

ADS131B26-Q1 Current, Voltage, and Temperature Measurement Automotive Analog Front-End for Battery Management Systems

1 Features

- AEC-Q100 qualified for automotive applications
 - Temperature grade 1: -40°C to $+125^{\circ}\text{C}$, T_A
- **Functional Safety-Compliant targeted**
 - Developed for functional safety applications
 - Documentation to aid ISO 26262 system design will be available upon production release
 - Systematic capability up to ASIL D targeted
 - Hardware capability up to ASIL D targeted
- Two simultaneous-sampling, 24-bit ADCs (ADC1A, ADC1B) for current shunt measurement
 - Programmable data rate: 500 SPS to 64 kSPS
 - Programmable full-scale range: $\pm 39\text{ mV}$ to $\pm 312.5\text{ mV}$
 - Offset error (global-chop mode): $2\ \mu\text{V}$ (max)
 - Gain drift: $15\text{ ppm}/^{\circ}\text{C}$ (max)
 - Digital overcurrent comparator with programmable thresholds and deglitch times per ADC
- Two simultaneous-sampling, 24-bit ADCs (ADC3A, ADC3B) for voltage measurement
 - Programmable data rate: 500 SPS to 64 kSPS
 - Programmable full-scale range: $\pm 312.5\text{ mV}$ to $\pm 1.25\text{ V}$
- Two multiplexed, 16-bit ADCs (ADC2A, ADC2B) for voltage and temperature measurement
 - Eight input channels per ADC
 - Programmable full-scale range: $\pm 312.5\text{ mV}$ to $\pm 1.25\text{ V}$
 - Channel autosequencer

2 Applications

- **Automotive battery management systems (BMS):**
 - Current-shunt measurements
 - Voltage measurements using external resistor dividers
 - Temperature measurements using thermistors or analog output temperature sensors

3 Description

The ADS131B26-Q1 is a complete analog front-end (AFE) for automotive electrical vehicle (EV) battery management systems (BMS) that integrates two simultaneous-sampling, high-precision, 24-bit ADC channels (ADC1A, ADC1B) to redundantly measure battery current with high resolution and accuracy using an external shunt resistor. Two independent digital overcurrent detection comparators work in parallel to the two ADCs for fast overcurrent detection.

Another set of two simultaneous-sampling, 24-bit ADCs (ADC3A, ADC3B) is integrated to measure battery pack voltage using external high-voltage resistor dividers synchronously to the battery current for accurate state-of-charge and state-of-health battery calculations.

Additional two, multiplexed, 16-bit ADC channels (ADC2A, ADC2B) are available to measure shunt temperature using external temperature sensors, such as thermistors or analog output temperature sensors, as well as other voltages in the system.

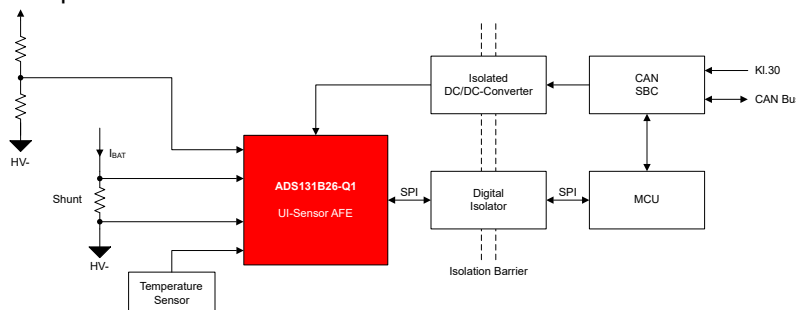
A multitude of monitoring and diagnostic features are integrated in the device to mitigate and detect random hardware faults to aid in the development of functional safe BMS.

The ADS131B26-Q1 is offered in a 48-pin HTQFP package and is specified over the automotive temperature range of -40°C to $+105^{\circ}\text{C}$.

Package Information⁽¹⁾

PART NUMBER	PACKAGE	BODY SIZE (NOM)
ADS131B26-Q1	PHP (HTQFP, 48)	7.00 mm × 7.00 mm

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



EV BMS Current-Sense Module (CSM) System Block Diagram

4 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

4.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Subscribe to updates* 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 Support Resources

TI E2E™ [support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is 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](#).

4.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.
All trademarks are the property of their respective owners.

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

[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.

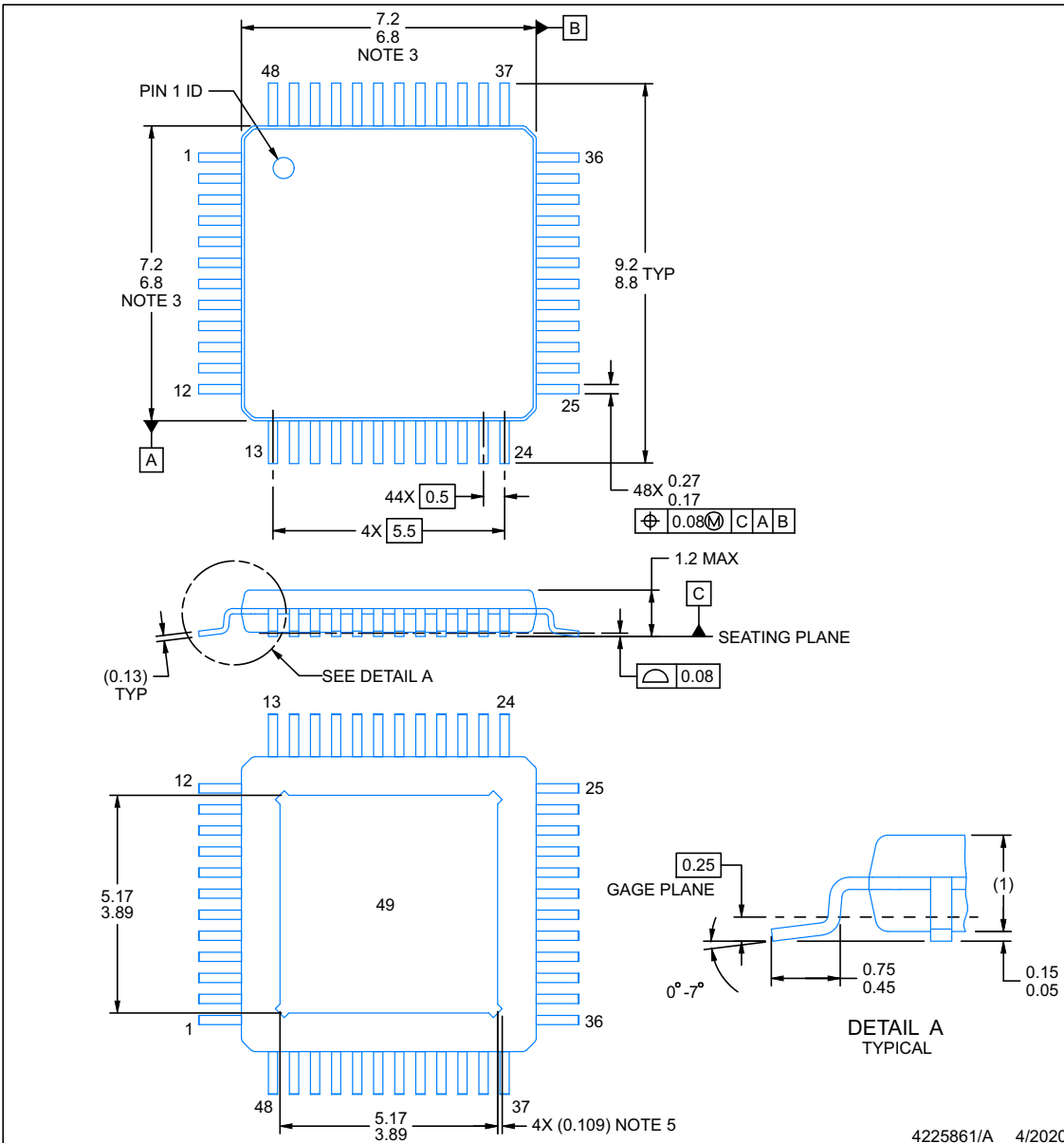
5.1 Mechanical Data

PACKAGE OUTLINE

PHP0048G

PowerPAD™ HTQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



NOTES:

PowerPAD is a trademark of Texas Instruments.

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. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MS-026.
5. Feature may not be present.

ADVANCE INFORMATION

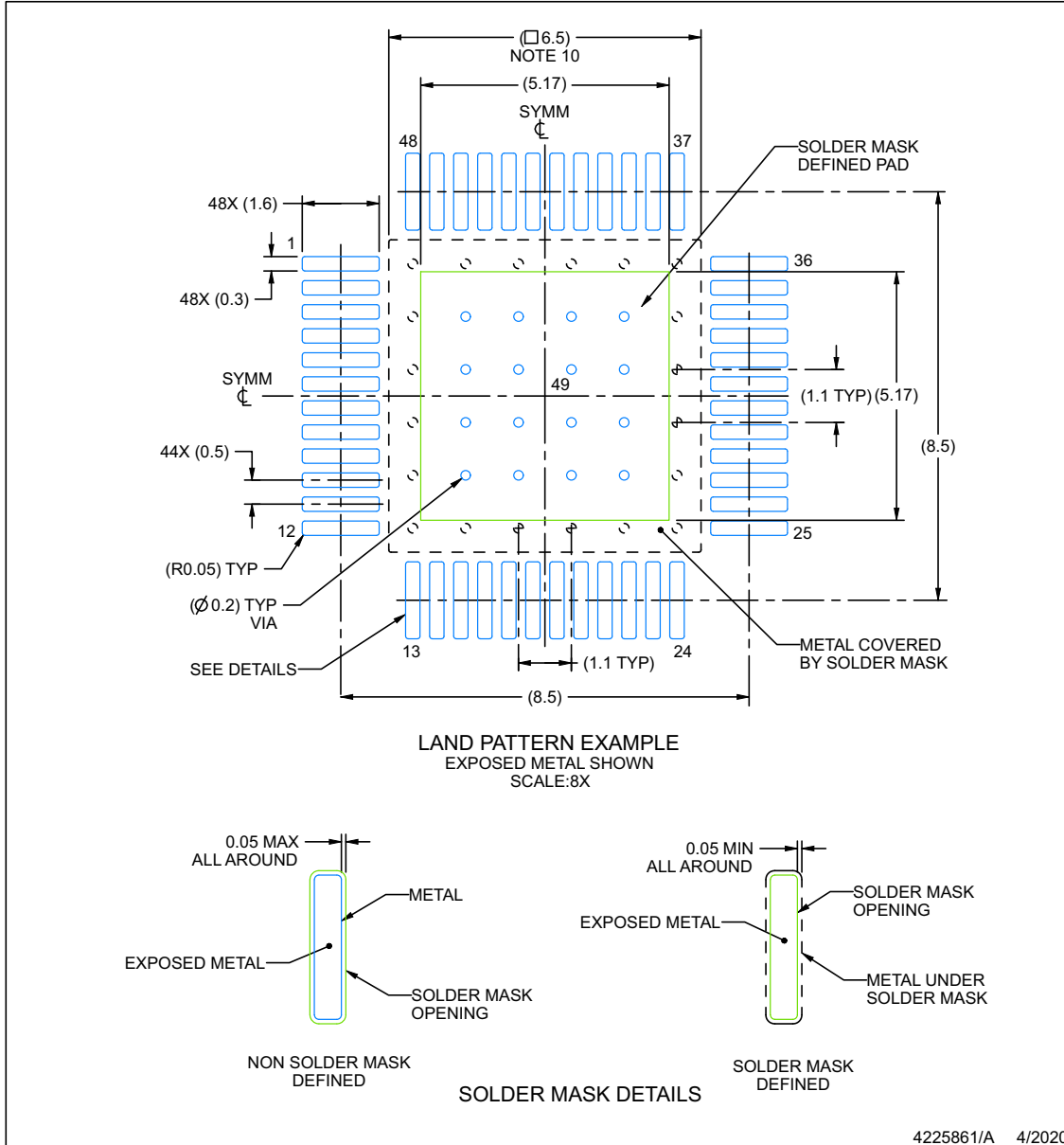
EXAMPLE BOARD LAYOUT

PHP0048G

PowerPAD™ HTQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK

ADVANCE INFORMATION



NOTES: (continued)

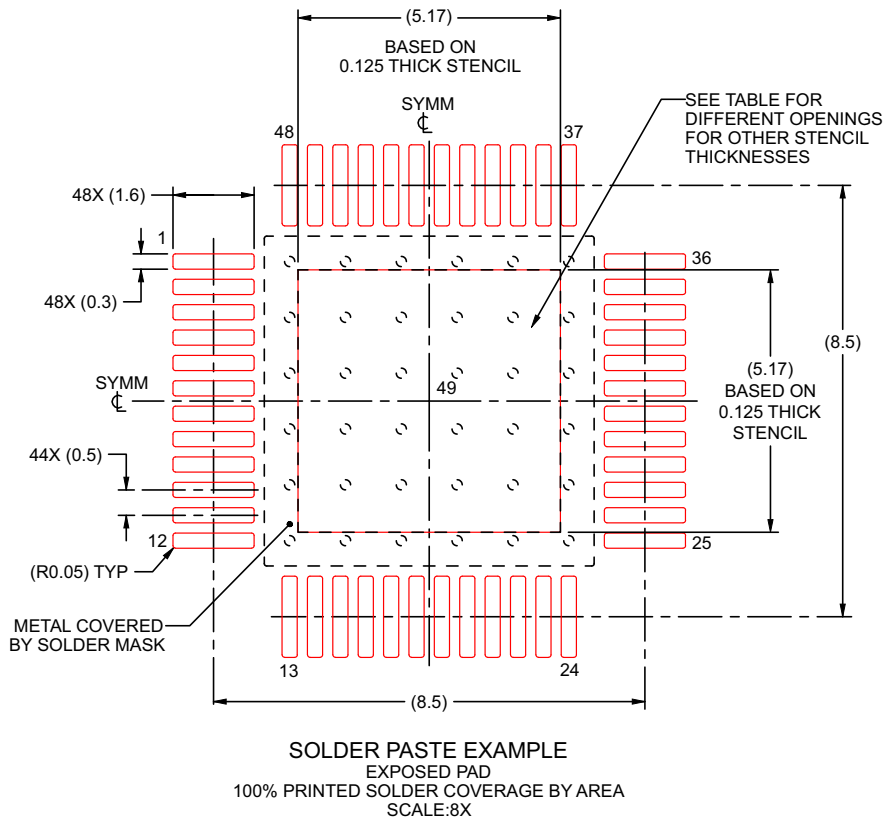
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. This package is designed to be soldered to a thermal pad on the board. See technical brief, Powerpad thermally enhanced package, Texas Instruments Literature No. SLMA002 (www.ti.com/lit/slma002) and SLMA004 (www.ti.com/lit/slma004).
9. Vias are optional depending on application, refer to device data sheet. It is recommended that vias under paste be filled, plugged or tented.
10. Size of metal pad may vary due to creepage requirement.

EXAMPLE STENCIL DESIGN

PHP0048G

PowerPAD™ HTQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



STENCIL THICKNESS	SOLDER STENCIL OPENING
0.1	5.78 X 5.78
0.125	5.17 X 5.17 (SHOWN)
0.150	4.72 X 4.72
0.175	4.37 X 4.37

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NOTES: (continued)

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

ADVANCE INFORMATION

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
PADS131B26QPHPRQ1	ACTIVE	HTQFP	PHP	48	1000	TBD	Call TI	Call TI	-40 to 125		Samples

(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 finish/Ball material - Orderable Devices 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.

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