

K-no.: 24512

**15 A Current Sensor for 5V- Supply Voltage**

Date: 30.01.2012

 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	15	A
$V_{out}$	Output voltage @ $I_P$	$V_{Ref} \pm (0.625 * I_P / I_{PN})$	V
$V_{out}$	Output voltage @ $I_P=0, T_A=25^\circ C$	$V_{Ref} \pm 0.008$	V
$V_{Ref}$	External Reference voltage range	0...4	V
	Internal Reference voltage	$2.5 \pm 0.005$	V
$K_N$	Turns ratio	1...3 : 2000	

**Accuracy – Dynamic performance data**

		min.	typ.	max.	Unit
$I_{P,max}$	Max. measuring range	±51			
X	Accuracy @ $I_{PN}, T_A=25^\circ C$			0.7	%
$\epsilon_L$	Linearity			0.1	%
$V_{out} - V_{Ref}$	Offset voltage @ $I_P=0, T_A=25^\circ C$			±8	mV
$\Delta V_o / V_{Ref} / \Delta T$	Temperature drift of $V_{out}$ @ $I_P=0, V_{Ref}=2,5V, T_A=-40...85^\circ C$	6		20	ppm/°C
$t_r$	Response time @ 90% von $I_{PN}$		300		ns
$\Delta t (I_{P,max})$	Delay time at $di/dt = 100 A/\mu s$		200		ns
f	Frequency bandwidth	DC...100			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

 According UL 840:  $V_{sys} = 600 V$ 

Date	Name	Issue	Amendment
30.01.12	Le	82	Values for clearance and creepage accordance UL 840 added. AA-444
28.01.11	Le	82	Date changed.

Hrsg.: KB-E editor	Bearb.: Le designer	KB-PM: Ga. check	freig.: HS released
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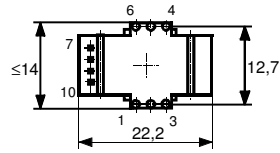
Customer: Standard type

Customers Part no.:

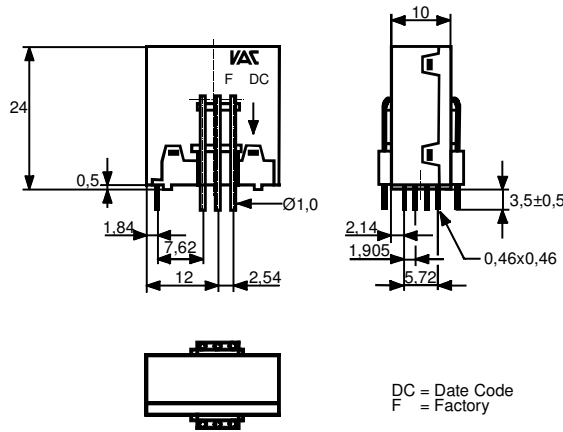
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**Mechanical outline (mm):**

General tolerances DIN ISO 2768-c



Toleranz der Stiftabstände  
±0,2 mm  
(Tolerances grid distance)



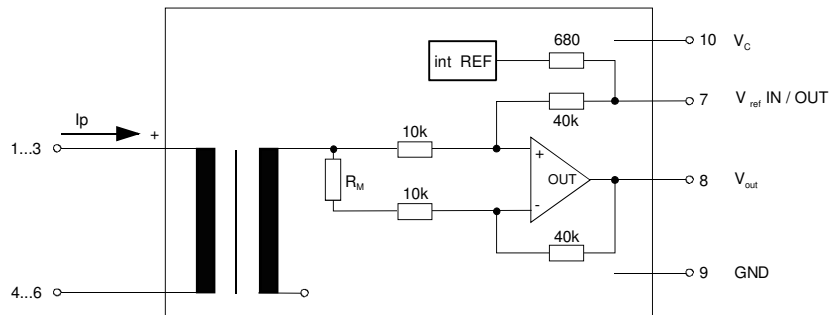
Connections:

1...6: Ø 1 mm  
7..10: 0,46\*0,46 mm

Marking:

**VAC**  
4646X662  
F DC

**Schematic diagram**



**Possibilities of wiring** (@ TA = 85 °C)

primary windings	primary current RMS	primary current maximal	output current RMS	turns ratio	primary resistance	wiring
$N_p$	$I_p$ [A]	$\hat{I}_{p,max}$ [A]	$I_s(I_p)$ [mA]	$K_N$	$R_p$ [mΩ]	
1	15	±51	2.5±0.625	1:2000	0.33	
2	7.5	±25	2.5±0.625	2:2000	1.5	
3	5	±17	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 @ $T_A=25^\circ\text{C}$		1		mΩ
$R_S$	Secondary coil resistance @ $T_A=85^\circ\text{C}$			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			kΩ
$C_L$	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:		3.5	10	mV
$V_{0t}$	Longtermdrift of $V_0$		2		mV
$V_{0T}$	Temperature drift von $V_0$ @ $T_A = -40 \dots +85^\circ\text{C}$		2		mV
$V_{0H}$	Hysteresis of $V_{out}$ @ $I_p=0$ (after an overload of $10 \times I_{PN}$ )		3		mV
$\Delta V_0 / \Delta V_C$	Supply voltage rejection ratio			1	mV/V
$V_{oss}$	Offsetripple (with 1 MHz- filter first order)			30	mV
$V_{oss}$	Offsetripple (with 100 kHz- filter first order)		4	8	mV
$V_{oss}$	Offsetripple (with 20 kHz- filter first order)		1.2	2	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 ( $I_p=15\text{A}$ , 40-80Hz)	625±0.7%	mV
$V_{out}-V_{Ref} (I_p=0)$	(V) M3226:	Offset voltage	± 0.008	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 kV
$V_e$	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  $I_s$ , by primary current in direction of the arrow.  
 Housing and bobbin material UL-listed: Flammability class 94V-0.  
 Enclosures according to IEC529: IP50.

Datum	Name	Index	Amendment
30.01.12	Le	82	Date adapted.
28.01.11	Le	82	Inspection M3011/6: 15A instead of 25A, typo. Lapidary change.

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  $di_P/dt \geq 100 \text{ A}/\mu\text{s}$ .

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

$U_{PD}$  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

$V_{0H}$ : Zero variation of  $V_0$  after overloading with a DC of tenfold the rated value

$V_{0t}$ : 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  $I_{PN}$

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

$\epsilon_L$ : Linearity fault defined by  $\epsilon_L = 100 \cdot \left| \frac{I_P}{I_{PN}} - \frac{V_{out}(I_P) - V_{out}(0)}{V_{out}(I_{PN}) - V_{out}(0)} \right| \%$

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

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