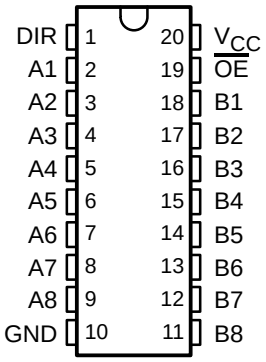
- **Q Devices Meet Automotive Performance Requirements**
- **Customer-Specific Configuration Control Can Be Supported Along With Major-Change Approval**
- **Operating Range 2-V to 5.5-V $V_{CC}$**
- **Latch-Up Performance Exceeds 250 mA Per JESD 17**

**DW OR PW PACKAGE**
**(TOP VIEW)**




## description

The SN74AHC245Q octal bus transceiver is designed for asynchronous two-way communication between data buses. The control-function implementation minimizes external timing requirements.

This device allows data transmission from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction-control (DIR) input. The output-enable ($\overline{OE}$) input can be used to disable the device so that the buses are effectively isolated.

To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to $V_{CC}$ through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

**ORDERING INFORMATION**

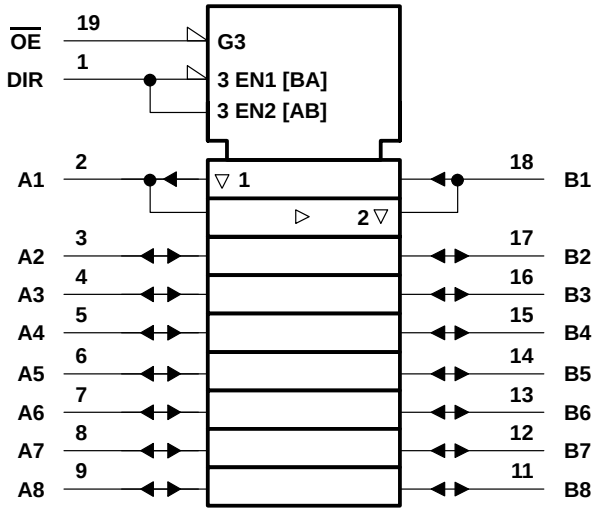
| $T_A$ | PACKAGE† | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---|---|---|---|---|
| –40°C to 125°C | SOIC – DW | Tape and reel | SN74AHC245QDWR | AHC245Q |
| | TSSOP – PW | Tape and reel | SN74AHC245QPWR | HA245Q |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

**FUNCTION TABLE**
**(each transceiver)**

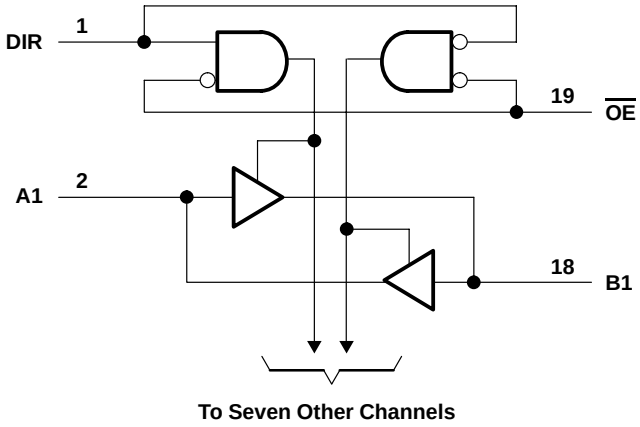
| INPUTS | | OPERATION |
|---|---|---|
| $\overline{OE}$ | DIR | |
| L | L | B data to A bus |
| L | H | A data to B bus |
| H | X | Isolation |

## logic symbol†




† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

## logic diagram (positive logic)



### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, $V_{CC}$ . . . . . –0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1): Control inputs . . . . . –0.5 V to 7 V
I/O, output voltage range, $V_O$ (see Note 1) . . . . . –0.5 V to $V_{CC}$ + 0.5 V
Input clamp current, $I_{IK}$ ($V_I$ < 0): Control inputs . . . . . –20 mA
I/O, output clamp current, $I_{OK}$ ($V_O$ < 0 or $V_O$ > $V_{CC}$) . . . . . ±20 mA
Continuous output current, $I_O$ ($V_O$ = 0 to $V_{CC}$) . . . . . ±25 mA
Continuous current through $V_{CC}$ or GND . . . . . ±75 mA
Package thermal impedance, $\theta_{JA}$ (see Note 2): DW package . . . . . 58°C/W
PW package . . . . . 83°C/W
Storage temperature range, $T_{stg}$ . . . . . –65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

### recommended operating conditions (see Note 3)

| | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | 2 | 5.5 | V |
| $V_{IH}$ | High-level input voltage | $V_{CC}$ = 2 V | 1.5 | | V |
| | | $V_{CC}$ = 3 V | 2.1 | | |
| | | $V_{CC}$ = 5.5 V | 3.85 | | |
| $V_{IL}$ | Low-level input voltage | $V_{CC}$ = 2 V | | 0.5 | V |
| | | $V_{CC}$ = 3 V | | 0.9 | |
| | | $V_{CC}$ = 5.5 V | | 1.65 | |
| $V_I$ | Input voltage | $\overline{OE}$ or DIR | 0 | 5.5 | V |
| $V_O$ | Output voltage | A or B | 0 | $V_{CC}$ | V |
| $I_{OH}$ | High-level output current | $V_{CC}$ = 2 V | | –50 | μA |
| | | $V_{CC}$ = 3.3 V ± 0.3 V | | –4 | mA |
| | | $V_{CC}$ = 5 V ± 0.5 V | | –8 | |
| $I_{OL}$ | Low-level output current | $V_{CC}$ = 2 V | | 50 | μA |
| | | $V_{CC}$ = 3.3 V ± 0.3 V | | 4 | mA |
| | | $V_{CC}$ = 5 V ± 0.5 V | | 8 | |
| $\Delta t/\Delta v$ | Input transition rise or fall rate | $V_{CC}$ = 3.3 V ± 0.3 V | | 100 | ns/V |
| | | $V_{CC}$ = 5 V ± 0.5 V | | 20 | |
| $T_A$ | Operating free-air temperature | | –40 | 125 | °C |

NOTE 3: All unused inputs of the device must be held at $V_{CC}$ or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | $V_{CC}$ | $T_A$ = 25°C | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | | | |
| $V_{OH}$ | | $I_{OH}$ = –50 μA | 2 V | 1.9 | 2 | | 1.9 | | V |
| | | | 3 V | 2.9 | 3 | | 2.9 | | |
| | | | 4.5 V | 4.4 | 4.5 | | 4.4 | | |
| | | $I_{OH}$ = –4 mA | 3 V | 2.58 | | | 2.48 | | |
| | | $I_{OH}$ = –8 mA | 4.5 V | 3.94 | | | 3.8 | | |
| $V_{OL}$ | | $I_{OL}$ = 50 μA | 2 V | | | 0.1 | | 0.1 | V |
| | | | 3 V | | | 0.1 | | 0.1 | |
| | | | 4.5 V | | | 0.1 | | 0.1 | |
| | | $I_{OL}$ = 4 mA | 3 V | | | 0.36 | | 0.5 | |
| | | $I_{OL}$ = 8 mA | 4.5 V | | | 0.36 | | 0.5 | |
| $I_I$ | A or B inputs | $V_I$ = 5.5 V or GND | 5.5 V | | | ±0.1 | | ±1 | μA |
| | $\overline{OE}$ or DIR | | 0 V to 5.5 V | | | ±0.1 | | ±1 | |
| $I_{OZ}$† | | $V_O = V_{CC}$ or GND, $V_I$ ($\overline{OE}$) = $V_{IL}$ or $V_{IH}$ | 5.5 V | | | ±0.25 | | ±2.5 | μA |
| $I_{CC}$ | | $V_I = V_{CC}$ or GND, $I_O$ = 0 | 5.5 V | | | 4 | | 40 | μA |
| $C_i$ | $\overline{OE}$ or DIR | $V_I = V_{CC}$ or GND | 5 V | | 2.5 | 10 | | | pF |
| $C_{io}$ | A or B inputs | $V_I = V_{CC}$ or GND | 5 V | | 4 | | | | pF |

† The parameter $I_{OZ}$ includes the input leakage current.

## switching characteristics over recommended operating free-air temperature range, $V_{CC}$ = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | LOAD CAPACITANCE | $T_A$ = 25°C | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | | | |
| $t_{PLH}$ | A or B | B or A | $C_L$ = 15 pF | | 5.8 | 8.4 | 1 | 10 | ns |
| $t_{PHL}$ | | | | | 5.8 | 8.4 | 1 | 10 | |
| $t_{PZH}$ | $\overline{OE}$ | A or B | $C_L$ = 15 pF | | 8.5 | 13.2 | 1 | 15.5 | ns |
| $t_{PZL}$ | | | | | 8.5 | 13.2 | 1 | 15.5 | |
| $t_{PHZ}$ | $\overline{OE}$ | A or B | $C_L$ = 15 pF | | 8.9 | 12.5 | 1 | 15.5 | ns |
| $t_{PLZ}$ | | | | | 8.9 | 12.5 | 1 | 15.5 | |
| $t_{PLH}$ | A or B | B or A | $C_L$ = 50 pF | | 8.3 | 11.9 | 1 | 13.5 | ns |
| $t_{PHL}$ | | | | | 8.3 | 11.9 | 1 | 13.5 | |
| $t_{PZH}$ | $\overline{OE}$ | A or B | $C_L$ = 50 pF | | 11 | 16.7 | 1 | 19 | ns |
| $t_{PZL}$ | | | | | 11 | 16.7 | 1 | 19 | |
| $t_{PHZ}$ | $\overline{OE}$ | A or B | $C_L$ = 50 pF | | 11.5 | 15.8 | 1 | 18 | ns |
| $t_{PLZ}$ | | | | | 11.5 | 15.8 | 1 | 18 | |

**switching characteristics over recommended operating free-air temperature range, $V_{CC}$ = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)**

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | LOAD CAPACITANCE | $T_A$ = 25°C | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | | | |
| $t_{PLH}$ | A or B | B or A | $C_L$ = 15 pF | | 4 | 5.5 | 1 | 6.5 | ns |
| $t_{PHL}$ | | | | | 4 | 5.5 | 1 | 6.5 | |
| $t_{PZH}$ | $\overline{OE}$ | A or B | $C_L$ = 15 pF | | 5.8 | 8.5 | 1 | 10 | ns |
| $t_{PZL}$ | | | | | 5.8 | 8.5 | 1 | 10 | |
| $t_{PHZ}$ | $\overline{OE}$ | A or B | $C_L$ = 15 pF | | 5.6 | 7.8 | 1 | 9.2 | ns |
| $t_{PLZ}$ | | | | | 5.6 | 7.8 | 1 | 9.2 | |
| $t_{PLH}$ | A or B | B or A | $C_L$ = 50 pF | | 5.5 | 7.5 | 1 | 8.5 | ns |
| $t_{PHL}$ | | | | | 5.5 | 7.5 | 1 | 8.5 | |
| $t_{PZH}$ | $\overline{OE}$ | A or B | $C_L$ = 50 pF | | 7.3 | 10.6 | 1 | 12 | ns |
| $t_{PZL}$ | | | | | 7.3 | 10.6 | 1 | 12 | |
| $t_{PHZ}$ | $\overline{OE}$ | A or B | $C_L$ = 50 pF | | 7 | 9.7 | 1 | 11 | ns |
| $t_{PLZ}$ | | | | | 7 | 9.7 | 1 | 11 | |

**noise characteristics, $V_{CC}$ = 5 V, $C_L$ = 50 pF, $T_A$ = 25°C (see Note 4)**

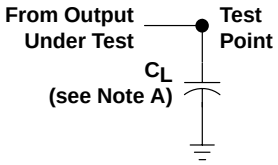
| PARAMETER | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| $V_{OL(P)}$ | Quiet output, maximum dynamic $V_{OL}$ | | 0.9 | | V |
| $V_{OL(V)}$ | Quiet output, minimum dynamic $V_{OL}$ | | –0.9 | | V |
| $V_{OH(V)}$ | Quiet output, minimum dynamic $V_{OH}$ | | 4.3 | | V |
| $V_{IH(D)}$ | High-level dynamic input voltage | 3.5 | | | V |
| $V_{IL(D)}$ | Low-level dynamic input voltage | | | 1.5 | V |

NOTE 4: Characteristics are for surface-mount packages only.

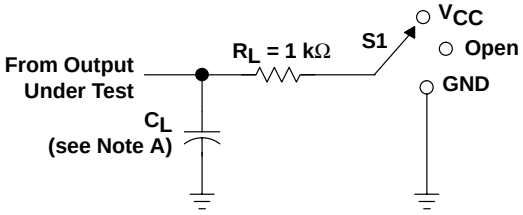
**operating characteristics, $V_{CC}$ = 5 V, $T_A$ = 25°C**

| PARAMETER | | TEST CONDITIONS | | TYP | UNIT |
|---|---|---|---|---|---|
| $C_{pd}$ | Power dissipation capacitance | No load, | f = 1 MHz | 14 | pF |

## PARAMETER MEASUREMENT INFORMATION

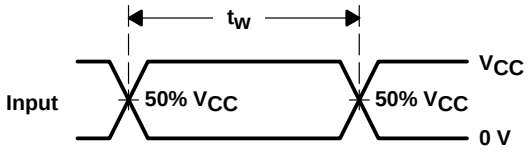



LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS

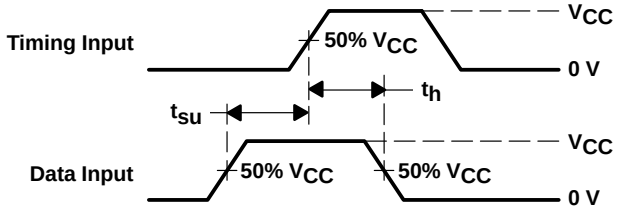



LOAD CIRCUIT FOR
3-STATE AND OPEN-DRAIN OUTPUTS

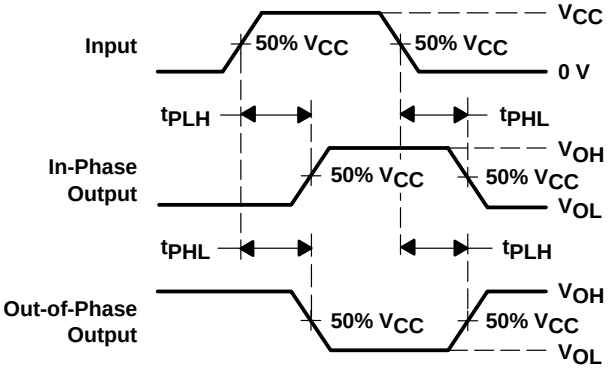
| TEST | S1 |
|---|---|
| $t_{PLH}/t_{PHL}$ | Open |
| $t_{PLZ}/t_{PZL}$ | $V_{CC}$ |
| $t_{PHZ}/t_{PZH}$ | GND |
| Open Drain | $V_{CC}$ |



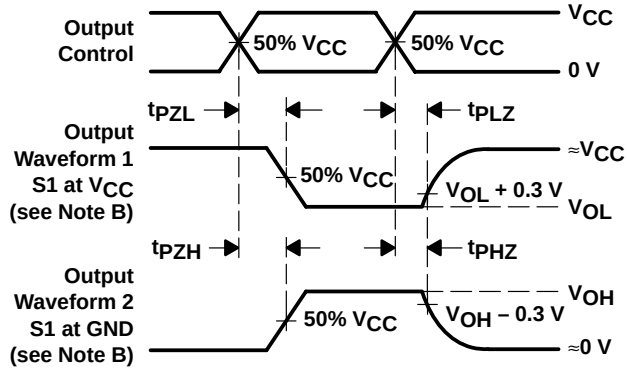

VOLTAGE WAVEFORMS
PULSE DURATION




VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES




VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS




VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

NOTES: A. $C_L$ includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
C. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, $Z_O$ = 50 Ω, $t_r$ ≤ 3 ns, $t_f$ ≤ 3 ns.
D. The outputs are measured one at a time with one input transition per measurement.

**Figure 1. Load Circuit and Voltage Waveforms**

## 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) |
|---|---|---|---|---|---|---|---|---|---|
| SN74AHC245QDWRG4Q1 | Active | Production | SOIC (DW) \| 20 | 2000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | - | AHC245Q1 |
| SN74AHC245QDWRG4Q1.A | Active | Production | SOIC (DW) \| 20 | 2000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | AHC245Q1 |
| SN74AHC245QPWR | Active | Production | TSSOP (PW) \| 20 | 2000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | HA245Q |
| SN74AHC245QPWR.A | Active | Production | TSSOP (PW) \| 20 | 2000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | HA245Q |
| SN74AHC245QPWRG4 | Active | Production | TSSOP (PW) \| 20 | 2000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | - | HA245Q |
| SN74AHC245QPWRG4.A | Active | Production | TSSOP (PW) \| 20 | 2000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | HA245Q |

(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.

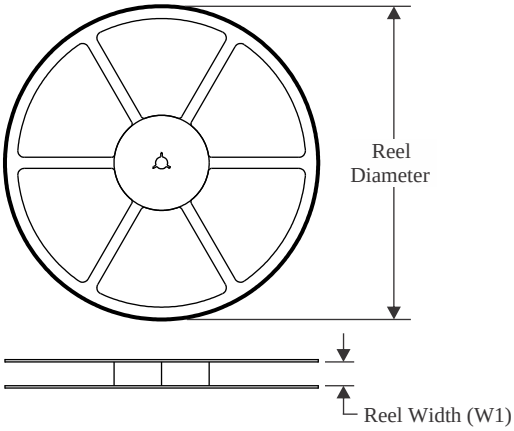
(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will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

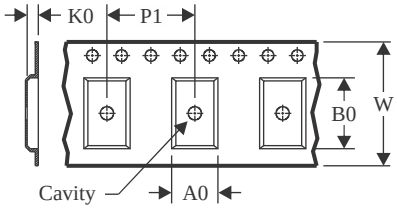
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

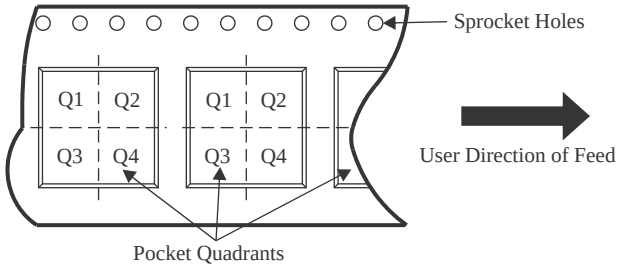



**TAPE DIMENSIONS**




| | |
|---|---|
| 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 |

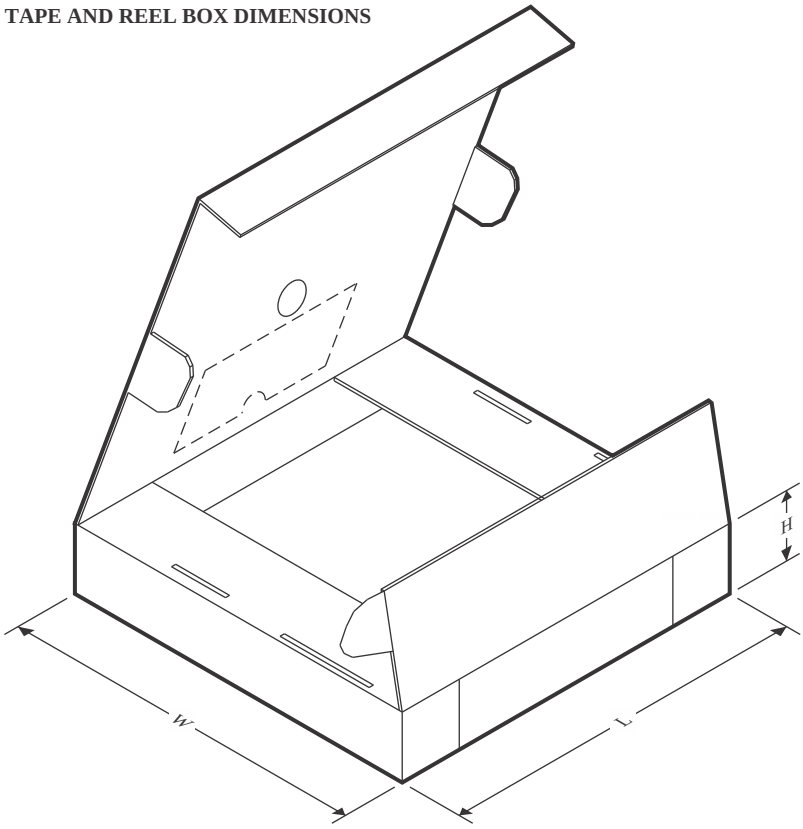
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**




*All dimensions are nominal

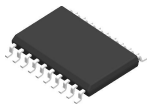
| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SN74AHC245QDWRG4Q1 | SOIC | DW | 20 | 2000 | 330.0 | 24.4 | 10.8 | 13.3 | 2.7 | 12.0 | 24.0 | Q1 |
| SN74AHC245QPWR | TSSOP | PW | 20 | 2000 | 330.0 | 16.4 | 6.95 | 7.0 | 1.4 | 8.0 | 16.0 | Q1 |
| SN74AHC245QPWRG4 | TSSOP | PW | 20 | 2000 | 330.0 | 16.4 | 6.95 | 7.1 | 1.6 | 8.0 | 16.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS




*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| SN74AHC245QDWRG4Q1 | SOIC | DW | 20 | 2000 | 367.0 | 367.0 | 45.0 |
| SN74AHC245QPWR | TSSOP | PW | 20 | 2000 | 356.0 | 356.0 | 35.0 |
| SN74AHC245QPWRG4 | TSSOP | PW | 20 | 2000 | 356.0 | 356.0 | 35.0 |

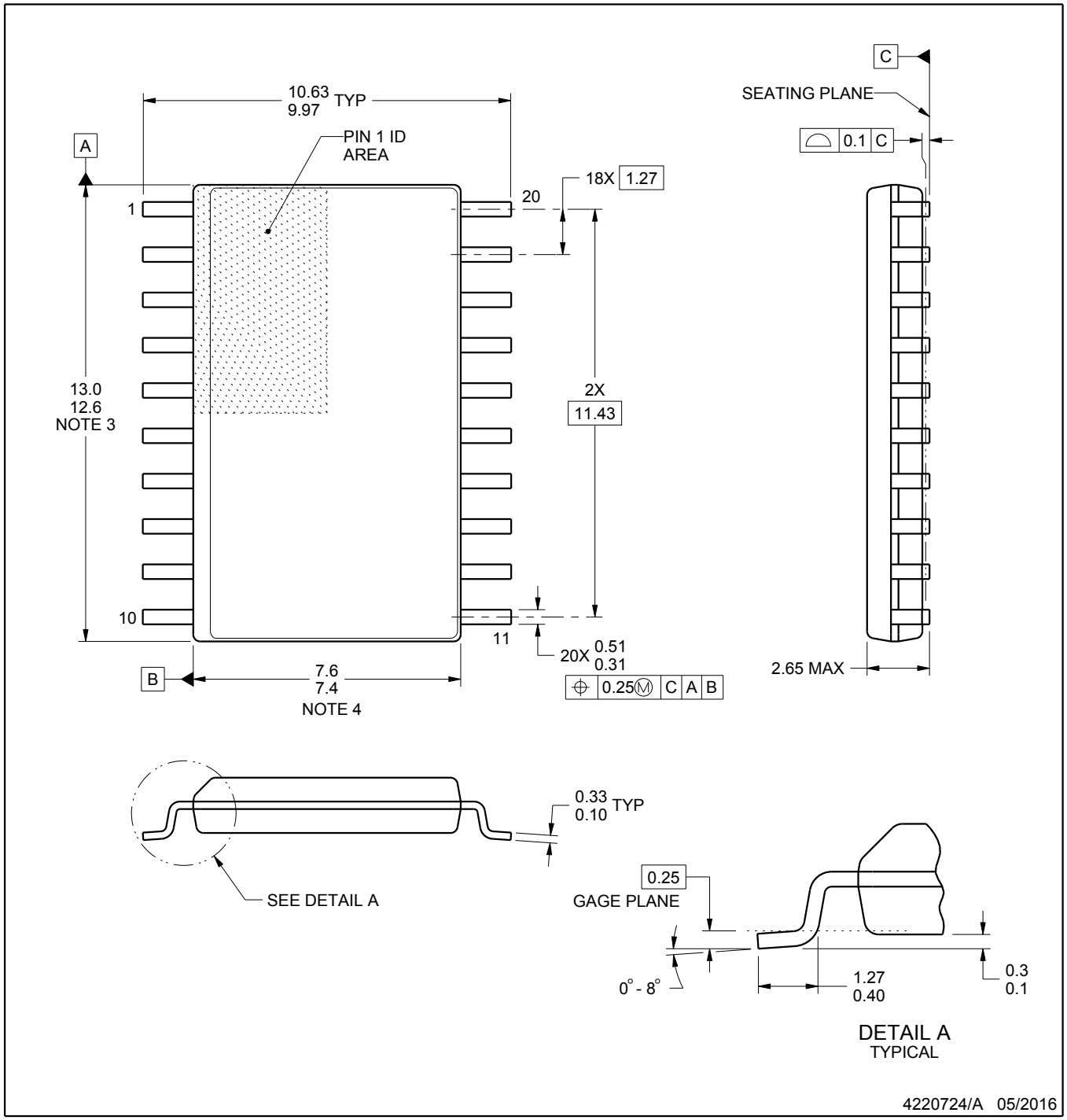


# PACKAGE OUTLINE

## DW0020A

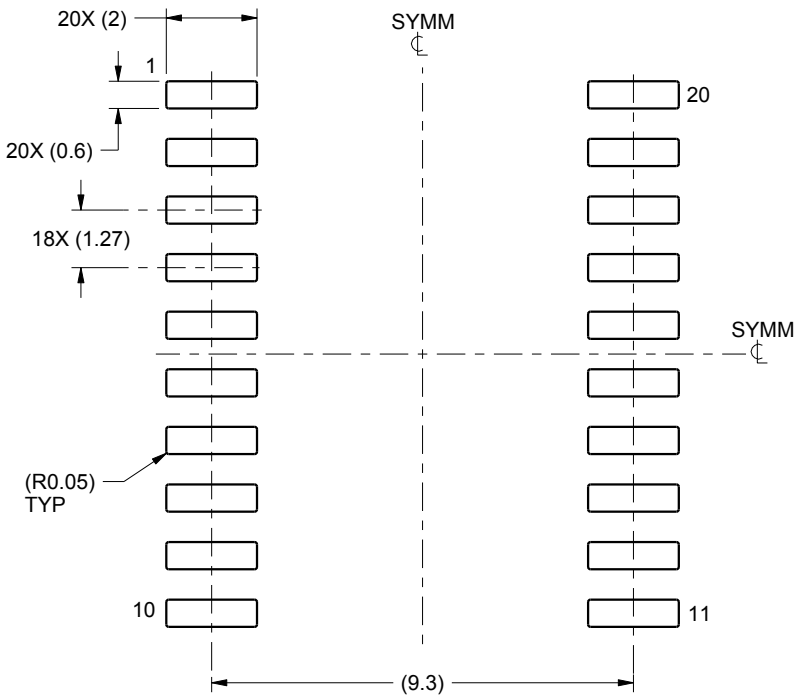
## SOIC - 2.65 mm max height

SOIC

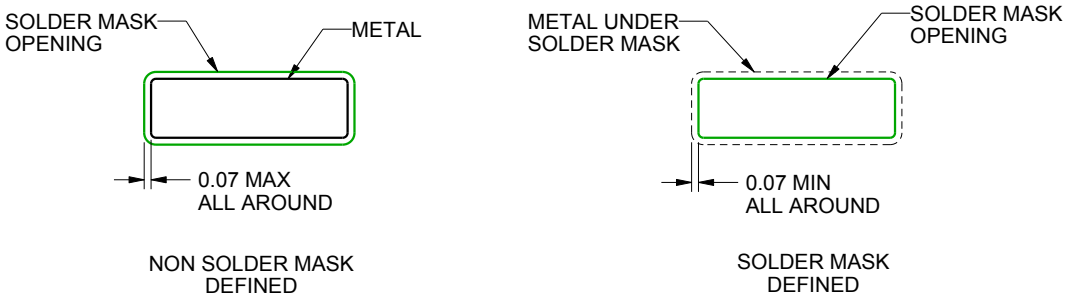



NOTES:

1. All linear dimensions are in millimeters. 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 0.43 mm per side.
5. Reference JEDEC registration MS-013.




LAND PATTERN EXAMPLE
SCALE:6X

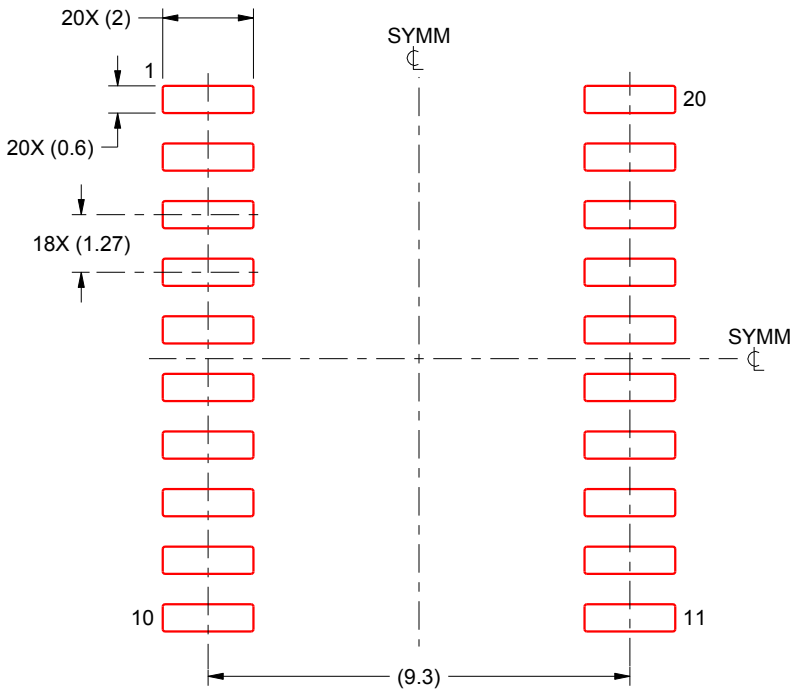



SOLDER MASK DETAILS

4220724/A 05/2016

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.




SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:6X

4220724/A 05/2016

NOTES: (continued)

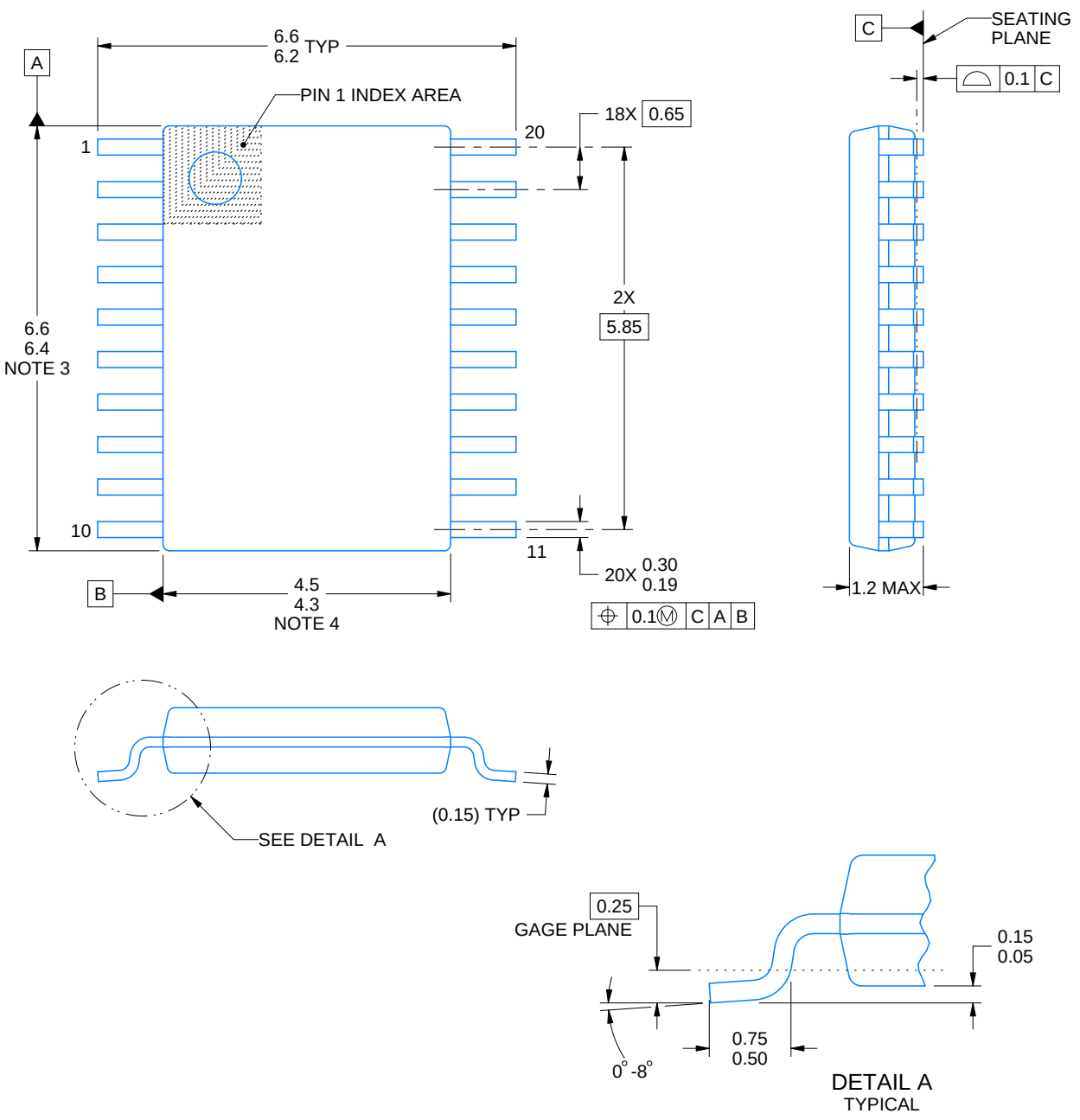
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

# PACKAGE OUTLINE

## PW0020A

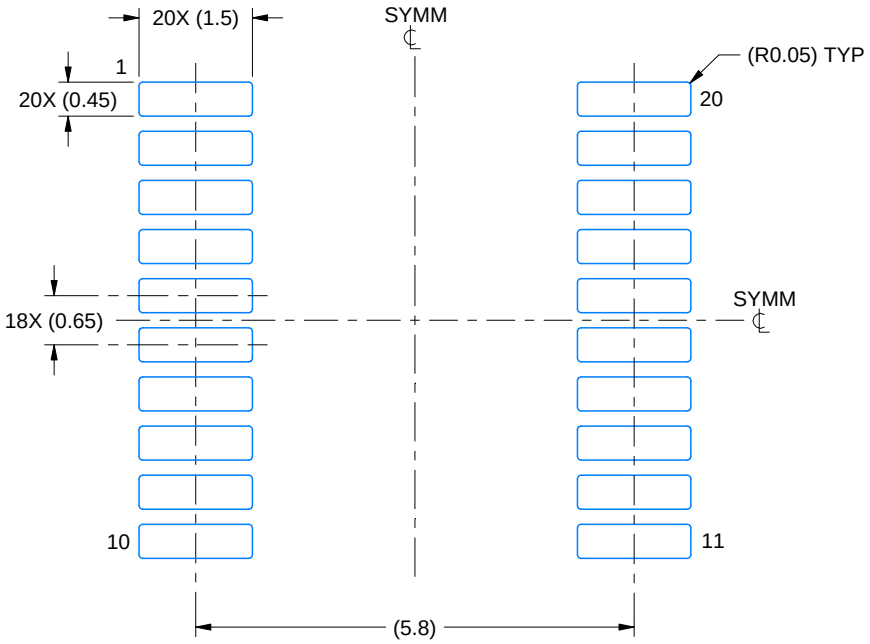
## TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE




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.




LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X


SOLDER MASK DETAILS

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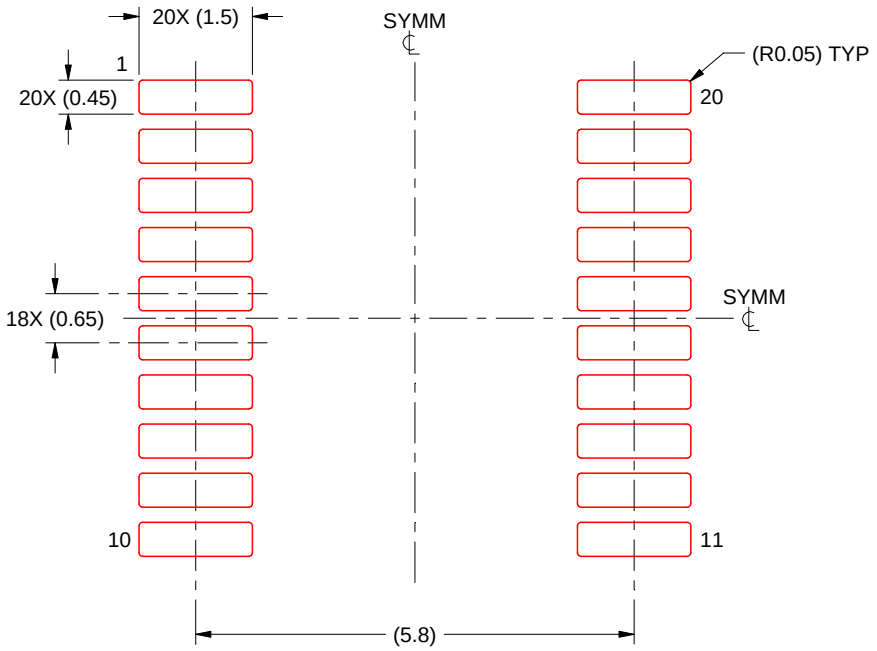
NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.




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

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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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