RDE20 Series

DC-DC Converter

XP Power

20 Watts

- Regulated Single & Dual Output
- 24-48 VDC & 72-110 VDC nominal inputs for Railway Applications
- 3000 VDC Isolation
- High Efficiency
- EN50155 Certified for Railway Applications
- EN50121-3-2 with External Components
- Remote On/Off
- Output Voltage Trim ±10%
- Operating Temperature -40 °C to +100 °C
- Full Power to +55 °C
- 3 Year Warranty



Dimensions:

RDE20:
1.0 x 1.0 x 0.41" (25.4 x 25.4 x 10.4 mm)

The RDE20 series provides a comprehensive wide DC input voltage range covering all requirements of the railway standard EN50155. The product features a robust design tested to railway standards and includes a remote on /off function, output voltage trimming, protection against short circuit, undervoltage lockout, overload and overvoltage.

Models & Ratings

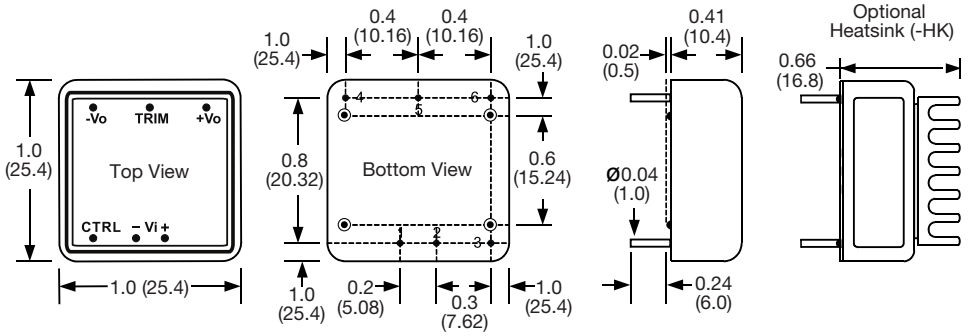
Input voltage	Output voltage	Output current	Input current[1]		Maximum capacitive load	Efficiency	Model number
			No load	Full load			
13-70 VDC	3.3 V	4500 mA	10 mA	711.20 mA	7000 µF	87%	RDE2024S3V3
	5.0 V	4000 mA		946.96 mA	5000 µF	88%	RDE2024S05
	12.0 V	1670 mA		936.33 mA	850 µF	89%	RDE2024S12
	15.0 V	1330 mA		925.92 mA	700 µF	90%	RDE2024S15
	±5.0 V	±2000 mA		968.99 mA	±1000 µF	86%	RDE2024D05
	±12.0 V	±833 mA		925.92 mA	±680 µF	90%	RDE2024D12
	±15.0 V	±666 mA		925.92 mA	±470 µF	90%	RDE2024D15
42-176 VDC	3.3 V	4500 mA	10 mA	156.97 mA	7000 µF	86%	RDE20110S3V3
	5.0 V	4000 mA		206.61 mA	5000 µF	88%	RDE20110S05
	12.0 V	1670 mA		211.41 mA	850 µF	86%	RDE20110S12
	15.0 V	1330 mA		211.41 mA	700 µF	86%	RDE20110S15
	±5.0 V	±2000 mA		216.45 mA	±1000 µF	84%	RDE20110D05
	±12.0 V	±833 mA		208.98 mA	±680 µF	87%	RDE20110D12
	±15.0 V	±666 mA		208.98 mA	±470 µF	87%	RDE20110D15

Notes

1. Input current measured at nominal input voltage.

2. For heatsink add suffix '-HK', e.g. RDE2024S15-HK

Mechanical Details



Pin Connections		
Pin	Single Output	Dual Output
1	+Vin	+Vin
2	-Vin	-Vin
3	Control	Control
4	+Vout	+Vout
5	Trim	Com
6	-Vout	-Vout

Notes

1. All dimensions are in inches (mm)

Input

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Input Voltage Range	13		70	VDC	24 V, 37.5 V, 48 V nominal inputs
	42		176		72 V, 96 V & 110 V nominal inputs
Input Filter	Internal Pi type				
Input Voltage Surge			100	VDC for 100 ms	RDE2024 series
			185		RDE20110 series
Undervoltage Lockout	OFF at <11.6 V, ON at 12.3 V				RDE2024 series
	OFF at <38.4 V, ON at 40.5 V				RDE20110 series
Remote On/Off (Positive Logic)	ON at 3.0 VDC to 12.0 VDC or open circuit				Positive logic reference to -Vin (pin 2)
	OFF at 0 VDC to 1.2 VDC or short pin 2 to pin 3				
Standby Current		3		mA	When module inhibited

Output

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Output Voltage	3.3		30	VDC	See Models and Ratings table
Output Trim			±10	%	Single output models only
Initial Set Accuracy			±1.0	%	At full load
Minimum Load				A	No minimum load required
Line Regulation			±0.5	%	From minimum to maximum input at full load
Load Regulation			±0.5/±1.0	%	From 0 to full load. Single Output/Dual Output
Cross Regulation			±5.0	%	On dual output models when one load is varied between 25% and 100% and other is fixed at 100%
Transient Response		±3	±5	% deviation	Recovery within 1% in less than 250 µs for a 25% load change.
Ripple & Noise			75	mV pk-pk	20 MHz bandwidth. Measured using external 10 µF MLCC
Overvoltage Protection		120		%	
Overload Protection		170		%	
Short Circuit Protection					Continuous trip & restart (hiccup mode), with auto recovery
Maximum Capacitive Load					See Models and Ratings table
Temperature Coefficient			0.02	%/°C	

General

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Efficiency	84		90	%	See Models and Ratings table
Isolation: Input to Output	3000			VDC	60 s functional isolation
Isolation Resistance	10^9			Ω	At 3 kVDC
Isolation Capacitance		2000		pF	
Switching Frequency		330 / 245		kHz	RDE2024 / 110 series
Power Density			48.8	W/in³	
Mean Time Between Failure	190			khrs	MIL-HDBK-217F, +25 °C GB
Case Material	Copper Case, Non conductive black plastic base, UL94V-0 rated				
Potting Material	Epoxy UL94V-0				
Fire Protection	Designed to meet EN45545-2				
PCB Pin Material	ø1.0 mm brass, solder coated				
Lead Free Reflow Solder Process	IPC JEDEC J-STD 020D.1. 260 °C max. 1.5 mm from case. 10 s max.				
Weight		0.041 (19.0)		lb (g)	Standard
		0.048 (22.0)			With heatsink

Environmental

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Operating Temperature	-40		+100	°C	See derating curve
Maximum Case Temperature			+105	°C	
Thermal Impedance to Air	13			°C/W	Without heatsink
	12				With heatsink
Storage Temperature	-55		+125	°C	
Altitude	5000 m operation				
Humidity			95	%RH	Non-condensing
Cooling	IEC/EN 60068-2-1				
Dry Heat	IEC/EN 60068-2-2				
Damp Heat	IEC/EN 60068-2-30				
Shock & Vibration	IEC/EN 61373				

EMC: Emissions

Phenomenon	Standard	Test Level	Notes & Conditions
Railway Equipment	EN50121-3-2		Conducted and Radiated

EMC: Immunity

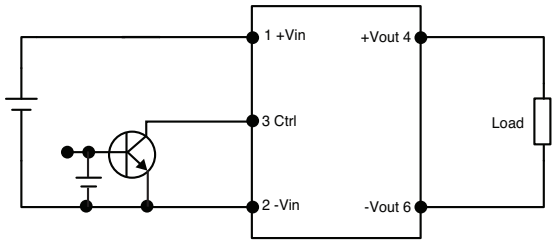
Phenomenon	Standard	Test Level	Criteria	Notes & Conditions
Railway Equipment	EN50121-3-2			Electromagnetic compatibility for rolling stock apparatus
ESD	EN50121-3-2	±8 kV air discharge, ±6 kV contact	A	
Radiated	EN50121-3-2	20 V/m	A	
EFT/Burst	EN50121-3-2	±2 kV	A	With external capacitor Suggested parts are 24V: CHEMI-CON KY 330 µF/100 V 110V: BXF SERIES 100 µF/250 V in parallel
Surge	EN50121-3-2	±2 kV	A	
Conducted	EN50121-3-2	10 V rms	A	See application note
Magnetic Fields	EN61000-4-8	100 A/m	A	

Safety Approvals

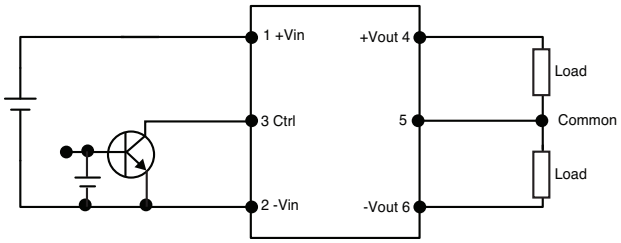
Report	Safety Standard	Notes & Conditions
CE	LVD	Evaluated to EN62368-1
EN	EN50155	Railway applications, electronic equipment used on rolling stock
CE	Meets all applicable directives	
UKCA	Meets all applicable legislation	

Application Notes

Remote On/Off – Single Output

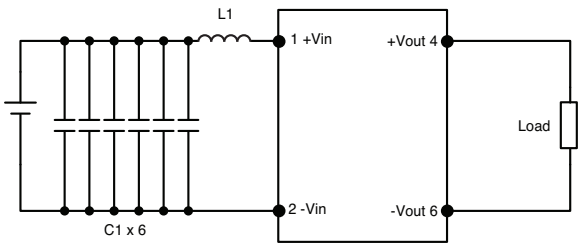


Remote On/Off – Dual Output



Positive logic. Module turns on with logic high. Logic low turns module off. On/Off is enabled by an external switch between the control pin 3 and -Vin pin 2, e.g. open collector or drain. If the Remote On/Off is not used leave pin 3 floating.

EMC – 110 V Input Models Only

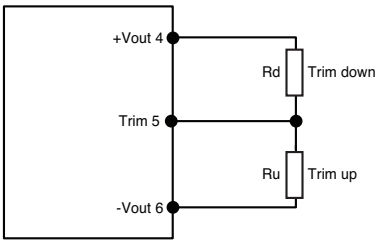


(MLCC type)

C1	L1
1 µF, 250 V	12 µH

Not required for RDE2024 series

Output Voltage Trim – Single Output Models Only



Trim Tables

Trim Down %	3.3 V	5 V	12 V	15 V
	Rd (kΩ)			
1	817.535	117.886	345.033	174.366
2	362.230	61.634	164.830	91.104
3	215.448	38.388	98.862	56.589
4	142.957	25.688	64.647	37.706
5	99.747	17.684	43.707	25.796
6	71.057	12.179	29.571	17.598
7	50.622	8.159	19.386	11.611
8	35.326	5.096	11.699	7.047
9	23.448	2.683	5.692	3.453
10	13.957	0.735	0.867	0.548

Trim Up%	3.3 V	5 V	12 V	15 V
	Ru (kΩ)			
1	567.584	616.020	1015.590	661.510
2	263.172	221.402	448.881	231.250
3	158.473	131.336	280.558	134.015
4	105.497	91.426	199.789	91.042
5	73.508	68.900	152.361	66.818
6	52.096	54.432	121.162	51.270
7	36.760	44.353	99.078	40.445
8	25.235	36.930	82.625	32.475
9	16.257	31.235	69.892	26.362
10	9.066	26.727	59.745	21.524

Derating Curve

