

1-Ω SPDT ANALOG SWITCH

5-V/3.3-V SINGLE-CHANNEL 2:1 MULTIPLEXER/DEMULTIPLEXER

Check for Samples: [TS5A3159A](#)

FEATURES

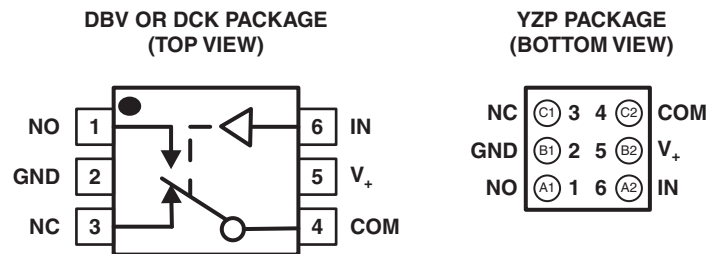
- Isolation in Power-Down Mode, $V_+ = 0$
- Pin Compatible With TS5A3159
- Specified Break-Before-Make Switching
- Low On-State Resistance (1 Ω)
- Control Inputs Are 5.5-V Tolerant
- Low Charge Injection
- Excellent On-State Resistance Matching
- Low Total Harmonic Distortion (THD)
- 1.65-V to 5.5-V Single-Supply Operation
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Performance Tested Per JESD
 - 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

DESCRIPTION

The TS5A3159A is a single-pole double-throw (SPDT) analog switch that is designed to operate from 1.65 V to 5.5 V. The device offers 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.



NO – Normally open
NC – Normally closed

FUNCTION TABLE

| IN | NC TO COM, COM TO NC | NO TO COM, COM TO NO |
|----|-------------------------|-------------------------|
| L | ON | OFF |
| H | OFF | ON |



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.

SUMMARY OF CHARACTERISTICS⁽¹⁾

| Configuration | 2:1 Multiplexer/ Demultiplexer (1 × SPDT) |
|---|---|
| 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}) | 20 ns/15 ns |
| Break-before-make time (t_{BBM}) | 12 ns |
| Charge injection (Q_C) | -20 pC |
| Bandwidth (BW) | 100 MHz |
| OFF isolation (O_{ISO}) | -65 dB at 1 MHz |
| Crosstalk (X_{TALK}) | -66 dB at 1 MHz |
| Total harmonic distortion (THD) | 0.01% |
| Leakage current ($I_{NO(OFF)}/I_{NC(OFF)}$) | ± 20 nA |
| Power-supply current (I_+) | 50 nA |
| Package options | 6-pin DBV, DCK, or YZP |

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

| T_A | PACKAGE ⁽²⁾ | | ORDERABLE PART NUMBER | TOP-SIDE MARKING ⁽³⁾ |
|---------------|--|--------------|--------------------------|------------------------------------|
| -40°C to 85°C | NanoFree™ – WCSP (DSBGA) 0.23-mm Large Bump – YZP (Pb-free) | Reel of 3000 | TS5A3159AYZPR | _ _ _ JJ _ |
| | SOT (SOT-23) – DBV | Reel of 3000 | TS5A3159ADBVR | JAJ _ |
| | SOT (SC-70) – DCK ⁽³⁾ | Reel of 3000 | TS5A3159ADCKR | JJ _ |

- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.
- (2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
- (3) DBV/DCK: The actual top-side marking has one additional character that designates the wafer fab/assembly 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 wafer fab/assembly site. Pin 1 identifier indicates solder-bump composition (1 = SnPb, • = Pb-free).

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_{NC} , V_{COM} | Analog voltage range ^{(3) (4) (5)} | | -0.5 | $V_+ + 0.5$ | V |
| I_K | Analog port diode current | $V_{NC}, V_{NO}, V_{COM} < 0$ | -50 | | mA |
| I_{NO} , I_{NC} | On-state switch current | $V_{NO}, V_{NC}, V_{COM} = 0$ to V_+ | -200 | 200 | mA |
| I_{COM} | On-state peak switch current ⁽⁶⁾ | $V_{NO}, V_{NC}, V_{COM} = 0$ to V_+ | -400 | 400 | mA |
| V_I | Digital input voltage range ^{(3) (4)} | | -0.5 | 6.5 | V |
| I_{IK} | Digital input clamp current | $V_I < 0$ | -50 | | mA |
| I_+ | Continuous current through V_+ | | | 100 | mA |
| I_{GND} | Continuous current through GND | | -100 | 100 | mA |
| θ_{JA} | Package thermal impedance ⁽⁷⁾ | DBV package | | 165 | °C/W |
| | | DCK package | | 259 | |
| | | YZP package | | 123 | |
| T_A | Absolute maximum operating temperature ⁽⁸⁾ | DBV or DCK package | | 150 | °C |
| | | YZP package | | 125 | |
| T_{stg} | Storage temperature range | | -65 | 150 | °C |

- (1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The 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.
- (6) Pulse at 1-ms duration <10% duty cycle
- (7) The package thermal impedance is calculated in accordance with JESD 51-7.
- (8) The lifetime of the device will be reduced if the device operates continually at this temperature.

Electrical Characteristics for 5-V Supply⁽¹⁾

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

| PARAMETER | SYMBOL | TEST CONDITIONS | T_A | V_+ | MIN | TYP | MAX | UNIT | |
|--|----------------------------------|--|------------------------------|-------|-------|------|-------|----------|---------------|
| Analog Switch | | | | | | | | | |
| Analog signal range | V_{COM}, V_{NO}, V_{NC} | | | | 0 | | V_+ | V | |
| Peak on resistance | r_{peak} | $0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_+$, $I_{COM} = -100\text{ mA}$, | Switch on, See Figure 15 | 25°C | 4.5 V | 0.8 | 1.1 | Ω | |
| | | | | Full | | | | | 1.5 |
| On-state resistance | r_{on} | $V_{NO} \text{ or } V_{NC} = 2.5\text{ V}$, $I_{COM} = -100\text{ mA}$, | Switch on, See Figure 15 | 25°C | 4.5 V | 0.7 | 0.9 | Ω | |
| | | | | Full | | | | | 1.1 |
| On-state resistance match between channels | Δr_{on} | $V_{NO} \text{ or } V_{NC} = 2.5\text{ V}$, $I_{COM} = -100\text{ mA}$, | Switch on, See Figure 15 | 25°C | 4.5 V | 0.05 | 0.1 | Ω | |
| | | | | Full | | | | | 0.1 |
| On-state resistance flatness | $r_{on(flat)}$ | $0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_+$, $I_{COM} = -100\text{ mA}$, | Switch on, See Figure 15 | 25°C | 4.5 V | 0.15 | | Ω | |
| | | | | 25°C | | 0.1 | 0.25 | | |
| | | | | Full | | 0.25 | | | |
| NC, NO off leakage current | $I_{NC(OFF)}, I_{NO(OFF)}$ | $V_{NC} \text{ or } V_{NO} = 1\text{ V}, V_{COM} = 1\text{ V to }4.5\text{ V}$, or $V_{NC} \text{ or } V_{NO} = 4.5\text{ V}, V_{COM} = 1\text{ V to }4.5\text{ V}$, | Switch off, See Figure 16 | 25°C | 5.5 V | -20 | 2 | 20 | nA |
| | | | | Full | | -100 | 100 | | |
| | $I_{NC(PWROFF)}, I_{NO(PWROFF)}$ | $V_{NC} \text{ or } V_{NO} = 0 \text{ to } 5.5\text{ V}$, $V_{COM} = 5.5\text{ V to } 0$, | Switch off, See Figure 16 | 25°C | 0 V | -1 | 0.2 | 1 | μA |
| | | | | Full | | -20 | 20 | | |
| NC, NO on leakage current | $I_{NC(ON)}, I_{NO(ON)}$ | $V_{NC} \text{ or } V_{NO} = 1\text{ V}, V_{COM} = \text{Open}$, or $V_{NC} \text{ or } V_{NO} = 4.5\text{ V}, V_{COM} = \text{Open}$, | Switch on, See Figure 17 | 25°C | 5.5 V | -20 | 2 | 20 | nA |
| | | | | Full | | -100 | 100 | | |
| COM off leakage current | $I_{COM(PWROFF)}$ | $V_{NC} \text{ or } V_{NO} = 0 \text{ to } 5.5\text{ V}$, $V_{COM} = 5.5\text{ V to } 0$, | Switch off, See Figure 16 | 25°C | 0 V | -1 | 0.1 | 1 | μA |
| | | | | Full | | -20 | 20 | | |
| COM on leakage current | $I_{COM(ON)}$ | $V_{NC} \text{ or } V_{NO} = \text{Open}, V_{COM} = 1\text{ V}$, or $V_{NC} \text{ or } V_{NO} = \text{Open}, V_{COM} = 4.5\text{ V}$, | Switch on, See Figure 17 | 25°C | 5.5 V | -20 | 2 | 20 | nA |
| | | | | Full | | -100 | 100 | | |
| Digital Input (IN) | | | | | | | | | |
| Input logic high | V_{IH} | | | Full | | 2.4 | 5.5 | V | |
| Input logic low | V_{IL} | | | Full | | 0 | 0.8 | | |
| Input leakage current | I_{IH}, I_{IL} | $V_I = 5.5\text{ V or } 0$ | | 25°C | 5.5 V | -2 | 2 | nA | |
| | | | | Full | | 100 | 100 | | |

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

Electrical Characteristics for 5-V Supply⁽¹⁾ (Continued)
 $V_+ = 4.5\text{ V to }5.5\text{ V}$, $T_A = -40^\circ\text{C to }85^\circ\text{C}$ (unless otherwise noted)

| PARAMETER | SYMBOL | TEST CONDITIONS | T_A | V_+ | MIN | TYP | MAX | UNIT | |
|---------------------------|----------------------------------|---|---|-------|-------------------|-----|-------|------|----|
| Dynamic | | | | | | | | | |
| Turn-on time | t_{ON} | $V_{COM} = V_+$, $R_L = 50\ \Omega$, | $C_L = 35\text{ pF}$, See Figure 19 | 25°C | 5 V | 1 | 12 | 30 | ns |
| | | | | Full | 4.5 V to 5.5 V | 1 | | 35 | |
| Turn-off time | t_{OFF} | $V_{COM} = V_+$, $R_L = 50\ \Omega$, | $C_L = 35\text{ pF}$, See Figure 19 | 25°C | 5 V | 1 | 5 | 20 | ns |
| | | | | Full | 4.5 V to 5.5 V | 1 | | 30 | |
| Break-before-make time | t_{BBM} | $V_{NC} = V_{NO} = V_+$, $R_L = 50\ \Omega$, | $C_L = 35\text{ pF}$, See Figure 20 | 25°C | 5 V | | 6 | | ns |
| | | | | Full | 4.5 V to 5.5 V | 1 | | 20 | |
| Charge injection | Q_C | $V_{GEN} = 0$, $R_{GEN} = 0$, | $C_L = 1\text{ nF}$, See Figure 24 | 25°C | 5 V | | -20 | pC | |
| NC, NO off capacitance | $C_{NC(OFF)}$, $C_{NO(OFF)}$ | V_{NC} or $V_{NO} = V_+$ or GND, Switch off, | See Figure 18 | 25°C | 5 V | | 18 | pF | |
| NC, NO on capacitance | $C_{NC(ON)}$, $C_{NO(ON)}$ | V_{NC} or $V_{NO} = V_+$ or GND, Switch on, | See Figure 18 | 25°C | 5 V | | 55 | pF | |
| COM on capacitance | $C_{COM(ON)}$ | $V_{COM} = V_+$ or GND, Switch on, | See Figure 18 | 25°C | 5 V | | 55 | pF | |
| Digital input capacitance | C_I | $V_I = V_+$ or GND, | See Figure 18 | 25°C | 5 V | | 2 | pF | |
| Bandwidth | BW | $R_L = 50\ \Omega$, Switch on, | See Figure 21 | 25°C | 5 V | | 100 | MHz | |
| Off isolation | O_{ISO} | $R_L = 50\ \Omega$, $f = 1\text{ MHz}$, | Switch off, See Figure 22 | 25°C | 5 V | | -64 | dB | |
| Crosstalk | X_{TALK} | $R_L = 50\ \Omega$, $f = 1\text{ MHz}$, | Switch on, See Figure 23 | 25°C | 5 V | | -64 | dB | |
| Total harmonic distortion | THD | $R_L = 600\ \Omega$, $C_L = 50\text{ pF}$, | $f = 200\text{ Hz to }20\text{ kHz}$, See Figure 25 | 25°C | 5 V | | 0.004 | % | |
| Supply | | | | | | | | | |
| Positive supply current | I_+ | $V_I = V_+$ or GND, | Switch on or off | 25°C | 5.5 V | | 10 | 50 | nA |
| | | | | Full | | | | 500 | |

(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⁾

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

| PARAMETER | SYMBOL | TEST CONDITIONS | T_A | V_+ | MIN | TYP | MAX | UNIT | |
|--|----------------------------|---|--|----------------------|-------|------|--------------------|----------|---------------|
| Analog Switch | | | | | | | | | |
| Analog signal range | V_{COM}, V_{NO}, V_{NC} | | | | 0 | | V_+ | V | |
| Peak on resistance | r_{peak} | $0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_+$, $I_{COM} = -100\text{ mA}$, | Switch on, See Figure 15 | 25°C Full | 3 V | 1.3 | 1.6 2 | Ω | |
| On-state resistance | r_{on} | $V_{NO} \text{ or } V_{NC} = 2\text{ V}$, $I_{COM} = -100\text{ mA}$, | Switch on, See Figure 15 | 25°C Full | 3 V | 1.2 | 1.5 1.7 | Ω | |
| On-state resistance match between channels | Δr_{on} | $V_{NO} \text{ or } V_{NC} = 2\text{ V}, 0.8\text{ V}$, $I_{COM} = -100\text{ mA}$, | Switch on, See Figure 15 | 25°C Full | 3 V | 0.1 | 0.15 0.15 | Ω | |
| On-state resistance flatness | $r_{on(Flat)}$ | $0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_+$, $I_{COM} = -100\text{ mA}$, $V_{NO} \text{ or } V_{NC} = 2\text{ V}, 0.8\text{ V}$, $I_{COM} = -100\text{ mA}$, | Switch on, See Figure 15 Switch on, See Figure 15 | 25°C 25°C Full | 3 V | 0.2 | 0.15 0.3 0.3 | Ω | |
| NC, NO off leakage current | $I_{NC(OFF)}, I_{NO(OFF)}$ | $V_{NC} \text{ or } V_{NO} = 1\text{ V}, V_{COM} = 1\text{ V to }3\text{ V}$, or $V_{NC} \text{ or } V_{NO} = 3\text{ V}, V_{COM} = 1\text{ V to }3\text{ V}$, | Switch off, See Figure 16 | 25°C | 3.6 V | -20 | 2 | 20 | nA |
| | | | | Full | | -50 | | 50 | |
| NC, NO on leakage current | $I_{NC(ON)}, I_{NO(ON)}$ | $V_{NC} \text{ or } V_{NO} = 1\text{ V}, V_{COM} = \text{Open}$, or $V_{NC} \text{ or } V_{NO} = 3\text{ V}, V_{COM} = \text{Open}$, | Switch on, See Figure 17 | 25°C | 3.6 V | -10 | 2 | 10 | nA |
| | | | | Full | | -20 | | 20 | |
| COM off leakage current | $I_{COM(PWROFF)}$ | $V_{NC} \text{ or } V_{NO} = 3.6\text{ V to }0$, $V_{COM} = 0\text{ to }3.6\text{ V}$, | Switch off, See Figure 16 | 25°C | 0 V | -1 | 0.2 | 1 | μA |
| | | | | Full | | -15 | | 15 | |
| COM on leakage current | $I_{COM(ON)}$ | $V_{NC} \text{ or } V_{NO} = \text{Open}, V_{COM} = 1\text{ V}$, or $V_{NC} \text{ or } V_{NO} = \text{Open}, V_{COM} = 3\text{ V}$, | Switch on, See Figure 17 | 25°C | 3.6 V | -10 | 2 | 10 | nA |
| | | | | Full | | -20 | | 20 | |
| Digital Input (IN) | | | | | | | | | |
| Input logic high | V_{IH} | | | Full | | 2.4 | 5.5 | V | |
| Input logic low | V_{IL} | | | Full | | 0 | 0.8 | | |
| Input leakage current | I_{IH}, I_{IL} | $V_I = 5.5\text{ V or }0$ | | 25°C | 3.6 V | -2 | 2 | nA | |
| | | | | Full | | -100 | | | 100 |

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

| PARAMETER | SYMBOL | TEST CONDITIONS | T_A | V_+ | MIN | TYP | MAX | UNIT | |
|---------------------------|----------------------------------|---|--|-------|--------------|-----|------|------|----|
| Dynamic | | | | | | | | | |
| Turn-on time | t_{ON} | $V_{COM} = V_+$, $R_L = 50\ \Omega$, | $C_L = 35\text{ pF}$, See Figure 19 | 25°C | 3.3 V | 5 | 16 | 35 | ns |
| | | | | Full | 3 V to 3.6 V | 3 | | 50 | |
| Turn-off time | t_{OFF} | $V_{COM} = V_+$, $R_L = 50\ \Omega$, | $C_L = 35\text{ pF}$, See Figure 19 | 25°C | 3.3 V | 1 | 9 | 20 | ns |
| | | | | Full | 3 V to 3.6 V | 1 | | 30 | |
| Break-before-make time | t_{BBM} | $V_{NC} = V_{NO} = V_+$, $R_L = 50\ \Omega$, | $C_L = 35\text{ pF}$, See Figure 20 | 25°C | 3.3 V | | 9 | | ns |
| | | | | Full | 3 V to 3.6 V | 1 | | 40 | |
| Charge injection | Q_C | $V_{GEN} = 0$, $R_{GEN} = 0$, | $C_L = 1\text{ nF}$, See Figure 24 | 25°C | 3.3 V | | -11 | pC | |
| NC, NO off capacitance | $C_{NC(OFF)}$, $C_{NO(OFF)}$ | V_{NC} or $V_{NO} = V_+$ or GND, Switch off, | See Figure 18 | 25°C | 3.3 V | | 18 | pF | |
| NC, NO on capacitance | $C_{NC(ON)}$, $C_{NO(ON)}$ | V_{NC} or $V_{NO} = V_+$ or GND, Switch on, | See Figure 18 | 25°C | 3.3 V | | 55 | pF | |
| COM on capacitance | $C_{COM(ON)}$ | $V_{COM} = V_+$ or GND, Switch on, | See Figure 18 | 25°C | 3.3 V | | 55 | pF | |
| Digital input capacitance | C_I | $V_I = V_+$ or GND, | See Figure 18 | 25°C | 3.3 V | | 2 | pF | |
| Bandwidth | BW | $R_L = 50\ \Omega$, Switch on, | See Figure 21 | 25°C | 3.3 V | | 100 | MHz | |
| Off isolation | O_{ISO} | $R_L = 50\ \Omega$, $f = 1\text{ MHz}$, | Switch off, See Figure 22 | 25°C | 3.3 V | | -64 | dB | |
| Crosstalk | X_{TALK} | $R_L = 50\ \Omega$, $f = 1\text{ MHz}$, | Switch on, See Figure 23 | 25°C | 3.3 V | | -64 | dB | |
| Total harmonic distortion | THD | $R_L = 600\ \Omega$, $C_L = 50\text{ pF}$, | $f = 20\text{ Hz to }20\text{ kHz}$, See Figure 25 | 25°C | 3.3 V | | 0.01 | % | |
| Supply | | | | | | | | | |
| Positive supply current | I_+ | $V_I = V_+$ or GND, | Switch on or off | 25°C | 3.6 V | | 10 | 25 | nA |
| | | | | Full | | | | 100 | |

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

Electrical Characteristics for 2.5-V Supply⁽¹⁾

V₊ = 2.3 V to 2.7, T_A = –40°C to 85°C (unless otherwise noted)

| PARAMETER | SYMBOL | TEST CONDITIONS | T _A | V ₊ | MIN | TYP | MAX | UNIT |
|--|--|--|------------------------------|----------------|-------|------|----------------|------|
| Analog Switch | | | | | | | | |
| Analog signal range | V _{COM} , V _{NO} , V _{NC} | | | | 0 | | V ₊ | V |
| Peak on resistance | r _{peak} | 0 ≤ (V _{NO} or V _{NC}) ≤ V ₊ , I _{COM} = –8 mA, | Switch on, See Figure 15 | 25°C | 2.3 V | 1.8 | 2.5 | Ω |
| | | | | Full | | | | |
| On-state resistance | r _{on} | V _{NO} or V _{NC} = 1.8 V, I _{COM} = –8 mA, | Switch on, See Figure 15 | 25°C | 2.3 V | 1.5 | 2 | Ω |
| | | | | Full | | | | |
| On-state resistance match between channels | Δr _{on} | V _{NO} or V _{NC} = 1.8 V, I _{COM} = –8 mA, | Switch on, See Figure 15 | 25°C | 2.3 V | 0.15 | 0.2 | Ω |
| | | | | Full | | | | |
| On-state resistance flatness | r _{on(flat)} | 0 ≤ (V _{NO} or V _{NC}) ≤ V ₊ , I _{COM} = –8 mA, | Switch on, See Figure 15 | 25°C | 2.3 V | 0.6 | | Ω |
| | | | | Full | | | | |
| NC, NO off leakage current | I _{NC(OFF)} , I _{NO(OFF)} | V _{NC} or V _{NO} = 0.5 V, V _{COM} = 0.5 V to 2.3 V, or V _{NC} or V _{NO} = 2.3 V, V _{COM} = 0.5 V to 2.3 V, | Switch off, See Figure 16 | 25°C | 2.7 V | –20 | 2 | 20 |
| | | | | Full | | | | |
| NC, NO on leakage current | I _{NC(ON)} , I _{NO(ON)} | V _{NC} or V _{NO} = 0.5 V, V _{COM} = Open, or V _{NC} or V _{NO} = 2.2 V, V _{COM} = Open, | Switch on, See Figure 17 | 25°C | 2.7 V | –10 | 2 | 10 |
| | | | | Full | | | | |
| COM off leakage current | I _{COM(PWROFF)} | V _{NC} or V _{NO} = 2.7 V to 0, V _{COM} = 0 to 2.7 V, | Switch off, See Figure 16 | 25° | 0 V | –1 | 0.1 | 10 |
| | | | | Full | | | | |
| COM on leakage current | I _{COM(ON)} | V _{NC} or V _{NO} = Open, V _{COM} = 0.5 V, or V _{NC} or V _{NO} = Open, V _{COM} = 2.2 V, | Switch on, See Figure 17 | 25°C | 2.7 V | –10 | 2 | 10 |
| | | | | Full | | | | |
| Digital Input (IN) | | | | | | | | |
| 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 _{IH} , I _{IL} | V _I = 5.5 V or 0 | | 25°C | 2.7 V | –2 | 2 | nA |
| | | | | Full | | | | |

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

Electrical Characteristics for 2.5-V Supply⁽¹⁾ (Continued)
 $V_+ = 2.3 \text{ V to } 2.7$, $T_A = -40^\circ\text{C to } 85^\circ\text{C}$ (unless otherwise noted)

| PARAMETER | SYMBOL | TEST CONDITIONS | T_A | V_+ | MIN | TYP | MAX | UNIT | |
|---------------------------|----------------------------------|---|---|-------|-------------------|-----|------|------|----|
| Dynamic | | | | | | | | | |
| Turn-on time | t_{ON} | $V_{COM} = V_+$, $R_L = 50 \Omega$, | $C_L = 35 \text{ pF}$, See Figure 19 | 25°C | 2.5 V | 5 | 22 | 40 | ns |
| | | | | Full | 2.3 V to 2.7 V | 5 | | 50 | |
| Turn-off time | t_{OFF} | $V_{COM} = V_+$, $R_L = 50 \Omega$, | $C_L = 35 \text{ pF}$, See Figure 19 | 25°C | 2.5 V | 2 | 6 | 35 | ns |
| | | | | Full | 2.3 V to 2.7 V | 2 | | 50 | |
| Break-before-make time | t_{BBM} | $V_{NC} = V_{NO} = V_+$, $R_L = 50 \Omega$, | $C_L = 35 \text{ pF}$, See Figure 20 | 25°C | 2.5 V | 2 | 13 | 35 | ns |
| | | | | Full | 2.3 V to 2.7 V | 2 | | 45 | |
| Charge injection | Q_C | $V_{GEN} = 0$, $R_{GEN} = 0$, | $C_L = 1 \text{ nF}$, See Figure 24 | 25°C | 2.5 V | | -7 | pC | |
| NC, NO off capacitance | $C_{NC(OFF)}$, $C_{NO(OFF)}$ | V_{NC} or $V_{NO} = V_+$ or GND, Switch off, | See Figure 18 | 25°C | 2.5 V | | 18 | pF | |
| NC, NO on capacitance | $C_{NC(ON)}$, $C_{NO(ON)}$ | V_{NC} or $V_{NO} = V_+$ or GND, Switch on, | See Figure 18 | 25°C | 2.5 V | | 55 | pF | |
| COM on capacitance | $C_{COM(ON)}$ | $V_{COM} = V_+$ or GND, Switch on, | See Figure 18 | 25°C | 2.5 V | | 55 | pF | |
| Digital input capacitance | C_I | $V_I = V_+$ or GND, | See Figure 18 | 25°C | 2.5 V | | 2 | pF | |
| Bandwidth | BW | $R_L = 50 \Omega$, Switch on, | See Figure 21 | 25°C | 2.5 V | | 100 | MHz | |
| Off isolation | O_{ISO} | $R_L = 50 \Omega$, $f = 1 \text{ MHz}$, | Switch off, See Figure 22 | 25°C | 2.5 V | | -64 | dB | |
| Crosstalk | X_{TALK} | $R_L = 50 \Omega$, $f = 1 \text{ MHz}$, | Switch on, See Figure 23 | 25°C | 2.5 V | | -64 | dB | |
| Total harmonic distortion | THD | $R_L = 600 \Omega$, $C_L = 50 \text{ pF}$, | $f = 20 \text{ Hz to } 20 \text{ kHz}$, See Figure 25 | 25°C | 2.5 V | | 0.02 | % | |
| Supply | | | | | | | | | |
| Positive supply current | I_+ | $V_I = V_+$ or GND, | Switch on or off | 25°C | 2.7 V | | 10 | 20 | nA |
| | | | | Full | | | | 50 | |

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

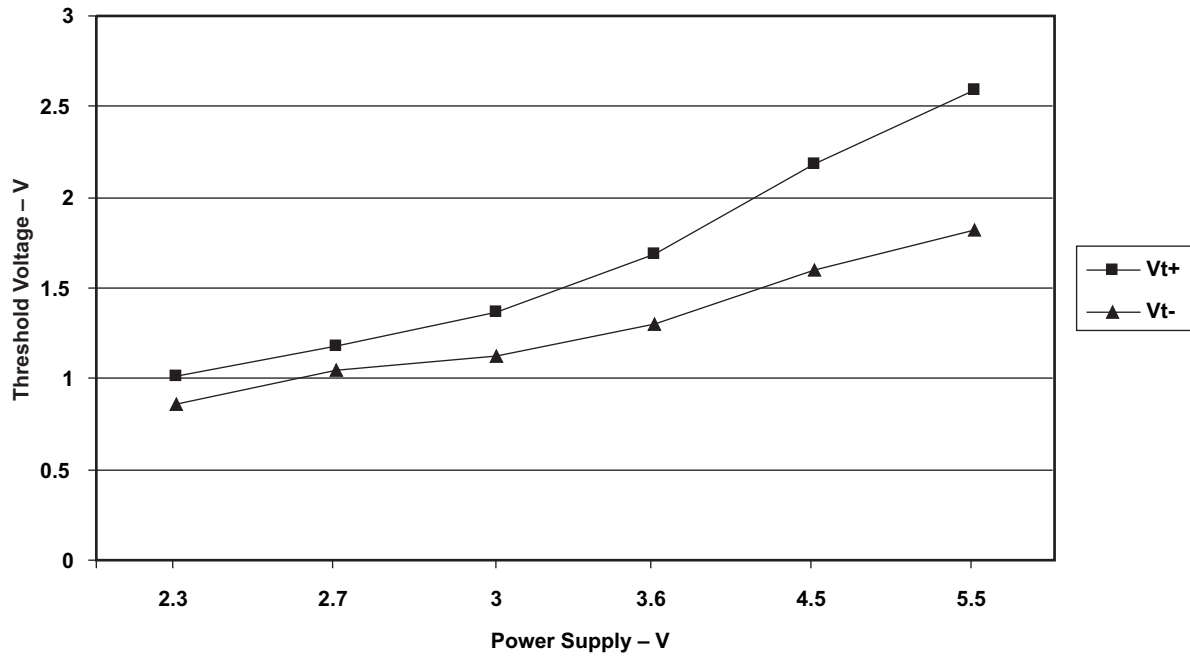


Figure 1. Logic Threshold vs Power Supply

Electrical Characteristics for 1.8-V Supply⁽¹⁾
 $V_+ = 1.65\text{ V to }1.95\text{ V}$, $T_A = -40^\circ\text{C to }85^\circ\text{C}$ (unless otherwise noted)

| PARAMETER | SYMBOL | TEST CONDITIONS | T_A | V_+ | MIN | TYP | MAX | UNIT | |
|--|----------------------------|---|--|-------|--------|--------|-------|----------|---------------|
| Analog Switch | | | | | | | | | |
| Analog signal range | V_{COM}, V_{NO}, V_{NC} | | | | 0 | | V_+ | V | |
| Peak on resistance | r_{peak} | $0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_+$, $I_{COM} = -2\text{ mA}$, | Switch on, See Figure 15 | 25°C | 1.65 V | 5 | | Ω | |
| | | | | Full | | 15 | | | |
| On-state resistance | r_{on} | $V_{NO} \text{ or } V_{NC} = 1.5\text{ V}$, $I_{COM} = -2\text{ mA}$, | Switch on, See Figure 15 | 25°C | 1.65 V | 2 | 2.5 | Ω | |
| | | | | Full | | 3.5 | | | |
| On-state resistance match between channels | Δr_{on} | $V_{NO} \text{ or } V_{NC} = 1.5\text{ V}$, $I_{COM} = -2\text{ mA}$, | Switch on, See Figure 15 | 25°C | 1.65 V | 0.15 | 0.4 | Ω | |
| | | | | Full | | 0.4 | | | |
| On-state resistance flatness | $r_{on(Flat)}$ | $0 \leq (V_{NO} \text{ or } V_{NC}) \leq V_+$, $I_{COM} = -8\text{ mA}$, | Switch on, See Figure 15 | 25°C | 1.65 V | 5 | | Ω | |
| | | | | 25°C | | 4.5 | | | |
| | | | | Full | | | | | |
| NC, NO off leakage current | $I_{NC(OFF)}, I_{NO(OFF)}$ | $V_{NC} \text{ or } V_{NO} = 0.3\text{ V}$, $V_{COM} = 0.3\text{ V to }1.65\text{ V}$, or $V_{NC} \text{ or } V_{NO} = 1.65\text{ V}$, $V_{COM} = 0.3\text{ V to }1.65\text{ V}$, | Switch off, See Figure 16 | 25°C | 1.95 V | -5 | 2 | 5 | nA |
| | | | | Full | | -20 20 | | | |
| NC, NO on leakage current | $I_{NC(ON)}, I_{NO(ON)}$ | $V_{NC} \text{ or } V_{NO} = 0.3\text{ V}$, $V_{COM} = \text{Open}$, or $V_{NC} \text{ or } V_{NO} = 1.65\text{ V}$, $V_{COM} = \text{Open}$, | Switch on, See Figure 17 | 25°C | 1.95 V | -5 | 2 | 5 | nA |
| | | | | Full | | -20 20 | | | |
| COM off leakage current | $I_{COM(PWROFF)}$ | $V_{NC} \text{ or } V_{NO} = 1.95\text{ V to }0$, $V_{COM} = 0 \text{ to }1.95\text{ V}$, | Switch off, See Figure 16 | 25° | 0 V | -1 | 0.1 | 7 | μA |
| | | | | Full | | -5 5 | | | |
| COM on leakage current | $I_{COM(ON)}$ | $V_{NC} \text{ or } V_{NO} = \text{Open}$, $V_{COM} = 0.3\text{ V}$, or $V_{NC} \text{ or } V_{NO} = \text{Open}$, $V_{COM} = 1.65\text{ V}$, | Switch on, See Figure 17 | 25°C | 1.95 V | -5 | 2 | 5 | nA |
| | | | | Full | | -20 20 | | | |
| Digital Input (IN) | | | | | | | | | |
| Input logic high | V_{IH} | | | Full | | 1.5 | 5.5 | V | |
| Input logic low | V_{IL} | | | Full | | 0 | 0.6 | | |
| Input leakage current | I_{IH}, I_{IL} | $V_I = 5.5\text{ V or }0$ | | 25°C | 1.95 V | -2 | 2 | nA | |
| | | | | Full | | 20 20 | | | |

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

| PARAMETER | SYMBOL | TEST CONDITIONS | T_A | V_+ | MIN | TYP | MAX | UNIT | |
|---------------------------|----------------------------------|---|---|-------|---------------------|-----|------|------|---------------|
| Dynamic | | | | | | | | | |
| Turn-on time | t_{ON} | $V_{COM} = V_+$, $R_L = 50 \Omega$, | $C_L = 35 \text{ pF}$, See Figure 19 | 25°C | 1.8 V | 10 | 35 | 70 | ns |
| | | | | Full | 1.65 V to 1.95 V | 10 | | 75 | |
| Turn-off time | t_{OFF} | $V_{COM} = V_+$, $R_L = 50 \Omega$, | $C_L = 35 \text{ pF}$, See Figure 19 | 25°C | 1.8 V | 2 | 15 | 40 | ns |
| | | | | Full | 1.65 V to 1.95 V | 2 | | 50 | |
| Break-before-make time | t_{BBM} | $V_{NC} = V_{NO} = V_+$, $R_L = 50 \Omega$, | $C_L = 35 \text{ pF}$, See Figure 20 | 25°C | 1.8 V | | 22 | | ns |
| | | | | Full | 1.65 V to 1.95 V | 2 | | 70 | |
| Charge injection | Q_C | $V_{GEN} = 0$, $R_{GEN} = 0$, | $C_L = 1 \text{ nF}$, See Figure 24 | 25°C | 1.8 V | | -4 | pC | |
| NC, NO off capacitance | $C_{NC(OFF)}$, $C_{NO(OFF)}$ | V_{NC} or $V_{NO} = V_+$ or GND, Switch off, | See Figure 18 | 25°C | 1.8 V | | 18 | pF | |
| NC, NO on capacitance | $C_{NC(ON)}$, $C_{NO(ON)}$ | V_{NC} or $V_{NO} = V_+$ or GND, Switch on, | See Figure 18 | 25°C | 1.8 V | | 55 | pF | |
| COM on capacitance | $C_{COM(ON)}$ | $V_{COM} = V_+$ or GND, Switch on, | See Figure 18 | 25°C | 1.8 V | | 55 | pF | |
| Digital input capacitance | C_I | $V_I = V_+$ or GND, | See Figure 18 | 25°C | 1.8 V | | 2 | pF | |
| Bandwidth | BW | $R_L = 50 \Omega$, Switch on, | See Figure 21 | 25°C | 1.8 V | | 105 | MHz | |
| Off isolation | O_{ISO} | $R_L = 50 \Omega$, $f = 1 \text{ MHz}$, | Switch off, See Figure 22 | 25°C | 1.8 V | | 64 | dB | |
| Crosstalk | X_{TALK} | $R_L = 50 \Omega$, $f = 1 \text{ MHz}$, | Switch on, See Figure 23 | 25°C | 1.8 V | | 64 | dB | |
| Total harmonic distortion | THD | $R_L = 600 \Omega$, $C_L = 50 \text{ pF}$, | $f = 20 \text{ Hz to } 20 \text{ kHz}$, See Figure 25 | 25°C | 1.8 V | | 0.06 | % | |
| Supply | | | | | | | | | |
| Positive supply current | I_+ | $V_I = V_+$ or GND, | Switch on or off | 25°C | 1.95 V | | 5 | 15 | μA |
| | | | | Full | | | | 50 | |

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

TYPICAL PERFORMANCE

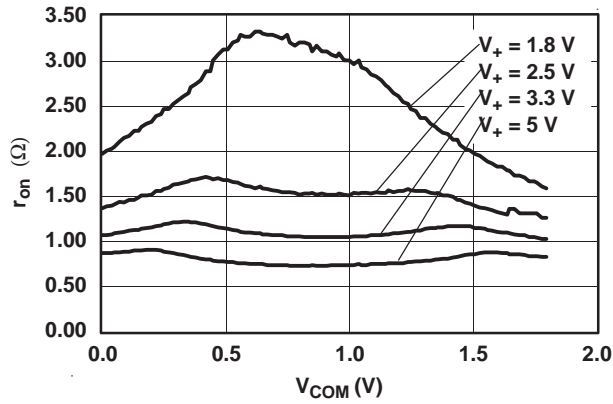


Figure 2. r_{on} vs V_{COM}

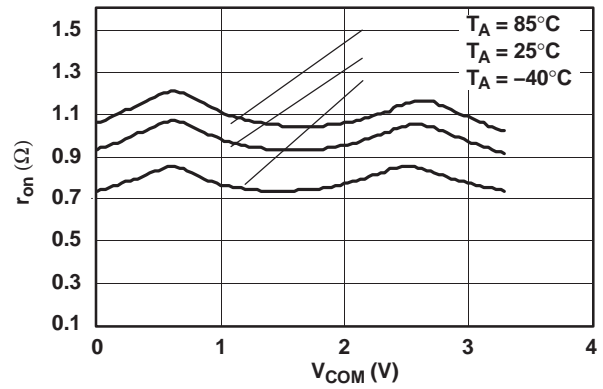


Figure 3. r_{on} vs V_{COM} ($V_+ = 3.3$ V)

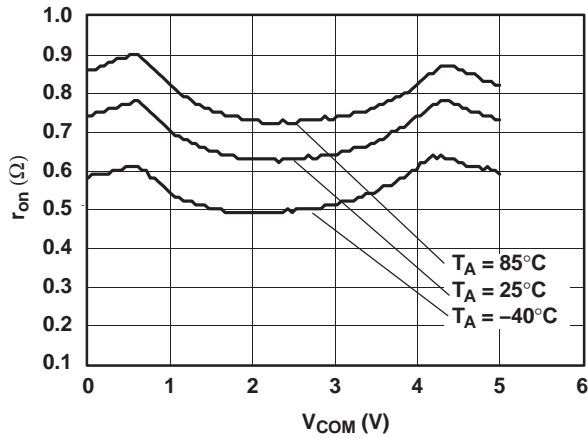


Figure 4. r_{on} vs V_{COM} ($V_+ = 5$ V)

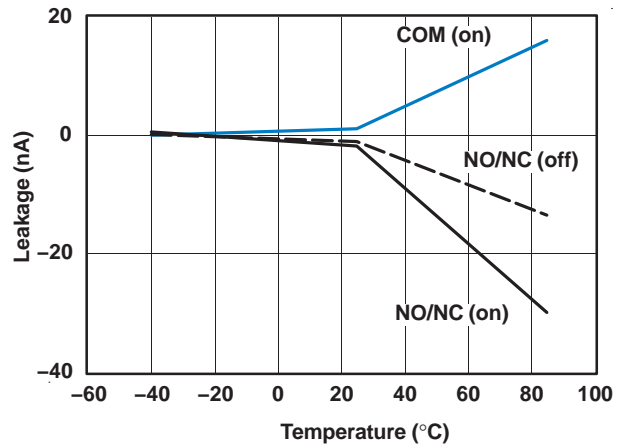


Figure 5. Leakage Current vs Temperature ($V_+ = 3.3$ V)

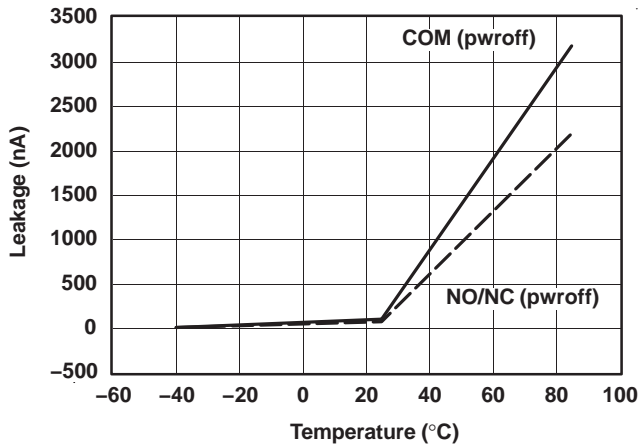


Figure 6. Leakage Current vs Temperature ($V_+ = 5$ V)

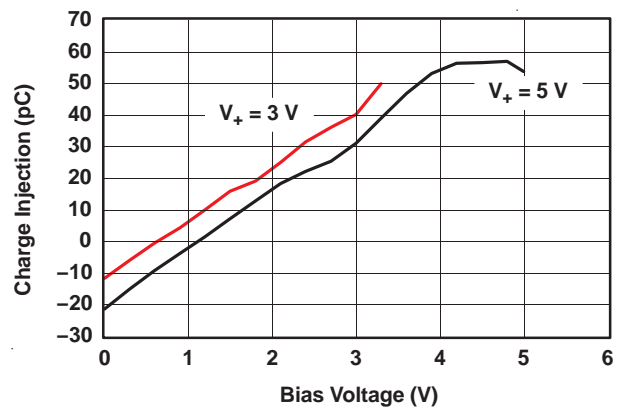


Figure 7. Charge Injection vs Bias Voltage

TYPICAL PERFORMANCE (continued)

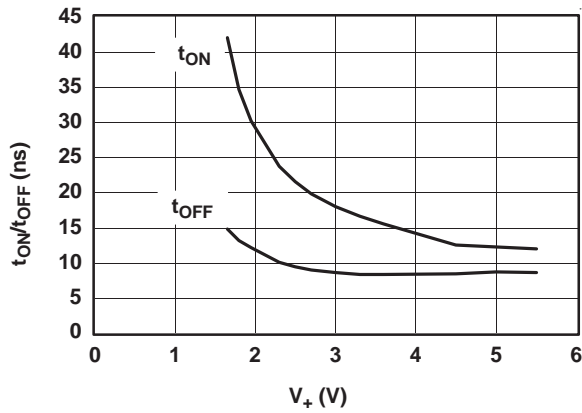


Figure 8. t_{ON} and t_{OFF} vs Supply Voltage

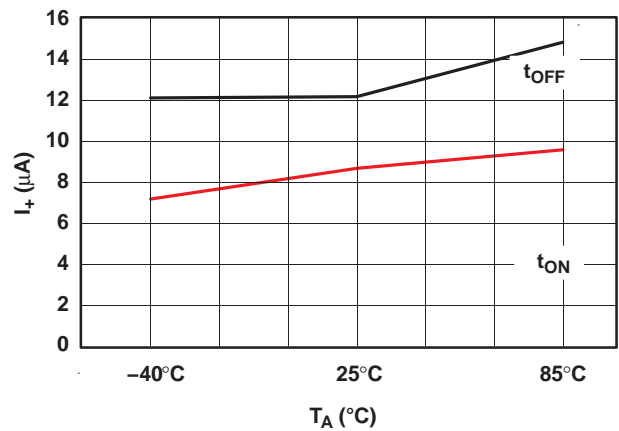


Figure 9. I_+ vs Temperature

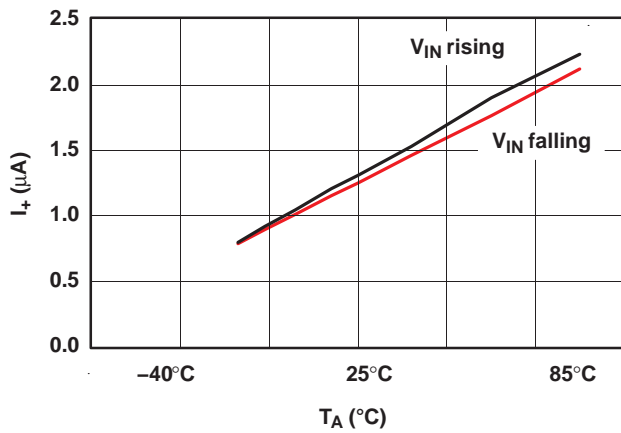


Figure 10. I_+ vs Temperature

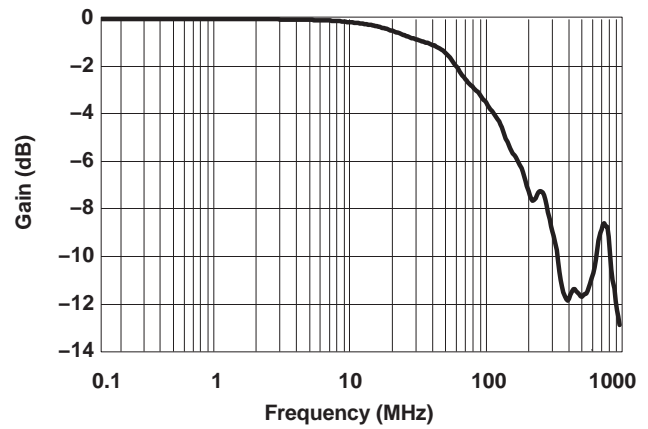


Figure 11. Bandwidth ($V_+ = 5\text{ V}$)

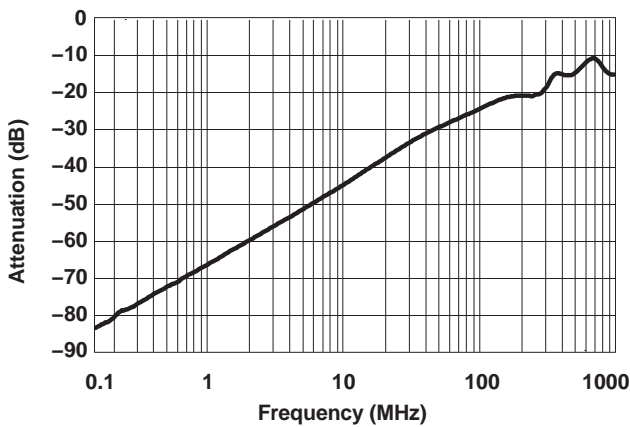


Figure 12. Attenuation vs Frequency

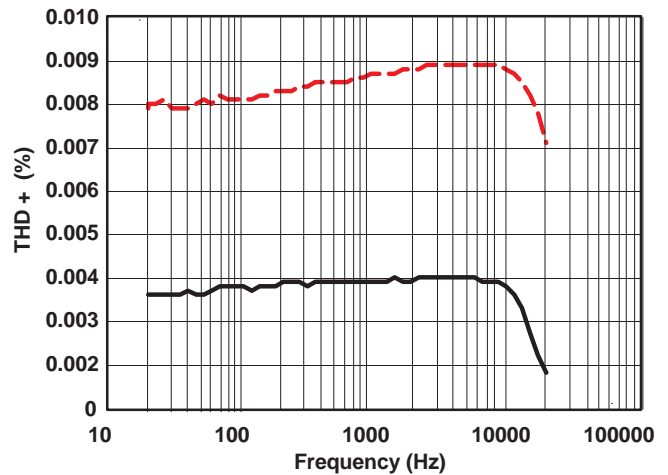


Figure 13. Total Harmonic Distortion vs Frequency ($V_+ = 5\text{ V}$)

TYPICAL PERFORMANCE (continued)

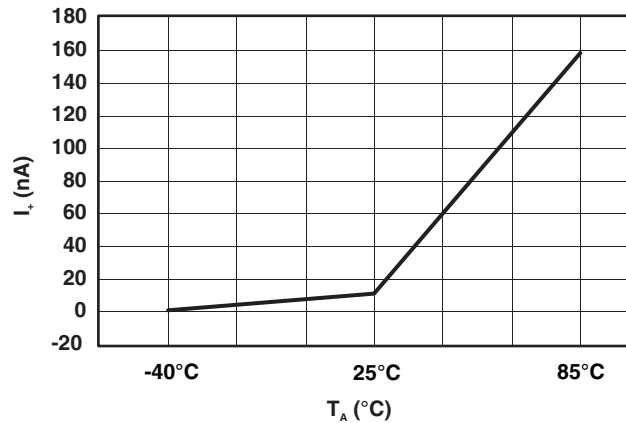


Figure 14. Power-Supply Current vs Temperature
($V_+ = 5\text{ V}$)

PIN DESCRIPTION

| NO. | NAME | DESCRIPTION |
|-----|-------|--------------------------------------|
| 1 | NO | Normally open |
| 2 | GND | Digital ground |
| 3 | NC | Normally closed |
| 4 | COM | Common |
| 5 | V_+ | Power supply |
| 6 | IN | Digital control to connect COM to NO |

PARAMETER DESCRIPTION

| SYMBOL | DESCRIPTION |
|-------------------|---|
| V_{COM} | Voltage at COM |
| V_{NC} | Voltage at NC |
| 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 r_{on} between channels |
| $r_{on(flat)}$ | Difference between the maximum and minimum value of r_{on} in a channel over the specified range of conditions |
| $I_{NC(OFF)}$ | Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the off state under worst-case input and output conditions |
| $I_{NC(PWROFF)}$ | Leakage current measured at the NC port during the power-down condition, $V_+ = 0$ |
| $I_{NO(OFF)}$ | Leakage current measured at the NO port, with the corresponding channel (NO to COM) in the off state under worst-case input and output conditions |
| $I_{NO(PWROFF)}$ | Leakage current measured at the NO port during the power-down condition, $V_+ = 0$ |
| $I_{NC(ON)}$ | Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the on state and the output (COM) being open |
| $I_{NO(ON)}$ | Leakage current measured at the NO port, with the corresponding channel (NO to COM) in the on state and the output (COM) being 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) being open |
| $I_{COM(PWROFF)}$ | 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 (IN) |
| I_{IH}, I_{IL} | Leakage current measured at (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 outputs (COM, NC, 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 outputs (COM, NC, 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 (NC, 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, $Q_C = C_L \times \Delta V_O$, C_L is the load capacitance and ΔV_O is the change in analog output voltage. |
| $C_{NC(OFF)}$ | Capacitance at the NC port when the corresponding channel (NC to COM) is off |
| $C_{NO(OFF)}$ | Capacitance at the NO port when the corresponding channel (NO to COM) is off |
| $C_{NC(ON)}$ | Capacitance at the NC port when the corresponding channel (NC to COM) is on |
| $C_{NO(ON)}$ | 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 NC or COM to NO) is on |
| C_{IN} | Capacitance of (IN) |
| OISO | OFF isolation of the switch is a measurement 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. |
| THD | Total harmonic distortion describes the signal distortion caused by the analog switch. This is defined as the ratio or 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 |

PARAMETER MEASUREMENT INFORMATION

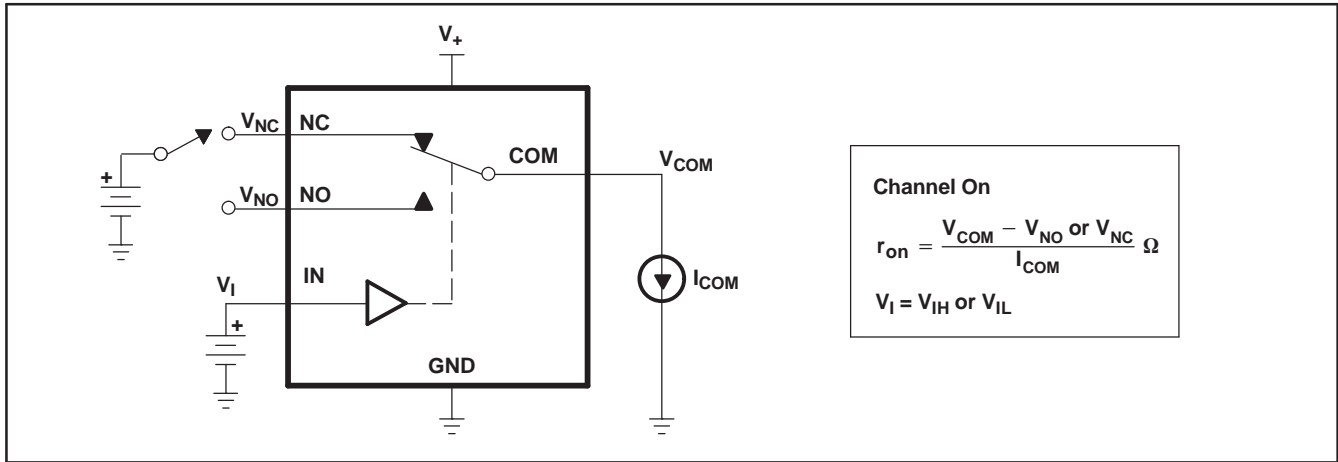


Figure 15. On-State Resistance (r_{on})

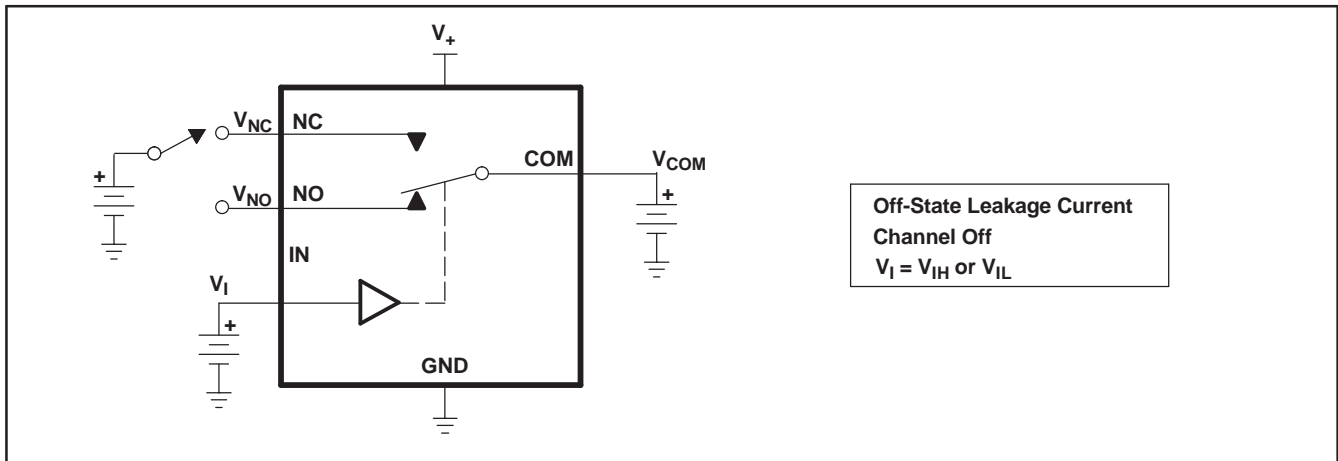


Figure 16. OFF-State Leakage Current ($I_{NC(OFF)}$, $I_{NC(PWROFF)}$, $I_{NO(OFF)}$, $I_{NO(PWROFF)}$, $I_{COM(OFF)}$, $I_{COM(PWROFF)}$)

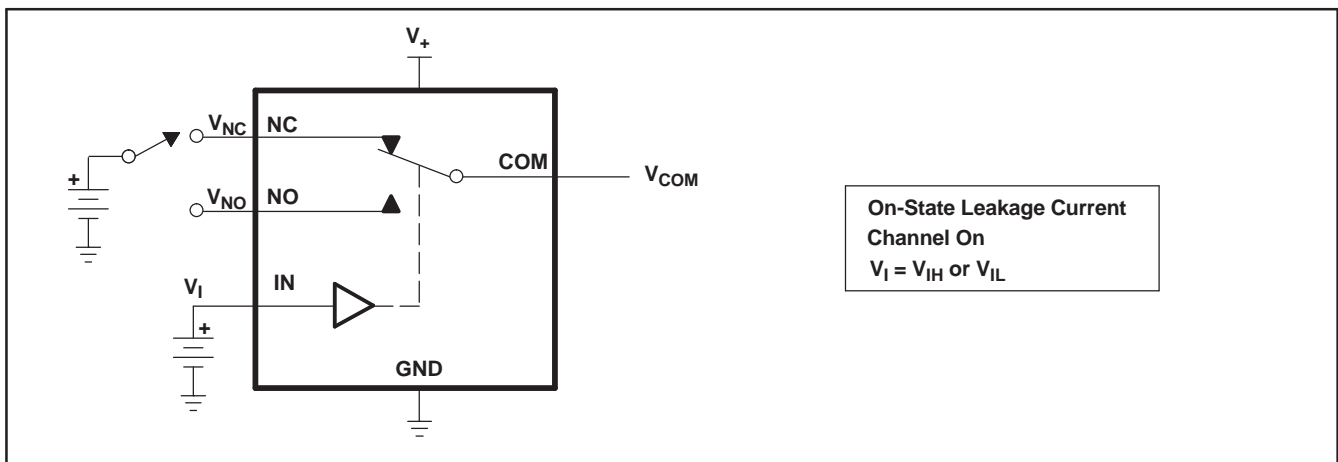


Figure 17. On-State Leakage Current ($I_{COM(ON)}$, $I_{NC(ON)}$, $I_{NO(ON)}$)

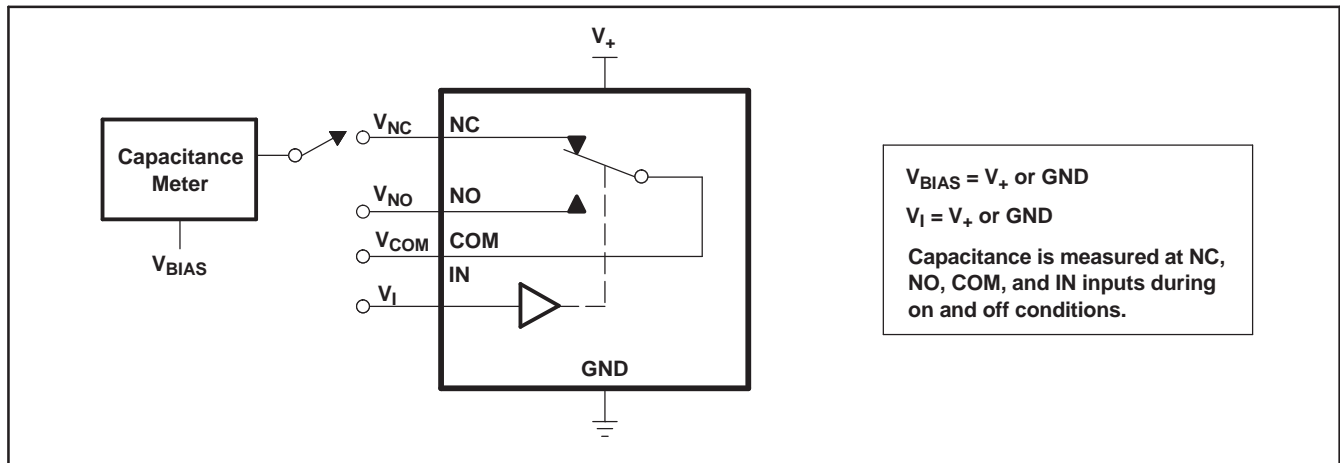
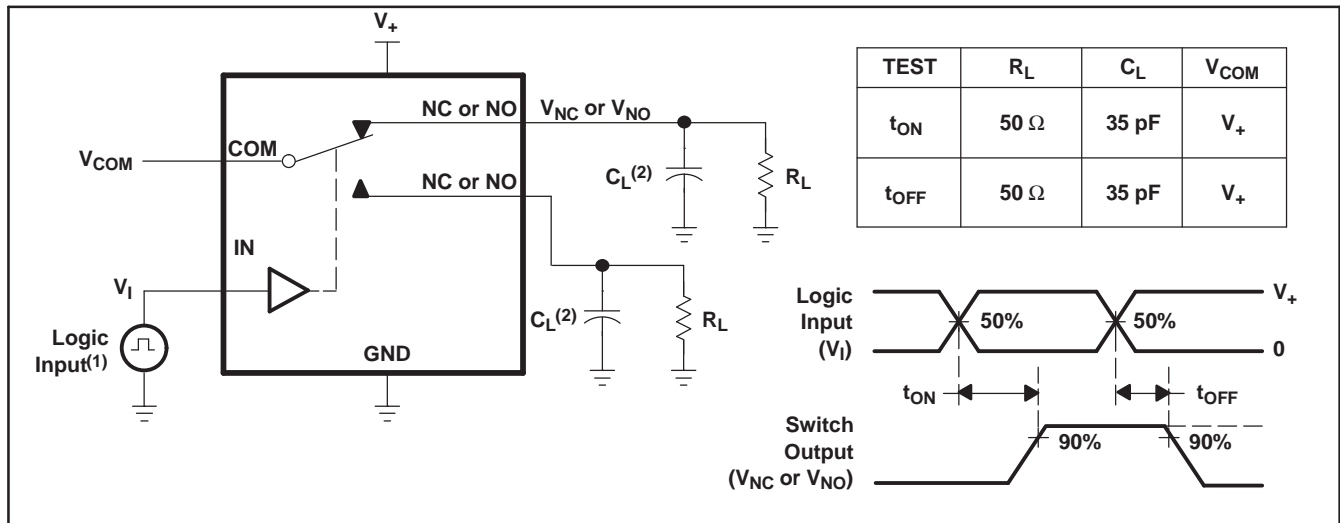
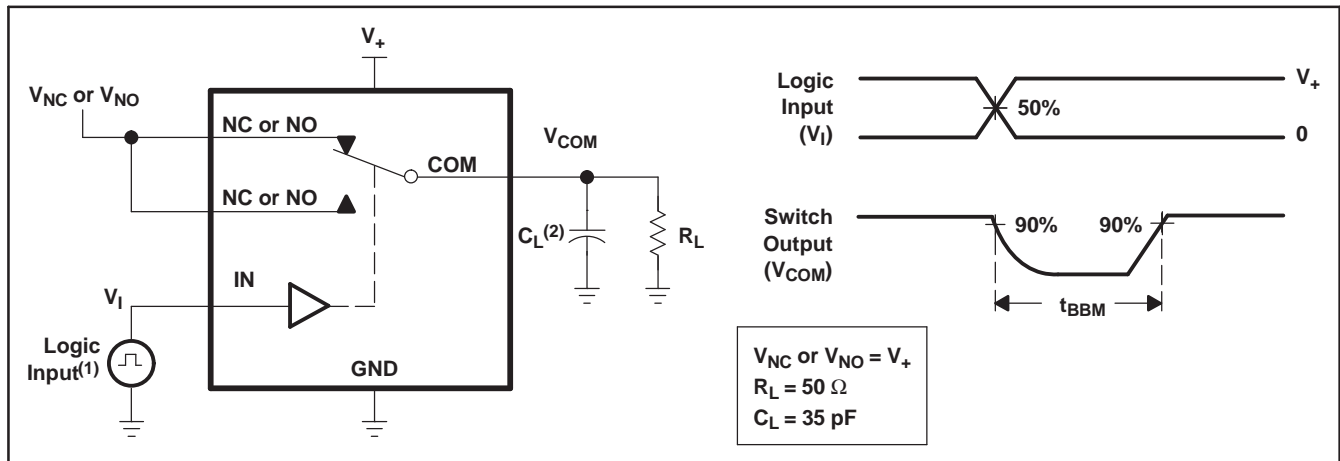


Figure 18. Capacitance (C_I , $C_{COM(ON)}$, $C_{NC(OFF)}$, $C_{NO(OFF)}$, $C_{NC(ON)}$, $C_{NO(ON)}$)



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

Figure 19. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})



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

Figure 20. Break-Before-Make Time (t_{BBM})

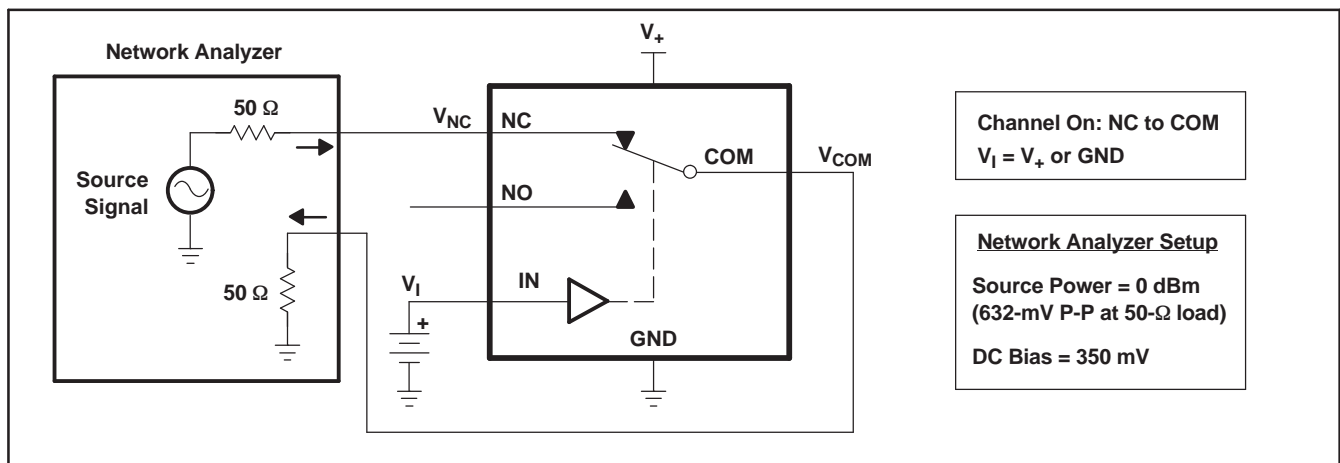


Figure 21. Bandwidth (BW)

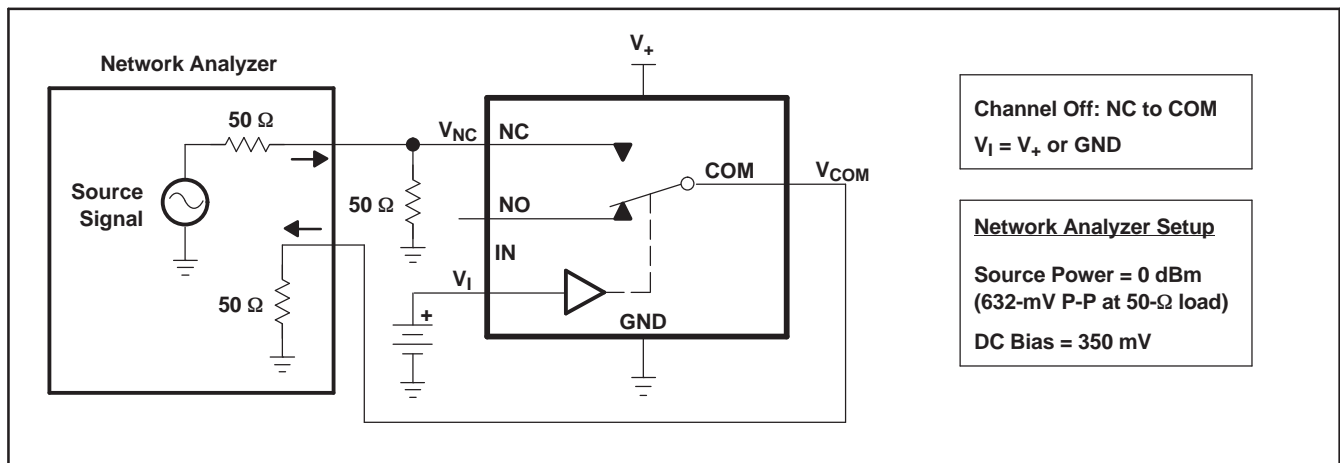


Figure 22. OFF Isolation (OISO)

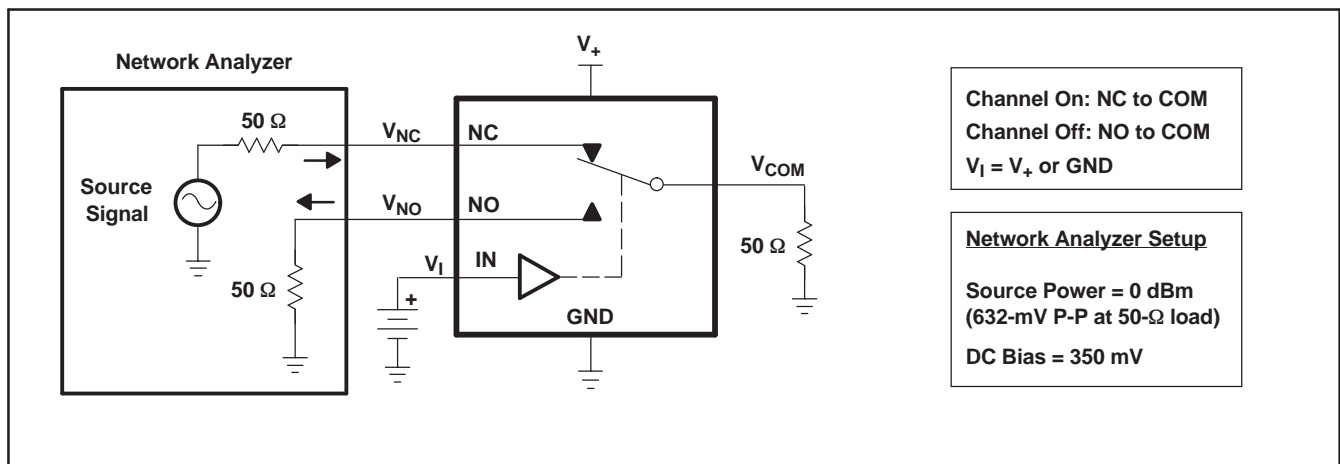
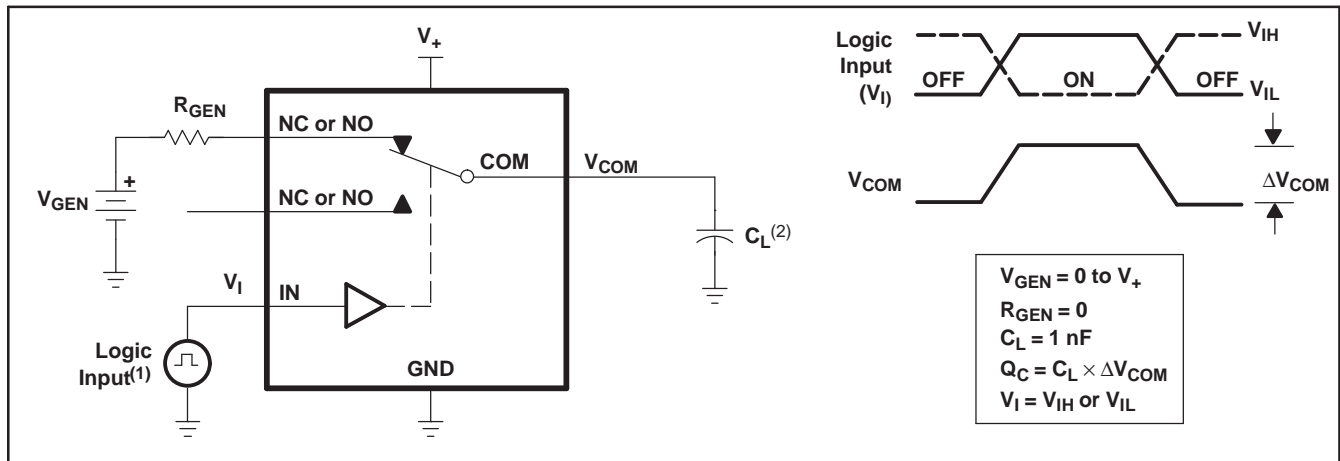
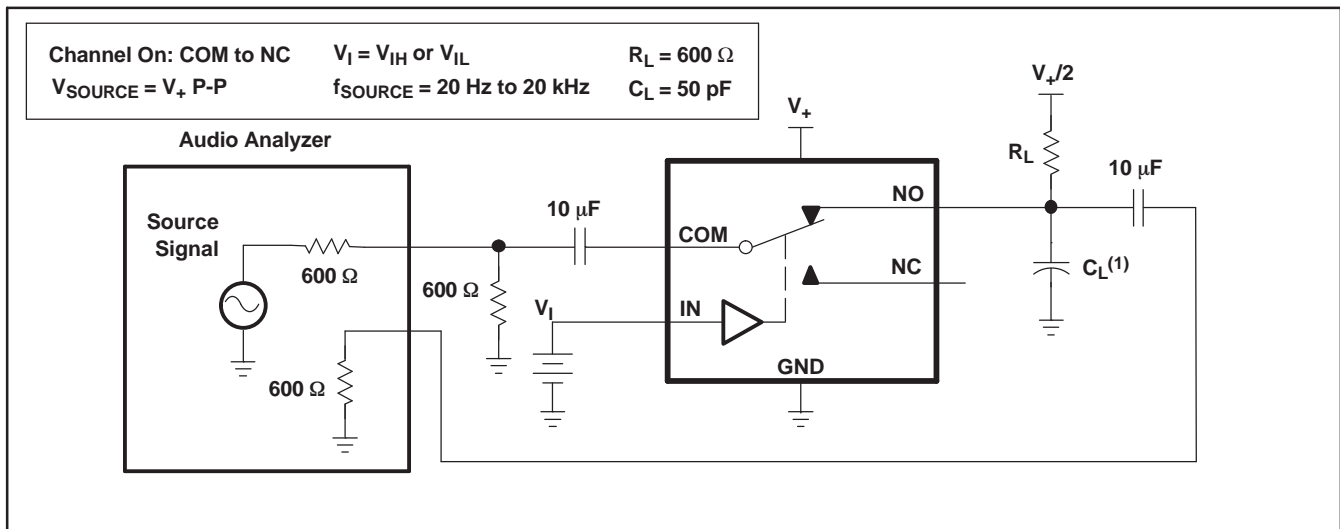


Figure 23. Crosstalk (X_{TALK})



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

Figure 24. Charge Injection (Q_C)



- A. C_L includes probe and jig capacitance.

Figure 25. Total Harmonic Distortion (THD)

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish | MSL Peak Temp (3) | Op Temp (°C) | Top-Side Markings (4) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|------------------|----------------------|--------------|--------------------------|-------------------------|
| TS5A3159ADBVR | ACTIVE | SOT-23 | DBV | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (JAJK ~ JAJR) | Samples |
| TS5A3159ADBVRE4 | ACTIVE | SOT-23 | DBV | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (JAJK ~ JAJR) | Samples |
| TS5A3159ADBVRG4 | ACTIVE | SOT-23 | DBV | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (JAJK ~ JAJR) | Samples |
| TS5A3159ADBVT | ACTIVE | SOT-23 | DBV | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (JAJK ~ JAJR) | Samples |
| TS5A3159ADBVTE4 | ACTIVE | SOT-23 | DBV | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (JAJK ~ JAJR) | Samples |
| TS5A3159ADBVTE4 | ACTIVE | SOT-23 | DBV | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (JAJK ~ JAJR) | Samples |
| TS5A3159ADCKR | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (JJK ~ JJR) | Samples |
| TS5A3159ADCKRE4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (JJK ~ JJR) | Samples |
| TS5A3159ADCKRG4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (JJK ~ JJR) | Samples |
| TS5A3159ADCKT | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (JJK ~ JJR) | Samples |
| TS5A3159ADCKTE4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (JJK ~ JJR) | Samples |
| TS5A3159ADCKTG4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (JJK ~ JJR) | Samples |
| TS5A3159AYZPR | ACTIVE | DSBGA | YZP | 6 | 3000 | Green (RoHS & no Sb/Br) | SNAGCU | Level-1-260C-UNLIM | -40 to 85 | (JJ2 ~ JJ7 ~ JJN) | Samples |

(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): TI'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, TI 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.

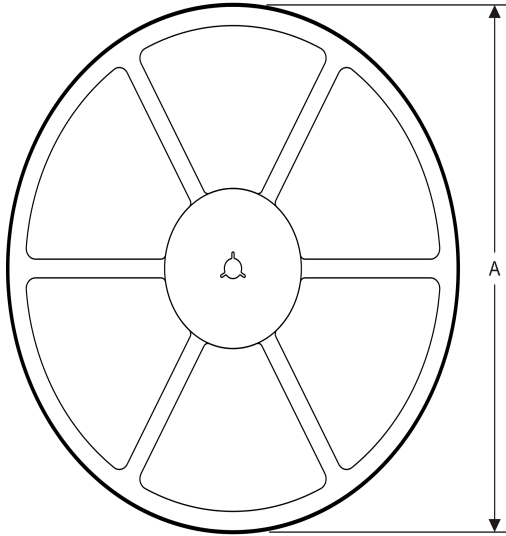
(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

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 knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

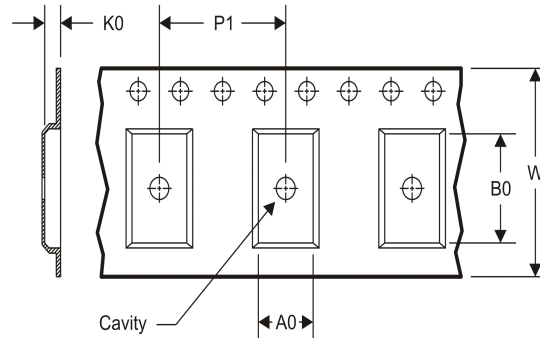
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



| | |
|----|---|
| 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 |

TAPE AND REEL INFORMATION

*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TS5A3159ADBVR | SOT-23 | DBV | 6 | 3000 | 180.0 | 9.2 | 3.17 | 3.23 | 1.37 | 4.0 | 8.0 | Q3 |
| TS5A3159ADBVT | SOT-23 | DBV | 6 | 250 | 180.0 | 9.2 | 3.17 | 3.23 | 1.37 | 4.0 | 8.0 | Q3 |
| TS5A3159ADCKR | SC70 | DCK | 6 | 3000 | 180.0 | 9.2 | 2.3 | 2.55 | 1.2 | 4.0 | 8.0 | Q3 |
| TS5A3159ADCKT | SC70 | DCK | 6 | 250 | 180.0 | 9.2 | 2.3 | 2.55 | 1.2 | 4.0 | 8.0 | Q3 |
| TS5A3159AYZPR | DSBGA | YZP | 6 | 3000 | 178.0 | 9.2 | 1.02 | 1.52 | 0.63 | 4.0 | 8.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TS5A3159ADBVR | SOT-23 | DBV | 6 | 3000 | 205.0 | 200.0 | 33.0 |
| TS5A3159ADBVT | SOT-23 | DBV | 6 | 250 | 205.0 | 200.0 | 33.0 |
| TS5A3159ADCKR | SC70 | DCK | 6 | 3000 | 205.0 | 200.0 | 33.0 |
| TS5A3159ADCKT | SC70 | DCK | 6 | 250 | 205.0 | 200.0 | 33.0 |
| TS5A3159AYZPR | DSBGA | YZP | 6 | 3000 | 220.0 | 220.0 | 35.0 |

DBV (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE



- 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. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
- \triangle Falls within JEDEC MO-178 Variation AB, except minimum lead width.

DBV (R-PDSO-G6)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
 - D. Publication IPC-7351 is recommended for alternate designs.
 - E. 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. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

DCK (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE



- 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-203 variation AB.

DCK (R-PDSO-G6)

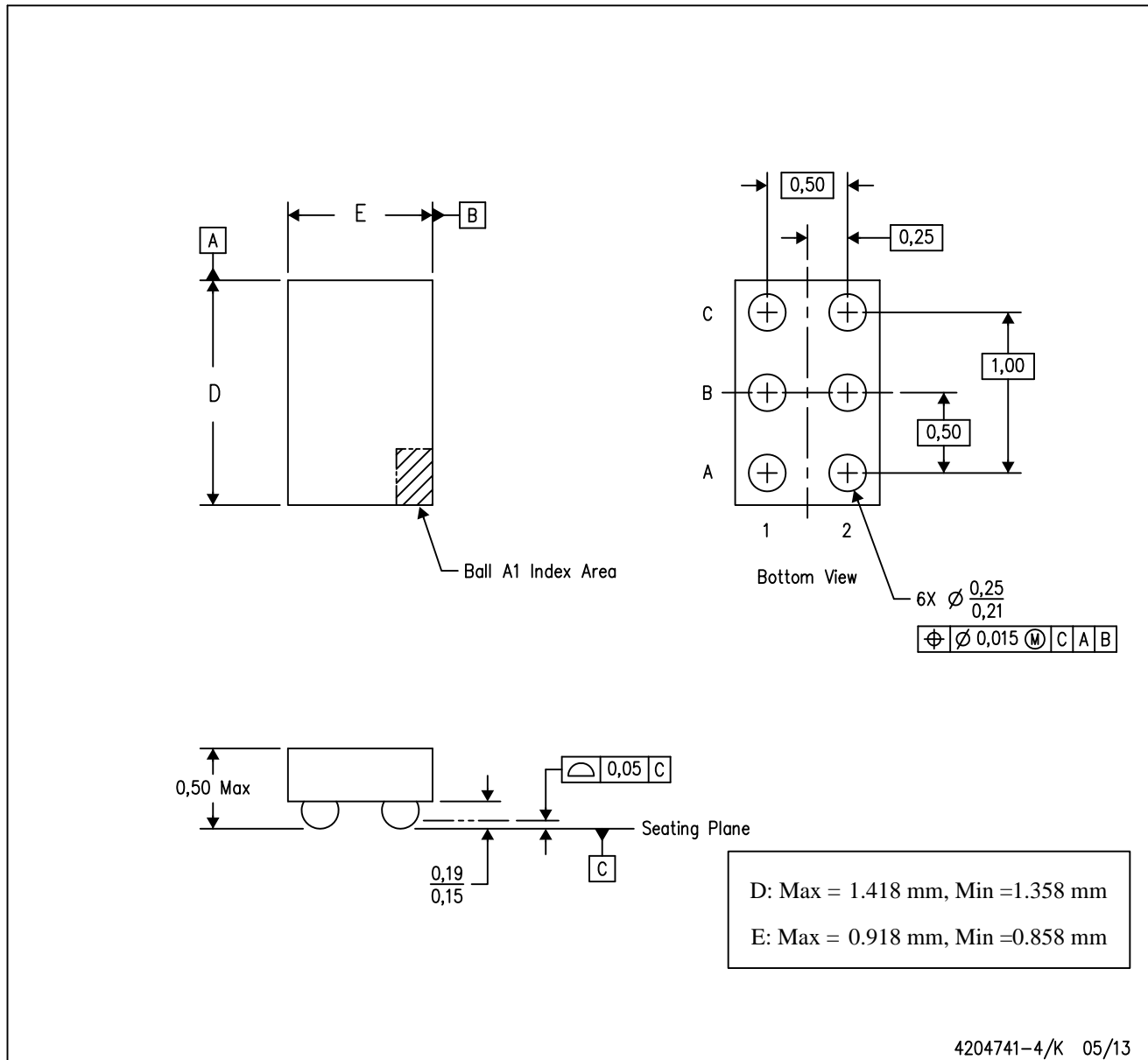
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
 - D. Publication IPC-7351 is recommended for alternate designs.
 - E. 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. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

YZP (R-XBGA-N6)

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.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

| | |
|------------------------------|--|
| Audio | www.ti.com/audio |
| Amplifiers | amplifier.ti.com |
| Data Converters | dataconverter.ti.com |
| DLP® Products | www.dlp.com |
| DSP | dsp.ti.com |
| Clocks and Timers | www.ti.com/clocks |
| Interface | interface.ti.com |
| Logic | logic.ti.com |
| Power Mgmt | power.ti.com |
| Microcontrollers | microcontroller.ti.com |
| RFID | www.ti-rfid.com |
| OMAP Applications Processors | www.ti.com/omap |
| Wireless Connectivity | www.ti.com/wirelessconnectivity |

Applications

| | |
|-------------------------------|--|
| Automotive and Transportation | www.ti.com/automotive |
| Communications and Telecom | www.ti.com/communications |
| Computers and Peripherals | www.ti.com/computers |
| Consumer Electronics | www.ti.com/consumer-apps |
| Energy and Lighting | www.ti.com/energy |
| Industrial | www.ti.com/industrial |
| Medical | www.ti.com/medical |
| Security | www.ti.com/security |
| Space, Avionics and Defense | www.ti.com/space-avionics-defense |
| Video and Imaging | www.ti.com/video |

TI E2E Community

e2e.ti.com