

# TMP461-SP Radiation Hardened Remote and Local Digital Temperature Sensor

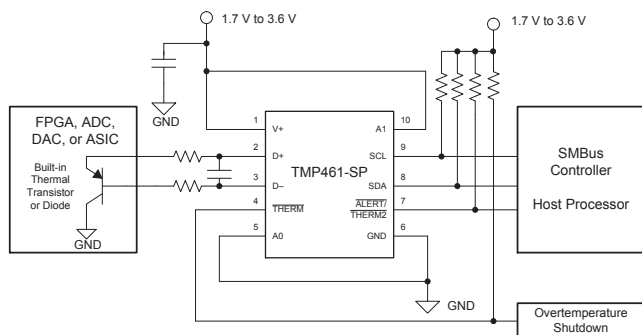
## 1 Features

- Remote Diode Temperature Sensor Accuracy:  $\pm 1.5^{\circ}\text{C}$
- Local Temperature Sensor Accuracy:  $\pm 2^{\circ}\text{C}$
- Resolution for Local and Remote Channels:  $0.0625^{\circ}\text{C}$
- Supply and Logic Voltage Range: 1.7 V to 3.6 V
- 35- $\mu\text{A}$  Operating Current (1 SPS), 3- $\mu\text{A}$  Shutdown Current
- Series Resistance Cancellation
- $\eta$ -Factor and Offset Correction
- Programmable Digital Filter
- Diode Fault Detection
- Two-Wire and SMBus™ Serial Interface Compatible with Pin-Programmable Address
- QMLV Qualified: 5962L1721801VXC
  - Thermally Enhanced HKU Package
  - Radiation Hardness Assured (RHA) up to Total Ionizing Dose (TID) 50 kRad (Si)
  - Single Event Latchup (SEL) Immune to 76 MeV.cm<sup>2</sup>/mg at 125°C
  - 10-Lead HKU Ceramic Package

## 2 Applications

- Spacecraft FPGA, ADC's, DAC's, and ASIC Temperature Monitoring
- Spacecraft Housekeeping and Telemetry

Simplified Block Diagram



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## 3 Description

The TMP461-SP device is a radiation-hardened, high-accuracy, low-power remote temperature sensor monitor with a built-in local temperature sensor. The remote temperature sensors are typically low-cost discrete NPN or PNP transistors, or substrate thermal transistors or diodes that are integral parts of microprocessors, analog-to-digital converters (ADC's), digital-to-analog converters (DAC's), microcontrollers, or field-programmable gate arrays (FPGAs). Temperature is represented as a 12-bit digital code for both local and remote sensors, giving a resolution of  $0.0625^{\circ}\text{C}$ . The two-wire serial interface accepts the SMBus communication protocol with up to nine different pin-programmable addresses.

Advanced features such as series resistance cancellation, programmable nonideality factor ( $\eta$ -factor), programmable offset, programmable temperature limits, and a programmable digital filter, are combined to provide a robust thermal monitoring solution with improved accuracy and noise immunity.

The TMP461-SP is ideal for multi-location, high-accuracy temperature measurements in a variety of distributed telemetry applications. The integrated local and remote temperature sensors simplify spacecraft housekeeping activities by providing an easy way of measuring temperature gradients. The device is specified for operation over a supply voltage range of 1.7 V to 3.6 V, and a temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ .

Device Information<sup>(1)</sup>

PART NUMBER	GRADE	PACKAGE
5962L1721801VXC	QMLV RHA [50 kRad]	10-lead CFP [HKU] 7.02 mm x 6.86 mm
TMP461HKU/EM <sup>(2)</sup>	Engineering Samples	10-lead CFP [HKU] 7.02 mm x 6.86 mm
TMP461EVM-CVAL	Ceramic Evaluation Board	

(1) For all available packages, see the orderable addendum at the end of the datasheet.

(2) These units are intended for engineering evaluation only. They are processed to a noncompliant flow and are functionally tested at  $25^{\circ}\text{C}$  only. These units are not suitable for qualification, production, radiation testing or flight use. Parts are not warranted for performance over the full MIL specified temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  or operating life.



## 4 Device and Documentation Support

### 4.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 4.2 Community Resources

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.

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### 4.3 Trademarks

E2E is a trademark of Texas Instruments.  
 SMBus is a trademark of Intel Corporation.  
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### 4.4 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 4.5 Glossary

[SLYZ022](#) — *TI Glossary*.

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

## 5 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 Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TMP461HKU/EM	ACTIVE	CFP	HKU	10	25	TBD	AU	N / A for Pkg Type	25 to 25	TMP461HKU/EM EVAL ONLY	<b>Samples</b>

(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.

**OBSELETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

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

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

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

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**OTHER QUALIFIED VERSIONS OF TMP461-SP :**

- Catalog: [TMP461](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

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