

Description

The TN9193 Series are highly precise, low noise, positive voltage LDO regulators manufactured using CMOS processes.

The TN9193 performance is optimized for battery-powered systems to deliver ultra low noise and low quiescent current.

Regulator ground current increases only slightly in dropout, further prolonging the battery life. The TN9193 Series also works with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications, critical in hand-held wireless devices. The TN9193 Series consumes less than 1μA in shutdown mode and has fast turn-on time less than 50μs. The other features include ultra low dropout voltage, high output accuracy, current limiting protection, and high ripple rejection ratio.

Features

- ◆ Ultra Low Noise for RF Application
- ◆ Ultra Fast Response in Line/Load Transient
- ◆ Low Power Consumption: 70uA(Typ.)
- ◆ PSRR=70dB@1KHz
- ◆ Maximum Output Current: 300mA
- ◆ Low Dropout : 130mV @ 100mA at $V_{OUT}=3.3V$
- ◆ Operating Voltage Ranges : 2V to 6.5V
- ◆ Over Temperature Protection
- ◆ Current Limiting Protection
- ◆ Thermal Shutdown Protection

Applications

- ◆ Battery-Powered Equipment
- ◆ CDMA/GSM Cellular Handsets
- ◆ Portable Information Appliances

SOT-23

3.VIN

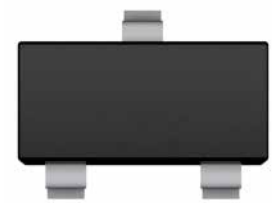


1.GND

2.VOUT

SOT-23-3

3.VIN



1.GND

2.VOUT

SOT-89

2.VIN



1.GND

2.VIN

3.VOUT

SOT-23-5

5.VOUT

4. NC

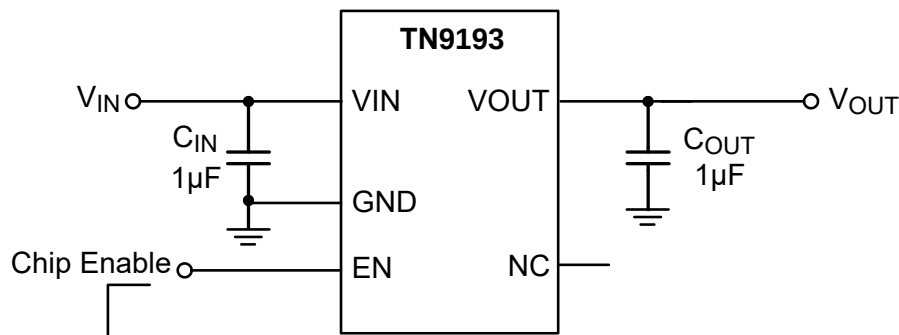


1.VIN

2.GND

3.EN

Typical Application Circuit



Functional Pin Description

Pin Name	Pin Function
EN	Chip Enable (Active High). Note that this pin is high impedance
NC	NO Connected
GND	Ground.
VOUT	Output Voltage.
VIN	Power Input Voltage.

Ordering Information

TN9193-□□□□

Package Type

SA:SOT-23 SC:SOT-23-3
SQ:SOT-89 SE:SOT-23-5

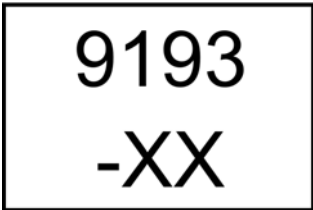
Output Voltage

12 : 1.2V 15 : 1.5V 18 : 1.8V
25 : 2.5V 28 : 2.8V 30 : 3.0V
33 : 3.3V 36 : 3.6V

Output current tap

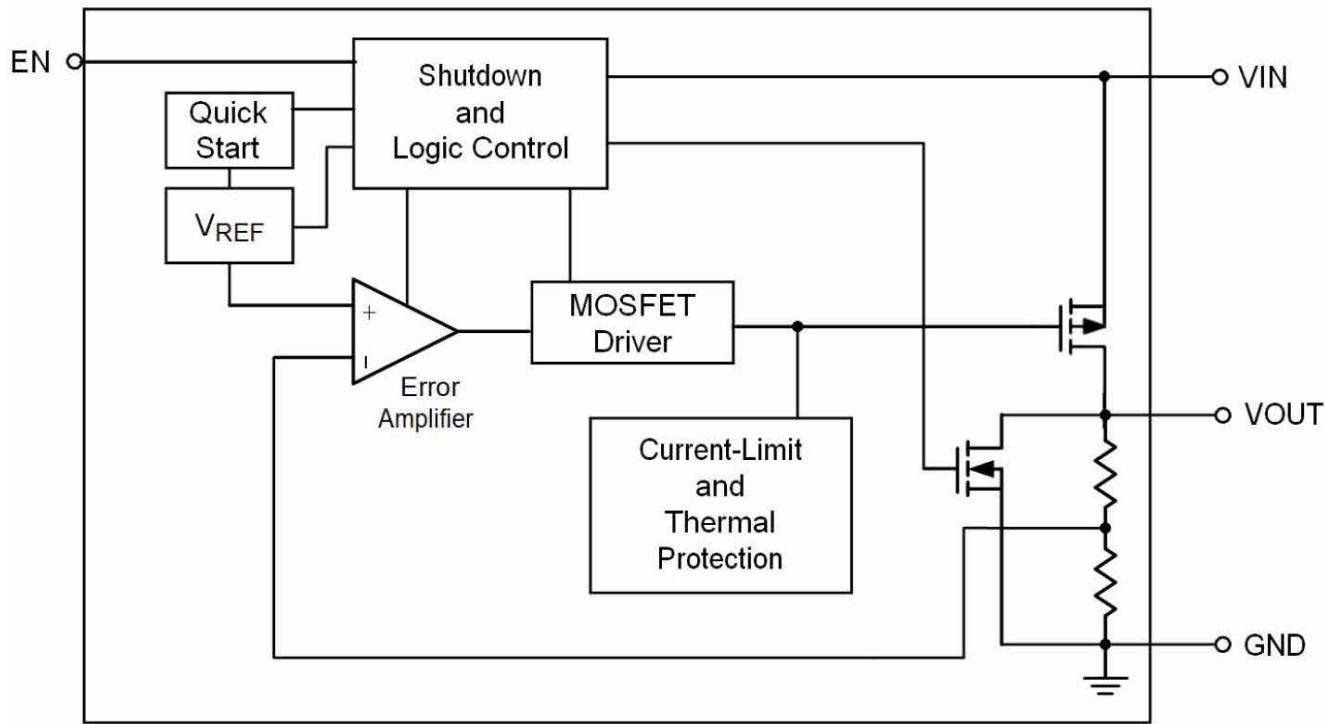
M : 300mA

Marking Code:



XX: Output Voltage
12 : 1.2V 15 : 1.5V 18 : 1.8V
25 : 2.5V 28 : 2.8V 30 : 3.0V
33 : 3.3V 36 : 3.6V

Function Block Diagram



Absolute Maximum Ratings ^{Note1}

Ratings at 25°C ambient temperature unless otherwise specified.

Parameter		Value	Unit
Input Voltage	V _{IN}	-0.3~7	V
	V _{ON/OFF}	-0.3~0.3	V
Output Voltage		-0.3~VIN+0.3	V
Power Dissipation	SOT-23	300	mW
	SOT-23-3	250	mW
	SOT-23-5	250	mW
	SOT-89	400	mW
Thermal Resistance,Junction-to-Ambient	SOT-23	330	°C/W
	SOT-23-3	400	°C/W
	SOT-23-5	400	°C/W
	SOT-89	250	°C/W
Operating Ambient Temperature		-40~85	°C
Maximum Junction Temperature		260	°C
Storage temperature range		-40~125	°C
ESD(HBM) ^{Note2}		4	KV
ESD(CDM) ^{Note2}		400	V

Note 1. Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions may affect device reliability.

2. ESD testing is performed according to the respective JESD22 JEDEC standard. The human body model is a 100pF capacitor discharged through a 1.5KΩ resistor into each pin.The machine model is a 200pF capacitor discharged directly into each pin.

Parameter	Value	Unit
Supply Voltage	2~6.5	V
Operating Junction Temperature Range,Tj	-40~125	°C
Operating Free Air Temperature Range,TA	-40~85	°C

Electrical Characteristics

($V_{IN}=V_{OUT}+1$, $V_{OUT} = 3.3V$, $C_{IN}=C_{OUT}=1\mu F$, $T_A=25^{\circ}C$, unless otherwise noted.)

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input Voltage		V_{IN}		-0.3	--	6.5	V
Output Voltage Accuracy		ΔV_{OUT}	$I_{OUT}=40mA$	-2	--	+2	%
Quiescent Current		I_Q	$V_{IN}>V_{OUT}$, $EN=V_{IN}$ $I_{OUT}=0mA$	--	70	--	μA
Dropout Voltage		V_{DROP}	$I_{OUT}=100mA$	--	130	--	mV
			$I_{OUT}=200mA$	--	250	--	
Line Regulation		ΔV_{LINE}	$V_{IN}=V_{OUT}+1V$ to $7V$ $I_{OUT}=40mA$	--	0.05	--	%/V
Load Regulation		ΔV_{LOAD}	$1mA<I_{OUT}<100mA$	--	50	--	mV
Output Voltage Temperature Coefficient		TC_{VOUT}	$I_{OUT}=10mA$	--	100	--	ppm/ $^{\circ}C$
Short circuit/start carrying current		I_{SHORT}	$R_L=1\Omega$	--	50	--	mA
EN Leakage Current		I_{EN}		--	1	--	μA
Current Limit		I_{LIM}	$V_{IN}=V_{OUT}+1$	--	450	--	mA
EN Input Threshold	Logic Low	V_{IL}	$V_{IN}=3V$ to $5.5V$, Shutdown	--	--	0.4	V
	Logic High	V_{IH}	$V_{IN}=3V$ to $5.5V$, Start up	1.2	--	--	V
Output Noise Voltage		e_{NO}	300Hz to 50KHz, $I_{OUT}=40mA$	--	50	--	μV_{RMS}
Power Supply Rejection Rate		PSRR	$V_{IN}=V_{OUT}+1$ $I_{OUT}=40mA$, $f=1KHz$		70		dB

Applications Information

Input Capacitor

A 1μF ceramic capacitor is recommended to connect between VIN and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both VIN and GND.

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended minimum output capacitance is 1μF, ceramic capacitor is recommended, and temperature characteristics are X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/overshoot. Place output capacitor as close as possible to VOUT and GND pins.

Enable Function

The TN9193 Series has an EN pin to turn on or turn off the regulator, When the EN pin is in logic high, the regulator will be turned on. The shutdown current is almost 0μA typical. The EN pin may be directly tied to VIN to keep the part on. The Enable input is CMOS logic and cannot be left floating.

Thermal Considerations

For continuous operation, do not exceed absolute maximum junction temperature. The maximum power dissipation depends on the thermal resistance of the IC package, PCB layout, rate of surrounding airflow, and difference between junction and ambient temperature. The maximum power dissipation can be calculated by the following formula :

$$PD(MAX) = (TJ(MAX) - TA) / R\theta JA$$

Where TJ(MAX) is the maximum operation junction temperature 125°C, TA is the ambient temperature and the RθJA is the junction to ambient thermal resistance.

The power dissipation definition in device is :

$$PD = (VIN - VOUT) \times I_{OUT} + VIN \times I_Q$$

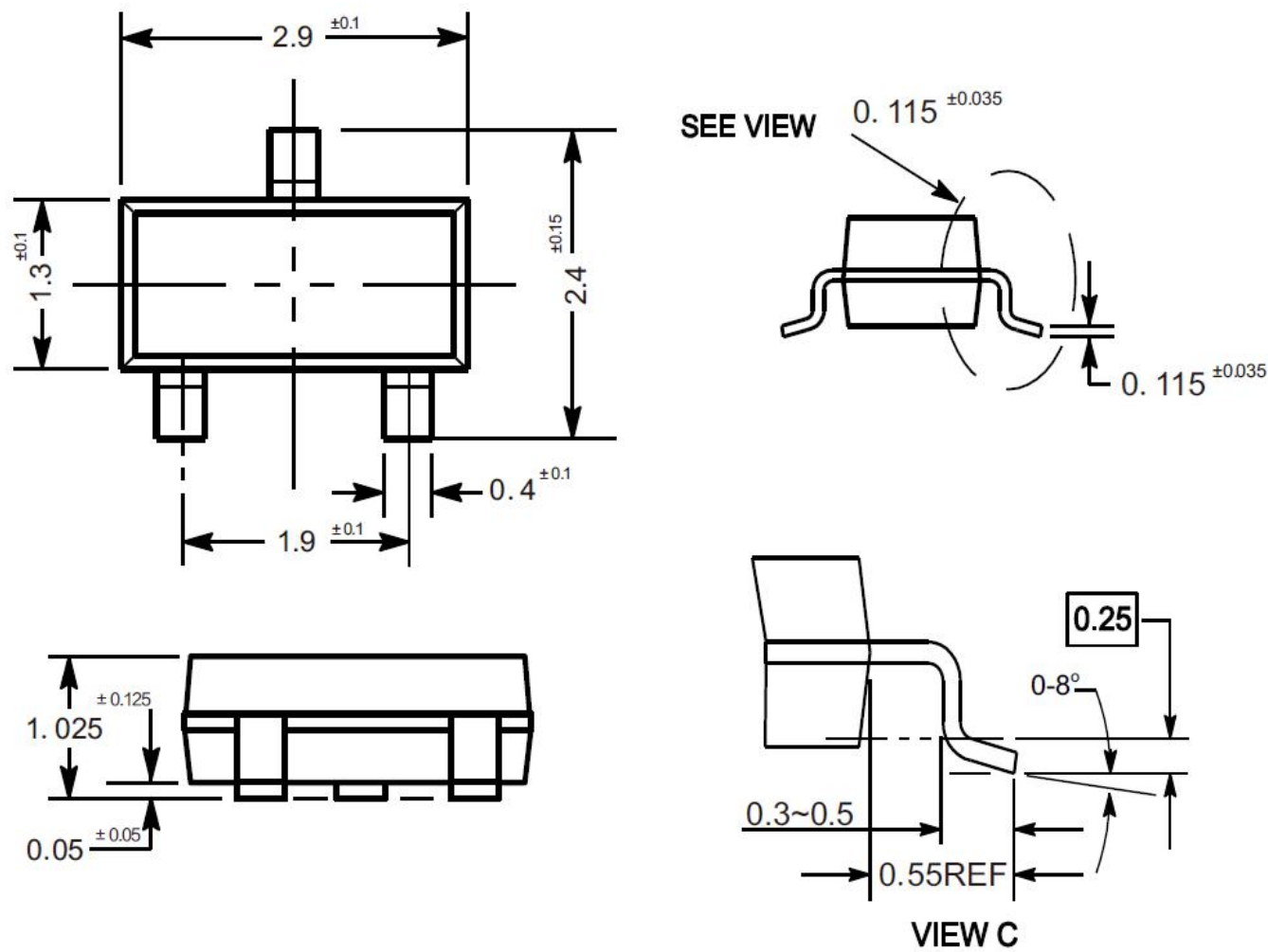
Layout Consideration

By placing input and output capacitors on the same side of the PCB as the LDO, and placing them as close as is practical to the package can achieve the best performance. The ground connections for input and output capacitors must be back to the TN9193 Series ground pin using as wide and as short of a copper trace as is practical. Connections using long trace lengths, narrow trace widths, and connections through via must be avoided. These add parasitic inductances and resistance that results in worse performance especially during transient conditions.

Package Outline

SOT-23

Dimensions in mm



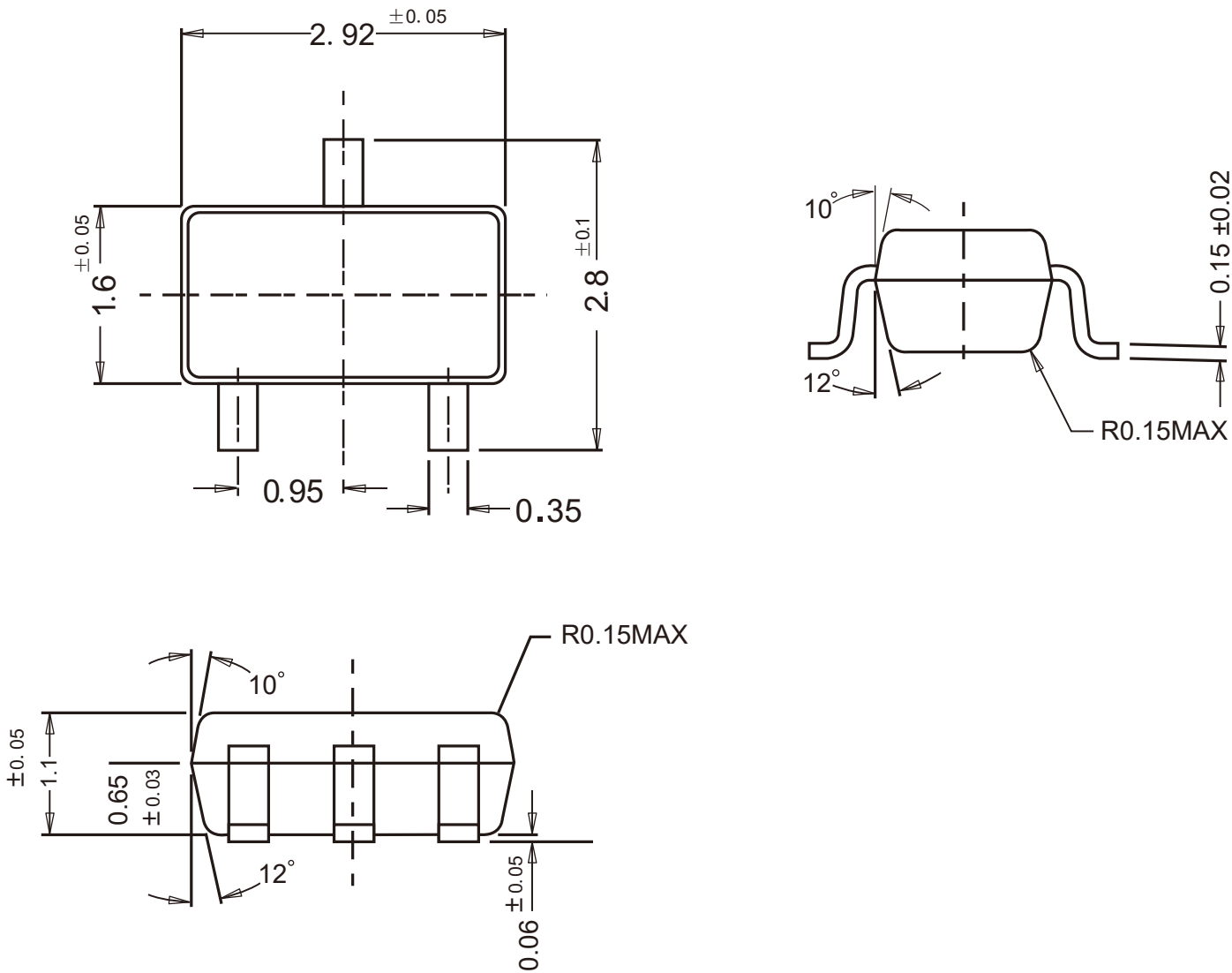
Ordering Information

Device	Package	Shipping
TN9193 Series	SOT-23	3,000/ Tape & Reel (7 inches)

Package Outline

SOT-23-3

Dimensions in mm



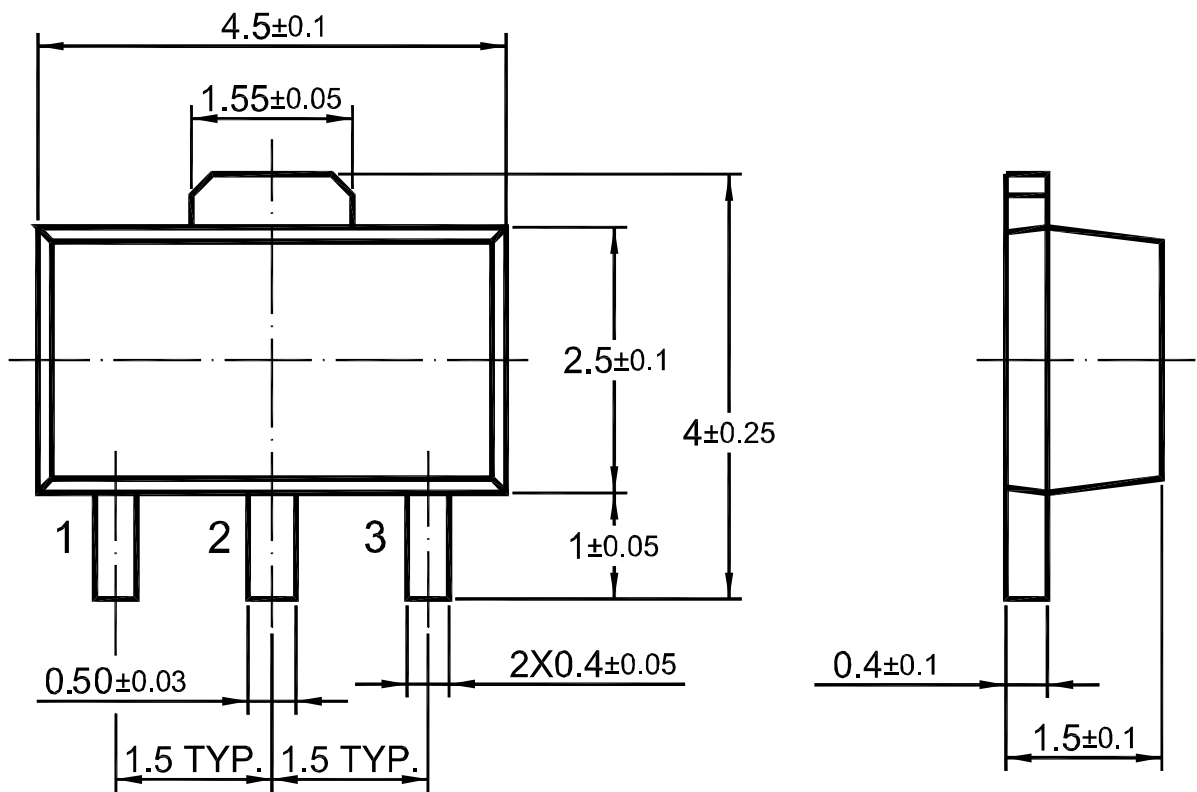
Ordering Information

Device	Package	Shipping
TN9193 Series	SOT-23-3	3,000/ Tape & Reel (7 inches)

Package Outline

SOT-89

Dimensions in mm



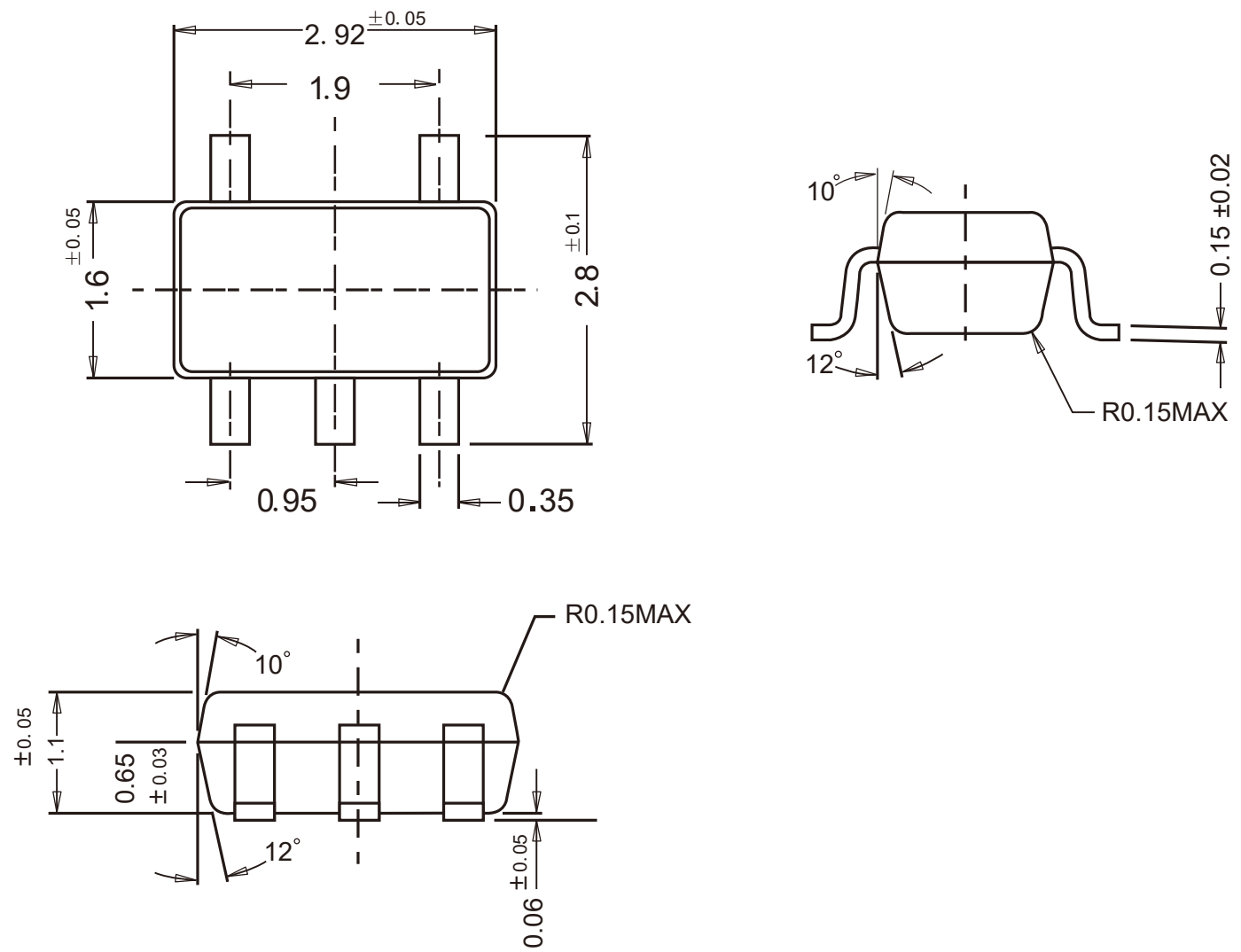
Ordering Information

Device	Package	Shipping
TN9193 Series	SOT-89	1,000PCS/Reel&Tape(7inch)

Package Outline

SOT-23-5

Dimensions in mm



Ordering Information

Device	Package	Shipping
TN9193 Series	SOT-23-5	3,000/ Tape & Reel (7 inches)

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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Product Specification Statement

The product specification aims to provide users with a reference regarding various product parameters, performance, and usage. It presents certain aspects of the product's performance in graphical form and is intended solely for users to select product and make product comparisons, enabling users to better understand and evaluate the characteristics and advantages of the product. It does not constitute any commitment, warranty, or guarantee.

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.

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