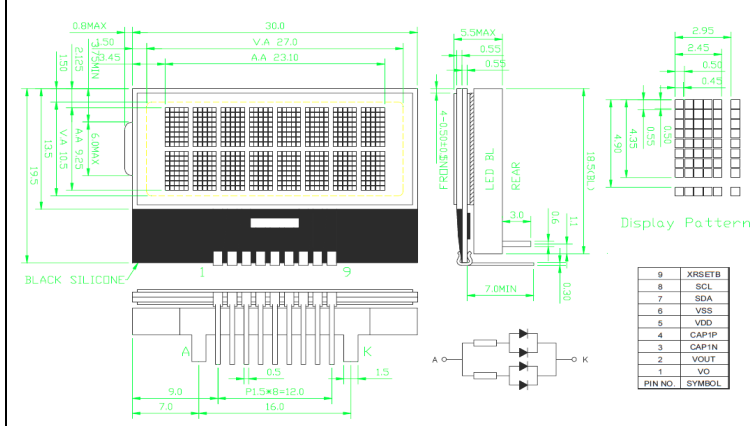


# バックライト付き 12C接続小型8文字×2行液晶 AQM0802A-FLW-GBW

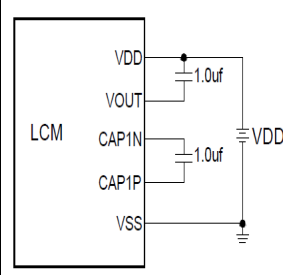
- ★30mm×19.5mm (画面27mm×10.5mm) の超小型サイズです。
- ★マイコンとの接続は、信号線2本の12Cインターフェイスです。
- ★液晶コントラストは、コマンドで設定。外付けVRが不要です。
- ★電源電圧3.3Vで、液晶本体の消費電流は1mAです。
- ★バックライト用の外付け抵抗は20Ω程度が推奨です。



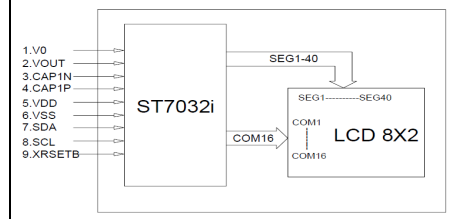
## PIN ASSIGNMENT

Pin No.	Symbol	Function
1	VO	Test PIN for VLCD, leave it open
2	VOUT	DC/DC voltage converter output
3	CAP1N	For voltage booster circuit(VDD-VSS)
4	CAP1P	External capacitor about 0.1u~4.7uf
5	VDD	+3.3V
6	VSS	Ground
7	SDA	Serial data input
8	SCL	Serial clock input
9	XRSETB	Chip reset signal. Active when low

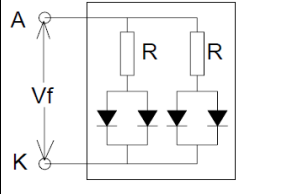
## POWER SUPPLY



## BLOCK DIAGRAM



## Backlight Control Circuit For LCM (1x4=4 pcs LED)



## ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min	Typ	Max	Unit
Operating temperature	Top	-20	-	70	°C
Storage temperature	Tst	-30	-	80	°C
Input voltage	Vin	Vss	-	Vdd	V
Supply voltage for logic	Vdd- Vss	2.7	-	5.5	V
Supply voltage for LCD drive	Vdd- Vo	3.0	-	7.0	V

## GENERAL SPECS

1. Display Format	8*2 Character
2. Power Supply	3.3V
3. Overall Module Size	30.0mm(W) x 19.5mm(H) x max 5.5mm(D)
4. Viewing Area(W*H)	27.0mm(W) x 10.5mm(H)
5. Dot Size (W*H)	0.45mm(W) x 0.50mm(H)
6. Dot Pitch (W*H)	0.50mm(W) x 0.55mm(H)
7. Character Size (W*H)	2.45mm(W) x 4.35mm(H)
8. Character Pitch (W*H)	2.95mm(W) x 4.90mm(H)
9. Viewing Direction	6:00 O'Clock
10. Driving Method	1/16Duty, 1/5Bias
11. Controller IC	ST7032i OR EQUIV
12. Display mode	STN (GRAY) /Positive/ Transflective
13. Backlight Options	LED-SIDE(White)
14. Operating temperature	-20°C ~ 70°C
15. Storage temperature	-30°C ~ 80°C
16. RoHS	RoHS Compliant

## Electrical-Optical Characteristics Of LED Backlight (Ta=25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage <sup>(1)</sup>	Vf	If=60mA	3.1	3.3	3.5	V
Reverse Voltage	Vr	-	-	-	4	V
Luminance <sup>(2)</sup>	Lv	If=60mA	100	-	-	cd/m <sup>2</sup>
Uniformity <sup>(3)</sup>	Δ	(Lvmin/Lvmax)%	70%	-	-	-
Peak wave length	λp	-	-	-	-	nm
Chroma coordinate	x	If=60mA	0.26	-	0.30	um
	y	If=60mA	0.27	-	0.31	um
Lifetime <sup>(4)</sup>	-	If=60mA	-	20000	-	Hours

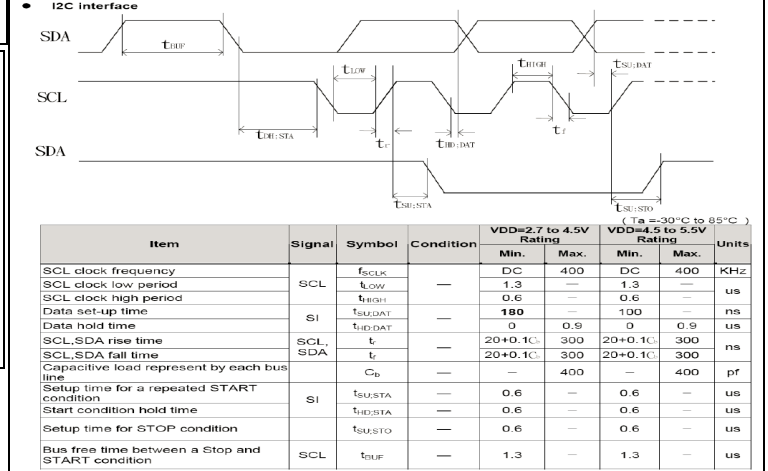
## Electrical Characteristics Of LCM

Item	Symbol	Condition	Min	Typ	Max	Unit
Power Supply Voltage	Vdd	25°C	-	3.3	-	V
Power Supply Current	Idd	Vdd=5.0V, fosc=270kHz	-	-	-	mA
Input voltage (high)	Vih	H level	0.8Vdd	-	Vdd	V
Input voltage (low)	Vil	L level	0	-	0.2Vdd	V
Recommended LC Driving Voltage	Vdd-Vo	-20°C	-	-	-	-
		25°C	4.3	4.5	4.7	V
		70°C	-	-	-	-

## CHARACTER PATTERNS

CGRAM	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0001	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0010	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0011	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0100	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0101	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0110	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0111	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
1000	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
1001	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
1010	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
1011	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
1100	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
1101	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
1110	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
1111	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

## TIMING CHARACTERISTICS



## DISPLAY INSTRUCTION Table

Instruction	Instruction Code								Description	Instruction Execution Time			
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2		DB1	DB0	OSC=380KHz	OSC=540KHz
Clear Display	0	0	0	0	0	0	0	0	0	1	1.08 ms	0.76 ms	0.59 ms
Return Home	0	0	0	0	0	0	0	0	1	x	1.08 ms	0.76 ms	0.59 ms
Entry Mode Set	0	0	0	0	0	0	0	1	V/D	S	26.3 us	18.5 us	14.3 us
Display ON/OFF	0	0	0	0	0	0	0	1	D	C B	26.3 us	18.5 us	14.3 us
Function Set	0	0	0	0	1	DL	N	DH	*0	IS	26.3 us	18.5 us	14.3 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	26.3 us	18.5 us	14.3 us
Read Busy flag and address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	0	0	0
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	26.3 us	18.5 us	14.3 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	26.3 us	18.5 us	14.3 us

Note \*: this bit is for test command , and must always set to "0"

## Instruction table 0 (IS=0)

Instruction	Instruction Code								Description	Instruction Execution Time			
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2		DB1	DB0	OSC=380KHz	OSC=540KHz
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	26.3 us	18.5 us	14.3 us
Set CGRAM	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	26.3 us	18.5 us	14.3 us

## Instruction table 1 (IS=1)

Instruction	Instruction Code								Description	Instruction Execution Time			
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2		DB1	DB0	OSC=380KHz	OSC=540KHz
Internal OSC frequency	0	0	0	0	0	1	BS	F2	F1	F0	26.3 us	18.5 us	14.3 us
Set ICON address	0	0	0	1	0	0	AC3	AC2	AC1	AC0	26.3 us	18.5 us	14.3 us
Power/ICON control/Contrast set	0	0	0	1	0	1	Ion	Bon	C5	C4	26.3 us	18.5 us	14.3 us
Follower control	0	0	0	1	1	0	Fon	Rab	Rab	Rab	26.3 us	18.5 us	14.3 us
Contrast set	0	0	0	1	1	1	C3	C2	C1	C0	26.3 us	18.5 us	14.3 us

■データとコマンドのWRITE方法■

LCDに対しては、書き込み (WRITE) のみが出来ます。読み込み (READ) は、出来ません。(I2CのACKはあります)。

また、Busyフラグ、内部のDDRAMアドレスカウンタは、読み取ることが出来ません。

スレーブアドレスは、0x7Cです。(アドレス0111110+O(RW))  
 コントロールバイトで「データ、コマンドの指定」RSと、「連続データ最終データの指定」Coを送信します。

コマンドの場合RS=0、データはRS=1になります。  
 データを複数送る場合Co=1で、最終データはCo=0です。

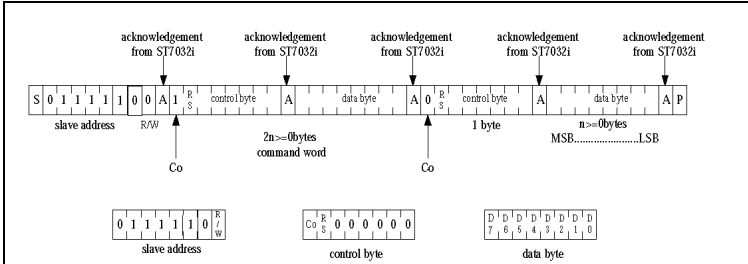


Figure 5. 2-line Interface protocol

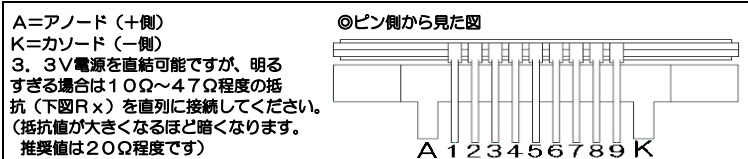
Co	0	Last control byte to be sent. Only a stream of data bytes is allowed to follow. This stream may only be terminated by a STOP condition.
Co	1	Another control byte will follow the data byte unless a STOP condition is received.

RS	R/W	Operation
L	L	Instruction Write operation (MPU writes Instruction code into IR)
H	L	Data Write operation (MPU writes data into DR)

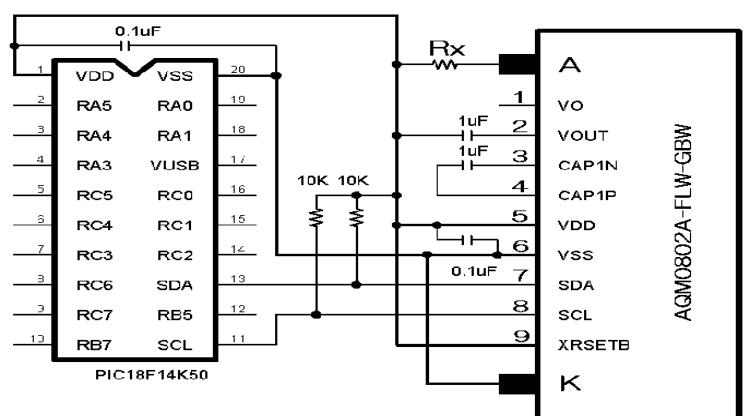
■使い方■

- 基本的なコマンドは、一般的なSC1602と同じです。
- コントラストは、外付けVRではなく、拡張コマンドで設定します。設定前は、表示が出ません。(■の連続も出ません。)
- コントラスト調整などの拡張コマンド(前頁DISPLY INSTRUCTION TABLEのIS=1の表)が追加されています。拡張コマンドを使用する場合は、「Function Set」で「IS=1」に指定します。拡張コマンド使用後は、「Function Set」で「IS=0」に戻します。
- I2C端子のSDA、SCLは外部でプルアップする必要があります。
- リセット端子XRSETBは、通常VDDに接続します。電源立ち上がり時間などでうまくリセットされない場合は、マイコンI/Oに接続し、マイコンからソフトウェアでリセットします。
- VOUT (2番ピン)、CAP1NとCAP1P (3番ピンと4番ピン)には、コンデンサを付ける必要があります。VOUT 1uF CAP1N CAP1P 0.1~4.7uF
- コントラスト調整は、拡張コマ「Power/ICONcontrol/Contrast set」のC5、C4と「Contrast set」のC3、C2、C1、C0で64段階で設定します。VDD=3Vの場合、C5=1,C4=0,C3=0,C2=0,C1=0,C0=0程度です。

■バックライトLEDの接続■



■接続例■

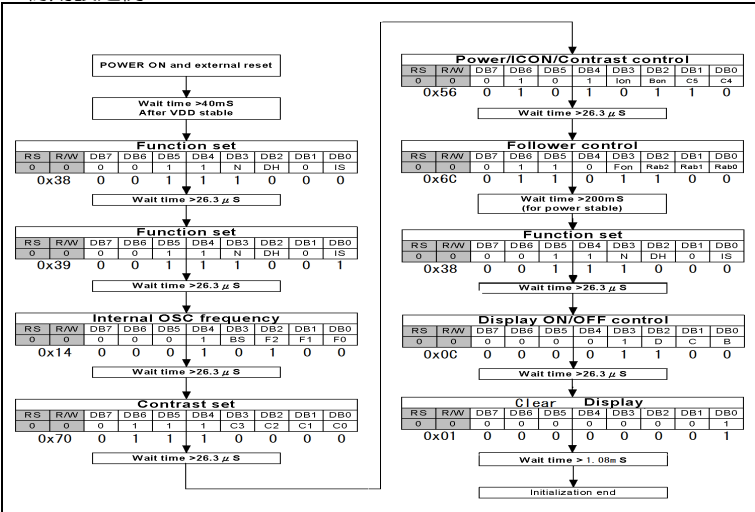


■液晶表示 DDRAMアドレス■

1行目	0x00	0x01	0x02	0x03	0x04	0x05	0x06	0x07
2行目	0x40	0x41	0x42	0x43	0x44	0x45	0x46	0x47

★コントローラIC ST7032 iの詳細な資料は、弊社ホームページAQM0802のページに参考pdf資料がございます。

■初期設定例■



■ Instruction Description

- Clear Display
 

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	0	1

Clear all the display data by writing "20H" (space code) to all DDRAM address, and set DDRAM address to "00H" into AC (address counter). Return cursor to the original status, namely, bring the cursor to the left edge on first line of the display. Make entry mode increment (ID = "1").
- Return Home
 

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	1	X

Return Home is cursor return home instruction. Set DDRAM address to "00H" into the address counter. Return cursor to its original site and return display to its original status, if shifted. Contents of DDRAM do not change.
- Entry Mode Set
 

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	1	S

Set the moving direction of cursor and display.

  - > ID: Increment / decrement of DDRAM address (cursor or blink)
    - When ID = "High", cursor/blink moves to right and DDRAM address is increased by 1.
    - When ID = "Low", cursor/blink moves to left and DDRAM address is decreased by 1.
    - CGRAM operates the same as DDRAM, when read from or write to CGRAM.
  - > S: Shift entire display
    - When DDRAM read (CGRAM read/write) operation or S = "Low", shift of entire display is not performed. If S = "High" and DDRAM write operation, shift of entire display is performed according to ID value (ID = "1": shift left, ID = "0": shift right).

S	ID	Description
H	H	Shift the display to the left
H	L	Shift the display to the right
- Display ON/OFF
 

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
0	0	0	0	0	0	0	1	D	C	B

Control display/cursor/blink ON/OFF 1 bit register.

  - > D: Display ON/OFF control bit
    - When D = "High", entire display is turned on.
    - When D = "Low", display is turned off, but display data is remained in DDRAM.
  - > C: Cursor ON/OFF control bit
    - When C = "High", cursor is turned on.
    - When C = "Low", cursor is disappeared in current display, but I/D register remains its data.
  - > B: Cursor Blink ON/OFF control bit
    - When B = "High", cursor blink is on, that performs alternate between all the high data and display character at the cursor position.
    - When B = "Low", blink is off.
- Cursor or Display Shift
 

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
0	0	0	0	0	0	1	S/C	R/L	X	X

Control display/cursor/blink ON/OFF 1 bit register.

  - > S/C: Screen/Cursor select bit
    - When S/C="High", Screen is controlled by R/L bit.
    - When S/C="Low", Cursor is controlled by R/L bit.
  - > R/L: Right/Left
    - When R/L="High", set direction to right.
    - When R/L="Low", set direction to left.

Without writing or reading of display data, shift right/left cursor position or display. This instruction is used to correct or search display data. During 2-line mode display, cursor moves to the 2nd line after 40th digit of 1st line. Note that display shift is performed simultaneously in all the line. When displayed data is shifted repeatedly, each line shifted individually. When display shift is performed, the contents of address counter are not changed.

S/C	R/L	Description	AC Value
L	L	Shift cursor to the left	AC=AC-1
L	H	Shift cursor to the right	AC=AC+1
H	L	Shift display to the left. Cursor follows the display shift	AC=AC
H	H	Shift display to the right. Cursor follows the display shift	AC=AC
- Display ON/OFF
 

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
0	0	0	0	0	0	0	1	D	C	B

Control display/cursor/blink ON/OFF 1 bit register.

  - > D: Display ON/OFF control bit
    - When D = "High", entire display is turned on.
    - When D = "Low", display is turned off, but display data is remained in DDRAM.
  - > C: Cursor ON/OFF control bit
    - When C = "High", cursor is turned on.
    - When C = "Low", cursor is disappeared in current display, but I/D register remains its data.
  - > B: Cursor Blink ON/OFF control bit
    - When B = "High", cursor blink is on, that performs alternate between all the high data and display character at the cursor position.
    - When B = "Low", blink is off.
- Cursor or Display Shift
 

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
0	0	0	0	0	0	1	S/C	R/L	X	X

Control display/cursor/blink ON/OFF 1 bit register.

  - > S/C: Screen/Cursor select bit
    - When S/C="High", Screen is controlled by R/L bit.
    - When S/C="Low", Cursor is controlled by R/L bit.
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    - When R/L="High", set direction to right.
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Without writing or reading of display data, shift right/left cursor position or display. This instruction is used to correct or search display data. During 2-line mode display, cursor moves to the 2nd line after 40th digit of 1st line. Note that display shift is performed simultaneously in all the line. When displayed data is shifted repeatedly, each line shifted individually. When display shift is performed, the contents of address counter are not changed.

S/C	R/L	Description	AC Value
L	L	Shift cursor to the left	AC=AC-1
L	H	Shift cursor to the right	AC=AC+1
H	L	Shift display to the left. Cursor follows the display shift	AC=AC
H	H	Shift display to the right. Cursor follows the display shift	AC=AC
- Function Set
 

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	DL	N	DH	0	IS

Control display/cursor/blink ON/OFF 1 bit register.

  - > DL: Interface data length control bit
    - When DL = "High", it means 8-bit bus mode with MPU.
    - When DL = "Low", it means 4-bit bus mode with MPU. So to speak, DL is a signal to select 8-bit or 4-bit bus mode.
  - > N: Display line number control bit
    - When N = "High", 2-line display mode is set.
    - When N = "Low", it means 1-line display mode.
  - > DH: Double height font type control bit
    - When DH = "High" and N = "Low", display font is selected to double height mode (5x16 dot). RAM address is 0x0000 (0x0000-0x007F).
    - When DH = "High" and N = "High", it is forbidden.
    - When DH = "Low", display font is normal (5x8 dot).
  - > IS: normal/extension instruction select
    - When IS = "High", extension instruction be selected (refer external instruction table)
    - When IS = "Low", normal instruction be selected (refer normal instruction table)