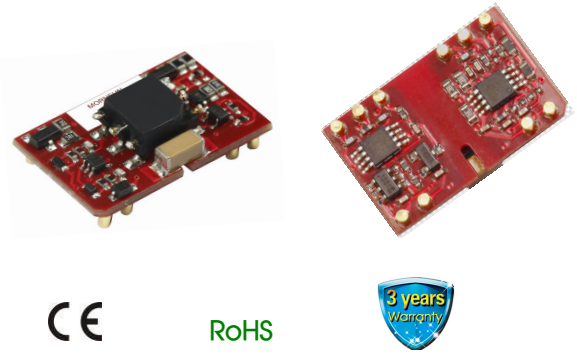
Signal conditioning modules



## FEATURES

- Two-port isolation (signal input and signal output)
- High linearity of 0.1% Full Scale
- Isolation voltage (2.5kVDC/60s)
- Low ripple & noise: ≤30mVpp, 20MHz
- Extremely low temperature coefficient (50PPM/℃, within -40 to +85℃)
- Compact size: SMD16 Package (21.00x13.00x6.50mm)
- Full and zeros adjustment functions
- ESD protection (IEC/EN61000-4-2 Contact ±4kV with performance perf. Criteria B)
- EN62368 approval

*The TNxxxxT series is a compact sized, passive isolation module with a pre-stage voltage signal input and a post-stage voltage/current signal output. The adopted circuit scheme is primary-excitation driving, dual MOS modulation, and secondary-side self-driven synchronous rectification and demodulation to transmit analog voltage signal. They have a two-terminal isolation from signal input to signal output. The series with external functions for zeros and full adjustment via potentiometers (Offset/Gain) offers a convenient way for design and adjustment to our customers.*

## Selection Guide

| Certification | Model | Power1 Input/Power2 Input-Typ.(VDC) | Input Signal | Output Signal | Isolated Power Output (VDC) |
|---|---|---|---|---|---|
| CE | TN555T | 12/12 | 0-10V | 0-10V | None |
| | TN655T | | 0-5V | 0-10V | |
| | TN755T | | 0-2.5V | 0-10V | |
| | TN565T | | 0-10V | 0-5V | |
| | TN575T | | 0-10V | 0-2.5V | |
| | TN875T | | 0.5-2.5V | 0-2.5V | |
| | TN865T | | 0.5-2.5V | 0-5V | |
| | TN511T | 12/15 | 0-10V | 4-20mA | |
| | TN611T | | 0-5V | 4-20mA | |
| | TN711T | | 0-2.5V | 4-20mA | |
| | TN521T | | 0-10V | 0-20mA | |
| | TN621T | | 0-5V | 0-20mA | |
| | TN721T | | 0-2.5V | 0-20mA | |

## Input Specifications

| Item | | Operating Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Power1 Input | Input Voltage | | Typ. | Typ. | Typ.+5% | V |
| | Input Power | Non-isolation power output | -- | 0.25 | 0.5 | W |
| | Power Supply Protection | | None | | | |
| Power2 Input | Input Voltage | | Typ. | Typ. | Typ.+5% | V |
| | Input Power | Non-isolation power output | -- | 0.25 | 0.5 | W |
| | Power Supply Protection | | None | | | |
| Signal Input | Input Signal | | See selection guide | | | |
| | Input Resistance | In case of max. input of voltage signal | 1 | -- | -- | MΩ |
| | Maximum over range | In case of input of voltage signal | -- | -- | 30 | V |
| Hot Plug | | Unavailable | | | | |

## Output Specifications

| Item | | Operating Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output | Output Signal | | See selection guide | | | |
| | Load Capacity | In case of output of voltage signal | 2 | -- | -- | kΩ |
| | | In case of output of current signal | -- | -- | 500 | Ω |
| | Ripple & Noise | Bandwidth 20MHz | -- | -- | 30 | mVp-p |


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## Transmission Specifications

| Item | Operating Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Zero Offset* | | -2.0 | -- | +2.0 | %FS |
| Linearity* | | -0.1 | -- | +0.1 | %FS |
| Temperature Coefficient | Operating temperature from -40℃ ~ +85℃ | -- | 50 | -- | PPM/℃ |
| Adjustable Function | Full Degree Regulation | -5 | -- | +5 | %FS |
| | Zero Regulation | -5 | -- | +5 | %FS |
| Bandwidth | | 2 | -- | -- | kHz |
| Response Time | | -- | -- | 1 | ms |

Note:There is no internal calibration for this series of products, customers can adjust Offset/Gain based on needs.
*Zero Offset of TN721T is +4%(Max.).
*The product linearity of 0-2.5V signal output is -0.2~0.2%.

## General Specifications

| Item | Operating Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Electric Isolation | | Isolated between the signal input and the signal output. | | | |
| Isolation Test | Electric strength test for 1 minute with a leakage current <1mA, humidity <70%RH | 2500 | -- | -- | VDC |
| Insulation Resistance | At 500VDC | 100 | -- | -- | MΩ |
| Operating Temperature | | -40 | -- | +85 | ℃ |
| Transportation and Storage Temperature | | -50 | -- | +105 | ℃ |
| Soldering Temperature | Reflow-soldering | Peak temp.≤245℃, maximum duration ≤60s at 217℃. Please also refer to IPC/JEDEC J-STD-020D.1. | | | |
| Application Environment | | The presence of dust, severe vibration, shock and corrosive gas may cause damage to the product | | | |

## Mechanical Specifications

| | |
|---|---|
| Package | SMD16 |
| Weight | 1.5g（typ.） |
| Cooling Method | Free air convection |

## Electromagnetic Compatibility (EMC)

| | | | | |
|---|---|---|---|---|
| Immunity | ESD | IEC/EN61000-4-2 | Contact ±4kV | perf. Criteria B |
| | EFT | IEC/EN61000-4-4 | Power supply port ±2kV (see Fig. 7, Fig. 8 for recommended circuit) | perf. Criteria B |
| | Surge | IEC/EN61000-4-5 | Power supply ±1kV (see Fig. 7, Fig. 8 for recommended circuit) | perf. Criteria B |

## Application Precautions

1. Please read the instructions carefully before use; contact our technical support if you have any problem;
2. Do not use the product in hazardous areas;
3. Use DC power supply for the product and 220V AC power supply is prohibited;
4. Do not dismount and assemble the product without permission to avoid failure or malfunction of equipment;
5. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%RH with power input nominal voltage and rated signal output full load.


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After-sales service

1. Ex-factory inspection and quality control have been strictly conducted for the product; if there occurs abnormal operation or possibility of failure of internal module, please contact the local representative or our technical support;
2. The warranty period for the product is 3 years as calculated from the date of delivery. If any quality problem occurs under normal use within the warranty period, the product can be repaired or changed for free.

Applied circuit

See *Application Notes for Isolated Transmitter* for details.

## Design Reference

### 1. Typical application

1) Schematic diagram

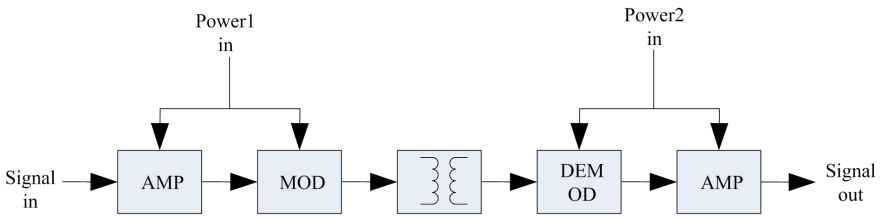



Fig. 1

2) Signal input and output correspondence diagram(Ideal state)

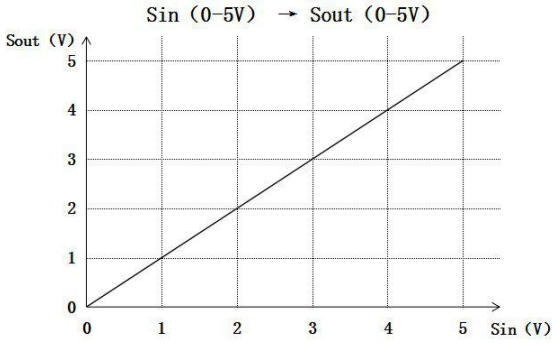



Fig. 2

3) Multi-channel voltage signal acquisition block diagram

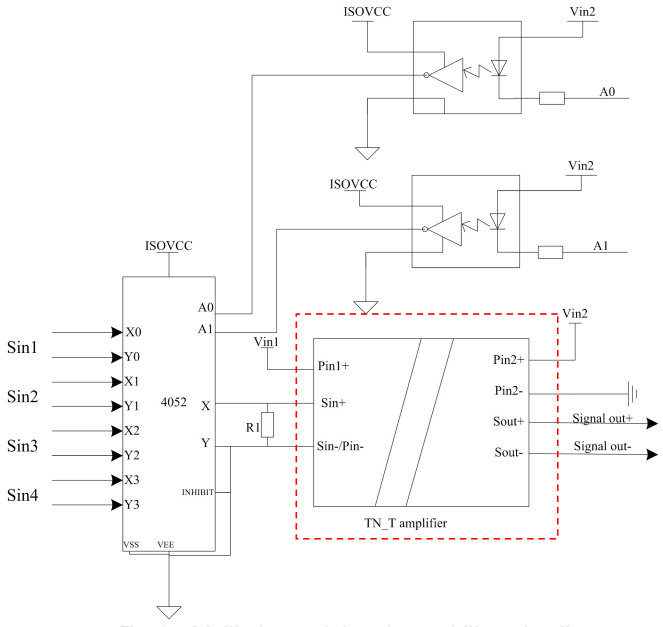



Fig. 3 Multi-channel signal acquisition circuit


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Functional Description

In figure 3, "Sin1" to "Sin4" are external input voltage signals, "A0" and "A1" are strobe signals and signal out is an isolated, external input signal sent to the control system. The optocouplers in the circuit realize the isolated transmission of the strobe signals. The TNxxxT series amplifier isolates the transmitted signals from the 4052 multi-channel strobe chip, which carries out the selective transmission of multiplex signals.

How it Works

The control system sends out the strobe signal A0-A1. Optocouplers transfer isolated strobe signal to the multi-channel 4052 strobe chip, and control the chip's corresponding channels with the external Sin1-Sin4 signal input of the multi-channel 4052 strobe chip. After each strobe, the chip transfers the corresponding signal to the signal input of TNxxxT transmitter. TNxxxT transmitter outputs the isolated input signal to the control system, thus implementing the control system and the external signal isolation circuit. Input power to the TNxxxT transmitter and the input Vcc of strobe signal transmission circuit are both provided by the control system.

4) Typical application ——Isolated transmission for electrical signals

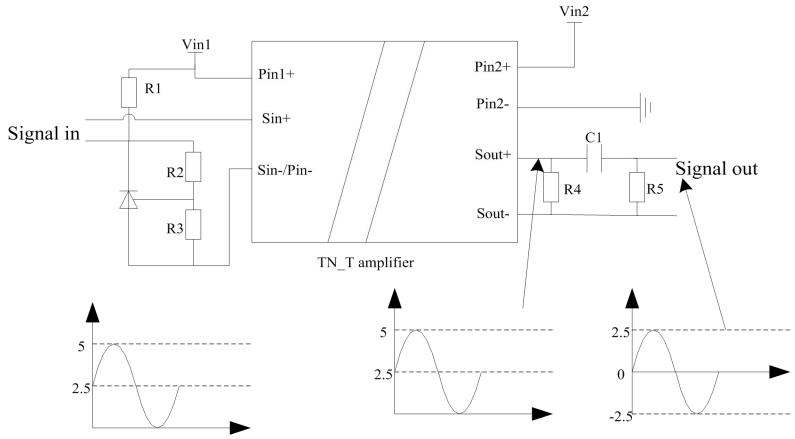



Fig. 4 Isolated transmission for electrical signals application

Functional Description

In figure 4, "Signal in" (Sin+, Sin-) is detecting the electrical signal and "Signal out" (Sout+, Sout-) sends and transmits the now isolated electrical signal to the control system. VCC is the isolated power supply source provided from the control system. The typical power signal is a sine wave signal with positive and negative amplitude. Reference 431 combined with R1, R2 and R3 form the voltage stabilizing circuit of the system, which can realize the zero adjustment of the input signal. The amplifier of TNxxxT series module does the signal transmission function. Resistor network R4 and R5 with C1 are filtering the DC output signal.

How it Works

Supposing the detected signal is a 2.5V sine wave signal: When the input signal is passed through the stabilizing circuit which is composed of 431, R1, R2 and R3 network, the input signal of TNxxxT transmitter becomes a 0-5V sine wave signal. If the amplifier has 0-5V input and 0-5V output, the TNxxxT module transmitter output would be 0-5V sine wave signal at this time as well. After passing through the filter circuit that is realized by R4, R5 and C1, the DC component of 0-5V sine wave signal is filtered, and the resulting output is now a ±2.5V sine wave signal.

Parameter

In the application, the typical value of R2 and R3 is 10KΩ, and the reference voltage of 431 is 1.25V. The stable voltage of the composition is 2.5V, and the voltage accuracy can achieve various high-precision application requirements according to the accuracy of the resistance value. The typical resistor value range of R4 is between 2kΩ and 5kΩ. Because of the signal output voltage being positive and negative, there will be a transmitter output signal reverse current phenomenon when the voltage signal output is negative. Therefore the value of R4 should be chosen as small as possible in order to reduce the influence of the reverse current, and C1 should have a low ESR (equivalent series resistor). Because C1 only passes through the AC and not the DC component of the signal, a ceramic capacitor with value of about 10uF or slightly more will normally suite the application. Capacitors with large a resistance and a small capacitance may distort the AC signal. The recommended value for R5 should be higher than 100kΩ, and it implements a DC signal to zero in the circuit. Increasing the value of R5 can make the time of the DC signal to zero longer, which also increases the startup time.

Note

Because the transmitter of TNxxxT series cannot be used with negative input voltage signals, the narrow signal voltage amplitude needs specific attention in order to have the necessary design margin. This way the signal distortion is minimized and the circuit can be working normally.

5) Application—Zero and full adjustment function

Circuit for Zero and full adjustment recommended setting is shown below


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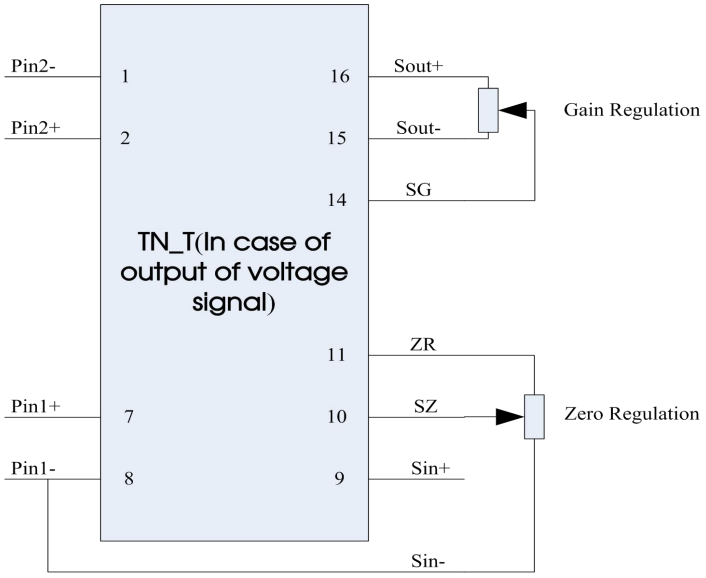



Fig. 5 TN_T（In case of output of voltage signal） zero and full adjustment circuit

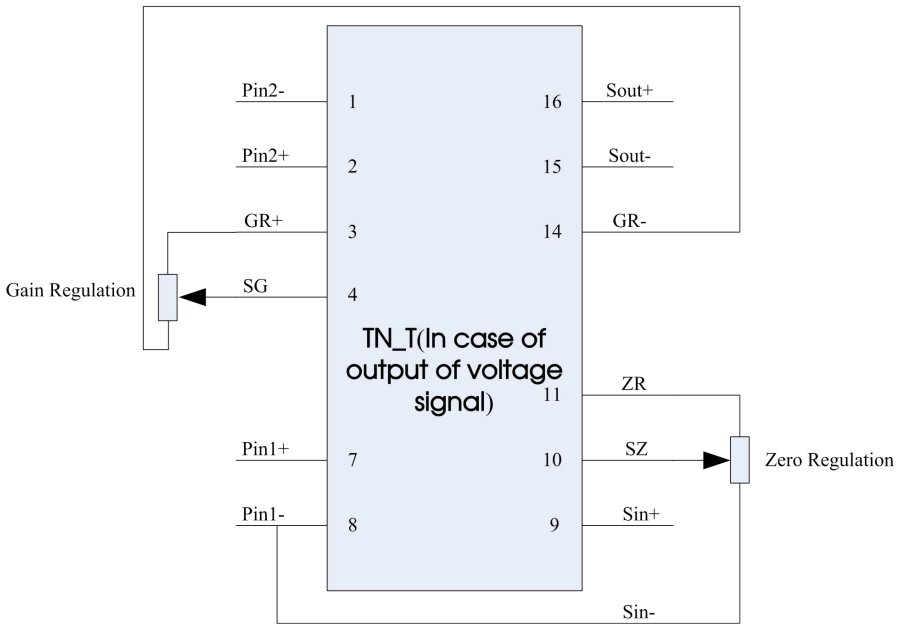



Fig. 6 TN_T（In case of output of current signal） zero and full adjustment circuit

## Functional Description

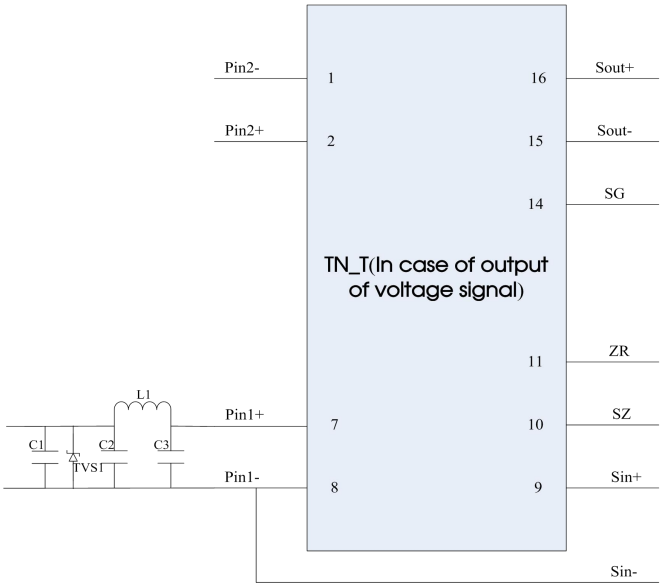
The Zero adjustment function can change the zero-signal transmission by setting the adjustment resistor to zero point, which makes the output signal overall migration. The Full adjustment function, also called gain adjustment, changes the signal transmission ratio by setting up the corresponding adjustment resistance for the full range. This changes the isolation transmission proportion of input and output signal value.

## How it Works

As shown in the figure, when the potentiometer slides to the negative end, the zero or full degree of the corresponding signal can be reduced; sliding to the positive end can increase the zero or fullness of the corresponding signal. The maximum resistance of the potentiometer is recommended to be in the range of 10KΩ-1MΩ. The choice of specific resistance is determined based on the required adjustment accuracy. A potentiometer with a large resistance value is required when high-precision fine adjustment is required. A potentiometer with a small resistance value is recommended when a large range of coarse adjustment is required.The potentiometer recommends the VG039NCHX series of HOKURIKU ELECTRIC INDUSTRY CO.,LTD.


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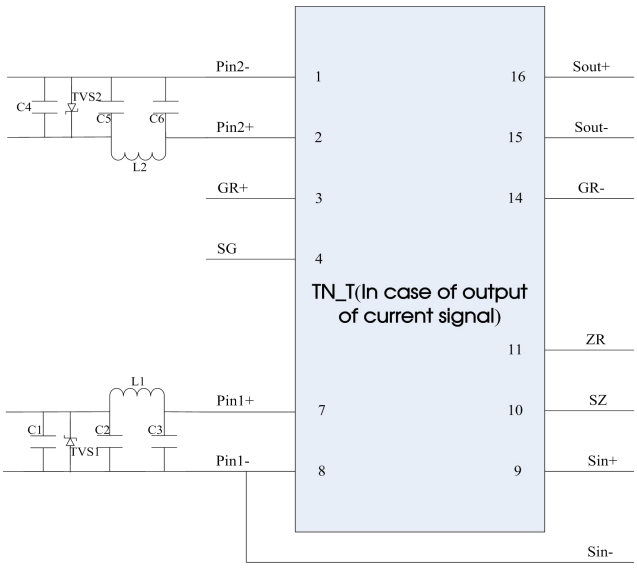
## 2. EMC compliance circuit




| | |
|---|---|
| C1 | 220uF/35V |
| C2 | 10uF/50V |
| C3 | 10uF/50V |
| L1 | 68uH |
| TVS1 | SMCJ15A |

Notes: the EMC compliance circuit of Pin2+、Pin2- is the same as the one of Pin1+、Pin1-。

Fig. 7




| | |
|---|---|
| C1 | 220uF/35V |
| C2 | 10uF/50V |
| C3 | 10uF/50V |
| L1 | 68uH |
| TVS1 | SMCJ15A |
| C4 | 220uF/35V |
| C5 | 10uF/50V |
| C6 | 10uF/50V |
| L2 | 68uH |
| TVS2 | SMCJ18A |

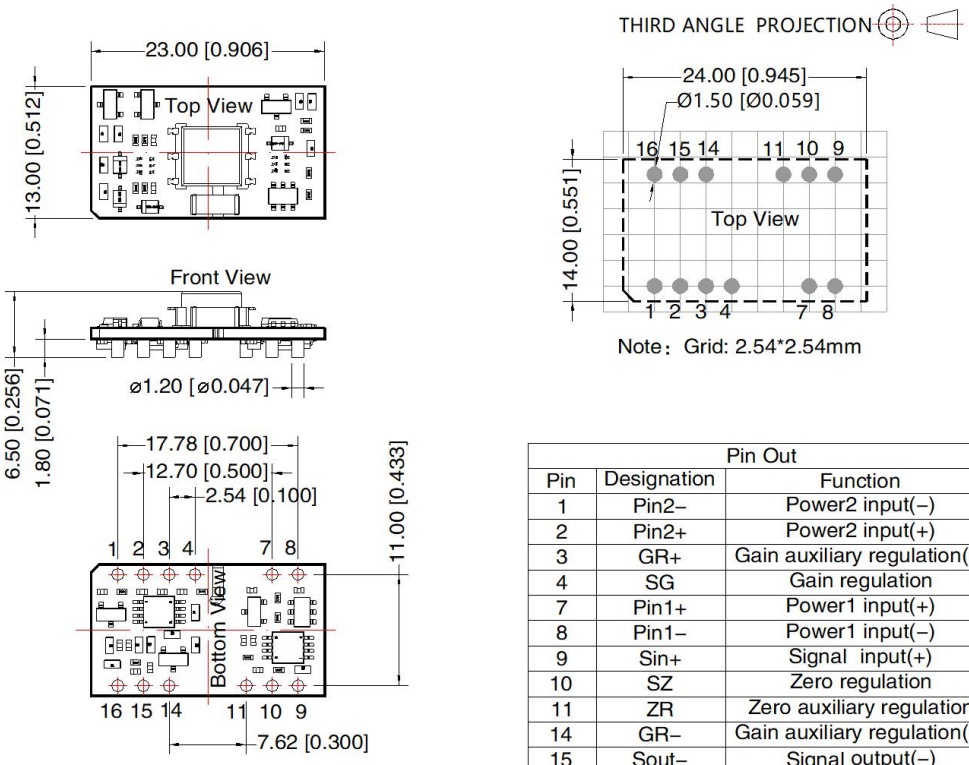
Fig. 8

3. For additional information please find the application notes on www.mornsun-power.com


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## Dimensions and Recommended Layout

①TN_T appearance size, recommended printing layout(In case of output of current signal)：

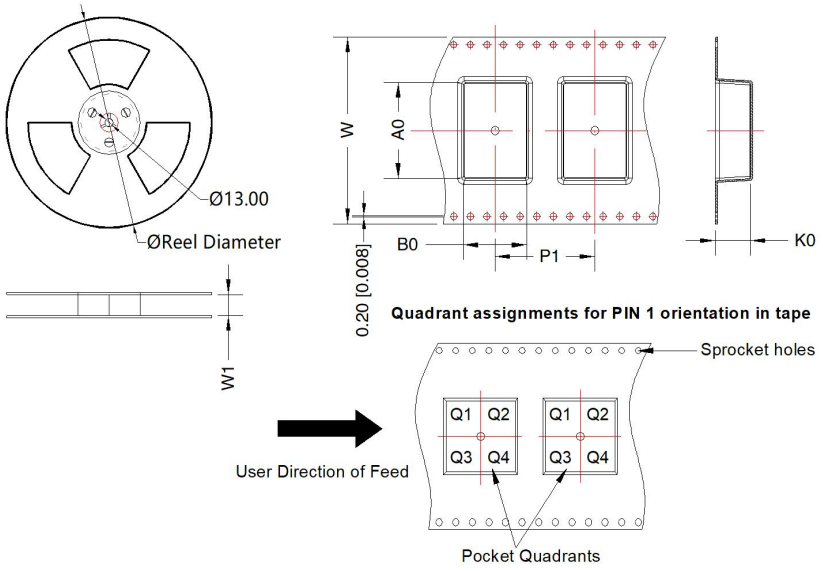



Note：Grid: 2.54*2.54mm

| Pin Out | | |
|---|---|---|
| Pin | Designation | Function |
| 1 | Pin2– | Power2 input(–) |
| 2 | Pin2+ | Power2 input(+) |
| 3 | GR+ | Gain auxiliary regulation(+) |
| 4 | SG | Gain regulation |
| 7 | Pin1+ | Power1 input(+) |
| 8 | Pin1– | Power1 input(–) |
| 9 | Sin+ | Signal input(+) |
| 10 | SZ | Zero regulation |
| 11 | ZR | Zero auxiliary regulation |
| 14 | GR– | Gain auxiliary regulation(–) |
| 15 | Sout– | Signal output(–) |
| 16 | Sout+ | Signal output(+) |

Note :
Unit: mm[inch]
Pin diameter tolerances: ±0.10[±0.004]
General tolerances: ±0.50[±0.020]
The layout of the device is for reference only，
please refer to the actual product

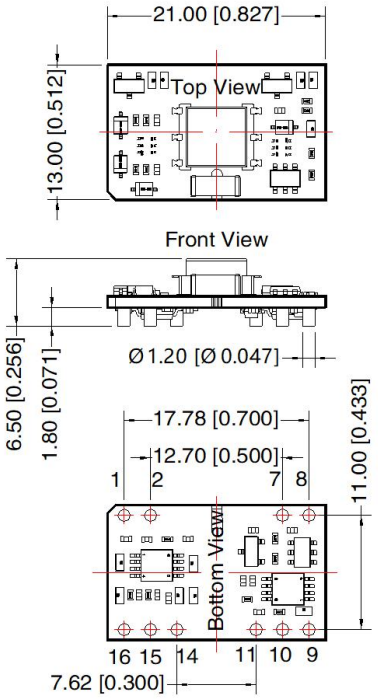
Package diagram:

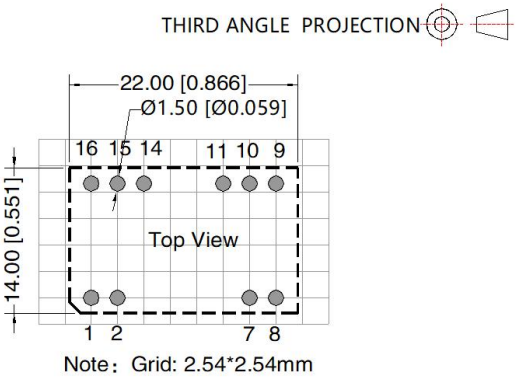



| Device | Package Type | Pin | MPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TN_T | SMD | 12 | 450 | 330.0 | 44.5 | 23.52 | 13.52 | 6.7 | 20.0 | 44.0 | Q1 |


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②TN_T appearance size, recommended printing layout(In case of output of voltage signal)：



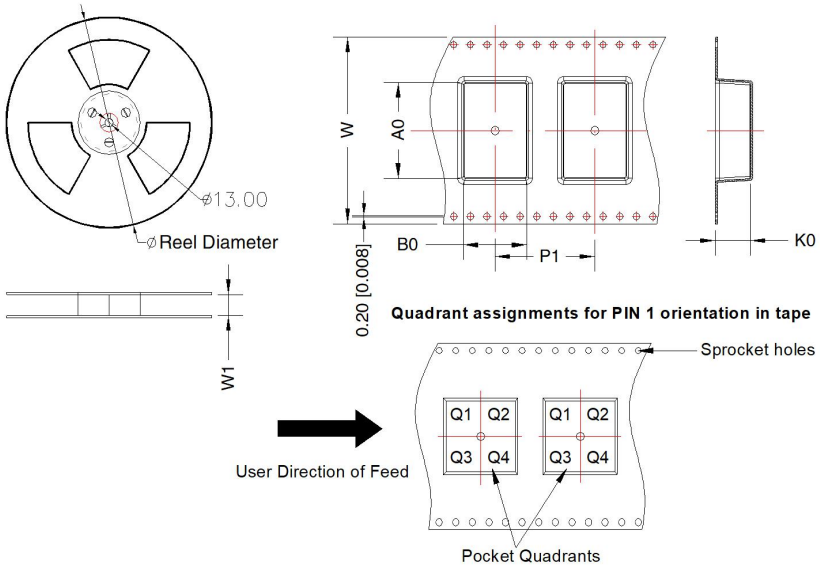




Note：Grid: 2.54*2.54mm

| Pin Out | | |
|---|---|---|
| Pin | Designation | Function |
| 1 | Pin2– | Power2 input(–) |
| 2 | Pin2+ | Power2 input(+) |
| 7 | Pin1+ | Power1 input(+) |
| 8 | Pin1– | Power1 input(–) |
| 9 | Sin+ | Signal input(+) |
| 10 | SZ | Zero regulation |
| 11 | ZR | Zero auxiliary regulation |
| 14 | SG | Gain regulation |
| 15 | Sout– | Signal output(–) |
| 16 | Sout+ | Signal output(+) |

Note :
Unit: mm[inch]
Pin diameter tolerances: ±0.10[±0.004]
General tolerances: ±0.50[±0.020]
The layout of the device is for reference only,
please refer to the actual product

Package diagram:




| Device | Package Type | Pin | MPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TN_T | SMD | 10 | 450 | 330.0 | 32.5 | 21.32 | 13.22 | 6.7 | 20.0 | 32.0 | Q1 |


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Notes:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. The Packaging bag number: 58210100(In case of output of voltage signal), 58210101(In case of output of current signal);
2. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage and rated output load.
3. All index testing methods in this datasheet are based on company corporate standards;
4. The above are the performance indicators of the product models listed in this datasheet. Some indicators of non-standard models will exceed the above requirements. For details, please contact our technical staff;
5. We can provide product customization service,please contact our technicians directly for specific information;
6. Products are related to laws and regulations: see "Features" and "EMC";
7. 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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