LMR436x0, 36-V, 1-A/2-A Buck Converter with 1.5 µA I_Q in 4-mm^2 HotRod™ QFN

ADVANCE INFORMATION

1 Features

- Miniature solution size and low component cost
  - 2-mm × 2-mm HotRod™ package with wettable flanks
  - Internal compensation
- Optimized for ultra-low EMI requirements
  - Spread spectrum reduces peak emissions
  - Pin selectable FPWM mode for constant frequency at light loads with MODE/SYNC pin
  - F_{SW} synchronization with MODE/SYNC pin
- Designed for industrial automotive applications
  - Junction temperature range: –40°C to +150°C
  - Supports 42-V transients
  - Supports 3-V_{IN} minimum
  - Adjustable up to 95% of V_{IN}, 3.3-V and 5-V fixed V_{OUT} options available
- > 85% efficiency at 1 mA
  - 1.5-µA I_Q (switching) at 24 V_{IN}, 3.3 fixed V_{OUT}
- Suitable for scalable power supplies
  - Adjustable F_{SW}: 200 kHz - 2.2 MHz with RT pin
  - Pin compatible with:
    - LMR36506 (65 V, 600 mA)
    - LMR36503 (65 V, 300 mA)

2 Applications

- Advanced driver assistance systems: radar ECU
- Infotainment and cluster: head unit, eCall
- Body electronics and lighting

3 Description

The LMR436x0 is the industry's smallest 36 V, 2 A and 1 A synchronous step-down DC/DC converters in 2-mm x 2-mm HotRod™ package. This easy-to-use converter supports a wide input voltage range of 3.0V to 36 V with transients up to 42 V. The transient tolerance reduces the necessary design effort to protect against input overvoltage and meets the surge immunity requirements of IEC 61000-4-5.

The control architecture and feature-set are optimized for an ultra-small solution size. The device uses peak current mode control to minimize output capacitance. The LMR436x0 minimizes input filter size by utilizing pseudo-random spread spectrum, a low-EMI HotRod™ package, and an optimized pin-out. The MODE/SYNC and RT pin variants can be used to set or synchronize the frequency between 200 kHz and 2.2 MHz to avoid noise sensistive frequency bands.

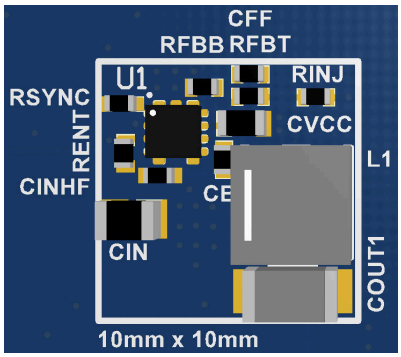
The rich feature set of the is designed to simplify implementation for a wide range of automotive end equipments.

The compact solution size and rich feature set of LMR436x0 simplifies implementation for a wide range of industrial applications.

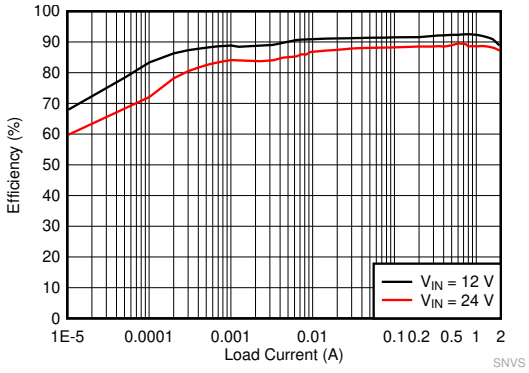
Device Information

PART NUMBER	PACKAGE(1)	BODY SIZE (NOM)
LMR43620	VQFN-HR (9)	2.00 mm × 2.00 mm
LMR43610	VQFN-HR (9)	2.00 mm × 2.00 mm

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



Typical Solution Size



Efficiency: V_{OUT} = 3.3 V (Fixed), 2.2 MHz

An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. ADVANCE INFORMATION for preproduction products; subject to change without notice.

ADVANCE INFORMATION

4 Device and Documentation Support

4.1 Documentation Support

4.1.1 Related Documentation

For related documentation see the following:

- Texas Instruments, *Thermal Design by Insight not Hindsight Application Report*
- Texas Instruments, *A Guide to Board Layout for Best Thermal Resistance for Exposed Pad Packages Application Report*
- Texas Instruments, *Semiconductor and IC Package Thermal Metrics Application Report*
- Texas Instruments, *Thermal Design Made Simple with LM43603 and LM43602 Application Report*
- Texas Instruments, *PowerPAD™ Thermally Enhanced Package Application Report*
- Texas Instruments, *PowerPAD™ Made Easy Application Report*
- Texas Instruments, *Using New Thermal Metrics Application Report*
- Texas Instruments, *Layout Guidelines for Switching Power Supplies Application Report*
- Texas Instruments, *Simple Switcher PCB Layout Guidelines Application Report*
- Texas Instruments, *Construction Your Power Supply- Layout Considerations Seminar*
- Texas Instruments, *Low Radiated EMI Layout Made Simple with LM4360x and LM4600x Application Report*

4.2 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.

4.3 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.

4.4 Trademarks

HotRod™, PowerPAD™, and are trademarks of TI.
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4.5 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.

4.6 Glossary

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

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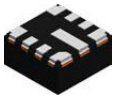
5 Mechanical, Packaging, and Orderable Information

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.

ADVANCE INFORMATION

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ADVANCE INFORMATION

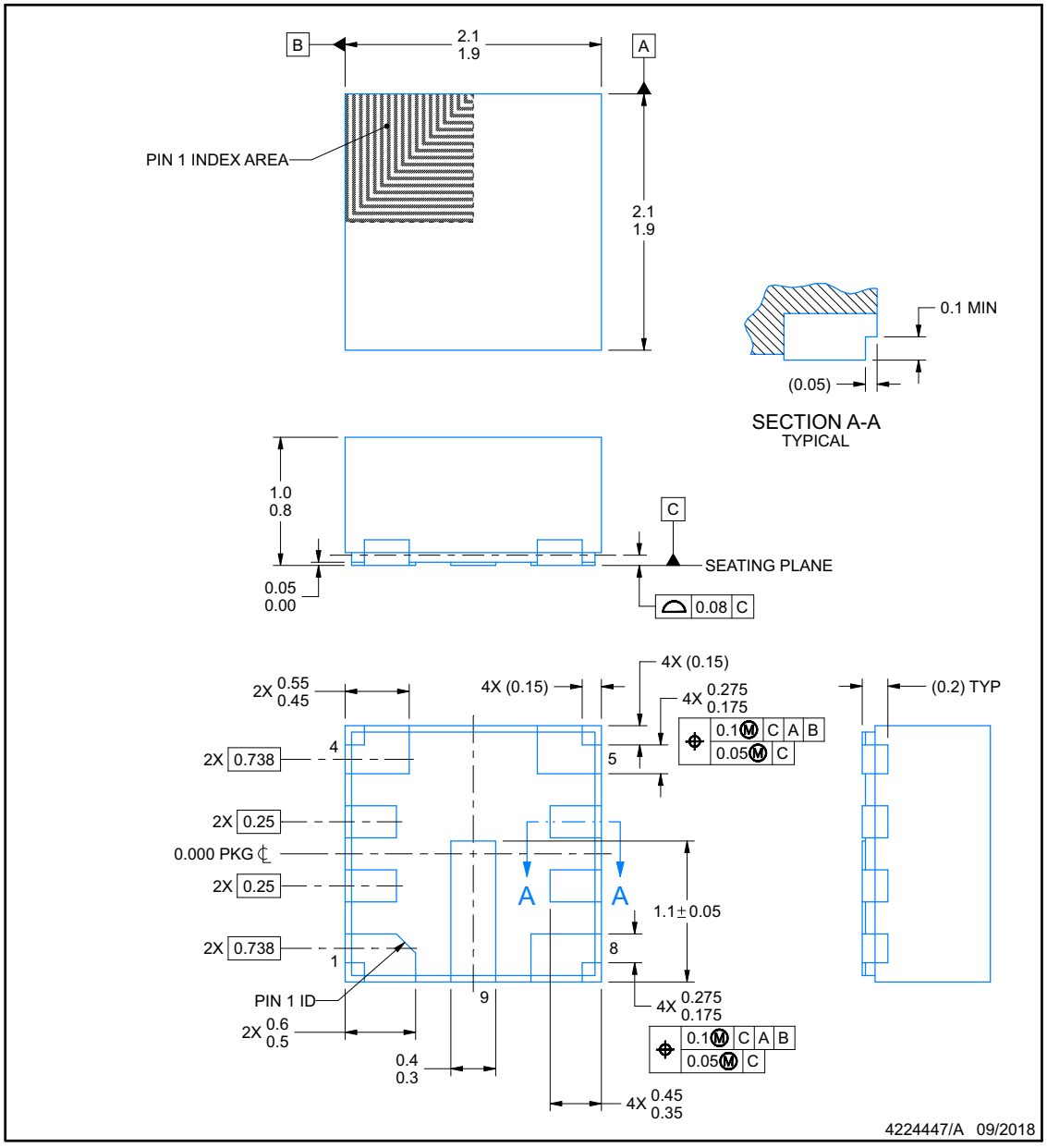


PACKAGE OUTLINE

RPE0009A

VQFN-HR - 1.0 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



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.

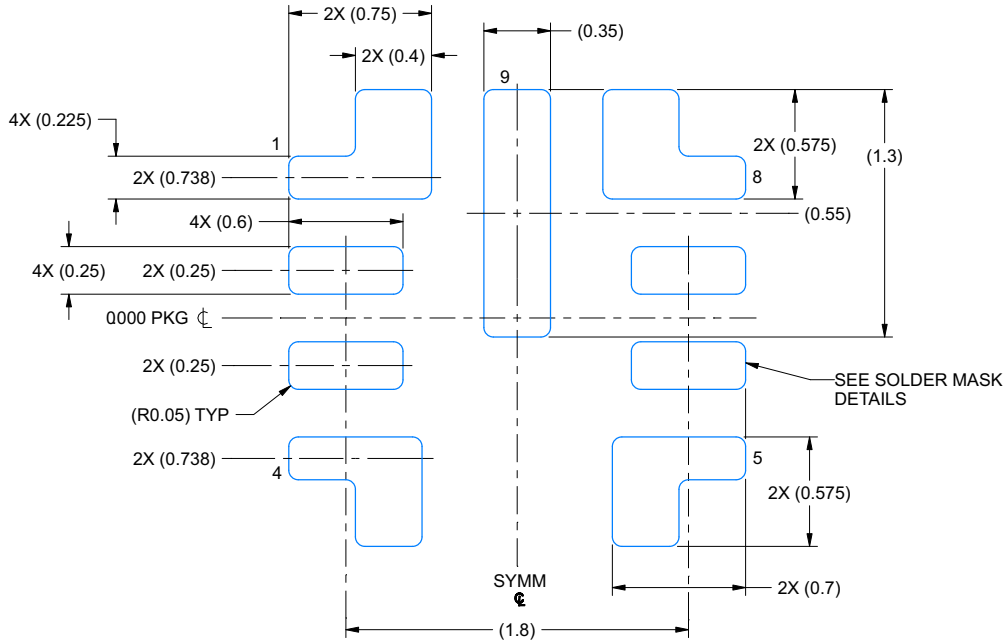
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EXAMPLE BOARD LAYOUT

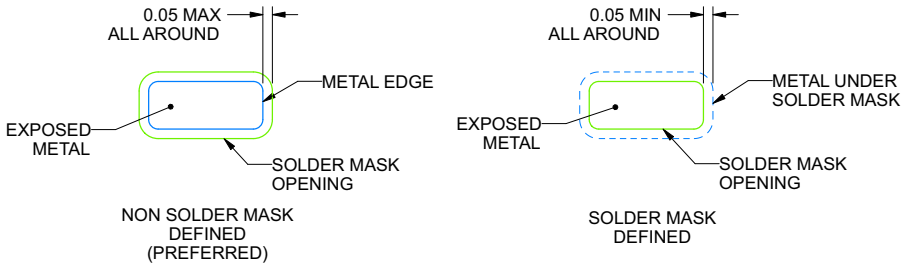
RPE0009A

VQFN-HR - 1.0 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 30X



SOLDER MASK DETAILS

4224447/A 09/2018

NOTES: (continued)

3. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
4. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

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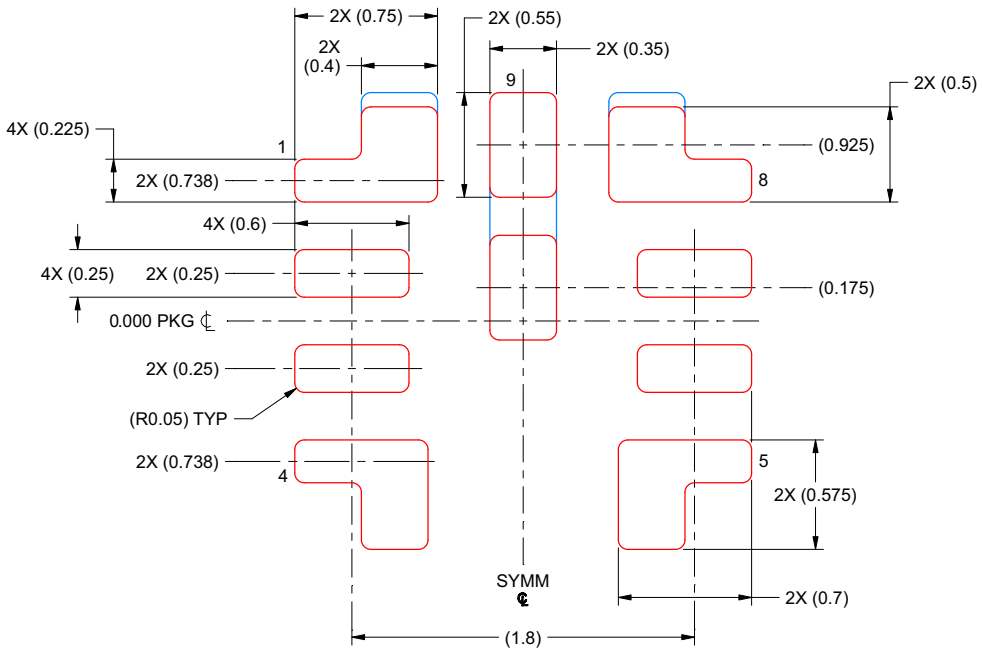
ADVANCE INFORMATION

ADVANCE INFORMATION

EXAMPLE STENCIL DESIGN

RPE0009A — **VQFN-HR - 1.0 mm max height**

PLASTIC QUAD FLATPACK - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 MM THICK STENCIL
SCALE: 30X

PADS 1 & 8:
90% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
PAD 9:
85% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE

DWG_NO:5/REV:5 MM_YYYY:5

NOTES: (continued)

5. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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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
LMR43610MB3RPER	PREVIEW	VQFN-HR	RPE	9	3000	TBD	Call TI	Call TI	-40 to 150		
LMR43620MB5RPER	PREVIEW	VQFN-HR	RPE	9	3000	TBD	Call TI	Call TI	-40 to 150		

(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) **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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