

SPECIFICATION FOR LCD MODULE

Model No. TM128128CCBWT4

Prepared by:	Date:
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TIANMA MICROELECTRONICS CO., LTD

REVISION RECORD

Date	Ref. Page	Revision No.	Revision Items	Check & Approval

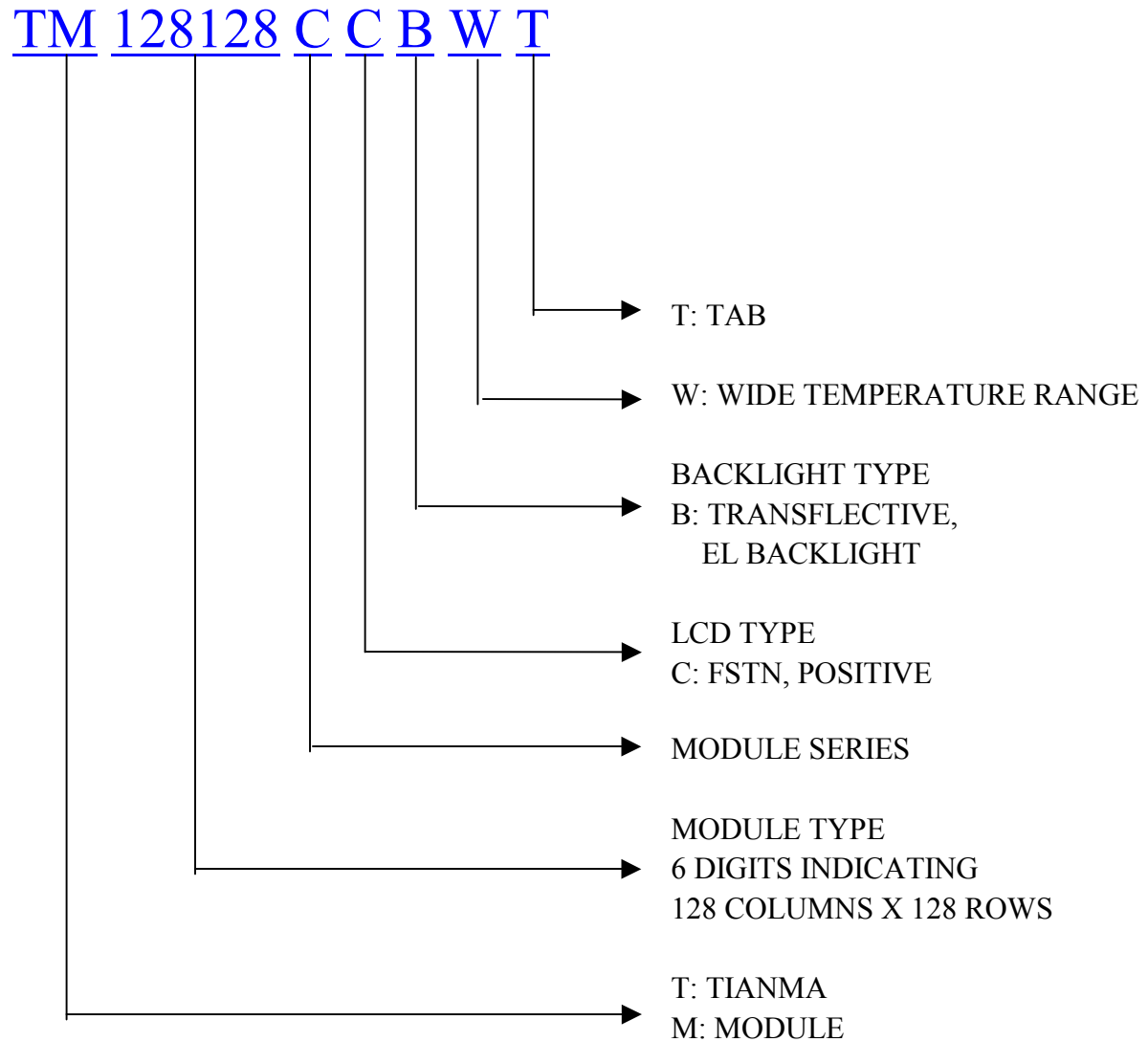
1. General Specifications:

- 1.1 Display type: FSTN
- 1.2 Display color*¹:
 - Display color: Blue-Black
 - Background*²: White
- 1.3 Polarizer mode: Transflective/Positive
- 1.4 Viewing Angle: 12:00
- 1.5 Driving Method: 1/128 Duty 1/12Bias
- 1.6 Logic Voltage: 3.0V
 - LCD Operating Voltage: 12.3V
- 1.7 Backlight: EL
- 1.8CONTROLLER: S6B0741X01-23XN
- 1.9 Data Transfer: SERIAL/8 Bits Parallel
- 1.10 Operating Temperature: -20----+70°C
 - Storage Temperature: -30----+80°C
- 1.11 Outline Dimensions: Refer to outline drawing on the fifths page
- 1.12 Dot Matrix: 128 X 128 Dots
- 1.13 Dot Size: 0.225 X 0.175 (mm)
- 1.14 Dot Pitch: 0.245 X 0.19(mm)
- 1.15 Weight: 10g (Approx.)

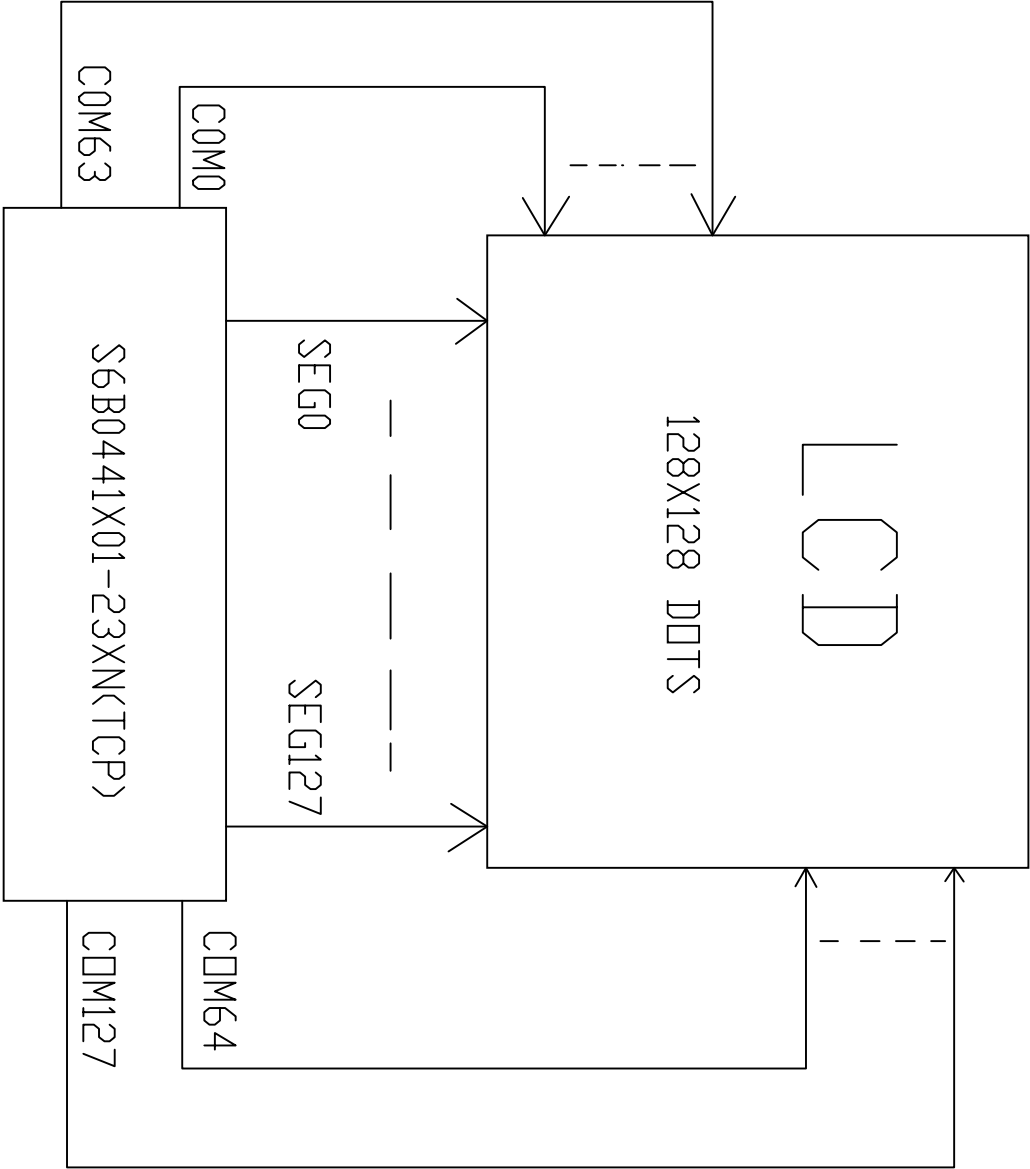
*¹ Color tone is slightly changed by temperature and driving voltage.

*² Color tone will be changed by backlight.

3. LCD Module Part Numbering System



4. Circuit Block Diagram



5. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	$V_{DD}-V_{SS}$	-0.3	7.0	V	
LCD Driving Voltage	V_{LCD}	-	17.0		
Operating Temperature Range	T_{OP}	-20	+70	°C	No Condensation
Storage Temperature Range	T_{ST}	-30	+80		

6. Electrical Specifications and Instruction Code

6.1 Electrical characteristics

Item		Symbol	Min.	Typ.	Max.	Unit
Supply Voltage (Logic)		$V_{DD}-V_{SS}$	2.85	3.0	3.15	V
Supply Voltage (LCD Drive)		V_{LCD}	-	12.3	-	V
Input Signal Voltage	High	V_{IH} ($V_{DD}=3.0V$)	$0.8V_{DD}$	-	V_{DD}	V
	Low	V_{IL} ($V_{DD}=3.0V$)	0	-	$0.2V_{DD}$	V
Supply current (Logic) (Display character)		I_{DD} ($V_{DD}-V_{SS}=3.0V$)	-	-	500.0	uA
Supply current (LED)		I_{EL}	-	-	1.7	mA

6.2 Interface Signals

Pin No.	Symbol	Level	Description
1	NC	-	NO Signal
2	PS0	H/L	Parallel/Serial data input select input
3	PS1	H/L	Microprocessor interface select input pin PS0=H,PS1=H:6800-series parallel mpu interface PS0=H,PS1=L:8080-series parallel mpu interface PS0=L,PS1=H:4-pin-spi mpu interface PS0=L,PS1=L: 3-pin-spi mpu interface
4	CSB	H/L	Chip select input pins(Data/instruction I/O is enabled when csb is L)
5	RESETB	H/L	Reset input pin (when resetb is L,initialization is executed)
6	RS	H/L	Register select input pins RS=H:D0-7are display data;RS=L,D0-7 are control data
7	RW_WR	H/L	Read/Write execution control pin
8	E_RD	H/L	Read/Write execution control pin
9	DB0	H/L	Data bit0
10	DB1	H/L	Data bit1
11	DB2	H/L	Data bit2
12	DB3	H/L	Data bit3
13	DB4	H/L	Data bit4
14	DB5	H/L	Data bit5
15	DB6	H/L	Data bit6
16	DB7	H/L	Data bit7
17	VDD	3.0V	Power supply
18	VCI	H/L	Voltage converter input voltage pin
19	VSS	0V	Ground

20	VOUT	-	Voltage converter input/output pin
21	C5+	-	Capacitor 5 positive connection pin for voltage converter
22	C3+	-	Capacitor 3 positive connection pin for voltage converter
23	C1-	-	Capacitor1 negative connection pin for voltage converter
24	C1+	-	Capacitor 1 positive connection pin for voltage converter
25	C2+	-	Capacitor 2 positive connection pin for voltage converter
26	C2-	-	Capacitor 2 negative connection pin for voltage converter
27	C4+	-	Capacitor 4 positive connection pin for voltage converter
28	REF	H/L	Selects the external vref voltage via the vext pin REF=H:using the internal VREF REF=L:using the external VREF
29	VEXT	H/L	Externally input reference voltage for the internal voltage regulator,it is valid only when REF is L,When using internal voltage regulator,connect to VDD,Vss or open this pin
30	INTRS	H/L	Internal resistor select pin
31	V4	-	Bias voltage
32	V3	-	Bias voltage
33	V2	-	Bias voltage
34	V1	-	Bias voltage
35	V0	12.3V	Bias voltage
36	VR	-	V0 voltage adjustment pin
37	OSC1	-	When using internal clock oscillator,connect a resistor between OSC1 and VDD.
38	NC	-	No Signal

6.3 Interface Timing Chart

Serial Interface Characteristics

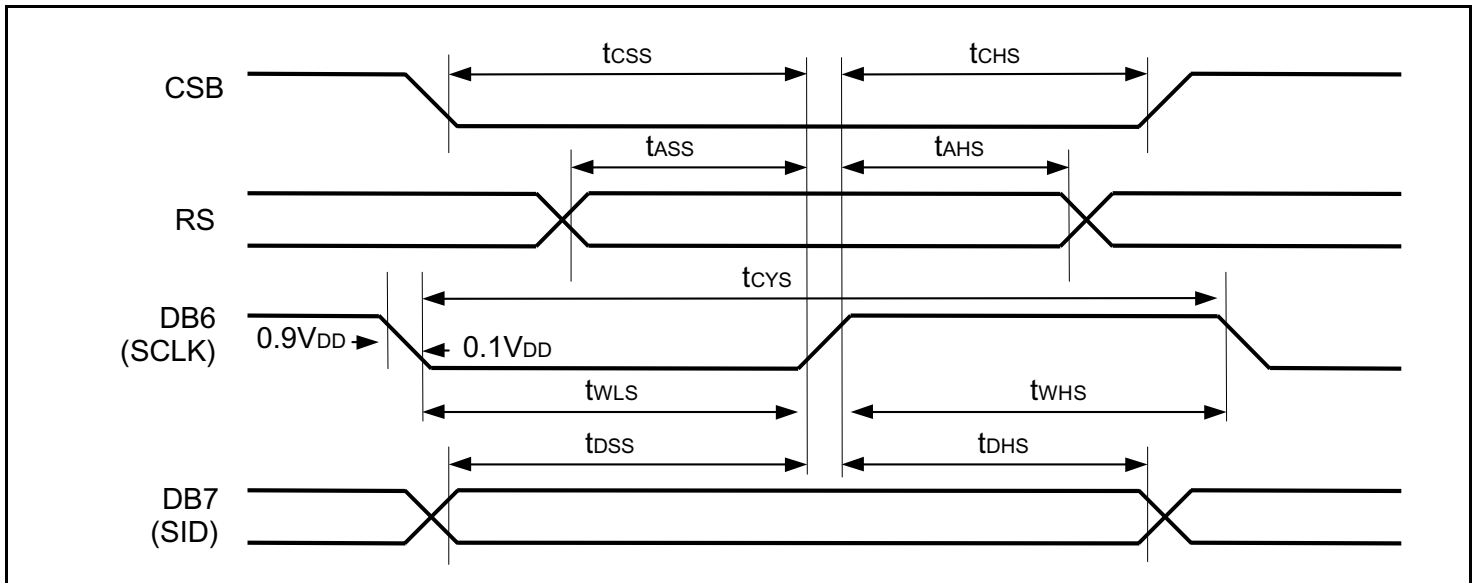


Figure 41. Serial Interface Characteristics

($V_{DD} = 1.8V$, $T_a = -40 \sim +85^{\circ}C$)

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock cycle	DB6 (SCLK)	t_{CYS}		111	-	ns
SCLK high pulse width		t_{WHS}		60	-	
SCLK low pulse width		t_{WLS}		60	-	
Address setup time	RS	t_{ASS}		60	-	ns
Address hold time		t_{AHS}		60	-	
Data setup time	DB7 (SID)	t_{DSS}		60	-	ns
Data hold time		t_{DHS}		60	-	
CSB setup time	CSB	t_{CSS}		60	-	ns
CSB hold time		t_{CHS}		$1/2 * t_{CYS}$	-	

($V_{DD} = 2.7V$, $T_a = -40 \sim +85^{\circ}C$)

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock cycle	DB6 (SCLK)	t_{CYS}		58.8	-	ns
SCLK high pulse width		t_{WHS}		30	-	
SCLK low pulse width		t_{WLS}		30	-	
Address setup time	RS	t_{ASS}		30	-	ns
Address hold time		t_{AHS}		30	-	
Data setup time	DB7 (SID)	t_{DSS}		30	-	ns
Data hold time		t_{DHS}		30	-	
CSB setup time	CSB	t_{CSS}		30	-	ns
CSB hold time		t_{CHS}		$1/2 * t_{CYS}$	-	

NOTE: *1. The input signal rise time and fall time (t_r , t_f) is specified at 15 ns or less.

6.4 Instruction code

INSTRUCTION DESCRIPTION

Table 17. Instruction Table

× : Don't care

Instruction	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
Read display data	1	1	Read data								Read data from 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	0	Y7	Y6	Y5	Set column address MSB
Set column address LSB	0	0	0	0	0	0	Y4	Y3	Y2	Y1	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	×	×	2-byte instruction to specify the initial display line to realize vertical scrolling
	0	0	×	S6	S5	S4	S3	S2	S1	S0	
Set initial COM0 register	0	0	0	1	0	0	0	1	×	×	2-byte instruction to specify the initial COM0 to realize window scrolling
	0	0	×	C6	C5	C4	C3	C2	C1	C0	
Set partial display duty ratio	0	0	0	1	0	0	1	0	×	×	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	×	×	2-byte instruction to set N-line inversion register
	0	0	×	×	×	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

Table 17. Instruction Table (Continued)

× : Don't care

Instruction	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
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 the internal voltage converter
Select regulator resistor	0	0	0	0	1	0	0	R2	R1	R0	Select internal resistance ratio of the regulator resistor
Set electronic volume register	0	0	1	0	0	0	0	0	0	1	2-byte instruction to specify the Reference voltage
	0	0	×	×	EV5	EV4	EV3	EV2	EV1	EV0	
Select LCD bias	0	0	0	1	0	1	0	B2	B1	B0	Select LCD bias
SHL select	0	0	1	1	0	0	SHL	×	×	×	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-directional 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	Initialize the internal functions
Set data direction & display data length(DDL)	×	×	1	1	1	0	1	0	0	0	2-byte instruction to specify the number of data bytes. (SPI Mode)
	×	×	D7	D6	D5	D4	D3	D2	D1	D0	
NOP	0	0	1	1	1	0	0	0	1	1	<i>No operation</i>
Test Instruction	0	0	1	1	1	1	×	×	×	×	<i>Don't use this instruction.</i>

Table 17. Instruction Table (Continued)

Instruction	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
Set FRC and PWM mode	0	0	1	0	0	1	0	FRC	PWM1	PWM0	FRC(1:3FRC, 0:4FRC) PWM1 PWM0 0 0 9PWM 0 1 9PWM 1 0 12PWM 1 1 15PWM
Set white mode and 1 st /2 nd frame, set pulse width	0	0	1	0	0	0	1	0	0	0	Set white mode and 1 st /2 nd frame
	0	0	WB3	WB2	WB1	WB0	WA3	WA2	WA1	WA0	
Set white mode and 3 rd /4 th frame, set pulse width	0	0	1	0	0	0	1	0	0	1	Set white mode and 3 rd /4 th frame
	0	0	WD3	WD2	WD1	WD0	WC3	WC2	WC1	WC0	
Set light gray mode and 1 st /2 nd frame, set pulse width	0	0	1	0	0	0	1	0	1	0	Set light gray mode and 1 st /2 nd frame
	0	0	LB3	LB2	LB1	LB0	LA3	LA2	LA1	LA0	
Set light gray mode and 3 rd /4 th frame, set pulse width	0	0	1	0	0	0	1	0	1	1	Set light gray mode and 3 rd /4 th frame
	0	0	LD3	LD2	LD1	LD0	LC3	LC2	LC1	LC0	
Set dark gray mode and 1 st /2 nd frame, set pulse width	0	0	1	0	0	0	1	1	0	0	Set dark gray mode and 1 st /2 nd frame
	0	0	DB3	DB2	DB1	DB0	DA3	DA2	DA1	DA0	
Set dark gray mode and 3 rd /4 th frame, set pulse width	0	0	1	0	0	0	1	1	0	1	Set dark gray mode and 3 rd /4 th frame
	0	0	DD3	DD2	DD1	DD0	DC3	DC2	DC1	DC0	
Set black mode and 1 st /2 nd frame, set pulse width	0	0	1	0	0	0	1	1	1	0	Set black mode and 1 st /2 nd frame
	0	0	BB3	BB2	BB1	BB0	BA3	BA2	BA1	BA0	
Set black mode and 3 rd /4 th frame, set pulse width	0	0	1	0	0	0	1	1	1	1	Set black mode and 3 rd /4 th frame
	0	0	BD3	BD2	BD1	BD0	BC3	BC2	BC1	BC0	