

SD1602HU0B-XA 小型LCDモジュール 16文字×2行 LEDバックライト付き

- FEATURES
- ◆ 5 x 7 DOTS WITH CURSOR
- ◆ BUILT-IN CONTROLLER (KS0068 OR EQUIVALENT)
- ◆ 5 V POWER SUPPLY
- ◆ 1/16 DUTY CYCLE
- ◆ 4.2 V LED FORWARD VOLTAGE

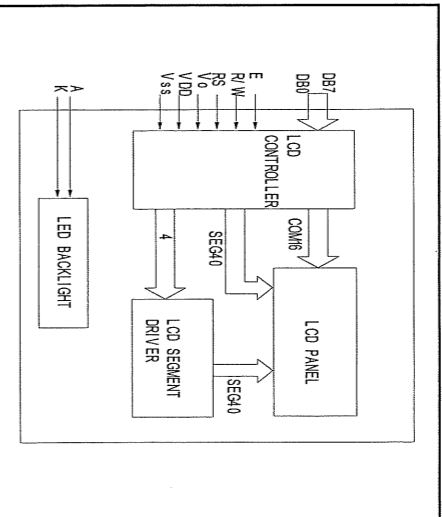
■ MECHANICAL DATA

ITEM	DIMENSIONS	UNIT
Module Size (W x H x T)	68.0 x 26.0 x 8.0	mm
Viewing Area (W x H)	52.0 x 16.0	mm
Character Size (W x H)	2.46 x 5.66	mm
Character Pitch (W x H)	2.96 x 5.94	mm
Dot Size (W x H)	0.46 x 0.66	mm
Dot Pitch (W x H)	0.50 x 0.70	mm

■ ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN.	Typ.	MAX.	UNIT
LCD Operating Voltage	V _{op-Vo}	T=0°C	-	4.8	-	V
		T=25°C	-	4.5	-	V
Supply Voltage	V _{op-Vss}	T=50°C	-	4.2	-	V
		-	-	4.7	5	5.3
Supply Current	I _{op}	-	-	2	4	mA
Input Voltage	V _{in}	"HIGH" Level	V _{in}	2.2	-	V
		"LOW" Level	V _L	0	-	0.6
Output Voltage	V _{oh}	"HIGH" Level	V _{oh}	-	2.4	V
		"LOW" Level	V _{ol}	-	-	0.4

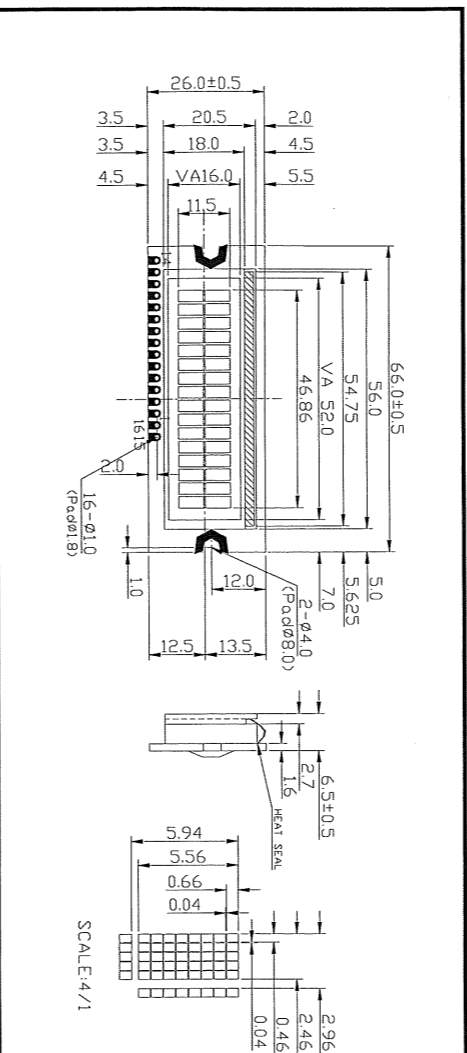
■ BLOCK DIAGRAM



■ INTERFACE PIN CONNECTIONS

NO.	SYMBOL	FUNCTION	NO.	SYMBOL	FUNCTION
1	V _{ss}	Supply Ground	9	DB2	Data Bit 2
2	V _{op}	Supply Voltage	10	DB3	Data Bit 3
3	V _o	Contrast Adj.	11	DB4	Data Bit 4
4	RS	Register Select	12	DB5	Data Bit 5
5	R/W	Read/Write	13	DB6	Data Bit 6
6	E	Enable Signal	14	DB7	Data Bit 7
7	DB0	Data Bit 0	15	A	LED Power
8	DB1	Data Bit 1	16	K	LED Power

■ EXTERNAL DIMENSIONS



■ LEDバックライトについて
1 5番ピン (アノード) 16番ピン (カソード) です。
V_F=4.2V I_F=40mAですので、20Ω~100Ω程度の抵抗を介して電源5Vに接続してください。

- 注意
- 1番ピン=GND、2番ピン=5Vです。SC1602BSLB、SC1602BS-1Bとは、異なります。
 - 基板一液晶接続シートに触れると、接触が悪くなり正しく表示されない事がありますので注意してください。

■ TIMING CHARACTERISTICS

FIG.1 WRITE OPERATION

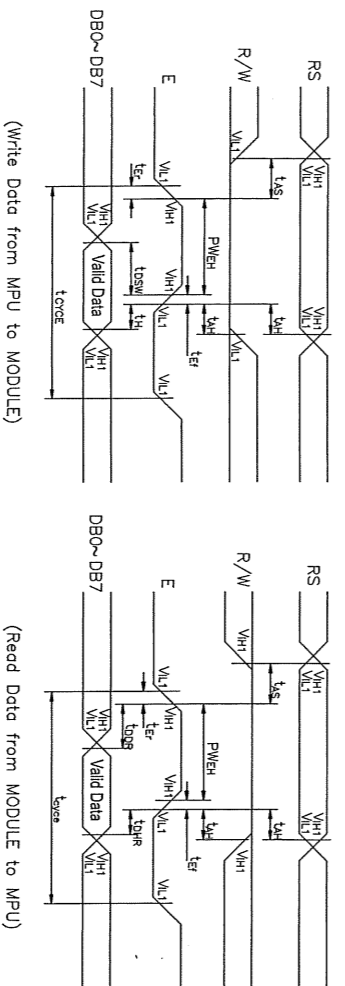
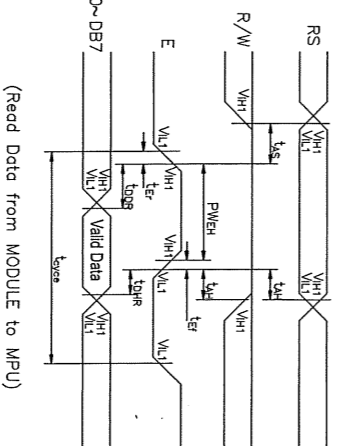


FIG.2 READ OPERATION



■ TIMING CHARACTERISTICS

AC Characteristics (V_{SS}=0V, V_{DD}=4.5V to 5.0V, T_a=0 to 50°C)

Mode	Characteristics	Symbol	Min.	Typ.	Max.	Unit
Write Mode	E Cycle Time	t _c	1200	-	-	ns
	E Rise/Fall Time	tr _{tf}	-	-	25	ns
	E Pulse Width (High,Low)	t _w	140	-	-	ns
	R/W And RS Setup Time	t _{su1}	0	-	-	ns
	R/W And RS Hold Time	t _{h1}	10	-	-	ns
	Data Setup Time	t _{su2}	40	-	-	ns
	Data Hold Time	t _{h2}	10	-	-	ns
	E Cycle Time	t _c	1200	-	-	ns
	E Rise /fall Time	tr _{tf}	-	-	25	ns
	E Pulse Width(High, Low)	t _w	140	-	-	ns
Read Mode	R/W And RS Setup Time	t _{su}	0	-	-	ns
	R/W And RS Hold Time	t _h	10	-	-	ns
	Data Setup Time	t _d	-	-	100	ns
	Data Hold Time	t _{dh}	10	-	-	ns

ABSOLUTE MAXIMUM RATING

(1) Electrical Absolute Ratings

Item	Symbol	Min.	Max.	Unit	Note
Power Supply for Logic	V _{DD-VSS}	-0.3	7.0	Volt	
Power Supply for LCD	V _{DD-Vo}	-0.3	12.0	Volt	
Input Voltage	V _i	-0.3	V _{DD}	Volt	
LED Power Dissipation	P _{AD}	-	370	mW	
LED Forward current	I _F	-	80	mA	
LED Reverse Voltage	V _R	-	5	V	

(2) Environmental Absolute Maximum Ratings

Item	Normal Temperature				Wide Temperature			
	Operating	Max.	Storage	Max.	Operating	Max.	Storage	Max.
Ambient Temperature	0°C	+50°C	-20°C	+70°C	-20°C	+70°C	-30°C	+80°C
Humidity(without condensation)	Note 2,4	Note 3,5	Note 4,5	Note 4,6	Note 4,6	Note 4,6	Note 4,6	Note 4,6

- Note 2 T_a ≤ 50°C: 80% RH max
 Note 3 T_a > 50°C: Absolute humidity must be lower than the humidity of 85%RH at 50°C
 Note 4 T_a at -20°C will be <48hrs at 70°C will be <120hrs when humidity is higher than 70%.
 Note 5 Background color changes slightly depending on ambient temperature. This phenomenon is reversible.
 Note 6 T_a ≤ 70°C: 75RH max
 Note 7 T_a > 70°C: absolute humidity must be lower than the humidity of 75%RH at 70°C
 Note 8 T_a at -30°C will be <48hrs. at 80 °C will be <120hrs when humidity is higher than 70%.

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ	Max.	Unit	note
Power Supply for Logic	V _{DD-VSS}	-	4.5	5.0	5.5	Volt	
Input Voltage	V _{IL}	L level	0	-	0.6	Volt	
		"H" level	2.2	-	V _{DD}	Volt	
LCM Recommend LCD Module Driving Voltage	V _{DD-Vo}	T _a =0°C	-	-	-	Volt	
		T _a =25°C	4.2	4.5	4.8	Volt	
Power Supply Current for LCM	I _{DD}	T _a =50°C	-	-	-	mA	
		V _{DD} =5.0V V _{DD-Vo} =4.5V	-	2.0	3.0	mA	
LED Forward Voltage	V _F	If=40mA	-	4.2	4.6	Volt	
LED Forward Current	I _F	-	-	40	-	mA	
LED Reverse Current	I _R	VR=5V	-	-	0.2	mA	

OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ	Max.	Unit	note
Rise Time	T _r	-	-	30	-	ms	
Fall Time	T _f	-	-	200	-	ms	
Frame frequency	F _{fm}	V _{DD-Vo} =4.5V	-	250	-	Hz	8,10
		T _a =25°C	-	64	-	Hz	
The Brightness Of Backlight Peak Emission Wavelength	L	IF=40mA	80	100	-	cd/m ²	
			570	-	-	nm	

INTERFACE PIN ASSIGNMENT

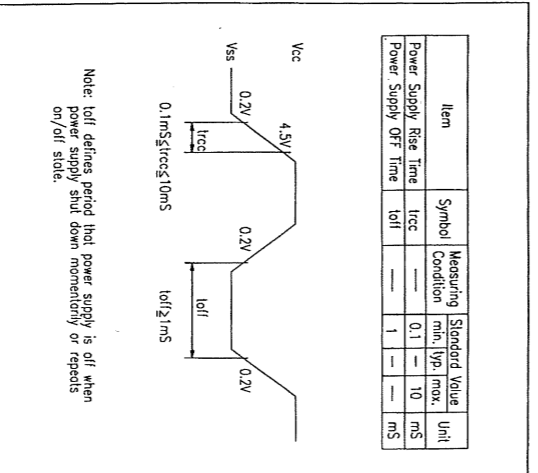
Pin No.	Pin Out	Level	Description
1	VSS	0V	Power Supply Ground
2	VDD	5V	Power Supply Voltage
3	VEE	---	Power Supply Voltage For LCD
4	RS	H/L	Register Select
5	R/W	H/L	Read / Write
6	E	H,H→L	Enable Signal
7	DB0	H/L	Data Bit 0
8	DB1	H/L	Data Bit 1
9	DB2	H/L	Data Bit 2
10	DB3	H/L	Data Bit 3
11	DB4	H/L	Data Bit 4
12	DB5	H/L	Data Bit 5
13	DB6	H/L	Data Bit 6
14	DB7	H/L	Data Bit 7
15	A	4.2V	LED Power Supply (+)
16	K	0V	LED Power Supply (-)

CHARACTER FONT TABLE

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
CG RAM (1)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (2)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (3)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (4)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (5)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (6)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (7)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (8)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (9)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (10)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (11)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (12)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (13)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (14)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (15)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (16)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (17)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (18)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (19)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (20)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (21)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (22)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (23)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (24)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (25)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (26)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (27)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
CG RAM (28)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

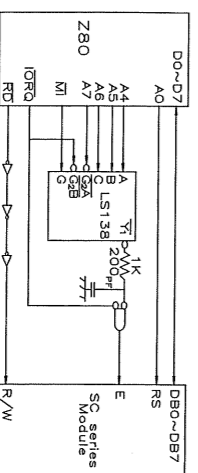
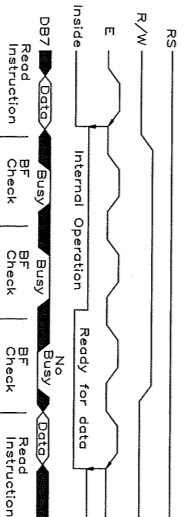
Power supply reset

The internal reset circuit 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.



CONNECTING BLOCK DIAGRAM

Example of interface with 8-bit MPU (Z80)



Character DD RAM Address	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
00	01	02	03	04	05	06	07	8	9	0A	0B	0C	0D	0E	0F	
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	

Commands

Instruction	Instruction code																Description	Execution Time (max)				
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	D7	D6	D5	D4	D3	D2			D1	D0		
Clear Display	0	0	0	0	0	0	0	0	0	1								Write "00H" to DDRAM and set DDRAM address to "00H" from AC	1.53ms			
Return Home	0	0	0	0	0	0	0	0	0	1								Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.53ms			
Entry Mode	0	0	0	0	0	0	0	0	1	I/D	S							Assign cursor moving direction and make shift of entire display enable.	39 μs			
Display ON/OFF	0	0	0	0	0	0	0	1	D	C	B							Set display(D), cursor(C), and blinking of cursor(B) on/off Control bit.	39 μs			
Cursor or Display Shift	0	0	0	0	0	0	1	S/C	R/L	*	*							Set cursor moving and display Shift control bit, and the Direction, without changing DDRAM data.	39 μs			
Function Set	0	0	0	0	1	DL	N	F	*	*	*							Set interface data bit(8-bit) numbers of line(N:1-line/2-line/display type(F:5*8 dots/5*11 dots))	39 μs			
Set CG RAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0								Set CGRAM address in address counter.	39 μs			
Set DD RAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0								Set CGRAM address in address Counter.	39 μs			
Read Busy Flag and Address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0								Whether during internal Operation or not can be known by reading BF. The contents of Address counter can also be read.	0 μs			
Write Data to ram	1	0	D7	D6	D5	D4	D3	D2	D1	D0								Write data into internal RAM (DDRAM/CGRAM).	43 μs			
Read Data From RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0								Read data from internal RAM (DDRAM/CGRAM).	43 μs			
Code										Description							Executed Time (max)					
I/D=1: Increment										DL=0:4-bit							DDRAM: Display Data RAM			fcp or fosc=250kHz		
I/D=0: Decrement										N=1: 2 lines							CGRAM: Character Generator RAM			However, when Frequency changes,		
S=1: With display shift										N=0: 1 lines							ACG:CGRAM Address			execution time also changes		
S/C=1: Display shift										F=1: 5 x 11 dots							ADD:DDRAM Address			Corresponds to cursor address.		
S/C=0: Cursor movement										F=0: 5 x 8 dots							AC: Address Counter, used for both DDRAM and CGRAM			EX if fcp or fosc is 270kHz		
RL=1: Shift to the right										BF=1: Internal operation is being performed										40μs x 250/270=37μs		
RL=0: Shift to the left										BF=0: Instruction acceptable												
DL=1: 8-bit																						

INITIALIZING BY INSTRUCTION

If the power supply conditions for correctly operating the internal reset circuit are not met, initialization by instruction is required.

(1) When interface is 8 bits

