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TFT | OLED | CHARACTER | GRAPHIC | UWVD | SEGMENT | CUSTOM

Graphic Display Module

Part Number

G12864C-KW-DW63

Overview:

- 128x64 Graphic LCD
- FSTN Negative, White
- 89.70x49.80mm Module
- Parallel & Serial Interfaces
- White LED Backlight

- Transmissive
- Wide Temp Range
- 3.0V
- LCD IC: ST7565P
- RoHS Compliant

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Graphic LCD Features
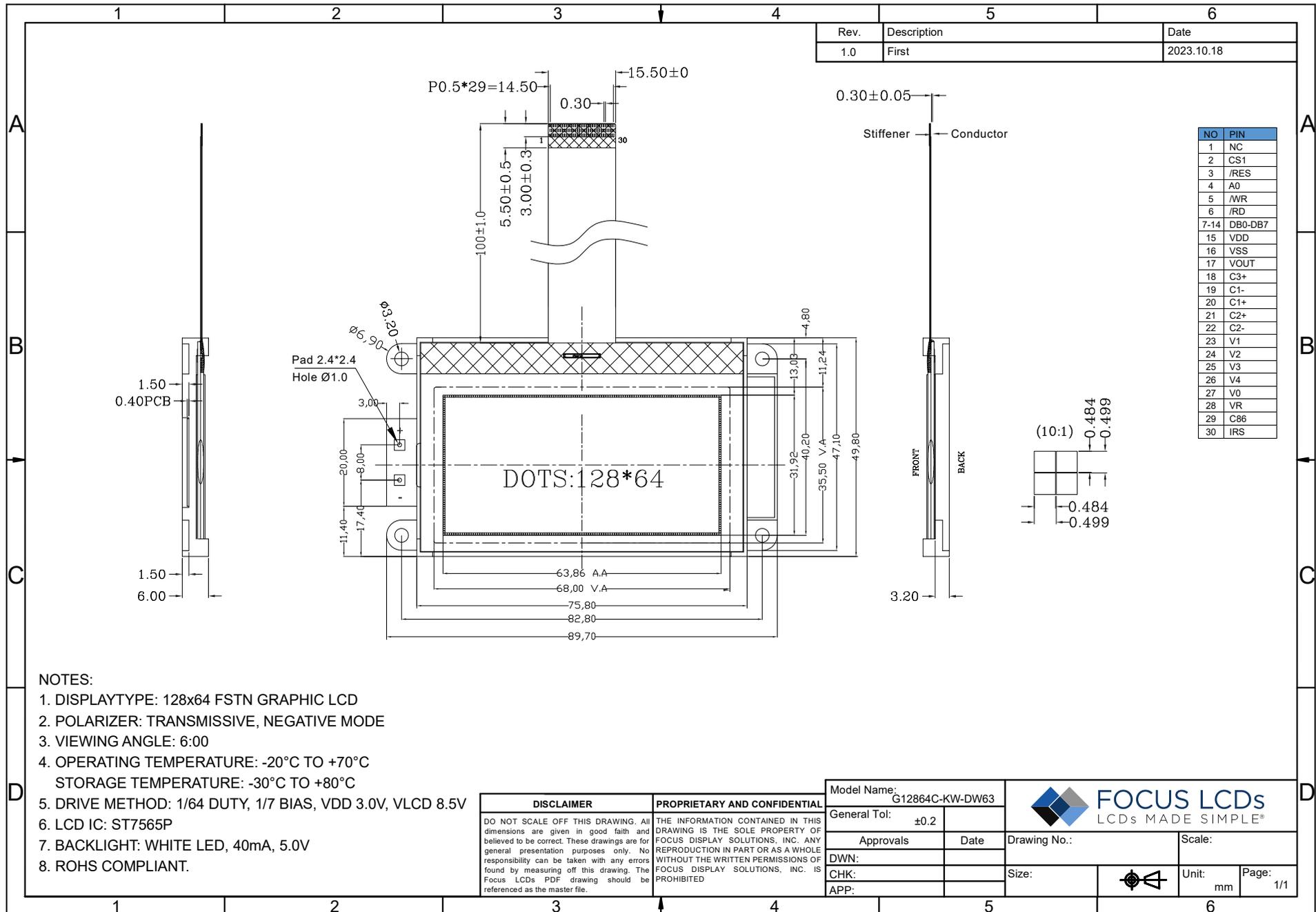
Resolution: 128x64 Dots
Interface(s): Parallel & SPI
RoHS Compliant.

General Information Items	Specification Main Panel	Unit	Note
Viewing Area (VA)	68.0 (H) x 35.5 (V)	mm	--
LCD Type	FSTN Negative	--	--
Viewing Angle	6:00	O'Clock	--
Polarizer	Transmissive	--	--
Backlight Type	LED	--	--
Backlight Color	White	--	--
LCD IC	ST7565P	--	--
Drive Mode	1/64 Duty, 1/7 Bias	--	--
Operating Temperature	-20 to +70	°C	--
Storage Temperature	-30 to +80	°C	--

Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	--	89.70	--	mm	--
	Vertical (V)	--	49.80	--	mm	--
	Depth (D)	--	6.00	--	mm	--
Weight		--	33	--	g	Approximate

1. Outline Dimensions

Pin Table:

NO	PIN
1	NC
2	CS1
3	/RES
4	A0
5	/WR
6	/RD
7-14	DB0-DB7
15	VDD
16	VSS
17	VOUT
18	C3+
19	C1-
20	C1+
21	C2+
22	C2-
23	V1
24	V2
25	V3
26	V4
27	V0
28	VR
29	C86
30	IRS

DOTS:128*64

NOTES:

1. DISPLAYTYPE: 128x64 FSTN GRAPHIC LCD
2. POLARIZER: TRANSMISSIVE, NEGATIVE MODE
3. VIEWING ANGLE: 6:00
4. OPERATING TEMPERATURE: -20°C TO +70°C
   STORAGE TEMPERATURE: -30°C TO +80°C
5. DRIVE METHOD: 1/64 DUTY, 1/7 BIAS, VDD 3.0V, VLCD 8.5V
6. LCD IC: ST7565P
7. BACKLIGHT: WHITE LED, 40mA, 5.0V
8. ROHS COMPLIANT.

2. Input Terminal Pin Assignment

NO.	Symbol	Description	I/O
1	NC	Not connected.	
2	CS1	Chip select in serial interface. Low active.	P
3	/RES	Reset.	I
4	A0	Select control data or display for read /write operation.	I
5	/WR	When connected to an 8080 MPU, this is active LOW. (R/W) This terminal connects to the 8080 MPU /WR signal. The signals on the data bus are latched at the rising edge of the /WR signal. When connected to a 6800 Series MPU: This is the read/write control signal input terminal. When R/W = "H": Read. When R/W = "L": Write.	I
6	/RD	When connected to an 8080 MPU, this is active LOW. (E) This pin is connected to the /RD signal of the 8080 MPU, and the ST7565P series data bus is in an output status when this signal is "L". When connected to a 6800 Series MPU, this is active HIGH. This is the 6800 Series MPU enable clock input terminal.	I
7-14	DB0-DB7	This is an 8-bit bi-directional data bus.	I/O
15	VDD	Power supply for logic for the LCM.	P
16	VSS	Signal ground for the LCM.	P
17	VOUT	DC/DC voltage converter.	P
18	C3+	Voltage boosting circuit.	P
19	C1-		
20	C1+		
21	C2+		
22	C2-		
23	V1	Power supply for the LCD.	P
24	V2		
25	V3		
26	V4		
27	V0		
28	VR	Voltage adjustment pad.	I
29	C86	This is the MPU interface switch terminal.	I
30	IRS	This terminal selects the resistors for the V0 voltage level adjustment. "H": Use the internal resistors. "L": Do not use the internal resistors.	I

I: Input, O: Output, P: Power

3. LCD Optical Characteristics

Item		Symbol	Condition	Min	Typ.	Max	Unit
Contrast Ratio		CR	--	--	5	--	--
Response Time	On	T_{on}	--	--	150	250	ms
	Off	T_{off}		--	180	300	ms
Viewing Angle $C_r{\geq}2$, 25°C	Hor.	Θ_L	Φ=270°, 9H	--	55	--	degree
		Θ_R	Φ=90°, 3H	--	55	--	
	Ver.	Θ_T	Φ=180°, 12H	--	40	--	
		Θ_B	Φ=0°, 6H	--	70	--	

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4. Electrical Characteristics

4.1 Absolute Maximum Rating

Characteristics	Symbol	Min	Max	Unit
Supply Voltage	VDD	0.3	5.0	V
	Vout	0.3	18.0	V
Input Voltage	Vin	VSS-0.3	VDD+0.3	V
Operating Temperature	T_{OP}	-20	+70	°C
Storage Temperature	T_{ST}	-30	+80	°C

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.

4.2 DC Electrical Characteristics

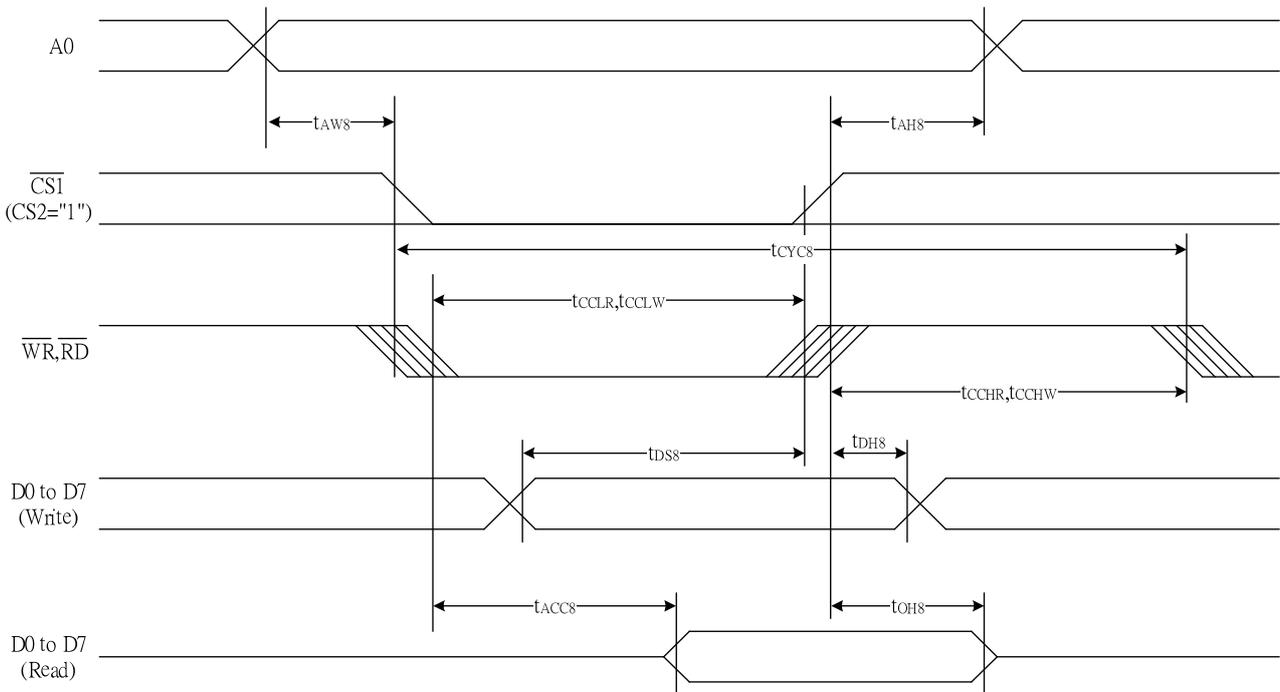| Characteristics		Symbol	Condition	Min	Typ.	Max	Unit
LCD Driving Voltage		VLCD	--	--	8.5	--	V
Supply Voltage		VDD	VDD-GND	--	3.0	--	V
Input Voltage	H Level	V_{IH}	--	0.8VDD	--	VDD	V
	L Level	V_{IL}	--	VSS	--	0.2VDD	V

Condition:
1. VDD = 3.0V
2. 1/64 Duty, 1/7 Bias

5. Module Function

5.1 Timing Characteristics

System Bus Read/Write Characteristics 1 (for the 8080 Series MPU)

(VDD=3.3V, Ta= –30 to 85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH8}		0	-	ns
Address setup time		t_{AW8}		0	-	
System cycle time		t_{CYC8}		240		
Enable L pulse width(write)	WR	t_{CCLW}		80	-	
Enable H pulse width(write)		t_{CCHW}		80	-	
Enable L pulse width(read)	RD	t_{CCLR}		140	-	
Enable H pulse width(read)		t_{CCHR}		80	-	
Write data setup time	D0~D7	t_{DS8}		40	-	
Write address hold time		t_{DH8}		0	-	
Read access time		t_{ACC8}	CL=100Pf	-	70	
Read output disable time		t_{OH8}	CL=100Pf	5	50	

System Bus Read/Write Characteristics 1 (for the 8080 Series MPU) - Continued

(VDD=2.7V, Ta= –30 to 85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH8}		0	-	ns
Address setup time		t_{AW8}		0	-	
System cycle time		t_{CYC8}		400		
Enable L pulse width(write)	WR	t_{CCLW}		220	-	
Enable H pulse width(write)		t_{CCHW}		180	-	
Enable L pulse width(read)	RD	t_{CCLR}		220	-	
Enable H pulse width(read)		t_{CCHR}		180	-	
Write data setup time	D0~D7	t_{DS8}		40	-	
Write address hold time		t_{DH8}		0	-	
Read access time		t_{ACC8}	C_L=100pF	-	140	
Read output disable time		t_{OH8}	C_L=100pF	10	100	

(VDD=1.8V, Ta= –30 to 85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH8}		0	-	ns
Address setup time		t_{AW8}		0	-	
System cycle time		t_{CYC8}		640		
Enable L pulse width(write)	WR	t_{CCLW}		360	-	
Enable H pulse width(write)		t_{CCHW}		280	-	
Enable L pulse width(read)	RD	t_{CCLR}		360	-	
Enable H pulse width(read)		t_{CCHR}		280	-	
Write data setup time	D0~D7	t_{DS8}		80	-	
Write address hold time		t_{DH8}		0	-	
Read access time		t_{ACC8}	C_L=100pF	-	240	
Read output disable time		t_{OH8}	C_L=100pF	10	200	

*1 The input signal rise time and fall time (t_r, t_f) is specified at 15 ns or less. When the system cycle time is extremely fast,
(t_r +t_f) $\leqq$ (t_{CYC8} – t_{CCLW} – t_{CCHW}) for (t_r + t_f) $\leqq$ (t_{CYC8} – t_{CCLR} – t_{CCHR}) are specified.
*2 All timing is specified using 20% and 80% of VDD as the reference.
*3 t_{CCLW} and t_{CCLR} are specified as the overlap between /CS1 being "L", (CS2 = "H"), and /WR and /RD being at the "L" level.

System Bus Read/Write Characteristics 2 (for the 6800 Series MPU)
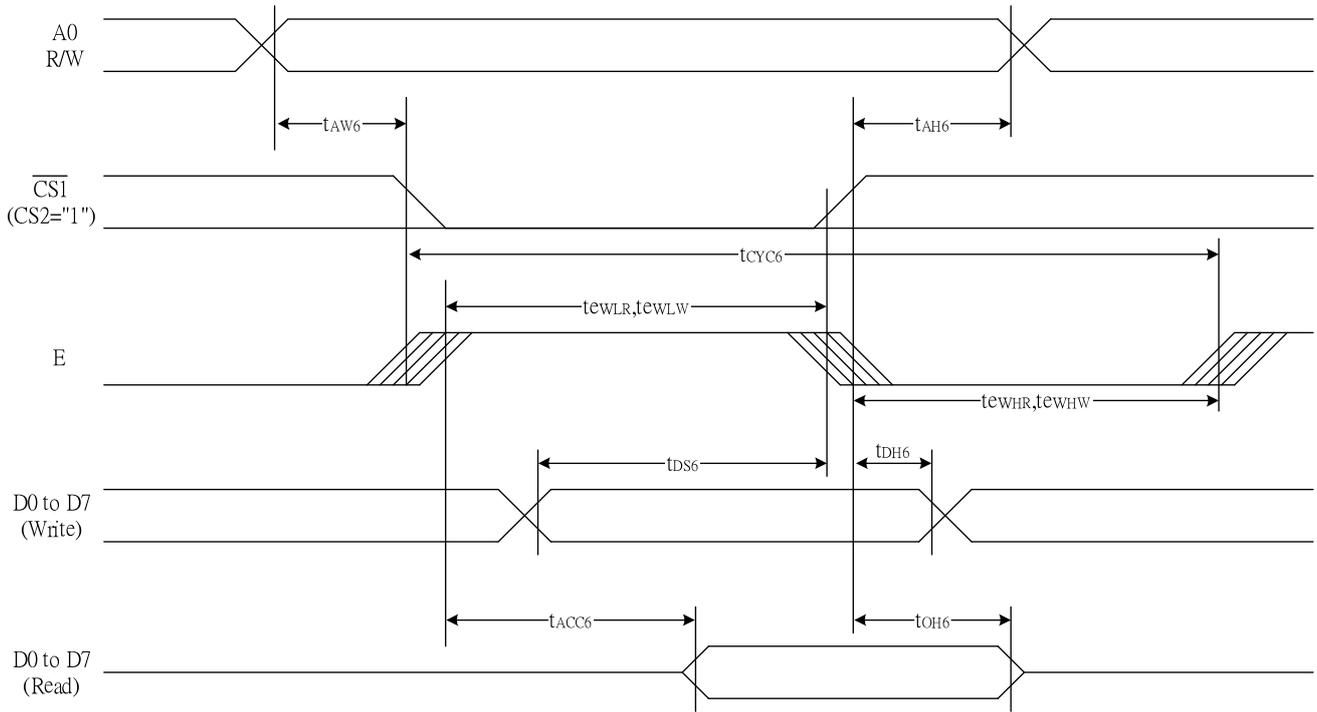
(VDD=3.3V, Ta= −30 to 85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH6}		0	-	ns
Address setup time		t_{AW6}		0	-	
System cycle time		t_{CYC6}		240		
Enable L pulse width(write)	WR	T_{EWLW}		80	-	
Enable H pulse width(write)		T_{EWHW}		80	-	
Enable L pulse width(read)	RD	T_{EWLR}		80	-	
Enable H pulse width(read)		T_{EWHR}		140	-	
Write data setup time	DB0~DB7	t_{DS6}		40	-	
Write address hold time		t_{DH6}		0	-	
Read access time		t_{ACC6}	C_L=100pF	-	70	
Read output disable time		t_{OH6}	C_L=100pF	5	50	

System Bus Read/Write Characteristics 2 (for the 6800 Series MPU) - Continued

(VDD=2.7V, Ta= –30 to 85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH6}		0	-	ns
Address setup time		t_{AW6}		0	-	
System cycle time		t_{CYC6}		400		
Enable L pulse width(write)	WR	T_{EWLW}		220	-	
Enable H pulse width(write)		T_{EWHW}		180	-	
Enable L pulse width(read)	RD	T_{EWLR}		220	-	
Enable H pulse width(read)		T_{EWHR}		180	-	
Write data setup time	DB0~DB7	t_{DS6}		40	-	
Write address hold time		t_{DH6}		0	-	
Read access time		t_{ACC6}	C_L=100pF	-	140	
Read output disable time		t_{OH6}	C_L=100pF	10	100	

(VDD=1.8V, Ta= –30 to 85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH6}		0	-	ns
Address setup time		t_{AW6}		0	-	
System cycle time		t_{CYC6}		640		
Enable L pulse width(write)	WR	T_{EWLW}		360	-	
Enable H pulse width(write)		T_{EWHW}		280	-	
Enable L pulse width(read)	RD	T_{EWLR}		360	-	
Enable H pulse width(read)		T_{EWHR}		280	-	
Write data setup time	DB0~DB7	t_{DS6}		80	-	
Write address hold time		t_{DH6}		0	-	
Read access time		t_{ACC6}	C_L=100pF	-	240	
Read output disable time		t_{OH6}	C_L=100pF	10	200	

*1 The input signal rise time and fall time (t_r, t_f) is specified at 15 ns or less. When the system cycle time is extremely fast,
(t_r +t_f) $\leqq$ ($t_{CYC6} - t_{EWLW} - t_{EWHW}$) for ($t_r$ + t_f) $\leqq$ ($t_{CYC6} - t_{EWLR} - t_{EWHR}$) are specified.
*2 All timing is specified using 20% and 80% of VDD as the reference.
*3 t_{EWLW} and t_{EWLR} are specified as the overlap between /CS1 being "L", (CS2 = "H"), and E.

The Serial Interface
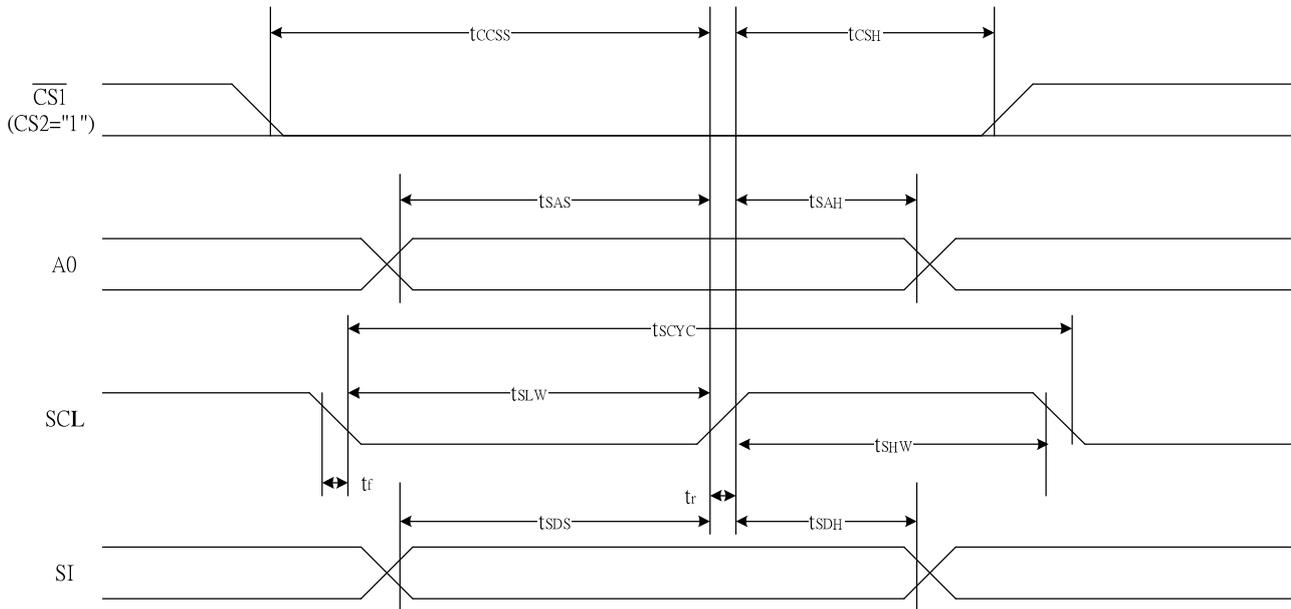
(VDD=3.3V, Ta= −30 to 85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period	SCL	T_{SCYC}		50	-	ns
SCL "H" pulse width		T_{SHW}		25	-	
SCL "L" pulse width		T_{SLW}		25		
Address setup time	A0	T_{SAS}		20	-	
Address hold time		T_{SAH}		10	-	
Data setup time	SI	T_{SDS}		20	-	
Data hold time		T_{SDH}		10	-	
CS-SCL time	CS	T_{CSS}		20	-	
CS-SCL time		T_{CSH}		40	-	

(VDD=2.7V, Ta= −30 to 85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period	SCL	T_{SCYC}		100	-	ns
SCL "H" pulse width		T_{SHW}		50	-	
SCL "L" pulse width		T_{SLW}		50		
Address setup time	A0	T_{SAS}		30	-	
Address hold time		T_{SAH}		20	-	
Data setup time	SI	T_{SDS}		30	-	
Data hold time		T_{SDH}		20	-	
CS-SCL time	CS	T_{CSS}		30	-	
CS-SCL time		T_{CSH}		60	-	

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The Serial Interface - Continued

(VDD=1.8V, Ta= –30 to 85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period	SCL	T_{SCYC}		200	-	ns
SCL "H" pulse width		T_{SHW}		80	-	
SCL "L" pulse width		T_{SLW}		80		
Address setup time	A0	T_{SAS}		60	-	
Address hold time		T_{SAH}		30	-	
Data setup time	SI	T_{SDS}		60	-	
Data hold time		T_{SDH}		30	-	
CS-SCL time	CS	T_{CSS}		40	-	
CS-SCL time		T_{CSH}		100	-	

*1 The input signal rise and fall time (t_r, t_f) are specified at 15 ns or less.
*2 All timing is specified using 20% and 80% of VDD as the standard.

5.2   LCM Application

Please see information on pages 31-33 of the data sheet for LCD controller ST7565P. The data sheet can be found here: https://focuslcds.com/wp-content/uploads/Drivers/ST7565P.pdf

5.3 Command Table

Command	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0/1	LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address						Sets the display RAM display start line address
(3) Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit	0	1	0	0	0	0	0	Least significant column address				Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data								Writes to the display RAM
(7) Display data read	1	0	1	Read data								Reads from the display RAM
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0/1	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9) Display normal/ reverse	0	1	0	1	0	1	0	0	1	1	0/1	Sets the LCD display normal/ reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0/1	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0/1	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565P)
(12) Read/modify/write	0	1	0	1	1	1	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	0/1	*	*	*	Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode
(17) V0 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	Set the V0 output voltage electronic volume register
Electronic volume register set				0	0	Electronic volume value						
(19) Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0/1	0: OFF, 1: ON
Static indicator register set				0	0	0	0	0	0	0	Mode	Set the flashing mode
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
				0	0	0	0	0	0	step-up value		
(21) Power saver												Display OFF and display all points ON compound command
(22) NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(23) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command

5.4   Initialization Code

```
void    lcd_init(void)
        {
        RES=1;
        Delays (10);
   RES=0;
   Delays (10);
   RES=1;
   Delays (50);

        writecommand(0xE2);//software reset
   delay (10);
        writecommand(0Xa3);//0xA2=1/9bias；0xA3=1/7bias
        writecommand(0xA1);//0xA0=seg0->seg131；0xA1=seg131->seg0
        writecommand(0xC0);//0xC0=com0->com63；0xC8=com63->com0；
        writecommand(0x22); //vop
        writecommand(0x81); //vop
        writecommand(0x2d); //vop
        writecommand(0x2c);     //VB=0: Built-in Booster OFF；VB=1: Built-in Booster ON
   delays (100);
        writecommand(0x2e); //VR=0: Built-in Regulator OFF；VR=1: Built-in Regulator
ON
   delays (100);
        writecommand(0x2f);  //VF=0: Built-in Follower OFF；VF=1: Built-in Follower ON
   delays (100);
        writecommand(0xB0);//0xb0
        writecommand(0xA6);//0xA6=Normal display；0xA7=Inverse display
writecommand(0xAF);  //0xaf
        }
```

6. Cautions and Handling Precautions

6.1 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.

6.2 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.

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