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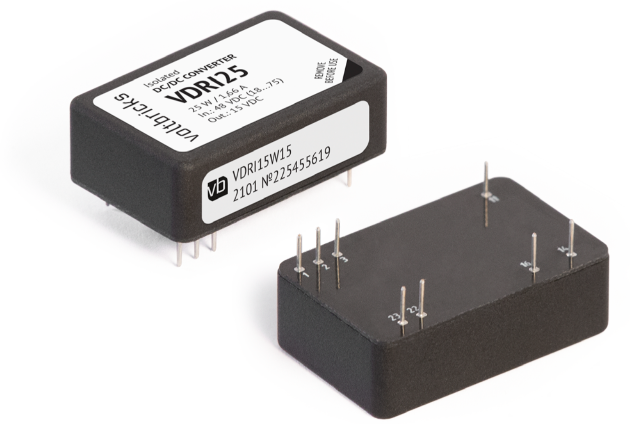
DATASHEET

VDRI Series

VDRI15, VDRI25

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 DIP-24
- Output current up to 6 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

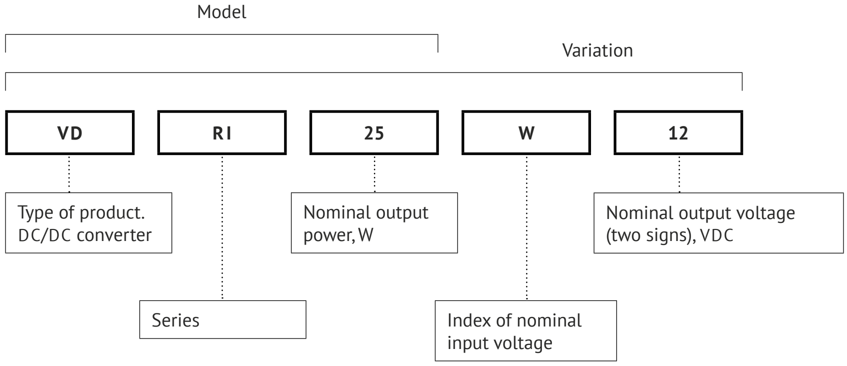
1.3.4. Reliability test

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

2. Contents

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 $8{,}6\times10^4$…$10{,}6\times10^4$ 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			21	°C/W
Remote on/off			Off.: 0…1 VDC or connection of pins "ON" and "−IN", I≤5 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}		15; 25	W
Typical efficiency	EFF	U_{IN}=24 V, U_{OUT}=12 V	91	%
		U_{IN}=48 V, U_{OUT}=12 V	88	%
Quantity of output channels			1	
Nominal output voltage	$U_{OUT.NOM}$		3,3; 5; 9; 12; 15; 24; 48	VDC
Output current (min)	$I_{OUT.MIN}$		0	A
Output current (max)	$I_{OUT.MAX}$	P_{OUT}=15 W	4,55	A
		P_{OUT}=25 W	6	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	%

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Parameter	Symbol	Conditions	Value		Unit
Voltage regulation, $U_{OUT.NOM}$		Gradual change of U_{IN} within set value range	max ±0,5		%
		Gradual change of I_{OUT} within 0,05…1×$I_{OUT.MAX}$	max ±0,5		%
		Thermal instability	max ±2		%
		Repeatability	max ±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}	U_{OUT}⩽5 V	<50		mV
		U_{OUT}>5 V	<1		%
Max total capacitance of output capacitors	$C_{OUT.MAX}$	U_{OUT}=3,3 V U_{OUT}=5 V U_{OUT}=9 V U_{OUT}=12 V U_{OUT}=15 V U_{OUT}=24 V U_{OUT}=48 V	10000 4500 1400 850 580 220 50 P_{OUT}=15 W	– 5400 2500 1400 1000 360 85 P_{OUT}=25 W	uF
Start up time	t_{IN}	$I_{OUT.MAX}$ + $C_{OUT.MAX}$, $U_{IN.NOM}$	<0,05		s
Trancient responce deviation, $U_{OUT.NOM}$		On change $U_{IN.NOM}$ to 1,4×$U_{IN.NOM}$; On change within (0,75…1)×$I_{OUT.MAX}$; front time >100 us.	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		U_{OUT} ⩽5 V	3 $I_{OUT.MAX}$	
		U_{OUT} >5 V	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°C	yes	

4.5. Physical specifications

Parameter	Symbol	Conditions	Value	Unit
Form-factor			DIP-24	
Case material			aluminium	
Coating			anodic oxide	
Pin material			bronze	
Weight			max 19	g
Soldering temperature		5 s	260	°C
Dimensions		Without output pins	max 31,8×20,3×10,2	mm

5. Diagrams

5.1. Layout

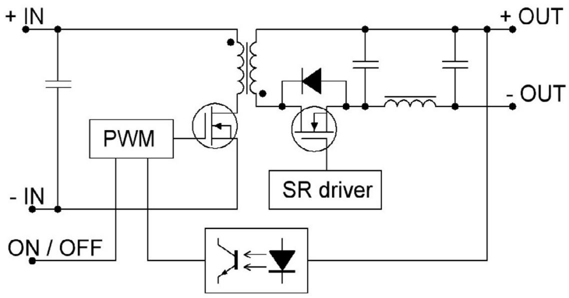

Figure 1. VDRI15, VDRI25 layout.

5.2. Typical connection diagram

5.2.1. Typical connection diagram

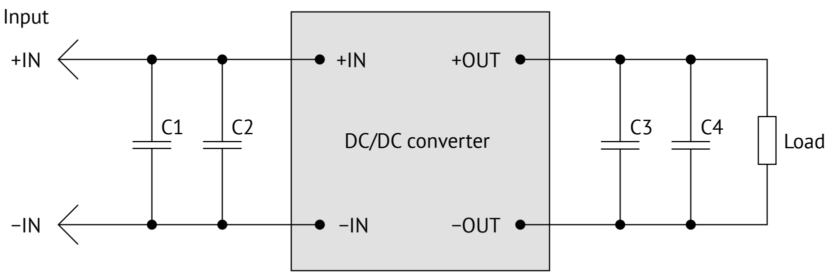

Figure 2. VDRI15, VDRI25 typical connection diagram.

Name	Type	Comment		VDRI15	VDRI25
C1	tantalum capasitor			22 µF	47 µF
C2	ceramic capacitor			4,7 µF	10 µF
C3	ceramic capacitor	Output voltage	3,3 up to 15 V on =24 V =48 V	10 µF 4,7 µF 2,2 µF	
C4	tantalum capasitor	Output voltage	=3,3 V =5 V 9 up to 12 V on =15 V 24 up to 48 V on	100 µF 68 µF 47 µF 33 µF 10 µF	

Table 1. Description of the elements of a typical VDRI15, VDRI25 connection diagram.

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5.2.2. Wiring diagram for compliance with EN55032 Class A

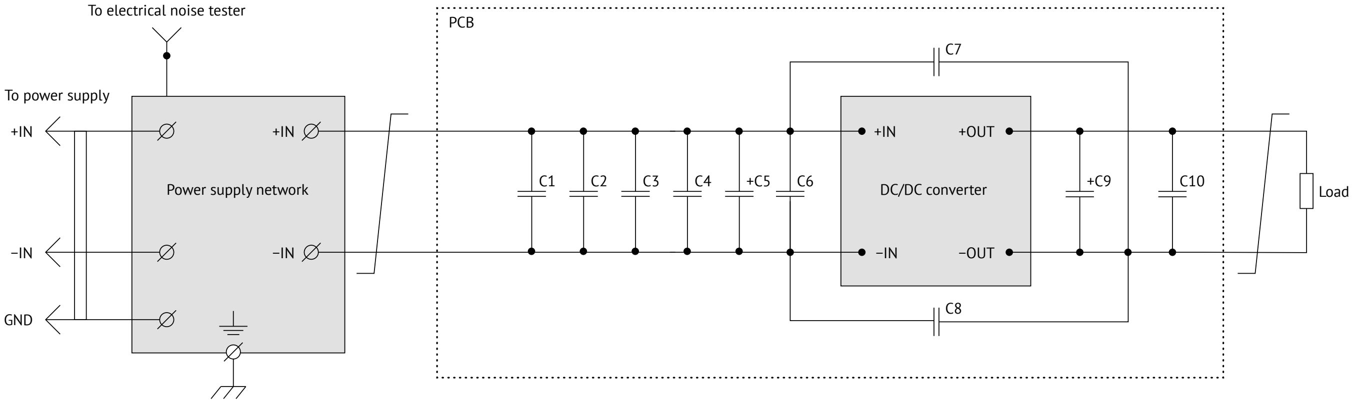

Figure 3. Connection diagram VDRI15, VDRI25.

Name	Type	Comment		VDRI15	VDRI25
C1, C2, C3, C4	ceramic capacitor			4,7 µF	10 µF
C5	tantalum capasitor			22 µF	47 µF
C6	ceramic capacitor			4,7 µF	10 µF
C7, C8	ceramic capacitor			3,9 nF	
C9	tantalum capasitor	Output voltage	=3,3 V =5 V 9 up to 12 V on =15 V 24 up to 48 V on	100 µF 68 µF 47 µF 33 µF 10 µF	
C10	ceramic capacitor	Output voltage	3,3 up to 15 V on =24 V =48 V	10 мк µF 4,7 µF 2,2 µF	

Table 2. Description of the elements VDRI15, VDRI25 for compliance with EN55032 Class A.

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5.2.3. Wiring diagram for compliance with EN55032 Class B

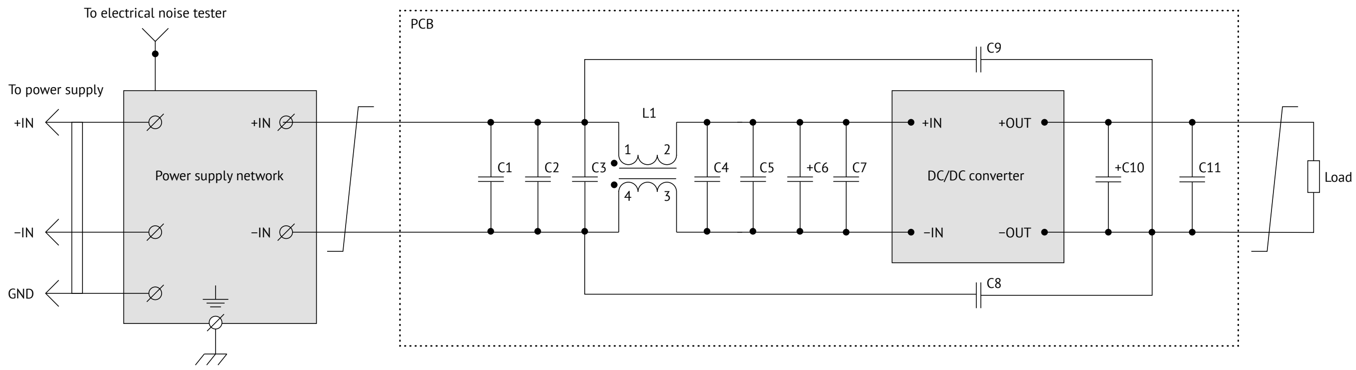

Figure 4. Connection diagram VDRI15, VDRI25.

Name	Type	Comment		VDRI15	VDRI25
C1, C2, C3, C4, C5	ceramic capacitor			4,7 μF	10 μF
C6	tantalum capasitor			22 μF	47 μF
C7	ceramic capacitor			4,7 μF	10 μF
C8, C9	ceramic capacitor			3,9 nF	
C10	tantalum capasitor	Output voltage	=3,3 V =5 V 9 up to 12 V on =15 V 24 up to 48 V on	100 μF 68 μF 47 μF 33 μF 10 μF	
C11	ceramic capacitor	Output voltage	3,3 up to 15 V on =24 V =48 V	10 μF 4,7 μF 2,2 μF	
L1	common mode choke			min 1 mH	

Table 3. Description of the elements VDRI15, VDRI25 for compliance with EN55032 Class B.

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

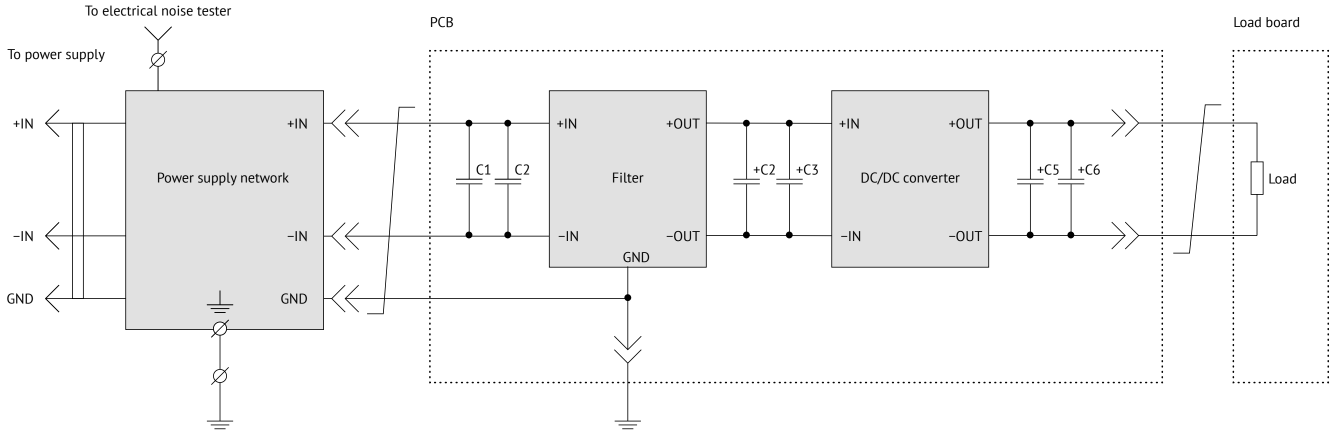

Figure 5. Connection diagram VDRI15, VDRI25.

Name	Type	Comment		VDRI15	VDRI25
C1	tantalum capasitor			22 μF	47 μF
C2	ceramic capacitor			4.7 μF	10 μF
C3	tantalum capasitor			22 μF	47 μF
C4	ceramic capacitor			4.7 μF	10 μF
C5	tantalum capasitor	Output voltage	=3,3 V =5 V 9 up to 12 V on =15 V =24 V =48 V	100 μF 68 μF 47 μF 33 μF 10 μF 10 μF	
C6	ceramic capacitor	Output voltage	3,3 up to 15 V on =24 V =48 V	10 μF 4,7 μF 2.2 μF	
Filter		Input voltage	=24 V =48 V	VFD07B VFD07W	

Table 4. Description of the elements VDRI15, VDRI25 for compliance with MIL-STD-461F CE102.

6. Service functions

6.1. Adjustment

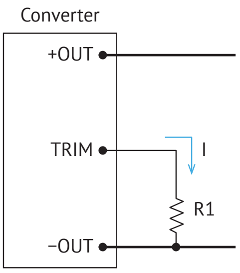

Figure 6. Output voltage increase.

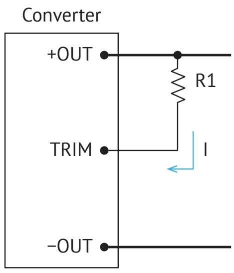

Figure 7. Output voltage decrease.

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]*.

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

$$Rdown: = \frac{U_{OUT} \times K1 - K2}{U_{NOM.OUT} - U_{OUT}} - K3 \qquad Rup: = \frac{K2}{U_{OUT} - U_{NOM.OUT}} - K3$$

$U_{NOM.OUT}$	3,3	5	9	12	15	24	48
K1	2,05	3,83	7,5	10,7	15	22,6	47
K2	2,54	4,75	9,3	13,27	18,6	56,5	117,5
K3	6,8	7,5	8,25	7,5	10	10	10

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

7. Test reports

7.1. Effiency

7.1.1. VDRI15 (Index "B")

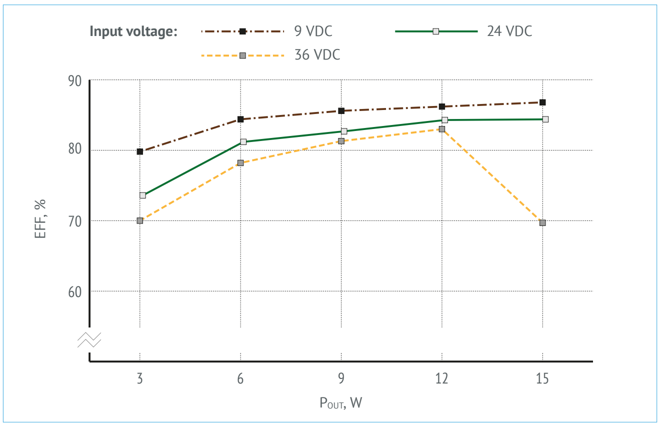

Figure 8. Efficiency of VDRI15B05.

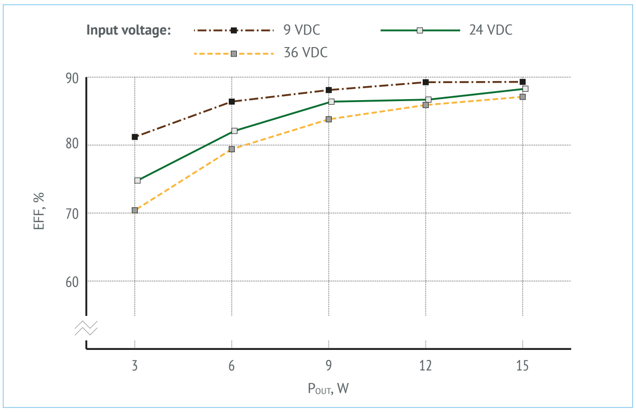

Figure 9. Efficiency of VDRI15B12.

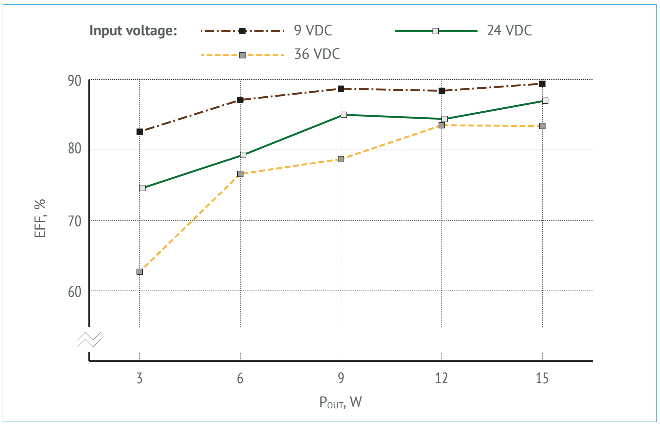

Figure 10. Efficiency of VDRI15B24.

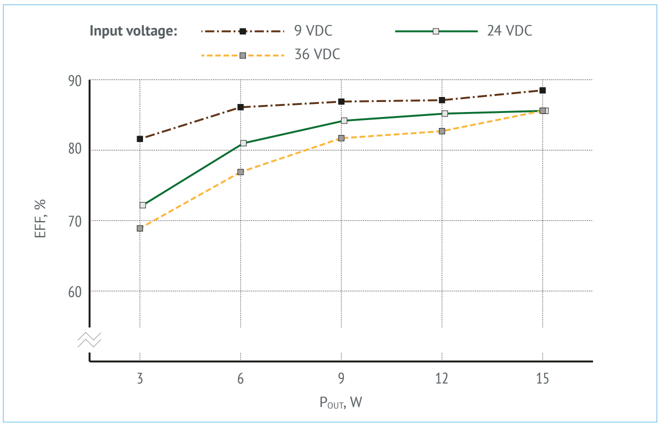

Figure 11. Efficiency of VDRI15B48.

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7.1.2. VDRI15 (Index "W")

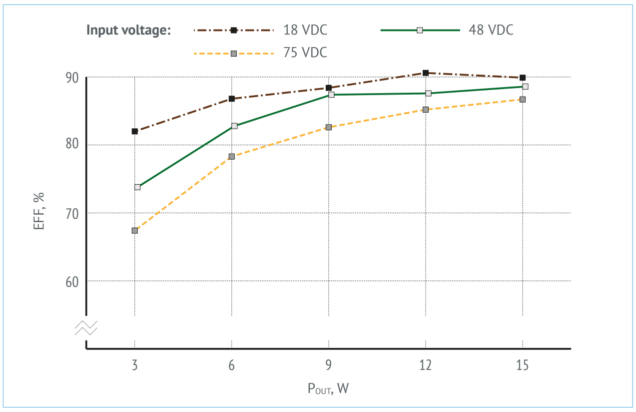

Figure 12. Efficiency of VDRI15W12.

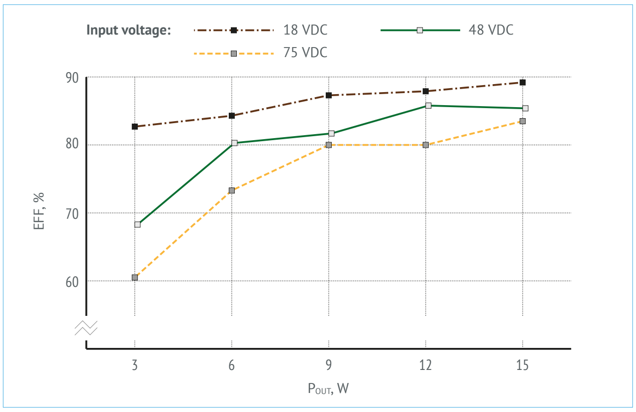

Figure 13. Efficiency of VDRI15W24.

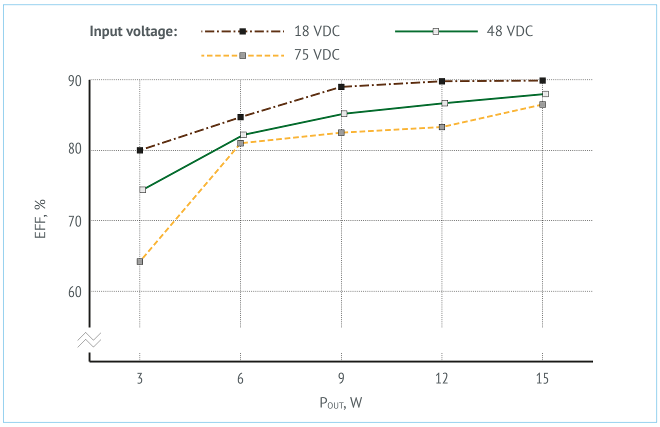

Figure 14. Efficiency of VDRI15W48.

7.1.3. VDRI25 (Index "B")

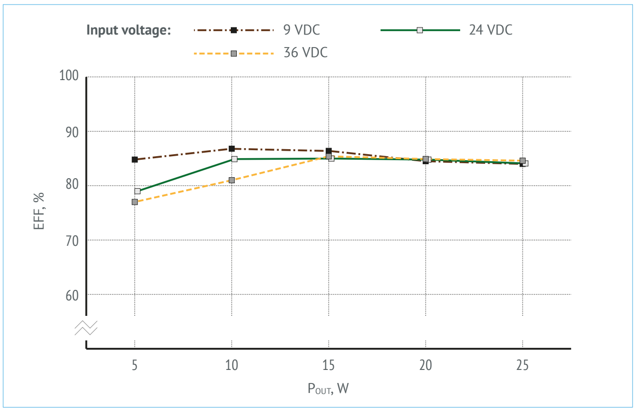

Figure 15. Efficiency of VDRI25B05.

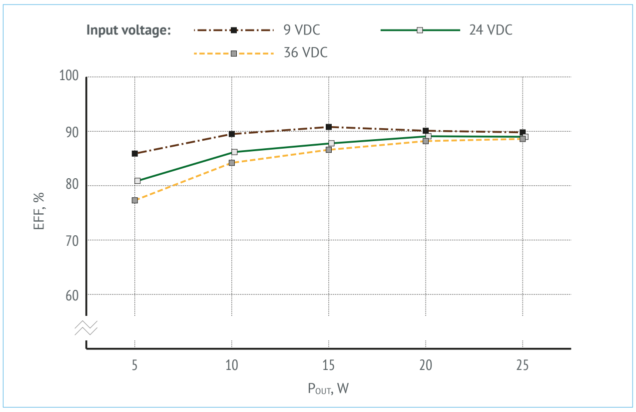

Figure 16. Efficiency of VDRI25B12.

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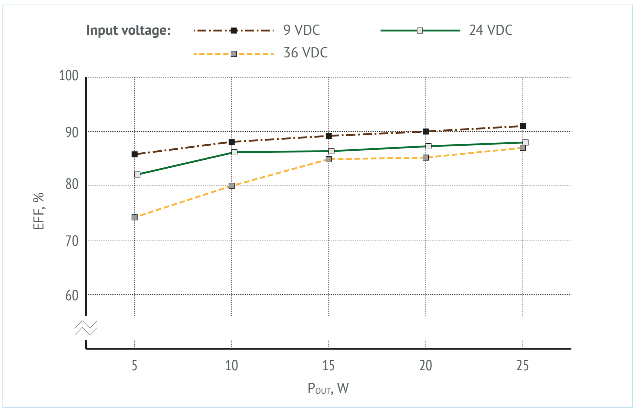

Figure 17. Efficiency of VDRI25B24.

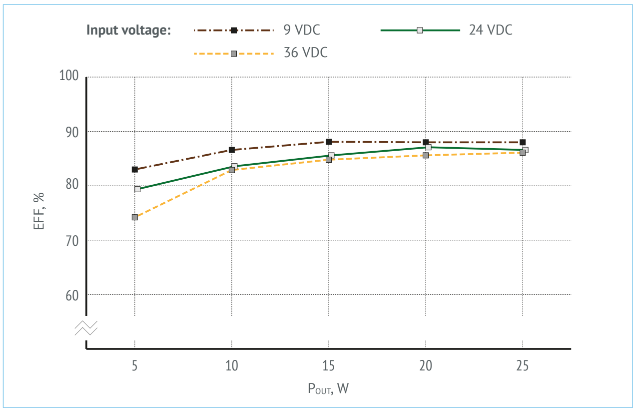

Figure 18. Efficiency of VDRI25B48.

7.1.4. VDRI25 (Index "W")

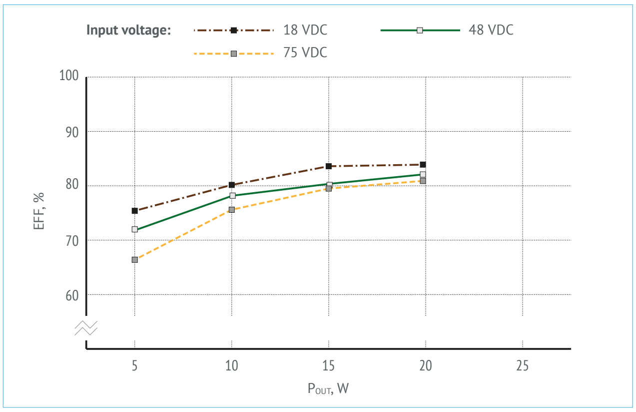

Figure 19. Efficiency of VDRI25W3,3.

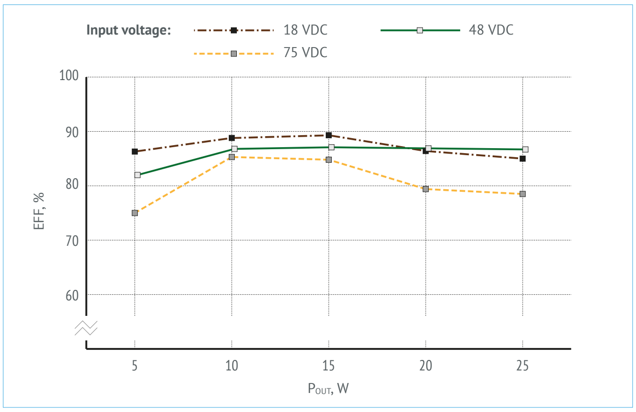

Figure 20. Efficiency of VDRI25W05.

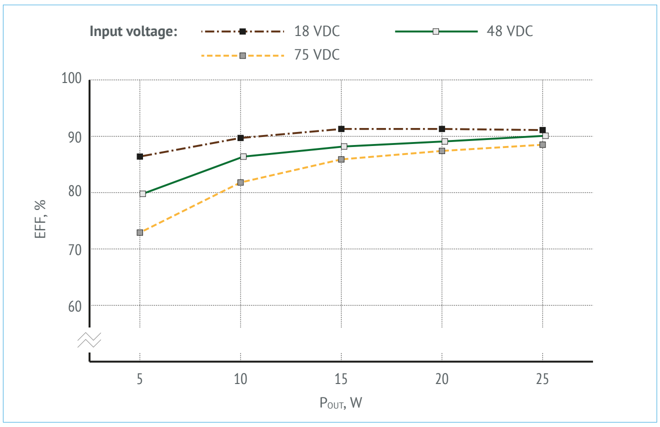

Figure 21. Efficiency of VDRI25W12.

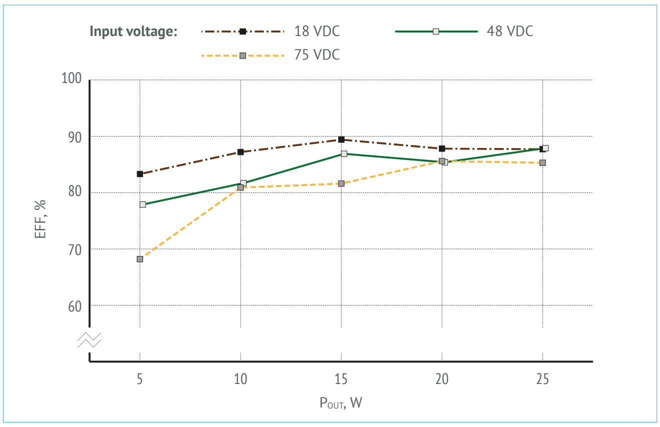

Figure 22. Efficiency of VDRI25W24.

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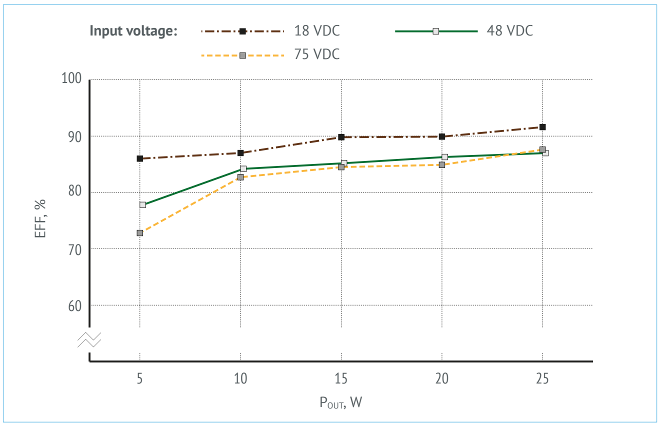

Figure 23. Efficiency of VDRI25W48.

7.2. P_{OUT} / T_{AMB} dependence

7.2.1. VDRI15

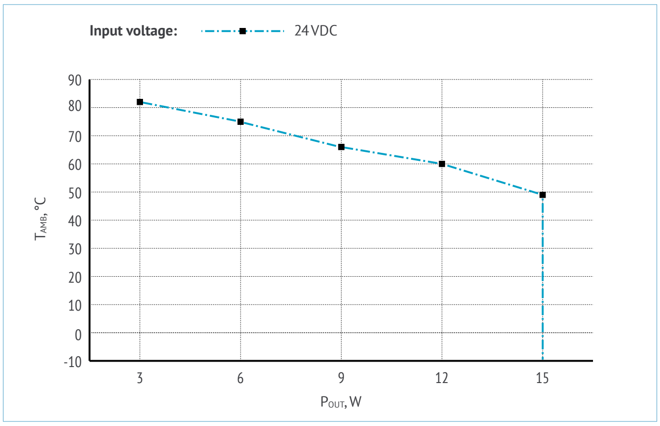

Figure 24. Chart for VDRI15B05.

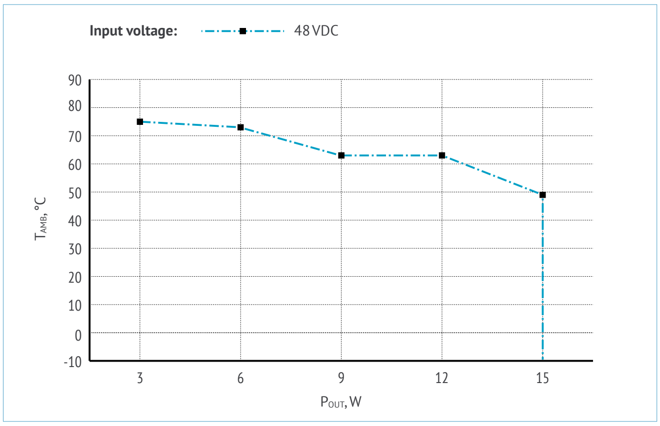

Figure 25. Chart for VDRI15W24.

7.2.2. VDRI25

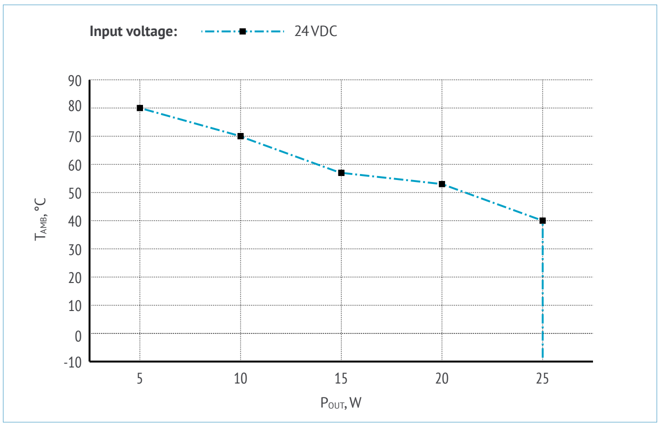

Figure 26. Chart for VDRI25B12.

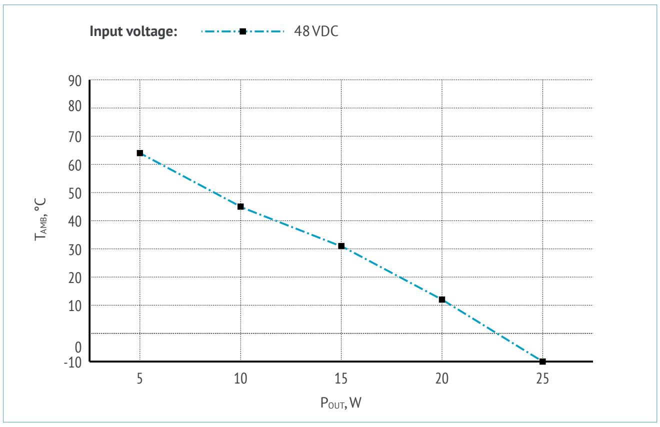

Figure 27. Chart for VDRI25W3,3.

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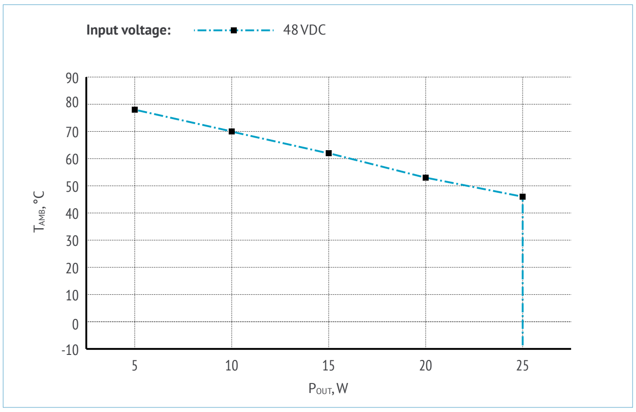

Figure 28. Chart for VDRI25W12.

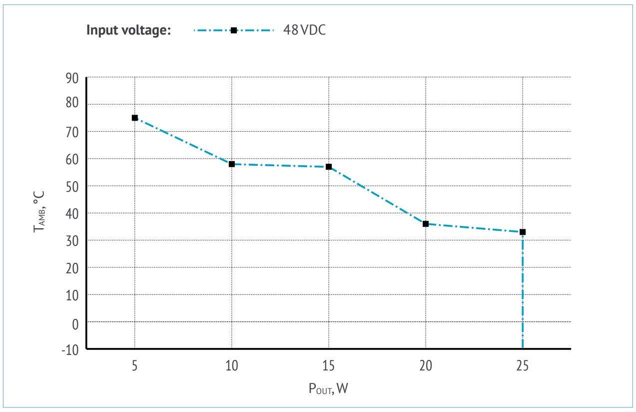

Figure 29. Chart for VDRI25W24.

7.3. Oscillograph charts

7.3.1. VDRI15B05

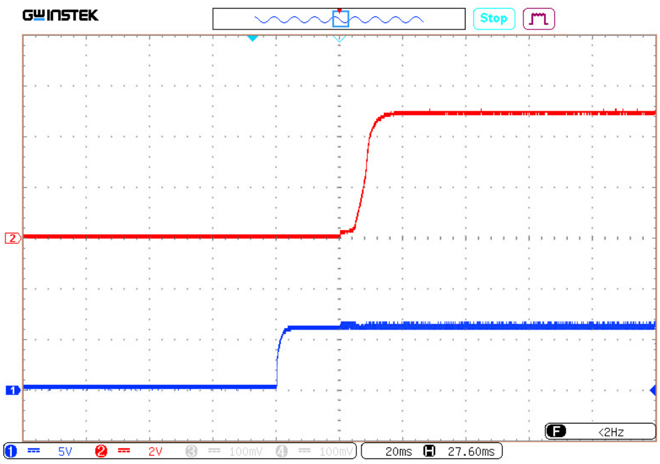

Figure 30. $U_{OUT.NOM}$ stabilizing with Remote On/Off option (ON and -OUT pins connection).

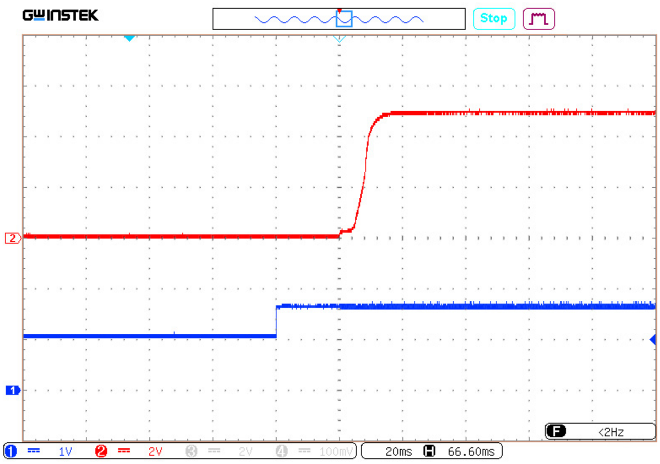

Figure 31. $U_{OUT.NOM}$ stabilizing with Remote On/Off option (control signal).

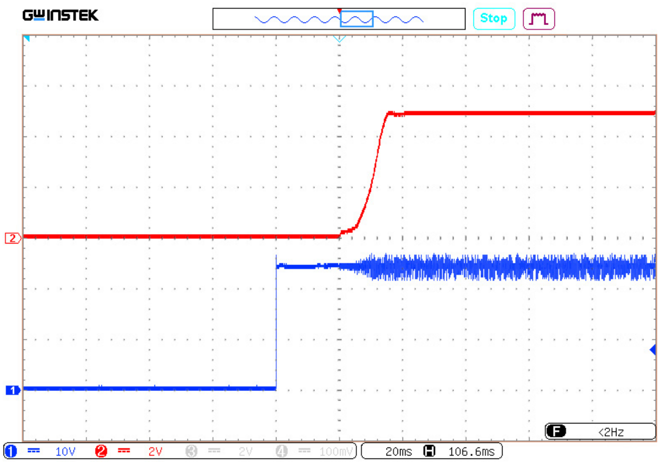

Figure 32. $U_{OUT.NOM}$ stabilizing with $U_{IN.NOM}$.

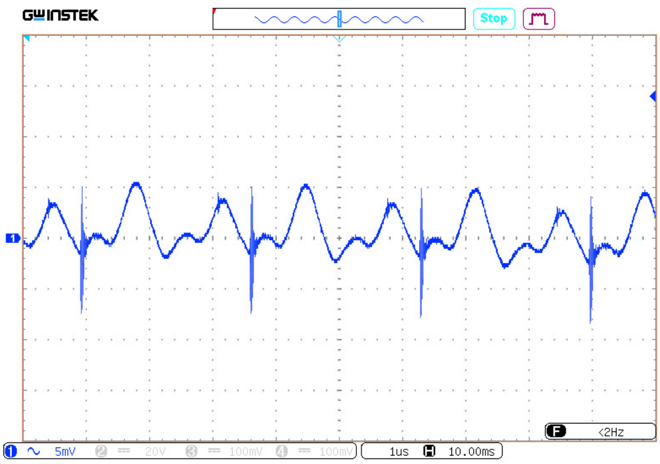

Figure 33. $U_{OUT.NOM}$ ripple.

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7.3.2. VDRI15W24

Figure 34. $U_{OUT.NOM}$ stabilizing with Remote On/Off option (ON and -OUT pins connection).

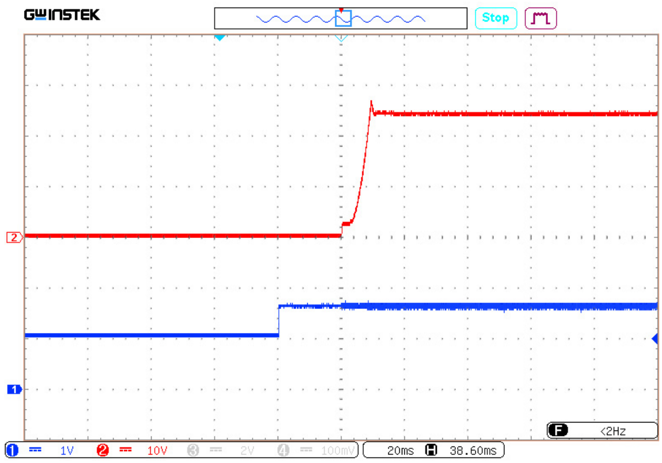

Figure 35. $U_{OUT.NOM}$ stabilizing with Remote On/Off option (control signal).

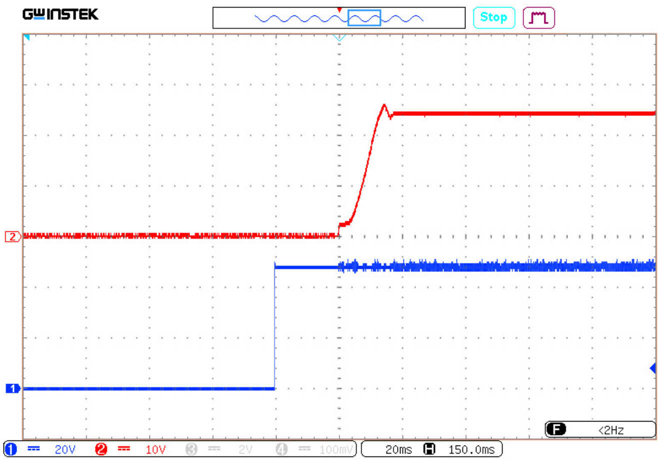

Figure 36. $U_{OUT.NOM}$ stabilizing with $U_{IN.NOM}$.

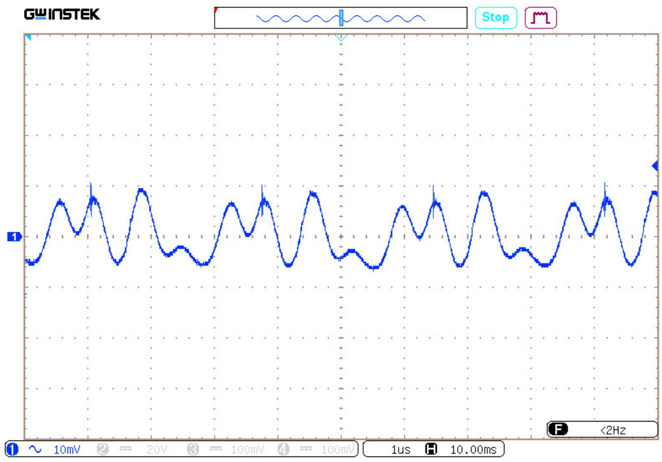

Figure 37. $U_{OUT.NOM}$ ripple.

7.3.3. VDRI25B12

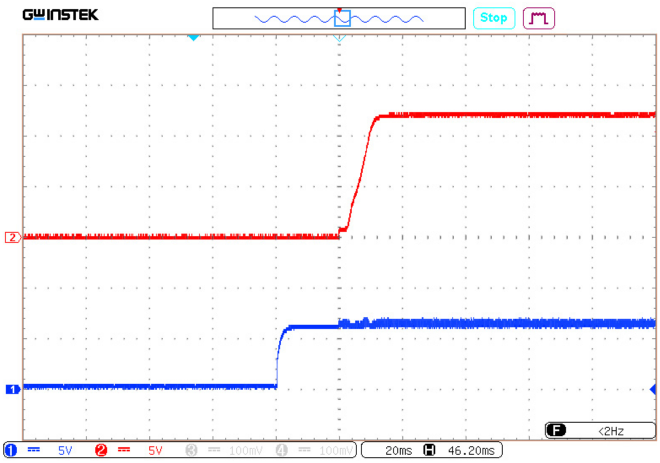

Figure 38. $U_{OUT.NOM}$ stabilizing with Remote On/Off option (ON and -OUT pins connection).

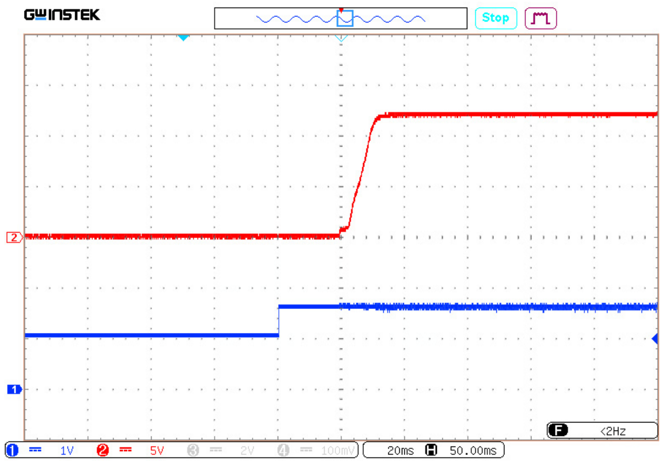

Figure 39. $U_{OUT.NOM}$ stabilizing with Remote On/Off option (control signal).

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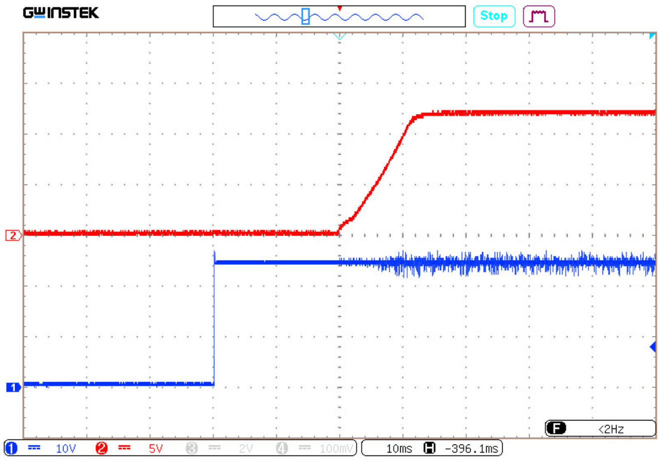

Figure 40. $U_{OUT.NOM}$ stabilizing with $U_{IN.NOM}$.

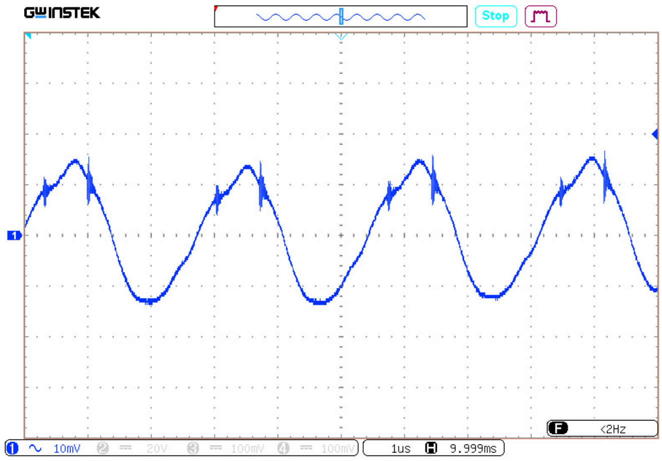

Figure 41. $U_{OUT.NOM}$ ripple.

7.3.4. VDRI25W3,3

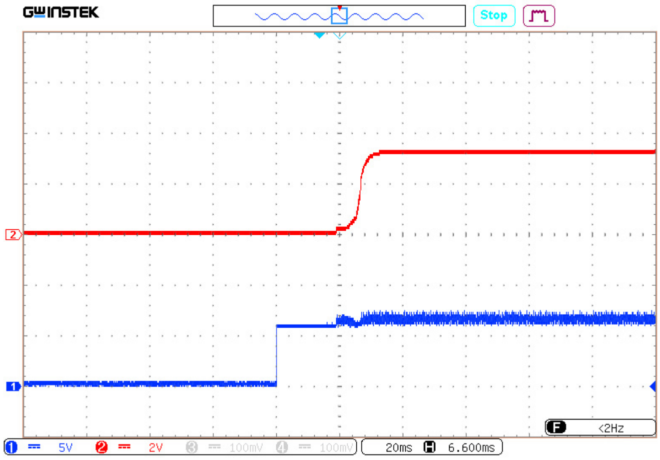

Figure 42. $U_{OUT.NOM}$ stabilizing with Remote On/Off option (ON and -OUT pins connection).

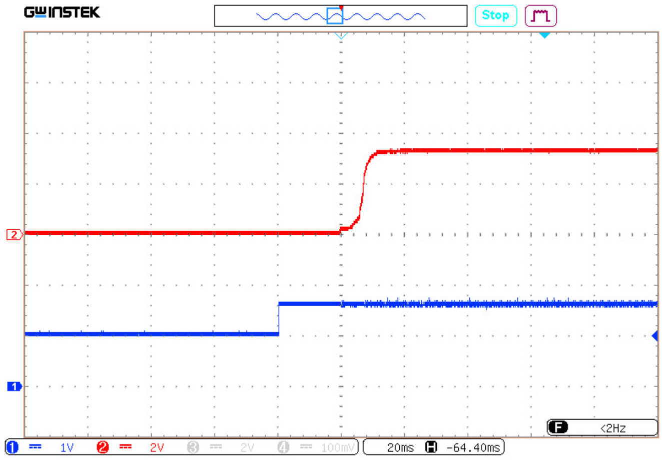

Figure 43. $U_{OUT.NOM}$ stabilizing with Remote On/Off option (control signal).

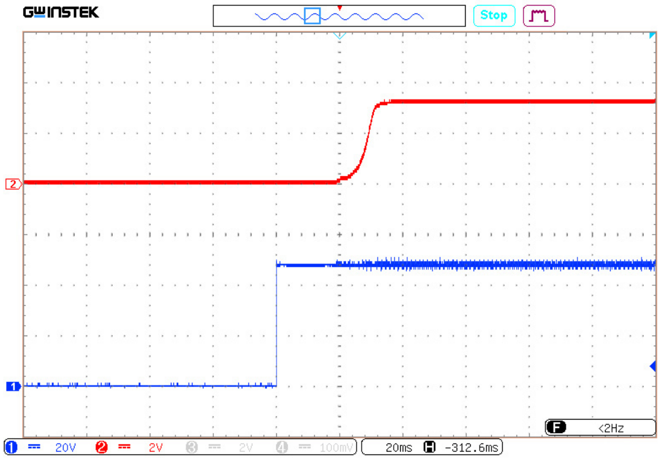

Figure 44. $U_{OUT.NOM}$ stabilizing with $U_{IN.NOM}$

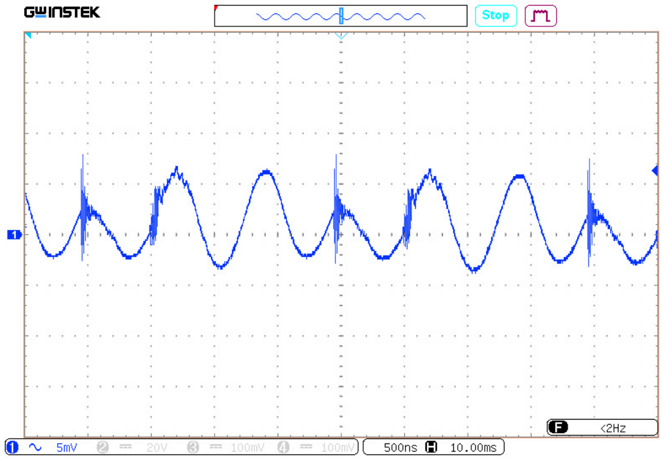

Figure 45. $U_{OUT.NOM}$ ripple.

7.4. Noise spectrogram

7.4.1. VDRI15B48

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.

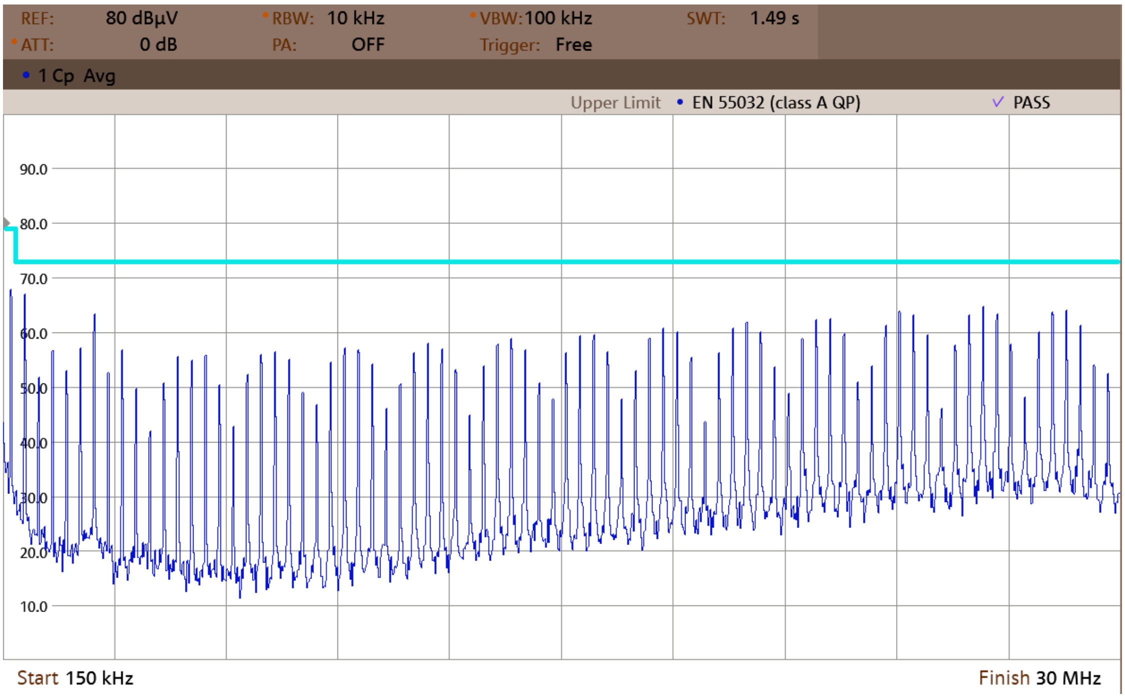

Figure 46. Compliance spectrogram EN55032 Class A (0,15–30 MHz).

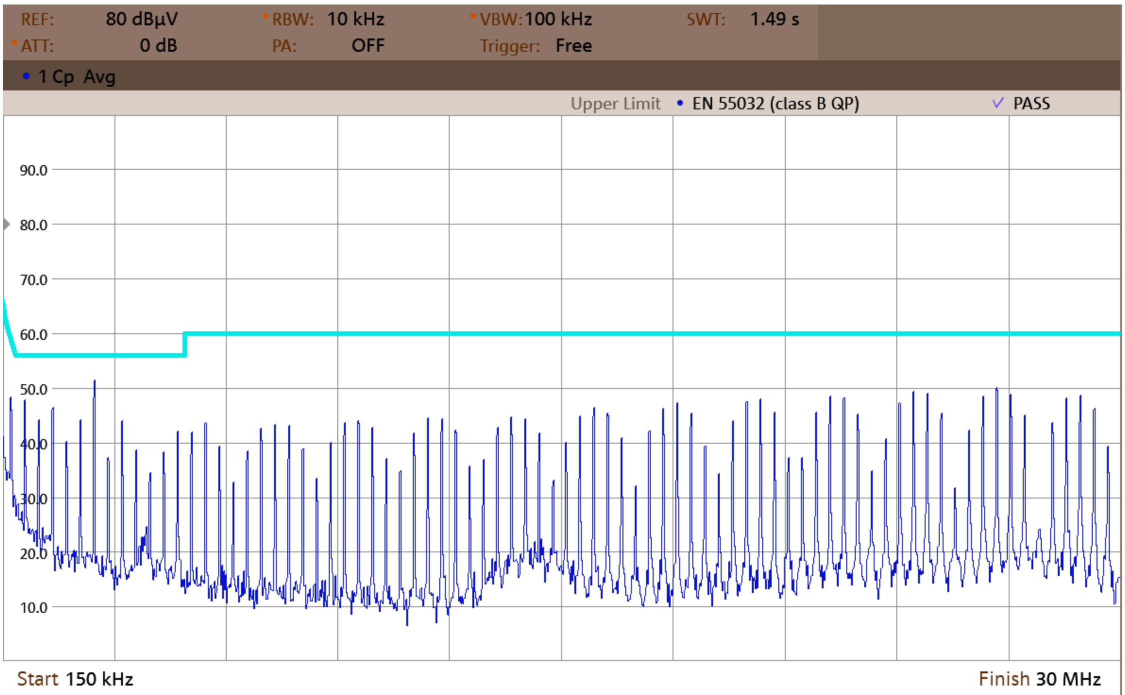

Figure 47. Compliance spectrogram EN55032 Class B (0,15–30 MHz).

7.4.2. VDRI15W48

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.

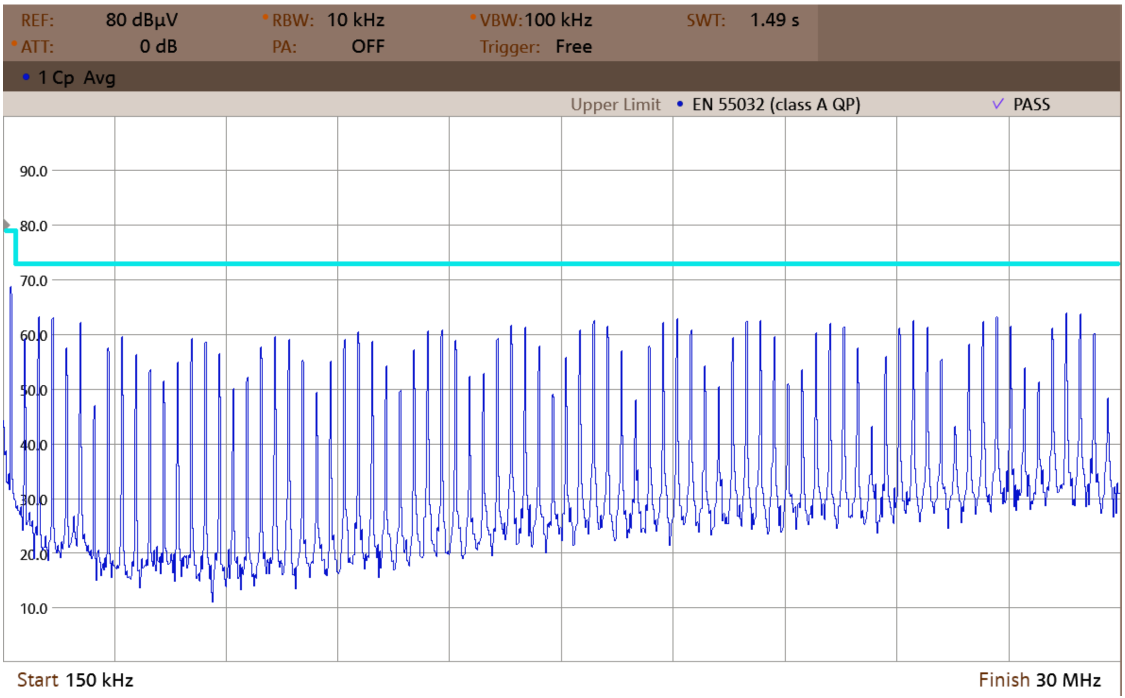

Figure 48. Compliance spectrogram EN55032 Class A (0,15–30 MHz).

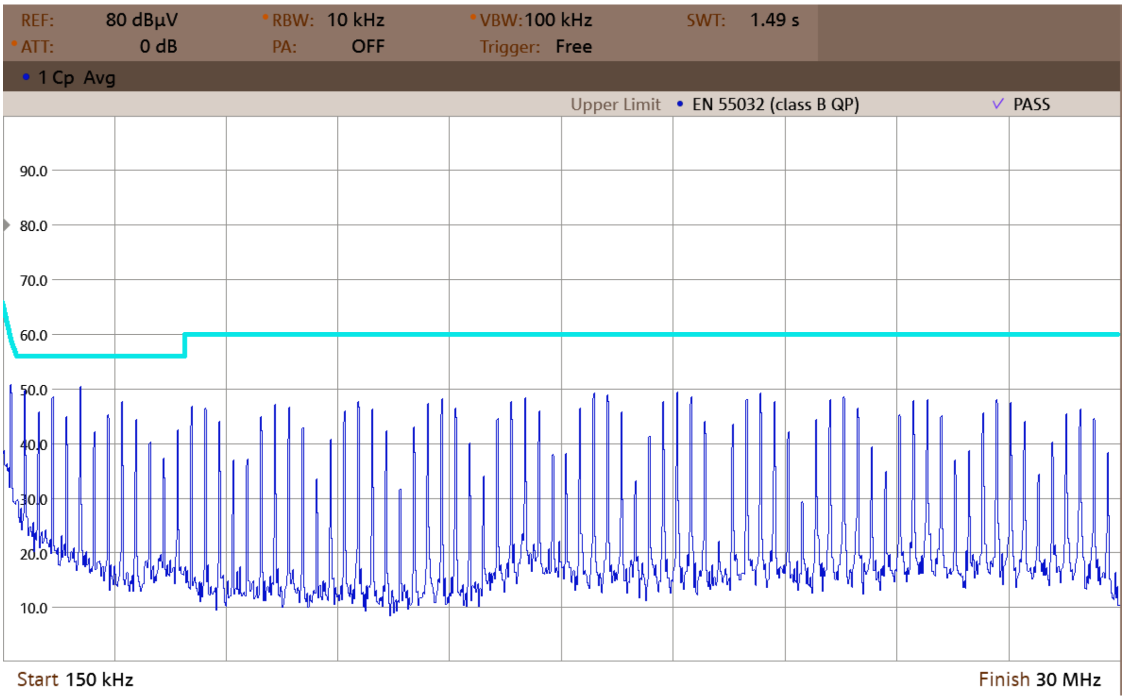

Figure 49. Compliance spectrogram EN55032 Class B (0,15–30 MHz).

7.4.3. VDRI25B48

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.

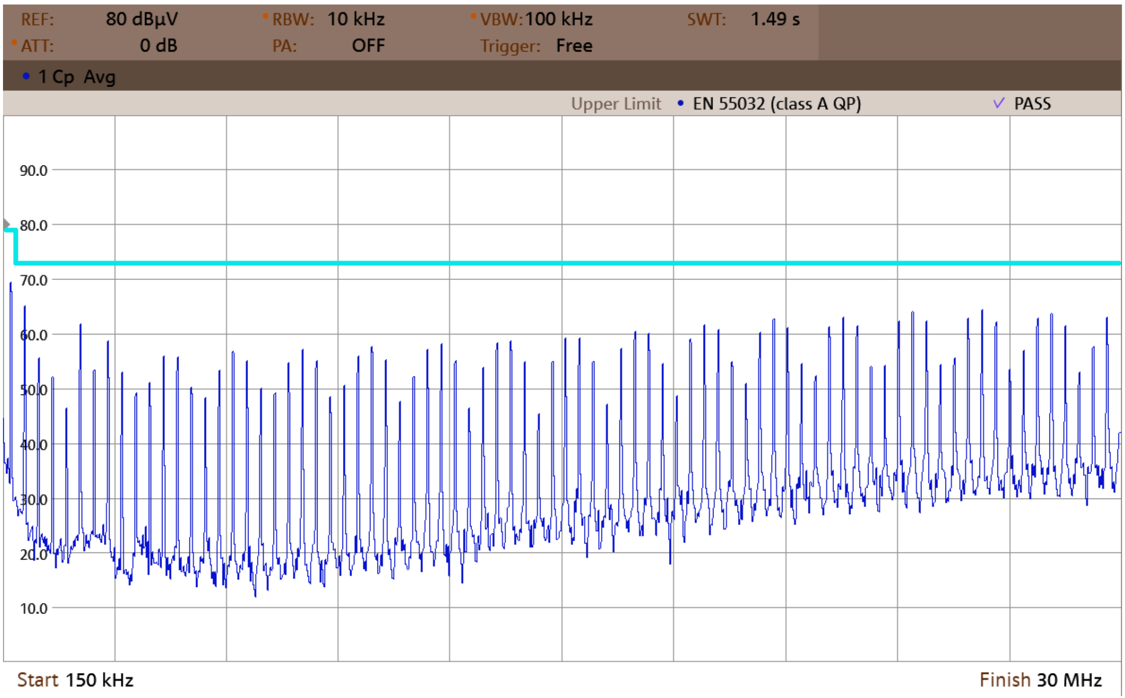

Figure 50. Compliance spectrogram EN55032 Class A (0,15–30 MHz).

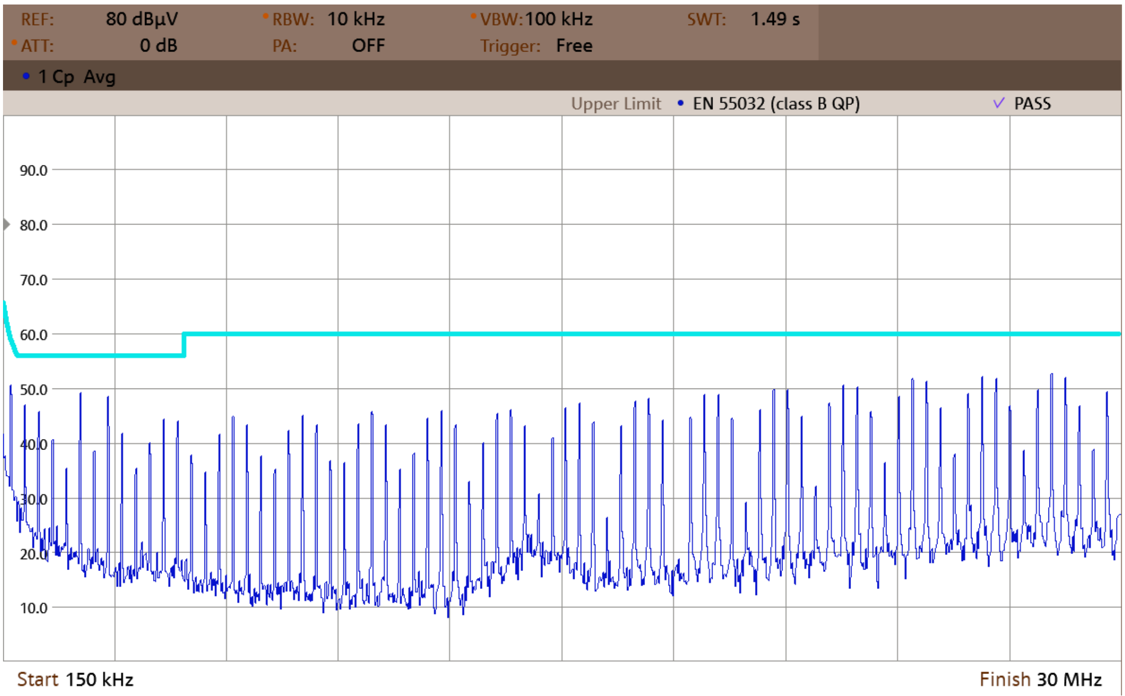

Figure 51. Compliance spectrogram EN55032 Class B (0,15–30 MHz).

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7.4.4. VDRI25W48

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.

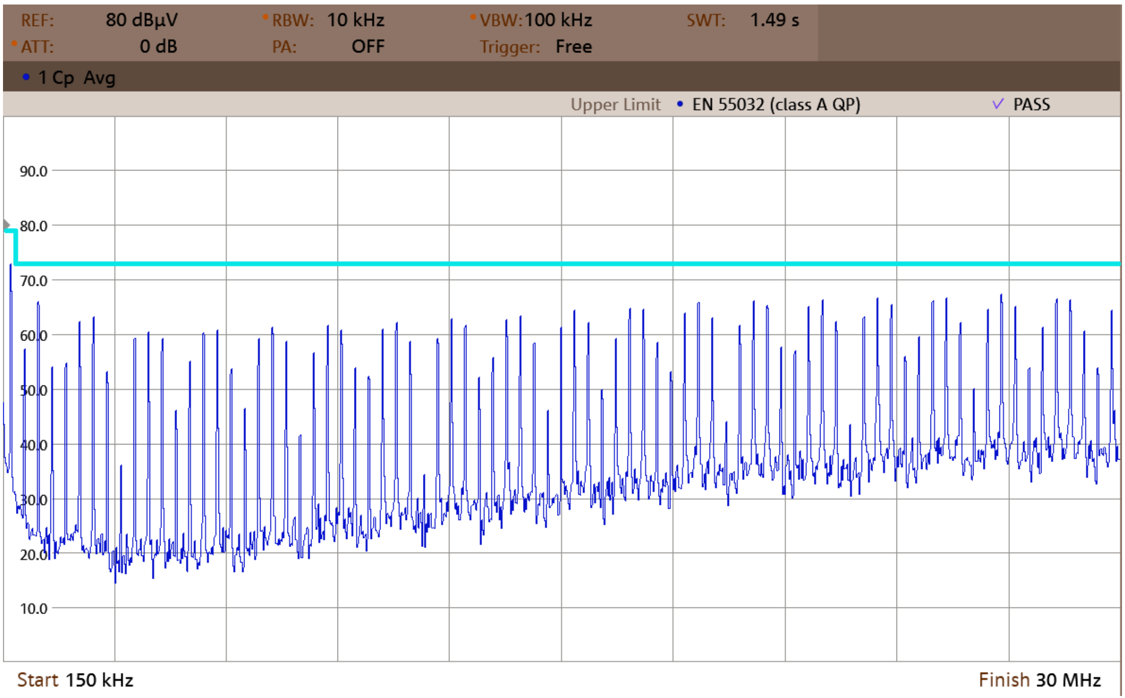

Figure 52. Compliance spectrogram EN55032 Class A (0,15–30 MHz).

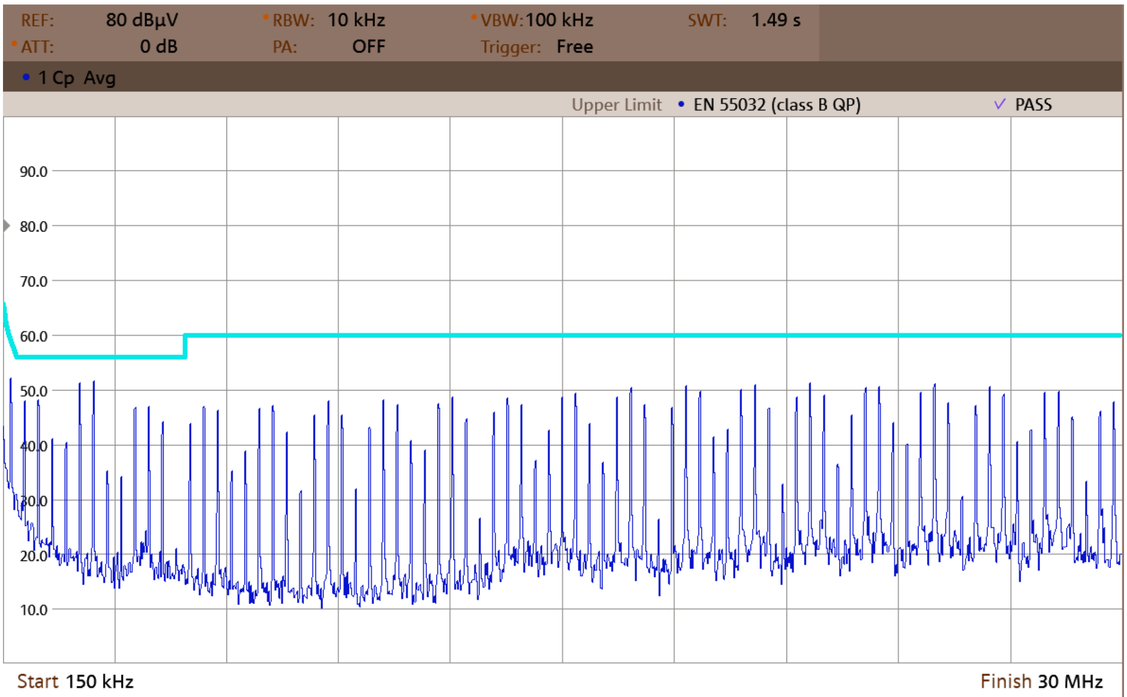

Figure 53. Compliance spectrogram EN55032 Class B (0,15–30 MHz).

8. Outline dimensions

Pin #	1	2, 3	11	14	16	22, 23
Function	Remote On/Off	−IN	TRIM	+OUT	−OUT	+IN

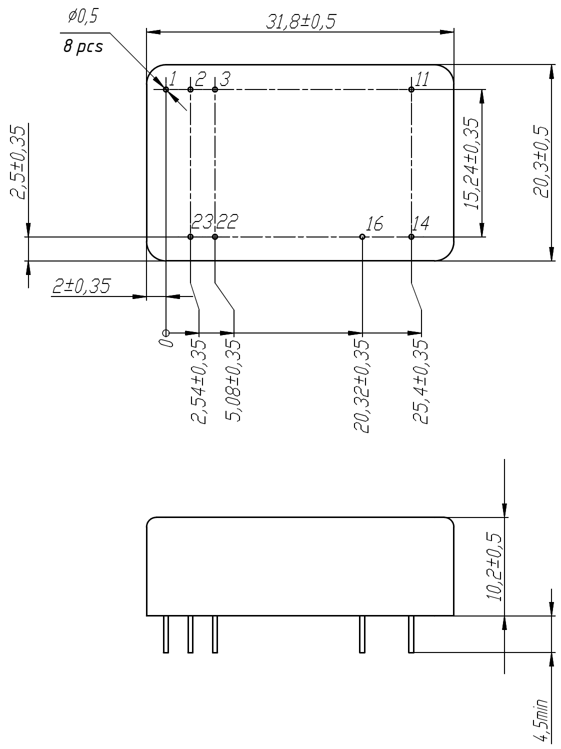

Figure 54. Valid for VDRI15, VDRI25.

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Manufacturer of reliable DC/DC converters and power supply systems

This datasheet is valid for the following units: VDRI15B3,3; VDRI15B05; VDRI15B09; VDRI15B12; VDRI15B15; VDRI15B24; VDRI15B48; VDRI15W3,3; VDRI15W05; VDRI15W09; VDRI15W12; VDRI15W15; VDRI15W24; VDRI15W48; VDRI25B3,3; VDRI25B05; VDRI25B09; VDRI25B12; VDRI25B15; VDRI25B24; VDRI25B48; VDRI25W3,3; VDRI25W05; VDRI25W09; VDRI25W12; VDRI25W15; VDRI25W24; VDRI25W48.