

Features

Regulated Converters

- Wide 4:1 Input Voltage Range
- 1.6kVDC Isolation
- Efficiency up to 89%
- Six-Sided Continuous Shield
- EN50155, UL60950 Certified



RP20-FR

20 Watt
2" x 1"
Single & Dual
Output



Description

The RP20-FR series wide range input DC/DC converters are certified to UL60950-1 and cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required. The 110VDC input versions have been especially designed for railway applications.

Selection Guide

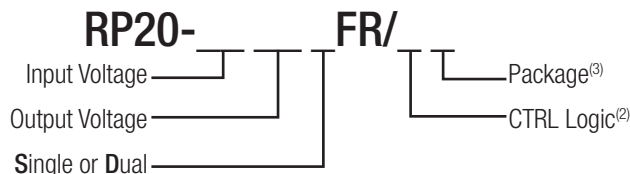
| Part Number | Input Voltage Range [VDC] | Output Voltage [VDC] | Output Current [mA] | Input ⁽¹⁾ Current [mA] | Efficiency ⁽¹⁾ typ. [%] | Max. Capacitive Load [μF] |
|---------------------------------|---------------------------|----------------------|---------------------|-----------------------------------|------------------------------------|---------------------------|
| RP20-243.3SFR ^(2,3) | 9-36 | 3.3 | 4500 | 728 | 85 | 7000 |
| RP20-2405SFR ^(2,3) | 9-36 | 5 | 4000 | 947 | 88 | 5000 |
| RP20-2412SFR ^(2,3) | 9-36 | 12 | 1670 | 938 | 89 | 850 |
| RP20-2415SFR ^(2,3) | 9-36 | 15 | 1330 | 945 | 88 | 700 |
| RP20-483.3SFR ^(2,3) | 18-75 | 3.3 | 4500 | 364 | 85 | 7000 |
| RP20-4805SFR ^(2,3) | 18-75 | 5 | 4000 | 473 | 88 | 5000 |
| RP20-4812SFR ^(2,3) | 18-75 | 12 | 1670 | 469 | 89 | 850 |
| RP20-4815SFR ^(2,3) | 18-75 | 15 | 1330 | 467 | 89 | 700 |
| RP20-1103.3SFR ^(2,3) | 43-160 | 3.3 | 4500 | 159 | 85 | 7000 |
| RP20-11005SFR ^(2,3) | 43-160 | 5 | 4000 | 209 | 87 | 5000 |
| RP20-11012SFR ^(2,3) | 43-160 | 12 | 1670 | 207 | 88 | 850 |
| RP20-11015SFR ^(2,3) | 43-160 | 15 | 1330 | 206 | 88 | 700 |
| RP20-2412DFR ^(2,3) | 9-36 | ±12 | ±833 | 947 | 88 | ±500 |
| RP20-2415DFR ^(2,3) | 9-36 | ±15 | ±667 | 937 | 89 | ±350 |
| RP20-4812DFR ^(2,3) | 18-75 | ±12 | ±833 | 473 | 88 | ±500 |
| RP20-4815DFR ^(2,3) | 18-75 | ±15 | ±667 | 468 | 89 | ±350 |
| RP20-11012DFR ^(2,3) | 43-160 | ±12 | ±833 | 207 | 88 | ±500 |
| RP20-11015DFR ^(2,3) | 43-160 | ±15 | ±667 | 204 | 89 | ±350 |

Notes:

Note1: at nominal input voltage and full load



Model Numbering



Ordering Examples

- RP20-2405SFR/P = 24V Input, 5V Output, Positive Logic CTRL pin and Trim pin fitted
- RP20-4812DFR/N-HC = 48V Input, ±12V Output, Negative Logic CTRL pin, with fitted Heat-sink
- RP20-2405SFR/XC = 24V Input, 5V Output, no CTRL pin and Trim pin fitted

Notes:

- Note2: standard part is with suffix "P" for positive logic (1=ON, 0=OFF) and trim pin or add suffix "N" instead for negative logic (0=ON, 1=OFF) and trim pin or add suffix "XC" instead for no CTRL pin (0=ON, 1=OFF) and trim pin
- Note3: add suffix "-HC" for premounted Heat-sink with clamps

EN50155 Certified
UL60950 Certified
CSA C22.2 No.601.1 Certified

Specifications measured at Ta = 25°C, nominal input voltage, full load otherwise noted

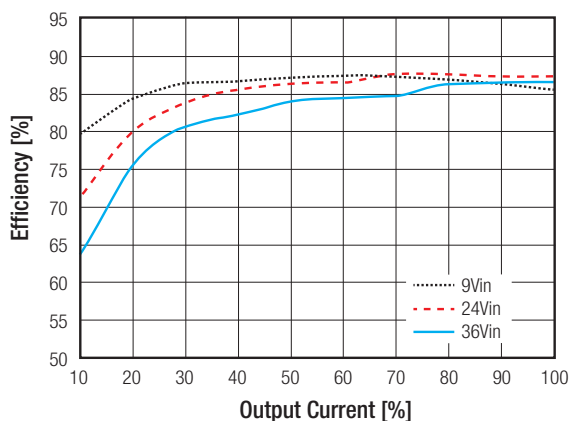
| BASIC CHARACTERISTICS | | | | | |
|------------------------------------|---|--|--|---|---------------------------|
| Parameter | Condition | | Min. | Typ. | Max. |
| Input Voltage Range | nom. Vin = 24V nom. Vin = 48V nom. Vin = 110V | | 9VDC 18VDC 43VDC | 24VDC 48VDC 110VDC | 36VDC 75VDC 160VDC |
| Under Voltage Lockout (UVLO) | Vin = 24V | DC-DC ON DC-DC OFF | | 8VDC | 9VDC |
| | Vin = 48V | DC-DC ON DC-DC OFF | | 16VDC | 18VDC |
| | Vin = 110V | DC-DC ON DC-DC OFF | | 40VDC | 43VDC |
| Input Filter | 24Vin, 48Vin | | Common Mode Choke | | |
| | 110Vin | | Pi-Type | | |
| Input Reflected Ripple Current | nominal Vin and full load | | | 30mA _{p-p} | |
| Input Surge Voltage | Vin = 24V, 100 ms max. Vin = 48V, 100 ms max. Vin = 110V, 100 ms max. | | | | 50VDC 100VDC 170VDC |
| Start-up time | Power up | | | | 30ms |
| | Remote ON/OFF | | | | 30ms |
| Operating Frequency Range | | | 297kHz | 330kHz | 363kHz |
| Ripple and Noise | measured by 20Mhz bandwidth with a 1µF/50V X7R MLCC | 3.3V _{out} , 5V _{out} 12V _{out} , 15V _{out} | | 75mV _{p-p} 100mV _{p-p} | |
| Remote ON/OFF ⁽⁴⁾ | Positive Logic | DC-DC ON DC-DC OFF | Open or 3.0V < Vr < 15V Short or 0V < Vr < 1.2V | | |
| | Negative Logic | DC-DC ON DC-DC OFF | Short or 0V < Vr < 1.2V Open or 3.0V < Vr < 15V | | |
| Input current of Remote pin (CTRL) | DC-DC OFF | | | 2.5mA | |
| | DC-DC ON | | -0.5mA | | 1.0mA |

Notes:

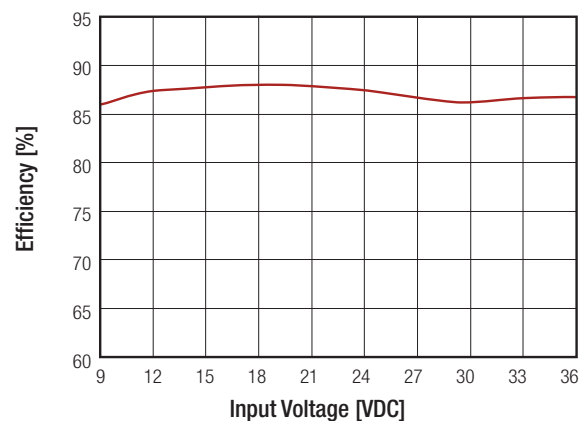
Note4: The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to -Vin pin.
If no suffix is specified, the control pin will be omitted.

RP20-2405SFR

Efficiency vs. Output Current



Efficiency vs. Input Voltage full load

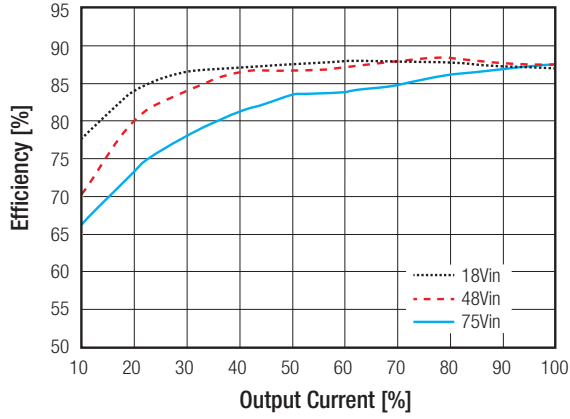


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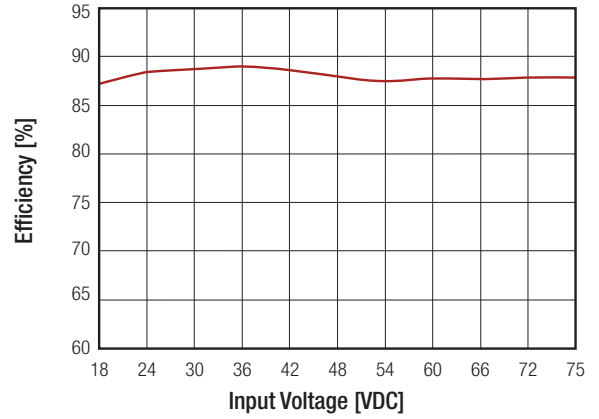
Specifications measured at Ta = 25°C, nominal input voltage, full load otherwise noted

RP20-4805SFR

Efficiency vs. Output Current

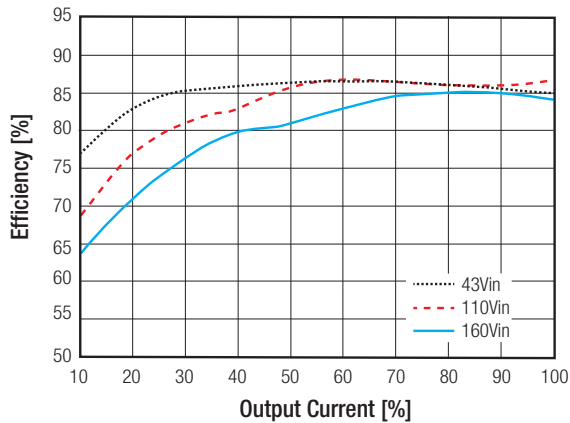


Efficiency vs. Input Voltage full load

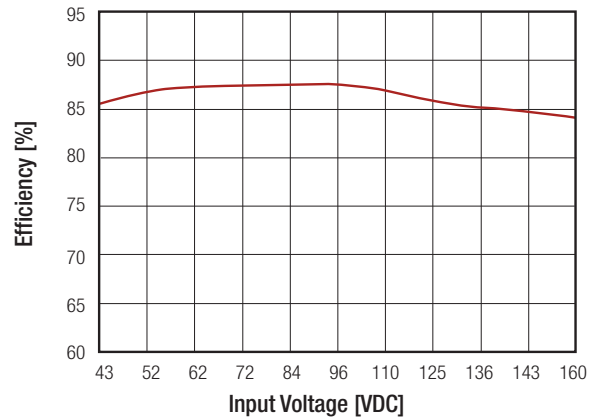


RP20-1105SFR

Efficiency vs. Output Current



Efficiency vs. Input Voltage full load



REGULATIONS

| Parameter | Condition | | Value |
|----------------------------------|------------------------------------|--------|------------|
| Output Voltage Accuracy | full load and nominal Vin | | ±1% |
| Voltage Adjustability | Single | | ±10% |
| Line Voltage Regulation | low line to high line at full load | Single | ±0.2% |
| | | Dual | ±0.5% |
| Load Voltage Regulation | 0% to 100% load | Single | ±0.2% |
| | | Dual | ±1.0% |
| Load Voltage Regulation | 10% load to 90% load | Single | ±0.1% |
| | | Dual | ±0.8% |
| Cross Regulation | asymmetrical 25% <> 100% load | | ±5% |
| Transient Response recovery time | 25% load step change | | 250µs typ. |

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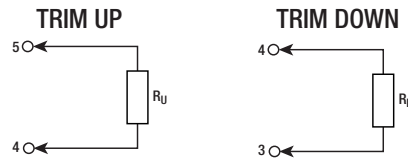
Specifications measured at $T_a = 25^\circ\text{C}$, nominal input voltage, full load otherwise noted

External Output Trimming

Output Voltage Trimming

Single output Powerline converters offer the feature of trimming the output voltage over a certain range around the nominal value by using external trim resistors. No general equation can be given for calculating the trim resistors, but the following trimtables give typical values for choosing these trimming resistors. If voltages between the given trim points are required, extrapolate between the two nearest given values to work out the resistor required or use a variable resistor to set the output voltage.

Output can be externally trimmed by using the method shown below.



RP20-xx3.3SFR

| Trim up | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
|--------------------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|
| V _{out} = | 3.333 | 3.366 | 3.399 | 3.432 | 3.465 | 3.498 | 3.531 | 3.564 | 3.597 | 3.63 | Volts |
| R _U = | 385.07 | 191.51 | 126.99 | 94.73 | 75.37 | 62.47 | 53.25 | 46.34 | 40.96 | 36.66 | KOhms |
| Trim down | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
| V _{out} = | 3.267 | 3.234 | 3.201 | 3.168 | 3.135 | 3.102 | 3.069 | 3.036 | 3.003 | 2.97 | Volts |
| R _D = | 116.72 | 54.78 | 34.13 | 23.81 | 17.62 | 13.49 | 10.54 | 8.33 | 6.60 | 5.23 | KOhms |

RP20-xx05SFR

| Trim up | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
|--------------------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| V _{out} = | 5.05 | 5.10 | 5.15 | 5.20 | 5.25 | 5.30 | 5.35 | 5.4 | 5.45 | 5.50 | Volts |
| R _U = | 253.45 | 125.70 | 83.18 | 61.83 | 49.05 | 40.53 | 34.45 | 29.89 | 26.34 | 23.50 | KOhms |
| Trim down | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
| V _{out} = | 4.95 | 4.90 | 4.85 | 4.80 | 4.75 | 4.70 | 4.65 | 4.60 | 4.55 | 4.50 | Volts |
| R _D = | 248.34 | 120.59 | 78.01 | 56.72 | 43.94 | 35.42 | 29.34 | 24.78 | 21.23 | 18.39 | KOhms |

RP20-xx12SFR

| Trim up | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
|--------------------|--------|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|
| V _{out} = | 12.12 | 12.24 | 12.36 | 12.48 | 12.60 | 12.72 | 12.84 | 12.96 | 13.08 | 13.20 | Volts |
| R _U = | 203.22 | 99.06 | 64.33 | 46.97 | 36.56 | 29.61 | 24.65 | 20.93 | 18.04 | 15.72 | KOhms |
| Trim down | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
| V _{out} = | 11.88 | 11.76 | 11.64 | 11.52 | 11.40 | 11.28 | 11.16 | 11.04 | 10.92 | 10.8 | Volts |
| R _D = | 776.56 | 380.72 | 248.78 | 182.81 | 143.22 | 116.83 | 97.99 | 83.84 | 72.85 | 64.06 | KOhms |

RP20-xx15SFR

| Trim up | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
|--------------------|--------|--------|--------|--------|--------|--------|--------|-------|-------|-------|-------|
| V _{out} = | 15.15 | 15.3 | 15.45 | 15.60 | 15.75 | 15.90 | 16.05 | 16.20 | 16.35 | 16.50 | Volts |
| R _U = | 161.56 | 78.22 | 50.45 | 36.56 | 28.22 | 22.67 | 18.70 | 15.72 | 13.41 | 11.56 | KOhms |
| Trim down | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | % |
| V _{out} = | 14.85 | 14.70 | 14.55 | 14.40 | 14.25 | 14.10 | 13.95 | 13.80 | 13.65 | 13.50 | Volts |
| R _D = | 515.22 | 401.56 | 262.67 | 193.22 | 151.56 | 123.78 | 103.94 | 89.06 | 77.48 | 68.22 | KOhms |

Specifications measured at Ta = 25°C, nominal input voltage, full load otherwise noted

PROTECTIONS

| Parameter | Condition | Value |
|--------------------------------|--------------------|--------------------------------|
| Short Circuit Protection (SCP) | | continuous, automatic recovery |
| Over Voltage Protection (OVP) | Zener Diode Clamp | 3.3Vout |
| | | 5Vout |
| | | 12Vout |
| | | 15Vout |
| Over Load Protection (OLP) | % Iout rated | 150% typ. |
| Isolation Voltage | I/P to O/P | 1.6kVDC/1minute |
| | I/P to O/P to case | 1.6kVDC/1minute |
| Isolation Resistance | 500 VDC | 1GΩ min. |
| Isolation Capacitance | | 3000pF max. |

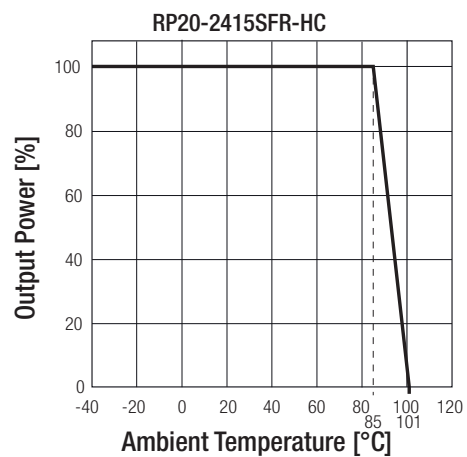
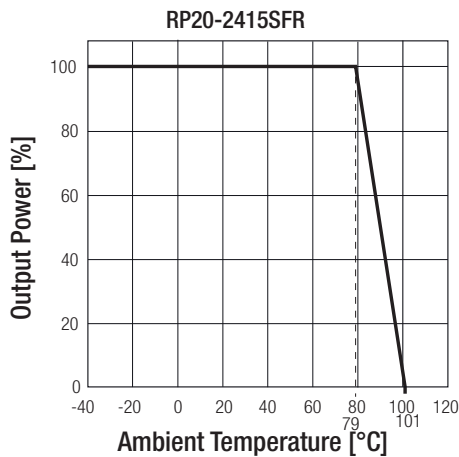
Notes:

Note5: This power module is not internally fused. An input line fuse must always be used.

ENVIRONMENTAL

| Parameter | Condition | Value |
|-----------------------------|--|------------------------------|
| Operating Temperature Range | without derating | -40°C to +79°C |
| | with derating | -40°C to +101°C |
| Maximum Case Temperature | | +105°C |
| Temperature Coefficient | | ±0.02%/°C max. |
| Thermal Impedance | Natural convection (20LFM) without Heat-sink | 12°C/W |
| | Natural convection (20LFM) with Heat-sink | 10°C/W |
| Operating Humidity | | 5% - 95% RH |
| Shock | | EN61373, MIL-STD-810F |
| Thermal Shock | | MIL-STD-810F |
| Vibration | | EN61373, MIL-STD-810F |
| MTBF | MIL-HDBK-217F | 1523 x 10 ³ hours |

Derating Graph⁽⁶⁾



Notes:

Note6: Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at techsupportAT@recom-power.com

Specifications measured at Ta = 25°C, nominal input voltage, full load otherwise noted

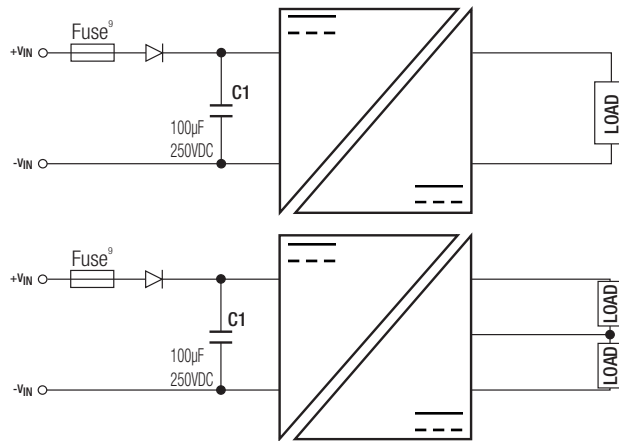
| SAFETY AND CERTIFICATIONS | | |
|---|-------------------------------|---|
| Certificate Type (Safety) | Report / File Number | Standard |
| Information Technology Equipment, General Requirements for Safety | E196683 | UL60950-1, 2nd Edition CSA C22.2 No. 601.1 |
| Railway Applications - Electrical Equipment used on rolling stock | 15A100704E-C | EN50155 |
| EMI Compliance | Condition | Standard / Criterion |
| Industrial, scientific and medical equipment - Radio frequency disturbance characteristics - Limits and methods of measurement ⁽⁷⁾ | | EN55011, Class A and B |
| Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement ⁽⁷⁾ | | EN55022, Class A and B |
| ESD Electrostatic discharge immunity test | Air ±8kV and Contact ±6kV | EN61000-4-2, Criteria A |
| Radiated, radio-frequency, electromagnetic field immunity test | 10 V/m | EN61000-4-3, Criteria A |
| Fast Transient and Burst Immunity ⁽⁸⁾ | ±2kV | EN61000-4-4, Criteria A |
| Surge Immunity ⁽⁸⁾ | ±2kV | EN61000-4-5, Criteria A |
| Immunity to conducted disturbances, induced by radio-frequency fields | 10 Vr.m.s | EN61000-4-6, Criteria A |
| Power Magnetic Field Immunity | 100A/m continuous; 1000A/m 1s | EN61000-4-8, Criteria A |

Notes:

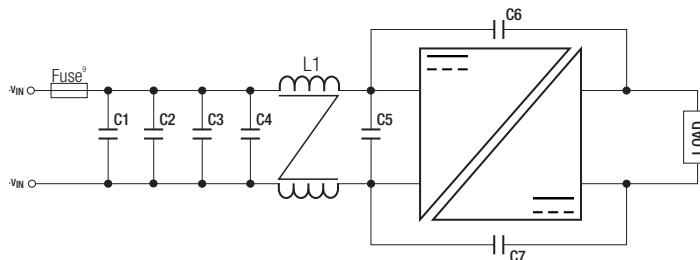
Note7: The 24VDC & 48VDC input standard modules meet EN55022 & EN55011 Class B without external components, 110VDC input meet EN55022 Class A without external components and meet Class B with external components.

Note8: An external input filter capacitor is required if the module has to meet EN61000-4-4, -5.
The filter Recom suggests: 24VDC and 48VDC input. Nippon chemi-con KY series, 220µF/100V.
110VDC input: Rubycon BXF series, 100µF/250V

EMC Railway Class A

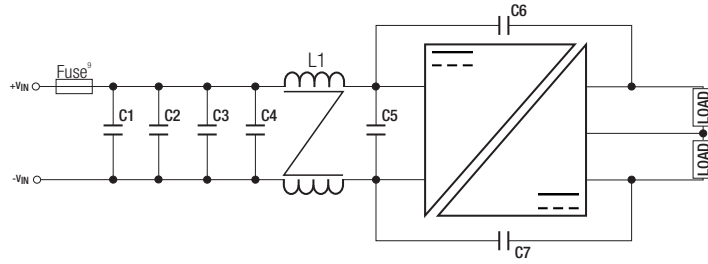


EMC Filtering Class B



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Specifications measured at Ta = 25°C, nominal input voltage, full load otherwise noted



| MODEL | C1 | C2/C3/C4 | C7 | L1 |
|---------------|---|--------------------------|-------------------------|--------------------------------------|
| RP20-110xxSFR | 39µF/250V Al Cap. (lie down) Rubycon BX | 0.47µF/250V 1812 MLCC | 1000pF/3kV 1808 MLCC | CMC: 470µH ref.: WE-SL5 744272471 |

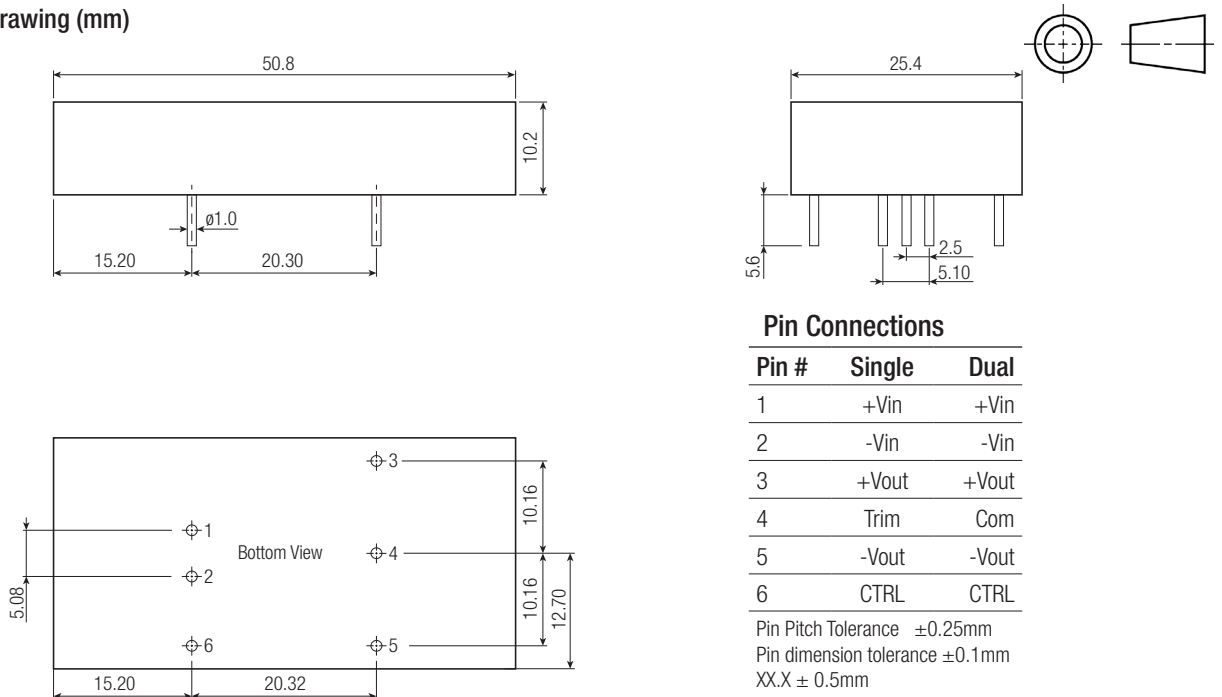
Notes:

Note9: Use fuse or over-current protection.

DIMENSIONS and PHYSICAL CHARACTERISTICS

| Parameter | Type | Value |
|-----------------------------|-------------------|----------------------|
| Material | Case | Nickel coated copper |
| | Base | FR4 PCB |
| | Potting | Silicone (UL94V-0) |
| Packaging Dimension (LxWxH) | without Heat-sink | 50.8 x 25.4 x 10.2mm |
| | with Heat-sink | 56.8 x 25.4 x 16.8mm |
| Packaging Weight | without Heat-sink | 30g |
| | with Heat-sink | 41g |

Dimension Drawing (mm)

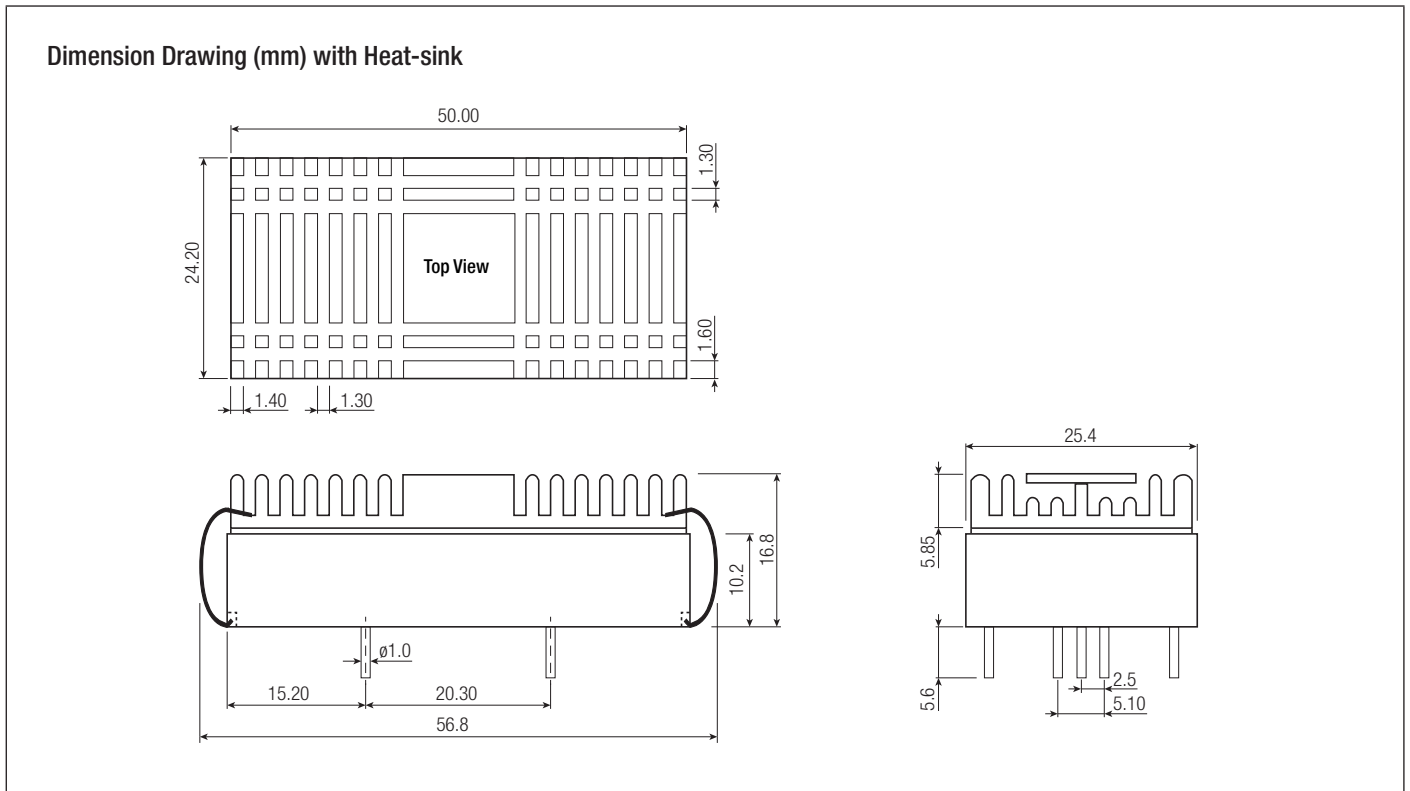


Pin Connections

| Pin # | Single | Dual |
|-------|--------|-------|
| 1 | +Vin | +Vin |
| 2 | -Vin | -Vin |
| 3 | +Vout | +Vout |
| 4 | Trim | Com |
| 5 | -Vout | -Vout |
| 6 | CTRL | CTRL |

Pin Pitch Tolerance ±0.25mm
Pin dimension tolerance ±0.1mm
XX.X ± 0.5mm
XX.XX ± 0.25mm

Specifications measured at Ta = 25°C, nominal input voltage, full load otherwise noted



PACKAGING INFORMATION

| Parameter | Type | Value |
|-----------------------------|------------------------|--------------------|
| Packaging Dimension (LxWxH) | Tube | 255 x 55 x 22mm |
| | Tray | 302.5 x 222 x 28mm |
| Packaging Quantity | without Heat-sink Tube | 9pcs. |
| | with Heat-sink Tray | 20pcs. |
| Storage Temperature Range | | -55°C to +125°C |
| Storage Humidity | | 5% - 95% RH |