

# Features

## Regulated Converters

- 2:1 and 4:1 Wide input voltage range
- SIP8 Package style
- UL94V-0 Package material
- Continuous short circuit protected
- Low noise
- 1kVDC, 2kVDC or 3kVDC Isolation

**RECOM**  
DC/DC Converter

## RSO-S(D)(Z)

**1 Watt**  
**SIP8**  
**Single & Dual**  
**Output**



UL60950-1 certified  
CAN/CSA No. 60950-1-07 certified  
IEC/EN60950-1 certified  
IEC/EN60601-1 certified  
CB Report

## Description

High-power-density, an industrial temperature range of -40°C to +100°C and extra features like On-Off-control are just some of the characteristics of this converter, ideal for highly sophisticated industrial-designs. The RSO series is available with isolation of 2kV or 3kV by choosing option „/H2“ or „/H3“. The standard version offers 2:1 input voltage range, while the “Z” version features 4:1 input voltage range, which includes an input voltage range covering both 5V and 12V supplies.

## Selection Guide

| Part Number | Input Voltage Range [VDC]                 | Output Voltage [VDC] | Output Current [mA] | Efficiency typ. [%] | max. Capacitive Load <sup>(3)</sup> [μF] |
|-------------|-------------------------------------------|----------------------|---------------------|---------------------|------------------------------------------|
| RSO-xx3.3S  | 4.5-9 <sup>(1)</sup> , 9-18, 18-36, 36-72 | 3.3                  | 300                 | 68-72               | 3300                                     |
| RSO-xx3.3SZ | 9-36, 18-72                               |                      |                     | 68-70               |                                          |
| RSO-xx05S   | 4.5-9 <sup>(1)</sup> , 9-18, 18-36, 36-72 | 5                    | 200                 | 73-78               | 1200                                     |
| RSO-xx05SZ  | 4.5-18 <sup>(1,2)</sup> , 9-36, 18-72     |                      |                     |                     |                                          |
| RSO-xx09S   | 4.5-9 <sup>(1)</sup> , 9-18, 18-36, 36-72 | 9                    | 111                 | 74-81               | 680                                      |
| RSO-xx09SZ  | 4.5-18 <sup>(1,2)</sup> , 9-36, 18-72     |                      |                     | 75-78               |                                          |
| RSO-xx12S   | 4.5-9 <sup>(1)</sup> , 9-18, 18-36, 36-72 | 12                   | 83                  | 75-83               | 680                                      |
| RSO-xx12SZ  | 4.5-18 <sup>(1,2)</sup> , 9-36, 18-72     |                      |                     | 77-83               |                                          |
| RSO-xx15S   | 4.5-9 <sup>(1)</sup> , 9-18, 18-36, 36-72 | 15                   | 67                  | 75-83               | 680                                      |
| RSO-xx15SZ  | 4.5-18 <sup>(1,2)</sup> , 9-36, 18-72     |                      |                     | 78-83               |                                          |
| RSO-xx3.3D  | 4.5-9 <sup>(1)</sup> , 9-18, 18-36, 36-72 | ±3.3                 | ±150                | 68-72               | ±1500                                    |
| RSO-xx3.3DZ | 9-36, 18-72                               |                      |                     | 70-74               |                                          |
| RSO-xx05D   | 4.5-9 <sup>(1)</sup> , 9-18, 18-36, 36-72 | ±5                   | ±100                | 73-76               | ±470                                     |
| RSO-xx05DZ  | 4.5-18 <sup>(1,2)</sup> , 9-36, 18-72     |                      |                     | 77                  |                                          |
| RSO-xx09D   | 4.5-9 <sup>(1)</sup> , 9-18, 18-36, 36-72 | ±9                   | ±56                 | 74-78               | ±470                                     |
| RSO-xx09DZ  | 4.5-18 <sup>(1,2)</sup> , 9-36, 18-72     |                      |                     | 74-78               |                                          |
| RSO-xx12D   | 4.5-9 <sup>(1)</sup> , 9-18, 18-36, 36-72 | ±12                  | ±42                 | 75-80               | ±330                                     |
| RSO-xx12DZ  | 4.5-18 <sup>(1,2)</sup> , 9-36, 18-72     |                      |                     | 75-80               |                                          |
| RSO-xx15D   | 4.5-9 <sup>(1)</sup> , 9-18, 18-36, 36-72 | ±15                  | ±34                 | 75-80               | ±330                                     |
| RSO-xx15DZ  | 4.5-18 <sup>(1,2)</sup> , 9-36, 18-72     |                      |                     | 75-80               |                                          |

### Notes:

- Note1: Derate to 75% if  $V_{IN}$  is <5VDC (refer to „Line Derating“ graph on page 2)  
 Note2: 12V 4:1 input also requires an external 10μF capacitor (refer to „Protection Circuit“ on page 3)  
 Note3: Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage the converter

## Model Numbering



### Notes:

- Note4: add „Z“ for 4:1 Input Voltage (12= 4.5-18VDC; 24= 9-36VDC; 48= 18-72VDC)  
 Note5: add suffix „/H2“ for 2kVDC isolation or „/H3“ for 3kVDC isolation, without = standard 1kVDC isolation

### Ordering Examples:

|               |           |        |        |                   |                 |
|---------------|-----------|--------|--------|-------------------|-----------------|
| RSO-0512S:    | 4.5-9Vin  | 12Vout | Single | 2:1 Input Voltage | 1kVDC Isolation |
| RSO-0505DZ/H3 | 4.5-9Vin  | ±5Vout | Dual   | 4:1 Input Voltage | 3kVDC Isolation |
| RSO-1212SZ/H2 | 4.5-18Vin | 12Vout | Single | 4:1 Input Voltage | 2kVDC Isolation |

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

## BASIC CHARACTERISTICS

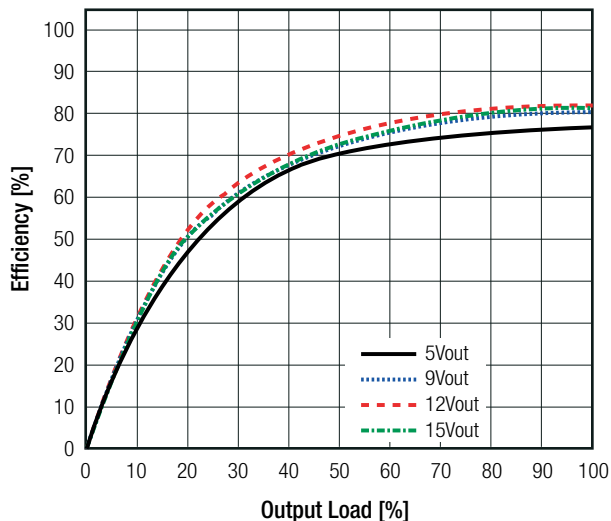
| Parameter                    | Condition                                |                | Min.                                                                                     | Typ.                         | Max.    |
|------------------------------|------------------------------------------|----------------|------------------------------------------------------------------------------------------|------------------------------|---------|
| Input Voltage Range          | 2:1 Input                                | 5VDC           | 4.5VDC <sup>(1)</sup>                                                                    |                              | 9VDC    |
|                              |                                          | nom Vin= 12VDC | 9VDC                                                                                     |                              | 18VDC   |
|                              |                                          | 24VDC          | 18VDC                                                                                    |                              | 36VDC   |
|                              |                                          | 48VDC          | 36VDC                                                                                    |                              | 72VDC   |
|                              | 4:1 Input                                | 12VDC          | 4.5VDC <sup>(1,2)</sup>                                                                  |                              | 18VDC   |
|                              |                                          | nom Vin= 24VDC | 9VDC                                                                                     |                              | 36VDC   |
|                              |                                          |                | 18VDC                                                                                    |                              | 72VDC   |
|                              |                                          | 48VDC          |                                                                                          |                              |         |
| Quiescent Current            | 5VDC<br>nom Vin= 12VDC<br>24VDC<br>48VDC |                |                                                                                          | 40mA<br>32mA<br>25mA<br>15mA |         |
| Minimum Load <sup>(6)</sup>  |                                          |                | 10%                                                                                      |                              |         |
| ON/OFF CTRL                  | DC-DC ON<br>DC-DC OFF                    |                | open or high impedance<br>external V <sub>CTRL</sub> = 5-12VDC + 1N4148 and 68Ω resistor |                              |         |
| Input Current of CTRL Pin    | DC-DC ON                                 |                |                                                                                          | 3mA                          | 6mA     |
| Standby Current              | DC-DC OFF                                |                |                                                                                          | 10mA                         |         |
| Internal Operating Frequency | 2:1 Input                                |                | 200kHz                                                                                   |                              | 500kHz  |
|                              | 4:1 Input                                |                | 100kHz                                                                                   |                              | 800kHz  |
| Output Ripple and Noise      | 20MHz BW                                 |                |                                                                                          |                              | 50mVp-p |

### Notes:

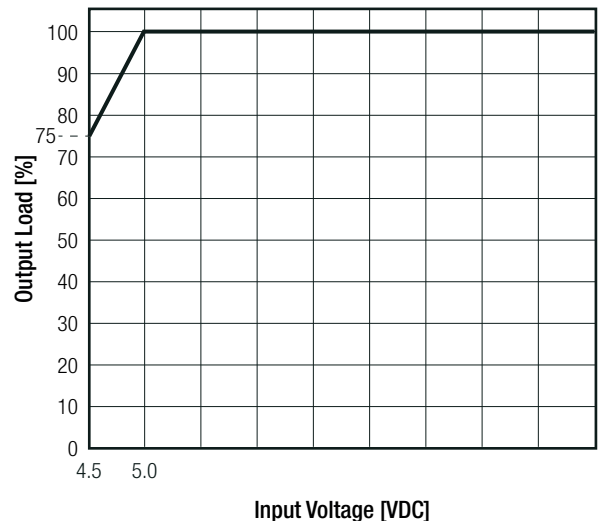
Note6: Operation below 10% load won't harm the converter, but specifications may not be met

Efficiency vs. Load

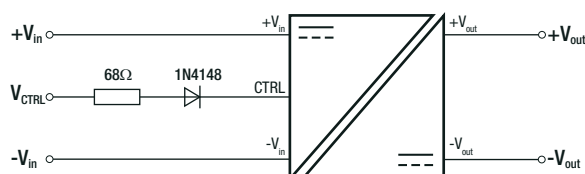
RSO-24xx



Line Derating



## ON/OFF CTRL

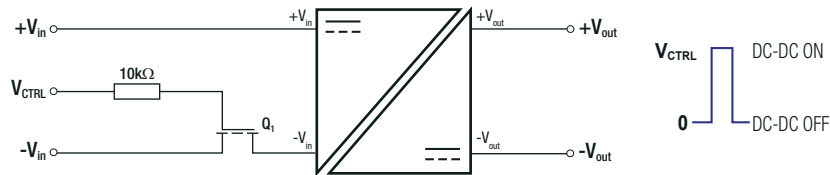


**DC-DC ON:** Open or high impedance

**DC-DC OFF:**  $V_{CTRL} = 5\text{-}12\text{VDC} + 1\text{N}4148$  and  $68\Omega$  resistor

continued on next page

**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 |                       |           | $\pm 2.0\%$ typ. |
| Line Regulation | 2:1 Input             |           | $\pm 0.2\%$ max. |
|                 | 4:1 Input             |           | $\pm 0.5\%$ max. |
| Load Regulation | 10% to 100% full load | 2:1 Input | 0.4% max.        |
|                 |                       | 4:1 Input | 0.5% typ.        |

### PROTECTIONS

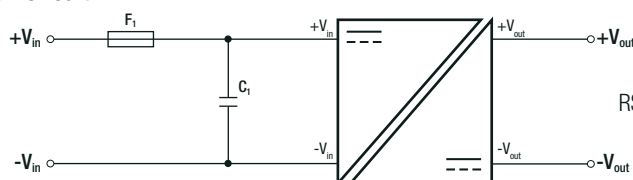
| Parameter                        | Type                    |                                     |                            | Value                                                                                   |
|----------------------------------|-------------------------|-------------------------------------|----------------------------|-----------------------------------------------------------------------------------------|
| Short Circuit Protection (SCP)   | below 100mΩ             |                                     |                            | continuous, auto recovery                                                               |
| Isolation Voltage <sup>(7)</sup> | standard without suffix | tested for 1 second                 |                            | 1kVDC                                                                                   |
|                                  |                         | rated for 1 minute                  |                            | 500VAC/60Hz                                                                             |
|                                  | /H2 version             | tested for 1 second                 |                            | 2kVDC                                                                                   |
|                                  |                         | rated for 1 minute                  |                            | 1kVAC/60Hz                                                                              |
|                                  | /H3 version             | tested for 1 second                 |                            | 3kVDC                                                                                   |
|                                  |                         | rated for 1 minute                  |                            | 1.5kVAC/60Hz                                                                            |
| Isolation Resistance             |                         |                                     |                            | 1GΩ min.                                                                                |
| Isolation Capacitance            | standard without suffix | 2:1 Input<br>2:1 Input<br>4:1 Input | Single<br>Dual<br>Single   | 10pF min. / 40pF typ. / 60pF max.<br>120pF min. / 170pF typ. / 250pF max.<br>200pF max. |
|                                  | /H2 and /H3 version     | 2:1 Input<br>4:1 Input              | Single/Dual<br>Single/Dual | 5pF min. / 30pF typ. / 60pF max.<br>30pF max.                                           |
| Insulation Grade                 |                         |                                     |                            | basic (IEC/EN60950-1)<br>functional (IEC/EN6060-1)                                      |

#### Notes:

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

Note8: Refer to local safety regulations if input over-current protection is also required. Recommended fuse: slow blow type

#### Protection Circuit



RSO-12xxSZ(DZ) requires a  $10\mu\text{F}$  MLCC capacitor (C1) on input side

### ENVIRONMENTAL

| Parameter                   | Condition                                       | Value                                       |
|-----------------------------|-------------------------------------------------|---------------------------------------------|
| Operating Temperature Range | with derating @ free air convection (see graph) | $-40^\circ\text{C}$ to $+100^\circ\text{C}$ |
| Operating Altitude          |                                                 | 5000m                                       |

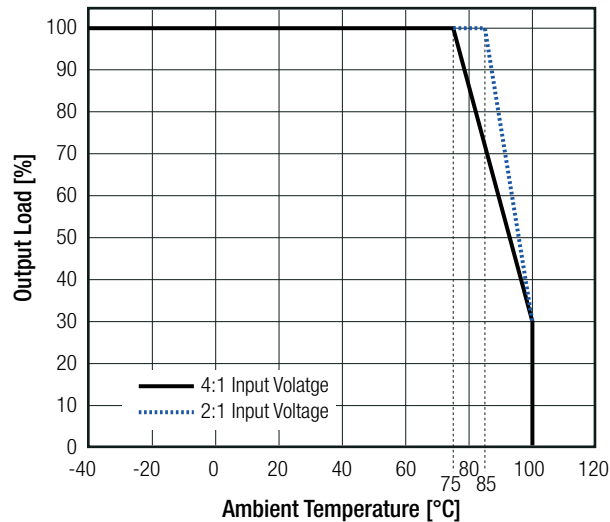
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**Specifications** (measured @  $T_a = 25^\circ\text{C}$ , nom.  $V_{in}$ , full load and after warm-up unless otherwise stated)

| Parameter          | Condition                        |                | Value                                                       |
|--------------------|----------------------------------|----------------|-------------------------------------------------------------|
| Operating Humidity | non-condensing                   |                | 95% RH max.                                                 |
| Pollution Degree   |                                  |                | PD2                                                         |
| MTBF               | according to MIL-HDBK-217F, G.B. | +25°C<br>+85°C | 1685 x 10 <sup>3</sup> hours<br>254 x 10 <sup>3</sup> hours |

**Derating Graph**

(@ Chamber and free air convection)



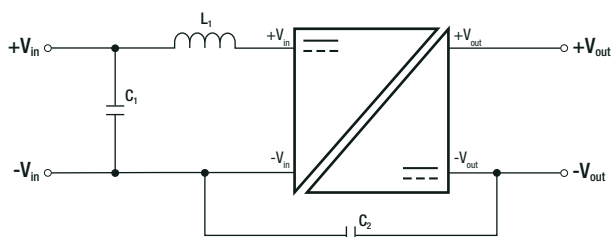
**SAFETY AND CERTIFICATIONS**

| Certificate Type (Safety)                                                             | Report / File Number | Standard                                                                                |
|---------------------------------------------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------|
| Information Technology Equipment, General Requirements for Safety (LVD)               | SPCLVD1605077-10     | IEC60950-1, 2nd Edition, AM2: 2013<br>EN60950-1, 2nd Edition, A2:2013                   |
| Information Technology Equipment, General Requirements for Safety (CB)                | L0339L48-CB-1-B1     | IEC60950-1:2005, 2nd Edition + A2:2013                                                  |
| Information Technology Equipment, General Requirements for Safety                     | E224736-A34-UL       | UL60950-1, 2nd Edition, 2014<br>CAN/CSA C22.2 No. 60950-1-07                            |
| Medical Electric Equipment, General Requirements for Safety and Essential Performance | WD-SE-R-180675-A0    | IEC60601-1:2005 + C2:2007 + A1:2012, 3rd Edition<br>EN60601-1:2006 + A1:2013 + A12:2014 |
| EAC                                                                                   | RU-AT.AB49.B.09571   | TP TC 004/2011                                                                          |
| RoHS2                                                                                 |                      | RoHS 2011/65/EU + AM2015/863                                                            |

**EMC Compliance**

| Condition                                                                                    | Standard / Criterion                                  |
|----------------------------------------------------------------------------------------------|-------------------------------------------------------|
| Electromagnetic compatibility of multimedia equipment - Emission requirements <sup>(9)</sup> | with external filter<br>(see filter suggestion below) |
|                                                                                              | EN55032, Class A<br>EN55032, Class B                  |

**EMC Filtering Suggestions according to EN55032**



**Notes:**

Note9: Filter suggestions are valid for indicated part numbers only.  
For other part numbers, please contact RECOM tech support for advice.

**Component List Class A**

| Model     | C1                | C2  | L1                                     |
|-----------|-------------------|-----|----------------------------------------|
| RSO-0505S | 10µF/100V<br>MLCC | N/A | 3.9µH choke<br><a href="#">RLS-397</a> |
| RSO-1205S |                   |     |                                        |
| RSO-2405S |                   |     |                                        |
| RSO-4805S |                   |     |                                        |

**Component List Class B**

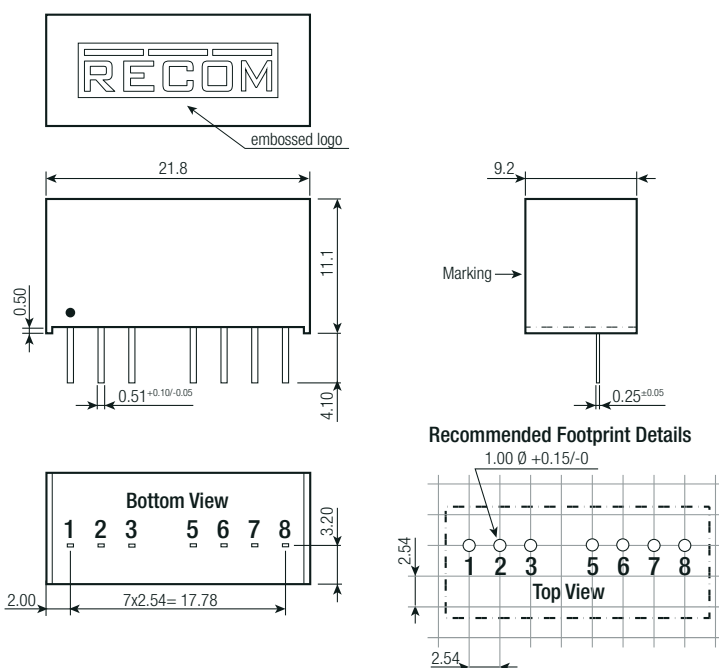
| Model     | C1                | C2    | L1                                     |
|-----------|-------------------|-------|----------------------------------------|
| RSO-0505S | 10µF/100V<br>MLCC | 2.2nF | 5.6µH choke<br><a href="#">RLS-567</a> |
| RSO-1205S |                   |       |                                        |
| RSO-2405S |                   |       |                                        |
| RSO-4805S |                   |       | 12µH choke <a href="#">RLS-126</a>     |

### 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<br>potting<br>PCB | non-conductive black plastic, (UL94 V-0)<br>epoxy, (UL94 V-0)<br>FR4, (UL94 V-0) |
| Dimension (LxWxH) |                        | 21.8 x 11.1 x 9.2mm                                                              |
| Weight            |                        | 4.7g typ.                                                                        |

### Dimension Drawing (mm)



## Pinning information

| Pin # | Single               | Dual                 |
|-------|----------------------|----------------------|
| 1     | -Vin                 | -Vin                 |
| 2     | +Vin                 | +Vin                 |
| 3     | CTRL <sup>(10)</sup> | CTRL <sup>(10)</sup> |
| 5     | NC                   | NC                   |
| 6     | +Vout                | +Vout                |
| 7     | -Vout                | COM                  |
| 8     | NC <sup>(11)</sup>   | -Vout                |

NC= no connection

Tolerance: xx.x=  $\pm 0.5\text{mm}$

xx.xx= ±0.25mm

**Notes:**

Note10: This pin provides an Off function which puts the converter into a low power mode. When the pin is 'high' the converter is OFF and when the pin is open the converter is ON. There is no allowed low state for this pin. (refer to „ON/OFF CTRL“ on page 2)

Note11: This pin is used internally. No external connection allowed

## PACKAGING INFORMATION

| Parameter                   | Type | Value                 |
|-----------------------------|------|-----------------------|
| Packaging Dimension (LxWxH) | tube | 520.0 x 17.0 x 10.0mm |
| Packaging Quantity          | tube | 22pcs                 |
| Storage Temperature Range   |      | -55°C to +125°C       |
| Storage Humidity            |      | 95% RH max.           |

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- Поставка более 17-ти миллионов наименований электронных компонентов;
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- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



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