

# Features

## Switching Regulator

- Efficiency up to 96%, no need for heatsinks
- 2A continuous output current
- Vin up to 32V
- Vout: 1.2V - 15V
- Wide operating temperature -40°C to +70°C at full load
- Continuous short circuit protection
- Pin compatible with TO220 linear regulators
- Positive to negative converter

### Description

The R-78Bxx-2.0 series high efficiency 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. Full power is available over a temperature range of -40°C up to 70°C without the need for heat sinks with their additional space and mounting costs. A high input voltage of up to 32VDC and output voltages from 1.2V up to 15V, low ripple and noise figures and a short circuit input current of typically only 50mA round off the specifications of this versatile converter series.

### Selection Guide

| Part Number  | Input Voltage Range [VDC] | Output Voltage [VDC] | Output Current [mA] | Efficiency @ full load @ min Vin [%] | Efficiency @ full load @ max. Vin [%] | Max. Capacitive Load <sup>(1)</sup> [μF] |
|--------------|---------------------------|----------------------|---------------------|--------------------------------------|---------------------------------------|------------------------------------------|
| R-78B1.2-2.0 | 4.75 - 32                 | 1.2                  | 2000                | 87                                   | 72                                    | 3300                                     |
| R-78B1.5-2.0 | 4.75 - 32                 | 1.5                  | 2000                | 90                                   | 79                                    | 3300                                     |
| R-78B1.8-2.0 | 4.75 - 32                 | 1.8                  | 2000                | 91                                   | 80                                    | 3300                                     |
| R-78B2.5-2.0 | 4.75 - 32                 | 2.5                  | 2000                | 92                                   | 84                                    | 2300                                     |
| R-78B3.3-2.0 | 4.75 - 32                 | 3.3                  | 2000                | 92                                   | 86                                    | 1800                                     |
| R-78B5.0-2.0 | 6.5 - 32                  | 5                    | 2000                | 94                                   | 90                                    | 820                                      |
| R-78B9.0-2.0 | 11 - 32                   | 9                    | 2000                | 95                                   | 93                                    | 620                                      |
| R-78B12-2.0  | 15 - 32                   | 12                   | 2000                | 96                                   | 94                                    | 470                                      |
| R-78B15-2.0  | 18 - 32                   | 15                   | 2000                | 96                                   | 95                                    | 470                                      |

#### Notes:

Note1: Max. cap load is tested by nominal input and full resistive load

### Model Numbering

R-78B -2.0  
Output Voltage ———— Output Current

**RECOM**  
DC/DC Converter

**R-78B-2.0**

**2.0 Amp  
SIP3  
Single Output**



IEC62368-1 certified  
EN62368-1 certified  
EN55032 compliant  
CB report

**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm up unless otherwise specified)

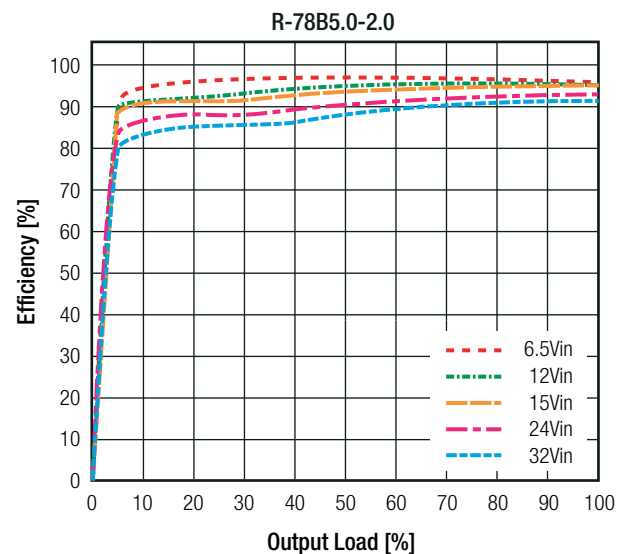
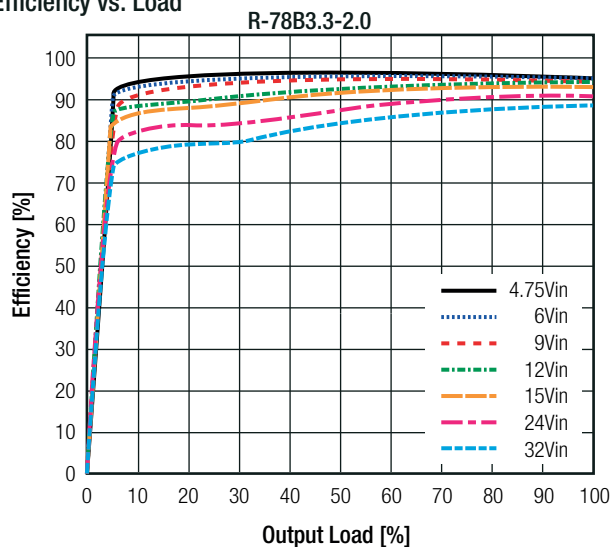
### BASIC CHARACTERISTICS

| Parameter                              | Condition       |                                                         | Min.                                         | Typ.               | Max.  |
|----------------------------------------|-----------------|---------------------------------------------------------|----------------------------------------------|--------------------|-------|
| Input Voltage Range                    | nom. Vin= 24VDC | 1.2Vout - 3.3Vout<br>5Vout<br>9Vout<br>12Vout<br>15Vout | 4.75VDC<br>6.5VDC<br>11VDC<br>15VDC<br>18VDC | 24VDC              | 32VDC |
| Maximum Reverse Voltage                |                 |                                                         |                                              |                    | 0V    |
| Inrush Current                         |                 |                                                         |                                              | 2A                 |       |
| Quiescent Current                      | nom. Vin= 24VDC |                                                         |                                              | 2mA                |       |
| Internal Power Dissipation             | Vout= 1.5VDC    |                                                         |                                              | 0.35W              | 0.8W  |
| Start-up time                          |                 |                                                         |                                              | 10ms               |       |
| Rise Time                              |                 |                                                         |                                              | 50μs               |       |
| Internal Operating Frequency           | nom. Vin= 24VDC |                                                         |                                              | 460kHz             |       |
| Minimum Load                           |                 |                                                         | 0%                                           |                    |       |
| Output Ripple and Noise <sup>(2)</sup> | 20MHz BW        | Vout ≤3.3VDC<br>Vout ≥5VDC                              |                                              | 50mVp-p<br>75mVp-p |       |

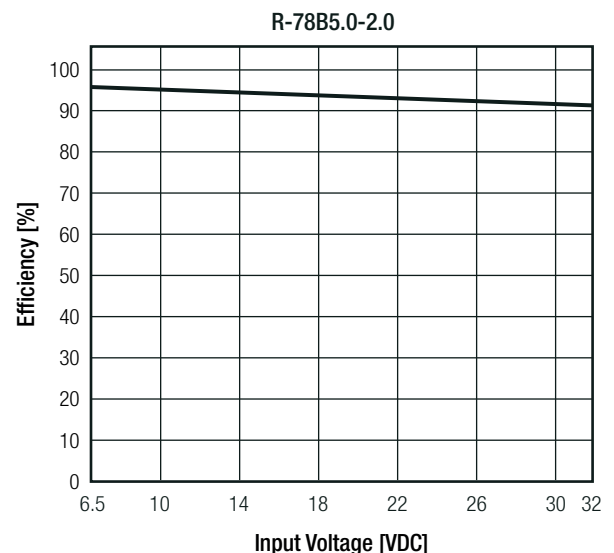
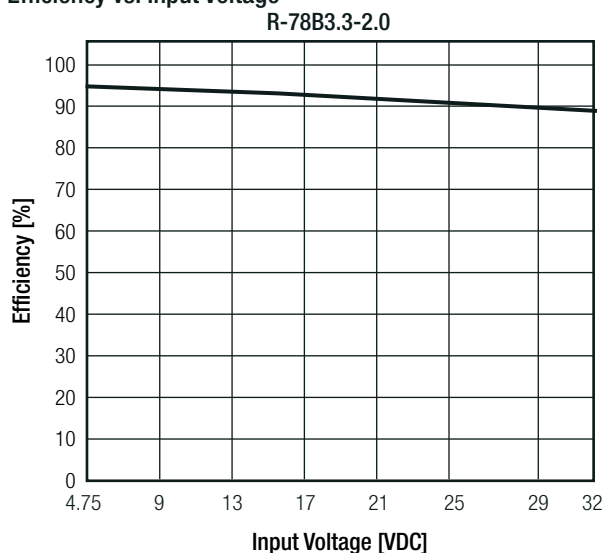
#### Notes:

Note2: Measurements are made with a 100nF MLCC across output (low ESR)

#### Efficiency vs. Load



#### Efficiency vs. Input Voltage



**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm up unless otherwise specified)

### REGULATIONS

| Parameter       | Condition                        | Value      |
|-----------------|----------------------------------|------------|
| Output Accuracy | 100% load                        | ±2.0% typ. |
| Line Regulation | low line to high line, full load | ±0.5% typ. |
| Load Regulation | 0% to 100% load                  | ±1.0% typ. |

### PROTECTIONS

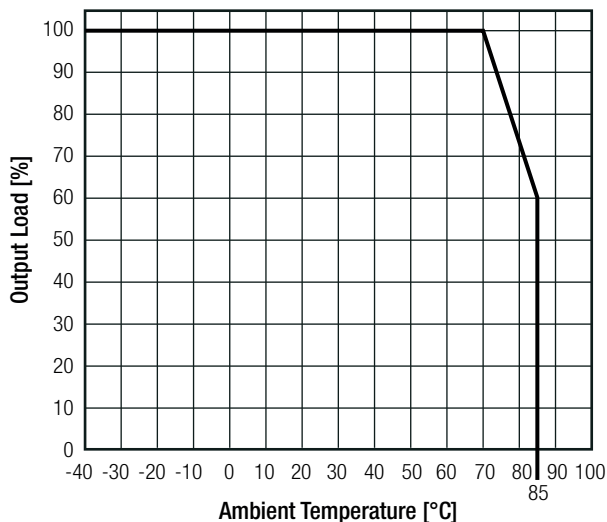
| Parameter                      | Condition       | Value                                                                            |
|--------------------------------|-----------------|----------------------------------------------------------------------------------|
| Short Circuit Protection (SCP) | below 100mΩ     | continuous, automatic recovery                                                   |
| Short Circuit Input Current    | nom. Vin= 24VDC | <div>&lt;5Vout</div> <div>≥5Vout</div> <div>50mA typ.</div> <div>75mA typ.</div> |

### ENVIRONMENTAL

| Parameter                   | Condition                        | Value                                    |
|-----------------------------|----------------------------------|------------------------------------------|
| Operating Temperature Range | without derating (see graph)     | -40°C to +70°C                           |
| Maximum Case Temperature    |                                  | +105°C                                   |
| Temperature Coefficient     |                                  | 0.02%/°C typ.                            |
| Operating Altitude          |                                  | 5000m                                    |
| Operating Humidity          | non-condensing                   | 95% RH max.                              |
| Pollution Degree            |                                  | PD2                                      |
| Vibration                   |                                  | 10-55Hz, 2G, 30min along X, Y and Z axis |
| MTBF                        | according to MIL-HDBK-217F, G.B. | +25°C                                    |
|                             |                                  | 6349 x 10 <sup>3</sup> hours             |

#### Derating Graph

(@ Chamber and natural convection 0.1 m/s)



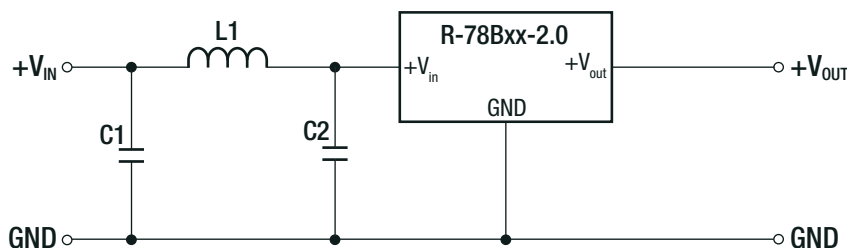
**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm up unless otherwise specified)

### SAFETY AND CERTIFICATIONS

| Certificate Type (Safety)                                                                          | Report / File Number | Standard                                         |
|----------------------------------------------------------------------------------------------------|----------------------|--------------------------------------------------|
| Audio/video, information and communication technology equipment<br>Safety requirements (CB Scheme) | L0339m38-B1-L        | IEC62368-1: 2014, 2nd Edition<br>EN62368-1: 2014 |
| EAC                                                                                                | RU-AT.49.09571       | TP TC 004/2011                                   |
| RoHS2+                                                                                             |                      | RoHS 2011/65/EU + AM2015/863                     |

| EMC Compliance                                                                                  | Condition                                                 | Standard / Criterion                 |
|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------|--------------------------------------|
| Electromagnetic compatibility of multimedia equipment - Emission requirements                   | with external components<br>(see filter suggestion below) | EN55032, Class A<br>EN55032, Class B |
| Information technology equipment - Immunity characteristics - Limits and methods of measurement |                                                           | EN55024:2010                         |
| Electromagnetic compatibility of multimedia equipment - Emission requirements                   |                                                           | EN55032: 2013, Class B               |
| ESD Electrostatic discharge immunity test                                                       | Air ±8kV; Contact ± 4kV                                   | IEC61000-4-2, Criteria A             |
| Radiated, radio-frequency, electromagnetic field immunity test                                  | 3 V/m                                                     | IEC61000-4-3, Criteria A             |
| Fast Transient and Burst Immunity                                                               | ±0.5kV                                                    | IEC61000-4-4, Criteria A             |
| Surge Immunity                                                                                  | ±0.5kV                                                    | IEC61000-4-5, Criteria A             |
| Immunity to conducted disturbances, induced by radio-frequency fields                           | 3V                                                        | IEC61000-4-6, Criteria A             |
| Power Magnetic Field Immunity                                                                   | 50Hz/ 1A/m                                                | IEC61000-4-8, Criteria A             |

### EMC Filtering Suggestion according to EN55032



| EN55022 | C1                  | C2                  | L1          |
|---------|---------------------|---------------------|-------------|
| Class A | 4.7µF 50V MLCC 1206 | N/A                 | 3.3µH Choke |
| Class B | 10µF 50V MLCC 1210  | 4.7µF 50V MLCC 1206 | 10µH Choke  |

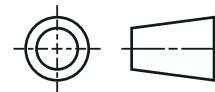
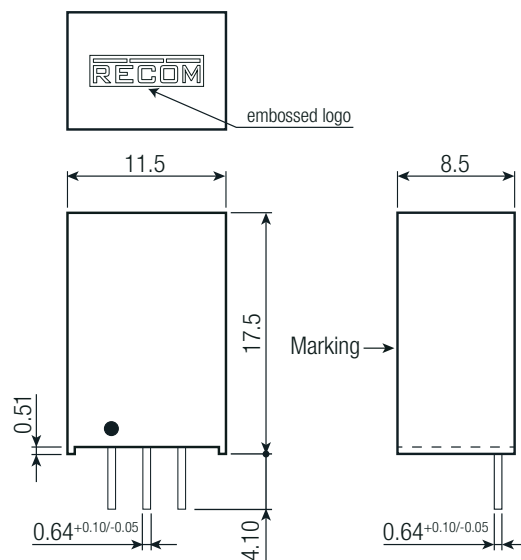
### DIMENSION and PHYSICAL CHARACTERISTICS

| Parameter         | Type                   | Value                                                          |
|-------------------|------------------------|----------------------------------------------------------------|
| Material          | case<br>potting<br>PCB | plastic, (UL94 V-0)<br>silicone, (UL94 V-0)<br>FR4, (UL94 V-0) |
| Dimension (LxWxH) |                        | 11.5 x 8.5 x 17.5mm                                            |
| Weight            |                        | 4.0g typ.                                                      |

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**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm up unless otherwise specified)

Dimension Drawing (mm)

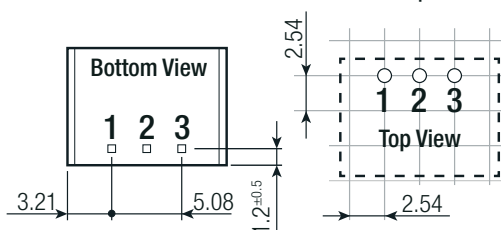


### Pin Connections

| Pin # | Single |
|-------|--------|
| 1     | +Vin   |
| 2     | GND    |
| 3     | +Vout  |

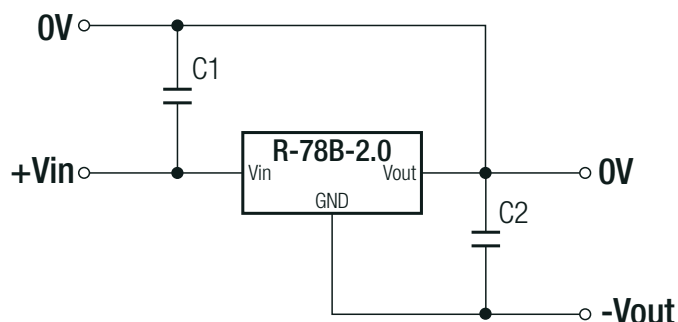
Tolerance: xx.x=  $\pm$ 0.5mm  
xx.xx=  $\pm$ 0.25mm

### Recommended Footprint Details



## INSTALLATION and APPLICATION

### Positive to Negative



| Part Number  | Input Voltage Range [VDC] | Output Voltage [VDC] | Output Current [mA] | Efficiency @ min Vin [%] | Efficiency @ max. Vin [%] | External Capacitor [C1 / C2] |
|--------------|---------------------------|----------------------|---------------------|--------------------------|---------------------------|------------------------------|
| R-78B1.2-2.0 | 4.75 - 32                 | -1.2                 | -1000               | 86                       | 86                        | 10 $\mu$ F / 10 $\mu$ F      |
| R-78B1.5-2.0 | 4.75 - 32                 | -1.5                 | -1000               | 74                       | 87                        | 10 $\mu$ F / 10 $\mu$ F      |
| R-78B1.8-2.0 | 4.75 - 32                 | -1.8                 | -1000               | 76                       | 88                        | 10 $\mu$ F / 10 $\mu$ F      |
| R-78B2.5-2.0 | 4.75 - 32                 | -2.5                 | -1000               | 79                       | 89                        | 10 $\mu$ F / 10 $\mu$ F      |
| R-78B3.3-2.0 | 4.75 - 32                 | -3.3                 | -1000               | 83                       | 89                        | 10 $\mu$ F / 10 $\mu$ F      |
| R-78B5.0-2.0 | 6.5 - 32                  | -5                   | -1000               | 86                       | 90                        | 10 $\mu$ F / 10 $\mu$ F      |
| R-78B9.0-2.0 | 11 - 32                   | -9                   | -1000               | 90                       | 91                        | 10 $\mu$ F / 10 $\mu$ F      |
| R-78B12-2.0  | 15 - 32                   | -12                  | -1000               | 91                       | 92                        | 10 $\mu$ F / 10 $\mu$ F      |
| R-78B15-2.0  | 18 - 32                   | -15                  | -1000               | 92                       | 93                        | 10 $\mu$ F / 10 $\mu$ F      |

**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm up unless otherwise specified)

| PACKAGING INFORMATION       |                |                       |
|-----------------------------|----------------|-----------------------|
| Parameter                   | Type           | Value                 |
| Packaging Dimension (LxWxH) | tube           | 520.0 x 25.1 x 10.6mm |
| Packaging Quantity          |                | 42pcs                 |
| Storage Temperature Range   |                | -55°C to +125°C       |
| Storage Humidity            | non-condensing | 95% RH max.           |

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