LED48RM

48 V_{dc} 8 A_{pk} DIN Rail Modbus CCCV DC/DC LED Driver

LED48RM photography

Feature summary

- Constant Current Constant Voltage
- 90% typical efficiency (94% peak)
- Programmable output voltage and current range
  (0 V .. 0.95 U_{in} | 0 A .. 8 A) using Modbus
- Programmable Blink Modes
- Wide input voltage (8 V to 50 V)
- Internal temperature monitoring with Thermal Shutdown
- Status Relay
- Input reverse polarity protection
- Output short circuit proof

Product description

The LED48RM is a non-isolated constant current / constant voltage digital DIN Rail buck LED driver with perfect steady-state output stability. It is designed to drive LED modules directly from a 48 V DC control-cabinet bus. The input voltage ranges from 8 V to 50 V. The output voltage must not exceed 90 % of the input voltage. The device is programmable over Modbus holding registers. Output current and voltage limits can be set and read back via Modbus. Comprehensive programming tools are available.

The device supports an output peak current of $I_{out,pk}$=8 A. By default it is configured to U_{out}=48 V and I_{out}=5 A.

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

Operation has been verified down to -40 °C ambient. Hot-end thermal derating is application-specific.

Specification overview

Description	Value
General	
Input Voltage Range	8 - 50 V
Max. Output Voltage	0.95 U_{in}
Max. Output Current	8 A
Typical Efficiency	85 - 95 %
Control Strategy	CCCV
Modbus	RTU
Relay-Type	SPDT
Relay-Rating	3A | 250 V_{ac}
Protection	
Input Fuse	yes
Input Reverse Polarity Protection	yes
Short Circuit Protection	yes
Input Overvoltage Suppressor	TVS

Ordering information

Order code	Default Output
LED48RM	$U_{out,default}$=48 V, $I_{out,default}$=5 A
Customization available. Contact DPS.	

Engineering standards

Applied engineering standards	
EN 55011 / CISPR 11	EN 61000-4-2
EN 61000-4-3	EN 61000-4-4
EN 61000-4-5	EN 61000-4-6
EN 61000-4-7	EN 61000-4-8

1 Functional description

1.1 Overview

The LED48RM is a non-isolated constant current / constant voltage digital DIN Rail buck LED driver with perfect steady-state output stability. It is designed to drive LED modules directly from a 48 V DC control-cabinet bus. The input voltage ranges from 8 V to 50 V. The output voltage must not exceed 90 % of the input voltage. The device is programmable over Modbus holding registers. Output current and voltage limits can be set and read back via Modbus. Comprehensive programming tools are available.

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

Operation has been verified down to -40 °C ambient. Hot-end thermal derating is application-specific.

1.2 Protections

The following protections are in place:

- **Input Reverse polarity:** The input may be connected in reverse polarity with an input of $U_{in,max}$ = -48 V.
- **Programmable Input Voltage Lockout:** The input voltage lockout (UVLO) can be digitally programmed. The UVLO disables the device when the input voltage is too low.
- **Thermal protection:** When the maximum temperature is exceeded, the device stops operation. When the re-enabling temperature is reached, the device restarts automatically.
- **Short circuit proof:** The output of the converter can be short-circuited 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 Relay

The device features a single-pole double-throw (SPDT) status relay intended for power-good signalling. In LED applications, the relay indicates whether the LED is being operated within the configured operating conditions, and can be wired into the cabinet's monitoring or interlock chain to flag a failed luminaire. The relay's switching capabilities are listed in the specification table (Section 3); a detailed description of the relay judgement algorithm and the associated configuration registers is given in Section 4.4.

1.4 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 cooldown period the device will restart.

1.5 Ordering Information

The following ordering options are available.

Ordercode	Voltage	EAN	Weight	HS-Code	Origin
LED48RM	48 V | 5 A	4262542250145	92 g	8504409590	Germany
Customisation available. Contact DPS.					

2 Pinout

The pinout of the converter is depicted in Figure 1.

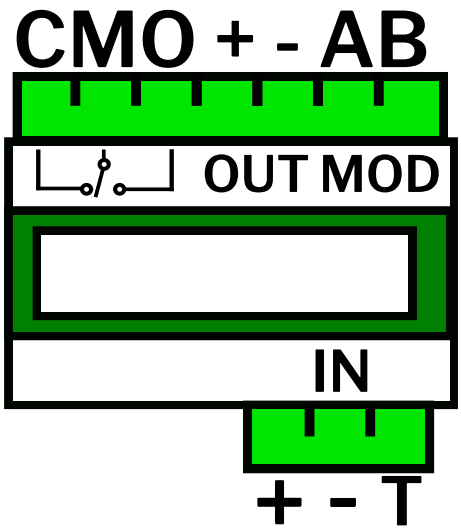

Figure 1: Power Supply Connection Diagram

2.1 Pin description

Pin	Functional description
Output - TOP	
C	Normally Closed Relay Pin of SPDT Relay
M	Midpoint Relay Pin of SPDT Relay
O	Normally Open Relay Pin of SPDT Relay
+	Plus Output of the DC/DC Converter.
-	Minus Output of the DC/DC Converter. Note that the Minus Pin is switched and contains a current sense. The pin is NOT equal to ground.
A	Modbus Pin A
B	Modbus Pin B
Input - Bottom	
-	Negative Input Pin
+	Positive Input Pin
T	Trigger Input Pin

2.2 RGB LED Color Codes

The LED48RM has an internal LED for status display. The LED is mounted inside the housing and is intended for service diagnostics only. **Opening the case to access the LED voids the warranty.**

Color	Functional State	Power
Green	Output in regulation	OK
Violet	Input voltage too low (UVLO)	Not OK
Blue	Overtemperature protection engaged	Not OK
Red	Output out of regulation	Not OK
White	Output disabled via Modbus command	–

2.3 Output Paralleling

Output paralleling is not supported. The device uses low-side current sensing; the negative output must not be grounded in order to ensure reliable current sensing.

3 Specification

The specification for LED48RM is shown in the following table. If not otherwise specified, the following parameters have been used: T_{amb}=25°C, U_{in}=48 V_{dc} and I_{out}=5 A_{dc} (U_{out} set by the load).

	Min	Typ	Max	Unit
Eingang Input				
Eingangsspannung Input Voltage	8		50	V_{dc}
Sicherungstyp Fuse Type		2410-1800		
Eingangskapazität Input Capacitance		25		µF
Schutzmosfet Polarität Eingang Input polarity protection MOSFET		yes		
Unterspannungsschutz, an Undervoltage Lockout on		8.5		V_{dc}
Unterspannungsschutz, aus Undervoltage Lockout off		7.5		V_{dc}
Unterspannungsschutz, programmierbarkeit Undervoltage configurable		yes		
Ausgang Output				
Regelstrategie Control Strategy		Constant Current Constant Voltage (CCCV)		
Ausgangsspannung Output Voltage	0.02		50	V_{dc}
Ausgangsspannung, max Output $Voltage_{max}$		0.95 U_{in}		V_{dc}
Strom Peak Current Peak	0		8	A_{dc}
Empfohlene mittlere Leistung Recommended Avg Power			150	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				
Schnittstelle Interface		Modbus RTU over RS485		
Modbus Modbus				
Modbus Adresse Modbus Address	1		247	
Modbus Baudrate Modbus Baudrate	1200	9600	57600	Baud
Trigger Eingang Trigger Input				
Polarität, Standard Polarity, default		active HIGH		
Polarität, Inversion Polarity, inversion		via Modbus (BlinkMode register)		
Pull-Verhalten Pull behaviour		pull-down to DC ground		
Rückstromsperre Reverse-current block		series diode		
Maximale Eingangsspannung Maximum input voltage	-50		50	V_{dc}
Statusrelais Status Relay				
Relaistyp Relay Type		SPDT		
Schaltspannung Switching Voltage			250	V_{ac}
Schaltstrom Switching Current			3	A
Sicherheitsfeatures Safety Features				
Verpolungsschutz Reverse polarity protection		yes		
Neg. Eingangsspannung Negative Input Voltage			-48	V_{dc}
Kurzschlussschutz Short circuit protection		yes		
Leerlaufschutz Open circuit protection		yes		

	Min	Typ	Max	Unit
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 to input - **Do not connect to "-" of the output, as this impacts current control behavior!**
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	CS RAW (LSB) CS RAW (MSB)	Measured output current	mA
4 5	Uin (LSB) Uin (MSB)	Input voltage	mV
6 7	NTC (LSB) NTC (MSB)	NTC temperature sensor reading	°C
8 9	Uout (LSB) Uout (MSB)	Output voltage	mV
10 11	ontime (LSB) ontime (MSB)	PWM on-time value (internal timing unit). Range: 0–2000. Higher value = more energy transferred.	-
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 (MSB)	Deadband for voltage control	mV
22 23	Deadband Current (LSB) Deadband Current (MSB)	Deadband for current control	mA
24 25	Uset (LSB) Uset (MSB)	Setpoint for output voltage	mV
26 27	Iset (LSB) Iset (MSB)	Setpoint for output current	mA
28 29	LEDTol (Voltage LSB) LEDTol (Voltage MSB)	Tolerance for LED voltage	mV

Continued on next page

ID	Name	Description	Unit
30 31	LEDTol (Current LSB) LEDTol (Current MSB)	Tolerance for LED current	mA
32 33	UVLO On (LSB) UVLO On (MSB)	Undervoltage lockout on threshold	mV
34 35	UVLO Off (LSB) UVLO Off (MSB)	Undervoltage lockout off threshold	mV
36 37	BlinkMode (LSB) BlinkMode (MSB)	Output control mode. See BlinkMode Values table below.	-
38 39	Blink ON (LSB) Blink ON (MSB)	On-time in ticks (100 ms/tick). Modes 4 & 5. Default: 3 (300 ms).	ticks
40 41	Blink PER (LSB) Blink PER (MSB)	Period (full cycle) in ticks (100 ms/tick). Modes 4 & 5. Duty = ON/PER. Default: 30 (3 s).	ticks
42 43	Modbus BAUD (LSB) Modbus BAUD (MSB)	Modbus communication baud rate (1200–57600). **Writing saves all settings to Flash and resets the device.**	Baud
44 45	Modbus ID (LSB) Modbus ID (MSB)	Modbus device ID (1–247). **Writing saves all settings to Flash and resets the device.**	-

4.3.2 BlinkMode Values

Value	Name	Description
0	Always ON	Output is permanently enabled. The converter operates continuously at the configured voltage and current setpoints.
1	Always OFF	Output is permanently disabled. No output voltage or current is produced. Use to shut down the output via Modbus.
2	Trigger Pin	Output state is controlled by the trigger pin: output is ON when the trigger pin reads HIGH, OFF when the trigger pin reads LOW.
3	Trigger Inverted	Output state is controlled by the trigger pin with inverted polarity: output is ON when the trigger pin reads LOW, OFF when the trigger pin reads HIGH.
4	Clever Blink	**Default mode.** Adaptive blink mode responding to the trigger pin. When the trigger pin is HIGH, the output is continuously ON. When the trigger pin goes LOW, the output first holds OFF for a hold-off period of approximately 10 s (99 blink ticks $\times$ 100 ms, **fixed in firmware – not user-configurable**), then starts blinking according to the Blink ON and Blink PER settings. When the trigger pin returns HIGH, the hold-off counter resets and the output turns ON immediately.
5	Blink	Free-running blink mode, independent of the trigger pin. The output blinks continuously: ON for Blink ON ticks, then OFF for the remainder of Blink PER. One blink tick = 100 ms.

4.4 Relay Output

The device provides a relay output that signals whether the connected load is being supplied within the configured operating conditions. The relay closes (energises) when the output is judged *good*, and opens (de-energises) when a fault condition is detected or when the output is intentionally disabled.

4.4.1 Evaluation and Filtering

The relay judgement is evaluated at **40 Hz** (every 25 ms). To prevent relay chatter and suppress transient measurement artefacts, a **32-sample sliding-window majority filter** is applied to the raw judgement signal before the relay is driven. The filter implements a hysteretic threshold with the following switching criteria:

Event	Condition (popcount of last 32 samples)
Relay closes	> 24 samples judged *good* ($> 75\,\%$ of window, $\approx 600\,\mathrm{ms}$)
Relay opens	< 8 samples judged *good* ($< 25\,\%$ of window, $\approx 600\,\mathrm{ms}$)
No change (hold)	$8 \leq$ count ≤ 24 (relay retains its current state)

This means the relay requires a sustained good condition for approximately **600 ms** before closing, and a sustained fault condition for approximately **600 ms** before opening.

4.4.2 Output-Off Behaviour

When the output is intentionally switched off (e.g. via BlinkMode = 1 or during hold-off in Clever Blink mode):

- If the measured output current remains **below 100 mA**, the relay **holds its last state**. This prevents oscillation during the output switch-off transient.
- If the output current **exceeds 100 mA** while the output should be off (indicating an unexpected condition), the relay **opens immediately** (raw judgement = 0, subject to the sliding-window filter).

4.4.3 Judgement Modes

The relay judgement algorithm has two operating modes, selected by the **LEDTol (Current)** register (Modbus ID 30/31).

Simple Current Mode (LEDTol Current = 0, factory default) In this mode the relay evaluates output current only. The relay judgement is *good* when:

$$I_{\text{out}} \;\geq\; \frac{256}{356} \times I_{\text{set}} \;\approx\; 0.72 \times I_{\text{set}}$$

The threshold of approximately **72 %** of the current setpoint is implemented as a fixed-point multiplication ($I_{\text{out}} \times 356 \gg 8$) to avoid division in the interrupt-driven control loop. This mode is appropriate for constant-current LED loads where reaching near-nominal current is the primary criterion for a healthy supply.

Dual-Tolerance Mode (LEDTol Current $\neq$ 0) When **LEDTol (Current)** is set to any non-zero value, the relay switches to a dual-window criterion that accommodates loads operating in either constant-voltage (CV) or constant-current (CC) mode. The relay judgement is *good* if **at least one** of the following conditions is satisfied:

1. **Voltage condition:** $|U_{\text{set}} - U_{\text{out}}| \;<$ *LEDTol (Voltage)*
2. **Current condition:** $|I_{\text{set}} - I_{\text{out}}| \;<$ *LEDTol (Current)*

The two conditions are evaluated as a logical **OR**: the first condition that is satisfied determines the judgement; the second is not evaluated. This is particularly useful for LED modules with a spread of forward voltages, where the converter may settle in CV mode on some units and CC mode on others.

4.4.4 Relay-Related Modbus Registers

ID	Name	Description
28/29	LEDTol (Voltage)	Voltage tolerance window for Dual-Tolerance Mode, in mV.
30/31	LEDTol (Current)	Current tolerance window in mA. **Value 0 selects Simple Current Mode. Any non-zero value enables Dual-Tolerance Mode.**

4.5 Saving of Variables

Register writes are held in RAM only. The values restored on power-up are the values that were in RAM *at the last Flash save*. Writing to the Modbus BAUD or Modbus ID register is the only event that triggers a Flash save: it commits the entire current register set (PID gains, setpoints, thresholds, BlinkMode, etc.) to Flash and then resets the device.

Therefore, to make changes to any other register persistent, the user must follow them with a (re-)write of the BAUD or ID register. A device reset or power cycle without such a save will revert all RAM-only changes to the last persisted set. When using sensitive loads, disconnect them before triggering a save (the device resets as part of the operation).

5 Measurements

5.1 Measurement Conditions

The following conditions apply to all measurements unless otherwise noted in the specific section.

	Min	Typ	Max	Unit
Eingang Input				
Eingangsspannung Input Voltage		48		V_{dc}
Umgebungsbedingungen Environment Conditions				
Temperatur Temperature	20		24	°C
Feuchtigkeit Humidity	30		90	$\%_{rel}$

5.2 Static Measurements

5.2.1 Measurement Conditions

	Min	Typ	Max	Unit
Last Load				
Lasttyp Load Type		Electronic Load		

5.2.2 Efficiency U_{in}=48V

The efficiency for an input voltage of 48 V_{dc} is plotted over the output voltage at fixed output currents of 2.5 A, 5.0 A, and 7.5 A. Figure 2 shows the efficiency overview while Figure 3 shows the zoomed efficiency.

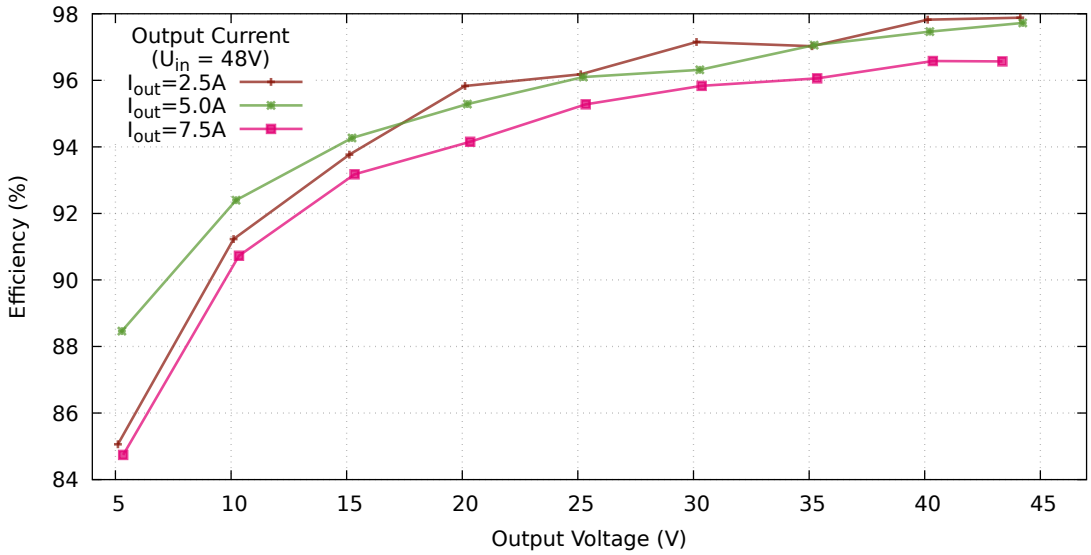

Figure 2: Efficiency in percent depicted over the output voltage.

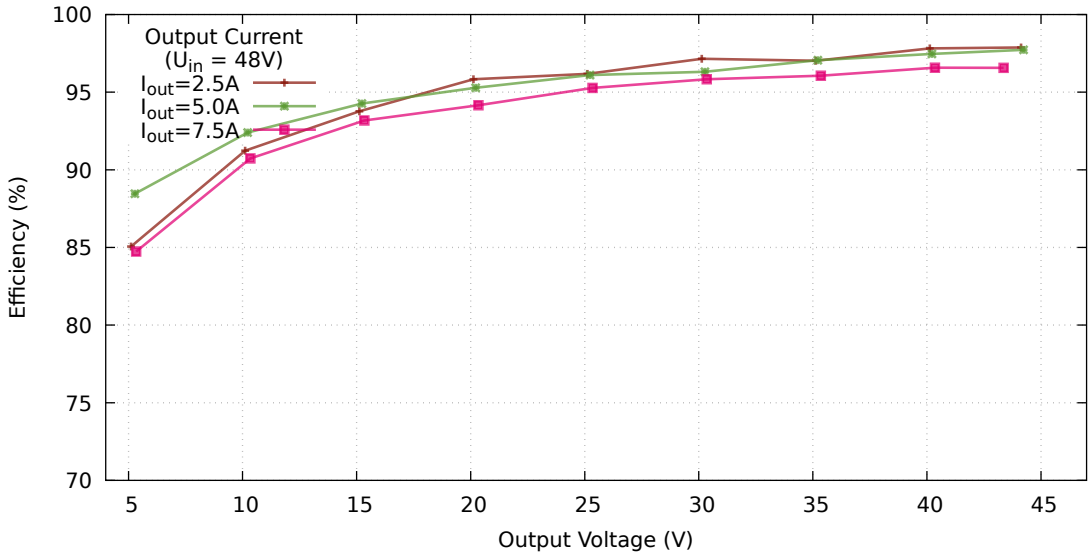

Figure 3: Zoomed efficiency in percent depicted over the output voltage.

5.2.3 Losses U_{in}=48V

The converter losses over the output voltage are depicted in Figure 4.

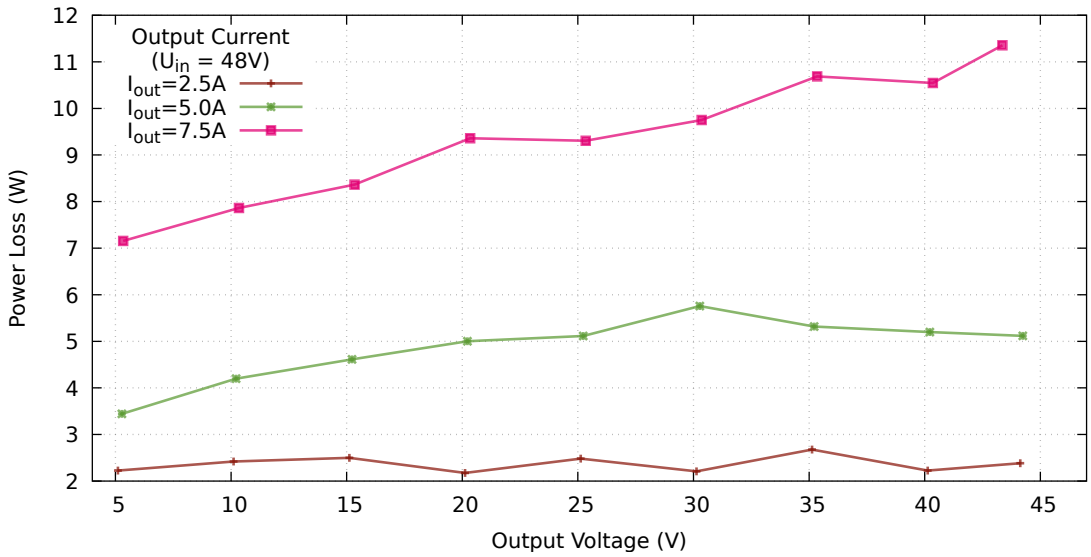

Figure 4: Losses over the output voltage.

5.2.4 Output Current Stability U_{in}=48V

The output current stability is depicted in Figure 5. The output current is shown as a percentage of the programmed set current across the full output voltage range.

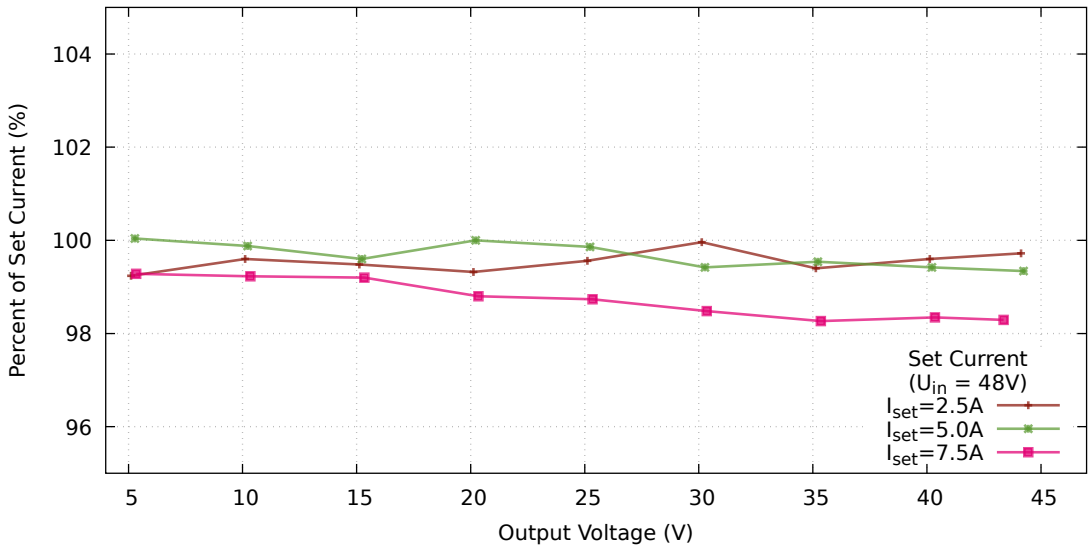

Figure 5: Output current as percent of set current over the output voltage.

5.2.5 Output Voltage Ripple U_{in}=48V

The output voltage ripple (RMS, bandwidth 20 MHz) is depicted in Figure 6.

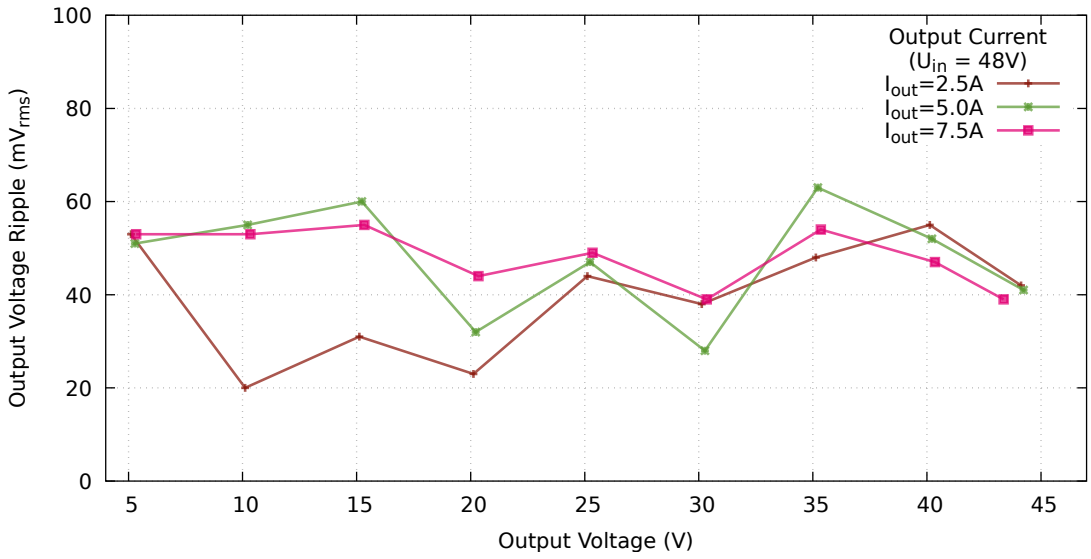

Figure 6: Output voltage ripple (mV rms) over the output voltage.

5.3 Output Waveforms – LED Module Load

5.3.1 Measurement Conditions

	Min	Typ	Max	Unit
Last Load				
Lasttyp Load Type		LED Load		
Ausgang Output				
Ausgangsspannung Output Voltage		30		V_{dc}

5.3.2 Full Operating Cycle

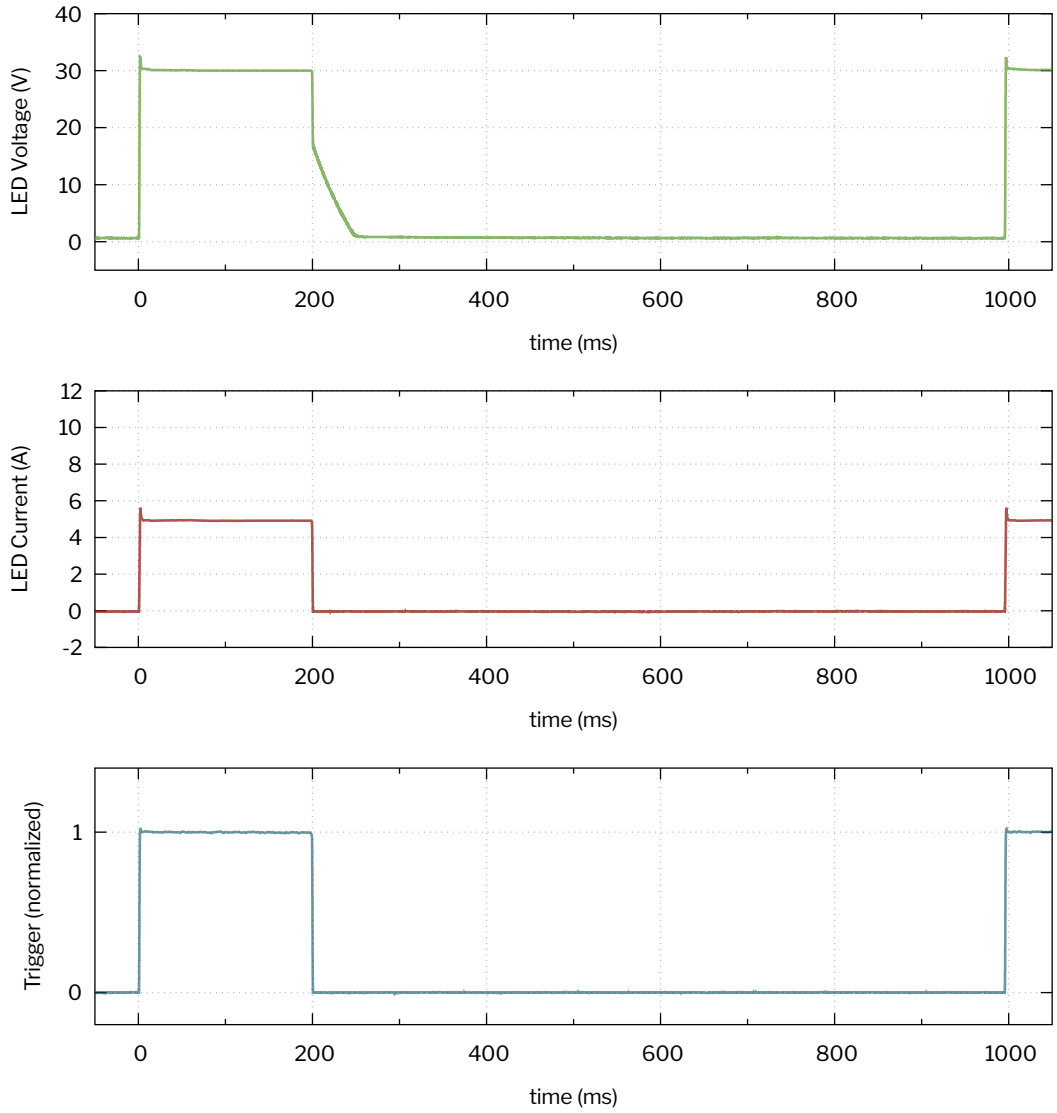

Figure 7: Output voltage (CH1) and output current envelope (CH2) over one full operating cycle. Signals are low-pass filtered at 1 kHz to reveal the slow modulation envelope. U_{in}=48 V_{dc}, LED module load, time scale 200 ms/div.

5.3.3 Turn-On Transient

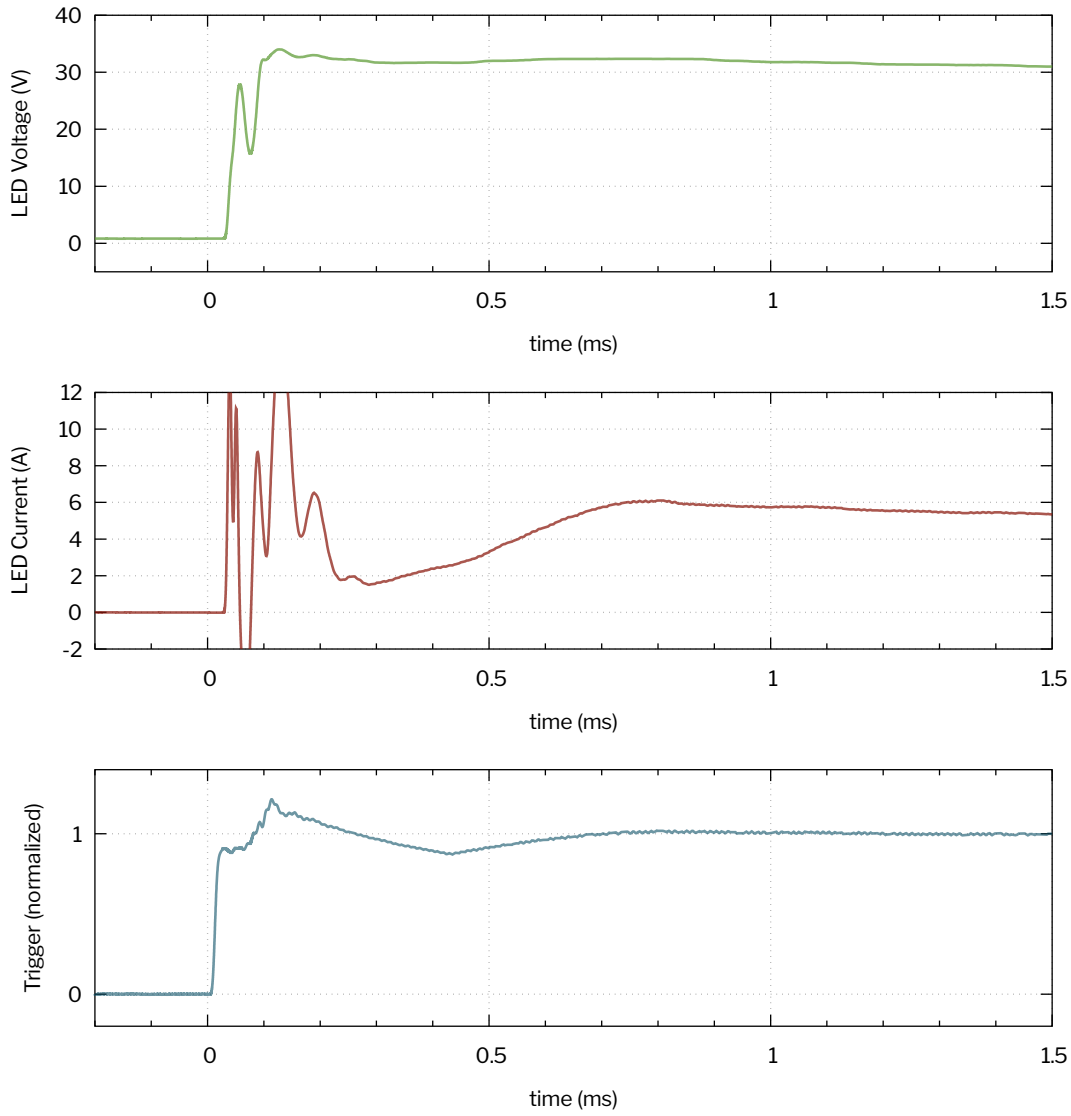

Figure 8: Turn-on transient of output voltage (CH1) and output current (CH2). t = 0 is aligned to the rising edge of the enable signal. U_{in}=48 V_{dc}, LED module load, time scale 1 ms/div.

5.3.4 Turn-Off Transient

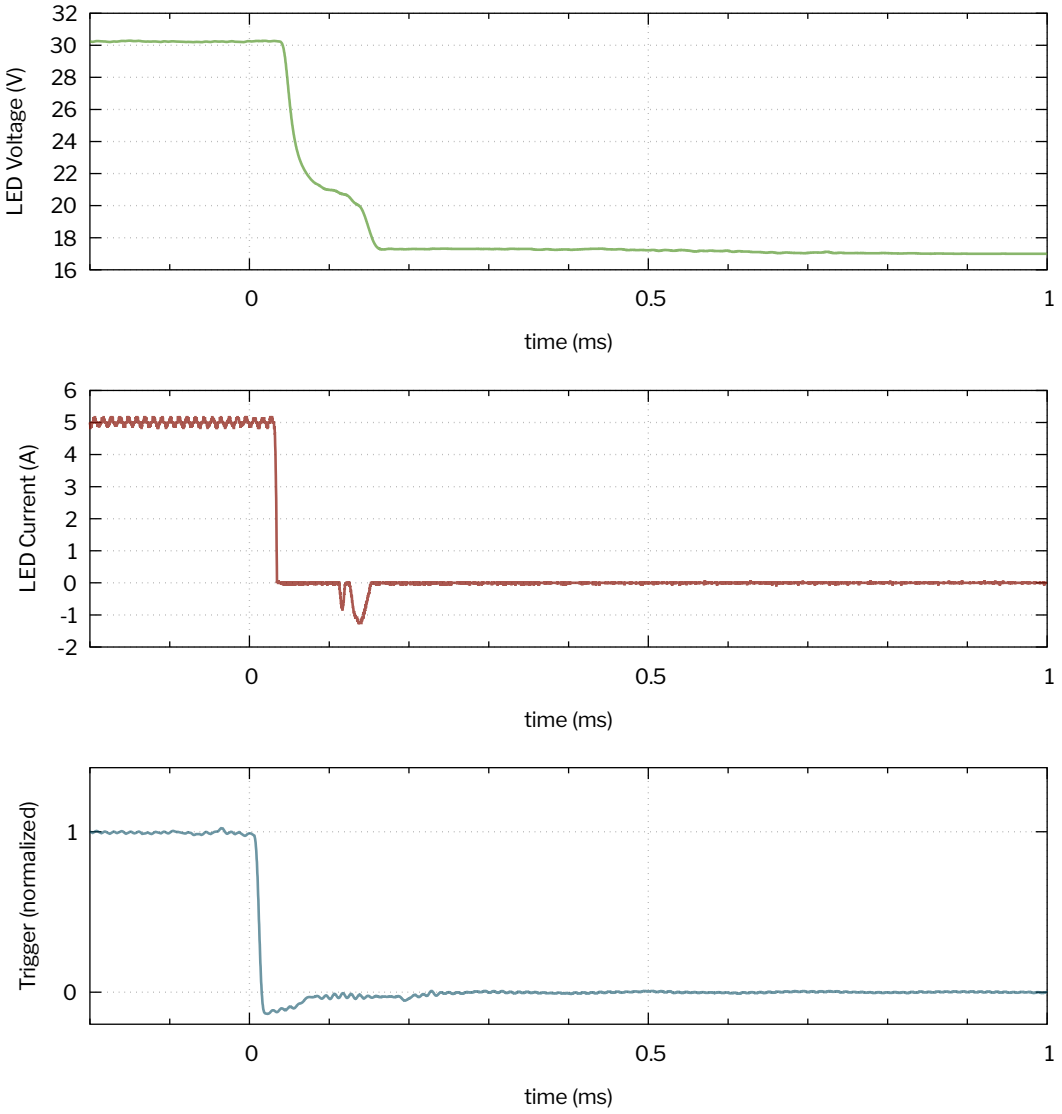

Figure 9: Turn-off transient of output voltage (CH1) and output current (CH2). t = 0 is aligned to the falling edge of the enable signal. U_{in}=48 V_{dc}, LED module load, time scale 20 ms/div.

6 EMC Measurements

6.1 Conducted Emissions

The conducted line EMC emissions are measured at an input voltage of U_{in}=48 V with an electronic load operated in constant-voltage mode set to 30 V as load. Both lines (L and N) are measured at the input and at the output against the CISPR 11 Class A DC limits (average and quasi-peak detector). All measurements pass the limits with margin.

The input-side conducted emissions are shown in Figure 10, the output-side conducted emissions in Figure 11.

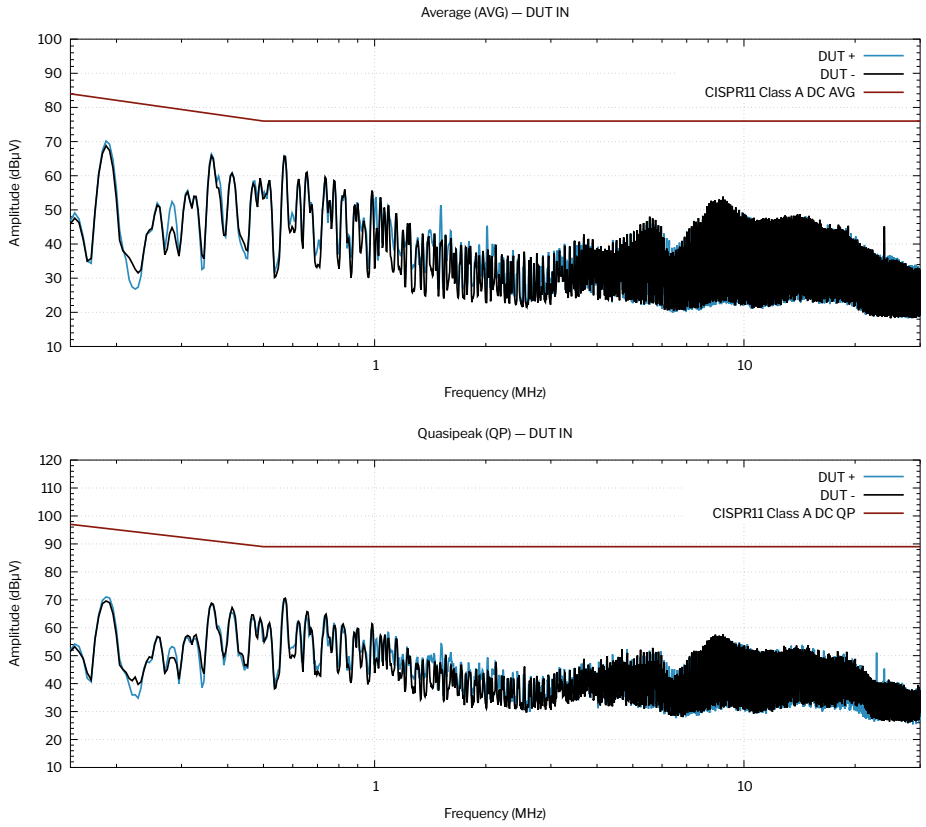

Figure 10: Conducted emissions at the input (48 V DC supply lines), L and N, average and quasi-peak detector vs. CISPR 11 Class A DC limits.

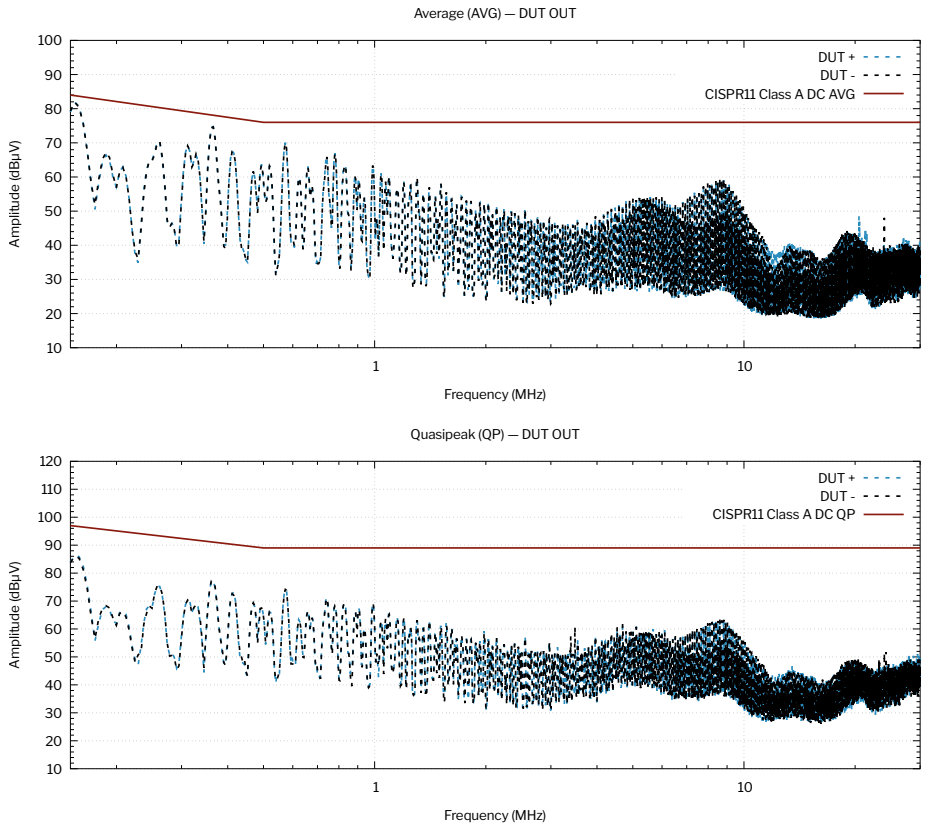

Figure 11: Conducted emissions at the output (LED module DC lines), L and N, average and quasi-peak detector vs. CISPR 11 Class A DC limits.

7 Case

The case drawing is shown in Figure 12.

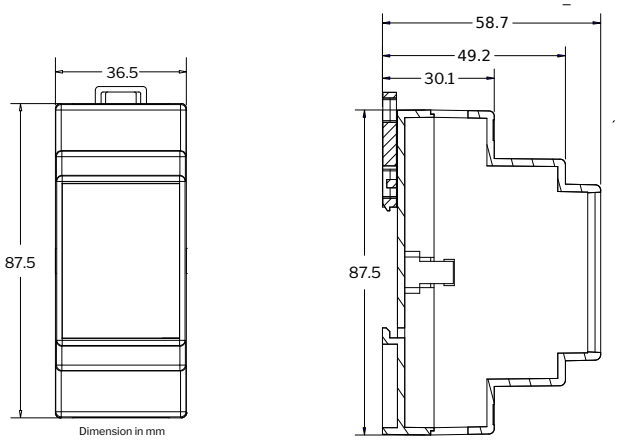

Figure 12: LED48RM case drawing.

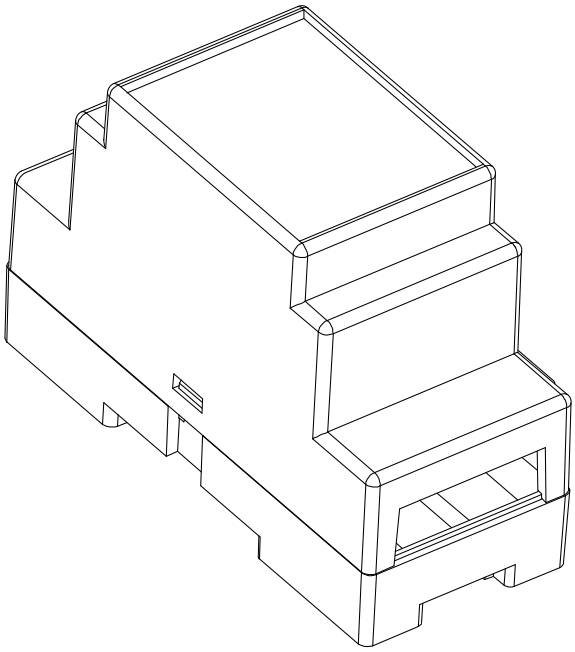

Figure 13: LED48RM's 3D View.

8 Product label

The label for the LED48RM is depicted in Figure 14.

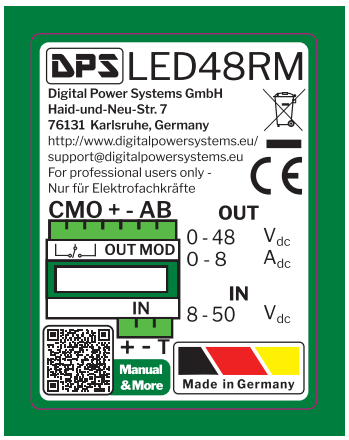

Figure 14: LED48RM product label

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
29.4.2026	Initial commit

9.3 Contact Information

This is a product of the Digital Power Systems GmbH (DPS). Visit our website:
https://digitalpowersystems.eu/