

# 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

# RECOM

## DC/DC Converter

## R-78B-2.0

**2.0 Amp**  
**SIP3**  
**Single Output**



### 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 heatsinks 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.

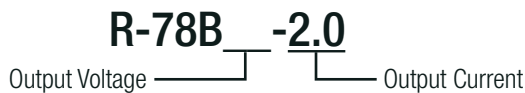
### Selection Guide

| Part Number  | Input Voltage Range [VDC] | Output Voltage [VDC] | Output Current [mA] | Efficiency @ full load |                | Max. Capacitive Load <sup>(1)</sup> [µF] |
|--------------|---------------------------|----------------------|---------------------|------------------------|----------------|--|
|              |                           |                      |                     | @ min Vin [%]          | @ max. Vin [%] |  |
| 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



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)

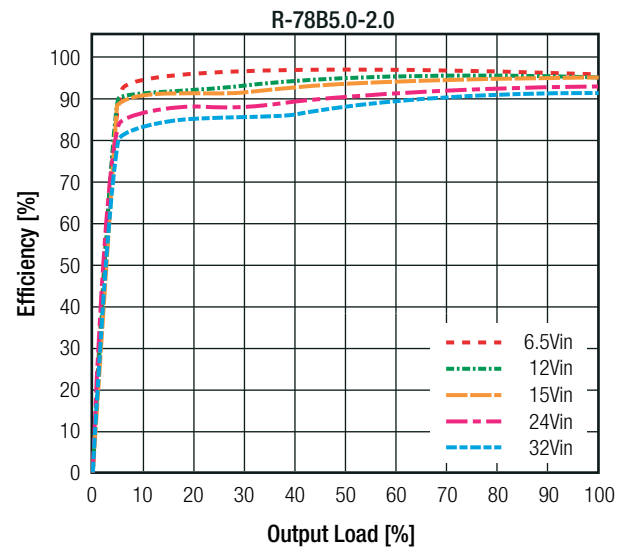
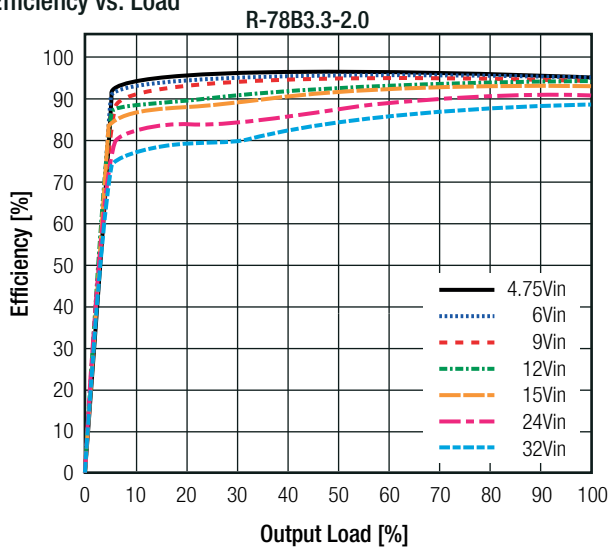
### BASIC CHARACTERISTICS

| Parameter                              | Condition       |                            | Min.    | Typ.               | Max.  |
|--|-----------------|----------------------------|---------|--------------------|-------|
| Input Voltage Range                    | nom. Vin= 24VDC | 1.2Vout - 3.3Vout          | 4.75VDC | 24VDC              | 32VDC |
|  |                 | 5Vout                      | 6.5VDC  |                    |       |
|  |                 | 9Vout                      | 11VDC   |                    |       |
|  |                 | 12Vout                     | 15VDC   |                    |       |
|  |                 | 15Vout                     | 18VDC   |                    |       |
| 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 |       |

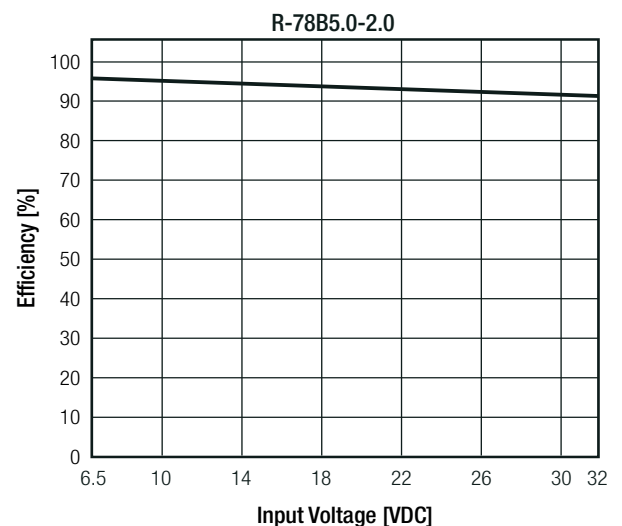
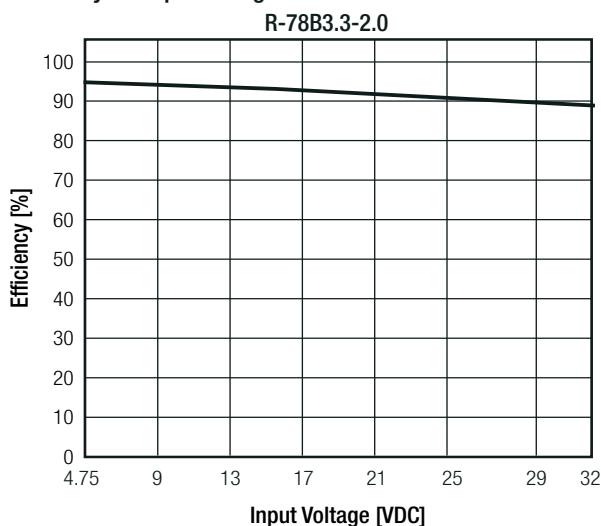
**Notes:**

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**

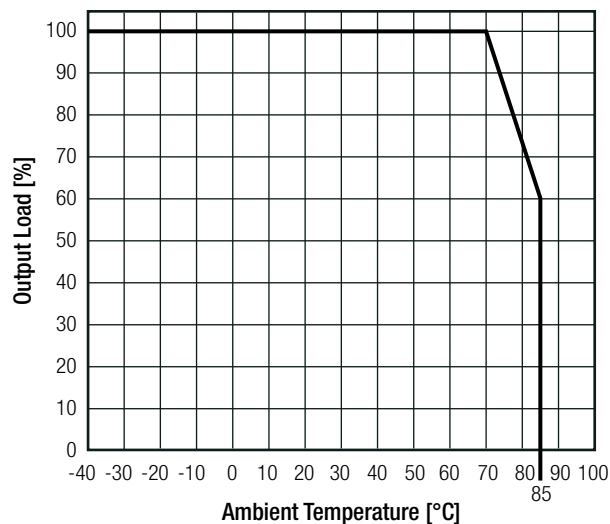
| Parameter                      | Condition       | Value                                      |
|--------------------------------|-----------------|--|
| Short Circuit Protection (SCP) | below 100mΩ     | continuous, automatic recovery             |
| Short Circuit Input Current    | nom. Vin= 24VDC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

**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<br>6349 x 10 <sup>3</sup> hours    |

**Derating Graph**

(@ Chamber and natural convection 0.1 m/s)



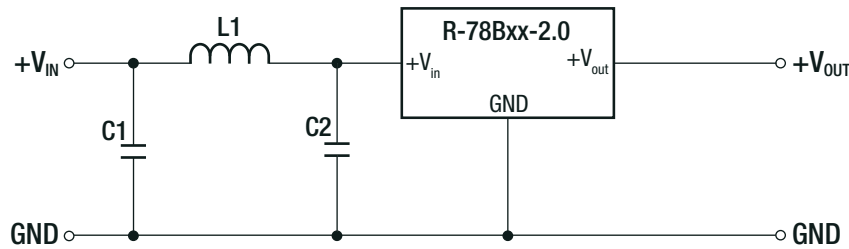
**Specifications** (measured @ Ta= 25°C, nom. Vin, full load and after warm up unless otherwise specified)

**SAFETY AND CERTIFICATIONS**

| Certificate Type (Safety)   | Report / File Number | Standard   |
|---|----------------------|--|
| Audio/video, information and communication technology equipment 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**



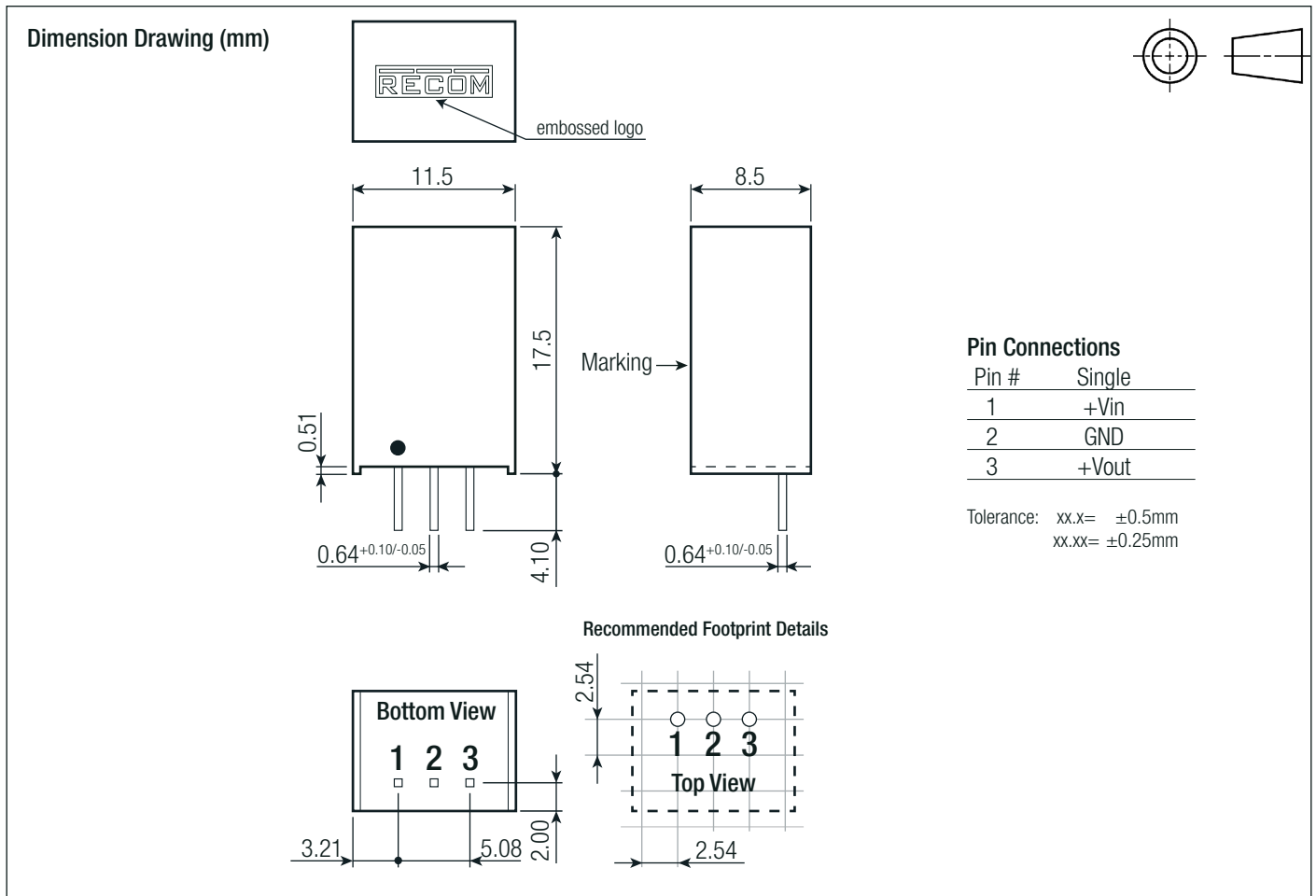
| EN55022 | C1                  | C2                  | L1          |
|---------|---------------------|---------------------|-------------|
| Class A | 4.7µF 50V MLCC 1206 | N/A                 | 3.3µH Choke |
| Class B | 10µF 50V MLCC 1210  | 4.7µF 50V MLCC 1206 | 10µH Choke  |

**DIMENSION and PHYSICAL CHARACTERISTICS**

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

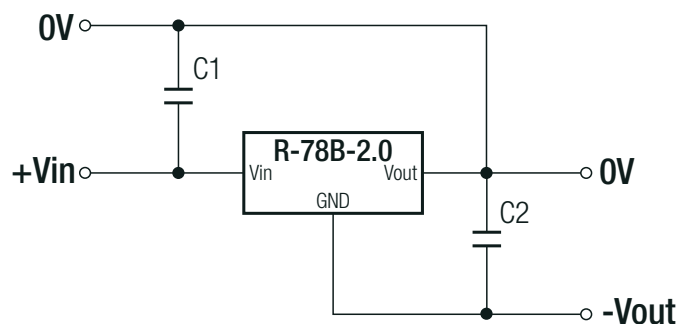
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Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm up unless otherwise specified)



## INSTALLATION and APPLICATION

### Positive to Negative



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

**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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