

08.01.2019

GENERAL SPECIFICATION

MODULE NO. :

DEM 128064L FGH-PW

VERSION NO.	CHANGE DESCRIPTION	DATE
0	Original Version	13.11.2009
1.0	Change Production Line	03.12.2018
1.1	Correct the module drawing/BL drawing/LCD drawing.	12.12.2018
2	Correct the LED BL circuit on page 7;Update the LCD drawing(IC layout) on page 16	27.12.2018
3	Correct the dimension of 0.45 in the drawing on page 3 an page 4	08.01.2019

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1. FUNCTIONS & FEATURES

I DEM 128064L FGH-PW Series LCD Type :

		MODULE	LCD TYPE	REMARKS
		DEM 128064L FGH-PW	FSTN Transflective Positive Mode	-
I	Viev	ving Direction	: 6 O'clock	
I	Drivi	ing Scheme	: 1/65 Duty Cycle, 1/9 Bias	
I	Powe	er Supply Voltage(Typ.)	: 3.3 Volt (typ)	
I	LCD	Operation Voltage	: 9.0 Volt (typ)	
I	Disp	lay Contents	: 128x64 Dots	
I	Back	light	: LED, Lightguide, White	
I	Oper	ating temperature	: $-20^{\circ}C \sim +70^{\circ}C$	
I	Stora	ige temperature	: -30°C ~ +80°C	
I	RoH	S Compliant		

2. MECHANICAL SPECIFICATIONS

I	Module Size:	: 46.60 x 40.00 x 10.40 mm (without FPC)
I	Viewing Area Size:	: 37.00 x 28.00 mm
I	Active Area Size	: 36.076 x 23.020 mm
I	Dot pitch:	: 0.282 x 0.36 mm
I	Dot Size:	: 0.262 x 0.34 mm

3. EXTERNAL DIMENSIONS



4. BLOCK DIAGRAM



5. PIN DESCRIPTION

Pin No.	Name	Description
1	IRS	This terminal selects the resistors for the V0 voltage level adjustment. IRS = "H": Use the internal resistors IRS = "L": Do not use the internal resistors. The V0 voltage level is regulated by an external resistive voltage divider attached to the VR terminal
2	HPMB	This is the power control terminal for the power supply circuit for liquid crystal drive. /HPM = "H": Normal mode /HPM = "L": High power mode (suggested)
3	PSB	This pin configures the interface to be parallel mode or serial mode. P/S = "H": Parallel data input/output. P/S = "L": Serial data input.
4	C86	This is the MPU interface selection pin. C86 = "H": 6800 Series MPU interface. C86 = "L": 8080 Series MPU interface.
5	VR	This is the internal-output VREG power supply for the LCD power supply voltage regulator.
6	V0	
7	V1	
8	V2	LCD driver supplies voltages
9	V3	
10	V4	
11	CAP4+	
12	CAP2-	
13	CAP2+	
14	CAP1+	DC/DC voltage converter.
15	CAP1-	
16	CAP3+	
17	VOUT	
18	VSS	Ground
19	VDD	Voltage supply
20	D7	
21	D6	
22	D5	This is an 8-bit bi-directional data bus that connects to an 8-bit or 16-bit standard MPU
23	D4	When the serial interface (SPI-4) is selected $(P/S = "L")$:
24	D3	D7 : serial data input (SI) ; D6 : the serial clock input (SCL).
25	D2	D0 to D5 should be connected to VDD or floating. When the chip select is not active. D0 to D7 are set to high impedance.
26	D1	
27	D0	
28	RD(E)	 When connected to 8080 series MPU, this pin is treated as the "/RD" signal of the 8080 MPU and is LOW-active. The data bus is in an output status when this signal is "L". When connected to 6800 series MPU, this pin is treated as the "E" signal of the 6800 MPU and is HIGH-active. This is the enable clock input terminal of the 6800 Series MPU.
29	WR(RW)	 When connected to 8080 series MPU, this pin is treated as the "/WR" signal of the 8080 MPU and is LOW-active. The signals on the data bus are latched at the rising edge of the /WR signal. When connected to 6800 series MPU, this pin is treated as the "R/W" signal of the 6800 MPU and decides the access type : When R/W = "H": Read. When R/W = "L": Write.

Product	Spe	cifica	ntion
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A0 $A0 = "H"$: Indicates that D0 to D7 are display data. $A0 = "L"$: Indicates that D0 to D7 are control data. 31 /RESThis is the chip select signal.	20	40	This is connect to the least significant bit of the normal MPU address bus, and it determines whether the data bits are data or command.
31 /RES This is the chip select signal.	50	AU	A0 = "H": Indicates that D0 to D7 are display data. A0 = "L": Indicates that D0 to D7 are control data.
	31	/RES	This is the chip select signal.
32 /CS1 The RESET signal	32	/CS1	The RESET signal

А	Supply voltage for backlight LED+
K	Supply voltage for backlight LED-

6. BACKLIGHT CHARACTERISTICS

Item	Symbol	min.	typ.	max.	Unit	Condition
Forward Voltagt	Vf	2.9	3.1	3.3	v	
Power Dissipation	Pd	174	186	198	mW	
Luminous Uniformity	∆Lv	70			%	lf= 60 mA
Lumi nance	Lv	420	500		cd/m ²	
Color Coordinate	х	0.260		0.30		T–25° C
	Ŷ	0.270		0.31		I- 2 J C
Lifetime	50000h				Hours	









COLOR: WHITE



Remarks: 1.Unmarked tolerance is ±0.3 2.All materials comply with RoHs 3._____..:critical dimension.

7. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Unit
Power Supply Voltage	VDD	-0.3 ~ 3.6	V
Power Supply Voltage (VDD Standard)	V0,VOUT	-0.3 ~ 13.5	V
Power Supply Voltage (VDD Standard)	V1, V2, V3, V4	-0.3 to V0	V
Operating Temperature	TOPR	-20 to +70	°C
Storage Temperature	TSTR	-30 to +80	°C

8. ELECTRICAL CHARACTERISTICS

8.1. DC CHARACTERISTICS

Itom	Sym	Condition	STA	unita		
Item	bol	Condition	Min.	Тур.	Max.	units
Operating Voltage	V _{DD}	Relative to VSS	2.7	3.3	3.3	
LCD Driving Voltage	V _{LCD}	Relative to VSS	8.7	9.0	9.3	
High-Level Input Voltage	V _{IHC}		0.8 x VDD		VDD	
Low-Level Input Voltage	V _{ILC}		VSS		0.2 x VDD	V
High-Level Output Voltage	V _{OHC}	IOH = -0.5 mA	0.8 x VDD		VDD	
Low-Level Output Voltage	Volc	IOH = -0.5 mA	VSS		0.2 x VDD	
Consumption Current	I _{DD}			TBD		mA

8.2. AC CHARACTERISTICS



Itom	Signal Symbol Condition		Condition	Rating		Unite
nem	Signal	Symbol	Condition	Min.	Max.	Units
Address hold time		tанв		0	-	
Address setup time	A0	t aws		0]
System cycle time		tcyc8		240	_]
Enable L pulse width (WRITE)		tcclw		80	_]
Enable H pulse width (WRITE)		tсснw		80	_]
Enable L pulse width (READ)		tcclr		140	—	Ns
Enable H pulse width (READ)		t CCHR		80]
WRITE Data setup time		tDS8		40	_]
WRITE Address hold time		tdн8		0	_]
READ access time		tacc8	CL = 100 pF	_	70]
READ Output disable time		tонв	C∟ = 100 pF	5	50]



System Bus Read/Write Characteristics 2 (For the 6800 Series MPU)

Itom	Signal	Symbol Condition		Rati	Unite	
nem	Signal	Symbol	Condition	Min.	Max.	Units
Address hold time		tан6		0	—	
Address setup time	A0	t awe		0	—	
System cycle time		tcyc6		240	—	
Enable L pulse width (WRITE)		tewlw		80	_	
Enable H pulse width (WRITE)		tewнw		80	—	
Enable L pulse width (READ)	PD	tewlr		80	—	ns
Enable H pulse width (READ)		tewhr		140		
WRITE Data setup time		tds6		40	—	
WRITE Address hold time		tdh6		0	—	
READ access time		tacc6	CL = 100 pF	—	70	
READ Output disable time		tоне	C∟ = 100 pF	5	50	



Itom	Signal	Symbol	Condition	Rat	Unite	
Item	Signal	Symbol	Condition	Min.	Max.	Units
4-line SPI Clock Period		Tscyc		50		
SCL "H" pulse width	SCL	Tshw		25	—	
SCL "L" pulse width		Tslw		25	_	
Address setup time	40	TSAS		20	_	
Address hold time		Tsah		10		ns
Data setup time	<u>e</u> 1	Tsds		20		
Data hold time	31	TSDH		10	—	
CS-SCL time	68	Tcss		20	—	
CS-SCL time		Tcsh		40	—	

Itom	Signal	Symbol	Condition	Rati	Unite		
item	Signal	Symbol	Condition	Min.	Max.	Units	
4-line SPI Clock Period		Tscyc		200	—		
SCL "H" pulse width	SCL	Тѕнѡ		80	—		
SCL "L" pulse width		Tslw		80	_]	
Address setup time	A.0	Tsas		60	_]	
Address hold time		Тѕан		30	_	ns	
Data setup time	61	Tsds		60	_]	
Data hold time		Тѕрн		30	_		
CS-SCL time	6	Tcss		40	_		
CS-SCL time		Тсѕн		100	_]	

*1 The input signal rise and fall time (tr, tf) are specified at 15 ns or less.

*2 All timing is specified using 20% and 80% of VDD as the standard.

Reset Timing



9. COMMAND TABLE

(COMMAND FOR ST7565R)

Command					Com	man	d Cod	le				Eurotion
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		Displ	ay si	tart a	ddre	ss	Sets the display RAM display start line address
(3) Page address set	0	1	0	1	0	1	1	F	Page	addr	ess	Sets the display RAM page address
(4) Column address set upper bit Column address set lower bit	0	1	0	0	0 0	0 0	1 0	M cc Le	ost si olumn east s	ignifi add ignif	cant ress icant	Sets the most significant 4 bits of the display RAM column address. Sets the least significant 4 bits of the display RAM column address
(5) Status read	0	0	1		Sta	atus		0	0	0	0	Reads the status data
(6) Display data write	1	1	0					W	rite d	ata		Writes to the display RAM
(7) Display data read	1	0	1					Re	ead d	ata		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 (ST7565R)
(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	0	pera moc	ting le	Select internal power supply operating mode
(17) V ₀ voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Re	sisto	r ratio	Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set Electronic volume register set	0	1	0	1 0	0 0	0 E	0 Electro	0 onic v	0 volun	0 ne va	1 alue	Set the V_0 output voltage electronic volume register
(19) Static indicator ON/OFF	_	_	•	1	0	1	0	1	1	0	0	0: OFF, 1: ON
Static indicator register set	0	1	0	0	0	0	0	0	0	0	1 Mode	Set the flashing mode
				1	1	1	1	1	0	0	0	select booster ratio
(20) Booster ratio set	0	1	0	0	0	0	0	0	0	ste vi	ep-up alue	01: 5x 11: 6x
(21) Power save	0	1	0									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

10. ELECTRO-OPTICAL DEFINITION

Optical Characteristics

Item	Symbo l	Description	Condition	Min	Тур	Max	Unt
Operating Voltage of			$Ta = -20^{\circ}C$	9.3	9.6	9.8	
	VLCD		Ta= 25°C	8.7	9.0	9.3	V
LCD			Ta= 70°C	$\Gamma a = 70^{\circ}C$ 8.3 8.6		8.9	
Desnonse Time	Tr	Rise	25°C		200	400	ms
kesponse 1 me	Tf	Fall	25°C		250	500	ms
Contrast	Cr		VDD=3.3V 25°C		4		
		6 o'clock axis	Cr > 2.0 VDD=3.3V 25°C		40		deg
Viewing Angle	θ	12 o'clock axis	VDD=3.3V 25°C		40		deg
		3 o'clock axis	VDD=3.3V 25°C		40		deg
		9 o'clock axis	VDD=3.3V 25°C		40		deg







11. LCD ARTWORK



12. SEG LAYOUT



13. COM LAYOUT



14. IC LAYOUT



15. QUALITY DESCRIPTION

DEFECT SPECIFICATION:

a:

Specific type-related items are covered in this sheet.

Table for Cosmetic defects (Note: nc = not counted). Sizes and number of defects (Max. Qty)



Defect Type	Max. defect d or L	t size [mm] W	Max. Quan tity.
Black or White Spots	d ≤ ′	nc	
	150< d	≤ 300	5
Black or White Lines		$W \leq 10$	nc
	L ≤ 5000	$W \leq 30$	3
	L ≤ 2000	$W \leq 50$	2
Pinhole	d ≤ ′ 150< d	150 ≤ 300	nc 1/seg ment
(Total		(5)	
Segment Deformation	W≤	100	nc
Bubble (e.g. under pola)	d ≤ ′	150	nc
	200< d	≤ 400	3
	400< d	1	

Examples/ Shapes

b: Glass defects

b1:Glass defects at contact ledge



b2:Glass chipping in other areas shall not be in conflict with the product's function.

16. RELIABILITY TEST

Operating life time: Longer than 50000 hours (at room temperature without direct irradiation of sunlight)

Reliability characteristics shall meet following requirements.

TEMPERATURE TESTS	NORMAL GRADE
High Temperature Storage	+80°C x 96HR
Low temperature Storage	-30°C x 96HR
High Temperature Operation	+70°C x 96HR
Low Temperature Operation	-20°C x 96HR
High Temperature, High Humidity	+60°C 90%RH 96HR
Thermal Shock	$\begin{array}{c} -20^{\circ}\text{C x } 30 \text{ min} \Leftarrow \\ 10s \neq 5\text{Cycles} \\ 70^{\circ}\text{C} * 30 \text{ min} \end{array}$
Vibration Test	Frequency x Swing x Time 40Hz x 4mm x 4hrs
Drop Test	Drop height x Times 1.0m x 6 times

17. LCD MODULES HANDLING PRECAUTIONS

- **n** The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- **n** If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If the substance come into contact with your skin or clothes promptly wash it off using soap and water.
- **n** Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- **n** The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.
- n To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.Be sure to ground the body when handling the LCD module.
 - -Tools required for assembly, such as soldering irons, must be properly grounded.

-To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions. -The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

n Storage precautions

When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below -20°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

18. OTHERS

- **n** Liquid crystals solidify at low temperature (below the storage temperature range) leading to defective orientation of liquid crystal or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.
- **n** If the LCD modules have been operating for a long time showing the same display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. Abnormal operating status can be resumed to be normal condition by suspending use for some time. It should be noted that this phenomena does not adversely affect performance reliability.
- **n** To minimize the performance degradation of the LCD modules resulting from caused by static electricity, etc. exercise care to avoid holding the following sections when handling the modules:
 - Exposed area of the printed circuit board
 - Terminal electrode sections