

K-No.: 24958

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: 16.06.2009

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	Ω
	$V_C = \pm 15V$	5 ... 400	Ω
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				
	@ $V_C = \pm 12V$, $R_M = 5 \Omega$ ($t_{max} = 10sec$)	± 188			A
	@ $V_C = \pm 15V$, $R_M = 5 \Omega$ ($t_{max} = 10sec$)	± 236			A
X	Accuracy @ I_{PN} , $T_A = 25^\circ C$		0.1	0.5	%
ϵ_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		μs
$\Delta t (I_{P,max})$	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	± 11.4	± 12 or ± 15	± 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	over voltage category 3		600	V
V_{work}	Working voltage	(table 7 acc. to EN61800-5-1) over voltage category 2		1000	V
U_{PD}	Rated discharge voltage	peak value		1225	V

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 Ω	5 Ω	5 Ω	5 Ω

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 Ω	20 Ω	5 Ω	5 Ω

Date	Name	Issue	Amendment
16.06.09	Le	81	Write error: Accuracy – Dynamic performance data, $I_{P,max}$ changed.
Hrsg.: KB-E editor	Bearb.: Le designer		KB-PM IA: KRe. check
			freig.: prs. released

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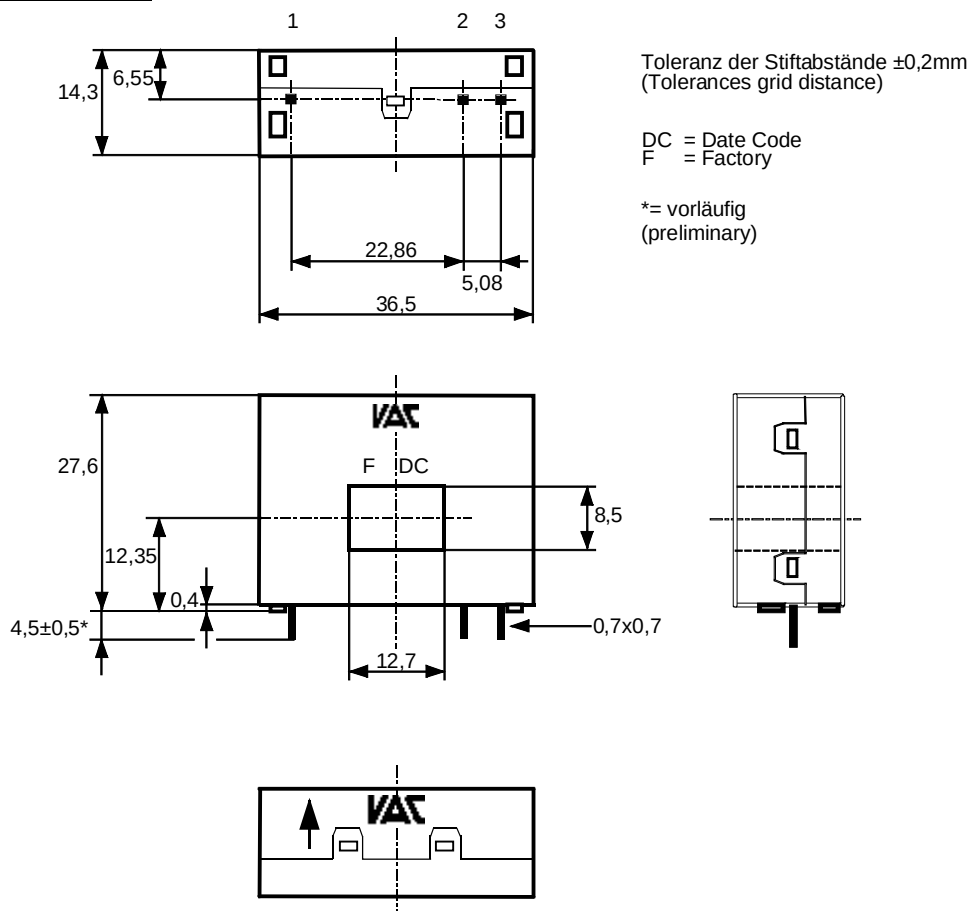
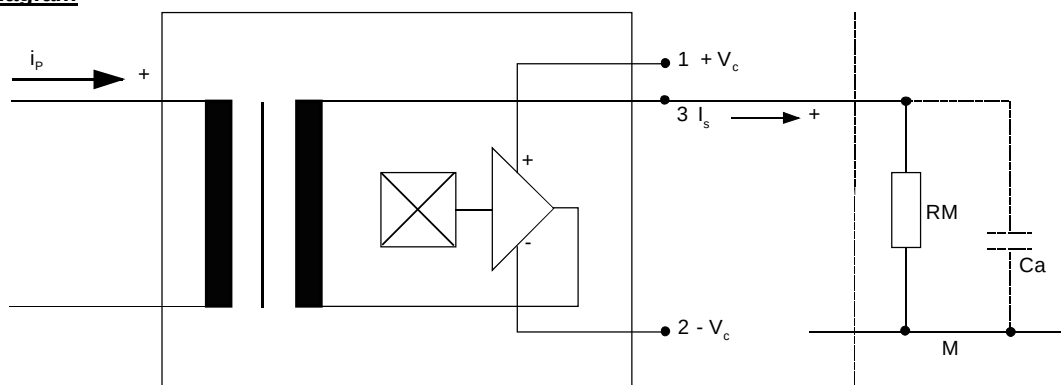
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Mechanical outline (mm):

General tolerances DIN ISO 2768-c


Schematic diagram

 Temperature of the primary conductor should not exceed 110°C
 Additional indications are obtainable on request.
 This specification is no declaration of warranty acc. BGB §443 dar.

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Electrical Data (investigate by a type checking)

		min.	typ.	max.	Unit
V_{Ctot}	Maximum supply voltage (without function) ± 15.75 to ± 18 V: for 1s per hour			± 18	V
R_S	Secondary coil resistance @ $T_A = 85^\circ\text{C}$			114	Ω
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_{loss}	Offset ripple (with 1 MHz- filter first order)			0,17	mA
i_{loss}	Offset ripple (with 100 kHz- filter first order)		0.025	0.05	mA
i_{loss}	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 μs / 50 μs -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

Datum	Name	Index	Änderung	Hrsg.: KB-E	Bearb: Le	KB-PM IA: KRe.	freig.: prs.
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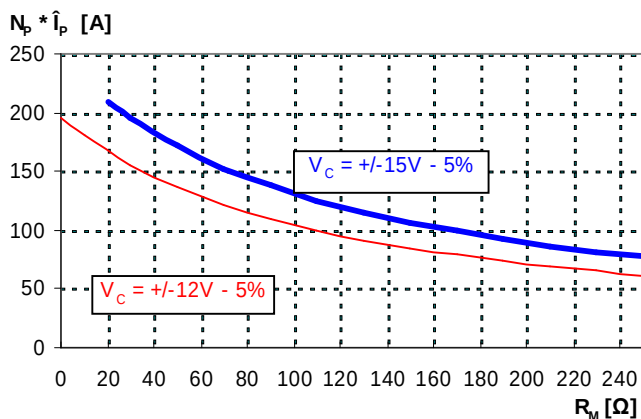
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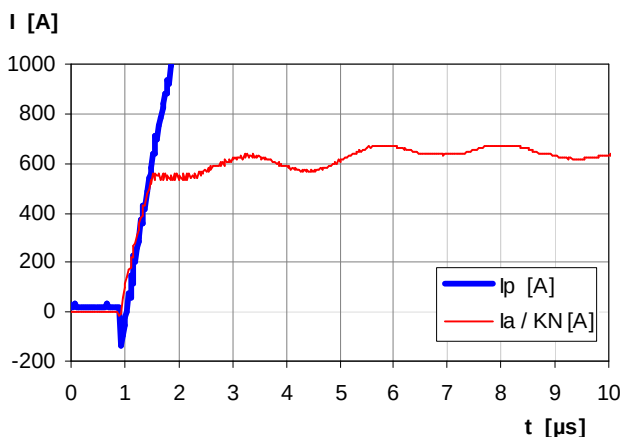
Limit curve of measurable current $\hat{I}_p(R_M)$

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



Maximum measuring range (μs-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

$$f_g = \frac{1}{2p \cdot R_M \cdot C_a}$$

In this case the response time is enlarged.

It is calculated from:

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

Applicable documents

Current direction: A positive output current appears at point I_s , by primary current in direction of the arrow.

Housing and bobbin material UL-listed: Flammability class 94V-0.

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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:

$$X_{Ti} = 100 \cdot \left| \frac{I_{SB}(T_{A2}) - I_{SB}(T_{A1})}{I_{SN}} \right|$$

ϵ_L : Linearity fault defined by $e_L = 100 \cdot \left| \frac{I_P}{I_{PN}} - \frac{I_{Sx}}{I_{SN}} \right|$

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

This "Additional information" is no declaration of warranty according BGB §443.

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