

## DC-DC CONVERTER HFBC60-W/Ks, .../Ksl

RAILWAY CONVERTER.

### FOR CHASSIS MOUNTING



### HIGHLIGHTS

- + Output Power up to 60 Watts\*
- + Efficiency up to 90%
- + Ultra Wide Input Range
- + Wide Temperature Range
- + Hold-up-time > 10ms
- + RoHS compliance
- + According to EN50155

### INPUT

Input Voltage Nominal	24, 36, 48, 72 and 110 VDC
Input Voltage Operating	16,8-137,5 VDC
Input Voltage Range	14,4-154 VDC (t ≤ 1,0 sec.)
No Load Input Current	See table page 2

### OUTPUT

Output Voltage	5,1 V, 12 V and 24 V (other voltages on request)
Initial Set Accuracy	< 2 % (no load)
Minimum Load	No minimum load
Short circuit	Continuous short circuit proof
Line Regulation	< 0,5 %
Load Regulation	< 2 % (0% - 100% load), < 3 % @ 5,1 V
Ripple & Noise	< 2 % pk-pk, 20 MHz bandwidth
Start Time	< 900 ms
Max. Output Capacitance	500 uF x I <sub>out nom</sub>
Temperature Coefficient	< 0.01 %/°C

### FEATURES

Enable Signal	See page 4
Active Inrush Current Limitation	Max. 8 A
Reverse Polarity Protection	Max.160 V
Hold-up-time	> 10 ms at full load
Adjust	See page 4
Tracking	See page 4

### PROTECTION

Over Voltage Protection (OVP)	110-130 % V <sub>out nom</sub> (latched, reset through EN or power off)
Over Current Protection (OCP)	See table page 2
Over Temperature Protection (OTP)	Shutdown at +105-110°C PCB-temp. with about 5°C hysteresis and auto recovery.

### GENERAL

Product Standard	EN 50155:2007
Isolation	2200 VDC Input to Output 2200 VDC Input to Earth (PE) 710 VDC Output to Earth (PE)
Switching Frequency	Typ. 120 kHz
Dimensions [mm]	113,5 x 35 x 46
Weight	approx. 320 g
MTBF	6.200.000 h acc. to MIL-HDBK-217F (GB, 25°C) 1.300.000 h acc. to MIL-HDBK-217F (GF, 25°C)

### ENVIRONMENTAL

Operating Ambient Temp.	-40°C to +85°C*
Storage Temperature	-55°C to +100°C
Vibration / Shock / Bump	EN 61373:1999, Cat. 1B

### EMC

EMC Standard	EN 50121-3-2:2006
Conducted Emissions	EN 55011:2009+A1:2010, Class A**
Radiated Emissions	EN 55011:2009+A1:2010, Class A**
ESD Immunity	EN 61000-4-2:2009, level 3 (6kV/8kV), Criteria A
Burst	EN 61000-4-4:2004, level 3 (2kV), Criteria A
Surge	EN 50121-3-2:2006, line to line ±1kV, 42R, and line to case ±2kV, 42R, Criteria B EN 61000-4-5:2006, line to line ±0,5kV, and line to case ±1kV
Conducted Immunity	EN 61000-4-6:2009, level 3 (10V), Criteria A
Radiated Immunity	EN 61000-4-3:2006+A1:2008+A2:2010, 20V/m, Criteria A
Safety Approvals	EN 60950-1:2006+A11:2009+A1:2010+A12:2012

\* +70°C continuously, +85°C max. 10 minutes at full load (baseplate temp. must not exceed +90°C).

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

# TECHNICAL DATA

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

## SPECIFICATION Input 14,4 - 154 VDC

TYPE		HFBC60-W/Ks					
ORDER NUMBER		87 71 08 0112 6					
CHARACTERISTIC		Unit					
INPUT	Input Voltage Nominal	V	24	36	48	72	110
	Input Voltage Range	V	14,4...36	21,6...51	28,8...67,2	43,2...101	66...154
	Under Voltage Turn-on	V	<15,0...16,8				
	Under Voltage Turn-off	V	<12,0...14,4 (14,4V < $V_{in}$ < 16,8V at $t > 1$ sec.)				
	Input Current @ Full Load	A	3,0	2,0	1,4	0,95	0,62
	Input Current @ No Load	A	0,09	0,06	0,05	0,03	0,02
	Recommended External Fuse	A	6,0***				
	OUTPUT	Output Voltage Nominal	V	5,1			
Output Current Nominal		A	12,0				
Output Power		W	60				
Efficiency @ Full Load (typical)		%	84	85	86	87	87
Output Current limit		A	13,0...18,0				
Short Circuit Current (typical)			28 (pulse approx. 3Hz)*				
Transient Response 25 % / 75 % Load Step Recovery Time < 1 ms		mV	$\pm 150$				

## SPECIFICATION Input 14,4 - 154 VDC

TYPE		HFBC60-W/Ks					
ORDER NUMBER		87 71 12 0112 1					
CHARACTERISTIC		Unit					
INPUT	Input Voltage Nominal	V	24	36	48	72	110
	Input Voltage Range	V	14,4...36	21,6...51	28,8...67,2	43,2...101	66...154
	Under Voltage Turn-on	V	<15,0...16,8				
	Under Voltage Turn-off	V	<12,0...14,4 (14,4V < $V_{in}$ < 16,8V at $t > 1$ sec.)				
	Input Current @ Full Load	A	2,93	1,9	1,4	0,95	0,62
	Input Current @ No Load	A	0,05	0,035	0,03	0,015	0,01
	Recommended External Fuse	A	6,0***				
	OUTPUT	Output Voltage Nominal	V	12			
Output Current Nominal		A	5				
Output Power		W	60				
Efficiency @ Full Load (typical)		%	86	88	88	89	90
Output Current limit		A	6,0...7,0				
Short Circuit Current (typical)		A	10 (pulse approx. 3Hz)*				
Transient Response 25 % / 75 % Load Step Recovery Time < 1 ms		mV	$\pm 180$				

## SPECIFICATION Input 14,4 - 154 VDC

TYPE		HFBC60-W/Ks** / HFBC60-W/Ks / HFBC60-W/Ksl / HFBC60-W/Ksl*					
ORDER NUMBER		87 71 24 0114 5** / 87 71 24 0112 6 / 87 71 24 0113 1 / 87 71 24 0119 7*					
CHARACTERISTIC		Unit					
INPUT	Input Voltage Nominal	V	24	36	48	72	110
	Input Voltage Range	V	14,4...36	21,6...51	28,8...67,2	43,2...101	66...154
	Under Voltage Turn-on	V	<15,0...16,8				
	Under Voltage Turn-off	V	<12,0...14,4 (14,4V < $V_{in}$ < 16,8V at $t > 1$ sec.)				
	Input Current @ Full Load	A	2,9	1,9	1,3	0,9	0,6
	Input Current @ No Load	A	0,05	0,03	0,025	0,015	0,01
	Recommended External Fuse	A	6,0***				
	OUTPUT	Output Voltage Nominal	V	24			
Output Current Nominal		A	2,5				
Output Power		W	60				
Efficiency @ Full Load (typical)		%	87	88	89	90	91
Output Current limit		A	2,8...3,8				
Short Circuit Current (typical)		A	5 (pulse approx. 3Hz)*				
Transient Response 25 % / 75 % Load Step Recovery Time < 1 ms		mV	$\pm 250$				

\*without mating connector

\*\*with pincover and conformal coating

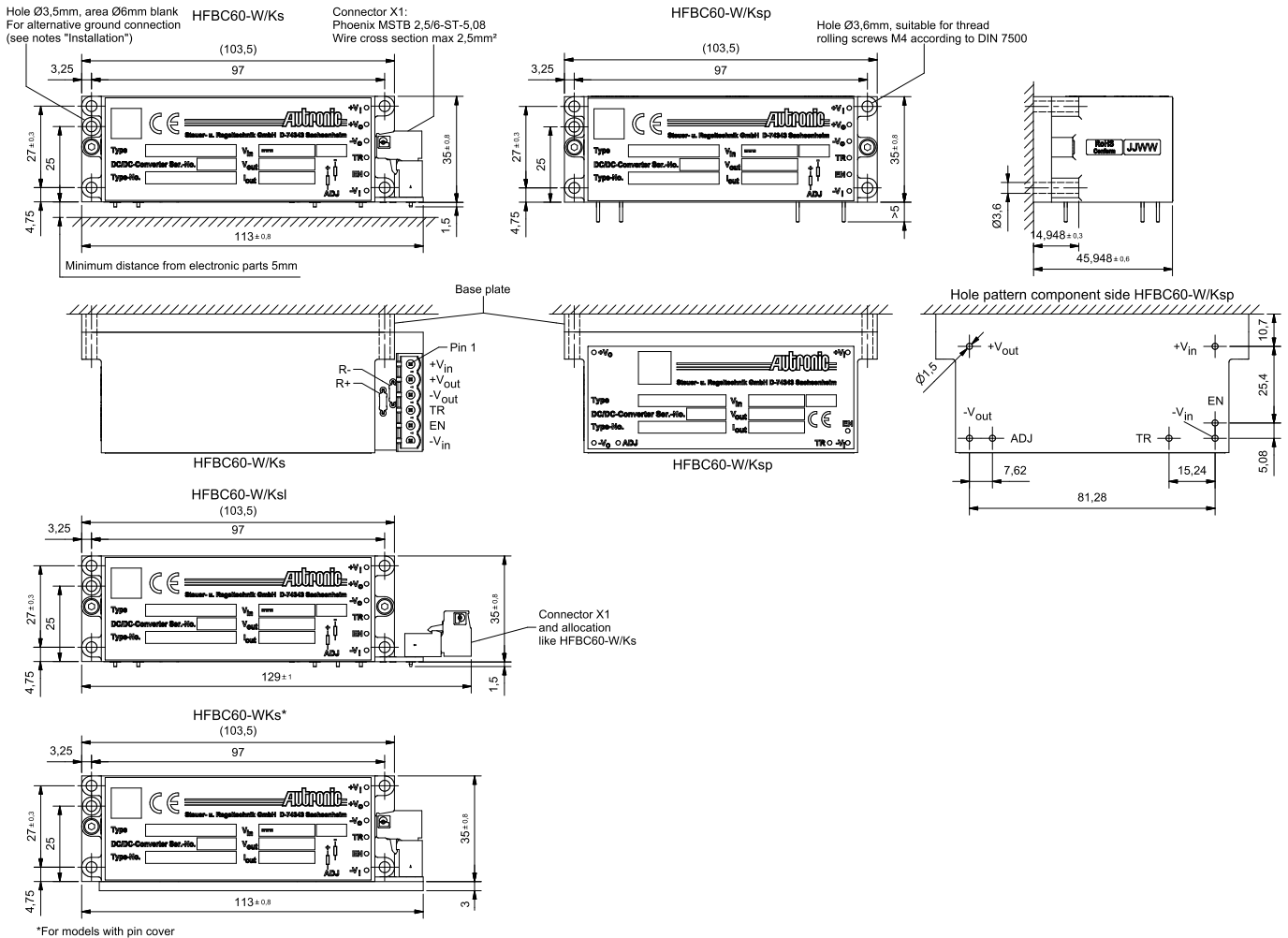
\*\*\* max. 6A, recommended : Schurter 0001.1011/00 01.1012/0001.2511 or LS circuit breaker with Z-characteristic

# TECHNICAL DATA

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

## MECHANICAL DETAILS

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



Resin compound: Polyurethane blue, UL94-V0, EN45545-2:2016-02 - HL3 (R24)

## PINNING

Pin	Function
X1-1	+V <sub>in</sub>
X1-2	+V <sub>out</sub>
X1-3	-V <sub>out</sub>
X1-4	TR
X1-5	EN
X1-6	-V <sub>in</sub>

## NOTES

Installation instructions:

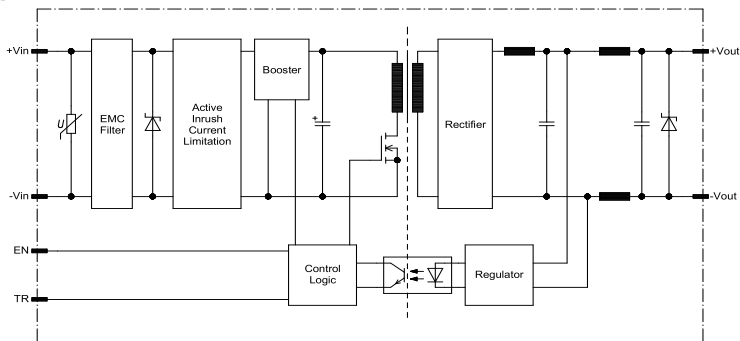
The converters have to be installed according to the guidelines currently in force, like other open electronic component assemblies. Attention must be paid to sufficient ventilation, carry off heat, fastening and protection against accidental contact. Plug in not under voltage. The base plate has to be grounded by using thread rolling screws M 4 according to DIN 7500. An alternative connection to ground can be realized by a special mounting hole, which is free of anodizing surface.

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.

# TECHNICAL DATA

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

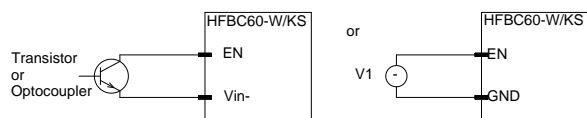
## BLOCK DIAGRAM



## ENABLE SIGNAL

The module may be disabled by pulling EN below 1,0 V with respect to the -Input.

This may be done with an open collector transistor, relay, optocoupler, or an external control voltage (V1).



Open-collector:  
Leakage current  $\leq 100\ \mu\text{A}$   
Min.  $V_{CE0} \geq 20\ \text{V}$

V1:  
3...5 V (Enable active)  
0...0,8 V (Enable inactive)

When not in use, leave Enable pin not-connected.

## ADJUST

Inserting a wire to "R+" increases the output voltage of about 8%. Intermediate values are obtained by means of a resistor. Adding a resistor for "R-" ensures that the output may be lowered by max. 8%.

When not in use, leave Adjust pin not-connected.

## TRACKING

If the TR pins of two or more converters are connected, the output voltages in case of short-circuit or overload go synchronously down.

The module may be disabled by pulling EN below 0,8 V with respect to the -Input.

This may be done with an open collector transistor, relay, optocoupler, or an external control voltage (V1).

When not in use, leave Tracking pin not-connected.

For 5,1 V output it is not allowed to use the converters in parallel.