

# Features

## Unregulated Converters

- Fully RoHS 6/6 Conform
- Full Power at 100°C Ambient Temperature
- 1kVDC or 3kVDC Isolation Options
- UL /CSA Certified, CB Report
- Suitable for Fully Automated Assembly (including Vapor Phase Soldering)
- Optional Continuous Short Circuit Protection
- Efficiency to 84%
- Built-In EN55022 Class A Filter

### Description

The R1S and R1D converters are of the enclosed open frame type, i.e. they are not potted. The converters are typically used in general purpose and industrial low power isolation and voltage matching applications where an SMD converter is required.

The converter series feature an extended ambient temperature operating range of -40°C to +100°C without derating and optional continuous short circuit protection.

In addition to two isolation options and three different case formats, the converters are also available prepacked as tape and reel for use with automatic insertion machines.

### Selection Guide

| Part Number SMD | (3kV) | Input Voltage (VDC) | Output Voltage (VDC) | Output Current (mA) | Efficiency (%) | Max Capacitive Load <sup>(1)</sup> |
|-----------------|-------|---------------------|----------------------|---------------------|----------------|------------------------------------|
| R1S**-xx3.3     | (H)   | 3.3, 5, 12, 15, 24  | 3.3                  | 303                 | 75             | 2200µF                             |
| R1S**-xx05      | (H)   | 3.3, 5, 12, 15, 24  | 5                    | 200                 | 72-78          | 1000µF                             |
| R1S**-xx09      | (H)   | 3.3, 5, 12, 15, 24  | 9                    | 111                 | 74-78          | 1000µF                             |
| R1S**-xx12      | (H)   | 3.3, 5, 12, 15, 24  | 12                   | 84                  | 75-80          | 470µF                              |
| R1S**-xx15      | (H)   | 3.3, 5, 12, 15, 24  | 15                   | 66                  | 75-82          | 470µF                              |
| R1S**-xx24      | (H)   | 3.3, 5, 12, 15, 24  | 24                   | 42                  | 74-84          | 220µF                              |
| R1D**-xx3.3     | (H)   | 3.3, 5, 12, 15, 24  | ±3.3                 | ±152                | 75             | ±1000µF                            |
| R1D**-xx05      | (H)   | 3.3, 5, 12, 15, 24  | ±5                   | ±100                | 72-78          | ±470µF                             |
| R1D**-xx09      | (H)   | 3.3, 5, 12, 15, 24  | ±9                   | ±56                 | 74-78          | ±470µF                             |
| R1D**-xx12      | (H)   | 3.3, 5, 12, 15, 24  | ±12                  | ±42                 | 75-80          | ±220µF                             |
| R1D**-xx15      | (H)   | 3.3, 5, 12, 15, 24  | ±15                  | ±33                 | 75-82          | ±220µF                             |
| R1D**-xx24      | (H)   | 3.3, 5, 12, 15, 24  | ±24                  | ±21                 | 74-84          | ±100µF                             |

xx = Input Voltage (other input and output voltage combinations available on request)

\* add Suffix "H" for 3kV Isolation, e.g. R1S-0505/H, R1D-0505/H, R1S12-0505/H, R1D12-0505/H

\* add Suffix "P" for Continuous Short Circuit Protection, e.g. R1S8-0505/P, R1S-0505/HP, R1D12-0505/HP

\* add suffix -R for tape & reel packing e.g. R1S-0505-R. For more details see Application Notes.

### Case and Pinning Options (note restrictions on /H option)

R1S\*\* : \*\* without marking denotes 5 pins out of 8 fitted (includes /H option)  
 \*\* with marking **8** denotes 8 pins out of 8 fitted (/H option not available)  
 \*\* with marking **12** denotes 10 pins out of 12 fitted (includes /H option)

R1D\*\* : \*\* without marking denotes 6 pins out of 10 fitted (includes /H option)  
 \*\* with marking **10** denotes with 10 pins out of 10 fitted (/H option not available)  
 \*\* with marking **12** denotes 10 pins out of 12 fitted (includes /H option)

### Specifications (measured at T<sub>A</sub> = 25°C, nominal input voltage, full load and after warm-up)

|                                                    |                                       |                     |
|----------------------------------------------------|---------------------------------------|---------------------|
| Input Voltage Range                                | ±10%                                  |                     |
| Output Voltage Accuracy                            | ±2% typ., ±5% max.                    |                     |
| Line Voltage Regulation                            | All Variants                          | 1.2%/1% of Vin typ. |
| Load Voltage Regulation<br>(10% to 100% full load) | 3.3V output types                     | 15% typ., 20% max.  |
|                                                    | 5V output type                        | 12% typ., 15% max.  |
|                                                    | 9V output type                        | 7% typ., 10% max.   |
|                                                    | 12V, 15V, 24V output types            | 6% typ., 10% max.   |
| Output Ripple and Noise (20MHz BW limited)         | 50mVp-p typ., 100mVp-p max.           |                     |
| Operating Frequency                                | 20kHz min. / 60kHz typ. / 100kHz max. |                     |

continued on next page

# ECONOLINE

## DC/DC-Converter

with 3 year Warranty

# RECOM

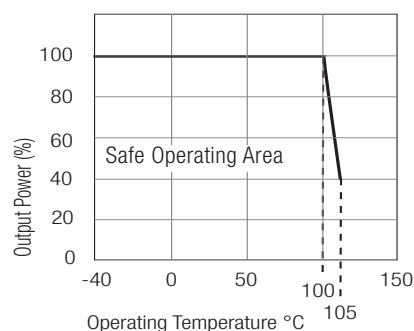
## 1 Watt SMD Single & Dual Output



**UL-60950-1 Certified**  
**EN-60950-1 Certified**  
**EN-60601-1 Certified\***  
 (\* /H suffix)

# R1S\_R1D

## Derating-Graph (Ambient Temperature)



Refer to Application Notes

### Specifications (measured at $T_A = 25^\circ\text{C}$ , nominal input voltage, full load and after warm-up)

|                                                   |                      |                                                                                                              |                                                        |
|---------------------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| Efficiency at Full Load                           |                      |                                                                                                              | See Selection Guide                                    |
| Minimum Load = 0%                                 |                      |                                                                                                              | Specifications valid for 10% minimum load only.        |
| Isolation Voltage                                 |                      | (tested for 1 second)<br>(rated for 1 minute***)                                                             | 1000VDC<br>500VAC / 60Hz                               |
| Isolation Voltage                                 | H-Suffix<br>H-Suffix | (tested for 1 second)<br>(rated for 1 minute***)                                                             | 3000VDC<br>1500VAC / 60Hz                              |
| Isolation Capacitance                             |                      | R1S, R1S8, R1D, R1D10<br>R1S12, R1D12                                                                        | 15pF min. / 70pF max.<br>10pF min. / 75pF max.         |
| Isolation Resistance                              |                      |                                                                                                              | 10 GΩ min.                                             |
| Short Circuit Protection                          |                      |                                                                                                              | 1 Second                                               |
| P-Suffix                                          |                      |                                                                                                              | Continuous                                             |
| Operating Temperature Range (free air convection) |                      |                                                                                                              | -40°C to +100°C (see Graph)                            |
| Storage Temperature Range                         |                      |                                                                                                              | -55°C to +125°C                                        |
| Reflow Temperature                                |                      | ROHS compliant                                                                                               | 245°C (30 sec), Peak 255°C (5 sec) max.                |
| Vapor Phase Process                               |                      | (for more details see Application Notes)                                                                     | 230°C (90 sec) max.                                    |
| Relative Humidity                                 |                      |                                                                                                              | 95% RH                                                 |
| Humidity Susceptibility Test                      |                      |                                                                                                              | 1000 hrs / 90% humidity / +85°C ambient                |
| Package weight                                    |                      | R1S<br>R1S8<br>R1S12, R1D, R1D10, R1D12                                                                      | 1.0g<br>1.1g<br>1.2g                                   |
| Packing Quantity                                  |                      | R1S, R1S8<br>R1S12, R1D, R1D10, R1D12<br>All Types                                                           | 40 pcs per Tube<br>33 pcs per tube<br>500 pcs per Reel |
| MTBF (+25°C)<br>(+85°C)                           |                      | } Detailed Information see<br>Application Notes chapter "MTBF"<br>using MIL-HDBK 217F<br>using MIL-HDBK 217F | 4275 x 10³ hours<br>1365 x 10³ hours                   |
| Certifications                                    |                      |                                                                                                              |                                                        |
| CB Test Report                                    |                      | Report: US/14402A/UL                                                                                         | IEC 60950-1:2001 1st Ed.                               |
| UL General Safety                                 |                      | Report: E358085                                                                                              | UL 60950-1 2nd Ed.                                     |
| CUL General Safety                                |                      |                                                                                                              | C22.2 No. 60950-1-03                                   |
| EN Medical Safety                                 |                      | Report: MDD1205098-2 + RM1205098-2<br>Medical Report + ISO14971 Risk Assessment                              | IEC/EN 60601-1 3rd Edition                             |
| EN General Safety                                 |                      | Report: SPCLVD1211033-3                                                                                      | EN60950-1: 2006 + A12:2011                             |
| Conducted / Radiated Emissions                    |                      | EN55022                                                                                                      | Level A                                                |

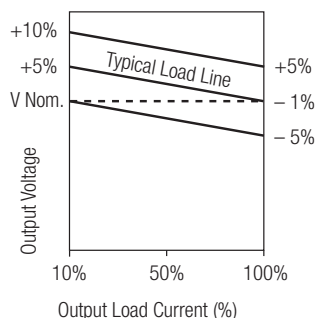
\*\*\*Any data referred to in this datasheet are of indicative nature and based on our practical experience only. For further details, please refer to our Application Notes.

#### Notes

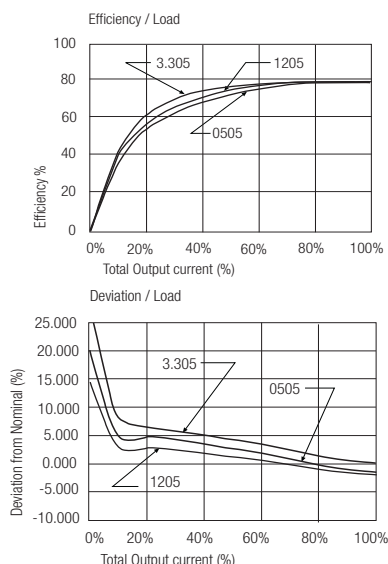
Note 1: Maximum capacitive load is defined as the capacitive load that will allow start up in under 1 second without damage to the converter.

### Typical Characteristics

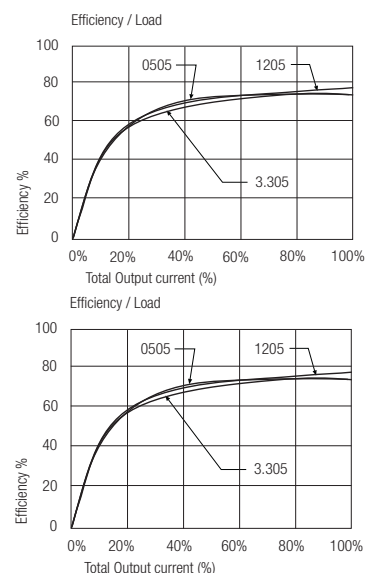
#### Tolerance Envelope



### R1S\*\*-xx05



### R1D\*\*-xx05

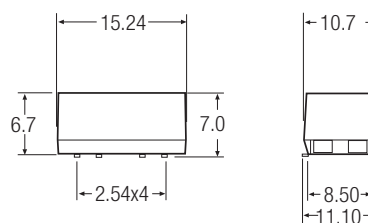
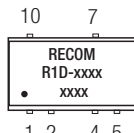
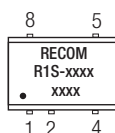
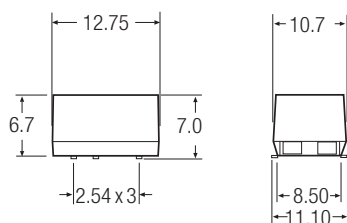


## Package Style and Pinning (mm)

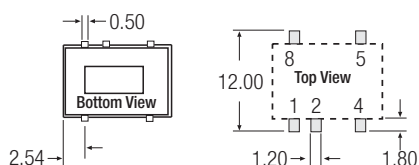
### 5 PIN Single SMD Package

Note: /H option is available in these pin packages

### 6 PIN Dual SMD Package



### Recommended Footprint Details



### Pin Connections

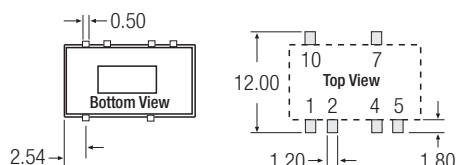
| Pin # | Single | Dual   |
|-------|--------|--------|
| 1     | -Vin   | -Vin   |
| 2     | +Vin   | +Vin   |
| 4     | -Vout  | Com    |
| 5     | +Vout  | -Vout  |
| 7     | No Pin | +Vout  |
| 8     | NC     | No Pin |
| 10    | No Pin | NC     |

NC = No Connection

XX.X ± 0.5 mm

XX.XX ± 0.25 mm

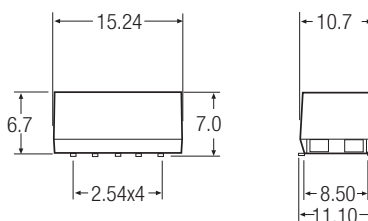
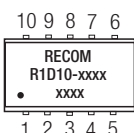
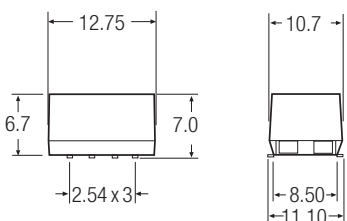
### Recommended Footprint Details



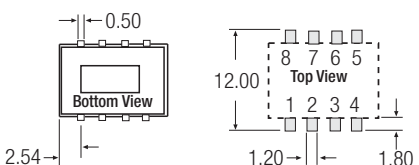
### 8 PIN Single SMD Package

Note: /H option is not available in these pin packages

### 10 PIN Dual SMD Package



### Recommended Footprint Details



### Pin Connections

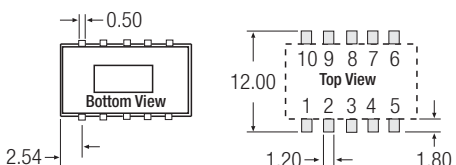
| Pin # | Single | Dual  |
|-------|--------|-------|
| 1     | -Vin   | -Vin  |
| 2     | +Vin   | +Vin  |
| 3     | NC     | NC    |
| 4     | -Vout  | Com   |
| 5     | +Vout  | -Vout |
| 6     | NC     | NC    |
| 7     | NC     | +Vout |
| 8     | NC     | NC    |
| 9     | -      | NC    |
| 10    | -      | NC    |

NC = No Connection

XX.X ± 0.5 mm

XX.XX ± 0.25 mm

### Recommended Footprint Details



R1S\*\* : \*\* without marking denotes 5 pins out of 8 fitted (includes /H option)  
 \*\* with marking **8** denotes 8 pins out of 8 fitted (/H option not available)

R1D\*\* : \*\* without marking denotes 6 pins out of 10 fitted (includes /H option)  
 \*\* with marking **10** denotes with 10 pins out of 10 fitted (/H option not available)

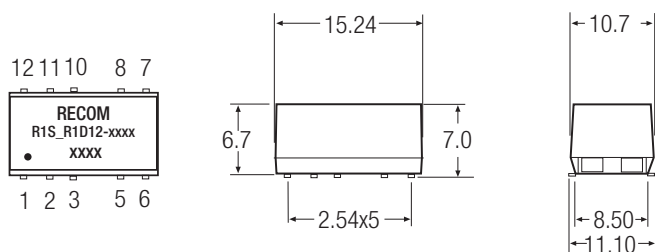
e.g. R1S-0505, R1S-0505/H, R1S-0505/HP  
 e.g. R1S8-0505, R1S8-0505/P

e.g. R1D-0505, R1D-0505/H, R1D-0505/HP  
 e.g. R1D10-0505, R1D10-0505/P

## Package Style and Pinning (mm)

### 12 PIN Single and Dual SMD Package

Note: /H option is available in this pin package



### Pin Connections

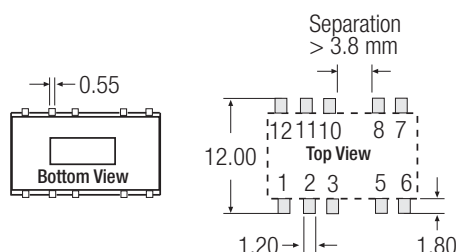
| Pin # | Single | Dual  |
|-------|--------|-------|
| 1     | -Vin   | -Vin  |
| 2     | +Vin   | +Vin  |
| 3     | NC     | NC    |
| 5     | -Vout  | Com   |
| 6     | NC     | -Vout |
| 7     | NC     | NC    |
| 8     | +Vout  | +Vout |
| 10    | NC     | NC    |
| 11    | NC     | NC    |
| 12    | NC     | NC    |

NC = No Connection

XX.X ± 0.5 mm

XX.XX ± 0.25 mm

### Recommended Footprint Details



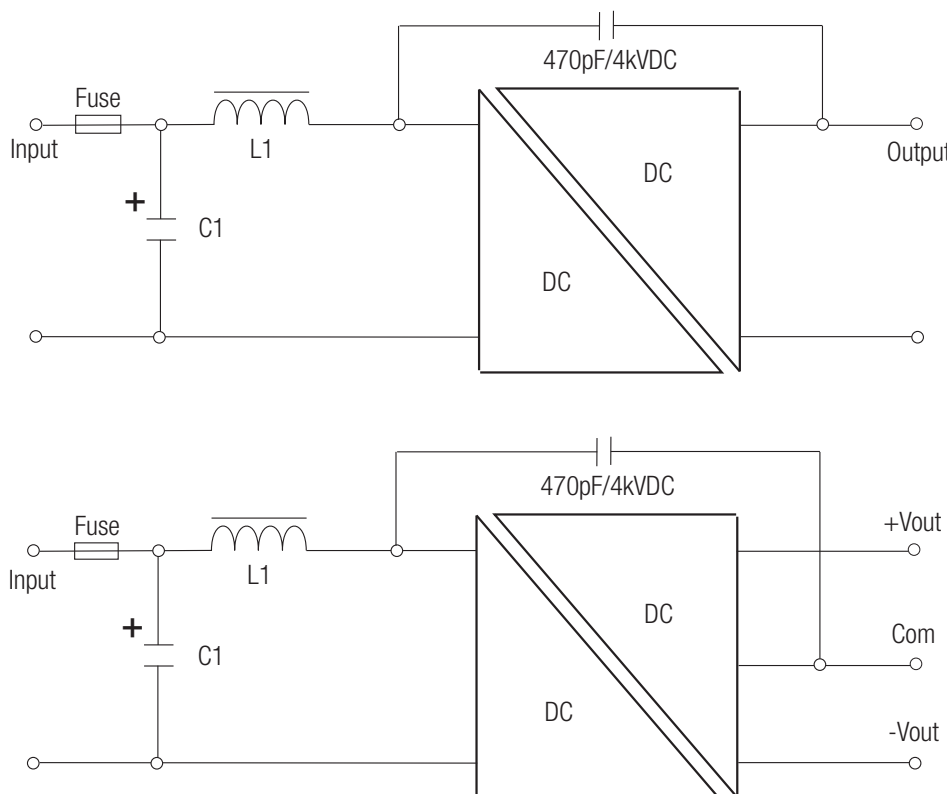
R1S\*\*: \*\* with marking 12 denotes 10 pins out of 12 fitted (includes /H option)

R1D\*\*: \*\* with marking 12 denotes 10 pins out of 12 fitted (includes /H option)

e.g. R1S12-0505, R1S12-0505/H, R1S12-0505/HP

e.g. R1D12-0505, R1D12-0505/H, R1D12-0505/HP

## EMC Filtering - Suggestion for EN55022 Class B (Conducted and Emitted)



### Standard and /H versions

| C1    | L1    | Vin  |
|-------|-------|------|
| 4.7µF | 3.3µH | 3.3V |
| 2.2µF | 4.7µH | 5V   |
| 2.2µF | 10µH  | 12V  |
| 2.2µF | 22µH  | 15V  |
| 4.7µF | 22µH  | 24V  |

### /P and /HP versions

| C1    | L1   | Vin  |
|-------|------|------|
| 4.7µF | 10µH | 3.3V |
| 10µF  | 10µH | 5V   |
| 4.7µF | 22µH | 12V  |
| 4.7µF | 22µH | 15V  |
| 10µF  | 47µH | 24V  |

C1 = MLCC

L1 = SMD Inductor