# Features

# Regulated Converter

- Wide 4:1 input voltage range
- 1.6kVDC isolation
- UL certified
- Efficiency up to 89%
- Six-sided continuous shield

RECOM
DC/DC Converter

# RP20-FW

## 20 Watt 2“ x 1“ Single and Dual Output

## Description

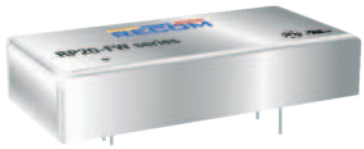
The RP20-FW series wide range input DC/DC converters are certified to UL 60950-1 and to cUL 60950-1. This makes them ideal for all telecom and industrial applications where approved safety standards are required. The industry standard 2” x 1” package meets military standards for thermal shock and vibration tolerance.

## Selection Guide

| Part Number | Input Voltage Range [VDC] | Output Voltage [VDC] | Output Current [mA] | Input (1) Current [mA] | Efficiency (1) typ. [%] | Max. Capacitive Load (2) [µF] |
|---|---|---|---|---|---|---|
| RP20-243.3SFW (3,4) | 9-36 | 3.3 | 5500 | 890 | 85 | 18000 |
| RP20-2405SFW (3,4) | 9-36 | 5 | 4000 | 947 | 88 | 9600 |
| RP20-2412SFW (3,4) | 9-36 | 12 | 1670 | 971 | 86 | 1650 |
| RP20-2415SFW (3,4) | 9-36 | 15 | 1330 | 967 | 86 | 1050 |
| RP20-483.3SFW (3,4) | 18-75 | 3.3 | 5500 | 445 | 85 | 18000 |
| RP20-4805SFW (3,4) | 18-75 | 5 | 4000 | 473 | 88 | 9600 |
| RP20-4812SFW (3,4) | 18-75 | 12 | 1670 | 480 | 87 | 1650 |
| RP20-4815SFW (3,4) | 18-75 | 15 | 1330 | 478 | 87 | 1050 |
| RP20-2405DFW (3,4) | 9-36 | ±5 | ±2000 | 947 | 88 | ±4800 |
| RP20-2412DFW (3,4) | 9-36 | ±12 | ±833 | 957 | 87 | ±825 |
| RP20-2415DFW (3,4) | 9-36 | ±15 | ±667 | 958 | 87 | ±525 |
| RP20-4805DFW (3,4) | 18-75 | ±5 | ±2000 | 468 | 89 | ±4800 |
| RP20-4812DFW (3,4) | 18-75 | ±12 | ±833 | 473 | 88 | ±825 |
| RP20-4815DFW (3,4) | 18-75 | ±15 | ±667 | 474 | 88 | ±525 |

**Notes:**

Note1: Maximum values at nominal input voltage and full load
Note2: Max. Cap load is tested at minimum input and constant resistive load



UL60950-1 certified

## Model Numbering

RP20-_____FW/_-

- nom. Input Voltage
- Output Voltage
- Single or Dual
- *“Package (4)”*
- *“CTRL Logic (3)”*

**Notes:**

Note3: no suffix for CTRL function with positive logic (1=ON, 0=OFF)
add suffix “N” for CTRL function with negative logic (0=ON, 1=OFF)
Note4: add suffix “-HC” for premounted Heat-sink with clips

**Ordering Examples**

RP20-2405SFW = 24V input, 5V output, single, positive Logic CTRL pin
RP20-4812DFW/N-HC = 48V input, ±12V output, dual, negative Logic CTRL pin, Heat-sink premounted

## Specifications (measured @ Ta= 25°C, nom. Vin, full load unless otherwise stated)

### BASIC CHARACTERISTICS

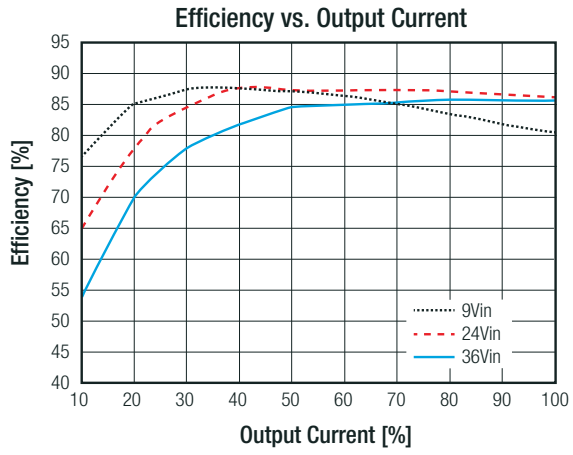
| Parameter | Condition | | Min. | Typ. | Max. |
|---|---|---|---|---|---|
| Input Filter | | | | | Pi-Type |
| Input Voltage Range | nom. Vin = 24VDC<br>nom. Vin = 48VDC | | 9VDC<br>18VDC | 24VDC<br>48VDC | 36VDC<br>75VDC |
| Input Surge Voltage | 100ms max. | nom. Vin = 24VDC<br>nom. Vin = 48VDC | | | 50VDC<br>100VDC |
| Under Voltage Lockout (UVLO) | nom. Vin = 24VDC | DC-DC ON<br>DC-DC OFF | | 7.5VDC | 9VDC |
| | nom. Vin = 48VDC | DC-DC ON<br>DC-DC OFF | | 15VDC | 18VDC |
| Output Voltage Trimming | refer to ***„OUTPUT VOLTAGE TRIMMING“*** | | -10% | | +10% |
| Input Reflected Ripple Current | | | | 20mAp-p | |
| Minimum Load [5] | | | 0% | | |
| Start-up Time | Power up<br>ON/OFF CTRL | | | 20ms<br>20ms | |
| ON/OFF CTRL [6] | Positive Logic | DC-DC ON<br>DC-DC OFF | | | Open or 3.0VDC < $V_{CTRL}$< 12VDC<br>Short or 0VDC < $V_{CTRL}$< 1.2VDC |
| | Negative Logic | DC-DC ON<br>DC-DC OFF | | | Short or 0VDC < $V_{CTRL}$< 1.2VDC<br>Open or 3.0VDC < $V_{CTRL}$< 12VDC |
| Input Current of CTRL pin | DC-DC ON | | -0.5mA | | +0.5mA |
| Standby Current | DC-DC OFF | | | 2mA | |
| Internal Operating Frequency | | | 360kHz | 400kHz | 440kHz |
| Ripple and Noise | measured at 20MHz BW<br>with a 0.1µF/50V MLCC | 3.3Vout<br>5Vout, 12Vout, 15Vout | | 60mVp-p<br>75mVp-p | |
| | | ±5Vout, ±12Vout, ±15Vout | | 100mVp-p | |

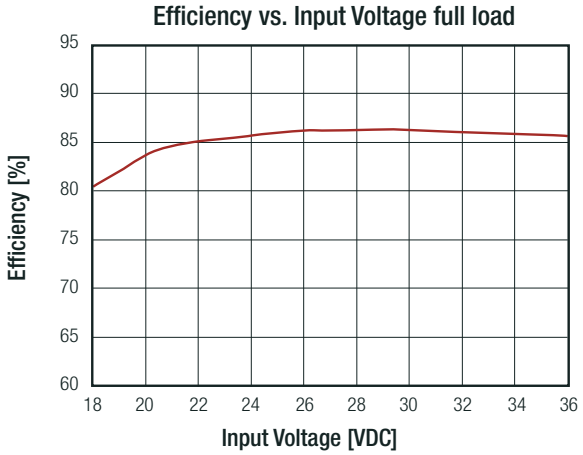
**Notes:**

Note5: The RP20-FW series requires a minimum of 10% loading on the output to maintain specified regulation. Operation under no-load condition will not damage these devices, however they may not meet all listed specification

Note6: The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to -Vin pin

**RP20-2405SFW**



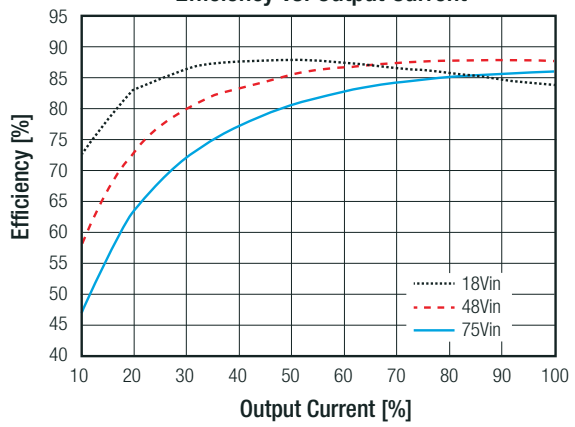




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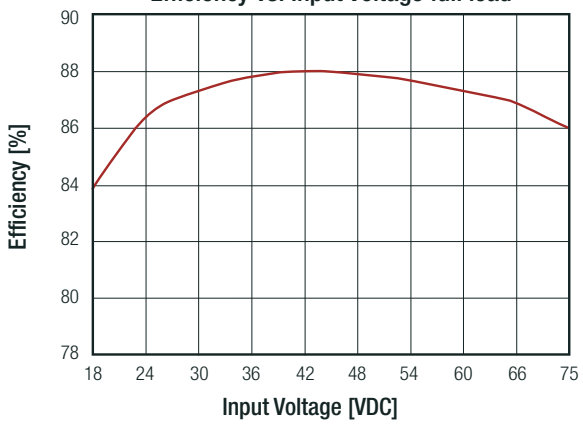
## Specifications (measured @ Ta= 25°C, nom. Vin, full load unless otherwise stated)

### RP20-4805SFW

Efficiency vs. Output Current



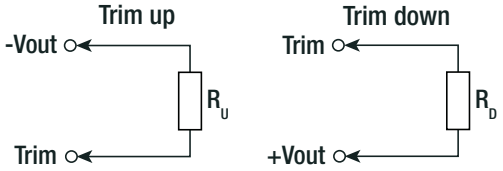

Efficiency vs. Input Voltage full load




## OUTPUT VOLTAGE 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-xx3.3SFW

| Trim up | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | [%] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Vout = | 3.333 | 3.366 | 3.399 | 3.432 | 3.465 | 3.498 | 3.531 | 3.564 | 3.597 | 3.63 | [VDC] |
| $R_U$ = | 57.93 | 26.16 | 15.58 | 10.28 | 7.11 | 4.99 | 3.48 | 2.34 | 1.46 | 0.75 | [kΩ] |
| | | | | | | | | | | | |
| Trim down | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | [%] |
| Vout = | 3.267 | 3.234 | 3.201 | 3.168 | 3.135 | 3.102 | 3.069 | 3.036 | 3.003 | 2.97 | [VDC] |
| $R_D$ = | 69.47 | 31.23 | 18.49 | 12.12 | 8.29 | 5.74 | 3.92 | 2.56 | 1.50 | 0.65 | [kΩ] |

### RP20-xx05SFW

| Trim up | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | [%] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Vout = | 5.05 | 5.10 | 5.15 | 5.20 | 5.25 | 5.30 | 5.35 | 5.4 | 5.45 | 5.50 | [VDC] |
| $R_U$ = | 36.57 | 16.58 | 9.92 | 6.58 | 4.59 | 3.25 | 2.30 | 1.59 | 1.03 | 0.59 | [kΩ] |
| | | | | | | | | | | | |
| Trim down | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | [%] |
| Vout = | 4.95 | 4.90 | 4.85 | 4.80 | 4.75 | 4.70 | 4.65 | 4.60 | 4.55 | 4.50 | [VDC] |
| $R_D$ = | 45.53 | 20.61 | 12.31 | 8.15 | 5.66 | 4.00 | 2.81 | 1.92 | 1.23 | 0.68 | [kΩ] |

continued on next page

## Specifications (measured @ Ta= 25°C, nom. Vin, full load unless otherwise stated)

| RP20-xx12SFW | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Trim up | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | [%] |
| Vout = | 12.12 | 12.24 | 12.36 | 12.48 | 12.60 | 12.72 | 12.84 | 12.96 | 13.08 | 13.20 | [VDC] |
| $R_U$ = | 367.91 | 165.95 | 98.64 | 64.98 | 44.78 | 31.32 | 21.70 | 14.49 | 8.88 | 4.39 | [kΩ] |
| | | | | | | | | | | | |
| Trim down | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | [%] |
| Vout = | 11.88 | 11.76 | 11.64 | 11.52 | 11.40 | 11.28 | 11.16 | 11.04 | 10.92 | 10.8 | [VDC] |
| $R_D$ = | 460.99 | 207.95 | 123.60 | 81.42 | 56.12 | 39.25 | 27.20 | 18.16 | 11.13 | 5.51 | [kΩ] |

| RP20-xx15SFW | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Trim up | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | [%] |
| Vout = | 15.15 | 15.3 | 15.45 | 15.60 | 15.75 | 15.90 | 16.05 | 16.20 | 16.35 | 16.50 | [VDC] |
| $R_U$ = | 404.18 | 180.59 | 106.06 | 68.80 | 46.44 | 31.53 | 20.88 | 12.90 | 6.69 | 1.72 | [kΩ] |
| | | | | | | | | | | | |
| Trim down | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | [%] |
| Vout = | 14.85 | 14.70 | 14.55 | 14.40 | 14.25 | 14.10 | 13.95 | 13.80 | 13.65 | 13.50 | [VDC] |
| $R_D$ = | 499.82 | 223.41 | 131.27 | 85.20 | 57.56 | 39.14 | 25.97 | 16.10 | 8.42 | 2.282 | [kΩ] |

## REGULATIONS

| Parameter | Condition | | Value |
|---|---|---|---|
| Output Accuracy | | | ±1.0% |
| Line Regulation | low line to high line, full load | Single<br>Dual | ±0.2%<br>±0.5% |
| Load Regulation | 0% to 100% load | Single<br>Dual | ±0.5%<br>±1.0% |
| Cross Regulation | asymmetrical 25%<>100% load | | ±5.0% |
| Transient Response Recovery Time | 25% load step change | | 250µs |

## PROTECTIONS

| Parameter | Condition | | Value |
|---|---|---|---|
| Short Circuit Protection (SCP) | | | continuous, automatic recovery |
| Over Voltage Protection (OVP) | zener diode clamp | 3.3Vout<br>5Vout<br>12Vout<br>15Vout | 3.9VDC<br>6.2VDC<br>15VDC<br>18VDC |
| Over Load Protection (OLP) | % Iout rated | | 150% typ. |
| Isolation Voltage (7) | I/P to O/P<br>I/P to O/P to case | | 1.6kVDC/ 1 minute<br>1.6kVDC/ 1 minute |
| Isolation Resistance | Viso= 500VDC | | 1GΩ min. |
| Isolation Capacitance | | | 1500pF max. |

**Notes:**

Note7: For repeat Hi-Pot testing, reduce the time and/or the test voltage

Note8: This power module is not internally fused. An input line fuse must always be used

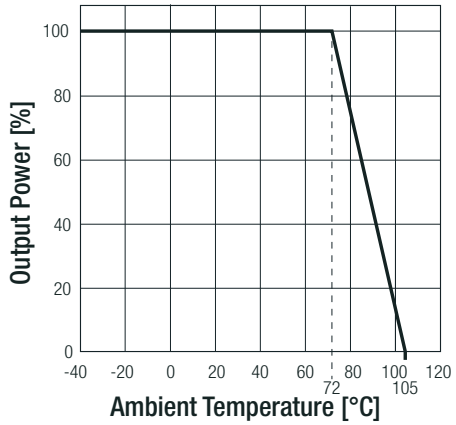
## Specifications (measured @ Ta= 25°C, nom. Vin, full load unless otherwise stated)

### ENVIRONMENTAL

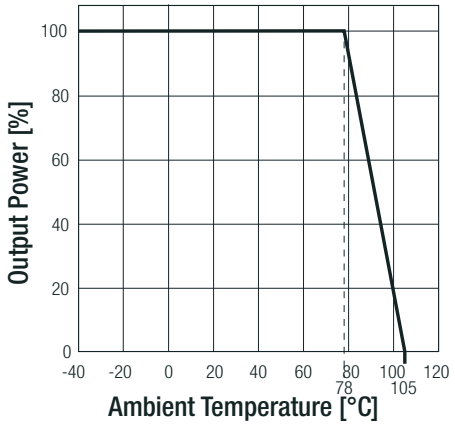
| Parameter | Condition | | Value |
|---|---|---|---|
| Operating Temperature Range | without derating<br>with derating | | -40°C to +72°C<br>-40°C to +105°C |
| Maximum Case Temperature | | | +105°C |
| Temperature Coefficient | | | ±0.02%/K max. |
| Thermal Impedance | @ natural convection<br>0.1m/s | without heat-sink<br>with heat-sink | 12K/W<br>10K/W |
| Operating Altitude | | | 2000m |
| Operating Humidity | non-condensing | | 5% - 95% RH |
| Pollution Degree | | | PD2 |
| Thermal Shock | | | according to MIL-STD-810F |
| Vibration | | | according to MIL-STD-810F |
| MTBF | MIL-HDBK-217F, G.B.<br>Bellcore TR-NWT-000332 (9) | | 1851 x $10^3$ hours<br>2350 x $10^3$ hours |

**Derating Graph (10)**

RP20-4805SFW




RP20-4805SFW-HC




**Notes:**

Note9: BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C (Ground fixed and controlled environment)

Note10: 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 RECOM Techsupport for detailed information

### SAFETY AND CERTIFICATIONS

| Certificate Type (Safety) | Condition | Standard |
|---|---|---|
| Information Technology Equipment, General Requirements for Safety | E196683 | UL60950-1, 2nd Edition, 2011<br>CAN/CSA-C22.2 No. 60950-1-03, 2nd Edition, 2011 |
| RoHS 2 | | RoHS-2011/65/EU + AM-2015/863 |

| EMC Compliance | Condition | Standard / Criterion |
|---|---|---|
| Electromagnetic compatibility of multimedia equipment - Emission requirements | with external filter<br>(see filter suggestion below) | EN55032, Class A and B |
| ESD Electrostatic discharge immunity test | Air ±8kV and Contact ±6kV | EN61000-4-2, Criteria B |
| Radiated, radio-frequency, electromagnetic field immunity test | 10 V/m | EN61000-4-3, Criteria A |
| Fast Transient and Burst Immunity (11) | ±2kV | EN61000-4-4, Criteria B |
| Surge Immunity (11) | ±1kV | 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 |

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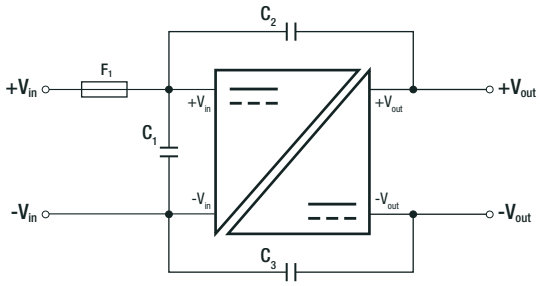
## Specifications (measured @ Ta= 25°C, nom. Vin, full load unless otherwise stated)

**Notes:**

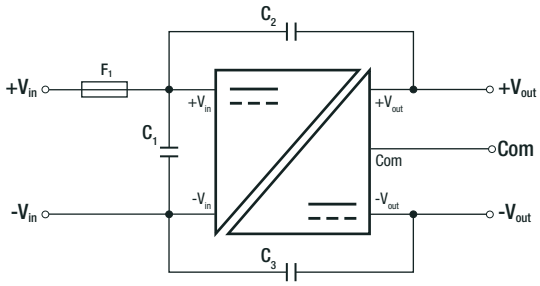
Note11: An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5
Recom suggests Nippon chemi-con KY series 220µF/100V

### EMC Filtering Suggestions according to EN55032

Single



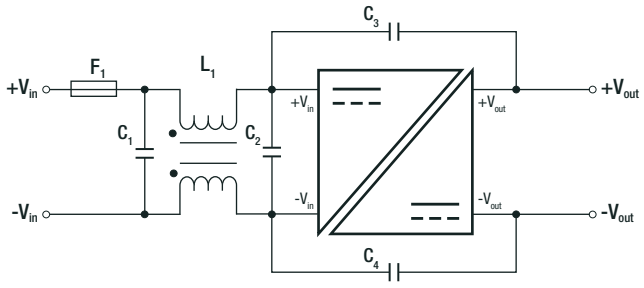

Dual



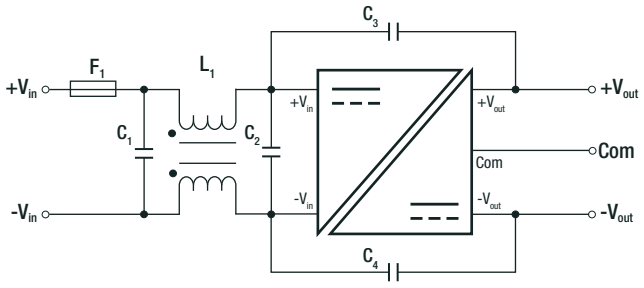

### Component List Class A

| MODEL | C1 | C2 | C3 |
|---|---|---|---|
| RP20-24xxSFW<br>RP20-24xxDFW | N/A | 1000pF/2kV<br>1808 MLCC | 1000pF/2kV<br>1808 MLCC |
| RP20-48xxSFW<br>RP20-48xxDFW | 1µF/100V<br>1210 MLCC | 1000pF/2kV<br>1808 MLCC | 1000pF/2kV<br>1808 MLCC |

Single




Dual




### Component List Class B

| MODEL | C1 | C2 | C3/C4 | L1 |
|---|---|---|---|---|
| RP20-24xxSFW<br>RP20-24xxDFW | 4.7µF/50V<br>1812 MLCC | N/A | 1000pF/2kV<br>1808 MLCC | CMC: 450µH<br>ref.: WE 7448227005 ref.: CMC-05 |
| RP20-48xxSFW<br>RP20-48xxDFW | 2.2µF/100V<br>1812 MLCC | 2.2µF/100V<br>1812 MLCC | 1000pF/2kV<br>1808 MLCC | CMC: 325µH<br>ref: WE 744290321 ref.: CMC-06 |

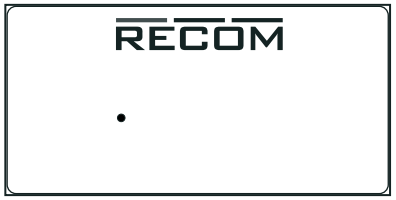
### DIMENSIONS and PHYSICAL CHARACTERISTICS

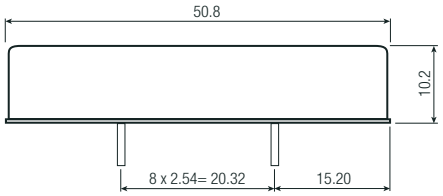
| Parameter | Type | Value |
|---|---|---|
| Material | case<br>base<br>potting | nickel coated copper<br>FR4 PCB<br>epoxy (UL94V-0) |
| Dimensions (LxWxH) | without Heat-sink<br>with Heat-sink | 50.8 x 25.4 x 10.2mm<br>56.8 x 25.4 x 16.8mm |
| Weight | without Heat-sink<br>with Heat-sink | 27g<br>37.89g |

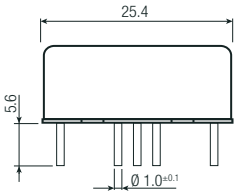
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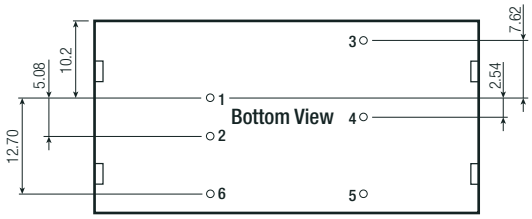
## Specifications (measured @ Ta= 25°C, nom. Vin, full load unless otherwise stated)

### Dimension Drawing (mm)

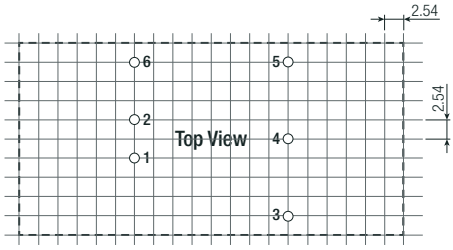


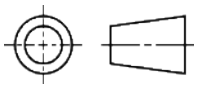




Recommended Footprint Details



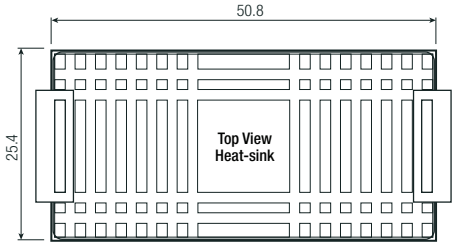



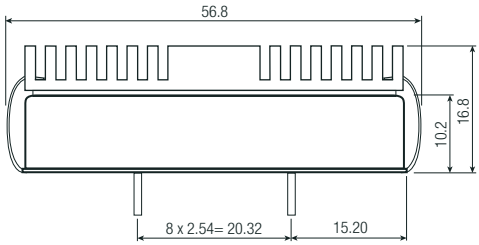
### Pinning Information

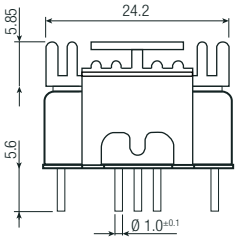
| Pin # | Single | Dual |
|---|---|---|
| 1 | +Vin | +Vin |
| 2 | -Vin | -Vin |
| 3 | +Vout | +Vout |
| 4 | Trim | Com |
| 5 | -Vout | -Vout |
| 6 | CTRL (3) | CTRL (3) |

Tolerance: xx.x= ±0.5mm
xx.xx= ±0.25mm

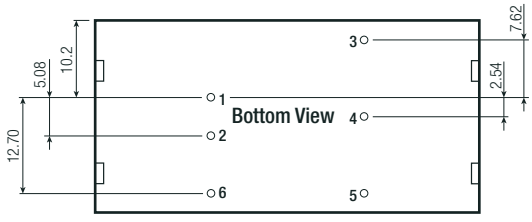
### Dimension Drawing with Heat-sink (mm)

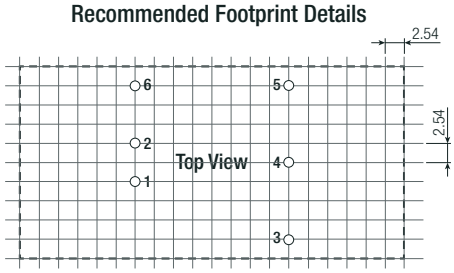



Recommended Footprint Details



## Specifications (measured @ Ta= 25°C, nom. Vin, full load unless otherwise stated)

| PACKAGING INFORMATION | | | |
|---|---|---|---|
| **Parameter** | **Type** | | **Value** |
| Packaging Dimension (LxWxH) | tube<br>tray | without heat-sink<br>with heat-sink | 255.0 x 54.0 x 22.0mm<br>302.5 x 222.0 x 20.0mm |
| Packaging Quantity | tube<br>tray | without heat-sink<br>with heat-sink | 9pcs<br>20pcs |
| Storage Temperature Range | | | -55°C to +125°C |
| Storage Humidity | non-condensing | | 5% - 95% RH |

The product information and specifications may be subject to changes even without prior written notice.The product has been designed for various applications; its suitability lies in the responsibility of each customer. The products are not authorized for use in safety-critical applications without RECOM's explicit written consent. A safety-critical application is an application where a failure may reasonably be expected to endanger or cause loss of life, inflict bodily harm or damage property. The applicant shall indemnify and hold harmless RECOM, its affiliated companies and its representatives against any damage claims in connection with the unauthorized use of RECOM products in such safety-critical applications.