

Display Elektronik GmbH

DATA SHEET

BCD MODULE

DEC 128064A BWH

2,7"

**128x64 Bi-Stable
Cholesteric Display**

Product Specification

Ver.: 3

03.12.2018

Table of Contents

No.	Contents	Page
1.	TECHNOLOGY DESCRIPTION.....	4
2.	TYPICAL APPLICATIONS	4
3.	GENERAL DESCRIPTION	4
4.	MECHANICAL SPECIFICATIONS	4
5.	INTERFACE SIGNALS	6
6.	ABSOLUTE MAXIMUM RATINGS.....	8
7.	ELECTRICAL SPECIFICATIONS	10
8.	OPTICAL CHARACTERISTICS AT 25°C	12
9.	LCD COSMETIC CONDITIONS	13
10.	HANDLING PRECAUTION	14

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

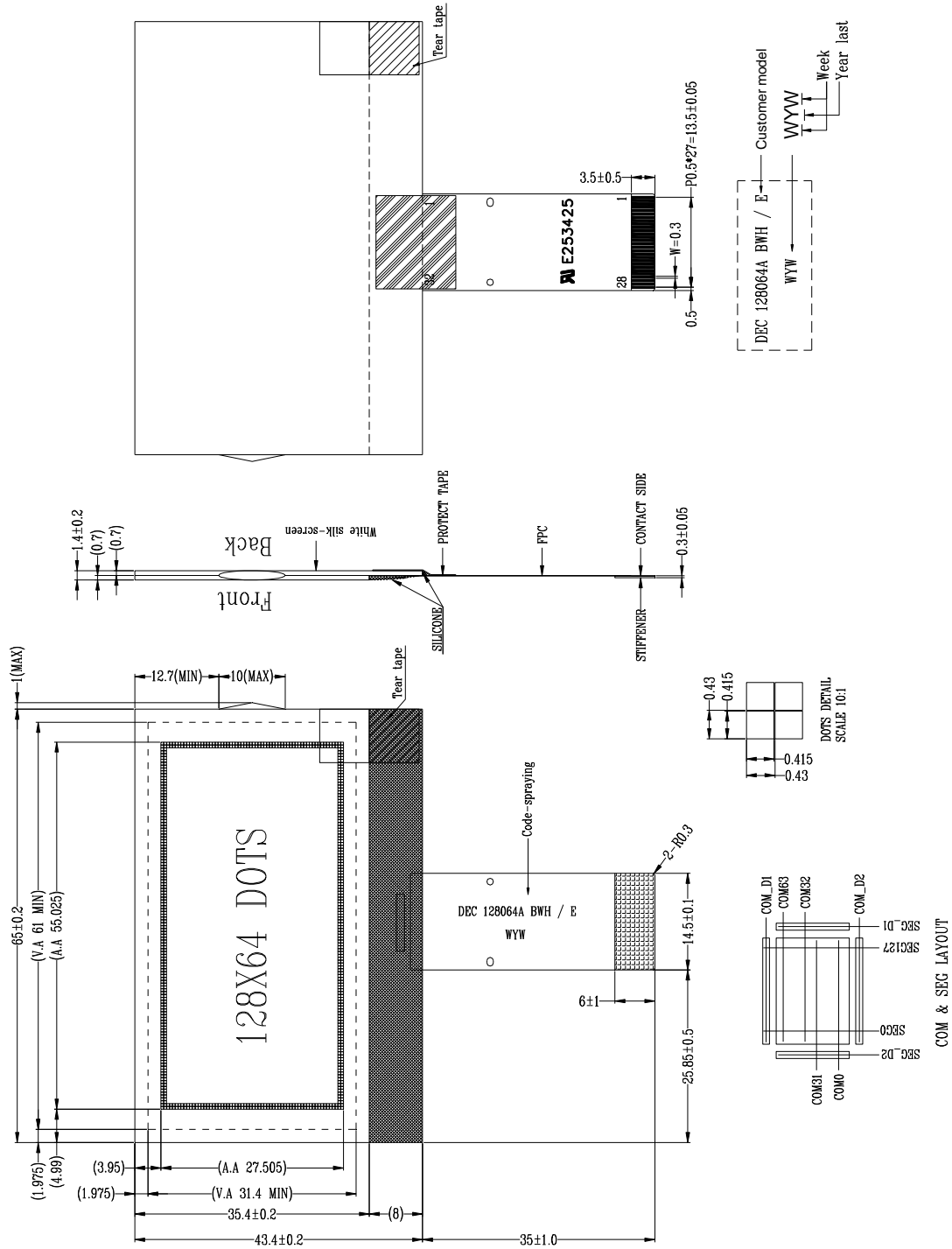
- * Technology : Passive Matrix Bistable Cholesteric LCD Graphic Module
- * Color : Blue & White
- * Display Mode : BCD – Bistable Cholesteric LCD
- * Driver/Controller IC : SSD1603 (Sitronix)
- * Interface Input Data : 4-Wire SPI Interface
- * Driving Scheme : Special BCD Driving Scheme
- * Driving Method : 1/64 Duty, Static
- * Viewing Direction : Full Viewing
- * Backlight : Without
- * Polarizer Mode : Reflective, without Polarizer
- * Sample NO. : -

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	61.00 x 31.40	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	VDDIO	21	VCP3
8	D/C	22	C3P
9	CS	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 (Blue/White)
 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° C~+70° C
 7. Storage temperature:-30° C~+80° C
 8. Driver/Controller IC:SSDI1603
 9. Logic power supply voltage:3.0V
 10. Connector type: COG+PPC
 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.

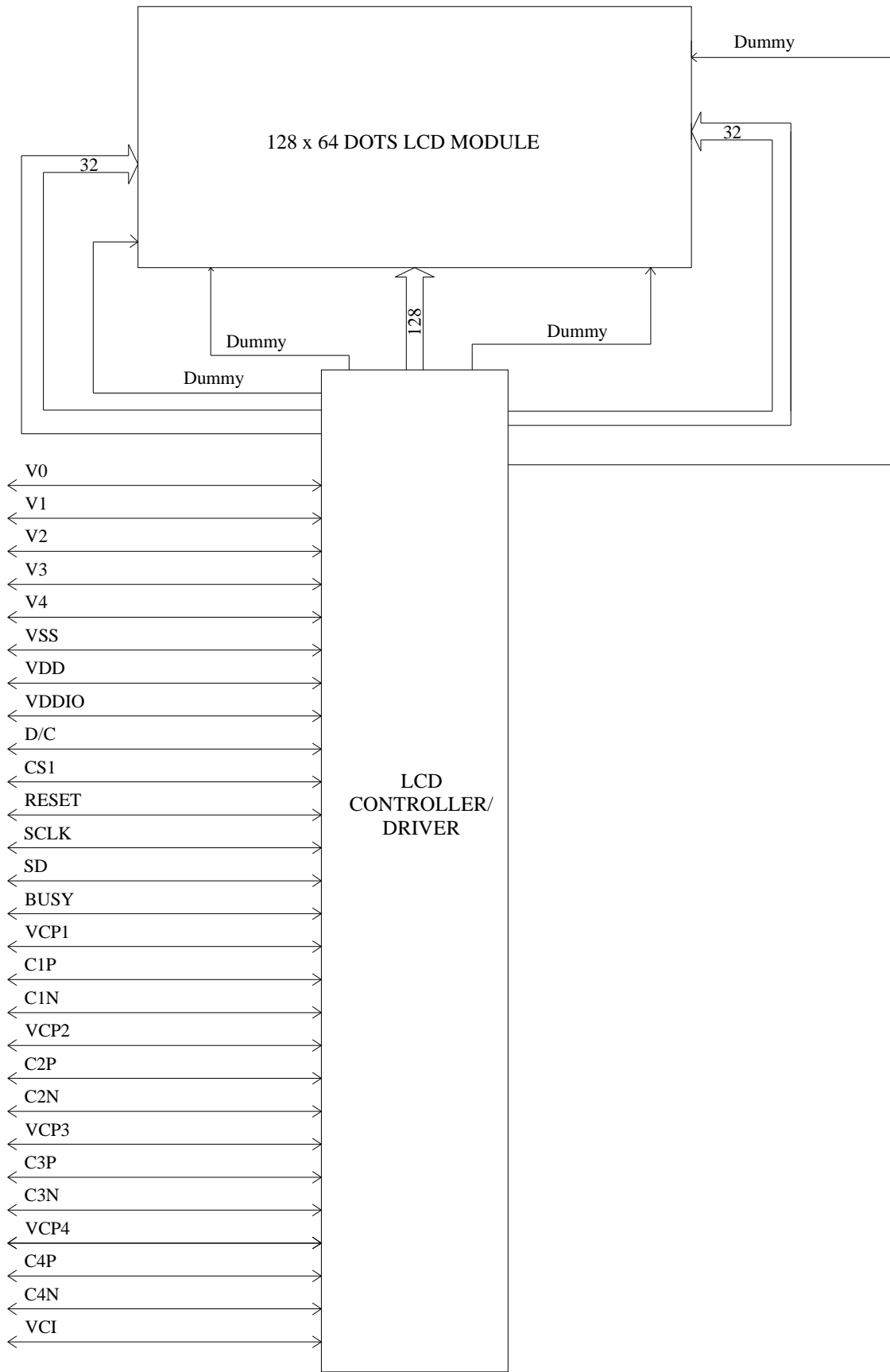
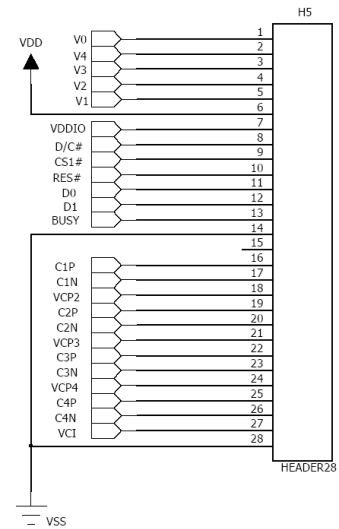
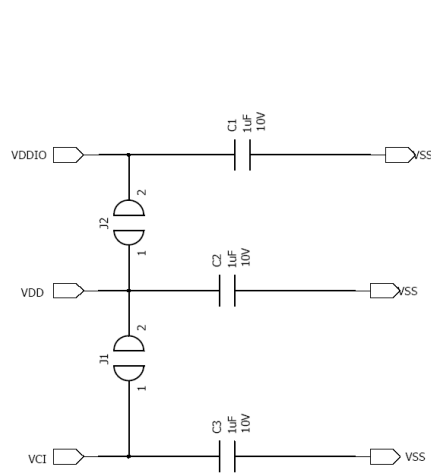
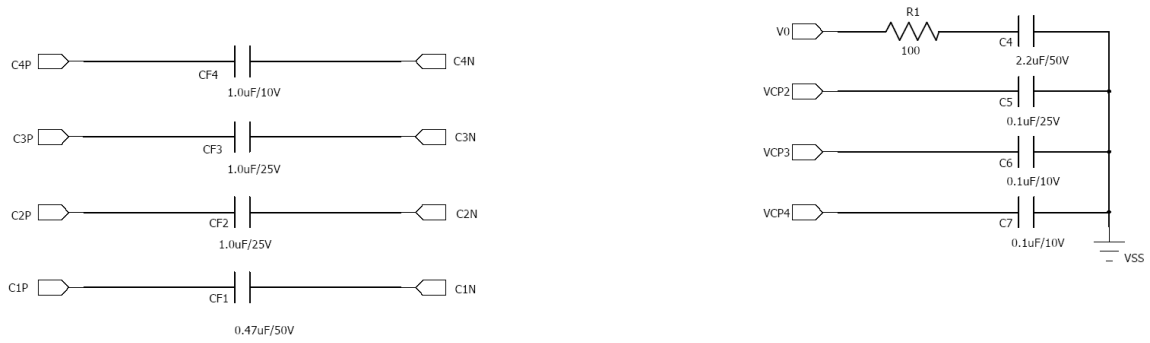


Figure 2: Block Diagram



COG Version IC Interface

D0 =SCLK D1 =SDIN

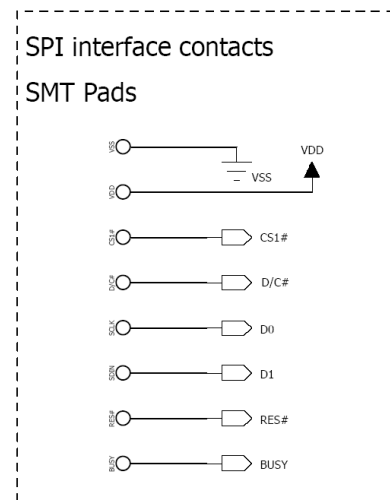
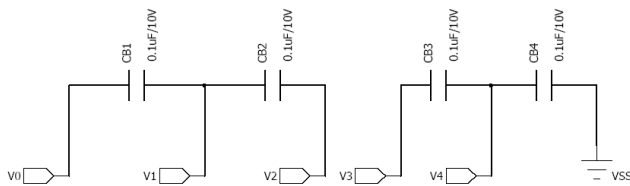


Figure 3: Circuit Diagram

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 _{SS} = 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 (T _{opr})		Storage Temperature (T _{stg})		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 $T_a = 25^\circ\text{C}$, $V_{DD} = +3.0\text{V} \pm 5\%$, $V_{SS} = 0\text{V}$.

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

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

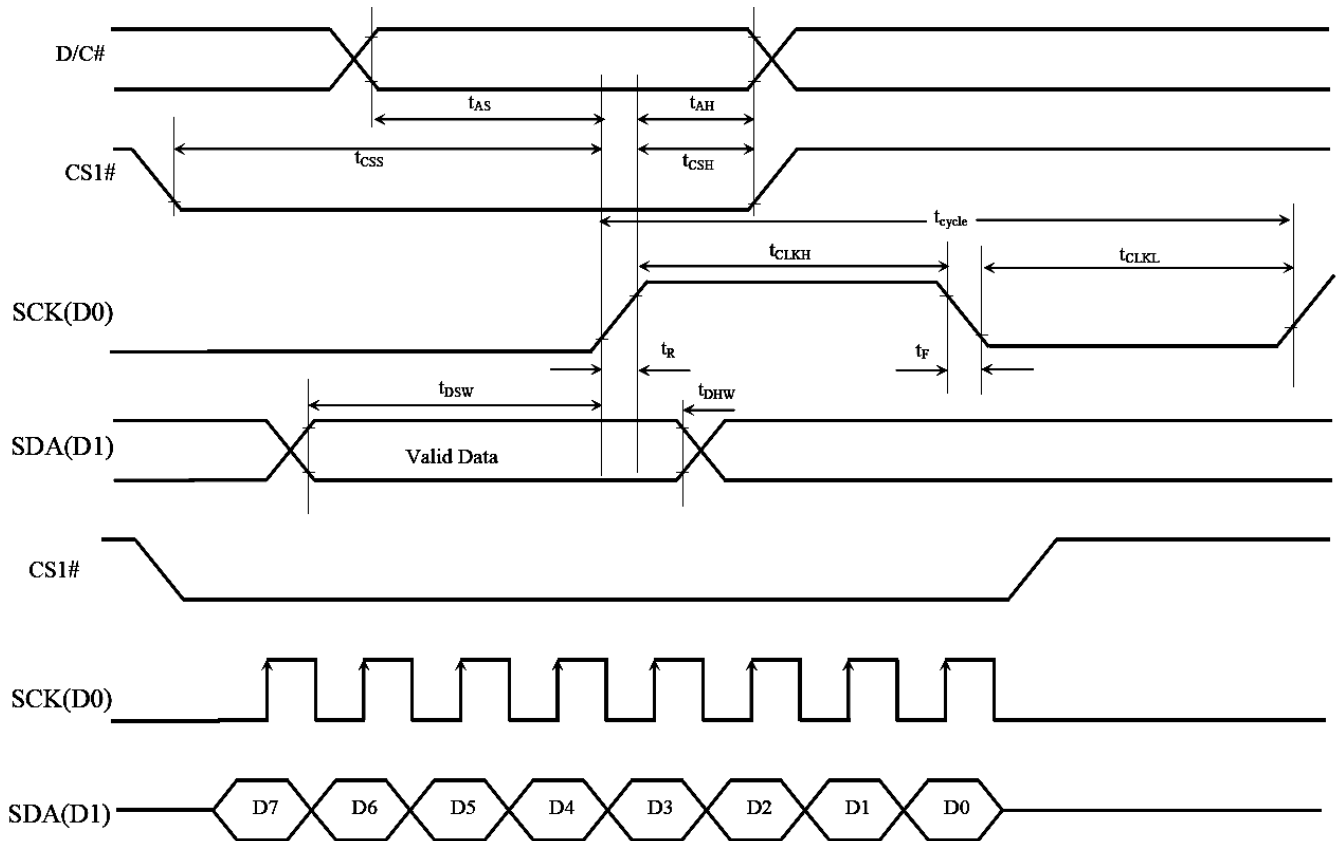


Figure 4: Timing characteristic of 4-wires Serial Interface

7.3 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)
$50 \leq T < 70$	6	12	100	12	6
$10 \leq T < 50$	18	12	100	12	18
$0 \leq T < 10$	35	12	150	12	35
$-5 \leq T < 0$	50	12	200	12	50
$-10 \leq T < -5$	80	12	250	12	80
$-15 \leq T < -10$	150	12	350	12	150
$-20 \leq T < -15$	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	-			

8.1 Optical Characteristics Definition

8.1.1 Viewing Angle

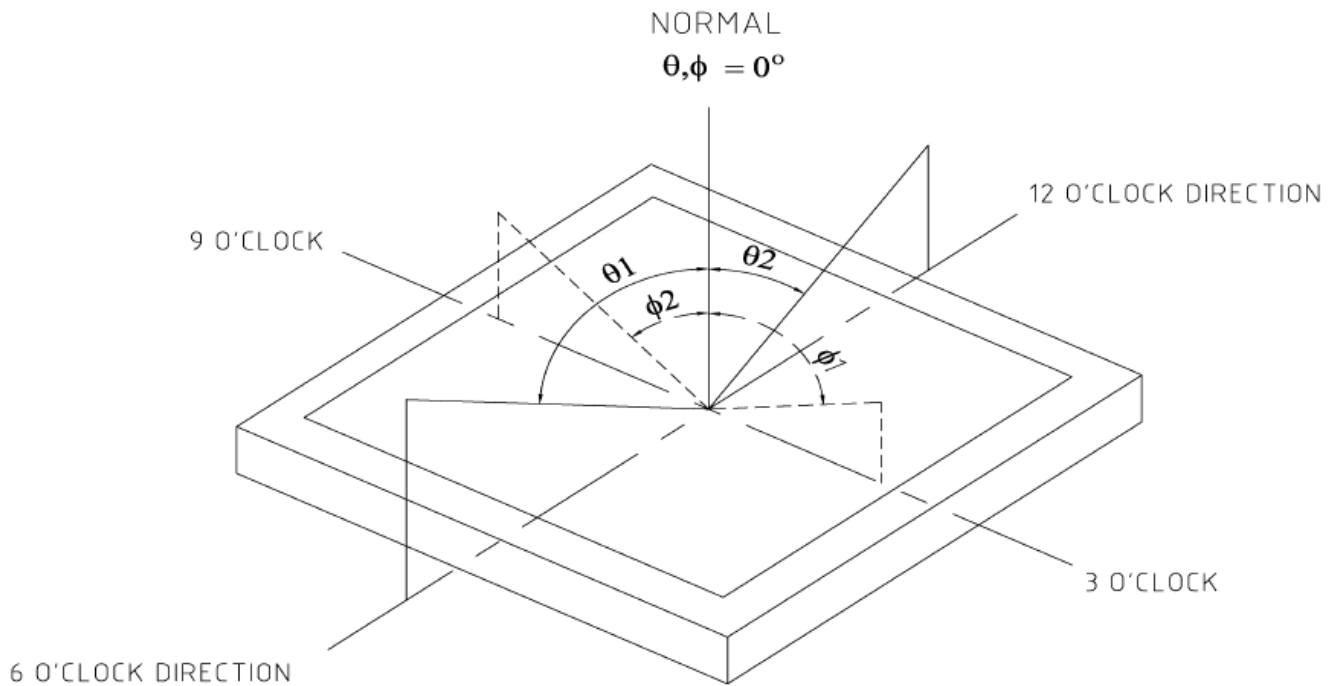


Figure 5

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