

# LCD-MODULE 2x16 - 6.68mm

## INCL. CONTROLLER HD44780

3.2008

no mounting  
required



EA DIP162-DHNLED  
68 x 27 x 11 mm

### FEATURES

- \* HIGH CONTRAST LCD SUPERTWIST DISPLAY
- \* EA DIP162-DNLED: YELLOW/GREEN WITH LED BACKLIGHT
- \* EA DIP162-DN3LW AND DIP162J-DN3LW WITH WHITE LED B/L., LOW POWER
- \* INCL. HD 44780 OR COMPATIBLE CONTROLLER
- \* INTERFACE FOR 4- AND 8-BIT DATA BUS
- \* POWER SUPPLY +5V OR  $\pm 2.7$ V OR  $\pm 3.3$ V
- \* OPERATING TEMPERATURE  $0 \sim +50^{\circ}\text{C}$  (-DN3LW, -DHNLED:  $-20 \sim +70^{\circ}\text{C}$ )
- \* LED BACKLIGHT Y/G max. 150mA@+25°C
- \* LED BACKLIGHT WHITE max. 45mA@+25°C
- \* SOME MORE MODULES WITH SAME MECHANIC AND SAME PINOUT:
  - DOTMATRIX 1x8, 4x20
  - GRAPHIC 122x32
- \* NO SCREWS REQUIRED: SOLDER ON IN PCB ONLY
- \* DETACHABLE VIA 9-PIN SOCKET EA B200-9 (2 PCS. REQUIRED)

### ORDERING INFORMATION

LCD MODULE 2x16 - 6.68mm WITH BACKLIGHT Y/G  
SAME BUT WITH  $T_{OP.} -20..+70^{\circ}\text{C}$  INCL. TEMP. COMPENSATION  
SAME IN BLUE-WHITE OPTIC,  $T_{OP.} -20..+70^{\circ}\text{C}$  INCL. TEMP. COMP.  
SAME IN BLACK&WHITE,  $T_{OP.} -20..+70^{\circ}\text{C}$  INCL. TEMP. COMP.  
9-PIN SOCKET, HEIGHT 4.3mm (1 PC.)  
SUITABLE BEZEL (WINDOW 60.0x14.8 mm)  
ADAPTOR PCB WITH STANDARD PINOUT PITCH 2.54mm

EA DIP162-DNLED  
EA DIP162-DHNLED  
EA DIP162-DN3LW  
EA DIP162J-DN3LW  
EA B200-9  
EA 017-2UKE  
EA 9907-DIP

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## Pinout

| Pin | Symbol | Level | Function                    | Pin | Symbol  | Level | Function                   |
|-----|--------|-------|-----------------------------|-----|---------|-------|----------------------------|
| 1   | VSS    | L     | Power Supply 0V (GND)       | 10  | D3      | H / L | Display Data               |
| 2   | VDD    | H     | Power Supply +5V            | 11  | D4 (D0) | H / L | Display Data               |
| 3   | VEE    | -     | Contrast adjust. (about 0V) | 12  | D5 (D1) | H / L | Display Data               |
| 4   | RS     | H / L | H=Command, L=Data           | 13  | D6 (D2) | H / L | Display Data               |
| 5   | R/W    | H / L | H=Read, L=Write             | 14  | D7 (D3) | H / L | Display Data, MSB          |
| 6   | E      | H     | Enable (falling edge)       | 15  | -       | -     | NC (see EA DIP122-5N)      |
| 7   | D0     | H / L | Display Data, LSB           | 16  | -       | -     | NC (see EA DIP122-5N)      |
| 8   | D1     | H / L | Display Data                | 17  | A       | -     | LED B/L+ Resistor required |
| 9   | D2     | H / L | Display Data                | 18  | C       | -     | LED B/L -                  |

## Contrast Adjustment

Contrast voltage for all displays of EA DIP162-D series is typ. 5V. That means that for 3.3V operation an additional negative voltage of min. 1.7V is required.

Display modules for -20..+70°C are equipped with an on-board temperature compensation. So there's no more need for contrast adjustment while operation anymore.

## Backlight

Using the LED backlight requires an current source or external current-limiting resistor. Forward voltage for yellow/green backlight is 3.9~4.2V and for white LED backlight 3.0~3.6V. Please take care of derating for  $T_a > +25^\circ\text{C}$

**Note:** Do never drive backlight direct to 5V; immediately damage my happen !

## Character set

Character set shown below is already built in. In addition to that you are able to define up to 8 characters by yourself.

| Lower 4 bit     | Upper 4 bit | 0000 (\$0x) | 0010 (\$2x) | 0011 (\$3x) | 0100 (\$4x) | 0101 (\$5x) | 0110 (\$6x) | 0111 (\$7x) | 1010 (\$Ax) | 1011 (\$Bx) | 1100 (\$Cx) | 1101 (\$Dx) | 1110 (\$Ex) | 1111 (\$Fx) |
|-----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| xxxx0000 (\$x0) | CG RAM (0)  |             | 0           | 1           | 2           | 3           | 4           | 5           | 6           | 7           | 8           | 9           | A           | B           |
| xxxx0001 (\$x1) | (1)         | !           | !           | A           | Q           | a           | q           |             | .           | 7           | 7           | 4           | ä           | q           |
| xxxx0010 (\$x2) | (2)         | "           | 2           | B           | R           | b           | r           |             | r           | イ           | ツ           | ノ           | ß           | ö           |
| xxxx0011 (\$x3) | (3)         | #           | 3           | C           | S           | c           | s           |             | 」           | ウ           | フ           | エ           | ε           | ω           |
| xxxx0100 (\$x4) | (4)         | \$          | 4           | D           | T           | d           | t           |             | 、           | I           | ト           | ハ           | μ           | Ω           |
| xxxx0101 (\$x5) | (5)         | %           | 5           | E           | U           | e           | u           |             | =           | オ           | ナ           | ユ           | σ           | Ü           |
| xxxx0110 (\$x6) | (6)         | &           | 6           | F           | V           | f           | v           |             | ヲ           | カ           | ニ           | ヨ           | ρ           | Σ           |
| xxxx0111 (\$x7) | (7)         | '           | 7           | G           | W           | g           | w           |             | ア           | キ           | ヌ           | ウ           | g           | π           |
| xxxx1000 (\$x8) | CG RAM (0)  | (           | 8           | H           | X           | h           | x           |             | イ           | ク           | ネ           | リ           | フ           | Σ           |
| xxxx1001 (\$x9) | (1)         | )           | 9           | I           | Y           | i           | y           |             | ウ           | ケ           | ル           | ル           | フ           | γ           |
| xxxx1010 (\$xA) | (2)         | *           | :           | J           | Z           | j           | z           |             | エ           | コ           | ハ           | レ           | j           | ≠           |
| xxxx1011 (\$xB) | (3)         | +           | ;           | K           | [           | k           | [           |             | オ           | サ           | ヒ           | ロ           | ×           | π           |
| xxxx1100 (\$xC) | (4)         | ,           | <           | L           | ¥           | l           | l           |             | ハ           | シ           | フ           | ワ           | Φ           | Π           |
| xxxx1101 (\$xD) | (5)         | -           | =           | M           | ]           | m           | ]           |             | ユ           | ズ           | ヘ           | ン           | ℓ           | ÷           |
| xxxx1110 (\$xE) | (6)         | .           | >           | N           | ^           | n           | →           |             | ヨ           | セ           | ホ           | ン           | ñ           |             |
| xxxx1111 (\$xF) | (7)         | /           | ?           | O           | _           | o           | ←           |             | ッ           | ソ           | マ           | ン           | ö           | ■           |

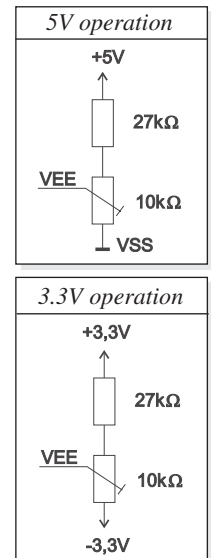


Table of command

| Instruction                | Code |     |            |      |      |      |      |      |      |      | Description                                                                                               | Execute Time (max.)                                                                                                                                     |        |
|----------------------------|------|-----|------------|------|------|------|------|------|------|------|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
|                            | RS   | R/W | DB 7       | DB 6 | DB 5 | DB 4 | DB 3 | DB 2 | DB 1 | DB 0 |                                                                                                           |                                                                                                                                                         |        |
| Clear Display              | 0    | 0   | 0          | 0    | 0    | 0    | 0    | 0    | 0    | 1    | Clears all display and returns the cursor to the home position (Address 0).                               | 1.64ms                                                                                                                                                  |        |
| Cursor At Home             | 0    | 0   | 0          | 0    | 0    | 0    | 0    | 0    | 0    | 1    | *                                                                                                         | Returns the Cursor to the home position (Address 0). Also returns the display being shifted to the original position. DD RAM contents remain unchanged. | 1.64ms |
| Entry Mode Set             | 0    | 0   | 0          | 0    | 0    | 0    | 0    | 0    | 1    | I/D  | S                                                                                                         | Sets the Cursor move direction and specifies or not to shift the display. These operation are performed during data write and read.                     | 40μs   |
| Display On/Off Control     | 0    | 0   | 0          | 0    | 0    | 0    | 0    | 1    | D    | C    | B                                                                                                         | Sets ON/OFF of all display (D) cursor ON/OFF (C), and blink of cursor position character (B).                                                           | 40μs   |
| Cursor / Display Shift     | 0    | 0   | 0          | 0    | 0    | 0    | 1    | S/C  | R/L  | *    | *                                                                                                         | Moves the Cursor and shifts the display without changing DD RAM contents.                                                                               | 40μs   |
| Function Set               | 0    | 0   | 0          | 0    | 0    | 1    | DL   | N    | F    | *    | *                                                                                                         | Sets interface data length (DL) number of display lines (L) and character font (F).                                                                     | 40μs   |
| CG RAM Address Set         | 0    | 0   | 0          | 1    | ACG  |      |      |      |      |      |                                                                                                           | Sets the CG RAM address. CG RAM data is sent and received after this setting.                                                                           | 40μs   |
| DD RAM Address Set         | 0    | 0   | 1          | ADD  |      |      |      |      |      |      | Sets the DD RAM address. DD RAM data is sent and received after this setting.                             | 40μs                                                                                                                                                    |        |
| Busy Flag / Address Read   | 0    | 1   | BF         | AC   |      |      |      |      |      |      | Reads Busy flag (BF) indicating internal operation is being performed and reads address counter contents. | -                                                                                                                                                       |        |
| CG RAM / DD RAM Data write | 1    | 0   | Write Data |      |      |      |      |      |      |      | Writes data into DD RAM or CG RAM                                                                         | 40μs                                                                                                                                                    |        |
| CG RAM / DD RAM Data Read  | 1    | 1   | Read Data  |      |      |      |      |      |      |      | Reads data from DD RAM or CG RAM                                                                          | 40μs                                                                                                                                                    |        |

### Creating your own characters

All these character display modules got the feature to create 8 own characters (ASCII Codes 0..7) in addition to the 192 ROM fixed 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".

| Set CG RAM Address |       |       |      |  | Data |   |   |   |   |   |   |   |     |  |  |
|--------------------|-------|-------|------|--|------|---|---|---|---|---|---|---|-----|--|--|
| Adresse            |       |       | Hex  |  | Bit  |   |   |   |   |   |   |   | Hex |  |  |
|                    |       |       |      |  | 7    | 6 | 5 | 4 | 3 | 2 | 1 | 0 |     |  |  |
| 0 1                | 0 0 0 | 0 0 0 | \$40 |  |      |   |   |   |   |   |   |   |     |  |  |
|                    |       | 0 0 1 | \$41 |  |      |   |   |   |   |   |   |   |     |  |  |
|                    |       | 0 1 0 | \$42 |  |      |   |   |   |   |   |   |   |     |  |  |
|                    |       | 0 1 1 | \$43 |  |      |   |   |   |   |   |   |   |     |  |  |
|                    |       | 1 0 0 | \$44 |  |      |   |   |   |   |   |   |   |     |  |  |
|                    |       | 1 0 1 | \$45 |  |      |   |   |   |   |   |   |   |     |  |  |
|                    |       | 1 1 0 | \$46 |  |      |   |   |   |   |   |   |   |     |  |  |
|                    |       | 1 1 1 | \$47 |  |      |   |   |   |   |   |   |   |     |  |  |

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### INITIALISATION FOR A 2 LINE DISPLAY / 8-BIT MODE

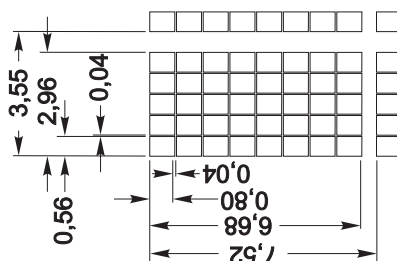
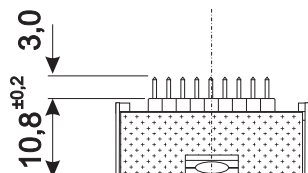
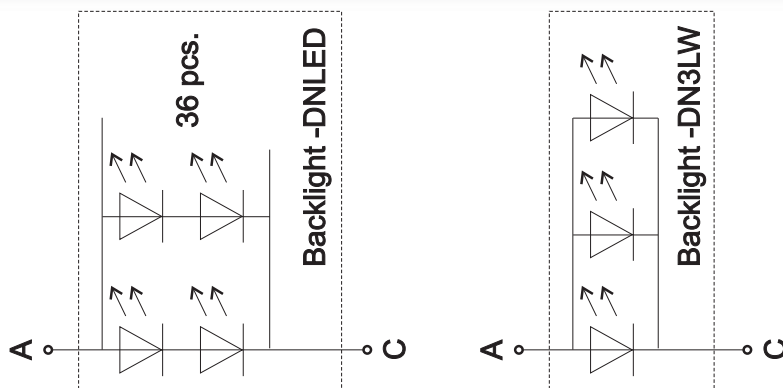
| Command        | RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Remark                                   |
|----------------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------------------------------------------|
| Function Set   | 0  | 0   | 0   | 0   | 1   | 1   | 1   | 0   | 0   | 0   | 8-Bit Data Length, 2/4 lines, 5x7 Font   |
| Display ON/OFF | 0  | 0   | 0   | 0   | 0   | 0   | 1   | 1   | 1   | 1   | Display on, Cursor visible, Cursor blink |
| Clear Display  | 0  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | Clear Display, Cursor Home               |
| Entry Mode Set | 0  | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 1   | 0   | Cursor Auto-Increment                    |

## Page 4

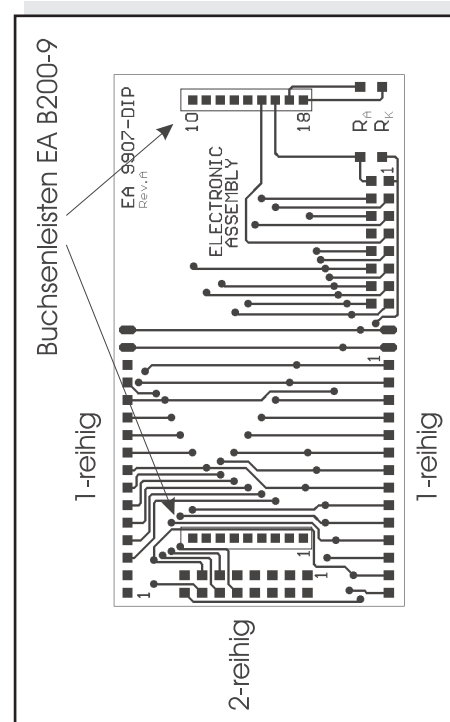
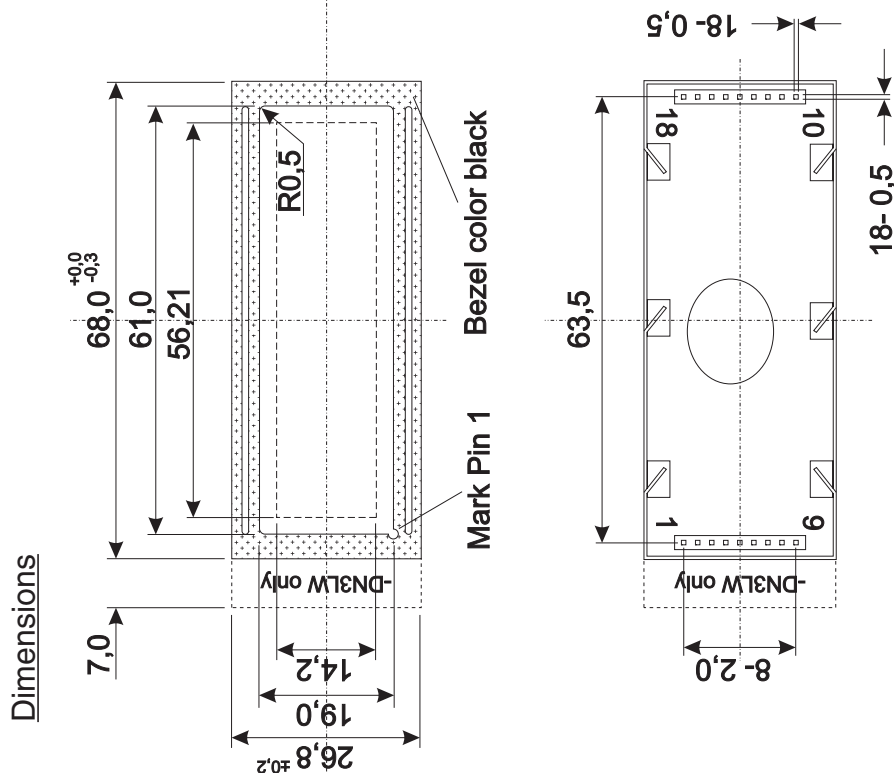
**ATTENTION**



handling precautions!



*all dimensions are in mm*



Test board for standard pinout 2.54mm  
EA 9907-DIP

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