TS5A3359 1-Ω SP3T ANALOG SWITCH 5-V/3.3-V SINGLE-CHANNEL 3:1 MULTIPLEXER/DEMULTIPLEXER

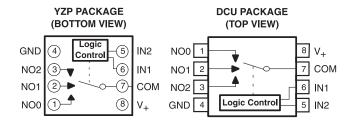
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FEATURES

- Isolation in Power-Down Mode, V₊ = 0
- Specified Break-Before-Make Switching
- Low ON-State Resistance (1 Ω)
- Control Inputs Are 5.5-V Tolerant
- Low Charge Injection
- Excellent ON-State Resistance Matching
- Low Total Harmonic Distortion (THD)
- 1.65-V to 5.5-V Single-Supply Operation
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Performance Tested Per JESD 22
 - 2000-V Human-Body Model (A114-B, Class II)
 - 1000-V Charged-Device Model (C101)

APPLICATIONS

- Cell Phones
- PDAs
- Portable Instrumentation
- Audio and Video Signal Routing
- Low-Voltage Data Acquisition Systems
- Communication Circuits
- Modems
- Hard Drives
- Computer Peripherals
- Wireless Terminals and Peripherals



FUNCTION TABLE

| IN2 | IN1 | COM TO NO, NO TO COM |
|-----|-----|-------------------------|
| L | L | OFF |
| L | Н | COM = NO0 |
| Н | L | COM = NO1 |
| Н | Н | COM = NO2 |

DESCRIPTION/ORDERING INFORMATION

The TS5A3359 is a single-pole triple-throw (SP3T) analog switch that is designed to operate from 1.65 V to 5.5 V. The device offers a low ON-state resistance and excellent ON-state resistance matching with the break-before-make feature, to prevent signal distortion during the transferring of a signal from one channel to another. The device has an excellent total harmonic distortion (THD) performance and consumes very low power. These features make this device suitable for portable audio applications.

ORDERING INFORMATION

| T _A | PACKAGE ⁽¹⁾⁽²⁾ | | ORDERABLE PART NUMBER | TOP-SIDE MARKING(3) | | |
|----------------|---|---------------|-----------------------|---------------------|--|--|
| -40°C to 85°C | NanoFree™ – WCSP (DSBGA) 0.23-mm Large Bump – YZP (Pb-free) | Tape and reel | TS5A3359YZPR | J9_ | | |
| | VSSOP - DCU | Tape and reel | TS5A3359DCUR | JAL_ | | |

- (1) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
- (2) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.
- (3) DCU: The actual top-side marking has one additional character that designates the assembly/test site. YZP: The actual top-side marking has three preceding characters to denote year, month, and sequence code, and one following character to designate the assembly/test site. Pin 1 identifier indicates solder-bump composition (1 = SnPb, = Pb-free).



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

NanoFree is a trademark of Texas Instruments.



Summary of Characteristics⁽¹⁾

| Configuration | Triple 3:1 Multiplexer/ Demultiplexer (1 × SP3T) | | | | | |
|--|---|--|--|--|--|--|
| Number of channels | 1 | | | | | |
| ON-state resistance (r _{on}) | 1.1 Ω | | | | | |
| ON-state resistance match (Δr _{on}) | 0.1 Ω | | | | | |
| ON-state resistance flatness (r _{on(flat)}) | 0.15 Ω | | | | | |
| Turn-on/turn-off time (t _{ON} /t _{OFF}) | 40 ns/35 ns | | | | | |
| Break-before-make time (t _{BBM}) | 1 ns | | | | | |
| Charge injection (Q _C) | 40 pC | | | | | |
| Bandwidth (BW) | 100 MHz | | | | | |
| OFF isolation (O _{ISO}) | -65 dB at 10 MHz | | | | | |
| Crosstalk (X _{TALK}) | -66 dB at 10 MHz | | | | | |
| Total harmonic distortion (THD) | 0.01% | | | | | |
| Leakage current (I _{COM(OFF)} /I _{NO(OFF)}) | ±20 μA | | | | | |
| Power supply current (I ₊) | 0.1 μΑ | | | | | |
| Package options | 8-pin DCU or YZP | | | | | |

(1) $V_+ = 5 \text{ V}, T_A = 25^{\circ}\text{C}$

ABSOLUTE MINIMUM AND MAXIMUM RATINGS(1)(2)

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

| | | | MIN | MAX | UNIT |
|--------------------|---|--|------|-----|------|
| V ₊ | Supply voltage range ⁽³⁾ | | -0.5 | 6.5 | V |
| $V_{NO} \ V_{COM}$ | Analog voltage range (3)(4)(5) | | | | V |
| I _K | Analog port diode current | V _{NO} , V _{COM} < 0 | -50 | | mA |
| I _{NO} | On-state switch current | V V 040 V | -200 | 200 | mA |
| I _{COM} | On-state switch current | V_{NO} , $V_{COM} = 0$ to V_{+} | -400 | 400 | IIIA |
| V_{I} | Digital input voltage range (3)(4) | | -0.5 | 6.5 | V |
| I _{IK} | Digital input clamp current | V ₁ < 0 | -50 | | mA |
| I ₊ | Continuous current through V ₊ | | | 100 | mA |
| I _{GND} | Continuous current through GND | | -100 | 100 | mA |
| T _{stg} | Storage temperature range | | -65 | 150 | °C |

⁽¹⁾ Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

- (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) The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (5) This value is limited to 5.5 V maximum.

PACKAGE THERMAL IMPEDANCE

| | | | UNI | Т |
|---------------|--|----------------|--------|------------|
| θ_{JA} | Package thermal impedance ⁽¹⁾ | DCU package 22 | 7 °C/V | ۸/ |
| | Package thermal impedance (**) | YZP package 14 | | / V |

(1) The package thermal impedance is calculated in accordance with JESD 51-7.

ELECTRICAL CHARACTERISTICS FOR 5-V SUPPLY⁽¹⁾

 $V_{+} = 4.5 \text{ V}$ to 5.5 V, $T_{A} = -40^{\circ}\text{C}$ to 85°C (unless otherwise noted)

| PARAMETER | SYMBOL | TEST COI | NDITIONS | TA | V ₊ | MIN | TYP | MAX | UNIT |
|--|------------------------------------|---|-----------------------------|--------------|----------------|------|---------|----------------|------|
| Analog Switch | | | | | | | | | |
| Analog signal range | V _{COM} , V _{NO} | | | | | 0 | | V ₊ | V |
| Peak ON resistance | r _{peak} | $0 \le (V_{NO}) \le V_{+},$ $I_{COM} = -100 \text{ mA},$ | Switch ON, See Figure 19 | 25°C Full | 4.5 V | | 8.0 | 1.1 1.5 | Ω |
| ON-state resistance | r _{on} | $V_{NO} = 2.5 \text{ V},$ $I_{COM} = -100 \text{ mA},$ | Switch ON, See Figure 19 | 25°C Full | 4.5 V | | 0.7 | 0.9 | Ω |
| ON-state | | | | 25°C | | | 0.1 | 0.1 | |
| resistance match between channels | Δr _{on} | $V_{NO} = 2.5 \text{ V},$ $I_{COM} = -100 \text{ mA},$ | Switch ON, See Figure 19 | Full | 4.5 V | | | 0.1 | Ω |
| ON-state | | $0 \le (V_{NO}) \le V_{+},$ $I_{COM} = -100 \text{ mA},$ | Switch ON, See Figure 19 | 25°C | | | 0.15 | | |
| resistance flatness | r _{on(flat)} | V _{NO} = 1 V, 1.5 V, 2.5 | Switch ON, | 25°C | 4.5 V | | 0.1 | 0.25 | Ω |
| namess | | $I_{COM} = -100 \text{ mA},$ | See Figure 19 | Full | | | | 0.25 | |
| | 1 | V _{NO} = 1 V or 4.5 V, | Switch OFF, | 25°C | 5.5 V | -20 | 5 20 nA | | |
| NO OFF leakage | I _{NO(OFF)} | $V_{COM} = 1 \text{ V to } 4.5 \text{ V},$ | See Figure 20 | Full | 3.5 V | -150 | | 150 | ПА |
| current | INO(DWDOEE) | $V_{NO} = 0 \text{ to } 5.5 \text{ V},$ | Switch OFF, | 25°C | 0 V | -1 | 8.0 | | μA |
| | I _{NO(PWROFF)} | $V_{COM} = 5.5 \text{ V to } 0,$ | See Figure 20 | Full | - V | -25 | | 25 | μΑ |
| NO ON leakage | | $V_{NO} = 1 \text{ V or } 4.5 \text{ V},$ | Switch ON, | 25°C | EEV | -30 | 5 | 30 | ~ ^ |
| current | I _{NO(ON)} | V _{COM} = Open, | See Figure 20 | Full | 5.5 V | -220 | | 220 | nA |
| | 1 | $V_{NO} = 4.5 \text{ V or } 1 \text{ V},$ | Switch OFF, | 25°C | 5.5 V | -25 | 8 | 25 | nA |
| COM OFF leakage | I _{COM(OFF)} | $V_{COM} = 1 \text{ V or } 4.5 \text{ V},$ | See Figure 20 | Full | 3.5 V | -250 | | 250 | ш |
| current | I _{COM(PWROFF)} | $V_{COM} = 0 \text{ to } 5.5 \text{ V},$ | Switch OFF, | 25°C | 0 V | -8 | 0.1 | 8 | μA |
| | COM(PWROFF) | $V_{NO} = 5.5 \text{ V to } 0,$ | See Figure 20 | Full | - V | -50 | | 50 | μπ |
| COM | | V _{NO} = Open, | Switch ON, | 25°C | EEV | -30 | 5 | 30 | ~ ^ |
| ON leakage current | I _{COM(ON)} | $V_{COM} = 1 \text{ V or } 4.5 \text{ V},$ | See Figure 20 | Full | 5.5 V | -220 | | 220 | nA |
| Digital Control | Inputs (IN1, IN | 2) ⁽²⁾ | | | | | | | |
| Input logic high | V _{IH} | | | Full | | 2.4 | | 5.5 | V |
| Input logic low | V_{IL} | | | Full | | 0 | | 8.0 | V |
| Input leakage | I _{IH} , I _{IL} | V _I = 5.5 V or 0 | | 25°C | 5.5 V | -2 | | 2 | μΑ |
| current | 'IH, 'IL | v ₁ = 3.5 v 01 0 | | Full | J.J V | -20 | | 20 | μΛ |

The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum All unused digital inputs of the device must be held at V_+ or GND to ensure proper device operation. Refer to the TI application report, Implications of Slow or Floating CMOS Inputs, literature number SCBA004.



ELECTRICAL CHARACTERISTICS FOR 5-V SUPPLY (continued)

 V_{+} = 4.5 V to 5.5 V, T_{A} = -40°C to 85°C (unless otherwise noted)

| PARAMETER | SYMBOL | TEST CO | NDITIONS | TA | V ₊ | MIN | TYP | MAX | UNIT |
|---------------------------|----------------------|--|---|------|----------------|-----|-------|------|------------|
| Dynamic | | | | | | | | | |
| Turn-on time | | $V_{COM} = V_+,$ | C _L = 35 pF, | 25°C | 5 V | 1 | 2.5 | 21 | ns |
| rum-on time | t _{ON} | $R_L = 50 \Omega$, | See Figure 23 | Full | 4.5 V to 5.5 V | 1 | | 23.5 | 115 |
| Turn-off time | t | $V_{COM} = V_+,$ | $C_L = 35 \text{ pF},$ | 25°C | 5 V | 1 | 6 | 10.5 | ns |
| rum-on time | t _{OFF} | $R_L = 50 \Omega$, | See Figure 23 | Full | 4.5 V to 5.5 V | 1 | | 12 | 115 |
| Break-before- | toou | $V_{NO} = V_{+}$ | $C_L = 35 \text{ pF},$ | 25°C | 5 V | 0.5 | 8.5 | 18 | ns |
| make time | t _{BBM} | $R_L = 50 \Omega$, | See Figure 24 | Full | 4.5 V to 5.5 V | 0.5 | | 23 | 113 |
| Charge injection | Q_{C} | $V_{GEN} = 0,$ $R_{GEN} = 0,$ | C _L = 1 nF, See Figure 28 | 25°C | 5 V | | 20 | | pC |
| NO OFF capacitance | $C_{NO(OFF)}$ | V _{NO} = V ₊ or GND, Switch OFF, | See Figure 22 | 25°C | 5 V | | 18 | | pF |
| COM OFF capacitance | $C_{COM(OFF)}$ | V _{COM} = V ₊ or GND, Switch OFF, | See Figure 22 | 25°C | 2.5 V | | 54 | | pF |
| NO ON capacitance | C _{NO(ON)} | V _{NO} = V ₊ or GND, Switch ON, | See Figure 22 | 25°C | 5 V | | 78 | | рF |
| COM ON capacitance | C _{COM(ON)} | V _{COM} = V ₊ or GND, Switch ON, | See Figure 22 | 25°C | 5 V | | 78 | | рF |
| Digital input capacitance | C _I | $V_I = V_+ \text{ or GND},$ | See Figure 22 | 25°C | 5 V | | 2.5 | | pF |
| Bandwidth | BW | $R_L = 50 \Omega$, Switch ON, | See Figure 25 | 25°C | 5 V | | 75 | | MHz |
| OFF isolation | O _{ISO} | $R_L = 50 \Omega$, $f = 1 MHz$, | Switch OFF, See Figure 26 | 25°C | 5 V | | -64 | | dB |
| Crosstalk | X _{TALK} | $R_L = 50 \Omega$, $f = 1 MHz$, | Switch ON, See Figure 27 | 25°C | 5 V | | -64 | | dB |
| Total harmonic distortion | THD | $R_L = 600 \Omega,$ $C_L = 50 pF,$ | f = 20 Hz to 20 kHz, See Figure 29 | 25°C | 5 V | | 0.005 | | % |
| Supply | | | | • | T. | | | , | |
| Positive supply | | V V or CND | Switch ON or OFF | 25°C | F. F. \/ | | 16 | 50 | ~ ^ |
| current | I ₊ | $V_I = V_+ \text{ or GND},$ | Switch ON or OFF | Full | 5.5 V | | | 1200 | nA |

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ELECTRICAL CHARACTERISTICS FOR 3.3-V SUPPLY⁽¹⁾

 $V_{+} = 3 \text{ V to } 3.6 \text{ V}, T_{A} = -40^{\circ}\text{C} \text{ to } 85^{\circ}\text{C} \text{ (unless otherwise noted)}$

| PARAMETER | SYMBOL | TEST CO | ONDITIONS | T _A | V ₊ | MIN | TYP | MAX | UNIT |
|------------------------|-----------------------------------|--|------------------------------|----------------|----------------|-----|-----|----------------|-------|
| Analog Switch | | | | | | | | | |
| Analog signal range | V_{COM} , V_{NO} | | | | | 0 | | V ₊ | ٧ |
| Peak ON | r . | $0 \le (V_{NO}) \le V_+,$ | Switch ON, | 25°C | 3 V | | 1.3 | 1.6 | Ω |
| resistance | r _{peak} | $I_{COM} = -100 \text{ mA},$ | See Figure 19 | Full | | | | 2 | |
| ON-state | r _{on} | V _{NO} = 2 V, | Switch ON, | 25°C | 3 V | | 1.2 | 1.6 | Ω |
| resistance | -011 | $I_{COM} = -100 \text{ mA},$ | See Figure 19 | Full | | | | 1.8 | |
| ON-state resistance | | V - 2 V 0 8 V | Switch ON, | 25°C | | | 0.1 | 0.15 | |
| match between channels | Δr_{on} | $V_{NO} = 2 \text{ V}, 0.8 \text{ V},$ $I_{COM} = -100 \text{ mA},$ | See Figure 19 | Full | 3 V | | | 0.15 | Ω |
| ON-state | | $0 \le (V_{NO}) \le V_{+},$ $I_{COM} = -100 \text{ mA},$ | Switch ON, See Figure 19 | 25°C | 0.17 | | 0.2 | | Ω |
| resistance flatness | r _{on(flat)} | $V_{NO} = 2 \text{ V}, 0.8 \text{ V},$ | Switch ON, | 25°C | 3 V | 3 V | 0.2 | 0.35 | |
| | | $I_{COM} = -100 \text{ mA},$ | See Figure 19 | Full | | | | 0.35 | |
| NO OFF leakage | I _{NO(OFF)} | $V_{NO} = 1 \text{ V or } 3 \text{ V},$ Switch OFF, | 25°C | 3.6 V | -15 | 3 | 15 | nA | |
| | | $V_{COM} = 1 \text{ V to 3 V},$ | See Figure 20 | Full | 0.0 . | -30 | | 30 | |
| current | I _{NO(PWROFF)} | $V_{NO} = 0 \text{ to } 3.6 \text{ V},$ | Switch OFF, | 25°C | 0 V | -1 | 0.2 | 1 | μA |
| | No(i Witoi i) | $V_{COM} = 3.6 \text{ V to } 0,$ | See Figure 20 | Full | | -10 | | 10 | |
| NO ON leakage | I _{NO(ON)} | $V_{NO} = 1 \text{ V or } 3 \text{ V},$ | Switch ON, | 25°C | 3.6 V | -15 | 3 | 15 | nA |
| current | 'NO(ON) | $V_{COM} = Open,$ | See Figure 20 | Full | 0.0 V | -40 | | 40 | |
| | | $V_{NO} = 0 V \text{ to } 3.6 V,$ | | 25°C | | -15 | 3 | 15 | |
| COM OFF leakage | I _{COM(OFF)} | $V_{COM} = 1 \text{ V or}$ $V_{NO} = 3.6 \text{ V to 0},$ $V_{COM} = 3 \text{ V},$ | Switch OFF, See Figure 20 | Full | 3.6 V | -75 | | 75 | nA |
| current | | $V_{COM} = 0 \text{ to } 3.6 \text{ V},$ | Switch OFF, | 25°C | 0.1/ | -1 | 0.2 | 1 | ^ |
| | I _{COM(PWROFF)} | $V_{NO} = 3.6 \text{ V to 0},$ | See Figure 20 | Full | 0 V | -20 | | 20 | μΑ |
| COM | | V _{NO} = Open, | Switch ON, | 25°C | | -15 | 4 | 15 | |
| ON leakage current | I _{COM(ON)} | $V_{COM} = 1 \text{ V or } 3 \text{ V},$ | See Figure 20 | Full 3.6 V -40 | | 40 | nA | | |
| Digital Control | Inputs (IN1, IN | 2) ⁽²⁾ | | | | | | | |
| Input logic high | V_{IH} | | | Full | | 2 | | 5.5 | V |
| Input logic low | V_{IL} | | | Full | | 0 | | 8.0 | V |
| Input leakage | I _{IH} , I _{IL} | $V_1 = 5.5 \text{ V or } 0$ | | 25°C | 3.6 V | -2 | | 2 | nΔ |
| current | יור, יונ | V ₁ = 0.0 V 01 0 | | Full | 3.0 v | -20 | | 20 | 11/-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 V₊ or GND to ensure proper device operation. Refer to the TI application report, Implications of Slow or Floating CMOS Inputs, literature number SCBA004.



ELECTRICAL CHARACTERISTICS FOR 3.3-V SUPPLY (continued)

 $V_{+} = 3 \text{ V to } 3.6 \text{ V}, T_{A} = -40^{\circ}\text{C to } 85^{\circ}\text{C} \text{ (unless otherwise noted)}$

| PARAMETER | SYMBOL | TEST CO | ONDITIONS | T _A | V ₊ | MIN | TYP MAX | | UNIT |
|---------------------------|-----------------------|--|--|----------------|----------------|-----|---------|------|------|
| Dynamic | | 1 | | | | | | | |
| Turn-on time | t _{ON} | $V_{COM} = V_+,$ | C _L = 35 pF, | 25°C | 3.3 V | 1 | 16 | 30.5 | ns |
| | -ON | $R_L = 50 \Omega$, | See Figure 23 | Full | 3 V to 3.6 V | 1 | | 34 | |
| Turn-off time | t _{OFF} | $V_{COM} = V_+,$ | $C_L = 35 \text{ pF},$ | 25°C | 3.3 V | 1 | 6 | 11.5 | ns |
| | -011 | $R_L = 50 \Omega$, | See Figure 23 | Full | 3 V to 3.6 V | 1 | | 12.5 | |
| Break-before- | t _{BBM} | $V_{NO} = V_+,$ | $C_L = 35 \text{ pF},$ | 25°C | 3.3 V | 0.5 | 13 | 26 | ns |
| make time | | $R_L = 50 \Omega$, | See Figure 24 | Full | 3 V to 3.6 V | 0.5 | | 30 | |
| Charge injection | Q_{C} | $V_{GEN} = 0,$ $R_{GEN} = 0,$ | $C_L = 1 \text{ nF},$ See Figure 28 | 25°C | 3.3 V | | 12 | | pC |
| NO OFF capacitance | $C_{NO(OFF)}$ | V _{NO} = V ₊ or GND, Switch OFF, | See Figure 22 | 25°C | 3.3 V | | 18 | | pF |
| COM OFF capacitance | C _{COM(OFF)} | V _{COM} = V ₊ or GND, Switch OFF, | See Figure 22 | 25°C | 3.3 V | | 55 | | pF |
| NO ON capacitance | C _{NO(ON)} | V _{NO} = V ₊ or GND, Switch ON, | See Figure 22 | 25°C | 3.3 V | | 78 | | pF |
| COM ON capacitance | C _{COM(ON)} | V _{COM} = V ₊ or GND, Switch ON, | See Figure 22 | 25°C | 3.3 V | | 78 | | pF |
| Digital input capacitance | Cı | $V_I = V_+ \text{ or GND},$ | See Figure 22 | 25°C | 3.3 V | | 2.5 | | pF |
| Bandwidth | BW | $R_L = 50 \Omega$, Switch ON, | See Figure 25 | 25°C | 3.3 V | | 73 | | MHz |
| OFF isolation | O _{ISO} | $R_L = 50 \Omega$, $f = 1 MHz$, | Switch OFF, See Figure 26 | 25°C | 3.3 V | | -64 | | dB |
| Crosstalk | X _{TALK} | $R_L = 50 \Omega$, f = 1 MHz, | Switch ON, See Figure 27 | 25°C | 3.3 V | | -64 | | dB |
| Total harmonic distortion | THD | $R_L = 600 \Omega,$ $C_L = 50 pF,$ | f = 20 Hz to 20 kHz, See Figure 29 | 25°C | 3.3 V | | 0.010 | | % |
| Supply | | | | | | | | | |
| Positive supply | 1 | V – V or CND | Switch ON or OFF | 25°C | 261/ | | 2 | 20 | nΛ |
| current | I ₊ | $V_I = V_+ \text{ or GND},$ | Switch ON or OFF | Full | 3.6 V | | | 350 | nA |

ELECTRICAL CHARACTERISTICS FOR 2.5-V SUPPLY⁽¹⁾

 V_{+} = 2.3 V to 2.7 V, T_{A} = -40°C to 85°C (unless otherwise noted)

| PARAMETER | SYMBOL | TEST CON | IDITIONS | T _A | V ₊ | MIN | TYP | MAX | UNIT | |
|---|--------------------------|---|---|----------------|----------------|-------|-----|----------------|------------|----|
| Analog Switch | | | | | | | | | | |
| Analog signal range | V_{COM}, V_{NO} | | | | | 0 | | V ₊ | ٧ | |
| Peak ON | r . | $0 \le (V_{NO}) \le V_+,$ | Switch ON, | 25°C | 2.3 V | | 1.8 | 2.5 | Ω | |
| resistance | r _{peak} | $I_{COM} = -8 \text{ mA},$ | See Figure 19 | Full | 2.5 V | | | 2.7 | 12 | |
| ON-state | r _{on} | $V_{NO} = 1.8 V,$ | Switch ON, | 25°C | 2.3 V | | 1.5 | 2 | Ω | |
| resistance | on | $I_{COM} = -8 \text{ mA},$ | See Figure 19 | Full | 2.0 V | | | 2.4 | 32 | |
| ON-state | | V 4.0.V | Switch ON | 25°C | | | | 0.2 | | |
| resistance match between channels | Δr_{on} | $V_{NO} = 1.8 \text{ V},$ $I_{COM} = -8 \text{ mA},$ | Switch ON, See Figure 19 | Full | 2.3 V | | | 0.2 | Ω | |
| ON-state | _ | $0 \le (V_{NO}) \le V_+,$ $I_{COM} = -8 \text{ mA},$ | Switch ON, See Figure 19 | 25°C | 2.3 V | | 0.6 | | 0 | |
| resistance flatness | r _{on(flat)} | $V_{NO} = 0.8 \text{ V}, 1.8 \text{ V}$ | Switch ON, | 25°C | 2.3 V | | | Ω | | |
| | | $I_{COM} = -8 \text{ mA},$ | See Figure 19 | Full | | | | 1 | | |
| | I _{NO(OFF)} | $V_{NO} = 0.5$ | $V_{NO} = 0.5 \text{ V or } 2.3 \text{ V},$ | Switch OFF, | 25°C | 2.7 V | -15 | 3 | 15 | nA |
| NO OFF leakage | | $V_{COM} = 0.5 \text{ V to } 2.3 \text{ V},$ | See Figure 20 | Full | | -30 | | 30 | | |
| current | I _{NO(PWROFF)} | $V_{NO} = 0$ to 2.7 V, | Switch OFF, | 25°C | 0 V | -1 | 0.1 | 1 | μΑ | |
| | -NO(FWROIT) | $V_{COM} = 2.7 \text{ V to 0},$ | See Figure 20 | Full | | -10 | | 10 | | |
| NO ON leakage | l | $V_{NO} = 0.5 \text{ V or } 2.3 \text{ V},$ | Switch ON, | 25°C | 2.7 V | -15 | 3 | 15 | nA | |
| current | I _{NO(ON)} | V _{COM} = Open, | See Figure 20 | Full | Z.7 V | -35 | | 35 | ш | |
| | | $V_{NO} = 0.3 \text{ V to } 2.3 \text{ V},$ | Switch OFF, | 25°C | 2.7 V | -15 | 3 | 15 | ~ ^ | |
| COM OFF leakage | I _{COM(OFF)} | $V_{COM} = 0.5 \text{ V or } 2.3 \text{ V},$ | See Figure 20 | Full | 2.7 V | -60 | | 60 | nA | |
| current | 1 | $V_{COM} = 0 \text{ to } 2.7 \text{ V},$ | Switch OFF, | 25°C | 0 V | -1 | 0.1 | 1 | μΑ | |
| | I _{COM(PWROFF)} | $V_{NO} = 2.7 \text{ V to } 0,$ | See Figure 20 | Full | 0 0 | -10 | | 10 | μА | |
| COM | | V _{NO} = Open, | Switch ON. | 25°C | . = 1/ | -15 | 3.5 | 15 | | |
| ON leakage current | I _{COM(ON)} | $V_{COM} = 0.5 \text{ V or } 2.2 \text{ V},$ | | Full | 2.7 V | -40 | | 40 | nA | |
| Digital Control | | 2) ⁽²⁾ | | | | _ | | - | | |
| Input logic high | V_{IH} | | | Full | | 1.8 | | 5.5 | V | |
| Input logic low | V_{IL} | | | Full | | 0 | | 0.6 | V | |
| Input leakage current | $I_{\rm IH},I_{\rm IL}$ | V _I = 5.5 V or 0 | | 25°C Full | 2.7 V | 10 | | 10 | nA | |

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 V₊ or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.



ELECTRICAL CHARACTERISTICS FOR 2.5-V SUPPLY (continued)

 V_{+} = 2.3 V to 2.7 V, T_{A} = -40°C to 85°C (unless otherwise noted)

| PARAMETER | SYMBOL | MBOL TEST CONDITIONS | | TA | V ₊ | MIN | TYP | MAX | UNIT |
|---------------------------|--|--|---|------|----------------|-----|-------|------|------|
| Dynamic | | | | | | | | | |
| Turn-on time | + | $V_{COM} = V_+,$ | C _L = 35 pF, | 25°C | 2.5 V | 2 | 4.5 | 43 | ns |
| rum-on time | t _{ON} | $R_L = 50 \Omega$, | See Figure 23 | Full | 2.3 V to 2.7 V | 2 | | 47.5 | 115 |
| Turn-off time | t | $V_{COM} = V_+,$ | $C_L = 35 pF$, | 25°C | 2.5 V | 2 | 8.5 | 11 | ns |
| rum-on ume | t _{OFF} | $R_L = 50 \Omega$, | See Figure 23 | Full | 2.3 V to 2.7 V | 2 | | 12.5 | 115 |
| Break-before- | t _{BBM} | $V_{NO} = V_+,$ | $C_L = 35 pF$, | 25°C | 2.5 V | 0.5 | 18.5 | 38.5 | ns |
| make time | BBM | $R_L = 50 \Omega$, | See Figure 24 | Full | 2.3 V to 2.7 V | 0.5 | | 43 | 110 |
| Charge injection | Q_{C} | $V_{GEN} = 0,$ $R_{GEN} = 0,$ | C _L = 1 nF, See Figure 28 | 25°C | 2.5 V | | 8 | | рС |
| NO OFF capacitance | $C_{NO(OFF)}$ | V _{NO} = V ₊ or GND, Switch OFF, | See Figure 22 | 25°C | 2.5 V | | 18.5 | | pF |
| COM OFF capacitance | $C_{\text{COM(OFF)}}$ | V _{COM} = V ₊ or GND, Switch OFF, | See Figure 22 | 25°C | 2.5 V | | 55 | | pF |
| NO ON capacitance | C _{NO(ON)} | V _{NO} = V ₊ or GND, Switch ON, | See Figure 22 | 25°C | 2.5 V | | 78 | | pF |
| COM ON capacitance | C _{COM(ON)} | V _{COM} = V ₊ or GND, Switch ON, | See Figure 22 | 25°C | 2.5 V | | 78 | | pF |
| Digital input capacitance | Cı | $V_I = V_+ \text{ or GND},$ | See Figure 22 | 25°C | 2.5 V | | 3 | | pF |
| Bandwidth | BW | $R_L = 50 \Omega$, Switch ON, | See Figure 25 | 25°C | 2.5 V | | 73 | | MHz |
| OFF isolation | O _{ISO} | $R_L = 50 \Omega$, $f = 1 MHz$, | Switch OFF, See Figure 26 | 25°C | 2.5 V | | -64 | | dB |
| Crosstalk | X _{TALK} | $R_L = 50 \Omega$, f = 1 MHz, | Switch ON, See Figure 27 | 25°C | 2.5 V | | -64 | | dB |
| Total harmonic distortion | THD | $R_L = 600 \ \Omega,$ $C_L = 50 \ pF,$ | f = 20 Hz to 20 kHz, See Figure 29 | 25°C | 2.5 V | | 0.030 | | % |
| Supply | | | | | | | | , | |
| Positive supply | 1 | V = V or GND | Switch ON or OFF | 25°C | 2.7 V | | 1 | 1 10 | nΛ |
| current | ''' I. IV = V. Or (ANI) SWITCH ON OF OFF | Full | 2.1 V | 250 | | | nA | | |

ELECTRICAL CHARACTERISTICS FOR 1.8-V SUPPLY⁽¹⁾

 $V_{+} = 1.65 \text{ V}$ to 1.95 V, $T_{A} = -40^{\circ}\text{C}$ to 85°C (unless otherwise noted)

| PARAMETER | SYMBOL | TEST CON | DITIONS | TA | V ₊ | MIN | TYP | MAX | UNIT | |
|--|------------------------------------|---|------------------------------|--------------|----------------|------------|-----------|----------------|------|--|
| Analog Switch | • | | | | | | | | | |
| Analog signal range | V _{COM} , V _{NO} | | | | | 0 | | V ₊ | V | |
| Peak ON resistance | r _{peak} | $0 \le (V_{NO}) \le V_+,$ $I_{COM} = -2 \text{ mA},$ | Switch ON, See Figure 19 | 25°C Full | 1.65 V | | 5 | 30 | Ω | |
| ON-state resistance | r _{on} | $V_{NO} = 1.5 \text{ V},$ $I_{COM} = -2 \text{ mA},$ | Switch ON, See Figure 19 | 25°C Full | 1.65 V | | 2 | 2.5 | Ω | |
| ON-state | | CON | | 25°C | | | 0.15 | 0.4 | | |
| resistance match between channels | Δr_{on} | $V_{NO} = 1.5 \text{ V},$ $I_{COM} = -2 \text{ mA},$ | Switch ON, See Figure 19 | Full | 1.65 V | | | 0.4 | Ω | |
| ON-state | | $0 \le (V_{NO}) \le V_+,$ $I_{COM} = -2 \text{ mA},$ | Switch ON, See Figure 19 | 25°C | | | 5 | | | |
| resistance flatness | r _{on(flat)} | $V_{NO} = 0.6 \text{ V}, 1.5 \text{ V}$ $I_{COM} = -2 \text{ mA},$ | Switch ON, See Figure 19 | 25°C Full | 1.65 V | | 4.5 5 | | Ω | |
| NO | I _{NO(OFF)} | V _{NO} =0.3 V or 1.65 V, V _{COM} = 0.3 V to 1.65 V, | Switch OFF, See Figure 20 | 25°C Full | 1.95 V | –15 –30 | 3 | 15 30 | nA | |
| OFF leakage current | lua aura ann | V _{VO} = 0 to 1.95 V | | Switch OFF, | 25°C | 0.1/ | -30 -1 | 0.1 | 1 | |
| | I _{NO(PWROFF)} | $V_{COM} = 1.95 \text{ V to } 0,$ | See Figure 20 | Full | 0 V | -15 | | 15 | μΑ | |
| NO ON leakage current | I _{NO(ON)} | V _{NO} =0.3 V or 1.65 V, V _{COM} = Open, | Switch ON, See Figure 20 | 25°C Full | 1.95 V | -15 -30 | 3 | 15 30 | nA | |
| | I _{COM(OFF)} | V _{NO} = 0.3 V to 1.65 V, | Switch OFF, | 25°C | 1.95 V | -15 | 3 | 15 | nA | |
| COM OFF leakage | -com(orr) | V _{COM} =0.3 V or 1.65 V, | See Figure 20 | Full | | -50 | | 50 | | |
| current | I _{COM(PWROF} F) | $V_{COM} = 0 \text{ to } 1.95 \text{ V},$ $V_{NO} = 1.95 \text{ V to } 0,$ | Switch OFF, See Figure 20 | 25°C Full | 0 V | -1 -10 | 0.1 | 10 | μΑ | |
| COM ON leakage current | I _{COM(ON)} | V _{NO} = Open, V _{COM} = 0.3 V or 1.65 V, | Switch ON, See Figure 20 | 25°C Full | 1.95 V | -15 -30 | 3 | 15 30 | nA | |
| Digital Control | Inputs (IN1. I | N2) ⁽²⁾ | | | | | | | | |
| Input logic high | V _{IH} | , | | Full | | 1.5 | | 5.5 | V | |
| Input logic low | V _{IL} | | | Full | | 0 | | 0.6 | V | |
| Input leakage current | I _{IH} , I _{IL} | V _I = 5.5 V or 0 | | 25°C Full | 1.95 V | -2 -20 | | 2 20 | nA | |

⁽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 V₊ or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

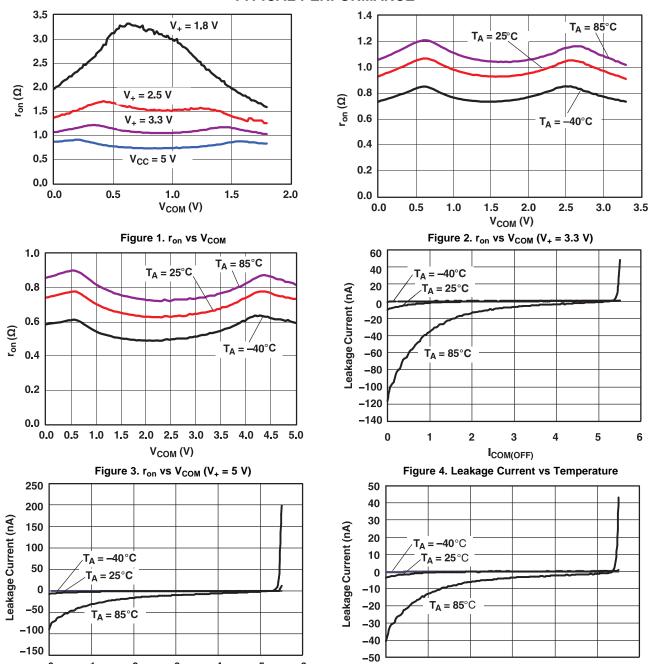


ELECTRICAL CHARACTERISTICS FOR 1.8-V SUPPLY (continued)

 V_{+} = 1.65 V to 1.95 V, T_{A} = -40°C to 85°C (unless otherwise noted)

| PARAMETER | SYMBOL | TEST CONDITIONS | | | V ₊ | MIN | TYP | MAX | UNIT |
|---------------------------|---|--|---|------|------------------|-----|-------|-----|------|
| Dynamic | | · | | • | <u></u> | | | | |
| Turn-on time | t _{ON} | $V_{COM} = V_+,$ | C _L = 35 pF, | 25°C | 1.8 V | 3 | 38.5 | 85 | ns |
| rum-on time | rON | $R_L = 50 \Omega$, | See Figure 23 | Full | 1.65 V to 1.95 V | 3 | | 90 | 115 |
| Turn-off time | torr | $V_{COM} = V_+,$ | $C_L = 35 \text{ pF},$ | 25°C | 1.8 V | 2 | 8.5 | 16 | ns |
| rum-on time | rn-off time t_{OFF} $R_L = 50 \Omega$, | | See Figure 23 | | 1.65 V to 1.95 V | 2 | | 18 | 113 |
| Break-before- | t _{BBM} | $V_{NO} = V_{+}$ | $C_L = 35 \text{ pF},$ | 25°C | 1.8 V | 1 | 33 | 75 | ns |
| make time | BBM | $R_L = 50 \Omega$, | See Figure 24 | Full | 1.65 V to 1.95 V | 1 | | 80 | 110 |
| Charge injection | Q_{C} | $V_{GEN} = 0,$ $R_{GEN} = 0,$ | C _L = 1 nF, See Figure 28 | 25°C | 1.8 V | | 5 | | pC |
| NO OFF capacitance | C _{NO(OFF)} | V _{NO} = V ₊ or GND, Switch OFF, | See Figure 22 | 25°C | 1.8 V | | 18.5 | | pF |
| COM OFF capacitance | C _{COM(OFF)} | V _{COM} = V ₊ or GND, Switch OFF, | See Figure 22 | 25°C | 1.8 V | | 55 | | pF |
| NO ON capacitance | C _{NO(ON)} | V _{NO} = V ₊ or GND, Switch ON, | See Figure 22 | 25°C | 1.8 V | | 78 | | pF |
| COM ON capacitance | C _{COM(ON)} | V _{COM} = V ₊ or GND, Switch ON, | See Figure 22 | 25°C | 1.8 V | | 78 | | pF |
| Digital input capacitance | C _I | $V_I = V_+ \text{ or GND},$ | See Figure 22 | 25°C | 1.8 V | | 3 | | pF |
| Bandwidth | BW | $R_L = 50 \Omega$, Switch ON, | See Figure 25 | 25°C | 1.8 V | | 73 | | MHz |
| OFF isolation | O _{ISO} | $R_L = 50 \Omega$, $f = 1 M Hz$, | Switch OFF, See Figure 26 | 25°C | 1.8 V | | -64 | | dB |
| Crosstalk | X _{TALK} | $R_L = 50 \Omega$, f = 1 MHz, | Switch ON, See Figure 27 | 25°C | 1.8 V | | -64 | | dB |
| Total harmonic distortion | THD | $R_L = 600 \Omega,$ $C_L = 50 pF,$ | f = 20 Hz to 20 kHz, See Figure 29 | 25°C | 1.8 V | | 0.080 | | % |
| Supply | | | | | | | | | |
| Positive supply | - | $V_1 = V_+$ or GND, | Switch ON or OFF | 25°C | 1.95 V | | 1 | | nΛ |
| current | I ₊ | $V_1 = V_+ \cup I \cup \cup \cup$ | SWILCTI ON OF OFF | Full | 1.95 V | | | 200 | nA |

TYPICAL PERFORMANCE



I_{NO(OFF)}
Figure 5. Leakage Current vs Temperature

3

4

5

2

I_{COM(ON)}
Figure 6. Leakage Current vs Temperature

3

4

5

6

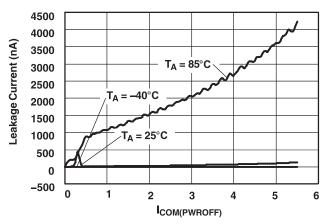
0

0

1



TYPICAL PERFORMANCE (continued)



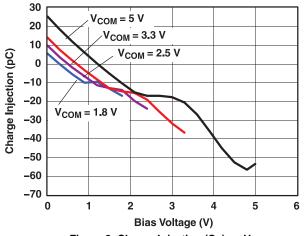
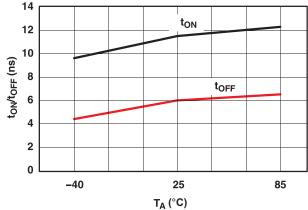


Figure 7. Leakage Current vs Temperature

90
80
70
topf
40
40
30
20
10
0
1 2 3 4 5 6

Figure 8. Charge Injection (Q_C) vs V_{COM}



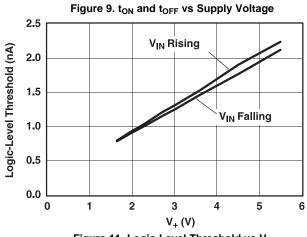


Figure 10. t_{ON} and t_{OFF} vs Temperature

0
-2
-4
-6
-8
-10
-12
-14
0.1 1 10 100 1000

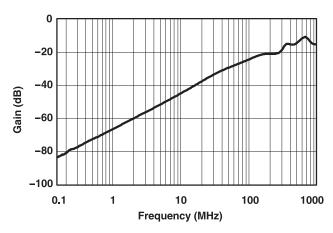
Frequency (MHz)

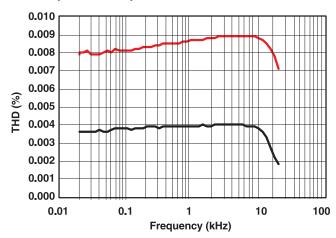
Figure 11. Logic-Level Threshold vs V₊

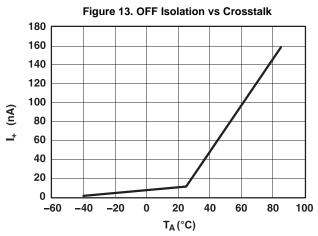
Figure 12. Bandwidth $(V_+ = 5 V)$



TYPICAL PERFORMANCE (continued)







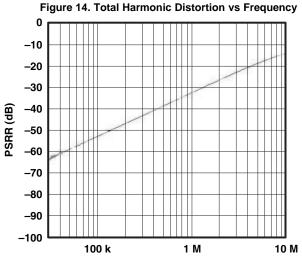
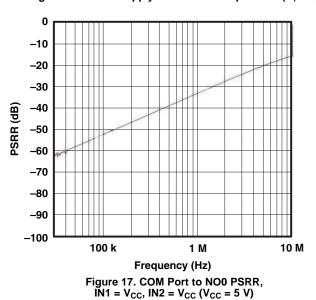
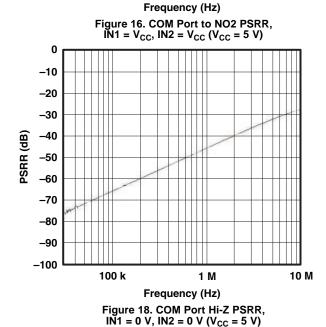


Figure 15. Power-Supply Current vs Temperature $(V_{+} = 5)$







PIN DESCRIPTION

| PIN NO. | NAME | DESCRIPTION |
|---------|----------------|--------------------------------------|
| 1 | NO0 | Normally open |
| 2 | NO1 | Normally open |
| 3 | NO2 | Normally open |
| 4 | GND | Digital ground |
| 5 | IN2 | Digital control to connect COM to NO |
| 6 | IN1 | Digital control to connect COM to NO |
| 7 | COM | Common |
| 8 | V ₊ | Power supply |

PARAMETER DESCRIPTION

| SYMBOL | DESCRIPTION |
|--------------------------|--|
| V _{COM} | Voltage at COM |
| V _{NO} | Voltage at NO |
| r _{on} | Resistance between COM and NC or COM and NO ports when the channel is ON |
| r _{peak} | Peak on-state resistance over a specified voltage range |
| Δr_{on} | Difference of ron between channels in a specific device |
| r _{on(flat)} | Difference between the maximum and minimum value of ron in a channel over the specified range of conditions |
| I _{NO(OFF)} | Leakage current measured at the NO port, with the corresponding channel (NO to COM) in the OFF state |
| I _{NO(PWROFF)} | Leakage current measured at the NO port during the power-down condition, $V_{+} = 0$. |
| I _{NO(ON)} | Leakage current measured at the NO port, with the corresponding channel (NO to COM) in the ON state and the output (COM) open |
| I _{COM(ON)} | Leakage current measured at the COM port, with the corresponding channel (COM to NO or COM to NC) in the ON state and the output (NC or NO) open |
| I _{COM(OFF)} | Leakage current measured at the COM port during the power-down condition, $V_{+} = 0$ |
| I _{COM(PWROFF)} | Leakage current measured at the COM port during the power-down condition, $V_{+} = 0$. |
| V_{IH} | Minimum input voltage for logic high for the control input (IN) |
| V_{IL} | Maximum input voltage for logic low for the control input (IN) |
| V_{I} | Voltage at the control input (IN) |
| $I_{\rm IH},~I_{\rm IL}$ | Leakage current measured at the control input (IN) |
| t _{ON} | Turn-on 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 (COM or NO) signal when the switch is turning ON. |
| t _{OFF} | Turn-off 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 (COM or NO) signal when the switch is turning OFF. |
| t _{BBM} | Break-before-make time. This parameter is measured under the specified range of conditions and by the propagation delay between the output of two adjacent analog channels (NC and NO) when the control signal changes state. |
| Q _C | Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NO or COM) output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control input. Charge injection, $Q_C = C_L \times \Delta V_{COM}$, C_L is the load capacitance and ΔV_{COM} is the change in analog output voltage. |
| $C_{NO(OFF)}$ | Capacitance at the NO port when the corresponding channel (NO to COM) is OFF |
| $C_{NO(ON)}$ | Capacitance at the NO port when the corresponding channel (NO to COM) is ON |
| $C_{COM(ON)}$ | Capacitance at the COM port when the corresponding channel (COM to NO) is ON |
| $C_{COM(OFF)}$ | Capacitance at the COM port when the corresponding channel (COM to NO) is OFF |
| C _I | Capacitance of control input (IN) |
| O _{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 or NO to COM) in the OFF state. |
| X _{TALK} | Crosstalk is a measurement of unwanted signal coupling from an ON channel to an OFF channel (NC to NO or NO to NC). 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. |



TS5A3359 1-Ω SP3T ANALOG SWITCH 5-V/3.3-V SINGLE-CHANNEL 3:1 MULTIPLEXER/DEMULTIPLEXER

SCDS214C-OCTOBER 2005-REVISED JANUARY 2008

PARAMETER DESCRIPTION (continued)

| SYMBOL | DESCRIPTION |
|----------------|--|
| 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. |
| I ₊ | Static power-supply current with the control (IN) pin at V ₊ or GND |

Product Folder Link(s): TS5A3359



PARAMETER MEASURMENT INFORMATION

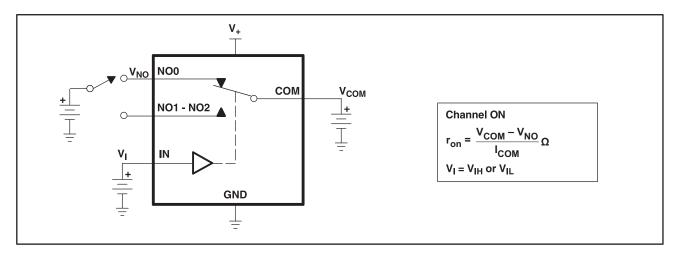
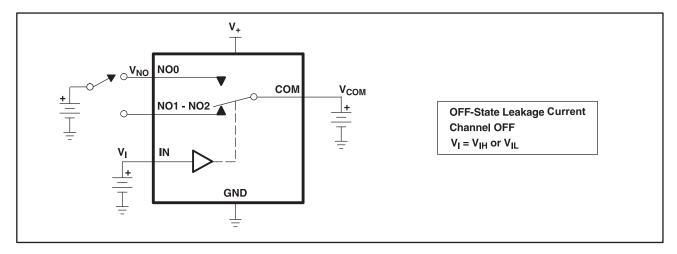


Figure 19. ON-State Resistance (ron)



 $\textbf{Figure 20. OFF-State Leakage Current (I}_{NC(OFF)}, I_{NO(OFF)}, I_{NO(PWROFF)}, I_{COM(OFF)}, I_{COM(PWROFF)})\\$

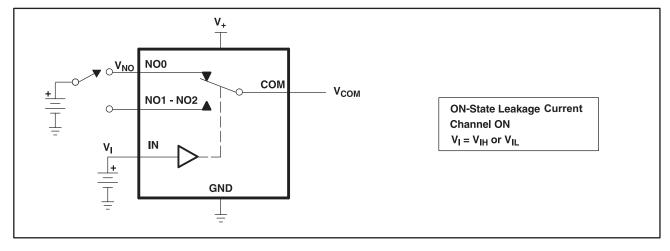


Figure 21. ON-State Leakage Current (I_{COM(ON)}, I_{NO(ON)})





PARAMETER MEASURMENT INFORMATION (continued)

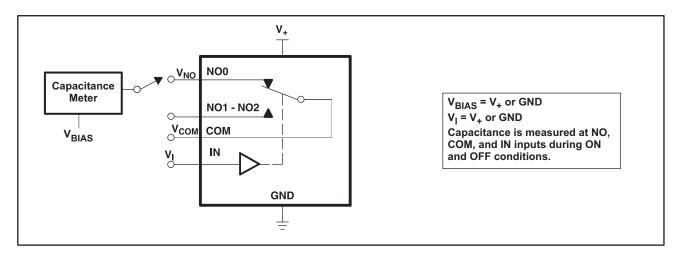
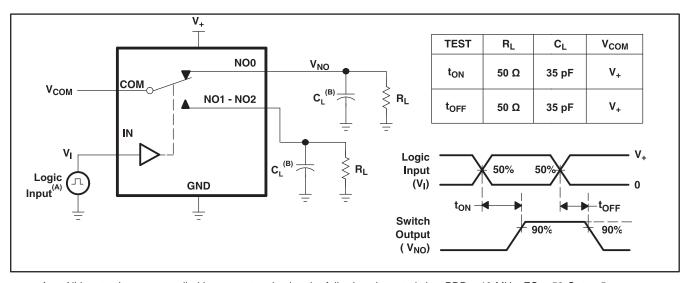


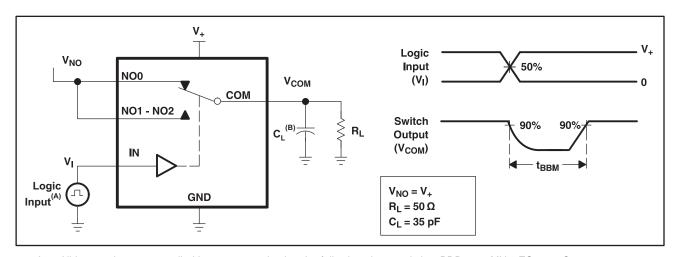
Figure 22. Capacitance (C_I, C_{COM(ON)}, C_{NO(OFF)}, C_{COM(OFF)}, C_{NO(ON)})



- A. All input pulses are supplied by generators having the following characteristics: PRR \leq 10 MHz, ZO = 50 Ω , $t_r < 5$ ns, $t_f < 5$ ns.
- B. C_L includes probe and jig capacitance.

Figure 23. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

PARAMETER MEASURMENT INFORMATION (continued)



- A. All input pulses are supplied by generators having the following characteristics: PRR \leq 10 MHz, ZO = 50 Ω , $t_r < 5$ ns, $t_f < 5$ ns.
- B. C_L includes probe and jig capacitance.

Figure 24. Break-Before-Make Time (t_{BBM})

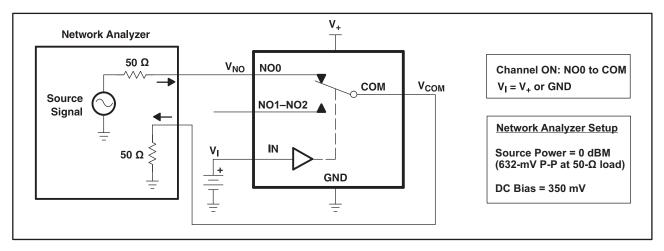


Figure 25. Bandwidth (BW)



PARAMETER MEASURMENT INFORMATION (continued)

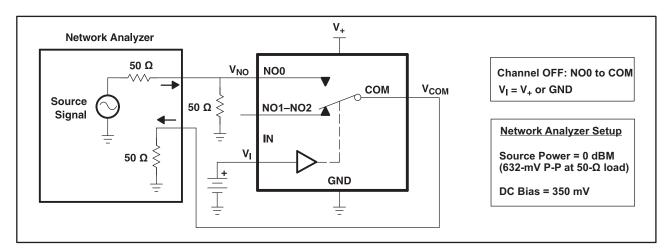


Figure 26. OFF Isolation (O_{ISO})

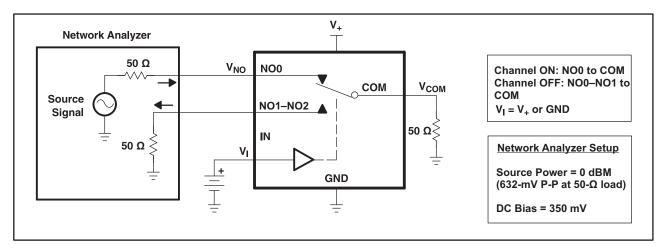
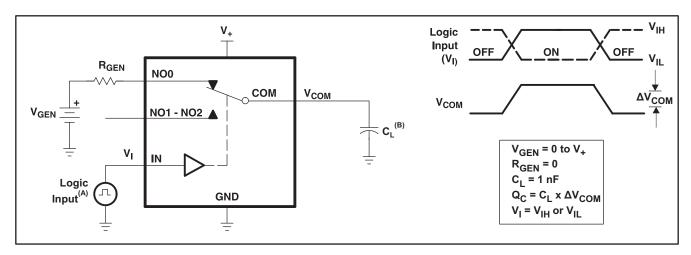


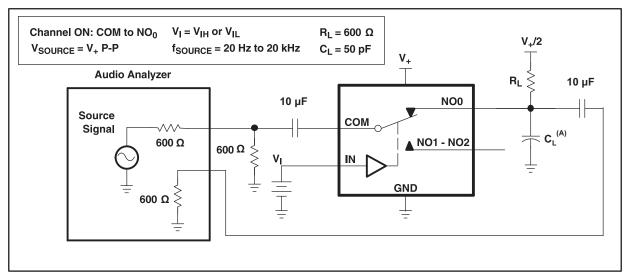
Figure 27. Crosstalk (X_{TALK})

PARAMETER MEASURMENT INFORMATION (continued)



- A. All input pulses are supplied by generators having the following characteristics: PRR \leq 10 MHz, ZO = 50 Ω , $t_r < 5$ ns. $t_f < 5$ ns.
- B. C_L includes probe and jig capacitance.

Figure 28. Charge Injection (Q_C)



A. C_L includes probe and jig capacitance.

Figure 29. Total Harmonic Distortion (THD)





17-May-2014

PACKAGING INFORMATION

| Orderable Device | Status | Package Type | Package | Pins | Package | Eco Plan | Lead/Ball Finish | MSL Peak Temp | Op Temp (°C) | Device Marking | Samples |
|------------------|----------|--------------|---------|------|---------|----------------------------|------------------|--------------------|--------------|-------------------|---------|
| | (1) | | Drawing | | Qty | (2) | (6) | (3) | | (4/5) | |
| TS5A3359DCUR | ACTIVE | US8 | DCU | 8 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (AL ~ JALR) JZ | Samples |
| TS5A3359DCURE4 | ACTIVE | US8 | DCU | 8 | | TBD | Call TI | Call TI | -40 to 85 | | Samples |
| TS5A3359DCURG4 | ACTIVE | US8 | DCU | 8 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (AL ~ JALR) JZ | Samples |
| TS5A3359DCUT | ACTIVE | US8 | DCU | 8 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (AL ~ JALR) JZ | Samples |
| TS5A3359DCUTE4 | ACTIVE | US8 | DCU | 8 | | TBD | Call TI | Call TI | -40 to 85 | | Samples |
| TS5A3359DCUTG4 | ACTIVE | US8 | DCU | 8 | 250 | TBD | Call TI | Call TI | -40 to 85 | (AL ~ JALR) JZ | Samples |
| TS5A3359YZPR | ACTIVE | DSBGA | YZP | 8 | 3000 | Green (RoHS & no Sb/Br) | SNAGCU | Level-1-260C-UNLIM | -40 to 85 | J97 | Samples |
| TS5A3359YZPRB | OBSOLETE | DSBGA | YZP | 8 | | TBD | Call TI | Call TI | | J97 | |

(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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): Tl's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, Tl Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽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.



PACKAGE OPTION ADDENDUM

17-May-2014

(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 line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

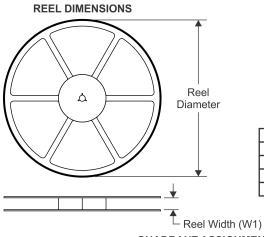
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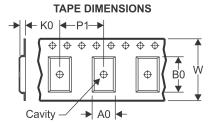
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

PACKAGE MATERIALS INFORMATION

www.ti.com 11-Feb-2014

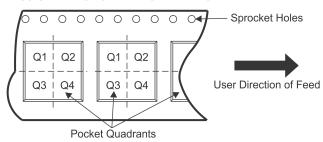
TAPE AND REEL INFORMATION





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

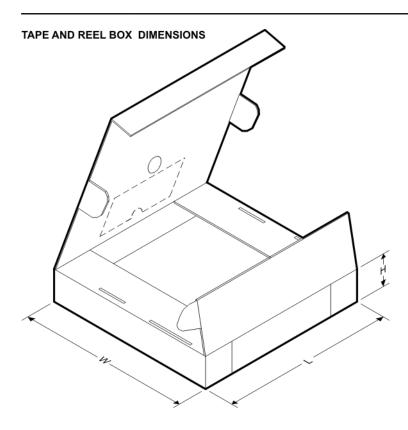
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

| Device | Package Type | Package Drawing | | | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|--------------|-----------------|--------------------|---|------|--------------------------|--------------------------|------------|------------|------------|------------|-----------|------------------|
| TS5A3359DCUR | US8 | DCU | 8 | 3000 | 180.0 | 8.4 | 2.25 | 3.35 | 1.05 | 4.0 | 8.0 | Q3 |

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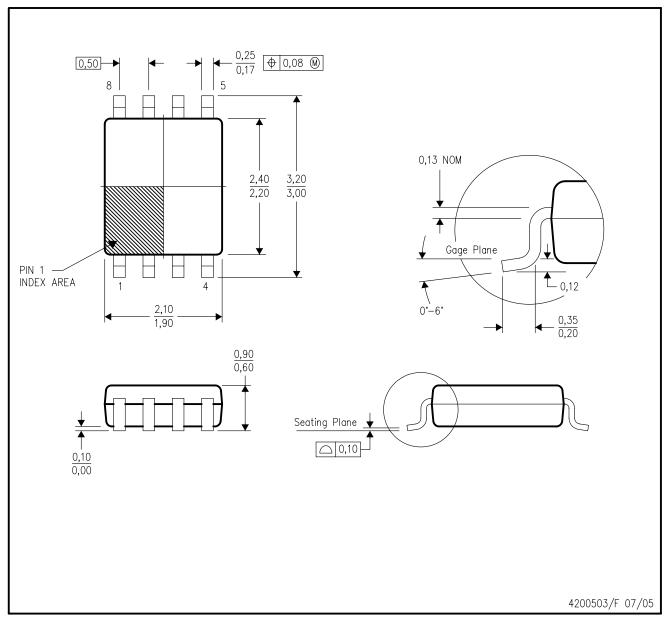


*All dimensions are nominal

| | Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| - | rs5A3359DCUR | US8 | DCU | 8 | 3000 | 202.0 | 201.0 | 28.0 |

DCU (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE (DIE DOWN)



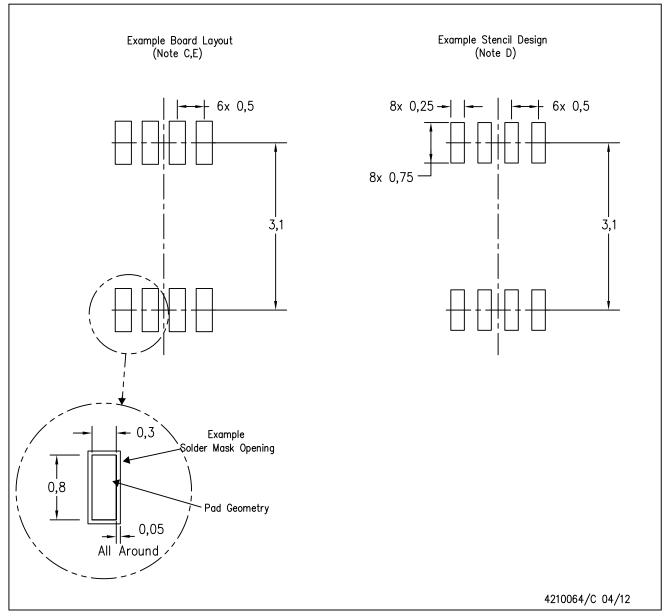
NOTES:

- : A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
 - D. Falls within JEDEC MO-187 variation CA.



DCU (S-PDSO-G8)

PLASTIC SMALL OUTLINE PACKAGE (DIE DOWN)



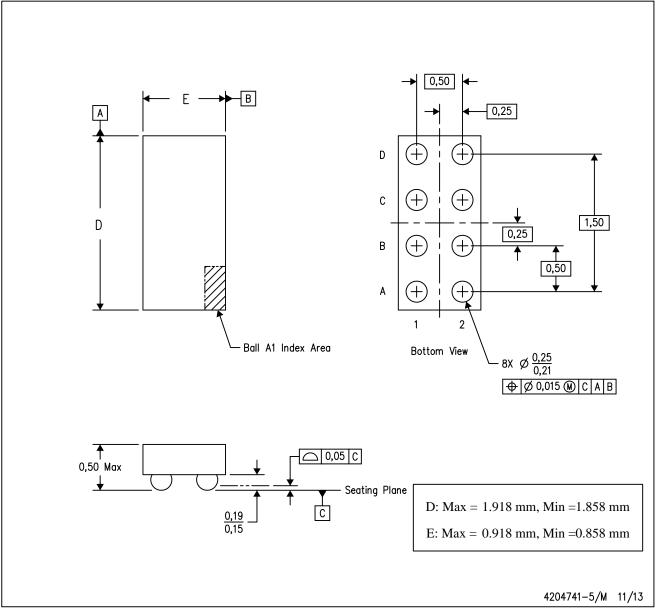
NOTES: A. All linear dimensions are in millimeters.

- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



YZP (R-XBGA-N8)

DIE-SIZE BALL GRID ARRAY



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. NanoFree™ package configuration.

NanoFree is a trademark of Texas Instruments.



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