EV Charger Residual Current Transducer
TLB6-A1PDM(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-A1PDM(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 residual current waveform covering Type B, and can detect 6mA DC residual current. The trigger is sensitive and responds to leakage events in time.*

Selection Guide

Part No.	Input Voltage (VDC)	Rated DC Residual Current (mA)	Rated AC Residual Current (mA)	Rated current (A)	Static Power Dissipation(W)
TLB6-A1PDM	5	6	30	40/ 80(3 phase/ 1 phase)	0.25
TLB6-A1PDMK	5	6	30	40/ 80(3 phase/ 1 phase)	0.25

Note: TLB6-A1PDMK enhances magnetic shielding performance. If there are electromagnetic control devices such as relays within 10cm of the residual current transducer, it is recommended to use TLB6-A1PDMK.

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}	4.8	5	5.2	V
Static Operating Current	--	--	30	50	mA

Protection and Detection Characteristics

Item	Symbol	Min	Typ	Max	Unit.
Calibration Test Input Low Level Voltage	$V_{TEST\text{-}IN\ IL}$	0	--	1	V
Calibration Test Input High Level Voltage	$V_{TEST\text{-}IN\ IH}$	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	$V_{X6\text{-}OUT/\ X30\text{-}OUT\ OL}$	0	--	0.6	V
Operating Output High Level Voltage	$V_{X6\text{-}OUT/\ X30\text{-}OUT\ OH}$	--	--	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
Calibration Test Input Low Pulse Limit	$T_{TEST\text{-}IN\ IL}$	--	40	--	ms
Calibration Test Input High Pulse Limit	$T_{TEST\text{-}IN\ IL}$	--	1.20	--	s

Isolation Characteristics

Item	Operating Conditions	Min	Typ	Max	Unit.
Isolation Voltage	Primary edge input, secondary output; 50Hz, 1min; leakage current<0.1mA	--	--	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	-50	--	+125	℃
Weight	TLB6-A1PDM	m	--	20	--	g
	TLB6-A1PDMK	m	--	24	--	g
Vibration		0-150Hz, 5g (GB2423.10, IEC60068-2-6)				
Overvoltage Category		OVC III (IEC61010)				

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
	$I_{\Delta NA0}$	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
	$I_{\Delta NIC-CPD}$	IC-CPD	18	24	42	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	40	ms
	$T_{\Delta NAC50@150mA}$	RMS 150mA Frequency 50Hz AC	--	10	25	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	--	10	25	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	--	15	25	ms
	$T_{\Delta NA90@42mA}$	RMS 42mA 90 Angle Pulsating DC	--	40	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

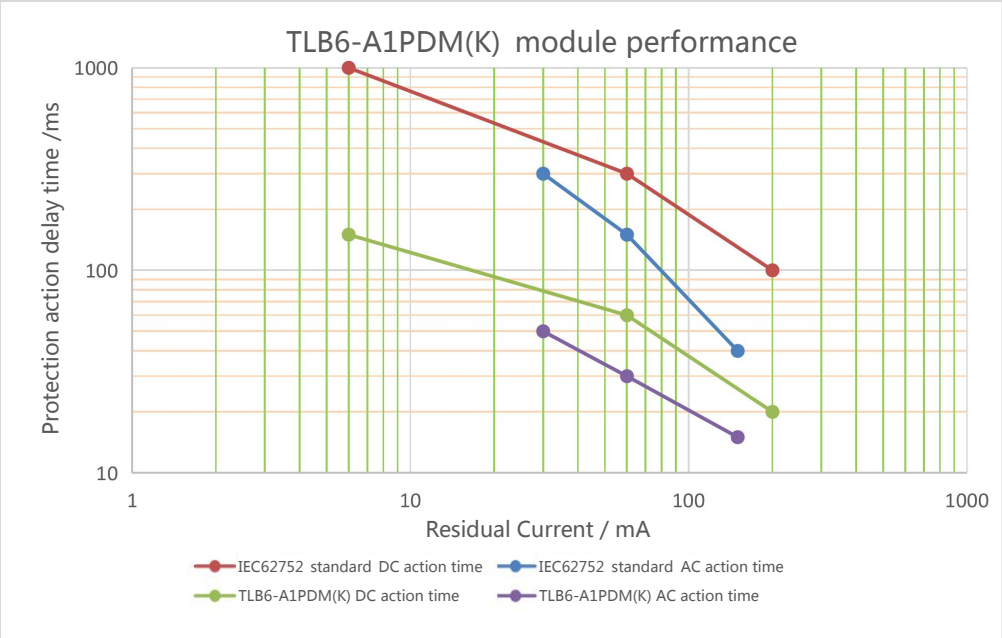
Performance Characteristic

Item	Symbol	Residual Current Waveform	Min	Typ	Max	Unit.
Response time	$T_{\Delta NA135@42mA+S-DC@6mA}$	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	60	ms
	$T_{\Delta NS-DC@300mA}$	300mA Smooth DC	--	10	25	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	60	ms
	$T_{\Delta N2PDC@300mA}$	RMS 300mA Two Phase Rectification DC	--	10	25	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	60	ms
	$T_{\Delta N3PDC@300mA}$	RMS 300mA Three Phase Rectification DC	--	10	25	ms
	$T_{\Delta NF@210mA}$	RMS 210mA Composite Current	--	15	25	ms

EMC

Item		Specifications	
EMI	CE	CISPR32/EN55032 CLASS B	
	RE	CISPR32/EN55032 CLASS B	
EMS	ESD	IEC/EN61000-4-2 Contact ±6kV, Air ±8kV	perf. Criteria A
	RS	IEC/EN61000-4-3 30V/m	perf. Criteria A
	EFT	IEC/EN61000-4-4 ±2kV	perf. Criteria A
	Surge Current	IEC62955 6000V/2Ω/3000A, 8/20μs	perf. Criteria B

Product Characteristic Curve



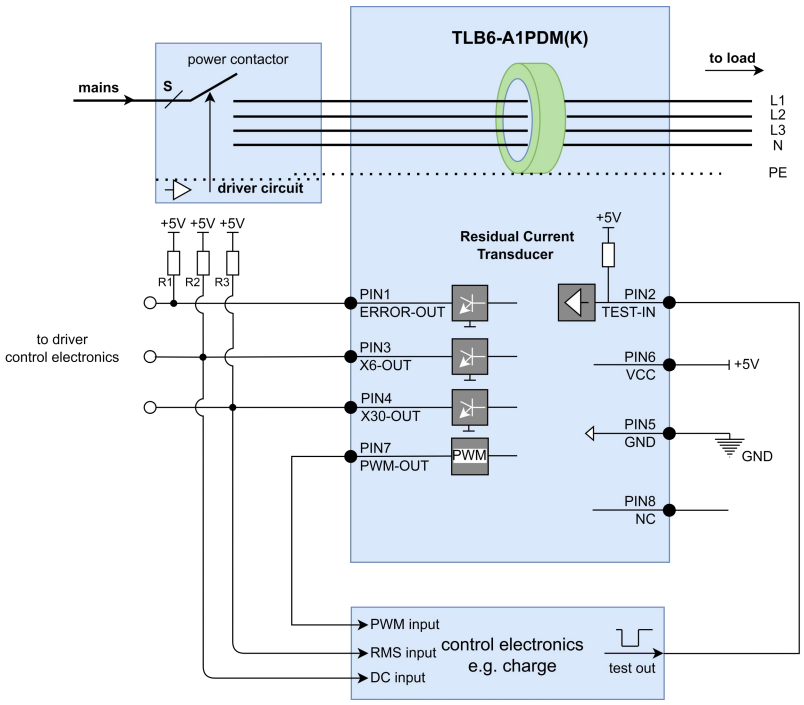
Pin Description

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 X6-OUT pin and the X30-OUT pin are also in the high impedance. If the system is normal, the pin is low level.
2	TEST-IN	Calibration Test pin, when the pin input a low voltage of >40ms and <1.2s in duration, the product performs a zero calibration.
3	X6-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 X30-OUT pin is in a high impedance, the pin is also set to a high impedance. See "Output pin truth Table".
4	X30-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	X6-OUT	X30-OUT	ERROR-OUT	Operating State
Pin Output State	Low level	Low level	Low level	System normal
	High impedance	Low level	Low level	IΔNDC > 6mA
	High impedance	High impedance	Low level	IΔNAC > 30mA
	High impedance	High impedance	High impedance	Error, system fault

Connection and Description



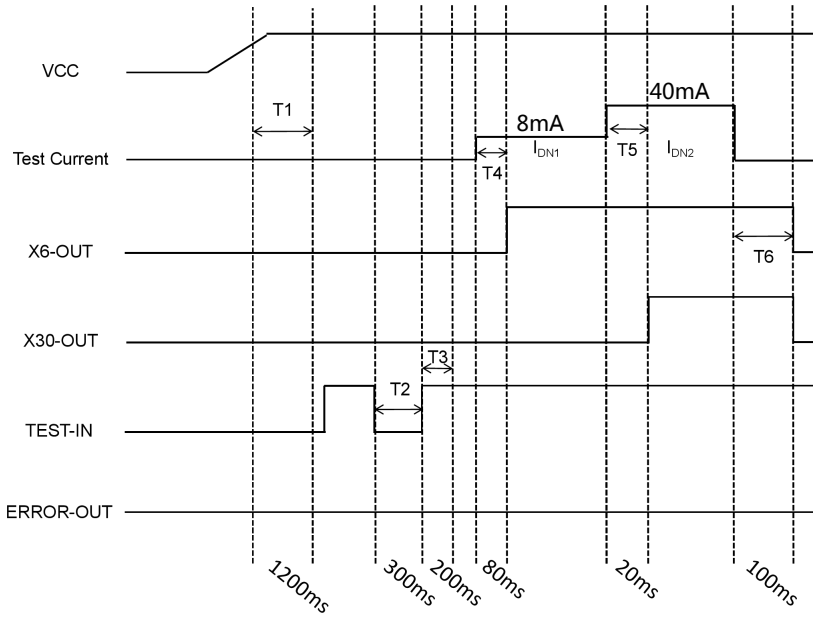
1. The VCC is connected to a 5V power supply.
2. DC action pin X6-OUT, AC action pin X30-OUT and duty ratio output pin PWM-OUT are usually connected to a microcontroller or to a power circuit to control back-end circuit breaker action.

3. The ERROR output pin ERROR-OUT, DC action pin X6-OUT, and AC action pin X30-OUT need to be connected to pull-up resistors R1, R2, and R3 respectively. 10 kΩ is recommended for pull-up resistors.
4. Calibration Test pin TEST-IN 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.
TEST-IN Signal Low Level Maintenance Time	T2	--	300	--	ms
ERROR-OUT Signal Output Delay Time (IDN3=500mA)	T_ERR	--	300	--	ms

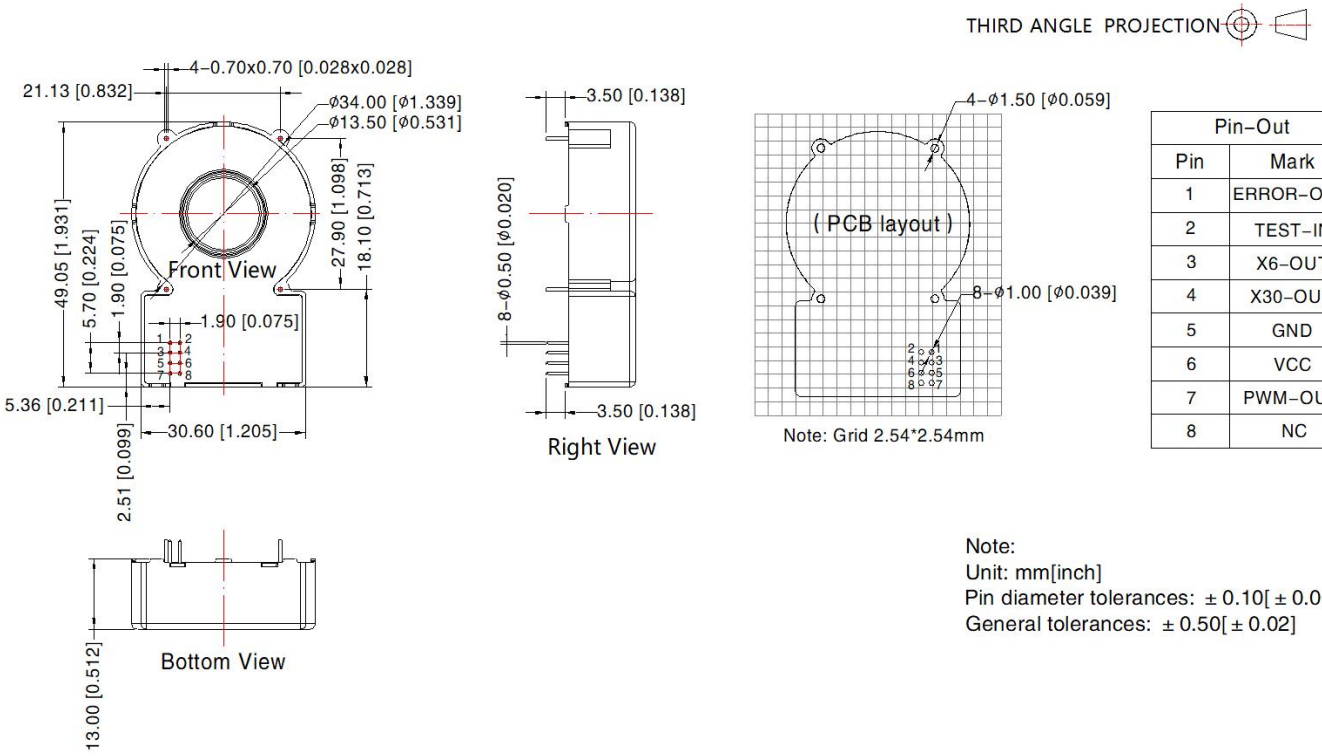
Timing Application Design



Timing application design essentials:

1. After the power supply is fully started, the startup and stabilization time of the module is about 40-1200ms (T1). During this period, it is recommended that the whole system do not operate.
2. When performing signal calibration, the external signal sets the TEST-IN pin to low level, and the recognition time (T2) of the TEST-IN pin low level is about 300ms. After successful identification, signal calibration test is carried out internally. The duration of the calibration test was approximately 200ms (T3).
3. External input test current I_{DN1}, delay about 80ms (T4), X6-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 X6-OUT pin and X30-OUT pin output high impedance (trip signal).
4. The test current input stops, and after a delay of about 200ms (T6), the X6-OUT pin and X30-OUT pin stop the output trip signal and output low level.
5. When the external input test current I_{DN3} (I_{DN3} is greater than the product measurement range), the X6-OUT pin and X30-OUT pin first output the high impedance (trip signal), and after a delay of about 300ms, the ERROR-OUT pin outputs the high impedance.

Dimensions and Recommended



Pin-Out	
Pin	Mark
1	ERROR-OUT
2	TEST-IN
3	X6-OUT
4	X30-OUT
5	GND
6	VCC
7	PWM-OUT
8	NC

Note:
Unit: mm[inch]
Pin diameter tolerances: ± 0.10[± 0.004]
General tolerances: ± 0.50[± 0.02]

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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