

# Features

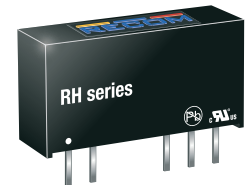
## Unregulated Converters

- 3kVDC/1s or 4kVDC/1s isolation
- Optional continuous short circuit protection
- UL94V-0 package material
- Efficiency up to 84%
- Suitable for IGBT applications

**RECOM**  
DC/DC Converter

## RK & RH

1 Watt  
SIP7  
Single and Dual  
Output



UL US  
E358085



### Description

The RK and RH Series DC/DC-Converter complements RECOM's industrial range of converters with very high isolations of 3kVDC/1s and 4kVDC/1s. The extended operating temperature range covering -40°C to +90°C is a standard feature. The converters are IEC/EN/UL60950-1 certified, and are suitable for IGBT driver applications.

### Selection Guide

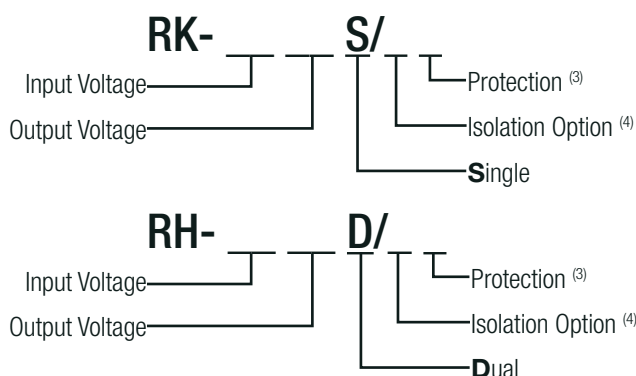
| Part Number                 | nom. Input Voltage [VDC] | Output Voltage [VDC] | Output Current [mA] | Efficiency typ. <sup>(1)</sup> [%] | Max. Capacitive Load <sup>(2)</sup> [μF] |
|-----------------------------|--------------------------|----------------------|---------------------|------------------------------------|------------------------------------------|
| RK-xx05S <sup>(3,4)</sup>   | 5, 12, 15, 24            | 5                    | 200                 | 70-78                              | 1000                                     |
| RK-xx09S <sup>(3,4)</sup>   | 5, 12, 15, 24            | 9                    | 111                 | 70-80                              | 1000                                     |
| RK-xx12S <sup>(3,4)</sup>   | 5, 12, 15, 24            | 12                   | 84                  | 78-82                              | 470                                      |
| RK-xx15S <sup>(3,4)</sup>   | 5, 12, 15, 24            | 15                   | 66                  | 80-82                              | 470                                      |
| RH-xx05D <sup>(3,4)</sup>   | 5, 12, 15, 24            | ±5                   | ±100                | 74-78                              | ±470                                     |
| RH-xx09D <sup>(3,4)</sup>   | 5, 12, 15, 24            | ±9                   | ±56                 | 76-79                              | ±470                                     |
| RH-xx12D <sup>(3,4)</sup>   | 5, 12, 15, 24            | ±12                  | ±42                 | 78-84                              | ±220                                     |
| RH-xx15D <sup>(3,4)</sup>   | 5, 12, 15, 24            | ±15                  | ±33                 | 80-84                              | ±220                                     |
| RH-xx1509D <sup>(3,4)</sup> | 5, 12, 24                | +15/-9               | +33/-56             | 70-81                              | +220/-470μF                              |

#### 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 and is defined as the capacitive load that will allow start up in under 1s without damage to the converter

### Model Numbering



#### Notes:

Note3: standard part is without Continuous Short Circuit Protection

add suffix „/P“ for Continuous Short Circuit Protection

Note4: add suffix „/H“ for 4kVDC/1s Isolation

or add suffix „/HP“ for Continuous Short Circuit Protection and 4kVDC/1s Isolation

#### Ordering Examples:

RH-123.3D/P: 12V Input Voltage, ±3.3V Output Voltage, Dual Output with continuous short circuit protection

RK-0509S/HP: 5V Input Voltage, 9V Output Voltage, Single Output with 4kVDC/1s Isolation and continuous short circuit protection

UL60950-1 certified  
CSA/CAN C22.2 No. 60950-1-07 certified  
IEC/EN60950-1 certified  
IEC/EN60601-1 certified\*  
EN55032 compliant

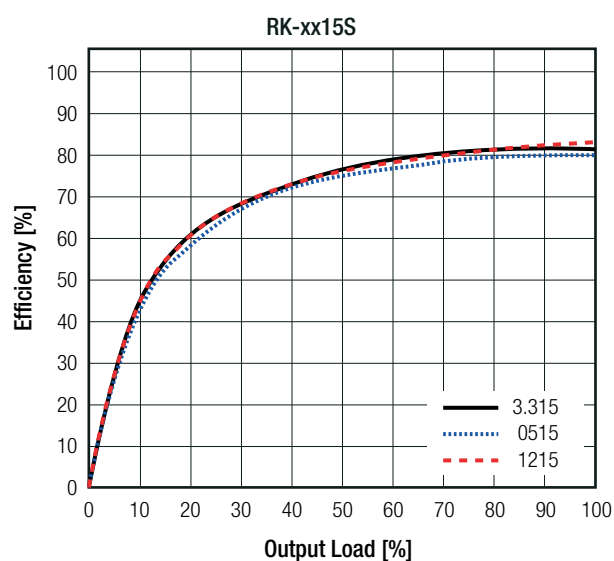
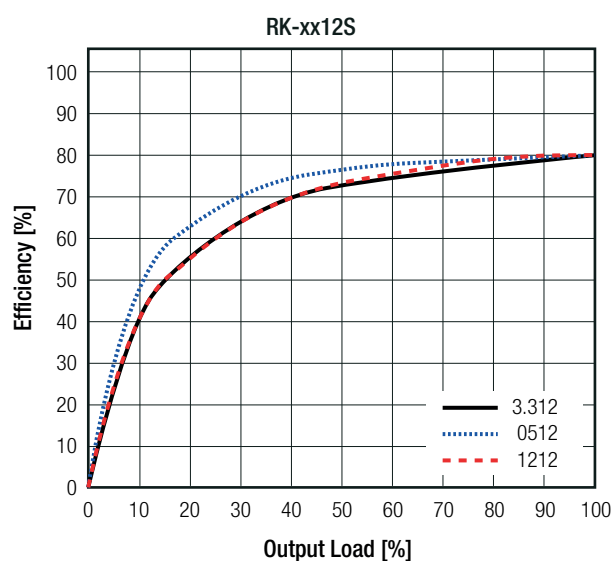
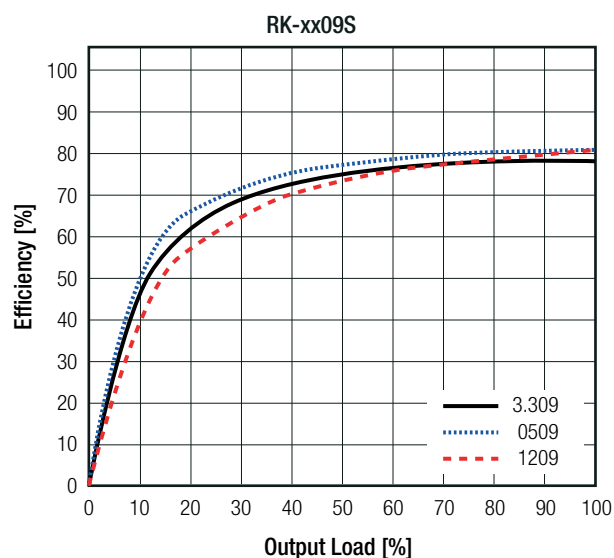
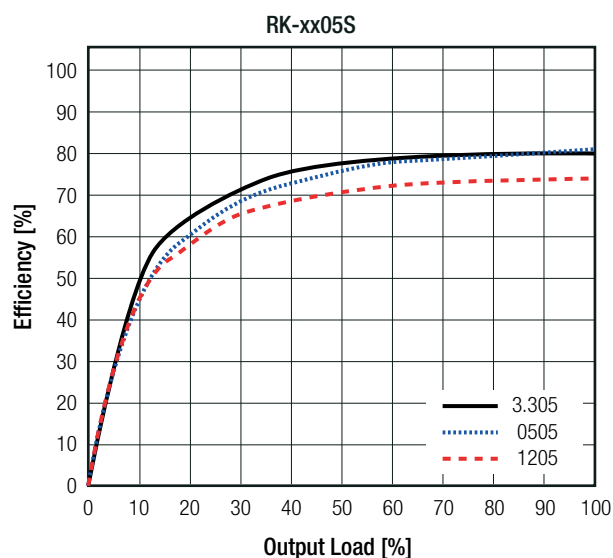
\*+15/-9 version excluded

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

### BASIC CHARACTERISTICS

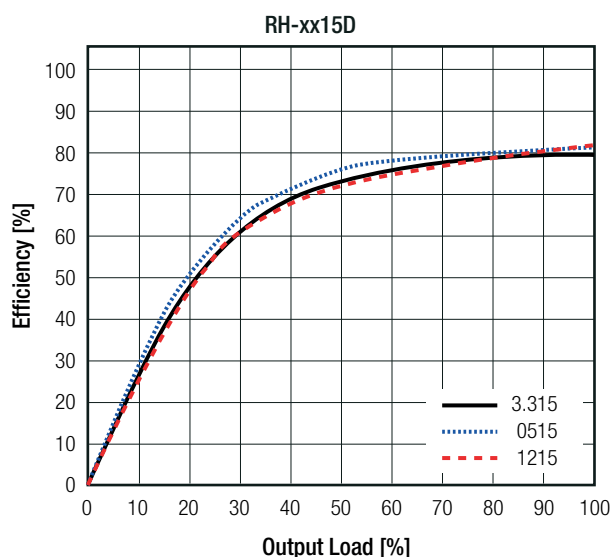
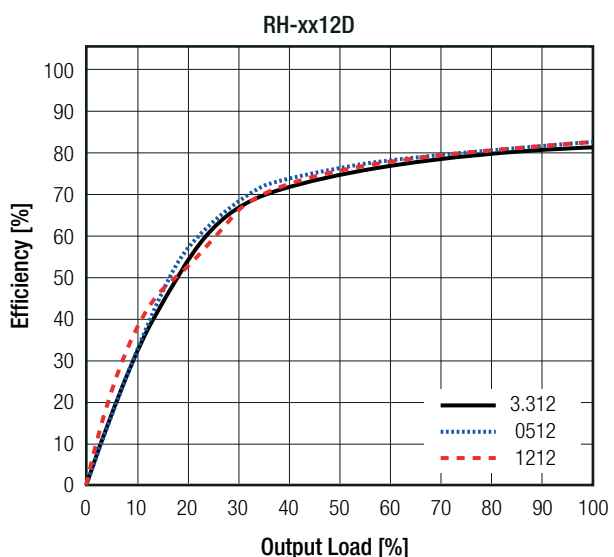
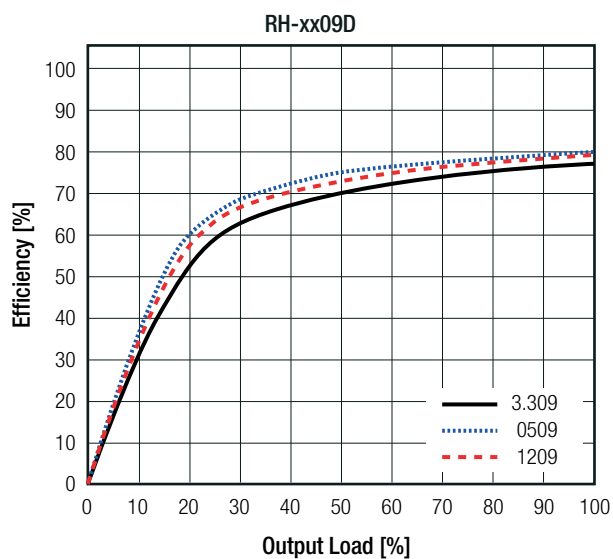
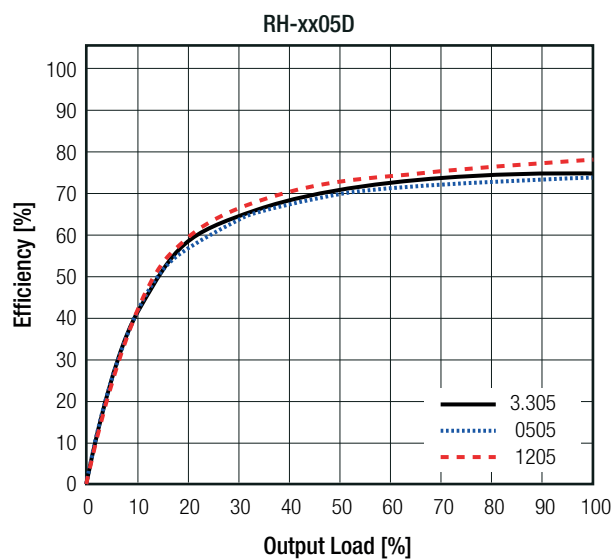
| Parameter                    | Condition | Min.  | Typ.   | Max.       |
|------------------------------|-----------|-------|--------|------------|
| Internal Input Fuse          |           |       |        | capacitors |
| Input Voltage Range          |           |       | ±10%   |            |
| Minimum Load                 |           | 0%    |        |            |
| Start-up Time                |           |       |        | 250ms      |
| Internal Operating Frequency |           | 50kHz | 100kHz | 105kHz     |
| Output Ripple and Noise      | 20MHz BW  |       |        | 100mVp-p   |

### Efficiency vs. Load



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

Efficiency vs. Load



## REGULATIONS

| Parameter                      | Condition             |                              | Values                 |
|--------------------------------|-----------------------|------------------------------|------------------------|
| Output Accuracy                |                       |                              | ±5.0% max.             |
| Line Regulation                | low line to high line |                              | ±1.2% of 1.0% Vin typ. |
| Load Regulation <sup>(5)</sup> | 10% to 100% load      | 5Vout                        | 15.0% max.             |
|                                |                       | 9, 12, 15Vout and RH-xx1509D | 10.0% max.             |

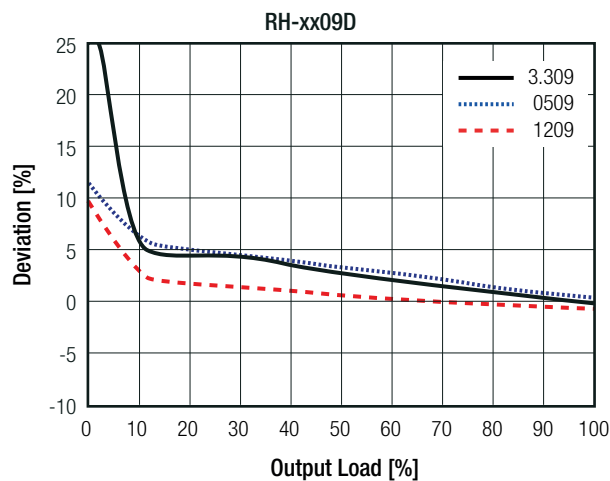
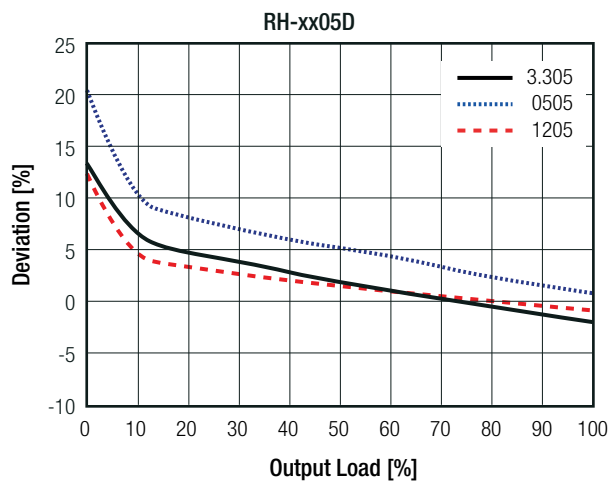
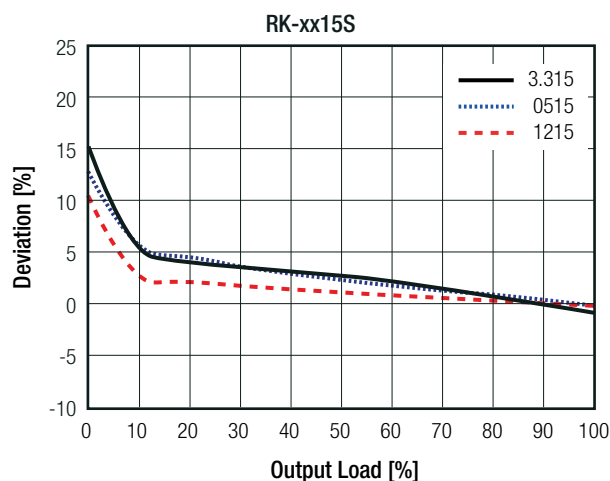
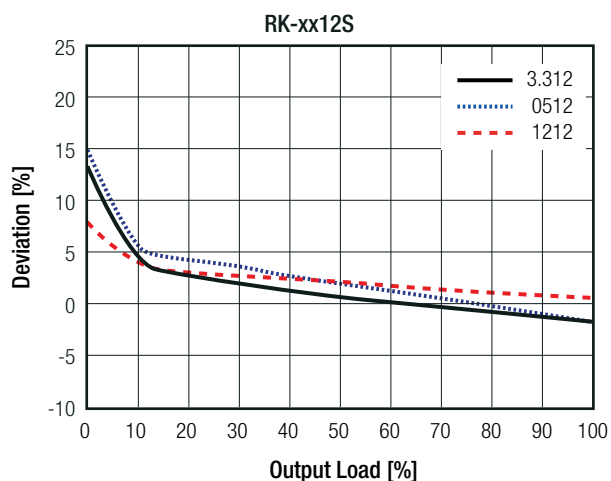
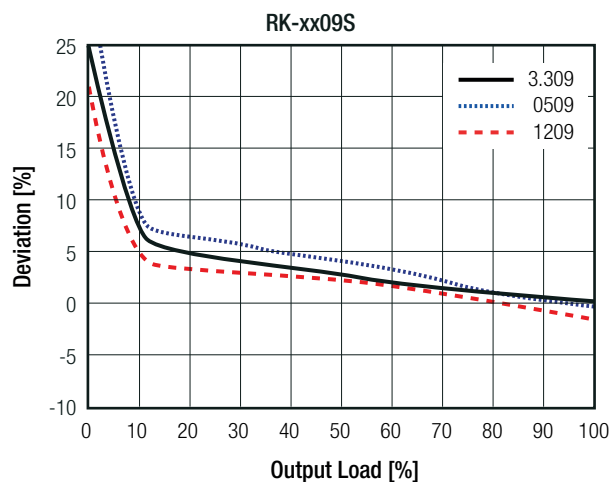
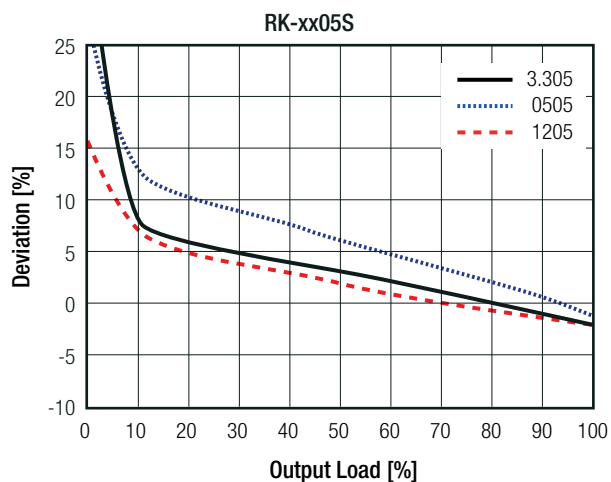
### Notes:

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

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

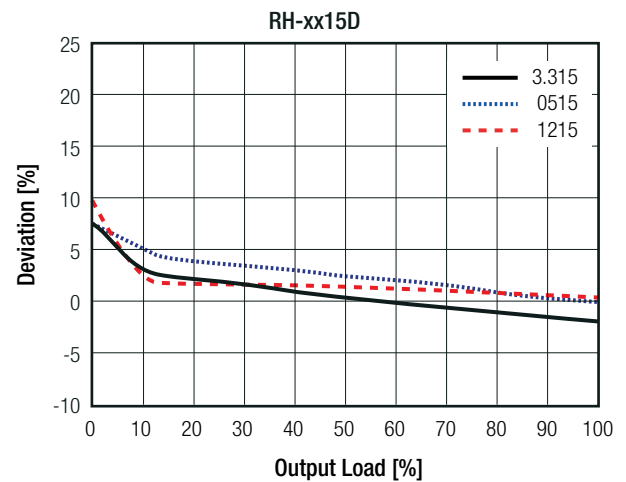
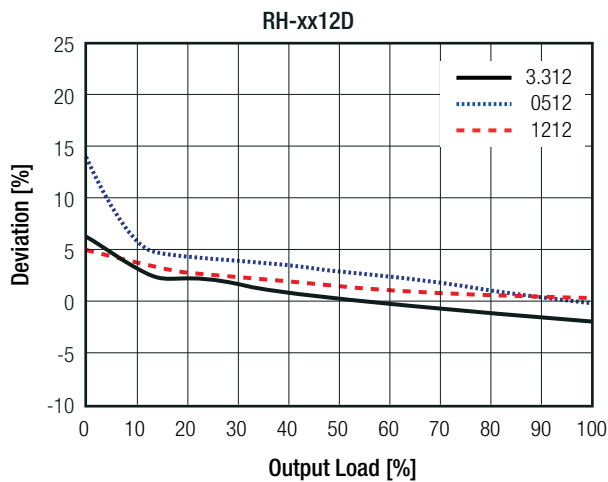
Deviation vs. Load



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

**Deviation vs. Load**



**PROTECTIONS**

| Parameter                                                                                                                    | Condition                          |                  |                                           | Value                                               |
|------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------|-------------------------------------------|-----------------------------------------------------|
| Short Circuit Protection (SCP)                                                                                               | without suffix<br>with suffix “/P” |                  |                                           | 1 second<br>continuous                              |
| Isolation Voltage <sup>(6)</sup>                                                                                             | I/P to O/P                         | without suffix   | tested for 1 second<br>rated for 1 minute | 3kVDC<br>1.5kVAC                                    |
|                                                                                                                              |                                    | with suffix “/H” | tested for 1 second<br>rated for 1 minute | 4kVDC<br>2kVAC                                      |
| Isolation Capacitance                                                                                                        | RK types<br>RH types               |                  |                                           | 20pF min. / 75pF max.<br>20pF min. / 65pF max.      |
| Isolation Resistance                                                                                                         |                                    |                  |                                           | 15GΩ min.                                           |
| Insulation Grade                                                                                                             |                                    |                  |                                           | basic (IEC/EN60950-1)<br>functional (IEC/EN60601-1) |
| <b>Notes:</b>                                                                                                                |                                    |                  |                                           |                                                     |
| Note6: For repeat Hi-Pot testing, reduce the time and/or the test voltage                                                    |                                    |                  |                                           |                                                     |
| Note7: Refer to local safety regulations if input over-current protection is also required. Recommended fuse: slow blow type |                                    |                  |                                           |                                                     |

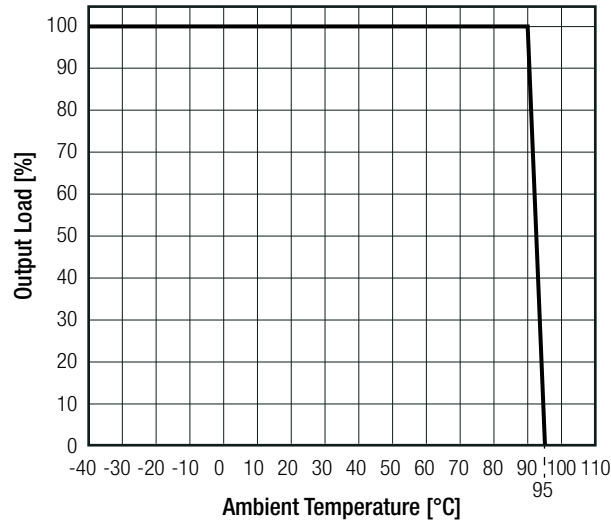
**ENVIRONMENTAL**

| Parameter                   | Condition                                   |         | Value                                 |
|-----------------------------|---------------------------------------------|---------|---------------------------------------|
| Operating Temperature Range | full load @ free air convection (see graph) |         | -40°C to +90°C                        |
| Operating Altitude          |                                             |         | 3000m                                 |
| Operating Humidity          | non-condensing                              |         | 5% - 95% RH max.%                     |
| Pollution Degree            |                                             |         | PD2                                   |
| MTBF                        | according to MIL-HDBK-217F; G.B.            | RK type | +25°C<br>992 x 10 <sup>3</sup> hours  |
|                             |                                             |         | +85°C<br>145 x 10 <sup>3</sup> hours  |
|                             |                                             | RH type | +25°C<br>1012 x 10 <sup>3</sup> hours |
|                             |                                             |         | +85°C<br>151 x 10 <sup>3</sup> hours  |

continued on next page

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

**Derating Graph**  
(@ free air convection)



**SAFETY AND CERTIFICATIONS**

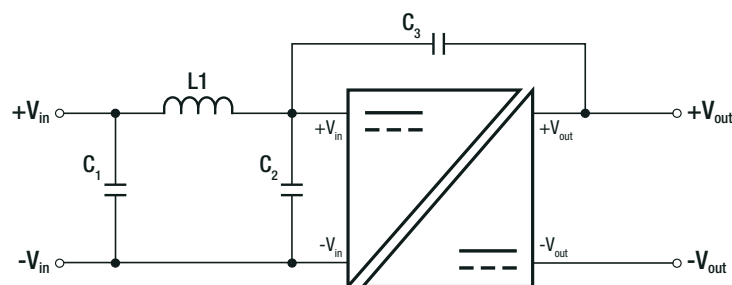
| Certificate Type (Safety)                                                                            | Report / File Number             | Standard                                                                      |
|------------------------------------------------------------------------------------------------------|----------------------------------|-------------------------------------------------------------------------------|
| Information Technology Equipment, General Requirements for Safety                                    | E358085-A4-UL                    | UL60950-1, 2nd Edition:2007<br>CAN/CSA C22.2 No. 60950-1-03, 2nd Edition:2007 |
| Information Technology Equipment, General Requirements for Safety                                    | SPCLVD1602031                    | IEC60950-1:2005, 2nd Edition + A2:2013<br>EN60950-1:2006 + A2:2013            |
| Medical electrical equipment Part 1: General requirements for basic safety and essential performance | WD-SE-R-180676-A0 <sup>(8)</sup> | IEC60601-1:2005 + A1:2012, 3rd Edition<br>EN60601-1:2006 + A1:2013 + A12:2014 |
| EAC                                                                                                  | RU-AT.49.09571                   | TP TC 004/2011                                                                |
| RoHS 2                                                                                               |                                  | RoHS-2011/65/EU + AM-2015/863                                                 |

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

**Notes:**

Note8: excluded +15/-9 version

**EMC Filter Suggestion according to EN55032**  
**Single Output**



**Component List Class A**

| MODEL    | C1                            | L1                             | C2  | C3  |
|----------|-------------------------------|--------------------------------|-----|-----|
| RK-0505S | 10 $\mu\text{F}$<br>100V MLCC | N/A                            | N/A | N/A |
| RK-0515S |                               | 22 $\mu\text{H}$ choke RLS-226 |     |     |
| RK-2405S |                               | 12 $\mu\text{H}$ choke RLS-126 |     |     |

**Component List Class B**

| MODEL    | C1                            | L1                                | C2                            | C3    |
|----------|-------------------------------|-----------------------------------|-------------------------------|-------|
| RK-0505S | 10 $\mu\text{F}$<br>100V MLCC | 12 $\mu\text{H}$ choke<br>RLS-126 | 4.7 $\mu\text{F}$<br>50V MLCC | N/A   |
| RK-0515S |                               |                                   |                               | 2.2nF |
| RK-2405S |                               |                                   |                               | N/A   |

**Notes:**

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

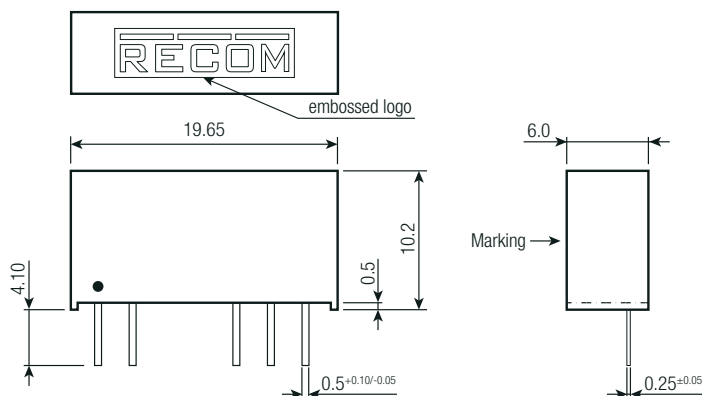
**Specifications** (measured @ Ta= 25°C, nom. Vin, full load unless otherwise stated)

**DIMENSION and PHYSICAL CHARACTERISTICS**

| Parameter         | Type                         | Value                                                         |
|-------------------|------------------------------|---------------------------------------------------------------|
| Material          | case<br>potting              | non-conductive black plastic, (UL94 V-0)<br>epoxy, (UL94 V-0) |
| Dimension (LxWxH) | standard<br>with suffix "/H" | 19.65 x 6.0 x 10.2mm<br>19.65 x 7.05 x 10.2mm                 |
| Weight            | standard<br>with suffix "/H" | 2.6g typ.<br>2.8g typ.                                        |

**Dimension Drawing (mm)**

**Standard Version**

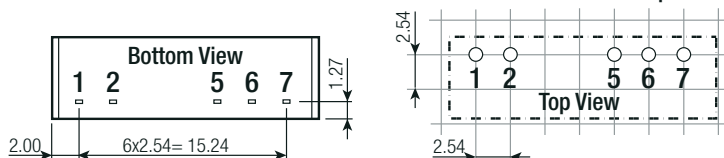


**Pinning Information**

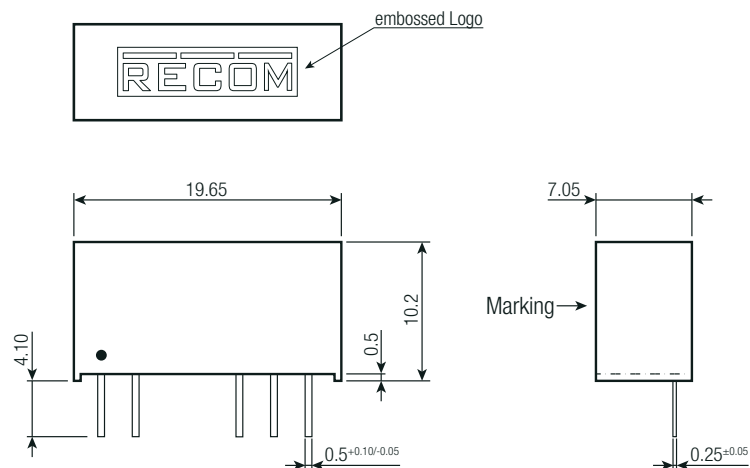
| Pin # | Single | Dual  |
|-------|--------|-------|
| 1     | +Vin   | +Vin  |
| 2     | -Vin   | -Vin  |
| 5     | -Vout  | -Vout |
| 6     | no pin | Com   |
| 7     | +Vout  | +Vout |

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

**Recommended Footprint**



**„H“ - Version**

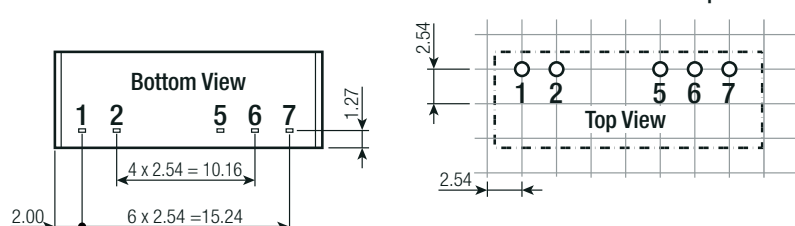


**Pinning Information**

| Pin # | Single | Dual  |
|-------|--------|-------|
| 1     | +Vin   | +Vin  |
| 2     | -Vin   | -Vin  |
| 5     | -Vout  | -Vout |
| 6     | no pin | Com   |
| 7     | +Vout  | +Vout |

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

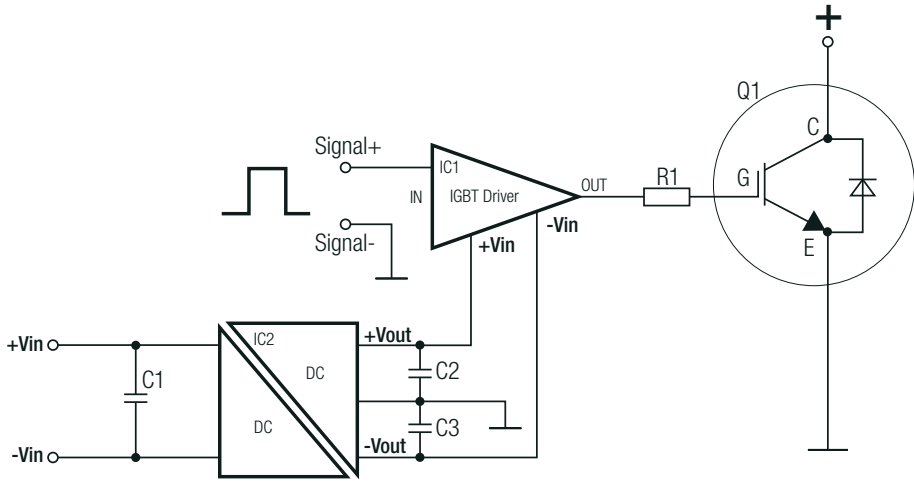
**Recommended Footprint**



Specifications (measured @ Ta= 25°C, nom. Vin, full load unless otherwise stated)

INSTALLATION AND APPLICATION

IGBT Application Circuit



PACKAGING INFORMATION

| Parameter                   | Type           | Value                |
|-----------------------------|----------------|----------------------|
| Packaging Dimension (LxWxH) | tube           | 520.0 x 16.0 x 9.0mm |
| Packaging Quantity          | tube           | 25pcs                |
| Storage Temperature Range   |                | -55°C to +125°C      |
| Storage Humidity            | non-condensing | 95% RH max.          |

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