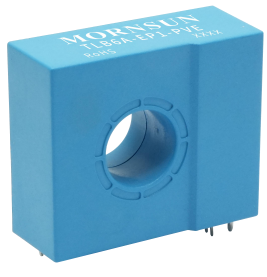
MORNSUN®

## Residual Current Transducer





Patent Protection RoHS

## Features

- Type B (suitable for type A+6) residual current transducer for charging pile
- Meets the basic residual current operating characteristics of IEC 62423(GB/T 22794)
- Meets the requirements of IEC 62752(GB/T 41589) Mode 2 residual current operating characteristics
- Meets the residual current operating requirements of IEC 62955(GB/T 40820) mode 3 RDC-PD
- Integrated self-check function
- PCB installation, simple application

*TLB6A-EP1-PVE is type B (suitable for type A+6) residual current protection module for charging piles. It is widely used in residual current protection of charging facilities of electric vehicles. Fluxgate detection technology is used to detect DC, AC and various pulsating residual current. The module meets the residual current operating characteristics requirements of mode 2 (IEC 62752, GB/T 41589) and mode 3 (IEC 62955, GB/T 40820), and can detect the residual current waveform covering type B. And can detect 6mA DC residual current, the module triggers accurate, timely response to leakage events.*

## Selection Guide

| Part No. | Input Voltage (VDC) | Rated DC Residual Current (mA) | Rated AC Residual Current (mA) | Rated current (A) | Maximum Power Dissipation(W) |
|---|---|---|---|---|---|
| TLB6A-EP1-PVE | 5 | 6 | 30 | 80A/40A (1 phase/ 3 phase) | 0.21 |

## 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 | 4.5 | 6 | mA |
| Range of Remaining AC Operating Current | $I_{\Delta NAC\text{-}RANGE}$ | 15 | 24 | 30 | mA |
| Input Voltage | VCC | 4.85 | 5 | 5.15 | V |
| Operating Current | -- | -- | 30 | -- | mA |

## Performance Characteristic

| Item | Symbol | Residual Current Waveform | Min | Typ | Max | Unit. |
|---|---|---|---|---|---|---|
| Operating Current | $I_{\Delta NAC50}$ | 50Hz AC | 15 | 23 | 30 | mA RMS |
| | $I_{\Delta NA0}$ | 50Hz 0 Angle Pulsating DC | 4.5 | 15 | 42 | mA RMS |
| | $I_{\Delta NA90}$ | 50Hz 90 Angle Pulsating DC | 6.3 | 23 | 42 | mA RMS |
| | $I_{\Delta NA135}$ | 50Hz 135 Angle Pulsating DC | 3.3 | 28 | 42 | mA RMS |
| | $I_{\Delta NS\text{-}DC}$ | Smooth DC | 3 | 4.5 | 6 | mA RMS |
| | $I_{\Delta N2PDC}$ | 50Hz Two Phase Rectification DC | 3.5 | 5.3 | 7 | mA RMS |
| | $I_{\Delta N3PDC}$ | 50Hz Three Phase Rectification DC | 3.1 | 4.6 | 6.2 | mA RMS |
| | $I_{\Delta NF}$ | Composite Current | 15 | 33 | 42 | mA RMS |

## Performance Characteristic

| Item | Symbol | Residual Current Waveform | Min | Typ | Max | Unit. |
|---|---|---|---|---|---|---|
| Response Time | $T_{\Delta NAC50@30mA}$ | RMS 30mA, Frequency 50Hz AC | -- | 60 | 200 | ms |
| | $T_{\Delta NAC50@60mA}$ | RMS 60mA, Frequency 50Hz AC | -- | 30 | 100 | ms |
| | $T_{\Delta NAC50@150mA}$ | RMS 150mA, Frequency 50Hz AC | -- | 15 | 40 | ms |
| | $T_{\Delta NAC50@5A-100A}$ | RMS 5A-100A, Frequency 50Hz AC | -- | 15 | 40 | ms |
| | $T_{\Delta A0@42mA}$ | RMS 42mA 0 Angle Pulsating DC | -- | 38 | 200 | ms |
| | $T_{\Delta A0@84mA}$ | RMS 84mA 0 Angle Pulsating DC | -- | 30 | 100 | ms |
| | $T_{\Delta A0@210mA}$ | RMS 210mA 0 Angle Pulsating DC | -- | 25 | 40 | ms |
| | $T_{\Delta A0@42mA+S-DC@6mA}$ | RMS 42mA 0 Angle Pulsating DC with 6mA Smooth DC | -- | 38 | 200 | ms |
| | $T_{\Delta A0@84mA+S-DC@6mA}$ | RMS 84mA 0 Angle Pulsating DC with 6mA Smooth DC | -- | 30 | 100 | ms |
| | $T_{\Delta A0@210mA+S-DC@6mA}$ | RMS 210mA 0 Angle Pulsating DC with 6mA Smooth DC | -- | 25 | 40 | ms |
| | $T_{\Delta S-DC@6mA}$ | 6mA Smooth DC | -- | 300 | 1000 | ms |
| | $T_{\Delta S-DC@60mA}$ | 60mA Smooth DC | -- | 25 | 200 | ms |
| | $T_{\Delta S-DC@300mA}$ | 300mA Smooth DC | -- | 25 | 40 | ms |
| | $T_{\Delta 2/3PDC@60mA}$ | RMS 60mA Two Phase/Three Phase Rectification DC | -- | 25 | 200 | ms |
| | $T_{\Delta 2/3PDC@120mA}$ | RMS 120mA Two Phase/Three Phase Rectification DC | -- | 20 | 100 | ms |
| | $T_{\Delta 2/3PDC@300mA}$ | RMS 300mA Two Phase/Three Phase Rectification DC | -- | 20 | 40 | ms |
| | $T_{\Delta 2/3PDC@5A-100A}$ | RMS 5A-100A Two Phase/Three Phase Rectification DC | -- | 15 | 40 | ms |
| | $T_{\Delta F@210mA}$ | RMS 210mA Composite Current | -- | 15 | 40 | ms |

## Protection and Detection Characteristics

| Item | Symbol | Min | Typ | Max | Unit. |
|---|---|---|---|---|---|
| Self Check TEST_IN Input Low Level Voltage | $V_{TEST-IN\ IL}$ | 0 | -- | 1 | V |
| Self Check TEST_IN Input High Level Voltage | $V_{TEST-IN\ IH}$ | 4 | -- | VCC | V |
| Action OUT Indicates the output low level voltage | $V_{CAL-IL}$ | 0 | -- | 1 | V |
| Action OUT Indicates the output high level voltage | $V_{CAL-IH}$ | 4 | -- | VCC | -- |
| Simulate AOUT output zero | $V_{AOUT-Offset}$ | 0 | -- | 0.6 | V |
| Simulate AOUT output sensitivity | $V_{AOUT-Sensitivity}$ | 4.5 | -- | VCC | V |

## Isolation Characteristics

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

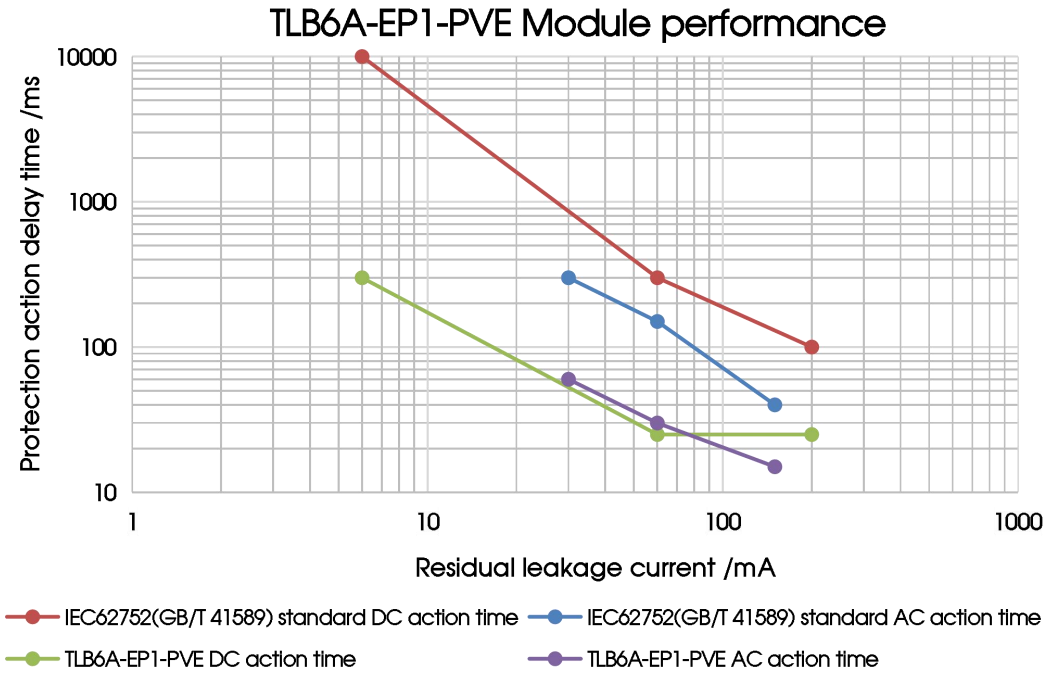
## General Characteristics

| Item | Symbol | Min | Typ | Max | Unit. |
|---|---|---|---|---|---|
| Operating Temperature | Ta | -40 | -- | +105 | ℃ |
| Storage Temperature | $T_S$ | -40 | -- | +105 | ℃ |
| Storage Humidity | Non-condensing | 5 | -- | 95 | %RH |
| Weight | m | -- | 19 | -- | g |
| Vibration | -- | 20-150Hz, 2g (GB2423.10, IEC60068-2-6) | | | |
| Overvoltage Category | -- | OVC III (IEC61010) | | | |

## EMC

| | | | | |
|---|---|---|---|---|
| EMI | CE | CISPR32/EN55032 | CLASS B | |
| | RE | CISPR32/EN55032 | CLASS B | |
| EMS | ESD | IEC/EN61000-4-2 | Contact ±4kV, Air ±8kV | perf. Criteria A |
| | EFT | IEC/EN61000-4-4 | ±2kV | perf. Criteria A |
| | Surge Current | IEC62955 | 6000V/2Ω/3000A, 8/20us | perf. Criteria B |

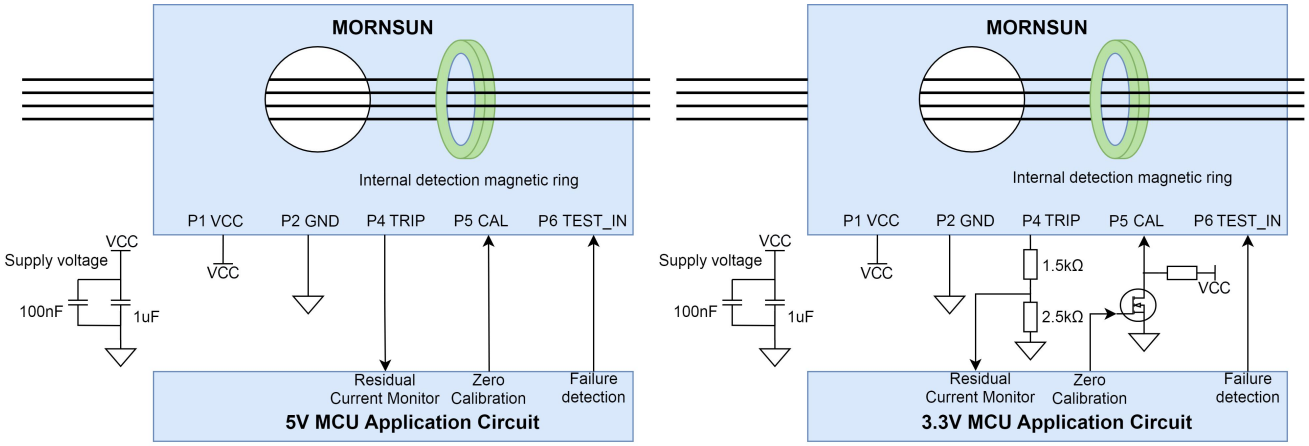
## Product Characteristic Curve




## Pin Description

| Pin | Mark | Description |
|---|---|---|
| 1 | VCC | ➢Product power supply pin<br>➢Input voltage range is required to be 4.85-5.15V with 100nF and 1uF capacitors in parallel at the input end |
| 2 | GND | ➢Product power grounding pin |
| 4 | TRIP | ➢Trip the output pin. When the residual current in the circuit exceeds the threshold is detected, this pin is set high to generate a trip signal |
| 5 | CAL | ➢The zero-point calibration pin, when a continuous low level is input to this pin, enables the calibration function. The current detected residual current is used as the zero current point for subsequent detection compensation. This residual current compensation value will be stored internally and continue to be compensated upon restart |
| 6 | TEST-IN | ➢Self-check test pin: When the input to this pin remains at a continuously high level, the product will conduct a self-check test, causing TRIP to output a high-level pulse signal |

## Connection and Description

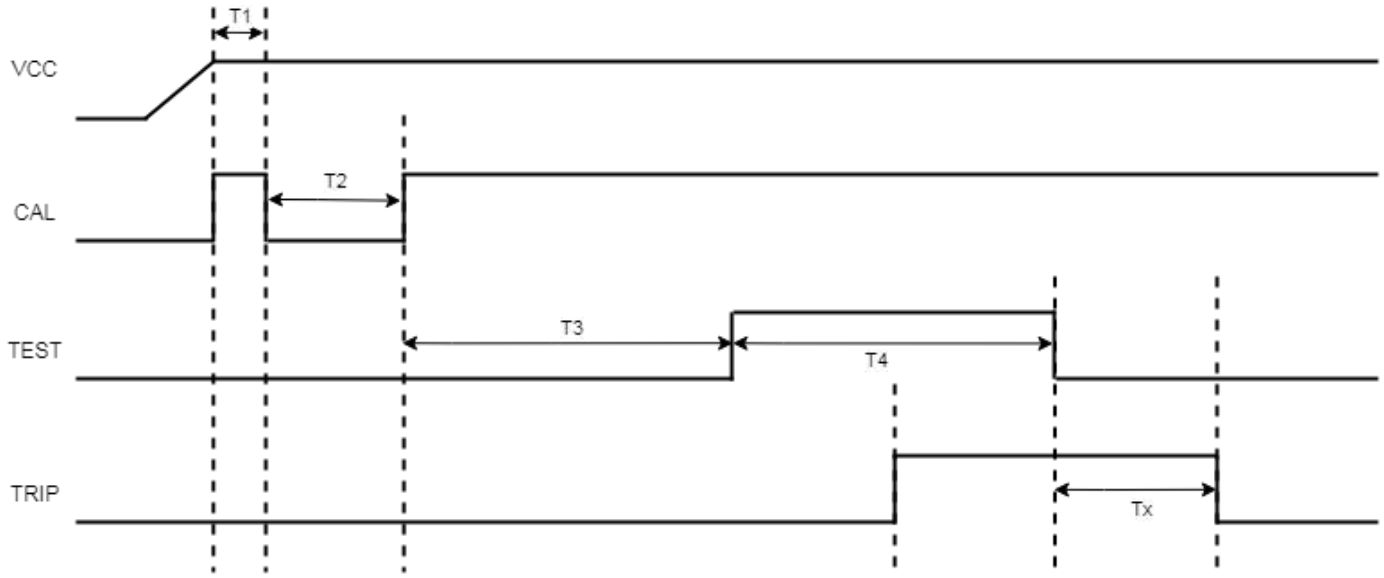



1. Two capacitors need to be connected between VCC at the product power supply end and GND at the product grounding end for energy storage and decoupling, respectively connecting 1uF/16V capacitor and 100nF/16V capacitor.
2. Residual current protection detection pin TRIP, zero calibration pin CAL, TEST pin test-IN are generally controlled by the microcontroller;
3. When the current value flowing through the internal detection magnetic ring exceeds the specification value, the residual current protection detection pin TRIP output high level;
4. When the module is started, it is recommended to keep the zero calibration pin CAL low for a period of time and then set the high level (see timing characteristic description) to carry out system calibration and eliminate system interference and residual current;
5. TEST pin test-IN is used to test the performance of the residual current protection module when self-test is required, and the test signal needs to meet the timing characteristics;
6. The product does not support hot swapping;
7. When the product is connected to 5V powered MCU, it is necessary to pay attention to level matching. If a 3.3V powered MCU is connected, the above level conversion circuit needs to be used for voltage conversion, and the 5V voltage is converted to 3.3V through two partial voltage resistors. Generally, the ratio of the two partial voltage resistors is close to 3:5. At the same time, the input impedance of the MCU should be considered, and the resistance value of the two partial voltages should not be greater than one-tenth of the input impedance of the MCU. For example, the value of two partial voltage resistors can be 1.5kΩ and 2.5kΩ, or both 10 kΩ and 15 kΩ. At the same time, the zero-point calibration function needs to adjust the level logic. When the 3.3V periphery of the MCU is connected, the MOS tube is used for level conversion, and the opposite logic is used for control.
8. This product is susceptible to magnetic interference, it is recommended that the main circuit switching relay be placed away from the product.

## Timing Characteristics

| Item | Symbol | Min | Typ | Max | Unit. |
|---|---|---|---|---|---|
| Power-on stability time | T1 | 600 | -- | -- | ms |
| Calibration instruction time | T2 | 50 | -- | 100 | ms |
| Complete internal calibration time | T3 | -- | 500 | -- | ms |
| Self-check instruction duration | T4 | 600 | -- | -- | ms |

## Timing Application Design




Design essentials:

1. It is recommended that the power supply VCC start from 0V, and the power-on process is monotonous without overshoot;
2. T1 indicates the stability period after power-on. Wait for T1 to reach 600ms or more;
3. T2 is the system calibration instruction time, calibration signal duration 50ms≤T2≤100ms, it is recommended that CAL duration T2 is 75ms
4. T3 is the internal calibration time of the system, and the calibration signal duration is T3≥500ms;
5. T4 is the duration of system self-test instruction, and the test-IN self-test TEST signal can only be applied after T3 is completed. When the duration of test-IN signal is about 140ms, TRIP is set high, and it is recommended that the duration of self-test command signal T4≥600ms;
6. After the module TRIP is set to high level, the TEST-IN can be set to low level. After the TEST-IN signal is turned off, the TRIP pin high level returns to low level after 200-300ms, and the residual current detection is required after 350ms.

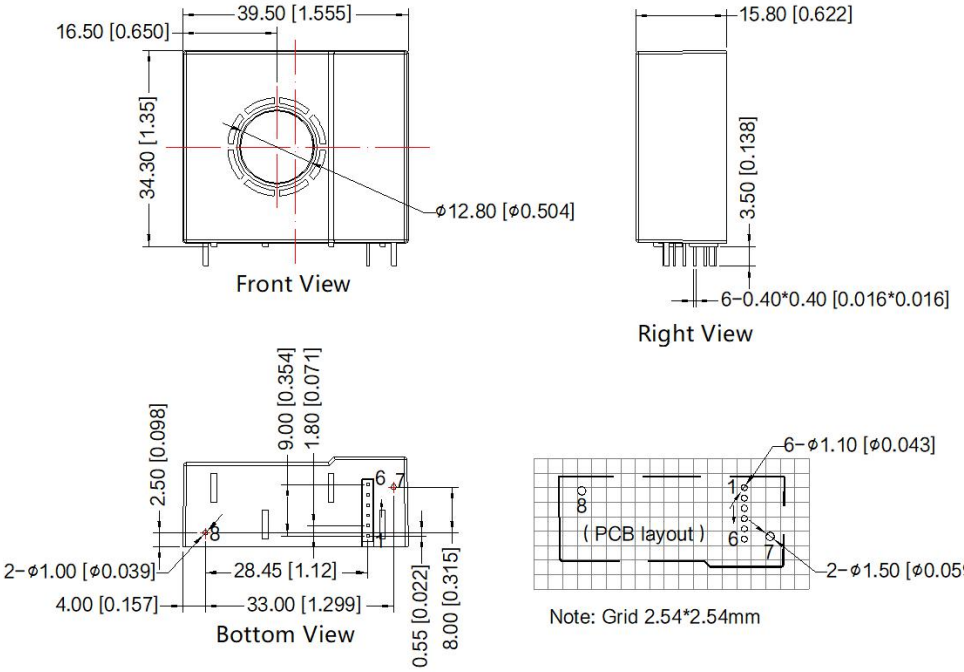
➢Note:

①In the process of self-test and calibration, that is, (T1+T2+T3+T4) process, do not close the main loop charging switch, so as to avoid residual residual current after switching on affecting the module self-test and calibration function. After the self-check and calibration function is completed, the RCD module is judged to be normal when the TRIP pin is turned over to a high level, and the self-check signal is removed. After the TRIP pin returns to a low level, the subsequent residual current detection operation is carried out;

②After completing the above calibration and self-test after starting, it is not recommended to continue calibration and self-test during normal operation.

## Dimensions and Recommended

THIRD ANGLE PROJECTION




| Pin-Out | |
|---|---|
| Pin | Mark |
| 1 | VCC |
| 2 | GND |
| 3 | NC |
| 4 | TRIP |
| 5 | CAL |
| 6 | TEST-IN |
| 7 | NC |
| 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: 58070025;
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, power supply 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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