

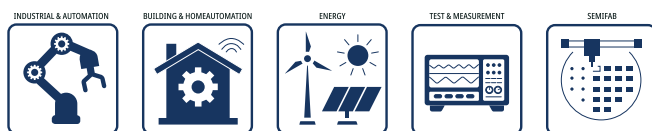
FEATURES

- 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



Dimensions (LxWxH): 11.5 x 8.5 x 17.5mm (0.45 x 0.33 x 0.69 inch)
4.0g (0.09 lbs)

APPLICATIONS



SAFETY & EMC



DESCRIPTION

The R-78K-2.0 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-2.0's high efficiency of up to 96% no heat-sink is required, and operation from -40 to 90°C is possible without derating. The compact TO-220 compatible SIP3 package measures only 11.5 x 8.5 x 17.5, 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-78K1.2-2.0 ⁽¹⁾	4.5 - 36	1.2	2000	75	73
R-78K1.5-2.0 ⁽¹⁾	4.5 - 36	1.5	2000	82	71
R-78K1.8-2.0 ⁽¹⁾	4.5 - 36	1.8	2000	85	78
R-78K2.5-2.0 ⁽¹⁾	4.5 - 36	2.5	2000	88	85
R-78K3.3-2.0 ⁽¹⁾	4.5 - 36	3.3	2000	92	86
R-78K5.0-2.0 ⁽¹⁾	6.5 - 36	5	2000	94	89
R-78K9.0-2.0 ⁽¹⁾	11 - 36	9	2000	95	93
R-78K12-2.0 ⁽¹⁾	14 - 36	12	2000	96	94
R-78K15-2.0 ⁽¹⁾	18 - 36	15	2000	96	94

Note1: add suffix "L" for 90° bent pins, e.g. R-78K5.0-2.0L

R-78K-2.0(L) series

2Amp / SIP3 Single Output

BASIC CHARACTERISTICS (measured @ $T_{AMB} = 25^{\circ}C$, nom. V_{IN} , full load and after warm-up unless otherwise stated)

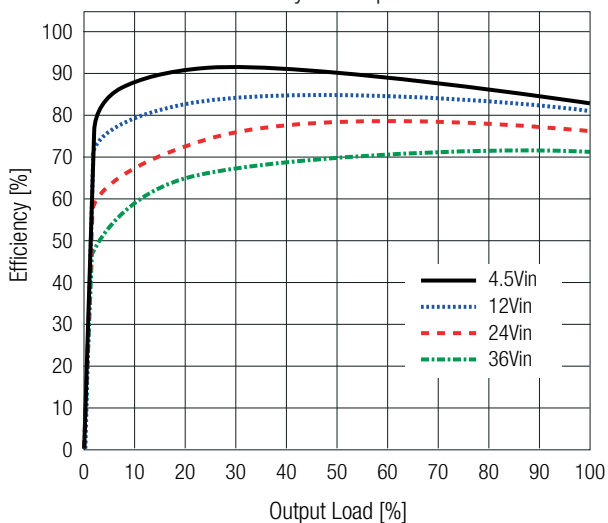
Parameter	Condition		Min.	Typ.	Max.
Input Under Voltage Lockout (UVLO)	others	DC-DC ON	4VDC		4.4VDC
		DC-DC OFF	3.8VDC		4.2VDC
	R-78K3.3-0.5	DC-DC ON	5VDC		6.5VDC
		DC-DC OFF	4.8VDC		6.3VDC
	R-78K5.0-0.5	DC-DC ON	9.9VDC		10.7VDC
		DC-DC OFF	9.7VDC		10.5VDC
	R-78K12-0.5	DC-DC ON	13.1VDC		14.0VDC
		DC-DC OFF	12.7VDC		13.8VDC
R-78K15-0.5	DC-DC ON	15.4VDC		16.7VDC	
	DC-DC OFF	15.2VDC		16.5VDC	
Maximum Input Voltage Slew Rate ⁽²⁾	+ V_{IN} to GND				10VDC/ μ s
Quiescent Current					1mA
Internal Operating Frequency				400kHz	
Minimum Load			0%		
Output Ripple and Noise ⁽³⁾	20MHz BW and full load	others		100mVp-p	120mVp-p
		R-78K12-2.0		170mVp-p	200mVp-p
		R-78K15-2.0		200mVp-p	250mVp-p

Note2: At higher slew rates or hard plugging, add 27 μ F E-Cap on + V_{IN} , especially when V_{IN} is greater than 18VDC

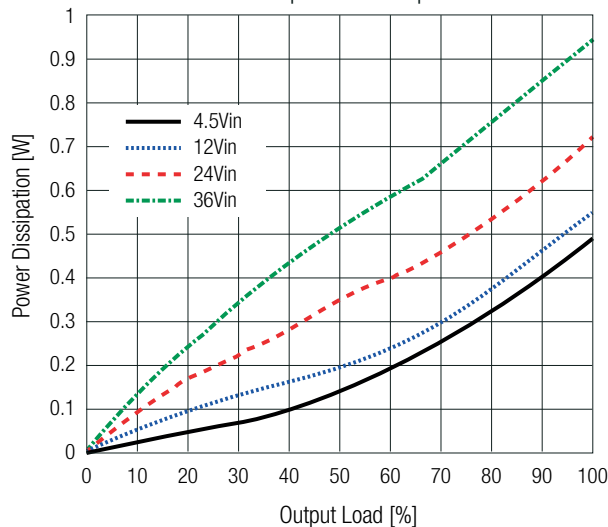
Note3: Measurements are made with a 10 μ F MLCC across output. (low ESR)

R-78K1.2-2.0

Efficiency vs. Output Load

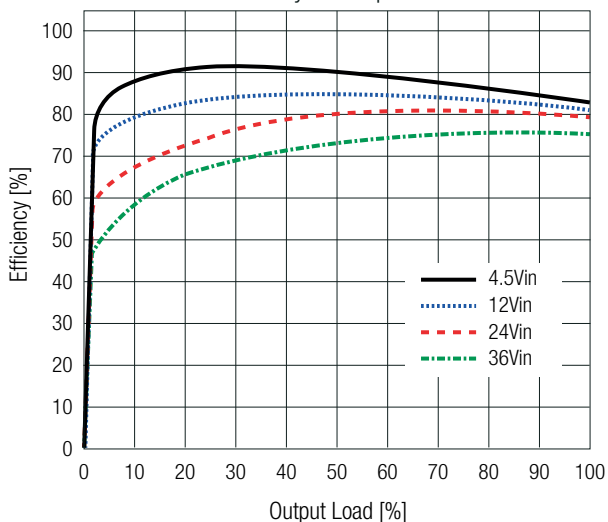


Power Dissipation vs. Output Load

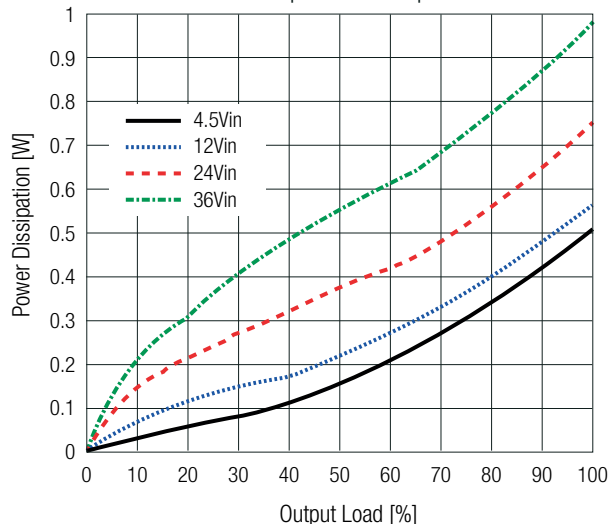


R-78K1.5-2.0

Efficiency vs. Output Load



Power Dissipation vs. Output Load



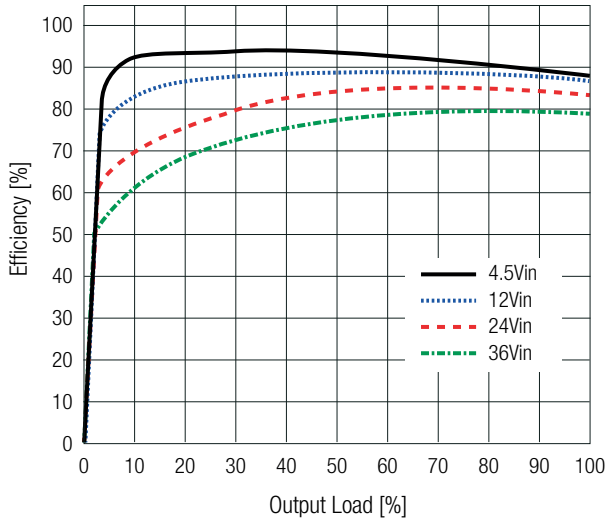
R-78K-2.0(L) series

2Amp / SIP3 Single Output

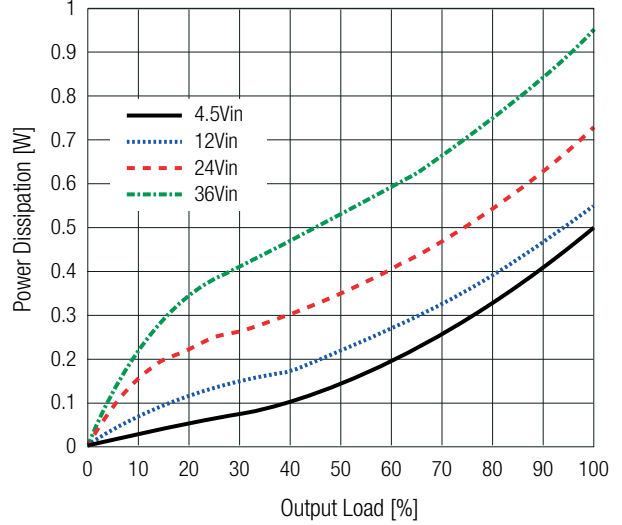
BASIC CHARACTERISTICS (measured @ $T_{AMB} = 25^{\circ}\text{C}$, nom. V_{IN} , full load and after warm-up unless otherwise stated)

R-78K1.8-2.0

Efficiency vs. Output Load

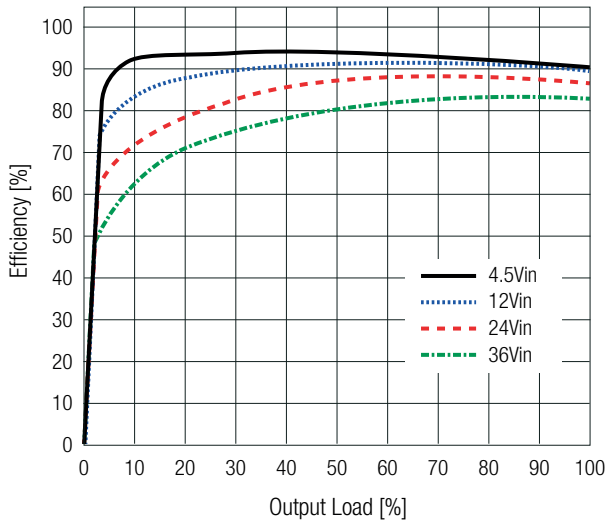


Power Dissipation vs. Output Load

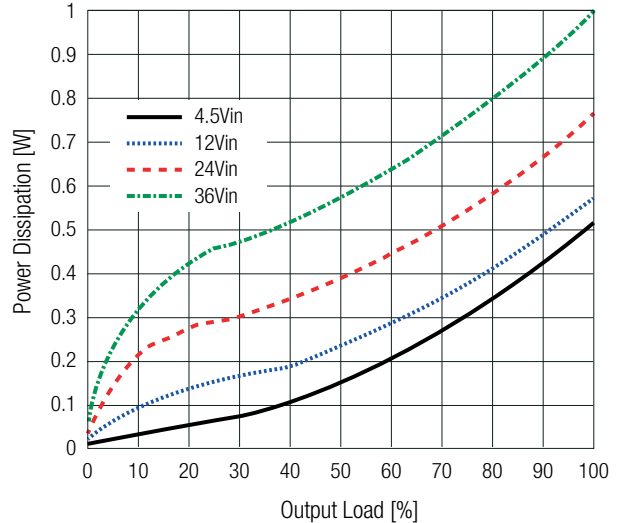


R-78K2.5-2.0

Efficiency vs. Output Load

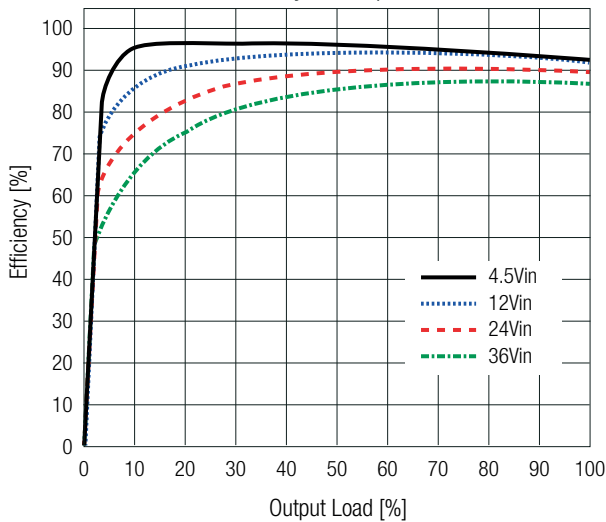


Power Dissipation vs. Output Load

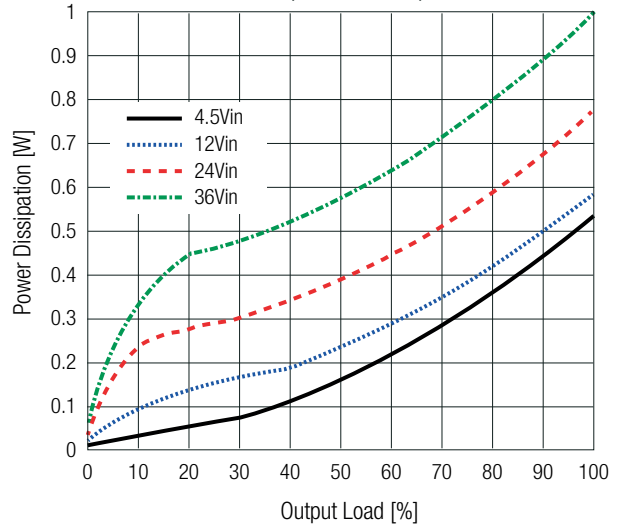


R-78K3.3-2.0

Efficiency vs. Output Load



Power Dissipation vs. Output Load

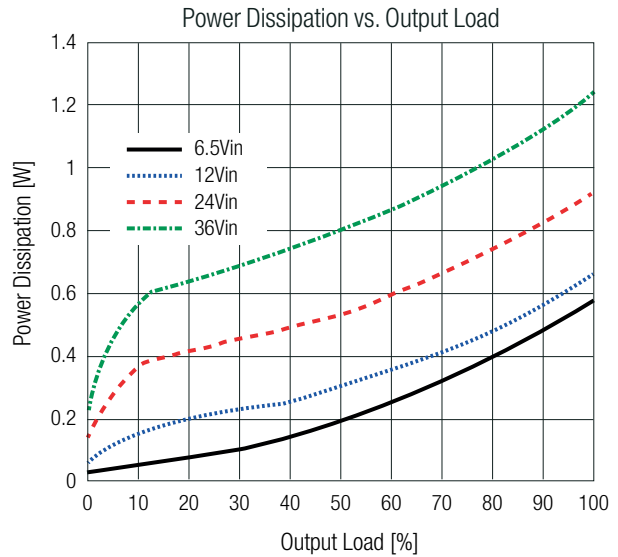
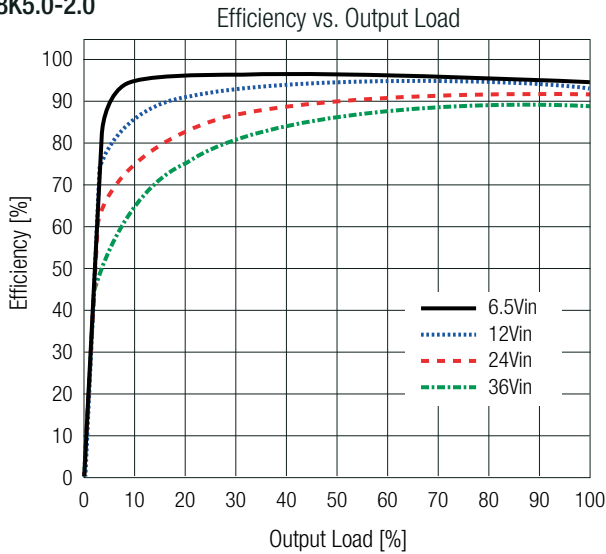


R-78K-2.0(L) series

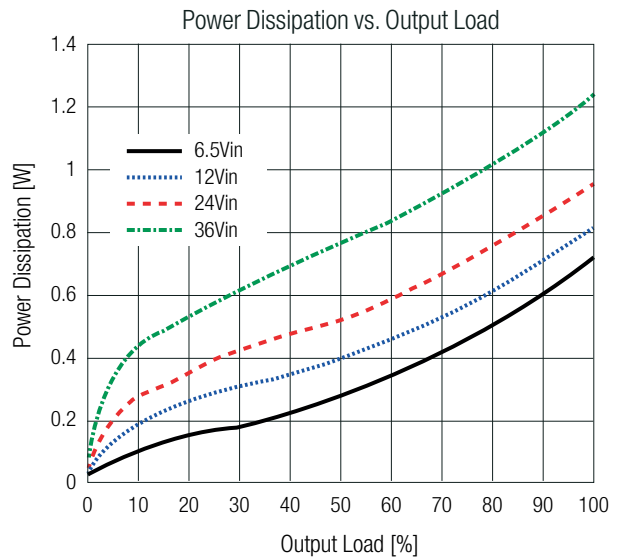
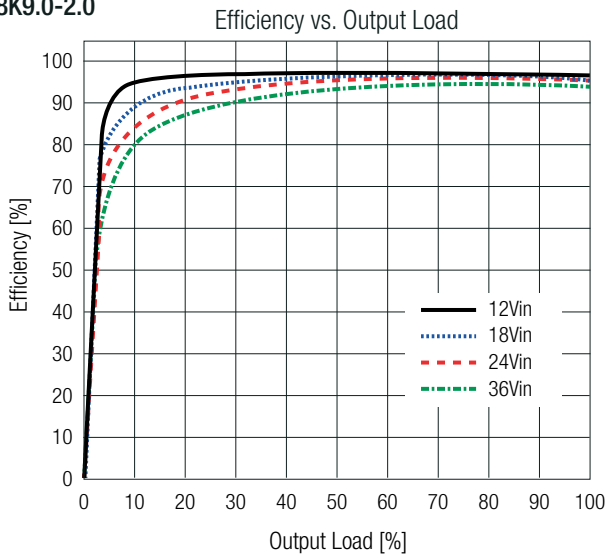
2Amp / SIP3 Single Output

BASIC CHARACTERISTICS (measured @ $T_{AMB} = 25^{\circ}C$, nom. V_{IN} , full load and after warm-up unless otherwise stated)

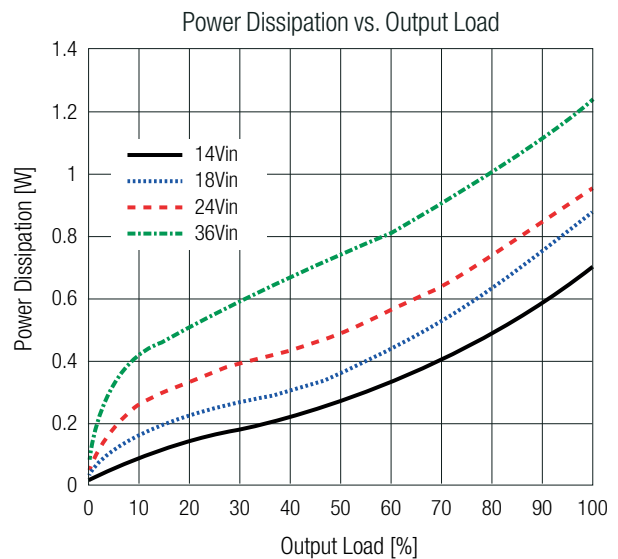
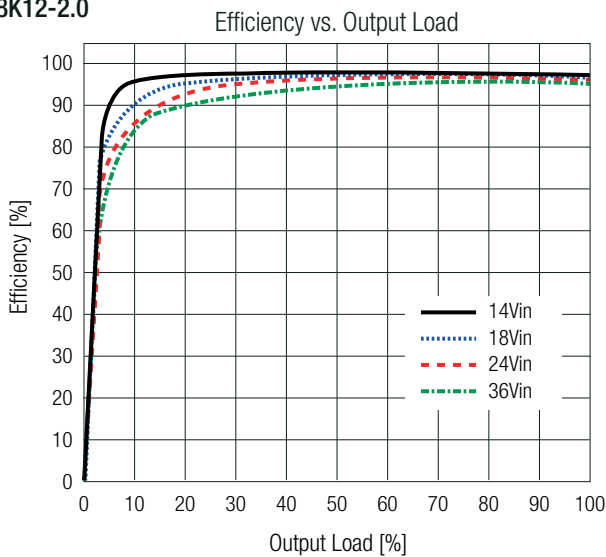
R-78K5.0-2.0



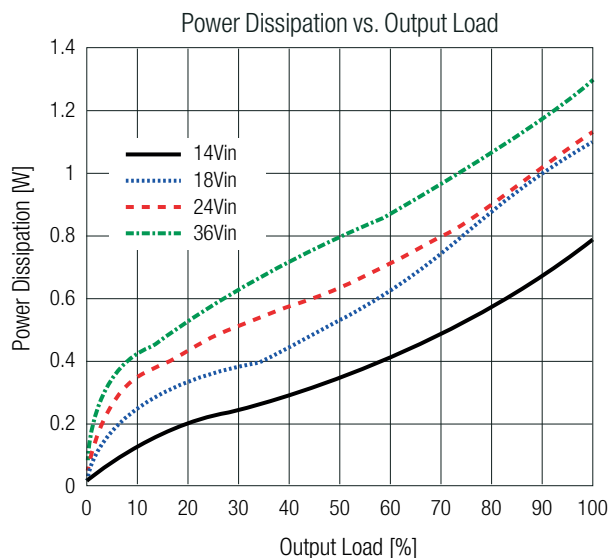
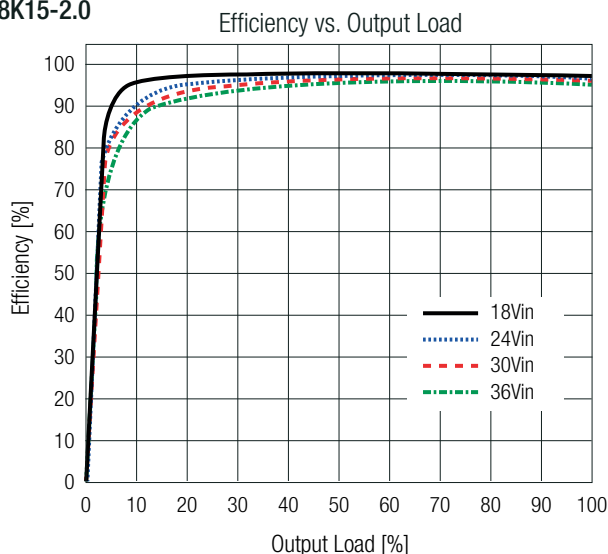
R-78K9.0-2.0



R-78K12-2.0



R-78K15-2.0



REGULATIONS

Parameter	Condition	Value
Output Accuracy		$\pm 3.0\%$ typ.
Line Regulation	low line to high line, full load	$\pm 0.5\%$ max.
Load Regulation	0% to 100%	4.0% max.

PROTECTIONS

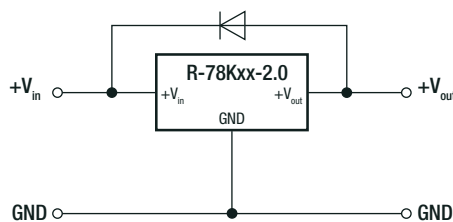
Parameter	Condition	Value
Short Circuit Protection (SCP)		continuous, automatic recovery

Optional Diode Protection Circuit

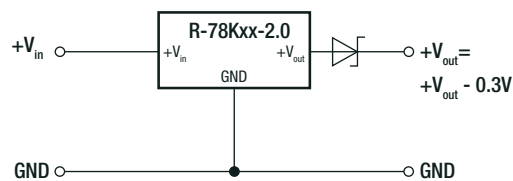
Add a blocking diode to V_{out} if current can flow backwards into the output, as this can damage the converter when it is powered down.

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:



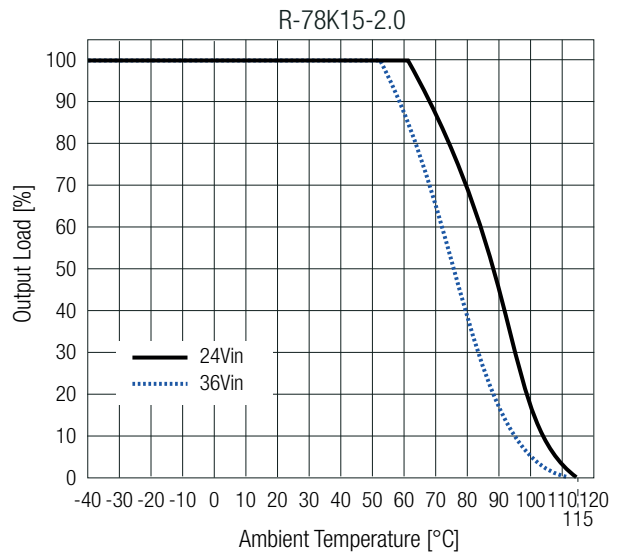
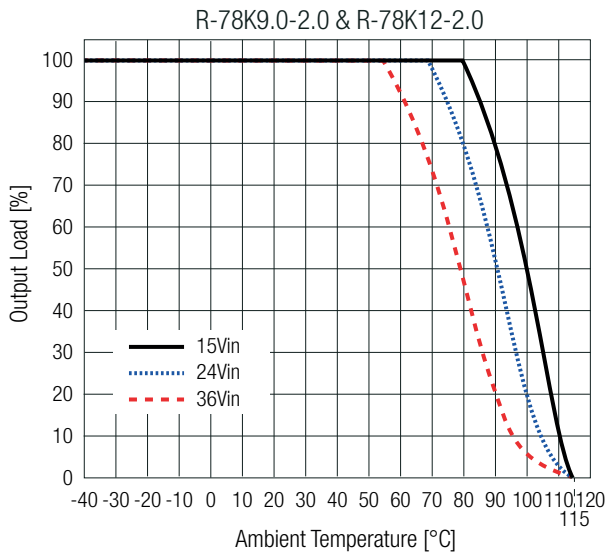
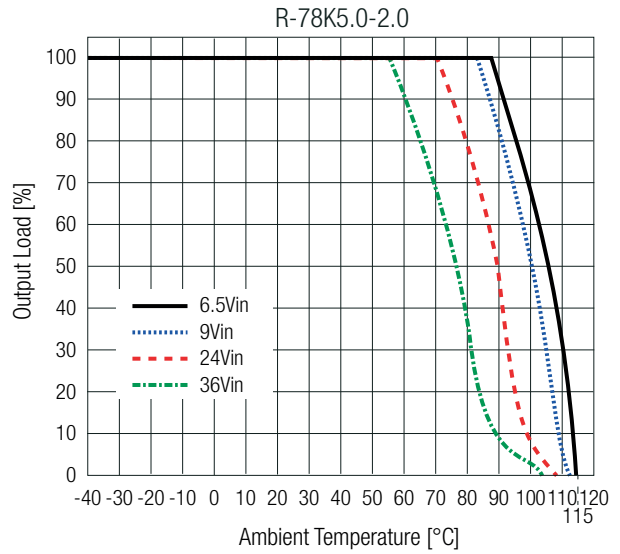
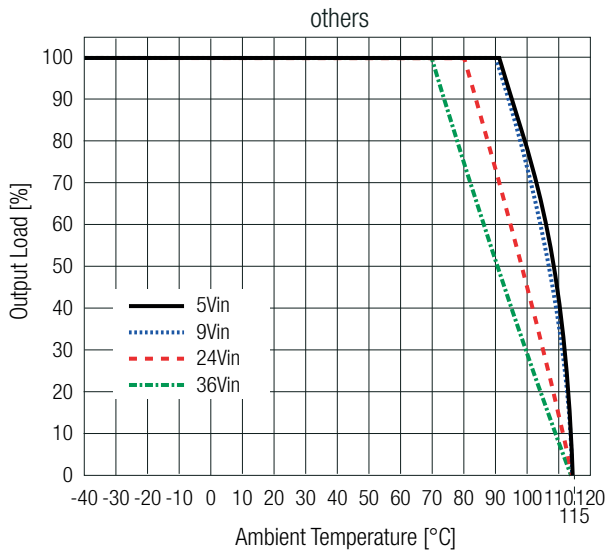
ENVIRONMENTAL

Parameter	Condition	Value	
Operating Temperature Range	refer to „Derating Graph“	$-40^{\circ}C$ to $+100^{\circ}C$	
Maximum Case Temperature		$+110^{\circ}C$	
Operating Altitude		5000m	
Operating Humidity	non-condensing	95% RH max.	
Pollution Degree		PD2	
MTBF	according to MIL-HDBK-217F, G.B., $+25^{\circ}C$	R-78K1.8-2.0	5139×10^3 hours
		R-78K2.5-2.0	4990×10^3 hours
		R-78K3.3-2.0	4878×10^3 hours
		R-78K5.0-2.0	5031×10^3 hours
		R-78K9.0-2.0	4546×10^3 hours
		R-78K12-2.0	4340×10^3 hours
		R-78K15-2.0	4546×10^3 hours
Vibration		10-55Hz, 2G, 30min along X,Y and Z axis	

ENVIRONMENTAL

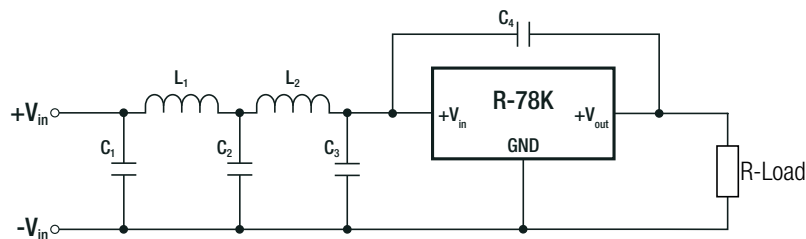
Derating Graph

(@ Chamber and natural convection 0.1m/s, over Vin)



SAFETY AND CERTIFICATIONS

Certificate Type (Safety)	Report Number	Standard
Audio/Video, information and communication technology equipment - Part 1: Safety requirements (CB Scheme)	085-220299301-100	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 A and B



Component List	C1	C2	C3	L1	L2	C4
Class A	22µF	22µF	N/A	4.7µH	N/A	N/A
Class B	10µF	22µF	22µF	4.7µH	22µH	1nF

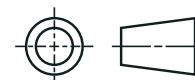
R-78K-2.0(L) series

2Amp / SIP3 Single Output

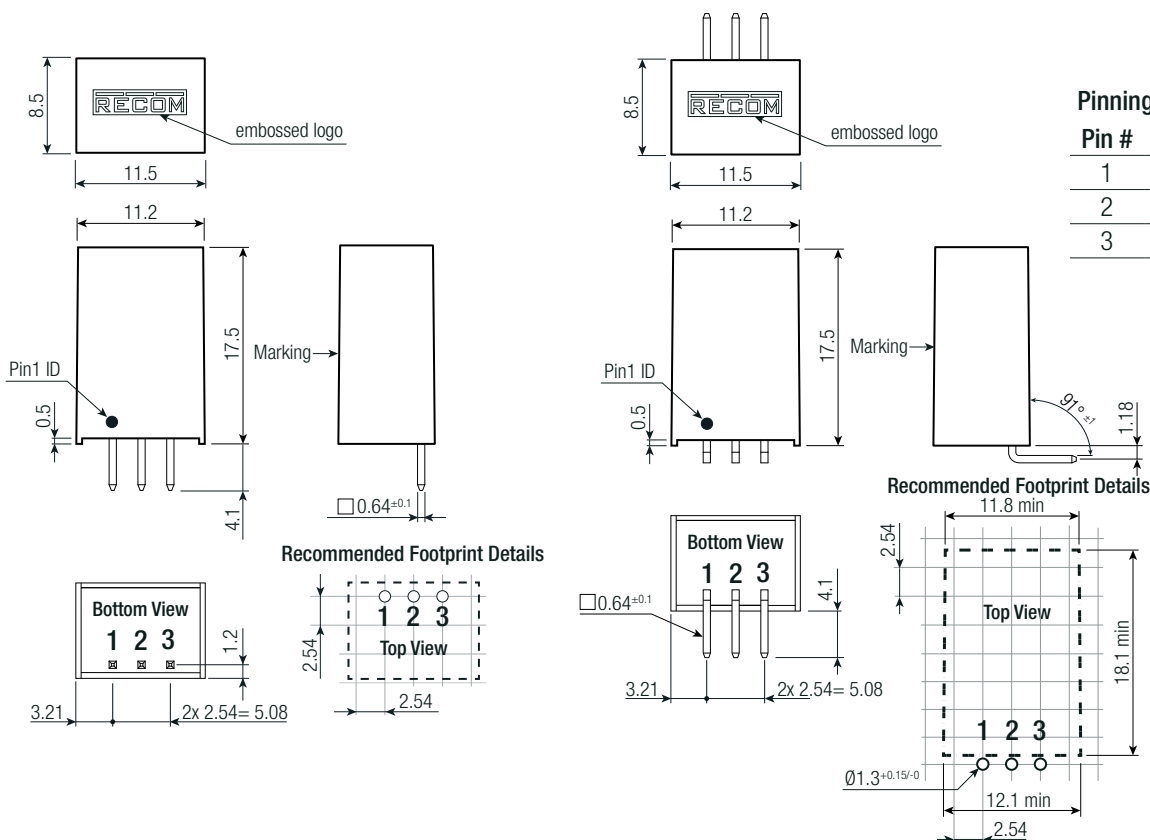
DIMENSION & PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	case	black plastic, (UL94 V-0)
	potting	PU, (UL94 V-0)
	PCB	FR4, (UL94 V-0)
Dimension (HxWxD)		11.5 x 8.5 x 17.5mm 0.45 x 0.33 x 0.69 inch
Weight		4.0g typ. 0.009 lbs

Dimension Drawing (mm)



with suffix "L" bent pins



Pinning Information

Pin #	Function
1	+V _{IN}
2	GND
3	+V _{OUT}

Tolerances:
x.x= ±0.5mm
x.xx= ±0.25mm



PACKAGING INFORMATION

Parameter	Type	Value	
Packaging Dimension (LxWxH)	tube	standard	520.0 x 25.5 x 10.5mm
		"L"-version	520.0 x 23.0 x 16.5mm
Packaging Quantity		43pcs	
Storage Temperature Range		-40°C to +125°C	
Storage Humidity	non-condensing	95% RH max.	

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