

**RECOM**  
 DC/DC Converter

## Features

## Switching Regulator

- Efficiency up to 96%, no need for heatsinks
- 4.5 - 36VDC wide input voltage
- -40°C to +90°C ambient operation without derating
- Pin compatible with 78 series regulators
- Non isolated DC/DC converter
- Undervoltage and short circuit protection

## R-78K-0.5

**0.5 Amp**  
**SIP3**  
**Single Output**



IEC/EN62368-1 3rd Edition certified  
 EN55032 compliant

## Description

The R-78K-0.5 series is a switching regulator module that has been designed to offer all the advantages of a switching regulator (high efficiency, wide input range, accurate output voltage regulation) but with a low cost for production quantities. Due to the R-78K-0.5's high efficiency of up to 96%, no heat-sink is required, and full load operation from -40 to 90°C is possible. The compact TO-220 compatible SIP3 package measures only 11.5 x 7.55 x 10.2mm, so it saves precious board space.

## Selection Guide

| Part Number  | Input Voltage Range [VDC] | Output Voltage [VDC] | Output Current [mA] | Efficiency     |                |
|--------------|---------------------------|----------------------|---------------------|----------------|----------------|
|              |                           |                      |                     | @ min. Vin [%] | @ max. Vin [%] |
| R-78K1.5-0.5 | 4.5 - 36                  | 1.5                  | 500                 | 83             | 66             |
| R-78K1.8-0.5 | 4.5 - 36                  | 1.8                  | 500                 | 85             | 70             |
| R-78K2.5-0.5 | 4.5 - 36                  | 2.5                  | 500                 | 87             | 75             |
| R-78K3.3-0.5 | 4.5 - 36                  | 3.3                  | 500                 | 89             | 80             |
| R-78K5.0-0.5 | 6.5 - 36                  | 5                    | 500                 | 92             | 85             |
| R-78K6.5-0.5 | 8 - 36                    | 6.5                  | 500                 | 93             | 86             |
| R-78K9.0-0.5 | 12 - 36                   | 9                    | 500                 | 94             | 89             |
| R-78K12-0.5  | 15 - 36                   | 12                   | 500                 | 95             | 91             |
| R-78K15-0.5  | 18 - 36                   | 15                   | 500                 | 96             | 92             |

## Model Numbering

**R-78K** - **Output Voltage** - **Output Current**

## Specifications

| ABSOLUTE MAX RATINGS (exceeding these ratings may damage the device)                                                              |                         |       |      |          |
|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------|------|----------|
| Parameter                                                                                                                         | Condition               | Min.  | Typ. | Max.     |
| Maximum Input Voltage Slew Rate <sup>(1)</sup>                                                                                    | +V <sub>IN</sub> to GND |       |      | 10VDC/μs |
| Case Temperature                                                                                                                  |                         | -40°C |      | 115°C    |
| Storage Temperature                                                                                                               |                         | -50°C |      | 125°C    |
| <b>Notes:</b><br>Note1: At higher slew rates or hard plugging, add 27μF E-Cap between +Vin and GND, especially when Vin is >18VDC |                         |       |      |          |

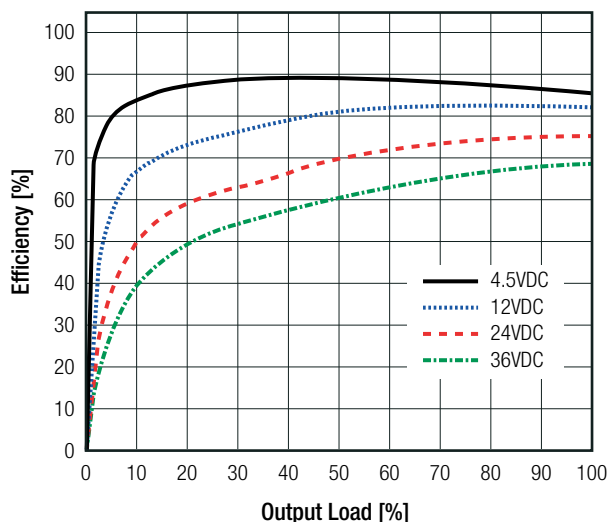
**Specifications** (measured @  $T_a = -40^{\circ}\text{C}$  to  $+90^{\circ}\text{C}$ ,  $V_{IN} = 24\text{VDC}$ , full load and after warm-up unless otherwise stated)

### BASIC CHARACTERISTICS

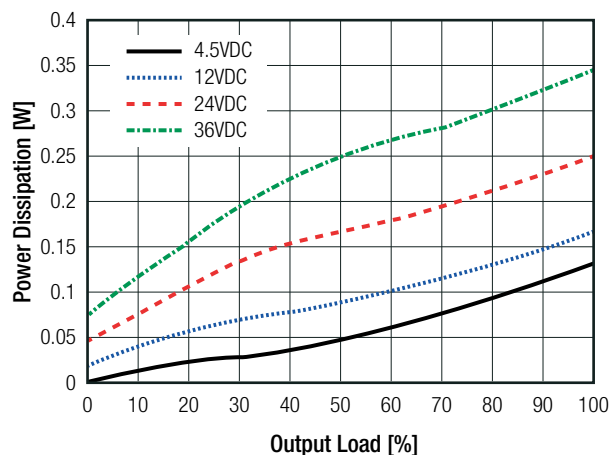
| Parameter                          | Condition                                                 | Min.                        | Typ.     | Max.    |
|------------------------------------|-----------------------------------------------------------|-----------------------------|----------|---------|
| Input Under Voltage Lockout (UVLO) | R-78K1.5-0.5, R-78K1.8-0.5,<br>R-78K2.5-0.5, R-78K3.3-0.5 | DC-DC ON                    | 5.15VDC  | 5.45VDC |
|                                    |                                                           | DC-DC OFF                   | 3.6VDC   | 3.9VDC  |
|                                    | R-78K5-0.5                                                | DC-DC ON                    | 5.15VDC  | 5.45VDC |
|                                    |                                                           | DC-DC OFF                   | 4.6VDC   | 4.9VDC  |
|                                    | R-78K6.5-0.5                                              | DC-DC ON                    | 7.0VDC   | 7.5VDC  |
|                                    |                                                           | DC-DC OFF                   | 6.3VDC   | 6.7VDC  |
|                                    | R-78K9-0.5                                                | DC-DC ON                    | 10.2VDC  | 10.8VDC |
|                                    |                                                           | DC-DC OFF                   | 9.1VDC   | 9.7VDC  |
|                                    | R-78K12-0.5                                               | DC-DC ON                    | 13.8VDC  | 14.4VDC |
|                                    |                                                           | DC-DC OFF                   | 12.4VDC  | 13.0VDC |
|                                    | R-78K15-0.5                                               | DC-DC ON                    | 16.9VDC  | 17.5VDC |
|                                    |                                                           | DC-DC OFF                   | 15.2VDC  | 15.8VDC |
| Quiescent Current                  |                                                           |                             |          | 1mA     |
| Internal Switching Frequency       |                                                           | 600kHz                      | 700kHz   | 800kHz  |
| Minimum Load                       |                                                           | 0%                          |          |         |
| Output Ripple and Noise            | 20MHz BW                                                  | R-78K1.5-0.5 - R-78K1.8-0.5 | 30mVp-p  |         |
|                                    |                                                           | R-78K2.5-0.5 - R-78K3.3-0.5 | 60mVp-p  |         |
|                                    |                                                           | R-78K5-0.5 - R-78K6.5-0.5   | 85mVp-p  |         |
|                                    |                                                           | R-78K9-0.5 - R-78K15-0.5    | 100mVp-p |         |

### R-78K1.5-0.5

Efficiency vs. Load



Power Dissipation vs. Load

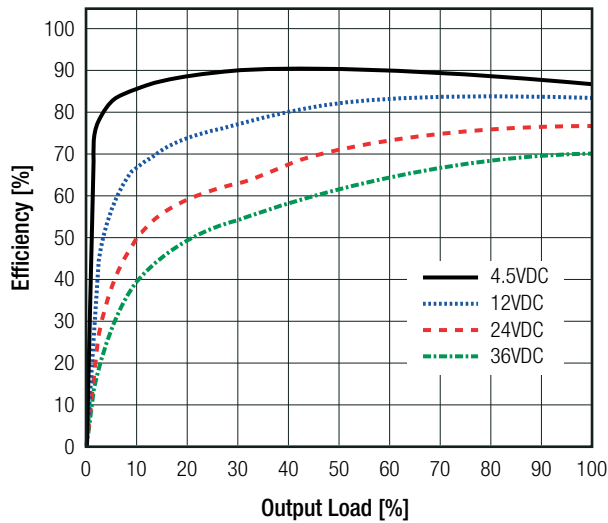


continued on next page

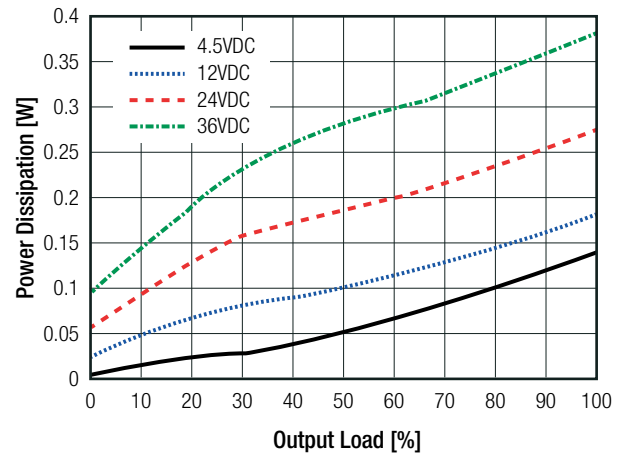
**Specifications** (measured @  $T_a = -40^\circ\text{C}$  to  $+90^\circ\text{C}$ ,  $V_{IN} = 24\text{VDC}$ , full load and after warm-up unless otherwise stated)

**R-78K1.8-0.5**

**Efficiency vs. Load**

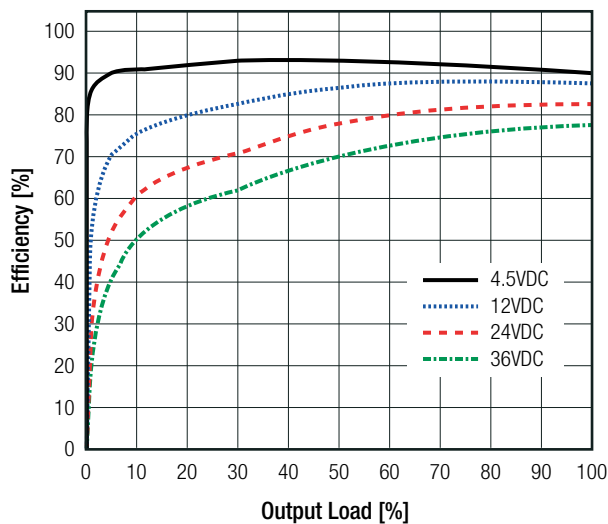


**Power Dissipation vs. Load**

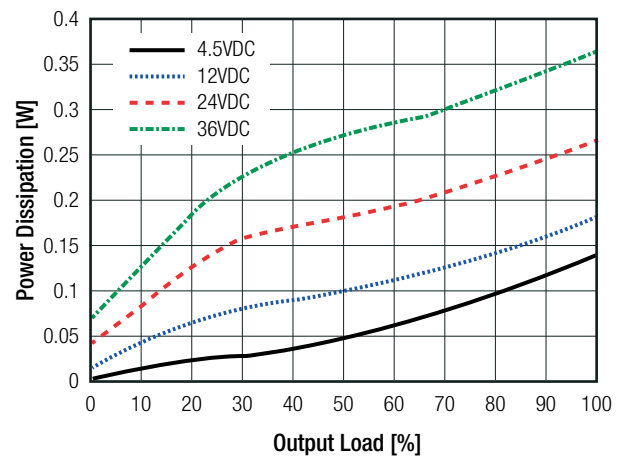


**R-78K2.5-0.5**

**Efficiency vs. Load**

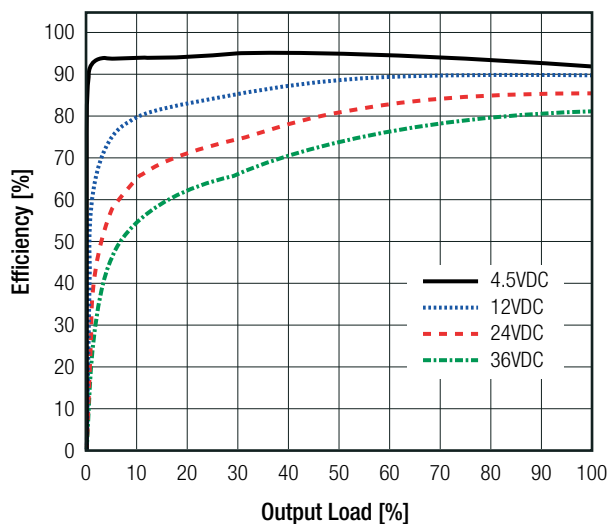


**Power Dissipation vs. Load**

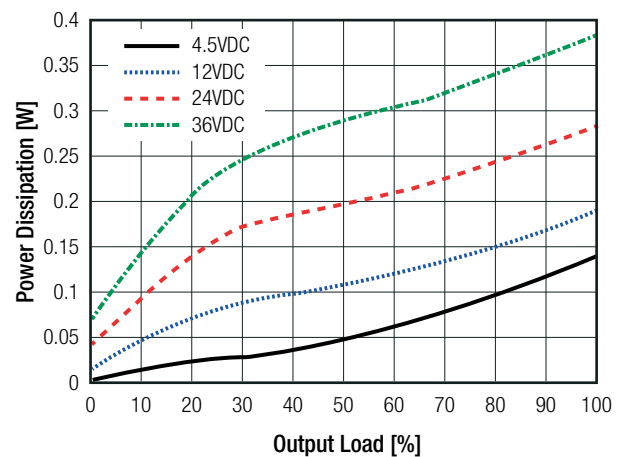


**R-78K3.3-0.5**

**Efficiency vs. Load**



**Power Dissipation vs. Load**

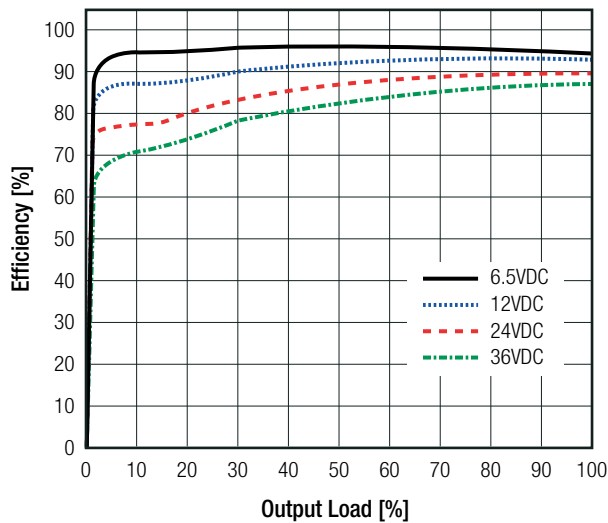


continued on next page

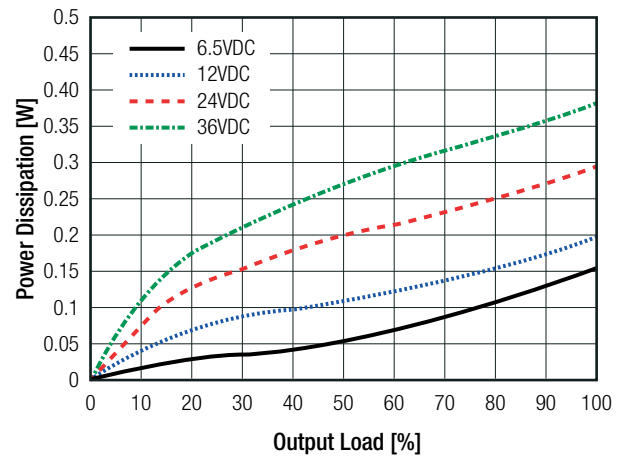
**Specifications** (measured @  $T_a = -40^{\circ}\text{C}$  to  $+90^{\circ}\text{C}$ ,  $V_{IN} = 24\text{VDC}$ , full load and after warm-up unless otherwise stated)

**R-78K5.0-0.5**

**Efficiency vs. Load**

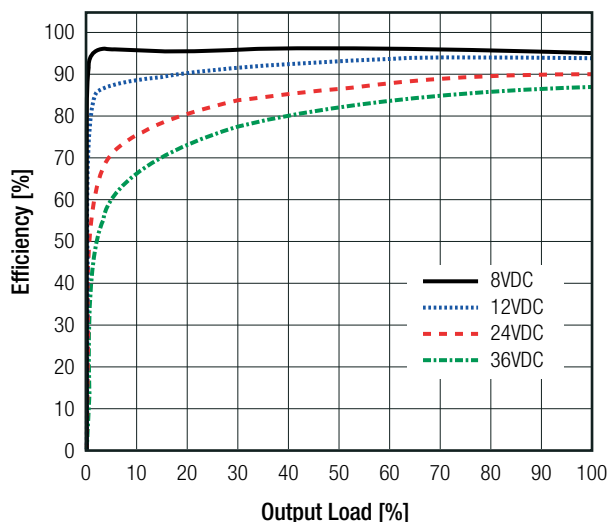


**Power Dissipation vs. Load**

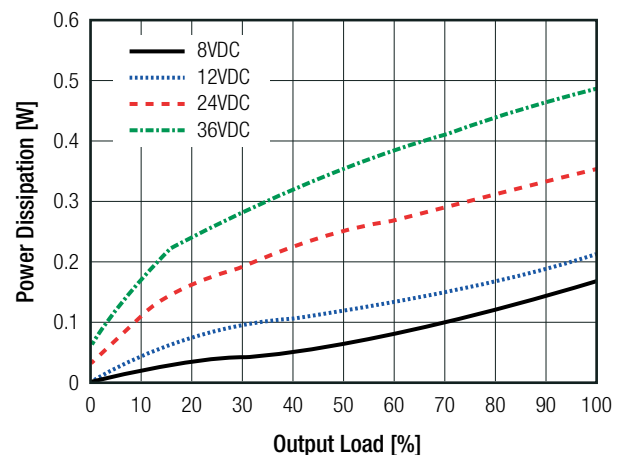


**R-78K6.5-0.5**

**Efficiency vs. Load**

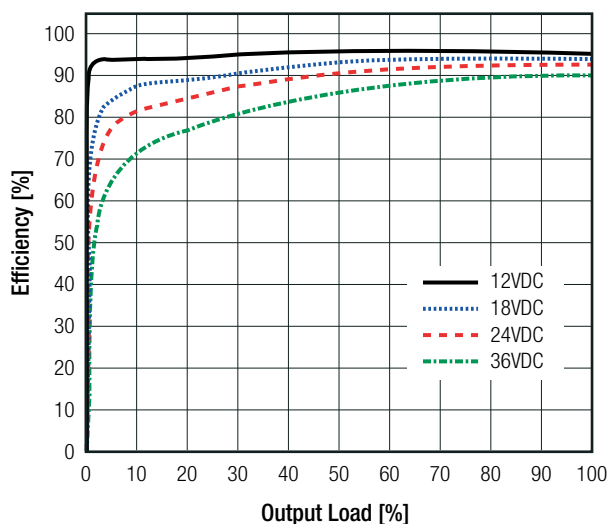


**Power Dissipation vs. Load**

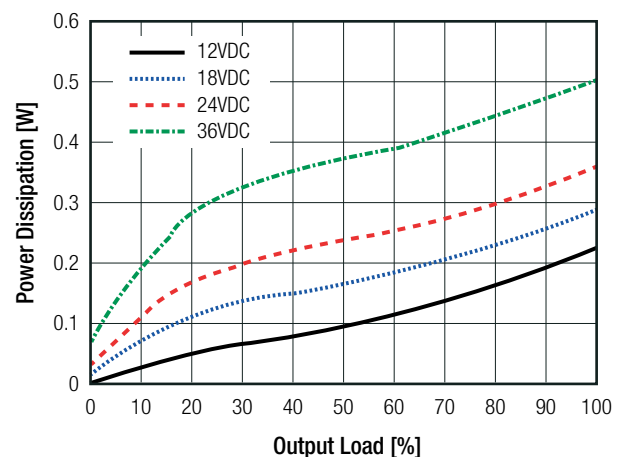


**R-78K9.0-0.5**

**Efficiency vs. Load**



**Power Dissipation vs. Load**

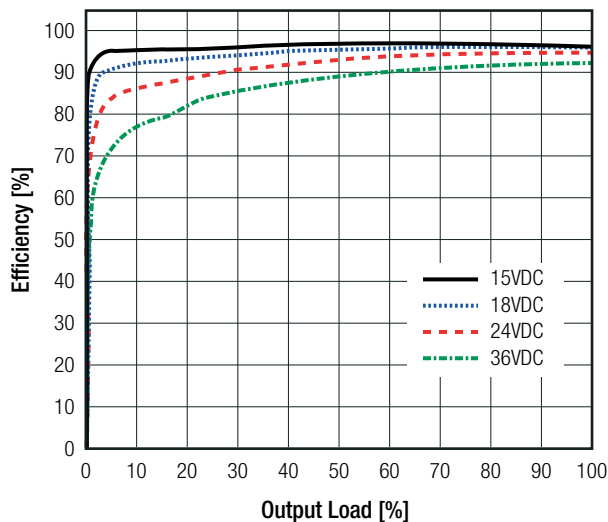


continued on next page

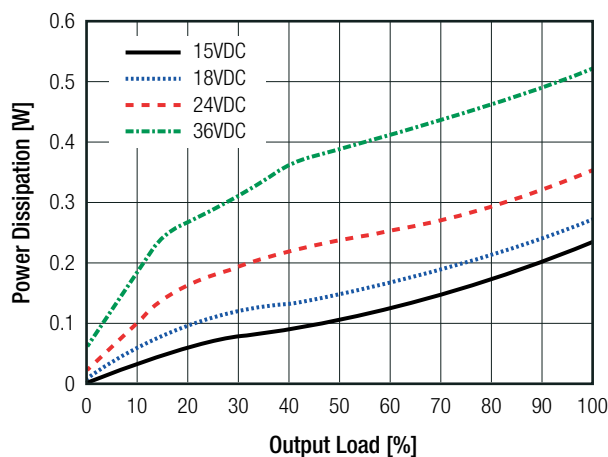
**Specifications** (measured @  $T_a = -40^{\circ}\text{C}$  to  $+90^{\circ}\text{C}$ ,  $V_{IN} = 24\text{VDC}$ , full load and after warm-up unless otherwise stated)

### R-78K12-0.5

Efficiency vs. Load

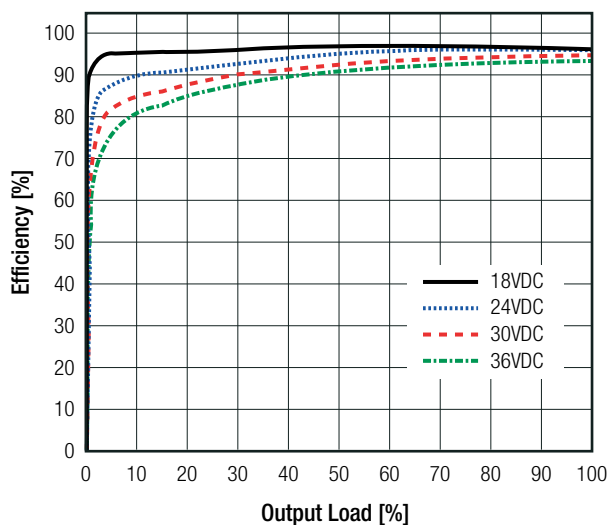


Power Dissipation vs. Load

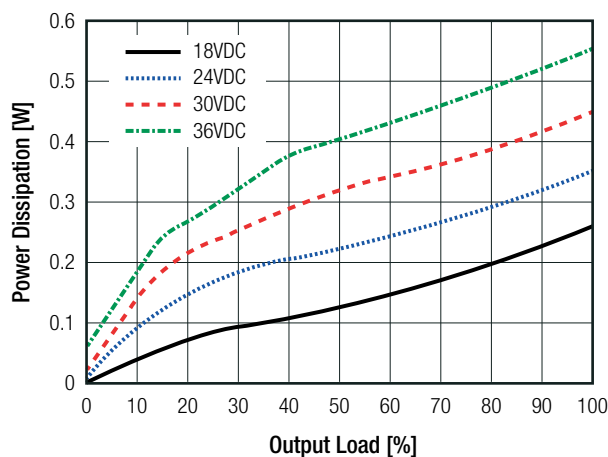


### R-78K15-0.5

Efficiency vs. Load



Power Dissipation vs. Load



### REGULATIONS

| Parameter       | Condition                        | Value                               |
|-----------------|----------------------------------|-------------------------------------|
| Output Accuracy |                                  | $\pm 1.7\%$ typ. / $\pm 2.7\%$ max. |
| Line Regulation | low line to high line, full load | $\pm 0.3\%$ max.                    |
| Load Regulation | 0% to 100%<br>10% to 100% load   | 1.7% typ. / 2.7% max.<br>1.5% max.  |

### PROTECTIONS

| Parameter                      | Condition | Value                          |
|--------------------------------|-----------|--------------------------------|
| Short Circuit Protection (SCP) |           | continuous, automatic recovery |
| Short Circuit Input Current    |           | 30mA max.                      |

continued on next page

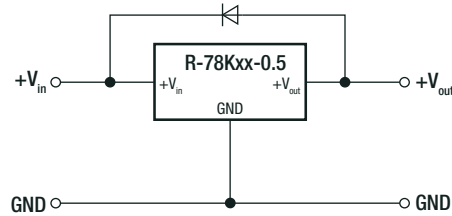
**Specifications** (measured @  $T_a = -40^{\circ}\text{C}$  to  $+90^{\circ}\text{C}$ ,  $V_{in} = 24\text{VDC}$ , full load and after warm-up unless otherwise stated)

### Optional Diode Protection Circuit

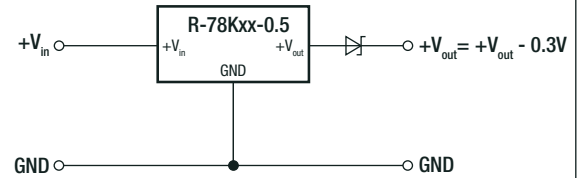
Add a blocking diode to  $V_{out}$  if current can flow backwards into the output, as this can damage the converter when it is powered down.

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

#### Optional Protection 1:



#### Optional Protection 2:



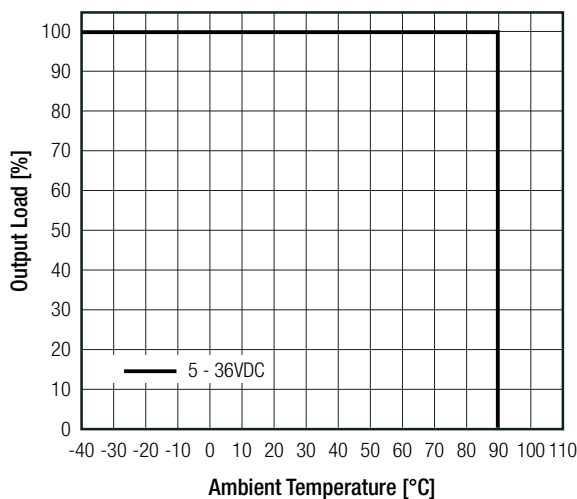
### ENVIRONMENTAL

| Parameter                   | Condition                                               | Value                                          |
|-----------------------------|---------------------------------------------------------|------------------------------------------------|
| Operating Temperature Range | refer to "Derating Graph"                               | $-40^{\circ}\text{C}$ to $+90^{\circ}\text{C}$ |
| Maximum Case Temperature    |                                                         | $+115^{\circ}\text{C}$                         |
| Temperature Coefficient     |                                                         | 0.01%/K                                        |
| Operating Humidity          | non-condensing                                          | 95% RH max.                                    |
| MTBF                        | according to MIL-HDBK-217F, G.B., $+25^{\circ}\text{C}$ | R-78K1.5-0.5                                   |
|                             |                                                         | R-78K1.8-0.5                                   |
|                             |                                                         | R-78K2.5-0.5                                   |
|                             |                                                         | R-78K3.3-0.5                                   |
|                             |                                                         | R-78K5.0-0.5                                   |
|                             |                                                         | R-78K6.5-0.5,<br>R-78K9.0-0.5                  |
|                             |                                                         | R-78K12-0.5                                    |
|                             |                                                         | R-78K15-0.5                                    |
| Vibration                   |                                                         | 10-55Hz, 2G, 30min along X,Y and Z axis        |

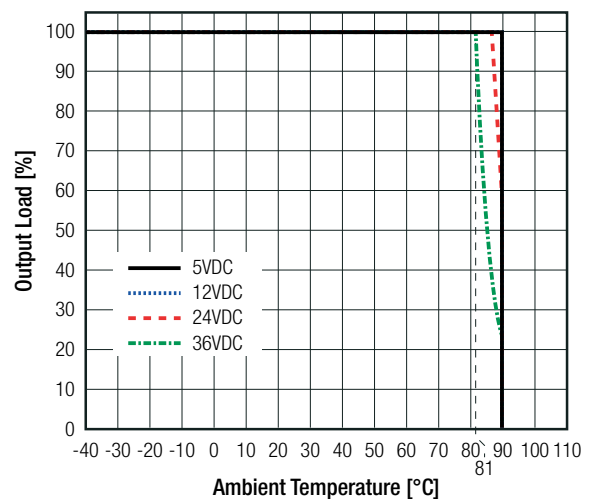
### Derating Graph

(@ Chamber and natural convection 0.1m/s, over  $V_{in}$ )

**R-78K1.5-0.5**



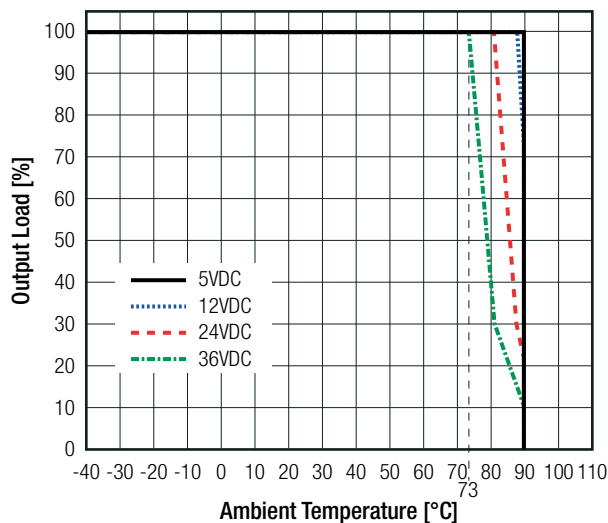
**R-78K1.8-0.5**



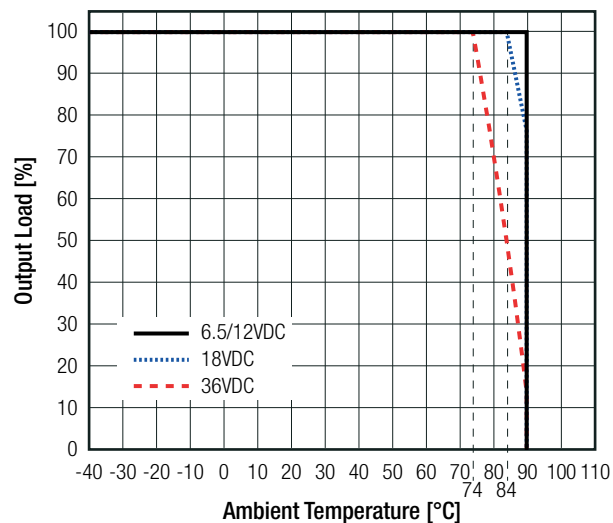
continued on next page

**Specifications** (measured @  $T_a = -40^{\circ}\text{C}$  to  $+90^{\circ}\text{C}$ ,  $V_{IN} = 24\text{VDC}$ , full load and after warm-up unless otherwise stated)

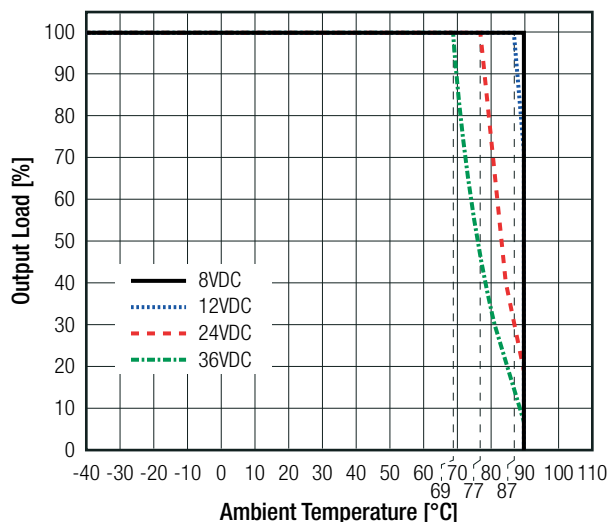
**R-78K2.5-0.5 & R-78K3.3-0.5**



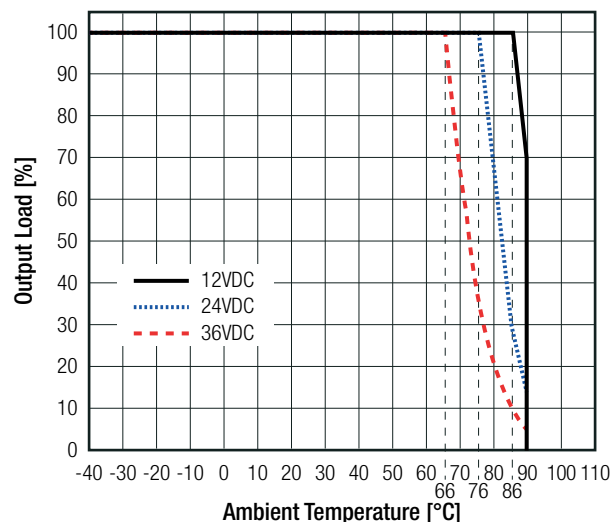
**R-78K5.0-0.5**



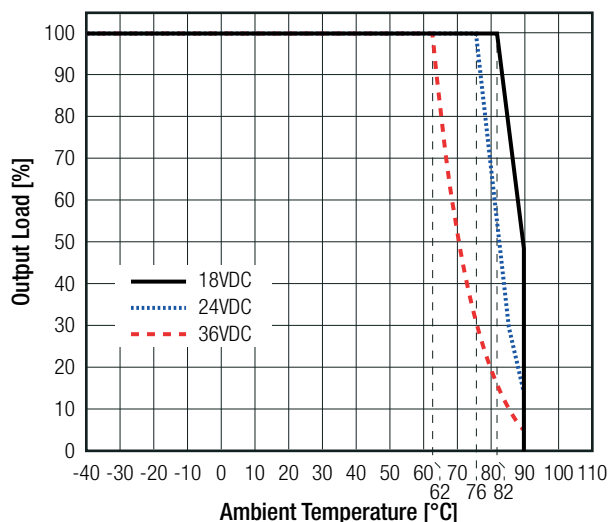
**R-78K6.5-0.5**



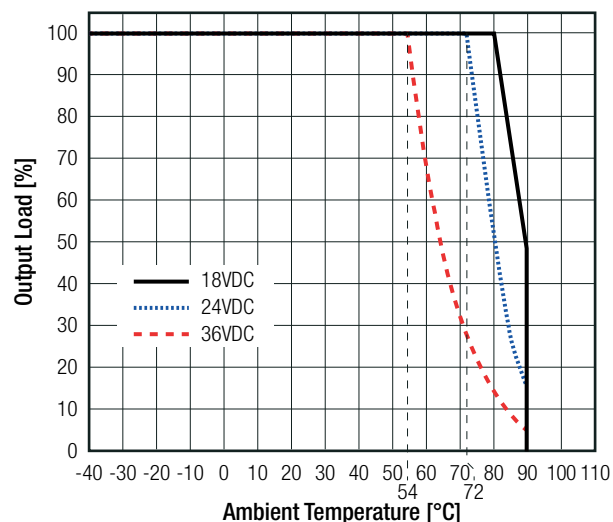
**R-78K9.0-0.5**



**R-78K12.0-0.5**



**R-78K15.0-0.5**



continued on next page

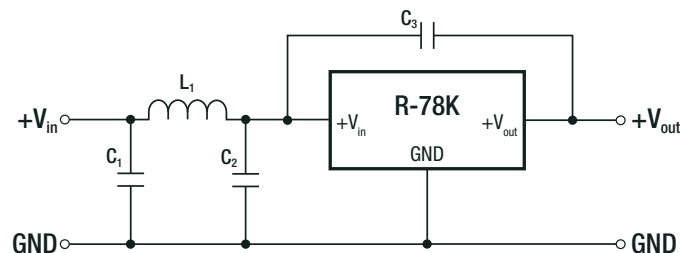
**Specifications** (measured @  $T_a = -40^{\circ}\text{C}$  to  $+90^{\circ}\text{C}$ ,  $V_{in} = 24\text{VDC}$ , full load and after warm-up unless otherwise stated)

### SAFETY AND CERTIFICATIONS (PENDING)

| Certificate Type (Safety)                                                                     | Report Number | Standard                     |
|-----------------------------------------------------------------------------------------------|---------------|------------------------------|
| Audio/Video, information and communication technology equipment - Part 1: Safety requirements | CN21UWPW002   | IEC62368-1:2018 3rd Edition  |
| RoHS2                                                                                         |               | RoHS 2011/65/EU + AM2015/863 |

| EMC Compliance                                                                | Condition                                     | Standard / Criterion |
|-------------------------------------------------------------------------------|-----------------------------------------------|----------------------|
| Electromagnetic compatibility of multimedia equipment - Emission requirements | with external filter refer to "EMC filtering" | EN55032, Class B     |

**EMC filtering suggestion according to EN55032**



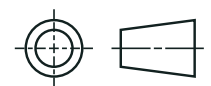
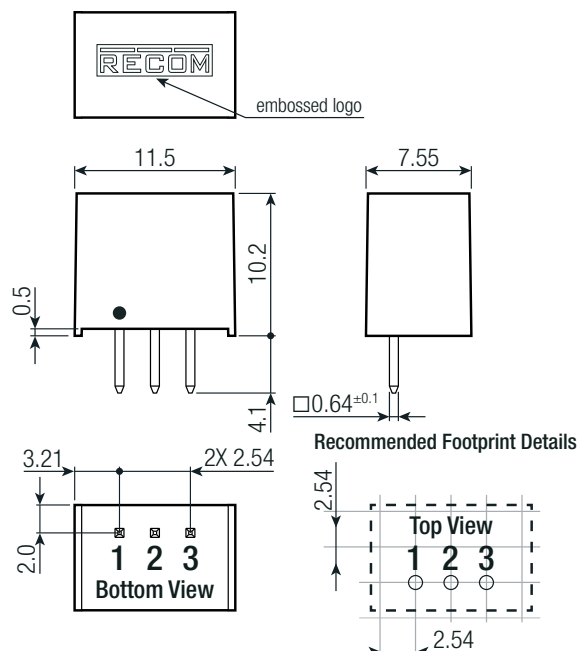
**Component List Class B**

| C1/C2            | C3  | L1                |
|------------------|-----|-------------------|
| 10 $\mu\text{F}$ | 1nF | 100 $\mu\text{H}$ |

### DIMENSION AND PHYSICAL CHARACTERISTICS

| Parameter         | Type                   | Value                                                          |
|-------------------|------------------------|----------------------------------------------------------------|
| Material          | case<br>potting<br>PCB | black plastic, (UL94 V-0)<br>PU, (UL94 V-0)<br>FR4, (UL94 V-0) |
| Dimension (LxWxH) |                        | 11.5 x 7.55 x 10.2mm                                           |
| Weight            |                        | 1.7g typ.                                                      |

#### Dimension Drawing (mm)



#### Pinning Information

| Pin # | Single            |
|-------|-------------------|
| 1     | +V <sub>IN</sub>  |
| 2     | GND               |
| 3     | +V <sub>OUT</sub> |

Tolerance:  
xx.x =  $\pm 0.5\text{mm}$   
xx.xx =  $\pm 0.25\text{mm}$

**Specifications** (measured @  $T_a = -40^{\circ}\text{C}$  to  $+90^{\circ}\text{C}$ ,  $V_{IN} = 24\text{VDC}$ , full load and after warm-up unless otherwise stated)**PACKAGING INFORMATION**

| Parameter                   | Type           | Value                                           |
|-----------------------------|----------------|-------------------------------------------------|
| Packaging Dimension (LxWxH) | tube           | 520.0 x 9.2 x 19.0mm                            |
| Packaging Quantity          |                | 43pcs                                           |
| Storage Temperature Range   |                | $-50^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ |
| Storage Humidity            | non-condensing | 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.