

## 符合 RS-232 的 3V 至 5.5V 多通道线路驱动器和接收器

### 1 特性

- 由 3V 至 5.5V  $V_{CC}$  电源供电
- 速率高达 1Mbit/s
- 低电源电流：300  $\mu$ A (典型值)
- 外部电容器：4  $\times$  0.1  $\mu$ F
- 接受 5V 逻辑输入及 3.3V 电源
- RS-232 总线引脚 ESD 保护大于  $\pm 15$ kV 人体放电模型 (HBM)

### 2 应用

- 工业 PC
- 有线网络
- 数据中心和企业级计算
- 电池供电型系统
- 笔记本电脑
- 笔记本电脑
- 掌上电脑
- 手持设备

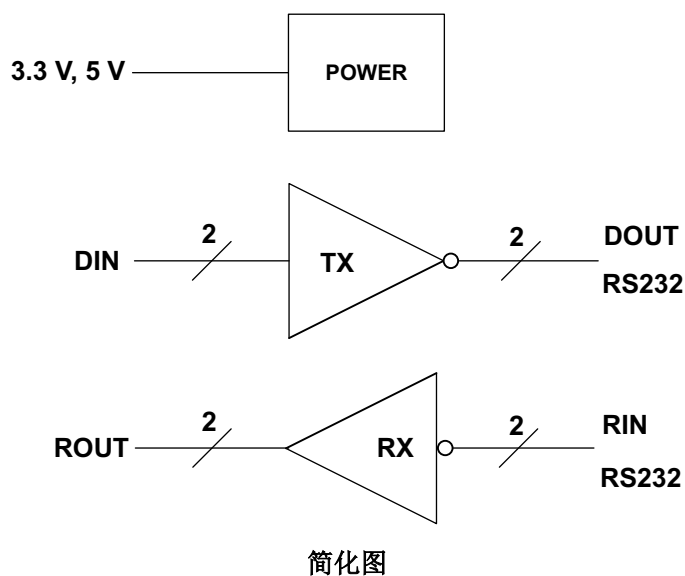
### 3 说明

SN65C3232 和 SN75C3232 由两个线路驱动器、两个线路接收器和一个双路电荷泵电路组成，具有引脚对引脚 (串行端口连接引脚，包括 GND)  $\pm 15$ kV ESD 保护。这些器件可在异步通信控制器和串行端口连接器之间提供电气接口。电荷泵和四个小型外部电容器支持由 3V 至 5.5V 单电源供电。该器件以高达 1Mbit/s 的典型数据信号传输速率运行，驱动器输出压摆率为 24V/ $\mu$ s 至 150V/ $\mu$ s。

#### 器件信息

| 器件型号                   | 封装 <sup>(1)</sup> | 封装尺寸 (标称值)      |
|------------------------|-------------------|-----------------|
| SN65C3232<br>SN75C3232 | D (SOIC) (16)     | 9.90mm x 3.91mm |
|                        | DB (SSOP) (16)    | 6.20mm x 5.30mm |
|                        | DW (SOIC) (16)    | 10.3mm x 7.50mm |
|                        | PW (TSSOP) (16)   | 5.00mm x 4.40mm |

(1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。



## Table of Contents

|  |    |  |    |
|--|----|--|----|
| <b>1 特性</b> .....                                      | 1  | 8.1 Overview.....  | 10 |
| <b>2 应用</b> .....                                      | 1  | 8.2 Functional Block Diagram.....                                | 10 |
| <b>3 说明</b> .....                                      | 1  | 8.3 Feature Description.....                                     | 10 |
| <b>4 Revision History</b> .....                        | 2  | 8.4 Device Functional Modes.....                                 | 11 |
| <b>5 Pin Configuration and Functions</b> .....         | 3  | <b>9 Application and Implementation</b> .....                    | 12 |
| <b>6 Specifications</b> .....                          | 4  | 9.1 Application Information.....                                 | 12 |
| 6.1 Absolute Maximum Ratings.....                      | 4  | <b>10 Layout</b> .....   | 14 |
| 6.2 ESD Ratings.....                                   | 4  | 10.1 Layout Guidelines.....                                      | 14 |
| 6.3 Recommended Operating Conditions.....              | 4  | 10.2 Layout Example.....   | 14 |
| 6.4 Thermal Information.....                           | 5  | <b>11 Device and Documentation Support</b> .....                 | 15 |
| 6.5 Electrical Characteristics.....                    | 5  | 11.1 Documentation Support.....                                  | 15 |
| 6.6 Driver Section - Electrical Characteristics.....   | 6  | 11.2 接收文档更新通知.....   | 15 |
| 6.7 Switching Characteristics.....                     | 6  | 11.3 支持资源.....   | 15 |
| 6.8 Receiver Section - Electrical Characteristics..... | 7  | 11.4 Trademarks.....   | 15 |
| 6.9 Switching Characteristics.....                     | 7  | 11.5 Electrostatic Discharge Caution.....                        | 15 |
| 6.10 Typical Characteristics.....                      | 8  | 11.6 Glossary.....   | 15 |
| <b>7 Parameter Measurement Information</b> .....       | 9  | <b>12 Mechanical, Packaging, and Orderable Information</b> ..... | 15 |
| <b>8 Detailed Description</b> .....                    | 10 |  |    |

## 4 Revision History

注：以前版本的页码可能与当前版本的页码不同

| <b>Changes from Revision B (November 2004) to Revision C (June 2021)</b>  | <b>Page</b> |
|---|-------------|
| • 添加了器件信息表、引脚配置和功能部分、ESD 等级表、特性说明部分、器件功能模式、应用和实施部分、电源相关建议部分、布局部分、器件和文档支持部分以及机械、封装和可订购信息部分.....  | 1           |
| • 添加了应用工业 PC、有线网络、数据中心和企业级计算.....   | 1           |
| • Added thermal parameter values for all packages and changed the thermal parameters for D package in the <i>Thermal Information</i> table..... | 5           |

## 5 Pin Configuration and Functions

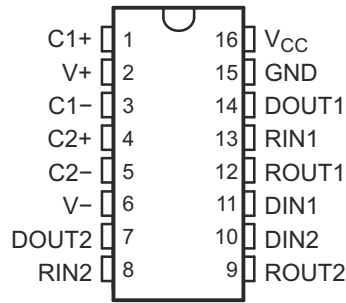


图 5-1. D, DW, DB and PW Package, 16-Pin SOIC, SSOP and TSSOP, Top View

| PIN             |     | I/O | DESCRIPTION   |
|-----------------|-----|-----|---|
| NAME            | NO. |     |   |
| C1+             | 1   | —   | Positive lead of C1 capacitor                                 |
| V+              | 2   | O   | Positive charge pump output for storage capacitor only        |
| C1 -            | 3   | —   | Negative lead of C1 capacitor                                 |
| C2+             | 4   | —   | Positive lead of C2 capacitor                                 |
| C2 -            | 5   | —   | Negative lead of C2 capacitor                                 |
| V -             | 6   | O   | Negative charge pump output for storage capacitor only        |
| DOUT2           | 7   | O   | RS232 line data output (to remote RS232 system)               |
| RIN2            | 8   | I   | RS232 line data input (from remote RS232 system)              |
| ROUT2           | 9   | O   | Logic data output (to UART)                                   |
| DIN2            | 10  | I   | Logic data input (from UART)                                  |
| DIN1            | 11  | I   | Logic data input (from UART)                                  |
| ROUT1           | 12  | O   | Logic data output (to UART)                                   |
| RIN1            | 13  | I   | RS232 line data input (from remote RS232 system)              |
| DOUT1           | 14  | O   | RS232 line data output (to remote RS232 system)               |
| GND             | 15  | —   | Ground  |
| V <sub>CC</sub> | 16  | —   | Supply Voltage, Connect to external 3-V to 5.5-V power supply |

## 6 Specifications

### 6.1 Absolute Maximum Ratings

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

|                  |   | MIN       | MAX    | UNIT                  |   |
|------------------|---|-----------|--------|-----------------------|---|
| V <sub>CC</sub>  | Supply voltage range <sup>(2)</sup>                 | - 0.3     | 6      | V                     |   |
| V+               | Positive-output supply voltage range <sup>(2)</sup> | - 0.3     | 7      | V                     |   |
| V-               | Negative-output supply voltage range <sup>(2)</sup> | 0.3       | - 7    | V                     |   |
| V+ - V-          | Supply voltage difference <sup>(2)</sup>            |           | 13     | V                     |   |
| V <sub>I</sub>   | Input voltage range                                 | Drivers   | - 0.3  | 6                     | V |
|                  |   | Receivers | - 25   | 25                    |   |
| V <sub>O</sub>   | Output voltage range                                | Drivers   | - 13.2 | 13.2                  | V |
|                  |   | Receivers | - 0.3  | V <sub>CC</sub> + 0.3 |   |
| T <sub>J</sub>   | Operating virtual junction temperature              |           | 150    | °C                    |   |
| T <sub>stg</sub> | Storage temperature range                           | - 65      | 150    | °C                    |   |

- (1) Operation outside the Absolute Maximum Ratings may cause permanent device damage. Absolute Maximum Ratings do not imply functional operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions. If used outside the Recommended Operating Conditions but within the Absolute Maximum Ratings, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.
- (2) All voltages are with respect to network GND.

### 6.2 ESD Ratings

|                    |                         |  | VALUE                        | UNIT    |   |
|--------------------|-------------------------|--|------------------------------|---------|---|
| V <sub>(ESD)</sub> | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>              | All pins except RIN and DOUT | ±3000   | V |
|                    |                         |  | RIN and DOUT Pins            | ±15,000 |   |
|                    |                         | Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup> | All pins                     | ±1500   |   |

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

### 6.3 Recommended Operating Conditions

See [图 9-1](#), See <sup>(1)</sup>

|                 |                                 | MIN                     | NOM                     | MAX | UNIT |    |
|-----------------|---------------------------------|-------------------------|-------------------------|-----|------|----|
| Supply voltage  |                                 | V <sub>CC</sub> = 3.3 V | 3                       | 3.3 | 3.6  | V  |
|                 |                                 | V <sub>CC</sub> = 5 V   | 4.5                     | 5   | 5.5  |    |
| V <sub>IH</sub> | Driver high-level input voltage | DIN                     | V <sub>CC</sub> = 3.3 V | 2   |      | V  |
|                 |                                 |                         | V <sub>CC</sub> = 5 V   | 2.4 |      |    |
| V <sub>IL</sub> | Driver low-level input voltage  | DIN                     |                         |     | 0.8  | V  |
| V <sub>I</sub>  | Driver input voltage            | DIN                     | 0                       |     | 5.5  | V  |
|                 | Receiver input voltage          |                         | - 25                    |     | 25   |    |
| T <sub>A</sub>  | Operating free-air temperature  | SN75C3232               | 0                       |     | 70   | °C |
|                 |                                 | SN65C3232               | - 40                    |     | 85   |    |

- (1) Test conditions are C1 - C4 = 0.1 μF at V<sub>CC</sub> = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2 - C4 = 0.33 μF at V<sub>CC</sub> = 5 V ± 0.5 V.

## 6.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup>                                   | SN65C3232, SN75C3232 |          |           |           | UNIT |
|---|----------------------|----------|-----------|-----------|------|
|   | PW (TSSOP)           | D (SOIC) | DW (SOIC) | DB (SSOP) |      |
|   | 16 PINS              | 16 PINS  | 16 PINS   | 16 PINS   |      |
| $R_{\theta JA}$ Junction-to-ambient thermal resistance          | 108.0                | 85.9     | 57.0      | 46.0      | °C/W |
| $R_{\theta Jctop}$ Junction-to-case (top) thermal resistance    | 20.8                 | 43.1     | 33.5      | 36.2      | °C/W |
| $R_{\theta JB}$ Junction-to-board thermal resistance            | 45.1                 | 44.5     | 37.1      | 43.8      | °C/W |
| $\psi_{JT}$ Junction-to-top characterization parameter          | 0.6                  | 10.1     | 7.5       | 4.2       | °C/W |
| $\psi_{JB}$ Junction-to-board characterization parameter        | 45.1                 | 44.1     | 37.1      | 42.9      | °C/W |
| $R_{\theta Jcbot}$ Junction-to-case (bottom) thermal resistance | -                    | -        | -         | -         | °C/W |

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

## 6.5 Electrical Characteristics

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see [Figure 9-1](#))

| PARAMETER <sup>(2)</sup> |                | TEST CONDITIONS                                  | MIN | TYP <sup>(1)</sup> | MAX | UNIT |
|--------------------------|----------------|--|-----|--------------------|-----|------|
| $I_{CC}$                 | Supply current | No load, $V_{CC} = 3.3\text{ V}$ or $5\text{ V}$ |     | 0.3                | 1   | mA   |

(1) All typical values are at  $V_{CC} = 3.3\text{ V}$  or  $V_{CC} = 5\text{ V}$ , and  $T_A = 25^\circ\text{C}$ .

(2) Test conditions are  $C1 - C4 = 0.1\ \mu\text{F}$  at  $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ ;  $C1 = 0.047\ \mu\text{F}$ ,  $C2 - C4 = 0.33\ \mu\text{F}$  at  $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ .

## 6.6 Driver Section - Electrical Characteristics

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see [图 9-1](#))

| PARAMETER       |   | TEST CONDITIONS <sup>(3)</sup>                              |                         | MIN | TYP <sup>(1)</sup> | MAX | UNIT |
|-----------------|---|---|-------------------------|-----|--------------------|-----|------|
| V <sub>OH</sub> | High-level output voltage                   | DOUT at R <sub>L</sub> = 3 kΩ to GND, DIN = GND             |                         | 5   | 5.4                |     | V    |
| V <sub>OL</sub> | Low-level output voltage                    | DOUT at R <sub>L</sub> = 3 kΩ to GND, DIN = V <sub>CC</sub> |                         | - 5 | - 5.4              |     | V    |
| I <sub>IH</sub> | High-level input current                    | V <sub>I</sub> = V <sub>CC</sub>                            |                         |     | ±0.01              | ±1  | μ A  |
| I <sub>IL</sub> | Low-level input current                     | V <sub>I</sub> at GND                                       |                         |     | ±0.01              | ±1  | μ A  |
| I <sub>OS</sub> | Short-circuit output current <sup>(2)</sup> | V <sub>O</sub> = 0 V  | V <sub>CC</sub> = 3.6 V |     | ±35                | ±60 | mA   |
|                 |   |   | V <sub>CC</sub> = 5.5 V |     | ±35                | ±90 |      |
| r <sub>o</sub>  | Output resistance                           | V <sub>CC</sub> , V+, and V- = 0 V,                         | V <sub>O</sub> = ±2 V   | 300 | 10M                |     | Ω    |

(1) All typical values are at V<sub>CC</sub> = 3.3 V or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.

(2) Short-circuit durations should be controlled to prevent exceeding the device absolute power dissipation ratings, and not more than one output should be shorted at a time.

(3) Test conditions are C1 - C4 = 0.1 μ F at V<sub>CC</sub> = 3.3 V ± 0.3 V; C1 = 0.047 μ F, C2 - C4 = 0.33 μ F at V<sub>CC</sub> = 5 V ± 0.5 V.

## 6.7 Switching Characteristics

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see [图 9-1](#))

| PARAMETER   |   | TEST CONDITIONS <sup>(3)</sup>                                     |   | MIN  | TYP <sup>(1)</sup> | MAX    | UNIT   |
|---|---|--|---|------|--------------------|--------|--------|
| Maximum data rate<br>(see <a href="#">图 7-1</a> ) | R <sub>L</sub> = 3 kΩ,<br>One DOOUT switching                   | C <sub>L</sub> = 1000 pF   |   | 250  |                    | kbit/s |        |
|   |   | C <sub>L</sub> = 250 pF,   | V <sub>CC</sub> = 3 V to 4.5 V                              | 1000 |                    |        |        |
|   |   | C <sub>L</sub> = 1000 pF,  | V <sub>CC</sub> = 4.5 V to 5.5 V                            | 1000 |                    |        |        |
| t <sub>sk(p)</sub>                                | Pulse skew <sup>(2)</sup>                                       | C <sub>L</sub> = 150 pF to 2500 pF, R <sub>L</sub> = 3 kΩ to 7 kΩ, | See <a href="#">图 7-2</a>                                   | 300  |                    | ns     |        |
| SR(tr)  | Slew rate,<br>transition region<br>(see <a href="#">图 7-1</a> ) | R <sub>L</sub> = 3 kΩ to 7 kΩ,                                     | C <sub>L</sub> = 150 pF to 1000 pF, V <sub>CC</sub> = 3.3 V | 18   |                    | 150    | V/ μ s |

(1) All typical values are at V<sub>CC</sub> = 3.3 V or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.

(2) Pulse skew is defined as |t<sub>PLH</sub> - t<sub>PHL</sub>| of each channel of the same device.

(3) Test conditions are C1 - C4 = 0.1 μ F at V<sub>CC</sub> = 3.3 V ± 0.3 V; C1 = 0.047 μ F, C2 - C4 = 0.33 μ F at V<sub>CC</sub> = 5 V ± 0.5 V.

## 6.8 Receiver Section - Electrical Characteristics

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see 图 9-1)

| PARAMETER        |   | TEST CONDITIONS <sup>(2)</sup> | MIN                   | TYP <sup>(1)</sup>    | MAX | UNIT |
|------------------|---|--------------------------------|-----------------------|-----------------------|-----|------|
| V <sub>OH</sub>  | High-level output voltage                               | I <sub>OH</sub> = -1 mA        | V <sub>CC</sub> - 0.6 | V <sub>CC</sub> - 0.1 |     | V    |
| V <sub>OL</sub>  | Low-level output voltage                                | I <sub>OL</sub> = 1.6 mA       |                       |                       | 0.4 | V    |
| V <sub>IT+</sub> | Positive-going input threshold voltage                  | V <sub>CC</sub> = 3.3 V        |                       | 1.5                   | 2.4 | V    |
|                  |   | V <sub>CC</sub> = 5 V          |                       | 1.8                   | 2.4 |      |
| V <sub>IT-</sub> | Negative-going input threshold voltage                  | V <sub>CC</sub> = 3.3 V        | 0.6                   | 1.2                   |     | V    |
|                  |   | V <sub>CC</sub> = 5 V          | 0.8                   | 1.5                   |     |      |
| V <sub>hys</sub> | Input hysteresis (V <sub>IT+</sub> - V <sub>IT-</sub> ) |                                |                       | 0.3                   |     | V    |
| r <sub>i</sub>   | Input resistance  | V <sub>I</sub> = ±3 V to ±25 V | 3                     | 5                     | 7   | kΩ   |

(1) All typical values are at V<sub>CC</sub> = 3.3 V or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.

(2) Test conditions are C1 - C4 = 0.1 μF at V<sub>CC</sub> = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2 - C4 = 0.33 μF at V<sub>CC</sub> = 5 V ± 0.5 V.

## 6.9 Switching Characteristics

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see 图 9-1)

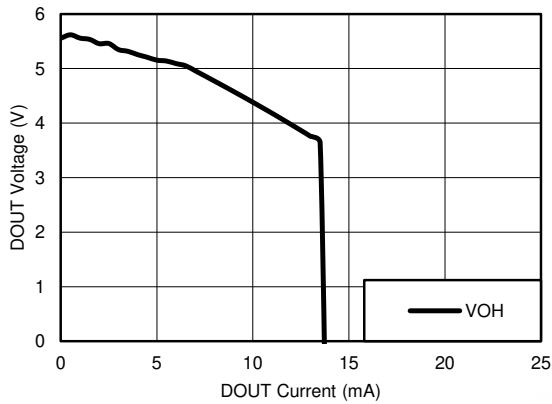
| PARAMETER          |   | TEST CONDITIONS <sup>(3)</sup> | TYP <sup>(1)</sup> | UNIT |
|--------------------|---|--------------------------------|--------------------|------|
| t <sub>PLH</sub>   | Propagation delay time, low- to high-level output | C <sub>L</sub> = 150 pF        | 300                | ns   |
| t <sub>PHL</sub>   | Propagation delay time, high- to low-level output | C <sub>L</sub> = 150 pF        | 300                | ns   |
| t <sub>sk(p)</sub> | Pulse skew <sup>(2)</sup>                         |                                | 300                | ns   |

(1) All typical values are at V<sub>CC</sub> = 3.3 V or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.

(2) Pulse skew is defined as |t<sub>PLH</sub> - t<sub>PHL</sub>| of each channel of the same device.

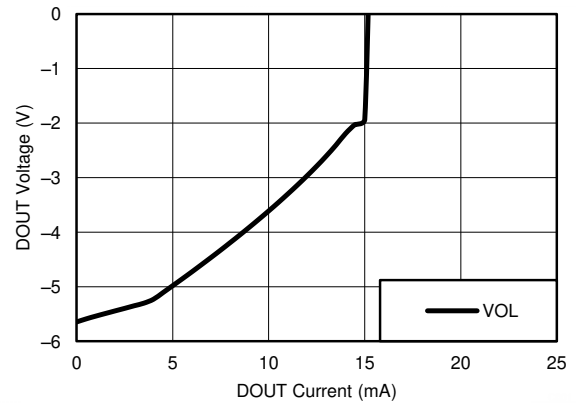
(3) Test conditions are C1 - C4 = 0.1 μF at V<sub>CC</sub> = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2 - C4 = 0.33 μF at V<sub>CC</sub> = 5 V ± 0.5 V.

### 6.10 Typical Characteristics



V<sub>CC</sub> = 3.3 V

图 6-1. DOUT V<sub>OH</sub> vs Load Current, Both Drivers Loaded

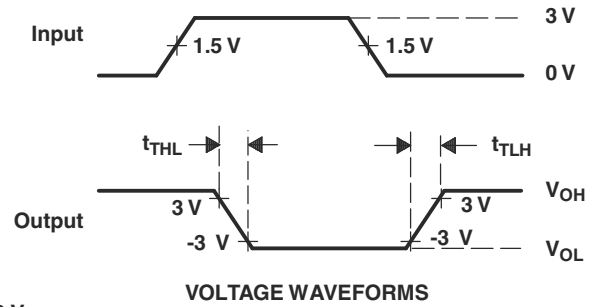
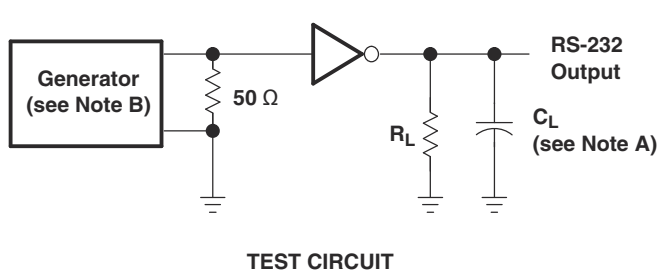


V<sub>CC</sub> = 3.3 V

图 6-2. DOUT V<sub>OL</sub> vs Load Current, Both Drivers Loaded



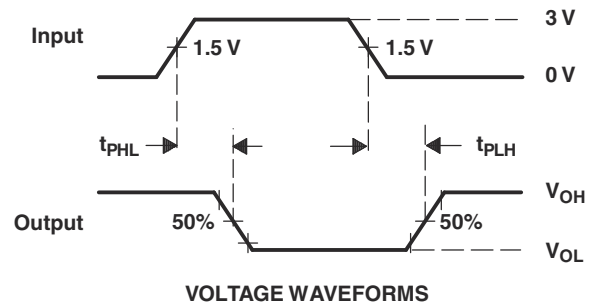
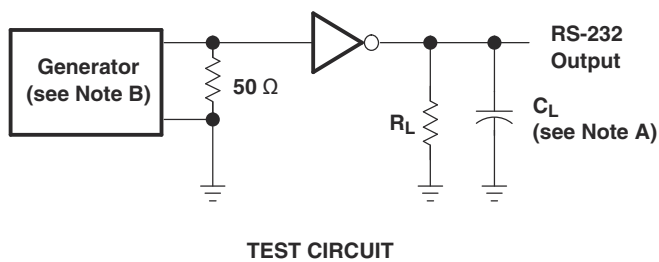
## 7 Parameter Measurement Information



$$SR(tr) = \frac{6\text{ V}}{t_{THL} \text{ or } t_{TLH}}$$

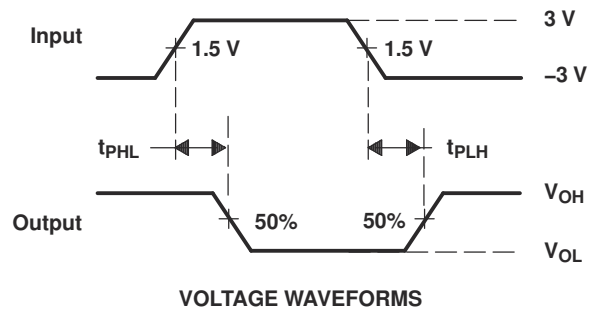
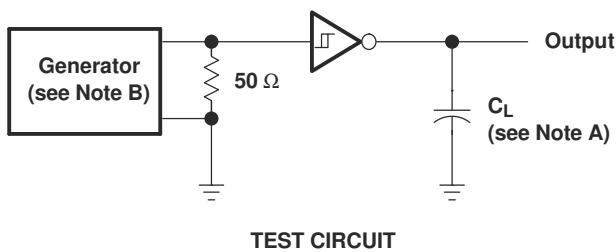
- A.  $C_L$  includes probe and jig capacitance.  
 B. The pulse generator has the following characteristics: PRR = 250 kbit/s,  $Z_O = 50\ \Omega$ , 50% duty cycle,  $t_r \leq 10\text{ ns}$ ,  $t_f \leq 10\text{ ns}$ .

图 7-1. Driver Slew Rate



- A.  $C_L$  includes probe and jig capacitance.  
 B. The pulse generator has the following characteristics: PRR = 250 kbit/s,  $Z_O = 50\ \Omega$ , 50% duty cycle,  $t_r \leq 10\text{ ns}$ ,  $t_f \leq 10\text{ ns}$ .

图 7-2. Driver Pulse Skew



- A.  $C_L$  includes probe and jig capacitance.  
 B. The pulse generator has the following characteristics:  $Z_O = 50\ \Omega$ , 50% duty cycle,  $t_r \leq 10\text{ ns}$ ,  $t_f \leq 10\text{ ns}$ .

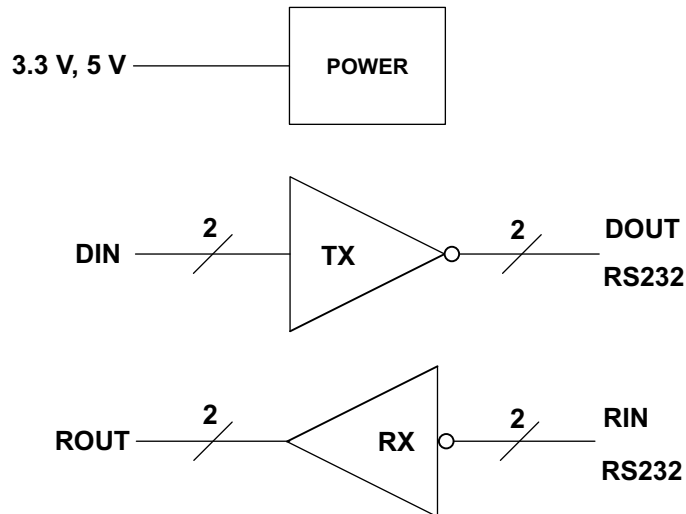
图 7-3. Receiver Propagation Delay Times

## 8 Detailed Description

### 8.1 Overview

The device consists of two line drivers, two-line receivers, and a dual charge-pump circuit with IEC61000-4-2 ESD protection terminal to terminal (serial-port connection terminals, including GND). The device meets the requirements of TIA/EIA-232-F and provides the electrical interface between an asynchronous communication controller and the serial-port connector. The charge pump and four small external capacitors allow operation from a single 3-V to 5.5-V supply. The device operates at data signaling rates up to 250 kbit/s and a maximum of 30-V/ $\mu$ s driver output slew rate. Outputs are protected against shorts to ground.

### 8.2 Functional Block Diagram



### 8.3 Feature Description

#### 8.3.1 Power

The power block increases, inverts, and regulates voltage at V+ and V- pins using a charge pump that requires four external capacitors.

#### 8.3.2 RS232 Driver

Two drivers interface standard logic level to RS232 levels. Both DIN inputs must be valid high or low.

#### 8.3.3 RS232 Receiver

Two receivers interface RS232 levels to standard logic levels. An open input will result in a high output on ROUT. Each RIN input includes an internal standard RS232 load.

## 8.4 Device Functional Modes

表 8-1 和 表 8-2 list the functional modes of the drivers and receivers of MAX3232E.

表 8-1. Each Driver<sup>(1)</sup>

| INPUT<br>DIN | OUTPUT<br>DOUT |
|--------------|----------------|
| L            | H              |
| H            | L              |

(1) H = high level, L = low level

表 8-2. Each Receiver<sup>(1)</sup>

| INPUT<br>RIN | OUTPUT<br>ROUT |
|--------------|----------------|
| L            | H              |
| H            | L              |
| Open         | H              |

(1) H = high level, L = low level,  
Open = input disconnected or connected driver off

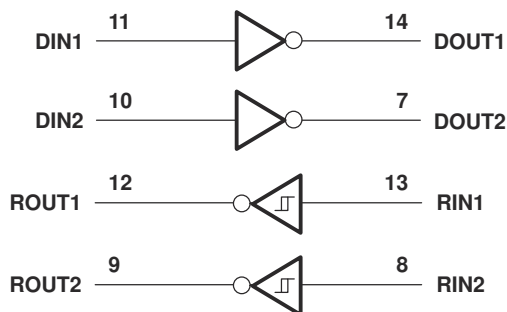


图 8-1. Logic Diagram

### 8.4.1 V<sub>CC</sub> Powered by 3 V to 5.5 V

The device is in normal operation.

### 8.4.2 V<sub>CC</sub> Unpowered, V<sub>CC</sub> = 0 V

When the device is unpowered, it can be safely connected to an active remote RS232 device.

## 9 Application and Implementation

### Note

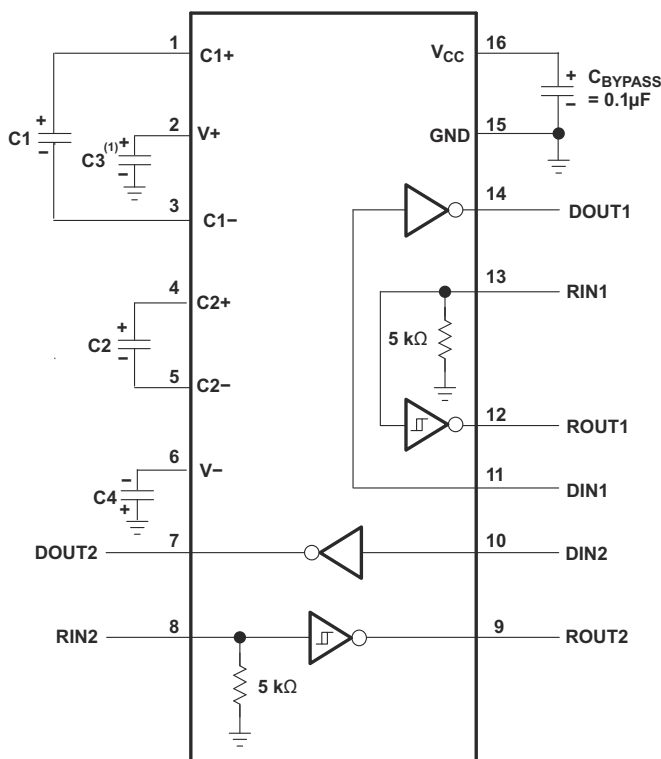
Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

### 9.1 Application Information

For proper operation, add capacitors as shown in 表 9-1.

#### 9.1.1 Typical Application

ROUT and DIN connect to UART or general-purpose logic lines. RIN and DOUT lines connect to a RS232 connector or cable.



- A. C3 can be connected to  $V_{CC}$  or GND
- A. Resistor values shown are nominal.
- B. Nonpolarized ceramic capacitors are acceptable. If polarized tantalum or electrolytic capacitors are used, they should be connected as shown.

图 9-1. Typical Operating Circuit and Capacitor Values

表 9-1. VCC vs Capacitor Values

| $V_{CC}$          | C1            | C2, C3, C4   |
|-------------------|---------------|--------------|
| 3.3 V $\pm$ 0.3 V | 0.1 $\mu$ F   | 0.1 $\mu$ F  |
| 5 V $\pm$ 0.5 V   | 0.047 $\mu$ F | 0.33 $\mu$ F |
| 3 V to 5.5 V      | 0.1 $\mu$ F   | 0.47 $\mu$ F |

### 9.1.1.1 Design Requirements

The recommended  $V_{CC}$  is 3.3 V or 5 V. 3 V to 5.5 V is also possible

The maximum recommended bit rate is 250 kbit/s.

### 9.1.1.2 Detailed Design Procedure

All DIN inputs must be connected to valid low or high logic levels.

Select capacitor values based on  $V_{CC}$  level for best performance.

### 9.1.1.3 Application Performance Plots

图 9-2 curves are for 3.3-V  $V_{CC}$  and 250-kbit/s alternative bit data stream.

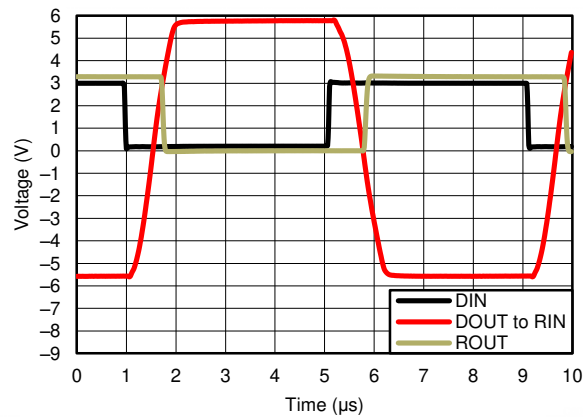


图 9-2. 250 kbit/s Driver to Receiver Loopback Timing Waveform,  $V_{CC} = 3.3 \text{ V}$

## 10 Layout

### 10.1 Layout Guidelines

Keep the external capacitor traces short, specifically on the C1 and C2 nodes that have the fastest rise and fall times.

### 10.2 Layout Example

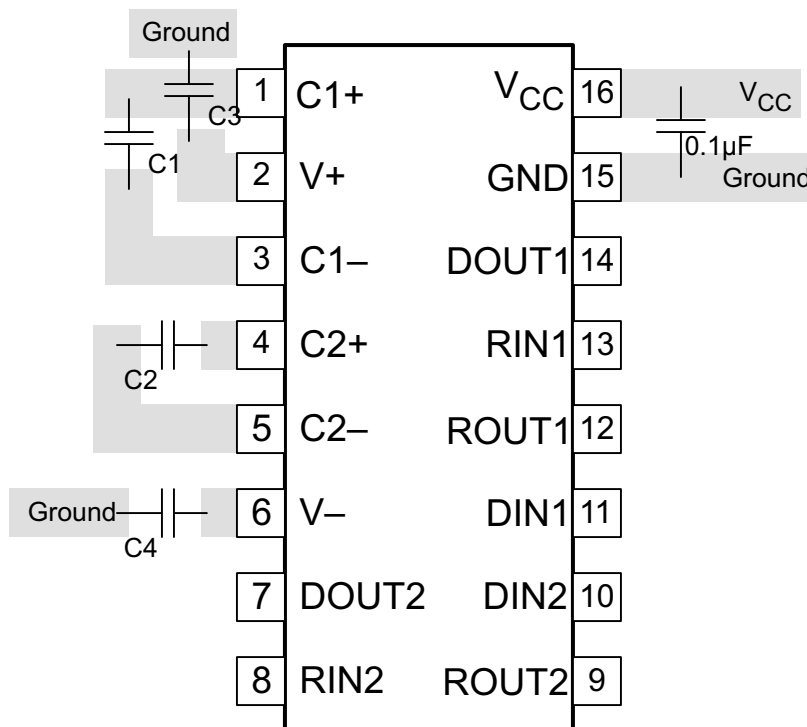


图 10-1. Layout Diagram

## 11 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

### 11.1 Documentation Support

#### 11.1.1 Related Documentation

##### 11.1.1.1 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to order now.

### 11.2 接收文档更新通知

要接收文档更新通知，请导航至 [ti.com](http://ti.com) 上的器件产品文件夹。点击 [订阅更新](#) 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

### 11.3 支持资源

TI E2E™ [支持论坛](#) 是工程师的重要参考资料，可直接从专家获得快速、经过验证的解答和设计帮助。搜索现有解答或提出自己的问题可获得所需的快速设计帮助。

链接的内容由各个贡献者“按原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的 [《使用条款》](#)。

### 11.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

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### 11.5 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 11.6 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 12 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.

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**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package Drawing | Pins | Package 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                 |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN65C3232DBR     | ACTIVE        | SSOP         | DB              | 16   | 2000        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | 65C3232                 | <a href="#">Samples</a> |
| SN65C3232DR      | ACTIVE        | SOIC         | D               | 16   | 2500        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | 65C3232                 | <a href="#">Samples</a> |
| SN65C3232DW      | ACTIVE        | SOIC         | DW              | 16   | 40          | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | 65C3232                 | <a href="#">Samples</a> |
| SN65C3232DWR     | ACTIVE        | SOIC         | DW              | 16   | 2000        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | 65C3232                 | <a href="#">Samples</a> |
| SN65C3232PWR     | ACTIVE        | TSSOP        | PW              | 16   | 2000        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | CB3232                  | <a href="#">Samples</a> |
| SN75C3232DBR     | ACTIVE        | SSOP         | DB              | 16   | 2000        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | CA3232                  | <a href="#">Samples</a> |
| SN75C3232DR      | ACTIVE        | SOIC         | D               | 16   | 2500        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | 75C3232                 | <a href="#">Samples</a> |
| SN75C3232DW      | ACTIVE        | SOIC         | DW              | 16   | 40          | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | 75C3232                 | <a href="#">Samples</a> |
| SN75C3232DWR     | ACTIVE        | SOIC         | DW              | 16   | 2000        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | 75C3232                 | <a href="#">Samples</a> |

(1) 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.

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

(2) **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.

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

(4) 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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## TAPE AND REEL INFORMATION



### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*All dimensions are nominal

| Device       | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN65C3232DBR | SSOP         | DB              | 16   | 2000 | 330.0              | 16.4               | 8.35    | 6.6     | 2.4     | 12.0    | 16.0   | Q1            |
| SN65C3232DR  | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| SN65C3232DWR | SOIC         | DW              | 16   | 2000 | 330.0              | 16.4               | 10.75   | 10.7    | 2.7     | 12.0    | 16.0   | Q1            |
| SN65C3232PWR | TSSOP        | PW              | 16   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| SN65C3232PWR | TSSOP        | PW              | 16   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| SN75C3232DBR | SSOP         | DB              | 16   | 2000 | 330.0              | 16.4               | 8.35    | 6.6     | 2.4     | 12.0    | 16.0   | Q1            |
| SN75C3232DR  | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| SN75C3232DWR | SOIC         | DW              | 16   | 2000 | 330.0              | 16.4               | 10.75   | 10.7    | 2.7     | 12.0    | 16.0   | Q1            |

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

| Device       | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN65C3232DBR | SSOP         | DB              | 16   | 2000 | 356.0       | 356.0      | 35.0        |
| SN65C3232DR  | SOIC         | D               | 16   | 2500 | 356.0       | 356.0      | 35.0        |
| SN65C3232DWR | SOIC         | DW              | 16   | 2000 | 350.0       | 350.0      | 43.0        |
| SN65C3232PWR | TSSOP        | PW              | 16   | 2000 | 356.0       | 356.0      | 35.0        |
| SN65C3232PWR | TSSOP        | PW              | 16   | 2000 | 356.0       | 356.0      | 35.0        |
| SN75C3232DBR | SSOP         | DB              | 16   | 2000 | 356.0       | 356.0      | 35.0        |
| SN75C3232DR  | SOIC         | D               | 16   | 2500 | 356.0       | 356.0      | 35.0        |
| SN75C3232DWR | SOIC         | DW              | 16   | 2000 | 350.0       | 350.0      | 43.0        |

**TUBE**


\*All dimensions are nominal

| Device      | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| SN65C3232DW | DW           | SOIC         | 16   | 40  | 506.98 | 12.7   | 4826   | 6.6    |
| SN75C3232DW | DW           | SOIC         | 16   | 40  | 506.98 | 12.7   | 4826   | 6.6    |

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AC.



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



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.

# DB0016A



# PACKAGE OUTLINE

## SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



4220763/A 05/2022

### NOTES:

- All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- 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.
- Reference JEDEC registration MO-150.

# EXAMPLE BOARD LAYOUT

DB0016A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



4220763/A 05/2022

NOTES: (continued)

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

# EXAMPLE STENCIL DESIGN

DB0016A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



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

4220763/A 05/2022

NOTES: (continued)

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

## GENERIC PACKAGE VIEW

**DW 16**

**SOIC - 2.65 mm max height**

7.5 x 10.3, 1.27 mm pitch

SMALL OUTLINE INTEGRATED CIRCUIT

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



4224780/A

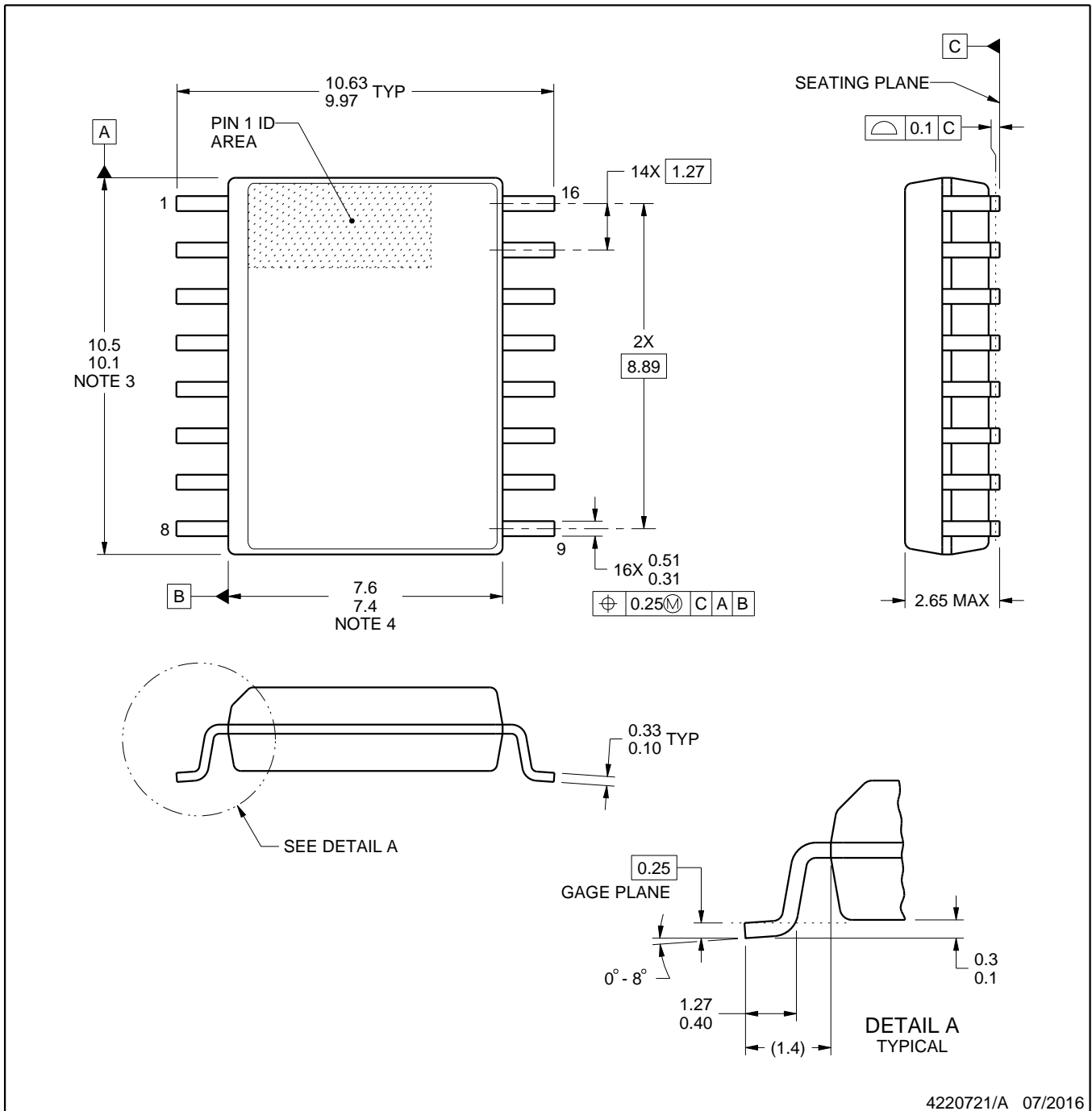


DW0016A

# PACKAGE OUTLINE

SOIC - 2.65 mm max height

SOIC



4220721/A 07/2016

**NOTES:**

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.
5. Reference JEDEC registration MS-013.

# EXAMPLE BOARD LAYOUT

DW0016A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:7X



SOLDER MASK DETAILS

4220721/A 07/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

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

# EXAMPLE STENCIL DESIGN

DW0016A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:7X

4220721/A 07/2016

NOTES: (continued)

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



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