Consumer Grade Temperature-to-Voltage Converters

FEATURES

- **Linearized Temperature-to-Voltage Converters**
- **Direct Centigrade Output Voltage Scaling (TC1133)**
- **Wide Temperature Measurement Range (TC1132) ..... – 20°C to +125°C**
- **Excellent Temperature Converter Linearity .. 0.8°C Over Temperature**
- **High Temperature Converter Accuracy at 25°C Guaranteed ..... ±3°C**
- **Small Packages ..... TO-92-3 and SOT-23B-3**

APPLICATIONS

- **Power Supply Thermal Shut-Down**
- **Temperature-Controlled Fans**
- **Temperature Measurement/Instrumentation**
- **Temperature Regulators**
- **Consumer Electronics**

GENERAL DESCRIPTION

The TC1132/33 temperature sensors furnish a linearized output voltage directly proportional to measured temperature. The TC1133 has a temperature measurement range of – 20°C to +100°C. Its output voltage is directly calibrated in degrees Centigrade (i.e. V_{OUT} = 10mV/°C x Temperature °C). An external pull-down resistor to a negative voltage source is required for temperature measurement below 0°C.

The TC1132 has a temperature measurement range of – 20°C to +125°C, and operates with a single supply. It has the same output voltage slope with temperature as the TC1133 (10mV/°C).

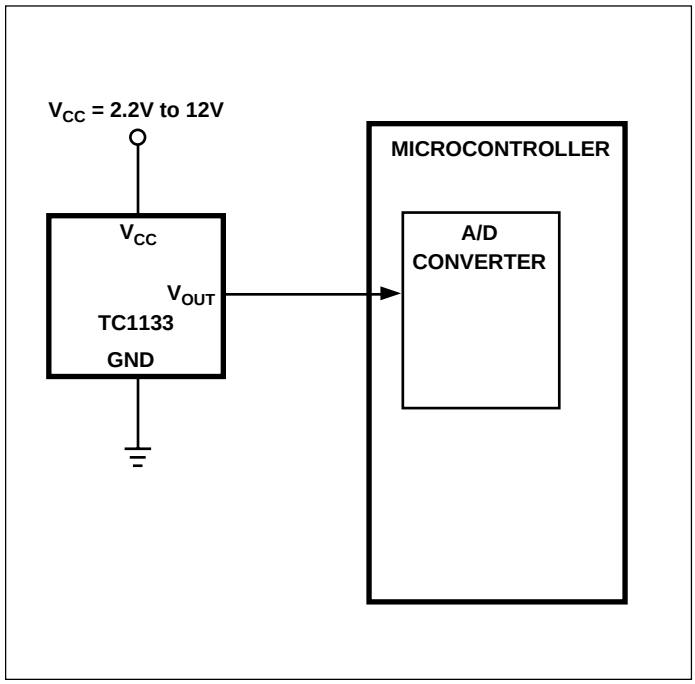
Small size, low cost and low power operation make the TC1132/33 suitable for a wide range of general purpose temperature measurement applications.

ORDERING INFORMATION

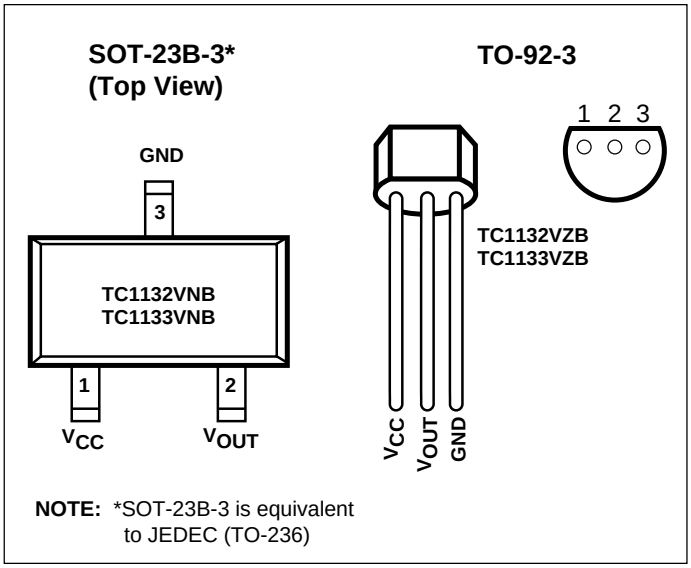
Part No.	Package	Output Voltage At 25°C	Temp. Range
TC1132VNB	SOT-23B-3	750mV	– 20°C to +125°C
*TC1132VZB	TO-92	750mV	– 20°C to +125°C
TC1133VNB	SOT-23B-3	250mV	– 20°C to +100°C
TC1133VZB	TO-92	250mV	– 20°C to +100°C

* Contact factory for availability.

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



NOTE: *SOT-23B-3 is equivalent to JEDEC (TO-236)

ABSOLUTE MAXIMUM RATINGS *

Supply Voltage 15V
Input Voltage, Any Terminal ..... – 1.0 to (V_{CC} +0.3V)
Operating Temperature (TC1132) ..... – 20°C to +125°C
Operating Temperature (TC1133) ..... – 20°C to +100°C
Storage Temperature ..... – 65°C to +150°C
Lead Temperature (Soldering, 10 sec)
SOT-23B-3 ..... +260°C
TO-92-3 ..... +300°C

* Static-sensitive device. Unused devices must be stored in conductive material. Protect devices from static discharge and static fields. Stresses above 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 above those indicated in the operational sections of the specifications is not implied. Exposure to Absolute Maximum Rating Conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS :

T_A = – 20°C to +125°C, V_{CC} = 5V ±5%, unless otherwise specified.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{CC}	Supply Voltage (TC1132)		3.0	—	12	V
V_{CC}	Supply Voltage (TC1133)		2.2	—	12	V
I_S	Supply Current	Note 1	—	40	80	µA
I_{SRC}	V_{OUT} Output Source Current		—	—	1.0	mA
	Accuracy at Room Temperature	T_A = 25°C (Note 2)	– 3	± 0.5	+3	°C
	Accuracy at Minimum Temperature	T_A = – 20°C	— (Note 2)	± 4	—	°C
	Accuracy at Maximum Temperature	TC1132: T_A = +125°C TC1133: T_A = +100°C (Note 2)	– 4 – 4	— —	+4 +4	°C
	Nonlinearity	Note 3	– 0.8	—	+0.8	°C
	Line Regulation		—	100	—	µV/V
A_V	Average Slope of Output Voltage		—	10	—	mV/°C
V_{OUTMAX}	Maximum Output Voltage	TC1132: 3.0V ≤ V_{CC} ≤ 12V TC1133: 2.2V ≤ V_{CC} ≤ 12V (Note 1)	—	—	V_{CC} – 1.2	V

Notes: 1. V_{OUT} outputs open circuited.
2. Accuracy = Difference between calculated output voltage (10mV/°C x Device case temperature at specified temperature and power supply) and measured output voltage expressed in °C.
3. Nonlinearity = deviation of output voltage versus temperature from the best-fit straight line over the device rated temperature range.
4. Guaranteed by design.

DETAILED DESCRIPTION

A plot of output voltage versus temperature for both the TC1132 and TC1133 appears in Figure 1. The TC1133 can be used with single power supply to measure temperatures from 0°C to 100°C. A pull-down resistor (R1 in Figure 2) must be added from V_{OUT} to the negative power supply for measuring temperatures less than 0°C. The value of the resistor must be chosen to limit the maximum current pulled from the output to the negative supply to – 50µA (i.e. R1 = V_{SS}/50µA).

OUTPUT STAGE

Both the TC1132 and TC1133 have Class A output stages capable of sourcing 1mA. These devices have a limited ability to drive heavy capacitive loads. Loads of 50pF (to ground) can be driven directly. For heavier loads, a 2kΩ (or greater) resistor should be placed in series with the output for decoupling. If the TC1132/33 is used in a noisy electrical environment, a 0.1µF bypass capacitor from V_{CC} to GND is recommended.

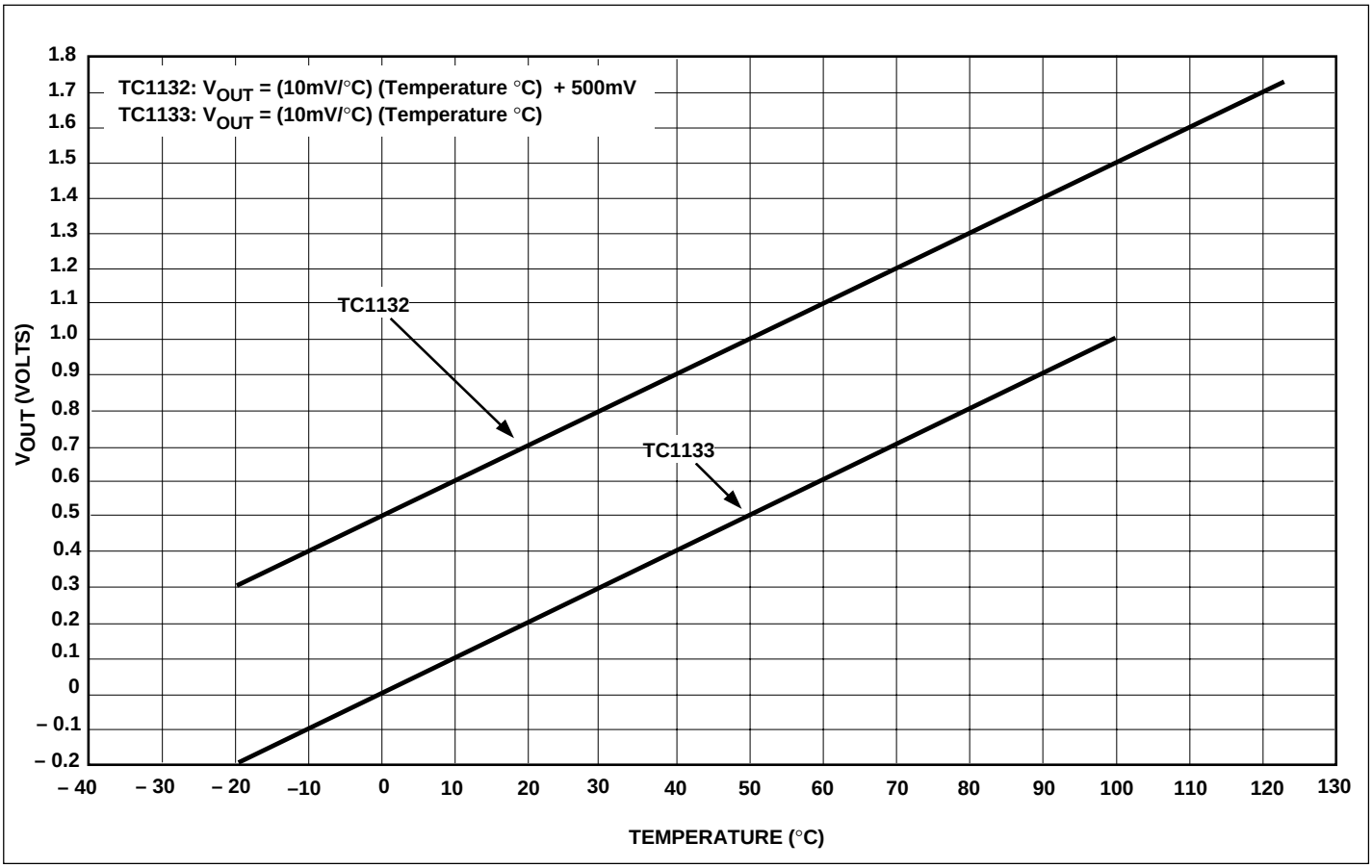


Figure 1. Output Voltage vs. Temperature

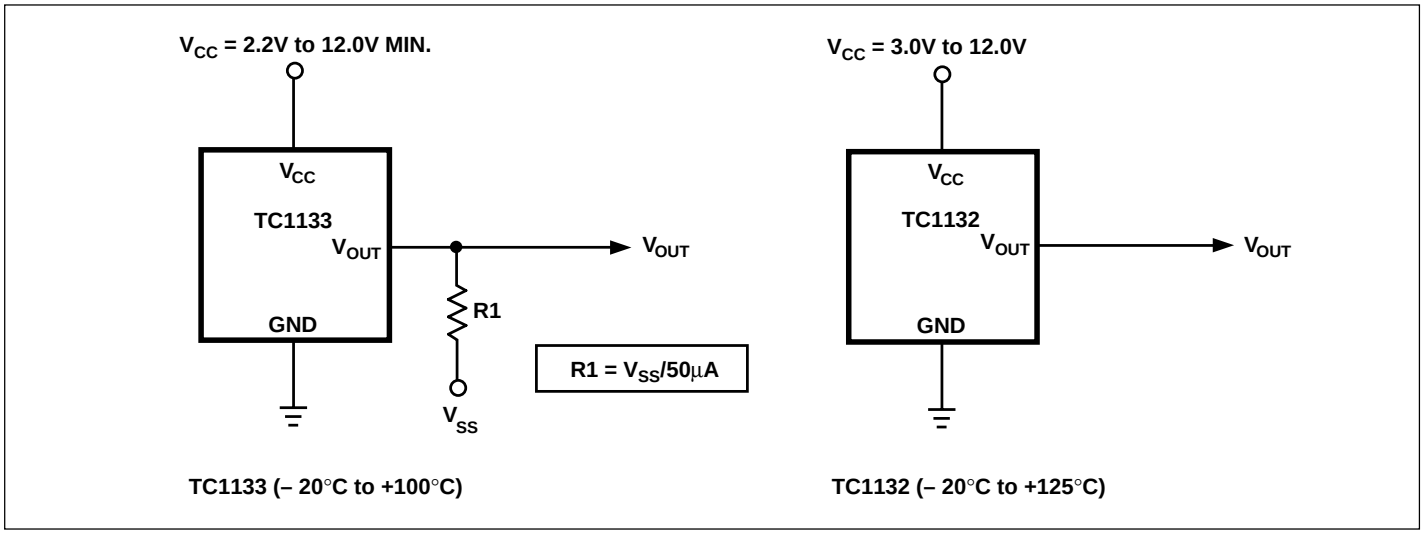
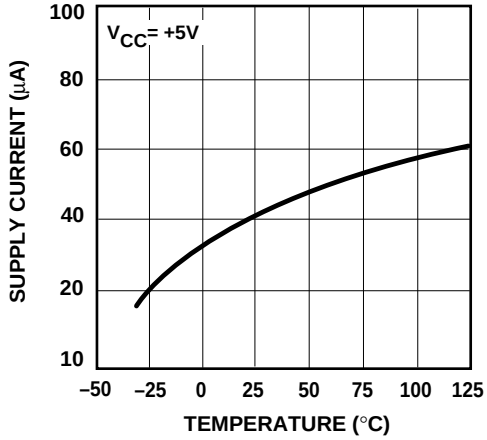


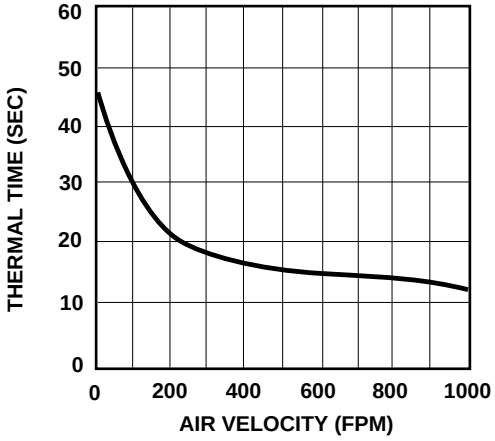
Figure 2. TC1132/33 Power Supply Connections for Full Scale Measurements

TYPICAL CHARACTERISTICS

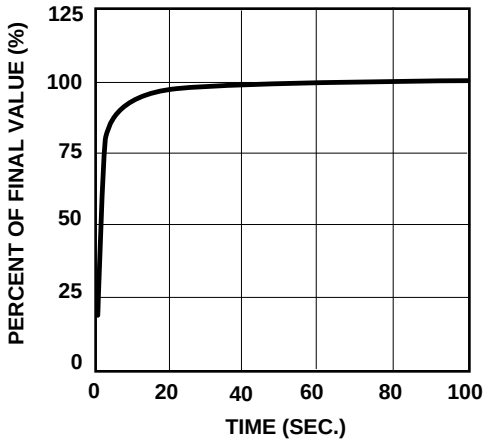
Supply Current vs. Temperature



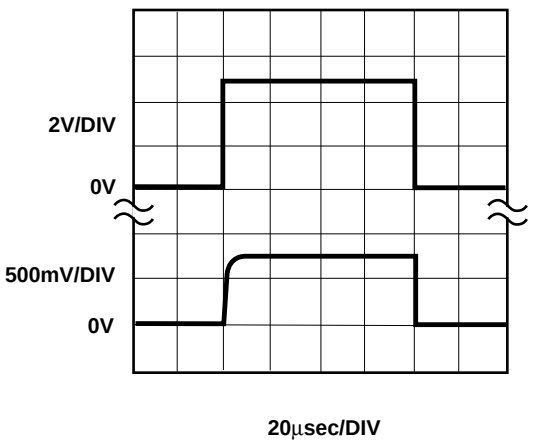
Thermal Time Constant (Sec) vs. Air Velocity



Thermal Response in Still Air vs.Time

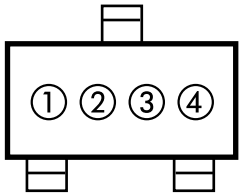


V_{OUT} (From Power Initially Applied) vs. Time (Turn-on Response)



MARKING

SOT-23B-3



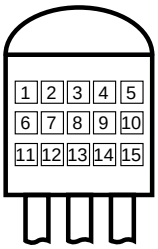
① & ② = part number code and temperature range
TC1132 = AC – 20°C to 125°C
TC1133 = AD – 20°C to 100°C

ex: 1132 = Ⓐ Ⓒ ◯ ◯
ex: 1133 = Ⓐ Ⓓ ◯ ◯

③ = year and quarter

④ = lot ID

TO-92



① & ② = TC (fixed)

③, ④ & ⑤ = blank

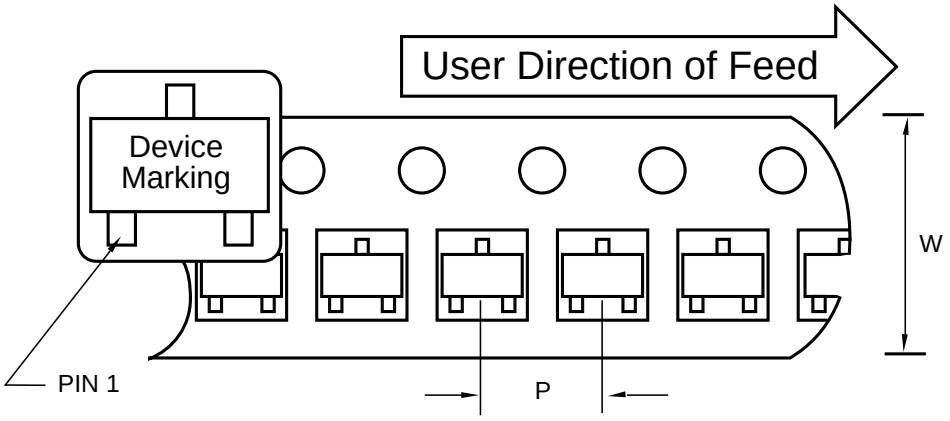
⑥, ⑦, ⑧ & ⑨ = part number

⑩ = temperature range
C = – 20°C to +125°C
D = – 20°C to +100°C

⑪, ⑫, ⑬, ⑭ & ⑮ = traceability code

TAPING FORMS

Component Taping Orientation for 3-Pin SOT-23B (JEDEC TO-236) Devices

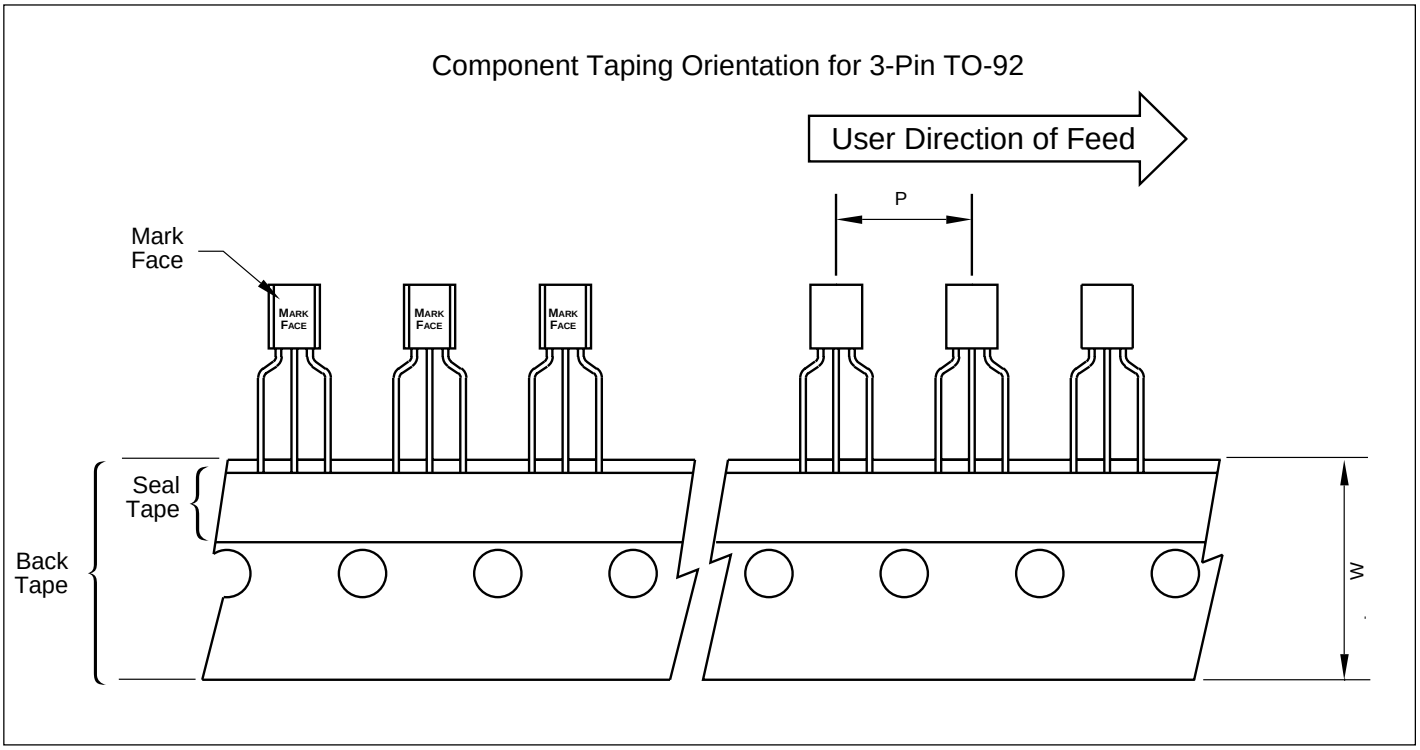


Standard Reel Component Orientation
For TR Suffix Device
(Mark Right Side Up)

Carrier Tape, Number of Components Per Reel and Reel Size

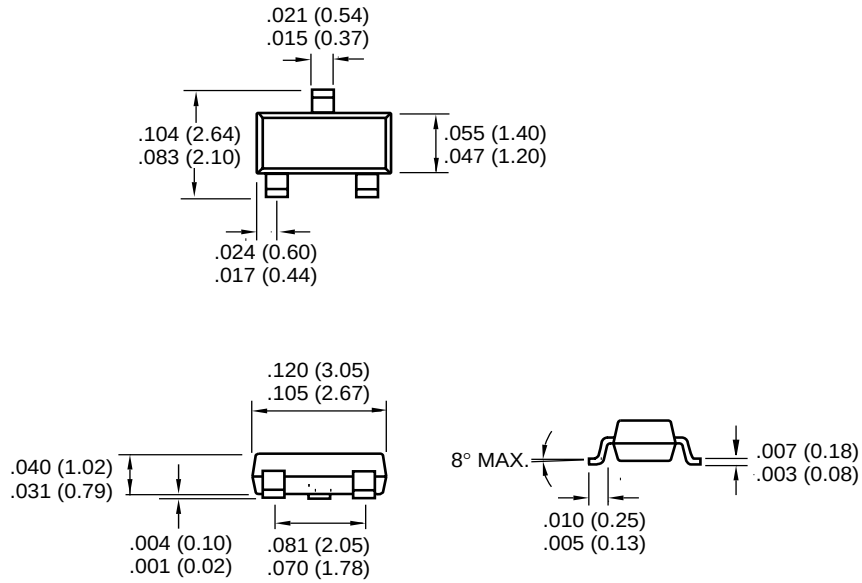
Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
3-Pin SOT-23B	8 mm	4 mm	3000	7 in

TAPING FORMS (Cont.)



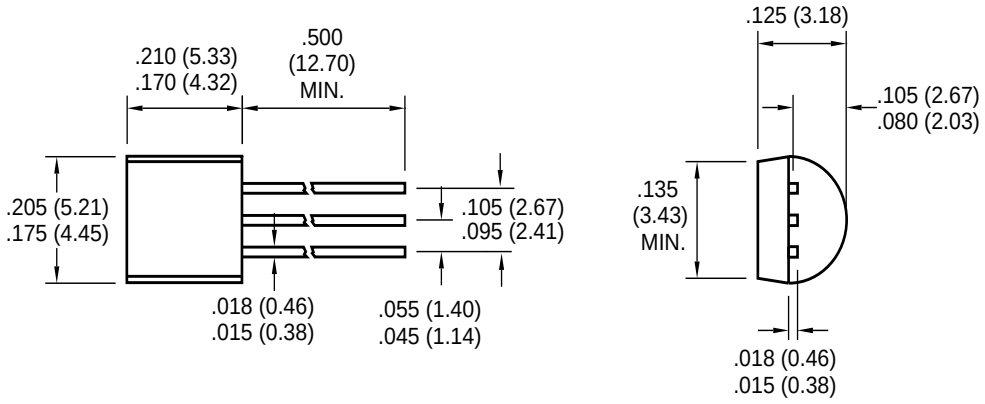
PACKAGE DIMENSIONS

SOT-23B-3*



***NOTE:** SOT-23B-3 is equivalent to JEDEC (TO-236)

TO-92-3



Dimensions: inches (mm)

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