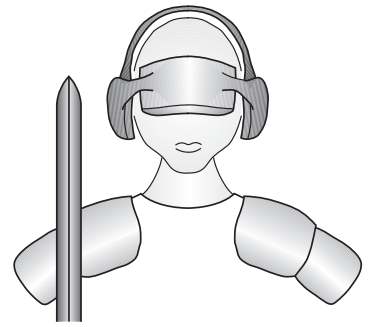


# LED-Warrior14



Code Mercenaries

## I2C to DALI Interface

### 1. Features

- DALI type II master
- I2C to DALI bridge
- Can transmit all 16 bit forward telegrams
- Receives 8 and 16 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 DALI 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 DALI bus and can provide some power for additional electronics like a RF receiver.

#### 1.4 Custom variants

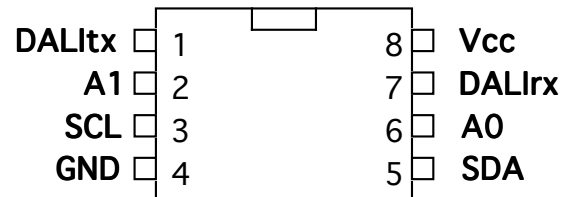
Custom variants are possible for the chips as well as for the modules.

### 2. Functional overview

LED-Warrior14 is a type II DALI master. It can coexist with other masters on the same bus but is not addressable.

LED-Warrior14 supports transmission of all 16 bit forward telegrams and receives 8 bit reply telegrams as well as any 16 bit forward telegrams transmitted by other masters. This allows to control light levels, retrieve status information and set configuration data in DALI devices.

### 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.

#### DALIrx

Receive data input from DALI bus.

Connect a DALI bus receiver to this pin.

Positive logic, high = high level on bus.

High impedance input.

#### DALItx

Transmit data output to DALI bus.

Connect a DALI bus driver to this pin.

Positive logic, high = high level on bus.

Open drain output with internal pull up resistor for high.

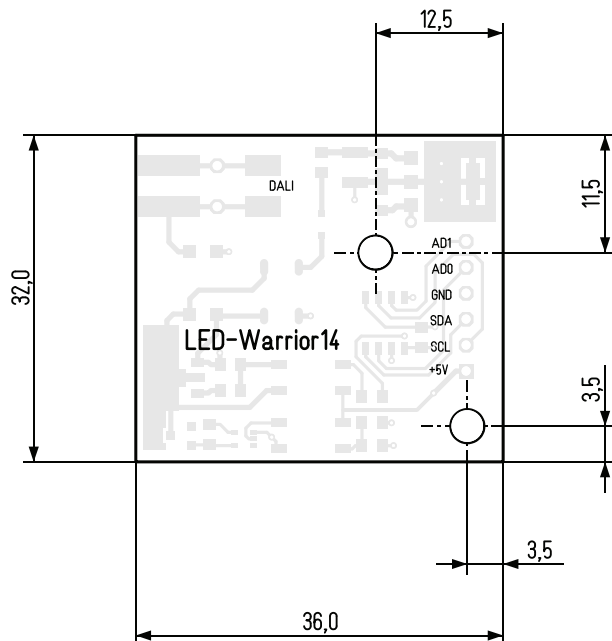
#### A0, A1

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.

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## 3.1 Mechanical dimensions (LW14-01/02MOD)



Dimensions in mm  
 Height at thickest point:  $\leq 6.1$  mm  
 Mounting holes: 3.1 mm  
 Tolerances, outer contour:  $\pm 0.2$  mm

## 3.2 Pin Descriptions (LW14-01MOD)

### DALI

Two lines for the DALI bus, not polarity sensitive, connect direct to the DALI 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)

### DALI

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

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## 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 addresses \$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	2 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 - 2 Byte telegram received
- 0 - 1 Byte 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 by 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 DALI = 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 transmission of a command and is reset to zero after 22 Te or on bus activity.

2 Byte telegram received is set to 1 if a forward telegram has been received on DALI. When reading register \$01 this bit is cleared.

1 Byte telegram received is set to 1 if a reply telegram is received. The bit is reset on reading register \$01.

### 4.3 Command register

The command register has two bytes which directly represent the DALI command. The first byte is the address byte, the second the command byte.

#### 4.3.1 DALI Commands

LW14 accepts all 16 bit DALI forward telegrams. Please refer to the DALI specification for details on the commands.

### 4.4 Config register

The Config register contains configuration options for the DALI bus.

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

DALI 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.

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## 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.

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## 5. Absolute maximum ratings (Chip)

Supply voltage (V <sub>cc</sub> relative to GND):	-0.5V to +6V
Input voltage into any pin (relative to GND):	GND - 0.5V to V <sub>cc</sub> + 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 (V <sub>cc</sub> 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 (V <sub>in</sub> relative to GND):	-0.5V to +6V
Input current (supply voltage):	max. 25mA
DALI 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
DALI input voltage (differential):	max. 24V
Supply current:	max. 25mA

### 5.4 Absolute maximum ratings (LW14-02MOD)

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

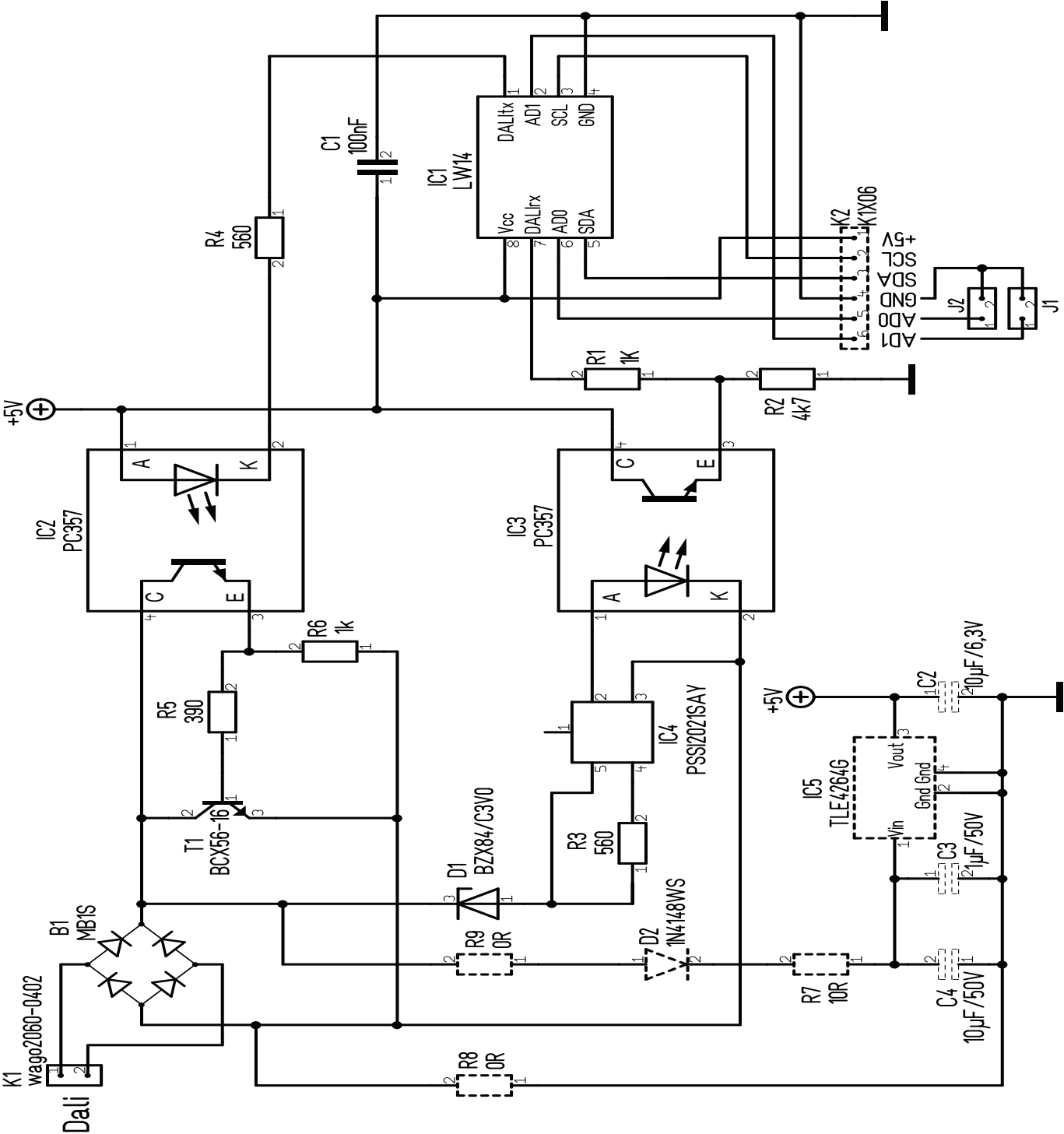
Absolute maximum ratings must not be exceeded or permanent damage to the LED-Warrior14 may result.

### 5.5 Operating specifications (LW14-02MOD)

Supply Voltage Output(V <sub>in</sub> relative to GND):	4.5V to 5.25V
Supply Output max. current:	15 mA
Operating temperature:	-20°C to +65°C
DALI input voltage (differential):	max. 24V
DALI bus current:	max. 25mA

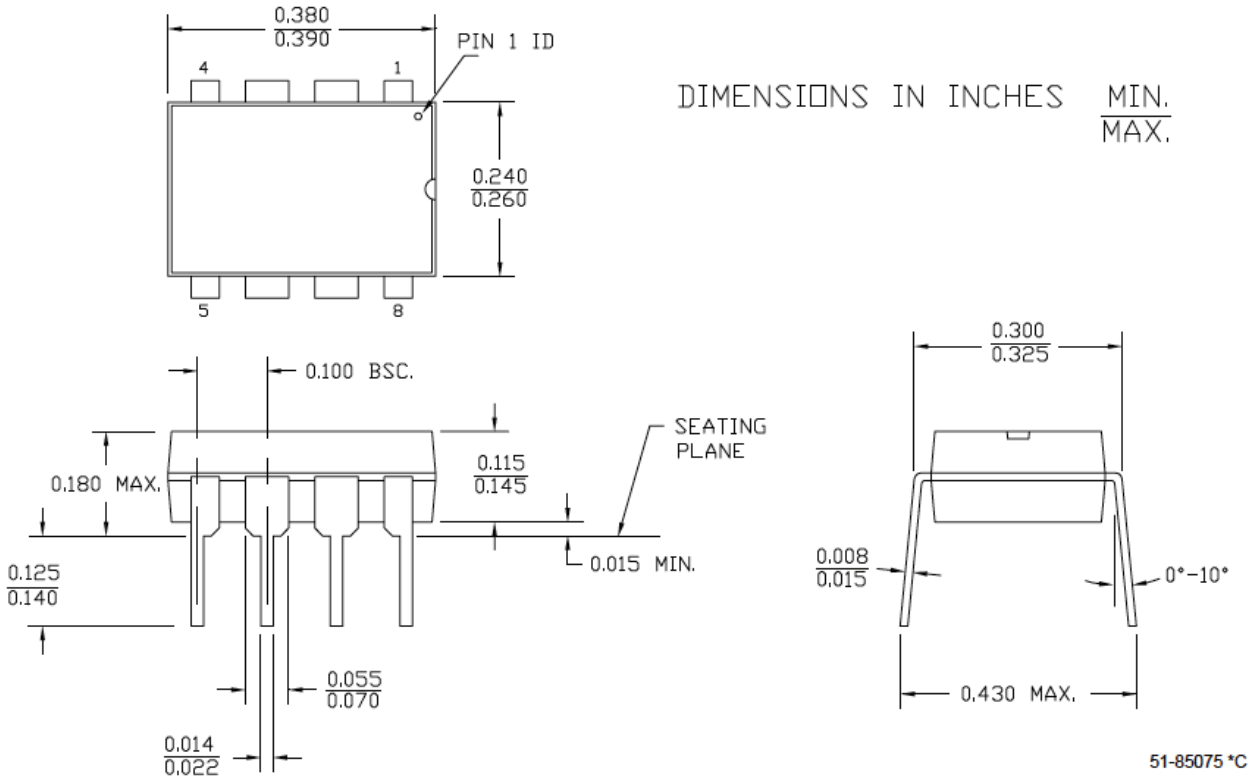
# LED-Warrior1 4

## 6. Application circuit (LW14-02MOD)

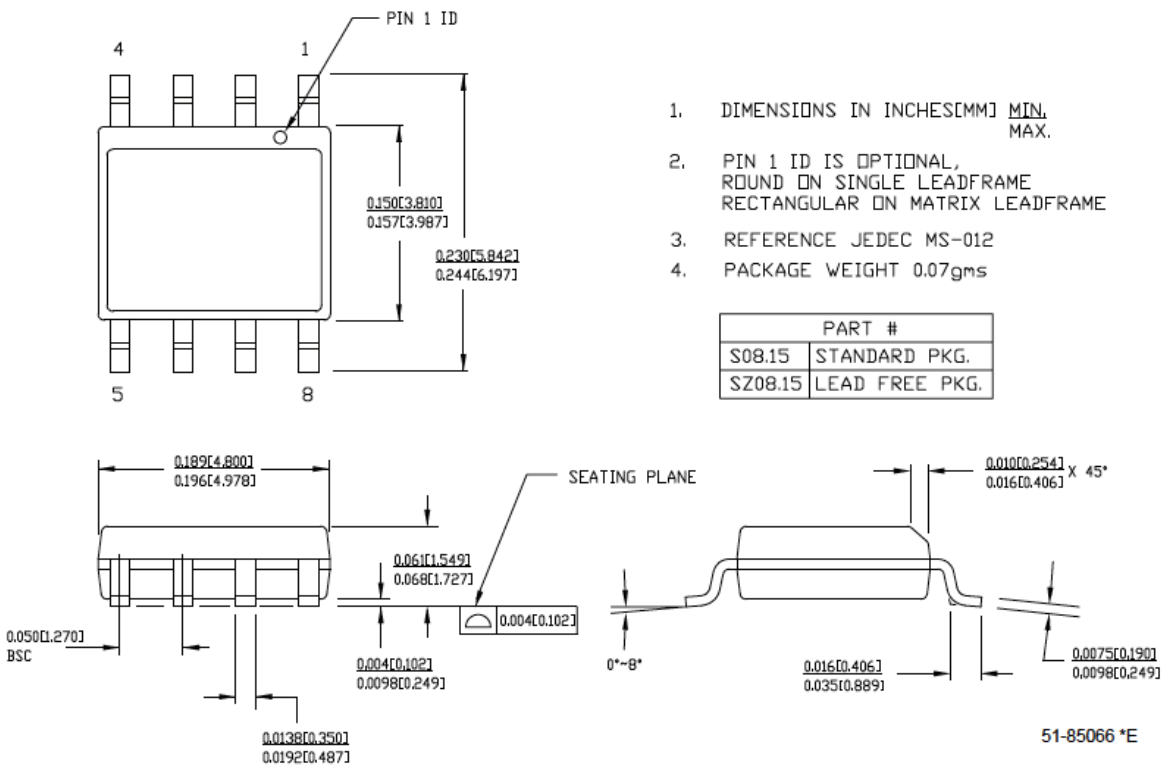


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## 7. Package dimensions DIL 8



## 7.1 Package dimensions SOIC8



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## 8. Ordering information

Partname	Order Code	Package	MOQ	Description
LED-Warrior14-S	LW14-S	SOIC-8	97	Single chip DALI master with I2C
LED-Warrior14-P	LW14-P	DIL 8	1	Single chip DALI master with I2C
LED-Warrior14-01MOD	LW14-01MOD	Module	1	DALI master module with I2C
LED-Warrior14-02MOD	LW14-02MOD	Module	1	DALI master module with supply voltage 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 V1.1.0.0

#### 8.2.1 Revision History

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 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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