LOW DROPOUT, NEGATIVE OUTPUT VOLTAGE REGULATOR

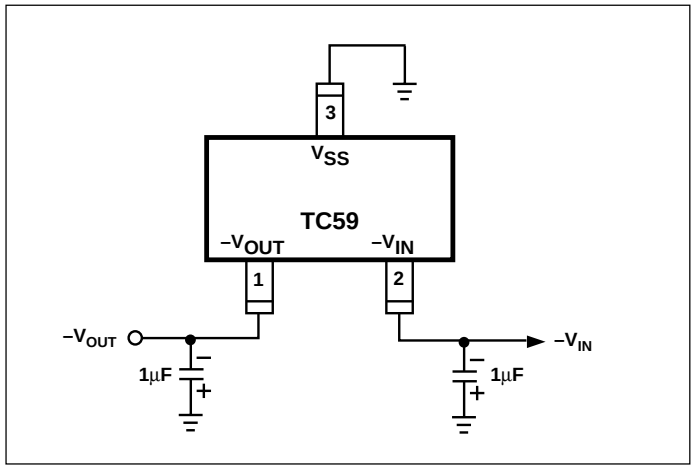
FEATURES

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

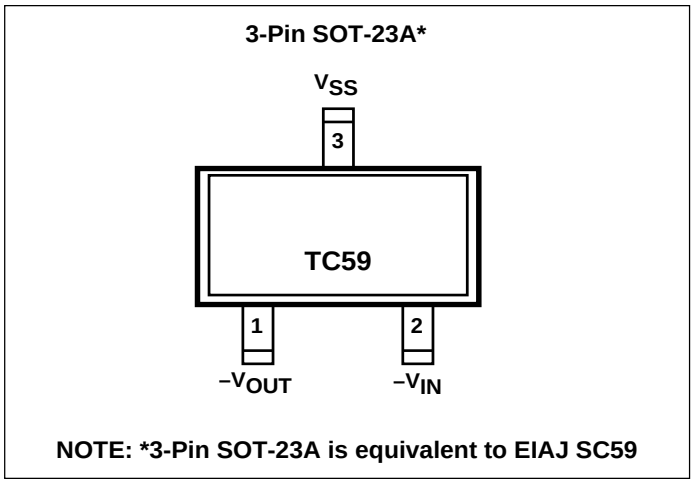
TYPICAL APPLICATIONS

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

TYPICAL APPLICATION



PIN CONFIGURATION



NOTE: *3-Pin SOT-23A is equivalent to EIAJ SC59

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 3.0μA) 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°C to ±85°C
3-Pin SOT-23A Package

Taping Direction:
TR = Standard
RT = Reverse

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

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 (Pd).....150mW
Operating Ambient Temperature (T_{OPR}) ..–40°C to +85°C
Storage Temperature (T_{STG}) .....–40°C to +125°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 µF; T_A = +25°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	100	—	—	mA
		V_{IN} = –5.0V; V_R = –4.0V, $V_{OUT} \leq$ –3.6V	80	—	—	mA
		V_{IN} = –4.0V; V_R = –3.0V, $V_{OUT} \leq$ –2.7V	60	—	—	mA
V_{OUT}	Output Voltage	I_{OUT} = 20mA	1.02 x V_R	—	0.98 x V_R	V
TC V_{OUT}	Output Voltage Temperature Coefficient	I_{OUT} = 20mA	—	±100	—	ppm/°C
ΔV_{OUT}/ (ΔV_{IN} x V_{OUT})	Line Regulation	I_{OUT} = 20mA; V_R = –5.0V; –6.0<V_{IN}<–10.0V		0.1	0.3	%/V
		V_R = –4.0V; –5.0<V_{IN}<–10.0V				
		V_R = –3.0V; –4.0<V_{IN}<–10.0V				
ΔV_{OUT}	Load Regulation	V_R = –5.0V; 1mA<I_{OUT}<50 mA		40	80	mV
		V_R = –4.0V; 1mA<I_{OUT}<45 mA				
		V_R = –3.0V; 1mA<I_{OUT}<40 mA				
$V_{IN} - V_{OUT}$	Dropout Voltage	V_R = –5.0V; I_{OUT} = 50mA	—	120	300	mV
		I_{OUT} = 100mA	—	380	600	mV
		V_R = –4.0V; I_{OUT} = 45mA	—	120	300	mV
		I_{OUT} = 90mA	—	380	600	mV
		V_R = –3.0V; I_{OUT} = 40mA	—	120	300	mV
		I_{OUT} = 80mA	—	380	600	mV

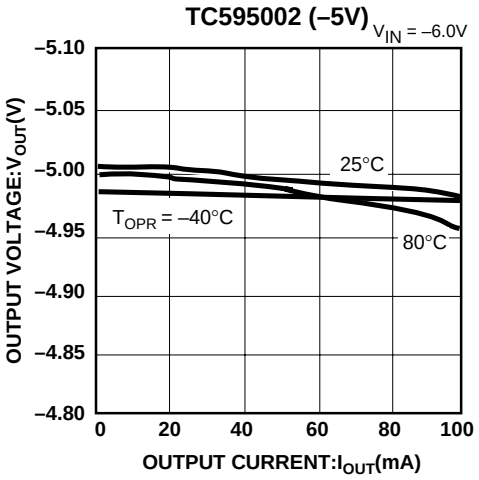
Notes:1.V_R is the regulator output voltage setting. For example: V_R = –2.5V, –3.6V, –4.0V, –2.7V, –3.0V, –3.3V, –5.0V.

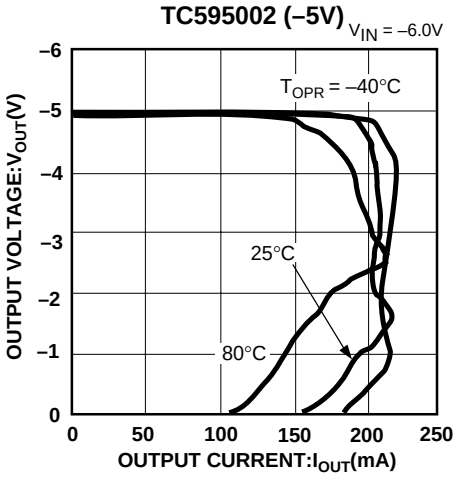
PIN DESCRIPTION

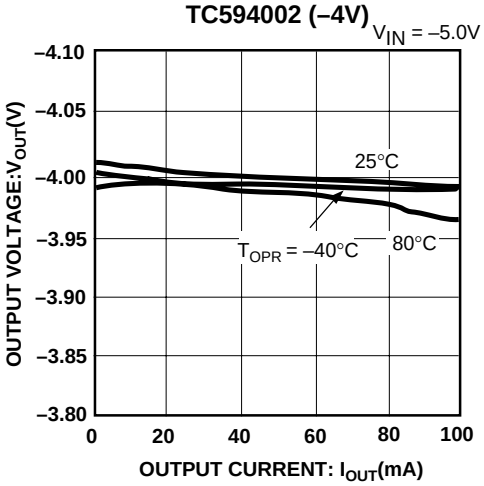
Pin Number	Name	Description
1	V_{OUT}	Regulated Voltage Output
2	V_{IN}	Supply Voltage Input
3	V_{SS}	Ground

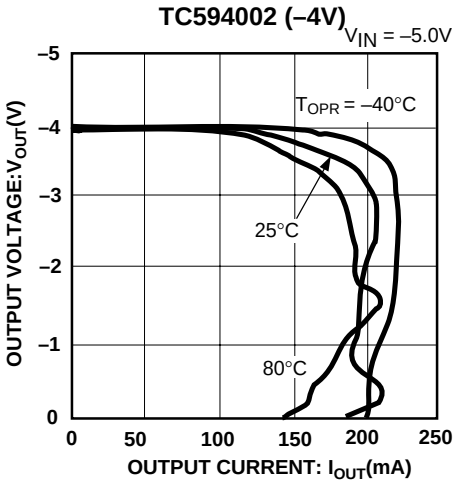
TYPICAL CHARACTERISTICS CURVES

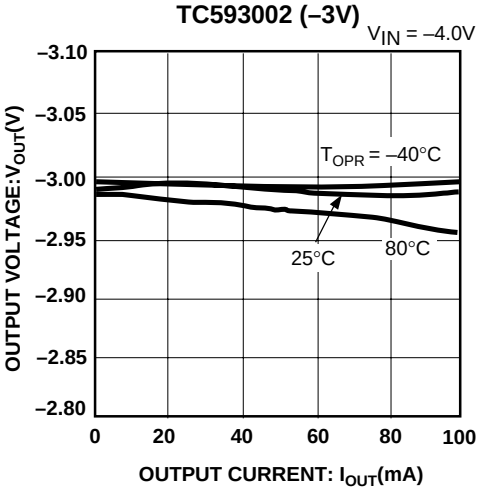
1. OUTPUT VOLTAGE vs. OUTPUT CURRENT

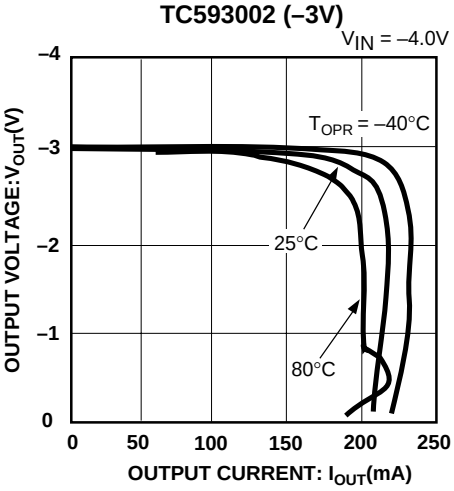








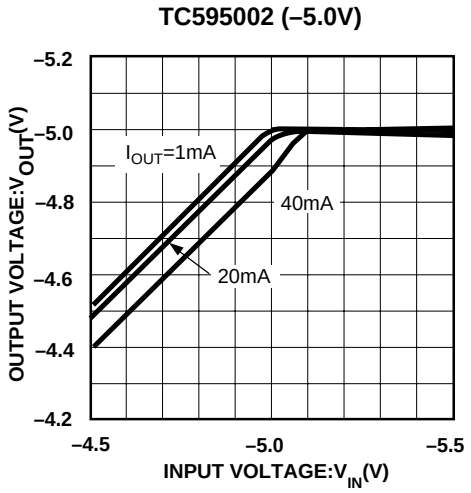


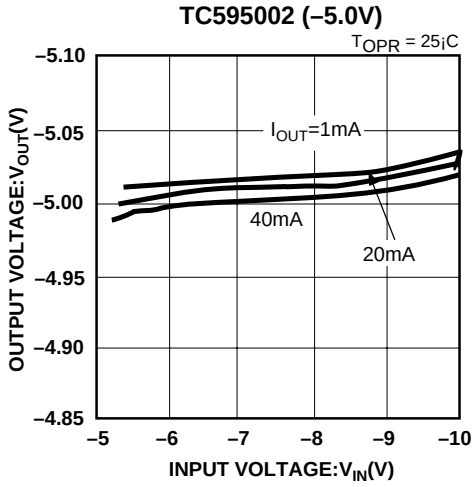


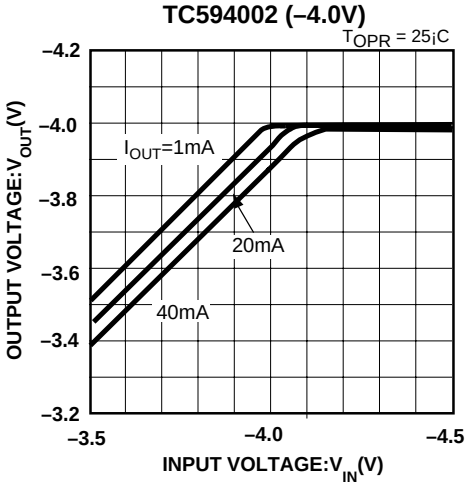
TC59

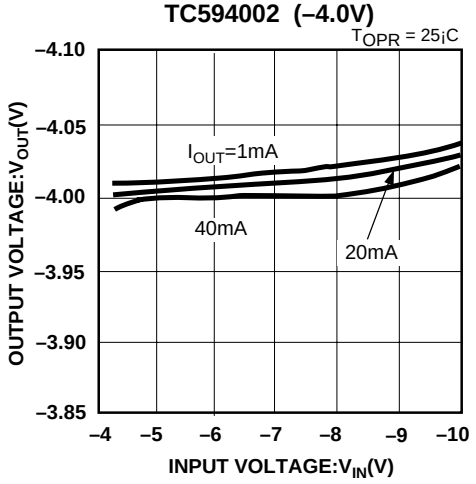
TYPICAL CHARACTERISTICS CURVES (CONT.)

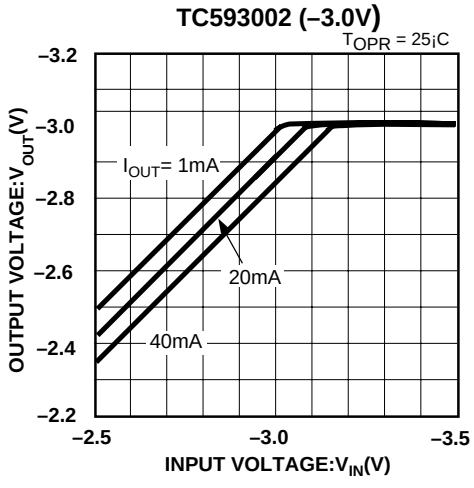
2. OUTPUT VOLTAGE vs. INPUT VOLTAGE

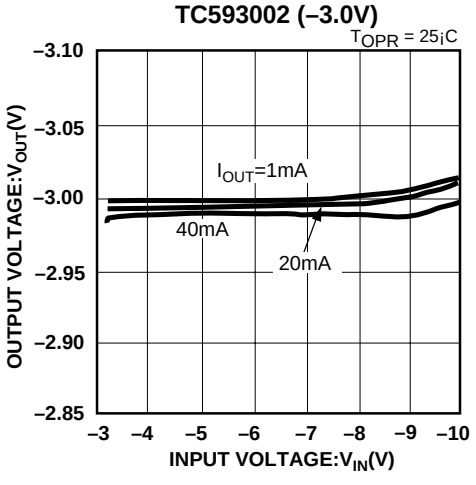






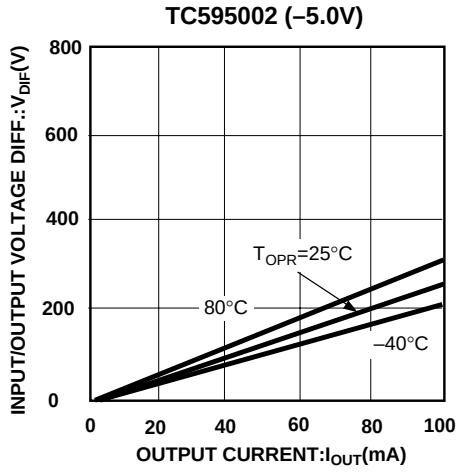


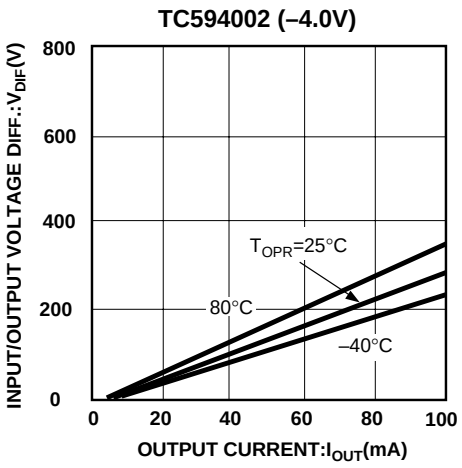


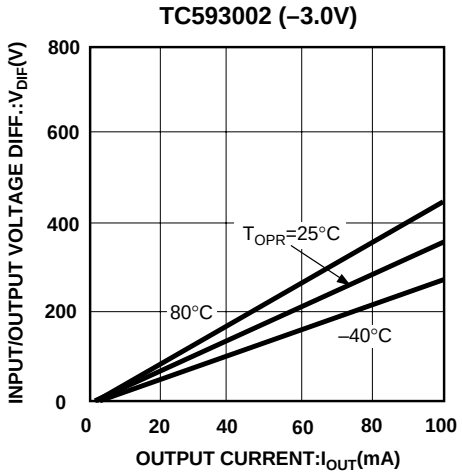


TYPICAL CHARACTERISTICS CURVES (CONT.)

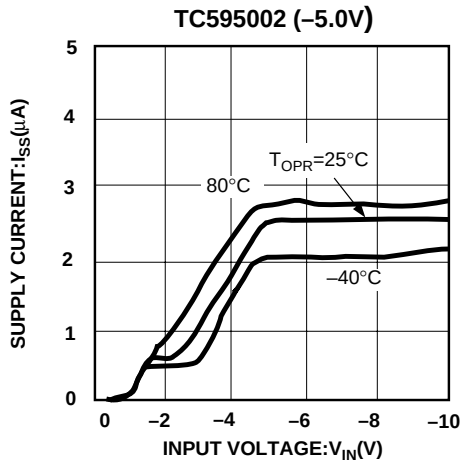
3. INPUT/OUTPUT VOLTAGE DIFFERENTIAL vs. OUTPUT CURRENT

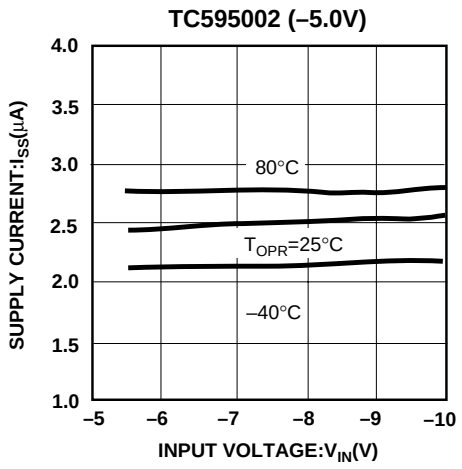






4. SUPPLY CURRENT vs. INPUT VOLTAGE





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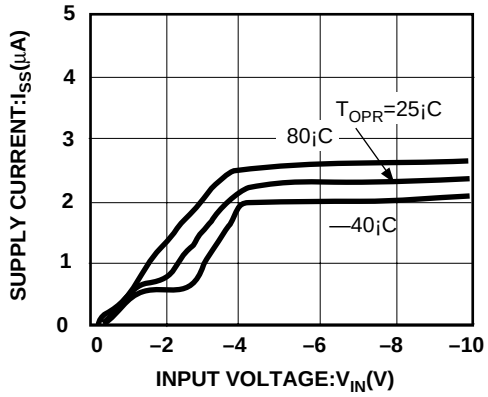
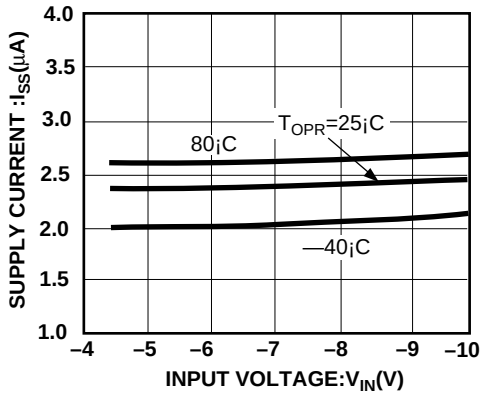
TYPICAL CHARACTERISTICS CURVES (CONT.)

4. SUPPLY CURRENT vs. INPUT VOLTAGE (CONTINUED)

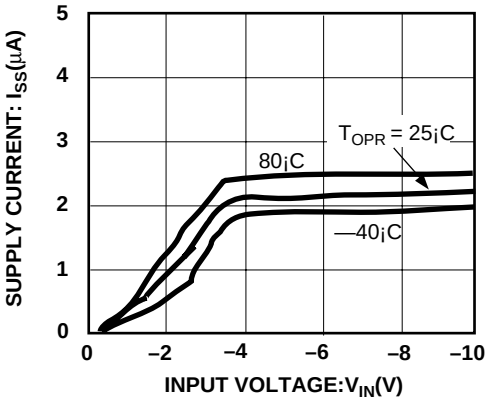
TC594002 (–4.0V)



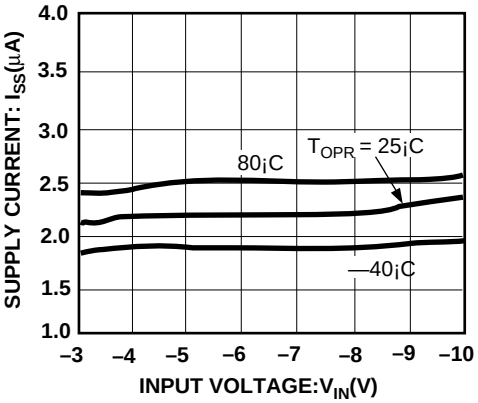
TC594002 (–4.0V)



TC593002 (–3.0V)

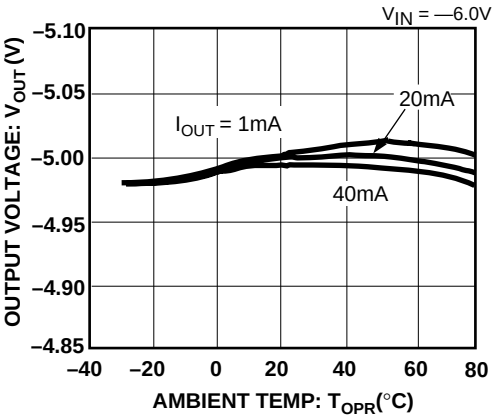


TC593002 (–3.0V)

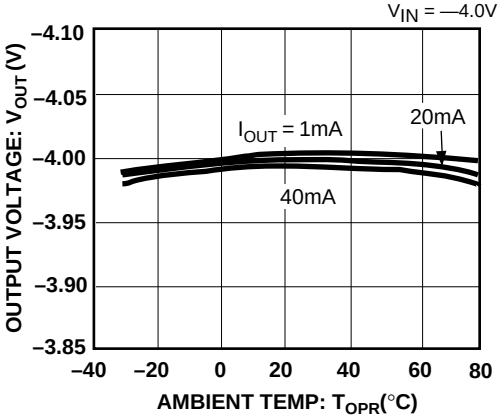


5. OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

TC595002 (–5.0V)



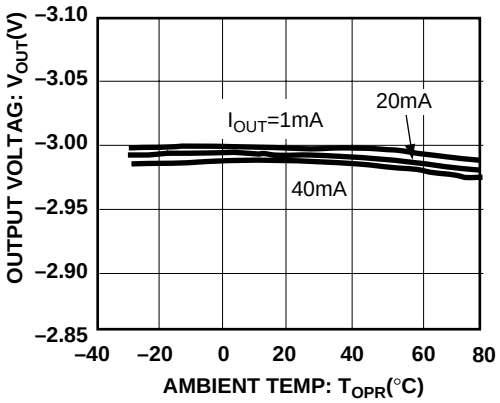
TC594002 (–4.0V)



TYPICAL CHARACTERISTICS CURVES (CONT.)

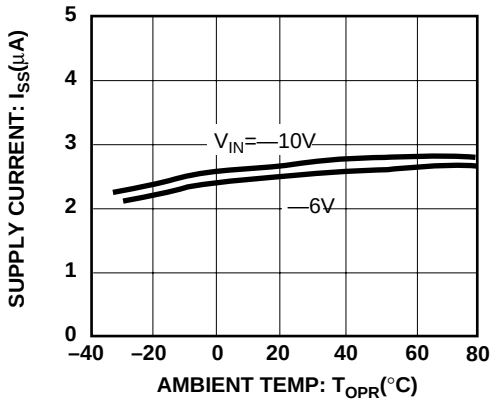
5. OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE (CONTINUED)

TC593002 (–3.0V)



6. SUPPLY CURRENT vs. AMBIENT TEMPERATURE

TC595002 (–5.0V)



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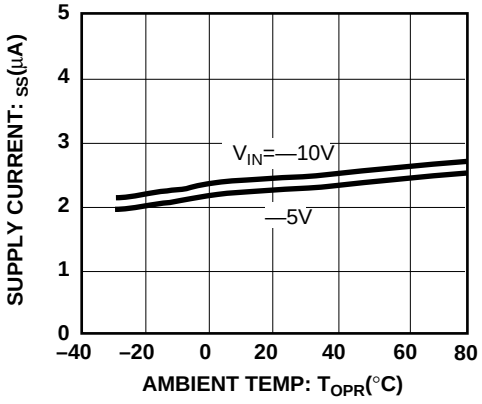

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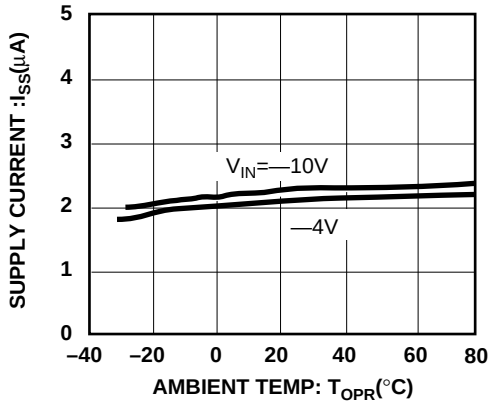
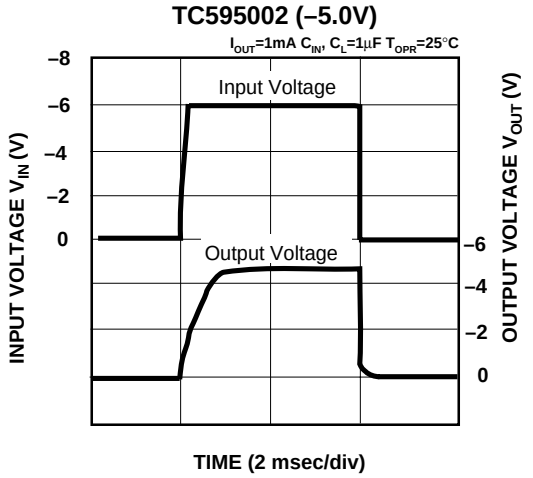
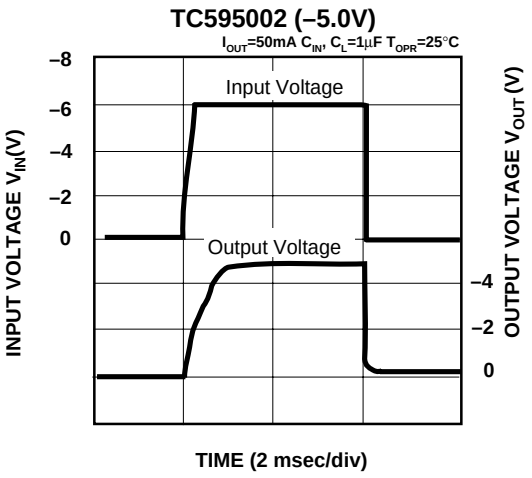
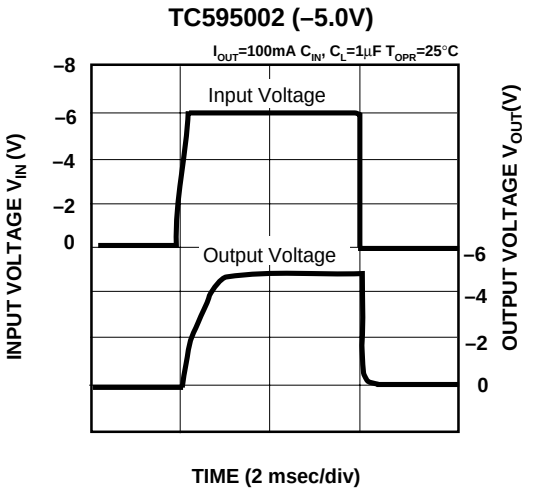


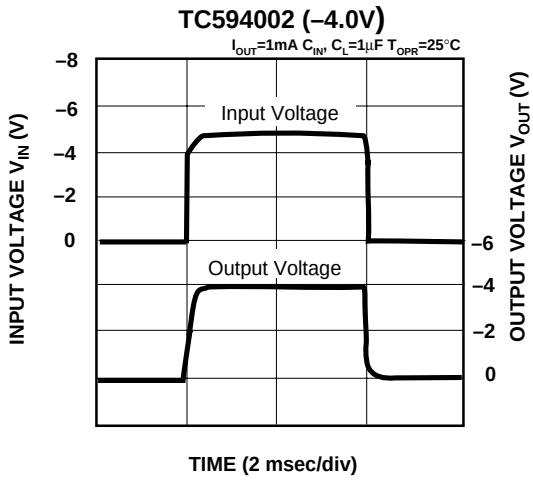
TYPICAL CHARACTERISTICS CURVES (CONT.)

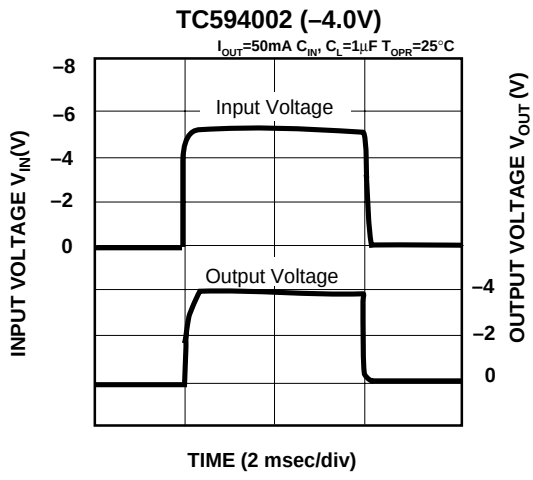
7. INPUT TRANSIENT RESPONSE







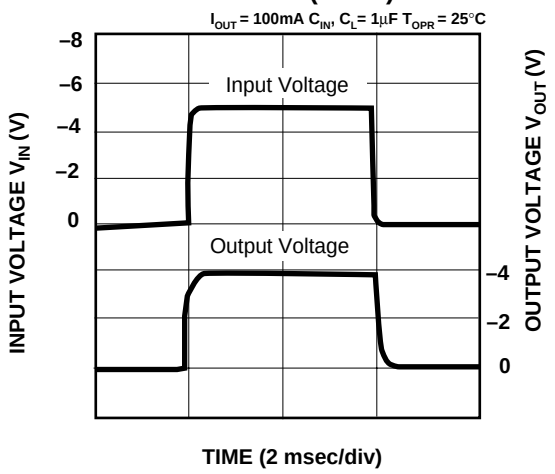




TYPICAL CHARACTERISTICS CURVES (CONT.)

7. INPUT TRANSIENT RESPONSE (Cont.)

TC594002 (–4.0V)



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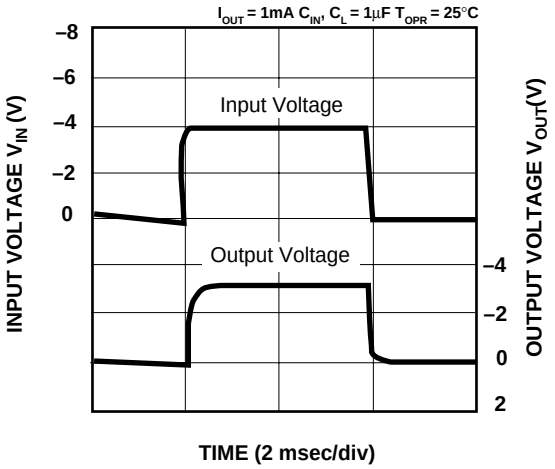

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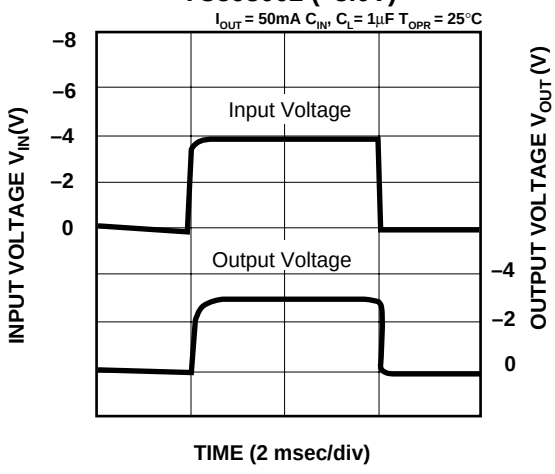

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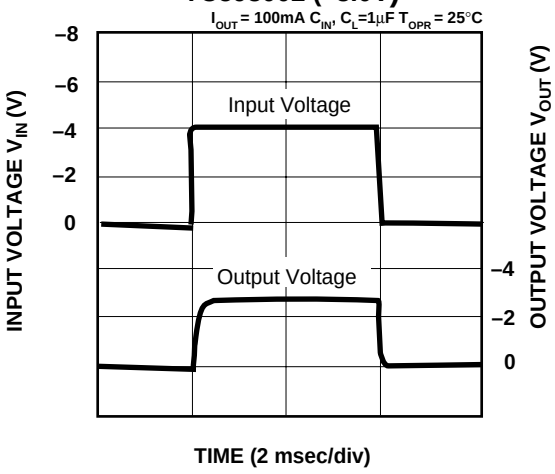
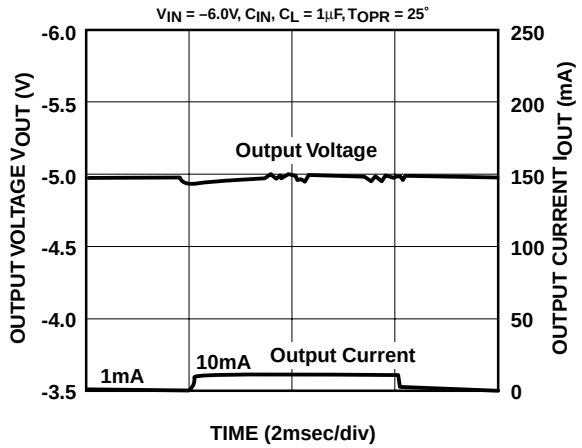


TC59

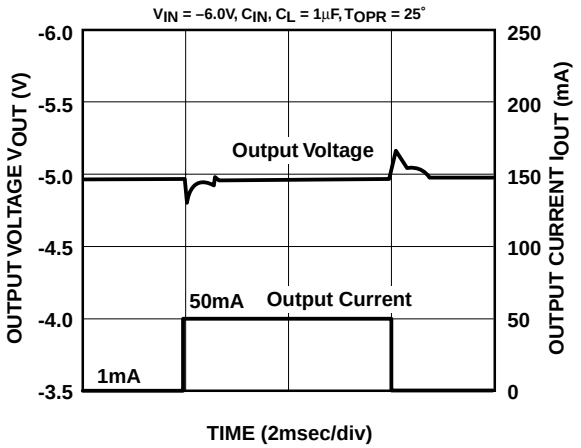
TYPICAL CHARACTERISTICS CURVES (CONT.)

8. LOAD TRANSIENT RESPONSE

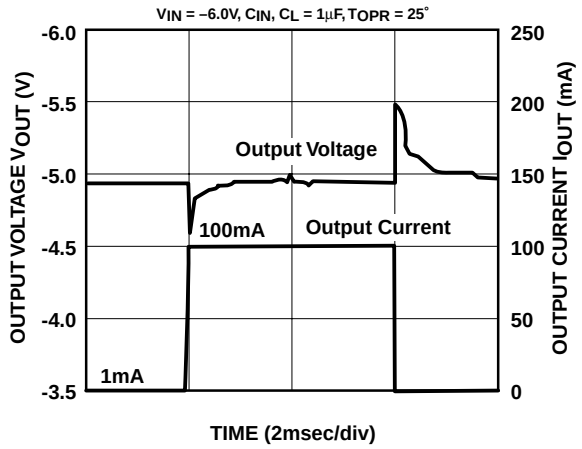
TC595002 (–5.0V)



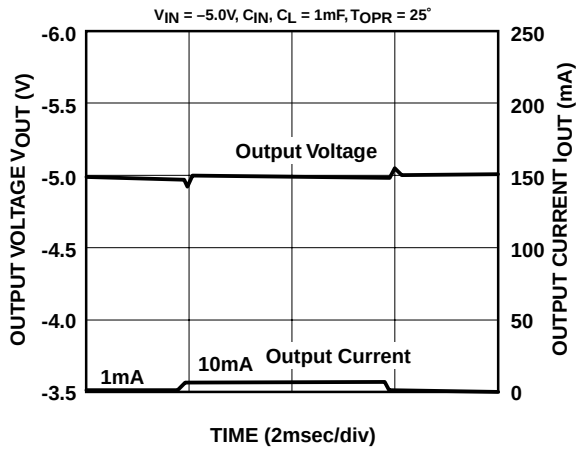
TC595002 (–5.0V)



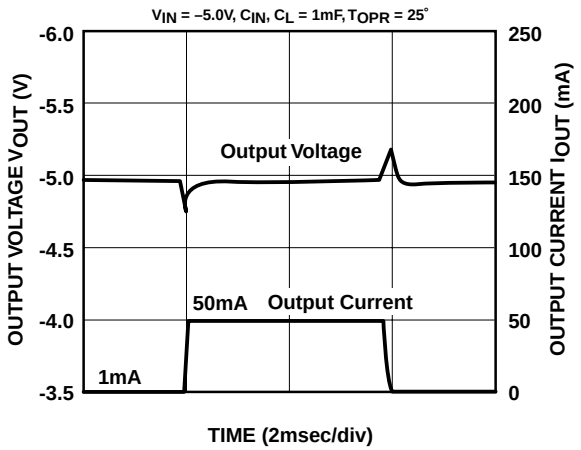
TC595002 (–5.0V)



TC594002 (–4.0V)



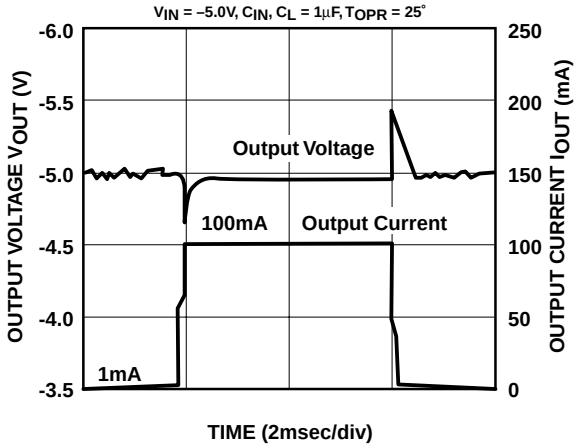
TC594002 (–5.0V)



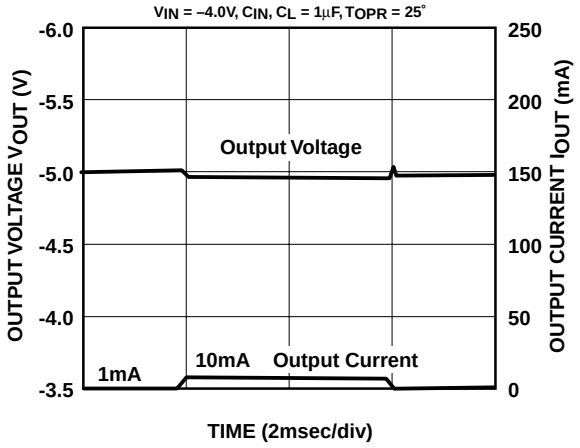
TYPICAL CHARACTERISTICS CURVES (CONT.)

8. LOAD TRANSIENT RESPONSE (CONT.)

TC594002 (–4.0V)



TC593002 (–3.0V)



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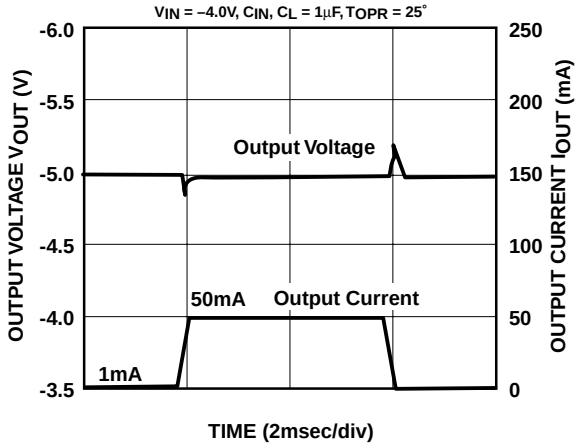
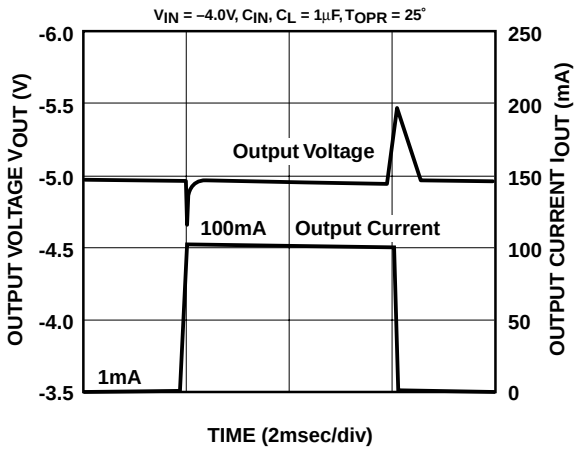
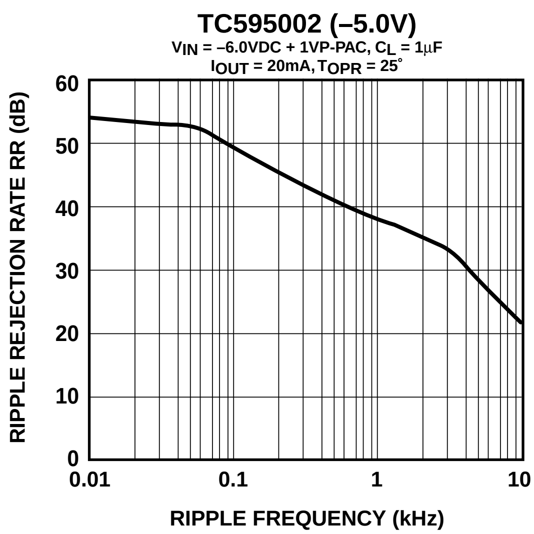


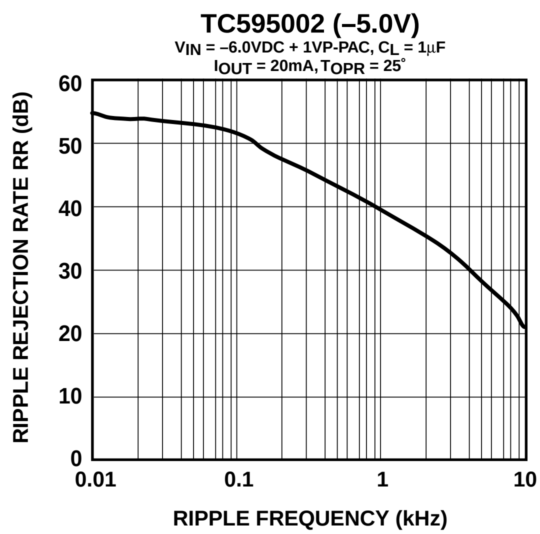
TC593002 (–3.0V)

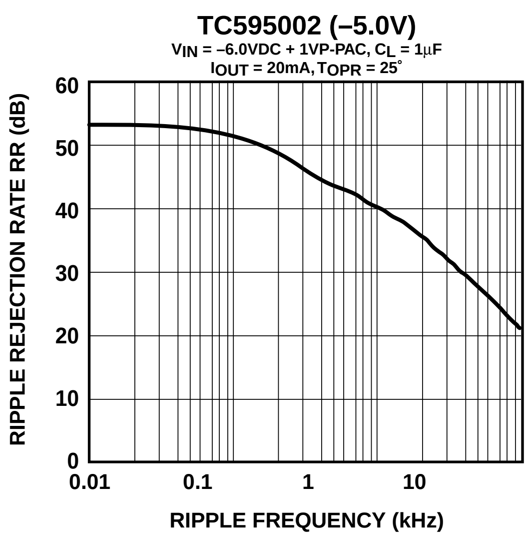


TYPICAL CHARACTERISTICS CURVES (CONT.)

9. RIPPLE REJECTION RATE

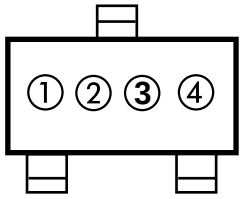






MARKINGS

3-Pin SOT-23A



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

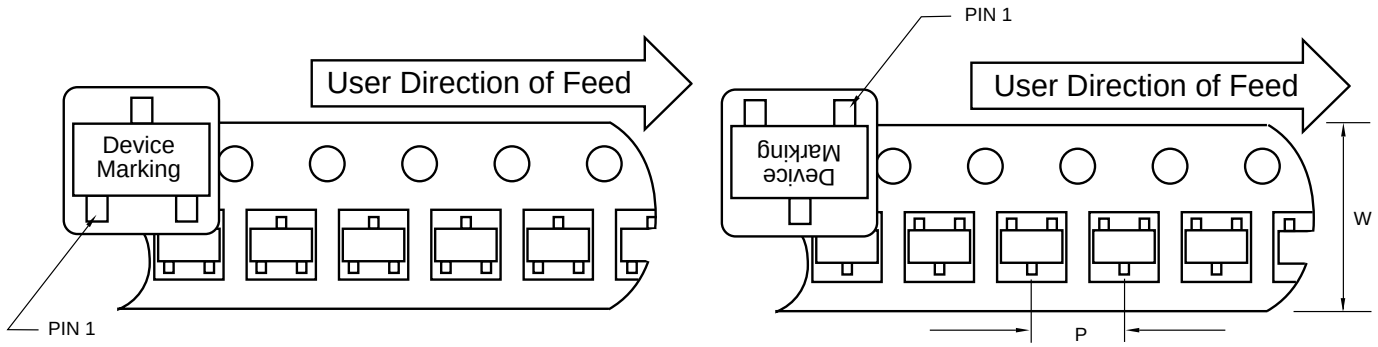
Symbol	Polarity
5	–

④ represents assembly lot code

TC59

TAPING FORMS

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



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

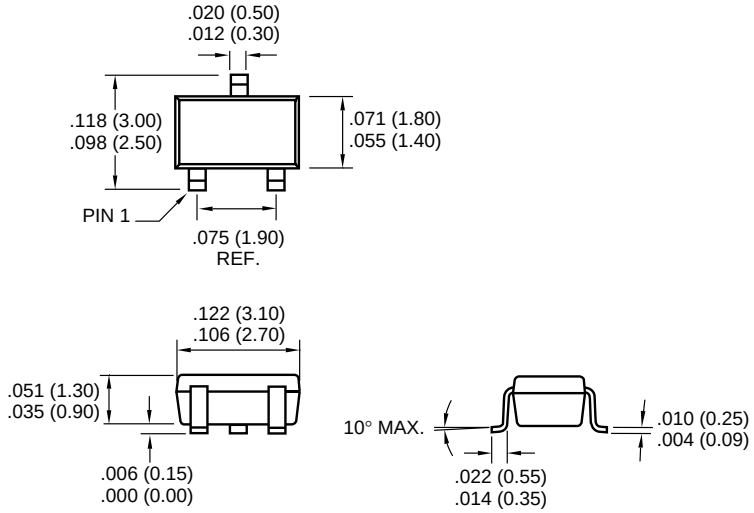
Reverse Reel Component Orientation
for RT Suffix Device
(Mark Upside Down)

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)

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