

**WPMDL9500xx / 17395xx78****MagI<sup>3</sup>C Power Module**  
**FDSM - Fixed Step Down Regulator Module****28V / 0.5A / 3.3V and 5V Output****DESCRIPTION**

The FDSM series of the MagI<sup>3</sup>C power module family is a fixed output voltage, fully integrated dc/dc power supply. The module integrates the switching power stage, control circuitry and inductor all in one package.

The module requires no external components for operation. Input and output capacitors are integrated. Design effort and complexity is reduced to a minimum.

The FDSM ensures fast time to market and low development costs.

It is pin compatible with the common 78xx linear regulator series. The high efficiency reduces the power dissipation and in many cases heatsinks and assembly parts are no longer necessary.

Typical 12V to 3.3V conversion achieves 85% efficiency. 12V to 5V conversion achieves 92 %.

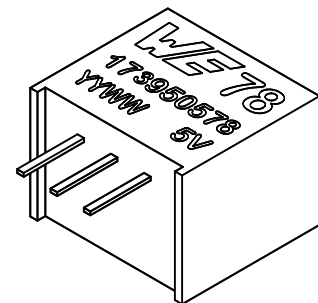
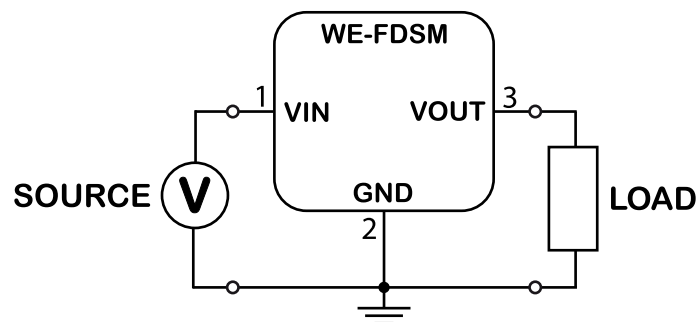
The standard THT package allows for easy assembly.

**FEATURES**

- Peak efficiency up to 95%
- 6V to 28V input voltage range
- 3.3V or 5V fixed output voltage
- 500mA output current
- Low output voltage ripple (typ. 10mV)
- Short circuit protection
- -40°C to 85°C ambient operating temperature range
- Thermal shutdown
- Integrated capacitors and inductor
- Pulse skipping for high efficiency at light loads
- Fixed 570 kHz switching frequency
- Output overvoltage protection
- RoHS & REACH compliant
- UL94V-0 package material

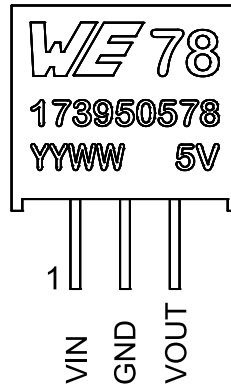
**TYPICAL APPLICATIONS**

- Point-of-Load from 18V, 15V, 12V, 9V rail
- Replacement for linear regulators
- Interface and microcontroller supply
- General purpose

**TYPICAL CURCUIT DIAGRAM**

**WPMDL9500xx / 17395xx78**

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**PACKAGE****PIN DESCRIPTION**

| PIN | SYMBOL    | TYPE  | PIN DESCRIPTION                              |
|-----|-----------|-------|--|
| 1   | $V_{IN}$  | Power | Input supply voltage                         |
| 2   | GND       | Power | Ground, reference for $V_{in}$ and $V_{out}$ |
| 3   | $V_{OUT}$ | Power | Output voltage                               |

**ORDERING INFORMATION**

| ORDER CODE | PART DESCRIPTION | PACKAGE | VOUT VERSION | PACKAGING UNIT |
|------------|------------------|---------|--------------|----------------|
| 173950578  | WPMDL950005      | SIP-3   | 5V           | TUBE 42 pcs.   |
| 173950378  | WPMDL950003      | SIP-3   | 3.3V         | TUBE 42 pcs.   |

**SALES INFORMATION**

| SALES CONTACT   |
|---|
| <p>Würth Elektronik eiSos GmbH &amp; Co. KG<br/>           EMC &amp; Inductive Solutions<br/>           Max-Eyth-Str. 1<br/>           74638 Waldenburg<br/>           Germany<br/>           Tel. +49 (0) 79 42 945 - 0<br/>           www.we-online.com<br/>           powermodules@we-online.com</p> |

**WPMDL9500xx / 17395xx78****MagI<sup>3</sup>C** Power Module  
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Caution:

Exceeding the listed absolute maximum ratings may affect the device negatively and may cause permanent damage.

| SYMBOL    | PARAMETER                                     | LIMITS         | UNIT |
|-----------|---|----------------|------|
| $V_{IN}$  | Input voltage                                 | -0.3 to 30     | V    |
| $V_{ESD}$ | ESD voltage (Human Body Model) <sup>(1)</sup> | -2000 to +2000 | V    |
| $T_{ST}$  | Storage temperature                           | -55 to 125     | °C   |

**OPERATING CONDITIONS**

Operating conditions are conditions under which operation of the device is intended to be functional. All values are referenced to GND and to a free ambient operating temperature of  $T_A = 25^\circ\text{C} \pm 5^\circ\text{C}$  unless otherwise specified.

| SYMBOL        | PARAMETER   | MIN <sup>(3)</sup> | TYP <sup>(4)</sup> | MAX <sup>(3)</sup> | UNIT |
|---------------|---|--------------------|--------------------|--------------------|------|
| $V_{IN}$      | Input voltage (173950378) 3.3V <sub>OUT</sub> version | 6                  | -                  | 28                 | V    |
| $V_{IN}$      | Input Voltage (173950578) 5V <sub>OUT</sub> version   | 7                  | -                  | 28                 | V    |
| $T_A$         | Ambient temperature range <sup>(2)</sup>              | -40                | -                  | +85                | °C   |
| $I_{OUT}$     | Output current  | 5                  | -                  | 500                | mA   |
| $C_{LOADMAX}$ | Maximum capacitive load                               | -                  | -                  | 220                | μF   |

**THERMAL SPECIFICATIONS**

| SYMBOL        | PARAMETER                              | MIN <sup>(3)</sup> | TYP <sup>(4)</sup> | MAX <sup>(3)</sup> | UNIT |
|---------------|--|--------------------|--------------------|--------------------|------|
| $\Theta_{JA}$ | Thermal resistance junction to ambient |                    | 166                |                    | K/W  |

**WPMDL9500xx / 17395xx78****MagI<sup>3</sup>C** Power Module  
FDSM - Fixed Step Down Regulator Module**ELECTRICAL SPECIFICATIONS**

MIN and MAX values are valid for recommended ambient temperature range of **-40°C to 85°C**. Typical values represent statistically the utmost probability at following conditions:  $V_{in} = 6V$  (3.3V version),  $V_{in} = 7V$  (5V version) to 28V at ambient temperature of 25°C (unless otherwise noted)

| SYMBOL                            | PARAMETER                | CONDITIONS   | MIN <sup>(3)</sup> | TYP <sup>(4)</sup> | MAX <sup>(3)</sup> | UNIT |
|-----------------------------------|--------------------------|--|--------------------|--------------------|--------------------|------|
| $V_{OUT}$                         | Regulated output voltage | order no. 173950578                                      | 4.850              | 5                  | 5.150              | V    |
|                                   | Regulated output voltage | order no. 173950378                                      | 3.201              | 3.3                | 3.399              | V    |
|                                   | Output voltage tolerance | $V_{out} = 3.3V$ and 5V                                  | -                  | -                  | 3                  | %    |
|                                   | Switch current limit     | $V_{in} = 12V$   | 2.3                | 3.5                | 5.3                | A    |
| $\Delta V_{OUT} / \Delta V_{IN}$  | Line regulation          | $V_{in MIN}$ to $V_{in MAX}$<br>$I_{OUT} = 5mA$ to 500mA | -                  | -                  | 0.5                | %    |
| $\Delta V_{OUT} / \Delta I_{OUT}$ | Load regulation          | 10% to 100% load   | -                  | -                  | 1                  | %    |
| $f_{SW}$                          | Switching frequency      | $V_{in} = 12V$   | 400                | 570                | 740                | kHz  |
| $I_Q$                             | Quiescent current        | $V_{in} = 24V$ , no load                                 | -                  | 1.5                | -                  | mA   |

**RELIABILITY**

| SYMBOL              | PARAMETER    | CONDITIONS    | MIN                    | TYP | MAX | UNIT |
|---------------------|--------------|---------------|------------------------|-----|-----|------|
| MTBF <sup>(5)</sup> | MTBF at 25°C | MIL-HDBK-217F | 4185 • 10 <sup>3</sup> |     |     | h    |
| MTBF <sup>(5)</sup> | MTBF at 75°C | MIL-HDBT-217F | 2182 • 10 <sup>3</sup> |     |     | h    |

**NOTES**

- (1) The human body model is defined as a 100pF capacitor which is discharged through a 1.5 kΩ resistor into each pin according to JESD-22-114.
- (2) Device mounted without heatsink. No air flow.
- (3) MIN and MAX limits are 100% production tested at 25°C. Limits over the operating temperature range are guaranteed through correlation using Statistical Quality Control (SQC) methods.
- (4) Typical numbers are valid at 25°C ambient temperature and represent statistically the utmost probability assuming the Gaussian distribution.
- (5) MTBF: Mean time before failure

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### PROTECTIVE FEATURES

#### Overvoltage transient protection

This protection mode minimizes the occurrence of output voltage overshooting. Once the output voltage reaches an overvoltage threshold the switching from  $V_{in}$  will be stopped immediately via the high side FET. When the output voltage falls below the overvoltage trip the high side FET will be enabled again.

#### Thermal shutdown

When the junction temperature exceeds a specific value the device stops switching until the junction temperature falls below this value.

#### Cycle by cycle current limiting

When the current through the high-side FET exceeds the current limit stated in the electrical specification the high side FET will stop the current flow until the following cycle.

#### Short circuit protection

The short circuit protection is realized via the cycle by cycle current limiting. The short circuit protection is indefinite with a recovery at the following switching cycle if the short circuit is removed.

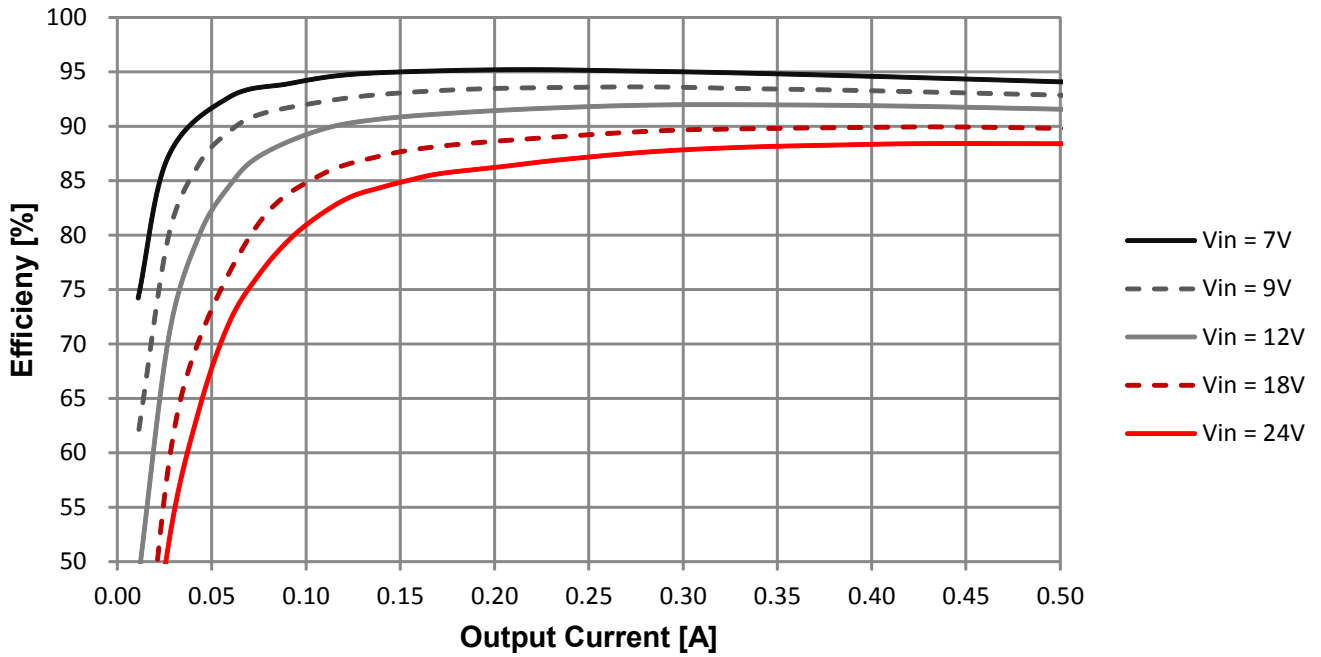
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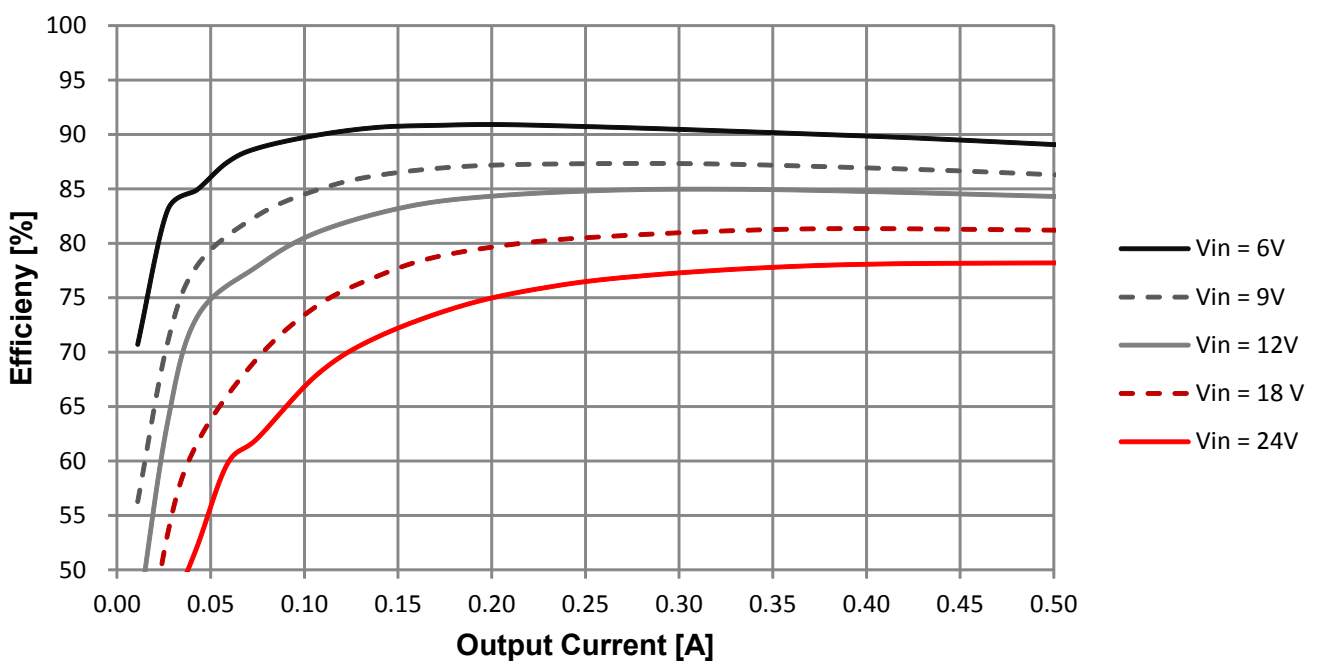


TYPICAL PERFORMANCE CURVES

173950578 5V Output



173950378 3.3V Output



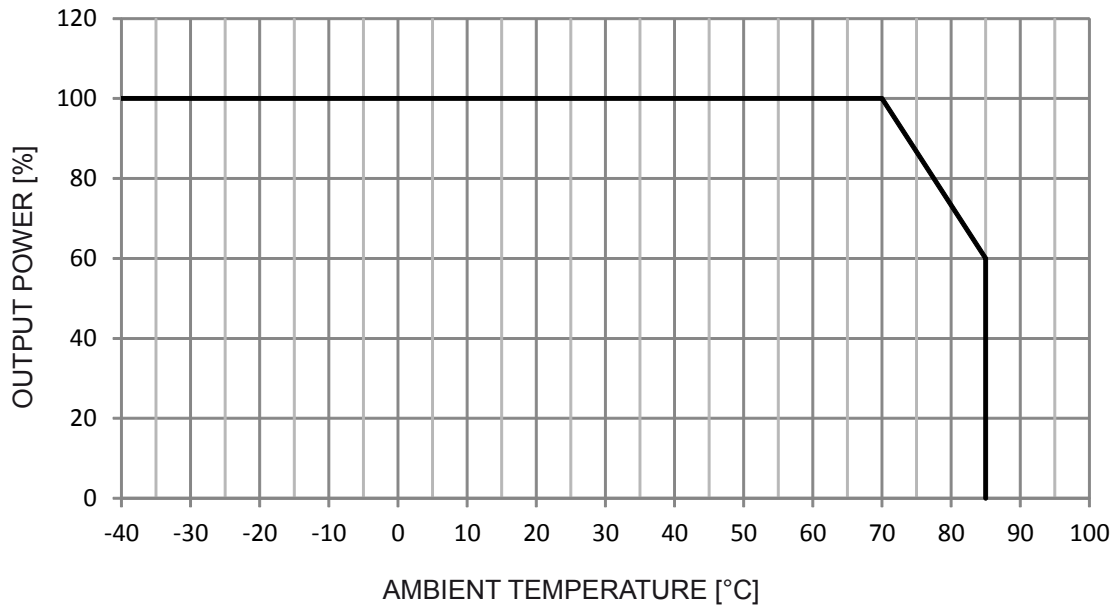
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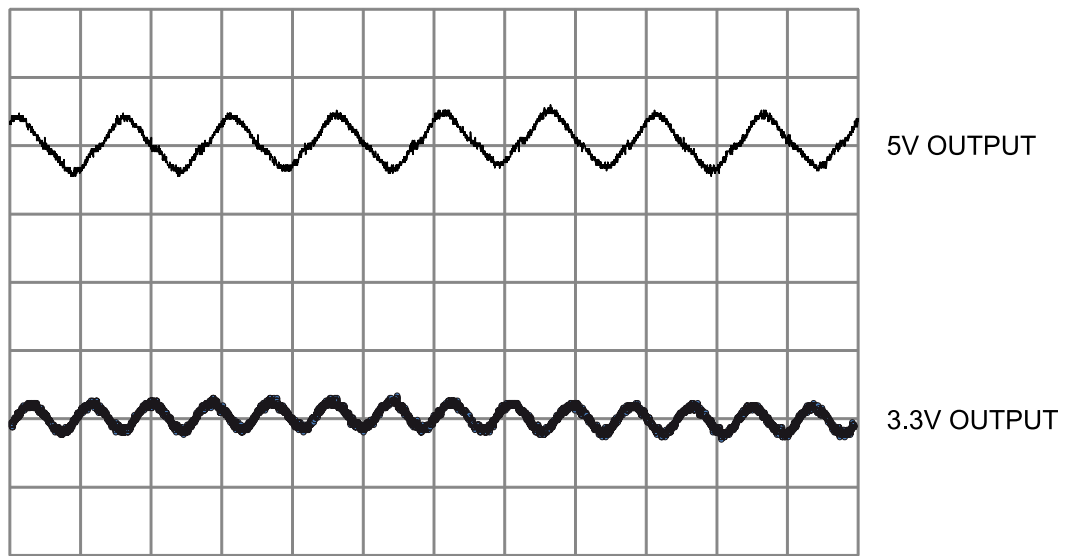


## TYPICAL PERFORMANCE CURVES

OUTPUT POWER DERATING OVER TEMPERATURE



OUTPUT VOLTAGE RIPPLE  $V_{IN} = 12V / I_{OUT} = 500mA$



Y: 10mV/DIV AC BWL 20MHz

X: 2µs/DIV

Measured at a 10µF ceramic capacitor with 10mm distance to regulator.

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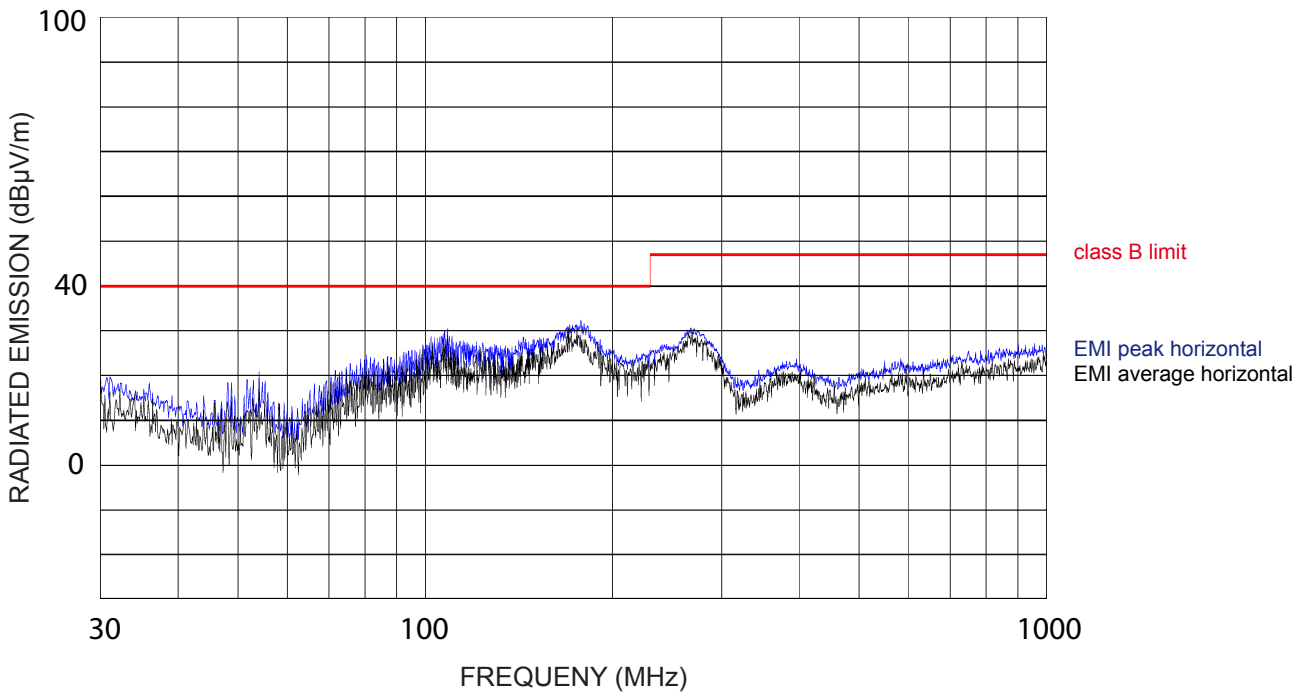
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## RADIATED EMISSIONS EN55022 (CISPR-22) CLASS B COMPLIANT

Measured on module without PCB or external filters at 3m antenna distance

$V_{IN} = 12V$  ;  $V_{OUT} = 5V$  ;  $I_{OUT} = 0.5A$



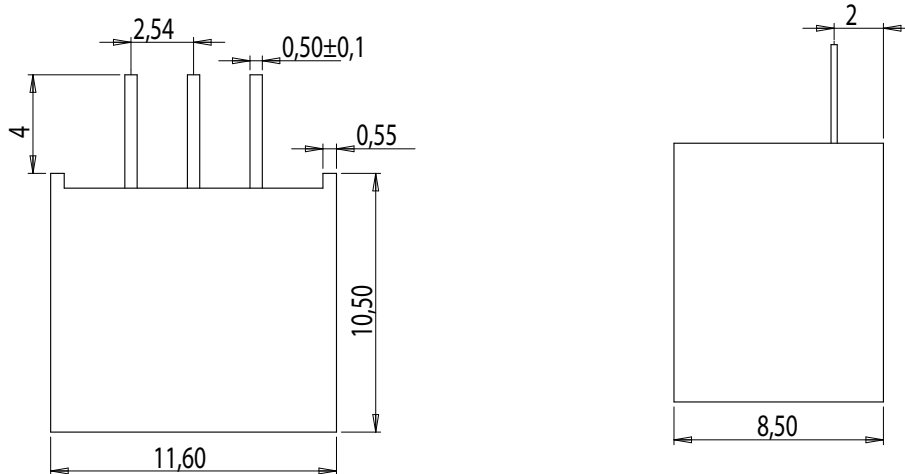


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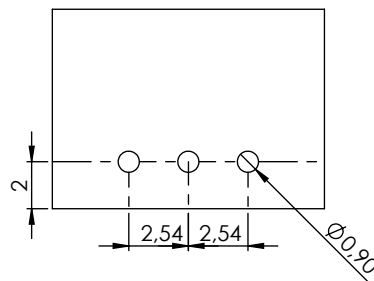
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## PHYSICAL DIMENSIONS



## RECOMMENDED DRILL PATTERN



All dimensions in mm. All tolerances  $\pm 0.5$  mm unless otherwise indicated.  
 Recommended plated drill diameter 0.9 mm.

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| REVISION | DATE       | DESCRIPTION         |
|----------|------------|---------------------|
| 0.1      | 2014.11.1  | preliminary version |
| 1.0      | 2014.12.18 | final version       |
|          |            |                     |

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## CAUTIONS AND WARNINGS

The following conditions apply to all goods within the product series of MagI<sup>3</sup>C of Würth Elektronik eiSos GmbH & Co. KG:

General: All recommendations according to the general technical specifications of the data-sheet have to be complied with.

The responsibility for the applicability of customer specific products and use in a particular customer design is always within the authority of the customer. All technical specifications for standard products do also apply for customer specific products.

Residual washing varnish agents that are used during the production to clean the application might change the characteristics of the body, pins or termination. The washing varnish agent could have a negative effect on the longterm function of the product.

Direct mechanical impact to the product shall be prevented as the material of the body, pins or termination could flake or in the worst case break. As these devices are sensitive to electrostatic discharge customer shall follow proper IC Handling Procedures.

The customer acknowledges and agrees that they are solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of Würth Elektronik eiSos GmbH & Co. KG components in its applications, notwithstanding any applications-related information or support that may be provided by Würth Elektronik eiSos GmbH & Co. KG. Customer represents and agrees that they have all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor these failures and their consequences lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Customer will fully indemnify Würth Elektronik eiSos and its representatives against any damages arising out of the use of any Würth Elektronik eiSos GmbH & Co. KG components in safety-critical applications.

Product specific: Follow all instructions mentioned in the datasheet, especially:

- The solder profile has to comply with the technical reflow / or wave soldering specification, otherwise this will void the warranty.
- All products are supposed to be used before the end of the period of 12 months based on the product date-code.
- Violation of the technical product specifications such as exceeding the absolute maximum ratings will void the warranty.
- It is also recommended to return the body to the original moisture proof bag and reseal the moisture proof bag again.
- ESD prevention methods need to be followed for manual handling and processing by machinery.

**WPMDL9500xx / 17395xx78****Magl<sup>3</sup>C Power Module**  
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The following conditions apply to all goods within the product range of Würth Elektronik eiSos GmbH & Co. KG:

**1. General Customer Responsibility**

Some goods within the product range of Würth Elektronik eiSos GmbH & Co. KG contain statements regarding general suitability for certain application areas. These statements about suitability are based on our knowledge and experience of typical requirements concerning the areas, serve as general guidance and cannot be estimated as binding statements about the suitability for a customer application. The responsibility for the applicability and use in a particular customer design is always solely within the authority of the customer. Due to this fact it is up to the customer to evaluate and investigate, where appropriate, and decide whether the device with the specific product characteristics described in the product specification is valid and suitable for the respective customer application or not. Accordingly, the customer is cautioned to verify that the datasheet is current before placing orders.

**2. Customer Responsibility related to Specific, in particular Safety-Relevant applications**

It has to be clearly pointed out that the possibility of a malfunction of electronic components or failure before the end of the usual lifetime cannot be completely eliminated in the current state of the art, even if the products are operated within the range of the specifications. In certain customer applications requiring a very high level of safety, and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health it must be ensured by advanced technological aid of suitable design for the customer application that no injury or damage is caused to third parties in the event of malfunction or failure of an electronic component.

**3. Optimal Care and Attention**

Any product-specific notes, warnings and cautions must be strictly observed.

**4. Customer Support for Product Specifications**

Some products within the product range may contain substances which are subject to restrictions in certain jurisdictions in order to serve specific technical requirements. Necessary information is available on request. In this case the field sales engineer or the internal sales person in charge should be contacted who will provide support in this matter.

**5. Product Research & Development**

Due to constant product improvement product specifications may change from time to time. As a standard reporting procedure of the Product Change Notification (PCN) according to the JEDEC-Standard we inform about minor and major changes. In case of further queries regarding the PCN, the field sales engineer or the internal sales person in charge should be contacted. The basic responsibility of the customer as per Section 1 and 2 remains unaffected.

**6. Product Life Cycle**

Due to technical progress and economical evaluation we also reserve the right to discontinue production and delivery of products. As a standard reporting procedure of the Product Termination Notification (PTN) according to the JEDEC-Standard we will inform at an early stage about inevitable product discontinuance. According to this we cannot guarantee that all products within our product range will always be available. Therefore it needs to be verified with the field sales engineer or the internal sales person in charge about the current product availability expectancy before or when the product for application design-in disposal is considered. The approach named above does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.

**7. Property Rights**

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**8. General Terms and Conditions**

Unless otherwise agreed upon in individual contracts, all orders are subject to the current version of the "General Terms and Conditions of Würth Elektronik eiSos Group", of which the latest version is available at [www.we-online.com](http://www.we-online.com).

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