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(L)

2.0 Amp SIP3 Single Output

3 YEAR warranty

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

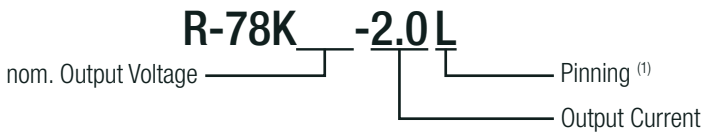
Description

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 (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	85	78
R-78K5.0-2.0 (1)	6.5 - 36	5	2000	85	78
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

Model Numbering



Notes:

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

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)	others	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

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

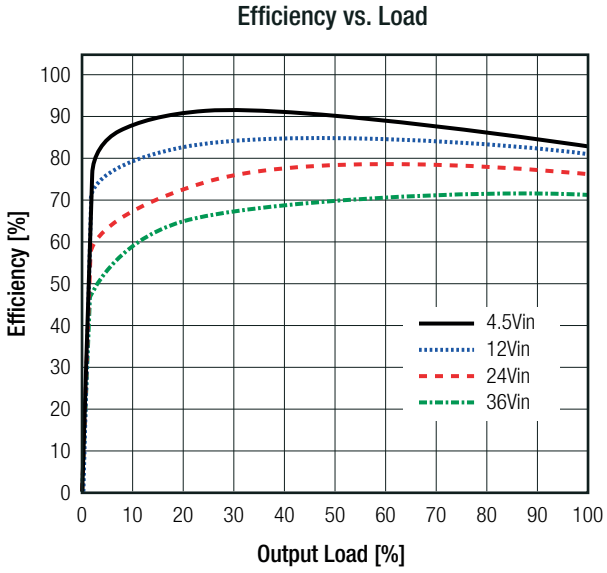
Parameter	Condition		Min.	Typ.	Max.
Maximum Input Voltage Slew Rate [2]	+V_{IN} to GND			10VDC/µs	10VDC/µs
Quiescent Current					1mA
Internal Switching Frequency				400kHz	
Minimum Load			0%		
Output Ripple and Noise [3]	20MHz BW	others		100mVp-p	120mVp-p
		R-78K12-2.0		170mVp-p	200mVp-p
		R-78K15-2.0		200mVp-p	250mVp-p

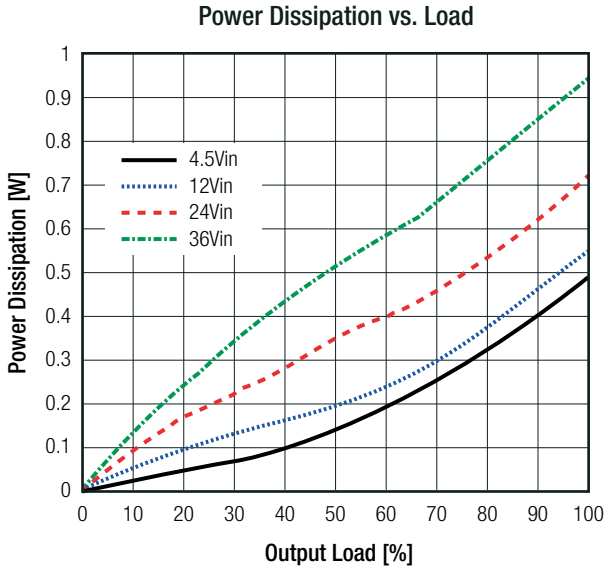
Notes:

Note2: At higher slew rates or hard plugging, add 27µF E-Cap between +Vin and GND, especially when Vin is >18VDC

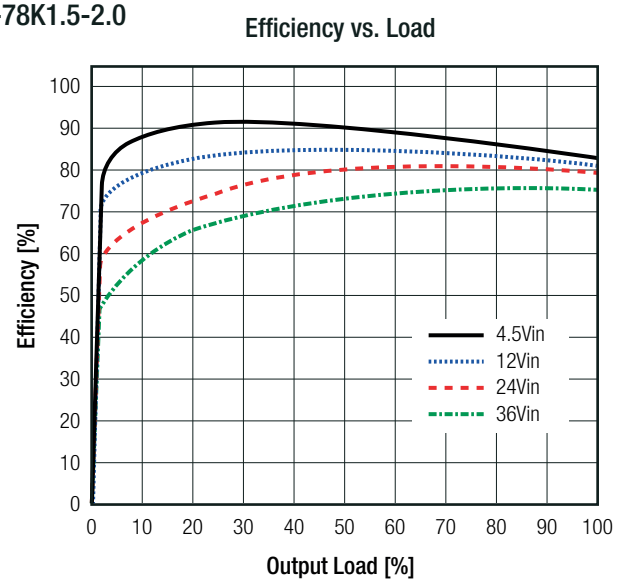
Note3: Measurements are made with a 0.1µF MLCC & 10µF E-cap across output (low ESR)

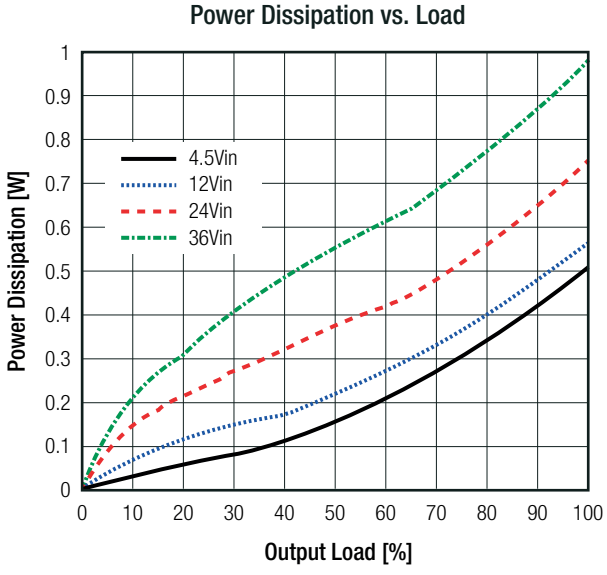
R-78K1.2-2.0





R-78K1.5-2.0





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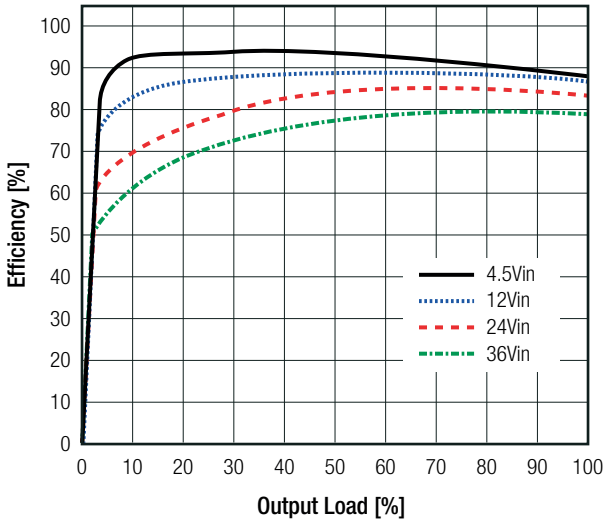
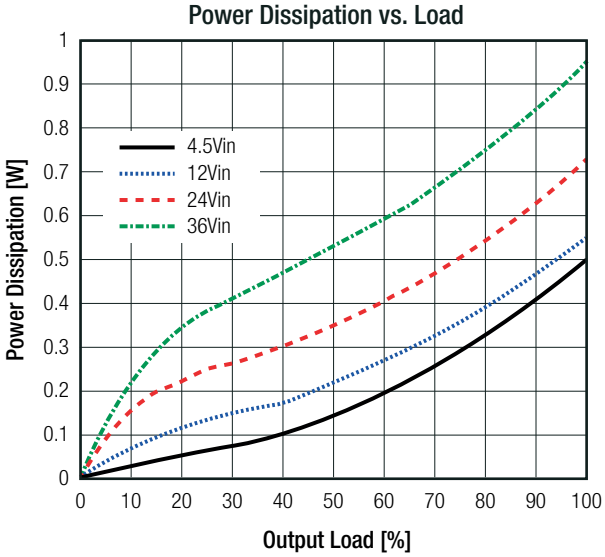
Specifications (measured @ Ta= -40°C to +90°C, V_{IN}= 24VDC, full load and after warm-up unless otherwise stated)

R-78K1.8-2.0

Efficiency vs. Load

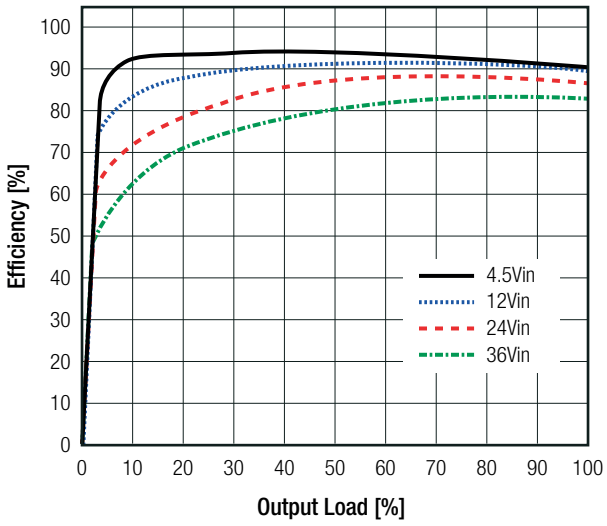


Power Dissipation vs. Load

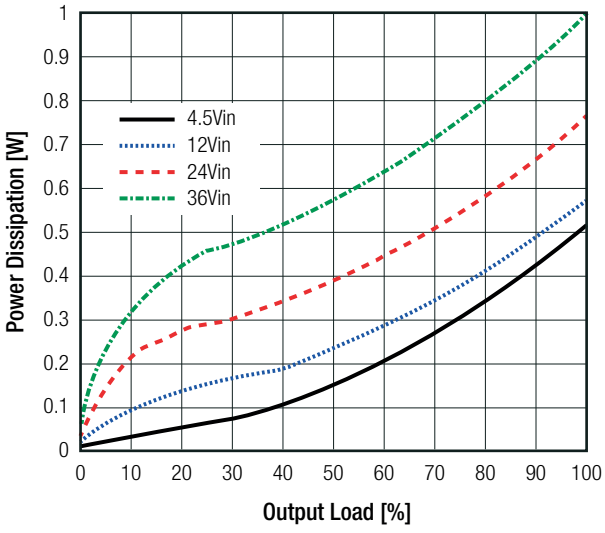


R-78K2.5-2.0

Efficiency vs. Load

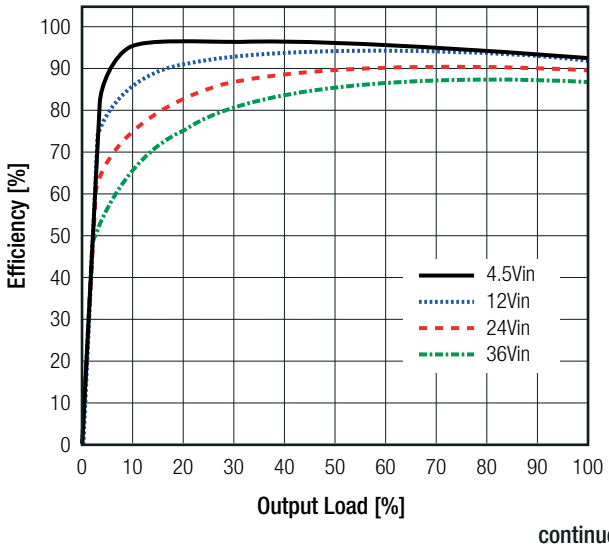


Power Dissipation vs. Load

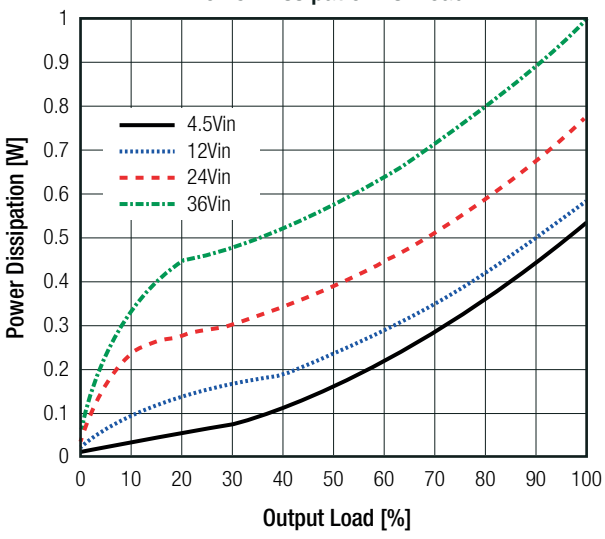


R-78K3.3-2.0

Efficiency vs. Load



Power Dissipation vs. Load



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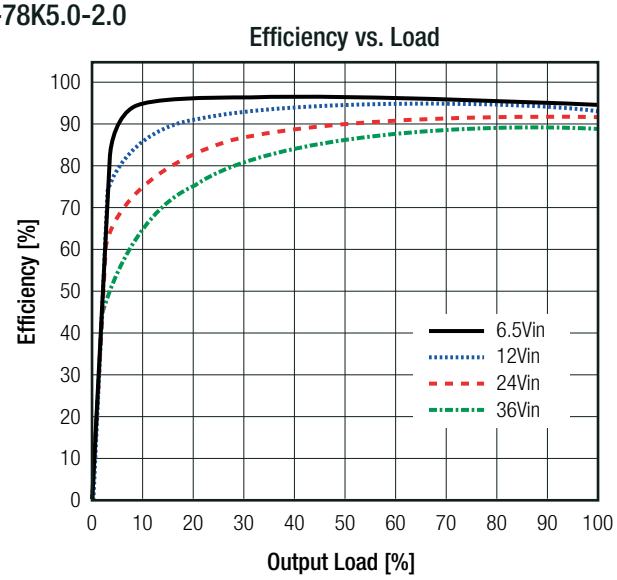
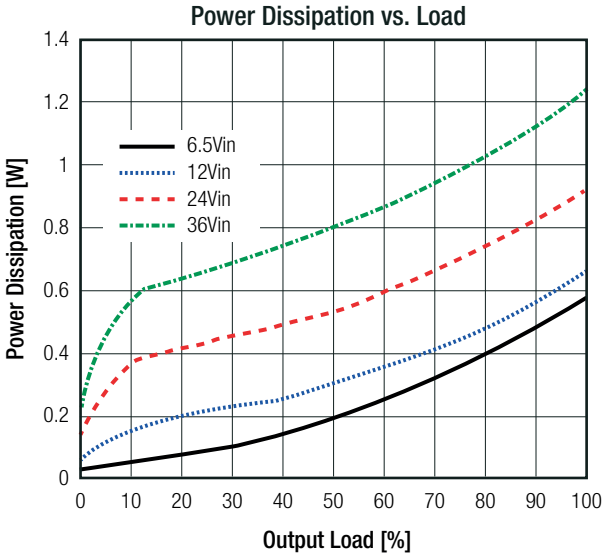
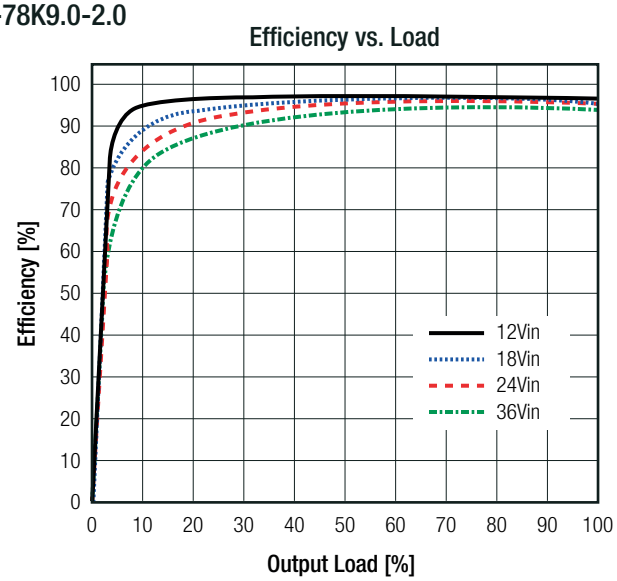
Specifications (measured @ Ta= -40°C to +90°C, V_{IN}= 24VDC, full load and after warm-up unless otherwise stated)

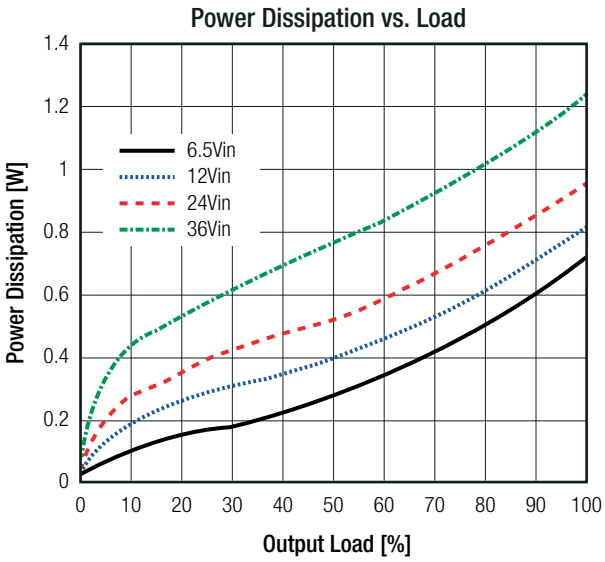
R-78K5.0-2.0



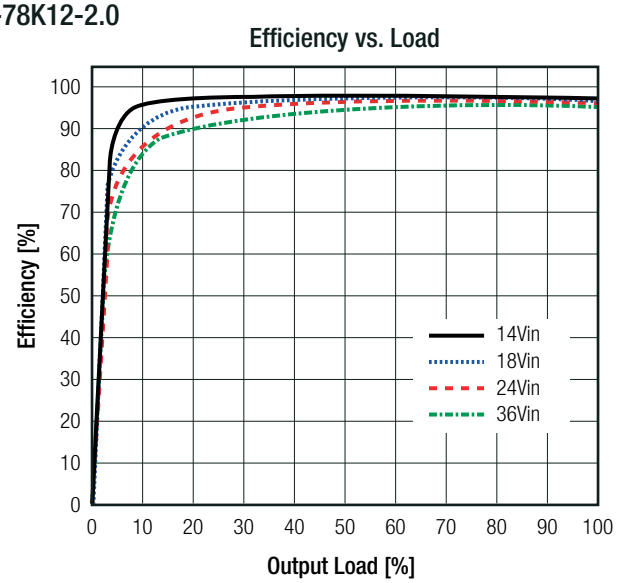


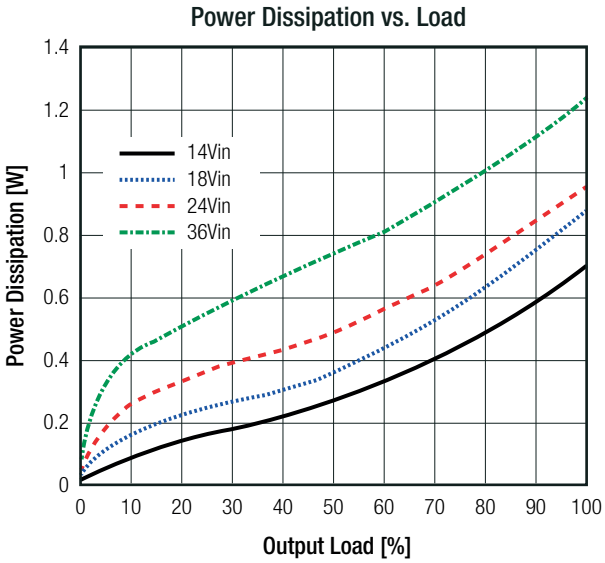
R-78K9.0-2.0





R-78K12-2.0





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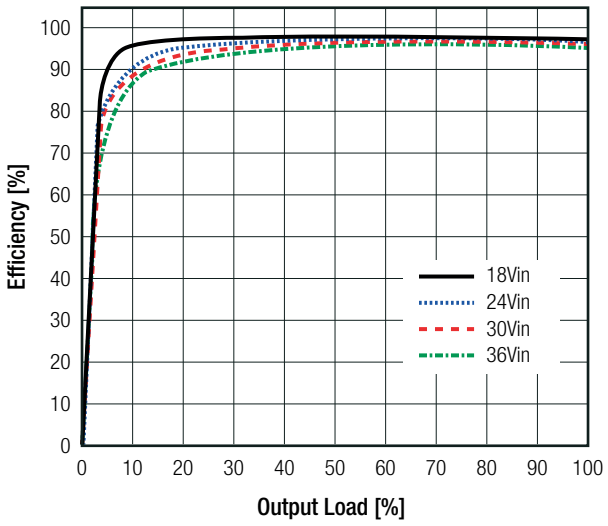
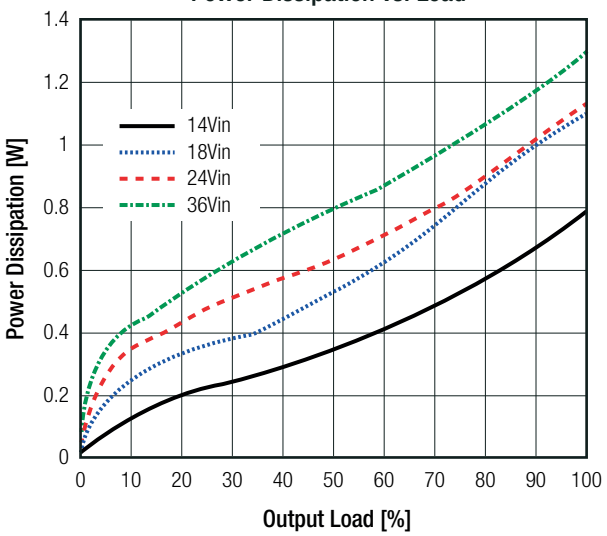
Specifications (measured @ Ta= -40°C to +90°C, V_{IN}= 24VDC, full load and after warm-up unless otherwise stated)

R-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.

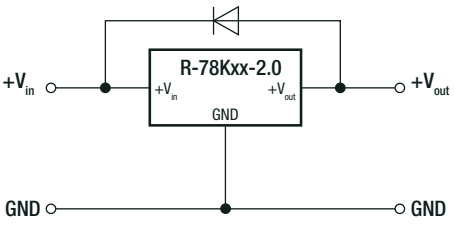
PROTECTIONS		
Parameter	**Condition**	**Value**
Short Circuit Protection (SCP)		continuous, automatic recovery
Short Circuit Input Current		50mA max.

Optional Diode Protection Circuit

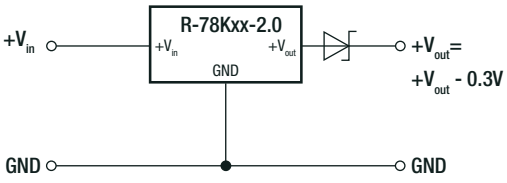
Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter when it is powered down.

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 Altitude		5000m
Operating Humidity	non-condensing	95% RH max.
Pollution Degree		PD2

continued on next page

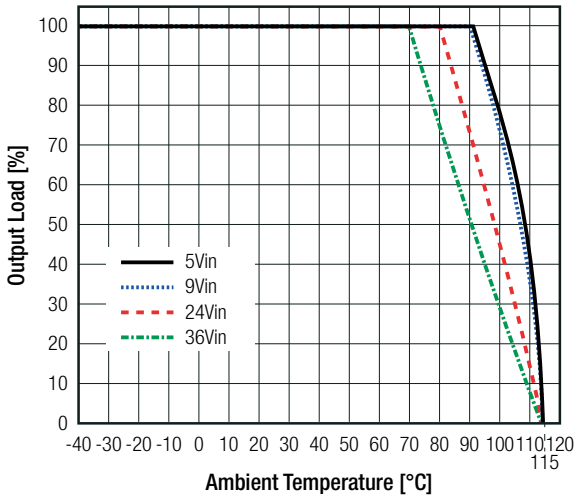
Specifications (measured @ Ta= -40°C to +90°C, V_{IN}= 24VDC, full load and after warm-up unless otherwise stated)

Parameter	Condition		Value
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

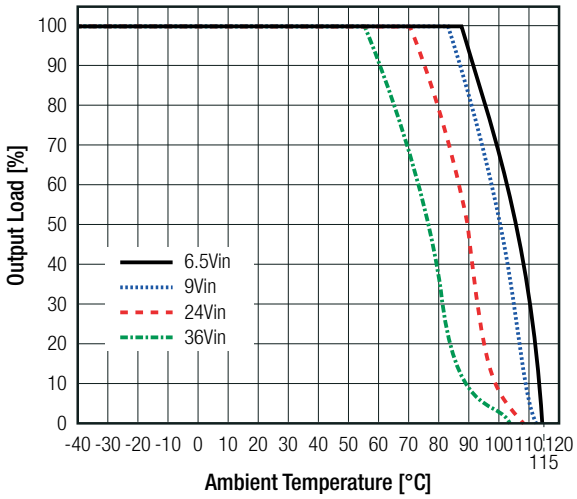
Derating Graph

(@ Chamber and natural convection 0.1m/s)

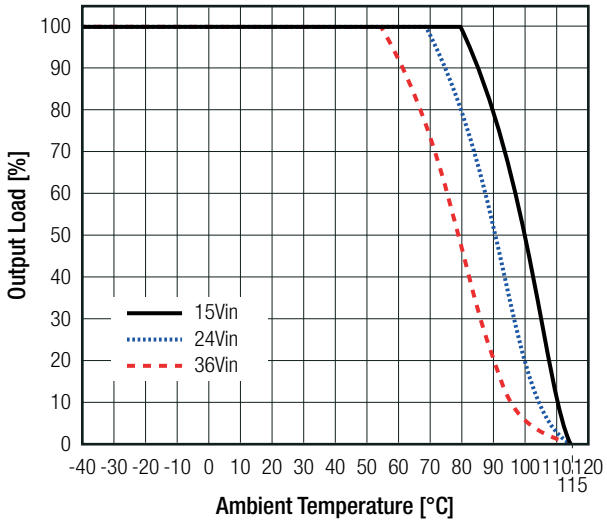
others



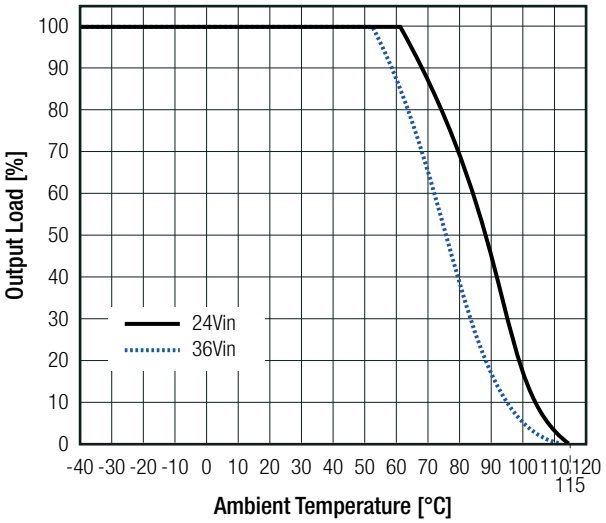
R-78K5.0-2.0



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



R-78K15-2.0



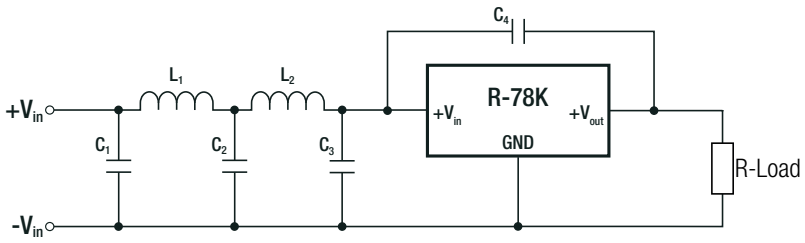
SAFETY AND CERTIFICATIONS

Certificate Type (Safety)	Report Number	Standard
Audio/Video, information and communication technology equipment - Part 1: Safety requirements 3rd Ed. (CB Scheme)	085-220299301-100	IEC62368-1:2018 3rd Edition
Audio/Video, information and communication technology equipment - Part 1: Safety requirements 3rd Ed.		EN IEC 62368-1:2020+A11:2020
RoHS2		RoHS 2011/65/EU + AM2015/863

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

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

EMC filtering suggestions according to EN55032

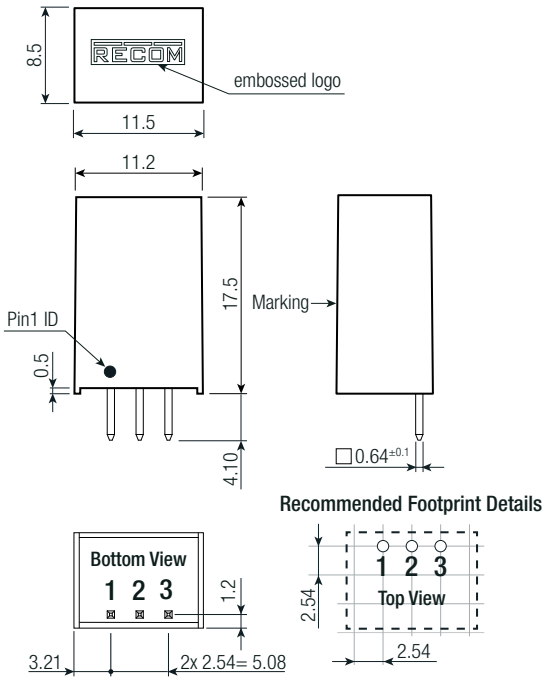


Component List	C1	C2	C3	L1	L2	C4
Class A	22µF	22µF	N/A	4.7µH	N/A	N/A
Class B	10µF	22µF	22µF	4.7µH	22µH	1nF

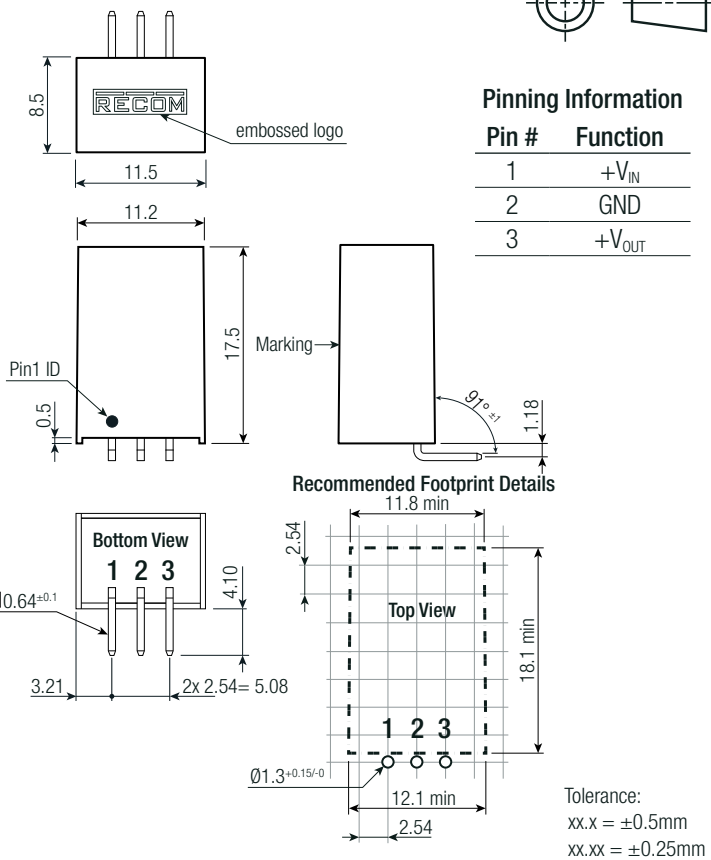
DIMENSION AND PHYSICAL CHARACTERISTICS

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)



with suffix "L" bent pins



Pinning Information

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

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

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

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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