LM61 2.7V、SOT-23またはTO-92温度センサ

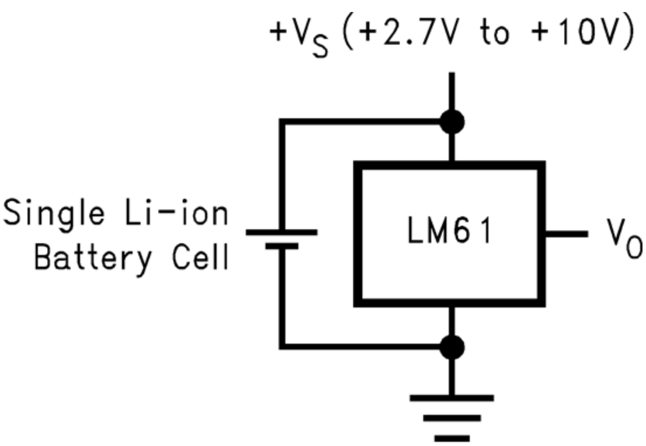
1 特長

- 較正済み線形スケール係数: 10mV/℃
- -30℃～100℃の動作温度範囲
- リモート・アプリケーションに最適
- UL認定のコンポーネント
- 25℃において±2℃または±3℃の精度(最大値)
- -25℃～85℃について±3℃の精度(最大値)
- -30℃～100℃について±4℃の精度(最大値)
- 10mV/℃の温度勾配(最大値)
- 電源電圧範囲: 2.7V～10V
- 消費電流: 25℃において125μA (最大値)
- 非直線性: ±0.8℃ (最大値)
- 出力インピーダンス: 800Ω (最大値)

2 アプリケーション

- 携帯電話
- コンピュータ
- 電源モジュール
- バッテリ管理
- FAXマシン
- プリンタ
- HVAC
- ディスク・ドライブ
- 家電製品

代表的なアプリケーション



V_O = (10mV/℃×T℃) + 600mV

3 概要

LM61デバイスは高精度の統合回路温度センサで、単一の2.7V電源により動作し、-30℃～100℃の温度範囲を検出できます。LM61の出力電圧は温度に正比例(10mV/℃)し、DCオフセットは600mVです。このオフセットにより、負電源を必要とせずに負温度を読み取れます。LM61 の公称出力電圧は、-30℃～100℃ の温度範囲について 300mV～1600mV です。LM61 は、室温で ±2℃、-25℃～85℃の温度範囲全体にわたって±3℃の精度を維持するよう較正済みです。

LM61の線形出力、600mVのオフセット、工場での較正により、単一電源の環境で負温度の読み取りが要求される場合に必要な外部回路が簡素化されます。静止電流が125μA未満なので、自己発熱が非常に少なく、静止空気中で0.2℃以下に抑えられています。LM61は本質的に低消費電力であり、様々なロジック・ゲートの出力から直接電源を供給できるので、専用の制御端子を備えていなくても容易にシャットダウンができます。

製品情報[(1)]

型番	パッケージ	本体サイズ(公称)
LM61	SOT-23 (3)	1.30mm×2.92mm
	TO-92 (3)	4.30mm×4.30mm

(1) 提供されているすべてのパッケージについては、巻末の注文情報を参照してください。

主な仕様

	値
25℃での精度	±2℃または±3℃
-25℃～85℃での精度	±3℃
-30℃～100℃での精度	±4℃
温度勾配	10mV/℃
電源電圧	2.7V～10V
25℃での消費電流	125μA
非線形性	±0.8℃
出力インピーダンス	800Ω

English Data Sheet: SNIS121

目次

4 改訂履歴

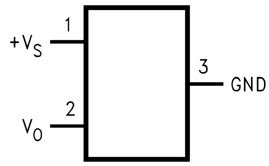
資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

Revision I (February 2013) から Revision J に変更	**Page**
• 「*製品情報*」表、「*デバイス比較表*」、「*ピン構成および機能*」セクション、「*仕様*」セクション、「*ESD定格*」表、「*詳細説明*」セクション、「*アプリケーションと実装*」セクション、「*電源に関する推奨事項*」セクション、「*レイアウト*」セクション、「*デバイスおよびドキュメントのサポート*」セクション、「*メカニカル、パッケージ、および注文情報*」セクション 追加	1
• Added *Thermal Information* table	4
• Changed $R_{\theta JA}$ values for DBZ (SOT-23) From: 450°C/W To: 286.3°C/W and for LP (TO-92) From: 180°C/W To: 162.2°C/W	4

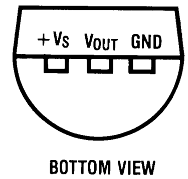
Revision H (February 2013) から Revision I に変更	**Page**
• ナショナル・セミコンダクターのデータシートのレイアウトをTIフォーマットに 変更	1

5 Pin Configuration and Functions

**DBZ Package
3-Pin SOT-23
Top View**



**LP Package
3-Pin TO-92**



Pin Functions

PIN		TYPE	DESCRIPTION
NAME	NO.		
+VS	1	Power	Positive power supply pin.
VOUT	2	Output	Temperature sensor analog output.
GND	3	Ground	Device ground pin, connected to power supply negative terminal.

6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)[1]

	MIN	MAX	UNIT
Supply voltage	12	–0.2	V
Output voltage	($+V_S$ + 0.6)	–0.6	V
Output current		10	mA
Input current at any pin[2]		5	mA
Maximum junction temperature, T_J		125	°C
Storage temperature, T_{stg}	–65	150	°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) When the input voltage (V_I) at any pin exceeds power supplies (V_I < GND or V_I > V_S), the current at that pin must be limited to 5 mA.

6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001[1][2]	±2500	V
		Machine Model (MM)[3]	±250	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) The human body model is a 100-pF capacitor discharged through a 1.5-kΩ resistor into each pin.
(3) The machine model is a 200-pF capacitor discharged directly into each pin.

6.3 Recommended Operating Conditions

			MIN	MAX	UNIT
$+V_S$	Supply voltage		2	10	V
T	Operating temperature	LM61C	–30	100	°C
		LM61B	–25	85	

6.4 Thermal Information

THERMAL METRIC[1]		LM61 DBZ (SOT-23) 3 PINS	LM61 LP (TO-92) 3 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance[2]	286.3	162.2	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	96	85	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	57.1	—	°C/W
ψ_{JT}	Junction-to-top characterization parameter	5.3	29.2	°C/W
ψ_{JB}	Junction-to-board characterization parameter	55.8	141.4	°C/W

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report.
(2) The junction-to-ambient thermal resistance is specified without a heat sink in still air.

6.5 Electrical Characteristics

$+V_S$ = 3 V (DC)[1][2]

PARAMETER	TEST CONDITIONS		MIN[3]	TYP[4]	MAX[3]	UNIT
Accuracy[5]	T_A = 25°C	LM61B	–2		2	°C
		LM61C	–3		3	
	LM61B		–3		3	
	LM61C		–4		4	
Output voltage at 0°C				600		mV
Nonlinearity[6]	LM61B		–0.6		0.6	°C
	LM61C		–0.8		0.8	
Sensor gain (average slope)	LM61B		9.7	10	10.3	mV/°C
	LM61C		9.6	10	10.4	
Output impedance	$+V_S$ = 3 V to 10 V				0.8	kΩ
	T_A = –30°C to 85°C, $+V_S$ = 2.7 V				2.3	
	T_A = 85°C to 100°C, $+V_S$ = 2.7 V				5	
Line regulation[7]	$+V_S$ = 3 V to 10 V		–0.7		0.7	mV/V
	$+V_S$ = 2.7 V to 3.3 V		–5.7		5.7	mV
Quiescent current	$+V_S$ = 2.7 V to 10 V	T_A = 25°C		82	125	µA
					155	
Change of quiescent current	$+V_S$ = 2.7 V to 10 V			±5		µA
Temperature coefficient of quiescent current				0.2		µA/°C
Long term stability[8]	$T_J = T_{MAX}$ = 100°C, for 1000 hours			±0.2		°C

(1) Limits are specified to TI's AOQL (Average Outgoing Quality Level).
(2) Typical limits represent most likely parametric norm.
(3) Maximum and minimum limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}.
(4) Typical limits apply for $T_A = T_J$ = 25°C.
(5) Accuracy is defined as the error between the output voltage and 10 mV/°C multiplied by the device's case temperature plus 600 mV, at specified conditions of voltage, current, and temperature (expressed in °C).
(6) Nonlinearity is defined as the deviation of the output-voltage-versus-temperature curve from the best-fit straight line, over the device's rated temperature range.
(7) Regulation is measured at constant junction temperature, using pulse testing with a low duty cycle. Changes in output due to heating effects can be computed by multiplying the internal dissipation by the thermal resistance.
(8) For best long-term stability, any precision circuit gives best results if the unit is aged at a warm temperature, or temperature cycled for at least 46 hours before long-term life test begins. This is especially true when a small (Surface-Mount) part is wave-soldered; allow time for stress relaxation to occur. The majority of the drift occurs in the first 1000 hours at elevated temperatures. The drift after 1000 hours does not continue at the first 1000-hour rate.

6.6 Typical Characteristics

The LM61 in the SOT-23 package mounted to a printed-circuit board as shown in Figure 18 was used to generate the following thermal curves.

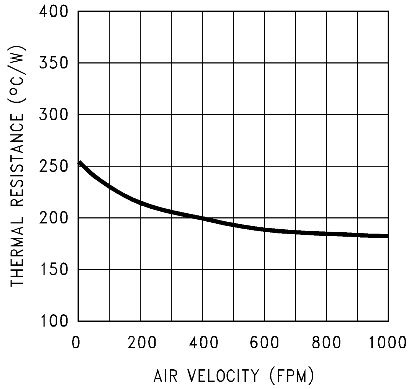


Figure 1. Junction-to-Ambient Thermal Resistance

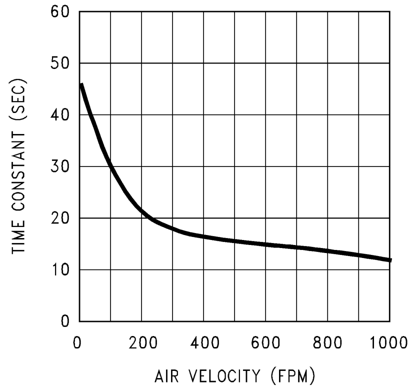


Figure 2. Thermal Time Constant

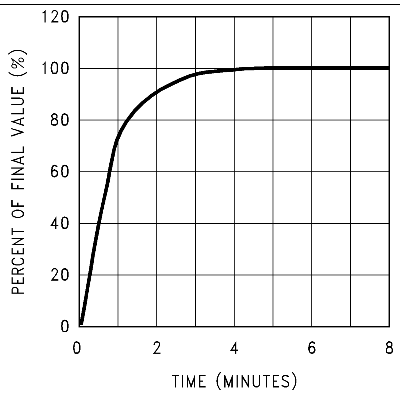


Figure 3. Thermal Response in Still Air with Heat Sink

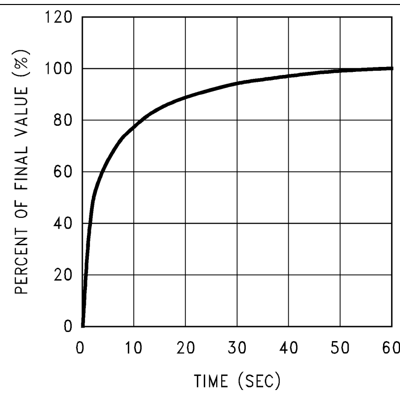


Figure 4. Thermal Response in Stirred Oil Bath with Heat Sink

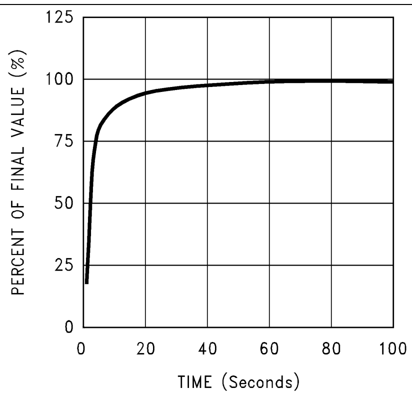


Figure 5. Thermal Response in Still Air without Heat Sink

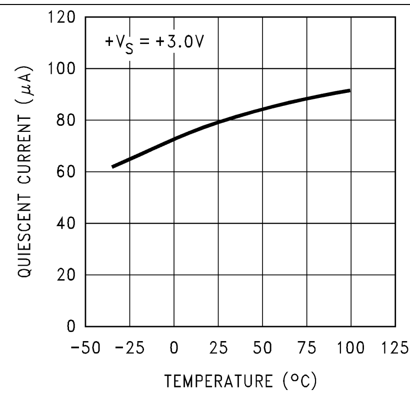


Figure 6. Quiescent Current vs Temperature

Typical Characteristics (continued)

The LM61 in the SOT-23 package mounted to a printed-circuit board as shown in Figure 18 was used to generate the following thermal curves.

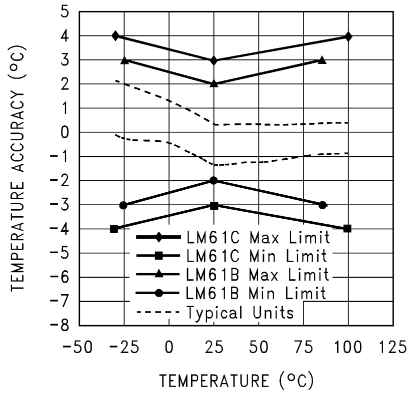


Figure 7. Accuracy vs Temperature

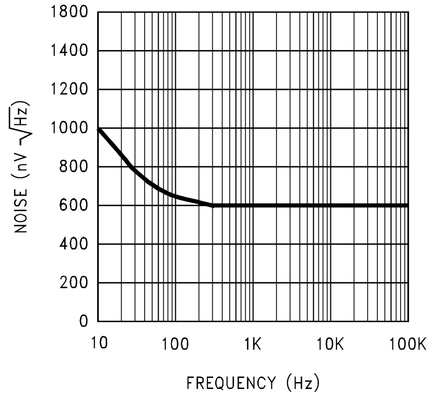


Figure 8. Noise Voltage

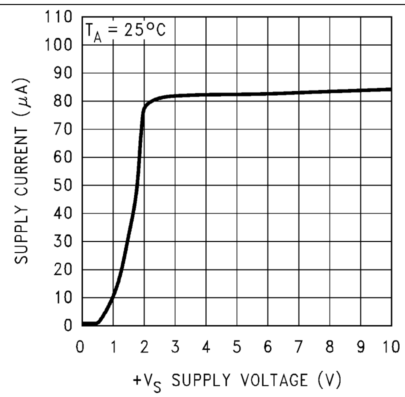


Figure 9. Supply Voltage vs Supply Current

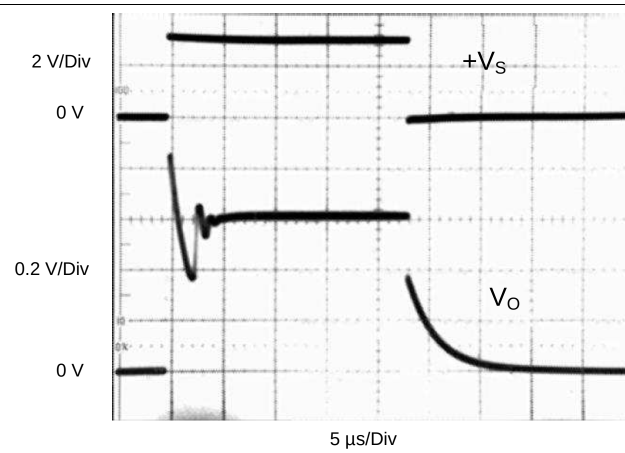


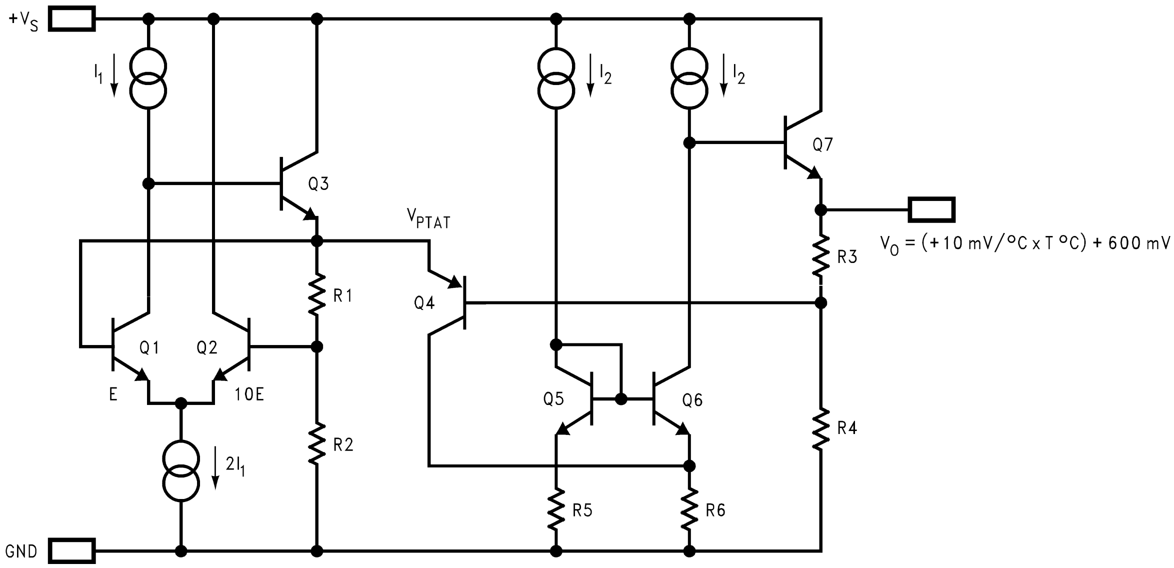
Figure 10. Start-Up Response

7 Detailed Description

7.1 Overview

The LM61 is a precision integrated-circuit temperature sensor that can sense a –30°C to 100°C temperature range using a single positive supply. The output voltage of the LM61 has a positive temperature slope of 10 mV/°C. A 600-mV offset is included, enabling negative temperature sensing when biased by a single supply. The temperature-sensing element is comprised of a delta-VBE architecture. The temperature-sensing element is then buffered by an amplifier and provided to the VOUT pin. The amplifier has a simple class A output stage as shown in *Functional Block Diagram*.

7.2 Functional Block Diagram



7.3 Feature Description

7.3.1 LM61 Transfer Function

The LM61 follows a simple linear transfer function to achieve the accuracy as listed in *Electrical Characteristics*. Use Equation 1 to calculate the value of V_O.

$$V_O = 10 \text{ mV/°C} \times T\text{°C} + 600 \text{ mV}$$

where

- T is the temperature in °C
- V_O is the LM61 output voltage (1)

7.4 Device Functional Modes

The only functional mode of the LM61 device is an analog output directly proportional to temperature.

8 Application and Implementation

NOTE

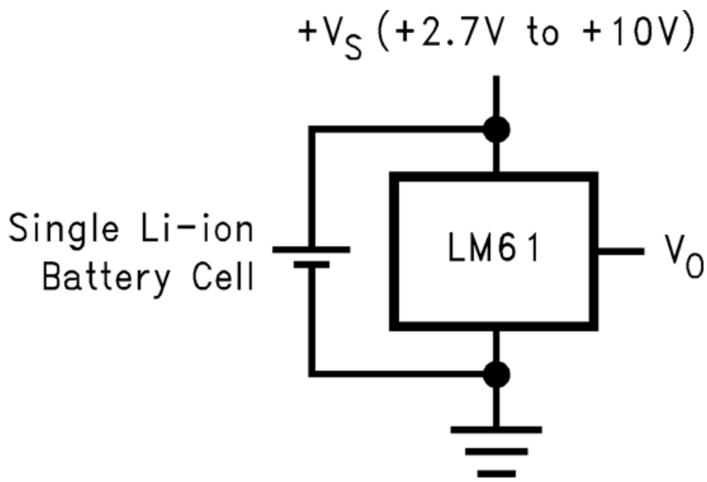
Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

8.1 Application Information

The LM61 has a wide supply range and a 10-mV/°C output slope with a 600-mV DC. Therefore, it can be easily applied in many temperature-sensing applications where a single supply is required for positive and negative temperatures.

8.2 Typical Applications

8.2.1 Typical Temperature Sensing Circuit



V_O = 10 mV/°C × T°C + 600 mV

Figure 11. Typical Temperature Sensing Circuit Diagram

8.2.1.1 Design Requirements

For this design example, use the parameters listed in Table 1 as the input parameters.

Table 1. Design Parameters

PARAMETER	VALUE
Power supply voltage	2.7 V to 3.3 V
Accuracy at 25°C	±2°C (maximum)
Accuracy over –25°C to 85°C	±3°C (maximum)
Temperature slope	10 mV/°C

8.2.1.2 Detailed Design Procedure

The LM61 is a simple temperature sensor that provides an analog output. Therefore, design requirements related to layout outweigh other requirements in importance. See *Layout* for more information.

8.2.1.2.1 Capacitive Loads

The LM61 handles capacitive loading well. Without any special precautions, the LM61 can drive any capacitive load as shown in Figure 12. Over the specified temperature range the LM61 has a maximum output impedance of 5 kΩ. In an extremely noisy environment it may be necessary to add some filtering to minimize noise pickup. It is recommended that 0.1-µF capacitor be added between +VS and GND to bypass the power-supply voltage, as shown in Figure 13. In a noisy environment it may be necessary to add a capacitor from VOUT to ground. A 1-µF output capacitor with the 5-kΩ maximum output impedance forms a 32-Hz lowpass filter. Because the thermal time constant of the LM61 is much slower than the 5-ms time constant formed by the RC, the overall response time of the LM61 is not significantly affected. For much larger capacitors this additional time lag increases the overall response time of the LM61.

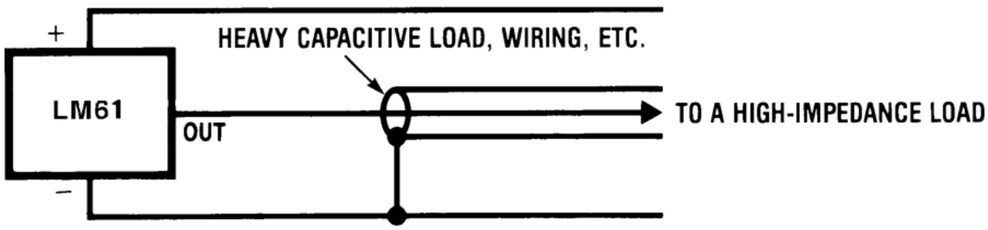


Figure 12. LM61 No Decoupling Required for Capacitive Load

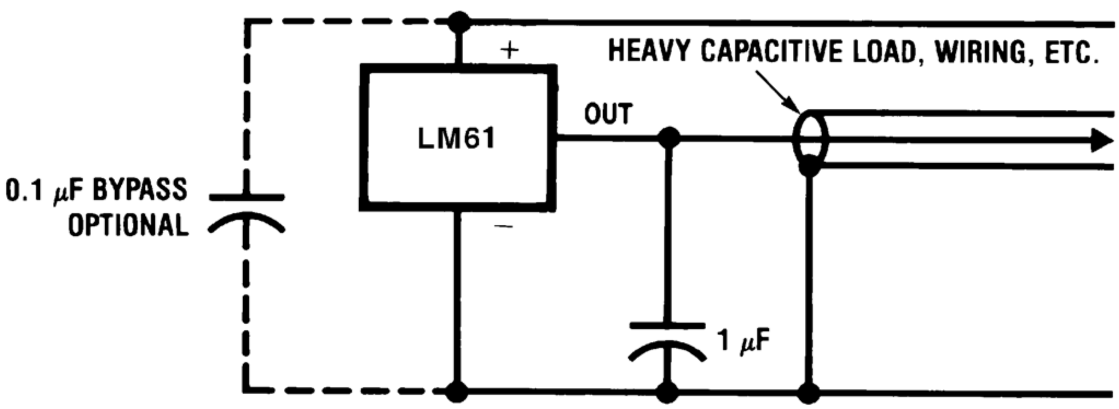


Figure 13. LM61 with Filter for Noisy Environments

8.2.1.3 Application Curve

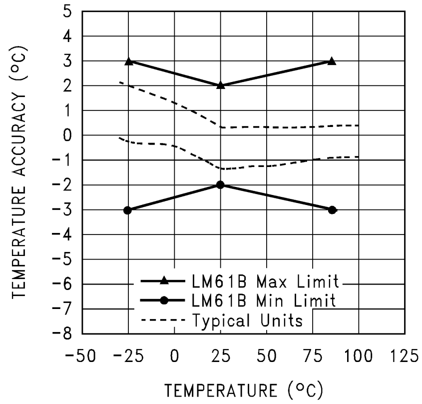
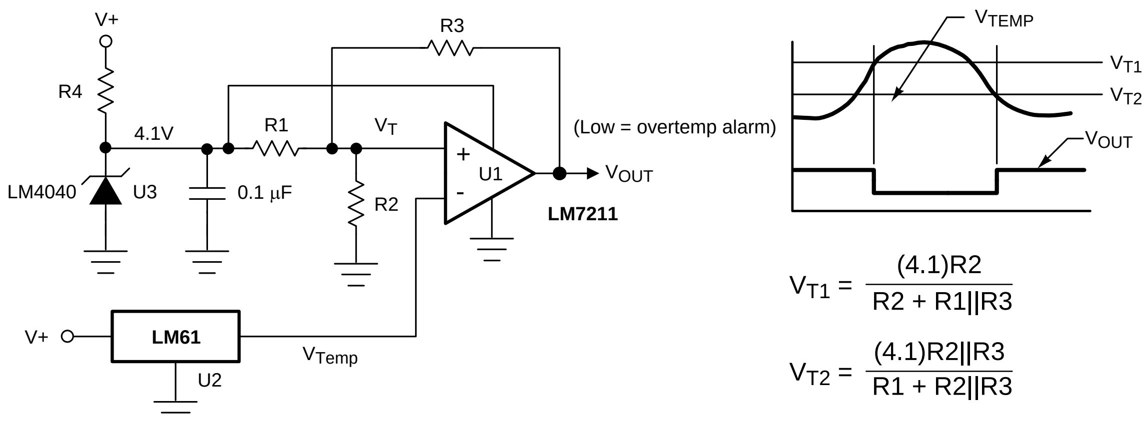


Figure 14. Accuracy vs Temperature

8.2.2 Other Application Circuits

Figure 15 shows an application circuit example using the LM61 device. Customers must fully validate and test any circuit before implementing a design based on an example in this section. Unless otherwise noted, the design procedures in *Typical Temperature Sensing Circuit* are applicable.



$$V_{T1} = \frac{(4.1)R2}{R2 + R1||R3}$$

$$V_{T2} = \frac{(4.1)R2||R3}{R1 + R2||R3}$$

Figure 15. Centigrade Thermostat

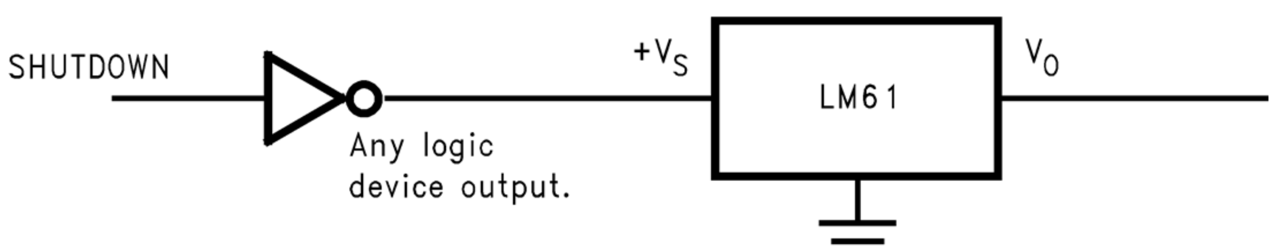


Figure 16. Conserving Power Dissipation with Shutdown

9 Power Supply Recommendations

In an extremely noisy environment, it may be necessary to add filtering to minimize noise pickup. TI recommends a 0.1-µF capacitor be added between +V_S to GND to bypass the power-supply voltage, as shown in Figure 13.

10 Layout

10.1 Layout Guidelines

10.1.1 Mounting

The LM61 can be applied easily in the same way as other integrated-circuit temperature sensors. It can be glued or cemented to a surface. The temperature that the LM61 senses is within about 0.2°C of the surface temperature that LM61's leads are attached to.

This presumes that the ambient air temperature is almost the same as the surface temperature; if the air temperature is much higher or lower than the surface temperature, the actual temperature measured would be at an intermediate temperature between the surface temperature and the air temperatures.

To ensure good thermal conductivity the backside of the LM61 die is directly attached to the GND pin. The lands and traces to the LM61 are part of the printed-circuit board, which is the object whose temperature is being measured.

Alternatively, the LM61 can be mounted inside a sealed-end metal tube, and can then be dipped into a bath or screwed into a threaded hole in a tank. As with any IC, the LM61 and accompanying wiring and circuits must be kept insulated and dry, to avoid leakage and corrosion. This is especially true if the circuit may operate at cold temperatures where condensation can occur. Printed-circuit coatings and varnishes such as Humiseal and epoxy paints or dips are often used to ensure that moisture cannot corrode the device or connections.

10.2 Layout Examples

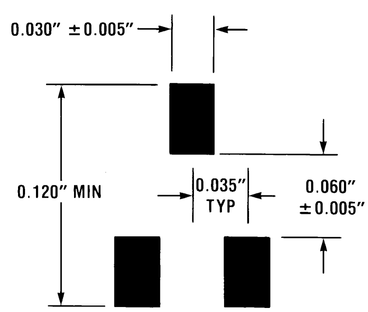
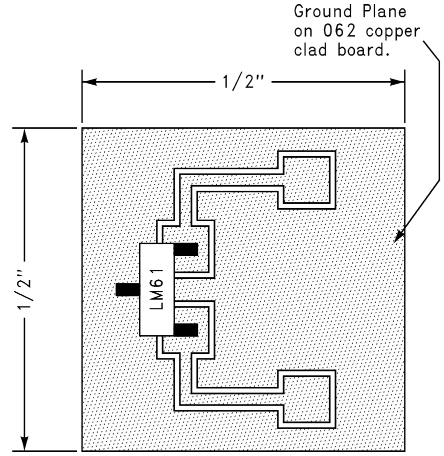


Figure 17. Recommended Solder Pads for SOT-23 Package

Layout Examples (continued)



A. 1/2 $in.^2$ printed-circuit board with 2 oz copper foil or similar.

Figure 18. Printed-Circuit Board Used for Heat Sink to Generate All Curves

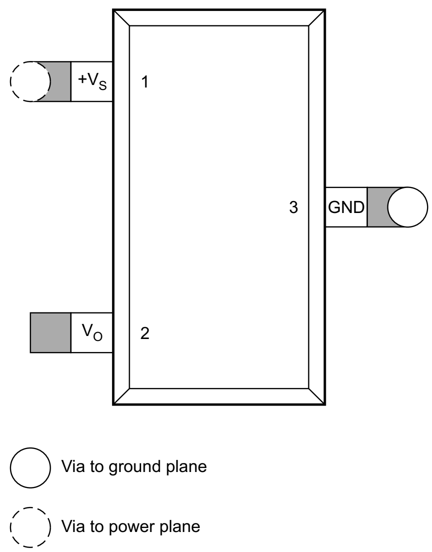


Figure 19. PCB Layout

10.3 Thermal Considerations

The junction-to-ambient thermal resistance is the parameter used to calculate the rise of a device junction temperature due to its power dissipation. For the LM61, Equation 2 is used to calculate the rise in the die temperature.

$$T_J = T_A + R_{\theta JA} \times ((+V_S \times I_Q) + (+V_S - V_O) \times I_L)$$

where

- I_Q is the quiescent current
- I_L is the load current on the output (2)

Table 2 summarizes the rise in die temperature of the LM61 without any loading with a 3.3-V supply, and the thermal resistance for different conditions.

Table 2. Temperature Rise of LM61 Due to Self-Heating and Thermal Resistance ($R_{\theta JA}$)

			$R_{\theta JA}$ (°C/W)	$T_J - T_A$ (°C)
SOT-23	No heat sink(1)	Still air	450	0.26
		Moving air	—	—
	Small heat fin(2)	Still air	260	0.13
		Moving air	180	0.09
TO-92	No heat sink(1)	Still air	180	0.09
		Moving air	90	0.05
	Small heat fin(3)	Still air	140	0.07
		Moving air	70	0.03

(1) Part soldered to 30 gauge wire.
(2) Heat sink used is 1/2 in.^{2} printed -circuit board with 2-oz foil with part attached as shown in Figure 18.
(3) Part glued and leads soldered to 1 in.^{2} of 1/16 in. printed circuit board with 2-oz foil or similar.

Table 3. Temperature and Typical V_O Values

TEMPERATURE	V_O(TYPICAL)
100°C	1600 mV
85°C	1450 mV
25°C	850 mV
0°C	600 mV
–25°C	350 mV
–30°C	300 mV

11 デバイスおよびドキュメントのサポート

11.1 関連資料

関連資料については、以下を参照してください。

- *『TO-92のパッケージ・オプションと注文情報』*(SNOA072)
- *『リモート・システム用の小型温度センサ』*(SNIA009)

11.2 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、ti.comのデバイス製品フォルダを開いてください。右上の隅にある「*通知を受け取る*」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れます。変更の詳細については、修正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。

11.3 コミュニティ・リソース

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

TI E2E™ Online Community ***TI's Engineer-to-Engineer (E2E) Community.*** Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support ***TI's Design Support*** Quickly find helpful E2E forums along with design support tools and contact information for technical support.

11.4 商標

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11.5 静電気放電に関する注意事項

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静電気放電はわずかな性能の低下から完全なデバイスの故障に至るまで、様々な損傷を与えます。高精度の集積回路は、損傷に対して敏感であり、極めてわずかなパラメータの変化により、デバイスに規定された仕様に適合しなくなる場合があります。

11.6 Glossary

SLYZ022 — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

12 メカニカル、パッケージ、および注文情報

以降のページには、メカニカル、パッケージ、および注文に関する情報が記載されています。この情報は、そのデバイスについて利用可能な最新のデータです。このデータは予告なく変更されることがあり、ドキュメントが改訂される場合もあります。本データシートのブラウザ版を使用されている場合は、画面左側の説明をご覧ください。

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)
LM61BIM3	NRND	Production	SOT-23 (DBZ) | 3	1000 | LARGE T&R	No	Call TI	Level-1-260C-UNLIM	-25 to 85	T1B
LM61BIM3.B	NRND	Production	SOT-23 (DBZ) | 3	1000 | LARGE T&R	No	Call TI	Level-1-260C-UNLIM	-25 to 85	T1B
LM61BIM3/NOPB	Obsolete	Production	SOT-23 (DBZ) | 3	-	-	Call TI	Call TI	-25 to 85	T1B
LM61BIM3X/NOPB	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-25 to 85	T1B
LM61BIM3X/NOPB.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-25 to 85	T1B
LM61BIM3X/NOPB.B	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-25 to 85	T1B
LM61BIZ/LFT3	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	-25 to 85	LM61 BIZ
LM61BIZ/LFT3.B	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	-25 to 85	LM61 BIZ
LM61BIZ/NOPB	Active	Production	TO-92 (LP) | 3	1800 | SMALL T&R	Yes	SN	N/A for Pkg Type	-25 to 85	LM61 BIZ
LM61BIZ/NOPB.A	Active	Production	TO-92 (LP) | 3	1800 | SMALL T&R	Yes	SN	N/A for Pkg Type	-25 to 85	LM61 BIZ
LM61BIZ/NOPB.B	Active	Production	TO-92 (LP) | 3	1800 | SMALL T&R	Yes	SN	N/A for Pkg Type	-25 to 85	LM61 BIZ
LM61CIM3	NRND	Production	SOT-23 (DBZ) | 3	1000 | LARGE T&R	No	Call TI	Level-1-260C-UNLIM	-30 to 100	T1C
LM61CIM3.B	NRND	Production	SOT-23 (DBZ) | 3	1000 | LARGE T&R	No	Call TI	Level-1-260C-UNLIM	-30 to 100	T1C
LM61CIM3/NOPB	Obsolete	Production	SOT-23 (DBZ) | 3	-	-	Call TI	Call TI	-30 to 100	T1C
LM61CIM3X/NOPB	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-30 to 100	T1C
LM61CIM3X/NOPB.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-30 to 100	T1C
LM61CIM3X/NOPB.B	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-30 to 100	T1C
LM61CIZ/LFT2	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	-30 to 100	LM61 CIZ
LM61CIZ/LFT2.B	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	-30 to 100	LM61 CIZ
LM61CIZ/NOPB	Active	Production	TO-92 (LP) | 3	1800 | SMALL T&R	Yes	SN	N/A for Pkg Type	-30 to 100	LM61 CIZ
LM61CIZ/NOPB.A	Active	Production	TO-92 (LP) | 3	1800 | SMALL T&R	Yes	SN	N/A for Pkg Type	-30 to 100	LM61 CIZ
LM61CIZ/NOPB.B	Active	Production	TO-92 (LP) | 3	1800 | SMALL T&R	Yes	SN	N/A for Pkg Type	-30 to 100	LM61 CIZ

[(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.

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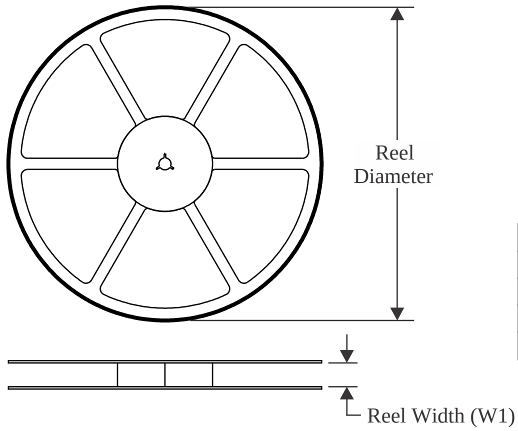
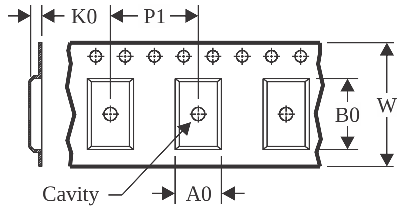
TAPE AND REEL INFORMATION

REEL DIMENSIONS

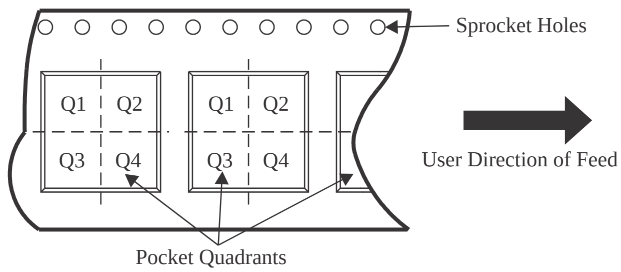


TAPE DIMENSIONS



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

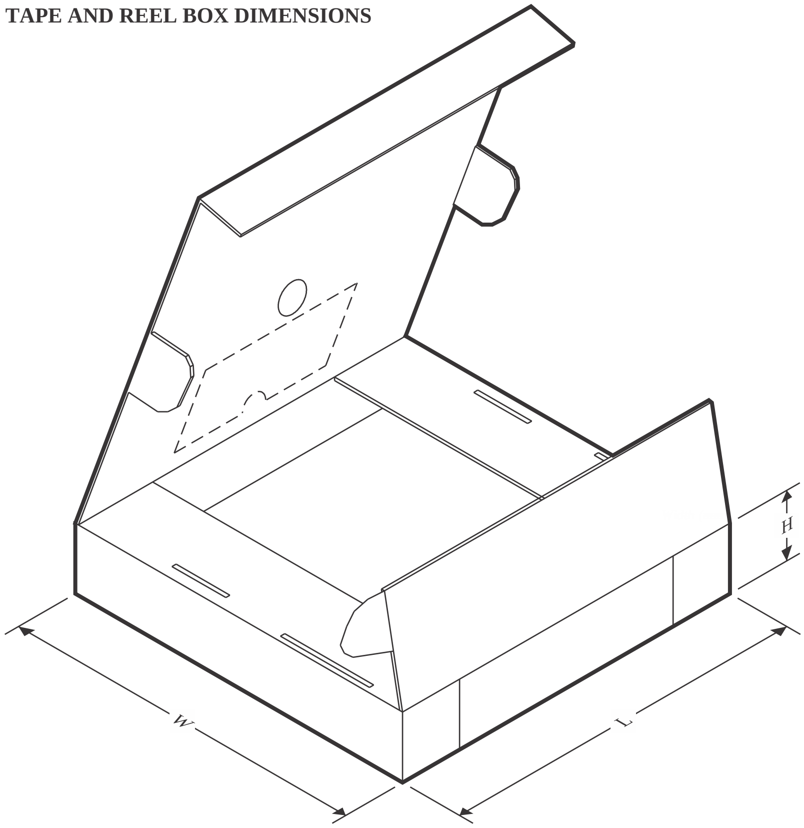
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

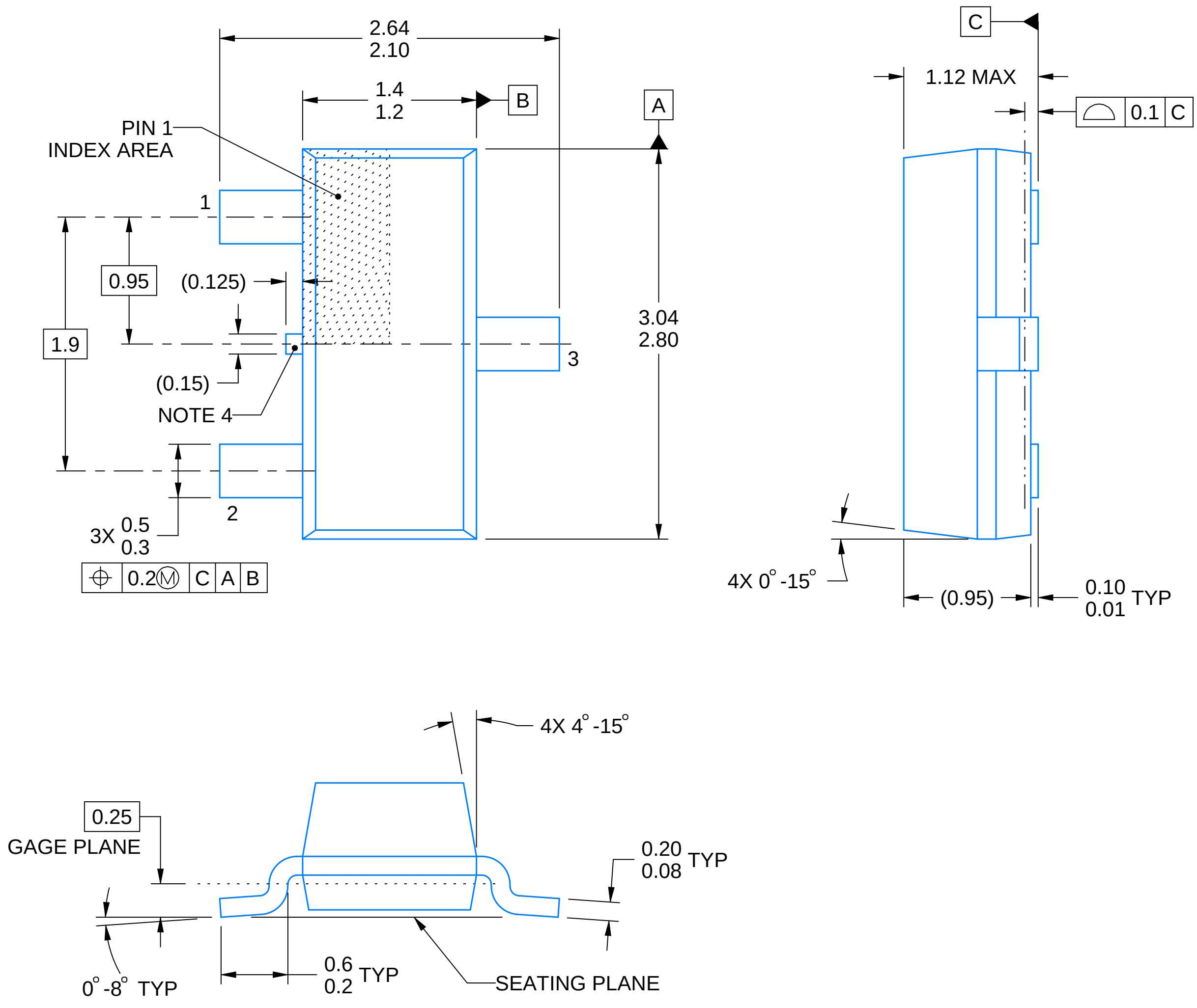
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM61BIM3X/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3
LM61CIM3X/NOPB	SOT-23	DBZ	3	3000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM61BIM3X/NOPB	SOT-23	DBZ	3	3000	208.0	191.0	35.0
LM61CIM3X/NOPB	SOT-23	DBZ	3	3000	208.0	191.0	35.0



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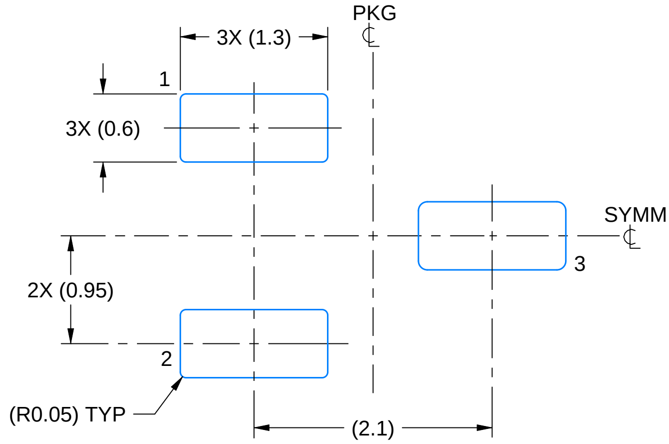
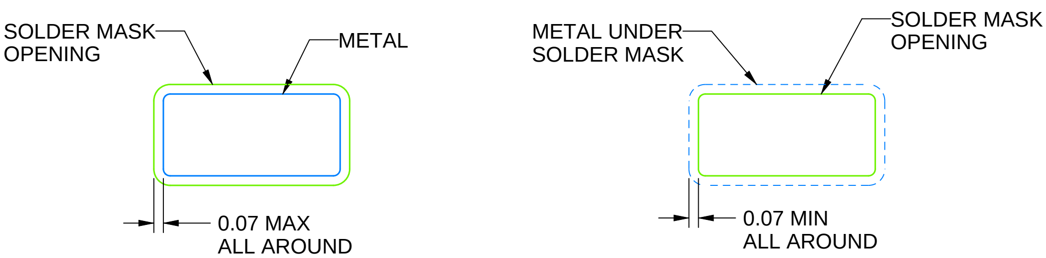
NOTES:

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



LAND PATTERN EXAMPLE
SCALE:15X



NON SOLDER MASK DEFINED (PREFERRED)

SOLDER MASK DEFINED

SOLDER MASK DETAILS

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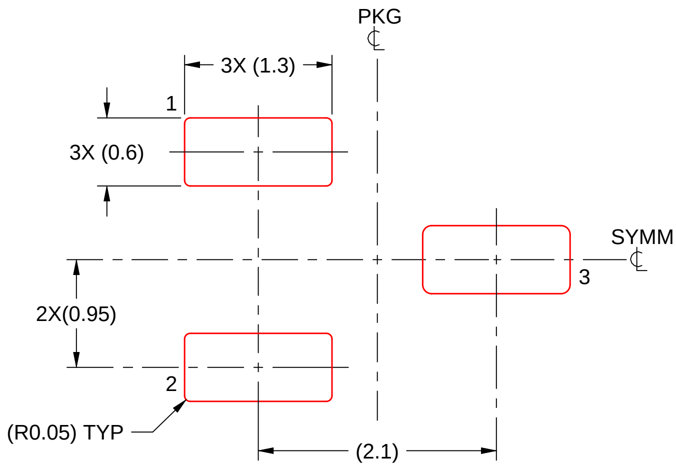
NOTES: (continued)

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



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

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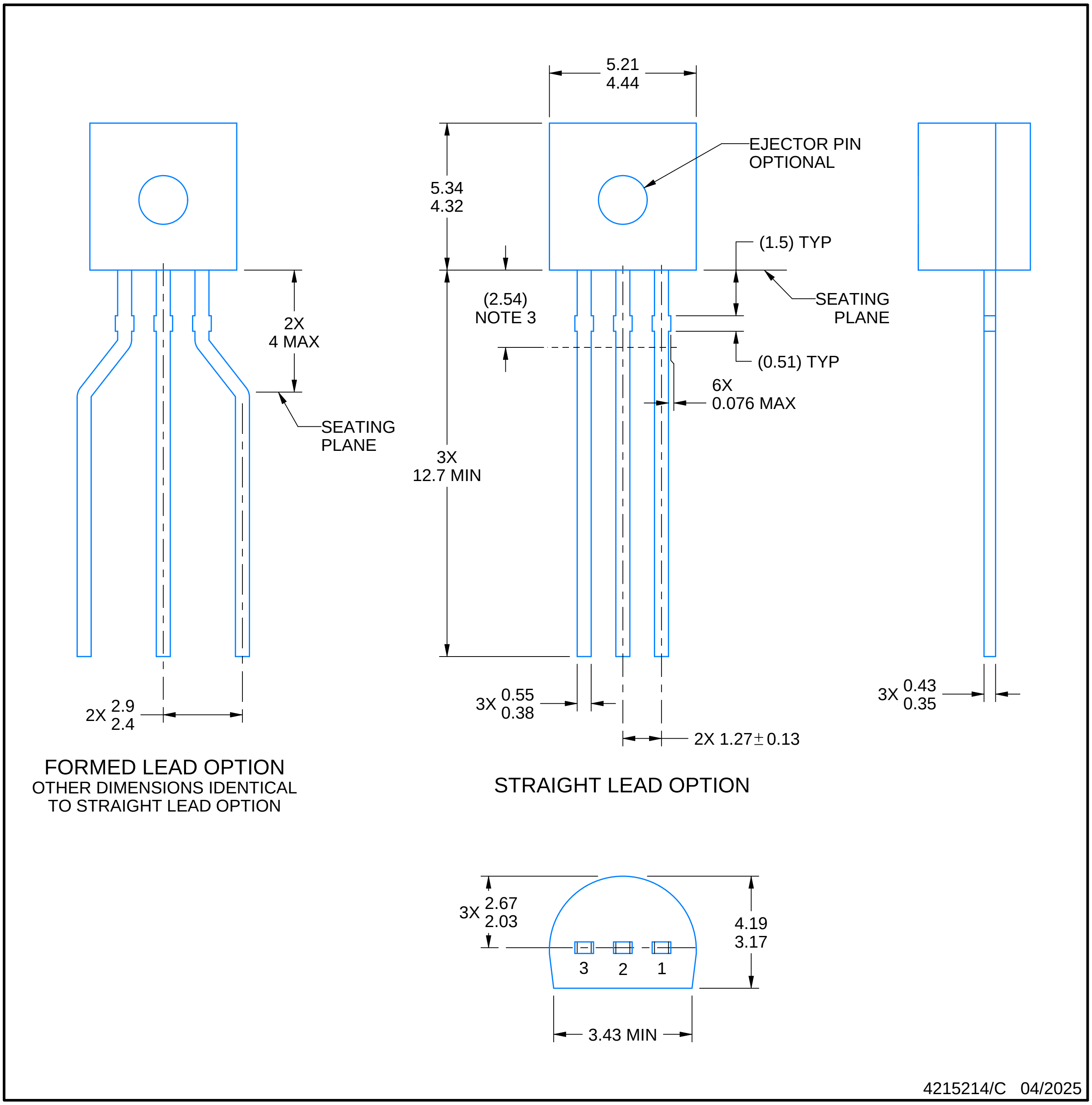
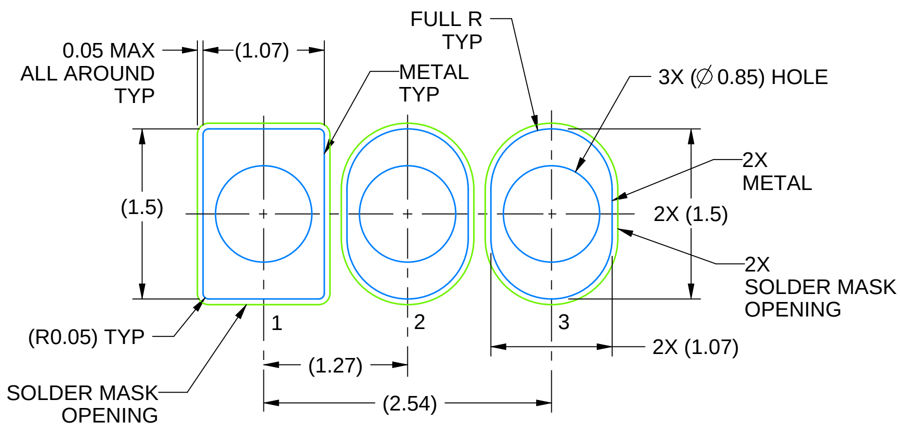
NOTES: (continued)

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.

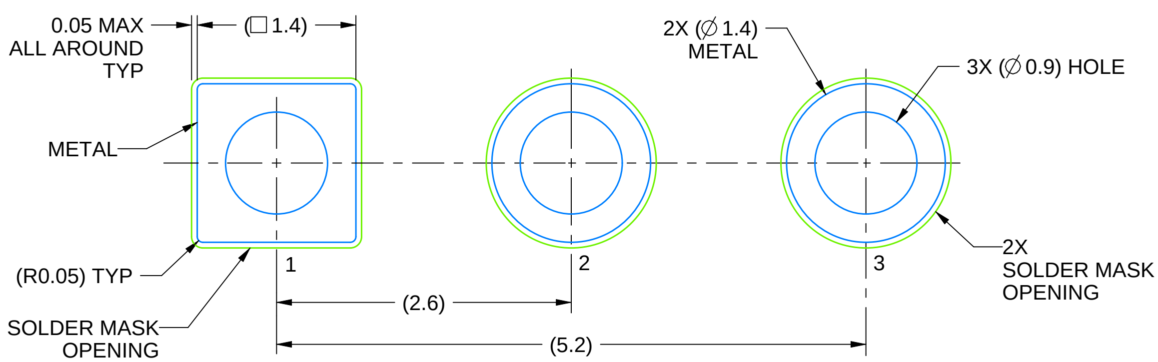


NOTES:

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.

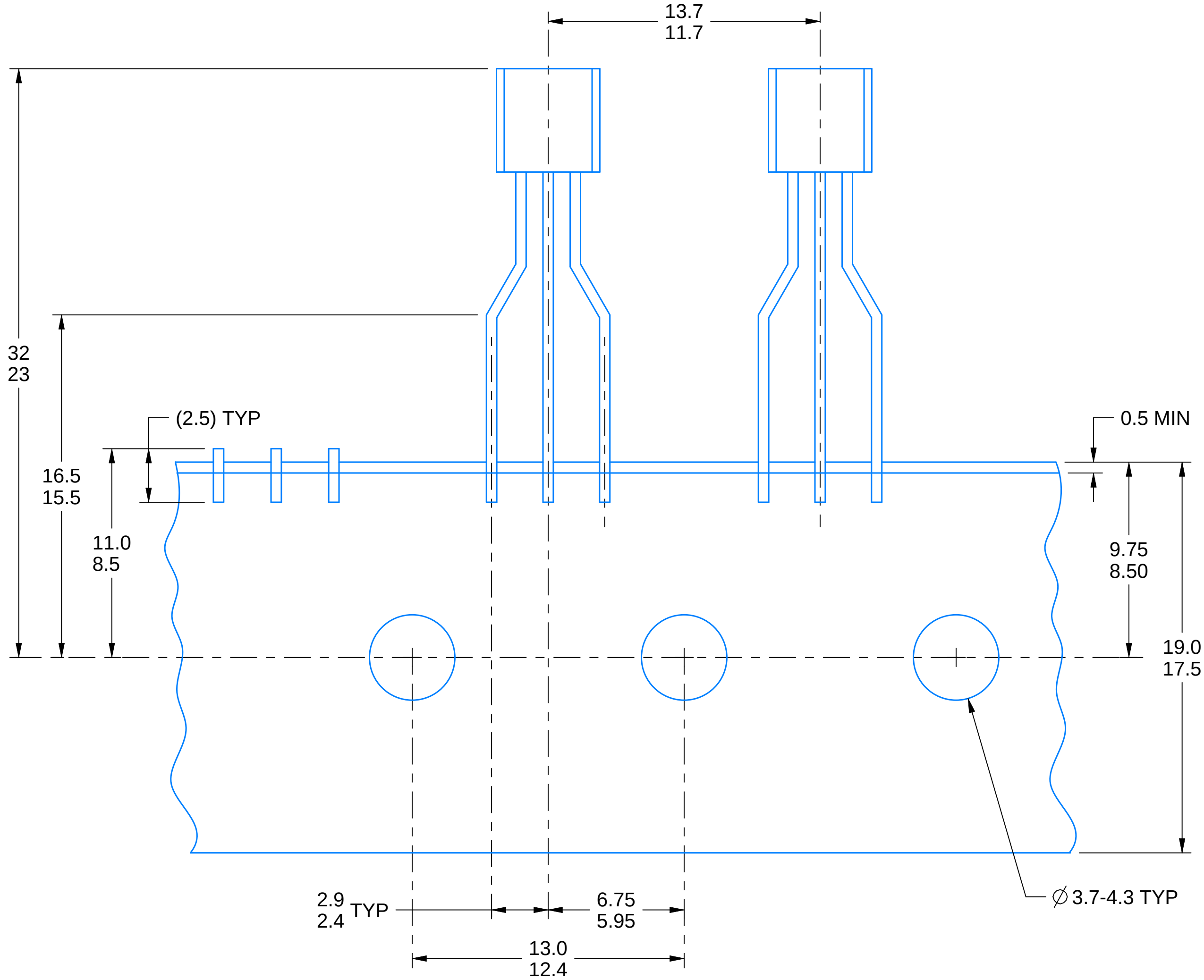


LAND PATTERN EXAMPLE
STRAIGHT LEAD OPTION
NON-SOLDER MASK DEFINED
SCALE:15X



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

4215214/C 04/2025



FOR FORMED LEAD OPTION PACKAGE

4215214/C 04/2025

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