

# Features

- OVC III and PD3 up to 5000m altitude
- 85-528VAC input range
- -40°C to +90°C operating temperature
- LPS limited power source
- EN55032 class “B”; floating outputs
- No load power consumption <0.3W

# Regulated Converter



## RAC15-K/480

15 Watt  
2" x 1.6"  
Single Output



### Description

The RAC15-K/480 series AC/DC modules with ultra-wide input range of 100-480 VAC are specially designed for harsh industrial conditions of overvoltage category OVC III and pollution degree PD3 in both single-phase and phase-to-phase power connections of class II. These power supplies are capable of operating over a wide temperature range of -40° to 90°C (up to 60°C without derating) by just adding an external fuse, and offer LPS limited outputs with continuous overcurrent protection and emission class B EMC compliance in potential free configuration of the load. These silicone-free encapsulated modules are built extremely compact to fit on printed circuit boards without compromising board area. Global safety certifications ensure fast time-to-market when integrated into applications for markets such as Smart Grid, Smart Metering, Renewable Energy; Sensors and actuators or IoT applications.

### Selection Guide

| Part Number    | Input Voltage Range [VAC] | Output Voltage [VDC] | Output Current [mA] | Efficiency typ <sup>(1)</sup> [%] | Max. Capacitive Load <sup>(1)</sup> [µF] |
|----------------|---------------------------|----------------------|---------------------|-----------------------------------|--|
| RAC15-05SK/480 | 85-528                    | 5                    | 3000                | 86                                | 20000                                    |
| RAC15-12SK/480 | 85-528                    | 12                   | 1250                | 84                                | 12000                                    |
| RAC15-15SK/480 | 85-528                    | 15                   | 1000                | 85                                | 10000                                    |
| RAC15-24SK/480 | 85-528                    | 24                   | 625                 | 87                                | 6000                                     |

**Notes:**

Note1: Is tested at 230VAC input and constant resistive load at +25°C ambient

### Model Numbering



### Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

| BASIC CHARACTERISTICS   |                      |        |      |                |
|---|----------------------|--------|------|----------------|
| Parameter   | Condition            | Min.   | Typ. | Max.           |
| Nominal Input Voltage <sup>(2)</sup>  | 50/60Hz              | 100VAC |      | 277VAC         |
|   |                      |        |      | 480VAC         |
| Input Voltage Range <sup>(3)</sup>  | 47-63HZ              | 85VAC  |      | 528VAC         |
|   | DC                   | 120VDC |      | 750VDC         |
| Input Current   | 115/230VAC<br>480VAC |        |      | 500mA<br>400mA |
| Inrush Current  | cold start           | 115VAC |      | 20A            |
|   |                      | 230VAC |      | 40A            |
|   |                      | 480VAC |      | 50A            |
| <p><b>Notes:</b></p> <p>Note2: 480VAC limited to L-L connections</p> <p>Note3: The products were submitted for safety files at AC-Input operation</p> <p style="text-align: center;">continued on next page</p> |                      |        |      |                |

- IEC/EN62368-1 certified
- UL62368-1 certified
- CAN/CSA-C22.2 No. 62368-1-14 certified
- IEC/EN61010 certified
- IEC/EN60335-1 pending
- EN62233 pending
- EN55032 compliant
- EN55035 compliant
- CB Report

**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

**BASIC CHARACTERISTICS**

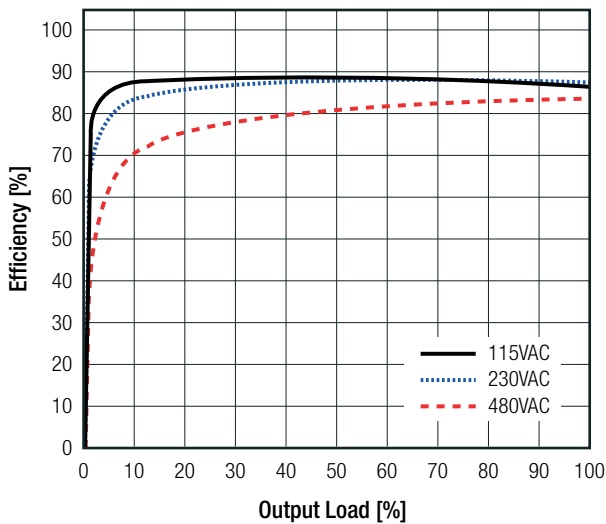
| Parameter                              | Condition  | Min.                    | Typ.  | Max.                   |
|--|------------|-------------------------|-------|------------------------|
| No Load Power Consumption              | 85-528VAC  |                         |       | 300mW                  |
| Input Frequency Range                  | AC Input   | 47Hz                    |       | 63Hz                   |
| Minimum Load                           |            | 0%                      |       |                        |
| Power Factor                           | 115/230VAC | 0.4                     |       |                        |
|  | 480VAC     | 0.3                     |       |                        |
| Start-up Time                          |            |                         | 150ms |                        |
| Rise Time                              |            |                         | 30ms  |                        |
| Hold-up Time                           | 230VAC     | 30ms                    |       |                        |
| Internal Operating Frequency           |            |                         | 50kHz |                        |
| Output Ripple and Noise <sup>(4)</sup> | 20MHz BW   | V <sub>OUT</sub> = 5VDC |       | 100mVp-p               |
|  |            | others                  |       | 1% of V <sub>OUT</sub> |

**Notes:**

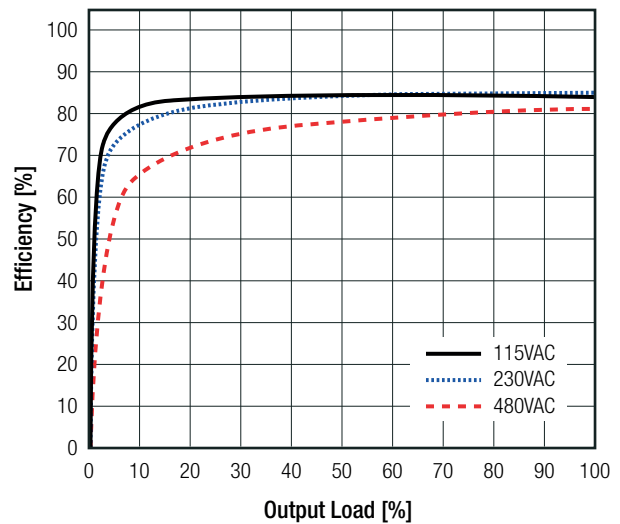
Note4: Measurements are made with a 0.1µF MLCC & 10µF E-cap in parallel across output (low ESR).

**Efficiency vs. Load**

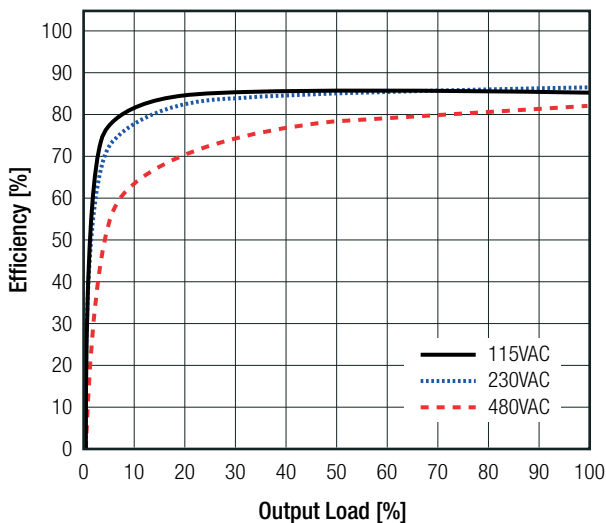
**RAC15-05SK/480**



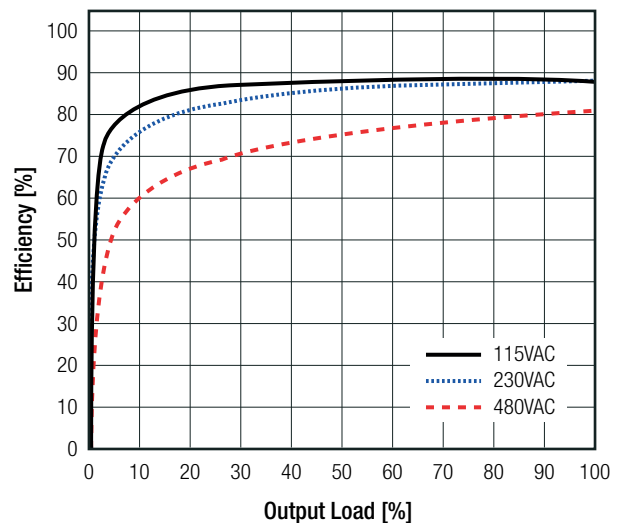
**RAC15-12SK/480**



**RAC15-15SK/480**



**RAC15-24SK/480**



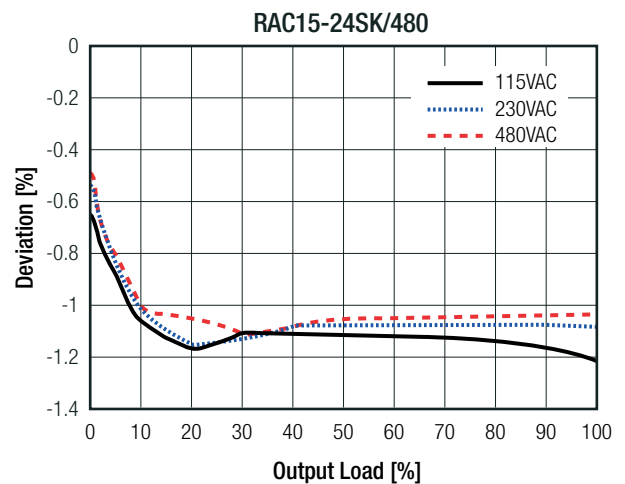
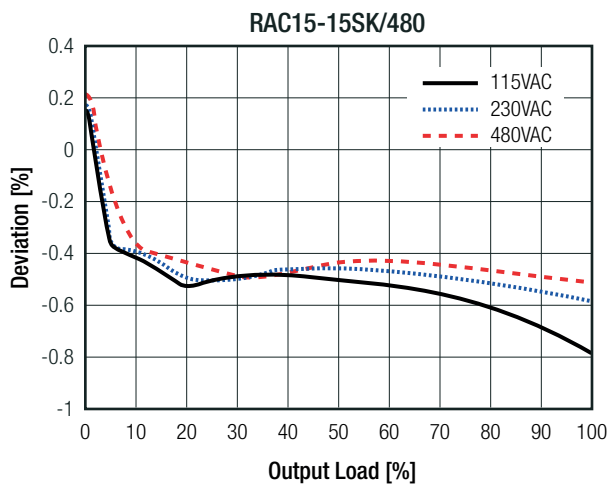
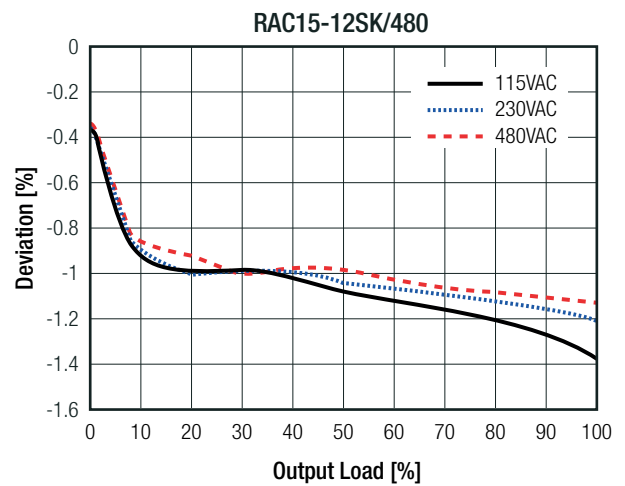
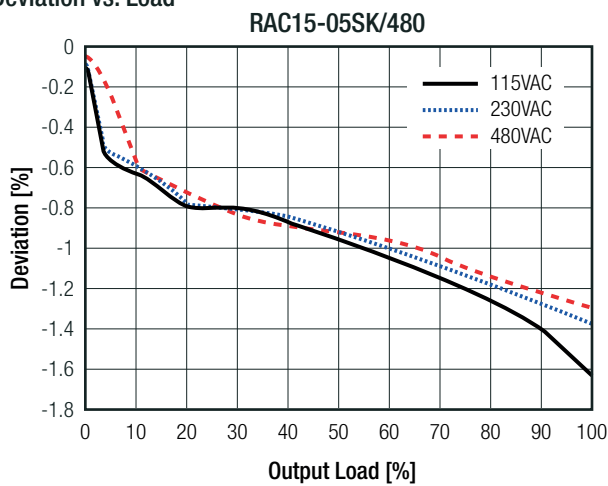
**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

| REGULATIONS                    |                       |            |
|--------------------------------|-----------------------|------------|
| Parameter                      | Condition             | Value      |
| Output Accuracy                |                       | ±3.0% max. |
| Line Regulation                | low line to high line | ±2.0% typ. |
| Load Regulation <sup>(5)</sup> | 10% to 100% load      | 2.0% typ.  |
| Transient Response             | 25% load step change  | 4.0% max.  |
|                                | recovery time         | 1ms typ.   |

**Notes:**

Note5: Operation below 10% load will not harm the converter, but specifications may not be met

**Deviation vs. Load**



| PROTECTIONS                    |  |                          |
|--------------------------------|--|--------------------------|
| Parameter                      | Type                                     | Value                    |
| Input Fuse                     | external (refer to "Protection Circuit") | T2A, 600VAC min.         |
| Limited Power Source (LPS)     | according to IEC62368-1 CB Report        | yes                      |
| Short Circuit Protection (SCP) | below 100mΩ                              | hiccup, auto recovery    |
| Over Voltage Protection (OVP)  |  | 105% - 120%, hiccup mode |
| Over Current Protection (OCP)  |  | 128% - 155%, hiccup mode |
| Over Voltage Category          | according to 61010-1                     | OVCIII (up to 5000m)     |

continued on next page

### Specifications (measured @ $T_a = 25^\circ\text{C}$ , nom. $V_{in}$ , full load and after warm-up unless otherwise stated)

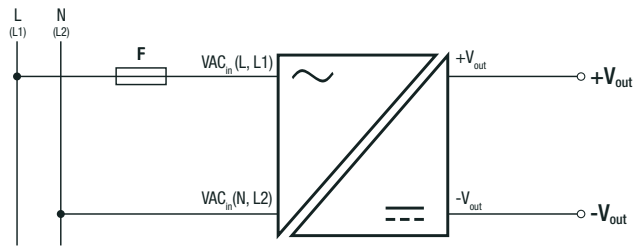
| Parameter                        | Type                 |            | Value            |
|----------------------------------|----------------------|------------|------------------|
| Isolation Voltage <sup>(6)</sup> | tested for 1 minute  | I/P to O/P | 3.6kVAC          |
|                                  | tested for 5 seconds |            | 5.4kVAC          |
| Isolation Resistance             |                      |            | 1G $\Omega$ max. |
| Isolation Capacitance            |                      |            | 200pF max.       |
| Insulation Grade                 |                      |            | reinforced       |
| Leakage Current                  |                      |            | 200 $\mu$ A max. |

#### Notes:

#### Protection Circuit

Note6: For repeat Hi-Pot testing, reduce the time and/or the test voltage

An external fuse is mandatory in order to protect the device in addition on the AC input side. RECOM recommend: slow blow type, 600VAC, 2A

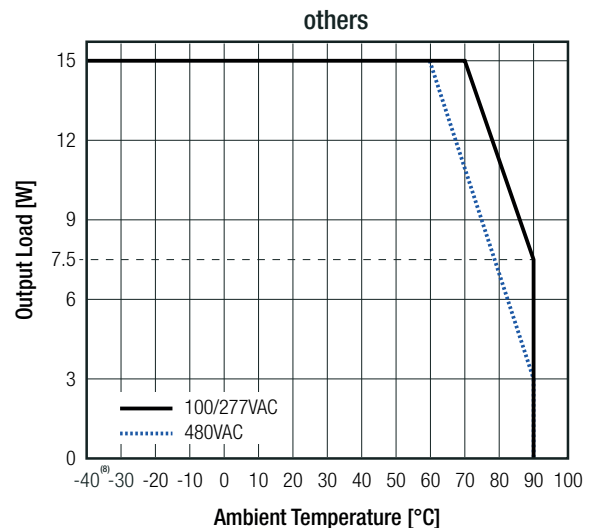
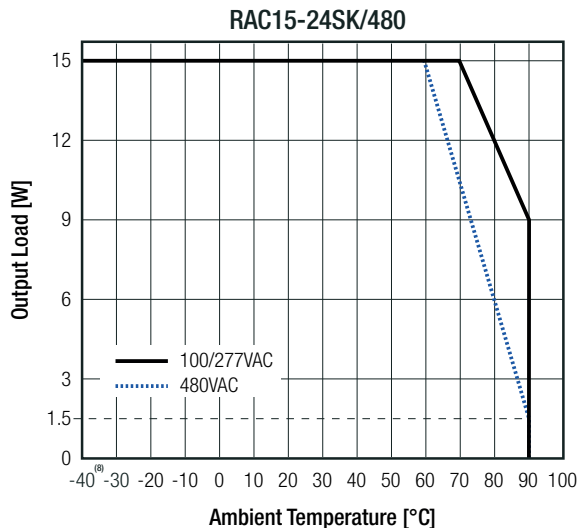


### ENVIRONMENTAL

| Parameter                                  | Condition                                 |                              | Value  |                              |
|--|---|------------------------------|--|------------------------------|
| Operating Temperature Range <sup>(7)</sup> | refer to "Derating Graph <sup>(7)</sup> " |                              | -40°C to +90°C   |                              |
| Maximum Case Temperature                   |   |                              | +105°C   |                              |
| Temperature Coefficient                    |   |                              | 0.02%/K  |                              |
| Operating Altitude                         |   |                              | 5000m  |                              |
| Operating Humidity                         | non-condensing                            |                              | 95% RH max.  |                              |
| Pollution Degree                           |   |                              | PD3  |                              |
| Vibration                                  | according to MIL-STD-202G                 |                              | 10-500Hz, 2G 10min./1cycle, 60min. each along x,y,z axes |                              |
| Design Lifetime                            | 230VAC/50Hz                               | +50°C                        | 30 x 10 <sup>3</sup> hours                               |                              |
| MTBF                                       | according to MIL-HDBK-217F, G.B.          | V <sub>OUT</sub> = 5, 12VDC  | +25°C  | 1450 x 10 <sup>3</sup> hours |
|  |   | V <sub>OUT</sub> = 15, 24VDC | +25°C  | 1720 x 10 <sup>3</sup> hours |
|  |   | V <sub>OUT</sub> = 5, 12VDC  | +40°C  | 1310 x 10 <sup>3</sup> hours |
|  |   | V <sub>OUT</sub> = 15, 24VDC | +40°C  | 1470 x 10 <sup>3</sup> hours |

#### Derating Graph <sup>(7)</sup>

(@ Chamber and natural convection 0.1m/s)



#### Notes:

Note7: Maximum load for coldstart at temperatures below -25°C should be limited to 12W

**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

| <b>SAFETY AND CERTIFICATIONS</b>   |                      |  |
|--|----------------------|--|
| <b>Certificate Type (Safety)</b>   | <b>Report Number</b> | <b>Standard</b>  |
| Audio/Video, information and communication technology equipment - Safety requirements                                      | E491408-A6021-UL     | UL62368-1, 3rd Edition, 2019<br>CAN/CSA C22.2 Nr. 62368-1-14, 3rd Ed. 2019 |
| Audio/Video, information and communication technology equipment - Safety requirements (CB)                                 | 211112011            | IEC62368-1:2014 2nd Edition  |
| Audio/Video, information and communication technology equipment - Safety requirements (LVD)                                |                      | EN62368-1:2014 + A11:2017  |
| Audio/Video, information and communication technology equipment - Safety requirements (CB)                                 | 211112010            | IEC62368-1:2018 3rd Edition  |
| Audio/Video, information and communication technology equipment - Safety requirements                                      |                      | EN/IEC62368-1:2020 + A11:2020  |
| Electrical Equipment For Measurement, Control, and Laboratory Use; Part 1: General Requirements                            | 085-210569501-000    | IEC61010-1:2010 3rd Edition + A1:2016                                      |
| Electrical Equipment For Measurement, Control, and Laboratory Use; Part 1: General Requirements                            | 64.210.21.05695.01   | EN61010-1:2010 + A1:2019   |
| Household and similar electrical appliances – Safety – Part 1: General requirements  | pending              | IEC60335-1:2010<br>EN60335-1:2012  |
| Measurement methods for electromagnetic fields of household appliances and similar apparatus with regard to human exposure | pending              | EN62233:2008   |
| EAC  |                      | TP TC 004/2011   |
| RoHS2  |                      | RoHS-2011/65/EU + AM-2015/863  |

| <b>EMC Compliance (EN55032) <sup>(8)</sup></b>                                | <b>Condition</b>  | <b>Standard / Criterion</b>                                    |
|---|---|--|
| Electromagnetic compatibility of multimedia equipment - Emission requirements |   | EN55032:2015 + A11:2020, Class B                               |
| Electromagnetic compatibility of multimedia equipment – Immunity requirements |   | EN55035:2017 + A11:2020  |
| ESD Electrostatic discharge immunity test                                     | Air: ±2, 4, 8kV<br>Contact: ±2, 4kV                                   | EN61000-4-2:2009, Criteria A                                   |
| Radiated, radio-frequency, electromagnetic field immunity test                | 3 V/m (80-5000MHz)  | EN61000-4-3:2006 + A2:2010, Criteria A                         |
| Fast Transient and Burst Immunity   | AC Port: L, N, L-N ±1kV   | EN61000-4-4:2012, Criteria A                                   |
| Surge Immunity  | AC Port: L-N: ±1kV  | EN61000-4-5:2015, Criteria A                                   |
| Immunity to conducted disturbances, induced by radio-frequency fields         | AC Port: 3Vrms (0.15-10MHz)<br>3-1Vrms (10-30MHz)<br>1Vrms (30-80MHz) | EN61000-4-6:2014, Criteria A                                   |
| Power Magnetic Field Immunity   | 1A/m  | EN61000-4-8:2010, Criteria A                                   |
| Voltage Dips  | 100% (0.5P, 0.5P)<br>30% (25P, 30P)                                   | EN61000-4-11:2004, Criteria A<br>EN61000-4-11:2004, Criteria A |
| Voltage Interruptions   | 100% (250P/300P)  | EN61000-4-11:2004, Criteria B                                  |

| <b>EMC Compliance (EN61204-3) <sup>(8)</sup></b>                                    | <b>Condition</b>   | <b>Standard / Criterion</b>             |
|---|--|---|
| Low voltage power supplies, d.c. output Part 3: Electromagnetic compatibility (EMC) |  | EN IEC 61204-3:2018                     |
| ESD Electrostatic discharge immunity test   | Air: ±2, 4, 8kV<br>Contact: ±4kV   | EN61000-4-2:2009, Criteria A            |
| Radiated, radio-frequency, electromagnetic field immunity test                      | 10V/m (80-1000MHz)<br>3V/m (1400-2000MHz)<br>1V/m (2000-2700MHz)                               | EN61000-4-3:2006 + A2:2010, Criteria A  |
| Fast Transient and Burst Immunity   | AC Port: L, N, L-N ±2kV  | EN61000-4-4:2012, Criteria A            |
| Surge Immunity  | AC Port: L-N: ±1kV   | EN61000-4-5:2014 + A1:2017, Criteria A  |
| Immunity to conducted disturbances, induced by radio-frequency fields               | AC Port: 10Vrms (0.15-80MHz)   | EN61000-4-6:2014, Criteria A            |
| Power Magnetic Field Immunity   | 30A/m  | EN61000-4-8:2010, Criteria A            |
| Voltage Dips  | 100% (0.5P, 0.5P)<br>100% (1.0P, 1.0P)<br>60% (10P, 12P)<br>30% (25P, 30P)<br>20% (250P, 300P) | EN61000-4-11:2004 + A1:2017, Criteria A |

**Notes:**

Note8: With earth referenced output connections, use of an external common mode choke 45mH (E-type) may be considered at the input.

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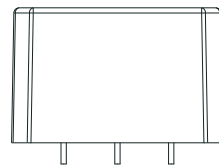
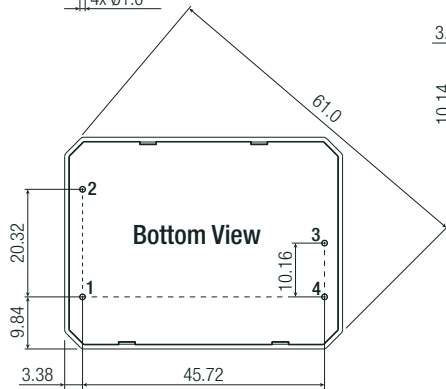
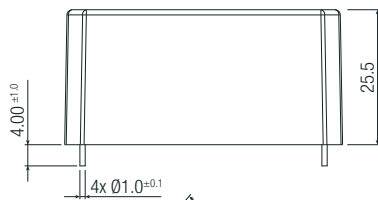
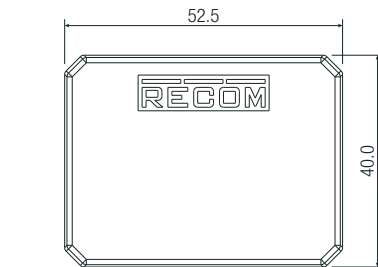
**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

| EMC Compliance (EN61204-3) (6)           | Condition         | Standard / Criterion                    |
|--|-------------------|---|
| Voltage Interruptions                    | 100% (250P, 300P) | EN61000-4-11:2004 + A1:2017, Criteria B |
| Limits of Harmonic Current Emissions     |                   | EN IEC 61000-3-2:2019                   |
| Limits of Harmonic Current Emissions     |                   | EN61000-3-2:2014                        |
| Limits of Voltage Fluctuations & Flicker |                   | EN61000-3-3:2013 + A1:2019              |

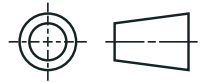
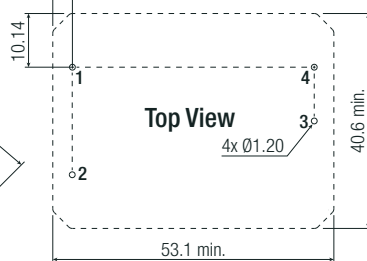
**DIMENSION AND PHYSICAL CHARACTERISTICS**

| Parameter         | Type           | Value                    |
|-------------------|----------------|--------------------------|
| Material          | case/baseplate | polycarbonate, (UL94V-0) |
|                   | potting        | PU, (UL94V-0)            |
|                   | PCB            | FR4, (UL94V-0)           |
| Dimension (LxWxH) |                | 52.5 x 40.0 x 25.5mm     |
| Weight            |                | 92g typ.                 |

**Dimension Drawing (mm)**



**Recommended Footprint Details**



**Pinning information**

| Pin # | Single          |
|-------|-----------------|
| 1     | VAC in (N) (L2) |
| 2     | VAC in (L) (L1) |
| 3     | -Vout           |
| 4     | +Vout           |

Tolerance: xx.x= ±0.5mm  
xx.xx= ±0.25mm

**PACKAGING INFORMATION**

| Parameter                   | Type           | Value                 |
|-----------------------------|----------------|-----------------------|
| Packaging Dimension (LxWxH) | tube           | 56.0 x 40.0 x 490.0mm |
| Packaging Quantity          |                | 11pcs                 |
| Storage Temperature Range   |                | -40°C to +90°C        |
| Storage Humidity            | non-condensing | 95%                   |

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