

# Features

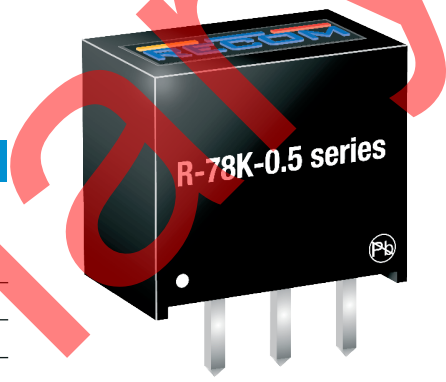
# Switching Regulator

- 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

**RECOM**  
DC/DC Converter

## 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



### 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

**Notes:**  
Note1: At higher slew rates or hard plugging, add 27μF E-Cap between +Vin and GND, especially when Vin is >18VDC

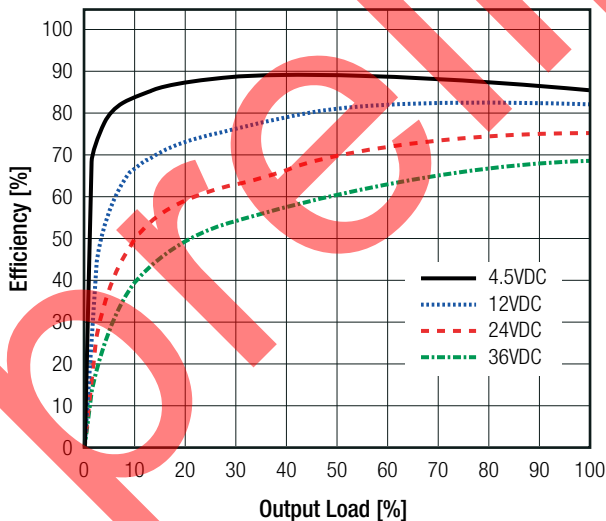
Specifications (measured @  $T_a = -40^{\circ}\text{C}$  to  $+90^{\circ}\text{C}$ ,  $V_{in} = 24\text{VDC}$ , full load and after warm-up unless otherwise stated)

**BASIC CHARACTERISTICS**

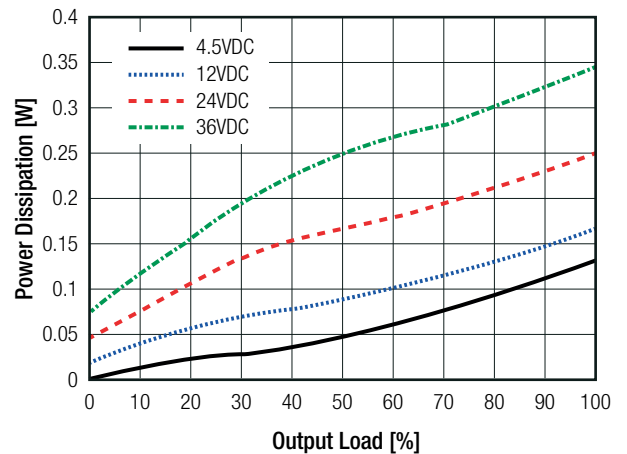
Parameter	Condition	Min.	Typ.	Max.	
Input Under Voltage Lockout (UVLO)	R-78K1.5-0.5, R-78K1.8-0.5, R-78K2.5-0.5, R-78K3.3-0.5	DC-DC ON	5.15VDC		5.45VDC
		DC-DC OFF	3.6VDC		3.9VDC
	R-78K5-0.5	DC-DC ON	5.15VDC		5.45VDC
		DC-DC OFF	4.6VDC		4.9VDC
	R-78K6.5-0.5	DC-DC ON	7.0VDC		7.5VDC
		DC-DC OFF	6.3VDC		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

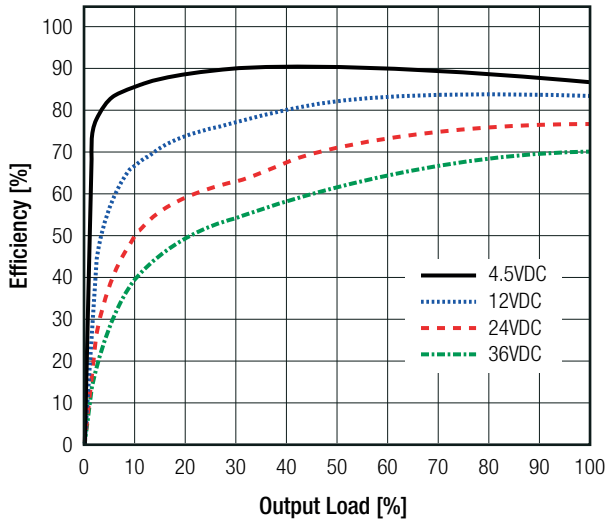


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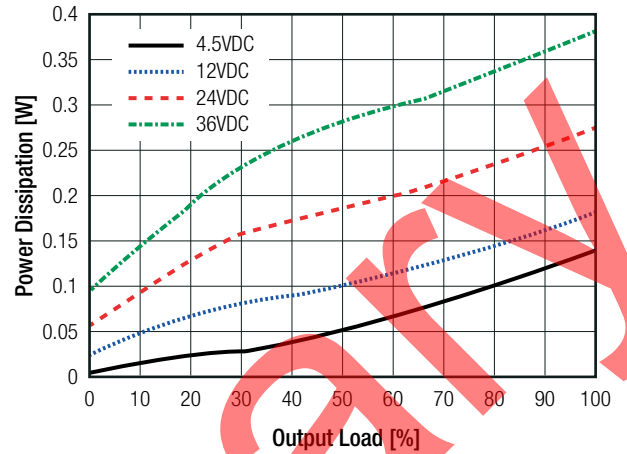
Specifications (measured @  $T_a = -40^\circ\text{C}$  to  $+90^\circ\text{C}$ ,  $V_{IN} = 24\text{VDC}$ , full load and after warm-up unless otherwise stated)

R-78K1.8-0.5

Efficiency vs. Load

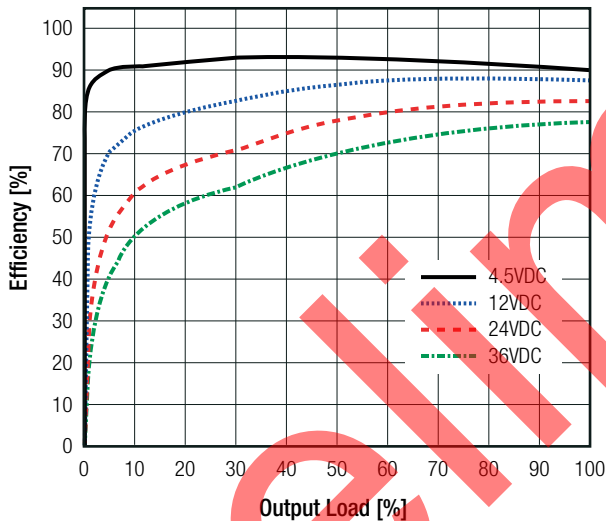


Power Dissipation vs. Load

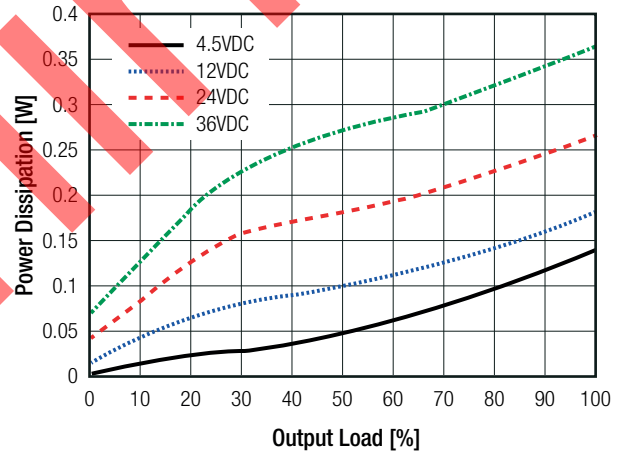


R-78K2.5-0.5

Efficiency vs. Load

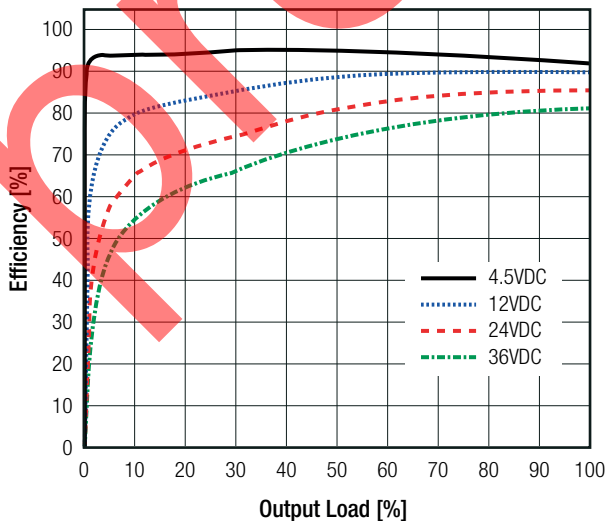


Power Dissipation vs. Load

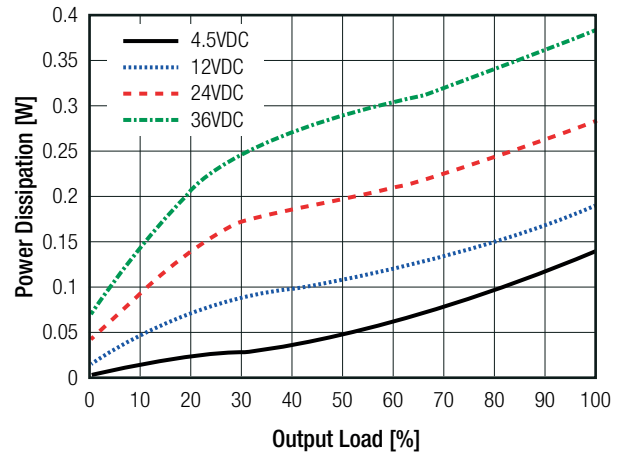


R-78K3.3-0.5

Efficiency vs. Load



Power Dissipation vs. Load

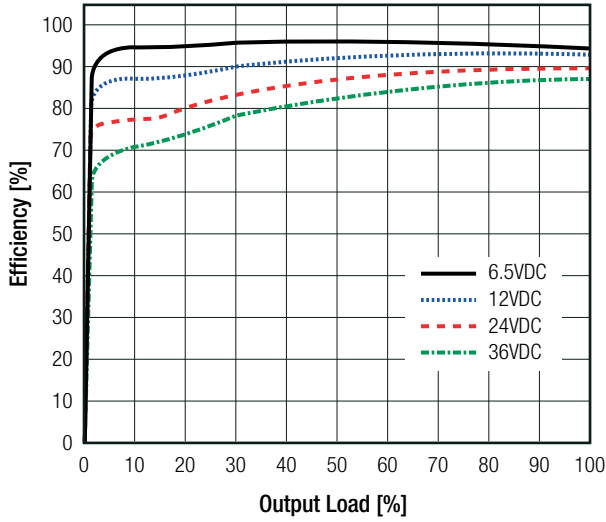


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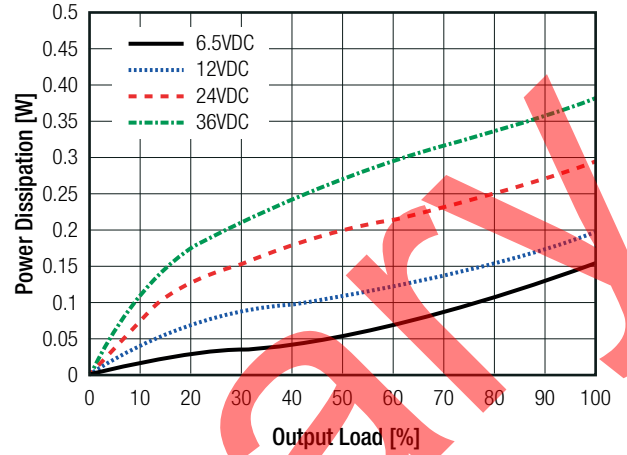
Specifications (measured @  $T_a = -40^\circ\text{C}$  to  $+90^\circ\text{C}$ ,  $V_{IN} = 24\text{VDC}$ , full load and after warm-up unless otherwise stated)

R-78K5.0-0.5

Efficiency vs. Load

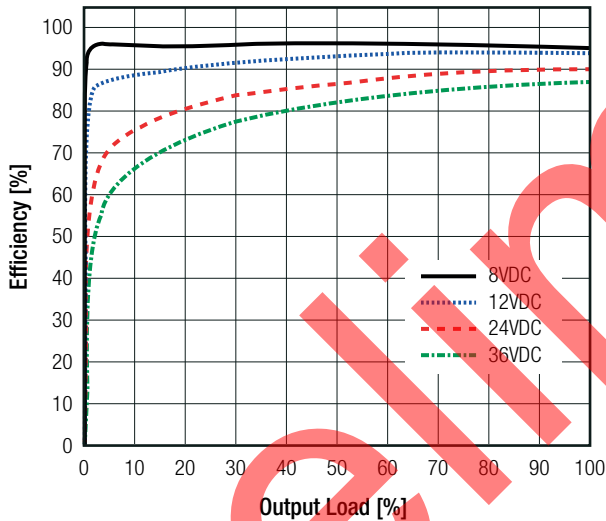


Power Dissipation vs. Load

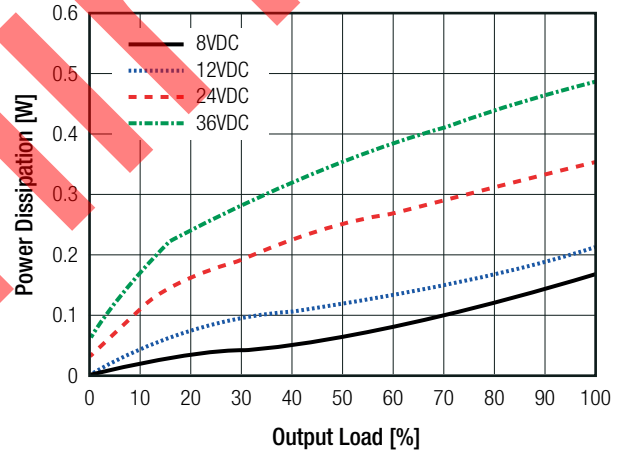


R-78K6.5-0.5

Efficiency vs. Load

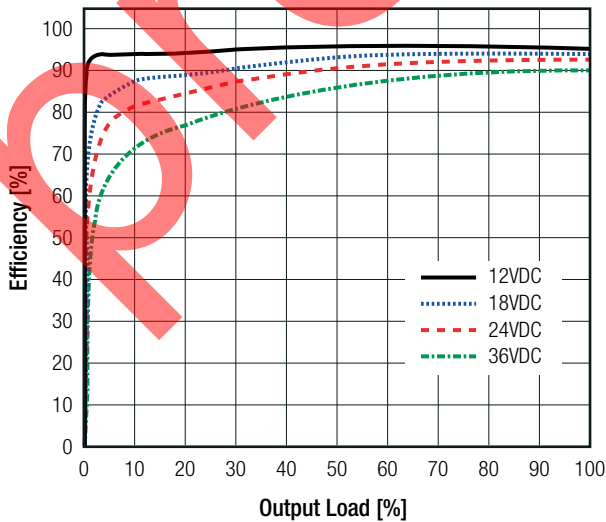


Power Dissipation vs. Load

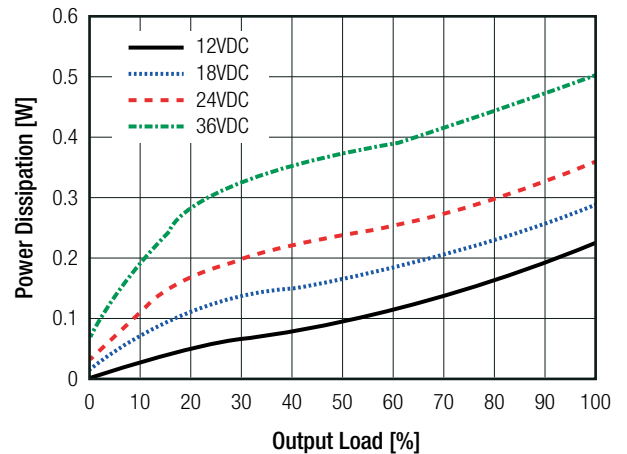


R-78K9.0-0.5

Efficiency vs. Load



Power Dissipation vs. Load

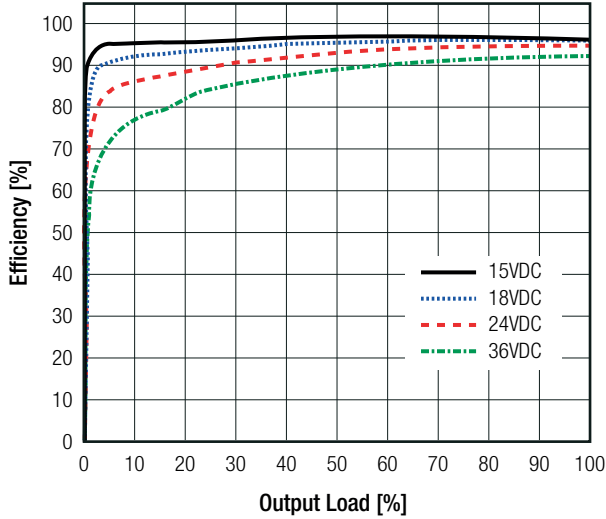


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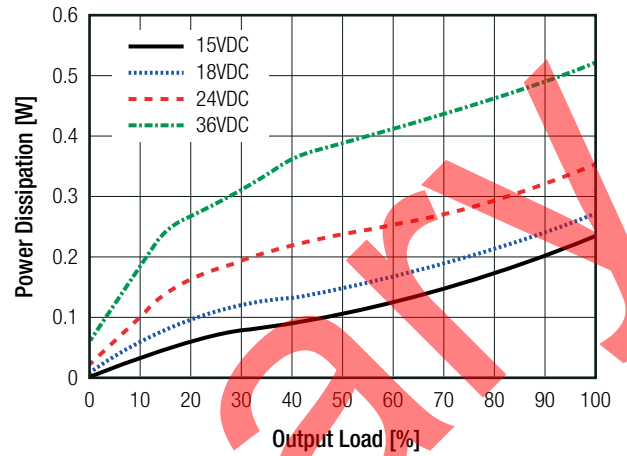
Specifications (measured @ Ta= -40°C to +90°C, V<sub>IN</sub>= 24VDC, full load and after warm-up unless otherwise stated)

**R-78K12-0.5**

Efficiency vs. Load

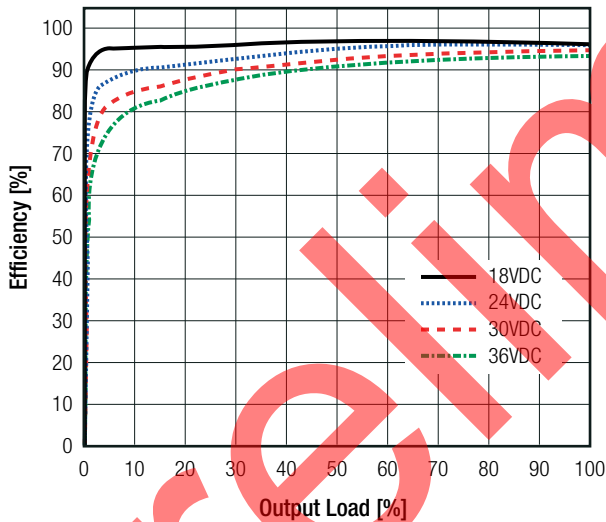


Power Dissipation vs. Load

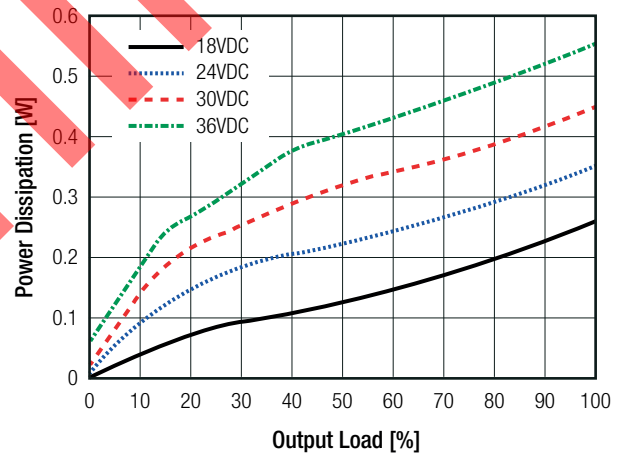


**R-78K15-0.5**

Efficiency vs. Load



Power Dissipation vs. Load



**REGULATIONS**

Parameter	Condition	Value
Output Accuracy		±1.7% typ. / ±2.7% max.
Line Regulation	low line to high line, full load	±0.3% max.
Load Regulation	0% to 100% 10% to 100% load	1.7% typ. / 2.7% max. 1.5% max.

**PROTECTIONS**

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

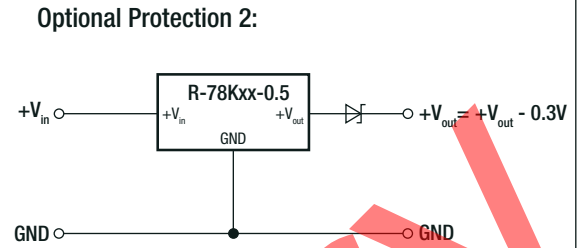
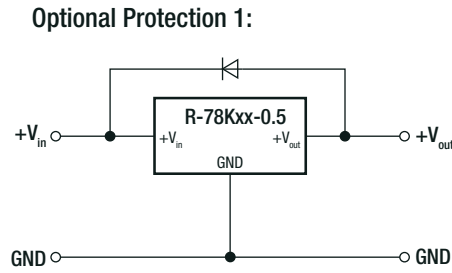
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**Specifications** (measured @  $T_a = -40^\circ\text{C}$  to  $+90^\circ\text{C}$ ,  $V_{in} = 24\text{VDC}$ , full load and after warm-up unless otherwise stated)

### 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.

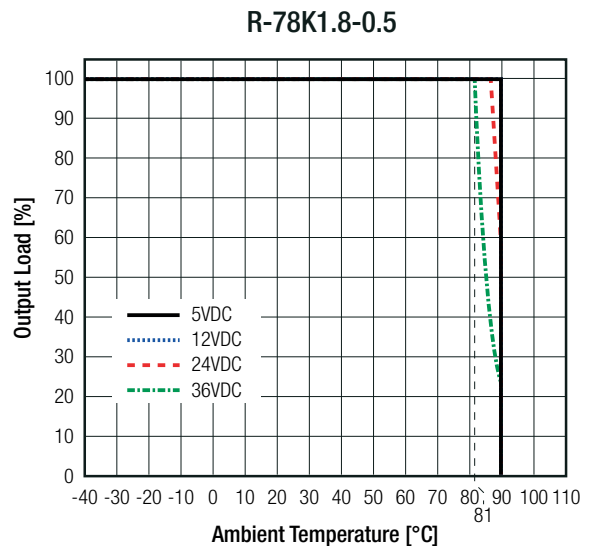
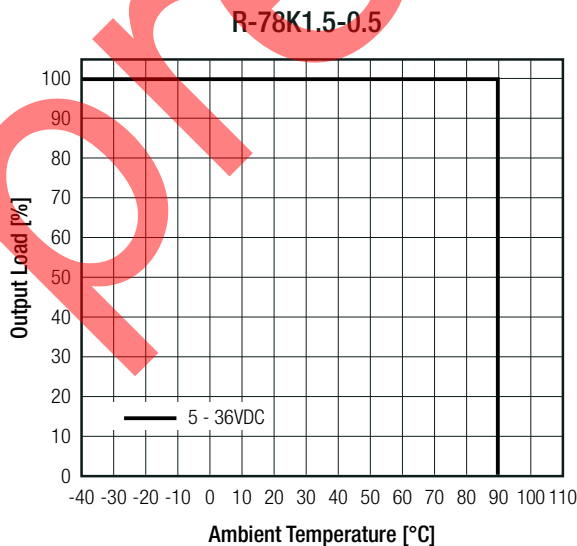
The diode can either be fitted across the device if the source is low impedance or fitted in series with the output (recommended).



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	$7517 \times 10^3$ hours
		R-78K1.8-0.5	$6644 \times 10^3$ hours
		R-78K2.5-0.5	$7538 \times 10^3$ hours
		R-78K3.3-0.5	$6762 \times 10^3$ hours
		R-78K5.0-0.5	$9861 \times 10^3$ hours
		R-78K6.5-0.5, R-78K9.0-0.5	$3361 \times 10^3$ hours
		R-78K12-0.5	$4523 \times 10^3$ hours
		R-78K15-0.5	$3485 \times 10^3$ hours
Vibration		10-55Hz, 2G, 30min along X,Y and Z axis	

### Derating Graph

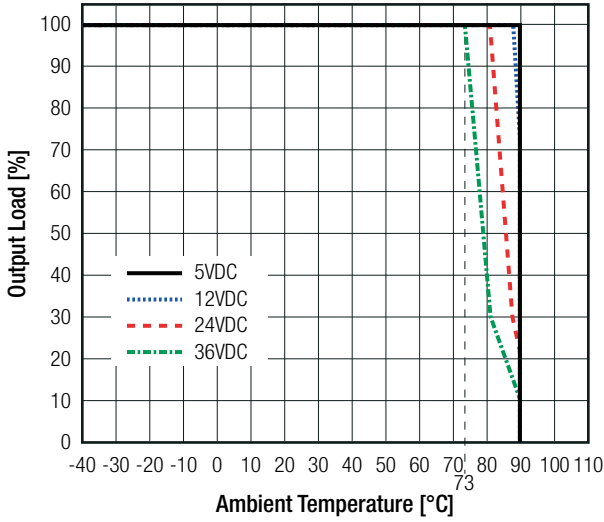
(@ Chamber and natural convection 0.1m/s, over  $V_{in}$ )



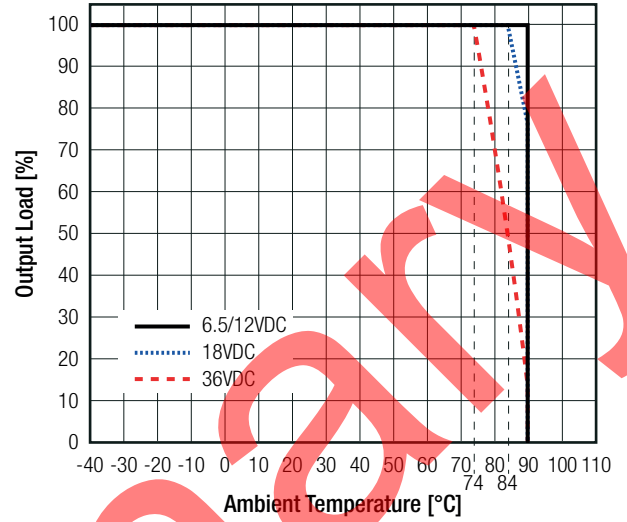
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Specifications (measured @  $T_a = -40^\circ\text{C}$  to  $+90^\circ\text{C}$ ,  $V_{IN} = 24\text{VDC}$ , full load and after warm-up unless otherwise stated)

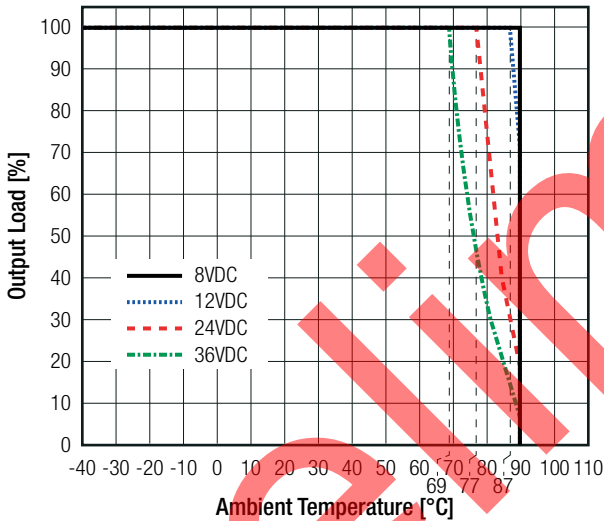
R-78K2.5-0.5 & R-78K3.3-0.5



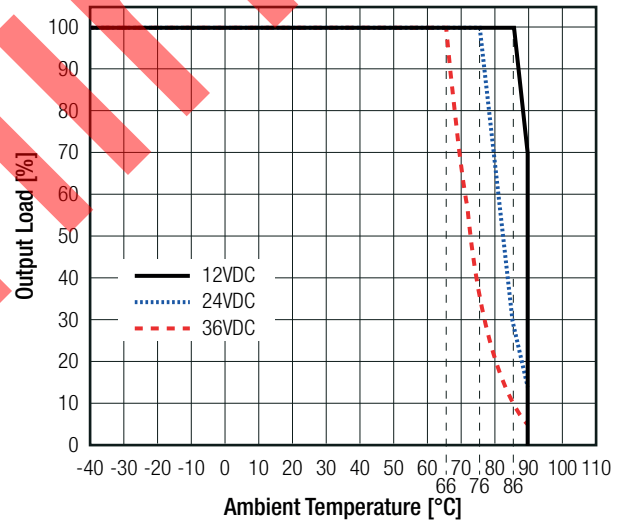
R-78K5.0-0.5



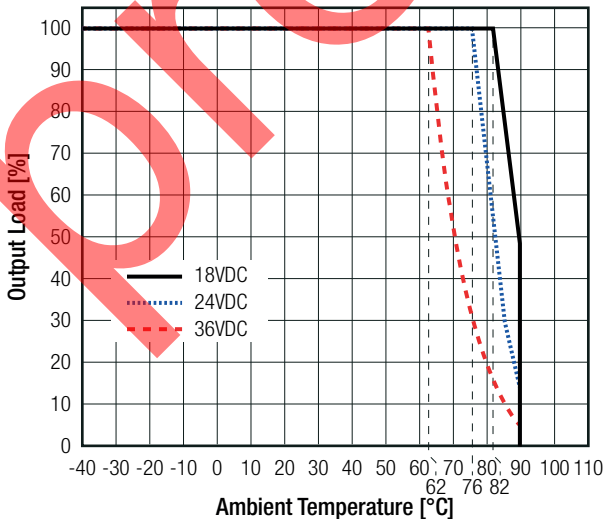
R-78K6.5-0.5



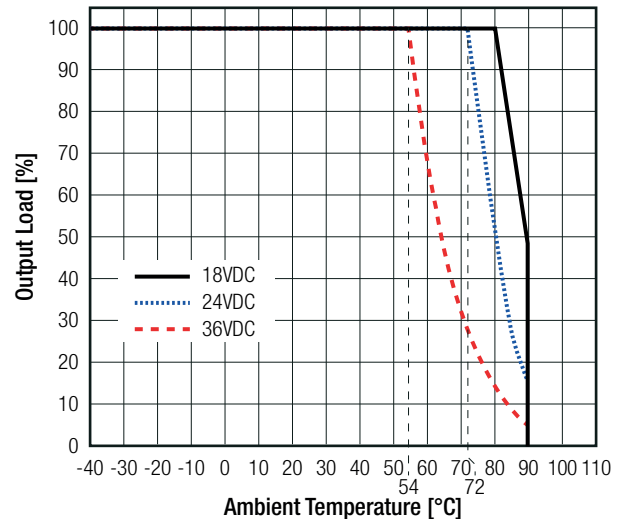
R-78K9.0-0.5



R-78K12.0-0.5



R-78K15.0-0.5



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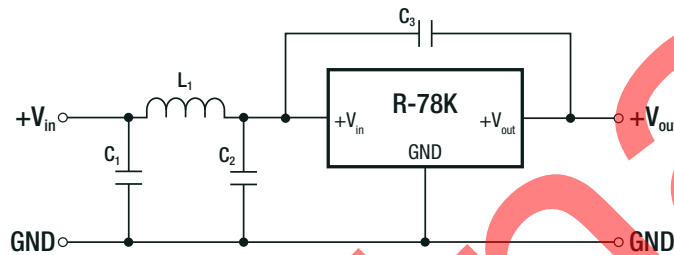
**Specifications** (measured @  $T_a = -40^\circ\text{C}$  to  $+90^\circ\text{C}$ ,  $V_{in} = 24\text{VDC}$ , full load and after warm-up unless otherwise stated)

**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 suggestions according to EN55032**



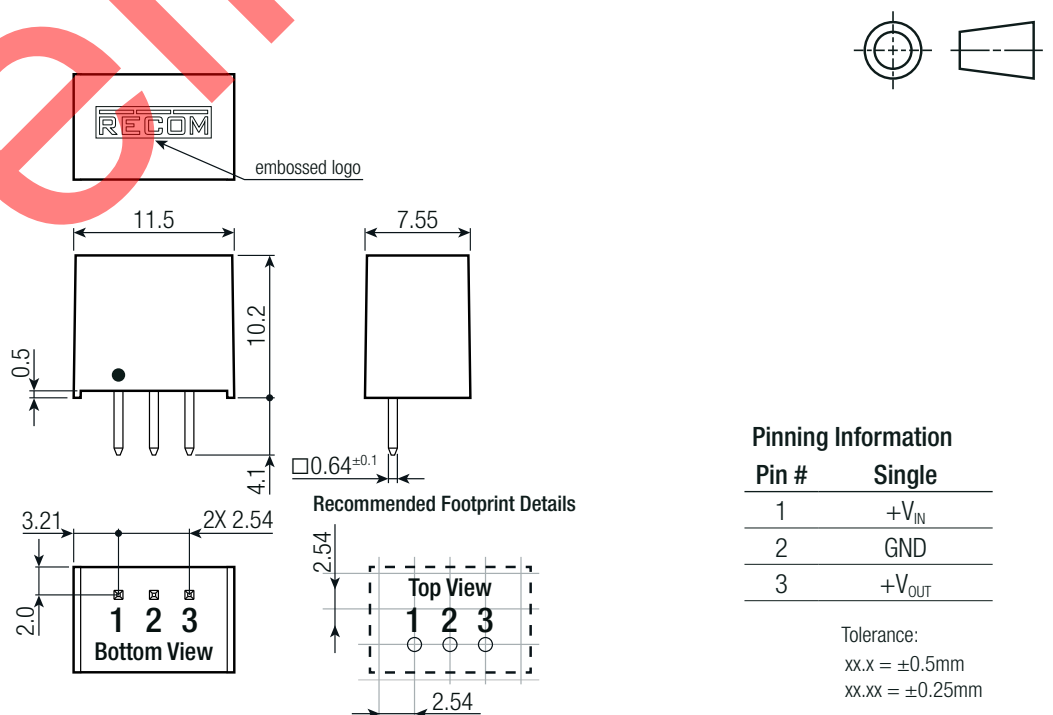
**Component List Class B**

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

**DIMENSION AND PHYSICAL CHARACTERISTICS**

Parameter	Type	Value
Material	case potting PCB	black plastic, (UL94 V-0) PU, (UL94 V-0) 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.

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