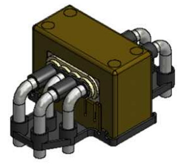
VAC VACUUMSCHMELZE	# Specification	Item no.: T60404-N4646-X931

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: 28.06.2021



Customer: Standard Type	Customers Part no:	Page 1 of 4

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
28.06.2021	DJ	82	Further standards: UL 508, file E317483, category NMTR2 / NMTR8. And add UL sign to mechanical dimension and marking info box in datasheet. CN-21-222

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

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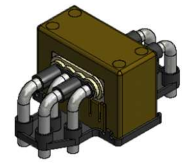
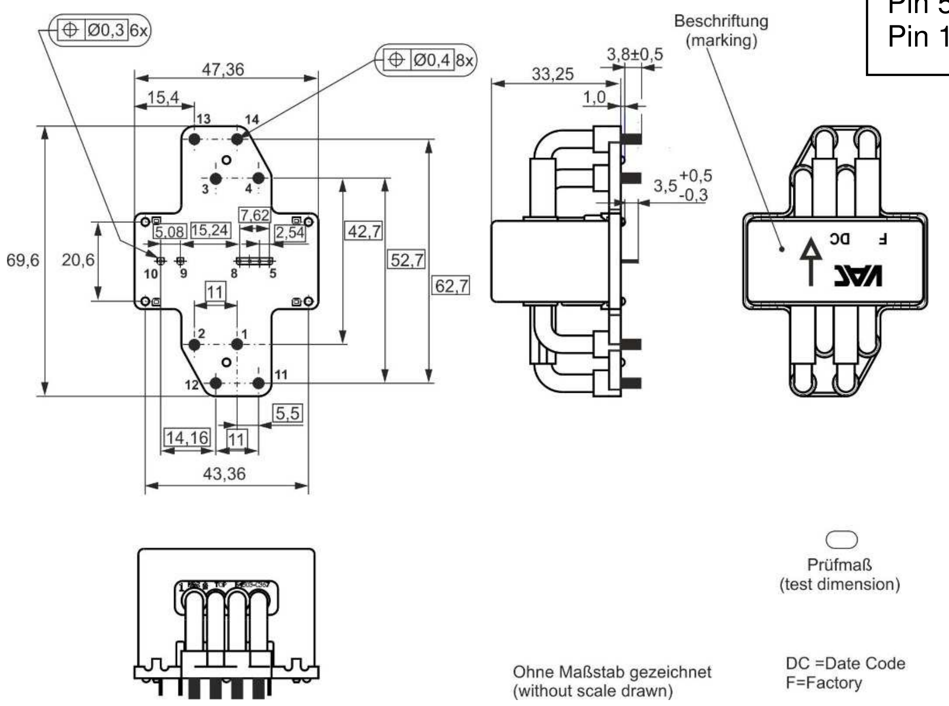


Customer: Standard Type	Customers Part no:	Page 2 of 4

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

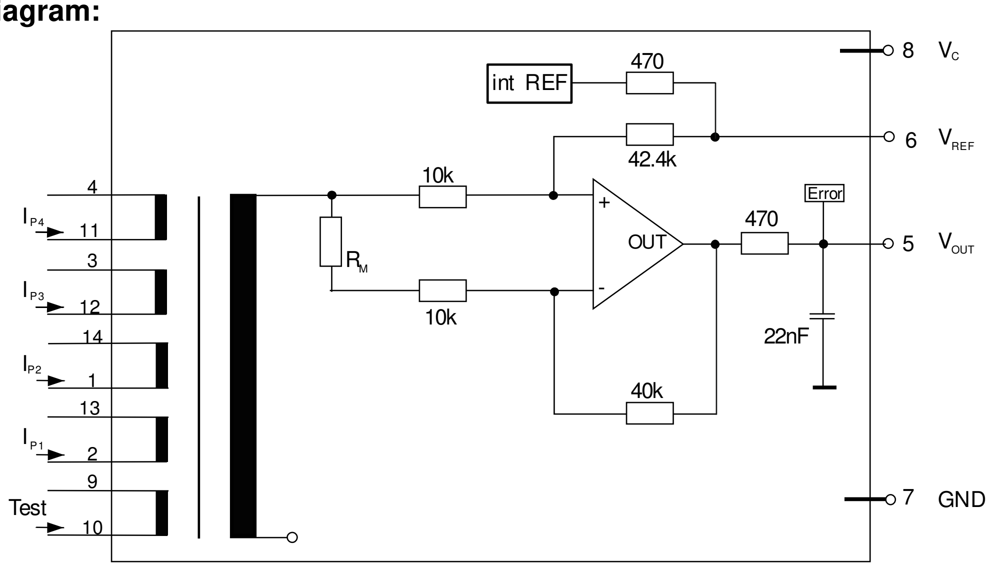


Marking:

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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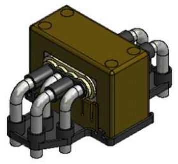

Customer: Standard Type	Customers Part no:	

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

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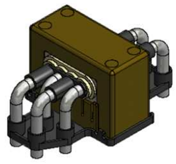
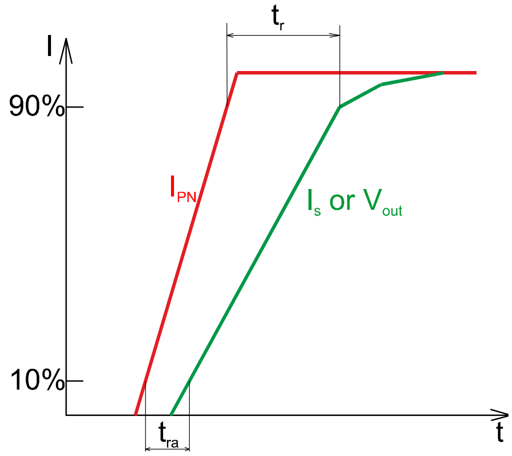


Explanation of several terms used in the tables:

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

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

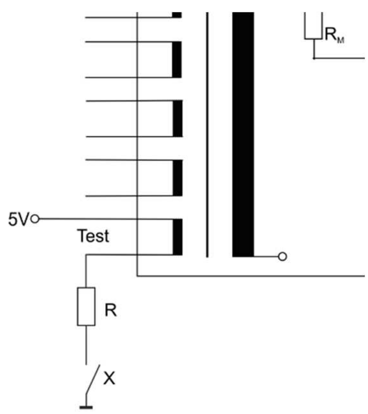
ε_L Linearity fault defined by: $\varepsilon_L = 100 * \left|\frac{I_{\Delta P}}{I_{\Delta N}} - \frac{V_{OUT}(I_{\Delta P}) - V_{OUT}(0)}{V_{OUT}(I_{\Delta N}) - V_{OUT}(0)}\right| \%$

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.



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