Specification

Item no.: T60404-N4646-X921

K-No.: 26621

300mA 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	50	A
$I_{\Delta N}$	Differential rated RMS current	0.3	A
V_{OUT}	Output voltage @ $I_{\Delta P}$	V_{REF} ± (0.74 * $I_{\Delta P}$ / $I_{\Delta N}$)	V
$V_{OUT}(0)$[1]	Output voltage @ I_P=0A, ϑ_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)[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 : 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 VREF 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)	±0.85			A
X	Accuracy @ $I_{\Delta N}$, ϑ_A = 25°C			±1.5	%
ε_L	Linearity			±1	%
V_O (V_{OUT}-V_{REF})	Offset voltage @ I_P = 0A, ϑ_A = 25°C			±25	mV
$\Delta V_O/\Delta T$	Temperature drift of V_{OUT} @ I_P=0A, ϑ_A		0.1		mV/°C
t_r	Response time @ 90% of $I_{\Delta N}$		35		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		60		g
V_C	Supply voltage	4.75	5	5.25	V
I_C	Supply current at I_P = 0A and RT		15		mA
[1)]s_{clear}	Clearance (component without solder pad)	8.5			mm
[1)]s_{creep}	Creepage (component without solder pad)	10.0			mm
[1)]U_{sys}	System voltage *determines impulse voltage acc. table 7			600	V_{RMS}
[1)]U_{AC}	Working voltage *acc. table 10			1000	V_{RMS}
[1)]U_{PD}	Rated discharge voltage *acc. table 24 with $U_{PD}=U_{AC}*\sqrt{2}$			1414	V_{PEAK}

[1)]Constructed and manufactured and tested in accordance with IEC 61800-5-1:2007
Reinforced Insulation, Pollution degree 2, Overvoltage category III, Insulation material group I

Date	Name	Issue	Amendment
02.02.2022	NSch.	81	Applicable documents changed on sheet 2. 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

VAC VACUUMSCHMELZE	Specification	Item no.: T60404-N4646-X921

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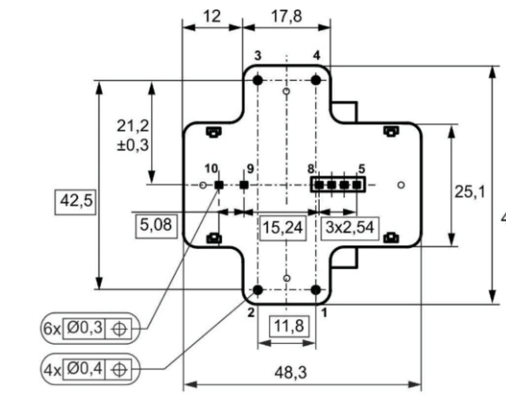
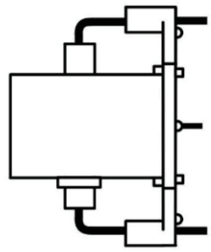
Customer: Standard type	Customers Part no:	

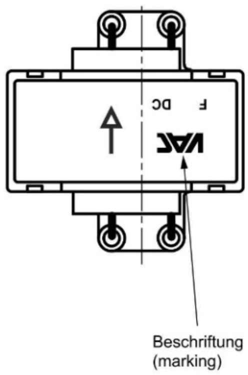
Mechanical outline (mm): General tolerances DIN ISO 2768-c

Connections:

Pin 5-10: 0.7mm x 0.7mm
Pin 1-4: Ø2.8mm

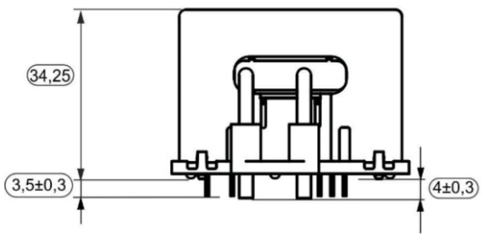






Marking:

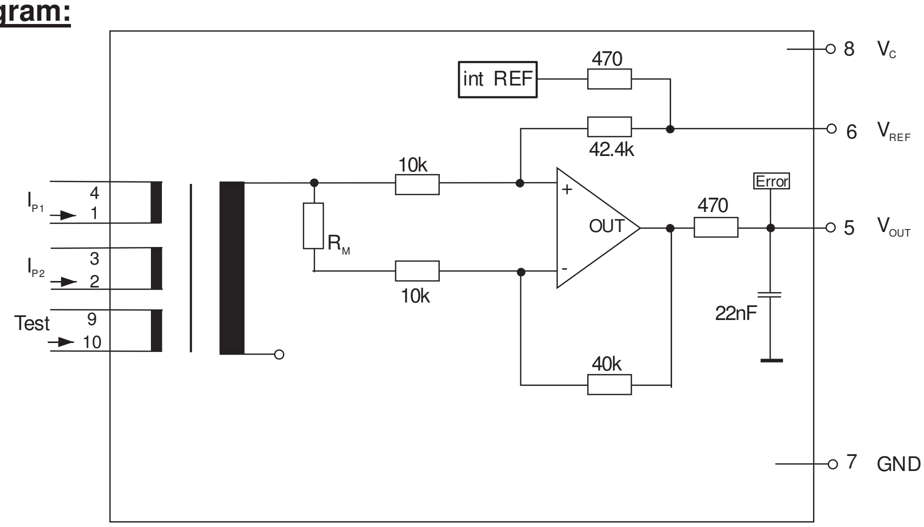
VAC
UL-sign
4646-X921
F DC



= Prüfmaß
(test dimension)

DC = Date Code
F = Factory

Schematic diagram:



Other instructions

- Current direction: A positive output voltage appears at point V_{OUT}, if primary current flows in direction of the arrow.
- Temperature of the primary conductor should not exceed **105°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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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	$15mA+I_{\Delta P}*K_N+V_{OUT}/R_L$			mA
$I_{OUT,SC}$	Short circuit output current		±10		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		**0.24**		mΩ
$R_{i,REF}$	Internal resistance of reference input		470		Ω
$R_{i,OUT}$	Output resistance of V_{OUT}		470		Ω
$\Delta X_\theta/\Delta\theta$	Temperature drift of X @ ϑ_A = -40°C ... 85°C			400	ppm/K
$\Delta V_{REF}/\Delta\theta$	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:			32	mV
V_{Ot}	Long term drift of V_O		12		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		10		mV/V
V_{OH} $V_{OH, Demag}$	Hysteresis of V_{OUT} @ I_P = 0 (after an overload of 1000x $I_{\Delta N}$) Hysteresis after Degaussing		75	125 25	mV
v_{OSS}	Offsetripple (without external filter)		70		mV
v_{OSS}	Offsetripple (with 20 kHz-Filter, first order)		20		mV
v_{OSS}	Offsetripple (with 1 kHz-Filter, first order)		6		mV
	Mechanical stress according to M3209/3 Settings: 10-2000Hz, 1min/Octave, 2 hours		1.5		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	729 … 751	mV
V_O	(100%) M3226:	Offset voltage (V_{OUT}-V_{REF})	±25	mV
V_{OUT}(test current)	(100%)	Output voltage @ V_{REF} = 0V	250 ± 60	mV
U_d	(100%) M3014:	Test voltage, 1s, Pin 1-4 vs. Pin 5-10	1.8	kV_{RMS}
U_{PDE} $U_{PD}\cdot 1.875$	(AQL 1/S4)	Partial discharge voltage (extinction) *acc. table 24	1.5 1.875	kV_{RMS}

Type Tests: (Precondition acc. to M3236)

$\hat{U}_W$	M3064:	Impulse test (1.2µs/50µs wave form) Pin 1-4 vs. Pin 5-10, 5 pulses ➔ polarity +, 5 pulses ➔ polarity -	6	kV
$\hat{U}_{W, prim-prim}$	M3064:	Impulse test (1.2µs/50µs wave form) Pin 1 vs. Pin 2	6	kV
U_d	M3014:	Test voltage, 60s Pin 1-4 vs. Pin 5-10	3.6	kV_{RMS}
$U_{d, prim-prim}$	M3014:	Test voltage between primary conductors, 60s Pin 1 vs. Pin 2	3.6	kV_{RMS}
U_{PDE} $U_{PD}\cdot 1.875$		Partial discharge voltage (extinction) *acc. table 24	1.5 1.875	kV_{RMS}

* IEC 61800-5-1:2007

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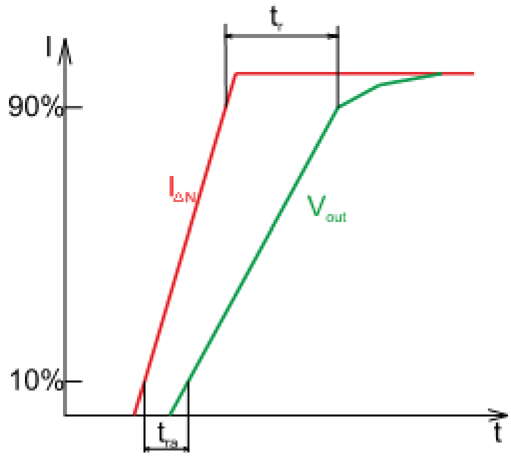
Explanation of several terms used in the tables:

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 $I_{\Delta N}$:

$$X_{ges(I_{\Delta N})} = 100 * \left|\frac{V_{OUT}(I_{\Delta N}) - 2.5V}{0.74V} - 1\right| \%$$

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

$$X = 100 * \left|\frac{V_{OUT}(I_{\Delta N}) - V_{OUT}(0)}{0.74V} - 1\right| \%$$

ΔX_θ $\Delta X_\theta = X_{\theta max} - X_{\theta min}$

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 $I_{\Delta P}$ is any input DC current and V_{OUT} the corresponding output term. ($V_O = 0$).

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.

$$V_{OUT} = V_{REF} \pm \frac{0.74 \cdot \frac{5V}{R + R_{Test}} \cdot 20}{I_{\Delta N}}$$