

K-No.: 25440

**100 A Current Sensor**

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

Date: 20.01.2023

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
- Uninterruptable Power Supplies (UPS)

**Electrical data – Ratings**

$I_{PN}$	Primary nominal r.m.s. current	100	A
$R_M$	Measuring resistance $V_C = \pm 12V$	0 ... 200	$\Omega$
	$V_C = \pm 15V$	5 ... 400	$\Omega$
$I_{SN}$	Secondary nominal r.m.s. current	50	mA
$K_N$	Turns ratio	1:2000	

**Accuracy – Dynamic performance data**

		min.	typ.	max.	Unit
$I_{P,max}$	Max. measuring range				
	@ $V_C = \pm 12V, R_M = 5 \Omega (t_{max} = 10sec)$	$\pm 188$			A
	@ $V_C = \pm 15V, R_M = 5 \Omega (t_{max} = 10sec)$	$\pm 236$			A
X	Accuracy @ $I_{PN}, T_A = 25^\circ C$		0.1	0.5	%
$\epsilon_L$	Linearity			0.1	%
$I_0$	Offset current @ $I_P = 0, T_A = 25^\circ C$		0.02	0.05	mA
$t_r$	Response time		1		$\mu s$
$\Delta t (I_{P,max})$	Delay time at $di/dt = 100 A/\mu s$		200		ns
f	Frequency bandwidth	DC...200			kHz

**General data**

		min.	typ.	max.	Unit
$T_A$	Ambient operating temperature	-40		+85	$^\circ C$
$T_S$	Ambient storage temperature	-40		+90	$^\circ C$
m	Mass		15		g
$V_C$	Supply voltage	$\pm 11.4$	$\pm 12$ or $\pm 15$	$\pm 15.75$	V
$I_C$	Current consumption		18		mA
	Constructed and manufactured and tested in accordance with EN 61800-5-1 (primary vs. 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 (table 7 acc. to EN61800-5-1) over voltage category 2	RMS		1000	V
$U_{PD}$	Rated discharge voltage	peak value		1225	V
	Max. potential difference acc. to UL 508	RMS		600	$V_{AC}$

**Maximale Dauer- und Spitzenströme bei bestimmten Temperaturen**

 Supply voltage  $\pm 12V$ :

$T_A$	85 $^\circ C$	85 $^\circ C$	70 $^\circ C$	55 $^\circ C$
$I_P$	100 A	125 A	150 A	150 A
$I_{P,max}$	188 A	183 A	185 A	194 A
$R_M$	5 $\Omega$	5 $\Omega$	5 $\Omega$	5 $\Omega$

 Supply voltage  $\pm 15V$ :

$T_A$	85 $^\circ C$	85 $^\circ C$	70 $^\circ C$	55 $^\circ C$
$I_P$	100 A	125 A	150 A	150 A
$I_{P,max}$	236 A	204 A	232 A	244 A
$R_M$	5 $\Omega$	20 $\Omega$	5 $\Omega$	5 $\Omega$

Date	Name	Issue	Amendment
20.01.2023	DJ	81	Other instructions on sheet 4 changed. The color of the plastic material... added. Minor change
17.04.13	KRe.	81	Mechanical outline: marking with UL-sign and max. potential difference acc. to UL 508 added. CN-651

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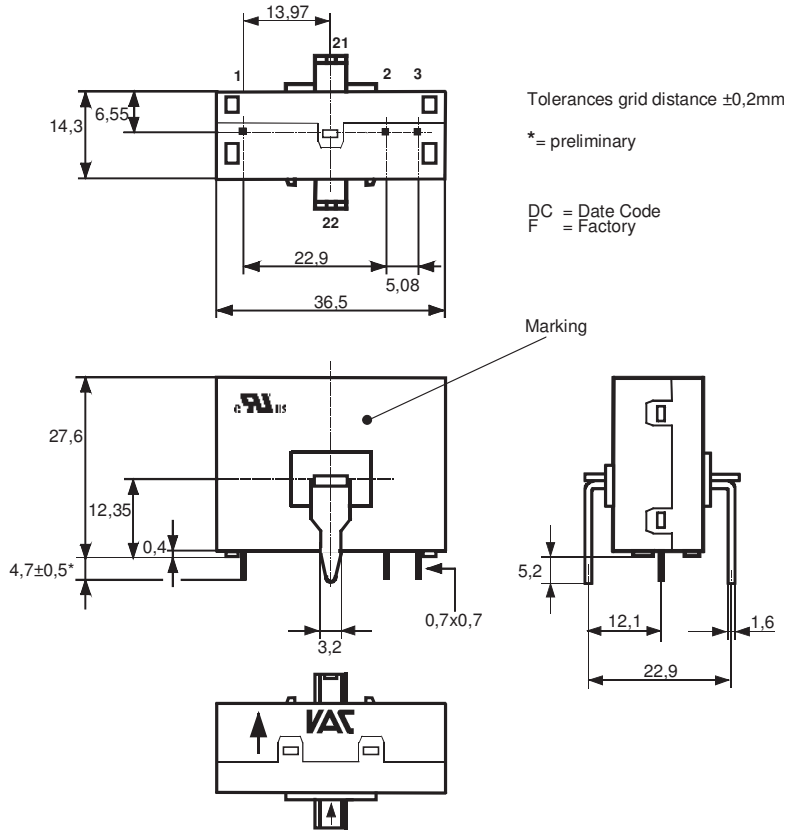
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**Mechanical outline (mm):**

General tolerances DIN ISO 2768-c



Connections:

1...3: 0,7 x 0,7 mm

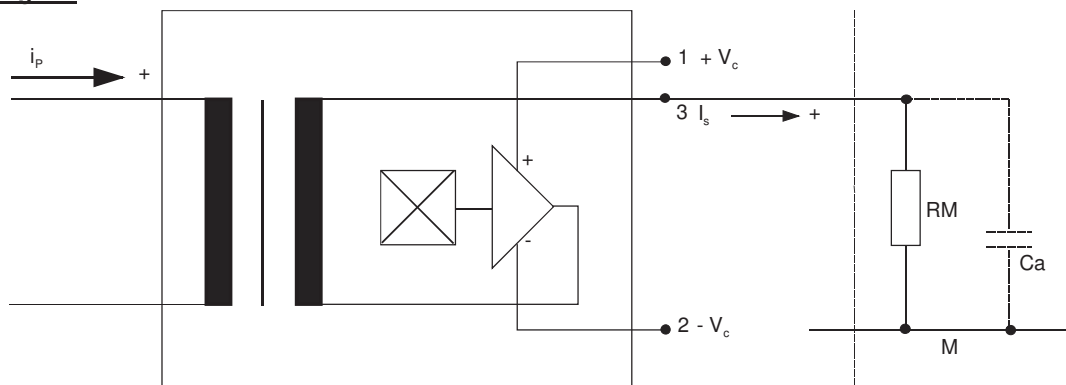
Marking:

UL-sign  
4646-X111  
F DC

Explanation:

DC = Date Code [Format YWW]

**Schematic diagram**



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**Electrical Data (investigate by a type checking)**

		min.	typ.	max.	Unit
$V_{Ctot}$	Maximum supply voltage (without function) $\pm 15.75$ to $\pm 18$ V: for 1s per hour			$\pm 18$	V
$R_S$	Secondary coil resistance @ $T_A=85^\circ\text{C}$			114	$\Omega$
$R_P$	Primary resistance @ $T_A=25^\circ\text{C}$		0,1		m $\Omega$
$X_{Ti}$	Temperature drift of X @ $T_A = -40 \dots +85^\circ\text{C}$			0.1	%
$I_{0ges}$	Offset current (including $I_0$ , $I_{0t}$ , $I_{0T}$ )			0.07	mA
$I_{0t}$	Long term drift Offset current $I_0$		0.025		mA
$I_{0T}$	Offset current temperature drift $I_0$ @ $T_A = -40 \dots +85^\circ\text{C}$		0.025		mA
$I_{0H}$	Hysteresis current @ $I_P=0$ (caused by primary current $10 \times I_{PN}$ )		0.025	0.05	mA
$\Delta I_0/\Delta V_C$	Supply voltage rejection ratio			0.01	mA/V
$i_{0ss}$	Offset ripple (with 1 MHz- filter first order)			0,17	mA
$i_{0ss}$	Offset ripple (with 100 kHz- filter first order)		0.025	0.05	mA
$i_{0ss}$	Offset ripple (with 20 kHz- filter first order)		0.008	0.013	mA
$C_k$	Maximum possible coupling capacity (primary – secondary)			6	pF

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

$K_N(N_1/N_2)$	(V)	M3011/6	Transformation ratio ( $I_P=100\text{A}$ , 40-80 Hz)	$1 : 2000 \pm 0,5$	%
$I_0$	(V)	M3226	Offset current	$< 0.05$	mA
$V_d$	(V)	M3014:	Test voltage, rms, 1 s pin 1 – 3 vs. 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 - 3 to hole)

$V_W$			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

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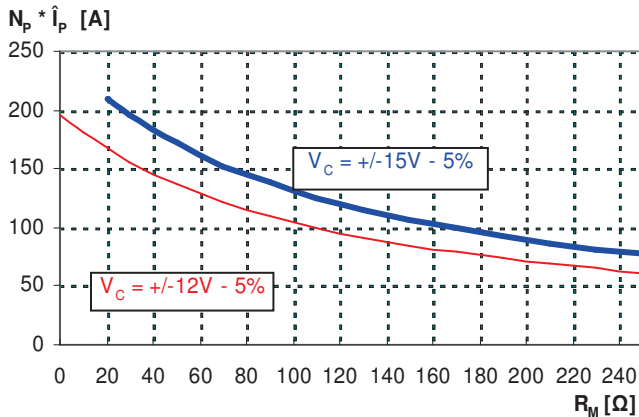
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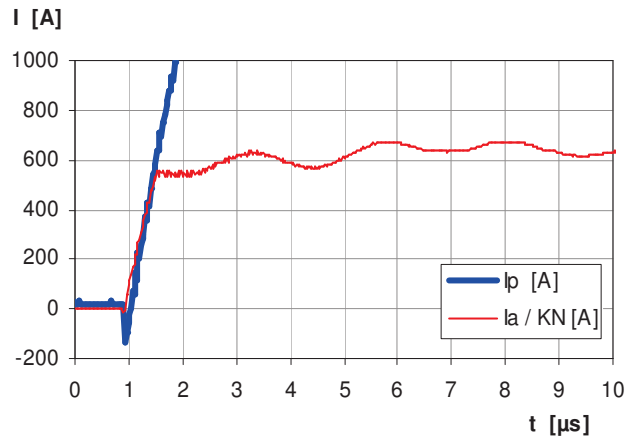
**Limit curve of measurable current  $\hat{I}_p(R_M)$**

@ ambient temperature  $\leq 85^\circ\text{C}$



**Maximum measuring range ( $\mu\text{s}$ -range)**

Output current behaviour of a 3kA current pulse  
@  $V_C = \pm 15\text{V}$  und  $R_M = 100\Omega$



Fast increasing currents (higher than the specified  $I_{p,max}$ ), e.g. in case of a short circuit, can be transmitted because the currents are transformed directly and be limited by diodes only.

The offset ripple can be reduced by an external low pass. Simplest solution is a passive low pass filter of 1st order with

$$f_s = \frac{1}{2\pi \cdot R_M \cdot C_a}$$

In this case the response time is enlarged.  
It is calculated from:

$$t'_r \leq t_r + 2,5R_M C_a$$

**Other instructions**

- Current direction: A positive output current appears at point  $I_s$ , by primary current in direction of the arrow.
- Further standards UL 508, file E317483, category NMTR2 / NMTR8
- Temperature of the primary conductor should not exceed  $105^\circ\text{C}$
- 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)**

- $I_{0H}$ : Zero variation after overloading with a DC of tenfold the rated value ( $R_M = R_{MN}$ )
- $I_{0t}$ : Long term drift of  $I_0$  after 100 temperature cycles in the range -40 bis 85 °C.
- $t_r$ : Response time, measured as delay time at  $I_P = 0,8 \cdot I_{Pmax}$  between a rectangular current and the output current.
- $\Delta t (I_{Pmax})$ : Delay time between  $I_{Pmax}$  and the output current  $i_a$  with a primary current rise of  $di_1/dt = 100 \text{ A}/\mu\text{s}$ .
- $U_{PD}$ : Rated discharge voltage (recurring peak voltage separated by the insulation) proved with a sinusoidal voltage  $V_e$   
 $U_{PD} = \sqrt{2} \cdot V_e / 1,5$
- $V_{vor}$ : 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  
 $V_{vor} = 1,875 \cdot U_{PD} / \sqrt{2}$
- $V_{sys}$ : System voltage RMS value of rated voltage according to IEC 61800-5-1
- $V_{work}$ : Working voltage voltage according to IEC 61800-5-1 which occurs by design in a circuit or across insulation
- $X_{ges}(I_{PN})$ : The sum of all possible errors over the temperature range by measuring a current  $I_{PN}$ :  

$$X_{ges} = 100 \cdot \left| \frac{I_S(I_{PN})}{K_N \cdot I_{SN}} - 1 \right|$$
- $X$ : Permissible measurement error in the final inspection at RT, defined by  

$$X = 100 \cdot \left| \frac{I_{SB}}{I_{SN}} - 1 \right|$$

where  $I_{SB}$  is the output DC value of an input DC current of the same magnitude as the (positive) rated current ( $I_0 = 0$ )
- $X_{Ti}$ : Temperature drift of the rated value orientated output term.  $I_{SN}$  (cf. Notes on  $F_i$ ) in a specified temperature range, obtained by:  

$$X_{Ti} = 100 \cdot \left| \frac{I_{SB}(T_{A2}) - I_{SB}(T_{A1})}{I_{SN}} \right|$$
- $\epsilon_L$ : Linearity fault defined by  $\epsilon_L = 100 \cdot \left| \frac{I_P}{I_{PN}} - \frac{I_{Sx}}{I_{SN}} \right|$   

Where  $I_P$  is any input DC and  $I_{Sx}$  the corresponding output term.  $I_{SN}$ : see notes of  $F_i$  ( $I_0 = 0$ ).

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