| VACUUMSCHMELZE | SPECIFICATION | Item no.: T60404-N4646-X956 |
|---|---|---|

| K-no.: 25927 | **300 mA Differential 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: 04.02.2022 |
|---|---|---|
| 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
- 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 rated current, r.m.s | 50 | A |
| $I_{\Delta N}$ | Differential rated current, r.m.s | 0.3 | A |
| $V_{out}$ | Output voltage @ $I_{\Delta N}$ | $V_{Ref}$ ± (0,74*$I_{\Delta P}/I_{\Delta N}$) | V |
| $V_{out}(0)$*) | Output voltage @ $I_P$=0, $T_A$=25°C | $V_{Ref}$ ± 0.025 | V |
| $V_{out}$ (Error) | in case of error ( current sensor) $V_{out}$ < 0,5V is set | <0.5 | V |
| $V_{Ref}$ | Internal Reference voltage | 2.5 ± 0.005 | V |
| | External Reference voltage range | 1.4 … 3.5 | V |
| $V_{Ref}$(test current)**) | Reference voltage (external) | 0…0.1 | V |
| $V_{out}$(Teststrom)**) | Ausgangsspannung @ $V_{Ref}$ = 0…0.1V | $V_{out}(0)$ + 0.250± 0.060 | V |
| $K_N$ | Turns ratio | (1) : 1: 1000 | |

*) With switching on and after "test current" the current sensor is degaussed by an internal AC-current for about 110ms. Meantime the output is set to $V_{out}$ < 0.5V.

**) Due to external $V_{Ref}$ = 0…0.1V an internal test current is generated.

## Accuracy – Dynamic performance data

| | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|
| $I_{\Delta P,max}$ | Max. measuring range (differencial current) | ±0.85 | | | |
| X | Accuracy @ $I_{\Delta N}$, $T_A$= 25°C | | | 1.5 | % |
| $\varepsilon_L$ | Linearity | | | 1 | % |
| $V_{out}$ - $V_{Ref}$ | Offset voltage @ $I_P$=0, $T_A$= 25°C | | | ±25 | mV |
| $\Delta V_o / \Delta T$ | Temperature drift of $V_{out}$ @ $I_P$=0, $T_A$= -40…85°C | | 0.1 | | mV/°C |
| $t_r$ | Response time @ 90% von $I_{\Delta N}$ | | 35 | | µs |
| f | Frequency bandwidth | DC…10 | | | 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 | | 42 | | g |
| $V_C$ | Supply voltage | 4.75 | 5 | 5.25 | V |
| $I_C$ | Current consumption | | 16 | | mA |

| Date | Name | Issue | Amendment |
|---|---|---|---|
| 04.02.2022 | NSch. | 81 | Applicable documents on sheet 3 changed. „The color of the plastic material… added. Minor change |
| 20.10.15 | DJ | 81 | Typo on page 4: X and Xges. Values adapted on output voltage on Page 1 (0.625 ➔ 0.74). Lapidary change. |

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

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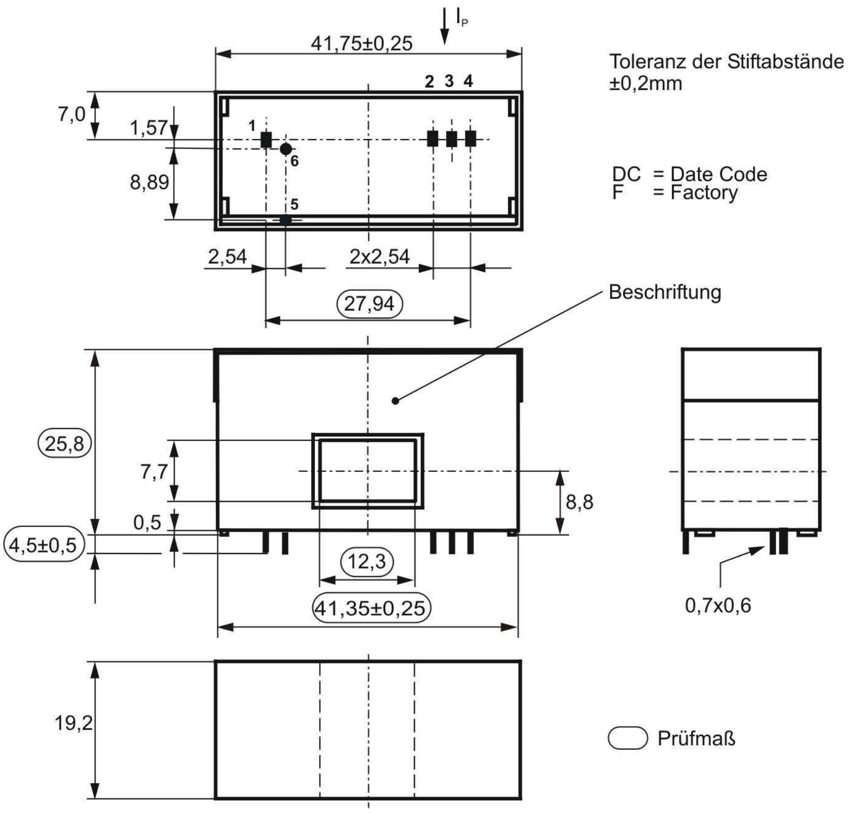
**Mechanical outline (mm):** General tolerances DIN ISO 2768-c



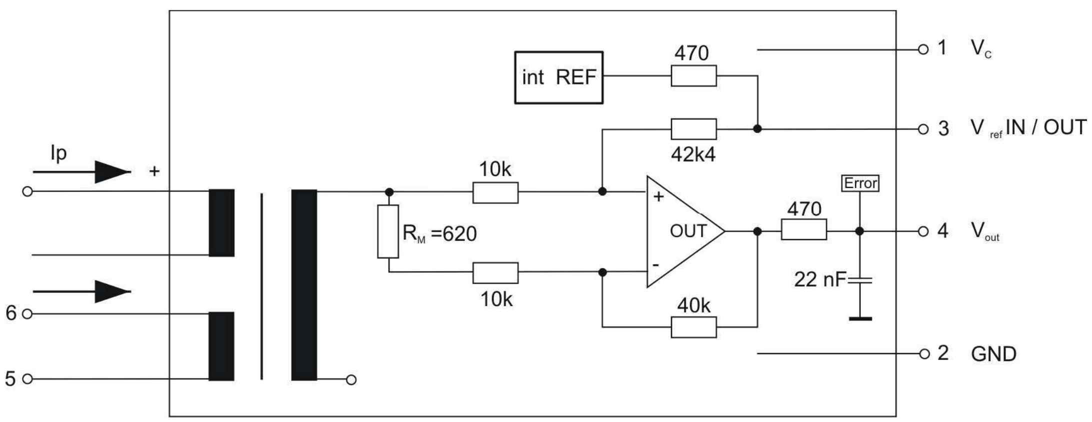

Connections:

1...4: 0,6*0,7 mm
5…6: 0,8 mm

Marking:

VAC
4646-X956
F DC

**Schematic diagram**



## Electrical Data

| | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|
| $V_{Ctot}$ | Maximum supply voltage (without function) | | | 6 | V |
| $I_C$ | Supply Current with primary current | | 16mA $+I_p*K_N+V_{out}/R_L$ | | mA |
| $I_{out,SC}$ | Short circuit output current | | ±20 | | mA |
| $R_{P1,P2}$ | Primary resistance @ $T_A$=25°C | | 0.17 | | mΩ |
| $R_{P3}$ | Primary resistance @ $T_A$=25°C | | 1.14 | | mΩ |
| $R_S$ | Secondary coil resistance @ $T_A$=85°C | | | 80 | Ω |
| $R_{i,Ref}$ | Internal resistance of Reference input | | 470 | | Ω |
| $R_i,(V_{out})$ | Output resistance of $V_{out}$ | | 470 | | Ω |
| $R_L$ | External recommended resistance of $V_{out}$ | | 100 | | kΩ |
| $C_L$ | External recommended capacitance of $V_{out}$ | | no limit | | pF |
| $\Delta X_{Ti} / \Delta T$ | Temperature drift of X @ $T_A$ = -40 ... +85 °C | | | 400 | ppm/K |
| $\Delta V_{Ref} / \Delta T$ | Temperature drift of $V_{Ref}$ @ $T_A$ = -40 ... +85 °C | | 5 | 50 | ppm/K |
| $\Delta V_0 = \Delta(V_{out} - V_{Ref})$ | Sum of any offset drift including: | | 16 | 25 | mV |
| $V_{0t}$ | Longtermdrift of $V_0$ | | 12 | | mV |
| $V_{0T}$ | Temperature drift von $V_0$ @ $T_A$ = -40 ...+85°C | | 10 | | mV |
| $\Delta V_0/\Delta V_C$ | Supply voltage rejection ratio | | 7.5 | 1 | mV/V |
| $V_{0H}$ | Hystereses of $V_{out}$ @ $I_P$=0 (after an overload of 1000 x $I_{PN}$) | | 75 | 175 | mV |
| $V_{0H, Demag}$ | Hystereses after Degaussing | | | 12 | mV |
| $v_{oss}$ | Offsetripple (without external filter) | | | 120 | mV |
| $v_{oss}$ | Offsetripple (with 20 kHz- filter firdt order) | | 35 | 50 | mV |
| $v_{oss}$ | Offsetripple (with 1.6 kHz- filter first order) | | 10 | 15 | mV |
| | Mechanical stress according to M3209/3<br>Settings: 10 – 2000 Hz, 1 min/Octave, 2 hours | | | 3g | |

**Inspection** (Measurement after temperature balance of the samples at room temperature, SC = significant characteristic, V = 100% test, AQL 1/S4 = accepted quality level)

| | | | | | |
|---|---|---|---|---|---|
| $V_{out} - V_{Ref}$ ($I_{\Delta P}$) | (V) | M3011/6: | Output voltage vs. reference ($I_{\Delta P}$=0.4A, 40-80Hz) | 0.972 … 1.002 | V (SC) |
| $V_{out} - V_{Ref}$ ($I_P$=0) | (V) | M3226: | Offset voltage | ± 0.025 | V |
| $V_{out}$(test current) | (V) | | Output voltage @ $V_{Ref}$ = 0V | 0.250± 0.060 | 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.
Short clearance and creepage distances due to metallic shielding.
Temperature of the primary conductor should not exceed 100°C.
To avoid shortcuts between Pin 6 and shielding make sure a minimum distance of 1mm between current sensor and pc-board
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 sever al 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 $I_{\Delta P} = 0{,}9 \cdot I_{\Delta N}$ between a rectangular current and the output voltage $V_{OUt}$ ($I_{\Delta p}$)

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

$$X = 100 \cdot \left| \frac{V_{out}(I_{\Delta N}) - V_{out}(0)}{0{,}74V} - 1 \right| \%$$

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

$$X_{ges} = 100 \cdot \left| \frac{V_{out}(I_{\Delta N}) - 2{,}5V}{0{,}74V} - 1 \right| \% \quad \text{or} \quad X_{ges} = 100 \cdot \left| \frac{V_{out}(I_{\Delta N}) - V_{ref}}{0{,}74V} - 1 \right| \%$$

$\varepsilon_L$: Linearity fault defined by

$$\varepsilon_L = 100 \cdot \left| \frac{I_{\Delta P}}{I_{\Delta N}} - \frac{V_{out}(I_{\Delta P}) - V_{out}(0)}{V_{out}(I_{\Delta N}) - V_{out}(0)} \right| \%$$

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