

# RV9-S/D20W

20W Regulated Single & Dual Output DC/DC Converter



Picture similar



- 1.6" x 1" Package
- Wide 4:1 Input Range
- 3000VDC Isolation
- No Minimum Load Required
- Efficiency up to 91%
- Operating Temperature Range -40°C ~ +100°C max.
- Adjustable Output Voltage
- Over Current Protection, Over and Under Voltage Protection
- EMI filter meets EN55032 class A without external components
- Soft Start
- Remote On/Off Control

## Output Specifications

|                                     |   |
|-------------------------------------|---|
| Voltage Accuracy                    | ±1%, max.   |
| Output Voltage Adjustability (Trim) | Single Output: ±10% max.                              |
| Maximum Output Current              | See table   |
| Line Regulation                     | ±0.5% max.  |
| Load Regulation                     | Single: ±0.5% max.<br>Dual: ±1%, max. (balanced load) |
| Cross Regulation (Dual Output)      | ±5%   |
| Over Voltage Protection             | 140% of Vout typ.                                     |
| Over Current Protection             | 170% of FL typ.                                       |
| Short Circuit Protection            | Indefinite (hiccup) (Automatic Recovery)              |
| Ripple & Noise (20 MHz bandwidth)   | 75mV/60mV pk-pk max. (Single/Dual)                    |
| Temperature Coefficient             | ±0.02%/°C   |
| Transient Recovery Time             | 250µs typ.  |
| Transient Response Deviation        | ±3 ~ 5% max.  |

## Input Specifications

|                                      |   |
|--------------------------------------|---|
| Voltage Range                        | See table                                   |
| Start-up Time                        | 30ms typ.                                   |
| No-Load/Full-Load Input Current      | See table                                   |
| Input Filter                         | C/L (see filter details on following pages) |
| Input Reflected Ripple Current       | 20mA pk-pk typ.                             |
| Remote ON                            | 3.0 ~ 12VDC or open circuit                 |
| Remote OFF                           | 0 ~ 1.2VDC or short circuit pin 2 and 3     |
| OFF Idle Current                     | 2mA typ.                                    |
| Surge Voltage (100 ms) <sup>1)</sup> |   |
| 24V Models                           | 50VDC max.                                  |
| 48V Models                           | 100VDC max.                                 |

## General Specifications

|                                     |                              |
|-------------------------------------|------------------------------|
| I/O Isolation Voltage (60 sec)      | 3000VDC                      |
| Isolation Voltage Case/Input&Output | 1600VDC                      |
| I/O Isolation Capacitance           | 2000pF typ.                  |
| I/O Isolation Resistance            | 1000M Ohm, min.              |
| Switching Frequency                 | 270kHz, 330kHz typ.          |
| Humidity                            | 95% rel H                    |
| Reliability Calculated MTBF         | >400khrs<br>(MIL-HDBK-217 f) |
| Safety Standard(s)                  | UL62368-1 approval           |

## Environmental Specifications

|  |  |
|--|--|
| Operating Temperature Range            | -40°C ~ +100°C (see Derating Curve)            |
| Maximum Case Temperature               | 105°C  |
| Storage Temperature                    | -55°C ~ +125°C                                 |
| Cooling                                | Natural Convection (optional Heat-sink)        |
| Soldering Profile and Peak Temperature | Wave Flow: 260°C (1.5 mm from case), 10s, max. |

## Physical Specifications

|                  |   |
|------------------|---|
| Case Material    | Copper Black<br>Base Material: Non-conductive Black Plastic (UL94V-0 rated) |
| Pin Material     | 1.0mm Brass Solder-coated   |
| Potting Material | Epoxy (UL94V-0 rated)   |
| Weight           | 29.0g   |
| Case Dimensions  | 1.60" x 1.00" x 0.41"   |

## EMC Specifications

|                                |                                |
|--------------------------------|--------------------------------|
| Radiated / Conducted Emissions | EN55032 Class A see EMI Filter |
| ESD                            | IEC 61000-4-2 Perf. Criteria B |
| Rad. RF                        | IEC 61000-4-3 Perf. Criteria A |
| EFT                            | IEC 61000-4-4 Perf. Criteria A |
| Surge                          | IEC 61000-4-5 Perf. Criteria A |
| Cond. RF                       | IEC 61000-4-6 Perf. Criteria A |
| PFMF                           | IEC 61000-4-8 Perf. Criteria A |
| VD/SI/VV                       | -                              |

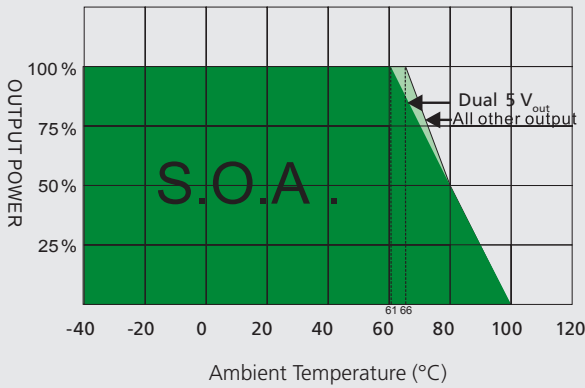
<sup>1)</sup> These are stress ratings; exposure of devices to any of these conditions may adversely affect long-term reliability. All specifications typical at T<sub>A</sub> = 25 °C, nominal input voltage and full load, unless otherwise specified.

The information and specification contained in this data sheet are believed to be correct at time of publication. However, AcAl BFi accepts no responsibility for consequences arising from printing errors or inaccuracies. [Specifications are subject to change without notice.](#)

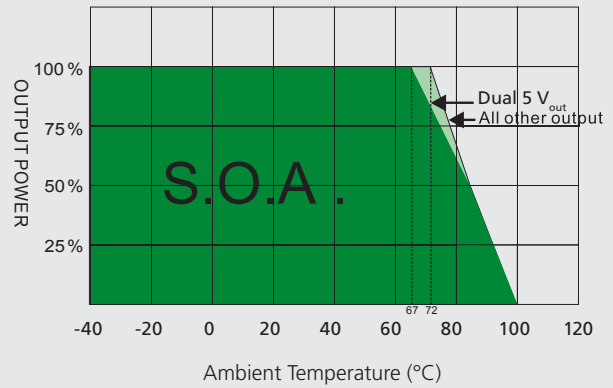
## Number structure RV9

|                     |                             |  |                        |                      |                   |                  |                    |            |
|---------------------|-----------------------------|--|------------------------|----------------------|-------------------|------------------|--------------------|------------|
| <b>RV9</b>          | <b>-</b>                    | <b>24</b>                                    | <b>05</b>              | <b>S</b>             | <b>20</b>         | <b>A</b>         | <b>3</b>           | <b>(W)</b> |
| <b>Name/package</b> | <b>V-input nom.</b>         | <b>V-output</b>                              | <b>Output type</b>     | <b>Power</b>         | <b>Int. Code</b>  | <b>Isolation</b> | <b>Wide-Input</b>  |            |
| RV9 = 1.6" x 1"     | 24 = 9V~36V<br>48 = 18V~75V | 03 = 3.3V<br>05 = 5V<br>12 = 15V<br>15 = 15V | S = Single<br>D = Dual | 15 = 15W<br>20 = 20W | Logistics<br>Code | 3 = 3kVDC        | _ = 2:1<br>W = 4:1 |            |

Derating Curve  
(without heat sink)



Derating Curve  
(with heat sink)



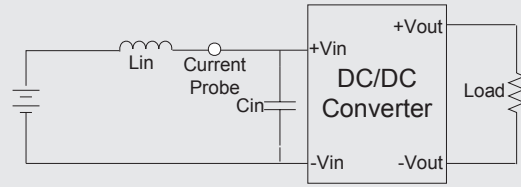
## Model Selection Guide

| Model Number   | Input<br>Voltage Range<br>(V DC) | Input Current         |                         | Output<br>Voltage<br>(V DC) | Output Current    |                   | Efficiency<br>@ Full Load<br>(%, typ.) | Capacitor Load<br>@ Full Load<br>(μF, max.) |
|----------------|----------------------------------|-----------------------|-------------------------|-----------------------------|-------------------|-------------------|--|---|
|                |                                  | No-Load<br>(mA, max.) | Full Load<br>(mA, typ.) |                             | Min. Load<br>(mA) | Full Load<br>(mA) |  |   |
| RV9-2403S20A3W | 9~36                             | 10                    | 849.72                  | 3.3                         | 0                 | 5500              | 89                                     | 10000                                       |
| RV9-2405S20A3W | 9~36                             | 10                    | 936.33                  | 5                           | 0                 | 4000              | 89                                     | 6800  |
| RV9-2412S20A3W | 9~36                             | 10                    | 943.50                  | 12                          | 0                 | 1670              | 88.5                                   | 1000  |
| RV9-2415S20A3W | 9~36                             | 15                    | 944.60                  | 15                          | 0                 | 1330              | 88                                     | 680   |
| RV9-4803S20A3W | 18~75                            | 8                     | 422.49                  | 3.3                         | 0                 | 5500              | 89.5                                   | 10000                                       |
| RV9-4805S20A3W | 18~75                            | 8                     | 462.96                  | 5                           | 0                 | 4000              | 90                                     | 6800  |
| RV9-4812S20A3W | 18~75                            | 8                     | 463.89                  | 12                          | 0                 | 1670              | 90                                     | 1000  |
| RV9-4815S20A3W | 18~75                            | 8                     | 456.73                  | 15                          | 0                 | 1330              | 91                                     | 680   |
| RV9-2405D20A3W | 9~36                             | 10                    | 968.99                  | ±5                          | 0                 | ±2000             | 86                                     | ±2200                                       |
| RV9-2412D20A3W | 9~36                             | 15                    | 943.50                  | ±12                         | 0                 | ±835              | 88.5                                   | ±470  |
| RV9-2415D20A3W | 9~36                             | 15                    | 939.27                  | ±15                         | 0                 | ±665              | 88.5                                   | ±330  |
| RV9-4805D20A3W | 18~75                            | 8                     | 478.93                  | ±5                          | 0                 | ±2000             | 87                                     | ±2200                                       |
| RV9-4812D20A3W | 18~75                            | 8                     | 463.89                  | ±12                         | 0                 | ±835              | 90                                     | ±470  |
| RV9-4815D20A3W | 18~75                            | 10                    | 459.25                  | ±15                         | 0                 | ±665              | 90.5                                   | ±330  |

## Test Configurations

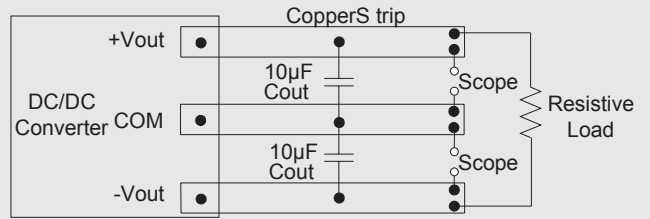
### Input Reflected Ripple Current Test Step

Input reflected ripple current is measured through a source inductor  $L_{in}$  (12  $\mu$ H) and a source capacitor  $C_{in}$  (47  $\mu$ F, ESR < 1.0  $\Omega$  at 100KHz) at nominal input and full load.



### Output Ripple & Noise Measurement Test

To reduce ripple and noise, it is recommended to use a 10 $\mu$ F ceramic disk capacitor to at the output.



## Design & Feature Configurations

### Over Voltage Protection

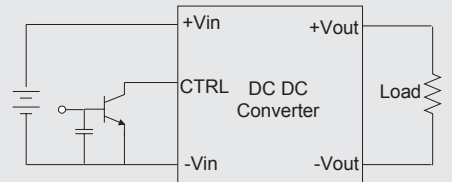
The module includes an internal output over voltage protection circuit, which monitors the voltage on the output terminals. If this voltage exceeds the over voltage set point, the module will activate the control loop of internal circuit to clamp the output voltage.

### Over Current Protection

The module includes an internal over current protection circuit, which will endure current limiting for an unlimited duration during output over load condition. If the output current exceeds the OCP set point, the module will shut down automatically (hiccup). The module will try to restart after shut down. If the over load condition still exists, the module will shut down again.

### CTRL Module ON / OFF

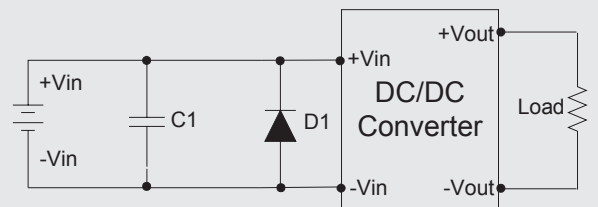
Positive logic turns on the module during high logic and off during low logic. Ctrl module on/off can be controlled by an external switch between the ctrl terminal and -Vin terminal. The switch can be an open collector or open drain. For positive logic if the ctrl feature is not used, please leave the ctrl pin floating.



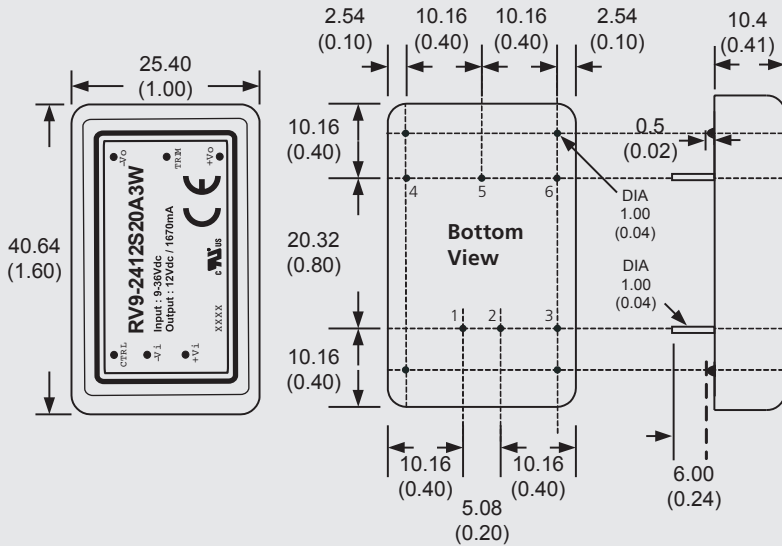
### EFT/Surge Filter

Input filter components (C1, D1) are used to help meet EN61000-4-4 and EN61000-4-5.

|            | C1                 | D1             |
|------------|--------------------|----------------|
| RV9-24xxxx | 330 $\mu$ F, 100 V | TVS, 58V, 3kW  |
| RV9-48xxxx | 330 $\mu$ F, 100 V | TVS, 120V, 3kW |



# Mechanical Specifications



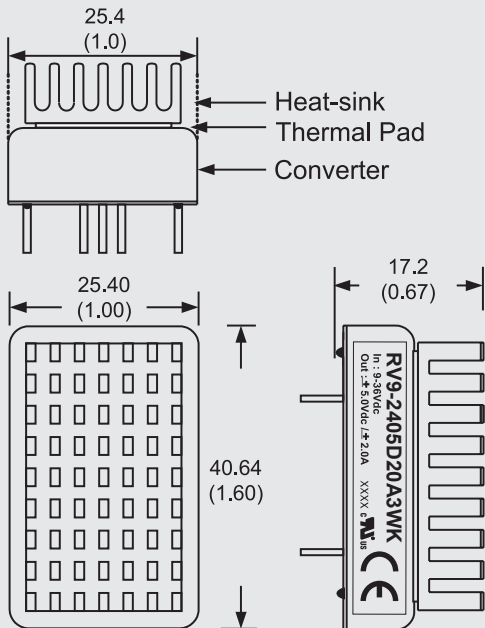
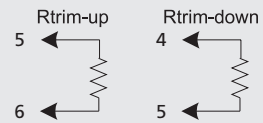
Notes: All dimensions are typical in millimeters (inches).

1. Pin diameter:  $0.5 \pm 0.05$  ( $0.02 \pm 0.002$ )
  2. Pin pitch and length tolerance:  $\pm 0.35$  ( $\pm 0.014$ )
  3. Case Tolerance:  $\pm 0.5$  ( $\pm 0.02$ )
  4. Stand-off Tolerance:  $\pm 0.1$  ( $\pm 0.004$ )
- (The Pin Connection of high isolation one is the same with normal one.)

| Pin Connections |           |           |
|-----------------|-----------|-----------|
| Pin Number      | Single    | Dual      |
| 1               | +V Input  | +V Input  |
| 2               | -V Input  | -V Input  |
| 3               | CTRL      | CTRL      |
| 4               | +V Output | +V Output |
| 5               | Trim      | Com       |
| 6               | -V Output | -V Output |

## External Output Trimming

Output can be externally trimmed by using the method as below. (single output models only).



Order code: RV9-XXXXK(contain: heat-sink, thermal pad)  
 Material: Aluminum  
 Finish: Anodic treatment (black)  
 Weight: 6.5 g (0.23oz) (without converter)

Note: Converters will be supplied with heat-sinks already mounted.

## Notes

1. For cross regulation one load is 25% to 100% load, the other load is 100% load, the output voltage variable rate is within  $\pm 5\%$ .
2. Capacitive load tested by minimal  $V_{in}$  and constant resistive load.
3. Transient recovery & response tested by normal  $V_{in}$  and 25% load step change (75%-50%-25% of  $I_o$ ).
4. Measured Input reflected ripple current with a simulated source inductance of 12H and a source capacitor  $C_{in}$  (47 $\mu$ F, ESR<1.0 $\Omega$  at 100kHz).
5. The remote on/off control pin is referenced to -Vin (pin 2).
6. Natural convection is usually about 30-65 LFM but is not equal to still air (0 LFM).
7. An external filter is required if the module has to meet IEC61000-4-4, IEC61000-4-5.  
 RV9-24XXXXX20 recommends an aluminum electrolytic capacitor (Nippon chemi-con KY series, 330 $\mu$ F/100V) and a TVS (SMDJ58A, 58V, 3000W peak pulse power) to be connected in parallel.  
 RV9-48XXXXX20 recommends an aluminum electrolytic capacitor (Nippon chemi-con KY series, 330 $\mu$ F/100V) and a TVS (SMDJ120A, 120V, 3000W peak pulse power) to be connected in parallel.  
 Refer to the EFT/Surge Filter of design & feature configuration.