

K-No.: 25256

**50 A Current Sensor Module for 5V-Sply Voltage**

 For electronic current measurement:  
 DC, AC, pulsed, mixed ...,  
 with a galvanic isolation between  
 primary circuit (high power) and  
 secondary circuit (electronic circuit)


Date: 28.10.2024

Customer: Standard type

Customers Part no.:

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**Description**

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

**Characteristics**

- Excellent accuracy
- Very low offset current
- Very low temperature dependency and offset current 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:

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

**Electrical data – Ratings**

		min.	typ.	max.	Einheit
$I_{PN}$	Primary nominal r.m.s. current		50		A
$V_{out}$	Output voltage @ $I_P$			$V_{Ref} \pm (0.625 \cdot I_P / I_{PN})$	V
$V_{out}$	Output voltage @ $I_P=0, T_A=25^\circ C$			$V_{Ref} \pm 0.0025$	V
$V_{Ref}$	Reference voltage external	0		4	V
$V_{Ref}$	Reference voltage internal			$2.5 \pm 0.005$	V
$K_N$	Turns ratio			1 : 1000	

**Accuracy – Dynamic performance data**

		min.	typ.	max.	Unit
$I_{P,max}$	Max. measuring range	$\pm 172$			
X	Accuracy @ $I_{PN}, T_A=25^\circ C$			1	%
$\varepsilon_L$	Linearity			0.1	%
$V_{out} -2,5V$	Offset voltage @ $I_P=0, T_A=25^\circ C$			$\pm 2,5$	mV
$\Delta V_{out} / 2,5V / \Delta T$	Temperature drift of $V_{out}$ @ $I_P=0, T_A=-40 \dots 85^\circ C$		3	10	ppm/K
$t_r$	Response time @ 80% von $I_{PN}$		1		$\mu s$
$\Delta t (I_{P,max})$	Delay time at $di/dt = 100 A/\mu s$		1		$\mu s$
f	Frequency bandwidth		DC...100		kHz

**General data**

		min.	typ.	max.	Unit
$T_A$	Ambient operating temperature	-40		+85	$^\circ C$
$T_S$	Ambient storage temperature	-40		+85	$^\circ C$
m	Mass		18		g
$V_C$	Supply voltage	4.75	5	5.25	V
$I_{C0}$	Current consumption		16		mA
	Constructed and manufactured and tested in accordance with EN 61800-5-1 (Primary to Secondary) Reinforced insulation, Insulation material group 1, Pollution degree 2				
$S_{clear}$	Clearance (component without solder pad)	12			mm
$S_{creep}$	Creepage (component without solder pad)	12			mm
$V_{sys}$	System voltage overvoltage category 3	RMS		600	V
$V_{work}$	Working voltage (tabel 7 acc. to EN61800-5-1) overvoltage category 2	RMS		1000	V
$U_{PD}$	Rated discharge voltage	peak value		1225	V
	Max. potential difference acc to UL 508	RMS		600	V

**Maximal continuous and peak currents at defined temperatures**

$T_A$	50 $^\circ C$	70 $^\circ C$	85 $^\circ C$	105 $^\circ C$
$I_P$	150 A	110 A	100 A	50 A
$I_{P,max}$	172 A	172 A	172 A	172 A

Date	Name	Issue	Amendment
28.10.2024	DJ	81	Missing measure added on p.2. CN-24-095
20.01.2023	DJ	81	Other instructions on sheet 4 changed. The color of the plastic material... added. Minor change

Hrsg.: R&D-PD CS editor	Bearb: DJ designer	MC-PM: FS check	freig.: SB released
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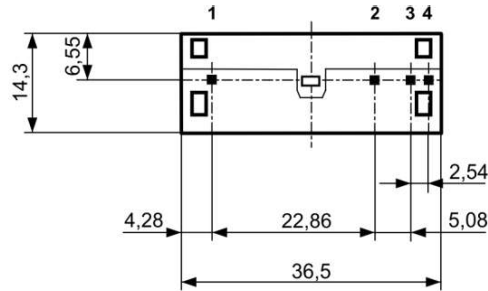
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**Mechanical outline (mm):**

General tolerances DIN ISO 2768-c

Connections:

1..4 = 0.7 x 0.7mm

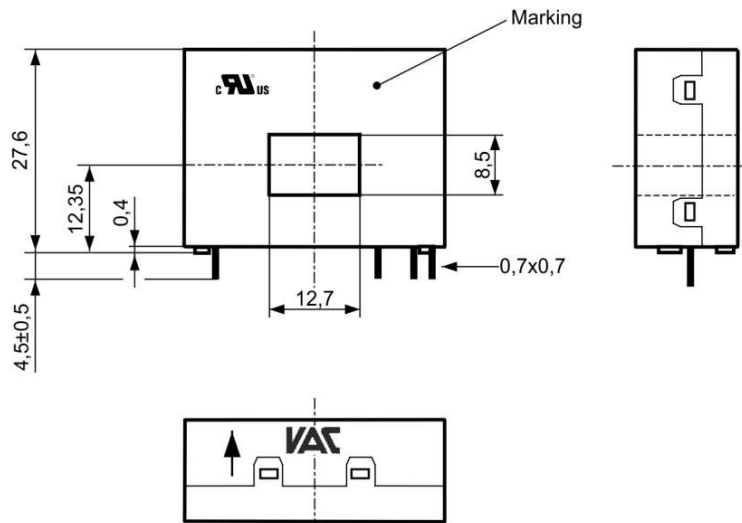


Tolerance of Pin distance  $\pm 0,2\text{mm}$

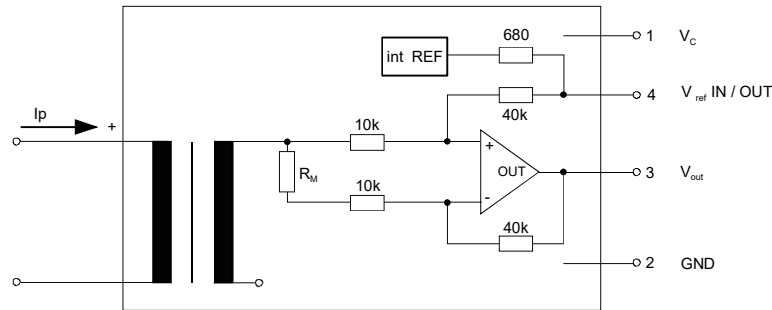
DC = Date Code  
F = Factory

Marking:

UL-sign  
4646-X161  
F DC



**Schematic diagram**



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**Electrical Data**

		min.	typ.	max.	Unit
$V_{Ctot}$	Maximum supply voltage (without function)			6	V
$I_C$	Supply Current with primary current	16mA + $I_p \cdot K_N + V_{out}/R_L$			mA
$I_{out,SC}$	Short circuit output current	±20			mA
$R_s$	Secondary coil resistance @ $T_A=85^\circ\text{C}$			14	$\Omega$
$R_{i,Ref}$	Internal resistance of Reference input	670			$\Omega$
$R_{i,(V_{out})}$	Output resistance of $V_{out}$			1	$\Omega$
$R_L$	External recommended resistance of $V_{out}$	1			k $\Omega$
$C_L$	External recommended capacitance of $V_{out}$			500	pF
$\Delta X_{Ti}/\Delta T$	Temperature drift of X @ $T_A = -40 \dots +85^\circ\text{C}$			40	ppm/K
$\Delta V_0 = \Delta(V_{out} - V_{Ref})$	Sum of any offset drift including:	2		6	mV
$V_{0t}$	Long term drift of $V_0$	1			mV
$V_{0T}$	Temperature drift von $V_0$ @ $T_A = -40 \dots +85^\circ\text{C}$	1			mV
$V_{0H}$	Hystereses of $V_{out}$ @ $I_P=0$ (after an overload of $10 \times I_{PN}$ )			1.5	mV
$\Delta V_0/\Delta V_C$	Supply voltage rejection ratio			1	mV/V
$V_{oss}$	Offsetripple (with 1 MHz- filter first order)			25	mV
$V_{oss}$	Offsetripple (with 100 kHz- filter first order)	2.5		6	mV
$V_{oss}$	Offsetripple (with 20 kHz- filter first order)	0.7		1.5	mV
$C_k$	Maximum possible coupling capacity (primary – secondary)	6			pF

Mechanical stress according to M3209/3  
 Settings: 10 – 2000 Hz, 1 min/Oktave, 2 hours

**Inspection** (Measurement after temperature balance of the samples at room temperature)

$V_{out}(I_P=I_{PN})$ (V)	M3011/6:	Output voltage vs. internal reference ( $I_P=50\text{A}$ , 40-80Hz)	625±1%	mV
$V_{out}-V_{Ref}(I_P=0)$ (V)	M3226:	Offset voltage	± 0.0025	V
$V_d$ (V)	M3014:	Test voltage, RMS, 1 s pin 1-4 to inner hole	1.8	kV
$V_e$ (AQL 1/S4)		Partial discharge voltage acc.M3024 (RMS) with $V_{vor}$ (RMS)	1300 1625	V V

**Type Testing** (Pin 1-4 to inner hole)

Designed according standard EN 50178 with insulation material group 1

$V_W$	HV transient test according to M3064 (1,2 $\mu\text{s}$ / 50 $\mu\text{s}$ -wave form)	8	kV
$V_d$	Testing voltage to M3014	(5 s)	3.6 kV
$V_e$	Partial discharge voltage acc.M3024 (RMS) with $V_{vor}$ (RMS)	1300 1625	V V

**Other instructions**

- Current direction: A positive output current appears at point  $I_s$ , by primary current in direction of the arrow.
- Enclosures according to IEC529: IP50.
- Temperature of the primary conductor should not exceed  $105^\circ\text{C}$
- Further standards UL 508, file E317483, category NMTR2 / NMTR8
- The color of the plastic material is not specified and the current sensor can be supplied in different colors (e.g. brown, black, white, natural). This has no effect on the specifications or UL approval

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**Explanation of several of the terms used in the tablets (in alphabetical order)**

**t<sub>r</sub>:** Response time (describe the dynamic performance for the specified measurement range), measured as delay time at  $I_P = 0.8 \cdot I_{PN}$  between a rectangular current and the output voltage  $V_{out}(I_P)$

**Δt (I<sub>Pmax</sub>):** Delay time (describe the dynamic performance for the rapid current pulse rate e.g short circuit current) measured between  $I_{Pmax}$  and the output voltage  $V_{out}(I_{Pmax})$  with a primary current rise of  $di_P/dt \geq 100 A/\mu s$ .

**U<sub>PD</sub>** Rated discharge voltage (recurring peak voltage separated by the insulation) proved with a sinusoidal voltage  $V_e$   
 $U_{PD} = \sqrt{2} \cdot V_e / 1.5$

**V<sub>vor</sub>** Defined voltage is the RMS value of a sinusoidal voltage with peak value of  $1.875 \cdot U_{PD}$  required for partial discharge test in IEC 61800-5-1  
 $V_{vor} = 1.875 \cdot U_{PD} / \sqrt{2}$

**V<sub>sys</sub>** System voltage RMS value of rated voltage according to IEC 61800-5-1

**V<sub>work</sub>** Working voltage voltage according to IEC 61800-5-1 which occurs by design in a circuit or across insulation

**V<sub>0</sub>:** Offset voltage between  $V_{out}$  and the rated reference voltage of  $V_{ref} = 2.5V$ .  
 $V_0 = V_{out}(0) - 2.5V$

**V<sub>0H</sub>:** Zero variation of  $V_0$  after overloading with a DC of tenfold the rated value

**V<sub>0t</sub>:** Long term drift of  $V_0$  after 100 temperature cycles in the range -40 bis 85 °C.

**X:** Permissible measurement error in the final inspection at RT, defined by

$$X = 100 \cdot \left| \frac{V_{out}(I_{PN}) - V_{out}(0)}{0,625V} - 1 \right| \%$$

**X<sub>ges</sub>(I<sub>PN</sub>):** Permissible measurement error including any drifts over the temperature range by the current measurement  $I_{PN}$

$$X_{ges} = 100 \cdot \left| \frac{V_{out}(I_{PN}) - 2,5V}{0,625V} - 1 \right| \% \quad \text{or} \quad X_{ges} = 100 \cdot \left| \frac{V_{out}(I_{PN}) - V_{ref}}{0,625V} - 1 \right| \%$$

**ε<sub>L</sub>:** Linearity fault defined by  $\epsilon_L = 100 \cdot \left| \frac{I_P}{I_{PN}} - \frac{V_{out}(I_P) - V_{out}(0)}{V_{out}(I_{PN}) - V_{out}(0)} \right| \%$

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