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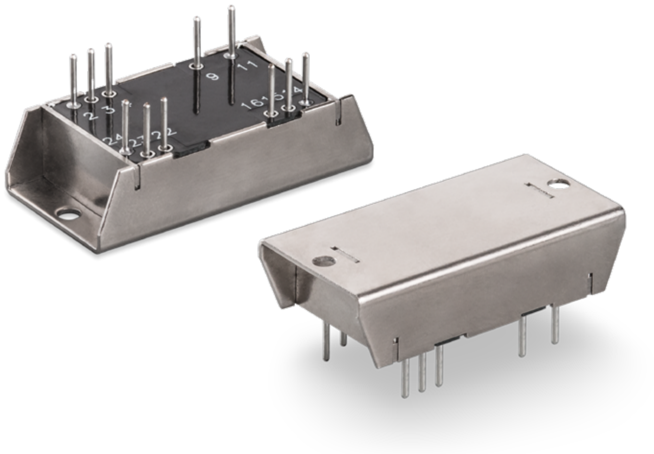
MIL-STD-461

DATASHEET

VDR Series

VDR15, VDR25

Ultra compact DC/DC converters



Description

Ultra compact isolated single channel DC/DC converters designed for industrial and special purpose applications. These compact units (40×20,2×10,25 mm without output pins) have output power up to 25 W and wide operating temperature range −60…+125°C. They can be switched on/off by a signal, equipped with protection from overcurrent, short circuit, output overvoltage and overtemperature and can be connected in series.

VDR25 can safely operate in conditions of ionizing radiation and high temperature. Polymer potting sealing protects units from different factors: vibration, dirt, moisture and salt fog. These modules undergo special thermal and limit test including burn-in test with extreme on/off modes.

Co-use of VDR converters and VFB filters (or recommended electrical circuit) makes the system compliant with MIL-STD-461F CE102 strict requirements.

Engineered in accordance with

- MIL-STD-810G
- MIL-STD-461E (CE102)
- MIL-STD-704F (index “W”)

Description of VDR Series on the manufacturer’s website
https://voltbricks.com/product/vdr

Features

- Output current up to 5 A
- Case operating temperature −60…+125°C
- 125 °C baseplate operation without derating
- 28 VDC (index “W”) input compliant with MIL-STD-704F
- Low-profile design 10,25 mm
- Copper case with mounting flanges
- Short circuit, overcurrent, output overvoltage, thermal protection
- Remote on/off
- Output voltage adjustment
- Switching frequency 800 kHz (fixed)
- Typical efficiency 87% (Uout.=12 VDC)
- Polymer potting sealing
- No optocouplers

Order registration
+65 6950 0011, Global Operations Team

Technical support
support@voltbricks.com

Reliability test
https://support.voltbricks.com/Reliability-Test_ENG.pdf

3D models
https://support.voltbricks.com/models/VDR25-en.stp

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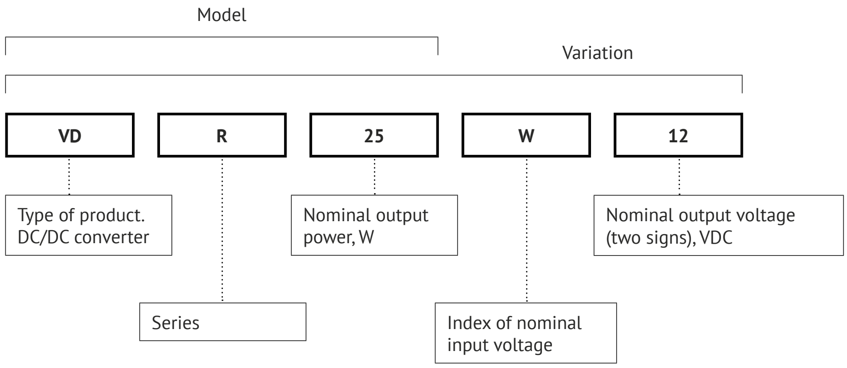
Ordering information



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Output power and current

Model	VDR15							VDR25						
Output power, W	15							16,5	25					
Output voltage, VDC	3,3	5	9	12	15	24	28	3,3	5	9	12	15	24	28
Maximal output current, A	4,55	3	1,66	1,25	1	0,625	0,53	5	5	2,78	2,08	1,67	1,04	0,89

Index of nominal input voltage

Parameter	Index "B"	Index "W"
Nominal input voltage, VDC	12	28
Input voltage range, VDC	9…36	18…75
Transient deviation (1 s), VDC	9…40	17…84
Typical efficiency for Uout.=12 VDC	87%	87%

Specifications

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

Output specifications

Parameter			Value
Output voltage adjustment			±5% Uout. nom
Regulation	Input voltage variation (Umin...Umax)		max ±2% Uout. nom
	Load variation (10...100% Imax)		
	Total regulation		max ±6% Uout. nom
Ripple and noise (p-p)			<2% Uout. nom
Maximum capacitive load*	15 W	3 up to 6 V above 6 up to 15 V above 15 up to 28 V	1500 uF 240 uF 120 uF
	25 W	3 up to 6 V above 6 up to 25 V above 15 up to 28 V	2500 uF 400 uF 125 uF
Start up time (remote)			<0,1 s
Trancient responce deviation	On change Uin.min...Uin.max		max ±10% (50% load step change, 500 us front time)
	On change within 0,5×Inom...Inom		
Duration of transient deviation			not applicable
Non-load operation mode**	Iout < 0.1 * Iout.nom		Uout ≤ 1,3·Uout.nom

* The specified maximum capacitive load ensures start up time of 100 ms at max ohmic load. The value can be increased during testing with lower load or in case the start up time should not be followed.

** When the power converter runs in the non-load operation mode, ripple of output voltage isn't defined. At the same time module can switch to hiccup operation mode when the output voltage appears and disappears periodically. Hiccup operation mode isn't a defect sign. Long time operation in non-load operation mode isn't recommended.

Protections***

Parameter	Value
Overload protection level	<2,7 Pmax
Short circuit protection	yes
Overvoltage protection	yes
Thermal protection level	+115...+130 °C
Vibration proof	1...2000 Hz, 200 (20) m/s² (g), 0,3 mm
Dust proof	yes
Salt fog resistant	yes
Moisture proof (Tamb.=35°C)	98%

*** Parameters are stated for the information purposes and could not be used at long term work, exceeding maximum output current, at work outside of a range of operating temperatures.

Specifications (cont.)

General specifications

Parameter			Value
Operating case temperature			−60...+125 °C
Operating ambient temperature (on condition the case temperature is maintained)			−60...+120 °C
Storage temperature			−60...+125 °C
Switching frequency			800 kHz typ. (fixed, pulse width modulation)
Input capacitance (10 kHz), external	Index «B»	15 W 25 W	33 uF tantalum + 20 uF ceramic 68 uF tantalum + 20 uF ceramic
	Index «W»	15 W 25 W	15 uF tantalum + 10 uF ceramic 22 uF tantalum + 10 uF ceramic
Isolation voltage (60 s)	input/output, input/case, output/case		500 VAC 50 Hz
			750 VDC
Isolation resistance @ 500 VDC	input/output, input/case, output/case		20 MOhm min
Thermal impedance			19,8 °C/W
Remote on/off			Off.: connection of pins «ON» and «−IN», I≤5 mA
Typical MTBF			1 737 900 hrs
Warranty			5 years

Physical specifications

Parameter	Value
Case material	copper alloy with nickel electroplating coating
Potting	epoxy
Pin material	copper
Weight	max 32 g
Soldering temperature	max 260 °C @ 5 s
Dimensions	max 40×20,2×10,25 mm without output pins

Design topologies

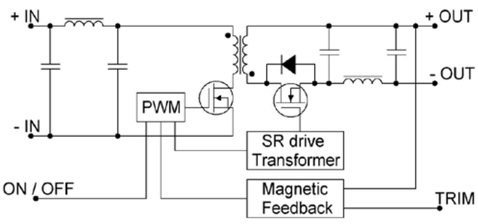

Figure 1 (a). VDR15 design topology.

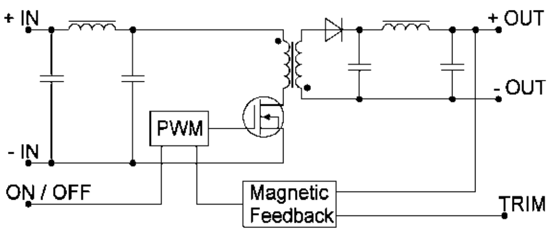

Figure 1 (b). VDR25 design topology.

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Service functions

Typical connection

Co-use of VDR converters and VFB filters (or recommended electrical circuit) makes the system compliant with MIL-STD-461F CE102 strict requirements.

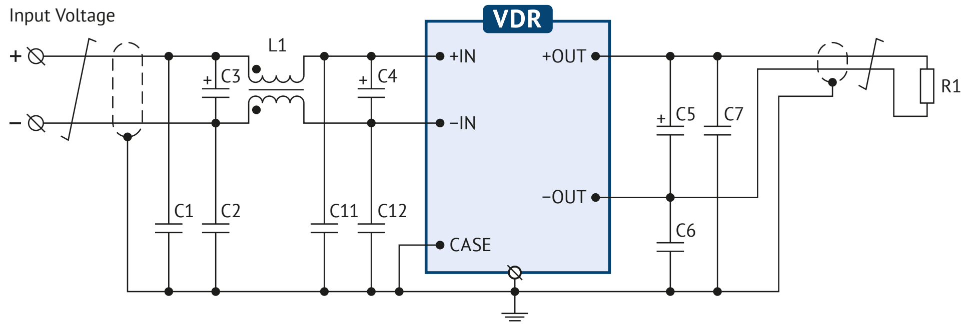

Figure 2 (a). Typical electrical circuit.

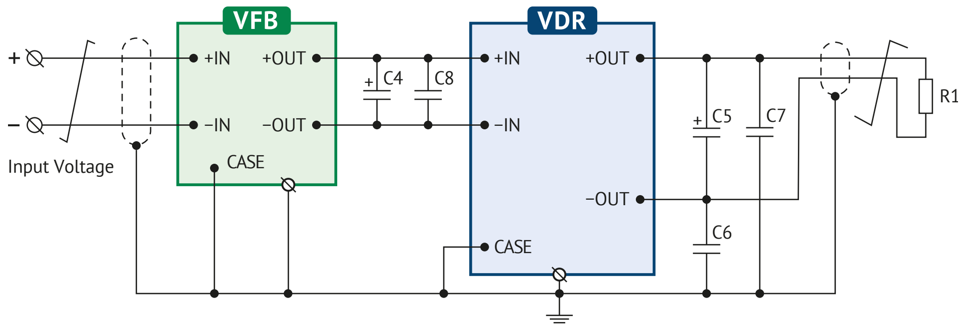

Figure 2 (b). VDR + VFB application.

VDR	DC/DC converter			15 W	25 W
L1	common mode choke			min 8 mH	
C3, C4	ceramic capacitor	Input voltage	12 VDC 28 VDC	20 uF 10 uF	
	tantalum capacitor	Input voltage	12 VDC 28 VDC	33 uF 15 uF	68 uF 22 uF
C1, C2, C6, C7, C11, C12	ceramic capacitor	Typical electrical circuit		10000 pF	
		VDR + VFB application		2200…4700 pF	
C5	tantalum or aluminum capacitor	Output voltage	3 up to 6 V above 6 up to 15 V above 15 up to 28 V	200 uF 100 uF 68 uF	300 uF 140 uF 100 uF
VFB	electromagnetic interference filter	Input voltage	12 VDC 28 VDC	VFB04BU VFB02WU	
C8	ceramic capacitor	Input voltage	12 VDC 28 VDC	20 uF 10 uF	

Table 1. Components of typical connecting circuit.

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Service functions (cont.)

Remote control

Function of remote control by a signal allows to control the unit's operation using mechanical relay or electric switch of "open collector" type.

The unit should be powered off by connecting "ON" output to "–IN" output. The switch can carry current of up to 5 mA, the max voltage drop on the switch should be less than 1,1 V.

The unit is powered on by disconnecting the switch within the time less then 5 µs. Being disconnected the switch is applied by approximately 5 V, allowable current leakage through the switch should not be over 50 µA.

To arrange remote power off/on of several units simultaneously it is not allowed to use additional elements in the circuit to connect outputs "ON" and "–IN" and a switch.

If the function of remote power off/on is not used, "ON" output is allowed to be left unconnected.

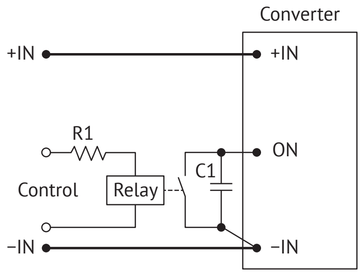

Figure 3 (a). ON/OFF control by relay.

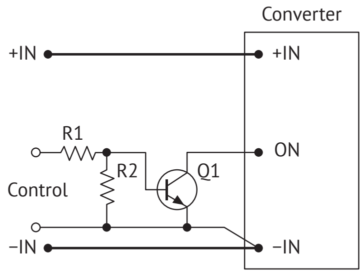

Figure 3 (b). ON/OFF control by bipolar transistor.

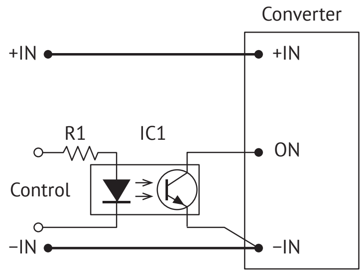

Figure 3 (c). ON/OFF control by optocoupler.

Adjustment

Adjustment of output voltage of a power supply unit within the range of at least ±5% can be done by connecting "ADJ" output (if available) through "–OUT" output to increase output voltage, or through "+OUT" output to decrease the output voltage.

In case of using variable resistor Rvar and outside resistors (R1, R2) it is possible to fulfill the adjustment both to increase and decrease the output voltage.

If you need to control the output voltage of a power supply unit by a signal from external source of current or voltage, e.g. in micro-controller automated control systems using DAC, the external current or voltage signal should be supplied to the adjustment output relating to "–OUT" output, as shown in the drawings (e) and (d).

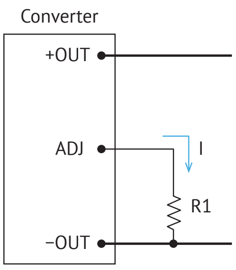

Figure 4 (a). Output voltage increase.

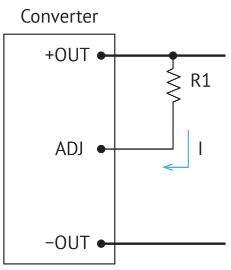

Figure 4 (b). Output voltage decrease.

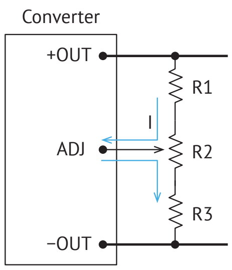

Figure 4 (c). Adjustment by resistive divider.

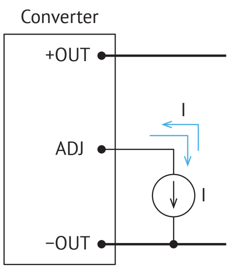

Figure 4 (e). Adjustment by current sourse.

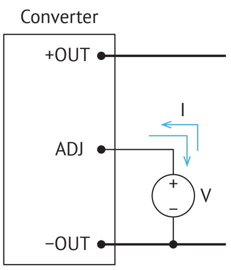

Figure 4 (d). Adjustment by voltage sourse.

Service functions (cont.)

Output voltage VS resistor rating of VDR15

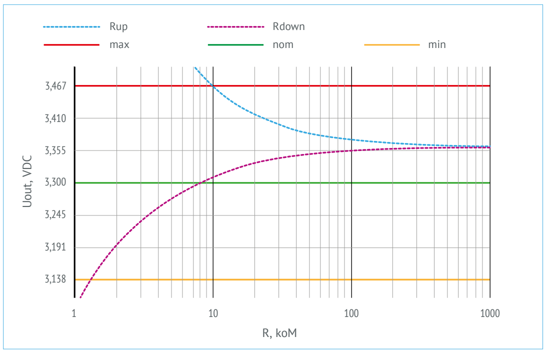

Figure 5 (a). Resistance values for adjustment of Uout.=3,3 VDC.

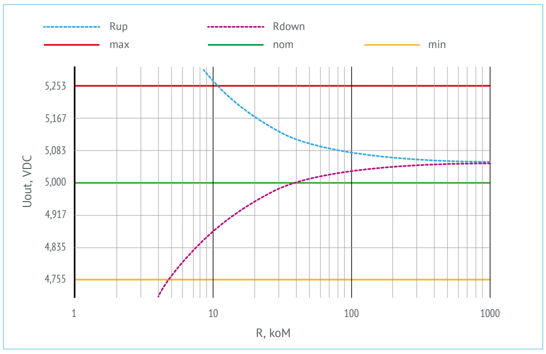

Figure 5 (b). Resistance values for adjustment of Uout.=5 VDC.

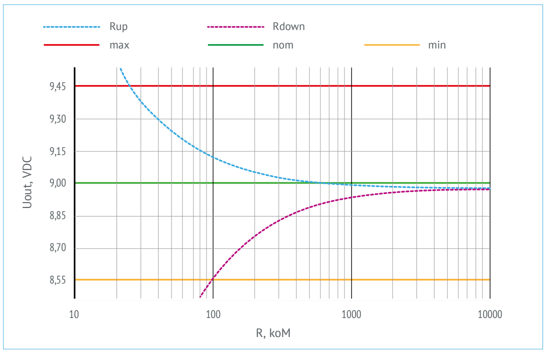

Figure 5 (c). Resistance values for adjustment of Uout.=9 VDC.

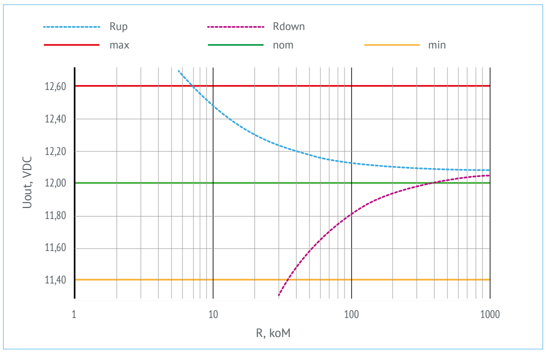

Figure 5 (d). Resistance values for adjustment of Uout.=12 VDC.

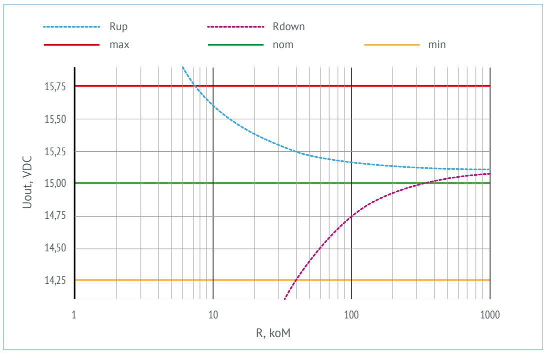

Figure 5 (e). Resistance values for adjustment of Uout.=15 VDC.

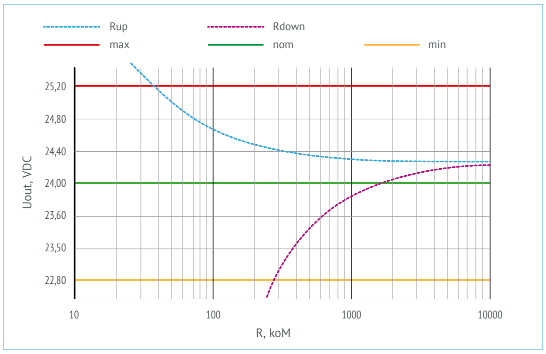

Figure 5 (f). Resistance values for adjustment of Uout.=24 VDC.

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Typical connection (cont.)

Output voltage adjustment

	95%	96%	97%	98%	99%	Unom.	101%	102%	103%	104%	105%
Uout., VDC	**3,14**	**3,17**	**3,2**	**3,23**	**3,27**	**3,3**	**3,33**	**3,37**	**3,4**	**3,43**	**3,47**
Itrim., mA	−0,27	−0,22	−0,17	−0,11	−0,05	0	0,05	0,11	0,17	0,22	0,27
Utrim., VDC	2,07	2,16	2,23	2,31	2,37	2,45	2,54	2,61	2,67	2,77	2,84
Uout., VDC	**4,75**	**4,8**	**4,85**	**4,9**	**4,95**	**5**	**5,05**	**5,1**	**5,15**	**5,2**	**5,25**
Itrim., mA	−0,06	−0,05	−0,035	−0,02	−0,01	0	0,01	0,02	0,035	0,5	0,06
Utrim., VDC	1,93	2,02	2,12	2,22	2,32	2,42	2,51	2,6	2,7	2,78	2,87
Uout., VDC	**11,4**	**11,52**	**11,64**	**11,76**	**11,88**	**12**	**12,12**	**12,24**	**12,36**	**12,48**	**12,6**
Itrim., mA	−0,16	−0,125	−0,08	−0,06	−0,03	0	0,03	0,06	0,08	0,125	0,16
Utrim., VDC	2,85	2,6	2,35	2,12	1,9	1,7	1,45	1,2	0,95	0,7	0,5
Uout., VDC	**25,65**	**25,92**	**26,2**	**26,46**	**26,73**	**27**	**27,27**	**27,54**	**27,8**	**28.08**	**28,35**
Itrim., mA	−0,065	−0,05	−0,037	−0,025	−0,015	0	0,015	0,025	0,037	0,05	0,065
Utrim., VDC	2,28	2,79	2,7	2,6	2,51	2,41	2,32	2,22	2,12	2,02	1,93

Table 2. Current and voltage values for adjustment.

Output voltage VS resistor rating of VDR25

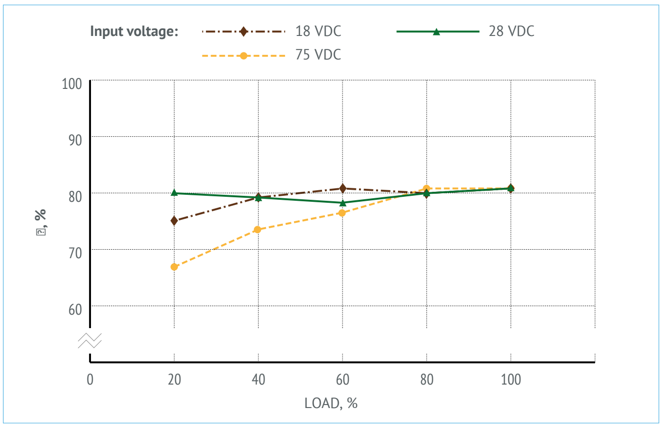

Figure 6 (a). Resistance values for adjustment of Uout.=5 VDC.

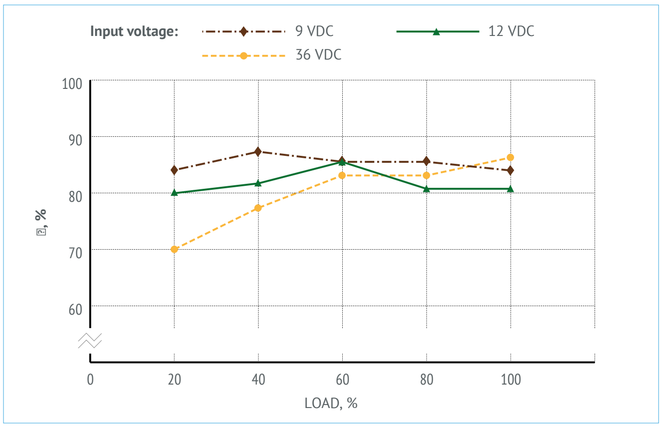

Figure 6 (b). Resistance values for adjustment of Uout.=12 VDC.

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Efficiency

VS load for VDR15 (Index "B")

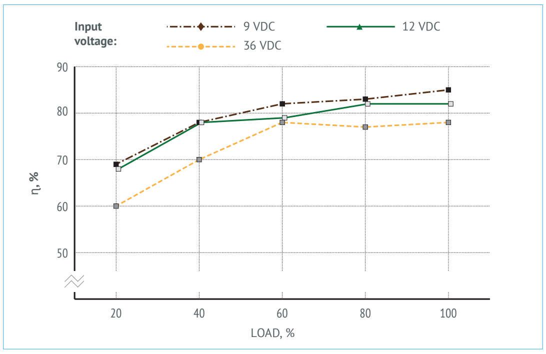

Figure 7 (a). Efficiency of VDR15B3,3.

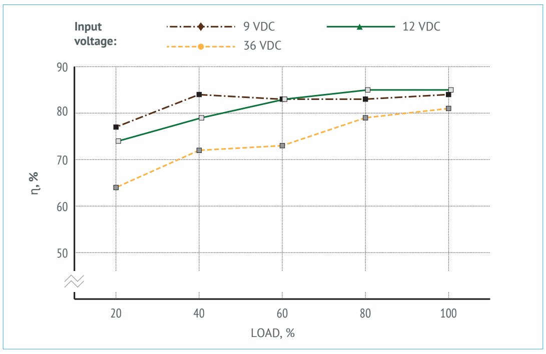

Figure 7 (b). Efficiency of VDR15B05.

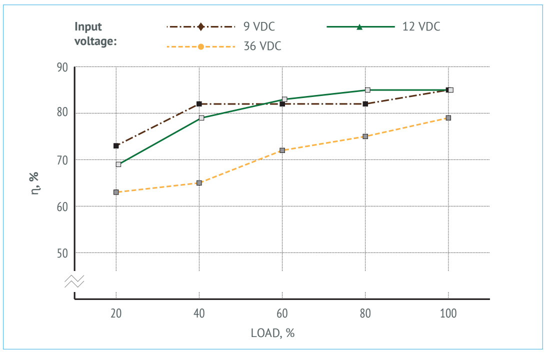

Figure 7 (c). Efficiency of VDR15B09.

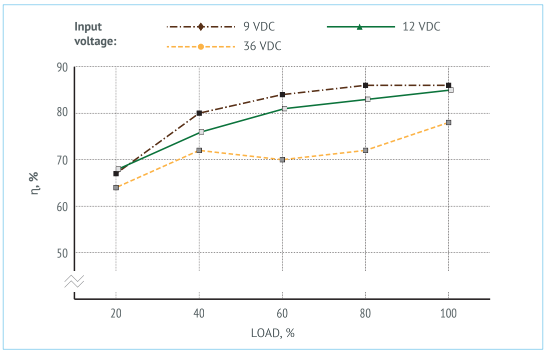

Figure 7 (d). Efficiency of VDR15B12.

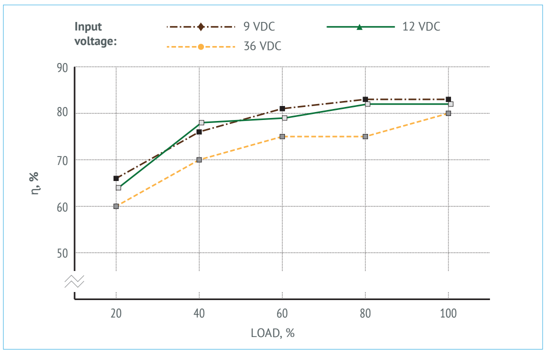

Figure 7 (e). Efficiency of VDR15B15.

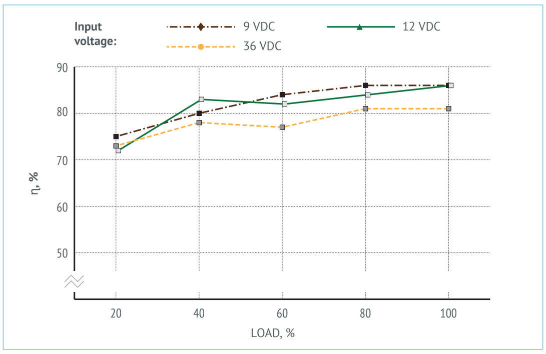

Figure 7 (f). Efficiency of VDR15B24.

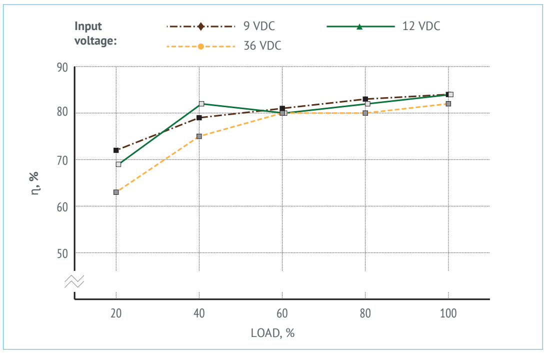

Figure 7 (g). Efficiency of VDR15B28.

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Efficiency (cont.)

VS load for VDR15 (Index “W”)

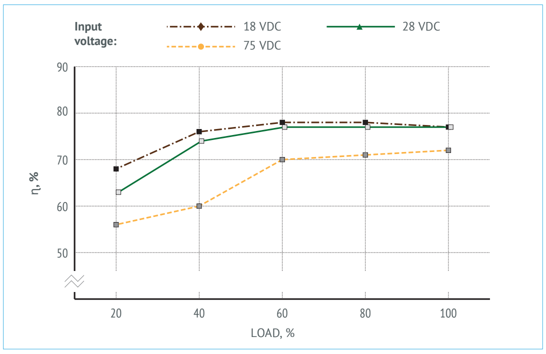

Figure 8 (a). Efficiency of VDR15W3,3.

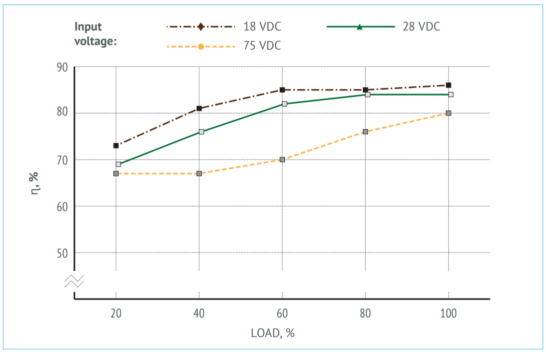

Figure 8 (b). Efficiency of VDR15W05.

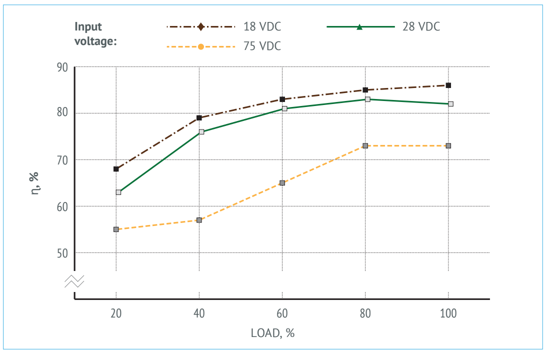

Figure 8 (c). Efficiency of VDR15W09.

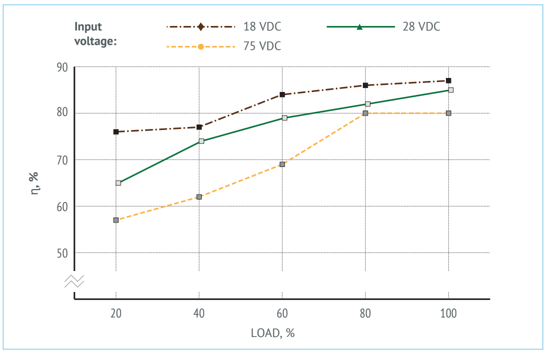

Figure 8 (d). Efficiency of VDR15W12.

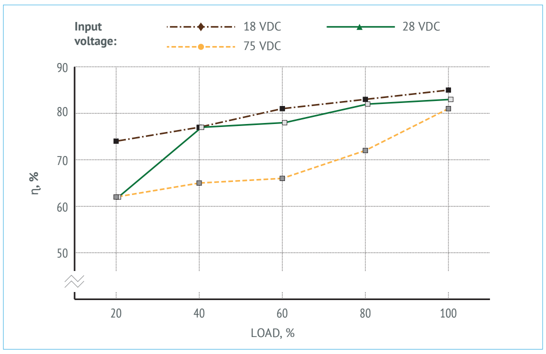

Figure 8 (e). Efficiency of VDR15W15.

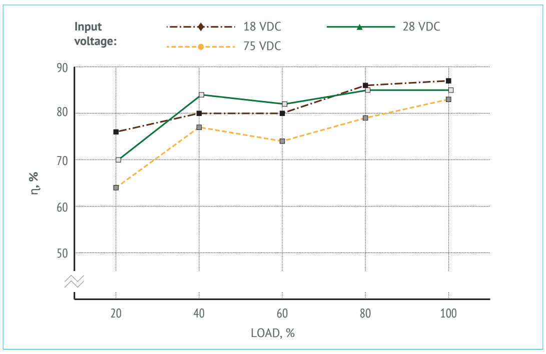

Figure 8 (f). Efficiency of VDR15W24.

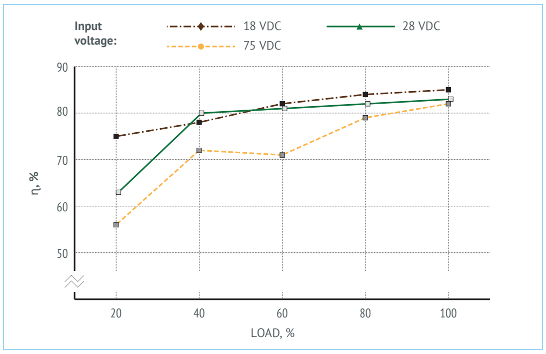

Figure 8 (g). Efficiency of VDR15W28.

Efficiency

VS load for VDR25

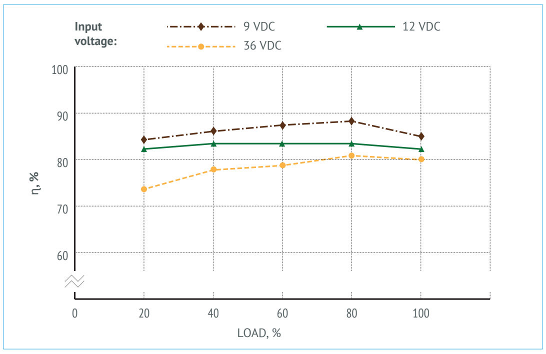

Figure 9 (a). Efficiency of VDR25B05.

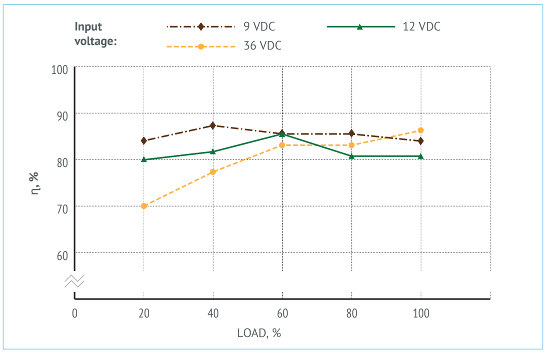

Figure 9 (b). Efficiency of VDR25B24.

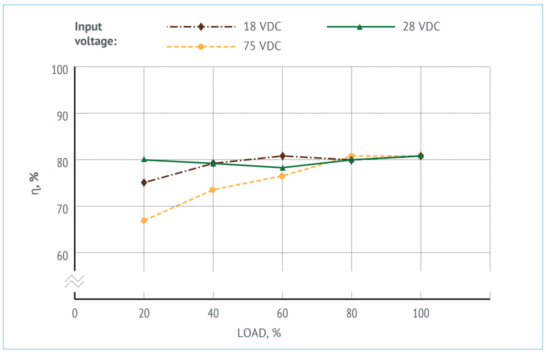

Figure 9 (c). Efficiency of VDR25W05.

Oscillograph charts

Charts of VDR15B05

Testing conditions Uin.=12 VDC, Iout.=3 A, Tamb.=25°C, Uout.=5 VDC, Cout.=300 uF

The database of regulated parameters of the maunfactured products is available. Pls. contact your personal manager or customer support service to get necessary information.

Figure 10 (a). Oscillograph chart of setting output voltage after supplying remote control signal to ON-input.

Ray 1 (blue) — voltage at ON-input. Scale 10 V/div.

Ray 2 (red) — output voltage. Scale 2 V/div.

Time scale 1 ms/div.

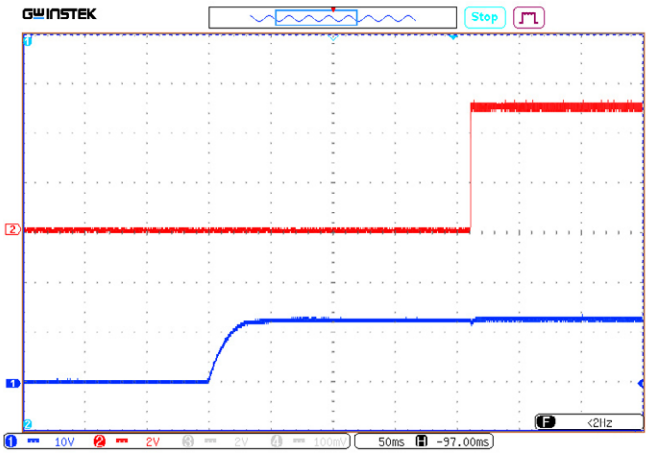

Figure 10 (b). Oscilliograph chart of output voltage after supplying the input voltage.

Ray 1 (blue) — input voltage. Scale 10 V/div.

Ray 2 (red) — output voltage. Scale 2 V/div.

Time scale 50 ms/div.

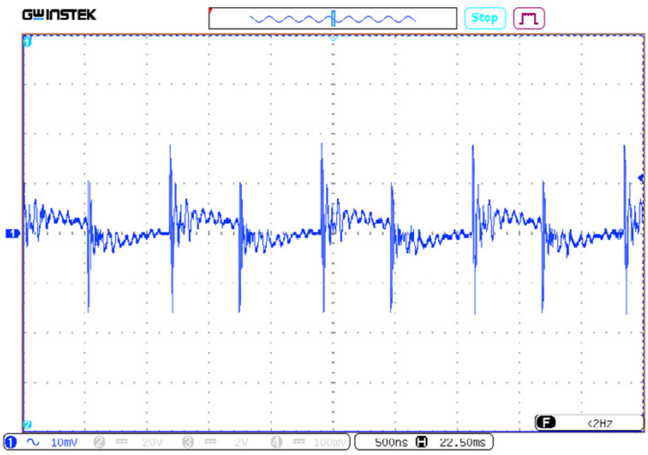

Figure 10 (c). Oscillograph chart of output voltage ripple.

Ripple of output voltage. Scale 10 mV/div. Time scale 500 ns/div.

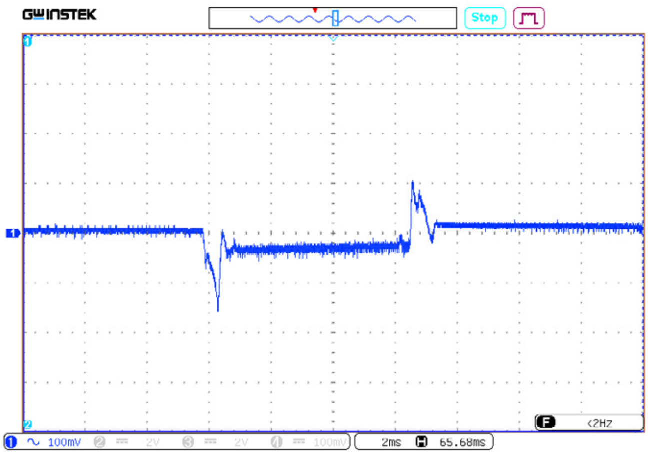

Figure 10 (d). Oscillograph chart of voltage transient deviation during load "drop/rise" 0…100 %.

Ray 1 (blue) — output voltage. Scale 100 mV/div. Time scale 2 ms/div.

Oscillograph charts

Charts of VDR15W28

Testing conditions Uin.=28 VDC, Iout.=0,53 A, Tamb.=25°C, Uout.=28 VDC, Cout.=100 uF

The database of regulated parameters of the maunfactured products is available. Pls. contact your personal manager or customer support service to get necessary information.

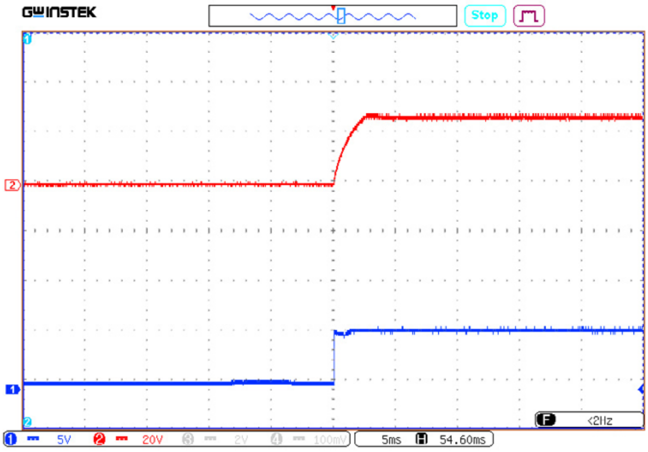

Figure 11 (a). Oscillograph chart of setting output voltage after supplying remote control signal to ON-input.

Ray 1 (blue) – voltage at ON-input. Scale 5 V/div.

Ray 2 (red) – output voltage. Scale 20 V/div.

Time scale 5 ms/div.

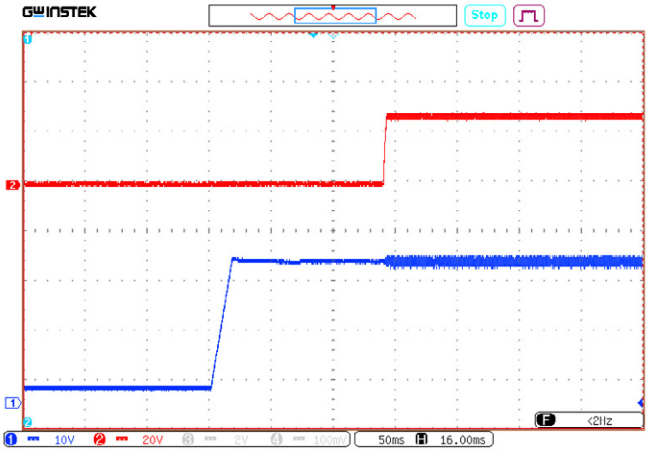

Figure 11 (b). Oscilliograph chart of output voltage after supplying the input voltage.

Ray 1 (blue) – input voltage. Scale 10 V/div.

Ray 2 (red) – output voltage. Scale 20 V/div.

Time scale 50 ms/div.

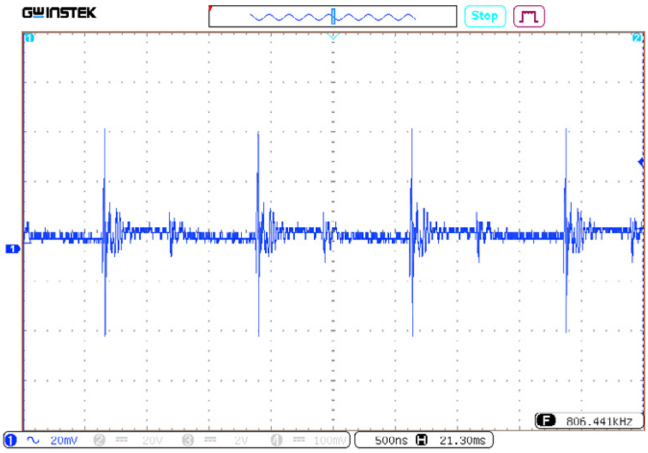

Figure 11 (c). Oscillograph chart of output voltage ripple.

Ripple of output voltage. Scale 20 mV/div. Time scale 500 ns/div.

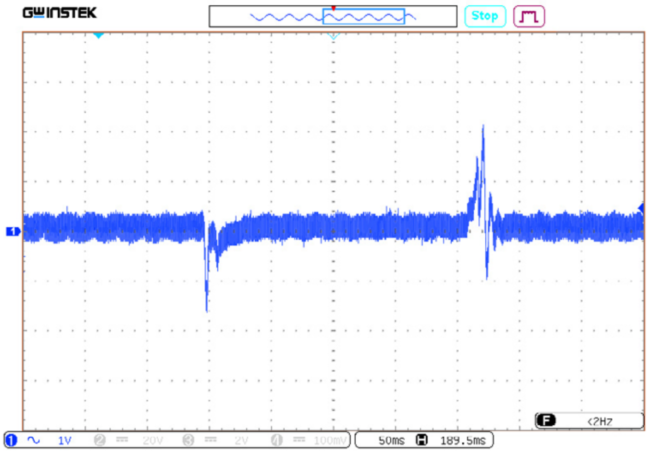

Figure 11 (d). Oscillograph chart of voltage transient deviation during load "drop/rise" 0…100 %.

Ray 1 (blue) – output voltage. Scale 1 V/div. Time scale 50 ms/div.

Noise spectrogram

EN 55032 compliance test results for typical electrical circuit

VDR15B05

Uin.=12 VDC, Tamb.=25 °C

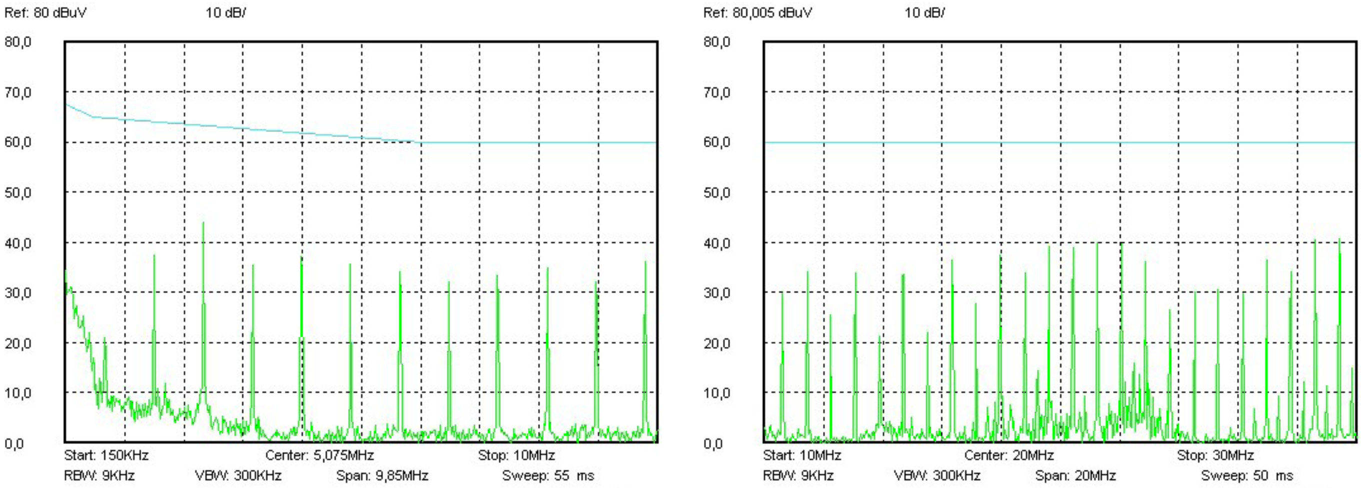

Figure 12 (a). Spectrogram 0,01–10 MHz.

VDR15W28

Uin.=28 B, Tamb.=25 °C

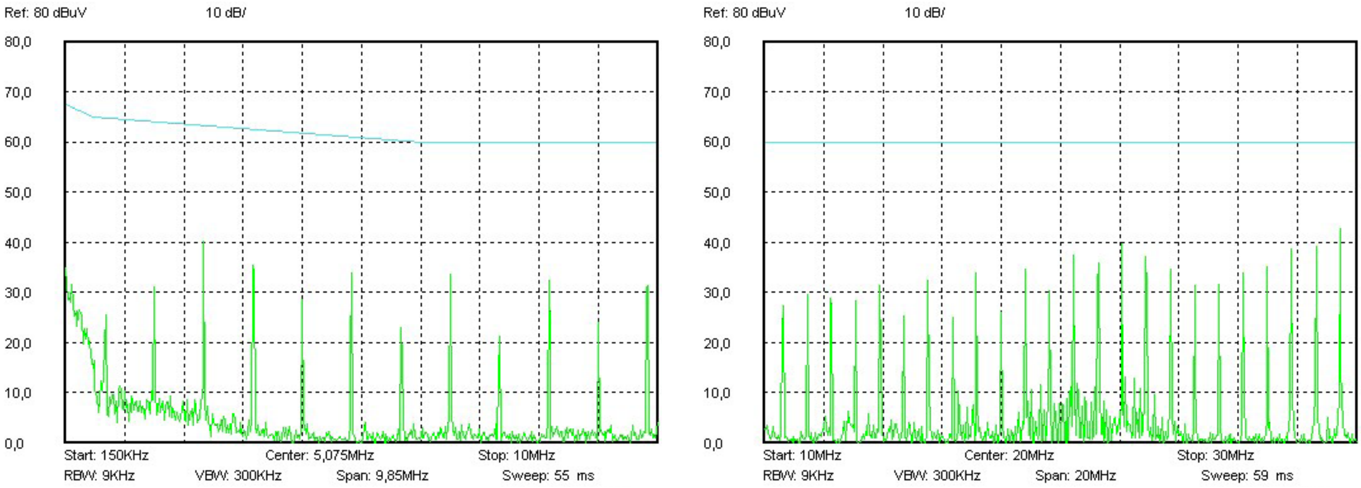

Figure 12 (b). Spectrogram 0,01–10 MHz.

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Noise spectrogram (cont.)

MIL-STD-461F CE102 compliance test results for typical electrical circuit

VDR15B05

Uin.=12 VDC, Tamb.=25 °C

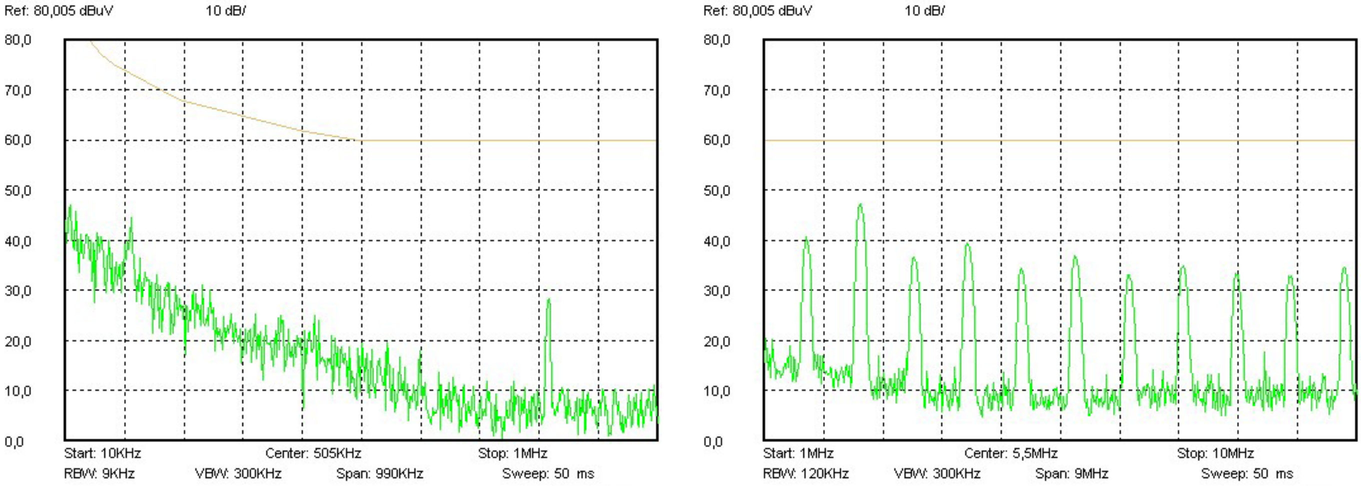

Figure 13 (a). Spectrogram 0,01–10 MHz.

VDR15W28

Uin.=28 VDC, Tamb.=25 °C

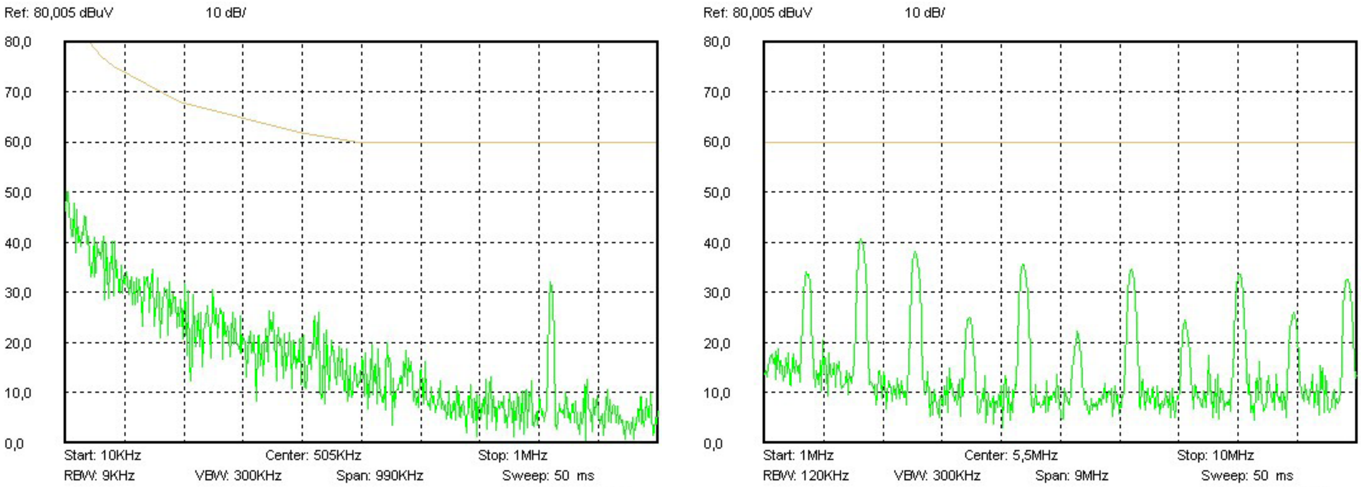

Figure 13 (b). Spectrogram 0,01–10 MHz.

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Noise spectrogram (cont.)

MIL-STD-461F CE102 compliance test results for VDR + VFB application

VDR25B05

Uin.=12 VDC, Tamb.=25 °C, LOAD = 100 %

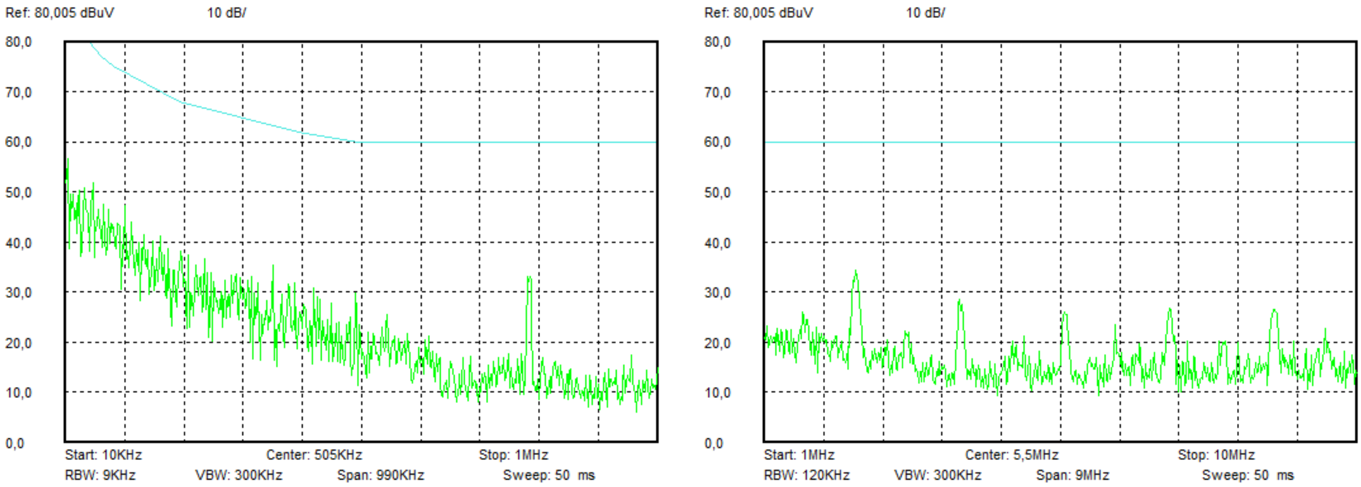

Figure 14 (a). Spectrogram 0,01 – 10 MHz.

VDR25W28

Uin.=28 VDC, Tamb.=25 °C, LOAD = 70 %

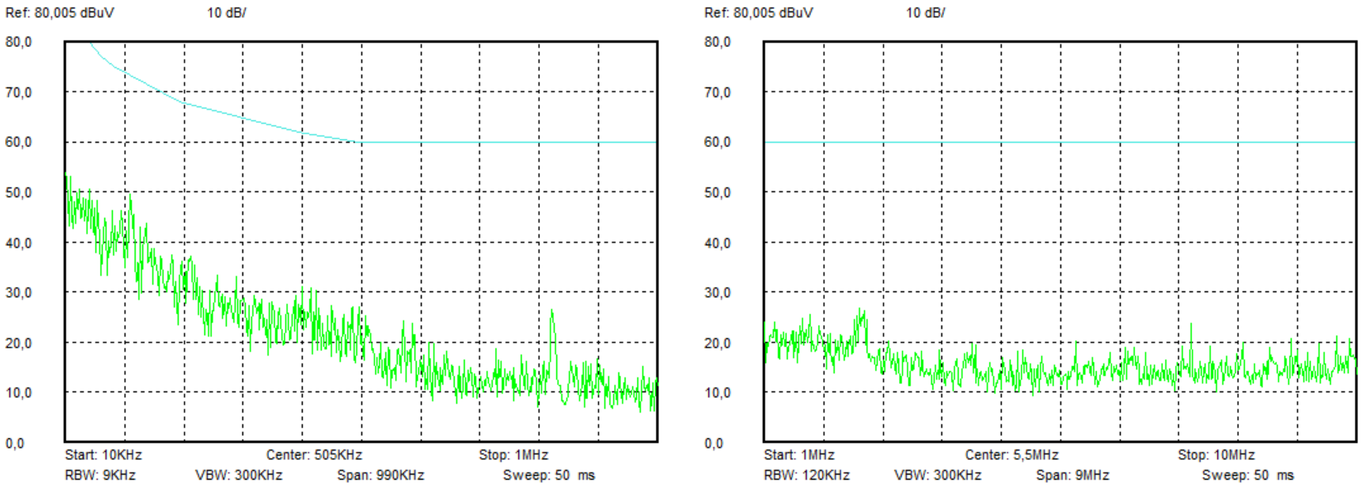

Figure 14 (b). Spectrogram 0,01 – 10 MHz.

Outline dimensions

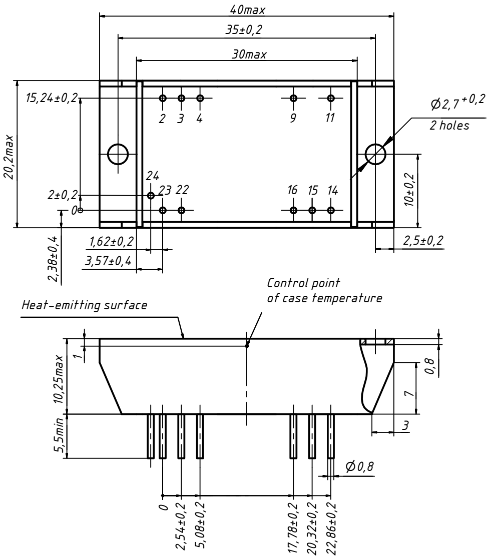

Figure 15. Flanged units.

Pin out

Pin #	2, 3	4	9, 11	14	15	16	22, 23	24
Function	–IN	ON	NOT USE	+OUT	TRIM	–OUT	+IN	CASE

Heatsink

Part number	Ribs configuration	Dimensions A×B×H×D, mm	Area, cm²	Weight, g	Picture, №
752694.001	Cross	40×20×14×2	74	14	*[Pic.1]*
752694.002	Longitudinal	40×20×14×2	74	14	*[Pic.2]*

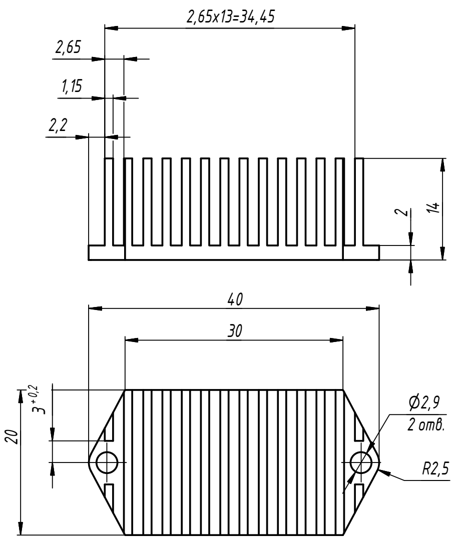

Figure 16 (a). *752694.001.*

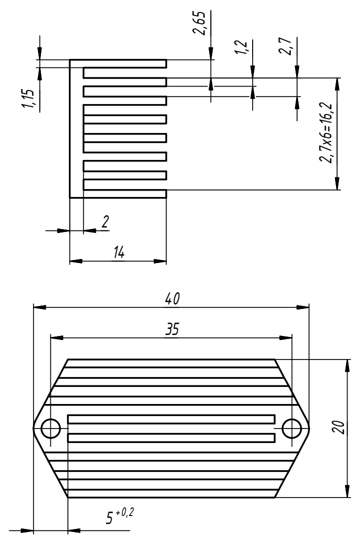

Figure 16 (b). *752694.002.*

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Manufacturer of reliable DC/DC converters and power supply systems

This datasheet is valid for the following units: VDR15B3,3; VDR15B05; VDR15B09; VDR15B12; VDR15B15; VDR15B24; VDR15B28; VDR15W3,3; VDR15W05; VDR15W09; VDR15W12; VDR15W15; VDR15W24; VDR15W28; VDR25B3,3; VDR25B05; VDR25B09; VDR25B12; VDR25B15; VDR25B24; VDR25B28; VDR25W3,3; VDR25W05; VDR25W09; VDR25W12; VDR25W15; VDR25W24; VDR25W28.