

## LM4041 精密低功耗并联电压基准

### 1 特性

- 具有 1.225V 固定输出电压和可调输出电压 ( 1.225V 至 10V )
- 严格输出容差和低温度系数
  - 0.1% ( 最大值 ), 100ppm/°C - A 级
  - 0.2% ( 最大值 ), 100ppm/°C - B 级
  - 0.5% ( 最大值 ), 100ppm/°C - C 级
  - 1.0% ( 最大值 ), 150ppm/°C - D 级
- 低输出噪声 ...20  $\mu$ V<sub>RMS</sub> ( 典型值 )
- 宽工作电流范围 ...  
45  $\mu$ A ( 典型值 ) 至 12mA
- 与所有容性负载一起工作时保持稳定 ; 无需输出电容器
- 可采用
  - 工业温度 : -40°C 至 85°C
  - 工作温度范围 : -40°C 至 125°C

### 2 应用

- 数据采集系统
- 电源和电源监控器
- 仪表和测试设备
- 过程控制
- 精密音频
- 汽车电子产品
- 能源管理/计量
- 电池供电设备

### 3 说明

LM4041 系列并联电压基准功能多样、易于使用, 适合各种应用。这些器件无需外部电容器即可运行, 与所有容性负载一起工作时均保持稳定。此外, 该基准具备低动态阻抗、低噪声和低温度系数, 可确保在宽工作电流和温度范围内实现稳定的输出电压。LM4041 在晶圆筛选期间使用保险丝和齐纳击穿反向击穿电压修整, 以提供四种输出电压容差 - 从最高 0.1% ( A 级 ) 到最高 1% ( D 级 )。这样设计人员可以非常灵活地为应用选择具有高性价比的产品。LM4041 可提供固定电压 ( 1.225V 标称值 ) 或可调电压版本 ( 需要外部电阻分压器将输出设为 1.225V 至 10V 间的任意值 )。

LM4041 采用节省空间的 SC-70 和 SOT-23-3 封装, 最低电流为 45  $\mu$ A ( 典型值 ), 也适用于便携式应用。如需穿孔封装, 我们还提供 TO-92 封装。LM4041xI 的额定工作环境温度范围是 - 40°C 至 85°C。LM4041xQ 的额定工作环境温度范围是 - 40°C 至 125°C。



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## 4 Pin Configuration and Functions

### Pin Functions

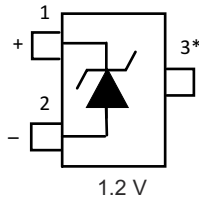


图 4-1. DBZ Package  
3-Pin SOT-23  
Top View

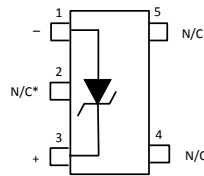


图 4-2. DCK Package  
5-Pin SC70  
Top View

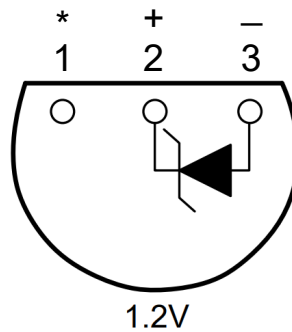


图 4-3. LP Package  
3-Pin TO-92  
Bottom View

### 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 <sup>(1)</sup>
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.

## 引脚功能：ADJ 引脚排列

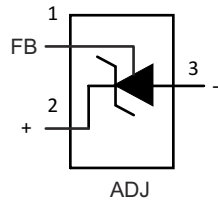


图 4-4. DBZ 封装  
3 引脚 SOT-23  
顶视图

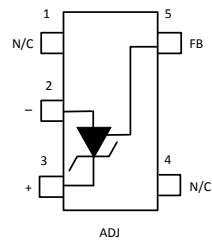


图 4-5. DCK 封装  
5 引脚 SC70  
顶视图

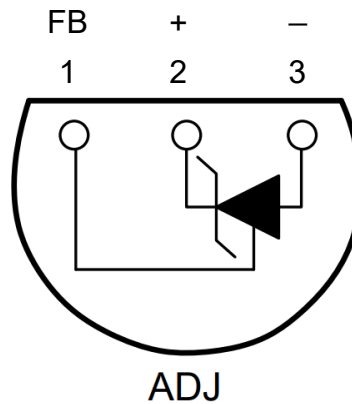


图 4-6. LP 封装  
3 引脚 TO-92  
底视图

名称	引脚			I/O	说明
	SOT-23	SC70	TO-92		
正极	3	2	3	O	正极引脚、正常接地
负极	2	3	2	I/O	分流电流和输出电压
FB	1	5	1	I	可调输出电压的反馈引脚
NC**	—	—	—	—	**必须悬空或连接到正极
NC	—	1、4	—	—	无连接

## 5 Specifications

### 5.1 Absolute Maximum Ratings

over free-air temperature range (unless otherwise noted)

		MIN	MAX <sup>(1)</sup>	UNIT
V <sub>Z</sub>	Continuous cathode voltage		15	V
I <sub>Z</sub>	Continuous cathode current	- 10	25	mA
θ <sub>JA</sub>	Package thermal impedance <sup>(2) (3)</sup>	DBZ package		206
		DCK package		252
		LP package		156
T <sub>J</sub>	Operating virtual junction temperature		150	°C
T <sub>stg</sub>	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<sub>J(max)</sub>, θ<sub>JA</sub>, and T<sub>A</sub>. The maximum allowable power dissipation at any allowable ambient temperature is P<sub>D</sub> = (T<sub>J(max)</sub> - T<sub>A</sub>) / θ<sub>JA</sub>. Operating at the absolute maximum T<sub>J</sub> of 150°C can affect reliability.
- (3) The package thermal impedance is calculated in accordance with JEDEC 51-7.

### 5.2 ESD Ratings

			VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic Discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1) (2)</sup>	±2000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(3)</sup>	±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  $85^\circ\text{C}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A$	LM4041A12I			LM4041B12I			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
$V_Z$	Reverse breakdown voltage	$I_Z = 100\ \mu\text{A}$	25°C			25°C			V
	Reverse breakdown voltage tolerance	$I_Z = 100\ \mu\text{A}$	25°C			25°C			mV
			Full range	- 9.2	9.2	- 10.4	10.4		
$I_{Z,\text{min}}$	Minimum cathode current		25°C			25°C			$\mu\text{A}$
			Full range	80		80			
$\alpha_{V_Z}$	Average temperature coefficient of reverse breakdown voltage	$I_Z = 10\text{mA}$	25°C			25°C			ppm/°C
			25°C			25°C			
			Full range	$\pm 100$		$\pm 100$			
$\frac{\Delta V_Z}{\Delta I_Z}$	Reverse breakdown voltage change with cathode current change	$I_{Z,\text{min}} < I_Z < 1\text{mA}$	25°C			25°C			mV
			Full range	2		2			
		$1\text{mA} < I_Z < 12\text{mA}$	25°C			25°C			
			Full range	8		8			
$Z_Z$	Reverse dynamic impedance	$I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ , $I_{AC} = 0.1 I_Z$	25°C			25°C			$\Omega$
$e_N$	Wideband noise	$I_Z = 100\ \mu\text{A}$ , $10\text{Hz} \leq f \leq 10\text{kHz}$	25°C			25°C			$\mu\text{V}_{\text{RMS}}$
	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			25°C			ppm

## 5.5 LM4041x12I Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	$T_A$	LM4041C12I			LM4041D12I			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
$V_Z$	Reverse breakdown voltage	$I_Z = 100\ \mu\text{A}$	25°C			1.225			V
	Reverse breakdown voltage tolerance	$I_Z = 100\ \mu\text{A}$	25°C			-6	6		mV
			Full range			-14	14		
$I_{Z,\text{min}}$	Minimum cathode current		25°C			45		75	$\mu\text{A}$
			Full range			80		80	
$\alpha_{V_Z}$	Average temperature coefficient of reverse breakdown voltage	$I_Z = 10\text{mA}$	25°C			$\pm 20$		ppm/°C	
		$I_Z = 1\text{mA}$	25°C			$\pm 15$			
			Full range			$\pm 100$			
		$I_Z = 100\ \mu\text{A}$	25°C			$\pm 15$			
$\frac{\Delta V_Z}{\Delta I_Z}$	Reverse breakdown voltage change with cathode current change	$I_{Z,\text{min}} < I_Z < 1\text{mA}$	25°C			0.7	1.5		mV
			Full range			2		2.5	
		$1\text{mA} < I_Z < 12\text{mA}$	25°C			2.5		6	
			Full range			8		10	
$Z_Z$	Reverse dynamic impedance	$I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ , $I_{AC} = 0.1 I_Z$	25°C			0.5	1.5		$\Omega$
$e_N$	Wideband noise	$I_Z = 100\ \mu\text{A}$ , $10\text{Hz} \leq f \leq 10\text{kHz}$	25°C			20		$\mu\text{V}_{\text{RMS}}$	
	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	

## 5.6 LM4041x12Q Electrical Characteristics

full-range  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A$	LM4041C12Q			LM4041D12Q			UNIT		
			MIN	TYP	MAX	MIN	TYP	MAX			
$V_Z$	Reverse breakdown voltage	$I_Z = 100\ \mu\text{A}$	25°C			1.225			V		
	Reverse breakdown voltage tolerance	$I_Z = 100\ \mu\text{A}$	25°C			-6	6		mV		
			Full range			-18.4	18.4			-31	31
$I_{Z,\text{min}}$	Minimum cathode current		25°C			45		75	$\mu\text{A}$		
			Full range			80		80			
$\alpha_{V_Z}$	Average temperature coefficient of reverse breakdown voltage	$I_Z = 10\text{mA}$	25°C			$\pm 20$		ppm/°C			
			25°C			$\pm 15$					
			Full range			$\pm 100$			$\pm 150$		
			25°C			$\pm 15$			$\pm 15$		
$\frac{\Delta V_Z}{\Delta I_Z}$	Reverse breakdown voltage change with cathode current change	$I_{Z,\text{min}} < I_Z < 1\text{mA}$	25°C			0.7	1.5		mV		
			Full range			2		2.5			
		$1\text{mA} < I_Z < 12\text{mA}$	25°C			2.5		6		2.5	8
			Full range			8		10			
$Z_Z$	Reverse dynamic impedance	$I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ , $I_{AC} = 0.1 I_Z$	25°C			0.5		$\Omega$			
			Full range			1.5			2		
$e_N$	Wideband noise	$I_Z = 100\ \mu\text{A}$ , $10\text{Hz} \leq f \leq 10\text{kHz}$	25°C			20		$\mu\text{V}_{\text{RMS}}$			
	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			

## 5.7 LM4041xl (Adjustable Version) Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	$T_A$	LM4041BI			LM4041CI			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
$V_{REF}$	Reference voltage	$I_Z = 100\ \mu\text{A}$ , $V_Z = 5\text{V}$	25°C			1.233			V	
	Reference voltage tolerance <sup>(1)</sup>	$I_Z = 100\ \mu\text{A}$ , $V_Z = 5\text{V}$	25°C			-2.5	2.5		mV	
			Full range			-10.5	10.5			
$I_{Z,min}$	Minimum cathode current		25°C			45	75		$\mu\text{A}$	
			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	1.5		mV	
			Full range			2				
		$1\text{mA} < I_Z < 12\text{mA}$	25°C			2		4		
			Full range			6				
$\Delta V_{REF}/\Delta V_{KA}$	Reference voltage change with output voltage change	$I_Z = 1\text{mA}$	25°C			-1.55	-2		mV/V	
			Full range			-2.5				
$I_{FB}$	Feedback current		25°C			60	100		nA	
			Full range			120				
$\alpha V_{REF}$	Average temperature coefficient of reference voltage <sup>(1)</sup>	$I_Z = 10\text{mA}$ , $V_Z = 5\text{V}$	25°C			$\pm 20$			ppm/°C	
		$I_Z = 1\text{mA}$ , $V_Z = 5\text{V}$	25°C			$\pm 15$				
			Full range			$\pm 100$				
		$I_Z = 100\ \mu\text{A}$ , $V_Z = 5\text{V}$	25°C			$\pm 15$				
$Z_Z$	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			$\Omega$	
		$I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ , $I_{AC} = 0.1 I_Z$ , $V_Z = 10\text{V}$	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			$\mu\text{V}_{RMS}$	
	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*.

## 5.8 LM4041xl (Adjustable Version) Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	$T_A$	LM4041DI			UNIT
			MIN	TYP	MAX	
$V_{REF}$	Reference voltage	$I_Z = 100\ \mu\text{A}$ , $V_Z = 5\text{V}$	$25^\circ\text{C}$	1.233		V
	Reference voltage tolerance <sup>(1)</sup>	$I_Z = 100\ \mu\text{A}$ , $V_Z = 5\text{V}$	$25^\circ\text{C}$	- 12	12	mV
			Full range	- 24	24	
$I_{Z,\text{min}}$	Minimum cathode current		$25^\circ\text{C}$	45	75	$\mu\text{A}$
			Full range		80	
$\Delta V_{REF}/\Delta I_Z$	Reference voltage change with cathode current change	$I_{Z,\text{min}} < I_Z < 1\text{mA}$	$25^\circ\text{C}$	0.7	2	mV
			Full range		2.5	
		$1\text{mA} < I_Z < 12\text{mA}$	$25^\circ\text{C}$	2	6	
			Full range		8	
$\Delta V_{REF}/\Delta V_{KA}$	Reference voltage change with output voltage change	$I_Z = 1\text{mA}$	$25^\circ\text{C}$	- 1.55	- 2	mV/V
			Full range		- 3	
$I_{FB}$	Feedback current		$25^\circ\text{C}$	60	150	nA
			Full range		200	
$\alpha V_{REF}$	Average temperature coefficient of reference voltage <sup>(1)</sup>	$I_Z = 10\text{mA}$ , $V_Z = 5\text{V}$	$25^\circ\text{C}$	$\pm 20$		ppm/ $^\circ\text{C}$
			Full range		$\pm 15$	
		$I_Z = 1\text{mA}$ , $V_Z = 5\text{V}$	$25^\circ\text{C}$	$\pm 15$		
			Full range		$\pm 150$	
$Z_Z$	Reverse dynamic impedance	$I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ , $I_{AC} = 0.1 I_Z$ , $V_Z = V_{REF}$	$25^\circ\text{C}$	0.3		$\Omega$
			$25^\circ\text{C}$	2		
$e_N$	Wideband noise	$I_Z = 100\ \mu\text{A}$ , $V_Z = V_{REF}$ , $10\text{Hz} \leq f \leq 10\text{kHz}$	$25^\circ\text{C}$	20		$\mu\text{V}_{\text{RMS}}$
	Long-term stability of reverse breakdown voltage	$t = 1000\text{ h}$ , $T_A = 25^\circ\text{C} \pm 0.1^\circ\text{C}$ , $I_Z = 100\ \mu\text{A}$	$25^\circ\text{C}$	120		ppm

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

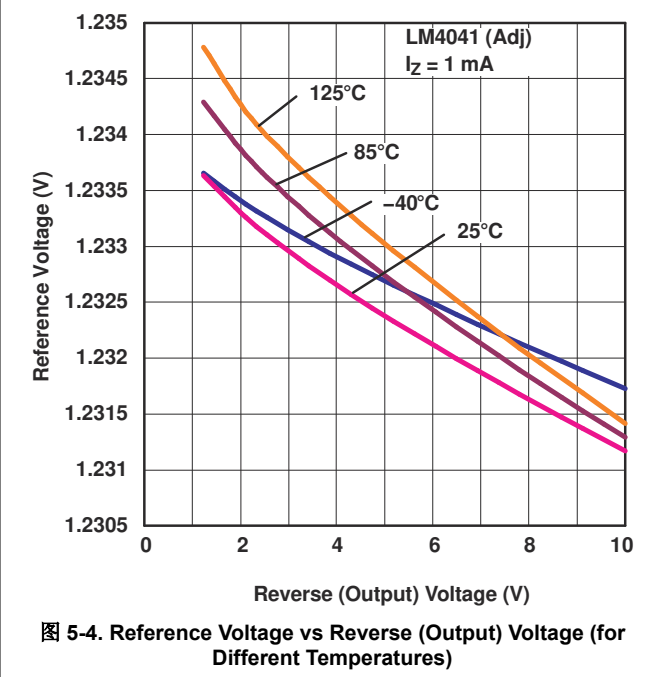
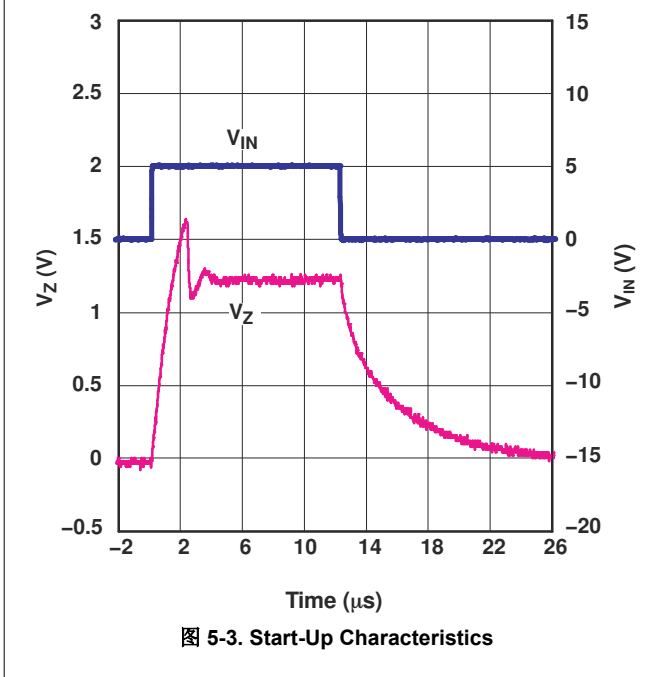
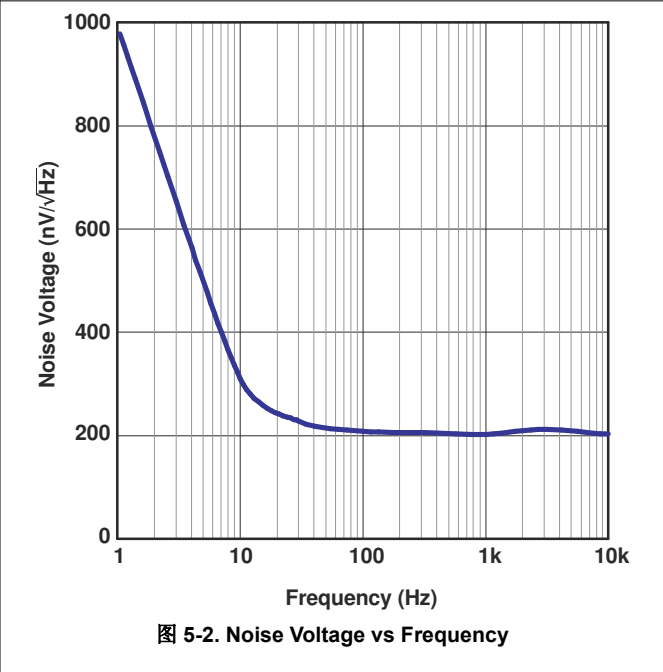
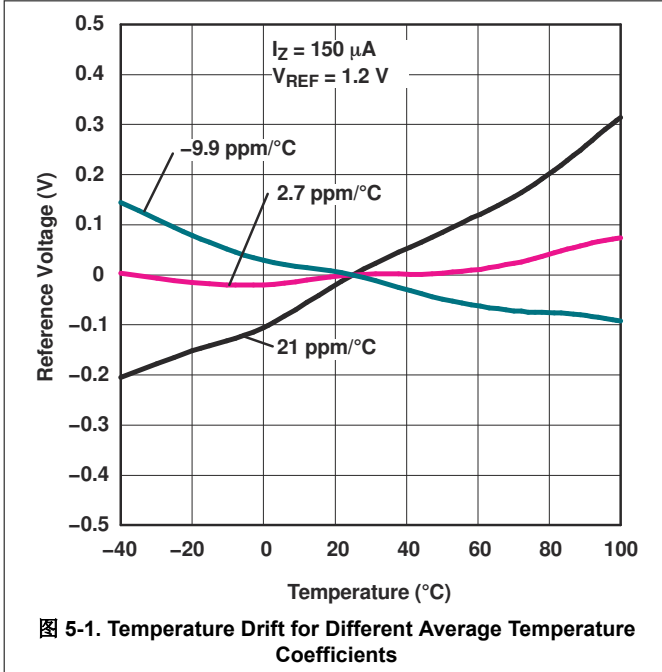
## 5.9 LM4041xQ (Adjustable Version) Electrical Characteristics

 full-range  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A$	LM4041CQ			LM4041DQ			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
$V_{REF}$	Reference voltage	$I_Z = 100\ \mu\text{A}$ , $V_Z = 5\text{V}$	25°C			1.233			V	
	Reference voltage tolerance <sup>(1)</sup>	$I_Z = 100\ \mu\text{A}$ , $V_Z = 5\text{V}$	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	$\mu\text{A}$
			Full range				80		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	1.5	0.7	2	mV
			Full range				2		2.5	
		$1\text{mA} < I_Z < 12\text{mA}$	25°C			2	4	2	6	
			Full range				8		10	
$\Delta V_{REF}/\Delta V_{KA}$	Reference voltage change with output voltage change	$I_Z = 1\text{mA}$	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	
$\alpha V_{REF}$	Average temperature coefficient of reference voltage <sup>(1)</sup>	$I_Z = 10\text{mA}$ , $V_Z = 5\text{V}$	25°C			$\pm 20$		$\pm 20$		ppm/°C
		$I_Z = 1\text{mA}$ , $V_Z = 5\text{V}$	25°C			$\pm 15$		$\pm 15$		
			Full range				$\pm 100$		$\pm 150$	
		$I_Z = 100\ \mu\text{A}$ , $V_Z = 5\text{V}$	25°C			$\pm 15$		$\pm 15$		
$Z_Z$	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		0.3		$\Omega$
		$I_Z = 1\text{mA}$ , $f = 120\text{Hz}$ , $I_{AC} = 0.1 I_Z$ , $V_Z = 10\text{V}$	25°C			2		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		20		$\mu\text{V}_{RMS}$
	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		120		ppm

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

### 5.10 Typical Characteristics



### 5.10 Typical Characteristics (continued)

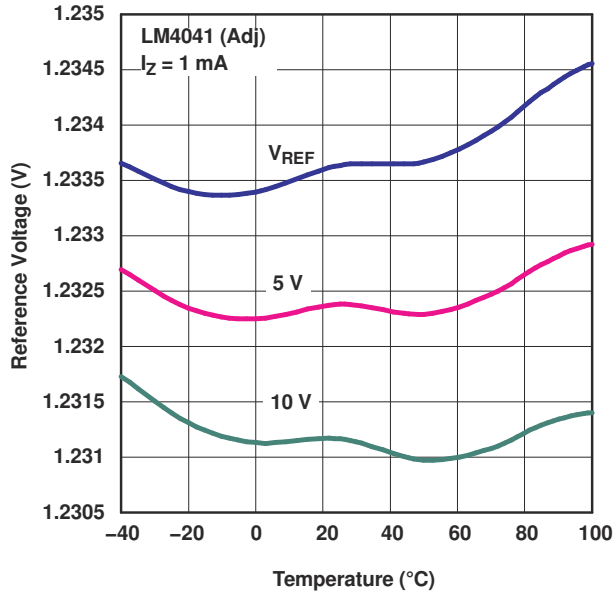


图 5-5. Reference Voltage vs Temperature (for Different Reverse Voltages)

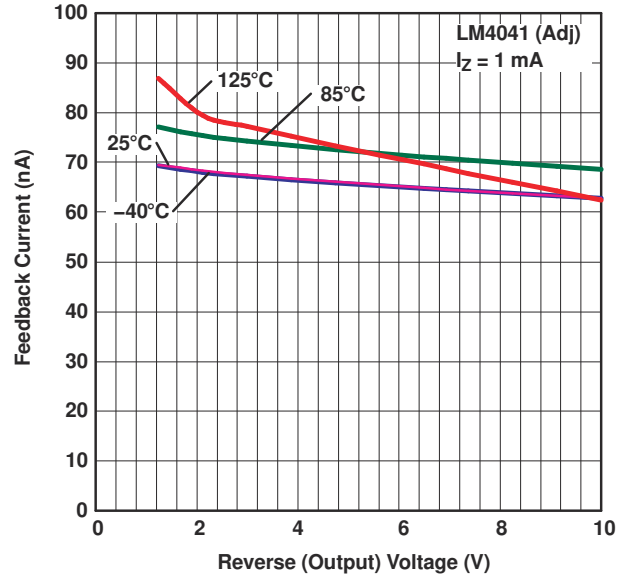


图 5-6. Feedback Current vs Reverse (Output) Voltage (for Different Temperatures)

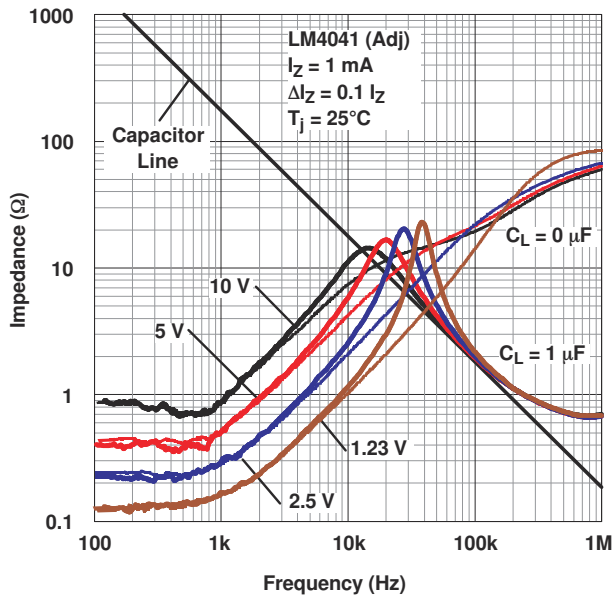


图 5-7. Output Impedance vs Frequency

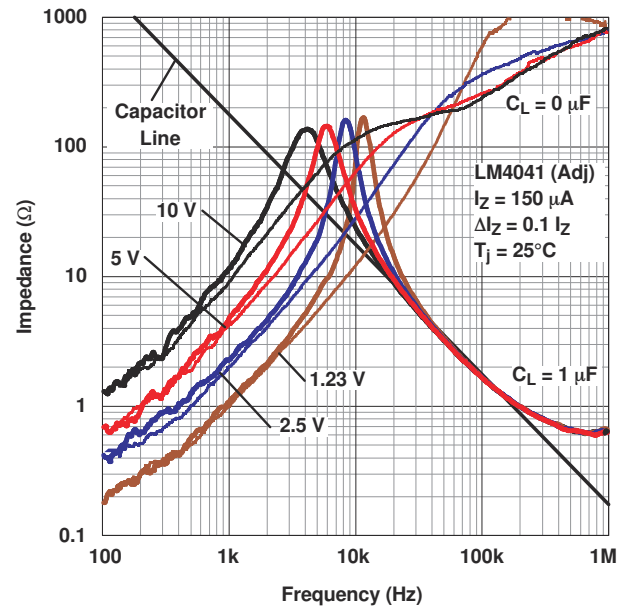
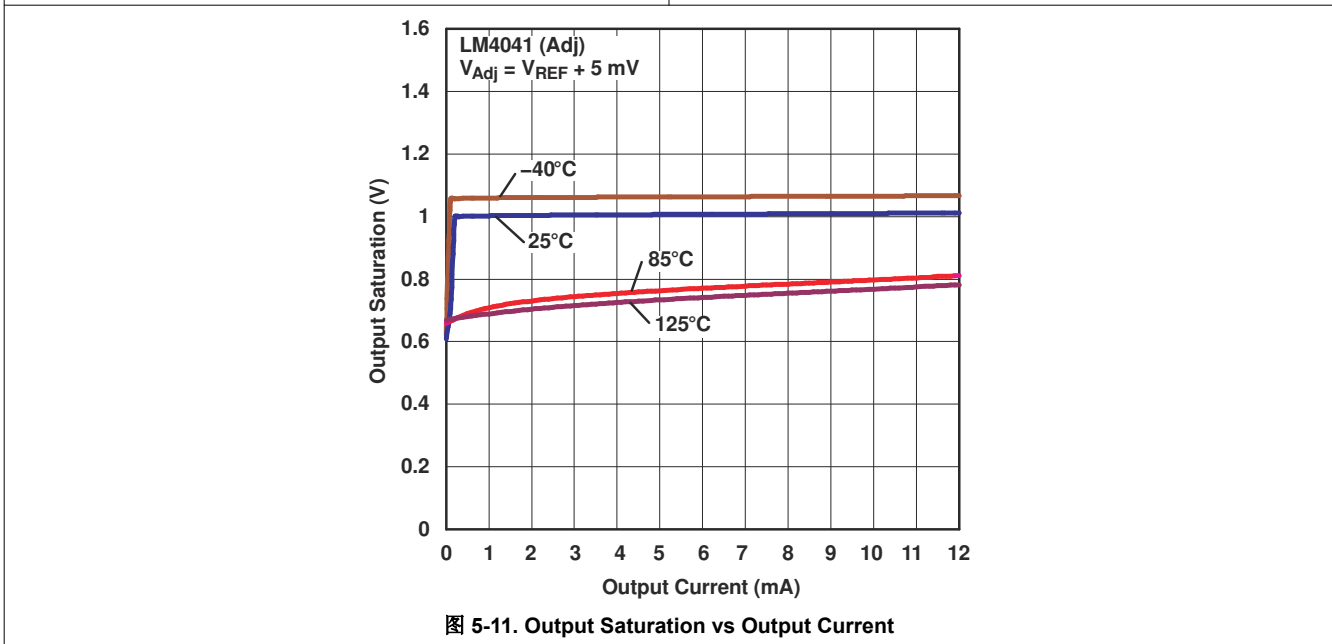
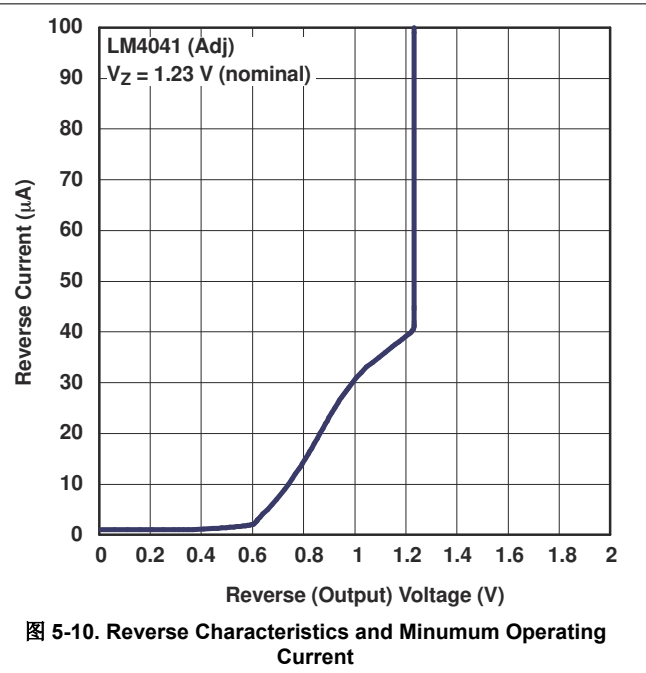
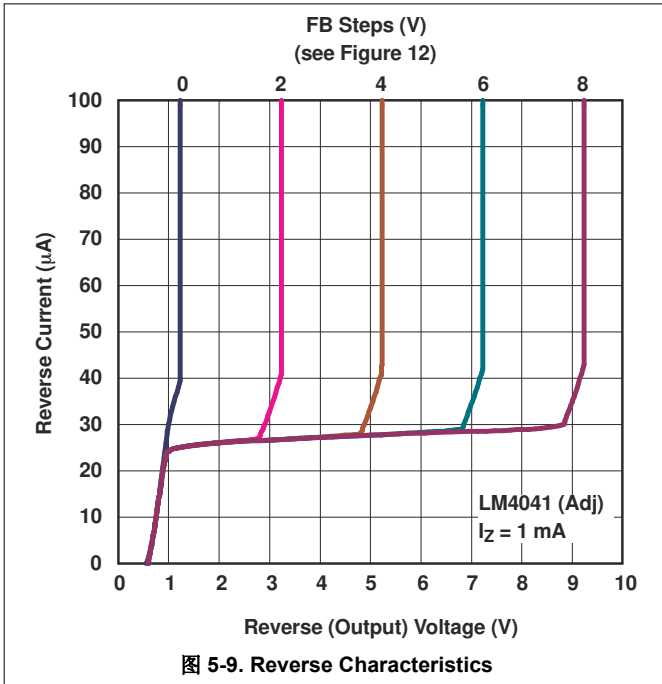


图 5-8. Output Impedance vs Frequency

5.10 Typical Characteristics (continued)



## 6 Functional Block Diagram

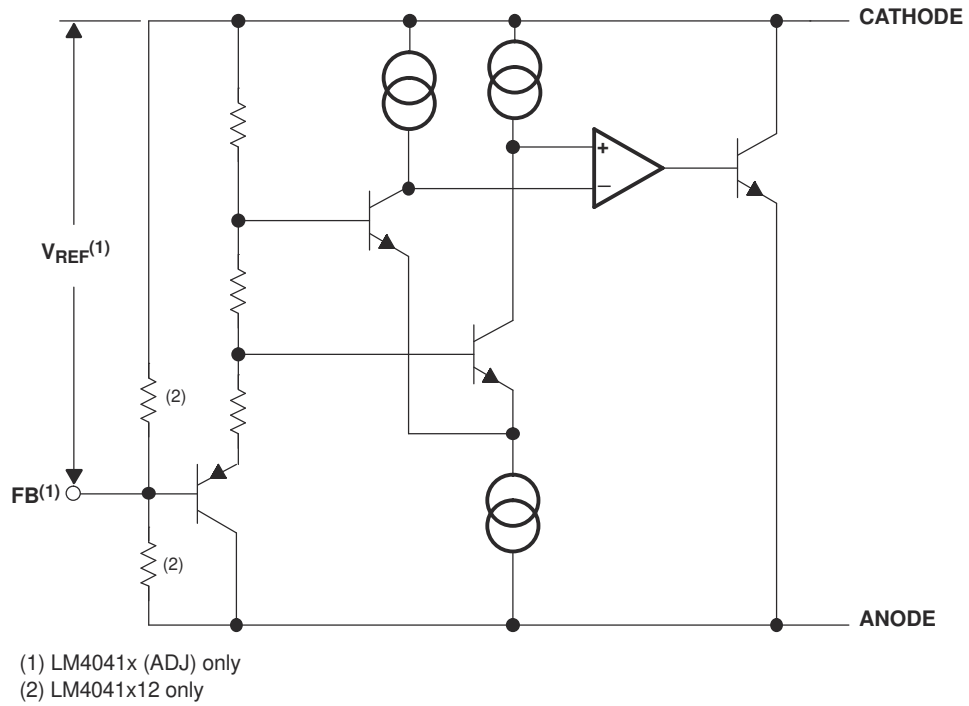


图 6-1. Functional Block Diagram

## 7 Application Information

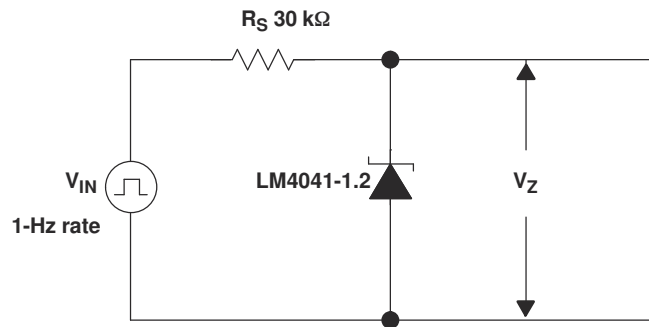


图 7-1. Startup Characteristics Test Circuit

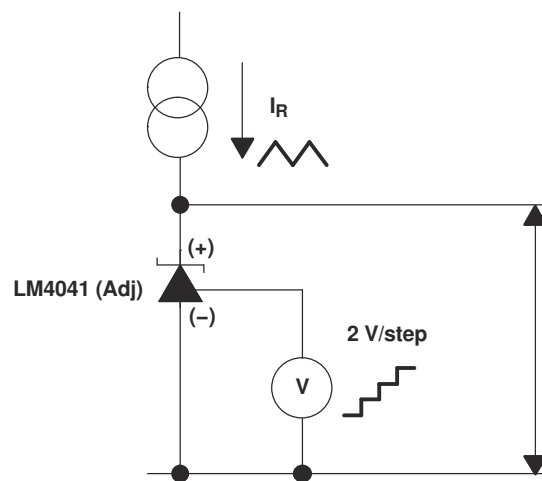


图 7-2. Reverse Characteristics Test Circuit

### 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 图 7-3.

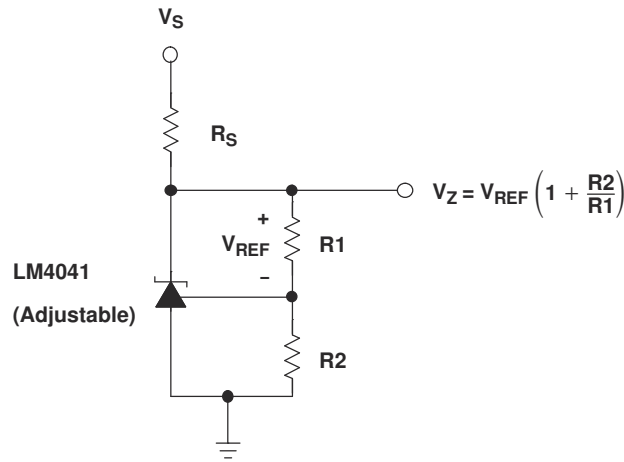


图 7-3. Adjustable Shunt Regulator

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 图 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 方程式 1.

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

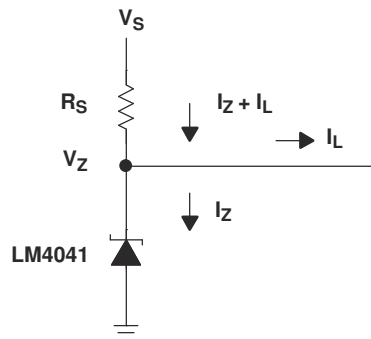


图 7-4. Shunt Regulator

## 8 器件和文档支持

### 8.1 接收文档更新通知

要接收文档更新通知，请导航至 [ti.com](https://www.ti.com) 上的器件产品文件夹。点击 [通知](#) 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

### 8.2 商标

TI E2E™ is a trademark of Texas Instruments.

所有商标均为其各自所有者的财产。

### 8.3 静电放电警告



静电放电 (ESD) 会损坏这个集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

### 8.4 支持资源

[TI E2E™ 中文支持论坛](#) 是工程师的重要参考资料，可直接从专家处获得快速、经过验证的解答和设计帮助。搜索现有解答或提出自己的问题，获得所需的快速设计帮助。

链接的内容由各个贡献者“按原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的 [使用条款](#)。

### 8.5 术语表

[TI 术语表](#) 本术语表列出并解释了术语、首字母缩略词和定义。

## 9 Revision History

注：以前版本的页码可能与当前版本的页码不同

<b>Changes from Revision G (July 2024) to Revision H (March 2025)</b>		<b>Page</b>
• 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
<b>Changes from Revision F (September 2020) to Revision G (July 2024)</b>		<b>Page</b>
• 更新了 <a href="#">应用</a> 链接.....		1
• Updated pinout diagrams .....		3

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

- 更新了整个文档中的表、图和交叉参考的编号格式..... 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.

**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)
<a href="#">LM4041A12IDBZR</a>	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)
<a href="#">LM4041A12IDBZT</a>	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
<a href="#">LM4041A12IDCKR</a>	Active	Production	SC70 (DCK)   5	3000   LARGE T&R	Yes	NIPDAU   SN	Level-1-260C-UNLIM	-40 to 85	MKU
LM4041A12IDCKR.A	Active	Production	SC70 (DCK)   5	3000   LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	MKU
<a href="#">LM4041B12IDBZR</a>	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)
<a href="#">LM4041B12IDBZT</a>	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)
<a href="#">LM4041B12IDCKR</a>	Active	Production	SC70 (DCK)   5	3000   LARGE T&R	Yes	NIPDAU   SN	Level-1-260C-UNLIM	-40 to 85	MLU
LM4041B12IDCKR.A	Active	Production	SC70 (DCK)   5	3000   LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	MLU
<a href="#">LM4041BIDBZR</a>	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)
<a href="#">LM4041BIDBZR1G4</a>	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)
<a href="#">LM4041BIDBZT</a>	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)
<a href="#">LM4041BIDCKR</a>	Active	Production	SC70 (DCK)   5	3000   LARGE T&R	Yes	NIPDAU   SN	Level-1-260C-UNLIM	-40 to 85	MGU
LM4041BIDCKR.A	Active	Production	SC70 (DCK)   5	3000   LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	MGU
<a href="#">LM4041BIDCKT</a>	Active	Production	SC70 (DCK)   5	250   SMALL T&R	Yes	NIPDAU   SN	Level-1-260C-UNLIM	-40 to 85	MGU
LM4041BIDCKT.A	Active	Production	SC70 (DCK)   5	250   SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	MGU
<a href="#">LM4041C12IDBZR</a>	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)
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
<a href="#">LM4041C12IDBZT</a>	Active	Production	SOT-23 (DBZ)   3	250   SMALL 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)
LM4041C12IDBZT.A	Active	Production	SOT-23 (DBZ)   3	250   SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MM3, 4MMU)
<a href="#">LM4041C12IDCKR</a>	Active	Production	SC70 (DCK)   5	3000   LARGE T&R	Yes	NIPDAU   SN	Level-1-260C-UNLIM	-40 to 85	MMU
LM4041C12IDCKR.A	Active	Production	SC70 (DCK)   5	3000   LARGE T&R	Yes	SN	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	
<a href="#">LM4041C12ILP</a>	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
<a href="#">LM4041C12ILPR</a>	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
<a href="#">LM4041C12QDBZR</a>	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)
<a href="#">LM4041C12QDBZT</a>	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)
<a href="#">LM4041CIDBZR</a>	Active	Production	SOT-23 (DBZ)   3	3000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MH3, 4MHU)
LM4041CIDBZR.A	Active	Production	SOT-23 (DBZ)   3	3000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(4MH3, 4MHU)
<a href="#">LM4041CIDBZT</a>	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)
<a href="#">LM4041CIDCKR</a>	Active	Production	SC70 (DCK)   5	3000   LARGE T&R	Yes	NIPDAU   SN	Level-1-260C-UNLIM	-40 to 85	MHU
LM4041CIDCKR.A	Active	Production	SC70 (DCK)   5	3000   LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	MHU
<a href="#">LM4041CIDCKT</a>	Active	Production	SC70 (DCK)   5	250   SMALL T&R	Yes	NIPDAU   SN	Level-1-260C-UNLIM	-40 to 85	MHU
LM4041CIDCKT.A	Active	Production	SC70 (DCK)   5	250   SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	MHU
<a href="#">LM4041CILP</a>	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	
<a href="#">LM4041CILPR</a>	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
<a href="#">LM4041CQDBZR</a>	Active	Production	SOT-23 (DBZ)   3	3000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MP3, 4MPU)
LM4041CQDBZR.A	Active	Production	SOT-23 (DBZ)   3	3000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MP3, 4MPU)
<a href="#">LM4041CQDBZT</a>	Active	Production	SOT-23 (DBZ)   3	250   SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MP3, 4MPU)
LM4041CQDBZT.A	Active	Production	SOT-23 (DBZ)   3	250   SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MP3, 4MPU)
<a href="#">LM4041D12IDBZR</a>	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)

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)
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
<a href="#">LM4041D12IDBZT</a>	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)
<a href="#">LM4041D12IDCKR</a>	Active	Production	SC70 (DCK)   5	3000   LARGE T&R	Yes	NIPDAU   SN	Level-1-260C-UNLIM	-40 to 85	MNU
LM4041D12IDCKR.A	Active	Production	SC70 (DCK)   5	3000   LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	MNU
<a href="#">LM4041D12ILP</a>	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	
<a href="#">LM4041D12ILPR</a>	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
<a href="#">LM4041D12IQDBZR</a>	Active	Production	SOT-23 (DBZ)   3	3000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MT3, 4MTU)
LM4041D12IQDBZR.A	Active	Production	SOT-23 (DBZ)   3	3000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(4MT3, 4MTU)
<a href="#">LM4041DIDBZR</a>	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)
<a href="#">LM4041DIDBZT</a>	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)
<a href="#">LM4041DIDCKR</a>	Active	Production	SC70 (DCK)   5	3000   LARGE T&R	Yes	NIPDAU   SN	Level-1-260C-UNLIM	-40 to 85	MJU
LM4041DIDCKR.A	Active	Production	SC70 (DCK)   5	3000   LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	MJU
<a href="#">LM4041DIDCKRG4</a>	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
<a href="#">LM4041DILP</a>	Obsolete	Production	TO-92 (LP)   3	-	-	Call TI	Call TI	-40 to 85	NPDI
<a href="#">LM4041DILPR</a>	Active	Production	TO-92 (LP)   3	2000   LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 85	NPDI
LM4041DILPR.A	Active	Production	TO-92 (LP)   3	2000   LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 85	NPDI
<a href="#">LM4041DQDBZR</a>	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)
<a href="#">LM4041DQDBZT</a>	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](#).

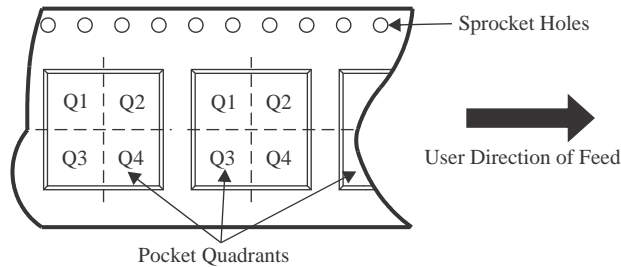
- (2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not 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	180.0	8.4	2.3	2.55	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
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	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
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
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

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
LM4041C12IDBZR	SOT-23	DBZ	3	3000	179.0	8.4	3.15	2.95	1.22	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
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	180.0	8.4	2.3	2.55	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	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	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
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	178.0	9.2	3.15	2.77	1.22	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	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
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	180.0	8.4	2.3	2.55	1.2	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	180.0	8.4	2.9	3.35	1.35	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	179.0	8.4	3.15	2.95	1.22	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
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	179.0	8.4	3.15	2.95	1.22	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
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

**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	210.0	185.0	35.0
LM4041B12IDCKR	SC70	DCK	5	3000	200.0	183.0	25.0
LM4041BIDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
LM4041BIDBZR1G4	SOT-23	DBZ	3	3000	180.0	180.0	18.0
LM4041BIDBZR1G4	SOT-23	DBZ	3	3000	200.0	183.0	25.0
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	200.0	183.0	25.0
LM4041BIDCKT	SC70	DCK	5	250	203.0	203.0	35.0
LM4041C12IDBZR	SOT-23	DBZ	3	3000	200.0	183.0	25.0
LM4041C12IDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
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	210.0	185.0	35.0
LM4041C12IDCKR	SC70	DCK	5	3000	200.0	183.0	25.0
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	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
LM4041CIDCKT	SC70	DCK	5	250	200.0	183.0	25.0
LM4041CQDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
LM4041CQDBZR	SOT-23	DBZ	3	3000	200.0	183.0	25.0
LM4041CQDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0
LM4041CQDBZT	SOT-23	DBZ	3	250	200.0	183.0	25.0
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	210.0	185.0	35.0
LM4041D12IDCKR	SC70	DCK	5	3000	200.0	183.0	25.0
LM4041D12QDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
LM4041DIDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
LM4041DIDBZR	SOT-23	DBZ	3	3000	200.0	183.0	25.0
LM4041DIDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0
LM4041DIDCKR	SC70	DCK	5	3000	200.0	183.0	25.0
LM4041DIDCKRG4	SC70	DCK	5	3000	200.0	183.0	25.0
LM4041DQDBZR	SOT-23	DBZ	3	3000	200.0	183.0	25.0
LM4041DQDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
LM4041DQDBZT	SOT-23	DBZ	3	250	203.0	203.0	35.0
LM4041DQDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0

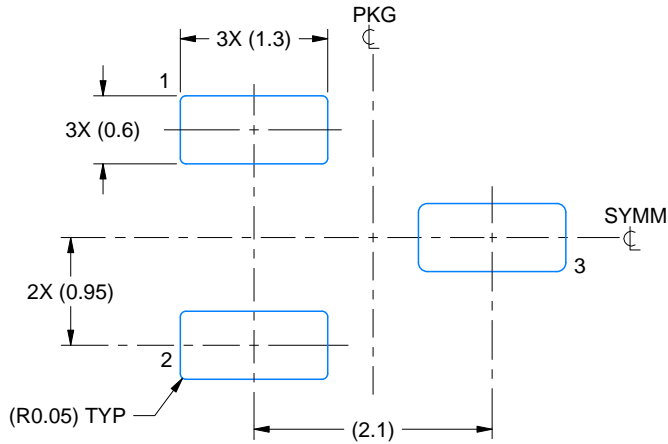


# EXAMPLE BOARD LAYOUT

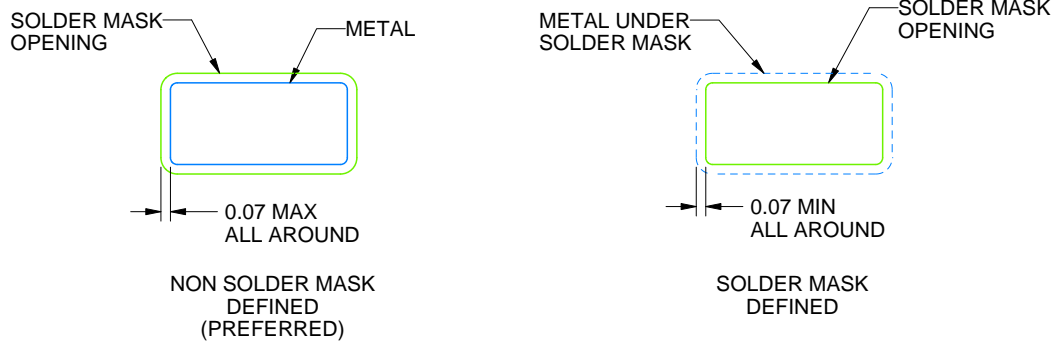
DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
SCALE:15X



SOLDER MASK DETAILS

4214838/F 08/2024

NOTES: (continued)

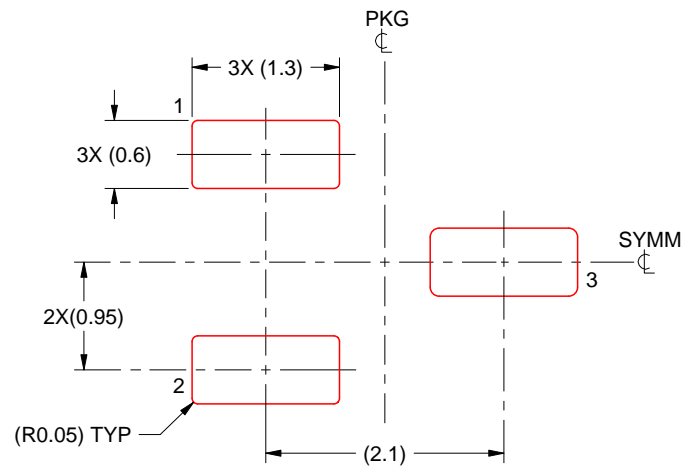
5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# 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.

# 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

# EXAMPLE BOARD LAYOUT

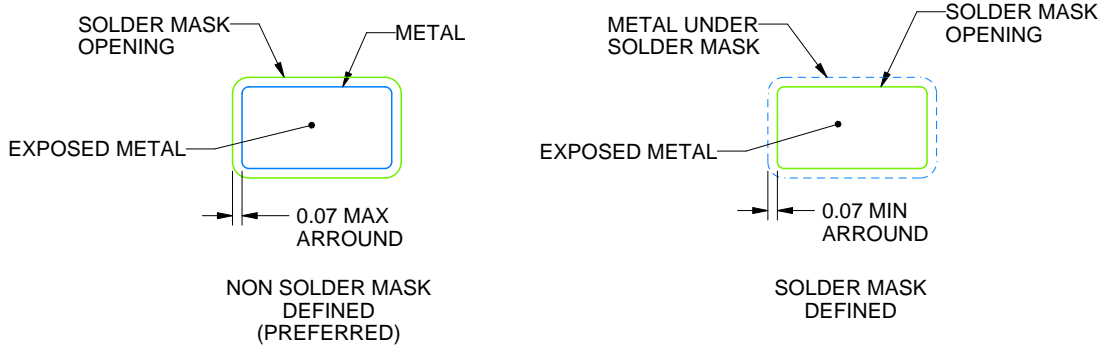
DCK0005A

SOT - 1.1 max height

SMALL OUTLINE TRANSISTOR



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.

# EXAMPLE STENCIL DESIGN

DCK0005A

SOT - 1.1 max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE  
BASED ON 0.125 THICK STENCIL  
SCALE: 18X

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.

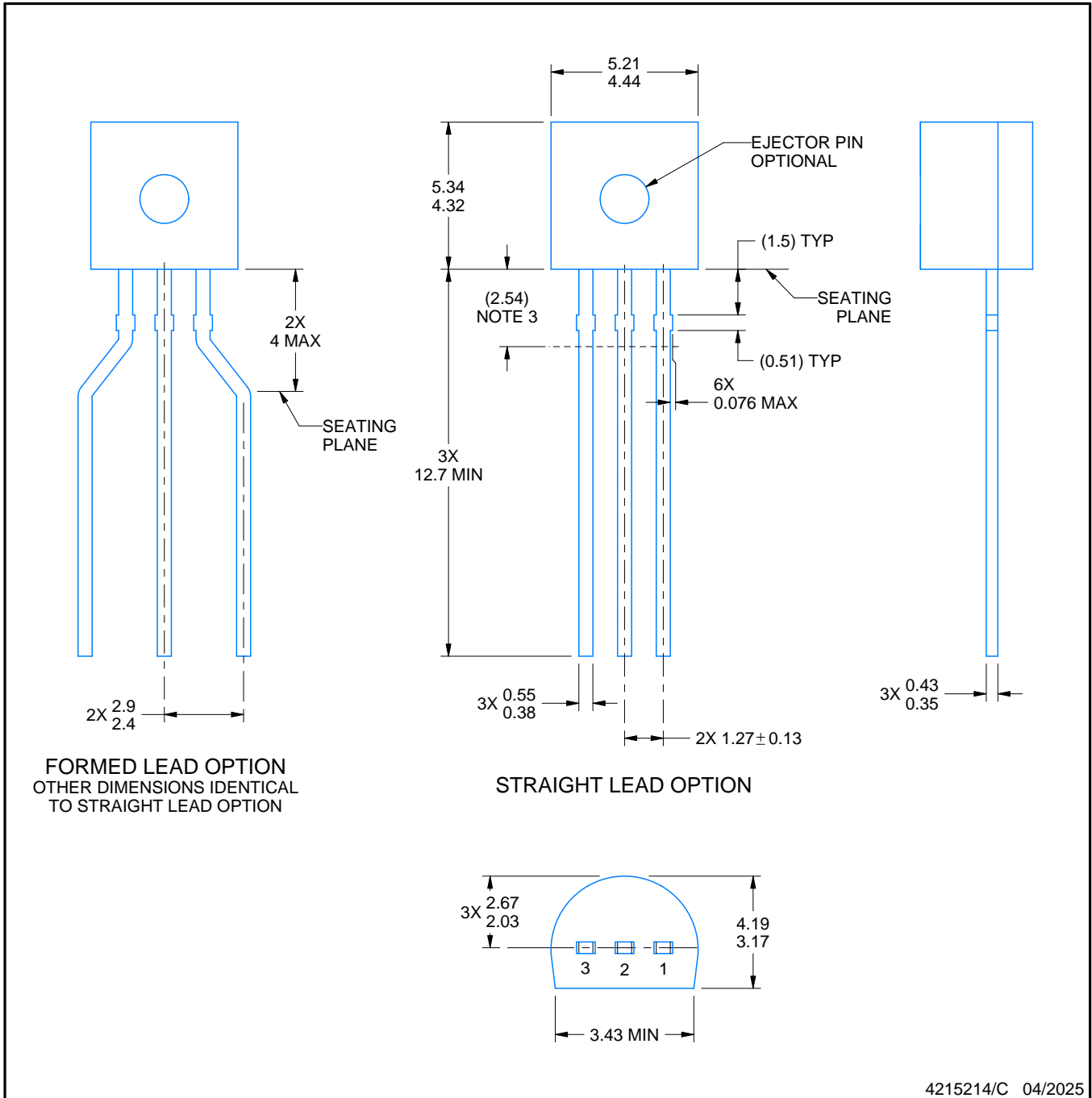
LP0003A



PACKAGE OUTLINE

TO-92 - 5.34 mm max height

TO-92



4215214/C 04/2025

NOTES:

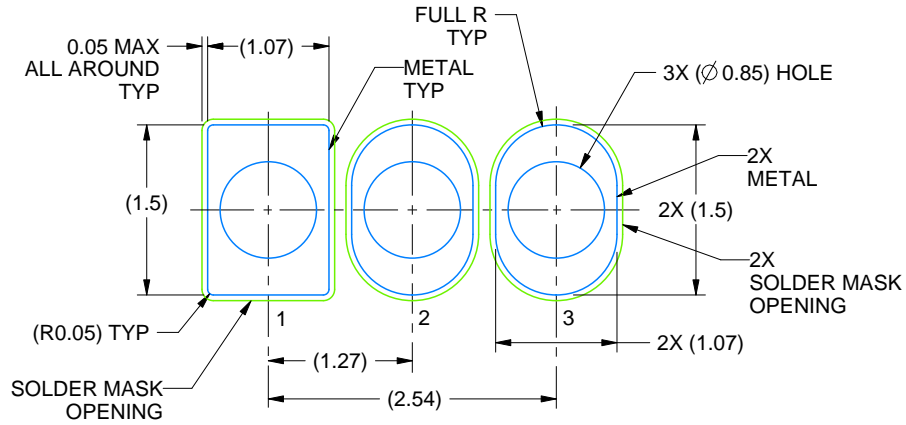
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Lead dimensions are not controlled within this area.
4. Reference JEDEC TO-226, variation AA.
5. Shipping 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

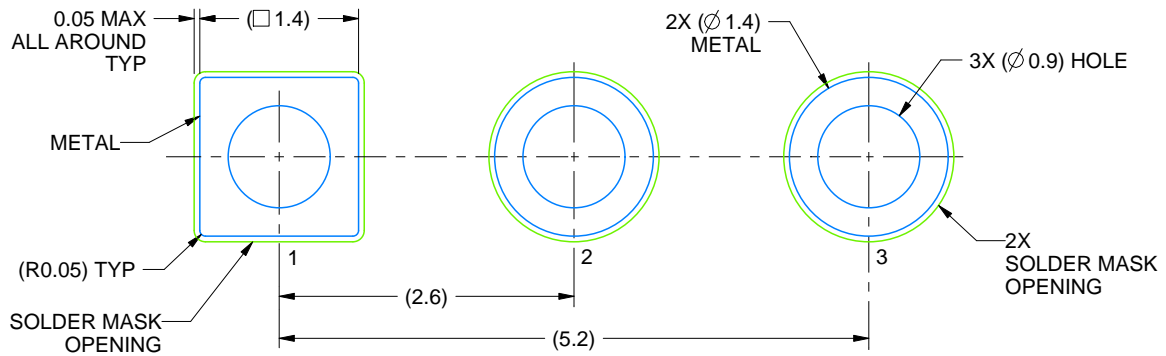
LP0003A

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

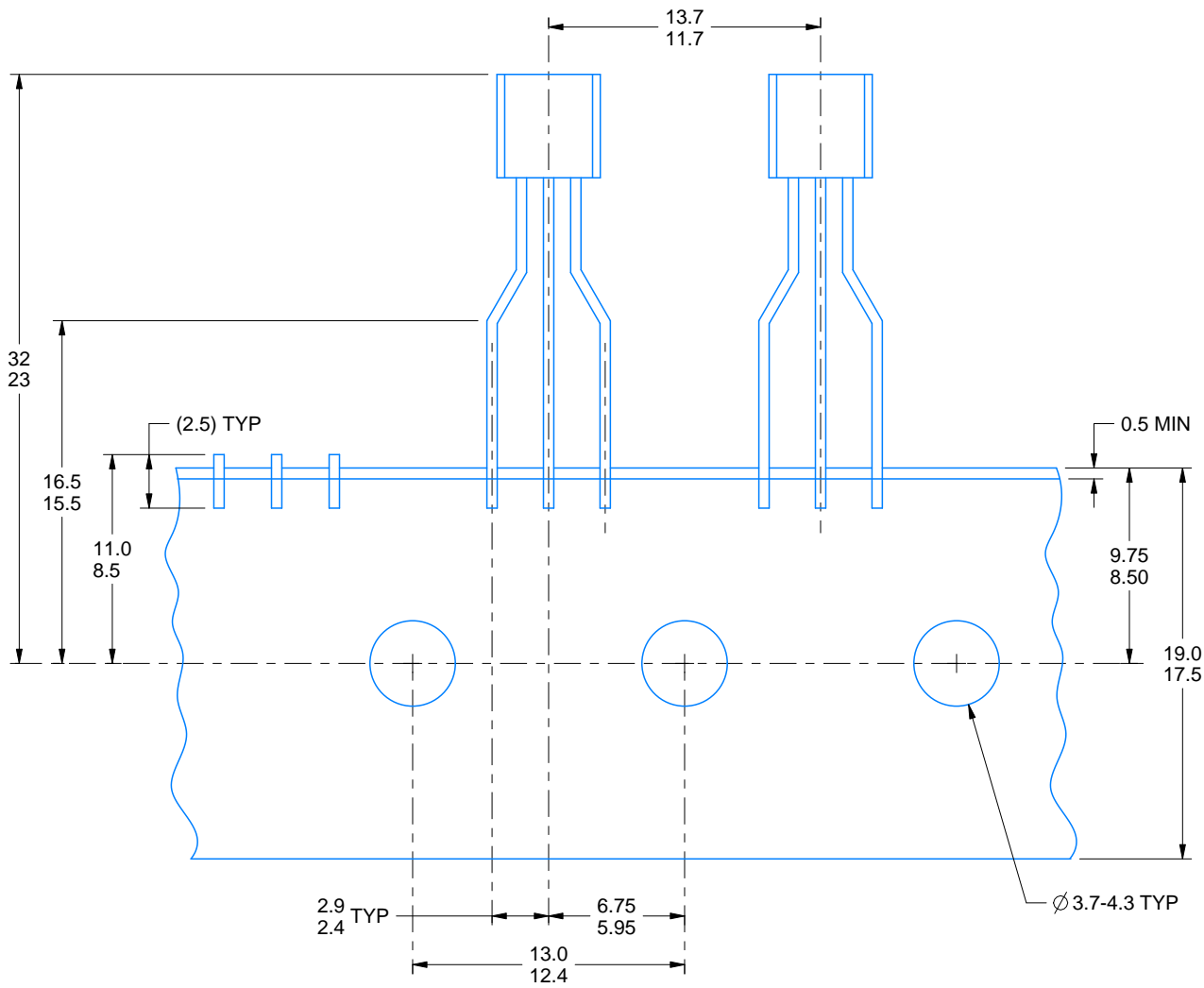
4215214/C 04/2025

# TAPE SPECIFICATIONS

LP0003A

TO-92 - 5.34 mm max height

TO-92



FOR FORMED LEAD OPTION PACKAGE

4215214/C 04/2025

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