



晶采光電科技股份有限公司
AMPIRE CO., LTD.

SPECIFICATIONS FOR LCD MODULE

CUSTOMER	
CUSTOMER PART NO.	
AMPIRE PART NO.	AM-480272MMTMQW-T65H-I
APPROVED BY	
DATE	

- Approved For Specifications
- Approved For Specifications & Sample

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RECORD OF REVISION

Revision Date	Page	Contents	Editor
2016/04/26	--	New Release	Mark

1. FEATURES

- (1) Construction : Amorphous silicon TFT-LCD with driving system, Stainless Bezel and White LED Backlight.
- (2) LCD type : Transmissive , Normally White.
- (3) Interface : 24bit RGB interface.
- (4) Power Supply Voltage: 3.3V power input for TFT, built-in power supply circuit.
- (5) Capacitive Touch Panel.
- (6) Touch Controller : ST1633i , I2C Interface
- (7) Viewing Direction: 6 o'clock (Gray Inversion)
- (8) LCD driver IC: ST7282T
- (9) New LCD Color Filter

2. PHYSICAL SPECIFICATIONS

Item	Specifications	unit
Display size (diagonal)	4.3	inch
Resolution	480 RGB(H) x 272(V)	Dot
Display area	95.04 (H) x 53.856 (V)	mm
Pixel pitch	0.198 (H) x 0.198 (V)	mm
Overall dimension	118.04 x 78.76 x 5.675 (Typ.)	mm
Color configuration	R.G.B Vertical stripe	
Brightness	425	cd/m ²
Backlight unit	LED	

3. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	VDD	-0.3	--	4	V	GND=0
Logic Signal Input Level	V _I	-0.3	--	4	V	
LED Current	I _L	--	40	--	mA	(1)(2)(3)
LED voltage	V _L	--	19.8	--	V	(1)(2)(3)
Operating Temperature	T _{ops}	-20	--	70	°C	
Storage Temperature	T _{stg}	-30	--	80	°C	

Note :

- (1) Permanent damage may occur to the LCD module if beyond this specification.
Functional operation should be restricted to the conditions described under normal operating conditions.
- (2) Ta =25±2°C
- (3) Test Condition: LED current 40 mA. The LED lifetime could be decreased if operating I_L is larger than 40mA.

4. OPTICAL CHARACTERISTICS

4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing Angle	Left	Θ_L	$CR \geq 10$	65	70	--	deg.	(1)(4)
	Right	Θ_R		65	70	--		
	Up	Θ_U		40	50	--		
	Down	Θ_D		60	70	--		
Contrast ratio		CR	$\Theta=0$ Normal viewing angle	400	500	--	--	(1)(2)
Response Time	Rising	T_R		--	8	10	msec	(1)(3)
	Falling	T_F		--	17	20	msec	
Color chromaticity (CIE1931)	White	W_x		0.26	0.31	0.36	--	(1)(4)
		W_y		0.28	0.33	0.38		
White Luminance (Center)		Y_L		340	425	--	cd/m ²	(1)(4)(7) (IL=40mA)
Brightness Uniformity		B_{UNI}	70	--	--	%	(5)(7)	

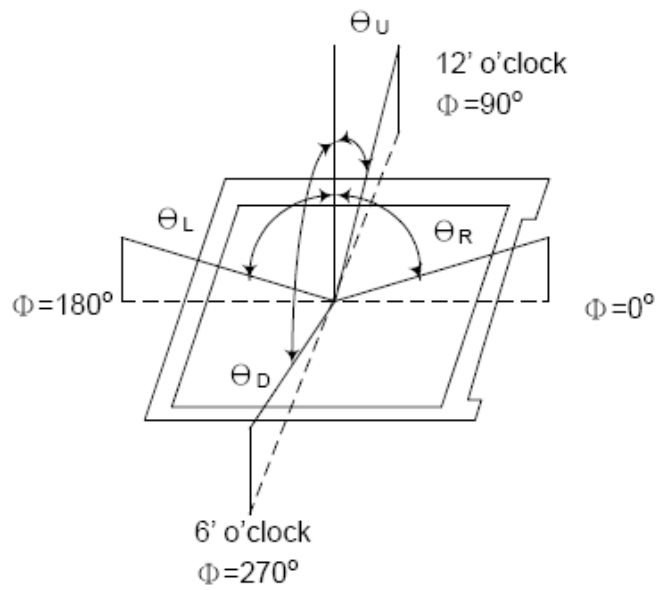
4.2 Measuring Condition

- (1) Measuring surrounding : dark room
- (2) LED current I_L : 40mA
- (3) Ambient temperature : 25±2°C
- (4) 15min. warm-up time.

4.3 Measuring Equipment

- (1) FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.
- (2) Measuring spot size : 20 ~ 21 m

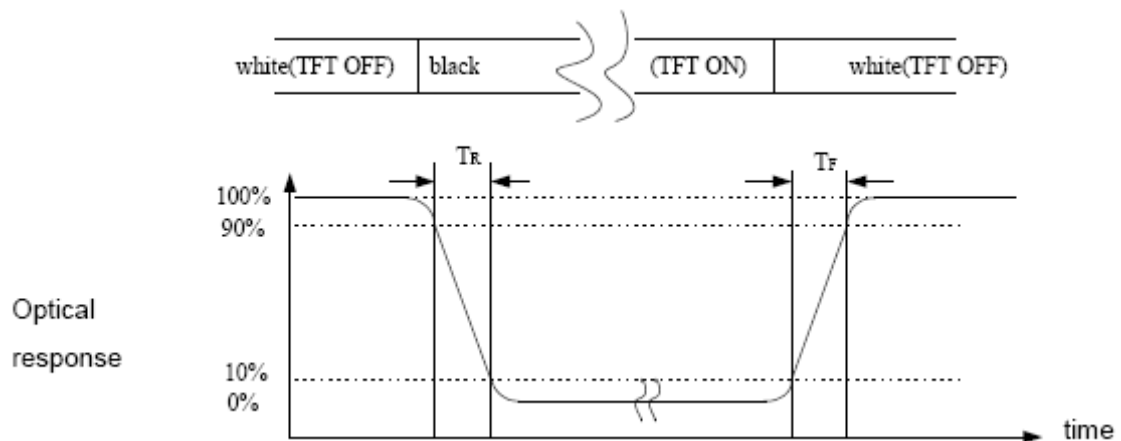
Note (1) Definition of Viewing Angle :



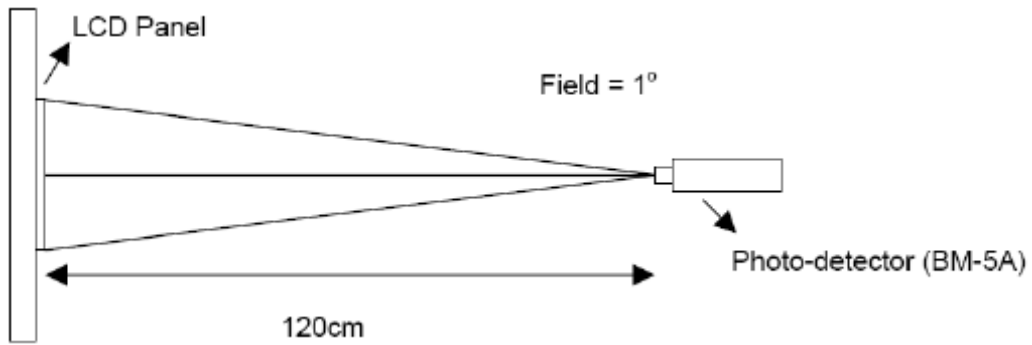
Note (2) Definition of Contrast Ratio (CR) :
measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

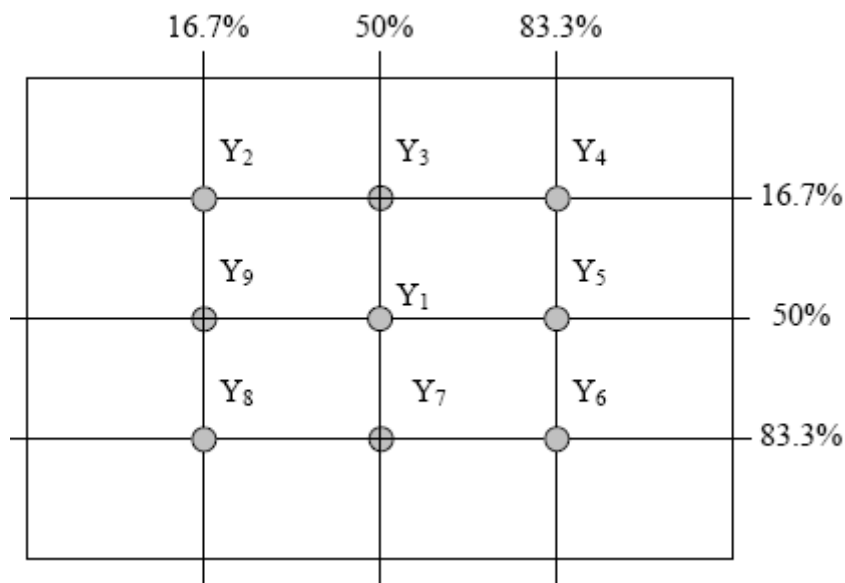
Note (3) Definition of Response Time : Sum of T_R and T_F



Note (4) Definition of optical measurement setup



Note (5) Definition of brightness uniformity



$$\text{Luminance uniformity} = \frac{\text{(Min Luminance of 9 points)}}{\text{(Max Luminance of 9 points)}} \times 100\%$$

Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.)

Note (7) Measured at the brightness of the panel when all terminals of LCD panel are electrically open.

5. ELECTRICAL CHARACTERISTICS

5.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	V _{DD}	3.0	3.3	3.6	V	
Input signal voltage	V _{IH}	0.7V _{DD}	--	V _{DD}	V	Note(1)
	V _{IL}	0	--	0.3V _{DD}	V	
Current of power supply	I _{CC}	--	55	--	mA	V _{DD} =3.3V

Note (1) : HSYNC , VSYNC , DE , R/G/B Data

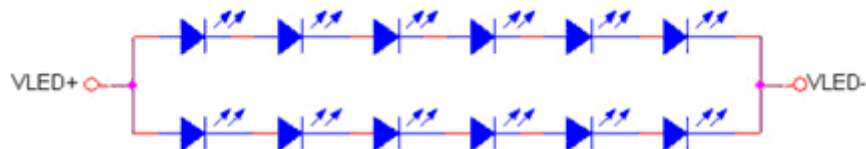
Note (2) : GND = 0V

5.2 Back-Light Unit

The back-light system is an edge-lighting type with 12 LED.

The characteristics of the LED are shown in the following tables.

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED current	I _L	--	40	--	mA	(2)
LED voltage	V _L	--	19.8	--	V	
Operating LED life time	Hr	20K	25K	--	Hours	(1)(2)

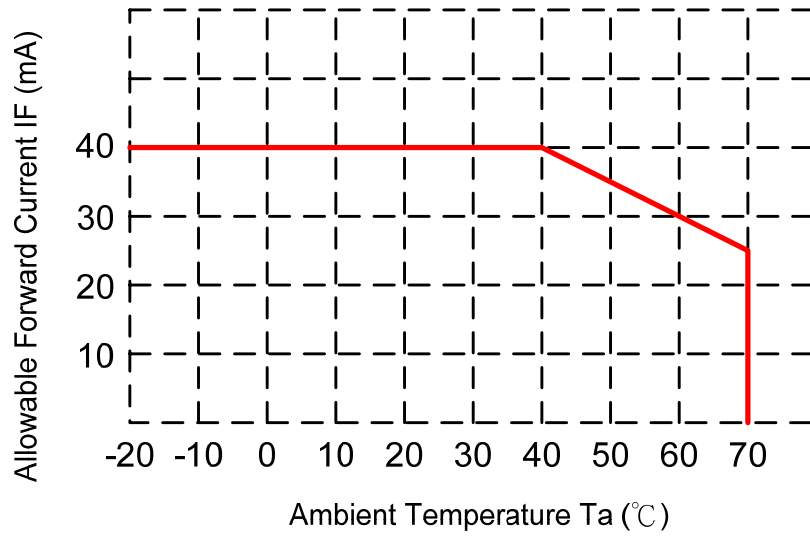


LED Light Bar Circuit

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: $T_a=25\pm 3^\circ\text{C}$, typical I_L value indicated in the above table until the brightness becomes less than 50%.

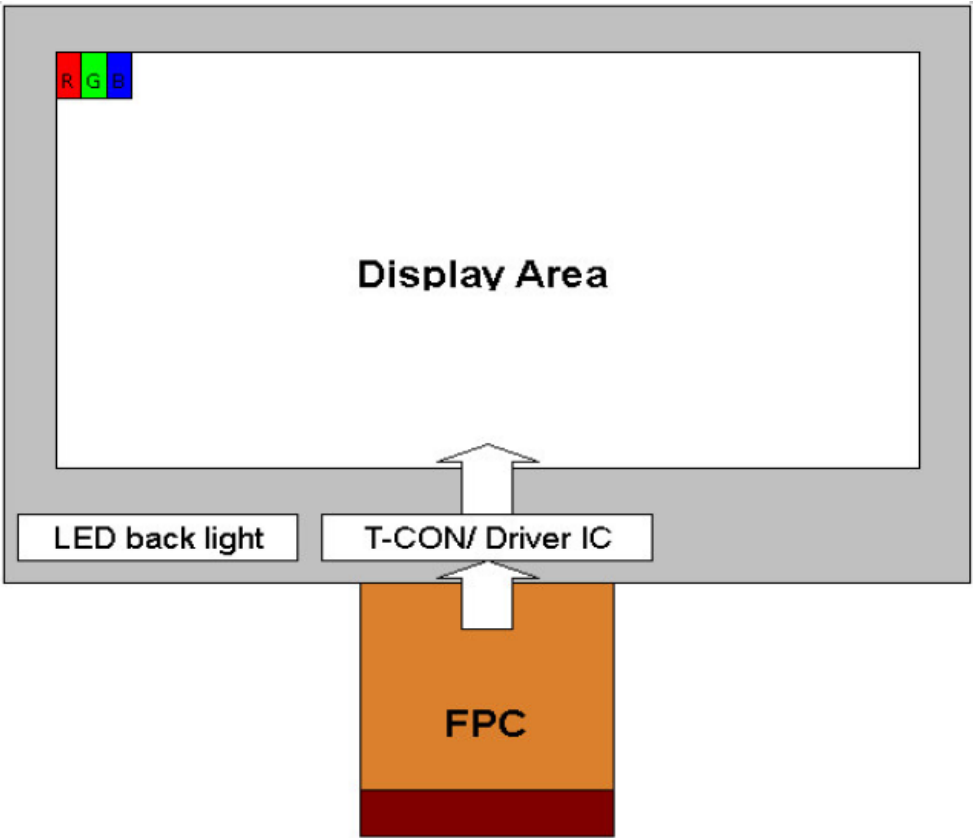
Note (2) The "LED life time" is defined as the module brightness decrease to 50% original brightness at $T_a=25^\circ\text{C}$ and I_L=40mA. The LED lifetime could be decreased if operating I_L is larger than 40mA. The constant current driving method is suggested.

The constant current source is needed for white LED back-light driving. When LCM is operated over 60°C ambient temperature, the I_L of the LED back-light should be adjusted to 30mA max.

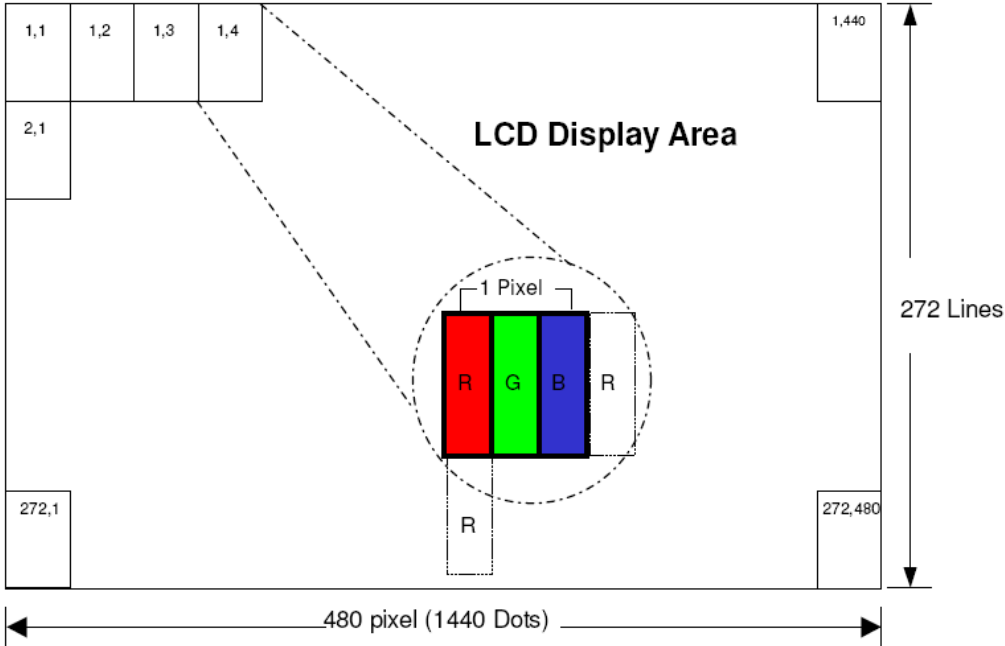


6. BLOCK DIAGRAM

6.1 TFT LCD Module



6.2 Pixel Format



7. INTERFACE PIN ASSIGNMENT

FPC connector is used for electronics interface. The recommended model is FH19SC-40S-0.5SH (05) manufactured by HIROSE

Pin no	Symbol	I/O	Function	Note
1	VLED-	P	Power for LED Backlight Cathode	
2	VLED+	P	Power for LED Backlight Anode	
3	GND	P	Power Ground	
4	VDD	P	Power Voltage	
5	R0	I	Red Data (LSB)	
6	R1	I	Red Data	
7	R2	I	Red Data	
8	R3	I	Red Data	
9	R4	I	Red Data	
10	R5	I	Red Data	
11	R6	I	Red Data	
12	R7	I	Red Data (MSB)	
13	G0	I	Green Data (LSB)	
14	G1	I	Green Data	
15	G2	I	Green Data	
16	G3	I	Green Data	
17	G4	I	Green Data	
18	G5	I	Green Data	
19	G6	I	Green Data	
20	G7	I	Green Data (MSB)	
21	B0	I	Blue Data (LSB)	
22	B1	I	Blue Data	
23	B2	I	Blue Data	
24	B3	I	Blue Data	
25	B4	I	Blue Data	
26	B5	I	Blue Data	
27	B6	I	Blue Data	

28	B7	I	Blue Data (MSB)	
29	GND	P	Power Ground	
30	DCLK	I	Pixel Clock Data latched at rising edge of this signal.	
31	DISP	I	Display On(Hi)/ Off(Lo)	
32	HSYNC	I	Horizontal Sync Signal	
33	VSYNC	I	Vertical Sync Signal	
34	DE	I	Data Enable	
35	NC	--	No connect	
36	GND	P	Power Ground	
37	X_R	I/O	No Connection	
38	Y_B	I/O	No Connection	
39	X_L	I/O	No Connection	
40	Y_T	I/O	No Connection	

I/O : I: input, O: output, P: power

7.2 Capacitive Touch Panel FPC Descriptions

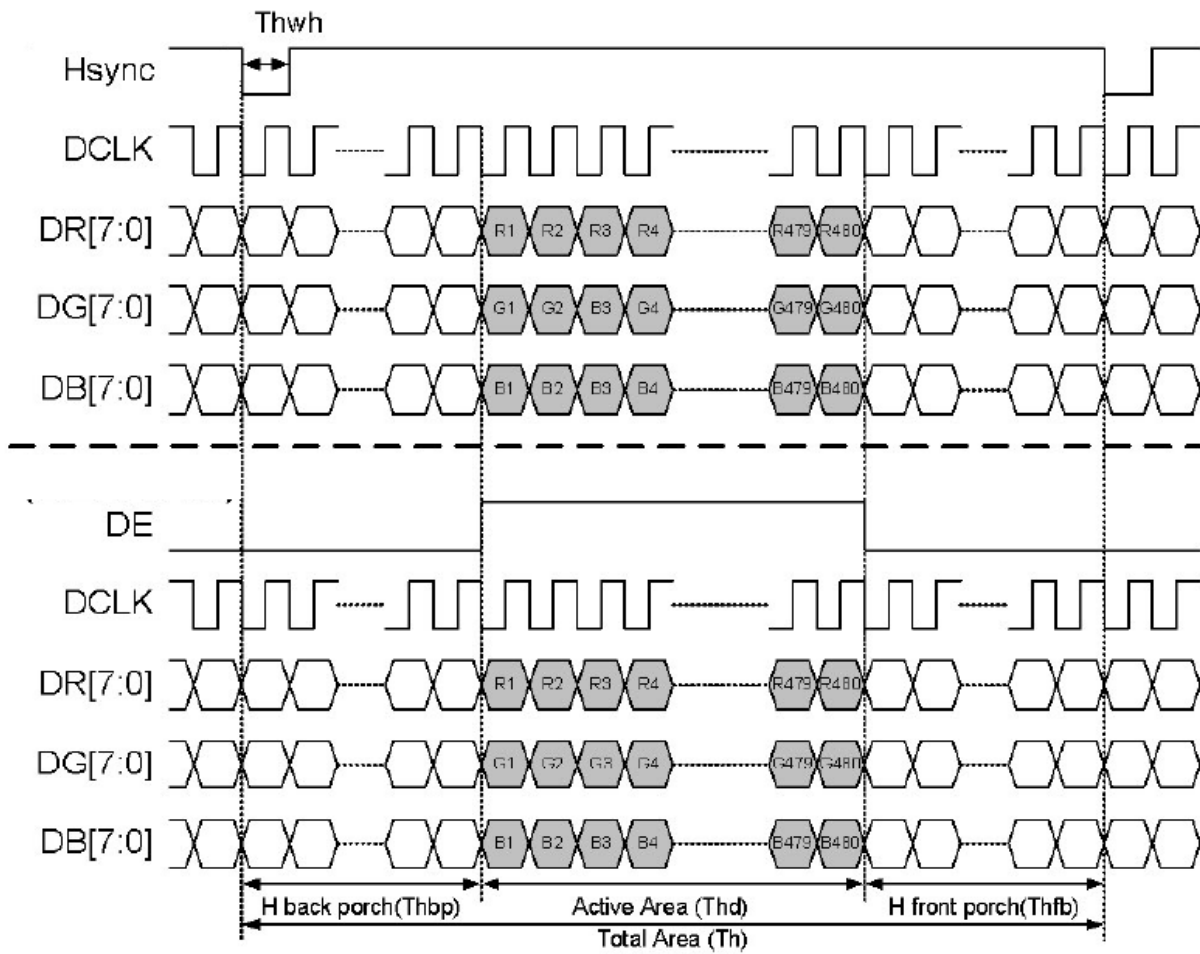
No.	Symbol	I/O	Description	Remark
1.	GND	-	Ground.(0V)	
2.	SDA	I/O	I2C Interface.	
3.	SCL	I		
4.	VDD	-	Power Supply for TP controller.(3.3V)	
5.	INT	O	IRQ Terminal.	
6.	XRES	I	Terminal of Reset TP controller.	

8. INTERFACE TIMING

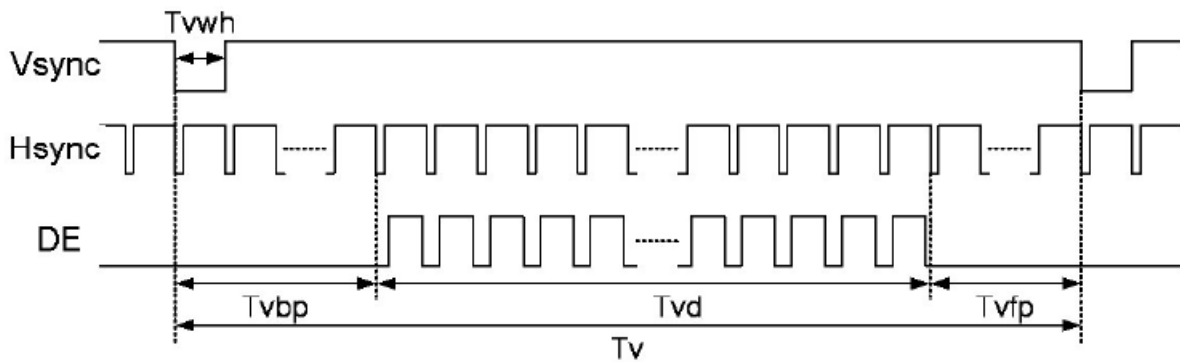
8.1 Parallel 24*bit RGB Input Timing Table

Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK frequency	Fclk	8	9	12	MHz	
VSYNC period time	Tv	285	286	399	Th	
VSYNC display area	Tvd	272			Th	
VSYNC back porch	Tvbp	1	2	11	Th	
VSYNC front porch	Tvfp	1	2	227	Th	
VSYNC pulse width	Tvwh	1	10	11	Th	
HSYNC period time	Th	525	525	605	DCLK	
HSYNC display area	Thd	480			DCLK	
HSYNC back porch	Thbp	36	40	255	DCLK	
HSYNC front porch	Thfp	2	2	82	DCLK	
HSYNC pulse width	Thwh	2	2	41	DCLK	

Parallel 24-bit RGB Mode Data Format (DE Mode)



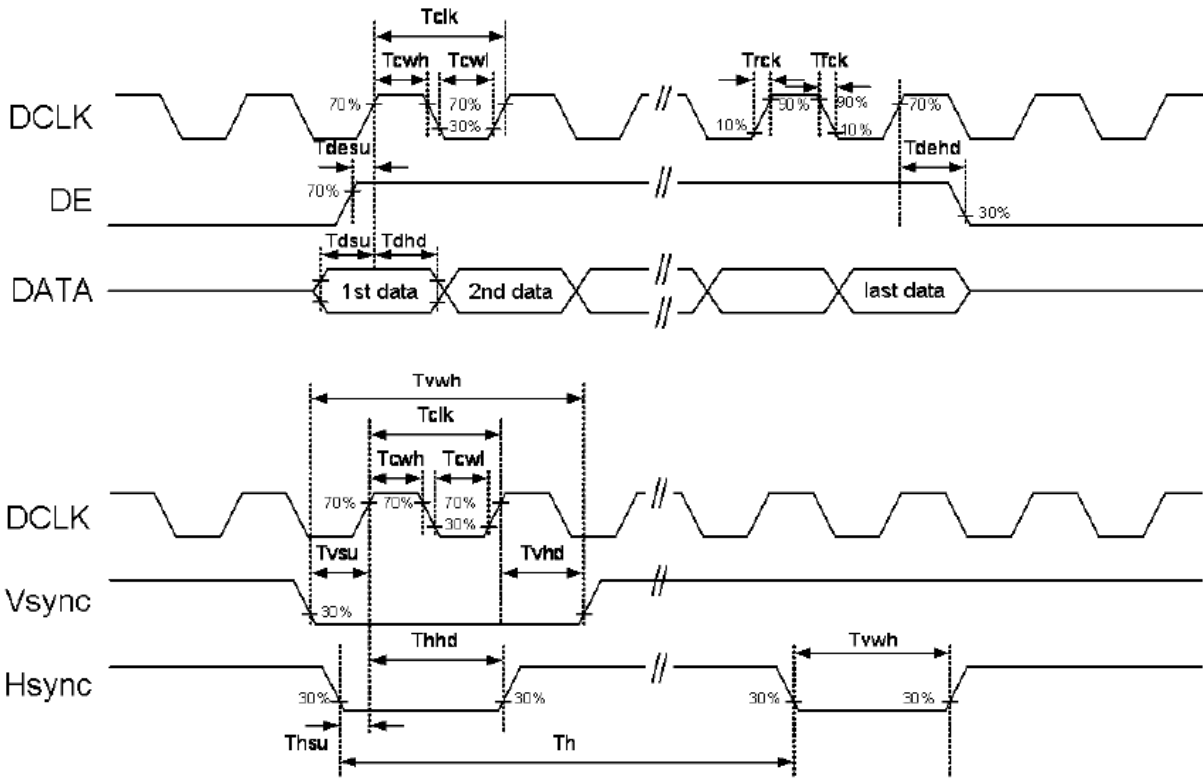
Vertical Input Timing



8.2 AC Electrical Characteristics

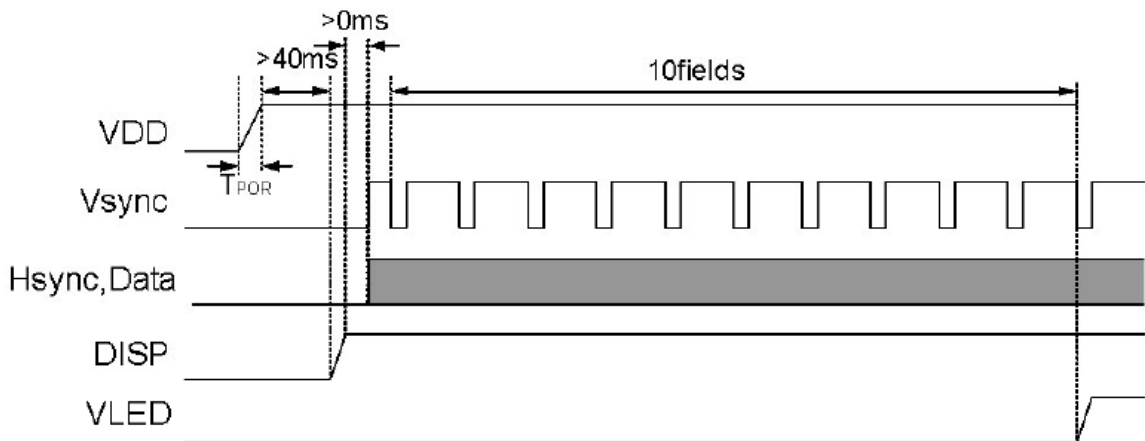
Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK period time	Tclk	66.7	--	--	ns	
DCLK rising time	Trck	--	--	6.65	ns	
DCLK falling time	Tfck	--	--	6.65	ns	
DCLK pulse duty	Tcwh	40	50	60	%	
DE setup time	Tdesu	10	--	--	ns	
DE hold time	Tdehd	10	--	--	ns	
HSYNC pulse width	Thwh	2	--	--	DCLK	
HSYNC setup time	Thsu	10	--	--	ns	
HSYNC hold time	Thhd	10	--	--	ns	
VSYNC pulse width	Tvwh	1	--	--	Th	
VSYNC setup time	Tvsu	10	--	--	ns	
VSYNC hold time	Tvhd	10	--	--	ns	
Data setup time	Tdsu	10	--	--	ns	
Data hold time	Tdhd	10	--	--	ns	

Clock and Data Input Timing Diagram

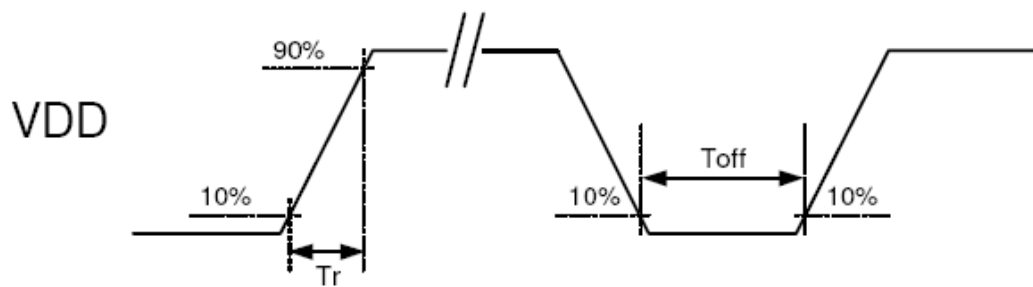
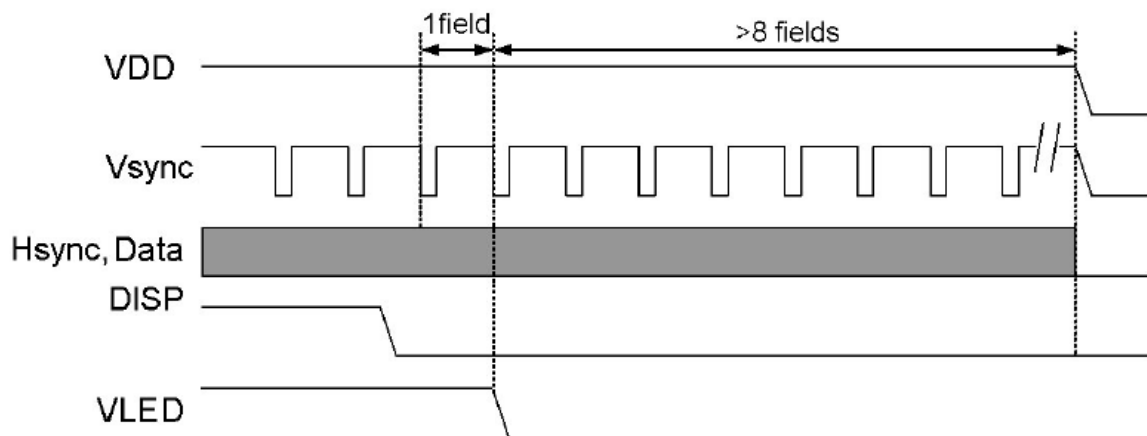


8.3 Power Sequence

Power On Sequence



Power Off Sequence



VDD power input timing

Notes:

- Data include R0~R7, G0~G7, B0~B7, HSD, VSD, DCLK, DE
- Power on sequence: VDD \rightarrow DISP \rightarrow Data \rightarrow V_{LED}
- Power off sequence: DISP \rightarrow V_{LED} \rightarrow Data \rightarrow VDD
- VDD power input timing: $0.5\text{ms} < Tr < 10\text{ms}$; $Toff > 500\text{ms}$

9. TP controller

ST1633 equipped with I2C provides two wires, serial data (SDA) and serial clock (SCL), to carry transferring information at up to 400 kbit/s(Fast mode). ST1633 plays the slave role in I2C transfer. Both SDA and SCL are bidirectional lines, connected to IOVDD via pull-up resistors. All transactions begin with a START (S) and can be terminated by a STOP (P). 7-bits address follows START to recognize device. Each byte is 8-bits length and followed by an acknowledge bit. A HIGH to LOW transition on the SDA line while SCL is HIGH defines a START condition. A LOW to HIGH transition on the SDA line while SCL is HIGH defines a STOP condition. The data on the SDA line must be stable during the HIGH period of the clock. The HIGH or LOW state of the data line can only change when the clock signal on the SCL line is LOW.

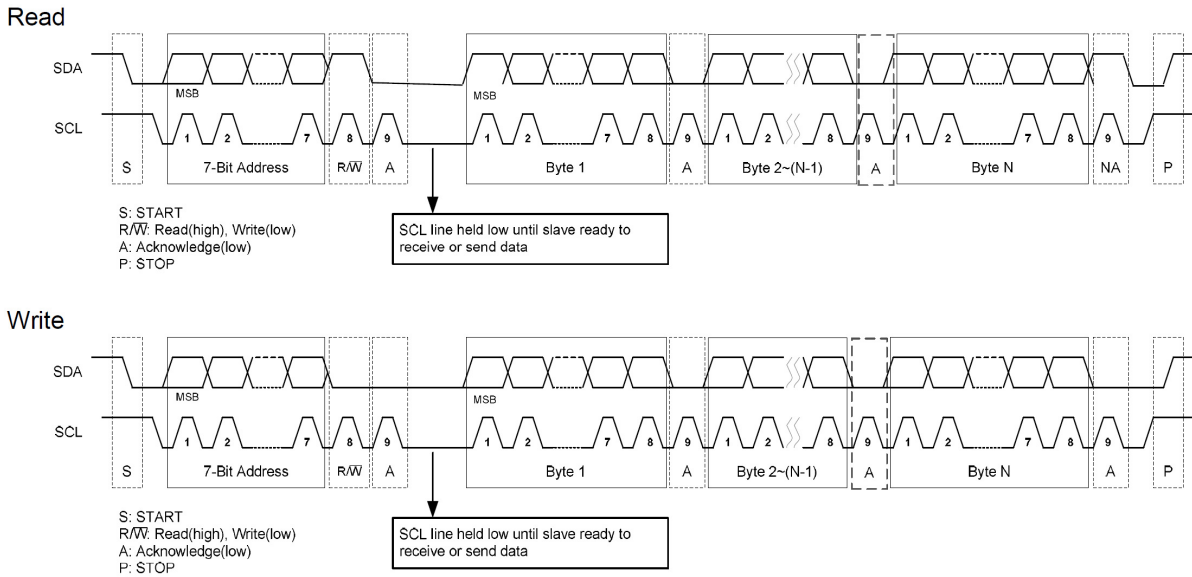


Figure 4-1 I2C Waveform

Parameter	Symbol	Min.	Typ.	Max.	Unit
VDD	V_{VDD}	2.7	-	3.6	V

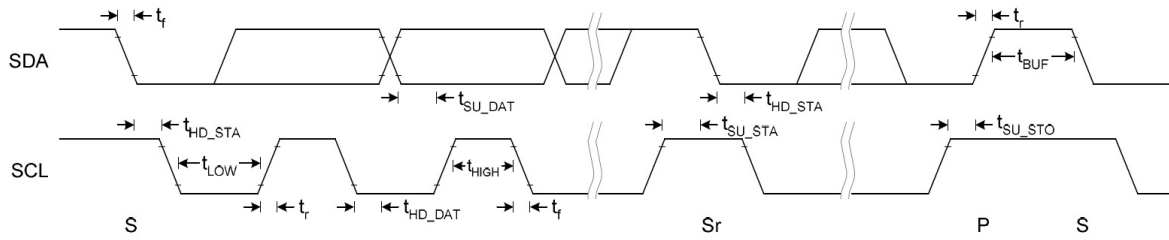


Figure 5-1 I2C Fast Mode Timing

Table 5-3 I2C Fast Mode Timing Characteristic

Conditions: VDD = 3.3V, GND = 0V, T_A = 25°C

Symbol	Parameter	Rating			Unit
		Min.	Typ.	Max.	
f _{SCL}	SCL clock frequency	0	-	400	kHz
t _{LOW}	Low period of the SCL clock	1.3	-	-	us
t _{HIGH}	High period of the SCL clock	0.6	-	-	us
t _f	Signal falling time	-	-	300	ns
t _r	Signal rising time	-	-	300	ns
t _{SU_STA}	Set up time for a repeated START condition	0.6	-	-	us
t _{HD_STA}	Hold time (repeated) START condition. After this period, the first clock pulse is generated	0.6	-	-	us
t _{SU_DAT}	Data set up time	100	-	-	ns
t _{HD_DAT}	Data hold time	0	-	0.9	us
t _{SU_STO}	Set up time for STOP condition	0.6	-	-	us
t _{BUF}	Bus free time between a STOP and START condition	1.3	-	-	us
C _b	Capacitive load for each bus line	-	-	400	pF

10. Reliability Test Items

Test Item	Test Conditions	Note
High Temperature Operation	70±3°C , t=240 hrs	
Low Temperature Operation	-20±3°C , t=240 hrs	
High Temperature Storage	80±3°C , t=240 hrs	1,2
Low Temperature Storage	-30±3°C , t=240 hrs	1,2
Storage at High Temperature and Humidity	60°C, 90% RH , 240 hrs	1,2
Thermal Shock Test	-20°C (30min) ~ 70°C (30min) 100 cycles	1,2
Vibration Test (Packing)	Sweep frequency : 10 ~ 55 ~ 10 Hz/1min Amplitude : 0.75mm Test direction : X.Y.Z/3 axis Duration : 30min/each axis	2

Note 1 : Condensation of water is not permitted on the module.

Note 2 : The module should be inspected after 1 hour storage in normal conditions (15-35°C , 45-65%RH).

11. GENERAL PRECAUTION

11-1 Use Restriction

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

11-2 Disassembling or Modification

Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. Ampire does not warrant the module, if customers disassemble or modify the module.

11-3 Breakage of LCD Panel

- (1) If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.
- (2) If liquid crystal contacts mouth or eyes, rinse out with water immediately.
- (3) If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.
- (4) Handle carefully with chips of glass that may cause injury, when the glass is broken.

11-4 Electric Shock

- (1) Disconnect power supply before handling LCD module.
- (2) Do not pull or fold the LED cable.
- (3) Do not touch the parts inside LCD modules and the fluorescent LED's connector or cables in order to prevent electric shock.

11-5 Absolute Maximum Ratings and Power Protection Circuit

- (1) Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged.
- (2) Please do not leave LCD module in the environment of high humidity and high temperature for a long time.
- (3) It's recommended to employ protection circuit for power supply.

11-6 Operation

- (1) Do not touch, push or rub the polarizer with anything harder than HB pencil lead.
- (2) Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.
- (3) When the surface is dusty, please wipe gently with absorbent cotton or other soft material.
- (4) Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may causes deformation or color fading.
- (5) When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzine or other adequate solvent.

11-7 Mechanism

Please mount LCD module by using mounting holes arranged in four corners tightly.

11-8 Static Electricity

- (1) Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.
- (2) Because LCD module use CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge. Persons who handle the module should be grounded through adequate methods.

11-9 Strong Light Exposure

The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.

11-10 Disposal

When disposing LCD module, obey the local environmental regulations.

11-11 Others

- (1) AMIPRE will provide one year warrantee for all products and three months warrantee for all repairing products.
- (2) Do not keep the LCD at the same display pattern continually. The residual image will happen and it will damage the LCD. Please use screen saver

12. OUTLINE DIMENSION

