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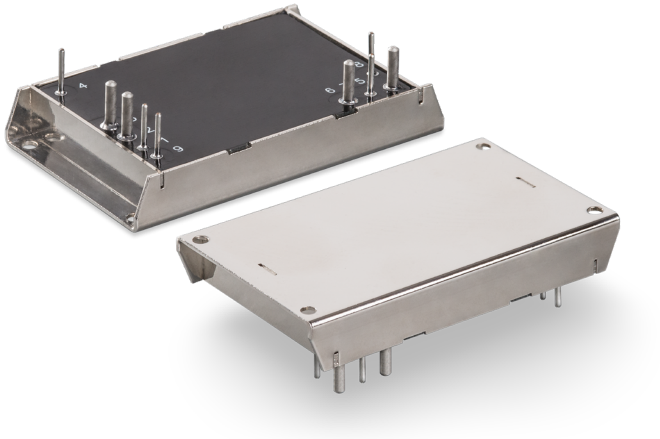
DATASHEET

VDR Series

VDR120, VDR160

Ultra compact DC/DC converters



Description

Ultra compact isolated single channel DC/DC converters designed for industrial and special purpose applications. These compact units (67,5×40,2×11,2 mm without output pins) have output power up to 160 W and wide operating temperature range (−60…+125°C for VDR120). They have remote On/Off option, full range of protections: overcurrent, short circuit, overvoltage and thermal, and can be connected both in parallel and series.

VDR160 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.

Engineered in accordance with

- MIL-STD-810G
- MIL-STD-461F (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 40 A
- Case operating temperature:
  −60…+125°C for VDR120
  −60…+115°C for VDR160
- 125 °C baseplate operation without derating
- 28 VDC (index "W") input compliant with MIL-STD-704F
- Low-profile design 11,2 mm
- Copper case with mounting flanges
- Short circuit, overcurrent, output overvoltage, thermal protection
- Remote on/off
- Output voltage adjustment
- Switching frequency 280 kHz (fixed)
- Typical efficiency 91% (Uout.=5 VDC)
- Polymer potting sealing
- No optocouplers
- Power sharing
- Output voltage adjustment
- Switching frequency external synchronization

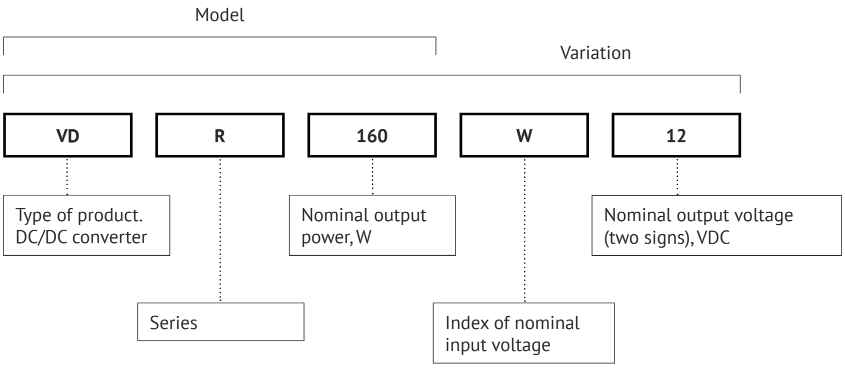
Order registration
+65 6950 0011, Global Operations Team

Technical support
support@voltbricks.com

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

3D models
https://support.voltbricks.com/models/VDR160-en.stp

Ordering information



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Output power and current

Model	VDR120							VDR160					
Output power, W	120							160					
Output voltage, VDC	3,3	5	9	12	15	24	28	5	9	12	15	24	28
Maximal output current, A	36,4	24	13,3	10	8	5	4,3	32	17,8	13,3	10,7	6,7	5,7

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

Specifications

All specifications valid for normal climatic conditions (ambient temp. 15…35°C; relative humidity 45…80%; air pressure $8,6 \times 10^4 \ldots 10,6 \times 10^4$ 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	±6% Uout. nom
Ripple and noise (p-p)		<2% Uout. nom
Start up time (remote)		<0,1 s
Overload protection level*		<1,5 Pmax
Short circuit protection*		hiccup auto recovery
Overvoltage protection		1,5 Unom, forced restriction
Trancient responce deviation		±10% (50% load step change, 500 us front time)
Non-load operation mode**	Iout < 0.1 * Iout.nom	Uout ≤ 1,3·Uout.nom

* 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.

** 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.

General specifications

Parameter		Value
Case temperature	Operating (natural convection) 120 W 160 W	−60…+125°C −60…+115°C
	Storage	−60…+125°C
Switching frequency		280 kHz typ. (fixed, pulse width modulation)
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		7,8 °C/W
Thermal protection level		118…125 °C, clamp, auto recovery
Remote on/off		Off.: 0…1,1 VDC or connection of pins "ON" and "–IN", I≤5 mA
Vibration and dust proof, salt fog resistant		+
Typical MTBF		1 737 900 hrs
Warranty		5 years

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Specifications (cont.)

Physical specifications

Parameter	Value
Case material	copper alloy with nickel electroplating coating
Potting	polymer
Pin material	bronze
Weight	max 110 g
Soldering temperature	260°C/5 s
Dimensions	max 67,5×40,2×11,2 mm without output pins

Design topologies

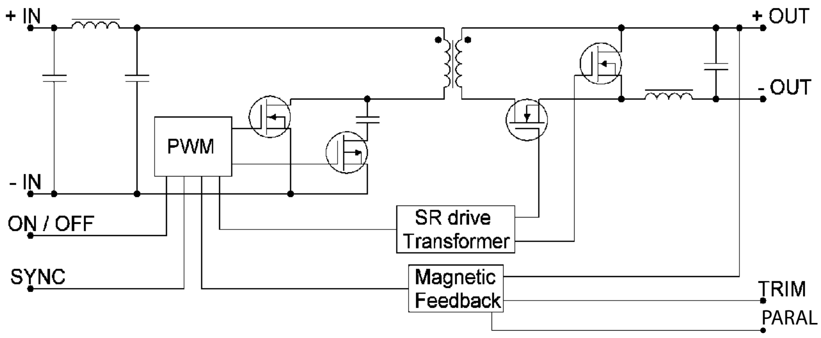

Figure 1. VDR160 design topology.

Typical connection

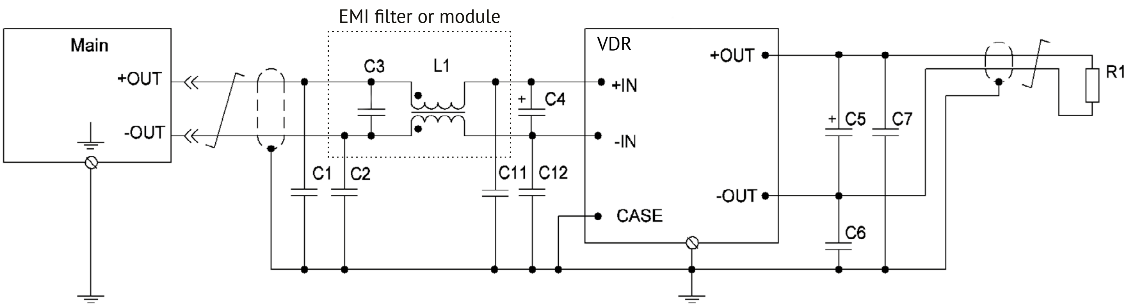

Figure 2. Typical connection with filtration unit.

C1, C2, C6, C7, C11, C12	ceramic capacitor		10000 pF	Y capacitors, part of EMI filter
C4	tantalum capasitor	Input voltage: 12 VDC 28 VDC	210 uF 100 uF	Obligatory element, part of EMI filter
C5	tantalum capasitor	Output voltage: 5 VDC 12 VDC 24 VDC	600 uF 300 uF 40 uF	Usage of this capasitor is advisory and influences the value of output voltage transient deviation

A1

EN55022 Class A EMI Filter	L1	common mode choke		8 mH	initial permeability from 10000 to 20000, part of EMI filter
	C3	ceramic capacitor	Input voltage: 12 VDC 28 VDC	30 uF 15 uF	Low ESR, part of EMI filter

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Typical connection

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.

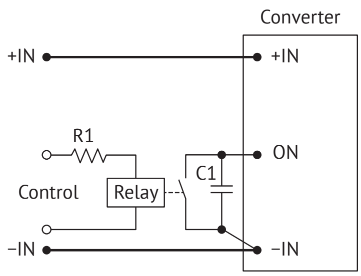

Figure 3 (a). ON/OFF control by relay.

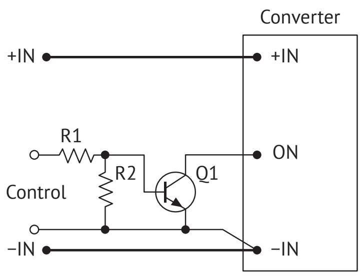

Figure 3 (b). ON/OFF control by bipolar transistor.

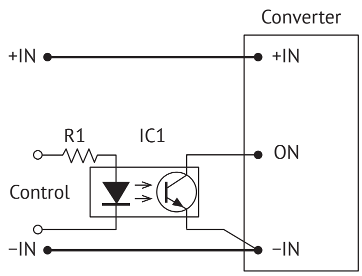

Figure 3 (c). ON/OFF control by optocoupler.

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).

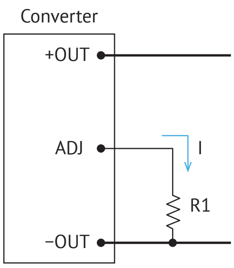

Figure 4 (a). Output voltage increase.

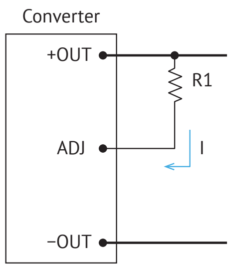

Figure 4 (b). Output voltage decrease.

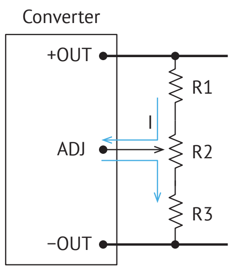

Figure 4 (c). Adjustment by current sourse.

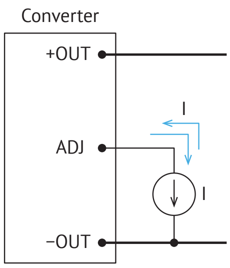

Figure 4 (e). Adjustment by esistive divider.

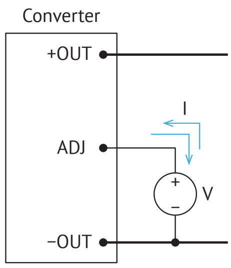

Figure 4 (d). Adjustment by voltage sourse.

Service functions (cont.)

Output voltage VS resistor rating of VDR120, VDR160

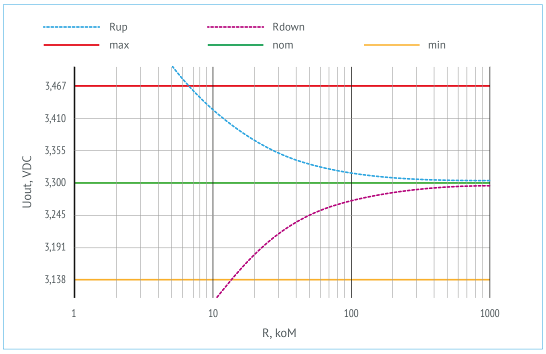

Figure 5 (a). Current and voltage values for adjustment of VDR120B3,3.

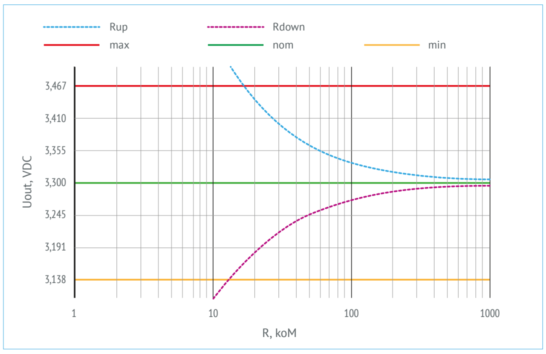

Figure 5 (b). Current and voltage values for adjustment of VDR120W3,3.

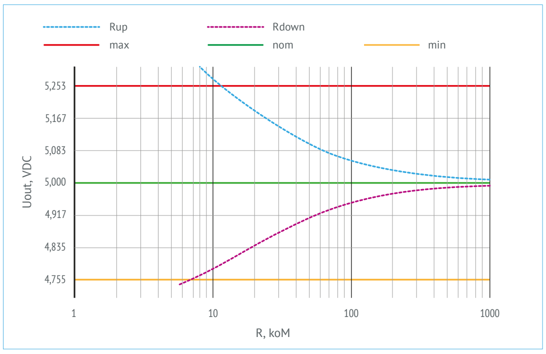

Figure 5 (c). Current and voltage values for adjustment of VDR160[...]05.

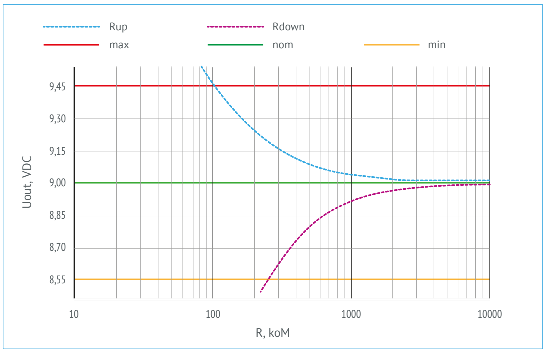

Figure 5 (d). Current and voltage values for adjustment of VDR160[...]09.

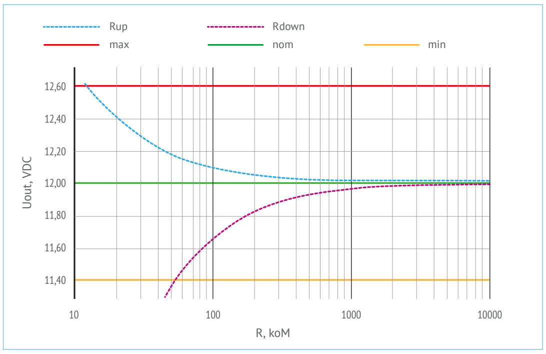

Figure 5 (e). Current and voltage values for adjustment of VDR160[...]12.

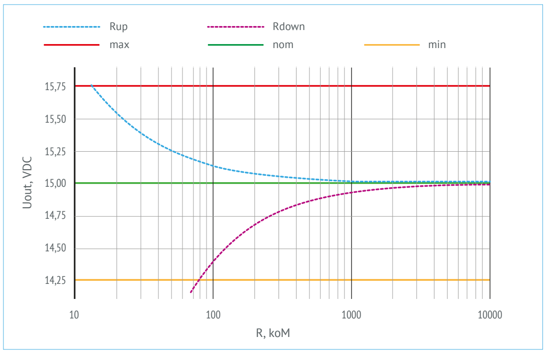

Figure 5 (f). Current and voltage values for adjustment of VDR160[...]15.

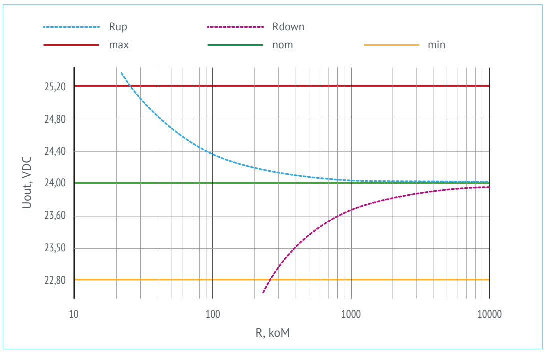

Figure 5 (g). Current and voltage values for adjustment of VDR160[...]24.

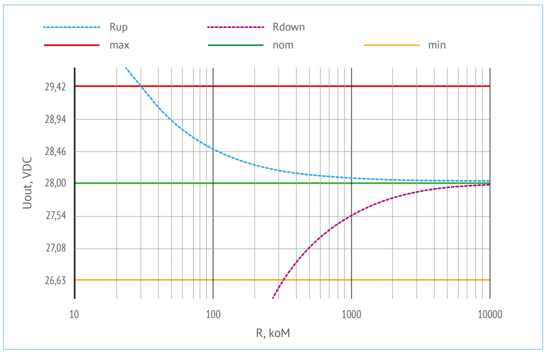

Figure 5 (i). Current and voltage values for adjustment of VDR160[...]28.

Efficiency

VS load for VDR160 (Index "B")

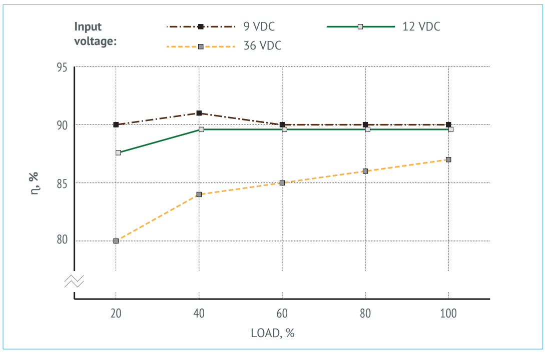

Figure 6 (a). Efficiency of VDR160B05.

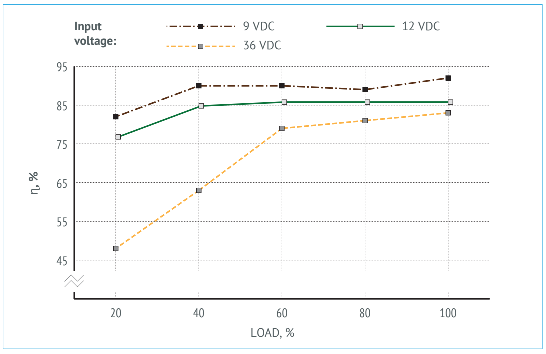

Figure 6 (b). Efficiency of VDR160B09.

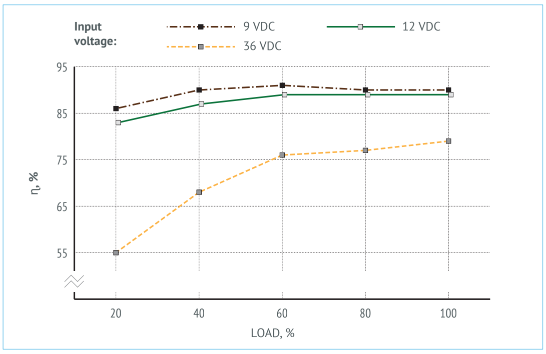

Figure 6 (c). Efficiency of VDR160B12.

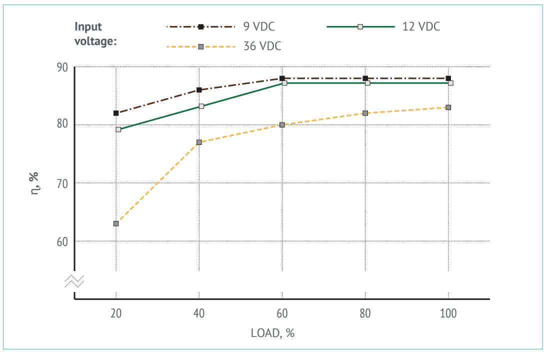

Figure 6 (d). Efficiency of VDR160B24.

Efficiency (cont.)

VS load for VDR160 (Index “W”)

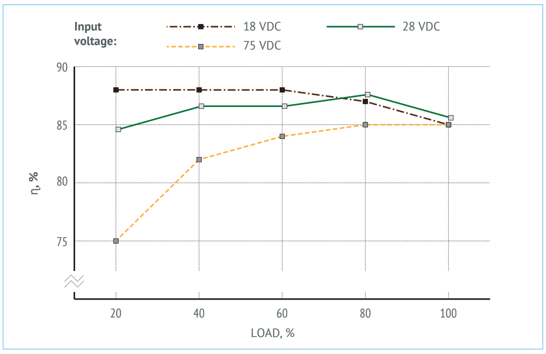

Figure 7 (a). Efficiency of VDR160W05.

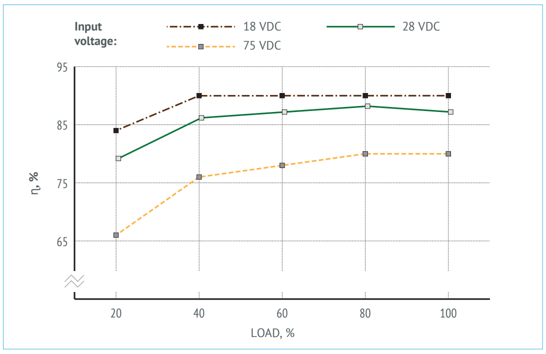

Figure 7 (b). Efficiency of VDR160W09.

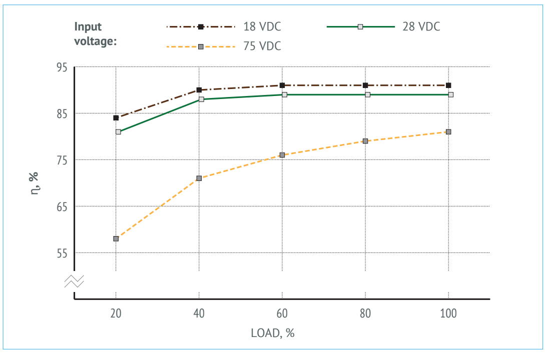

Figure 7 (c). Efficiency of VDR160W12.

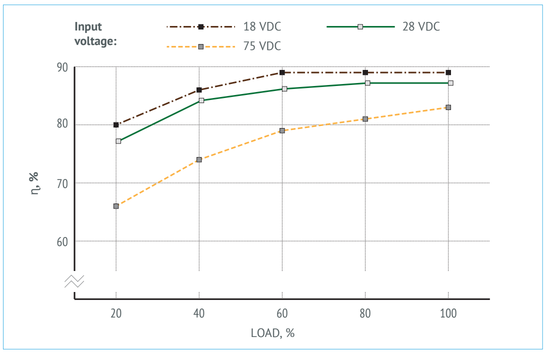

Figure 7 (d). Efficiency of VDR160W24.

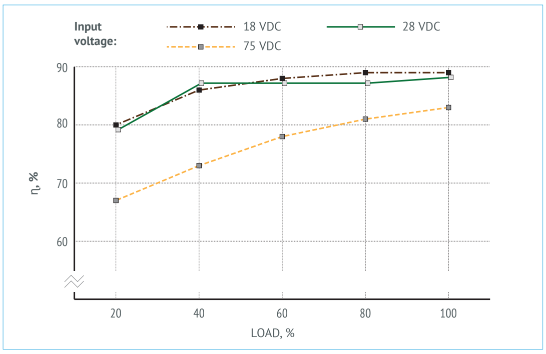

Figure 7 (e). Efficiency of VDR160W28.

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Oscillograph charts

Charts of VDR160B12

Testing conditions Uin.=12 VDC, Iout.=13,3 A, Tamb.=25°C, Uout.=12 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.

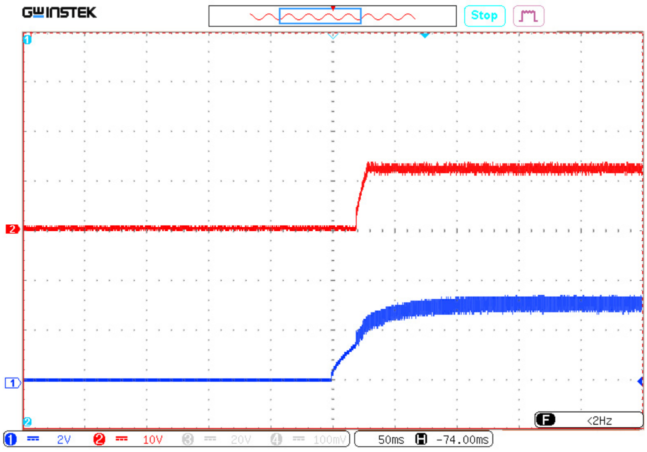

Figure 8 (a). Oscillograph chart of setting output voltage after supplying remote control signal to ON-input.

Ray 1 (blue) – voltage at ON-input. Scale 2 V/div.
Ray 2 (red) – output voltage. Scale 10 V/div.
Time scale 50 ms/div.

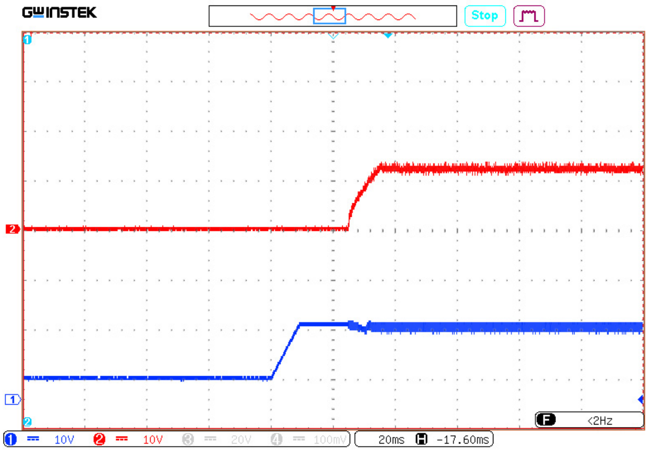

Figure 8 (b). Oscilliograph chart of output voltage after supplying the input voltage.

Ray 1 (blue) – input voltage. Scale 10 V/div.
Ray 2 (red) – output voltage. Scale 10 V/div.
Time scale 20 ms/div.

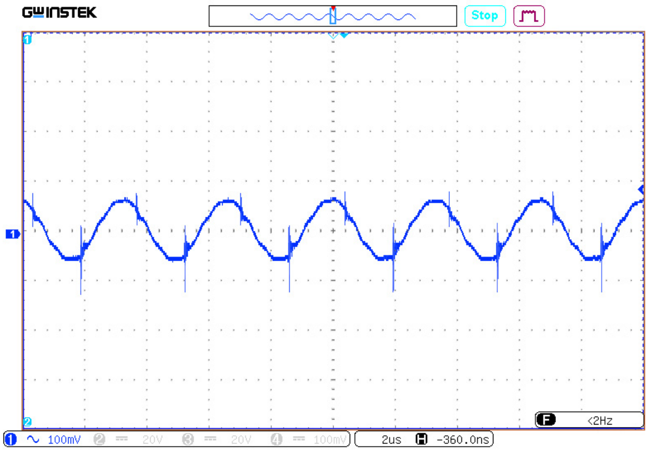

Figure 8 (c). Oscillograph chart of output voltage ripple.

Ripple of output voltage. Scale 100 mV/div. Time scale 2 us/div.

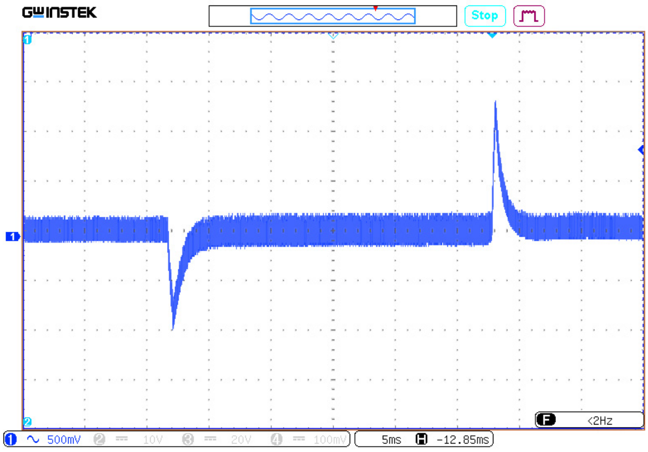

Figure 8 (d). Oscillograph chart of voltage transient deviation during load “drop/rise” 0…100 %.

Ray 1 (blue) – output voltage. Scale 500 mV/div. Time scale 5 ms/div.

Oscillograph charts (cont.)

Charts of VDR160W09

Testing conditions Uin.=28 VDC, Iout.=17,8 A, Tamb.=25°C, Uout.=9 VDC, Cout.=450 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.

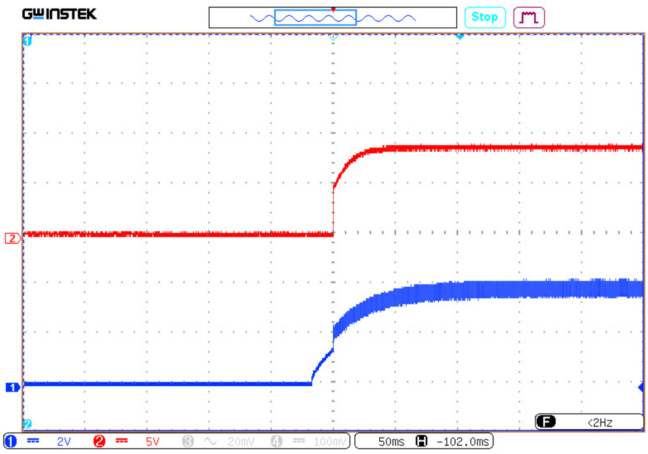

Figure 9 (a). Oscillograph chart of setting output voltage after supplying remote control signal to ON-input.

Ray 1 (blue) — voltage at ON-input. Scale 2 V/div.
Ray 2 (red) — output voltage. Scale 5 V/div.
Time scale 50 ms/div.

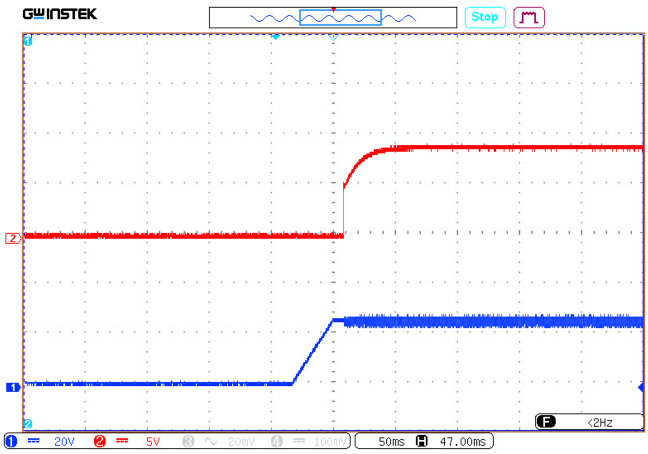

Figure 9 (b). Oscilliograph chart of output voltage after supplying the input voltage.

Ray 1 (blue) — input voltage. Scale 20 V/div.
Ray 2 (red) — output voltage. Scale 5 V/div.
Time scale 50 ms/div.

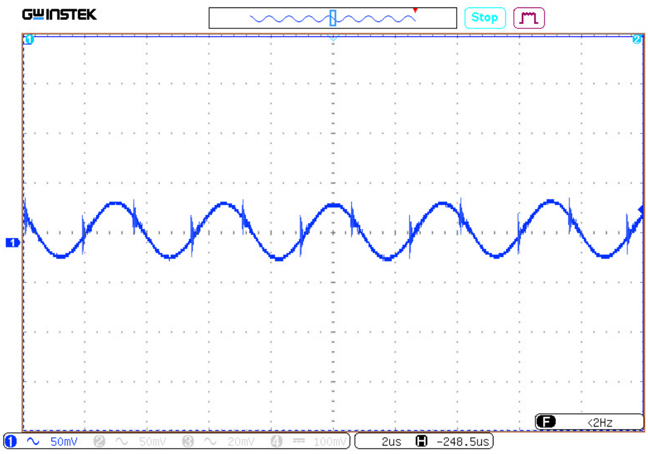

Figure 9 (c). Oscillograph chart of output voltage ripple.

Ripple of output voltage. Scale 50 mV/div. Time scale 2 us/div.

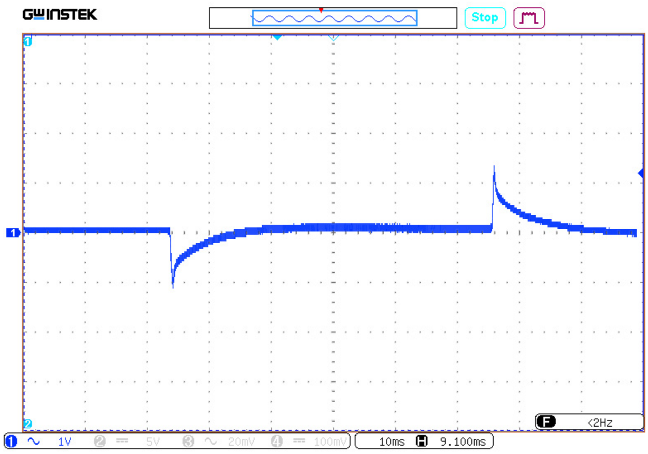

Figure 9 (d). Oscillograph chart of voltage transient deviation during load "drop/rise" 0...100 %.

Ray 1 (blue) — output voltage. Scale 1 V/div. Time scale 10 ms/div.

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Noise spectrogram

Spectrogram of VDR160B05 with typical connection diagram

Testing according to MIL-STD-461F CE102. (Tcase=25°C, Vin.=+12 V, full load, unless otherwise specified)

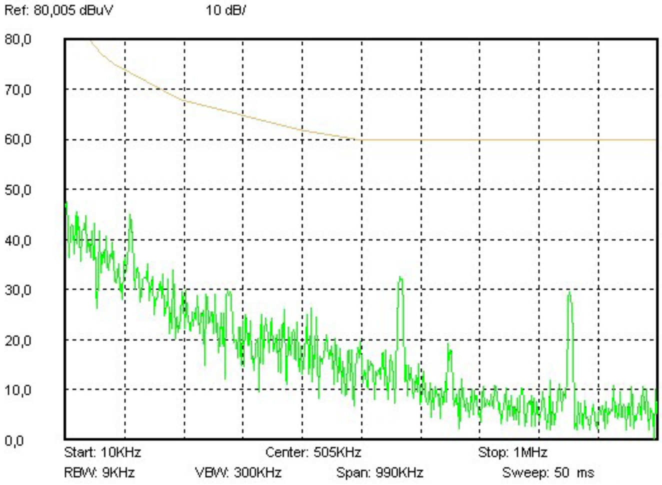

Figure 10 (a). Spectrogram 0,01 – 1 MHz.

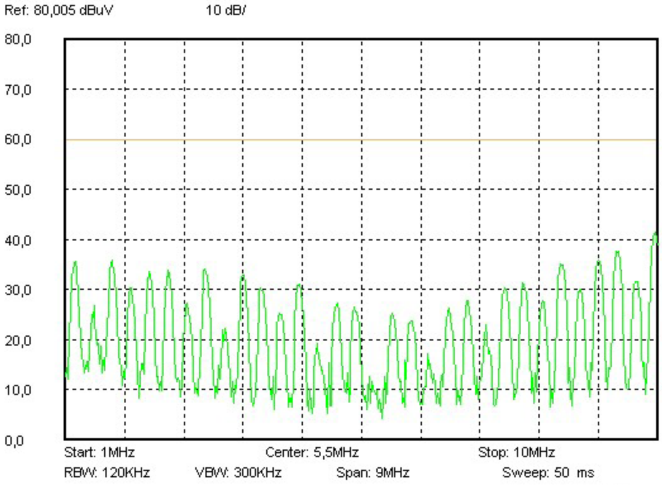

Figure 10 (b). Spectrogram 1 – 10 MHz.

Spectrogram of VDR160W09 with typical connection diagram

Testing according to MIL-STD-461F CE102. (Tcase=25°C, Vin.=+28 V, full load, unless otherwise specified)

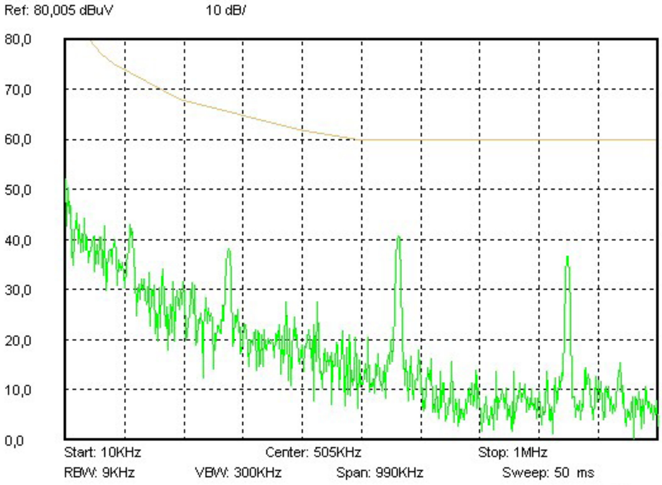

Figure 11 (a). Spectrogram 0,01 – 1 MHz.

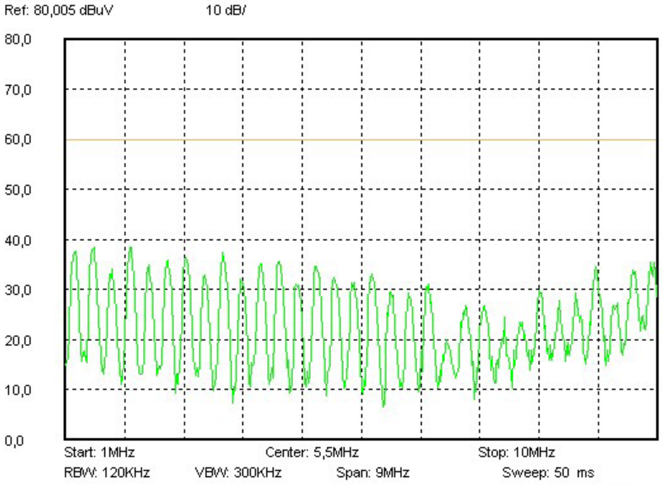

Figure 11 (b). Spectrogram 1 – 10 MHz.

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Outline dimensions

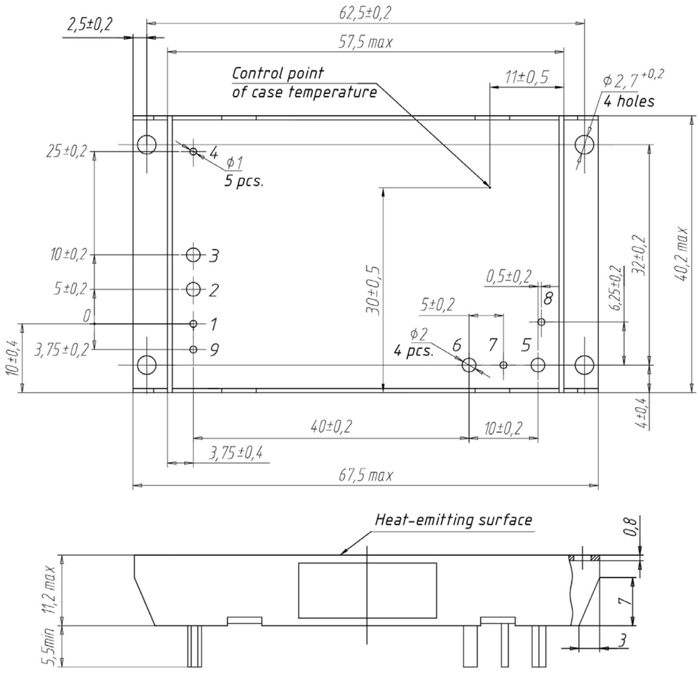

Figure. 12. Flanged units.

Pin out

Pin #	1	2	3	4	5	6	7	8	9
Function	CASE	+IN	−IN	ON	+OUT	−OUT	TRIM	PARAL	SYNC

Heatsink

Type	Ribs configuration	Dimensions A×B×H×D, mm	Area, cm²	Weight, g
752695.004	Cross	67,5×40×14×4	130	54
752695.005	Longitudinal	67,5×40×14×4	143	55
752695.004-01	Cross	67,5×40×24×4	224	77
752695.005-01	Longitudinal	67,5×40×24×4	251	81

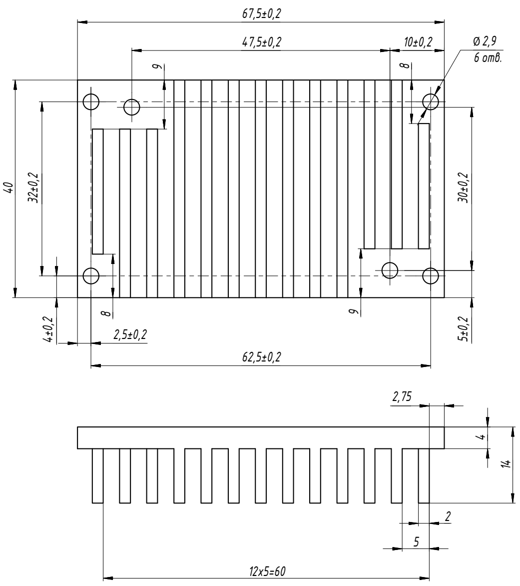

Figure 13 (a). *752695.004.*

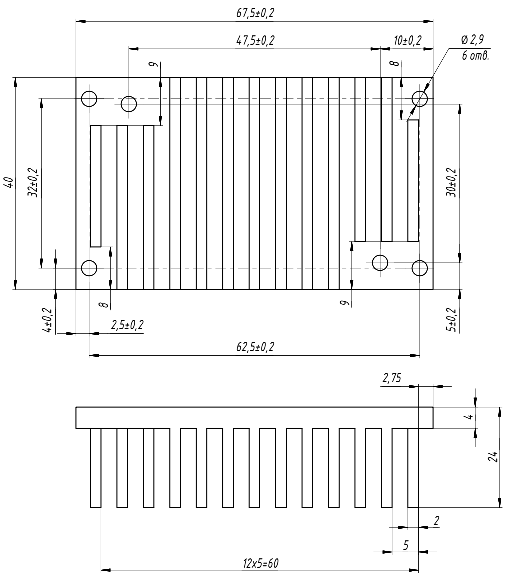

Figure 13 (b). *752695.004-01.*

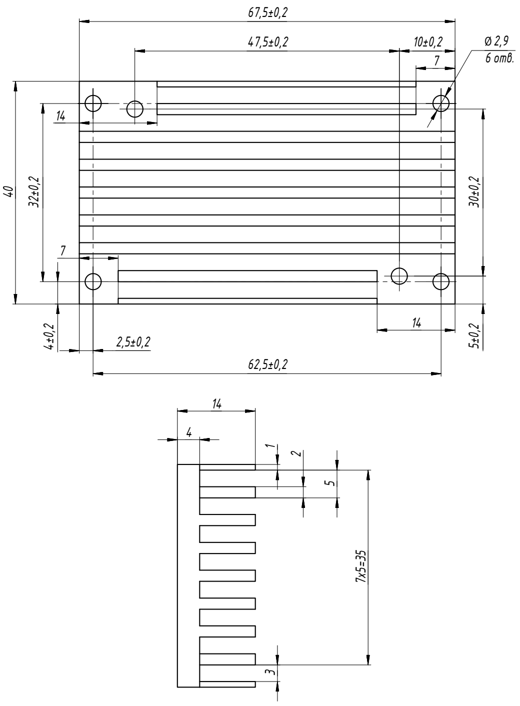

Figure 13 (c). *752695.005.*

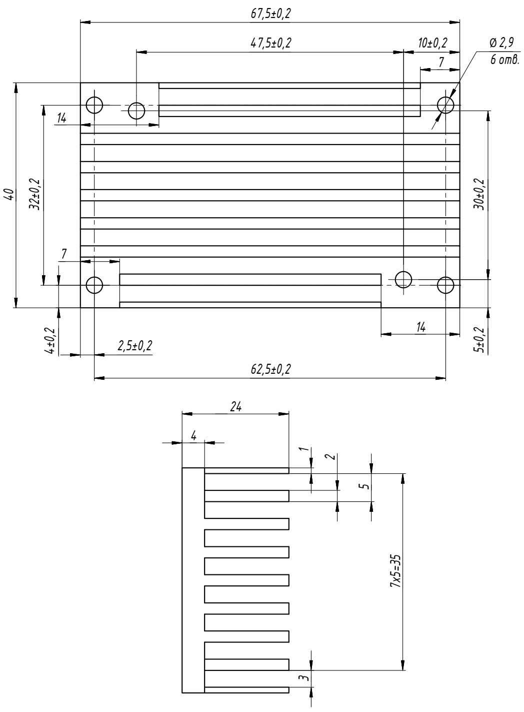

Figure 13 (d). *752695.005-01.*

+65 6950 0011
info@voltbricks.com
voltbricks.com

www.voltbricks.com info@voltbricks.com

VOLTBRICKS PTE. LTD.

105 Cecil street

#15-01 The OCTAGONE

Singapore 069534

+65 6950 0011

Manufacturer of reliable DC/DC converters and power supply systems

This datasheet is valid for the following units: VDR120B3,3; VDR120B05; VDR120B09; VDR120B12; VDR120B15; VDR120B24; VDR120B28; VDR120W3,3; VDR120W05; VDR120W09; VDR120W12; VDR120W15; VDR120W24; VDR120W28; VDR160B05; VDR160B09; VDR160B12; VDR160B15; VDR160B24; VDR160B28; VDR160W05; VDR160W09; VDR160W12; VDR160W15; VDR160W24; VDR160W28.