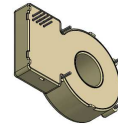


Differential Current Sensor for stationary applications acc. to the standard IEC62955



Date: 10.03.2020

K-No.: 30028

Customer: Standard type

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Description

- Fluxgate current sensor with toroidal core
- PCB mounting

Characteristics

- Excellent accuracy
- AEC-Q qualified components
- Switching open-collector outputs
- Compact design

Applications

Mainly used for stationary and mobile applications:

- IC-CPD
- Wallbox

Electrical data – Ratings

		min.	typ.	max.	Unit
I_P	Primary nominal RMS current (1phase / 3phase)			80 / 40	A
$I_{\Delta N1}$	Rated residual operating current 1		6		mA DC
$I_{\Delta N1, \text{tolerance}}$	Trip tolerance 1	4	5	6	mA DC
$S_{\text{PWM-OUT}}$	Scaling factor of the DC component $I_{\Delta N1}$ (for monitoring purpose only!)		3.33		%/mA
$I_{\Delta RI,1}$ (Fig.1)	Recovery current level for $I_{\Delta N1}$ (absolute value DC)		2.5		mA

Accuracy – Dynamic performance data

$I_{\Delta N, \text{max}}$	Max. measuring range (peak)	-300		+300	mA
X	Resolution (@ $I_{\Delta N}$, $\Theta_A = 25^\circ\text{C}$)		< 0.2		mA
$f_{\text{BW}} (I_{\Delta N1})$	Frequency range		DC		

General data

ϑ_A	Ambient operation temperature	-40		85	$^\circ\text{C}$
$\vartheta_{\text{Storage}}$	Ambient storage temperature ⁽⁴⁾	-40		85	$^\circ\text{C}$
m	Mass		21		g
V_{CC}	Supply voltage	4.8	5	5.2	V
I_{CC}	Consumption current	38		45	mA
$S_{\text{clear, ps}}$	Clearance (primary to secondary)		not applicable if isolated cable is used ⁽⁵⁾		
$S_{\text{creep, ps}}$	Creepage (primary to secondary)		not applicable if isolated cable is used ⁽⁵⁾		
FIT	EN/IEC 61709 / SN 29500 ⁽⁶⁾ (MIL-HDBK-217F) ⁽⁶⁾		1529 (6349)		fit
SW	Firmware		D596 V1.08		

⁽³⁾ Switching time of a standard relay ($t = 20\text{ms}$) is considered.

⁽⁴⁾ see VAC M-sheet 3101; storage temperature inside cardboard packaging

⁽⁵⁾ Constructed, manufactured and tested in accordance with IEC60664-1:2007

Isolated wires are preferred to fulfill the insulation coordination acc. to IEC 62955:2018, it is necessary to use insulated primary conductors that meet the requirements of the basic insulation for the rated voltage. If isolated primary conductors are used, the isolation coordination is acc. to: Reinforced insulation, Insulation material group 1, Pollution degree 2 and overvoltage category III.

⁽⁶⁾ The results are valid under following conditions: 55°C mean component ambient temperature by continuous operation (8760h per year);

Environment condition: ground mobile, no dust or harmful substances, according to IEC61709; Fit equals one failure per 10^9 component hours.

General description of sensor function:

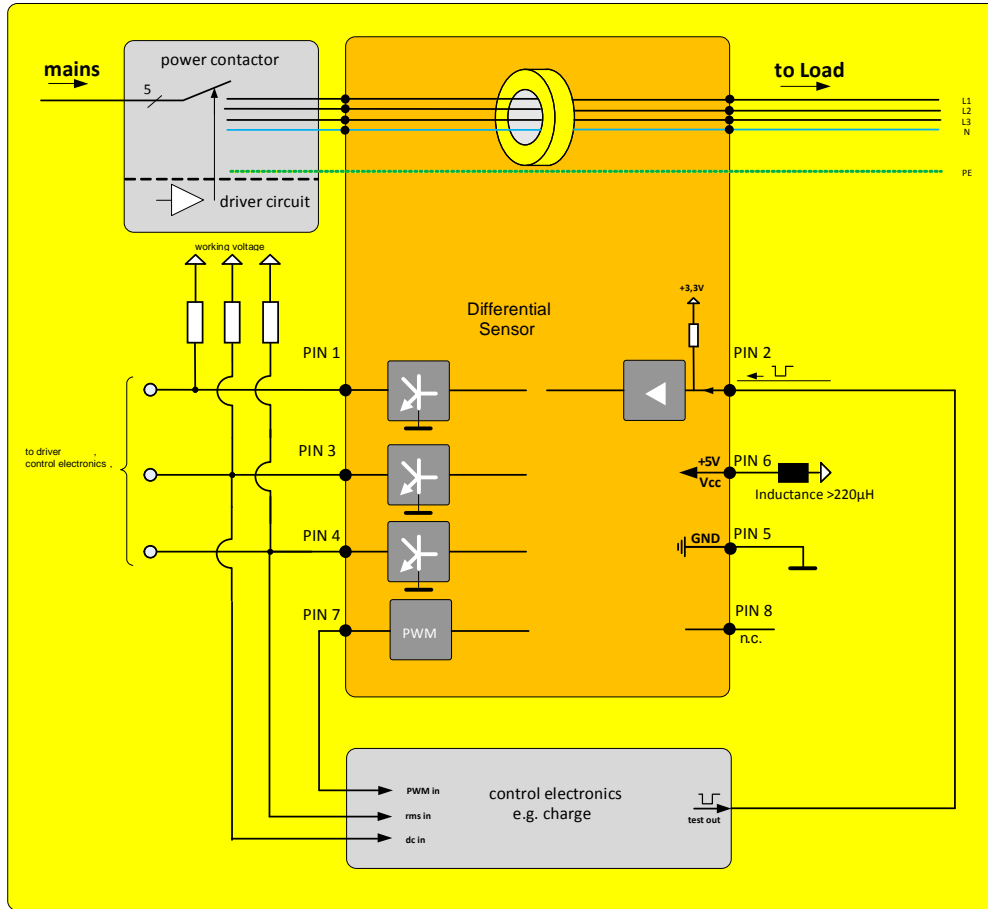
The sensor is sensitive to DC currents and can be used for fault current detection in EV-charging applications according IEC 62955:2018. In the event of a DC fault current, PIN3 and PIN4 will change its state from a low level to a high impedance state.

Error conditions (e.g. an internal error) are signaled on PIN 1 (ERROR-OUT).

The sensor only fulfills the switch-off characteristic of the IEC62955 standard (monitoring the residual current). An additional driver-circuit must be used for driving RCBO, RCCB or circuit breaker as defined in IEC62955. The sensor's outputs are limited to max. 40V/50mA!

Datum	Name	Index	Änderung
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Editor.: R&D-PD-NPI D Designer: MB MC-PM: BZ Released by: SB			

Typical application diagram:



Absolute maximum Ratings⁽⁶⁾:

		Min	Typ.	Max	Unit
V_{CE}	Collector-Emitter voltage (PINS 1, 3 and 4)			40	V
I_C	Collector current (PINS 1, 3 and 4)			50	mA
V_{CC}	Maximum supply voltage (without function)	-0.3		7	V
U_{MAX}	Maximum rated voltage of primary conductors (AC rms)			250	V
$V_{TEST-IN, low}$	TEST-IN Input Voltage, low level	0		0.6	V
$V_{TEST-IN, high}$	TEST-IN Input Voltage, high level	2.5		5	V

⁽⁵⁾ Stresses above these ratings may cause permanent damage. Exposure to these conditions for extended periods may degrade device reliability. Functional operation of the device at these or any other conditions beyond those specified is not supported.

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

		Min.	Max.	Unit
Vcc	Supply voltage	4.9	5.1	V
Icc	Supply current	38.0	45.0	mA
TEST-IN (SC)	TEST-IN voltage	2.8	3.4	V
X6-OUT (normal)	X6-OUT voltage	0	0.6	V
X30-OUT (normal)	X30-OUT voltage	0	0.6	V
ERROR-OUT (normal)	ERROR-OUT voltage	0	0.6	V
X6-OUT (activated)	X6-OUT voltage activated @5V, 1kΩ (pull-up)*	4.9	5.1	V
X30-OUT (activated)	X30-OUT voltage activated @5V, 1kΩ (pull-up)*	4.9	5.1	V
ERROR-OUT (activated)	ERROR-OUT voltage activated @5V, 1kΩ (pull-up)*	4.9	5.1	V
TC1	Trip current 1 – X6	4.1	5.4	mA
TC2	Trip current 2 – X6	-5.4	-4.1	mA
PWM-OUT (frequency)	PWM-OUT frequency	7.8	8.2	kHz
PWM-OUT (duty-cycle)	PWM-OUT duty-cycle @6mA DC	18	22	%
LV1	Limit values of break time - X6-OUT@6mA DC	0	700	ms
LV2	Limit values of break time - X6-OUT@30mA DC	0	500	ms
NTC1	X6-OUT & X30-OUT@50mA,50Hz	0	0,6	V

* the maximum values of collector-emitter voltage and current see "Absolute maximum ratings"

Product Tests:

	Acc. to VAC sheet M3238 Following tests differ from M3238:	passed	
PD	4.5a: Damp heat, steady state. Duration: 1000 h IEC61000-4-1, EN60270, M3024 UPDE M3024, Partial discharge voltage (extinction) *acc. to table 24	1.5	kV rms
ESD	Air- and contact discharge; U=±2000V, R=1500Ω, C=100pF Acc. to Human Body Model JESD22-A114	±2.0	kV
EMC	IEC61000-4-3 (Radiated, radio-frequency, electromagnetic field immunity) 20V/m 80MHz – 1GHz 80%AM 1kHz, recommend with the use of inductance of >220µH in series of Vcc input.	passed	
EMC	IEC61000-4-6 (Immunity to conducted disturbances), recommend with the use of inductance of >220µH in series of Vcc input.	passed	
A(f), Φ(f)	IEC61000-6-4 (Emission standard for industrial environments, conducted disturbances)	Should be done in end application	
Impulse test	Amplitude and phase response over frequency 1% of I _{PN} or I _{Δn}	passed	
	Monitoring of CS function during the current phase test 100A to 5kA	passed	

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Regualification Tests: (replicated every year, Precondition acc. to M3238)

$\hat{U}_{W, \text{prim-sec}}$	M3064	Impulse test (1.2 μ s/50 μ s waveform) PIN 1-8 vs. insulated primary wire 5 pulse \rightarrow polarity +, 5 pulse \rightarrow polarity -	8.0	kV
U_d	M3014	Test voltage, 60s PIN 1-8 vs. insulated primary wire	1.5	kV rms
U_{PDE}	M3024	Partial discharge voltage (extinction) PIN 1-8 vs. insulated primary wire *acc. to table 24	1.2	kV rms
$U_{PD} \times 1.875$	M3024	Partial discharge voltage (extinction) PIN 1-8 vs. insulated primary wire *acc. to table 24	1.5	kV rms

* IEC 61800-5-1:2007

Other instructions:

- Temperature of the primary conductor should not exceed 105°C.
- Vcc during Test-IN function test must be at least 4.8V
- Fall- and rise-time of Vcc 2...50 μ s/V

Figures:

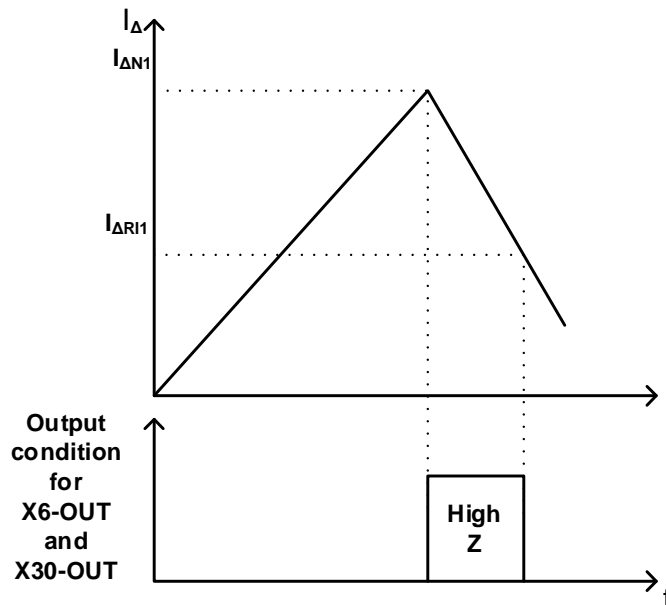
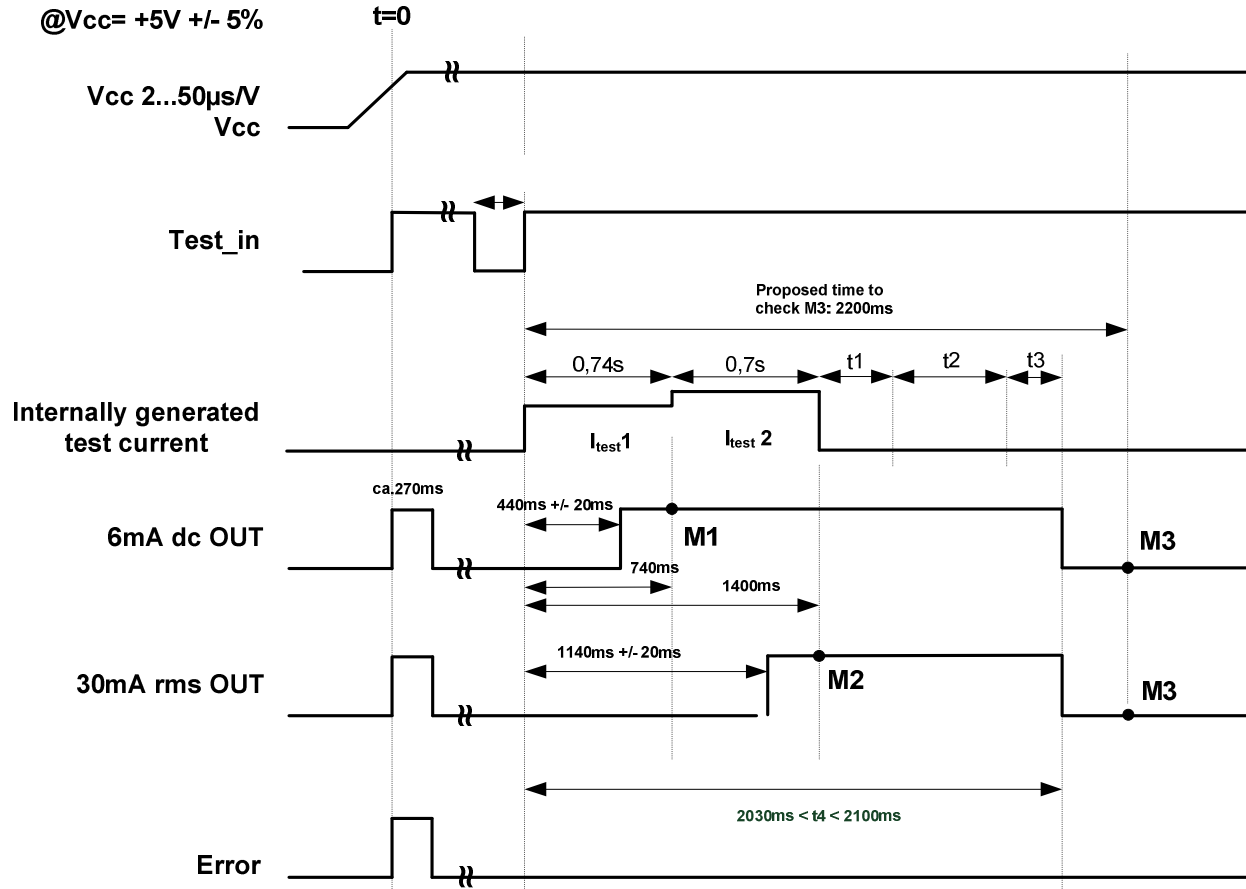


Fig. 1: Meaning of switching recovery level

If the trip-level $I_{\Delta N1}$ is accomplished the output X6-OUT/X30-OUT will change its state from low-level (GND) to high impedance. Depending on the existence of the differential current I_{Δ} , the outputs X6-OUT/X30-OUT will remain in this state until I_{Δ} fell below recovery threshold $I_{\Delta RH1}$.



$t1 = 10ms$ or $100ms$

$t2 = 500ms$

$t3 = 0ms$ to $50ms$

Optional time to check for welded contacts.
10ms if check is disabled.

Time for offset calibration (if it was requested).

Optional time required to store the offset calibration value. Depends on the difference to the value already stored in memory.

Fig. 2: Power-Up timing diagram

X6-OUT	X30-OUT	ERROR-OUT	State
low level	low level	low level	Normal condition
low level	low level	low level	$I_{\Delta} < 30mA_{AC}$
High impedance	High impedance	low level	$I_{\Delta} \geq 6mA_{DC}$
High impedance	High impedance	High impedance	Error, system fault
All other conditions not mentioned in the table are not possible. If these conditions occur, the sensor is in unknown state and describes an Error.			

Table 1: Possible output states



Specification

Item no.: T60404-N4641-X904

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	6mA	60mA	200mA
Standard values acc. to IEC62955:2018	10s	0.3s	0.1s
Typical values of sensor	0.45s	0.06s	0.035s

Table 2: Maximum and typical values of break time for residual direct currents

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Designer: MB

MC-PM: BZ

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