

**DM-COG128128-711**  
**128128 COG GRAPHIC LCD WITH**  
**PARALLEL OR SERIAL MPU INTERFACE**

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## 1 Revision History

Date	Changes
2015-03-13	First release
2015-11-19	Update Description

## 2 Main Features

Item	Specification	Unit
Resolution	128 x 128	pixels
Display Mode	STN Gray, Transflective	-
Controller IC	ST7528	-
Interface	parallel or serial	
Power Supply	3.0V	V
View Direction	6:00	-
Duty	1/128 duty, 1/12 bias	
Backlight	White LED	-
Weight	49.3	g

### 3 Pin Description

Pin No.	Symbol	Function Description
1~3	PS0~PS2	Microprocessor interface select input pin - PS[2:0]=001: 8080-series parallel MPU interface - PS[2:0]=011: 68000-series parallel MPU interface - PS[2:0]=000: 3-Line-SPI MPU interface - PS[2:0]=010: 4-Line-SPI MPU interface - PS[2:0]=100: IIC not available ( tie low)
4	CSB	Chip select input pins
5	RST	Reset input pin
6	A0	Register select input pin. A0=1:Data, A0=0:Command
7	RW-WR	Read / Write execution control pin
8	E-RD	Read / Write execution control pin
9-16	DB0~DB7	8-bit bi-directional data bus that is connected to the standard 8-bit microprocessor data bus. When the 3-Line/4-Line serial interface selected(PS[2:0]='000' or '111' -DB0 to DB5: high impedance -DB6: serial input clock (SCLK) -DB7: serial input data (SID)
17	VDD	Power supply for LCM (+3.0V)
18	VDD	Power supply for LCM (+3.0V)
19	VSS	
20	VSS	
21	VOUT-OUT	If the internal Vout voltage generator is used, the VOUT_IN & VOUT_OUT must be connected together. If an external supply is used, this pin must be left open.
22	VOUT-IN	An external Vout supply voltage can be supplied using the VOUT_IN pad. In this case, VOUT_OUT has to be left open, and the internal voltage generator has to be programmed to zero.
23~27	V4~V0	LCD driver supply voltages
28	VR	V0 voltage adjustment pin
29	INTRS	Internal resistor select pin
30	NC	

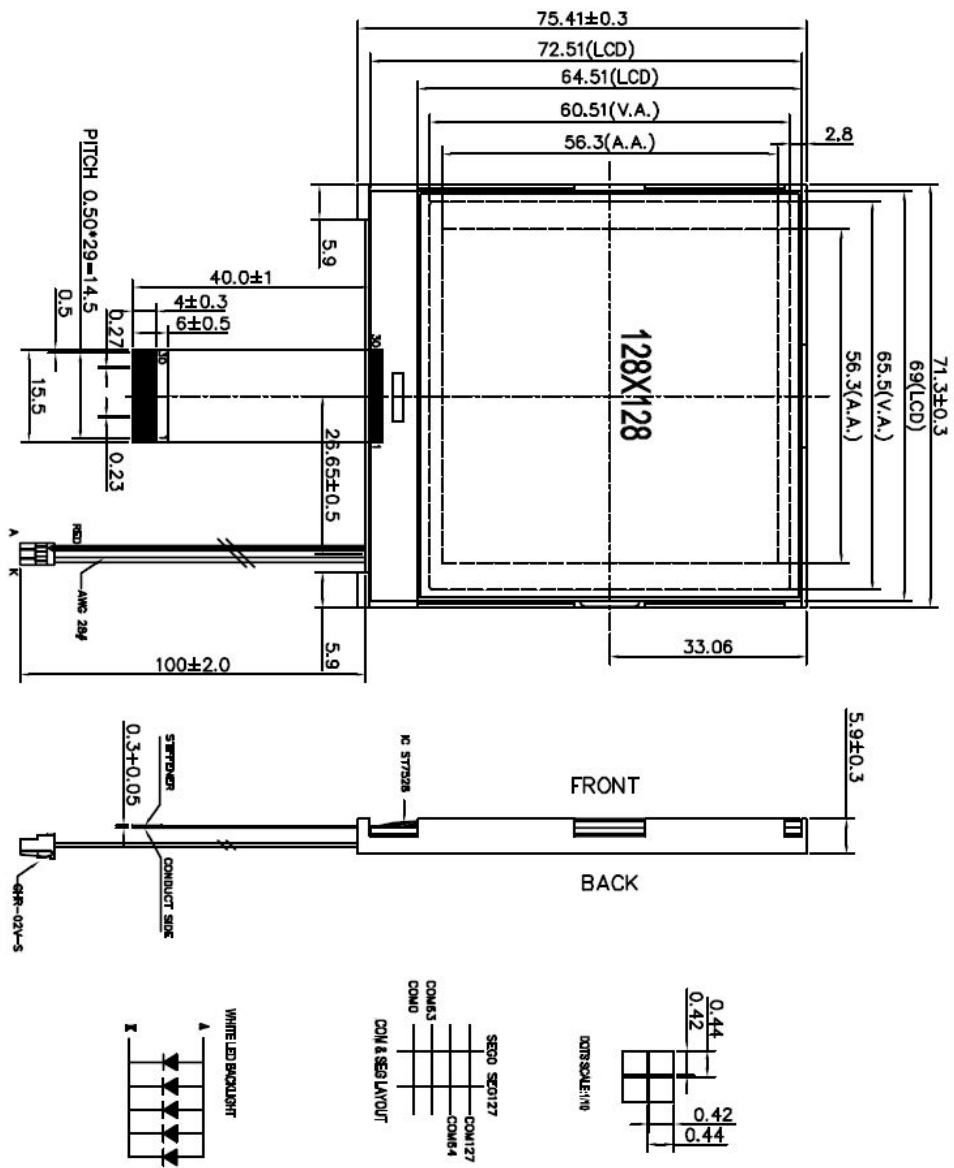
Recommended LCD connector: 0.5mm Pitch, 30 pin FFC. Molex p/n: 52892-3095

Backlight connector: GHR-02V-S Mates with: BM02B-GHS-T

**Note:** more information of interface, please see controller/driver IC [ST7528](#) datasheet

# 4 Mechanical Drawing

- Specification:
1. Driving: 1/128 Duty, 1/12 Bias, Vcd: 13.5V
  2. Viewing Direction: 6 O'clock
  3. Display mode: STN/Positive/Transflective/Gray
  4. Operating temp.: -20°C~+70°C  
Storage temp.: -30°C~+80°C
  5. Driver : ST7528 Vdd: 3V
  6. Edge Backlight: White Color, 3~3.3V, Current: 75~90mA
  7. RoHS Compliant



**PIN ASSIGNMENT**

NO.	SIGNAL
1	PS0
2	PS1
3	PS2
4	CSB
5	RST
6	A0
7	RN/ANR
8	ERD
9	DB0
10	DB1
11	DB2
12	DB3
13	DB4
14	DB5
15	DB6
16	DB7
17	VDD
18	VDD
19	VSS
20	VSS
21	VOUT-OUT
22	VOUT-IN
23	V4
24	V3
25	V2
26	V1
27	V0
28	VR
29	INTRS
30	NC

## 5 Electrical Characteristics

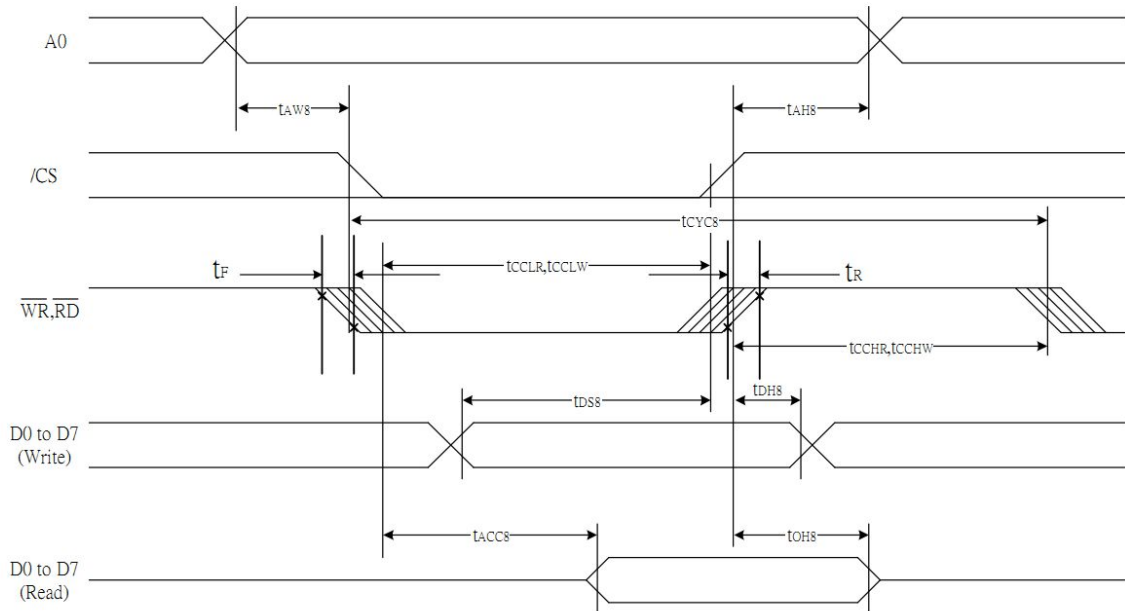
Item	Symbol	Condition	Min	Typ.	Max	Unit
Supply Voltage	VDD			3.0		V
Supply Current	IDD	-	-	0.25	0.45	mA
Low Level Input Voltage	V <sub>IL</sub>		0	-	0.6	V
High Level Input Voltage	V <sub>IH</sub>		2.2	-	VDD	V
Low Level Output Voltage	V <sub>OL</sub>		-		0.4	V
High Level Output Voltage	V <sub>OH</sub>		2.4		-	V
Backlight Forward Voltage	V <sub>LED</sub>			3.0		V
Backlight Forward Current	I <sub>LED</sub>		75		90	mA
Operating Temperature	TOP	Absolute Max	-20		70	°C
Storage Temperature	TST	Absolute Max	-30		80	°C

## 6 Optical Characteristics

Item	Symbol	Min	Typ	Max	Unit
View Angle-Vertical	AV		60		°
View Angle-Horizontal	AH		70		°
Response Time (25°C)	Tr + Tf		350	550	ms
Contrast Ratio	CR	3	5		

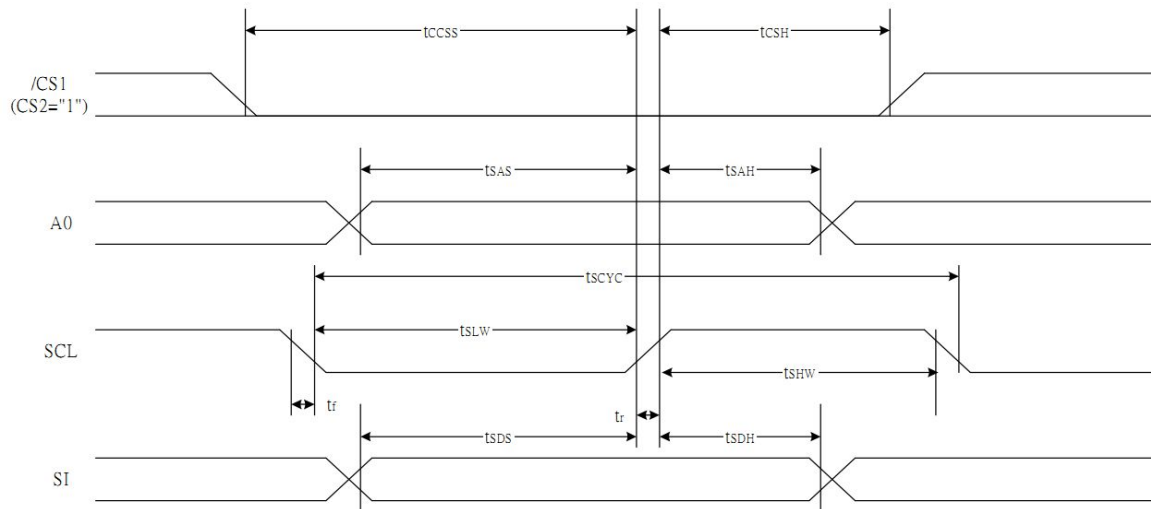
## 7 Timing Characteristics

### System Bus Read/Write Characteristics (For the 8080 Series MPU)



(VDD = 3.3V, Ta = -30-85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	tAH8		0	—	ns
Address setup time		tAW8		0	—	
System cycle time		tCYC8		240	—	
Enable L pulse width (WRITE)	WR	tCCLW		80	—	
Enable H pulse width (WRITE)		tCCHW		80	—	
Enable L pulse width (READ)	RD	tCCLR		140	—	
Enable H pulse width (READ)		tCCHR		80	—	
WRITE Data setup time	D0 to D7	tDS8		40	—	
WRITE Data hold time		tDH8		10	—	
READ access time		tACC8	CL = 100 pF	—	70	
READ Output disable time		tOH8	CL = 100 pF	5	50	

**Serial Interface (4-Wire Interface)**

 ( $V_{DD}=3.3V, T_a=-30\sim 85^{\circ}C$ )

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	CSB	$t_{CSS}$		20	—	
CS-SCL time		$t_{CSH}$		40	—	



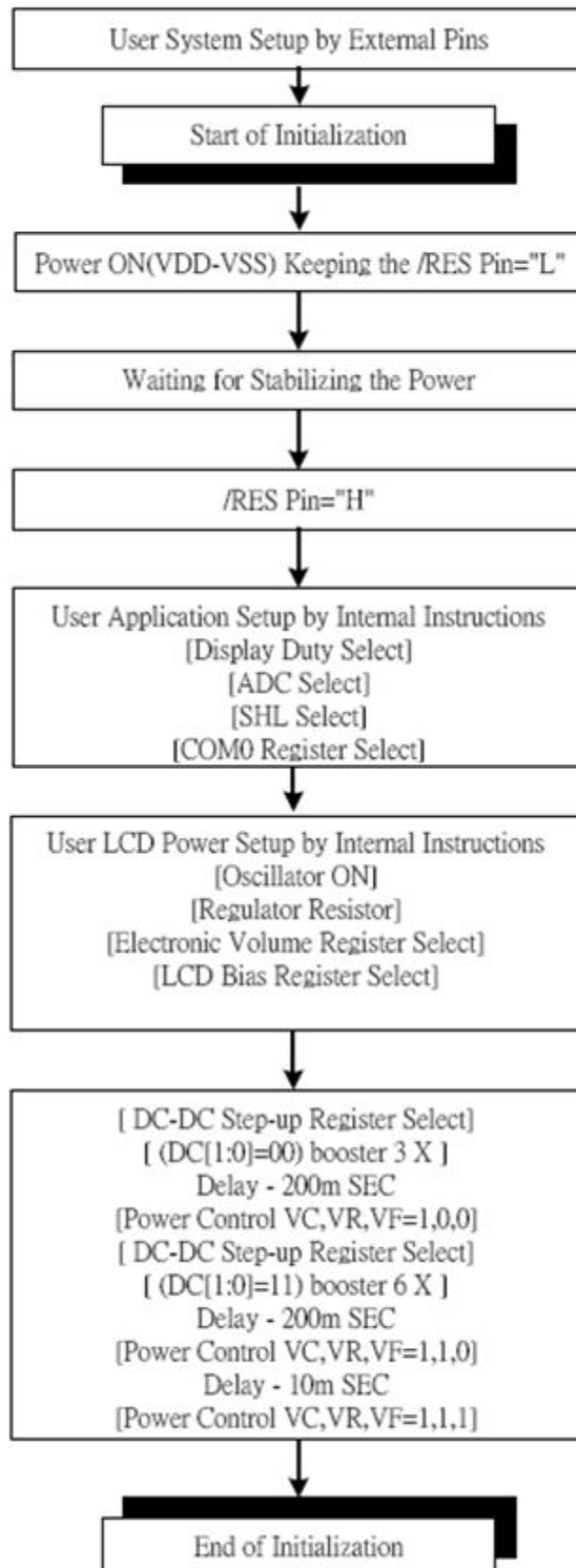
## 8 Table of Commands

Instruction	A0	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
<b>EXT=0 or 1</b>											
Mode Set	0	0	0	0	1	1	1	0	0	0	2-byte instruction to set Mode and FR( Frame frequency control) BE( Booster efficiency control)
	0	0	FR3	FR2	FR1	FR0	0	BE	x'	EXT	
<b>EXT=0</b>											
Read display data	1	1	Read data								Read data into DDRAM
Write display data	1	0	Write data								Write data into DDRAM
Read status	0	1	BUSY	ON	RES	MF2	MF1	MF0	DS1	DS0	Read the internal status
ICON control register ON/OFF	0	0	1	0	1	0	0	0	1	ICON	ICON=0: ICON disable(default) ICON=1: ICON enable & set the page address to 16
Set page address	0	0	1	0	1	1	P3	P2	P1	P0	Set page address
Set column address MSB	0	0	0	0	0	1	Y9	Y8	Y7	Y6	Set column address MSB
Set column address LSB	0	0	0	0	0	0	Y5	Y4	Y3	Y2	Set column address LSB
Set modify-read	0	0	1	1	1	0	0	0	0	0	Set modify-read mode
Reset modify-read	0	0	1	1	1	0	1	1	1	0	release modify-read mode
Display ON/OFF	0	0	1	0	1	0	1	1	1	D	D=0: Display OFF D=1: Display ON
Set initial display line register	0	0	0	1	0	0	0	0	x'	x'	2-byte instruction to specify the initial display line to realize vertical scrolling
	0	0	x'	S6	S5	S4	S3	S2	S1	S0	
Set initial COM0 register	0	0	0	1	0	0	0	1	x'	x'	2-byte instruction to specify the initial COM0 to realize window scrolling
	0	0	x'	C6	C5	C4	C3	C2	C1	C0	
Set partial display duty ration	0	0	0	1	0	0	1	0	x'	x'	2-byte instruction to set partial display duty ratio
	0	0	D7	D6	D5	D4	D3	D2	D1	D0	
Set N-line inversion	0	0	0	1	0	0	1	1	x'	x'	2-byte instruction to set N-line inversion register
	0	0	x'	x'	x'	N4	N3	N2	N1	N0	
Release N-line inversion	0	0	1	1	1	0	0	1	0	0	Release N-line inversion mode
Reverse display ON/OFF	0	0	1	0	1	0	0	1	1	REV	REV=0: normal display REV=1: reverse display
Entire display ON/OFF	0	0	1	0	1	0	0	1	0	EON	EON=0: normal display EON=1: entire display ON

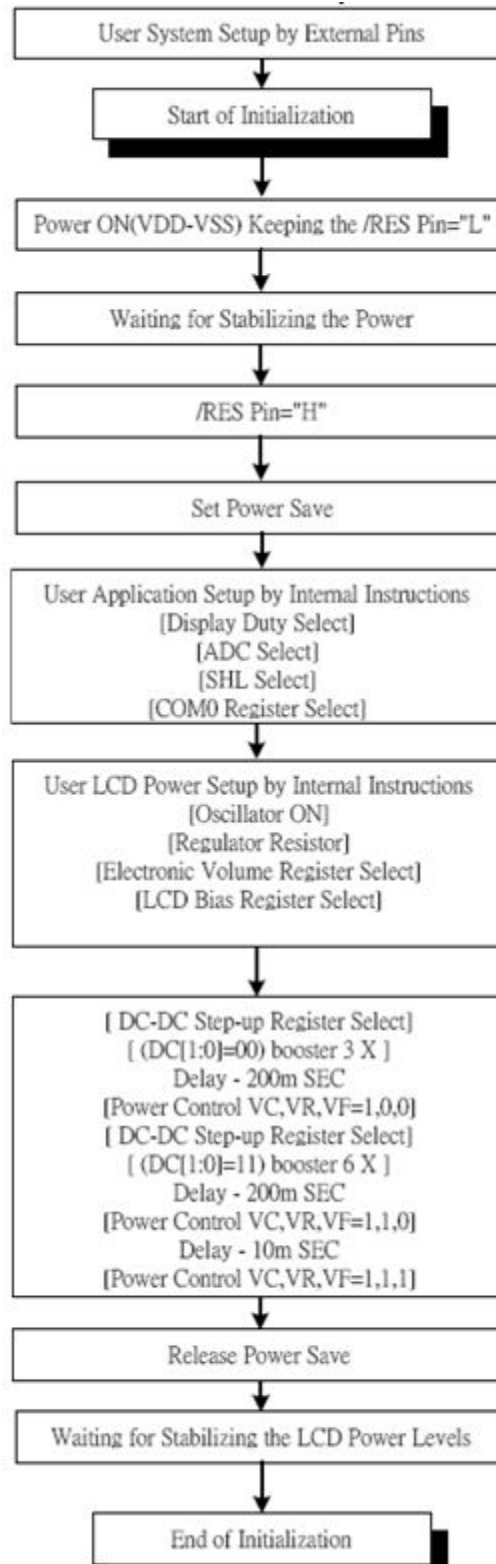
Instruction	A0	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
<b>Ext=0</b>											
Power control	0	0	0	0	1	0	1	VC	VR	VF	Control power circuit operation
Select DC-DC step-up	0	0	0	1	1	0	0	1	DC1	DC0	Select the step-up of internal voltage converter
Select regulator register	0	0	0	0	1	0	0	R2	R1	R0	Select the internal resistance ratio of the regulator resistor
Select electronic volume register	0	0	1	0	0	0	0	0	0	1	2-byte instruction to specify the reference voltage
	0	0	x'	x'	EV5	EV4	EV3	EV2	EV1	EV0	
Select LCD bias	0	0	0	1	0	1	0	B2	B1	B0	Select LCD bias
Bias Power Save	0	0	1	1	1	1	0	0	1	1	Bias Power save Save the Bias current consumption
	0	0	0	0	0	0	0	0	0	0	
SHL select	0	0	1	1	0	0	SHL	x'	x'	x'	COM bi-directional selection SHL=0: normal direction SHL=1: reverse direction
ADC select	0	0	1	0	1	0	0	0	0	ADC	SEG bi-direction selection ADC=0: normal direction ADC=1: reverse direction
Oscillator on start	0	0	1	0	1	0	1	0	1	1	Start the built-in oscillator
Set power save mode	0	0	1	0	1	0	1	0	0	P	P=0: normal mode P=1: sleep mode
Release power save mode	0	0	1	1	1	0	0	0	0	1	release power save mode
Reset	0	0	1	1	1	0	0	0	1	0	initial the internal function
Set data direction & display data length(DDL)	x'	x'	1	1	1	0	1	0	0	0	2-byte instruction to specify the number of data bytes. (SPI mode)
	x'	x'	D7	D6	D5	D4	D3	D2	D1	D0	
Select FRC and PWM mode	0	0	1	0	0	1	0	FRC	PWM1	PWM0	FRC(1:3FRC, 0:4FRC) PWM1 PWM0 0 0 45PWM 0 1 45 PWM 1 0 60PWM 1 1 ---
NOP	0	0	1	1	1	0	0	0	1	1	<i>No operation</i>
Test Instruction	0	0	1	1	1	1	x'	x'	x'	x'	<i>Don't use this instruction</i>

Instruction	A0	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
EXT=1											
Set white mode and 1 <sup>st</sup> frame, set pulse width	0	0	1	0	0	0	0	0	0	0	Set white mode and 1st frame
	0	0	X'	X'	GA05	GA04	GA03	GA02	GA01	GA00	
Set white mode and 2 <sup>nd</sup> frame, set pulse width	0	0	1	0	0	0	0	0	0	1	Set white mode and 2nd frame
	0	0	X'	X'	GA05	GA04	GA03	GA02	GA01	GA00	
Set white mode and 3 <sup>rd</sup> frame, set pulse width	0	0	1	0	0	0	0	0	1	0	Set white mode and 3rd frame
	0	0	X'	X'	GA05	GA04	GA03	GA02	GA01	GA00	
Set white mode and 4 <sup>th</sup> frame, set pulse width	0	0	1	0	0	0	0	0	1	1	Set white mode and 4th frame
	0	0	X'	X'	GA05	GA04	GA03	GA02	GA01	GA00	
Set gray level 1 mode	0	0	84H~87H (4 bytes)								Set gray level1
Set gray level 2 mode	0	0	88H~8BH (4 bytes)								Set gray level2
Set gray level 3 mode	0	0	8CH~8FH (4bytes)								Set gray level3
Set gray level 4 mode	0	0	90H~93H (4bytes)								Set gray level4
Set gray level 5 mode	0	0	94H~97H (4bytes)								Set gray level5
Set gray level 6 mode	0	0	98H~9BH (4 bytes)								Set gray level6
Set gray level 7 mode	0	0	9CH~9FH (4 bytes)								Set gray level7
Set gray level 8 mode	0	0	A0H~A3H (4 bytes)								Set gray level8
Set gray level 9 mode	0	0	A4H~A7H (4 bytes)								Set gray level9
Set gray level 10 mode	0	0	A8H~ABH (4 bytes)								Set gray level10
Set gray level 11mode	0	0	ACH~AFH (4 bytes)								Set gray level11
Set gray level 12 mode	0	0	B0H~B3H (4 bytes)								Set gray level12
Set gray level 13 mode	0	0	B4H~B7H (4 bytes)								Set gray level13
Set gray level 14 mode	0	0	B8H~BBH (4 bytes)								Set gray level14
Set Dark mode and 1st frame, set pulse width	0	0	1	0	1	1	1	1	0	0	Set Dark mode and 1st frame, set pulse width
	0	0	X'	X'	GAF5	GAF4	GAF3	GAF2	GAF1	GAF0	
Set Dark mode and 2nd frame, set pulse width	0	0	1	0	1	1	1	1	0	1	Set Dark mode and 2nd frame, set pulse width
	0	0	X'	X'	GAF5	GAF4	GAF3	GAF2	GAF1	GAF0	
Set Dark mode and 3rd frame, set pulse width	0	0	1	0	1	1	1	1	1	0	Set Dark mode and 3rd frame, set pulse width
	0	0	X'	X'	GAF5	GAF4	GAF3	GAF2	GAF1	GAF0	
Set Dark mode and 4th frame, set pulse width	0	0	1	0	1	1	1	1	1	1	Set Dark mode and 4th frame, set pulse width
	0	0	X'	X'	GAF5	GAF4	GAF3	GAF2	GAF1	GAF0	

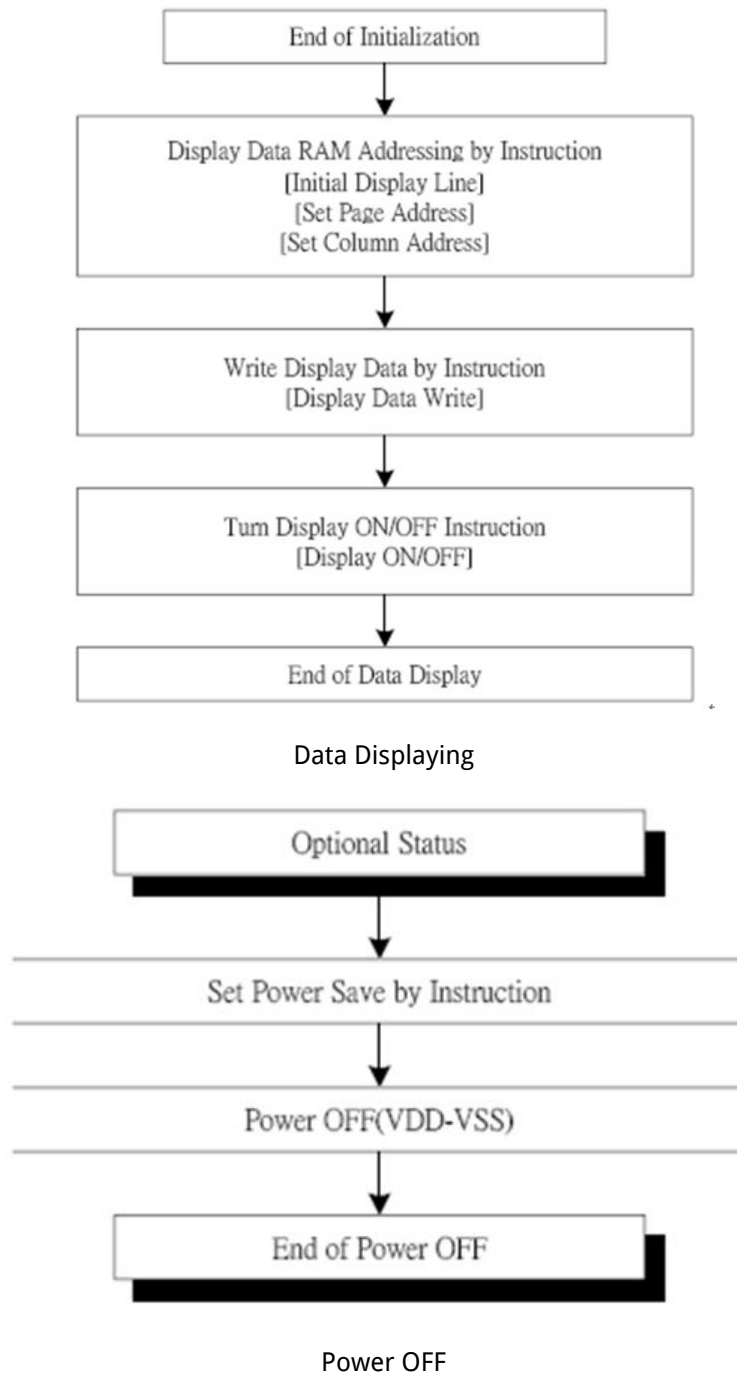
## 9 Command Description



Initializing with the Built-in Power Supply Circuits



Initializing without Built-in Power Supply Circuits

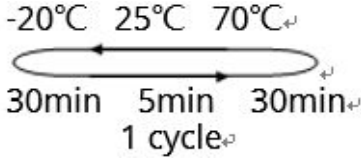


## 10 Driver/Controller Information

Built-in ST7528 Controller:

<https://drive.google.com/file/ST7528>

## 11 Reliability

Test Item	Content of Test	Test Condition	Note
High Temperature Storage	Endurance test applying the high storage temperature for a long time.	80°C 200hrs	2
Low Temperature Storage	Endurance test applying the high storage temperature for a long time.	-30°C 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70°C 200hrs	-
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20 °C 200hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60°C,90%RH max, for 96hrs under no-load condition excluding the polarizer. Then taking it out and drying it at normal temperature.	60°C,90%RH 96hrs	1,2
Thermal Shock Resistance	The sample should be allowed stand the following 10 cycles of operation 	-20°C/70°C 10 cycles	-
Vibration Test	Endurance test applying the vibration during transportation and using	Total fixed amplitude: 15mm; Vibration: 10~55Hz; One cycle 60 seconds to 3 directions of X, Y, Z, for each 16 minutes.	3
Static Electricity Test	Endurance test apply the electric stress to the terminal.	VS=800V, RS=1.5kΩ, CS=100pF, 1 time.	-

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal. Temperature and humidity after remove from the rest chamber.

Note3: Test performed on product itself, not inside a container.

## 12 Warranty and Conditions

<http://www.displaymodule.com/pages/faq>