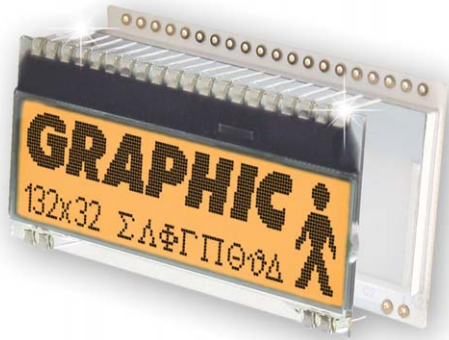


# DOGM GRAPHIC 132x32

Issue 11.2019

## INCL. CONTROLLER ST7565R



EA DOGM132W-5 +  
EA LED55x31-A



EA DOGM132B-5 +  
EA LED55x31-W



EA DOGM132W-5 +  
EA LED55x31-W

## TECHNICAL DATA

- \* HIGH-CONTRAST LCD SUPERTWIST DISPLAY (STN AND FSTN) WITH 15µm DOT GAP
- \* OPTIONAL LED BACKLIGHTS IN VARIOUS COLORS
- \* 132x32 PIXELS (CORRESPONDS TO 4x22 CHARACTERS OR 2x16 LARGE CHARACTERS)
- \* ST 7565R CONTROLLER WITH SPI (4-WIRE) INTERFACE
- \* POWER SUPPLY: SINGLE SUPPLY 2.4..3.3V (TYPICALLY 140µA)
- \* NO ADDITIONAL VOLTAGES REQUIRED
- \* OPERATING TEMPERATURE RANGE -20°C TO +70°C (STORAGE -30°C TO +80°C)
- \* LED BACKLIGHTING 5..45mA
- \* NO MOUNTING REQUIRED: SIMPLY SOLDER ONTO PCB

## ORDERING CODE

GRAPHICS DISPLAY, 132x32, 55x31mm

- x: W = white background (FSTN pos. transfective)*  
*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, FULL COLOR RGB

**EA DOGM132x-5**

**EA LED55X31-W**  
**EA LED55X31-G**  
**EA LED55X31-B**  
**EA LED55X31-R**  
**EA LED55X31-A**  
**EA LED55X31-RGB**

## ACCESSORIES

USB TEST BOARD FOR PC (WINDOWS) **EA 9780-4USB**  
 SOCKET CONNECTOR 4.8 mm HEIGHT (2 PCS. ARE REQUIRED) **EA FL-20P**  
 FONTEEDITOR WITH CHARACTER SETS e.g. 6x8, 8x8, 8x16, CYRILLIC **EA USBSTICK-FONT**

## EA DOGM132

The EA DOGM132, a 132x32-pixel graphics display, is a new member to ELECTRONIC ASSEMBLY's EA DOGM series. It also has pins that allow it to be mounted quickly and easily. 6 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 (55x31 mm) with a large viewing area of 51x15 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 +2.4 V or +3.3 V
- \* Typical power consumption of only 140µA 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°C), thanks to the integrated temperature compensation.

## LED BACKLIGHT

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

There are 2 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 about 80,000 hours.

**Important: Never connect the backlight LEDs directly to a 5V/3.3V supply as this will immediately destroy the LEDs. Always use a current source. Please note that derating applies at temperatures exceeding +25°C.**

## ASSEMBLY

First, clip the display and backlight modules together by gently pushing the display pins through the corresponding holes on the backlight module. Don't forget to remove the protection foil from display and backlight before. Then insert the entire module into the socket or into the soldering holes on the pcb. The backlight pins (the 4 pins at the bottom side) must be soldered on the top side as well to ensure good contact between the modules.

**Important: 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.**

| yellow/green<br>EA LED55x31-G | Forward<br>voltage | Current<br>max. | Limiting resistor |        |
|-------------------------------|--------------------|-----------------|-------------------|--------|
|                               |                    |                 | @ 3,3 V           | @ 5 V  |
| Connected in parallel         | 2,2 V              | 80 mA           | 14 ohm            | 35 ohm |
| Connected in series           | 4,4 V              | 40 mA           | -                 | 15 ohm |

| white<br>EA LED55x31-W | Forward<br>voltage | Current<br>max. | Limiting resistor |        |
|------------------------|--------------------|-----------------|-------------------|--------|
|                        |                    |                 | @ 3,3 V           | @ 5 V  |
| Connected in parallel  | 3,2 V              | 60 mA           | 1,6 ohm           | 30 ohm |
| Connected in series    | 6,4 V              | 30 mA           | -                 | -      |

| blue<br>EA LED55x31-B | Forward<br>voltage | Current<br>max. | Limiting resistor |        |
|-----------------------|--------------------|-----------------|-------------------|--------|
|                       |                    |                 | @ 3,3 V           | @ 5 V  |
| Connected in parallel | 3,2 V              | 60 mA           | 1,6 ohm           | 30 ohm |
| Connected in series   | 6,4 V              | 30 mA           | -                 | -      |






| amber<br>EA LED55x31-A | Forward<br>voltage | Current<br>max. | Limiting resistor |        |
|------------------------|--------------------|-----------------|-------------------|--------|
|                        |                    |                 | @ 3,3 V           | @ 5 V  |
| Connected in parallel  | 2,4 V              | 80 mA           | 11 ohm            | 32 ohm |
| Connected in series    | 4,8 V              | 40 mA           | -                 | 5 ohm  |

| red<br>EA LED55x31-R  | Forward<br>voltage | Current<br>max. | Limiting resistor |        |
|-----------------------|--------------------|-----------------|-------------------|--------|
|                       |                    |                 | @ 3,3 V           | @ 5 V  |
| Connected in parallel | 2,1 V              | 80 mA           | 15 ohm            | 36 ohm |
| Connected in series   | 4,2 V              | 40 mA           | -                 | 20 ohm |

| Full color<br>EA LED55x31-RGB | Forward<br>voltage | Current<br>max. | Limiting resistor |          |
|-------------------------------|--------------------|-----------------|-------------------|----------|
|                               |                    |                 | @3,3 V            | @ 5 V    |
| Connected in parallel         | 4 V                | 125 mA          | -                 | 3x24 ohm |

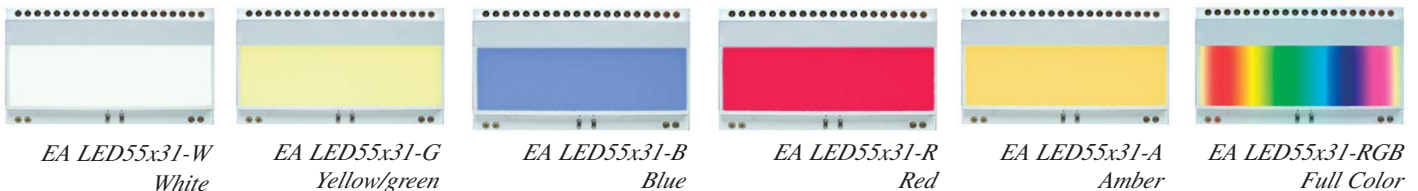
**5 DIFFERENT TECHNOLOGIES**

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

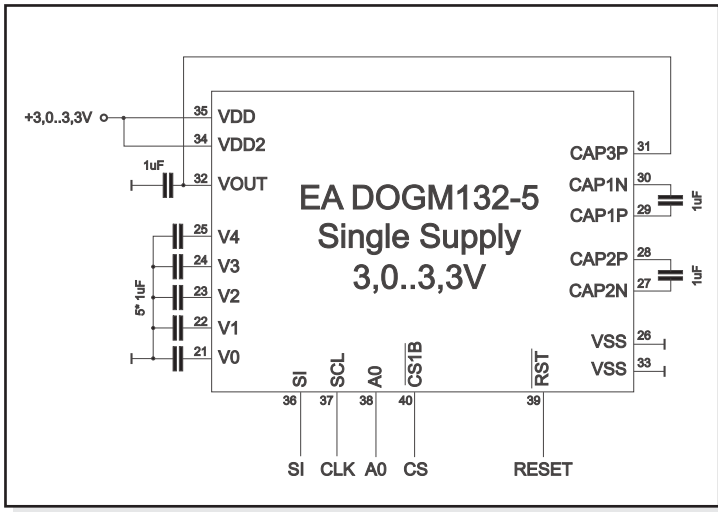
| Display   | Technology   | Optional backlight                                  | Readability                         | Display color non backlighted | Display color with backlight             | Required backlight      |
|---|--|---|-------------------------------------|-------------------------------|--|-------------------------|
|    | EA DOGM132W<br>FSTN pos.<br>transflective            | usage is possible with and without backlight module | even without backlight readable     | black on white                | black on backlight color                 | white, blue, amber, RGB |
|    | EA DOGM132E<br>STN pos.<br>yellow/green transmissive | backlight module is necessary                       | even without backlight readable     | dark green on yellow/green    | black on yellow/green                    | yellow/green            |
|    | EA DOGM132B<br>STN neg. blue transmissive            | backlight module is necessary                       | ---                                 | ---                           | backlight color on blue~black background | white, yellow/green     |
|   | EA DOGM132S<br>FSTN neg. transmissive                | backlight module is necessary                       | ---                                 | ---                           | backlight color on black background      | white, amber, RGB       |
|  | EA DOGM132L<br>STN pos.<br>yellow/green reflective   | no backlight possible                               | good at "normal" ambient brightness | 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 EA LED55x31-W.



**APPLICATION EXAMPLES**

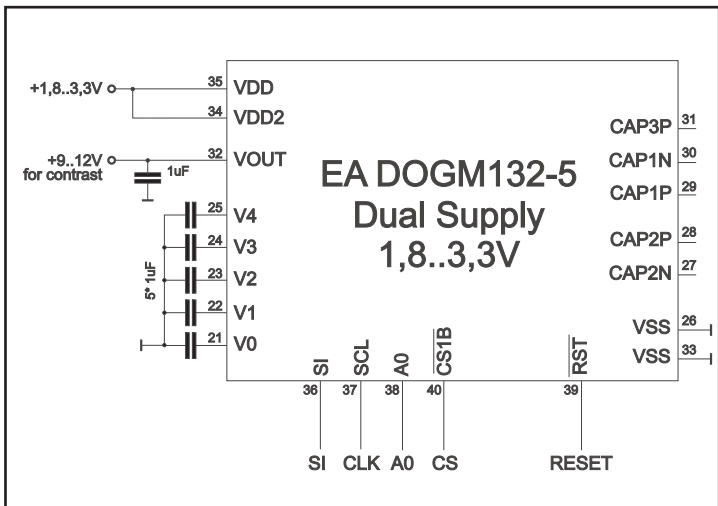
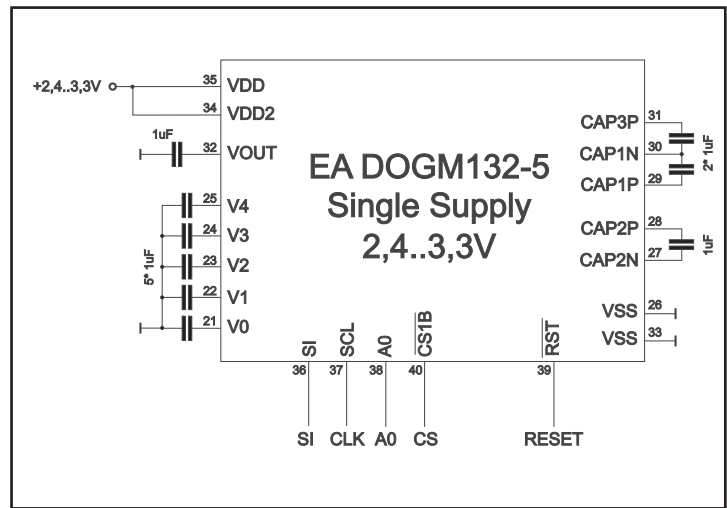


**LOW POWER**

+3.0V or +3.3V (single supply) operation requires 8 external capacitors. Current consumption typ. 110uA

**WIDE RANGE**

The operation on +2.4..+3.3V (single supply) requires 9 external capacitors. Current consumption is typ. 150uA.

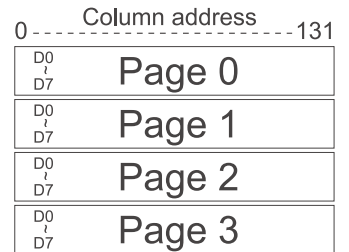


**LOW VOLTAGE**

If an external source of +9..+12V (does not have to be stabilized) is available, the charge pump is not needed and less external components are required. Supply and logic voltage may be 1.8..3.3V

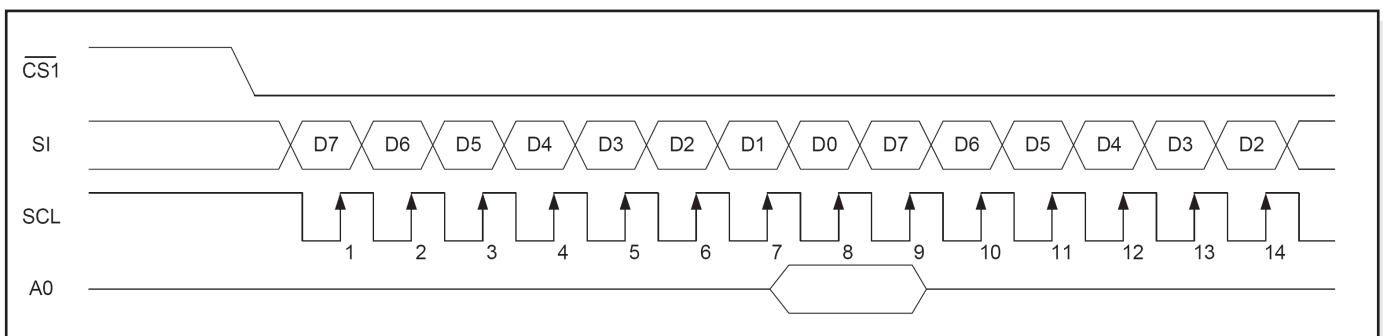
**TABLE OF PROGRAMMING COMMANDS**

| Command   | Command Code |            |    |                         |    |                                  |                |    |               | Function  |   |
|---|--------------|------------|----|-------------------------|----|----------------------------------|----------------|----|---------------|---|---|
|   | A0           | D7         | D6 | D5                      | D4 | D3                               | D2             | D1 | D0            |   |   |
| (1) Display ON/OFF  | 0            | 1          | 0  | 1                       | 0  | 1                                | 1              | 1  | 0             | 1   | LCD display ON/OFF<br>0: OFF, 1: ON   |
| (2) Display start line set  | 0            | 0          | 1  | Display start address   |    |                                  |                |    |               |   | Sets the display RAM display start line address                                 |
| (3) Page address set  | 0            | 1          | 0  | 1                       | 1  | Page address                     |                |    |               | Sets the display RAM page address   |   |
| (4) Column address set upper bit<br>Column address set lower bit  | 0            | 0          | 0  | 0                       | 1  | Most significant column address  |                |    |               | Sets the most significant 4 bits of the display RAM column address.<br>Sets the least significant 4 bits of the display RAM column address. |   |
|   |              | 0          | 0  | 0                       | 0  | Least significant column address |                |    |               |   |   |
| (6) Display data write  | 1            | Write data |    |                         |    |                                  |                |    |               |   | 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<br>0: normal, 1: reverse |
| (9) Display normal/reverse  | 0            | 1          | 0  | 1                       | 0  | 0                                | 1              | 1  | 0             | 1   | Sets the LCD display normal/ reverse<br>0: normal, 1: reverse                   |
| (10) Display all points ON/OFF                                    | 0            | 1          | 0  | 1                       | 0  | 0                                | 1              | 0  | 0             | 0   | Display all points<br>0: normal display<br>1: all points ON                     |
|   |              |            |    |                         |    |                                  |                |    |               | 1   |   |
| (11) LCD bias set   | 0            | 1          | 0  | 1                       | 0  | 0                                | 0              | 1  | 0             | 0   | Sets the LCD drive voltage bias ratio<br>0: 1/9 bias, 1: 1/7 bias (ST7565R)     |
|   |              |            |    |                         |    |                                  |                |    |               | 1   |   |
| (14) Reset  | 0            | 1          | 1  | 1                       | 0  | 0                                | 0              | 1  | 0             | 0   | Internal reset  |
| (15) Common output mode select                                    | 0            | 1          | 1  | 0                       | 0  | 0                                | *              | *  | *             | *   | Select COM output scan direction<br>0: normal direction<br>1: reverse direction |
|   |              |            |    |                         |    |                                  |                |    |               | 1   |   |
| (16) Power control set  | 0            | 0          | 0  | 1                       | 0  | 1                                | Operating mode |    |               | Select internal power supply operating mode   |   |
| (17) V <sub>0</sub> voltage regulator internal resistor ratio set | 0            | 0          | 0  | 1                       | 0  | 0                                | Resistor ratio |    |               | Select internal resistor ratio(Rb/Ra) mode  |   |
| (18) Electronic volume mode set<br>Electronic volume register set | 0            | 1          | 0  | 0                       | 0  | 0                                | 0              | 0  | 1             |   | Set the V <sub>0</sub> output voltage electronic volume register                |
|   |              | 0          | 0  | Electronic volume value |    |                                  |                |    |               |   |   |
| (19) Static indicator ON/OFF<br>Static indicator register set     | 0            | 1          | 0  | 1                       | 0  | 1                                | 1              | 0  | 0             | 0   | 0: OFF, 1: ON<br><br>Set the flashing mode                                      |
|   |              |            |    |                         |    |                                  |                |    |               | 1   |   |
| (20) Booster ratio set  | 0            | 1          | 1  | 1                       | 1  | 1                                | 0              | 0  | 0             | 0   | select booster ratio<br>00: 2x,3x,4x<br>01: 5x<br>11: 6x                        |
|   |              | 0          | 0  | 0                       | 0  | 0                                | 0              | 0  | step-up value |   |   |
| (21) Power save   | 0            |            |    |                         |    |                                  |                |    |               |   | Display OFF and display all points ON compound command                          |
| (22) NOP  | 0            | 1          | 1  | 1                       | 0  | 0                                | 0              | 1  | 1             | 1   | Command for non-operation   |



**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 @3.3V, 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 [www.lcd-module.de/eng/pdf/zubehoer/st7565r.pdf](http://www.lcd-module.de/eng/pdf/zubehoer/st7565r.pdf)





**INITIALISATION EXAMPLE**

Using the internal voltage converter (single supply +2.4V ..+3.3V).  
Applications „LOW POWER“ and „WIDE RANGE“

| Initialisation example for single supply (bottom view) |    |    |    |    |    |    |    |    |    |      |                                    |  |
|--|----|----|----|----|----|----|----|----|----|------|------------------------------------|--|
| Command  | A0 | 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~COM31                  |  |
| (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 1/33)           |  |
| (16) Power control set                                 | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | \$2F | Booster, Regulator and Follower on |  |
| (20) Booster ratio set                                 | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | \$F8 | Set internal Booster to 3x / 4x    |  |
|  |    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | \$00 |                                    |  |
| (17) V0 voltage regulator set                          | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 1  | 1  | \$23 | Contrast set                       |  |
| (18) Electronic volume mode set                        | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | \$81 |                                    |  |
|  |    | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | \$1F |                                    |  |
| (19) Static indicator set                              | 0  | 1  | 0  | 1  | 0  | 1  | 1  | 0  | 0  | \$AC | No indicator                       |  |
|  |    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | \$00 |                                    |  |
| (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) !



Orientation for 6 o'clock (Bottom View)

**INITIALISATION EXAMPLE**

Using an external power supply for contrast (dual power supply).  
Application „LOW VOLTAGE“

| Initialisation example for dual power supply (bottom view) |    |    |    |    |    |    |    |    |    |      |                                     |  |
|--|----|----|----|----|----|----|----|----|----|------|-------------------------------------|--|
| Command  | A0 | 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~COM31                   |  |
| (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 1/33)            |  |
| (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  | 0  | 1  | 1  | \$23 | Contrast set                        |  |
| (18) Electronic volume mode set                            | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | \$81 |                                     |  |
|  |    | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | \$1F |                                     |  |
| (19) Static indicator set                                  | 0  | 1  | 0  | 1  | 0  | 1  | 1  | 0  | 0  | \$AC | No indicator                        |  |
|  |    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | \$00 |                                     |  |
| (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 rotates the 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.

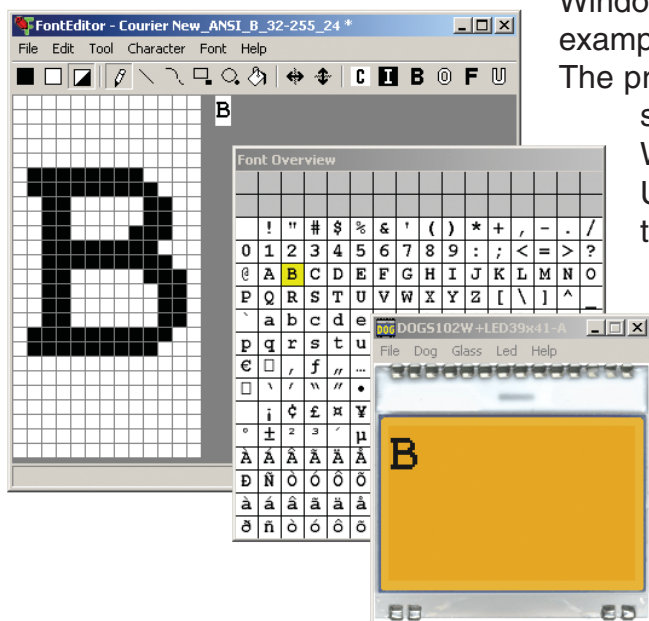


*Orientation for 12 o'clock (Top View)*

| Initialisation example top view |    |    |    |    |    |    |    |    |    |      |                    |
|---------------------------------|----|----|----|----|----|----|----|----|----|------|--------------------|
| Command                         | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Hex  | Remark             |
| (8) ADC set                     | 0  | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | \$A0 | ADC normal         |
| (15) Common output mode select  | 0  | 1  | 1  | 0  | 0  | 1  | 0  | 0  | 0  | \$C8 | Reverse COM31-COM0 |

**CHARACTER SET AND FONT EDITOR (ACCESSORY)**

With the ordering code EA USBSTICK-FONT a memory stick comes with various character sets, especially made for this small display EA DOGM132-5. An import function allows additionally to use Windows fonts. With the FontEditor it is easy to generate for example Cyrillic, Greek and Arabic fonts.



The preview function shows immediately the size and style in simulation window.

When the testboard EA 9780-2USB is connected to the USB port, you can see the character (or any predefined text) live on the display !

No need to say that the export function generates a C- and Basic source code as an include file to your software.

Included is also a software that is called BitmapEdit. With that it becomes easy to convert standard \*.bmp files into the EA DOGM132-5 format.

**USB-TEST BOARD EA 9780-4USB**

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 be displayed directly on the connected display. You will find more information on the test board in the EA 9780-4USB data sheet.

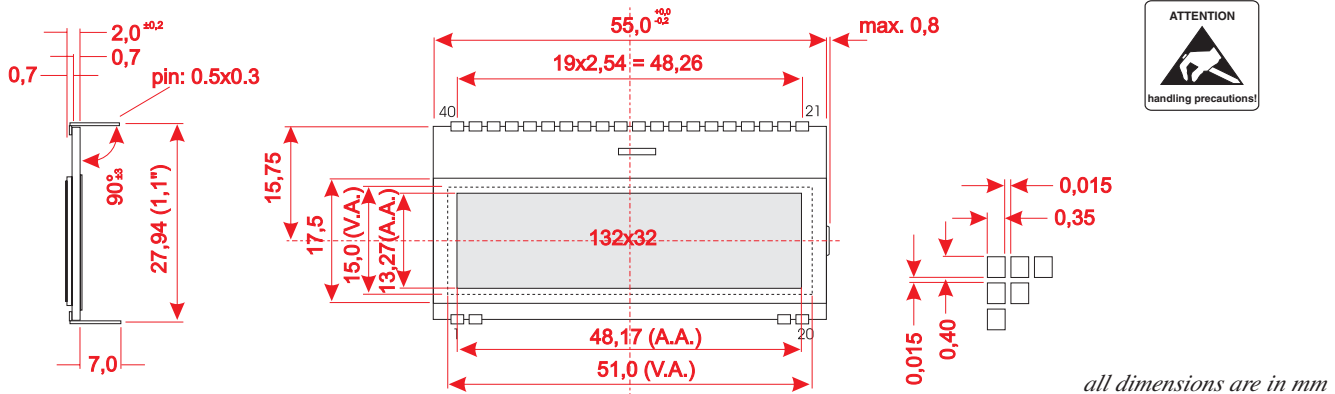
**SIMULATION WITH WINDOWS**

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:

[www.lcd-module.de/fileadmin/downloads/startdog\\_v45.zip](http://www.lcd-module.de/fileadmin/downloads/startdog_v45.zip)



**DIMENSION DISPLAY**



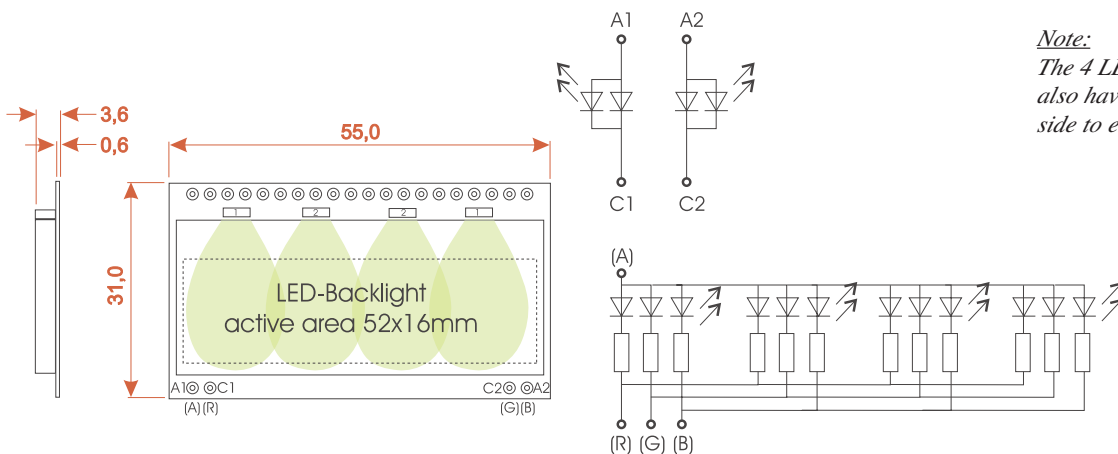
all dimensions are in mm

| Pin | Symbol | Level | Function             | Pin | Symbol | Level | Function                 |
|-----|--------|-------|----------------------|-----|--------|-------|--------------------------|
| 1   | NC     |       | (A1+: LED backlight) | 21  | V0     | -     | LC Drive                 |
| 2   | NC     |       | (C1-: LED backlight) | 22  | V1     | -     | LC Drive                 |
| 3   |        |       |                      | 23  | V2     | -     | LC Drive                 |
| 4   |        |       |                      | 24  | V3     | -     | LC Drive                 |
| 5   |        |       |                      | 25  | V4     | -     | LC Drive                 |
| 6   |        |       |                      | 26  | VSS    | L     | Power Supply 0V (GND)    |
| 7   |        |       |                      | 27  | CAP2N  | -     | Voltage Converter        |
| 8   |        |       |                      | 28  | CAP2P  | -     | Voltage Converter        |
| 9   |        |       |                      | 29  | CAP1P  | -     | Voltage Converter        |
| 10  |        |       |                      | 30  | CAP1N  | -     | Voltage Converter        |
| 11  |        |       |                      | 31  | CAP3P  | -     | Voltage Converter        |
| 12  |        |       |                      | 32  | VOUT   | -     | Voltage Output +9..12V   |
| 13  |        |       |                      | 33  | VSS    | L     | Power Supply 0V (GND)    |
| 14  |        |       |                      | 34  | VDD2   | H     | Power Supply Booster     |
| 15  |        |       |                      | 35  | VDD    | H     | Power Supply +1.8..3.3V  |
| 16  |        |       |                      | 36  | SI     | H / L | Serial Data In           |
| 17  |        |       |                      | 37  | SCL    | H / L | Serial Clock             |
| 18  |        |       |                      | 38  | A0     | H / L | L= Command, H= Data      |
| 19  | NC     |       | (C2-: LED backlight) | 39  | RST    | L     | Reset (active low)       |
| 20  | NC     |       | (A2+: LED backlight) | 40  | CS1B   | L     | Chip Select (active low) |

Note:

- 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 those before mounting.
- Make sure that either display nor backlight will never come into contact with any kind of liquid like fluxer, cleaner or water.

**DIMENSION BACKLIGHT (OPTIONALLY)**



all dimensions are in mm

Note:

The 4 LED pins A1/A2 and C1/C2 also have to be soldered from top side to ensure good contact.



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