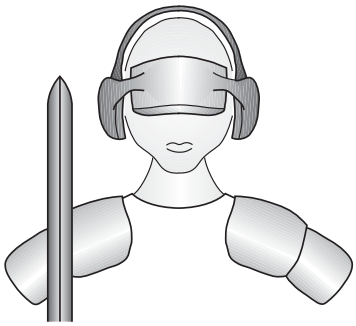
LED-Warrior14

I2C to IEC62386 Interface



Code Mercenaries

1. Features

- IEC62386 type II master
- I2C to IEC62386 bridge
- Can act as master or slave device
- Receives and transmits all 8, 16, and 24 bit telegrams
- According to DIN EN 62386-103/2011
- Minimal external circuitry
- 5 V supply

1.1 Variants

LED-Warrior14 is available in DIL8, SOIC8 packages, or as modules.

1.2 LW14-01MOD

The LW14-01MOD is a ready to use module. It works as a I2C to IEC62386 bridge and needs a 5 V power supply.

1.3 LW14-02MOD

The LW14-02MOD is a ready to use module for stand alone devices. It extracts its power supply from the IEC62386 bus and can provide some power for additional electronics like a RF receiver.

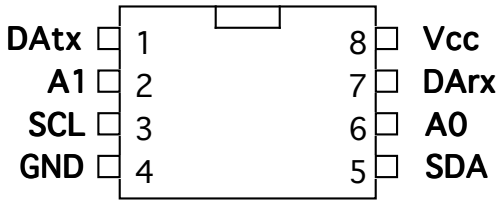
1.4 Custom variants

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

2. Functional overview

LED-Warrior14 is a type II IEC62386 master. It can coexist with other masters on the same bus but is not addressable.
LED-Warrior14 supports transmission of all 8, 16, and 24 bit telegrams. This allows to control light levels, retrieve status information and set configuration data in IEC62386 devices, as well as acting as a IEC62386 device.

3. Pin Descriptions (Chip SOIC-8 or DIL-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.

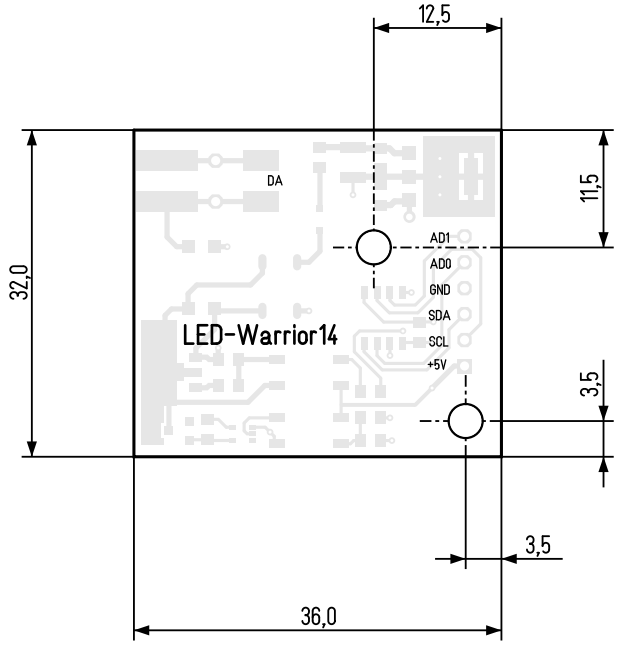
DArx
Receive data input from IEC62386 bus.
Connect a IEC62386 bus receiver to this pin.
Positive logic, high = high level on bus.
High impedance input.

DAtx
Transmit data output to IEC62386 bus.
Connect a IEC62386 bus driver to this pin.
Positive logic, high = high level on bus.
Open drain output with internal pull up resistor for high.

A0, A1
Lower address bits for I2C. The status of these two pins replaces the lower two bits of the I2C address. This allows to directly assign LED-Warrior14 to four different I2C addresses by hardware.
Inputs, internal pull up.

LED-Warrior14

3.1 Mechanical dimensions (LW14-01/02MOD)



Dimensions in mm
Height at thickest point: ≤ 6.1 mm
Mounting holes: 3.1 mm
Tolerances, outer contour: ±0.2 mm

3.2 Pin Descriptions (LW14-01MOD)

DA
Two lines for the IEC62386 bus, not polarity sensitive, connect direct to the IEC62386 bus.

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.

SW0, SW1 (A0, A1)
Lower address bits for I2C. The status of these two pins replaces the lower two bits of the I2C address. This allows to directly assign LED-Warrior14 to four different I2C addresses by hardware.
Inputs, internal pull up.

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

GND
Ground supply voltage.

3.3 Pin Descriptions (LW14-02MOD)

DA
Two lines for the IEC62386 bus, not polarity sensitive, connect direct to the IEC62386 bus.

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.

SW0, SW1 (A0, A1)
Lower address bits for I2C. The status of these two pins replaces the lower two bits of the I2C address. This allows to directly assign LED-Warrior14 to four different I2C addresses by hardware.
Inputs, internal pull up.

+5V
Positive supply voltage output. Can supply up to 15mA at 5 V to external circuits like RF receiver modules.

GND
Ground supply voltage.

4. I2C Addressing

The I2C address of LED-Warrior14 is defined by the upper five bits of the base address plus the value of the A0, A1 pins for the lowest two bits. The factory default I2C address is $20 (7 bit value, will be shifted and extended by R/W bit and combined with the address pins: 0100 0A1A0R).
Depending on the status of the A0, A1 pins the LED-Warrior14 will respond to the adresses $20, $21, $22, or $23. Reassigning a different base address is possible via I2C commands.

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 status register.

Register	R/W	Function	Data
$00	R	Status	1 Byte
$01	R/W	Command	3 Bytes
$02	W	Config	1 Byte
$F0	R	Signature	6 Bytes
$FE	W	Set Addr	2 Bytes

4.2 Status register

The status register is one byte that contains the bus status and command status flags:
7 - Bus Error Status, 0 = Bus OK, 1 = Bus fault
6 - Busy, 0 = ready, 1 = busy
5 - Overrun
4 - Frame Error
3 - Valid Reply
2 - Reply Timeframe, < 22 Te since last command
1 - MSB byte count for telegram received
0 - LSB byte count for telegram received

Bus Error Status = 1 indicates that the bus is not working, either another device is pulling it permanently low or the bus is not connected. Commands to register 1 will be ignored if the bus is not working.
Busy = 1 indicates that the last command has not yet been transmitted. Any new command sent to register 1 will be ignored until the last command has been transmitted and the busy bit is cleared.
Overrun = 1 is set if a new telegram is received before the last one was read from register $01. This bit is reset be reading register $01.
Frame Error = 1 if an invalid telegram has been on the bus since last read of the status register. Reset by reading the status register.
Valid Reply = 1 if a telegram has been received within 22 Te (1 Te = 1/2 bit cell on IEC62386 = 416μs) of sending a command. If the received telegram is a forward telegram from another master this indicates that the gap between forward telegrams has been violated. Reset by reading register $01.
Reply Timeframe = 1 indicates that the time frame for a reply from the last addressed device has not yet timed out. This bit is set to 1 after the transimission of a command and is reset to zero after 22 Te or on bus activity.
The two lowest bits indicate the number of bytes in the last received telegram. 0 indicates there is no new data, 1 is a 1 byte reply telegram, 2 and 3 indicate 16 and 24 bit forward telegrams respectively. Both bits are reset upon reading register $01.
Versions of LW14 prior to V2.0.0.0 did use these two bits as flags to indicate 8 or 16 bit telegrams. The use as a counter is upwards compatible, but care must be taken in existing software to check that if both bits are set this is decoded properly.

4.3 Command register

The command register accepts one to three bytes of data. Writing a single byte to the command register causes the LW14 to immediately send this byte as a return telegram onto the IEC62386 bus. No checking of bus status is done, so this may cause a bus collision as is required by some IEC62386 interactions. Inter telegram timing has to be taken care for by the application, LW14 transmits the telegram immediately after receiving it via I2C.
Writing two or three bytes causes a 16 or 24 bit IEC62386 command to be send onto the bus. The first byte is the address byte, the second (and third) the command byte.
LW14 does observe bus avctivity and intra telegram timing when sending a 16 or 24 bit telegram. Priotrity of the telegram is set via the config register (see 4.4).

4.3.1 IEC62386 Commands

LW14 receives all 16 and 24 bit IEC62386 forward telegrams.
Please refer to the IEC62386 specification for details on the commands.

4.4 Config register

The Config register contains configuration options for the IEC62386 bus.

7 - unused, write zero
6 - unused, write zero
5 - unused, write zero
4 - unused, write zero
3 - unused, write zero
2 - Bus priority MSB
1 - Bus priority
0 - Bus priority LSB

Bus priority sets the priority for the commands to be transmitted. Valid values are 1 to 5, values will be clipped if out of range. Default value is 2.
Use priority 1 for commands within a transaction, except for the first command. Priority 2 is for user issued commands, 3 for the start of a multi-command transaction, 4 for automatically generated commands, 5 for commands and starts of transactions that query status or memory.

4.5 Signature register

The signature register can be used to identify LED-Warrior14 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-Warrior14 has 14 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 LW14 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), 0.
Values of 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.

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-Warrior14 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 Absolute maximum ratings (LW014-01MOD)

Supply Voltage (Vin relative to GND): ..... -0.5V to +6V
Input current (supply voltage): ..... max. 25mA
IEC62386 input voltage (differential): ..... max. 50V
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-Warrior14 may result.

5.3 Operating specifications (LW14-01MOD)

Supply Voltage (+5V relative to GND): ..... 4.5V to 5.25V
Operating temperature: ..... -20°C to +65°C
IEC62386 input voltage (differential): ..... max. 24V
Supply current: ..... max. 25mA

5.4 Absolute maximum ratings (LW14-02MOD)

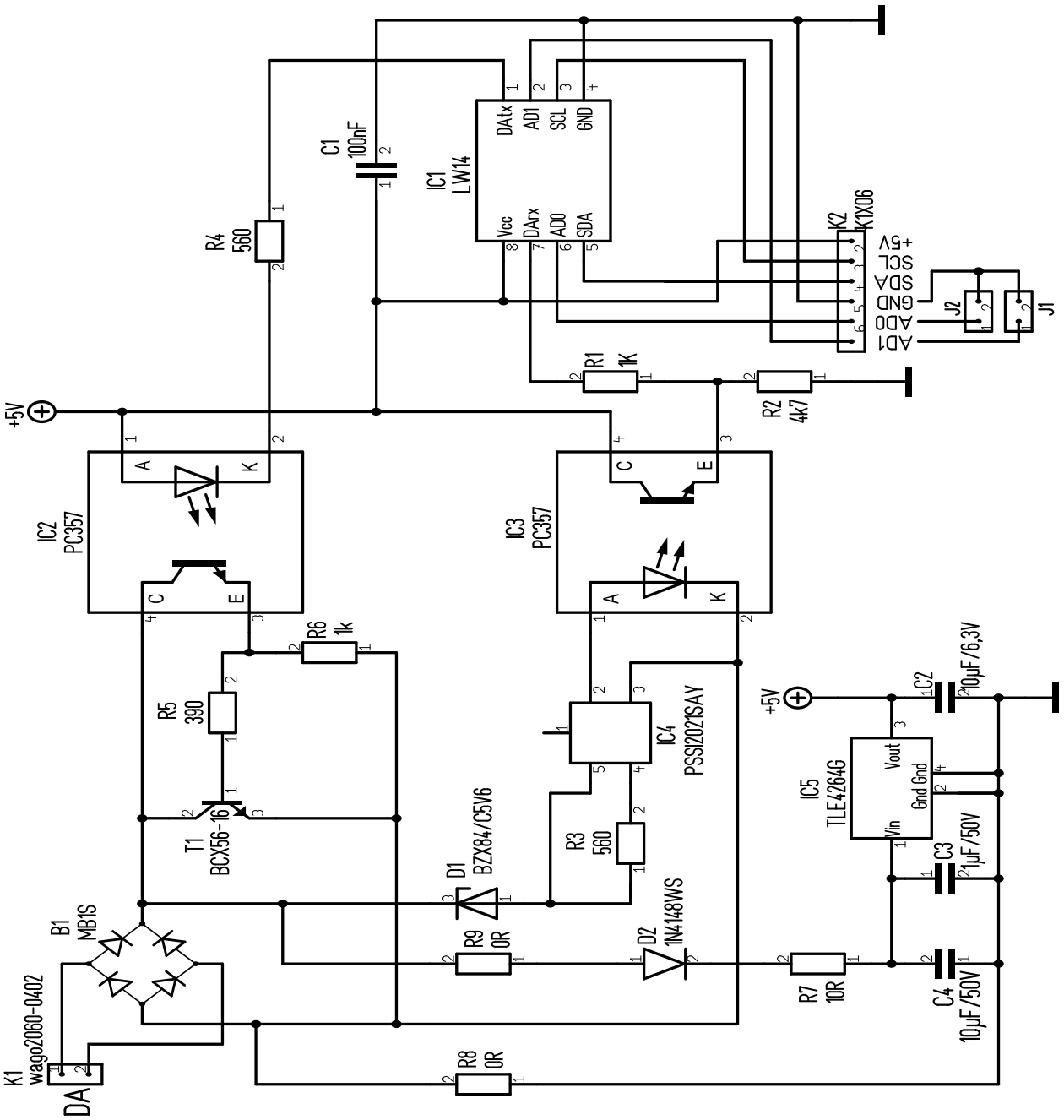
IEC62386 input voltage (differential): ..... max. 45V
IEC62386 input current: ..... max. 50 mA
Storage temperature: ..... -55°C to +100°C
ESD: ..... 2000V human body model

Absolute maximum ratings must not be exceeded or permanent damage to the LED-Warrior14 may result.

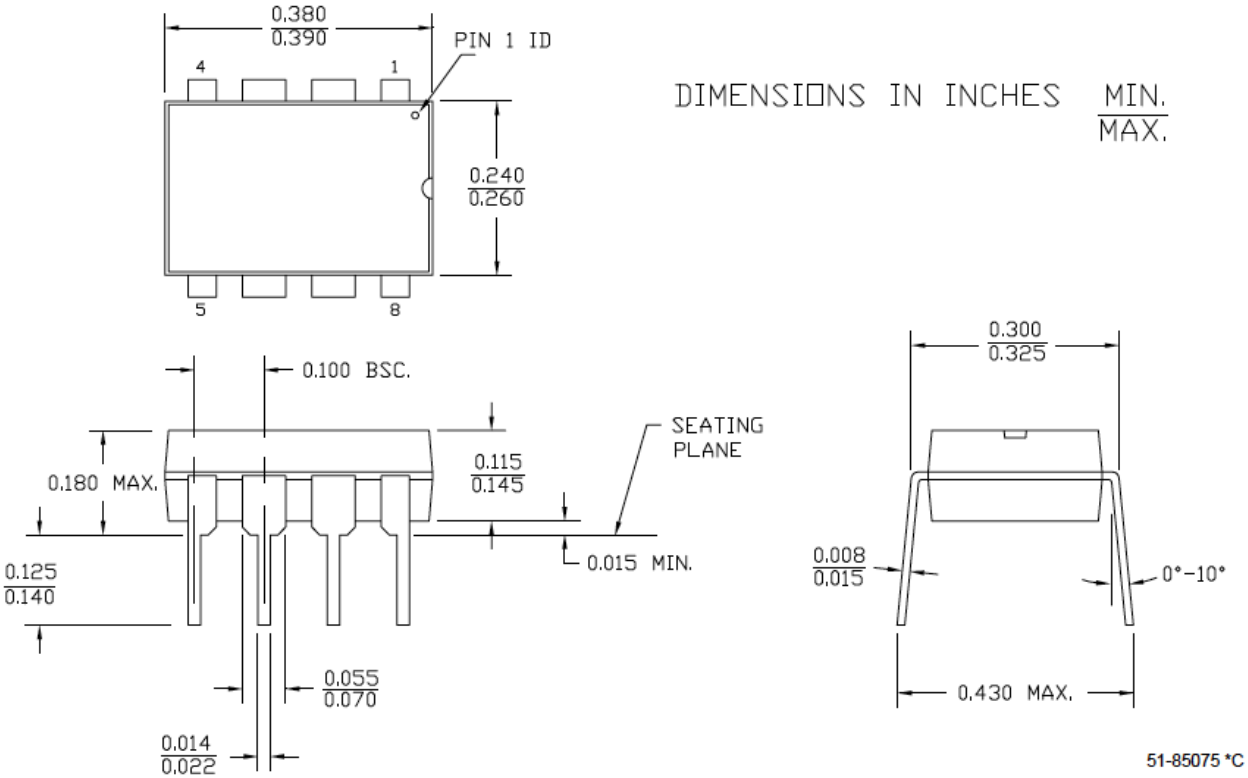
5.5 Operating specifications (LW14-02MOD)

Supply Voltage Output(Vin relative to GND): ..... 4.5V to 5.25V
Supply Output max. current: ..... 15 mA
Operating temperature: ..... -20°C to +65°C
IEC62386 input voltage (differential): ..... max. 24V
IEC62386 bus current: ..... max. 25mA

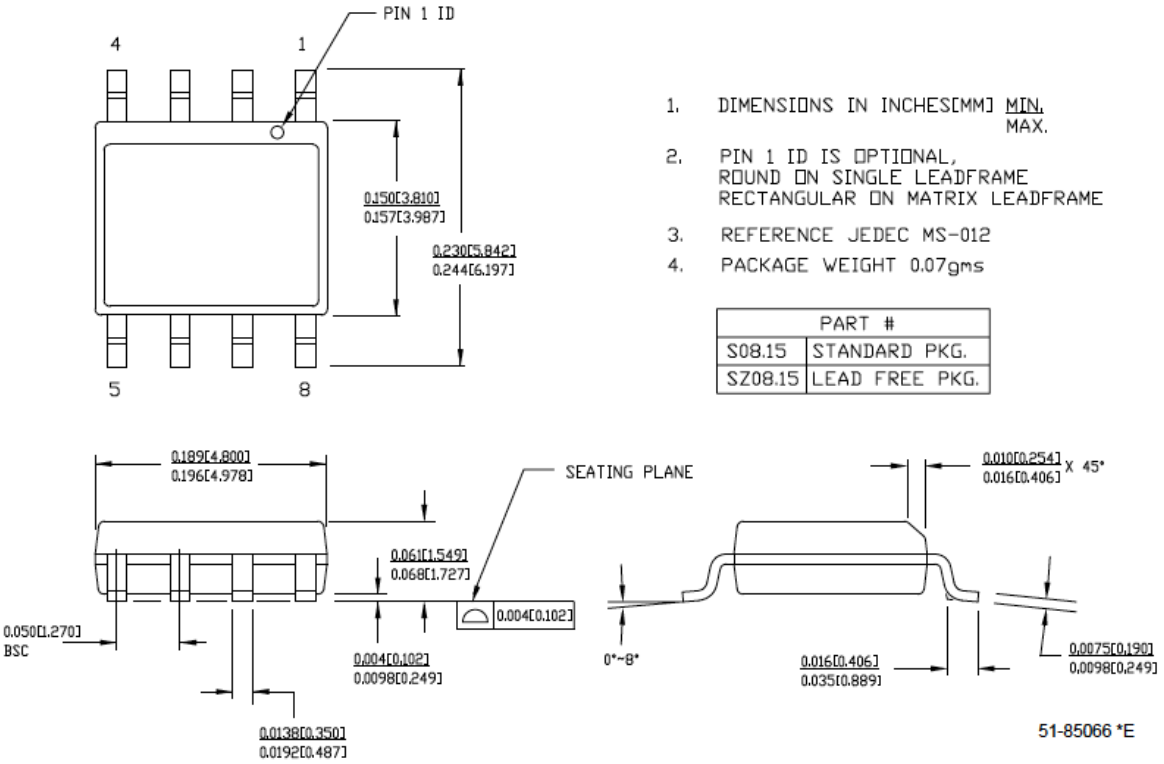
6. Application circuit (LW14-02MOD)



7. Package dimensions DIL 8



7.1 Package dimensions SOIC8



8. Ordering information

Partname	Order Code	Package	MOQ	Description
LED-Warrior14-S	LW14-S	SOIC-8	97	Single chip IEC62386 master with I2C
LED-Warrior14-P	LW14-P	DIL 8	1	Single chip IEC62386 master with I2C
LED-Warrior14-01MOD	LW14-01MOD	Module	1	IEC62386 master module with I2C
LED-Warrior14-02MOD	LW14-02MOD	Module	1	IEC62386 master module with supply extraction

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.

DIL-8 chips are packaged in tubes with 53 chips each.

The modules are packaged in single units.

8.2 Shipping version

LED-Warrior14 is currently shipping in version V2.0.0.0

8.2.1 Revision History

V2.0.0.0 - Added handling 24 bit telegrams.

V1.2.0.0 - Added transmitting 8 bit telegrams.

V1.1.0.0 - Initial shipping version.

8.3 FCC / CE

The LED-Warrior14 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 excerted 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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