

# RVA-S/D20

## 20W Regulated Single & Dual Output DC/DC Converter



Picture similar



- 1" x 1" Package
- Ultra-wide Railway Input Range
- 3000VDC Isolation
- EN50155 approval for railway applications
- Efficiency up to 90%
- Operating Temperature Range -40°C ~ +100°C max.
- Continuous Short Circuit Protection
- Over Current Protection, Over and Under Voltage Protection
- EMI filter meets EN55121-3-2 class A without external components
- Adjustable Output Voltage
- 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	from 0% to 100% Load: Single ±0.5% max. 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/75mV 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	3mA typ.
Surge Voltage (100 ms) <sup>1)</sup>	
24V Models	100VDC max.
110V Models	185VDC 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	245kHz, 330kHz typ.
Humidity	95% rel H
Reliability Calculated MTBF	>190KHrs (MIL-HDBK-217 f)
Safety Standard(s)	EN50155 approval, IEC/EN62368-1 (meet)

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 with Heat-sink
Soldering Profile and Peak Temperature	Wave Flow: 260°C (1.5 mm from case), 10s, max.

Physical Specifications	
Case Material	Aluminium
	Base Material: Non-conductive Black Plastic (UL94V-0 rated)
Pin Material	1.0mm Brass Solder-coated
Potting Material	Epoxy (UL94V-0 rated)
Weight	22.7g
Case Dimensions	1.09" x 1.09" x 0.65"

EMC Specifications	
Radiated / Conducted Emissions	EN50121-3-2 see note EMI Filter
ESD	EN50121-3-2 Air ±8KV Perf.Criteria A
Rad. RF	EN50121-3-2 20V/m Perf.Criteria A
EFT	EN50121-3-2 2.0KV Perf.Criteria A
Surge	EN50121-3-2 2.0KV Perf.Criteria A
Cond. RF	EN50121-3-2 10V Perf.Criteria A
PFMF	IEC 61000-4-8 100A/m Perf.Criteria A
VD/SI/VV	–

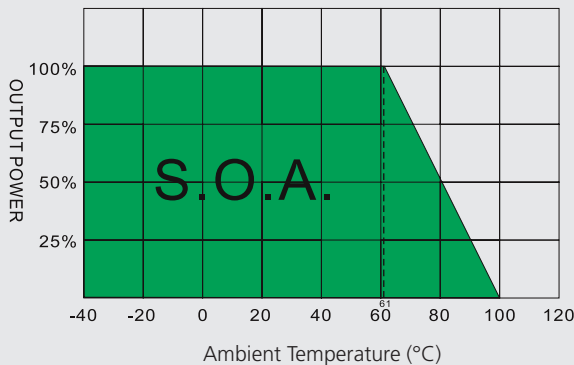
<sup>1)</sup> These are stress ratings; exposure of devices to any of these conditions may adversely affect long-term reliability.  
All specifications typical at T<sub>A</sub> = 25 °C, nominal input voltage and full load, unless otherwise specified.

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 RRA/RVA Series

RVA	–	24	05	S	20	A	3
<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>
RRA = DIL24		24 = 13V~70V	03 = 3.3V	S = Single	08 = 8W	Logistics	3 = 3.0 kVDC
RVA = 1" x 1"		110 = 42V~176V	05 = 5V	D = Dual	20 = 20W	Code	
			...				
			15 = 15V				

Derating Curve



## Model Selection Guide

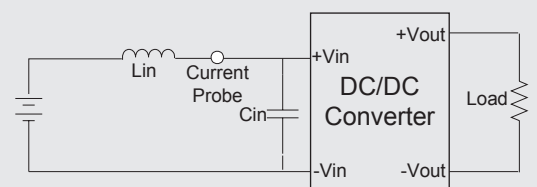
Model Number	Input	Input Current		Output	Output Current		Efficiency	Capacitor Load
	Voltage Range (V DC)	No-Load (mA, max.)	Full Load (mA, typ.)	Voltage (V DC)	Min. Load (mA)	Full Load (mA)	@ Full Load (% , typ.)	@ Full Load (μF, max.)
RVA-2403S20A3	13-70V DC or 24V DC	10	711.20	3.3	0	4500	87	7000
RVA-2405S20A3	13-70V DC or 24V DC	10	946.96	5	0	4000	88	5000
RVA-2412S20A3	13-70V DC or 24V DC	10	936.33	12	0	1670	89	850
RVA-2415S20A3	13-70V DC or 24V DC	10	925.92	15	0	1330	90	700
RVA-2405D20A3	13-70V DC or 24V DC	10	968.99	±5	0	±2000	86	±1000
RVA-2412D20A3	13-70V DC or 24V DC	10	925.92	±12	0	±833	90	±680
RVA-2415D20A3	13-70V DC or 24V DC	10	925.92	±15	0	±666	90	±470
RVA-11003S20A3	42-176V DC or 110V DC	10	156.97	3.3	0	4500	86	7000
RVA-11005S20A3	42-176V DC or 110V DC	10	204.29	5	0	4000	89	5000
RVA-11012S20A3	42-176V DC or 110V DC	10	211.41	12	0	1670	86	850
RVA-11015S20A3	42-176V DC or 110V DC	10	211.41	15	0	1330	86	700
RVA-11005D20A3	42-176V DC or 110V DC	10	216.45	±5	0	±2000	84	±1000
RVA-11012D20A3	42-176V DC or 110V DC	10	208.98	±12	0	±833	87	±680
RVA-11015D20A3	42-176V DC or 110V DC	10	208.98	±15	0	±666	87	±470

## Test Configurations

### Input Reflected Ripple Current Test Step

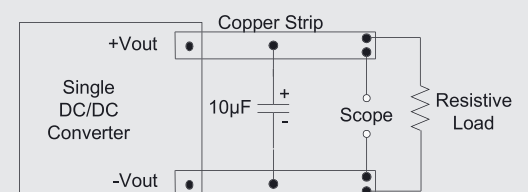
Input reflected ripple current is measured through a source inductor  $L_{in}$  (26μH) and a source capacitor  $C_{in}$  (33μF, ESR<1.0Ω at 100KHz) at nominal input and full load.

Input filter components are used to help meet conducted emissions 79dBμV from 0.15-0.5MHZ and 73dBμV from 0.5-30MHZ requirement for the module, Which application refer to the EMI Filter of design & feature configuration.



### Output Ripple & Noise Measurement Test

To reduce ripple and noise, it is recommended to use a 10μF 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 Load 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).

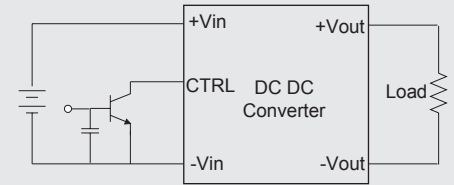
The module will try to restart after shut down. If the over load condition still exists, the module will shut down again.

### 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.

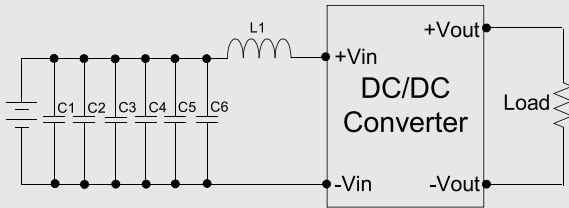
For positive logic if the ctrl feature is not used, please leave the ctrl pin floating.



### EMI Filter

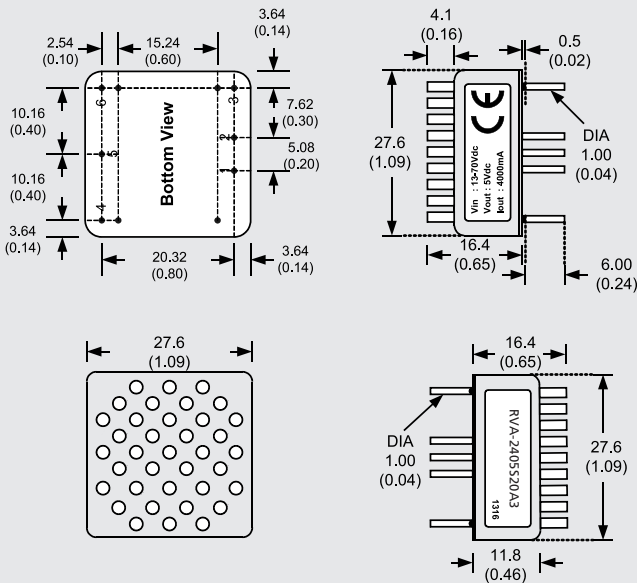
Input filter components (C1,C2,C3,C4,C5,C6) are used to help meet conducted emissions 79dBμV from 0.15-0.5MHZ and 73dBμV from 0.5-30MHZ requirement for the module.

These components should be mounted as close as possible to the module; and all leads should be minimized to decrease radiated noise.



	C1/C2/C3/C4/C5/C6	L1
RVA-24XX	none	none
RVA-110XX	1812, 1μF, 250V	12μH

## Dimensions and Recommended Layout



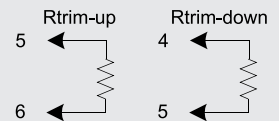
Note: All dimensions are typical in millimeters ( inches ).

1. Pin diameter:  $1.0 \pm 0.05$  (  $0.04 \pm 0.002$  )
2. Pin pitch tolerance:  $\pm 0.35$  (  $\pm 0.014$  )
3. Pin to case tolerance:  $\pm 0.5$  (  $\pm 0.02$  )
4. Case Tolerance:  $\pm 0.5$  (  $\pm 0.02$  )
5. Stand-off tolerance:  $\pm 0.1$  (  $\pm 0.004$  )

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

### External Output Trimming

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



### Notes

1. 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 is tested at nominal input voltage and constant resistor load.
3. Transient recovery and response are tested at normal Vin and 25% load step change (75%-50%-25% of Io).
4. Measured Input reflected ripple current with a simulated source inductance of 26μH and a source capacitor Cin (33μF, ESR<1.0Ω 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 capacitor is required if the module has to meet EFT and Surge in EN50121-3-2. The suggested filter capacitor:  
RVA-24XXX: one electrolytic capacitor (Nippon chemi-con KY series, 330μF/100V).  
RVA-110XXX: two electrolytic capacitors (Ruby-con BXF series, 100μF/250V) in parallel.