

LM4041 高精度マイクロパワー・シャント電圧リファレンス

1 特長

- 固定出力 (1.225V)、
可変出力 (1.225V ~ 10V)
- 厳しい出力許容誤差と小さい温度係数
 - 最大 0.1%、100ppm/°C – A グレード
 - 最大 0.2%、100ppm/°C – B グレード
 - 最大 0.5%、100ppm/°C – C グレード
 - 最大 1.0%、150ppm/°C – D グレード
- 低い出力ノイズ ...20μV_{RMS} (標準値)
- 広い動作電流範囲 ...
12mA に対し 45μA (標準値)
- 容量性負荷の大小にかかわらず安定して動作するため、出力コンデンサは不要
- 利用可能なバージョン:
 - 産業用温度範囲: -40°C ~ 85°C
 - 拡張動作温度範囲: -40°C ~ 125°C

2 アプリケーション

- データ アクイジション システム
- 電源と電源モニタ
- 計装およびテスト機器
- プロセス制御
- 高精度オーディオ
- 車載用電子機器
- エネルギー管理 / 測定
- バッテリー駆動の機器

3 概要

LM4041 シリーズのシャント電圧リファレンスは、多様なアプリケーション向けに設計された汎用性が高く使いやすい基準電圧です。これらの部品は動作に外付けコンデンサを必要とせず、容量性負荷の大小にかかわらず安定して動作します。また、この基準電圧はダイナミック インピーダンス、ノイズ、温度係数が小さく、広範囲の動作電流および温度にわたって安定した電圧を維持します。LM4041 では、ウェハー ソート時のヒューズとツェナー ザップ逆方向ブレイクダウンによる電圧調整を使用して、最大 0.1% (A グレード) から最大 1% (D グレード) までの 4 種類の出力電圧許容誤差の製品を提供しています。このため、アプリケーションに適した最良のコスト / 性能比を非常に柔軟に選択できます。LM4041 は、固定バージョン (公称 1.225V) または可変バージョン (出力を 1.225V ~ 10V の値に設定するための外付け抵抗分割器が必要です) で提供しています。

省スペースの SC-70 と SOT-23-3 にパッケージ化され、最低電流 45μA (標準値) で動作する LM4041 は、ポータブル アプリケーション向けに設計されています。スルーホール パッケージの要求に対しては、TO-92 パッケージも提供しています。LM4041xI は -40°C ~ 85°C の周囲温度範囲で動作します。LM4041xQ は -40°C ~ 125°C の周囲温度範囲で動作します。

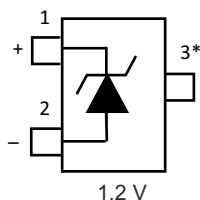


Table of Contents

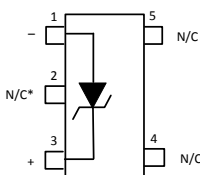
1 特長	1	5.10 Typical Characteristics.....	12
2 アプリケーション	1	6 Functional Block Diagram	15
3 概要	1	7 Application Information	16
4 Pin Configuration and Functions	3	7.1 Output Capacitor.....	16
Pin Functions.....	3	7.2 SOT-23 and SC-70 Pin Connections.....	16
ピンの機能: ADJ ピン配置.....	4	7.3 Adjustable Version.....	17
5 Specifications	5	7.4 Cathode and Load Currents.....	17
5.1 Absolute Maximum Ratings.....	5	8 Device and Documentation Support	18
5.2 ESD Ratings.....	5	8.1 ドキュメントの更新通知を受け取る方法.....	18
5.3 Recommended Operating Conditions.....	6	8.2 Trademarks.....	18
5.4 LM4041x12I Electrical Characteristics.....	6	8.3 静電気放電に関する注意事項.....	18
5.5 LM4041x12I Electrical Characteristics.....	7	8.4 サポート・リソース.....	18
5.6 LM4041x12Q Electrical Characteristics.....	8	8.5 用語集.....	18
5.7 LM4041xI (Adjustable Version) Electrical Characteristics.....	9	9 Revision History	18
5.8 LM4041xI (Adjustable Version) Electrical Characteristics.....	10	10 Mechanical, Packaging, and Orderable Information	20
5.9 LM4041xQ (Adjustable Version) Electrical Characteristics.....	11		

4 Pin Configuration and Functions

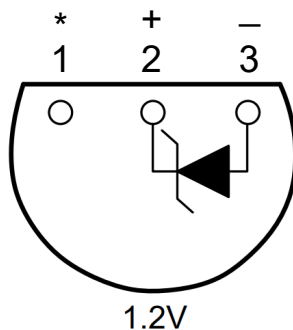
Pin Functions



✎ 4-1. DBZ Package
3-Pin SOT-23
Top View



✎ 4-2. DCK Package
5-Pin SC70
Top View



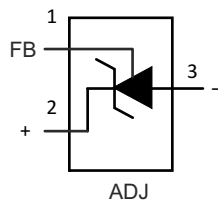
✎ 4-3. LP Package
3-Pin TO-92
Bottom View

Pin Functions

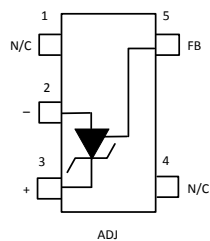
NAME	PIN			I/O	DESCRIPTION
	SOT-23	SC70	TO-92		
Anode	2	1	3	O	Anode pin, normally grounded
Cathode	1	3	2	I/O	Shunt current and output voltage
FB	—	—	—	I	Feedback pin for adjustable output voltage
NC*	3	2	1	—	**Must float or connect to anode ⁽¹⁾
NC	—	4, 5	—	—	No connect

(1) In applications with high electromagnetic interference (for example, when placed near transformers or other electromagnetic sources) or significant high-frequency switching noise, TI recommends to connect this pin to the anode.

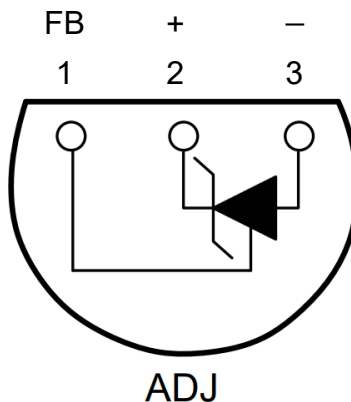
ピンの機能 : ADJ ピン配置



**図 4-4. DBZ パッケージ
3 ピン SOT-23
上面図**



**図 4-5. DCK パッケージ
5 ピン SC70
上面図**



**図 4-6. LP パッケージ
3 ピン TO-92
底面図**

ピン				I/O	説明
名称	SOT-23	SC70	TO-92		
アノード	3	2	3	O	アノードピン、通常はグランドに接続
カソード	2	3	2	I/O	シャント電流と出力電圧
FB	1	5	1	I	調整可能な出力電圧用の帰還ピン
NC**	—	—	—	—	**フローティング状態にするか、アノードに接続する必要があります
NC	—	1、4	—	—	無接続

5 Specifications

5.1 Absolute Maximum Ratings

over free-air temperature range (unless otherwise noted)

		MIN	MAX ⁽¹⁾	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" can 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 can 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)/θ_{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.

5.2 ESD Ratings

			VALUE	UNIT
V _(ESD)	Electrostatic Discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ^{(1) (2)}	±2000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽³⁾	±500	

- (1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.
- (2) The human-body model is a 100pF capacitor discharged through a 1.5kΩ resistor into each pin. The machine model is a 200pF capacitor discharged directly into each pin. All pins are rated at 2kV for human-body model, but the feedback pin which is rated at 1kV.
- (3) JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 250V CDM is possible with the necessary precautions.

5.3 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

5.4 LM4041x12I Electrical Characteristics

full-range $T_A = -40^{\circ}\text{C}$ 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 = 100μA	25°C	1.225			1.225			V
	Reverse breakdown voltage tolerance	I _Z = 100μA	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 = 10mA	25°C	±20			±20			ppm/°C
		I _Z = 1mA	25°C	±15			±15			
			Full range			±100			±100	
		I _Z = 100μA	25°C	±15			±15			
ΔV _Z /ΔI _Z	Reverse breakdown voltage change with cathode current change	I _{Z,min} < I _Z < 1mA	25°C	0.7	1.5	0.7		1.5	mV	
			Full range			2				2
		1mA < I _Z < 12mA	25°C	4		6	4			6
			Full range			8				8
Z _Z	Reverse dynamic impedance	I _Z = 1mA, f = 120Hz, I _{AC} = 0.1 I _Z	25°C	0.5		1.5	0.5		1.5	Ω
e _N	Wideband noise	I _Z = 100μA, 10Hz ≤ f ≤ 10kHz	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 = 100μA	25°C	120			120			ppm

5.5 LM4041x12I Electrical Characteristics

full-range $T_A = -40^{\circ}\text{C}$ 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	$I_Z = 100\mu\text{A}$		1.225			1.225		V
	Reverse breakdown voltage tolerance	$I_Z = 100\mu\text{A}$							mV
		Full range	–6		6	–12		12	
$I_{Z,\text{min}}$	Minimum cathode current	25°C		45	75		45	75	μA
		Full range			80			80	
α_{VZ}	Average temperature coefficient of reverse breakdown voltage	$I_Z = 10\text{mA}$		± 20			± 20		ppm/ $^{\circ}\text{C}$
		$I_Z = 1\text{mA}$		± 15			± 15		
		Full range			± 100			± 150	
		$I_Z = 100\mu\text{A}$		± 15			± 15		
$\Delta V_Z/\Delta I_Z$	Reverse breakdown voltage change with cathode current change	$I_{Z,\text{min}} < I_Z < 1\text{mA}$		0.7	1.5		0.7	2	mV
		Full range			2			2.5	
		$1\text{mA} < I_Z < 12\text{mA}$		2.5	6		2.5	8	
		Full range			8			10	
Z_Z	Reverse dynamic impedance	$I_Z = 1\text{mA}$, $f = 120\text{Hz}$, $I_{AC} = 0.1 I_Z$		0.5	1.5		0.5	2	Ω
e_N	Wideband noise	$I_Z = 100\mu\text{A}$, $10\text{Hz} \leq f \leq 10\text{kHz}$		20			20		μV_{RMS}
	Long-term stability of reverse breakdown voltage	$t = 1000\text{ h}$, $T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$, $I_Z = 100\mu\text{A}$		120			120		ppm

5.6 LM4041x12Q Electrical Characteristics

full-range $T_A = -40^{\circ}\text{C}$ 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	$I_Z = 100\mu\text{A}$		1.225			1.225		V
	Reverse breakdown voltage tolerance	$I_Z = 100\mu\text{A}$							mV
		Full range	–6		6	–12		12	
$I_{Z,\text{min}}$	Minimum cathode current	25°C		45	75		45	75	μA
		Full range			80			80	
α_{VZ}	Average temperature coefficient of reverse breakdown voltage	$I_Z = 10\text{mA}$		± 20			± 20		ppm/ $^{\circ}\text{C}$
		25°C		± 15			± 15		
		Full range			± 100			± 150	
		$I_Z = 100\mu\text{A}$		± 15			± 15		
$\Delta V_Z / \Delta I_Z$	Reverse breakdown voltage change with cathode current change	$I_{Z,\text{min}} < I_Z < 1\text{mA}$		0.7	1.5		0.7	2	mV
		Full range			2			2.5	
		$1\text{mA} < I_Z < 12\text{mA}$		2.5	6		2.5	8	
		Full range			8			10	
Z_Z	Reverse dynamic impedance	$I_Z = 1\text{mA}$, $f = 120\text{Hz}$, $I_{AC} = 0.1 I_Z$		0.5			0.5		Ω
		Full range			1.5			2	
e_N	Wideband noise	$I_Z = 100\mu\text{A}$, $10\text{Hz} \leq f \leq 10\text{kHz}$		20			20		μV_{RMS}
	Long-term stability of reverse breakdown voltage	$t = 1000\text{ h}$, $T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$, $I_Z = 100\mu\text{A}$		120			120		ppm

5.7 LM4041xl (Adjustable Version) Electrical Characteristics

full-range $T_A = -40^{\circ}\text{C}$ 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 = 100μA, V _Z = 5V	25°C	1.233			1.233			V
	Reference voltage tolerance ⁽¹⁾	I _Z = 100μA, V _Z = 5V	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	
ΔV _{REF} /ΔI _Z	Reference voltage change with cathode current change	I _{Z,min} < I _Z < 1mA	25°C	0.7		1.5	0.7		1.5	mV
			Full range			2			2	
		1mA < I _Z < 12mA	25°C	2		4	2		4	
			Full range			6			6	
ΔV _{REF} /ΔV _{KA}	Reference voltage change with output voltage change	I _Z = 1mA	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 = 10mA, V _Z = 5V	25°C	±20			±20			ppm/°C
		I _Z = 1mA, V _Z = 5V	25°C	±15			±15			
			Full range				±100	±100		
		I _Z = 100μA, V _Z = 5V	25°C	±15			±15			
Z _Z	Reverse dynamic impedance	I _Z = 1mA, f = 120Hz, I _{AC} = 0.1 I _Z , V _Z = V _{REF}	25°C	0.3			0.3			Ω
		I _Z = 1mA, f = 120Hz, I _{AC} = 0.1 I _Z , V _Z = 10V	25°C	2			2			
e _N	Wideband noise	I _Z = 100μA, V _Z = V _{REF} , 10Hz ≤ f ≤ 10kHz	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 = 100μA	25°C	120			120			ppm

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

5.8 LM4041xI (Adjustable Version) Electrical Characteristics

full-range $T_A = -40^{\circ}\text{C}$ to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	LM4041DI			UNIT
				MIN	TYP	MAX	
V_{REF}	Reference voltage	$I_Z = 100\mu\text{A}$, $V_Z = 5\text{V}$	25°C		1.233		V
	Reference voltage tolerance ⁽¹⁾	$I_Z = 100\mu\text{A}$, $V_Z = 5\text{V}$	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	$I_{Z,min} < I_Z < 1\text{mA}$	25°C		0.7	2	mV
			Full range			2.5	
		$1\text{mA} < I_Z < 12\text{mA}$	25°C		2	6	
			Full range			8	
$\Delta V_{REF}/\Delta V_{KA}$	Reference voltage change with output voltage change	$I_Z = 1\text{mA}$	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⁾	$I_Z = 10\text{mA}$, $V_Z = 5\text{V}$	25°C		± 20		ppm/ $^{\circ}\text{C}$
		$I_Z = 1\text{mA}$, $V_Z = 5\text{V}$	25°C		± 15		
			Full range			± 150	
		$I_Z = 100\mu\text{A}$, $V_Z = 5\text{V}$	25°C		± 15		
Z_Z	Reverse dynamic impedance	$I_Z = 1\text{mA}$, $f = 120\text{Hz}$, $I_{AC} = 0.1 I_Z$, $V_Z = V_{REF}$	25°C		0.3		Ω
		$I_Z = 1\text{mA}$, $f = 120\text{Hz}$, $I_{AC} = 0.1 I_Z$, $V_Z = 10\text{V}$	25°C		2		
e_N	Wideband noise	$I_Z = 100\mu\text{A}$, $V_Z = V_{REF}$, $10\text{Hz} \leq f \leq 10\text{kHz}$	25°C		20		μV_{RMS}
	Long-term stability of reverse breakdown voltage	$t = 1000\text{ h}$, $T_A = 25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$, $I_Z = 100\mu\text{A}$	25°C		120		ppm

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

5.9 LM4041xQ (Adjustable Version) Electrical Characteristics

full-range $T_A = -40^{\circ}\text{C}$ 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 = 100μA, V _Z = 5V	25°C	1.233			1.233			V
	Reference voltage tolerance ⁽¹⁾	I _Z = 100μA, V _Z = 5V	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	
ΔV _{REF} /ΔI _Z	Reference voltage change with cathode current change	I _{Z,min} < I _Z < 1mA	25°C	0.7		1.5	0.7		2	mV
			Full range			2			2.5	
		1mA < I _Z < 12mA	25°C	2		4	2		6	
			Full range			8			10	
ΔV _{REF} /ΔV _{KA}	Reference voltage change with output voltage change	I _Z = 1mA	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 = 10mA, V _Z = 5V	25°C	±20			±20			ppm/°C
		I _Z = 1mA, V _Z = 5V	25°C	±15			±15			
			Full range			±100			±150	
		I _Z = 100μA, V _Z = 5V	25°C	±15			±15			
Z _Z	Reverse dynamic impedance	I _Z = 1mA, f = 120Hz, I _{AC} = 0.1 I _Z , V _Z = V _{REF}	25°C	0.3			0.3			Ω
		I _Z = 1mA, f = 120Hz, I _{AC} = 0.1 I _Z , V _Z = 10V	25°C	2			2			
e _N	Wideband noise	I _Z = 100μA, V _Z = V _{REF} , 10Hz ≤ f ≤ 10kHz	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 = 100μA	25°C	120			120			ppm

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

5.10 Typical Characteristics

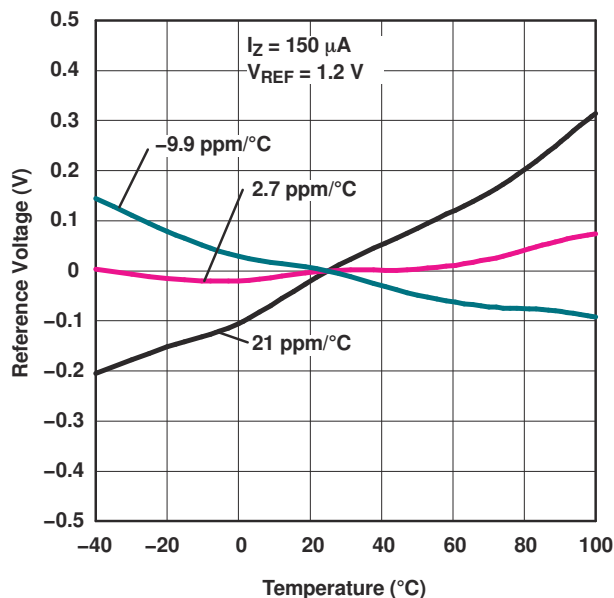


图 5-1. Temperature Drift for Different Average Temperature Coefficients

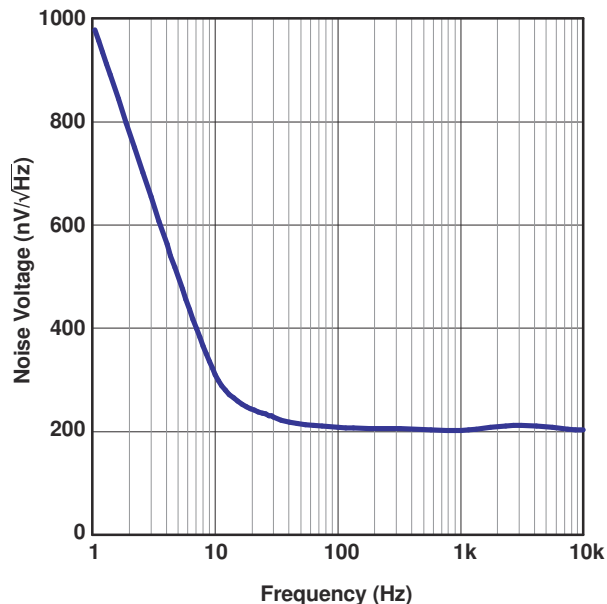


图 5-2. Noise Voltage vs Frequency

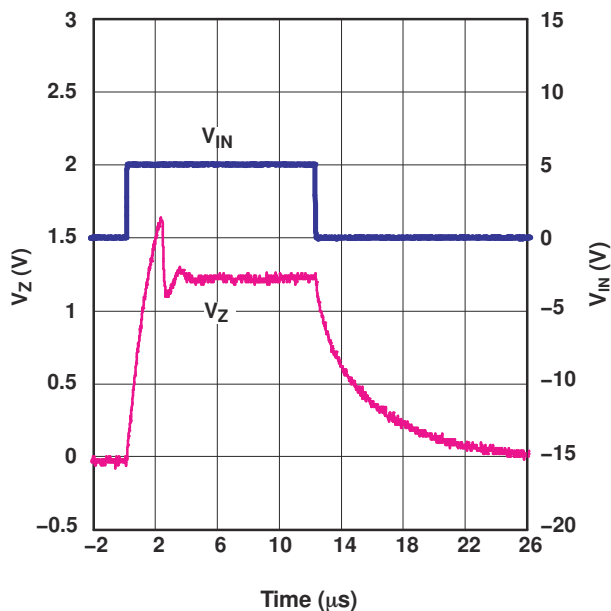


图 5-3. Start-Up Characteristics

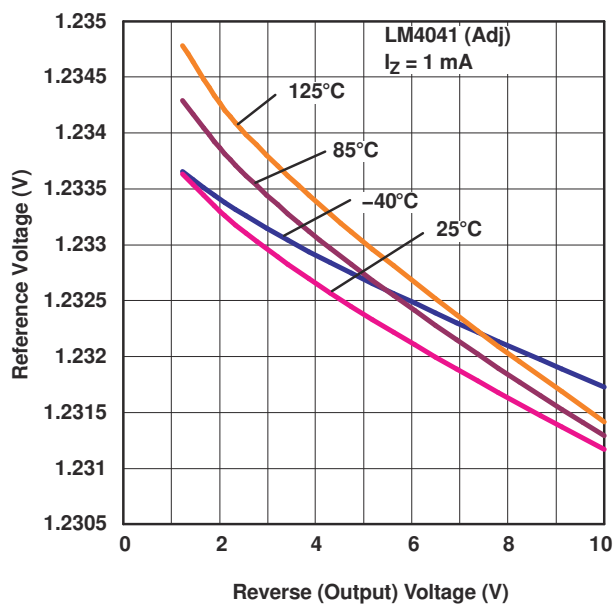


图 5-4. Reference Voltage vs Reverse (Output) Voltage (for Different Temperatures)

5.10 Typical Characteristics (continued)

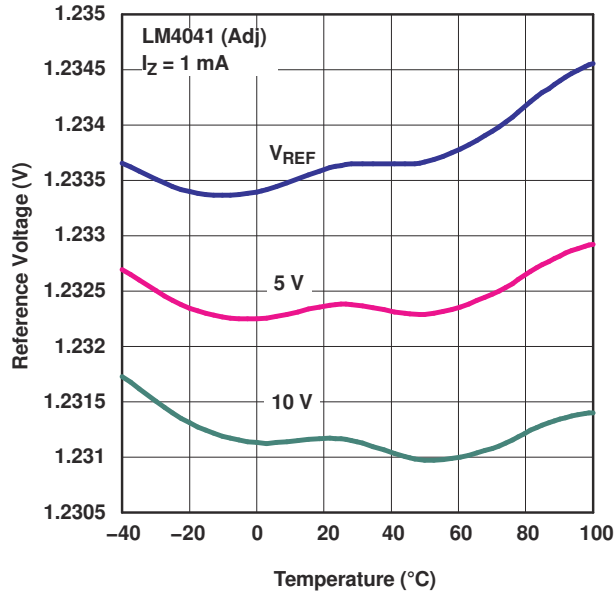


Figure 5-5. Reference Voltage vs Temperature (for Different Reverse Voltages)

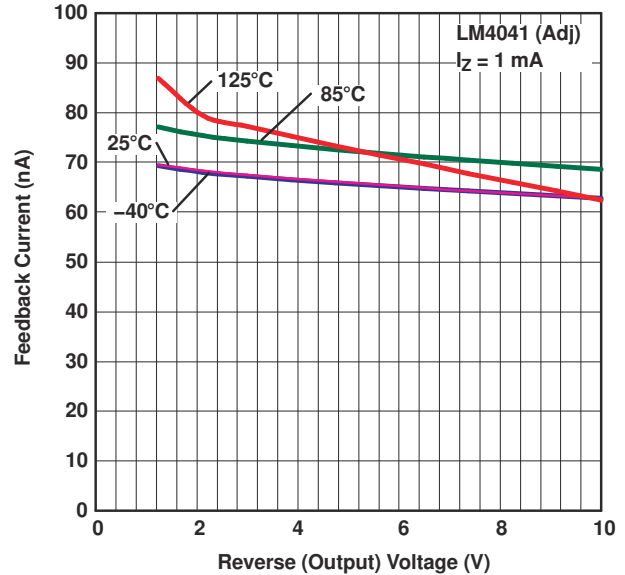


Figure 5-6. Feedback Current vs Reverse (Output) Voltage (for Different Temperatures)

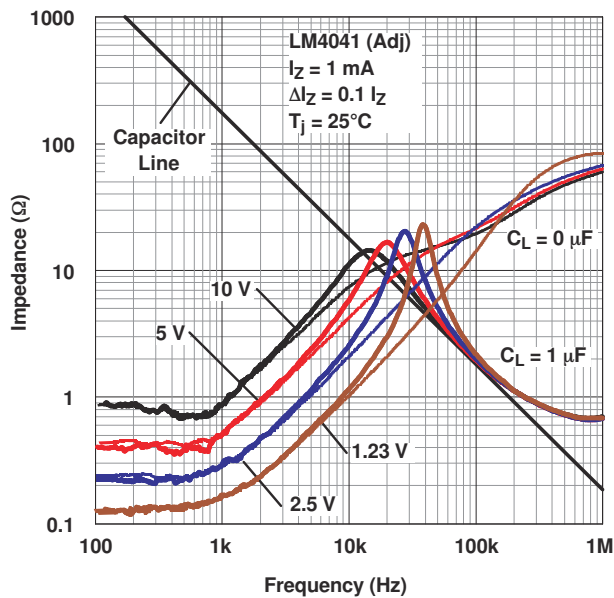


Figure 5-7. Output Impedance vs Frequency

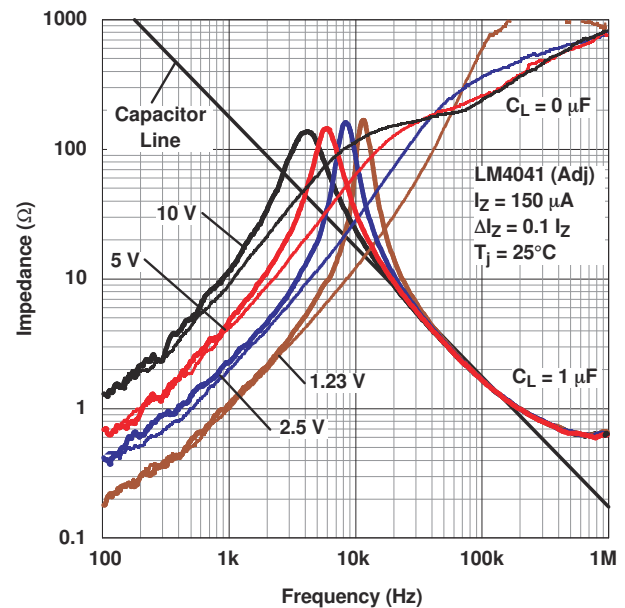


Figure 5-8. Output Impedance vs Frequency

5.10 Typical Characteristics (continued)

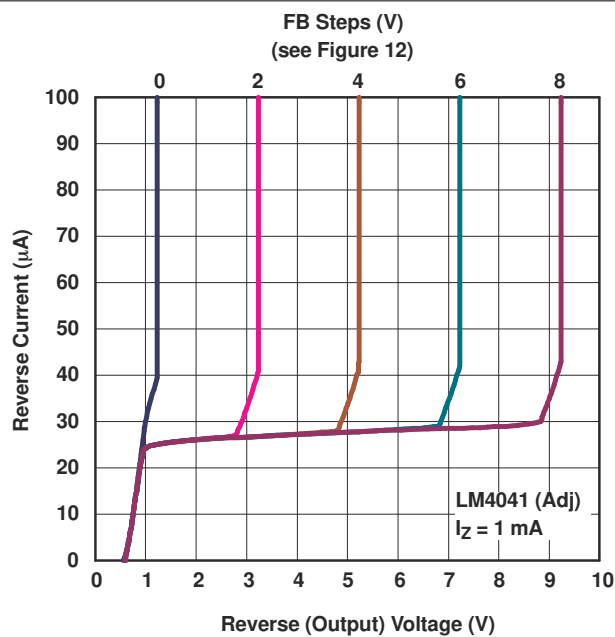


図 5-9. Reverse Characteristics

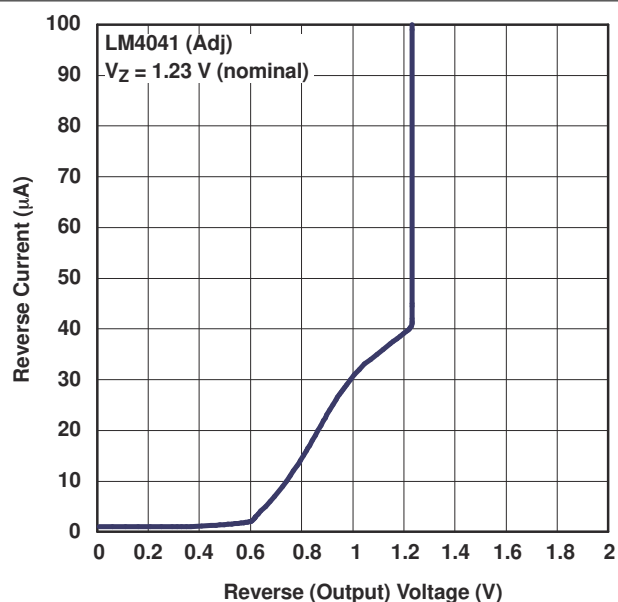


図 5-10. Reverse Characteristics and Minimum Operating Current

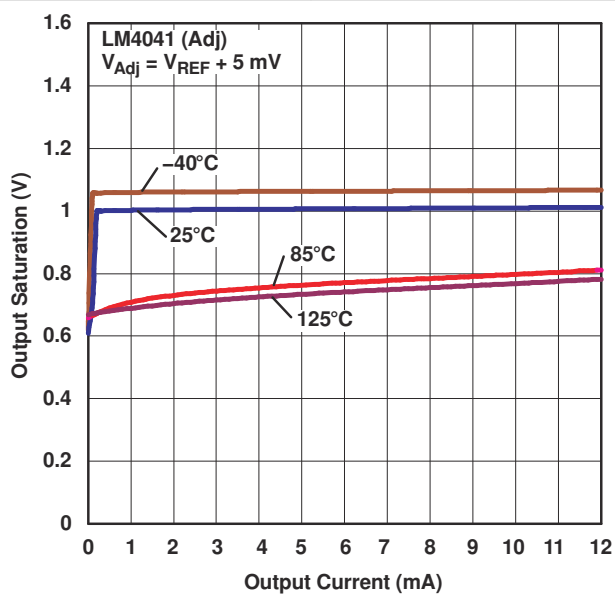


図 5-11. Output Saturation vs Output Current

6 Functional Block Diagram

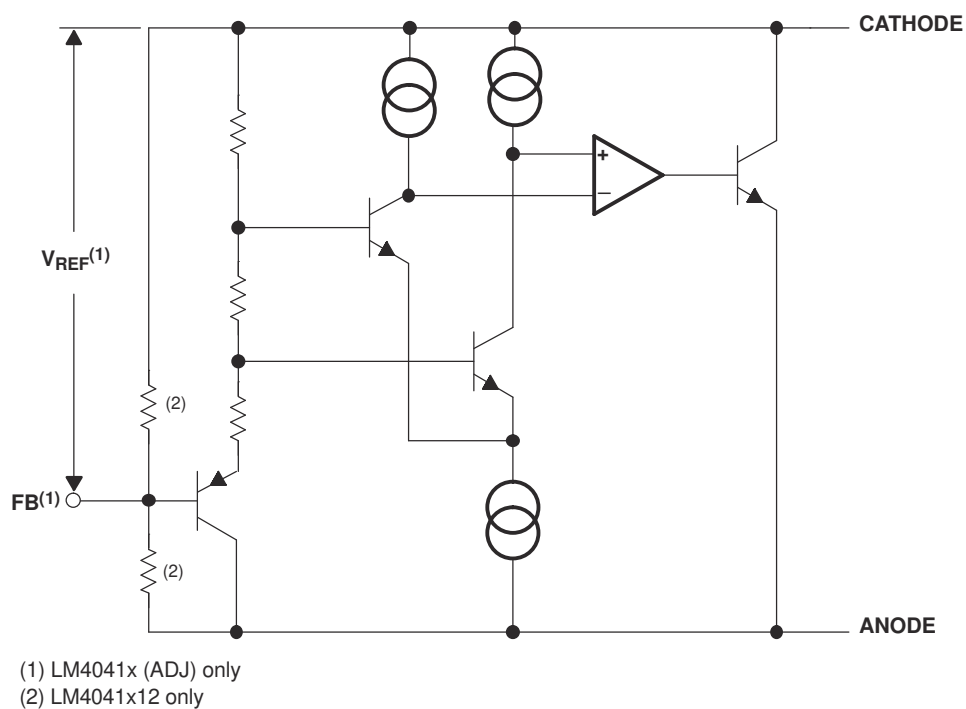


Figure 6-1. Functional Block Diagram

7 Application Information

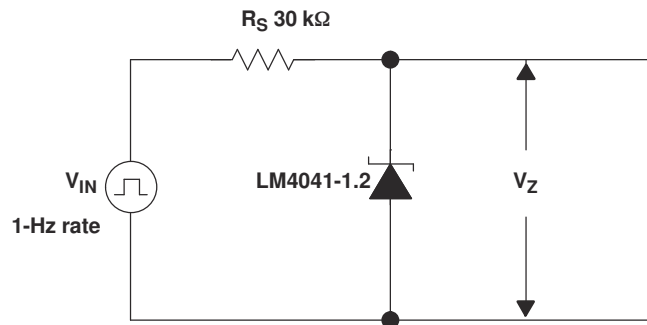


图 7-1. Startup Characteristics Test Circuit

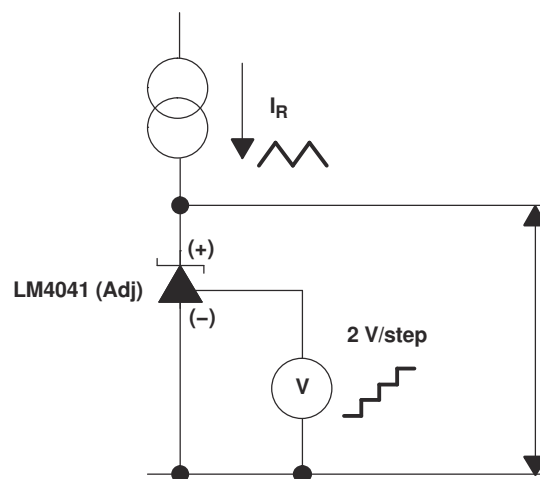


图 7-2. Reverse Characteristics Test Circuit

7.1 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.

7.2 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.

7.3 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 図 7-3.

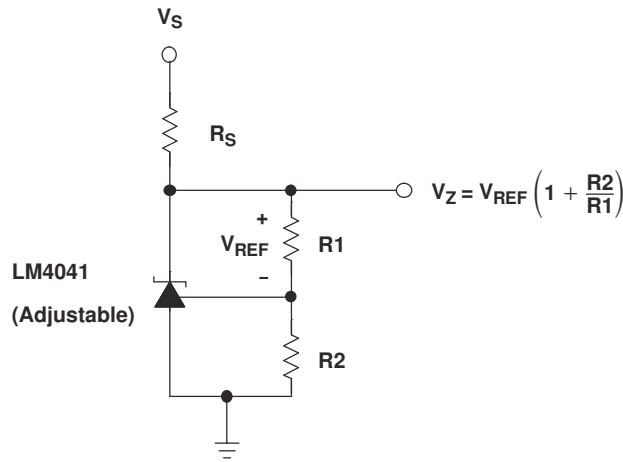


図 7-3. Adjustable Shunt Regulator

When the output voltage, V_Z , is set below 2.5V on adjustable versions of LM4041, the device can experience increased reference voltage change with output voltage change ($\Delta V_{REF}/\Delta V_{KA}$) when compared to output voltages set equal to or above 2.5V.

7.4 Cathode and Load Currents

In a typical shunt regulator configuration (see 図 7-4), an external resistor, R_S , is connected between the supply and the cathode of the LM4041. R_S must be set properly, this 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 the maximum recommended rating of 12mA.

R_S is calculated as shown in 式 1.

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

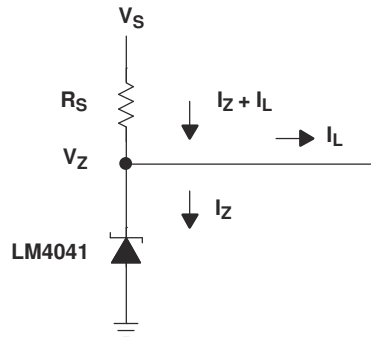


図 7-4. Shunt Regulator

8 Device and Documentation Support

8.1 ドキュメントの更新通知を受け取る方法

ドキュメントの更新についての通知を受け取るには、www.tij.co.jp のデバイス製品フォルダを開いてください。[通知] をクリックして登録すると、変更されたすべての製品情報に関するダイジェストを毎週受け取ることができます。変更の詳細については、改訂されたドキュメントに含まれている改訂履歴をご覧ください。

8.2 Trademarks

テキサス・インスツルメンツ E2E™ is a trademark of Texas Instruments.

すべての商標は、それぞれの所有者に帰属します。

8.3 静電気放電に関する注意事項



この IC は、ESD によって破損する可能性があります。テキサス・インスツルメンツは、IC を取り扱う際には常に適切な注意を払うことを推奨します。正しい取り扱いおよび設置手順に従わない場合、デバイスを破損するおそれがあります。

ESD による破損は、わずかな性能低下からデバイスの完全な故障まで多岐にわたります。精密な IC の場合、パラメータがわずかに変化するだけで公表されている仕様から外れる可能性があるため、破損が発生しやすくなっています。

8.4 サポート・リソース

テキサス・インスツルメンツ E2E™ サポート・フォーラムは、エンジニアが検証済みの回答と設計に関するヒントをエキスパートから迅速かつ直接得ることができる場所です。既存の回答を検索したり、独自の質問をしたりすることで、設計に必要な支援を迅速に得ることができます。

リンクされているコンテンツは、各寄稿者により「現状のまま」提供されるものです。これらはテキサス・インスツルメンツの仕様を構成するものではなく、必ずしもテキサス・インスツルメンツの見解を反映したものではありません。テキサス・インスツルメンツの[使用条件](#)を参照してください。

8.5 用語集

[テキサス・インスツルメンツ用語集](#)

この用語集には、用語や略語の一覧および定義が記載されています。

9 Revision History

資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

Changes from Revision G (July 2024) to Revision H (March 2025)	Page
• Updated LP pin numbering.....	3
• Added electromagnetic interference note and updated LP pinout numbering.....	3
• Added ESD ratings.....	5
• Added reference voltage change with output voltage change details.....	17

Changes from Revision F (September 2020) to Revision G (July 2024)	Page
• 「アプリケーション」のリンクを更新	1
• Updated pinout diagrams	3

Changes from Revision E (February 2006) to Revision F (September 2020)

Page

- ドキュメント全体にわたって表、図、相互参照の採番方法を更新。..... 1
- Deleted *Ordering Information* table. See Mechanical, Packaging, and Orderable Information at the end of the data sheet..... 15

10 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

重要なお知らせと免責事項

テキサス・インスツルメンツは、技術データと信頼性データ (データシートを含みます)、設計リソース (リファレンス デザインを含みます)、アプリケーションや設計に関する各種アドバイス、Web ツール、安全性情報、その他のリソースを、欠陥が存在する可能性のある「現状のまま」提供しており、商品性および特定目的に対する適合性の黙示保証、第三者の知的財産権の非侵害保証を含むいかなる保証も、明示的または黙示的にかかわらず拒否します。

これらのリソースは、テキサス・インスツルメンツ製品を使用する設計の経験を積んだ開発者への提供を意図したものです。(1) お客様のアプリケーションに適した テキサス・インスツルメンツ製品の選定、(2) お客様のアプリケーションの設計、検証、試験、(3) お客様のアプリケーションに該当する各種規格や、その他のあらゆる安全性、セキュリティ、規制、または他の要件への確実な適合に関する責任を、お客様のみが単独で負うものとします。

上記の各種リソースは、予告なく変更される可能性があります。これらのリソースは、リソースで説明されている テキサス・インスツルメンツ製品を使用するアプリケーションの開発の目的でのみ、テキサス・インスツルメンツはその使用をお客様に許諾します。これらのリソースに関して、他の目的で複製することや掲載することは禁止されています。テキサス・インスツルメンツや第三者の知的財産権のライセンスが付与されている訳ではありません。お客様は、これらのリソースを自身で使用した結果発生するあらゆる申し立て、損害、費用、損失、責任について、テキサス・インスツルメンツおよびその代理人を完全に補償するものとし、テキサス・インスツルメンツは一切の責任を拒否します。

テキサス・インスツルメンツの製品は、[テキサス・インスツルメンツの販売条件](#)、または [ti.com](https://www.ti.com) やかかる テキサス・インスツルメンツ製品の関連資料などのいずれかを通じて提供する適用可能な条項の下で提供されています。テキサス・インスツルメンツがこれらのリソースを提供することは、適用されるテキサス・インスツルメンツの保証または他の保証の放棄の拡大や変更を意味するものではありません。

お客様がいかなる追加条項または代替条項を提案した場合でも、テキサス・インスツルメンツはそれらに異議を唱え、拒否します。

郵送先住所: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2025, Texas Instruments Incorporated

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
LM4041A12IDBZR	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 85	(4MK3, 4MKU)
LM4041A12IDBZR.A	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MK3, 4MKU)
LM4041A12IDBZT	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MK3, 4MKU)
LM4041A12IDBZT.A	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MK3, 4MKU)
LM4041A12IDBZT1G4	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	4MK3
LM4041A12IDBZT1G4.A	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	4MK3
LM4041A12IDCKR	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	NIPDAU POST- PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MKU
LM4041A12IDCKR.A	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	POST-PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MKU
LM4041B12IDBZR	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4ML3, 4MLU)
LM4041B12IDBZR.A	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4ML3, 4MLU)
LM4041B12IDBZT	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4ML3, 4MLU)
LM4041B12IDBZT.A	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4ML3, 4MLU)
LM4041B12IDCKR	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	NIPDAU POST- PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MLU
LM4041B12IDCKR.A	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	POST-PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MLU
LM4041BIDBZR	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 85	(4MG3, 4MGU)
LM4041BIDBZR.A	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	(4MG3, 4MGU)
LM4041BIDBZR1G4	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MG3, 4MGU)
LM4041BIDBZR1G4.A	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MG3, 4MGU)
LM4041BIDBZT	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 85	(4MG3, 4MGU)
LM4041BIDBZT.A	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	(4MG3, 4MGU)
LM4041BIDCKR	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	NIPDAU POST- PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MGU
LM4041BIDCKR.A	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	POST-PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MGU
LM4041BIDCKT	Active	Production	SC70 (DCK) 5	250 SMALL T&R	Yes	NIPDAU POST- PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MGU
LM4041BIDCKT.A	Active	Production	SC70 (DCK) 5	250 SMALL T&R	Yes	POST-PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MGU
LM4041C12IDBZR	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MM3, 4MMU)
LM4041C12IDBZR.A	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MM3, 4MMU)

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
LM4041C12IDBZR1G4	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	4MM3
LM4041C12IDBZR1G4.A	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	4MM3
LM4041C12IDBZT	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MM3, 4MMU)
LM4041C12IDBZT.A	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MM3, 4MMU)
LM4041C12IDCKR	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	NIPDAU POST- PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MMU
LM4041C12IDCKR.A	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	POST-PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MMU
LM4041C12IDCKRE4	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	-	Call TI	Call TI	-40 to 85	
LM4041C12IDCKRG4	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	-	Call TI	Call TI	-40 to 85	
LM4041C12ILP	Active	Production	TO-92 (LP) 3	1000 BULK	Yes	SN	N/A for Pkg Type	-40 to 85	NPC12I
LM4041C12ILP.A	Active	Production	TO-92 (LP) 3	1000 BULK	Yes	SN	N/A for Pkg Type	-40 to 85	NPC12I
LM4041C12ILPR	Active	Production	TO-92 (LP) 3	2000 LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 85	NPC12I
LM4041C12ILPR.A	Active	Production	TO-92 (LP) 3	2000 LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 85	NPC12I
LM4041C12QDBZR	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MS3, 4MSU)
LM4041C12QDBZR.A	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MS3, 4MSU)
LM4041C12QDBZT	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MS3, 4MSU)
LM4041C12QDBZT.A	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MS3, 4MSU)
LM4041CIDBZR	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 85	(4MH3, 4MHU)
LM4041CIDBZR.A	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	(4MH3, 4MHU)
LM4041CIDBZT	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 85	(4MH3, 4MHU)
LM4041CIDBZT.A	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	(4MH3, 4MHU)
LM4041CIDCKR	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	NIPDAU POST- PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MHU
LM4041CIDCKR.A	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	POST-PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MHU
LM4041CIDCKT	Active	Production	SC70 (DCK) 5	250 SMALL T&R	Yes	NIPDAU POST- PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MHU
LM4041CIDCKT.A	Active	Production	SC70 (DCK) 5	250 SMALL T&R	Yes	POST-PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MHU
LM4041CILP	Obsolete	Production	TO-92 (LP) 3	-	-	Call TI	Call TI	-40 to 85	NPCI
LM4041CILPE3	NRND	Production	TO-92 (LP) 3	1000 BULK	-	Call TI	Call TI	-40 to 85	
LM4041CILPR	Active	Production	TO-92 (LP) 3	2000 LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 85	NPCI
LM4041CILPR.A	Active	Production	TO-92 (LP) 3	2000 LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 85	NPCI

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
LM4041CQDBZR	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 125	(4MP3, 4MPU)
LM4041CQDBZR.A	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(4MP3, 4MPU)
LM4041CQDBZT	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 125	(4MP3, 4MPU)
LM4041CQDBZT.A	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(4MP3, 4MPU)
LM4041D12IDBZR	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MN3, 4MNU)
LM4041D12IDBZR.A	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MN3, 4MNU)
LM4041D12IDBZR1G4	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	4MN3
LM4041D12IDBZR1G4.A	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	4MN3
LM4041D12IDBZT	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MN3, 4MNU)
LM4041D12IDBZT.A	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MN3, 4MNU)
LM4041D12IDCKR	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	NIPDAU POST- PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MNU
LM4041D12IDCKR.A	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	POST-PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MNU
LM4041D12ILP	Active	Production	TO-92 (LP) 3	1000 BULK	Yes	SN	N/A for Pkg Type	-40 to 85	NPD12I
LM4041D12ILP.A	Active	Production	TO-92 (LP) 3	1000 BULK	Yes	SN	N/A for Pkg Type	-40 to 85	NPD12I
LM4041D12ILPE3	Active	Production	TO-92 (LP) 3	1000 BULK	-	Call TI	Call TI	-40 to 85	
LM4041D12ILPR	Active	Production	TO-92 (LP) 3	2000 LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 85	NPD12I
LM4041D12ILPR.A	Active	Production	TO-92 (LP) 3	2000 LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 85	NPD12I
LM4041D12QDBZR	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MT3, 4MTU)
LM4041D12QDBZR.A	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MT3, 4MTU)
LM4041DIDBZR	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 85	(4MJ3, 4MJU)
LM4041DIDBZR.A	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	(4MJ3, 4MJU)
LM4041DIDBZT	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 85	(4MJ3, 4MJU)
LM4041DIDBZT.A	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	(4MJ3, 4MJU)
LM4041DIDCKR	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	NIPDAU POST- PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MJU
LM4041DIDCKR.A	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	POST-PLAT AG SPOT	Level-1-260C-UNLIM	-40 to 85	MJU
LM4041DIDCKRG4	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MJU
LM4041DIDCKRG4.A	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MJU
LM4041DILP	Obsolete	Production	TO-92 (LP) 3	-	-	Call TI	Call TI	-40 to 85	NPDI
LM4041DILPR	Active	Production	TO-92 (LP) 3	2000 LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 85	NPDI

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
LM4041DILPR.A	Active	Production	TO-92 (LP) 3	2000 LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 85	NPDI
LM4041DQDBZR	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 125	(4MR3, 4MRU)
LM4041DQDBZR.A	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(4MR3, 4MRU)
LM4041DQDBZT	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 125	(4MR3, 4MRU)
LM4041DQDBZT.A	Active	Production	SOT-23 (DBZ) 3	250 SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(4MR3, 4MRU)

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

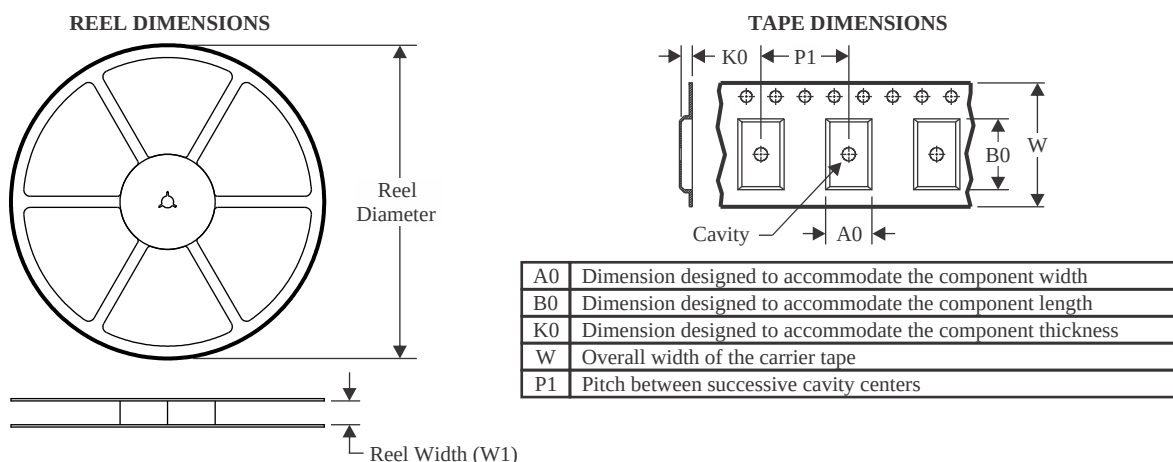
⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

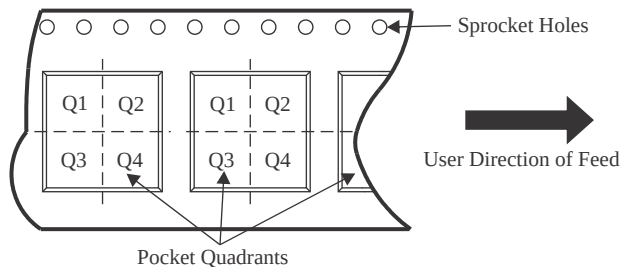
Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



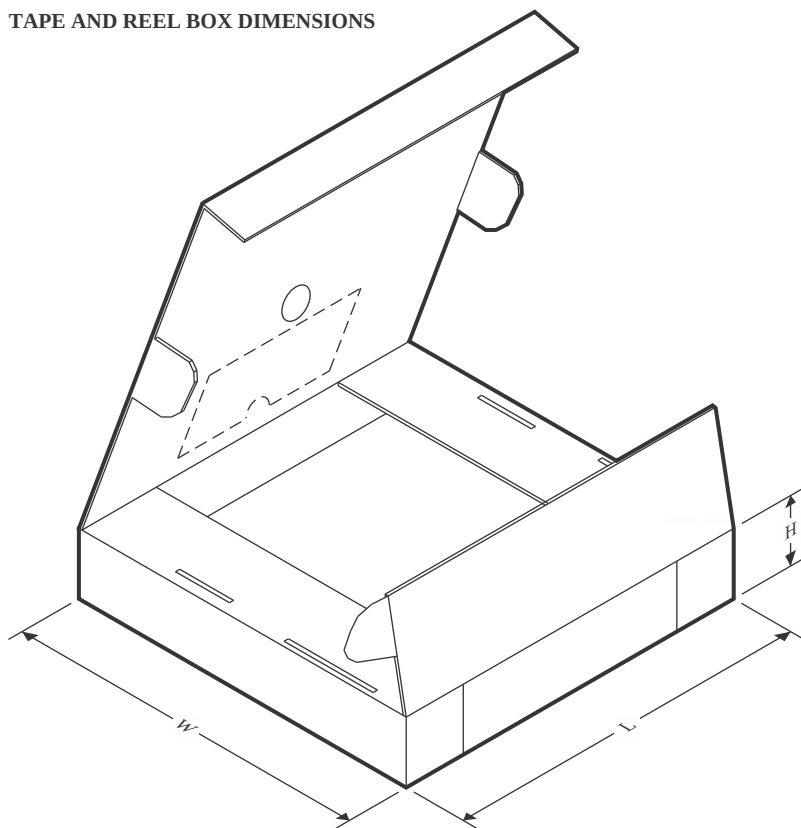
*All dimensions are nominal

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
LM4041A12IDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
LM4041A12IDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
LM4041A12IDBZT1G4	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
LM4041A12IDCKR	SC70	DCK	5	3000	180.0	8.4	2.3	2.55	1.2	4.0	8.0	Q3
LM4041A12IDCKR	SC70	DCK	5	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
LM4041B12IDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
LM4041B12IDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	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
LM4041B12IDCKR	SC70	DCK	5	3000	180.0	8.4	2.3	2.55	1.2	4.0	8.0	Q3
LM4041BIDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
LM4041BIDBZR	SOT-23	DBZ	3	3000	178.0	9.2	3.15	2.77	1.22	4.0	8.0	Q3
LM4041BIDBZR1G4	SOT-23	DBZ	3	3000	179.0	8.4	3.15	2.95	1.22	4.0	8.0	Q3
LM4041BIDBZR1G4	SOT-23	DBZ	3	3000	178.0	9.2	3.15	2.77	1.22	4.0	8.0	Q3
LM4041BIDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
LM4041BIDBZT	SOT-23	DBZ	3	250	178.0	9.2	3.15	2.77	1.22	4.0	8.0	Q3
LM4041BIDBZT	SOT-23	DBZ	3	250	179.0	8.4	3.15	2.95	1.22	4.0	8.0	Q3

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
LM4041BIDCKR	SC70	DCK	5	3000	180.0	8.4	2.3	2.55	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	180.0	8.4	2.3	2.55	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
LM4041C12IDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
LM4041C12IDBZR	SOT-23	DBZ	3	3000	179.0	8.4	3.15	2.95	1.22	4.0	8.0	Q3
LM4041C12IDBZR1G4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
LM4041C12IDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	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
LM4041C12IDCKR	SC70	DCK	5	3000	180.0	8.4	2.3	2.55	1.2	4.0	8.0	Q3
LM4041C12QDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
LM4041C12QDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
LM4041CIDBZR	SOT-23	DBZ	3	3000	178.0	9.2	3.15	2.77	1.22	4.0	8.0	Q3
LM4041CIDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
LM4041CIDBZT	SOT-23	DBZ	3	250	179.0	8.4	3.15	2.95	1.22	4.0	8.0	Q3
LM4041CIDBZT	SOT-23	DBZ	3	250	178.0	9.2	3.15	2.77	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
LM4041CIDCKR	SC70	DCK	5	3000	180.0	8.4	2.3	2.55	1.2	4.0	8.0	Q3
LM4041CIDCKT	SC70	DCK	5	250	180.0	8.4	2.3	2.55	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
LM4041CQDBZR	SOT-23	DBZ	3	3000	178.0	9.2	3.15	2.77	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
LM4041CQDBZT	SOT-23	DBZ	3	250	178.0	9.2	3.15	2.77	1.22	4.0	8.0	Q3
LM4041D12IDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
LM4041D12IDBZR1G4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
LM4041D12IDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	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
LM4041D12IDCKR	SC70	DCK	5	3000	180.0	8.4	2.3	2.55	1.2	4.0	8.0	Q3
LM4041D12QDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
LM4041DIDBZR	SOT-23	DBZ	3	3000	179.0	8.4	3.15	2.95	1.22	4.0	8.0	Q3
LM4041DIDBZR	SOT-23	DBZ	3	3000	178.0	9.2	3.15	2.77	1.22	4.0	8.0	Q3
LM4041DIDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
LM4041DIDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
LM4041DIDBZT	SOT-23	DBZ	3	250	178.0	9.2	3.15	2.77	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
LM4041DIDCKR	SC70	DCK	5	3000	180.0	8.4	2.3	2.55	1.2	4.0	8.0	Q3
LM4041DIDCKRG4	SC70	DCK	5	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
LM4041DQDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
LM4041DQDBZR	SOT-23	DBZ	3	3000	178.0	9.2	3.15	2.77	1.22	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

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
LM4041DQDBZT	SOT-23	DBZ	3	250	179.0	8.4	3.15	2.95	1.22	4.0	8.0	Q3
LM4041DQDBZT	SOT-23	DBZ	3	250	178.0	9.2	3.15	2.77	1.22	4.0	8.0	Q3
LM4041DQDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	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)
LM4041A12IDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4041A12IDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
LM4041A12IDBZT1G4	SOT-23	DBZ	3	250	210.0	185.0	35.0
LM4041A12IDCKR	SC70	DCK	5	3000	210.0	185.0	35.0
LM4041A12IDCKR	SC70	DCK	5	3000	200.0	183.0	25.0
LM4041B12IDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4041B12IDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
LM4041B12IDCKR	SC70	DCK	5	3000	200.0	183.0	25.0
LM4041B12IDCKR	SC70	DCK	5	3000	210.0	185.0	35.0
LM4041BIDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4041BIDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
LM4041BIDBZR1G4	SOT-23	DBZ	3	3000	200.0	183.0	25.0
LM4041BIDBZR1G4	SOT-23	DBZ	3	3000	180.0	180.0	18.0
LM4041BIDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
LM4041BIDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0
LM4041BIDBZT	SOT-23	DBZ	3	250	200.0	183.0	25.0
LM4041BIDCKR	SC70	DCK	5	3000	210.0	185.0	35.0
LM4041BIDCKR	SC70	DCK	5	3000	200.0	183.0	25.0

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM4041BIDCKT	SC70	DCK	5	250	210.0	185.0	35.0
LM4041BIDCKT	SC70	DCK	5	250	203.0	203.0	35.0
LM4041C12IDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4041C12IDBZR	SOT-23	DBZ	3	3000	200.0	183.0	25.0
LM4041C12IDBZR1G4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4041C12IDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
LM4041C12IDCKR	SC70	DCK	5	3000	200.0	183.0	25.0
LM4041C12IDCKR	SC70	DCK	5	3000	210.0	185.0	35.0
LM4041C12QDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4041C12QDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
LM4041CIDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
LM4041CIDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
LM4041CIDBZT	SOT-23	DBZ	3	250	203.0	203.0	35.0
LM4041CIDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0
LM4041CIDCKR	SC70	DCK	5	3000	200.0	183.0	25.0
LM4041CIDCKR	SC70	DCK	5	3000	210.0	185.0	35.0
LM4041CIDCKT	SC70	DCK	5	250	210.0	185.0	35.0
LM4041CIDCKT	SC70	DCK	5	250	200.0	183.0	25.0
LM4041CQDBZR	SOT-23	DBZ	3	3000	200.0	183.0	25.0
LM4041CQDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
LM4041CQDBZT	SOT-23	DBZ	3	250	200.0	183.0	25.0
LM4041CQDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0
LM4041D12IDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4041D12IDBZR1G4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4041D12IDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
LM4041D12IDCKR	SC70	DCK	5	3000	200.0	183.0	25.0
LM4041D12IDCKR	SC70	DCK	5	3000	210.0	185.0	35.0
LM4041D12QDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4041DIDBZR	SOT-23	DBZ	3	3000	200.0	183.0	25.0
LM4041DIDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
LM4041DIDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4041DIDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
LM4041DIDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0
LM4041DIDCKR	SC70	DCK	5	3000	200.0	183.0	25.0
LM4041DIDCKR	SC70	DCK	5	3000	210.0	185.0	35.0
LM4041DIDCKRG4	SC70	DCK	5	3000	200.0	183.0	25.0
LM4041DQDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4041DQDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
LM4041DQDBZR	SOT-23	DBZ	3	3000	200.0	183.0	25.0
LM4041DQDBZT	SOT-23	DBZ	3	250	203.0	203.0	35.0
LM4041DQDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0
LM4041DQDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0

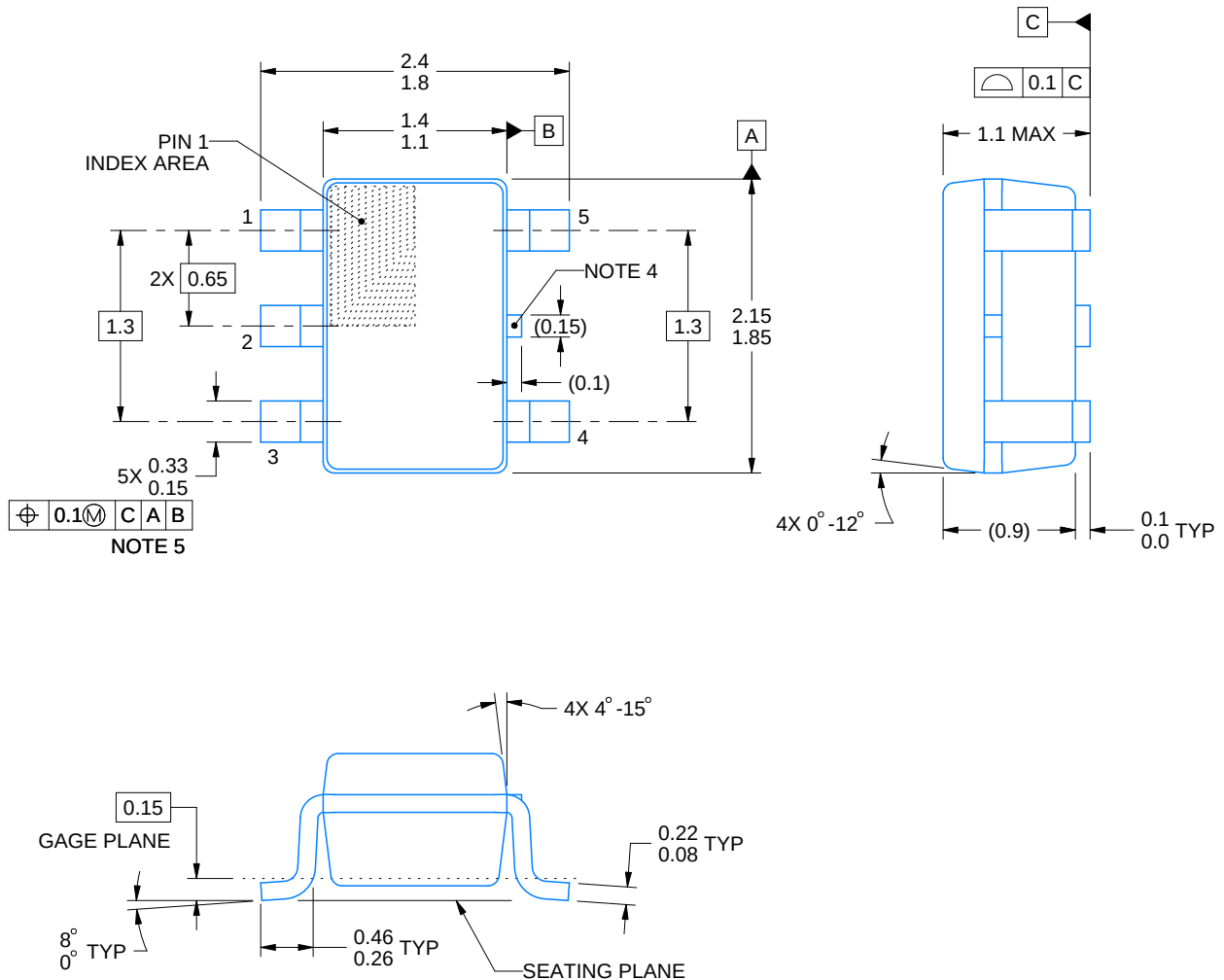
DCK0005A



PACKAGE OUTLINE

SOT - 1.1 max height

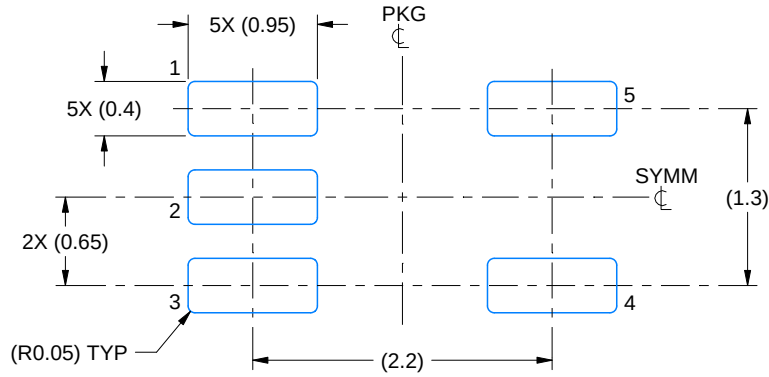
SMALL OUTLINE TRANSISTOR



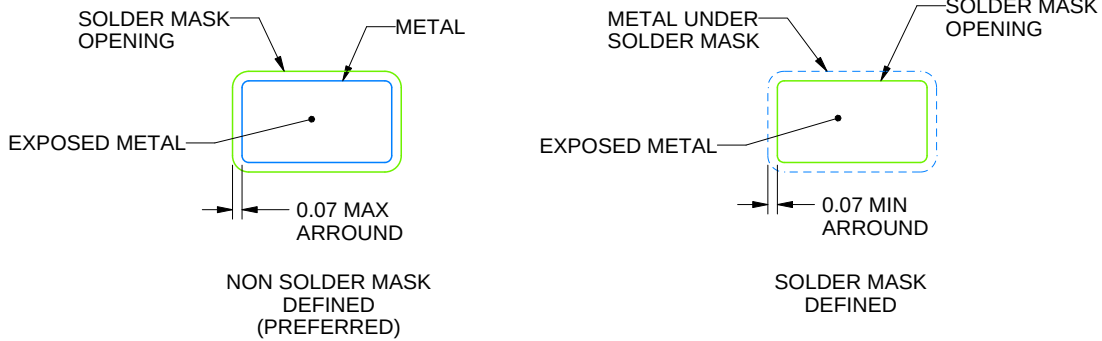
4214834/G 11/2024

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC MO-203.
4. Support pin may differ or may not be present.
5. Lead width does not comply with JEDEC.
6. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25mm per side



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:18X



SOLDER MASK DETAILS

4214834/G 11/2024

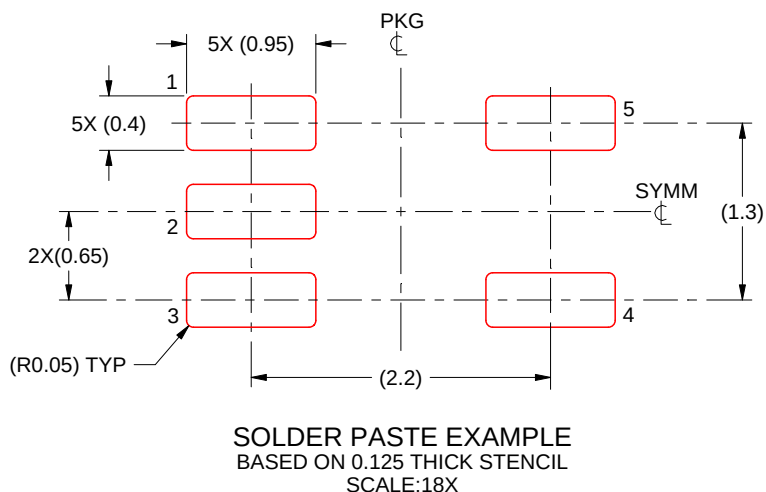
NOTES: (continued)

7. Publication IPC-7351 may have alternate designs.
8. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

DCK0005A

SOT - 1.1 max height

SMALL OUTLINE TRANSISTOR



4214834/G 11/2024

NOTES: (continued)

9. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
10. Board assembly site may have different recommendations for stencil design.

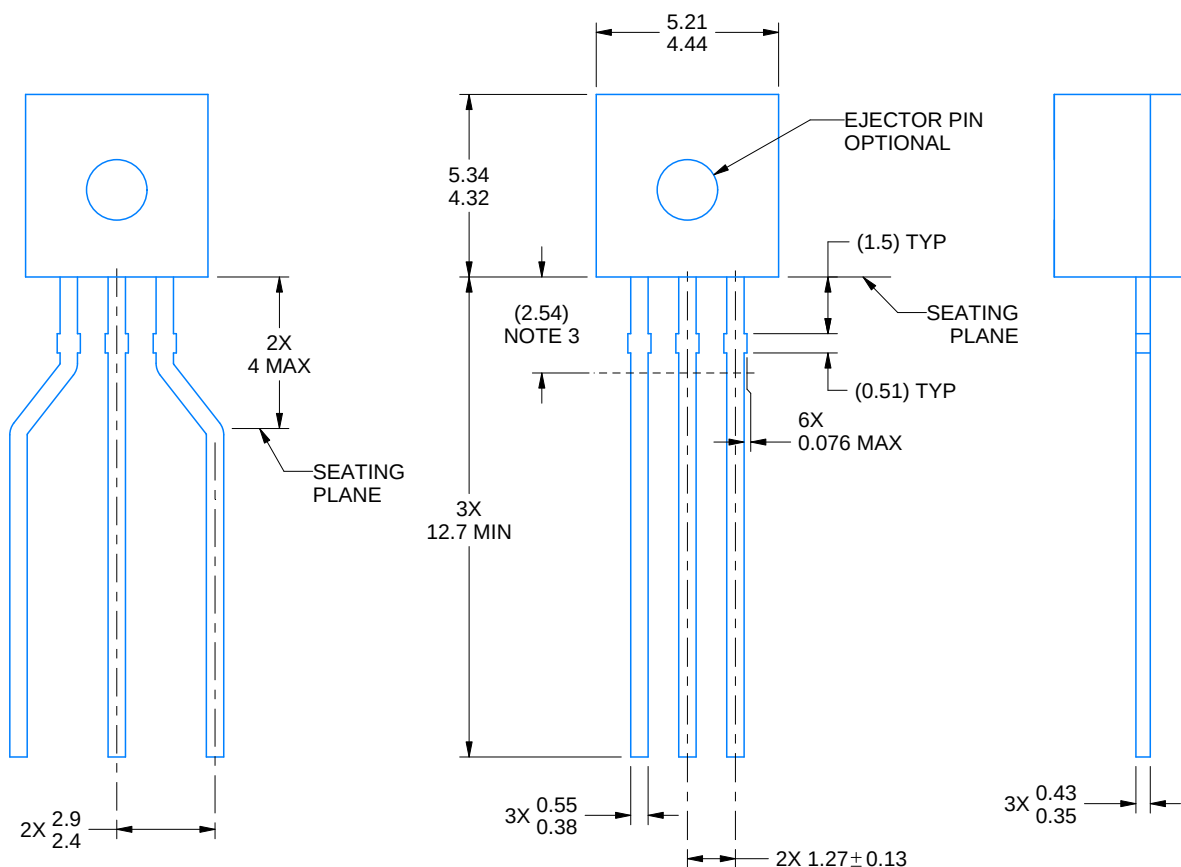
LP0003A



PACKAGE OUTLINE

TO-92 - 5.34 mm max height

TO-92



4215214/C 04/2025

NOTES:

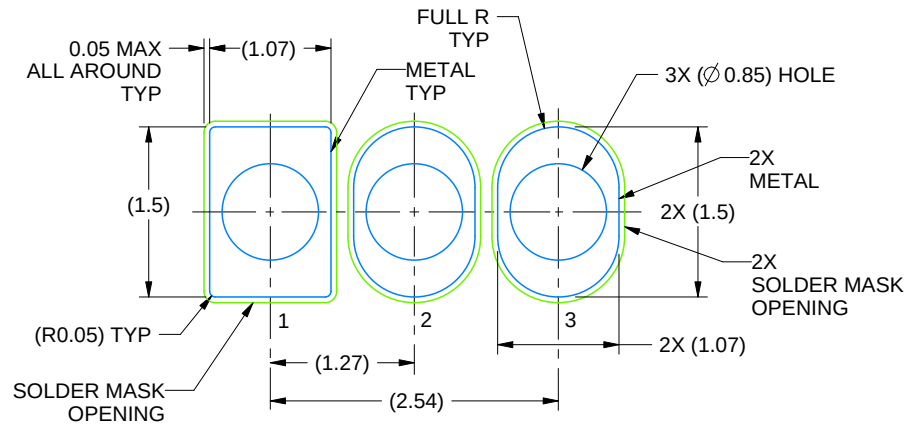
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Lead dimensions are not controlled within this area.
4. Reference JEDEC TO-226, variation AA.
5. Shipping method:
 - a. Straight lead option available in bulk pack only.
 - b. Formed lead option available in tape and reel or ammo pack.
 - c. Specific products can be offered in limited combinations of shipping medium and lead options.
 - d. Consult product folder for more information on available options.

EXAMPLE BOARD LAYOUT

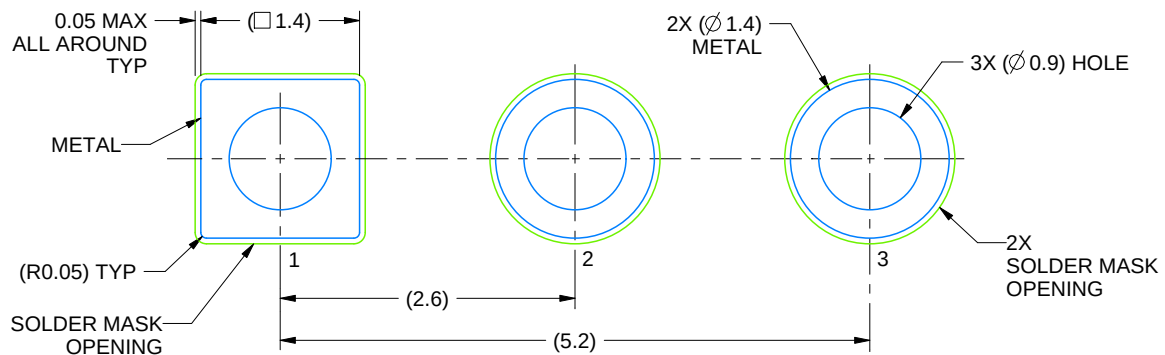
LP0003A

TO-92 - 5.34 mm max height

TO-92



LAND PATTERN EXAMPLE
STRAIGHT LEAD OPTION
NON-SOLDER MASK DEFINED
SCALE:15X



LAND PATTERN EXAMPLE
FORMED LEAD OPTION
NON-SOLDER MASK DEFINED
SCALE:15X

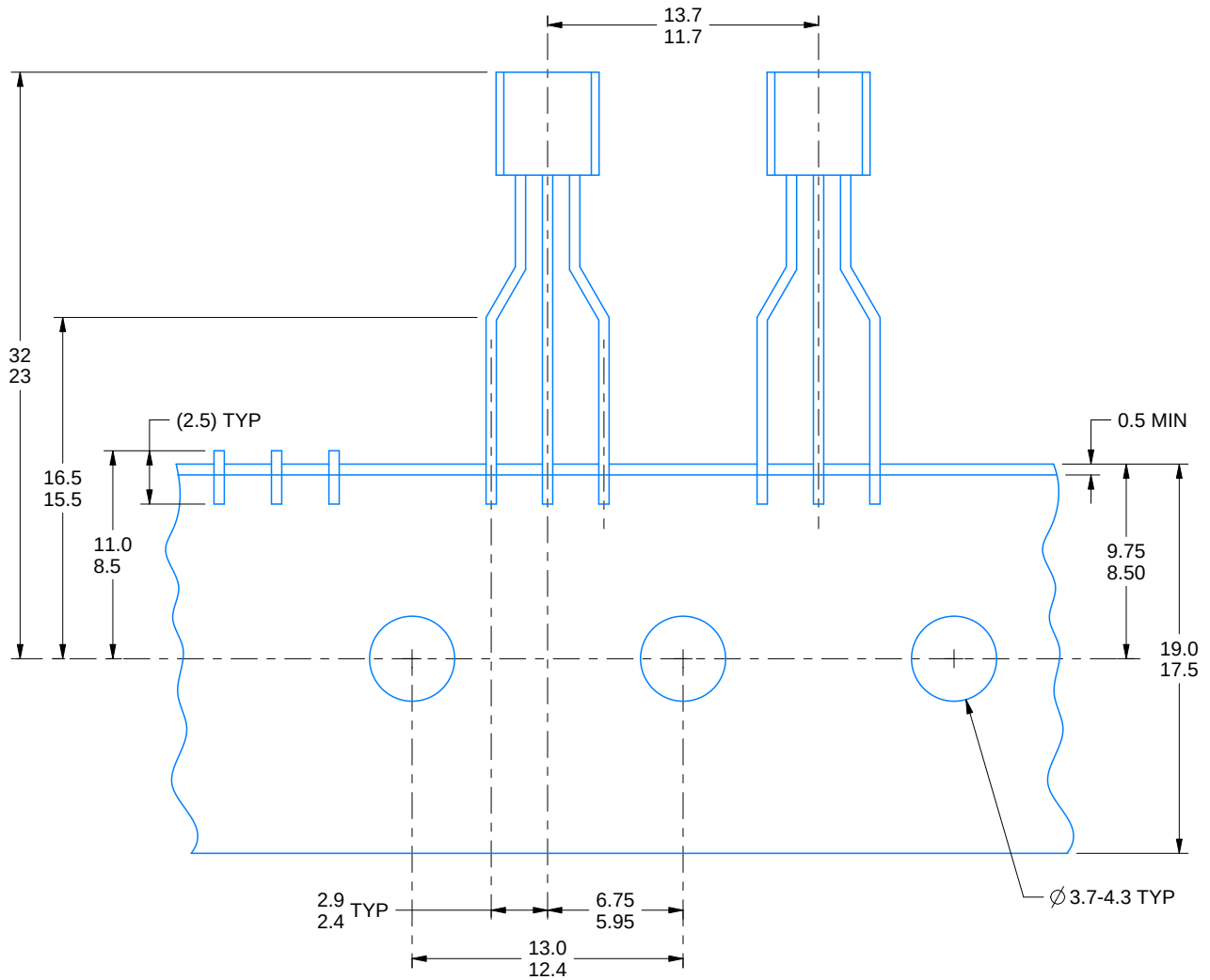
4215214/C 04/2025

TAPE SPECIFICATIONS

LP0003A

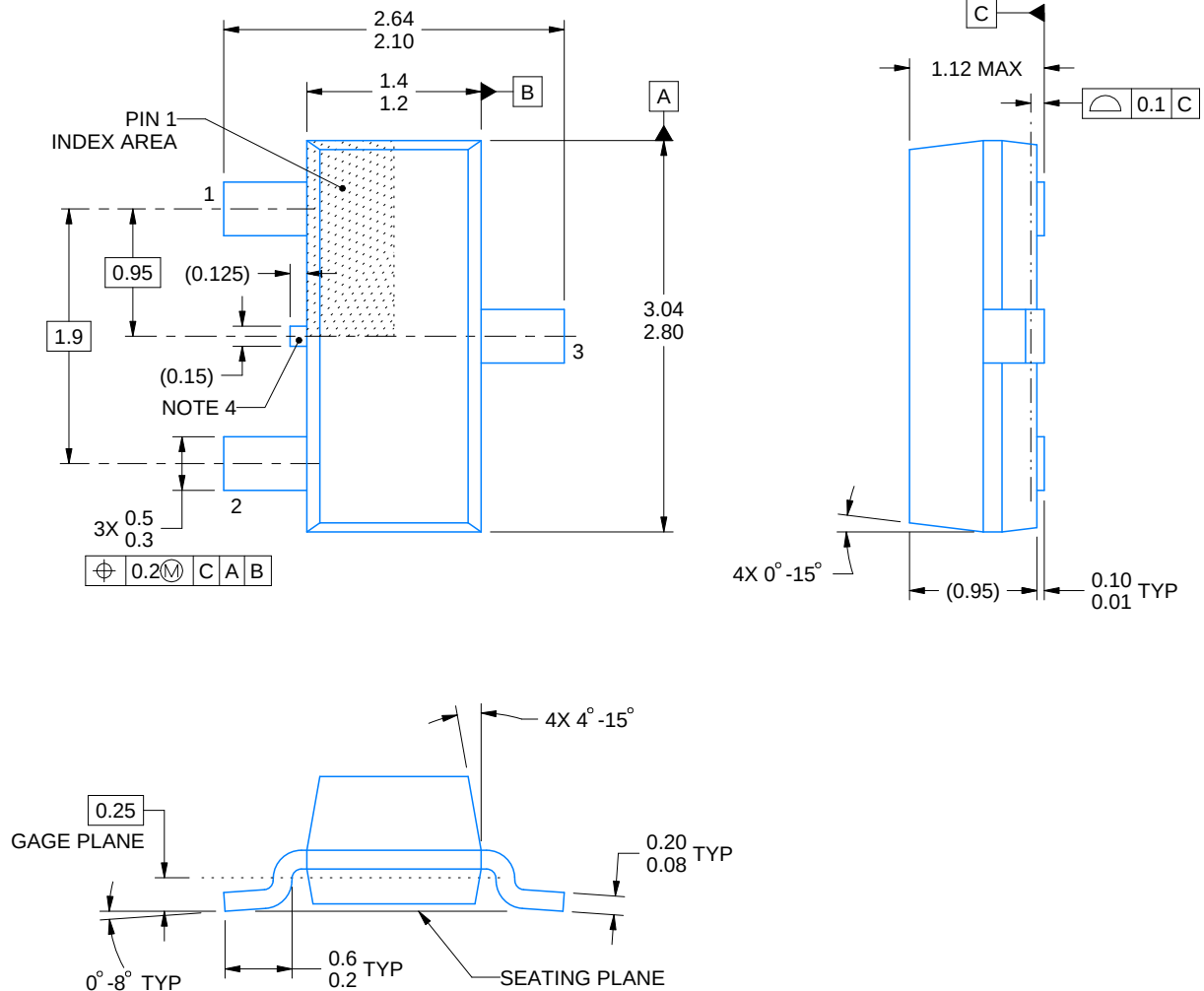
TO-92 - 5.34 mm max height

TO-92



FOR FORMED LEAD OPTION PACKAGE

4215214/C 04/2025



4214838/F 08/2024

NOTES:

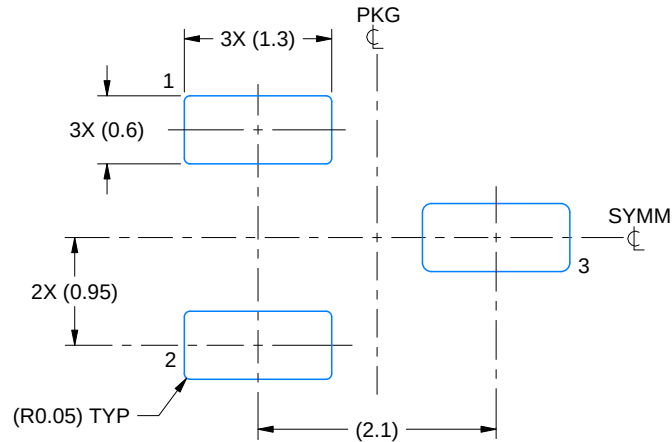
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration TO-236, except minimum foot length.
4. Support pin may differ or may not be present.
5. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25mm per side

EXAMPLE BOARD LAYOUT

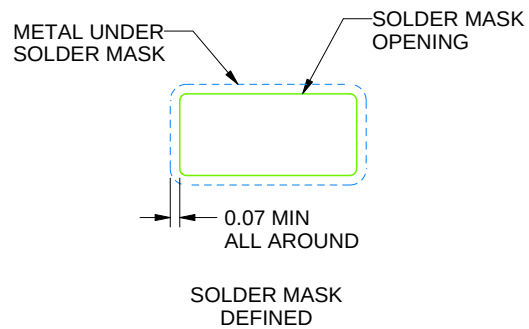
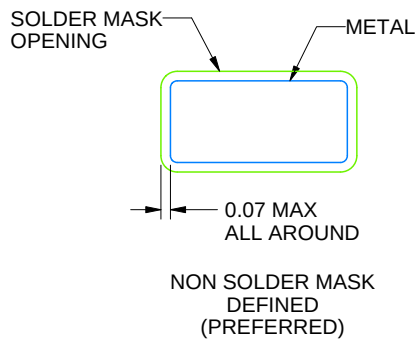
DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
SCALE:15X



SOLDER MASK DETAILS

4214838/F 08/2024

NOTES: (continued)

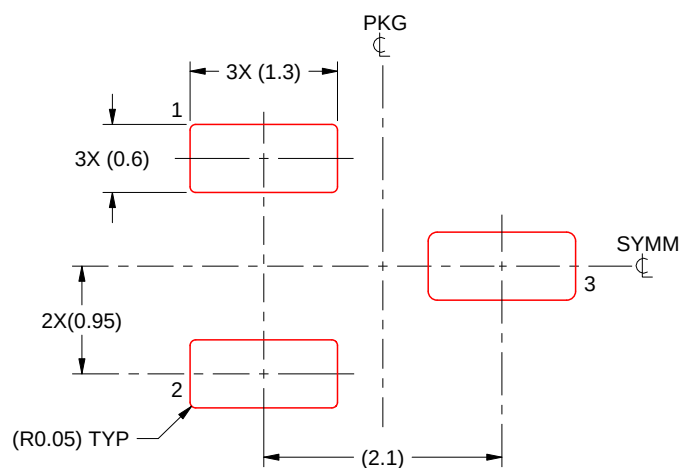
5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE
BASED ON 0.125 THICK STENCIL
SCALE:15X

4214838/F 08/2024

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

重要なお知らせと免責事項

TI は、技術データと信頼性データ (データシートを含みます)、設計リソース (リファレンス デザインを含みます)、アプリケーションや設計に関する各種アドバイス、Web ツール、安全性情報、その他のリソースを、欠陥が存在する可能性のある「現状のまま」提供しており、商品性および特定目的に対する適合性の黙示保証、第三者の知的財産権の非侵害保証を含みいかなる保証も、明示的または黙示的にかかわらず拒否します。

これらのリソースは、TI 製品を使用する設計の経験を積んだ開発者への提供を意図したものです。(1) お客様のアプリケーションに適した TI 製品の選定、(2) お客様のアプリケーションの設計、検証、試験、(3) お客様のアプリケーションに該当する各種規格や、その他のあらゆる安全性、セキュリティ、規制、または他の要件への確実な適合に関する責任を、お客様のみが単独で負うものとし、TI は一切の責任を拒否します。

上記の各種リソースは、予告なく変更される可能性があります。これらのリソースは、リソースで説明されている TI 製品を使用するアプリケーションの開発の目的でのみ、TI はその使用をお客様に許諾します。これらのリソースに関して、他の目的で複製することや掲載することは禁止されています。TI や第三者の知的財産権のライセンスが付与されている訳ではありません。お客様は、これらのリソースを自身で使用した結果発生するあらゆる申し立て、損害、費用、損失、責任について、TI およびその代理人を完全に補償するものとし、TI は一切の責任を拒否します。

TI の製品は、[TI の販売条件](#)、[TI の総合的な品質ガイドライン](#)、[ti.com](#) または TI 製品などに関連して提供される他の適用条件に従い提供されます。TI がこれらのリソースを提供することは、適用される TI の保証または他の保証の放棄の拡大や変更を意味するものではありません。TI がカスタム、またはカスタマー仕様として明示的に指定していない限り、TI の製品は標準的なカタログに掲載される汎用機器です。

お客様がいかなる追加条項または代替条項を提案する場合も、TI はそれらに異議を唱え、拒否します。

Copyright © 2026, Texas Instruments Incorporated

最終更新日：2025 年 10 月