TelCom Semiconductor, Inc.

TCN4040
TCN4041

PRECISION MICROPOWER SHUNT VOLTAGE REFERENCE

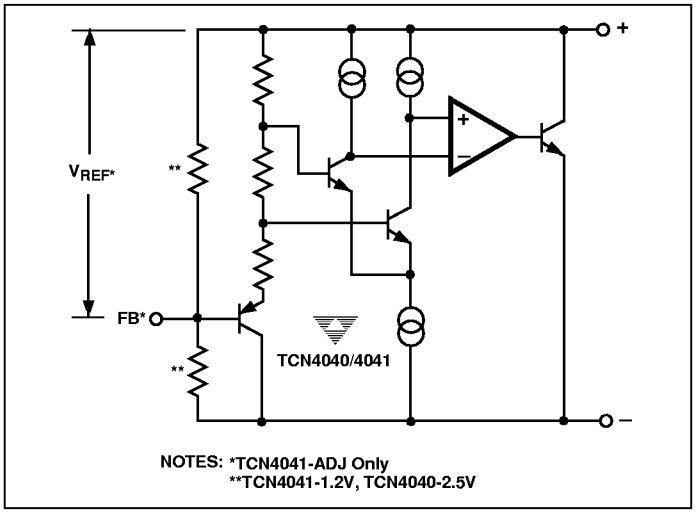
FEATURES

- **Small Packages ... SOT-23B-3, TO-92, and SOIC-8**
- **Output Capacitor Not Required**
- **Handles Capacitive Loads**
- **Adjustable Voltage and Fixed Reverse Breakdown Voltage:**
  TCN4040 .....2.5V
  TCN4041 ..... 1.2V, Adjustable
- **Low Output Noise**
- **Wide Operating Current Range:**
  TCN4040 ..... 60 μA to 15 mA
  TCN4041 ..... 60 μA to 12 mA
- **Extended Operating Temperature Range ..... – 40°C to + 85°C**

APPLICATIONS

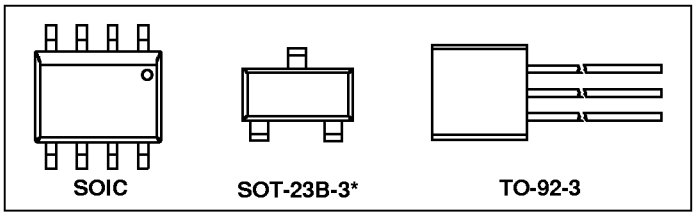
- **Portable, Battery-Powered Equipment**
- **Data Acquisition Systems**
- **Instrumentation**
- **Process Control**
- **Energy Management**
- **Product Testing**
- **Automotive**
- **Precision Audio Components**

FUNCTIONAL BLOCK DIAGRAM



NOTES: *TCN4041-ADJ Only
**TCN4041-1.2V, TCN4040-2.5V

AVAILABLE PACKAGES



GENERAL DESCRIPTION

For applications in tight quarters, the TCN4040/4041 precision voltage references are available in space-saving 3 mm by 1.3 mm SOT-23B-3 surface mount packages. The devices eliminate the need for an external stabilizing capacitor while maintaining stability with any capacitive load.

The minimum operating current for both the TCN4041-1.2V and the TCN4041-ADJ is 60 μA. Both versions have a maximum operating current of 12 mA. Minimum operating current for the TCN4040 also is 60 μA, and maximum operating current is 15 mA.

Low dynamic impedance maintains stable reverse breakdown voltage accuracy over a wide range of operating temperatures and currents.

The TCN4040/4041 are available in small SOT-23B-3, TO-92, and 8-Pin SOIC packages.

ORDERING INFORMATION

PART CODE **TC404X X XXX E XX XXX**

Product Part Number:
4040
4041

Voltage Tolerance Temperature Coefficient Grade:
C: ±0.5%, 100 ppm/°C Max
D: ±1.0%, 150 ppm/°C Max
E: ±2.0%, 150 ppm/°C Max

Grade Output Voltage:
1.2V: TCN4041C/D/E
2.5V: TCN4040C/D/E, TCN4041D
ADJ: TCN4041C/D

Operating Temperature Range:
E: – 40°C to +85°C

Package Type and Pin Count:
NB: SOT-23B-3*
OA: 8-Pin SOIC
ZB: TO-92-3

Taping Direction:
713: Standard Taping
723: Reverse Taping
No Suffix: TO-92 Bulk

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

TCN4040
TCN4041

ABSOLUTE MAXIMUM RATINGS* (Note 1)

Reverse Current. .....20 mA
Forward Current .....10 mA
Power Dissipation (T_A = 25°C) (Note 2)
- 8-Pin SOIC Package .....470 mW
- SOT-23B-3 Package .....230 mW
- TO-92 Package .....440 mW

Storage Temperature ..... – 65°C to + 150°C
Lead Temperature (Soldering, 10 seconds)
- 8-Pin SOIC Package .....+260°C
- SOT-23B-3 Package .....+300°C
- TO-92 Package .....+300°C

ESD Susceptibility
- Human Body Model (Note 3) .....2 kV
- Machine Model (Note 3) 200V

OPERATING RATINGS (Notes 1 and 2)

Temperature Range
- ($T_{MIN} \le T_A \le T_{MAX}$) ..... – 40°C ≤ T_A ≤ +85°C

Reverse Current
- TCN4040 ..... 60 µA to 15 mA
- TCN4041-1.2 ..... 60 µA to 12 mA
- TCN4041-ADJ ..... 60 µA to12 mA

Output Voltage Range
- TCN4041-ADJ ..... 1.24V to 10V

Functional operation above the absolute maximum stress rating is not implied.

NOTES:
1. Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see *Electrical Characteristics*. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.
2. The maximum power dissipation must be derated at elevated temperatures and is dictated by T_{JMAX} (maximum junction temperature), θ_{JA} (junction to ambient thermal resistance), and T_A (ambient temperature). The maximum allowable power dissipation at any temperature is $PD_{MAX} = (T_{JMAX} - T_A) / \theta_{JA}$ or the number given in Absolute Maximum Ratings, whichever is lower. For the TCN4040 and TCN4041, T_{JMAX} = 125°C, and the typical thermal resistance (θ_{JA}), when board mounted, is 185°C/W for the M package, 326°C/W for the SOT-23B-3 package, and 180°C/W with 0.4" lead length and 170°C/W with 0.125" lead length for the TO-92-3 package.
3. The human body model is a 100 pF capacitor discharged through a 1.5 kW resistor into each pin. The machine model is a 200 pF capacitor discharged directly into each pin.

TCN4040-2.5 ELECTRICAL CHARACTERISTICS:

Boldface type specifications apply for $T_A = T_J = T_{MIN}$ to T_{MAX}. All other specifications; $T_A = T_J$ = 25°C. The grades C, D, and E designate initial Reverse Breakdown Voltage tolerances of ±0.5%, ±1.0%, and ±2.0%, respectively, unless otherwise specified.

			GRADE C			GRADE D			GRADE E			
Symbol	**Parameter**	**Test Conditions**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
V_R	Reverse Breakdown Voltage	I_R = 100 µA Notes 4, 5	—	2.500	—	—	2.500	—	—	2.500	—	V
	Reverse Breakdown Voltage Tolerance	I_R = 100 µA Notes 4, 5, 6	— —		±12 **±29**	— —		±25 **±49**	— —	—	±50 **±74**	mV
I_{RMIN}	Minimum Operating Current	Notes 4, 5	— —	45	60 **65**	— —	45	65 **70**	— —	45	65 **70**	µA
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient	I_R = 10 mA I_R = 1 mA I_R = 100 µA Notes 4, 5	—	±20 ±15 ±15	**±100**	—	±20 ±15 ±15	**±150**	—	±20 ±15 ±15	**±150**	ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change	$I_{RMIN} \le I_R \le$ 1 mA Notes 4, 5	— —	0.4	0.8 **1.0**	— —	0.4	1.0 **1.2**	— —	0.4	1.0 **1.2**	mV
		1 mA ≤ $I_R \le$ 15 mA	— —	2.5	6.0 **8.0**	— —	2.5	8.0 **10.0**	— —	2.5	8.0 **10.0**	mV

TCN4040-2.5 ELECTRICAL CHARACTERISTICS (Cont.)

Boldface type specifications apply for $T_A = T_J = T_{MIN}$ to T_{MAX}. All other specifications; $T_A = T_J = 25°C$. The grades C, D, and E designate initial Reverse Breakdown Voltage tolerances of ±0.5%, ±1.0%, and ±2.0%, respectively, unless otherwise specified.

			GRADE C			GRADE D			GRADE E			
Symbol	**Parameter**	**Test Conditions**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120 Hz, $I_{AC} = 0.1\ I_R$ Notes 4, 5	—	0.3	0.9	—	0.3	1.1	—	0.3	1.1	Ω
e_N	Wideband Noise	I_R = 100 µA, 10 Hz ≤ f ≤ 10 kHz Notes 4, 5	—	35	—	—	35	—	—	35	—	μV_{RMS}
ΔV_R	Reverse Breakdown Voltage Long Term Stability	t = 1000 hrs T = 25°C ±0.1°C I_R = 100 µA Notes 4, 5	—	120	—	—	120	—	—	120	—	ppm/°C

NOTES:
4. Typicals are at T_J = 25°C and represent most likely parametric norm.
5. Limits are 100% production tested at 25°C.
6. The boldface (over-temperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance ±[($\Delta V_R/\Delta T$)(65°C)(V_R)]. $\Delta V_R/\Delta T$ is the V_R temperature coefficient, 65°C is the temperature range from –40°C to the reference point of 25°C, and V_R is the reverse breakdown voltage. The total over-temperature tolerance for the different grades are:
   C-grade: ±1.15% = ±0.5% ±100 ppm/°C x 65°C.
   D-grade: ±1.98% = ±1.0% ±150 ppm/°C x 65°C.
   E-grade: ±2.98% = ±2.0% ±150 ppm/°C x 65°C.

TCN4041-1.2V ELECTRICAL CHARACTERISTICS:

Boldface type specifications apply for $T_A = T_J = T_{MIN}$ to T_{MAX}. All other specifications; $T_A = T_J = 25°C$. The grades C, D, and E designate initial Reverse Breakdown Voltage tolerances of ±0.5%, ±1.0%, and ±2.0%, respectively, unless otherwise specified.

			GRADE C			GRADE D			GRADE E			
Symbol	**Parameter**	**Test Conditions**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
V_R	Reverse Breakdown Voltage	I_R = 100 µA Notes 4, 5	—	1.225	—	—	1.225	—	—	1.225	—	V
	Reverse Breakdown Voltage Tolerance	I_R = 100 µA Notes 4, 5, 6	—		±6 **±14**	—		±12 **±24**	—	—	±25 **±36**	mV
I_{RMIN}	Minimum Operating Current	Notes 4, 5	—	45	60 **65**	—	45	65 **70**	—	45	65 **70**	µA
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient	I_R = 10 mA I_R = 1 mA I_R = 100 µA Notes 4, 5	—	±20 ±15 ±15	**±100**	—	±20 ±15 ±15	**±150**	—	±20 ±15 ±15	**±150**	ppm/°C
$\Delta V_R/\Delta I_R$	Reverse Breakdown Voltage Change with Operating Current Change	$I_{RMIN} \le I_R \le 1$ mA Notes 4, 5	—	0.7	1.5 **2.0**	—	0.7	2.0 **2.5**	—	0.7	2.0 **2.5**	mV
		1 mA ≤ I_R ≤ 12 mA	—	2.5	6.0 **8.0**	—	2.5	8.0 **10.0**	—	2.5	8.0 **10.0**	mV

TCN4041-1.2 ELECTRICAL CHARACTERISTICS (Cont.):

Boldface type specifications apply for $T_A = T_J = T_{MIN}$ to T_{MAX}. All other specifications; $T_A = T_J = 25°C$. The grades C, D, and E designate initial Reverse Breakdown Voltage tolerances of ±0.5%, ±1.0%, and ±2.0%, respectively, unless otherwise specified.

			GRADE C			GRADE D			GRADE E			
Symbol	**Parameter**	**Test Conditions**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
Z_R	Reverse Dynamic Impedance	I_R = 1 mA, f = 120Hz, I_{AC} = 0.1 I_R Notes 4, 5	—	0.5	1.5	—	0.5	2.0	—	0.5	2.0	Ω
e_N	Wideband Noise	I_R = 100 µA, 10 Hz ≤ f ≤ 10 kHz Notes 4, 5	—	20	—	—	20	—	—	20	—	µVrms
ΔV_R	Reverse Breakdown Voltage Long Term Stability	t =1000 hrs T = 25°C ±0.1°C I_R =100 µA Notes 4, 5	—	120	—	—	120	—	—	120	—	ppm/°C

NOTES:
4. Typicals are at T_J = 25°C and represent most likely parametric norm.
5. Limits are 100% production tested at 25°C.
6. The boldface (over-temperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance ±[($\Delta V_R/\Delta T$)(65°C)(V_R)]. $\Delta V_R/\Delta T$ is the V_R temperature coefficient, 65°C is the temperature range from – 40°C to the reference point of 25°C, and V_R is the reverse breakdown voltage. The total over-temperature tolerance for the different grades are:
   C-grade: ±1.15% = ±0.5% ±100 ppm/°C x 65°C.
   D-grade: ±1.98% = ±1.0% ±150 ppm/°C x 65°C.
   E-grade: ±2.98% = ±2.0% ±150 ppm/°C x 65°C.

TCN4041-ADJ ELECTRICAL CHARACTERISTICS:

Boldface type specifications apply for $T_A = T_J = T_{MIN}$ to T_{MAX}. All other specifications; $T_A = T_J$ = 25°C, unless otherwise specified (SOT-23B-3, see Note 7), $I_{RMIN} \le I_R \le 12$ mA, $V_{REF} \le V_{OUT} \le$ 0V.The grades C and D designate initial Reverse Breakdown Voltage tolerances of ±0.5% and ±1.0%, respectively, unless otherwise specified.

			GRADE C			GRADE D			
Symbol	**Parameter**	**Test Conditions**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
V_R	Reverse Breakdown Voltage	I_R = 100 µA, V_{OUT} = 5V Notes 4, 5	—	1.233	—	—	1.233	—	V
	Reverse Breakdown Voltage Tolerance	I_R = 100 µA, V_{OUT} = 5V Notes 4, 5, 8	—	—	±6.2 **±14**	—	—	±12 **±24**	mV
I_{RMIN}	Minimum Operating Current	Notes 4, 5	—	45	60 **65**	—	45	65 **70**	µA
$\Delta V_{REF}/\Delta I_R$	Reference Voltage Change with Operating Current Change	$I_{RMIN} \le I_R \le$ 1 mA SOT-23B: $V_{OUT} \ge$ 1.6V Notes 4, 5, 7	—	0.7	1.5 **2.0**	—	0.7	2.0 **2.5**	mV
		$I_{RMIN} \le I_R \le$ 12 mA SOT-23B: $V_{OUT} \ge$ 1.6V Notes 4,5, 7	—	2	4 **6**	—	2	6 **8**	mV
$\Delta V_{REF}/\Delta V_{OUT}$	Reverse Voltage Change with Output Voltage Change	I_R = 1 mA Notes 4, 5	—	– 1.3	– 2.0 **– 2.5**	—	–1.3	– 2.5 **– 3.0**	mV/V

TCN4041-ADJ ELECTRICAL CHARACTERISTICS (Cont.):

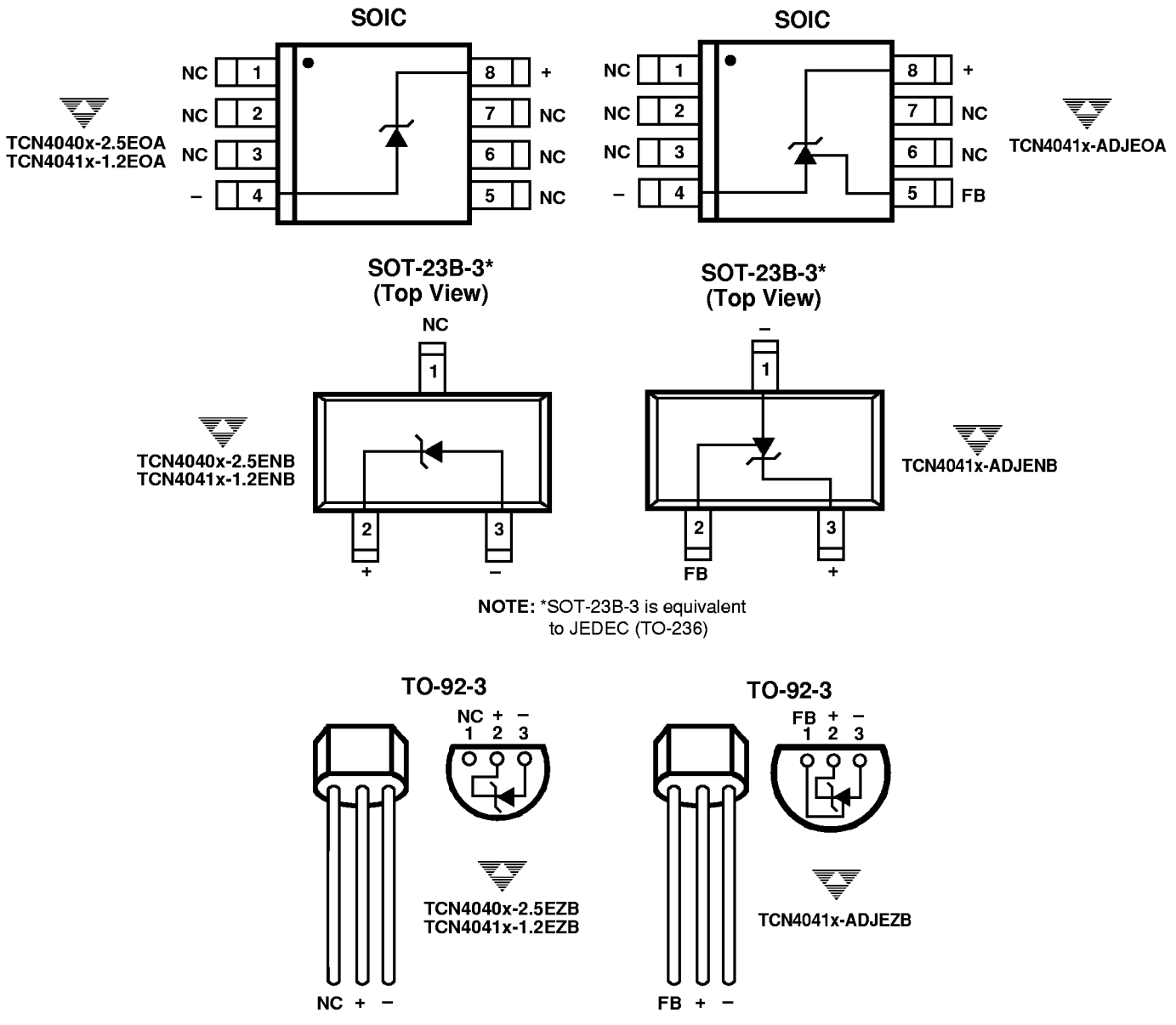
Boldface type specifications apply for $T_A = T_J = T_{MIN}$ to T_{MAX}. All other specifications; $T_A = T_J = 25°C$, unless otherwise specified (SOT-23B-3, see Note 7), $I_{RMIN} \leq I_R \leq 12$ mA, $V_{REF} \leq V_{OUT} \leq 10V$.The grades C and D designate initial Reverse Breakdown Voltage tolerances of ±0.5% and ±1.0%, respectively, unless otherwise specified.

			GRADE C			GRADE D			
Symbol	**Parameter**	**Test Conditions**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
I_{FB}	Feedback Current	Notes 4, 5	—	60	100 **120**	—	60	150 **200**	nA
$\Delta V_R/\Delta T$	Average Reverse Breakdown Voltage Temperature Coefficient	V_{OUT} = 5V, I_R = 10 mA I_R = 1 mA I_R = 100 µA Notes 4, 5	—	±20 ±15 ±15	±**100**	—	±20 ±15 ±15	±**150**	ppm/°C
Z_{OUT}	Dynamic Output Impedance	I_R = 1 mA, f = 120 Hz, I_{AC} = 0.1 I_R , $V_{OUT} = V_{REF}$ V_{OUT} = 10V Notes, 4, 5	—	0.3 2	—	—	0.3 2	—	Ω
e_N	Wideband Noise	I_R = 100 µA, $V_{OUT} = V_{REF}$ 10 Hz ≤ f ≤ 10 kHz Notes 4, 5	—	20	—	—	20	—	μV_{RMS}
ΔV_R	Reverse Voltage Long Term Stability	t =1000 hrs T = 25°C ±0.1°C I_R =100 µA Notes 4, 5	—	120	—	—	120	—	ppm/°C

NOTES:
4. Typicals are at T_J = 25°C and represent most likely parametric norm.
5. Limits are 100% production tested at 25°C.
6. The boldface (over-temperature) limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance ±[($\Delta V_R/\Delta T$)(65°C)(V_R)]. $\Delta V_R/\Delta T$ is the V_R temperature coefficient, 65°C is the temperature range from –40°C to the reference point of 25°C, and V_R is the reverse breakdown voltage. The total over-temperature tolerance for the different grades are:
   C-grade: ±1.15% = ±0.5% ±100 ppm/°C x 65°C
   D-grade: ±1.98% = ±1.0% ±150 ppm/°C x 65°C
   E-grade: ±2.98% = ±2.0% ±150 ppm/°C x 65°C
7. When $V_{OUT} \leq 1.6V$, the TCN4041-ADJ in the SOT-23B-3 package must operate at reduced I_R. This is caused by the series resistance of the die attach between the die (-) output and the package (-) output pin. See the Output Saturation (SOT-23-B only) curve in the *Typical Characteristics* section.
8. Reference voltage and temperature coefficient will change with output voltage. See *Typical Characteristics* curves.

TCN4040
TCN4041

PIN CONFIGURATIONS



PIN DESCRIPTION

Pin No. 8-Pin SOIC 1.2V & 2.5V	Pin No. 8-Pin SOIC ADJ	Pin No. SOT-23B-3 1.2V & 2.5V	Pin No. SOT-23-B-3 ADJ	Pin No. TO-92-3 1.2V & 2.5V	Pin No. TO-92-3 ADJ	Symbol	Description
1, 2, 3, 5, 6, 7	1, 2, 3, 6, 7	1		1		NC	No connection
4	4	3	1	3	3	–	Negative terminal
8	8	2	3	2	2	+	Positive terminal
	5		2		1	FB	Feedback current

APPLICATIONS INFORMATION

Available in space-saving SOT-23B-3 surface mount packages, the TCN4040/41 are precision micro-power bandgap shunt voltage references. They are designed for stable operation without an external capacitor connected between the "+" pin and the "–" pin. The TCN4040/4041 also remain stable, however, if a bypass capacitor is used. The devices are available in either a fixed 1.2V or an adjustable reverse breakdown voltage (TCN4041); or a fixed voltage of 2.5V (TCN4040). The minimum operating current is 60 µA, and the maximum operating current is 12 mA for both TCN4041 options and 15 mA for the TCN4040.

TCN4040/4041s in the SOT-23B-3 package have pin 1 connected as the "–" terminal of a parasitic Schottky diode. (Die attach interface contact). Therefore, pin 1 of the TCN4041-1.2 and TCN4040 must be left floating or connected to pin 3, and pin 1 on the TCN4041-ADJ is the (–) output.

In a conventional shunt regulator application, an external series resistor (R_S) is connected between the supply voltage and the TCN4040/4041 (Figure 1). R_S determines the current that flows through the load (I_L) and the TCN4040/4041 (I_Q). Even when the supply voltage is at its minimum, and the load current is at its maximum value, R_S should be small enough to supply at least the minimum acceptable I_Q to the TCN4040/4041 since load current and supply voltage may vary. Conversely, when the supply voltage is at its maximum and I_L is at its minimum, R_S should be large enough that the current flowing through the TCN4041 is less than 12 mA, and current flowing through the TCN4040 is less than 15 mA.

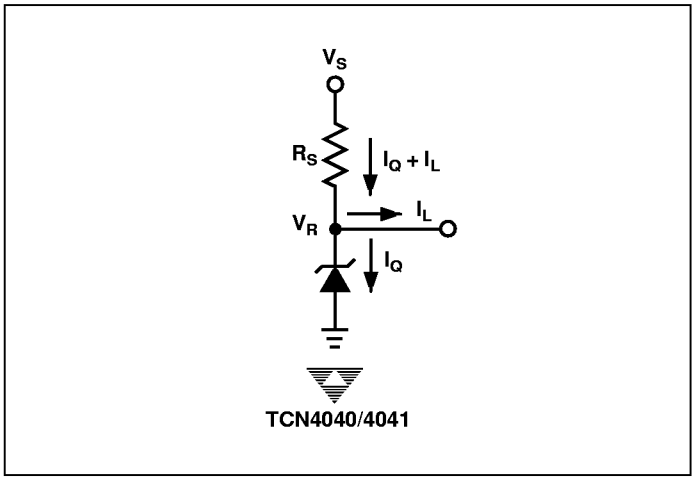


Figure 1. Shunt Regulator

R_S is determined by the supply voltage, (V_S), the load and operating current, (I_L and I_Q), and the TCN4040/4041's reverse breakdown voltage, V_R.

$$R_S = \frac{V_S - V_R}{I_L + I_Q}$$

Output voltage on the TCN4041-ADJ can be adjusted to any value between 1.24V and 10V. It is a function of the internal reference voltage (V_{REF}) and the ratio of the external feedback resistors (see Figure 2). The output can be found with the equation (where V_{OUT} is the desired output voltage):

$$V_{OUT} = V_{REF} (R2/R1 + 1)$$

Equation 1.

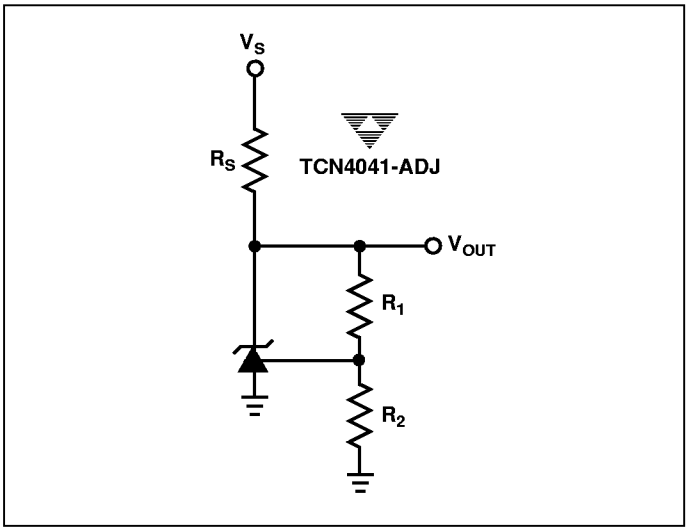


Figure 2. Adjustable Shunt

The value of the internal V_{REF} is a function of V_{OUT}. The "corrected" V_{REF} can be determined by (where V_{OUT} is the desired output voltage):

$$V_{REF} = V_{OUT} (\Delta V_{REF}/\Delta V_{OUT}) + V_Y$$

Equation 2.

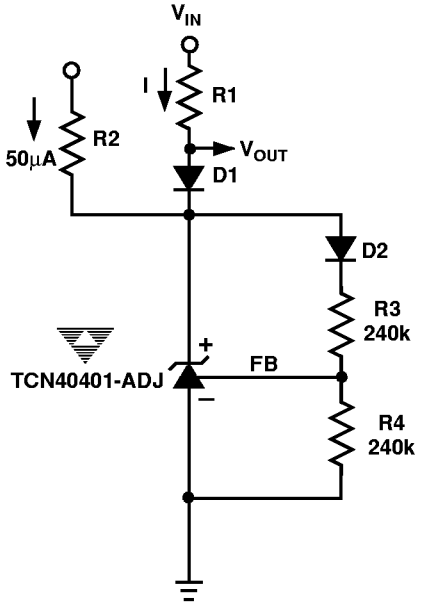
$\Delta V_{REF}/\Delta V_{OUT}$ is typically –1.3 mV/V, and V_Y = 1.240V. Replace the value of V_{REF} in Equation 1 with the value determined using Equation 2.

The actual output voltage can deviate from that predicted by the typical $\Delta V_{REF}/\Delta V_{OUT}$ in Equation 2. The worst case $\Delta V_{REF}/\Delta V_{OUT}$ for C-grade parts is –2.5 mV/V and V_Y = 1.246V; for D-grade, the worst case is –3.0 mV/V and V_Y = 1.248V.

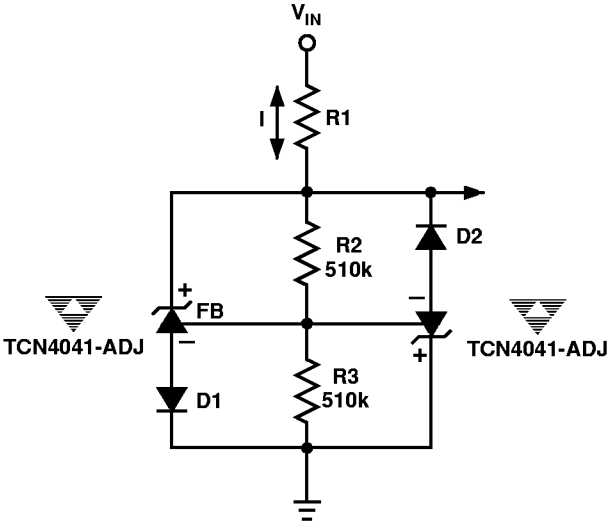
The difference in output voltage resulting from typical worst case values are shown in the following example: Let V_{OUT} = +9V. Using the typical value of $\Delta V_{REF}/\Delta V_{OUT}$, V_{REF} is 1.228; choosing a value of R1 = 10 kΩ, R2 = 63.272 kΩ.

The output voltage, when using worst case $\Delta V_{REF}/\Delta V_{OUT}$ for C-grade and D-grade parts, is 8.965V and 8.946V, respectively. This could result in errors as large as 0.39% for C-grade, and 0.59% for D-grade parts. However, resistor values resulting from the typical value of $\Delta V_{REF}/\Delta V_{OUT}$ will work most of the time, requiring no additional adjustments.

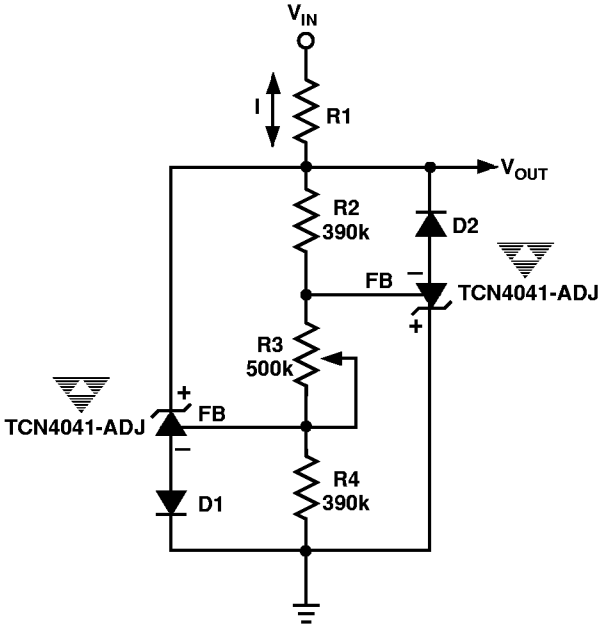
TYPICAL APPLICATIONS



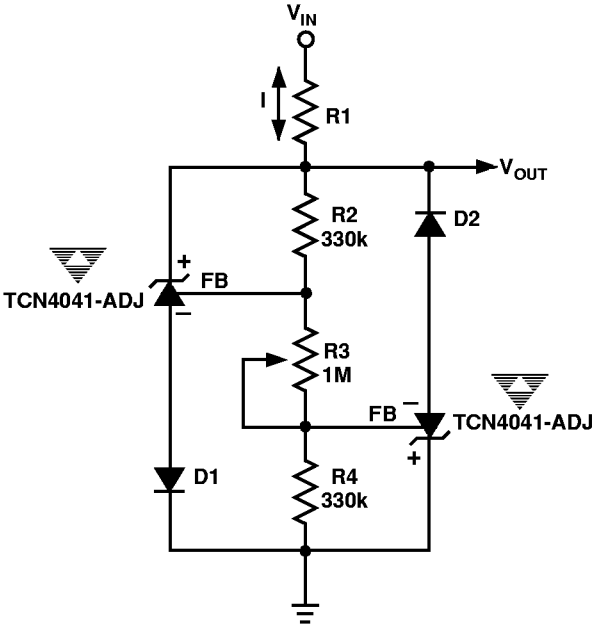
Fast Positive Clamp
$2.4V + \Delta V_{D1}$



Bidirectional Clamp

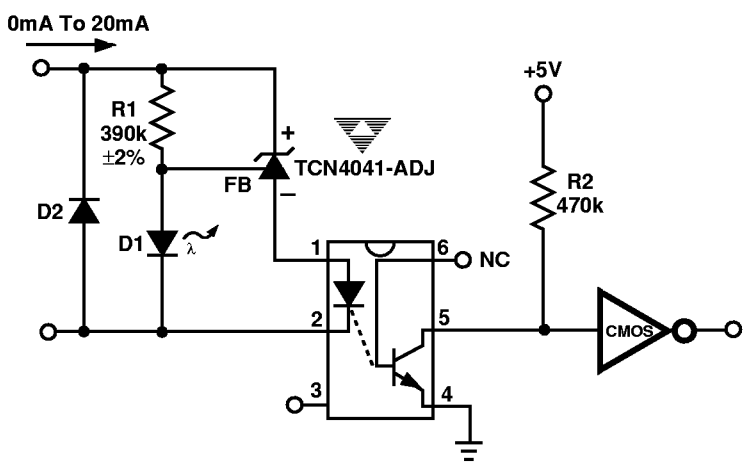


Bidirectional Adjustable Clamp
±18V to ± 2.4V

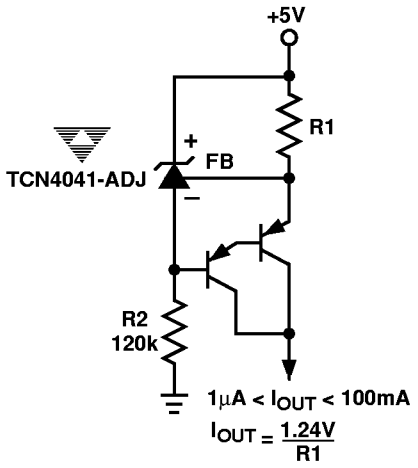


Bidirectional Adjustable Clamp
± 2.4V to ±6V

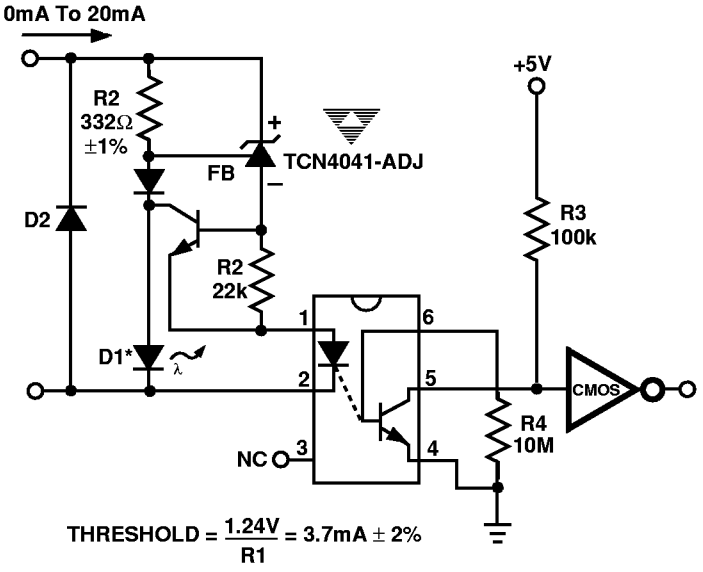
TYPICAL APPLICATIONS (Cont.)



Simple Floating Current Detector

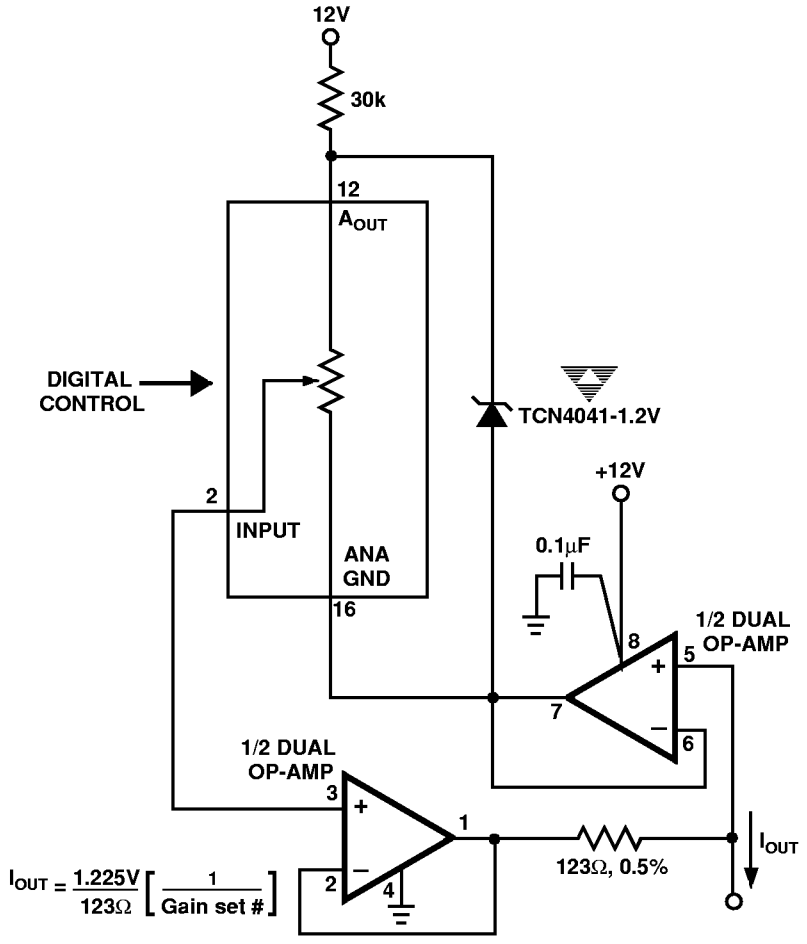


Current Source

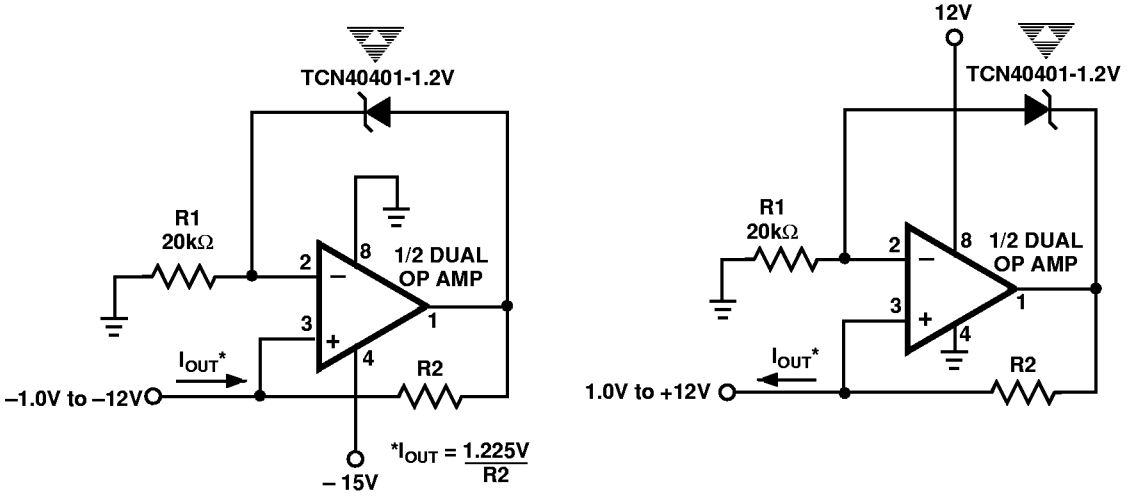


Precision Floating Current Detector

TYPICAL APPLICATIONS (Cont.)



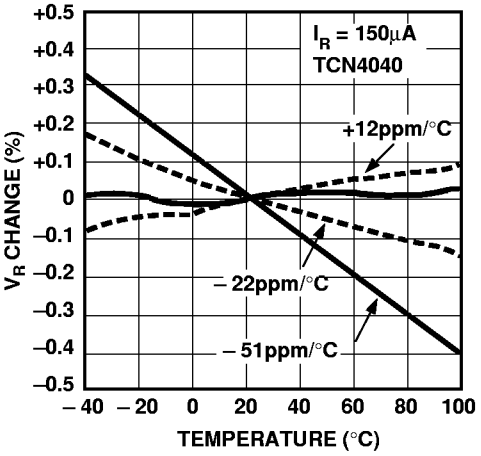
Programmable Current Source



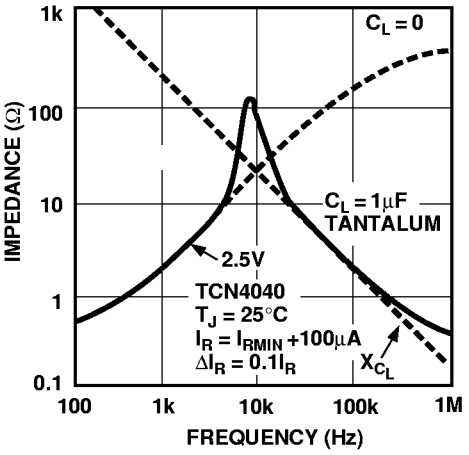
Precision 1μA to 1mA Current Sources

TYPICAL CHARACTERISTICS

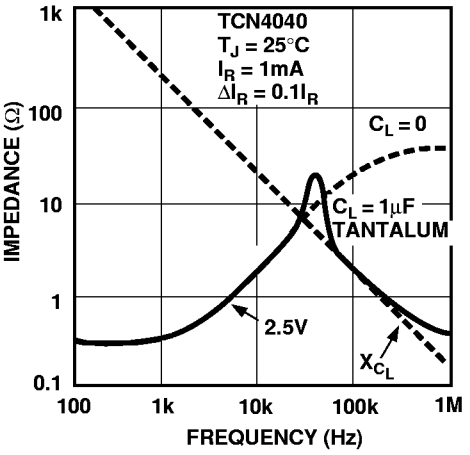
Temperature Drift for Different Average Temperature Coefficient



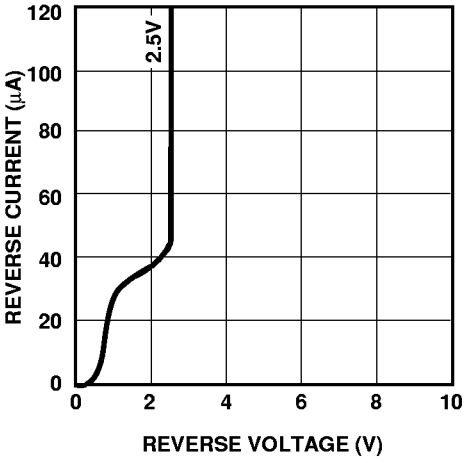
Output Impedance vs. Frequency



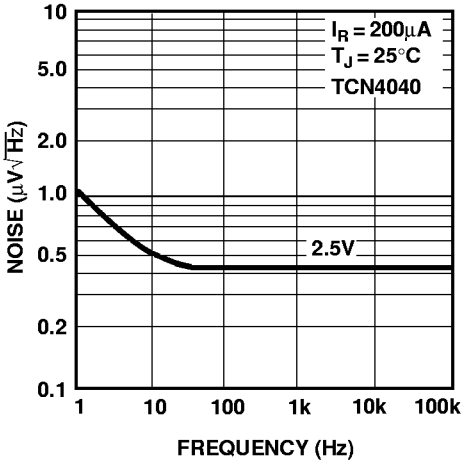
Output Impedance vs. Frequency



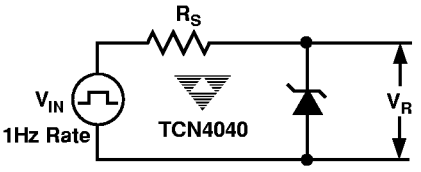
Reverse Characteristics and Minimum Operating Current

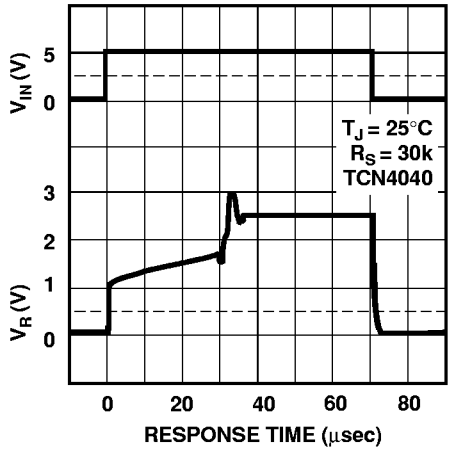


Noise Voltage vs. Frequency



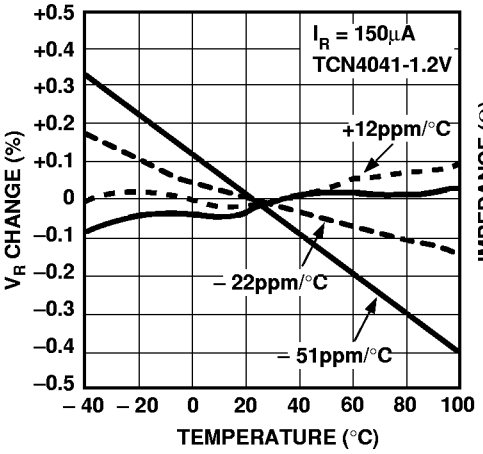
Test Circuit



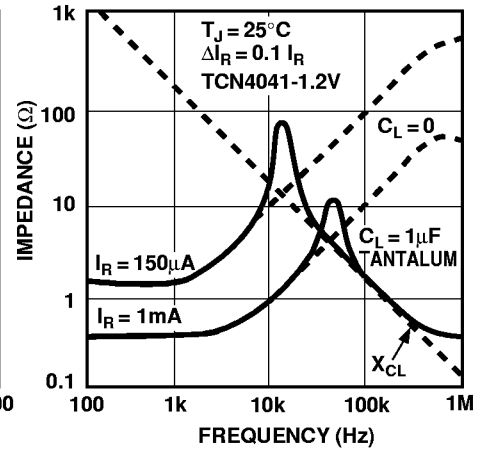


TYPICAL CHARACTERISTICS

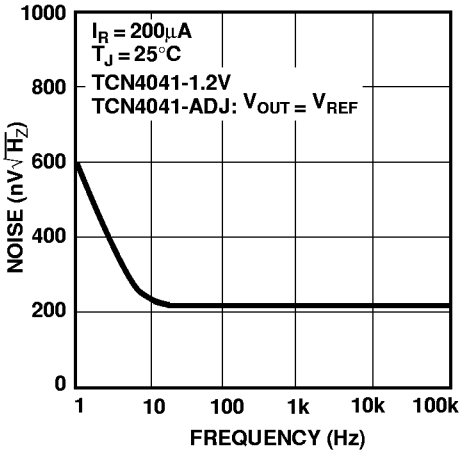
Temperature Drift for Different Average Temperature Coefficient



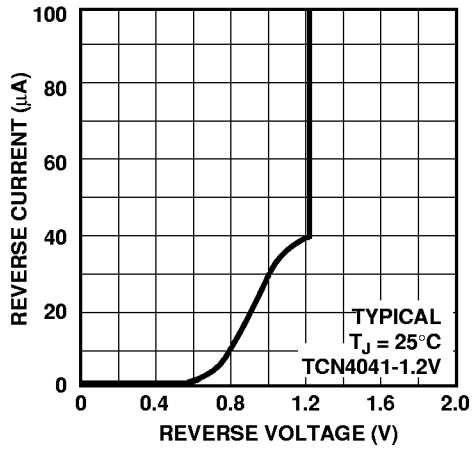
Output Impedance vs. Frequency

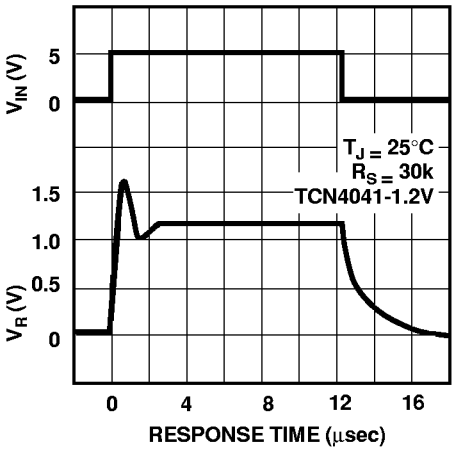


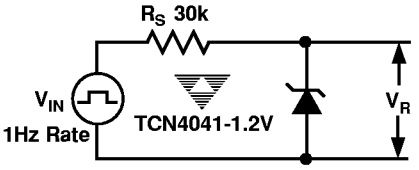
Noise Voltage



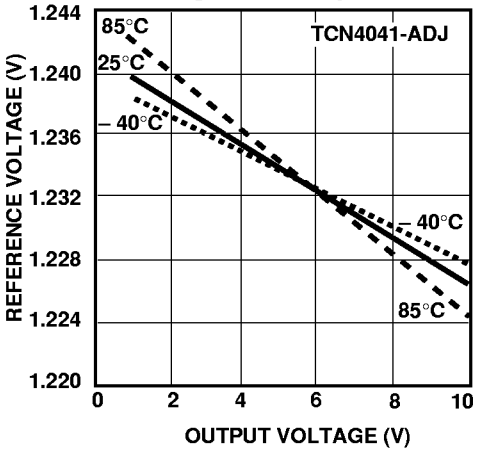
Reverse Characteristics and Minimum Operating Current



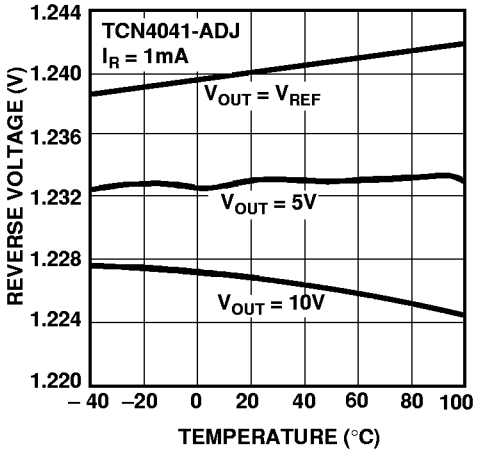




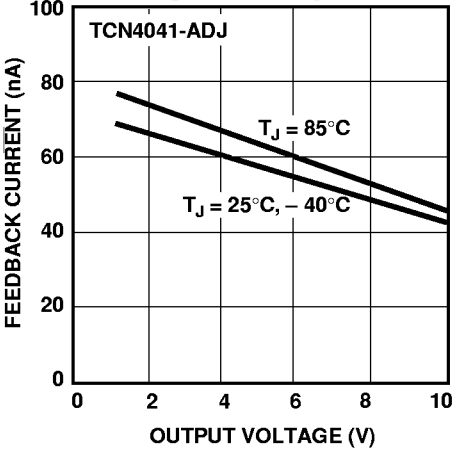
Reference Voltage vs. Output Voltage and Temperature



Reference Voltage vs. Temperature and Output Voltage

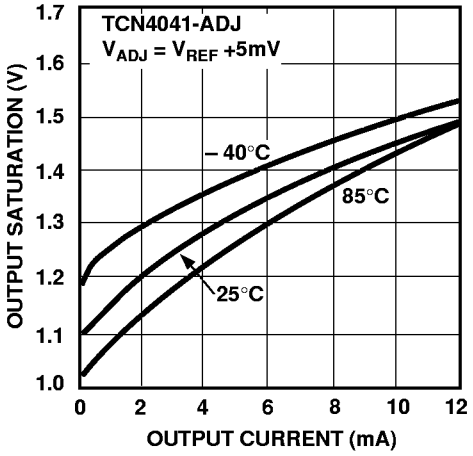


Feedback Current vs. Output Voltage and Temperature

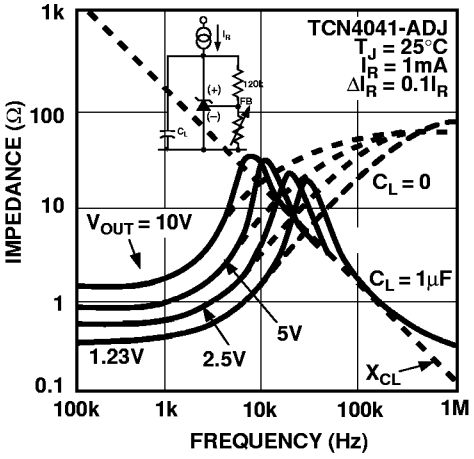


TYPICAL CHARACTERISTICS (CONT.)

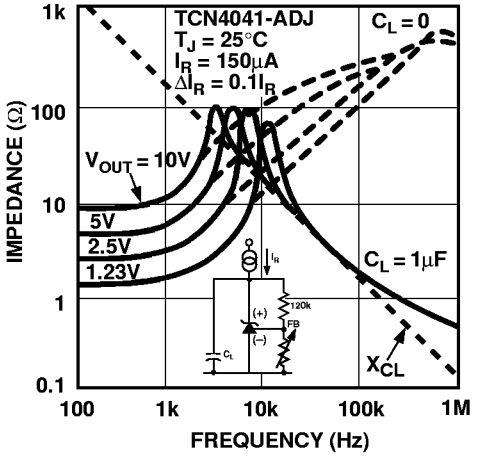
Output Saturation (SOT-23B-3 Only)



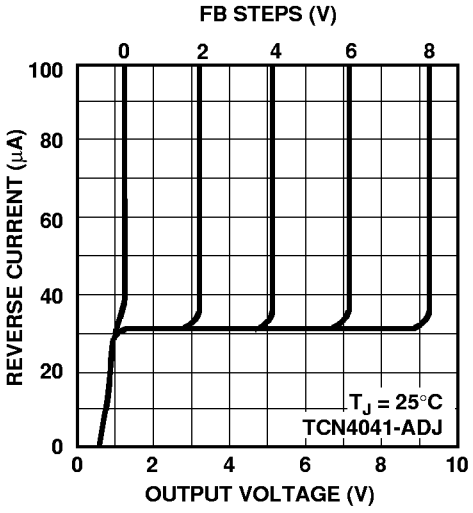
Output Impedance vs. Frequency

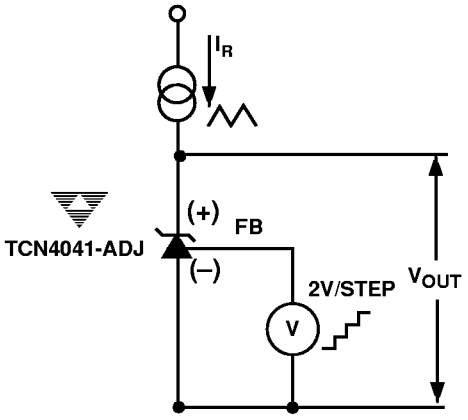


Output Impedance vs. Frequency

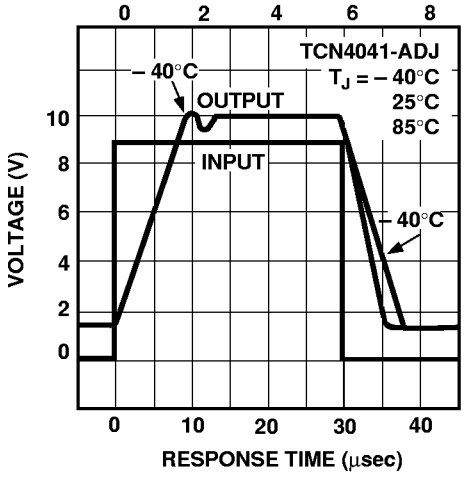


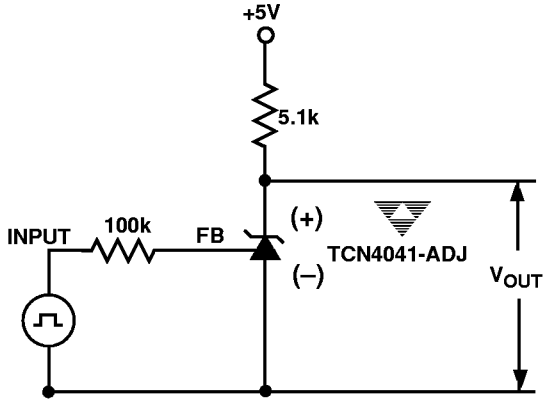
Reverse Characteristics





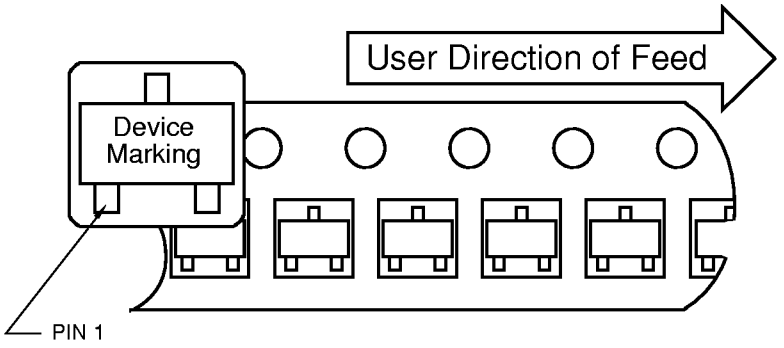
Large Signal Response





TAPING FORM

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



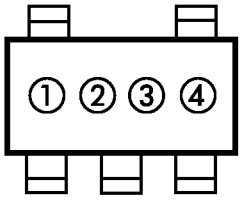
Standard Reel Component Orientation
for 713 or TR Suffix Device
(Mark Right Side Up)

Tape and Reel Specifications Table

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

MARKING

SOT-23B-3



Only three fields of marking are possible on the SOT-23B-3's small surface. The meanings of the three fields are as follows:

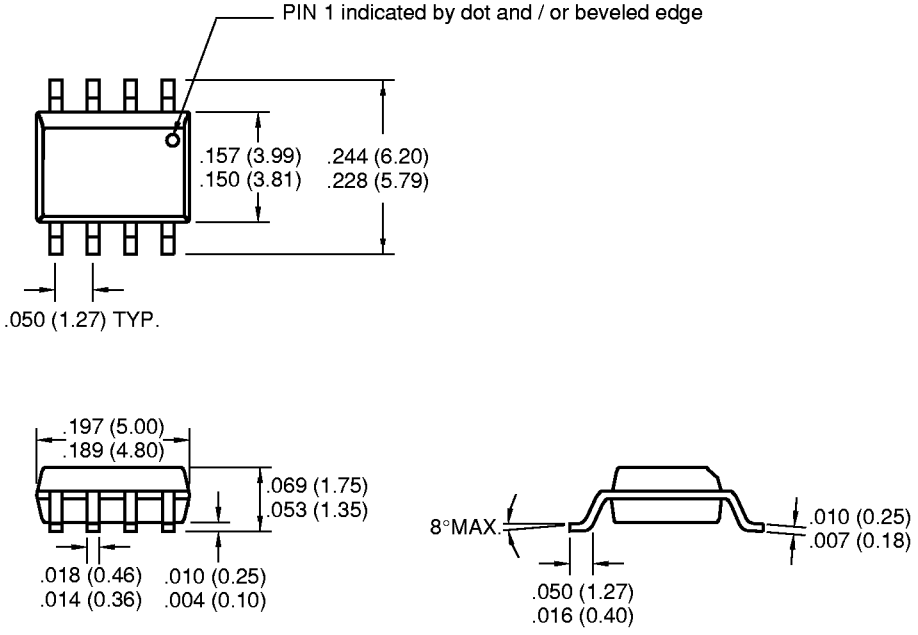
First field (fixed):
TBD
Second Field:
TBD
Third Field:
TBD

Example: Package marking "TBD" indicates…

TCN4041 (V)	Code
1.2	H1
ADJ	H2

PACKAGE DIMENSIONS

8-Pin SOIC

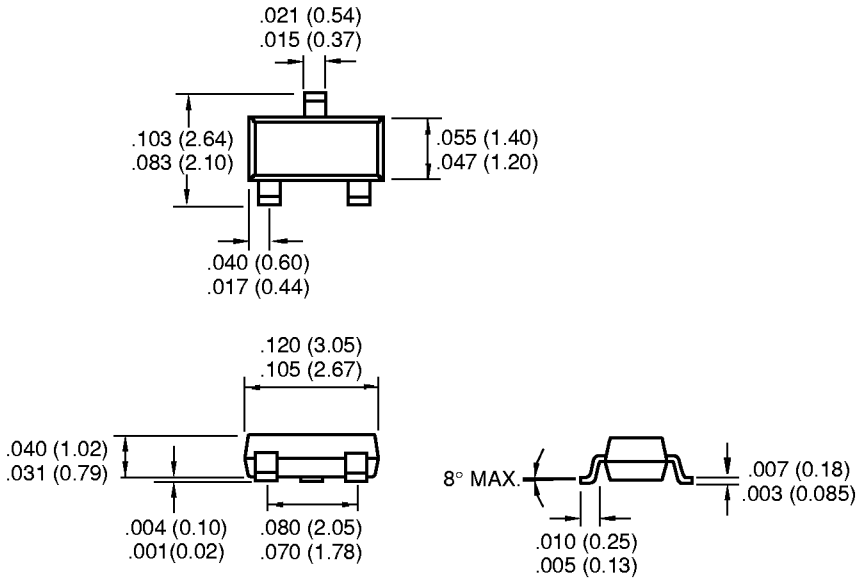


NOTE: *SOT-23B-3 is equivalent to the JEDEC (TO-236)

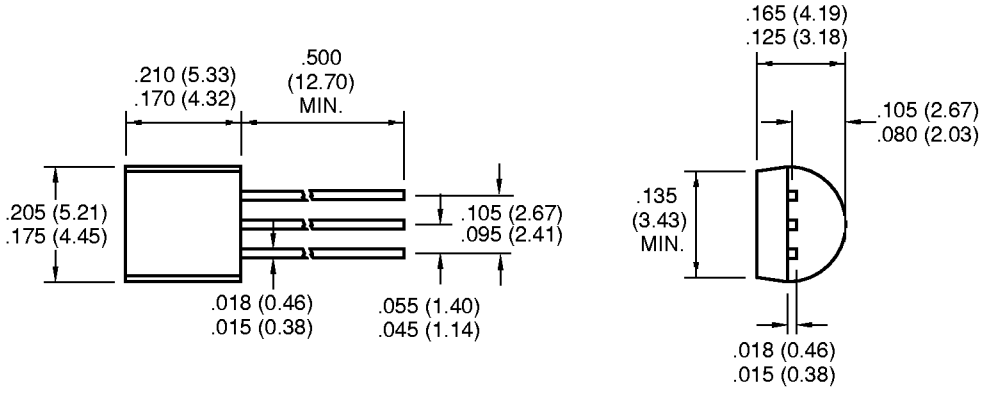
Dimensions: inches (mm)

PACKAGE DIMENSIONS (CONT.)

SOT-23B-3*



TO-92-3



Dimensions: inches (mm)

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