

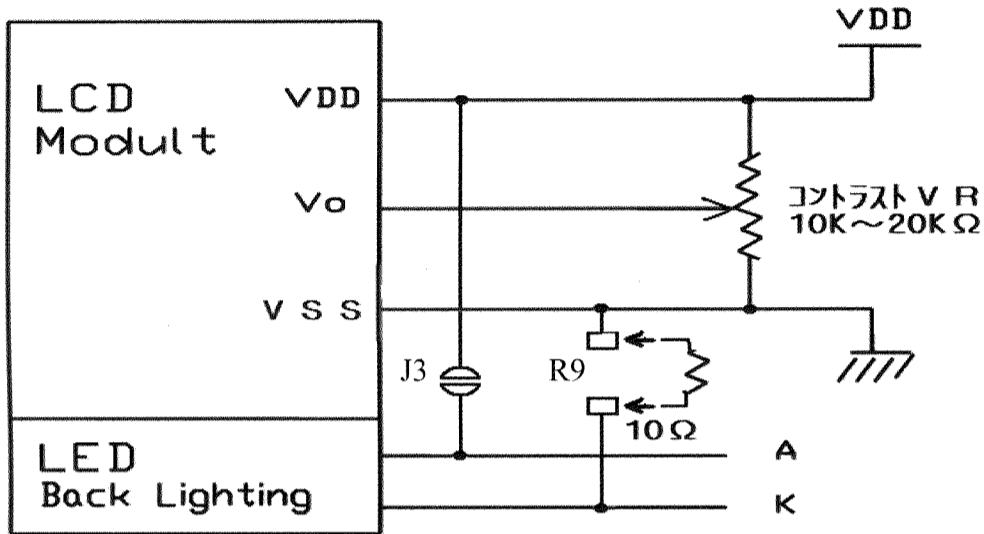
3. 3V動作 キャラクタLCDモジュール SC1602BBWB-XA-LB-G 白抜き文字バックライト付き16文字×2行

★電源電圧3.3V(2.7V~4.5V)のキャラクタ液晶モジュールです
3.3V系マイコンの表示に最適です。

★白抜き文字表示(白バックライト付き)で、ハッキリ良く見えます。
★アルファベット、記号、カタカナ、千、万、円、など表示出来ます。

■白LEDバックライトについて

白抜き文字表示ですので、バックライトを点灯させないと正しく表示しません。
白LEDバックライトを点灯させるには、基板裏面のジャンパーポイント「J3」を半田ショートし、パターン「R9」に10Ω抵抗1本を半田付けしてください。
(抵抗が1本以上入っている場合がありますが1本半田付けしてください)



★注意★

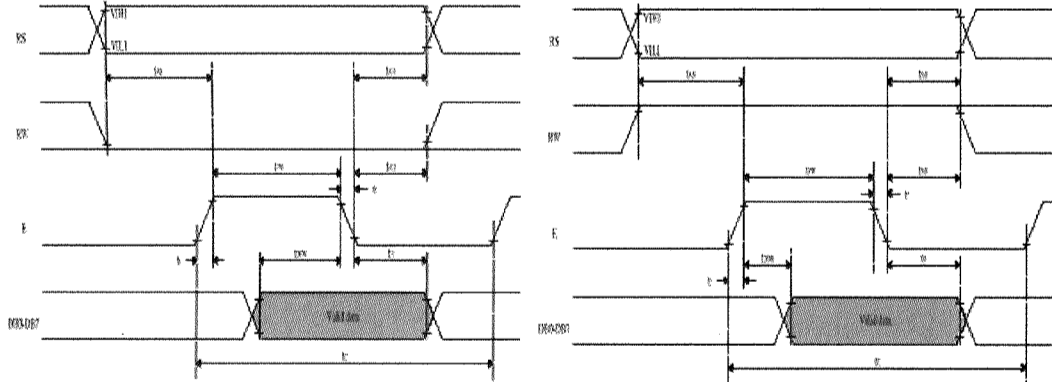
このLCDモジュールの、LCD部は電源電圧 2.7V~4.5Vで動作します。
バックライトは白LEDですので、電源電圧3V以下ではほとんど発光しません。
ジャンパーポイント「J3」、「R9」を共にオープンにすると、LCD部電源(VDD、VSS)とバックライトLED(基板裏面A、K)が切り離されますので、別電源を、電流が20mA程度になる様に抵抗を介して A、Kに接続してください。

電源電圧が3.3Vより高い場合は、LED電流が20mAを超えない様に抵抗を調整してください。(例 電源電圧4.5Vの場合R8は、75Ωを1本)

■コントラスト調整

このLCDモジュールは、外部にコントラスト調整用の半固定抵抗(VR)をVo(3番ピン)に付ける必要があります。(付属していません)。

コントラスト調整用の半固定抵抗で、見やすい表示濃さに調整してください。



Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
Internal Clock Operation						
f_{OSC}	OSC Frequency	R = 75KΩ	190	270	350	KHz
External Clock Operation						
f_{EX}	External Frequency	-	125	270	410	KHz
	Duty Cycle	-	45	50	55	%
$T_{R,TF}$	Rise/Fall Time	-	-	-	0.2	μs
Write Mode (Writing data from MPU to ST7066U)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	460	-	-	ns
$T_{R,TF}$	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DSW}	Data Setup Time	Pins: DB0 - DB7	80	-	-	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns
Read Mode (Reading Data from ST7066U to MPU)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	480	-	-	ns
$T_{R,TF}$	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DDR}	Data Setup Time	Pins: DB0 - DB7	-	-	320	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

ABSOLUTE MAXIMUM RATING

(1) Electrical Absolute Ratings

Item	Symbol	Min.	Max.	Unit	Note
Power Supply for Logic	$V_{DD}-V_{SS}$	-0.3	7.0	Volt	
Power Supply for LCD	$V_{DD}-V_O$	-0.3	10.0	Volt	
Input Voltage	V_I	-0.3	V_{DD}	Volt	
LED Power Dissipation	P_{AD}	-	90	mW	
LED Forward current	I_{AF}	-	25	mA	
LED Reverse Voltage	V_R	-	5	V	

(2) Environmental Absolute Maximum Ratings

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

Note 2 $T_a \leq 50^\circ\text{C}$: 80% RH max

$T_a > 50^\circ\text{C}$: Absolute humidity must be lower than the humidity of 85%RH at 50°C

Note 3 T_a at -20°C will be <48hrs at 70°C will be <120hrs when humidity is higher than 70%.

Note 4 Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note 5 $T_a \leq 70^\circ\text{C}$: 75RH max

$T_a > 70^\circ\text{C}$: absolute humidity must be lower than the humidity of 75%RH at 70°C

Note 6 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	$V_{DD}-V_{SS}$	-	2.7	3.3	4.5	Volt	
Input Voltage	V_{IL}	L level	0	-	0.6	Volt	
	V_{IH}	H level	2.2	-	V_{DD}	Volt	
LCM Recommend LCD Module Driving Voltage	$V_{DD}-V_O$	$T_a=0^\circ\text{C}$	-	-	-	Volt	
		$T_a=25^\circ\text{C}$	2.7	3.3	4.5		
		$T_a=50^\circ\text{C}$	-	-	-		
Power Supply Current for LCM	I_{DD}	$V_{DD}=3.3\text{V}$ $V_{DD}-V_O=3.3\text{V}$	-	2.0	3.0	mA	
LED Forward Voltage	V_F	$I_f=20\text{mA}$	-	3.4	3.6	Volt	
LED Forward Current	I_F	-	-	20	-	mA	
LED Reverse Current	I_R	$V_R=5\text{V}$	-	-	0.2	mA	

OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ	Max.	Unit	note	
Viewing angle range	$\Phi f(12\text{ o'clock})$	When $Cr \geq 1.4$	-	20	-	Degree	9,10	
	$\Phi b(6\text{ o'clock})$		-	40	-			
	$\Phi l(9\text{ o'clock})$		-	30	-			
	$\Phi r(3\text{ o'clock})$		-	30	-			
Rise Time	T_r	$V_{DD}-V_O=3.3\text{V}$ $T_a=25^\circ\text{C}$	-	200	-	mS		
Fall Time	T_f		-	250	-			
Frame frequency	F_{rm}		-	64	-	Hz		8,10
Contrast	Cr		-	3.0	-			7
The Brightness Of Backlight	L	$I_F=20\text{mA}$	120	180	-	cd/m ²		
			Peak Emission Wavelength	λ_P	X=0.29 Y=0.30			X=0.31 Y=0.32

INTERFACE PIN ASSIGNMENT

Pin No.	Pin Out	Level	Description
1	VDD	3.3V	Power Supply Voltage
2	VSS	0V	Power Supply Ground
3	Vo	---	Contrast Adj
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

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
HIGHER 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)															

Commands

Instruction	Instruction code										Description	Execution Time (fosc is 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" from AC	1.53mS
Return Home	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	1	I/D	S	Assign cursor moving direction and make shift of entire display enable.	37 μS
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	Set display(D), cursor(C), and blinking of cursor(B) on/off Control bit.	37 μS
Cursor or Display Shift	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.	37 μS
Function Set	0	0	0	0	1	DL	N	F	*	*	Set interface data length (DL:4-bit/8-bit), numbers of display line(N:1-line/2-line), display type(F:5*8 dots/5*11 dots)	37 μS
Set CG RAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	37 μS
Set DD RAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address Counter.	37 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).	37 μS
Read Data From RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	37 μS

Code	Description	Executed Time (max)
I/D=1: Increment	DL=0:4-bit	DDRAM: Display Data RAM
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 × 11 dots	ADD: DDRAM Address Corresponds to cursor address.
S/C=0: Cursor movement	F=0: 5 × 8 dots	AC: Address Counter, used for both DDRAM and CGRAM
R/L=1: Shift to the right	BF=1: Internal operation is being performed	*: Invalid.
R/L=0: Shift to the left	BF=0: Instruction acceptable	
DL=1: 8-bit		

Reset function

Initialization 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 40ms after V_{DD} reach to 2.7V

1. Display clear

2. Function set

DL=1: 8bit long interface data

DL=0: 4bit F=0: 5 × dot character font

N=1: 2 lines

N=0: 1 lines

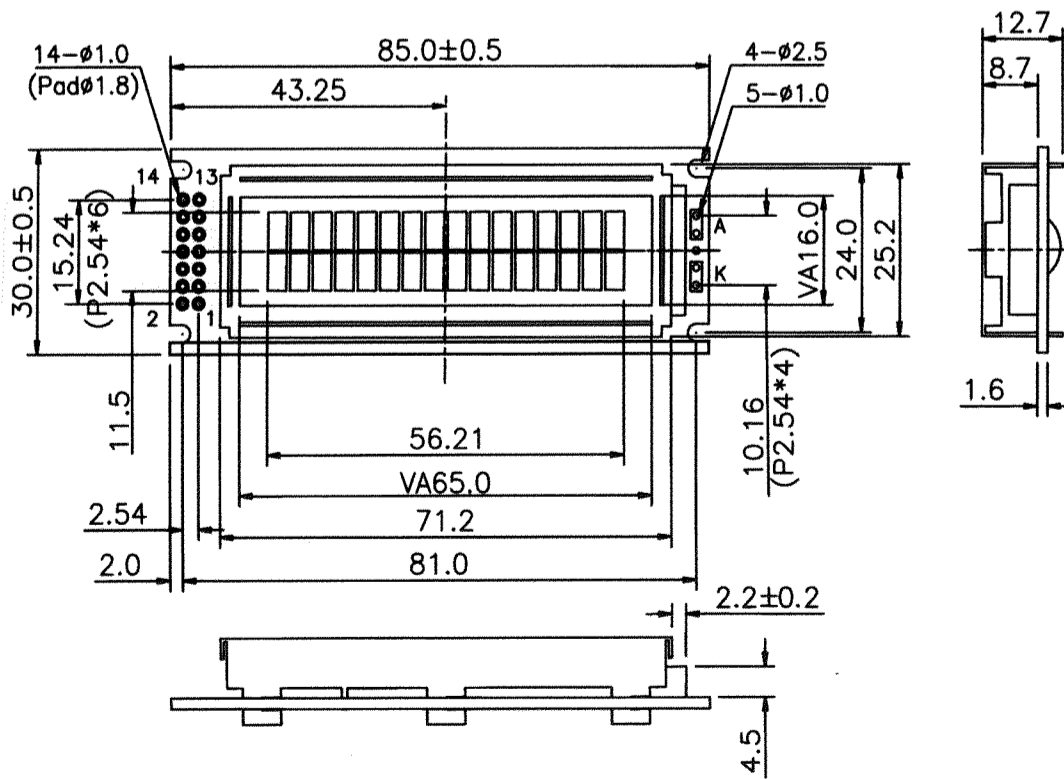
3. Display ON/OFF control

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

4. Entry mode set

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

Note: When conditions stated in "Power Supply Conditions Using Internal Reset Circuit" are not satisfied, the internal reset circuit will not operate properly and initialization will not be performed. Please make initialization using MPU and "Initialization along with instructions."



For 16*2 or 8*2 Display

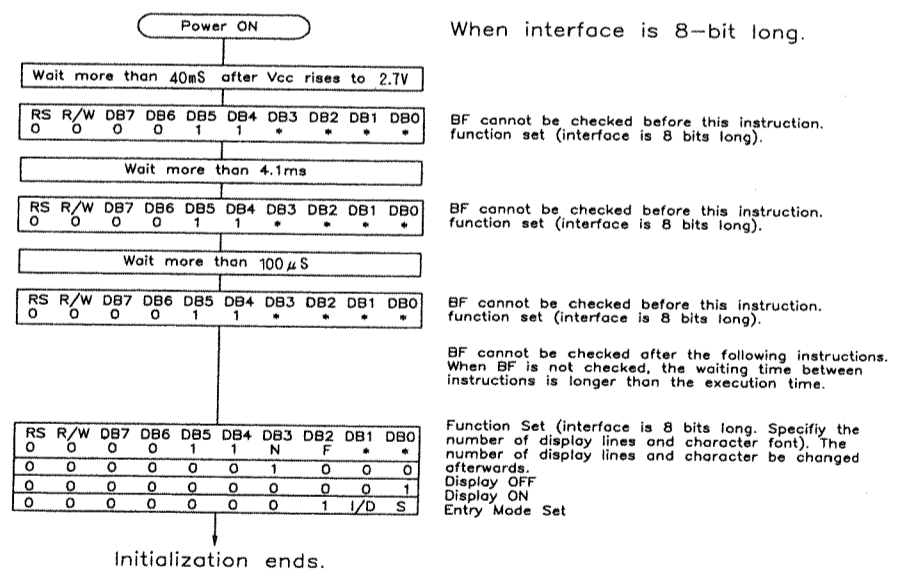
Character DD RAM Address

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

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



(2) When interface is 4 bits

