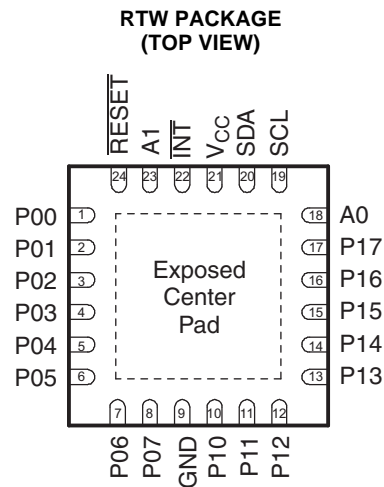
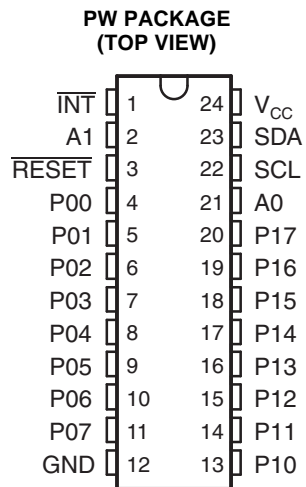


# LOW VOLTAGE 16-BIT I<sup>2</sup>C I/O EXPANDER WITH INTERRUPT AND RESET

Check for Samples: [TCA1116](#)

## FEATURES

- I<sup>2</sup>C to Parallel Port Expander
- Supports partial power down i.e. SDA and SCL are 5V tolerant (<1uA leakage) even when V<sub>CC</sub>=0
- Supports 1.8V I<sup>2</sup>C operation
- Open-Drain Active-Low Interrupt Output
- Active-Low Reset Input
- I/O Ports are 5V tolerant
- Low Standby-Current Consumption of 3 µA Max
- 400-kHz Fast I<sup>2</sup>C Bus support
- Polarity Inversion Register
- Configurable with up to four different I<sup>2</sup>C addresses using hardware pins
- Directly drive LEDs using high current push pull outputs
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 1000-V Charged-Device Model (C101)



The exposed center pad, if used, must be connected as a secondary ground or left electrically open.

## DESCRIPTION

This 16-bit I/O expander for the two-line bidirectional bus (I<sup>2</sup>C) is designed for 1.65-V to 5.5-V V<sub>CC</sub> operation. It provides general-purpose remote I/O expansion for most microcontroller families via the I<sup>2</sup>C interface [serial clock (SCL), serial data (SDA)]. Two hardware pins (A0 and A1) are used to program and vary the fixed I<sup>2</sup>C address and allow up to four devices to share the same I<sup>2</sup>C bus. The TCA1116 consists of two 8-bit Configuration (input or output selection), Input Port, Output Port, and Polarity Inversion (active-high or active-low operation) registers. At power-on, the I/Os are configured as inputs. The system master can enable the I/Os as either inputs or outputs by writing to the I/O configuration bits. The data for each input or output is kept in the corresponding Input or output register. The polarity of the Input Port register can be inverted with the Polarity Inversion register. All registers can be read by the system master.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



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.

## DESCRIPTION CONTINUED

The system master can reset the TCA1116 in the event of a time-out or other improper operation by asserting a low in the **RESET** input. The power-on reset puts the registers in their default state and initializes the I<sup>2</sup>C/SMBus state machine. Asserting **RESET** causes the same reset/initialization to occur without depowering the part.

The TCA1116 open-drain interrupt (**INT**) output is activated when any input state differs from its corresponding Input Port register state and is used to indicate to the system master that an input state has changed.

**INT** can be connected to the interrupt input of a microcontroller. By sending an interrupt signal on this line, the remote I/O can inform the microcontroller if there is incoming data on its ports without having to communicate via the I<sup>2</sup>C bus. Thus, the TCA1116 can remain a simple slave device.

The device outputs (latched) have high-current drive capability for directly driving LEDs. The device has low current consumption.

## ORDERING INFORMATION

| T <sub>A</sub> | PACKAGE <sup>(1)</sup> (2) |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|----------------------------|--------------|-----------------------|------------------|
| –40°C to 85°C  | TSSOP – PW                 | Reel of 2000 | TCA1116PWR            | RL116            |
|                | QFN – RTW                  | Reel of 3000 | TCA1116RTWR           | RL116            |

(1) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).

(2) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at [www.ti.com](http://www.ti.com).

To request a full data sheet, please send an email to:

[ual\\_i2c@list.ti.com](mailto:ual_i2c@list.ti.com)

## PACKAGING INFORMATION

| Orderable part number | Status<br>(1) | Material type<br>(2) | Package   Pins  | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C)    | Part marking<br>(6) |
|-----------------------|---------------|----------------------|-----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|-----------------|---------------------|
| TCA1116PWR.A          | Active        | Production           | TSSOP (PW)   24 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | See TCA1116PWR  | RL116               |
| TCA1116RTWR.A         | Active        | Production           | WQFN (RTW)   24 | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | See TCA1116RTWR | RL116               |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **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.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **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.

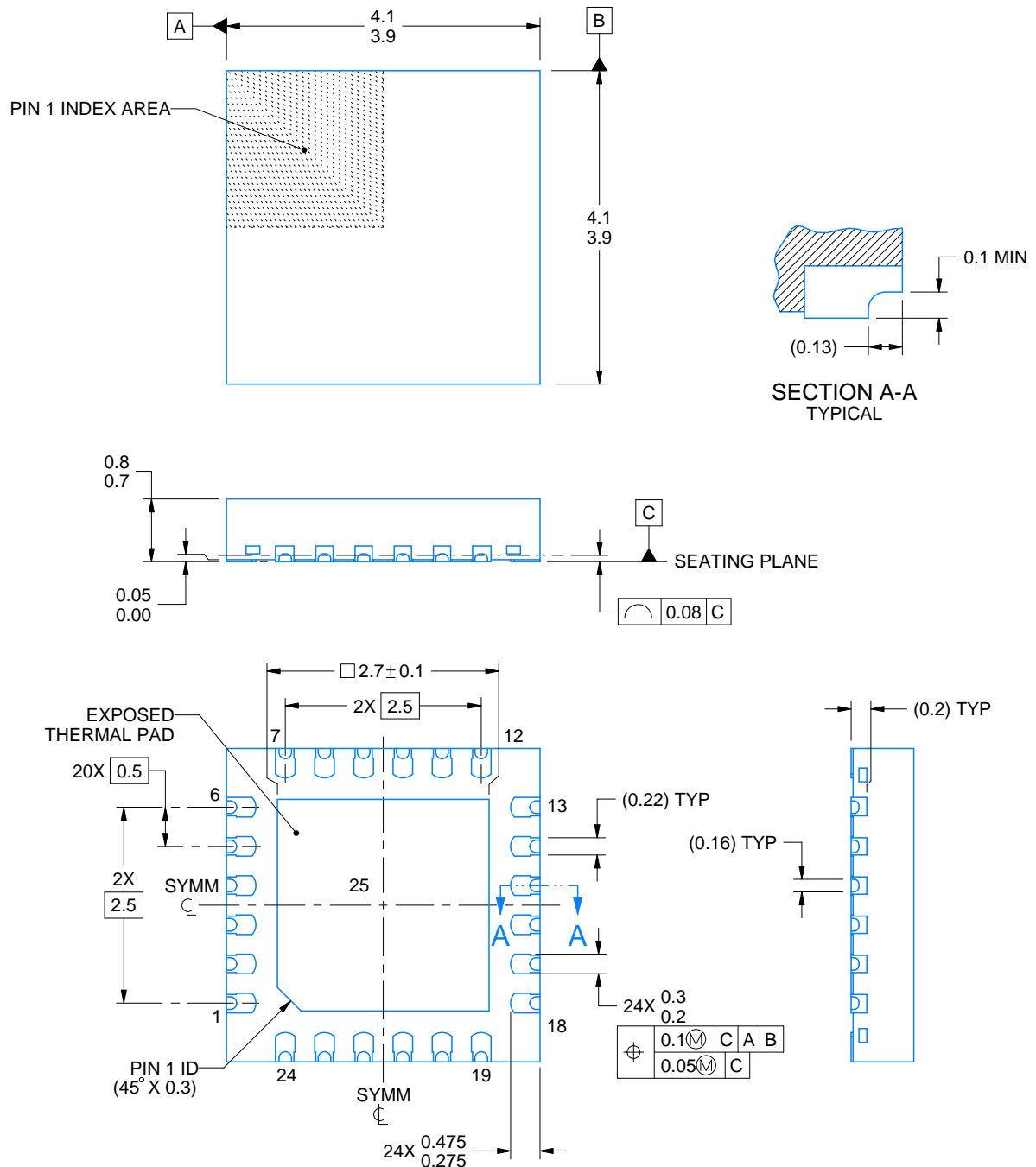
<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature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

<sup>(6)</sup> **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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4232062/A 07/2025

## NOTES:

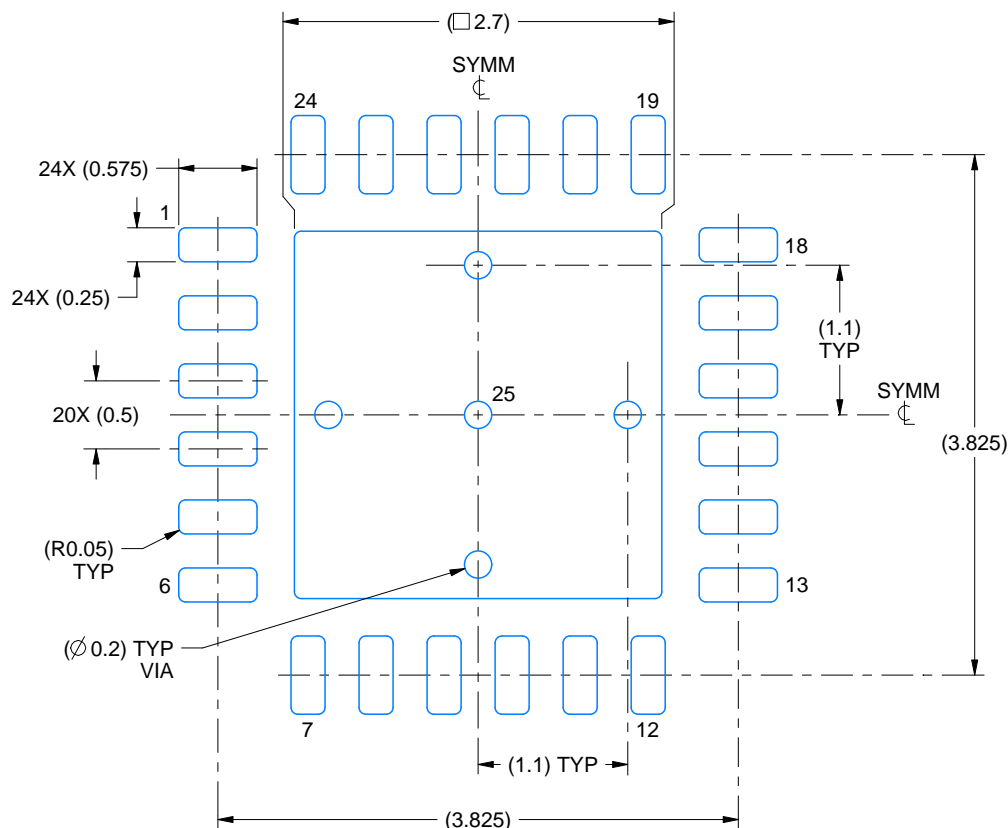
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.
4. Reference JEDEC registration MO-220.

# EXAMPLE BOARD LAYOUT

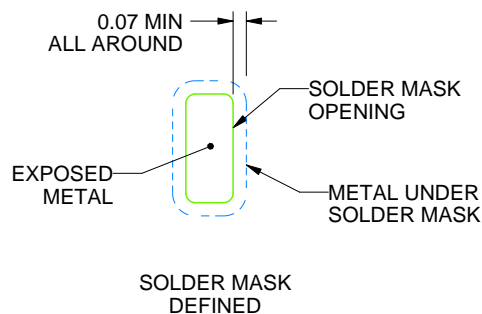
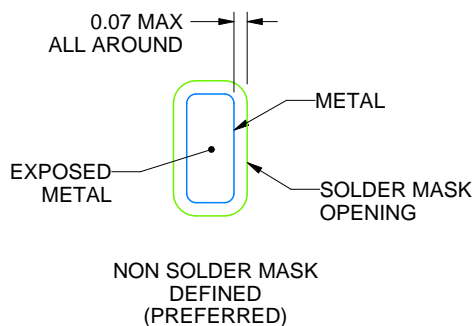
RTW0024AD

WQFN - 0.8 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:18X



SOLDER MASK DETAILS

4232062/A 07/2025

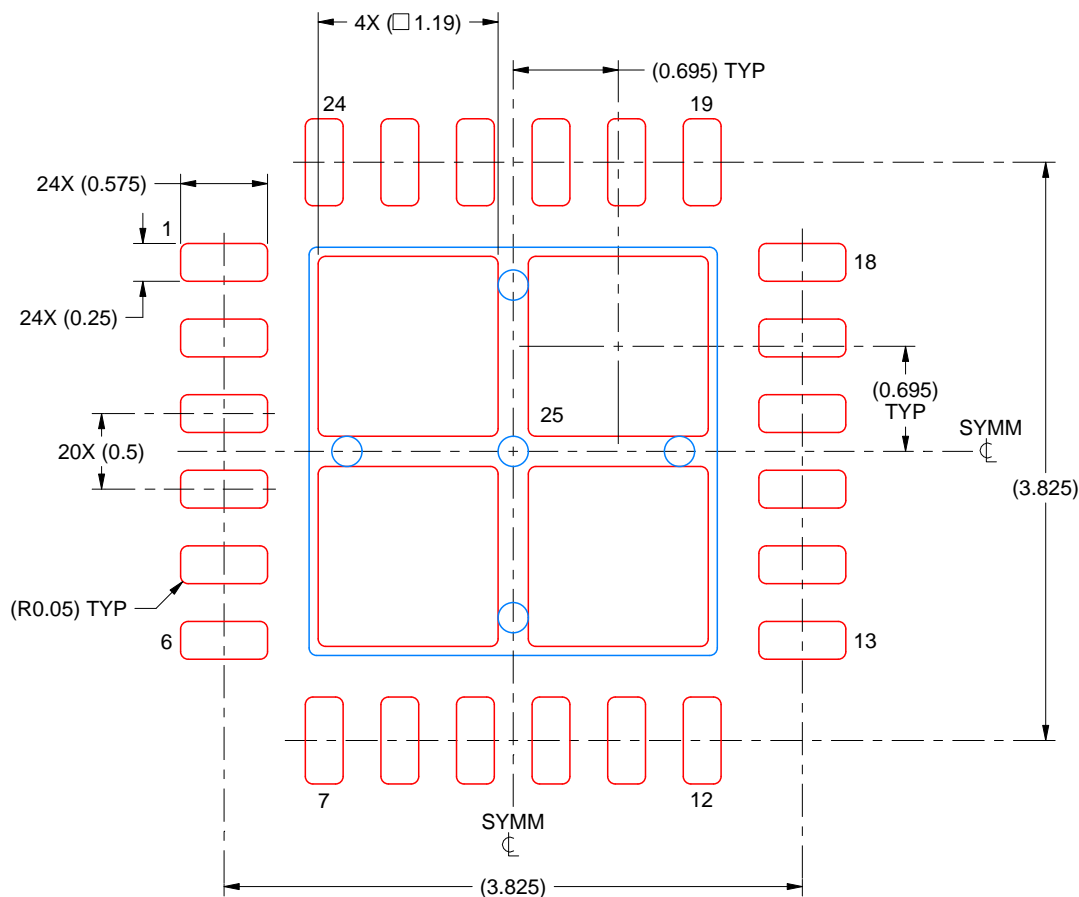
NOTES: (continued)

5. 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/sluea271](http://www.ti.com/lit/sluea271)).
6. 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.

RTW0024AD

### WQFN - 0.8 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



## SOLDER PASTE EXAMPLE BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 25  
78% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE  
SCALE:20X

4232062/A 07/2025

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

## PACKAGE OUTLINE

WQFN - 0.8 mm max height

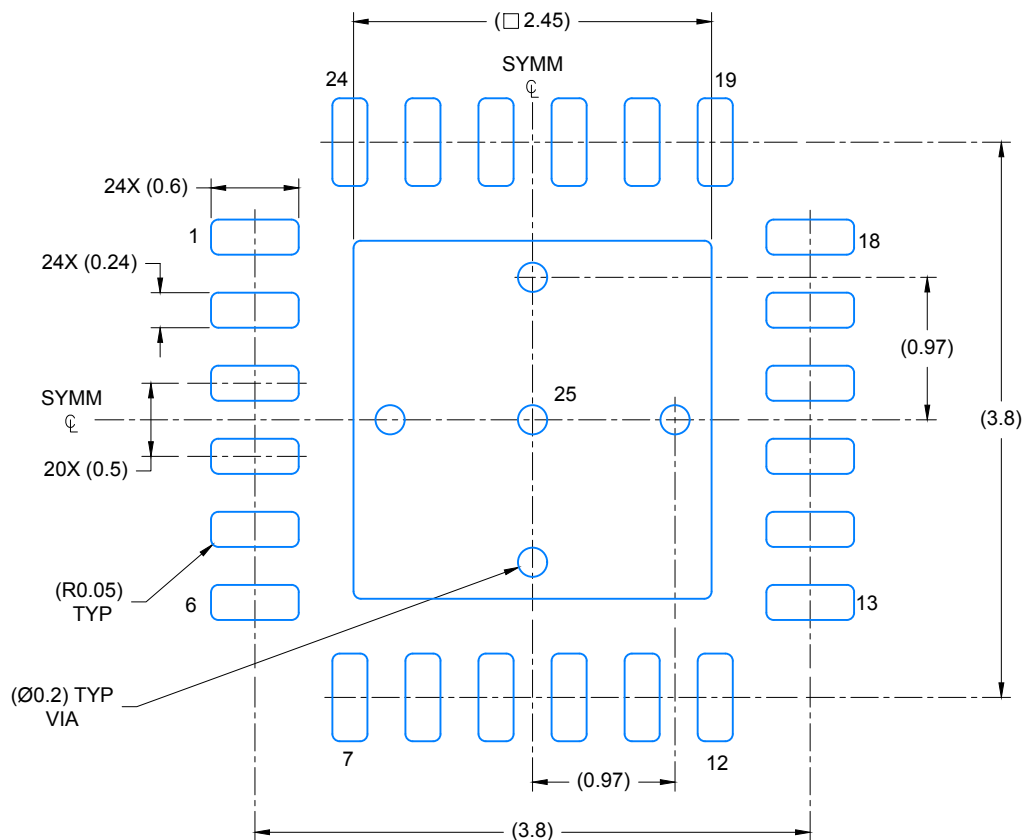
The drawing illustrates the mechanical specifications of the BGA package through three views:

- Top View:** Shows the square footprint with a side length of 4.15 (3.85). A shaded region on the left is designated as the "PIN 1 INDEX AREA".
- Side View:** Shows the package height of 0.8 MAX and a thickness of 0.05 (0.00). It identifies the "SEATING PLANE" and includes a surface finish symbol with a 0.08 C requirement.
- Detail View:** Provides a close-up of the solder balls. It shows a 25x25 grid of balls with a pitch of 0.5. The central area is labeled "EXPOSED THERMAL PAD". Various dimensions for the ball array and pad are provided, including 2X 2.5, 20X 0.5, 24X 0.3, and 24X 0.5. Symmetry (SYMM) is indicated for both horizontal and vertical axes. A positional tolerance of 0.1 (M) C A B and a circular runout tolerance of 0.05 (M) C are specified for the ball array.

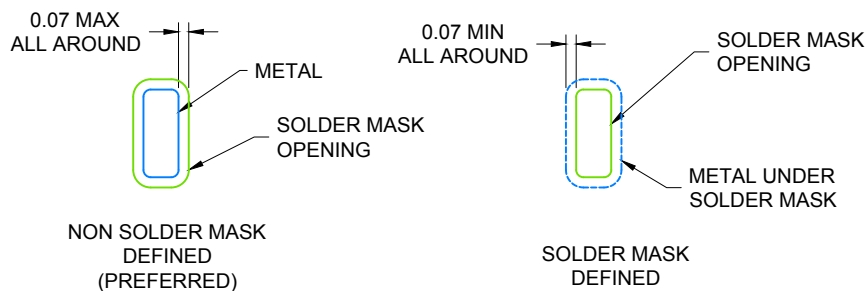
NOTES:

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  
SCALE: 20X

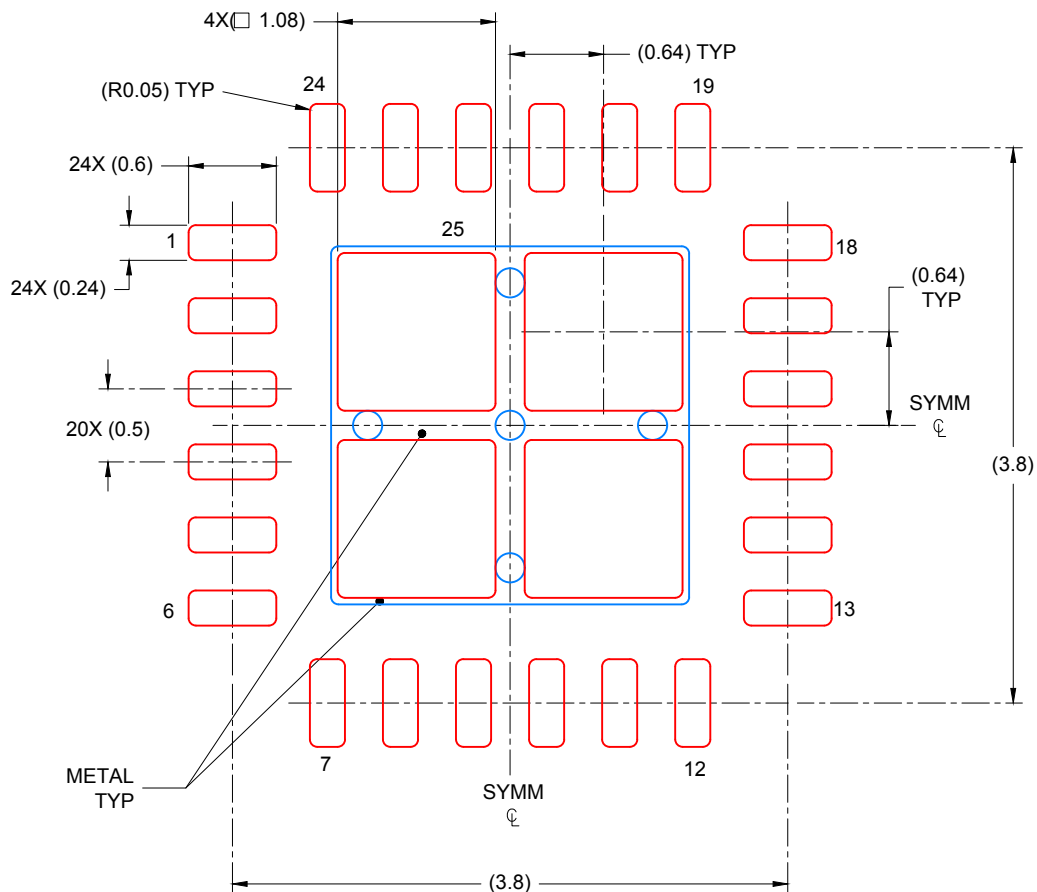


SOLDER MASK DETAILS

4219135/B 11/2016

NOTES: (continued)

- For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/sluea271](http://www.ti.com/lit/sluea271)).



SOLDER PASTE EXAMPLE  
 BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 25:  
 78% PRINTED COVERAGE BY AREA UNDER PACKAGE  
 SCALE: 20X

4219135/B 11/2016

NOTES: (continued)

4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

## GENERIC PACKAGE VIEW

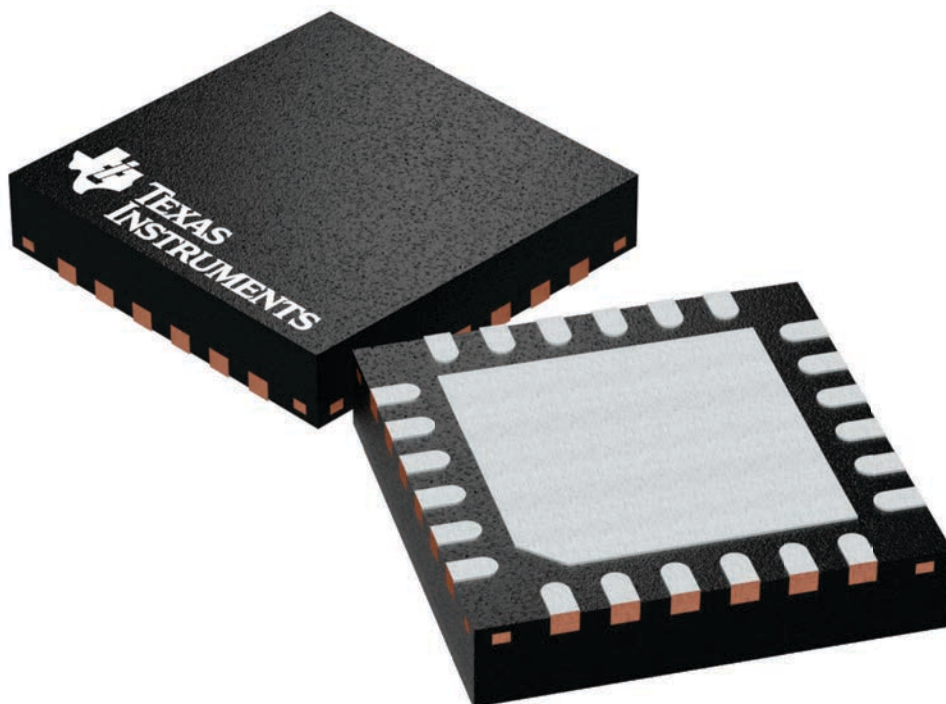
**RTW 24**

**WQFN - 0.8 mm max height**

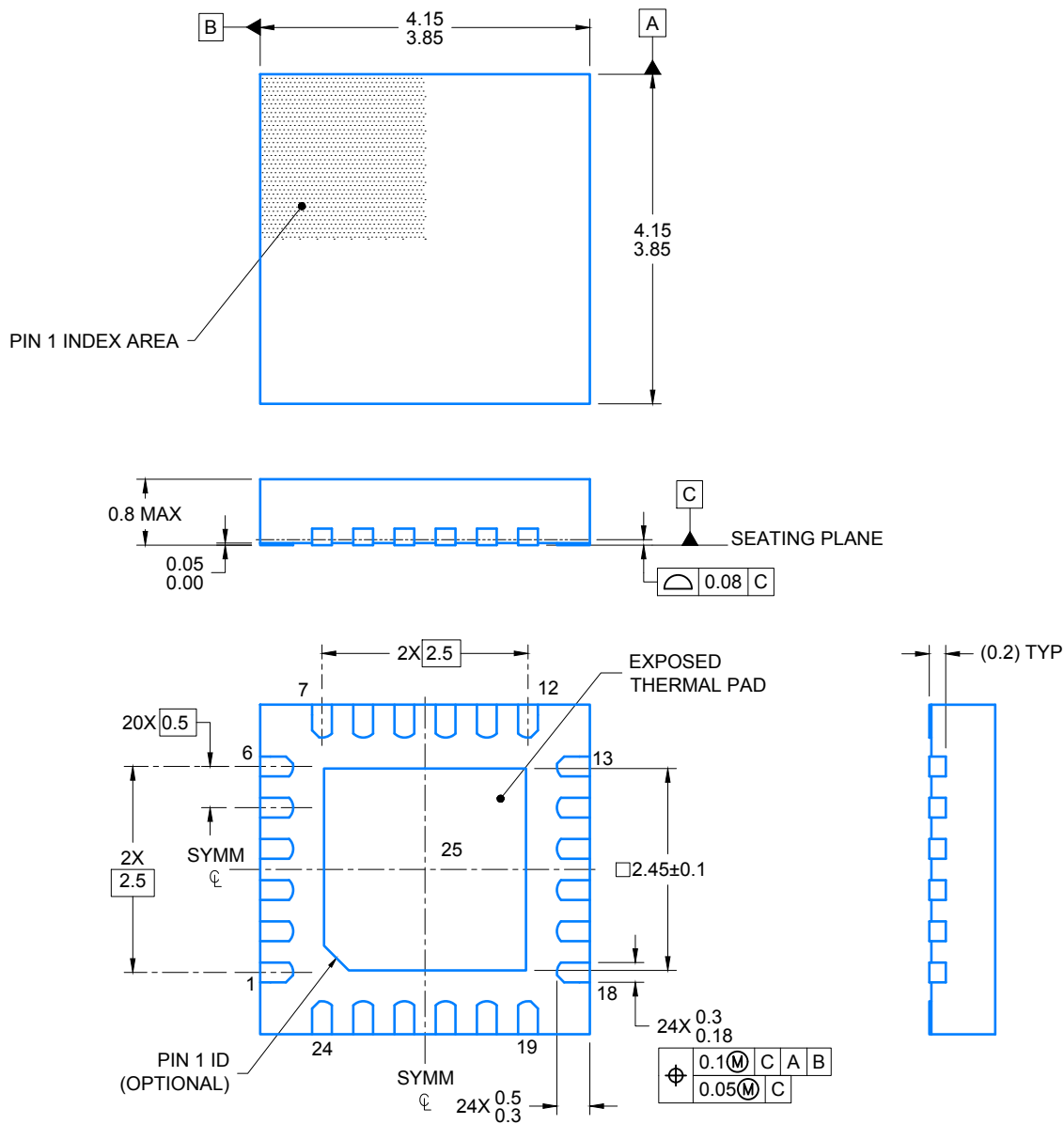
4 x 4, 0.5 mm pitch

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.



4224801/A



4219135/B 11/2016

## 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.

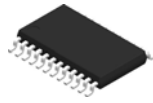
**WQFN - 0.8 mm max height**

[illegible]

4219135/B 11/2016

3. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/sl原因271](http://www.ti.com/lit/sl原因271)).

PLASTIC QUAD FLATPACK-NO LEAD



4220208/A 02/2017

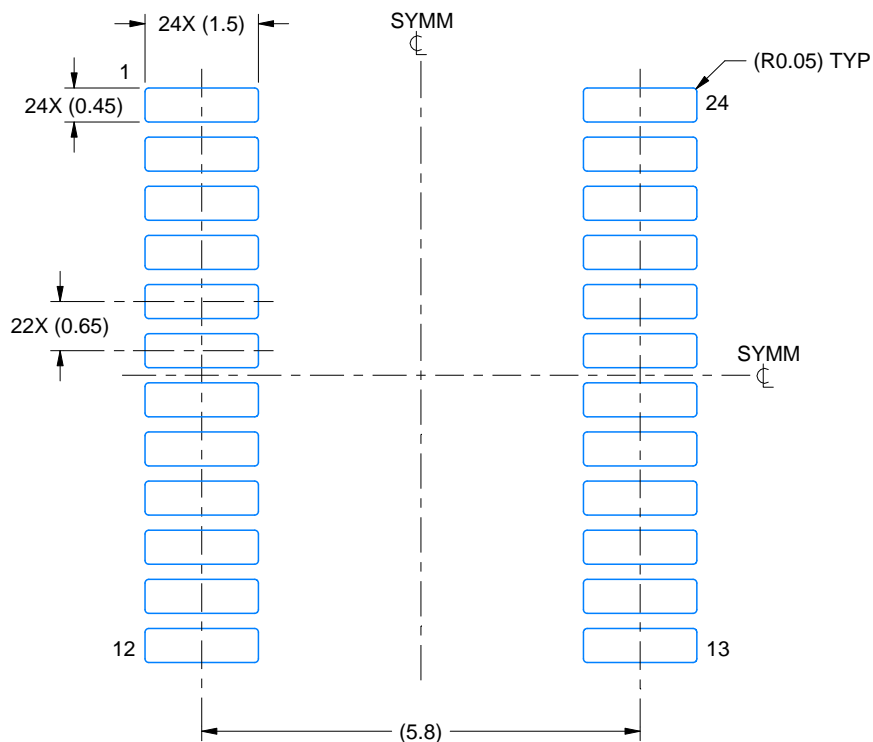
## NOTES:

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. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

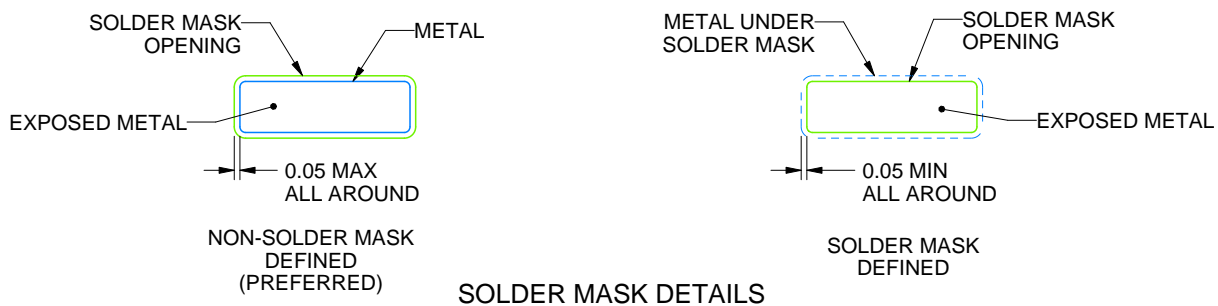
**PW0024A**

## TSSOP - 1.2 mm max height

## SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



4220208/A 02/2017

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



# EXAMPLE STENCIL DESIGN

PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 10X

4220208/A 02/2017

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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