

Features

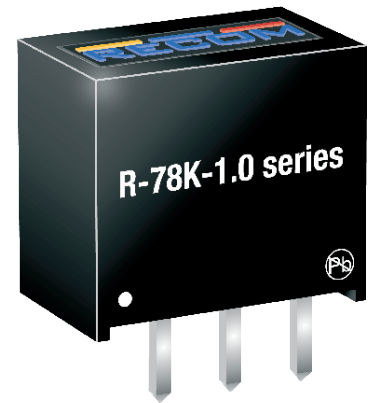
Switching Regulator

- Efficiency up to 95%, 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-1.0

1.0 Amp
SIP3
Single Output



IEC/EN62368-1 3rd Edition certified
EN55032 compliant
CB-Report

Description

The R-78K-1.0 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-1.0's high efficiency of up to 95% no heat-sink is required, and operation from -40 to 90°C is possible with slight derating. 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-78K1.8-1.0	4.5 - 36	1.8	1000	83	71
R-78K2.5-1.0	4.5 - 36	2.5	1000	85	75
R-78K3.3-1.0	4.5 - 36	3.3	1000	88	79
R-78K5.0-1.0	6.5 - 36	5	1000	92	85
R-78K9.0-1.0	12 - 36	9	1000	93	89
R-78K12-1.0	15 - 36	12	1000	95	91
R-78K15-1.0	18 - 36	15	1000	94	91

Model Numbering



Specifications

ABSOLUTE MAX RATINGS (exceeding these ratings may damage the device)				
Parameter	Condition	Min.	Typ.	Max.
Maximum Input Voltage Slew Rate ⁽¹⁾	+V _{IN} to GND			10VDC/μs
Case Temperature		-40°C		110°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

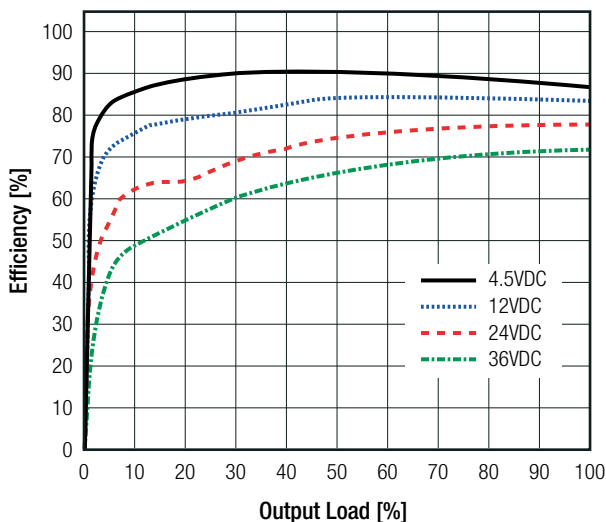
Specifications (measured @ Ta= -40°C to +90°C, V_{IN}= 24VDC, full load and after warm-up unless otherwise stated)

BASIC CHARACTERISTICS

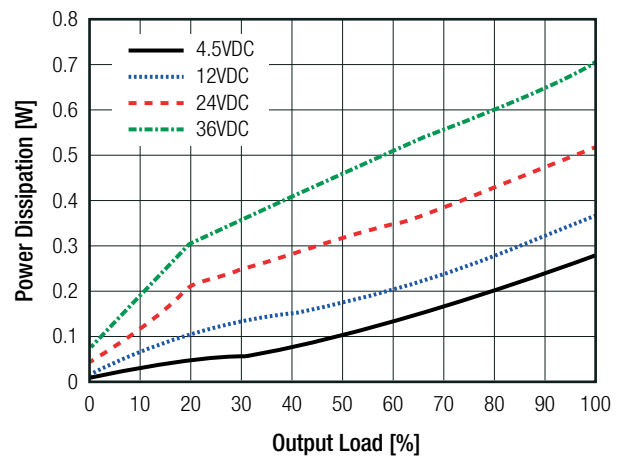
Parameter	Condition	Min.	Typ.	Max.	
Input Under Voltage Lockout (UVLO)	R-78K1.8-1.0, R-78K2.5-1.0, R-78K3.3-1.0	DC-DC ON	3.75VDC		4.05VDC
		DC-DC OFF	3.6VDC		3.8VDC
	R-78K5.0-1.0	DC-DC ON	5VDC		5.25VDC
		DC-DC OFF	4.6VDC		4.9VDC
	R-78K9.0-1.0	DC-DC ON	9.5VDC		10.5VDC
		DC-DC OFF	9.1VDC		9.7VDC
	R-78K12-1.0	DC-DC ON	13.0VDC		13.5VDC
		DC-DC OFF	12.5VDC		13.1VDC
	R-78K15-1.0	DC-DC ON	16.9VDC		17.5VDC
		DC-DC OFF	15.6VDC		16.6VDC
	Quiescent Current				1mA
	Internal Switching Frequency			400kHz	
Minimum Load		0%			
Output Ripple and Noise	20MHz BW	R-78K1.8-1.0 - R-78K5.0-1.0		50mVp-p	
		R-78K9.0-1.0		60mVp-p	
		R-78K12-1.0		75mVp-p	
		R-78K15-1.0		100mVp-p	

R-78K1.8-1.0

Efficiency vs. Load



Power Dissipation vs. Load

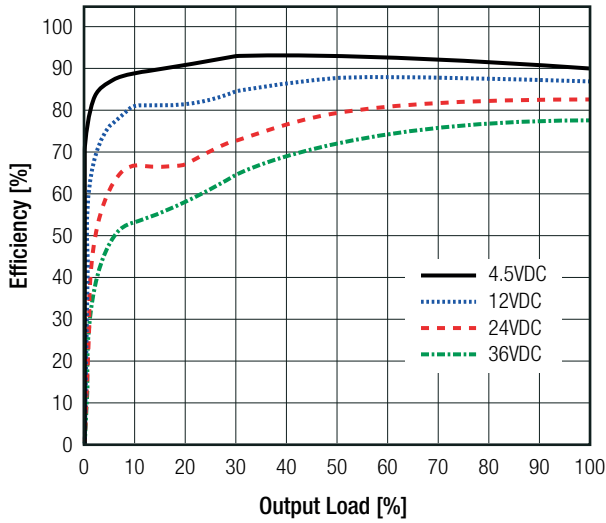


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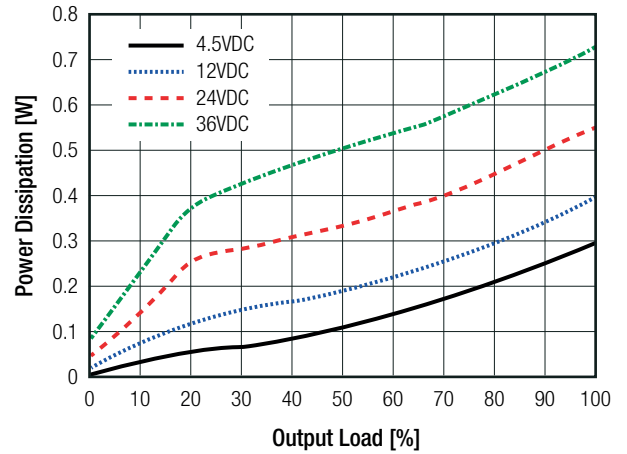
Specifications (measured @ $T_a = -40^\circ\text{C}$ to $+90^\circ\text{C}$, $V_{IN} = 24\text{VDC}$, full load and after warm-up unless otherwise stated)

R-78K2.5-1.0

Efficiency vs. Load

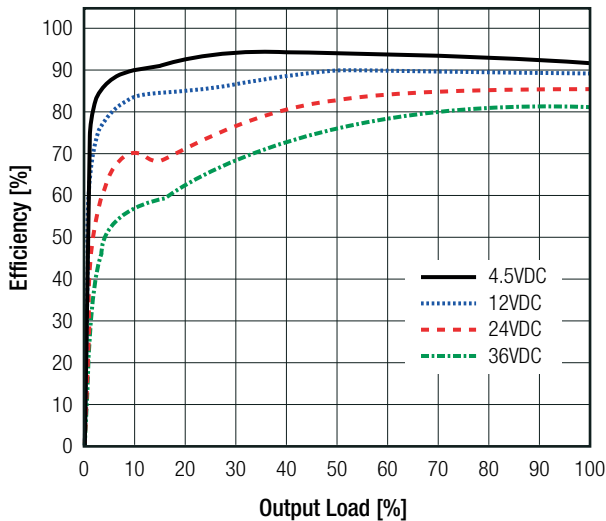


Power Dissipation vs. Load

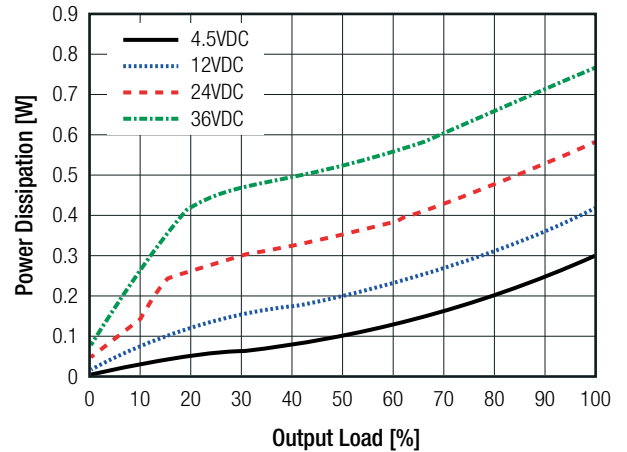


R-78K3.3-1.0

Efficiency vs. Load

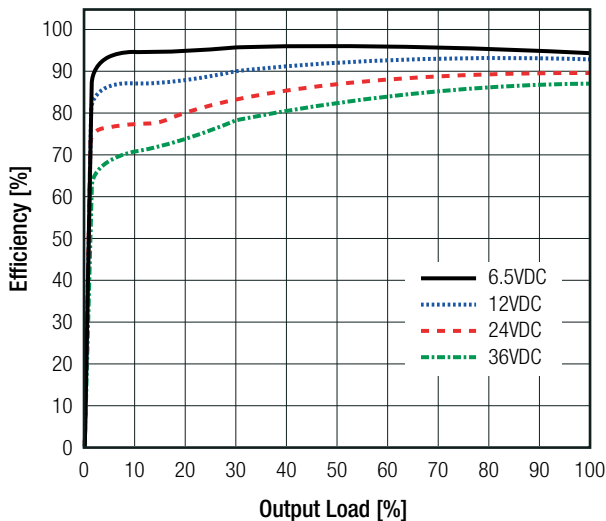


Power Dissipation vs. Load

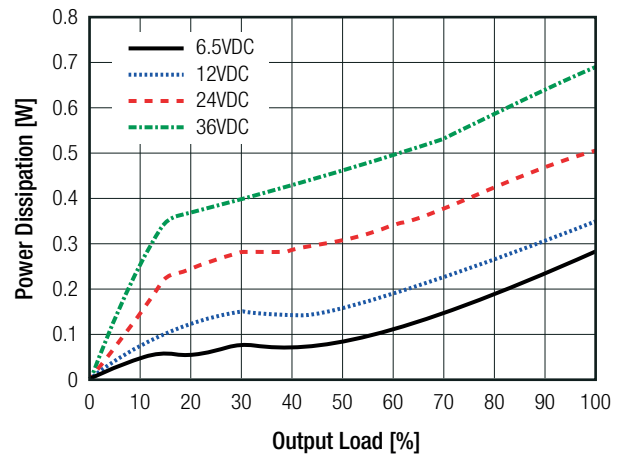


R-78K5.0-1.0

Efficiency vs. Load



Power Dissipation vs. Load

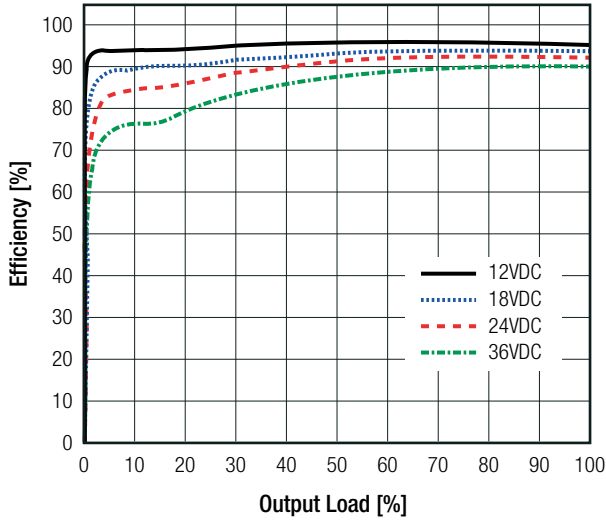


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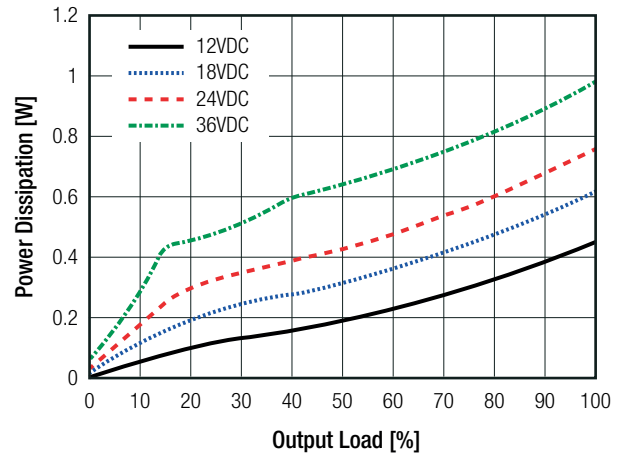
Specifications (measured @ $T_a = -40^\circ\text{C}$ to $+90^\circ\text{C}$, $V_{IN} = 24\text{VDC}$, full load and after warm-up unless otherwise stated)

R-78K9.0-1.0

Efficiency vs. Load

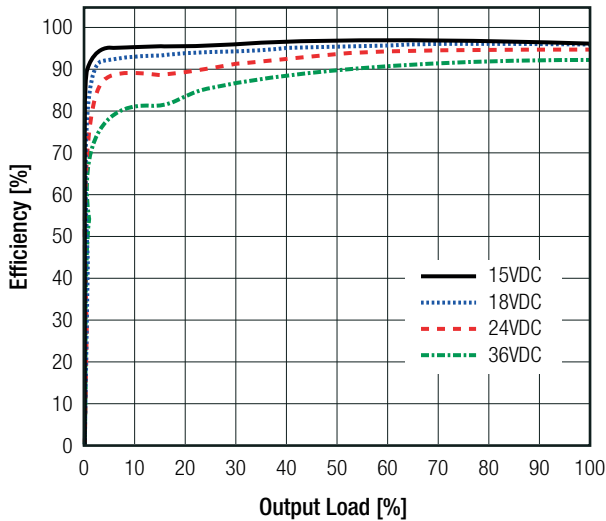


Power Dissipation vs. Load

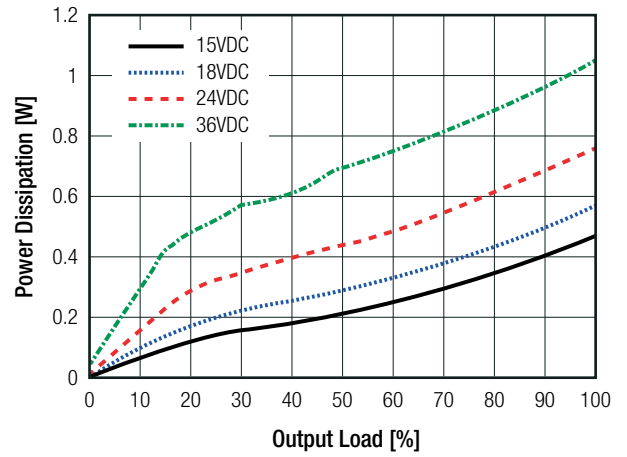


R-78K12-1.0

Efficiency vs. Load

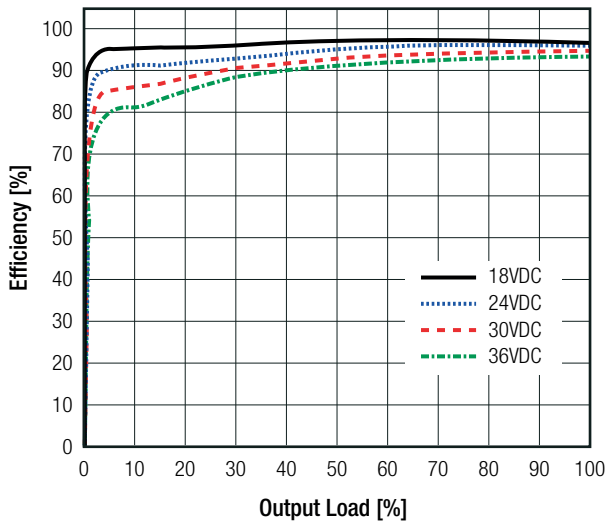


Power Dissipation vs. Load

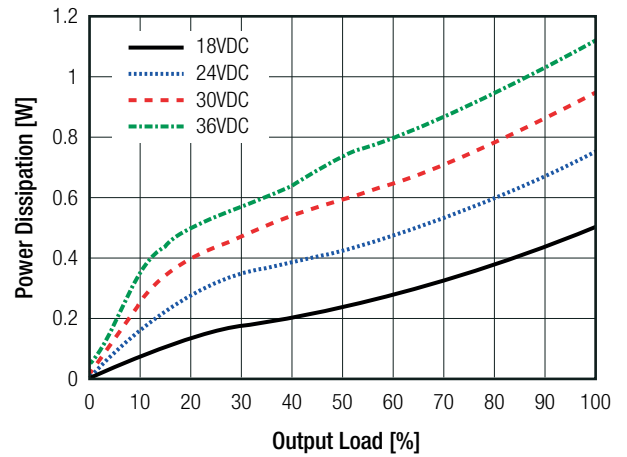


R-78K15-1.0

Efficiency vs. Load



Power Dissipation vs. Load



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)

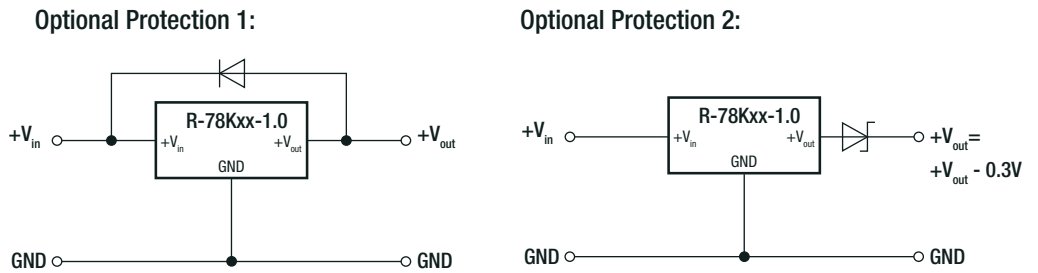
REGULATIONS		
Parameter	Condition	Value
Output Accuracy		$\pm 2.0\%$ typ. / $\pm 3.5\%$ max.
Line Regulation	low line to high line, full load	$\pm 0.5\%$ max.
Load Regulation	0% to 100%	2.0% typ. / 3.5% max.

PROTECTIONS		
Parameter	Condition	Value
Short Circuit Protection (SCP)		continuous, automatic recovery
Short Circuit Input Current		50mA max.

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°C to $+90^\circ\text{C}$	
Maximum Case Temperature		$+110^\circ\text{C}$	
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-78K1.8-1.0	5139×10^3 hours
		R-78K2.5-1.0	4990×10^3 hours
		R-78K3.3-1.0	4878×10^3 hours
		R-78K5.0-1.0	5031×10^3 hours
		R-78K9.0-1.0	4546×10^3 hours
		R-78K12-1.0	4340×10^3 hours
		R-78K15-1.0	4546×10^3 hours
Vibration		10-55Hz, 2G, 30min along X,Y and Z axis	

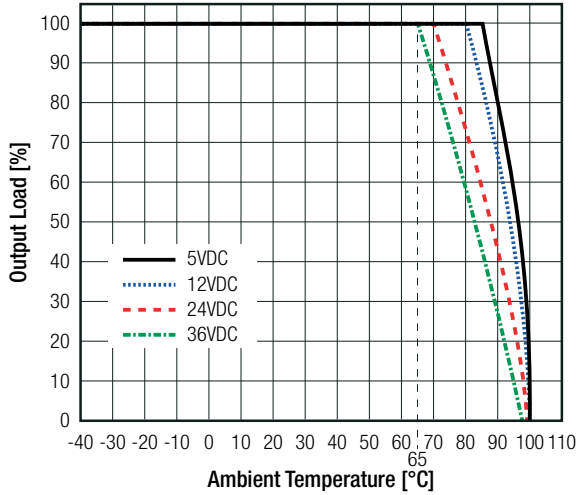
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Specifications (measured @ $T_a = -40^\circ\text{C}$ to $+90^\circ\text{C}$, $V_{in} = 24\text{VDC}$, full load and after warm-up unless otherwise stated)

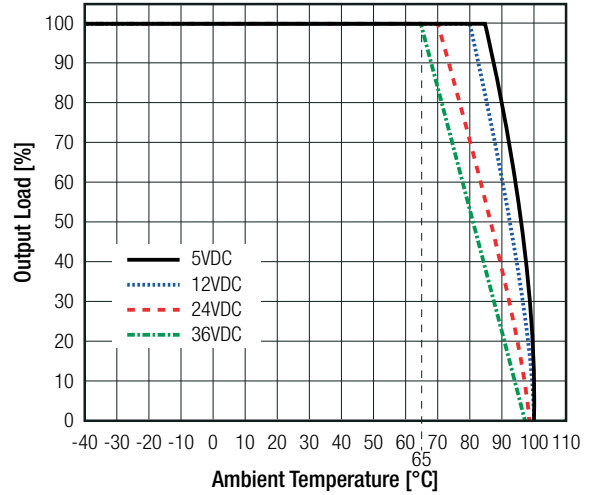
Derating Graph

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

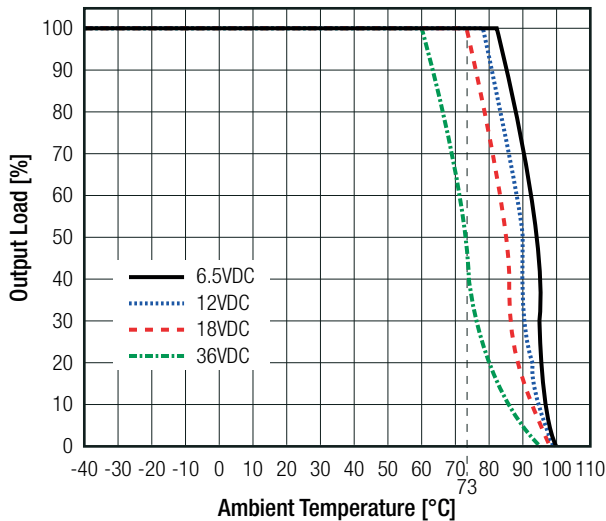
R-78K1.8-1.0 & R-78K2.5-1.0



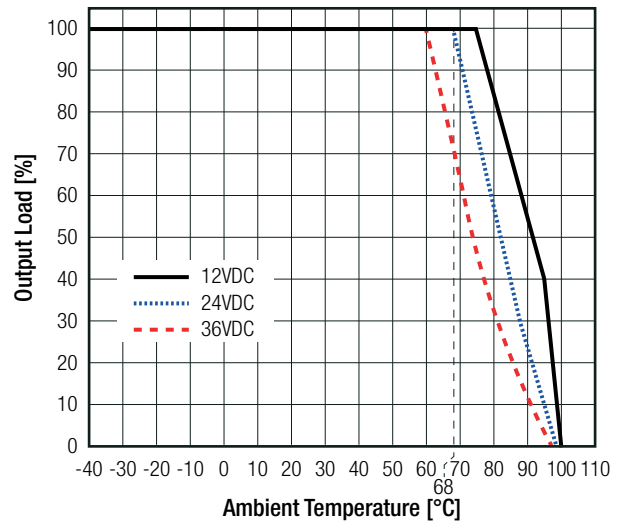
R-78K3.3-1.0



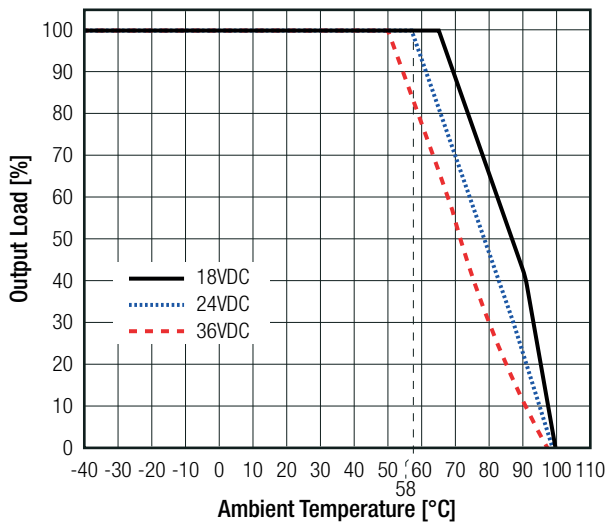
R-78K5.0-1.0



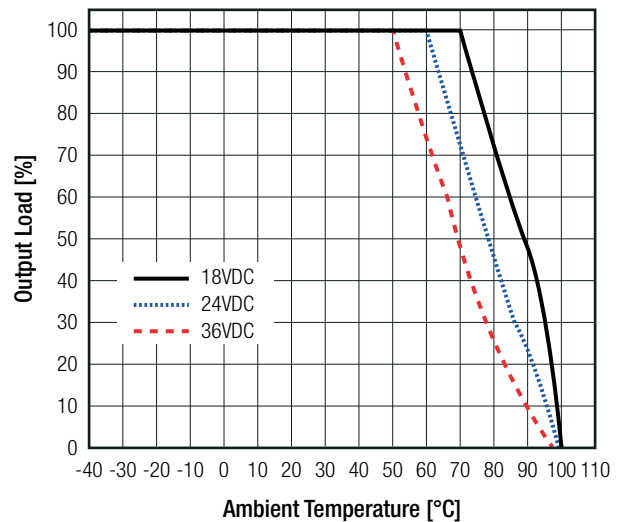
R-78K9.0-1.0



R-78K12-1.0



R-78K15-1.0



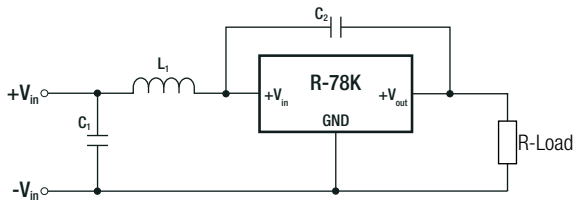
Specifications (measured @ Ta= -40°C to +90°C, V_{IN}= 24VDC, full load and after warm-up unless otherwise stated)

SAFETY AND CERTIFICATIONS

Certificate Type (Safety)	Report Number	Standard
Audio/Video, information and communication technology equipment - Part 1: Safety requirements (CB Scheme)	085-210593601-100	IEC62368-1:2018 3rd Edition
Audio/Video, information and communication technology equipment - Part 1: Safety requirements		EN IEC 62368-1:2020+A11:2020
RoHS2		RoHS 2011/65/EU + AM2015/863

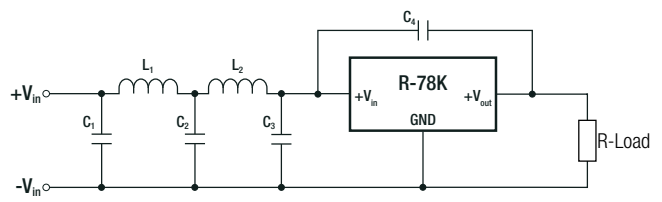
EMC Compliance	Condition	Standard / Criterion
Electromagnetic compatibility of multimedia equipment - Emission requirements	with external filter	EN55032, Class B

EMC filtering suggestions according to EN55032



Component List Class B for 1.8V, 2.5V, 3.3V version

C1	L1	C2
10µF	RLS-186	1nF



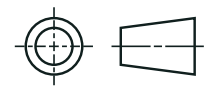
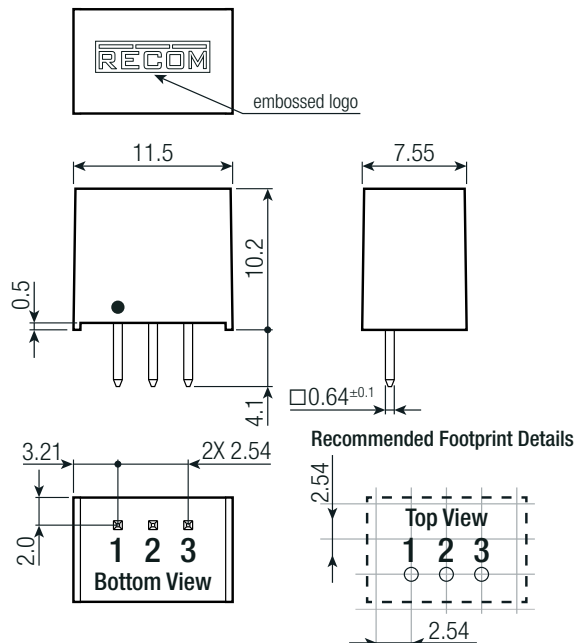
Component List Class B for 5V, 12V & 15V version

C1/C2	L1	C3	C4	L2
10µF	RLS-397	22µF	1nF	RLS-186

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 _{IN}
2	GND
3	+V _{OUT}

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

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°C to $+125^{\circ}\text{C}$
Storage Humidity	non-condensing	95% RH max.

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