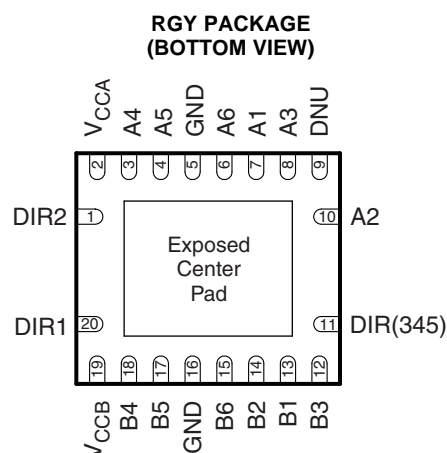
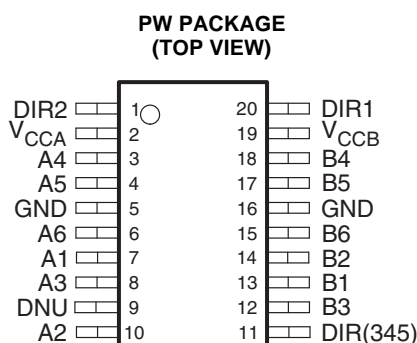


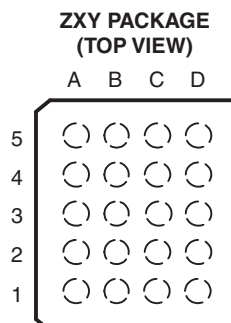
## AUDIO CODEC AC'97 VOLTAGE-TRANSLATION TRANSCEIVER

### FEATURES

- **Voltage-Level Transceiver for Interfacing 1.8 V Audio Codec (AC'97) Controllers With 3.3 V AC'97 Codec Links**
- **Configurable I/O Switching Levels With Dual-Supply Pins Operating Over Full 1.2-V to 3.6-V Power-Supply Range**
- **For Low-Power Operation, A and B Ports Are Placed in High-Impedance State When Either Supply Voltage Is Switched Off**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**
- **ESD Protection Exceeds JESD 22**
  - 7000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1500-V Charged-Device Model (C101)



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



### TERMINAL ASSIGNMENTS (20-Ball ZXY Package)

|   | A                  | B    | C        | D    |
|---|--------------------|------|----------|------|
| 5 | VCCA               | DIR2 | DIR1     | VCCB |
| 4 | A5                 | A4   | B4       | B5   |
| 3 | A6                 | GND  | GND      | B6   |
| 2 | A3                 | A1   | B2       | B1   |
| 1 | DNU <sup>(1)</sup> | A2   | DIR(345) | B3   |

(1) DNU – Do not use; should be left unconnected

### DESCRIPTION/ORDERING INFORMATION

The SN74AVC6T622 is a voltage-level transceiver for interfacing 1.8 V audio codec (AC'97) controllers, the audio/analog modem functionality found in personal computers, with 3.3V AC'97 codec links. With the digital switching levels of today's AC'97 codecs lowering to 1.8-V logic levels, the SN74AVC6T622 device can be used to bridge the gap between legacy 3.3-V AC'97 codecs and AC'97 controllers that are now operating at 1.8 V. The 6-bit wide SN74AVC6T622 device complies with the AC'97 electrical interface (both levels and timing) specification.



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.

Two supply-voltage pins allow the A-port and B-port input switching thresholds to be configured separately. The A port is designed to track  $V_{CCA}$ , while the B port is designed to track  $V_{CCB}$ .  $V_{CCA}$  and  $V_{CCB}$  can accept any supply voltage from 1.2 V to 3.6 V.

If either  $V_{CC}$  is switched off ( $V_{CCA} = 0$  V and/or  $V_{CCB} = 0$  V), all outputs are placed in the high-impedance state to conserve power.

The SN74AVC6T622 is available in two 0.5-mm-pitch ball grid array (BGA) packages. The 20-ball package has dimensions of 3 mm × 2.5 mm, and the 24-ball package measures 3 mm × 3 mm. Memory cards are widely used in mobile phones, PDAs, digital cameras, personal media players, camcorders, set-top boxes, etc. Low static power consumption and small package size make the SN74AVC6T622 an ideal choice for these applications.

## ORDERING INFORMATION

| $T_A$         | PACKAGE <sup>(1)(2)</sup> |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|---------------------------|--------------|-----------------------|------------------|
| –40°C to 85°C | QFN – RGY                 | Reel of 1000 | SN74AVC6T622RGYR      | WU622            |
|               | TSSOP – PW                | Reel of 2000 | SN74AVC6T622PWR       | WU622            |
|               | UFBGA – ZXY (Pb-Free)     | Reel of 2500 | SN74AVC6T622ZXYR      | WU622            |

(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).

## REFERENCE DESIGN

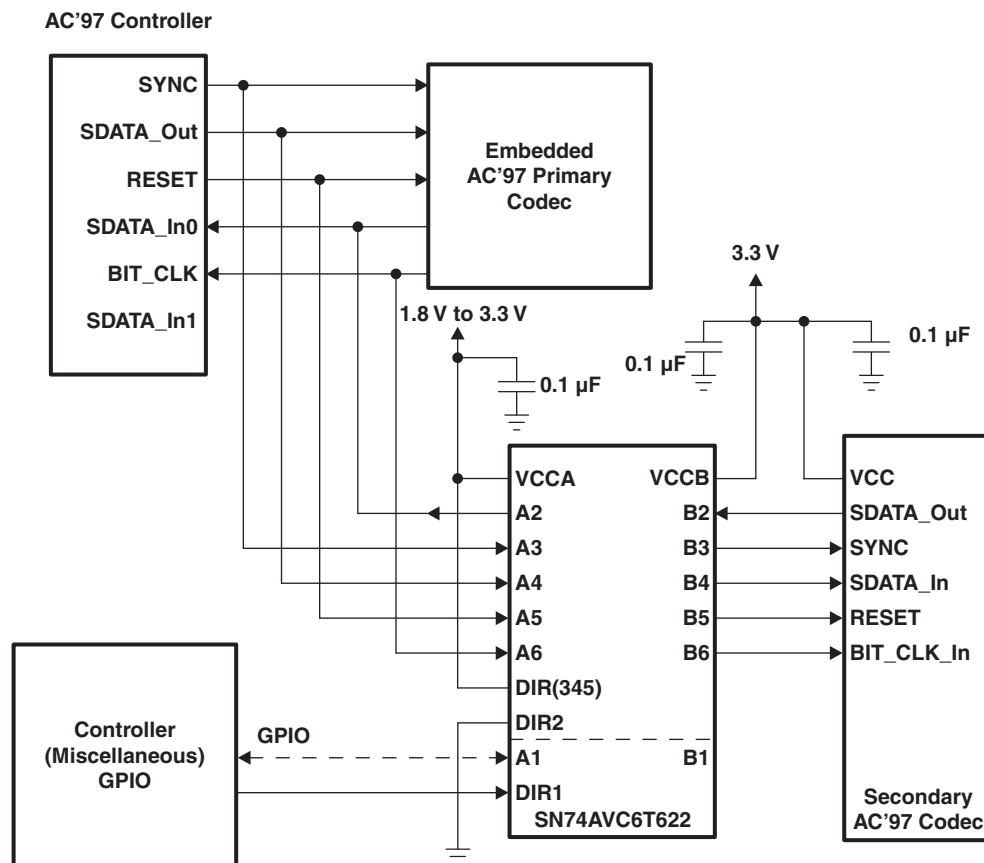


Figure 1. Interfacing 1.8 V AC'97 Controllers With 3.3 V AC'97 Controllers

**TERMINAL FUNCTIONS**

| ZXY BALL NO. | RGY, PW PIN NO. | NAME             | TYPE | DESCRIPTION  |
|--------------|-----------------|------------------|------|--|
| A1           | 9               | DNU              |      | Do not use; leave unconnected  |
| A2           | 8               | A3               | I    | AC'97 controller SYNC signal   |
| A3           | 6               | A6               | I    | AC'97 controller BIT_CLK signal  |
| A4           | 4               | A5               | I    | AC'97 controller RESET signal  |
| A5           | 2               | V <sub>CCA</sub> | Pwr  | A-port supply voltage. V <sub>CCA</sub> powers all A-port I/Os and control pins. |
| B1           | 10              | A2               | O    | AC'97 controller SDATA_In0 signal  |
| B2           | 7               | A1               | I/O  | GPIO to miscellaneous GPIO controller  |
| B3, C3       | 5, 16           | GND              | –    | Ground   |
| B4           | 3               | A4               | I    | AC'97 controller SDATA_Out signal  |
| B5           | 1               | DIR2             | –    | Should be tied to GND  |
| C1           | 11              | DIR(345)         | –    | Should be tied to V <sub>CCA</sub>   |
| C2           | 14              | B2               | I    | Secondary AC'97 codec SDATA_Out signal   |
| C4           | 18              | B4               | O    | Secondary AC'97 codec SDATA_In signal  |
| C5           | 20              | DIR1             | I    | Direction control from miscellaneous GPIO controller                             |
| D1           | 12              | B3               | O    | Secondary AC'97 codec SYNC signal  |
| D2           | 13              | B1               | O    | Optional GPIO signal if A1 is enabled  |
| D3           | 15              | B6               | O    | Secondary AC'97 codec BIT_CLK_In signal  |
| D4           | 17              | B5               | O    | Secondary AC'97 codec RESET signal   |
| D5           | 19              | V <sub>CCB</sub> | Pwr  | B-port supply voltage. V <sub>CCB</sub> powers all B-port I/Os and control pins. |

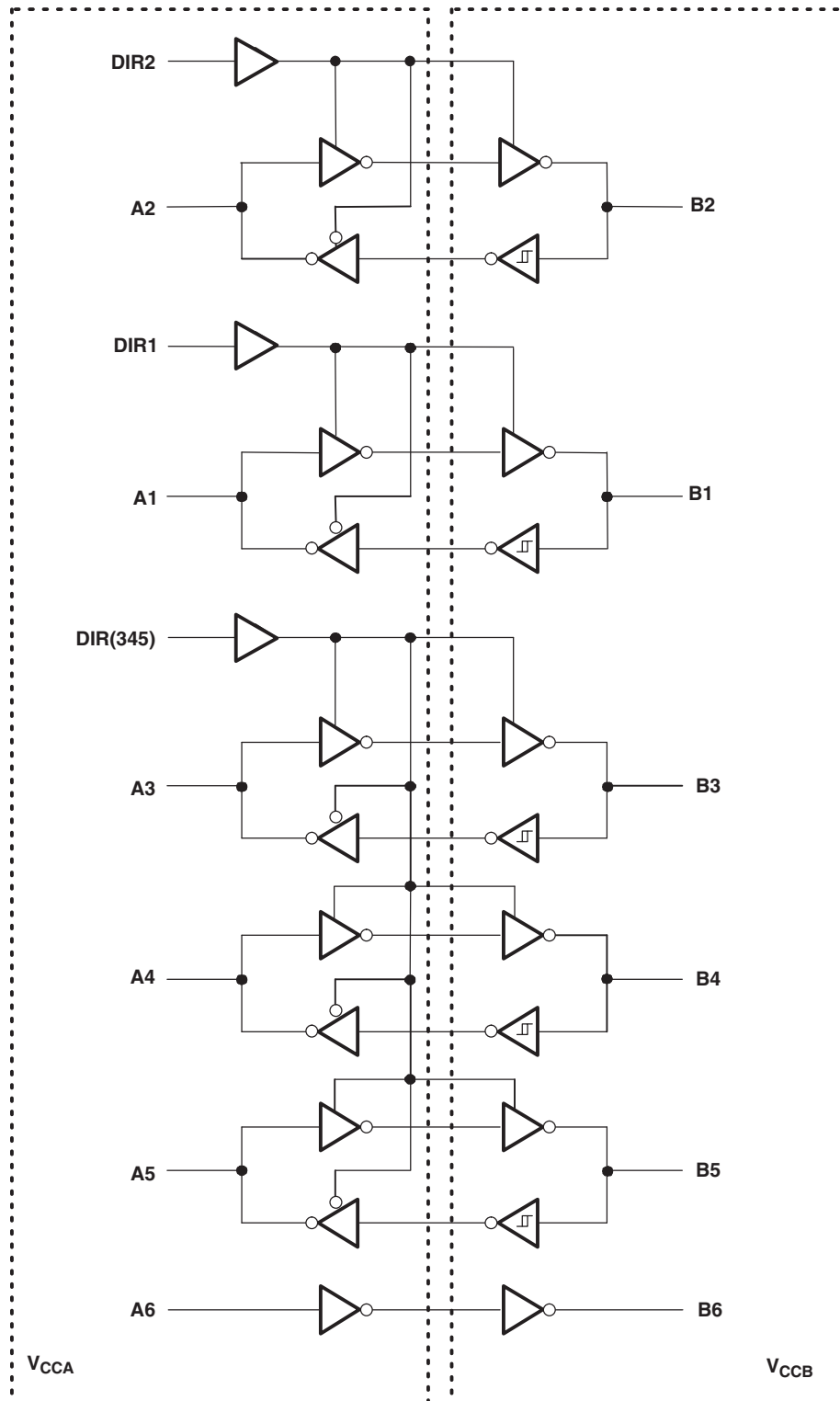
**FUNCTION TABLES**

| <b>CONTROL INPUT<br/>DIR2</b> | <b>OUTPUT CIRCUITS</b> |           | <b>OPERATION</b> |
|-------------------------------|------------------------|-----------|------------------|
|                               | <b>A2</b>              | <b>B2</b> |                  |
| High                          | Hi-Z                   | Enabled   | A2 to B2         |
| Low                           | Enabled                | Hi-Z      | B2 to A2         |

| <b>CONTROL INPUT<br/>DIR1</b> | <b>OUTPUT CIRCUITS</b> |           | <b>FUNCTION</b> |
|-------------------------------|------------------------|-----------|-----------------|
|                               | <b>A1</b>              | <b>B1</b> |                 |
| High                          | Hi-Z                   | Enabled   | A1 to B1        |
| Low                           | Enabled                | Hi-Z      | B1 to A1        |

| <b>CONTROL INPUT<br/>DIR(345)</b> | <b>OUTPUT CIRCUITS</b> |                   | <b>FUNCTION</b> |
|-----------------------------------|------------------------|-------------------|-----------------|
|                                   | <b>A3, A4, A5</b>      | <b>B3, B4, B5</b> |                 |
| High                              | Hi-Z                   | Enabled           | A3 to B3        |
|                                   |                        |                   | A4 to B4        |
|                                   |                        |                   | A5 to B5        |
| Low                               | Enabled                | Hi-Z              | B3 to A3        |
|                                   |                        |                   | B4 to A4        |
|                                   |                        |                   | B5 to A5        |

**LOGIC DIAGRAM (POSITIVE LOGIC)**



**ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>**

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

|                        |   |                            | MIN  | MAX             | UNIT |
|------------------------|---|----------------------------|------|-----------------|------|
| $V_{CCA}$<br>$V_{CCB}$ | Supply voltage range  |                            | −0.5 | 4.6             | V    |
| $V_I$                  | Input voltage range <sup>(2)</sup>  | I/O ports (A port)         | −0.5 | 4.6             | V    |
|                        |   | I/O ports (B port)         | −0.5 | 4.6             |      |
|                        |   | Control inputs             | −0.5 | 4.6             |      |
| $V_O$                  | Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup> | A port                     | −0.5 | 4.6             | V    |
|                        |   | B port                     | −0.5 | 4.6             |      |
| $V_O$                  | Voltage range applied to any output in the high or low state <sup>(2)(3)</sup>              | A port                     | −0.5 | $V_{CCA} + 0.5$ | V    |
|                        |   | B port                     | −0.5 | $V_{CCB} + 0.5$ |      |
| $I_{IK}$               | Input clamp current   | $V_I < 0$                  |      | −50             | mA   |
| $I_{OK}$               | Output clamp current  | $V_O < 0$                  |      | −50             | mA   |
| $I_O$                  | Continuous output current   |                            |      | ±50             | mA   |
|                        | Continuous current through $V_{CCA}$ , $V_{CCB}$ , or GND                                   |                            |      | ±100            | mA   |
| $\theta_{JA}$          | Package thermal impedance   | PW package <sup>(4)</sup>  |      | 83              | °C/W |
|                        |   | RGY package <sup>(5)</sup> |      | 37              |      |
|                        |   | ZXY package <sup>(4)</sup> |      | 193             |      |
| $T_{stg}$              | Storage temperature range   |                            | −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 voltage and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The output positive-voltage rating may be exceeded up to 4.6 V maximum if the output current rating is observed.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.
- (5) The package thermal impedance is calculated in accordance with JESD 51-5.

**RECOMMENDED OPERATING CONDITIONS<sup>(1)(2)(3)</sup>**

|                  |                                    |                           | <b>V<sub>CCI</sub></b> | <b>V<sub>CCO</sub></b> | <b>MIN</b>              | <b>MAX</b>       | <b>UNIT</b> |
|------------------|------------------------------------|---------------------------|------------------------|------------------------|-------------------------|------------------|-------------|
| V <sub>CCA</sub> | Supply voltage                     |                           |                        |                        | 1.2                     | 3.6              | V           |
| V <sub>CCB</sub> | Supply voltage                     |                           |                        |                        | 1.2                     | 3.6              | V           |
| V <sub>IH</sub>  | High-level input voltage           | All inputs <sup>(4)</sup> | 1.2 V to 1.95 V        |                        | V <sub>CCI</sub> × 0.65 |                  | V           |
|                  |                                    |                           | 1.95 V to 2.7 V        |                        | 1.7                     |                  |             |
|                  |                                    |                           | 2.7 V to 3.6 V         |                        | 2                       |                  |             |
| V <sub>IL</sub>  | Low-level input voltage            | All inputs <sup>(4)</sup> | 1.2 V to 1.95 V        |                        | V <sub>CCI</sub> × 0.35 |                  | V           |
|                  |                                    |                           | 1.95 V to 2.7 V        |                        | 0.7                     |                  |             |
|                  |                                    |                           | 2.7 V to 3.6 V         |                        | 0.8                     |                  |             |
| V <sub>I</sub>   | Input voltage                      | Control inputs            |                        |                        | 0                       | 3.6              | V           |
| V <sub>I/O</sub> | Input/output voltage               | Active state              |                        |                        | 0                       | V <sub>CCO</sub> | V           |
|                  |                                    | 3-state                   |                        |                        | 0                       | 3.6              |             |
| I <sub>OH</sub>  | High-level output current (A port) |                           |                        | 1.2 V                  |                         | –1               | mA          |
|                  |                                    |                           |                        | 1.4 V to 1.6 V         |                         | –1               |             |
|                  |                                    |                           |                        | 1.65 V to 1.95 V       |                         | –2               |             |
|                  |                                    |                           |                        | 2.3 V to 2.7 V         |                         | –4               |             |
|                  |                                    |                           |                        | 3 V to 3.6 V           |                         | –8               |             |
| I <sub>OL</sub>  | Low-level output current (A port)  |                           |                        | 1.2 V                  |                         | 1                | mA          |
|                  |                                    |                           |                        | 1.4 V to 1.6 V         |                         | 1                |             |
|                  |                                    |                           |                        | 1.65 V to 1.95 V       |                         | 2                |             |
|                  |                                    |                           |                        | 2.3 V to 2.7 V         |                         | 4                |             |
|                  |                                    |                           |                        | 3 V to 3.6 V           |                         | 8                |             |
| I <sub>OH</sub>  | High-level output current (B port) |                           |                        | 1.2 V                  |                         | –1               | mA          |
|                  |                                    |                           |                        | 1.4 V to 1.6 V         |                         | –2               |             |
|                  |                                    |                           |                        | 1.65 V to 1.95 V       |                         | –4               |             |
|                  |                                    |                           |                        | 2.3 V to 2.7 V         |                         | –8               |             |
|                  |                                    |                           |                        | 3 V to 3.6 V           |                         | –16              |             |
| I <sub>OL</sub>  | Low-level output current (B port)  |                           |                        | 1.2 V                  |                         | 1                | mA          |
|                  |                                    |                           |                        | 1.4 V to 1.6 V         |                         | 2                |             |
|                  |                                    |                           |                        | 1.65 V to 1.95 V       |                         | 4                |             |
|                  |                                    |                           |                        | 2.3 V to 2.7 V         |                         | 8                |             |
|                  |                                    |                           |                        | 3 V to 3.6 V           |                         | 16               |             |
| Δt/Δv            | Input transition rise or fall rate |                           |                        |                        |                         | 5                | ns/V        |
| T <sub>A</sub>   | Operating free-air temperature     |                           |                        |                        | –40                     | 85               | °C          |

(1) V<sub>CCI</sub> is the V<sub>CC</sub> associated with the input port.

(2) V<sub>CCO</sub> is the V<sub>CC</sub> associated with the output port.

(3) All unused data inputs of the device must be held at V<sub>CCI</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

(4) DIR2, DIR1, and DIR(345) are referenced to V<sub>CCA</sub>.

**ELECTRICAL CHARACTERISTICS<sup>(1)(2)</sup>**

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

| PARAMETER                           |                | TEST CONDITIONS   |   | V <sub>CCA</sub> | V <sub>CCB</sub> | T <sub>A</sub> = 25°C  |                    |     | UNIT |
|-------------------------------------|----------------|---|---|------------------|------------------|------------------------|--------------------|-----|------|
|                                     |                |   |   |                  |                  | MIN                    | TYP <sup>(3)</sup> | MAX |      |
| V <sub>OH</sub>                     | A port         | I <sub>OH</sub> = −100 μA   | V <sub>I</sub> = V <sub>IH</sub>                          | 1.2 V to 3.6 V   | 1.2 V to 3.6 V   | V <sub>CCO</sub> − 0.2 |                    | V   |      |
|                                     |                | I <sub>OH</sub> = −1 mA   |   | 1.2 V            | 1.2 V            | 1.1                    |                    |     |      |
|                                     |                | I <sub>OH</sub> = −2 mA   |   | 1.4 V            | 1.4 V            | 1.05                   |                    |     |      |
|                                     |                | I <sub>OH</sub> = −4 mA   |   | 1.65 V           | 1.65 V           | 1.2                    |                    |     |      |
|                                     |                | I <sub>OH</sub> = −8 mA   |   | 2.3 V            | 2.3 V            | 1.75                   |                    |     |      |
|                                     |                | I <sub>OH</sub> = −8 mA   |   | 3 V              | 3 V              | 2.3                    |                    |     |      |
| V <sub>OL</sub>                     | A port         | I <sub>OL</sub> = 100 μA  | V <sub>I</sub> = V <sub>IL</sub>                          | 1.2 V to 3.6 V   | 1.2 V to 3.6 V   | 0.2                    |                    | V   |      |
|                                     |                | I <sub>OL</sub> = 1 mA  |   | 1.2 V            | 1.2 V            | 0.07                   |                    |     |      |
|                                     |                | I <sub>OL</sub> = 2 mA  |   | 1.4 V            | 1.4 V            | 0.35                   |                    |     |      |
|                                     |                | I <sub>OL</sub> = 4 mA  |   | 1.65 V           | 1.65 V           | 0.45                   |                    |     |      |
|                                     |                | I <sub>OL</sub> = 4 mA  |   | 2.3 V            | 2.3 V            | 0.55                   |                    |     |      |
|                                     |                | I <sub>OL</sub> = 8 mA  |   | 3 V              | 3 V              | 0.7                    |                    |     |      |
| V <sub>OH</sub>                     | B port         | I <sub>OH</sub> = −100 μA   | V <sub>I</sub> = V <sub>IH</sub>                          | 1.2 V to 3.6 V   | 1.2 V to 3.6 V   | V <sub>CCO</sub> − 0.2 |                    | V   |      |
|                                     |                | I <sub>OH</sub> = −1 mA   |   | 1.2 V            | 1.2 V            | 1.1                    |                    |     |      |
|                                     |                | I <sub>OH</sub> = −2 mA   |   | 1.4 V            | 1.4 V            | 1.05                   |                    |     |      |
|                                     |                | I <sub>OH</sub> = −4 mA   |   | 1.65 V           | 1.65 V           | 1.2                    |                    |     |      |
|                                     |                | I <sub>OH</sub> = −8 mA   |   | 2.3 V            | 2.3 V            | 1.75                   |                    |     |      |
|                                     |                | I <sub>OH</sub> = −16 mA  |   | 3 V              | 3 V              | 2.3                    |                    |     |      |
| V <sub>OL</sub>                     | B port         | I <sub>OL</sub> = 100 μA  | V <sub>I</sub> = V <sub>IL</sub>                          | 1.2 V to 3.6 V   | 1.2 V to 3.6 V   | 0.2                    |                    | V   |      |
|                                     |                | I <sub>OL</sub> = 1 mA  |   | 1.2 V            | 1.2 V            | 0.07                   |                    |     |      |
|                                     |                | I <sub>OL</sub> = 2 mA  |   | 1.4 V            | 1.4 V            | 0.35                   |                    |     |      |
|                                     |                | I <sub>OL</sub> = 4 mA  |   | 1.65 V           | 1.65 V           | 0.45                   |                    |     |      |
|                                     |                | I <sub>OL</sub> = 8 mA  |   | 2.3 V            | 2.3 V            | 0.55                   |                    |     |      |
|                                     |                | I <sub>OL</sub> = 16 mA   |   | 3 V              | 3 V              | 0.7                    |                    |     |      |
| I <sub>I</sub>                      | Control inputs | V <sub>I</sub> = V <sub>CCA</sub> or GND  |   | 1.2 V to 3.6 V   | 1.2 V to 3.6 V   | ±1                     |                    | μA  |      |
| I <sub>off</sub>                    | A or B port    | V <sub>I</sub> or V <sub>O</sub> = 0 to 3.6 V   |   | 0 V              | 0 V to 3.6 V     | ±5                     |                    | μA  |      |
|                                     |                |   |   | 0 V to 3.6 V     | 0 V              | ±5                     |                    |     |      |
| I <sub>OZ</sub> <sup>(4)</sup>      | A or B port    | V <sub>O</sub> = V <sub>CCO</sub> or GND,<br>V <sub>I</sub> = V <sub>CCI</sub> or GND | See function table for input states when outputs are Hi Z | 3.6 V            | 3.6 V            | ±5                     |                    | μA  |      |
| I <sub>CCA</sub>                    |                | V <sub>I</sub> = V <sub>CCI</sub> or GND, I <sub>O</sub> = 0                          |   | 1.2 V to 3.6 V   | 1.2 V to 3.6 V   | 10                     |                    | μA  |      |
|                                     |                |   |   | 3.6 V            | 0 V              | 10                     |                    |     |      |
|                                     |                |   |   | 0 V              | 3.6 V            | −1                     |                    |     |      |
| I <sub>CCB</sub>                    |                | V <sub>I</sub> = V <sub>CCI</sub> or GND, I <sub>O</sub> = 0                          |   | 1.2 V to 3.6 V   | 1.2 V to 3.6 V   | 10                     |                    | μA  |      |
|                                     |                |   |   | 3.6 V            | 0 V              | −1                     |                    |     |      |
|                                     |                |   |   | 0 V              | 3.6 V            | 10                     |                    |     |      |
| I <sub>CCA</sub> + I <sub>CCB</sub> |                | V <sub>I</sub> = V <sub>CCI</sub> or GND, I <sub>O</sub> = 0                          |   | 1.2 V to 3.6 V   | 1.2 V to 3.6 V   | 15                     |                    | μA  |      |
| C <sub>i</sub>                      | Control inputs | V <sub>I</sub> = V <sub>CCA</sub> or GND  |   | 1.8 V            | 3 V              | 1.5                    | 2                  | pF  |      |
|                                     | Clock input    |   |   |                  |                  | 2                      | 2.5                |     |      |
| C <sub>io</sub>                     | A port         | V <sub>O</sub> = V <sub>CCA</sub> or GND  |   | 1.8 V            | 3 V              | 2.5                    | 3                  | pF  |      |
|                                     | B port         | V <sub>O</sub> = V <sub>CCB</sub> or GND  |   |                  |                  | 2.5                    | 3                  |     |      |

(1)  $V_{CCO}$  is the  $V_{CC}$  associated with the output port.(2)  $V_{CCI}$  is the  $V_{CC}$  associated with the input port.(3) All typical values are at  $T_A = 25^\circ\text{C}$ .(4) For I/O ports, the parameter  $I_{OZ}$  includes the input leakage current.



## OUTPUT SLEW RATES<sup>(1)</sup>

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

| PARAMETER | FROM | TO  | $V_{CCA} = 1.8\text{ V} \pm 0.15\text{ V}$ ,<br>$V_{CCB} = 3\text{ V} \pm 0.3\text{ V}$ |                  | UNIT |
|-----------|------|-----|---|------------------|------|
|           |      |     | MIN   | MAX              |      |
| $t_r$     | 10%  | 90% |   | 3 <sup>(2)</sup> | ns   |
| $t_f$     | 90%  | 10% |   | 3 <sup>(2)</sup> | ns   |

(1) Values are characterized, but not production tested.

(2) Using  $C_L = 15\text{ pF}$  on the B side and  $C_L = 7\text{ pF}$  on the A side

## TYPICAL SWITCHING CHARACTERISTICS

$T_A = 25^\circ\text{C}$ ,  $V_{CCA} = 1.2\text{ V}$  (see [Figure 2](#))

| PARAMETER       | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CCB} = 1.2\text{ V}$ | $V_{CCB} = 1.5\text{ V}$ | $V_{CCB} = 1.8\text{ V}$ | $V_{CCB} = 2.5\text{ V}$ | $V_{CCB} = 3\text{ V}$ | $V_{CCB} = 3.3\text{ V}$ | UNIT |
|-----------------|-----------------|----------------|--------------------------|--------------------------|--------------------------|--------------------------|------------------------|--------------------------|------|
|                 |                 |                | TYP                      | TYP                      | TYP                      | TYP                      | TYP                    | TYP                      |      |
| $t_{pd}$        | A               | B              | 3.8                      | 3                        | 2.6                      | 2.5                      | 2.5                    | 2.6                      | ns   |
|                 | B               | A              | 4.6                      | 4.2                      | 4                        | 3.9                      | 3.9                    | 3.8                      |      |
|                 | A6              | B6             | 3.8                      | 3                        | 2.6                      | 2.5                      | 2.5                    | 2.6                      |      |
|                 | A2              | B2             | 3.8                      | 3                        | 2.6                      | 2.5                      | 2.5                    | 2.6                      |      |
|                 | B2              | A2             | 4.6                      | 4.2                      | 4                        | 3.9                      | 3.9                    | 3.8                      |      |
| $t_{en}^{(1)}$  | DIR             | B              | 4.8                      | 4                        | 3.7                      | 3.4                      | 3.4                    | 3.4                      | ns   |
|                 |                 | A              | 4.5                      | 4.4                      | 5                        | 5.4                      | 5.4                    | 5.4                      |      |
| $t_{dis}^{(1)}$ | DIR             | B              | 6.3                      | 5.2                      | 5.6                      | 4.8                      | 4.8                    | 6.1                      | ns   |
|                 |                 | A              | 4.8                      | 4.6                      | 5.3                      | 5.4                      | 5.4                    | 5.3                      |      |

(1) DIR refers to DIR2, DIR1, and DIR(345).

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $V_{CCA} = 1.5\text{ V} \pm 0.1\text{ V}$  (see [Figure 2](#))

| PARAMETER       | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CCB} = 1.2\text{ V}$ | $V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$ |     | $V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$ |      | $V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$ |     | $V_{CCB} = 3\text{ V} \pm 0.3\text{ V}$ |     | $V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$ |      | UNIT |
|-----------------|-----------------|----------------|--------------------------|---|-----|--|------|---|-----|---|-----|---|------|------|
|                 |                 |                | TYP                      | MIN                                       | MAX | MIN  | MAX  | MIN                                       | MAX | MIN                                     | MAX | MIN                                       | MAX  |      |
| $t_{pd}$        | A               | B              | 3.4                      | 1.1                                       | 5.6 | 1  | 4.8  | 1   | 3.9 | 0.9                                     | 3.9 | 0.9                                       | 3.8  | ns   |
|                 | B               | A              | 3.8                      | 1.4                                       | 6   | 1.3  | 5.6  | 1.3                                       | 5.2 | 0.5                                     | 5.2 | 0.3                                       | 5.2  |      |
|                 | A6              | B6             | 3.4                      | 1.1                                       | 5.6 | 1  | 4.8  | 1   | 3.9 | 0.9                                     | 3.9 | 0.9                                       | 3.8  |      |
|                 | A2              | B2             | 3.4                      | 1.1                                       | 5.6 | 1  | 4.8  | 1   | 3.9 | 0.9                                     | 3.9 | 0.9                                       | 3.8  |      |
|                 | B2              | A2             | 3.8                      | 1.4                                       | 6   | 1.3  | 5.6  | 1.3                                       | 5.2 | 0.5                                     | 5.2 | 0.3                                       | 5.2  |      |
| $t_{en}^{(1)}$  | DIR             | B              | 4                        | 1.3                                       | 7.7 | 1.1  | 6.9  | 0.8                                       | 6.1 | 0.8                                     | 6   | 0.8                                       | 5.9  | ns   |
|                 |                 | A              | 3.5                      | 1.4                                       | 7   | 1.5  | 7.4  | 1.7                                       | 8.2 | 1.7                                     | 8.2 | 1.7                                       | 7.7  |      |
| $t_{dis}^{(1)}$ | DIR             | B              | 5.7                      | 1.9                                       | 8.9 | 2.1  | 10.4 | 1.8                                       | 8.7 | 1.7                                     | 8.5 | 2.4                                       | 11.4 | ns   |
|                 |                 | A              | 3.4                      | 1.2                                       | 7   | 1.2  | 6.8  | 1.2                                       | 6.9 | 1.2                                     | 6.5 | 1.2                                       | 6.6  |      |

(1) DIR refers to DIR2, DIR1, and DIR(345).

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$  (see [Figure 2](#))

| PARAMETER       | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CCB} = 1.2 \text{ V}$ | $V_{CCB} = 1.5 \text{ V} \pm 0.1 \text{ V}$ |     | $V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$ |     | $V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$ |     | $V_{CCB} = 3 \text{ V} \pm 0.3 \text{ V}$ |     | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ |     | UNIT |
|-----------------|-----------------|----------------|---------------------------|---|-----|--|-----|---|-----|---|-----|---|-----|------|
|                 |                 |                | TYP                       | MIN   | MAX | MIN  | MAX | MIN   | MAX | MIN                                       | MAX | MIN   | MAX |      |
| $t_{pd}$        | A               | B              | 3.2                       | 1   | 5.2 | 0.8  | 4.4 | 0.7   | 3.5 | 0.6                                       | 3.4 | 0.7   | 3.1 | ns   |
|                 | B               | A              | 3.4                       | 1.1   | 5.2 | 1  | 4.8 | 0.9   | 4.3 | 0.3                                       | 4.3 | 0.2   | 4.3 |      |
|                 | A6              | B6             | 3.2                       | 1   | 5.2 | 0.8  | 4.4 | 0.7   | 3.5 | 0.6                                       | 3.4 | 0.7   | 3.1 |      |
|                 | A2              | B2             | 3.2                       | 1   | 5.2 | 0.8  | 4.4 | 0.7   | 3.5 | 0.6                                       | 3.4 | 0.7   | 3.1 |      |
|                 | B2              | A2             | 3.4                       | 1.1   | 5.2 | 1  | 4.8 | 0.9   | 4.3 | 0.3                                       | 4.3 | 0.2   | 4.3 |      |
| $t_{en}^{(1)}$  | DIR             | B              | 3.5                       | 1.2   | 6.8 | 0.9  | 6   | 0.7   | 5.1 | 0.7                                       | 5   | 0.7   | 4.8 | ns   |
|                 |                 | A              | 2.9                       | 1.1   | 4.7 | 1.1  | 5.2 | 1.4   | 5.1 | 1.4                                       | 5.1 | 1.4   | 5.3 |      |
| $t_{dis}^{(1)}$ | DIR             | B              | 5.3                       | 1.6   | 8.4 | 2  | 9.5 | 1.6   | 8.2 | 1.4                                       | 8.1 | 2.2   | 8.2 | ns   |
|                 |                 | A              | 3.6                       | 1.3   | 7.7 | 1.2  | 7.9 | 1.3   | 7.5 | 1.3                                       | 7.5 | 1.3   | 7.6 |      |

(1) DIR refers to DIR2, DIR1, and DIR(345).

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$  (see [Figure 2](#))

| PARAMETER      | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CCB} = 1.2 \text{ V}$ | $V_{CCB} = 1.5 \text{ V} \pm 0.1 \text{ V}$ |     | $V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$ |     | $V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$ |     | $V_{CCB} = 3 \text{ V} \pm 0.3 \text{ V}$ |     | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ |     | UNIT |
|----------------|-----------------|----------------|---------------------------|---|-----|--|-----|---|-----|---|-----|---|-----|------|
|                |                 |                | TYP                       | MIN   | MAX | MIN  | MAX | MIN   | MAX | MIN                                       | MAX | MIN   | MAX |      |
| $t_{pd}$       | A               | B              | 3                         | 0.8   | 4.7 | 0.7  | 3.8 | 0.6   | 2.9 | 0.4                                       | 2.7 | 0.5   | 2.5 | ns   |
|                | B               | A              | 3                         | 0.9   | 4.4 | 0.7  | 3.9 | 0.6   | 3.3 | 0.3                                       | 3.2 | 0.3   | 3.2 |      |
|                | A6              | B6             | 3                         | 0.8   | 4.7 | 0.7  | 3.8 | 0.6   | 2.9 | 0.4                                       | 2.7 | 0.5   | 2.5 |      |
|                | A2              | B2             | 3                         | 0.8   | 4.7 | 0.7  | 3.8 | 0.6   | 2.9 | 0.4                                       | 2.7 | 0.5   | 2.5 |      |
|                | B2              | A2             | 3                         | 0.9   | 4.4 | 0.7  | 3.9 | 0.6   | 3.3 | 0.3                                       | 3.2 | 0.3   | 3.2 |      |
| $t_{en}^{(1)}$ | DIR             | B              | 3.1                       | 1   | 5.7 | 0.8  | 4.8 | 0.5   | 3.9 | 0.5                                       | 3.7 | 0.5   | 3.6 | ns   |
|                |                 | A              | 2.2                       | 0.7   | 3.5 | 0.6  | 4.3 | 1.2   | 4.4 | 0.7                                       | 4.6 | 0.4   | 4.7 |      |
| $t_{dis}$      | DIR             | B              | 4.6                       | 1.4   | 7.6 | 1.8  | 8.4 | 1.3   | 7.2 | 1.3                                       | 7.1 | 2   | 7.5 | ns   |
|                |                 | A              | 2.6                       | 0.9   | 5.6 | 0.9  | 5.4 | 1   | 5.5 | 0.9                                       | 5.5 | 0.9   | 5.8 |      |

(1) DIR refers to DIR2, DIR1, and DIR(345).

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $V_{CCA} = 3.3 \text{ V} \pm 0.3 \text{ V}$  (see [Figure 2](#))

| PARAMETER       | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CCB} = 1.2 \text{ V}$ | $V_{CCB} = 1.5 \text{ V} \pm 0.1 \text{ V}$ |     | $V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$ |     | $V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$ |     | $V_{CCB} = 3 \text{ V} \pm 0.3 \text{ V}$ |     | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ |     | UNIT |
|-----------------|-----------------|----------------|---------------------------|---|-----|--|-----|---|-----|---|-----|---|-----|------|
|                 |                 |                | TYP                       | MIN   | MAX | MIN  | MAX | MIN   | MAX | MIN                                       | MAX | MIN   | MAX |      |
| $t_{pd}$        | A               | B              | 2.8                       | 0.8   | 4.5 | 0.6  | 3.6 | 0.4   | 2.7 | 0.4                                       | 2.7 | 0.3   | 2.3 | ns   |
|                 | B               | A              | 2.9                       | 0.8   | 4.3 | 0.6  | 3.7 | 0.5   | 3   | 0.5                                       | 3   | 0.1   | 2.7 |      |
|                 | A6              | B6             | 2.8                       | 0.8   | 4.5 | 0.6  | 3.6 | 0.4   | 2.7 | 0.4                                       | 2.7 | 0.3   | 2.3 |      |
|                 | A2              | B2             | 2.8                       | 0.8   | 4.5 | 0.6  | 3.6 | 0.4   | 2.7 | 0.4                                       | 2.7 | 0.3   | 2.3 |      |
|                 | B2              | A2             | 2.9                       | 0.8   | 4.3 | 0.6  | 3.7 | 0.5   | 3   | 0.5                                       | 3   | 0.1   | 2.7 |      |
| $t_{en}^{(1)}$  | DIR             | B              | 3                         | 1   | 5.1 | 0.6  | 4.3 | 0.5   | 3.4 | 0.5                                       | 3.4 | 0.4   | 3   | ns   |
|                 |                 | A              | 2                         | 0.6   | 3.1 | 0.6  | 5.4 | 0.7   | 5.4 | 0.7                                       | 5.4 | 0.5   | 5.4 |      |
| $t_{dis}^{(1)}$ | DIR             | B              | 4.4                       | 1.4   | 7.4 | 1.8  | 8.3 | 1.2   | 7   | 1.2                                       | 7   | 2   | 7.3 | ns   |
|                 |                 | A              | 3.7                       | 1.5   | 8.1 | 1.5  | 7.9 | 1.5   | 7.9 | 1.5                                       | 7.9 | 1.5   | 8   |      |

(1) DIR refers to DIR2, DIR1, and DIR(345).

## TYPICAL FREQUENCY AND OUTPUT SKEW

$T_A = 25^\circ\text{C}$ ,  $V_{CCA} = 1.2 \text{ V}$  (see [Figure 2](#))

| PARAMETER   |                    | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CCB} = 1.2 \text{ V}$ | $V_{CCB} = 1.5 \text{ V}$ | $V_{CCB} = 1.8 \text{ V}$ | $V_{CCB} = 2.5 \text{ V}$ | $V_{CCB} = 3 \text{ V}$ | $V_{CCB} = 3.3 \text{ V}$ | UNIT |
|-------------|--------------------|-----------------|----------------|---------------------------|---------------------------|---------------------------|---------------------------|-------------------------|---------------------------|------|
|             |                    |                 |                | TYP                       | TYP                       | TYP                       | TYP                       | TYP                     | TYP                       |      |
| $t_{max}$   | Clock              | A6              | B6             | 95                        | 95                        | 95                        | 95                        | 95                      | 95                        | MHz  |
|             | Data               | A               | B              | 95                        | 95                        | 95                        | 95                        | 95                      | 95                        |      |
|             |                    | B               | A              | 95                        | 95                        | 95                        | 95                        | 95                      | 95                        |      |
| $t_{sk(o)}$ | Channel-to-channel | A               | B              | 0.5                       | 0.4                       | 0.4                       | 0.3                       | 0.5                     | 0.5                       | ns   |

## MAXIMUM FREQUENCY AND OUTPUT SKEW

over recommended operating free-air temperature range,  $V_{CCA} = 1.5 \text{ V} \pm 0.1 \text{ V}$  (see [Figure 2](#))

| PARAMETER   |                    | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CCB} = 1.2 \text{ V}$ | $V_{CCB} = 1.5 \text{ V} \pm 0.1 \text{ V}$ |     | $V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$ |     | $V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$ |     | $V_{CCB} = 3 \text{ V} \pm 0.3 \text{ V}$ |     | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ |     | UNIT |
|-------------|--------------------|-----------------|----------------|---------------------------|---|-----|--|-----|---|-----|---|-----|---|-----|------|
|             |                    |                 |                | TYP                       | MIN   | MAX | MIN  | MAX | MIN   | MAX | MIN                                       | MAX | MIN   | MAX |      |
| $f_{max}$   | Clock              | A6              | B6             | 95                        | 95  |     | 95   |     | 95  |     | 95  |     | 95  |     | MHz  |
|             | Data               | A               | B              | 95                        | 95  |     | 95   |     | 95  |     | 95  |     | 95  |     |      |
|             |                    | B               | A              | 95                        | 95  |     | 95   |     | 95  |     | 95  |     | 95  |     |      |
| $t_{sk(o)}$ | Channel-to-channel | DIR             | B              | 0.3                       |   | 0.3 |  | 0.3 |   | 0.3 |   | 0.5 |   | 0.4 | ns   |

## MAXIMUM FREQUENCY AND OUTPUT SKEW

over recommended operating free-air temperature range,  $V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$  (see [Figure 2](#))

| PARAMETER   |                    | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CCB} = 1.2 \text{ V}$ | $V_{CCB} = 1.5 \text{ V} \pm 0.1 \text{ V}$ |     | $V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$ |     | $V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$ |     | $V_{CCB} = 3 \text{ V} \pm 0.3 \text{ V}$ |     | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ |     | UNIT |
|-------------|--------------------|-----------------|----------------|---------------------------|---|-----|--|-----|---|-----|---|-----|---|-----|------|
|             |                    |                 |                | TYP                       | MIN   | MAX | MIN  | MAX | MIN   | MAX | MIN                                       | MAX | MIN   | MAX |      |
| $f_{max}$   | Clock              | A6              | B6             | 95                        | 95  |     | 95   |     | 95  |     | 95  |     | 95  |     | MHz  |
|             | Data               | A               | B              | 95                        | 95  |     | 95   |     | 95  |     | 95  |     | 95  |     |      |
|             |                    | B               | A              | 95                        | 95  |     | 95   |     | 95  |     | 95  |     | 95  |     |      |
| $t_{sk(o)}$ | Channel-to-channel | DIR             | B              | 0.3                       |   | 0.3 |  | 0.3 |   | 0.3 |   | 0.5 |   | 0.3 | ns   |

## MAXIMUM FREQUENCY AND OUTPUT SKEW

over recommended operating free-air temperature range,  $V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$  (see [Figure 2](#))

| PARAMETER   |                    | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CCB} = 1.2 \text{ V}$ | $V_{CCB} = 1.5 \text{ V} \pm 0.1 \text{ V}$ |     | $V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$ |     | $V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$ |     | $V_{CCB} = 3 \text{ V} \pm 0.3 \text{ V}$ |     | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ |     | UNIT |
|-------------|--------------------|-----------------|----------------|---------------------------|---|-----|--|-----|---|-----|---|-----|---|-----|------|
|             |                    |                 |                | TYP                       | MIN   | MAX | MIN  | MAX | MIN   | MAX | MIN                                       | MAX | MIN   | MAX |      |
| $f_{\max}$  | Clock              | A6              | B6             | 95                        | 95  |     | 95   |     | 95  |     | 95  |     | 95  |     | MHz  |
|             | Data               | A               | B              | 95                        | 95  |     | 95   |     | 95  |     | 95  |     | 95  |     |      |
|             |                    | B               | A              | 95                        | 95  |     | 95   |     | 95  |     | 95  |     | 95  |     |      |
| $t_{sk(o)}$ | Channel-to-channel | DIR             | B              | 0.3                       |   | 0.3 |  | 0.3 |   | 0.2 |   | 0.6 |   | 0.3 | ns   |

## MAXIMUM FREQUENCY AND OUTPUT SKEW

over recommended operating free-air temperature range,  $V_{CCA} = 3.3 \text{ V} \pm 0.3 \text{ V}$  (see [Figure 2](#))

| PARAMETER   |                    | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CCB} = 1.2 \text{ V}$ | $V_{CCB} = 1.5 \text{ V} \pm 0.1 \text{ V}$ |     | $V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$ |     | $V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$ |     | $V_{CCB} = 3 \text{ V} \pm 0.3 \text{ V}$ |     | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ |     | UNIT |
|-------------|--------------------|-----------------|----------------|---------------------------|---|-----|--|-----|---|-----|---|-----|---|-----|------|
|             |                    |                 |                | TYP                       | MIN   | MAX | MIN  | MAX | MIN   | MAX | MIN                                       | MAX | MIN   | MAX |      |
| $f_{\max}$  | Clock              | A6              | B6             | 95                        | 95  |     | 95   |     | 95  |     | 95  |     | 95  |     | MHz  |
|             | Data               | A               | B              | 95                        | 95  |     | 95   |     | 95  |     | 95  |     | 95  |     |      |
|             |                    | B               | A              | 95                        | 95  |     | 95   |     | 95  |     | 95  |     | 95  |     |      |
| $t_{sk(o)}$ | Channel-to-channel | DIR             | B              | 0.3                       |   | 0.3 |  | 0.4 |   | 0.3 |   | 0.6 |   | 0.4 | ns   |

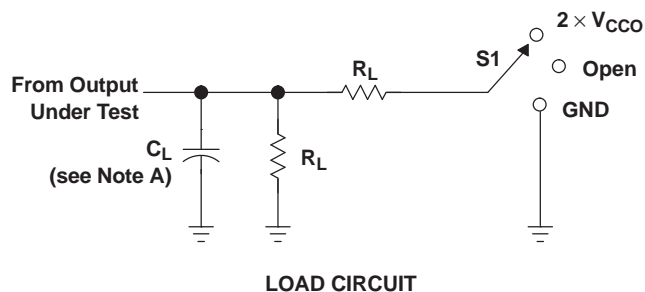
## OPERATING CHARACTERISTICS

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

| PARAMETER       |                             | TEST CONDITIONS   | $V_{CCA} = V_{CCB} = 1.2\text{ V}$ | $V_{CCA} = V_{CCB} = 1.5\text{ V}$ | $V_{CCA} = V_{CCB} = 1.8\text{ V}$ | $V_{CCA} = V_{CCB} = 2.5\text{ V}$ | $V_{CCA} = V_{CCB} = 3\text{ V}$ | $V_{CCA} = V_{CCB} = 3.3\text{ V}$ | UNIT |
|-----------------|-----------------------------|---|------------------------------------|------------------------------------|------------------------------------|------------------------------------|----------------------------------|------------------------------------|------|
|                 |                             |   | TYP                                | TYP                                | TYP                                | TYP                                | TYP                              | TYP                                |      |
| $C_{pdA}^{(1)}$ | A-port input, B-port output | $C_L = 0$ ,<br>$f = 10\text{ MHz}$ ,<br>$t_r = t_f = 1\text{ ns}$ | 1.9                                | 2                                  | 2.1                                | 2.4                                | 2.7                              | 2.9                                | pF   |
|                 | B-port input, A-port output |   | 4.4                                | 4.5                                | 4.6                                | 4.7                                | 4.8                              | 4.9                                |      |
| $C_{pdB}^{(1)}$ | A-port input, B-port output | $C_L = 0$ ,<br>$f = 10\text{ MHz}$ ,<br>$t_r = t_f = 1\text{ ns}$ | 5.3                                | 5.4                                | 5.4                                | 5.7                                | 5.8                              | 5.9                                | pF   |
|                 | B-port input, A-port output |   | 0.3                                | 0.3                                | 0.4                                | 0.5                                | 0.6                              | 0.6                                |      |

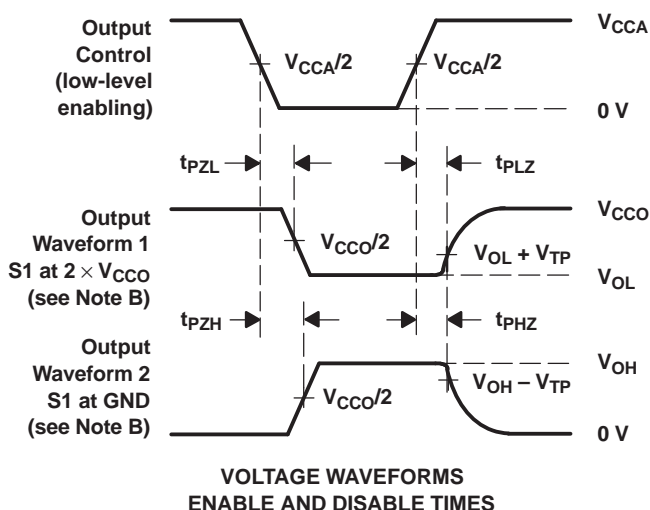
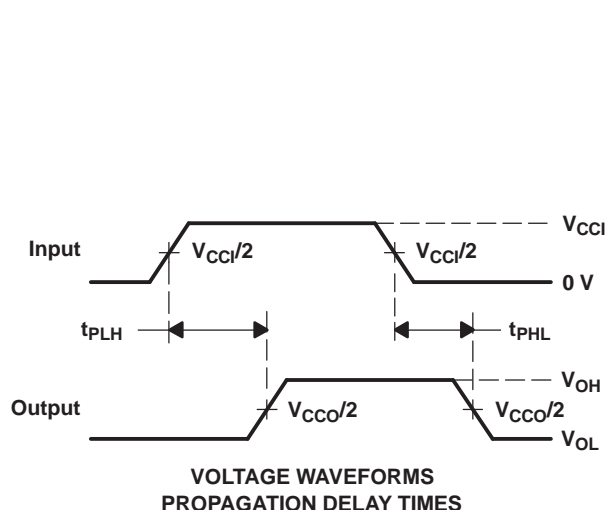
(1) Power dissipation capacitance per transceiver

## PARAMETER MEASUREMENT INFORMATION



| TEST              | S1                 |
|-------------------|--------------------|
| $t_{pd}$          | Open               |
| $t_{PLZ}/t_{PZL}$ | $2 \times V_{CCO}$ |
| $t_{PHZ}/t_{PZH}$ | GND                |

| $V_{CCO}$                        | $C_L$ | $R_L$        | $V_{TP}$ |
|----------------------------------|-------|--------------|----------|
| $1.5\text{ V} \pm 0.1\text{ V}$  | 15 pF | 2 k $\Omega$ | 0.1 V    |
| $1.8\text{ V} \pm 0.15\text{ V}$ | 15 pF | 2 k $\Omega$ | 0.15 V   |
| $2.5\text{ V} \pm 0.2\text{ V}$  | 15 pF | 2 k $\Omega$ | 0.15 V   |
| $3.3\text{ V} \pm 0.3\text{ V}$  | 15 pF | 2 k $\Omega$ | 0.3 V    |



- NOTES:
- $C_L$  includes probe and jig capacitance.
  - 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.
  - All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $dv/dt \geq 1\text{ V/ns}$ .
  - The outputs are measured one at a time, with one transition per measurement.
  - $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
  - $V_{CCI}$  is the  $V_{CC}$  associated with the input port.
  - $V_{CCO}$  is the  $V_{CC}$  associated with the output port.

Figure 2. Load Circuit and Voltage Waveforms

## 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) |
|----------------------------------|---------------|----------------------|-----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| <a href="#">SN74AVC6T622PWR</a>  | Active        | Production           | TSSOP (PW)   20 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | WU622               |
| SN74AVC6T622PWR.B                | Active        | Production           | TSSOP (PW)   20 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | WU622               |
| <a href="#">SN74AVC6T622RGYR</a> | Active        | Production           | VQFN (RGY)   20 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-2-260C-1 YEAR               | -40 to 85    | WU622               |
| SN74AVC6T622RGYR.B               | Active        | Production           | VQFN (RGY)   20 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-2-260C-1 YEAR               | -40 to 85    | WU622               |

<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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## 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 |
|------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74AVC6T622PWR  | TSSOP        | PW              | 20   | 2000 | 330.0              | 16.4               | 6.95    | 7.0     | 1.4     | 8.0     | 16.0   | Q1            |
| SN74AVC6T622RGYR | VQFN         | RGY             | 20   | 3000 | 330.0              | 12.4               | 3.71    | 4.71    | 1.1     | 8.0     | 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) |
|------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74AVC6T622PWR  | TSSOP        | PW              | 20   | 2000 | 353.0       | 353.0      | 32.0        |
| SN74AVC6T622RGYR | VQFN         | RGY             | 20   | 3000 | 353.0       | 353.0      | 32.0        |

## GENERIC PACKAGE VIEW

**RGY 20**

**VQFN - 1 mm max height**

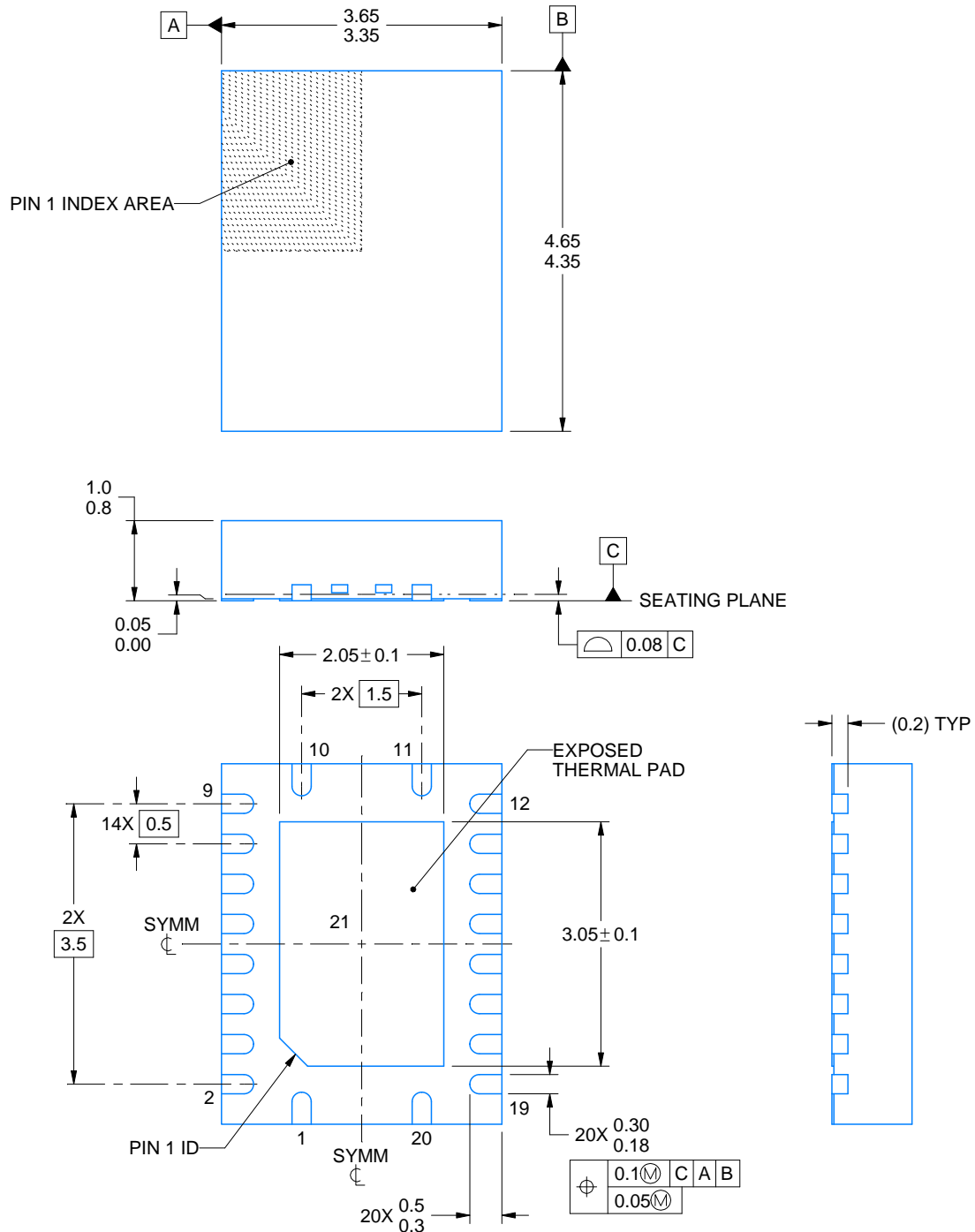
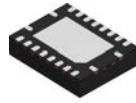
3.5 x 4.5, 0.5 mm pitch

PLASTIC QUAD FGLATPACK - NO LEAD

This image is a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.



4225264/A



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NOTES:

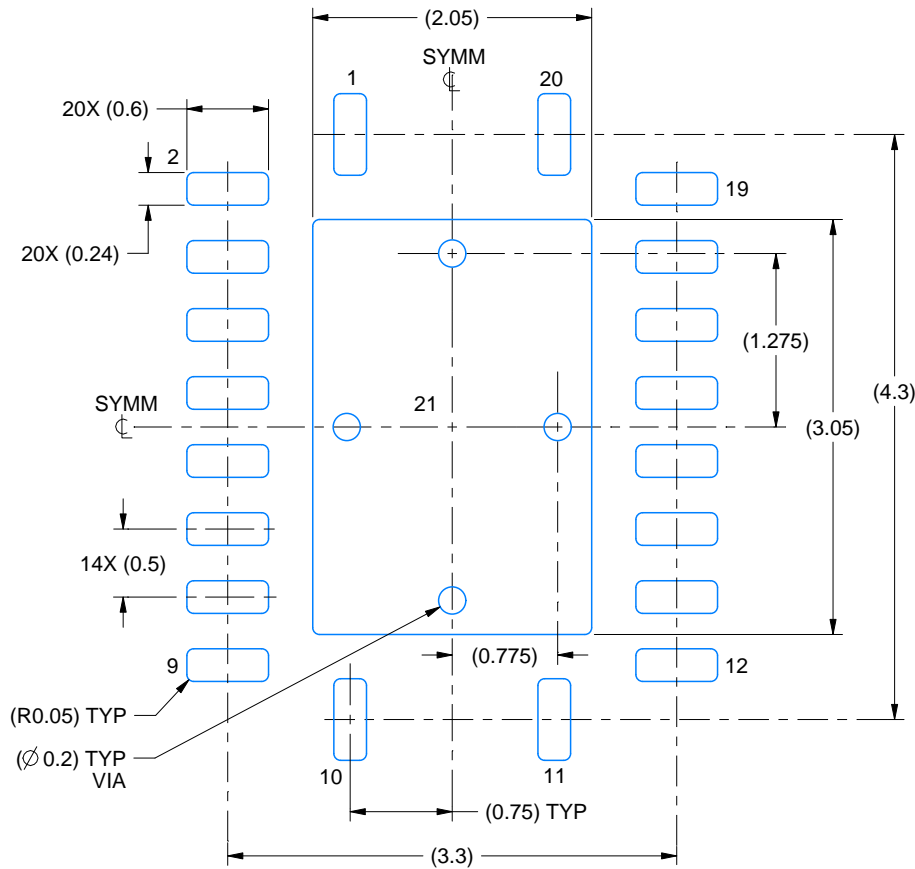
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

# EXAMPLE BOARD LAYOUT

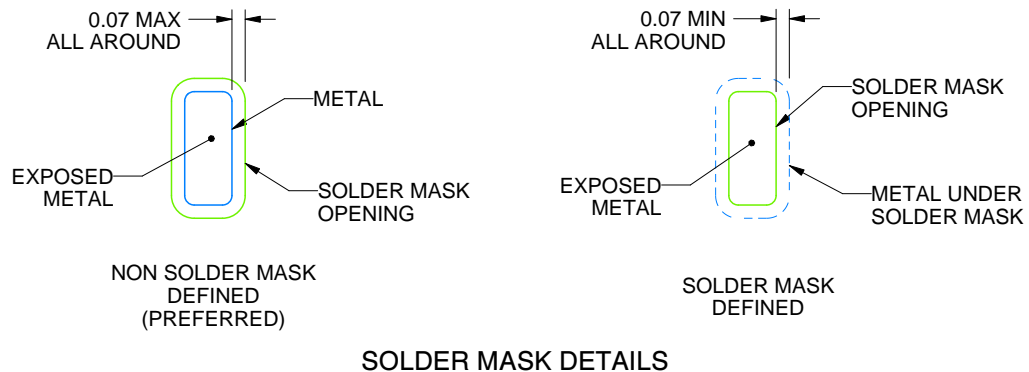
RGY0020A

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:18X



4225320/A 09/2019

NOTES: (continued)

- This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/slua271](http://www.ti.com/lit/slua271)).
- 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.

# EXAMPLE STENCIL DESIGN

RGY0020A

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



**SOLDER PASTE EXAMPLE**  
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 21  
78% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE  
SCALE:20X

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NOTES: (continued)

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



## TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

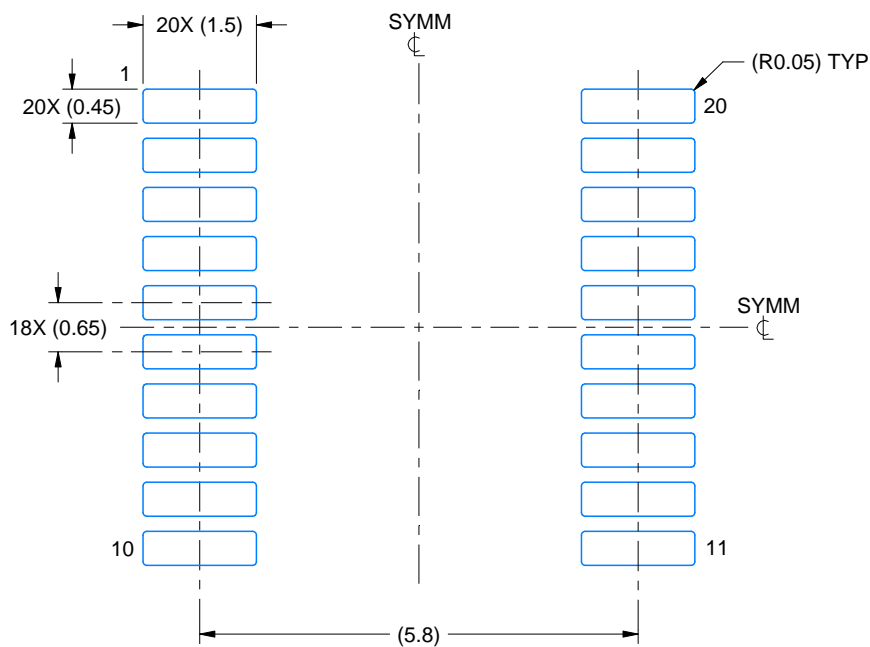


1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or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

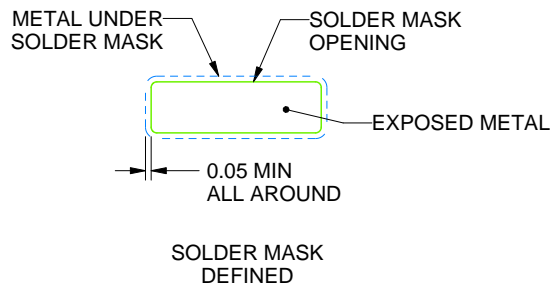
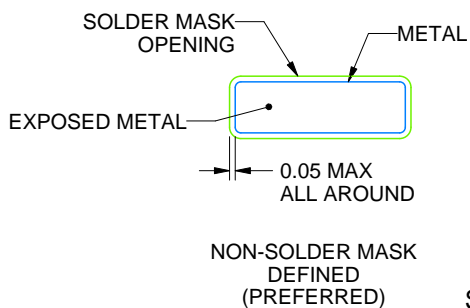
**PW0020A**

## TSSOP - 1.2 mm max height

## SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



## SOLDER MASK DETAILS

4220206/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

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

4220206/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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