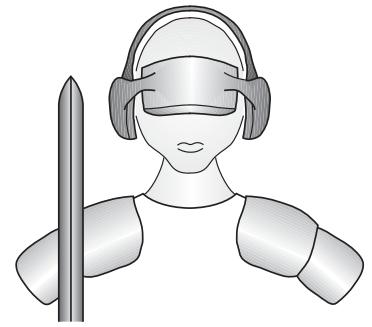


LED-Warrior18

I2C to dual PWM LED driver



Code Mercenaries

1. Features

- I2C to dual PWM LED driver
- 2 x 16 bit PWM ranging from 0.001% to 100%
- PWM output at 730 Hz
- Programmable period length for higher frequency/lower resolution
- 8 Bit data to log mapping available
- Synch mode for controlling multiple units
- Default power on status programmable
- Minimal external circuitry
- 5 V supply

1.1 Variants

LED-Warrior18 is available in SOIC8 package and as a module.

1.2 LW18-01MOD

The LW18-01MOD is a ready to use module. It works as a I2C to dual PWM LED driver and needs a 5 V power supply.

1.3 Custom variants

Custom variants are possible for the chips as well as for the modules.

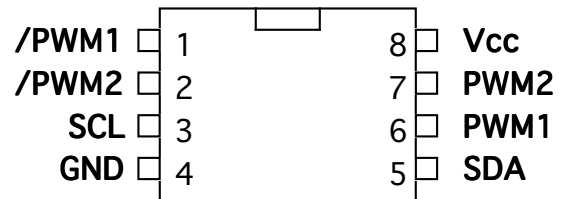
2. Functional overview

LED-Warrior18 is an I2C slave device. It accepts 16 bit or 8 bit data for the two PWM outputs. 8 Bit data is internally mapped to a logarithmic scale, to allow seamless dimming. Optionally the mapping can be switched off.

The power on values for both PWM outputs can be set. This allows LW18 to be used stand alone for a fixed PWM signal.

A sync mode is available in which brightness values are preloaded to each LW18 and then activated on all LW18 on the same bus by a broadcast command. This allows multiple LW18 on the same I2C bus to simultaneously change to new values.

3. Pin descriptions (Chip SOIC-8)



Vcc

5 V supply voltage positive input.

GND

Supply voltage negative input.

SDA

Data line of I2C interface.

High impedance input and open drain output.

SCL

Clock line of I2C interface.

High impedance input and open drain output.

PWM1

730 Hz PWM1 signal output. Positive logic.
high = power on to lamps.

Constant low for off, constant high for maximum.
CMOS level output.

/PWM1

Inverted PWM1 signal. Negative logic.
high = power off on lamps.

Constant high for off, constant low for maximum.
CMOS level output.

PWM2

730 Hz PWM2 signal output. Positive logic.
high = power on to lamps.

Constant low for off, constant high for maximum.
CMOS level output.

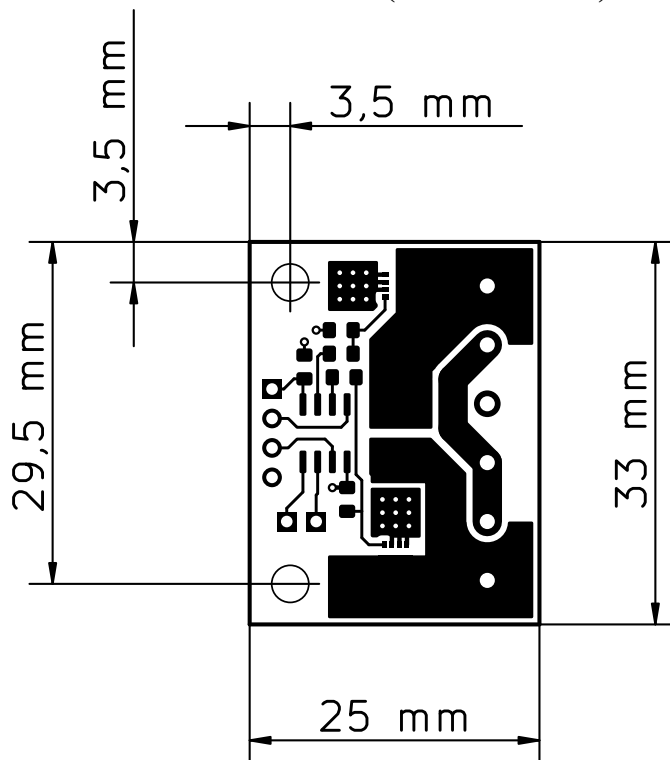
/PWM2

Inverted PWM2 signal. Negative logic.
high = power off on lamps.

Constant high for off, constant low for maximum.
CMOS level output.

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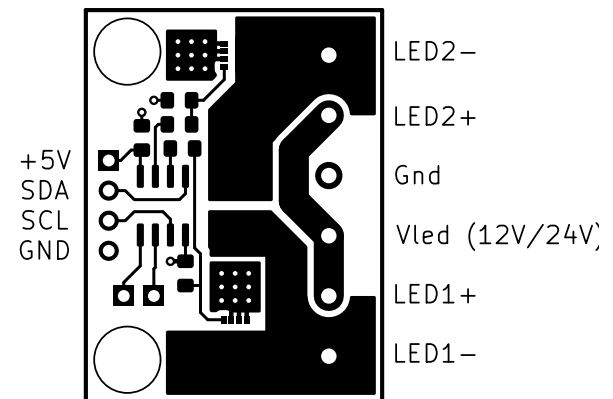
3.1 Mechanical dimensions (LW18-01MOD)



Dimensions in mm
 Height at thickest point: 3.2 mm
 Mounting holes: 3.2 mm
 Tolerances, outer contour: ± 0.2 mm

Terminal blocks are not installed on the standard version of the module.

3.2 Pin descriptions (LW18-01MOD)



SDA
 Data line of I2C interface.
 High impedance input and open drain output.

SCL
 Clock line of I2C interface.
 High impedance input and open drain output.

+5V
 Positive supply voltage input. +5 V required.

GND
 Ground supply voltage.

LED1-
 PWM1 output. Provides a chopped ground to directly drive constant voltage LED assemblies. Connect the cathode end of the LEDs here and the anode to the positive power supply. Up to 4 A.

LED2-
 PWM2 output. Provides a chopped ground to directly drive constant voltage LED assemblies. Connect the cathode end of the LEDs here and the anode to the positive power supply. Up to 4 A.

Gnd
 Common ground for the two PWM outputs. Connect to the ground of the LED power supply.

Vled
 Connect the positive supply for the LEDs here.

LED1+, LED2+
 Connect the anode ends of the LEDs here. Directly connected to Vled.

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4. I2C addressing

The factory default I2C address of LED-Warrior18 is \$20 (7 bit value, will be shifted and extended by R/W bit). Reassigning a different base address is possible via I2C command.

4.1 I2C commands

Commands are implemented via register addresses that are transmitted as the first byte following the I2C address byte. Reading from registers is done by first doing a write transaction transmitting the I2C address and the register number, then a restart and a read transaction.

The register number is always reset to zero at the end of a transaction, so reading without first writing a register address always returns the content of the "Command" register.

Register	R/W	Function	Data
\$00	R/W	Command	1 Byte
\$01	R/W	16 bit PWM	4 Bytes
\$02	W	8 bit PWM	2 Bytes
\$03	W	Period	4 Bytes
\$F0	R	Signature	6 Bytes
\$FE	W	Set Addr	2 Bytes

4.2 Command register

The command register is one byte that has two bit that are used.

Bit 0 sets the sync mode. If \$01 is send to the command register LW18 will enter sync mode. Sending \$00 will reset sync mode. The sync status can be read back from the register.

Command \$80 will write the current 16 bit PWM values to internal Flash ROM. The next time LW18 gets powered up it will set the PWM outputs to these values.

Command register bits:

- 0 - Sync mode
- 1 - Lin mapping
- 2 - not used, write 0
- 3 - not used, write 0
- 4 - not used, write 0
- 5 - not used, write 0
- 6 - not used, write 0
- 7 - Write values to Flash

4.3 16 bit PWM register

This register holds the current PWM value, or in case of sync mode the last preload values for the PWM outputs. The register can be read and it will be written to the Flash ROM when the write command is issued.

The format of the register is:

- PWM1 - LSB
- PWM1 - MSB
- PWM2 - LSB
- PWM2 - MSB

4.4 8 bit PWM register

One byte each for PWM1 and PWM2 can be written to this register. The value then gets linearly or logarithmically mapped to 16 bit values and stored in the 16 bit PWM register.

4.5 Period register

If less than 16 bits resolution is fine but a higher PWM frequency is required it is possible to set the period of the signal to a different value. This registers holds two bytes for each channel. The values in this register set the period for the PWM signal by dividing the internal 48 MHz master clock by n+1.

The PWM values have to be adjusted accordingly. Any PWM values \geq period will result in a 100% signal. The PWM value is the number of PWM master clock cycles before the PWM output goes inactive.

The period register is not written to the Flash ROM.

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4.5 Signature register

The signature register can be used to identify LED-PWM Warrior18 and get the revision information for the chips firmware. The content of the signature is fixed and can not be changed. It contains 6 bytes with the following content:

- 0 - Vendor MSB
- 1 - Vendor LSB
- 2 - Product MSB
- 3 - Product LSB
- 4 - Version MSB
- 5 - Version LSB

The 16 bit VendorID allows us to differentiate standard and custom chips. Standard chips use 0 as our ID.

Product is a 16 bit product code, LED-Warrior18 has 18 as its product code value.

Version is the four digit BCD version number identifying the chips firmware version. I.e. V1.0.3.5 would be stored as \$1035.

4.6 Set Address register

With the Set Address register it is possible to move LW18 to a different I2C address.

To prevent address reprogramming by mistake the address has to be send in normal and inverted format to register \$FE. The address is transmitted in 7 bit right aligned format (i.e. values range from 1 to 127).

The value 0 and 128 and more are not accepted.

The first byte has to contain the address in normal format (i.e. values 0 to 127), the second byte must contain the value of the first byte XORed with \$FF.

4.7 Broadcast command

LW18 accepts one broadcast command that will copy the 16 bit PWM values to the PWM generators.

When running in sync mode writing to the 16 bit and 8 bit PWM registers does not directly affect the output. The new PWM value wil only be stored but not copied to the PWM generators.

By sending a write transaction to address \$00 followed by the data byte \$0A all LW18 on the I2C bus will be simultaneously commanded to copy the values to the PWM generators.

There is no register number for the broadcast command, you just send the address byte \$00 followed by the command \$0A.

This is the same command as used by LED-Warrior04, so combined setups of LW18 and LW04 can be run in sync.

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5. Absolute maximum ratings (Chip)

Supply voltage (Vcc relative to GND):	-0.5V to +6V
Input voltage into any pin (relative to GND):	GND - 0.5V to Vcc + 0.5V
Input current into any pin:	-25 to +50mA
Storage temperature:	-55°C to +100°C
ESD:	2000V human body model

Absolute maximum ratings must not be exceeded or permanent damage to the LED-Warrior18 may result.

5.1 Operating specifications (Chip)

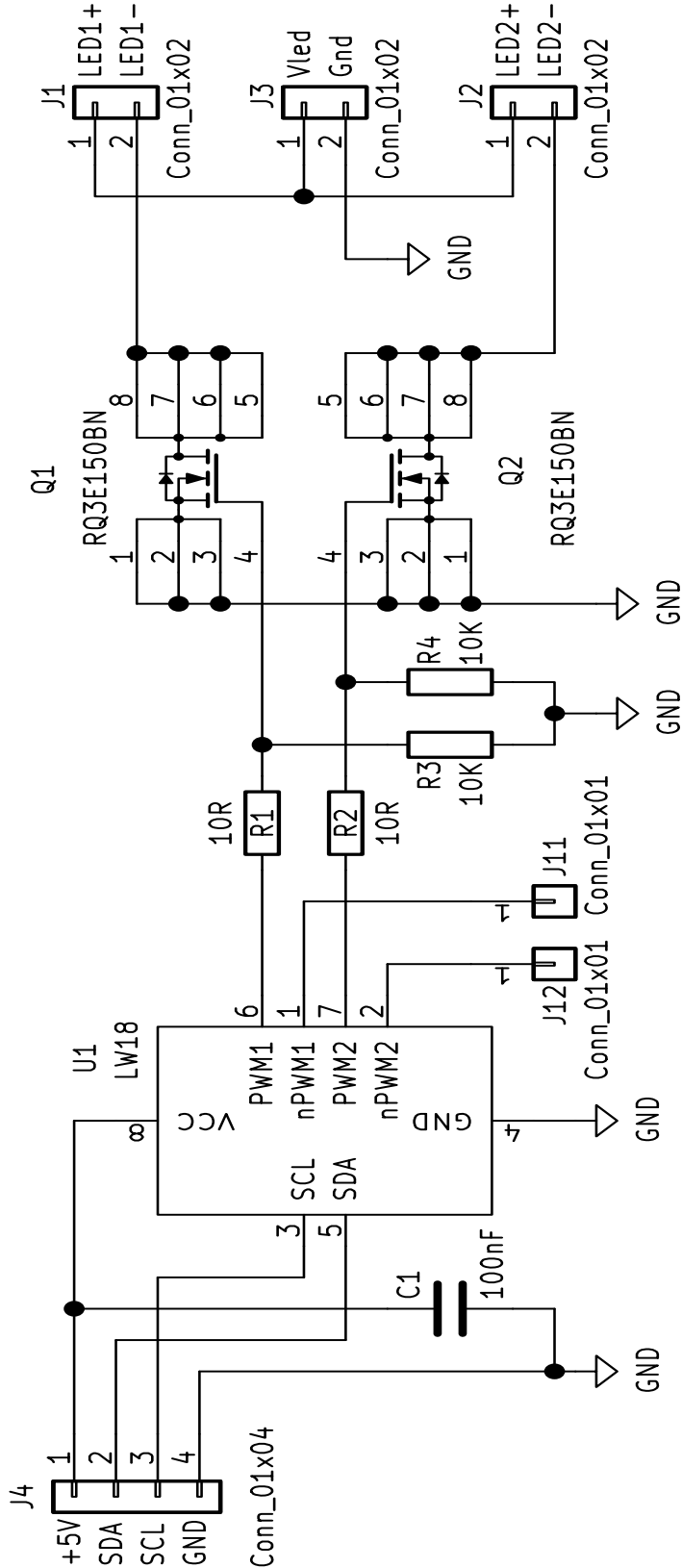
Supply voltage (Vcc relative to GND):	4.5V to 5.25V
Operating temperature:	-40°C to +85°C
Supply current:	8mA max.
Internal pull up resistors:	min. 4kΩ max. 8kΩ typ. 5.6kΩ
Input low voltage:	max. 0.8V
Input high voltage:	min. 2.1V

5.2 Operating specifications (LW18-01MOD)

LED Voltage (PWM1/PWM2 relative to Gnd):	+40V max.
Operating temperature:	-40°C to +85°C
Load sink current: (for each output)	max. 4 A

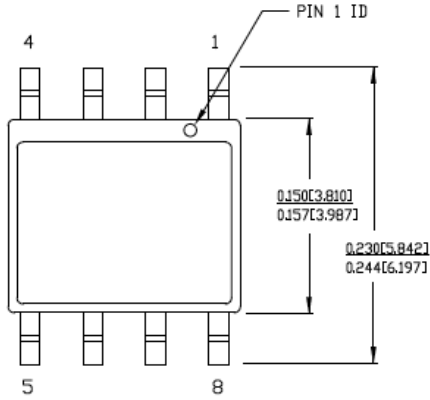
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6. Application circuit (LW18-01MOD)



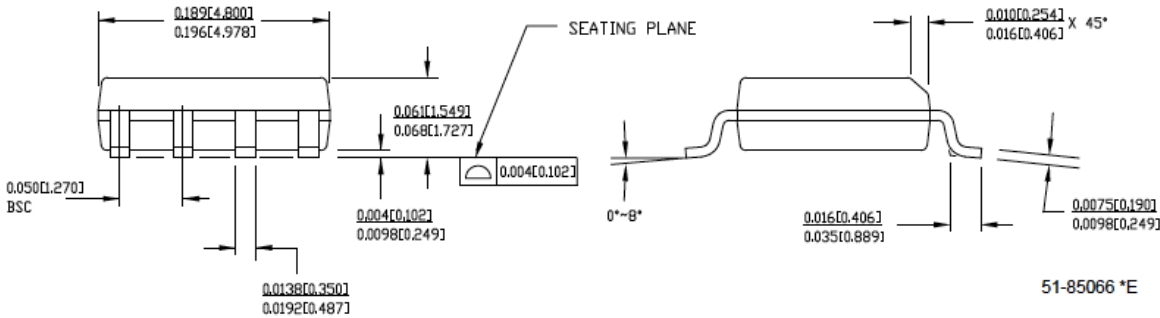
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7. Package dimensions SOIC8



1. DIMENSIONS IN INCHES[MM] MIN. MAX.
2. PIN 1 ID IS OPTIONAL, ROUND ON SINGLE LEADFRAME RECTANGULAR ON MATRIX LEADFRAME
3. REFERENCE JEDEC MS-012
4. PACKAGE WEIGHT 0.07gms

PART #	
S08.15	STANDARD PKG.
SZ08.15	LEAD FREE PKG.



51-85066 *E

LED-Warrior18

8. Ordering information

Partname	Order Code	Package	MOQ	Description
LED-Warrior18-S	LW18-S	SOIC-8	97	I2C to dual PWM LED driver
LED-Warrior18-01MOD	LW18-01MOD	Module	1	I2C to dual PWM LED driver module

The chips and modules listed here are standard products. Customized chips and modules are available on request.

8.1 Packaging info

SOIC-8 chips are packaged in tubes of 97 units each. The SOIC-8 chips are not individually marked and are sold only in full tubes.

The modules are packaged in single units.

8.2 Shipping version

LED-Warrior18 is currently shipping in version V1.0.0.0

8.2.1 Revision History

V1.0.0.0 - Initial shipping version.

8.3 FCC / CE

The LED-Warrior18 is sold as a chip or module to be integrated into a device. As such it can not be FCC or CE approved.

Code Mercenaries has exerted greatest care in designing this chip and module to minimize RF emission and assure safe and stable operation. Though the use of proper cable materials and correct integration into a device is crucial to assure product safety and interference free operation.

The integrator who assembles the module into a device has to take care for appropriate construction and testing.

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