

## Features

- Efficiency up to 96%, Non isolated, no need for heatsinks
- Pin-out compatible with LM78XX Linears
- Low profile( L\*W\*H=11.5\*8.5\*17.5mm)
- High voltage input range, up to 72V
- Short circuit protection, Thermal shutdown
- Non-standard outputs available as specials between 3.3V~24V
- Low ripple and noise
- "L" version with 90° pins
- See Innoline Application Notes for use as an inverter (alternative to LM79xx Linear)

## Description

The R-78HBxx-Series high efficiency, high input voltage switching regulators are ideally suited to replace 78xx linear regulators and are pin compatible. The efficiency of up to 96% means that very little energy is wasted as heat so there is no need for any heat sinks with their additional space and mounting costs.

An input voltage range of up to 8:1 is unsurpassed by any other converter and allows the full stored energy utilization of standard and high voltage batteries. The fully protected output is ideal for industrial applications (especially for industry standard 24VDC bus supplies) and the L-Version with 90° pins allows direct replacement for laid-flat regulators where component height is at a premium. Low ripple and noise figures and a short circuit input current of typically only 15mA round off the specifications of this versatile converter series.

Typical applications include telecommunication, automotive, industrial, aerospace and battery powered applications.

## Selection Guide

| Part Number<br>SIP3 | Input Range<br>(V) | Output Voltage<br>(V) | Output Current<br>(A) | Efficiency   |            |            |
|---------------------|--------------------|-----------------------|-----------------------|--------------|------------|------------|
|                     |                    |                       |                       | Vmin.<br>(%) | 30V<br>(%) | 72V<br>(%) |
| R-78HB3.3-0.5       | 9 - 72             | 3.3                   | 0.5                   | 82           | 80         | 76         |
| R-78HB5.0-0.5       | 9 - 72             | 5.0                   | 0.5                   | 87           | 85         | 81         |
| R-78HB6.5-0.5       | 9 - 72             | 6.5                   | 0.5                   | 91           | 87         | 84         |
| R-78HB9.0-0.5       | 14 - 72            | 9.0                   | 0.5                   | 92           | 90         | 86         |
| R-78HB12-0.5        | 17 - 72            | 12                    | 0.5                   | 94           | 93         | 89         |
| R-78HB15-0.5        | 20 - 72            | 15                    | 0.5                   | 95           | 94         | 91         |
| R-78HB24-0.3        | 36 - 72            | 24                    | 0.3                   | 96           |            | 92         |

\* add Suffix "L" for 90° bent pins, e.g. R-78HB5.0-0.5L

## Specifications (refer to the standard application circuit, Ta: 25°C, minimum load = 10%)

| Characteristics                                      | Conditions                      | Min.                           | Typ.          | Max.     |
|------------------------------------------------------|---------------------------------|--------------------------------|---------------|----------|
| Input Voltage Range                                  | See table                       | 9V                             | 72V           | 75V max. |
| Output Voltage Range (for customized parts)          | All Series                      | 3.3V                           |               | 24V      |
| Output Current (see Note 1)                          | 3.3V, 5V, 6.5V, 9V, 12V, 15V    | 10mA                           |               | 500mA    |
|                                                      | 24V                             | 6mA                            |               | 300mA    |
| Short Circuit Input Current                          | All Series                      |                                | 15mA          | 25mA     |
| Internal Input Filter                                |                                 |                                | 1µF Capacitor |          |
| Internal Power Dissipation                           |                                 |                                |               | 0.65W    |
| Short Circuit Protection                             |                                 | Continuous, automatic recovery |               |          |
| Output Voltage Accuracy                              | At 100% Load                    |                                | ±2%           | ±3%      |
| Line Voltage Regulation                              | Vin = min. to max. at full load |                                | 0.4%          | 1%       |
| Load Regulation                                      | 10% to 100% full load           |                                | 0.3%          | 0.6%     |
| Dynamic Load Stability (with Output Capacitor=100µF) | 100% <-> 50% load               |                                | ±75mV         | ±100mV   |
| Ripple & Noise (without Output Capacitor)            | 10% to 100% full load           |                                | 20mVp-p       | 60mVp-p  |

continued on next page

## INNOLINE DC/DC-Converter

with year Warranty

# RECOM

## 0.5 AMP SIP3

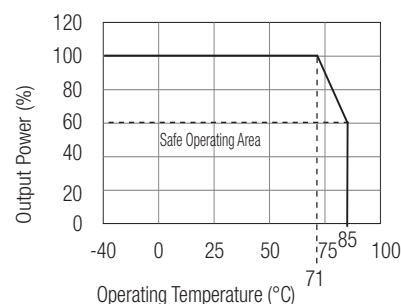
## Single Output



**EN-55022 Certified**  
**EN-55024 Certified**  
**IEC/EN-60950-1 Certified**

# R-78HB

## Derating-Graph (Ambient Temperature)

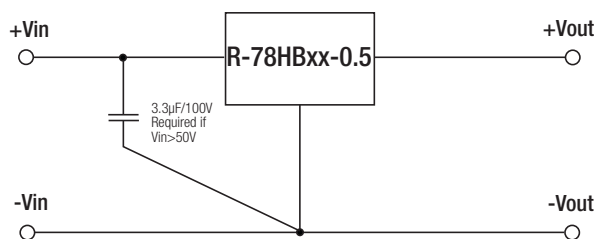


Refer to Application Notes

**Specifications (refer to the standard application circuit, Ta: 25°C, minimum load = 10%)**

| Characteristics                 | Conditions                                                   | Min.                | Typ.                         | Max.                         |
|---------------------------------|--------------------------------------------------------------|---------------------|------------------------------|------------------------------|
| Temperature Coefficient         | -40°C ~ +85°C ambient                                        |                     |                              | 0.015%/°C                    |
| Max capacitance Load            | with normal start-up time, no external components            |                     |                              | 100μF                        |
|                                 | with <1 second start up time + diode protection circuit      |                     |                              | 6800μF                       |
| Switching Frequency (See Graph) | Full Load                                                    | 120kHz              |                              | 800kHz                       |
| Quiescent Current               | Vin = 48VDC. at minimum load                                 | 1mA                 |                              | 5mA                          |
| Operating Temperature Range     |                                                              | -40°C               |                              | +85°C                        |
| Operating Case Temperature      |                                                              |                     |                              | +100°C                       |
| Storage Temperature Range       |                                                              | -55°C               |                              | +125°C                       |
| Case Thermal Impedance          |                                                              |                     |                              | 60°C / W                     |
| Relative Humidity               |                                                              |                     |                              | 95% RH                       |
| Case Material                   |                                                              |                     | Non-Conductive Black Plastic |                              |
| Potting Material                |                                                              |                     | Epoxy (UL94V-0)              |                              |
| Package Weight                  |                                                              |                     | 4g                           |                              |
| Packing Quantity                |                                                              |                     |                              | 42 pcs per Tube              |
| Soldering Temperature           |                                                              |                     |                              | 265°C max./10 sec.           |
| Conducted Emissions             | EN55022                                                      |                     |                              | Class B                      |
| Radiated Emissions              | EN55022                                                      |                     |                              | Class B                      |
| ESD                             | EN61000-4-2                                                  |                     |                              | Class A                      |
| IEC/EN General Safety           | Report: SPCLVD 1407030-1                                     |                     |                              | IEC/EN-60950-1, 2nd Edition  |
| MTBF (+25°C)                    | Detailed Information see<br>Application Notes chapter "MTBF" | using MIL-HDBK 217F |                              | 7395 x 10 <sup>3</sup> hours |
| (+71°C)                         |                                                              | using MIL-HDBK 217F |                              | 1242 x 10 <sup>3</sup> hours |

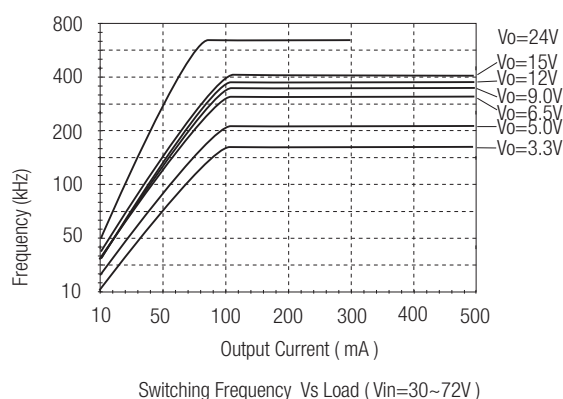
## Typical Application Circuit



The converter has a built in soft start circuit. Rapidly changing the input voltage from Vin(min) ↔ Vin(max) can bypass this circuit and damage the converter.

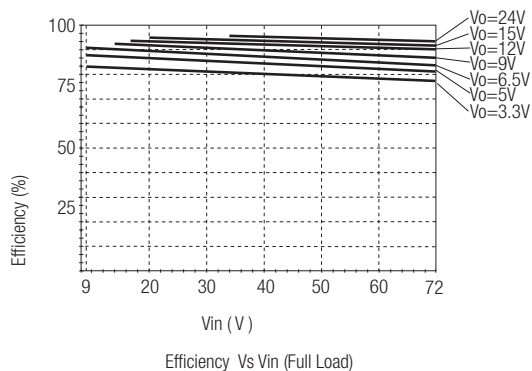
## Typical Characteristics

**Switching  
Frequency  
vs  
Load**

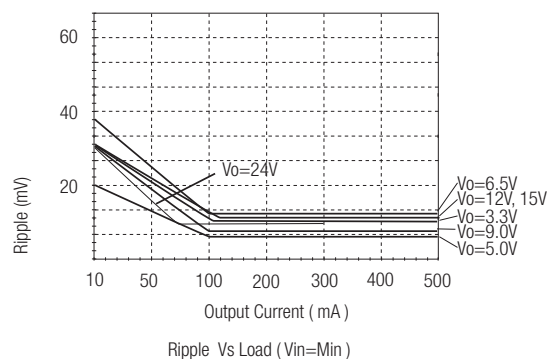
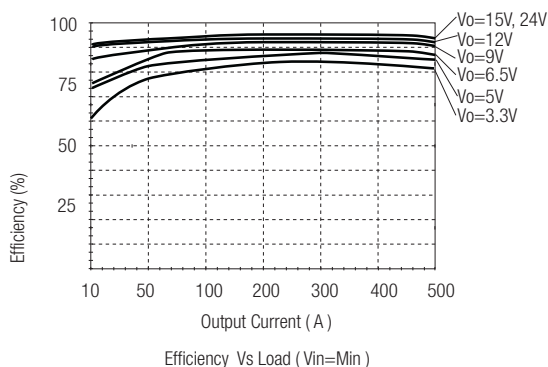
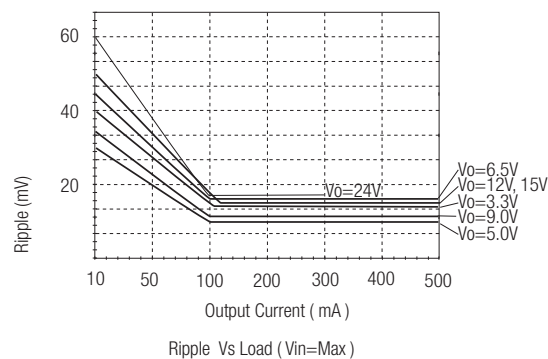
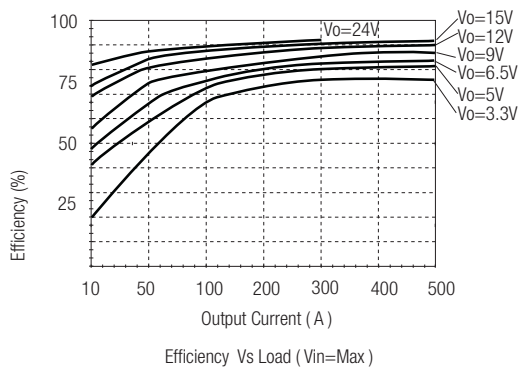
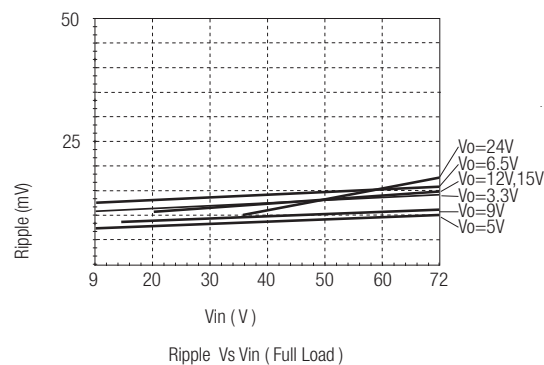


## Typical Characteristics

### Efficiency



### Ripple



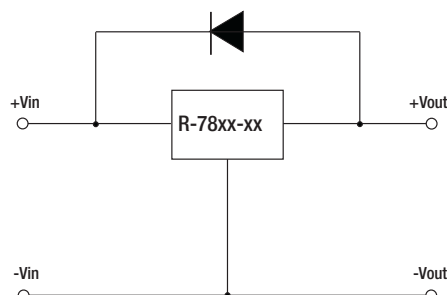
\*Note: Operation under no load will not damage these devices, however they may not meet all specifications. A minimum load of 10mA is recommended

## Optional Protection Circuit

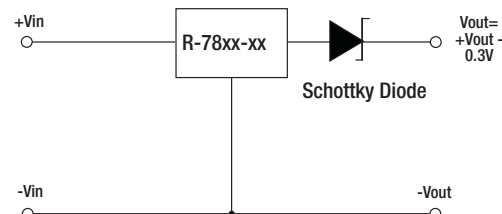
### Optional Protection 1:

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).

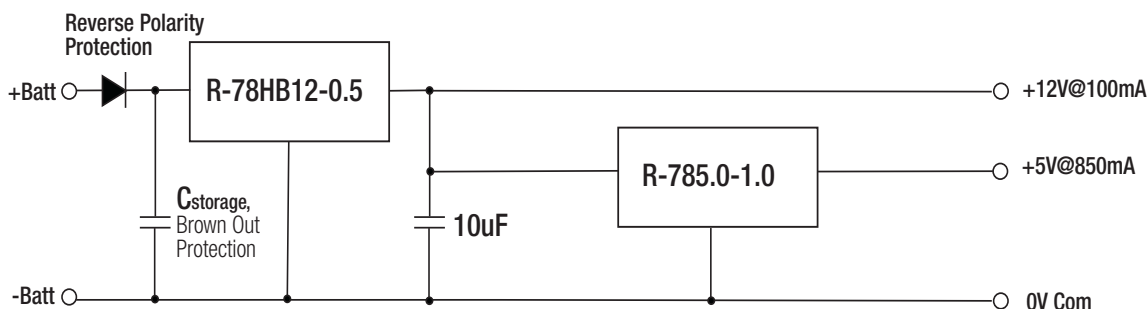


### Optional Protection 2:



## Typical Application

### High Input Voltage Multiple Output Supply

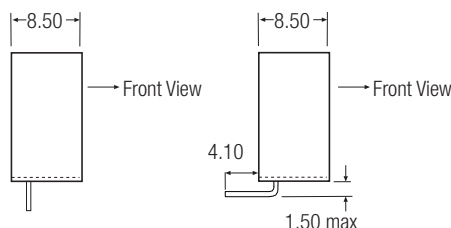
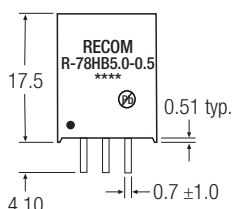


- Wide input range 18V to 72V - can be used with 24V, 48V or 60V batteries
- +12V output for interface and display electronics
- +5V high current output for digital electronics
- Further decoupling filtering may be necessary between the converters

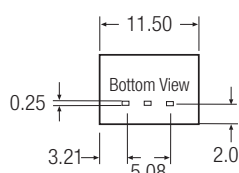
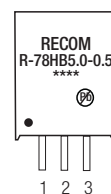
R-78HB

## Package Style and Pinning (mm)

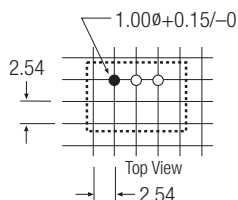
### SIP3 PIN Package



### L - Version



### Recommended Footprint Details



### Pin Connections

| Pin # |         |
|-------|---------|
| 1     | +Vin    |
| 2     | GND     |
| 3     | +Vout   |
| xx.x  | ±0.5mm  |
| xx.xx | ±0.25mm |