精密微功耗并联电压基准

查询样品: LM4040-EP

特性

- 固定电压输出 **2.5 V**
- 严格的输出电压允差和低温度系数
  - 最大 **0.65%, 100 ppm/°C**
- 低输出噪音**: 35 μV_{RMS}** 典型值
- 宽工作电流范围**: 45 μA Typ** 至 **15 mA**
- 所有电容负载下均稳定**;** 无需输出电容器

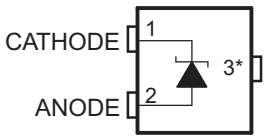
应用范围

- 数据采集系统
- 电源和电源监视器
- 测量仪器和测试设备
- 过程控制
- 高精度音频
- 车用电子器件
- 能耗管理
- 电池供电设备

支持国防、航天和医疗应用

- 受控基线
- 一个组装**/**测试场所
- 一个制造场所
- 可在军用温度范围内 **(–55°C/125°C)**工作(1)
- 产品生命周期有所延长
- 拓展的产品变更通知
- 产品可追溯性

DBZ (SOT-23) PACKAGE
(TOP VIEW)



* Pin 3 is attached to substrate and must be connected to ANODE or left open.

(1) 可提供定制温度范围的器件

说明**/**订购信息

LM4040 并联电压基准系列是多用途的，易于使用的基准，能满足广泛应用。 2-引脚固定输出设备工作时无需外部电容器并对所用电容负载都稳定。 除此之外, 此基准提供低动态阻抗、低噪音和低温度系数以保证大范围工作电流和温度下的稳定输出电压。 LM4040 在片子分类过程中使用熔丝和Zener-zap 反向击穿电压微调以提供允许偏差在0.65%的输出电压。

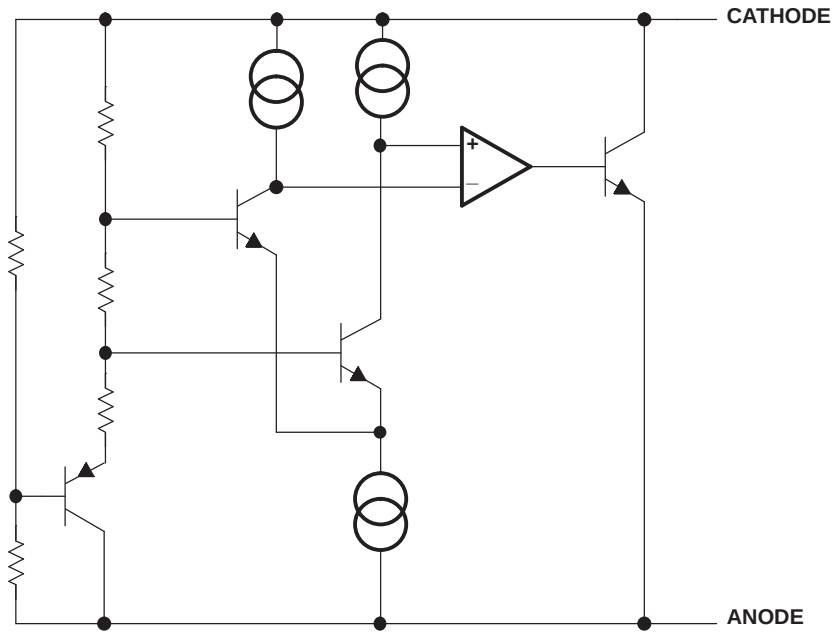
封装在节约空间的SOT-23-3封转内并要求 45 μA (典型值)最小电流, LM4040 同样也是便携式应用的最佳选择。 LM4040C25 工作环境温度范围为 –55°C 至 125°C。

ORDERING INFORMATION(1)

T_A	DEVICE GRADE	V_{KA}	PACKAGE		ORDERABLE PART NUMBER	TOP-SIDE MARKING(2)
–55°C to 125°C	0.65% initial accuracy and 100 ppm/°C temperature coefficient	2.5 V	SOT-23-3 (DBZ)	Reel of 250	LM4040C25MDBZTEP	SAGU

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.
(2) The actual top-side marking has one additional character that designates the wafer fab/assembly site.

FUNCTIONAL BLOCK DIAGRAM



Absolute Maximum Ratings(1)

over free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
I_Z	Continuous cathode current	–10	25	mA
T_J	Operating virtual junction temperature		150	°C
T_{stg}	Storage temperature range	–65	150	°C

(1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

THERMAL INFORMATION

THERMAL METRIC(1)		LM4040 DBZ 3 PINS	UNITS
θ_{JA}	Junction-to-ambient thermal resistance(2)	320.8	°C/W
θ_{JC}	Junction-to-case thermal resistance	98.2	
θ_{JB}	Junction-to-board thermal resistance(3)	53.3	
ψ_{JT}	Junction-to-top characterization parameter(4)	3.3	
ψ_{JB}	Junction-to-board characterization parameter(5)	51.8	

(1) 有关传统和新的热度量的更多信息，请参阅 *IC* 封装热度量 应用报告 SPRA953。
(2) 在 JESD51-2a 描述的环境中，按照 JESD51-7 的指定在一个 JEDEC 标准 high-K 测试电路板上进行仿真，从而获得自然对流条件下的结到外部热阻。
(3) 按照 JESD51-8 中的说明，通过在配有用于控制 PCB 温度的环形冷板夹具的环境中进行仿真，以获得结到电路板热阻。
(4) 结到顶部的表征参数 (ψ_{JT}) 估算真实系统中器件的结温，并使用 JESD51-2a (第 6 章和第 7 章) 中描述的程序从从得到 θ_{JA}的仿真数据中提取出该参数。
(5) 结到电路板的表征参数 (ψ_{JB}) 估算真实系统中器件的结温，并使用 JESD51-2a (第 6 章和第7 章) 中描述的程序从从得到 θ_{JA} 的仿真数据中提取出该参数。

Recommended Operating Conditions

		MIN	MAX	UNIT
I_Z	Cathode current	See (1)	15	mA
T_A	Free-air temperature	–55	125	°C

(1) See parametric tables

Electrical Characteristics

at extended temperature range, full-range T_A = –55°C to 125°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
V_Z	Reverse breakdown voltage	I_Z = 100 µA	25°C		2.5		V
ΔV_Z	Reverse breakdown voltage tolerance	I_Z = 100 µA	25°C	–16		16	mV
			Full range	–42		42	
$I_{Z,min}$	Minimum cathode current		25°C		45	75	µA
			Full range			82	
α_{VZ}	Average temperature coefficient of reverse breakdown voltage	I_Z = 10 mA	25°C		±20		ppm/°C
		I_Z = 1 mA	25°C		±15		
			Full range			±100	
		I_Z = 100 µA	25°C		±15		
$\frac{\Delta V_Z}{\Delta I_Z}$	Reverse breakdown voltage change with cathode current change	$I_{Z,min} < I_Z < 1$ mA	25°C		0.3	0.8	mV
			Full range			1.1	
		1 mA < I_Z < 15 mA	25°C		2.5	6	
			Full range			9	
Z_Z	Reverse dynamic impedance	I_Z = 1 mA, f = 120 Hz, I_{AC} = 0.1 I_Z	25°C		0.3		Ω
e_N	Wideband noise	I_Z = 100 µA, 10 Hz ≤ f ≤ 10 kHz	25°C		35		μV_{RMS}
	Long-term stability of reverse breakdown voltage	t = 1000 h, T_A = 25°C ± 0.1°C, I_Z = 100 µA			120		ppm
V_{HYST}	Thermal hysteresis (1)	ΔT_A = –55°C to 125°C			0.08		%

(1) Thermal hysteresis is defined as $V_{Z,25°C}$ (after cycling to –55°C) – $V_{Z,25°C}$ (after cycling to 125°C).

TYPICAL CHARACTERISTICS

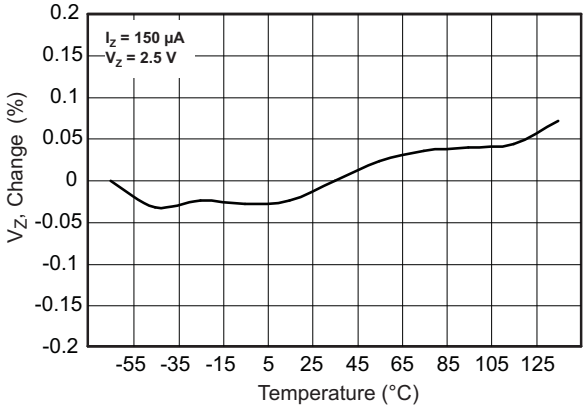


Figure 1. Change in V_Z vs Change in Temperature

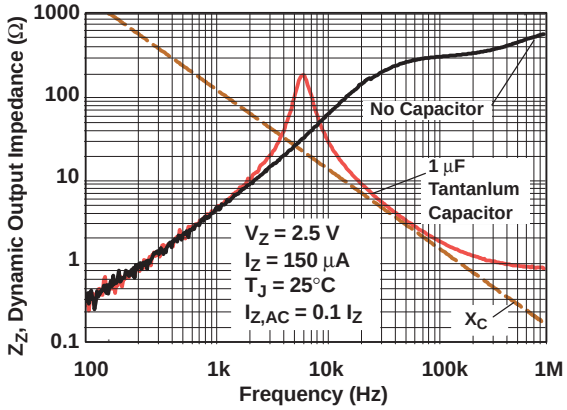


Figure 2. Output Impedance vs Frequency

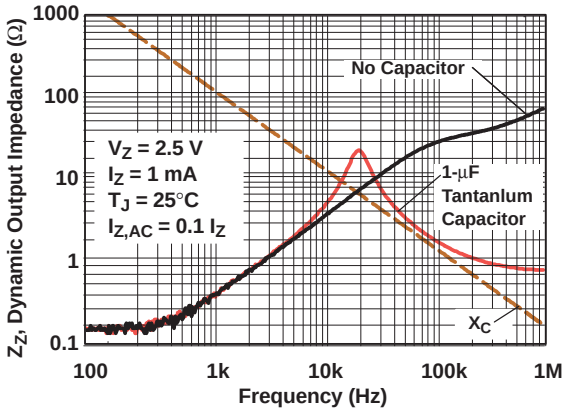


Figure 3. Output Impedance vs Frequency

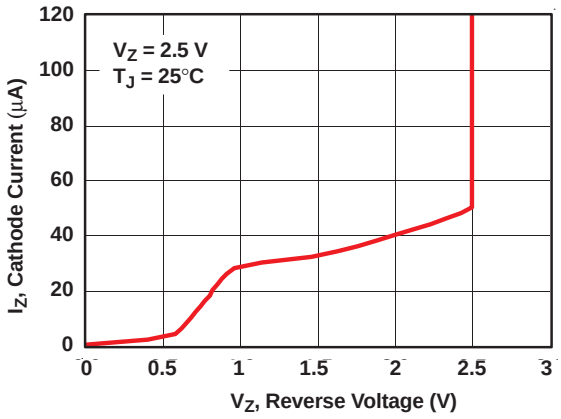


Figure 4. Cathode Current vs Reverse Voltage

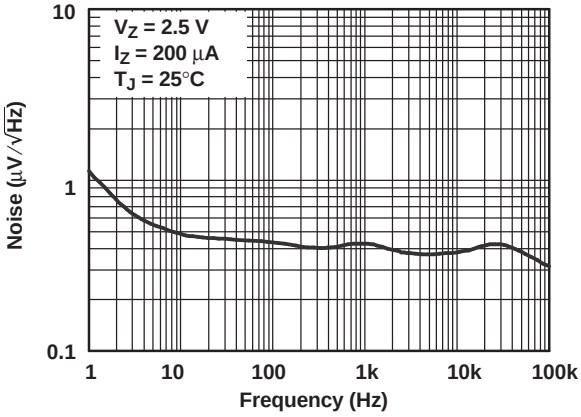


Figure 5. Noise Voltage vs Frequency

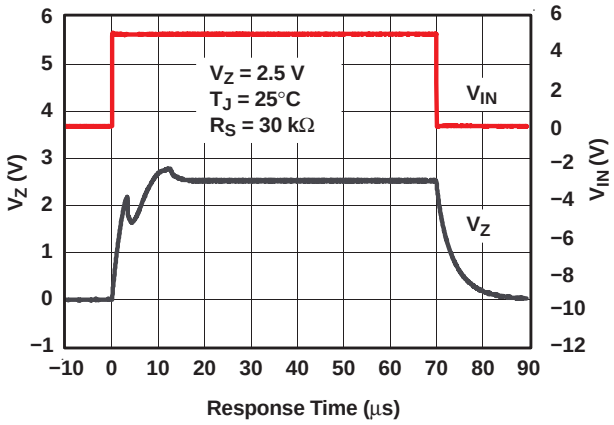


Figure 6. Start-Up Characteristics

APPLICATION INFORMATION

Start-Up Characteristics

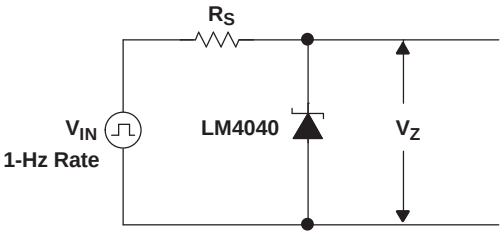


Figure 7. Test Circuit

Output Capacitor

The LM4040 does not require an output capacitor across cathode and anode for stability. However, if an output bypass capacitor is desired, the LM4040 is designed to be stable with all capacitive loads.

SOT-23 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.

Cathode and Load Currents

In a typical shunt-regulator configuration (see Figure 8), an external resistor, R_S, is connected between the supply and the cathode of the LM4040. R_S must be set properly, as it sets the total current available to supply the load (I_L) and bias the LM4040 (I_Z). In all cases, I_Z must stay within a specified range for proper operation of the reference. Taking into consideration one extreme in the variation of the load and supply voltage (maximum I_L and minimum V_S), R_S must be small enough to supply the minimum I_Z required for operation of the regulator, as given by data-sheet parameters. At the other extreme, maximum V_S and minimum I_L, R_S must be large enough to limit I_Z to less than its maximum-rated value of 15 mA.

R_S is calculated according to Equation 1:

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

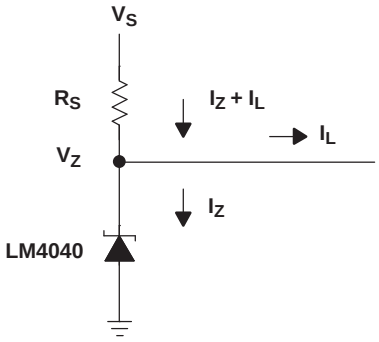


Figure 8. Shunt Regulator

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/ Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
LM4040C25MDBZTEP	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
V62/11615-01XB	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	

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

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

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

OTHER QUALIFIED VERSIONS OF LM4040C25-EP :

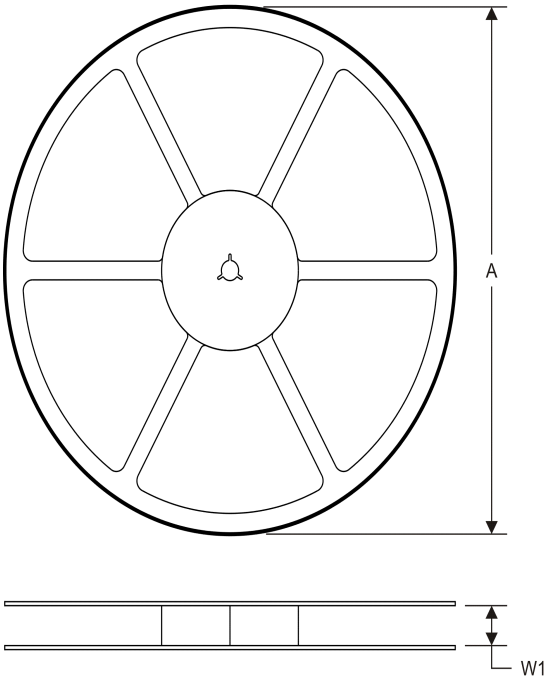
- Catalog: LM4040C25

NOTE: Qualified Version Definitions:

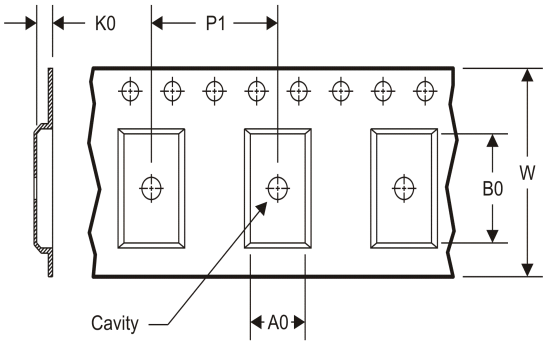
- Catalog - TI's standard catalog product

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



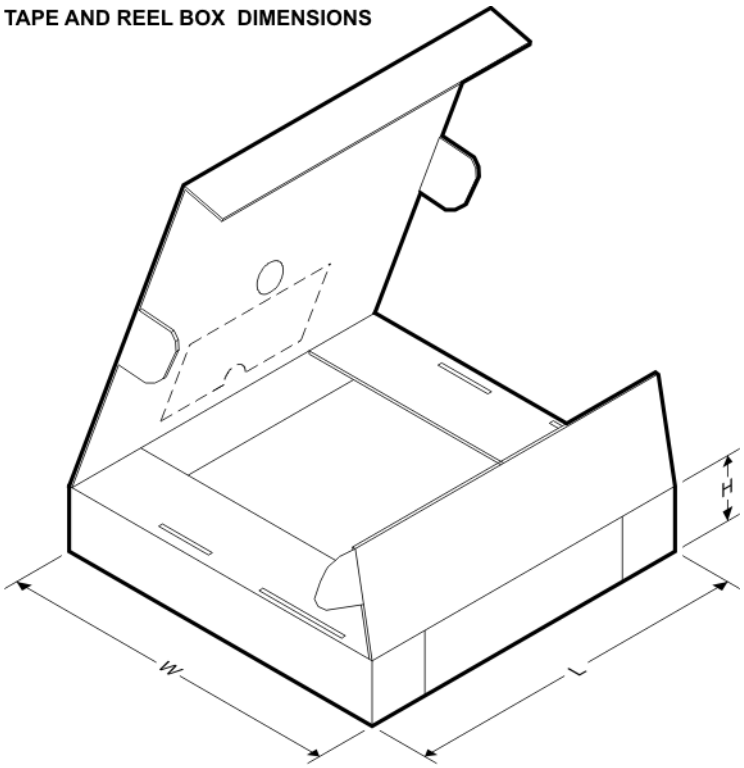
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

TAPE AND REEL INFORMATION

*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
LM4040C25MDBZTEP	SOT-23	DBZ	3	250	179.0	8.4	3.15	2.95	1.22	4.0	8.0	Q3

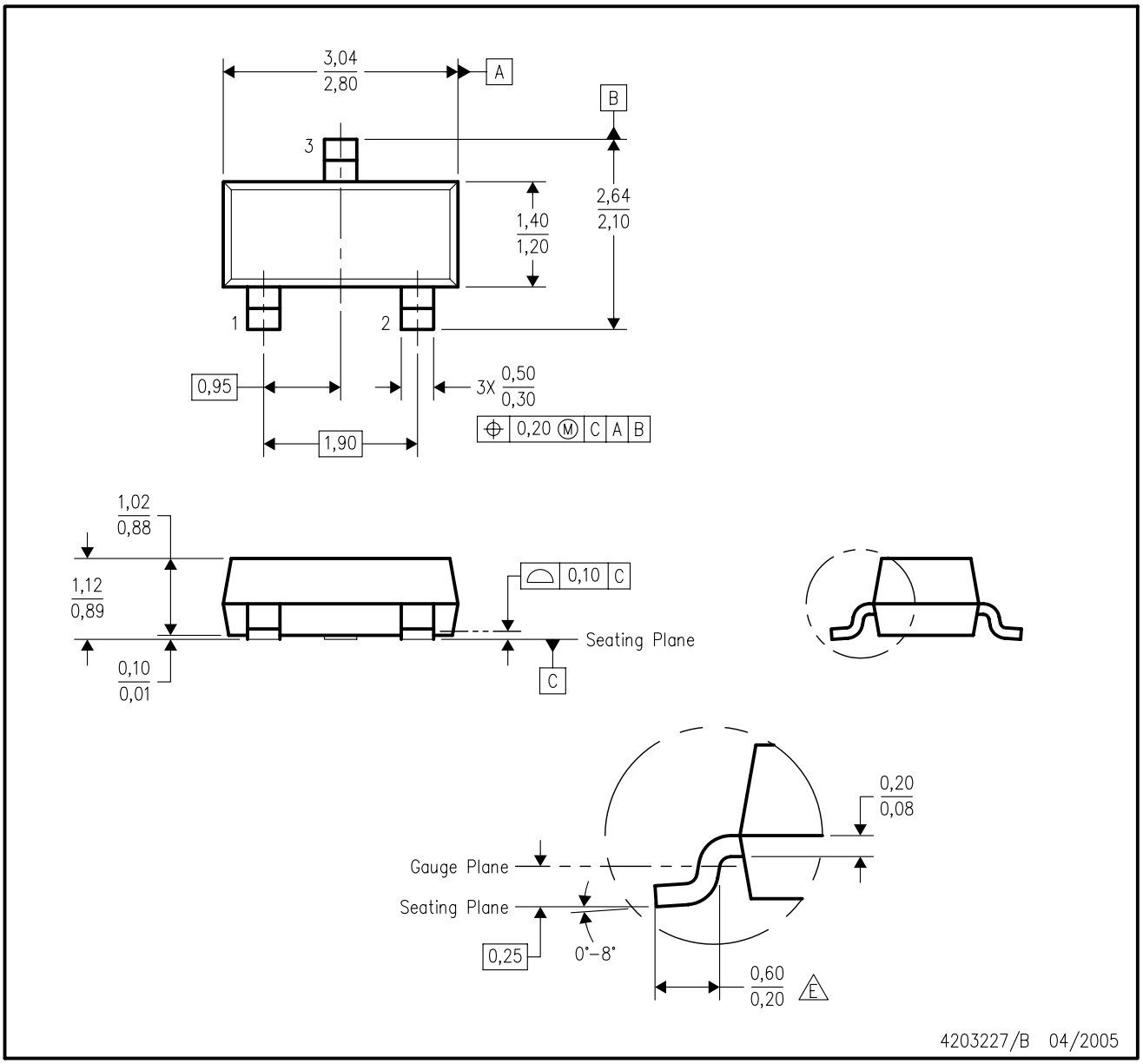
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

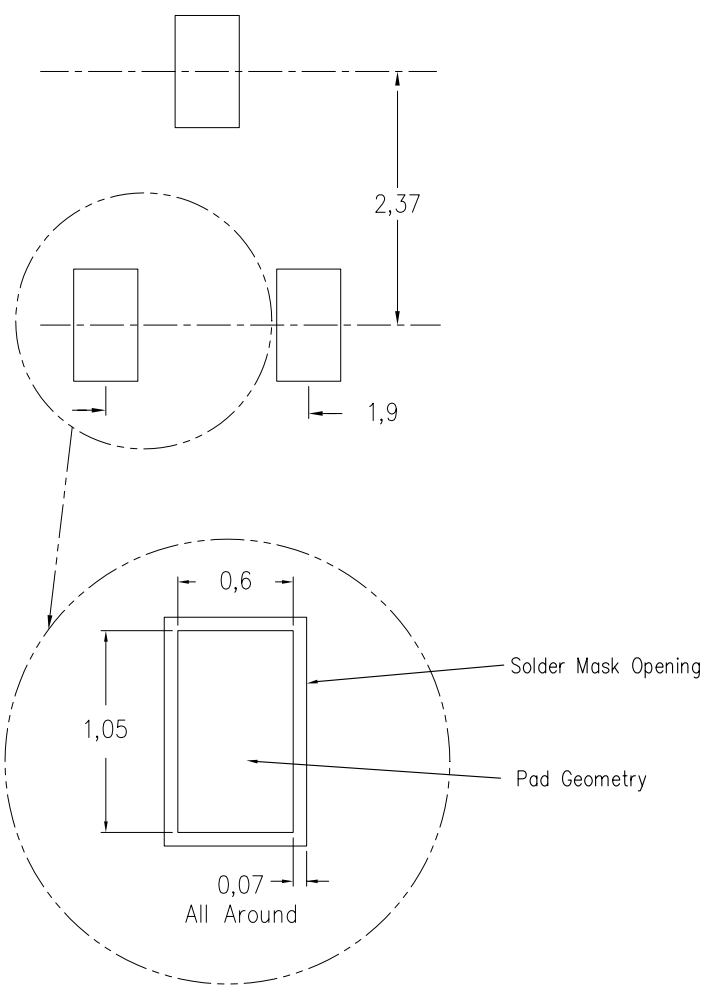
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM4040C25MDBZTEP	SOT-23	DBZ	3	250	203.0	203.0	35.0

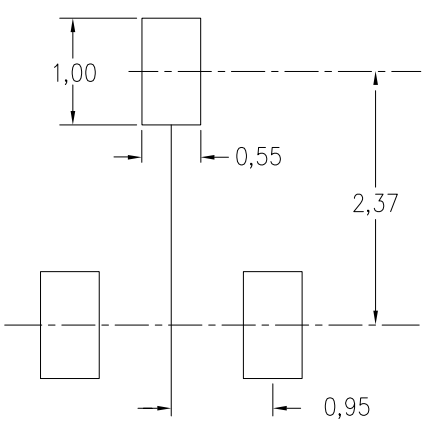
DBZ (R–PDSO–G3) PLASTIC SMALL–OUTLINE



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

DBZ (R–PDSO–G3) PLASTIC SMALL OUTLINE





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

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数据转换器	http://www.ti.com.cn/dataconverters	消费电子	www.ti.com/consumer-apps
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微控制器 (MCU)	http://www.ti.com.cn/microcontrollers	无线通信	www.ti.com.cn/wireless
RFID 系统	http://www.ti.com.cn/rfidsys		
RF/IF 和 ZigBee® 解决方案	www.ti.com.cn/radiofre		
	TI E2E 工程师社区	http://e2e.ti.com/cn/	

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