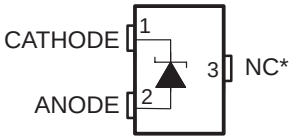
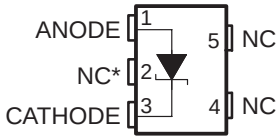
- **1.225-V Fixed and Adjustable Outputs (1.225 V to 10 V)**
- **Tight Output Tolerances and Low Temperature Coefficient**
  - **Max 0.1%, 100 ppm/°C − A Grade**
  - **Max 0.2%, 100 ppm/°C − B Grade**
  - **Max 0.5%, 100 ppm/°C − C Grade**
  - **Max 1.0%, 150 ppm/°C − D Grade**
- **Low Output Noise . . . 20 μV_{RMS} (Typ)**
- **Wide Operating Current Range . . . 60 μA to 12 mA**
- **Stable With All Capacitive Loads; No Output Capacitor Required**
- **Available in**
  - **Industrial Temperature: −40°C to 85°C**
  - **Extended Temperature: −40°C to 125°C**
- **Applications**
  - **Data-Acquisition Systems**
  - **Power Supplies and Power-Supply Monitors**
  - **Instrumentation and Test Equipment**
  - **Process Control**
  - **Precision Audio**
  - **Automotive Electronics**
  - **Energy Management/Metering**
  - **Battery-Powered Equipment**

1.2 V . . . DBZ (SOT-23) PACKAGE (TOP VIEW)



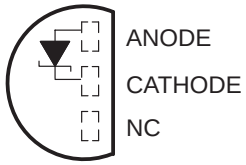
NC − No internal connection
* This pin is connected internally to ANODE via die substrate; leave open or connect to ANODE.

1.2 V . . . DCK (SC-70) PACKAGE (TOP VIEW)



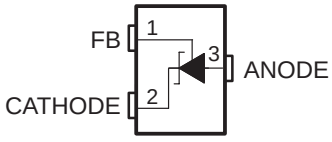
NC − No internal connection
* This pin is connected internally to ANODE via die substrate; leave open or connect to ANODE.

1.2 V . . . LP (TO-92/TO-226) PACKAGE (TOP VIEW)

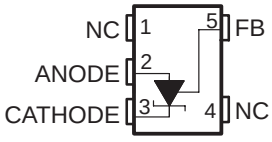


NC − No internal connection

Adjustable . . . DBZ (SOT-23) PACKAGE (TOP VIEW)

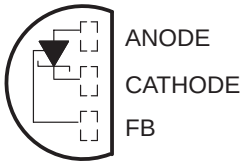


Adjustable . . . DCK (SC-70) PACKAGE (TOP VIEW)



NC − No internal connection

Adjustable . . . LP (TO-92/TO-226) PACKAGE (TOP VIEW)



PRODUCT PREVIEW

description/ordering information

The LM4041 series of shunt voltage references are versatile, easy-to-use references with a vast array of applications. They require no external resistors or capacitors for operation and are stable with all capacitive loads. Additionally, the reference offers low dynamic impedance, low noise, and a low temperature coefficient to ensure a stable output voltage over a wide range of operating currents and temperatures. The LM4041 uses fuse and Zener-zap reverse breakdown voltage trim during wafer sort to offer four output voltage tolerances, ranging from 0.1% (max) for the A grade to 1% (max) for the D grade. Thus, a great deal of flexibility is offered to designers in choosing the best cost-to-performance ratio for their applications. The LM4041 is available in a fixed (1.225 V nominal) or an adjustable version (which requires an external resistor divider to set the output to a value between 1.225 V and 10 V).

Packaged in space-saving SC-70 and SOT-23-3 and operating from a minimum current of 60 to 100 μA, the LM4041 also is ideal for portable applications. The TO-92 package also is available for through-hole packaging needs. The LM4041xI is characterized for operation over an ambient temperature range of −40°C to 85°C. The LM4041xQ is characterized for operation over an ambient temperature range of −40°C to 125°C.

ORDERING INFORMATION

T_A	DEVICE GRADE	V_Z	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
−40°C to 85°C	A grade: 0.1% initial accuracy and 100 ppm/°C temperature coefficient	1.2 V	SC-70 (DCK)	Reel of 3000	LM4041A12IDCKR	
				Reel of 250	LM4041A12IDCKT	
			SOT-23-3 (DBZ)	Reel of 3000	LM4041A12IDBZR	
				Reel of 250	LM4041A12IDBZT	
			TO-92/TO-226 (LP)	Bulk of 1000	LM4041A12ILP	
				Ammo pack of 2000	LM4041A12ILPM	
				Reel of 2000	LM4041A12ILPR	
	B grade: 0.2% initial accuracy and 100 ppm/°C temperature coefficient	ADJ	SC-70 (DCK)	Reel of 3000	LM4041BIDCKR	
				Reel of 250	LM4041BIDCKT	
			SOT-23-3 (DBZ)	Reel of 3000	LM4041BIDBZR	
				Reel of 250	LM4041BIDBZT	
			TO-92/TO-226 (LP)	Bulk of 1000	LM4041BILP	
				Ammo pack of 2000	LM4041BILPM	
				Reel of 2000	LM4041BILPR	
		1.2 V	SC-70 (DCK)	Reel of 3000	LM4041B12IDCKR	
				Reel of 250	LM4041B12IDCKT	
			SOT-23-3 (DBZ)	Reel of 3000	LM4041B12IDBZR	
				Reel of 250	LM4041B12IDBZT	
			TO-92/TO-226 (LP)	Bulk of 1000	LM4041B12ILP	
				Ammo pack of 2000	LM4041B12ILPM	
				Reel of 2000	LM4041B12ILPR	
	C grade: 0.5% initial accuracy and 100 ppm/°C temperature coefficient	ADJ	SC-70 (DCK)	Reel of 3000	LM4041CIDCKR	
				Reel of 250	LM4041CIDCKT	
			SOT-23-3 (DBZ)	Reel of 3000	LM4041CIDBZR	
				Reel of 250	LM4041CIDBZT	
			TO-92/TO-226 (LP)	Bulk of 1000	LM4041CILP	
				Ammo pack of 2000	LM4041CILPM	
				Reel of 2000	LM4041CILPR	
		1.2 V	SC-70 (DCK)	Reel of 3000	LM4041C12IDCKR	
				Reel of 250	LM4041C12IDCKT	
			SOT-23-3 (DBZ)	Reel of 3000	LM4041C12IDBZR	
				Reel of 250	LM4041C12IDBZT	
			TO-92/TO-226 (LP)	Bulk of 1000	LM4041C12ILP	
				Ammo pack of 2000	LM4041C12ILPM	
				Reel of 2000	LM4041C12ILPR	

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

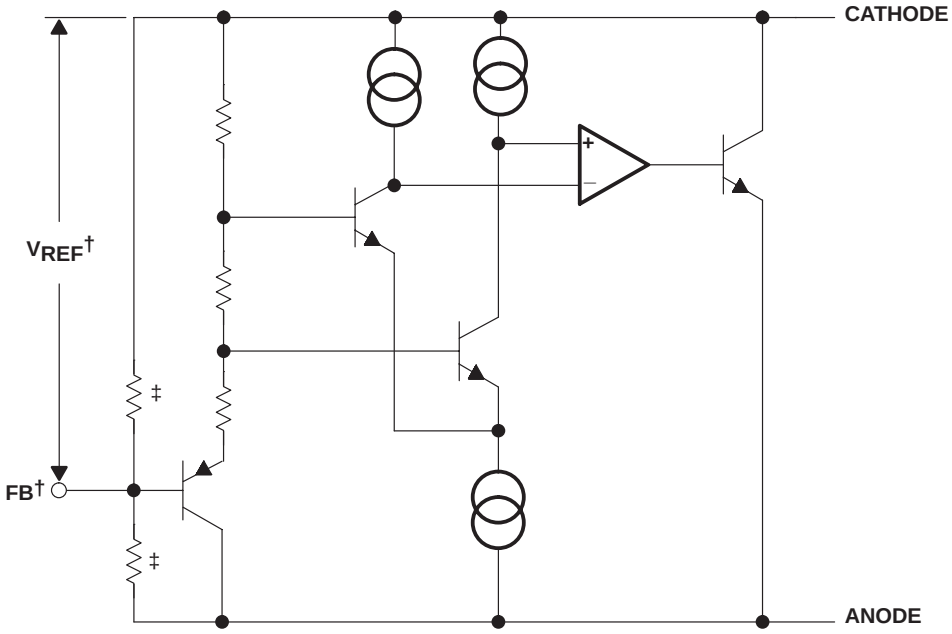
ORDERING INFORMATION

T_A	DEVICE GRADE	V_Z	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
−40°C to 85°C	D grade: 1.0% initial accuracy and 150 ppm/°C temperature coefficient	ADJ	SC-70 (DCK)	Reel of 3000	LM4041DIDCKR	
				Reel of 250	LM4041DIDCKT	
			SOT-23-3 (DBZ)	Reel of 3000	LM4041DIDBZR	
				Reel of 250	LM4041DIDBZT	
			TO-92/TO-226 (LP)	Bulk of 1000	LM4041DILP	
				Ammo pack of 2000	LM4041DILPM	
				Reel of 2000	LM4041DILPR	
		1.2 V	SC-70 (DCK)	Reel of 3000	LM4041D12IDCKR	
				Reel of 250	LM4041D12IDCKT	
			SOT-23-3 (DBZ)	Reel of 3000	LM4041D12IDBZR	
				Reel of 250	LM4041D12IDBZT	
			TO-92/TO-226 (LP)	Bulk of 1000	LM4041D12ILP	
				Ammo pack of 2000	LM4041D12ILPM	
				Reel of 2000	LM4041D12ILPR	
−40°C to 125°C	C grade: 0.5% initial accuracy and 100 ppm/°C temperature coefficient	ADJ	SOT-23-3 (DBZ)	Reel of 3000	LM4041CQDBZR	
				Reel of 250	LM4041CQDBZT	
		1.2 V	SOT-23-3 (DBZ)	Reel of 3000	LM4041C12QDBZR	
				Reel of 250	LM4041C12QDBZT	
	D grade: 1.0% initial accuracy and 150 ppm/°C temperature coefficient	ADJ	SOT-23-3 (DBZ)	Reel of 3000	LM4041DQDBZR	
				Reel of 250	LM4041DQDBZT	
		1.2 V	SOT-23-3 (DBZ)	Reel of 3000	LM4041D12QDBZR	
				Reel of 250	LM4041D12QDBZT	

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

PRODUCT PREVIEW

functional block diagram



† LM4041x (ADJ) only
‡ LM4041x12 only

absolute maximum ratings over the free-air temperature range (unless otherwise noted)†

Continuous cathode voltage, V_Z . . . . . 15 V
Continuous cathode current, I_Z . . . . . −10 mA to 25 mA
Package thermal impedance, θ_{JA} (see Notes 1 and 2): DBZ package . . . . . 206°C/W
DCK package . . . . . 252°C/W
LP package . . . . . 156°C/W
Operating virtual junction temperature, T_J . . . . . 150°C
Storage temperature range, T_{stg} . . . . . −65°C to 110°C

† Stresses beyond 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 beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. Maximum power dissipation is a function of $T_J(max)$, θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

			MIN	MAX	UNIT
I_Z	Cathode current		‡	12	mA
V_Z	Reverse breakdown voltage (adjustable version)			10	V
T_A	Free-air temperature range	LM4041 (I temperature)	−40	85	°C
		LM4041 (Q temperature)	−40	125	

‡ See parametric tables

LM4041x12I electrical characteristics, full-range T_A = −40°C to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	LM4041A12I			LM4041B12I			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_Z	Reverse breakdown voltage	I_Z = 100 μA	25°C		1.225			1.225		V
	Reverse breakdown voltage tolerance	I_Z = 100 μA	25°C	−1.2		1.2	−2.4		2.4	mV
			Full range	−9.2		9.2	−10.4		10.4	
$I_{Z,min}$	Minimum cathode current		25°C		45	75		45	75	μA
			Full range			80			80	
α_{VZ}	Average temperature coefficient of reverse breakdown voltage	I_Z = 10 mA	25°C		±20			±20		ppm/°C
		I_Z = 1 mA	25°C		±15			±15		
			Full range			±100			±100	
		I_L = 100 μA	25°C		±15			±15		
$\Delta V_Z/\Delta I_Z$	Reverse breakdown voltage change with cathode current change	$I_{Z,min} < I_Z < 1$ mA	25°C		0.7	1.5		0.7	1.5	mV
			Full range			2			2	
		1 mA < I_Z < 12 mA	25°C		4	6		4	6	
			Full range			8			8	
z_Z	Reverse dynamic impedance	I_Z = 1 mA, f = 120 Hz, I_{AC} = 0.1 I_Z	25°C		0.5	1.5		0.5	1.5	Ω
e_N	Wideband noise	I_Z = 100 μA, 10 Hz ≤ f ≤ 10 kHz	25°C		20			20		μV_{RMS}
	Long-term stability of reverse breakdown voltage	t = 1000 h, T_A = 25°C ± 0.1°C, I_Z = 100 μA	25°C		120			120		ppm

PRODUCT PREVIEW

LM4041x12I electrical characteristics, full-range T_A = −40°C to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	LM4041C12I			LM4041D12I			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_Z	Reverse breakdown voltage	I_Z = 100 μA	25°C		1.225			1.225		V
	Reverse breakdown voltage tolerance	I_Z = 100 μA	25°C	−6		6	−12		12	mV
			Full range	−14		14	−24		24	
$I_{Z,min}$	Minimum cathode current		25°C		45	75		45	75	μA
			Full range			80			80	
α_{VZ}	Average temperature coefficient of reverse breakdown voltage	I_Z = 10 mA	25°C		±20			±20		ppm/°C
		I_Z = 1 mA	25°C		±15			±15		
			Full range			±100			±150	
		I_L = 100 μA	25°C		±15			±15		
$\Delta V_Z/\Delta I_Z$	Reverse breakdown voltage change with cathode current change	$I_{Z,min} < I_Z < 1$ mA	25°C		0.7	1.5		0.7	2	mV
			Full range			2			2.5	
		1 mA < I_Z < 12 mA	25°C		2.5	6		2.5	8	
			Full range			8			10	
z_Z	Reverse dynamic impedance	I_Z = 1 mA, f = 120 Hz, I_{AC} = 0.1 I_Z	25°C		0.5	1.5		0.5	2	Ω
e_N	Wideband noise	I_Z = 100 μA, 10 Hz ≤ f ≤ 10 kHz	25°C		20			20		μV_{RMS}
	Long-term stability of reverse breakdown voltage	t = 1000 h, T_A = 25°C ± 0.1°C, I_Z = 100 μA	25°C		120			120		ppm

PRODUCT PREVIEW

LM4041x12Q electrical characteristics full-range T_A = −40°C to 125°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	LM4041C12Q			LM4041D12Q			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_Z	Reverse breakdown voltage	I_Z = 100 µA	25°C		1.225			1.225		V
	Reverse breakdown voltage tolerance	I_Z = 100 µA	25°C	−6		6	−12		12	mV
			Full range	−18.4		18.4	−31		31	
$I_{Z,min}$	Minimum cathode current		25°C		45	75		45	75	µA
			Full range			80			80	
α_{VZ}	Average temperature coefficient of reverse breakdown voltage	I_Z = 10 mA	25°C		±20			±20		ppm/°C
		I_Z = 1 mA	25°C		±15			±15		
			Full range			±100			±150	
		I_L = 100 µA	25°C		±15			±15		
$\Delta V_Z/\Delta I_Z$	Reverse breakdown voltage change with cathode current change	$I_{Z,min} < I_Z < 1$ mA	25°C		0.7	1.5		0.7	2	mV
			Full range			2			2.5	
		1 mA < I_Z < 12 mA	25°C		2.5	6		2.5	8	
			Full range			8			10	
z_Z	Reverse dynamic impedance	I_Z = 1 mA, f = 120 Hz, I_{AC} = 0.1 I_Z	25°C		0.5			0.5		Ω
			Full range			1.5			2	
e_N	Wideband noise	I_Z = 100 µA, 10 Hz ≤ f ≤ 10 kHz	25°C		20			20		μV_{RMS}
	Long-term stability of reverse breakdown voltage	t = 1000 h, T_A = 25°C ± 0.1°C, I_Z = 100 µA	25°C		120			120		ppm

PRODUCT PREVIEW

LM4041xI (adjustable version) electrical characteristics, full-range T_A = −40°C to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	LM4041B			LM4041C			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{REF}	Reference voltage	I_Z = 100 µA, V_Z = 5 V	25°C		1.233			1.233		V
	Reference voltage tolerance (see Note 3)	I_Z = 100 µA, V_Z = 5 V	25°C	−2.5		2.5	−6.2		6.2	mV
			Full range	−10.5		10.5	−14		14	
$I_{Z,min}$	Minimum cathode current		25°C		45	75		45	75	µA
			Full range			80			80	
$\Delta V_{REF}/\Delta I_Z$	Reference voltage change with cathode current change	$I_{Z,min} < I_Z < 1$ mA (see Note 4) SOT-23-3: $V_Z \geq 1.6$ V	25°C		0.7	1.5		0.7	1.5	mV
			Full range			2			2	
		1 mA < I_Z < 12 mA (see Note 4) SOT-23-3: $V_Z = V_{REF}$	25°C		2	4		2	4	
			Full range			6			6	
$\Delta V_{REF}/\Delta V_{KA}$	Reference voltage change with output voltage change	I_Z = 1 mA	25°C		−1.55	−2		−1.55	−2	mV/V
			Full range			−2.5			−2.5	
I_{FB}	Feedback current		25°C		60	100		60	100	nA
			Full range			120			120	
αV_{REF}	Average temperature coefficient of reference voltage (see Note 3)	I_Z = 10 mA, V_Z = 5 V	25°C		±20			±20		ppm/°C
		I_Z = 1 mA, V_Z = 5 V	25°C		±15			±15		
			Full range			±100			±100	
		I_L = 100 µA, V_Z = 5 V	25°C		±15			±15		
Z_Z	Reverse dynamic impedance	I_Z = 1 mA, f = 120 Hz, $I_{AC} = 0.1\ I_Z$, $V_Z = V_{REF}$	25°C		0.3			0.3		Ω
		I_Z = 1 mA, f = 120 Hz, $I_{AC} = 0.1\ I_Z$, V_Z = 10 V	25°C		2			2		
e_N	Wideband noise	I_Z = 100 µA, $V_Z = V_{REF}$, 10 Hz ≤ f ≤ 10 kHz	25°C		20			20		μV_{RMS}
	Long-term stability of reverse breakdown voltage	t = 1000 h, T_A = 25°C ± 0.1°C, I_Z = 100 µA	25°C		120			120		ppm

NOTES: 3. Reference Voltage Tolerance and Average Temperature Coefficient will change with output voltage (V_Z). See Performance Curves.
4. For $V_Z \leq 1.6$ V, the LM4041 (adjustable) must operate with reduced I_Z in the SOT-23-3 package due to the series resistance of the die attach between the die anode output and the package anode pin (Pin 3). See Figure 9, Output Saturation (SOT-23-3 Only) in *typical performance characteristics*.

LM4041xI (adjustable version) electrical characteristics, full-range T_A = −40°C to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	LM4041D			UNIT
				MIN	TYP	MAX	
V_{REF}	Reference voltage	I_Z = 100 μA, V_Z = 5 V	25°C		1.233		V
	Reference voltage tolerance (see Note 3)	I_Z = 100 μA, V_Z = 5 V	25°C	−12		12	mV
			Full range	−24		24	
$I_{Z,min}$	Minimum cathode current		25°C		45	75	μA
			Full range			80	
$\Delta V_{REF}/\Delta I_Z$	Reference voltage change with cathode current change	$I_{Z,min} < I_Z < 1$ mA (see Note 4) SOT-23-3: $V_Z \geq 1.6$ V	25°C		0.7	2	mV
			Full range			2.5	
		1 mA < I_Z < 12 mA (see Note 4) SOT-23-3: $V_Z = V_{REF}$	25°C		2	6	
			Full range			8	
$\Delta V_{REF}/\Delta V_{KA}$	Reference voltage change with output voltage change	I_Z = 1 mA	25°C		−1.55	−2.5	mV/V
			Full range			−3	
I_{FB}	Feedback current		25°C		60	150	nA
			Full range			200	
αV_{REF}	Average temperature coefficient of reference voltage (see Note 3)	I_Z = 10 mA, V_Z = 5 V	25°C		±20		ppm/°C
		I_Z = 1 mA, V_Z = 5 V	25°C		±15		
			Full range			±150	
		I_L = 100 μA, V_Z = 5 V	25°C		±15		
z_Z	Reverse dynamic impedance	I_Z = 1 mA, f = 120 Hz, $I_{AC} = 0.1\ I_Z$, $V_Z = V_{REF}$	25°C		0.3		Ω
		I_Z = 1 mA, f = 120 Hz, $I_{AC} = 0.1\ I_Z$, V_Z = 10 V	25°C		2		
e_N	Wideband noise	I_Z = 100 μA, $V_Z = V_{REF}$, 10 Hz ≤ f ≤ 10 kHz	25°C		20		μV_{RMS}
	Long-term stability of reverse breakdown voltage	t = 1000 h, T_A = 25°C ± 0.1°C, I_Z = 100 μA	25°C		120		ppm

NOTES: 3. Reference Voltage Tolerance and Average Temperature Coefficient will change with output voltage (V_Z). See Performance Curves.
4. For $V_Z \leq 1.6$ V, the LM4041 (adjustable) must operate with reduced I_Z in the SOT-23-3 package due to the series resistance of the die attach between the die anode output and the package anode pin (Pin 3). See Figure 9, Output Saturation (SOT-23-3 Only) in *typical performance characteristics*.

PRODUCT PREVIEW

LM4041xQ (adjustable version) electrical characteristics, full-range T_A = −40°C to 125°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	LM4041C			LM4041D			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{REF}	Reference voltage	I_Z = 100 μA, V_Z = 5 V	25°C		1.233			1.233		V
	Reference voltage tolerance (see Note 3)	I_Z = 100 μA, V_Z = 5 V	25°C	−6.2		6.2	−12		12	mV
			Full range	−18		18	−30		30	
$I_{Z,min}$	Minimum cathode current		25°C		45	60		45	65	μA
			Full range			68			73	
$\Delta V_{REF}/\Delta I_Z$	Reference voltage change with cathode current change	$I_{Z,min} < I_Z < 1$ mA (see Note 4) SOT-23-3: $V_Z \geq 1.6$ V	25°C		0.7	1.5		0.7	2	mV
			Full range			2			2.5	
		1 mA < I_Z < 12 mA (see Note 4) SOT-23-3: $V_Z = V_{REF}$	25°C		2	8		2	10	
			Full range			6			8	
$\Delta V_{REF}/\Delta V_{KA}$	Reference voltage change with output voltage change	I_Z = 1 mA	25°C		−1.55	−2		−1.55	−2.5	mV/V
			Full range			−3			−4	
I_{FB}	Feedback current		25°C		60	100		60	150	nA
			Full range			120			200	
αV_{REF}	Average temperature coefficient of reference voltage (see Note 3)	I_Z = 10 mA, V_Z = 5 V	25°C		±20			±20		ppm/°C
		I_Z = 1 mA, V_Z = 5 V	25°C		±15			±15		
			Full range			±100			±150	
		I_L = 100 μA, V_Z = 5 V	25°C		±15			±15		
Z_Z	Reverse dynamic impedance	I_Z = 1 mA, f = 120 Hz, $I_{AC} = 0.1\ I_Z$, $V_Z = V_{REF}$	25°C		0.3			0.3		Ω
		I_Z = 1 mA, f = 120 Hz, $I_{AC} = 0.1\ I_Z$, V_Z = 10 V	25°C		2			2		
e_N	Wideband noise	I_Z = 100 μA, $V_Z = V_{REF}$, 10 Hz ≤ f ≤ 10 kHz	25°C		20			20		μV_{RMS}
	Long-term stability of reverse breakdown voltage	t = 1000 h, T_A = 25°C ± 0.1°C, I_Z = 100 μA	25°C		120			120		ppm

NOTES: 3. Reference Voltage Tolerance and Average Temperature Coefficient will change with output voltage (V_Z). See Performance Curves.
4. For $V_Z \leq 1.6$ V, the LM4041 (adjustable) must operate with reduced I_Z in the SOT-23-3 package due to the series resistance of the die attach between the die anode output and the package anode pin (Pin 3). See Figure 9, Output Saturation (SOT-23-3 Only) in *typical performance characteristics*.

APPLICATION INFORMATION

start-up characteristics

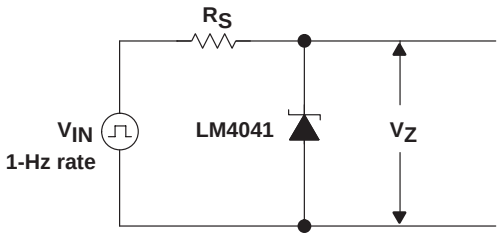


Figure 1. Test Circuit

output capacitor

The LM4041 does not require an output capacitor across CATHODE and ANODE for stability. However, if an output bypass capacitor is desired, the LM4041 is designed to be stable with all capacitive loads.

SOT-23 and SC-70 pin connections

There is a parasitic Schottky diode connected between pins 2 and 3 of the SOT-23 packaged device. Thus, pin 3 of the SOT-23 package must be left floating or connected to pin 2. Similarly, pin 2 of the SC-70 package also must be left floating or connected to pin 1.

ADJUSTABLE VERSION: The adjustable version allows V_Z to be set by a user-defined resistor divider. The output voltage, V_Z , is set according to the equation shown in Figure 2.

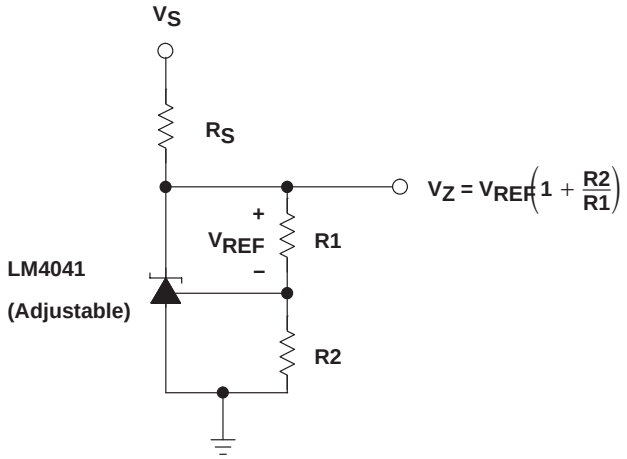


Figure 2. Adjustable Shunt Regulator

PRODUCT PREVIEW

APPLICATION INFORMATION

cathode and load currents

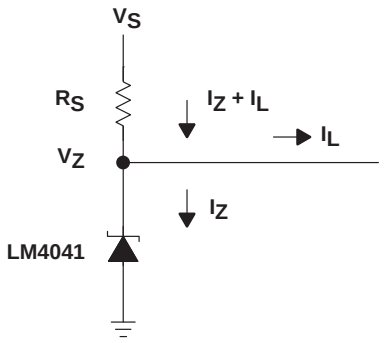


Figure 3. Shunt Regulator

In a typical shunt regulator configuration (see Figure 3), an external resistor, R_S, is connected between the supply and the cathode of the LM4041. R_S must be set properly, as it sets the total current available to supply the load (I_L) and bias the LM4041 (I_Z). In all cases, I_Z must stay within a specified range for proper operation of the reference. Taking into consideration one extreme in the variation of the load and supply voltage (maximum I_L and minimum V_S), R_S must be small enough to supply the minimum I_Z required for operation of the regulator, as given by data-sheet parameters. At the other extreme, maximum V_S and minimum I_L, R_S must be large enough to limit I_Z to less than its maximum rated value of 20 mA.

R_S is calculated according to the following equation:

$$R_S = \frac{(V_S - V_Z)}{(I_L + I_Z)}$$

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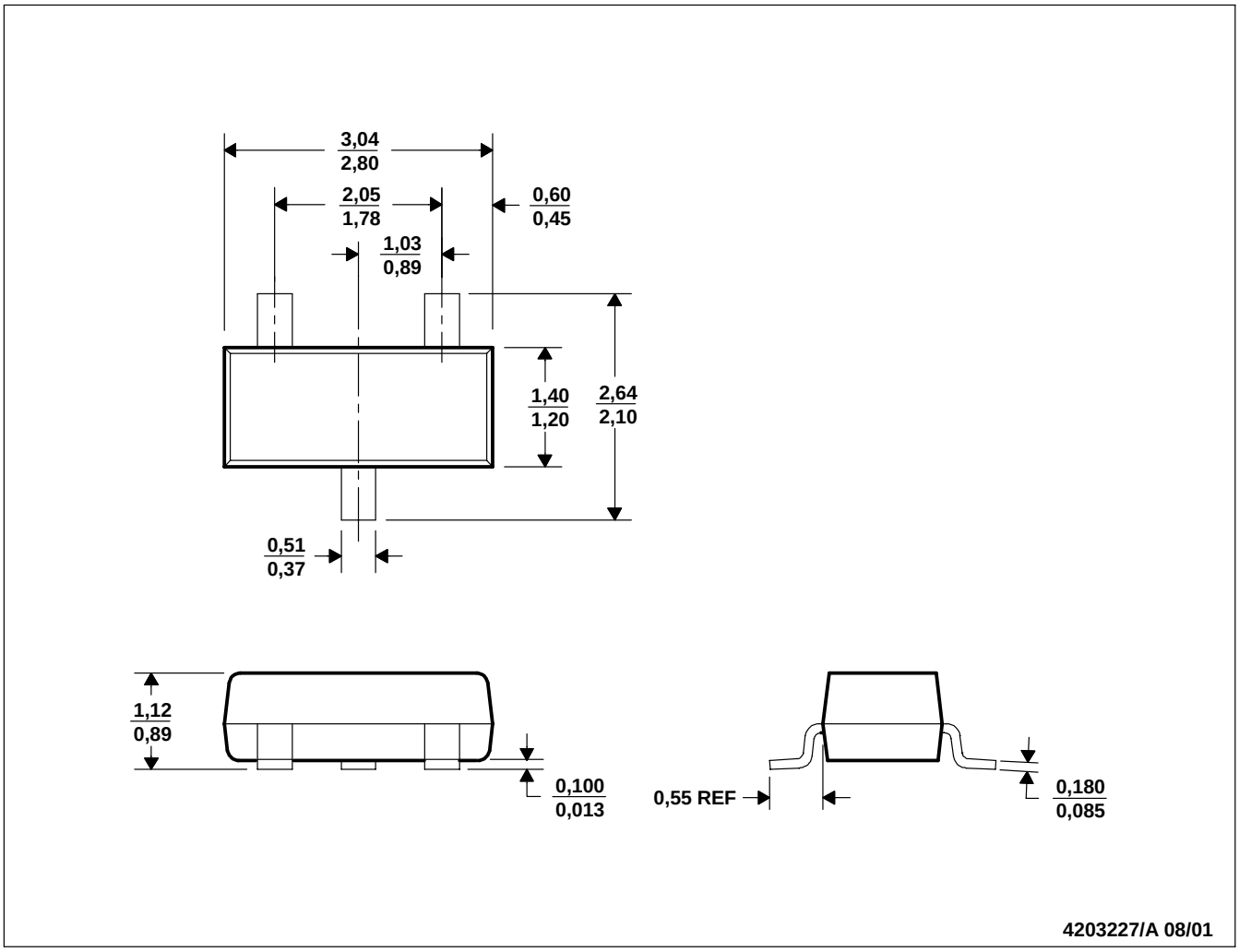
DBZ (R-PDSO-G3) **PLASTIC SMALL-OUTLINE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Dimensions are inclusive of plating.
D. Dimensions are exclusive of mold flash and metal burr.

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