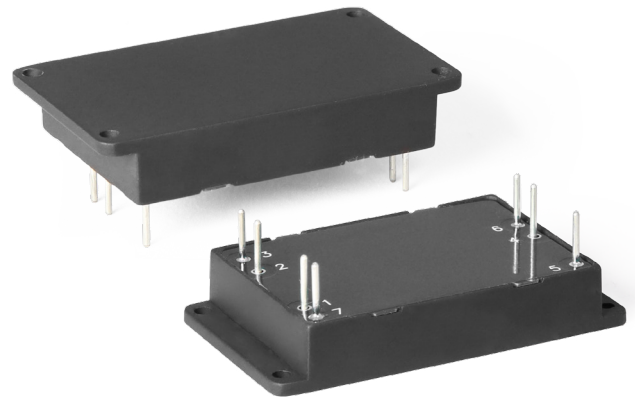# MDV Family
# MDV25 Series

# Multi-purpose compact DC/DC converters

## Description

**Compact isolated DC/DC converters of MDV Series** for industrial and special purpose applications. Despite the small size (47,5×33,2×10,15 mm) the maximum output power of modules reach up 25 W and they are able to operate in a wide case operating temperature range (−60…+125°C). These modules might have single or dual galvanically isolated output, remote on/off, short circuit, overcurrent and thermal protection and can operate in series modes. Without optocouplers in the converter's circuit it can safely operate in conditions of ionizing radiation and high temperature. Power supplies have variable protections from different factors: vibration, dirt, moisture fog and salt fog.

These modules undergo special thermal and limit test including burn-in test with extreme on/off modes.

## Compliance

- MIL-STD-810G
- MIL-STD-461F (CE102)
- MIL-STD-704A-F

Description of MDV Family on the manufacturer's website
eng.aedon.ru/pr-universal.php

## Features

- 5 year warranty
- Output current up to 5 A
- 28 VDC input compliant with MIL-STD-704A-F (except Cat. C)
- Low-profile design (10,15 mm) with cylindrical pin outs
- Case operating temperature −60…+125°C
- 125 °C baseplate operation without derating
- Magnetic feedback without optocouplers
- Single and dual output models
- Short circuit protection, overvoltage, thermal protection
- Remote on/off
- Output voltage adjustment
- Typical efficiency 85% (Uout.=24 VDC)
- Polymer potting sealing

**Order registration**
+7 473 200 87 80, Global Operations Team

**Technical support**
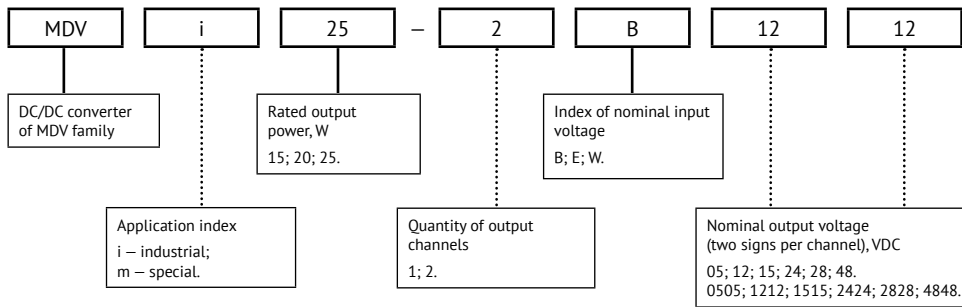techsup@aedon.ru

**Reliability test**
eng.aedon.ru/downloads/documentation/Reliability-Test_ENG.pdf

**3D models**
www.aedon.ru/content/catalog/docs/199/MDM20V.zip

# Ordering information

| MDV | i | 25 | – | 2 | B | 12 | 12 |
|---|---|---|---|---|---|---|---|

DC/DC converter of MDV family

Rated output power, W
15; 20; 25.

Index of nominal input voltage
B; E; W.

Application index
i — industrial;
m — special.

Quantity of output channels
1; 2.

Nominal output voltage
(two signs per channel), VDC
05; 12; 15; 24; 28; 48.
0505; 1212; 1515; 2424; 2828; 4848.

**For more information please contact our Global Operations Team**

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## Application index

| Parameter | | Index "m" | Index "i" |
|---|---|---|---|
| Case operating temperature | | −60...+125°C | −40...+85°C |
| Compliance | MIL-STD-810G | + | − |
| | EN60950-1 | + | |
| | MIL-STD-461F | CE102 | |
| | MIL-STD-704A-F | 28 VDC input (index "E") | |
| Total regulation (Inom 10–100%) | single channel models | ±6% | ±4% |
| | dual channel models | ±6% output1; ±10% output2 | ±4% output1; ±7% output2 |
| Vibration proof | | + | − |
| Moisture proof (Tamb.=25°C) | | 98% | 60% |
| Dust proof | | + | − |
| Salt fog resistant | | + | − |
| Typical MTBF | | 2 000 000 hrs | 500 000 hrs |
| Failure rate | | <0,05% | <1% |
| Warranty | | 5 years | 3 year |

## Rated output power and current

| Power | 15 W | | | | | | 20 W | | | | | | 25 W | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Output voltage, VDC** | 5 | 12 | 15 | 24 | 28 | 48 | 5 | 12 | 15 | 24 | 28 | 48 | 5 | 12 | 15 | 24 | 28 | 48 |
| **Rated output current, A** | 3 | 1,25 | 1 | 0,63 | 0,53 | 0,31 | 4 | 1,67 | 1,33 | 0,83 | 0,71 | 0,42 | 5 | 2,1 | 1,6 | 1,04 | 0,89 | 0,52 |

Other output voltage within range 3...70 VDC is also available upon special request.

## Index of nominal input voltage*

| Parameter | | Index "B" | Index "W" | Index "E" |
|---|---|---|---|---|
| Nominal input voltage, VDC | | 12 | 24 | 28 |
| Input voltage range, VDC | | 9...36 | 18...75 | 9...36 |
| Transient deviation, VDC | 1 s<br>10 s | 9...40<br>— | 17...84<br>— | —<br>8...80 |
| Typical efficiency for Uout.=24 VDC | | 85% | 85% | 84% |

* Reflected input ripple current (10–10000 Hz) — 8% Uin. nom

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# Specifications

All specifications valid for normal climatic conditions (ambient temp. 15...35°C; relative humidity 45...80%; air pressure 8,6*10⁴...10,6*10⁴ Pa), Uin. nom, Iout. nom, unless otherwise stated. It is important to note that the information herein is not full. More detailed information (specific requirements, basic connection circuits, operating instructions etc.) can be found on our web-site: eng.aedon.ru

## Output specifications

| Parameter | | Value |
|---|---|---|
| Output voltage adjustment of single channel models | | 5% Uout. nom |
| Total regulation | Input voltage variation (Umin...Umax) | max ±2% |
| | Load variation (10...100% Imax) | |
| Ripple and noise (p-p) | | <2% Uout. nom |
| Maximum capacitive load | 5 VDC<br>12 VDC<br>24 VDC<br>48 VDC | 1300 uF<br>130 uF<br>40 uF<br>20 uF |
| Start up time (remote) | | max 0,1 s |
| Overload protection level* | 15 W<br>20 W<br>25 W | <3 Pmax<br><2,2 Pmax<br><1,7 Pmax |
| Short circuit protection* | | hiccup auto recovery |
| Overvoltage protection | | 1,5 Unom |
| Trancient responce deviation | | see fig. 8 (d) |

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

## General specifications

| Parameter | | Value |
|---|---|---|
| Case temperature | Operating (natural convection)<br>— power derating (natural convection)<br>— without power derating with heatsink | −60...+125°C<br>see power derating diagram (dashed, dash-dotted curve)<br>see power derating diagram (solid curve) |
| | Storage | −60...+125°C |
| Switching frequency | | 290–310 kHz |
| Isolation capacitance | input/output | 1500 pF |
| Isolation voltage (60 s) | input/output, input/case, output/case | 500 VAC |
| Isolation resistance @ 500 VDC | input/output, input/case, output/case | 20 MOhm min |
| Thermal impedance | | 8,7°C/W |
| Thermal protection level | | 118...125°C, clamp, auto recovery |
| Remote on/off | | Off.: connection of pins "ON" and "−IN", I⩽5 mA |

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## Specifications (cont.)

**Physical specifications**

| Parameter | Value |
| --- | --- |
| Case material | aluminium |
| Potting | epoxy polimer |
| Pin material | phosphor bronze, SnP8 plated |
| Weight | max 45 g |
| Soldering temperature | 260°C @ 5 s |

## Design topology
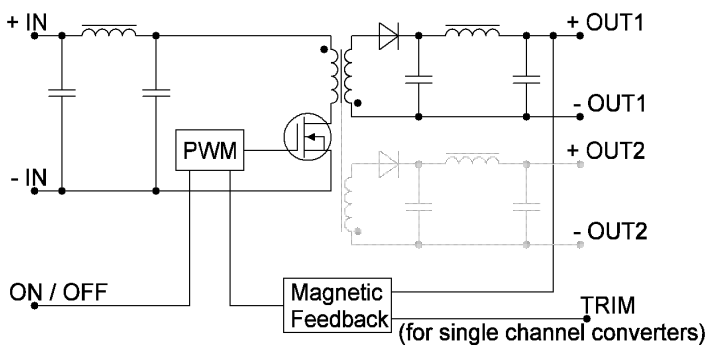
**Figure 1.** Design topology.
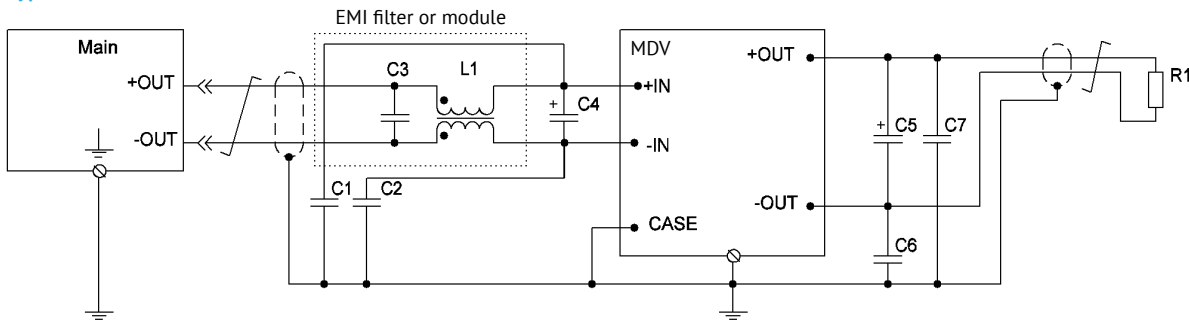
# Service functions

**Typical connection**



EMI filter or module

**Figure 2.** Design topology with filtration unit.

| C1, C2, C6, C7 | | ceramic capacitor | | | 100…4700 pF 500 VDC min |
|---|---|---|---|---|---|
| C4 | | tantalum capasitor | Input voltage | 12 VDC<br>24 (28) VDC | 68 uF 50 V<br>22 uF 100 V |
| C5 | | tantalum capasitor | Output voltage | 5 VDC<br>12 VDC<br>24 VDC<br>48 VDC | 300 uF<br>140 uF<br>100 uF<br>33 uF |
| EMI Filter | L1 | common mode choke | | | 8 mH |
| | C3 | ceramic capacitor | Input voltage | 12 VDC<br>24 (28) VDC | 20 uF 50 V<br>10 uF 100 V |
| EMI Module | M series | Double Pi filter EMI module.<br>See datasheet M Series | Maximum current up to 20 A, overvoltage and surge protection, loss insertion up to 60 db | | |

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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.
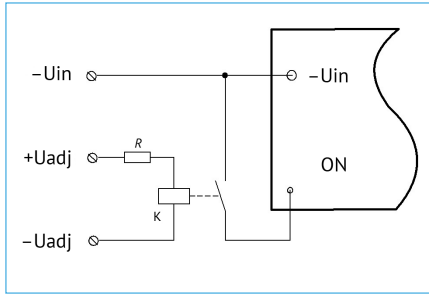


**Figure 3 (a).** Layout of mechanical relay control.
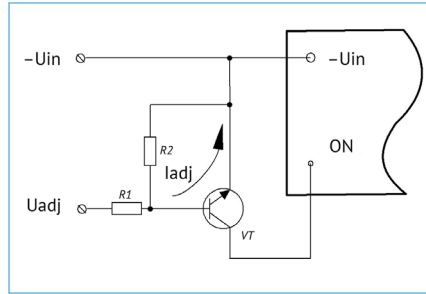


**Figure 3 (b).** Layout of bipolar transistor control.
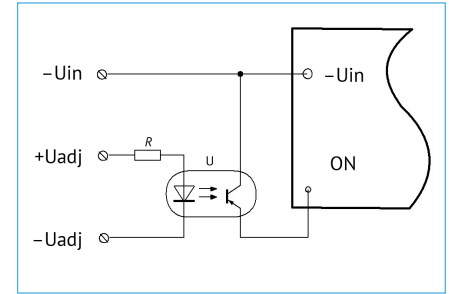


**Figure 3 (c).** Layout of optocoupler control.

## Adjustment

Adjustment of output voltage of a power supply unit within the rage of at least ±5% can be done by connecting "TRIM" 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 (b) and (c).

Calculation formula of nominal values of circuit elements (a), current (b) and voltage (c) can be found in Technical Guides available on www.eng.aedon.ru.
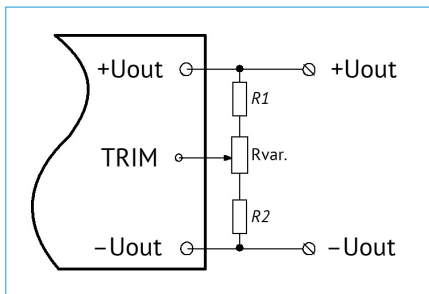


**Figure 4 (a).**



**Figure 4 (b).**



**Figure 4 (c).**

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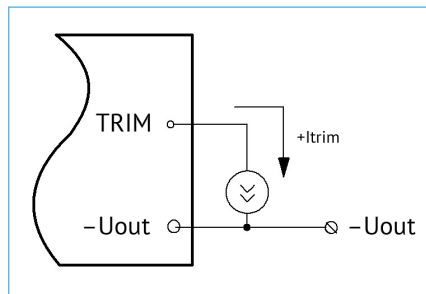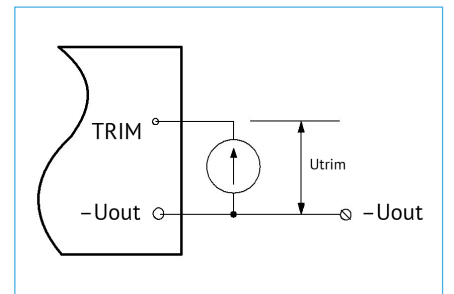
# Service functions (cont.)

**Output voltage VS resistor rating**
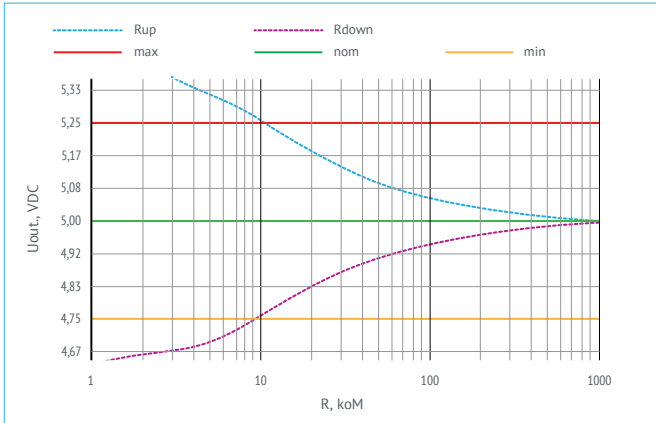


**Figure 5 (a).** Current and voltage values for adjustment of MDVx25-xx05.
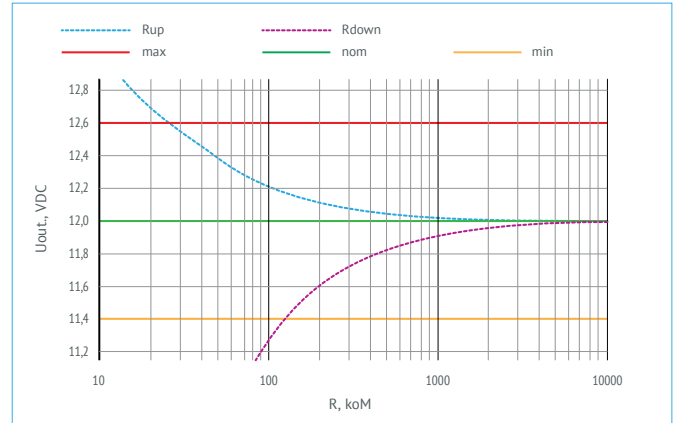


**Figure 5 (b).** Current and voltage values for adjustment of MDVx25-xx12.
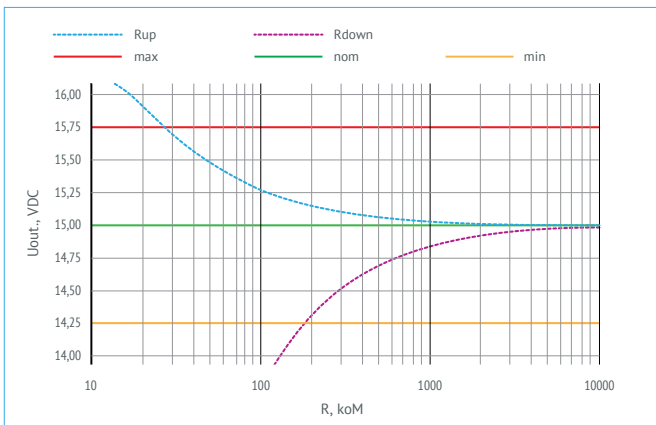


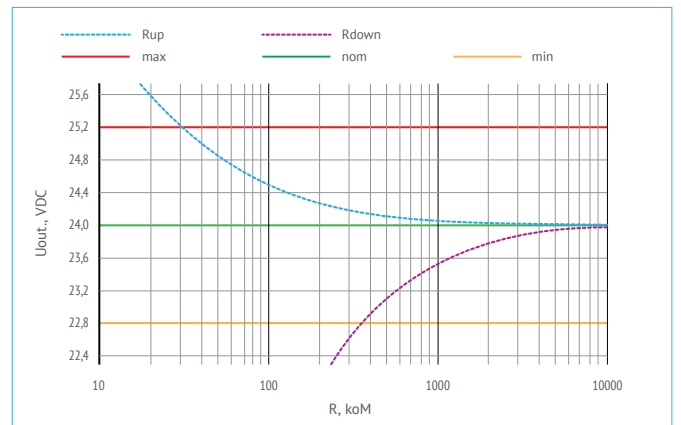**Figure 5 (c).** Current and voltage values for adjustment of MDVx25-xx15.



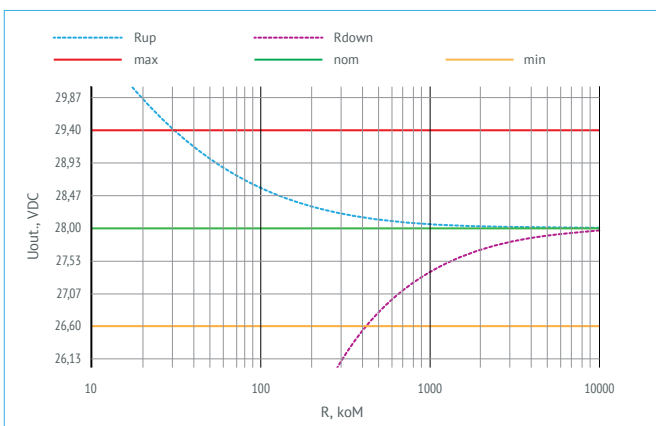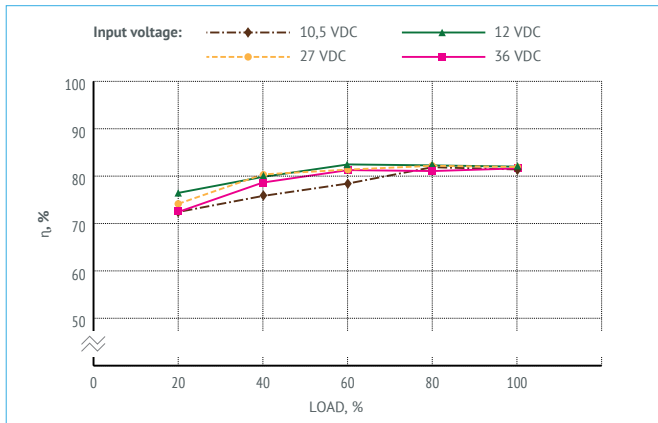**Figure 5 (d).** Current and voltage values for adjustment of MDVx25-xx24.



**Figure 5 (e).** Current and voltage values for adjustment of MDVx25-xx28.

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# Effiency

## VS load



**Figure 6 (a).** Efficiency of MDVx25-1B05.
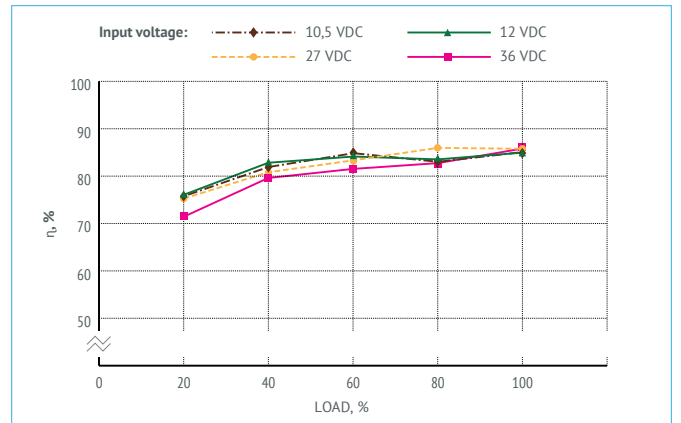


**Figure 6 (b).** Efficiency of MDVx25-1B27.
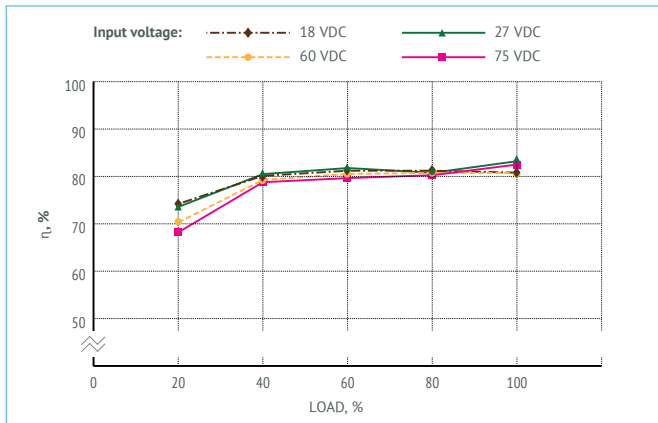


**Figure 6 (c).** Efficiency of MDVx25-1W05.
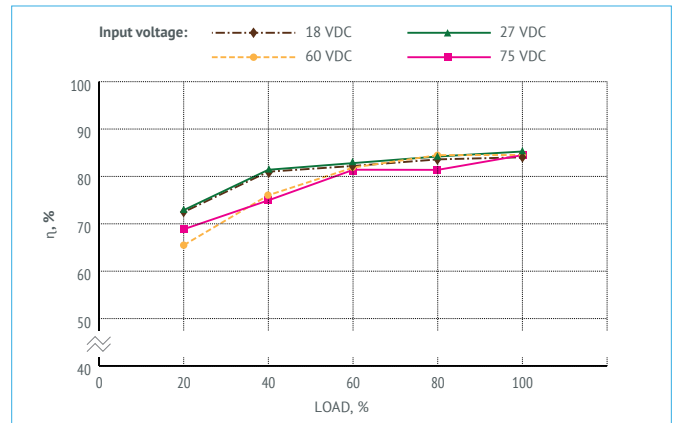


**Figure 6 (d).** Efficiency of MDVx25-1W27.

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# Power derating

## VS ambient temperature and baseplate temperature

The PSU is able to operate with 100% load within the complete range of case operating temperature (−60…+125 °C). On condition the case temperature is kept from −60°C to 125 °C the PSU will operate without derating regardless of the ambient temperature.

Thermal Management section of the Application Notes shows the resulting heatsink area, as well as baseplate-vs-ambient thermal resistance, the min thickness of the heatsink, and the max PSU output power without heatsink.
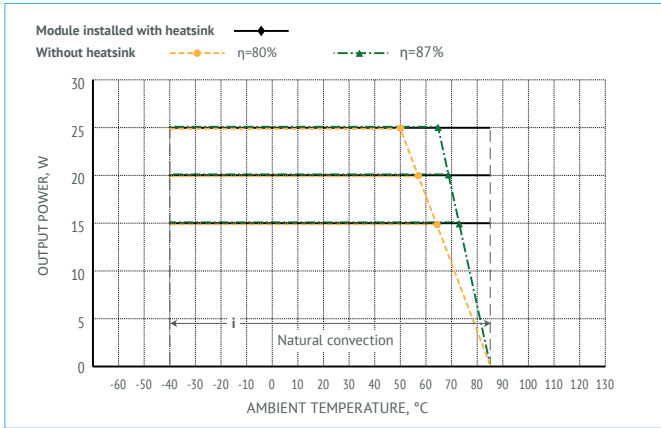


**Figure 7 (a).** Power derating of MDVi25-xxx.
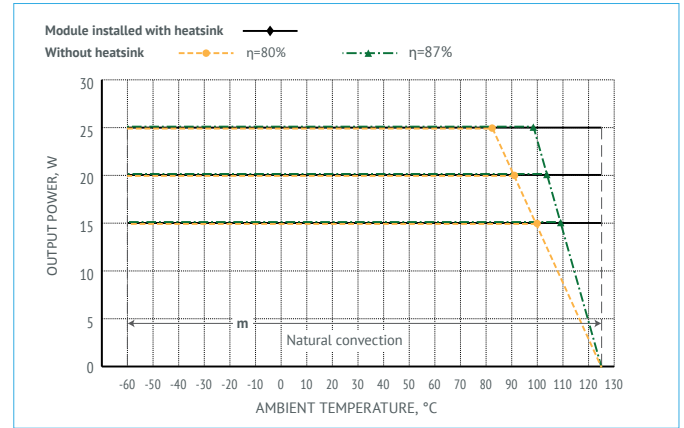


**Figure 7 (b).** Power derating of MDVm25-xxx.

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# Oscillograph charts of MDVx25-xxx

Testing conditions Uin.=28 VDC, Iout.=2.08 A, Tamb.=25°C, Uout.=12 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.
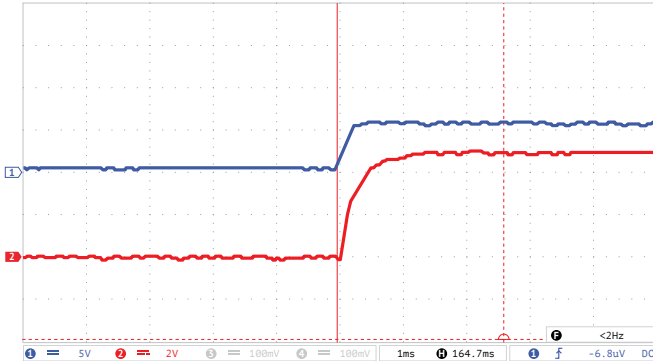
**Figure 8 (a).** Oscillograph chart of setting output voltage after supplying remote control signal to ON-output.

*Ray 1 (blue) — voltage at ON-output. Scale 5 V/div.*
*Ray 2 (red) — output voltage. Scale 2 V/div.*
*Time scale t=1 ms/div.*
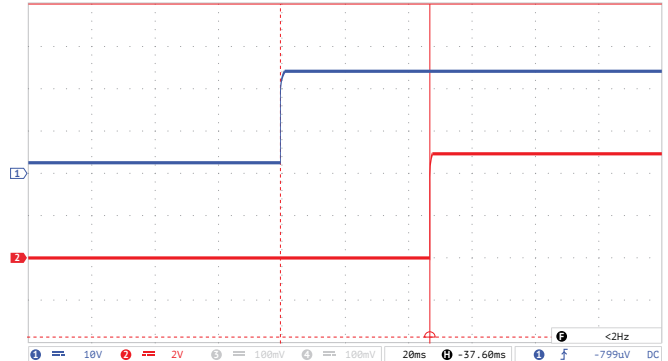
**Figure 8 (b).** Oscilliograph chart of output voltage after supplying the input voltage.

*Ray 1 (blue) — input voltage. Scale 10 V/div.*
*Ray 2 (red) — output voltage. Scale 2 V/div.*
*Time scale t=20 ms/div.*
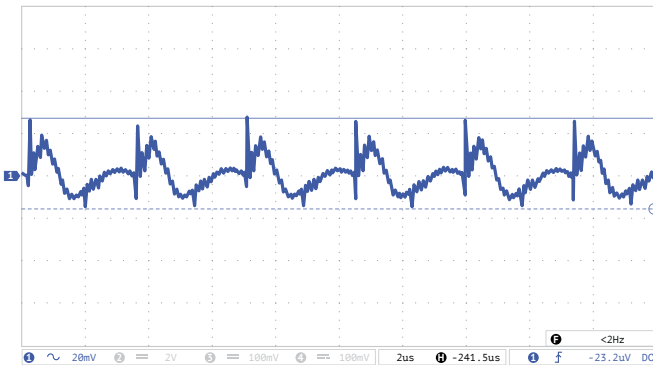
**Figure 8 (c).** Oscillograph chart of output voltage ripple.

*Ray 1 (blue) — ripple of output voltage. Scale 20 mV/div.*
*Time scale 2 us/div.*
*Measuring technique: see Electrical Test Screen.*
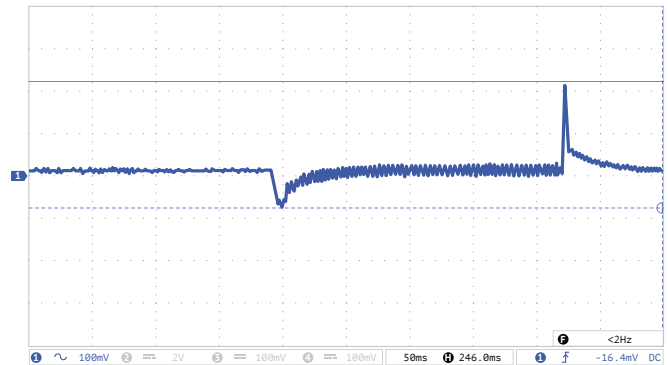
**Figure 8 (d).** Oscillograph chart of voltage transient deviation during load "drop/rise".

*Ray 1 (blue) - output voltage. Scale 100 mV/div.*
*Time scale t=50 ms/div.*

*Modes:*
*— "drop" output current variation (10...100%) Inom;*
*— "rise" output current variation (10...100%) Inom;*
*— build-up time 500 us.*

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# Noise spectrogram

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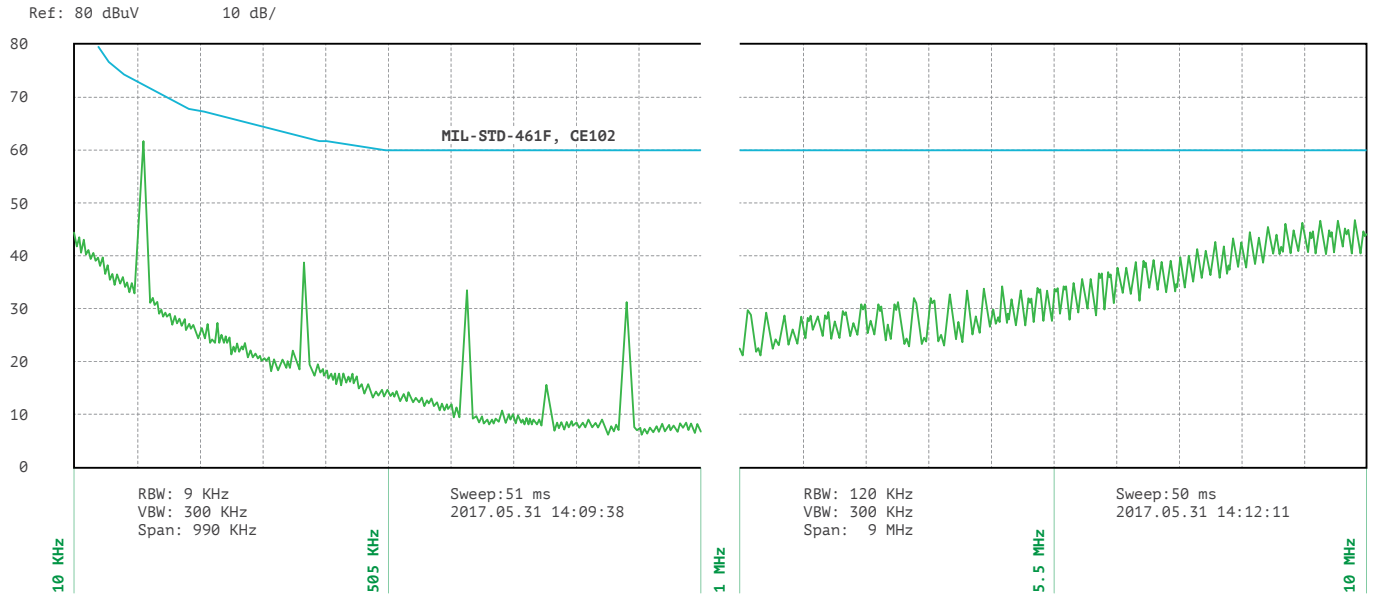


**Figure 9.** Spectrogram of MDVx20-1W24 with typical connection diagram.

# Outline dimensions

**Models packed in reinforced case with flanges**
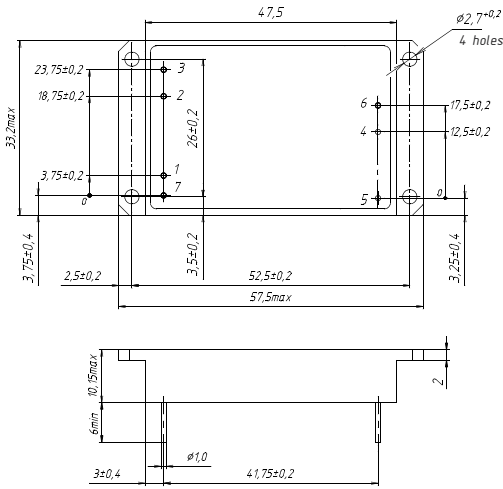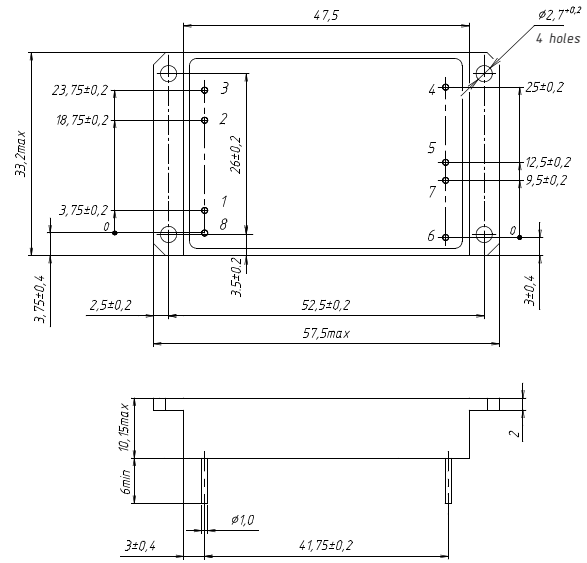


**Figure 10 (a).** Single-output models.



**Figure 10 (b).** Dual-output models.

**Pin out**

| Pin # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| **Single channel** | +IN | −IN | ON | +OUT | −OUT | TRIM | CASE | – |
| **Dual channel** | +IN | −IN | ON | +OUT1 | −OUT1 | −OUT2 | +OUT2 | CASE |

# Accessories

**Heatsink**
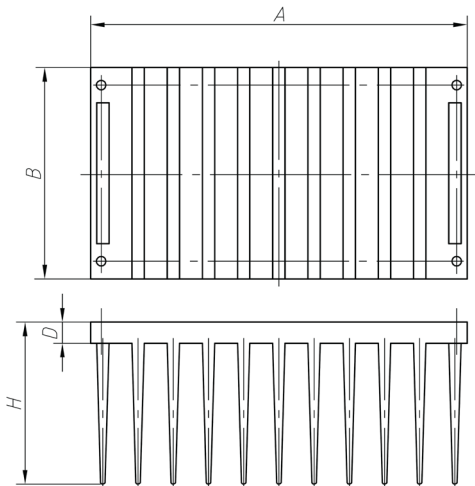


**Figure 11 (a).** Heatsink with transversal ribs for index "i" — 57,5×32×14×4 mm and index "m" — 57,5×32×24×4 mm (A×B×H×D).
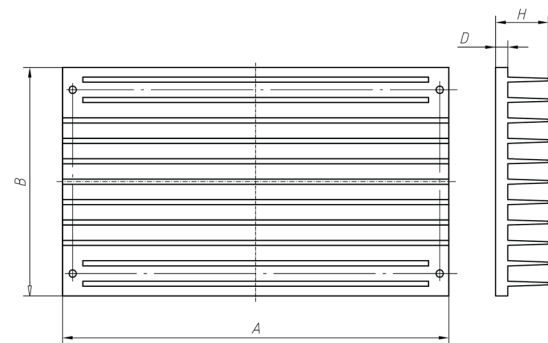


**Figure 11 (b).** Heatsink with transversal ribs for index "i" — 57,5×32×14×4 mm and index "m" — 57,5×32×24×4 mm (A×B×H×D).

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