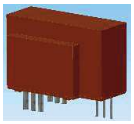
K-No.: 24578

25 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: 20.01.2022

Customer: Standard type | Customers Part no.: |

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
- Low 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	25	A
R_M	Measuring resistance V_C=± 12V	10 ... 200	Ω
	V_C=± 15V	22 … 400	Ω
I_{SN}	Secondary nominal r.m.s. current	25	mA
K_N	Turns ratio	1…3 : 1000	

Accuracy – Dynamic performance data

		min.	typ.	max.	Unit
$I_{P,max}$	Max. measuring range				
	@ V_C = ±12V, R_M = 10 Ω (t_{max} = 10sec)	±120			A
	@ V_C = ±15V, R_M = 22 Ω (t_{max} = 10sec)	±130			A
X	Accuracy @ I_{PN}, θ_A = 25°C		0.1	0.5	%
ε_L	Linearity			0.1	%
I_0	Offset current @ I_P=0A, θ_A = 25°C		0.02	0.1	mA
t_r	Response time		500		ns
t_{ra}	Reaction time at di/dt = 100 A/µs		200		ns
f_{BW}	Frequency bandwidth	DC...200			kHz

General data

		min.	typ.	max.	Unit
ϑ_A	Ambient operating temperature	-40		+85	°C
ϑ_S	Ambient storage temperature	-40		+90	°C
m	Mass		12		g
V_C	Supply voltage	±11.4	±12 or ±15	±15.75	V
I_C	Current consumption		18,5		mA
*S_{clear}	clearance (component without solder pad)	10.2			mm
*S_{creep}	creepage (component without solder pad)	10.2			mm
*U_{sys}	System voltage			600	V_{RMS}
*U_{AC}	Working voltage			1020	V_{RMS}
*U_{PD}	Rated discharge voltage			1400	V_S
	Max. potential difference acc. to UL 508			600	V_{AC}

*Constructed and manufactored and tested in accordance with EN 61800-5-1:2007 (Pin 1 - 6 to Pin 7 – 9)
Reinforced insulation, Insulation material group 1, Pollution degree 2, overvoltage category 3

Date	Name	Isuue	Amendment
20.01.2022	NSch.	82	Apllicable document on sheet 4 changed. „The color of the plastic material… added. Minor change
17.08.15	DJ	82	Marking of item-no, value of primary resistance in page 2 (possibilities of wiring).changed. CN-15-420

Hrg KB-E editor	Bearb: DJ designer		KB-PM: Sn. check		freig.: SB released

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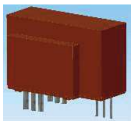
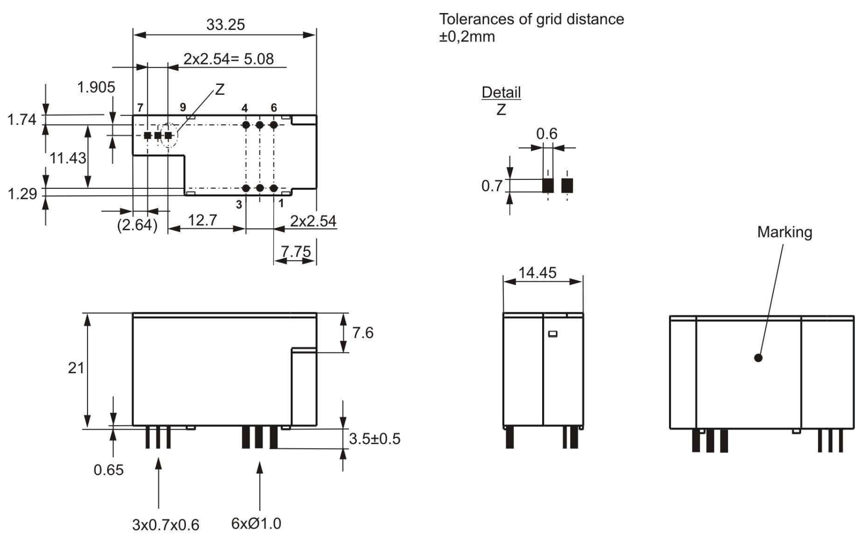


Mechanical outline (mm): General tolerances DIN ISO 2768-c



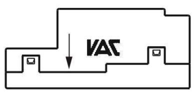
Connections:
1...6: ∅ 1.0 mm
7...9: 0.6x0.7 mm

Marking:

c UL us
4646-X400
F DC

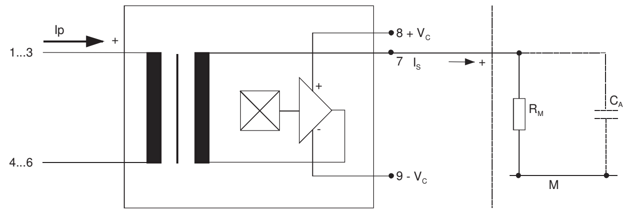
Explanation:

DC = Date Code
F = Factory

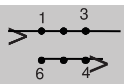
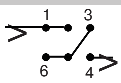
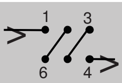


Current direction: A positive output current appears at point I_S, by primary current in direction of the arrow.

Schematic diagram



Possibilities of wiring for V_C = ±15V (@ θ_A = 85°C, R_M = 22 Ω)

primary windings N_P	primary current RMS I_P [A]	maximal $\hat{I}_{P,max}$ [A]	output current RMS I_S (I_P) [mA]	turns ratio K_N	primary resistance R_P [mΩ]	wiring
1	25	130	25	1:1000	0.3	
2	10	65	20	2:1000	1.35	
3	8	43	24	3:1000	2.4	

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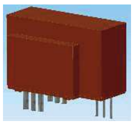


Electrical Data (investigate by a type checking)

		min.	typ.	max.	Unit
V_{Ctot}	Maximum supply voltage (without function) ±15.75 … ±18 V: for 1s per hour			±18	V
R_S	Secondary coil resistance @ θ_A=85°C			88	Ω
R_p	Primary coil resistance per turn @ T_A=25°C			1	mΩ
X_{Ti}	Temperature drift of X @ ϑ_A = -40 ... +85 °C			0.1	%
I_{0ges}	Offset current (including I_0, I_{0t}, I_{0T})			0.15	mA
I_{0t}	Long term drift Offset current I_0		0.05		mA
I_{0T}	Offset current temperature drift I_0 @ ϑ_A = -40 ...+85°C		0.05		mA
I_{0H}	Hyteresis current @ I_P=0 (caused by primary current 3 x I_{PN})		0.04	0.1	mA
$\Delta I_0/\Delta V_C$	Supply voltage rejection ratio			0.01	mA/V
i_{oss}	Offset ripple (with1 MHz- filter first order)			0,15	mA
i_{oss}	Offset ripple (with 100 kHz- filter first order)		0.03	0.05	mA
i_{oss}	Offset ripple (with 20 kHz- filter first order)		0.007	0.015	mA
C_k	Maximum possible coupling capacity (primary – secondary)		4		pF
	Mechanical Stress according to M3209/3 Settings: 10 – 2000 Hz, 1 min/Oktave, 2 hours			10g	

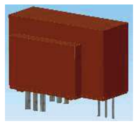
Inspection (Measurement after temperature balance of the samples at room temperature)

$K_N(N_1/N_2)$	(V)	M3011/6	Transformation ratio (I_P=3*10A, 40-80 Hz)	1…3 : 1000 ± 0.5	%
I_0	(V)	M3226	Offset current	< 0.1	mA
$V_{P,eff}$	(V)	M3014	Test voltage, rms, 1s Pin 1 - 6 to Pin 7 - 9	2.5	kV
V_e	(AQL 1/S4)		Partial discharge voltage acc. M3024 (RMS) with V_{vor} (RMS)	1300 1625	V V

Type Testing (Pin 1 - 6 to Pin 7 – 9)

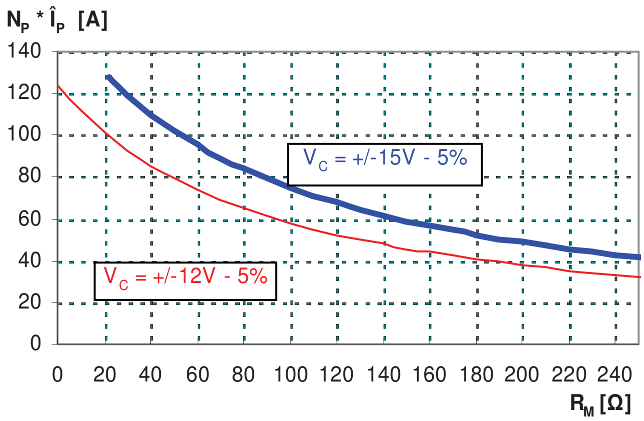
Designed according standard EN 61800-5-1:2007 with insulation material group 1

V_W	HV transient test according (to M3064) (1.2 µs / 50 µs-wave form)		8	kV
V_d	Testing voltage acc. M3014 (RMS)	(5 s)	5	kV
V_e	Partial discharge voltage acc. M3024 (RMS) with V_{vor} (RMS)		1500 1875	V V



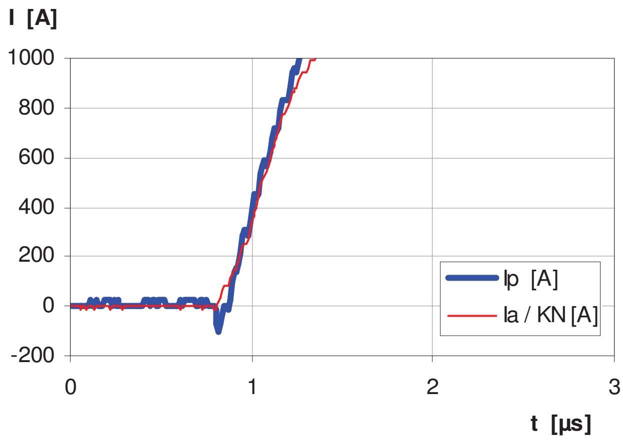
Limit curve of measurable current $\hat{I}_P(R_M)$

@ ambient temperature $T_A \leq 85$ °C



Maximum measuring range (µs-range)

Output current behaviour of a 3kA current pulse
@ V_C = ±15V und R_M= 25Ω



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.

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

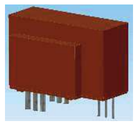
$$f_g = \frac{1}{2\pi \cdot R_M \cdot C_a}$$

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

$$t_r' \leq t_r + 2.5 R_M \cdot C_a$$

Applicable documents

Constructed and manufactored and tested in accordance with EN 61800.
Temperature of the primary conductor should not exceed 100°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."



I_{0H}: Zero variation of I_o after overloading with a DC of tenfold the rated value ($R_M = R_{MN}$)

I_{0t}: Long term drift of I_o after 100 temperature cycles in the range -40 bis 85 °C.

t_r: Response time (describe the dynamic performance for the specified measurement range), measured as delay time at $I_P = 0.9 \cdot I_{Pmax}$ between a rectangular current and the output current.

Δt (I_{Pmax}): Delay time (describe the dynamic performance for the rapid current pulse rate e.g short circuit current) measured between I_{Pmax} and the output current i_a with a primary current rise of di_1/dt = 100 A/µs.

$X_{ges}(I_{PN})$: 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_o = 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:

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

(I_{SB}: Secondary current θ_{A1} or θ_{A2})

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

Where I_P is any input DC and I_{Sx} the corresponding output term.