ULC1001-Q1 Configurable Ultrasonic PWM Modulator With I/V Sense Amplifiers

1 Features

- Integrated Programmable Cleaning Modes
  - Water (expelling)
  - Deice (melting and expelling)
  - Mud (dehydrating and expelling)
  - Auto-cleaning (detecting mass and expelling)
  - Custom cleaning modes
- Embedded algorithms
  - Lens system calibration
  - Automatic mass detection
  - Power regulation
  - System diagnostics
- System diagnostics
  - Driver fault reporting
  - Lens system fault reporting
  - Transducer temperature regulation
- Wide-drive frequency range
  - High-efficiency direct drive (10kHz - 5MHz)
  - AD modulation (<50kHz)
- I^2C user interface
- Clock source required
  - External oscillator (10MHz, 5ppm recommended)
- Power supplies
  - IOVDD: 3.3V
- 32-pin, QFN-HR package

2 Applications

- Automotive thermal camera
- Mirror replacement/camera mirror system
- Rear camera
- Surround view system ECU
- Front Camera

3 Description

The ULC1001-Q1 is a configurable PWM modulator with current and voltage sensing capabilities specifically for piezo-based lens cleaning systems.

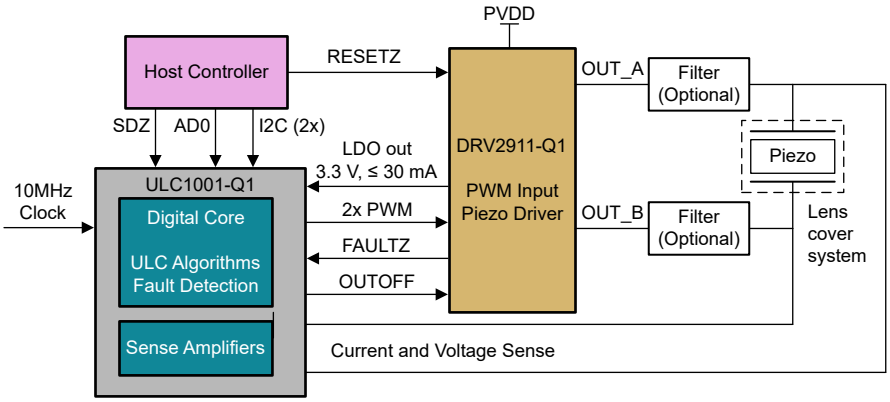
An on-chip, low-latency DSP supports Texas Instruments' proprietary algorithms designed for lens cleaning. The ULC1001-Q1 and DRV2911-Q1 work together to create an Ultrasonic Lens Cleaning system.

The ULC1001-Q1 device is available in a 32-pin QFN-HR package for a compact PCB footprint.

Device Information

PART NUMBER	PACKAGE(1)	PACKAGE SIZE(2)
ULC1001-Q1	HRQFN	4.5mm × 5.0mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.



Simplified Application

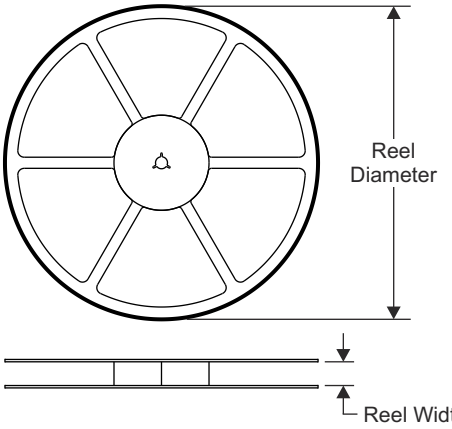
Table of Contents

4 Mechanical, Packaging, and Orderable Information

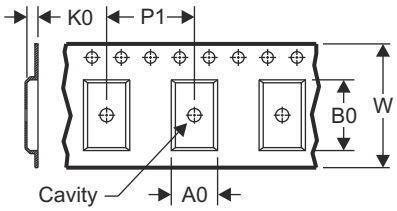
The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

4.1 Tape and Reel Information

REEL DIMENSIONS

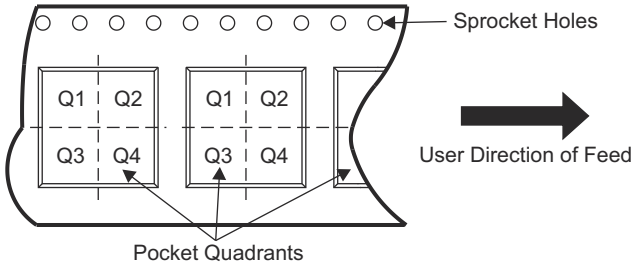


TAPE DIMENSIONS



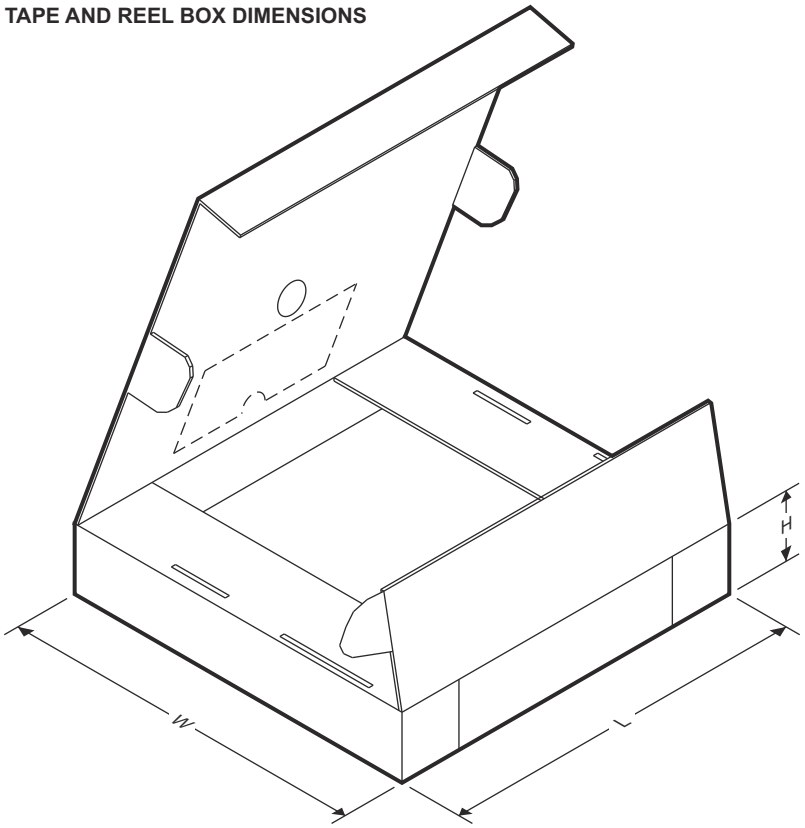
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

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
ULC1001QWRQTRQ1	VQFN-HR	RTQ	32	3000	330.0	12.4	4.8	5.3	1.15	8.0	12.0	Q2

TAPE AND REEL BOX DIMENSIONS



Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
ULC1001QWRQTRQ1	VQFN-HR	RTQ	32	3000	367.0	367.0	35.0

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
ULC1001QWRQTRQ1	ACTIVE	VQFN-HR	RQT	32	3000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	ULC 1001WQ1	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.

OTHER QUALIFIED VERSIONS OF ULC1001-Q1 :

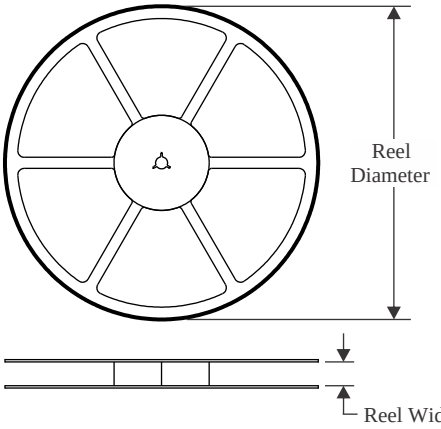
- Catalog : ULC1001

NOTE: Qualified Version Definitions:

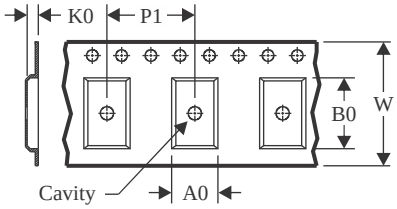
- Catalog - TI's standard catalog product

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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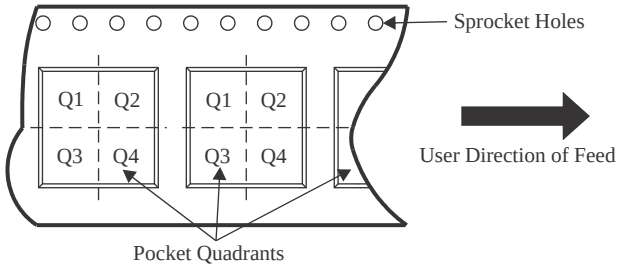

*All dimensions are nominal

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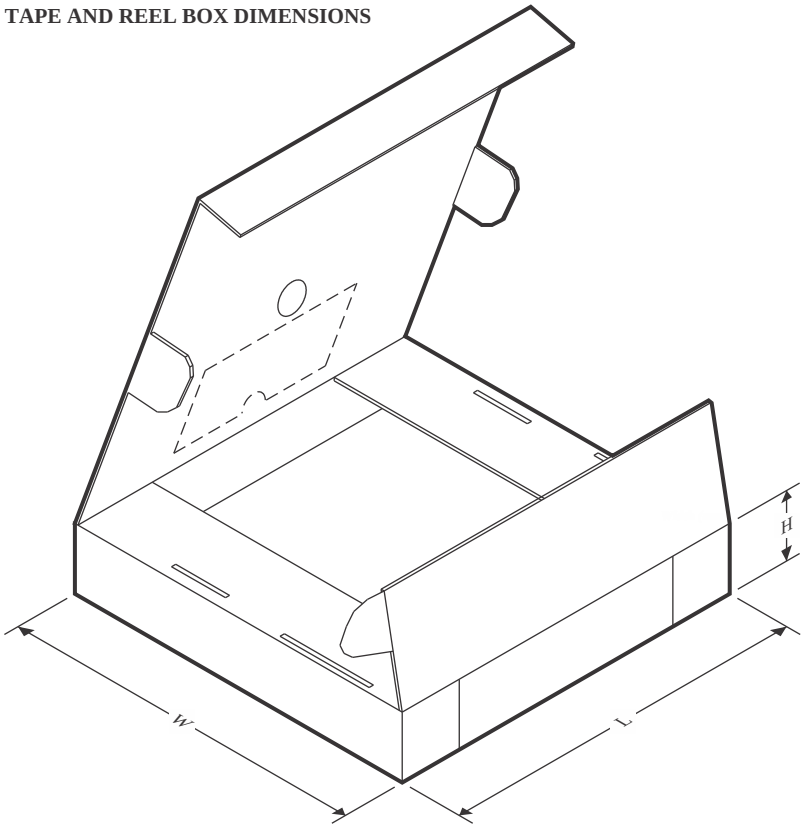
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
ULC1001QWRQTRQ1	VQFN-HR	RQT	32	3000	367.0	367.0	35.0

GENERIC PACKAGE VIEW

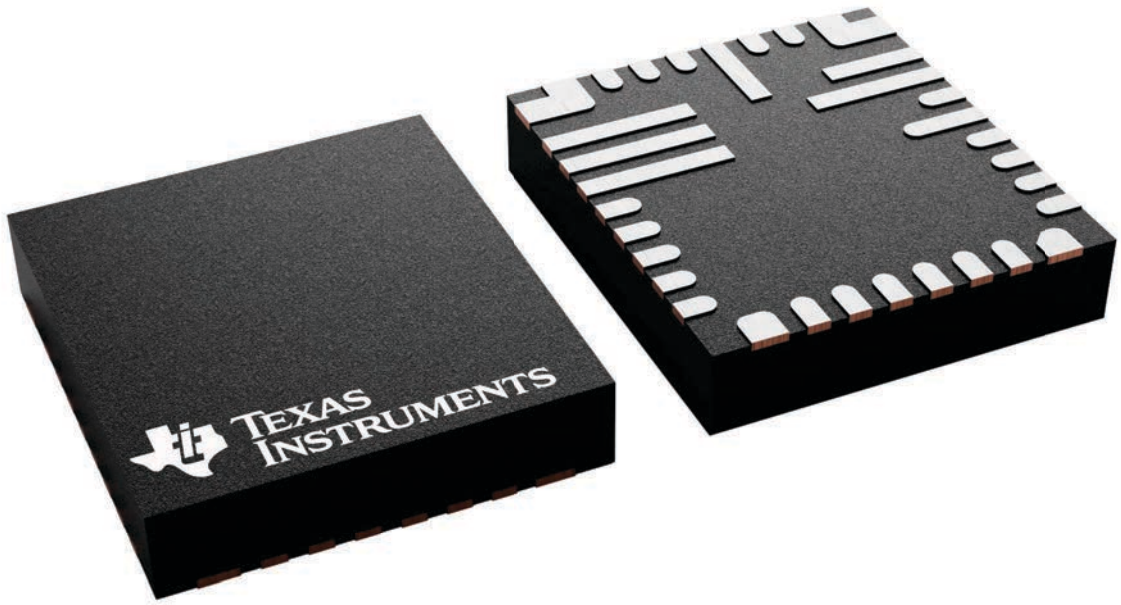
RQT 32

VQFN-HR - 1 mm max height

5 x 4.5, 0.5 mm pitch

PLASTIC QUAD FLATPACK - NO LEAD

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

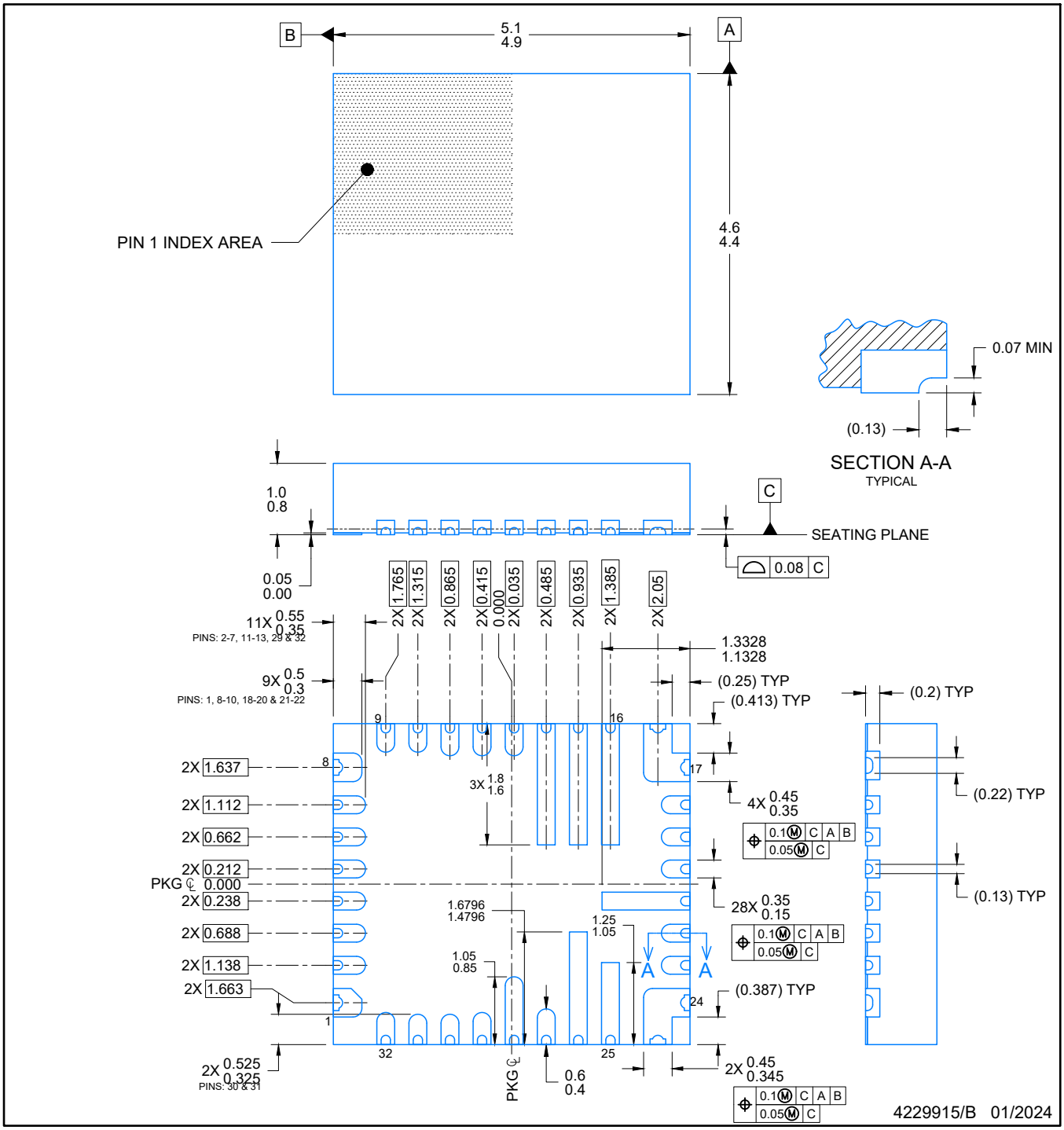


PACKAGE OUTLINE

RQT0032B

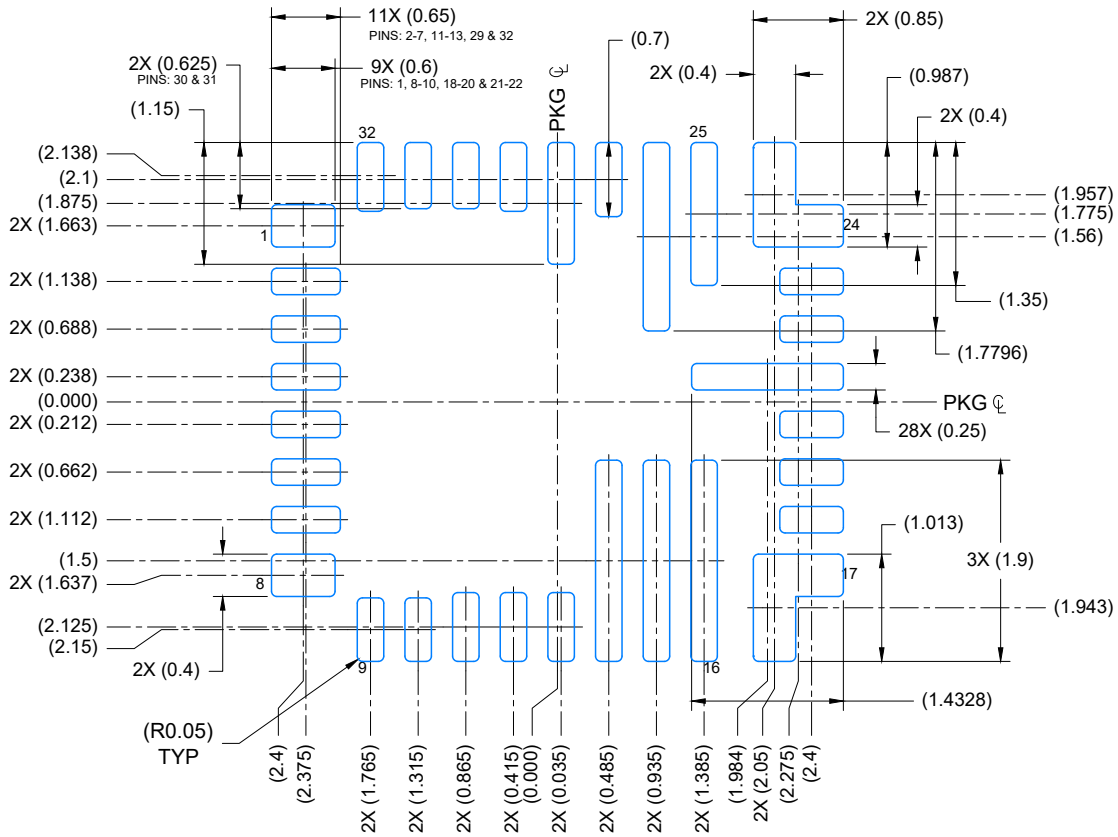
VQFN-HR - 1 mm max height

PLASTIC QUAD FLATPACK- NO LEAD

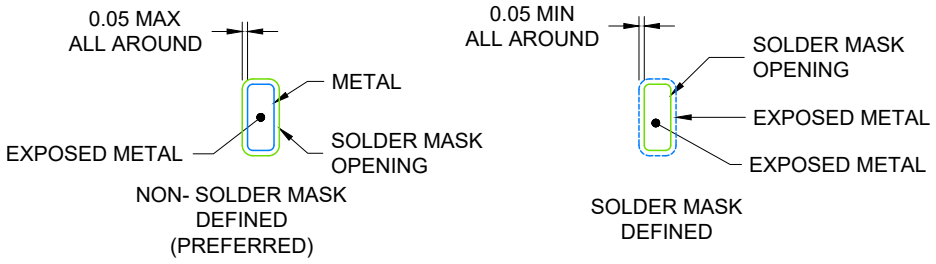


NOTES:

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.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 14X

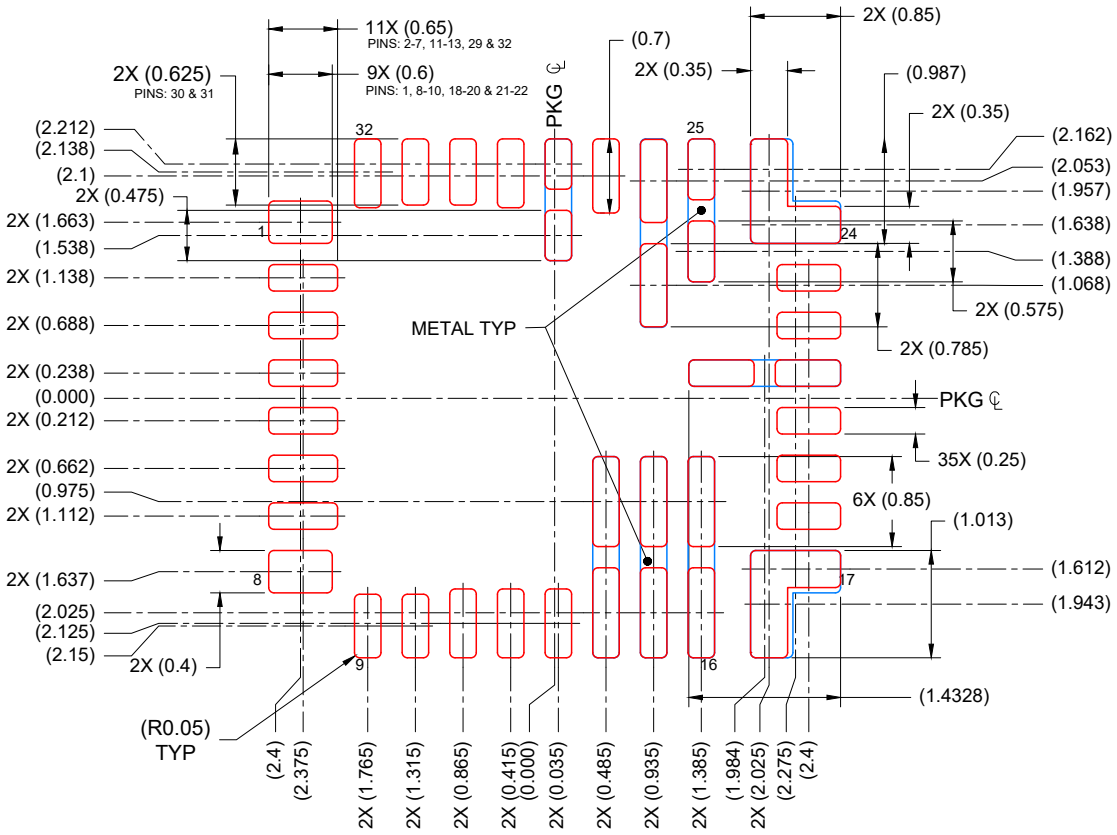


SOLDER MASK DETAILS

4229915/B 01/2024

NOTES: (continued)

3. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271) .
4. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE: 14X

PRINTED COVERAGE BY AREA
PAD 14,15,16: 89%
PAD 21: 85%
PAD 17& 24: 90%
PAD 25: 84%
PAD 26: 88%
PAD 28: 82%

4229915/B 01/2024

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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