voltbricks

DATASHEET

VDRW Series

VDRW100

DC/DC converters for railway application

1. Description

VDRW — ultra-compact isolated DC to DC converters for railway application. Despite its dimensions VDRW output power reaches up to 100 W. It has several features: wide range of operating temperatures (ambient −40...+85 °C), Remote On/Off, full range of protections: overcurrent, overtemperature, short circuit.

Internal configuration without optocouplers allows it to operate in high-temperatures conditions during all lifetime period. Polymer potting guarantees a high level of environmental protection as well as vibration, dust, humidity and salt mist. Every unit is tested for thermal resistance, including burn-in test in extreme power on/off mode.

1.1. Engineered in accordance with

- EN 50155
- EN 61373
- EN 50121-3-2
- EN 55032
- EN 61000-6-2 Class A

1.2. Features

- Warranty 5 years
- 1/4 Brick case
- Output current up to 10 A
- Low profile design (13,1 mm)
- Short-circuit, overvoltage, thermal protection
- No-load operation
- Remote on/off
- Ultra-wide input voltage range 33...160 VDC with transient deviation 25...166 VDC
- Isolation voltage 2500 VDC

1.3. Additional information

1.3.1. Description on the manufacturer’s website

https://voltbricks.com/product/vdrw

1.3.2. Order registration

+65 6950 0011

sales@voltbricks.com

1.3.3. Technical support

support@voltbricks.com

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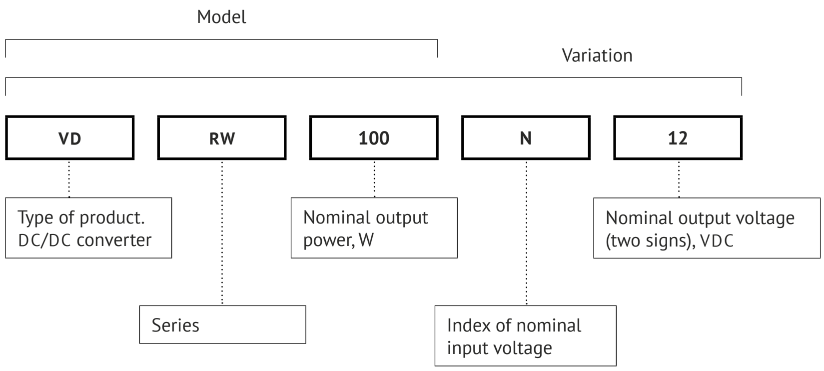
voltbricks.com

2. Contents

3. Part number

For more information please contact our Global Operations Team: +65 6950 0011



4. Specifications

All specifications valid for normal climatic conditions (ambient temp. 15…35 °C; relative humidity 45…80 %; air pressure $8{,}6\times10^4$…$10{,}6\times10^4$ Pa), $U_{IN.NOM}$, $I_{OUT.NOM}$, unless otherwise stated. It is important to note that the information herein is not full.

4.1. General specifications

Parameter	Symbol	Conditions	Value	Unit
Operating case temperature	T_{CASE}		−40…+100	°C
Operating ambient temperature	T_{AMB}	Case temperature in standard limits	−40…+85	°C
Storage temperature			−50…+110	°C
Switching frequency			150−180	kHz
Isolation voltage @ 60 s		Input/output, input/case, output/case	2500	VDC
Isolation resistance @ 500 VDC		Normal climatic conditions	>100	MOhm
Thermal impedance			7,51	°C/W
Remote on/off			Off.: 0…1,5 VDC or connection of pins "ON" and "−IN", I≤5 mA	
MTBF		T_{CASE}=70 °C, P=70 %	1 400 000	hrs
Warranty			5	years

4.2. Input specifications

Parameter	Symbol	Conditions	Value	Unit
Nominal input voltage	$U_{IN.NOM}$	Index "N"	72	VDC
Input voltage range			33…160	VDC
Transient deviation U_{IN}		During 1 s	(25[1])28…166	VDC

4.3. Output specifications

Parameter	Symbol	Conditions	Value	Unit
Output power	P_{OUT}		100	W
Typical efficiency	EFF	U_{IN}=72 VDC, U_{OUT}=12 VDC	87	%
Quantity of output channels			1	
Nominal output voltage	$U_{OUT.NOM}$		5; 12; 15; 24; 36; 48	VDC
Output current (min)	$I_{OUT.MIN}$		0	
Output current (max)	$I_{OUT.MAX}$	P_{OUT}=50 W	20	A
Output voltage adjustment			+10…−20	%
Steady-state output voltage deviation, $U_{OUT.NOM}$		$U_{IN.NOM}$, $I_{OUT.MAX}$, normal climatic conditions	max ±1	%
Voltage regulation, $U_{OUT.NOM}$		Gradual change of U_{IN} within set value range	max ±0,75	%
		Gradual change of I_{OUT} within 0,05…1×$I_{OUT.MAX}$	max ±0,75	%
		Thermal instability	max ±2	%
		Repeatability	max ±1	%
		Total voltage regulation within the complete range of U_{IN}, I_{OUT} and T_{AMB}	max ±4	%
Ripple and noise (p-p), $U_{OUT.NOM}$	U_{P-P}		<1	%

[1] It remains possible a 15% Pout.nom. reducing in case of 25…28 VDC transient range..

Parameter	Symbol	Conditions	Value	Unit
Max total capacitance of output capacitors	$C_{OUT.MAX}$	U_{OUT}=5 VDC U_{OUT}=12 VDC U_{OUT}=15 VDC U_{OUT}=24 VDC U_{OUT}=36 VDC U_{OUT}=48 VDC	8000 1300 1000 330 170 100	µF
Start up time		by input voltage, $I_{OUT.MAX}$, $C_{OUT.MAX}$	<100	ms
		by Remote ON/OFF, $I_{OUT.MAX}$, $C_{OUT.MAX}$	<35	ms
Trancient responce deviation, $U_{OUT.NOM}$		On change $U_{IN.NOM}$ 0,6...1,4×$U_{IN.NOM}$ (during 0,1 ms); On change 1.25×I_{OUT} front time ≤0,1 A/µs	max ±5	%
Parallel operation			no	
Remote sense		Line-drop compensation up to 10% $U_{OUT.NOM}$	yes	

4.4. Protections

Parameters are stated for the information purposes and could not be used for long term operation, over current operation, operation out of stated temperature limits.

Parameter	Symbol	Conditions	Value	Unit
Overcurrent protection I_{OUT}			1,3...1,4 I_{NOM}	
Thermal protection			115 ± 10 °C (latching with automatic recovery)	
Short-circuit protection			yes, with auto recovery after short-circuit clearance	
Output overvoltage			1,3 $U_{OUT.NOM}$	
Vibration proof			10...2000 Hz, 200 (20) m/s^2 (g), 2 mm	
Shielding			yes	
Potting			yes	
Dust proof			yes	
Salt fog resistant			yes	
Moisture proof		98% at T_{AMB}= 35°C	yes	
Resistance to mechanical stress			yes	

4.5. Physical specifications

Parameter	Symbol	Conditions	Value	Unit
Form-factor			1/4 Brick	
Heatsink			separate	
Case material			duralumin	
Coating			microarc oxidation	
Pin material			bronze/brass	
Weight			max 95	g
Type of contacts			pins for PCB soldering	
Soldering temperature		5 s	260	°C
Dimensions		Without output pins	max 58,8x37,2x13,1	mm

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5. Service functions

5.1. Layout

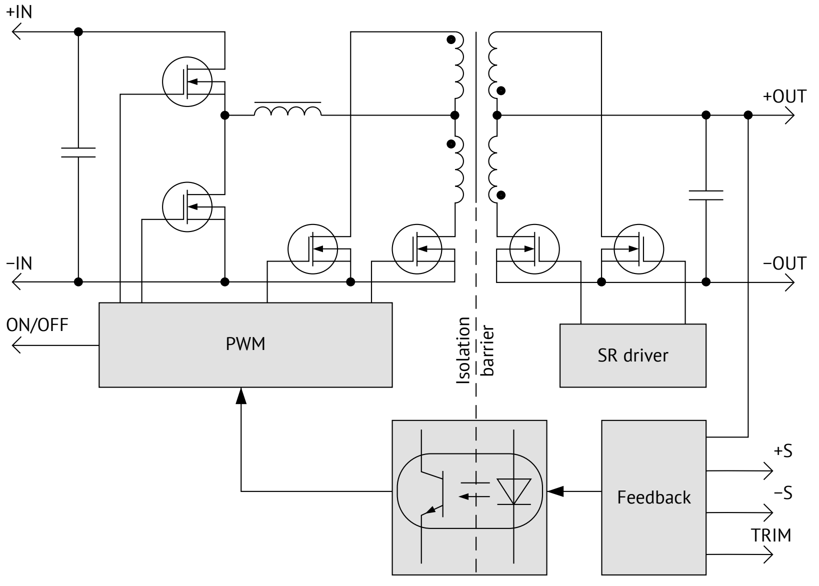

Figure 1. VDRW100 layout.

5.2. Connection diagrams

5.2.1. Typical connection diagram

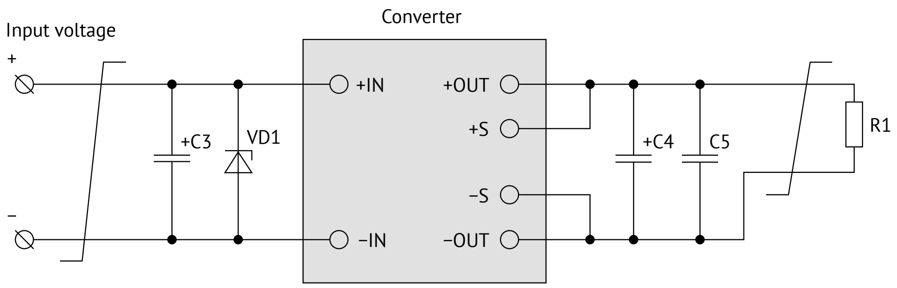

Figure 2. VDRW100 typical connection diagram.

C3 – 120 μF Low ESR.

VD1 – suppressor SMBJ170CA.

C5 – ceramic capacitor MLCC 1 μF.

C4 – capacitance is stated below:

U_{OUT}	C4	Type	ESR
5 VDC	2×470 μF	polymer	<14 mOhm
12 VDC	2×220 μF	polymer	<12 mOhm
15 VDC	2×220 μF	polymer	<15 mOhm
24 VDC	2×33 μF	polymer	<16 mOhm
36; 48 VDC	15 μF	polymer	<40 mOhm

5.2.2. Typical circuit for EN55032 Class B compliance

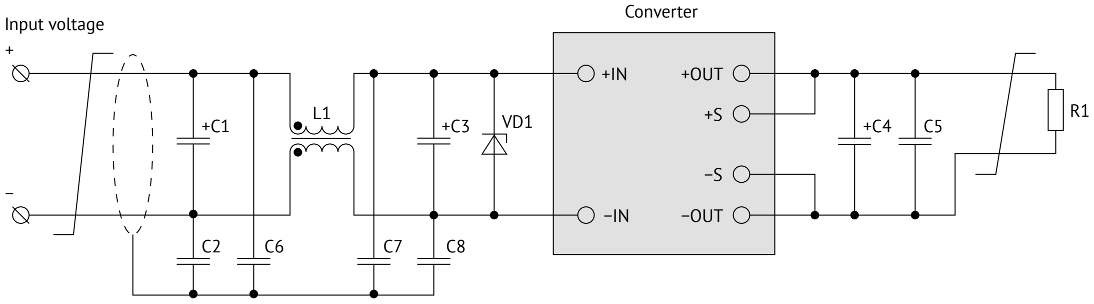

Figure 3. VDRW100 connection circuit for EN55032 Class B..

C1, C3 — 120 µF Low ESR.
C2, C6, C7, C8 — ceramic capacitor MLCC 2,2 nF.
C5 — ceramic capacitor MLCC 1 µF.
L1 — common mode choke ≥1 mH.
VD1 — suppressor SMBJ170CA.
C4 — capacitance is stated below:

U_{OUT}	C4	Type	ESR
5 VDC	2×470 µF	polymer	<14 mOhm
12 VDC	2×220 µF	polymer	<12 mOhm
15 VDC	2×220 µF	polymer	<15 mOhm
24 VDC	2×33 µF	polymer	<16 mOhm
36; 48 VDC	15 µF	polymer	<40 mOhm

Please note: input and output capacitors can consist of several parallel connected capacitors; ESRmax is stated for 100 kHz, 20 °C.

5.3. U_{OUT} trimming

5.3.1. Resistor connection

To trim down $U_{OUT.NOM}$ you should connect a resistor between “TRIM” and “+S” pins. To trim up — between “TRIM” and “–S” pins. Please see details below.

It is not recommended to connect “–S” and “TRIM” pins directly, without any intermediate resistor, to avoid overvoltage protection operation and output voltage ripple increase (or even output voltage loss) — as its’ result.

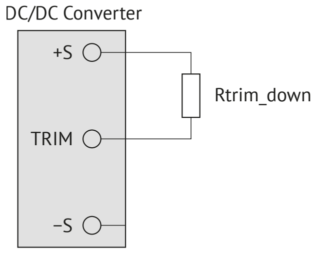

Figure 4. Resistor connection for $U_{OUT.NOM}$ trim down.

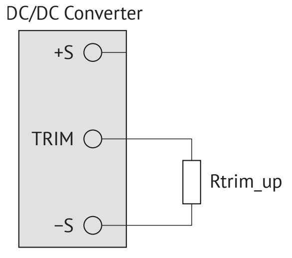

Figure 5. Resistor connection for $U_{OUT.NOM}$ trim up.

5.3.2. Resistor nominals diagram

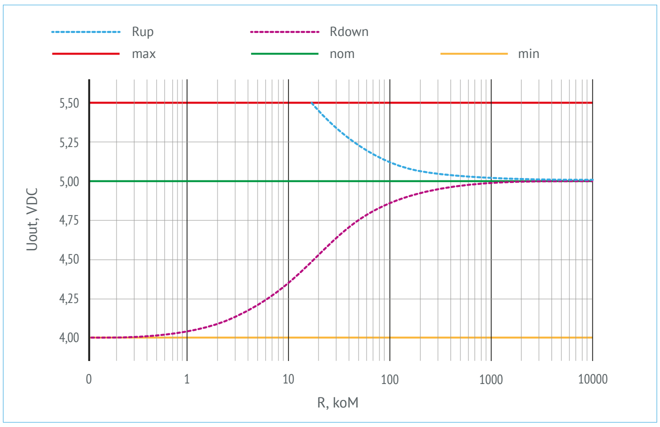

Figure 6. Chart for VDRW100N05.

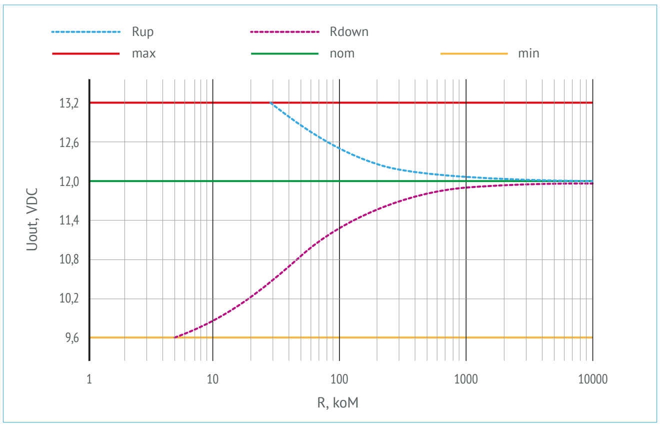

Figure 7. Chart for VDRW100N12.

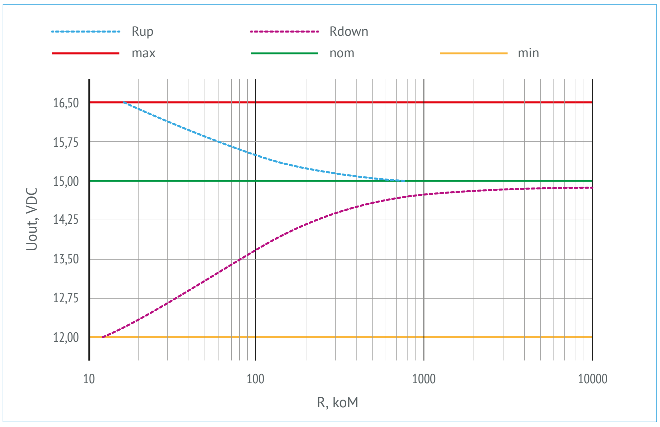

Figure 8. Chart for VDRW100N15.

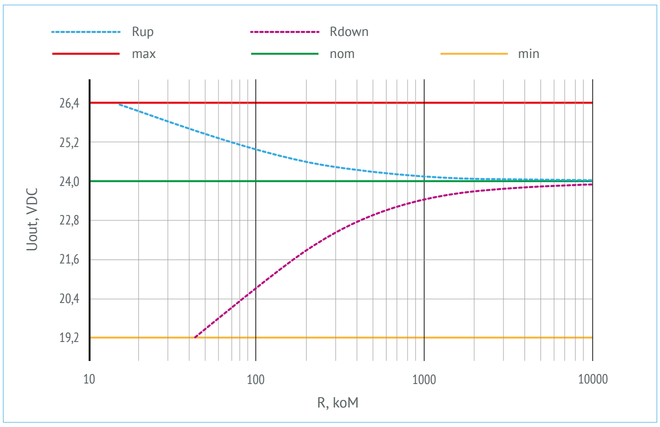

Figure 9. Chart for VDRW100N24.

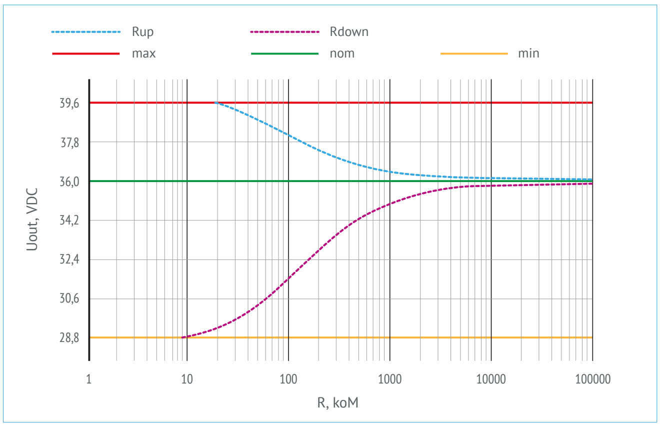

Figure 10. Chart for VDRW100N36.

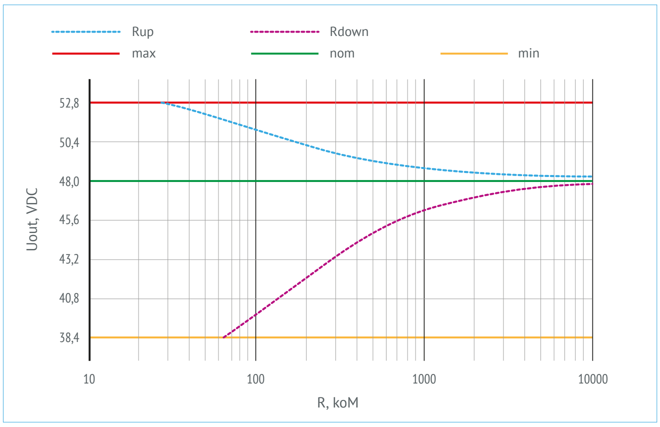

Figure 11. Chart for VDRW100N48.

5.4. External feedback

Application of external feedback allows to compensate for output voltage drop on extended power lines and isolating diodes. The maximum value of compensation for output voltage drop is no less than 10%. If it's necessary to provide better A/J, "+RS" and "-RS" pins should be connected to the load with twisted-pair wire which has cross-section area no less than 0,1 mm².

Typical connection diagram of external feedback application for power supply system with extended power lines is shown in *[Figure 12]*:

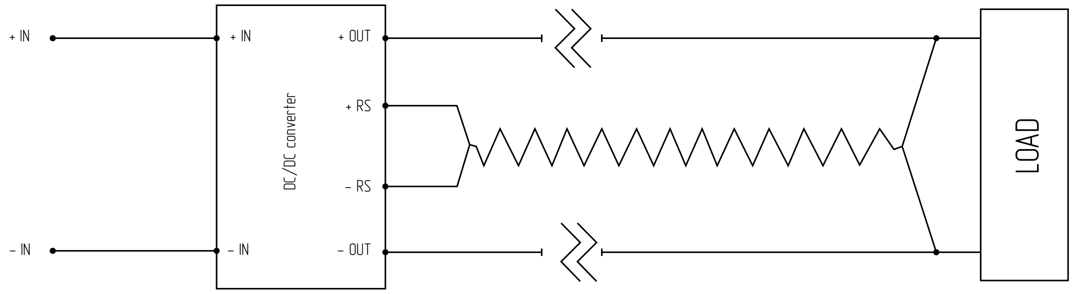

Figure 12. Typical connection diagram of external feedback application.

If there no need to apply external feedback, "+RS" and "-RS" pins should be connected with "+IN" and "-IN" directly according to the *[Figure 13]*. It is strictly forbidden to leave "+RS" and "-RS" pins disconnected.

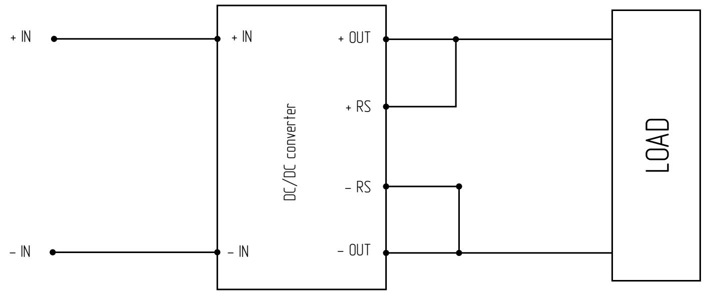

Figure 13. Typical connection diagram without external feedback application.

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6. Test reports

6.1. Efficiency and P_{OUT} / T_{AMB} dependence

6.1.1. VDRW100N05

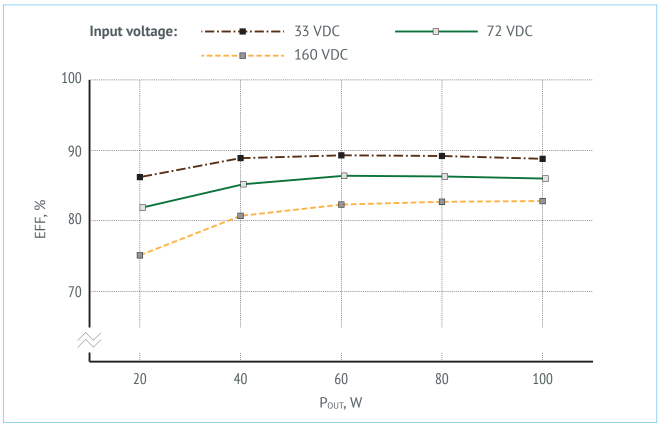

Figure 14. Efficiency.

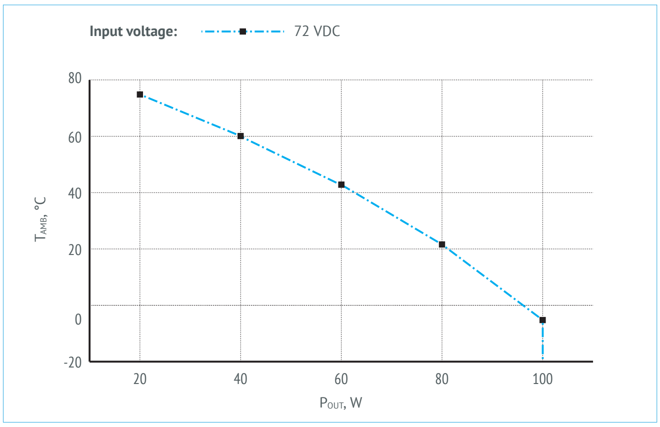

Figure 15. P_{OUT} vs T_{AMB} chart.

6.1.2. VDRW100N12

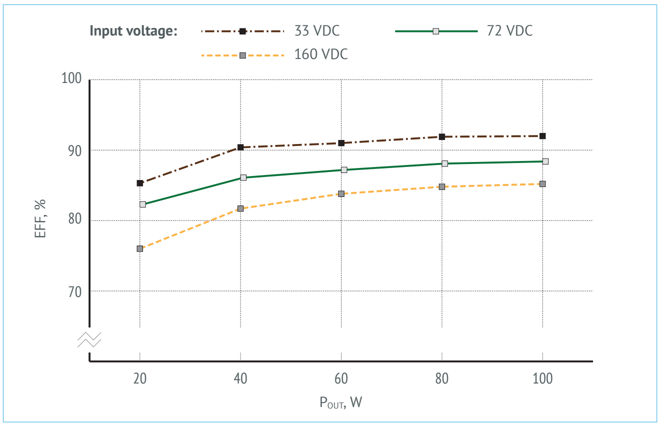

Figure 16. Efficiency.

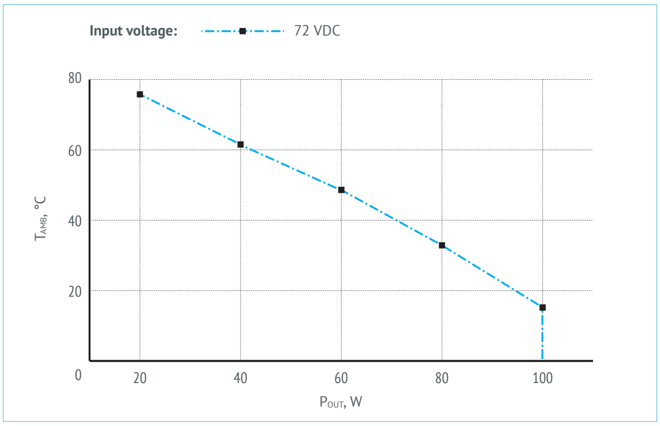

Figure 17. P_{OUT} vs T_{AMB} chart.

6.1.3. VDRW100N15

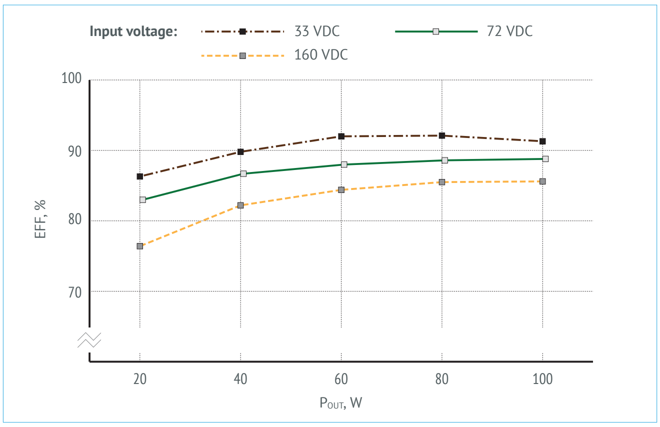

Figure 18. Efficiency.

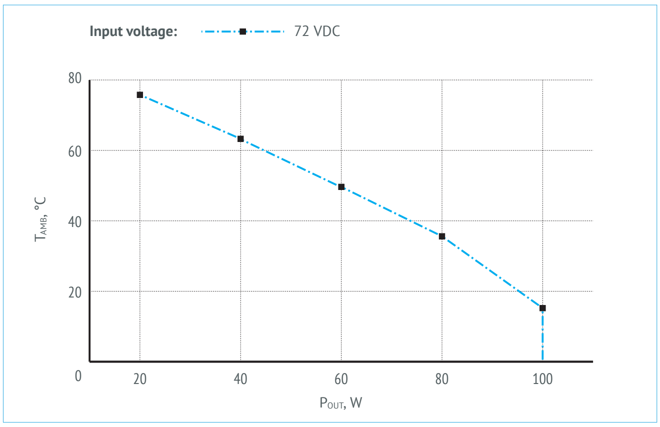

Figure 19. P_{OUT} vs T_{AMB} chart.

6.1.4. VDRW100N24

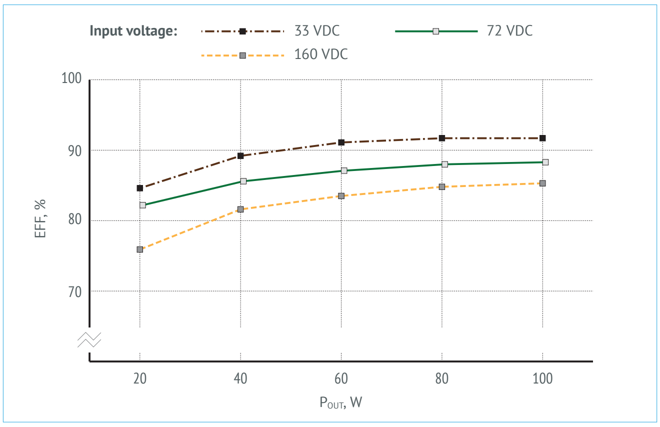

Figure 20. Efficiency.

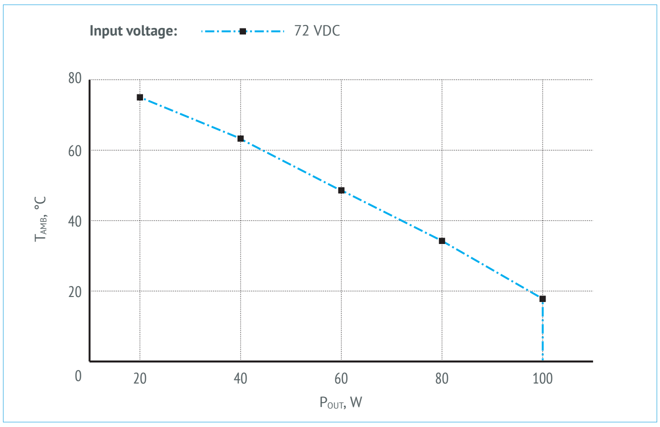

Figure 21. P_{OUT} vs T_{AMB} chart.

6.1.5. VDRW100N36

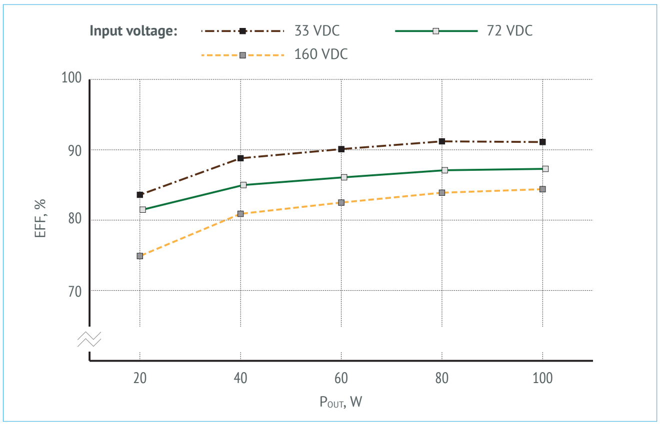

Figure 22. Efficiency.

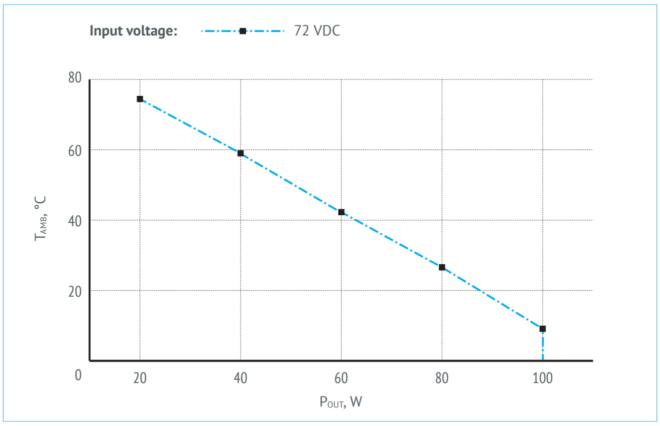

Figure 23. P_{OUT} vs T_{AMB} chart.

6.1.6. VDRW100N48

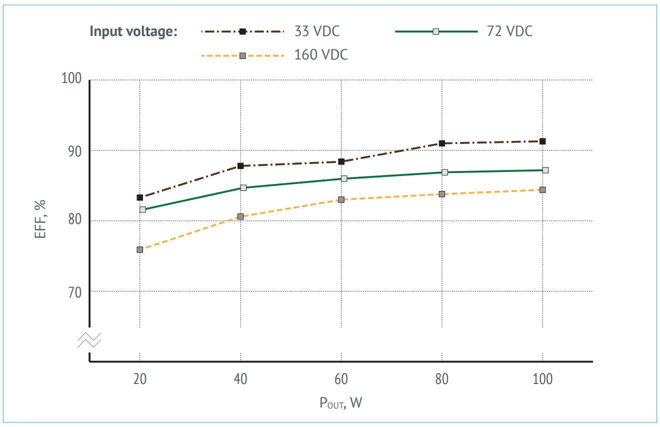

Figure 24. Efficiency.

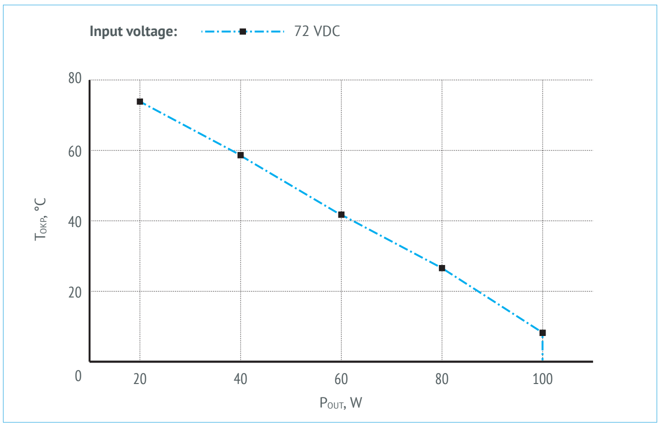

Figure 25. P_{OUT} *vs* T_{AMB} *chart.*

6.2. Oscillograph charts

6.2.1. VDRW100N36

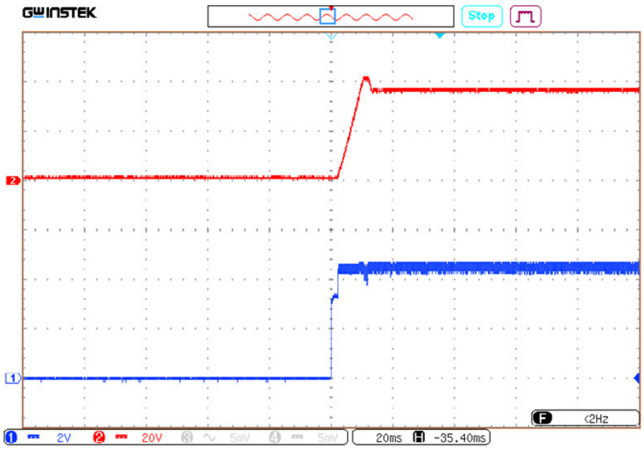

Figure 26. $U_{OUT.NOM}$ stabilizing with Remote On/Off option (ON and -OUT pins connection).

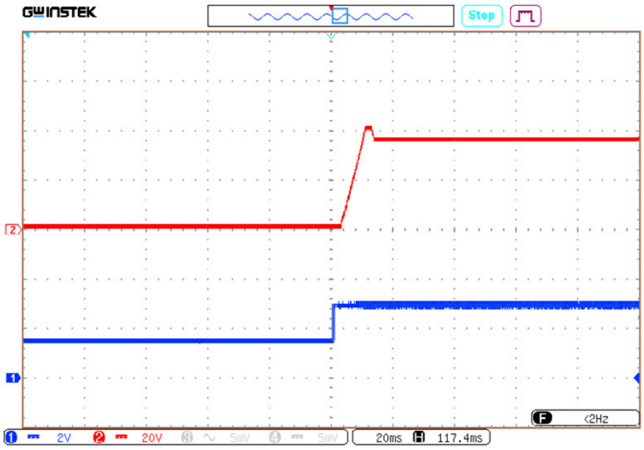

Figure 27. $U_{OUT.NOM}$ stabilizing with Remote On/Off option (control signal).

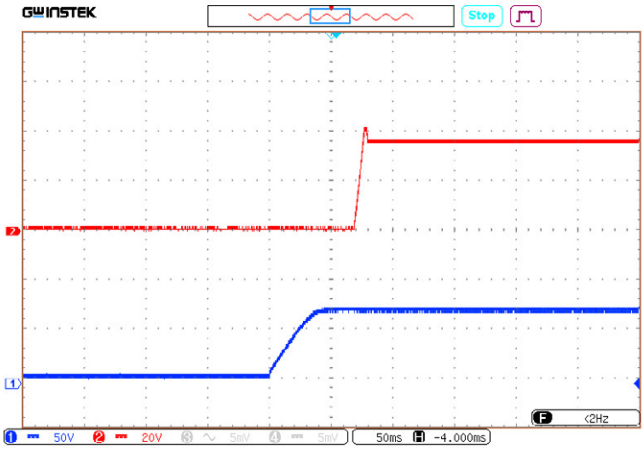

Figure 28. $U_{OUT.NOM}$ stabilizing with $U_{IN.NOM}$.

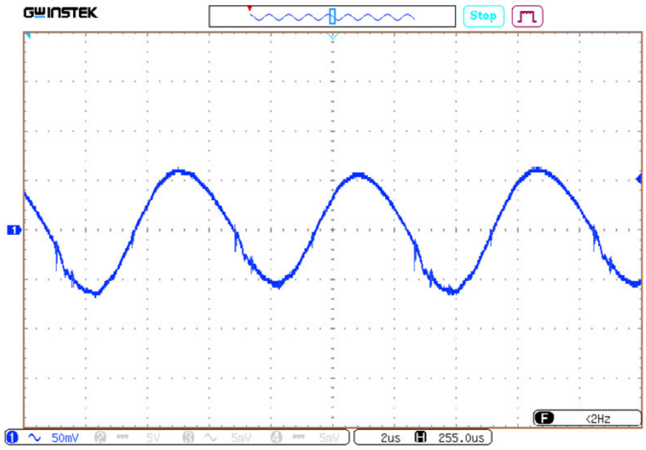

Figure 29. $U_{OUT.NOM}$ ripple.

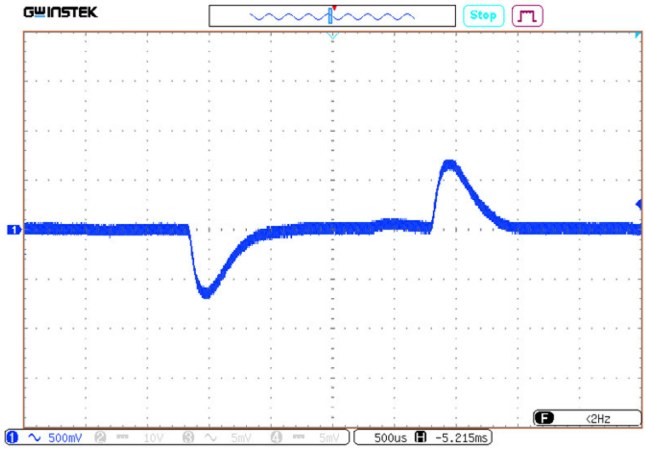

Figure 30. $U_{OUT.NOM}$ transient deviation on 0,75...1×I_{OUT} change.

6.3. Noise spectrogram

6.3.1. VDRW100N05

EN55032 Class B compliance tests.

Conditions: U_{IN}=72 VDC, T_{AMB}=25 °C.

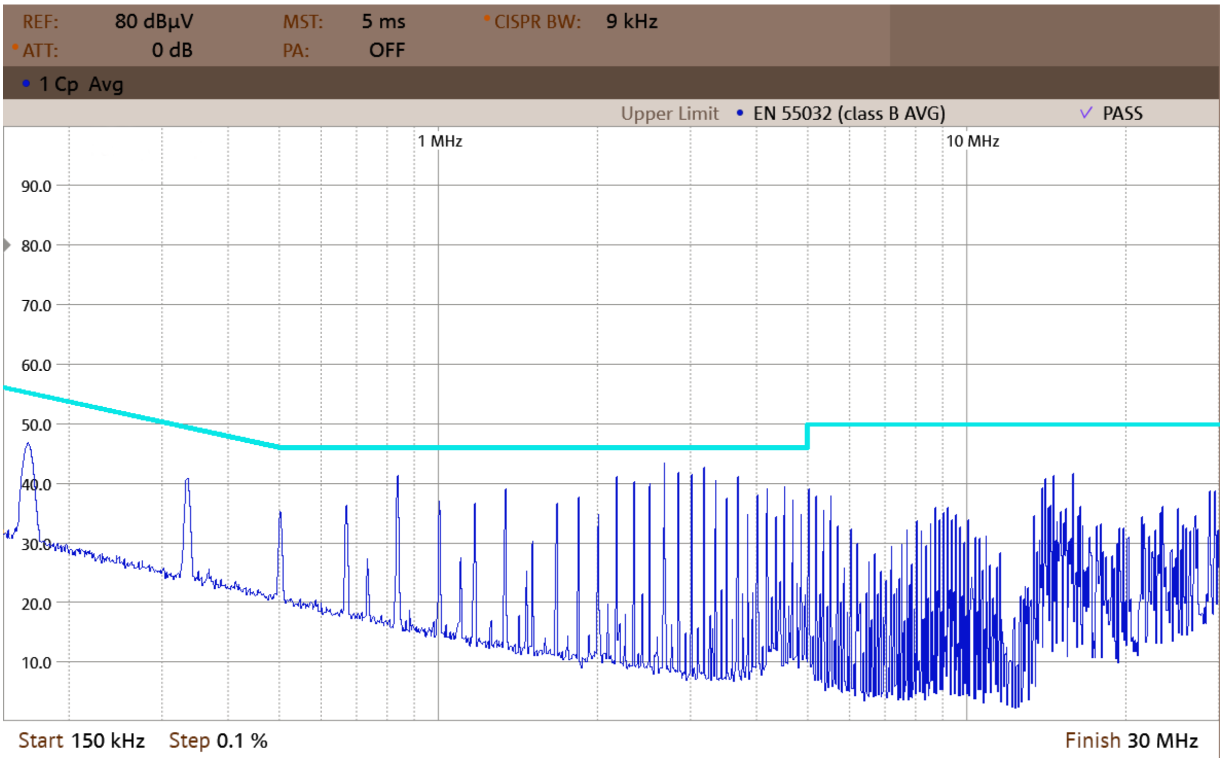

Figure 31. Spectrogram 0,15–30 MHz.

7. Outline dimensions

Pin #	1	2	3	4	5	6	7	8
Function	+IN	Remote On/Off	−IN	−OUT	−S	TRIM	+S	+OUT

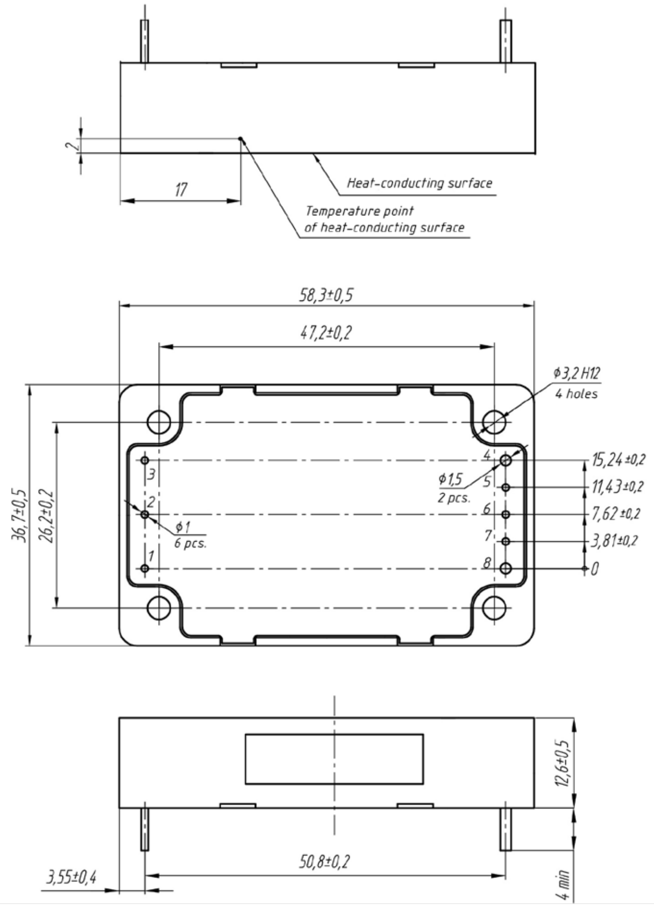

Figure 32. 1/4 Brick.

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Manufacturer of reliable DC/DC converters and power supply systems

This datasheet is valid for the following units:: VDRW100N05; VDRW100N12; VDRW100N15; VDRW100N24; VDRW100N36; VDRW100N48.