

# SN74LV595A-Q1 3 ステート出力レジスタ搭載 8 ビット・シフト・レジスタ

## 1 特長

- 車載アプリケーション認定済み
- ウェットابل・フランク QFN (WBQB) パッケージで供給
- お客様固有の構成の管理は、大幅変更承認によって対応可能
- 2V~5.5V の  $V_{CC}$  で動作
- 標準  $V_{OLP}$  (出力グランド・バウンス)  $< 0.8V$  ( $V_{CC} = 3.3V$ ,  $T_A = 25^\circ C$ )
- 標準  $V_{OHV}$  (出力  $V_{OH}$  アンダーシュート)  $> 2.3V$  ( $V_{CC} = 3.3V$ ,  $T_A = 25^\circ C$ )
- すべてのポートで混合モード電圧動作をサポート
- 8 ビットのシリアル・イン / パラレル・アウト・シフト
- $I_{off}$  により部分的パワーダウン・モードでの動作をサポート
- シフト・レジスタはダイレクト・クリアを装備

## 2 アプリケーション

- 出力拡張
- LED マトリクス制御
- 7 セグメント・ディスプレイ制御

## 3 説明

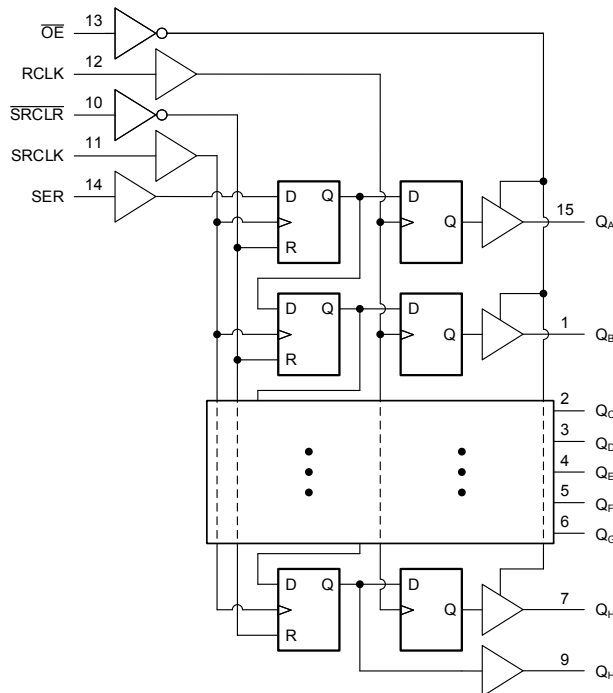
SN74LV595A-Q1 には、8 ビットのシリアル・イン、パラレル・アウトのシフト・レジスタが内蔵されており、8 ビットの D タイプ・ストレージ・レジスタへデータを供給します。ストレージ・レジスタはパラレル 3 ステート出力を備えています。シフト・レジスタとストレージ・レジスタの両方に、それぞれ独立したクロックが供給されます。シフト・レジスタは、ダイレクト・オーバーライディング・クリア ( $\overline{SRCLR}$ ) 入力、シリアル ( $SER$ ) 入力、カスケード接続用シリアル出力を備えています。出力イネーブル ( $\overline{OE}$ ) 入力が HIGH のとき、 $Q_H$  を除くすべての出力が高インピーダンス状態になります。

このデバイスは、 $I_{off}$  を使用する部分的パワーダウン・アプリケーション用に完全に動作が規定されています。 $I_{off}$  回路が出力をディセーブルにするので、電源切断時にデバイスに電流が逆流して損傷に至ることを回避できます。

### パッケージ情報<sup>(1)</sup>

| 部品番号          | パッケージ           | 本体サイズ (公称)      |
|---------------|-----------------|-----------------|
| SN74LV595A-Q1 | PW (TSSOP, 16)  | 5.00mm × 4.40mm |
|               | WBQB (WQFN, 16) | 3.60mm × 2.60mm |

(1) 利用可能なすべてのパッケージについては、このデータシートの末尾にある注文情報を参照してください。



論理図 (正論理)



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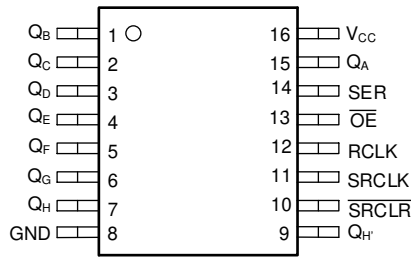
## 4 Revision History

資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

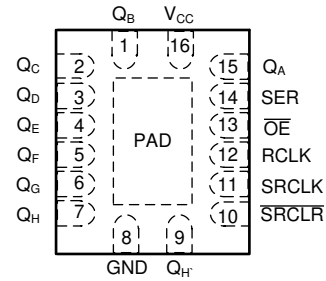
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| • ドキュメントの構造レイアウトを現在の標準に更新.....                                                                                                                                                                                                                                          | 1    |
| • Updated thermal values for PW package from $R_{\theta JA} = 108$ to $138.7$ , $R_{\theta JC}(\text{top}) = 40.8$ to $69.1$ , $R_{\theta JB} = 51.1$ to $81.8$ , $\Psi_{JT} = 3.8$ to $20.3$ , $\Psi_{JB} = 50.6$ to $81.3$ , all values in $^{\circ}\text{C/W}$ ..... | 5    |

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## 5 Pin Configuration and Functions



**図 5-1. PW Package,  
16-Pin TSSOP  
(Top View)**



**図 5-2. WBQB Package,  
16-Pin WQFN  
Transparent (Top View)**

**表 5-1. Pin Functions**

| PIN             |     | TYPE <sup>(1)</sup> | DESCRIPTION                |
|-----------------|-----|---------------------|----------------------------|
| NAME            | NO. |                     |                            |
| GND             | 8   | G                   | Ground                     |
| $\overline{OE}$ | 13  | I                   | Output Enable Pin          |
| QA              | 15  | O                   | QA Output                  |
| QB              | 1   | O                   | QB Output                  |
| QC              | 2   | O                   | QC Output                  |
| QD              | 3   | O                   | QD Output                  |
| QE              | 4   | O                   | QE Output                  |
| QF              | 5   | O                   | QF Output                  |
| QG              | 6   | O                   | QG Output                  |
| QH              | 7   | O                   | QH Output                  |
| QH'             | 9   | O                   | QH' Output                 |
| SRCLR           | 10  | I                   | SRCLR Input                |
| SRCLK           | 11  | I                   | SRCLK Input                |
| RCLK            | 12  | I                   | RCLK Input                 |
| SER             | 14  | I                   | SER Input                  |
| VCC             | 16  | P                   | Positive Supply            |
| PAD             | —   | —                   | Thermal Pad <sup>(2)</sup> |

(1) I = Input, O = Output, I/O = Input or Output, G = Ground, P = Power.

(2) WBQB Package Only

## 6 Specifications

### 6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

|           |                                                                                             | MIN       | MAX            | UNIT   |
|-----------|---------------------------------------------------------------------------------------------|-----------|----------------|--------|
| $V_{CC}$  | Supply voltage range                                                                        | −0.5      | 7.0            | V      |
| $V_I$     | Input voltage range <sup>(2)</sup>                                                          | −0.5      | 7.0            | V      |
| $V_O$     | Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup> | −0.5      | 4.6            | V      |
|           | Output voltage range applied to any output in the high or low state <sup>(2) (3)</sup>      | −0.5      | $V_{CC} + 0.5$ | V      |
| $I_{IK}$  | Input clamp current <sup>(2)</sup>                                                          | $V_I < 0$ |                | −20 mA |
| $I_{OK}$  | Output clamp current <sup>(2)</sup>                                                         | $V_O < 0$ |                | −50 mA |
| $I_O$     | Continuous output current                                                                   |           |                | ±35 mA |
|           | Continuous current through $V_{CC}$ or GND                                                  |           |                | ±70 mA |
| $T_J$     | Junction temperature                                                                        |           |                | 150 °C |
| $T_{stg}$ | Storage temperature                                                                         | −65       | 150            | °C     |

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

### 6.2 ESD Ratings

|             |                                                                                        | VALUE | UNIT |
|-------------|----------------------------------------------------------------------------------------|-------|------|
| $V_{(ESD)}$ | Electrostatic discharge                                                                |       |      |
|             | Human-body model (HBM), per AEC Q100-002 HBM ESD Classification Level 2 <sup>(1)</sup> | ±2000 | V    |
|             | Machine Model (MM), per JEDEC specification                                            | ±200  |      |
|             | Charged-device model (CDM), per AEC Q100-011 CDM ESD Classification Level C4B          | ±1000 |      |

- (1) AEC Q100-002 indicate that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

## 6.3 Recommended Operating Conditions

|                 |                                 |                                          | MIN                   | MAX                   | UNIT |
|-----------------|---------------------------------|------------------------------------------|-----------------------|-----------------------|------|
| V <sub>CC</sub> | Supply voltage                  |                                          | 2                     | 5.5                   | V    |
| V <sub>IH</sub> | High-level input voltage        | V <sub>CC</sub> = 2 V                    | 1.5                   |                       | V    |
|                 |                                 | V <sub>CC</sub> = 2.3 V to 2.7 V         | V <sub>CC</sub> × 0.7 |                       |      |
|                 |                                 | V <sub>CC</sub> = 3 V to 3.6 V           | V <sub>CC</sub> × 0.7 |                       |      |
|                 |                                 | V <sub>CC</sub> = 4.5 V to 5.5 V         | V <sub>CC</sub> × 0.7 |                       |      |
| V <sub>IL</sub> | Low-level input voltage         | V <sub>CC</sub> = 2 V                    |                       | 0.5                   | V    |
|                 |                                 | V <sub>CC</sub> = 2.3 V to 2.7 V         |                       | V <sub>CC</sub> × 0.3 |      |
|                 |                                 | V <sub>CC</sub> = 3 V to 3.6 V           |                       | V <sub>CC</sub> × 0.3 |      |
|                 |                                 | V <sub>CC</sub> = 4.5 V to 5.5 V         |                       | V <sub>CC</sub> × 0.3 |      |
| V <sub>I</sub>  | Input voltage <sup>(1)</sup>    |                                          | 0                     | 5.5                   | V    |
| V <sub>O</sub>  | Output voltage                  | High or low state                        | 0                     | V <sub>CC</sub>       | V    |
|                 |                                 | 3-state                                  | 0                     | 5.5                   |      |
| I <sub>OH</sub> | High level output current       | V <sub>CC</sub> = 2 V                    |                       | –50                   | μA   |
|                 |                                 | V <sub>CC</sub> = 2.3 V to 2.7 V         |                       | –2                    | mA   |
|                 |                                 | V <sub>CC</sub> = 3 V to 3.6 V           |                       | –8                    |      |
|                 |                                 | V <sub>CC</sub> = 4.5 V to 5.5 V         |                       | –16                   |      |
| I <sub>OL</sub> | Low level output current        | V <sub>CC</sub> = 2 V                    |                       | 50                    | μA   |
|                 |                                 | V <sub>CC</sub> = 2.3 V to 2.7 V         |                       | 2                     | mA   |
|                 |                                 | V <sub>CC</sub> = 3 V to 3.6 V           |                       | 8                     |      |
|                 |                                 | V <sub>CC</sub> = 4.5 V to 5.5 V         |                       | 16                    |      |
| Δt/Δv           | Input transition rise/fall time | V <sub>CC</sub> = 2.3 V to 2.7 V         |                       | 200                   | ns/V |
|                 |                                 | V <sub>CC</sub> = 3 V to 3.6 V           |                       | 100                   |      |
|                 |                                 | V <sub>CC</sub> = 4.5 V to 5.5 V         |                       | 20                    |      |
| T <sub>A</sub>  | Operating free-air temperature  | SN74LV595AIPWRQ1                         | –40                   | 85                    | °C   |
|                 |                                 | SN74LV595AQPWRQ1<br>or SN74LV595AQWBQRQ1 | –40                   | 125                   |      |

(1) All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. See the TI application report, [Implications of Slow or Floating CMOS Inputs](#).

## 6.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |                                              | SN74LV595A-Q1 |             | UNIT |
|-------------------------------|----------------------------------------------|---------------|-------------|------|
|                               |                                              | PW (TSSOP)    | WBQB (WQFN) |      |
|                               |                                              | 16 PINS       | 16 PINS     |      |
| R <sub>θJA</sub>              | Junction-to-ambient thermal resistance       | 138.7         | 86          | °C/W |
| R <sub>θJC(top)</sub>         | Junction-to-case (top) thermal resistance    | 69.1          | 82.6        | °C/W |
| R <sub>θJB</sub>              | Junction-to-board thermal resistance         | 81.8          | 54.9        | °C/W |
| Ψ <sub>JT</sub>               | Junction-to-top characterization parameter   | 20.3          | 9.5         | °C/W |
| Ψ <sub>JB</sub>               | Junction-to-board characterization parameter | 81.3          | 54.9        | °C/W |
| R <sub>θJC(bot)</sub>         | Junction-to-case (bottom) thermal resistance | N/A           | 32.5        | °C/W |

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](#).

## 6.5 Electrical Characteristics

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

| PARAMETER        | TEST CONDITIONS                                             |                                          | V <sub>CC</sub> | –40°C to 85°C         |     |     | –40°C to 125°C        |     |     | UNIT |
|------------------|-------------------------------------------------------------|------------------------------------------|-----------------|-----------------------|-----|-----|-----------------------|-----|-----|------|
|                  |                                                             |                                          |                 | MIN                   | TYP | MAX | MIN                   | TYP | MAX |      |
| V <sub>OH</sub>  |                                                             | I <sub>OH</sub> = –50 μA                 | 2 V to 5.5 V    | V <sub>CC</sub> – 0.1 |     |     | V <sub>CC</sub> – 0.1 |     |     | V    |
|                  |                                                             | I <sub>OH</sub> = –2 mA                  | 2.3 V           | 2                     |     |     | 2                     |     |     |      |
|                  | Q <sub>H'</sub>                                             | I <sub>OH</sub> = –6 mA                  | 3 V             | 2.48                  |     |     | 2.45                  |     |     |      |
|                  | Q <sub>A</sub> –Q <sub>H</sub>                              | I <sub>OH</sub> = –8 mA                  |                 | 2.48                  |     |     | 2.45                  |     |     |      |
|                  | Q <sub>H'</sub>                                             | I <sub>OH</sub> = –12 mA                 | 4.5 V           | 3.8                   |     |     | 3.7                   |     |     |      |
|                  | Q <sub>A</sub> –Q <sub>H</sub>                              | I <sub>OH</sub> = –16 mA                 |                 | 3.8                   |     |     | 3.7                   |     |     |      |
| V <sub>OL</sub>  |                                                             | I <sub>OL</sub> = 50 μA                  | 2 V to 5.5 V    | 0.1                   |     |     | 0.1                   |     |     | V    |
|                  |                                                             | I <sub>OL</sub> = 2 mA                   | 2.3 V           | 0.4                   |     |     | 0.45                  |     |     |      |
|                  | Q <sub>H'</sub>                                             | I <sub>OL</sub> = 6 mA                   | 3 V             | 0.44                  |     |     | 0.5                   |     |     |      |
|                  | Q <sub>A</sub> –Q <sub>H</sub>                              | I <sub>OL</sub> = 8 mA                   |                 | 0.44                  |     |     | 0.5                   |     |     |      |
|                  | Q <sub>H'</sub>                                             | I <sub>OL</sub> = 12 mA                  | 4.5 V           | 0.55                  |     |     | 0.65                  |     |     |      |
|                  | Q <sub>A</sub> –Q <sub>H</sub>                              | I <sub>OL</sub> = 16 mA                  |                 | 0.55                  |     |     | 0.65                  |     |     |      |
| I <sub>I</sub>   | V <sub>I</sub> = 5.5 V or GND                               |                                          | 0 to 5.5 V      | ±1                    |     |     | ±1                    |     |     | μA   |
| I <sub>OZ</sub>  | Q <sub>A</sub> – Q <sub>H</sub>                             | V <sub>O</sub> = V <sub>CC</sub> or GND, | 5.5 V           | ±5                    |     |     | ±10                   |     |     | μA   |
| I <sub>CC</sub>  | V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0 |                                          | 5.5 V           | 20                    |     |     | 40                    |     |     | μA   |
| I <sub>off</sub> | V <sub>I</sub> or V <sub>O</sub> = 0 to 5.5 V               |                                          | 0 V             | 5                     |     |     | 10                    |     |     | μA   |
| C <sub>i</sub>   | V <sub>I</sub> = V <sub>CC</sub> or GND                     |                                          | 3.3 V           | 3.5                   |     |     | 3.5                   |     |     | pF   |

## 6.6 Timing Requirements, $V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$

over operating free-air temperature range (unless otherwise noted)

|          |                |                                                        | $T_A = 25^\circ\text{C}$ |     | $T_A = -40^\circ\text{C TO } 85^\circ\text{C}$ |     | $T_A = -40^\circ\text{C TO } 125^\circ\text{C}$ |     | UNIT |
|----------|----------------|--------------------------------------------------------|--------------------------|-----|------------------------------------------------|-----|-------------------------------------------------|-----|------|
|          |                |                                                        | MIN                      | MAX | MIN                                            | MAX | MIN                                             | MAX |      |
| $t_w$    | Pulse duration | SRCLK high or low                                      | 7                        |     | 7.5                                            |     | 8.5                                             |     | ns   |
|          |                | RCLK high or low                                       | 7                        |     | 7.5                                            |     | 8.5                                             |     |      |
|          |                | SRCLR low                                              | 6                        |     | 6.5                                            |     | 7.5                                             |     |      |
| $t_{su}$ | Setup time     | SER before SRCLK $\uparrow$                            | 5.5                      |     | 5.5                                            |     | 6.5                                             |     | ns   |
|          |                | SRCLK $\uparrow$ before RCLK $\uparrow$ <sup>(1)</sup> | 8                        |     | 9                                              |     | 10                                              |     |      |
|          |                | SRCLR low before RCLK $\uparrow$                       | 8.5                      |     | 9.5                                            |     | 10.5                                            |     |      |
|          |                | SRCLR high (inactive) before SRCLK $\uparrow$          | 4                        |     | 4                                              |     | 5                                               |     |      |
| $t_h$    | Hold time      | SER after SRCLK $\uparrow$                             | 1.5                      |     | 1.5                                            |     | 2.5                                             |     | ns   |

- (1) This setup time allows the storage register to receive stable data from the shift register. The clocks can be tied together, in which case the shift register is one clock pulse ahead of the storage register.

## 6.7 Timing Requirements, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$

over operating free-air temperature range (unless otherwise noted)

|                 |                | T <sub>A</sub> = 25°C                |     | T <sub>A</sub> = -40°C TO 85°C |     | T <sub>A</sub> = -40°C TO 125°C |     | UNIT |  |    |
|-----------------|----------------|--------------------------------------|-----|--------------------------------|-----|---------------------------------|-----|------|--|----|
|                 |                | MIN                                  | MAX | MIN                            | MAX | MIN                             | MAX |      |  |    |
| t <sub>w</sub>  | Pulse duration | SRCLK high or low                    |     | 5.5                            |     | 5.5                             |     | 6.5  |  | ns |
|                 |                | RCLK high or low                     |     | 5.5                            |     | 5.5                             |     | 6.5  |  |    |
|                 |                | SRCLR low                            |     | 5                              |     | 5                               |     | 6    |  |    |
| t <sub>su</sub> | Setup time     | SER before SRCLK ↑                   |     | 3.5                            |     | 3.5                             |     | 4.5  |  | ns |
|                 |                | SRCLK ↑ before RCLK ↑ <sup>(1)</sup> |     | 8                              |     | 8.5                             |     | 9.5  |  |    |
|                 |                | SRCLR low before RCLK ↑              |     | 8                              |     | 9                               |     | 10   |  |    |
|                 |                | SRCLR high (inactive) before SRCLK ↑ |     | 3                              |     | 3                               |     | 4    |  |    |
| t <sub>h</sub>  | Hold time      | SER after SRCLK ↑                    |     | 1.5                            |     | 1.5                             |     | 2.5  |  | ns |

- (1) This setup time allows the storage register to receive stable data from the shift register. The clocks can be tied together, in which case the shift register is one clock pulse ahead of the storage register.

## 6.8 Timing Requirements, $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$

over operating free-air temperature range (unless otherwise noted)

|                 |                | T <sub>A</sub> = 25°C                |     | T <sub>A</sub> = -40°C TO 85°C |     | T <sub>A</sub> = -40°C TO 125°C |     | UNIT |
|-----------------|----------------|--------------------------------------|-----|--------------------------------|-----|---------------------------------|-----|------|
|                 |                | MIN                                  | MAX | MIN                            | MAX | MIN                             | MAX |      |
| t <sub>w</sub>  | Pulse duration | SRCLK high or low                    |     | 5                              | 5   | 5                               | 6   | ns   |
|                 |                | RCLK high or low                     |     | 5                              | 5   | 5                               | 6   |      |
|                 |                | SRCLR low                            |     | 5.2                            | 5.2 | 6.2                             | 6.2 |      |
| t <sub>su</sub> | Setup time     | SER before SRCLK ↑                   |     | 3                              | 3   | 3                               | 4   | ns   |
|                 |                | SRCLK ↑ before RCLK ↑ <sup>(1)</sup> |     | 5                              | 5   | 5                               | 6   |      |
|                 |                | SRCLR low before RCLK ↑              |     | 5                              | 5   | 5                               | 6   |      |
|                 |                | SRCLR high (inactive) before SRCLK ↑ |     | 2.5                            | 2.5 | 3.5                             | 3.5 |      |
| t <sub>h</sub>  | Hold time      | SER after SRCLK ↑                    |     | 2                              | 2   | 2                               | 3   | ns   |

- (1) This setup time allows the storage register to receive stable data from the shift register. The clocks can be tied together, in which case the shift register is one clock pulse ahead of the storage register.

## 6.9 Switching Characteristics, $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$

over recommended operating free-air temperature range,  $C_L = 50\text{ pF}$  (unless otherwise noted)

| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | $T_A = 25^\circ\text{C}$ |      |     | $T_A = -40^\circ\text{C}$<br>TO $85^\circ\text{C}$ |      | $T_A = -40^\circ\text{C}$<br>TO $125^\circ\text{C}$ |      | UNIT |
|-----------|-----------------|----------------|--------------------------|------|-----|----------------------------------------------------|------|-----------------------------------------------------|------|------|
|           |                 |                | MIN                      | TYP  | MAX | MIN                                                | MAX  | MIN                                                 | MAX  |      |
| $f_{max}$ |                 |                | 60                       | 70   |     | 40                                                 |      | 30                                                  |      | MHz  |
| $t_{PLH}$ | RCLK            | $Q_A$ – $Q_H$  | 11.2                     | 17.2 |     | 1                                                  | 19.3 | 1                                                   | 22.3 | ns   |
| $t_{PHL}$ |                 |                | 11.2                     | 17.2 |     | 1                                                  | 19.3 | 1                                                   | 22.3 | ns   |
| $t_{PLH}$ | SRCLK           | $Q_H$          | 13.1                     | 22.5 |     | 1                                                  | 25.5 | 1                                                   | 28.5 | ns   |
| $t_{PHL}$ |                 |                | 13.1                     | 22.5 |     | 1                                                  | 25.5 | 1                                                   | 28.5 | ns   |
| $t_{PHL}$ | SRCLR           | $Q_H$          | 12.4                     | 18.8 |     | 1                                                  | 21.1 | 1                                                   | 24.1 | ns   |
| $t_{PZH}$ | $\overline{OE}$ | $Q_A$ – $Q_H$  | 10.8                     | 17   |     | 1                                                  | 18.3 | 1                                                   | 21.3 | ns   |
| $t_{PZL}$ |                 |                | 13.4                     | 21   |     | 1                                                  | 23   | 1                                                   | 26   | ns   |
| $t_{PHZ}$ | $\overline{OE}$ | $Q_A$ – $Q_H$  | 12.2                     | 18.3 |     | 1                                                  | 19.5 | 1                                                   | 22.5 | ns   |
| $t_{PLZ}$ |                 |                | 14                       | 20.9 |     | 1                                                  | 22.6 | 1                                                   | 25.6 | ns   |

## 6.10 Switching Characteristics, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$

over recommended operating free-air temperature range,  $C_L = 50\text{ pF}$  (unless otherwise noted)

| PARAMETER  | FROM<br>(INPUT)           | TO<br>(OUTPUT) | $T_A = 25^\circ\text{C}$ |     |      | $T_A = -40^\circ\text{C}$<br>TO $85^\circ\text{C}$ |      | $T_A = -40^\circ\text{C}$<br>TO $125^\circ\text{C}$ |      | UNIT |
|------------|---------------------------|----------------|--------------------------|-----|------|----------------------------------------------------|------|-----------------------------------------------------|------|------|
|            |                           |                | MIN                      | TYP | MAX  | MIN                                                | MAX  | MIN                                                 | MAX  |      |
| $f_{\max}$ |                           |                | 55                       | 105 |      | 50                                                 |      | 40                                                  |      | MHz  |
| $t_{PLH}$  | RCLK                      | $Q_A-Q_H$      |                          | 7.9 | 15.4 | 1                                                  | 17   | 1                                                   | 20   | ns   |
| $t_{PHL}$  |                           |                |                          | 7.9 | 15.4 | 1                                                  | 17   | 1                                                   | 20   | ns   |
| $t_{PLH}$  | SRCLK                     | $Q_{H'}$       |                          | 9.2 | 16.5 | 1                                                  | 18.5 | 1                                                   | 21.5 | ns   |
| $t_{PHL}$  |                           |                |                          | 9.2 | 16.5 | 1                                                  | 18.5 | 1                                                   | 21.5 | ns   |
| $t_{PHL}$  | $\overline{\text{SRCLR}}$ | $Q_{H'}$       |                          | 9   | 16.3 | 1                                                  | 17.2 | 1                                                   | 20.2 | ns   |
| $t_{PZH}$  | $\overline{\text{OE}}$    | $Q_A-Q_H$      |                          | 7.8 | 15   | 1                                                  | 17   | 1                                                   | 20   | ns   |
| $t_{PZL}$  |                           |                |                          | 9.6 | 15   | 1                                                  | 17   | 1                                                   | 20   | ns   |
| $t_{PHZ}$  | $\overline{\text{OE}}$    | $Q_A-Q_H$      |                          | 8.1 | 15.7 | 1                                                  | 16.2 | 1                                                   | 19.2 | ns   |
| $t_{PLZ}$  |                           |                |                          | 9.3 | 15.7 | 1                                                  | 16.2 | 1                                                   | 19.2 | ns   |

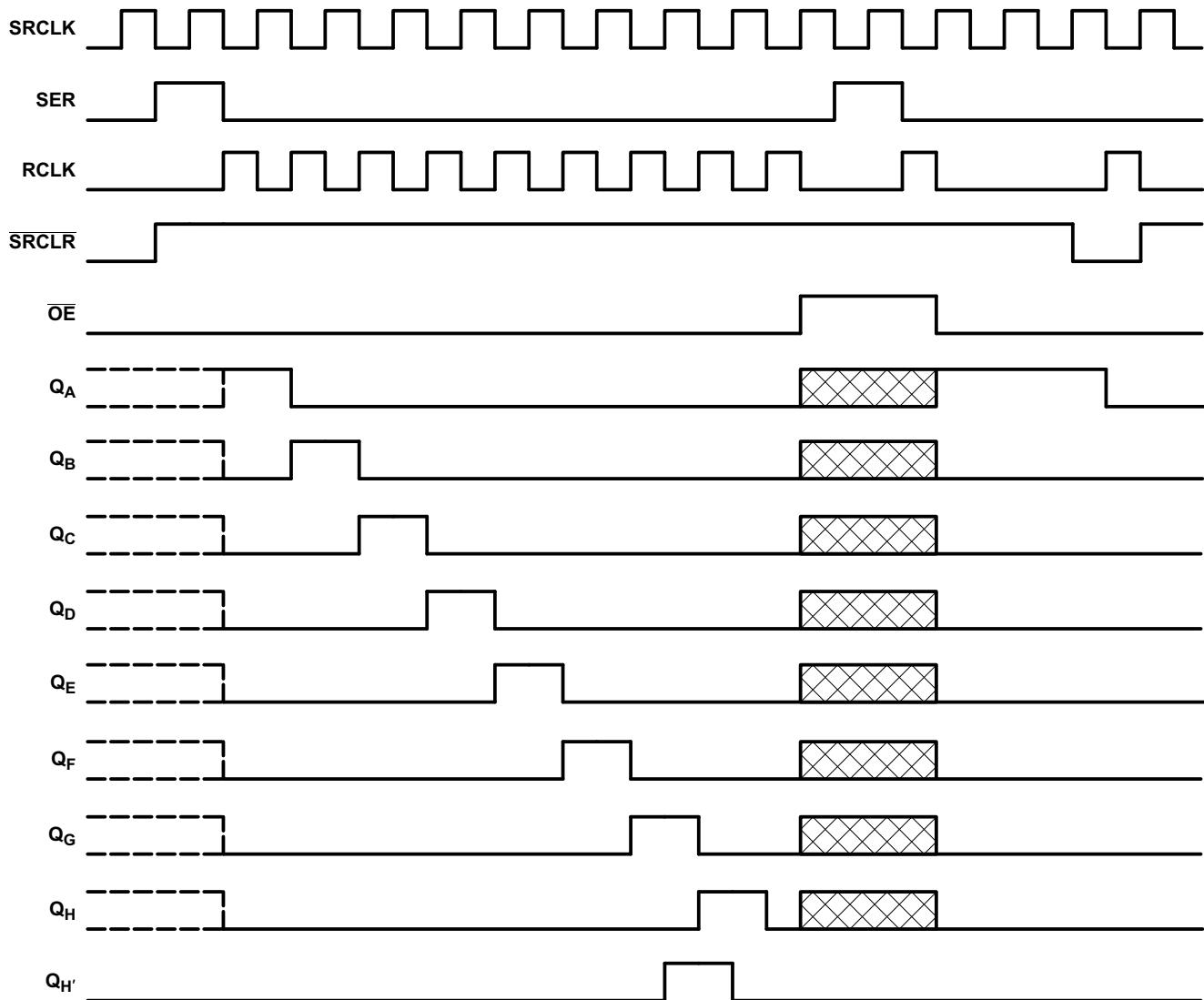
## 6.11 Switching Characteristics, $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$

over recommended operating free-air temperature range,  $C_L = 50\text{ pF}$  (unless otherwise noted)

| PARAMETER  | FROM<br>(INPUT)           | TO<br>(OUTPUT) | $T_A = 25^\circ\text{C}$ |     |      | $T_A = -40^\circ\text{C}$<br>TO $85^\circ\text{C}$ |      | $T_A = -40^\circ\text{C}$<br>TO $125^\circ\text{C}$ |      | UNIT |
|------------|---------------------------|----------------|--------------------------|-----|------|----------------------------------------------------|------|-----------------------------------------------------|------|------|
|            |                           |                | MIN                      | TYP | MAX  | MIN                                                | MAX  | MIN                                                 | MAX  |      |
| $f_{\max}$ |                           |                | 95                       | 140 |      | 85                                                 |      | 75                                                  |      | MHz  |
| $t_{PLH}$  | RCLK                      | $Q_A-Q_H$      |                          | 5.6 | 9.4  | 1                                                  | 10.5 | 1                                                   | 13.5 | ns   |
| $t_{PHL}$  |                           |                |                          | 5.6 | 9.4  | 1                                                  | 10.5 | 1                                                   | 13.5 | ns   |
| $t_{PLH}$  | SRCLK                     | $Q_{H'}$       |                          | 6.4 | 10.2 | 1                                                  | 11.4 | 1                                                   | 14.4 | ns   |
| $t_{PHL}$  |                           |                |                          | 6.4 | 10.2 | 1                                                  | 11.4 | 1                                                   | 14.4 | ns   |
| $t_{PHL}$  | $\overline{\text{SRCLR}}$ | $Q_{H'}$       |                          | 6.4 | 10   | 1                                                  | 11.1 | 1                                                   | 14.1 | ns   |
| $t_{PZH}$  | $\overline{\text{OE}}$    | $Q_A-Q_H$      |                          | 5.7 | 10.6 | 1                                                  | 12   | 1                                                   | 15   | ns   |
| $t_{PZL}$  |                           |                |                          | 6.8 | 10.6 | 1                                                  | 12   | 1                                                   | 15   | ns   |
| $t_{PHZ}$  | $\overline{\text{OE}}$    | $Q_A-Q_H$      |                          | 3.5 | 10.3 | 1                                                  | 11   | 1                                                   | 14   | ns   |
| $t_{PLZ}$  |                           |                |                          | 3.4 | 10.3 | 1                                                  | 11   | 1                                                   | 14   | ns   |



## 6.12 Timing Diagrams



NOTE:  implies that the output is in 3-State mode.

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**6-1. Timing Diagram**

## 6.13 Noise Characteristics

$V_{CC} = 3.3\text{ V}$ ,  $C_L = 50\text{ pF}$ ,  $T_A = 25^\circ\text{C}^{(1)}$

| PARAMETER   |                                        | MIN  | TYP  | MAX  | UNIT |
|-------------|----------------------------------------|------|------|------|------|
| $V_{OL(P)}$ | Quiet output, maximum dynamic $V_{OL}$ |      | 0.3  |      | V    |
| $V_{OL(V)}$ | Quiet output, minimum dynamic $V_{OL}$ |      | -0.2 |      | V    |
| $V_{OH(V)}$ | Quiet output, minimum dynamic $V_{OH}$ |      | 2.8  |      | V    |
| $V_{IH(D)}$ | High-level dynamic input voltage       | 2.31 |      |      | V    |
| $V_{IL(D)}$ | Low-level dynamic input voltage        |      |      | 0.99 | V    |

(1) Characteristics are for surface-mount packages only.

## 6.14 Operating Characteristics

 $T_A = 25^\circ\text{C}$ 

| PARAMETER |                               | TEST CONDITIONS                            |                         | TYP | UNIT |
|-----------|-------------------------------|--------------------------------------------|-------------------------|-----|------|
| $C_{pd}$  | Power dissipation capacitance | $C_L = 50\text{ pF}$ , $f = 10\text{ MHz}$ | $V_{CC} = 3.3\text{ V}$ | 111 | pF   |
|           |                               |                                            | $V_{CC} = 5\text{ V}$   | 114 |      |

## 6.15 Typical Characteristics

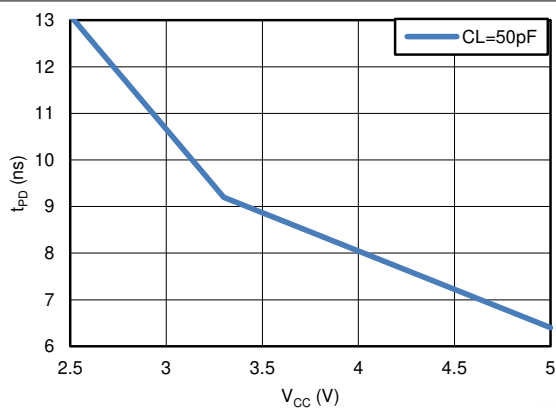
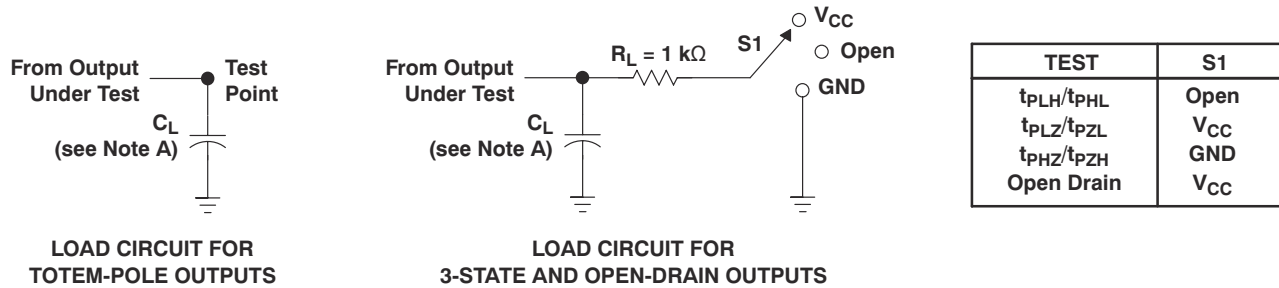


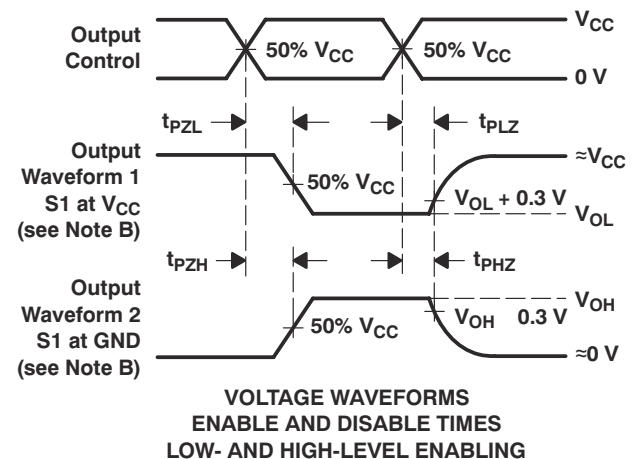
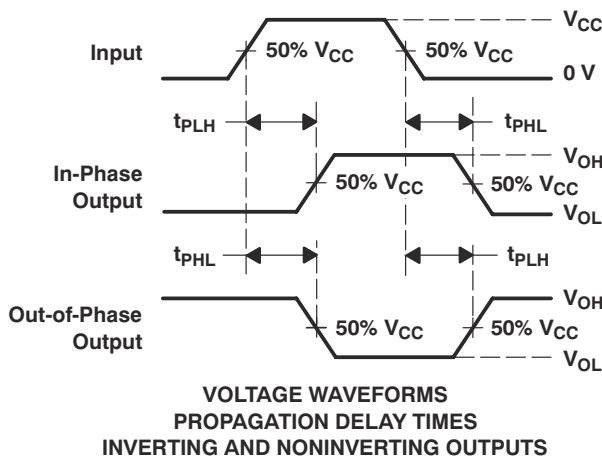
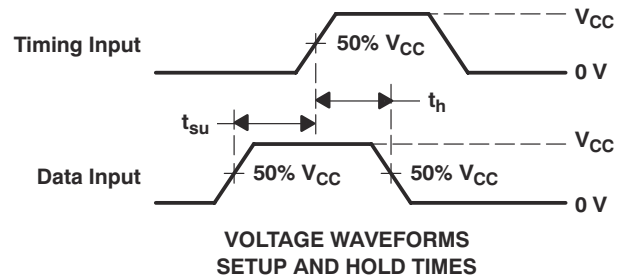
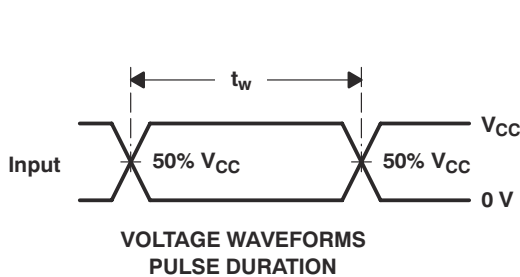
图 6-2. TPD vs  $V_{CC}$

## 7 Parameter Measurement Information



LOAD CIRCUIT FOR  
TOTEM-POLE OUTPUTS

LOAD CIRCUIT FOR  
3-STATE AND OPEN-DRAIN OUTPUTS



- 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:  $PRR \leq 1\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r \leq 3\text{ ns}$ ,  $t_f \leq 3\text{ ns}$ .
  - D. The outputs are measured one at a time, with one input transition per measurement.
  - E.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - F.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - G.  $t_{PHL}$  and  $t_{PLH}$  are the same as  $t_{pd}$ .
  - H. All parameters and waveforms are not applicable to all devices.

7-1. Load Circuit and Voltage Waveforms

## 8 Detailed Description

### 8.1 Overview

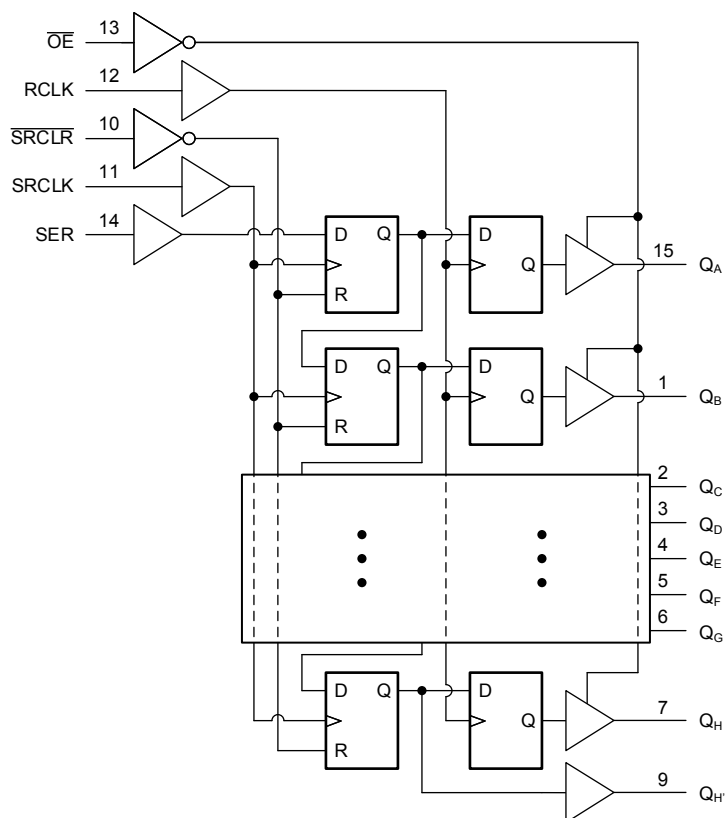
The SN74LV595A-Q1 contains an 8-bit serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. The storage register has parallel 3-state outputs. Separate clocks are provided for both the shift and storage register. The shift register has a direct overriding clear ( $\overline{\text{SRCLR}}$ ) input, serial (SER) input, and a serial output for cascading. When the output-enable ( $\overline{\text{OE}}$ ) input is high, all outputs except  $Q_{H'}$  are in the high-impedance state.

Both the shift register clock (SRCLK) and storage register clock (RCLK) are positive-edge triggered. If both clocks are connected together, the shift register always is one clock pulse ahead of the storage register.

To ensure the high-impedance state during power up or power down,  $\overline{\text{OE}}$  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.

The device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

### 8.2 Functional Block Diagram



8-1. Logic Diagram (Positive Logic)

## 8.3 Feature Description

### 8.3.1 Balanced CMOS 3-State Outputs

This device includes balanced CMOS 3-state outputs. Driving high, driving low, and high impedance are the three states that these outputs can be in. The term *balanced* indicates that the device can sink and source similar currents. The drive capability of this device may create fast edges into light loads, so routing and load conditions should be considered to prevent ringing. Additionally, the outputs of this device can drive larger currents than the device can sustain without being damaged. It is important for the output power of the device to be limited to avoid damage due to overcurrent. The electrical and thermal limits defined in the *Absolute Maximum Ratings* must be followed at all times.

When placed into the high-impedance mode, the output will neither source nor sink current, with the exception of minor leakage current as defined in the *Electrical Characteristics* table. In the high-impedance state, the output voltage is not controlled by the device and is dependent on external factors. If no other drivers are connected to the node, then this is known as a floating node and the voltage is unknown. A pull-up or pull-down resistor can be connected to the output to provide a known voltage at the output while it is in the high-impedance state. The value of the resistor will depend on multiple factors, including parasitic capacitance and power consumption limitations. Typically, a 10-k $\Omega$  resistor can be used to meet these requirements.

Unused 3-state CMOS outputs should be left disconnected.

### 8.3.2 Latching Logic

This device includes latching logic circuitry. Latching circuits commonly include D-type latches and D-type flip-flops, but include all logic circuits that act as volatile memory.

When the device is powered on, the state of each latch is unknown. There is no default state for each latch at start-up.

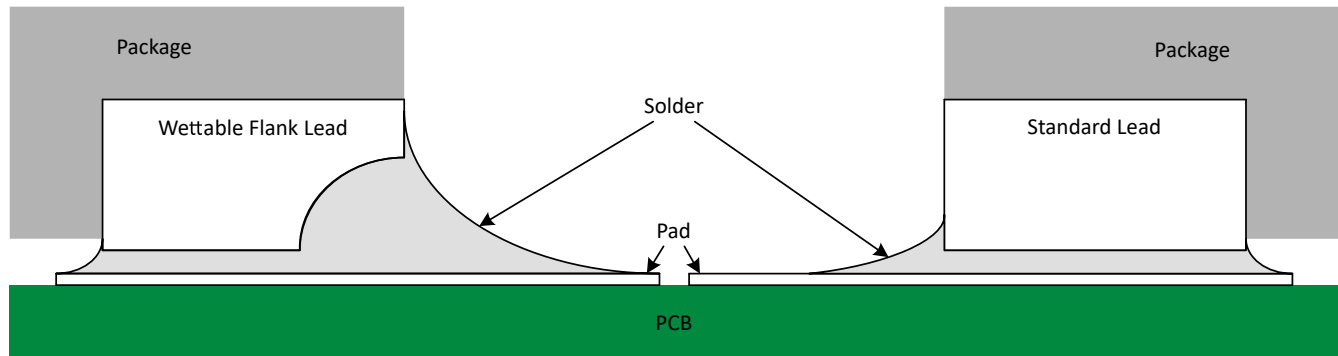
The output state of each latching logic circuit only remains stable as long as power is applied to the device within the supply voltage range specified in the *Recommended Operating Conditions* table.

### 8.3.3 Partial Power Down ( $I_{off}$ )

This device includes circuitry to disable all outputs when the supply pin is held at 0 V. When disabled, the outputs will neither source nor sink current, regardless of the input voltages applied. The amount of leakage current at each output is defined by the  $I_{off}$  specification in the *Electrical Characteristics* table.

### 8.3.4 Wettable Flanks

This device includes wettable flanks for at least one package. See the *Features* section on the front page of the data sheet for which packages include this feature.



**Figure 8-2. Simplified Cutaway View of Wettable-Flank QFN Package and Standard QFN Package After Soldering**

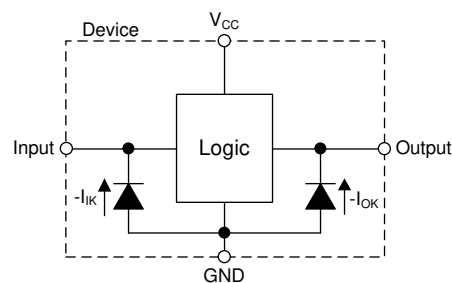
Wettable flanks help improve side wetting after soldering, which makes QFN packages easier to inspect with automatic optical inspection (AOI). As shown in Figure 8-2, a wettable flank can be dimpled or step-cut to provide additional surface area for solder adhesion which assists in reliably creating a side fillet. Please see the mechanical drawing for additional details.

### 8.3.5 Clamp Diode Structure

Figure 8-3 shows the inputs and outputs to this device have negative clamping diodes only.

**注意**

Voltages beyond the values specified in the *Absolute Maximum Ratings* table can cause damage to the device. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.



**Figure 8-3. Electrical Placement of Clamping Diodes for Each Input and Output**

## 8.4 Device Functional Modes

**表 8-1. Function Table**

| INPUTS <sup>(1)</sup> |       |                           |      |                        | FUNCTION                                                                                                     |
|-----------------------|-------|---------------------------|------|------------------------|--------------------------------------------------------------------------------------------------------------|
| SER                   | SRCLK | $\overline{\text{SRCLR}}$ | RCLK | $\overline{\text{OE}}$ |                                                                                                              |
| X                     | X     | X                         | X    | H                      | Outputs Q <sub>A</sub> –Q <sub>H</sub> are disabled.<br>Q <sub>H</sub> <sup>1</sup> remains enabled.         |
| X                     | X     | X                         | X    | L                      | Outputs Q <sub>A</sub> –Q <sub>H</sub> are enabled.                                                          |
| X                     | X     | L                         | X    | X                      | Shift register is cleared.                                                                                   |
| L                     | ↑     | H                         | X    | X                      | First stage of the shift register goes low.<br>Other stages store the data of previous stage, respectively.  |
| H                     | ↑     | H                         | X    | X                      | First stage of the shift register goes high.<br>Other stages store the data of previous stage, respectively. |
| X                     | X     | X                         | ↑    | X                      | Shift-register data is stored in the storage register.                                                       |

(1) H = High Voltage Level, L = Low Voltage Level, X = Do not Care, Z = High Impedance

## 9 Application and Implementation

### 注

以下のアプリケーション情報は、TI の製品仕様に含まれるものではなく、TI ではその正確性または完全性を保証いたしません。個々の目的に対する製品の適合性については、お客様の責任で判断していただくことになります。お客様は自身の設計実装を検証しテストすることで、システムの機能を確認する必要があります。

### 9.1 Application Information

The SN74LV595A-Q1 is a low-drive CMOS device that can be used for a multitude of bus interface type applications where output ringing is a concern. The low drive and slow edge rates will minimize overshoot and undershoot on the outputs. The inputs are 5-V tolerant allowing for down translation to  $V_{CC}$ .

### 9.2 Typical Application

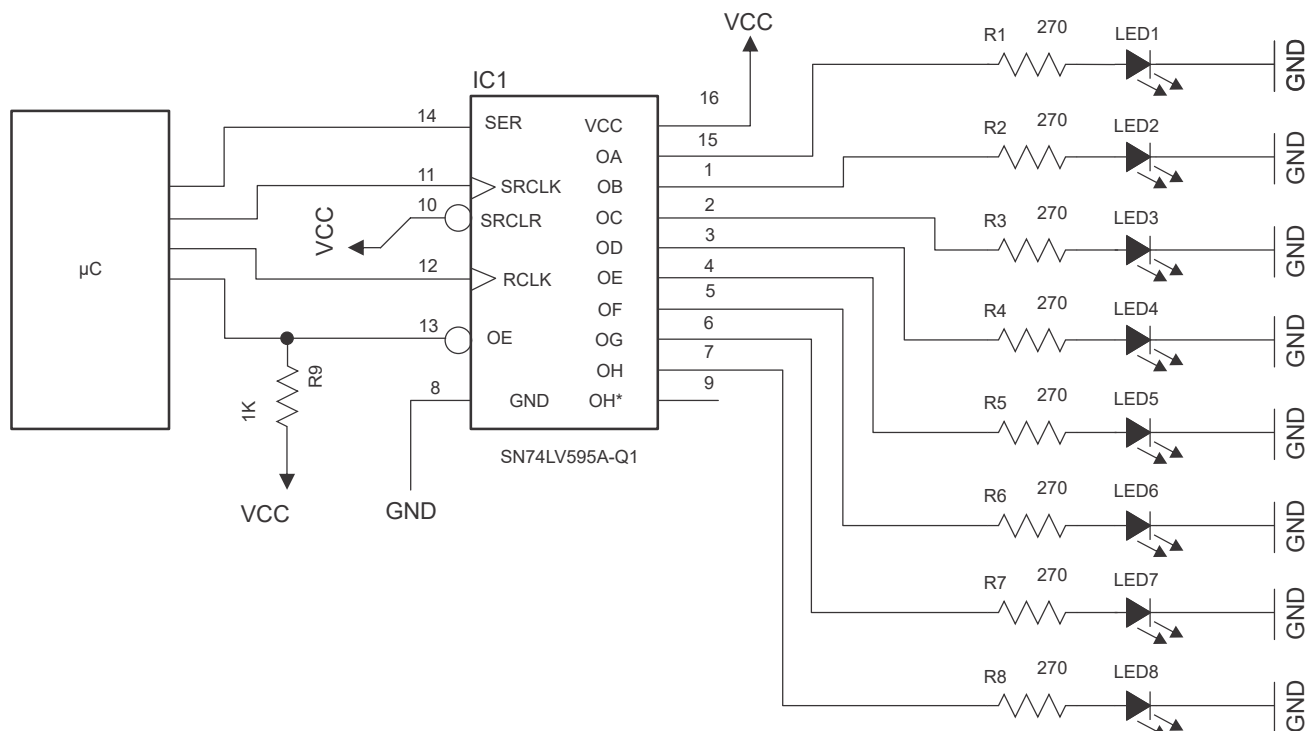


図 9-1. SN74LV595A-Q1 Expanding IOs to Drive LEDs

#### 9.2.1 Power Considerations

Ensure the desired supply voltage is within the range specified in the *Recommended Operating Conditions*. The supply voltage sets the device's electrical characteristics as described in the *Electrical Characteristics* section.

The positive voltage supply must be capable of sourcing current equal to the total current to be sourced by all outputs of the SN74LV595A-Q1 plus the maximum static supply current,  $I_{CC}$ , listed in the *Electrical Characteristics*, and any transient current required for switching. The logic device can only source as much current that is provided by the positive supply source. Be sure to not exceed the maximum total current through  $V_{CC}$  listed in the *Absolute Maximum Ratings*.



The ground must be capable of sinking current equal to the total current to be sunk by all outputs of the SN74LV595A-Q1 plus the maximum supply current,  $I_{CC}$ , listed in the *Electrical Characteristics*, and any transient current required for switching. The logic device can only sink as much current that can be sunk into its ground connection. Be sure to not exceed the maximum total current through GND listed in the *Absolute Maximum Ratings*.

The SN74LV595A-Q1 can drive a load with a total capacitance less than or equal to 50 pF while still meeting all of the data sheet specifications. Larger capacitive loads can be applied; however, it is not recommended to exceed 50 pF.

The SN74LV595A-Q1 can drive a load with total resistance described by  $R_L \geq V_O / I_O$ , with the output voltage and current defined in the *Electrical Characteristics* table with  $V_{OH}$  and  $V_{OL}$ . When outputting in the HIGH state, the output voltage in the equation is defined as the difference between the measured output voltage and the supply voltage at the  $V_{CC}$  pin.

Total power consumption can be calculated using the information provided in [CMOS Power Consumption and Cpd Calculation](#).

Thermal increase can be calculated using the information provided in [Thermal Characteristics of Standard Linear and Logic \(SLL\) Packages and Devices](#).

#### 注意

The maximum junction temperature,  $T_{J(max)}$  listed in the *Absolute Maximum Ratings*, is an additional limitation to prevent damage to the device. Do not violate any values listed in the *Absolute Maximum Ratings*. These limits are provided to prevent damage to the device.

### 9.2.2 Input Considerations

Input signals must cross  $V_{IL(max)}$  to be considered a logic LOW, and  $V_{IH(min)}$  to be considered a logic HIGH. Do not exceed the maximum input voltage range found in the *Absolute Maximum Ratings*.

Unused inputs must be terminated to either  $V_{CC}$  or ground. The unused inputs can be directly terminated if the input is completely unused, or they can be connected with a pull-up or pull-down resistor if the input will be used sometimes, but not always. A pull-up resistor is used for a default state of HIGH, and a pull-down resistor is used for a default state of LOW. The drive current of the controller, leakage current into the SN74LV595A-Q1 (as specified in the *Electrical Characteristics*), and the desired input transition rate limits the resistor size. A 10-k $\Omega$  resistor value is often used due to these factors.

The SN74LV595A-Q1 has CMOS inputs and thus requires fast input transitions to operate correctly, as defined in the *Recommended Operating Conditions* table. Slow input transitions can cause oscillations, additional power consumption, and reduction in device reliability.

Refer to the *Feature Description* section for additional information regarding the inputs for this device.

### 9.2.3 Output Considerations

The positive supply voltage is used to produce the output HIGH voltage. Drawing current from the output will decrease the output voltage as specified by the  $V_{OH}$  specification in the *Electrical Characteristics*. The ground voltage is used to produce the output LOW voltage. Sinking current into the output will increase the output voltage as specified by the  $V_{OL}$  specification in the *Electrical Characteristics*.

Push-pull outputs that could be in opposite states, even for a very short time period, should never be connected directly together. This can cause excessive current and damage to the device.

Two channels within the same device with the same input signals can be connected in parallel for additional output drive strength.

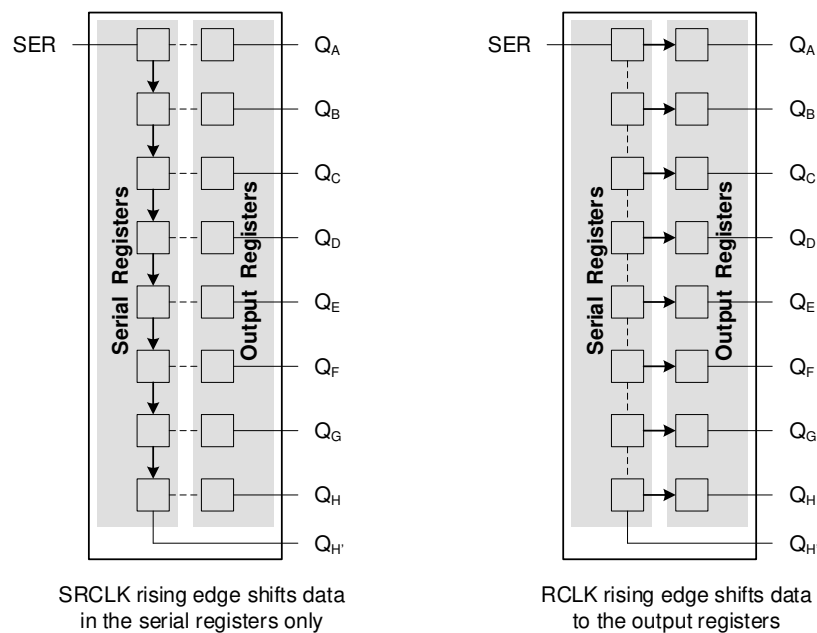
Unused outputs can be left floating. Do not connect outputs directly to  $V_{CC}$  or ground.

Refer to the *Feature Description* section for additional information regarding the outputs for this device.

### 9.2.4 Detailed Design Procedure

1. Add a decoupling capacitor from  $V_{CC}$  to GND. The capacitor needs to be placed physically close to the device and electrically close to both the  $V_{CC}$  and GND pins. An example layout is shown in the *Layout* section.
2. Ensure the capacitive load at the output is  $\leq 50$  pF. This is not a hard limit; it will, however, ensure optimal performance. This can be accomplished by providing short, appropriately sized traces from the SN74LV595A-Q1 to one or more of the receiving devices.
3. Ensure the resistive load at the output is larger than  $(V_{CC} / I_{O(max)}) \Omega$ . This will ensure that the maximum output current from the *Absolute Maximum Ratings* is not violated. Most CMOS inputs have a resistive load measured in  $M\Omega$ ; much larger than the minimum calculated previously.
4. Thermal issues are rarely a concern for logic gates; the power consumption and thermal increase, however, can be calculated using the steps provided in the application report, [CMOS Power Consumption and Cpd Calculation](#).

### 9.2.5 Application Curves



**9-2. Simplified Functional Diagram Showing Clock Operation**

## 9.3 Power Supply Recommendations

The power supply can be any voltage between the MIN and MAX supply voltage rating located in the [Recommended Operating Conditions](#) table.

Each  $V_{CC}$  terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, a 0.1  $\mu\text{F}$  capacitor is recommended. If there are multiple  $V_{CC}$  terminals then 0.01  $\mu\text{F}$  or 0.022  $\mu\text{F}$  capacitors are recommended for each power terminal. It is ok to parallel multiple bypass capacitors to reject different frequencies of noise. 0.1  $\mu\text{F}$  and 1.0  $\mu\text{F}$  capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for the best results.

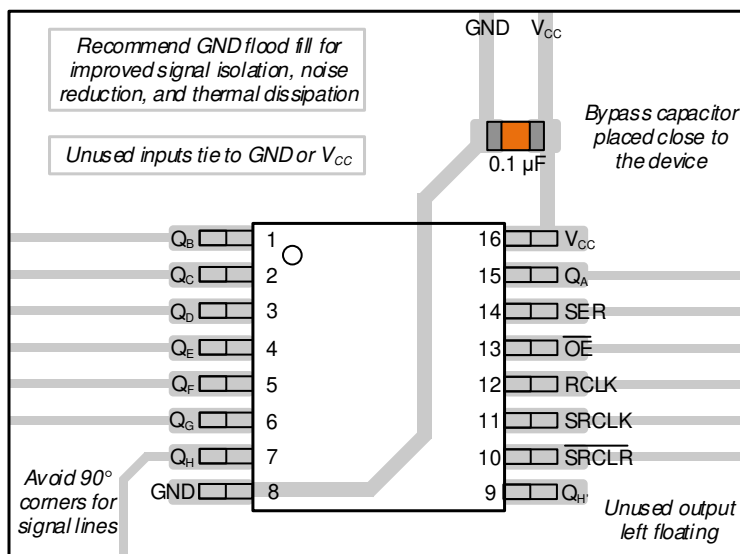
## 9.4 Layout

### 9.4.1 Layout Guidelines

When using multiple bit logic devices, inputs should not float. In many cases, functions or parts of functions of digital logic devices are unused. Some examples are when only two inputs of a triple-input AND gate are used, or when only 3 of the 4-buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states.

Specified in [Figure 9-3](#) are rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or  $V_{CC}$ , whichever makes more sense or is more convenient. It is acceptable to float outputs unless the part is a transceiver. If the transceiver has an output enable pin, it will disable the outputs section of the part when asserted. This will not disable the input section of the I/Os so they also cannot float when disabled.

### 9.4.2 Layout Example



**Figure 9-3. Layout Example for the SN74LV595A-Q1**

## 10 Device and Documentation Support

### 10.1 Documentation Support

#### 10.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, [CMOS Power Consumption and Cpd Calculation application report](#)
- Texas Instruments, [Thermal Characteristics of Standard Linear and Logic \(SLL\) Packages and Devices application report](#)

### 10.2 ドキュメントの更新通知を受け取る方法

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### 10.3 サポート・リソース

[TI E2E™ サポート・フォーラム](#)は、エンジニアが検証済みの回答と設計に関するヒントをエキスパートから迅速かつ直接得ることができる場所です。既存の回答を検索したり、独自の質問をしたりすることで、設計に必要な支援を迅速に得ることができます。

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### 10.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

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### 10.5 静電気放電に関する注意事項



この IC は、ESD によって破損する可能性があります。テキサス・インスツルメンツは、IC を取り扱う際には常に適切な注意を払うことを推奨します。正しい取り扱いおよび設置手順に従わない場合、デバイスを破損するおそれがあります。

ESD による破損は、わずかな性能低下からデバイスの完全な故障まで多岐にわたります。精密な IC の場合、パラメータがわずかに変化するだけで公表されている仕様から外れる可能性があるため、破損が発生しやすくなっています。

### 10.6 用語集

[テキサス・インスツルメンツ用語集](#) この用語集には、用語や略語の一覧および定義が記載されています。

## 11 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 Device   | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|--------------------|---------------|--------------|--------------------|------|----------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74LV595AIPWRG4Q1 | ACTIVE        | TSSOP        | PW                 | 16   | 2000           | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | LV595AI                 | <a href="#">Samples</a> |
| SN74LV595AIPWRQ1   | ACTIVE        | TSSOP        | PW                 | 16   | 2000           | RoHS & Green    | NIPDAU                               | Level-3-260C-168 HR  | -40 to 85    | LV595AI                 | <a href="#">Samples</a> |
| SN74LV595AQPWRQ1   | ACTIVE        | TSSOP        | PW                 | 16   | 2000           | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | LV595AQ                 | <a href="#">Samples</a> |
| SN74LV595AQWBQBRQ1 | ACTIVE        | WQFN         | BQB                | 16   | 3000           | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | LV595Q                  | <a href="#">Samples</a> |

<sup>(1)</sup> 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.

**OBSELETE:** TI has discontinued the production of the device.

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

<sup>(3)</sup> MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

<sup>(4)</sup> There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

<sup>(5)</sup> 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.

<sup>(6)</sup> 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.

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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF SN74LV595A-Q1 :**

- Catalog : [SN74LV595A](#)
- Enhanced Product : [SN74LV595A-EP](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

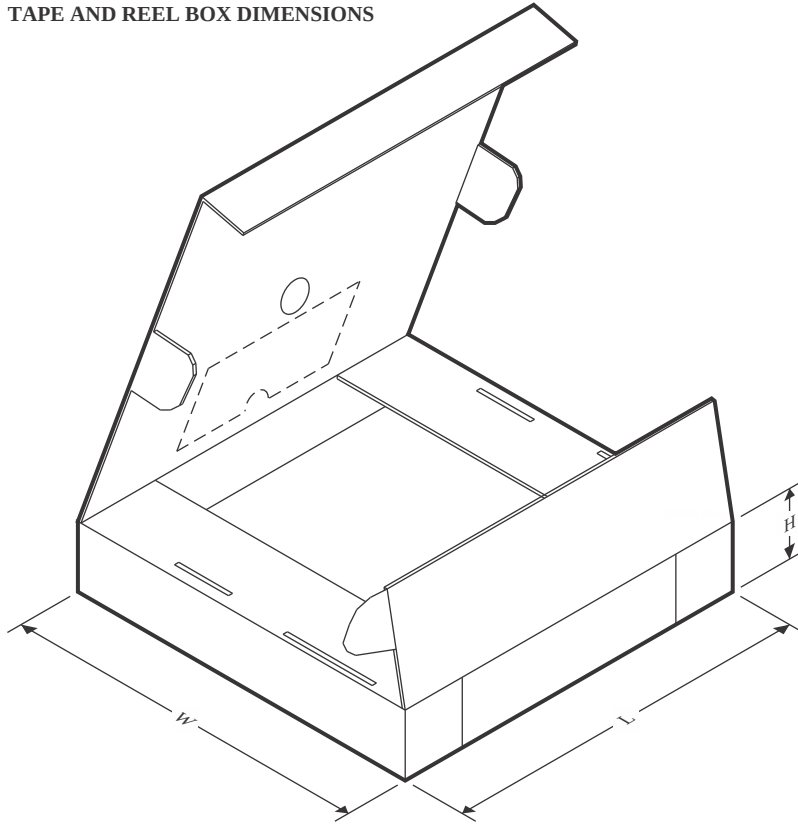
## TAPE AND REEL INFORMATION



\*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 |
|--------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LV595AIPWRG4Q1 | TSSOP        | PW              | 16   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| SN74LV595AIPWRQ1   | TSSOP        | PW              | 16   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| SN74LV595AQPWRQ1   | TSSOP        | PW              | 16   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| SN74LV595AQPWRQ1   | TSSOP        | PW              | 16   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| SN74LV595AQWBQBRQ1 | WQFN         | BQB             | 16   | 3000 | 180.0              | 12.4               | 2.8     | 3.8     | 1.2     | 4.0     | 12.0   | Q1            |

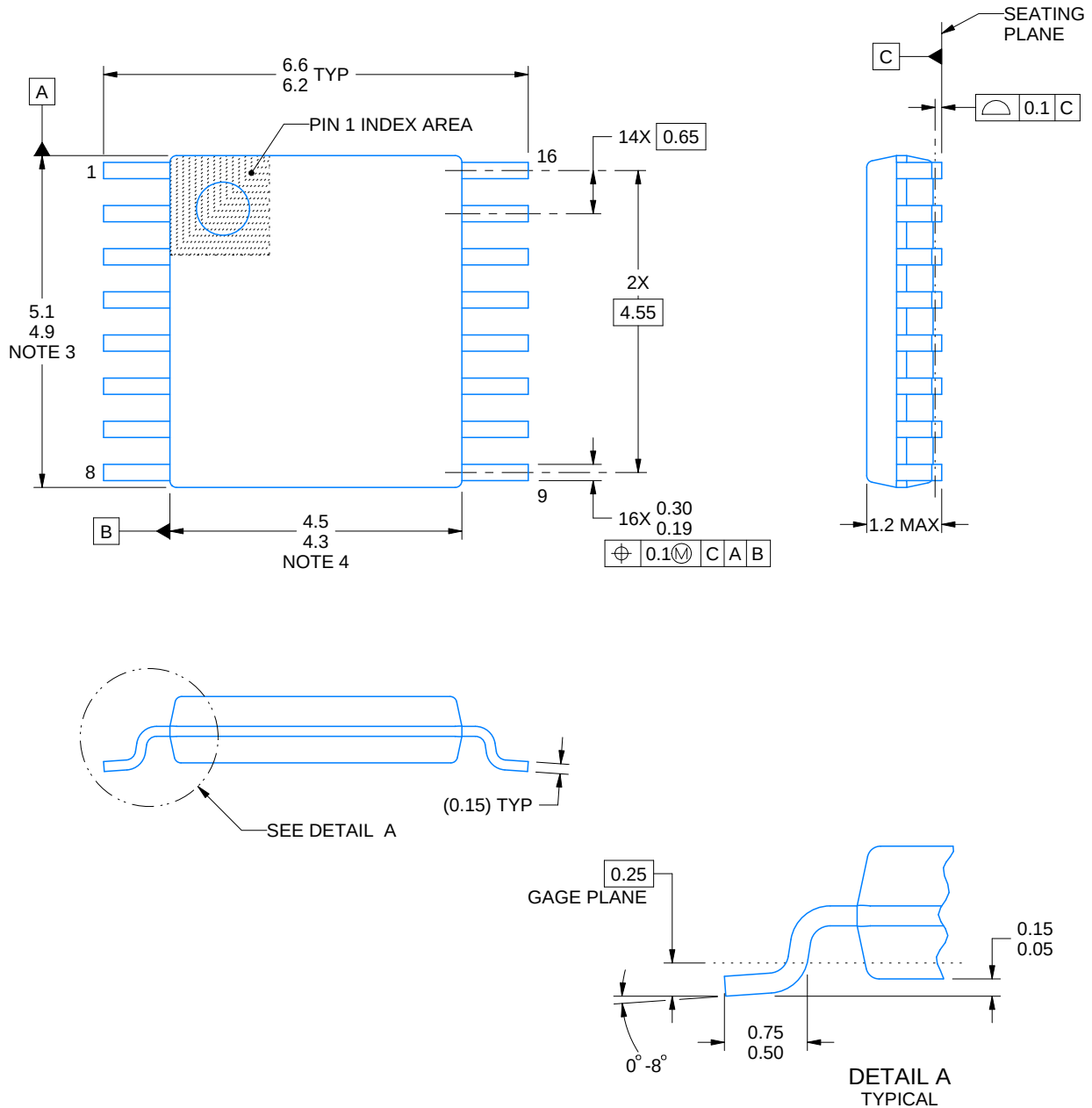
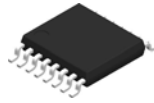
## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device             | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|--------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LV595AIPWRG4Q1 | TSSOP        | PW              | 16   | 2000 | 356.0       | 356.0      | 35.0        |
| SN74LV595AIPWRQ1   | TSSOP        | PW              | 16   | 2000 | 356.0       | 356.0      | 35.0        |
| SN74LV595AQPWRQ1   | TSSOP        | PW              | 16   | 2000 | 356.0       | 356.0      | 35.0        |
| SN74LV595AQPWRQ1   | TSSOP        | PW              | 16   | 2000 | 353.0       | 353.0      | 32.0        |
| SN74LV595AQWBQBRQ1 | WQFN         | BQB             | 16   | 3000 | 210.0       | 185.0      | 35.0        |





4220204/A 02/2017

## NOTES:

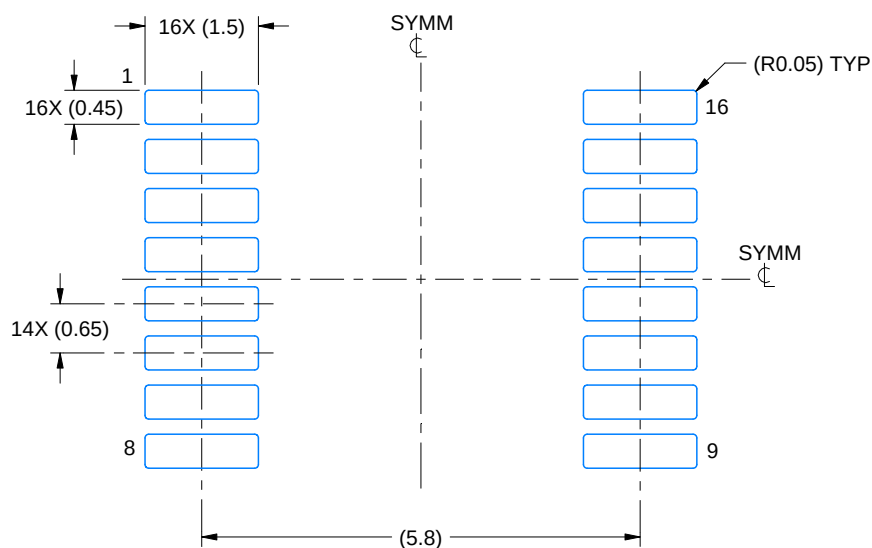
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or 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.

# EXAMPLE BOARD LAYOUT

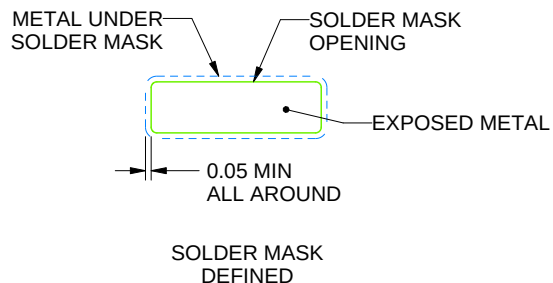
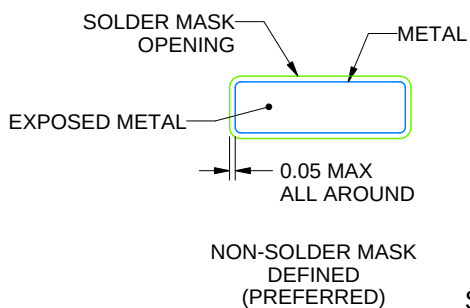
PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

4220204/A 02/2017

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

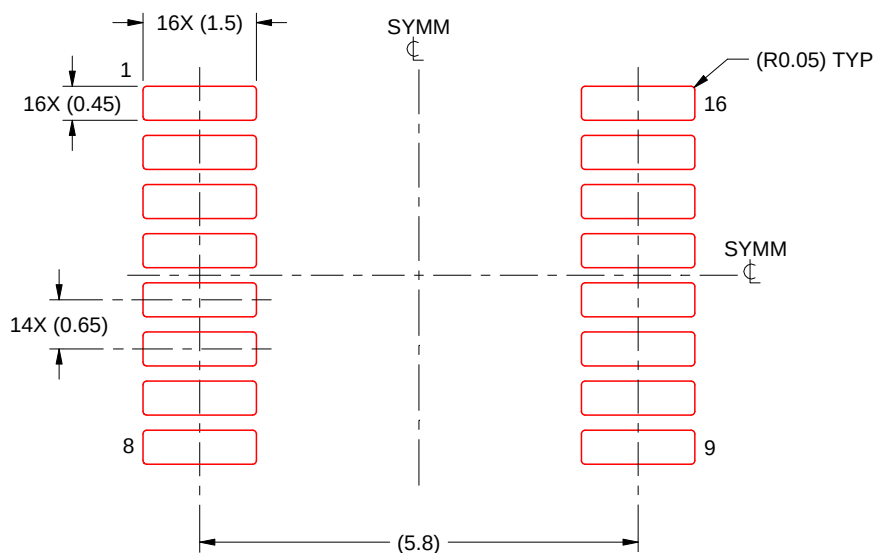
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

4220204/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.

## GENERIC PACKAGE VIEW

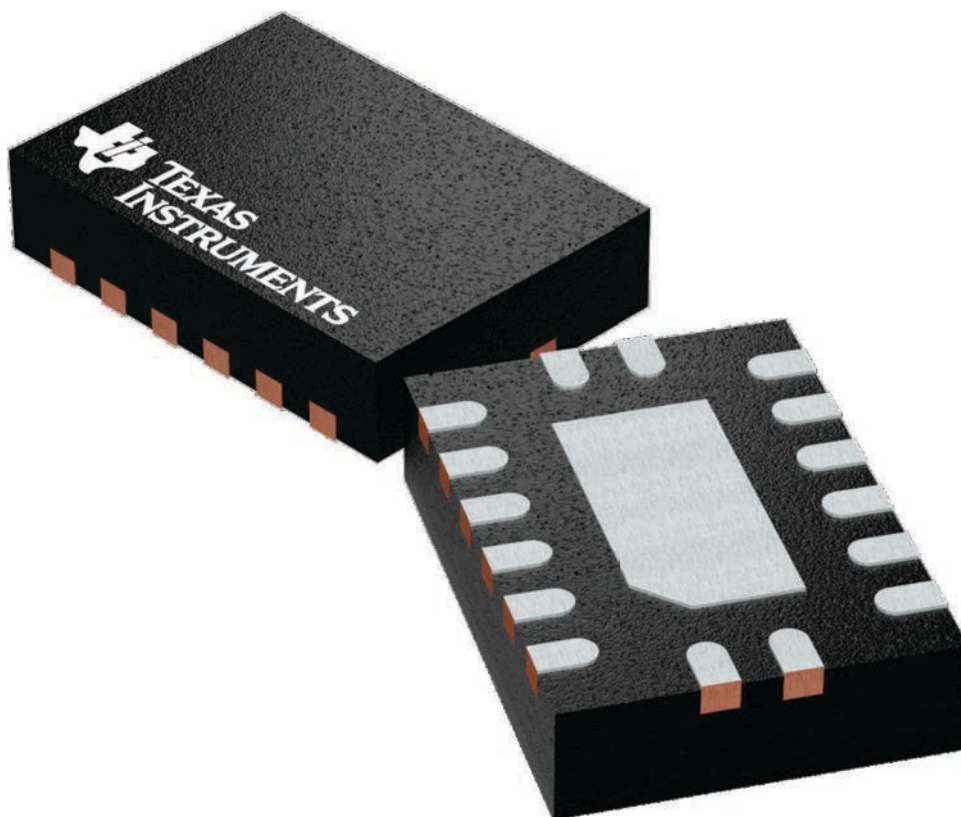
**BQB 16**

**WQFN - 0.8 mm max height**

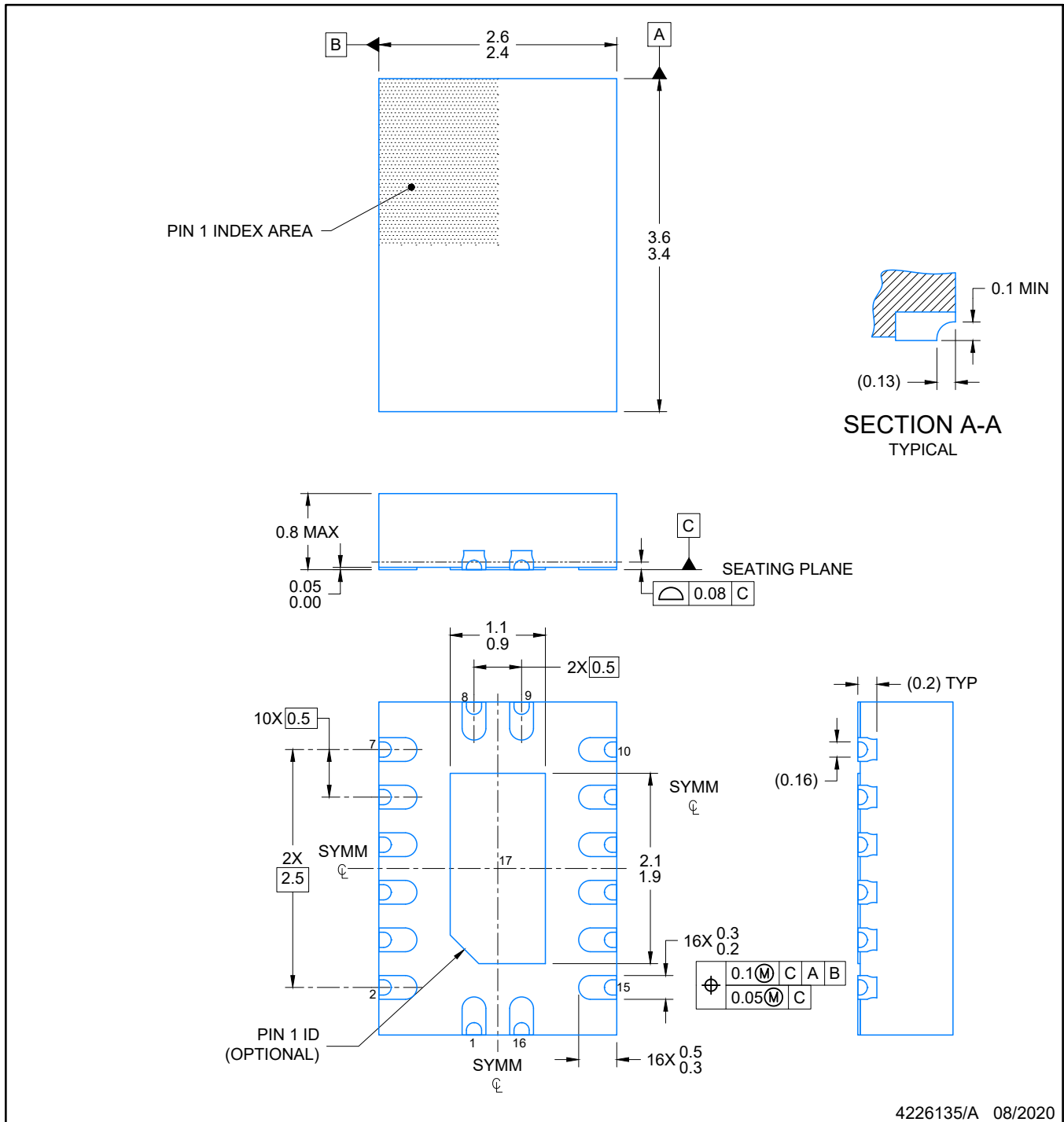
2.5 x 3.5, 0.5 mm pitch

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.



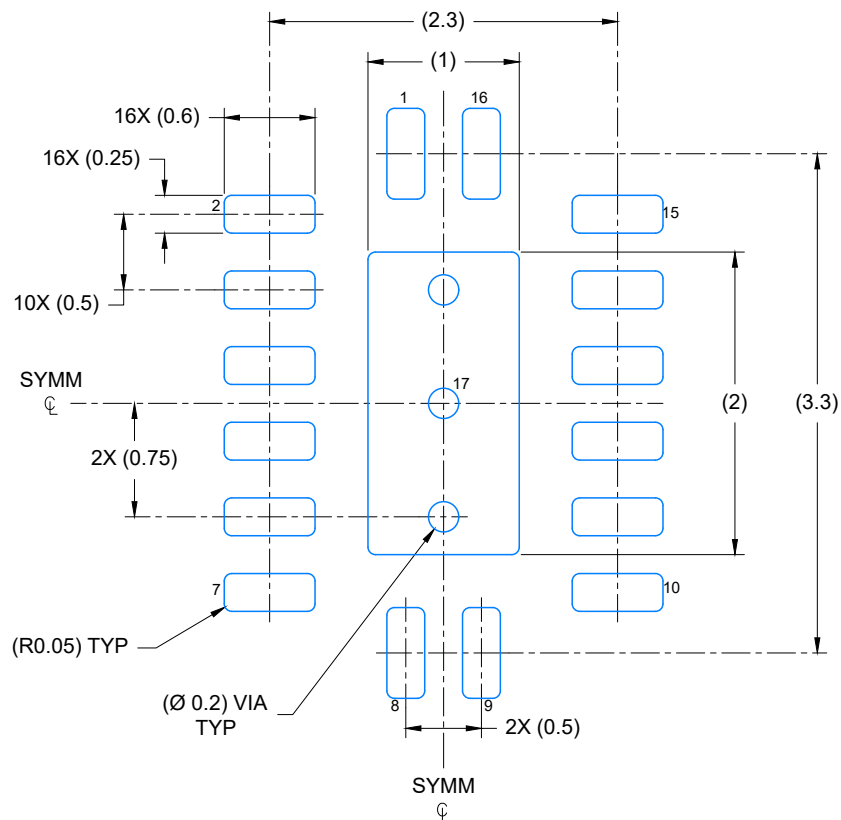
4226161/A



4226135/A 08/2020

## 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 optimal thermal and mechanical performance.

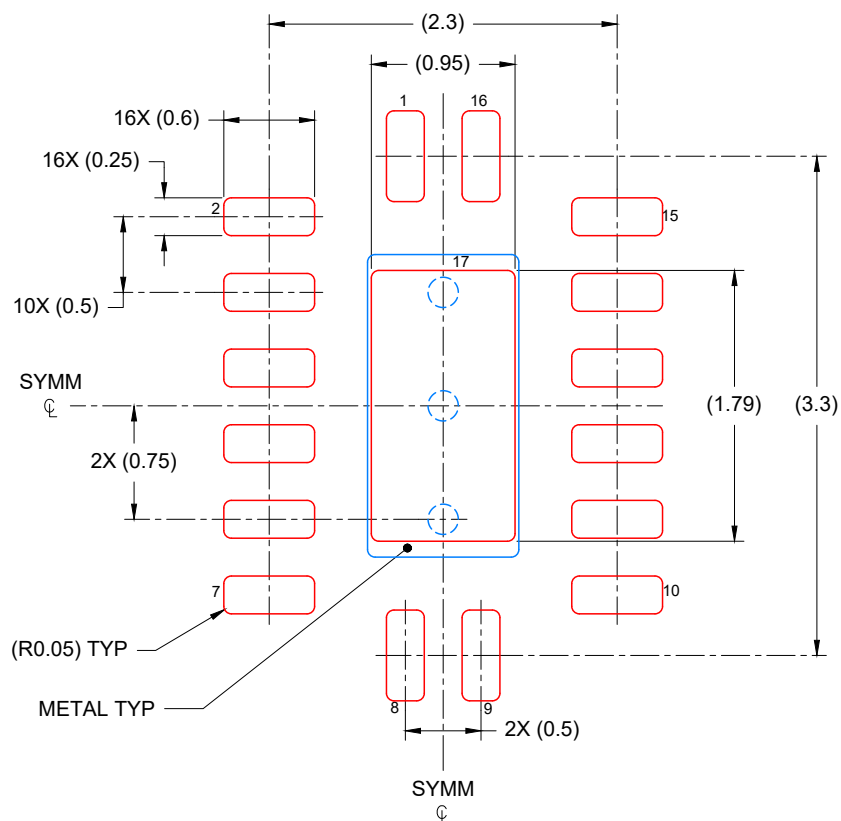


LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 20X

4226135/A 08/2020

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

EXPOSED PAD  
85% PRINTED COVERAGE BY AREA  
SCALE: 20X

4226135/A 08/2020

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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