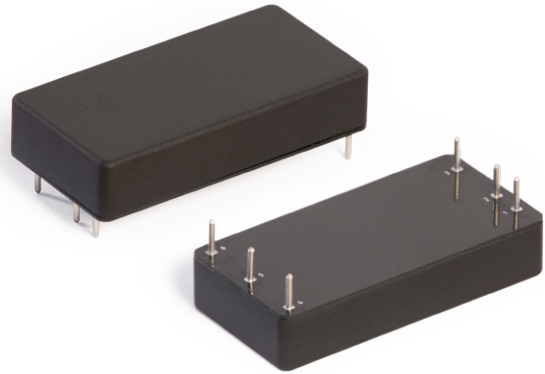


VDRI Series

VDRI40, VDRI60

Miniature DC/DC converters
for industrial application



1. Description

Universal isolated DC/DC converters of high reliability and extended service life were designed for industrial application.

Waterproof potting securely protects the unit from aggressive external factors and allows this converter to operate in a wide range of environmental conditions.

Each batch of products is tested for compliance to dozens of various electric parameters, and is exposed to special types of peak thermal tests.

1.1. Engineered in accordance with

- Safety Std. Approval
EN 60950-1, RoHS
- EMC Std
EN55032 Class B

1.2. Features

- 3 year warranty
- Form-factor 1×2 inch
- Output current up to 12 A
- Case operating temperature –40...+105 °C
- Low-profile design 10,2 mm
- Short circuit and overvoltage
- Remote on/off
- On-peak efficiency 91 %
- Potting sealing

1.3. Additional information

1.3.1. Description on the manufacturer's website

<https://voltbricks.com/product/vdri>



1.3.2. Order registration

+65 6950 0011

sales@voltbricks.com

1.3.3. Technical support

support@voltbricks.com

1.3.4. Reliability test

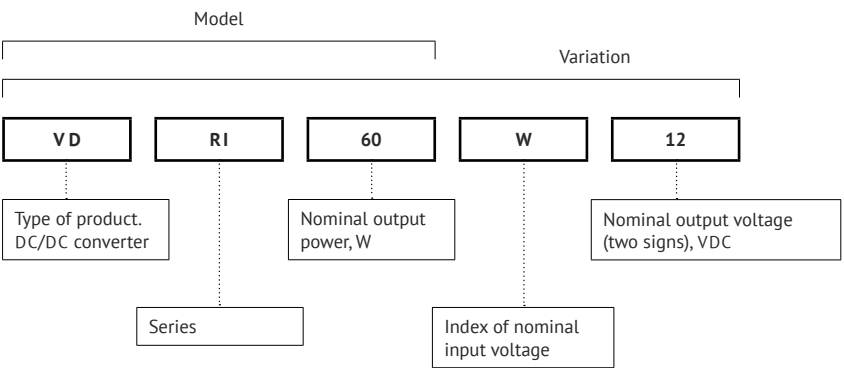
https://support.voltbricks.com/Reliability-Test_ENG.pdf

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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 $8,6 \times 10^4 \dots 10,6 \times 10^4$ 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...+105	°C
Operating ambient temperature	T_{AMB}	Case temperature in standard limits	-40...+85	°C
Storage temperature			-50...+110	°C
Switching frequency			350–450	kHz
Isolation voltage @ 60 s		Input/output, input/case, output/case	1500	VDC
Isolation resistance @ 500 VDC		Input/output, input/case, output/case	min 1	GOhm
Thermal impedance			12,5	°C/W
Remote on/off			Off.: 0...1 VDC or connection of pins "ON" and "–IN", $I < 2$ mA	
MTBF		$T_{CASE}=75$ °C, $P_{OUT}=70$ %	585 000	hrs
Warranty			3	years

4.2. Input specifications

Parameter	Symbol	Conditions	Value	Unit
Nominal input voltage	$U_{IN,NOM}$	Index «B»	24	VDC
		Index «W»	48	VDC
Input voltage range		$U_{IN,NOM}=24$ V	9...36	VDC
		$U_{IN,NOM}=48$ V	18...75	VDC
Transient deviation U_{IN}		$U_{IN,NOM}=24$ V @ 1 s	8...40	VDC
		$U_{IN,NOM}=48$ V @ 1 s	16...80	VDC

4.3. Output specifications

Parameter	Symbol	Conditions	Value	Unit
Output power	P_{OUT}		40; 60	W
Typical efficiency	EFF	$U_{IN}=24$ V, $U_{OUT}=12$ V	91	%
		$U_{IN}=48$ V, $U_{OUT}=12$ V	91	%
Quantity of output channels			1	
Nominal output voltage	$U_{OUT,NOM}$	$P_{OUT}=40$ W	5; 9; 12; 15; 24; 48	VDC
		$P_{OUT}=60$ W	5; 9; 12; 15; 24; 48	VDC
Output current (min)	$I_{OUT,MIN}$		0	A
Output current (max)	$I_{OUT,MAX}$		12	A
Output voltage adjustment			min ± 10	%
Steady-state output voltage deviation, $U_{OUT,NOM}$		$U_{IN,NOM}$, $I_{OUT,MAX}$, normal climatic conditions	max ± 1	%

Parameter	Symbol	Conditions	Value		Unit
Voltage regulation, $U_{OUT,NOM}$		Gradual change of U_{IN} within set value range	max $\pm 0,5$		%
		Gradual change of I_{OUT} within $0,05...1 \times I_{OUT,MAX}$	max $\pm 0,5$		%
		Thermal instability	max ± 2		%
		Repeatability	max $\pm 0,5$		%
		Total voltage regulation within the complete range of output voltage, output current and ambient temperature	max ± 4		%
Ripple and noise (p-p), $U_{OUT,NOM}$	U_{p-p}		<1		%
Max total capacitance of output capacitors	$C_{OUT,MAX}$	$U_{OUT}=5V$	12000	18000	μF
		$U_{OUT}=9V$	4200	6400	
		$U_{OUT}=12V$	2400	3500	
		$U_{OUT}=15V$	1500	2200	
		$U_{OUT}=24V$	600	900	
		$U_{OUT}=48V$	130	210	
			$P_{OUT}=40W$	$P_{OUT}=60W$	
Start up time	t_{IN}	$I_{OUT,MAX} + C_{OUT,MAX}; U_{IN,NOM}$	<0,05		s
Transient response deviation, $U_{OUT,NOM}$		On change $U_{IN,NOM}$ to $1,4 \times U_{IN,NOM}$; On change within $(0,75...1) \times I_{OUT,MAX}$; front time >100 μs .	max ± 5		%

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
Short circuit protection			<2 $I_{OUT,MAX}$		
Overvoltage protection			<1,3 $U_{OUT,NOM}$		
Vibration proof			10...2000 Hz, 200 (20) m/s^2 (g), 0,3 mm		
Dust proof			yes		
Salt fog resistant			yes		
Moisture proof		98% at $T_{AMB} = 35^\circ C$	yes		

4.5. Physical specifications

Parameter	Symbol	Conditions	Value		Unit
Form-factor			1×2 inch		
Case material			aluminium		
Coating			anodic oxide		
Pin material			bronze		
Weight			max 40		g
Soldering temperature		5 s	260		$^\circ C$
Dimensions		Without output pins	max 50,8×25,4×10,2		mm

5. Diagrams

5.1. Layout

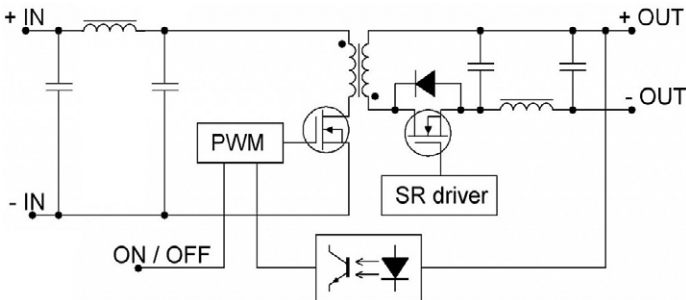


Figure 1. VDRI40, VDRI60 layout.

5.2. Typical connection diagram

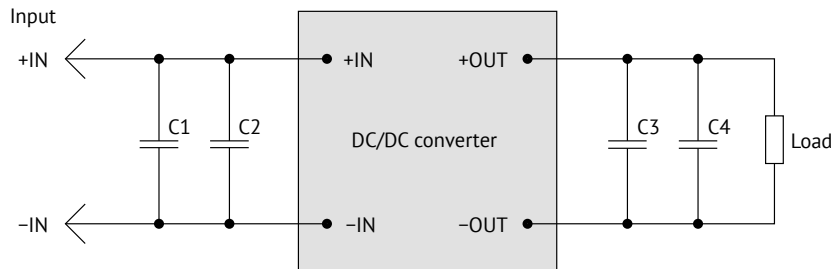


Figure 2. VDRI40, VDRI60 typical connection diagram.

Name	Type	Comment	Denomination
C1	tantalum capasitor	Input voltage	=24 V 100 µF
C2	ceramic capacitor		=48 V 47 µF
C3	ceramic capacitor	Output voltage	=24 V 20 µF
C4	tantalum capasitor		=48 V 10 µF
			5 up to 15 V on 10 µF
			=24 V 4,7 µF
			=48 V 2,2 µF
			=5 B 68 µF
			9 up to 12 V on 47 µF
			=15 V 33 µF
			24 up to 48V on 10 µF

Table 1. Description of the elements of a typical VDRI40, VDRI60 connection diagram.

5.2.1. Wiring diagram for compliance with EN55032 Class A

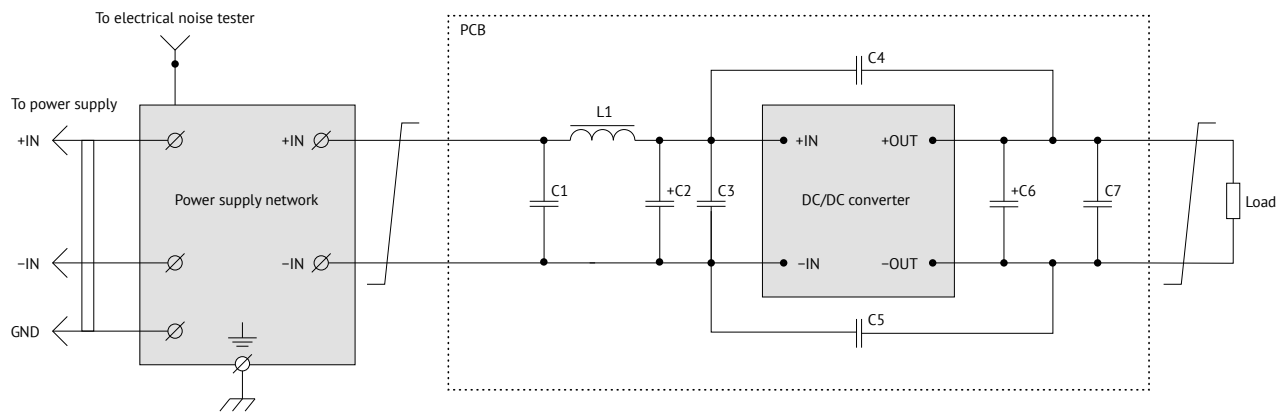


Figure 3. Connection diagram VDRI40, VDRI60.

Name	Type	Comment		Denomination
C1	ceramic capacitor			4,7 μ F
C2	tantalum capasitor	Input voltage	=24 V	100 μ F
			=48 V	47 μ F
C3	ceramic capacitor		=24 V	20 μ F
			=48 V	10 μ F
C4, C5	ceramic capacitor			7,5 nF
C6	tantalum capasitor	Output voltage	=5 V	68 μ F
			9 up to 12 V on	47 μ F
			=15 V	33 μ F
			24 up to 48 V on	10 μ F
C7	ceramic capacitor		5 up to 15 V on	10 μ F
			=24 V	4,7 μ F
			=48 V	2,2 μ F
L1				min 2,2 μ H

Table 2. Description of the elements VDRI40, VDRI60 for compliance with EN55032 Class A.

5.2.2. Wiring diagram for compliance with EN55032 Class B

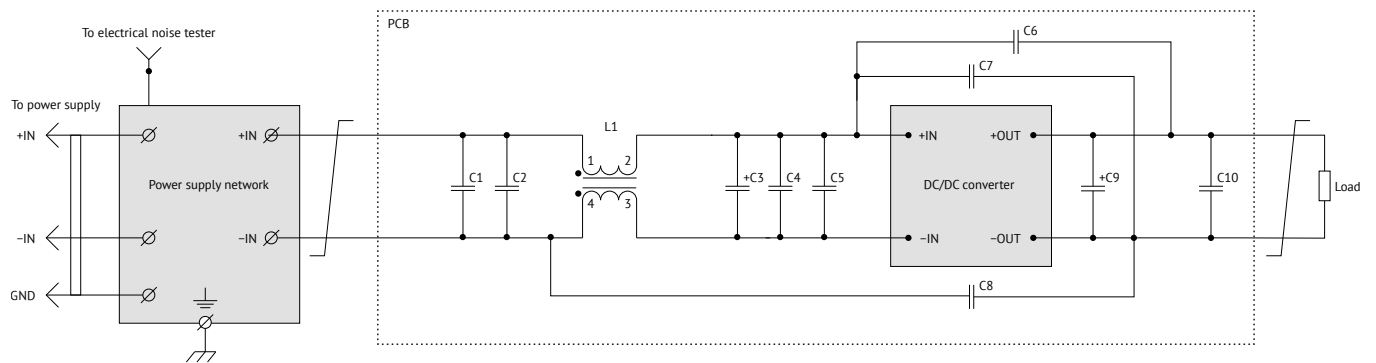


Figure 4. Connection diagram VDRI40, VDRI60.

Name	Type	Comment	Denomination
C1, C2, C4, C5	ceramic capacitor		4,7 μ F
C3	electrolytic capacitor		100 μ F
C6, C8	ceramic capacitor		1000 pF
C7	ceramic capacitor		12 nF
C9	tantalum capacitor	Output voltage	=5 V 68 μ F 9 up to 12 V on 47 μ F =15 V 33 μ F 24 up to 48 V on 10 μ F
C10	ceramic capacitor		5 up to 15 V on 10 μ F =24 V 4,7 μ F =48 V 2,2 μ F
L1	common mode choke	Input voltage	=24 V min 4.7 mH =48 V min 12 mH

Table 3. Description of the elements VDRI40, VDRI60 for compliance with EN55032 Class B.

5.2.3. Wiring diagram for compliance with MIL-STD-461F CE102

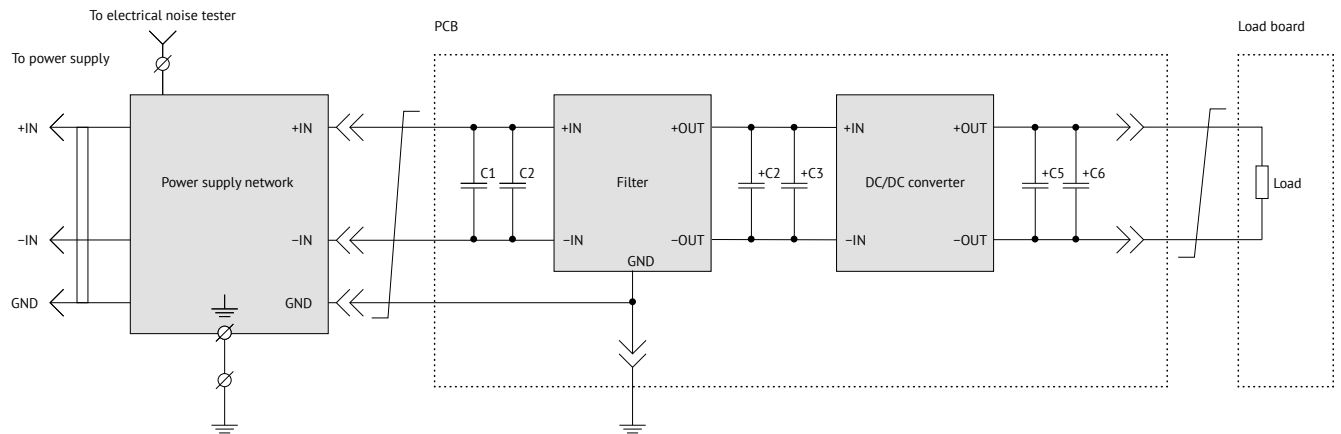


Figure 5. Connection diagram VDRI40, VDRI60.

Name	Type	Comment	Denomination
C1	tantalum capacitor	Input voltage	=24 V =48 V 100 μ F 47 μ F
C2	ceramic capacitor		=24 V =48 V 20 μ F 10 μ F
C3	tantalum capacitor		=24 V =48 V 100 μ F 47 μ F
C4	ceramic capacitor		=24 V =48 V 20 μ F 10 μ F
C5	tantalum capacitor	Output voltage	=5 V 9 up to 12 V on =15 V =24 V =48 V 68 μ F 47 μ F 33 μ F 10 μ F 10 μ F
C6	ceramic capacitor		5 up to 15 V on =24 V =48 V 10 μ F 4,7 μ F 2,2 μ F
Filter		Input voltage	=24 V =48 V VFD07B VFD07W

Table 4. Description of the elements VDRI40, VDRI60 for compliance with MIL-STD-461F CE102.

6. Service functions

6.1. Adjustment

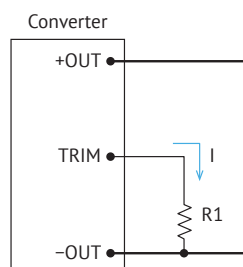


Figure 6. Output voltage increase.

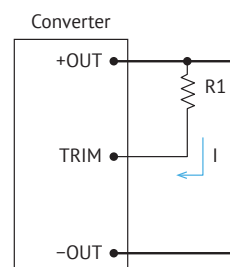


Figure 7. Output voltage decrease.

Output voltage adjustment can be performed by "TRIM" and "-OUT" pins connection through resistor - for output voltage increase [Figure 6];
and by "TRIM" and "+OUT" pins connection through resistor - for output voltage decrease [Figure 7].

Tuning resistor R1 value can be calculated by the following formulas:

$$R_{\text{down}} = \frac{U_{\text{OUT}} \times K1 - K2}{U_{\text{NOM.OUT}} - U_{\text{OUT}}} - K3 \quad R_{\text{up}} = \frac{K2}{U_{\text{OUT}} - U_{\text{NOM.OUT}}} - K3$$

U _{NOM.OUT}	3,3	5	9	12	15	24	48
K1	2,2	3,83	6,65	9,53	12,4	22	45,3
K2	2,73	4,75	16,59	23,78	30,94	54,89	113,02
K3	7,5	7,5	15	15	15	15	20

U_{NOM.OUT} - nominal output voltage,
U_{OUT} - required output voltage after adjustment.
Resistor value in kOhm.

7. Test reports

7.1. Efficiency

7.1.1. VDRI60 (Index "B")

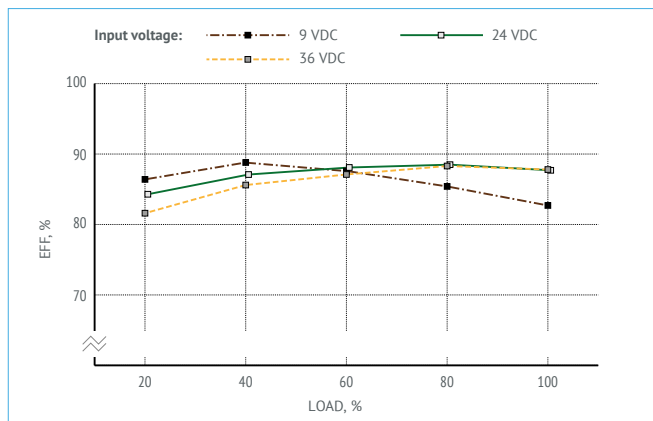


Figure 8. VDRI60B05.

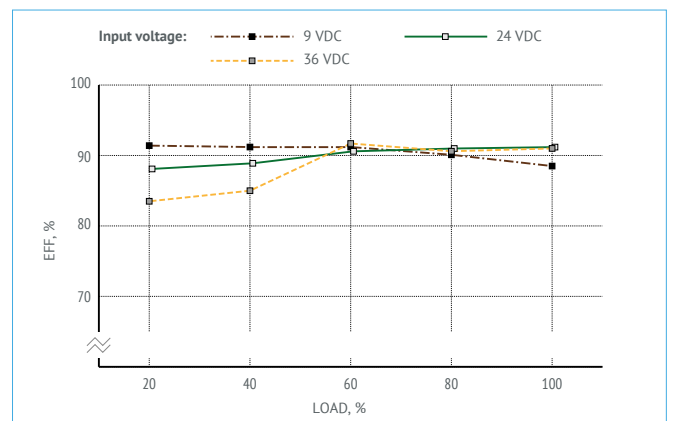


Figure 9. VDRI60B12.

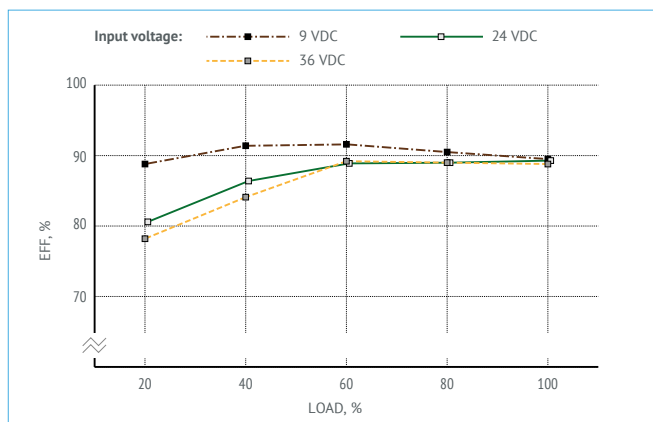


Figure 10. VDRI60B15.

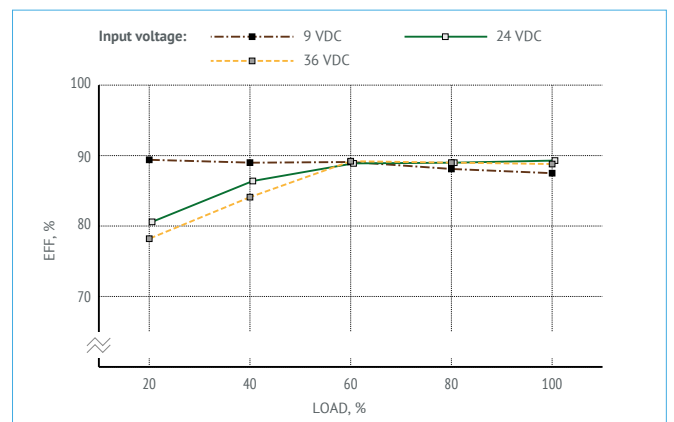


Figure 11. VDRI60B24.

7.1.2. VDRI60 (Index “W”)

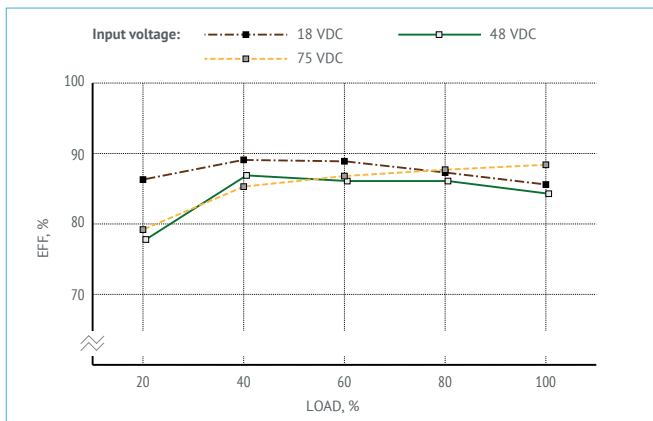


Figure 12. VDRI60W05.

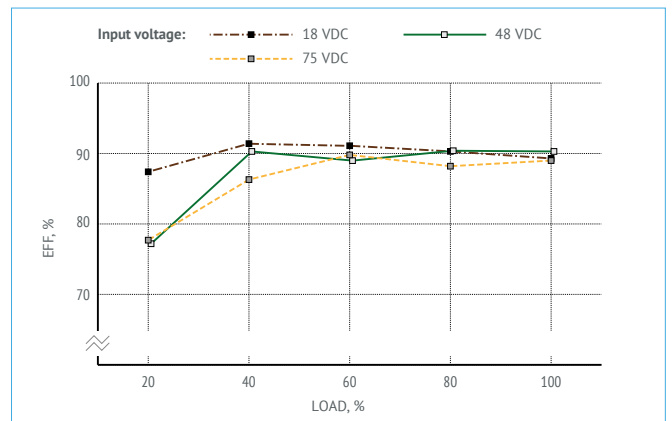


Figure 13. VDRI60W09.

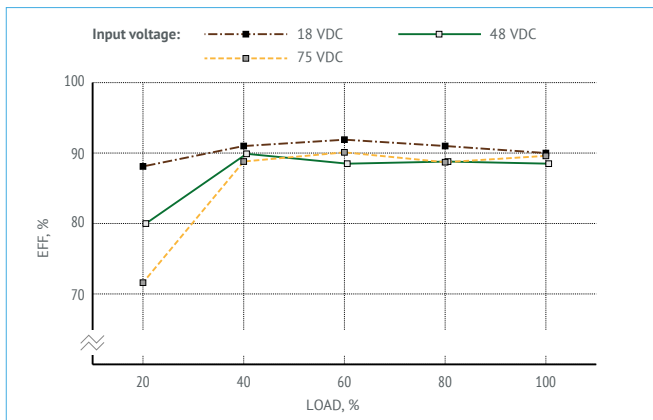


Figure 14. VDRI60W12.

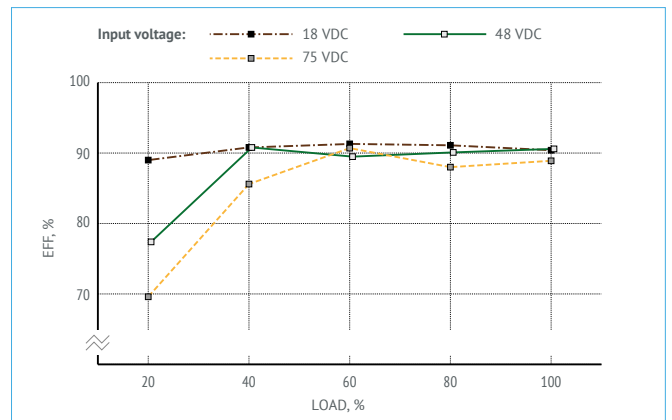


Figure 15. VDRI60W15.

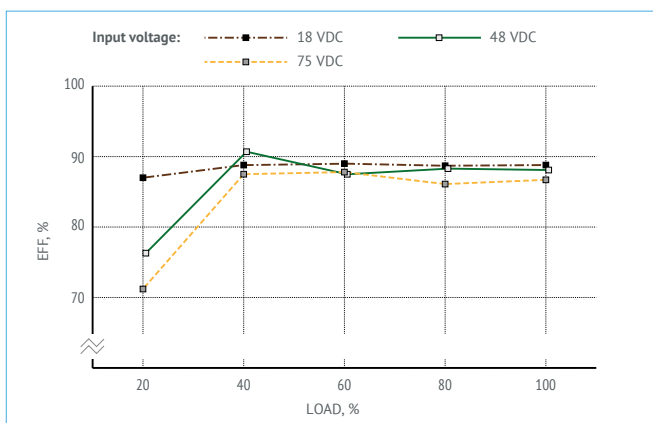


Figure 16. VDRI60W24.

7.2. Oscillograph charts

7.2.1. VDRI40B15

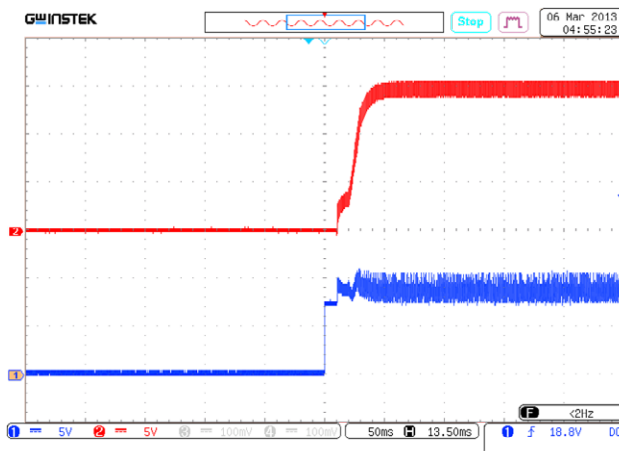


Figure 17. $U_{OUT,NOM}$ stabilizing with Remote On/Off option (ON and -OUT pins connection).

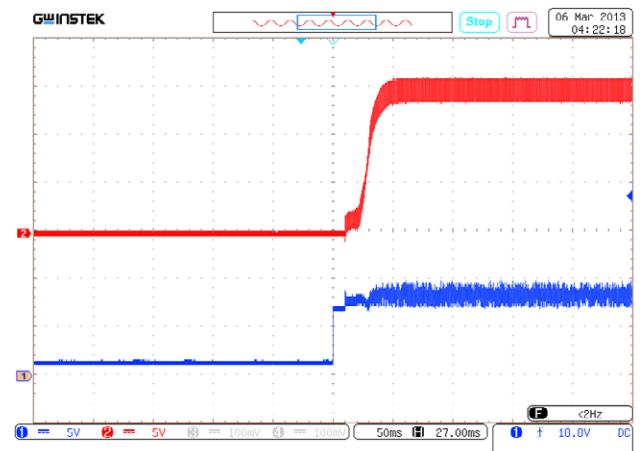


Figure 18. $U_{OUT,NOM}$ stabilizing with Remote On/Off option (control signal).

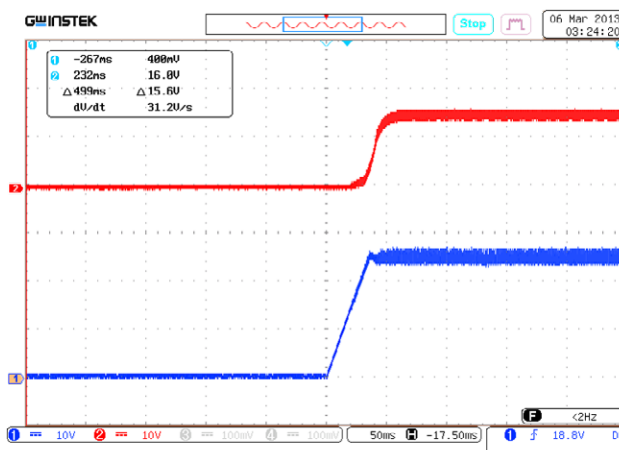


Figure 19. $U_{OUT,NOM}$ stabilizing with $U_{IN,NOM}$.

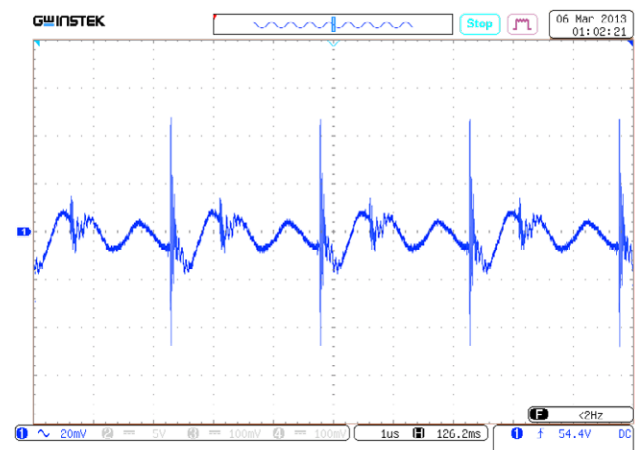


Figure 20. $U_{OUT,NOM}$ ripple

7.2.2. VDRI40W12

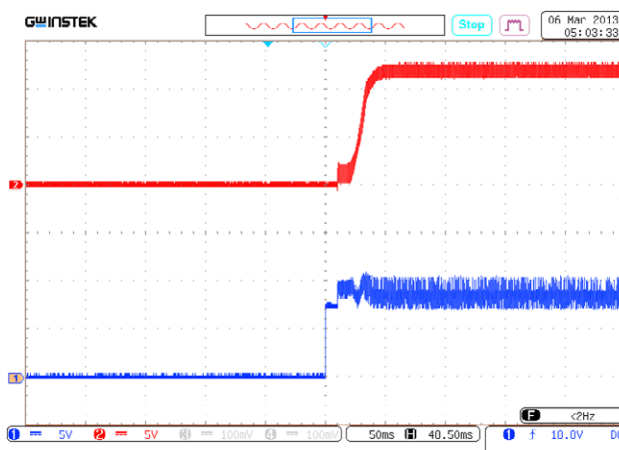


Figure 21. $U_{OUT,NOM}$ stabilizing with Remote On/Off option (ON and -OUT pins connection).

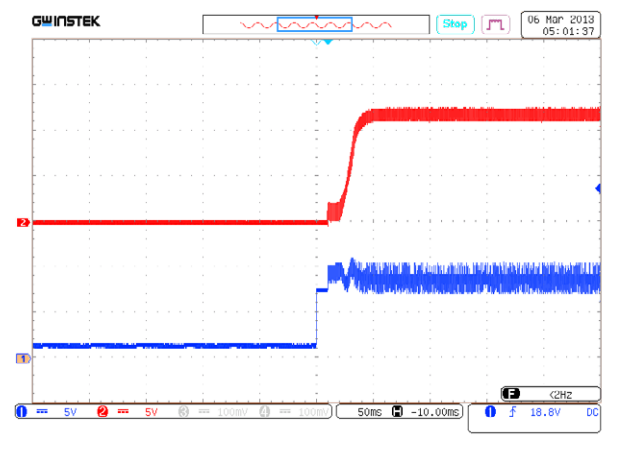


Figure 22. $U_{OUT,NOM}$ stabilizing with Remote On/Off option (control signal).

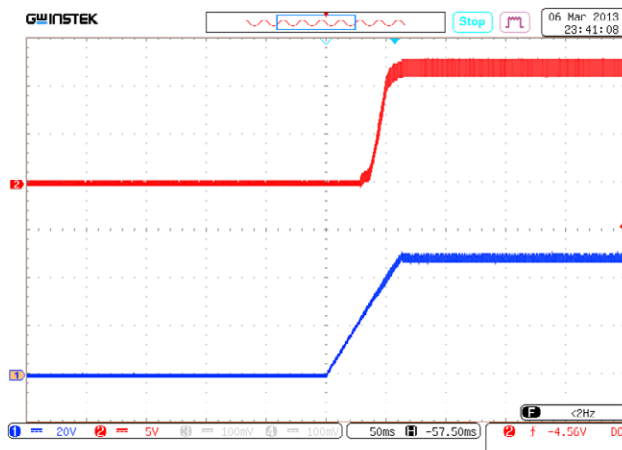


Figure 23. $U_{OUT,NOM}$ stabilizing with $U_{IN,NOM}$.

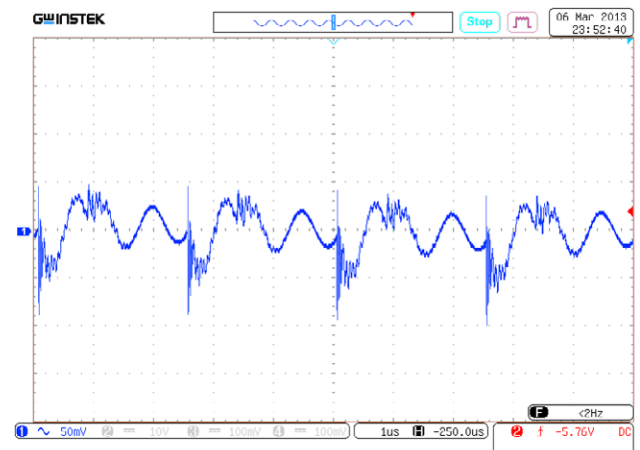


Figure 24. $U_{OUT,NOM}$ ripple.

7.2.3. VDRI60B24

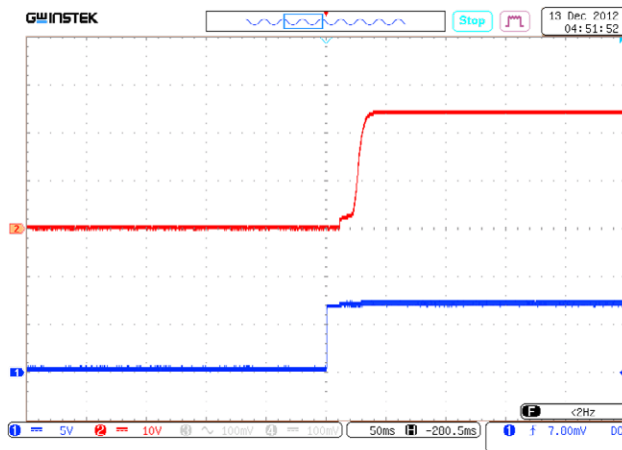


Figure 25. $U_{OUT,NOM}$ stabilizing with Remote On/Off option (ON and -OUT pins connection).

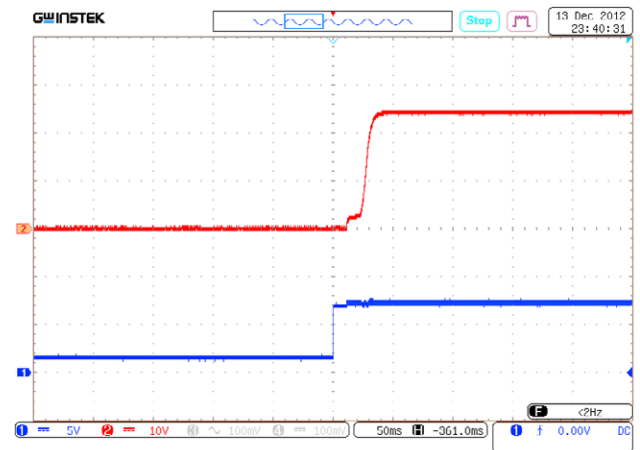


Figure 26. $U_{OUT,NOM}$ stabilizing with Remote On/Off option (control signal).

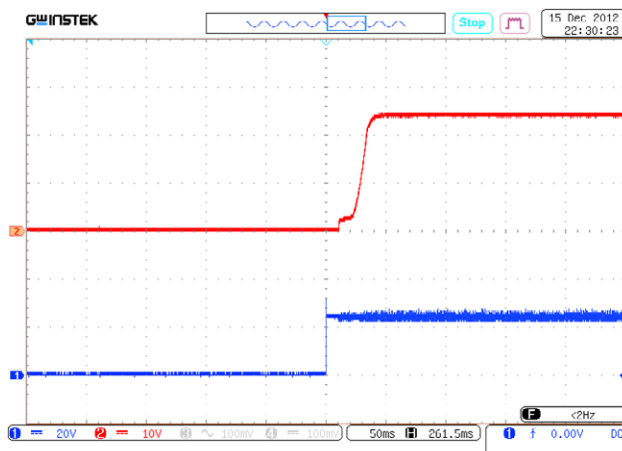


Figure 27. $U_{OUT,NOM}$ stabilizing with $U_{IN,NOM}$.

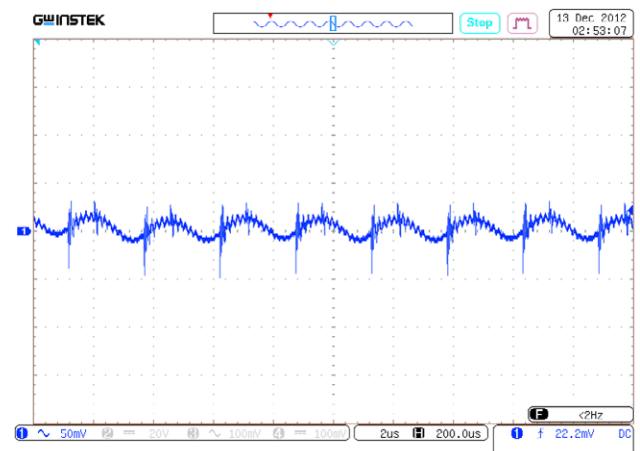


Figure 28. $U_{OUT,NOM}$ ripple.

7.2.4. VDRI60W24

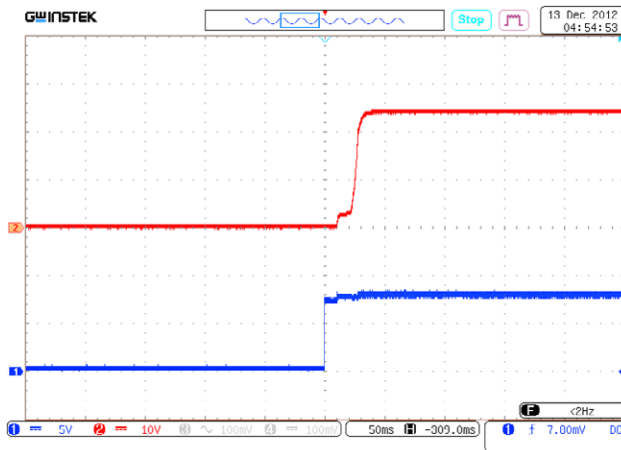


Figure 29. $U_{OUT,NOM}$ stabilizing with Remote On/Off option (ON and -OUT pins connection).

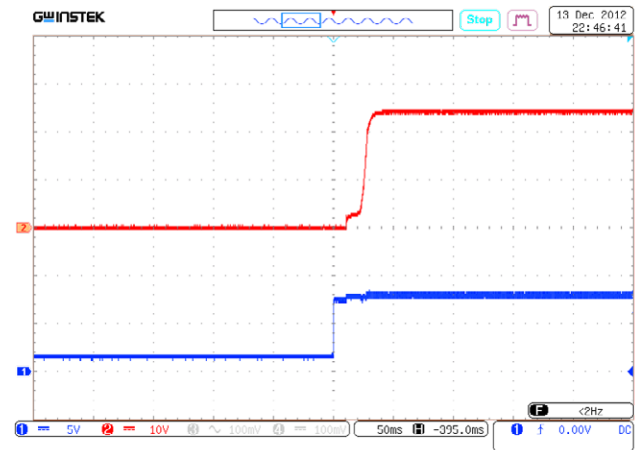


Figure 30. $U_{OUT,NOM}$ stabilizing with Remote On/Off option (control signal).

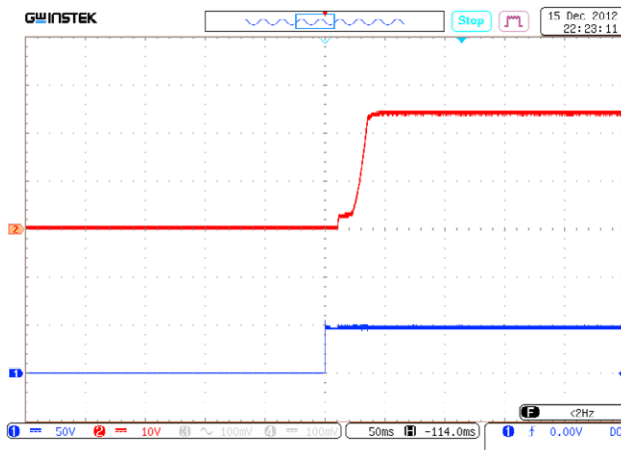


Figure 31. $U_{OUT,NOM}$ stabilizing with $U_{IN,NOM}$.

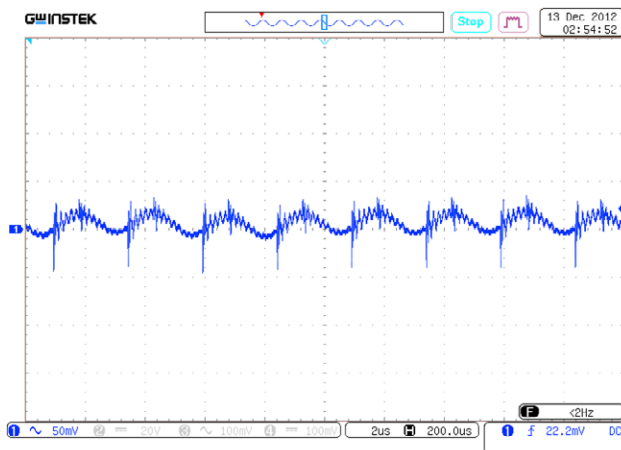


Figure 32. $U_{OUT,NOM}$ ripple.

7.3. Noise spectrogram

7.3.1. VDRI40B15

For testing we used connection circuits to comply EN55032 Class A [Figure 3] and EN55032 Class B [Figure 4].

Test conditions: $U_{IN}=24\text{ VDC}$, $T_{AMB}=25\text{ }^{\circ}\text{C}$.

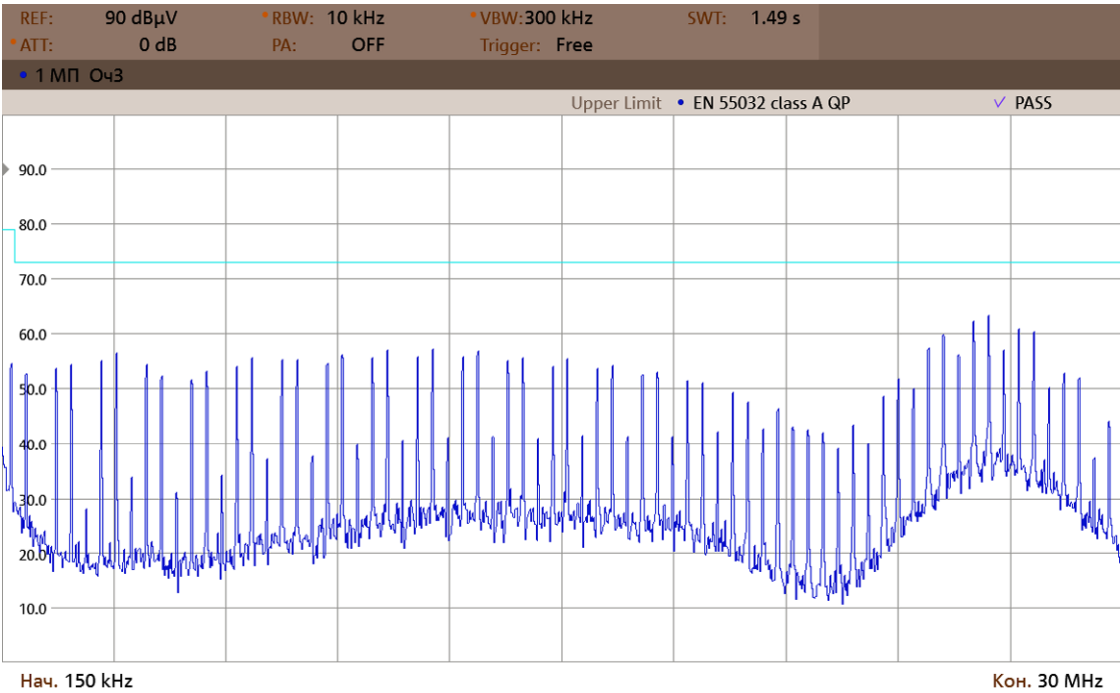


Figure 33. Compliance spectrogram EN55032 Class A (0,15–30 MHz).

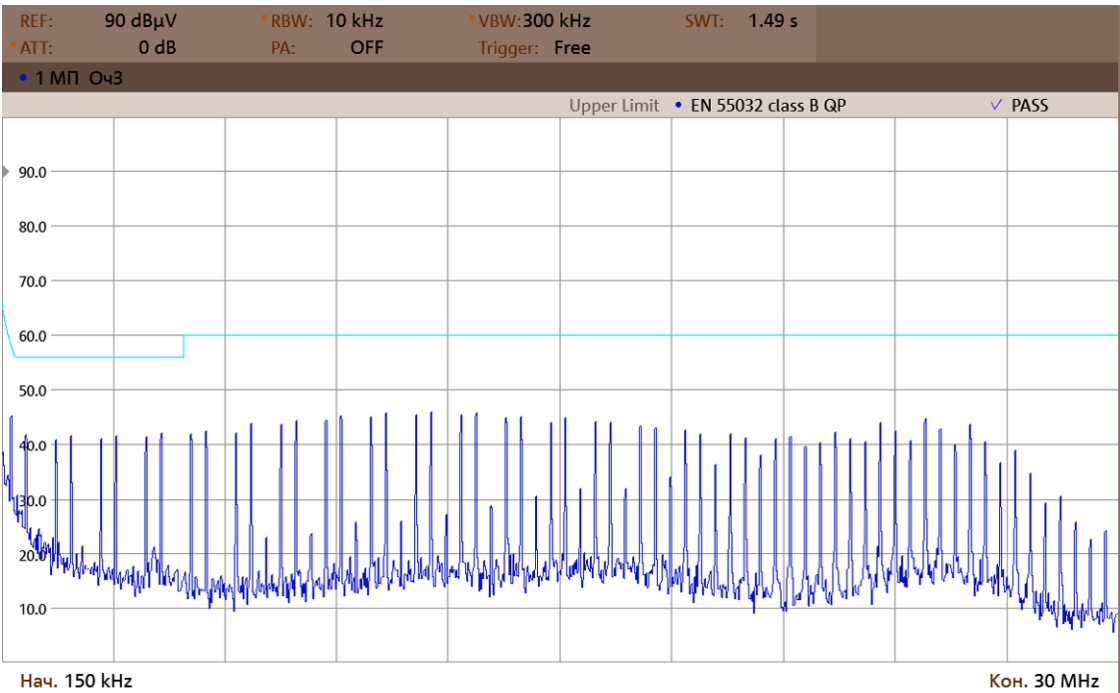


Figure 34. Compliance spectrogram EN55032 Class B (0,15–30 MHz).

7.3.2. VDRI40W15

For testing we used connection circuits to comply EN55032 Class A [Figure 3] and EN55032 Class B [Figure 4].
Test conditions: $U_{IN}=48$ VDC, $T_{AMB}=25$ °C.

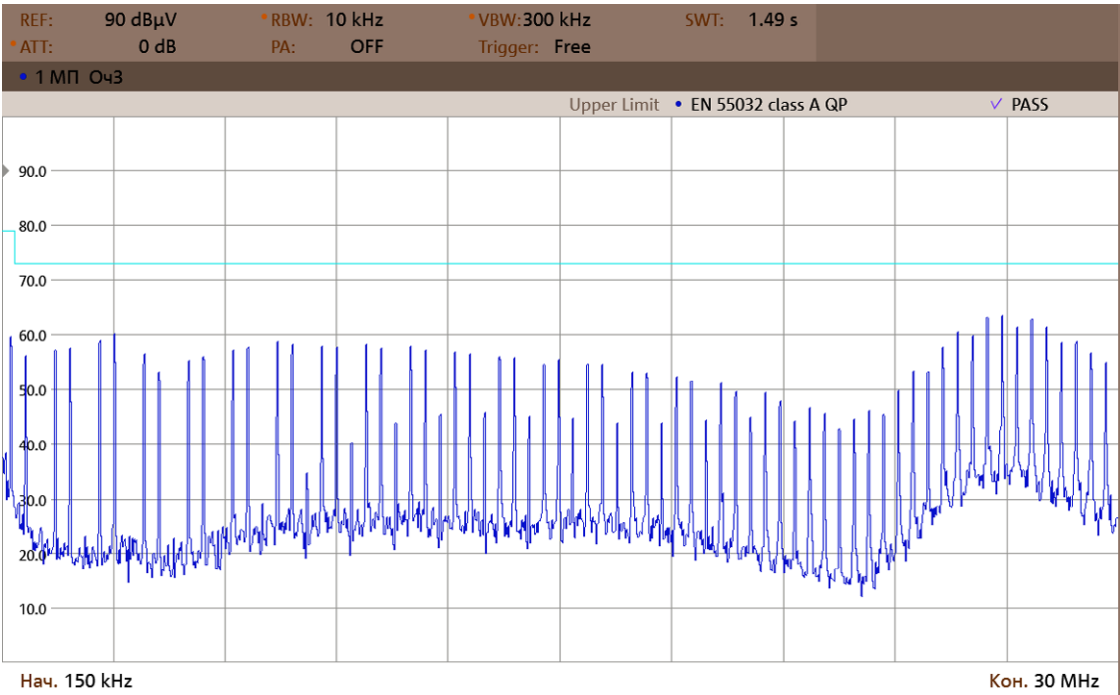


Figure 35. Compliance spectrogram EN55032 Class A (0,15–30 MHz).

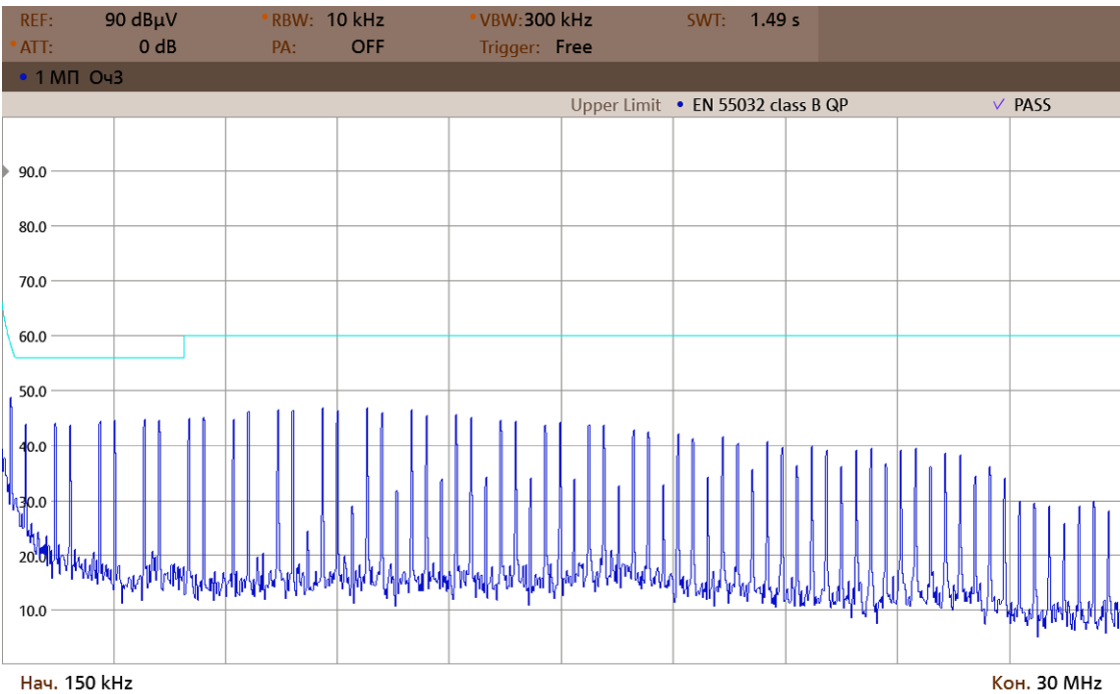


Figure 36. Compliance spectrogram EN55032 Class B (0,15–30 MHz).

7.3.3. VDRI60B15

For testing we used connection circuits to comply EN55032 Class A [Figure 3] and EN55032 Class B [Figure 4].

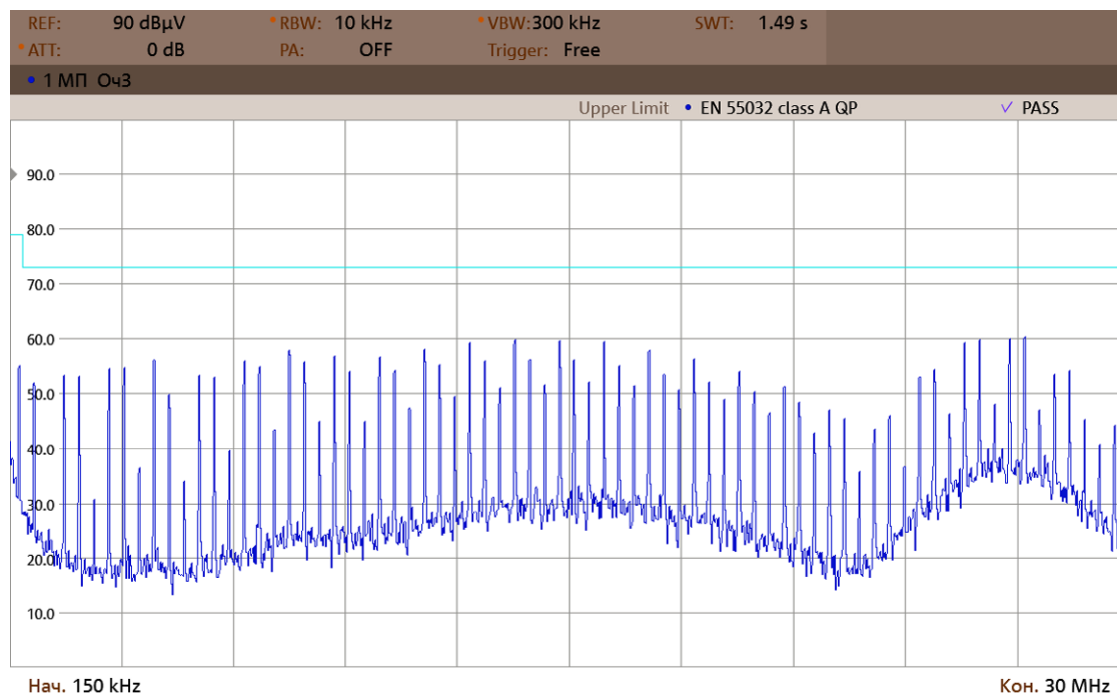
Test conditions: $U_{IN}=24$ VDC, $T_{AMB}=25$ °C.

Figure 37. Compliance spectrogram EN55032 Class A (0,15–30 MHz).

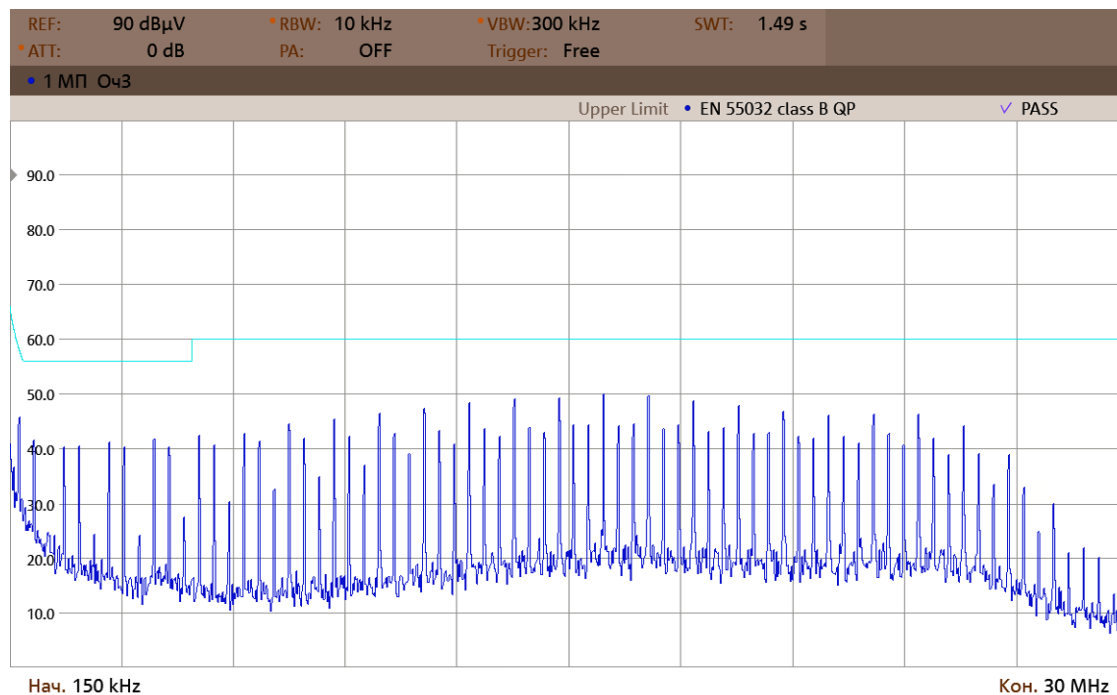


Figure 38. Compliance spectrogram EN55032 Class B (0,15–30 MHz).

7.3.4. VDRI60W15

For testing we used connection circuits to comply EN55032 Class A [Figure 3] and EN55032 Class B [Figure 4].

Test conditions: $U_{IN}=48\text{ VDC}$, $T_{AMB}=25\text{ }^{\circ}\text{C}$.

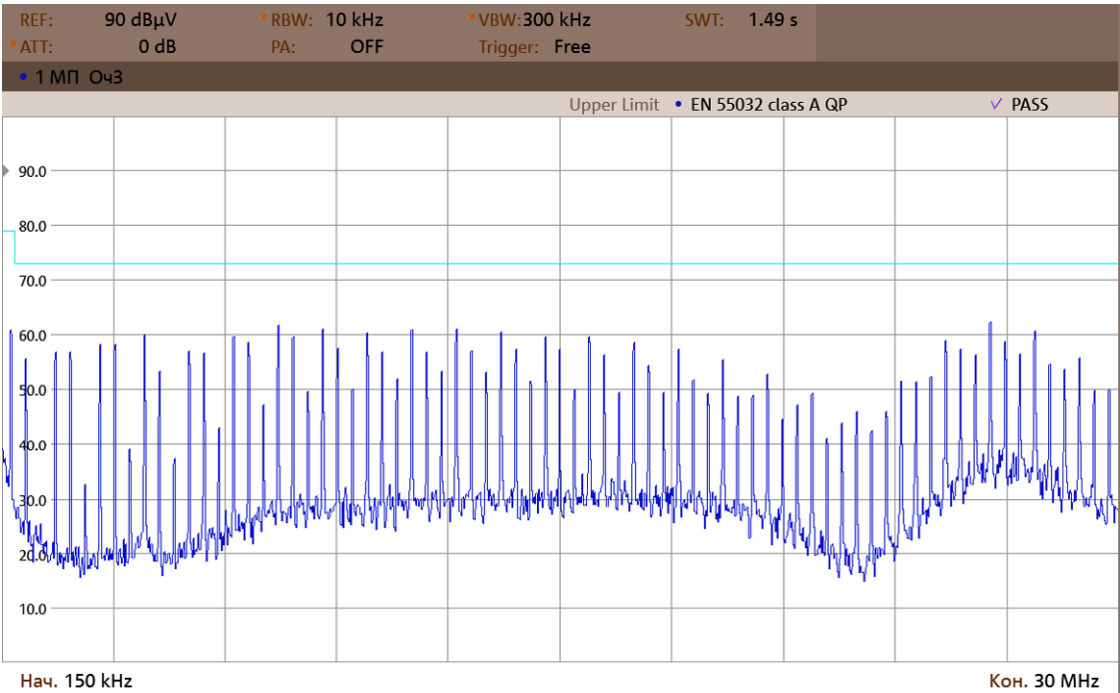


Figure 39. Compliance spectrogram EN55032 Class A (0,15–30 MHz).

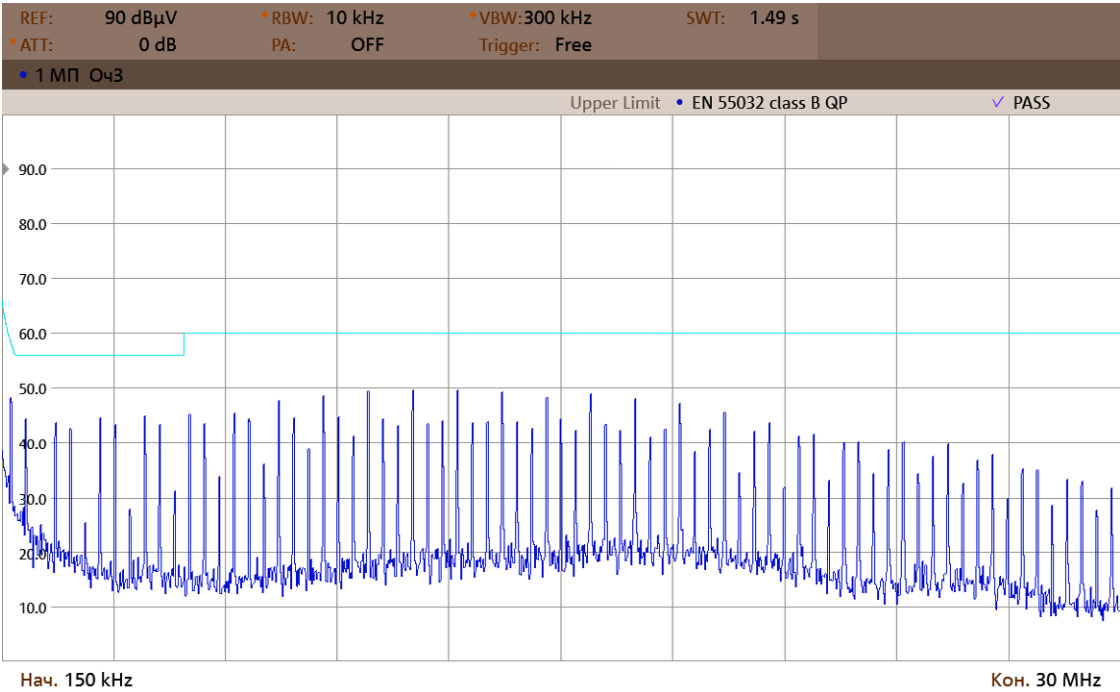


Figure 40. Compliance spectrogram EN55032 Class B (0,15–30 MHz).

8. Outline dimensions

Pin #	1	2	3	4	5	6
Function	+IN	-IN	Remote On/Off	+OUT	-OUT	TRIM

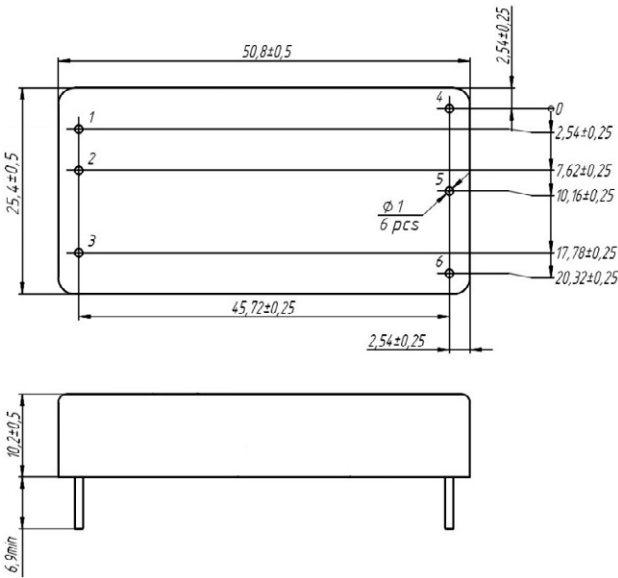


Figure 41. Valid for VDRI40, VDRI60.

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This datasheet is valid for the following units: VDRI40B05; VDRI40B09; VDRI40B12; VDRI40B15; VDRI40B24; VDRI40B48; VDRI40W05; VDRI40W09; VDRI40W12; VDRI40W15; VDRI40W24; VDRI40W48; VDRI60B05; VDRI60B09; VDRI60B12; VDRI60B15; VDRI60B24; VDRI60B48; VDRI60W05; VDRI60W09; VDRI60W12; VDRI60W15; VDRI60W24; VDRI60W48.