VACUUMSCHMELZE	**SPECIFICATION**	**Item no.:**	**T60404-N4646-X652**

K-no.: 24508	**15 A Current Sensor Module for 5V- Supply Voltage** For electronic current measurement: DC, AC, pulsed, mixed ..., with a galvanic isolation between primary circuit (high power) and secondary circuit (electronic circuit)	Date: 26.01.2022
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 nominal r.m.s. current	15	A
V_{out}	Output voltage @ I_P	2.5 ± (0.625*I_P/I_{PN})	V
V_{out}	Output voltage @ I_P=0, T_A=25°C	2.5 ± 0.0071	V
V_{Ref}	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	±51			
X	Accuracy @ I_{PN}, T_A= 25°C			0.7	%
ε_L	Linearity			0.1	%
V_{out} -2,5V	Offset voltage @ I_P=0, T_A= 25°C			±7.1	mV
ΔV_{out}/2,5V/ΔT	Temperatur drift of V_{out} @ I_P=0, T_A= -40…85°C		16	32	ppm/K
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 – 9)
Reinforced insulation, Insulation material group 1, Pollution degree 2

S_{clear}	Clearance (component without solder pad)		7.5		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
Max. potential difference acc. to UL 508			RMS	600	V_{AC}

Date	Name	Issue	Amendment
26.01.2022	NSch.	83	Applicable documents changed on sheet 3. „The color of the plastic material… added. Minor change

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

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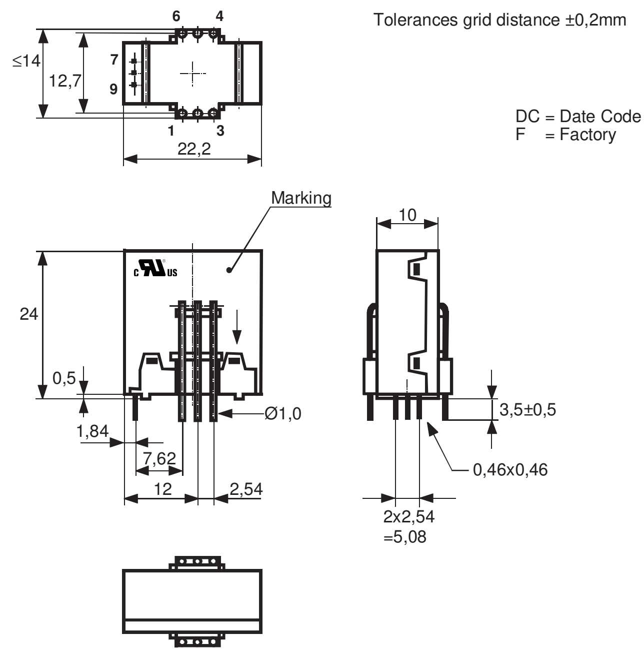
Mechanical outline (mm):

General tolerances DIN ISO 2768-c

Tolerances grid distance ±0,2mm

DC = Date Code
F = Factory

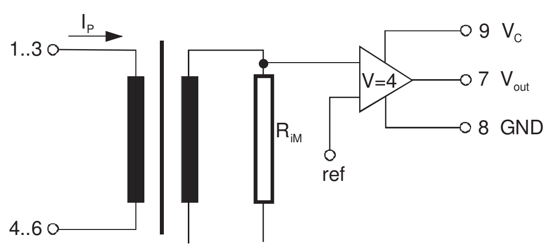
Connections:
1...6: ∅ 1 mm
7...9: 0,46*0,46 mm



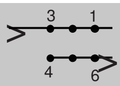
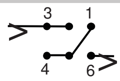
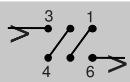
Marking:

VAC UL-sign
4646-X652
F DC

Schematic diagram



Possibilities of wiring (@ T_A = 85°C)

primary windings N_P	primary current RMS I_P [A]	primary current maximal $\hat{I}_{P,max}$ [A]	output voltage RMS $V_{out}(I_P)$ [V]	turns ratio K_N	primary resistance R_P [mΩ]	wiring
1	15	±51	2.5±0.625	1:2000	0.33	
2	7,5	±25	2.5±0.625	2:2000	1.5	
3	5	±17	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,(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
$\Delta V_0 = \Delta(V_{out}$ -2.5V)	Sum of any offset drift including:		6	12	mV
V_{0t}	Long term drift of V_0		2		mV
V_{0T}	Temperature drift von V_0 @ T_A = -40 ...+85°C		5		mV
V_{0H}	Hysteresis of V_{out} @ I_P=0 (after an overload of 10 x I_{PN})		3	mV	
$\Delta V_0/\Delta V_C$	Supply voltage rejection ratio			1	mV/V
v_{oss}	Offsetripple (with 1 MHz- filter first order)			70	mV
v_{oss}	Offsetripple (with 100 kHz- filter firdt order)		5.5	11	mV
v_{oss}	Offsetripple (with 20 kHz- filter first order)		1.5	3	mV
C_k	Maximum possible coupling capacity (primary – secondary)		5	10	pF
	Mechanical stress according to M3209/3 Settings: 10 – 2000 Hz, 1 min/Octave, 2 hours			30g	

Inspection (Measurement after temperature balance of the samples at room temperature)

V_{out} (I_P=I_{PN})	(V)	M3011/6:	Output voltage vs. internal reference (I_P=15A, 40-80Hz)	625±0.7%	mV
V_{out}–2.5V (I_P=0)	(V)	M3226:	Offset voltage	± 7.1	mV
V_d	(V)	M3014:	Test voltage, rms, 1 s pin 1 – 6 vs. pin 7 – 9	1.5	kV
V_e	(AQL 1/S4)		Partial discharge voltage acc.M3024 (RMS) with V_{vor} (RMS)	1400 1750	V V

Type Testing (Pin 1 - 6 to Pin 7 - 9)

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) with V_{vor} (RMS)		1400 1750	V V

Applicable documents

Current direction: A positive output current appears at point I_S, by primary current in direction of the arrow.
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)

Δt (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

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

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

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

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