



DM-TFT30-407

**3.0" 240 × 400 DISPLAY PANEL
WITH CAPACITIVE TOUCH - SPI,
MCU, RGB**

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1 Revision History

Date	Changes
2019-12-26	First release

2 Main Features

Item	Specification	Unit
Diagonal Size	3.0	inch
Display Mode	TFT active matrix	-
Display Colors	65K/262K	Colors
Pixel arrangement	RGB vertical stripe	-
Viewing angle	ALL	o'clock
Controller IC	ST7796S	-
LCM Interface	8/9/16/18-bit MCU; 3/4-SPI+16/18-bit RGB; 3-Line/4-Line serial interface	-
CTP Driver IC	FT6336G	-
CTP Interface	I2C	-
CTP Structure	G+F	-
Touch mode	Single point and Gestures	-
CTP Slave Adress	0x38(7bit)/8bit:0x70(Write) 0x71(Read)	-
Resolution	240(RGB) x 400	pixel
Active Area	38.88 x 64.8	mm
Panel Dimension	45.04x 77 x 3.85	mm
Pixel Pitch	0.162 x 0.162	mm
Weight	TBD	g

3 Pin Description

3.1 Panel Pin Description

Pin No.	Symbol	Function Description
1	IM0	Interface selecting signal.
2	M1	
3	IM2	
4	RESET	This signal low will reset the device and must be applied to properly initialize the chip. Signal is low active
5	VSYNC	Frame synchronizing signal for RGB interface operation. fix this pin at VCI or GND when not in use.
6	HSYNC	Line synchronizing signal for RGB interface operation. fix this pin at VCI or GND when not in use
7	PCLK	Dot clock signal for RGB interface operation Fix this pin at VCI or GND when not in use.
8	DE	Data enable signal for RGB interface operation. fix this pin at VCI or GND when not in use.
9-26	DB17-DB0	18-bit parallel bi-directional data bus for MCU system and RGB interface mode . Fix to GND level when not in use
27	SDO	Serial data output pin in serial bus system interface. If not used, please open this pin.
28	DIN(SDA)	Serial input signal.The data is applied on the rising edge of the SCL signal. If not used, please fix this pin at GND level.
29	RD	Serves as a read signal and MCU read data at the rising edge. If not used, please fix this pin at VCC or GND level.
30	WR(SCL)	DBI Type B: WRX pin, serves as a write signal DBI Type C: SCL pin as Serial Clock when operates in the serial interface If not used, please fix this pin at GND level.
31	RS	Display data / Command selection pin D/CX='1': Display data. D/CX='0': Command data. If not used, please fix this pin at GND level.
32	CS	Chip select input pin ("Low" enable). If not used, please fix this pin at GND level.
33	VCC	Power supply voltage (VCC/VCI=2.5V-3.3V).
34	VCC	
35	GND	Ground.
36	GND	
37	LEDK4	LED Cathode 4.
38	LEDK3	LED Cathode 3.
39	LEDK2	LED Cathode 2.
40	LEDK1	LED Cathode 1.
41	LEDA	LED Anode.
42	XR(NC)	NC.
43	YD(NC)	NC.
44	XL(NC)	NC.
45	YU(NC)	NC.

3.2 CTP Pin Description

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

4 Mechanical Drawing

4.1 Panel Mechanical Drawing

Front View

Side View

Rear View

FPC stretch shipment

B/L Circuit

CTP PPC Logic

NO.	Pin Name
1	100
2	101
3	102
4	RES1
5	VSSC
6	VSSC
7	PLM
8	103
9	104
10	105
11	106
12	107
13	108
14	109
15	110
16	111
17	112
18	113
19	114
20	115
21	116
22	117
23	118
24	119
25	120
26	121
27	122
28	123
29	124
30	125
31	126
32	127
33	128
34	129
35	130
36	131
37	132
38	133
39	134
40	135
41	136
42	137
43	138
44	139
45	140

NO	NO	Interface type	DB Pin in use
0	0	DB17-DB0	DB17-DB0
0	0	DB17-DB1	DB17-DB1
0	0	DB17-DB2	DB17-DB2
0	1	DB17-DB3	DB17-DB3
0	1	DB17-DB4	DB17-DB4
0	1	DB17-DB5	DB17-DB5
0	1	DB17-DB6	DB17-DB6
0	1	DB17-DB7	DB17-DB7
0	1	DB17-DB8	DB17-DB8
0	1	DB17-DB9	DB17-DB9
0	1	DB17-DB10	DB17-DB10
0	1	DB17-DB11	DB17-DB11
0	1	DB17-DB12	DB17-DB12
0	1	DB17-DB13	DB17-DB13
0	1	DB17-DB14	DB17-DB14
0	1	DB17-DB15	DB17-DB15
0	1	DB17-DB16	DB17-DB16
0	1	DB17-DB17	DB17-DB17
0	1	DB17-DB18	DB17-DB18
0	1	DB17-DB19	DB17-DB19
0	1	DB17-DB20	DB17-DB20
0	1	DB17-DB21	DB17-DB21
0	1	DB17-DB22	DB17-DB22
0	1	DB17-DB23	DB17-DB23
0	1	DB17-DB24	DB17-DB24
0	1	DB17-DB25	DB17-DB25
0	1	DB17-DB26	DB17-DB26
0	1	DB17-DB27	DB17-DB27
0	1	DB17-DB28	DB17-DB28
0	1	DB17-DB29	DB17-DB29
0	1	DB17-DB30	DB17-DB30
0	1	DB17-DB31	DB17-DB31
0	1	DB17-DB32	DB17-DB32
0	1	DB17-DB33	DB17-DB33
0	1	DB17-DB34	DB17-DB34
0	1	DB17-DB35	DB17-DB35
0	1	DB17-DB36	DB17-DB36
0	1	DB17-DB37	DB17-DB37
0	1	DB17-DB38	DB17-DB38
0	1	DB17-DB39	DB17-DB39
0	1	DB17-DB40	DB17-DB40
0	1	DB17-DB41	DB17-DB41
0	1	DB17-DB42	DB17-DB42
0	1	DB17-DB43	DB17-DB43
0	1	DB17-DB44	DB17-DB44
0	1	DB17-DB45	DB17-DB45

CTP PPC Logic

Pin	Logic
1	Logic
2	Logic
3	Logic
4	Logic
5	Logic
6	Logic
7	Logic
8	Logic

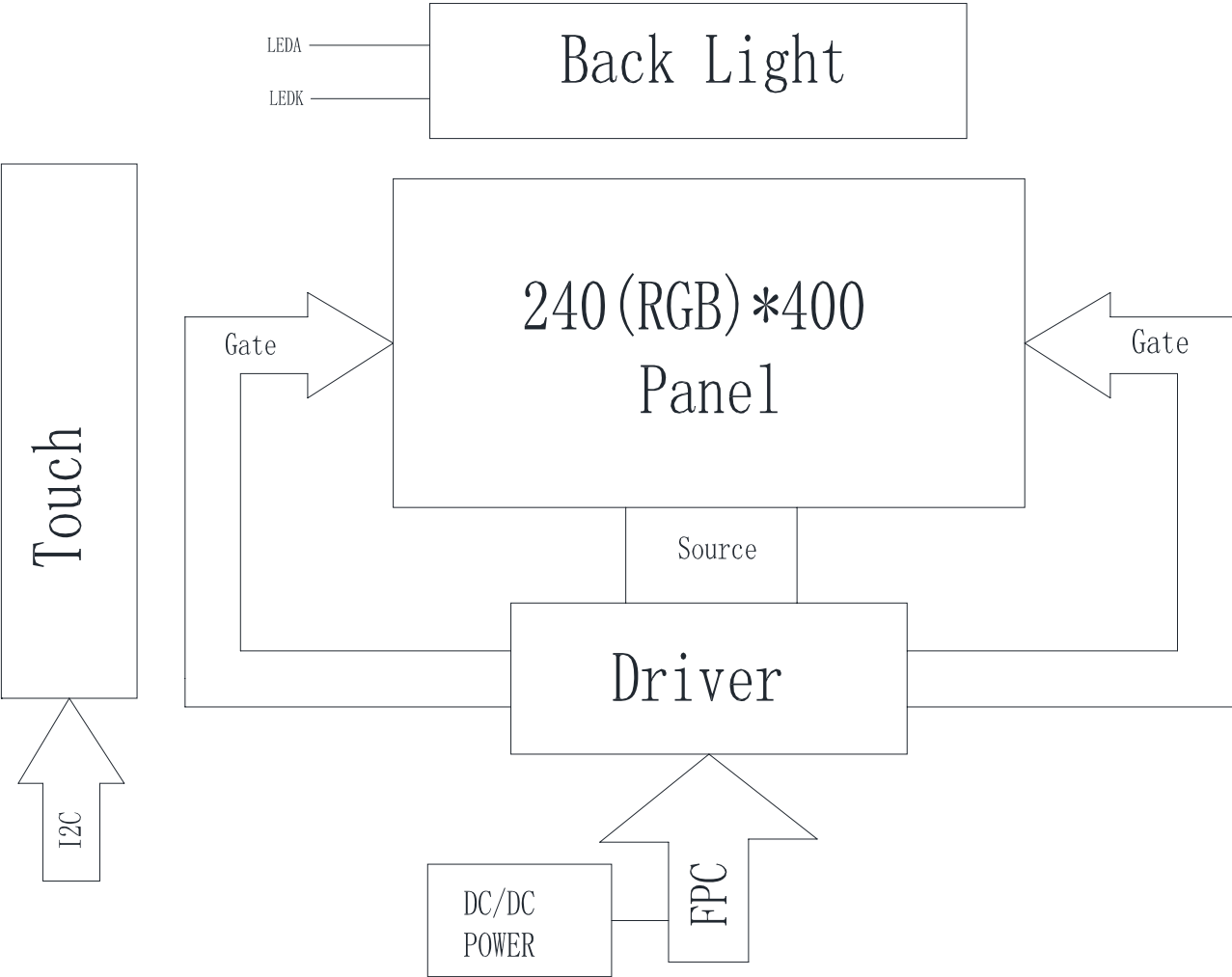
Notes:

1. If not use PIN fix to the GND , 10VCC or NC.
2. If use RGB interface must select serial interface

Notes:

1. DISPLAY TYPE: 3.0" TFT-LCD, 65K/252K COLORS
2. DISPLAY MODE: NORMALLY BLACK
3. VIEWING DIRECTION: ALL
4. DRIVER IC, SETTINGS (TPO, CTP Driver IC: FT73386)
5. ICM Interface: RGB, CTP Interface: I2C
6. VCI/TPO: 3.3V/10VCC: 1.8V/3.3V
7. STORAGE TEMPE: -20° C TO 70° C
8. BACK LIGHT: LED WHITE, 4 LED, 6V~9VDC, 3.2V±0.3V
9. HOUS COMPLIANT:

5 Function Block Diagram



6 Optics & Electrical Characteristics

6.1 Optical Characteristics

Item	Symbol	Min	Typ	Max	Unit	Remark
View Angles	Θ_L	-	80	-	°	CR>10
	Θ_R	-	80	-	°	
	Θ_U	-	80	-	°	
	Θ_D	-	80	-	°	
C.I.E. (White)	(x)	0.245	0.285	0.325	-	CIE1931
	(y)	0.271	0.311	0.351	-	
C.I.E(Red)	(x)	0.568	0.608	0.648	-	CIE1931
	(y)	0.315	0.355	0.395	-	
C.I.E(Green)	(x)	0.287	0.327	0.367	-	CIE1931
	(y)	0.535	0.575	0.615	-	
C.I.E(Blue)	(x)	0.114	0.154	0.194	-	CIE1931
	(y)	0.055	0.095	0.135	-	
Response time	T_R+T_F	-	35	-	msec	$\Theta=0$;Normal viewing angle
Contrast Ratio	CR	-	600	-	-	-
Color Gamut	S(%)	50	55	-	%	-

Note: The data comes from the LCD specification.

Measuring surrounding : dark room

- Ambient temperature : 25±2oC

- 15min. warm-up time.

6.2 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Remark
Supply Voltage for panel	V_{CC}	-0.3	4.6	V	-
Operating Temperature	T_{OP}	-20	70	°C	-
Storage Temperature	T_{STG}	-30	80	°C	-

Note: If one of the above items is exceeded its maximum limitation momentarily, the quality of the product may be degraded. Absolute maximum limitation, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the recommend range.

6.3 DC Characteristics

Item	Symbol	Min	Typ.	Max	Unit
Supply Voltage for panel	V_{CC}	2.5	3.3	3.6	V
Normal mode Current consumption	I_{DD}	-	10	20	mA
Low Level Input Voltage	V_{IL}	GND	-	$0.3 \times V_{CC}$	V
High Level Input Voltage	V_{IH}	$0.7 \times V_{CC}$	-	V_{CC}	V
Low Level Output Voltage	V_{OL}	GND	-	$0.2 \times V_{CC}$	V
High Level Output Voltage	V_{OH}	$0.8 \times V_{CC}$	-	V_{CC}	V

Note : The VCC input must be kept in a stable value; ripple and noise are not allowed.

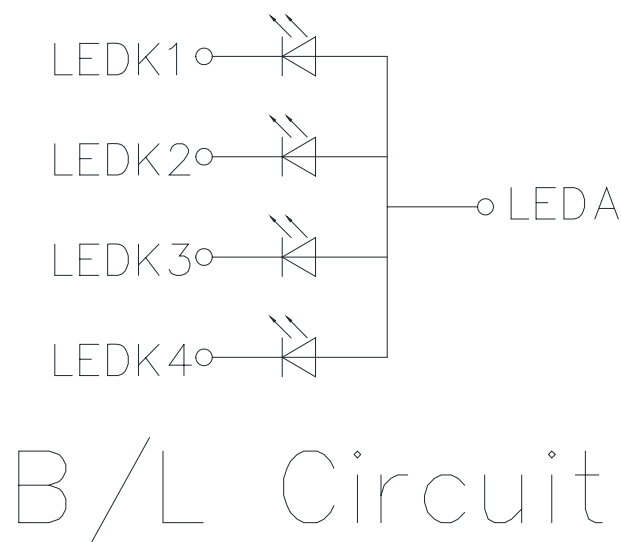
6.4 LED Backlight Characteristics

The back-light system is edge-lighting type with 4chips White LED

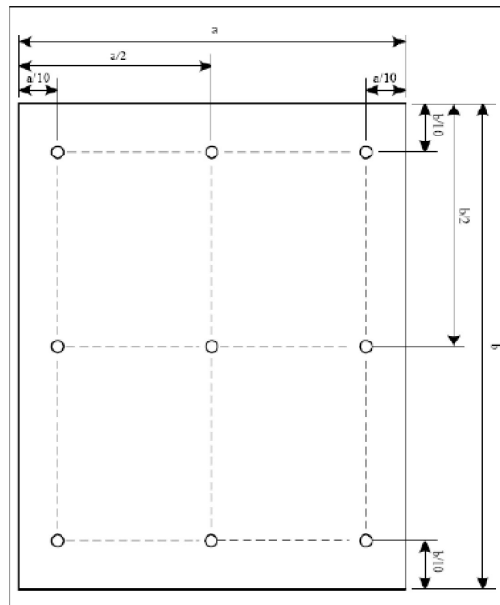
Parameter	Symbol	Min	Typ	Max	Unit	Remark
Forward voltage	V_F	-	3.2	-	V	
Forward current	I_F	60	80	-	mA	
LCM Luminance	L_V	300	350	-	cd/m ²	Note3
LED life time	Hr	-	50000	-	Hour	Note1,2
Uniformity	Avg	80	-	-	%	Note3

Note1: LED life time (Hr) can be defined as the time in which it continues to operate under the condition: $T_a=25\pm 3$ °C, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note2: The “LED life time” is defined as the module brightness decrease to 50% original brightness at $T_a=25$ °C and $I_L=80$ mA. The LED lifetime could be decreased if operating I_L is larger than 80mA. The constant current driving method is suggested.



Note3: Luminance Uniformity of these 9 points is defined as below:

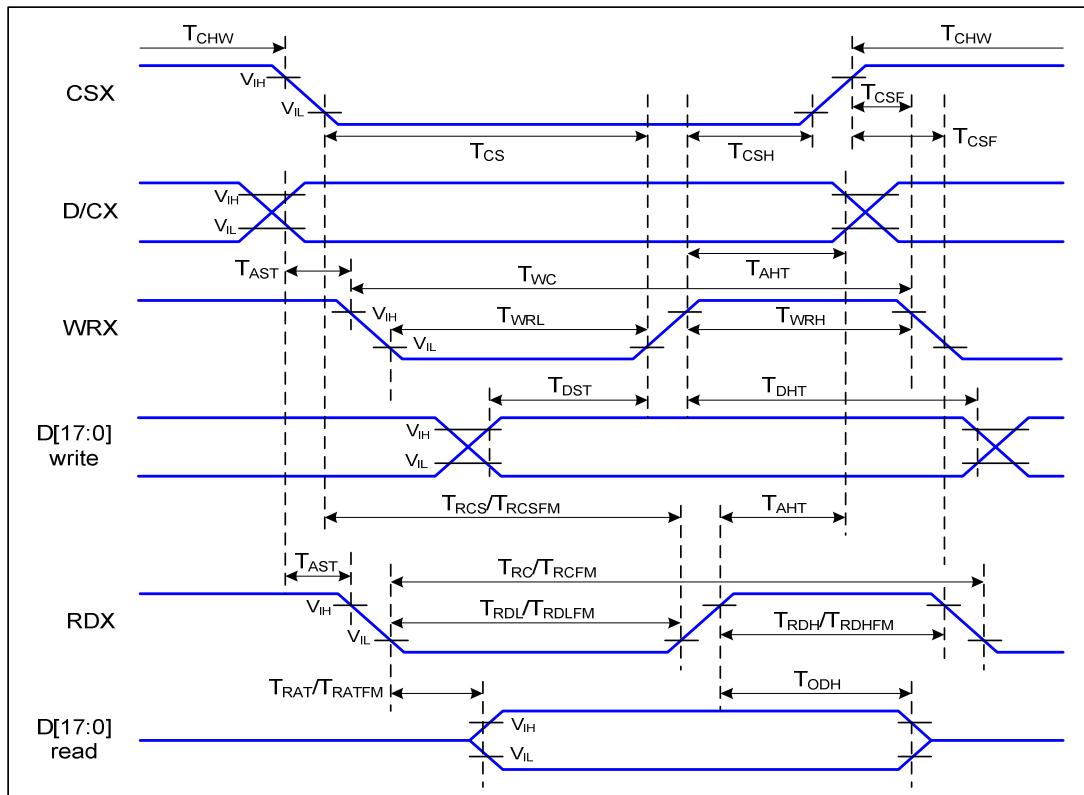


$$\text{Uniformity} = \frac{\text{minimun luminance in 9 points}(1-9)}{\text{maximun luminance in 9 points}(1-9)}$$

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

6.5 AC Characteristics

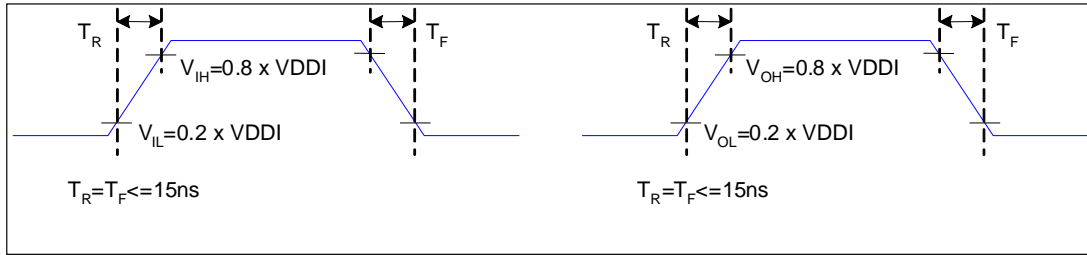
6.5.1 8080-Series MPU Parallel Interface Timing Characteristics



8080-series parallel interface characteristics

$V_{DDI}=1.8V, V_{DDA}=2.8V, AGND=0V, Ta=25^{\circ}C$

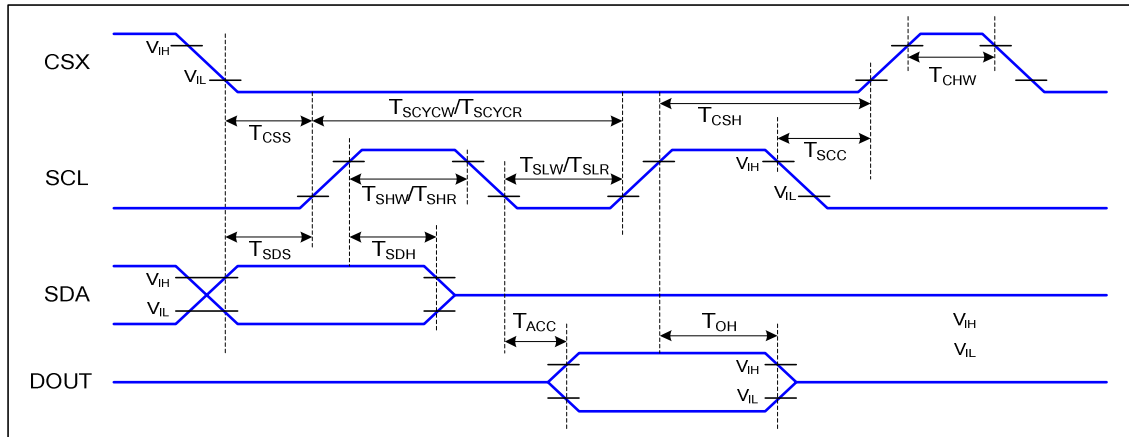
Signal	Symbol	Description	Min	Max	Unit	Note
D/CX	T_{AST}	Address setup time	0	-	ns	
	T_{AHT}	Address hold time(Write/Read)	10	-	ns	
CSX	T_{CHW}	Chip select "H" Pulse Width	0	-	ns	
	T_{CS}	Chip select setup time(Write)	10	-	ns	
	T_{RCS}	Chip select setup time(Read ID)	45	-	ns	
	T_{RCSFM}	Chip select setup time(Read FM)	355	-	ns	
	T_{CSF}	Chip select wait time(Write/Read)	10	-	ns	
	T_{CSH}	Chip select hold time	10	-	ns	
WRX	T_{WC}	Write cycle	66	-	ns	
	T_{WRH}	Control pulse H duration	15	-	ns	
	T_{WRL}	Control pulse L duration	15	-	ns	
RDX (ID)	T_{RC}	Read cycle (ID)	160	-	ns	When read ID data
	T_{RDH}	Control pulse H duration(ID)	90	-	ns	
	T_{RDL}	Control pulse L duration(ID)	45	-	ns	
RDX (FM)	T_{RCFM}	Read cycle (FM)	450	-	ns	When read from frame memory
	T_{RDHFM}	Control pulse H duration(FM)	90	-	ns	
	T_{RDLFM}	Control pules L duration(FM)	355	-	ns	
D[17...0]	T_{DST}	Data setup time	10	-	ns	For CL=30pF
	T_{DHT}	Data hold time	10	-	ns	
	T_{RAT}	Read access time(ID)	-	40	ns	
	T_{RATFM}	Read access time(FM)	-	340	ns	
	T_{ODH}	Output disable time	20	80	ns	



Rising and Falling Timing for I/O Signal

Note: The rising time and falling time (T_r , T_f) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 20% and 80% of V_{DDI} for Input signals.

6.5.2 3-SPI Serial Interface Timing Characteristics:

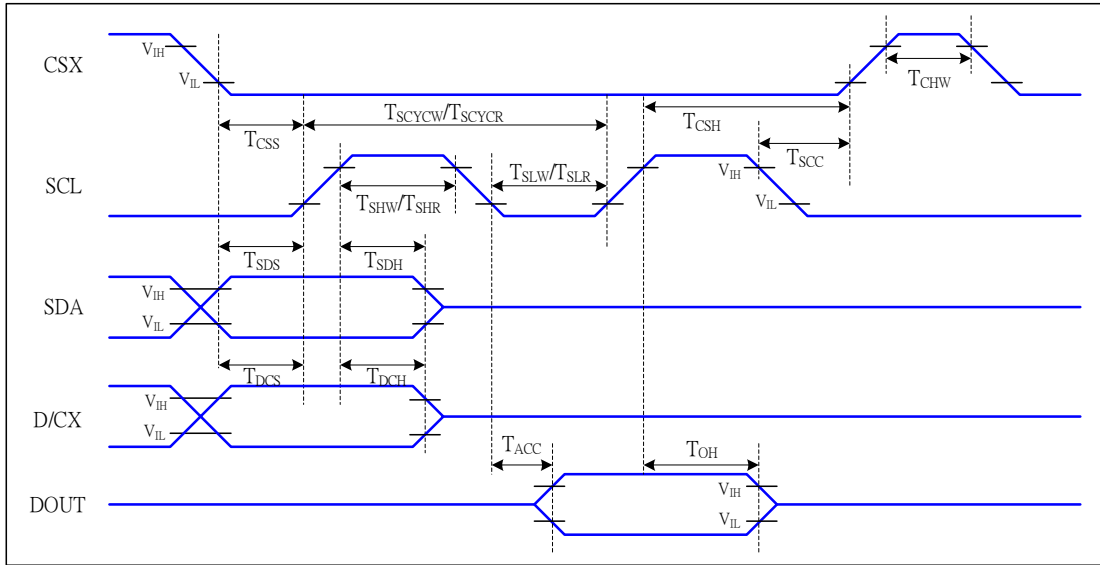


3-line serial Interface Timing Characteristics

$V_{DDI}=1.8V, V_{DDA}=2.8V, AGND=DGND=0V, T_a=25\text{ }^\circ\text{C}$

Signal	Symbol	Description	Min	Max	Unit	Remark
CSX	T _{CSS}	Chip Select Setup Time (Write)	15	-	ns	
	T _{CSH}	Chip Select Hold Time (Write)	15	-	ns	
	T _{CSS}	Chip Select Setup Time (Read)	60	-	ns	
	T _{SCC}	Chip Select Hold Time (Read)	65	-	ns	
	T _{CHW}	Chip Select "H" Pulse Width	40	-	ns	
SCL	T _{SCYCW}	Serial Clock Cycle (Write)	66	-	ns	
	T _{SHW}	SCL "H" Pulse Width (Write)	15	-	ns	
	T _{SLW}	SCL "L" Pulse Width (Write)	15	-	ns	
	T _{SCYCR}	Serial Clock Cycle (Read)	150	-	ns	
	T _{SHR}	SCL "H" Pulse Width (Read)	60	-	ns	
	T _{SLR}	SCL "L" Pulse Width (Read)	60	-	ns	
SDA (DIN)	T _{SDS}	Data Setup Time	10	-	ns	
	T _{SDH}	Data Hold Time	15	-	ns	
DOUT	T _{ACC}	Access Time	10	50	ns	For Maximum CL=30pF
	T _{OH}	Output Disable Time	15	50	ns	For Minimum CL=8pF

6.5.3 4-SPI Serial Interface Timing Characteristics:

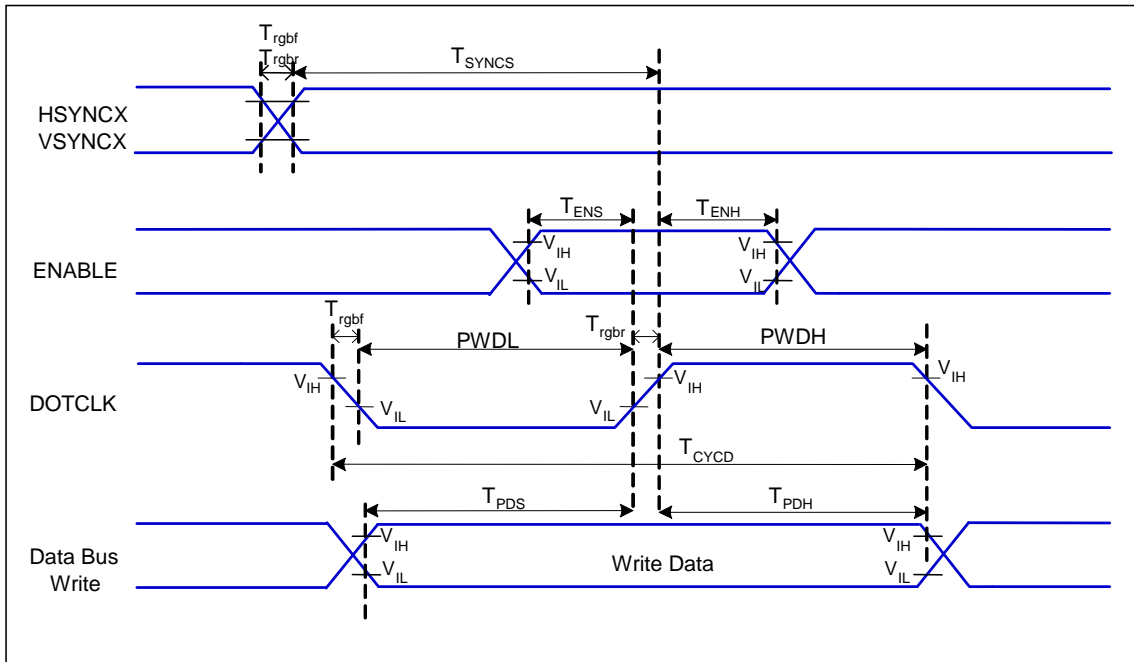


4-line serial Interface Timing Characteristics

V_{DDI}=1.8V, V_{DDA}=2.8V, AGND=DGND=0V, T_a=25 °C

Signal	Symbol	Description	Min	Max	Unit	Remark
CSX	T _{CSS}	Chip Select Setup Time (Write)	15	-	ns	
	T _{CSH}	Chip Select Hold Time (Write)	15	-	ns	
	T _{CSS}	Chip Select Setup Time (Read)	60	-	ns	
	T _{SCC}	Chip Select Hold Time (Read)	65	-	ns	
	T _{CHW}	Chip Select "H" Pulse Width	40	-	ns	
SCL	T _{SCYCW}	Serial Clock Cycle (Write)	66	-	ns	
	T _{SHW}	SCL "H" Pulse Width (Write)	15	-	ns	-write command & data ram
	T _{SLW}	SCL "L" Pulse Width (Write)	15	-	ns	
	T _{SCYCR}	Serial Clock Cycle (Read)	150	-	ns	
	T _{SHR}	SCL "H" Pulse Width (Read)	60	-	ns	-read command & data ram
	T _{SLR}	SCL "L" Pulse Width (Read)	60	-	ns	
D/CX	T _{DCS}	D/CX Setup Time	10	-	ns	
	T _{DCH}	D/CX Hold Time	10	-	ns	
SDA (DIN)	T _{SDS}	Data Setup Time	10	-	ns	
	T _{SDH}	Data Hold Time	10	-	ns	
DOUT	T _{ACC}	Access Time	10	50	ns	For Maximum CL=30pF
	T _{OH}	Output Disable Time	15	50	ns	For Minimum CL=8pF

6.5.4 RGB Interface Timing Characteristics:



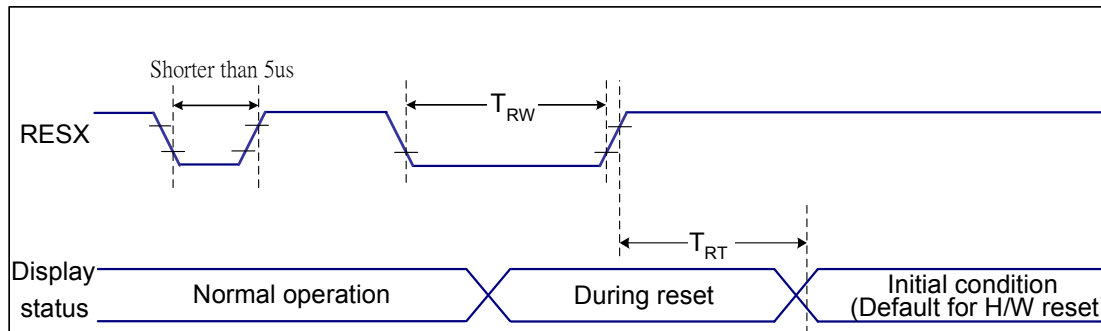
RGB Interface Timing Characteristics

$V_{\text{DDI}}=1.8\text{V}, V_{\text{DDA}}=2.8\text{V}, A_{\text{GND}}=D_{\text{GND}}=0\text{V}, T_a=25\text{ }^\circ\text{C}$

Signal	Symbol	Description	Min	Max	Unit	Remark
HSYNC, VSYNC	T_{SYNCX}	VSYNC, HSYNC Setup Time	15	-	ns	
ENABLE	T_{ENS}	Enable Setup Time	15	-	ns	
	T_{ENH}	Enable Hold Time	15	-	ns	
DOTCLK	P_{WDH}	DOTCLK High-level Pulse Width	30	-	ns	
	P_{WDL}	DOTCLK Low-level Pulse Width	30	-	ns	
	T_{CYCD}	DOTCLK Cycle Time	66	-	ns	
	$T_{\text{rghr}}, T_{\text{rghf}}$	DOTCLK Rise/Fall time	-	15	ns	
DB	T_{PDS}	PD Data Setup Time	15	-	ns	
	T_{PDH}	PD Data Hold Time	15	-	ns	

6.5.5 Display RESET Timing Characteristics

Reset input timing



Timing Parameters

$$VDDI=1.8V, VDDA=2.8V, AGND=DGND=0V, Ta=25\text{ }^{\circ}\text{C}$$

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

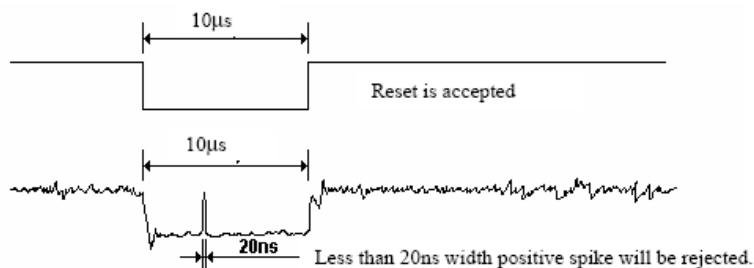
Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

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

RESX Pulse	Action
Shorter than $5\mu\text{s}$	Reset Rejected
Longer than $9\mu\text{s}$	Reset
Between $5\mu\text{s}$ and $9\mu\text{s}$	Reset starts

Note 3: During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, 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.

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



Note 5: When Reset applied during Sleep In Mode.

Note 6: When Reset applied during Sleep Out Mode.

Note 7: It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

7 CTP Specification

7.1 Electrical Characteristics

7.1.1 Absolute Maximum Rating

Item	Symbol	Min	Max	Unit	Note
Power Supply Voltage	VDDA -VSSA	-0.3	3.6	V	1,2
Power Supply Voltage2	VDD3 - VSS	-0.3	3.6	V	1,3
I/O Digital Voltage	IOVCC	1.8	3.6	V	1
Operating Temperature	TOP	-30	+85	°C	1
Storage Temperature	TST	-30	+85	°C	1

Notes

1. If used beyond the absolute maximum ratings, FT6336G may be permanently damaged. 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.
2. Make sure VDDA (high) \geq VSSA (low).
3. Make sure VDD(high) \geq VSS(low)

7.1.2 DC Electrical Characteristics

(VDDA=2.8~3.6V, Ta=-40~85°C)

Item	Symbol	Min	Type	Max	Unit	Remark
Input low -level voltage	VIL	-0.3	-	0.3 x IOVCC	V	
Input high-level voltage	VIH	0.7 x IOVCC	-	IOVCC	V	
Output low -level voltage	VOL	-	-	0.3 x IOVCC	V	IOH=0.1mA
Output high -level voltage	VOH	0.7 x IOVCC	-	-	V	IOH=-0.1mA
I/O leakage current	ILI	-1	-	1	μA	Vin=0~VDDA
Current consumption (Normal operation mode)	Iopr	-	4.32*1	-	mA	VDDA =VDD3= 2.8V Ta=25°C MCLK=18MHz
Current consumption (Monitor mode)	Imon	-	220*2	-	mA	VDDA =VDD3= 2.8V Ta=25°C MCLK=18MHz
Current consumption (Sleep mode)	Islp	-	55	-	μA	VDDA =VDD3= 2.8V Ta=25°C
Step-up output voltage	VDD5	-	5	-	V	VDDA = VDD3=2.8V
Power Supply voltage	VDDA VDD3	2.8	-	3.3	V	

*1: Report Rate: 75Hz @ 4"TP

*2: Report Rate: 25Hz @ 4"TP

7.1.3 AC Characteristics

AC Characteristics of Oscillators

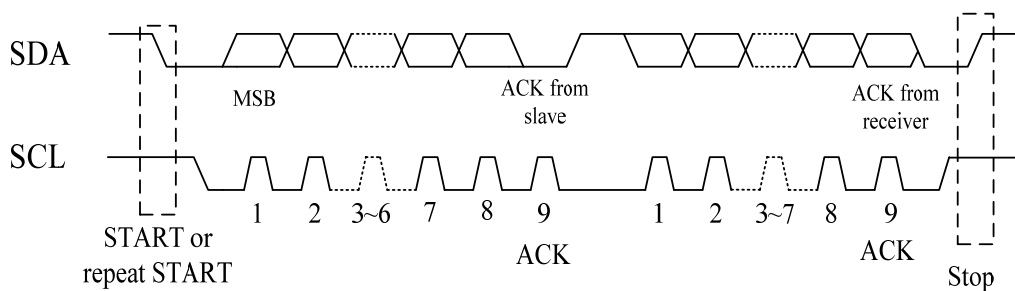
Item	Symbol	Min	Typ	Max	Unit	Remark
OSC clock 1	fosc1	34.64	36	36.36	MHz	VDDA= 2.8V; Ta=25°C

AC Characteristics of sensor

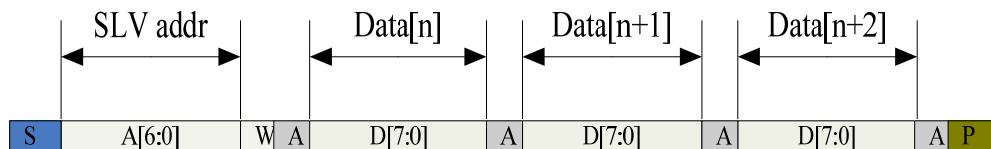
Item	Symbol	Min	Typ	Max	Unit	Remark
Sensor acceptable clock	ftx	0	100	300	KHz	VDDA= 2.8V; Ta=25°C
Sensor output rise time	Ttxr	-	100	-	nS	VDDA= 2.8V; Ta=25°C
Sensor output fall time	Ttxf	-	80	-	nS	VDDA= 2.8V; Ta=25°C
Sensor input voltage	Trxi	-	5	-	V	VDDA= 2.8V; Ta=25°C

7.2 I2C Timing

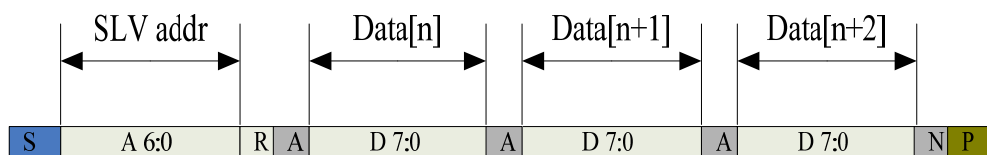
The I2C is always configured in the Slave mode. The data transfer format is shown in the figure below:



I2C Serial Data Transfer Format



I2C master write,slave read



I2C master read,slave write

Mnemonics Description

Item	Unit
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 Characteristic

Parameter	Min	Max	Unit
SCL frequency	10	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	\	μs
Setup time for a repeated START condition	4.7	\	μs
Setup Time for STOP condition	4.0	\	μs

8 Reliability

Test Item	Content of Test	Test Condition	Note
High Temperature Storage	Endurance test applying the high storage temperature for a long time.	80°C 96hrs	2
Low Temperature Storage	Endurance test applying the high storage temperature for a long time.	-30°C 96hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70°C 96hrs	-
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20°C 96hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60°C,90%RH max, for 96hrs under no-load condition excluding the polarizer. Then taking it out and drying it at normal temperature.	60°C,90%RH 96hrs	1,2
Thermal Shock Resistance	The sample should be allowed stand the following 10 cycles of operation	-10°C/60°C 20 cycles	-

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal. Temperature and humidity after remove from the rest chamber.

9 Warranty and Conditions

<http://www.displaymodule.com/pages/faq> HYPERLINK

"http://www.displaymodule.com/pages/faq"