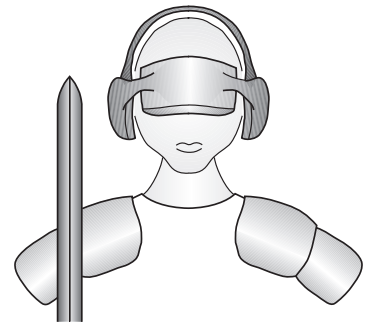# AN7: Efficient Backlight Supply for LCD Modules

Using LED-Warrior01 with LCDs

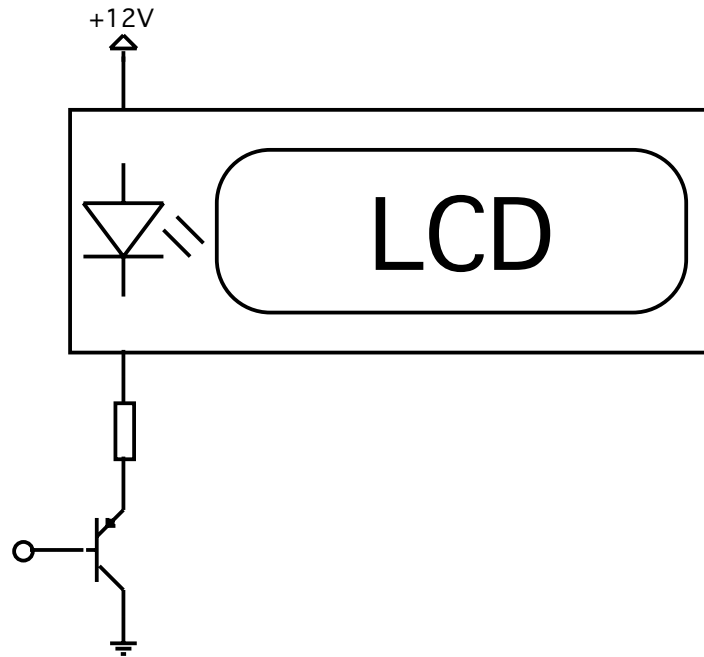**Code Mercenaries**

1. Overview

Many LCD modules which are used in industry applications use LEDs for the backlight. Typically these backlights have forward voltages around 4V with currents ranging to 1A.

The classic transistor plus resistor method for supplying the current to the backlight and putting it under software control has the downside of wasting a lot of energy. Using a LED-Warrior01 to supply the power to the backlight can significantly cut the power required for the backlight and also reduces waste heat in the system.

2. Classic method

The classic method to supply the backlight is to use a series resistor and if switching the backlight is required a transistor. The circuit will typically look somewhat like this:

Usually this circuit wastes about 30-60% of the energy in the series resistor and the transistor. Using a lower supply voltage would help, but if software control of the backlight is required the forward voltage of the transistor has to be taken into account.

If the combined forward voltages of the transistor and the backlight LEDs are larger than the supply voltage this results in a dim backlight since the current will be lower than required.

5V and 12V are the typical voltages available and 5V is usually too low. With 12V the wasted energy is typically twice as much as the energy used by the backlight since the backlights have forward volategs around 4V, so the remaining 8V need to be dropped at the series resistor and transistor.

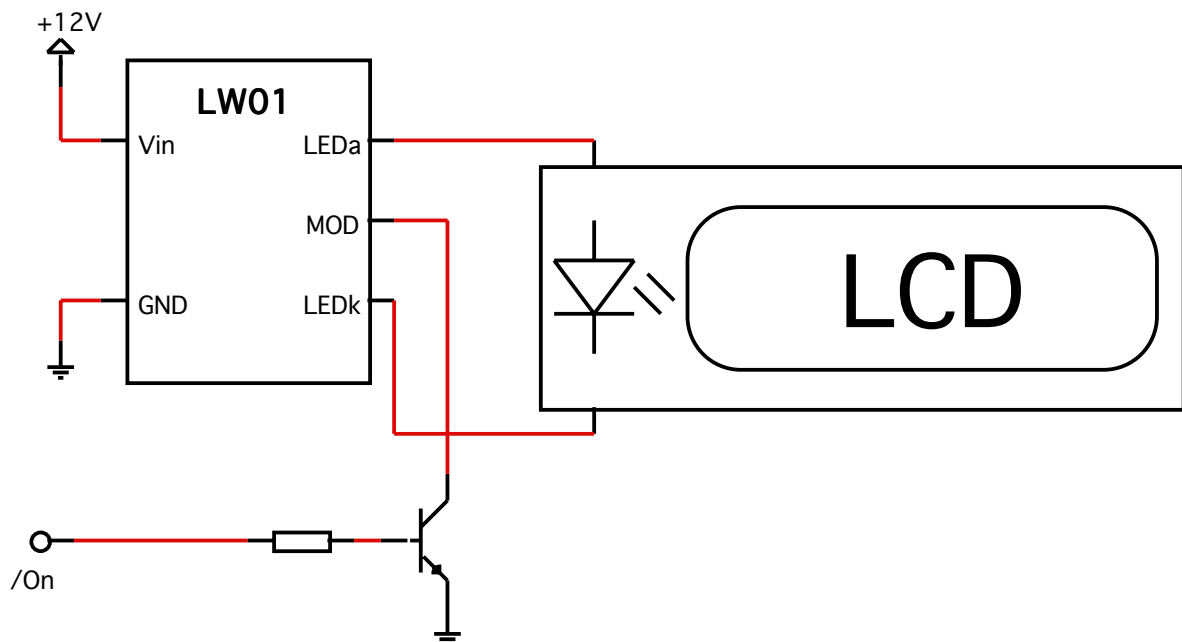### 3. LED-Warrior01 driving the backlight

By using a LED-Warrior01 to drive the backlight the efficiency can be increased to 80% to 85% or even better, depending on the required current, forward voltage of the backlight, and supply voltage.

The input voltage for LED-Warrior01 can range from 7V to 30V, the typically available 12V would be well suited for this.

Controlling the backlight can be done by a open collector output. Optionally dimming the backlight by using a PWM signal on this open collector output is possible.
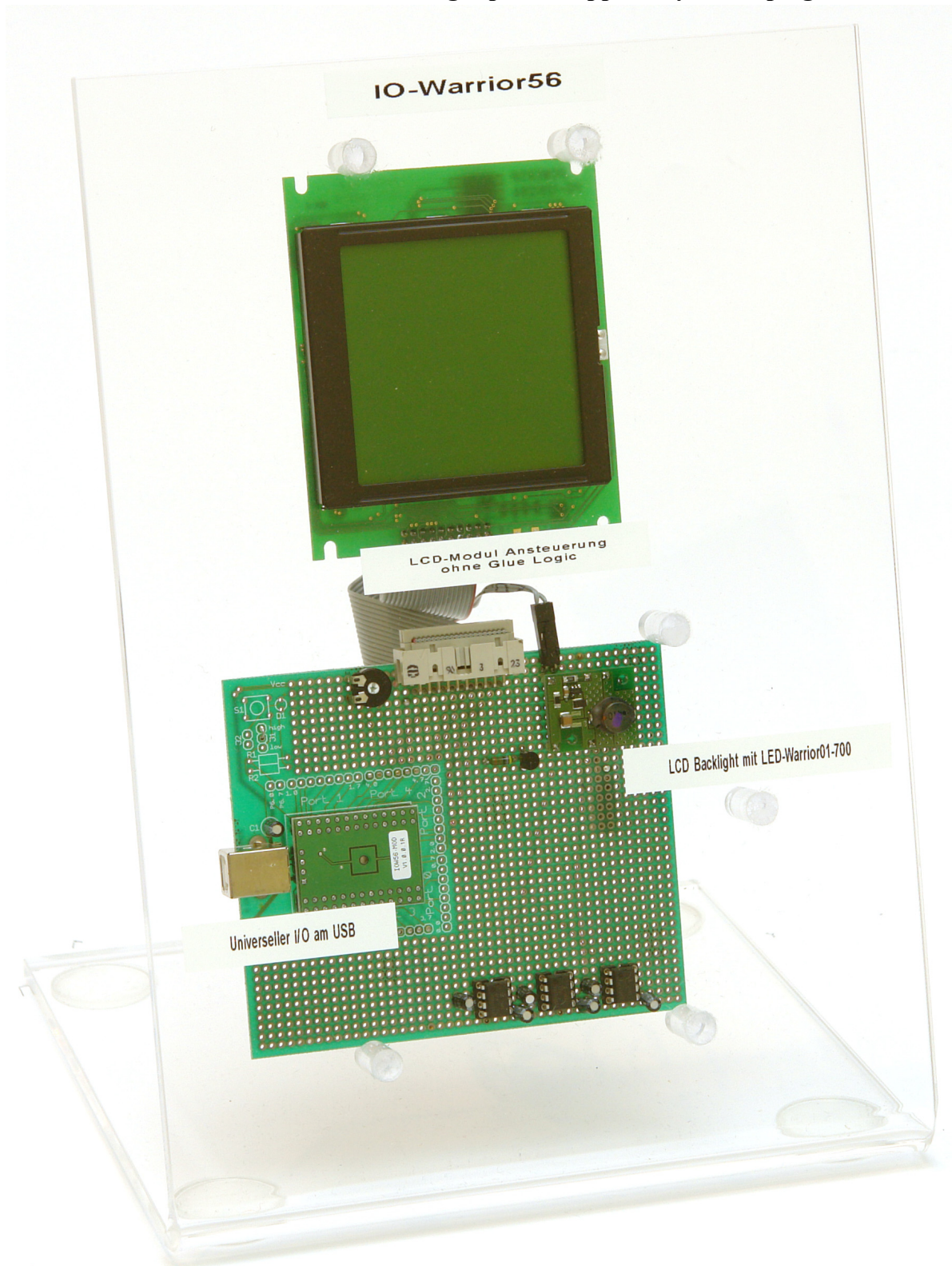
Following is a circuit diagram that shows how the LED-Warrior01 may be connected to drive the backlight. An open collector inverter is included so the backlight gets enabled when the /On input is pulled low. If an open collector or open drain output is available it can be directly connected to the MOD input of LED-Warrior01, in this case pulling the singal low disables the backlight.

A PWM signal up to 1kHz can be used to control the LED-Warrior01 to achieve 100:1 dimming range.

Demo setup of a LCD module controlled via USB by a IO-Warrior56 with the backlight driven by a LED-Warrior01-700, backlight power supplied by a wall plug

Legal Stuff

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