

DC-DC CONVERTER HFBC250-2DW/O

RAILWAY CONVERTER

FOR CHASSIS MOUNTING



HIGHLIGHTS

- + Output Power up to 255 Watts*
- + Efficiency up to 95 %
- + Wide Temperature Range
- + Ultra Wide Input Range
- + Hold-up-time > 10 ms
- + RoHS compliance
- + According to EN 50155

INPUT

Input Voltage Nominal	24, 36, 48, 72, 96 and 110 VDC
Input Voltage Operating	15 - 137,5 VDC
Input Voltage Range	12 - 154 VDC (t ≤ 1,0 s.) (Class C1)
No Load Input Current	See table page 2

OUTPUT

Output Voltage	12 V / 5 V stby, 24 V / 5 V stby
Initial Set Accuracy	< 2 % (no load)
Minimum Load	No minimum load
Short circuit	Continuous short circuit proof
Line Regulation	< 0,5 %
Load Regulation	< 1 % (0 % - 100 % load)
Ripple & Noise	See table page 2
Start Time	< 2,0 s / 0,5 s (EN)
Max. Output Capacitance	500 uF x I _{outnom}
Temperature Coefficient	< 0,02 %/°C

FEATURES

Active Reverse Polarity Protection	Max. 160 V
Active Inrush Current Limitation	Max. 30 A (at t > 1,0 ms) < 6,0 A ² s
Enable Signal Secondary	See page 5
Fail Signal	See page 5

PROTECTION

Over Voltage Protection (OVP)	115 - 125 % V _{outnom} and 110 - 140 % V _{out2nom} . The outputs switches-off and restarts automatically.
Over Current Protection (OCP)	I _{out nom} > 105 %. The output switches-off when V _{out nom} < 90 % and restarts automatically latest after 1,5 s of elimination of the overload.
Over Temperature Protection (OTP)	Shutdown at +105-115 °C PCB-temp. with about 10 °C hysteresis and auto recovery.

GENERAL

Product Standard	EN 50155:2021
Isolation	2200 VDC Input to Output 1500 VDC Input to Earth (PE) 750 VDC Output to Earth (PE)
Pollution Degree	PD2 according to EN 50124-1:2017
Switching Frequency	Typ. 70 / 90 / 110 kHz
Dimensions [mm]	170,25 x 100 x 42
Weight	approx. 530 g
MTBF / Useful Life	TBD / Class L4 (20 years)
Fire & Smoke	EN 45545-2013, HL3 / R25

ENVIRONMENTAL

Operating Ambient Temp.	-40 °C to +85 °C* (Class OT4 + ST1, ST2)
Storage Temperature	-40 °C to +85 °C
Rapid Temperature Variation	Class H1
Altitude	Up to 3000 m
Vibration / Shock / Bump	EN 61373:2010, Cat. 1B

EMC

EMC Standard	EN 50121-3-2:2016
Emissions	EN 55011:2016+A1:2017, Class A**
Burst	EN 61000-4-4:2012, level 3 (2 kV), Criteria A
Surge	EN 50121-3-2:2016, line to line ±1kV, 42R, line to case ±2kV, 42R, Criteria A EN 61000-4-5:2014,+A1:2017 line to line ±0,5kV, line to case ±1kV, Criteria A
Conducted Immunity	EN 61000-4-6:2014, level 3 (10 V), Criteria A
Radiated Immunity	EN 61000-4-3:2006+A1:2008+A2:2010, 20 V/m, Criteria A
Safety	IEC 62368-1:2014, EN 50124-1:2017

*+70 °C continuously +85 °C max. 10 minutes at full load (mounting surface must not exceed +90 °C).

** In built-in condition the devices may show different EMC properties.

TECHNICAL DATA

For $T_{amb} = 25\text{ °C}$, $V_{in\ nom}$, $I_{out\ nom}$ unless otherwise specified

SPECIFICATION Input 12 - 154 VDC

TYPE		HFBC 250-2DW/O						
ORDER NUMBER		87 68 12 0142 5						
CHARACTERISTIC		Unit						
INPUT	Input Voltage Nominal	V	24	36	48	72	96	110
	Input Voltage Range	V	12...36	21,6...51	28,8...67,2	43,2...101	57,6...134,4	66...154
	Under Voltage Turn-on	V	<15,0					
	Under Voltage Turn-off	V	<12,0					
	Input Current @ 250 W Load	A	11,50	7,60	5,67	3,76	2,80	2,44
	Input Current @ No Load	A	0,13	0,10	0,07	0,040	0,025	0,025
	Input Current disabled mode*	mA	18	12	10	9	8	8
	Recom-external Fuse	A	25 T					
OUTPUT		V	Output 1			Output 2		
	Output Voltage Nominal	V	12			5,0		
	Output Current Nominal	A	20,8			1		
	Output Power	W	250			5		
	Output Power Max.	W	255					
	Efficiency @ 200 W	%	92	93	93	93	94	94
	Efficiency @ 250 W	%	91	93	93	93	94	95
	Output Current limit	A	21,8 ... 24,0			1,3 ... 2,0		
	Ripple & Noise 20 MHz bandwidth	%	< 1			< 3		
	Short Circuit Current (typical)	A	35...45 (pulse)**			4...6 (pulse)**		
	Transient Response 25 % / 75 % Load Step	mV	±250			±100		

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CHARACTERISTIC		Unit						
INPUT	Input Voltage Nominal	V	24	36	48	72	96	110
	Input Voltage Range	V	12...36	21,6...51	28,8...67,2	43,2...101	57,6...134,4	66...154
	Under Voltage Turn-on	V	<15,0					
	Under Voltage Turn-off	V	<12,0					
	Input Current @ 250 W Load	A	11,50	7,60	5,67	3,76	2,80	2,44
	Input Current @ No Load	A	0,13	0,10	0,07	0,040	0,025	0,025
	Input Current disabled mode*	mA	18	12	10	9	8	8
	Recom-external Fuse	A	25 T					
OUTPUT		V	Output 1			Output 2		
	Output Voltage Nominal	V	14			5,0		
	Output Current Nominal	A	10,4			1		
	Output Power	W	250			5		
	Output Power Max.	W	255					
	Efficiency @ 200 W	%	92	93	93	93	94	94
	Efficiency @ 250 W	%	91	93	93	93	94	95
	Output Current limit	A	12,0 ... 16,0			1,3 ... 2,0		
	Ripple & Noise 20 MHz bandwidth	%	< 1			< 3		
	Short Circuit Current (typical)	A	16...22 (pulse)**			4...6 (pulse)**		
	Transient Response 25 % / 75 % Load Step	mV	±500			±100		

* Enable signal open

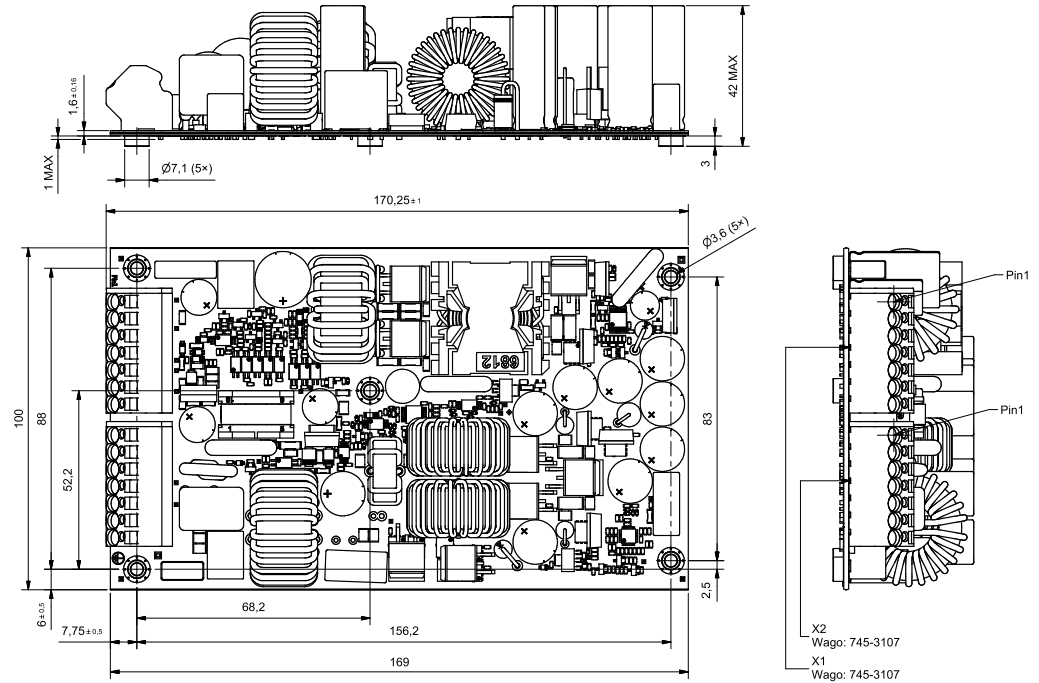
** Pulsating current time duration 50 ms

TECHNICAL DATA

For $T_{amb} = 25^{\circ}\text{C}$, $V_{in\ nom}$, $I_{out\ nom}$ unless otherwise specified

MECHANICAL DETAILS

1. Dimensions are in mm
2. Unless otherwise specified, general tolerances $\pm 0,5$ are for values in brackets (XX)
Values not in brackets are according to ISO-2768-1m



Coating: Lackwerke Peters ELPEGUARD SL 1307-FLZ/2

Protection Degree: IP00

Production acc. to IPC-A-610 (exception bonding)

TECHNICAL DATA

For $T_{amb} = 25\text{ }^{\circ}\text{C}$, $V_{in\ nom}$, $I_{out\ nom}$ unless otherwise specified

PINNING

Pin		Function
X1-1	GND	Ground
X1-2	GND	Ground
X1-3	+Vout1	+12 V Output Voltage
X1-4	+Vout1	+12 V Output Voltage
X1-5	FAIL	Fail Signal
X1-6	EN	Enable Signal
X1-7	+Vout2	+5 V Output Voltage
X2-1	i.c	Internal Connected
X2-2	i.c	Internal Connected
X2-3	+Vin	Positiv Input Voltage
X2-4	+Vin	Positiv Input Voltage
X2-5	-Vin	Negativ Input Voltage
X2-6	-Vin	Negativ Input Voltage
X2-7	PE	Potential of the earth

NOTES

Installation instructions:

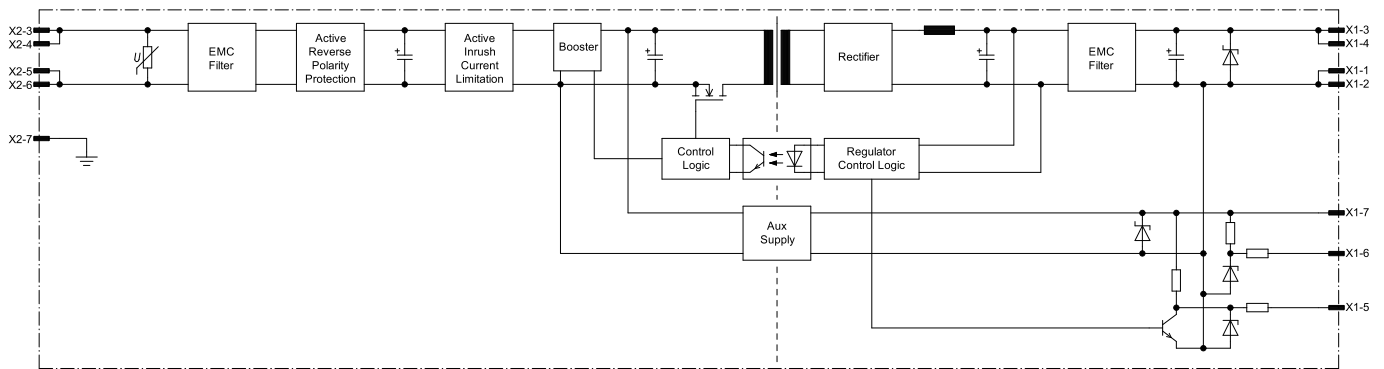
The converters have to be installed according to the guidelines currently in force, like other open electronic component assemblies. Attention must be paid to sufficient ventilation, carry off heat, fastening and protection against accidental contact. Additional thermal conductive pad might be necessary to get a thermal coupling to the mounting-surface. The mounting surface must be flat and able to remove the thermal energy of the baseplate (mounting surface must not exceed $+90\text{ }^{\circ}\text{C}$).

The connection to earth/chassis ground has to be done by the 4 outer mounting holes or the pin X2-7 PE (⚡ / ⚙).

Fault protection: For input protection a time-lag fuse corresponding to IEC 60127-2 must be installed. For recommended rating of the fuse refer to specification table above. Pay attention on sufficient current source in case of short circuit. In some applications 2 fuses would be necessary, one in each input line. Caution:

1. No protection against touching, dangerous voltage
2. After power off, wait 10 s before disconnecting or touching
3. Wire cross section: $2,5\text{ mm}^2$
4. Output Vout1 PS3 (EN62368-1)

BLOCK DIAGRAM



DESCRIPTION OF FEATURES

ENABLE SIGNAL

The converter may be enabled by pulling EN below 0,8 V with respect to GND.
This may be done with an open collector transistor, relay, optocoupler or an external control voltage.
The pin sources about 2,5 mA at low level.

0...0,8 V converter active
3 V...4,7 V converter inactive

The maximum output voltage of the EN pin is 4,7 V (internal limited) with a source resistance of 221 Ω .

FAIL SIGNAL

The Fail Signal is an open-collector output, emitter grounded (npn-Transistor) with pull-up 1K2.
Maximum current 2,05 mA and maximum voltage 4,7 V (internal limited) with a source resistance of 221 Ω .

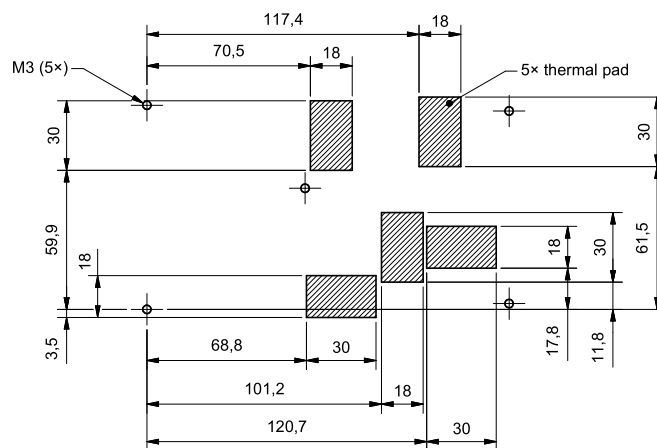
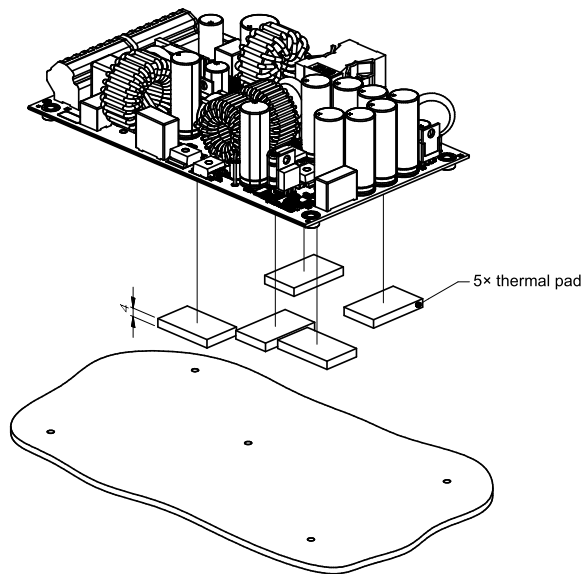
0...0,8 V ($V_{out1} < 10$ V or PCB > 100 °C)
2 V...4,7 V ($V_{out} > 10$ V or PCB < 100 °C)

When not in use, leave fail signal not connected

APPLICATION NOTES

THERMAL PADS

Recommendation: Soft gap-pads with a thermal conductivity of $> 2,5 \text{ W/mK}$, shore00 ≤ 20 , example: HALA TGF-MUS4000-SI



To avoid a mechanical deformation of the printed circuit board, please fasten the middle screw first.

CHANGE HISTORY

Revision	Date	Author	Modification
a00	2023-12-14	Ehrhardt	First edition