VS DISPLAY TECHNOLOGY (HK) LTD

LCD Module Specification

Model No.: VS2043-BMDWH6V

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RECORD OF REVISION

Rev.	Date	Page	Item	Description
0.1	2007/09/14	-	-	New release

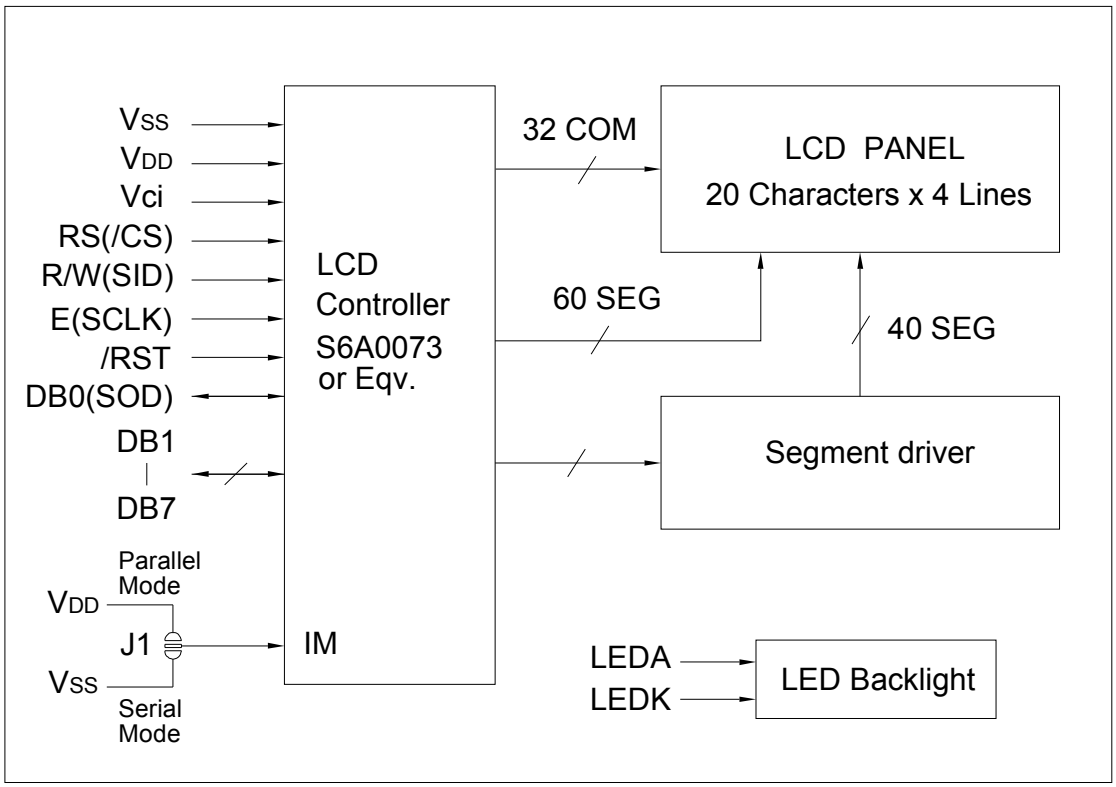
VS DISPLAY TECHNOLOGY (HK) LTD

1. BASIC SPECIFICATIONS

1.1 Features

Item	Specifications	Unit
Display Format	20 Characters x 4 Lines	-
LCD Type	STN - Blue - Negative - Transmissive White characters on blue background	-
Driving Method	1/33 Duty, 1/6.7 Bias	-
Viewing Direction	6	O'clock
Backlight & Color	LED, white color	-
Outline Dimension (WxHxT)	75.0 x 26.8 x 14.0	mm
Viewing Area (WxH)	61.0 x 19.0	mm
Character Size (WxH)	2.32 x 3.73	mm
Dot Size (WxH)	0.44 x 0.44	mm
Weight	28	g
Controller	S6A0073X01	-
Interface	4/8-bit parallel or serial	-
Power Supply (VDD)	3.3 to 5.0	V

1.2 Block Diagram



1.3 Terminal Functions

Pin No.	Symbol	Level	Function
1	VSS	0V	Ground (connects to frame ground via jumper J3)
2	VDD	+3.3V to +5V	Power supply for logic. Refer to section 3.4
3	Vci	-	Input voltage to the internal voltage converter to generate LCD drive voltage. Vci is used for LCD contrast adjusting. Refer to section 3.5.
4	RS (/CS)	H/L	Parallel mode: Data or instruction selection H: Display data L: Instruction code Serial mode: Chip selection. Active "L".
5	R/W (SID)	H/L	Parallel mode: Read or write selection H: Read operation L: Write operation Serial mode: Serial data input
6	E (SCLK)	H, H→L	Parallel mode: Enable signal In read mode (R/W="H"), data appears at DB0 to DB7 while E is "H"; In write mode (R/W="L"), data of DB0 to DB7 is latched at the falling edge of E Serial mode: Serial clock input
7	DB0 (SOD)	H/L	In 8-bit mode, used as low order bi-directional data bus. In 4-bit mode, open these terminals. In serial mode, open DB1 to DB3. DB0 (SOD) is used as serial data output pin. If not in read operation, open DB0 (SOD) pin.
8	DB1	H/L	
9	DB2	H/L	
10	DB3	H/L	
11	DB4	H/L	In 8-bit mode, used as high order bi-directional data bus. In 4-bit mode, used as both high and low order data bus. In serial mode, open these pins.
12	DB5	H/L	
13	DB6	H/L	
14	DB7	H/L	
15	NC	-	No connection
16	/RST	L	Reset signal. Active "L".
17	LEDA	+5V	Power supply for LED backlight Refer to section 3.3, 3.4
18	LEDK	0V	

1.4 Set Interface Mode (IM) by Jumper J1

J1 Jumper Status	IM Level	Function
Close to **4/8** side	H	4/8-bit parallel mode selected **<Default>**
Close to **Serial** side	L	Serial mode selected

2. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit
Supply Voltage (Logic)	VDD-VSS	-0.3	7.0	V
Supply Voltage (LCD)	Vci	-0.3	4.3	V
Input Voltage	VI	-0.3	VDD+0.3	V
Operating Temperature	Topr	-20	70	°C
Storage Temperature	Tstg	-30	80	°C

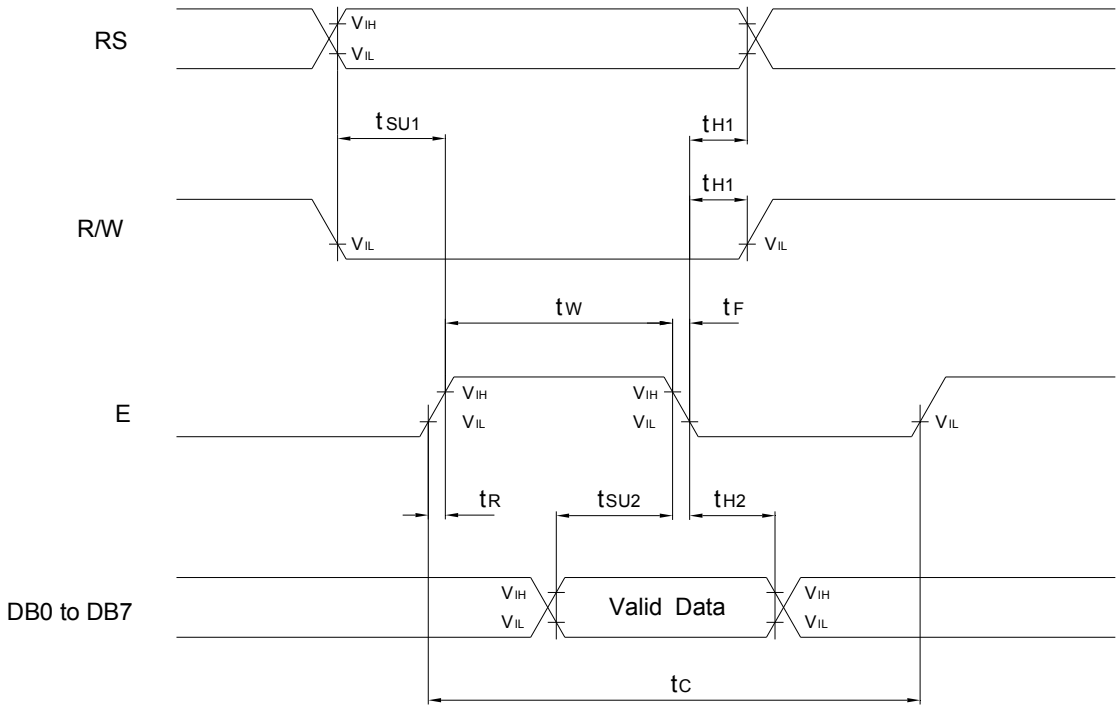
3. ELECTRICAL CHARACTERISTICS

3.1 DC Characteristics (VDD=3.3 to 5.5V, Ta=25°C)

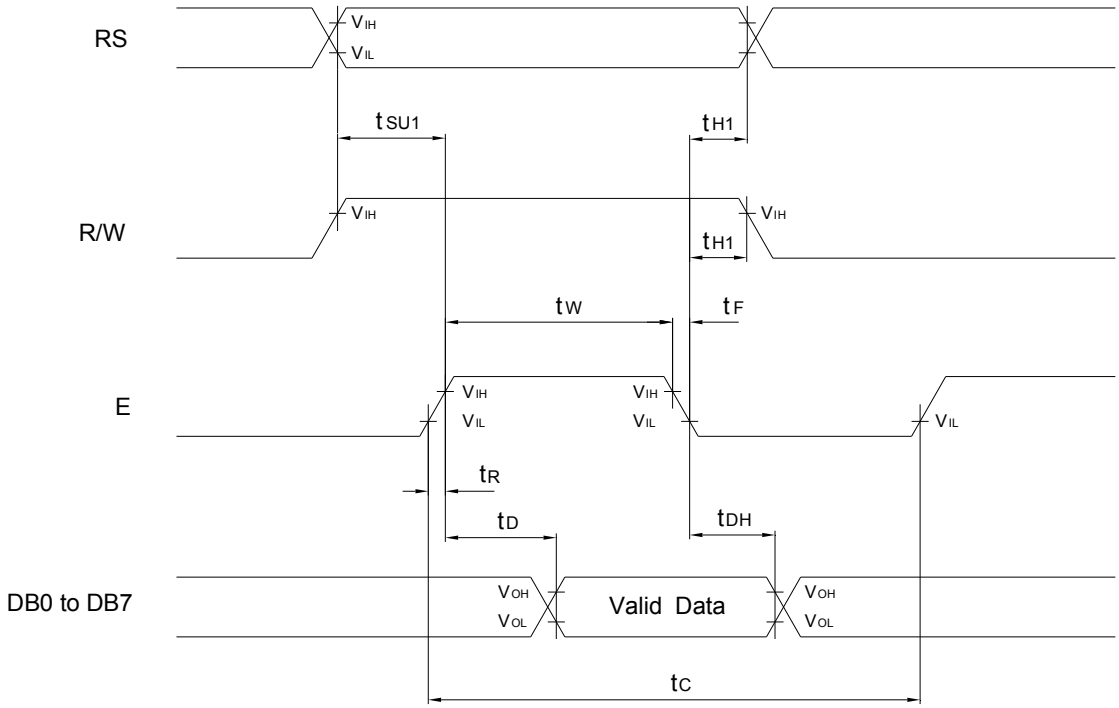
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage (Logic)	VDD		3.3	5.0	5.5	V
Supply Voltage (LCD Drive)	VDD-V5		-	8.0	-	V
Input High Voltage	VIH		0.7VDD	-	VDD	V
Input Low Voltage	VIL		-0.3	-	0.6	V
Output High Voltage	VOH	IOH=-0.1mA	0.75VDD	-	VDD	V
Output Low Voltage	VOL	IOL=0.1mA	0	-	0.2VDD	V
Supply Current (Logic)	IDD	VDD=5.0V	-	1.5	2.0	mA
		VDD=3.3V	-	1.0	1.5	mA

3.2 Interface Timing Chart (VDD=3.3 to 5.5V, Ta=25°C)

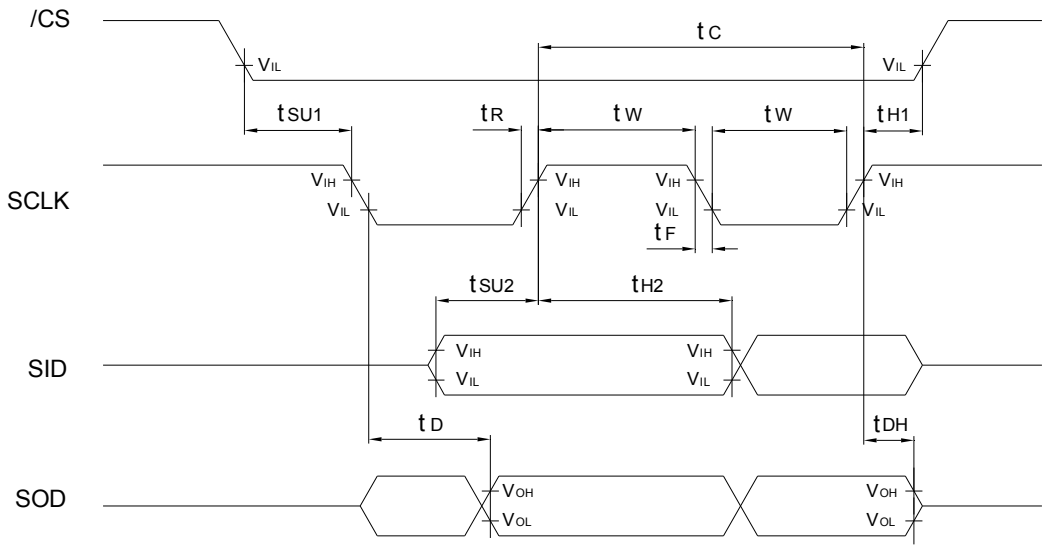
Mode	Characteristic	Symbol	VDD=4.5 to 5.5V		VDD=3.3 to 4.5V		Unit
			Min.	Max.	Min.	Max.	
Write Mode (Refer to MPU Write Timing)	E Cycle Time	t_C	500	-	1000	-	ns
	E Rise/Fall Time	t_R, t_F	-	20	-	25	
	E Pulse Width (High, Low)	t_W	230	-	450	-	
	R/W and RS Setup Time	t_{SU1}	40	-	60	-	
	R/W and RS Hold Time	t_{H1}	10	-	20	-	
	Data Setup Time	t_{SU2}	60	-	195	-	
	Data Hold Time	t_{H2}	10	-	10	-	
Read Mode (Refer to MPU Read Timing)	E Cycle Time	t_C	500	-	1000	-	ns
	E Rise/Fall Time	t_R, t_F	-	20	-	25	
	E Pulse Width (High, Low)	t_W	230	-	450	-	
	R/W and RS Setup Time	t_{SU}	40	-	60	-	
	R/W and RS Hold Time	t_H	10	-	20	-	
	Data Output Delay Time	t_D	-	160	-	360	
	Data Hold Time	t_{DH}	5	-	5	-	
Serial Mode (Refer to Serial Mode Timing)	Serial Clock Cycle Time	t_C	0.5	20	1	20	μs
	Serial Clock Rise/Fall Time	t_R, t_F	-	50	-	50	ns
	Serial Clock Width (High,Low)	t_W	200	-	400	-	
	Chip Select Setup Time	t_{SU1}	60	--	60	-	
	Chip Select Hold Time	t_{H1}	20	--	20	-	
	Serial Input Data Setup Time	t_{SU2}	100	-	200	-	
	Serial Input Data Hold Time	t_{H2}	100	--	200	-	
	Serial Output Data Delay Time	t_D	-	160	-	360	
	Serial Output Data Hold Time	t_{DH}	5	-	5	-	



MPU Write Timing



MPU Read Timing

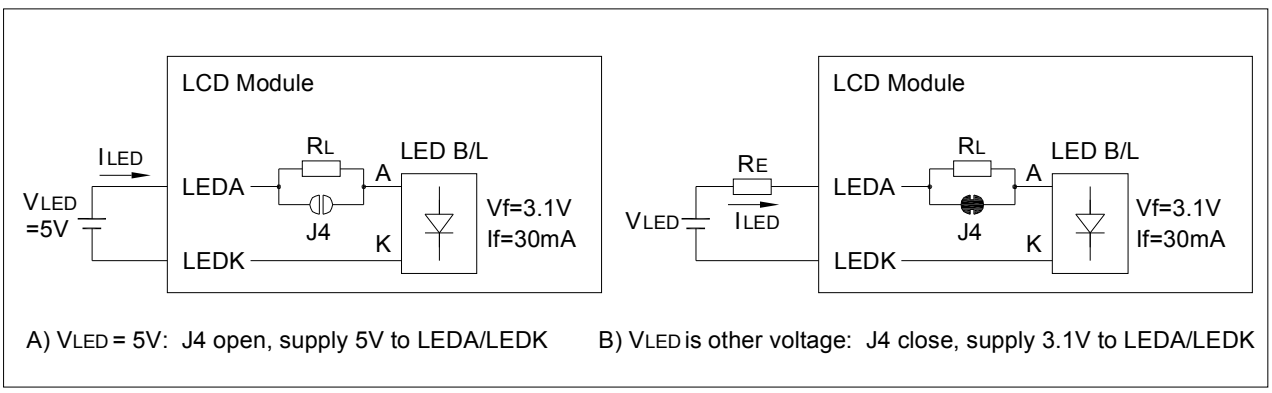


Serial Mode Timing

3.3 LED Backlight Characteristics (Ta=25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	Vf		2.9	3.1	3.3	V
Forward Current	If	Vf=3.1V	-	30	-	mA
Color	White					

3.4 Power Supply for LED Backlight



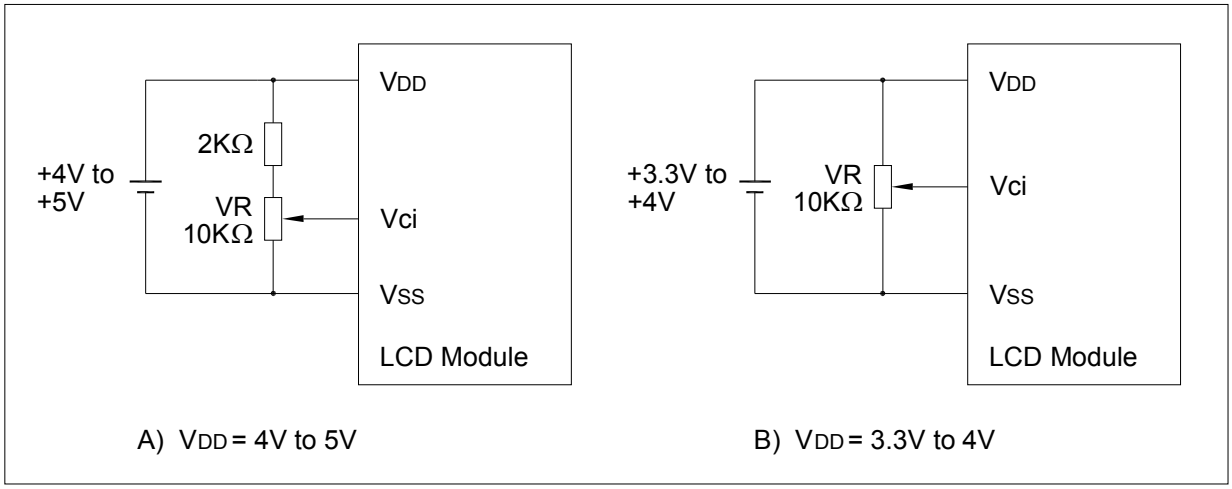
* RL (internal) and RE (external) are the current limiting resistors for LED backlight

1) VLED=5.0V: J4 open. Supply 5.0V to LEDA (Pin 17) and LEDK (Pin 18) **<Default>**

2) VLED=3.3V: J4 close; RE=(3.3V-3.1V)/30mA=6.7Ω. Supply 3.1V to LEDA (Pin 17) and LEDK (Pin 18)

3) VLED is other voltage: J4 close; RE=(VLED-3.1V)/30mA. Supply 3.1V to LEDA (Pin 17) and LEDK (Pin 18)

3.5 Power Supply for Logic and LCD Driving



* VR is for LCD contrast adjusting. **Vci voltage should not be over 4.3V.**

4. INSTRUCTION SET (IE=HIGH)

Instruction	RE	Instruction code										Description	Execution time (fosc=270 KHz)
		RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	-	0	0	0	0	0	0	0	0	0	1	Write 20H to DDRAM, and set DDRAM address to 00H in AC.	1.53ms
Return Home	0	0	0	0	0	0	0	0	0	1	-	Set DDRAM address to 00H in AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.53ms
Power Down Mode	1	0	0	0	0	0	0	0	0	1	PD	Set power down mode. PD=1: power down mode set. PD=0: power down mode disable.	39μs
Entry Mode Set	0	0	0	0	0	0	0	0	1	I/D	S	Assign cursor moving direction and the shift of entire display. I/D=1: increment. I/D=0: decrement. S=1: enable display shift of the enabled lines by DS4-DS1 bits in the Shift Enable instruction. S=0: display shift disable.	39μs
	1	0	0	0	0	0	0	0	1	1	BID	Segment bidirectional function. BID=1: Seg60→Seg1. BID=0: Seg1→Seg60.	39μs
Display ON/OFF Control	0	0	0	0	0	0	0	1	D	C	B	Set entire display, cursor and blinking of cursor position character on/off. D=1: entire display on. D=0: entire display off. C=1: cursor on. C=0: cursor off. B=1: cursor blink on. B=0: cursor blink off.	39μs
Extended Function Set	1	0	0	0	0	0	0	1	FW	B/W	NW	Assign font width, black/white inverting of cursor, and 4-line display mode. FW=1: 6-dot font width. FW=0: 5-dot font width. B/W=1: black/white inverting of cursor enable. B/W=0: black/white inverting of cursor disable. NW=1: 4-line display mode. NW=0: 1-line or 2-line display mode.	39μs
Cursor or Display Shift	0	0	0	0	0	0	1	S/C	R/L	-	-	Cursor or display shift. S/C=1: display shift. S/C=0: cursor shift. R/L=1: shift to right. R/L=0: shift to left.	39μs
Shift Enable	1	0	0	0	0	0	1	DS4	DS3	DS2	DS1	Assign the line for display shift (DH=1) DS1=1/0: 1st line display shift enable/disable. DS2=1/0: 2nd line display shift enable/disable. DS3=1/0: 3rd line display shift enable/disable. DS4=1/0: 4th line display shift enable/disable.	39μs

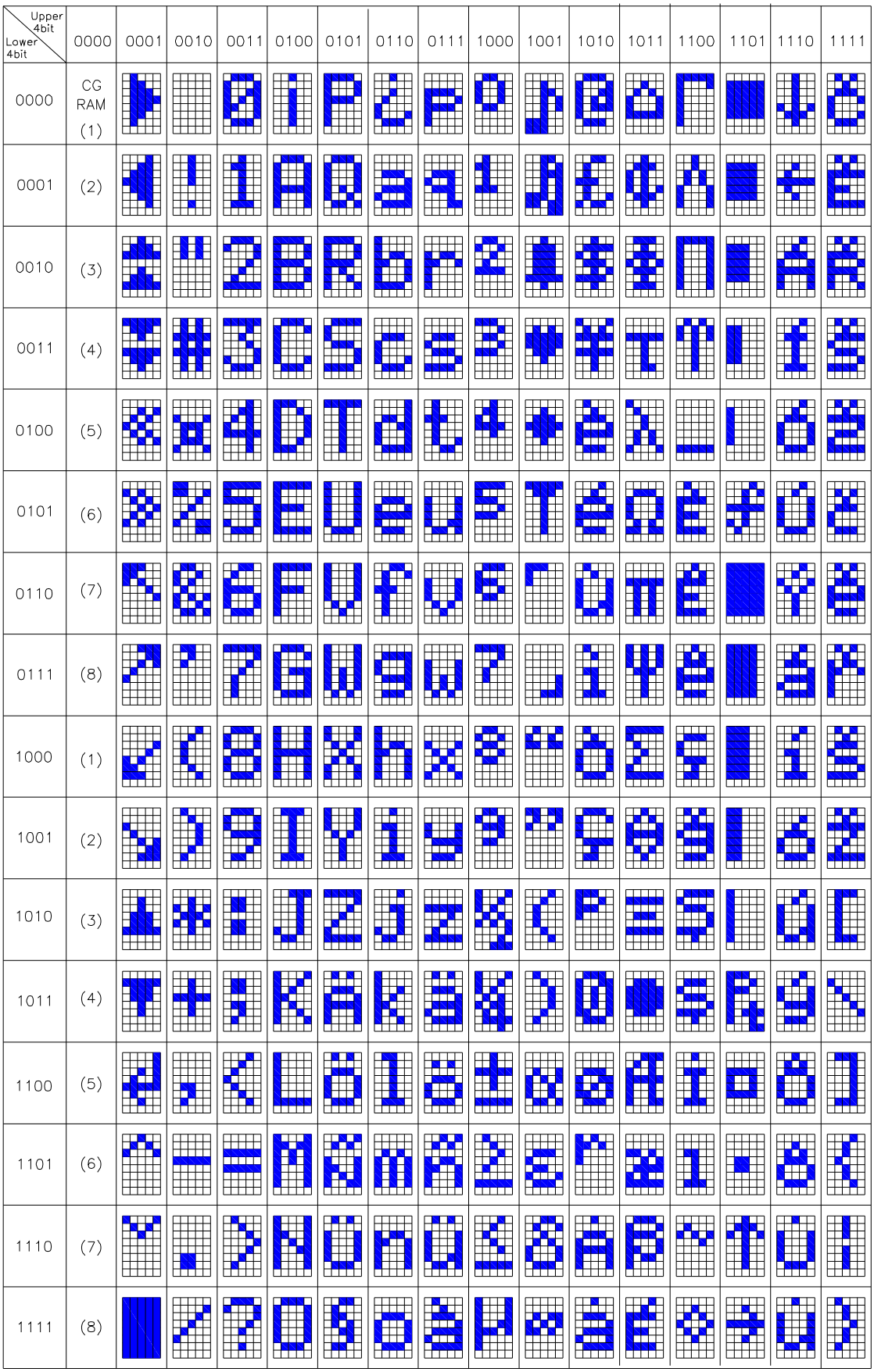
Instruction Set Continued (IE=HIGH)

Instruction	RE	Instruction code										Description	Execution time (fosc=270 KHz)
		RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Scroll Enable	1	0	0	0	0	0	1	HS4	HS3	HS2	HS1	Assign the line for horizontal smooth scroll (DH=0). HS1=1/0: 1st line dot scroll enable/disable. HS2=1/0: 2nd line dot scroll enable/disable. HS3=1/0: 3rd line dot scroll enable/disable. HS4=1/0: 4th line dot scroll enable/disable.	39μs
Function Set	0	0	0	0	0	0	1	DL	N	RE (0)	DH	REV	Set interface data length, numbers of display line when NW=0, extension register RE (0), shift/scroll enable, and reverse bit. DL=1: 8-bit data length. DL=0: 4-bit data length. N=1: 2-line display. N=0: 1-line display. DH=1: display shift enable. DH=0: dot scroll enable. REV=1: reverse display. REV=0: normal display.	39μs
	1	0	0	0	0	1	DL	N	RE (1)	BE	LP	Set DL, N, RE (1) and CGRAM/SEGRAM blink enable. BE=1: CGRAM/SEGRAM blink enable BE=0: CGRAM/SEGRAM blink disable LP=1: low power mode. LP=0: normal operation mode.	39μs
Set CGRAM Address	0	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	39μs
Set SEGRAM Address	1	0	0	0	1	-	-	AC3	AC2	AC1	AC0	Set SEGRAM address in address counter.	39μs
Set DDRAM Address	0	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.	39μs
Set Scroll Quantity	1	0	0	1	-	SQ5	SQ4	SQ3	SQ2	SQ1	SQ0	Set the quantity of horizontal dot scroll.	39μs
Read Busy Flag and Address	-	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Read busy flag BF indicating internal operation is being performed or not. The contents of address counter can also be read. BF=1: busy state. BF=0: ready state.	0μs
Write data	-	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM/SEGRAM).	43μs
Read data	-	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM/SEGRAM).	43μs

"-" : don't care

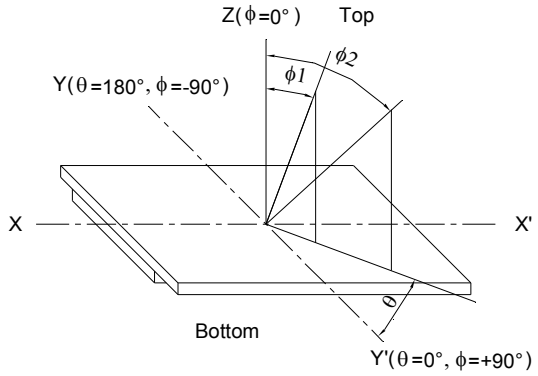
Note: Please refer to S6A0073 datasheet for details.

5. CGROM Character Code Table (S6A0073-00)

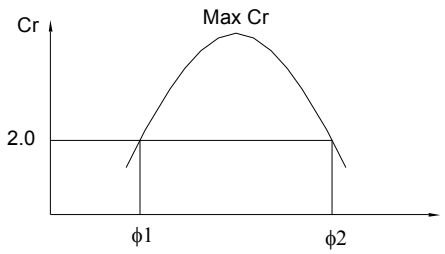


6. ELECTRO-OPTICAL CHARACTERISTICS (Ta=25°C)

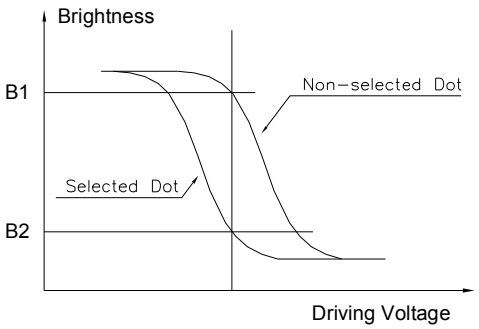
Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
View Angle	Φ2-Φ1	Cr≥2 , θ=0°	-	70	-	Deg	Note1, Note2
Contrast Ratio	Cr	Φ=0°,θ=0°	3	-	-	-	Note3
Response Time	tr (rise)	Φ=0°,θ=0°	-	200	-	ms	Note4
	tf (fall)	Φ=0°,θ=0°	-	250	-	ms	



Note1: Definition of viewing angle ϕ, θ

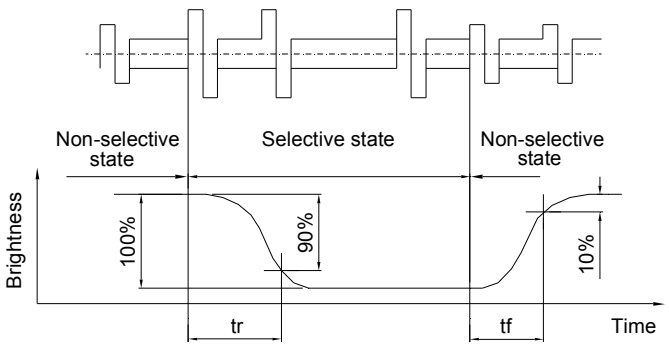


Note2: Definition of viewing angle range ϕ1, ϕ2



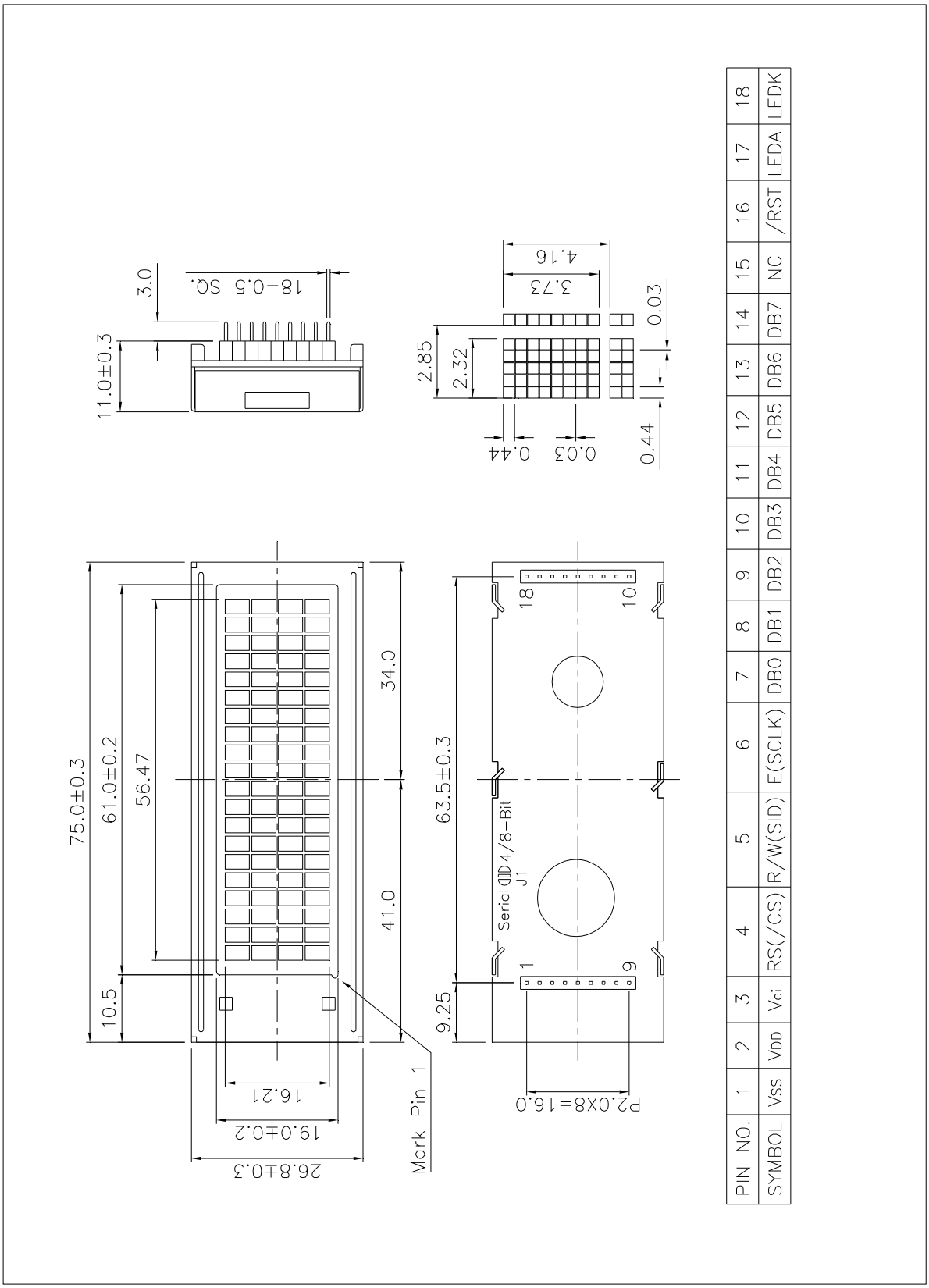
$$\text{Contrast Ratio} = \frac{\text{Brightness of non-selected dot (B1)}}{\text{Brightness of selected dot (B2)}}$$

Note3: Definition of contrast ratio (positive type)



Note3: Definition of response time

7. DIMENSIONAL OUTLINE



PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
SYMBOL	Vss	VDD	Vci	RS(/CS)	R/W(SID)	E(SCLK)	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	NC	/RST	LEDA	LEDK

8. LCD MODULE NUMBERING SYSTEM

V	S	20	4	3	-	B	M	D	W	H	6	V	-	XXXXX
(1)	(2)	(3)	(4)	(5)		(6)	(7)	(8)	(9)	(10)	(11)	(12)		(13)

(1) Brand

(2) Module type

C - Character module

G - Graphic module

(3) Display format

Character module : Number of characters per line, two digits XX

Graphic module : Number of columns, three digits XXX

(4) Display format

Character module : Number of lines, one digit X

Graphic module : Number of rows, two or three digits XX or XXX

(5) Development number : One or two digits X or XX

(6) LCD mode

T - TN Positive, Gray **N** - TN Negative, Blue

S - STN Positive, Yellow green **G** - STN Positive, Gray

B - STN Negative, Blue **F** - FSTN Positive, White

K - FSTN Negative, Black **L** - FSTN Negative, Blue

Q - FFSTN Negative, Black

(7) Polarizer mode

R - Reflective **F** - Transflective **M** - Transmissive

(8) Backlight type

N - Without backlight **L** - Array LED **D** - Edge light LED **E** - EL **C** - CCFL

(9) Backlight color

Y - Yellow green **B** - Blue **W** - White **G** - Green

A - Amber **R** - Red **M** - Multi color **Nil** - Without backlight

(10) Operating temperature range

S - Standard temperature (0 to +50 ^{o}C) **H** - Extended temperature (-20 to +70 ^{o}C)

(11) Viewing direction

3 - 3:00 **6** - 6:00 **9** - 9:00 **U** - 12:00

(12) DC-DC Converter

N or Nil - Without DC-DC converter **V** - Built in DC-DC converter

(13) Version code

Nil or 0 to ZZZZZ - Version code

9. PRECAUTIONS FOR USE OF LCD MODULE

9.1 Handing Precautions

1) The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
2) If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth. If the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
3) Do not apply excessive force on the surface of display or the adjoining areas of LCD module since this may cause the color tone to vary.
4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
5) If the display surface of LCD module becomes contaminated, blow on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents.
   · Isopropyl alcohol
   · Ethyl alcohol
   Solvents other than those mentioned above may damage the polarizer.
   Especially, do not use the following:
   · Water
   · Ketone
   · Aromatic Solvents
6) When mounting the LCD module make sure that it is free of twisting, warping, and distortion. Distortion has great influence upon display quality. Also keep the stiffness enough regarding the outer case.
7) Be sure to avoid any solvent such as flux for soldering never stick to Heat-Seal. Such solvent on Heat-Seal may cause connection problem of heat-Seal and TAB.
8) Do not forcibly pull or bend the TAB I/O terminals.
9) Do not attempt to disassemble or process the LCD module.
10) NC terminal should be open. Do not connect anything.
11) If the logic circuit power is off, do not apply the input signals.
12) To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
   · Be sure to ground the body when handling the LCD module.
   · Tools required for assembly, such as soldering irons, must be properly grounded.
   · To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
   · The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

9.2 Storage Precautions

1) When storing the LCD module, avoid exposure to direct sunlight or to the light of fluorescent lamps and high temperature/high humidity. Whenever possible, the LCD module should be stored in the same conditions in which they were shipped from our company.

2) Exercise care to minimize corrosion of the electrodes. Corrosion of the electrodes is accelerated by water droplets or a current flow in a high humidity environment.

9.3 Design Precautions

1) The absolute maximum ratings represent the rated value beyond which LCD module can not exceed. When the LCD modules are used in excess of this rated value, their operating characteristics may be adversely affected.
2) To prevent the occurrence of erroneous operation caused by noise, attention must be paid to satisfy VIL, VIH specification values, including taking the precaution of using signal cables that are short.
3) The liquid crystal display exhibits temperature dependency characteristics. Since recognition of the display becomes difficult when the LCD is used outside its designated operating temperature range, be sure to use the LCD within this range. Also, keep in mind that the LCD driving voltage levels necessary for clear displays will vary according to temperature.
4) Sufficiently notice the mutual noise interference occurred by peripheral devices.
5) To cope with EMI, take measures basically on outputting side.
6) If DC is impressed on the liquid crystal display panel, display definition is rapidly deteriorated by the electrochemical reaction that occurs inside the liquid crystal display panel. To eliminate the opportunity of DC impressing, be sure to maintain the AC characteristics of the input signals sent to the LCD Module.

9.4 Others

1) Liquid crystals solidify under low temperatures (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the LCD module is subjected to a strong shock at a low temperature.
2) If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.
3) To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity, etc., exercise care to avoid touching the following sections when handling the module:
   · Terminal electrode sections.
   · Part of pattern wiring on TAB, etc.