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-2.0

2.0 Amp SIP3 Single Output

3 YEAR warranty

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

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 [%]	Efficiency @ max. Vin [%]
R-78K1.2-2.0	4.5 - 36	1.2	2000	75	73
R-78K1.5-2.0	4.5 - 36	1.5	2000	82	71
R-78K1.8-2.0	4.5 - 36	1.8	2000	85	78
R-78K2.5-2.0	4.5 - 36	2.5	2000	88	85
R-78K3.3-2.0	4.5 - 36	3.3	2000	85	78
R-78K5.0-2.0	6.5 - 36	5	2000	85	78
R-78K9.0-2.0	11 - 36	9	2000	95	93
R-78K12-2.0	14 - 36	12	2000	96	94
R-78K15-2.0	18 - 36	15	2000	96	94

Model Numbering

R-78K___-2.0

nom. 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 (2)	$+V_{IN}$ to GND			10VDC/µs
Case Temperature		-40°C		110°C
Storage Temperature		-50°C		125°C

Notes:

Note2: 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

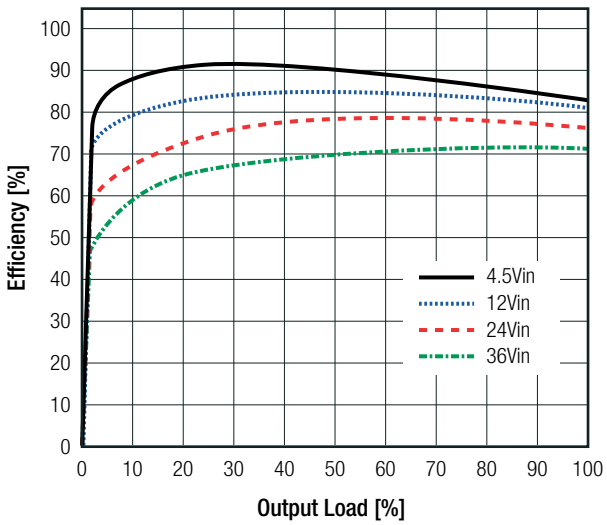
Parameter	Condition		Min.	Typ.	Max.
Input Under Voltage Lockout (UVLO)	R-78K1.2-2.0, R-78K1.5-2.0, R-78K1.8-2.0, R-78K2.5-2.0, R-78K3.3-2.0	DC-DC ON	4VDC		4.4VDC
		DC-DC OFF	3.8VDC		4.2VDC
	R-78K5.0-2.0	DC-DC ON	5VDC		6.5VDC
		DC-DC OFF	4.8VDC		6.3VDC
	R-78K9.0-2.0	DC-DC ON	9.9VDC		10.7VDC
		DC-DC OFF	9.7VDC		10.5VDC
	R-78K12-2.0	DC-DC ON	13.1VDC		14.0VDC
		DC-DC OFF	12.7VDC		13.8VDC
	R-78K15-2.0	DC-DC ON	15.4VDC		16.7VDC
		DC-DC OFF	15.2VDC		16.5VDC
Quiescent Current					1mA
Internal Switching Frequency				400kHz	
Minimum Load			0%		
Output Ripple and Noise [3]	20MHz BW	others		100mVp-p	120mVp-p
		R-78K12-2.0		170mVp-p	200mVp-p
		R-78K15-2.0		200mVp-p	250mVp-p

Notes:

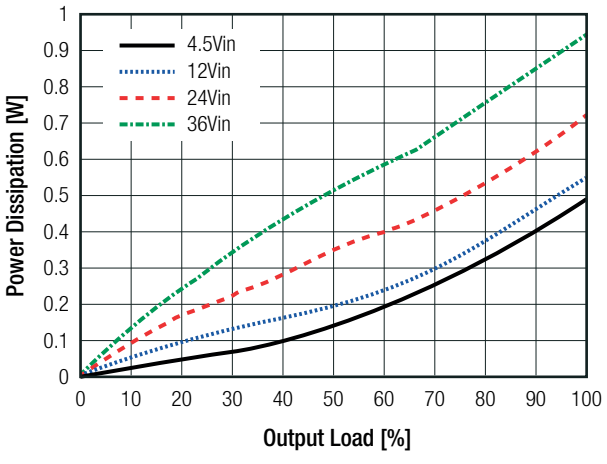
Note3: Measurements are made with a 0.1µF MLCC & 10µF E-cap across output (low ESR)

R-78K1.2-2.0

Efficiency vs. Load



Power Dissipation vs. Load



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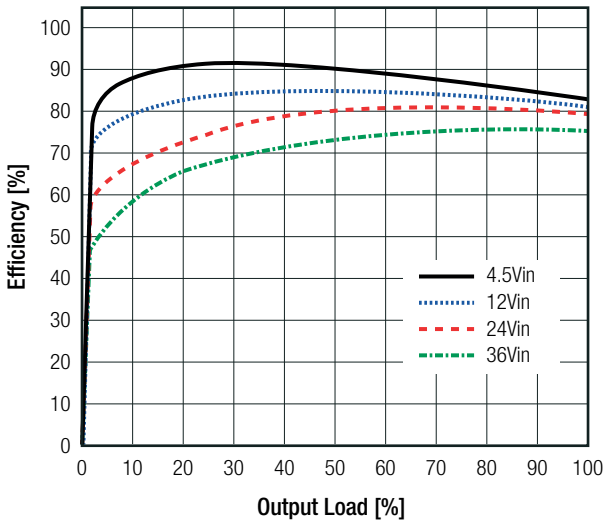
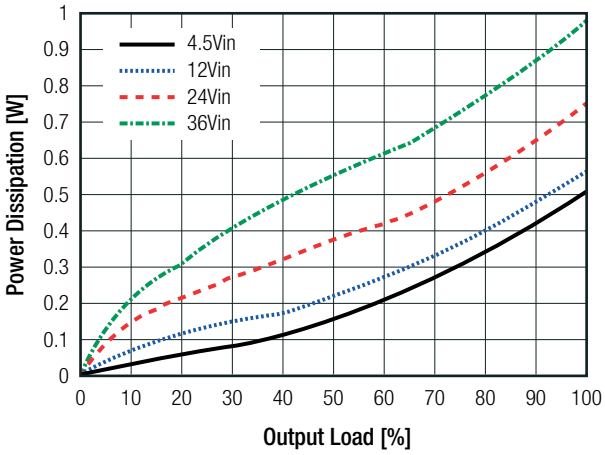
Specifications (measured @ Ta= -40°C to +90°C, V_{IN}= 24VDC, full load and after warm-up unless otherwise stated)

R-78K1.5-2.0

Efficiency vs. Load

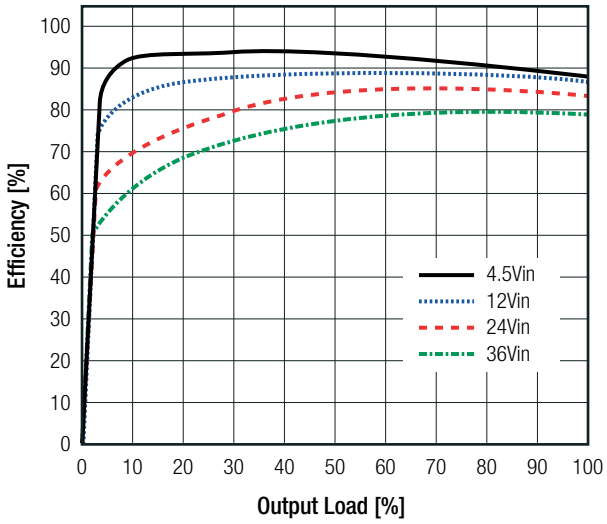


Power Dissipation vs. Load

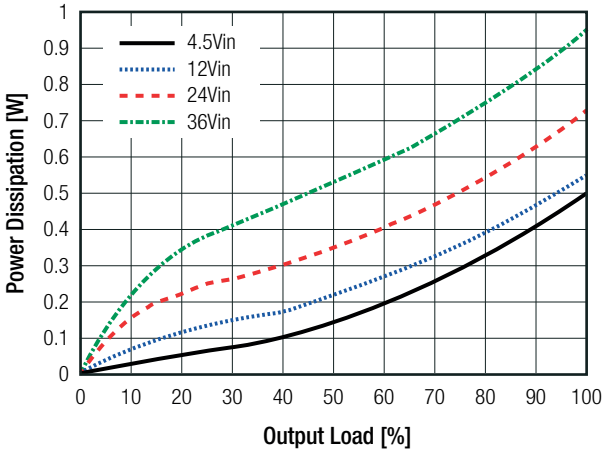


R-78K1.8-2.0

Efficiency vs. Load

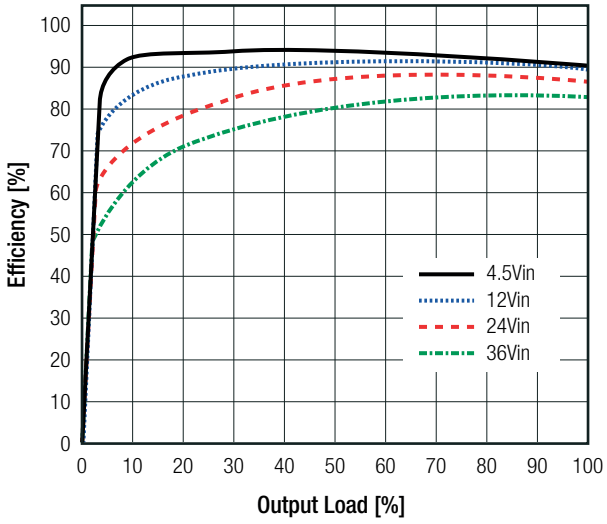


Power Dissipation vs. Load

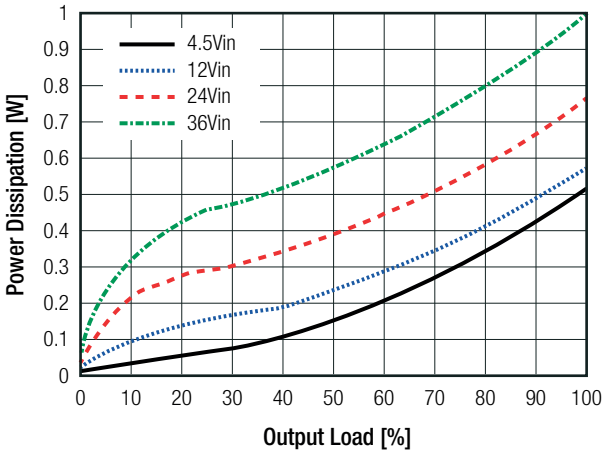


R-78K2.5-2.0

Efficiency vs. Load



Power Dissipation vs. Load



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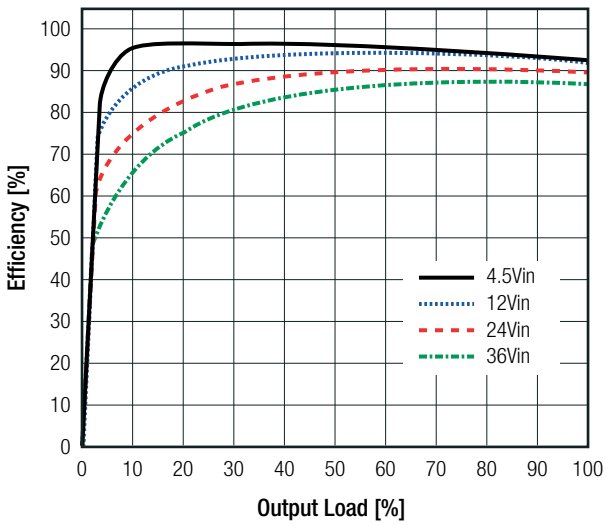
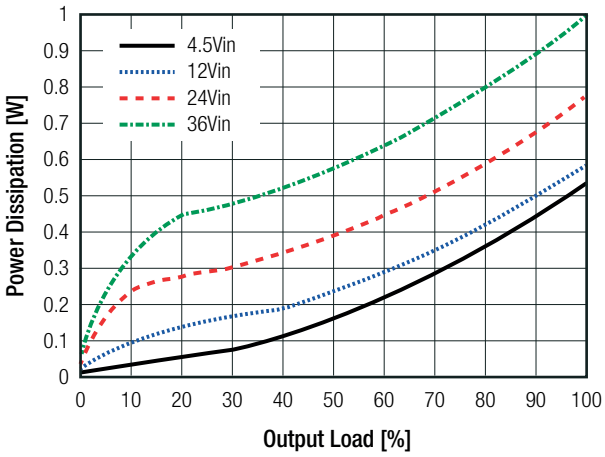
Specifications (measured @ Ta= -40°C to +90°C, V_{IN}= 24VDC, full load and after warm-up unless otherwise stated)

R-78K3.3-2.0

Efficiency vs. Load

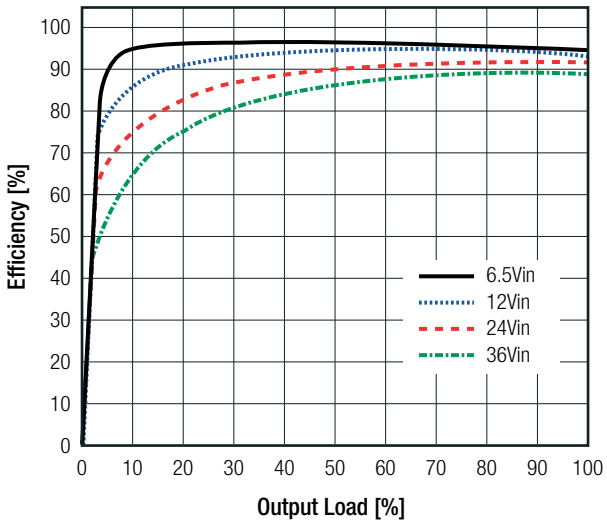


Power Dissipation vs. Load

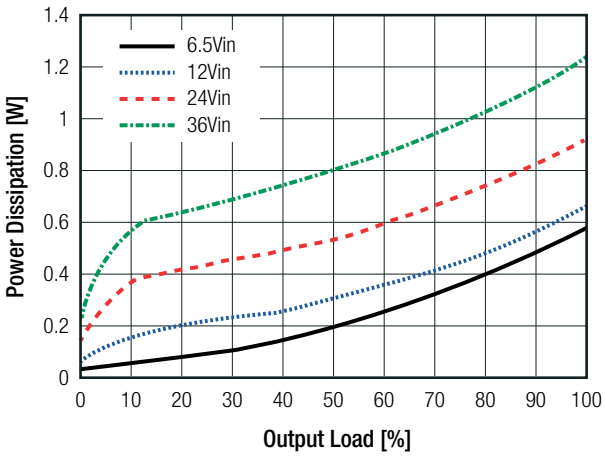


R-78K5.0-2.0

Efficiency vs. Load

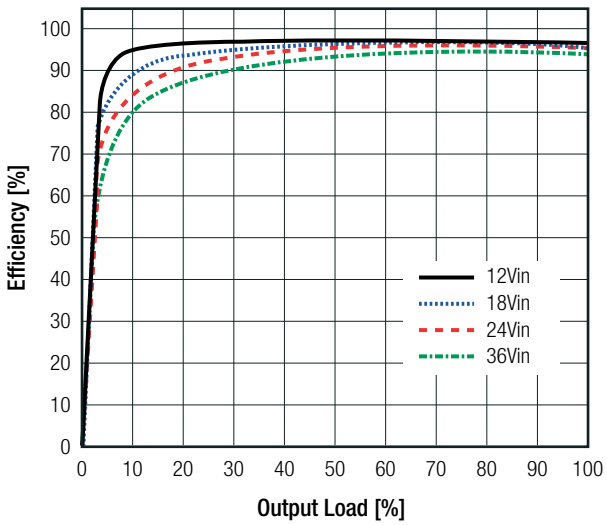


Power Dissipation vs. Load

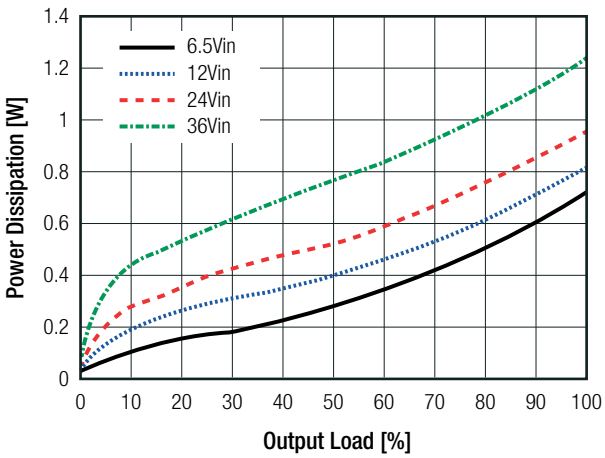


R-78K9.0-2.0

Efficiency vs. Load



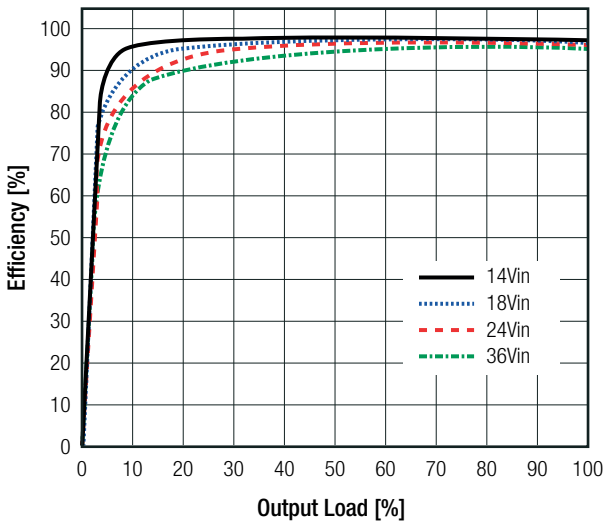
Power Dissipation vs. Load



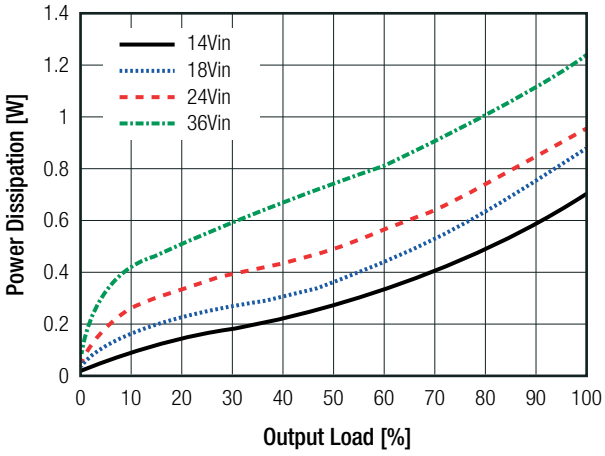
Specifications (measured @ Ta= -40°C to +90°C, V_{IN}= 24VDC, full load and after warm-up unless otherwise stated)

R-78K12-2.0

Efficiency vs. Load

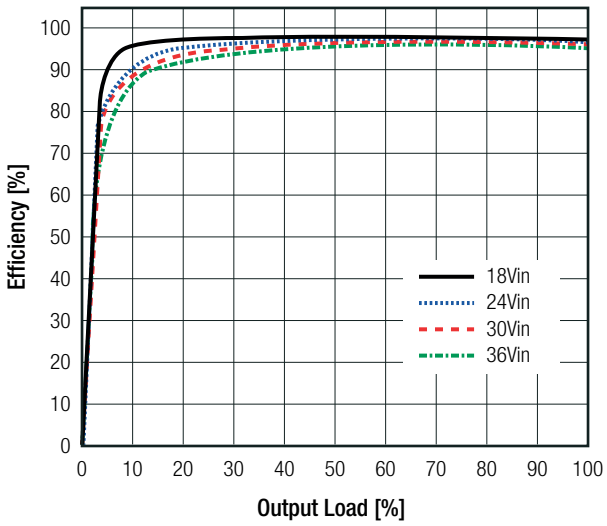


Power Dissipation vs. Load

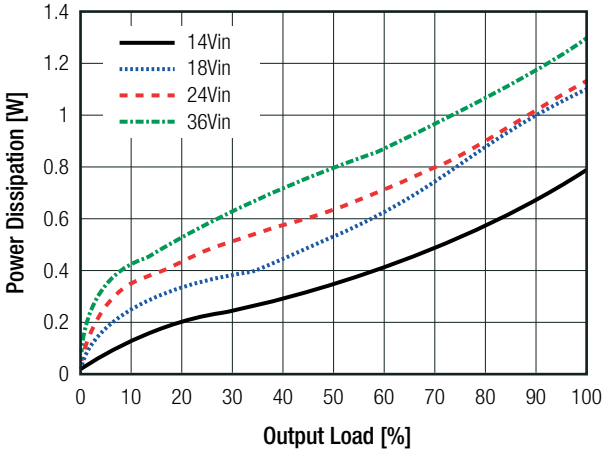


R-78K15-2.0

Efficiency vs. Load



Power Dissipation vs. Load



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

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

PROTECTIONS

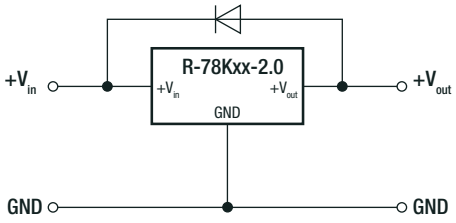
Parameter	Condition	Value
Short Circuit Protection (SCP)		continuous, automatic recovery
Short Circuit Input Current		50mA max.

Optional Diode Protection Circuit

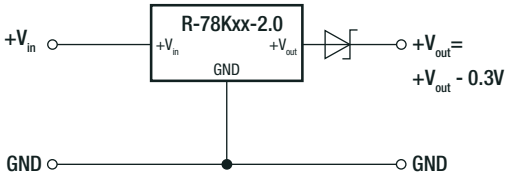
Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter when it is powered down.

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

Optional Protection 1:



Optional Protection 2:



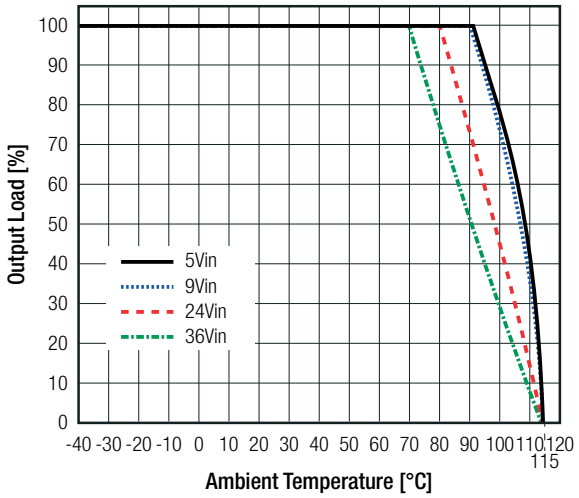
ENVIRONMENTAL

Parameter	Condition		Value
Operating Temperature Range	with derating, refer to **"Derating Graph"**		-40°C to +90°C
Maximum Case Temperature			+110°C
Temperature Coefficient			0.01%/K
Operating Humidity	non-condensing		95% RH max.
MTBF	according to MIL-HDBK-217F, G.B., +25°C	R-78K1.8-2.0	5139 x 10^3 hours
		R-78K2.5-2.0	4990 x 10^3 hours
		R-78K3.3-2.0	4878 x 10^3 hours
		R-78K5.0-2.0	5031 x 10^3 hours
		R-78K9.0-2.0	4546 x 10^3 hours
		R-78K12-2.0	4340 x 10^3 hours
		R-78K15-2.0	4546 x 10^3 hours
Vibration			10-55Hz, 2G, 30min along X,Y and Z axis

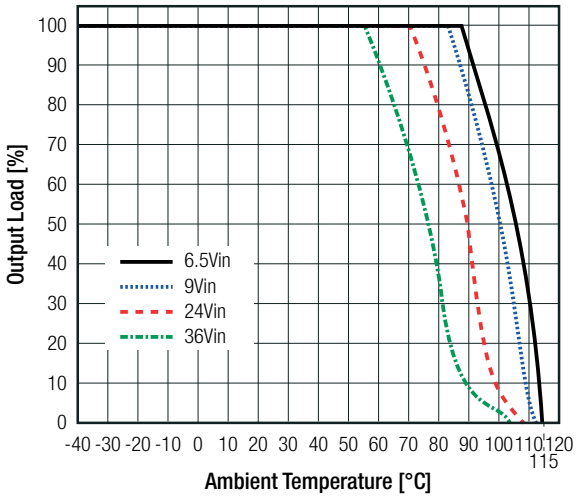
Derating Graph

(@ Chamber and natural convection 0.1m/s)

others



R-78K5.0-2.0



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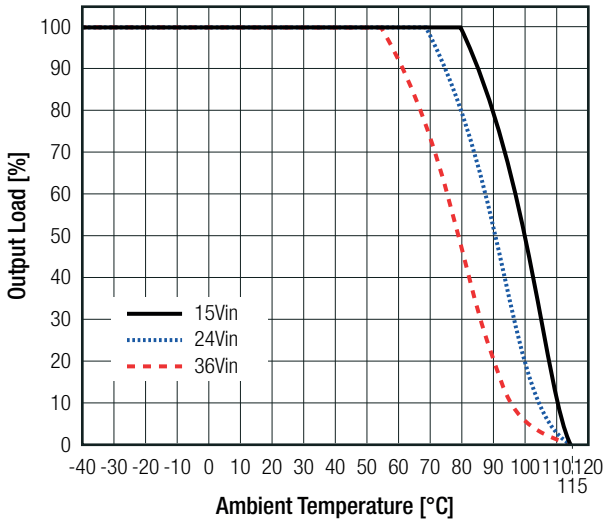
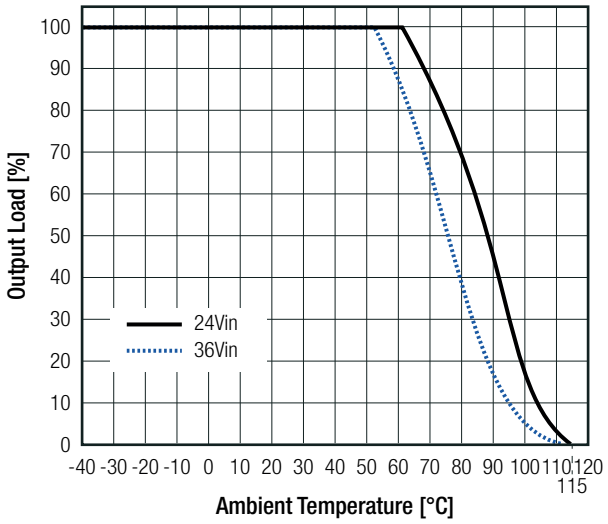
Specifications (measured @ Ta= -40°C to +90°C, V_{IN}= 24VDC, full load and after warm-up unless otherwise stated)

R-78K9.0-2.0 & R-78K12-2.0



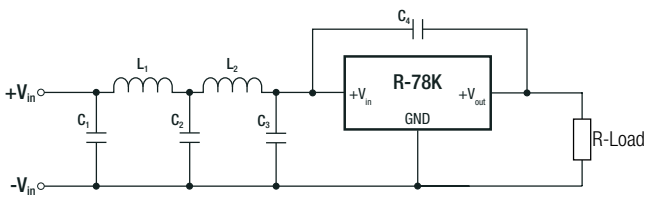
R-78K15-2.0



SAFETY AND CERTIFICATIONS (PENDING)		
Certificate Type (Safety)	**Report Number**	**Standard**
Audio/Video, information and communication technology equipment - Part 1: Safety requirements 3rd Edition (CB Scheme)	085-220299301-100	IEC62368-1:2018 3rd Edition
Audio/Video, information and communication technology equipment - Part 1: Safety requirements 3rd Edition		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



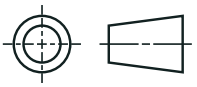
Component List Class B						
Vin Range	**CE1**	**C1/C2**	**L1**	**C3**	**L2**	**C4**
4.5 - 36	100µF	10µF	22µH	N/A	N/A	1nF
11 - 36	N/A	10µF	22µH	1nF	4.7µH	1nF

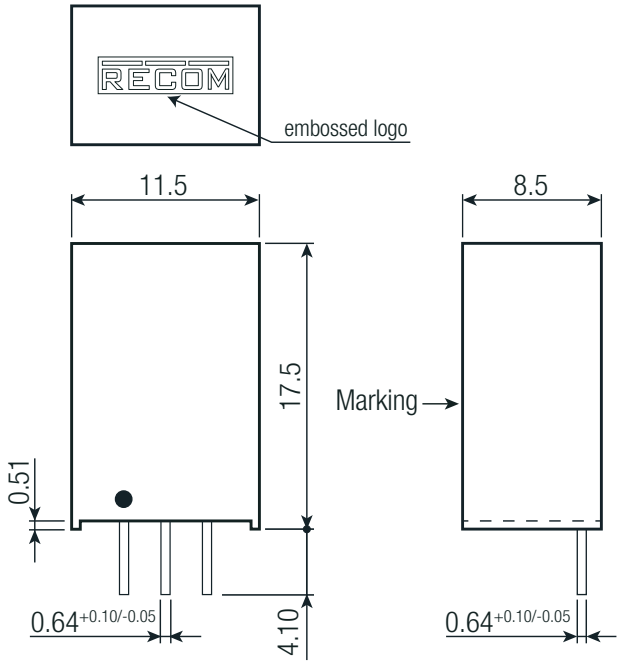
Specifications (measured @ Ta= -40°C to +90°C, V_{IN}= 24VDC, full load and after warm-up unless otherwise stated)

DIMENSION AND PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	case	black plastic, (UL94 V-0)
	potting	PU, (UL94 V-0)
	PCB	FR4, (UL94 V-0)
Dimension (LxWxH)		11.5 x 8.5 x 17.5mm
Weight		4g typ.

Dimension Drawing (mm)



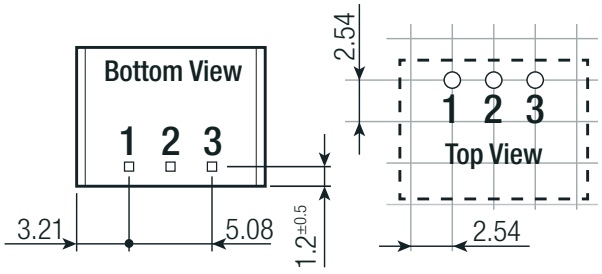


Pinning Information

Pin #	Single
1	$+V_{IN}$
2	GND
3	$+V_{OUT}$

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

Recommended Footprint Details



PACKAGING INFORMATION

Parameter	Type	Value
Packaging Dimension (LxWxH)	tube	520.0 x 25.5 x 10.5mm
Packaging Quantity		43pcs
Storage Temperature Range		-50°C to +125°C
Storage Humidity	non-condensing	95% RH max.