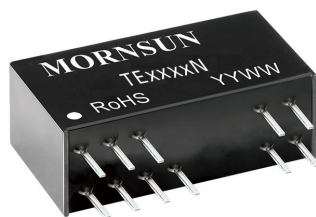


Active high precision isolated transmitter



## FEATURES

- Two-port isolation (signal input and signal output)
- High accuracy of 0.1% Full Scale
- High linearity of 0.1% Full Scale
- Isolation test voltage 2kVAC for 60s
- Low ripple & noise:  $\leq 30\text{mVpp}$ , 20MHz
- Extremely low temperature coefficient of  $\leq 50\text{PPM}/^\circ\text{C}$  over entire range from  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$
- Compact DIP18 package, size 26 x 9.5 x 12.5mm
- ESD protection (IEC/EN61000-4-2 Contact  $\pm 4\text{kV}$  with performance perf. Criteria B)

The TExxxN series is a high precision isolated transmitter with an inner high efficiency isolated micro-power source. It can provide isolation power to peripheral circuit at the same time of providing power to internal signal processing circuit. The adopted electromagnetic isolation technology has a much higher accuracy and a lower temperature drift in comparison with photo/opto-coupler isolators. They have a two-terminal isolation from signal input/power output to signal output/power input. 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         | Power Supply input Typ.(VDC) | Input Signal | Output Signal | Isolated Power Output (VDC) |
|---------------|---------------|------------------------------|--------------|---------------|-----------------------------|
| EN            | TE5534N       | 24V                          | 0-10V        | 0-10V         | 15V                         |
|               | TE5544N       | 15V                          | 0-10V        | 0-10V         | 15V                         |
|               | TE5554N       | 12V                          | 0-10V        | 0-10V         | 15V                         |
|               | TE5634N       | 24V                          | 0-10V        | 0-5V          | 15V                         |
|               | TE6634N       | 24V                          | 0-5V         | 0-5V          | 15V                         |
|               | TE6644N       | 15V                          | 0-5V         | 0-5V          | 15V                         |
|               | TE6650N       | 12V                          | 0-5V         | 0-5V          | None                        |
|               | TE6654N       | 12V                          | 0-5V         | 0-5V          | 15V                         |
|               | TE6664N       | 5V                           | 0-5V         | 0-5V          | 15V                         |
|               | TE1533N       | 24V                          | 4-20mA       | 0-10V         | 24V                         |
|               | TE1530N       | 24V                          | 4-20mA       | 0-10V         | None                        |
|               | TE1550N       | 12V                          | 4-20mA       | 0-10V         | None                        |
|               | TE1633N       | 24V                          | 4-20mA       | 0-5V          | 24V                         |
|               | TE1630N       | 24V                          | 4-20mA       | 0-5V          | None                        |
|               | TE1650N       | 12V                          | 4-20mA       | 0-5V          | None                        |
|               | TE1660N       | 5V                           | 4-20mA       | 0-5V          | None                        |
|               | TE1430N       | 24V                          | 4-20mA       | 1-5V          | None                        |
|               | TE1433N       | 24V                          | 4-20mA       | 1-5V          | 24V                         |
|               | TE1450N       | 12V                          | 4-20mA       | 1-5V          | None                        |
|               | TE1S34N-2.5   | 24V                          | 4-20mA       | 0-2.5V        | 15V                         |
|               | TE1S60N-2.5   | 5V                           | 4-20mA       | 0-2.5V        | None                        |
|               | TE1S60N-3.3   | 5V                           | 4-20mA       | 0-3.3V        | None                        |
|               | TE1S65N-3.3   | 5V                           | 4-20mA       | 0-3.3V        | 12V                         |
|               | TESS64N-1-1   | 5V                           | 0-1V         | 0-1V          | 15V                         |
|               | TE2530N       | 24V                          | 0-20mA       | 0-10V         | None                        |
|               | TE2650N       | 12V                          | 0-20mA       | 0-5V          | None                        |
|               | TE6S6SN-3.3-9 | 5V                           | 0-5V         | 0-3.3V        | 9V                          |

|    |            |    |      |      |      |
|----|------------|----|------|------|------|
| -- | TE6660N-HK | 5V | 0-5V | 0-5V | None |
| -- | TE6664N-G  | 5V | 0-5V | 0-5V | 24V  |

### Input Specifications

| Item         |                               | Operating Conditions  | Min.                | Typ. | Max.    | Unit       |
|--------------|-------------------------------|---|---------------------|------|---------|------------|
| Power Input  | Input Voltage                 |   | Typ.-5%             | Typ. | Typ.+5% | V          |
|              | Input Power                   | Non-isolation power output  | --                  | --   | 1.0     | W          |
|              |                               | Isolation power output  | --                  | --   | 1.5     | W          |
|              | Power Supply Protection       | Input reverse polarity protection (Models with 5V power input do NOT provide this function) |                     |      |         |            |
| Signal Input | Input Signal                  |   | See selection guide |      |         |            |
|              | Input Impedance               | In case of max. input of current signal   | --                  | --   | 250     | mV         |
|              |                               | In case of max. input of voltage signal   | 10                  | --   | --      | M $\Omega$ |
|              | Maximum Continuous Over Range | In case of input of current signal  | --                  | --   | 50      | mA         |
|              |                               | In case of input of voltage signal  | --                  | --   | 30      | V          |

### Output Specifications

| Item                   |                | Operating Conditions                | Min.                | Typ. | Max.     | Unit       |
|------------------------|----------------|-------------------------------------|---------------------|------|----------|------------|
| Isolation Power Output | Output Voltage | Isolation power output at full load | Typ.-10%            | Typ. | Typ.+10% | V          |
|                        | Output Current |                                     | --                  | --   | 25       | mA         |
| Output                 | Output Signal  |                                     | See selection guide |      |          |            |
|                        | Load Capacity  |                                     | 2                   | --   | --       | k $\Omega$ |
|                        | Ripple & Noise | Bandwidth 20MHz                     | --                  | --   | 30       | mVpp       |

### Transmission Specifications

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

### 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 | 2   | --   | --   | kVAC       |
| Insulation Resistance                  |  | At 500VDC  | 100   | --   | --   | M $\Omega$ |
| Operating Temperature                  |  |  | -40   | --   | +85  | ℃          |
| Transportation and Storage Temperature |  |  | -50   | --   | +105 | ℃          |
| Safety Standard                        |  |  | EN62368-1 (Report)  |      |      |            |
| Safety Class                           |  |  | CLASS III   |      |      |            |
| Application Environment                |  |  | The presence of dust, severe vibration, shock and corrosive gas may cause damage to the product |      |      |            |

### Mechanical Specifications

|                |  |
|----------------|--|
| Case Material  | Black plastic, flame-retardant heat- resistant |
| Package        | DIP18  |
| Weight         | 5.5g(typ.)                                     |
| Cooling Method | Free air convection                            |

### Electromagnetic Compatibility (EMC)

| Emissions | CE    | CISPR32/EN55032 | CLASS A (see Fig. 6 for recommended circuit)                            |                  |
|-----------|-------|-----------------|---|------------------|
| Immunity  | ESD   | IEC/EN61000-4-2 | Contact $\pm 4\text{kV}$  | perf. Criteria B |
|           | EFT   | IEC/EN61000-4-4 | Power supply port $\pm 2\text{kV}$ (see Fig. 6 for recommended circuit) | perf. Criteria B |
|           | Surge | IEC/EN61000-4-5 | Power supply port $\pm 1\text{kV}$ (see Fig. 6 for recommended circuit) | perf. Criteria B |

Note: The electrostatic discharge of TE6664N-G is contact  $\pm 2\text{kV}$

### Application Precautions

1. Carefully read and follow the instructions before use; contact our technical support if you have any question;
2. Do not use the product in hazardous areas;
3. Use only DC power supply source for this product. 220VAC power supply is prohibited;
4. It is strictly forbidden to disassemble the product privately in order to avoid product failure or malfunction;
5. Unless otherwise specified, parameters in this datasheet were measured under the conditions of  $T_a=25^\circ\text{C}$ , humidity<75%RH with nominal input voltage and rated output load.

#### After-sales service

1. Factory inspection and quality control are strictly enforced before shipping any product; please contact your local representative or our technical support if you experience any abnormal operation or possible failure of the module;
2. The products have a 3-year warranty period, from the date of shipment. The product will be repaired or exchanged free of charge within the warranty period for any quality problem that occurs under normal use.

#### Applied circuit

Please refer to Isolated Transmitter Application Notes.

### Design Reference

#### 1. Typical application

##### 1) Schematic diagram

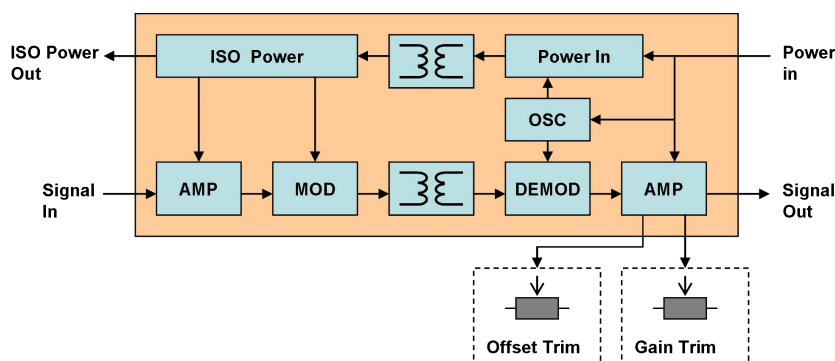


Fig. 1

## 2) Schematic diagram of signal input and signal output

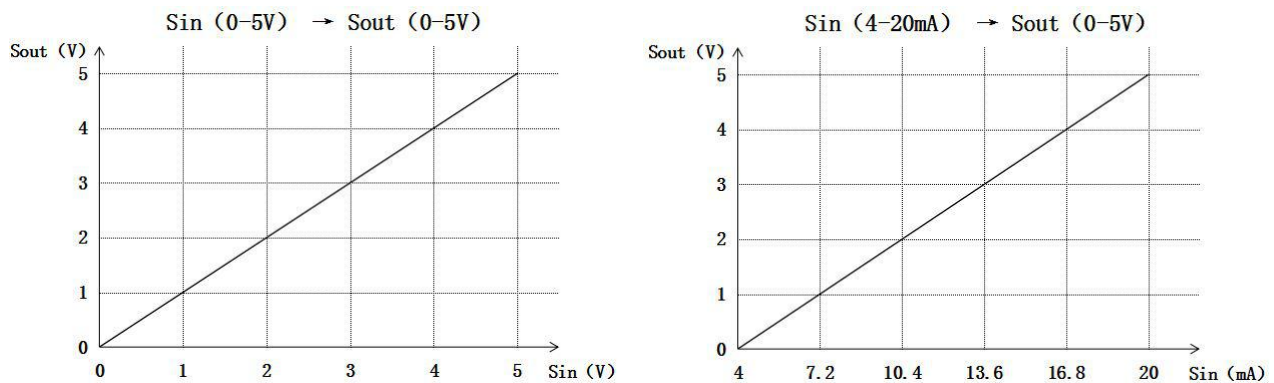


Fig. 2

## 3) Multi-channel voltage signal acquisition block diagram

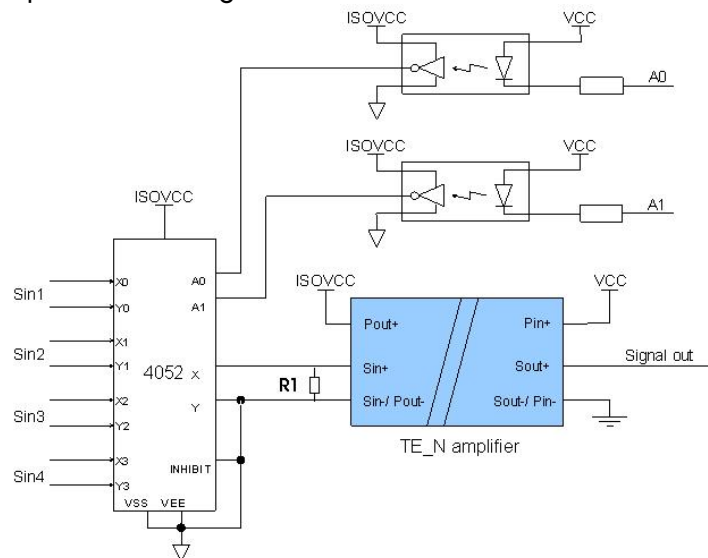


Fig. 3 Multi-channel signal acquisition circuit

### 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 TExxxN series amplifier isolates the transmitted signals as well as the power supplement 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 TExxxN transmitter. TExxxN 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 TExxxN transmitter and the input Vcc of strobe signal transmission circuit are both provided by the control system. Once the strobe signal is isolated, the transmission circuit and the multi-channel 4052 strobe chip power ports ISOVCC, both receive their power source from the power distribution output Pout+.

### Note

When the input signal port is open circuit, if the output signal value need near 0, please connect a resistor R1 ( $R1 < 100K \Omega$ ) in parallel at the signal input port of the model.

### 4) Typical application — Isolated transmission for electrical signals

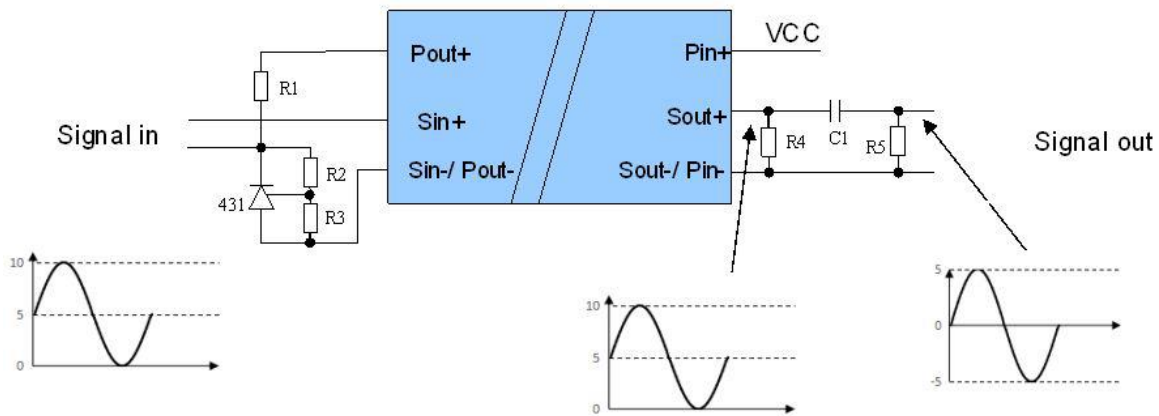


Fig. 4 Isolated transmission for electrical signals application

### Functional Description

Per 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 TExxxN series module does the signal transmission function and the power supply function of voltage stabilizing circuit. Resistor network R4 and R5 with C1 are filtering the DC output signal.

### How it Works

Supposing the detected signal is a 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 TExxxN transmitter becomes a 0-1V sine wave signal. If the amplifier has 0-10V input and 0-10V output, the TExxxN module transmitter output would be 0-10V 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 0-10V sine wave signal is filtered, and the resulting output is now a  $\pm 5V$  sine wave signal.

### Parameter

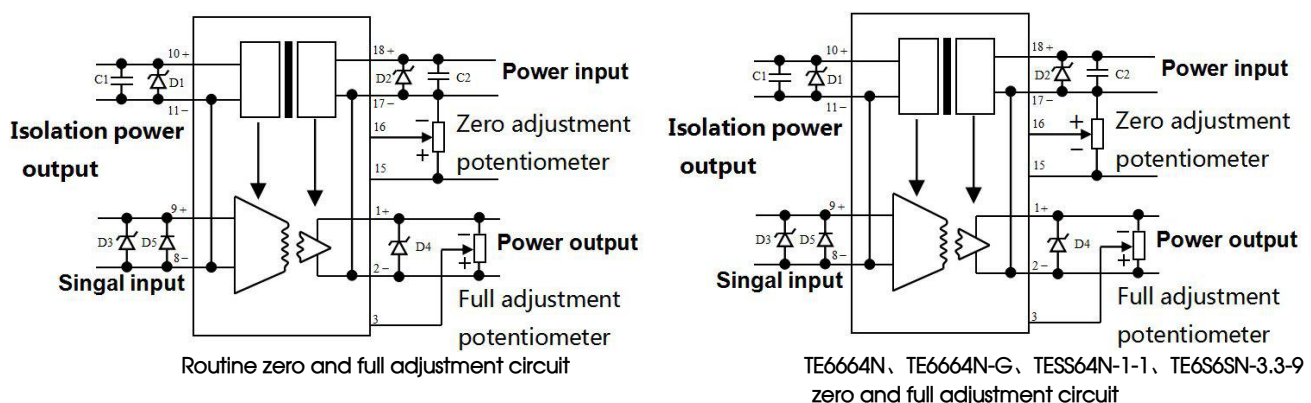
In the application, the typical value of R2 and R3 is  $10K\Omega$ , and the reference voltage of 431 is 2.5V. The stable voltage of the composition is 2.5V, and the voltage accuracy can achieve various high-precision application requirements according to the accuracy of the resistance value. The typical resistor value range of R4 is between  $2k\Omega$  and  $5k\Omega$ . 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  $100k\Omega$ , 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 TExxxN 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





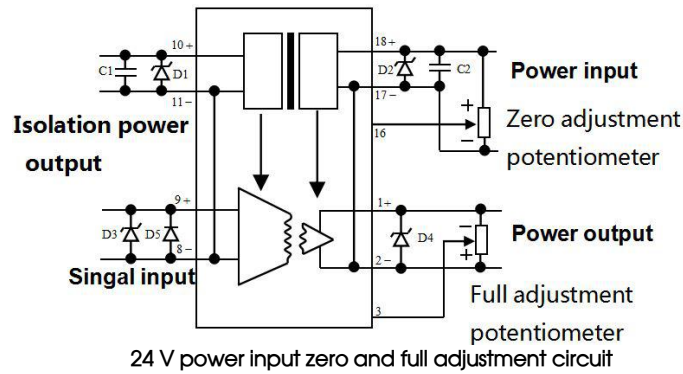


Fig. 5

## 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

Adding and reducing negative zero resistance can lower the zero point of the signal output. Adding and reducing positive zero resistance can raise the zero point of the signal output. Adding and reducing negative full adjustable resistance can lower the ratio of signal transmission, and adding and reducing negative full adjustable resistance can raise the ratio of the signal transmission. Use the potentiometers to adjust the output signal for zero and full adjustment accordingly to suite the application. As shown in the figure 5, the terminal of full or zero adjustment is connected to the slider of the respective potentiometer, and either end of the potentiometers are the zero or full reference for positive and negative regulation. Sliding potentiometer to adjust signal full or changing the ratio of rise and fall can also adjust zero and full of the output signal.

As shown in the figure 5, the conventional products, TE6664N, TE6664N-G, TESS64N-1-1, TE6S6SN-3.3-9, and 24V power input products have different zero point and full-scale adjustment circuits, and need to be wired according to each reference circuit. As shown in the figure, sliding the potentiometer to the + end can increase the signal output zero/fullness, and sliding the potentiometer to the - end can reduce the signal output zero/fullness. 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 small resistance potentiometer is recommended when a large range of coarse adjustment is required.

## Note

TE\_N series transmitter products have already met the accuracy specification of 0.1% FS at the time of production. The zero point and full scale adjustment function will affect the original accuracy of the product. Due to the influence of the temperature drift characteristics of the external adjustment resistor and the stability of the potentiometer, the temperature drift of the product will also change. When the ratio of positive regulation resistance and negative regulation resistance of the full-scale adjustment potentiometer is about 1:1, it is the product preset full scale (except TE6664N, TE6664N-G, TESS64N-1-1, TE6S6SN-3.3-9, making these three products full. The ratio of the positive and negative resistances corresponding to the zero point potentiometer of the product is different. For the zero point adjustment potentiometer, the zero point of each product is the product preset zero point potentiometer corresponding to the ratio of positive resistance and negative resistance. Please set the potentiometer resistance according to the actual adjustment.

## 2. EMC compliance circuit

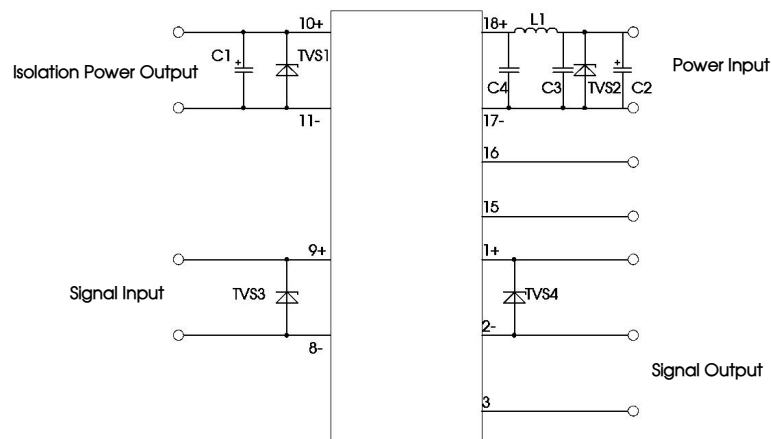


Fig. 6

Routine product:

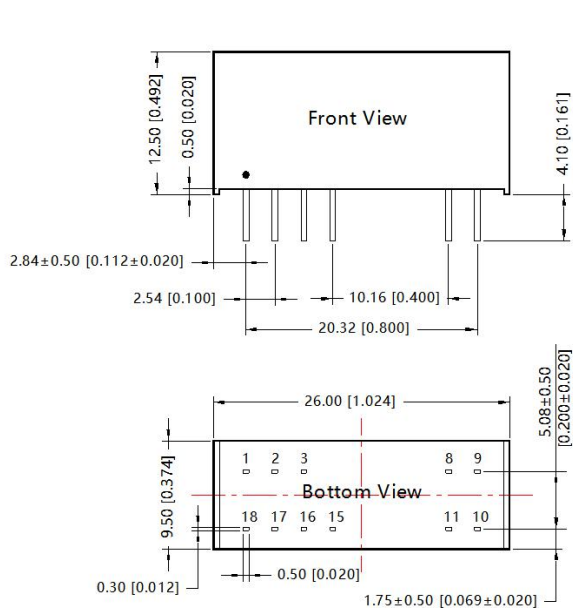
|      |           |
|------|-----------|
| C1   | 4.7uF/35V |
| C2   | 220uF/35V |
| C3   | 10uF/50V  |
| C4   | 10uF/50V  |
| L1   | 68uH      |
| TVS1 | SMCJ30A   |
| TVS2 | SMCJ28A   |
| TVS3 | SMBJ15A   |
| TVS4 | SMBJ15A   |

5V Power-in product:

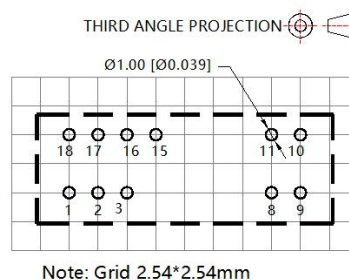
|      |           |
|------|-----------|
| C1   | 4.7uF/35V |
| C2   | 220uF/35V |
| C3   | 10uF/50V  |
| C4   | 10uF/50V  |
| L1   | 68uH      |
| TVS1 | SMCJ30A   |
| TVS2 | SMCJ12A   |
| TVS3 | SMBJ15A   |
| TVS4 | SMBJ15A   |

3. For additional information please find the application notes on [www.mornsun-power.com](http://www.mornsun-power.com)

## Dimensions and Recommended Layout



Note:  
Unit: mm[inch]  
Pin section tolerances:  $\pm 0.10[\pm 0.004]$   
General tolerances:  $\pm 0.25[\pm 0.010]$



| Pin-Out |       |                           |   |       |                            |
|---------|-------|---------------------------|---|-------|----------------------------|
| 1       | Sout+ | Signal output(+)          | 11  | Pout- | Isolation power output(-)  |
| 2       | Sout- | Signal output(-)          | 15  | ZR    | Zero auxiliary regulation* |
| 3       | SG    | Gain regulation           | 16  | SZ    | Zero regulation            |
| 8       | Sin-  | Signal input(-)           | 17  | Pin-  | Power input(-)             |
| 9       | Sin+  | Signal input(+)           | 18  | Pin+  | Power input(+)             |
| 10      | Pout+ | Isolation power output(+) | * Note: the power input of 24V without 15 Pin |       |                            |

Notes:

1. For additional information on Product Packaging please refer to [www.mornsun-power.com](http://www.mornsun-power.com). The Packaging bag number: 58240002;
2. Unless otherwise specified, parameters in this datasheet were measured under the conditions of  $T_a=25^{\circ}\text{C}$ , 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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