TPS6289x-Q1 2.8V to 6V Input, 30A, 40A, and 50A, Automotive, Stackable Step-Down Converter With I²C Interface and Telemetry

1 Features

- AEC-Q100 qualified for automotive applications
  - Device temperature grade 1: –40°C to 125°C T_A
  - –40°C to 150°C junction temperature range
- Functional Safety-Capable
  - Documentation available to aid functional safety system design
- Input voltage range: 2.8V to 6V
- ±0.5% output voltage accuracy
- Output voltage range from 0.4V to 1.0V
- 1.8mΩ and 0.7mΩ internal power MOSFETs
- External compensation
- Optional stacked operation for increased output current capability
- Adjustable switching frequency from 833kHz to 3MHz (product preview)
- External synchronization
- Forced PWM or power save mode operation
- Optimized load transient operation
- Fixed frequency DCS-Control
- Transient non-synchronous mode
- Adjustable droop compensation
- Optimized for small and low-profile inductors
- I²C-compatible interface with up to 3.4MHz
- Differential remote sense
- Thermal pre-warning and thermal shutdown
- Input and output overvoltage protection
- Output discharge
- Optional spread spectrum clocking
- Telemetry for V_{IN}, Temp, V_{OUT}, and I_{OUT}
- Interrupt output
- Power-good output with window comparator with adjustable thresholds
- Available in 5.0mm × 6.0mm, VQFN package

2 Applications

- ADAS sensor fusion
- Surround view ECU
- Hybrid and reconfigurable cluster
- Head unit, telematics control unit

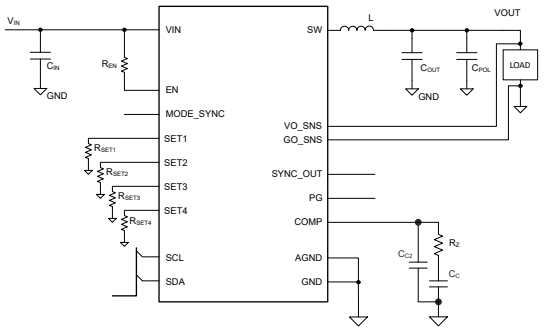
3 Description

The TPS6289x-Q1 devices are a family of pin-to-pin 30A, 40A, and 50A synchronous step-down DC/DC converters with I²C interface and differential remote sense. Low-resistance power switches allow up to 50A continuous output current at high ambient temperatures. The devices can operate in stacked mode to deliver higher output currents or to spread the power dissipation across multiple devices. In stacked operation, the converters frequencies are synchronized, share a common compensation signal and shift the phases to supply loads with several hundreds of amperes. The TPS6289x-Q1 family implements a fixed-frequency-DCS-Control scheme with adjustable switching frequency and adjustable loop compensation. The high switching frequency and loop bandwidth is optimized for low-profile- and small-size inductors and low output capacitance. Devices can operate in power-save mode (PSM) for maximum efficiency, or forced-PWM mode for best transient performance and lowest output voltage ripple. The I²C compatible interface offers several control, monitoring and warning features including telemetry data of input voltage, output voltage, output current, and temperature. Four SET pins can be used to program default settings before start-up.

Device Information

PART NUMBER(3)	CURRENT RATING	PACKAGE(1)	PACKAGE SIZE(2)
TPS62891-Q1(4)	30A	VAA (WQFN-FCRLF, 20)	5mm × 6mm
TPS62892-Q1(4)	40A		
TPS62893-Q1	50A		

(1) For more information, see Section 7.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.
(3) See the *Device Options* table.
(4) Preview information (not Production Data)



TPS6289x-Q1 Simplified Schematic

Table of Contents

4 Device Options

ORDERABLE PART NUMBER	OUTPUT CURRENT	DEFAULT F_{SW}
TPS628912QWVAARQ1(1)	30A	2.25MHz
TPS628922QWVAARQ1(1)	40A	2.25MHz
TPS628932QWVAARQ1	50A	2.25MHz

(1) Preview information (not Production Data)

5 Device and Documentation Support

5.1 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.

5.2 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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5.3 Trademarks

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5.4 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.

5.5 Glossary

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

6 Revision History

DATE	REVISION	NOTES
July 2025	*	Initial Release

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)
TPS628932QWVAARQ1	Active	Production	WQFN-FCRLF (VAA) | 20	3000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	T932Q

(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.

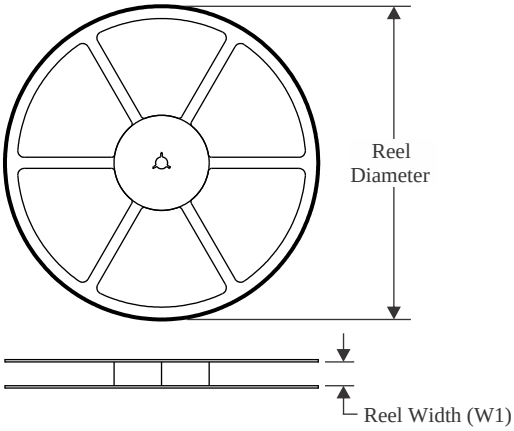
(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will 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.

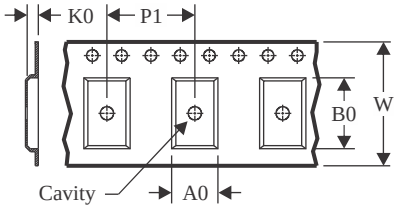
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

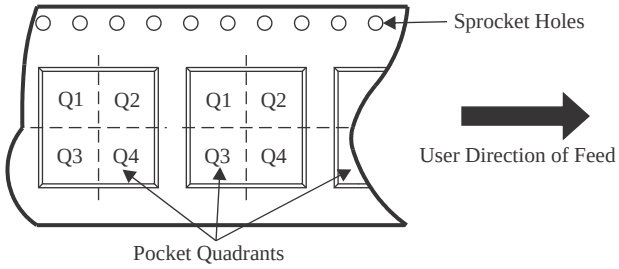


TAPE DIMENSIONS



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

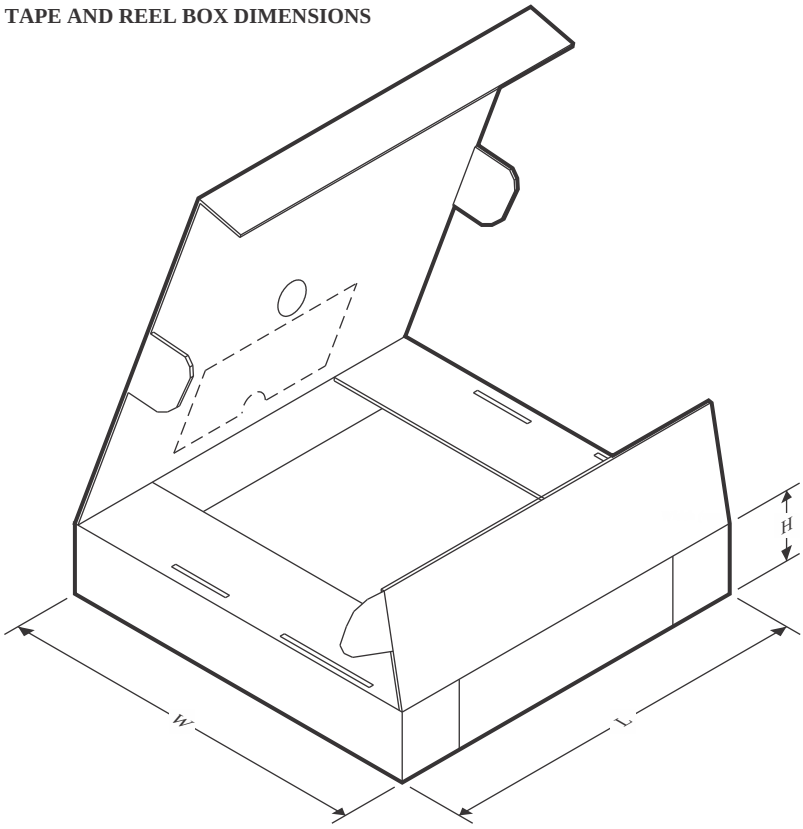
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TPS628932QWVAARQ1	WQFN-FCRLF	VAA	20	3000	330.0	12.4	5.25	6.25	0.9	8.0	12.0	Q2

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

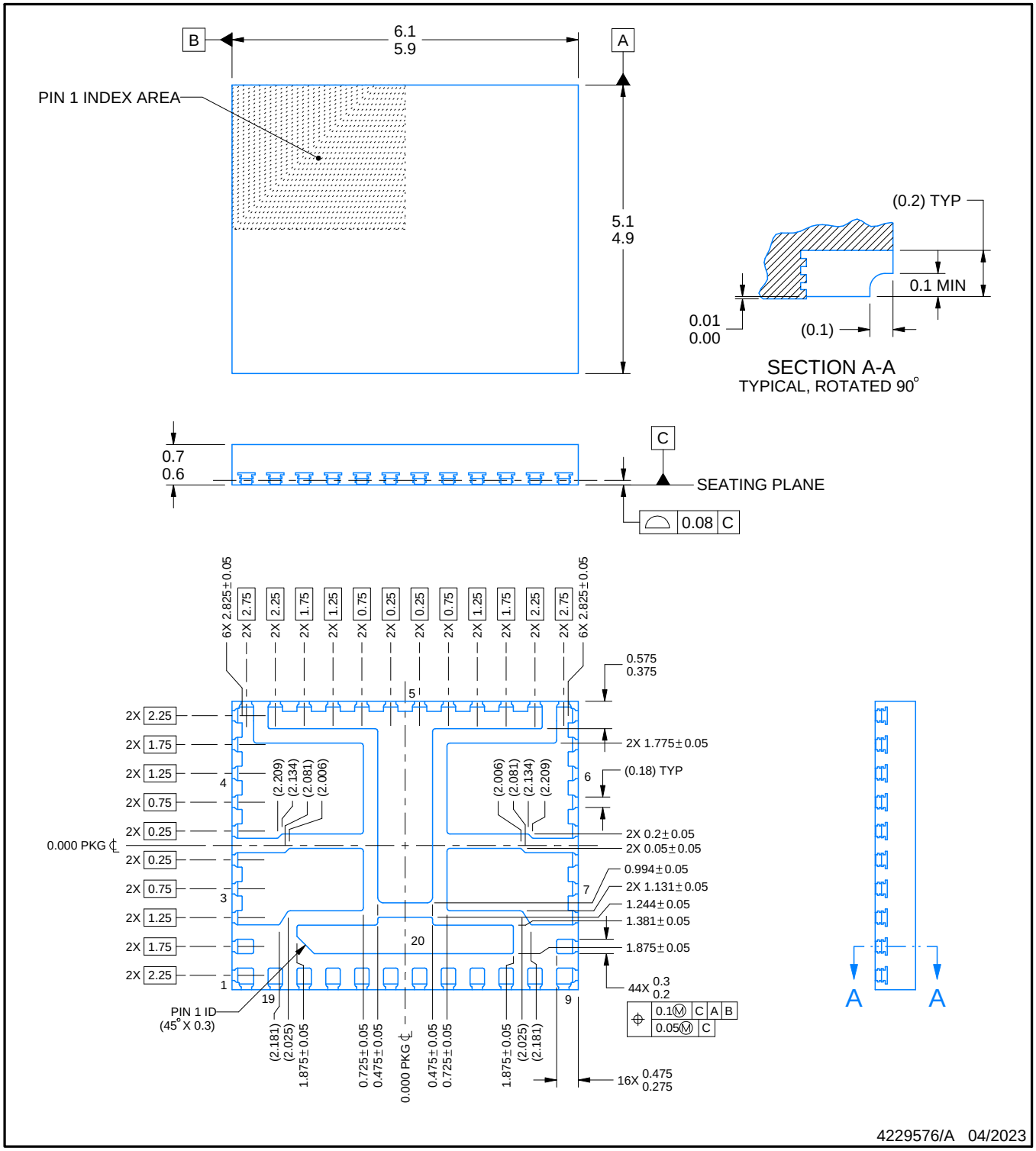
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS628932QWVAARQ1	WQFN-FCRLF	VAA	20	3000	367.0	367.0	35.0

PACKAGE OUTLINE

VAA0020A

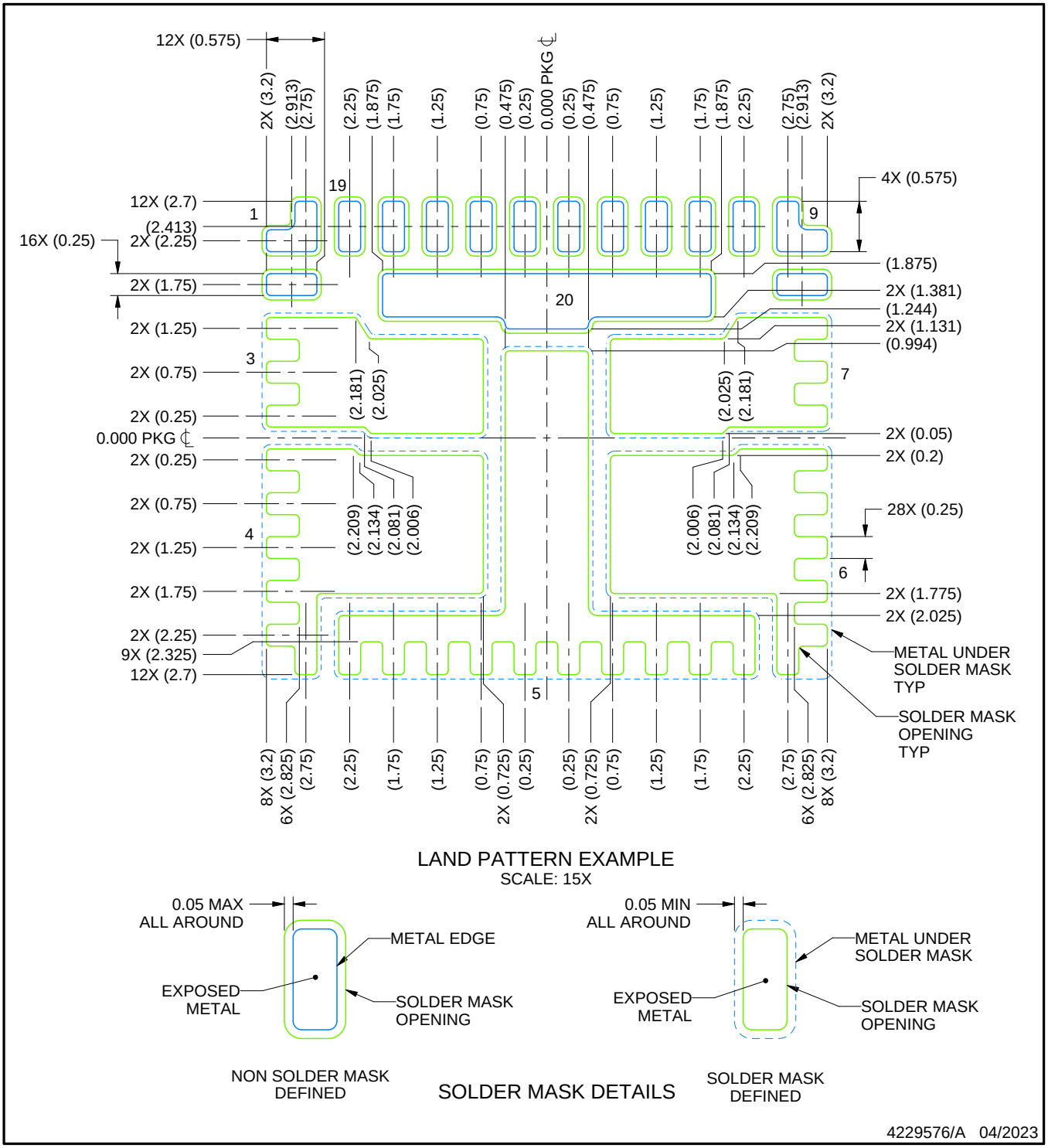
WQFN-FCRLF - 0.7 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



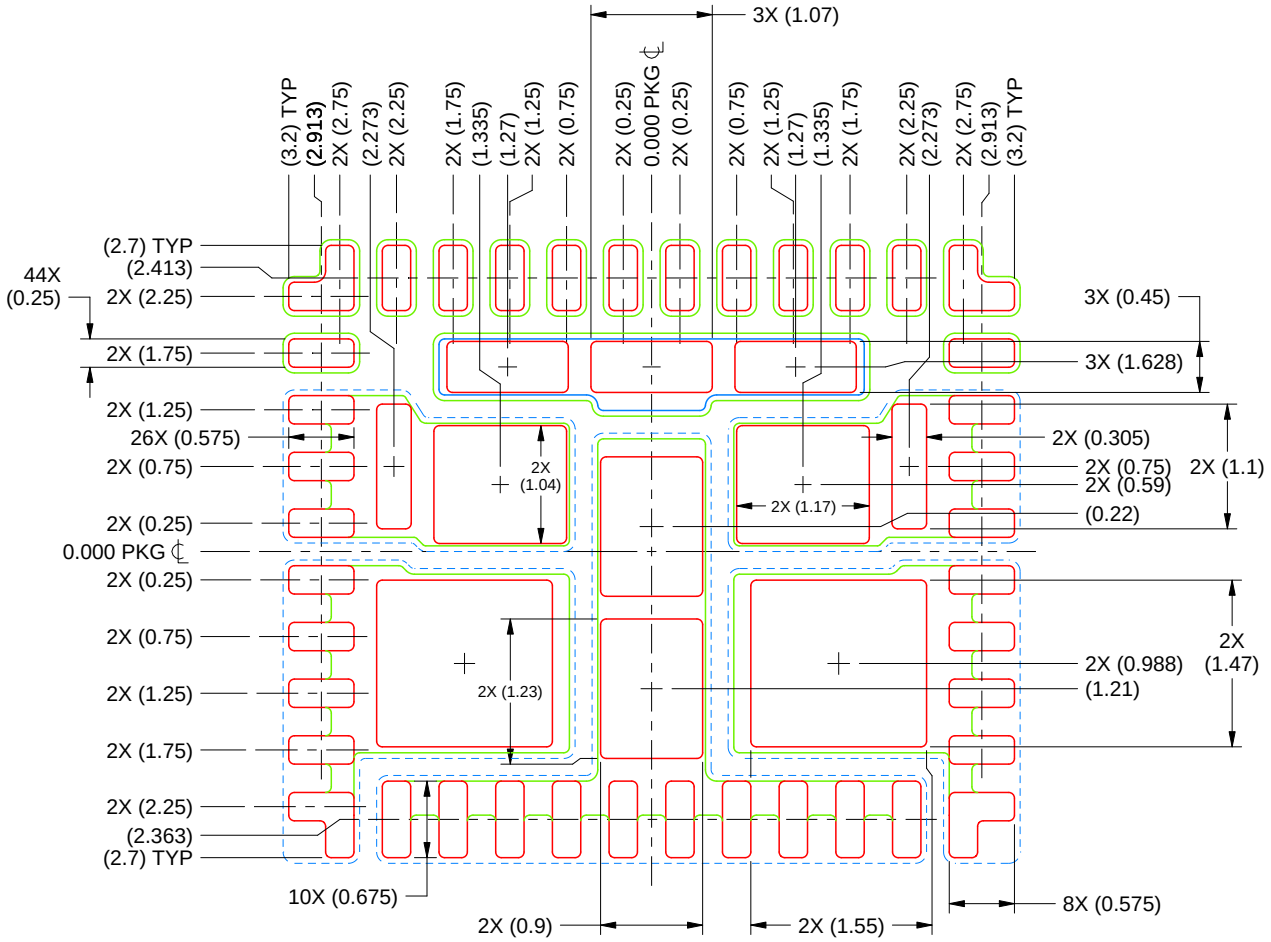
NOTES:

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.



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
SCALE: 15X

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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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Last updated 10/2025