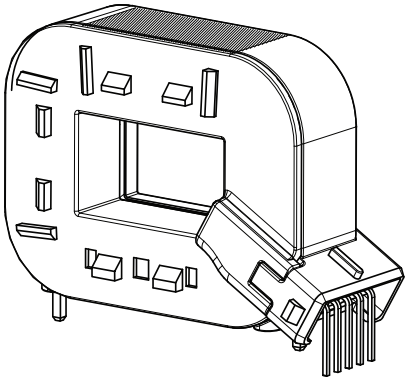
Current Transducer HOF-P/SP1 series

I_{PN} = 65 ... 700 A

Ref: HOF 65-P/SP1, HOF 120-P/SP1, HOF 150-P/SP1, HOF 180-P/SP1, HOF 200-P/SP1, HOF 220-P/SP1, HOF 300-P/SP1, HOF 350-P/SP1, HOF 500-P/SP1, HOF 700-P/SP1

For the electronic measurement of current: DC, AC, pulsed..., with galvanic separation between the primary and the secondary circuit.



Features

- Open loop multi-range current transducer
- Voltage output
- Single power supply +5 V
- Overcurrent detection 1.56 × I_{PN} (peak value)
- EEPROM Control
- Galvanic separation between primary and secondary circuit
- Low power consumption
- Compact design for THT PCB mounting
- Aperture: 10 × 16 mm
- Factory calibrated
- $U_{out} - U_{ref}$ = 1.5 V @ I_{PN}
- Sensing element protected by potting.

Special feature

- Delay time 6 µs.

Advantages

- Low offset drift
- Over-drivable U_{ref}
- 8 mm creepage/clearance
- Fast response.

Applications

- AC variable speed and servo motor drives
- Static converters for DC motor drives
- Battery supplied applications
- Uninterruptible Power Supplies (UPS)
- Switched Mode Power Supplies (SMPS)
- Power supplies for welding applications
- Combiner box
- MPPT.

Standards

- IEC 61800-3: 2004
- IEC 61800-5-1: 2007
- IEC 62109-1: 2010
- UL 508: 2013.

Application Domain

- Industrial.

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Safety

Caution

If the device is used in a way that is not specified by the manufacturer, the protection provided by the device may be compromised.
Always inspect the electronics unit and connecting cable before using this product and do not use it if damaged.
Mounting assembly shall guarantee the maximum primary conductor temperature, fulfill clearance and creepage distance, minimize electric and magnetic coupling, and unless otherwise specified can be mounted in any orientation.

Caution, risk of electrical shock

This transducer must be used in limited-energy secondary circuits SELV according to IEC 61010-1, in electric/electronic equipment with respect to applicable standards and safety requirements in accordance with the manufacturer's operating specifications.

Use caution during installation and use of this product; certain parts of the module can carry hazardous voltages and high currents (e.g. power supply, primary conductor).
Ignoring this warning can lead to injury and or/or cause serious damage.
De-energize all circuits and hazardous live parts before installing the product.
All installations, maintenance, servicing operations and use must be carried out by trained and qualified personnel practicing applicable safety precautions.

This transducer is a build-in device, whose hazardous live parts must be inaccessible after installation.
This transducer must be mounted in a suitable end-enclosure.
Besides make sure to have a distance of minimum 30 mm between the primary terminals of the transducer and other neighboring components.

Main supply must be able to be disconnected.
Always inspect the flexible probe for damage before using this product.
Never connect or disconnect the external power supply while the primary circuit is connected to live parts.
Never connect the output to any equipment with a common mode voltage to earth greater than 30 V.
Always wear protective clothing and gloves if hazardous live parts are present in the installation where the measurement is carried out.
This transducer is a built-in device, not intended to be cleaned with any product. Nevertheless if the user must implement cleaning or washing process, validation of the cleaning program has to be done by himself.
When defining soldering process, please use no cleaning process only.

ESD susceptibility
The product is susceptible to be damaged from an ESD event and the personnel should be grounded when handling it.

Do not dispose of this product as unsorted municipal waste. Contact a qualified recycler for disposal.

Underwriters Laboratory Inc. recognized component

Absolute maximum ratings

Parameter	Symbol	Unit	Value
Maximum supply voltage (not destructive)	$U_{C\ max}$	V	8
Maximum supply voltage (not entering non standard modes)	$U_{C\ max}$	V	6.5
Maximum primary conductor temperature	$T_{B\ max}$	°C	120
Electrostatic discharge voltage (HBM - Human Body Model)	$U_{ESD\ HBM}$	kV	2

Stresses above these ratings may cause permanent damage. Exposure to absolute maximum ratings for extended periods may degrade reliability.

UL 508: Ratings and assumptions of certification

File # E189713 Volume: 2 Section: 15

Standards

- CSA C22.2 NO. 14-18 INDUSTRIAL CONTROL EQUIPMENT - Edition 18
- UL 508 STANDARD FOR INDUSTRIAL CONTROL EQUIPMENT - Edition 18

Ratings

Parameter	Symbol	Unit	Value
Primary involved potential		V AC/DC	600
Ambient operating temperature	T_A	°C	105
Primary current	I_P	A	According to series primary current
Supply voltage	U_C	V DC	5
Output voltage	U_{out}	V	0 to 5

Conditions of acceptability

1 - These devices have been evaluated for overvoltage category III and for use in pollution degree 2 environment or better.

2 - A suitable enclosure shall be provided in the end-use application.

3 - The terminals have not been evaluated for field wiring.

4 - These devices are intended to be mounted on a printed wiring board of end use equipment. The suitability of the connections (including spacings) shall be determined in the end-use application.

5 - Primary terminals shall not be straightened since assembly of housing case depends upon bending of the terminals.

6 - Any surface of polymeric housing have not been evaluated as insulating barrier.

7 - Low voltage control circuit shall be supplied by an isolating source (such as a transformer, optical isolator, limiting impedance or electro-mechanical relay).

Marking

Only those products bearing the UR Mark should be considered to be Listed or Recognized and covered under UL's Follow-Up Service. Always look for the Mark on the product.

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Insulation coordination

Parameter	Symbol	Unit	Value	Comment
RMS voltage for AC insulation test, 50/60 Hz, 1 min	U_d	kV	4.3	
Impulse withstand voltage 1.2/50 µs	U_{Ni}	kV	8	
Partial discharge RMS test voltage (q_m < 10 pC)	U_t	V	1500	Busbar/secondary, jumpers/secondary
Clearance (pri. - sec.)	d_{Cl}	mm	> 8	Shortest distance through air
Creepage distance (pri. - sec.)	d_{Cp}	mm	> 8	Shortest path along device body
Clearance (pri. - sec.)	-	mm	> 8	When mounted on PCB with recommended layout
Case material	-	-	V0	According to UL 94
Comparative tracking index	CTI		600	
Application example	-	V	600	Reinforced insulation according to IEC 61800-5-1, CAT III, PD2
Application example	-	V	1000	Basic insulation according to IEC 61800-5-1, CAT III, PD2

Environmental and mechanical characteristics

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Ambient operating temperature	T_A	°C	−40		105	
Ambient storage temperature	$T_{A\,st}$	°C	−40		105	
Mass	m	g		34		

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At T_A = 25 °C, U_C = +5 V, R_L = 10 kΩ unless otherwise noted (see Min, Max, typ. definition paragraph in page 15).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal RMS current	I_{PN}	A		65		
Primary current, measuring range	I_{PM}	A	−86.7		86.7	@ U_C ≥ 4.6 V
Number of primary turns	N_P	-		1		See application information
Supply voltage	U_C	V	4.5	5	5.5	
Current consumption	I_C	mA		19	25	
Reference voltage (output)	U_{ref}	V	2.48	2.5	2.52	Internal reference
Reference voltage (input)	U_{ref}	V	0.5		2.65	External reference
Output voltage range @ I_{PM}	$U_{out} - U_{ref}$	V	−2		2	Over operating temperature range
U_{ref} output resistance	R_{ref}	Ω	130	200	300	Series
U_{out} output resistance	R_{out}	Ω		2	5	Series
Load capacitance	C_L	nF	0		6	
Hold time	t_{hold}	ms	0.7	1	1.4	Additional time after threshold has released
EEPROM control	U_{out}	mV	0		50	U_{out} forced to GND when EEPROM in an error state
Electrical offset voltage @ I_P = 0 A	U_{OE}	mV	−5		5	$U_{out} - U_{ref}$ @ U_{ref} = 2.5 V
Electrical offset current referred to primary	I_{OE}	A	−0.217		0.217	
Temperature coefficient of U_{ref}	TCU_{ref}	ppm/K	−170		170	−40 °C … 105 °C
Temperature coefficient of U_{OE}	TCU_{OE}	mV/K	−0.075		0.075	−40 °C … 105 °C
Offset drift referred to primary @ I_P = 0 A	TCI_{OE}	mA/K	−3.25		3.25	−40 °C … 105 °C
Nominal sensitivity	S_N	mV/A		23.077		1.5 V @ I_{PN}
Sensitivity error @ I_{PN}	ε_S	%	−0.5		0.5	Factory adjustment (straight busbar)
Temperature coefficient of S	TCS	ppm/K	−350		350	−40 °C … 105 °C
Linearity error 0 … I_{PN}	ε_L	% of I_{PN}	−0.75		0.75	
Linearity error 0 … I_{PM}	ε_L	% of I_{PM}	−0.75		0.75	
Magnetic offset current (@ 10 × I_{PN}) referred to primary	I_{OM}	A	−0.92		0.92	One turn
Magnetic offset current (@ I_{PN}) referred to primary	I_{OM}	A	−0.37		0.37	One turn
Delay time to 10 % of the final output value for I_{PN} step	t_{D10}	µs			4	@ 50 A/µs
Delay time to 90 % of the final output value for I_{PN} step	t_{D90}	µs			6	@ 50 A/µs
Frequency bandwidth (−3 dB)	BW	kHz		60		Small signals
Noise voltage spectral density referred to primary (100 Hz … 100 kHz)	u_{no}	µVRMS/√Hz			28	
RMS noise voltage referred to primary (DC … 10 kHz) (DC … 100 kHz) (DC … 1 MHz)	U_{no}	mVpp		11.3 28.6 41.2		
Sum of sensitivity and linearity error @ I_{PN}	ε_{SL}	% of I_{PN}	−1.5		1.5	
Sum of sensitivity and linearity error at 105° C @ I_{PN}	ε_{SL105}	% of I_{PN}	−4.7		4.7	See formula note [1]
Sum of sensitivity and linearity error at 85° C @ I_{PN}	ε_{SL85}	% of I_{PN}	−3.9		3.9	See formula note [1]

Note: [1] $\varepsilon_{SL}(T_A) = \varepsilon_{SL25} + \left(\frac{TCS}{10000} + \frac{TCI_{OE}}{1000 \times I_{PN}}\right) \times |T_A - 25|$

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At T_A = 25 °C, U_C = +5 V, R_L = 10 kΩ unless otherwise noted (see Min, Max, typ. definition paragraph in page 15).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal RMS current	I_{PN}	A		120		
Primary current, measuring range	I_{PM}	A	−160		160	@ U_C ≥ 4.6 V
Number of primary turns	N_P	-		1		See application information
Supply voltage	U_C	V	4.5	5	5.5	
Current consumption	I_C	mA		19	25	
Reference voltage (output)	U_{ref}	V	2.48	2.5	2.52	Internal reference
Reference voltage (input)	U_{ref}	V	0.5		2.65	External reference
Output voltage range @ I_{PM}	$U_{out} - U_{ref}$	V	−2		2	Over operating temperature range
U_{ref} output resistance	R_{ref}	Ω	130	200	300	Series
U_{out} output resistance	R_{out}	Ω		2	5	Series
Load capacitance	C_L	nF	0		6	
Hold time	t_{hold}	ms	0.7	1	1.4	Additional time after threshold has released
EEPROM control	U_{out}	mV	0		50	U_{out} forced to GND when EEPROM in an error state
Electrical offset voltage @ I_P = 0 A	U_{OE}	mV	−5		5	$U_{out} - U_{ref}$ @ U_{ref} = 2.5 V
Electrical offset current referred to primary	I_{OE}	A	−0.4		0.4	
Temperature coefficient of U_{ref}	TCU_{ref}	ppm/K	−170		170	−40 °C … 105 °C
Temperature coefficient of U_{OE}	TCU_{OE}	mV/K	−0.075		0.075	−40 °C … 105 °C
Offset drift referred to primary @ I_P = 0 A	TCI_{OE}	mA/K	−6		6	−40 °C … 105 °C
Nominal sensitivity	S_N	mV/A		12.5		1.5 V @ I_{PN}
Sensitivity error @ I_{PN}	ε_S	%	−0.5		0.5	Factory adjustment (straight busbar)
Temperature coefficient of S	TCS	ppm/K	−350		350	−40 °C … 105 °C
Linearity error 0 … I_{PN}	ε_L	% of I_{PN}	−0.5		0.5	
Linearity error 0 … I_{PM}	ε_L	% of I_{PM}	−0.5		0.5	
Magnetic offset current (@ 10 × I_{PN}) referred to primary	I_{OM}	A	−0.92		0.92	One turn
Magnetic offset current (@ I_{PN}) referred to primary	I_{OM}	A	−0.39		0.39	One turn
Delay time to 10 % of the final output value for I_{PN} step	t_{D10}	µs			4	@ 50 A/µs
Delay time to 90 % of the final output value for I_{PN} step	t_{D90}	µs			6	@ 50 A/µs
Frequency bandwidth (−3 dB)	BW	kHz		60		Small signals
Noise voltage spectral density referred to primary (100 Hz … 100 kHz)	u_{no}	µVRMS/√Hz			9.2	
RMS noise voltage (DC … 10 kHz) (DC … 100 kHz) (DC … 1 MHz)	U_{no}	mVpp		 5 13.8 26		
Sum of sensitivity and linearity error @ I_{PN}	ε_{SL}	% of I_{PN}	−1		1	
Sum of sensitivity and linearity error at 105° C @ I_{PN}	ε_{SL105}	% of I_{PN}	−4.2		4.2	See formula note [1]
Sum of sensitivity and linearity error at 85° C @ I_{PN}	ε_{SL85}	% of I_{PN}	−3.4		3.4	See formula note [1]

Note: [1] $\varepsilon_{SL}(T_A) = \varepsilon_{SL25} + \left(\frac{TCS}{10000} + \frac{TCI_{OE}}{1000 \times I_{PN}}\right) \times |T_A - 25|$

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At T_A = 25 °C, U_C = +5 V, R_L = 10 kΩ unless otherwise noted (see Min, Max, typ. definition paragraph in page 15).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal RMS current	I_{PN}	A		150		
Primary current, measuring range	I_{PM}	A	−200		200	@ U_C ≥ 4.6 V
Number of primary turns	N_P	-		1		See application information
Supply voltage	U_C	V	4.5	5	5.5	
Current consumption	I_C	mA		19	25	
Reference voltage (output)	U_{ref}	V	2.48	2.5	2.52	Internal reference
Reference voltage (input)	U_{ref}	V	0.5		2.65	External reference
Output voltage range @ I_{PM}	$U_{out} - U_{ref}$	V	−2		2	Over operating temperature range
U_{ref} output resistance	R_{ref}	Ω	130	200	300	Series
U_{out} output resistance	R_{out}	Ω		2	5	Series
Load capacitance	C_L	nF	0		6	
Hold time	t_{hold}	ms	0.7	1	1.4	Additional time after threshold has released
EEPROM control	U_{out}	mV	0		50	U_{out} forced to GND when EEPROM in an error state
Electrical offset voltage @ I_P = 0 A	U_{OE}	mV	−5		5	$U_{out} - U_{ref}$ @ U_{ref} = 2.5 V
Electrical offset current referred to primary	I_{OE}	A	−0.5		0.5	
Temperature coefficient of U_{ref}	TCU_{ref}	ppm/K	−170		170	−40 °C … 105 °C
Temperature coefficient of U_{OE}	TCU_{OE}	mV/K	−0.075		0.075	−40 °C … 105 °C
Offset drift referred to primary @ I_P = 0 A	TCI_{OE}	mA/K	−7.5		7.5	−40 °C … 105 °C
Nominal sensitivity	S_N	mV/A		10		1.5 V @ I_{PN}
Sensitivity error @ I_{PN}	ε_S	%	−0.5		0.5	Factory adjustment (straight busbar)
Temperature coefficient of S	TCS	ppm/K	−350		350	−40 °C … 105 °C
Linearity error 0 … I_{PN}	ε_L	% of I_{PN}	−0.5		0.5	
Linearity error 0 … I_{PM}	ε_L	% of I_{PM}	−0.5		0.5	
Magnetic offset current (@ 10 × I_{PN}) referred to primary	I_{OM}	A	−0.92		0.92	One turn
Magnetic offset current (@ I_{PN}) referred to primary	I_{OM}	A	−0.39		0.39	One turn
Delay time to 10 % of the final output value for I_{PN} step	t_{D10}	µs			4	@ 50 A/µs
Delay time to 90 % of the final output value for I_{PN} step	t_{D90}	µs			6	@ 50 A/µs
Frequency bandwidth (−3 dB)	BW	kHz		60		Small signals
Noise voltage spectral density referred to primary (100 Hz … 100 kHz)	u_{no}	µVRMS/√Hz			8.1	
RMS noise voltage (DC … 10 kHz) (DC … 100 kHz) (DC … 1 MHz)	U_{no}	mVpp		4.6 12 23		
Sum of sensitivity and linearity error @ I_{PN}	ε_{SL}	% of I_{PN}	−1		1	
Sum of sensitivity and linearity error at 105° C @ I_{PN}	ε_{SL105}	% of I_{PN}	−4.2		4.2	See formula note [1]
Sum of sensitivity and linearity error at 85° C @ I_{PN}	ε_{SL85}	% of I_{PN}	−3.4		3.4	See formula note [1]

Note: [1] $\varepsilon_{SL}(T_A) = \varepsilon_{SL25} + \left(\frac{TCS}{10000} + \frac{TCI_{OE}}{1000 \times I_{PN}}\right) \times |T_A - 25|$

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At T_A = 25 °C, U_C = +5 V, R_L = 10 kΩ unless otherwise noted (see Min, Max, typ. definition paragraph in page 15).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal RMS current	I_{PN}	A		180		
Primary current, measuring range	I_{PM}	A	−240		240	@ U_C ≥ 4.6 V
Number of primary turns	N_P	-		1		See application information
Supply voltage	U_C	V	4.5	5	5.5	
Current consumption	I_C	mA		19	25	
Reference voltage (output)	U_{ref}	V	2.48	2.5	2.52	Internal reference
Reference voltage (input)	U_{ref}	V	0.5		2.65	External reference
Output voltage range @ I_{PM}	$U_{out} - U_{ref}$	V	−2		2	Over operating temperature range
U_{ref} output resistance	R_{ref}	Ω	130	200	300	Series
U_{out} output resistance	R_{out}	Ω		2	5	Series
Load capacitance	C_L	nF	0		6	
Hold time	t_{hold}	ms	0.7	1	1.4	Additional time after threshold has released
EEPROM control	U_{out}	mV	0		50	U_{out} forced to GND when EEPROM in an error state
Electrical offset voltage @ I_P = 0 A	U_{OE}	mV	−5		5	$U_{out} - U_{ref}$ @ U_{ref} = 2.5 V
Electrical offset current referred to primary	I_{OE}	A	−0.6		0.6	
Temperature coefficient of U_{ref}	TCU_{ref}	ppm/K	−170		170	−40 °C … 105 °C
Temperature coefficient of U_{OE}	TCU_{OE}	mV/K	−0.075		0.075	−40 °C … 105 °C
Offset drift referred to primary @ I_P = 0 A	TCI_{OE}	mA/K	−9		9	−40 °C … 105 °C
Nominal sensitivity	S_N	mV/A		8.333		1.5 V @ I_{PN}
Sensitivity error @ I_{PN}	ε_S	%	−0.5		0.5	Factory adjustment (straight busbar)
Temperature coefficient of S	TCS	ppm/K	−350		350	−40 °C … 105 °C
Linearity error 0 … I_{PN}	ε_L	% of I_{PN}	−0.5		0.5	
Linearity error 0 … I_{PM}	ε_L	% of I_{PM}	−0.5		0.5	
Magnetic offset current (@ 10 × I_{PN}) referred to primary	I_{OM}	A	−0.92		0.92	One turn
Magnetic offset current (@ I_{PN}) referred to primary	I_{OM}	A	−0.40		0.40	One turn
Delay time to 10 % of the final output value for I_{PN} step	t_{D10}	µs			4	@ 50 A/µs
Delay time to 90 % of the final output value for I_{PN} step	t_{D90}	µs			6	@ 50 A/µs
Frequency bandwidth (−3 dB)	BW	kHz		60		Small signals
Noise voltage spectral density referred to primary (100 Hz … 100 kHz)	u_{no}	µVRMS/√Hz			6.7	
RMS noise voltage (DC … 10 kHz) (DC … 100 kHz) (DC … 1 MHz)	U_{no}	mVpp		4 9.9 19.2		
Sum of sensitivity and linearity error @ I_{PN}	ε_{SL}	% of I_{PN}	−1		1	
Sum of sensitivity and linearity error at 105° C @ I_{PN}	ε_{SL105}	% of I_{PN}	−4.2		4.2	See formula note [1]
Sum of sensitivity and linearity error at 85° C @ I_{PN}	ε_{SL85}	% of I_{PN}	−3.4		3.4	See formula note [1]

Note: [1] $\varepsilon_{SL}(T_A) = \varepsilon_{SL25} + \left(\frac{TCS}{10000} + \frac{TCI_{OE}}{1000 \times I_{PN}}\right) \times |T_A - 25|$

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At T_A = 25 °C, U_C = +5 V, R_L = 10 kΩ unless otherwise noted (see Min, Max, typ. definition paragraph in page 15).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal RMS current	I_{PN}	A		200		
Primary current, measuring range	I_{PM}	A	−266		266	@ U_C ≥ 4.6 V
Number of primary turns	N_P	-		1		See application information
Supply voltage	U_C	V	4.5	5	5.5	
Current consumption	I_C	mA		19	25	
Reference voltage (output)	U_{ref}	V	2.48	2.5	2.52	Internal reference
Reference voltage (input)	U_{ref}	V	0.5		2.65	External reference
Output voltage range @ I_{PM}	$U_{out} - U_{ref}$	V	−2		2	Over operating temperature range
U_{ref} output resistance	R_{ref}	Ω	130	200	300	Series
U_{out} output resistance	R_{out}	Ω		2	5	Series
Load capacitance	C_L	nF	0		6	
Hold time	t_{hold}	ms	0.7	1	1.4	Additional time after threshold has released
EEPROM control	U_{out}	mV	0		50	U_{out} forced to GND when EEPROM in an error state
Electrical offset voltage @ I_P = 0 A	U_{OE}	mV	−5		5	$U_{out} - U_{ref}$ @ U_{ref} = 2.5 V
Electrical offset current referred to primary	I_{OE}	A	−0.667		0.667	
Temperature coefficient of U_{ref}	TCU_{ref}	ppm/K	−170		170	−40 °C … 105 °C
Temperature coefficient of U_{OE}	TCU_{OE}	mV/K	−0.075		0.075	−40 °C … 105 °C
Offset drift referred to primary @ I_P = 0 A	TCI_{OE}	mA/K	−10		10	−40 °C … 105 °C
Nominal sensitivity	S_N	mV/A		7.5		1.5 V @ I_{PN}
Sensitivity error @ I_{PN}	ε_S	%	−0.5		0.5	Factory adjustment (straight busbar)
Temperature coefficient of S	TCS	ppm/K	−350		350	−40 °C … 105 °C
Linearity error 0 … I_{PN}	ε_L	% of I_{PN}	−0.5		0.5	
Linearity error 0 … I_{PM}	ε_L	% of I_{PM}	−0.5		0.5	
Magnetic offset current (@ 10 × I_{PN}) referred to primary	I_{OM}	A	−0.92		0.92	One turn
Magnetic offset current (@ I_{PN}) referred to primary	I_{OM}	A	−0.40		0.40	One turn
Delay time to 10 % of the final output value for I_{PN} step	t_{D10}	µs			4	@ 50 A/µs
Delay time to 90 % of the final output value for I_{PN} step	t_{D90}	µs			6	@ 50 A/µs
Frequency bandwidth (−3 dB)	BW	kHz		60		Small signals
Noise voltage spectral density referred to primary (100 Hz … 100 kHz)	u_{no}	µVRMS/√Hz			6	
Output noise voltage (DC … 10 kHz) (DC … 100 kHz) (DC … 1 MHz)	U_{no}	mVpp		3.5 8.7 16.9		
Sum of sensitivity and linearity error @ I_{PN}	ε_{SL}	% of I_{PN}	−1		1	
Sum of sensitivity and linearity error at 105° C @ I_{PN}	ε_{SL105}	% of I_{PN}	−4.2		4.2	See formula note [1]
Sum of sensitivity and linearity error at 85° C @ I_{PN}	ε_{SL85}	% of I_{PN}	−3.4		3.4	See formula note [1]

Note: [1] $\varepsilon_{SL}(T_A) = \varepsilon_{SL25} + \left(\frac{TCS}{10000} + \frac{TCI_{OE}}{1000 \times I_{PN}}\right) \times |T_A - 25|$

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At T_A = 25 °C, U_C = +5 V, R_L = 10 kΩ unless otherwise noted (see Min, Max, typ. definition paragraph in page 15).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal RMS current	I_{PN}	A		220		
Primary current, measuring range	I_{PM}	A	−293.3		293.3	@ U_C ≥ 4.6 V
Number of primary turns	N_P	-		1		See application information
Supply voltage	U_C	V	4.5	5	5.5	
Current consumption	I_C	mA		19	25	
Reference voltage (output)	U_{ref}	V	2.48	2.5	2.52	Internal reference
Reference voltage (input)	U_{ref}	V	0.5		2.65	External reference
Output voltage range @ I_{PM}	$U_{out} - U_{ref}$	V	−2		2	Over operating temperature range
U_{ref} output resistance	R_{ref}	Ω	130	200	300	Series
U_{out} output resistance	R_{out}	Ω		2	5	Series
Load capacitance	C_L	nF	0		6	
Hold time	t_{hold}	ms	0.7	1	1.4	Additional time after threshold has released
EEPROM control	U_{out}	mV	0		50	U_{out} forced to GND when EEPROM in an error state
Electrical offset voltage @ I_P = 0 A	U_{OE}	mV	−5		5	$U_{out} - U_{ref}$ @ U_{ref} = 2.5 V
Electrical offset current referred to primary	I_{OE}	A	−0.733		0.733	
Temperature coefficient of U_{ref}	TCU_{ref}	ppm/K	−170		170	−40 °C … 105 °C
Temperature coefficient of U_{OE}	TCU_{OE}	mV/K	−0.075		0.075	−40 °C … 105 °C
Offset drift referred to primary @ I_P = 0 A	TCI_{OE}	mA/K	−11		11	−40 °C … 105 °C
Nominal sensitivity	S_N	mV/A		6.818		1.5 V @ I_{PN}
Sensitivity error @ I_{PN}	ε_S	%	−0.5		0.5	Factory adjustment (straight busbar)
Temperature coefficient of S	TCS	ppm/K	−350		350	−40 °C … 105 °C
Linearity error 0 … I_{PN}	ε_L	% of I_{PN}	−0.5		0.5	
Linearity error 0 … I_{PM}	ε_L	% of I_{PM}	−0.5		0.5	
Magnetic offset current (@ 10 × I_{PN}) referred to primary	I_{OM}	A	−0.92		0.92	One turn
Magnetic offset current (@ I_{PN}) referred to primary	I_{OM}	A	−0.40		0.40	One turn
Delay time to 10 % of the final output value for I_{PN} step	t_{D10}	µs			4	@ 50 A/µs
Delay time to 90 % of the final output value for I_{PN} step	t_{D90}	µs			6	@ 50 A/µs
Frequency bandwidth (−3 dB)	BW	kHz		60		Small signals
Noise voltage spectral density referred to primary (100 Hz … 100 kHz)	u_{no}	µVRMS/√Hz			6	
Output noise voltage (DC … 10 kHz) (DC … 100 kHz) (DC … 1 MHz)	U_{no}	mVpp		3.5 8.7 16.9		
Sum of sensitivity and linearity error @ I_{PN}	ε_{SL}	% of I_{PN}	−1		1	
Sum of sensitivity and linearity error at 105° C @ I_{PN}	ε_{SL105}	% of I_{PN}	−4.2		4.2	See formula note [1]
Sum of sensitivity and linearity error at 85° C @ I_{PN}	ε_{SL85}	% of I_{PN}	−3.4		3.4	See formula note [1]

Note: [1] $\varepsilon_{SL}(T_A) = \varepsilon_{SL25} + \left(\frac{TCS}{10000} + \frac{TCI_{OE}}{1000 \times I_{PN}}\right) \times |T_A - 25|$

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At T_A = 25 °C, U_C = +5 V, R_L = 10 kΩ unless otherwise noted (see Min, Max, typ. definition paragraph in page 15).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal RMS current	I_{PN}	A		300		
Primary current, measuring range	I_{PM}	A	−400		400	@ U_C ≥ 4.6 V
Number of primary turns	N_P	-		1		See application information
Supply voltage	U_C	V	4.5	5	5.5	
Current consumption	I_C	mA		19	25	
Reference voltage (output)	U_{ref}	V	2.48	2.5	2.52	Internal reference
Reference voltage (input)	U_{ref}	V	0.5		2.65	External reference
Output voltage range @ I_{PM}	$U_{out} - U_{ref}$	V	−2		2	Over operating temperature range
U_{ref} output resistance	R_{ref}	Ω	130	200	300	Series
U_{out} output resistance	R_{out}	Ω		2	5	Series
Load capacitance	C_L	nF	0		6	
Hold time	t_{hold}	ms	0.7	1	1.4	Additional time after threshold has released
EEPROM control	U_{out}	mV	0		50	U_{out} forced to GND when EEPROM in an error state
Electrical offset voltage @ I_P = 0 A	U_{OE}	mV	−5		5	$U_{out} - U_{ref}$ @ U_{ref} = 2.5 V
Electrical offset current referred to primary	I_{OE}	A	−1		1	
Temperature coefficient of U_{ref}	TCU_{ref}	ppm/K	−170		170	−40 °C … 105 °C
Temperature coefficient of U_{OE}	TCU_{OE}	mV/K	−0.075		0.075	−40 °C … 105 °C
Offset drift referred to primary @ I_P = 0 A	TCI_{OE}	mA/K	−15		15	−40 °C … 105 °C
Nominal sensitivity	S_N	mV/A		5		1.5 V @ I_{PN}
Sensitivity error @ I_{PN}	ε_S	%	−0.5		0.5	Factory adjustment (straight busbar)
Temperature coefficient of S	TCS	ppm/K	−350		350	−40 °C … 105 °C
Linearity error 0 … I_{PN}	ε_L	% of I_{PN}	−0.5		0.5	
Linearity error 0 … I_{PM}	ε_L	% of I_{PM}	−0.5		0.5	
Magnetic offset current (@ 10 × I_{PN}) referred to primary	I_{OM}	A	−0.92		0.92	One turn
Magnetic offset current (@ I_{PN}) referred to primary	I_{OM}	A	−0.41		0.41	One turn
Delay time to 10 % of the final output value for I_{PN} step	t_{D10}	µs			4	@ 50 A/µs
Delay time to 90 % of the final output value for I_{PN} step	t_{D90}	µs			6	@ 50 A/µs
Frequency bandwidth (−3 dB)	BW	kHz		60		Small signals
Noise voltage spectral density referred to primary (100 Hz …100 kHz)	u_{no}	µVRMS/√Hz			4.7	
Output noise voltage (DC … 10 kHz) (DC … 100 kHz) (DC … 1 MHz)	U_{no}	mVpp		3.2 6.7 13.3		
Sum of sensitivity and linearity error @ I_{PN}	ε_{SL}	% of I_{PN}	−1		1	
Sum of sensitivity and linearity error at 105° C @ I_{PN}	ε_{SL105}	% of I_{PN}	−4.2		4.2	See formula note [1]
Sum of sensitivity and linearity error at 85° C @ I_{PN}	ε_{SL85}	% of I_{PN}	−3.4		3.4	See formula note [1]

Note: [1] $\varepsilon_{SL}(T_A) = \varepsilon_{SL25} + \left(\frac{TCS}{10000} + \frac{TCI_{OE}}{1000 \times I_{PN}}\right) \times |T_A - 25|$

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At T_A = 25 °C, U_C = +5 V, R_L = 10 kΩ unless otherwise noted (see Min, Max, typ. definition paragraph in page 15).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal RMS current	I_{PN}	A		350		
Primary current, measuring range	I_{PM}	A	−466.7		466.7	@ U_C ≥ 4.6 V
Number of primary turns	N_P	-		1		See application information
Supply voltage	U_C	V	4.5	5	5.5	
Current consumption	I_C	mA		19	25	
Reference voltage (output)	U_{ref}	V	2.48	2.5	2.52	Internal reference
Reference voltage (input)	U_{ref}	V	0.5		2.65	External reference
Output voltage range @ I_{PM}	$U_{out} - U_{ref}$	V	−2		2	Over operating temperature range
U_{ref} output resistance	R_{ref}	Ω	130	200	300	Series
U_{out} output resistance	R_{out}	Ω		2	5	Series
Load capacitance	C_L	nF	0		6	
Hold time	t_{hold}	ms	0.7	1	1.4	Additional time after threshold has released
EEPROM control	U_{out}	mV	0		50	U_{out} forced to GND when EEPROM in an error state
Electrical offset voltage @ I_P = 0 A	U_{OE}	mV	−5		5	$U_{out} - U_{ref}$ @ U_{ref} = 2.5 V
Electrical offset current referred to primary	I_{OE}	A	−1.167		1.167	
Temperature coefficient of U_{ref}	TCU_{ref}	ppm/K	−170		170	−40 °C … 105 °C
Temperature coefficient of U_{OE}	TCU_{OE}	mV/K	−0.075		0.075	−40 °C … 105 °C
Offset drift referred to primary @ I_P = 0 A	TCI_{OE}	mA/K	−17.5		17.5	−40 °C … 105 °C
Nominal sensitivity	S_N	mV/A		4.286		1.5 V @ I_{PN}
Sensitivity error @ I_{PN}	ε_S	%	−0.5		0.5	Factory adjustment (straight busbar)
Temperature coefficient of S	TCS	ppm/K	−350		350	−40 °C … 105 °C
Linearity error 0 … I_{PN}	ε_L	% of I_{PN}	−0.5		0.5	
Linearity error 0 … I_{PM}	ε_L	% of I_{PM}	−0.5		0.5	
Magnetic offset current (@ 10 × I_{PN}) referred to primary	I_{OM}	A	−0.92		0.92	One turn
Magnetic offset current (@ I_{PN}) referred to primary	I_{OM}	A	−0.41		0.41	One turn
Delay time to 10 % of the final output value for I_{PN} step	t_{D10}	µs			4	@ 50 A/µs
Delay time to 90 % of the final output value for I_{PN} step	t_{D90}	µs			6	@ 50 A/µs
Frequency bandwidth (−3 dB)	BW	kHz		60		Small signals
Noise voltage spectral density referred to primary (100 Hz …100 kHz)	u_{no}	µVRMS/√Hz			4.1	
Output noise voltage (DC … 10 kHz) (DC … 100 kHz) (DC … 1 MHz)	U_{no}	mVpp		3 5.9 11.7		
Sum of sensitivity and linearity error @ I_{PN}	ε_{SL}	% of I_{PN}	−1		1	
Sum of sensitivity and linearity error at 105° C @ I_{PN}	ε_{SL105}	% of I_{PN}	−4.2		4.2	See formula note [1]
Sum of sensitivity and linearity error at 85° C @ I_{PN}	ε_{SL85}	% of I_{PN}	−3.4		3.4	See formula note [1]

Note: [1] $\varepsilon_{SL}(T_A) = \varepsilon_{SL25} + \left(\frac{TCS}{10000} + \frac{TCI_{OE}}{1000 \times I_{PN}}\right) \times |T_A - 25|$

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Electrical data HOF 500-P/SP1

At T_A = 25 °C, U_C = +5 V, R_L = 10 kΩ unless otherwise noted (see Min, Max, typ. definition paragraph in page 15).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal RMS current	I_{PN}	A		500		
Primary current, measuring range	I_{PM}	A	−666.7		666.7	@ U_C ≥ 4.6 V
Number of primary turns	N_P	-		1		See application information
Supply voltage	U_C	V	4.5	5	5.5	
Current consumption	I_C	mA		19	25	
Reference voltage (output)	U_{ref}	V	2.48	2.5	2.52	Internal reference
Reference voltage (input)	U_{ref}	V	0.5		2.65	External reference
Output voltage range @ I_{PM}	$U_{out} - U_{ref}$	V	−2		2	Over operating temperature range
U_{ref} output resistance	R_{ref}	Ω	130	200	300	Series
U_{out} output resistance	R_{out}	Ω		2	5	Series
Load capacitance	C_L	nF	0		6	
Hold time	t_{hold}	ms	0.7	1	1.4	Additional time after threshold has released
EEPROM control	U_{out}	mV	0		50	U_{out} forced to GND when EEPROM in an error state
Electrical offset voltage @ I_P = 0 A	U_{OE}	mV	−5		5	$U_{out} - U_{ref}$ @ U_{ref} = 2.5 V
Electrical offset current referred to primary	I_{OE}	A	−1.167		1.167	
Temperature coefficient of U_{ref}	TCU_{ref}	ppm/K	−170		170	−40 °C … 105 °C
Temperature coefficient of U_{OE}	TCU_{OE}	mV/K	−0.075		0.075	−40 °C … 105 °C
Offset drift referred to primary @ I_P = 0 A	TCI_{OE}	mA/K	−25		25	−40 °C … 105 °C
Nominal sensitivity	S_N	mV/A		3		1.5 V @ I_{PN}
Sensitivity error @ I_{PN}	ε_S	%	−0.5		0.5	Factory adjustment (straight busbar)
Temperature coefficient of S	TCS	ppm/K	−350		350	−40 °C … 105 °C
Linearity error 0 … I_{PN}	ε_L	% of I_{PN}	−0.5		0.5	
Linearity error 0 … I_{PM}	ε_L	% of I_{PM}	−0.5		0.5	
Magnetic offset current (@ 10 × I_{PN}) referred to primary	I_{OM}	A	−0.92		0.92	One turn
Magnetic offset current (@ I_{PN}) referred to primary	I_{OM}	A	−0.45		0.45	One turn
Delay time to 10 % of the final output value for I_{PN} step	t_{D10}	µs			4	@ 50 A/µs
Delay time to 90 % of the final output value for I_{PN} step	t_{D90}	µs			6	@ 50 A/µs
Frequency bandwidth (−3 dB)	BW	kHz		60		Small signals
Noise voltage spectral density referred to primary (100 Hz …100 kHz)	u_{no}	µVRMS/√Hz			3.5	
Output noise voltage (DC … 10 kHz) (DC … 100 kHz) (DC … 1 MHz)	U_{no}	mVpp		2.5 5 8.7		
Sum of sensitivity and linearity error @ I_{PN}	ε_{SL}	% of I_{PN}	−1		1	
Sum of sensitivity and linearity error at 105° C @ I_{PN}	ε_{SL105}	% of I_{PN}	−4.2		4.2	See formula note [1]
Sum of sensitivity and linearity error at 85° C @ I_{PN}	ε_{SL85}	% of I_{PN}	−3.4		3.4	See formula note [1]

Note: [1] $\varepsilon_{SL}(T_A) = \varepsilon_{SL25} + \left(\frac{TCS}{10000} + \frac{TCI_{OE}}{1000 \times I_{PN}}\right) \times |T_A - 25|$

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Electrical data HOF 700-P/SP1

At T_A = 25 °C, U_C = +5 V, R_L = 10 kΩ unless otherwise noted (see Min, Max, typ. definition paragraph in page 15).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal RMS current	I_{PN}	A		700		
Primary current, measuring range	I_{PM}	A	−933.3		933.3	@ U_C ≥ 4.6 V
Number of primary turns	N_P	-		1		See application information
Supply voltage	U_C	V	4.5	5	5.5	
Current consumption	I_C	mA		19	25	
Reference voltage (output)	U_{ref}	V	2.48	2.5	2.52	Internal reference
Reference voltage (input)	U_{ref}	V	0.5		2.65	External reference
Output voltage range @ I_{PM}	$U_{out} - U_{ref}$	V	−2		2	Over operating temperature range
U_{ref} output resistance	R_{ref}	Ω	130	200	300	Series
U_{out} output resistance	R_{out}	Ω		2	5	Series
Load capacitance	C_L	nF	0		6	
Hold time	t_{hold}	ms	0.7	1	1.4	Additional time after threshold has released
EEPROM control	U_{out}	mV	0		50	U_{out} forced to GND when EEPROM in an error state
Electrical offset voltage @ I_P = 0 A	U_{OE}	mV	−5		5	$U_{out} - U_{ref}$ @ U_{ref} = 2.5 V
Electrical offset current referred to primary	I_{OE}	A	−2.333		2.333	
Temperature coefficient of U_{ref}	TCU_{ref}	ppm/K	−170		170	−40 °C … 105 °C
Temperature coefficient of U_{OE}	TCU_{OE}	mV/K	−0.075		0.075	−40 °C … 105 °C
Offset drift referred to primary @ I_P = 0 A	TCI_{OE}	mA/K	−35		35	−40 °C … 105 °C
Nominal sensitivity	S_N	mV/A		2.143		1.5 V @ I_{PN}
Sensitivity error @ I_{PN}	ε_S	%	−0.5		0.5	Factory adjustment (straight busbar)
Temperature coefficient of S	TCS	ppm/K	−350		350	−40 °C … 105 °C
Linearity error I_{PN} 0 A … 610 A 610 A … I_{PN}	ε_L	% of I_{PN}	 −0.5 −0.75		 0.5 0.75	
Linearity error I_{PM} 0 A … 610 A 610 A … 840 A 840 A … I_{PM}	ε_L	% of I_{PM}	 −0.5 −0.75 −1.75		 0.5 0.75 1.75	
Magnetic offset current (@ 10 × I_{PN}) referred to primary	I_{OM}	A	−0.92		0.92	One turn
Magnetic offset current (@ I_{PN}) referred to primary	I_{OM}	A	−0.46		0.46	One turn
Delay time to 10 % of the final output value for I_{PN} step	t_{D10}	µs			4	@ 50 A/µs
Delay time to 90 % of the final output value for I_{PN} step	t_{D90}	µs			6	@ 50 A/µs
Frequency bandwidth (−3 dB)	BW	kHz		60		Small signals
Noise voltage spectral density referred to primary (100 Hz …100 kHz)	u_{no}	µVRMS/√Hz			3.1	
Output noise voltage (DC … 10 kHz) (DC … 100 kHz) (DC … 1 MHz)	U_{no}	mVpp		 2.7 4.8 8.5		
Sum of sensitivity and linearity error @ I_{PN}	ε_{SL}	% of I_{PN}	−1		1	
Sum of sensitivity and linearity error at 105° C @ I_{PN}	ε_{SL105}	% of I_{PN}	−4.2		4.2	See formula note [1]
Sum of sensitivity and linearity error at 85° C @ I_{PN}	ε_{SL85}	% of I_{PN}	−3.4		3.4	See formula note [1]

Note: [1] $\varepsilon_{SL}(T_A) = \varepsilon_{SL25} + \left(\frac{TCS}{10000} + \frac{TCI_{OE}}{1000 \times I_{PN}}\right) \times |T_A - 25|$

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Application information

HOFxx-P/SP1 series is designed to be used with a busbar or a cable [1)] to carry the current through the aperture with a maximum cross-section of 10 × 16 mm.
The 2 pins at the bottom of the transducer should be used as mechanical fixation on the PCBA and must be kept in open circuit.

Definition of typical, minimum and maximum values

Minimum and maximum values for specified limiting and safety conditions have to be understood as such as well as values shown in “typical” graphs.
On the other hand, measured values are part of a statistical distribution that can be specified by an interval with upper and lower limits and a probability for measured values to lie within this interval.
Unless otherwise stated (e.g. “100 % tested”), the LEM definition for such intervals designated with “min” and “max” is that the probability for values of samples to lie in this interval is 99.73 %.
For a normal (Gaussian) distribution, this corresponds to an interval between −3 sigma and +3 sigma. If “typical” values are not obviously mean or average values, those values are defined to delimit intervals with a probability of 68.27 %, corresponding to an interval between −sigma and +sigma for a normal distribution.
Typical, maximal and minimal values are determined during the initial characterization of the product.

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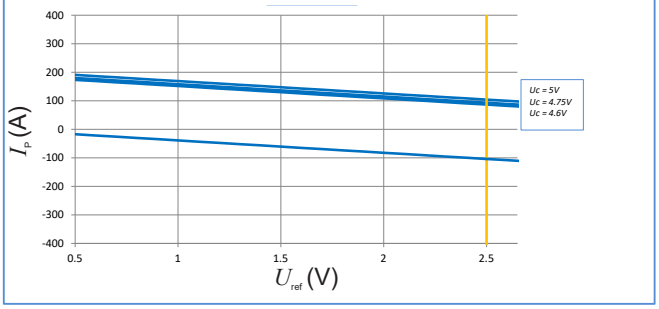
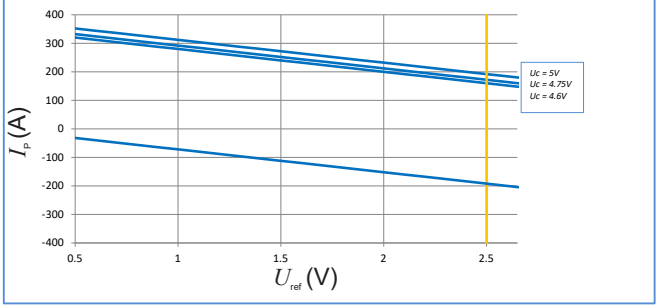
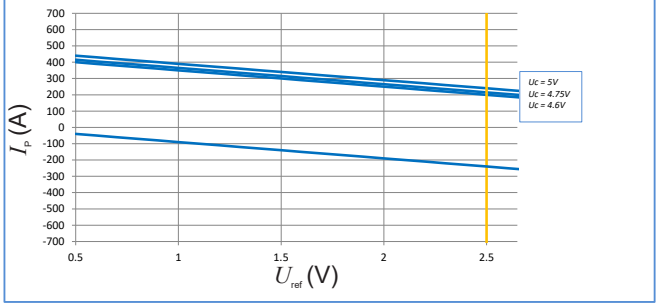
HOF 65-P/SP1



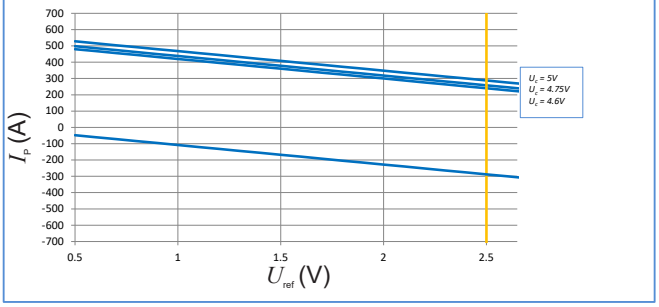
HOF 120-P/SP1



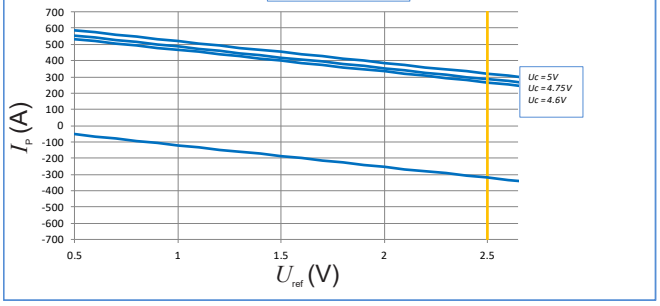
HOF 150-P/SP1



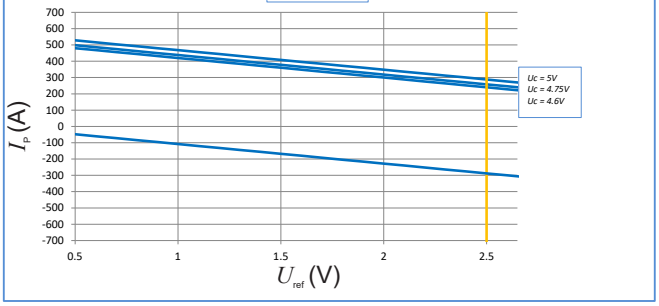
HOF 180-P/SP1



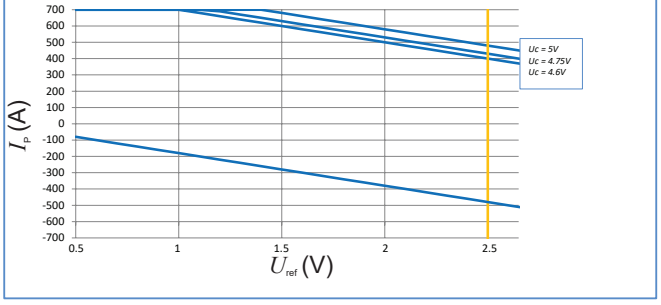
HOF 200-P/SP1



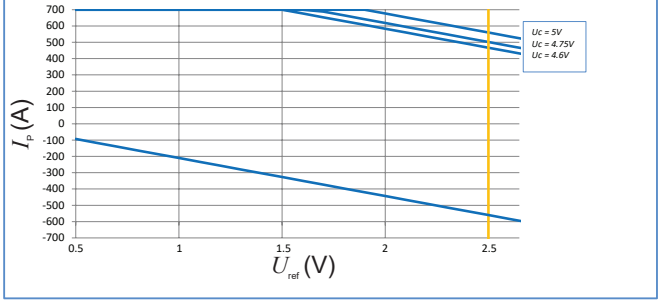
HOF 220-P/SP1



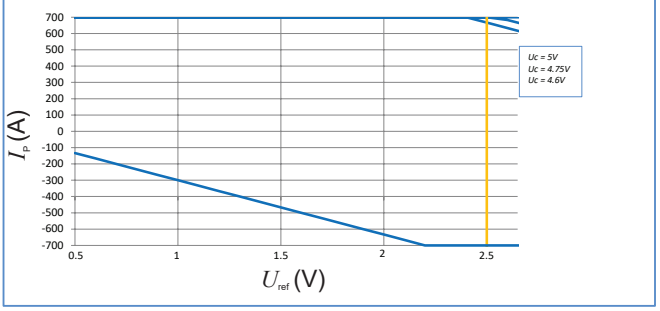
HOF 300-P/SP1



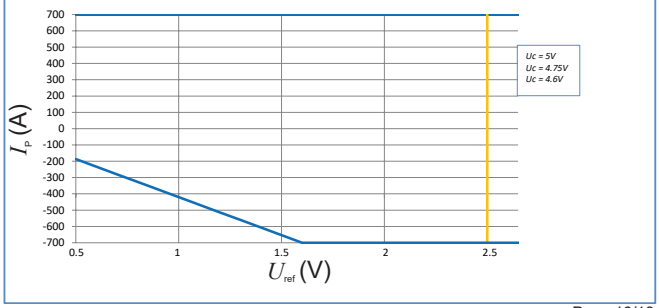
HOF 350-P/SP1



HOF 500-P/SP1



HOF 700-P/SP1



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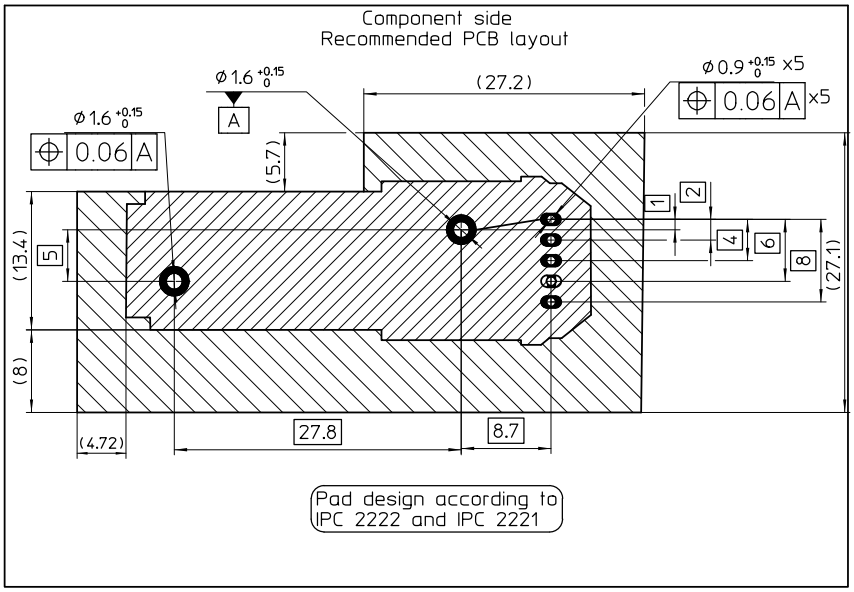
PCB Footprint in mm



No pads of primary busbar on this area for isolation

Assembly on PCB

- Recommended PCB hole diameter — 1.6 mm for mechanical fixation
  0.9 mm for secondary pin
- Maximum PCB thickness — 2.4 mm
- Wave soldering profile — maximum 260 °C, 10 s
  No clean process only

Insulation distance (nominal values):

	d_{Cp}	d_{Cl}
On PCB:	8 mm	-
Between primary busbar and secondary pin	18.1 mm	-
Between primary busbar and core	-	8.10 mm

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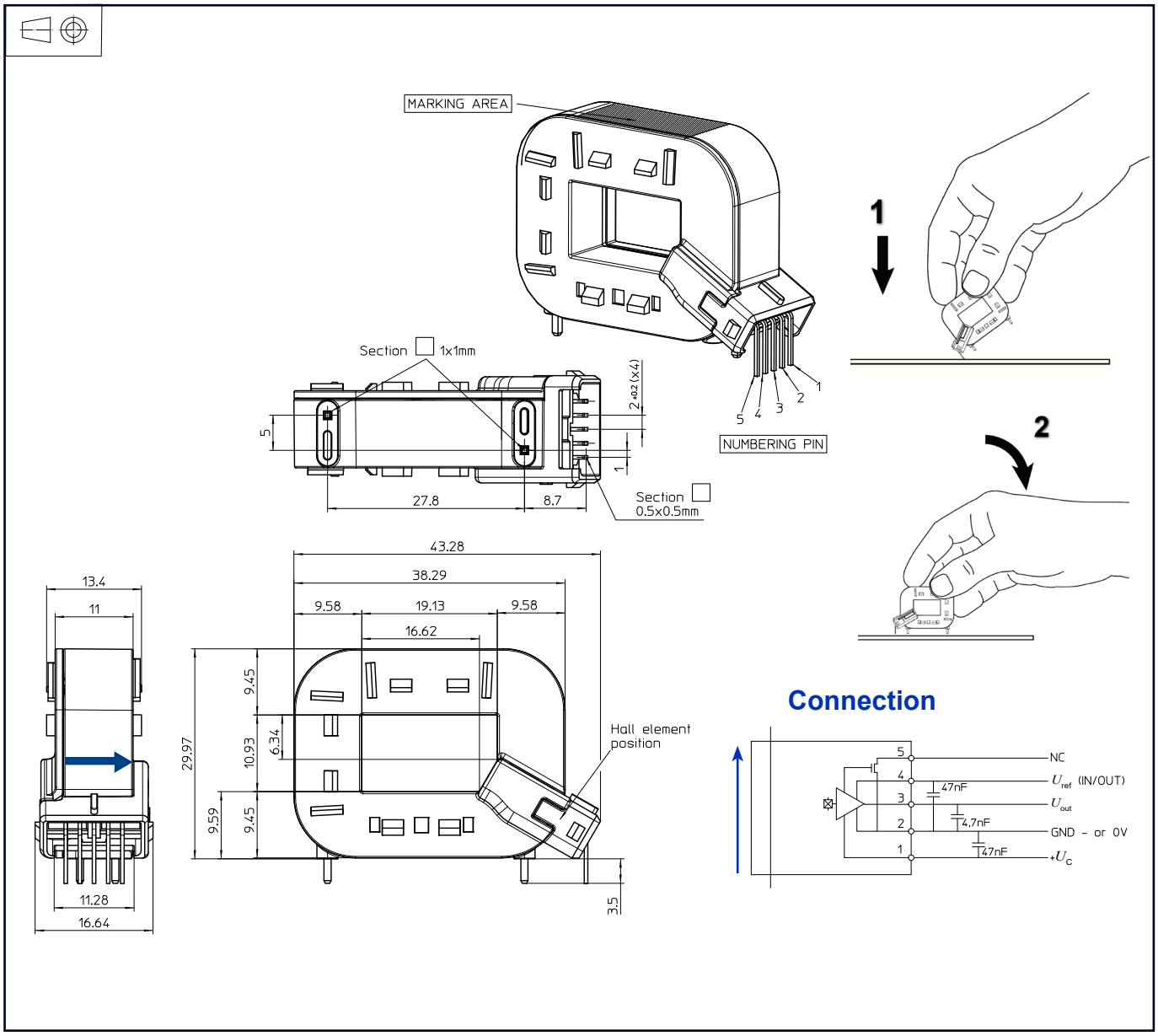
Dimensions HOF-P/SP1 series (mm, general linear tolerance ±0.3 mm)



Remark:

- U_{out} is positive with respect to U_{ref} when positive I_P flows in direction of the arrow shown on the drawing above.

Mounting recommendation:

- Recommendation for manual mounting:
  - Special care has to be taken during insertion to avaid any deformation or violent bending.
  - It is recommended to start with the insertion of the secondary pins (1).
  - Then the primary pins (2) can be aligned with their mounting holes and the insertion process be easily completed.
- Automatic insertion is not recommended for this product or may require special jigs.

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