# DOGM GRAPHIC SERIES 128x64 DOTS

available in low quantities ! flat: 5.6mm with LED b./l. mounted







*EA DOGM128B-6* + *EA LED55x46-W* 

*EA DOGM128W-6* + *EA LED55x46-W* 

## **TECHNICAL DATA**

- \* HIGH-CONTRAST LCD SUPERTWIST DISPLAY (STN AND FSTN) WITH 15µm DOT GAP
- \* OPTIONAL LED BACKLIGHTS IN VARIOUS COLORS
- \* 128x64 PIXELS (CORRESPONDS TO 8x21 CHARACTERS OR 4x10 LARGE CHARACTERS)
- \* ST 7565R CONTROLLER WITH SPI (4-WIRE) INTERFACE
- \* POWER SUPPLY: SINGLE SUPPLY 3.0V TO 3.3V (TYPICALLY 270μA)
- \* NO ADDITIONAL VOLTAGES REQUIRED
- \* OPERATING TEMPERATURE RANGE -20°C TO +70°C (STORAGE -30°C TO +80°C)
- \* LED BACKLIGHTING 5mA TO 40mA
- \* NO MOUNTING REQUIRED: SIMPLY SOLDER ONTO PCB

## **ORDERING CODE**

#### GRAPHICS DISPLAY, 128x64, 55x46mm

*x*: *W* = white background (FSTN pos. transflective)

- $E = yellow/green \ background \ (STN \ pos. \ transmissive)$
- B = blue background (STN neg. transmissive)
- S = black background (FSTN neg. transmissive)
- L = yellow/green background (STN pos. reflective, cannot be backlit)

LED BACKLIGHT, WHITE

- LED BACKLIGHT, YELLOW/GREEN
- LED BACKLIGHT, BLUE
- LED BACKLIGHT, RED
- LED BACKLIGHT, AMBER
- LED BACKLIGHT, GREEN
- LED BACKLIGHT, FULL COLOR RGB

## ACCESSORIES

USB TEST BOARD FOR PC (WINDOWS) TOUCH PANEL, 4-WIRE, ANALOG, STICK-ON ZIF CONNECTOR FOR TOUCH PANEL, BOTTOM CONTACT SOCKET CONNECTOR 4.8 mm HEIGHT (2 PCS. REQUIRED)



EA DOGM128X-6

EA LED55X46-W

EA LED55X46-G

EA LED55X46-B

EA LED55X46-R

EA LED55X46-A

EA LED55X46-E

EA LED55X46-RGB

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#### EA DOGM128

The EA DOGM128, a 128x64-pixel graphics display, is a new addition to ELECTRONIC ASSEMBLY's EA DOGM series. It, too, has pins that allow it to be mounted quickly and easily. 7 different optional LED backlights are available. These can be combined with 5 different display technologies, making it possible to have up to around 20 different designs. Designed for compact, handheld devices, this modern LCD series offers a number of benefits with and without backlighting:

- \* Extremely compact (55x46 mm) with a large viewing area of 51x31 mm
- \* Super-flat: 2.0 mm without backlight module, and only 5.8 mm with a b./l. module mounted
- \* Serial SPI interface (4-wire)
- \* Single supply +3.0 V or +3.3 V
- \* Typical power consumption of only  $150\mu$ A in full operation (white LED backlight from 5mA)
- \* Easily mounted by soldering
- \* Wide range of design variants orderable as single units
- \* Backlighting color changes possible

#### CONTRAST ADJUSTMENT

The contrast can be set by means of a command for all the displays in the EA DOGM series. The contrast setting of the display must be set once by the software, and is then kept constant throughout the entire operating temperature range ( $-20..+70^{\circ}$ C), thanks to the integrated temperature compensation.

#### LED BACKLIGHT

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

There are 3 separate LED paths available for each monochrome backlight that can be switched in parallel or in series to suit the system voltage. This means that most backlights can be run at either 3.3 V or 5 V.

To operate the backlight, we recommend a current source (e.g. CAT4238TD) or an external series resistor to limit the current. This can be calculated from R=U/I; you can find the values in the table on the right. To prolong the life of the backlights, we recommend that you use a current source.

The operating life of the yellow/green, red and amber backlights is 100,000 hours. The life of the white and blue backlights is considerably shorter. We recommend that you dim these or switch them off whenever possible.

**Important:** Never connect the backlight LEDs directly to a 5 V/3.3 V supply as this will immediately destroy the LEDs. Always use a current source. Please note that

Limiting resistor Current Forward voltage (V) (ohm, each path) LED backlight max. (mA) @3.3 V @5 V min max typ yellow/green 40 40 2.1 97 EA LED55x46-G white 3.3 25 CAT4238 82 EA LED55x46-W amber 1.9 40 47 103 EA LED55x46-A green 3 40 8.5 57 EA LED55x46-E blue CAT4238 68 3.3 30 EA LED55x46-B red 40 47 103 1.9 EA LED55x46-R blue red green full color 40 each CAT4238 25 EA LED55x46-RGB typ. 4V colour typ. 4V typ. 4V

derating applies at temperatures exceeding +25°C.

#### ASSEMBLING

First, clip the display and backlight modules together by gently pushing the display pins through the corresponding holes on the backlight module. Then insert the entire module into the socket, or into the soldering holes on the pcb. The backlight pins (the 2 rows with 3 pins at the bottom) must be soldered on the top side as well to ensure good contact between the modules.

<u>Important:</u> The display has a protective film on the top and/or the bottom, and there is also one on the backlight. These must be removed.

Make sure that neither display nor backlight will never come into contact with any kind of liquid like Fluxer, Cleaner, Water.



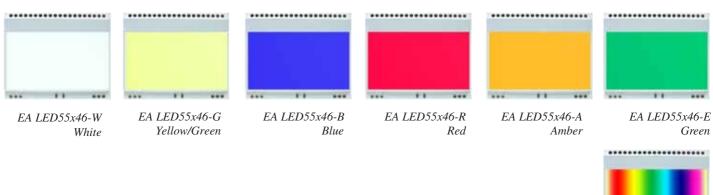
## **5 DIFFERENT TECHNOLOGIES**

See below for an overview of available technologies, combinations with available backlights and their usability:

display type	technology	optional backlight	readability	display color non backlighted	display color with backlighted	recommended backlight color
ELECTRONIC ASSEMBLY ER DOGM128H-6	FSTN pos. transflective	it's fine with and without backlight	readable even without backlight	black on white	black on backlight color	white, blue, green, RGB
ELECTRONIC ASSEMBLY EA DOGH128E-6	STN pos. yellow/green transmissive	backlight unit required	readable even without backlight	dark green on yellow/green	black on yellow/green or amber	yellow/green, amber
ELECTRONIC ASSEMBLY EA DOGH1288-6	STN neg. blue transmissive	usage only with backlight			backlight color on blue background	white, yellow/green
ELECTRONIC ASSEMBLY EA DOGH1285-6	FSTN neg. transmissive	usage only with backlight			backlight color on black background	white, green, RGB
ELECTRONIC ASSEMBLY EA DOGH128L-6	STN pos. yellow/green reflective	no backlight possible	finest readable without backlight	dark green on yellow/green		

### **6 AND MORE DIFFERENT BACKLIGHTS**

6 and more different backlight colors are available to match equipments design as much as possible. The most effective and brightest one is the white one EALED55x31-W.



If you see black and white pictures on this page but you want to see the colors of the displays, you can download a full-colored version of this document at <a href="http://www.lcd-module.de/eng/pdf/grafik/dogm128e.pdf">http://www.lcd-module.de/eng/pdf/grafik/dogm128e.pdf</a>

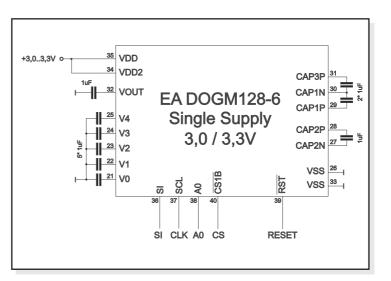
EA LED55x46-RGB Full Color

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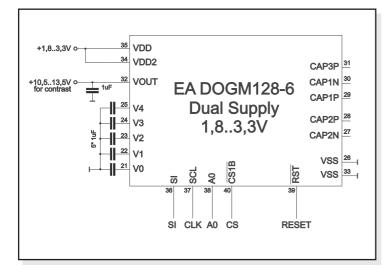
11 ....



#### **APPLICATION EXAMPLES**



+3.0V or +3.3V (single supply) operation requires 9 external capacitors



If an external source of  $+10.5 \sim +13.5V$  (does not have to be stabilized) is available, the charge pump is not needed and less external components are required.

#### **USB-TEST BOARD EA 9780-1USB**

For easy startup, a USB test board is available that can be connected to a PC. A USB cable and Windows software is supplied with the product. This allows text and images (BMP) to displayed directly on the connected display. You will find more information on the test board in the EA 9780-1USB data sheet.

#### 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.zip





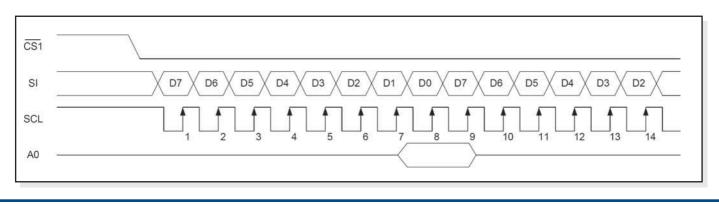
#### TABLE OF PROGRAMMING COMMANDS

Command			Com	mand	d Coc	le				Function		
Command	A0	D7	D6	D5	D4	D3	D2	D1	D0	- Function		
(1) Display ON/OFF	0	1	0	1	0	1	1	1	0 1	LCD display ON/OFF 0: OFF, 1: ON		
(2) Display start line set	0	0	1		Displ	lay st	art a	ddres	SS	Sets the display RAM display start line address		
(3) Page address set	0	1	0	1	1	P	age	addre	ess	Sets the display RAM page address		
(4) Column address set upper bit Column address set lower bit	0	0 0	0 0	0 0	1 0	co Le	ost s lumn ast s	add	ress cant	Sets the most significant 4 bits of the display RAM column address. Sets the least significant 4 bits of the display RAM column address.		
(6) Display data write	1					W	rite d	ata		Writes to the display RAM		
(8) ADC select	0	1	0	1	0	0	0	0	0 1	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse		
<li>(9) Display normal/ reverse</li>	0	1	0	1	0	0	1	1	0	Sets the LCD display normal/ reverse 0: normal, 1: reverse		
(10) Display all points ON/OFF	0	1	0	1	0	0	1	0	0 1	Display all points 0: normal display 1: all points ON		
(11) LCD bias set	0	1	0	1	0	0	0	1	0 1	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565R)		
(14) Reset	0	1	1	1	0	0	0	1	0	Internal reset		
(15) Common output mode select	0	1	1	0	0	0	*	*	*	Select COM output scan direction 0: normal direction 1: reverse direction		
(16) Power control set	0	0	0	1	0	1	0	pera mod		Select internal power supply operating mode		
(17) V <sub>0</sub> voltage regulator internal resistor ratio set	0	0	0	1	0	0	Re	sistor	ratio	Select internal resistor ratio(Rb/Ra) mode		
(18) Electronic volume mode set Electronic volume register set	0	1 0	0	0 E	0 lectro	0 onic v	0 volun	0 ne va	1 Ilue	Set the V <sub>0</sub> output voltage electronic volume register		
(19) Static indicator ON/OFF	0	1	0	1	0	1	1	0	0	0: OFF, 1: ON		
Static indicator register set	1276	0	0	0	0	0	0	0	Mode	Set the flashing mode		
(20) Booster ratio set	0	1	1	1	1	1	0	0 ste	0 ep-up	select booster ratio 00: 2x,3x,4x 01: 5x		
		0	0	0	0	0	0		alue	11: 6x		
(21) Power save	0									Display OFF and display all points ON compound command		
(22) NOP	0	1	1	1	0	0	0	1	1	Command for non-operation		

00	Column address
D0 2 D7	Page 0
D0 ~ D7	Page 1
D0 ₹ D7	Page 2
D0 <sup>2</sup> D7	Page 3
D0 2 D7	Page 4
D0 ? D7	Page 5
D0 2 D7	Page 6
D0 2 D7	Page 7

### DATA TRANSFER

Data transfer is unidirectional. That means that data can only be written; it cannot be read again. In contrast to other displays, a busy query is not necessary with this display. The clock-pulse rate of the SCL line can be up to 20 MHz, depending on the supply voltage. You will find more detailed information on timing on pages 64 and 65 of the data sheet of the ST7565R controller, which you will find on our website at <a href="http://www.lcd-module.de/eng/pdf/zubehoer/st7565r.pdf">http://www.lcd-module.de/eng/pdf/zubehoer/st7565r.pdf</a>





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#### **INITIALISATION EXAMPLE**

Internal contrast voltage generator (single supply +3.0V/+3.3V)

	Initialisation	exa	mp	le f	or s	sing	jle :	sup	ply	+3	.3V	(bottom view)	
Command			D7	D6	D5	D4	D3	D2	D1	D0	Hex	Remark	
(2)	Display start line set	0	0	1	0	0	0	0	0	0	\$40	Display start line 0	
(8)	ADC set	0	1	0	1	0	0	0	0	1	\$A1	ADC reverse *)	
(15)	Common output mode select	0	1	1	0	0	0	0	0	0	\$C0	Normal COM0~COM63	
(9)	Display normal/reverse	0	1	0	1	0	0	1	1	0	\$A6	Display normal	
(11)	LCD bias set	0	1	0	1	0	0	0	1	0	\$A2	Set bias 1/9 (Duty 1/65)	
(16)	Power control set	0	0	0	1	0	1	1	1	1	\$2F	Booster, Regulator and Follower on	
(00)	Decelormetic cet	•	1	1	1	1	1	0	0	0	\$F8		
(20)	Booster ratio set	0	0	0	0	0	0	0	0	0	\$00	Set internal Booster to 4x	
(17)	V0 voltage regulator set	0	0	0	1	0	0	1	1	1	\$27		
(10)	<b>-</b>		1	0	0	0	0	0	0	1	\$81	Contrast set	
(18)	Electronic volume mode set	0	0	0	0	1	0	1	1	0	\$16		
(10)		_	1	0	1	0	1	1	0	0	\$AC	No. in dia statu	
(19)	Static indicator set	0	0	0	0	0	0	0	0	0	\$00	No indicator	
(1)	Display ON/OFF	0	1	0	1	0	1	1	1	1	\$AF	Display on	

\*) Make sure that for 6:00 viewing direction ADC has to be set to "reverse" (mirrored layout) !



#### INITIALISATION EXAMPLE

External contrast voltage (dual power supply)

	Initialisation example for dual power supply (bottom view)													
Com	nand	A0	A0 D7 D6 D5 D4 D3 D2 D1 D0 Hex Remark								Remark			
(2)	Display start line set	0	0	1	0	0	0	0	0	0	\$40	Display start line 0		
(8)	ADC set	0	1	0	1	0	0	0	0	1	\$A1	ADC reverse *)		
(15)	Common output mode select	0	1	1	0	0	0	0	0	0	\$C0	Normal COM0~COM63		
(9)	Display normal/reverse	0	1	0	1	0	0	1	1	0	\$A6	Display normal		
(11)	LCD bias set	0	1	0	1	0	0	0	1	0	\$A2	Set bias 1/9 (Duty 1/65)		
(16)	Power control set	0	0	0	1	0	1	0	1	1	\$2B	Booster off, Regulator, Follower on		
(17)	V0 voltage regulator set	0	0	0	1	0	0	1	1	1	\$27			
(10)	Electronic volume mode set	_	1	0	0	0	0	0	0	1	\$81	Contrast set		
(18)	Electronic volume mode set	0	0	0	0	1	0	1	1	0	\$16			
(10)	Otatia indiantar ant		1	0	1	0	1	1	0	0	\$AC			
(19)	Static indicator set 0	0	0	\$00	No indicator									
(1)	Display ON/OFF	0	1	0	1	0	1	1	1	1	\$AF	Display on		

\*) Make sure that for 6:00 viewing direction ADC has to be set to "reverse" (mirrored layout) !



#### 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 rotaties the

4	Column address
D0 2 D7	Page 0
D0 2 D7	Page 1
D0 ~ D7	Page 2
D0 2 D7	Page 3
D0 2 D7	Page 4
D0 2 D7	Page 5
D0 2 D7	Page 6
D0 2 D7	Page 7

display by 180°. A slightly different initialization setup is required for this. Also keep in mind that the leftmost column (normally numbered as 0) will now change to 4.



**EA DOGM128-6** 

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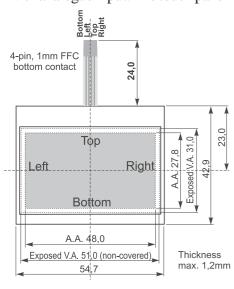
Assembling for 12:00 (Top View)

	Initialisation example top view												
Co	ommand	A0	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Remark	
(8	8) ADC set	0	1	0	1	0	0	0	0	0	\$A0	ADC normal	
(15	5) Common output mode select	0	1	1	0	0	1	0	0	0	\$C8	Reverse COM63~COM0	

#### **TOUCH PANEL EA TOUCH128-1 (OPTIONAL)**

An analog touch panel is available as an accessory. It has a self-adhesive material on its rear surface and is simply stuck onto the display. The connection is made by means of a 4-pin flexible cable for a ZIF connector (e.g. EA WF100-04S) with a grid of 1.0 mm. Bending radius is defined with min. 5mm. For optimum readability we recommend that you use a backlight with the display.

Interfacing to a processor can be either done by an external touch panel controller or with a controller that is featured with analogue input. The touch panel is similar to a potentiometer: connecting



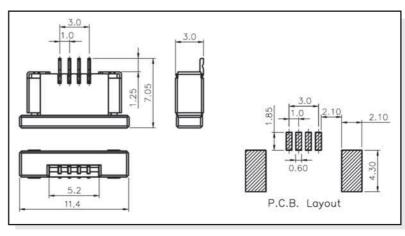
a voltage of e.g. 3.3V to the pins *Top-Bottom* makes it possible to read out a voltage on pin *Left* or *Right* which is linear to the Y-coordinate of the pressed point. The X-coordinate will result when the voltage will be supplied to *Left-Right* and measurement is done at *Top* or *Bottom*.

The pinout of the connecting cable is shown in the drawing.

Spe	Specification											
Specification	min	max	Unit									
Top-Bottom	120	300	Ω									
Left-Right	580	900	Ω									
Voltage	3	12	V									
Current	5	25	mA									
Linearity		1,5	%									
Force	45	65	g									
Contact Bounce	5	10	ms									
Op. Temperatur	-20	+60	°C									
Stor. Temperatur	-20	+70	°C									
Transmission	75	85	%									
Life Time	10000		Cycles									

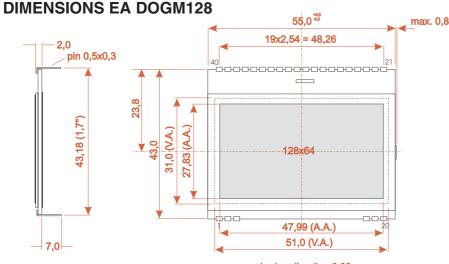
#### **ZIF CONNECTOR EA WF100-04S**

As an accessory for the touch panel we do provide a ZIF connector (4 pins) with pitch 1.0mm (SMD type). This connector ,,bottom side contact" type.





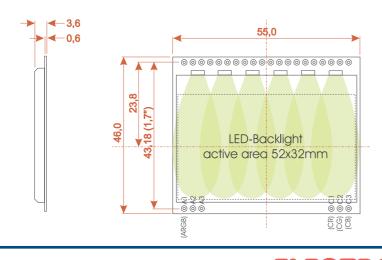
alle dimensions are in mm

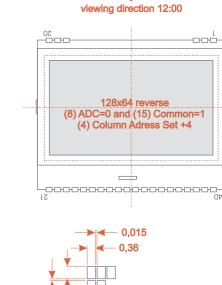




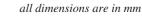
Pin	Symbol	Level Function		Pin	Symbol	Level	Function
1	NC	(A1+: LED backlight)		21	V0	-	LC Drive
2	NC	(A2+: LED backlight)		22	V1	-	LC Drive
3	NC	(A3+: LED backlight)	I	23	V2	-	LC Drive
4			ſ	24	V3	-	LC Drive
5				25	V4	-	LC Drive
6			I	26	VSS	L	Pow er Supply 0V (GND)
7			ſ	27	CAP2N	-	Voltage Converter
8				28	CAP2P	-	Voltage Converter
9				29	CAP1P	-	Voltage Converter
10			ſ	30	CAP1N	-	Voltage Converter
11				31	CAP3P	-	Voltage Converter
12			I	32	VOUT	-	Voltage Output about +12V
13			ſ	33	VSS	L	Pow er Supply 0V (GND)
14				34	VDD2	Н	Pow er Supply Booster
15			I	35	VDD	Н	Pow er Supply +"2.43,3V
16			ſ	36	SI	H/L	Serial Data In
17			I	37	SCL	H/L	Serial Clock
18	NC	(C1-: LED backlight)	I	38	A0	H/L	L= Command, H= Data
19	NC	(C2-: LED backlight)		39	RST	L	Reset (active low)
20	NC	(C3-: LED backlight)		40	CS1B	L	Chip Select (active low)

#### **DIMENSIONS EA LED55X46**





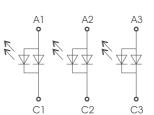
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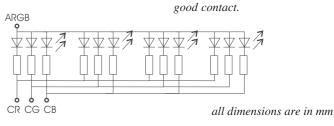


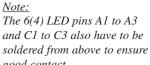
#### <u>Note:</u>

0,015 - 0,42

- LC displays are generally not suited for wave or reflow soldering. Temperatures of over 80°C can cause lasting damage.
- The surfaces of the displays and backlights are protected from scratching by self-adhesive protective foils. Please remove these before mounting (2 pcs. on display and 1 pc. on backlight).
- Make sure that either display nor backlight will never come into contact with any kind of liquid like Fluxer, Cleaner, Water.







ATTENTION

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