# Click to view price, real time Inventory, Delivery \& Lifecycle Information ; 

## TS3A27518ERTWR

## Texas instruments

Multiplexer Switch ICs 6B 1-of-2 Mux/Demux w/ 240 MHz BW

Any questions, please feel free to contact us.
info@kaimte.com

Texas
INSTRUMENTS

## TS3A27518E 6-channel (qSPI), 1:2 multiplexer/demultiplexer with integrated IEC L-4 ESD and 1.8-V logic compatible control inputs

## 1 Features

- $1.65-\mathrm{V}$ to $3.6-\mathrm{V}$ Single-Supply Operation
- Isolation in Power-Down Mode, $\mathrm{V}_{\mathrm{CC}}=0$
- Low-Capacitance Switches, 21.5 pF (Typical)
- Bandwidth Up to 240 MHz for High-Speed Rail-to-Rail Signal Handling
- Crosstalk and OFF Isolation of -62 dB
- 1.8-V Logic Compatible Control Inputs
- 3.6-V Tolerant Control Inputs
- Latch-Up Performance Exceeds 100-mA Per JESD 78, Class II
- ESD Performance Tested Per JESD 22
- 2500-V Human-Body Model (A114-B, Class II)
- 1500-V Charged-Device Model (C101)
- ESD Performance: NC/NO Ports
- $\pm 6-k V$ Contact Discharge (IEC 61000-4-2)
- 24-WQFN ( $4.00 \mathrm{~mm} \times 4.00 \mathrm{~mm}$ ), 24-BGA
$(3.00 \mathrm{~mm} \times 3.00 \mathrm{~mm}$ ) and 24 -TSSOP
$(7.90 \mathrm{~mm} \times 6.60 \mathrm{~mm}$ ) Packages


## 3 Description

The TS3A27518E is a bidirectional, 6-channel, 1:2 multiplexer-demultiplexer designed to operate from 1.65 V to 3.6 V . This device can handle both digital and analog signals, and can transmit signals up to $\mathrm{V}_{\mathrm{CC}}$ in either direction. The TS3A27518E has two control pins, each controlling three 1:2 muxes at the same time, and an enable pin that put all outputs in high-impedance mode. The control pins are compatible with $1.8-\mathrm{V}$ logic thresholds and are backward compatible with $2.5-\mathrm{V}$ and $3.3-\mathrm{V}$ logic thresholds.
The TS3A27518E allows any SD, SDIO, and multimedia card host controllers to expand out to multiple cards or peripherals because the SDIO interface consists of 6-bits: CMD, CLK, and Data[0:3] signals. This device will support other 6-bit interfaces such a qSPI. The TS3A27518E has two control pins that give additional flexibility to the user. For example, the ability to mux two different audio-video signals in equipment such as an LCD television, an LCD monitor, or a notebook docking station.

Device Information ${ }^{(1)}$

## 2 Applications

- SD-SDIO and MMC Two-Port MUX
- PC VGA Video MUX-Video Systems
- Audio and Video Signal Routing

| PACKAGE | BODY SIZE (NOM) |
| :--- | :---: |
| WQFN $(24)$ | $4.00 \mathrm{~mm} \times 4.00 \mathrm{~mm}$ |
| TSSOP $(24)$ | $7.90 \mathrm{~mm} \times 6.60 \mathrm{~mm}$ |
| BGA MICROSTAR <br> JUNIOR $(24)$ | $3.00 \mathrm{~mm} \times 3.00 \mathrm{~mm}$ |

(1) For all available packages, see the orderable addendum at the end of the data sheet.

Typical Application


## Table of Contents

1 Features .....  1
2 Applications ..... 1
3 Description ..... 1
4 Revision History ..... 2
5 Pin Configuration and Functions ..... 3
6 Specifications ..... 5
6.1 Absolute Maximum Ratings .....  5
6.2 ESD Ratings ..... 5
6.3 Recommended Operating Conditions .....  5
6.4 Thermal Information ..... 6
6.5 Electrical Characteristics for 3.3-V Supply .....  6
6.6 Electrical Characteristics for 2.5-V Supply ..... 8
6.7 Electrical Characteristics for 1.8-V Supply ..... 9
6.8 Typical Characteristics ..... 12
7 Parameter Measurement Information ..... 15
8 Detailed Description ..... 20
8.1 Overview ..... 20
8.2 Functional Block Diagram ..... 20
8.3 Feature Description. ..... 20
8.4 Device Functional Modes. ..... 20
9 Application and Implementation ..... 21
9.1 Application Information ..... 21
9.2 Typical Application ..... 21
10 Power Supply Recommendations ..... 23
11 Layout. ..... 23
11.1 Layout Guidelines ..... 23
11.2 Layout Example ..... 23
12 Device and Documentation Support ..... 24
12.1 Community Resources ..... 24
12.2 Trademarks ..... 24
12.3 Electrostatic Discharge Caution. ..... 24
12.4 Glossary ..... 24
13 Mechanical, Packaging, and Orderable Information ..... 24

## 4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.
Changes from Revision D (May 2016) to Revision E ..... Page

- Changed the Typical Application ..... 1
- Changed the Pin Configuration images. ..... 3
- Removed Note: "The input and output voltage ratings..." from the Absolute Maximum Ratings table ..... 5
- Removed Note: "This value is limited to 5.5-V maximum" from the Absolute Maximum Ratings table ..... 5
- Changed the Application Information section. ..... 21
- Added Figure 27 ..... 22
Changes from Revision C (December 2015) to Revision D ..... Page
- Updated Pin Functions table ..... 1
Changes from Revision B (May 2009) to Revision C ..... Page
- Added ESD Ratings table, Feature Description section, Device Functional Modes, Application and Implementation section, Power Supply Recommendations section, Layout section, Device and Documentation Support section, and Mechanical, Packaging, and Orderable Information section ..... 1
Changes from Revision A (March 2009) to Revision B ..... Page
- Changed the data sheet From: Product Preview To: Production data .....  1


## 5 Pin Configuration and Functions




ZQS Package
24-Pin BGA MICROSTAR JUNIOR

## Top View



Pin Functions

| PIN |  |  |  | I/O | DESCRIPTION |
| :---: | :---: | :---: | :---: | :---: | :---: |
| NAME | RTW | ZQS | PW |  |  |
| COM1 | 1 | A1 | 4 | 1/O | Common-signal path |
| COM2 | 3 | B1 | 6 | I/O | Common-signal path |
| COM3 | 4 | C1 | 7 | I/O | Common-signal path |
| COM4 | 6 | D1 | 9 | I/O | Common-signal path |
| COM5 | 7 | E1 | 10 | I/O | Common-signal path |
| COM6 | 9 | D2 | 12 | I/O | Common-signal path |
| $\overline{\mathrm{EN}}$ | 17 | C4 | 20 | 1 | Digital control to enable or disable all signal paths |
| GND | 2 | C3 | 5 | - | Ground. |
| IN1 | 21 | B4 | 24 | 1 | Digital control to connect COM to NC or NO |
| IN2 | 11 | D3 | 14 | 1 | Digital control to connect COM to NC or NO |
| N.C. | 24 | A3 | 3 | - | Not connected |
| NC1 | 23 | B3 | 2 | I/O | Normally closed-signal path |
| NC2 | 22 | A2 | 1 | 1/O | Normally closed-signal path |
| NC3 | 20 | A4 | 23 | I/O | Normally closed-signal path |
| NC4 | 18 | B5 | 21 | I/O | Normally closed-signal path |
| NC5 | 16 | C5 | 19 | I/O | Normally closed-signal path |
| NC6 | 19 | A5 | 22 | I/O | Normally closed-signal path |
| NO1 | 8 | E2 | 11 | I/O | Normally open-signal path |
| NO2 | 10 | E3 | 13 | 1/O | Normally open-signal path |
| NO3 | 12 | E4 | 15 | I/O | Normally open-signal path |
| NO4 | 14 | D5 | 17 | 1/O | Normally open-signal path |
| NO5 | 15 | D4 | 18 | 1/O | Normally open-signal path |
| NO6 | 13 | E5 | 16 | I/O | Normally open-signal path |
| $\mathrm{V}_{\mathrm{CC}}$ | 5 | C2 | 8 | - | Voltage supply |

TS3A27518E
www.ti.com
SCDS260E -MARCH 2009-REVISED MARCH 2019

## 6 Specifications

### 6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) (1) (2)

|  |  |  | MIN | MAX | UNIT |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Supply voltage ${ }^{(3)}$ |  | -0.5 | 4.6 | V |
| $\mathrm{V}_{\mathrm{NC}}$ <br> $\mathrm{V}_{\mathrm{NO}}$ <br> $V_{\mathrm{COM}}$ | Analog signal voltage ${ }^{(3)}$ |  | -0.5 | 4.6 | V |
| $\mathrm{I}_{\mathrm{K}}$ | Analog port diode current ${ }^{(4)}$ | $\mathrm{V}_{\mathrm{CC}}<\mathrm{V}_{\mathrm{NC}}, \mathrm{V}_{\mathrm{NO}}, \mathrm{V}_{\mathrm{COM}}<0$ | -50 |  | mA |
| $I_{\mathrm{NC}}$ <br> $\mathrm{I}_{\mathrm{NO}}$ <br> $\mathrm{I}^{2}$ INo Icom | ON-state switch current ${ }^{(5)}$ | $\mathrm{V}_{\mathrm{NC}}, \mathrm{V}_{\mathrm{NO}}, \mathrm{V}_{\mathrm{COM}}=0$ to $\mathrm{V}_{\mathrm{CC}}$ | -50 | 50 | mA |
| $\mathrm{V}_{1}$ | Digital input voltage ${ }^{(3)}$ |  | -0.5 | 4.6 | V |
| $\mathrm{I}_{\mathrm{K}}$ | Digital input clamp current ${ }^{(3)}$ | $\mathrm{V}_{10}<\mathrm{V}_{1}<0$ | -50 |  | mA |
| ICC | Continuous current through $\mathrm{V}_{\mathrm{CC}}$ |  |  | 100 | mA |
| $\mathrm{I}_{\text {GND }}$ | Continuous current through GND |  | -100 |  | mA |
| $\mathrm{T}_{\text {stg }}$ | Storage temperature |  | -65 | 150 | ${ }^{\circ} \mathrm{C}$ |

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum.
(3) All voltages are with respect to ground, unless otherwise specified.
(4) Requires clamp diodes on analog port to $\mathrm{V}_{\mathrm{CC}}$.
(5) Pulse at $1-\mathrm{ms}$ duration $<10 \%$ duty cycle.

### 6.2 ESD Ratings

|  |  | VALUE | UNIT |
| :---: | :---: | :---: | :---: |
|  | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ${ }^{(1)}$ | $\pm 2500$ |  |
| $\mathrm{V}_{\text {(ESD) }} \quad$ Electrostatic discharge | Charged-device model (CDM), per JEDEC specification JESD22-C101 or ANSI/ESDA/JEDEC JS-002 (2) | $\pm 1500$ | V |

(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

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

|  |  | MIN | MAX | UNIT |
| :---: | :---: | :---: | :---: | :---: |
| Supply voltage | $\mathrm{V}_{\text {CC }}$ | 1.65 | 3.6 | V |
|  | $\mathrm{V}_{\mathrm{NC}}$ |  |  |  |
| Analog signal voltage | $\mathrm{V}_{\mathrm{NO}}$ | 0 | $\mathrm{V}_{\mathrm{CC}}$ | v |
|  | $\mathrm{V}_{\text {COM }}$ |  |  |  |
| Digital input voltage | $\mathrm{V}_{1}$ | 0 | $\mathrm{V}_{\mathrm{CC}}$ | V |

### 6.4 Thermal Information

| THERMAL METRIC ${ }^{(1)}$ |  | TS3A27518E |  |  | UNIT |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\begin{gathered} \text { PW } \\ \text { (TSSOP) } \end{gathered}$ | RTW (WQFN) | ZQS (BGA MICROSTAR JUNIOR) |  |
|  |  | 24 PINS | 24 PINS | 24 PINS |  |
| $\mathrm{R}_{\theta \mathrm{JA}}$ | Junction-to-ambient thermal resistance | 104 | 40.7 | 155.7 | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |
| $\mathrm{R}_{\theta \text { өJC(top) }}$ | Junction-to-case (top) thermal resistance | 51.6 | 42.9 | 69.9 | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |
| $\mathrm{R}_{\theta \mathrm{JB}}$ | Junction-to-board thermal resistance | 57.5 | 19.2 | 94.6 | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |
| \%JT | Junction-to-top characterization parameter | 9.9 | 1 | 9 | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |
| $\Psi_{\text {JB }}$ | Junction-to-board characterization parameter | 57.1 | 19.3 | 92.2 | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |
|  | Junction-to-case (bottom) thermal resistance | - | 8 | - | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |

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

### 6.5 Electrical Characteristics for 3.3-V Supply ${ }^{(1)}$

$\mathrm{V}_{\mathrm{CC}}=3 \mathrm{~V}$ to $3.6 \mathrm{~V}, \mathrm{~T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ (unless otherwise noted)

| PARAMETER |  | TEST CONDITIONS |  |  |  | MIN | TYP | MAX | UNIT |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ANALOG SWITCH |  |  |  |  |  |  |  |  |  |
| $\mathrm{V}_{\text {сом }}$, <br> $\mathrm{V}_{\mathrm{NO}}, \mathrm{V}_{\mathrm{NC}}$ | Analog signal voltage |  |  |  |  | 0 |  | $\mathrm{V}_{\text {cc }}$ | V |
| $\mathrm{r}_{\text {on }}$ | ON-state resistance | $\mathrm{V}_{\mathrm{CC}}=3 \mathrm{~V}$ | $\begin{aligned} & 0 \leq\left(\mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}\right) \\ & \leq \mathrm{V}_{\mathrm{CC}}, \\ & \mathrm{I}_{\mathrm{CO}}=-32 \mathrm{~mA} \end{aligned}$ | Switch ON, see Figure 15 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ |  | 4.4 | 6.2 |  |
|  |  |  |  |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ |  |  | 7.6 | V |
| $\Delta r_{\text {on }}$ | ON-state resistance match between channels | $\mathrm{V}_{\mathrm{CC}}=3 \mathrm{~V}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=2.1 \\ & \mathrm{~V}, \\ & \mathrm{I}_{\mathrm{COM}}=-32 \mathrm{~mA} \end{aligned}$ | Switch ON, see Figure 15 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ |  | 0.3 | 0.7 |  |
|  |  |  |  |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ |  |  | 0.8 | $\Omega$ |
| $\mathrm{r}_{\text {on(flat) }}$ | ON-state resistance flatness | $\mathrm{V}_{\mathrm{CC}}=3 \mathrm{~V}$ | $\begin{aligned} & 0 \leq\left(\mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}\right) \\ & \leq \mathrm{V}_{\mathrm{CC}}, \\ & \mathrm{I}_{\mathrm{COM}}=-32 \mathrm{~mA} \end{aligned}$ | Switch ON, see Figure 16 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ |  | 0.95 | 2.1 | $\Omega$ |
|  |  |  |  |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ |  |  | 2.3 |  |
| $\mathrm{I}_{\mathrm{NC}(\mathrm{OFF})}$, $\mathrm{I}_{\mathrm{NO}(\mathrm{OFF})}$ | NC, NO OFF leakage current | $\mathrm{V}_{\mathrm{CC}}=3.6 \mathrm{~V}$ | $\begin{aligned} & \hline \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=1 \\ & \mathrm{~V}, \\ & \mathrm{~V}_{\mathrm{COM}}=3 \mathrm{~V}, \\ & \text { or } \\ & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=3 \\ & \mathrm{~V}, \\ & \mathrm{~V}_{\mathrm{COM}}=1 \mathrm{~V} \\ & \hline \end{aligned}$ | Switch OFF, <br> see Figure 16 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -0.5 | 0.05 | 0.5 | $\mu \mathrm{A}$ |
|  |  |  |  |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ | -7 |  | 7 |  |
| $I_{\text {NC(PWROFF) }}$, $I_{\text {NO(PWROFF) }}$ |  | $\mathrm{V}_{\mathrm{CC}}=0 \mathrm{~V}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=0 \\ & \text { to } 3.6 \mathrm{~V}, \\ & \mathrm{~V}_{\mathrm{COM}}=3.6 \mathrm{~V} \text { to } \\ & 0, \\ & \text { or } \\ & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=3.6 \\ & \mathrm{~V}^{\text {to } 0,} \\ & \mathrm{~V}_{\mathrm{COM}}=0 \text { to } 3.6 \\ & \mathrm{~V} \end{aligned}$ |  | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -1 | 0.05 | 1 |  |
|  |  |  |  |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ | -12 |  | 12 |  |
| $\mathrm{I}_{\text {Com(OFF) }}$ | COM OFF leakage current | $\mathrm{V}_{\mathrm{CC}}=3.6 \mathrm{~V}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=3 \\ & \mathrm{~V}^{2}, \\ & \mathrm{~V}_{\mathrm{COM}}=1 \mathrm{~V}, \\ & \text { or } \\ & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=1 \\ & \mathrm{~V} \\ & \mathrm{~V}_{\mathrm{COM}}=3 \mathrm{~V} \\ & \hline \end{aligned}$ | Switch OFF, <br> see Figure 16 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -1 | 0.01 | 1 | $\mu \mathrm{A}$ |
|  |  |  |  |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ | -2 |  | 2 |  |
| $\mathrm{I}_{\text {COM(PWROFF) }}$ |  | $\mathrm{V}_{\mathrm{CC}}=0 \mathrm{~V}$ | $\mathrm{V}_{\mathrm{NC}}$ or $\mathrm{V}_{\mathrm{NO}}=3.6$ <br> V to 0 , <br> $\mathrm{V}_{\text {COM }}=0$ to 3.6 <br> V, <br> or <br> $\mathrm{V}_{\mathrm{NC}}$ or $\mathrm{V}_{\mathrm{NO}}=0$ <br> to 3.6 V , <br> $\mathrm{V}_{\text {COM }}=3.6 \mathrm{~V}$ to <br> 0 |  | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -1 | 0.02 | 1 |  |
|  |  |  |  |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ | -12 |  | 1 |  |

(1) The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum.

## Electrical Characteristics for 3.3-V Supply ${ }^{(1)}$ (continued)

$\mathrm{V}_{\mathrm{CC}}=3 \mathrm{~V}$ to $3.6 \mathrm{~V}, \mathrm{~T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ (unless otherwise noted)

(2) All unused digital inputs of the device must be held at $\mathrm{V}_{\mathrm{CC}}$ or GND to ensure proper device operation. See the TI application report, Implications of Slow or Floating CMOS Inputs, SCBA004

## Electrical Characteristics for 3.3-V Supply ${ }^{(1)}$ (continued)

$\mathrm{V}_{\mathrm{CC}}=3 \mathrm{~V}$ to $3.6 \mathrm{~V}, \mathrm{~T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ (unless otherwise noted)


### 6.6 Electrical Characteristics for 2.5-V Supply ${ }^{(1)}$

$\mathrm{V}_{\mathrm{CC}}=2.3 \mathrm{~V}$ to $2.7 \mathrm{~V}, \mathrm{~T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ (unless otherwise noted)

| PARAMETER |  | TEST CONDITIONS |  |  |  | MIN | TYP | MAX | UNIT |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ANALOG SWITCH |  |  |  |  |  |  |  |  |  |
| $\mathrm{V}_{\text {сом }}$, <br> $\mathrm{V}_{\mathrm{NO}}, \mathrm{V}_{\mathrm{NC}}$ | Analog signal voltage |  |  |  |  | 0 |  | $\mathrm{V}_{\mathrm{cc}}$ | V |
| $\mathrm{r}_{\text {on }}$ | ON-state resistance | $\mathrm{V}_{\mathrm{CC}}=2.3 \mathrm{~V}$ | $\begin{aligned} & 0 \leq\left(\mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}\right) \leq \mathrm{V}_{\mathrm{CC}}, \\ & \mathrm{I}_{\mathrm{COM}}=-32 \mathrm{~mA} \end{aligned}$ | Switch ON, see Figure 15 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ |  | 5.5 | 9.6 | $\Omega$ |
|  |  |  |  |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ |  |  | 11.5 |  |
| $\Delta r_{\text {on }}$ | ON-state resistance match between channels | $\mathrm{V}_{\mathrm{CC}}=2.3 \mathrm{~V}$ | $\mathrm{V}_{\mathrm{NC}}$ or $\mathrm{V}_{\mathrm{NO}}=1.6 \mathrm{~V}$, $\mathrm{I}_{\text {COM }}=-32 \mathrm{~mA}$ | Switch ON, see Figure 15 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ |  | 0.3 | 0.8 |  |
|  |  |  |  |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ |  |  | 0.9 | $\Omega$ |
| $\mathrm{r}_{\text {on(flat) }}$ | ON-state resistance flatness | $\mathrm{V}_{\mathrm{CC}}=2.3 \mathrm{~V}$ | $\begin{aligned} & 0 \leq\left(\mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}\right) \leq \mathrm{V}_{\mathrm{CC}}, \\ & \mathrm{I}_{\mathrm{COM}}=-32 \mathrm{~mA} \end{aligned}$ | Switch ON, see Figure 16 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ |  | 0.91 | 2.2 |  |
|  |  |  |  |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ |  |  | 2.3 | $\Omega$ |
| $\mathrm{I}_{\text {NC(OFF) }}$, <br> $\mathrm{I}_{\mathrm{NO}(\mathrm{OFF})}$ | NC, NO OFF leakage current | $\mathrm{V}_{\mathrm{CC}}=2.7 \mathrm{~V}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=0.5 \mathrm{~V}, \\ & \mathrm{~V}_{\mathrm{COM}}=2.3 \mathrm{~V}, \\ & \text { or } \\ & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=2.3 \mathrm{~V}, \\ & \mathrm{~V}_{\mathrm{COM}}=0.5 \mathrm{~V} \\ & \hline \end{aligned}$ | Switch OFF, see Figure 16 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -0.3 | 0.04 | 0.3 |  |
|  |  |  |  |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ | -6 |  | 6 |  |
| $I_{\text {nC(PWROFF) }}$, $\mathrm{I}_{\text {NO(PWROFF) }}$ |  | $\mathrm{V}_{\mathrm{CC}}=0 \mathrm{~V}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=0 \text { to } 2.7 \mathrm{~V} \text {, } \\ & \mathrm{V}_{\mathrm{COM}}=2.7 \mathrm{~V} \text { to } 0, \\ & \text { or } \\ & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=2.7 \mathrm{~V} \text { to } 0, \\ & \mathrm{~V}_{\mathrm{COM}}=0 \text { to } 2.7 \mathrm{~V} \end{aligned}$ |  | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -0.6 | 0.02 | 0.6 | A |
|  |  |  |  |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ | -10 |  | 10 |  |
| $\mathrm{I}_{\text {COM (OFF) }}$ | COM OFF leakage current | $\mathrm{V}_{\mathrm{CC}}=2.7 \mathrm{~V}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=0.5 \mathrm{~V}, \\ & \mathrm{~V}_{\mathrm{COM}}=2.3 \mathrm{~V}, \\ & \text { or } \\ & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=2.3 \mathrm{~V}, \\ & \mathrm{~V}_{\mathrm{COM}}=0.5 \mathrm{~V} \end{aligned}$ | Switch OFF, <br> see Figure 16 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -0.7 | 0.02 | 0.7 |  |
|  |  |  |  |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ | -1 |  | 1 |  |
|  |  |  | $\mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=2.7 \mathrm{~V} \text { to } 0 \text {, }$ |  | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -0.7 | 0.02 | 0.7 | $\mu \mathrm{A}$ |
| ICOM(PWROFF) |  | $\mathrm{V}_{\mathrm{CC}}=0 \mathrm{~V}$ | or $\begin{aligned} & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=0 \text { to } 2.7 \mathrm{~V}, \\ & \mathrm{~V}_{\mathrm{COM}}=2.7 \mathrm{~V} \text { to } 0 \end{aligned}$ |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ | -7.2 |  | 7.2 |  |
| $\mathrm{I}_{\mathrm{NO}(\mathrm{ON})}$ <br> $\mathrm{I}_{\mathrm{NC}(\mathrm{ON})}$ | NC, NO ON leakage current | $\mathrm{V}_{\mathrm{CC}}=2.7 \mathrm{~V}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=0.5 \mathrm{~V} \text { or } \\ & 2.3 \mathrm{~V} \text {, } \\ & \mathrm{V}_{\mathrm{COM}}=\text { open } \end{aligned}$ | Switch ON, see Figure 17 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -2.1 | 0.03 | 2.1 | $\mu \mathrm{A}$ |
|  |  |  |  |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ | -6 |  | 6 |  |
| $\mathrm{I}_{\text {Com(ON) }}$ | COM <br> ON leakage current | $\mathrm{V}_{C C}=2.7 \mathrm{~V}$ | $\mathrm{V}_{\mathrm{NC}}$ or $\mathrm{V}_{\mathrm{NO}}=$ open, <br> $\mathrm{V}_{\text {COM }}=0.5 \mathrm{~V}$, <br> or <br> $\mathrm{V}_{\mathrm{NC}}$ or $\mathrm{V}_{\mathrm{NO}}=$ open, <br> $\mathrm{V}_{\mathrm{COM}}=2.3 \mathrm{~V}$ | Switch ON, see Figure 17 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -2 | 0.02 | 2 |  |
|  |  |  |  |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ | -5.7 |  | 5.7 | $\mu \mathrm{A}$ |
| DIGITAL CONTROL INPUTS (IN1, IN2, $\overline{\text { EN }}$ ) ${ }^{(2)}$ |  |  |  |  |  |  |  |  |  |
| $\mathrm{V}_{\mathrm{HH}}$ | Input logic high | $\mathrm{V}_{C C}=2.7 \mathrm{~V}$ | $\mathrm{V}_{1}=\mathrm{V}_{\text {CC }}$ or GND |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ | 1.15 |  | 3.6 | V |
| $\mathrm{V}_{\mathrm{IL}}$ | Input logic low | $\mathrm{V}_{\mathrm{CC}}=2.7 \mathrm{~V}$ |  |  |  | 0 |  | 0.55 | V |
| $\mathrm{I}_{\mathrm{H}}, \mathrm{I}_{\text {IL }}$ | Input leakage current | $\mathrm{V}_{\mathrm{CC}}=2.7 \mathrm{~V}$ | $\mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{CC}}$ or 0 |  | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -0.1 | 0.01 | 0.1 | $\mu \mathrm{A}$ |
|  |  |  |  |  | $\begin{aligned} & \mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C} \text { to } \\ & +85^{\circ} \mathrm{C} \end{aligned}$ | -2.1 |  | 2.1 |  |

(1) The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum.
(2) All unused digital inputs of the device must be held at $\mathrm{V}_{\mathrm{Cc}}$ or GND to ensure proper device operation. Refer to the TI application report, Implications of Slow or Floating CMOS Inputs, SCBA004.

## Electrical Characteristics for 2.5-V Supply ${ }^{(1)}$ (continued)

$\mathrm{V}_{\mathrm{CC}}=2.3 \mathrm{~V}$ to $2.7 \mathrm{~V}, \mathrm{~T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ (unless otherwise noted)


### 6.7 Electrical Characteristics for 1.8-V Supply ${ }^{(1)}$

$\mathrm{V}_{\mathrm{CC}}=1.65 \mathrm{~V}$ to $1.95 \mathrm{~V}, \mathrm{~T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $85^{\circ} \mathrm{C}$ (unless otherwise noted)

| PARAMETER |  | TEST CONDITIONS |  |  |  | MIN | TYP | MAX | UNIT |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ANALOG SWITCH |  |  |  |  |  |  |  |  |  |
| $\mathrm{V}_{\text {сом }}$, <br> $\mathrm{V}_{\mathrm{NO}}, \mathrm{V}_{\mathrm{NC}}$ | Analog signal voltage |  |  |  |  | 0 |  | $\mathrm{V}_{\mathrm{Cc}}$ | V |
| $\mathrm{r}_{\text {on }}$ | ON-state resistance | $\mathrm{V}_{\mathrm{CC}}=1.65 \mathrm{~V}$ | $0 \leq\left(\mathrm{V}_{\mathrm{NC}}\right.$ or $\left.\mathrm{V}_{\mathrm{NO}}\right) \leq$ $\mathrm{V}_{\mathrm{CC}}$, <br> $\mathrm{I}_{\text {Сом }}=-32 \mathrm{~mA}$ | Switch ON, see Figure 15 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ |  | 7.1 | 14.4 | $\Omega$ |
|  |  |  |  |  | $\mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ |  |  | 16.3 |  |
| $\Delta r_{\text {on }}$ | ON-state resistance match between channels | $\mathrm{V}_{\mathrm{CC}}=1.65 \mathrm{~V}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=1.5 \mathrm{~V}, \\ & \mathrm{I}_{\mathrm{COM}}=-32 \mathrm{~mA} \end{aligned}$ | Switch ON, see Figure 15 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ |  | 0.3 | 1 |  |
|  |  |  |  |  | $\mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ |  |  | 1.2 | $\Omega$ |
| $\mathrm{r}_{\text {on(flat) }}$ | ON-state resistance flatness | $\mathrm{V}_{\mathrm{CC}}=1.65 \mathrm{~V}$ | $\begin{aligned} & 0 \leq\left(\mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}\right) \leq \\ & \mathrm{V}_{\mathrm{CC}}, \\ & \mathrm{I}_{\mathrm{COM}}=-32 \mathrm{~mA} \end{aligned}$ | Switch ON, see Figure 16 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ |  | 2.7 | 5.5 | $\Omega$ |
|  |  |  |  |  | $\mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ |  |  | 7.3 |  |

(1) The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum.

## Electrical Characteristics for 1.8-V Supply ${ }^{(1)}$ (continued)

$\mathrm{V}_{\mathrm{CC}}=1.65 \mathrm{~V}$ to $1.95 \mathrm{~V}, \mathrm{~T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $85^{\circ} \mathrm{C}$ (unless otherwise noted)

| PARAMETER |  | TEST CONDITIONS |  |  |  | MIN | TYP | MAX | UNIT |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{I}_{\text {NC(OFF) }}$, $\mathrm{I}_{\mathrm{NO}(\mathrm{OFF})}$ | NC, NO OFF leakage current | $\mathrm{V}_{\mathrm{CC}}=1.95 \mathrm{~V}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=0.3 \mathrm{~V}, \\ & \mathrm{~V}_{\mathrm{COM}}=1.65 \mathrm{~V}, \\ & \text { or } \\ & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=1.65 \mathrm{~V}, \\ & \mathrm{~V}_{\mathrm{COM}}=0.3 \mathrm{~V} \end{aligned}$ | Switch OFF, see Figure 16 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -0.25 | 0.03 | 0.25 |  |
|  |  |  |  |  | $\mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ | -5 |  | 5 | $\mu \mathrm{A}$ |
| $\mathrm{I}_{\text {NC(PWROFF) }}$, $I_{\text {No(PWROFF) }}$ |  | $\mathrm{V}_{\mathrm{CC}}=0 \mathrm{~V}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=1.95 \mathrm{~V} \\ & \text { to } 0, \\ & \mathrm{~V}_{\mathrm{COM}}=0 \text { to } 1.95 \mathrm{~V} \text {, } \\ & \text { or } \\ & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=0 \text { to } \\ & 1.95 \mathrm{~V}, \\ & \mathrm{~V}_{\mathrm{COM}}=1.95 \mathrm{~V} \text { to } 0 \\ & \hline \end{aligned}$ |  | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -0.4 | 0.01 | 0.4 |  |
|  |  |  |  |  | $\mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ | -7.2 |  | 7.2 | $\mu \mathrm{A}$ |
| $\mathrm{I}_{\text {com(OFF) }}$ | COM OFF leakage current | $\mathrm{V}_{\mathrm{CC}}=1.95 \mathrm{~V}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=0.3 \mathrm{~V}, \\ & \mathrm{~V}_{\mathrm{COM}}=1.65 \mathrm{~V}, \\ & \text { or } \\ & \mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=1.65 \mathrm{~V}, \\ & \mathrm{~V}_{\mathrm{COM}}=0.3 \mathrm{~V} \end{aligned}$ | Switch OFF, see Figure 16 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -0.4 | 0.02 | 0.4 |  |
|  |  |  |  |  | $\mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ | -0.9 |  | 0.9 | $\mu \mathrm{A}$ |
|  |  |  | $\mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=1.95 \mathrm{~V}$ |  | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -0.4 | 0.02 | 0.4 |  |
| ICOM(PWROFF) |  | $\mathrm{V}_{\mathrm{CC}}=0 \mathrm{~V}$ | or <br> $\mathrm{V}_{\mathrm{NC}}$ or $\mathrm{V}_{\mathrm{NO}}=0$ to <br> 1.95 V , <br> $\mathrm{V}_{\text {COM }}=1.95 \mathrm{~V}$ to 0 |  | $\mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ | -5 |  | 5 | $\mu \mathrm{A}$ |
| $\mathrm{I}_{\mathrm{NO}(\mathrm{ON})}$, $\mathrm{I}_{\mathrm{NC}(\mathrm{ON})}$ | NC, NO ON leakage current | $\mathrm{V}_{\mathrm{CC}}=1.95 \mathrm{~V}$ | $\mathrm{V}_{\mathrm{NC}}$ or $\mathrm{V}_{\mathrm{NO}}=0.3 \mathrm{~V}$, <br> $\mathrm{V}_{\text {COM }}=$ open, <br> or <br> $\mathrm{V}_{\mathrm{NC}}$ or $\mathrm{V}_{\mathrm{NO}}=1.65 \mathrm{~V}$, <br> $\mathrm{V}_{\text {COM }}=$ open | Switch ON, see Figure 17 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -2 | 0.02 | 2 |  |
|  |  |  |  |  | $\mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ | -5.2 |  | 5.2 | $\mu \mathrm{A}$ |
| $\mathrm{I}_{\text {COM }}^{\text {(ON }}$ ) | COM <br> ON leakage current |  | $\mathrm{V}_{\mathrm{NC}}$ or $\mathrm{V}_{\mathrm{NO}}=$ open, <br> $\mathrm{V}_{\text {COM }}=0.3 \mathrm{~V}$, <br> or <br> $\mathrm{V}_{\mathrm{NC}}$ or $\mathrm{V}_{\mathrm{NO}}=$ open, <br> $\mathrm{V}_{\text {COM }}=1.65 \mathrm{~V}$ | Switch ON, see Figure 17 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -2 | 0.02 | 2 |  |
|  |  | $\mathrm{V}_{\mathrm{CC}}=1.95 \mathrm{~V}$ |  |  | $\mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ | -5.2 |  | 5.2 | $\mu \mathrm{A}$ |
| DIGITAL CONTROL INPUTS (IN1, IN2, EN) ${ }^{(2)}$ |  |  |  |  |  |  |  |  |  |
| $\mathrm{V}_{\mathrm{IH}}$ | Input logic high | $\mathrm{V}_{\mathrm{CC}}=1.95 \mathrm{~V}$ | $\mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{CC}}$ or GND |  | $\mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ | 1 |  | 3.6 | V |
| $\mathrm{V}_{\mathrm{IL}}$ | Input logic low | $\mathrm{V}_{\mathrm{CC}}=1.95 \mathrm{~V}$ |  |  | $\mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ | 0 |  | 0.4 | V |
| $\mathrm{I}_{\mathrm{IH}}, \mathrm{I}_{\text {IL }}$ | Input leakage current | $\mathrm{V}_{\mathrm{CC}}=1.95 \mathrm{~V}$ | $\mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\text {CC }}$ or 0 |  | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | -0.1 | 0.01 | 0.1 | $\mu \mathrm{A}$ |
|  |  |  |  |  | $\mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ | -2.1 |  | 2.1 |  |
| DYNAMIC |  |  |  |  |  |  |  |  |  |
| $\mathrm{t}_{\mathrm{on}}$ | Turnon time | $\mathrm{V}_{\mathrm{CC}}=1.8 \mathrm{~V}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{COM}}=\mathrm{V}_{\mathrm{CC}}, \\ & \mathrm{R}_{\mathrm{L}}=50 \Omega \end{aligned}$ | $\mathrm{C}_{\mathrm{L}}=35 \mathrm{pF},$ <br> see Figure 19 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ |  | 14.1 | 49.3 |  |
|  |  | $\begin{aligned} & \mathrm{V}_{\mathrm{CC}}=1.65 \mathrm{~V} \\ & \text { to } 1.95 \mathrm{~V} \end{aligned}$ |  |  | $\mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ |  |  | 56.7 | ns |
| $\mathrm{t}_{\text {OFF }}$ | Turnoff time | $\mathrm{V}_{\mathrm{CC}}=1.8 \mathrm{~V}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{COM}}=\mathrm{V}_{\mathrm{CC}}, \\ & \mathrm{R}_{\mathrm{L}}=50 \Omega \end{aligned}$ | $\mathrm{C}_{\mathrm{L}}=35 \mathrm{pF},$ <br> see Figure 19 | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ |  | 16.1 | 26.5 |  |
|  |  | $\begin{aligned} & \mathrm{V}_{\mathrm{CC}}=1.65 \mathrm{~V} \\ & \text { to } 1.95 \mathrm{~V} \end{aligned}$ |  |  | $\mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ |  |  | 31.2 | ns |
| $\mathrm{t}_{\text {BBM }}$ | Break-beforemake time | $\mathrm{V}_{C C}=1.8 \mathrm{~V}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{NC}}=\mathrm{V}_{\mathrm{NO}}=\mathrm{V}_{\mathrm{CC}} / 2, \\ & \mathrm{R}_{\mathrm{L}}=50 \Omega \end{aligned}$ | $\begin{aligned} & C_{\mathrm{L}}=35 \mathrm{pF}, \\ & \text { see Figure } 20 \end{aligned}$ | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | 5.3 | 18.4 | 58 | ns |
|  |  | $\begin{aligned} & \mathrm{V}_{\mathrm{CC}}=1.65 \mathrm{~V} \\ & \text { to } 1.95 \mathrm{~V} \end{aligned}$ |  |  | $\mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ |  |  | 58 |  |
| $Q_{C}$ | Charge injection | $\mathrm{V}_{\mathrm{CC}}=1.8 \mathrm{~V}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{GEN}}=0, \\ & \mathrm{R}_{\mathrm{GEN}}=0 \end{aligned}$ | $\mathrm{C}_{\mathrm{L}}=1 \mathrm{nF},$ <br> see Figure 24 |  |  | 0.21 |  | pC |
| $\mathrm{C}_{\text {NC( } \text { (OFF) }}$, $\mathrm{C}_{\mathrm{NO}(\mathrm{OFF})}$ | $\mathrm{NC}, \mathrm{NO}$ OFF capacitance | $\mathrm{V}_{\mathrm{CC}}=1.8 \mathrm{~V}$ | $\mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=\mathrm{V}_{\mathrm{CC}} \text { or }$ GND, switch OFF | See Figure 18 |  |  | 9 |  | pF |
| $\mathrm{C}_{\mathrm{NC}(\mathrm{ON})}$, <br> $\mathrm{C}_{\mathrm{NO}(\mathrm{ON})}$ | NC, NO ON capacitance | $\mathrm{V}_{\mathrm{CC}}=1.8 \mathrm{~V}$ | $\mathrm{V}_{\mathrm{NC}} \text { or } \mathrm{V}_{\mathrm{NO}}=\mathrm{V}_{\mathrm{CC}} \text { or }$ GND, switch OFF | See Figure 18 |  |  | 22 |  | pF |
| $\mathrm{C}_{\text {com(ON) }}$ | COM <br> ON capacitance | $\mathrm{V}_{C C}=1.8 \mathrm{~V}$ | $\mathrm{V}_{\mathrm{COM}}=\mathrm{V}_{\mathrm{CC}}$ or GND, switch ON | See Figure 18 |  |  | 22 |  | pF |

(2) All unused digital inputs of the device must be held at $\mathrm{V}_{\mathrm{Cc}}$ or GND to ensure proper device operation. Refer to the TI application report, Implications of Slow or Floating CMOS Inputs, SCBA004.

## Electrical Characteristics for 1.8-V Supply ${ }^{(1)}$ (continued)

$\mathrm{V}_{\mathrm{CC}}=1.65 \mathrm{~V}$ to $1.95 \mathrm{~V}, \mathrm{~T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $85^{\circ} \mathrm{C}$ (unless otherwise noted)

| PARAMETER |  | TEST CONDITIONS |  |  |  | MIN TYP | MAX | UNIT |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{C}_{1}$ | Digital input capacitance | $\mathrm{V}_{C C}=1.8 \mathrm{~V}$ | $\mathrm{V}_{1}=\mathrm{V}_{\text {CC }}$ or GND | See Figure 18 |  | 2 |  | pF |
| BW | Bandwidth | $\mathrm{V}_{\mathrm{CC}}=1.8 \mathrm{~V}$ | $\mathrm{R}_{\mathrm{L}}=50 \Omega$ | Switch ON, see Figure 20 |  | 240 |  | MHz |
| OISo | OFF isolation | $\mathrm{V}_{\mathrm{CC}}=1.8 \mathrm{~V}$ | $\begin{aligned} & \mathrm{R}_{\mathrm{L}}=50 \Omega, \\ & \mathrm{f}=10 \mathrm{MHz} \end{aligned}$ | Switch OFF, see Figure 22 |  | -60 |  | dB |
| $\mathrm{X}_{\text {TALK }}$ | Crosstalk | $\mathrm{V}_{\mathrm{CC}}=1.8 \mathrm{~V}$ | $\begin{aligned} & \mathrm{R}_{\mathrm{L}}=50 \Omega, \\ & \mathrm{f}=10 \mathrm{MHz} \end{aligned}$ | Switch ON, see Figure 23 |  | -60 |  | dB |
| $\mathrm{X}_{\text {TALK(ADJ) }}$ | Crosstalk adjacent | $\mathrm{V}_{\mathrm{CC}}=1.8 \mathrm{~V}$ | $\begin{aligned} & \mathrm{R}_{\mathrm{L}}=50 \Omega, \\ & \mathrm{f}=10 \mathrm{MHz} \end{aligned}$ | Switch ON, see Figure 23 |  | -71 |  | dB |
| THD | Total harmonic distortion | $\mathrm{V}_{\mathrm{CC}}=1.8 \mathrm{~V}$ | $\begin{aligned} & \mathrm{R}_{\mathrm{L}}=600 \Omega, \\ & \mathrm{C}_{\mathrm{L}}=50 \mathrm{pF} \end{aligned}$ | $\mathrm{f}=20 \mathrm{~Hz} \text { to } 20 \mathrm{kHz} \text {, }$ <br> see Figure 25 |  | 0.1\% |  |  |
| SUPPLY |  |  |  |  |  |  |  |  |
| $\mathrm{I}_{\mathrm{cc}}$ | Positive supply current | $\mathrm{V}_{\mathrm{CC}}=1.95 \mathrm{~V}$ | $\mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{CC}}$ or GND | Switch ON or OFF | $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ | 0.01 | 0.1 | $\mu \mathrm{A}$ |
|  |  |  |  |  | $\mathrm{T}_{\mathrm{A}}=-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ |  | 1.5 |  |

### 6.8 Typical Characteristics



## Typical Characteristics (continued)



Figure 7. Crosstalk Adjacent


Figure 9. Total Harmonic Distortion vs Frequency


Figure 11. Insertion Loss


Figure 8. Crosstalk


Figure 10. OFF Isolation


Figure 12. Charge Injection vs Bias Voltage (1.8 V)

## Typical Characteristics (continued)



Figure 13. Charge Injection vs Bias Voltage (2.5 V)


Figure 14. Charge Injection vs Bias Voltage (3.3 V)

## 7 Parameter Measurement Information

Table 1. Parameter Description

| DESCRIPTION |  |
| :---: | :---: |
| $\mathrm{V}_{\text {COM }}$ | Voltage at COM. |
| $\mathrm{V}_{\mathrm{NC}}$ | Voltage at NC. |
| $\mathrm{V}_{\mathrm{NO}}$ | Voltage at NO. |
| $\mathrm{r}_{\text {on }}$ | Resistance between COM and NC or NO ports when the channel is ON. |
| $\Delta r_{\text {on }}$ | Difference of $r_{\text {on }}$ between channels in a specific device. |
| $\mathrm{r}_{\text {on(flat) }}$ | Difference between the maximum and minimum value of $r_{\text {on }}$ in a channel over the specified range of conditions. |
| $\mathrm{I}_{\mathrm{NC} \text { (OFF) }}$ | Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the OFF state. |
| $\mathrm{I}_{\mathrm{NC}(\mathrm{ON})}$ | Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the ON state and the output (COM) open. |
| $\mathrm{I}_{\mathrm{NO}(\mathrm{OFF})}$ | Leakage current measured at the NO port, with the corresponding channel (NO to COM) in the OFF state. |
| $\mathrm{I}_{\mathrm{NO}(\mathrm{ON})}$ | Leakage current measured at the NO port, with the corresponding channel ( NO to COM) in the ON state and the output (COM) open. |
| $\mathrm{I}_{\text {COM(OFF) }}$ | Leakage current measured at the COM port, with the corresponding channel (COM to NC or NO) in the OFF state. |
| $\mathrm{I}_{\text {COM }}(\mathrm{ON})$ | Leakage current measured at the COM port, with the corresponding channel (COM to NC or NO) in the ON state and the output (NC or NO) open. |
| $\mathrm{V}_{\text {IH }}$ | Minimum input voltage for logic high for the control input (IN, $\overline{\mathrm{EN}}$ ). |
| $\mathrm{V}_{\text {IL }}$ | Maximum input voltage for logic low for the control input (IN, $\overline{\mathrm{EN}}$ ). |
| $\mathrm{V}_{1}$ | Voltage at the control input (IN, $\overline{\mathrm{EN}}$ ). |
| $\mathrm{I}_{\mathrm{IH}}, \mathrm{I}_{\text {IL }}$ | Leakage current measured at the control input (IN, $\overline{\mathrm{EN}}$ ). |
| ton | Turnon time for the switch. This parameter is measured under the specified range of conditions and by the propagation delay between the digital control (IN) signal and analog output ( NC or NO ) signal when the switch is turning ON. |
| $\mathrm{t}_{\text {OFF }}$ | Turnoff time for the switch. This parameter is measured under the specified range of conditions and by the propagation delay between the digital control (IN) signal and analog output (NC or NO) signal when the switch is turning OFF. |
| $Q_{C}$ | Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NC or NO) output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control input. Charge injection, $\mathrm{Q}_{\mathrm{C}}=\mathrm{C}_{\mathrm{L}} \times \Delta \mathrm{V}_{\mathrm{COM}}, \mathrm{C}_{\mathrm{L}}$ is the load capacitance, and $\Delta \mathrm{V}_{\mathrm{COM}}$ is the change in analog output voltage. |
| $\mathrm{C}_{\mathrm{NC} \text { (OFF) }}$ | Capacitance at the NC port when the corresponding channel (NC to COM) is OFF. |
| $\mathrm{C}_{\mathrm{NC}(\mathrm{ON})}$ | Capacitance at the NC port when the corresponding channel (NC to COM) is ON. |
| $\mathrm{C}_{\mathrm{NO} \text { (OFF) }}$ | Capacitance at the NC port when the corresponding channel (NO to COM) is OFF. |
| $\mathrm{C}_{\mathrm{NO}(\mathrm{ON})}$ | Capacitance at the NC port when the corresponding channel (NO to COM) is ON. |
| $\mathrm{C}_{\text {COM(OFF) }}$ | Capacitance at the COM port when the corresponding channel (COM to NC) is OFF. |
| $\mathrm{C}_{\text {COM(ON) }}$ | Capacitance at the COM port when the corresponding channel (COM to NC) is ON. |
| $\mathrm{Cl}_{1}$ | Capacitance of control input (IN, EN). |
| $\mathrm{O}_{\text {ISO }}$ | OFF isolation of the switch is a measurement of OFF-state switch impedance. This is measured in dB in a specific frequency, with the corresponding channel (NC to COM) in the OFF state. |
| $\mathrm{X}_{\text {TALK }}$ | Crosstalk is a measurement of unwanted signal coupling from an ON channel to an OFF channel (NC1 to NO1). Adjacent crosstalk is a measure of unwanted signal coupling from an ON channel to an adjacent ON channel (NC1 to NC2). This is measured in a specific frequency and in dB. |
| BW | Bandwidth of the switch. This is the frequency in which the gain of an ON channel is -3 dB below the DC gain. |
| THD | Total harmonic distortion describes the signal distortion caused by the analog switch. This is defined as the ratio of root mean square (RMS) value of the second, third, and higher harmonic to the absolute magnitude of the fundamental harmonic. |
| $\mathrm{I}_{\mathrm{CC}}$ | Static power-supply current with the control (IN) pin at $\mathrm{V}_{\mathrm{CC}}$ or GND. |



Channel ON
$r_{\text {on }}=\frac{V_{\text {COM }} V_{\text {NO }}}{I_{\text {COM }}} \Omega$
$\mathbf{V}_{\mathbf{I N}}=\mathbf{V}_{\mathbf{I H}}$ or $\mathbf{V}_{\mathbf{I L}}$

Figure 15. ON-State Resistance (ron)


Figure 16. OFF-State Leakage Current (ICom(OFF), $\left.I_{\text {IC(OFF) }}, I_{\text {Com(PWROFF) }}, I_{\text {NC(PWROFF) }}\right)$


ON-State Leakage Current
Channel ON

Figure 17. ON-State Leakage Current
(ICOM(ON), $\left.I_{\text {NC(ON) }}\right)$


$$
\mathrm{V}_{\mathrm{BIAS}}=\mathrm{V}_{\mathrm{CC}} \text { or } \mathrm{GND} \text { and }
$$

$$
\mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{IH}} \text { or } \mathrm{V}_{\mathrm{IL}}
$$

Capacitance is measured at NO, COM, and IN inputs during ON and OFF conditions.

Figure 18. Capacitance

## ( $\left.\mathrm{C}_{\mathrm{l}}, \mathrm{C}_{\text {COM(OFF) }}, \mathrm{C}_{\text {COM(ON) }}, \mathrm{C}_{\mathrm{NC}(\mathrm{OFF})}, \mathrm{C}_{\mathrm{NC}(\mathrm{ON})}\right)$

All input pulses are supplied by generators having the following characteristics: $\mathrm{PRR} \leq 10 \mathrm{MHz}, \mathrm{Z}_{\mathrm{O}}=50 \Omega, \mathrm{t}_{\mathrm{r}}<5 \mathrm{~ns}$, $\mathrm{t}_{\mathrm{f}}<5 \mathrm{~ns}$.
$\mathrm{C}_{\mathrm{L}}$ includes probe and jig capacitance.


Figure 19. Turnon ( $\mathrm{t}_{\mathrm{ON}}$ ) and Turnoff Time ( $\mathrm{t}_{\mathrm{OFF}}$ )
$\mathrm{C}_{\mathrm{L}}$ includes probe and jig capacitance.
All input pulses are supplied by generators having the following characteristics: $\mathrm{PRR} \leq 10 \mathrm{MHz}, \mathrm{Z}_{\mathrm{O}}=50 \Omega, \mathrm{t}_{\mathrm{r}}<5 \mathrm{~ns}$, $\mathrm{t}_{\mathrm{f}}<5 \mathrm{~ns}$.


Figure 20. Break-Before-Make Time ( $\mathrm{t}_{\mathrm{BBM}}$ )


Channel ON: NO to COM
$\mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{IH}}$ or $\mathrm{V}_{\mathrm{IL}}$

Network Analyzer Setup
Source Power = 0 dBM (632-mV P-P at $50-\Omega$ load) DC Bias $=350 \mathrm{mV}$

Figure 21. Bandwidth (BW)


Channel OFF: NO to COM
$\mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{IH}}$ or $\mathrm{V}_{\mathrm{IL}}$

## Network Analyzer Setup

Source Power = 0 dBM
(632-mV P-P at $50-\Omega$ load) DC Bias $=\mathbf{3 5 0} \mathbf{~ m V}$

Figure 22. OFF Isolation ( $\mathrm{O}_{\mathrm{ISO}}$ )


Channel ON: NC to COM Channel OFF: NO to COM $\mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{IH}}$ or $\mathrm{V}_{\mathrm{IL}}$

Network Analyzer Setup
Source Power $=0 \mathrm{dBM}$ ( $632-\mathrm{mV}$ P-P at $50-\Omega$ load) DC Bias $=\mathbf{3 5 0} \mathbf{~ m V}$

Figure 23. Crosstalk ( $\mathrm{X}_{\text {TALK }}$ )
All input pulses are supplied by generators having the following characteristics: PRR $\leq 10 \mathrm{MHz}, \mathrm{Z}_{\mathrm{O}}=50 \Omega, \mathrm{t}_{\mathrm{r}}<5 \mathrm{~ns}$, $\mathrm{t}_{\mathrm{f}}<5 \mathrm{~ns}$.
$\mathrm{C}_{\mathrm{L}}$ includes probe and jig capacitance.


Figure 24. Charge Injection ( $\mathrm{Q}_{\mathrm{C}}$ )
$C_{L}$ includes probe and jig capacitance.

|  |  |  |
| :--- | :--- | :--- |
| Channel ON: COM to NO | $V_{I}=V_{I H}$ or $V_{I L}$ | $R_{L}=600 \Omega$ |
| $V_{\text {SOURCE }}=V_{C C} P-P$ | $f_{\text {SOURCE }}=20 \mathrm{~Hz}$ to 20 kHz | $C_{L}=50 \mathrm{pF}$ |



Figure 25. Total Harmonic Distortion (THD)

## 8 Detailed Description

### 8.1 Overview

The TS3A27518E is a bidirectional, 6-channel, 1:2 multiplexer-demultiplexer designed to operate from 1.65 V to 3.6 V. This device can handle both digital and analog signals, and can transmit signals up to $\mathrm{V}_{\mathrm{cc}}$ in either direction. The TS3A27518E has two control pins, each controlling three 1:2 muxes at the same time, and an enable pin that puts all outputs in high-impedance mode. The control pins are compatible with $1.8-\mathrm{V}$ logic thresholds and are backward compatible with $2.5-\mathrm{V}$ and 3.3-V logic thresholds.

### 8.2 Functional Block Diagram



### 8.3 Feature Description

The isolation in power-down mode, $\mathrm{V}_{\mathrm{CC}}=0$ feature places all switch paths in high-impedance state (High-Z) when the supply voltage equals 0 V .

### 8.4 Device Functional Modes

The TS3A27518E is a bidirectional device that has two sets of three single-pole double-throw switches.
Two digital signals control the 6 channels of the switch; one digital control for each set of three single-pole, double-throw switches. Digital input pin IN1 controls switches 1, 2, and 3, while pin IN2 controls switches 4, 5, and 6.
The TS3A27518 has an $\overline{\mathrm{EN}}$ pin that when set to logic high, it places all channels into a high-impedance or HIGH$Z$ state. Table 2 lists the functions of TS3A27518E

Table 2. Function Table

| $\overline{E N}$ | IN1 | IN2 | NC1/2/3 TO COM1/2/3, <br> COM1/2/3 TO NC1/2/3 | NC4/5/6 TO COM4/5/6, <br> COM4/5/6 TO NC4/5/6 | NO1/2/3 TO COM1/2/3, <br> COM1/2/3 TO NO1/2/3 | NO4/5/6 TO COM4/5/6, <br> COM4/5/6 TO NO4/5/6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| H | X | X | OFF | OFF | OFF | OFF |
| L | L | L | ON | ON | OFF | OFF |
| L | H | L | OFF | ON | ON | OFF |
| L | L | H | ON | OFF | OFF | ON |
| L | H | H | OFF | OFF | ON | ON |

## 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. Tl's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

### 9.1 Application Information

The switches are bidirectional, so the NO, NC, and COM pins can be used as either inputs or outputs. This functionality allows port expansion to support many different types of bidirectional signal inferfaces such as SD, SDIO, GPIO, MMC and qSPI.

### 9.2 Typical Application



Figure 26. SDIO Expander Application Block Diagram

## Typical Application (continued)



Figure 27. qSPI Expander Application Block Diagram

### 9.2.1 Design Requirement

Ensure that all of the signals passing through the switch are within the recommended operating ranges to ensure proper performance, see Recommended Operating Conditions.

### 9.2.2 Detailed Design Procedure

The TS3A27518E can be properly operated without any external components. However, TI recommends connecting unused pins to the ground through a $50-\Omega$ resistor to prevent signal reflections back into the device. TI also recommends that the digital control pins (INX) be pulled up to $\mathrm{V}_{\mathrm{CC}}$ or down to GND to avoid undesired switch positions that could result from the floating pin.

For the RTW package connect the thermal pad to ground.

### 9.2.3 Application Curve



Figure 28. ON-State Resistance vs COM Voltage ( $\mathrm{V}_{\mathrm{cc}}=3 \mathrm{~V}$ )

## 10 Power Supply Recommendations

TI recommends proper power-supply sequencing for all CMOS devices. Do not exceed the absolute maximum ratings, because stresses beyond the listed ratings can cause permanent damage to the device. Always sequence $\mathrm{V}_{\mathrm{CC}}$ on first, followed by NO, NC, or COM. Although it is not required, power-supply bypassing improves noise margin and prevents switching noise propagation from the $\mathrm{V}_{\mathrm{CC}}$ supply to other components. A $0.1-\mu \mathrm{F}$ capacitor is adequate for most applications, if connected from $\mathrm{V}_{\mathrm{CC}}$ to GND.

## 11 Layout

### 11.1 Layout Guidelines

To ensure reliability of the device, TI recommends following these common printed-circuit board layout guidelines:

- Bypass capacitors should be used on power supplies, and should be placed as close as possible to the $\mathrm{V}_{\mathrm{CC}}$ pin
- Short trace-lengths should be used to avoid excessive loading
- For the RTW package, connect the thermal pad to ground


### 11.2 Layout Example



Figure 29. WQFN Layout Recommendation

## 12 Device and Documentation Support

### 12.1 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute Tl specifications and do not necessarily reflect Tl's views; see Tl's Terms of Use.
TI E2E ${ }^{\text {TM }}$ Online Community TI's Engineer-to-Engineer (E2E) Community. Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.
Design Support TI's Design Support Quickly find helpful E2E forums along with design support tools and contact information for technical support.

### 12.2 Trademarks

E2E is a trademark of Texas Instruments.
All other trademarks are the property of their respective owners.

### 12.3 Electrostatic Discharge Caution

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### 12.4 Glossary

SLYZ022 - TI Glossary.
This glossary lists and explains terms, acronyms, and definitions.

## 13 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.
www.ti.com

## PACKAGING INFORMATION

| Orderable Device | Status <br> $(1)$ | Package Type Package | Pins <br> Drawing | Package <br> Qty | Eco Plan <br> $(2)$ | Lead finish/ <br> Ball material <br> $(6)$ | MSL Peak Temp <br> $(3)$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| TS3A27518EPWR | ACTIVE | TSSOP | PW | 24 | 2000 | RoHS \& Green | NIPDAU | Level-1-260C-UNLIM |
| TS3A27518ERTWR | ACTIVE | WQFN | RTW | 24 | 3000 | RoHS \& Green | NIPDAU | Level-2-260C-1 YEAR |

${ }^{(1)}$ 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 t 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 s 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: Tl defines "Green" to mean the content of Chlorine $(\mathrm{Cl})$ and Bromine $(\mathrm{Br})$ based flame retardants meet JS709B low halogen requirements of <=1000ppI 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.
${ }^{(5)}$ 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 lir of the previous line and the two combined represent the entire Device Marking for that device.
${ }^{(6)}$ Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/E lines if the finish value exceeds the maximum column width.

Important Information and Disclaimer:The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate informatior continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis o TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer o
www.ti.com

## OTHER QUALIFIED VERSIONS OF TS3A27518E :

- Automotive: TS3A27518E-Q1

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects


## TAPE AND REEL INFORMATION



| A0 | Dimension designed to accommodate the component width |
| :--- | :--- |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

*All dimensions are nominal

| Device | Package <br> Type | Package <br> Drawing | Pins | SPQ | Reel <br> Diameter <br> $(\mathbf{m m})$ | Reel <br> Width <br> W1 $(\mathbf{m m})$ | A0 <br> $(\mathbf{m m})$ | B0 <br> $(\mathbf{m m})$ | K0 <br> $(\mathbf{m m})$ | P1 <br> $(\mathbf{m m})$ | W <br> $(\mathbf{m m})$ | Pin1 <br> Quadrant |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| TS3A27518EPWR | TSSOP | PW | 24 | 2000 | 330.0 | 16.4 | 6.95 | 8.3 | 1.6 | 8.0 | 16.0 | Q1 |
| TS3A27518ERTWR | WQFN | RTW | 24 | 3000 | 330.0 | 12.4 | 4.25 | 4.25 | 1.15 | 8.0 | 12.0 | Q2 |


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| TS3A27518EPWR | TSSOP | PW | 24 | 2000 | 853.0 | 449.0 | 35.0 |
| TS3A27518ERTWR | WQFN | RTW | 24 | 3000 | 853.0 | 449.0 | 35.0 |



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.


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


SOLDER PASTE EXAMPLE BASED ON 0.125 mm THICK STENCIL

SCALE: 10X

## 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.


NOTES: A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
B. This drawing is subject to change without notice.
C. Quad Flatpack, No-Leads (QFN) package configuration.
D. The package thermal pad must be soldered to the board for thermal and mechanical performance.
E. See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
F. Falls within JEDEC MO-220.


## 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.


NOTES: (continued)
3. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).


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

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.
These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.
Tl's products are provided subject to TI's Terms of Sale (www.ti.com/legal/termsofsale.html) or other applicable terms available either on ti.com or provided in conjunction with such TI products. Tl's provision of these resources does not expand or otherwise alter Tl's applicable warranties or warranty disclaimers for TI products.

