TelCom Semiconductor, Inc.

1μA LOW DROPOUT POSITIVE VOLTAGE REGULATOR

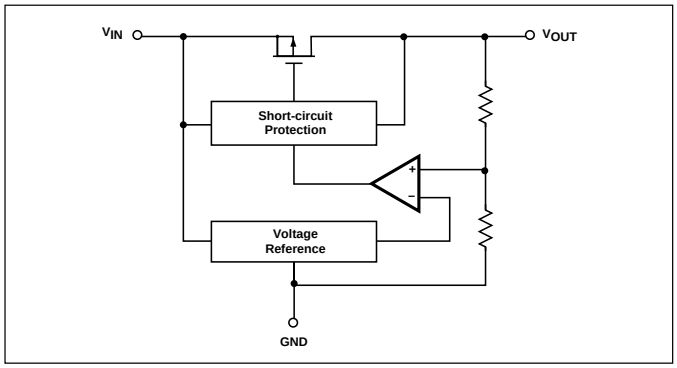
FEATURES

- **Extremely Low Power Consumption 1.1μA (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 ..... ±2%**
  (±1% Semicustom Version)
- **Wide Output Voltage Range 1.1V-6.0V**
- **Low Power Consumption ..... 1.1μA (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**

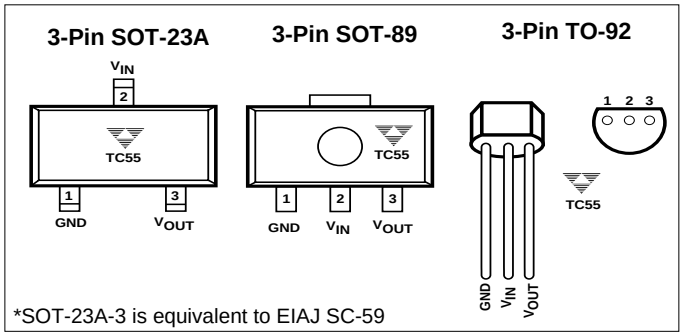
APPLICATIONS

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

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



*SOT-23A-3 is equivalent to EIAJ SC-59

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 (1.1μA 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 1μF 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

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: ($T_A \leq 70°C$)	3-Pin SOT-23A 3-Pin SOT-89 3-Pin TO-92	Pd	240 400 440	mW
Operating Temperature Range		T_A	– 40 to +85	°C
Storage Temperature Range		T_{stg}	– 65 to +150	°C

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{OUT}(A)$	Output Voltage	$I_{OUT} = 40mA$ $V_{IN} = 6.0V$	— 4.90	— 5.0	— 5.10	V
$I_{OUT}max$	Maximum Output Current	$V_{IN} = 6.0V$, $V_{OUT}(A) \geq 4.5V$	250	—	—	mA
ΔV_{OUT}	Load Regulation	$V_{IN} = 6.0$ V, $1mA \leq I_{OUT} \leq 100mA$	—	40	80	mV
V_{dif}	I/O Voltage Difference	$I_{OUT} = 100mA$ $I_{OUT} = 200mA$	— —	120 380	300 600	mV
I_{SS}	Current Consumption	$V_{IN} = 6.0V$	—	1.1	3.0	μA
$\frac{V_{OUT}(A) \cdot 100}{\Delta V_{IN} \cdot V_{OUT}(S)}$	Voltage Regulation	$I_{OUT} = 40mA$ $6.0V \leq V_{IN} \leq 10.0V$	—	0.2	0.3	%/V
V_{IN}	Input Voltage		—	—	10.0	V
$\frac{\Delta V_{OUT}(A) \cdot 10^6}{V_{OUT}(S) \cdot \Delta T_A}$	Temperature Coefficient of Output Voltage	$I_{OUT} = 40mA$ $– 40°C \leq T_A \leq 85°C$	—	±100	—	ppm/°C
	Long Term Stability	$T_A = 125°C$, 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 = $\{V_{IN}1 - V_{OUT}(A)\}$
$V_{OUT}(A)$: Output Voltage when I_{OUT} is fixed and $V_{IN} = V_{OUT}(S) + 1.0V$
$V_{IN}1$: Input Voltage when the output voltage is 98% $V_{OUT}(A)$

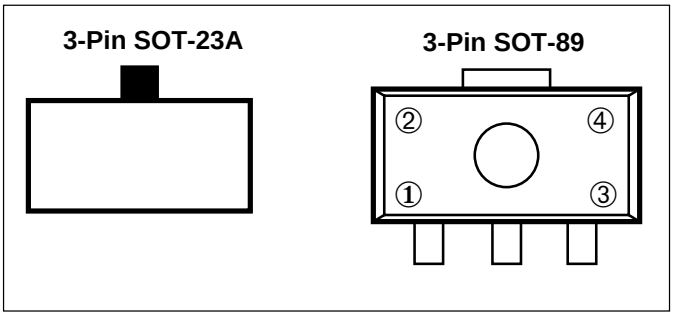
TC55RP40 ELECTRICAL CHARACTERISTICS: $V_{OUT}(S) = 4.0V$, $T_A = 25°C$ unless otherwise specified (see REMARKS).

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{OUT}(A)$	Output Voltage	$I_{OUT} = 40mA$ $V_{IN} = 5.0V$	— 3.92	— 4.0	— 4.08	V
$I_{OUT}max$	Maximum Output Current	$V_{IN} = 5.0V$, $V_{OUT}(A) \geq 3.6V$	200	—	—	mA
ΔV_{OUT}	Load Regulation	$V_{IN} = 5.0V$, $1mA \leq I_{OUT} \leq 100mA$	—	45	90	mV
V_{dif}	I/O Voltage Difference	$I_{OUT} = 100mA$ $I_{OUT} = 200mA$	— —	170 400	330 630	mV
I_{SS}	Current Consumption	$V_{IN} = 5.0V$	—	1.0	2.9	μA
$\frac{\Delta V_{OUT}(A) \cdot 100}{\Delta V_{IN} \cdot V_{OUT}(S)}$	Voltage Regulation	$I_{OUT} = 40mA$ $5.0V \leq V_{IN} \leq 10.0V$	—	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	$I_{OUT} = 40mA$ $– 40°C \leq T_A \leq 85°C$	—	±100	—	ppm/°C
	Long Term Stability	$T_A = 125°C$, 1000 Hours	—	0.5	—	%

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{OUT}(A)	Output Voltage	I_{OUT} = 40mA V_{IN} = 4.0V	— 2.94	— 3.0	— 3.06	V
I_{OUT}max	Maximum Output Current	V_{IN} = 4.0V, V_{OUT}(A) ≥ 2.7V	150	—	—	mA
ΔV_{OUT}	Load Regulation	V_{IN} = 4.0V, 1mA ≤ I_{OUT} ≤ 80mA	—	45	90	mV
V_{dif}	I/O Voltage Difference	I_{OUT} = 80mA I_{OUT} = 160mA	— —	180 400	360 700	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 4.0V ≤ V_{IN} ≤ 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 – 40°C ≤ T_A ≤ 85°C	—	±100	—	ppm/°C
	Long Term Stability	T_A = 125°C, 1000 Hours	—	0.5	—	%

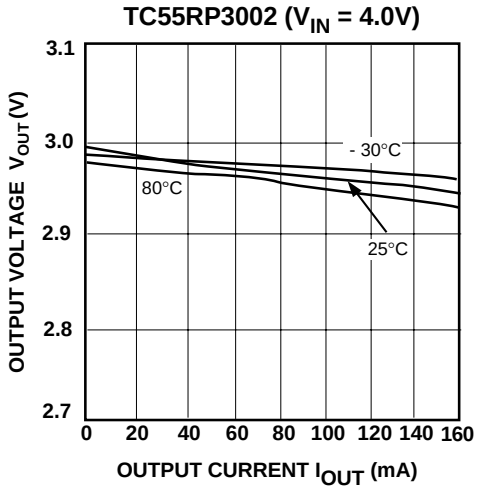
MARKING

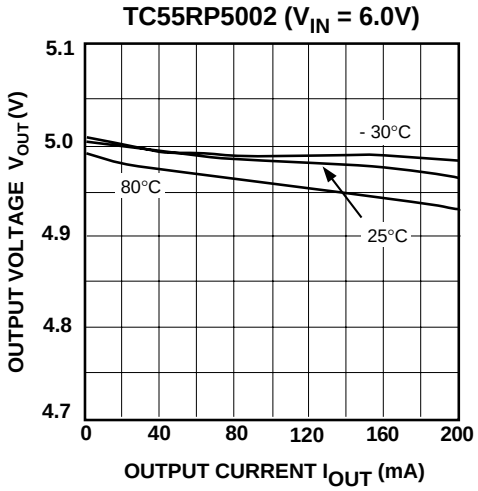


TC55 Series

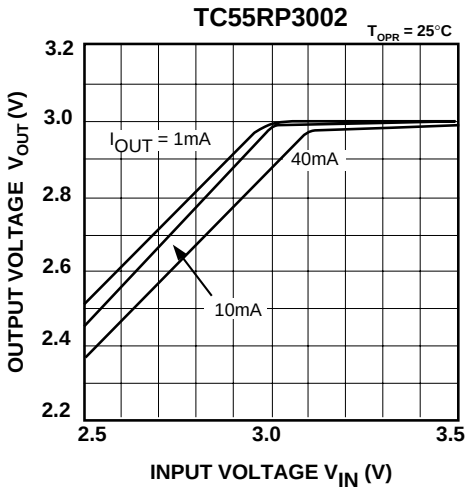
TYPICAL CHARACTERISTICS

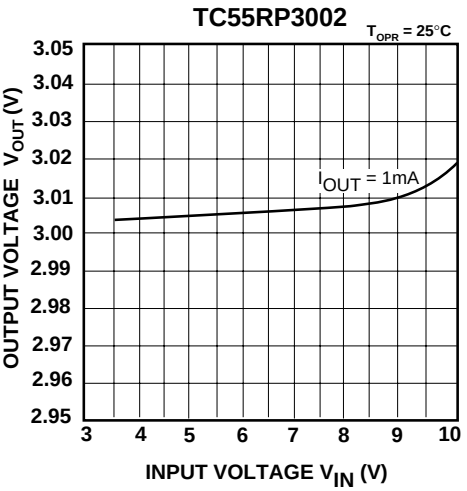
1. OUTPUT VOLTAGE vs. OUTPUT CURRENT

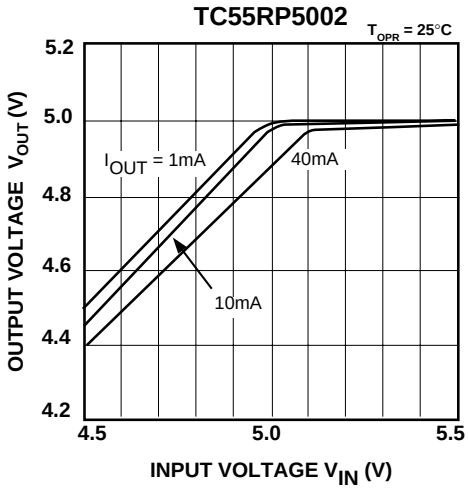


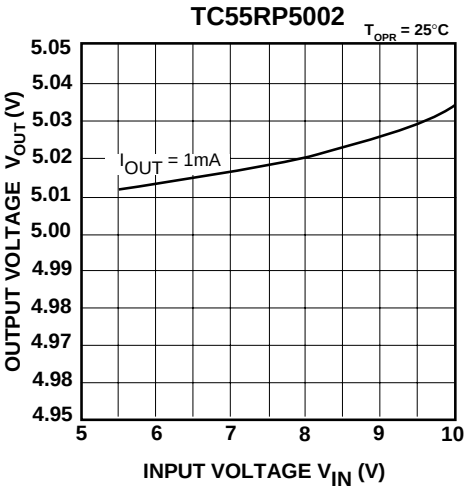


2. OUTPUT VOLTAGE vs. INPUT VOLTAGE





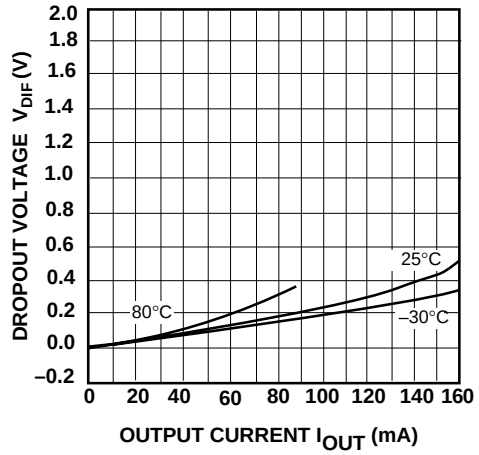




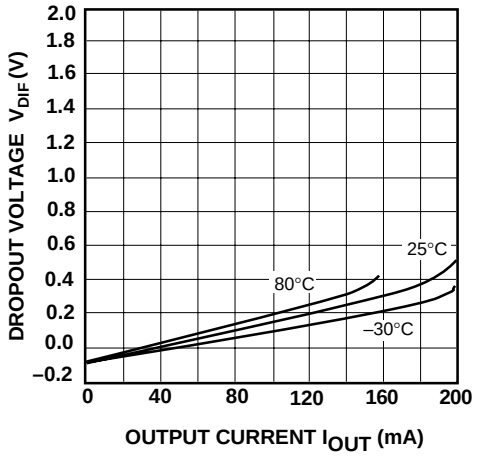
TYPICAL CHARACTERISTICS

3. DROPOUT VOLTAGE vs. OUTPUT CURRENT

TC55RP3002

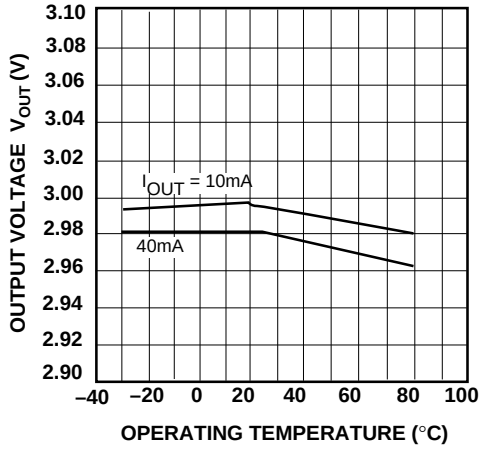


TC55RP5002

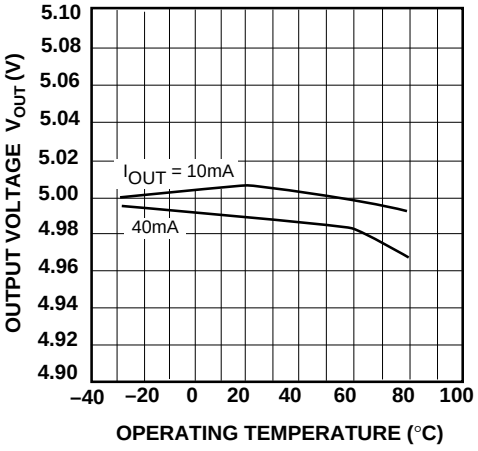


4. OUTPUT VOLTAGE vs. OPERATING TEMPERATURE

TC55RP3002 (V_{IN} = 4.0V)

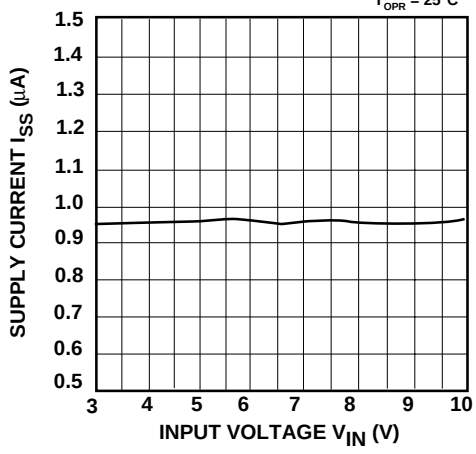


TC55RP5002 (V_{IN} = 6.0V)

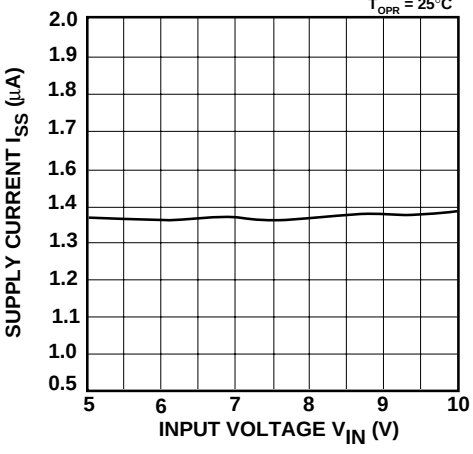


5. SUPPLY CURRENT vs. INPUT VOLTAGE

TC55RP3002 T_{OPR} = 25°C



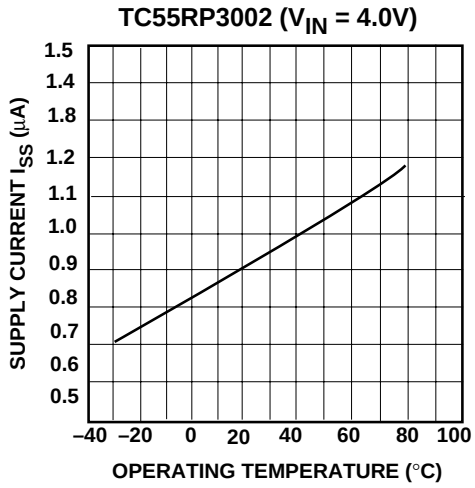
TC55RP5002 T_{OPR} = 25°C

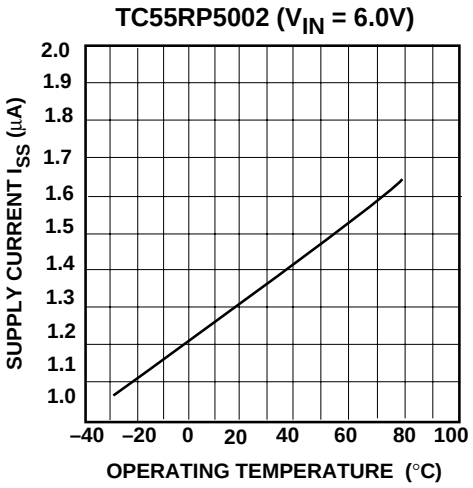


TC55 Series

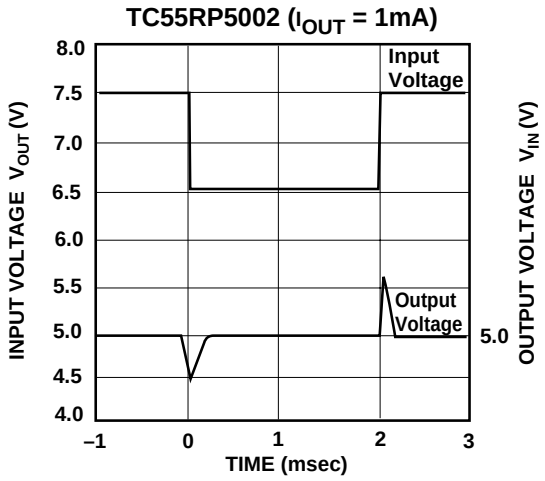
TYPICAL CHARACTERISTICS

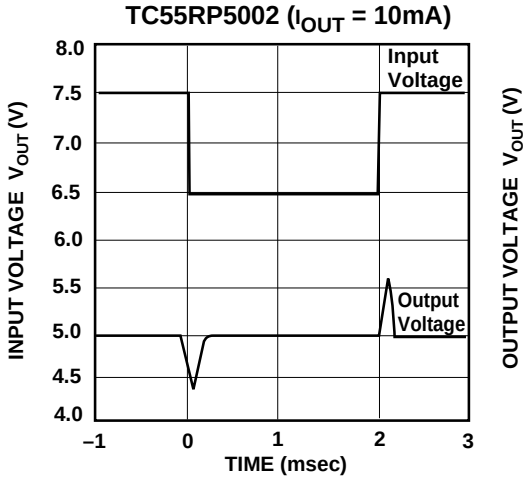
6. SUPPLY CURRENT vs. OPERATING TEMPERATURE





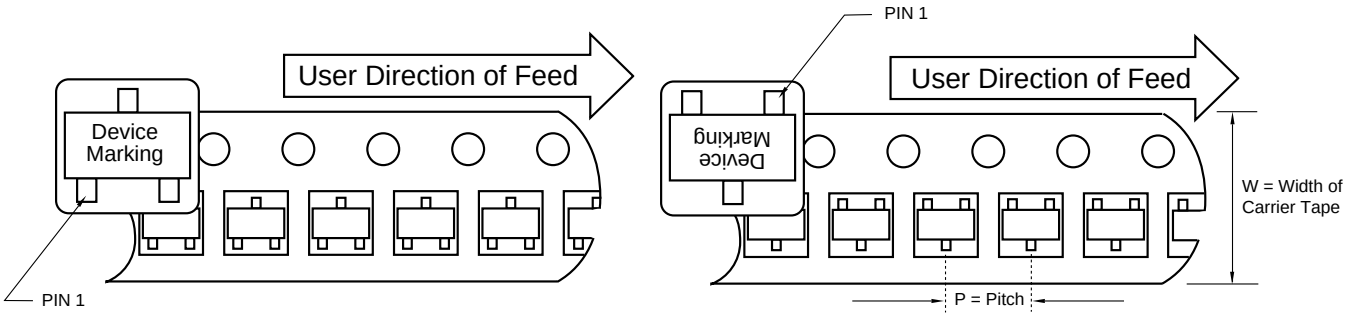
7.INPUT TRANSIENT RESPONSE





TAPING FORMS

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



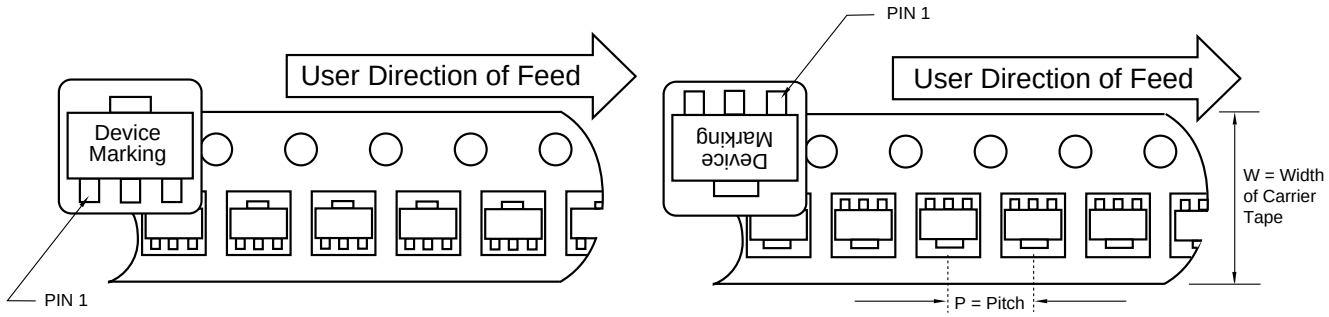
Standard Reel Component Orientation
for 713 or TR Suffix Device
(Mark Right Side Up)

Reverse Reel Component Orientation
for 723 or RT Suffix Device
(Mark Upside Down)

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



Standard Reel Component Orientation
for 713 or TR Suffix Device
(Mark Right Side Up)

Reverse Reel Component Orientation
for 723 or RT Suffix Device
(Mark Upside Down)

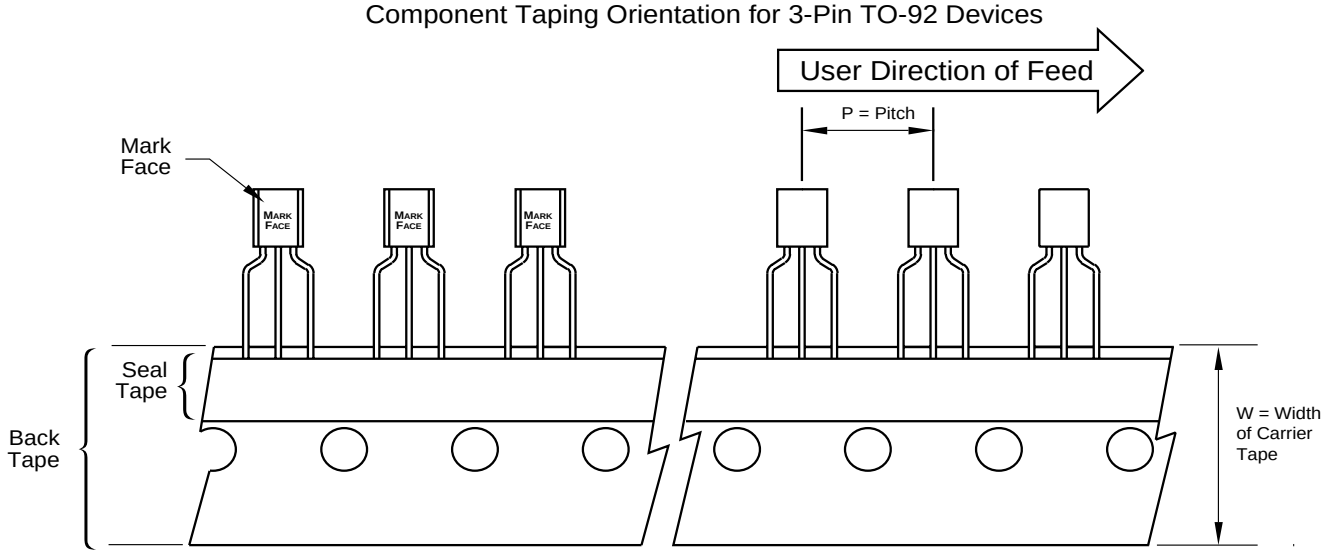
Carrier Tape, Reel Size, and Number of Components Per Reel

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

TC55 Series

TAPING FORMS (Cont.)

Component Taping Orientation for 3-Pin TO-92 Devices

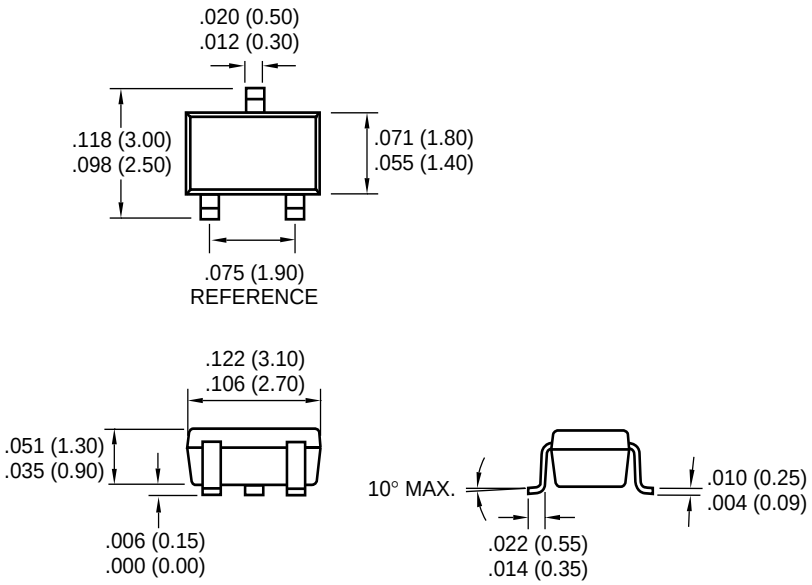


Carrier Tape, Reel Size, and Number of Components Per Reel

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
3-Pin TO-92	18 mm	12.7 mm	1000	14 in

PACKAGE DIMENSIONS

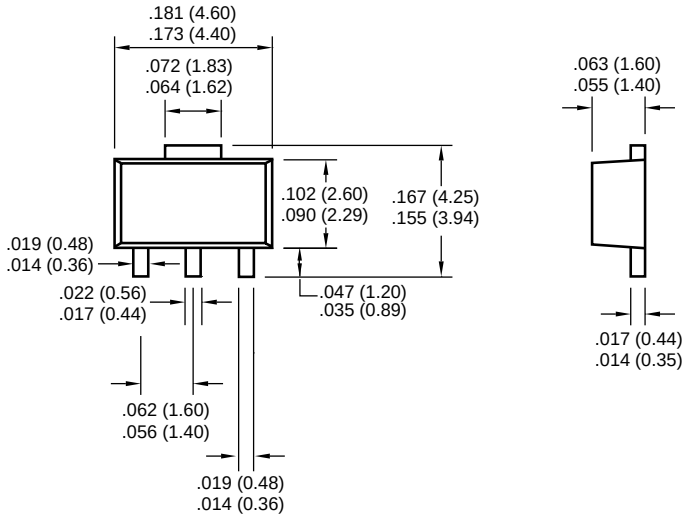
3-Pin SOT-23A (EIAJ SC-59)



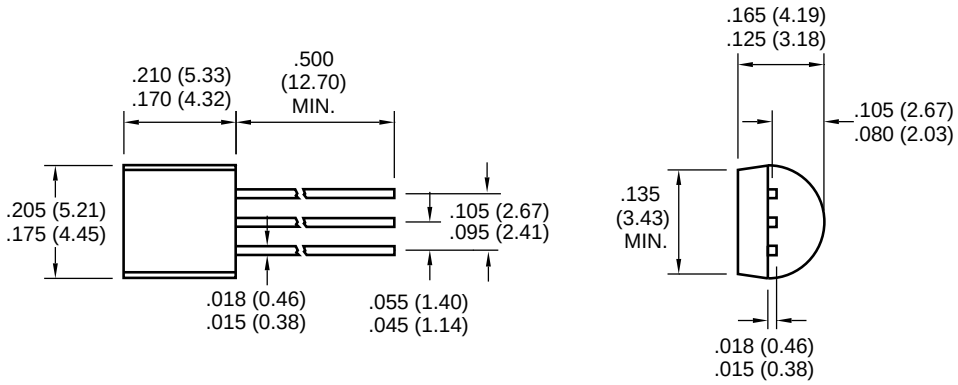
Dimensions: inches (mm)

PACKAGE DIMENSIONS (CONT.)

3-Pin SOT-89



3-Pin TO-92



Dimensions: inches (mm)

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