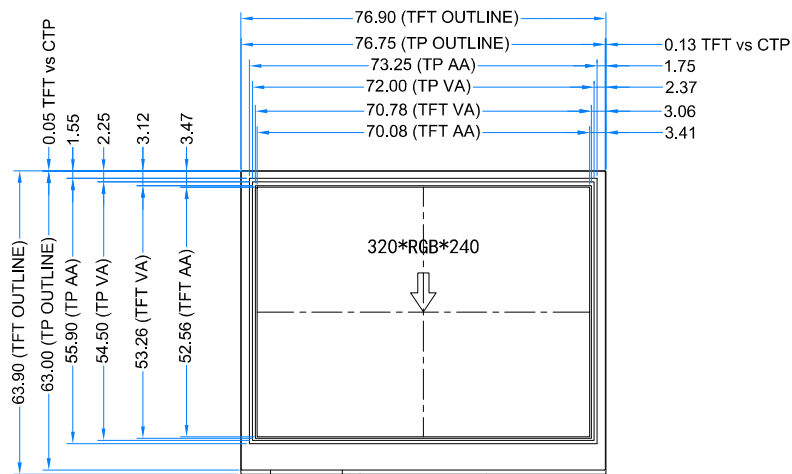
<b>RV</b>	<b>T</b>	<b>3.5</b>	<b>A</b>	<b>320240</b>	<b>C</b>	<b>N</b>	<b>W</b>	<b>C</b>	<b>36</b>
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.

1.	<b>BRAND</b>	<b>RV – Riverdi</b>
2.	<b>PRODUCT TYPE</b>	<b>T – TFT Standard</b> F – TFT Custom
3.	<b>DISPLAY SIZE</b>	<b>3.5 – 3.5"</b> <b>4.3 – 4.3"</b> <b>5.7 – 5.7"</b> <b>7.0 – 7.0"</b>
4.	<b>MODEL SERIAL NO.</b>	<b>A (A-Z)</b>
5.	<b>RESOLUTION</b>	<b>320240 – 320x240 px</b> <b>480272 – 480x272 px</b> <b>800480 – 800x480 px</b>
6.	<b>INTERFACE</b>	<b>T – TFT LCD, RGB</b> <b>L – TFT LCD, LVDS</b> <b>C – TFT + Controller</b>
7.	<b>FRAME</b>	<b>N – No Frame</b> F – Mounting Frame
8.	<b>BACKLIGHT TYPE</b>	<b>W – LED White</b>
9.	<b>TOUCH PANEL</b>	<b>N – No Touch Panel</b> <b>R – Resistive Touch Panel</b> <b>C – Capacitive Touch Panel</b>
10.	<b>VERSION</b>	<b>36 (00-99)</b>

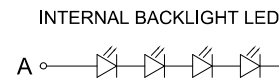
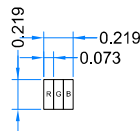
# LCD TFT Datasheet Rev.1.3

## RVT3.5A320240CNWC36

PIN	DESC
1	GND
2	VDD
3	BL_E
4	D/C
5	WR
6	RD
7	D0
8	D1
9	D2
10	D3
11	D4
12	D5
13	D6
14	D7
15	D8
16	D9
17	D10
18	D11
19	D12
20	D13
21	D14
22	D15
23	NC
24	TP_INT
25	CS
26	RESET
27	DISP_ON
28	NC
29	TP_SCL
30	TP_SDA
31	TP_RST
32	TP_WAKE
33	BLGND
34	BLGND
35	BLVDD
36	BLVDD



DETAIL A  
SCALE 60:1



**NOTES:**

- DISPLAY TYPE: TFT, TRANSMISSIVE, NORMALLY WHITE
- OPERATION VOLTAGE: VDD=3.3V
- VIEWING DIRECTION: 12 O'CLOCK
- IC CONTROLLER: SSD1963
- OPERATING TEMP.: -20°C ~ 70°C
- STORAGE TEMP.: -30°C ~ 80°C
- LED BACKLIGHT: 6-LED WHITE, BUILT-IN INVERTER
- SURFACE LUMINANCE: 480 cd/m<sup>2</sup>
- GENERAL TOLERANCE: ±0.2
- RoHS COMPLIANT

1.1	Adding Pin information	2015.08.05
1.0	Initial case	2015.05.30
Rev.	DESCRIPTION	DATE

CUSTOMER APVL	
DRAWN	
DFTG CHK	
ENGR CHK	
APPROVAL	



### 3. ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage For Logic	VDD	-0.3	4.6	V
Input Voltage For Logic	VIN	-0.3	VDD	V
Input Voltage For LED Inverter	BLVDD	-0.3	7.0	V
Operating Temperature	T <sub>OP</sub>	-20	70	°C
Storage Temperature	T <sub>ST</sub>	-30	80	°C
Humidity	RH	-	90% (Max 60°C)	RH

### 4. ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	NOTES
Supply Voltage For Module	VDD	3.0	3.3	3.6	V	
Input Voltage for LED Inverter	BLVDD	2.8	3.3	5.5	V	
Input Voltage 'H' level for BL_E pin	BL_EH	1.5	-	5.5	V	
Input Voltage 'L' level for BL_E pin	BL_EL	0	-	0.7		
Input Current (Exclude LED Backlight)	IDD	-	31	39	mA	VDD = 3.3V
LED Backlight Current	IDD <sub>backlight</sub>		150	187	mA	BLVDD=3.3V
LED Backlight Current	IDD <sub>backlight</sub>		95	119	mA	BLVDD=5V
Total Input Current (Include LED Backlight 100%)	IDD <sub>total</sub>	-	181	226	mA	BLVDD=3.3V
Input Voltage 'H' level	V <sub>IH</sub>	0.7VDD	-	VDD	V	
Input Voltage 'L' level	V <sub>IL</sub>	0	-	0.2VDD	V	
LED Life Time	-	40000	50000	-	Hrs	Note 1

**Note 1:** The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C.

### 5. ELECTRO-OPTICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	REMARK	NOTE
Response Time	Tr+Tf	θ=0° φ=0° Ta=25°C	-	25	30	ms	Figure 1	4
Contrast Ratio	Cr		-	350	-	---	Figure 2	1
Luminance Uniformity	δ WHITE		75	80	-	%	Figure 2	3
Surface Luminance	Lv		-	480	-	cd/m <sup>2</sup>	Figure 2	2
Viewing Angle Range	θ	φ = 90°	30	40	-	deg	Figure 3	6
		φ = 270°	50	60	-	deg	Figure 3	
		φ = 0°	50	60	-	deg	Figure 3	
		φ = 180°	50	60	-	deg	Figure 3	
CIE (x, y) Chromaticity	Red	x	0.574	0.624	0.674	Figure 2	5	
		y	0.318	0.368	0.418			
	Green	x	0.300	0.350	0.400			
		y	0.500	0.550	0.600			
	Blue	x	0.093	0.143	0.193			
		y	0.069	0.119	0.169			
	White	x	0.260	0.310	0.360			
		y	0.283	0.333	0.383			
NTSC	-	-	-	50	-	%	-	

**Note 1.** Contrast Ratio(CR) is defined mathematically as below, for more information see Figure 1.

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Average Surface Luminance with all black pixels (P1, P2, P3, P4, P5)}}$$

**Note 2.** Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information see Figure 2.

$L_v$  = Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)

**Note 3.** The uniformity in surface luminance  $\delta$  WHITE is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance. For more information see Figure 2.

$$\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Maximum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}$$

**Note 4.** Response time is the time required for the display to transition from white to black (Rise Time,  $T_r$ ) and from black to white (Decay Time,  $T_f$ ). For additional information see Figure 1. The test equipment is Autronic-Melchers's ConoScope series.

**Note 5.** CIE (x, y) chromaticity, the x, y value is determined by measuring luminance at each test position 1 through 5, and then make average value.

**Note 6.** Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see Figure 3.

**Note 7.** For viewing angle and response time testing, the testing data is based on Autronic-Melchers's ConoScope series. Instruments for Contrast Ratio, Surface Luminance, Luminance Uniformity, CIE the test data is based on TOPCON's BM-5 photo detector.

**Note 8.** For TFT module, gray scale reverse occurs in the direction of panel viewing angle.

Figure 1. The definition of response time

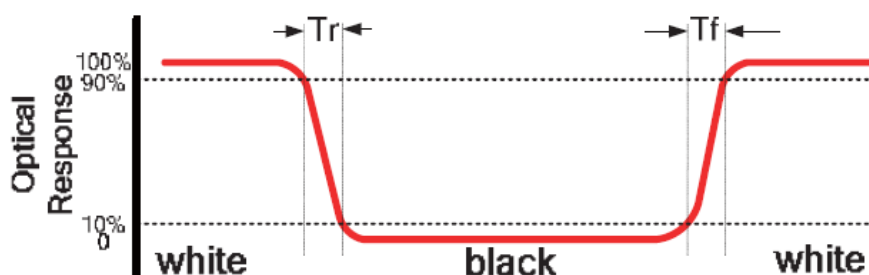


Figure 2. Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x,y) chromaticity

A : 5 mm  
B : 5 mm  
H, V : Active Area  
Light spot size  $\varnothing=5\text{mm}$ , 500mm distance from the LCD surface to detector lens  
measurement instrument is TOPCON's luminance meter BM-5

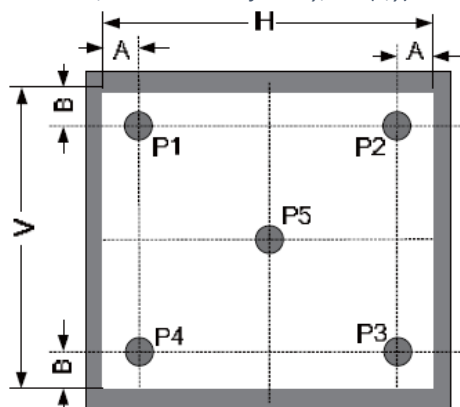
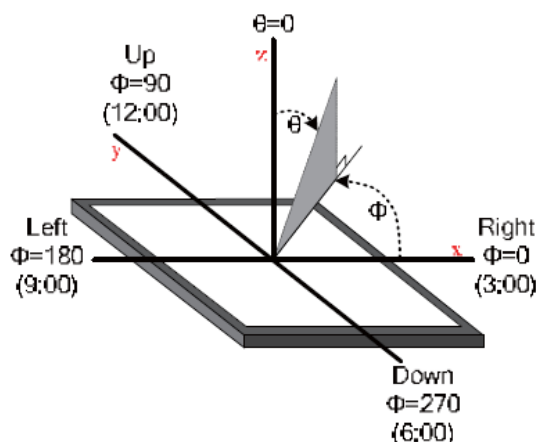


Figure 3. The definition of viewing angle



## 6. INTERFACE DESCRIPTION

PIN NO.	SYMBOL	I/O	DESCRIPTION
1	GND	P	Power Ground
2	VDD	P	Power Supply: +3.3V
3	BL_E	I	Backlight Control Signal, H: On/L: Off (internally pulled-up to BLVDD)
4	D/C	I	Data/Command Select
5	WR	I	Write Strobe Signal
6	RD	I	Read Strobe Signal
7-22	D0-D15	I	Data Bus. Pins not used should be floating.
23	NC	-	No Connection
24	TP_INT	-	Touch Panel INT
25	CS	I	Chip Select
26	RESET	I	Hardware reset
27	DISP ON	I	Display Control H: On/L: Off (internally pulled-up)
28	NC	-	No Connection
29	TP_SCL	-	Touch Panel I2C SCL Signal
30	TP_SDA	-	Touch Panel I2C SDA Signal
31	TP_RST	-	Touch Panel RST Signal, Active Low
32	TP_WAKE	-	Touch Panel Wake Signal, Active Low
33	BLGND	-	Backlight ground, can be connected to GND
34	BLGND	-	Backlight ground, can be connected to GND
35	BLVDD	-	Backlight power supply, can be connected to VDD
36	BLVDD	-	Backlight power supply, can be connected to VDD

## 7. INTERFACE TIMING CHARACTERISTICS

### 7.1. 8080 Mode

The 8080 mode MCU interface consist of CS#, D/C#, RD#, WR#, D[15:0]. This interface use WR# to define a write cycle and RD# for read cycle. If the WR# goes low when the CS# signal is low, the data or command will be latched into the system at the rising edge of WR#. Similarly, the read cycle will start when RD# goes low and end at the rising edge of RD#.

### 7.2. Pixel Data Format

Interface	Cycle	D[17]	D[16]	D[15]	D[14]	D[13]	D[12]	D[11]	D[10]	D[9]	D[8]	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
16 bits (565 format)	1 <sup>st</sup>			R5	R4	R3	R2	R1	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1
16 bits	1 <sup>st</sup>			R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0
	2 <sup>nd</sup>			B7	B6	B5	B4	B3	B2	B1	B0	R7	R6	R5	R4	R3	R2	R1	R0
	3 <sup>rd</sup>			G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
12 bits	1 <sup>st</sup>							R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4
	2 <sup>nd</sup>							G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
9 bits	1 <sup>st</sup>										R5	R4	R3	R2	R1	R0	G5	G4	G3
	2 <sup>nd</sup>									G2	G1	G0	B5	B4	B3	B2	B1	B0	
8 bits	1 <sup>st</sup>											R7	R6	R5	R4	R3	R2	R1	R0
	2 <sup>nd</sup>											G7	G6	G5	G4	G3	G2	G1	G0
	3 <sup>rd</sup>											B7	B6	B5	B4	B3	B2	B1	B0

### 7.3. Parallel 8080-series Interface Timing

Figure 4. Parallel 8080-series Interface Timing Diagram (Write Cycle)

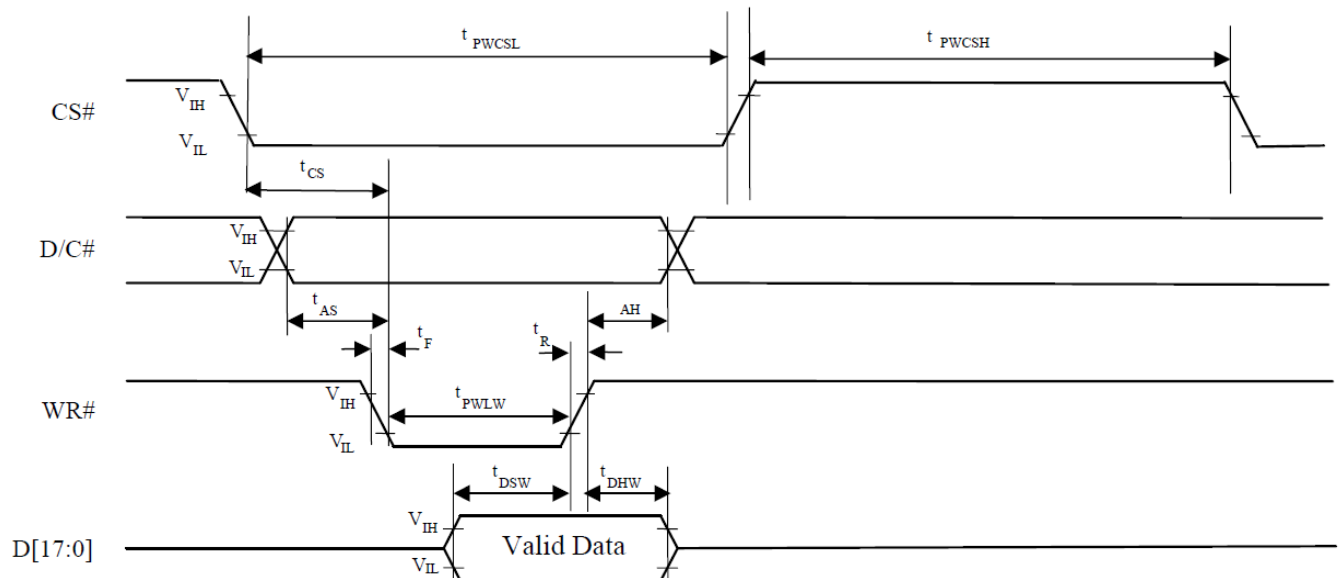
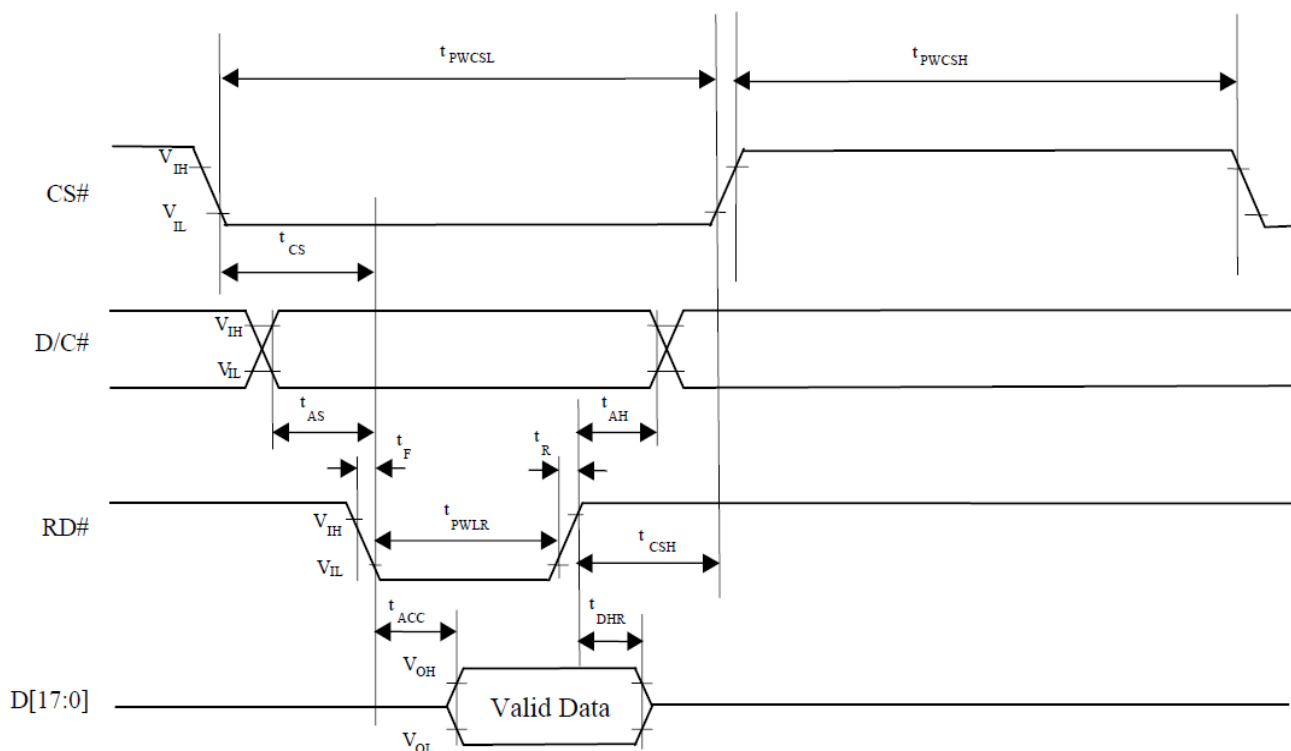




Figure 5.Parallel 8080-series Interface Timing Diagram (Read Cycle)



## 8. LCD TIMING CHARACTERISTICS

### 8.1. Timing Chart

Timing parameter (VDD=3.3V, GND=0V, Ta=25°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	CONDITION
CLK Clock Time	$T_{clk}$	$1/Max(F_{CLK})$	-	$1/Min(F_{CLK})$	ns	-
CLK Pulse Duty	$T_{chw}$	40	50	60	%	$T_{CLK}$
HSYNC to CLK	$T_{hc}$	-	-	1	CLK	-
HSYNC Width	$T_{hwh}$	1	-	-	CLK	-
VSYNC Width	$T_{vwh}$	1	-	-	ns	-
HSYNC Period Time	$T_h$	60	63.56	67	ns	-
VSYNC Set-up Time	$T_{vst}$	12	-	-	ns	-
VSYNC Hold Time	$T_{vhd}$	12	-	-	ns	-
HSYNC Setup Time	$T_{hst}$	12	-	-	ns	-
HSYNC Hold Time	$T_{hhd}$	12	-	-	ns	-
Data Set-up Time	$T_{dsu}$	12	-	-	ns	D00~D23 to CLK
Data Hold Time	$T_{dhd}$	12	-	-	ns	D00~D23 to CLK
DEN Set-up Time	$T_{esu}$	12	-	-	ns	DEN to CLK

Figure 6. DE mode timing diagram

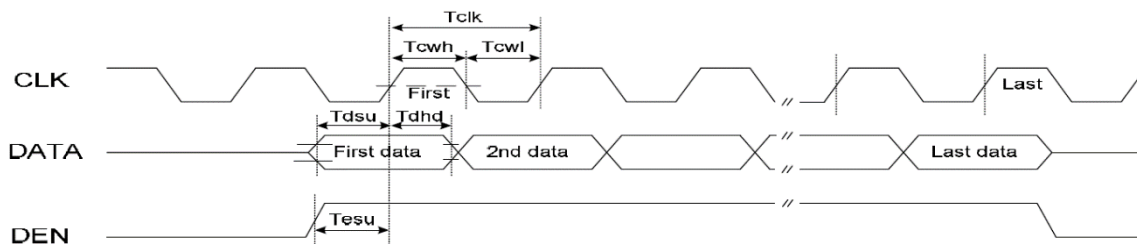


Figure 7. SYNC mode timing diagram

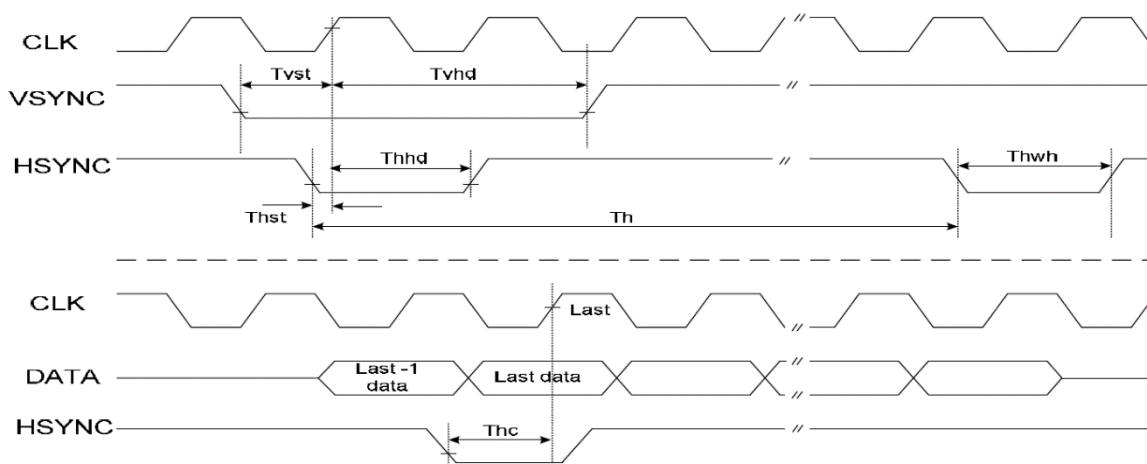
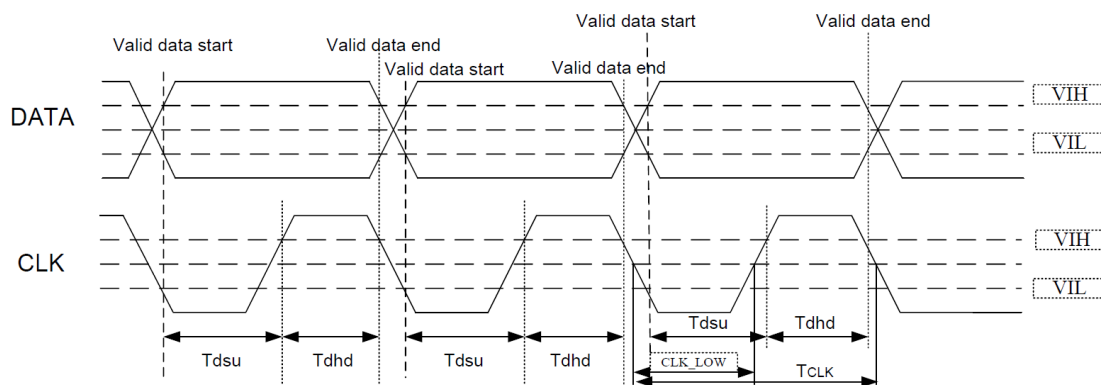


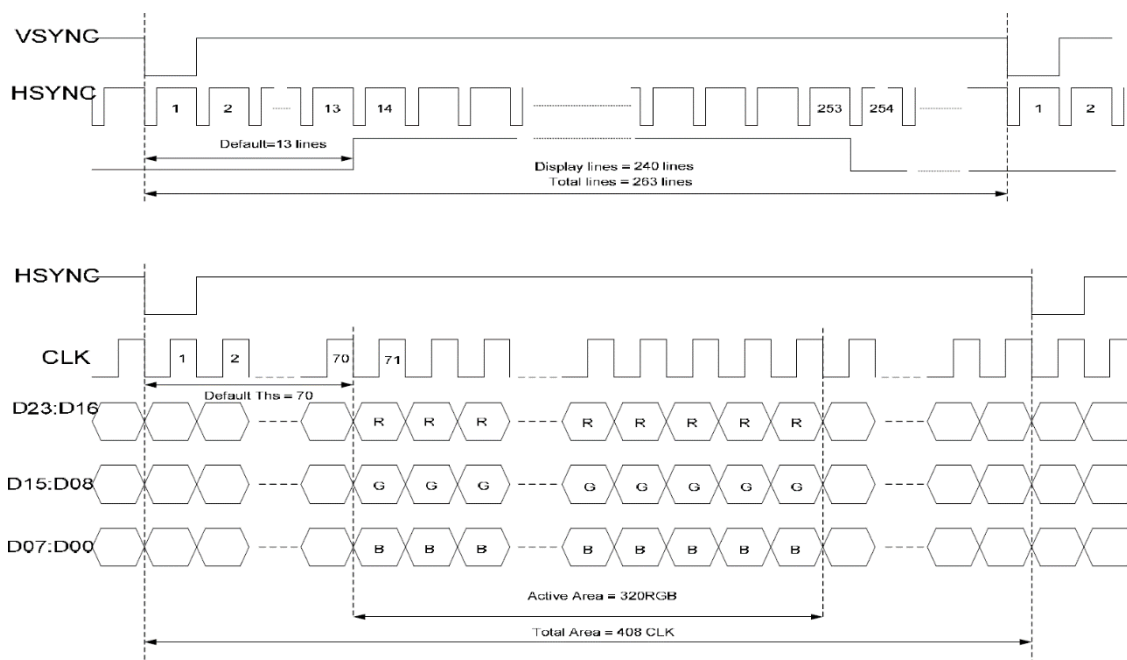
Figure 8. Timing diagram



## 8.2. 24 Bit RGB Mode for 320 x RGB x 240

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	CONDITION
CLK Frequency	$F_{clk}$	7.0	8.0	9.0	MHz	VDD=3.0V~3.6V
CLK Cycle Time	$T_{clk}$	143	125	111	ns	-
CLK Pulse Duty	$T_{cwh}$	40	50	60	%	-
Time that HSYNC to 1st Data Input (NTSC)	$T_{hs}$	40	70	255	CLK	DDLY=70 Offset=0(fixed)

Figure 9. 24 bit RGB SYNC mode timing



## 9. CAPACITIVE TOUCH SCREEN PANEL SPECIFICATIONS

### 9.1. Mechanical characteristics

DESCRIPTION	INL SPECIFICATION	REMARK
Touch Panel Size	3.5 inch	
Outline Dimension (OD)	76.75 mm x 63.00mm	Cover Lens Outline
Product Thickness	1.26mm ± 0.1mm	
Glass Thickness	0.7 mm ± 0.1mm	
Ink View Area	72.85mm x 55.50mm	
Sensor Active Area	73.25mm x 55.90mm	
Input Method	5 Finger	
Activation Force	Touch	
Surface Hardness	≥7H	

### 9.2. Electrical characteristics

DESCRIPTION	SPECIFICATION
Operating Voltage	DC 2.8~3.6V
Power Consumption (IDD)	Active Mode
	Sleep Mode
Interface	I <sup>2</sup> C
Linearity	<1.5%
Controller	FT5206
I2C address	0x38 (7 bit address)
Resolution	896*640

### 9.3. Interface timing characteristics

PARAMETER	MIN	MAX	UNIT
SCL Frequency	0	400	kHz
Bus Free Time Between a STOP and START Condition	4.7	/	μs
Hold Time (repeated) START Condition	4.0	/	μs
Data Setup Time	250	/	ns
Setup Time for Repeated START Condition	4.7	/	μs
Setup Time for STOP Condition	4.0	/	μs

### 9.4. I2C Read/Write Interface Description

Figure 10. Write N bytes to I2C slave

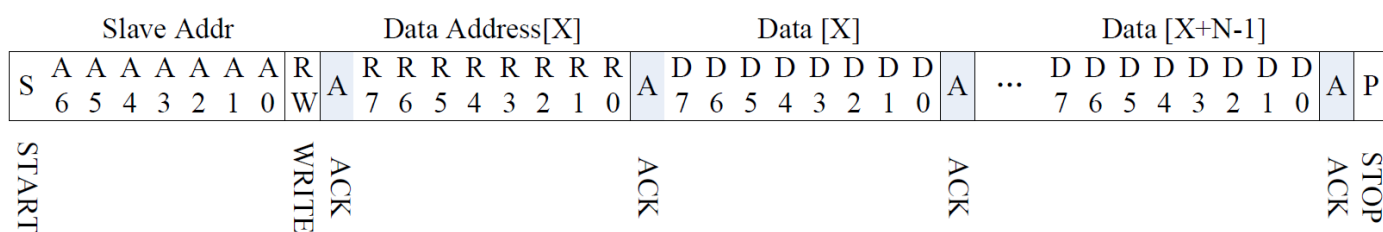


Figure 11. Set Data Address

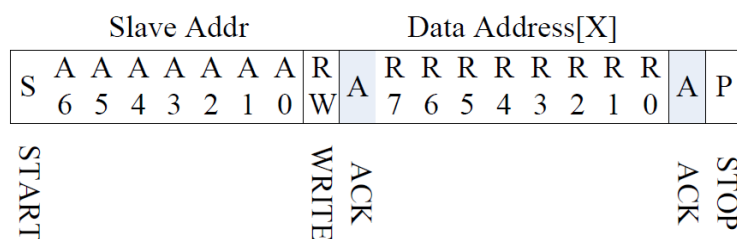
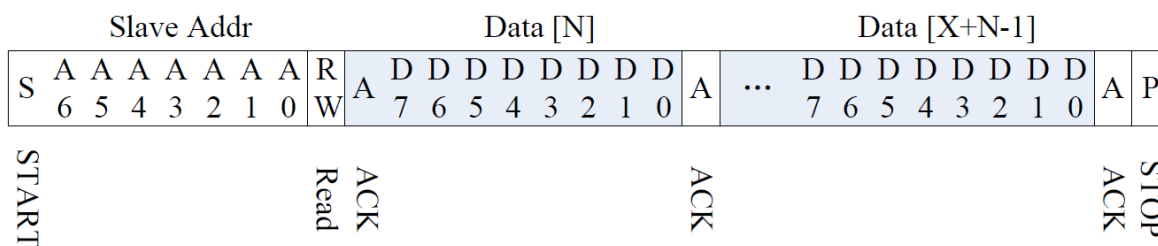
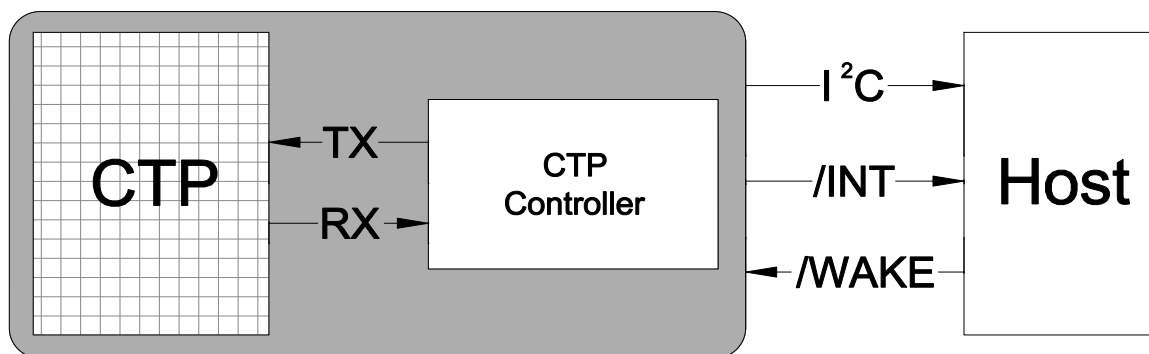


Figure 12. Read X bytes from I2C Slave



### 9.5. Communication of the I<sup>2</sup>C interface with Host

Figure 13. Communication of the I<sup>2</sup>C interface with Host



### 9.6. Touch data read protocol

ADDRESS	NAME	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0	HOST ACCESS	
00h	DEVIDE_MODE	Device Mode[2:0]									RW
01h	GEST_ID	Gesture ID[7:0]								R	
02h	TD_STATUS					Number of touch points[3:0]				R	
03h	TOUCH1_XH	1 <sup>st</sup> Event Flag			1 <sup>st</sup> Touch X Position[11:8]					R	
04h	TOUCH1_XL	1 <sup>st</sup> Touch X Position[7:0]								R	
05h	TOUCH1_YH	1 <sup>st</sup> Touch ID[3:0]			1 <sup>st</sup> Touch X Position[11:8]					R	
06h	TOUCH1_YL	1 <sup>st</sup> Touch Y Position[7:0]								R	
07h										R	
08h										R	
09h	TOUCH2_XH	2 <sup>nd</sup> Event Flag			2 <sup>nd</sup> Touch X Position[11:8]					R	
0Ah	TOUCH2_XL	2 <sup>nd</sup> Touch X Position[7:0]								R	
0Bh	TOUCH2_YH	2 <sup>nd</sup> Touch ID[3:0]			2 <sup>nd</sup> Touch X Position[11:8]					R	
0Ch	TOUCH2_YL	2 <sup>nd</sup> Touch Y Position[7:0]								R	
0Dh										R	
0Eh										R	
0Fh	TOUCH3_XH	3 <sup>rd</sup> Event Flag			3 <sup>rd</sup> Touch X Position[11:8]					R	
10h	TOUCH3_XL	3 <sup>rd</sup> Touch X Position[7:0]								R	
11h	TOUCH3_YH	3 <sup>rd</sup> Touch ID[3:0]			3 <sup>rd</sup> Touch X Position[11:8]					R	
12h	TOUCH3_YL	3 <sup>rd</sup> Touch Y Position[7:0]								R	
13h										R	
14h										R	
15h	TOUCH4_XH	4 <sup>th</sup> Event Flag			4 <sup>th</sup> Touch X Position[11:8]					R	
16h	TOUCH4_XL	4 <sup>th</sup> Touch X Position[7:0]								R	
17h	TOUCH4_YH	4 <sup>th</sup> Touch ID[3:0]			4 <sup>th</sup> Touch X Position[11:8]					R	
18h	TOUCH4_YL	4 <sup>th</sup> Touch Y Position[7:0]								R	
19h										R	
1Ah										R	
1Bh	TOUCH5_XH	5 <sup>th</sup> Event Flag			5 <sup>th</sup> Touch X Position[11:8]					R	
1Ch	TOUCH5_XL	5 <sup>th</sup> Touch X Position[7:0]								R	
1Dh	TOUCH5_YH	5 <sup>th</sup> Touch ID[3:0]			5 <sup>th</sup> Touch X Position[11:8]					R	
1Eh	TOUCH5_YL	5 <sup>th</sup> Touch Y Position[7:0]								R	

9.7. Data description.

**DEVICE\_MODE**

This register is the device mode register, configure it to determine the current mode of the chip.

ADDRESS	BIT ADDRESS	REGISTER NAME	DESCRIPTION
00h	6:4	Device Mode [2:0]	000b Work Mode 100b Factory Mode – Read Raw Data

**GEST\_ID**

This register describes the gesture of a valid touch.

ADDRESS	BIT ADDRESS	REGISTER NAME	DESCRIPTION
01h	7:0	Gesture ID [7:0]	Gesture ID 0x10 Move Up 0x14 Move Down 0x18 Move Right 0x48 Zoom In 0x49 Zoom Out 0x00 No Gesture

**TD\_STATUS**

This register is the Touch Data status register.

ADDRESS	BIT ADDRESS	REGISTER NAME	DESCRIPTION
02h	3:0	Number of Touch Points [2:0]	How Many Points Detected 1-5 is Valid
	7:4		

**TOUCHn\_XH(n:1-10)**

This register describes MSB of the X coordinate of the nth touch point and the corresponding event flag.

ADDRESS	BIT ADDRESS	REGISTER NAME	DESCRIPTION
03h ~ 39h	7:6	Event Flag	00b: Put Down 01b: Put Up 10b: Contact 11b: Reserved
	5:4		Reserved
	3:0	Touch X Position [11:8]	MSB of Touch X Position in Pixels

### TOUCHn\_XL(n:1-10)

This register describes LSB of the X coordinate of the nth touch point.

ADDRESS	BIT ADDRESS	REGISTER NAME	DESCRIPTION
04h ~ 3Ah	7:0	Touch X Position [7:0]	LSB of the Touch X Position in Pixels

### TOUCHn\_YH(n:1-10)

This register describes MSB of the Y coordinate of the nth touch point and corresponding touch ID.

ADDRESS	BIT ADDRESS	REGISTER NAME	DESCRIPTION
05h ~ 3Bh	7:4 3:0	Touch ID[3:0] Touch X Position [11:8]	Touch ID of Touch Point MSB of Touch Y Position in Pixels

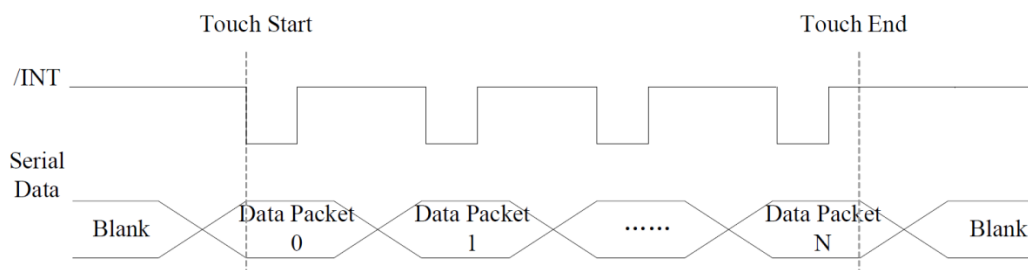
### TOUCHn\_YL(n:1-10)

This register describes LSB of the Y coordinate of the nth touch point.

ADDRESS	BIT ADDRESS	REGISTER NAME	DESCRIPTION
05h ~ 3Bh	7:0	Touch X Position [7:0]	LSB of the Touch Y Position in Pixels

## 9.8. Interrupt Trigger Mode

Figure 14. Interrupt trigger mode timing



## 10. RELIABILITY TEST

NO.	TEST ITEM	TEST CONDITION	INSPECTION AFTER TEST
1	High Temperature Storage	80±2°C/240 hours	Inspection after 2~4 hours storage at room temperature, the sample shall be free from defects: <ol style="list-style-type: none"> <li>1. Air bubble in the LCD</li> <li>2. Seal leak</li> <li>3. Non-display</li> <li>4. Missing segments</li> <li>5. Glass crack</li> <li>6. Current <math>I_{dd}</math> is twice higher than initial value</li> <li>7. The surface shall be free from damage</li> <li>8. Linearity must be no more than 1.5% by the linearity tester</li> <li>9. The Electric characteristics requirements shall be satisfied</li> </ol>
2	Low Temperature Storage	-30±2°C/240 hours	
3	High Temperature Operating	70±2°C/240 hours	
4	Low Temperature Operating	-20±2°C/240 hours	
5	Temperature Cycle	-30±2°C~25~70±2°C × 30 cycles	
6	Damp Proof Test	60°C ±5°C × 90%RH/160 hours	
7	Vibration Test	Frequency 10Hz~55Hz Stroke: 1.5mm Sweep: 10Hz~55Hz~10Hz 2 hours For each direction of X, Y, Z (6 hours for total)	
8	Mechanical Shock	60G 6ms, ± X, ± Y, ± Z 3 times for each direction	
9	Packing Drop Test	Height: 80 cm 1 corner, 3 edges, 6 surfaces	
10	Package Vibration Test	Random vibration: 0.015G <sup>2</sup> /Hz from 5-200Hz -6dB/Octave from 200-500Hz 2 hours for each direction of X, Y, Z (6 hours for total)	
11	Electrostatic Discharge	Air: ±8KV 150pF/330Ω 5 times Contact: ±4KV 150pF/330Ω 5 times	
12	Hitting Test	1,000,000 times in the same point Hitting pad: tip R3.75mm, Silicone rubber, Hardness: 40deg. Load: 2.45N Hitting speed: Twice/sec Electric load: none Test area should be at 1.8mm inside of insulation.	
13	Pen Sliding Durability Test	100,000 times minimum Hitting pad: tip R0.8mm plastic pen Load: 1.47N Sliding speed: 60 mm/sec Electric load: none Test area should be at 1.8mm inside of insulation.	

**Remark:**

1. The test samples should be applied to only one test item.
2. Sample size for each test item is 5~10pcs.
3. For Damp Proof Test, Pure water(Resistance 10MΩ) should be used.
4. In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
5. EL evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
6. Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.



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