EV Charger Residual Current Transducer
TLB6-A1TDM(K)

RoHS

Features

- Open-loop, fluxgate-based current transducer
- Meet IEC 62752: 2018 (IC-CPD)
- Meet IEC 62955: 2018 (RDC-PD)
- Meet the requirements of AC 30mA and DC 6mA residual current detection
- PCB installation, easy for using
- 3,000 A surge current capability

TLB6-A1TDM(K) *is a residual current transducer for EV charger. It can be widely used in the electric vehicle charger industry. It uses fluxgate detection technology to detect DC, AC, and various pulsating residual currents. The module meets the residual current requirements of IEC62752 (mode 2) and IEC62955 (mode 3) testing standards. It can detect 6mA DC residual current. The trigger is sensitive and responds to leakage events in time.*

Selection Guide

Part No.	Input Voltage	Rated DC Residual Current	Rated AC Residual Current	Rated current	Static Power Dissipation
TLB6-A1TDM	5VDC	6mA	30mA	40A	0.25W
TLB6-A1TDMK	5VDC	6mA	30mA	40A	0.25W

Note: TLB6-A1TDMK enhances magnetic shielding performance.

Electrical Characteristics

Item	Symbol	Min	Typ	Max	Unit.
Rated Residual DC Operating Current	$I_{\Delta NDC}$	--	6	--	mA
Rated Residual AC Operating Current	$I_{\Delta NAC}$	--	30	--	mA
Range of Remaining DC Operating Current	$I_{\Delta NDC\text{-}RANGE}$	3	--	6	mA
Range of Remaining AC Operating Current	$I_{\Delta NAC\text{-}RANGE}$	15	--	30	mA
Maximum Residual Current Measurement Range	$I_{\Delta RANGE}$	--	±300	--	mA
Input Voltage	V_{CC}	4.85	5	5.15	V
Static Operating Current	--	--	30	45	mA
Rated current	I_P	--	32	40	A

Protection and Detection Characteristics

Item	Symbol	Min	Typ	Max	Unit.
Calibration Input Low Level Voltage	$V_{CAL\ IL}$	0	--	1	V
Calibration Input High Level Voltage	$V_{CAL\ IH}$	4	--	5.15	V
Error Output Low Level Voltage	$V_{ERROR\text{-}OUT\ OL}$	0	--	0.6	V
Error Output High Level Voltage	$V_{ERROR\text{-}OUT\ OH}$	--	--	High impedance	--
Operating Output Low Level Voltage	$V_{DC\text{-}OUT/\ AC\text{-}OUT\ OL}$	0	--	0.6	V
Operating Output High Level Voltage	$V_{DC\text{-}OUT/\ AC\text{-}OUT\ OH}$	--	--	High impedance	--
PWM Output Duty Ratio	$S_{PWM\text{-}OUT}$	3	3.3	3.6	%/mA
Frequency of PWM Output Duty Ratio	$f_{PWM\text{-}OUT}$	7.8	8	8.2	kHz
Error Output Delay Time	$T_{ERROR\text{-}OUT}$	150	--	--	ms
Calibration Input Low Pulse Time Limit	$T_{CAL\ IL}$	--	40	--	ms
Calibration Input High Pulse Time Limit	$T_{CAL\ IL}$	--	1.2	--	s

Performance Characteristic

Item	Symbol	Residual Current Waveform	Min	Typ	Max	Unit.
Residual operating current	$I_{\Delta NAC50}$	Frequency 50Hz AC	15	22.5	30	mA RMS
	$I_{\Delta NAC1000}$	Frequency 1000Hz AC	--	300	--	mA RMS
	$I_{\Delta NA0}$	0 Angle Pulsating DC	11	15	30	mA RMS
	$I_{\Delta NA90}$	90 Angle Pulsating DC	10	15	30	mA RMS
	$I_{\Delta NA135}$	135 Angle Pulsating DC	10	15	35	mA RMS
	$I_{\Delta NS-DC}$	Smooth DC	3	4.5	6	mA RMS
	$I_{\Delta N2PDC}$	Two Phase Rectification DC	3.5	5	7	mA RMS
	$I_{\Delta N3PDC}$	Three Phase Rectification DC	3.1	4.5	6.2	mA RMS
	$I_{\Delta IC-CPD}$	IC-CPD Current	18	28	38	mA RMS
Response time	$T_{\Delta NAC50@30mA}$	RMS 30mA Frequency 50Hz AC	--	55	70	ms
	$T_{\Delta NAC50@60mA}$	RMS 60mA Frequency 50Hz AC	--	30	35	ms
	$T_{\Delta NAC50@150mA}$	RMS 150mA Frequency 50Hz AC	--	15	20	ms
	$T_{\Delta NA0@42mA}$	RMS 42mA 0 Angle Pulsating DC	--	38	50	ms
	$T_{\Delta NA0@84mA}$	RMS 84mA 0 Angle Pulsating DC	--	30	40	ms
	$T_{\Delta NA0@210mA}$	RMS 210mA 0 Angle Pulsating DC	--	25	35	ms
	$T_{\Delta NA0@42mA+S-DC@6mA}$	RMS 42mA 0 Angle Pulsating DC with 6mA Smooth DC	--	38	50	ms
	$T_{\Delta NA0@84mA+S-DC@6mA}$	RMS 84mA 0 Angle Pulsating DC with 6mA Smooth DC	--	30	40	ms
	$T_{\Delta NA0@210mA+S-DC@6mA}$	RMS 210mA 0 Angle Pulsating DC with 6mA Smooth DC	--	25	35	ms
	$T_{\Delta NA90@42mA}$	RMS 42mA 90 Angle Pulsating DC	--	38	50	ms
	$T_{\Delta NA90@84mA}$	RMS 84mA 90 Angle Pulsating DC	--	30	40	ms
	$T_{\Delta NA90@210mA}$	RMS 210mA 90 Angle Pulsating DC	--	25	35	ms
	$T_{\Delta NA90@42mA+S-DC@6mA}$	RMS 42mA 90 Angle Pulsating DC with 6mA Smooth DC	--	38	50	ms
	$T_{\Delta NA90@84mA+S-DC@6mA}$	RMS 84mA 90 Angle Pulsating DC with 6mA Smooth DC	--	30	40	ms
	$T_{\Delta NA90@210mA+S-DC@6mA}$	RMS 210mA 90 Angle Pulsating DC with 6mA Smooth DC	--	25	35	ms
	$T_{\Delta NA135@42mA}$	RMS 42mA 135 Angle Pulsating DC	--	38	50	ms
	$T_{\Delta NA135@84mA}$	RMS 84mA 135 Angle Pulsating DC	--	30	40	ms
	$T_{\Delta NA135@210mA}$	RMS 210mA 135 Angle Pulsating DC	--	25	35	ms
	$T_{\Delta NA135@42mA+S-DC@6mA}$	RMS 42mA 135 Angle Pulsating DC with 6mA Smooth DC	--	38	50	ms
	$T_{\Delta NA135@84mA+S-DC@6mA}$	RMS 84mA 135 Angle Pulsating DC with 6mA Smooth DC	--	30	40	ms
	$T_{\Delta NA135@210mA+S-DC@6mA}$	RMS 210mA 135 Angle Pulsating DC with 6mA Smooth DC	--	25	35	ms
	$T_{\Delta NS-DC@6mA}$	6mA Smooth DC	--	120	200	ms
	$T_{\Delta NS-DC@60mA}$	60mA Smooth DC	--	25	30	ms
	$T_{\Delta NS-DC@300mA}$	300mA Smooth DC	--	25	30	ms
	$T_{\Delta N2PDC@6mA}$	RMS 6mA Two Phase Rectification DC	--	120	200	ms
	$T_{\Delta N2PDC@60mA}$	RMS 60mA Two Phase Rectification DC	--	25	30	ms
	$T_{\Delta N2PDC@300mA}$	RMS 300mA Two Phase Rectification DC	--	25	30	ms
	$T_{\Delta N3PDC@6mA}$	RMS 6mA Three Phase Rectification DC	--	120	200	ms
	$T_{\Delta N3PDC@60mA}$	RMS 60mA Three Phase Rectification DC	--	25	30	ms
	$T_{\Delta N3PDC@300mA}$	RMS 300mA Three Phase Rectification DC	--	25	30	ms
	$T_{\Delta NF@210mA}$	RMS 210mA Composite Current	--	15	25	ms
	$T_{\Delta IC-CPD@210mA}$	RMS 210mA IC-CPD Current	--	15	25	ms

Isolation Characteristics

Item	Operating Conditions	Min	Typ	Max	Unit.
Isolation Voltage	Primary edge input, secondary output; 50Hz, 1min; leakage current<1mA	--	--	4	kVAC
Pulse Withstand Voltage	1.2/50μs	--	5.5	--	kV
Insulation Resistance	500VDC	1	--	--	GΩ

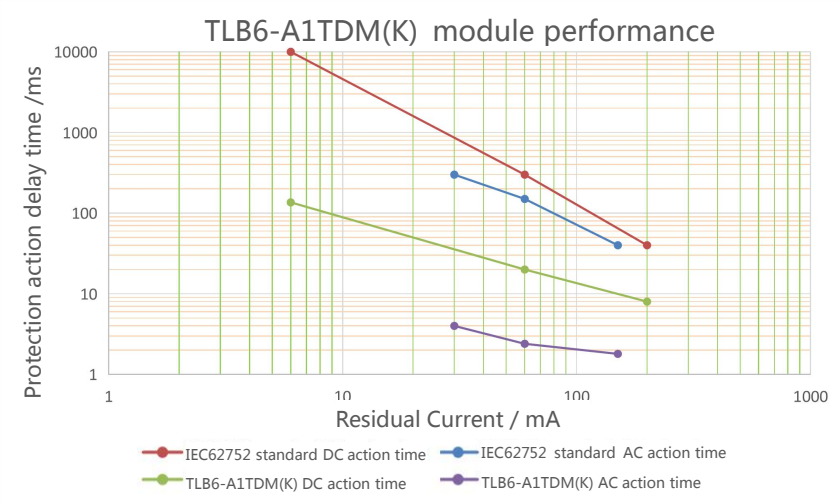
General Characteristics

Item	Symbol	Min	Typ	Max	Unit.
Operating Temperature	Ta	-40	--	85	℃
Storage Temperature	T_S	-40	--	105	℃
Weight (TLB6-A1TDM)	m	--	31	--	g
Weight (TLB6-A1TDMK)	m	--	37	--	g
Vibration	0-150Hz, 5g (GB2423.10, IEC60068-2-6)				
Overvoltage Category	OVC III (IEC61010)				

EMC

Item		Specifications	
EMI	CE	CISPR32/EN55032 CLASS B	
	RE	CISPR32/EN55032 CLASS B	
EMS	ESD	IEC/EN61000-4-2 Contact ±4kV, Air ±8kV	perf. Criteria B
	RS	IEC/EN61000-4-3 20V/m	perf. Criteria A
	EFT	IEC/EN61000-4-4 ±2kV	perf. Criteria B
	Surge Current	3000A, 8/20us	perf. Criteria B

Product Characteristic Curve



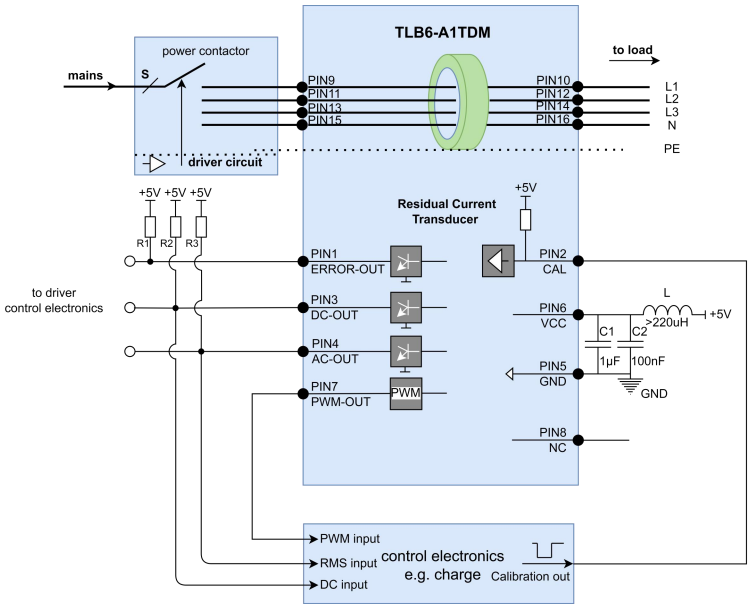
Pin Description

Pin	Mark	Description
1	ERROR-OUT	Error output pin, when the pin is in the high impedance, it indicates that the system is faulty. At this time, the DC-OUT pin and the AC-OUT pin are also in the high impedance. If the system is normal, the pin is low level.
2	CAL	Calibration pin, when the pin input a low voltage of >40ms and <1.2s in duration, the product performs a calibration.
3	DC-OUT	DC action pin. Under the condition that the system is fault-free, the pin is low level when the DC residual current is less than 6mA; otherwise, the pin is high impedance. In addition, when the AC-OUT pin is in a high impedance, the pin is also set to a high impedance. See "Output pin truth Table".
4	AC-OUT	AC action pin. Under the condition that the system is fault-free, the pin is low level when the AC residual current is less than 30mA; otherwise, the pin is high impedance.
5	GND	Product-powered ground.
6	VCC	The product is powered by VCC, which requires a capacitor of 100nF and 1uF in parallel at the input end.
7	PWM-OUT	Duty ratio output pin. Output a square wave signal with 8kHz frequency, and the duty ratio varies with the input current by 3.3% per mA.
8	NC	Not connected.

Output Pin Truth Table

Pin	DC-OUT	AC-OUT	ERROR-OUT	Operating State
Pin Output State	Low level	Low level	Low level	System normal
	High impedance	Low level	Low level	$I_{\Delta NDC}$ > 6mA
	High impedance	High impedance	Low level	$I_{\Delta NAC}$ > 30mA
	High impedance	High impedance	High impedance	Error, system fault

Connection and Description



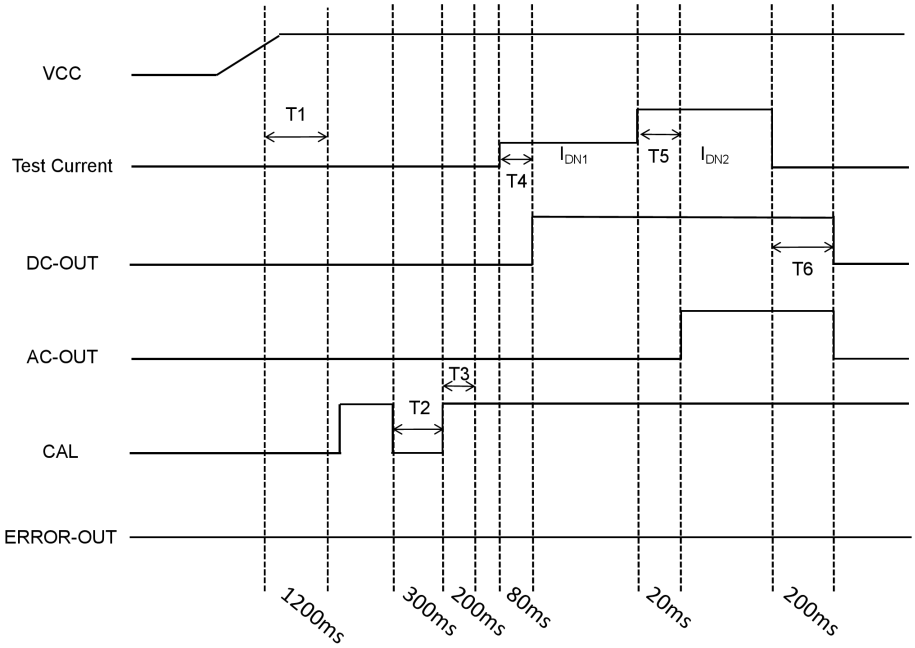
1. Two capacitors 1uF/16V and 100nF/16V need to be provided at VCC and GND for energy storage and decoupling. The value of inductance L is greater than 220μH.
2. DC action pin DC-OUT, AC action pin AC-OUT and duty ratio output pin PWM-OUT are usually connected to a microcontroller or to a power circuit to control back-end circuit breaker action.
3. The ERROR output pin ERROR-OUT, DC action pin DC-OUT, and AC action pin AC-OUT need to be connected to pull-up resistors R1, R2, and R3 respectively. 10 kΩ is recommended for pull-up resistors.
4. Calibration pin CAL is generally controlled by a microcontroller. See "Pin Description" for details.
5. Hot plug is unavailable.

6. The product should pay attention to level matching and use 5V MCU. If 3.3V MCU is used, the pull-up resistors R1, R2, and R3 need to be connected to a 3.3V power supply.

Timing Characteristics

Item	Symbol	Min	Typ	Max	Unit.
Start-up to Operating time	T1	--	--	1200	ms
CAL Signal Low Level Maintenance Time	T2	40	300	1200	ms
CAL Calibration Duration	T3	--	200	--	ms
Idn1 Test Signal Action Time (I_{DN1}=8mA)	T4	--	80	--	ms
Idn2 Test Signal Action Time (I_{DN2}=40mA)	T5	--	20	--	ms
Trip Signal Maintenance Time	T6	--	200	--	ms

Timing Application Design

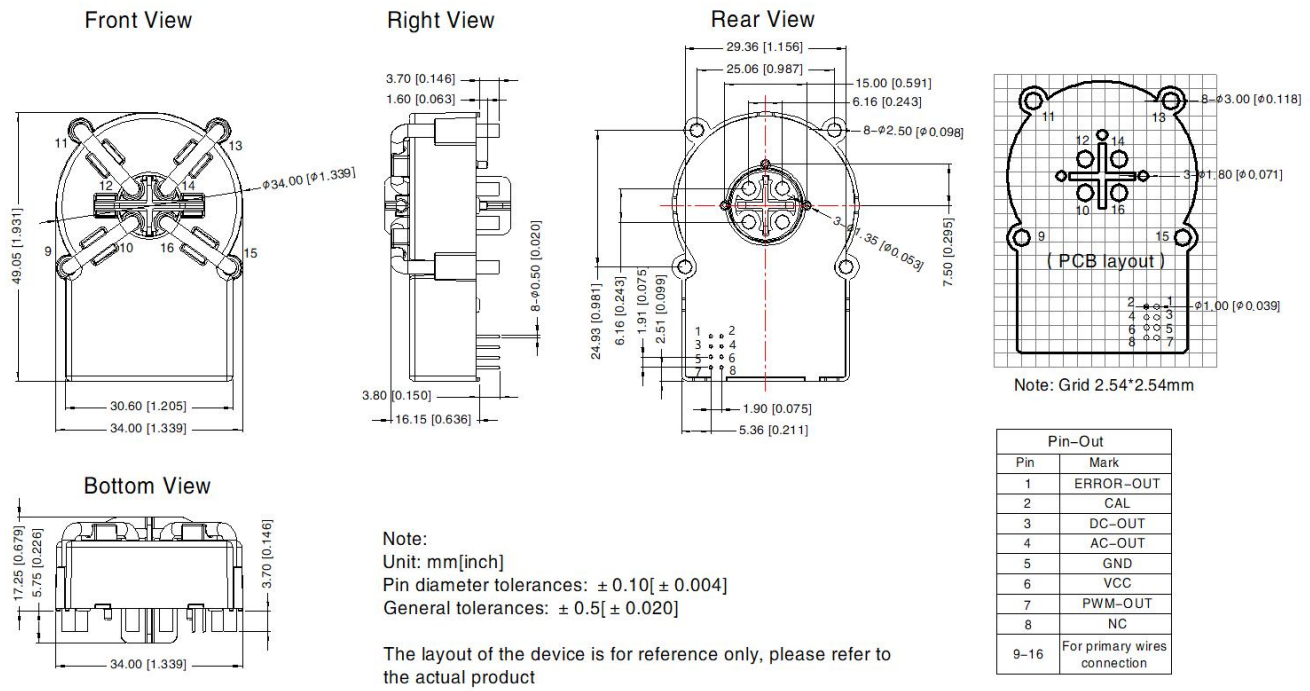


Timing application design essentials:

1. After the power supply is fully started, the startup and stabilization time of the module is about 1200ms (T1). During this period, it is recommended that the whole system do not operate.
2. When performing signal calibration, the external signal sets the CAL pin to low level, and the recognition time (T2) of the CAL pin low level is about 300ms. After successful identification, signal calibration is carried out internally. The duration of the calibration was approximately 200ms (T3).
3. External input test current I_{DN1}, delay about 80ms (T4), DC-OUT pin output high impedance (trip signal); Then the test current is increased to I_{DN2}, and after a delay of about 20ms (T5), the DC-OUT pin and AC-OUT pin output high impedance (trip signal).
4. The test current input stops, and after a delay of about 200ms (T6), the DC-OUT pin and AC-OUT pin stop the output trip signal and output low level.

Dimensions and Recommended

THIRD ANGLE PROJECTION



Pin-Out	
Pin	Mark
1	ERROR-OUT
2	CAL
3	DC-OUT
4	AC-OUT
5	GND
6	VCC
7	PWM-OUT
8	NC
9-16	For primary wires connection

Note:
Unit: mm[inch]
Pin diameter tolerances: ± 0.10[± 0.004]
General tolerances: ± 0.5[± 0.020]

The layout of the device is for reference only, please refer to the actual product

Notes:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58240085;
2. All index testing methods in this datasheet are based on company corporate standards;
3. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage;
4. We can provide product customization service, please contact our technicians directly for specific information;
5. This products is used in electronic equipment, please follow the operation and instructions of the manual, and use it in a standard and safe environment;
6. Please do not install the product in a dangerous area; beware of the risk of electric shock during operating, some modules may generate dangerous voltages (such as primary wires);
7. This products is a build-in device, After installation, the conductive part must not be touched completely. A protective box or shield can be used;
8. It is strictly forbidden to disassemble and assemble the products privately to prevent equipment without failure or malfunction;
9. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

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