TCAN245x-Q1 Automotive Signal Improvement Capable CAN FD System Basis Chip (SBC) with Integrated Buck Regulator and Watchdog

1 Features

- AEC-Q100 qualified for automotive applications
- Meets the requirements of ISO 11898-2:2024 for CAN-FD and CAN-FD Signal Improvement Capability (SIC)
- Integrated 3.3V or 5V Buck regulator (VCC1) with 1A output capability
  - Pin-selectable output (3.3V or 5V) based on VSEL pin connection
  - Switching frequency options from 1.8MHz to 2.4MHz to enable a smaller on-board inductor
  - Integrated spread spectrum modulation to improve EMC performance
- 5V LDO regulator (VCC2) supporting up to 200mA with off-board capability and short-to-battery protection
- Multiple methods to wake-up from Sleep mode
  - CAN bus wake-up pattern (WUP)
  - Local wake up (LWU) via four WAKE pins
    - Cyclic sensing wake-up using a high-side switch (HSS4)
  - Selective wake/partial networking capability, TCAN2451-Q1 only
  - Digital wake-up using SW pin
- WAKE pins configurable as ID pins to identify ECU location in the vehicle
- Four high-side switches to support multiple loads and allow for cyclic sensing wake
- Fail-safe output pin (LIMP):
  - Optionally used as a low-side switch
- ±58V Bus fault protection
- Advanced CAN bus fault diagnostics
- Timeout, window and Q&A watchdog support
- Access to EEPROM to save device configuration
- Available in 32-pin leadless package with wettable flank for improved automated optical inspection (AOI) capability

2 Applications

- Body electronics and lighting
- Car access and security
- Hybrid, electric and powertrain systems
- Industrial transportation

3 Description

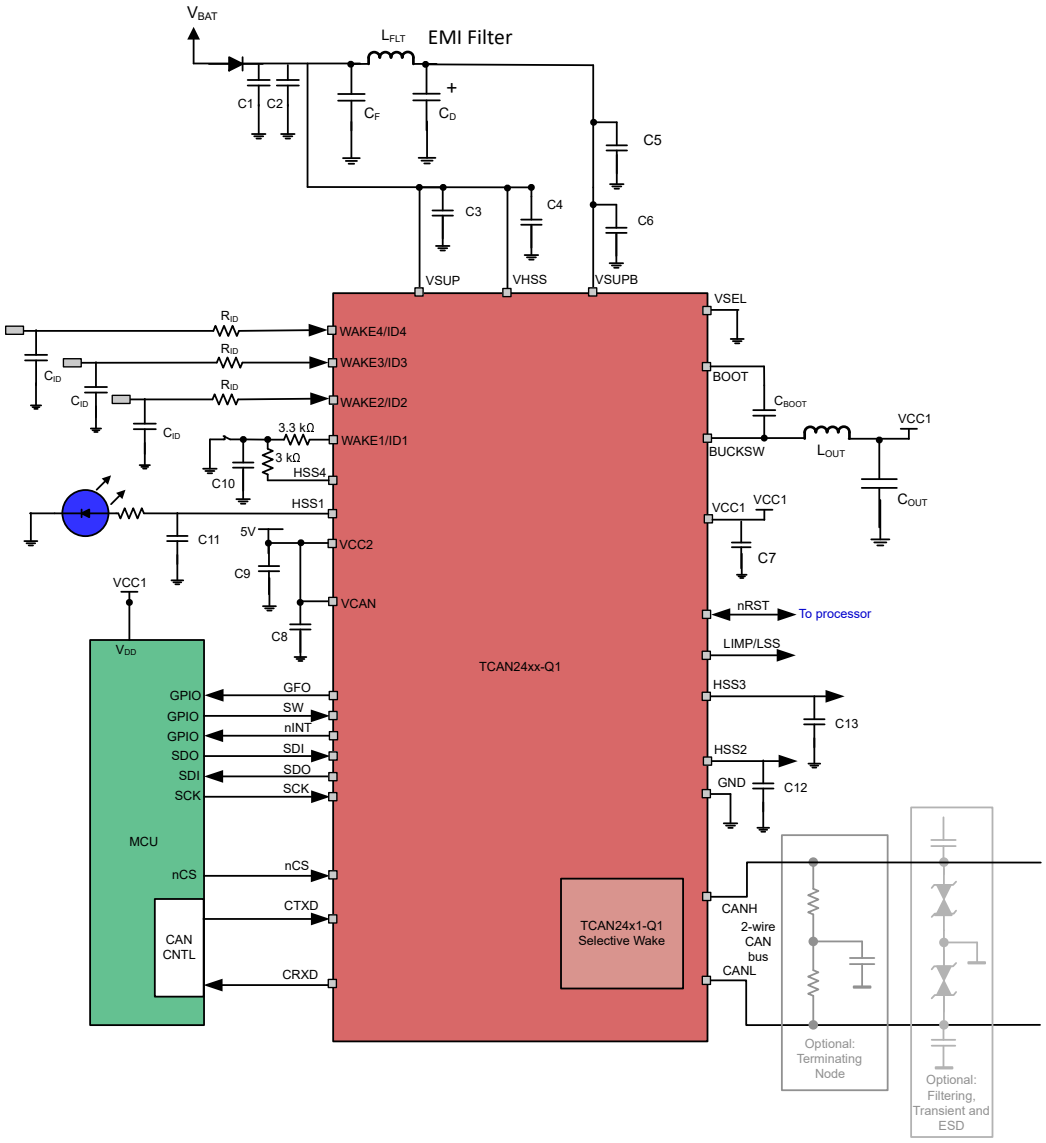
The TCAN245x-Q1 is a family of system basis chips (SBC) that provide a control area network flexible data rate capable (CAN FD) transceiver that meets the physical layer requirements of ISO-11898:2-2024 including the SIC specification. The CAN FD transceiver supports data rates up to 8Mbps. The TCAN245x-Q1 integrates a buck regulator (VCC1) that can output either 3.3V or 5V, and provide up to 1A output current. The buck regulator integrates spread spectrum modulation to improve EMC performance. VCC2 LDO provides 5V output for loads up to 200mA. TCAN2451-Q1 supports Partial Networking by recognizing a selective wakeup frame (WUF)

The TCAN245x-Q1 includes features such as LIMP, four local wake inputs and four high side switches. The high side switch can be on/off, 10-bit PWM or timer controlled. Using the GFO pin, controlling an external CAN FD, LIN transceiver, CAN SBC or LIN SBC is possible. The WAKE pins can be configured for static sensing, cyclic sensing (with HSS4 pin) and pulse based for waking up. These devices provide EEPROM to store specific device configuration information: thus, avoiding extensive reprogramming after power fluctuations.

Package Information

PART NUMBER	PACKAGE(1)	PACKAGE SIZE(2)
TCAN2450-Q1 TCAN2451-Q1	VQFN (32)	5mm x 5mm

(1) For more information, see Section 7.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.



Typical Application Diagram

4 Pin Configuration and Functions

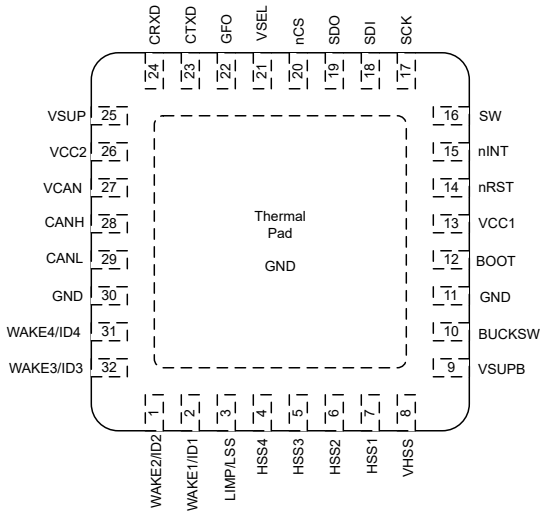


Figure 4-1. RHB Package, 32 Pin (VQFN) (Top View)

Table 4-1. Pin Functions

NAME	PIN NO.	TYPE[1]	DESCRIPTION
	RHB		
WAKE2/ID2	1	I	High voltage (HV) capable. Local wake input terminal. Configurable as an ID pin
WAKE1/ID1	2	I	HV capable. Local wake input terminal. Configurable as an ID pin
LIMP/LSS	3	O	HV capable. Limp home output (Active low; open-drain output)
HSS4	4	O	HV. High side switch 4 output
HSS3	5	O	HV. High side switch 3 output
HSS2	6	O	HV. High side switch 2 output
HSS1	7	O	HV. High side switch 1 output
VHSS	8	P	HV. Separate input supply for the high side switches. Typically connected to the battery but can also be supplied independently.
VSUPB	9	P	HV. Input supply from the battery for the buck regulator. VSUPB and VSUP must be to the same battery supply, but separated by the EMI filter as shown in the application schematic to reduce the conducted EMI on the VSUP pin.
BUCKSW	10	P	HV. Buck regulator switching node. Connect to power inductor.
GND	11	G	Ground
BOOT	12	P	HV. Bootstrap supply voltage for internal high-side driver. Connect a high-quality 100nF capacitor from this pin to the BUCKSW pin.
VCC1	13	P	Buck regulator output 3.3V or 5V. Connect a high-quality capacitor to GND.
nRST	14	I/O	Low-voltage (LV) digital. VCC1 under-voltage monitor output pin (active low) and device reset input
nINT	15	O	LV digital. Interrupt output (active low)
SW	16	I	LV digital . Programming mode input pin (SPI configurable active high or active low). Internal pull-up (active low configuration) or pull-down (active high configuration) of 60 kΩ
SCK	17	I	LV digital. SPI clock input
SDI	18	I	LV digital. SPI data input. Internal pull-up of 60kΩ
SDO	19	O	LV digital. SPI data output.
nCS	20	I	LV digital. Chip select input (active low). Internal pull-up of 60kΩ

Table 4-1. Pin Functions (continued)

NAME	PIN NO.	TYPE[1]	DESCRIPTION
	RHB		
VSEL	21	I	LV digital. VCC1 output voltage selector pin. 1. Connected to GND: VCC1 = 5V 2. Floating: VCC1 = 3.3V. Internal pull-up of 30kΩ
GFO	22	O	LV digital. General function output pin (SPI configurable); Push-pull
CTXD	23	I	LV digital. CAN transmit data input (low for dominant and high for recessive bus states); Internal pull-up of 60kΩ.
CRXD	24	O	LV digital. CAN receive data output (low for dominant and high for recessive bus states), tri-state
VSUP	25	P	HV. Input supply pin, typically connected to battery.
VCC2	26	P	5V LDO output. Short-to-battery protected.
VCAN	27	P	5V power supply input for the CAN FD transceiver
CANH	28	I/O	HV capable. High level CAN bus I/O line
CANL	29	I/O	HV capable . Low level CAN bus I/O line
GND	30	G	Ground connection: Must be soldered to ground
WAKE4/ID4	31	I	HV capable. Local wake input terminal. Configurable as ID pin
WAKE3/ID3	32	I	HV. Local wake input terminal. Configurable as an ID pin
NC	-	NC	Not connected internally.
GND	Thermal Pad	G	Ground connection: Must be soldered to ground

(1) I = Input, O = Output, I/O = Input or Output, G = Ground, P = Power, NC = No Connect

5 Device and Documentation Support

This device will conform to the following CAN standards. The core of what is needed is covered within this system spec, however reference should be made to these standards and any discrepancies pointed out and discussed. This document should provide all the basics of what is needed. However, for a full understanding of CAN including the protocol these additional sources will be very helpful as the scope of CAN protocol in detail is outside the scope of this physical layer (transceiver) specification.

5.1 Documentation Support

5.1.1 CAN Transceiver Physical Layer Standards:

- ISO 11898-2:2024: High speed medium access unit with low power mode (super sets -2 standard electrically in several specs and adds the original wake up capability via the bus in low power mode)
- ISO 8802-3: CSMA/CD – referenced for collision detection from ISO11898-2
- SAE J2284-2: High Speed CAN (HSC) for Vehicle Applications at 250 kbps
- SAE J2284-3: High Speed CAN (HSC) for Vehicle Applications at 500 kbps

5.1.2 EMC Requirements:

- SAEJ2962-2: US3 requirements for CAN Transceivers (-2, -5, GM will propose updates to address -6 + FD, but this is the best place for a working start)
- HW Requirements for CAN, LIN, FR V1.3: German OEM requirements for CAN and LIN
- ISO 10605: Road vehicles - Test methods for electrical disturbances from electrostatic discharge
- ISO 11452-4:2011: Road vehicles - Component test methods for electrical disturbances from narrowband radiated electromagnetic energy - Part 4: Harness excitation methods
- ISO 7637-1:2015: Road vehicles - Electrical disturbances from conduction and coupling - Part 1: Definitions and general considerations
- ISO 7637-3: Road vehicles - Electrical disturbances from conduction and coupling - Part 3: Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines
- IEC 62132-4:2006: Integrated circuits - Measurement of electromagnetic immunity 150 kHz to 1 GHz - Part 4: Direct RF power injection method
- IEC 61000-4-2
- IEC 61967-4
- CISPR25

5.1.3 Conformance Test Requirements:

- HS_TRX_Test_Spec_V_1_0: GIFT / ICT CAN test requirements for High Speed Physical Layer
- ISO/DIS 17987-7.2: Road vehicles -- Local Interconnect Network (LIN) -- Part 7: Electrical Physical Layer (EPL) conformance test specification
- SAEJ2602-2: LIN Network for Vehicle Applications Conformance Test

5.1.4 Related Documentation

- “A Comprehensible Guide to Controller Area Network”, Wilfried Voss, Copperhill Media Corporation
- “CAN System Engineering: From Theory to Practical Applications”, 2nd Edition, 2013; Dr. Wolfhard Lawrenz, Springer.

5.2 Receiving Notification of Documentation Updates

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

5.3 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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5.4 Trademarks

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5.5 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.

5.6 Glossary

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

6 Revision History

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

Changes from Revision * (April 2024) to Revision A (June 2025)	Page
• Changed the document status from *Advanced Information* to *Production* data	1

7 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 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)
PTCAN2450RHBRQ1	Active	Preproduction	VQFN (RHB) | 32	5000 | LARGE T&R	-	Call TI	Call TI	-40 to 125	
PTCAN2450RHBRQ1.A	Active	Preproduction	VQFN (RHB) | 32	5000 | LARGE T&R	-	Call TI	Call TI	-40 to 125	
PTCAN2451RHBRQ1	Active	Preproduction	VQFN (RHB) | 32	5000 | LARGE T&R	-	Call TI	Call TI	-40 to 125	
PTCAN2451RHBRQ1.A	Active	Preproduction	VQFN (RHB) | 32	5000 | LARGE T&R	-	Call TI	Call TI	-40 to 125	
TCAN2450RHBRQ1	Active	Production	VQFN (RHB) | 32	5000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	TCAN 2450
TCAN2450RHBRQ1.A	Active	Production	VQFN (RHB) | 32	5000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	TCAN 2450
TCAN2451RHBRQ1	Active	Production	VQFN (RHB) | 32	5000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	TCAN 2451

(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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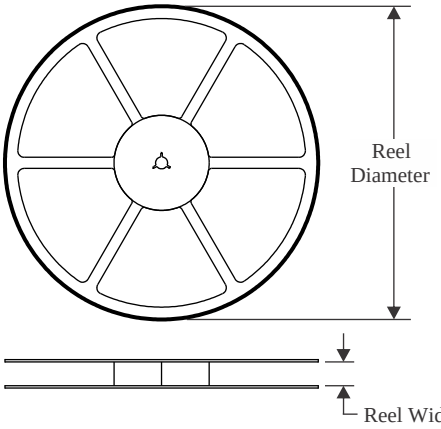
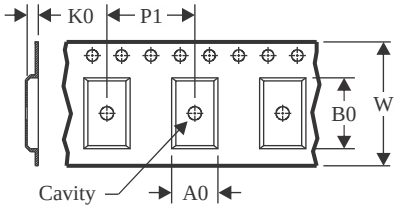
TAPE AND REEL INFORMATION

REEL DIMENSIONS

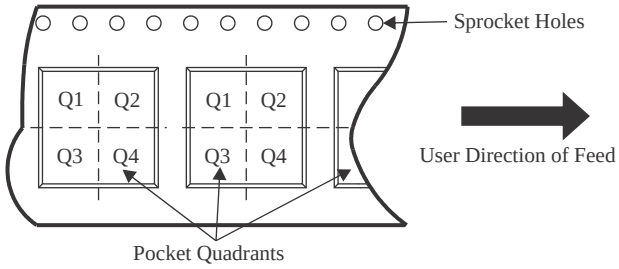


TAPE DIMENSIONS



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

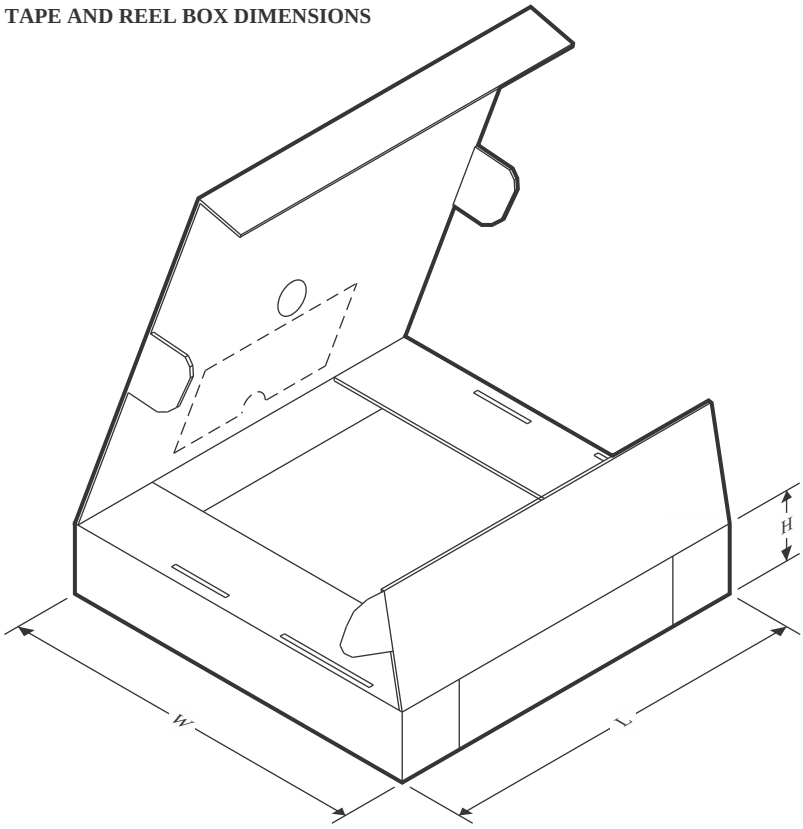
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TCAN2450RHBRQ1	VQFN	RHB	32	5000	330.0	12.4	5.3	5.3	1.1	8.0	12.0	Q2
TCAN2451RHBRQ1	VQFN	RHB	32	5000	330.0	12.4	5.3	5.3	1.1	8.0	12.0	Q2

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TCAN2450RHBRQ1	VQFN	RHB	32	5000	367.0	367.0	35.0
TCAN2451RHBRQ1	VQFN	RHB	32	5000	367.0	367.0	35.0

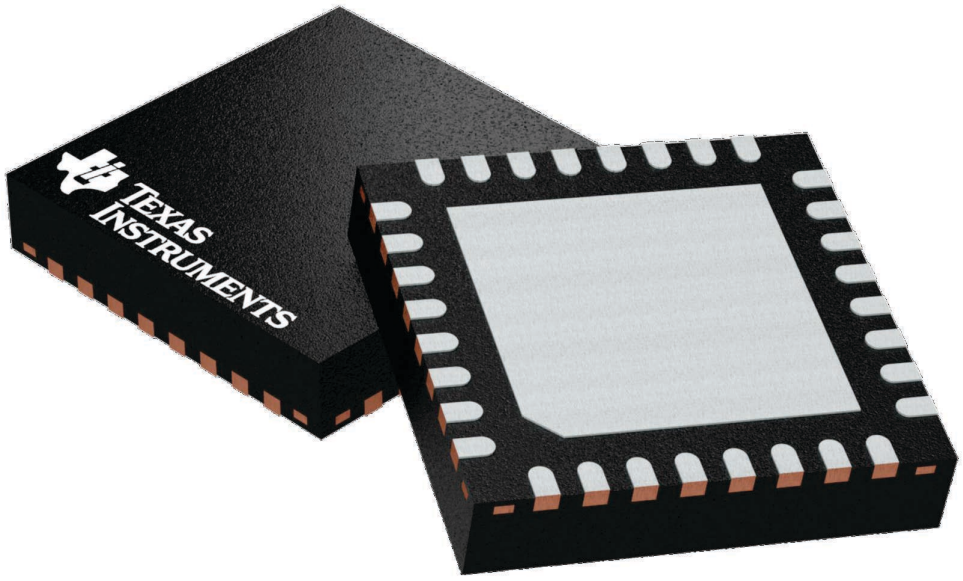
GENERIC PACKAGE VIEW

RHB 32

VQFN - 1 mm max height

5 x 5, 0.5 mm pitch

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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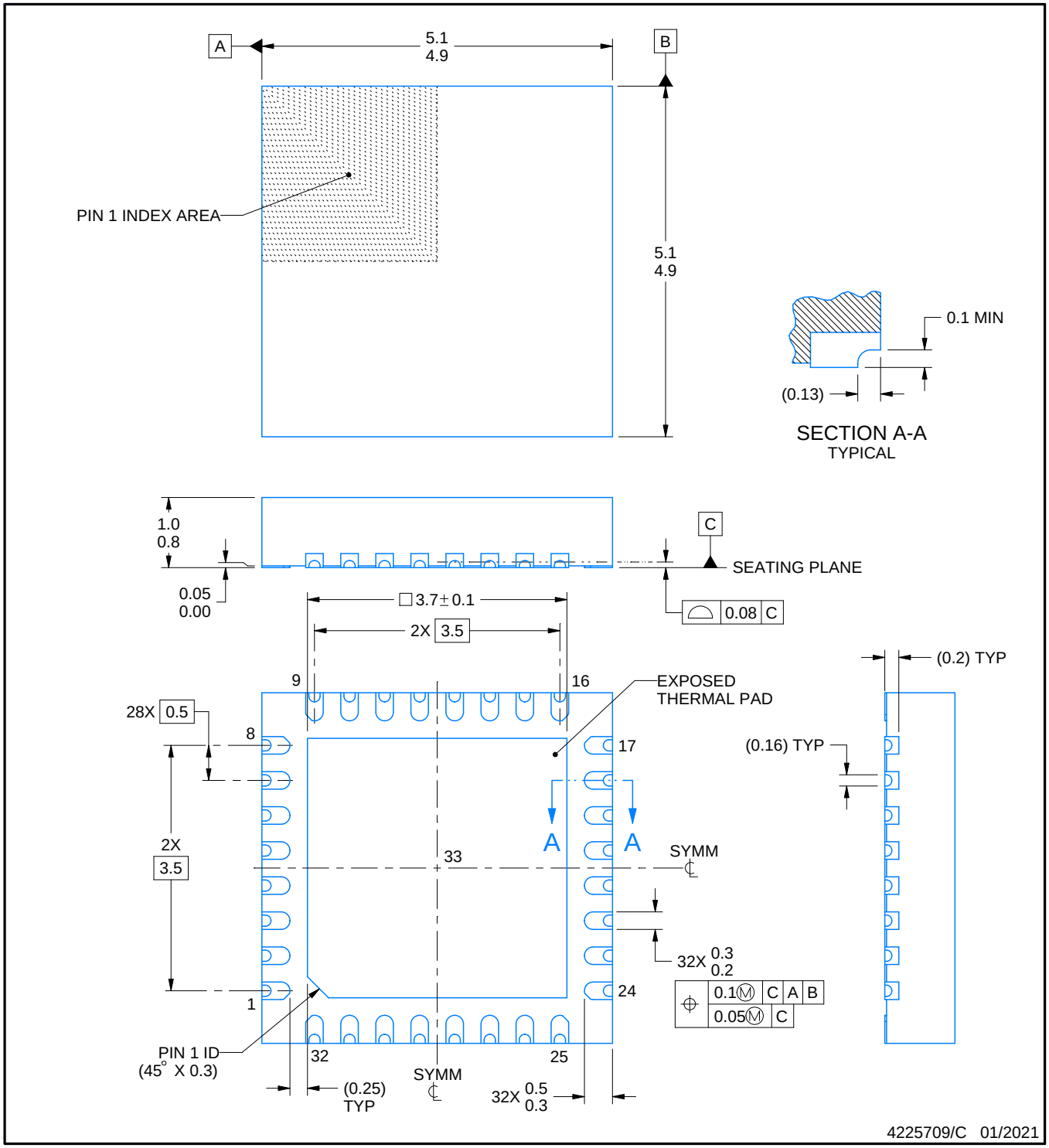
RHB0032U

PACKAGE OUTLINE

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



NOTES:

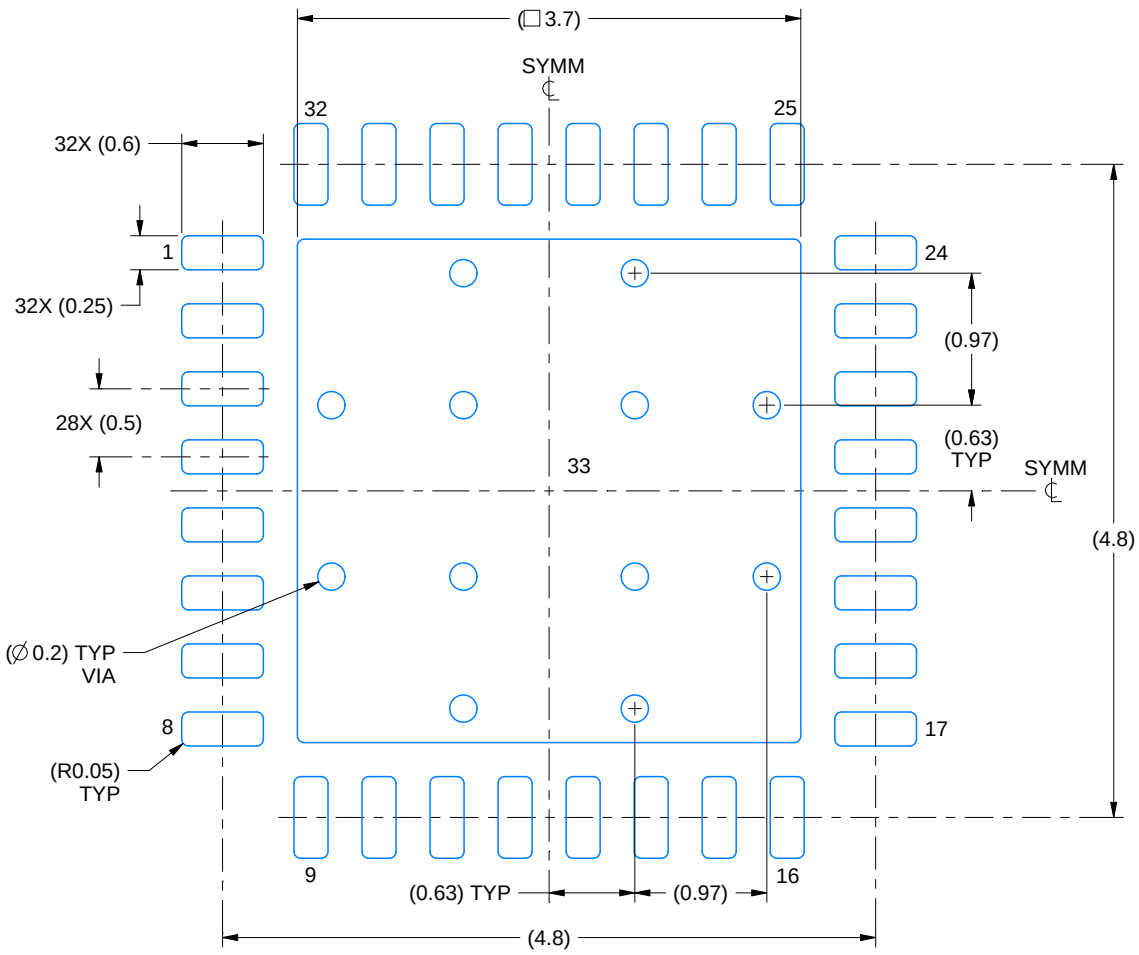
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

EXAMPLE BOARD LAYOUT

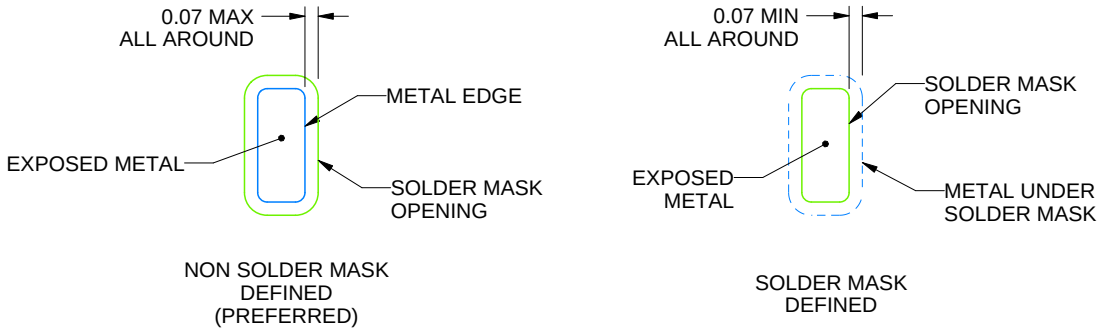
RHB0032U

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:18X



SOLDER MASK DETAILS

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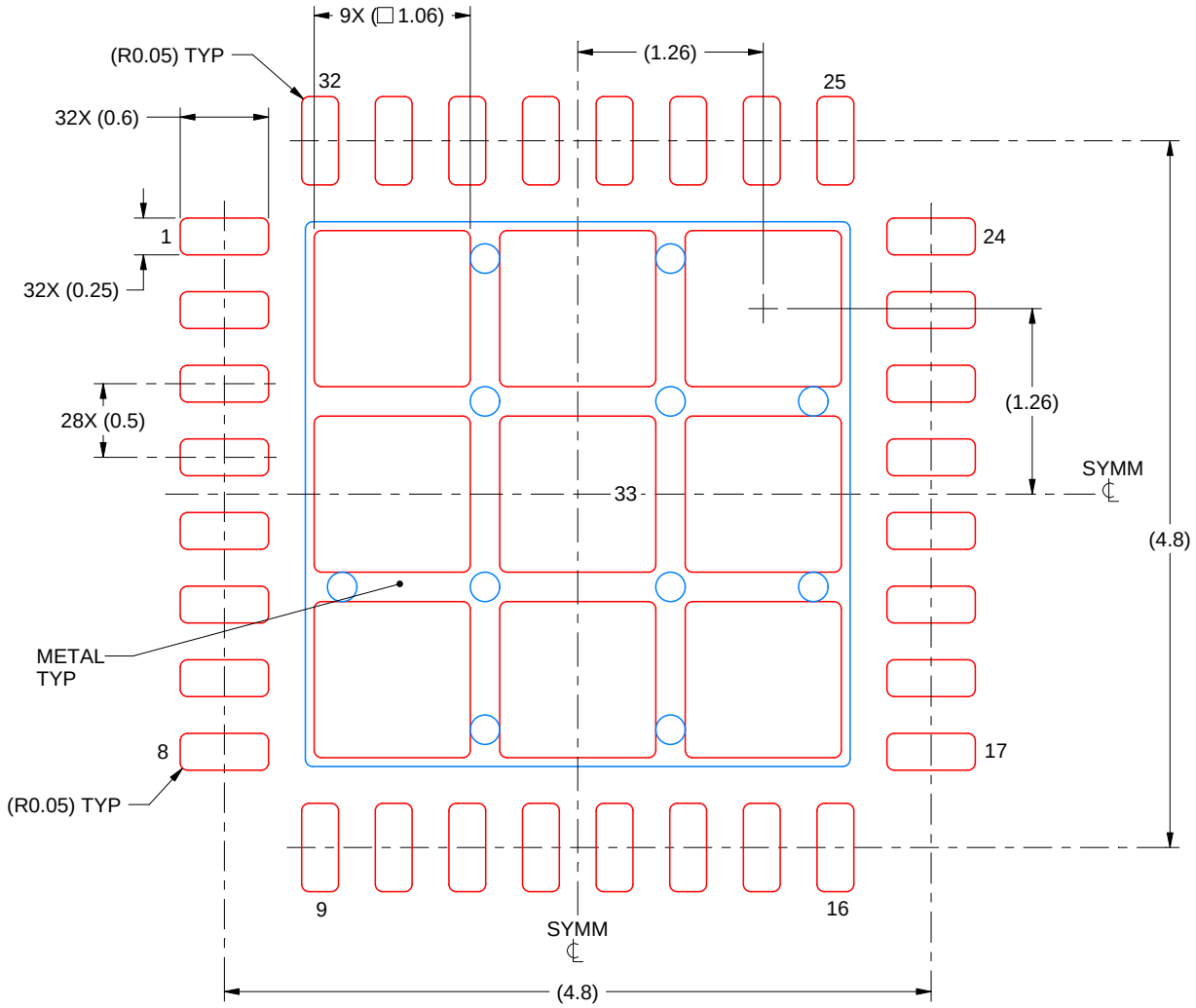
NOTES: (continued)

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.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 33:
74% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE:20X

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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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