

16文字×2行 超ハイコントラスト大文字LCDモジュール

SC1602BSLB(バックライト付) SC1602BS*B(無) 共通資料

FEATURE:

- 5×7ドット+カーソル表示
- 液晶コントロール内蔵
- 5V単一電源(低消費電力)
- 1/16デューティサイクル
- Vf=4.2V LED(バックライト内蔵品のみ)
- M1632, L1672ピンコンパチブル

MECHANICAL DATA

ITEM	DIMENSIONS	UNIT
Module Size (W × H × T)	85.0×30.0×8.8(12.7LED)	mm
Viewing Area (W × H)	66.0 × 16.0	mm
Character Size (W × H)	2.96 × 5.56	mm
Character Pitch(W × H)	3.55 × 5.94	mm
Dot Size(W × H)	0.56 × 0.66	mm
Dot Pitch(W × H)	0.60 × 0.70	mm

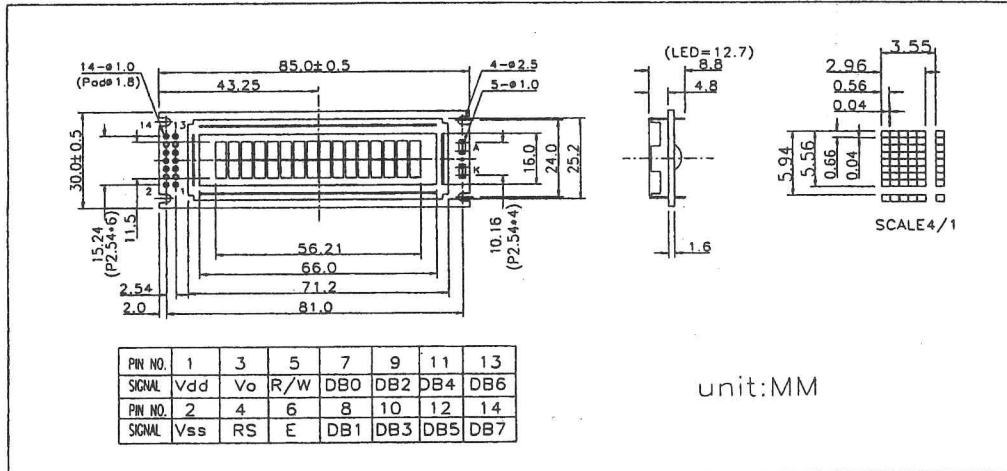
INTERFACE PIN CONNECTIONS:

No	Symbol	Function	No	Symbol	Function
1	V _{DD}	5V	9	DB2	DATA BIT2
2	V _{SS}	0V	10	DB3	DATA BIT3
3	V _O	CONTRAST ADJ.	11	DB4	DATA BIT4
4	RS	REGISTER SELECT	12	DB5	DATA BIT5
5	R/W	READ/WRITE	13	DB6	DATA BIT6
6	E	ENABLE SIGNAL	14	DB7	DATA BIT7
7	DB0	DATA BIT0			
8	DB1	DATA BIT1			

ELECTRICAL CHARACTERISTICS:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
LCD Operating Voltage	V _{DD-V_O}	Ta=0℃	—	4.8	—	V
		Ta=25℃	—	4.5	—	V
		Ta=50℃	—	4.2	—	V
Supply Voltage	V _{DD-V_{SS}}	—	4.7	5	5.3	V
Input Voltage "High" Level	V _{IH}	—	2.2	—	V _{DD}	V
Input Voltage "Low" Level	V _{IL}	—	0	—	0.6	V
Output Voltage "High" Level	V _{OH}	—	2.4	—	—	V
Output Voltage "Low" Level	V _{OL}	—	—	—	0.4	V

EXTERNAL DIMENSION



- M1632とピン・インストラクションは同じです。(差し替え可能)
但し、メーカーのピン番号の振り方が逆になっています。(1~14, 14~1)
■ LEDバックライトについて
・LEDの順方向電圧が4.2V(typ)ですので、電源とは抵抗を介して接続してください。抵抗値は周囲の明るさで多少変わります(約10Ω~100Ω)
・液晶基板上のJ3部分をショートし、LEDのカソード側のパターンに抵抗(チップ抵抗)を半田付けしてもバックライトが点灯します。(液晶側電源と共用できます)

ELECTRICAL CHARACTERISTICS

1.DC Characteristics (V_{DD}=5V±10%, V_{SS}=0V, Ta=25℃)

Parameter	Symbol	Condition	Applicable PIN	Min.	Typ.	Max.	Unit
H level input voltage(1)	V _{IH1}	—	DB0~DB7	2.2	—	V _{DD}	V
L level input voltage(1)	V _{IL1}	—	RS, R/W, E	-0.3	—	0.6	V
H level input voltage(2)	V _{IH2}	—	OSC1	V _{DD} -1.0	—	V _{DD}	V
L level input voltage(2)	V _{IL2}	—	—	-0.2	—	1	V
H level output voltage(1)	V _{OH1}	I _{OH} =-0.205mA	DB0~DB7	2.4	—	—	V
L level output voltage(1)	V _{OL1}	I _{OL} =1.2mA	—	—	—	0.4	V
H level output voltage(2)	V _{OH2}	I _{OH} =-40uA	XSC LP DO	0.9V _{DD}	—	—	V
L level output voltage(2)	V _{OL2}	I _{OL} =40uA	—	—	—	0.1 V _{DD}	V
I/O leakage current	I _{IL}	V _{IN} =0 to V _{DD}	—	-1	—	1	uA
Pull-UP Mos Current	-I _p	V _{DD} =5V	—	50	125	250	uA
Supply current	I _{op}	R _f oscillation from external clock V _{DD} =5V f _{osc} =270kHz	V _{DD}	—	0.35	0.6	uA

Internal clock operation (RF oscillation)

Oscillation frequency	f _{osc}	R _f =91k±2%	OSC1~OSC2	190	270	350	kHz
Oscillation frequency	f _{osc}	Ceramic filter	OSC1~OSC2	245	250	255	kHz
LCD driving voltage	V _{icd}	V _{DD} -V ₅	V1~V5	3.0	—	11.0	V

2.AC Characteristics (V_{DD}=5V±10%, V_{SS}=0V, Ta=25℃)

1).Read Cycle

Parameter	Symbol	Min.	Typ.	Max.	Unit.	TEST PIN
Enable cycle time	t _c	500	—	—	ns	E
Enable "H" level pulse width	t _w	220	—	—	ns	E
Enable rise / fall time	t _r , t _f	—	—	25	ns	E
RS, R/W setup time	t _{su}	40	—	—	ns	R/W, RS
RS, R/W address hold time	t _h	10	—	—	ns	R/W, RS
Read data output delay	t _d	60	—	120	ns	DB0~DB7
Read data hold time	t _{dh}	20	—	—	ns	DB0~DB7

2).Write Cycle

Parameter	Symbol	Min.	Typ.	Max.	Unit.	TEST PIN
Enable cycle time	t _c	500	—	—	ns	E
Enable "H" level pulse width	t _w	220	—	—	ns	E
Enable rise / fall time	t _r , t _f	—	—	25	ns	E
RS, R/W setup time	t _{su}	40	—	—	ns	R/W, RS
RS, R/W address hold time	t _h	10	—	—	ns	R/W, RS
Data setup time	t _{su}	60	—	—	ns	DB0~DB7
Write data hold time	t _h	10	—	—	ns	DB0~DB7

Absolute maximum ratings

Item	Symbol	Test condition	Standard value		Unit
			min.	max.	
Supply voltage for logic	V _{DD-V_{SS}}	Ta=25℃	-0.3	7	V
Supply voltage for LCD drive	V _{icd}	Ta=25℃	V _{DD} -13.5	V _{DD} +0.3	V
Input voltage	V _{in}	Ta=25℃	-0.3	V _{DD} +0.3	V
Operating temperature	T _{opr}	—	0	50	℃
Storage temperature	T _{stg}	—	-20	70	℃

Reliability conditions

LCD Module (Consumer Type)		
High temperature operation	Operation 96~100Hrs at 50 ± 2℃ surrounding temp.	No visible inferiority in appearance no function.
Low temperature operation	Operation 96~100Hrs at 0 ± 2℃ surrounding temp.No dew to be found.	
High temperature storage	Storage 96~100Hrs at 60 ± 2℃ surrounding temp.then storage 4Hrs at normal condition (Power Off).	
Low temperature storage	Storage 96~100Hrs at -20 ± 2℃ surrounding temp.then storage 4Hrs at normal condition (Power Off). No dew to be found.	
Damp proof	Storage 96~100Hrs at 40 ± 2℃ and 90~95% RH surrounding condition then storage 4Hrs at normal condition(Power Off).No dew to be found.	

Note:The above mentioned conditions are nominal ones, which may differ in special specifications.

Optical characteristics

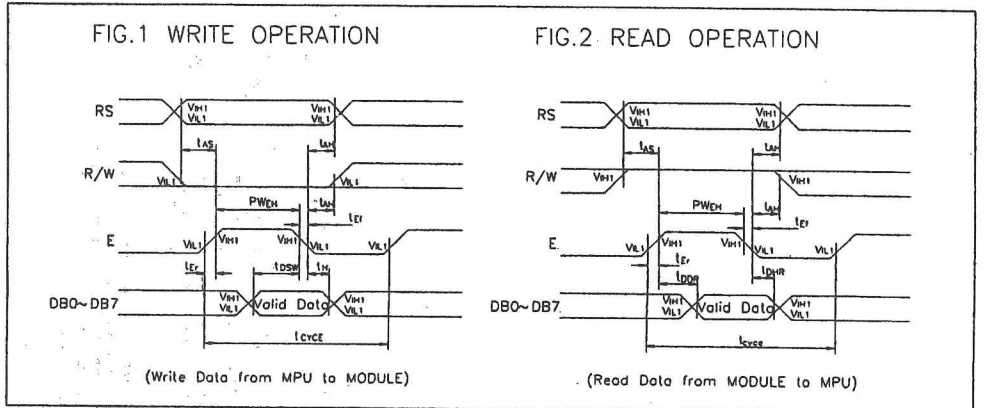
1.STN Type

Item	Symbol	Condition	min.	typ.	max.	Unit	Note
Viewing angle	φ 2-φ 1	K=2.0	60	—	—	deg.	A
Contrast ratio	K	φ =10, θ =0	5	—	—	—	B
Response time (Rise)	t _r	φ =10, θ =0	—	150	250	ms	C
Response time (Fall)	t _f	φ =10, θ =0	—	200	300	ms	C

2.TN Type

Item	Symbol	Condition	min.	typ.	max.	Unit	Note
Viewing angle	φ 2-φ 1	K=2.0	—	40	—	deg.	A
Contrast ratio	K	φ =25, θ =0	—	5	—	—	B
Response time (Rise)	t _r	φ =25, θ =0	—	80	120	ms	C
Response time (Fall)	t _f	φ =25, θ =0	—	60	90	ms	C

Pin assignment



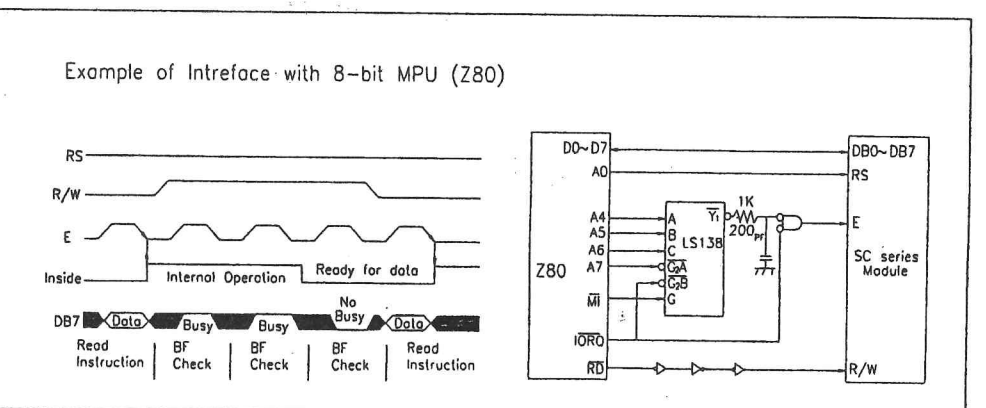
Pin No	Symbol	Level	Function
1	V _{DD}	...	5V
2	V _{SS}	...	0V(GND)
3	V _O	...	for LCD Drive
4	RS	H/L	Register select signal Register H:Data input Select L:Instruction Input
5	R/W	H/L	H:Data read(Module → MPU) L:Data Write(Module ← MPU)
6	E	H,H → L	Enable signal(no pull-up resistor)
7	DB0	H/L	Data bus line
8	DB1	H/L	
9	DB2	H/L	
10	DB3	H/L	
11	DB4	H/L	
12	DB5	H/L	
13	DB6	H/L	
14	DB7	H/L	

※ Interface between data bus line and 4-bit or 8-bit MPU is available. Data transfer are made in twice in case of 4-bit MPU, and once in case of 8-bit MPU.

■ If interface data is 4-bit long
Data transfer are made through 4 bus line from DB4 to DB7. While the rest of 4 bus line from DB0 to DB3 are not used. Data transfer with MPU are completed when 4-bit data are transferred in twice. First upper 4-bit data, then lower 4-bit data.

■ If interface data is 8-bit long
Data transfer are made through all of 8 bus line from DB0 to DB7

Interface with MPU



● Standard Character Pattern(S0)

		Higher 4-bit (D4 to D7) of Character Code (Hexadecimal)															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Lower 4-bit (D0 to D3) of Character Code (Hexadecimal)	0	CG RAM (1)															
	1	CG RAM (2)															
	2	CG RAM (3)															
	3	CG RAM (4)															
	4	CG RAM (5)															
	5	CG RAM (6)															
	6	CG RAM (7)															
	7	CG RAM (8)															
	8	CG RAM (1)															
	9	CG RAM (2)															
	A	CG RAM (3)															
	B	CG RAM (4)															
	C	CG RAM (5)															
	D	CG RAM (6)															
	E	CG RAM (7)															
	F	CG RAM (8)															

■ Instructions

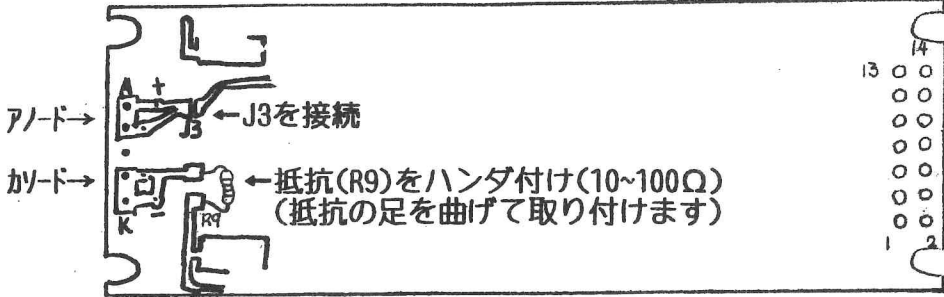
Instruction	Code										Description	Executed Timp(max.)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears all display and returns the cursor to home position (Address 0)	1.64ms
Cursor At Home	0	0	0	0	0	0	0	0	1	*	Returns the cursor to the home positiion(Address 0).Also returns the display being shifted to the original position DDAM contents remain unchanged. (during data write and read.)	1.64ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets the cursor move direction and specifies or not shift the display.These operations are performed during data write and read.	40 μ s
Display On/Off Control	0	0	0	0	0	0	1	D	C	B	Sets ON/OFF of all display(D) cursor ON/OFF(C),and blink of cursor position character(B).	40 μ s
Couosr/Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	Moves the cursor and shifts the display without changing DDRAM contents.	40 μ s
Function Set	0	0	0	0	1	DL	N	F	*	*	Sets interface data length(DL) number of display lines (N)and character font(F).	40 μ s
CGRAM Address Set	0	0	0	1	ACG						Sets the CGRAM address.CGRAM data is sent and received after this setting.	40 μ s
DDRAM Address Set	0	0	1	ADD						Sets the DDRAM address. DDRAM data is sent and received afterthis setting.	40 μ s	
Busy Flag/ Address Read	0	1	BF	AC						Reads Busy flag (BF)indicating internal operation is being performed and read address counter contents.	40 μ s	
CGRAM/DDRAM Data Write	1	0	WRITE DATA						Writes data into DDRAM or CGRAM			40 μ s
CGRAM/DDRAM Data Read	1	1	READ DATA						Reads data into DDRAM or CGRAM			40 μ s

Code		Description	Executed Time(max)
I/D=1:Increment	DL=0:4bit	DDRAM:Display Data RAM	fcp or fosc=250kHz However,when frequency changes,ecution time also changes EX if fcp or fosc is 270kHz, 40 μ s $\times$ 250/270=37 μ s
I/D=0:Decrement	N=1:2 lines	CGRAM:Character Generator RAM	
S=1:With display shift	N=0:1 lines	ACG:CGRAM Address	
S/C=1:Display shift	F=1:5 $\times$ 10dots	ADD:DDRAM Address Corresponds to cursor address.	
S/C=0:Cursor movement	F=0:5 $\times$ 7dots	AC:Address Counter,used for both DDRAM and CGRAM	
R/L=1:Shift to the right	BF=1:Internal operation is being performed		
R/L=0:Shift to the left	BF=0:Instruction acceptable		
DL=1:8-bit		*:Invalid	

■ LEDバックライト接続方法

直列に入れる抵抗で明るさ・消費電流が変化します。
抵抗は100 Ω 1/6Wを1本又は2本並列にしてください。

液晶基板ウラ面



■ Electrical characteristics

VDD=5V $\pm$ 5%
VSS=0V,Top=0-50 $^{\circ}$ C

Item	Symbol	Condition	Standard Value			Unit	Applicable terminal
			min.	typ.	max.		
Power Voltage	Vdd	...	4.75	5	5.25	V	Vdd
Input H-level voltage	VIH	...	2.2	...	Vdd	V	RS,R/W,E
Input L-level voltage	VIL	...	-0.3	...	0.6	V	DB0-DB7
Output H-level voltage	VOH	IOH=0.205mA	2.4	...	...	V	DB0-DB7
Output L-level voltage	VOL	IOL=1.2mA	...	...	0.4	V	RS,R/W,E
I/O leakage current	IIL	VIN=0-VDD	-1	...	1	μ A	DB0-DB7
Supply current	IDD	Vdd=5V	...	0.35	0.6	mV	Vdd
LCD operation voltage	VLDC	Vdd-Vo	3	...	11	V	V0

■ Timing chart

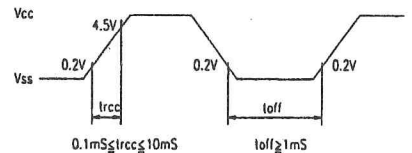
VDD=5V $\pm$ 5%
VSS=0V,Top=0-50 $^{\circ}$ C

Item	Symbol	Min.	Max.	Unit
Enable cycle time	tCYCE	500	...	ns
Enable pulse width "High" Level	PWEH	220	...	ns
Enable rise/fall time	tEr,tEf	...	25	ns
Set-up time	tAS	40	...	ns
Address hold time	tAH	10	...	ns
Data set-up time	tDSW	60	...	ns
Data delay time	tDDR	60	120	ns
Data hold time (writing)	tH	10	...	ns
Data hold time (reading)	tDHR	20	...	ns
Colck pscillating frequency	tOSC	270 (TYP)		KHZ

■ Power supply reset

The internal reset circle will be operated properly when the following power supply conditions are satisfied.If it is not operated properly,please perform initial setting along with the instruction.

Item	Symbol	Measuring Condition	Standard Value	Unit
Power Supply Rise Time	trcc	---	0.1 - 10	mS
Power Supply OFF Time	loff	---	1 -	mS



Note: loff defines period that power supply is off when power supply shut down momentarily or repeats on/off state.

■ Reset function

● Initlttalzation mode by Internal Reset Circuit

HD44780 automatically initializes (resets)when power is supplied (built-in internal reset circuit). The following instructions are executed in initialization. The busy flag (BF)is kept in busy state until initialization ends. (BF=1)

The busy state is 10mS after Vdd reach to 4.5V.

1.Display clear

2.Function set

DL=1:8bit long interface data

DL=0:4bit F=0:5 $\times$ dot character font

N=1:2 lines

N=0:1 lines

3.Display.ON/OFF control

D=0:Display OFF C=0:Cursor OFF B=0:Blink OFF

4.Entry mode set

1/D=1:+1(increment)S=0:No shift

Note:When coditions stated in "Power Supply Condi tions Using Internal Reset Circui" are not satisfied, the internal reset circuit will not operate properly and initialization will not be performed. Please make initial- ization using MPU along with Initialization (along with) instructions.

● Initialization along with instruction

If power supply conditions are not satisfied, which for proper operation of internal reset circuit, it is required to make initialization along with instruction. Please make following procedures:

