

LOW DROPOUT, NEGATIVE OUTPUT VOLTAGE REGULATOR

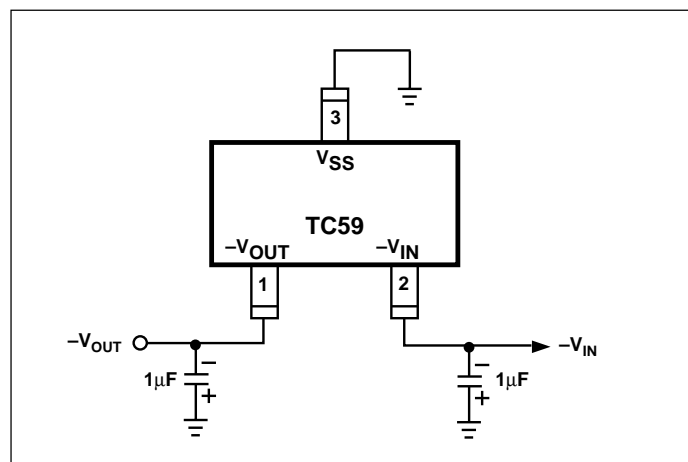
FEATURES

- Low Dropout Voltage (Typically 120mV at 50mA; 380mV at 100mA) for $-5.0V$ Output Part
- Tight Output Voltage Tolerance ($\pm 2\%$, Max)
- Low Supply Current (3.5 μA , Typ)
- Factory-Programmed Output Voltages of $-2.1V$ to $-6.0V$ in 100mV Increments
- Space-Saving 3-Pin SOT-23A Package

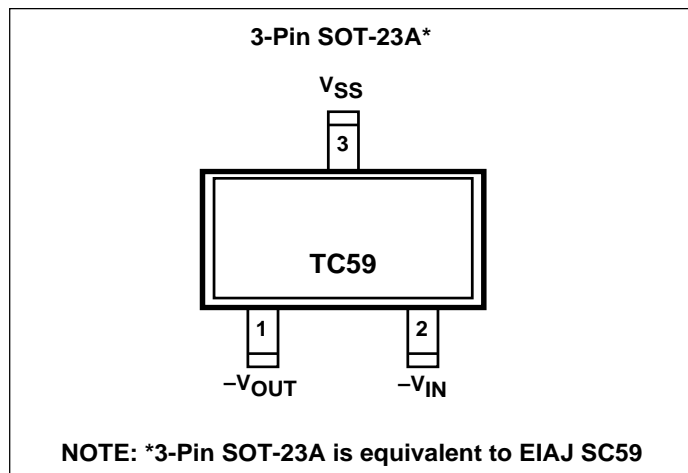
TYPICAL APPLICATIONS

- Cellular Phones
- Battery Operated Systems
- Palmtops
- Portable Cameras

TYPICAL APPLICATION



PIN CONFIGURATION



GENERAL DESCRIPTION

The TC59 is a low dropout, negative output voltage regulator designed specifically for battery-operated systems. Its full CMOS construction eliminates the wasted ground current typical of bipolar LDOs. This reduced supply current significantly extends battery life, particularly when the TC59 is operated in dropout.

Other TC59 key features include low supply current (typically 3.0 μA) and low dropout operation (typically 120mV at 50mA). Factory-programmed output voltages of $-2.1V$ to $-6.0V$ in 100mV steps are available. The TC59 is packaged in a tiny 3-Pin SOT-23A package.

ORDERING INFORMATION

PART CODE	TC59	30	02	ECB	XX
	TC59	50	02	ECB	XX

Output Voltage: _____
 Ex: 50 = $-5.0V$; 30 = $-3.0V$

Max Output Tolerance: _____
 Ex: 02 = 2%; 01 = 1%

Package/Temperature _____
 $-40^{\circ}C$ to $\pm 85^{\circ}C$
 3-Pin SOT-23A Package

Taping Direction: _____
 TR = Standard
 RT = Reverse

*Other voltages are available. Please contact Microchip Technology Inc. for details.

LOW DROPOUT, NEGATIVE OUTPUT VOLTAGE REGULATOR

TC59

ABSOLUTE MAXIMUM RATINGS*

Input Voltage (V_{IN})-12V
Output Current (I_{OUT})200mA
Output Voltage (V_{OUT}) $-V_{DD} - 0.3V$ to $V_{IN} + 0.3V$
Power Dissipation (P_d)150mW
Operating Ambient Temperature (T_{OPR})	.. $-40^{\circ}C$ to $+85^{\circ}C$
Storage Temperature (T_{STG}) $-40^{\circ}C$ to $+125^{\circ}C$

*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: $V_{IN} = V_R - 1.0V$; Note 1; $C_L = 10 \mu F$; $T_A = +25^{\circ}C$, unless otherwise specified.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}	Supply Voltage	$I_{OUT} = 20mA$	—	—	-10	V
I_{DD}	Supply Current		—	3	7	μA
$I_{OUT(MAX)}$	Maximum Output Current	$V_{IN} = -6.0V$; $V_R = -5.0V$, $V_{OUT} \leq -4.5V$ $V_{IN} = -5.0V$; $V_R = -4.0V$, $V_{OUT} \leq -3.6V$ $V_{IN} = -4.0V$; $V_R = -3.0V$, $V_{OUT} \leq -2.7V$	100 80 60	— — —	— — —	mA mA mA
V_{OUT}	Output Voltage	$I_{OUT} = 20mA$	$1.02 \times V_R$	—	$0.98 \times V_R$	V
TC V_{OUT}	Output Voltage Temperature Coefficient	$I_{OUT} = 20mA$	—	± 100	—	ppm/ $^{\circ}C$
$\Delta V_{OUT}/(\Delta V_{IN} \times V_{OUT})$	Line Regulation	$I_{OUT} = 20mA$; $V_R = -5.0V$; $-6.0 < V_{IN} < -10.0V$ $V_R = -4.0V$; $-5.0 < V_{IN} < -10.0V$ $V_R = -3.0V$; $-4.0 < V_{IN} < -10.0V$		0.1	0.3	%/V
ΔV_{OUT}	Load Regulation	$V_R = -5.0V$; $1mA < I_{OUT} < 50mA$ $V_R = -4.0V$; $1mA < I_{OUT} < 45mA$ $V_R = -3.0V$; $1mA < I_{OUT} < 40mA$		40	80	mV
$V_{IN} - V_{OUT}$	Dropout Voltage	$V_R = -5.0V$; $I_{OUT} = 50mA$ $I_{OUT} = 100mA$ $V_R = -4.0V$; $I_{OUT} = 45mA$ $I_{OUT} = 90mA$ $V_R = -3.0V$; $I_{OUT} = 40mA$ $I_{OUT} = 80mA$	— — — — — —	120 380 120 380 120 380	300 600 300 600 300 600	mV mV mV mV mV mV

Notes: 1. V_R is the regulator output voltage setting. For example: $V_R = -2.5V, -3.6V, -4.0V, -2.7V, -3.0V, -3.3V, -5.0V$.

PIN DESCRIPTION

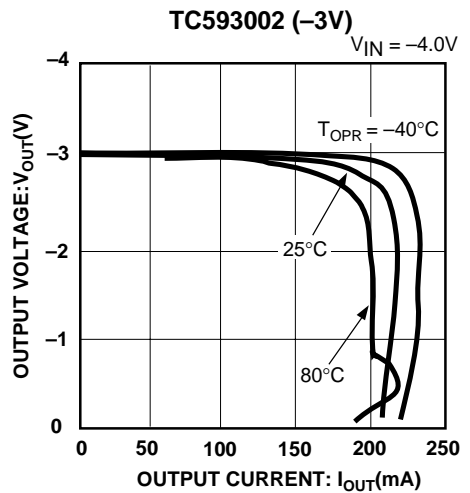
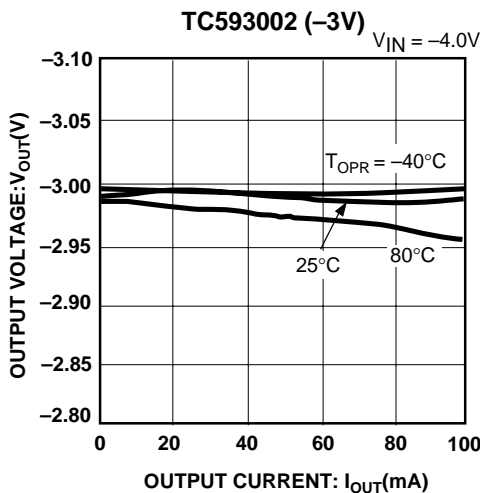
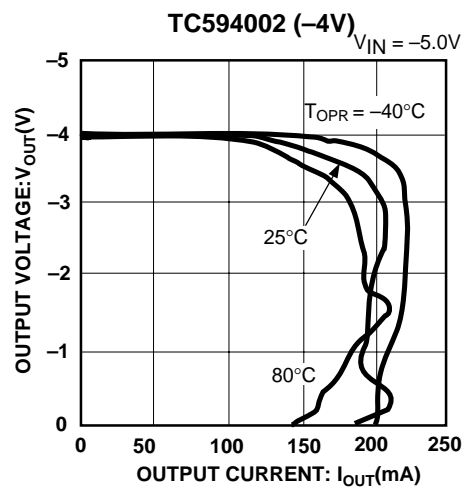
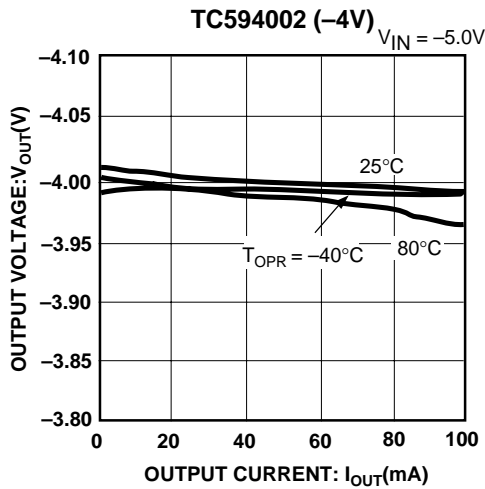
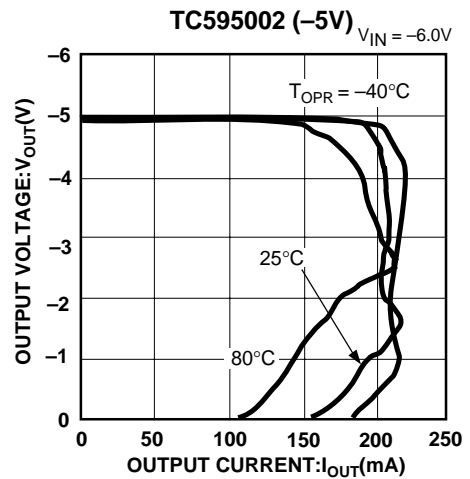
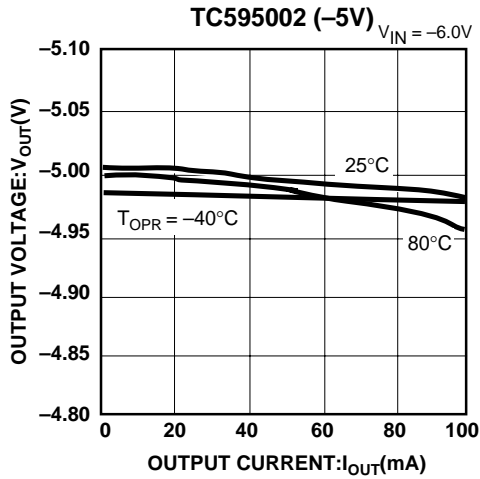
Pin Number	Name	Description
1	V_{OUT}	Regulated Voltage Output
2	V_{IN}	Supply Voltage Input
3	V_{SS}	Ground

LOW DROPOUT, NEGATIVE OUTPUT VOLTAGE REGULATOR

TC59

TYPICAL CHARACTERISTICS CURVES

1. OUTPUT VOLTAGE vs. OUTPUT CURRENT

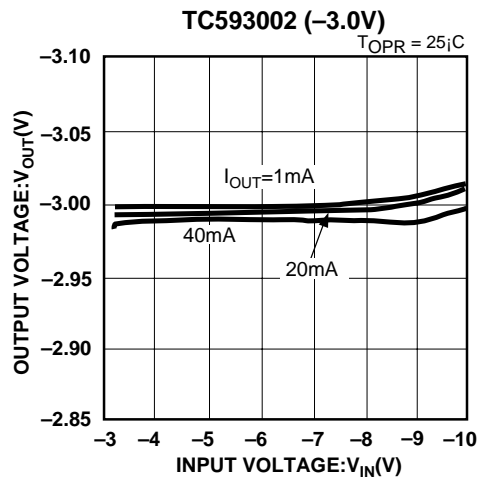
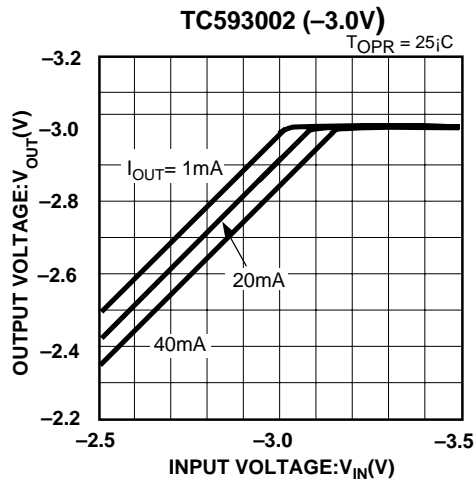
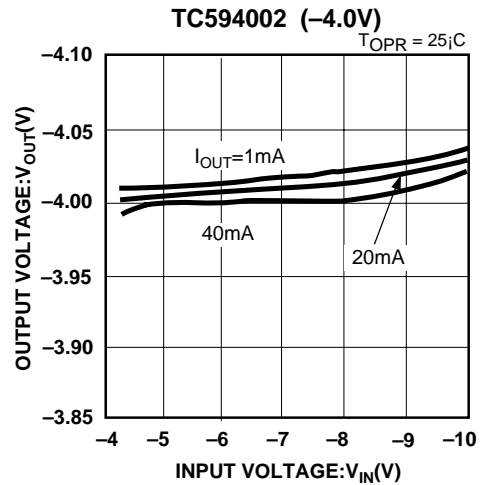
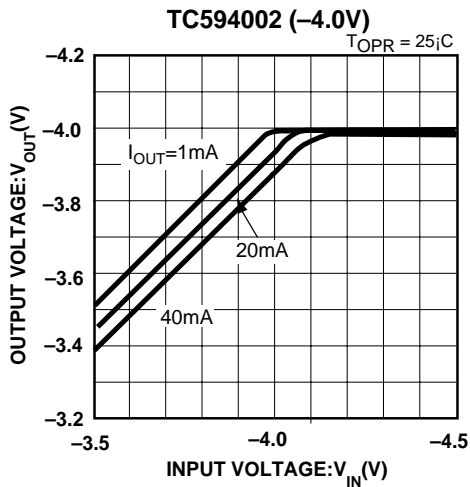
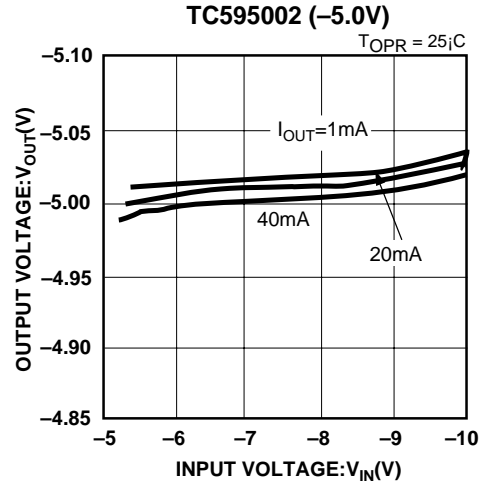
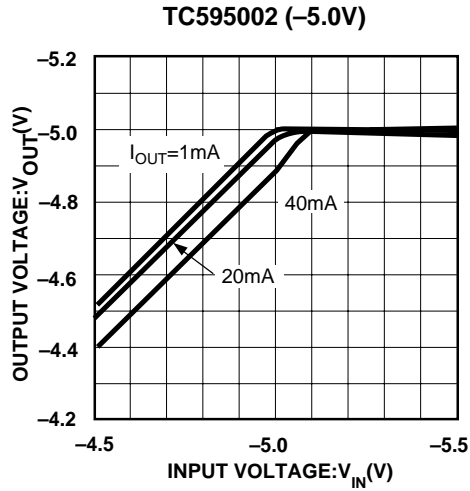


LOW DROPOUT, NEGATIVE OUTPUT VOLTAGE REGULATOR

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TYPICAL CHARACTERISTICS CURVES (CONT.)

2. OUTPUT VOLTAGE vs. INPUT VOLTAGE

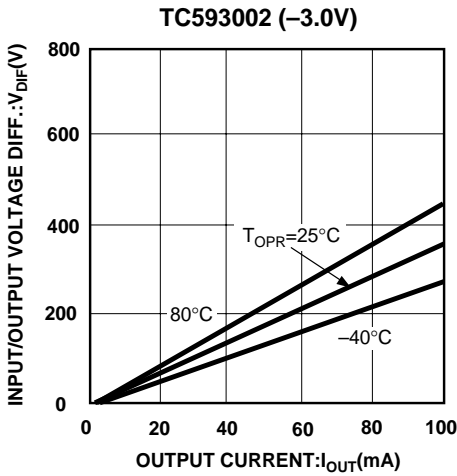
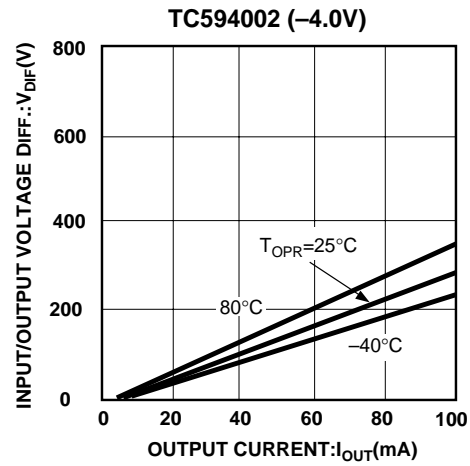
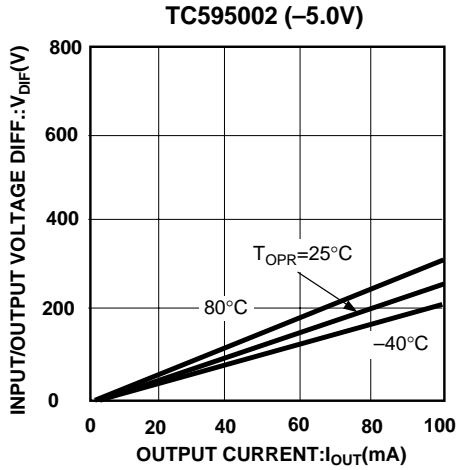


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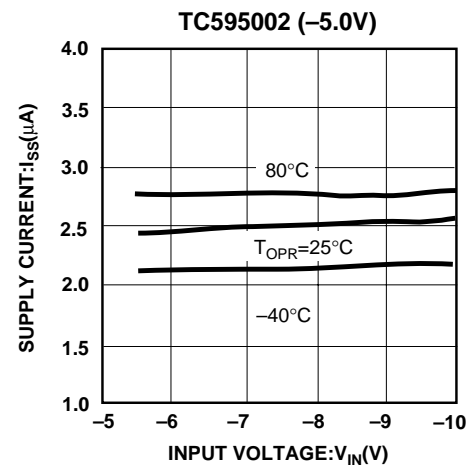
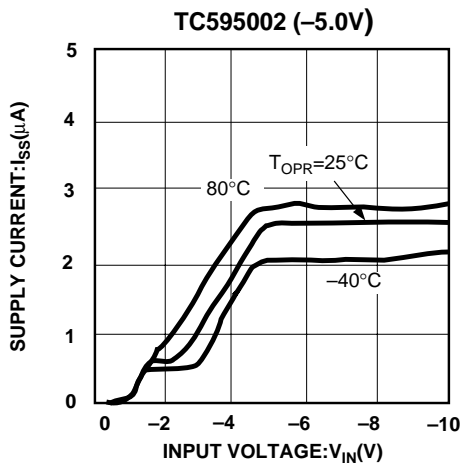
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TYPICAL CHARACTERISTICS CURVES (CONT.)

3. INPUT/OUTPUT VOLTAGE DIFFERENTIAL vs. OUTPUT CURRENT



4. SUPPLY CURRENT vs. INPUT VOLTAGE

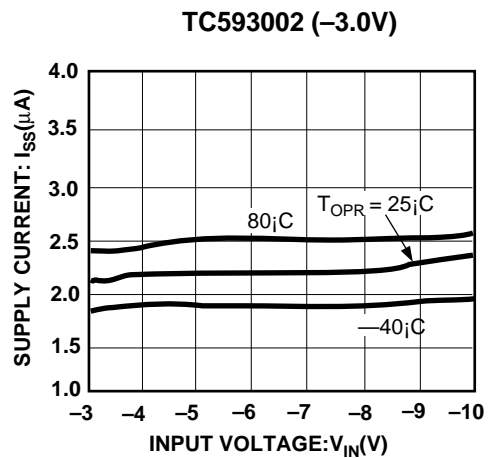
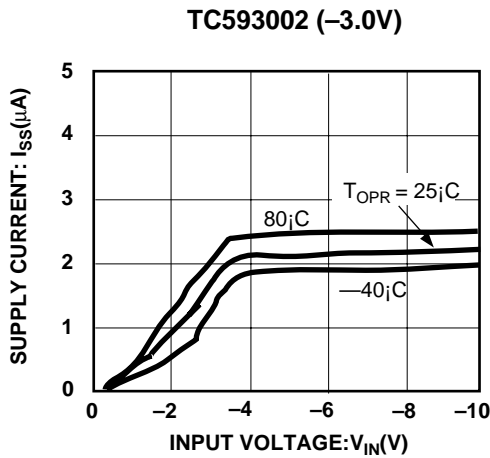
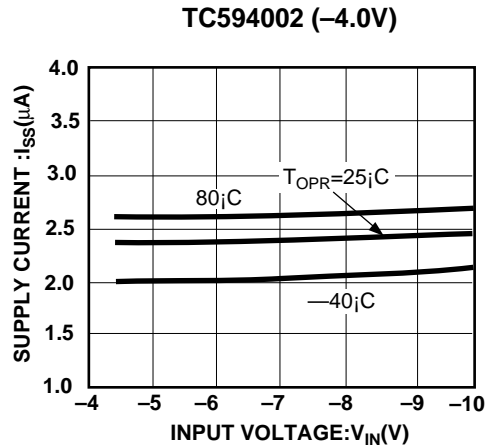
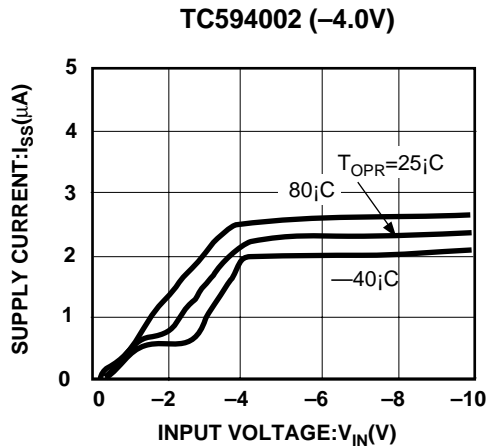


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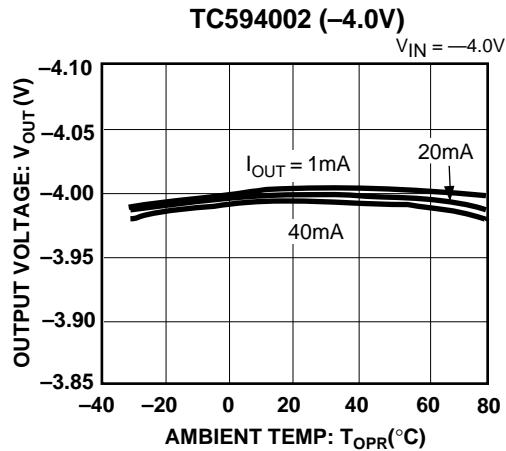
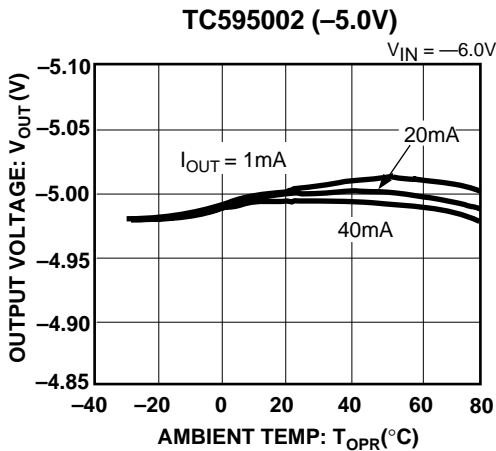
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TYPICAL CHARACTERISTICS CURVES (CONT.)

4. SUPPLY CURRENT vs. INPUT VOLTAGE (CONTINUED)



5. OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

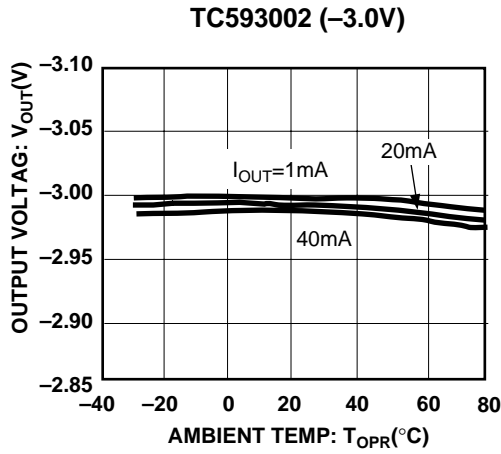


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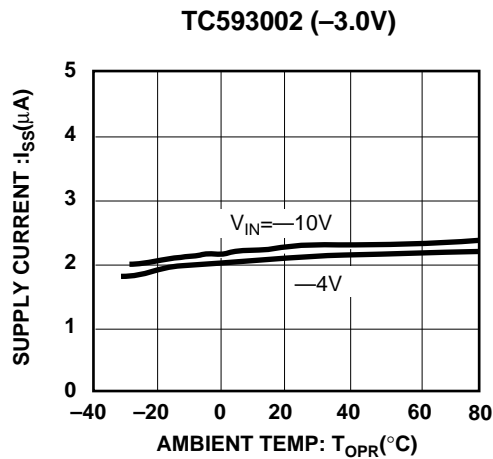
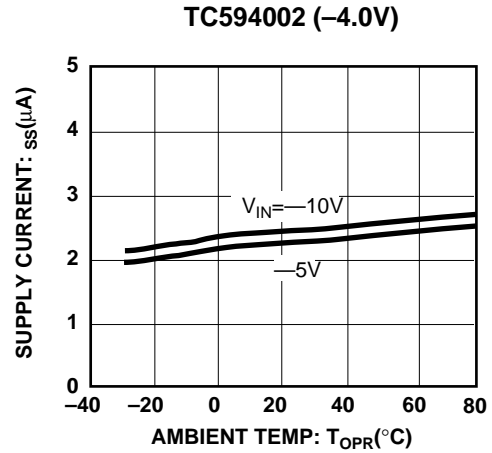
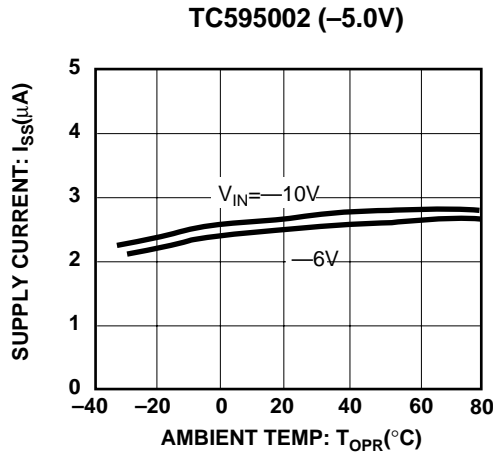
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TYPICAL CHARACTERISTICS CURVES (CONT.)

5. OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE (CONTINUED)



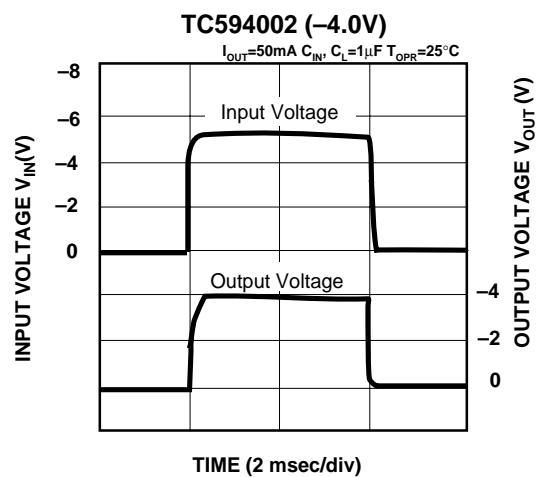
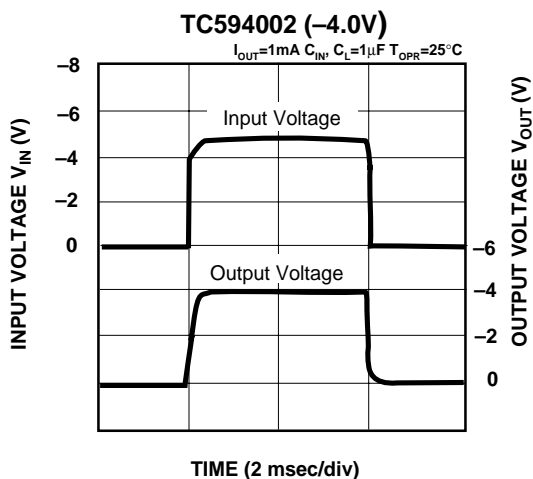
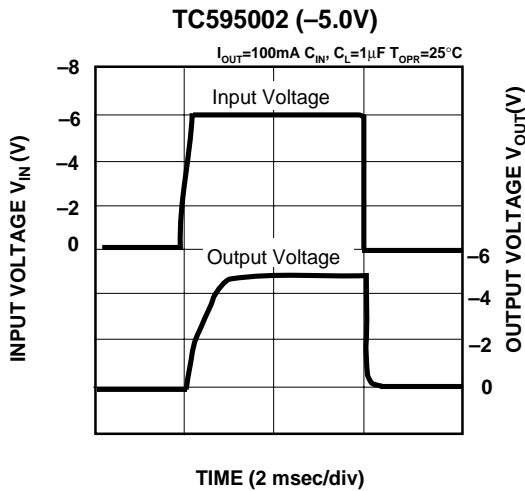
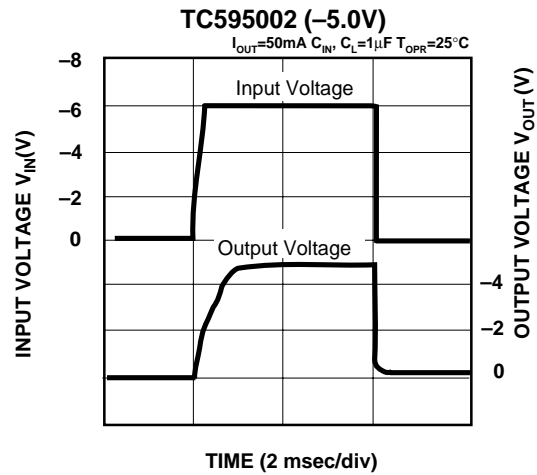
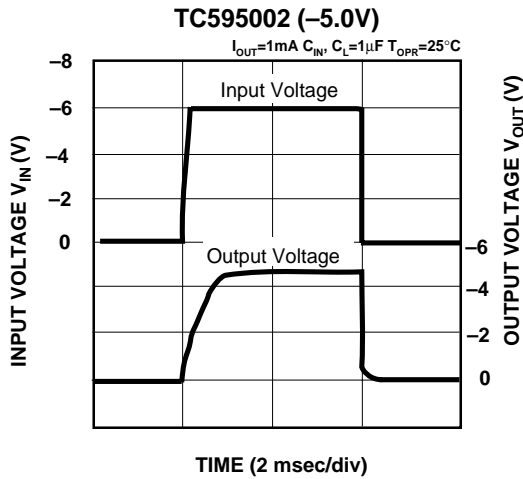
6. SUPPLY CURRENT vs. AMBIENT TEMPERATURE



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TYPICAL CHARACTERISTICS CURVES (CONT.)

7. INPUT TRANSIENT RESPONSE

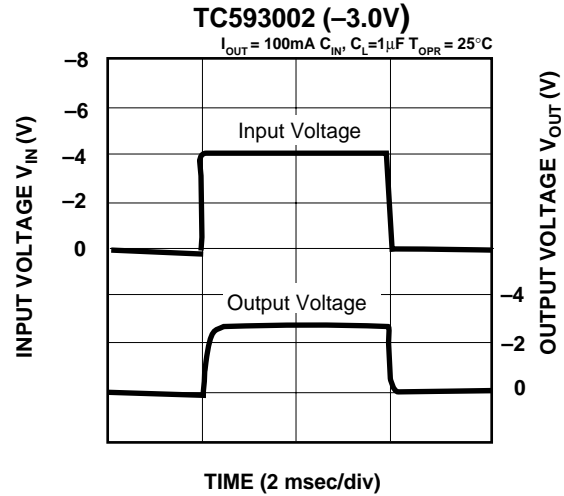
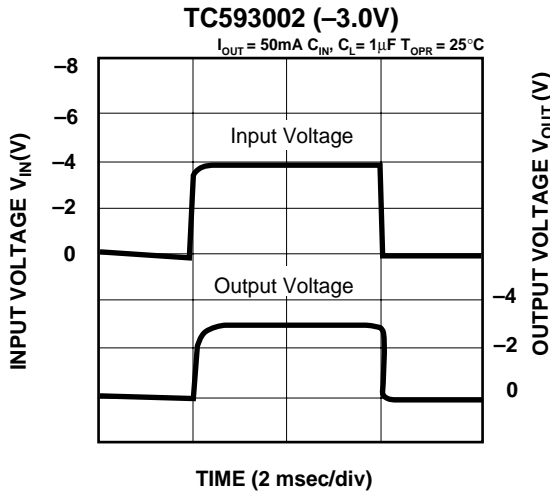
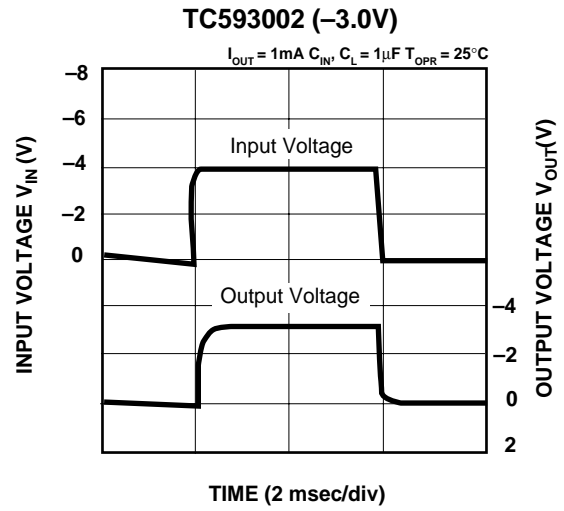
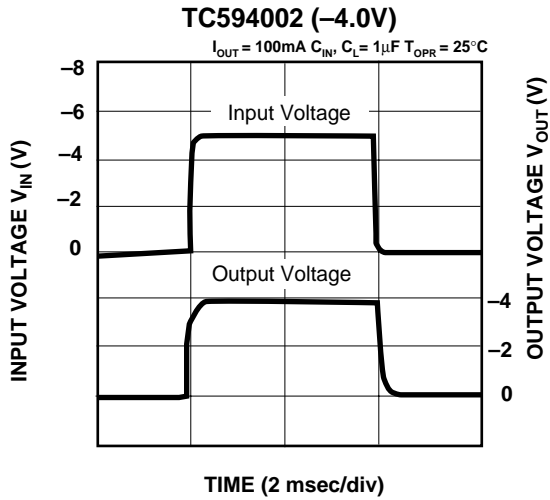


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TYPICAL CHARACTERISTICS CURVES (CONT.)

7. INPUT TRANSIENT RESPONSE (Cont.)

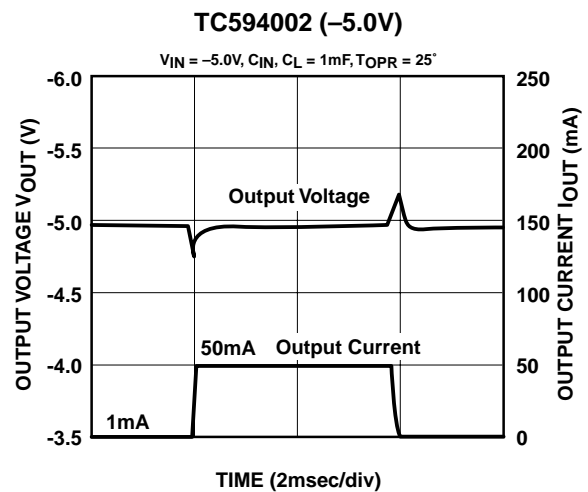
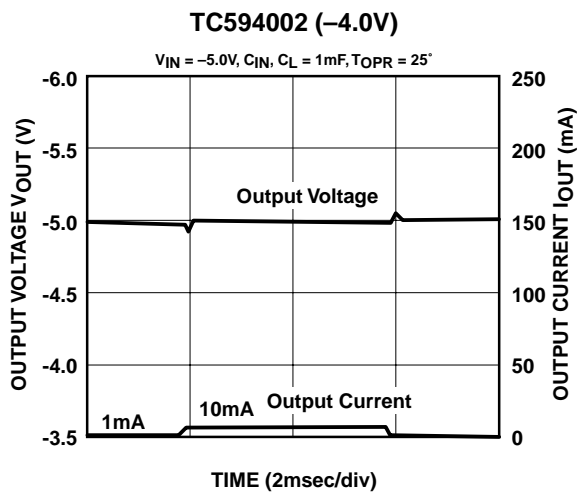
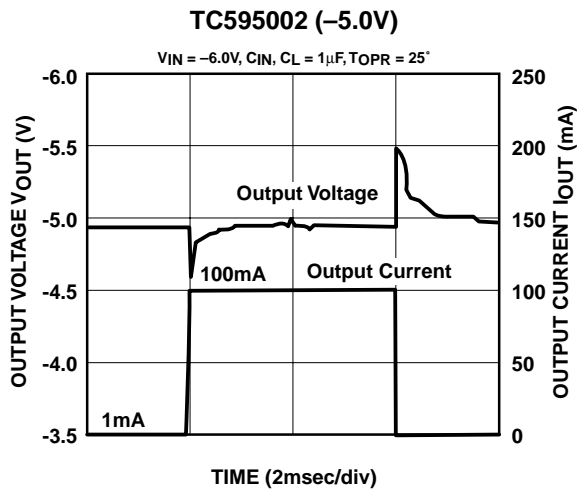
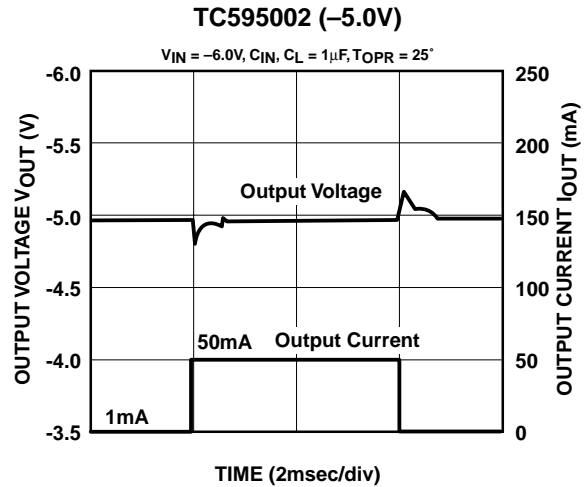
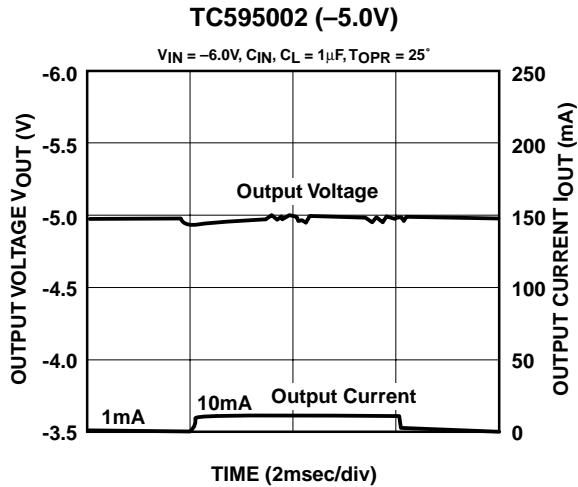


LOW DROPOUT, NEGATIVE OUTPUT VOLTAGE REGULATOR

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TYPICAL CHARACTERISTICS CURVES (CONT.)

8. LOAD TRANSIENT RESPONSE

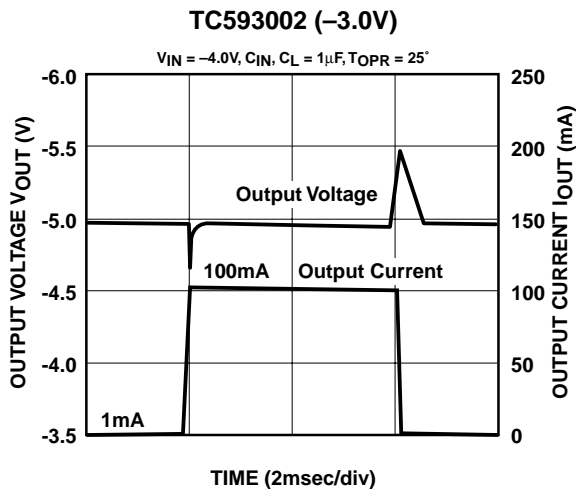
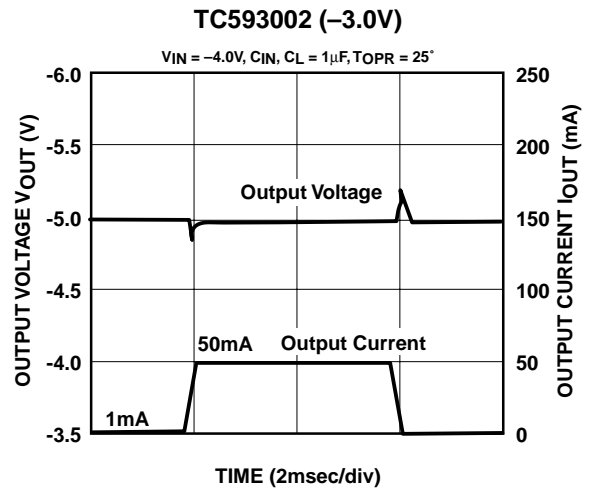
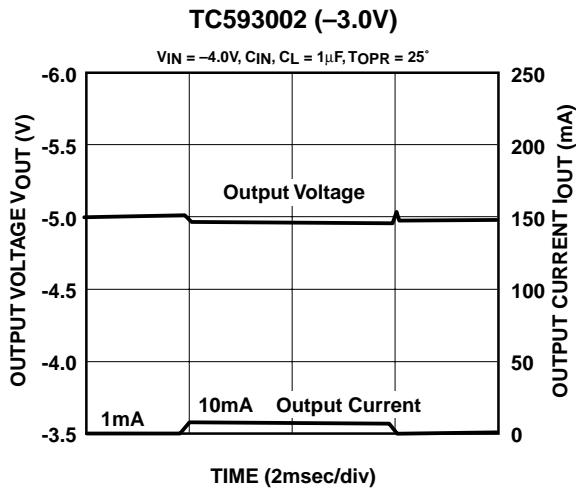
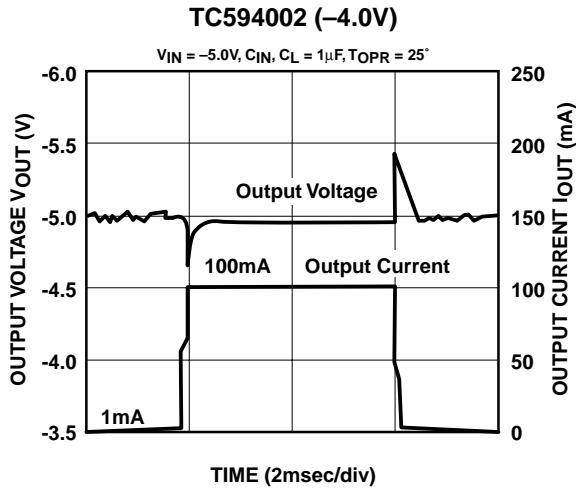


LOW DROPOUT, NEGATIVE OUTPUT VOLTAGE REGULATOR

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TYPICAL CHARACTERISTICS CURVES (CONT.)

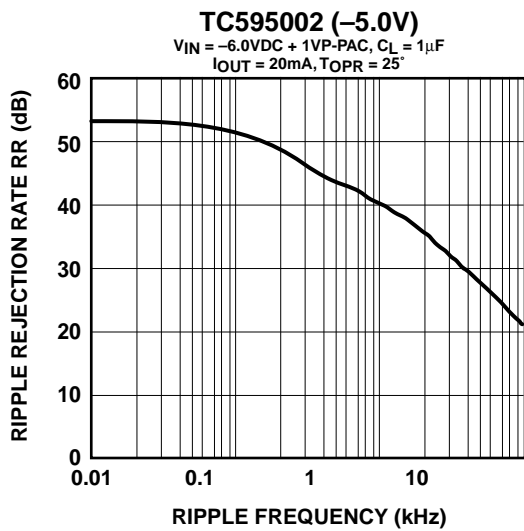
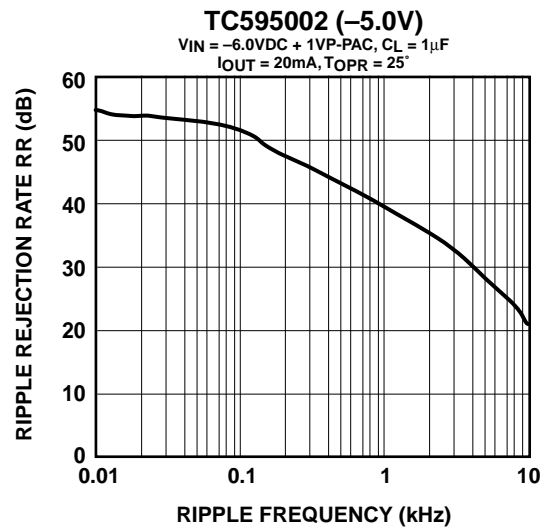
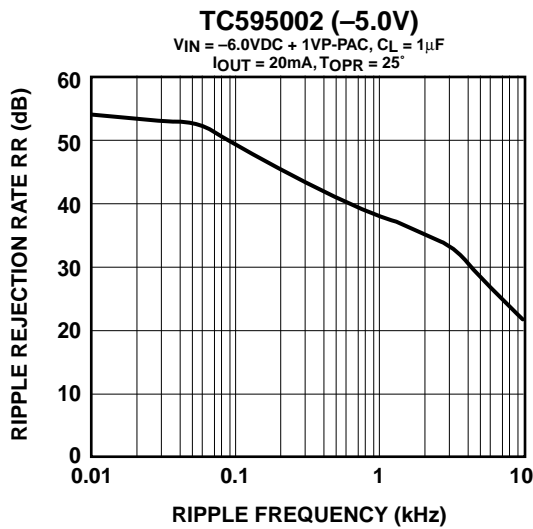
8. LOAD TRANSIENT RESPONSE (CONT.)



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TYPICAL CHARACTERISTICS CURVES (CONT.)

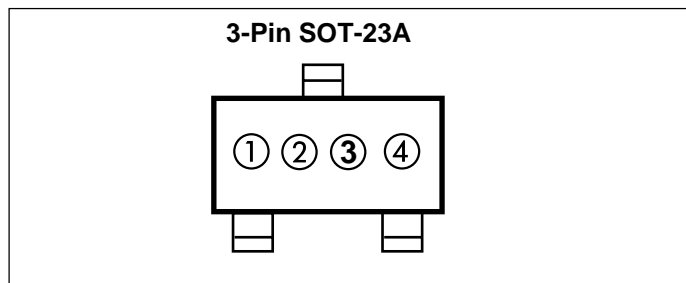
9. RIPPLE REJECTION RATE



LOW DROPOUT, NEGATIVE OUTPUT VOLTAGE REGULATOR

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MARKINGS



① represents 1st integer of voltage

Symbol	Voltage
0	0.
1	1.
2	2.
3	3.
4	4.
5	5.
6	6.
7	7.
8	8.
9	9.

② represents 1st decimal of voltage

Symbol	Voltage	Symbol	Voltage
A	.0	F	.5
B	.1	H	.6
C	.2	K	.7
D	.3	L	.8
E	.4	M	.9

③ represents voltage polarity

Symbol	Polarity
5	-

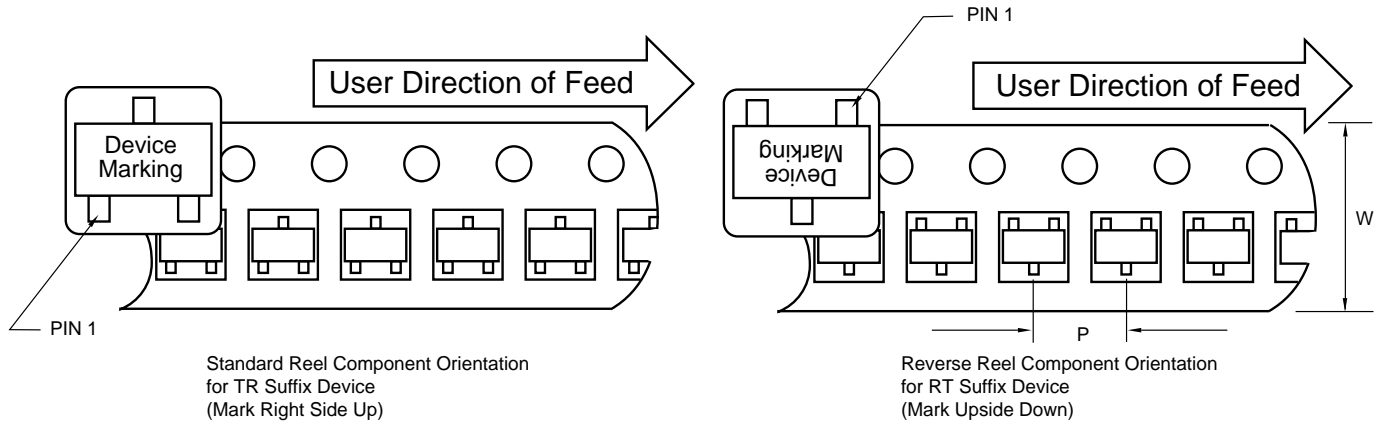
④ represents assembly lot code

LOW DROPOUT, NEGATIVE OUTPUT VOLTAGE REGULATOR

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TAPING FORMS

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

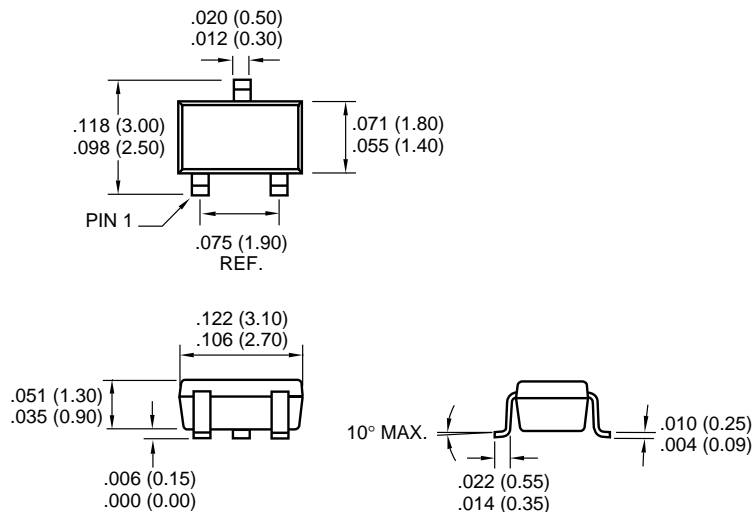


Carrier Tape, Number of Components Per Reel and Reel Size

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

PACKAGE DIMENSIONS

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



Dimensions: inches (mm)



WORLDWIDE SALES AND SERVICE

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