DCP48M photography

Feature summary

- Constant Current Constant Voltage
- 90% typical efficiency (94% peak)
- Programmable output voltage range (0V .. 30V)
- Programmable output current range (0A .. 8A) - derating required
- Output paralleling possible with diodes
- Wide input voltage (8V to 50V)
- Internal temperature monitoring with Thermal Shutdown
- Factory programmable Undervoltage Lockout
- Input reverse polarity protection
- Output short circuit proof

Product description

The DCP48 is a constant current constant non-isolated voltage digital DIN Rail buck converter with perfect steady-state output stability. It's a powerful tool to provide additional lower output voltages in control cabinets. The input voltage ranges from 8V (min. 90% of the output voltage) to 50V. For more power, outputs can be paralleled using a diode. The device is programmable over Modbus holding registers. Output parameters can be set and requested via Modbus. The input voltage must always be higher than the input voltage.

The device can is default configured to an Output Voltage U_{out}=5V, while 12V and 24V options are also available.

The device is resilient to typical operating failures: Input reverse polarity, output short circuit, open circuit, moderate input transients.

It between -40°C and 50°C. A derating over temperature is required.

Specification overview

Description	Value
General	
Input Voltage Range	8 - 50 V
Max. Output Voltage	0.9 V_{in}
Max. Output Current	8A
Typical Efficiency	85 - 95 %
Control Strategy	CCCV
Indicator	RGB LED
Protection	
Input Fuse	yes
Input Reverse polarity protection	yes
Short circuit protection	yes
Input Overvoltage suppressor	TVS

Ordering information

Order code	Interface
DCP48M	$U_{out,default}$=5V
DCP48M-12V	$U_{out,default}$=12V
DCP48M-24V	$U_{out,default}$=24V
Customization available. Contact DPS.	

Engineering standards

Applied engineering standards	
IEC 55032	IEC 61000-4-2
IEC 61000-4-3	IEC 61000-4-4
IEC 61000-4-5	IEC 61000-4-6
IEC 61000-4-7	IEC 61000-4-8

1 Functional description

1.1 Overview

The DCP48 is a constant current constant non-isolated voltage digital DIN Rail buck converter with perfect steady-state output stability. It's a powerful tool to provide additional lower output voltages in control cabinets. The input voltage ranges from 8V (min. 90% of the output voltage) to 50V. For more power, outputs can be paralleled using a diode. The device is programmable over Modbus holding registers. Output parameters can be set and requested via Modbus. The input voltage must always be higher than the input voltage.

The device can is default configured to an Output Voltage U_{out}=5V, while 12V and 24V options are also available.

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It between -40°C and 50°C. A derating over temperature is required.

1.2 Protections

The following output protections are in place:

- **Input Reverse polarity:** The input may be connected in reverse polarity with an input of $U_{in,max}$ = -48V.
- **Programmable Input Voltage Lockout:** The input voltage lockout (UVLO) can be digitally programmed. The UVLO disables the device when a too low input voltage is present.
- **Thermal protection:** The maximum temperature is exceeded, the device stops operation. When the re-enabling temperature is reached,
- **Short circuit proof:** The output of the converter can be shortcircuited without problems for infinite time.
- **Open circuit proof** The output may be operated in open circuit for infinite time.
- **Input TVS diode** The converter features an input TVS diode for protection.

1.3 Output Power

The maximum output power is limited by the case power dissipation. The maximum continuous recommended output power is denoted in the specification table. It should be verified in the application. In case the output power is too high, the DC/DC converter will shut down in thermal protection. The device will not be damaged. After a specific time the device will restart.

1.4 Ordering Information

The following ordering options are available. When the device should be used for Modbus applications, we recommend to use the DCP48M.

Ordercode	$U_{out,default}$	$I_{out,default}$	EAN
DCP48M	5 V	8 A	0735654854081
DCP48M-12V	12 V	8 A	0735654854098
DCP48M-24V	24 V	8 A	0735654854142
Customisation available. Contact DPS.			

2 Pinout

The pinout of the converter is depicted in Figure 2.

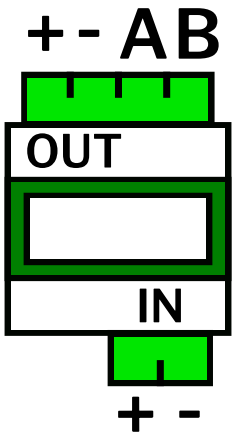

Figure 1: Power Supply connection Diagram

2.1 Pin description

Pin	Functional description
Input	
IN- IN+	Negative Input Pin Positive Input Pin
Output	
OUT- OUT+	Negative Output Pin Positive Output Pin
Modbus option (M suffix)	
A B	ModBus A Pin ModBus B Connection

2.2 RGB LED Color Codes

The DCP48 has an internal LED for status display. The LED is not visible to the user.

Color	Functional State	Power
Green	Operation in Constant Voltage Mode	OK
Yellow	Operation in Constant Current Mode	OK
Purple	Input Voltage too low (UVLO)	Not OK
Blue	Overtemperature protection engaged	Not OK
Red	Control out of range	Not OK

2.3 Output Paralleling

For increased output power, outputs can be easily paralleled with an output diode. Paralleling without an output diode is not possible and will lead to DCP48 control loop instability. Fitting output diodes modules are available from DPS. The Constant Current Constant Voltage behavior of the power supply ensures stable operation. For paralleling, identical supplies of the same partnumber must be used.

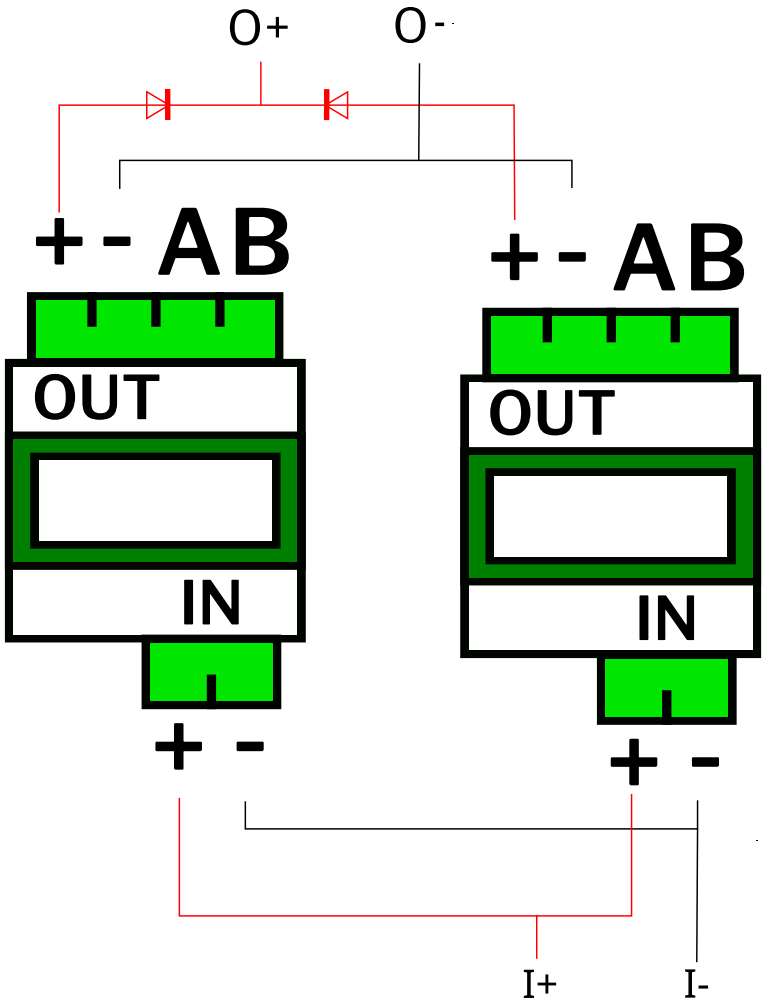

Figure 2: To parallel DCP48, two output diodes on the O+ Pins have to be inserted. By that, also redundancy can be achieved.

3 Specification

The specification for DCP48 is shown in the following table. If not otherwise specified the following parameters have been used: T_{amb}=25°C, U_{in}=30 V_{dc} and U_{out}=5 V_{dc}.

	Min	Typ	Max	Unit
Eingang Input				
Eingangsspannung Input Voltage	8		50	V_{dc}
Sicherungstyp Fuse Type		2410-1800		
Eingangskapazität Input Capacitance		17		µF
Schutzmosfet Polarität Eingang Input polarity protection Mosfet		yes		
Unterspannungsschutz, an Undervoltage Lockout on		8		V_{dc}
Unterspannungsschutz, aus Undervoltage Lockout off		7		V_{dc}
Unterspannungsschutz, programmierbarkeit Undervoltage configurable		yes		
Eingang Output				
Regelstrategie Control Strategy		Constant Current Constant Voltage (CCCV)		
Spannung Output Voltage	0		29	V_{dc}
Spannung, max Output Voltage$_{max}$		0.9 U_{in}		V_{dc}
Strom Peak Current Peak	0		8	A_{dc}
Emfohlene mittlere Leistung Recommended Avg Power	30		100	W

	Min	Typ	Max	Unit
Gehäuse Case				
Montageform Mounting Type		Din Rail		
Breiteneinheiten Mounting Width		36.5		mm
Montagehöhe Mounting Height		58.7		mm
Programmierbarkeit Programmability				
Interface DCP48S Interface DCP48S		3.3V RS232 with mcu_tracer Protokol		
Interface DCP48M Interface DCP48M		Modbus Protocoll		
Sicherheitsfeatures Safety Features				
Verpolungsschutz Reverse polarity protection		yes		
Neg. Eingangsspannung Negative Input Voltage			- 50	V_{dc}
Kurzschlussschutz Short circuit protection		yes		
Leerlaufschutz Open circuit protection		yes		
Betriebsbedingungen Operating Conditions				
Temperaturbereich Temperature Range	-40		50	°C
Technische Merkmale Technical Characteristics				
Elektrolytkondensatoren Electrolytic Capacitors		No electrolytic capacitors		

4 Modbus Interfacing

The device is able to communicate over modbus.

4.1 Safety - Read before

Only electrical personnel are allowed to program the device. Wrong programming may lead to destruction of the device or devices connected to it, injury or death of persons.

4.2 Modbus Default Parameters

The modbus connection parameters are listed below:

Parameter	Setting
Cable	
Type of Cable	RS485
A	Connect A / + Pin of RS485
B	Connect B / - Pin of RS485
-	Connect GND of RS485 (optional)
UART Configuration	
Baud-Default-Rate	9600 Baud
Parity	none
Data-Bits	8
Stop-Bits	1
Modbus-Default-ID	1

4.3 Supported commands

The following commands are supported:

1. Read Holding registers (3)
2. Write Single Register (6)
3. Write Multiple Registers (16)

4.3.1 Modbus Holding Registers

ID	Name	Description	Unit
0 1	Systick (LSB) Systick (MSB)	Systick, incremented 10 times per second.	-
2 3	Iout (LSB) Iout (MSB)	Output Current	mA
4 5	Uin (LSB) Uin (MSB)	Input voltage	mV
6 7	NTC (LSB) NTC (MSB)	Raw value from NTC temperature sensor	-
8 9	Uout (LSB) Uout (MSB)	Output voltage	mV
10 11	Ontime (LSB) Ontime (MSB)	On-time duration	ms
12 13	KUp (LSB) KUp (MSB)	Proportional gain for voltage PID	-
14 15	KUi (LSB) KUi (MSB)	Integral gain for voltage PID	-
16 17	KIp (LSB) KIp (MSB)	Proportional gain for current PID	-
18 19	KIi (LSB) KIi (MSB)	Integral gain for current PID	-
20 21	Deadband Voltage (LSB) Deadband Voltage (HSB)	Deadband for voltage control	mV
22 23	Deadband Current (LSB) Deadband Current (HSB)	Deadband for current control	mA
24 25	Uset (LSB) Uset (HSB)	Setpoint for output voltage	mV
26 27	Iset (LSB) Iset (HSB)	Setpoint for output current	mA
28 29	LEDTol (Voltage LSB) LEDTol (Voltage HSB)	Tolerance for LED voltage	mV

Continued on next page

ID	Name	Description	Unit
30 31	LEDTol (Current LSB) LEDTol (Current HSB)	Tolerance for LED current	mA
32 33	UVLO On (LSB) UVLO On (HSB)	Undervoltage lockout on threshold	mV
34 35	UVLO Off (LSB) UVLO Off (HSB)	Undervoltage lockout off threshold	mV
36 37	Modbus OFF(1)ON(0) (LSB) Modbus OFF(1)ON(0) (HSB)	Modbus mode, where OFF = 1 and ON = 0	-
38 39	Modbus BAUD (LSB) Modbus BAUD (HSB)	Modbus communication baud rate	Baud
40 41	Modbus ID (LSB) Modbus ID (HSB)	Modbus device ID	-

5 Measurements

5.1 Efficiency U_{in}=48V

The efficiency for an input voltage of 48 V_{dc} is plotted over the output current. Figure 3 shows the efficiency overview while the Figure 4 shows the zoomed efficiency.

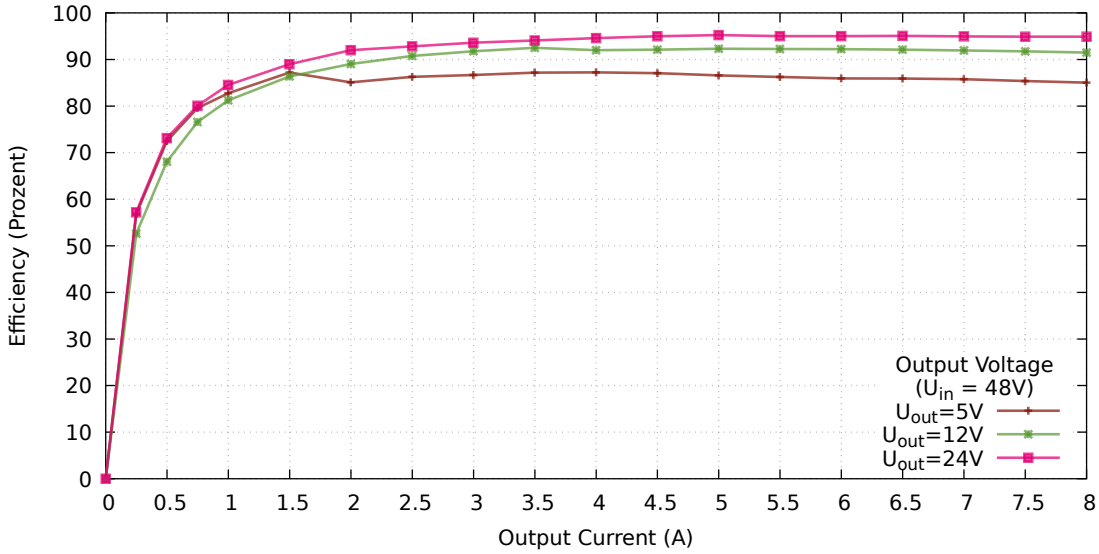

Figure 3: Efficiency in percent depicted over the output current.

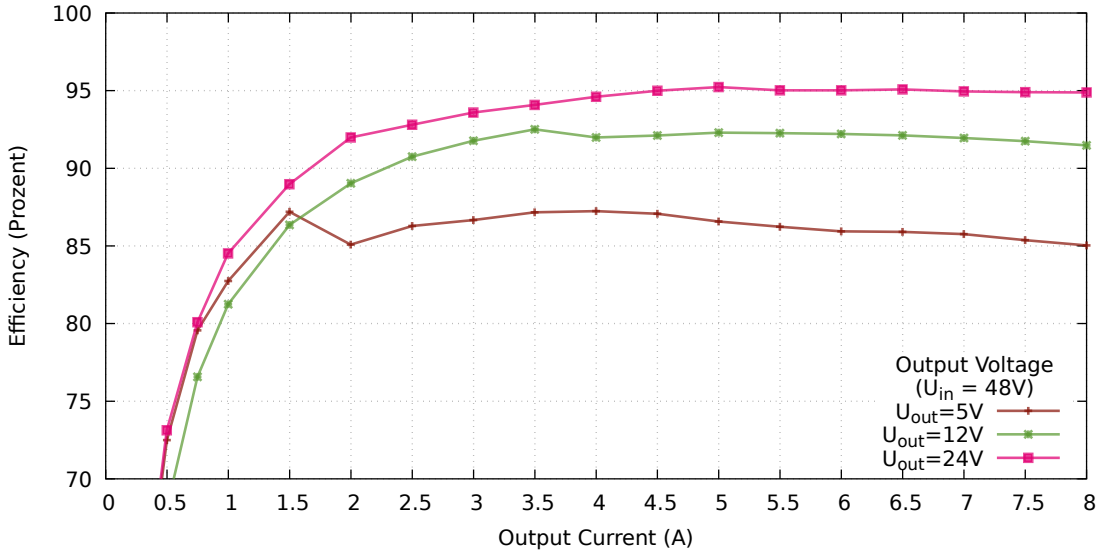

Figure 4: Zoomed Efficiency in percent depicted over the output current.

5.2 Losses U_{in}=48V

The losses over the output current are depicted in Figure 5.

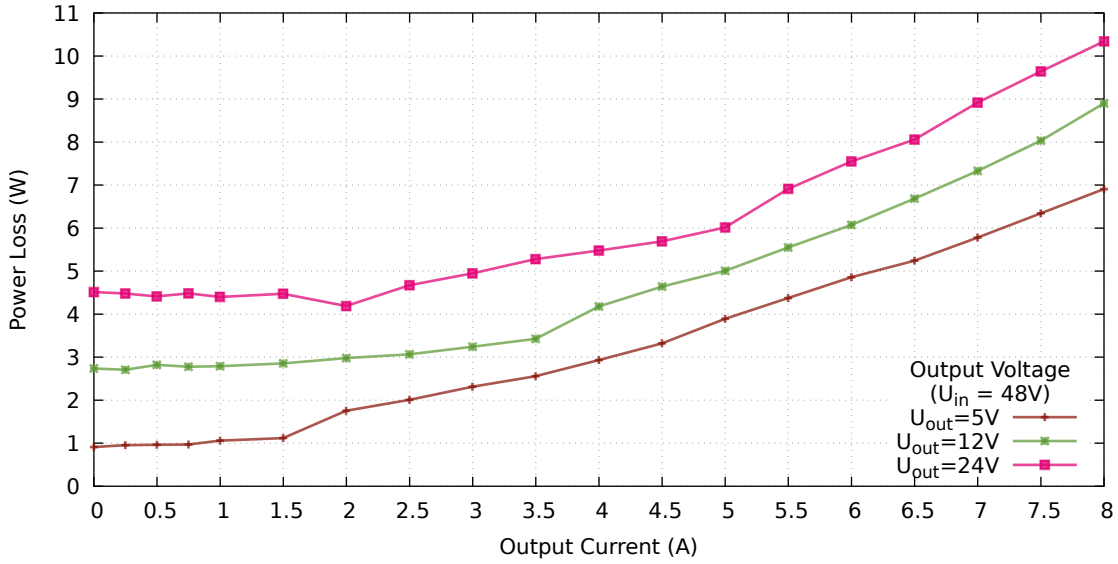

Figure 5: Losses over the output current.

5.3 Output Voltage Stability U_{in}=48V

The output voltage stability is depicted in Figure 6.

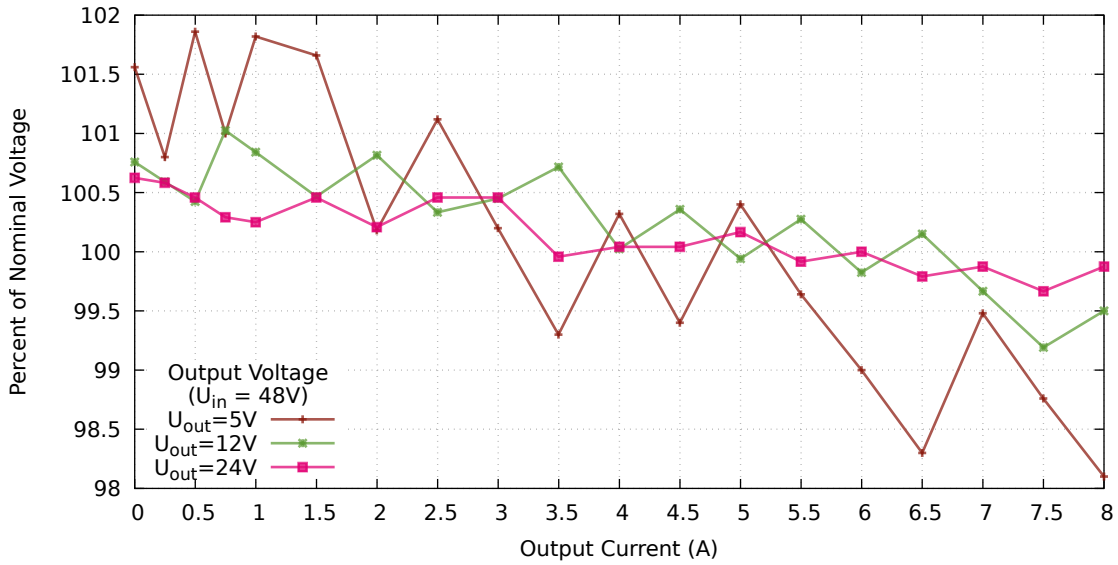

Figure 6: Losses over the output current.

5.4 Output Voltage Ripple U_{in}=48V

The output voltage ripple (Measured Peak to Peak with a Bandwidth of 20 MHz) is depicted in Figure 7.

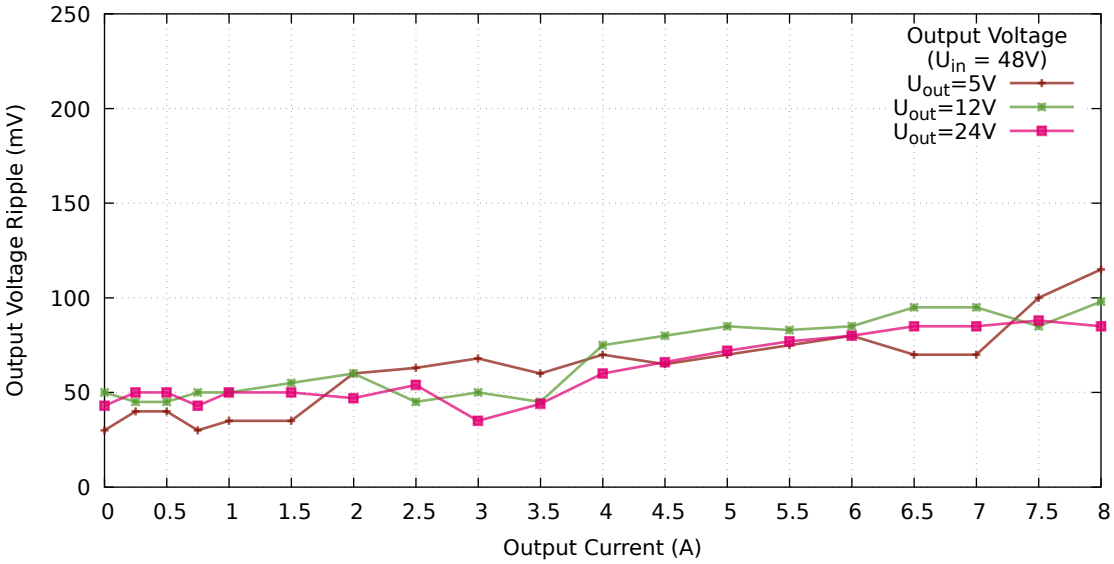

Figure 7: Output voltage ripple (mV) over the output current.

5.5 Efficiency U_{in}=24V

The efficiency for an input voltage of 24 V_{dc} is plotted over the output current. Figure 8 shows the efficiency overview while the Figure 9 shows the zommed efficiency.

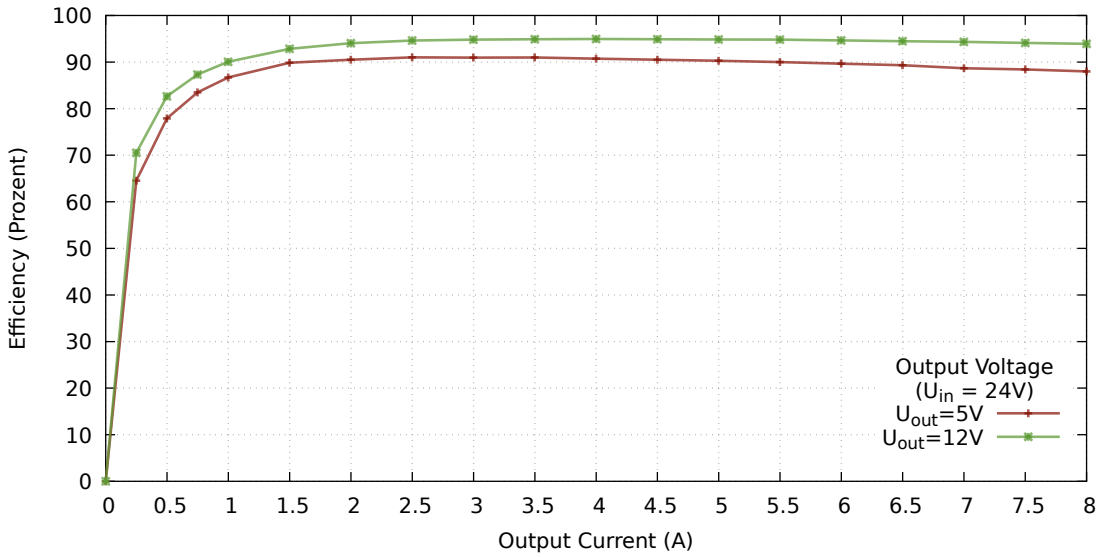

Figure 8: Efficiency in percent depicted over the output current.

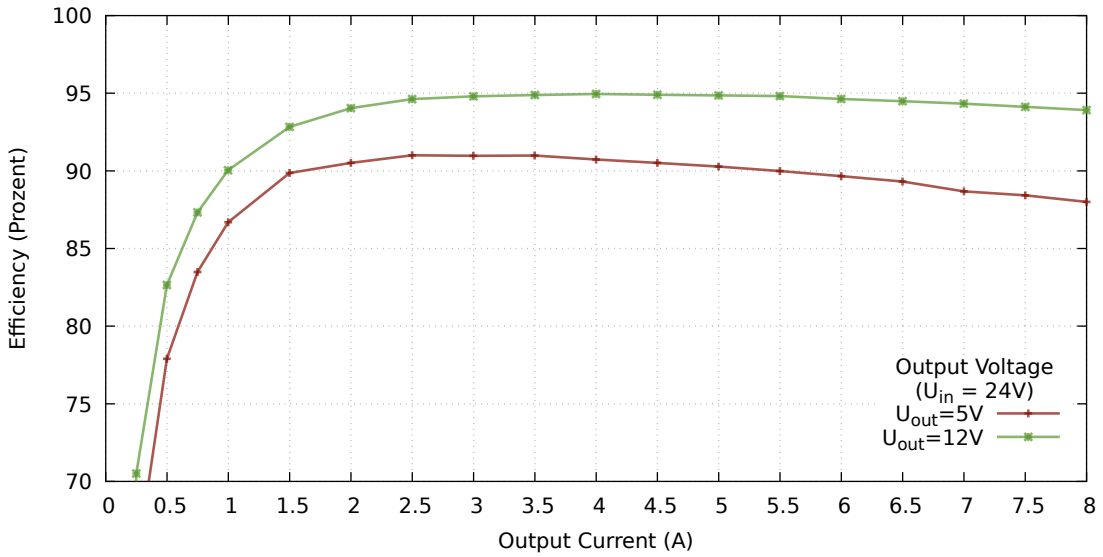

Figure 9: Zoomed Efficiency in percent depicted over the output current.

5.6 Losses U_{in}=24V

The losses over the output current are depicted in Figure 5.

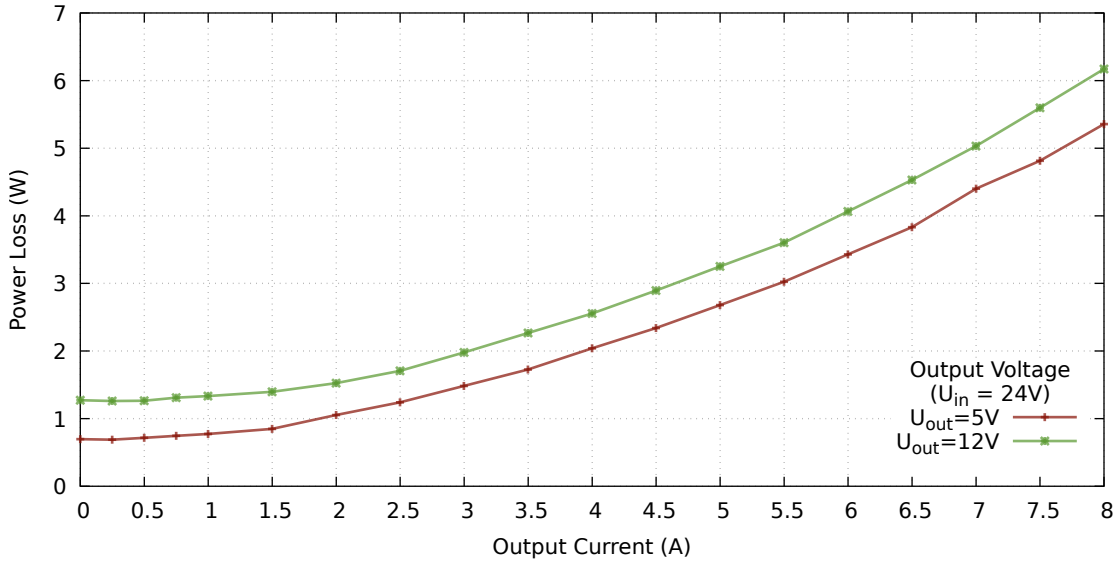

Figure 10: Losses over the output current.

5.7 Output Voltage Stability U_{in}=24V

The output voltage stability is depicted in Figure 11.

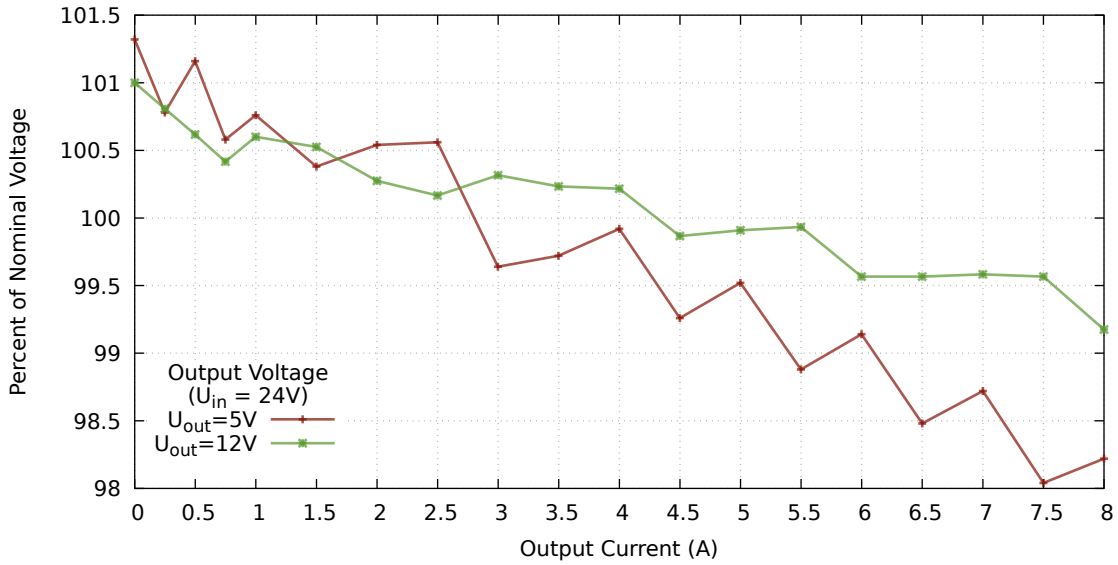

Figure 11: Losses over the output current.

5.8 Output Voltage Ripple U_{in}=24V

The output voltage ripple is measured at input voltage of 24 V.

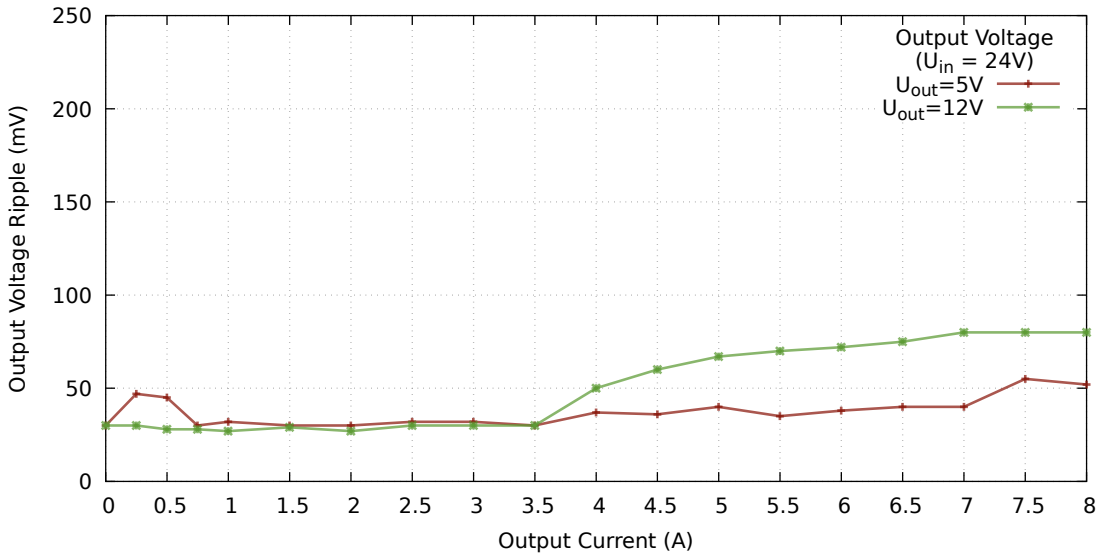

Figure 12: Output Voltage Ripple at U_{in}=24V

5.9 Transient Response

The output transient response was measured at an Input Voltage of U_{in}=48 V_{dc}.

5.9.1 Output Voltage 5V

The output Voltage is set to 5V with the default parameters.

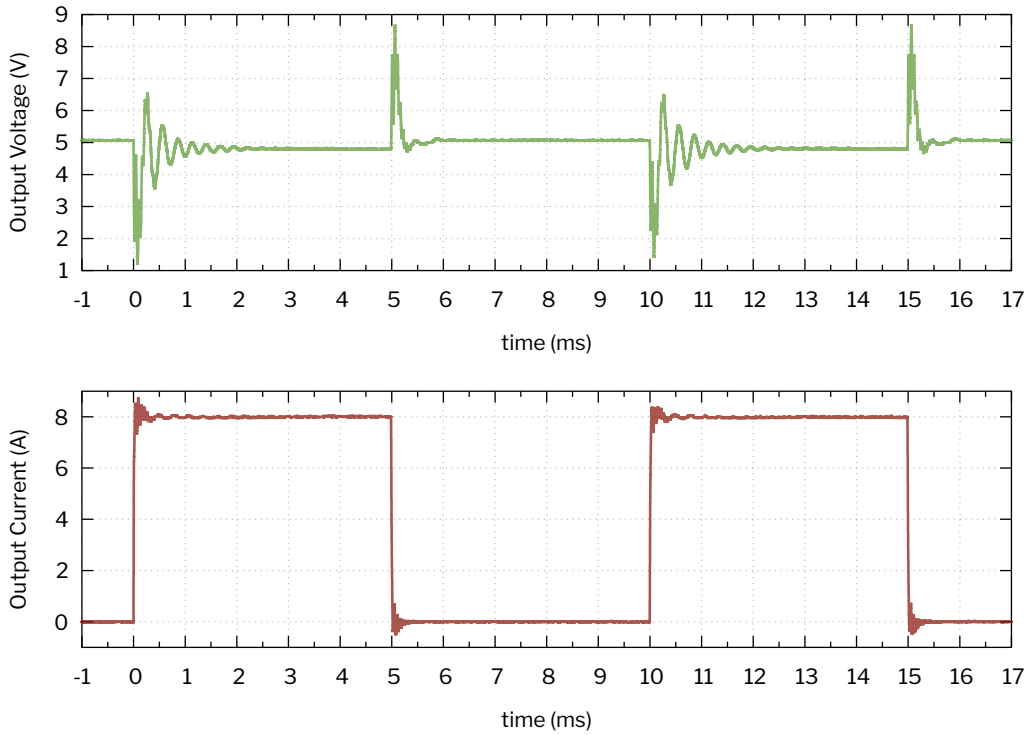

Figure 13: Transient Response U_{out}=15V

5.9.2 Output Voltage 12V

The output Voltage is set to 12V with the default parameters.

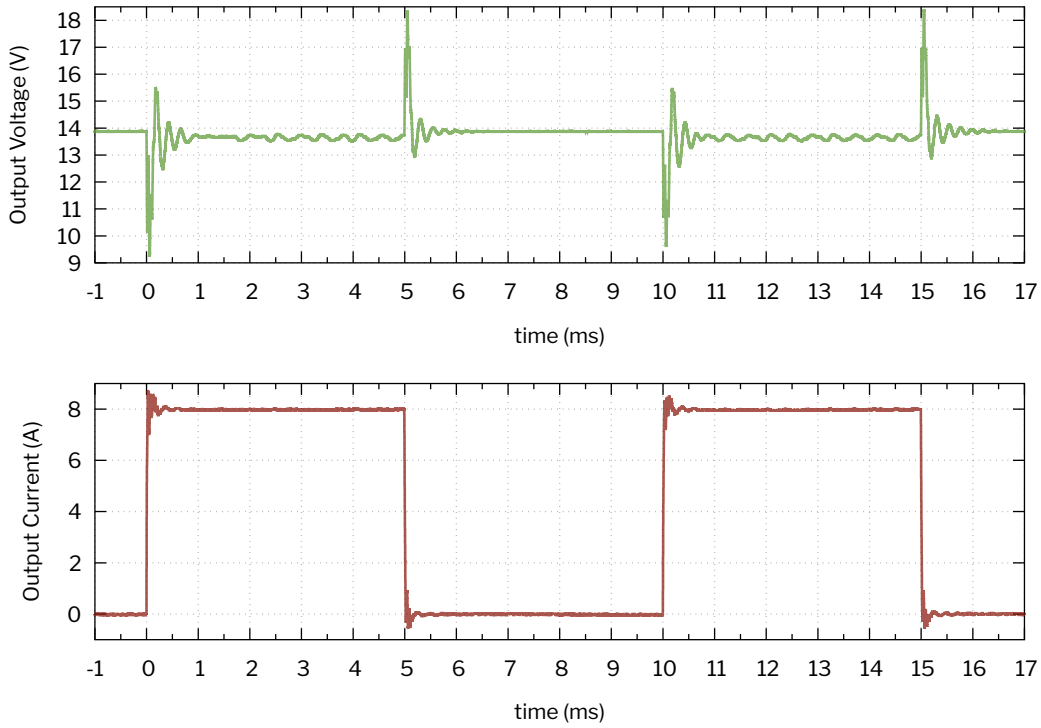

Figure 14: Transient Response U_{out}=12V

5.9.3 Output Voltage 24V

The output Voltage is set to 24V with the default parameters.

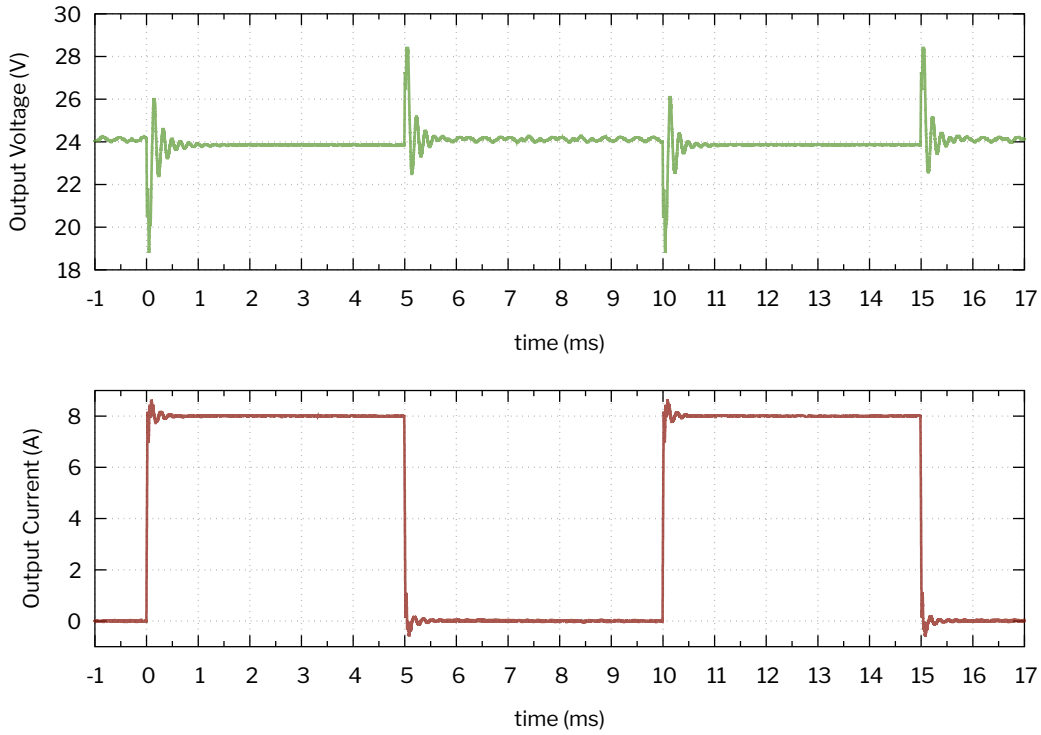

Figure 15: Transient Response U_{out}=12V

6 EMC Measurements

6.1 Conducted Emissions

The average EMC conducted line emission are depicted in 16. The QP EMC Emissions are depicted in 17. The parameter are measured at an input voltage of U_{in}=48V and output voltage of U_{in}=5V.

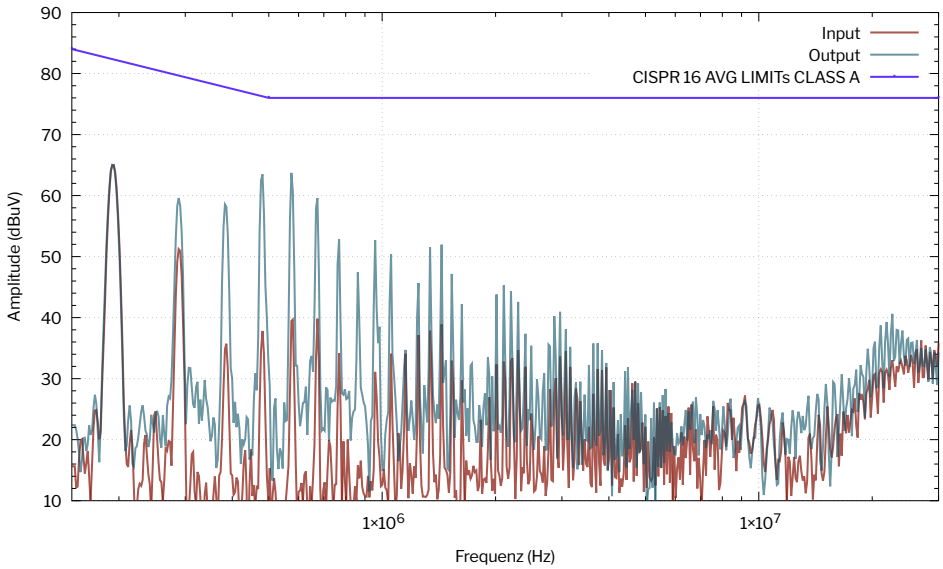

Figure 16: AVG EMC Emssions

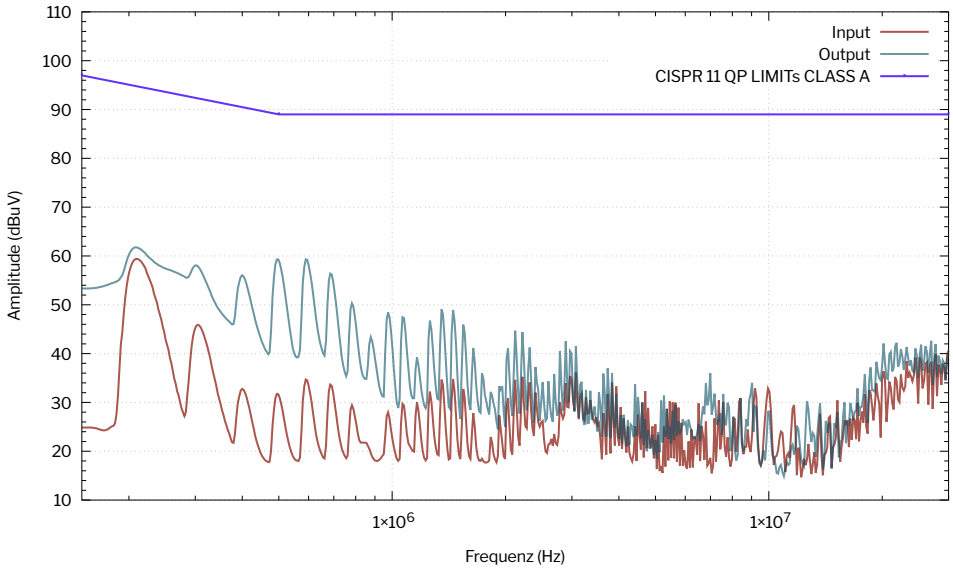

Figure 17: QP EMC Emssions

7 Case

The case drawing is shown in Figure 18.

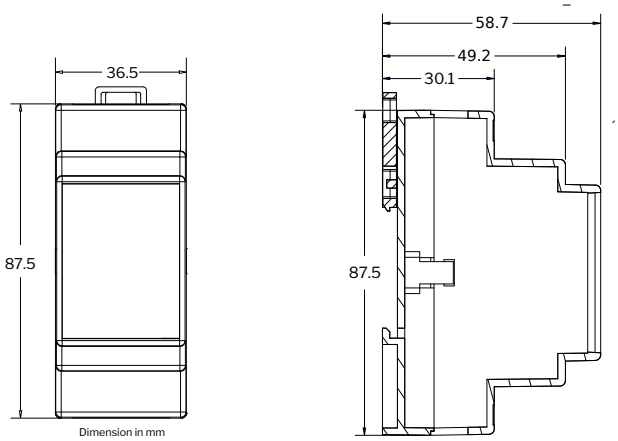

Figure 18: DCP48 case drawing.

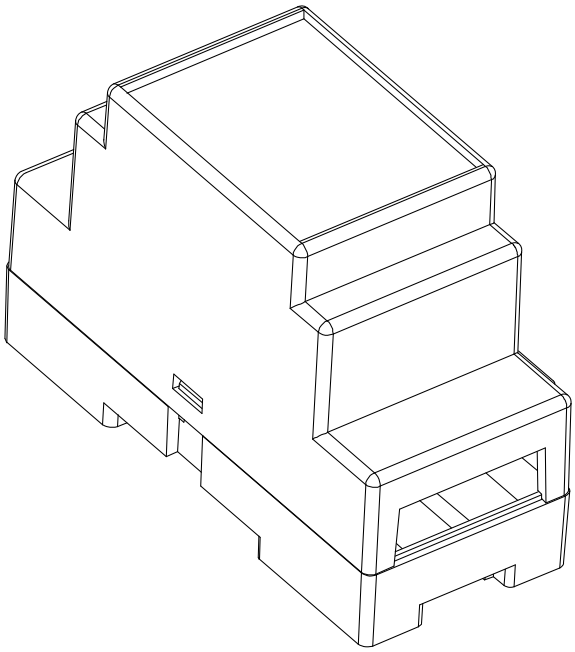

Figure 19: DCP48's 3D View.

8 Product label

The Label for the DCP48 is depicted in the following Figure 20.

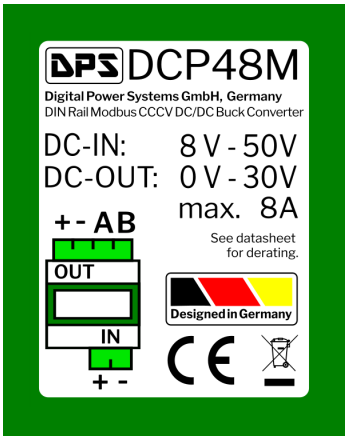

Figure 20: DCP48Modbus Version Label

All DCP48 configurations share the same product label. The configuration between each subversion can be caanged via the Modbus communication interface.

9 Document

9.1 Datasheet Quality

Digital Power Systems aims for the highest datasheet quality. We value your feedback to improve this document. Please email:

`datasheet (ät) digitalpowersystems (döt) eu`

9.2 Revision History

The revision history is depicted in the following table.

Date	Changes in Revision
27.6.2024	Initial datasheet release

9.3 Contact Information

This is a product of the Digital Power Systems GmbH (DPS). Visit out website:
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