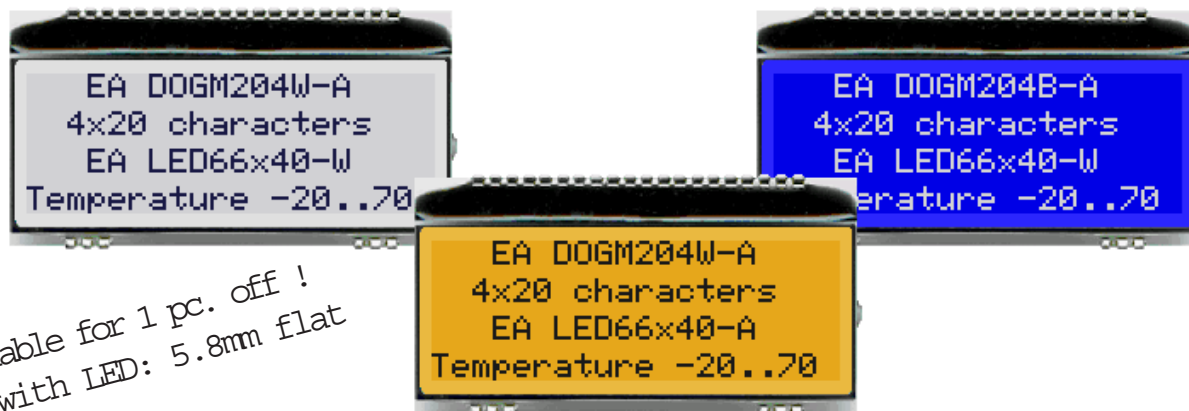


EA DOGM204-A

INCL. CONTROLLER SSD1803A FOR 4-/8-BIT, SPI AND I²C



available for 1 pc. off !
even with LED: 5.8mm flat

TECHNICAL DATA

- * HIGH-CONTRAST LCD SUPERTWIST DISPLAY
- * OPTIONAL LED BACKLIGHT UNITS IN DIFFERENT COLORS
- * 4x20 CHARACTER WITH 4.8 mm HEIGHT
- * SSD1803A CONTROLLER FOR 4-/8-BIT, SPI (4-WIRE) AND I²C (2-WIRE) INTERFACE
- * SINGLE POWER SUPPLY +3.3V (typically 250µA)
- * NO ADDITIONAL VOLTAGES REQUIRED
- * OPERATING TEMPERATURE RANGE -20 THROUGH +70°C
- * LED BACKLIGHT 3 through 80mA@3.3V or 2 through 40mA@5V
- * NO MOUNTING REQUIRED, SIMPLY SOLDER INTO PCB
- * 3 DIFFERENT CHARACTER SETS (CYRILLIC, ENGLISH-JAPANESE AND EUROPEAN) INCLUDED IN THE SAME CONTROLLER
- * 2 VIEWING DIRECTION POSSIBLE (BOTTOM AND TOP VIEW)

ORDERING CODE

LCD MODULE 4x20 - 4.8 mm

x: *B* = blue background

W = white background transfective

S = black background

N=white background reflective

LED BACKLIGHT, WHITE

LED BACKLIGHT, AMBER

LED BACKLIGHT, GREEN/RED

USB TEST BOARD FOR PC (WINDOWS)

SOCKET CONNECTOR 4.8 mm HIGH (1x20-PIN, 2.54mm PITCH)

EA DOGM204x-A

EA LED66X40-W

EA LED66X40-A

EA LED66X40-GR

EA 9780-3USB

EA FL-22P

EA DOG SERIES

With its EA DOG series, ELECTRONIC ASSEMBLY presents the world's first display series which will run on 3.3 V systems without auxiliary power.

Unlike normal LCD modules, you order the display and the corresponding backlight separately. This gives you a wealth of possible combinations.

Designed for compact hand-held devices, this modern LCD range provides a number of real benefits with or without backlight:

- * extremely compact at 66 x 40 mm at the standard font size of 4.8 mm (4 x 10)
- * ultra-flat at 2.0 mm without backlight or 5.8 mm including LED backlight
- * 4-bit, 8-bit, SPI interface (4-wire) and I²C (2-wire)
- * typical power consumption of only 250µA in full operation (LED white backlight as of 3mA)
- * easy installation by simply soldering into the board
- * A whole range of design variants can be supplied as of single units
- * Changing background color

LED BACKLIGHTS

6 different variants are available for individual backlighting: white, yellow/green, blue, red, amber and full color.

For monochrome backlights, 2 separate LED paths are available, which can be switched in parallel or in series to ideally match the system voltage. This means that all the backlights can be run either at 5 V or at 3.3 V.

Operation of the backlight requires an external series resistor for current limiting. This can be calculated from $R=U/I$; you will find the values in the table. To improve life time it is recommended to use a current source only.

The operating life of the yellow/green, red and amber backlights is 100,000 hours and that of the white and blue backlights much shorter.

Important: Never operate the backlight directly on a 5 V/3.3V supply, as this can immediately destroy the LEDs!

INSTALLATION

First, the display and the corresponding backlight are clipped together. The complete unit is then inserted into a PCB and soldered. Note that the 4 pins for the backlight must also be soldered from the top.

Important: There are one or two protective films on the display (top and/or rear side) and one on each backlight. Those have to be removed during or after production.

amber EA LED66x40-A	Forward voltage	Current max.	Limiting resistor	
			@ 3,3 V	@ 5 V
Connected in parallel	2,1 V	72 mA	18 ohm	47 ohm
Connected in series	6,3 V	24 mA	-	-


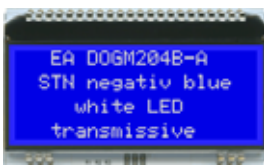
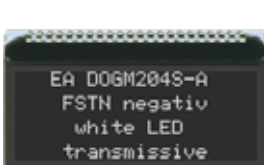
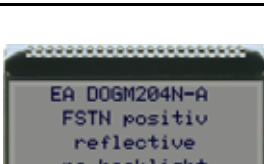
white EA LED66x40-W	Forward voltage	Current max.	Limiting resistor	
			@ 3,3 V	@ 5 V
Connected in parallel	3,2 V	90 mA	1,2 ohm	24 ohm
Connected in series	9,6 V	30 mA	-	-

green/red EA LED66x40-GR	Forward voltage	Current max.	Limiting resistor	
			@ 3,3 V	@ 5 V
red path (ARG/CR)	2,1 V	80 mA	24 ohm	48 ohm
green path (ARG/CG)	2,1 V	80 mA	18 ohm	39 ohm

EA DOGM204-A

4 DIFFERENT TECHNOLOGIES

As a standard we provide 4 different technologies as STN and FSTN:

display type	technology	optional backlight	readability	display color non backlighted	display color with backlighted	recommend backlight color
	FSTN pos. transfective	it's fine with and without backlight	readable even without backlight	black on white	black on backlight color	white, blue, RGB
	STN neg. blue transmissive	usage only with backlight	---	---	backlight color on blue background	white, yellow/green
	FSTN neg. transmissive	usage only with backlight	---	---	backlight color on black background	white, RGB
	FSTN pos. white reflective	no backlight possible	finest readable without backlight	black on white	---	---

3 DIFFERENT BACKLIGHTS

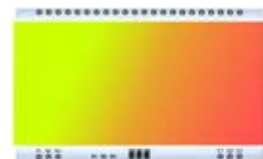
3 different backlight colors are available to match equipments design as much as possible. The most effective and brightest one is the white one EA LED66x40-W.



EA LED66x40-W
White



EA LED66x40-A
Amber



EA LED66x40-GR
Bi-color green and red

When you can see black and white pictures only here on this page then you're able to download a coloured version from our website <http://www.lcd-module.de/eng/pdf/doma/dogm204e.pdf>

USB-TEST BOARD EA 9780-3USB

For easy startup, a USB test board is available that can be connected to a PC. An USB cable and a Windows software is supplied with the product. This allows individual text and to be displayed directly on the connected display.

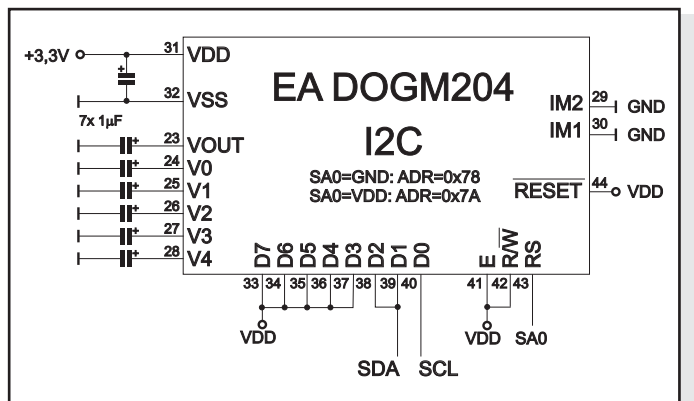
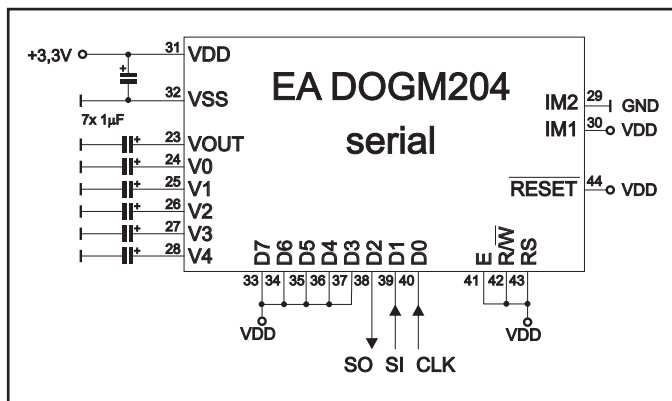
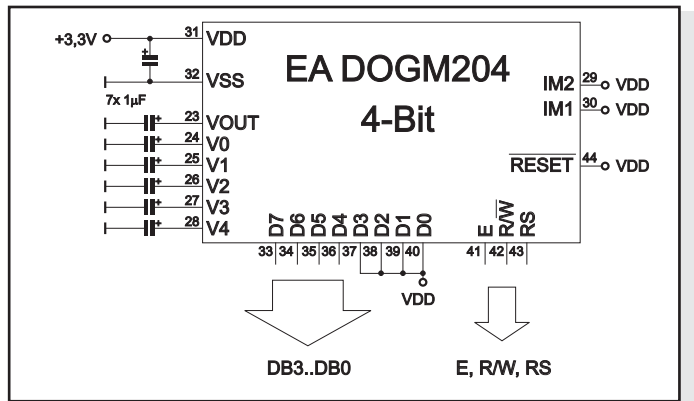
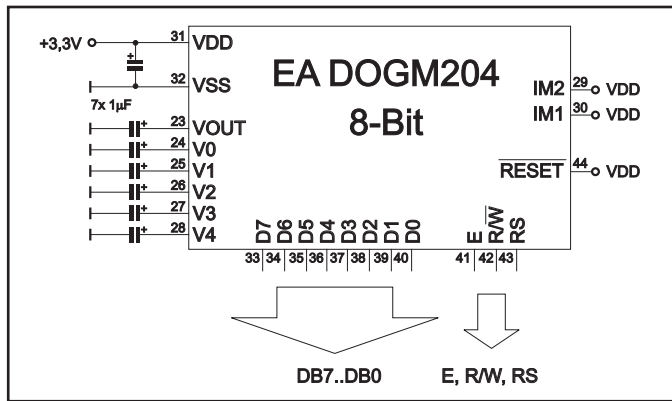
SIMULATION WITH WINDOWS

A simulator window also displays the contents of the display. The software can simulate all the displays and colors even without the hardware. You can download the software free from our website: http://www.lcd-module.de/deu/disk/startdog_v20.zip

APPLICATION EXAMPLES

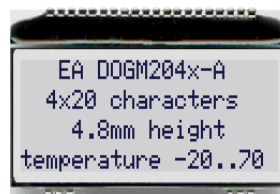
Different wiring must be used depending on the interface.

Note that the COG technology means that the current capacity of the outputs is limited. Therefore, a large load on the bus may cause signal loops and unclean levels. If in doubt, additional pull-down resistors (8051) are required or additional waits/NOPs must be incorporated.



12:00 VIEWING ANGLE, TOP VIEW OPTION

If the display is read mostly from above (on the front of a laboratory power supply unit, for example), the preferred angle of viewing can be set to 12 o'clock. This rotates the display by 180°. A slightly different initialization setup is required for this.



6 o'clock (Bottom View)



12 o'clock (Top View)

SETTING THE CONTRAST

The contrast on all displays of the EA DOG series can be set with a command. This is done using bits C0 through C5 in the commands "Contrast Set" and "Power/Icon Control/Contrast Set". Generally, the contrast is set once and kept constant across the entire operating temperature range (-20 through +70°C) thanks to the integrated temperature compensation function.

Even when run at 3.3 V, the displays do not require any additional negative voltage!

Contrast set (8-Bit)												
Command	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Hex	Remark
Function Set	0	0	0	0	1	1	1	0	0	1	\$39	8-Bit data length extension Bit RE=0; IS=1
Power control	0	0	0	1	0	1	0	1	1	1	\$57	Booster on and set contrast (DB1=C5, DB0=C4)
Contrast Set	0	0	0	1	1	1	0	0	1	0	\$72	Set contrast (DB3-DB0=C3-C0)
Function Set	0	0	0	0	1	1	1	0	1	0	\$38	8-Bit data length extension Bit RE=0; IS=0

INITIALISATION EXAMPLES

Init example 8-Bit (also valid for SPI and I2C)												
Command	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Hex	Remark
Function Set	0	0	0	0	1	1	1	0	1	0	\$3A	8-Bit data length extension Bit RE=1; REV=0
Extended function set	0	0	0	0	0	0	1	0	0	1	\$09	4 line display
Entry mode set	0	0	0	0	0	0	0	1	1	0	\$06	bottom view
Bias setting	0	0	0	0	0	1	1	1	1	0	\$1E	BS1=1
Function Set	0	0	0	0	1	1	1	0	0	1	\$39	8-Bit data length extension Bit RE=0; IS=1
Internal OSC	0	0	0	0	0	1	1	0	1	1	\$1B	BS0=1 -> Bias=1/6
Follower control	0	0	0	1	1	0	1	1	1	0	\$6E	Divider on and set value
Power control	0	0	0	1	0	1	0	1	1	1	\$57	Booster on and set contrast (DB1=C5, DB0=C4)
Contrast Set	0	0	0	1	1	1	0	0	1	0	\$72	Set contrast (DB3-DB0=C3-C0)
Function Set	0	0	0	0	1	1	1	0	1	0	\$38	8-Bit data length extension Bit RE=0; IS=0
Display On	0	0	0	0	0	0	1	1	1	1	\$0F	Display on, cursor on, blink on

Init example 4-Bit													
Command	RS	R/W	DB7	DB6	DB5	DB4	Hex						Remark
Synchronize 1	0	0	0	0	1	1	\$33						Make sure to switch to 8 bit data length
			0	0	1	1							
Synchronize 2	0	0	0	0	1	1	\$32						Switch to 4 Bit data length
			0	0	1	0							
Function Set	0	0	0	0	1	0	\$2A						4-Bit data length extension Bit RE=1; REV=0
			1	0	1	0							
Extended function set	0	0	0	0	0	0	\$09						4 line display
			1	0	0	1							
Entry mode set	0	0	0	0	0	0	\$06						bottom view
			0	1	1	0							
Bias setting	0	0	0	0	0	1	\$1E						4-Bit data length extension Bit RE=0; IS=1
			1	1	1	0							
Function Set	0	0	0	0	1	0	\$29						4-Bit data length extension Bit RE=0; IS=1
			1	0	0	1							
Internal OSC	0	0	0	0	1	1	\$1B						4-Bit data length extension Bit RE=0; IS=1
			1	0	1	1							
Follower control	0	0	0	1	1	0	\$6E						Divider on and set value
			1	1	1	0							
Power control	0	0	0	1	0	1	\$57						Booster on and set contrast (DB1=C5, DB0=C4)
			0	1	1	1							
Contrast Set	0	0	0	1	1	1	\$72						Set contrast (DB3-DB0=C3-C0)
			0	0	1	0							
Function Set	0	0	0	0	1	0	\$28						4-Bit data length extension Bit RE=0; IS=0
			1	0	0	1							
Display on	0	0	0	0	0	0	\$0F						Display on, cursor on, blink on
			1	1	1	1							

Further information about the commands of the SSD1803A, please refer to the datasheet:

http://www.lcd-module.de/fileadmin/eng/pdf/zubehoer/ssd1803a_2_0.pdf

CREATING YOUR OWN CHARACTERS

It's possible to create 8 own additional characters (ASCII Codes 0..7) to the fixes ROM codes

- 1.) The command "CG RAM Address Set" defines the ASCII code (Bit 3,4,5) and the dot line (Bit 0,1,2) of the new character. Example demonstrates creating ASCII code \$00.
- 2.) Doing 8 times the write command "Data Write" defines line by line the new character. 8th. byte stands for the cursor line.
- 3.) The new defined character can be used as a "normal" ASCII code (0..7); use with "DD RAM Address Set" and "Data Write".

Character-data									
Bit									Hex
7	6	5	4	3	2	1	0		
X	X	X	0	0	1	0	0	0	\$04
			0	0	1	0	0	0	\$04
			0	0	1	0	0	0	\$04
			0	0	1	0	0	0	\$04
			1	0	1	0	1		\$15
			0	1	1	1	0		\$0E
			0	0	1	0	0		\$04
			0	0	0	0	0		\$00

Define own character												
Command	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Hex	Remark
CG-RAM address set	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	\$40	Set address of character \$40=0; \$48=1; \$54=2...\$78=7
Character-data	1	0	x	x	x	0	0	1	0	0	\$04	first line
						0	0	1	0	0	\$04	second line
						0	0	1	0	0	\$04	third line
						0	0	1	0	0	\$04	fourth line
						1	0	1	0	1	\$15	fifth line
						0	1	1	1	0	\$0E	sixth line
						0	0	1	0	0	\$04	seventh line
						0	0	0	0	0	\$00	eighth line, cursor line

CHARACTER SET

The controller has 3 built-in character sets. They can be selected with the command "ROM-Selection" in the extended command set.

b3-0
b7-4

0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
00															
10	▶◀	⊕	⊗	⊘	⊙	⊚	⊛	⊜	⊝	⊞	⊟	⊠	⊡	⊢	⊣
20	!	"	#	%	&	'	()	*	+	,	-	.	/	
30	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>?
40	i	A	B	C	D	E	F	G	H	I	J	K	L	M	N
50	P	Q	R	S	T	U	V	W	X	Y	Z	Ä	Ö	Š	Ü
60	ˆ	a	b	c	d	e	f	g	h	i	j	k	l	m	n
70	P	q	r	s	t	u	v	w	x	y	z	ä	ö	š	ü
80	0	1	2	3	4	5	6	7	8	9	%	±	≥	≤	μ
90	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣	␣
A0	Ⓔ	Ⓕ	Ⓖ	Ⓗ	Ⓘ	Ⓚ	Ⓛ	Ⓜ	Ⓝ	Ⓞ	Ⓟ	Ⓠ	Ⓡ	Ⓢ	Ⓣ
B0	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ	Ⓗ	Ⓘ	Ⓚ	Ⓛ	Ⓜ	Ⓝ	Ⓞ	Ⓟ
C0	Γ	Δ	Π	Υ	ϕ	ε	σ	τ	θ	ω	ι	⌘			
D0	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
E0	↓	←	↗	↘	↙	↚	↛	↜	↝	↞	↠	↡	↢	↣	↤
F0	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ	Ⓗ	Ⓘ	Ⓚ	Ⓛ	Ⓜ	Ⓝ	Ⓞ	Ⓟ	Ⓠ	Ⓡ

ROM A

b3-0
b7-4

0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
00															
10	▶◀	⊕	⊗	⊘	⊙	⊚	⊛	⊜	⊝	⊞	⊟	⊠	⊡	⊢	⊣
20	!	"	#	\$	%	&	'	()	*	+	,	-	.	/
30	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>?
40	0	A	B	C	D	E	F	G	H	I	J	K	L	M	N
50	P	Q	R	S	T	U	V	W	X	Y	Z	[\	^	_
60	ˆ	a	b	c	d	e	f	g	h	i	j	k	l	m	n
70	P	q	r	s	t	u	v	w	x	y	z	()	~	!
80	A	B	В	Г	Д	Е	Ж	З	И	Й	К	Л	М	Н	О
90	P	С	Т	У	Ф	Х	Ц	Ч	Ш	Щ	Ъ	Ы	Ь	Э	Ю
A0	Ä	Å	Ǿ	ǿ	Ǿ	ǿ	ǿ	ǿ	ǿ	ǿ	ǿ	ǿ	ǿ	ǿ	ǿ
B0	Š	Š	Š	Š	Š	Š	Š	Š	Š	Š	Š	Š	Š	Š	Š
C0	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā
D0	Ð	ð	ð	ð	ð	ð	ð	ð	ð	ð	ð	ð	ð	ð	ð
E0	š	š	š	š	š	š	š	š	š	š	š	š	š	š	š
F0	š	š	š	š	š	š	š	š	š	š	š	š	š	š	š

ROM B

b3-0
b7-4

0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
00															
10	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ	Ⓗ	Ⓘ	Ⓚ	Ⓛ	Ⓜ	Ⓝ	Ⓞ	Ⓟ
20	!	"	#	\$	%	&	'	()	*	+	,	-	.	/
30	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>?
40	0	A	B	C	D	E	F	G	H	I	J	K	L	M	N
50	P	Q	R	S	T	U	V	W	X	Y	Z	[]	^	_
60	ˆ	a	b	c	d	e	f	g	h	i	j	k	l	m	n
70	P	q	r	s	t	u	v	w	x	y	z	()	~	!
80	Š	š	š	š	š	š	š	š	š	š	š	š	š	š	š
90	É	é	é	é	é	é	é	é	é	é	é	é	é	é	é
A0	。 「 」 、 ・	ヲ	アイ	ウ	エ	オ	カ	キ	ク	ケ	コ	サ	シ	ス	セ
B0	ー	ア	イ	ウ	エ	オ	カ	キ	ク	ケ	コ	サ	シ	ス	セ
C0	タ	チ	ツ	テ	ト	ナ	ニ	ヌ	ネ	ノ	ヒ	フ	ハ	ホ	マ
D0	ミ	ム	メ	モ	ヨ	リ	ル	レ	ロ	ワ	ン	°	□		
E0	á	í	ó	ú	ç	£	¥	℞	ƒ	¡	§	§	§	§	§
F0	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ

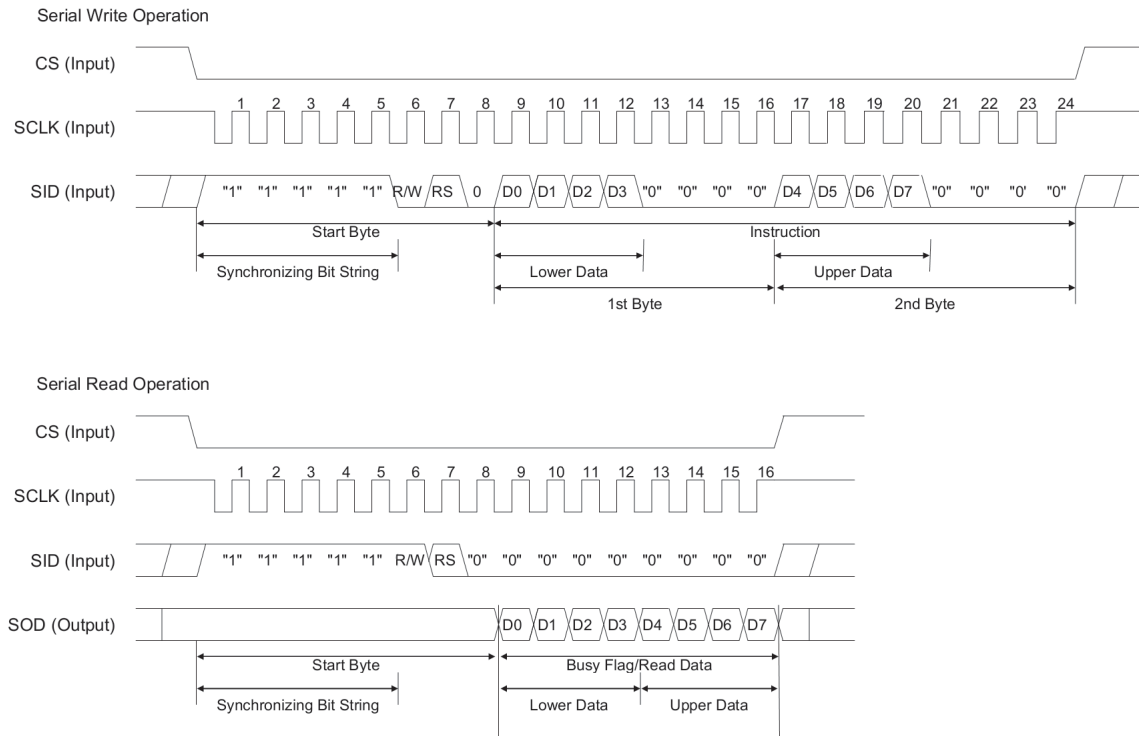
ROM C

Example code:

Change character table												
Command	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Hex	Remark
Function Set	0	0	0	0	1	1	1	0	1	0	\$3A	8-Bit data length extension Bit RE=1
ROM Selection	0	0	0	0	0	0	1	0	0	1	\$72	ROM selection double byte command \$00 = ROMA; \$04 = ROMB; \$0C = ROMC
	1	0	0	0	0	0	R2	R1	0	0	\$0X	
Function Set	0	0	0	0	1	1	1	0	0	0	\$38	8-Bit data length extension Bit RE=0

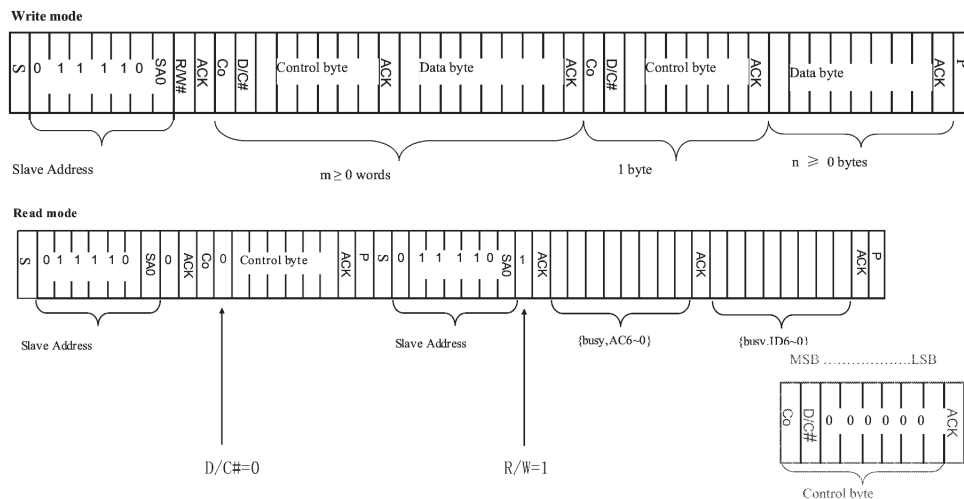
SERIAL INTERFACE (SPI)

The serial interface always needs a synchronization byte. In write mode, the byte to send has to be divided in two bytes, into the “lower data” and “upper data”. Please refer to the following chart. The maximum clock frequency for SCLK is 1 MHz.



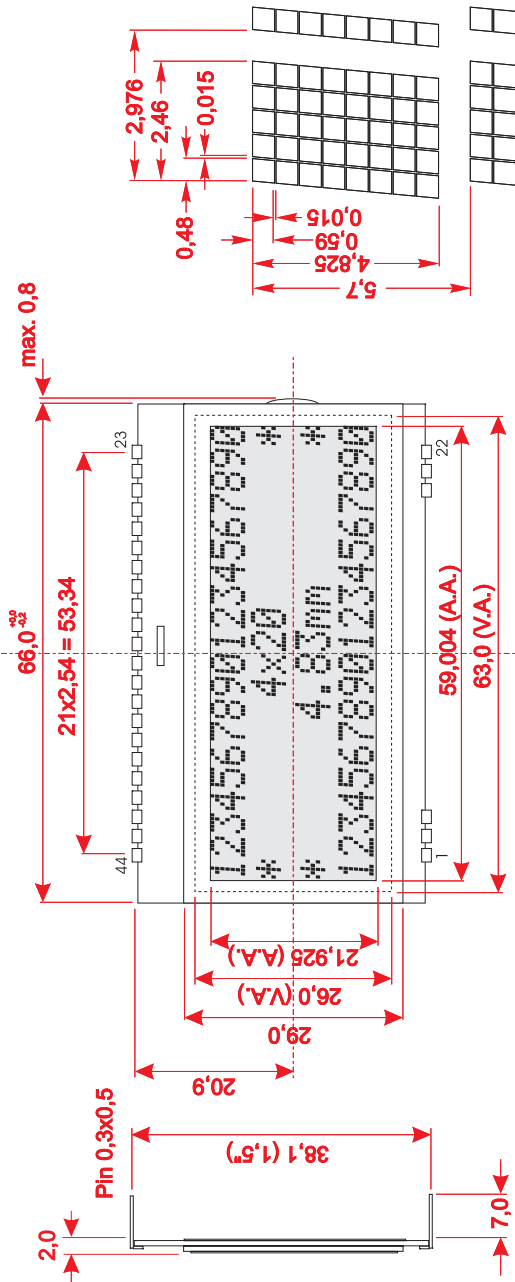
I²C INTERFACE

The display can be assigned to the slave address 0x78 or 0x7A (PIN SA0). After transferring the start condition, the hardware address, together with the Read(1)/Write(0) bit has to be transmitted. While writing to the display, after the slave address, there always is a control byte holding the information Data(1) or Command(0) and the continuation bit. If the continuation bit is set to 0, the following bytes are data bytes until the next stop condition occurs. The maximum clock rate for I²C bus is 400 kHz.



Further information about the interfaces and the timing of the SSD1803A, please refer to the datasheet http://www.lcd-module.de/fileadmin/user_upload/pdf/zubehoer/ssd1803a_2_0.pdf

DIMENSIONS



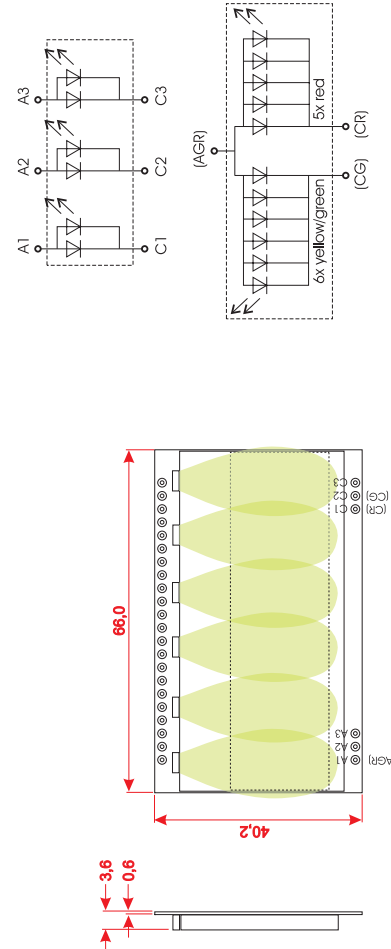
alle dimensions are in mm

Note:

- LC-displays are not suited for wave soldering or reflow soldering. Temperatures above +80°C may damage lcd-module.
- Surfaces of display and backlight are with protection foils protected against scratching. Please remove before use.



Pin	Symbol Level	Function
1	NC	(A1+; LED backlight)
2	NC	(A2+; LED backlight)
3	NC	(A3+; LED backlight)
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23	VOOUT	Voltage converter output
24	V0	Regulated voltage output
25	V1	Regulated voltage output
26	V2	Regulated voltage output
27	V3	Regulated voltage output
28	V4	Regulated voltage output
29	IM2	H/L Interface mode select 2
30	IM1	H/L Interface mode select 1
31	VDD	Power Supply +2..4..+3..6V
32	VSS	Power Supply 0V
33	D7	Data
34	D6	Data
35	D5	Data
36	D4	Data
37	D3	Data
38	D2	Data / SOD / SDAout
39	D1	Data / SID / SDAin
40	D0	Data / SCLK / SCL
41	E	Enable (falling edge)
42	R/W	H/L = Write, H=Read
43	RS	H/L = Cmd, H=Data / SAO
44	RESET	L = Reset



Note: The 6 LED pins A1, A2, C2 and A3, C3 (or A, R, G, B) must be soldered from the top to ensure a clean contact.