CC35xE 2.4GHz SimpleLink™ Wi-Fi 6 and Bluetooth®Low Energy Wireless MCU

1 Features

Microcontroller

- Powerful 160MHz Arm® Cortex®-M33 processor with FPU, TrustZone®, and AI acceleration
- High-speed quad-SPI and octal-SPI for XiP flash with on-the-fly decryption
- Flexible configuration of low-latency TCM (up to 32KB) and Cache (32KB or 64KB) for improved code execution performance
- Over 1MB embedded SRAM including 128KB TCM for Wi-Fi, BLE, networking, and application data

Peripherals

- Up to 38 I/Os with flexible multiplexing options
- 8 × general-purpose timers and pulse-width modulation (PWM)
- 2 × universal asynchronous receiver-transmitter (UART)
- 2 × Serial Peripheral Interface (SPI)
- 2 × inter-integrated circuit (I^2C)
- Inter-IC sound (I^2S)
- Pulse density modulation (PDM)
- Secure digital and multimedia card (SD/MMC)
- Secure digital input output (SDIO) 2.0
- Controller area network (CAN) 2.0
- 8-channel, 12-bit analog-to-digital converter (ADC)

System Services

- Direct memory access (DMA)
- One-time-programmable memory (OTP)
- Real-time clock (RTC) and watchdog timer (WDT)

Radio

- Wi-Fi 6 (802.11ax)
  - 2.4GHz, single-stream 20MHz channels with application throughput up to 20Mbps (UDP)
  - Compatible with IEEE 802.11 b/g/n/ax
    - Orthogonal frequency-division multiple access (OFDMA)
    - Target wake time (TWT)
    - Trigger frames
    - Basic service set (BSS) color
  - Integrated PA for a complete WLAN system with up to 20dBm output power at 1 DSSS
  - Role support: STA, softAP with up to four stations, Wi-Fi direct, multi-role AP + STA
  - Support for personal and enterprise Wi-Fi security: WPA and WPA2 PSK, WPA2 Enterprise, WPA3 personal or enterprise
  - Wi-Fi TX Power:
  - • 20dBm at 1 DSSS
    • 16dBm at 54 OFDM
  - Wi-Fi RX Sensitivity:
    • –98.6dBm at 1 DSSS
    • –77.2dBm at 54 OFDM
- Bluetooth® low energy
  - Bluetooth low energy 5.4 certified stack
  - Supports long-range and high-speed PHYs (up to 2Mbps)

Security Features

- ARM TrustZone
- Hardware security module supporting all of the following:
  - ECC, RSA, AES, SHA2/3, MD5, CRC 16/32, and TRNG
  - Secure key storage
- Initial secure programming
- Secure boot
- Software IP and cloning protection
- Debug security through JTAG and debug port lock
- OTP with the ability to program root-of-trust public key
- Secure over-the-air (OTA) updates
- Anti-rollback protection

Clock Source

- 52MHz crystal
- Internal 32.768kHz low-frequency oscillator, external XTAL, or slow clock options

Power Management

- Support for 3.3V and 1.8V on multiple I/O domains
- Supplies: VPA: 3.3V, VMAIN: 1.8V, VIO: 1.8/3.3V

Key Benefits

- Complete software development kit with open-source TCP/IP and TLS stacks
- Operating temperature: –40°C to +105°C
- Support for 3-wire PTA coexistence interface for use with external 2.4GHz radios (for example Thread or Zigbee®)
- Antenna selection capability

Package

- Easy to design with 56-pin, 7mm × 7mm quad flat no leaded (QFN) package

2 Applications

- Building Automation

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  - Thermostat
  - HVAC motor control
  - Wireless security camera
  - Video Doorbell
  - Garage door system
- Appliances
  - Refrigerator and freezer
  - Oven
  - Washer and dryer
  - Residential water heater
  - Air conditioner indoor unit
  - Coffee machine
  - Vacuum robot
  - Robotic lawn mower
- Grid Infrastructure
  - Electricity meter
  - String Inverter
  - Micro Inverter
  - Battery energy storage systems
  - EV charging infrastructure
- Medical
  - Infusion pump
  - Electronic hospital bed and bed control
  - Multiparameter patient monitor
  - CPAP machine
  - Telehealth systems
  - Ultrasound scanner
  - Ultrasound smart probe
  - Electric toothbrush
- Retail automation and payment
- Connected peripherals and printers
- Factory automation and control
- Asset tracking

3 Description

The SimpleLink™ Wi-Fi system-on-chip CC35xx family is where affordability meets reliability, enabling engineers to connect more applications with confidence. CC35xx are single-chip Wi-Fi 6 and Bluetooth Low Energy 5.4 wireless microcontrollers (MCUs). The CC3500E and CC3501E are the first dual-band devices in this pin-to-pin compatible family.

- CC3500E: 2.4GHz Wi-Fi 6 wireless MCU
- CC3501E: 2.4GHz Wi-Fi 6 and Bluetooth low energy 5.4 wireless MCU

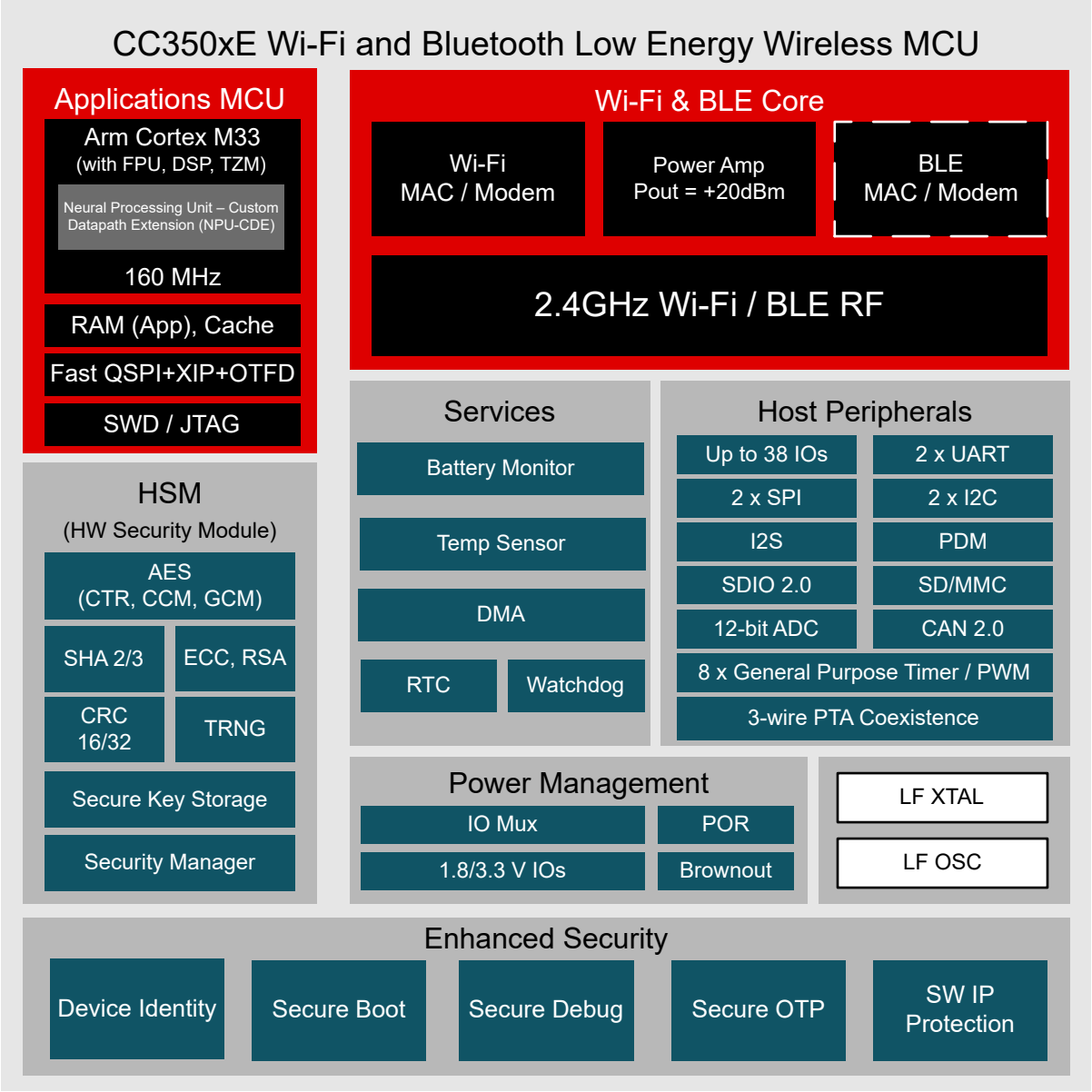
The CC350xE offers the latest standards from Wi-Fi and BLE while maintaining compatibility with Wi-Fi 4 (802.11 b/g/n) and Wi-Fi 5 (802.11 ac). These CC350xE are the 10th-generation connectivity combo chip from Texas Instruments. As such, the CC350xE is based on proven technology. These devices are an excellent choice to use in cost-sensitive embedded applications with RTOS software. CC350xE brings the efficiency of Wi-Fi 6 to embedded device applications for the Internet of Things (IoT), with a small PCB footprint and highly optimized bill of materials.

Table 3-1. Device Information

PART NUMBER	WI-FI 6 2.4GHz SISO	BLUETOOTH LOW ENERGY
CC3500E	✓	
CC3501E	✓	✓

4 Functional Block Diagram

The figure below shows a functional block diagram of the CC350xE.



– – – – CC3501E only

Figure 4-1. CC350xE High-Level System Diagram

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5 Pin Diagram

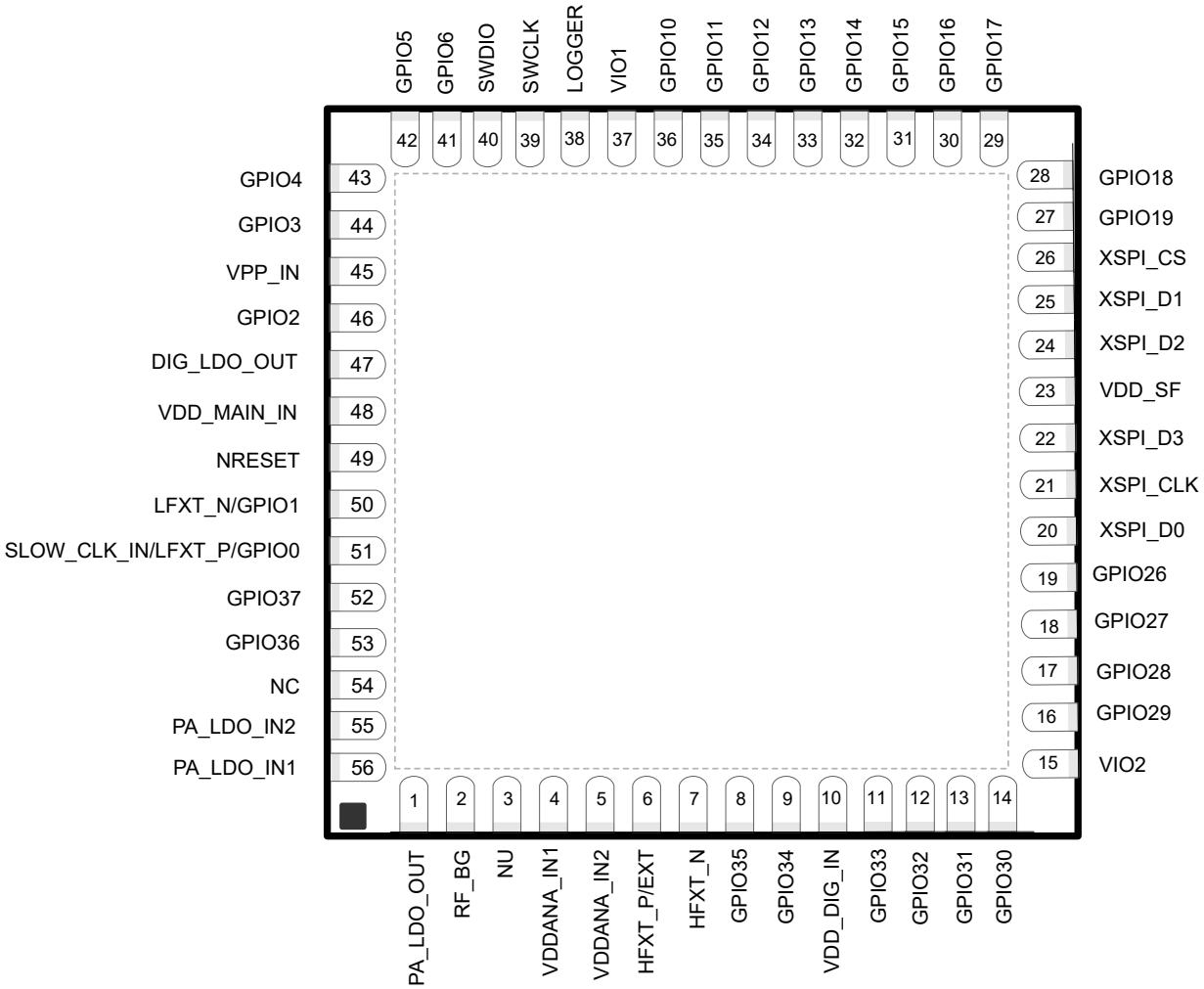

Figure 5-1. CC350xE Pin Diagram

6 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 systems are listed below.

6.1 Third-Party Products Disclaimer

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6.3 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.

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6.4 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.

6.5 Glossary

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

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7 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

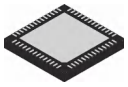
Changes from September 1, 2024 to January 1, 2025 (from Revision * (September 2024) to Revision A (January 2025))	Page
• Updated Features	1

8 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

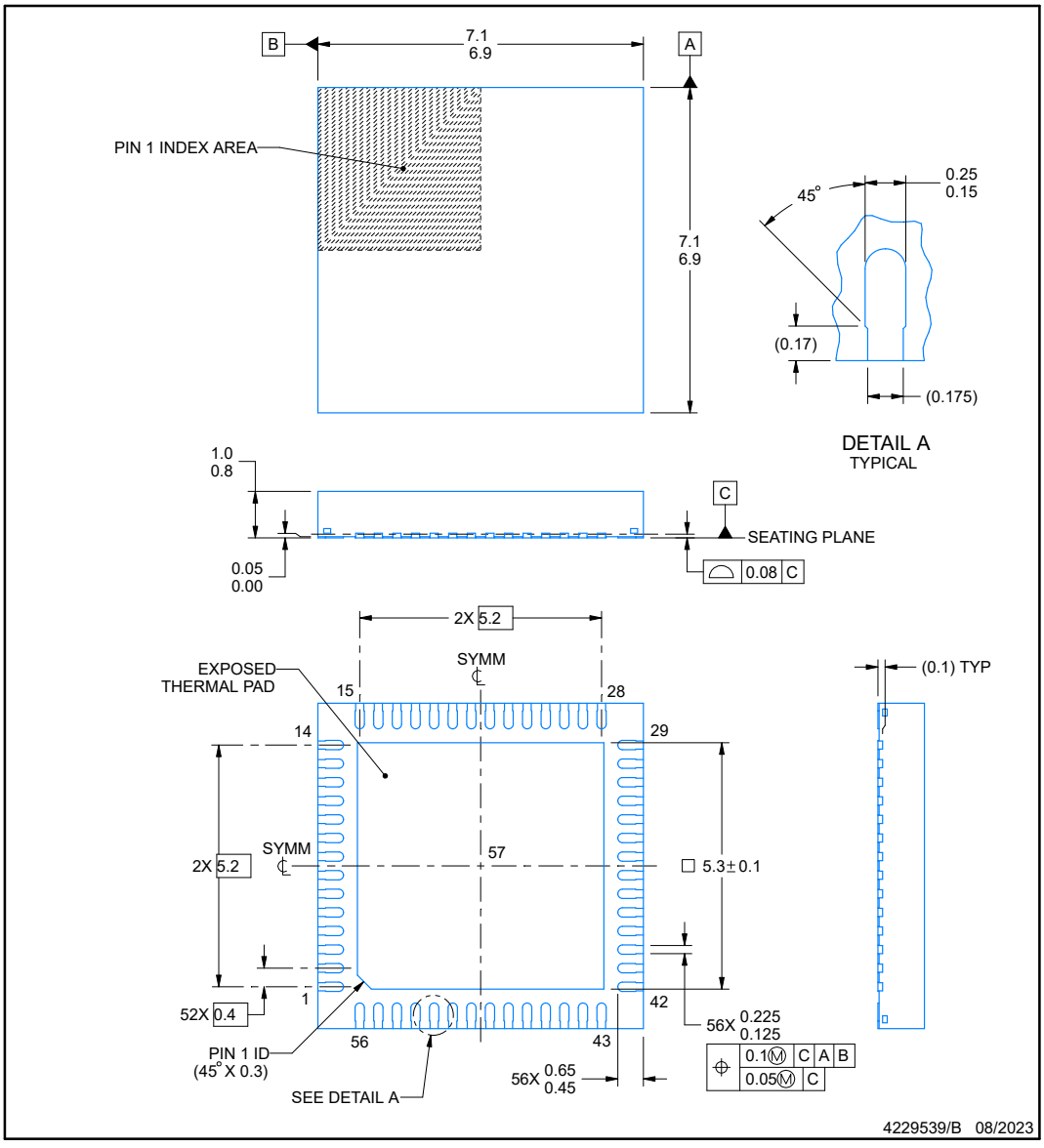
RSH0056G



PACKAGE OUTLINE

VQFN - 1 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.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

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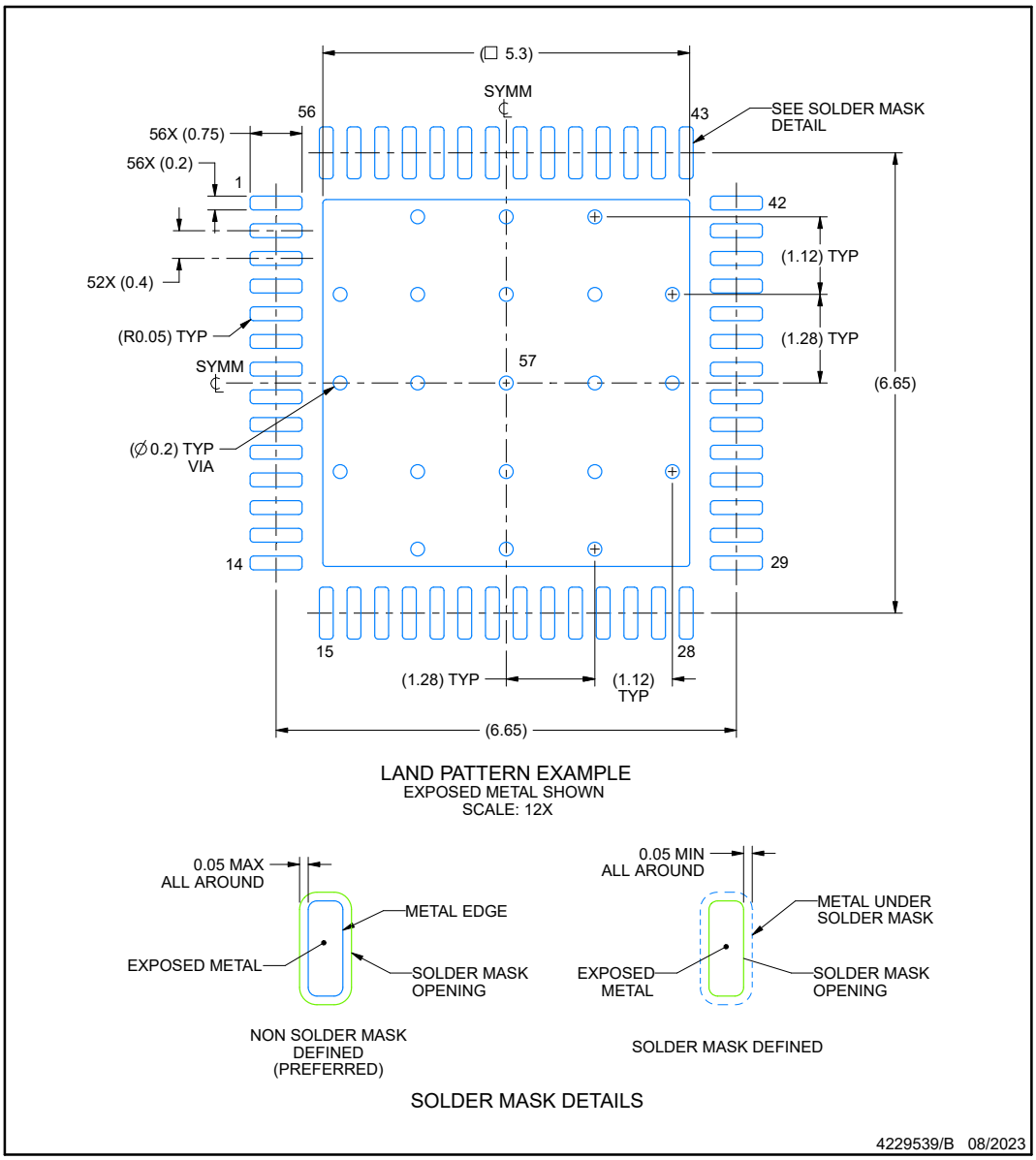
Figure 8-1.

EXAMPLE BOARD LAYOUT

RSH0056G — **VQFN - 1 mm max height**

PLASTIC QUAD FLATPACK - NO LEAD



NOTES: (continued)

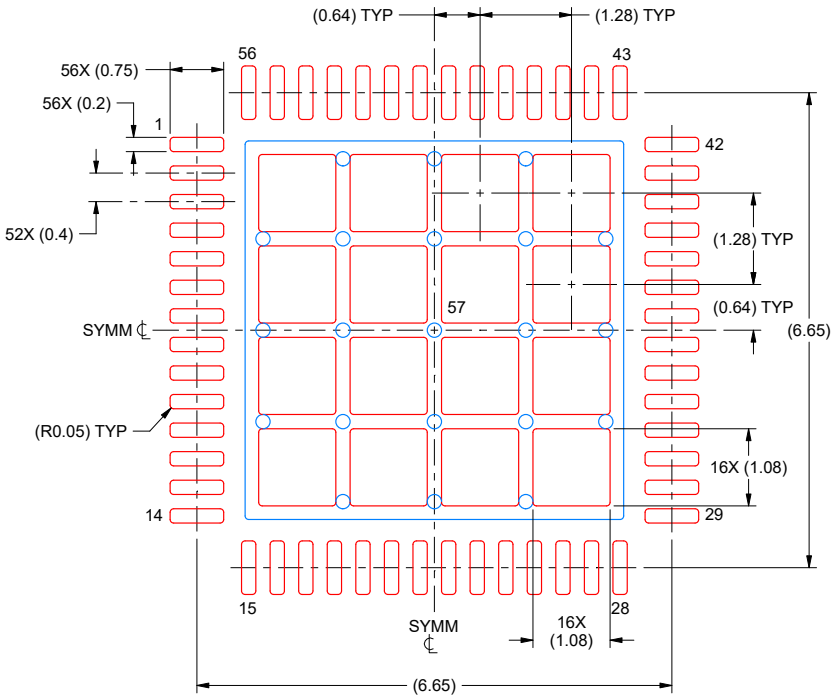
4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown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

Figure 8-2.

EXAMPLE STENCIL DESIGN

RSH0056G — **VQFN - 1 mm max height**

PLASTIC QUAD FLATPACK - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.100 MM THICK STENCIL
SCALE: 12X

EXPOSED PAD 57
66% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE

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NOTES: (continued)

6. 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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Figure 8-3.

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
XCC3500ENJARSHR	ACTIVE	VQFN	RSH	56	2500	TBD	Call TI	Call TI	-40 to 105		Samples
XCC3501ENJARSHR	ACTIVE	VQFN	RSH	56	2500	TBD	Call TI	Call TI	-40 to 105		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.
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.

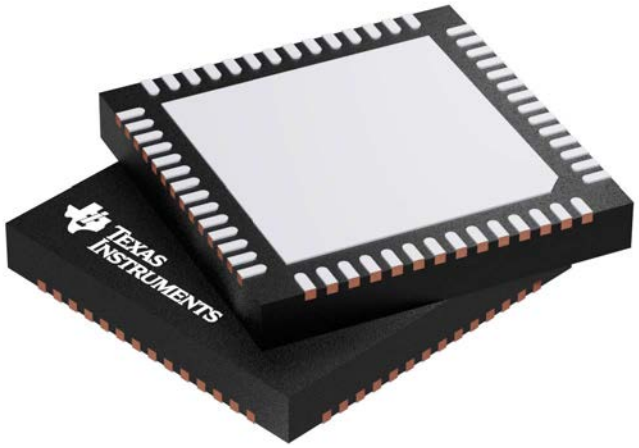
(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

GENERIC PACKAGE VIEW

RSH 56

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

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