

# Features

# Switching Regulator

- Efficiency up to 94%, no need for heatsinks
- High reflow temperature SMD package
- Adjustable output voltage buck converter
- Short circuit protection, thermal shutdown
- Remote on/off control
- Very low shutdown current



## R-78AA-1.0

**1.0 Amp  
SMD  
Single Output**



### Description

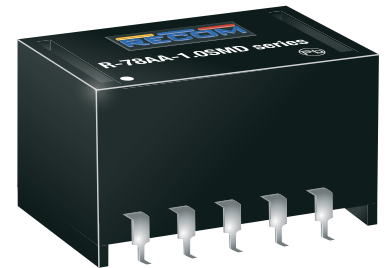
The R-78AAxx-1.0SMD series are adjustable output non-isolated buck converters that meet the requirements for RoHS 10/10 as well as the reflow soldering temperatures associated with vapor phase soldering, making these high efficiency switching regulators ideally suited to modern pick-and-place mass production. The efficiency of up to 97% means that very little energy is wasted as heat. The additional features of remote on/off control, continuous short circuit protection and adjustable output voltages will find many uses in the battery-powered, industrial, medical and automotive markets.

### Selection Guide

Part Number	Input Voltage Range [VDC]	Output Voltage [VDC]	Vout Adjust Range [VDC]	Output Current [A]	Efficiency @ min Vin [%]	Efficiency @ max. Vin [%]
R-78AA1.5-1.0SMD	4.75 - 18	1.5	fixed	1.0	77	73
R-78AA1.8-1.0SMD	4.75 - 18	1.8	1.5 - 3.0	1.0	82	76
R-78AA2.5-1.0SMD	4.75 - 18	2.5	1.5 - 3.0	1.0	87	81
R-78AA3.3-1.0SMD	4.75 - 18	3.3	3.0 - 5.5	1.0	90	84
R-78AA5.0-1.0SMD	6.5 - 18	5.0	3.0 - 5.5	1.0	94	89

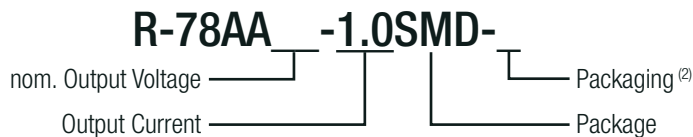
#### Notes:

Note1: Input voltage ranges valid for nominal output voltages  
Vin must be higher than Vout including adjust range and dropout voltage



EN60950-1 certified  
IEC60950-1 certified

### Model Numbering



#### Notes:

Note2: add suffix -R for tape & reel packaging

#### Ordering Examples:

R-78AA5.0-1.0SMD-R = 5.0VDC Output Voltage, 1.0A, SMD, tape and reel packaging  
R-78AA2.5-1.0SMD = 2.5VDC Output Voltage, 1.0A, SMD, tube

Specifications (measured @ Ta= 25°C, 10% minimum load, unless otherwise stated)

### BASIC CHARACTERISTICS

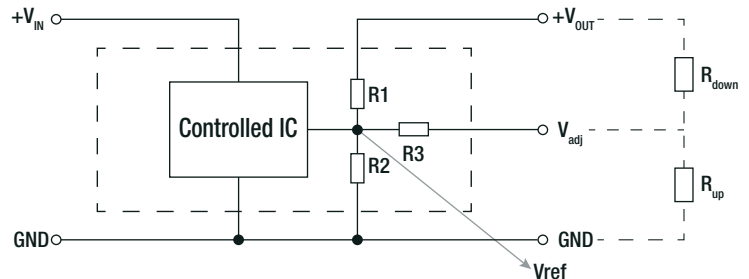
Parameter	Condition	Min.	Typ.	Max.
Quiescent Current	Vin= min. to max.		5mA	7mA
Internal Power Dissipation				0.4W
Output Voltage Adjustability				see calculation
Minimum Load <sup>(2)</sup>		0%		
Start-up time	ON/OFF CTRL		50ms	
ON/OFF CTRL	DC-DC ON DC-DC OFF		Open or 2.8VDC < Vr < 5VDC GND or 0VDC < Vr < 0.8VDC	
Input Current of CTRL Pin	DC-DC OFF		1.8µA	
Standby Current			20µA	35µA
CTRL Thershold Voltage		2.4VDC	2.6VDC	2.8VDC
CTRL Voltage Hysteresis			250mV	
Internal Operating Frequency		335kHz	385kHz	435kHz
Output Ripple and Noise	20MHz BW		20mVp-p	30mVp-p
Maximum Capacitive Load	with normal start-up time, no external components			470µF
	with <1 second start-up time + diode protection circuit			6800µF

#### Notes:

Note3: Operation under no load will not harm the converter, but specifications may not be met.  
A minimum load of 10mA is recommended

#### Output Voltage Adjustability Adjustment Resistor Values

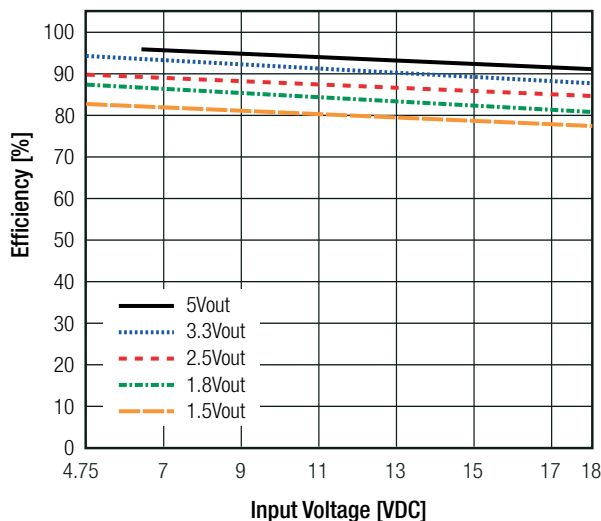
	R1	R2	R3	Vref(V)
1.8V	10KΩ	21KΩ	5.6KΩ	1.23
2.5V	22KΩ	21KΩ	5.6KΩ	1.23
3.3V	16.9KΩ	10KΩ	5.6KΩ	1.23
5.0V	30.9KΩ	10KΩ	10KΩ	1.23



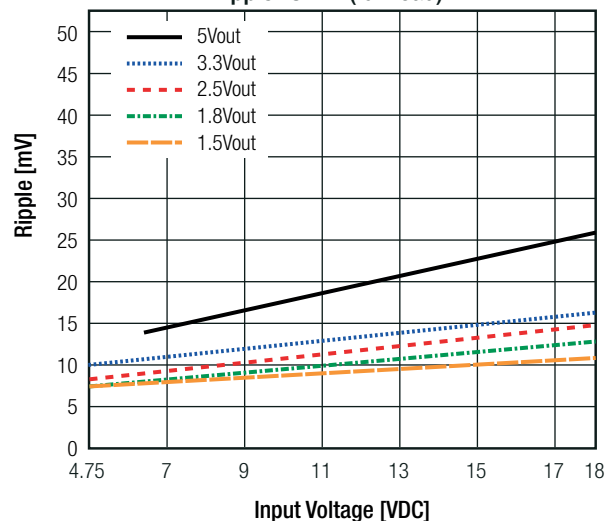
$$\text{Trim down } R_{\text{down}} = \frac{R_2(R_1 + R_3) \times (V_{\text{ref}} - V_o) + V_{\text{ref}} \times R_1 R_3}{R_2 V_o - V_{\text{ref}} (R_1 + R_2)}$$

$$\text{Trim up } R_{\text{up}} = \frac{R_2 R_3 (V_{\text{ref}} - V_o) + V_{\text{ref}} R_1 (R_2 + R_3)}{R_2 (V_o - V_{\text{ref}}) - V_{\text{ref}} R_1}$$

Efficiency vs. Vin (full load)



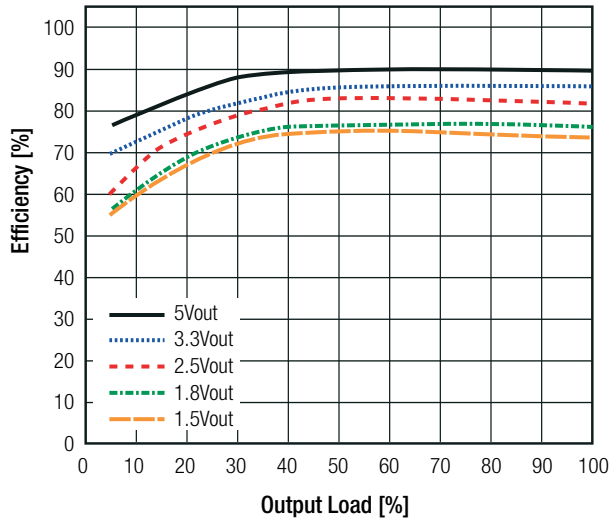
Ripple vs. Vin (full load)



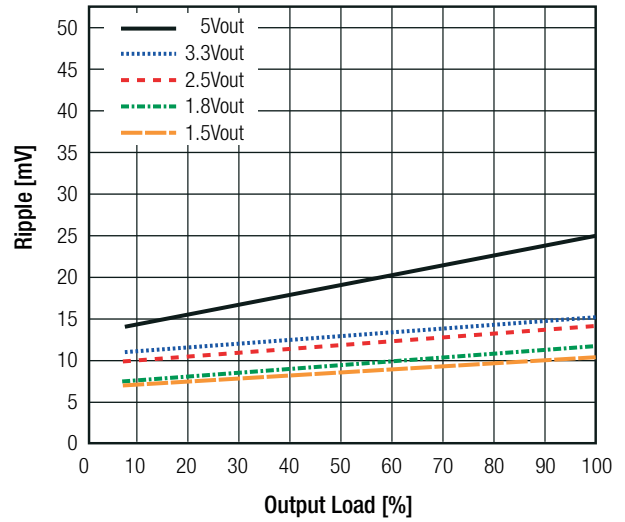
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Specifications (measured @ Ta= 25°C, 10% minimum load, unless otherwise stated)

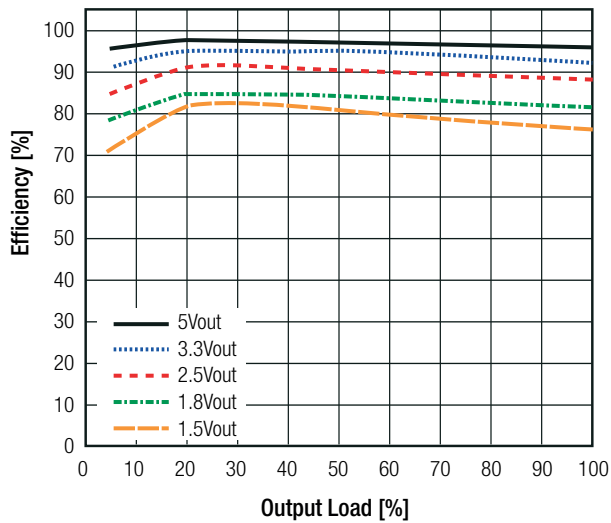
Efficiency vs. Load (max. Vin)



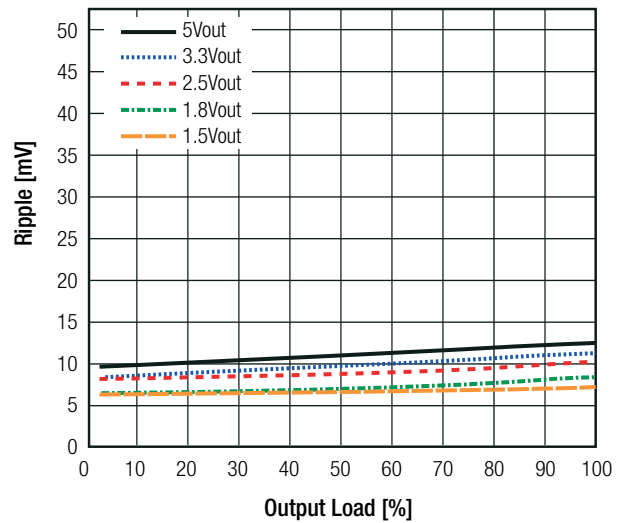
Ripple vs. Load (max. Vin)



Efficiency vs. Load (min. Vin)



Ripple vs. Load (min. Vin)



### REGULATIONS

Parameter	Condition		Value
Output Accuracy	full load		±2.0% typ. / ±3.0% max.
Line Regulation	low line to high line, full load		±0.2% typ. / ±0.4% max.
Load Regulation	10% to 100% load		±0.7% typ. / ±1.0% max.
Transient Response	25mA/μs	100% <-> 50% load	±85mV typ. / ±100mV max.

**Specifications** (measured @ Ta= 25°C, 10% minimum load, unless otherwise stated)

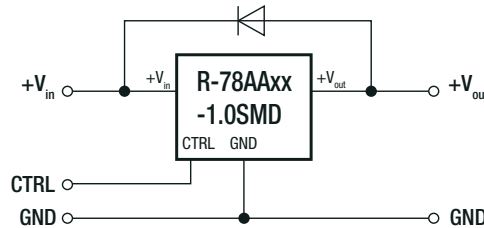
PROTECTIONS		
Parameter	Condition	Value
Short Circuit Protection (SCP)		continuous, automatic recovery
Short Circuit Input Current	nom. Vin= 12VDC	120mA max.

**Optional Diode Protection Circuit**

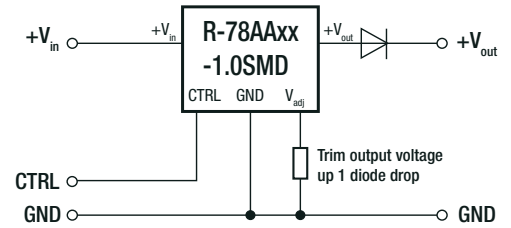
Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter when it is powered down.

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:**

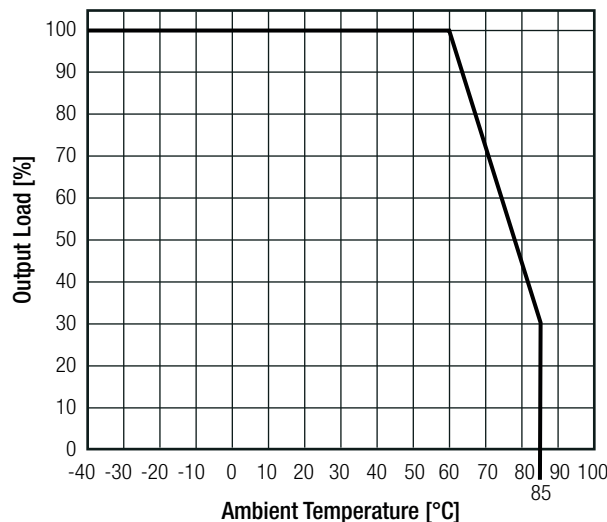


**Optional Protection 2:**



ENVIRONMENTAL			
Parameter	Condition		Value
Operating Temperature Range	with derating (see graph)		-40°C to +85°C
Maximum Case Temperature			+100°C
Temperature Coefficient			±0.015%/°C
Thermal Impedance	0.1m/s, horizontal		70°C/W
Operating Altitude			2000m
Operating Humidity	non-condensing		5% - 95% RH max.
Pollution Degree			PD2
MTBF	according to MIL-HDBK-217F, G.B.	+25°C + 71°C	13338 - 21070 x 10 <sup>3</sup> hours 3880 - 6769 x 10 <sup>3</sup> hours

**Derating Graph**



**Specifications** (measured @ Ta= 25°C, 10% minimum load, unless otherwise stated)

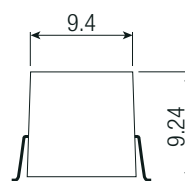
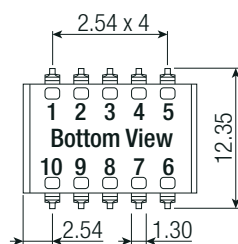
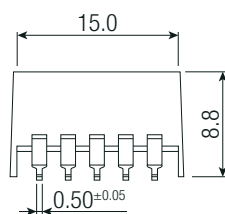
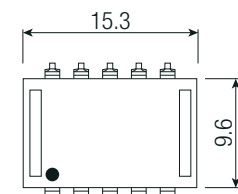
**SAFETY AND CERTIFICATIONS**

Certificate Type (Safety)	Report / File Number	Standard
Information Technology Equipment, General Requirements for Safety	1603123	IEC60950-1:2005, 2nd Edition + AM 2:2013 EN60950-1:2006 + AM 2:2013
EAC	RU-AT.49.09571	TP TC 004/2011 TP TC 004/2011
RoHS 2+		RoHS 2011/65/EU + AM2015/863
EMC Compliance	Condition	Standard / Criterion
Electromagnetic compatibility of multimedia equipment - Emission requirements	with external filter	EN55032, Class B
ESD Electrostatic discharge immunity test	Air ±8kV; Contact ±4kV	EN61000-4-2
Radiated, radio-frequency, electromagnetic field immunity test	3V/m	EN61000-4-3

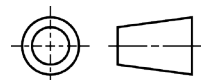
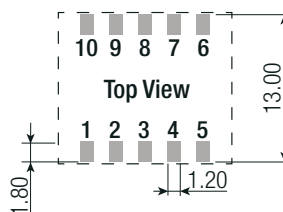
**DIMENSION AND PHYSICAL CHARACTERISTICS**

Parameter	Type	Value
Material	case PCB	non-conductive black plastic, (UL94 V-2) FR4, (UL94 V-1)
Dimension (LxWxH)		15.3 x 9.6 x 8.8mm
Weight		1.7g typ.

**Dimension Drawing (mm)**



**Recommended Footprint Details**



**Pinning information**

Pin #	Single
1,2	+Vin
3,7,8,9	GND
4,5	+Vout
6	Vadj
10	CTRL

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

**Specifications** (measured @ Ta= 25°C, 10% minimum load, unless otherwise stated)

PACKAGING INFORMATION		
Parameter	Type	Value
Packaging Dimension (LxWxH)	tube	530.0 x 17.0 x 13.0mm
	tape and reel (carton)	355.0 x 342.0 x 36.0mm
Packaging Quantity	tube	33pcs
	tape and reel	250pcs
Tape Width		24mm
Storage Temperature Range		-55°C to +125°C
Storage Humidity		95% RH max.

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