

K-No.:27107

### 1A Differential Current Sensor for 5V Supply Voltage

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



Date: 28.06.2021

Customer: Standard type

Customers Part no:

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#### Description

- Closed loop (compensation) Current Sensor with magnetic probe
- Printed circuit board mounting
- Casing and materials UL-listed

#### Characteristics

- excellent accuracy
- very low offset current
- very low temperature dependency and offset drift
- very low hysteresis of offset current
- short response time
- wide frequency bandwidth
- compact design
- reduced offset ripple

#### Applications

- Mainly used for stationary operation in industrial applications:
- Solar inverter

#### Electrical data – Ratings

$I_{PN}$	Primary nominal RMS current	150	A
$I_{\Delta N}$	Differential rated RMS current	1.0	A
$V_{OUT}$	Output voltage @ $I_{\Delta P}$	$V_{REF} \pm (0.74 * I_{\Delta P} / I_{\Delta N})$	V
$V_{OUT(0)}^1$	Output voltage @ $I_P=0A, \theta_A=25^\circ C$	$V_{REF} \pm 0.015$	V
$V_{OUT(Error)}$	in case of error (current sensor) $V_{OUT} < 0.5V$ is set	$< 0.5$	V
$V_{REF}$	internal reference voltage	$2.5 \pm 0.005$	V
	external reference voltage range	1.4...3.5	V
$V_{REF(test\ current)}^2$	Reference voltage (external)	0 ... 0.1	V
$V_{OUT(test\ current)}^2$	Output voltage @ $V_{REF} = 0...0.1V$	$V_{OUT(0)} + 0.25 \pm 0.06$	V
$K_N$	Transformation ratio	1 : 1 : 1 : 1000	
	Turns count for test winding	20	

<sup>1</sup> with switching on and after "test current" the sensor is degaussed by an internal AC-current for about 110ms. In this time the output is set to  $V_{OUT} < 0.5V$ .

<sup>2</sup> If  $V_{REF}$  is set external to 0...0.1V an internal test current is generated.

#### Accuracy – Dynamic performance data

		min.	typ.	max.	Unit
$I_{\Delta P,max}$	Max. measuring range (differential current)	$\pm 3$			A
X	Accuracy @ $I_{PN}, \theta_A = 25^\circ C$			1.5	%
$\epsilon_L$	Linearity			1	%
$V_O (V_{OUT}-V_{REF})$	Offset voltage @ $I_P = 0A, \theta_A = 25^\circ C$	-15		15	mV
$\Delta V_O / \Delta \theta$	Temperature drift of $V_{OUT}$ @ $I_P=0A, \theta_A$		0.07		mV/°C
$t_r$	Response time @ 90% of $I_{\Delta N}$		30		$\mu s$
f	Frequency bandwidth	DC...10			kHz

#### General data

$\theta_A$	Ambient operation temperature	-40		85	°C
$\theta_S$	Ambient storage temperature (acc. to M3101)	-40		85	°C
m	Mass		175		g
$V_C$	Supply voltage	4.75	5	5.25	V
$I_C$	Supply current @ $I_P = 0A$		14		mA

<sup>1</sup> $S_{clear}$	Clearance (component without solder pad)	12			mm
<sup>1</sup> $S_{creep}$	Creepage (component without solder pad)	13			mm
<sup>1</sup> $U_{sys, re}$	System Voltage (reinforced insulation)			600	$V_{RMS}$
<sup>1</sup> $U_{work, re}$	Working voltage (reinforced insulation)			1000	$V_{RMS}$
<sup>1</sup> $U_{PD}$	Rated discharge voltage			1414	$V_{PEAK}$
<sup>1</sup> $U_{sys, basic}$	System Voltage (basic insulation)			1500	$V_{RMS}$
<sup>1</sup> $U_{work, basic}$	Working voltage (basic insulation)			2500	$V_{RMS}$

<sup>1</sup>Constructed and manufactured and tested in accordance with IEC 61800-5-1:2007  
Insulation material group 1, Pollution degree 2, Overvoltage category III

Date	Name	Issue	Change
28.06.2021	DJ	81	Further standards: UL 508, file E317483, category NMTR2 / NMTR8. And add UL sign to mechanical dimension and marking info box in datasheet. CN-21-219

Editor: R&D-PD CS	Designer: DJ	MC-PM: NSch.	Release: SB
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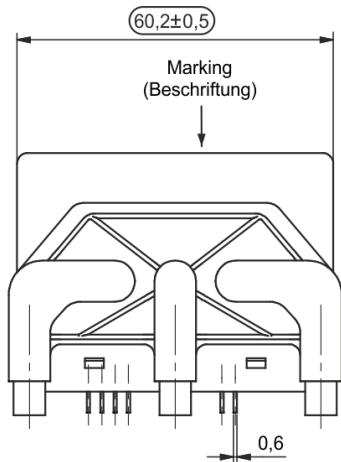
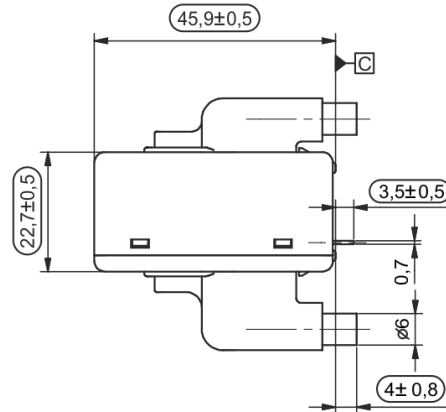
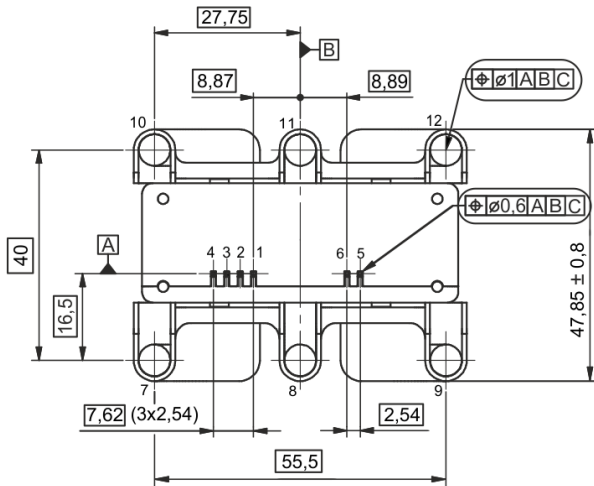
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#### Mechanical outline (mm):

General tolerances DIN ISO 2768-c



DC = Date Code    ◯ test dimension  
F = Factory

#### Connections:

1-6: 0.7 x 0.6mm  
7-12:  $\varnothing$  6mm

#### Marking:

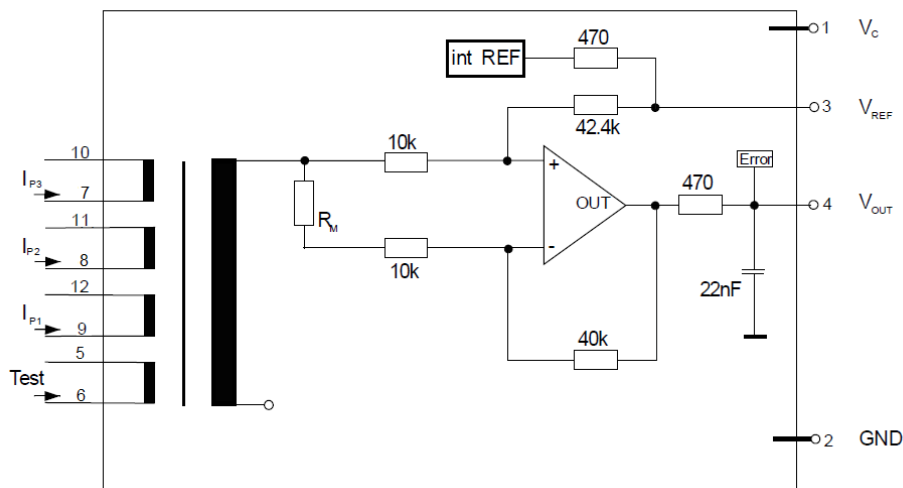


UL-sign  
4647-P983  
F DC

Format DC: YYWW

Example: 1912:  
Year 2019, Week 12

#### Schematic diagram:



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#### Electrical data: (investigate by a type checking)

		min.	typ.	max.	Unit
$V_{C,max}$	maximum supply voltage (without function)			6	V
$I_C$	Supply current with primary current	16mA + $I_{\Delta P} \cdot K_N + V_{OUT}/R_L$			mA
$I_{OUT,SC}$	Short circuit output current		$\pm 20$		mA
$R_S$	Secondary coil resistance @ $\theta_A = 85^\circ C$		55		$\Omega$
$R_P$	Resistance of primary conductor @ $\theta_A = 25^\circ C$		0.07		m $\Omega$
$R_{i,REF}$	Internal resistance of reference input		470		$\Omega$
$R_{i,OUT}$	Output resistance of $V_{OUT}$		470		$\Omega$
$\Delta X_\theta / \Delta \theta$	Temperature drift of X @ $\vartheta_A = -40^\circ C \dots 85^\circ C$			400	ppm/K
$\Delta V_{REF} / \Delta \theta$	Temperature drift of $V_{REF}$ @ $\vartheta_A = -40^\circ C \dots 85^\circ C$		5	50	ppm/K
$\Delta V_{O=}$ $\Delta (V_{OUT} - V_{REF})$	Sum of any offset drift included:		17		mV
$V_{Ot}$	Long term drift of $V_O$		7		mV
$V_{O\theta}$	Temperature drift of $V_O$ @ $\vartheta_A = -40^\circ C \dots 85^\circ C$		8		mV
$\Delta V_O / \Delta V_C$	Supply voltage rejection ratio		3.5		mV/V
$V_{OH}$	Hysteresis of $V_{OUT}$ @ $I_P = 0$ (after an overload of $800 \times I_{\Delta N}$ )		35	65	mV
$V_{OH, Demag}$	Hysteresis after Degaussing		8	25	mV
$V_{OSS}$	Offsetripple (without external filter)		180		mV <sub>PP</sub>
$V_{OSS}$	Offsetripple (with 100kHz-Filter, first order)		22		mV <sub>PP</sub>
$V_{OSS}$	Offsetripple (with 20kHz-Filter, first order)		9		mV <sub>PP</sub>
	Mechanical stress according to M3209/3 Settings: 10-2000Hz, 1min/Octave, 2 hours		2		g

#### Routine Tests: (Measurement after temperature balance of the samples at room temperature, SC=significant characteristic)

$V_{OUT} (SC)$	(100%) M3011/6:	Output voltage	729 ... 751	mV
$V_O$	(100%) M3226:	Offset voltage	15	mV
$U_d$	(100%) M3014:	Test voltage, 1s	1.8	kV <sub>RMS</sub>
$U_{PDE}$	(AQL 1/S4)	Partial discharge voltage (extinction)	1.5	kV <sub>RMS</sub>
$U_{PD} * 1.875$	M3024:		1.875	

#### Type Tests: (Precondition acc. M3236)

$\hat{U}_W$	M3064:	HV Impulse test (1.2 $\mu$ s/50 $\mu$ s wave form) 5 pulses -> polarity +, 5 pulses -> polarity -	8	kV
$U_d$	M3014:	Test voltage, 60s	3.6	kV <sub>RMS</sub>
$U_{PDE}$	M3024	Partial discharge voltage (extinction)	1.5	kV <sub>RMS</sub>
$U_{PD} * 1.875$			1.875	

#### Other instructions

- A positive output voltage appears at point  $V_{OUT}$ , if primary current flows in direction of the arrow.
- Temperature of the primary conductor should not exceed 105°C.
- Housing and bobbin material UL-listed: Flammability class 94V-0.
- Housing without red phosphorous.
- Further standards: UL 508, file E317483, category NMTR2 / NMTR8

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