

## 1 $\mu$ A LOW DROPOUT POSITIVE VOLTAGE REGULATOR

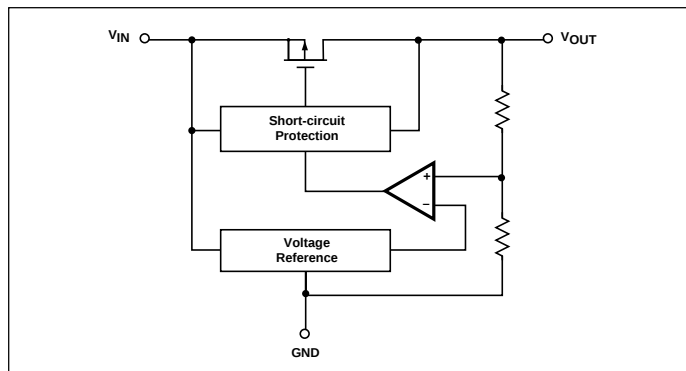
### FEATURES

- Extremely Low Power Consumption 1.1 $\mu$ A (Typ.)
- Very Low Dropout Voltage .... 120mV typ at 100mA  
380mV typ at 200mA
- Wide Input Voltage Range ..... 10V (max.)
- High Output Current ..... 250mA ( $V_{OUT} = 5.0V$ )
- High Accuracy Output Voltage .....  $\pm 2\%$   
( $\pm 1\%$  Semicustom Version)
- Wide Output Voltage Range ..... 1.1V-6.0V
- Low Power Consumption ..... 1.1 $\mu$ A (Typ.)
- Excellent Line Regulation ..... 0.2%/V (Typ.)
- Package Options .. 3-Pin SOT-23A, SOT-89, TO-92
- Short Circuit Protection
- Custom Voltages Available from 1.1V to 6.0V in  
0.1V Steps for a 2%, and 2.0V to 6.0V for a 1%  
Tolerance

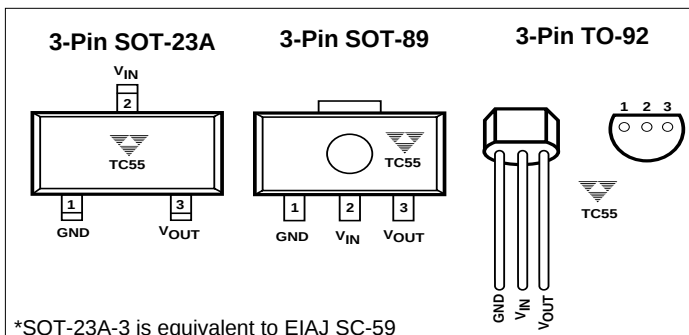
### APPLICATIONS

- Battery-Powered Devices
- Cameras and Portable Video Equipment
- Pagers and Cellular Phones
- Solar-Powered Instruments
- Consumer Products

### FUNCTIONAL BLOCK DIAGRAM



### PIN CONFIGURATION



### GENERAL DESCRIPTION

The TC55 Series is a family of CMOS low dropout positive voltage regulators which can source up to 250mA of current. The extremely low operating current (1.1 $\mu$ A typical) makes this part the ideal choice for battery operated applications and eliminates the need for an additional shutdown mode. The power consumption of the TC55 is 1000 times lower than in bipolar regulators, significantly extending battery life.

The maximum input voltage of 10V combined with the wide output voltage range (1.1V to 6.0V, in 100mV increments) makes this device suitable for a large variety of applications. Other key features include low dropout voltage (380mV typical at 200mA) and excellent line regulation (0.2%/V). The low voltage differential (dropout voltage) also extends battery operating lifetime and permits high currents in small packages when operated with minimum  $V_{IN} - V_{OUT}$  differentials.

The circuit also incorporates short-circuit protection to ensure maximum reliability. The TC55 is stable with an output capacitor (ceramic or tantalum) of only 1 $\mu$ F and is available in a tiny SOT-23A package for space critical applications, as well as in a 3-pin SOT-89 and a 3-pin TO-92 package.

### ORDERING INFORMATION

**PART CODE** TC55 RP XX X X X XX XXX

**Output Voltage:** \_\_\_\_\_  
Ex: 20 = 2.0V; 60 = 6.0V 1.0% Tol.  
Ex: 11 = 1.1V; 60 = 6.0V 2.0% Tol.

**Extra Feature Code:** Fixed: 0 \_\_\_\_\_

**Tolerance:** \_\_\_\_\_  
1 = 1.0% (Custom)  
2 = 2.0% (Standard)

**Temperature:** E: - 40°C to +85°C \_\_\_\_\_

**Package Type and Pin Count:** \_\_\_\_\_  
CB: 3-Pin SOT-23A (equivalent to EIAJ SC-59)  
MB: 3-Pin SOT-89  
ZB: 3-Pin TO-92

**Taping Direction:** \_\_\_\_\_  
TR or 713: Standard Taping  
RT or 723: Reverse Taping  
No suffix: TO-92 Bulk

# 1μA LOW DROPOUT POSITIVE VOLTAGE REGULATOR

## TC55 Series

### ABSOLUTE MAXIMUM RATINGS\*

| Item                                                  | Code                                         | Ratings                              | Units            |
|-------------------------------------------------------|----------------------------------------------|--------------------------------------|------------------|
| Input Voltage                                         | $V_{IN}$                                     | +12                                  | V                |
| Output Current                                        | $I_{OUT}$                                    | $Pd/(V_{IN} - V_{OUT})$              | mA               |
| Output Voltage                                        | $V_{OUT}$                                    | $(V_{SS} - 0.3)$ to $(V_{IN} + 0.3)$ | V                |
| Power Dissipation:<br>( $T_A \leq 70^\circ\text{C}$ ) | 3-Pin SOT-23A<br>3-Pin SOT-89<br>3-Pin TO-92 | Pd<br>240<br>400<br>440              | mW               |
| Operating Temperature Range                           | $T_A$                                        | - 40 to +85                          | $^\circ\text{C}$ |
| Storage Temperature Range                             | $T_{stg}$                                    | - 65 to +150                         | $^\circ\text{C}$ |

### TC55RP50 ELECTRICAL CHARACTERISTICS: $V_{OUT(S)} = 5.0\text{V}$ , $T_A = 25^\circ\text{C}$ unless otherwise specified (see REMARKS).

| Symbol                                                             | Parameter                                 | Test Conditions                                                               | Min       | Typ        | Max        | Unit                  |
|--------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------------|-----------|------------|------------|-----------------------|
| $V_{OUT(A)}$                                                       | Output Voltage                            | $I_{OUT} = 40\text{mA}$<br>$V_{IN} = 6.0\text{V}$                             | —<br>4.90 | —<br>5.0   | —<br>5.10  | V                     |
| $I_{OUTmax}$                                                       | Maximum Output Current                    | $V_{IN} = 6.0\text{V}$ , $V_{OUT(A)} \geq 4.5\text{V}$                        | 250       | —          | —          | mA                    |
| $\Delta V_{OUT}$                                                   | Load Regulation                           | $V_{IN} = 6.0\text{V}$ , $1\text{mA} \leq I_{OUT} \leq 100\text{mA}$          | —         | 40         | 80         | mV                    |
| $V_{dif}$                                                          | I/O Voltage Difference                    | $I_{OUT} = 100\text{mA}$<br>$I_{OUT} = 200\text{mA}$                          | —<br>—    | 120<br>380 | 300<br>600 | mV                    |
| $I_{SS}$                                                           | Current Consumption                       | $V_{IN} = 6.0\text{V}$                                                        | —         | 1.1        | 3.0        | $\mu\text{A}$         |
| $\frac{V_{OUT(A)} \cdot 100}{\Delta V_{IN} \cdot V_{OUT(S)}}$      | Voltage Regulation                        | $I_{OUT} = 40\text{mA}$<br>$6.0\text{V} \leq V_{IN} \leq 10.0\text{V}$        | —         | 0.2        | 0.3        | %/V                   |
| $V_{IN}$                                                           | Input Voltage                             |                                                                               | —         | —          | 10.0       | V                     |
| $\frac{\Delta V_{OUT(A)} \cdot 10^6}{V_{OUT(S)} \cdot \Delta T_A}$ | Temperature Coefficient of Output Voltage | $I_{OUT} = 40\text{mA}$<br>$-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$ | —         | $\pm 100$  | —          | ppm/ $^\circ\text{C}$ |
|                                                                    | Long Term Stability                       | $T_A = 125^\circ\text{C}$ , 1000 Hours                                        | —         | 0.5        | —          | %                     |

**REMARKS:**  
 $V_{OUT(S)}$ : Preset value of Output voltage  
 $V_{OUT(A)}$ : Actual value of Output voltage  
 $V_{dif}$ : Definition of I/O voltage difference =  $\{V_{IN1} - V_{OUT(A)}\}$   
 $V_{OUT(A)}$ : Output Voltage when  $I_{OUT}$  is fixed and  $V_{IN} = V_{OUT(S)} + 1.0\text{V}$   
 $V_{IN1}$ : Input Voltage when the output voltage is 98%  $V_{OUT(A)}$

### TC55RP40 ELECTRICAL CHARACTERISTICS: $V_{OUT(S)} = 4.0\text{V}$ , $T_A = 25^\circ\text{C}$ unless otherwise specified (see REMARKS).

| Symbol                                                               | Parameter                                 | Test Conditions                                                               | Min       | Typ        | Max        | Unit                  |
|----------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------------|-----------|------------|------------|-----------------------|
| $V_{OUT(A)}$                                                         | Output Voltage                            | $I_{OUT} = 40\text{mA}$<br>$V_{IN} = 5.0\text{V}$                             | —<br>3.92 | —<br>4.0   | —<br>4.08  | V                     |
| $I_{OUTmax}$                                                         | Maximum Output Current                    | $V_{IN} = 5.0\text{V}$ , $V_{OUT(A)} \geq 3.6\text{V}$                        | 200       | —          | —          | mA                    |
| $\Delta V_{OUT}$                                                     | Load Regulation                           | $V_{IN} = 5.0\text{V}$ , $1\text{mA} \leq I_{OUT} \leq 100\text{mA}$          | —         | 45         | 90         | mV                    |
| $V_{dif}$                                                            | I/O Voltage Difference                    | $I_{OUT} = 100\text{mA}$<br>$I_{OUT} = 200\text{mA}$                          | —<br>—    | 170<br>400 | 330<br>630 | mV                    |
| $I_{SS}$                                                             | Current Consumption                       | $V_{IN} = 5.0\text{V}$                                                        | —         | 1.0        | 2.9        | $\mu\text{A}$         |
| $\frac{\Delta V_{OUT(A)} \cdot 100}{\Delta V_{IN} \cdot V_{OUT(S)}}$ | Voltage Regulation                        | $I_{OUT} = 40\text{mA}$<br>$5.0\text{V} \leq V_{IN} \leq 10.0\text{V}$        | —         | 0.2        | 0.3        | %/V                   |
| $V_{IN}$                                                             | Input Voltage                             |                                                                               | —         | —          | 10.0       | V                     |
| $\frac{\Delta V_{OUT(A)}}{V_{OUT(S)} \cdot \Delta T_A}$              | Temperature Coefficient of Output Voltage | $I_{OUT} = 40\text{mA}$<br>$-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$ | —         | $\pm 100$  | —          | ppm/ $^\circ\text{C}$ |
|                                                                      | Long Term Stability                       | $T_A = 125^\circ\text{C}$ , 1000 Hours                                        | —         | 0.5        | —          | %                     |

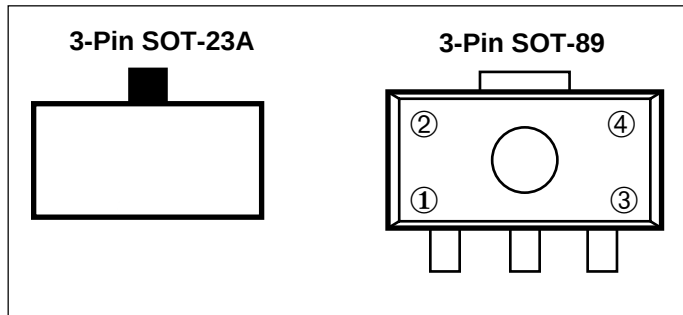
# 1μA LOW DROPOUT POSITIVE VOLTAGE REGULATOR

## TC55 Series

**TC55RP30 ELECTRICAL CHARACTERISTICS:**  $V_{OUT(S)} = 3.0V$ ,  $T_A = 25^{\circ}C$  unless otherwise specified (see REMARKS).

| Symbol                                                             | Parameter                                 | Test Conditions                                              | Min       | Typ        | Max        | Unit   |
|--------------------------------------------------------------------|-------------------------------------------|--------------------------------------------------------------|-----------|------------|------------|--------|
| $V_{OUT(A)}$                                                       | Output Voltage                            | $I_{OUT} = 40mA$<br>$V_{IN} = 4.0V$                          | —<br>2.94 | —<br>3.0   | —<br>3.06  | V      |
| $I_{OUTmax}$                                                       | Maximum Output Current                    | $V_{IN} = 4.0V$ , $V_{OUT(A)} \geq 2.7V$                     | 150       | —          | —          | mA     |
| $\Delta V_{OUT}$                                                   | Load Regulation                           | $V_{IN} = 4.0V$ , $1mA \leq I_{OUT} \leq 80mA$               | —         | 45         | 90         | mV     |
| $V_{dif}$                                                          | I/O Voltage Difference                    | $I_{OUT} = 80mA$<br>$I_{OUT} = 160mA$                        | —<br>—    | 180<br>400 | 360<br>700 | mV     |
| $I_{SS}$                                                           | Current Consumption                       | $V_{IN} = 4.0V$                                              | —         | 0.9        | 2.8        | μA     |
| $\frac{V_{OUT(A)} \cdot 100}{\Delta V_{IN} \cdot V_{OUT(S)}}$      | Voltage Regulation                        | $I_{OUT} = 40mA$<br>$4.0V \leq V_{IN} \leq 10.0V$            | —         | 0.2        | 0.3        | %/V    |
| $V_{IN}$                                                           | Input Voltage                             |                                                              | —         | —          | 10.0       | V      |
| $\frac{\Delta V_{OUT(A)} \cdot 10^6}{\Delta T_A \cdot V_{OUT(S)}}$ | Temperature Coefficient of Output Voltage | $I_{OUT} = 40mA$<br>$-40^{\circ}C \leq T_A \leq 85^{\circ}C$ | —         | ±100       | —          | ppm/°C |
|                                                                    | Long Term Stability                       | $T_A = 125^{\circ}C$ , 1000 Hours                            | —         | 0.5        | —          | %      |

### MARKING

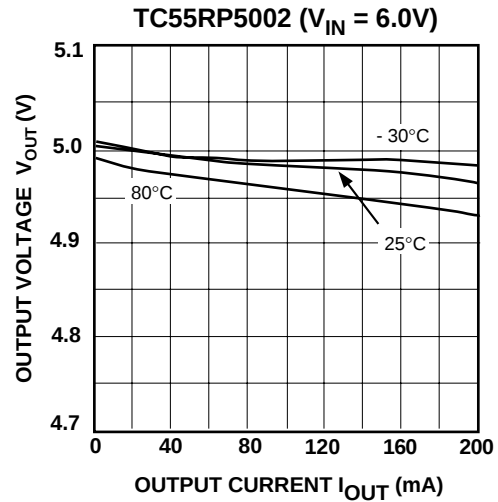
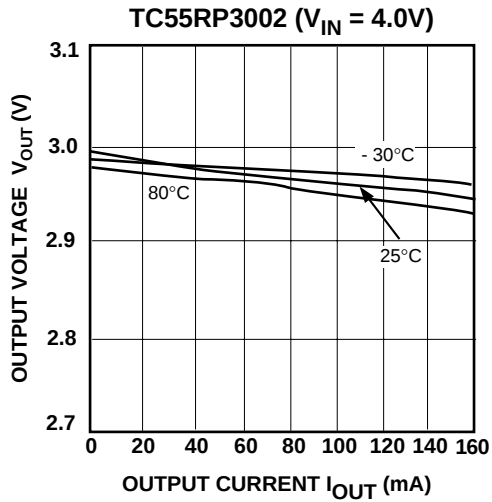


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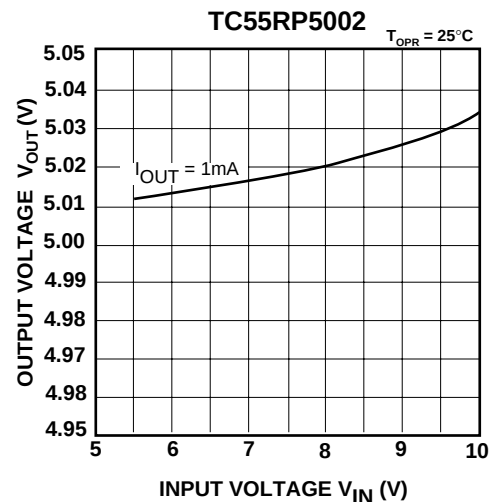
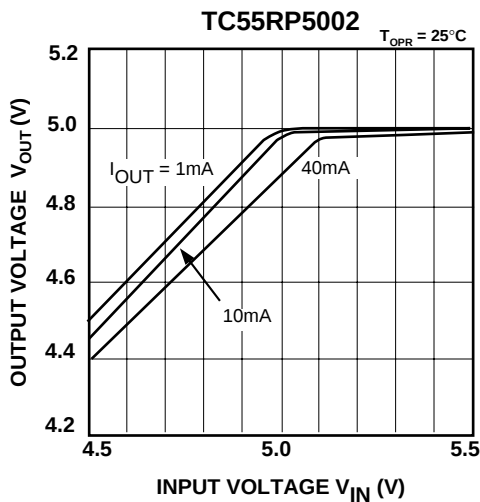
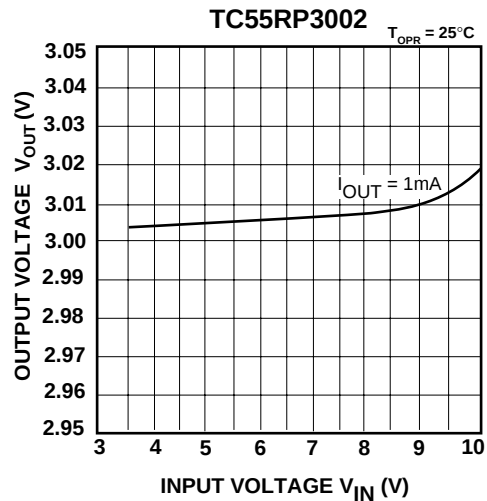
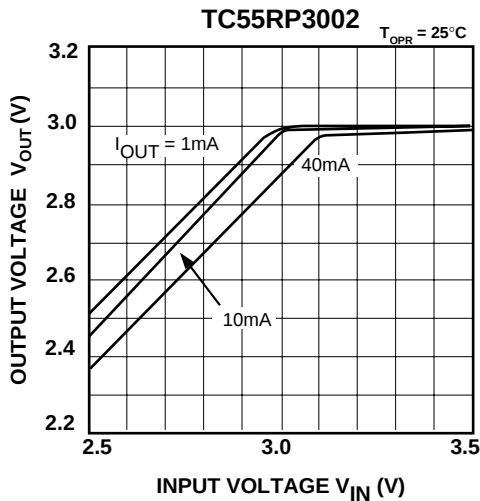
## TC55 Series

### TYPICAL CHARACTERISTICS

#### 1. OUTPUT VOLTAGE vs. OUTPUT CURRENT



#### 2. OUTPUT VOLTAGE vs. INPUT VOLTAGE

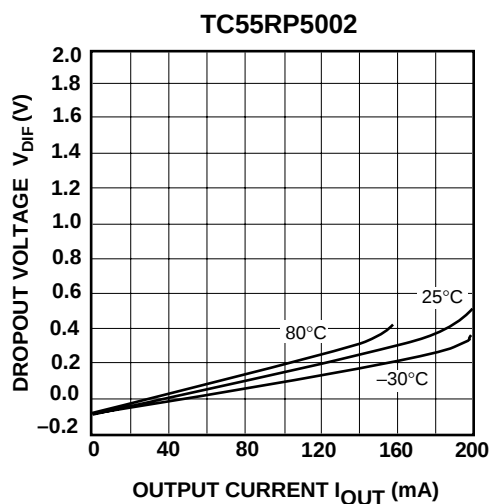
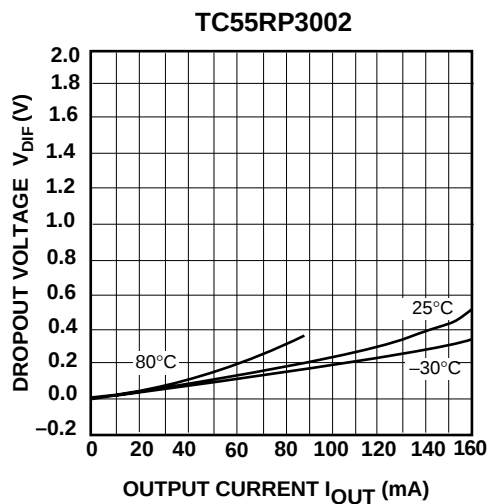


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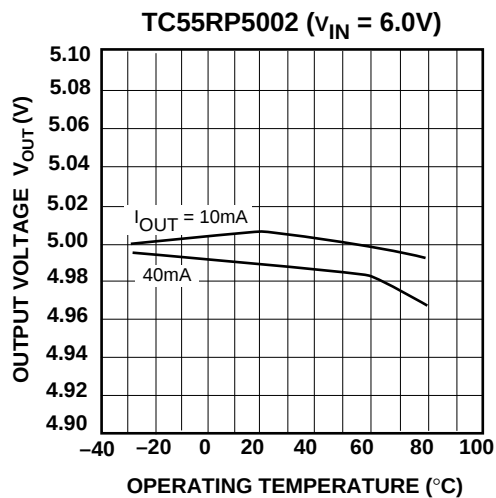
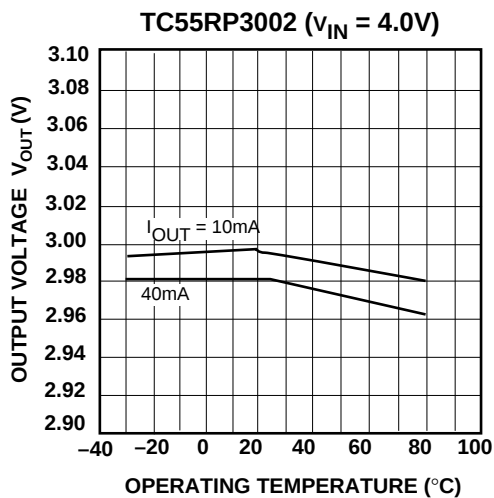
TC55 Series

## TYPICAL CHARACTERISTICS

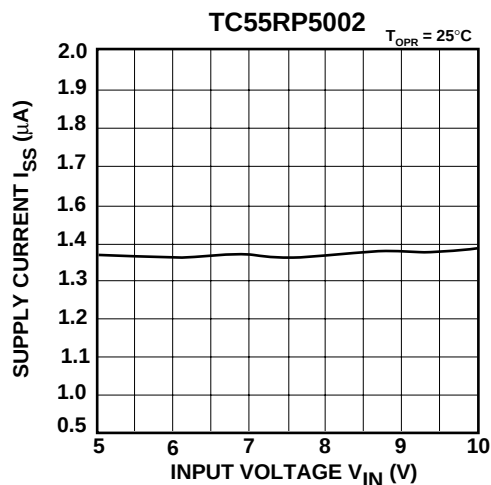
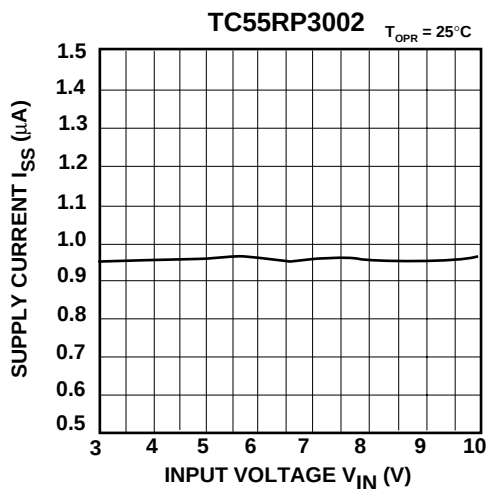
### 3. DROPOUT VOLTAGE vs. OUTPUT CURRENT



### 4. OUTPUT VOLTAGE vs. OPERATING TEMPERATURE



### 5. SUPPLY CURRENT vs. INPUT VOLTAGE

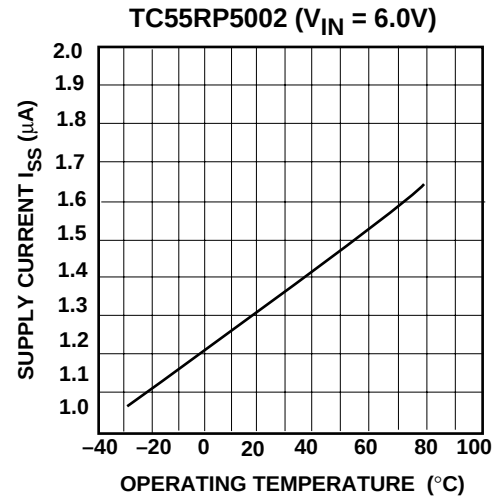
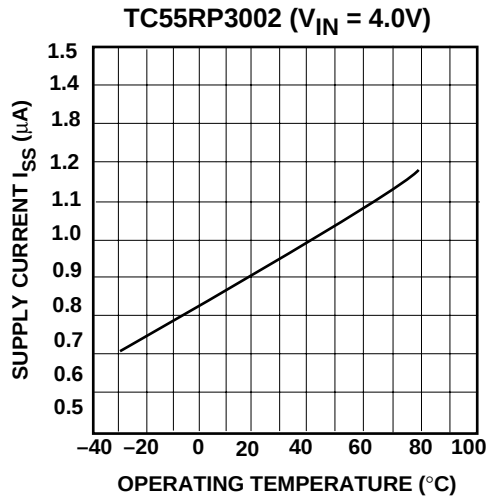


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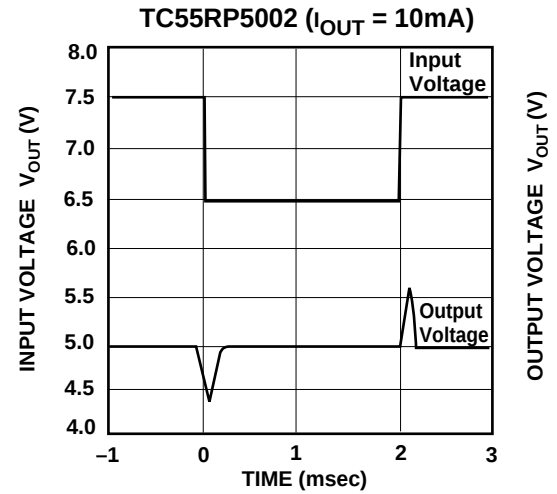
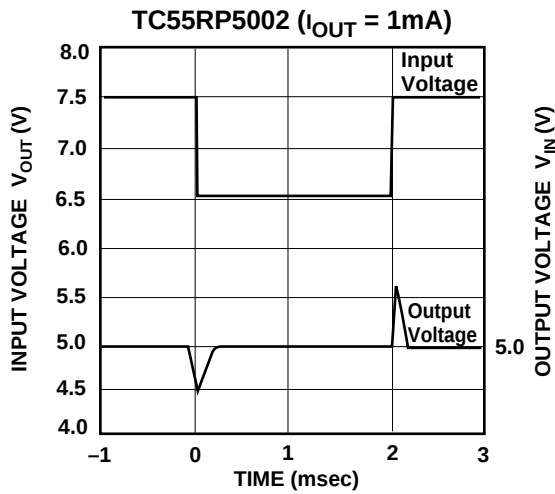
## TC55 Series

### TYPICAL CHARACTERISTICS

#### 6. SUPPLY CURRENT vs. OPERATING TEMPERATURE

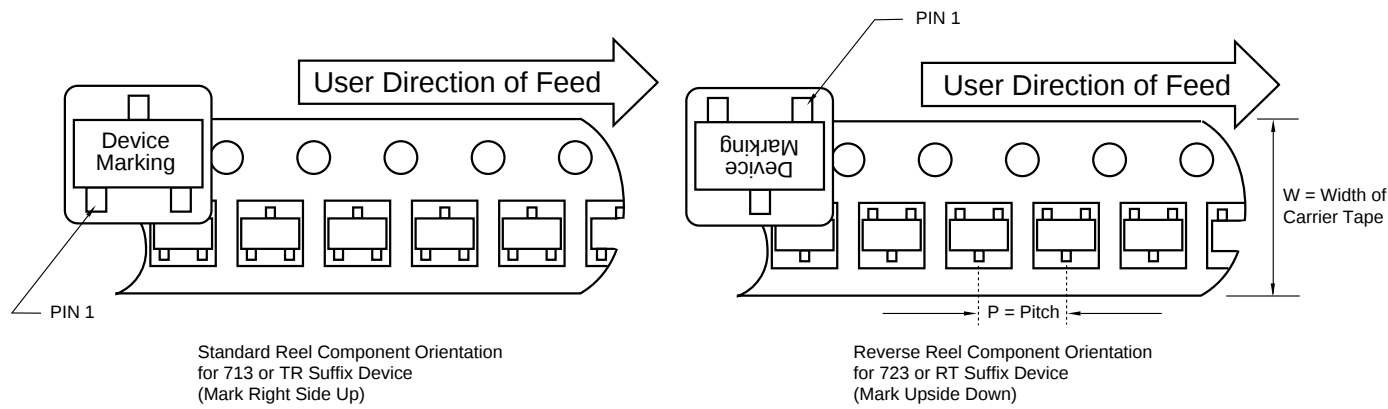


#### 7. INPUT TRANSIENT RESPONSE



TAPING FORMS

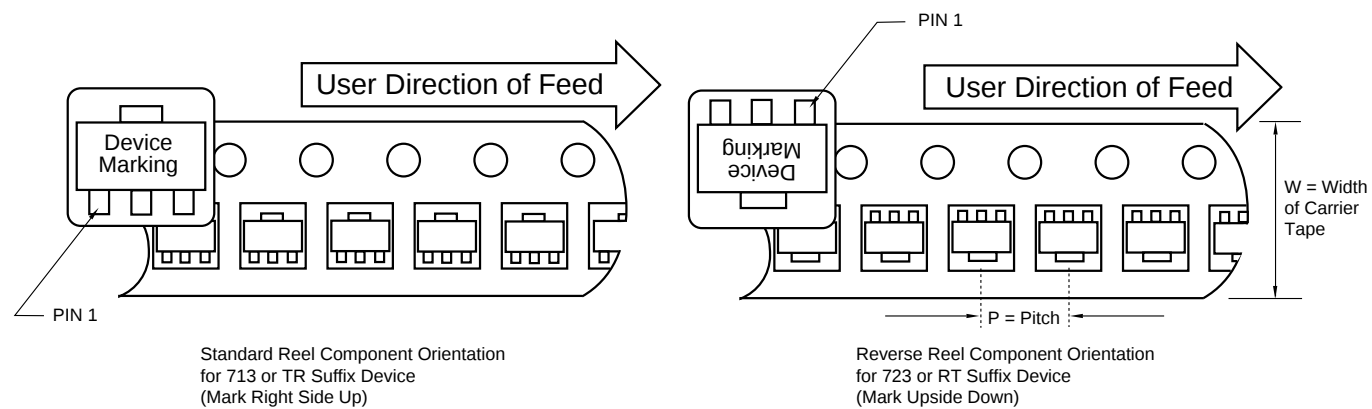
Component Taping Orientation for 3-Pin SOT-23A (EIAJ SC-59) Devices



Carrier Tape, Reel Size, and Number of Components Per Reel

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

Component Taping Orientation for 3-Pin SOT-89 Devices



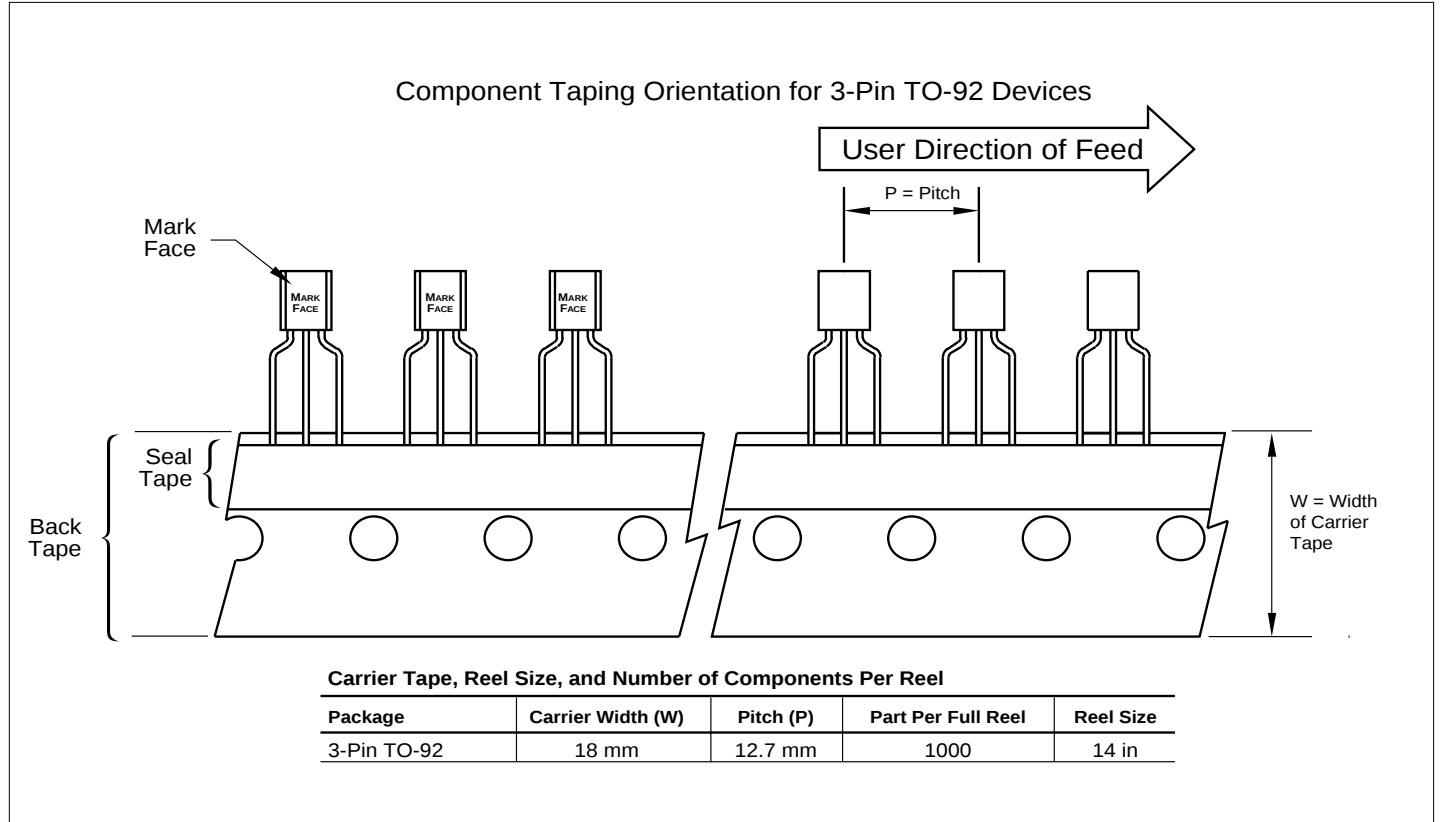
Carrier Tape, Reel Size, and Number of Components Per Reel

| Package      | Carrier Width (W) | Pitch (P) | Part Per Full Reel | Reel Size |
|--------------|-------------------|-----------|--------------------|-----------|
| 2-Pin SOT-89 | 12 mm             | 8 mm      | 1000               | 7 in      |

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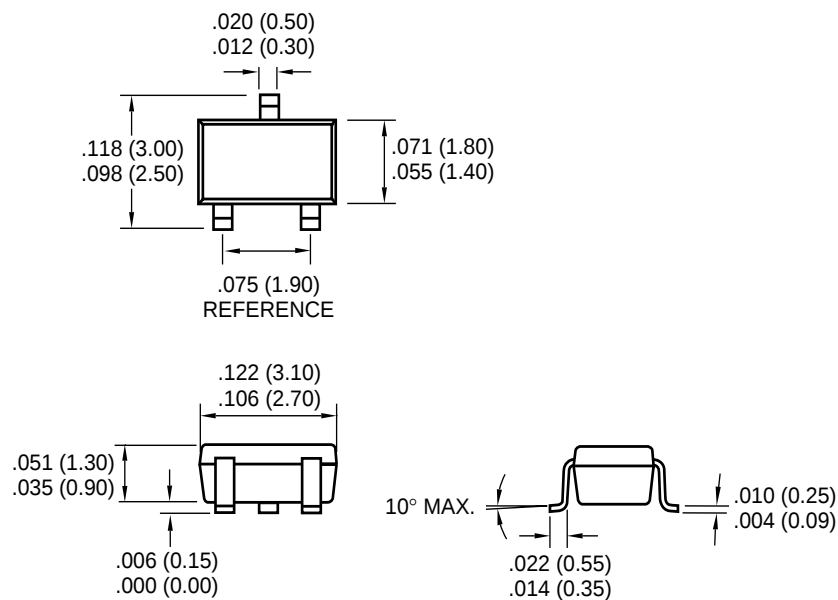
## TC55 Series

### TAPING FORMS (Cont.)



### PACKAGE DIMENSIONS

#### 3-Pin SOT-23A (EIAJ SC-59)



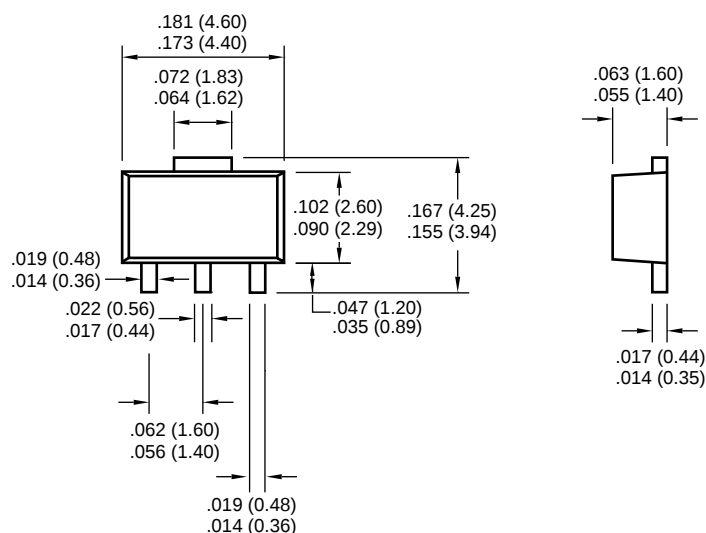
Dimensions: inches (mm)

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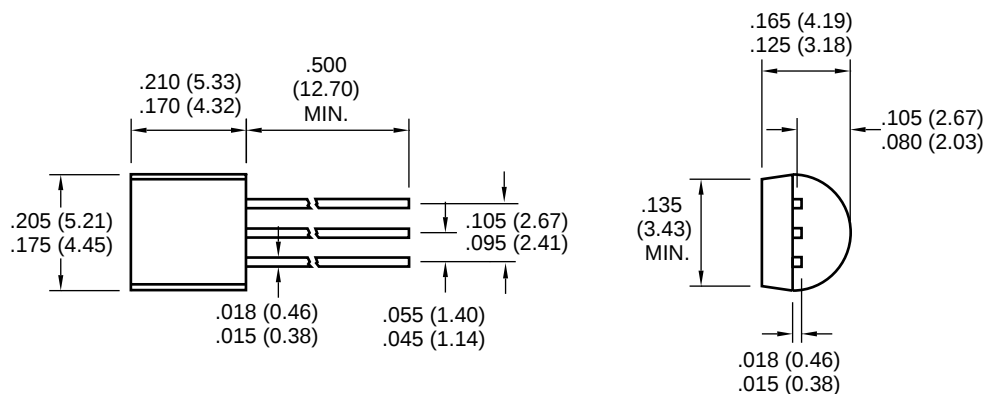
TC55 Series

## PACKAGE DIMENSIONS (CONT.)

### 3-Pin SOT-89



### 3-Pin TO-92



Dimensions: inches (mm)

## Sales Offices

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