

Display Elektronik GmbH

# DATA SHEET

**BCD MODULE**

**DEC 128064A DYH**

2,7"

128x64 Bi-Stable  
Cholesteric Display

Product Specification

Ver.: 6

10.05.2022



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## 1. Technology Description

BCD (Bi-stable Cholesteric Display) is a sunlight readable reflective LCD with extremely low power consumption characteristics. Due to the non-volatile memory feature of the technology, zero power is required to retain the image of the display. Energy is only required to change the displayed image. No backlighting is required, only ambient lighting from the surrounding is required. Readability when under direct sunlight is excellent and good contrast from viewing at very wide angles are possible.

## 2. Typical Applications

This module is intended for general purpose graphic and character display applications. Suggested uses include instrumentation, remote control, electronic product or price label, point of sale display, general purpose indoor or outdoor signage and information display.

## 3. General Description

The features of LCD are as follows

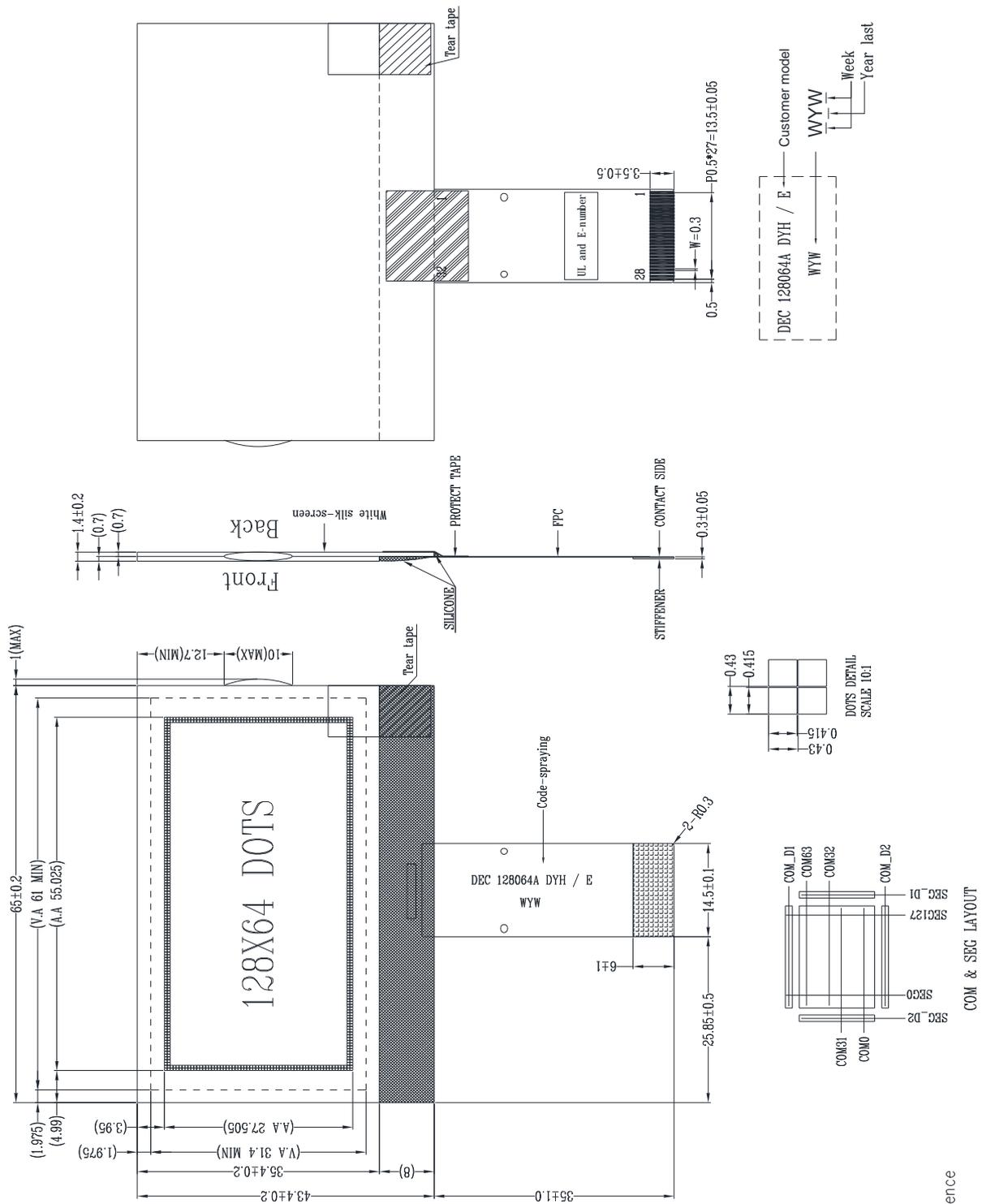
- \* Passive matrix bistable cholesteric LCD graphic module
- \* Color : Black & Yellow
- \* Display mode : BCD
- \* Driver/Controller IC : SSD1603
- \* Interface Input Data : 4-wires serial interface
- \* Driving scheme : Special BCD driving scheme
- \* Driving Method : 1/64 Duty,static
- \* Viewing Direction : Full viewing
- \* Backlight : Without
- \* Polarizer mode : Without polarizer
- \* Sample NO. : G1206ZDTRNFG-C0\_01/20181005

## 4. Mechanical Specifications

The mechanical detail is shown in Fig. 1 and summarized in Table 1 below.

Table 1

Item	Specification	Unit
Module Size	65.00 x 43.40 x 1.40	mm
Viewing Area	61 MIN x 31.4 MIN	mm
Active Area	55.025 x 27.505	mm
Number of Dots	128 x 64 Dots	-
Dot Size	0.415 x 0.415	mm
Dot Pitch	0.43 x 0.43	mm



Pin Assignment			
NO.	Symbol	NO. Symbol	
1	V0	15	VCP1
2	V4	16	C1P
3	V3	17	C1N
4	V2	18	VCP2
5	V1	19	C2P
6	VDD	20	C2N
7	VDDI0	21	VCP3
8	D/C	22	C3P
9	CS1	23	C3N
10	RESET	24	VCP4
11	SCLK	25	C4P
12	SD	26	C4N
13	BUSY	27	VCI
14	VSS	28	VSS

- NOTES:
1. Display type: BCD (Black/Yellow)
  2. Viewing direction: FULL Viewing
  3. Drive method: BCD Driving Scheme
  4. Polarizer mode: Without polarizer
  5. LCD Operating voltage: 24.0V
  6. Operation temperature: -20+70 C
  7. Storage temperature: -30+80 C
  8. Driver/Controller IC: SSD1603
  9. Logic power supply voltage: 3.0V
  10. Connector type: COG+FPC
  11. Dimensions with mark ( ) are reference
  12. ROHS must be complied

Figure 1: Module Specification

## 5. Interface Signals

Table 2

PIN NO.	SYMBOL	FUNCTIONS
1	V0	It is the high voltage power input pin and panel driving voltage. It should be connected to VCP1.
2	V4	Panel driving voltage. If bias divider is enabled with the presence of V0. The voltage is equal to $1/N * V0$ , where N is equal to the Bias ratio Setting.
3	V3	Panel driving voltage. If bias divider is enabled with the presence of V0. The voltage is equal to $2/N * V0$ , where N is equal to the Bias ratio Setting.
4	V2	Panel driving voltage. If bias divider is enabled with the presence of V0. The voltage is equal to $(N-2)/N * V0$ , where N is equal to the Bias ratio Setting.
5	V1	Panel driving voltage. If bias divider is enabled with the presence of V0. The voltage is equal to $(N-1)/N * V0$ , where N is equal to the Bias ratio Setting.
6	VDD	This pin is the system power supply pin of the logic block.
7	VDDIO	Power supply for interface logic level. It should be match with the MCU interface voltage level. It must always be equal or lower than VDD.
8	D/C	This pin is Data/Command control pin. A high at D/C indicates data input while a low at D/C indicates command input.
9	CS1	These pins are the chip select inputs for communication between MCU. To select the chip CS1# must be low and CS2 must set high. For serial mode, it is needed to select the chip which CS1# must be low and CS2 must set high.
10	RESET	This pin is the reset signal input. Initialization of the chip is started once this pin is pulled low. Minimum pulse width for reset sequence is 20us.
11	SCLK	In serial interface mode, D1 is the serial data input (SDIN), D0 is the serial clock input, (SCLK).
12	SD	
13	BUSY	A high level indicates busy status (output driving waveform) of the driver.
14	VSS	Ground.
15	VCP1	DC/DC output voltage. Connect with a capacitor to VSSC. It should be connected to V0.
16	C1P	DC/DC flying capacitor terminal. Connect a capacitor between C1N and C1P.
17	C1N	
18	VCP2	DC/DC intermediate output voltage. Connect with a capacitor to VSSC. If using external mode with HV buffer enabled, it should be connected to V0.
19	C2P	DC/DC flying capacitor terminal. Connect a capacitor between C2N and C2P.
20	C2N	
21	VCP3	DC/DC intermediate output voltage. Connect with a capacitor to VSSC.
22	C3P	DC/DC flying capacitor terminal. Connect a capacitor between C3N and C3P.
23	C3N	
24	VCP4	DC/DC intermediate output voltage. Connect with a capacitor to VSSC.
25	C4P	DC/DC flying capacitor terminal. Connect a capacitor between C4N and C4P.
26	C4N	
27	VCI	Power supply for DC-DC converter and analog part of the chip. It should be connected to VDD.
28	VSS	Ground.

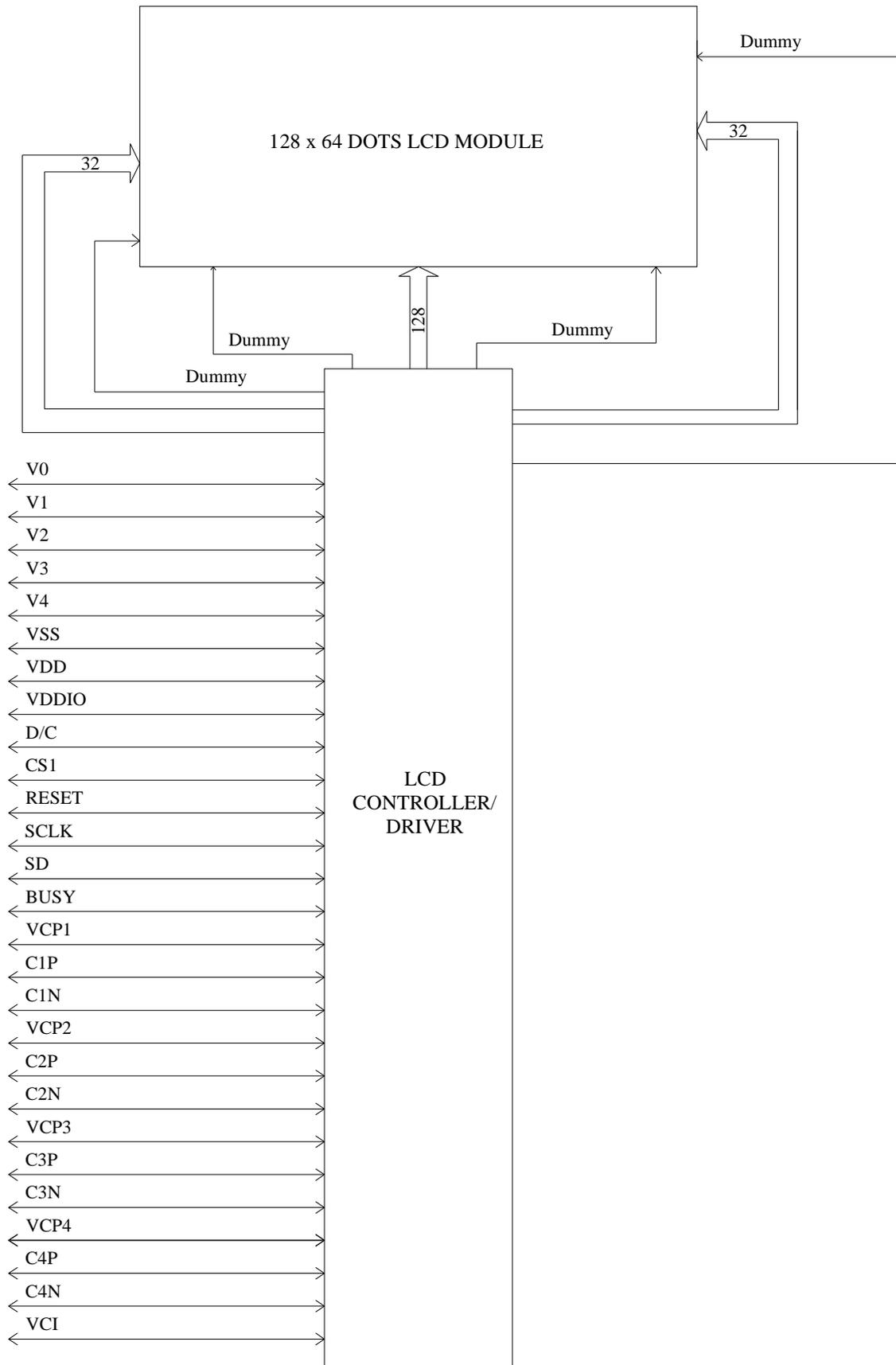
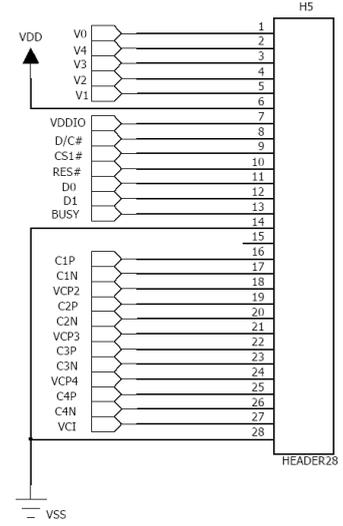
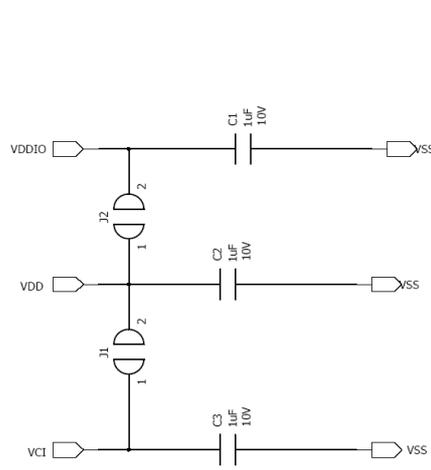
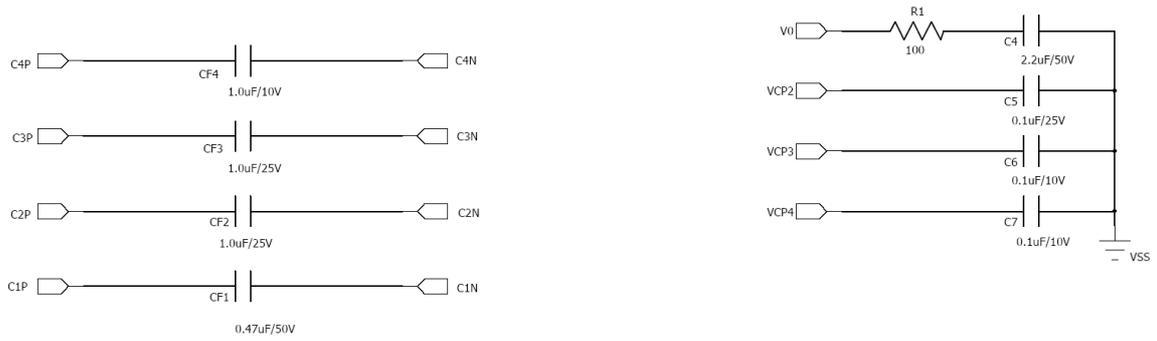


Figure 2: Block Diagram



COG Version IC Interface

D0 =SCLK      D1 =SDIN

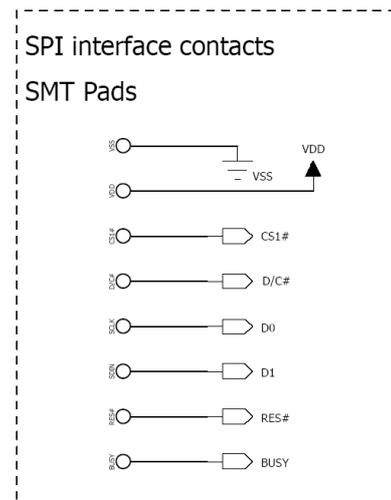
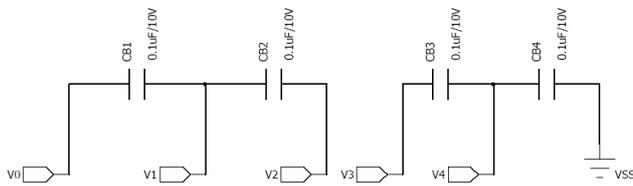


Figure 3: Circuit Diagram

## 6. Absolute Maximum Ratings

### 6.1 Electrical Maximum Ratings-For IC Only

Table3

Parameter	Symbol	Conditions	Min.	Max.	Unit
Supply Voltage	$V_{DD}$	TA=+25°C, Referenced to V <sub>SS</sub> = 0V	-0.3	+3.6	V
	$V_{DDIO}$		-0.3	Min(VDD+0.5,+3.6)	V
	$V_0$		-0.3	+38	V
	$V_{CI}$		-0.3	+3.6	V
Input Voltage	$V_{in}$		$V_{SS} - 0.3$	$V_{DDIO} + 0.3$	V

Note1: TA = +25°C.

Note2: The maximum applicable voltage on any pin with respect to VSS (0V).

Note3: The modules may be destroyed if they are used beyond the absolute maximum ratings.

### 6.2 Environmental Condition

Table4

Item	Operating temperature (Topr)		Storage temperature (Tstg)		Remark
	Min.	Max.	Min.	Max.	
Ambient temperature	-20°C	+70°C	-30°C	+80°C	Dry
Humidity	90% max. RH for Ta ≤ 40°C < 50% RH for 40°C < Ta ≤ Maximum operating temperature				No condensation
Packing vibration(GB/T5170.14-2009)	Frequency range:10Hz~50Hz Acceleration of gravity:5G X,Y,Z 30 min for each direction.				3 directions

Note : Product cannot sustain at extreme storage conditions for long time.

## 7. Electrical Specifications

### 7.1 Typical Electrical Characteristics

At  $T_a = 25\text{ }^\circ\text{C}$ ,  $V_{DD} = +3.0\text{V} \pm 5\%$ ,  $V_{SS} = 0\text{V}$ .

Table5

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage (System)	VDD-VSS		2.7	3.0	3.5	V
	VCI-VSS		VDD	-	3.5	V
	VLCD		-	26.0	-	V
Input signal voltage low	$V_{IL}$		0	-	$0.2V_{DDIO}$	V
Input signal voltage high	$V_{IH}$		$0.8V_{DDIO}$	-	$V_{DDIO}$	V
Supply current	IDD	VDD=3.0V	-	0.5	-	mA
	ICI	VCI=3.0V	-	0.9	2.0	mA

\* Internally Generated

### 7.2 TIMING Specifications

At  $T_a = +25\text{ }^\circ\text{C}$ ,  $V_{DD} = V_{CI} = V_{DDIO} = +3.0\text{V} \pm 5\%$

Table 6

Symbol	Parameter	Min	Typ	Max	Unit
$t_{cycle}$	Clock Cycle Time	60	-	-	ns
$t_{AS}$	Address Setup Time	10	-	-	ns
$t_{AH}$	Address Hold Time	20	-	-	ns
$t_{DSW}$	Write Data Setup Time	30	-	-	ns
$t_{DHW}$	Write Data Hold Time	30	-	-	ns
$T_{CLKL}$	Clock Low Time	30	-	-	ns
$T_{CLKH}$	Clock High Time	30	-	-	ns
$t_{CSS}$	Chip Select Setup Time (for D7 input)	30	-	-	ns
$t_{CSH}$	Chip Select Hold Time (for D0 input)	30	-	-	ns
$t_R$	Rise Time	-	-	10	ns
$t_F$	Fall Time	-	-	10	ns

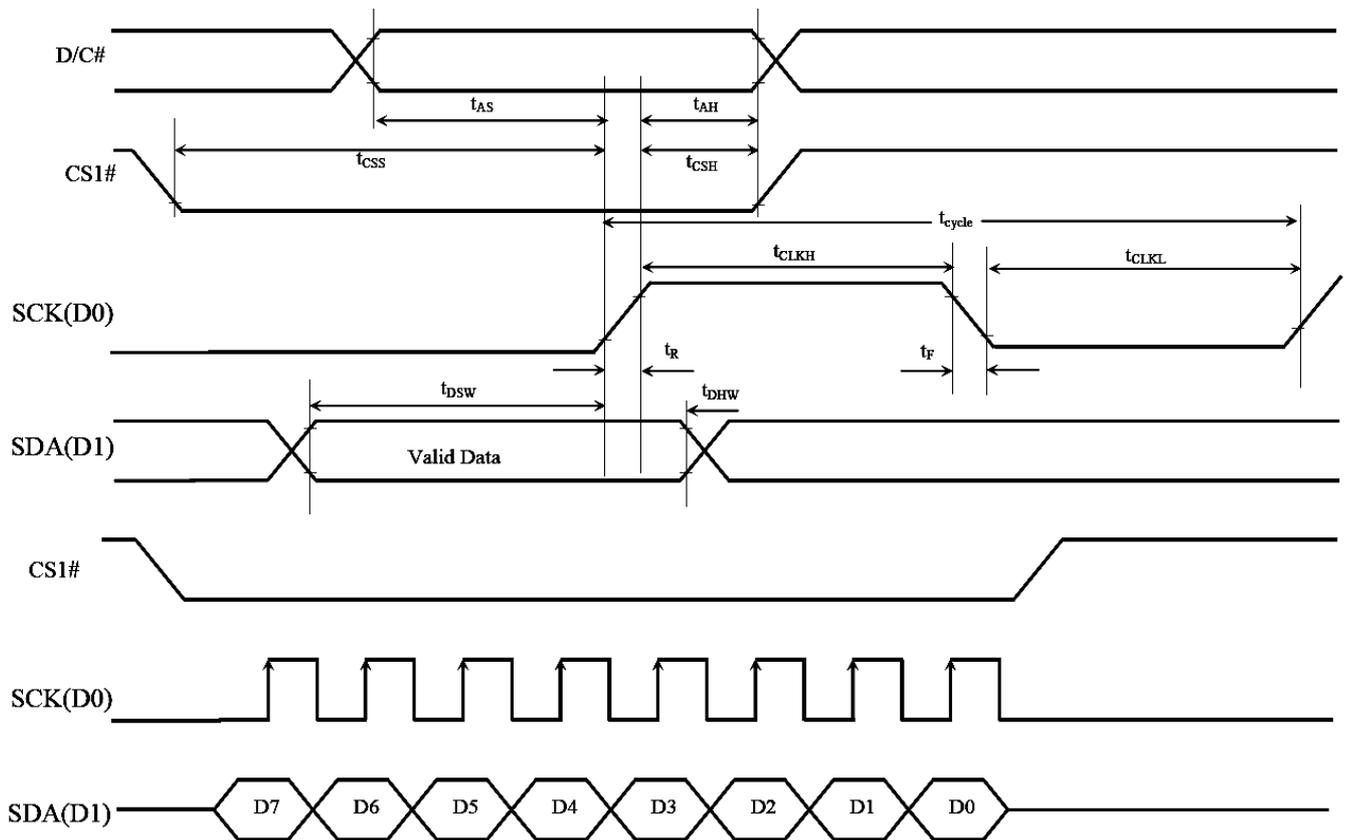


Figure 4: Timing characteristic of 4-wires Serial Interface

## 7.3 COMMAND TABLE

## 7.3.1. Command Table

(D/C# = 0, R/W#(WR#) = 0, E=1(RD# = 1) unless specific setting is stated)

D/C	Hex	D <sub>7</sub>	D <sub>6</sub>	D <sub>5</sub>	D <sub>4</sub>	D <sub>3</sub>	D <sub>2</sub>	D <sub>1</sub>	D <sub>0</sub>	Command	Description
0	10 – 1F	0	0	0	1	A <sub>3</sub>	A <sub>2</sub>	A <sub>1</sub>	A <sub>0</sub>	Set column address	Set the higher nibble of the column address register using A <sub>3</sub> A <sub>2</sub> A <sub>1</sub> A <sub>0</sub> as data bits. The higher nibble of column address is reset to 0000b after POR. [POR=10 <sub>HEX</sub> ] Set the lower nibble of the column address register using B <sub>3</sub> B <sub>2</sub> B <sub>1</sub> B <sub>0</sub> as data bits. The lower nibble of column address is reset to 0000b after POR. [POR=00 <sub>HEX</sub> ]
0	2A – 2F	0	0	1	0	1	X <sub>2</sub>	1	X <sub>0</sub>	Set Power Control Register	X <sub>2</sub> =0: turns off Charge Pump X <sub>2</sub> =1: turns on Charge Pump X <sub>0</sub> = 0: turns off Bias Voltage buffer X <sub>0</sub> =1: turns on Bias Voltage buffer [POR=2A <sub>HEX</sub> ]
0	31	0	0	1	1	0	0	0	1	Driving update	Update RAM content to the screen through segment and common pins. Driving sequence is always in: VA clearing phase → Idle 1 phase → AA clearing phase → Idle 2 phase → Driving phase
0	32	0	0	1	1	0	0	1	0	Driving Scheme	Driving Scheme Setting Active Area Control after clearing X <sub>6</sub> X <sub>5</sub> =01, Active Area is responsible to data 1 X <sub>6</sub> X <sub>5</sub> =11, Active Area is responsible to data 0 Border Control after clearing X <sub>4</sub> =X <sub>1</sub> =0, Border is responsible to data 0 X <sub>4</sub> =X <sub>1</sub> =1, Border is responsible to data 1 X <sub>3</sub> : driving polarity 0: M starts as 1 at Driving phase 1: M starts as 0 at Driving phase X <sub>2</sub> : clearing polarity 0: M starts as 1 at Clearing phase 1: M starts as 0 at Clearing phase [POR=00 <sub>HEX</sub> ]
0	40 – 7F	0	1	X <sub>5</sub>	X <sub>4</sub>	X <sub>3</sub>	X <sub>2</sub>	X <sub>1</sub>	X <sub>0</sub>	Set Display Start Line	Display start line register is reset to 000000 after POR for all MUX modes. [POR=40 <sub>HEX</sub> ]
0	80	1	0	0	0	0	0	0	0	Set the control scheme	Set the control scheme.
0	00	0	0	0	0	0	0	0	0		
0	B[4:0]	0	0	0	B <sub>4</sub>	B <sub>3</sub>	B <sub>2</sub>	B <sub>1</sub>	B <sub>0</sub>		B[4:0] : VA Clearing Duration
0	C[4:0]	0	0	0	C <sub>4</sub>	C <sub>3</sub>	C <sub>2</sub>	C <sub>1</sub>	C <sub>0</sub>		C[4:0] : Idle 1 Duration
0	D[4:0]	0	0	0	D <sub>4</sub>	D <sub>3</sub>	D <sub>2</sub>	D <sub>1</sub>	D <sub>0</sub>		D[4:0] : AA Clearing Duration
0	E[4:0]	0	0	0	E <sub>4</sub>	E <sub>3</sub>	E <sub>2</sub>	E <sub>1</sub>	E <sub>0</sub>		E[4:0] : Idle 2 Duration
0	F[4:0]	0	0	0	F <sub>4</sub>	F <sub>3</sub>	F <sub>2</sub>	F <sub>1</sub>	F <sub>0</sub>		F[4:0] : Driving Duration
0	G[6:1]	0	G <sub>6</sub>	G <sub>5</sub>	G <sub>4</sub>	G <sub>3</sub>	G <sub>2</sub>	G <sub>1</sub>	0		G[6:1] : Clearing Voltage
0	H[6:1]	0	H <sub>6</sub>	H <sub>5</sub>	H <sub>4</sub>	H <sub>3</sub>	H <sub>2</sub>	H <sub>1</sub>	0		H[6:1] : Driving Voltage
0	93	1	0	0	1	0	0	1	1	Set view area phase repeat times	X <sub>3</sub> X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> is Repeat time setting *Remark: If VA clearing phase repeat time is set to 0, it is also needed to set the idle 1 phase repeat time to 0. [POR=01 <sub>HEX</sub> ]
0	94	1	0	0	1	0	1	0	0	Set idle 1 phase repeat times	X <sub>3</sub> X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> is Repeat time setting *Remark: If Idle 1 phase repeat time is set to 0, it is also needed to set the VA clearing phase repeat time to 0. [POR=01 <sub>HEX</sub> ]
0	95	1	0	0	1	0	1	0	1	Set active area clearing phase repeat times	X <sub>3</sub> X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> is Repeat time setting *Remark: If AA clearing phase repeat time is set to 0, it is also needed to set the idle2 phase repeat time to 0. [POR=01 <sub>HEX</sub> ]
0	96	1	0	0	1	0	1	1	0	Set idle 2 phase repeat times	X <sub>3</sub> X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> is Repeat time setting *Remark: If Idle 2 phase repeat time is set to 0, it is also needed to set the AA clearing phase repeat time to 0. [POR=01 <sub>HEX</sub> ]
0	97	1	0	0	1	0	1	1	1	Set drive phase repeat times	X <sub>3</sub> X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> is Repeat time setting [POR=01 <sub>HEX</sub> ]
0	A0 – A1	1	0	1	0	0	0	0	X <sub>0</sub>	Set Segment Re-map	X <sub>0</sub> =0: Column address 00h is mapped to SEG0 X <sub>0</sub> =1: Column address 83h is mapped to SEG0 [POR=A0 <sub>HEX</sub> ]

D/C	Hex	D <sub>7</sub>	D <sub>6</sub>	D <sub>5</sub>	D <sub>4</sub>	D <sub>3</sub>	D <sub>2</sub>	D <sub>1</sub>	D <sub>0</sub>	Command	Description
0	A2	1	0	1	0	0	0	1	0	Set LCD Bias	X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> =000: 1/9 X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> =001: 1/8, X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> =010: 1/7, X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> =011: 1/6, X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> =100: 1/5, X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> =111: 1/4 [POR=00 <sub>HEX</sub> ]
0	A3	1	0	1	0	0	0	1	1	Set analog control	X <sub>4</sub> X <sub>3</sub> = 00: Disable X <sub>4</sub> X <sub>3</sub> = 11: Enable X <sub>1</sub> = 0: Standard BIAS VOLTAGE Buffer Setting X <sub>1</sub> = 1: Extra BIAS VOLTAGE Buffer Setting [POR=00 <sub>HEX</sub> ]
0	A4 – A5	1	0	1	0	0	1	0	X <sub>0</sub>	Set Entire Display On/Off	X <sub>0</sub> =0: normal display X <sub>0</sub> =1: entire display on [POR=A4 <sub>HEX</sub> ]
0	A6 – A7	1	0	1	0	0	1	1	X <sub>0</sub>	Set Normal/Reverse Display	X <sub>0</sub> =0: normal display X <sub>0</sub> =1: reverse display [POR=A6 <sub>HEX</sub> ]
0	A8	1	0	1	0	1	0	0	0	Set Multiplex Ratio	To select multiplex ratio N MUX X <sub>6</sub> X <sub>5</sub> X <sub>4</sub> X <sub>3</sub> X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> = N from 2 to 64 [POR=40 <sub>HEX</sub> ]
0	A9	1	0	1	0	1	0	0	1	Analog Control Auto ON/OFF	X <sub>0</sub> = 0: OFF X <sub>0</sub> = 1: ON [POR=00 <sub>HEX</sub> ]
0	AD	1	0	1	0	1	1	0	1	RAM Read/Write Direction	X <sub>0</sub> = 0: RAM read/write horizontal X <sub>0</sub> = 1: RAM read/write vertical [POR=00 <sub>HEX</sub> ]
0	AE	1	0	1	0	1	1	1	0	Set Auto Charge pump Threshold Value	X <sub>6</sub> X <sub>5</sub> X <sub>4</sub> X <sub>3</sub> X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> : Auto Charge Pump Threshold If contrast setting > threshold, 16X Charge Pump setting would be selected, Otherwise, 8X Charge Pump is used. [POR=20 <sub>HEX</sub> ]
0	B0 – B7	1	0	1	1	0	X <sub>2</sub>	X <sub>1</sub>	X <sub>0</sub>	Set Page Address	Set GDDRAM Page Address (0-7) for read/write using X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> [POR=B0 <sub>HEX</sub> ]
0	C0 / C8	1	1	0	0	X <sub>3</sub>	0	0	0	Set COM Output Scan Direction	X <sub>3</sub> =0: normal mode X <sub>3</sub> =1: remapped mode COM0 to COM [N-1] becomes COM [N-1] to COM0 when Multiplex ratio is equal to N. [POR=C0 <sub>HEX</sub> ]
0	D3	1	1	0	1	0	0	1	1	Set Display Offset	After setting MUX ratio less than default value, data will be displayed at the beginning/towards the end of display matrix. To move display towards Row 0 by L, X <sub>5</sub> X <sub>4</sub> X <sub>3</sub> X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> = L To move display away from Row 0 by L, X <sub>5</sub> X <sub>4</sub> X <sub>3</sub> X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> = Y – L Note: max value of L = Y – display MUX Y represents POR default MUX [POR=00 <sub>HEX</sub> ]
0	E2	1	1	1	0	0	0	1	0	Software Reset	Initialize internal status registers.
0	E3	1	1	1	0	0	0	1	1	NOP	No operation
0	E9	1	1	1	0	1	0	0	1	Set Bias Resistor Ladder	X <sub>7</sub> = 0: Disable X <sub>7</sub> = 1: Enable [POR=04 <sub>HEX</sub> ]
0	F6	1	1	1	1	0	1	1	0	Set Internal Oscillator	X <sub>6</sub> = 0: Disable X <sub>6</sub> = 1: Enable [POR=00 <sub>HEX</sub> ]
0	FD	1	1	1	1	1	1	0	1	Lock/unlock driver	X <sub>2</sub> = 0: unlock driver X <sub>2</sub> = 1: lock driver Or unlock driver when hardware reset  (No command or data will be written to driver when the lock is high) [POR=12 <sub>HEX</sub> ]
0	FE	1	1	1	1	1	1	1	0	Set Clock Enable	X <sub>7</sub> = 0: Disable X <sub>7</sub> = 1: Enable [POR=00 <sub>HEX</sub> ]
0		X <sub>7</sub>	0	0	0	0	0	0	0		

## 7.3.2. Read Command Table

(D/C# = 0, R/W#(WR#) = 1, E=1(RD# = 0) unless specific setting is stated)

D/C	Hex	D <sub>7</sub>	D <sub>6</sub>	D <sub>5</sub>	D <sub>4</sub>	D <sub>3</sub>	D <sub>2</sub>	D <sub>1</sub>	D <sub>0</sub>	Command	Description
0	00 - FF	X <sub>7</sub>	X <sub>6</sub>	X <sub>5</sub>	0	X <sub>3</sub>	X <sub>2</sub>	X <sub>1</sub>	X <sub>0</sub>	Status Register Read	X <sub>7</sub> =0: indicates the driver is ready for command. X <sub>7</sub> =1: indicates the driver is Busy. X <sub>6</sub> =0: indicates normal segment mapping with column address. X <sub>6</sub> =1: indicates reverse segment mapping with column address. X <sub>5</sub> =0: indicates the display is ON. X <sub>5</sub> =1: indicates the display is OFF. X <sub>3</sub> X <sub>2</sub> X <sub>1</sub> X <sub>0</sub> = 0010, the 4-bit is fixed to 0010 which could be used to identify as Device.

## 7.4 Temperature Compensation

Table 7: TC Table

Temperature, T(°C)	View Area Clear Duration (ms)	View Area Idle Duration (ms)	Active Area Clear Duration (ms)	Active Area Idle Duration (ms)	Drive Duration (ms)
50 ≤ T < 70	6	12	100	12	6
10 ≤ T < 50	18	12	100	12	18
0 ≤ T < 10	35	12	150	12	35
-5 ≤ T < 0	50	12	200	12	50
-10 ≤ T < -5	80	12	250	12	80
-15 ≤ T < -10	150	12	350	12	150
-20 ≤ T < -15	350	12	700	12	350

Notes: For details, please reference to BCD application notes.

## 8. Optical Characteristics at 25 °C

Table 8

Item	Symbol	Value			Unit	Condition	
		Min.	Typ.	Max.			
Image refresh time	-	-	2.4	-	S	VDD=3.0V, VLCD =31.0V At Ta = -20 °C	
	-	-	2.2	-	S	VDD=3.0V, VLCD =28.0V At Ta = -10 °C	
	-	-	2.0	-	S	VDD=3.0V, VLCD =26.8V At Ta = 0 °C	
	-	-	1.8	-	S	VDD=3.0V, VLCD =26.0V At Ta = +5 °C	
	-	-	1.8	-	S	VDD=3.0V, VLCD =26.0V At Ta = +25 °C	
	-	-	1.8	-	S	VDD=3.0V, VLCD =25.7V At Ta = +50 °C	
	-	-	1.6	-	S	VDD=3.0V, VLCD =25.0V At Ta = +70 °C	
Contrast ratio	CR	-	6	-	-	-	
Optimum viewing area Cr ≥ 2	θ1(6 o'clock)	-	80	-	DEG	φ = 0°	Vop= Optimum voltage
	θ2(12 o'clock)	-	80	-			
	φ1(3 o'clock)	-	80	-		φ = 0°	
	φ2(9 o'clock)	-	80	-			

Notes: The above data are for reference only.

## 8.1 Optical Characteristics Definition

### 8.1.1 Viewing Angle

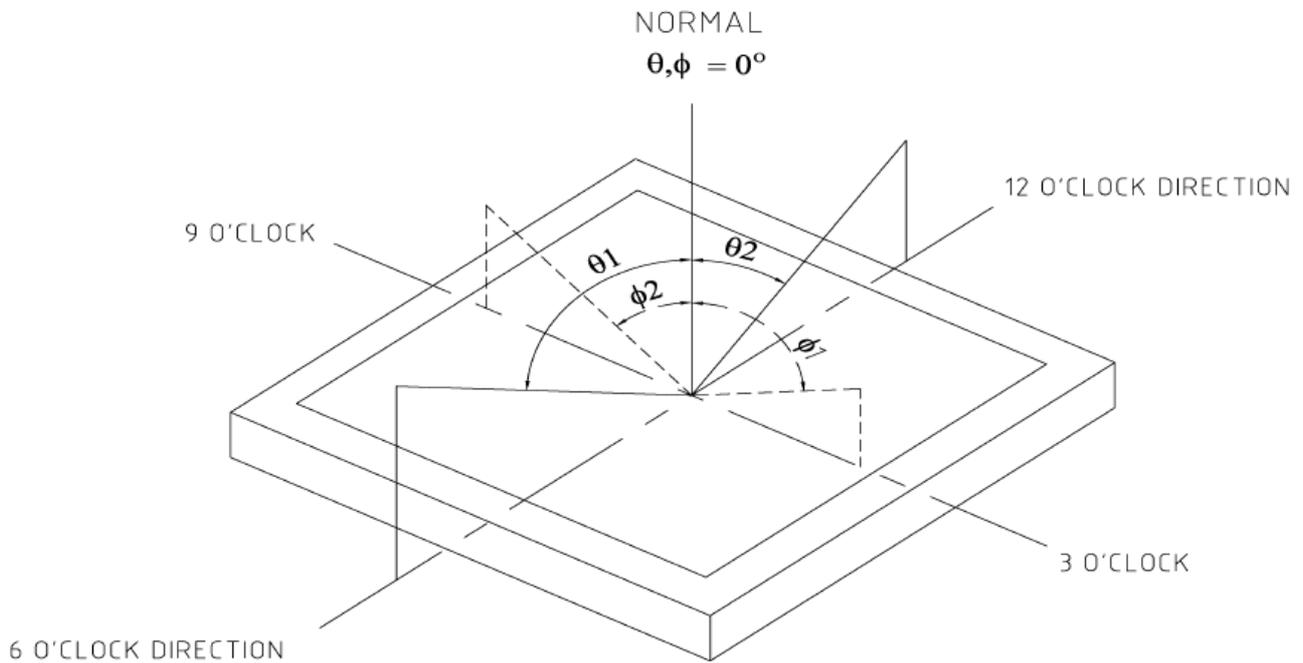


Figure 5

### 8.1.2 Contrast Ratio

B1 = pixel luminance at stable dark state

B2 = pixel luminance at stable bright state

Contrast Ratio =  $B2/B1$

## 9. LCD Cosmetic Conditions

LCD size of the product is small.

## 10. HANDLING PRECAUTION

### (1) Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizers which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD Modules.

### (2) Caution of LCD handling & cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichloro trifloro thane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Ketone
- Aromatics

### (3) Caution against static charge

The LCD Module use C-MOS LSI drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

### (4) Packaging

- Modules use LCD elements, and must be treated as such. Avoid intense shock and falls from a height.
- To prevent modules from degradation. Do not operate or store them exposed directly to sunshine or high temperature/humidity.

### (5) Caution for operation

- It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shorten LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's. Which will come back in the specified operating temperature range.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the relative condition of 40°C, 50%RH or less is reequired.

### (6) Storage

In the case of storing for a long period of time (for instance.) For years) for the purpose or replacement use, The following ways are recommended.

- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping temperature in the specified storage temperature range.
- Storing with no touch on polarizer surface by the anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)

### (7) Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol.

Which should be burned up later.

### (8) Other

- After the product shipped, any product quality issues must be feedback within three months, otherwise, we will not be responsible for the subsequent or consequential events.