

## Features

## Regulated Converter

- Universal input 85-305VAC
- 4W PCB mount package
- <75mW No load power consumption
- Ultra low profile, compact size
- -40°C to +85°C Operating temperature
- Continuous SCP, OCP, OVP
- IEC/EN/UL60950 & EN60335-1 certified, EN55032 Class A

## Description

The RAC04-GA series are low cost AC/DC power supplies, ideal for PCB mounted, compact, board level industrial applications. They feature universal AC input voltage range, regulated and short-circuit -proof isolated DC outputs, low standby power consumption and -40°C to +85°C operating temperature range. The RAC04-GA have a built-in Class A / FCC Part 15 EMC filter, are certified to IEC/EN/UL60950-1 and EN60335 and are certified to IEC/EN/UL62368 and EN61558 safety standards and come with a three year warranty.

## Selection Guide

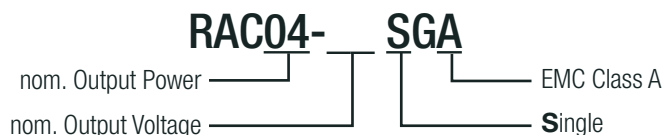
| Part Number       | Input Voltage Range [VAC] | Output Voltage [VDC] | Output Current [mA] | Efficiency typ <sup>(1)</sup> [%] | Max. Capacitive Load <sup>(2)</sup> [μF] |
|-------------------|---------------------------|----------------------|---------------------|-----------------------------------|--|
| RAC04-05SGA       | 85-305                    | 5                    | 800                 | 72                                | 1500                                     |
| RAC04-09SGA       | 85-305                    | 9                    | 440                 | 77                                | 1000                                     |
| RAC04-12SGA       | 85-305                    | 12                   | 330                 | 78                                | 500                                      |
| RAC04-24SGA       | 85-305                    | 24                   | 170                 | 80                                | 150                                      |
| <b>On Request</b> |                           |                      |                     |                                   |  |
| RAC04-3.3SGA      | 85-305                    | 3.3                  | 1210                | 70                                | 2000                                     |
| RAC04-15SGA       | 85-305                    | 15                   | 270                 | 78                                | 200                                      |

### Notes:

Note1: Efficiency is tested at 230VAC and full load at +25°C ambient

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

## Model Numbering



### Ordering Examples:

RAC04-12SGA    12Vout    Single Output    EMC Class A

**4 Watt  
 Single  
 Output  
 EMC Class A**



UL60950-1 certified  
 IEC/EN60950-1 certified  
 UL62368-1 certified  
 IEC/EN62368-1 certified  
 EN61558-1 certified  
 EN61558-2-16 certified  
 EN60335-1 certified  
 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.   |
|--|--------------------------|------------------|------------------------------------|--------------|--|
| Internal Input Filter                  |                          |                  | Pi-type                            |              |  |
| Input Voltage Range <sup>(3,4)</sup>   | nom. Vin = 230VDC        |                  | 85VAC<br>120VDC                    |              | 305VAC<br>430VDC                             |
| Input Current                          | 115VAC<br>230VAC         |                  |                                    | 85mA<br>55mA |  |
| Inrush Current                         | cold start at 25°C       | 115VAC<br>230VAC |                                    |              | 10A<br>20A                                   |
| No load Power Consumption              |                          |                  |                                    |              | 75mW   |
| Input Frequency Range                  | AC Input                 |                  | 45Hz                               |              | 65Hz   |
| Minimum Load                           |                          |                  | 0%                                 |              |  |
| Power Factor                           | 115VAC<br>230VAC         |                  |                                    | 0.55<br>0.42 |  |
| Start-up Time                          | 115VAC, 230VAC           |                  |                                    | 30ms         | 1s   |
| Hold-up time                           | 115VAC<br>230VAC         |                  |                                    | 5ms<br>40ms  |  |
| Internal Operating Frequency           | 100% load at nominal Vin |                  |                                    | 65kHz        |  |
| Output Ripple and Noise <sup>(6)</sup> | 20MHz BW                 | 0°C to 85 °C     | 5Vout<br>9Vout<br>12Vout<br>24Vout |              | 100mVp-p<br>120mVp-p<br>150mVp-p<br>240mVp-p |
|  |                          | -30 °C to 0 °C   | 5Vout<br>9Vout<br>12Vout<br>24Vout |              | 200mVp-p<br>250mVp-p<br>250mVp-p<br>300mVp-p |

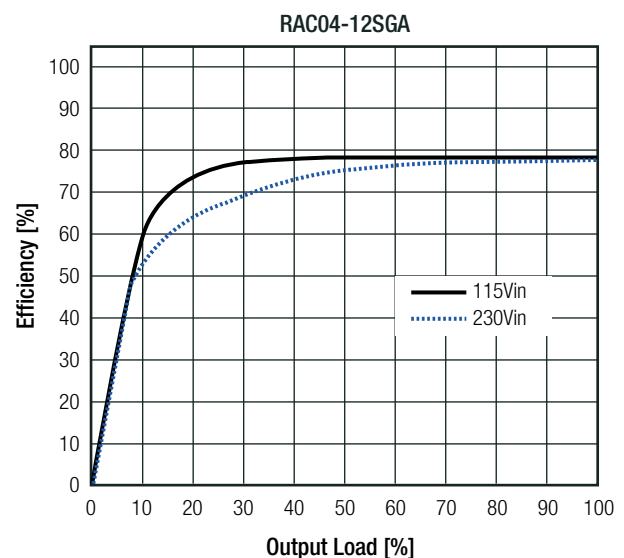
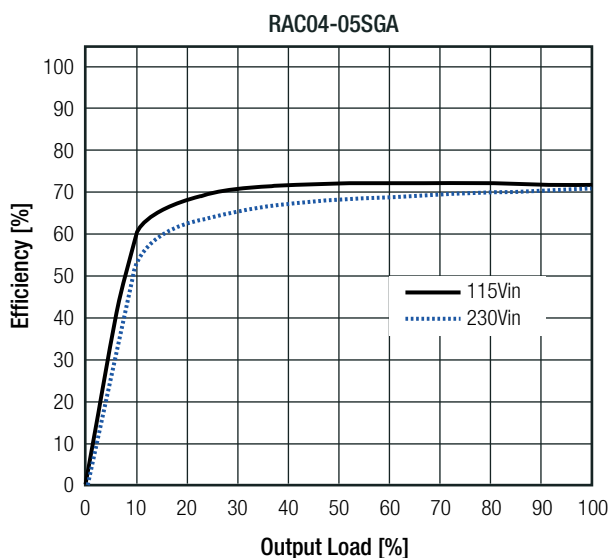
#### Notes:

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

Note4: Refer to **"Line Derating"**

Note5: Measurements are made with a 12" twisted pair-wire with a 0.1µF and 10µF parallel capacitor across output (low ESR)

### Efficiency vs. Load



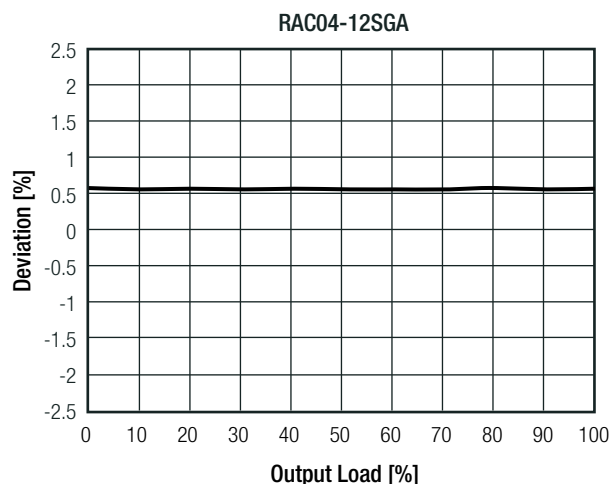
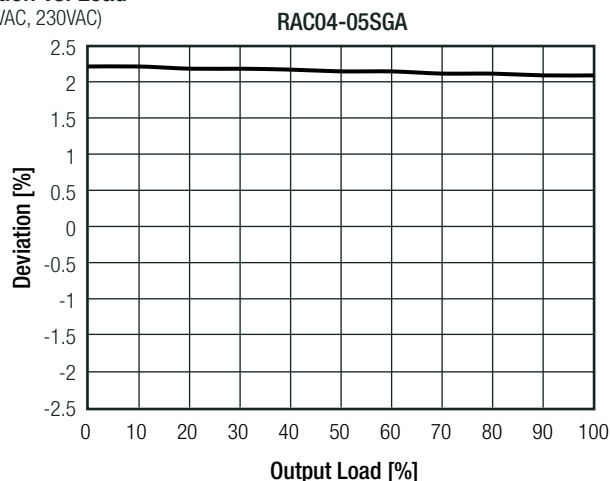
**Specifications** (measured @  $T_a = 25^\circ\text{C}$ , nom.  $V_{in}$ , full load and after warm-up unless otherwise stated)

### REGULATIONS

| Parameter       | Condition             | Value            |
|-----------------|-----------------------|------------------|
| Output Accuracy |                       | $\pm 2.5\%$ max. |
| Line Regulation | low line to high line | $\pm 0.5\%$ max. |
| Load Regulation | 10% to 100% load      | 0.5% max.        |

#### Deviation vs. Load

(at 115VAC, 230VAC)



### PROTECTIONS

| Parameter                        | Type   | Value   |
|----------------------------------|--|---|
| Input Fuse <sup>(6)</sup>        | internal   | T1A slow blow type, 300V  |
| Short Circuit Protection (SCP)   | below 100m $\Omega$  | long-term mode, auto recovery   |
| Over Voltage Protection (OVP)    | 5V <sub>out</sub><br>9V <sub>out</sub><br>12V <sub>out</sub><br>24V <sub>out</sub> | 5.3V - 6.8V<br>10.3V - 12.2V<br>12.6V - 16.2V<br>25.2V - 32.4V<br>hiccup mode, auto recovery  |
| Over Voltage Category            |  | OVCII   |
| Over Current Protection (OCP)    | 5V <sub>out</sub><br>9V <sub>out</sub><br>12V <sub>out</sub><br>24V <sub>out</sub> | 0.91A - 2.2A<br>0.49A - 1.25A<br>0.37A - 0.95A<br>0.19A - 0.45A<br>hiccup mode, auto recovery |
| Class of Equipment               |  | Class II  |
| Isolation Voltage <sup>(7)</sup> | I/P to O/P   | rated for 1 minute<br>3kVAC/10mA  |
| Isolation Resistance             |  | 10M $\Omega$ min.   |
| Isolation Capacitance            |  | 800pF min. / 1200pF max.  |
| Insulation Grade                 |  | reinforced  |
| Leakage Current                  | 277VAC, 50Hz   | 0.1mA max.  |

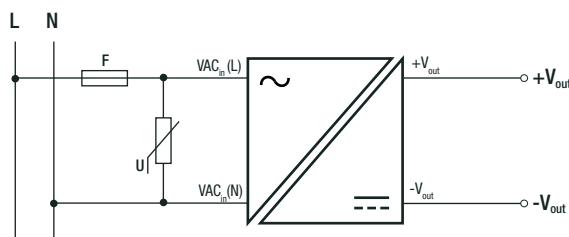
#### Notes:

Note6: Refer to local wiring regulations if input over-current protection is also required

Note7: For repeat Hi-Pot testing, reduce the time and/or the test voltage

Note8: For operation  $\geq 230\text{VAC}$ , an external MOV is recommended. The Varistor should comply with IEC61051-2. eg. EPCOS S14 series

#### Protection Circuit



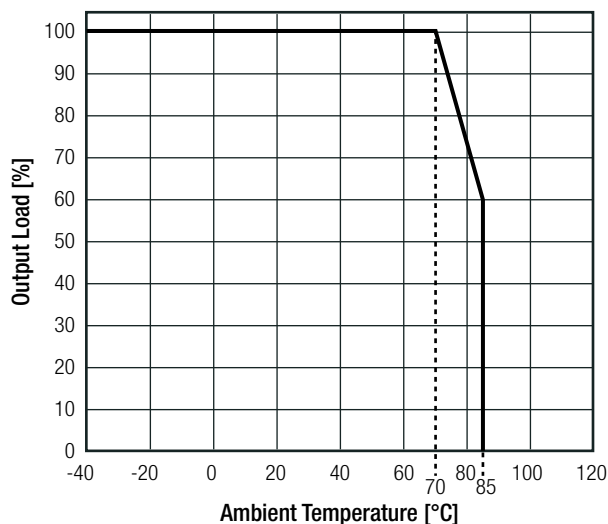
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### ENVIRONMENTAL

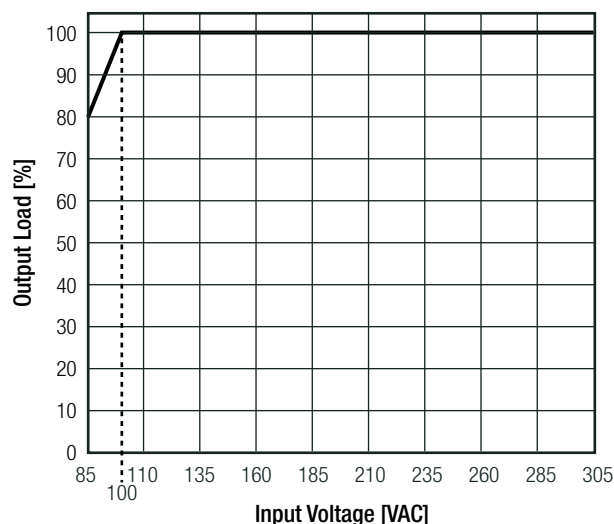
| Parameter                   | Condition                        |                                  | Value  |
|-----------------------------|----------------------------------|----------------------------------|--|
| Operating Temperature Range | @ natural convection 0.1m/s      | full load                        | -40°C to +70°C   |
|                             |                                  | refer to <b>"Derating Graph"</b> | -40°C to +85°C   |
| Maximum Case Temperature    |                                  |                                  | +100°C   |
| Temperature Coefficient     |                                  |                                  | 0.03%/K  |
| Operating Altitude          |                                  |                                  | 3000m  |
| Operating Humidity          | non-condensing                   |                                  | 5% - 95% RH  |
| Pollution Degree            |                                  |                                  | PD2  |
| Shock                       |                                  |                                  | 20G/11ms pulse, 3 times at each x, y, z axes                               |
| Vibration                   |                                  |                                  | 10-150Hz, 2G 10min./1cycle, period 60min.<br>along x,y,z axes for 6 cycles |
| Design Lifetime             | +25°C                            |                                  | 90 x 10 <sup>3</sup> hours   |
|                             | +50°C                            |                                  | 62 x 10 <sup>3</sup> hours   |
| MTBF                        | according to MIL-HDBK-217F, G.B. | +25°C                            | >910 x 10 <sup>3</sup> hours   |
|                             |                                  | +50°C                            | >198 x 10 <sup>3</sup> hours   |

#### Derating Graph

(@ Chamber and natural convection 0.1m/s)



#### Line Derating



### SAFETY AND CERTIFICATIONS

| Certificate Type (Safety)  | Report / File Number       | Standard  |
|--|----------------------------|---|
| Information Technology Equipment, General Requirements for Safety  | E196683-A4-UL              | UL60950-1, 2nd Edition, 2014<br>CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014 |
| Audio/video, information and communication technology equipment. Safety requirements                                       |                            | UL62368-1, 2nd Edition<br>CAN/CSA C22.2 No 62368-1-14                           |
| Information Technology Equipment, General Requirements for Safety  | SA1703184S 001             | EN60950-1: 2006 + A2:2013   |
| Information Technology Equipment, General Requirements for Safety (CB)   |                            | IEC60950-1:2005, 2nd Edition + A2:2013  |
| Audio/video, information and communication technology equipment. Safety requirements                                       | 4787985921-<br>20171025-CB | EN62368-1: 2014   |
| Audio/video, information and communication technology equipment. Safety requirements (CB)                                  |                            | IEC62368-1:2014, 2nd Edition  |
| Household and similar electrical appliances – Safety – Part 1: General requirements  | 211-600771-000             | EN60335-1:2012+A12:2017   |
| Household and similar electrical appliances – Safety – Part 1: General requirements (CB)                                   |                            | IEC60335-1:2010, 5th Edition + A1:2013  |
| Household and similar electrical appliances – Safety – Part 1: General requirements  | SA1703184L 01001           | EN60335-1:2012+A11:2014   |
| Measurement methods for electromagnetic fields of household appliances and similar apparatus with regard to human exposure |                            | EN62233:2008  |

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

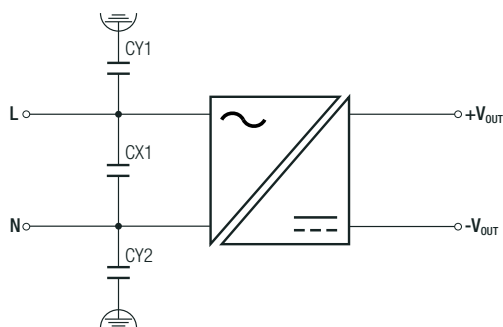
| Certificate Type (Safety)   | Report / File Number | Standard                                  |
|---|----------------------|---|
| Safety of power transformers, power supplies, reactors and similar products for supply voltages up to 1100 V                                      | SA 1703184L 02001    | 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              |
| Safety of power transformers, power supplies, reactors and similar products for supply voltages up to 1100 V                                      | 211-600770-000       | 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              |
| Safety of power transformers, power supplies, reactors and similar products for supply voltages up to 1100 V (CB)                                 | 211-600770-000       | 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) |                      | IEC61558-2-16:2009, 1st Edition + A1:2013 |
| EAC   | RU-AT.03.67361       | TP TC 004/020, 2011                       |
| RoHS 2+   |                      | RoHS 2011/65/EU + AM2015/863              |

| EMC Compliance  | Condition              | Standard / Criterion                     |
|---|------------------------|--|
| Electromagnetic compatibility of multimedia equipment – Emission Requirements <sup>(9)</sup>          | EA1703184E 01001       | EN55032: 2015, Class A                   |
| Information technology equipment - Immunity characteristics - Limits and methods of measurement       |                        | EN55024:2010 + A1:2015                   |
| Limitations on the amount of electromagnetic interference allowed from digital and electronic devices | EA1703184F 01001       | 47 CFR FCC Part 15 Subpart B: 2016       |
| ESD Electrostatic discharge immunity test   | Air ±8kV, Contact ±4kV | EN61000-4-2: 2009, Criteria A            |
| Radiated, radio-frequency, electromagnetic field immunity test  | 3V/m                   | EN61000-4-3: 2006 + A2, 2010, Criteria A |
| Fast Transient and Burst Immunity   | AC Port ±1kV           | EN61000-4-4: 2012, Criteria A            |
| Surge Immunity  | AC Port L-N ±1kV       | EN61000-4-5: 2014, Criteria B            |
| Immunity to conducted disturbances, induced by radio-frequency fields                                 | AC Power Port 3V       | EN61000-4-6: 2014, Criteria A            |
| Voltage Dips and Interruption   | Voltage Dips >95%      | EN61000-4-11: 2004, Criteria A           |
|   | Voltage Dips 30%       | EN61000-4-11: 2004, Criteria A           |
|   | Interruptions >95%     | EN61000-4-11: 2004, Criteria C           |

**Notes:**

Note9: If output is connected to GND, please contact RECOM tech support for advice

**EMC Filtering according to EN55014-1 / EN55032 Class B Compliance**



| CY1, CY2 | CX1        |
|----------|------------|
| 1nF, 2kV | 100nF, 2kV |

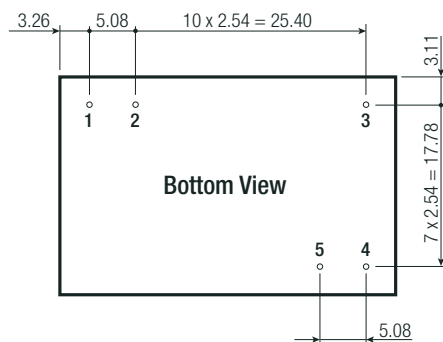
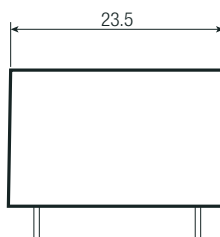
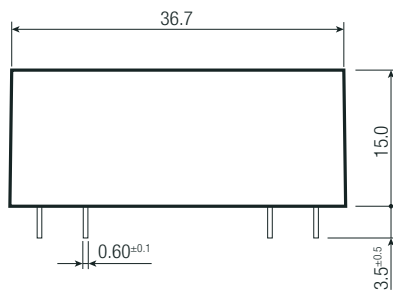
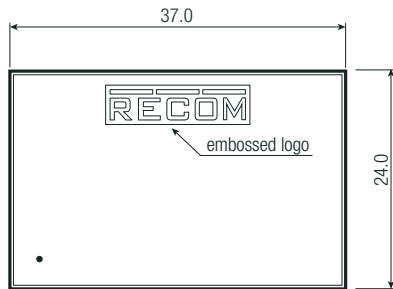
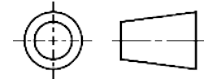
**DIMENSION AND PHYSICAL CHARACTERISTICS**

| Parameter         | Type        | Value                                      |
|-------------------|-------------|--|
| Material          | case<br>PCB | black plastic, (UL94V-0)<br>FR4, (UL94V-0) |
| Dimension (LxWxH) |             | 37.0 x 24.0 x 15.0mm                       |
| Weight            |             | 20g typ.                                   |

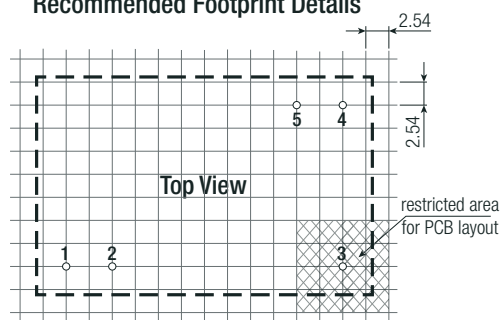
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**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

Dimension Drawing (mm)



Recommended Footprint Details



Pin Connections

| Pin # | Single     |
|-------|------------|
| 1     | VAC in (L) |
| 2     | VAC in (N) |
| 3     | NC         |
| 4     | -Vout      |
| 5     | +Vout      |

NC: Not Connected

Tolerances:

xx.x= ±0.5mm

x.xx= ±0.25mm

### PACKAGING INFORMATION

| Parameter                   | Type           | Value                 |
|-----------------------------|----------------|-----------------------|
| Packaging Dimension (LxWxH) | tube           | 505.0 x 39.7 x 23.2mm |
| Packaging Quantity          |                | 20pcs                 |
| Storage Temperature Range   |                | -40°C to +100°C       |
| Storage Humidity            | non-condensing | 5% -95% RH max.       |

The product information and specifications may be subject to changes even without prior written notice. The product has been designed for various applications; its suitability lies in the responsibility of each customer. The products are not authorized for use in safety-critical applications without RECOM's explicit written consent. A safety-critical application is an application where a failure may reasonably be expected to endanger or cause loss of life, inflict bodily harm or damage property. The applicant shall indemnify and hold harmless RECOM, its affiliated companies and its representatives against any damage claims in connection with the unauthorized use of RECOM products in such safety-critical applications.