

**K-no.:** 24508

**15 A Current Sensor Module for 5V- Supply Voltage**
**Date:** 08.04.2008

 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.:**
**Page** 1 **of** 2

**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 @ $I_P$                         | $2.5 \pm (0.625 \cdot I_P / I_{PN})$ | V |
| $V_{out}$ | Output voltage @ $I_P=0, T_A=25^\circ\text{C}$ | $2.5 \pm 0.020$                      | V |
| $V_{Ref}$ | 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 @ $I_{PN}, T_A=25^\circ\text{C}$                            | 0.7      |      |      | %     |
| $\epsilon_L$                       | Linearity  | 0.1      |      |      | %     |
| $V_{out} -2,5V$                    | Offset voltage @ $I_P=0, T_A=25^\circ\text{C}$                       | ±20      |      |      | mV    |
| $\Delta V_{out} / 2,5V / \Delta T$ | Temperatur drift of $V_{out}$ @ $I_P=0, T_A= -40...85^\circ\text{C}$ | 16       |      | 32   | ppm/K |
| $t_r$                              | 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...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 – 9)  
 Reinforced insulation, Insulation material group 1, Pollution degree 2

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

| Date     | Name | Issue | Amendment            |
|----------|------|-------|----------------------|
| 08.04.08 | Le   | 82    | "preliminary" delete |

 Hrsg.: KB-E  
 editor

 Bearb.: Le  
 designer

 KB-PM: KRe  
 check

 freig.: Heu.  
 released

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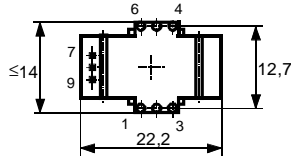
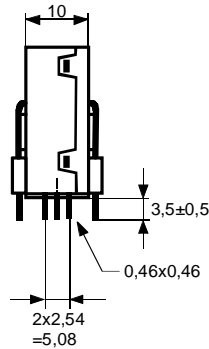
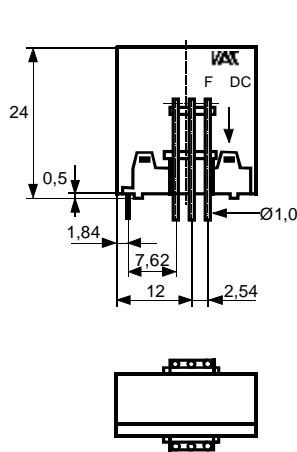
**Customer:** Standard type

**Customers Part no.:**
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**Mechanical outline (mm):**

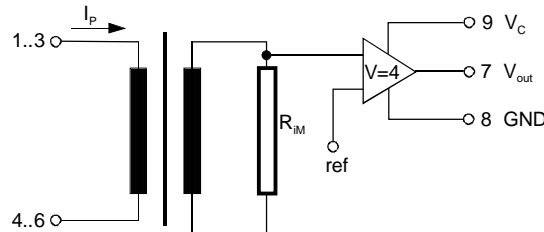
General tolerances DIN ISO 2768-c

**Connections:**

 1...6:  $\varnothing$  1 mm  
 7...9: 0,46\*0,46 mm

 Toleranz der Stiftabstände  
 $\pm 0,2$  mm  
 (Tolerances grid distance)

**Marking:**


 4646X652  
 F DC

 DC = Date Code  
 F = Factory

**Schematic diagram**

**Possibilities of wiring** (@  $T_A = 85^\circ\text{C}$ )

| primary windings | primary current RMS | primary current maximal | output voltage RMS    | turns ratio | primary resistance | wiring |
|------------------|---------------------|-------------------------|-----------------------|-------------|--------------------|--------|
| $N_P$            | $I_P$ [A]           | $\hat{I}_{P,max}$ [A]   | $V_{out}(I_{PN})$ [V] | $K_N$       | $R_P$ [mW]         |        |
| 1                | 15                  | $\pm 51$                | $2.5 \pm 0.625$       | 1:2000      | 0.33               |        |
| 2                | 7,5                 | $\pm 25$                | $2.5 \pm 0.625$       | 2:2000      | 1.5                |        |
| 3                | 5                   | $\pm 17$                | $2.5 \pm 0.625$       | 3:2000      | 3                  |        |

 Temperature of the primary conductor should not exceed  $110^\circ\text{C}$ .  
 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  |      | $\pm 20$                             |      | mA         |
| $R_P$                                 | Resistance / primary winding @ $T_A=25^\circ C$   |      | 1                                    |      | m $\Omega$ |
| $R_S$                                 | Secondary coil resistance @ $T_A=85^\circ C$  |      |                                      | 67   | $\Omega$   |
| $R_{i,(V_{out})}$                     | Output resistance of $V_{out}$  |      |                                      | 1    | $\Omega$   |
| $R_L$                                 | External recommended resistance of $V_{out}$  | 1    |                                      |      | k $\Omega$ |
| $C_L$                                 | External recommended capacitance of $V_{out}$   |      |                                      | 500  | pF         |
| $\Delta X_T/\Delta T$                 | Temperature drift of X @ $T_A = -40 \dots +85^\circ C$                                  |      |                                      | 40   | ppm/K      |
| $\Delta V_0 = \Delta(V_{out} - 2.5V)$ | Sum of any offset drift including:  |      | 6                                    | 12   | mV         |
| $V_{0t}$                              | Long term drift of $V_0$  |      | 2                                    |      | mV         |
| $V_{0T}$                              | Temperature drift von $V_0$ @ $T_A = -40 \dots +85^\circ C$                             |      | 5                                    |      | 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)   |      |                                      | 70   | mV         |
| $V_{oss}$                             | Offsetripple (with 100 kHz- filter first order)   |      | 5.5                                  | 11   | mV         |
| $V_{oss}$                             | Offsetripple (with 20 kHz- filter first order)  |      | 1.5                                  | 3    | mV         |
| $C_k$                                 | Maximum possible coupling capacity (primary – secondary)                                |      | 5                                    | 10   | pF         |
|                                       | Mechanical stress according to M3209/3<br>Settings: 10 – 2000 Hz, 1 min/Decade, 2 hours |      |                                      | 30g  |            |

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

|                        |            |          |   |                |        |
|------------------------|------------|----------|---|----------------|--------|
| $V_{out} (I_P=I_{PN})$ | (V)        | M3011/6: | Output voltage vs. internal reference ( $I_P=15A$ , 40-80Hz)      | 625 $\pm$ 0.7% | mV     |
| $V_{out}-2.5V (I_P=0)$ | (V)        | M3226:   | Offset voltage  | $\pm 0.020$    | V      |
| $V_d$                  | (V)        | M3014:   | Test voltage, rms, 1 s<br>pin 1 – 6 vs. pin 7 – 9                 | 1.5            | kV     |
| $V_e$                  | (AQL 1/S4) |          | Partial discharge voltage acc.M3024 (RMS)<br>with $V_{vor}$ (RMS) | 1400<br>1750   | V<br>V |

**Type Testing** (Pin 1 - 6 to Pin 7 - 9)

Designed according standard EN 50178 with insulation material group 1

|       |  |  |  |              |        |    |
|-------|--|--|--|--------------|--------|----|
| $V_W$ |  |  | HV transient test according (to M3064) (1,2 $\mu s$ / 50 $\mu s$ -wave form) | 8            | kV     |    |
| $V_d$ |  |  | Testing voltage to M3014   | (5 s)        | 3      | kV |
| $V_e$ |  |  | Partial discharge voltage acc.M3024 (RMS)<br>with $V_{vor}$ (RMS)            | 1400<br>1750 | V<br>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    | Index | Änderung                 |
|----------|-------|--------------------------|
| 08.04.08 | Le    | 82 "preliminary" delete. |

|                       |                        |                     |                          |
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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  $di_P/dt \geq 100 A/\mu s$ .

$U_{PD}$  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

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

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

$V_{0t}$ : Long term drift of  $V_o$  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  $e_L = 100 \cdot \left| \frac{I_P}{I_{PN}} - \frac{V_{out}(I_P) - V_{out}(0)}{V_{out}(I_{PN}) - V_{out}(0)} \right| \%$

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

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