

## Features

- Replacement for R-78Axx-1.0SMD series
- RoHS 6/6 Conform (100% Lead Free)
- High Reflow Temperature SMD Package
- Adjustable Output Voltage
- Short circuit protection, Thermal shutdown
- Remote On/Off Control
- Very Low Shutdown Current

## Description

The R-78Axx-1.0SMD series are manufactured without lead and meet the requirements for RoHS 6/6 as well as the increased reflow soldering temperatures associated with vapour phase soldering, making these high efficiency switching regulators ideally suited to modern pick-and-place mass production. The efficiency of up to 94% means that very little energy is wasted as heat. The additional features of remote on/off control and adjustable output voltages will find many uses in the battery-powered, industrial, medical and automotive markets.

## Selection Guide

| Part Number SMD  | Input Range (V) | Output Voltage (V) | Adjust Range (V) | Output Current (A) | Efficiency Min. Vin (%) | 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           |

## Specifications ( typical at 25°C, 10% minimum load, unless otherwise specified )

| Characteristics                                         | Conditions                                              | Min.                           | Typ.         | Max.      |
|---------------------------------------------------------|---------------------------------------------------------|--------------------------------|--------------|-----------|
| Input Voltage Range                                     | See Table                                               | 4.75V                          |              | 18.0V     |
| Output Voltage Range                                    | See Table                                               | 1.5V                           |              | 5.5V      |
| Output Current                                          | All Series                                              | 0mA*                           |              | 1000mA    |
| Output Current Limit                                    | All Series                                              |                                |              | 5500mA    |
| Short Circuit Input Current                             | Vin = 12V                                               |                                |              | 120mA     |
| Internal Power Dissipation                              |                                                         |                                |              | 0.4W      |
| Short Circuit Protection                                |                                                         | Continuous, automatic recovery |              |           |
| Output Voltage Accuracy                                 | 100% Load                                               |                                | ±2%          | ±3%       |
| Adjustable Voltage Range                                | See Table 1                                             |                                |              | ±50%      |
| Line Voltage Regulation (Vin = min to max at full load) |                                                         |                                | 0.2%         | 0.4%      |
| Load Regulation (10% to 100% full load)                 |                                                         |                                | 0.7%         | 1.0%      |
| Dynamic Load Stability                                  | 100%<>50% load, 25mA/μs                                 |                                | ±85mV        | ±100mV    |
| Ripple & Noise (20MHz BW)                               |                                                         |                                | 20mVp-p      | 30mVp-p   |
| Temperature Coefficient                                 | -40°C~+85°C ambient                                     |                                |              | 0.015%/°C |
| Max capacitance Load                                    | with normal start-up time, no external components       |                                |              | 470μF     |
|                                                         | with <1 second start up time + diode protection circuit |                                |              | 6800μF    |
| Switching Frequency                                     |                                                         | 335kHz                         | 385kHz       | 435kHz    |
| Quiescent Current                                       | Vin = min. to max. at 0% load                           |                                | 5mA          | 7mA       |
| ON/OFF Remote Control Pin Drive Current                 | ON: Open or 1.6V<Vr<5V<br>OFF: GND or 0<Vr<1.6V         |                                | Ir=1.8μA typ |           |
| Converter Input Current (valid for Vr < 1.6V)           |                                                         |                                | 20μA         | 35μA      |
| Remote On/Off Threshold Voltage (Vr rising)             |                                                         | 2.4V                           | 2.6V         | 2.8V      |
| Remote On/Off Voltage Hysteresis                        |                                                         |                                | 250mV        |           |
| Operating Temperature Range                             |                                                         | -40°C                          |              | +85°C     |
| Switch On/Off Time                                      | (using Remote On/Off Control)                           |                                |              | 50ms      |
| Operating Case Temperature                              |                                                         |                                |              | +100°C    |
| Storage Temperature Range                               |                                                         | -55°C                          |              | +125°C    |
| Case Thermal Impedance                                  |                                                         |                                |              | 70°C / W  |
| Thermal Shutdown                                        | Internal IC junction                                    |                                |              | +160°C    |
| Case Material                                           |                                                         | Non-Conductive Black Plastic   |              |           |
| Potting Material                                        |                                                         | Epoxy (UL94V-0)                |              |           |

cont.

**INNOLINE**  
DC/DC-Converter  
with 3 year Warranty

**RECOM**

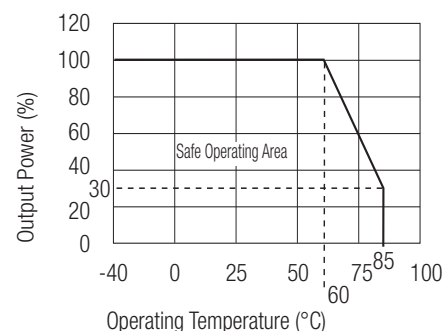
**1.0 AMP**  
**SMD**  
**Single Output**



**EN-60950-1 Certified**

**R-78AA-1.0**

## Derating-Graph (Ambient Temperature)



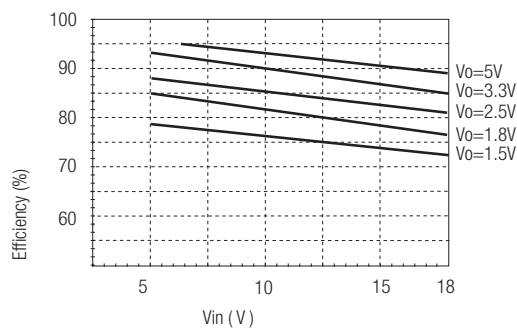
## Standard Application Circuit

|                      |                                                              |                                     |                     |
|----------------------|--------------------------------------------------------------|-------------------------------------|---------------------|
| EMC                  | Conducted Emissions (with filter)                            | EN55022                             | Class B             |
|                      | Radiated Emissions (with filter)                             | EN55022                             | Class B             |
|                      | ESD                                                          | EN61000-4-2                         | Class A             |
|                      | Radiated Immunity                                            | EN61000-4-3                         | Class A             |
|                      | Fast Transient                                               | EN61000-4-4                         | Class A             |
|                      | Conducted Immunity                                           | EN61000-4-6                         | Class A             |
|                      | Magnetic Field Immunity                                      | EN61000-4-8                         | Class A             |
| Safety Certification | EN-60950-1                                                   |                                     |                     |
| Package Weight       | 1.7g                                                         |                                     |                     |
| Packing Quantity     | 33 pcs per Tube<br>250 pcs per Reel                          |                                     |                     |
| MTBF (+25°C)         | Detailed Information see<br>Application Notes chapter "MTBF" | 13338~21070 x 10 <sup>3</sup> hours | using MIL-HDBK 217F |
| (+71°C)              |                                                              |                                     |                     |
|                      |                                                              | 3880~6769 x 10 <sup>3</sup> hours   |                     |

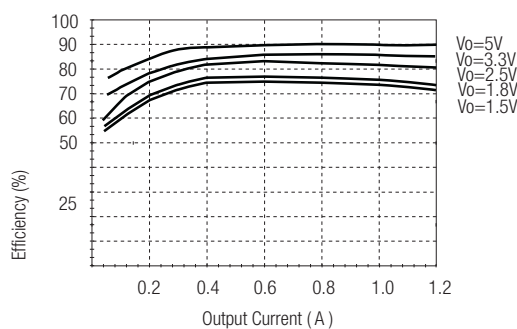
\*Note: Operation under no load will not damage these devices, however they may not meet all specifications. A minimum load of 10mA is recommended

## Characteristics

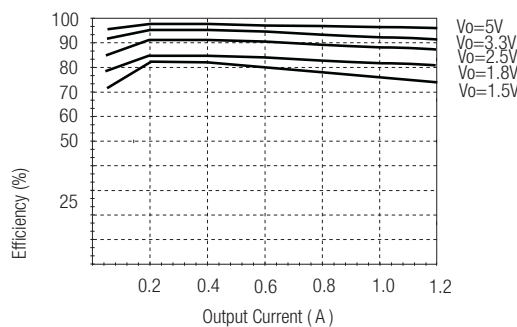
### Efficiency



Efficiency Vs Vin (Full Load)

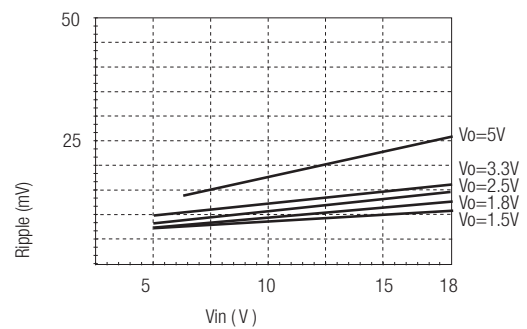


Efficiency Vs Load (Vin=Max)

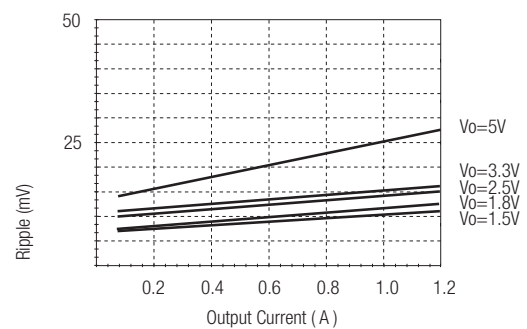


Efficiency Vs Load (Vin=Min)

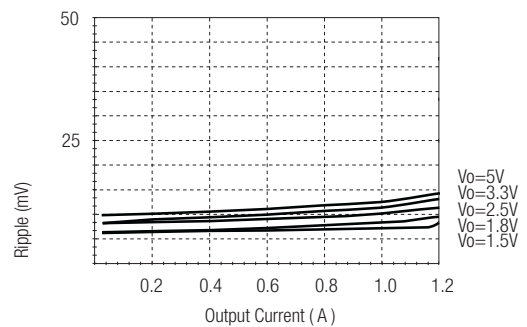
### Ripple



Ripple Vs Vin (Full Load)

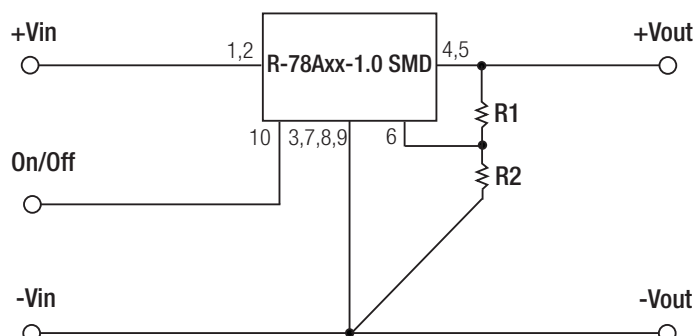


Ripple Vs Load (Vin=Max)



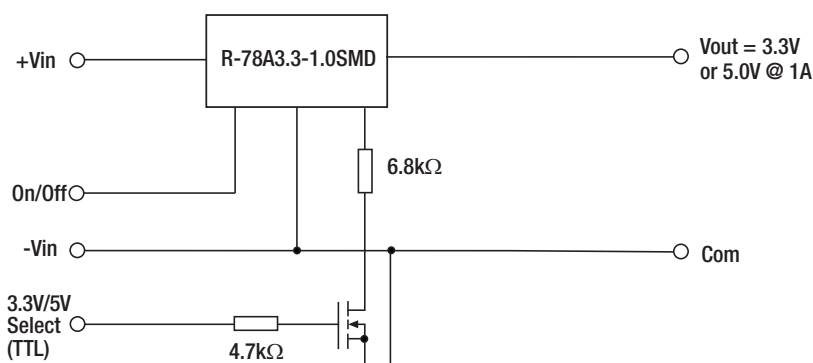
Ripple Vs Load (Vin=Min)

## Standard Application Circuit



## Application Examples

### 3.3V/5V Selectable 1A Power Supply

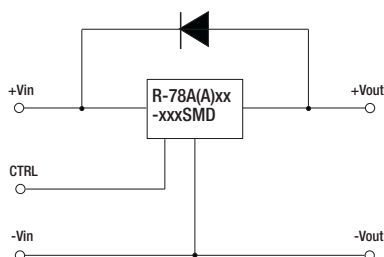


## Optional Protection Circuit

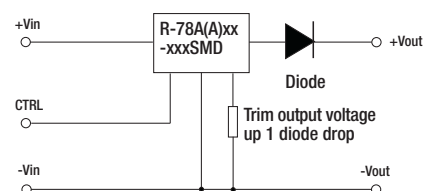
### Optional Protection 1:

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.

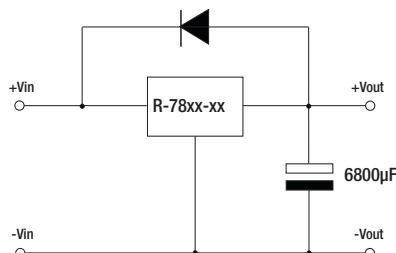
The diode can either be fitted across the device if the source is low impedance or fitted in series with the output (recommended).



### Optional Protection 2:



Application example:  
Driving a high capacitive load

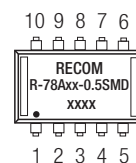
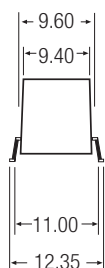
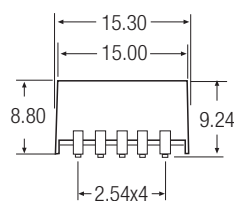


**Table 1: Adjustment Resistor Values**

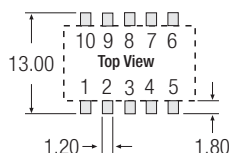
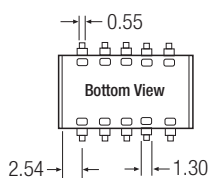
| 1.0A <sub>dc</sub>      | R-78A1.8-1.0SMD    |       | R-78A2.5-1.0SMD    |       | R-78A3.3-1.0SMD    |       | R-78A5.0-1.0SMD    |       |
|-------------------------|--------------------|-------|--------------------|-------|--------------------|-------|--------------------|-------|
| V <sub>out</sub> (nom.) | 1.8V <sub>dc</sub> |       | 2.5V <sub>dc</sub> |       | 3.3V <sub>dc</sub> |       | 5.0V <sub>dc</sub> |       |
| V <sub>out</sub> (adj)  | R1                 | R2    | R1                 | R2    | R1                 | R2    | R1                 | R2    |
| 1.5 (V)                 | 3K $\Omega$        |       | 200 $\Omega$       |       |                    |       |                    |       |
| 1.8 (V)                 |                    |       | 12K $\Omega$       |       |                    |       |                    |       |
| 2.5 (V)                 |                    | 11.8K |                    |       |                    |       |                    |       |
| 3.0 (V)                 |                    | 4.64K |                    | 44.2K | 88.4K              |       | 17K                |       |
| 3.3 (V)                 |                    |       |                    |       |                    |       | 27K                |       |
| 3.6 (V)                 |                    |       |                    |       |                    | 60.4K | 42K                |       |
| 3.9 (V)                 |                    |       |                    |       |                    | 28K   | 58K                |       |
| 4.5 (V)                 |                    |       |                    |       |                    | 11.3K | 180K               |       |
| 4.9 (V)                 |                    |       |                    |       |                    | 7.15K | 850K               |       |
| 5.0 (V)                 |                    |       |                    |       |                    | 6.34K |                    |       |
| 5.1 (V)                 |                    |       |                    |       |                    | 5.9K  |                    | 231K  |
| 5.5 (V)                 |                    |       |                    |       |                    | 3.9K  |                    | 56.2K |

## Package Style and Pinning (mm)

### SMD 10Pin Package



### Recommended Footprint Details



### Pin Connections

| Pin #   |                     |
|---------|---------------------|
| 1,2     | +Vin                |
| 3,7,8,9 | GND                 |
| 4,5     | +Vout               |
| 6       | V adj               |
| 10      | Remote On/Off       |
| xx.x    | $\pm 0.5\text{mm}$  |
| xx.xx   | $\pm 0.25\text{mm}$ |

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