

**Display Elektronik GmbH**

# DATA SHEET

**MIP Display**

**DE MIP128128B-W**

**Product Specification**

**Ver.: 1**

**26.12.2023**

Revise Records

Rev.	Date	Contents	Written	Approved
0	26.12.2023	Preliminary Specification	MHI	MH
1	26.12.2023	Release Specification	MHI	MH

Special Notes

Note1.	
Note2.	
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**1. General Description and Features**

DE MIP128128B-W is a Reflective Active-Matrix with slightly transmissive type memory liquid crystal display module with 128 x128 panel which uses CG silicon thin film transistor.

**1.1 Features**

- 1.28 inch 128 x 128 monochrome HR-TFT transfective Panel
- Display Control with Serial Data Signal Communication
- Internal 1Bit Memory within the Panel for Data Memory
- Super Low Power Consumption TFT Panel

**1.2 LCD Module**

Item	Specification	Unit
Screen Size	1.28 Inches	Diagonal
Display Resolution	128 x 128	Dot
Active Area	23.04 x 23.04	mm
Outline Dimension	26.60 x 30.30 x 0.741	mm
Pixel Array	Square	--
Dot Pitch	0.18 x 0.18	mm
Surface Hardness	3H	--

**2. Mechanical Information**

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	--	26.6	--	mm	--
	Vertical (V)	--	30.3	--	mm	--
	Thickness (T)	--	0.741	--	mm	(1)
Weight		--	1.2	--	g	--

Note (1) Not Include Component. Refer to the Outline Dimension Drawing as attached.

### 3. Electrical Specifications

#### 3.1 Absolute Max. Ratings

##### 3.1.1 Absolute Ratings of Environment

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

( $T_a = 25 \pm 2^\circ\text{C}$ ,  $V_{SS} = \text{GND} = 0$ )

Item	Symbol	Min.	Max.	Unit	Note
Storage Temperature	$T_{STG}$	-30	80	$^\circ\text{C}$	(1)
Operating Temperature	$T_{OPR}$	-20	70	$^\circ\text{C}$	(1,2,3)

Note (1) 95 % RH Max. ( $40^\circ\text{C} \geq T_a$ ). Maximum wet-bulb temperature at  $39^\circ\text{C}$  or less. ( $T_a > 40^\circ\text{C}$ ) No condensation.

Note (2) In case of below  $0^\circ\text{C}$ , the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character

Note (3) Only operation is guaranteed at operating temperature. Contrast, response time, another display quality are evaluated at  $+25^\circ\text{C}$ .

#### 3.1.2 Electrical Absolute Maximum Ratings

##### 3.1.2.1 TFT-LCD Module

Parameter		Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	Analog Power Supply	VDDA	-0.3	3.6	V	--
	Logic Power Supply	VDD	-0.3	3.6	V	(3.1)
Input Signal Voltage	High Level	$V_{IH}$	--	VDD	V	(3.2)
	Low Level	$V_{IL}$	-0.3	--	V	--

Note 3.1: Also applicable to EXTMODE.

Note 3.2: Applicable to SCLK, SI, SCS, DISP, EXTCOMIN

## 3.1.3 DC Electrical Characteristics of the TFT LCD

Parameter		Symbol	Min.	Typ	Max.	Unit	Note
Power Supply Voltage	Analog Power Supply	VDDA	2.7	3.0	3.3	V	--
	Logic Power Supply	VDD	2.7	3.0	3.3	V	(3.3)
Input Signal Voltage	High Level	VIH	VDD-0.1	--	VDD	V	(3.4)
	Low Level	VIL	VSS	--	VSS+0.1	V	

Note 3.3: Also applicable to EXTMODE="H".

Note 3.4: Applies to SCLK, SI, SCS, DISP, EXTCOMIN

## Power Consumption

Item	Min	TYP	MAX	Unit	Note
Measurement Condition 1	--	12	50	uW	(3.5)
Measurement Condition 2	--	50	130	uW	(3.5)

## \*Measurement Condition 1

Display mode (no display data update), Display pattern: Vertical stripe display

## \*Measurement Condition 2

Data update mode (with display data update: 1Hz)

Common inversion with VDD=3V、VDDA=3V、fSCLK=1MHz、fSCS=1Hz, Display pattern: Vertical stripe display

Note 3.5: This is value in steady condition, not the value of peak power at the time of COM operation.

Some margining for power supply is recommended.

We recommend capacitor for VDD and VDDA.

(If VDD and VDDA are on separate systems, we recommend capacitor for each.)

## 3.2 Timing Characteristic of The LCD

## 3.2.1 Input Signal Basic Characteristics

(Ta=25°C, SCS, SCLK, SI, DISP, EXTCOMIN=3.0V, VDD=3.0V, VSS pin=0V)

Pin name	Item	Code	Min	Typ.	Max	Unit	Notes
SCS	Frame frequency	fSCS	54		65	Hz	(*1)
SCLK	Clock frequency	fSCLK	-	1	1.1	MHz	
-	Vertical period	tv	15.38		18.52	msec	
-	COM frequency	fCOM	27		32.5	Hz	

(\*1) Please use a frame frequency in the range where there are no problems with the display quality.

## 3.2.2 Input Signals

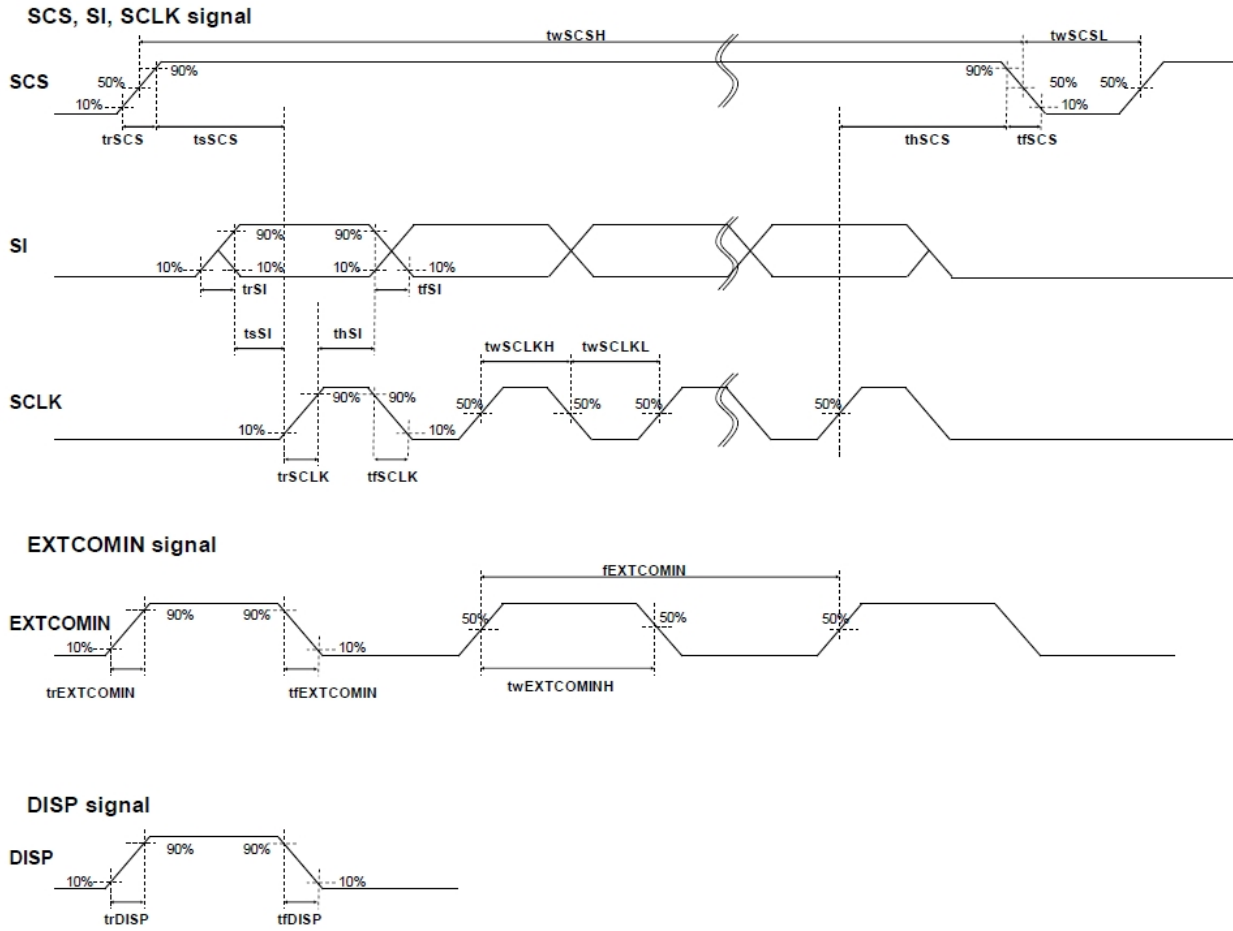
Input signals

(Ta=25°C, SCS, SCLK, SI, DISP, EXTCOMIN=3.0V, VDD=3.0V, VSS pin=0V)

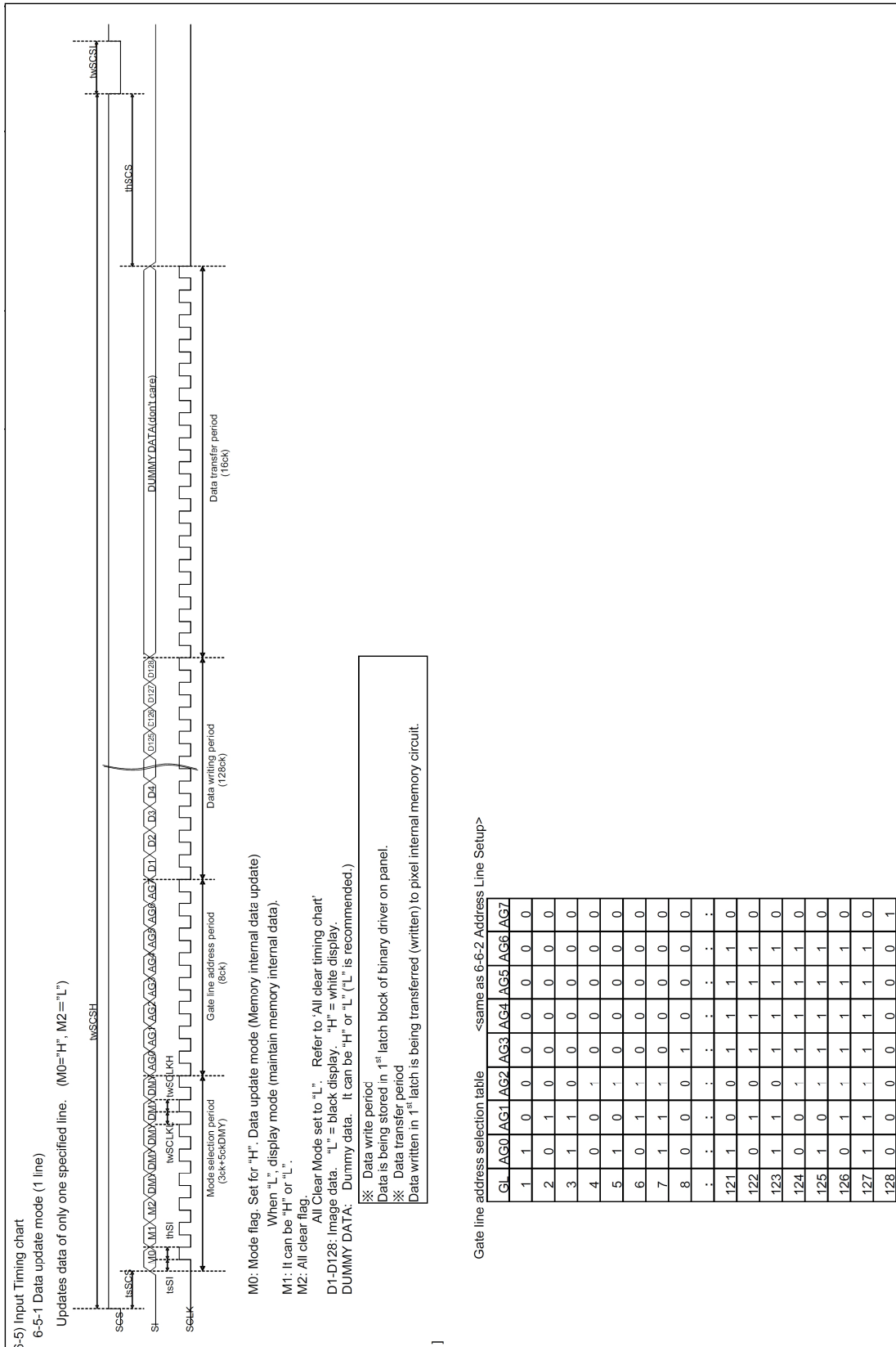
Pin name	Item	Code	Min	Typ.	Max	Unit	Notes
SCS	SCS rise time	trSCS			50	nsec	
	SCS fall time	tfSCS			50	nsec	
	SCS Highwidth	twSCSH	153.45			μsec	Data update mode
			22.55			μsec	Display mode
	SCS Low width	twSCSL	6			μsec	
	SCS set up time	tsSCS	6			μsec	
SCS hold time	thSCS	2			μsec		
SI	SI rise time	frSI			50	nsec	
	SI rise time	trSI			50	nsec	
	SI set up time	tsSCS	227			nsec	
	SI hold time	thSI	525			nsec	
SCLK	SCLK rise time	trSCLK			50	nsec	
	SCLK fall time	tfSCLK			50	nsec	
	SCLK High width	twSCLKH	404.55	450		nsec	
	SCLK Low width	twSCLKL	404.55	450		nsec	
EXTCOMIN	EXTCOMIN frequency	fEXTCOMIN	54		65	Hz	(*1)
	EXTCOMIN rise time	trEXTCOMIN			50	nsec	
	EXTCOMIN fall time	tfEXTCOMIN			50	nsec	
	EXTCOMIN High width	twEXTCOMIN	2			μsec	
	EXTCOMIN set up time	tsEXTCOMIN	5			μsec	
	EXTCOMIN hold time	thEXTCOMIN	0			μsec	
DISP	DISP rise time	trDISP			50	nsec	
	DISP fall time	tfDISP			50	nsec	

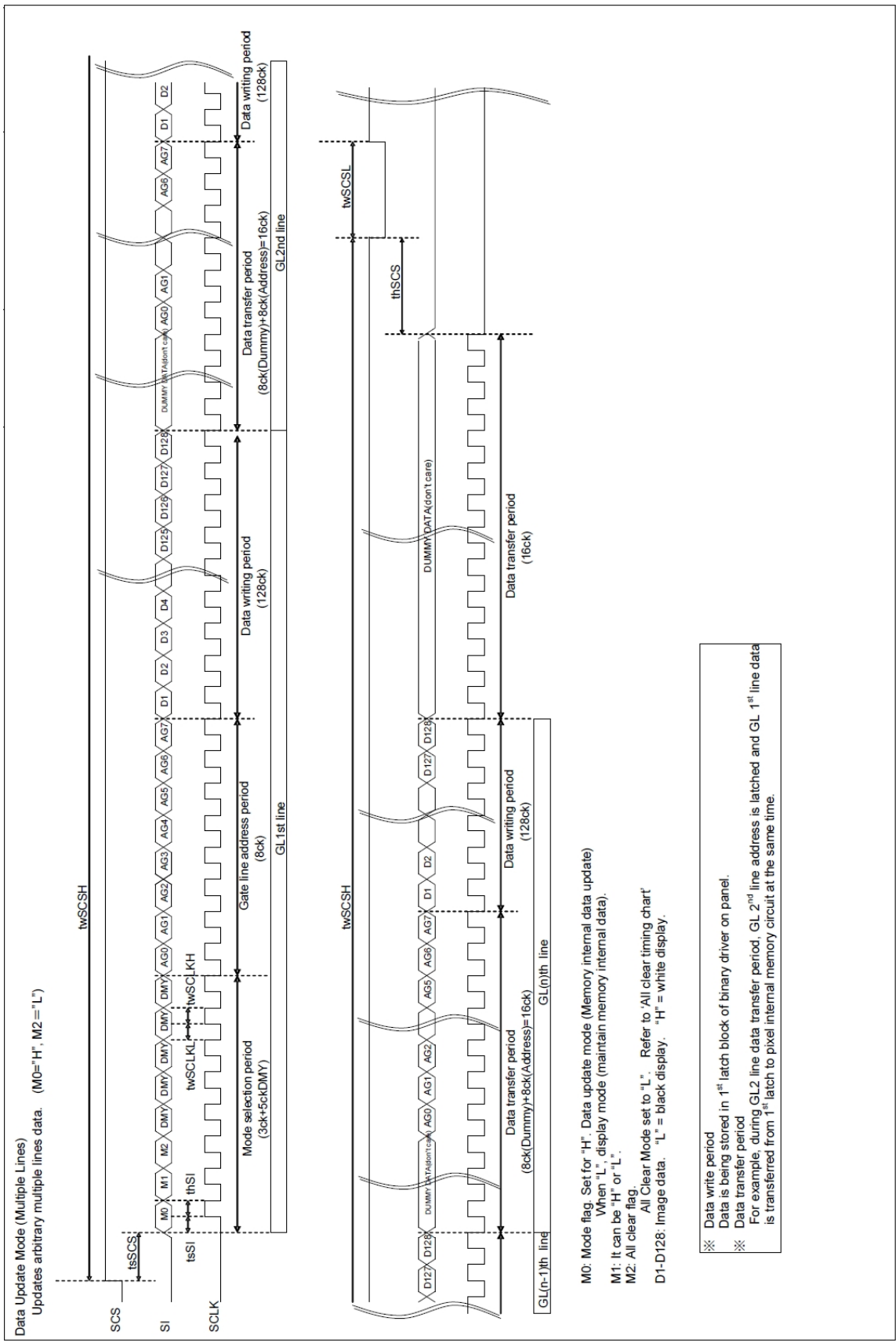
(\*1) Please make the EXTCOMIN frequency less than the frame rate frequency.

Signal Timing



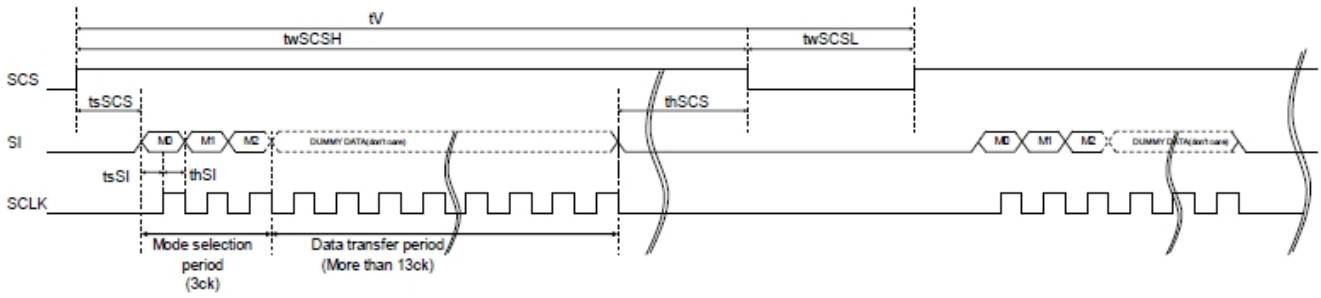
Input Signal Timing Chart





**Display Mode**

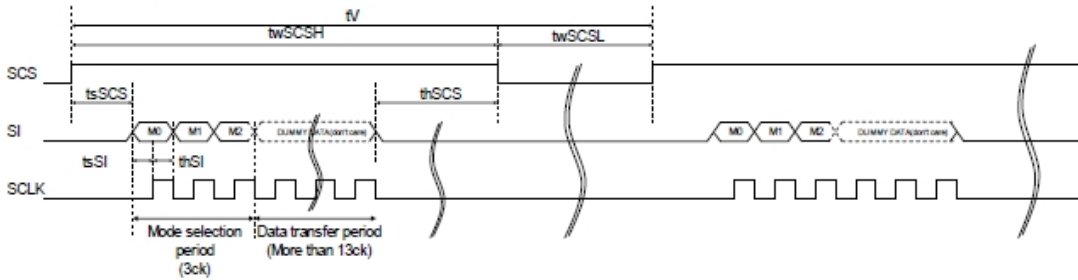
Maintains memory internal data (maintains current display). (M0="L", M2="L")



- M0: Mode flag.  
When "L", display mode (maintain memory internal data).  
Set for "H". Data update mode (Memory internal data update)
- M1: It can be "H" or "L".
- M2: All clear flag.  
All Clear Mode set to "L". Refer to 'All clear timing chart'
- DUMMY DATA: Dummy data. It can be "H" or "L" ("L" is recommended.)

**All Clear Mode**

Clears memory internal data and writes white. (M0="L", M2="H")

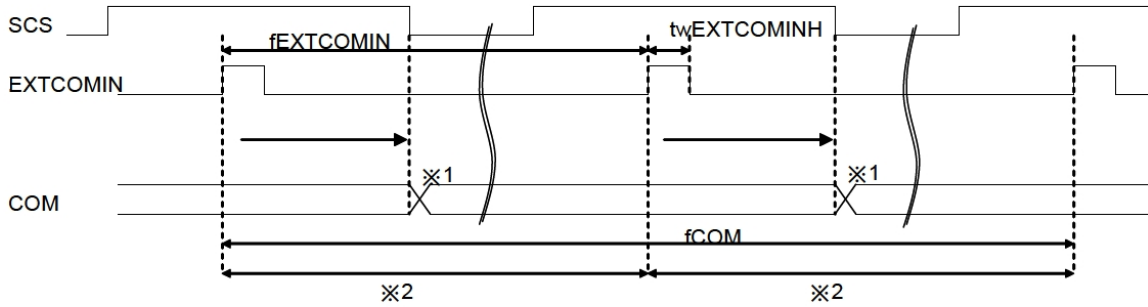


- M0: Mode flag.  
Set it "L".
- M1: It can be "H" or "L".
- M2: All clear flag.  
Set it "H"
- DUMMY DATA: Dummy data. It can be "H" or "L" ("L" is recommended.)

**COM Inversion**

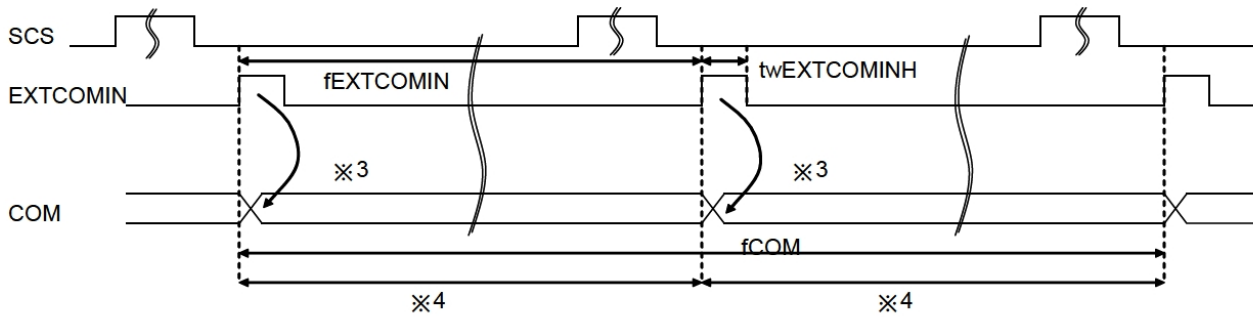
EXTCOMIN has 2 timing conditions:

(1): The EXTCOMIN input during high period of the SCS signal



- ※ 1: LC inversion polarity has been set by the falling edge of SCS signal.
- ※ 2: The period of EXTCOMIN should be constant.

(2): the EXTCOMIN input during low period of the SCS signal



- ※ 3: LC inversion polarity has been set by the rising edge of EXTCOMIN.
- ※ 4: The period of EXTCOMIN should be constant.

Power Sequence

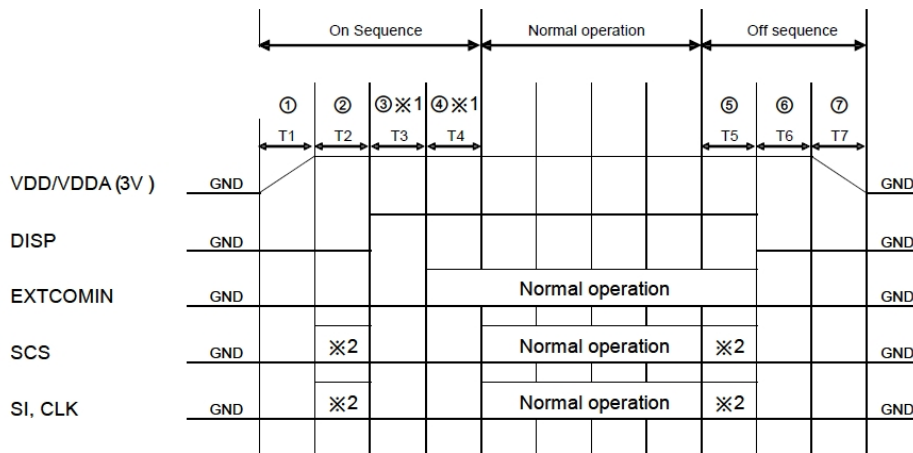


Figure 6-1 Power source sequence

- ※ Refer to timing chart and AC timing characteristics for detail
- ※ 1. (3) and (4) may be opposite (however, TCOM polarity inversion will not occur even with EXTCOMIN between DISP="L". Also, when DISP and EXTCOMIN are simultaneously started up, allow 30us or more before SCS starts up (It may be less than 60us).
- ※ 2. Setting value for pixel memory initialization

SCS=Driving accordingly to clear pixel internal memory method (use all clear flag or write all screen white)

S1=M2 (all clear flag) = "H" or write white

SCLK: Normal Driving

[ON Sequence]

(1) 3V rise time (depends on IC)

(2) Pixel memory initialisation

Use M2 (all clear flag) to initialise (at least once).

tsSCS + SCLK: at least 16ck + thSCS (refer to All Clear timing chart) Or

Write whole screen white (at least 1 frame)

(3) Release time for initialisation of TCOM latch T3: 30us or more

Time required to release COM related latch circuit initialisation which is initializing using DISP signals

(4) TCOM polarity initialisation time T4: 30us or more

Time required initialising TCOM polarity accordingly to EXTCOMIN input

[Normal Operation]

Duration of normal driving

[Off Sequence]

(5) Pixel memory initialisation time Contents same as (2)

(6) VA, VB, VCOM initialisation time T6: 30us or more

(7) 3V falling time (Depends on IC)

4. Optical Characteristics

4.1 Optical characteristic of the LCD

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods.

Measuring equipment: BM-7A

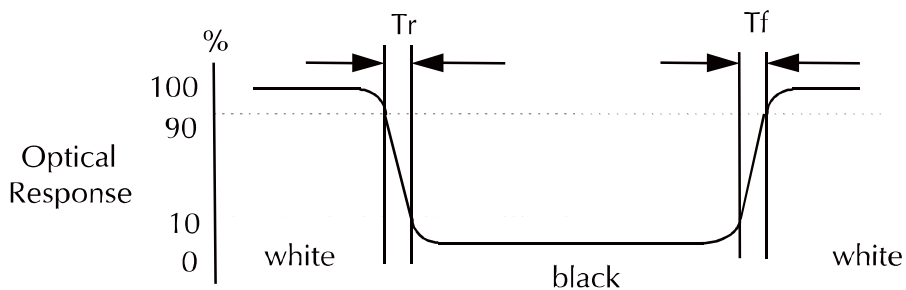
Item	Symbol	Condition	Min	Type	Max	Unit	Note	
Reflectivity Ratio	R	--	14	18	--	%	--	
Transmissivity Ratio	T	--	--	(0.2)	--	%	--	
Response Time	$T_r + T_f$	$\theta = 0^\circ$	--	30	60	ms	--	
Contrast Ratio	CR	At optimized viewing angle	14	18	--	--	--	
Color Chromaticity (CIE 1931)	White	$W_x$	$\theta = 0^\circ$ Normal Viewing Angle	--	(0.31)	--	--	BM-7A
		$W_y$		--	(0.33)	--		
Viewing Angle	Hor.	$\theta_R$	CR $\geq$ 10	40	60	--	Degree	--
		$\theta_L$		40	60	--		
	Ver.	$\theta_U$		40	60	--		
		$\theta_D$		40	60	--		

a. Test equipment setup

After stabilizing and leaving the panel alone shall be warmed up for the stable operation of LCM, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7(fast) with a viewing angle of 2° at a distance of 50cm and normal direction.

b. Definition of response time:  $T_r$  and  $T_f$

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

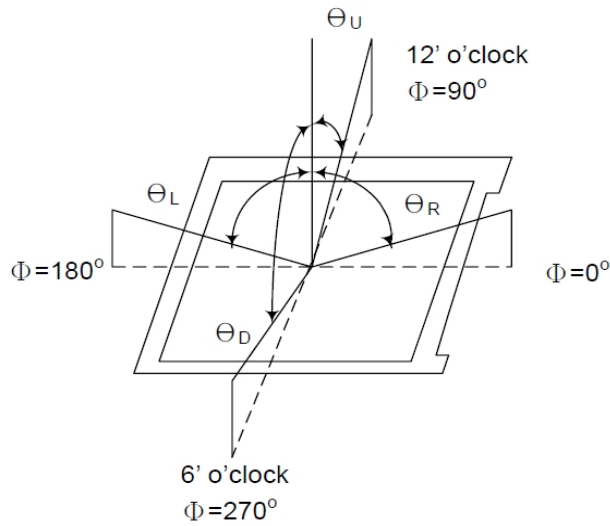


c. Definition of contrast ratio:

Brightness measured when LCD is at "white state"

Contrast Ratio (CR) = \_\_\_\_\_  
 Brightness measured when LCD is at "black state"

- d. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.
- e. View Angle



- f. Definition of Luminance of White: Luminance of white at the center points

Light Source of Back-Light Unit	LED Type
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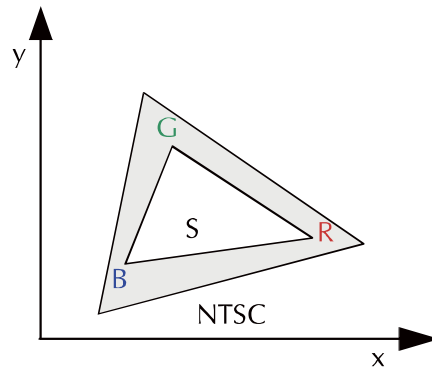
- g. Definition of White Uniformity

$$\text{White Uniformity} = \frac{\text{Min. luminance of white among 9-points}}{\text{Max. luminance of white among 9-points}} \times 100\%$$

- h. The definition of Color Gamut -Color Chromaticity CIE 1931

Color coordinate of white & red, green, blue at center point.

Color Gamut : NTSC(%) = ( RGB Triangle Area / NTSC Triangle Area ) x 100



**5. I/O Terminal**

5.1 LCM Pin Definition (Connector: SMK FP12 Series: CFP-4610-0150F or equivalent)

No.	Pin Define	I/O	Signal name	Note
1	SCLK	I	Serial clock signal	
2	SI	I	Serial input signal	
3	SCS	I	Chip select signal	
4	EXTCOMIN	I	COM inversion polarity input pin	
5	DISP	I	Display ON/OFF switching signal	(5-2)
6	VDDA	I	Power source for Analog	
7	VDD	I	Power source for Logic	
8	EXTMODE	I	COM inversion mode switch terminal	(5-1)
9	VSS	I	Logic ground	
10	VSSA	I	Analogue ground	

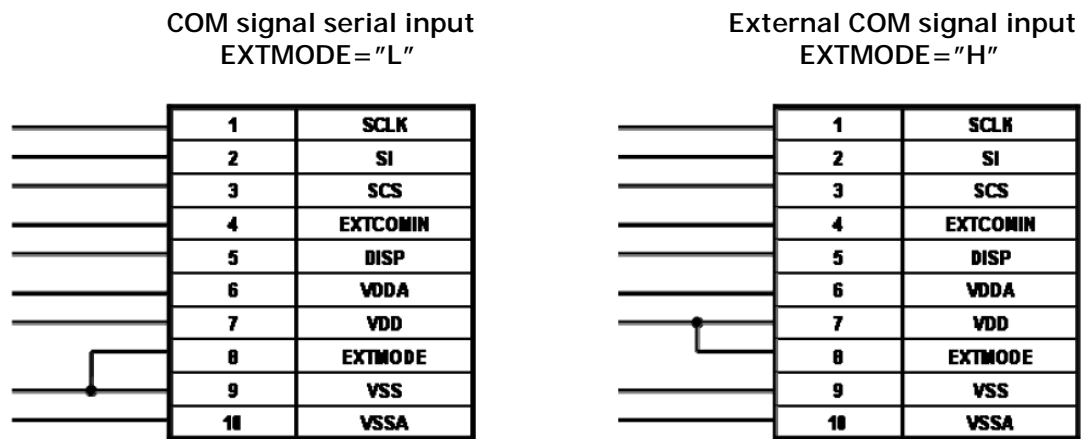
Note 5.1: "H"=EXTCOMIN signal enabled, "L"=Serial input flag enabled.

When "H", connect EXTMODE to VDD and when "L" to VSS.

Note 5.2: ON/OFF for LCD display only. Memory data is maintained.

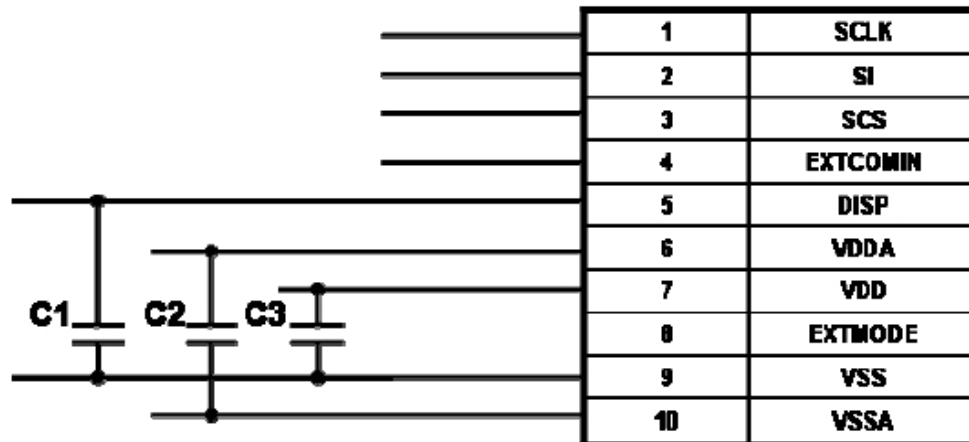
When "H", displays with memory data, and when "L", displays all white with memory data maintained.

**Recommended Circuit**



Recommended Circuit

## Example of External Circuit



External circuit diagram (recommended)

## &lt;Recommended Capacitor&gt;

C1: Between DISP-VSS, B characteristics 0.1uF ceramic capacitor

C2: Between VDDA-VSS, B characteristics 0.1uF or more cerac capacitor

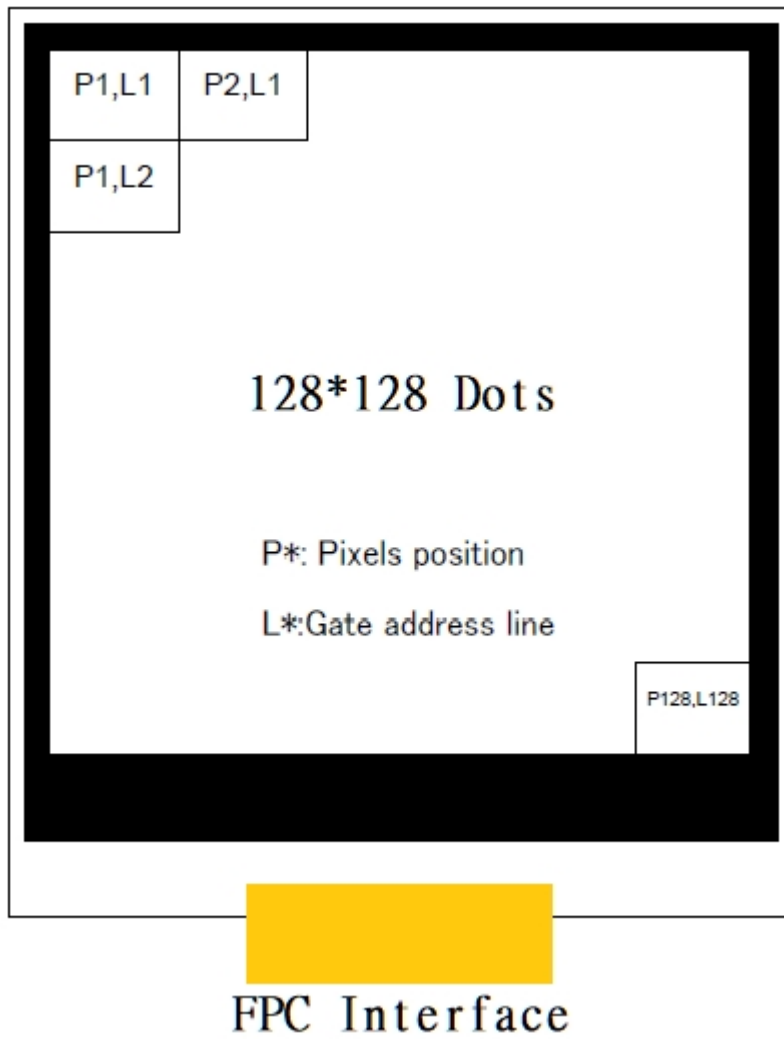
C3: Between VDD-VSS, B characteristics 1uF or more ceramic capacitor

※ Above circuit and parts are only recommendation

For actual use, please evaluate their conformity with your system and design.

(Capacitor pressure resistance can be larger than resistance indicated above.)

5.2 Block Diagram



**6. Reliability Condition**

No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: 20°C±5°C

Humidity: 65% ± 5%RH

Tests will be not conducted under functioning state.

No.	Parameter	Condition	Notes
1	High Temperature Operating	+70°C ± 2°C, 240hrs (Operation state).	--
2	Low Temperature Operating	-20°C ± 2°C, 240hrs (Operation state).	(1)
3	High Temperature Storage	+80°C ± 2°C, 240hrs.	(2)
4	Low Temperature Storage	-30°C ± 2°C, 240hrs.	(1),(2)
5	High Temperature and High Humidity Operation Test	+40°C ± 2°C, 95%, 240hrs.	(1),(2)

Notes:

1. No dew condensation to be observed.
2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.

7. Dimensional Outlines

