



■ Features

- Compliance with railway standard EN50155
- DIP 2"x1" package with standard pinout
- 18:1(8.5~160Vdc) ultra-wide input range
- Wide operating temperature range -40 ~ +95°C
- No minimum load required
- Full encapsulated
- Protections: Short circuit (Continuous) / Overload / Over voltage / Input under voltage
- 3KVAC I/O isolation
- Operating altitude up to 5000 meters (Note.5)
- Remote ON/OFF control
- 3 years warranty

■ Description

RSDW20UW and RDDW20UW series are 20W module type DC-DC reliable railway converter with 2"x1" package. It features international standard pins, a high efficiency up to 89%, wide working temperature range -40~+95°C, 3KVAC I/P-O/P isolation voltage, meet EN50155 with external circuits, continuous-mode short circuit protection, etc. The models account for 8.5~160VDC 18:1 ultra-wide input range, and various output voltage, 5V/12V/15V for single output and $\pm 12V/\pm 15V/\pm 24V$ for dual outputs, which are suitable for railway, trams, buses and also can be used in the harsh environment with high vibration, high dust, extremely low or high temperature, etc.

■ Model Encoding

RSDW20UW-**12**

Output voltage (5/12/15Vdc, $\pm 12/\pm 15/\pm 24Vdc$)

Ultra wide input voltage (8.5~160Vdc)

Rated wattage

Series name { S:Single output
D: Dual output

File Name:RSDW20UW,RDDW20UW-SPEC 2020-08-13

MODEL SELECTION TABLE

ORDER NO.	INPUT			OUTPUT		EFFICIENCY (Typ.)	CAPACITOR LOAD (MAX.)
	INPUT VOLTAGE (RANGE)	INPUT CURRENT		OUTPUT VOLTAGE	OUTPUT CURRENT		
		NO LOAD	FULL LOAD				
RSDW20UW-05	Normal 12V,24V,48V,72V,96V,110V (8.5 ~ 160V)	5mA	323mA	5V	4000mA	85.5%	6800μF
RSDW20UW-12		10mA	312mA	12V	1670mA	89%	3300μF
RSDW20UW-15		8mA	312mA	15V	1330mA	89%	2200μF
RDDW20UW-12		8mA	312mA	±12V	±0 ~833mA	88%	*820μF
RDDW20UW-15		9mA	312mA	±15V	±0 ~ 667mA	89%	*680μF
RDDW20UW-24		9mA	309mA	±24V	±0 ~ 417mA	89%	*330μF

* For each output

SPECIFICATION				
INPUT	VOLTAGE RANGE	8.5 ~ 160Vdc		
	SURGE VOLTAGE (100ms max.)	200Vdc		
	FILTER	Pi type		
	PROTECTION	4A fast acting fuse		
OUTPUT	VOLTAGE ACCURACY	±1.0%		
	RATED POWER	20W		
	RIPPLE & NOISE Note.2	100mVp-p		
	LINE REGULATION Note.3	±0.2%		
	LOAD REGULATION Note.4	Single output models: ±0.3%, Dual output models:±1%		
	SWITCHING FREQUENCY (Typ.)	200KHz		
	EXTERNAL TRIM ADJ. RANGE (Typ.)	-20% ~ +15% (Single output model only)		
PROTECTION	SHORT CIRCUIT	Protection type : Continuous, automatic recovery		
	OVERLOAD	110 ~ 180% rated output power		
		Protection type : Recovers automatically after fault condition is removed		
	OVER VOLTAGE	Protection type : Clamp by diode		
	UNDER VOLTAGE LOCKOUT	Start-up voltage	9Vdc	
Shutdown voltage		8Vdc		
FUNCTION	REMOTE CONTROL	Power ON: >4.0~160Vdc or open circuit Power OFF: <1.2Vdc or short		
ENVIRONMENT	COOLING	Free-air convection		
	WORKING TEMP.	-40 ~ +95℃ (Refer to "Derating Curve")		
	CASE TEMPERATURE	+105℃ max. (+110℃ thermal shutdown)		
	WORKING HUMIDITY	20% ~ 90% RH non-condensing		
	STORAGE TEMP., HUMIDITY	-55 ~ +125℃, 10 ~ 95% RH non-condensing		
	TEMP. COEFFICIENT	0.03% / °C (0 ~ 95℃)		
	SOLDERING TEMPERATURE	1.5mm from case of 1 ~ 3sec./260℃ max.		
	VIBRATION	10 ~ 500Hz, 2G 10min./1cycle, period for 60min. each along X, Y, Z axes		
	OPERATING ALTITUDE Note.5	5000 meters		
SAFETY & EMC (Note.6)	SAFETY STANDARDS	UL62368-1, EAC TP TC 004 approved		
	WITHSTAND VOLTAGE	I/P-O/P:3KVAC		
	ISOLATION RESISTANCE	I/P-O/P:100M Ohms / 500VDC / 25℃ / 70% RH		
	ISOLATION CAPACITANCE (Typ.)	20pF		
	EMC EMISSION	Parameter	Standard	Test Level / Note
		Conducted	EN50121-3-2	Class A/B with external components
		Radiated	EN50121-3-2	N/A
	EMC IMMUNITY	Parameter	Standard	Test Level / Note
		ESD	EN61000-4-2	Level 3, ±8KV air, ±6KV contact
		Radiated Susceptibility	EN61000-4-3	Level 3, 80~1000MHz, 20V/m
		EFT/Burest	EN61000-4-4	Level 3, On power input port, ±2KV external input capacitor required
		Surge	EN61000-4-5	Level 4, Line to earth, ±4KV Line to Line, ±2KV
		Conducted	EN61000-4-6	Level 3, 0.15~80MHz, 10V
RAILWAY STANDARD	EN50155 / IEC60571 including EN61373 for shock & vibration, EN50121-3-2 for EMC			
OTHERS	MTBF	1570Khrs MIL-HDBK-217F(25℃)		
	DIMENSION (L*W*H)	50.8*25.4*10.2mm (2*1*0.4 inch)		
	CASE MATERIAL	Black coated copper with Non-Conductive Base		
	PACKING	28.5g		
NOTE	1.All parameters are specified at normal input(72Vdc), rated load, 25℃ 70% RH ambient. 2.Ripple & noise are measured at 20MHz by using a 12" twisted pair terminated with a 0.1µf & 47µf capacitor. 3.Line regulation is measured from low line to high line at rated load. 4.Load regulation is measured from 0% to 100% rated load. 5.The ambient temperature derating of 3.5℃/1000m for operating altitude higher than 2000m(6500ft). 6.The final equipment must be re-confirm that it still meet EMC directives. For guidance on how to perform these EMC tests, please refer to "EMI testing of component power supplies."			

■ External Output Trimming

In order to trim the voltage up or down, one needs to connect the trim resistor either between the trim pin and -Vout for trim-up or between trim pin and +Vout for trim-down. The output voltage trim range is -20% to +15%. This is shown in Figures 1 and 2:

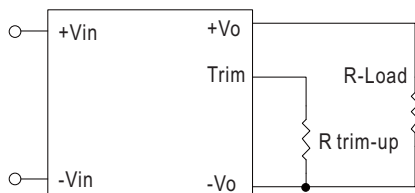


Figure 1. Trim-up Voltage Setup

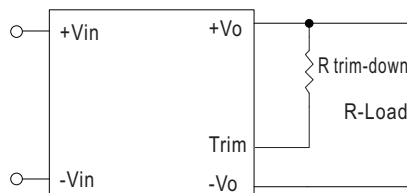


Figure 2. Trim-down Voltage Setup

1. The RSDW20UW-05 value of R_{trim-up} defined as:

$$R_{\text{trim-up}} = \frac{22.13 - 3.976 \times (V_o - V_{o, \text{nom}})}{7.017 \times (V_o - V_{o, \text{nom}})} - 3.3 \text{ (K}\Omega\text{)}$$

2. The RSDW20UW-12 value of R_{trim-up} defined as:

$$R_{\text{trim-up}} = \frac{120.76}{3 \times (V_o - V_{o, \text{nom}})} - 18 \text{ (K}\Omega\text{)}$$

3. The RSDW20UW-15 value of R_{trim-up} defined as:

$$R_{\text{trim-up}} = \frac{104.42}{2.28 \times (V_o - V_{o, \text{nom}})} - 18 \text{ (K}\Omega\text{)}$$

Where

R_{trim-up} is the external resistor in Kohm.

V_{o, nom} is the nominal output voltage.

V_o is the desired output voltage.

Trim up Resistor Values are internal to the unit and are defined in Table 1.

For example, to trim-up the output voltage of 5V module (RSDW20UW-05) by 5% to 5.25V, R trim-up is calculated as follows:

$$R_{\text{trim-up}} = \frac{22.13 - 3.976 \times (5.25 - 5)}{7.017 \times (5.25 - 5)} - 3.3 = 8.75 \text{ (K}\Omega\text{)}$$

Table 1 – The typical value of R_{trim-up}

R _{trim up} %	5V	12V	15V
	R _{trim up} (KΩ)		
1%	59.21	317.46	287.32
2%	27.67	149.73	134.66
3%	17.16	93.82	83.77
4%	11.90	65.86	58.33
5%	8.75	49.09	43.06
6%	6.65	37.91	32.89
7%	5.14	29.92	25.62
8%	4.02	23.93	20.17
9%	3.14	19.27	15.92
10%	2.44	15.55	12.53
11%	1.87	12.50	9.76
12%	1.39	9.95	7.44
13%	0.99	7.80	5.49
14%	0.64	5.96	3.81
15%	0.34	4.36	2.35

4. The RSDW20UW-05 value of R_{trim-down} defined as:

$$R_{\text{trim-down}} = \frac{42 - 16.803 \times (V_{o, \text{nom}} - V_o)}{7.017 \times (V_{o, \text{nom}} - V_o)} - 3.3 \text{ (K}\Omega\text{)}$$

5. The RSDW20UW-12 value of R_{trim-down} defined as:

$$R_{\text{trim-down}} = \frac{206.116}{3 \times (V_{o, \text{nom}} - V_o)} - 27.08 \text{ (K}\Omega\text{)}$$

6. The RSDW20UW-15 value of R_{trim-down} defined as:

$$R_{\text{trim-down}} = \frac{206.116}{2.28 \times (V_{o, \text{nom}} - V_o)} - 27.08 \text{ (K}\Omega\text{)}$$

Where

R_{trim-down} is the external resistor in Kohm.

V_{o, nom} is the nominal output voltage.

V_o is the desired output voltage.

Trim down Resistor Values are internal to the unit and are defined in Table 2.

For example, to trim-down the output voltage of 12V module (RSDW20UW-12) by 5% to 11.4V, R_{trim-down} is calculated as follows:

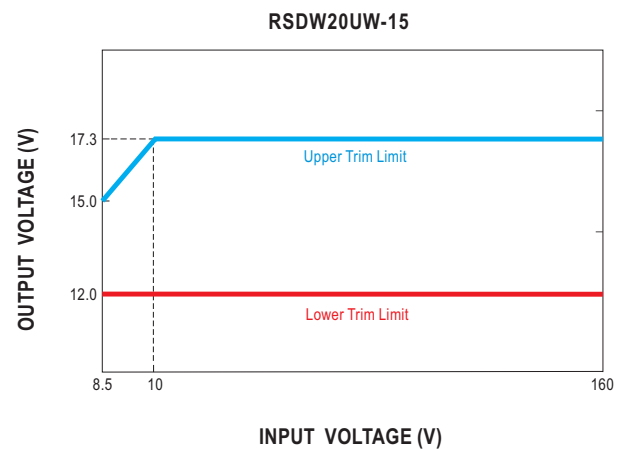
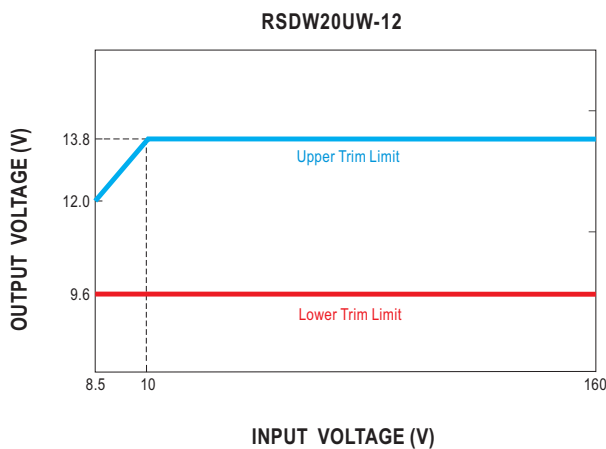
$$R_{\text{trim-down}} = \frac{206.116}{3 \times (12 - 11.4)} - 27.08 = 87.43 \text{ (K}\Omega\text{)}$$

Table 2 – The typical value of R_{trim-down}

R _{trim down} %	5V	12V	15V
	R _{trim down} (KΩ)		
1%	114.03	545.46	575.60
2%	54.17	259.19	274.26
3%	34.21	163.77	173.81
4%	24.24	116.06	123.59
5%	18.25	87.43	93.46
6%	14.26	68.34	73.37
7%	11.41	54.71	59.02
8%	9.27	44.49	48.25
9%	7.61	36.54	39.88
10%	6.28	30.17	33.19
11%	5.19	24.97	27.71
12%	4.28	20.63	23.14
13%	3.52	16.96	19.28
14%	2.86	13.82	15.97
15%	2.29	11.09	13.10
16%	1.79	8.70	10.59
17%	1.35	6.60	8.37
18%	0.96	4.73	6.40
19%	0.61	3.05	4.64
20%	0.29	1.55	3.05

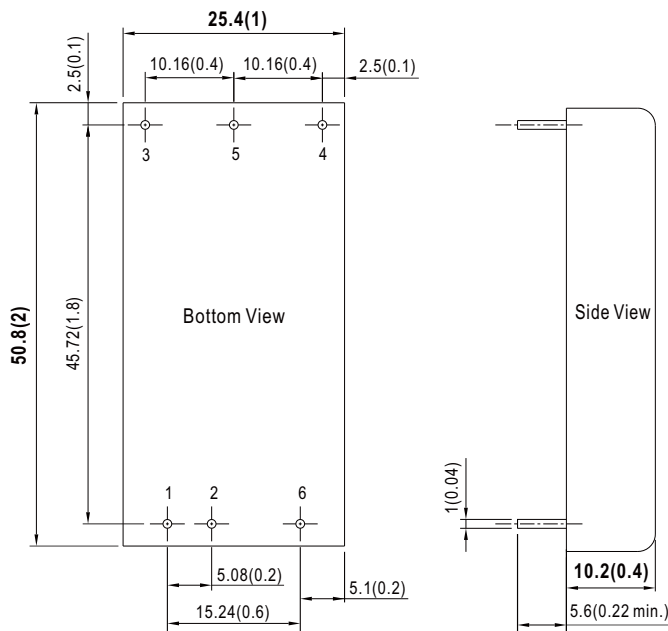
The RSDW20UW-05 models is adjustable within the range of -20% to +15%.

For RSDW20UW-12 and RSDW20UW-15 models, see input & output trim curves for trim up and trim down ranges.



Mechanical Specification

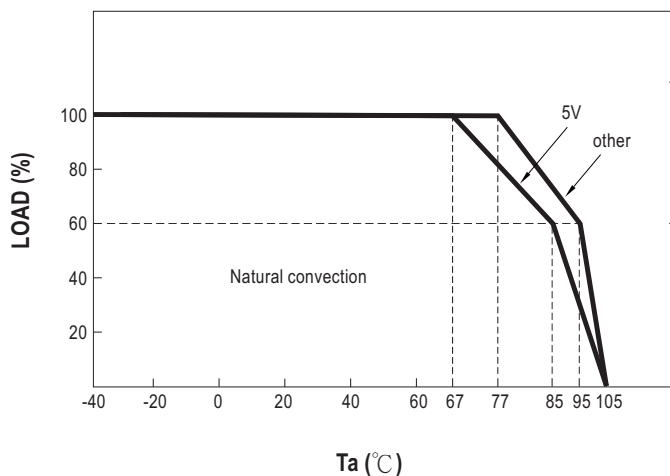
- All dimensions in mm(inch)
- Tolerance: $x.x \pm 0.5\text{mm}$ ($x.xx \pm 0.02"$)
 $x.xx \pm 0.25\text{mm}$ ($x.xxx \pm 0.010"$)
- Pin size is: $0.5 \pm 0.05\text{mm}$ ($0.02" \pm 0.002"$)



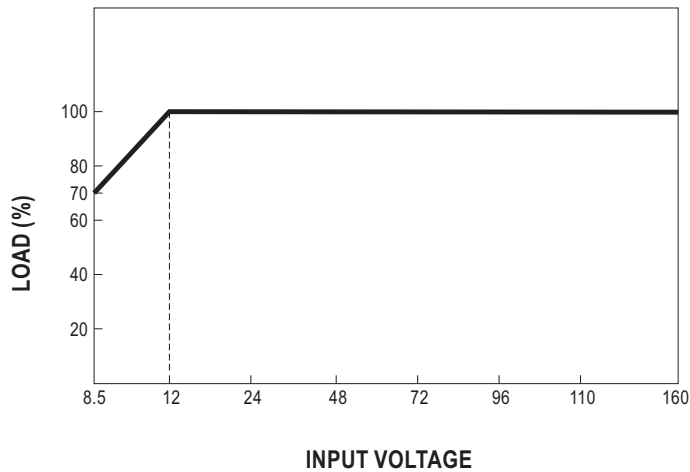
Plug Assignment

Pin-Out		
Pin No.	RSDW20UW (Single output)	RDDW20UW (Dual output)
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	Trim	-Vout
5	-Vout	Common
6	Remote ON/OFF	Remote ON/OFF

Derating Curve

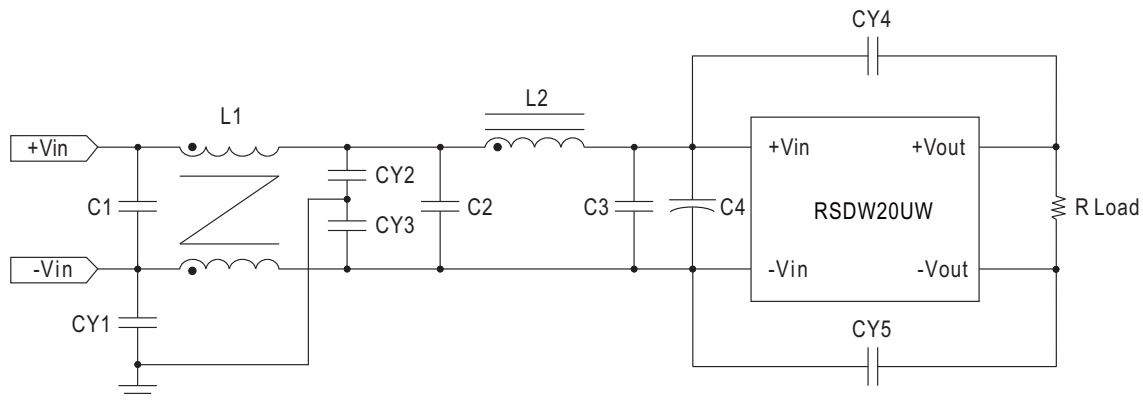


Output derating VS Input voltage



EMC Suggestion Circuit

※ EMI Test standard: EN55032 Conducted & Radiated Emission, EN50121-3-2:2016 Output Conducted Emission
Test Condition: Input Voltage: 110Vdc, Output Load: Full Load



Model No.	EN55032 Class B						
	C1,C2,C3	C4	CY1	CY2, CY3	CY4, CY5	L1	L2
RSDW20UW-05	1uF/250V 1812 Ceramic capacitor	120uF/220V KXJ Series Aluminum capacitor	680pF 400VAC Y1 capacitor	500pF 400VAC Y1 capacitor	2200pF 400VAC Y1 capacitor	1.4mH φ 0.4mmx1/13T ACMEA151 T10x5x5C	10μH/7A 2525CZ Vishay
RSDW20UW-12							
RSDW20UW-15							
RDDW20UW-15			470pF 400VAC Y1 capacitor				
RDDW20UW-15							

Note: C1, C2, C3: 1812 X7R ceramic capacitor.
C4: NIPPON CHEMI-CON KXJ series aluminum capacitor or equivalent.
CY1, CY2, CY3, CY4, CY5: TDK Y1 capacitor or equivalent.
L1: 1.4mH φ 0.4mmx1/13T ACMEA151 T10x5x5C (G91C9925115).
L2: 10μH/7A 2525CZ VISHAY (G91B0904007).