TCAN285x-Q1 Automotive CAN FD SIC and LIN System Basis Chip (SBC) with Wake Inputs and High-side Switches

ADVANCE INFORMATION

1 Features

- AEC-Q100 qualified for automotive applications
- Meets the requirements for CAN flexible data (FD) including the signal improvement capability (SIC) per ISO 11898-2:2024
- Local interconnect network (LIN) physical layer specification ISO/DIS 17987–4:2024 compliant and conforms to SAEJ2602 recommended practice for LIN
- Functional Safety Quality-Managed
- Simplifies system power management with up to three regulators
  - Low drop out (LDO) regulator supporting up to 250mA for 3.3V or 5V MCUs (VCC1)
  - Short-to-battery protected 5V LDO regulator supporting up to 200mA externally (VCC2)
  - Control of an external PNP transistor supporting up to 350mA at 1.8V, 2.5V, 3.3V or 5V (VEXCC)
- Multiple methods to wake from sleep mode
  - CAN and LIN bus wake up pattern (WUP)
  - Optional, CAN selective wake up frame (WUF) capability (partial networking)
  - Local wake up (LWU) via WAKE pins
    - Cyclic sensing wake up support with HSS4
  - Digital wake up using the SW pin
- Four high-side switches for loads up to 150mA
- Protection and Diagnostic Features
  - Timeout, window and Q&A watchdog support
  - Undervoltage (UV), overvoltage (OV) and short-circuit supervision on regulator outputs
  - Fail-safe output (LIMP)
  - UV supervision of VSUP and VHSS; OV supervision of VHSS
  - Advanced CAN bus fault diagnostics
  - ±58V CAN bus fault tolerance
  - Integrated system level ESD protection
- Customer-accessible EEPROM to save device configuration
- QFN (32) package with improved automated optical inspection (AOI) capability

2 Applications

- Body electronics and lighting
- Body Control Modules
- Infotainment and cluster
- Hybrid, electric and power train systems
- Industrial transportation

3 Description

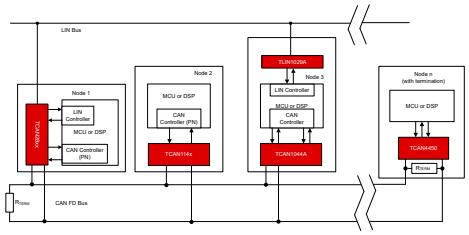
The TCAN285x-Q1 is a family of system basis chips (SBC) that provide a control area network flexible data rate capable (CAN FD) SICtransceiver that supports selective wake. The TCAN2857-Q1 includes a local interconnect network (LIN) transceiver. The CAN FD SICtransceiver supports data rates up to 8Mbps while the LIN transceiver supports fast mode data rates up to 200kbps. The VCC1 LDO provides 3.3V or 5V ±2% with up to 250mA of current and determines the digital IO logic levels. If more current is needed, an external PNP transistor can be used to support up to 350mA and voltages of 1.8V, 2.5V, 3.3V or 5V. VCC2 LDO provides 5V up to 200mA.

The TCAN285x-Q1 includes features such as LIMP, three local wake inputs and four high side switches. The high side switch can be on/off, 10-bit PWM or timer controlled. Controlling an external CAN FD, LIN transceiver, CAN SBC or LIN SBC is possible using the GFO pin. 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. WAKE1 and WAKE2 can enable an internal switch between pins to enable external V_{BAT} monitoring. WAKE3 can be configured as a direct drive control pin for any combinations of high-side switches when cyclic sensing wake is enabled.

Package Information

PART NUMBER	PACKAGE(1)	PACKAGE SIZE(2)
TCAN2855-Q1 TCAN2857-Q1	QFN (RHB, 32)	5mm x 5mm

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



Simplified Schematic

ADVANCE INFORMATION

Table of Contents

4 Device Comparison Table

Device Number	CAN FD SIC Transceiver	LIN Transceiver	Selective Wake	3.3V LDO	5V LDO
TCAN28553RHBQ1	X		X	X	
TCAN28555RHBQ1	X		X		X
TCAN28573RHBQ1	X	X	X	X	
TCAN28575RHBQ1	X	X	X		X

5 Pin Configuration and Functions

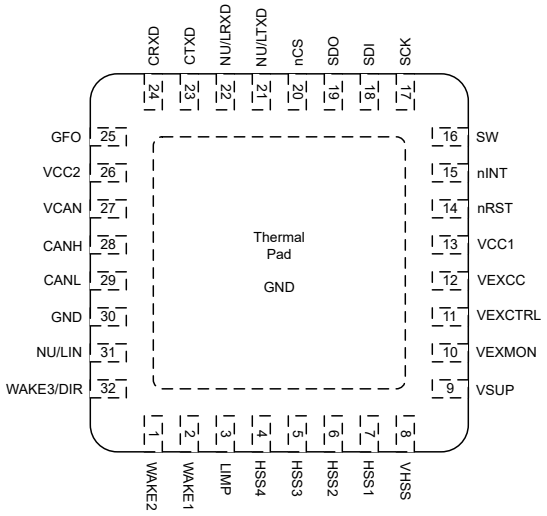


Figure 5-1. RHB Package, 32 Pin (QFN)
Top View

Table 5-1. Pin Functions RHB Package

NO.PIN			TYPE	DESCRIPTION
	TCAN2855-Q1	TCAN2857-Q1		
1	WAKE2	WAKE2	high voltage	Local wake input terminal, high voltage capable
2	WAKE1	WAKE1	high voltage	Local wake input terminal, high voltage capable
3	LIMP	LIMP	high voltage	Limp home output (Active low; open-drain output)
4	HSS4	HSS4	high voltage	High side switch
5	HSS3	HSS3	high voltage	High side switch
6	HSS2	HSS2	high voltage	High side switch
7	HSS1	HSS1	high voltage	High side switch
8	VHSS	VHSS	power	High side switch power
9	VSUP	VSUP	high voltage power	High voltage supply from the battery
10	VEXMON	VEXMON	power	External PNP emitter connection, shunt connection. Connect to VSUP if external PNP LDO is not used. DO not leave floating.
11	VEXCTRL	VEXCTRL	power	External PNP base control
12	VEXCC	VEXCC	power	External PNP collector connection feedback
13	VCC1	VCC1	power	LDO supply output: 3.3V or 5V
14	nRST	nRST	digital	VCC output monitor pin (active low) and device reset input
15	nINT	nINT	digital	Interrupt output (active low)
16	SW	SW	digital	Programming mode input pin (SPI configurable active high or active low)
17	SCK	SCK	digital	SPI clock input
18	SDI	SDI	digital	SPI data input
19	SDO	SDO	digital	SPI data output
20	nCS	nCS	digital	Chip select input (active low)
21	NU	LTXD	digital	LIN transmit data input (low for dominant and high for recessive bus states). NU is not used and should not be connected to anything.
22	NU	LRXD	digital	LIN receive data output (low for dominant and high for recessive bus states), tri-state. NU is not used and should not be connected to anything.
23	CTXD	CTXD	digital	CAN transmit data input (low for dominant and high for recessive bus states).
24	CRXD	CRXD	digital	CAN receive data output (low for dominant and high for recessive bus states), tri-state.
25	GFO	GFO	digital	Function output pin (SPI configurable)
26	VCC2	VCC2	power	5V LDO output
27	VCAN	VCAN	power	CAN FD transceiver 5V power supply input
28	CANH	CANH	bus I/O	High level CAN bus I/O line

ADVANCE INFORMATION

Table 5-1. Pin Functions RHB Package (continued)

NO.PIN			TYPE	DESCRIPTION
	TCAN2855-Q1	TCAN2857-Q1		
29	CANL	CANL	bus I/O	Low level CAN bus I/O line
30	GND	GND	power	Ground connection: Must be soldered to ground
31	NU	LIN	high voltage I/O	LIN bus input/output pin: NU is not used and should not be connected to anything.
32	WAKE3/DIR	WAKE3/DIR	high voltage	Local wake input terminal, high voltage capable. Direct drive to control any HSSx when configured
PAD(1)	GND	GND	power	Ground connection: Must be soldered to ground

(1) The thermal pad, PAD, is a device ground pin must be soldered to GND

ADVANCE INFORMATION

6 Device and Documentation Support

This device conforms 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 are helpful as the scope of CAN protocol in detail is outside the scope of this physical layer (transceiver) specification.

6.1 Documentation Support

6.1.1 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

6.1.2 LIN Transceiver Physical Layer Standards

- ISO/DIS 17987-1: Road vehicles -- Local Interconnect Network (LIN) -- Part 1: General information and use case definition
- ISO/DIS 17987-4: 2023 Road vehicles -- Local Interconnect Network (LIN) -- Part 4: Electrical Physical Layer (EPL) specification 12V
- SAEJ2602-1: LIN Network for Vehicle Applications
- LIN2.0, LIN2.1, LIN2.2 and LIN2.2A specification

6.1.3 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

6.1.4 Conformance Test Requirements:

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

6.1.5 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.

ADVANCE INFORMATION

6.2 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.

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 Trademarks

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6.5 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.

6.6 Glossary

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

7 Revision History

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

DATE	REVISION	NOTES
November 2024	*	Initial Release

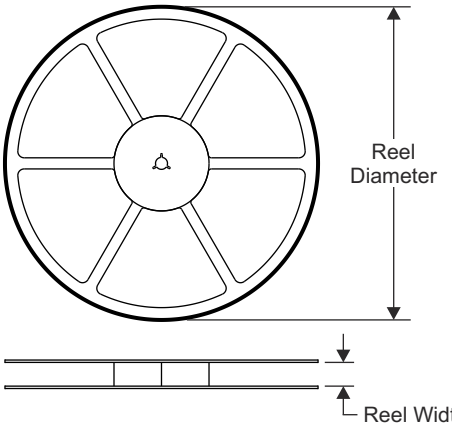
8 Mechanical, Packaging, and Orderable Information

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.

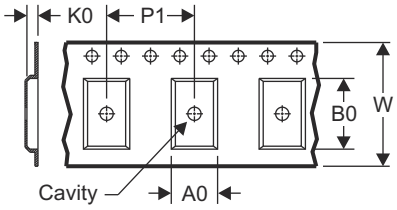
ADVANCE INFORMATION

8.1 Tape and Reel Information

REEL DIMENSIONS

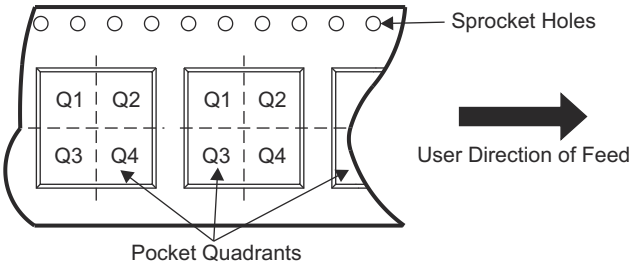


TAPE DIMENSIONS



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

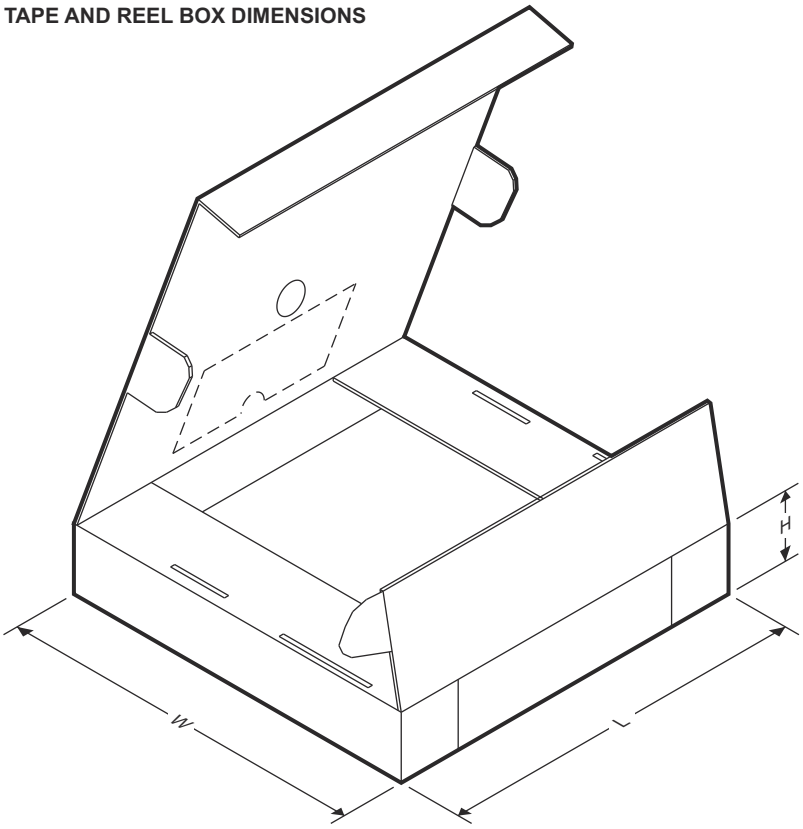


Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
PTCAN28553RHBRQ1 TCAN28553RHBRQ1	VQFN	RHB	32	3000	330.0	12.4	5.3	5.3	1.1	8.0	12.0	Q2
PTCAN28555RHBRQ1 TCAN28555RHBRQ1	VQFN	RHB	32	3000	330.0	12.4	5.3	5.3	1.1	8.0	12.0	Q2
PTCAN28573RHBRQ1 TCAN28573RHBRQ1	VQFN	RHB	32	3000	330.0	12.4	5.3	5.3	1.1	8.0	12.0	Q2
PTCAN28575RHBRQ1 TCAN28575RHBRQ1	VQFN	RHB	32	3000	330.0	12.4	5.3	5.3	1.1	8.0	12.0	Q2

ADVANCE INFORMATION

ADVANCE INFORMATION

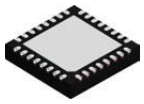
TAPE AND REEL BOX DIMENSIONS



Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TCAN28553RHBRQ1	VQFN	RHB	32	3000	367.0	367.0	35.0
TCAN28555RHBRQ1	VQFN	RHB	32	3000	367.0	367.0	35.0
TCAN28573RHBRQ1	VQFN	RHB	32	3000	367.0	367.0	35.0
TCAN28575RHBRQ1	VQFN	RHB	32	3000	367.0	367.0	35.0

8.2 Mechanical Data

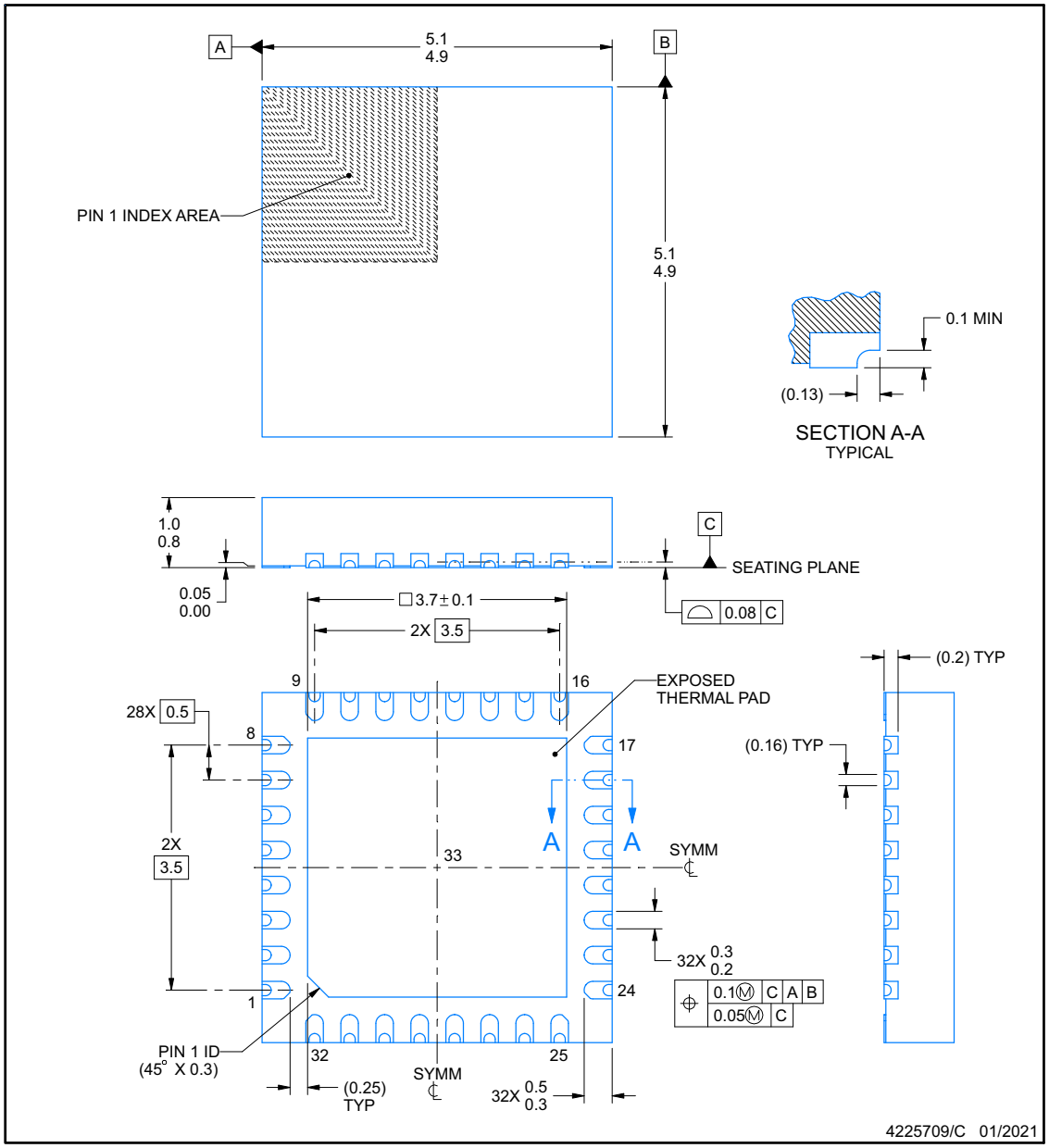
RHB0032U



PACKAGE OUTLINE

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



NOTES:

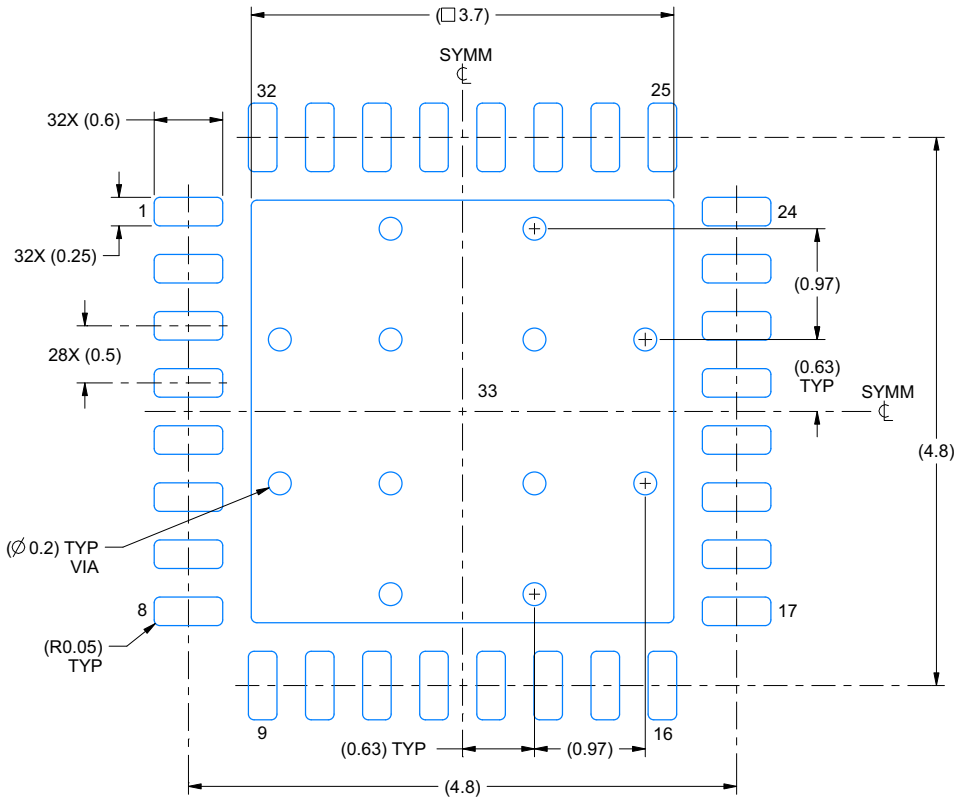
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

ADVANCE INFORMATION

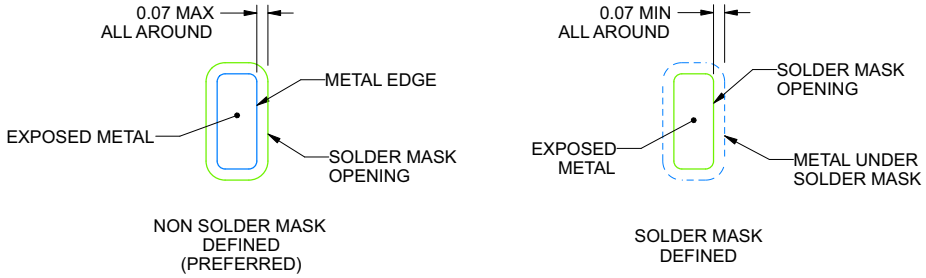
EXAMPLE BOARD LAYOUT

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)

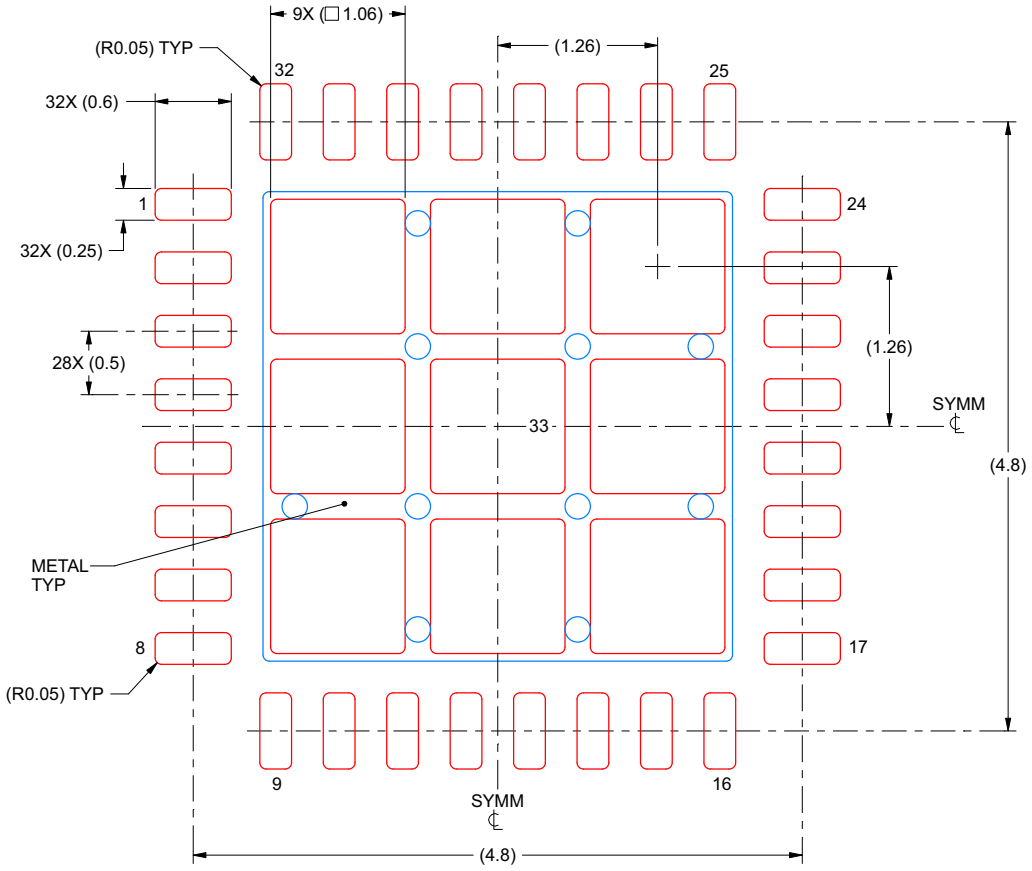
4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown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

EXAMPLE STENCIL DESIGN

RHB0032U

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



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.

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)
PTCAN28553RHBRQ1	Active	Preproduction	VQFN (RHB) | 32	5000 | LARGE T&R	-	Call TI	Call TI	-40 to 125	
PTCAN28553RHBRQ1.A	Active	Preproduction	VQFN (RHB) | 32	5000 | LARGE T&R	-	Call TI	Call TI	-40 to 125	
PTCAN28555RHBRQ1	Active	Preproduction	VQFN (RHB) | 32	5000 | LARGE T&R	-	Call TI	Call TI	-40 to 125	
PTCAN28555RHBRQ1.A	Active	Preproduction	VQFN (RHB) | 32	5000 | LARGE T&R	-	Call TI	Call TI	-40 to 125	
PTCAN28573RHBRQ1	Active	Preproduction	VQFN (RHB) | 32	5000 | LARGE T&R	-	Call TI	Call TI	-40 to 125	
PTCAN28573RHBRQ1.A	Active	Preproduction	VQFN (RHB) | 32	5000 | LARGE T&R	-	Call TI	Call TI	-40 to 125	
PTCAN28575RHBRQ1	Active	Preproduction	VQFN (RHB) | 32	5000 | LARGE T&R	-	Call TI	Call TI	-40 to 125	
PTCAN28575RHBRQ1.A	Active	Preproduction	VQFN (RHB) | 32	5000 | LARGE T&R	-	Call TI	Call TI	-40 to 125	

(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.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

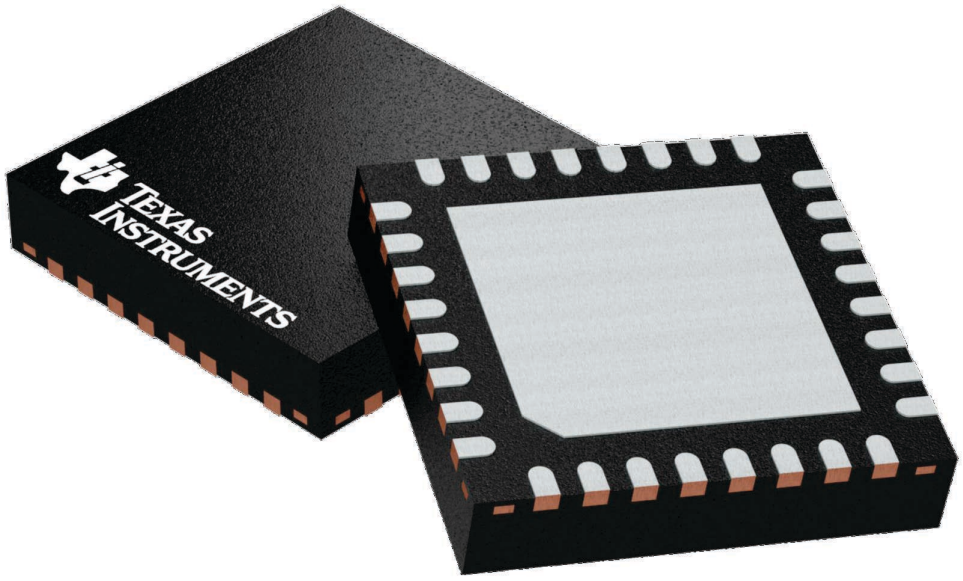
GENERIC PACKAGE VIEW

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.

4224745/A

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