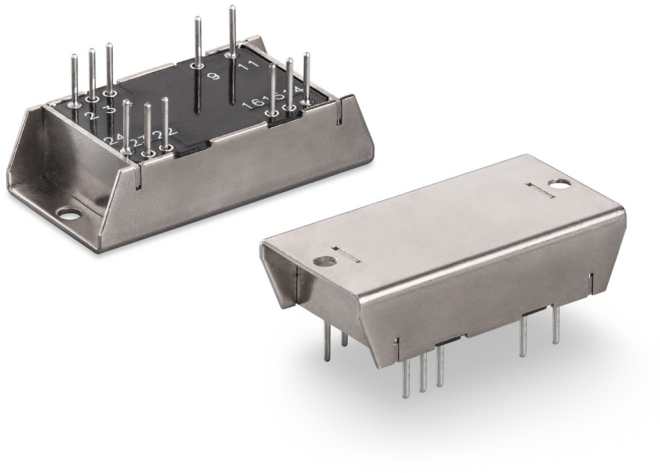
MDR Family
MDR25 Series

Ultra compact DC/DC converters



Description

Ultra compact isolated single channel DC/DC converters of MDR25 Series have been designed for industrial and special purpose applications. These compact units (30×20,2×10,25 mm without mounting flanges) 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 parallel or series.

MDR25 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.

Compliance

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

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

Features

- Output current up to 5 A
- Case operating temperature –60...+125°C
- 125 °C baseplate operation without derating
- 24 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 90% (Uout.=24 VDC)
- Polymer potting sealing
- No optocouplers

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

Technical support
techsup@aedon.ru

Complete specifications
www.aedon.ru/files/documentation/tu-436630.004.pdf

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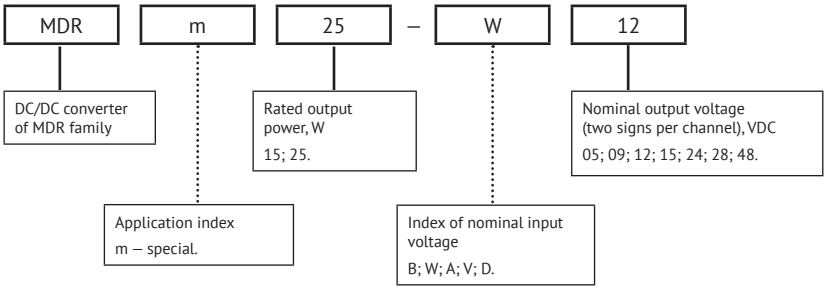
Ordering information



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Application index

Parameter		Index "m"
Case operating temperature		–60...+125°C
Compliance	EN60950-1	+
	MIL-STD-810G	+
	MIL-STD-461E	CE102
	MIL-STD-704F	24 VDC input (index "W")
Vibration proof		+
Moisture proof (Tamb.=25°C)		98%
Dust proof		+
Salt fog resistant		+
Typical MTBF		2 000 000 hrs
Failure rate		<0,05%
Warranty		5 years

Rated output power and current

Power	15 W							25 W						
Output voltage, VDC	5	9	12	15	24	28	48	5	9	12	15	24	28	48
Rated output current, A	3	1,66	1,25	1	0,625	0,53	0,31	5	2,87	2,08	1,67	1,04	0,89	0,52

Index of nominal input voltage*

Parameter	Index "B"	Index "W"	Index "A"	Index "V"	Index "D"
Nominal input voltage, VDC	12	24	12	27	48
Input voltage range, VDC	9...36	18...75	9...18	17...36	36...75
Transient deviation (1 s), VDC	9...40	17...84	–	17...40	36...74

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

Specifications

All specifications valid for normal climatic conditions (ambient temp. 15…35°C; relative humidity 45…80%; air pressure 8,6*10^4…10,6*10^4 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		5% Uout. nom
Total regulation	Input voltage variation (Umin…Umax)	1% Uout. nom
	Load variation (10…100% Imax)	1% (10…100%)
Ripple and noise (p-p)		<2% Uout. nom
Maximum capacitive load*	5 VDC 12 VDC 24 VDC 48 VDC	20000 uF 3200 uF 1000 uF 200 uF
Start up time (remote)		<0,1 s
Overload protection level**		<2,7 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)
Trancient recovery time		3 ms
Remote on/off		Off.: 0…1,1 VDC or connection of pins “ON” and “–IN”, I≤5 mA

* The specified maximum capacitive load ensures start up time of 25 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.

** 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.

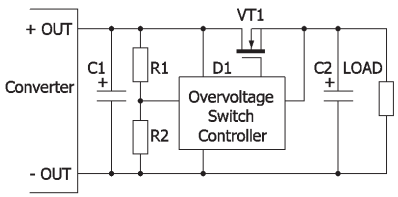

Figure 1. Overvoltage protection circuit.

General specifications

Parameter		Value
Case temperature	Operating (natural convection) – power derating (natural convection) – without power derating with heatsink	–60…+125°C see power derating diagram (dashed, dash-dotted curve) see power derating diagram (solid curve)
	Storage	–60…+125°C
Switching frequency		800 kHz typ. (fixed, pulse width modulation)
Isolation capacitance	input/output	1500 pF
Isolation voltage (60 s)	input/output input/case output/case	500 VDC 500 VDC 500 VDC
Isolation resistance @ 500 VDC	input/output, input/case, output/case	20 MOhm min
Thermal impedance		19,8°C/W
Thermal protection level		118…125°C, clamp, auto recovery

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Specifications (cont.)

Physical specifications

Parameter	Value
Case material	copper alloy with nickel electroplating coating
Potting	epoxy
Pin material	phosphor bronze, SnP8 plated
Weight	max 32 g
Soldering temperature	260°C/5 s

Design topologies

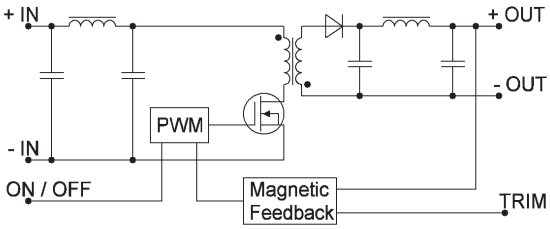

Figure 2. Single channel design topologies.

Typical connection

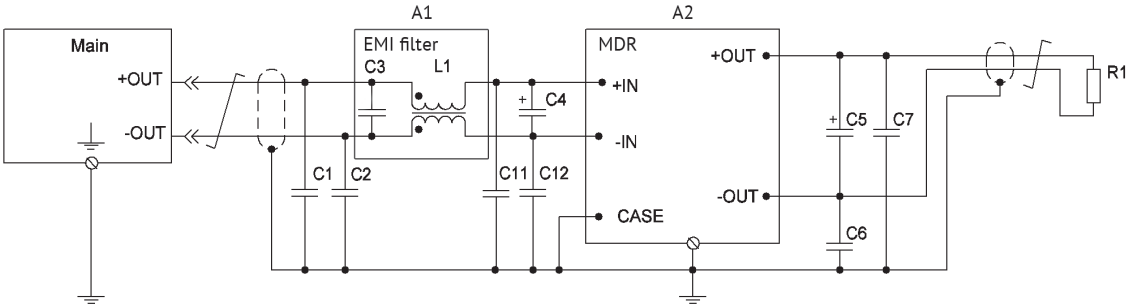

Figure 3. Design topology with filtration unit.

C1, C2, C6, C7	ceramic capacitor			100...4700 pF 500 VDC min	Y capacitors, part of EMI filter
C4	tantalum capasitor	Input voltage	12 VDC 24 VDC	68 uF 50 V 22 uF 100 V	Obligatory element, part of EMI filter
C5	tantalum capasitor	Output voltage	5 VDC 12 VDC 24 VDC 48 VDC	300 uF 140 uF 100 uF 33 uF	Usage of this capasitor is advisory and influences the value of 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 24 VDC	20 uF 50 V 10 uF 100 V	Low ESR, part of EMI filter
EN55022 Class B EMI Filter	M Series	Double Pi filter EMI module. See datasheet **M Series**	Maximum current up to 20 A, overvoltage and surge protection, loss insertion up to 60 db		

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Typical connection (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.

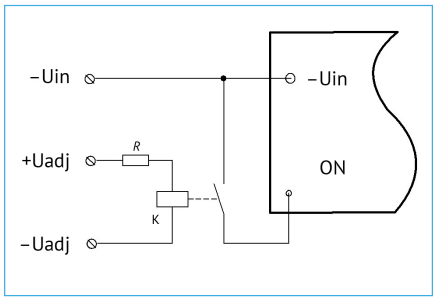

Figure 4 (a). Layout of mechanical relay control.

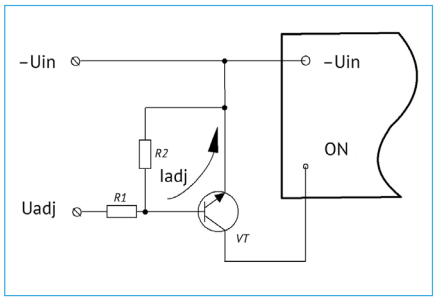

Figure 4 (b). Layout of bipolar transistor control.

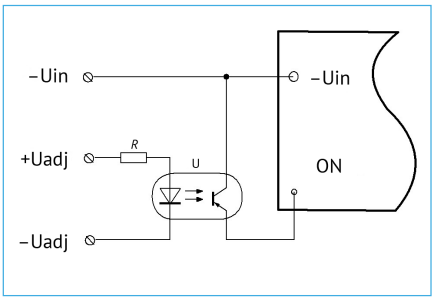

Figure 4 (c). Layout of optocoupler control.

Adjustment

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

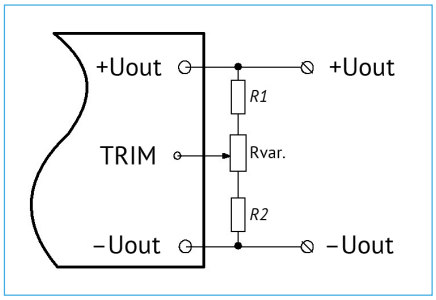

Figure 5 (a).

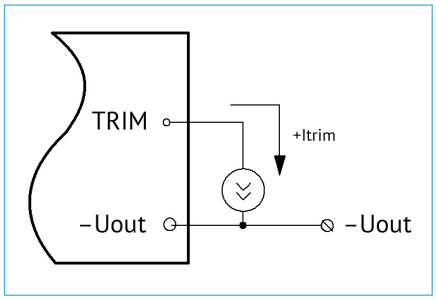

Figure 5 (b).

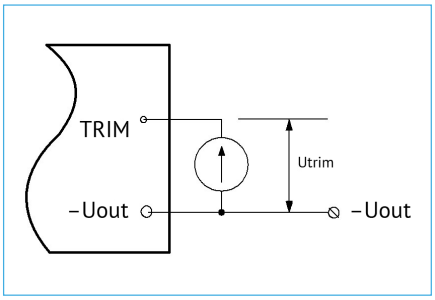

Figure 5 (c).

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Typical connection (cont.)

Output voltage adjustment

	95%	96%	97%	98%	99%	**Unom.**	101%	102%	103%	104%	105%
Uout.	**3,14**	**3,17**	**3,2**	**3,23**	**3,27**	**3,3**	**3,33**	**3,37**	**3,4**	**3,43**	**3,47**
Itrim.	–0,27	–0,22	–0,17	–0,11	–0,05	0	0,05	0,11	0,17	0,22	0,27
Utrim.	2,07	2,16	2,23	2,31	2,37	2,45	2,54	2,61	2,67	2,77	2,84
Uout.	**4,75**	**4,8**	**4,85**	**4,9**	**4,95**	**5**	**5,05**	**5,1**	**5,15**	**5,2**	**5,25**
Itrim.	–0,06	–0,05	–0,035	–0,02	–0,01	0	0,01	0,02	0,035	0,5	0,06
Utrim.	1,93	2,02	2,12	2,22	2,32	2,42	2,51	2,6	2,7	2,78	2,87
Uout.	**11,4**	**11,52**	**11,64**	**11,76**	**11,88**	**12**	**12,12**	**12,24**	**12,36**	**12,48**	**12,6**
Itrim.	–0,16	–0,125	–0,08	–0,06	–0,03	0	0,03	0,06	0,08	0,125	0,16
Utrim.	2,85	2,6	2,35	2,12	1,9	1,7	1,45	1,2	0,95	0,7	0,5
Uout.	**25,65**	**25,92**	**26,2**	**26,46**	**26,73**	**27**	**27,27**	**27,54**	**27,8**	**28.08**	**28,35**
Itrim.	–0,065	–0,05	–0,037	–0,025	–0,015	0	0,015	0,025	0,037	0,05	0,065
Utrim.	2,28	2,79	2,7	2,6	2,51	2,41	2,32	2,22	2,12	2,02	1,93
Uout.	**45,6**	**46,1**	**46,6**	**47**	**47,5**	**48**	**48,5**	**49**	**49,4**	**49,9**	**50,4**
Itrim.	–0,05	–0,04	–0,03	–0,02	–0,01	0	0,01	0,02	0,03	0,04	0,05
Utrim.	2,73	2,63	2,57	2,46	2,4	2,33	2,24	2,17	2,07	2	1,92

Figure 6. Current and voltage values for adjustment.

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Efficiency

VS load

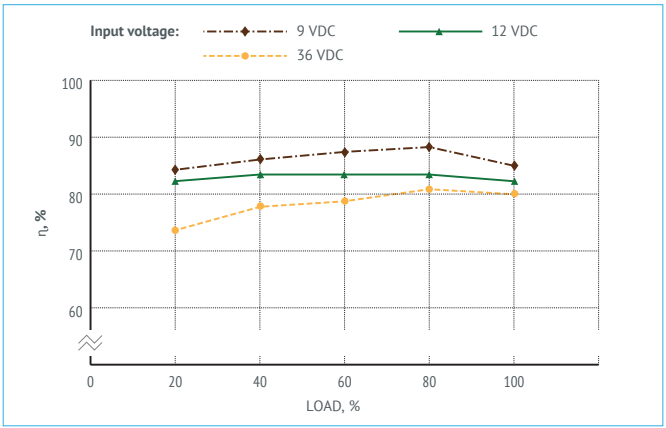

Figure 7 (a). Efficiency of MDR25-1B05.

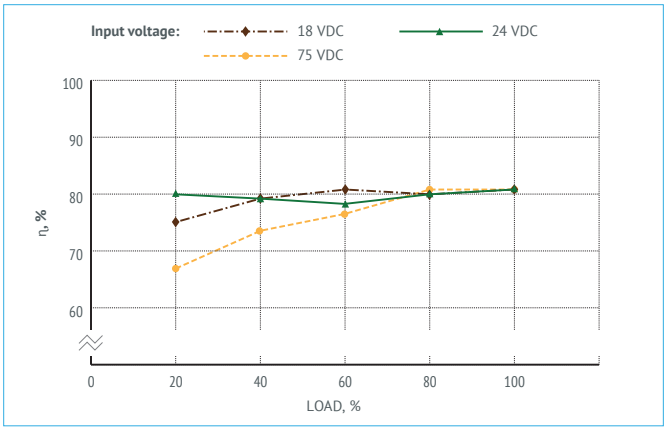

Figure 7 (b). Efficiency of MDR25-1W05.

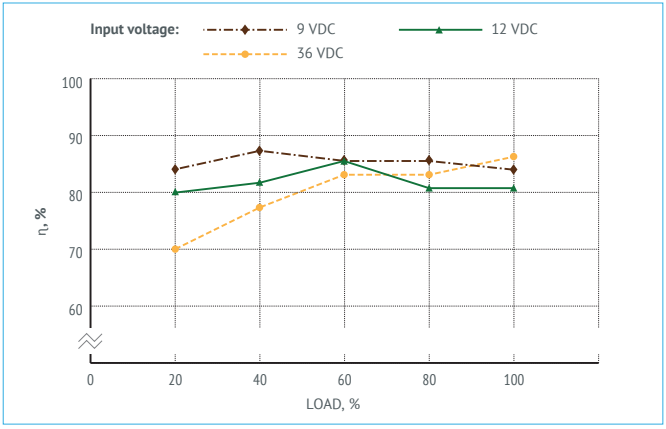

Figure 7 (c). Efficiency of MDR25-1B24.

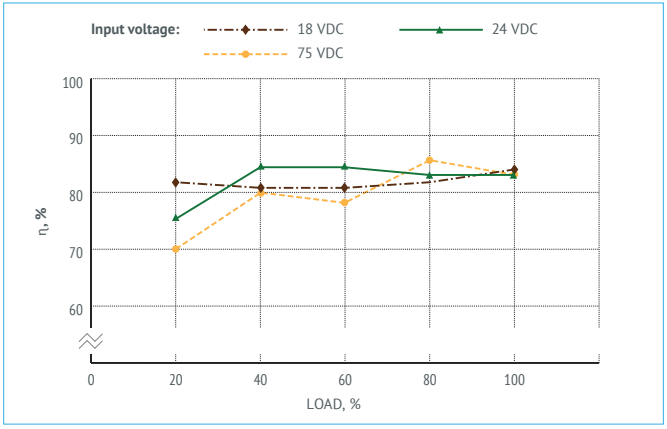

Figure 7 (d). Efficiency of MDR25-1W24.

Power derating

VS ambient temperature and baseplate temperaturetemperature

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.

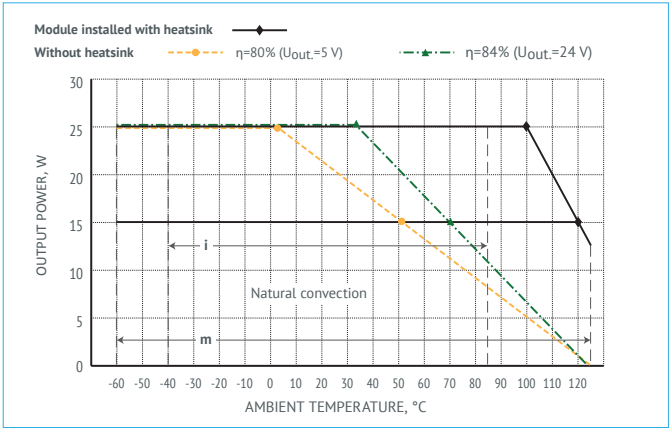

Figure 9. Power derating of MDR15-xxx and MDR25-xxx.

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Oscillograph charts of MDR25-1W12U

Testing conditions Uin.=27 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.

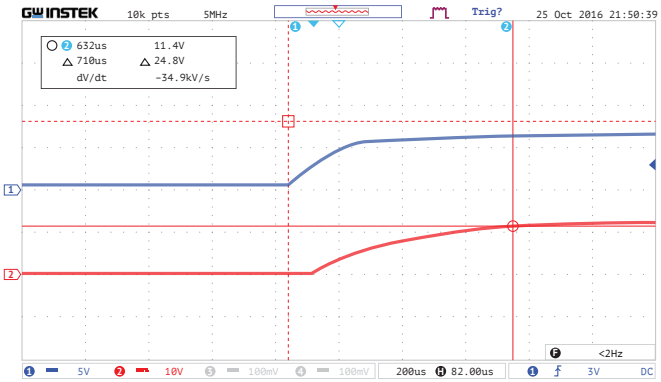

Figure 10 (a). Oscillograph chart of setting output voltage after supplying remote control signal to ON-output.

Ray 1 (blue) — voltage at ON-output. Scale 5 V/div.
Ray 2 (red) — output voltage. Scale 10 V/div.
Time scale t=200 us/div.

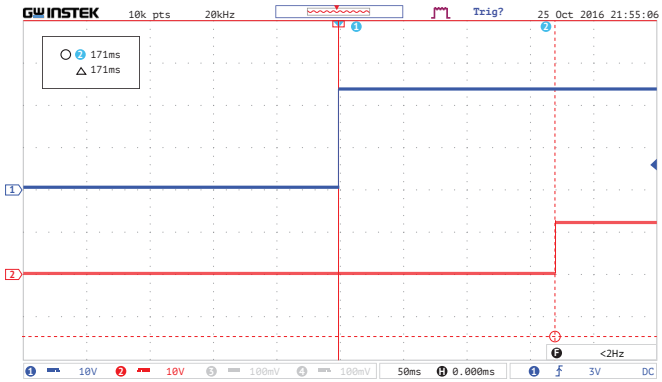

Figure 10 (b). Oscilliograph chart of output voltage after supplying the input voltage.

Ray 1 (blue) — input voltage. Scale 10 V/div.
Ray 2 (red) — output voltage. Scale 10 V/div.
Time scale t=50 ms/div.

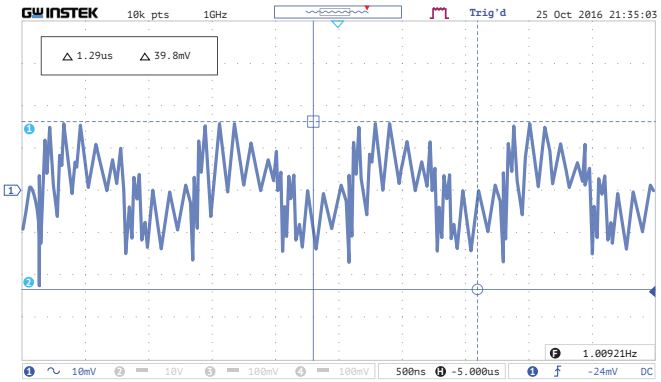

Figure 10 (c). Oscillograph chart of output voltage ripple.

Ray 1 (blue) — ripple of output voltage. Scale 10 mV/div.
Time scale 500 ns/div.
Measuring technique: see Electrical Test Screen.

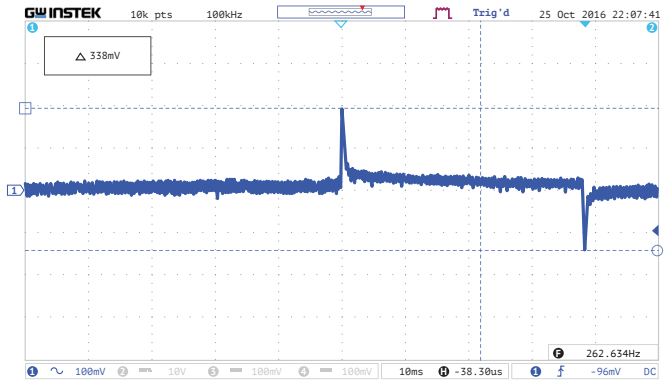

Figure 10 (c). Oscillograph chart of voltage transient deviation during load "drop/rise".

Ray 1 (blue) - output voltage. Scale 100 mV/div.
Time scale t=10 ms/div.

Modes:
— "drop" output current variation (100...50%) Imax;
— "rise" output current variation (50...100%) Imax;
— build-up time 500 us.

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Noise spectrogram

Testing according to MIL461, group CE102. (Tcase=25°C, Vin.=+12 V ±5%, full load, unless otherwise specified)

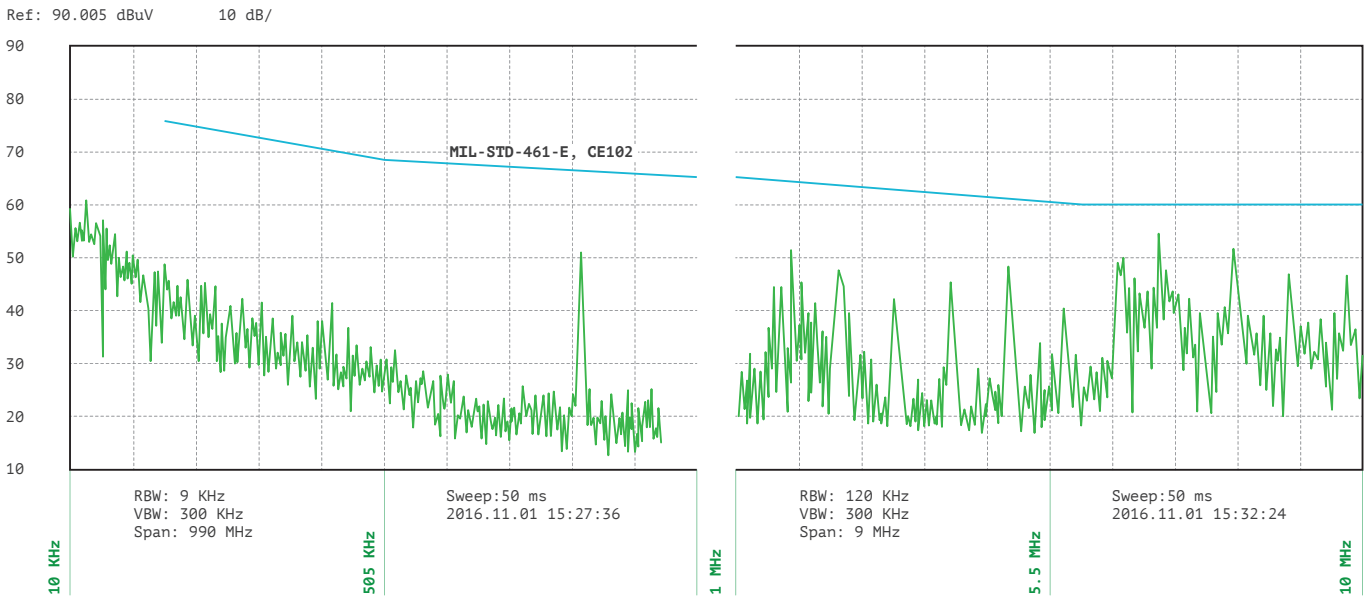

Figure 11 (a). Spectrogram of MDR25-1B24 with typical connection diagram.

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Outline dimensions

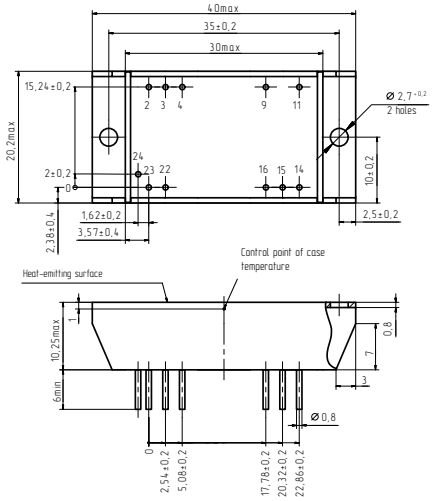

Figure 12 (a). Flanged units.

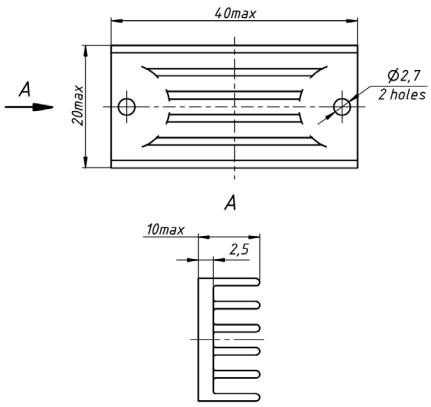

Figure 12 (b). Heatsink with longitudal ribs.

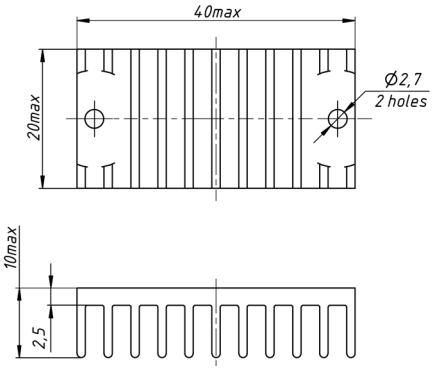

Figure 12 (c). Heatsink with transversal ribs.

Pin out

Pin #	Functions	Description
2	–IN	negative input voltage
3	–IN	negative input voltage
4	ON	unit power ON
9	NOT USE	no output
11	NOT USE	no output for single-channel models
14	+OUT	positive output voltage
15	ADJ	output for parallel connection of the unit
16	–OUT	negative output voltage
22	+IN	positive input voltage
23	+IN	positive input voltage with case output
24	CASE	case output

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AEDON, LLC is the leading Russian developer and manufacturer of DC/DC converters and power supply systems for critical applications.

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This datasheet is valid for the following units: MDRm15–B05; MDRm15–B09; MDRm15–B12; MDRm15–B15; MDRm15–B24; MDRm15–B28; MDRm15–B48; MDRm15–W05; MDRm15–W09; MDRm15–W12; MDRm15–W15; MDRm15–W24; MDRm15–W28; MDRm15–W48; MDRm15–A05; MDRm15–A09; MDRm15–A12; MDRm15–A15; MDRm15–A24; MDRm15–A28; MDRm15–A48; MDRm15–V05; MDRm15–V09; MDRm15–V12; MDRm15–V15; MDRm15–V24; MDRm15–V28; MDRm15–V48; MDRm15–D05; MDRm15–D09; MDRm15–D12; MDRm15–D15; MDRm15–D24; MDRm15–D28; MDRm15–D48; MDRm25–B05; MDRm25–B09; MDRm25–B12; MDRm25–B15; MDRm25–B24; MDRm25–B28; MDRm25–B48; MDRm25–W05; MDRm25–W09; MDRm25–W12; MDRm25–W15; MDRm25–W24; MDRm25–W28; MDRm25–W48; MDRm25–A05; MDRm25–A09; MDRm25–A12; MDRm25–A15; MDRm25–A24; MDRm25–A28; MDRm25–A48; MDRm25–V05; MDRm25–V09; MDRm25–V12; MDRm25–V15; MDRm25–V24; MDRm25–V28; MDRm25–V48; MDRm25–D05; MDRm25–D09; MDRm25–D12; MDRm25–D15; MDRm25–D24; MDRm25–D28; MDRm25–D48.