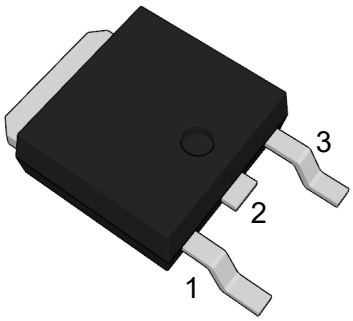
# TN78MXXTE

## 3-Terminal Voltage Regulators

## Description

The TN78MXXTE series of three-terminal positive regulators are available in TO-252 package. Each type employs internal current limiting, thermal shut-down and safe area protection, making it essentially indestructible. If adequate heat sinking is provided,It can deliver over 0.5A output current, Although designed as fixed voltage regulator, This device can be used with external components to obtain adjustable voltage and currents.

**TO-252**




1. VIN 2. GND 3. VOUT

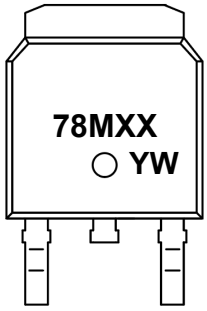
## Features

- Input voltage: up to 35V
- Output voltage: 5V,6V,8V,9V,10V,12V,15V,18V,24V
- Output current up to 500 mA
- Thermal overload protection
- Short circuit current limiting

## Applications

- DC motor drivers
- Household electric appliances
- Industrial power supplies
- Test and measurement equipment

## Ordering Information

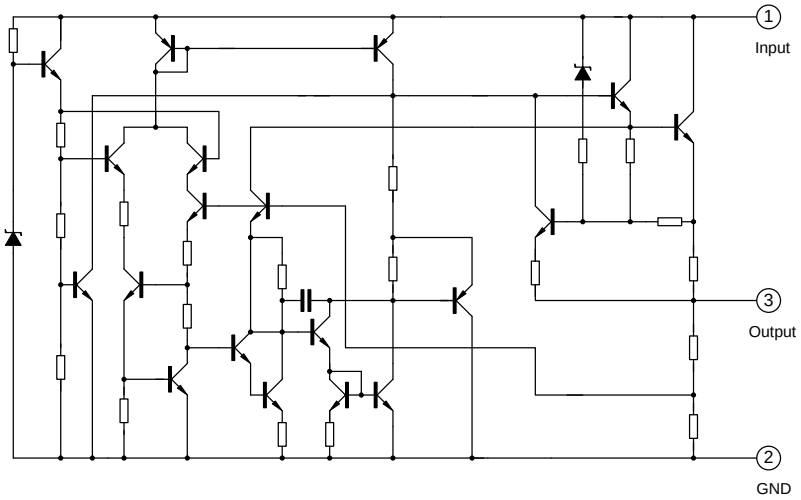
| Orderable Device | Package | Reel (inch) | Package Qty (PCS) | Eco Plan Note | MSL Level | Marking Code |
|---|---|---|---|---|---|---|
| TN78M05TE | TO-252 | 13 | 2500 | RoHS & Green | MSL3 |  |
| TN78M06TE | | | | | | |
| TN78M08TE | | | | | | |
| TN78M09TE | | | | | | |
| TN78M10TE | | | | | | |
| TN78M12TE | | | | | | |
| TN78M15TE | | | | | | |
| TN78M18TE | | | | | | |
| TN78M24TE | | | | | | |



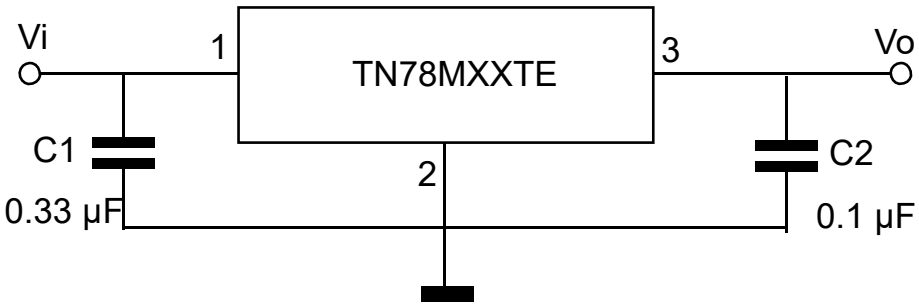
78MXX: Product code
e.g. TN78M05TE:78M05
YW: Year code and Week code

**Note:**
RoHS: TN defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials.
Green: TN defines "Green" to mean Halogen-Free and Antimony-Free.

## Function Block Diagram




## Typical Application Circuit




## Absolute Maximum Ratings

Ratings at 25°C ambient temperature unless otherwise specified.

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Input Voltage | $V_I$ | 35 | V |
| Output Current | $I_O$ | 500 | mA |
| Maximum Power Dissipation | $P_D$ | 1.25 | W |
| Operating Temperature Range | $T_{OPR}$ | -40 to +125 | °C |
| Storage Temperature Range | $T_{STG}$ | -65 to +150 | °C |

## TN78M05TE Electrical Characteristics

$V_I$=10V, $I_O$=350mA, $T_J$=25℃, $C_I$=0.33μF,$C_O$=0.1μF,unless otherwise specified.

| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 4.8 | 5.0 | 5.2 | V |
| | | $I_O$=5mA to 350mA, $V_I$=7V to 20V | 4.75 | -- | 5.25 | V |
| Line Regulation | $\triangle V_O$ | $I_O$=200mA,$V_I$=7V to 25V | -- | -- | 100 | mV |
| | | $I_O$=200mA,$V_I$=8V to 25V | -- | -- | 50 | mV |
| Load Regulation | $\triangle V_O$ | $I_O$=5mA to 500mA | -- | -- | 100 | mV |
| | | $I_O$=5mA to 200mA | -- | -- | 50 | mV |
| Ripple Rejection | RR | $V_I$=8V to 18V, f=120Hz, $I_O$=300mA | 62 | -- | -- | dB |
| Dropout Voltage | $V_D$ | | -- | 2 | -- | V |
| Quiescent Current | $I_Q$ | | -- | -- | 6 | mA |
| Temperature coefficient of $V_O$ | $\triangle V_O/\triangle T$ | $I_O$=5mA,$T_J$=0°C~125°C | -- | 0.5 | -- | mV/°C |
| Quiescent Current Change | $\triangle I_Q$ | $I_O$=200mA, $V_I$=8V to 25V | -- | -- | 0.8 | mA |
| | | $I_O$=5mA to 350mA | -- | -- | 0.5 | mA |
| Output Noise Voltage | $V_N$ | 10Hz≤f≤100kHz | -- | 40 | -- | μV |

## TN78M06TE Electrical Characteristics

$V_I$=11V, $I_O$=350mA, $T_J$=25℃, $C_I$=0.33μF,$C_O$=0.1μF,unless otherwise specified.

| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 5.75 | 6.0 | 6.25 | V |
| | | $I_O$=5mA to 350mA, $V_I$=8V to 21V | 5.7 | 6.0 | 6.3 | V |
| Line Regulation | $\triangle V_O$ | $I_O$=200mA,$V_I$=8V to 25V | -- | -- | 120 | mV |
| | | $I_O$=200mA,$V_I$=9V to 25V | -- | -- | 60 | mV |
| Load Regulation | $\triangle V_O$ | $I_O$=5mA to 500mA | -- | -- | 120 | mV |
| | | $I_O$=5mA to 200mA | -- | -- | 60 | mV |
| Ripple Rejection | RR | $V_I$=9V to 19V, f=120Hz, $I_O$=300mA | 59 | -- | -- | dB |
| Dropout Voltage | $V_D$ | | -- | 2 | -- | V |
| Quiescent Current | $I_Q$ | | -- | -- | 6 | mA |
| Temperature coefficient of $V_O$ | $\triangle V_O/\triangle T$ | $I_O$=5mA,$T_J$=0°C~125°C | -- | 0.6 | -- | mV/°C |
| Quiescent Current Change | $\triangle I_Q$ | $I_O$=200mA, $V_I$=9V to 25V | -- | -- | 0.8 | mA |
| | | $I_O$=5mA to 350mA | -- | -- | 0.5 | mA |
| Output Noise Voltage | $V_N$ | 10Hz≤f≤100kHz | -- | 45 | -- | μV |

## TN78M08TE Electrical Characteristics

$V_I$=14V, $I_O$=350mA, $T_J$=25℃, $C_I$=0.33μF,$C_O$=0.1μF,unless otherwise specified.

| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 7.7 | 8.0 | 8.3 | V |
| | | $I_O$=5mA to 350mA, $V_I$=10.5V to 23V | 7.6 | 8.0 | 8.4 | V |
| Line Regulation | $\triangle V_O$ | $I_O$=200mA,$V_I$=10.5V to 25V | -- | -- | 160 | mV |
| | | $I_O$=200mA,$V_I$=11V to 25V | -- | -- | 80 | mV |
| Load Regulation | $\triangle V_O$ | $I_O$=5mA to 500mA | -- | -- | 160 | mV |
| | | $I_O$=5mA to 200mA | -- | -- | 80 | mV |
| Ripple Rejection | RR | $V_I$=11.5V to 21.5V, f=120Hz, $I_O$=300mA | 56 | -- | -- | dB |
| Dropout Voltage | $V_D$ | | -- | 2 | -- | V |
| Quiescent Current | $I_Q$ | | -- | -- | 6 | mA |
| Temperature coefficient of $V_O$ | $\triangle V_O/\triangle T$ | $I_O$=5mA,$T_J$=0°C~125°C | -- | 0.7 | -- | mV/°C |
| Quiescent Current Change | $\triangle I_Q$ | $I_O$=200mA, $V_I$=10V to 25V | -- | -- | 0.8 | mA |
| | | $I_O$=5mA to 350mA | -- | -- | 0.5 | mA |
| Output Noise Voltage | $V_N$ | 10Hz≤f≤100kHz | -- | 52 | -- | μV |

## TN78M09TE Electrical Characteristics

$V_I$=15V, $I_O$=350mA, $T_J$=25℃, $C_I$=0.33μF,$C_O$=0.1μF,unless otherwise specified.

| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 8.65 | 9.0 | 9.35 | V |
| | | $I_O$=5mA to 350mA, $V_I$=11.5V to 24V | 8.55 | 9.0 | 9.45 | V |
| Line Regulation | $\triangle V_O$ | $I_O$=200mA,$V_I$=11.5V to 25V | -- | -- | 180 | mV |
| | | $I_O$=200mA,$V_I$=12V to 25V | -- | -- | 90 | mV |
| Load Regulation | $\triangle V_O$ | $I_O$=5mA to 500mA | -- | -- | 180 | mV |
| | | $I_O$=5mA to 200mA | -- | -- | 90 | mV |
| Ripple Rejection | RR | $V_I$=12.5V to 23V, f=120Hz, $I_O$=300mA | 56 | -- | -- | dB |
| Dropout Voltage | $V_D$ | | -- | 2 | -- | V |
| Quiescent Current | $I_Q$ | | -- | -- | 6 | mA |
| Temperature coefficient of $V_O$ | $\triangle V_O/\triangle T$ | $I_O$=5mA,$T_J$=0°C~125°C | -- | 0.9 | -- | mV/°C |
| Quiescent Current Change | $\triangle I_Q$ | $I_O$=200mA, $V_I$=11.5V to 25V | -- | -- | 0.8 | mA |
| | | $I_O$=5mA to 350mA | -- | -- | 0.5 | mA |
| Output Noise Voltage | $V_N$ | 10Hz≤f≤100kHz | -- | 58 | -- | μV |

## TN78M10TE Electrical Characteristics

$V_I$=17V, $I_O$=350mA, $T_J$=25℃, $C_I$=0.33μF,$C_O$=0.1μF,unless otherwise specified.

| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 9.6 | 10 | 10.4 | V |
| | | $I_O$=5mA to 350mA, $V_I$=12.5V to 25V | 9.5 | 10 | 10.5 | V |
| Line Regulation | $\triangle V_O$ | $I_O$=200mA,$V_I$=12.5V to 28V | -- | -- | 210 | mV |
| | | $I_O$=200mA,$V_I$=14V to 20V | -- | -- | 120 | mV |
| Load Regulation | $\triangle V_O$ | $I_O$=5mA to 500mA | -- | -- | 210 | mV |
| | | $I_O$=5mA to 200mA | -- | -- | 120 | mV |
| Ripple Rejection | RR | $V_I$=12.5V to 28V, f=120Hz, $I_O$=300mA | 55 | -- | -- | dB |
| Dropout Voltage | $V_D$ | | -- | 2 | -- | V |
| Quiescent Current | $I_Q$ | | -- | -- | 6 | mA |
| Temperature coefficient of $V_O$ | $\triangle V_O/\triangle T$ | $I_O$=5mA,$T_J$=0°C~125°C | -- | 1 | -- | mV/°C |
| Quiescent Current Change | $\triangle I_Q$ | $I_O$=200mA, $V_I$=12.5V to 28V | -- | -- | 0.8 | mA |
| | | $I_O$=5mA to 350mA | -- | -- | 0.5 | mA |
| Output Noise Voltage | $V_N$ | 10Hz≤f≤100kHz | -- | 75 | -- | μV |

## TN78M12TE Electrical Characteristics

$V_I$=19V, $I_O$=350mA, $T_J$=25℃, $C_I$=0.33μF,$C_O$=0.1μF,unless otherwise specified.

| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 11.5 | 12 | 12.5 | V |
| | | $I_O$=5mA to 350mA, $V_I$=14.5V to 27V | 11.4 | 12 | 12.6 | V |
| Line Regulation | $\triangle V_O$ | $I_O$=200mA,$V_I$=14.5V to 30V | -- | -- | 240 | mV |
| | | $I_O$=200mA,$V_I$=16V to 30V | -- | -- | 120 | mV |
| Load Regulation | $\triangle V_O$ | $I_O$=5mA to 500mA | -- | -- | 240 | mV |
| | | $I_O$=5mA to 200mA | -- | -- | 120 | mV |
| Ripple Rejection | RR | $V_I$=15V to 25V, f=120Hz, $I_O$=300mA | 55 | -- | -- | dB |
| Dropout Voltage | $V_D$ | | -- | 2 | -- | V |
| Quiescent Current | $I_Q$ | | -- | -- | 6 | mA |
| Temperature coefficient of $V_O$ | $\triangle V_O/\triangle T$ | $I_O$=5mA,$T_J$=0°C~125°C | -- | 1 | -- | mV/°C |
| Quiescent Current Change | $\triangle I_Q$ | $I_O$=200mA, $V_I$=14.5V to 30V | -- | -- | 0.8 | mA |
| | | $I_O$=5mA to 350mA | -- | -- | 0.5 | mA |
| Output Noise Voltage | $V_N$ | 10Hz≤f≤100kHz | -- | 75 | -- | μV |

## TN78M15TE Electrical Characteristics

$V_I$=23V, $I_O$=350mA, $T_J$=25℃, $C_I$=0.33μF,$C_O$=0.1μF,unless otherwise specified.

| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 14.4 | 15 | 15.6 | V |
| | | $I_O$=5mA to 350mA, $V_I$=17.5V to 30V | 14.25 | 15 | 15.75 | V |
| Line Regulation | $\triangle V_O$ | $I_O$=200mA,$V_I$=17.5V to 30V | -- | -- | 300 | mV |
| | | $I_O$=200mA,$V_I$=20V to 30V | -- | -- | 150 | mV |
| Load Regulation | $\triangle V_O$ | $I_O$=5mA to 500mA | -- | -- | 300 | mV |
| | | $I_O$=5mA to 200mA | -- | -- | 150 | mV |
| Ripple Rejection | RR | $V_I$=18.5V to 28.5V, f=120Hz, $I_O$=300mA | 53 | -- | -- | dB |
| Dropout Voltage | $V_D$ | | -- | 2 | -- | V |
| Quiescent Current | $I_Q$ | | -- | -- | 6 | mA |
| Temperature coefficient of $V_O$ | $\triangle V_O/\triangle T$ | $I_O$=5mA,$T_J$=0°C~125°C | -- | 1.2 | -- | mV/°C |
| Quiescent Current Change | $\triangle I_Q$ | $I_O$=200mA, $V_I$=17.5V to 30V | -- | -- | 0.8 | mA |
| | | $I_O$=5mA to 350mA | -- | -- | 0.5 | mA |
| Output Noise Voltage | $V_N$ | 10Hz≤f≤100kHz | -- | 100 | -- | μV |

## TN78M18TE Electrical Characteristics

$V_I$=26V, $I_O$=350mA, $T_J$=25℃, $C_I$=0.33μF,$C_O$=0.1μF,unless otherwise specified.

| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 17.3 | 18 | 18.7 | V |
| | | $I_O$=5mA to 350mA, $V_I$=20.5V to 33V | 17.1 | 18 | 18.9 | V |
| Line Regulation | $\triangle V_O$ | $I_O$=200mA,$V_I$=21V to 33V | -- | -- | 360 | mV |
| | | $I_O$=200mA,$V_I$=24V to 33V | -- | -- | 180 | mV |
| Load Regulation | $\triangle V_O$ | $I_O$=5mA to 500mA | -- | -- | 360 | mV |
| | | $I_O$=5mA to 200mA | -- | -- | 180 | mV |
| Ripple Rejection | RR | $V_I$=22V to 32V, f=120Hz, $I_O$=300mA | 53 | -- | -- | dB |
| Dropout Voltage | $V_D$ | | -- | 2 | -- | V |
| Quiescent Current | $I_Q$ | | -- | -- | 6 | mA |
| Temperature coefficient of $V_O$ | $\triangle V_O/\triangle T$ | $I_O$=5mA,$T_J$=0°C~125°C | -- | -1.1 | -- | mV/°C |
| Quiescent Current Change | $\triangle I_Q$ | $I_O$=200mA, $V_I$=21V to 33V | -- | -- | 0.8 | mA |
| | | $I_O$=5mA to 350mA | -- | -- | 0.5 | mA |
| Output Noise Voltage | $V_N$ | 10Hz≤f≤100kHz | -- | 100 | -- | μV |

## TN78M24TE Electrical Characteristics

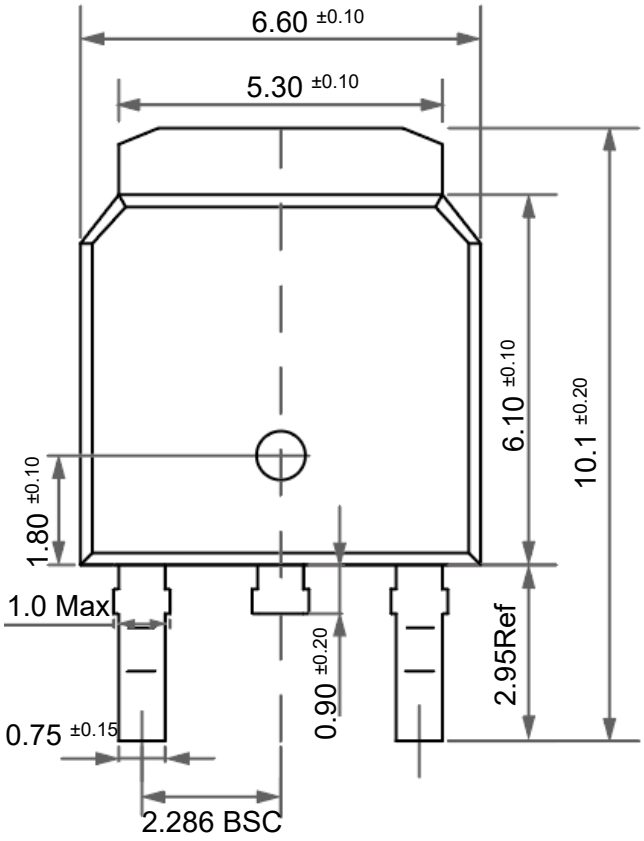
$V_I$=33V, $I_O$=350mA, $T_J$=25℃, $C_I$=0.33μF,$C_O$=0.1μF,unless otherwise specified.

| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | | 23 | 24 | 25 | V |
| | | $I_O$=5mA to 350mA, $V_I$=27V to 38V | 22.8 | 24 | 25.2 | V |
| Line Regulation | $\triangle V_O$ | $I_O$=200mA,$V_I$=27V to 38V | -- | -- | 480 | mV |
| | | $I_O$=200mA,$V_I$=28V to 38V | -- | -- | 240 | mV |
| Load Regulation | $\triangle V_O$ | $I_O$=5mA to 500mA | -- | -- | 480 | mV |
| | | $I_O$=5mA to 200mA | -- | -- | 240 | mV |
| Ripple Rejection | RR | $V_I$=28V to 38V, f=120Hz, $I_O$=300mA | 50 | -- | -- | dB |
| Dropout Voltage | $V_D$ | | -- | 2 | -- | V |
| Quiescent Current | $I_Q$ | | -- | -- | 6 | mA |
| Temperature coefficient of $V_O$ | $\triangle V_O/\triangle T$ | $I_O$=5mA,$T_J$=0°C~125°C | -- | -1.2 | -- | mV/°C |
| Quiescent Current Change | $\triangle I_Q$ | $I_O$=200mA, $V_I$=27V to 38V | -- | -- | 0.8 | mA |
| | | $I_O$=5mA to 350mA | -- | -- | 0.5 | mA |
| Output Noise Voltage | $V_N$ | 10Hz≤f≤100kHz | -- | 170 | -- | μV |

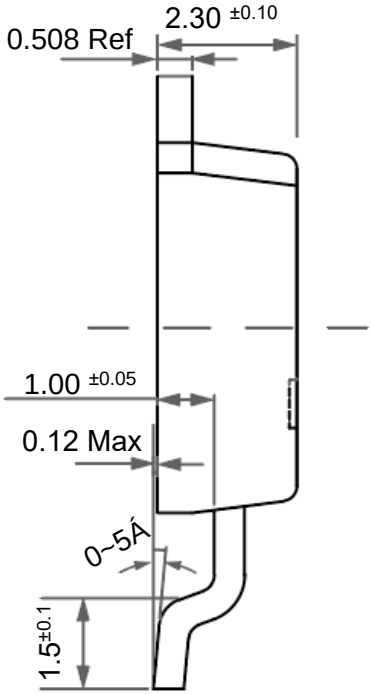
## Package Outline

TO-252

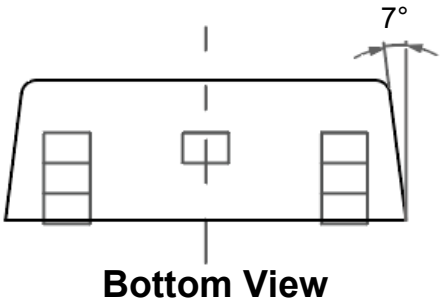
Dimensions in mm




**Front View**




**Side View**




**Bottom View**

## Contact Information

TANI website: **http://www.tanisemi.com** Email:tani@tanisemi.com

For additional information, please contact your local Sales Representative.

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*The product parameters described in the product specification are numerical values, characteristics, and functions obtained through actual testing or theoretical calculations of the product in an independent or ideal state. Due to the complexity of product applications and variations in test conditions and equipment, there may be slight fluctuations in parameter test values. TANI shall not guarantee that the actual performance of the product when installed in the customer's system or equipment will be entirely consistent with the product specification, especially concerning dynamic parameters. It is recommended that users consult with professionals for product selection and system design. Users should also thoroughly validate and assess whether the actual parameters and performance when installed in their respective systems or equipment meet their requirements or expectations. Additionally, users should exercise caution in verifying product compatibility issues, and TANI assumes no responsibility for the application of the product. TANI strives to provide accurate and up -to- date information to the best of our ability. However, due to technical, human, or other reasons, TANI cannot guarantee that the information provided in the product specification is entirely accurate and error-free. TANI shall not be held responsible for any losses or damages resulting from the use or reliance on any information in these product specifications.*

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*Users are advised to pay attention to the parameter limit values specified in the product specification and maintain a certain margin in design or application to ensure that the product does not exceed the parameter limit values defined in the product specification. This precaution should be taken to avoid exceeding one or more of the limit values, which may result in permanent irreversible damage to the product, ultimately affecting the quality and reliability of the system or equipment.*

*The design of the product is intended to meet civilian needs and is not guaranteed for use in harsh environments or precision equipment. It is not recommended for use in systems or equipment such as medical devices, aircraft, nuclear power, and similar systems, where failures in these systems or equipment could reasonably be expected to result in personal injury. TANI shall assume no responsibility for any consequences resulting from such usage.*

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