# Features

# Regulated Converter

- Wide input range 85-305VAC
- Standby mode optimized (eco design Lot 6)
- High efficiency over the entire load range
- Operating temperature range: -40°C to +90°C
- Class II installations (without FG)
- Overvoltage and overcurrent protected
- EMC compliant without external components

RECOM

AC/DC Converter

# RAC3.5-K/277

## 3.5 Watt Single Output

## Description

The RAC3.5-K/277 series are multipurpose 3.5 watt AC/DC power supplies for enhanced mains input conditions from 85VAC up to 305VAC with an extra wide operating temperature range from -40°C to +90°C. These modules are designed to supply worldwide applications in automation, Industry 4.0, IoT, household and smart buildings. For worldwide use they come with international safety certifications for industrial, domestic and ITE as well as household standards. With fully protected outputs, as well as EMC class B emissions compliance without any external components, these are the easiest to use modular power solutions in the industry.

## Selection Guide

| Part Number | Input Voltage Range [VAC] | Output Voltage [VDC] | Output Current [mA] | Efficiency typ (1) [%] | Max. Capacitive Load (2) [µF] |
|---|---|---|---|---|---|
| RAC3.5-3.3SK/277 | 85-305 | 3.3 | 1060 | 77 | 10000 |
| RAC3.5-05SK/277 | 85-305 | 5 | 700 | 80 | 8000 |
| RAC3.5-12SK/277 | 85-305 | 12 | 291 | 83 | 1500 |
| RAC3.5-15SK/277 | 85-305 | 15 | 233 | 83 | 1000 |
| RAC3.5-24SK/277 | 85-305 | 24 | 146 | 84 | 330 |

**Notes:**

Note1: Efficiency is tested at nominal input and full load at +25°C ambient

Note2: Max Cap Load is tested at nominal input and full resistive load

UL62368-1 certified
EN62368-1 certified
IEC/EN60335-1 certified
EN62233 certified
IEC/EN61558-1 certified
IEC/EN61558-2-16 certified
EN55032 compliant
EN55014-1(-2) compliant
CB Report

## Model Numbering

RAC3.5- __ SK/277

- nom. Output Power
- Output Voltage
- Single

**Ordering Examples:**

| | | | |
|---|---|---|---|
| RAC3.5-05SK/277 | 3.5 Watt | 5Vout | Single Output |
| RAC3.5-24SK/277 | 3.5 Watt | 24Vout | Single Output |

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

### BASIC CHARACTERISTICS

| Parameter | Condition | | Min. | Typ. | Max. |
|---|---|---|---|---|---|
| Internal Input Filter | | | | | Pi type |
| Input Voltage Range (3,4) | nom. Vin = 277VAC | | 85VAC<br>120VDC | 277VAC | 305VAC<br>430VDC |
| Input Current | 115VAC<br>230VAC<br>277VAC | | | 110mA<br>80mA<br>60mA | |
| Inrush Current | cold start at +25°C | 115VAC<br>230VAC<br>277VAC | | | 15A<br>30A<br>35A |
| No Load Power Consumption | | | | | 100mW |
| ErP Lot 6 Standby Mode Conformity (Output Load Capability) | Input Power= | 0.5W<br>1.0W | | | 0.34W<br>0.70W |
| Input Frequency Range | | | 47Hz | | 63Hz |
| Minimum Load | | | 0% | | |
| Power Factor | 115VAC<br>230VAC<br>277VAC | | 0.50<br>0.40<br>0.35 | | |
| Start-up Time | | | | 20ms | |
| Rise Time | | | | 10ms | |
| Hold-up Time | 115VAC<br>230VAC<br>277VAC | | | 20ms<br>25ms<br>90ms | |
| Internal Operating Frequency | 100% load at nominal Vin | | | 130kHz | |
| Output Ripple and Noise (5) | 20MHz BW | 3.3, 5Vout<br>others | | 60mVp-p<br>1% of Vout | |

**Notes:**

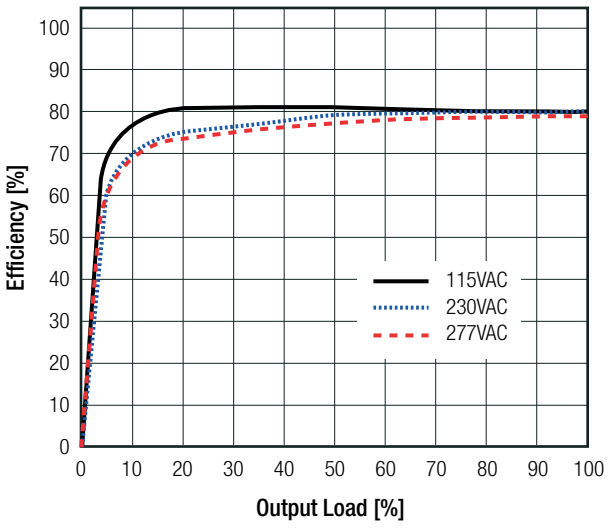
Note3: The products were submitted for safety files at AC-Input operation

Note4: Refer to ***„Line Derating“***

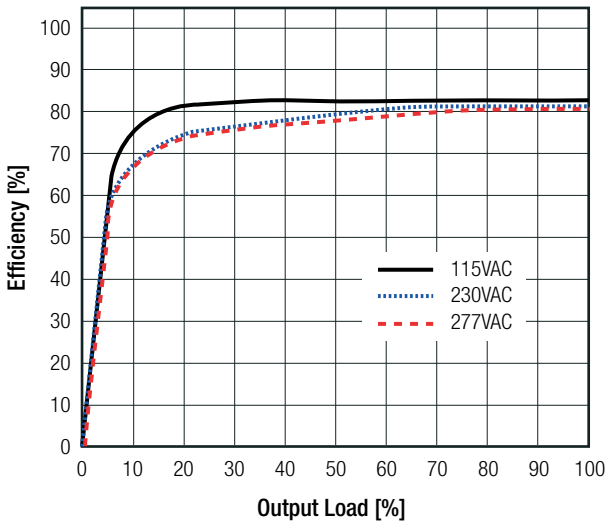
Note5: Measurements are made with a 0.1µF MLCC & 10µF E-cap in parallel across output. (low ESR)

### Efficiency vs. Load

RAC3.5-05SK/277




RAC3.5-12SK/277



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

### REGULATIONS

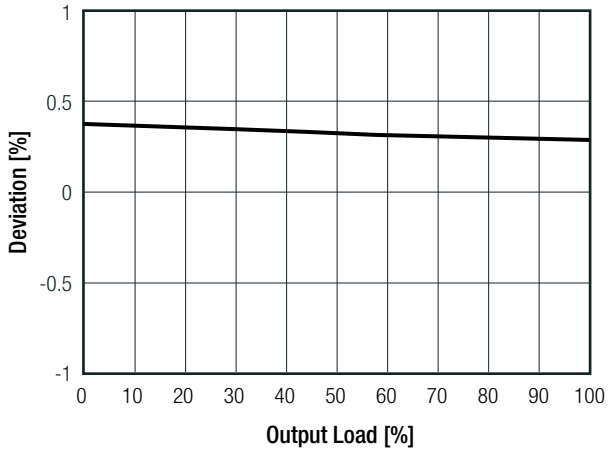
| Parameter | Condition | Value |
|---|---|---|
| Output Accuracy | | ±1.0% typ. |
| Line Regulation | low line to high line, full load | ±0.5% typ. |
| Load Regulation (6) | 10% to 100% load | 1.0% typ. |
| Transient Response | 25% load step change | 4.0% max. |
| | recovery time | 500µs typ. |

**Notes:**

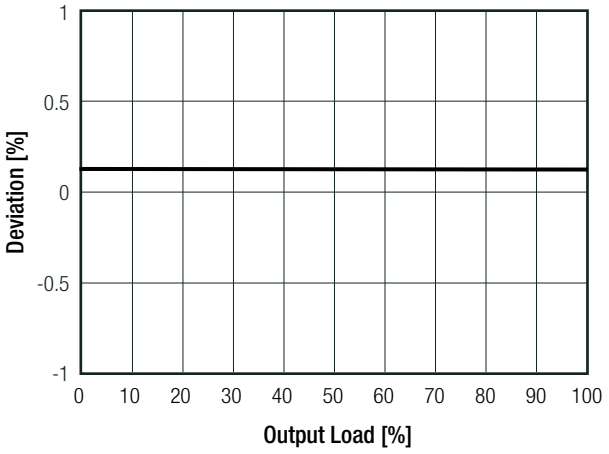
Note6: Operation below 10% load will not harm the converter, but specifications may not be met

**Deviation vs. Load**
(at 115VAC, 230VAC, 277VAC)

RAC3.5-05SK/277




RAC3.5-12SK/277




### PROTECTIONS

| Parameter | Type | | Value |
|---|---|---|---|
| Input Fuse (7) | internal | | T1A, slow blow |
| Short Circuit Protection (SCP) | below 100mΩ | | hiccup, automatic restart |
| Over Voltage Protection (OVP) | | | 125% - 195%, latch of mode |
| Over Voltage Category | | | OVCII |
| Over Current Protection (OCP) | | | 175% - 275%, hiccup mode |
| Class of Equipment | | | Class II |
| Isolation Voltage (8) | I/P to O/P | 1 minute | 4.2kVAC |
| Isolation Resistance | | Viso= 500VDC | 1GΩ min. |
| Isolation Capacitance | | | 100pF max. |
| Insulation Grade | | | reinforced |
| Leakage Current | | | 0.25mA max. |

**Notes:**

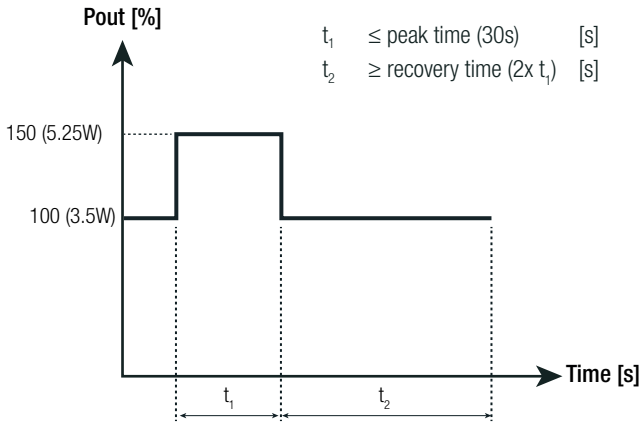
Note7: Refer to local safety regulations if input over-current protection is also required

Note8: For repeat Hi-Pot testing, reduce the time and/or the test voltage

**continued on next page**

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

### Peak Load Capability




### ENVIRONMENTAL

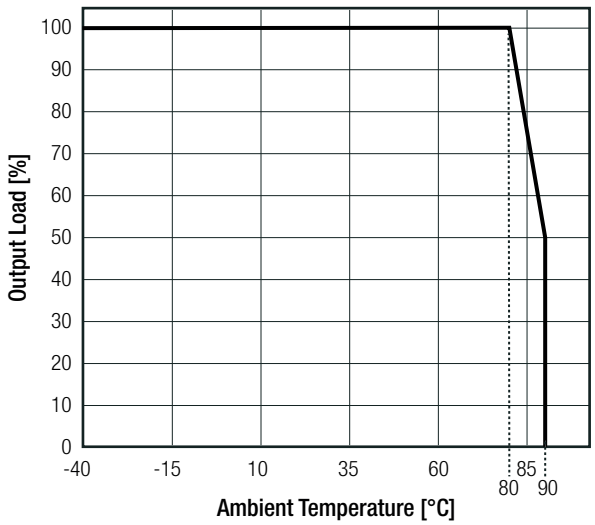
| Parameter | Condition | | Value |
|---|---|---|---|
| Operating Temperature Range | @ natural convection 0.1m/s | full load | -40°C to +80°C |
| | | refer to ***„Derating Graph"*** | -40°C to +90°C |
| Maximum Case Temperature | | | +95°C |
| Temperature Coefficient | | | 0.05%/K |
| Operating Altitude (9) | | | 5000m |
| Operating Humidity | non-condensing | | 5% - 95% RH max. |
| Pollution Degree | | | PD2 |
| Vibration | according to MIL-STD-202G | | 10-500Hz, 2G 10min./1cycle, period 60min. each along x,y,z axis |
| MTBF | according to MIL-HDBK-217F, G.B. | +25°C | >600 x $10^3$ hours |
| Design Lifetime | 230VAC | +25°C | 125 x $10^3$ hours |
| | | +70°C | 34 x $10^3$ hours |
| | 277VAC | +25°C | 105 x $10^3$ hours |
| | | +70°C | 27 x $10^3$ hours |

**Notes:**

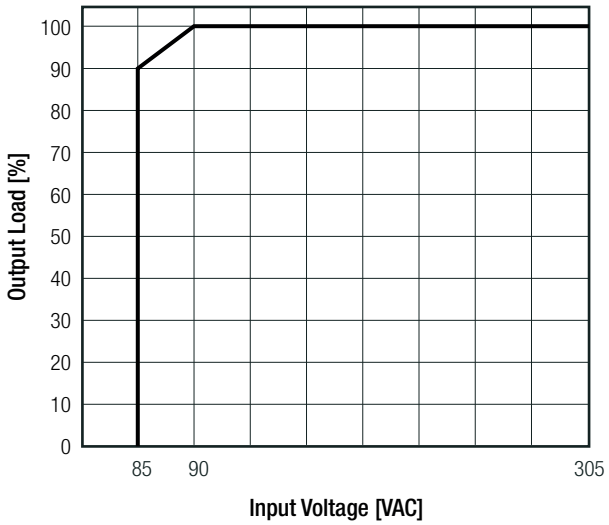
Note9: Recognized by UL for safe operation up to 5000m. High altitude operation may impact the performance and lifetime. Contact RECOM tech support for advice

### Derating Graph

(@ Chamber and natural convection 0.1m/s)




### Line Derating



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

| SAFETY AND CERTIFICATIONS | | |
|---|---|---|
| **Certificate Type (Safety)** | **Report / File Number** | **Standard** |
| Audio/Video, information and communication technology equipment - Part 1: Safety requirements | E491408-A6004-UL | UL62368-1, 2nd Edition, 2014-12-01<br>CAN/CSA-C22.2 No. 62368-1-14, 2nd Edt., 2014-12 |
| Audio/Video, information and communication technology equipment - Part 1: Safety requirements (CB Scheme) | E491408-A6007-CB-1 | IEC62368-1:2014 2nd Edition |
| Audio/Video, information and communication technology equipment - Part 1: Safety requirements (LVD) | | EN62368-1:2014 + A11:2017 |
| Household and similar electrical appliances - Safety - Part 1: General requirements | LCS190308001CS | IEC60335-1:2010 + A2:2016 + C1:2016, 5th Edt.<br>EN60335-1:2012 + A13:2017 |
| Measurement methods for electromagnetic fields of household appliances and similar apparatus with regard to human exposure | | EN62233:2008 |
| Safety of power transformers, power supplies, reactors and similar products for supply voltages up to 1100 V (CB Scheme) | 50230493 001 | IEC61558-1:2005 2nd Edition + A1:2009 |
| Safety of power transformers, power supplies, reactors and similar products for supply voltages up to 1100 V Part 2: Particular requirements (CB Scheme) | | IEC61558-2-16:2009 1st Edition + A1:2013 |
| Safety of power transformers, power supplies, reactors and similar products for supply voltages up to 1100 V | | EN61558-1:2005 + A1:2009 |
| Safety of power transformers, power supplies, reactors and similar products for supply voltages up to 1100 V Part 2: Particular requirements | | EN61558-2-16:2009 + A1:2013 |
| RoHS2 | | RoHS-2011/65/EU + AM-2015/863 |

| EMC Compliance | Conditions | Standard / Criterion |
|---|---|---|
| Low-voltage power supplies DC output - Part 3: Electromagnetic compatibility | | EN61204-3: 2018, Class B |
| Electromagnetic compatibility of multimedia equipment - Emission requirements (11) | | EN55032:2015, Class B |
| Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission | | EN55014-1:2006 + A2:2011 |
| Information technology equipment - Immunity characteristics - Limits and methods of measurement | | EN55024:2010 + A1:2015 |
| Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 2: Immunity | | EN55014-2:2015 |
| ESD Electrostatic discharge immunity test | Air: ±2, 4, 8kV<br>Contact: ±2, 4kV | EN61000-4-2: 2009, Criteria B |
| Radiated, radio-frequency, electromagnetic field immunity test | 10V/m, 80MHz-1GHz<br>3V/m, 1.4GHz-2GHz<br>1V/m, 2GHz-2.7GHz | EN61000-4-3: 2006 + A1, 2009, Criteria A |
| Fast Transient and Burst Immunity | AC and DC Port: ±2kV | EN61000-4-4: 2012, Criteria B |
| Surge Immunity | AC In Port (L-N): ±1kV<br>DC Output Port: ±0.5kV | EN61000-4-5: 2014 +A1:2017, Criteria B |
| Immunity to conducted disturbances, induced by radio-frequency fields | AC and DC Port: 10V | EN61000-4-6: 2014, Criteria A |
| Power Magnetic Field Immunity | 50Hz, 30A/m | EN61000-4-8: 2010, Criteria A |
| Voltage Dips and Interruptions | Voltage Dips: 30%<br>Voltage Dips: 60%<br>Voltage Dips: 100%<br>Interruptions: >95% | EN61000-4-11:2004 + A1:2017, Criteria C<br>EN61000-4-11:2004 + A1:2017, Criteria C<br>EN61000-4-11:2014 + A1:2017, Criteria B<br>EN61000-4-11: 2014 + A1:2017,Criteria C |
| Voltage Fluctuations and Flicker in Public Low-Voltage Systems <=16A per phase | | EN61000-3-3: 2013 |
| Limitations on the amount of electromagnetic interference allowed from digital and electronic devices | | FCC 47 CFR Part 15 Supbart B, Class B |
| Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz | | ANSI C63.4-2014, Class B |

**Notes:**

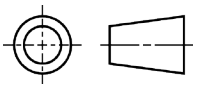
Note11: If output is connected to GND, please contact RECOM tech support for advice

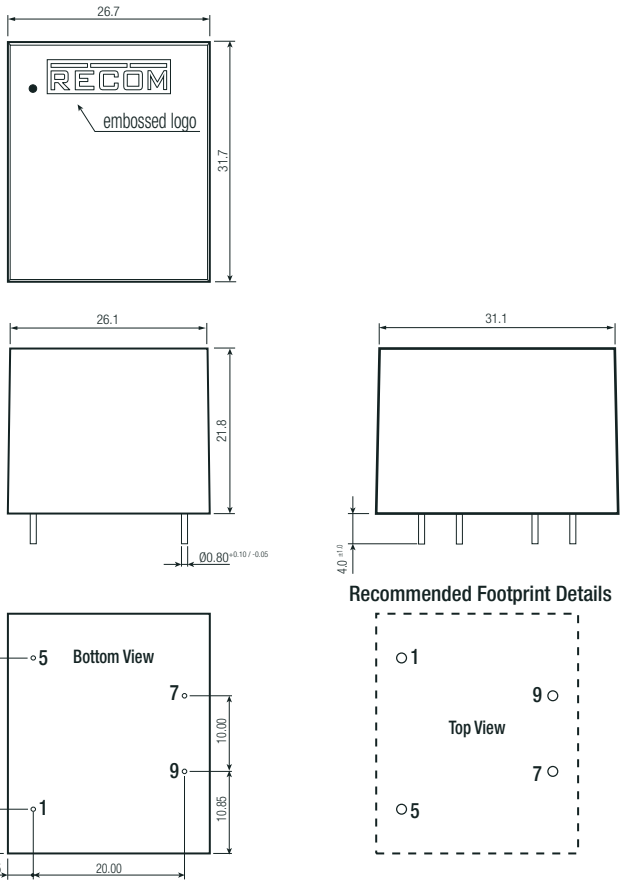
## Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

### DIMENSION AND PHYSICAL CHARACTERISTICS

| Parameter | Type | Value |
|---|---|---|
| Material | case, baseplate<br>potting<br>PCB | black plastic, (UL94V-0)<br>silicone, (UL94V-0)<br>FR4, (UL94V-0) |
| Dimension (LxWxH) | | 31.7 x 26.7 x 21.8mm |
| Weight | | 31.5g typ. |

**Dimension Drawing (mm)**






**Pin Connections**

| Pin # | Single |
|---|---|
| 1 | VAC in (N) |
| 5 | VAC in (L) |
| 7 | +Vout |
| 9 | -Vout |

Tolerance: xx.x= ±0.8mm
xx.xx= ±0.25mm

### PACKAGING INFORMATION

| Parameter | Type | Value |
|---|---|---|
| Packaging Dimension (LxWxH) | tube | 466.0 x 30.4 x 29.3mm |
| Packaging Quantity | tube | 12pcs |
| Storage Temperature Range | | -40°C to +85°C |
| Storage Humidity | non-condensing | 20% to 90% RH max. |

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001
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