| VACUUMSCHMELZE | SPECIFICATION | Item no.: T60404-N4646-X663 |
|---|---|---|

| K-no.: 24513 | **6 A Current Sensor for 5V- Supply Voltage**<br>For electronic current measurement:<br>DC, AC, pulsed, mixed ..., with a galvanic isolation between primary circuit (high power) and secondary circuit (electronic circuit) | Date: 28.01.2022 |
|---|---|---|
| Customer: Standard type | Customers Part no.: | Page 1 of 4 |

**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 @ $I_P$ | $V_{Ref}$ ± (0.625*$I_P$/$I_{PN}$) | V |
| $V_{out}$ | Output voltage @ $I_P$=0, $T_A$=25°C | $V_{Ref}$ ± 0.0053 | 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°C | | | 0.7 | % |
| $\varepsilon_L$ | Linearity | | | 0.1 | % |
| $V_{out}$ - $V_{Ref}$ | Offset voltage @ $I_P$=0, $T_A$= 25°C | | | ±5.3 | mV |
| Δ $V_o$ / $V_{Ref}$ / ΔT | Temperature drift of $V_{out}$ @ $I_P$=0, $V_{Ref}$ =2,5V, $T_A$= -40…85°C | | **6** | 30 | ppm/°C |
| $t_r$ | Response time @ 90% von $I_{PN}$ | | 300 | | ns |
| Δt ($I_{P,max}$) | Delay time at di/dt = 100 A/µs | | 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 manufactored 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 |
|---|---|---|---|
| 28.01.2022 | NSch. | 83 | Applicable document on changed on sheet 3. „The color of the plastic material… added. Minor change |
| | | | |

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

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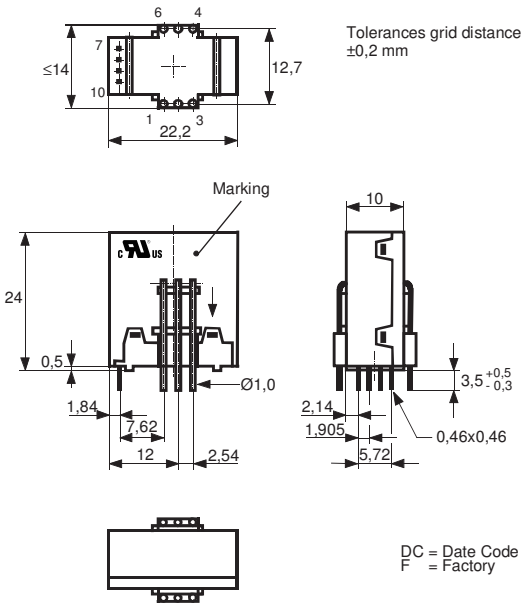
**Mechanical outline (mm):** General tolerances DIN ISO 2768-c



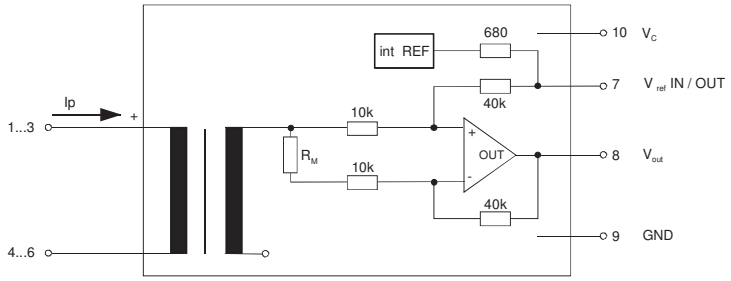

Connections:

1...6: ∅ 1 mm
7..10: 0,46*0,46 mm

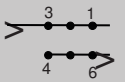
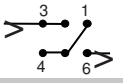
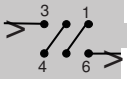
Marking:

UL-sign
4646-X663-83
F DC

**Schematic diagram**




**Possibilities of wiring** (@ $T_A$ = 85°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] | $V_{out}$ ($I_P$) [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 |  |



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|---|---|---|---|---|---|---|

## Electrical Data

| | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|
| $V_{Ctot}$ | Maximum supply voltage (without function) | | | 7 | V |
| $I_C$ | Supply Current with primary current | | 15mA +$I_p$*$K_N$+$V_{out}$/$R_L$ | | mA |
| $I_{out,SC}$ | Short circuit output current | | ±20 | | mA |
| $R_P$ | Resistance / primary winding @ $T_A$=25°C | | 1 | | mΩ |
| $R_S$ | Secondary coil resistance @ $T_A$=85°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 ... +85 °C | | | 40 | ppm/K |
| $\Delta V_0 = \Delta(V_{out} - V_{Ref})$ | Sum of any offset drift including: | | 5 | 15 | mV |
| $V_{0t}$ | Longtermdrift of $V_0$ | | 3 | | mV |
| $V_{0T}$ | Temperature drift von $V_0$ @ $T_A$ = -40 ...+85°C | | 3 | | mV |
| $V_{0H}$ | Hysteresis of $V_{out}$ @ $I_P$=0 (after an overload of 10 x $I_{PN}$) | | | 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 firdt 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<br>Settings: 10 – 2000 Hz, 1 min/Octave, 2 hours | | | 30g | |

**Inspection** (Measurement after temperature balance of the samples at room temperature), SC = significant characteristic

| | | | | | |
|---|---|---|---|---|---|
| $V_{out}$ (SC) | (V) | M3011/6: | Output voltage vs. external reference ($I_P$=6A, 40-80Hz) | 625±0.7% | mV |
| $V_{out}$–$V_{Ref}$ ($I_P$=0) | (V) | M3226: | Offset voltage | ± 5.3 | mV |
| $V_d$ | (V) | M3014: | Test voltage, rms, 1 s<br>pin 1 – 6 vs. pin 7 – 10 | 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 - 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)<br>with $V_{vor}$ (RMS) | | 1400 V<br>1750 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
Temperature of the primary conductor should not exceed 110°C.
„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."

**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/µs.

$U_{PD}$ Rated discharge voltage (recurring peak voltage separated by the insulation) proved with a sinusoidal voltage $V_e$

$U_{PD} = \sqrt{2} * V_e / 1{,}5$

$V_{vor}$ Defined voltage is the RMS valve of a sinusoidal voltage with peak value of 1,875 * $U_{PD}$ required for partial discharge test in IEC 61800-5-1

$V_{vor} = 1{,}875 * U_{PD} / \sqrt{2}$

$V_{sys}$ 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.
$V_o = V_{out}(0) - 2{,}5V$

$V_{0H}$: 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

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

$X_{ges}(I_{PN})$: Permissible measurement error including any drifts over the temperature range by the current measurement $I_{PN}$

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

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