Display Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 128064P SBH-PW-N

Product Specification   **Ver.: 3**

11.12.2012

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
0	09.11.2012	First issue	MH
1	12.11.2012	Update	MH
2	21.11.2012	Update Specification First Page	MH
3	11.12.2012	Update	MH

CONTENTS

1. FUNCTIONS & FEATURES

Display Format	: 128 x 64 Dots
LCD Mode	: STN-BLUE, Transmissive, Negative
Backlight	: LED, Lightguide, White
Viewing Direction	: 6 o'clock
Driving Scheme	: 1/65 Duty, 1/9 Bias
Power Supply Voltage (V_{DD})	: 3.3 Volt (typ.)
LCD Driving Voltage	: 9.0 Volt (typ.)
Operation Temperature	: -20 to +70°C
Storage Temperature	: -30 to +80°C

2. MECHANICAL SPECIFICATIONS

Module Size	: 37.00 x 30.30 x 7.10 mm
Viewing Area	: 31.40 x 20.30 mm
Active Area	: 27.50 x 15.98 mm
Dot Pitch	: 0.215 x 0.250 mm
Dot Size	: 0.195 x 0.230 mm

3. BLOCK DIAGRAM
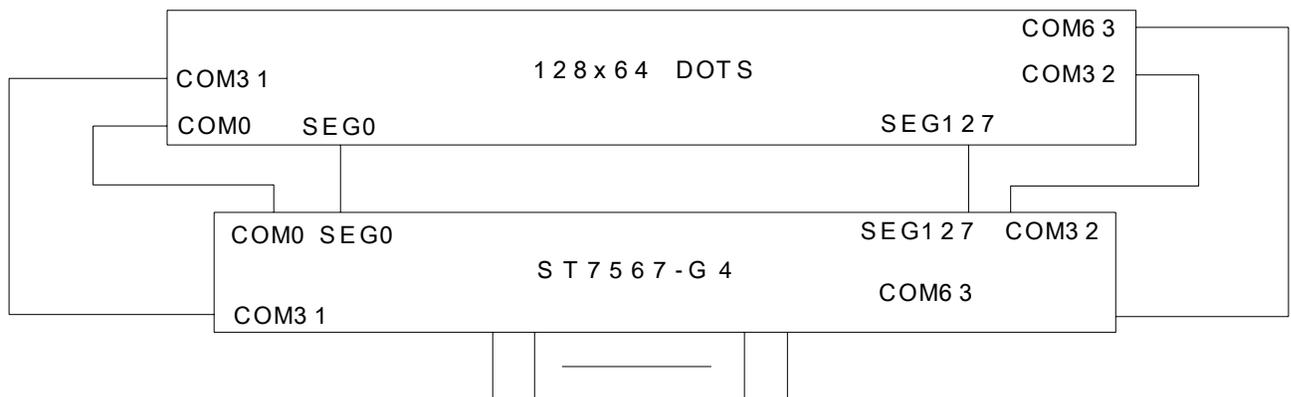
Figure 1 . Block Diagram

4. DIMENSIONAL OUTLINE

CONSTANT CURRENT:30mA,3.1V(REF.)
BACKLIGHT DRIVER CIRCUIT DIAGRAM

PIN	1	2	3	4	5	6	7	8	9	10
CONNECTION	NC	/CS1	/RES	A0	SCL	SI	VDD	VSS	NC	NC
PIN	11	12	13	14	15	16	17	18	19	20
CONNECTION	VO	XV0	NC	NC	NC	NC	NC	NC	VG	NC

COM&SEG LAYOUT

128*64DOTS
SEG127   SEG0
COM0 COM31 ST7567-G4 COM32 COM63

DOTS DETAIL
SCALE:15/1

BACK

FRONT

LIGHT GUIDE
SILICON
CONTACT SIDE
STIFFENER
TAPE
FPC

128*64 DOTS
VIEWING DIRECTION

Silk Screen
DEM 128064P
UL:XXXXXX
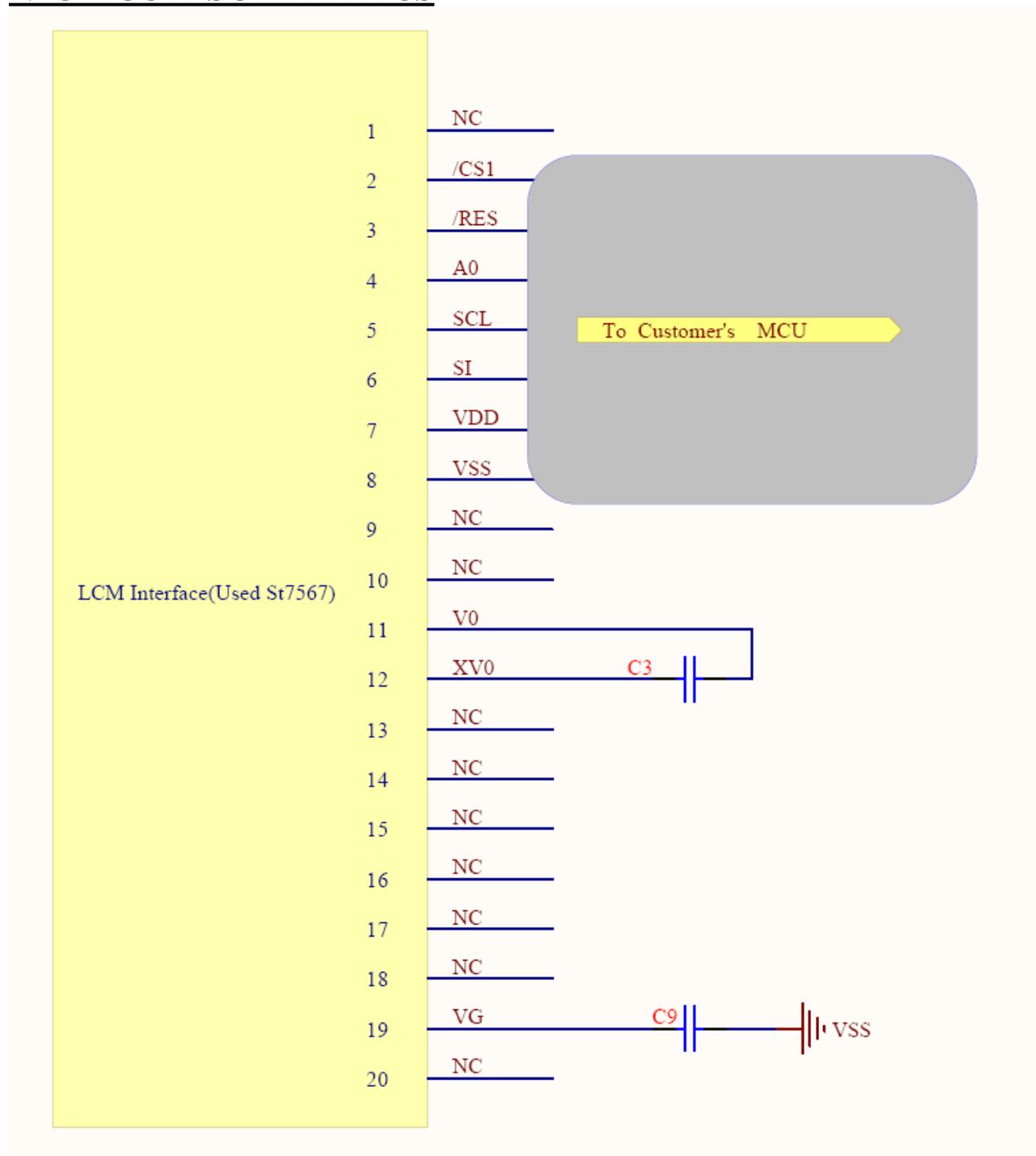
FRONT
BACK
A   K

5. PIN DESCRIPTION

No.	Symbol	Function
1	NC	No Connection
2	/CS1	Chip select input pin,interface access is enable when /CS1 is"L"
3	/RES	Hardware reset input pin. When /RES is "L", internal initialization is executed and the internal registers will be initialized.
4	A0	Register selection (H: Data register , L :Instruction register)
5	SCL	Serial clock input.
6	SI	Serial data input.
7	VDD	Power supply for Logic(+3.3V)
8	VSS	Power ground (0V)
9~10	NC	No Connection
11	V0	V0 is the LCD driving voltage for common circuits at negative frame
12	XV0	XV0 is the LCD driving voltage for common circuits at positive frame.
13~18	NC	No Connection
19	VG	VG is the LCD driving voltage for segment circuits.
20	NC	No Connection

6. MAXIMUM ABSOLUTE LIMIT

Item	Symbol	MIN	MAX	Unit
Supply Voltage for Logic	V_{DD}	-0.3	3.6	V
LCD Power supply voltage	$V_0 - XV_0$	-0.3	16	V
Input Voltage	Vi	-0.3	VDD+0.3	V
Supply Current for Backlight	I_F (Ta = 25°C)	---	36	mA
Reverse Voltage for Backlight	V_R (Ta = 25°C)	---	0.8	V
Operating Temperature	Top	-20	70	°C
Storage Temperature	Tst	-30	80	°C

7. CIRCUIT SCHEMATICS

Pin	Signal
1	NC
2	/CS1
3	/RES
4	A0
5	SCL
6	SI
7	VDD
8	VSS
9	NC
10	NC
11	V0
12	XV0
13	NC
14	NC
15	NC
16	NC
17	NC
18	NC
19	VG
20	NC

LCM Interface(Used St7567)

To Customer's MCU

C3

C9 — VSS

8. ELECTRICAL CHARACTERISTICS

DC Characteristics

Item	Symbol	Condition		Rating			Unit	Applicable Pin
				Min.	Typ.	Max.		
Operating Voltage (1)	VDD1			1.7	—	3.3	V	VDD1
Operating Voltage (2)	VDD2			2.4	—	3.3	V	VDD2
Operating Voltage (3)	VDD3			2.4	—	3.3	V	VDD3
Input High-level Voltage	V_{IHC}			0.7 x VDD1	—	VDD1	V	MPU Interface
Input Low-level Voltage	V_{ILC}			VSS1	—	0.3 x VDD1	V	MPU Interface
Output High-level Voltage	V_{OHC}	I_{OUT}=1mA, VDD1=1.8V		0.8 x VDD1	—	VDD1	V	D[7:0]
Output Low-level Voltage	V_{OLC}	I_{OUT}=-1mA, VDD1=1.8V		VSS1	—	0.2 x VDD1	V	D[7:0]
Input Leakage Current	I_{LI}			−1.0	—	1.0	µA	MPU Interface
Output Leakage Current	I_{LO}			−3.0	—	3.0	µA	MPU Interface
Liquid Crystal Driver ON Resistance	R_{ON}	Ta=25°C	Vop=8.5V, $\triangle$V=0.85V	—	0.6	0.8	KΩ	COMx
			VG=1.9V, $\triangle$V=0.19V	—	1.3	1.5	KΩ	SEGx
Frame Frequency	FR	Duty=1/65, Vop=8.5V Ta = 25°C		70	75	80	Hz	

Current consumption: During Display, with internal power system, current consumed by whole IC (bare die).

Test Pattern	Symbol	Condition	Rating			Unit	Note
			Min.	Typ.	Max.		
Display Pattern: SNOW (Static)	ISS	VDD1=VDD2=VDD3=3.0V, Booster X5 V_{OP} = 8.5 V, Bias=1/9 Ta=25°C	—	150	300	µA	
Display OFF	ISS	VDD1=VDD2=VDD3=3.0V, Booster X5 V_{OP} = 8.5 V, Bias=1/9 Ta=25°C	—	95	190	uA	
Power Down	ISS	VDD1=VDD2=VDD3=3.0V, Ta=25°C	—	8	16	µA	

Note:
- *The Current Consumption is DC characteristics*

9. TIMING CHARACTERISTICS

System Bus Timing for 4-Line Serial Interface
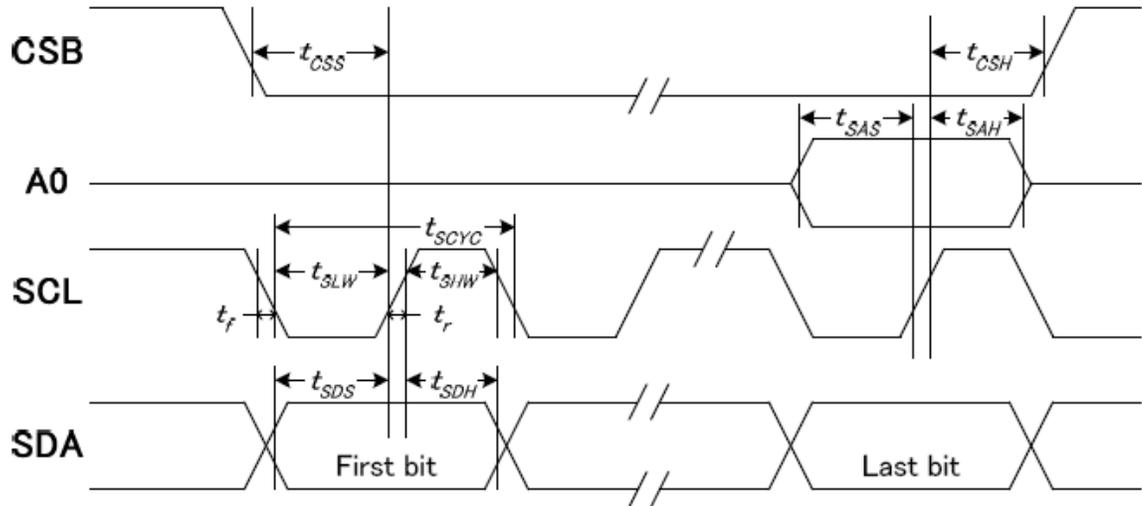
$(V_{DD}=3.3V, Ta=25°C)$

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period	SCLK	tSCYC		50	—	ns
SCLK "H" pulse width		tSHW		25	—	
SCLK "L" pulse width		tSLW		25	—	
Address setup time	A0	tSAS		20	—	
Address hold time		tSAH		10	—	
Data setup time	SDA	tSDS		20	—	
Data hold time		tSDH		10	—	
CSB-SCLK time	CSB	tCSS		20	—	
CSB-SCLK time		tCSH		40	—	

Hardware Reset Timing
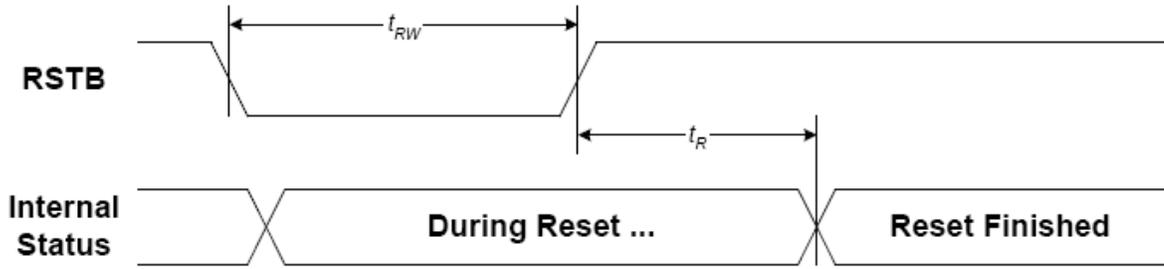
(V$_{DD}$=3.3V,Ta=25°C)

Item	Symbol	Condition	Min.	Max.	Unit
Reset time	tR		—	1.0	us
Reset "L" pulse width	tRW		1.0	—	

10. BACKLIGHT CHARACTERISTICS

LCD Module with Edge White LED Backlight

ELECTRICAL   RATINGS   Ta = 25°C

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	IF=30mA	2.9	3.1	3.3	V
Reverse Current	Ir	VR=0.8V	---	15	---	mA
Luminous Intensity (without LCD)	LV	IF=30mA	400	500	---	Cd/m^2
Luminous Intensity (with LCD)	LV	IF=30mA	47	72	---	Cd/m^2
Dominant Wavelength (without LCD)	X Y	IF=30mA	0.26---0.273---0.30 0.26---0.282---0.30			
Backlight Uniformity	≥ 75%					
Color	White					

When the temperature exceed 25°C, the approved current decrease rate for Backlight change as the temperature increase is: -0.36mA*/°C(below 25°C, the current refer to constant, which would not change with temperature).

11. ELECTRO-OPTICAL CHARACTERISTICS

(V_{DD}=3.3V, Ta = 25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Operating Voltage for LCD	Vop	Ta = -20°C	---	---	---	V
		Ta = 25°C	9.0	9.2	9.5	
		Ta = 70°C	---	---	---	
Response Time	Tr	Ta = 25°C	---	200	---	ms
	Tf		---	220	---	ms
Contrast	Cr	Ta = 25°C	2	4	---	---
Viewing Angle Range	θx-	Cr ≥ 2	30	35	---	deg
	θx+		30	35	---	deg
	θy-		35	45	---	deg
	θy+		35	40	---	deg

$$Cr = \frac{\text{Brightness of non-selected segment(B2)}}{\text{Brightness of selected segment(B1)}}$$
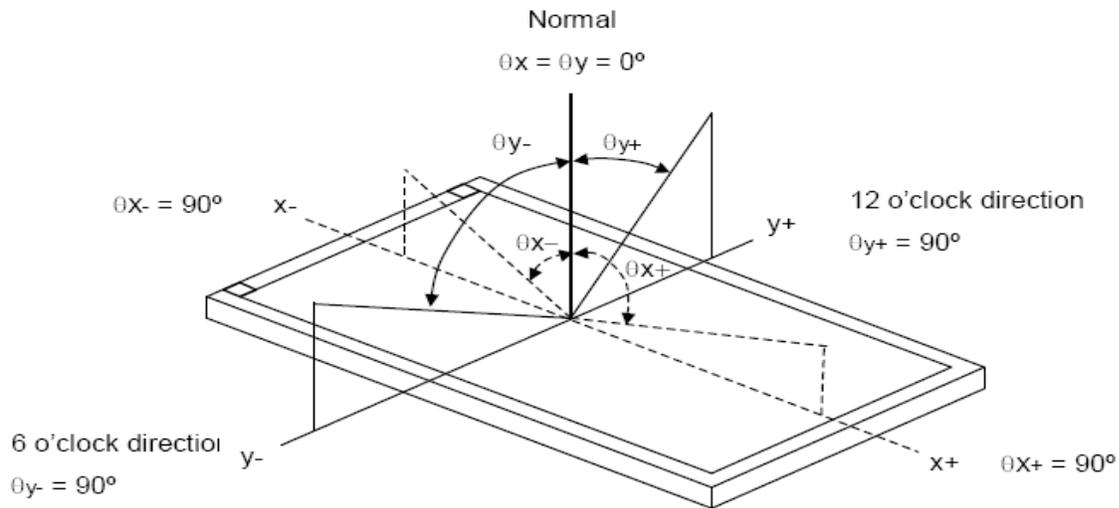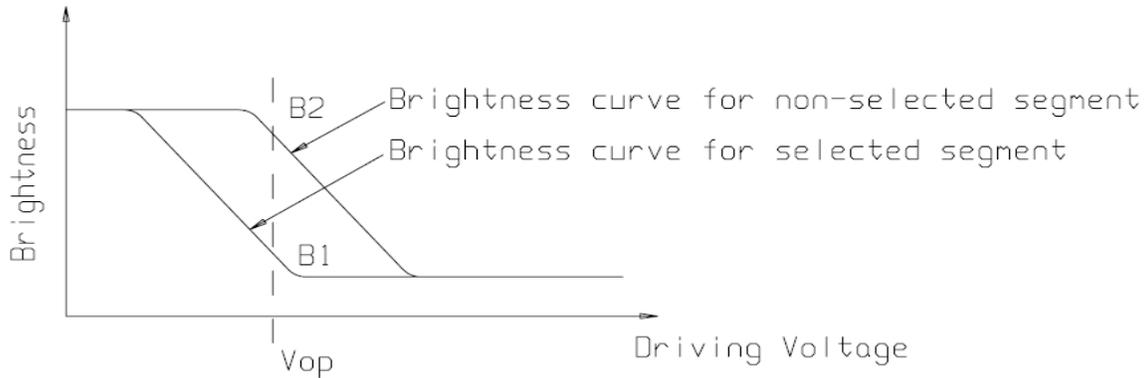
12. CONTROL AND DISPLAY INSTRUCTION

INSTRUCTION	A0	R/W (RWR)	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
(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!!
	0	0	0	0	0	0	0	0	0	BL	Set booster level: BL=0: 4X BL=1: 5X
(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) Test	0	0	1	1	1	1	1	1	1	-	Do NOT use. Reserved for testing.

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

13. PRECAUTION FOR USING LCD/LCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any

alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isoproply alcohol, ethyl alcohol or trichlorotriflorothane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting DISPLAY.
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: 270~300°C
4. Soldering time: 2 to 3 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage Vo.
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

DISPLAY LCDs and modules are not consumer products, but may be incorporated by DISPLAY's customers into consumer products or components thereof, DISPLAY does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of DISPLAY is limited to repair or replacement on the terms set forth below. DISPLAY will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between DISPLAY and the customer, DISPLAY will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with DISPLAY general LCD inspection standard . (Copies available on request)
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.

In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.

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