

K-no.: 24513

6 A Current Sensor for 5V- Supply Voltage

Date: 21.12.2012

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

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

I_{PN}	Primary nominal r.m.s. current	6	A
V_{out}	Output voltage @ I_P	$V_{Ref} \pm (0.625 \cdot I_P / I_{PN})$	V
V_{out}	Output voltage @ $I_P=0$, $T_A=25^\circ\text{C}$	$V_{Ref} \pm 0.015$	V
V_{Ref}	External Reference voltage range	0...4	V
	Internal Reference voltage	2.5 ± 0.005	V
K_N	Turns ratio	1...3 : 2000	

Accuracy – Dynamic performance data

		min.	typ.	max.	Unit
$I_{P,max}$	Max. measuring range	± 20			
X	Accuracy @ I_{PN} , $T_A=25^\circ\text{C}$			0.7	%
ϵ_L	Linearity			0.1	%
$V_{out} - V_{Ref}$	Offset voltage @ $I_P=0$, $T_A=25^\circ\text{C}$			± 15	mV
$\Delta V_o / V_{Ref} / \Delta T$	Temperature drift of V_{out} @ $I_P=0$, $V_{Ref}=2.5\text{V}$, $T_A=-40...85^\circ\text{C}$	6		30	ppm/°C
t_r	Response time @ 90% von I_{PN}		300		ns
$\Delta t (I_{P,max})$	Delay time at $di/dt = 100 \text{ A}/\mu\text{s}$		200		ns
f	Frequency bandwidth	DC...200			kHz

General data

		min.	typ.	max.	Unit
T_A	Ambient operating temperature	-40		+85	°C
T_S	Ambient storage temperature	-40		+85	°C
m	Mass		12		g
V_C	Supply voltage	4.75	5	5.25	V
I_C	Current consumption		15		mA

Constructed and manufactured and tested in accordance with EN 61800-5-1 (Pin 1 - 6 to Pin 7 – 10)
Reinforced insulation, Insulation material group 1, Pollution degree 2

S_{clear}	Clearance (component without solder pad)	7.4			mm
S_{creep}	Creepage (component without solder pad)	8.0			mm
V_{sys}	System voltage	overvoltage category 3	RMS	300	V
V_{work}	Working voltage	(tabel 7 acc. to EN61800-5-1) overvoltage category 2	RMS	650	V
U_{PD}	Rated discharge voltage	peak value		1320	V

Note: “According UL 508: Max. potential difference = 600 V_{AC}

Date	Name	Issue	Amendment
21.12.12	KRe.	83	Note added, clearance and creepage from 7 to 7.4 and 7 to 8.0, frequency bandwidth from 100 kHz to 200 kHz, Temperature drift from typ. 10 of typ. 6 changed. Mechanical outline / marking with UL-sign. + issue. CN-572
Hrsg.: KB-E editor	Bearb.: Le. designer		KB-PM: KRe. check
			freig.: HS released

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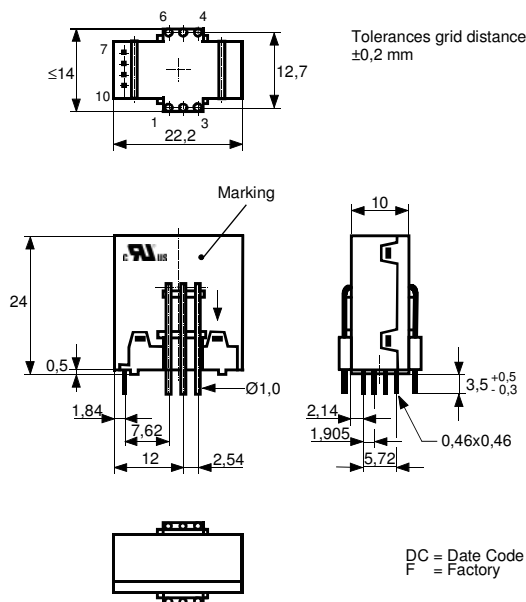
Customer: Standard type

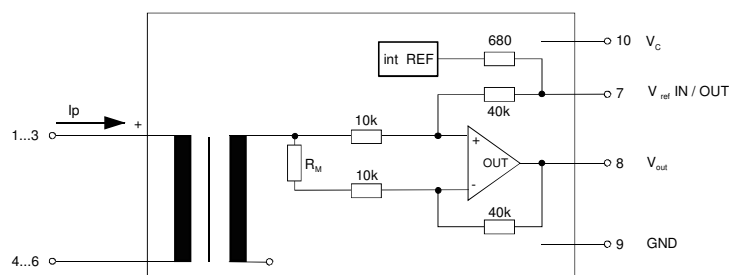
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Mechanical outline (mm):

General tolerances DIN ISO 2768-c

Connections:

 1...6: Ø 1 mm
 7..10: 0,46*0,46 mm

Marking:
VAC UL-sign
 4646X663-83
 F DC

Schematic diagram

Possibilities of wiring

 (@ $T_A = 85^\circ\text{C}$)

primary windings	primary current RMS	output voltage maximal	output voltage RMS	turns ratio	primary resistance	wiring
N_P	I_P [A]	$\hat{I}_{P,max}$ [A]	$V_{out}(I_P)$ [V]	K_N	R_P [mΩ]	
1	6	±20	2.5±0.625	1:2000	0.33	
2	3	±10	2.5±0.625	2:2000	1.5	
3	2	±6.7	2.5±0.625	3:2000	3	

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

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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	15mA	$+I_p \cdot K_N + V_{out}/R_L$		mA
$I_{out,SC}$	Short circuit output current		± 20		mA
R_P	Resistance / primary winding @ $T_A=25^\circ C$		1		m Ω
R_S	Secondary coil resistance @ $T_A=85^\circ C$			67	Ω
$R_{i,Ref}$	Internal resistance of Reference input		670		Ω
$R_{i,V_{out}}$	Output resistance of V_{out}			1	Ω
R_L	External recommended resistance of V_{out}	1			k Ω
C_L	External recommended capacitance of V_{out}			500	pF
$\Delta X_{Ti} / \Delta T$	Temperature drift of X @ $T_A = -40 \dots +85^\circ C$			40	ppm/K
$\Delta V_0 = \Delta(V_{out} - V_{Ref})$	Sum of any offset drift including:		5	15	mV
V_{0t}	Longterm drift of V_0		3		mV
V_{0T}	Temperature drift von V_0 @ $T_A = -40 \dots +85^\circ C$		3		mV
V_{0H}	Hysteresis of V_{out} @ $I_P=0$ (after an overload of $10 \times I_{PN}$)		7.5	mV	
$\Delta V_0 / \Delta V_C$	Supply voltage rejection ratio			1	mV/V
V_{OSS}	Offsetripple (with 1 MHz- filter first order)			55	mV
V_{OSS}	Offsetripple (with 100 kHz- filter first order)		9	15	mV
V_{OSS}	Offsetripple (with 20 kHz- filter first order)		2.5	4	mV
C_k	Maximum possible coupling capacity (primary – secondary)		5	10	pF
	Mechanical stress according to M3209/3			30g	
	Settings: 10 – 2000 Hz, 1 min/Decade, 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. external reference ($I_P=6A$, 40-80Hz)	625 $\pm$ 0.7%	mV
$V_{out}-V_{Ref} (I_P=0)$	(V)	M3226:	Offset voltage	± 0.015	V
V_d	(V)	M3014:	Test voltage, rms, 1 s pin 1 – 6 vs. pin 7 – 10	1.5	kV
V_e	(AQL 1/S4)		Partial discharge voltage acc.M3024 (RMS) with V_{vor} (RMS)	1400 1750	V V

Type Testing (Pin 1 - 6 to Pin 7 - 10)

Designed according standard EN 50178 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, to M3014	(5 s)	3
V_e	Partial discharge voltage acc.M3024 (RMS) with V_{vor} (RMS)	1400 1750	V V

Applicable documents

Current direction: A positive output current appears at point V_{out} , by primary current in direction of the arrow.

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

Enclosures according to IEC529: IP50.

Further standards UL 508 ; file E317483, category NMTR2 / NMTR8

Datum	Name	Index	Ämendment
21.12.12	Le	83	Applicable documents added. CN-572
08.04.08	Le.	82	"preliminary" delete.

Hrsg.: KB-E editor	Bearb: Le. designer	KB-PM: KRe check	freig.: HS released
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Explanation of several of the terms used in the tablets (in alphabetical order)

t_r : Response time (describe the dynamic performance for the specified measurement range), measured as delay time at $I_P = 0,9 \cdot I_{PN}$ between a rectangular current and the output voltage $V_{out}(I_P)$

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

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

V_0 : Offset voltage between V_{out} and the rated reference voltage of $V_{ref} = 2,5V$.
 $V_0 = V_{out}(0) - 2,5V$

V_{OH} : Zero variation of V_0 after overloading with a DC of tenfold the rated value

V_{Ot} : 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

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

$X_{ges}(I_{PN})$: 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_L : 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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