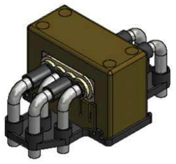
VAC VACUUMSCHMELZE	**Specification**	**Item no.: T60404-N4646-X931**

K-No.: 26543

1 A Differential Current Sensor for 5V Supply Voltage

For the electronic measurement of current:
DC, AC, pulsed ..., with galvanic isolation between the primary and the secondary circuit



Date: 02.02.2022

Customer: Standard Type | Customers Part no: |

Description

- Closed loop (compensation) Current Sensor with magnetic probe
- Printed circuit board mounting
- Casing and materials UL-listed

Characteristics

- excellent accuracy
- very low offset current
- very low temperature dependency and offset 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:

- Solar inverter

Electrical data - Ratings

I_{PN}	Primary nominal RMS current	85	A
$I_{\Delta N}$	Differential rated RMS current	1.0	A
V_{OUT}	Output voltage @ $I_{\Delta P}$	V_{REF} ± (1.2V * $I_{\Delta P}$ / $I_{\Delta N}$)	V
$V_{OUT}(0)$[1]	Output voltage @ $I_{\Delta P}$=0A, θ_A=25°C	V_{REF} ± 0.015	V
V_{OUT}(Error)	in case of error (current sensor) V_{OUT} < 0.5V is set	< 0.5	V
V_{REF}	internal reference voltage @ $I_{\Delta P}$=0A	2.5 ± 0.005	V
	external reference voltage range	1.4…3.5	V
V_{REF}(test current)[2]	Reference voltage (external)	0 … 0.1	V
V_{OUT}(test current)[2]	Output voltage @ V_{REF} = 0…0.1V	$V_{OUT}(0)$ + 0.25±0.06	V
K_N	Transformation ratio	1:1:1:1 : 20 : 1000	

[1] with switching on and after "test current" the sensor is degaussed by an internal AC-current for about 110ms. In this time the output is set to V_{OUT} < 0.5V.
[2] If V_{REF} is set external to 0…0.1V an internal test current is generated.

Accuracy – Dynamic performance data

		min.	typ.	max.	Unit
$I_{\Delta P,max}$	Max. measuring range (differential current)	±1.7			A
X	Accuracy @ I_{PN}, θ_A = 25°C			1.5	%
ε_L	Linearity			1	%
V_O (V_{OUT}-V_{REF})	Offset voltage @ $I_{\Delta P}$ = 0A, θ_A = 25°C			15	mV
$\Delta V_O/\Delta T$	Temperature drift of V_{OUT} @ $I_{\Delta P}$=0A, ϑ_A		0.05		mV/°C
t_r	Response time @ 90% of $I_{\Delta N}$		40		µs
f_{BW}	Frequency bandwidth	DC…8			kHz

General data

		min.	typ.	max.	Unit
ϑ_A	Ambient operation temperature	-40		85	°C
ϑ_S	Ambient storage temperature (acc to M3101)	-40		85	°C
m	Mass		105		g
V_C	Supply voltage	4.75	5	5.25	V
I_C	Supply current at $I_{\Delta P}$ = 0A and RT		15		mA
[1, 2]s_{clear}	Clearance (component without solder pad)	3.9			mm
[1, 2]s_{creep}	Creepage (component without solder pad)	4.5			mm
[1)]U_{sys}	System Voltage *determines impulse voltage acc. table 7			600	V_{RMS}
[1)]U_{AC}	Working voltage *acc. table 10			800	V_{RMS}
[1)]U_{PD}	Rated discharge voltage *acc. table 24 with $U_{PD}=U_{AC}*\sqrt{2}$			1132	V_{PEAK}

[1)] Constructed and manufactured and tested in accordance with IEC 61800-5-1:2007
Prim - Prim: Functional Insolation, Prim - Sec: Basic Insulation,
Insulation material group 1, Pollution degree 2, Overvoltage category III
[2)] According to customers specification

Date	Name	Issue	Amendment
02.02.2022	NSch.	82	Applicable documents changed on sheet 3. The color of the plastic material… added. Minor change

Hrg.: R&D-PD NPI D editor	Bearb.: DJ designer		MC-PM: NSch. check			freig.: SB released

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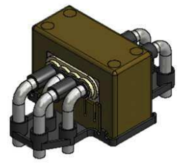


Customer: Standard Type	Customers Part no:	Page 2 of 4

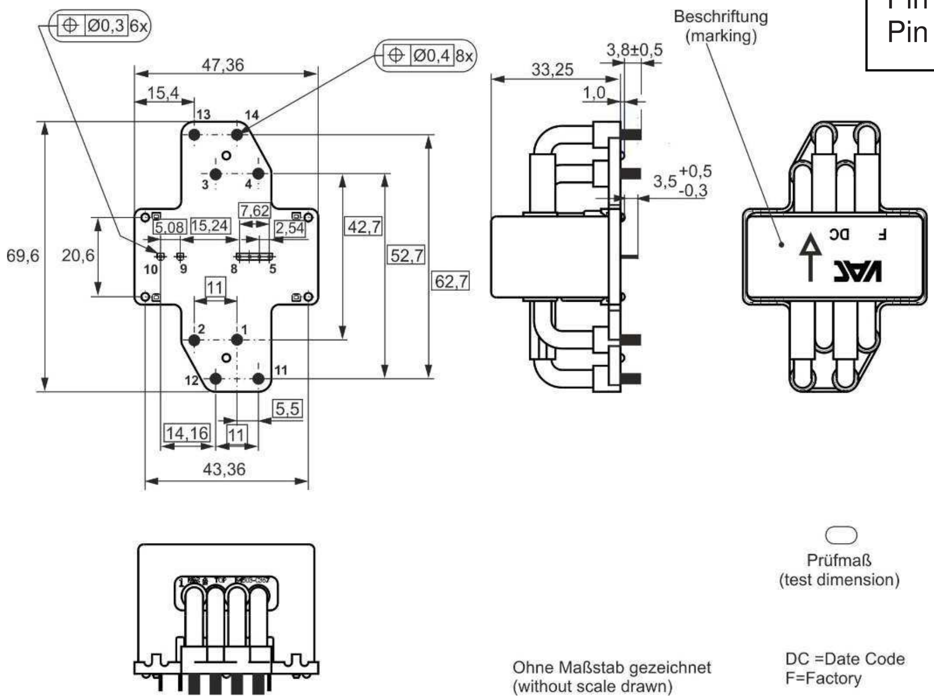
Mechanical outline (mm): **General tolerances DIN ISO 2768-c**

Connections:

Pin 5-10: 0.7mm x 0.7mm
Pin 1-4, 11-14: Ø4.5mm

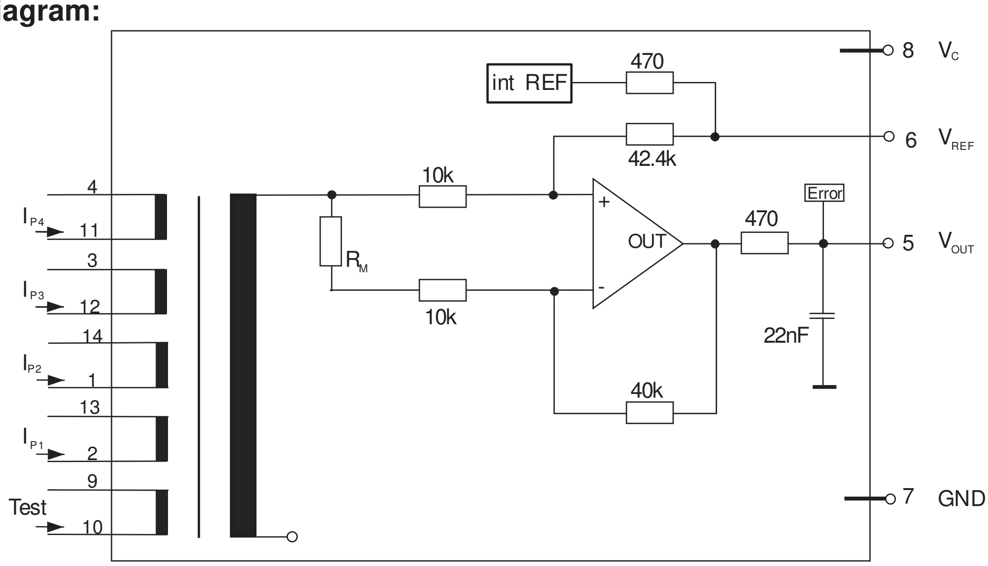
Marking:

VAC
UL-sign
4646-X931
F DC



Current direction: A positive output voltage appears at point V_{OUT}, if primary current flows in direction of the arrow.

Schematic diagram:



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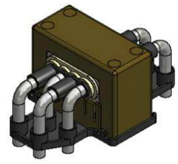

Customer: Standard Type	Customers Part no:	

Electrical data: (investigate by a type checking)

		min.	typ.	max.	Unit
$V_{C,max}$	maximum supply voltage (without function)			6	V
I_C	Supply current with primary current		$16mA+I_{\Delta P}*K_N+V_{OUT}/R_L$		mA
$I_{OUT,SC}$	Short circuit output current		±20		mA
R_S	Secondary coil resistance @ θ_A = 85°C			80	Ω
R_{Test}	Test winding resistance @ θ_A = 25°C		0.9		Ω
$R_{P1,P2}$	Primary wire resistance @ θ_A = 25°C		0.1		mΩ
$R_{i,REF}$	Internal resistance of reference input		470		Ω
$R_{i,OUT}$	Output resistance of V_{OUT}		470		Ω
$\Delta X_{Ti}/\Delta T$	Temperature drift of X @ ϑ_A = -40°C ... 85°C			400	ppm/K
$\Delta V_{REF}/\Delta T$	Temperature drift of V_{REF} @ ϑ_A = -40°C ... 85°C		5	50	ppm/K
$\Delta V_O = \Delta(V_{OUT}-V_{REF})$	Sum of any offset drift including:		30		mV
V_{Ot}	Long term drift of V_O		10		mV
V_{OT}	Temperature drift of V_O @ ϑ_A = -40°C … 85°C		10		mV
$\Delta V_O/\Delta V_C$	Supply voltage rejection ratio		20		mV/V
V_{OH}	Hysteresis of V_{OUT} @ $I_{\Delta P}$ = 0 (after an overload of 1000x $I_{\Delta N}$)		125	250	mV
$V_{OH, Demag}$	Hysteresis after Degaussing			40	mV
v_{OSS}	Offsetripple (without external filter)			150	mV
v_{OSS}	Offsetripple (with 20 kHz-Filter, first order)		25		mV
v_{OSS}	Offsetripple (with 1.6 kHz-Filter, first order)		10		mV
	Mechanical stress according to M3209/3 Settings: 10-2000Hz, 1min/Octave, 2 hours		2		g

Routine Tests: (Measurement after temperature balance of the samples at room temperature, SC=significant characteristic)

V_{OUT} (SC)	(100%) M3011/6:	Output voltage vs. reference	1182 … 1218	mV
V_O	(100%) M3226:	Offset voltage ($V_{OUT}-V_{REF}$)	15	mV
U_d	(100%) M3014:	Test voltage, 1s, Pin 1-4 vs. Pin 5-10, *acc. table 21	2.0	kV_{RMS}
U_{PDE} U_{PDE}*1.875	(AQL 1/S4) M3024:	Partial discharge voltage (extinction) *acc. table 24 Pin 1-4 vs. Pin 5-10	1.2 1.5	kV_{RMS}

Requalification Tests: (replicated every year, Precondition acc. to M3236)

$\hat{U}_W$	M3064	Impulse test (1.2µs/50µs wave form) Pin 1-4 vs. Pin 5-10	6	kV
$\hat{U}_{W, prim-prim}$	M3064	Impulse test (1.2µs/50µs wave form) Pin 1 vs. Pin 11,12 and Pin 12 vs. Pin 1,2	6	kV
U_d	M3014	Test voltage, 5s Pin 1-4 vs. Pin 5-10	2.0	kV_{RMS}
$U_{d, prim-prim}$	M3014	Test voltage between primary conductors, 5s Pin 1 vs. Pin 11,12 and Pin 12 vs. Pin 1,2	2.0	kV_{RMS}
U_{PDE} U_{PDE}*1.875	M3024	Partial discharge voltage (extinction) *acc. table 24	1.2 1.5	kV_{RMS}

* IEC 61800-5-1:2007

Other instructions

- Temperature of the primary conductor should not exceed 100°C.
- Housing and bobbin material UL-listed: Flammability class 94V-0.
- Further standards: UL 508, file E317483, category NMTR2 / NMTR8
- 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.

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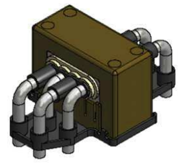
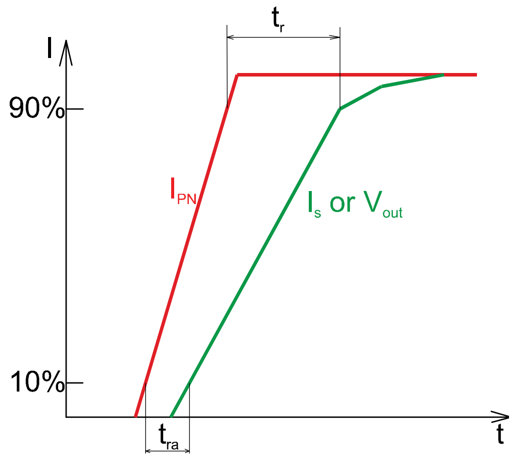


Explanation of several terms used in the tables:

V_{Ot} Long term drift of V_O after 100 temperature cycles in the range -40°C to 85°C.

t_r Response time, measured as a delay time at $I_{\Delta P} = 0.9 * I_{\Delta N}$ between a rectangular primary current and the output current or voltage.

t_{ra} Reaction time, measured as a delay time at $I_{\Delta P} = 0.1 * I_{\Delta N}$ between a rectangular primary current and the output current or voltage.



$X_{ges}(I_{\Delta N})$ The sum of all possible errors over the temperature range by measuring a current $I_{\Delta N}$:

$$X_{ges(I_{\Delta N})} = 100 * \left|\frac{V_{OUT}(I_{\Delta N}) - 2.5V}{1.2V} - 1\right| \%$$

X Permissible measurement error in the final inspection at RT, defined by

$$X = 100 * \left|\frac{V_{OUT}(I_{\Delta N}) - V_{OUT}(0)}{1.2V} - 1\right| \%$$

ε_L Linearity fault defined by: $\varepsilon_L = 100 * \left|\frac{I_{\Delta P}}{I_{\Delta N}} - \frac{V_{OUT}(I_{\Delta P}) - V_{OUT}(0)}{V_{OUT}(I_{\Delta N}) - V_{OUT}(0)}\right| \%$

Where I_P is any input DC current and V_{OUT} the corresponding output term. ($I_O = 0$).

RT Room temperature

Application Information

The external test current can be generated with the use of a resistor R and a switch X or something similar (Transistor, Mosfet, etc.). The resistor determine the current at a given voltage and so the output voltage can be calculated.

$$V_{OUT} = V_{REF} \pm \frac{1.2 \cdot \frac{5V}{R + R_{Test}} \cdot 20}{I_{\Delta N}}$$