LCD MODULE

MODULE NO. :

GM12864-072C SERIES

Customer:
Approved by:

RECORDS OF REVISION

Part Number	Revision	Revision Content	Revised on
GM12864-072C	00	First issue	June. 20th, 2016

CONTENTS

1. FUNCTIONS & FEATURES

- LCD TYPE:

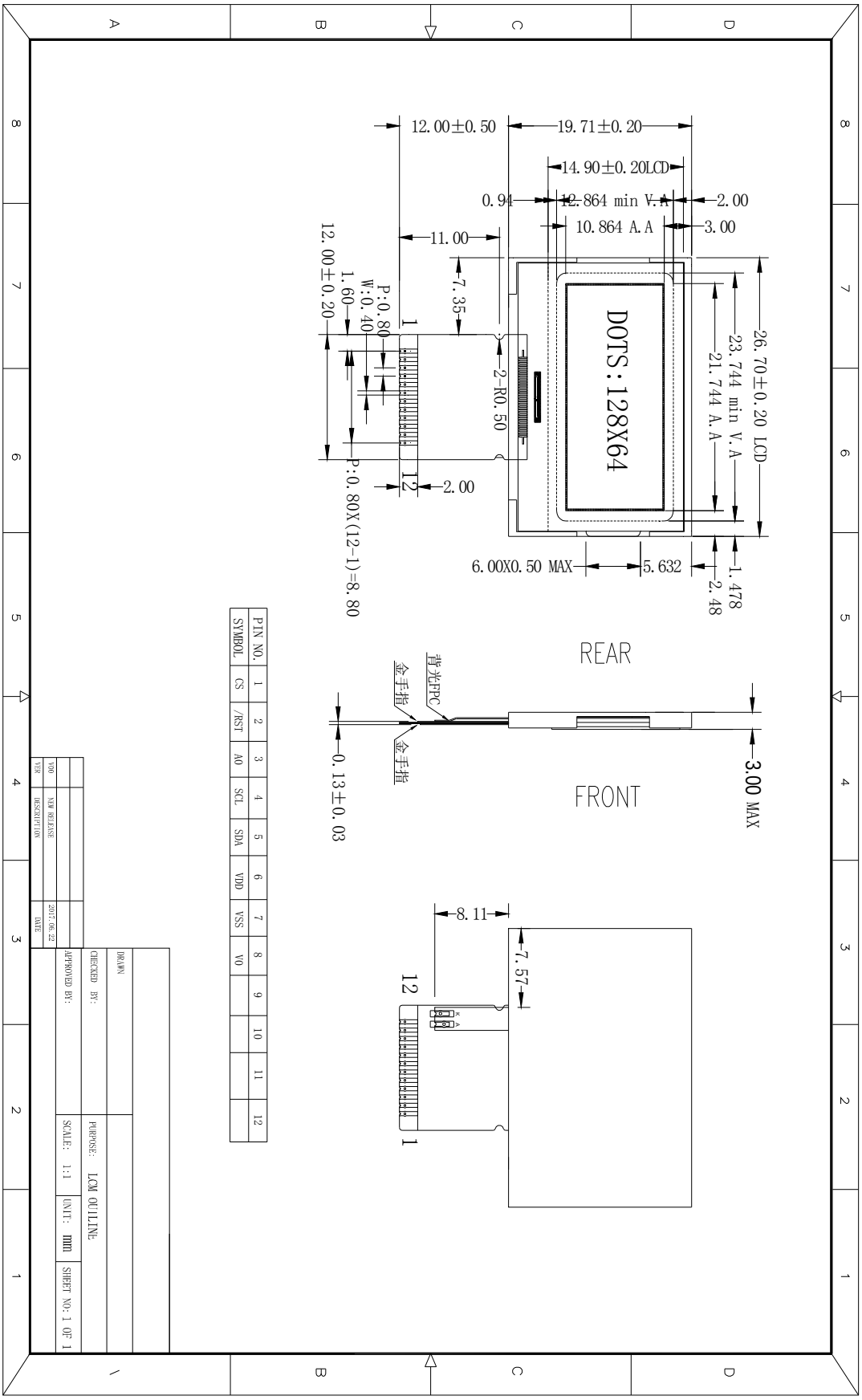
MODULE MODEL	LCD TYPE	REMARK
GMG12864-072C	FSTN Transmissive Negative Mode	-

- Driving Scheme : 1/65 Duty, 1/9Bias
- Viewing direction : 6 O'clock
- Drive IC : ST7567S
- Power Supply Voltage : 3.0V
- V_{LCD} : 9.00V
- Interface : 4-SPI
- RoSH Compliant

2. MECHANICAL SPECIFICATIONS

- Module Size : 26.70 (L) x19.71 (W) x3.00Max (T) mm
- Viewing Area : 23.744(L) x 12.864 (W) mm
- Active Area : 21.744 (L) x 10.864 (W) mm
- Dot Pitch : 0.17 (W) x 0.17 (H) mm
- Dot Size : 0.154(W) x 0.154 (H) mm

3. EXTERNAL DIMENSIONS (unit: mm)

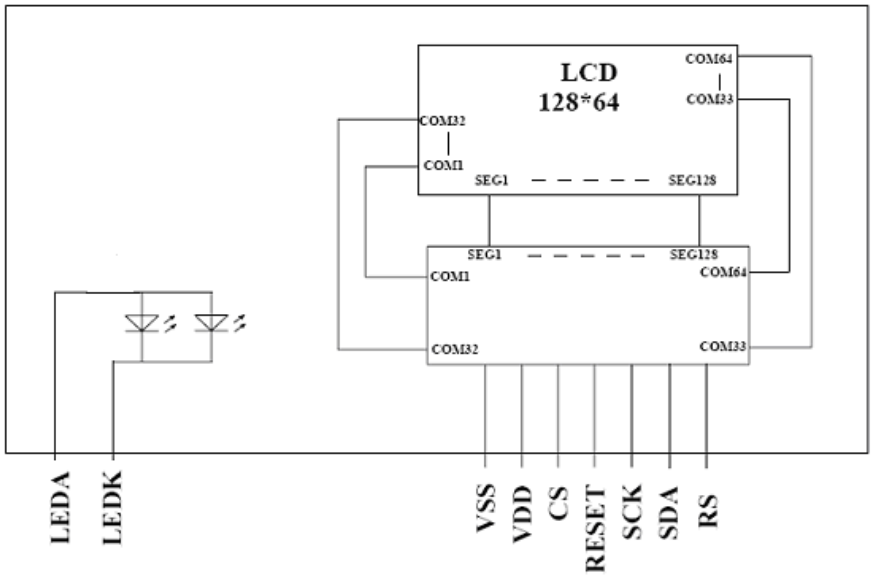


PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12
SYMBOL	CS	/RST	A0	SCL	SDA	VDD	VSS	V0				

VER.	DESCRIPTION	DATE
V00	NEW RELEASE	2017.06.22

DRAWN
CHECKED BY:
APPROVED BY:
PURPOSE: LCM OUTLINE
SCALE: 1:1
UNIT: mm
SHEET NO: 1 OF 1

4. BLOCK DIAGRAM



5. PIN ASSIGNMENT

PIN	SYMBOL	Descriptions
1	CS	Chip Select. Chip is selected when CS0 = “L”.
2	RST	When RST=”L”, all control registers are re-initialized by their default states. Since UC1701x has built-in Power-On Reset and Software Reset command, RST pin is not required for proper chip operation. An RC Filter has been included on-chip. There is no need for external RC noise filter. When RST is not used, connect the pin to VDD.
3	CD	Select Control data or Display data for read/write operation. ”L”: Control data ”H”: Display data
4	SCK	Serial clock input.
5	SDA	Serial data input.
6	VDD	This is a voltage supply pin. It must be connected to external source.
7	GND	Ground of Logic Circuit
8	V0	V0 is the LCD driving voltage for common circuits at negative frame. XV0 is the LCD driving voltage for common circuits at positive frame. XV0in is the V0 input of common circuits. VG is the LCD driving voltage for segment circuits.
9	XV0	
10	VG	
11	LEDA	Backlight Anode
12	LEDK	Backlight Cathode

6. ABSOLUTE MAXIMUM RATINGS

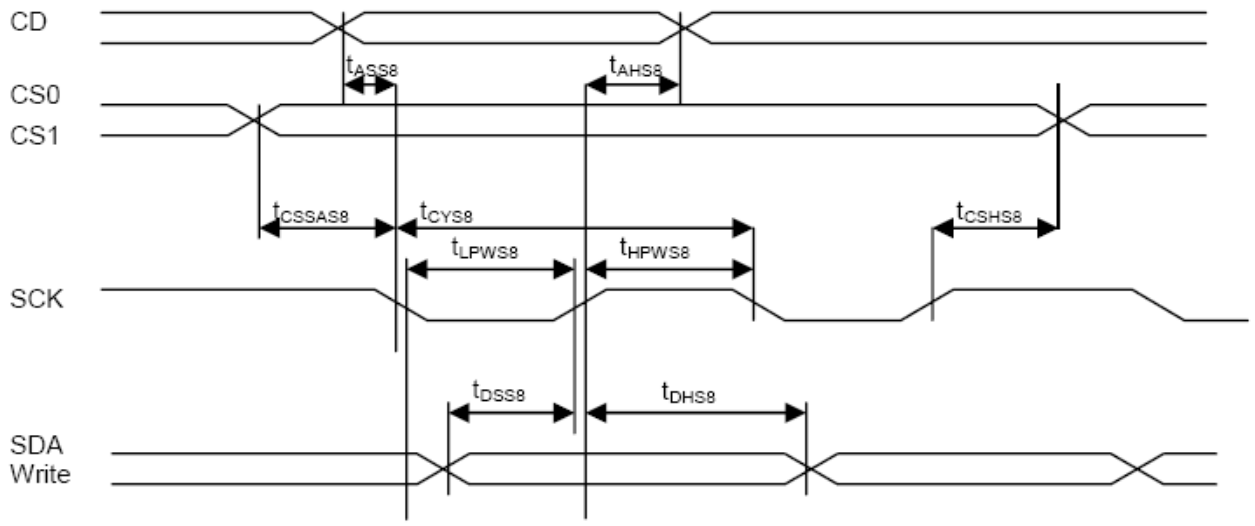
PARAMETER	SYMBOL	RATING	TEST CONDITIONS	UNIT
Supply voltage for logic	V_{DD}	-0.3~+7.0	-----	V
LCD drive voltage	V_{OP}	13(MAX)	$V_{OP}=V_{LCD}$-VSS	V
Input voltage	V_{IN}	-0.3 to V_{DD}+0.3	-----	V
Operating temperature range	T_{OPR}	-20 to 70	Ta=25℃	℃
Storage temperature range	T_{STR}	-30 to 80	Ta=25℃	℃

7. ELECTRICAL CHARACTERISTICS

7.1. DC CHARACTERISICS

ITEM	symbol	STANDARD VALUE			TEST CONDITION	UNIT
		MIN	TYP	MAX		
Supply Voltage For Logic	V_{DD}	2.7	3.0	3.3	----------	V
LCD Bias Voltage	V_{OP}	8.80	9.00	9.20	$V_{OP}=V_{LCD}-V_{SS}$	
Current Consumption	I_{DD}	--	--	0.75	V_{DD}=3.0V±5%	mA

7.2. AC CHARACTERISTICS



Symbol	Signal	Description		Condition	Min.	Max.	Units
t_{ASS8} t_{AHS8}	CD	Address	setup time hold time		0 0	–	nS
t_{CSSAS8} t_{CSHS8}	CS1/CS0	Chip select	setup time hold time		5 5	–	nS
t_{CYS8}	SCK	Cycle time	read write		100 30	–	nS
t_{LPWS8}		Low pulse width	read write		50 15	–	nS
t_{HPWS8}		High pulse width	read write		50 15	–	nS
t_{DSS8} t_{DHS8}	SDA	Data	setup time hold time		12 0	–	nS

8. COMMANDS

INSTRUCTION	A0	R/W (RWR)	COMMAND BYTE D7	D6	D5	D4	D3	D2	D1	D0	DESCRIPTION
(1) Display ON/OFF	0	0	1	0	1	0	1	1	1	D	D=1, display ON D=0, display OFF
(2) Set Start Line	0	0	0	1	S5	S4	S3	S2	S1	S0	Set display start line
(3) Set Page Address	0	0	1	0	1	1	Y3	Y2	Y1	Y0	Set page address
(4)Set Column Address	0	0	0	0	0	1	X7	X6	X5	X4	Set column address (MSB)
	0	0	0	0	0	0	X3	X2	X1	X0	Set column address (LSB)
(5) Read Status	0	1	0	MX	D	RST	0	0	0	0	Read IC Status
(6) Write Data	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write display data to RAM
(7) Read Data	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read display data from RAM
(8) SEG Direction	0	0	1	0	1	0	0	0	0	MX	Set scan direction of SEG MX=1, reverse direction MX=0, normal direction
(9) Inverse Display	0	0	1	0	1	0	0	1	1	INV	INV =1, inverse display INV =0, normal display
(10) All Pixel ON	0	0	1	0	1	0	0	1	0	AP	AP=1, set all pixel ON AP=0, normal display
(11) Bias Select	0	0	1	0	1	0	0	0	1	BS	Select bias setting 0=1/9; 1=1/7 (at 1/65 duty)
(12) Read-modify-Write	0	0	1	1	1	0	0	0	0	0	Column address increment: Read:+0 , Write:+1
(13) END	0	0	1	1	1	0	1	1	1	0	Exit Read-modify-Write mode
(14) RESET	0	0	1	1	1	0	0	0	1	0	Software reset
(15) COM Direction	0	0	1	1	0	0	MY	-	-	-	Set output direction of COM MY=1, reverse direction MY=0, normal direction
(16) Power Control	0	0	0	0	1	0	1	VB	VR	VF	Control built-in power circuit ON/OFF
(17) Regulation Ratio	0	0	0	0	1	0	0	RR2	RR1	RR0	Select regulation resistor ratio
(18) Set EV	0	0	1	0	0	0	0	0	0	1	Double command!! Set electronic volume (EV) level
	0	0	0	0	EV5	EV4	EV3	EV2	EV1	EV0	
(19) Set Booster	0	0	1	1	1	1	1	0	0	0	Double command!! Set booster level: BL=0: 4X BL=1: 5X
	0	0	0	0	0	0	0	0	0	BL	
(20) Power Save	0	0	Compound Command								Display OFF + All Pixel ON
(21) NOP	0	0	1	1	1	0	0	0	1	1	No operation
(22)SPI Read Status	0	*	1	1	1	1	1	1	0	0	SPI read status command
	0	*	0	MX	D	RST	ID3	ID2	ID1	ID0	SPI read status
(23)SPI Read DDRAM	0	*	1	1	1	1	1	1	0	1	SPI read DDRAM command
	1	*	D7	D6	D5	D4	D3	D2	D1	D0	SPI read DDRAM
(24) VLCD Enhance	0	0	1	1	1	1	1	1	1	1	VLCD Enhance ON
	0	0	0	1	1	0	1	0	1	1	
	0	0	1	1	1	1	1	1	1	0	

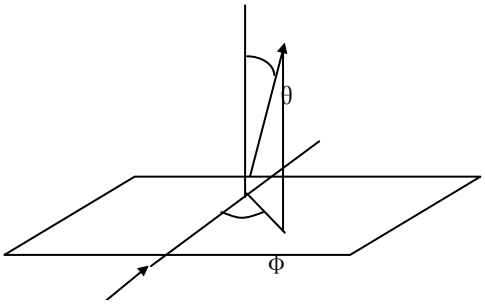
Note: Symbol "-" means this bit can be "H" or "L".

9. LCD PANEL OPTICAL CHARACTERISTICS

9.1 OPTICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Viewing angle	θ	ϕ=0℃	Ta=25℃ Cr≥2.0	10	15	20	Deg
		ϕ=180℃		15	35	45	
		ϕ=90℃		20	25	30	
		ϕ=270℃		20	25	30	
Contrast Ratio	Cr(MAX)	θ=0 and Ta=25℃		3	4	4.4	
Response time	T_R	Ta=25℃		200	217.649	250	ms
	T_F	Ta=25℃		250	276.527	300	

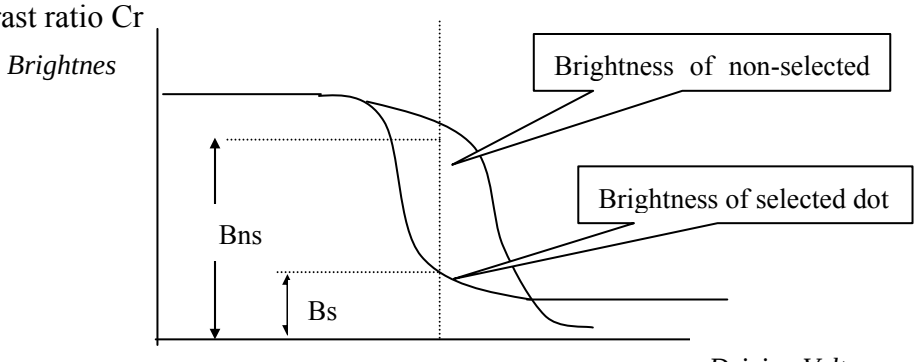
9.2 θ and ϕ



View

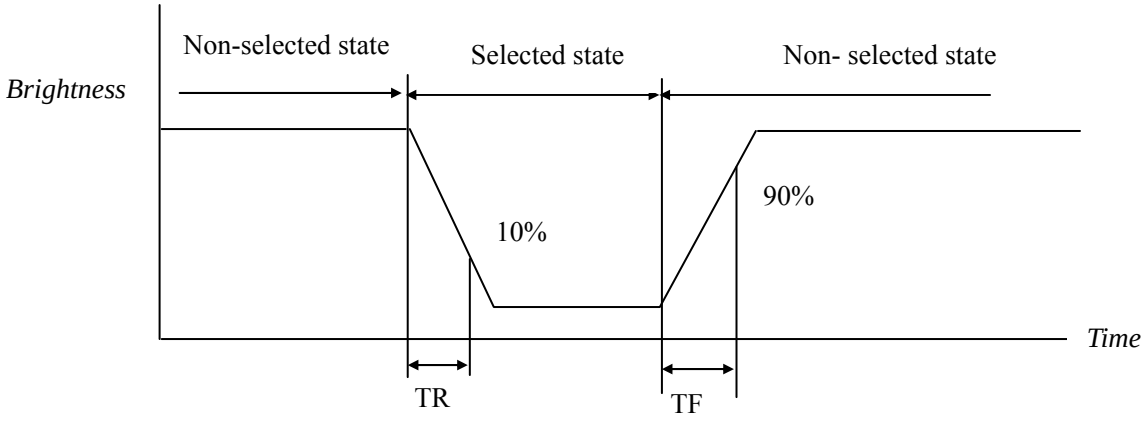
- The contrast of the display is optimal when viewed in the "*View Direction*"(ϕ=0°)
- 0° ≤ θ ≤90°, 0° ≤ ϕ ≤360°

9.3 Contrast ratio Cr



Contrast Ratio: Cr= Bns/Bs

9.4 Response times T_R and T_F



10. MODULE ACCEPT QUALITY LEVEL (AQL)

10.1 AQL Standard Value: Critical Defect =0.1, Major Defect=0.65; Minor Defect =2.5.

10.2 Inspection Standard: MIL-STD-105E Table Normal Inspection Single Sampling Level II

11. RELIABILITY TEST.

Operating life time: 50,000 hours

(at room temperature without direct irradiation of sunlight)

Reliability characteristics shall meet following requirements.

Test Item	Test Condition
High temperature storage	+80℃ x 96HR
Low temperature storage	-30℃ x 96HR
High temperature operation	+70℃ x 96HR
Low temperature operation	-20℃ x 96HR
High temperature, High humidity	+60℃ x 90%RH x 96HR
Thermal shock	-20℃ x 30min → 25℃ x 10s → +70℃ x 30min x 5 Cycles
Vibration test	Frequency x Swing x Time 40Hz x 4mm x 4hrs
Drop test	Height x no. of drop 1.0m x 6 drops

12. LCD MODULES HANDLING PRECAUTIONS

- Please remove the protection foil of polarizer before using.
- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

- 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.

- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.

- 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.

- 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 0 ℃).Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

13. OTHERS

- 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.

- 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.

- 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