



**THE DATASHEET OF  
R-781.8-0.5**



# Features

# Switching Regulator

- Efficiency up to 97%, no need for heatsinks
- Pin-out compatible with LM78XX linears
- Very low profile
- 4.75V - 32V Wide input range
- Short circuit protection, thermal shutdown
- Low ripple and noise
- IEC/EN60950-1 certified

# RECOM DC/DC Converter

## R-78-0.5

0.5 Amp  
SIP3  
Single Output



### Description

The R-78xx-Series high efficiency switching regulators are ideally suited to replace 78xx linear regulators and are pin compatible. The efficiency of up to 97% means that very little energy is wasted as heat so there is no need for any heat sinks with their additional space and mounting costs. Low ripple and noise figures and short circuit, overload and over-temperature protection round off the specifications of this versatile converter series. This R-78xx-0.5 is fully certified to EN55032 EMC Standard and for IEC/EN-60950-1 + AM2 Safety.

### Selection Guide

| Part Number | Input Voltage Range [VDC] | Output Voltage [VDC] | Output Current [A] | Efficiency    |                |
|-------------|---------------------------|----------------------|--------------------|---------------|----------------|
|             |                           |                      |                    | @ min Vin [%] | @ max. Vin [%] |
| R-781.5-0.5 | 4.75 - 30 <sup>(1)</sup>  | 1.5                  | 0.5                | 73            | 63             |
| R-781.8-0.5 | 4.75 - 32                 | 1.8                  | 0.5                | 82            | 71             |
| R-782.5-0.5 | 4.75 - 32                 | 2.5                  | 0.5                | 87            | 77             |
| R-783.3-0.5 | 4.75 <sup>(2)</sup> - 32  | 3.3                  | 0.5                | 91            | 81             |
| R-785.0-0.5 | 6.5 - 32                  | 5.0                  | 0.5                | 94            | 86             |
| R-786.5-0.5 | 8.0 - 32                  | 6.5                  | 0.5                | 95            | 88             |
| R-789.0-0.5 | 11 - 32                   | 9.0                  | 0.5                | 96            | 92             |
| R-7812-0.5  | 15 - 32                   | 12                   | 0.5                | 97            | 94             |
| R-7815-0.5  | 18 - 32                   | 15                   | 0.5                | 97            | 95             |

#### Notes:

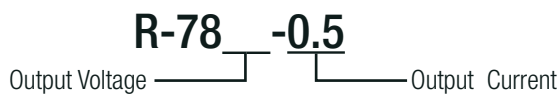
Note1: 1.5V Output can be unstable with Vin>30VDC

Note2: Refer to Transient Response on page I-3



IEC/EN60950-1 certified  
EN55032 compliant

### Model Numbering



**Specifications** (measured @ Ta= 25°C, 10% minimum load, unless otherwise stated)

**BASIC CHARACTERISTICS**

| Parameter                        | Condition                                     | Min.                        | Typ.               | Max.               |
|----------------------------------|---|-----------------------------|--------------------|--------------------|
| Absolute Maximum Input Voltage   |   |                             |                    | 34VDC              |
| Quiescent Current                | nom. Vin= 24VDC                               |                             | 5mA                | 7mA                |
| Internal Power Dissipation       |   |                             |                    | 0.4W               |
| Minimum Load <sup>(3)</sup>      |   | 0%                          |                    |                    |
| Internal Operating Frequency     |   | 280kHz                      | 330kHz             | 380kHz             |
| Output Ripple and Noise          | 20MHz BW, without output capacitor            | 1.5 - 6.5VDC<br>9 - 15.5VDC | 20mVp-p<br>30mVp-p | 30mVp-p<br>40mVp-p |
|                                  | 20MHz BW <sup>(4)</sup>                       | 1.5VDC<br>1.8 - 15.5VDC     | 15mVp-p<br>25mVp-p | 20mVp-p<br>35mVp-p |
| Absolute Maximum Capacitive Load | 1 second start up, no external components     |                             |                    | 220µF              |
|                                  | <1 second start up + diode protection circuit |                             |                    | 6800µF             |

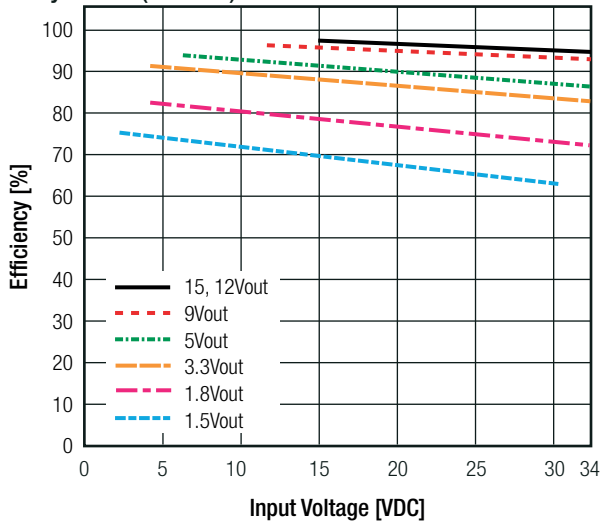
**Notes:**

Note3: Operation under no load will not harm the converter, but specifications may not be met

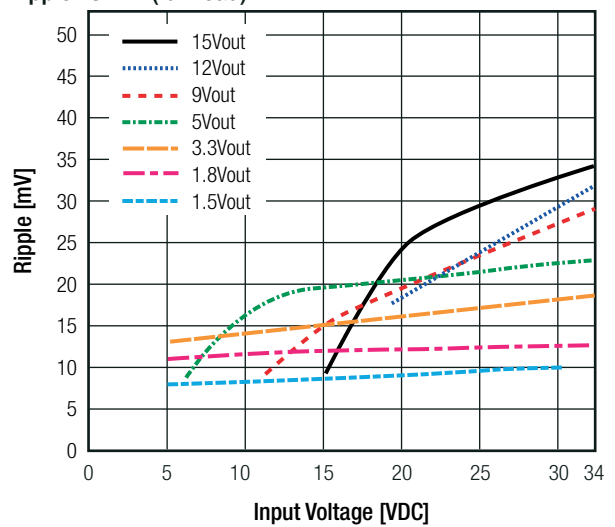
A minimum load of 6mA is recommended

Note4: Measurements are made with a 100nF MLCC across output (low ESR)

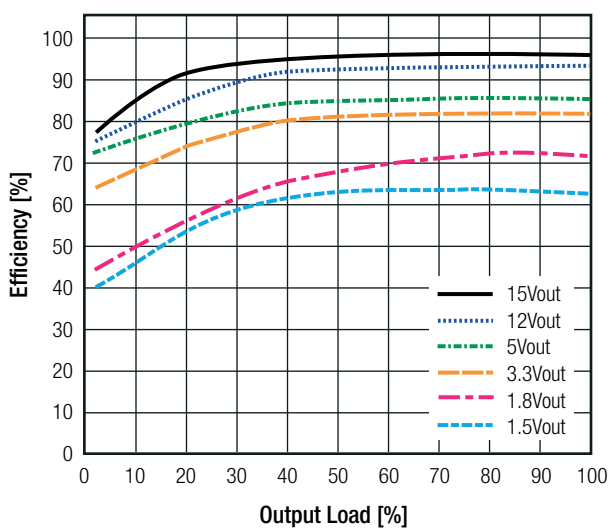
**Efficiency vs. Vin (full load)**



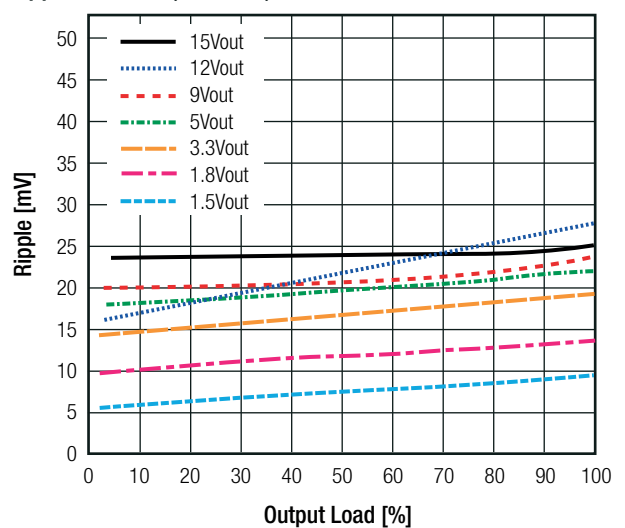
**Ripple vs. Vin (full load)**



**Efficiency vs. Load (max. Vin)**



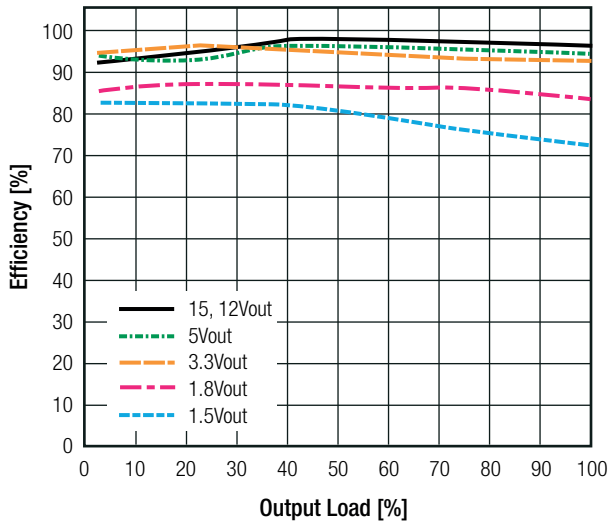
**Ripple vs. Load (nom. Vin)**



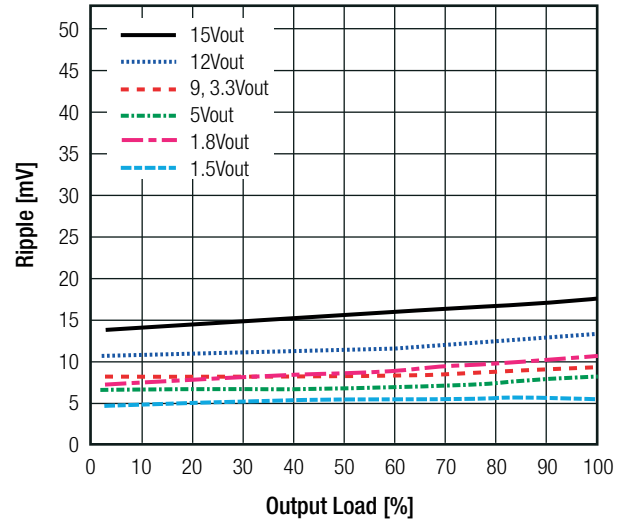
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**Specifications** (measured @ Ta= 25°C, 10% minimum load, unless otherwise stated)

**Efficiency vs. Load (min. Vin)**



**Ripple vs. Load (min. Vin)**



### REGULATIONS

| Parameter                         | Condition                        |             | Value                    |
|-----------------------------------|----------------------------------|-------------|--------------------------|
| Output Accuracy                   | 100% load                        |             | ±2.0% typ / ±3.0% max.   |
| Line Regulation                   | low line to high line, 100% load | 1.5V - 6.5V | ±0.2% typ. / ±0.4% max.  |
|                                   |                                  | 9V - 15.5V  | ±0.1% typ. / ±0.2% max.  |
| Load Regulation                   | 10% to 100% load                 | 1.5V - 6.5V | ±0.4% typ. / ±0.6% max.  |
|                                   |                                  | 9V - 15.5V  | ±0.25% typ. / ±0.4% max. |
| Transient Response <sup>(5)</sup> | 100% <-> 50% load                |             | ±75mV typ.               |
|                                   | 100% <-> 10% load                |             | ±100mV max.              |

**Notes:**

Note5: The R.783.3-0.5 requires Vin>5.5V to meet the Transient Response specifications

### PROTECTIONS

| Parameter                      | Condition       | Value                          |
|--------------------------------|-----------------|--------------------------------|
| Short Circuit Protection (SCP) |                 | continuous, automatic recovery |
| Short Circuit Input Current    | nom. Vin= 24VDC | 60mA max.                      |

#### Optional Diode Protection Circuit

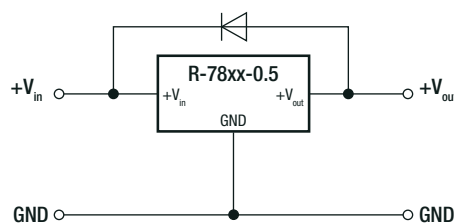
Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter when it is powered down.

The diode can either be fitted across the device if the source is low impedance or fitted in series with the output (recommended).

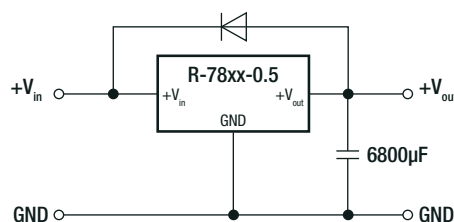
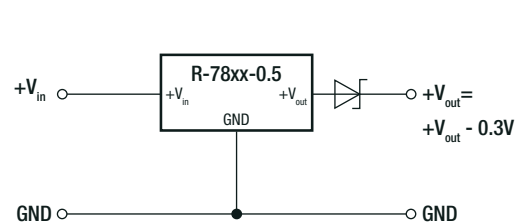
**Application example:**

Driving a high capacitive load

**Optional Protection 1:**



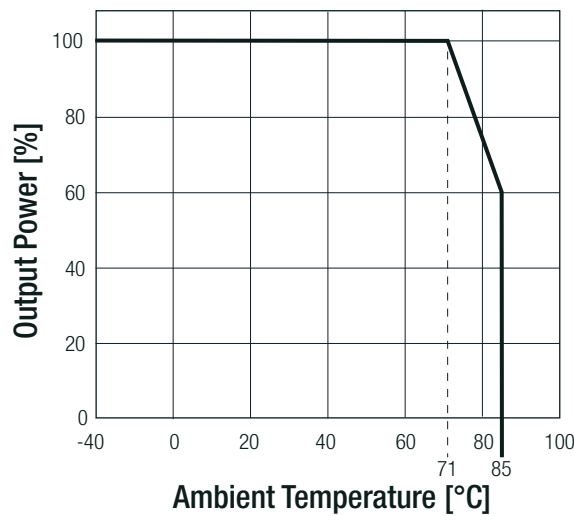
**Optional Protection 2:**



**Specifications** (measured @ Ta= 25°C, 10% minimum load, unless otherwise stated)

| ENVIRONMENTAL               |   |                               |
|-----------------------------|---|-------------------------------|
| Parameter                   | Condition                                   | Value                         |
| Operating Temperature Range | with derating (see graph)                   | -40°C to +85°C                |
| Maximum Case Temperature    |   | +100°C                        |
| Temperature Coefficient     |   | ±0.015%/K                     |
| Thermal Impedance           | 0.1 m/s, vertical                           | 70K/W                         |
| Operating Altitude          |   | 2000m                         |
| Operating Humidity          | non-condensing                              | 95% RH max.                   |
| Pollution Degree            |   | PD2                           |
| MTBF                        | according to MIL-HDBK-217F, G.B.      +25°C | 26163 x 10 <sup>3</sup> hours |

**Derating Graph**

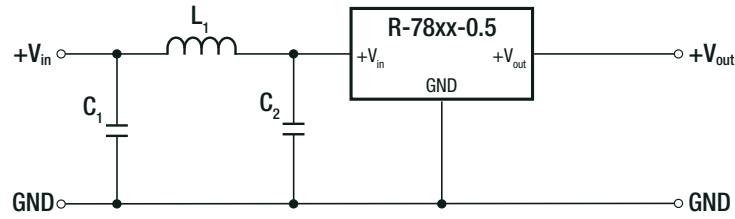


| SAFETY AND CERTIFICATIONS   |   |  |
|---|---|--|
| Certificate Type (Safety)   | Report / File Number                                  | Standard   |
| Information Technology Equipment, General Requirements for Safety             | 1603123   | IEC60950-1:2005, 2nd Edition + Am 2:2013<br>EN60950-1:2006 + Am 2:2013 |
| EAC   | RU-AT.49.09571  | TP TC 004/2011   |
| RoHS 2+   |   | RoHS 2011/65/EU + AM2015/863   |
| EMC Compliance  | Condition   | Standard / Criterion   |
| Electromagnetic compatibility of multimedia equipment - Emission requirements | with external filter<br>(see filter suggestion below) | EN55032, Class A and B   |
| ESD Electrostatic discharge immunity test                                     | Contact ±6kV  | EN61000-4-2, Criteria A  |
| Radiated, radio-frequency, electromagnetic field immunity test                | 3V/m  | EN61000-4-3, Criteria A  |
| Fast Transient and Burst Immunity   | ±1.0kV  | EN61000-4-4, Criteria A  |
| Immunity to conducted disturbances, induced by radio-frequency fields         | 3V  | EN61000-4-6, Criteria A  |
| Power Magnetic Field Immunity   | 50Hz, 3A/m  | EN61000-4-8, Criteria A  |

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**Specifications** (measured @ Ta= 25°C, 10% minimum load, unless otherwise stated)

EMC Filter Suggestion according to EN55032



**Component List Class A**

| MODEL       | C1        | C2        | L1          |
|-------------|-----------|-----------|-------------|
| R-785.0-0.5 | 10µF      | 3.3µF     | 3.9µH choke |
| R-7812-0.5  | 100V MLCC | 100V MLCC | RLS-397     |

**Component List Class B**

| MODEL       | C1        | C2        | L1          |
|-------------|-----------|-----------|-------------|
| R-785.0-0.5 | 10µF      | 3.3µF     | 5.6µH choke |
| R-7812-0.5  | 100V MLCC | 100V MLCC | RLS-567     |

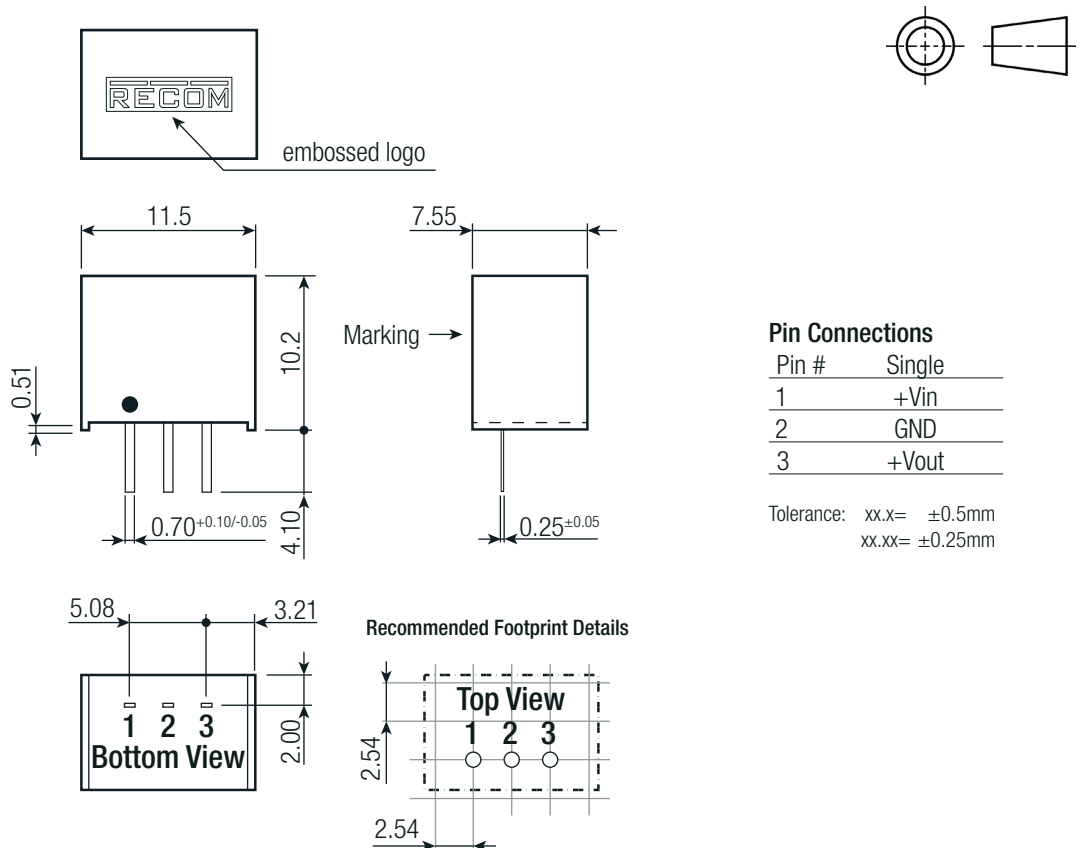
**Notes:**

Note6: Filter suggestions are valid for indicated part numbers only. For other part numbers, please contact RECOM tech support for advice

**DIMENSION AND PHYSICAL CHARACTERISTICS**

| Parameter                 | Type                   | Value   |
|---------------------------|------------------------|---|
| Material                  | case<br>potting<br>PCB | non-conductive black plastic, (UL94 V-0)<br>silicone, (UL94 V-0)<br>FR4, (UL94 V-0) |
| Package Dimension (LxWxH) |                        | 11.5 x 7.55 x 10.2mm  |
| Package Weight            |                        | 1.9g typ.   |

**Dimension Drawing (mm)**



**Pin Connections**

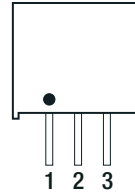
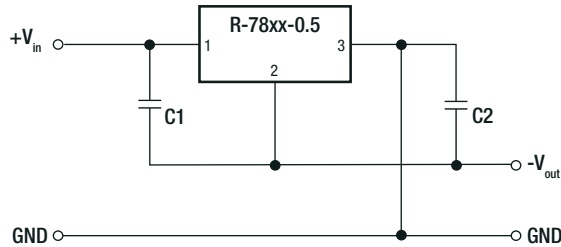
| Pin # | Single |
|-------|--------|
| 1     | +Vin   |
| 2     | GND    |
| 3     | +Vout  |

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

**Specifications** (measured @ Ta= 25°C, 10% minimum load, unless otherwise stated)

### INSTALLATION AND APPLICATION

#### Positive to Negative Converter



C1 and C2 are required and should be fitted close to the converter pins.

Maximum capacitive load including C2 is 220µF

#### Pin Connections

| Pin # | Negative | Positive |
|-------|----------|----------|
| 1     | +Vin     | +Vin     |
| 2     | -Vout    | GND      |
| 3     | GND      | +Vout    |

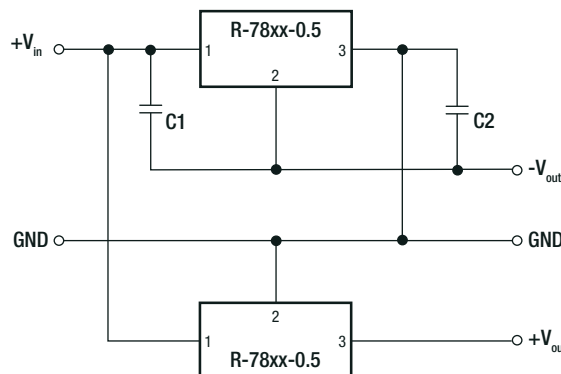
#### Selection Guide - Negative Output

| Part Number | Input Voltage Range [VDC] | Output Voltage [VDC] | Output Current [A] | Efficiency    |                | External Capacitor |                   |
|-------------|---------------------------|----------------------|--------------------|---------------|----------------|--------------------|-------------------|
|             |                           |                      |                    | @ min Vin [%] | @ max. Vin [%] | C1                 | C2 <sup>(7)</sup> |
| R-781.5-0.5 | 4.75 - 28                 | -1.5                 | -0.4               | 68            | 67             | 10µF/35V           | 22µF/6.3V         |
| R-781.8-0.5 | 4.75 - 28                 | -1.8                 | -0.4               | 71            | 70             | 10µF/50V           | 22µF/6.3V         |
| R-782.5-0.5 | 4.75 - 28                 | -2.5                 | -0.4               | 75            | 76             | 10µF/50V           | 22µF/6.3V         |
| R-783.3-0.5 | 4.75 - 28                 | -3.3                 | -0.4               | 77            | 80             | 10µF/50V           | 22µF/6.3V         |
| R-785.0-0.5 | 4.75 - 28                 | -5.0                 | -0.4               | 79            | 84             | 10µF/50V           | 22µF/10V          |
| R-786.5-0.5 | 5.0 - 26                  | -6.5                 | -0.3               | 81            | 86             | 10µF/50V           | 10µF/10V          |
| R-789.0-0.5 | 8.0 - 18                  | -9.0                 | -0.2               | 87            | 89             | 10µF/50V           | 10µF/16V          |
| R-7812-0.5  | 8.0 - 18                  | -12                  | -0.2               | 87            | 90             | 10µF/50V           | 10µF/25V          |
| R-7815-0.5  | 8.0 - 18                  | -15                  | -0.2               | 87            | 81             | 10µF/50V           | 10µF/25V          |

#### Notes:

Note7: Maximum Capacitive Load including C2 is 220µF

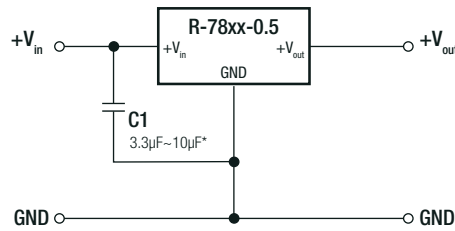
#### Dual Output (two Converters) with Negative Output



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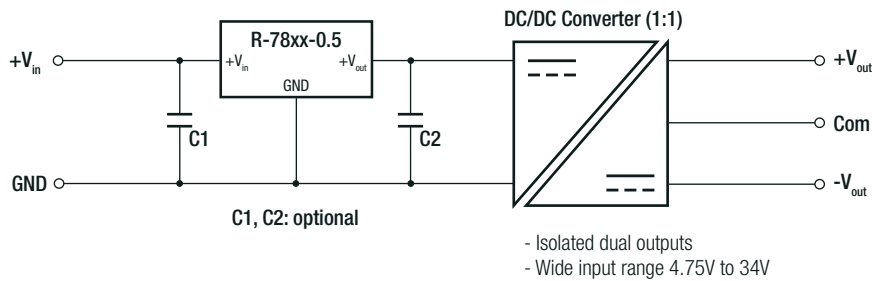
**Specifications** (measured @ Ta= 25°C, 10% minimum load, unless otherwise stated)

**Standard Application Circuit**

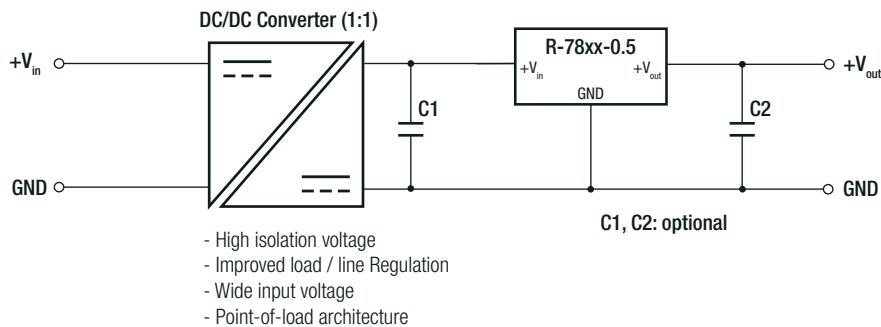


\* Input capacitor required if  $V_{in} > 26VDC$  ( $3.3\mu F$ ) or if the supply is a battery or other low impedance source ( $4.7\mu F \sim 10\mu F$ )  
Capacitor should be electrolytic or MLCC with low ESR ( $\leq 1\Omega$ )

**High Efficiency, Isolated, Dual Unregulated Output**



**Isolated (up to 6kVDC), Wide Input Range Regulated Output**





**PACKAGING INFORMATION**

| Parameter                   | Type | Value                |
|-----------------------------|------|----------------------|
| Packaging Dimension (LxWxH) | tube | 520.0 x 9.3 x 16.5mm |
| Packaging Quantity          | tube | 42pcs                |
| Storage Temperature Range   |      | -55°C to +125°C      |
| Storage Humidity            |      | 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.

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