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.

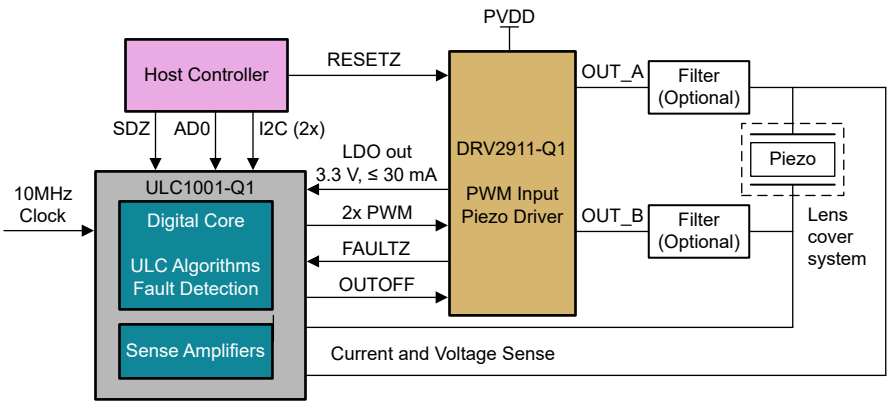
An on-chip, low-latency DSP supports Texas Instruments' proprietary algorithms designed for lens cleaning. The ULC1001-Q1 and DRV2911-Q1 work together to create an Ultrasonic Lens Cleaning system.

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

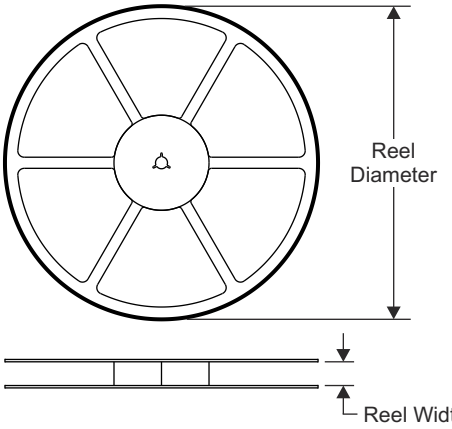
Table of Contents

4 Mechanical, Packaging, and Orderable Information

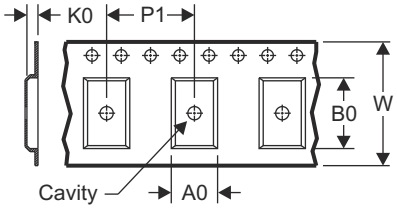
The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand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

4.1 Tape and Reel Information

REEL DIMENSIONS

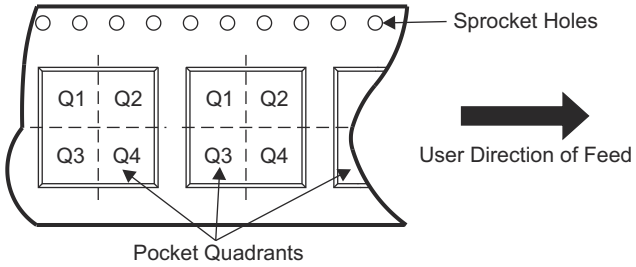


TAPE DIMENSIONS



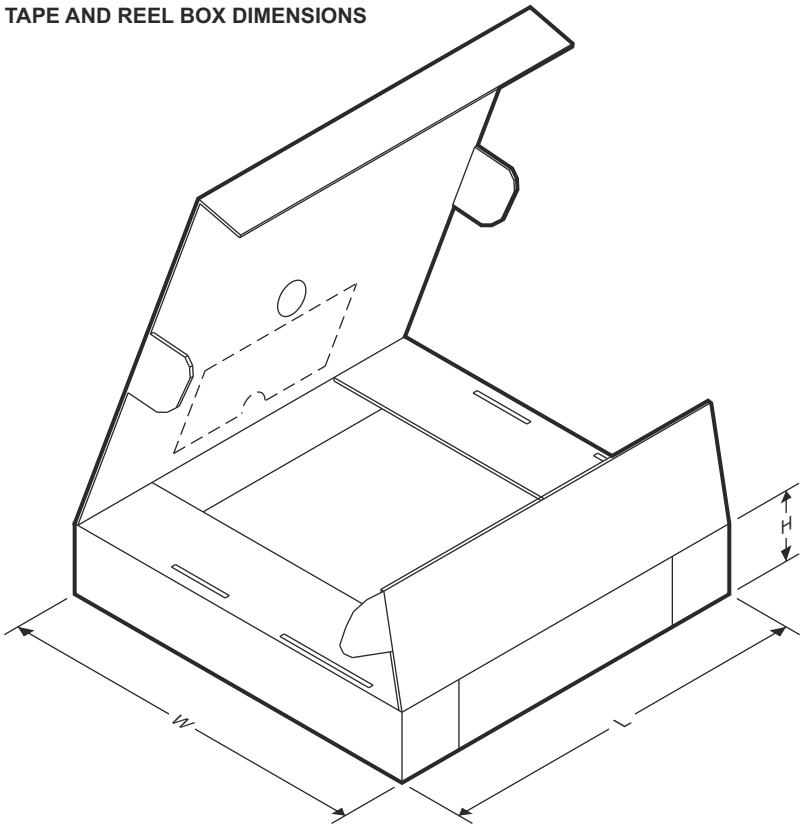
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

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 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)
ULC1001QWRQTRQ1	Active	Production	VQFN-HR (RQT) | 32	3000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	ULC 1001WQ1
ULC1001QWRQTRQ1.A	Active	Production	VQFN-HR (RQT) | 32	3000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	ULC 1001WQ1

(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.

OTHER QUALIFIED VERSIONS OF ULC1001-Q1 :

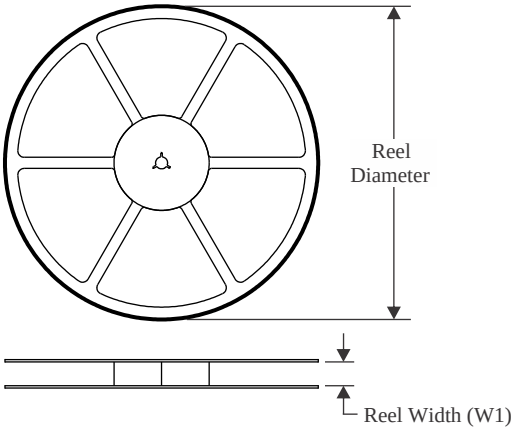
- Catalog : ULC1001

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

TAPE AND REEL INFORMATION

REEL DIMENSIONS



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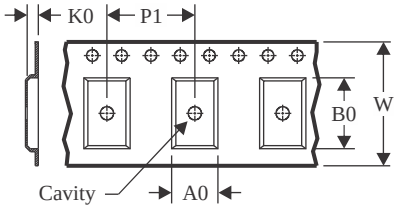

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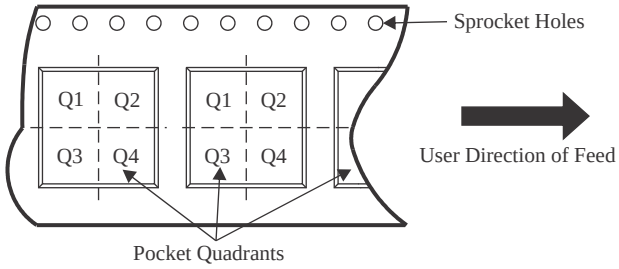
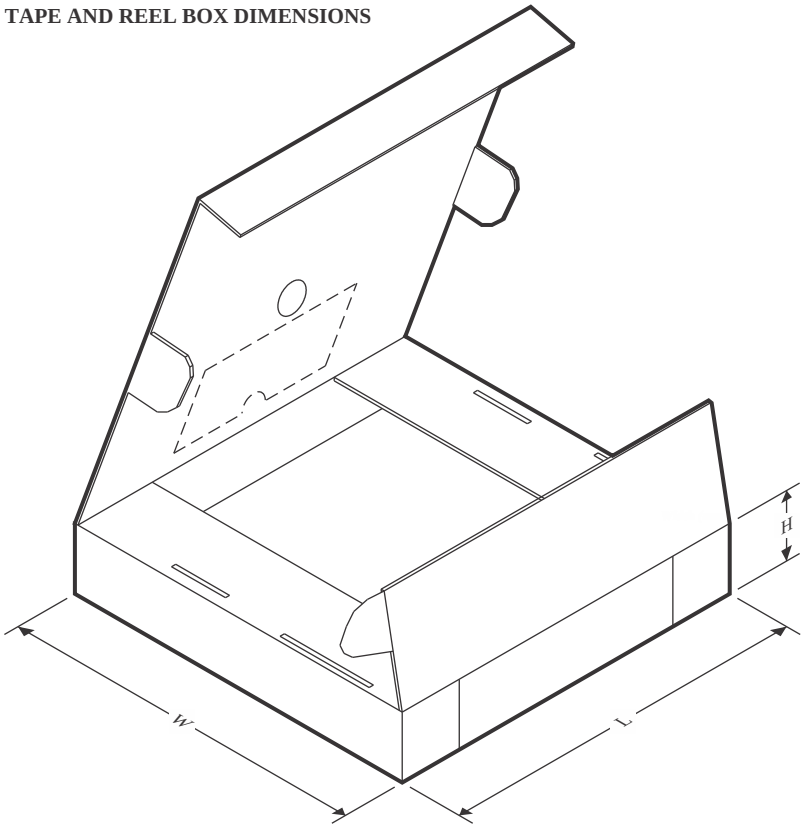


*All dimensions are nominal

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
ULC1001QWRQTRQ1	VQFN-HR	RQT	32	3000	330.0	12.4	4.8	5.3	1.15	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)
ULC1001QWRQTRQ1	VQFN-HR	RQT	32	3000	367.0	367.0	35.0

GENERIC PACKAGE VIEW

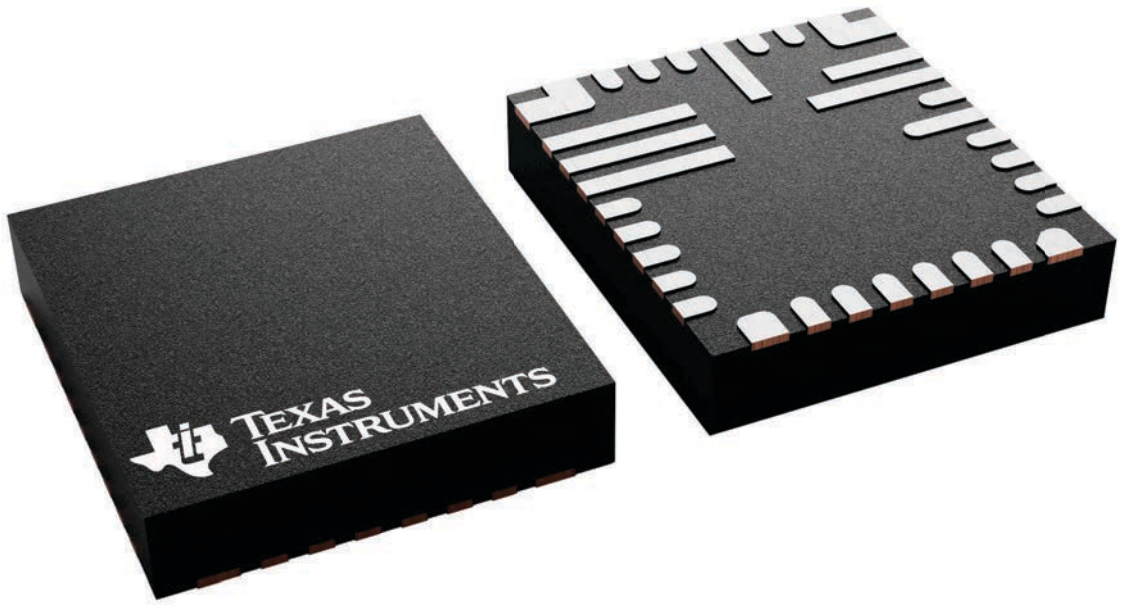
RQT 32

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.

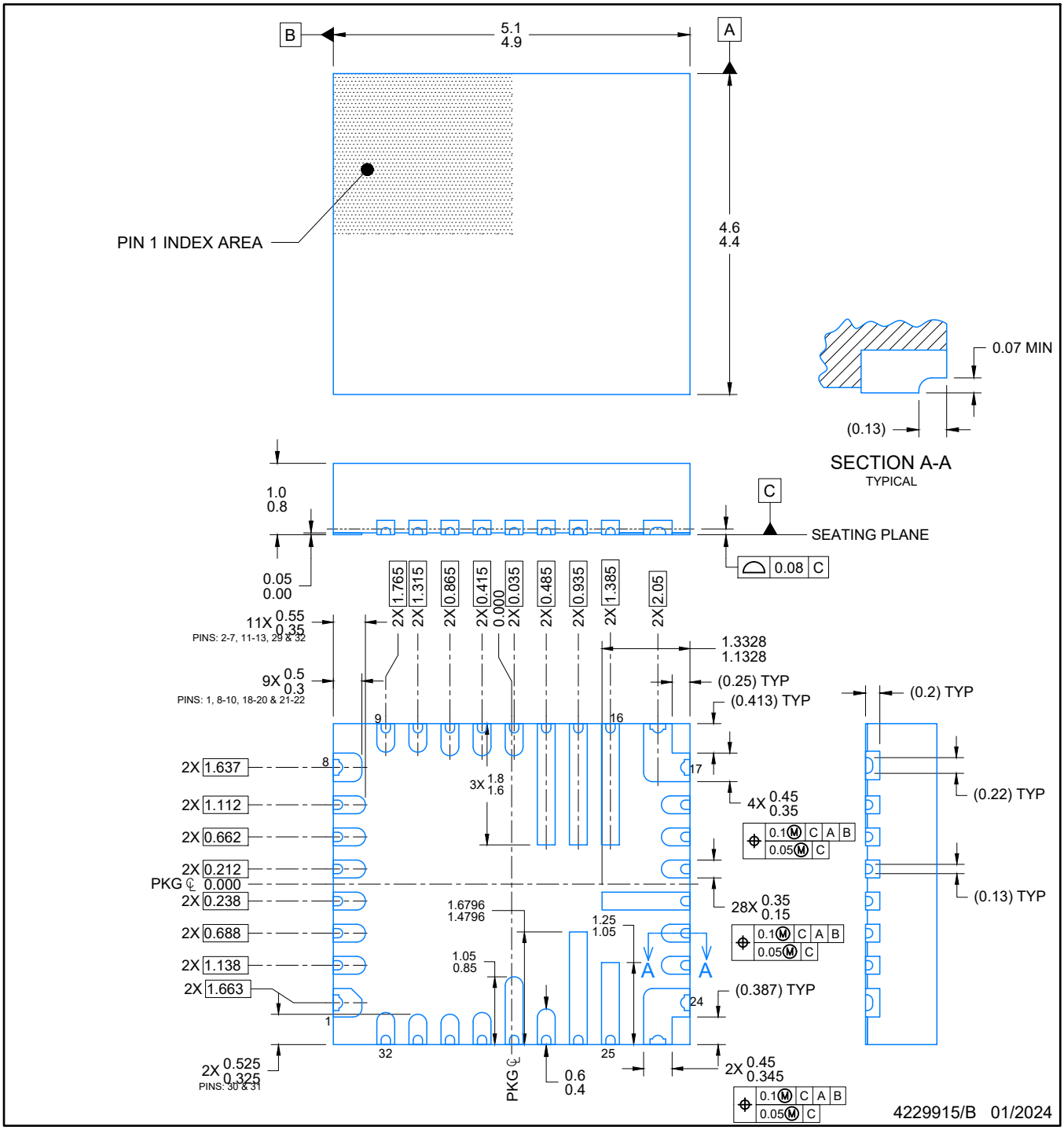


PACKAGE OUTLINE

RQT0032B

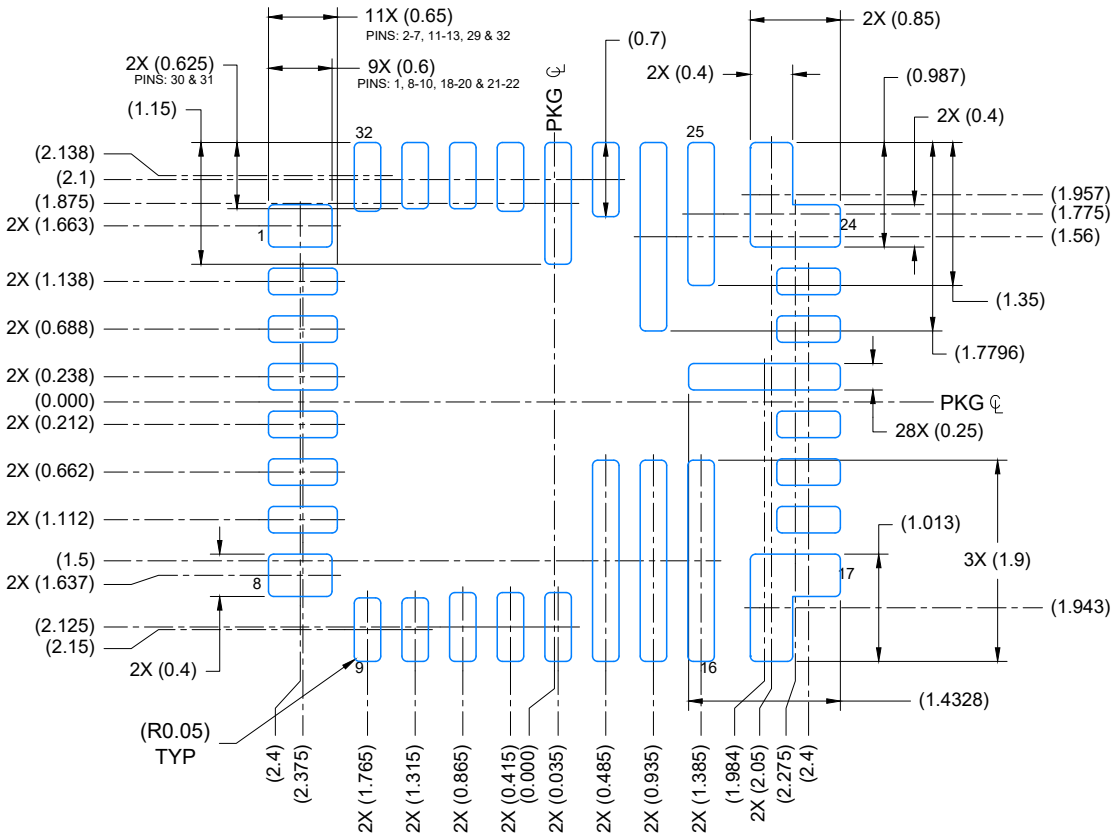
VQFN-HR - 1 mm max height

PLASTIC QUAD FLATPACK- NO LEAD

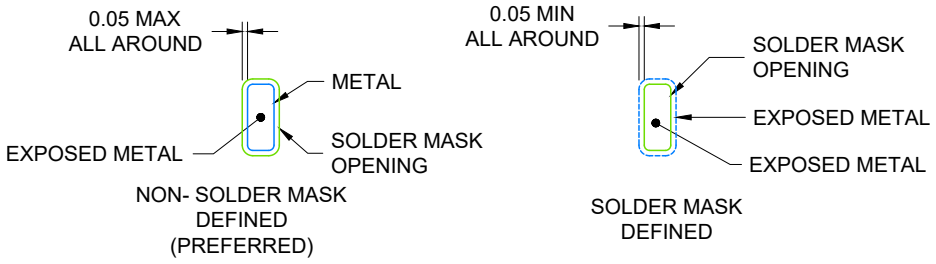


NOTES:

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

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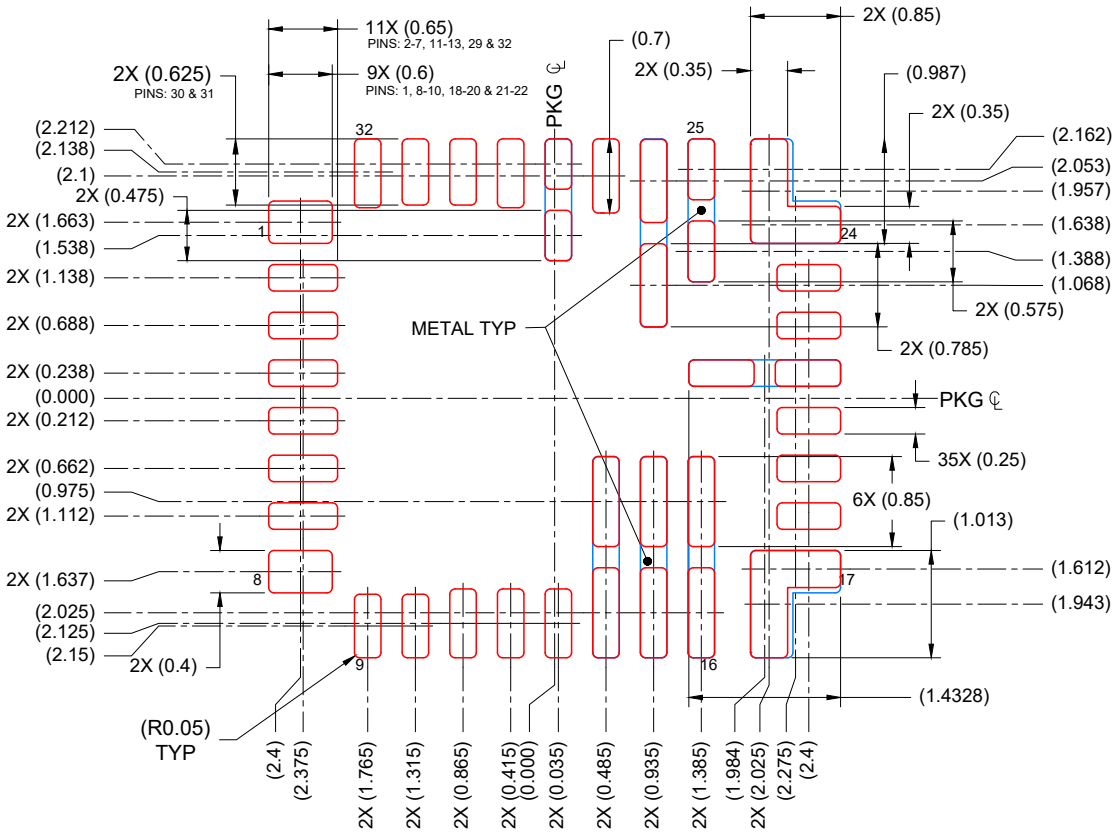
NOTES: (continued)

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%

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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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