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LM128128EFW

LCD Module User Manual

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Rev.	Descriptions	Release Date
0.1	Preliminary release	2013-09-16

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1. Basic Specifications

1.1 Display Specifications

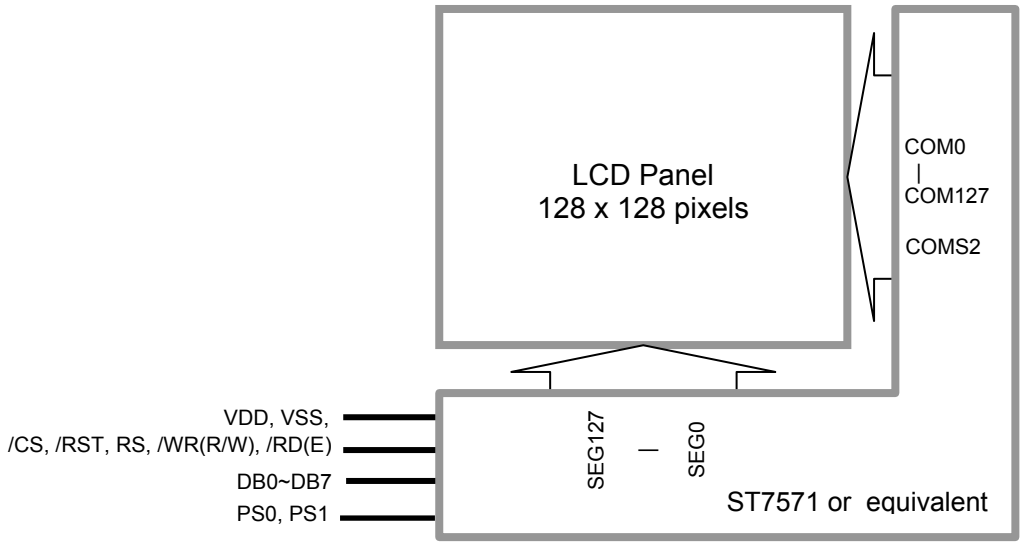
1) LCD Display Mode : STN-Blue, Negative, Transmissive
2) Display Color : Display Data = “1” : Dark Gray (*1)
: Display Data = “0” : Light Gray (*2)
3) Viewing Angle : 6 H
4) Driving Method : 1/128 duty, 1/9bias
5) Back Light : White LED backlight

Note:
*1. Color tone may slightly change by Temperature and Driving Condition.
*2. The Color is defined as the inactive / background color
*3. Fine Contrast adjustment function is necessary in the application design for optimal display result

1.2 Mechanical Specifications

1) Outline Dimension : 52.0 x 50.0 x 8.9MAX
(See attached Outline Drawing for details)

1.3 Block Diagram



1.4 Terminal Functions

Pin No.	Pin Name	I/O	Descriptions		
			8-bit parallel 8080 mode(*1)	8-bit parallel 6800 mode	Serial 4-Line
1	VSS	Power	Ground (0V supply)		
2	VDD	Power	Positive Power Supply		
3	DB7(SID)	Input	8-bit Data bus; Three state I/O terminal for display data or instruction data when CSB =H DB0~DB7=High Impedance		Serial data input(DB7)
4	DB6(SCLK)				Serial clock input(DB6)
5	DB5				Not use, connect to VDD
:	:				
10	DB0				
11	/RD(E)	Input	/WR=H,/RD=L→H; Data or status read form the LCD module	R/W=L, E=H→L; Data or Status latch into the LCD module	Not use, connect to VDD
12	/WR(R/W)	Input	/WR=L→H, /RD=H; Data or Instruction latch into the LCD module	R/W=H, E= H; Data or status read form the LCD module	
13	RS	Input	Register Select RS = H, Transferring the Display RAM data RS = L, Transferring the Instruction data		
14	/RST	Input	Reset input pin, when /RST is "L", initialization is executed		
15	/CS	Input	Chip Select CSB=L : Data IO is enabled		
16	BLA	Power	Positive Power Supply for LED backlight		
17	NC	-	No connection (leave open)		
:	:	-	:		
32	NC	-	No connection (leave open)		

Note: it is impossible to read data from the on-chip DDRAM in serial mode.
*1. default mode.

1.5 Jumper Functions

Jumper Setting				Function	Condition
JP1	JP2	JP3	JP4		
OPEN	CLOSE	CLOSE	OPEN	8080 mode	Set to 8080 mode (8-bit parallel)<default setting>
CLOSE	CLOSE	OPEN	OPEN	6800 mode	Set to 6800 interface mode(8-bit parallel)
CLOSE	OPEN	OPEN	CLOSE	4pin SPI	Set to 4-pin SPI mode(serial)
OPEN	OPEN	CLOSE	CLOSE	3pin SPI	Set to 3-pin SPI mode(serial)

2. Absolute Maximum Ratings

Items	Symbol	Min.	Max.	Unit	Condition
Supply Voltage	V_{DD}	0	3.4	V	V_{SS} = 0V
Operating Temperature	T_{OP}	-20	70	°C	No Condensation
Storage Temperature	T_{ST}	-30	80	°C	No Condensation

Cautions:
Any Stresses exceeding the Absolute Maximum Ratings may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

3. Electrical Characteristics

3.1 DC Characteristics

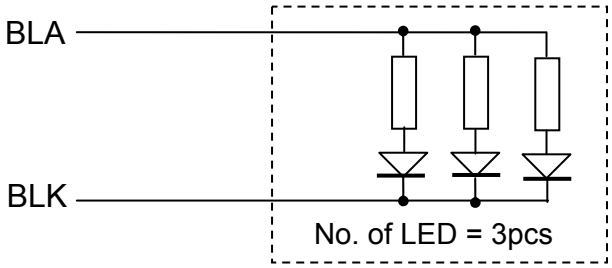
V_{SS}=0V, V_{DD} =3.3V, T_{OP} =25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Applicable Pin
Operating Voltage	V_{DD}	-	3.3	3.4	V	VDD
Input High Voltage	V_{IH}	$0.8V_{DD}$	-	V_{DD}	V	/CSB,A0,DB0~DB7, /WR(R/W),/RD(E),/RST
Input Low Voltage	V_{IL}	V_{SS}	-	$0.2V_{DD}$	V	

3.2 LED Backlight Circuit Characteristics

Items	Symbol	MIN.	TYP.	MAX.	Unit	Applicable Pin
Forward Voltage	Vf_{BLA}	-	3.3	-	V	BLA
Forward Current	If_{BLA}	-	45	60	mA	BLA

Cautions:
Exceeding the recommended driving current could cause substantial damage to the backlight and shorten its lifetime.



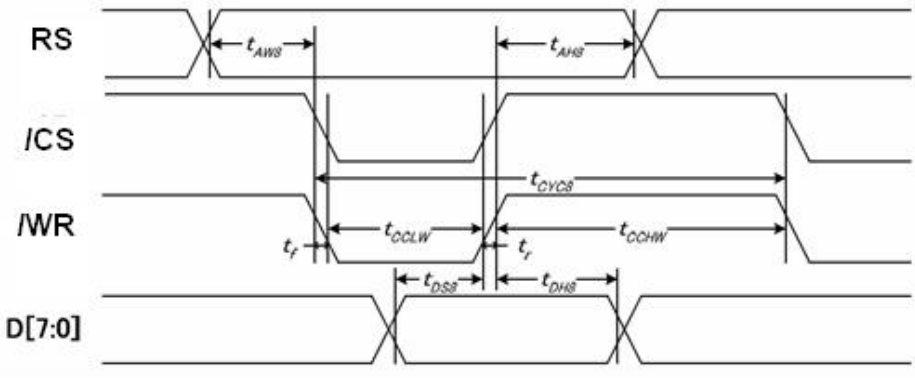
3.3 AC Characteristics

3.3.1 8080 Interface

VSS=0V, VDD=3.3V, T_{OP} =25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit
Address Hold Time	tah8	5	-	-	ns
Address Setup Time	taw8	5	-	-	ns
System Cycle Time	tcyc8	714	-	-	ns
Enable L Pulse Width (write)	tcclw	357	-	-	ns
Enable H Pulse Width (write)	tcchw	357	-	-	ns
Write Data Setup Time	tds8	114	-	-	ns
Write Data Hold Time	tdh8	42	-	-	ns

note: signal rise time and fall time should less than 12ns

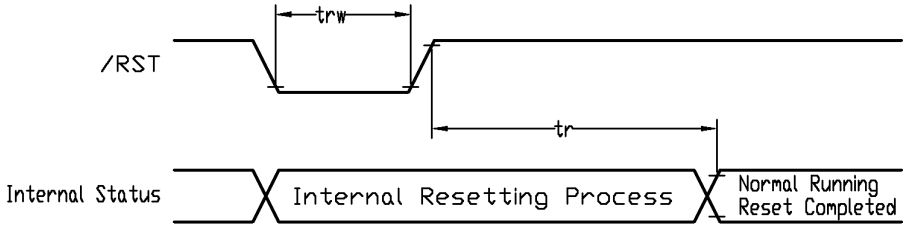


3.3.2 Reset Input

V_{SS}=0V, V_{DD} =3.3V, T_{OP} =25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit

Reset Low Pulse Width	trw	2.0	-	-	us
Reset Time	tr	120	-	-	ms



4. Function Specifications

4.1 Adjusting the Display Contrast

- This LCD module equipped with latest digital contrast adjustment function. Its display contrast could be adjusted by MCU command. (Please see the command tables for details)
- It is recommended to provide a contrast adjustment interface for end-user, where the best display result could meet the individual preference in mass production.

4.2 Resetting the LCD module

The LCD module should be initialized by setting /RST terminal at low level after the power supply stable.

4.3 Display Memory Map

Page	data	LCD Display (front view)								
0	D0 : D7									
1	D0 : D7									
2	D0 : D7									
: :	: :	128x128 Pixels								
17	D0 : D7									
15	D0 : D7									
Internal address	Y0	0	1	0	1	……	0	1	0	1
Column Address	Y7 . . Y1	00H		01H		……	7EH		7FH	

Note: Display start line = 0, COM0 Register=0, Duty Ratio = 1/128, ADC=1, SHL=0
Only the upper 7bit(Y7:Y1)could be accessed by Column Address instruction,and the instruction Will set the Y0 to “0” .

4.4 Instructions

Instruction	A0	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
Set Mode	0	0	0	0	1	1	1	0	0	0	2-byte instruction
	0	0	FR3	FR2	FR1	FR0	BE1	BE0	--	0	FR[3:0]: Set frame frequency BE[1:0]: Set booster efficiency
Write Display Data	1	0	Write data								Write data into DDRAM
Set Icon	0	0	1	0	1	0	0	0	1	ION	ION=0: Disable Icon function ION=1: Enable Icon function and set Page Address = 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	0	X7	X6	X5	Set MSB of Column Address
Set Column Address (LSB)	0	0	0	0	0	0	X4	X3	X2	X1	Set LSB of Column Address
Display ON/OFF	0	0	1	0	1	0	1	1	1	D	D=0: Display OFF D=1: Display ON
Set Display Start Line	0	0	0	1	0	0	0	0	--	--	2-byte instruction. Specify Line Address for the 1st display line of DDRAM (vertical scrolling).
	0	0	--	S6	S5	S4	S3	S2	S1	S0	
Set COM0	0	0	0	1	0	0	0	1	--	--	2-byte instruction. Specify a COM pin to be COM0 (moving partial display window).
	0	0	--	C6	C5	C4	C3	C2	C1	C0	
Set Display Duty	0	0	0	1	0	0	1	0	--	--	2-byte instruction. Set display duty
	0	0	L7	L6	L5	L4	L3	L2	L1	L0	
Set N-line Inversion	0	0	0	1	0	0	1	1	--	--	2-byte instruction. Set N-line inversion counter
	0	0	--	--	--	N4	N3	N2	N1	N0	
Release N-line Inversion	0	0	1	1	1	0	0	1	0	0	Exit N-line inversion mode
Reverse Display	0	0	1	0	1	0	0	1	1	REV	REV=0: Normal display REV=1: Reverse display
Entire Display ON	0	0	1	0	1	0	0	1	0	EON	EON=0: Normal display EON=1: Entire display ON

Note:

*1. For the details of the Display Control Instructions, please refer to ST7571 datasheet.

Instruction (cont')

Instruction	A0	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
Power Control	0	0	0	0	1	0	1	VC	VR	VF	Set internal power ON/OFF
Select Regulator Register	0	0	0	0	1	0	0	R2	R1	R0	Select internal Regulator resistor
Set Contrast	0	0	1	0	0	0	0	0	0	1	2-byte instruction. Select EV for internal Regulator's reference
	0	0	--	--	EV5	EV4	EV3	EV2	EV1	EV0	
Select LCD bias	0	0	0	1	0	1	0	B2	B1	B0	Select LCD bias
Set COM Scan Direction	0	0	1	1	0	0	MY	--	--	--	Set COM scan direction: MY=0: Normal direction MY=1: Reverse direction
Set SEG Scan Direction	0	0	1	0	1	0	0	0	0	MX	Set SEG scan direction: MX=0: Normal direction MX=1: Reverse direction
Oscillator ON	0	0	1	0	1	0	1	0	1	1	Turn ON internal Oscillator
Set Power-Save Mode	0	0	1	0	1	0	1	0	0	P	P=0: Normal mode P=1: Enable Power-Save mode
Release Power-Save Mode	0	0	1	1	1	0	0	0	0	1	Exit Power-Save mode
RESET	0	0	1	1	1	0	0	0	1	0	Software reset
Set Display Data Length	--	--	1	1	1	0	1	0	0	0	2-byte instruction. Set the data counter in 3-Line SPI only
	--	--	DL7	DL6	DL5	DL4	DL3	DL2	DL1	DL0	
NOP	0	0	1	1	1	0	0	0	1	1	No operation
Reserved	0	0	1	1	1	0	0	0	0	0	Do NOT use
Reserved	0	0	1	1	1	0	1	1	1	0	Do NOT use
Reserved	0	0	1	1	1	1	--	--	--	--	Reserved for testing
Test Command Set1	0	0	1	1	1	1	1	1	0	TE1	TE1=1: Enter test Mode1
Test Command Set2	0	0	1	1	0	1	0	0	0	TE2	TE2=1: Enter test Mode2
Test Command Set3	0	0	0	1	1	1	1	0	1	TE3	TE3=1: Enter test Mode3

Note:
*1. For the details of the Display Control Instructions, please refer to ST7571 datasheet.

4.4.1 Power off the LCD Module

It recommends that LCD module should enter sleep mode before power off.

4.4.2 Refreshing The LCD Module

It recommends that the operating modes and display contents should be refreshed periodically to prevent the effect of unexpected noise.

5. Design and Handling Precaution

1. The LCD panel is made by glass. Any mechanical shock (eg. dropping form high place) will damage the LCD module.
2. Do not add excessive force on the surface of the display, which may cause the Display color change abnormally.
3. The polarizer on the LCD is easily get scratched. If possible, do not remove the LCD protective film until the last step of installation.
4. Never attempt to disassemble or rework the LCD module.
5. Only Clean the LCD with Isopropyl Alcohol or Ethyl Alcohol. Other solvents (eg. water) may damage the LCD.
6. When mounting the LCD module, make sure that it is free form twisting, warping and distortion.
7. Ensure to provide enough space (with cushion) between case and LCD panel to prevent external force adding on it, or it may cause damage to the LCD or degrade the display result.
8. Only hold the LCD module by its side. Never hold LCD module by add force on the heat seal or TAB.
9. Never add force to component of the LCD module. It may cause invisible damage or degrade of the reliability.
10. LCD module could be easily damaged by static electricity. Be careful to maintain an optimum anti-static work environment to protect the LCD module.
11. When peeling off the protective film from LCD, static charge may cause abnormal display pattern. It is normal and will resume to normal in a short while.
12. Take care and prevent get hurt by the LCD panel sharp edge.
13. Never operate the LCD module exceed the absolute maximum ratings.
14. Keep the signal line as short as possible to prevent noisy signal applying to LCD module.
15. Never apply signal to the LCD module without power supply.
16. IC chip (eg. TAB or COG) is sensitive to the light. Strong lighting environment could possibly cause malfunction. Light sealing structure casing is recommend.
17. LCD module reliability may be reduced by temperature shock.
18. When storing the LCD module, avoid exposure to the direct sunlight, high humidity, high temperature or low temperature. They may damage or degrade the LCD module