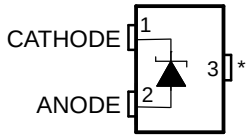
FEATURES

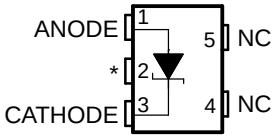
- **1.225-V Fixed and Adjustable Outputs (1.225 V to 10 V)**
- **Tight Output Tolerances and Low Temperature Coefficient**
  - **Max 0.1%, 100 ppm/°C – A Grade**
  - **Max 0.2%, 100 ppm/°C – B Grade**
  - **Max 0.5%, 100 ppm/°C – C Grade**
  - **Max 1.0%, 150 ppm/°C – D Grade**
- **Low Output Noise . . . 20 μV_{RMS} (Typ)**
- **Wide Operating Current Range . . . 45 μA (Typ) 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)



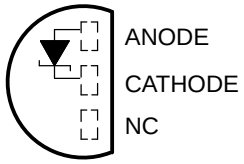
* Pin 3 must be connected to ANODE or left open.

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



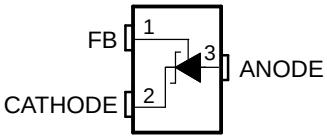
NC − No internal connection
* Pin 2 must be connected to ANODE or left open.

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

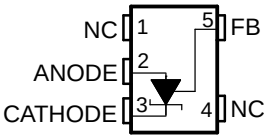


NC − No internal connection

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

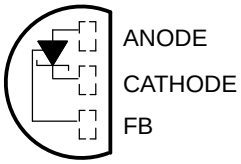


Adjustable . . . DCK (SC-70) PACKAGE (TOP VIEW)



NC − No internal connection

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



DESCRIPTION/ORDERING INFORMATION

The LM4041 series of shunt voltage references are versatile, easy-to-use references suitable for a wide array of applications. They require no external 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 requiring a minimum current of 45 μA (typ), 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(1)		ORDERABLE PART NUMBER	TOP-SIDE MARKING(2)
–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	MK_
			SOT-23-3 (DBZ)	Reel of 3000	LM4041A12IDBZR	4MK_
				Reel of 250	LM4041A12IDBZT	
			TO-92/TO-226 (LP)	Bulk of 1000	LM4041A12ILP	PREVIEW
				Reel of 2000	LM4041A12ILPR	
	B grade: 0.2% initial accuracy and 100 ppm/°C temperature coefficient	ADJ	SC-70 (DCK)	Reel of 3000	LM4041BIDCKR	MG_
				Reel of 250	LM4041BIDCKT	
			SOT-23-3 (DBZ)	Reel of 3000	LM4041BIDBZR	4MG_
				Reel of 250	LM4041BIDBZT	
			TO-92/TO-226 (LP)	Bulk of 1000	LM4041BILP	PREVIEW
				Reel of 2000	LM4041BILPR	
		1.2 V	SC-70 (DCK)	Reel of 3000	LM4041B12IDCKR	ML_
			SOT-23-3 (DBZ)	Reel of 3000	LM4041B12IDBZR	4ML_
				Reel of 250	LM4041B12IDBZT	
			TO-92/TO-226 (LP)	Bulk of 1000	LM4041B12ILP	PREVIEW
				Reel of 2000	LM4041B12ILPR	
	C grade: 0.5% initial accuracy and 100 ppm/°C temperature coefficient	ADJ	SC-70 (DCK)	Reel of 3000	LM4041CIDCKR	MH_
				Reel of 250	LM4041CIDCKT	
			SOT-23-3 (DBZ)	Reel of 3000	LM4041CIDBZR	4MH_
				Reel of 250	LM4041CIDBZT	
			TO-92/TO-226 (LP)	Bulk of 1000	LM4041CILP	PREVIEW
				Reel of 2000	LM4041CILPR	
		1.2 V	SC-70 (DCK)	Reel of 3000	LM4041C12IDCKR	MM_
			SOT-23-3 (DBZ)	Reel of 3000	LM4041C12IDBZR	4MM_
				Reel of 250	LM4041C12IDBZT	
			TO-92/TO-226 (LP)	Bulk of 1000	LM4041C12ILP	PREVIEW
				Reel of 2000	LM4041C12ILPR	
	D grade: 1.0% initial accuracy and 150 ppm/°C temperature coefficient	ADJ	SC-70 (DCK)	Reel of 3000	LM4041DIDCKR	MJ_
				Reel of 250	LM4041DIDCKT	
			SOT-23-3 (DBZ)	Reel of 3000	LM4041DIDBZR	4MJ_
				Reel of 250	LM4041DIDBZT	
			TO-92/TO-226 (LP)	Bulk of 1000	LM4041DILP	PREVIEW
				Reel of 2000	LM4041DILPR	
		1.2 V	SC-70 (DCK)	Reel of 3000	LM4041D12IDCKR	MN_
			SOT-23-3 (DBZ)	Reel of 3000	LM4041D12IDBZR	4MN_
				Reel of 250	LM4041D12IDBZT	
			TO-92/TO-226 (LP)	Bulk of 1000	LM4041D12ILP	PREVIEW
				Reel of 2000	LM4041D12ILPR	

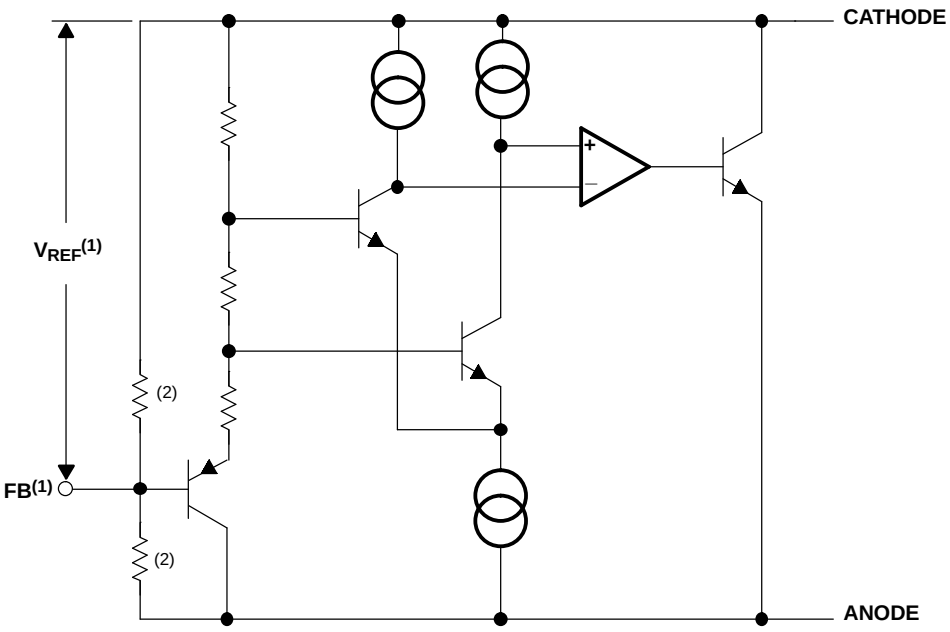
(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.
(2) DBZ/DCK: The actual top-side marking has one additional character that designates the assembly/test site.

ORDERING INFORMATION

T_A	DEVICE GRADE	V_Z	PACKAGE(1)		ORDERABLE PART NUMBER	TOP-SIDE MARKING(2)
–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	4MP_
				Reel of 250	LM4041CQDBZT	
		1.2 V	SOT-23-3 (DBZ)	Reel of 3000	LM4041C12QDBZR	4MS_
				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	4MR_
				Reel of 250	LM4041DQDBZT	
		1.2 V	SOT-23-3 (DBZ)	Reel of 3000	LM4041D12QDBZR	4MT_
				Reel of 250	LM4041D12QDBZT	

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.
(2) DBZ/DCK: The actual top-side marking has one additional character that designates the assembly/test site.

FUNCTIONAL BLOCK DIAGRAM



(1) LM4041x (ADJ) only
(2) LM4041x12 only

Absolute Maximum Ratings(1)

over free-air temperature range (unless otherwise noted)

			MIN	MAX	UNIT
V_Z	Continuous cathode voltage			15	V
I_Z	Continuous cathode current		–10	25	mA
θ_{JA}	Package thermal impedance(2)(3)	DBZ package		206	°C/W
		DCK package		252	
		LP package		156	
T_J	Operating virtual junction temperature			150	°C
T_{stg}	Storage temperature range		–65	150	°C

(1) 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.
(2) 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.
(3) The package thermal impedance is calculated in accordance with JESD 51-7.

Recommended Operating Conditions

			MIN	MAX	UNIT
I_Z	Cathode current		(1)	12	mA
V_Z	Reverse breakdown voltage (adjustable version)			10	V
T_A	Free-air temperature	LM4041 (I temperature)	–40	85	°C
		LM4041 (Q temperature)	–40	125	

(1) 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_Z = 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

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_Z = 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

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_Z = 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

LM4041xI (Adjustable Version) Electrical Characteristics

full-range T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	LM4041BI			LM4041CI			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(1)	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	25°C		0.7	1.5		0.7	1.5	mV
			Full range			2			2	
		1 mA < I_Z < 12 mA	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(1)	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_Z = 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

(1) Reference voltage tolerance and average temperature coefficient change with output voltage (V_Z). See *Typical Characteristics*.

LM4041xI (Adjustable Version) Electrical Characteristics

full-range T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	LM4041DI			UNIT
				MIN	TYP	MAX	
V_{REF}	Reference voltage	I_Z = 100 µA, V_Z = 5 V	25°C		1.233		V
	Reference voltage tolerance(1)	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	25°C		0.7	2	mV
			Full range			2.5	
		1 mA < I_Z < 12 mA	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	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(1)	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_Z = 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

(1) Reference voltage tolerance and average temperature coefficient change with output voltage (V_Z). See *Typical Characteristics*.

LM4041xQ (Adjustable Version) Electrical Characteristics

full-range T_A = –40°C to 125°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	LM4041CQ			LM4041DQ			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(1)	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	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	25°C		0.7	1.5		0.7	2	mV
			Full range			2			2.5	
		1 mA < I_Z < 12 mA	25°C		2	4		2	6	
			Full range			8			10	
$\Delta V_{REF}/\Delta V_{KA}$	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(1)	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_Z = 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

(1) Reference voltage tolerance and average temperature coefficient change with output voltage (V_Z). See *Typical Characteristics*.

TYPICAL CHARACTERISTICS

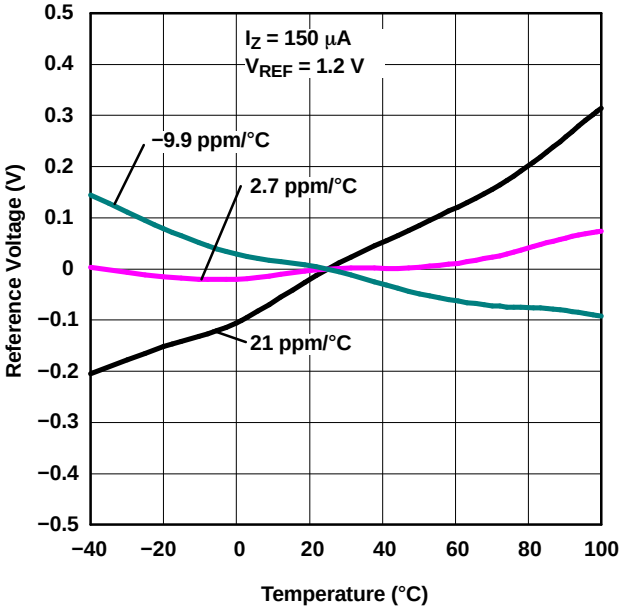


Figure 1. Temperature Drift for Different Average Temperature Coefficients

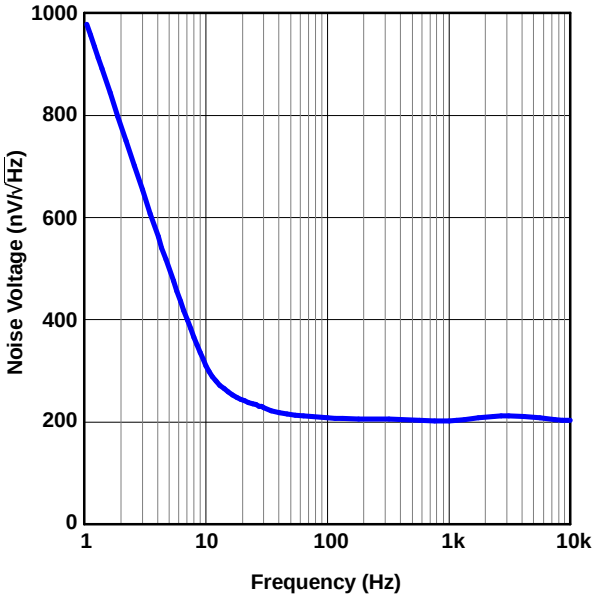


Figure 2. Noise Voltage vs Frequency

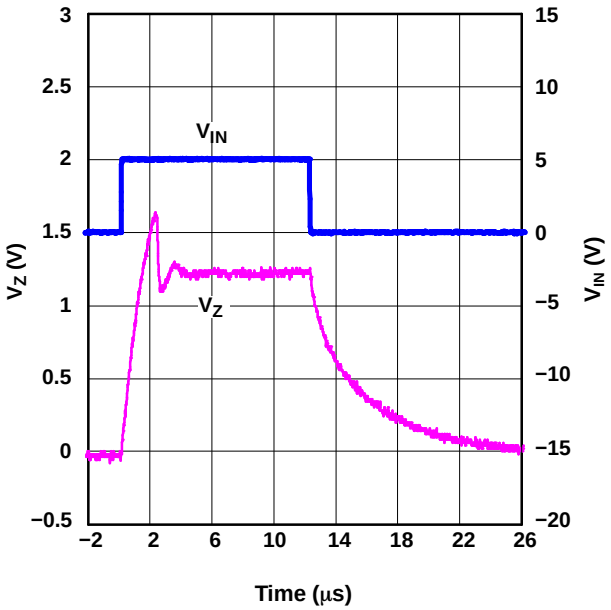


Figure 3. Start-Up Characteristics

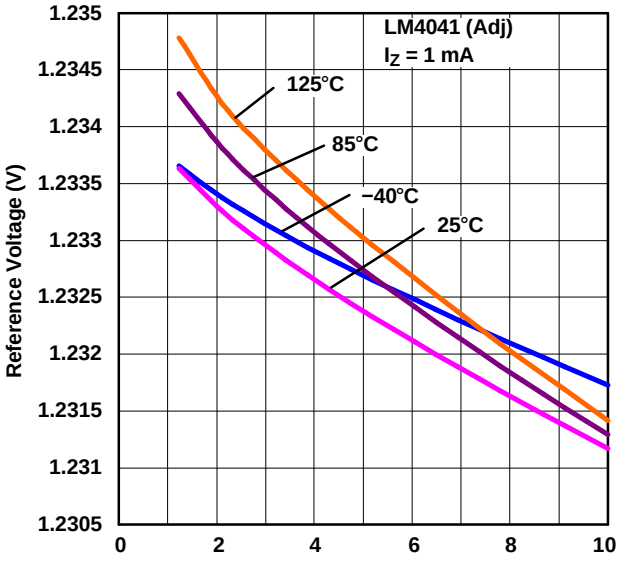


Figure 4. Reference Voltage vs Reverse (Output) Voltage (for Different Temperatures)

TYPICAL CHARACTERISTICS

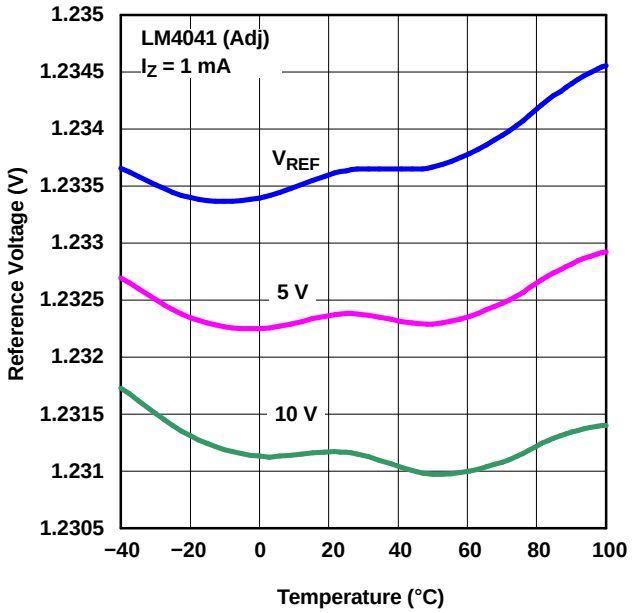


Figure 5. Reference Voltage vs Temperature (for Different Reverse Voltages)

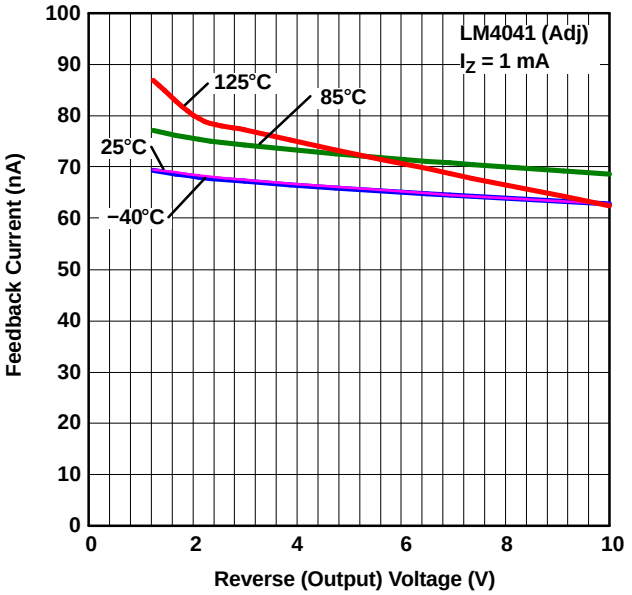


Figure 6. Feedback Current vs Reverse (Output) Voltage (for Different Temperatures)

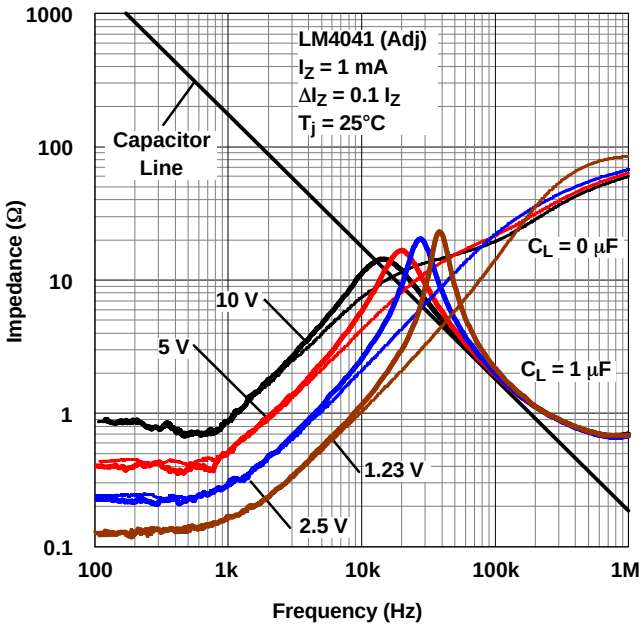


Figure 7. Output Impedance vs Frequency

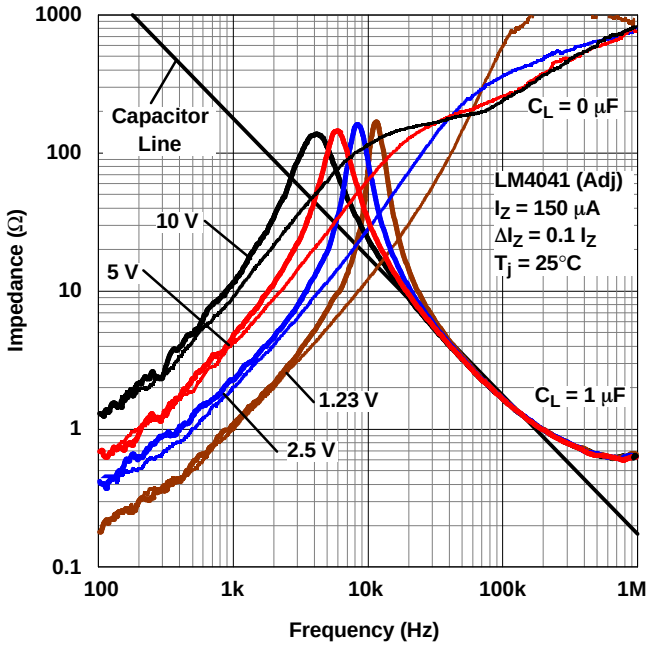


Figure 8. Output Impedance vs Frequency

TYPICAL CHARACTERISTICS

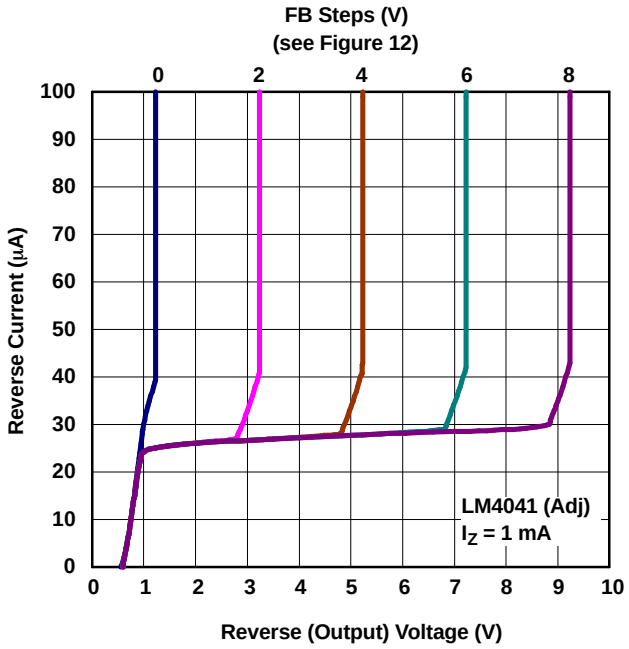


Figure 9. Reverse Characteristics

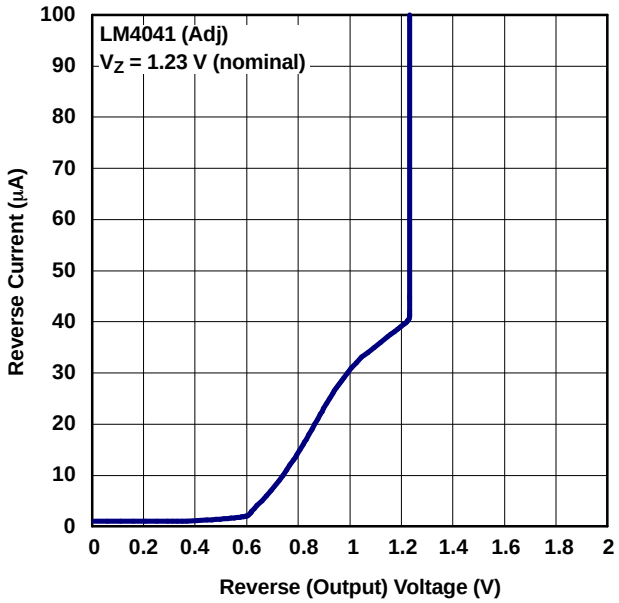


Figure 10. Reverse Characteristics and Minumum Operating Current

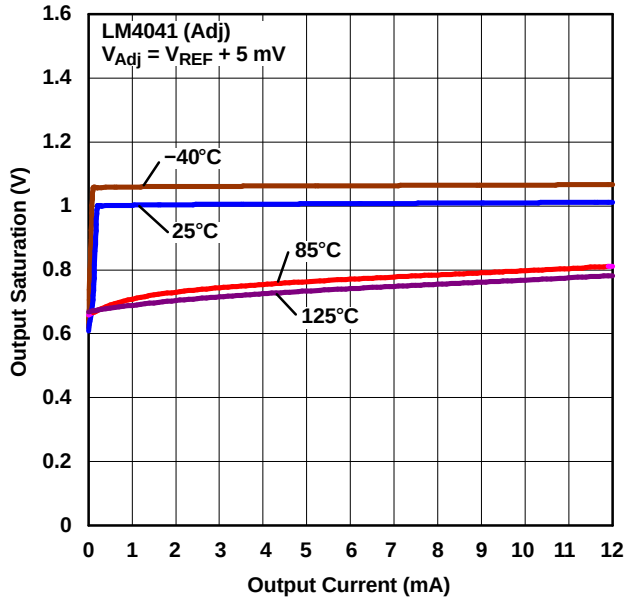


Figure 11. Output Saturation vs Output Current

APPLICATION INFORMATION

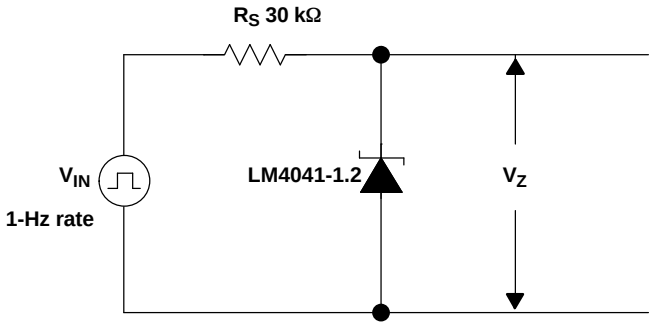


Figure 12. Startup Characteristics Test Circuit

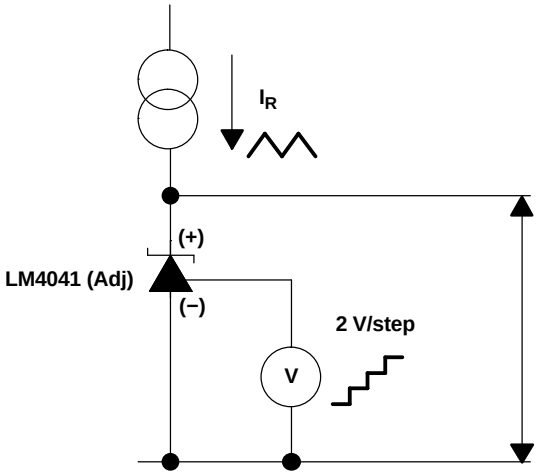


Figure 13. Reverse Characteristics Test Circuit

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.

APPLICATION INFORMATION

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 14.

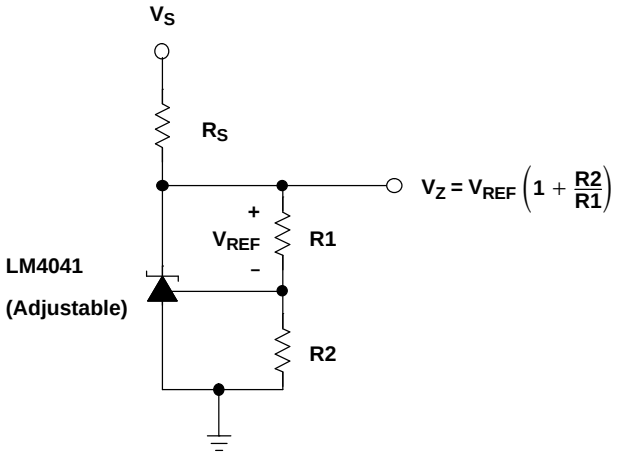


Figure 14. Adjustable Shunt Regulator

Cathode and Load Currents

In a typical shunt regulator configuration (see Figure 15), 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 recommended rating of 12 mA.

R_S is calculated as shown in Equation 1.

$$R_S = \frac{(V_S - V_Z)}{(I_L + I_Z)} \quad (1)$$

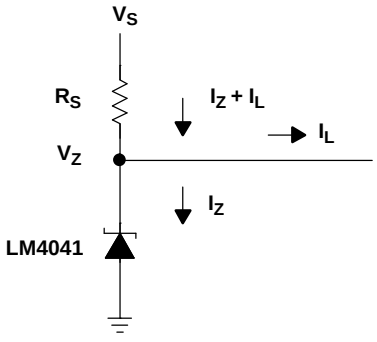


Figure 15. Shunt Regulator

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM4041A12IDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MK3 ~ 4MKU)	Samples
LM4041A12IDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MK3 ~ 4MKU)	Samples
LM4041A12IDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MK3 ~ 4MKU)	Samples
LM4041A12IDCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MKU	Samples
LM4041A12ILP	PREVIEW	TO-92	LP	3	1000	TBD	Call TI	Call TI	-40 to 85		
LM4041B12IDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4ML3 ~ 4MLU)	Samples
LM4041B12IDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4ML3 ~ 4MLU)	Samples
LM4041B12IDCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MLU	Samples
LM4041B12ILP	PREVIEW	TO-92	LP	3	1000	TBD	Call TI	Call TI	-40 to 85		
LM4041BIDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MG3 ~ 4MGU)	Samples
LM4041BIDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MG3 ~ 4MGU)	Samples
LM4041BIDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MG3 ~ 4MGU)	Samples
LM4041BIDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MG3 ~ 4MGU)	Samples
LM4041BIDCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MGU	Samples
LM4041BIDCKT	ACTIVE	SC70	DCK	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MGU	Samples
LM4041BILP	PREVIEW	TO-92	LP	3	1000	TBD	Call TI	Call TI	-40 to 85		
LM4041BILPR	PREVIEW	TO-92	LP	3	2000	TBD	Call TI	Call TI	-40 to 85		
LM4041C12IDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MM3 ~ 4MMU)	Samples
LM4041C12IDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MM3 ~ 4MMU)	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM4041C12IDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MM3 ~ 4MMU)	Samples
LM4041C12IDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MM3 ~ 4MMU)	Samples
LM4041C12IDCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MMU	Samples
LM4041C12IDCKRE4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MMU	Samples
LM4041C12IDCKRG4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MMU	Samples
LM4041C12ILP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	-40 to 85	NPC12I	Samples
LM4041C12ILPE3	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	-40 to 85	NPC12I	Samples
LM4041C12ILPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	-40 to 85	NPC12I	Samples
LM4041C12QDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MS3 ~ 4MSU)	Samples
LM4041C12QDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MS3 ~ 4MSU)	Samples
LM4041CIDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MH3 ~ 4MHU)	Samples
LM4041CIDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MH3 ~ 4MHU)	Samples
LM4041CIDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MH3 ~ 4MHU)	Samples
LM4041CIDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MH3 ~ 4MHU)	Samples
LM4041CIDCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MHU	Samples
LM4041CIDCKT	ACTIVE	SC70	DCK	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MHU	Samples
LM4041CIDCKTG4	ACTIVE	SC70	DCK	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MHU	Samples
LM4041CILP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	-40 to 85	NPCI	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM4041CILPE3	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	-40 to 85	NPCI	Samples
LM4041CILPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	-40 to 85	NPCI	Samples
LM4041CQDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MP3 ~ 4MPU)	Samples
LM4041CQDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MP3 ~ 4MPU)	Samples
LM4041CQDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MP3 ~ 4MPU)	Samples
LM4041D12IDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MN3 ~ 4MNU)	Samples
LM4041D12IDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MN3 ~ 4MNU)	Samples
LM4041D12IDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MN3 ~ 4MNU)	Samples
LM4041D12IDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MN3 ~ 4MNU)	Samples
LM4041D12IDCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MNU	Samples
LM4041D12ILP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	-40 to 85	NPD12I	Samples
LM4041D12ILPE3	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	-40 to 85	NPD12I	Samples
LM4041D12ILPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	-40 to 85	NPD12I	Samples
LM4041D12QDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MT3 ~ 4MTU)	Samples
LM4041DIDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MJ3 ~ 4MJU)	Samples
LM4041DIDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MJ3 ~ 4MJU)	Samples
LM4041DIDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MJ3 ~ 4MJU)	Samples
LM4041DIDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MJ3 ~ 4MJU)	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM4041DIDCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MJU	Samples
LM4041DIDCKT	ACTIVE	SC70	DCK	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MJU	Samples
LM4041DILP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	-40 to 85	NPDI	Samples
LM4041DILPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	-40 to 85	NPDI	Samples
LM4041DILPRE3	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	-40 to 85	NPDI	Samples
LM4041DQDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MR3 ~ 4MRU)	Samples
LM4041DQDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MR3 ~ 4MRU)	Samples
LM4041DQDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MR3 ~ 4MRU)	Samples
LM4041DQDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MR3 ~ 4MRU)	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

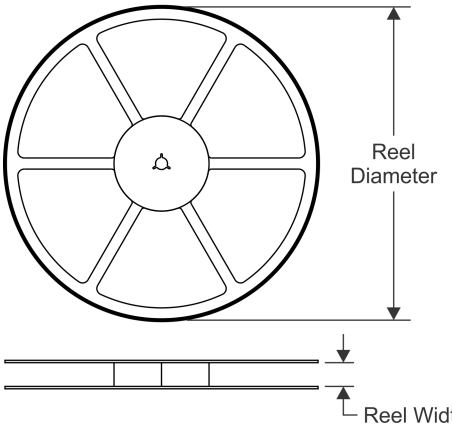
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

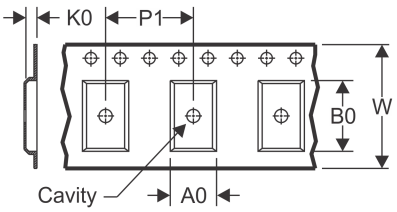
(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

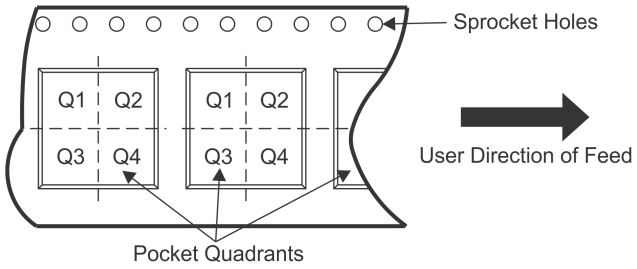


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

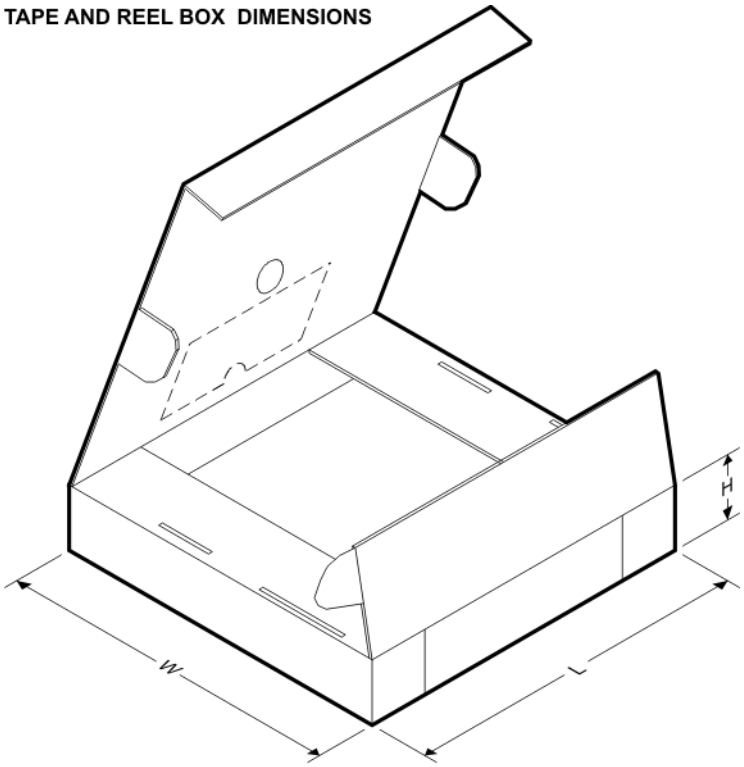
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM4041A12IDCKR	SC70	DCK	5	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
LM4041B12IDCKR	SC70	DCK	5	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
LM4041BIDCKR	SC70	DCK	5	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
LM4041BIDCKT	SC70	DCK	5	250	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
LM4041C12IDCKR	SC70	DCK	5	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
LM4041C12QDBZR	SOT-23	DBZ	3	3000	179.0	8.4	3.15	2.95	1.22	4.0	8.0	Q3
LM4041C12QDBZT	SOT-23	DBZ	3	250	179.0	8.4	3.15	2.95	1.22	4.0	8.0	Q3
LM4041CIDCKR	SC70	DCK	5	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
LM4041CIDCKT	SC70	DCK	5	250	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
LM4041CQDBZR	SOT-23	DBZ	3	3000	179.0	8.4	3.15	2.95	1.22	4.0	8.0	Q3
LM4041CQDBZT	SOT-23	DBZ	3	250	179.0	8.4	3.15	2.95	1.22	4.0	8.0	Q3
LM4041D12IDCKR	SC70	DCK	5	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
LM4041D12QDBZR	SOT-23	DBZ	3	3000	179.0	8.4	3.15	2.95	1.22	4.0	8.0	Q3
LM4041DIDCKR	SC70	DCK	5	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
LM4041DIDCKT	SC70	DCK	5	250	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
LM4041DQDBZR	SOT-23	DBZ	3	3000	179.0	8.4	3.15	2.95	1.22	4.0	8.0	Q3
LM4041DQDBZT	SOT-23	DBZ	3	250	179.0	8.4	3.15	2.95	1.22	4.0	8.0	Q3

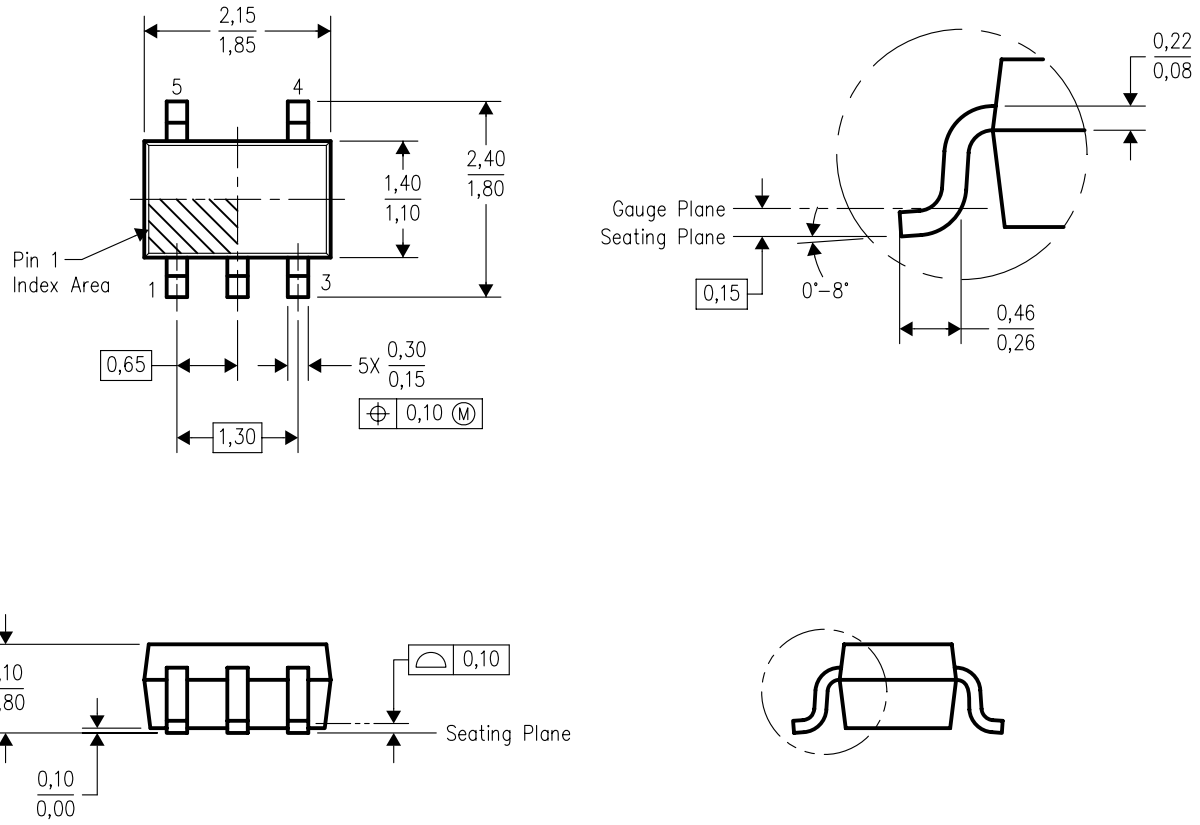
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM4041A12IDCKR	SC70	DCK	5	3000	203.0	203.0	35.0
LM4041B12IDCKR	SC70	DCK	5	3000	203.0	203.0	35.0
LM4041BIDCKR	SC70	DCK	5	3000	203.0	203.0	35.0
LM4041BIDCKT	SC70	DCK	5	250	203.0	203.0	35.0
LM4041C12IDCKR	SC70	DCK	5	3000	203.0	203.0	35.0
LM4041C12QDBZR	SOT-23	DBZ	3	3000	203.0	203.0	35.0
LM4041C12QDBZT	SOT-23	DBZ	3	250	203.0	203.0	35.0
LM4041CIDCKR	SC70	DCK	5	3000	203.0	203.0	35.0
LM4041CIDCKT	SC70	DCK	5	250	203.0	203.0	35.0
LM4041CQDBZR	SOT-23	DBZ	3	3000	203.0	203.0	35.0
LM4041CQDBZT	SOT-23	DBZ	3	250	203.0	203.0	35.0
LM4041D12IDCKR	SC70	DCK	5	3000	203.0	203.0	35.0
LM4041D12QDBZR	SOT-23	DBZ	3	3000	203.0	203.0	35.0
LM4041DIDCKR	SC70	DCK	5	3000	203.0	203.0	35.0
LM4041DIDCKT	SC70	DCK	5	250	203.0	203.0	35.0
LM4041DQDBZR	SOT-23	DBZ	3	3000	203.0	203.0	35.0
LM4041DQDBZT	SOT-23	DBZ	3	250	203.0	203.0	35.0

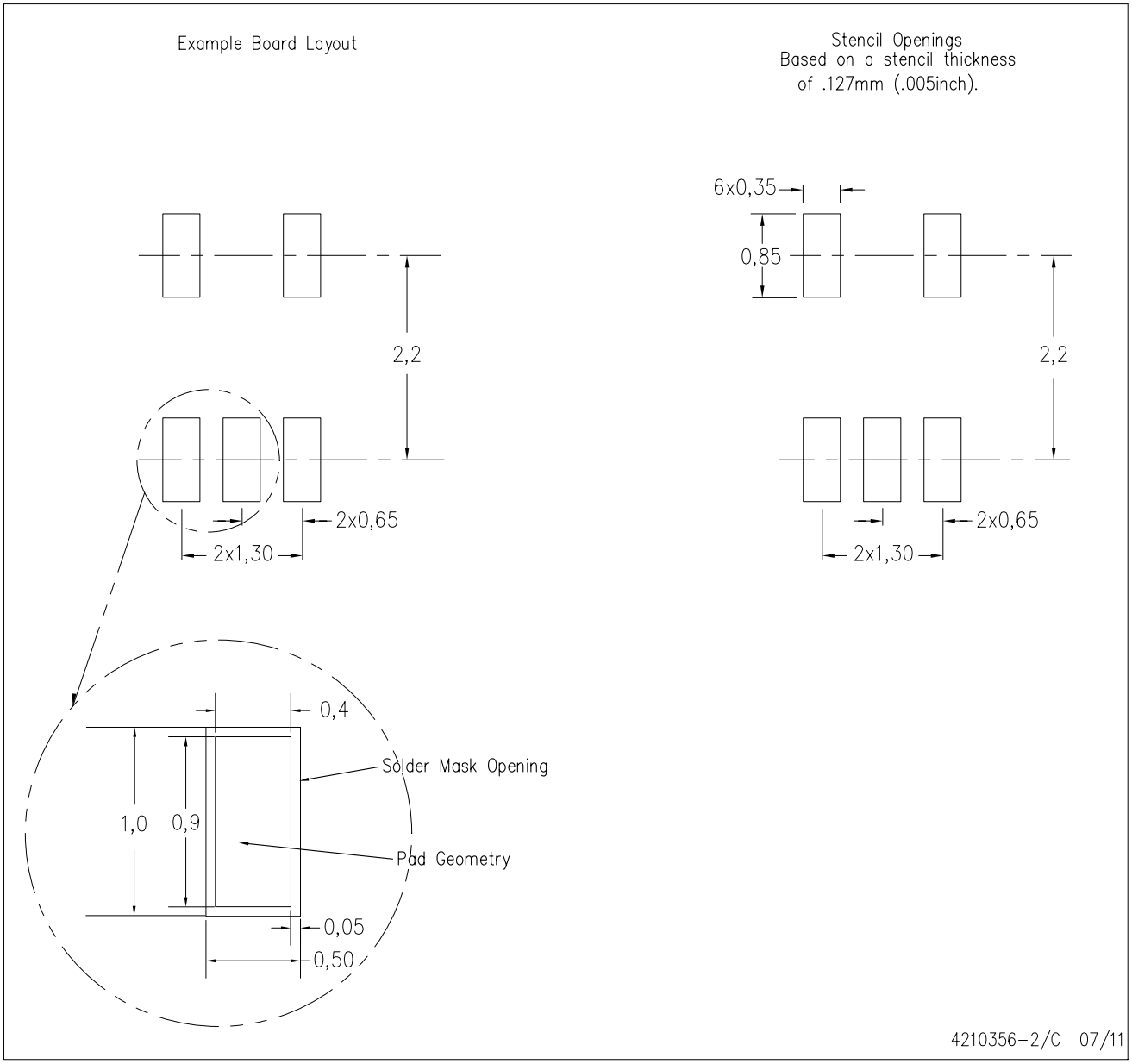
DCK (R–PDSO–G5) PLASTIC SMALL–OUTLINE PACKAGE



4093553–3/G 01/2007

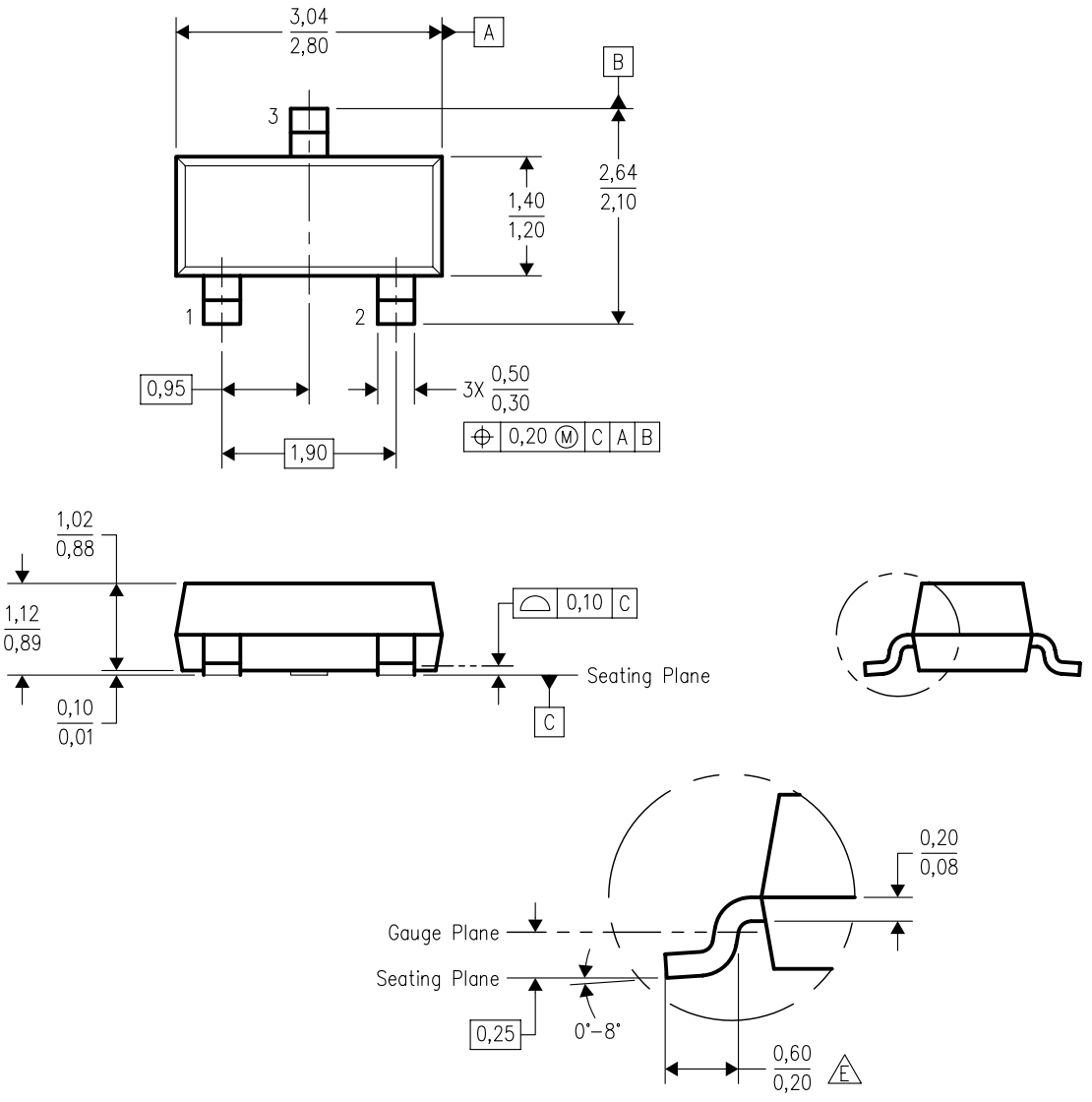
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
D. Falls within JEDEC MO–203 variation AA.

DCK (R–PDSO–G5) PLASTIC SMALL OUTLINE



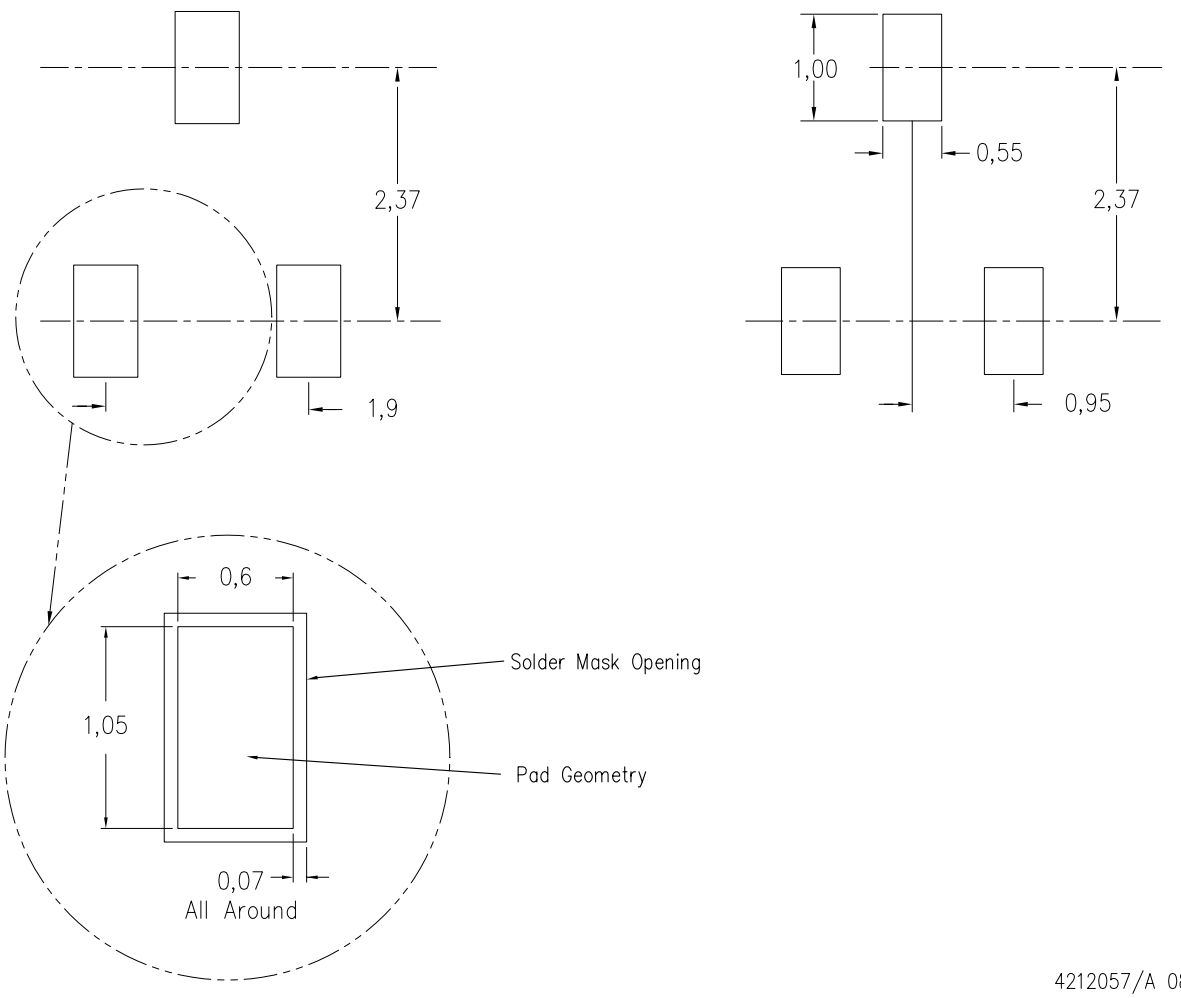
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
D. Publication IPC–7351 is recommended for alternate designs.
E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC–7525 for other stencil recommendations.

DBZ (R–PDSO–G3) PLASTIC SMALL–OUTLINE



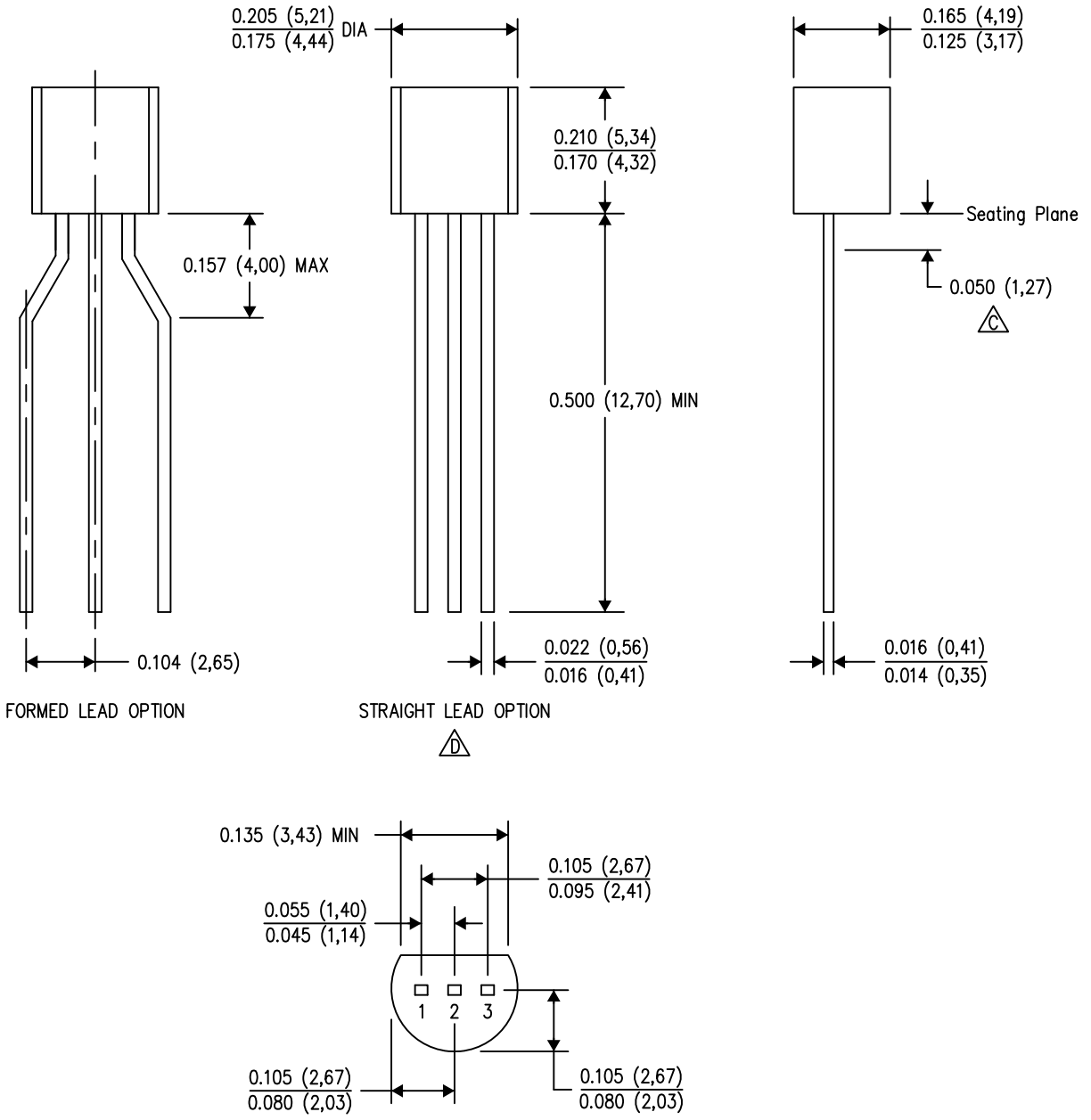
NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. Lead dimensions are inclusive of plating.
D. Body dimensions are exclusive of mold flash and protrusion. Mold flash and protrusion not to exceed 0.25 per side.
E. Falls within JEDEC TO–236 variation AB, except minimum foot length.

DBZ (R–PDSO–G3) PLASTIC SMALL OUTLINE



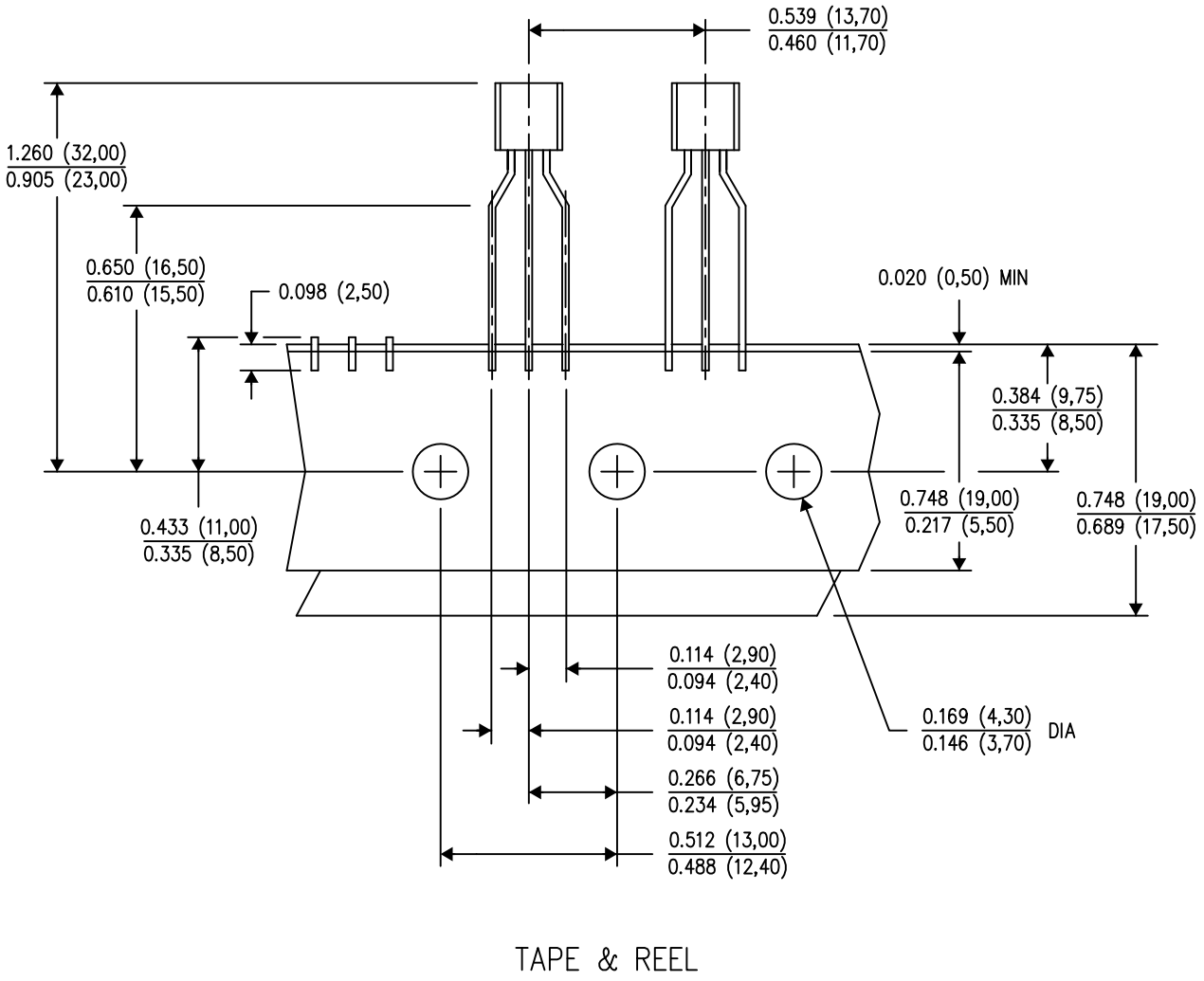
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
D. Publication IPC–7351 is recommended for alternate designs.
E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC–7525 for other stencil recommendations.

LP (O–PBCY–W3) PLASTIC CYLINDRICAL PACKAGE



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. Falls within JEDEC TO–226 Variation AA (TO–226 replaces TO–92).
E. Shipping Method:
Straight lead option available in bulk pack only.
Formed lead option available in tape & reel or ammo pack.
Specific products can be offered in limited combinations of shipping mediums and lead options.
Consult product folder for more information on available options.

LP (O–PBCY–W3) PLASTIC CYLINDRICAL PACKAGE



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Tape and Reel information for the Formed Lead Option package.

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