

TS5A2066 Dual-Channel 10-Ω SPST Analog Switch

1 Features

- Low ON-State Resistance (10 Ω)
- Control Inputs Are 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)

2 Applications

- Sample-and-Hold Circuits
- Battery-Powered Equipment
- Audio and Video Signal Routing
- Communication Circuits
- Cell Phones
- Low-Voltage Data-Acquisition Systems
- PDAs

3 Description

The TS5A2066 device is a dual single-pole single-throw (SPST) analog switch that is designed to operate from 1.65 V to 5.5 V. This device can handle both digital and analog signals, and signals up to V_{CC} can be transmitted in either direction.

Device Information⁽¹⁾

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|-------------|-------------|-------------------|
| TS5A2066 | SSOP (DCT) | 2.95 mm x 2.80 mm |
| | VSSOP (DCU) | 2.30 mm x 2.00 mm |
| | DSBGA (YZP) | 1.25 mm x 2.25 mm |

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

Functional Block Diagram

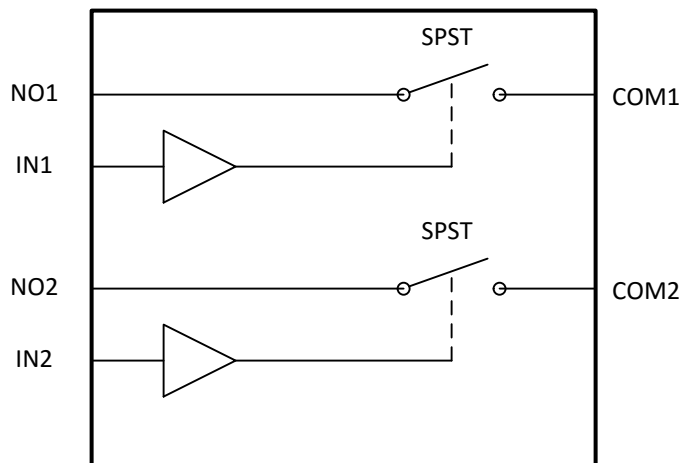


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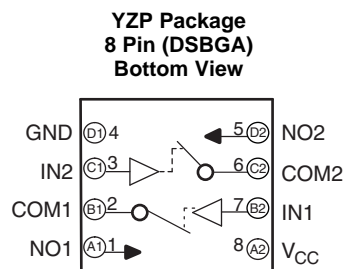
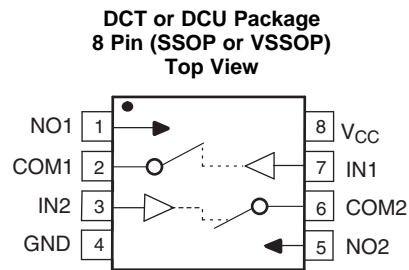
4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Revision E (June 2017) to Revision F | Page |
|--|-------------|
| • Changed the YZP Package From: Top View To: Bottom View | 3 |

| Changes from Revision D (April 2010) to Revision E | Page |
|--|-------------|
| • Added <i>Device Information</i> table, <i>Pin Configuration and Functions</i> section, <i>ESD Ratings</i> table, <i>Recommended Operating Conditions</i> table, <i>Thermal Information</i> table, <i>Feature Description</i> section, <i>Device Functional Modes</i> , <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section | 1 |
| • Deleted the <i>Summary of Characteristics</i> table | 3 |
| • Changed pin 8 From: V_+ To: V_{CC} in the pinout images | 3 |
| • Deleted the ON-state resistance Min values of 10 Ω and 12 Ω in the <i>Electrical Characteristics For 3.3-V Supply</i> table | 7 |
| • Deleted the ON-state resistance Min values of 20 Ω in the <i>Electrical Characteristics For 2.5-V Supply</i> table | 9 |
| • Changed Test Conditions for Charge injection From: See Figure 23 To; See Figure 24 in the <i>Electrical Characteristics For 2.5-V Supply</i> table | 10 |
| • Deleted the ON-state resistance Min values of 80 Ω and 90 Ω in the <i>Electrical Characteristics For 1.8-V Supply</i> table | 11 |
| • Changed V_+ to V_{CC} in the <i>Typical Performance</i> graphs | 13 |
| • Changed V_+ to V_{CC} in the <i>Parameter Measurement Information</i> images | 16 |

5 Pin Configuration and Functions



Pin Functions

| NO. | NAME | DESCRIPTION |
|-----|-----------------|--------------------------------------|
| 1 | NO1 | Normally open |
| 2 | COM1 | Common |
| 3 | IN2 | Digital control to connect COM to NO |
| 4 | GND | Digital ground |
| 5 | NO2 | Normally open |
| 6 | COM2 | Common |
| 7 | IN1 | Digital control to connect COM to NO |
| 8 | V _{CC} | Power supply |

6 Specifications

6.1 Absolute Maximum Ratings⁽¹⁾⁽²⁾

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

| | | MIN | MAX | UNIT |
|-------------------------------------|---|------|-----------------------|------|
| V _{CC} | Supply voltage range ⁽³⁾ | -0.5 | 6.5 | V |
| V _{NO} V _{COM} | Analog voltage range ⁽³⁾⁽⁴⁾⁽⁵⁾ | -0.5 | V _{CC} + 0.5 | V |
| I _K | Analog port diode current V _{NO} , V _{COM} < 0 or V _{NO} , V _{COM} > V _{CC} | -50 | 50 | mA |
| I _{NO} I _{COM} | On-state switch current V _{NO} , V _{COM} = 0 to V _{CC} | -50 | 50 | mA |
| V _{IN} | Digital input voltage range ⁽³⁾⁽⁴⁾ | -0.5 | 6.5 | V |
| I _{IK} | Digital input clamp current V _{IN} < 0 | -50 | | mA |
| I _{CC} | Continuous current through V _{CC} | | 100 | mA |
| I _{GND} | Continuous current through GND | -100 | 100 | mA |
| 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.

6.2 ESD Ratings

| | | VALUE | UNIT |
|--|---|-------|------|
| V _(ESD) | Electrostatic discharge | | |
| | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾ | ±2000 | V |
| Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾ | ±1000 | | |

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

6.3 Recommended Operating Conditions

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

| | | MIN | MAX | UNIT |
|----------------------------------|-----------------------------|------|-----------------|------|
| V _{CC} | Supply voltage range | 1.65 | 5.5 | V |
| V _{NO} V _{COM} | Analog voltage range | 0 | V _{CC} | V |
| V _{IN} | Digital input voltage range | 0 | 5.5 | V |

6.4 Thermal Information

| THERMAL METRIC ⁽¹⁾ | TS5A2066 | | | UNIT | |
|-------------------------------|--|-------------|-------------|------|------|
| | DCT (SSOP) | DCU (VSSOP) | YZP (DSBGA) | | |
| | 8 PINS | 8 PINS | 8 PINS | | |
| R _{θJA} | Junction-to-ambient thermal resistance | 214.1 | 212.8 | 99.8 | °C/W |
| R _{θJC(top)} | Junction-to-case (top) thermal resistance | 106.8 | 93.6 | 1.0 | °C/W |
| R _{θJB} | Junction-to-board thermal resistance | 127.8 | 133.6 | 29.6 | °C/W |
| ψ _{JT} | Junction-to-top characterization parameter | 30.2 | 30.4 | 0.5 | °C/W |
| ψ _{JB} | Junction-to-board characterization parameter | 125.5 | 133.1 | 29.8 | °C/W |

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

6.5 Electrical Characteristics For 5-V Supply⁽¹⁾

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

| PARAMETER | SYMBOL | TEST CONDITIONS | T_A | V_{CC} | MIN | TYP | MAX | UNIT |
|--|-------------------|--|--------------|----------|---------------------|------|---------------------|---------------|
| Analog Switch | | | | | | | | |
| Analog signal range | V_{COM}, V_{NO} | | | | 0 | | V_{CC} | V |
| ON-state resistance | r_{on} | $0 \leq V_{NO} \leq V_{CC}$, $I_{COM} = -32\text{ mA}$, Switch ON, See Figure 16 | 25°C Full | 4.5 V | | 7.5 | 10 | Ω |
| ON-state resistance match between channels | Δr_{on} | $V_{NO} = 3.15\text{ V}$, $I_{COM} = -32\text{ mA}$, Switch ON, See Figure 16 | 25°C Full | 4.5 V | | 0.4 | 1 | Ω |
| ON-state resistance flatness | $r_{on(Flat)}$ | $0 \leq V_{NO} \leq V_{CC}$, $I_{COM} = -32\text{ mA}$, Switch ON, See Figure 16 | 25°C Full | 4.5 V | | 3.5 | 5 | Ω |
| NO OFF leakage current | $I_{NO(OFF)}$ | $V_{NO} = 1\text{ V}$, $V_{COM} = 4.5\text{ V}$, or $V_{NO} = 4.5\text{ V}$, $V_{COM} = 1\text{ V}$, Switch OFF, See Figure 17 | 25°C Full | 5.5 V | -30 | -10 | 30 | nA |
| COM OFF leakage current | $I_{COM(OFF)}$ | $V_{COM} = 1\text{ V}$, $V_{NO} = 4.5\text{ V}$, or $V_{COM} = 4.5\text{ V}$, $V_{NO} = 1\text{ V}$, Switch OFF, See Figure 17 | 25°C Full | 5.5 V | -50 | -8 | 50 | nA |
| NO ON leakage current | $I_{NO(ON)}$ | $V_{NO} = 1\text{ V}$, $V_{COM} = \text{Open}$, or $V_{NO} = 4.5\text{ V}$, $V_{COM} = \text{Open}$, Switch ON, See Figure 18 | 25°C Full | 5.5 V | -40 | -12 | 40 | nA |
| COM ON leakage current | $I_{COM(ON)}$ | $V_{COM} = 1\text{ V}$, $V_{NO} = \text{Open}$, or $V_{COM} = 4.5\text{ V}$, $V_{NO} = \text{Open}$, Switch ON, See Figure 18 | 25°C Full | 5.5 V | -70 | -30 | 70 | nA |
| Digital Control Input (IN) | | | | | | | | |
| Input logic high | V_{IH} | | Full | | $V_{CC} \times 0.7$ | | 5.5 | V |
| Input logic low | V_{IL} | | Full | | 0 | | $V_{CC} \times 0.3$ | V |
| Input leakage current | I_{IH}, I_{IL} | $V_{IN} = 5.5\text{ V or }0$ | 25°C Full | 5.5 V | -0.1 | 0.05 | 0.1 | μA |
| | | | | | -1 | | 1 | |

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

| PARAMETER | SYMBOL | TEST CONDITIONS | T_A | V_{CC} | MIN | TYP | MAX | UNIT | |
|------------------------------|----------------|---|--|----------|----------------------|-----|-------|------|---------------|
| Dynamic | | | | | | | | | |
| Turn-on time | t_{ON} | $V_{COM} = 3\text{ V}$, $R_L = 300\ \Omega$, | $C_L = 35\text{ pF}$, See Figure 20 | 25°C | 5 V | 4.4 | 5.2 | 5.8 | ns |
| | | | | Full | 4.5 V to 5.5 V | 3.4 | | 6.1 | |
| Turn-off time | t_{OFF} | $V_{COM} = 3\text{ V}$, $R_L = 300\ \Omega$, | $C_L = 35\text{ pF}$, See Figure 20 | 25°C | 5 V | 1.7 | 2.6 | 3.6 | ns |
| | | | | Full | 4.5 V to 5.5 V | 1.3 | | 4.2 | |
| Charge injection | Q_C | $V_{GEN} = 0$, $R_{GEN} = 0$, | $C_L = 0.1\text{ nF}$, See Figure 24 | 25°C | 5 V | | 1 | pC | |
| NO OFF capacitance | $C_{NO(OFF)}$ | $V_{NO} = V_{CC}$ or GND, | Switch OFF, See Figure 19 | 25°C | 5 V | | 5.5 | pF | |
| COM OFF capacitance | $C_{COM(OFF)}$ | $V_{COM} = V_{CC}$ or GND, | Switch OFF, See Figure 19 | 25°C | 5 V | | 5.5 | pF | |
| NO ON capacitance | $C_{NO(ON)}$ | $V_{NO} = V_{CC}$ or GND, | Switch ON, See Figure 19 | 25°C | 5 V | | 13.5 | pF | |
| COM ON capacitance | $C_{COM(ON)}$ | $V_{COM} = V_{CC}$ or GND, | Switch ON, See Figure 19 | 25°C | 5 V | | 13.5 | pF | |
| Digital input capacitance | C_{IN} | $V_{IN} = V_{CC}$ or GND, | See Figure 19 | 25°C | 5 V | | 2.5 | pF | |
| Bandwidth | BW | $R_L = 50\ \Omega$, | Switch ON, See Figure 21 | 25°C | 5 V | | 300 | MHz | |
| OFF isolation | O_{ISO} | $R_L = 50\ \Omega$, $f = 10\text{ MHz}$, | Switch OFF, See Figure 22 | 25°C | 5 V | | -68 | dB | |
| Crosstalk | X_{TALK} | $R_L = 50\ \Omega$, $f = 10\text{ MHz}$, | Switch ON, See Figure 23 | 25°C | 5 V | | -66 | 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 | 5 V | | 0.01% | | |
| Supply | | | | | | | | | |
| Positive supply current | I_{CC} | $V_{IN} = V_{CC}$ or GND, | Switch ON or OFF | 25°C | 5.5 V | | 0.1 | 1 | μA |
| | | | | Full | | | | 5 | |

6.6 Electrical Characteristics For 3.3-V Supply⁽¹⁾

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

| PARAMETER | SYMBOL | TEST CONDITIONS | T_A | V_{CC} | MIN | TYP | MAX | UNIT |
|--|-------------------|---|-------|----------|---------------------|------|---------------------|----------|
| Analog Switch | | | | | | | | |
| Analog signal range | V_{COM}, V_{NO} | | | | 0 | | V_{CC} | V |
| ON-state resistance | r_{on} | $0 \leq V_{NO} \leq V_{CC}$, $I_{COM} = -24\text{ mA}$, Switch ON, See Figure 16 | 25°C | 3 V | | 12 | 15 | Ω |
| | | | Full | | | | 20 | |
| ON-state resistance match between channels | Δr_{on} | $V_{NO} = 2.1\text{ V}$, $I_{COM} = -24\text{ mA}$, Switch ON, See Figure 16 | 25°C | 3 V | | 0.5 | 1.5 | Ω |
| | | | Full | | | | 3.5 | |
| ON-state resistance flatness | $r_{on(Flat)}$ | $0 \leq V_{NO} \leq V_{CC}$, $I_{COM} = -24\text{ mA}$, Switch ON, See Figure 16 | 25°C | 3 V | | 7 | 8 | Ω |
| | | | Full | | | | 12 | |
| NO OFF leakage current | $I_{NO(OFF)}$ | $V_{NO} = 1\text{ V}$, $V_{COM} = 3\text{ V}$, or $V_{NO} = 3\text{ V}$, $V_{COM} = 1\text{ V}$, Switch OFF, See Figure 17 | 25°C | 3.6 V | | -30 | -6 | 30 |
| | | | Full | | | | -40 | 40 |
| COM OFF leakage current | $I_{COM(OFF)}$ | $V_{COM} = 1\text{ V}$, $V_{NO} = 3\text{ V}$, or $V_{COM} = 3\text{ V}$, $V_{NO} = 1\text{ V}$, Switch OFF, See Figure 17 | 25°C | 3.6 V | | -50 | -7 | 50 |
| | | | Full | | | | -50 | 50 |
| NO ON leakage current | $I_{NO(ON)}$ | $V_{NO} = 1\text{ V}$, $V_{COM} = \text{Open}$, or $V_{NO} = 3\text{ V}$, $V_{COM} = \text{Open}$, Switch ON, See Figure 18 | 25°C | 3.6 V | | -40 | -7 | 40 |
| | | | Full | | | | -40 | 40 |
| COM ON leakage current | $I_{COM(ON)}$ | $V_{COM} = 1\text{ V}$, $V_{NO} = \text{Open}$, or $V_{COM} = 3\text{ V}$, $V_{NO} = \text{Open}$, Switch ON, See Figure 18 | 25°C | 3.6 V | | -70 | -20 | 70 |
| | | | Full | | | | -70 | 70 |
| Digital Control Input (IN) | | | | | | | | |
| Input logic high | V_{IH} | | Full | | $V_{CC} \times 0.7$ | | 5.5 | V |
| Input logic low | V_{IL} | | Full | | 0 | | $V_{CC} \times 0.3$ | V |
| Input leakage current | I_{IH}, I_{IL} | $V_{IN} = 5.5\text{ V or }0$ | 25°C | 3.6 V | | -0.1 | 0.05 | 0.1 |
| | | | Full | | | | -1 | 1 |

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

Electrical Characteristics For 3.3-V Supply⁽¹⁾ (continued)
 $V_{CC} = 3\text{ V to }3.6\text{ V}$, $T_A = -40^\circ\text{C to }85^\circ\text{C}$ (unless otherwise noted)

| PARAMETER | SYMBOL | TEST CONDITIONS | T_A | V_{CC} | MIN | TYP | MAX | UNIT | |
|---------------------------|----------------|---|--|----------|--------------|-----|--------|------|---------------|
| Dynamic | | | | | | | | | |
| Turn-on time | t_{ON} | $V_{COM} = 2\text{ V}$, $R_L = 300\ \Omega$, | $C_L = 35\text{ pF}$, See Figure 20 | 25°C | 3.3 V | 4.9 | 5.6 | 6.4 | ns |
| | | | | Full | 3 V to 3.6 V | 4.3 | | 7.1 | |
| Turn-off time | t_{OFF} | $V_{COM} = 2\text{ V}$, $R_L = 300\ \Omega$, | $C_L = 35\text{ pF}$, See Figure 20 | 25°C | 3.3 V | 2 | 2.7 | 3.7 | ns |
| | | | | Full | 3 V to 3.6 V | 1.3 | | 4.7 | |
| Charge injection | Q_C | $V_{GEN} = 0$, $R_{GEN} = 0$, | $C_L = 0.1\text{ nF}$, See Figure 24 | 25°C | 3.3 V | | 0.5 | pC | |
| NO OFF capacitance | $C_{NO(OFF)}$ | $V_{NO} = V_{CC}$ or GND, | Switch OFF, See Figure 19 | 25°C | 3.3 V | | 5.5 | pF | |
| COM OFF capacitance | $C_{COM(OFF)}$ | $V_{COM} = V_{CC}$ or GND, | Switch OFF, See Figure 19 | 25°C | 3.3 V | | 6 | pF | |
| NO ON capacitance | $C_{NO(ON)}$ | $V_{NO} = V_{CC}$ or GND, | Switch ON, See Figure 19 | 25°C | 3.3 V | | 14 | pF | |
| COM ON capacitance | $C_{COM(ON)}$ | $V_{COM} = V_{CC}$ or GND, | Switch ON, See Figure 19 | 25°C | 3.3 V | | 14 | pF | |
| Digital input capacitance | C_I | $V_{IN} = V_{CC}$ or GND, | See Figure 19 | 25°C | 3.3 V | | 3 | pF | |
| Bandwidth | BW | $R_L = 50\ \Omega$, | Switch ON, See Figure 21 | 25°C | 3.3 V | | 300 | MHz | |
| OFF isolation | O_{ISO} | $R_L = 50\ \Omega$, $f = 10\text{ MHz}$, | Switch OFF, See Figure 22 | 25°C | 3.3 V | | -68 | dB | |
| Crosstalk | X_{TALK} | $R_L = 50\ \Omega$, $f = 10\text{ MHz}$, | Switch ON, See Figure 23 | 25°C | 3.3 V | | -66 | 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 | | 0.065% | | |
| Supply | | | | | | | | | |
| Positive supply current | I_{CC} | $V_{IN} = V_{CC}$ or GND, | Switch ON or OFF | 25°C | 3.6 V | 0.1 | | 1 | μA |
| | | | | Full | | | | 5 | |

6.7 Electrical Characteristics For 2.5-V Supply⁽¹⁾

 $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$, $T_A = -40^\circ\text{C to } 85^\circ\text{C}$ (unless otherwise noted)

| PARAMETER | SYMBOL | TEST CONDITIONS | T_A | V_{CC} | MIN | TYP | MAX | UNIT |
|--|-------------------|--|-------|----------|---------------------|---------------------|----------|---------------|
| Analog Switch | | | | | | | | |
| Analog signal range | V_{COM}, V_{NO} | | | | 0 | | V_{CC} | V |
| ON-state resistance | r_{on} | $0 \leq V_{NO} \leq V_{CC}$, $I_{COM} = -8 \text{ mA}$, Switch ON, See Figure 16 | 25°C | 2.3 V | 22 | | 30 | Ω |
| | | | Full | | | | | |
| ON-state resistance match between channels | Δr_{on} | $V_{NO} = 1.6 \text{ V}$, $I_{COM} = -8 \text{ mA}$, Switch ON, See Figure 16 | 25°C | 2.3 V | 0.5 | | 1.5 | Ω |
| | | | Full | | | | 5 | |
| ON-state resistance flatness | $r_{on(Flat)}$ | $0 \leq V_{NO} \leq V_{CC}$, $I_{COM} = -8 \text{ mA}$, Switch ON, See Figure 16 | 25°C | 2.3 V | 16 | | 18 | Ω |
| | | | Full | | | | 25 | |
| NO OFF leakage current | $I_{NO(OFF)}$ | $V_{NO} = 0.5 \text{ V}$, $V_{COM} = 2.2 \text{ V}$, or $V_{NO} = 2.2 \text{ V}$, $V_{COM} = 0.5 \text{ V}$, Switch OFF, See Figure 17 | 25°C | 2.7 V | -30 | -5.5 | 30 | nA |
| | | | Full | | -40 | | 40 | |
| COM OFF leakage current | $I_{COM(OFF)}$ | $V_{COM} = 0.5 \text{ V}$, $V_{NO} = 2.2 \text{ V}$, or $V_{COM} = 2.2 \text{ V}$, $V_{NO} = 0.5 \text{ V}$, Switch OFF, See Figure 17 | 25°C | 2.7 V | -50 | -7.5 | 50 | nA |
| | | | Full | | -50 | | 50 | |
| NO ON leakage current | $I_{NO(ON)}$ | $V_{NO} = 0.5 \text{ V}$, $V_{COM} = \text{Open}$, or $V_{NO} = 2.2 \text{ V}$, $V_{COM} = \text{Open}$, Switch ON, See Figure 18 | 25°C | 2.7 V | -40 | -5 | 40 | nA |
| | | | Full | | -40 | | 40 | |
| COM ON leakage current | $I_{COM(ON)}$ | $V_{COM} = 0.5 \text{ V}$, $V_{NO} = \text{Open}$, or $V_{COM} = 2.2 \text{ V}$, $V_{NO} = \text{Open}$, Switch ON, See Figure 18 | 25°C | 2.7 V | -70 | -12 | 70 | nA |
| | | | Full | | -70 | | 70 | |
| Digital Control Input (IN) | | | | | | | | |
| Input logic high | V_{IH} | | Full | | $V_{CC} \times 0.7$ | | 5.5 | V |
| Input logic low | V_{IL} | | Full | | 0 | $V_{CC} \times 0.3$ | | V |
| Input leakage current | I_{IH}, I_{IL} | $V_{IN} = 5.5 \text{ V or } 0$ | 25°C | 2.7 V | -0.1 | 0.05 | 0.1 | μA |
| | | | Full | | -1 | | 1 | |

(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)
 $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$, $T_A = -40^\circ\text{C to } 85^\circ\text{C}$ (unless otherwise noted)

| PARAMETER | SYMBOL | TEST CONDITIONS | T_A | V_{CC} | MIN | TYP | MAX | UNIT |
|---------------------------|----------------|--|-------|----------------|-----|-------|-----|---------------|
| Dynamic | | | | | | | | |
| Turn-on time | t_{ON} | $V_{COM} = 1.5 \text{ V}$, $R_L = 300 \Omega$, See Figure 20 | 25°C | 2.5 V | 5.7 | 6.4 | 8.1 | ns |
| | | | Full | 2.3 V to 2.7 V | 4.4 | | 8.5 | |
| Turn-off time | t_{OFF} | $V_{COM} = 1.5 \text{ V}$, $R_L = 300 \Omega$, See Figure 20 | 25°C | 2.5 V | 2.1 | 3.1 | 4.3 | ns |
| | | | Full | 2.3 V to 2.7 V | 1.8 | | 4.8 | |
| Charge injection | Q_C | $V_{GEN} = 0$, $R_{GEN} = 0$, $C_L = 0.1 \text{ nF}$, See Figure 24 | 25°C | 2.5 V | | 0.5 | | pC |
| NO OFF capacitance | $C_{NO(OFF)}$ | $V_{NO} = V_{CC}$ or GND, Switch OFF, See Figure 19 | 25°C | 2.5 V | | 6 | | pF |
| COM OFF capacitance | $C_{COM(OFF)}$ | $V_{COM} = V_{CC}$ or GND, Switch OFF, See Figure 19 | 25°C | 2.5 V | | 6 | | pF |
| NO ON capacitance | $C_{NO(ON)}$ | $V_{NO} = V_{CC}$ or GND, Switch ON, See Figure 19 | 25°C | 2.5 V | | 14 | | pF |
| COM ON capacitance | $C_{COM(ON)}$ | $V_{COM} = V_{CC}$ or GND, Switch ON, See Figure 19 | 25°C | 2.5 V | | 14 | | pF |
| Digital input capacitance | C_{IN} | $V_{IN} = V_{CC}$ or GND, See Figure 19 | 25°C | 2.5 V | | 3 | | pF |
| Bandwidth | BW | $R_L = 50 \Omega$, Switch ON, See Figure 21 | 25°C | 2.5 V | | 300 | | MHz |
| OFF isolation | O_{ISO} | $R_L = 50 \Omega$, $f = 10 \text{ MHz}$, Switch OFF, See Figure 22 | 25°C | 2.5 V | | -68 | | dB |
| Crosstalk | X_{TALK} | $R_L = 50 \Omega$, $f = 10 \text{ MHz}$, Switch ON, See Figure 23 | 25°C | 2.5 V | | -66 | | 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 | | 0.35% | | |
| Supply | | | | | | | | |
| Positive supply current | I_{CC} | $V_{IN} = V_{CC}$ or GND, Switch ON or OFF | 25°C | 2.7 V | 0.1 | | 1 | μA |
| | | | Full | | | | 5 | |

6.8 Electrical Characteristics For 1.8-V Supply⁽¹⁾

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

| PARAMETER | SYMBOL | TEST CONDITIONS | T_A | V_{CC} | MIN | TYP | MAX | UNIT | |
|--|-------------------|--|--|----------|----------------------|----------------------|----------|---------------|----|
| Analog Switch | | | | | | | | | |
| Analog signal range | V_{COM}, V_{NO} | | | | 0 | | V_{CC} | V | |
| ON-state resistance | r_{on} | $0 \leq V_{NO} \leq V_{CC}$, $I_{COM} = -4\text{ mA}$, | Switch ON, See Figure 16 | 25°C | 1.65 V | 85 | | Ω | |
| | | | | Full | | 120 | | | |
| ON-state resistance match between channels | Δr_{on} | $V_{NO} = 1.15\text{ V}$, $I_{COM} = -4\text{ mA}$, | Switch ON, See Figure 16 | 25°C | 1.65 V | 0.9 | | Ω | |
| | | | | Full | | 2 | | | |
| ON-state resistance flatness | $r_{on(Flat)}$ | $0 \leq V_{NO} \leq V_{CC}$, $I_{COM} = -4\text{ mA}$, | Switch ON, See Figure 16 | 25°C | 1.65 V | 75 | | Ω | |
| | | | | Full | | 85 | | | |
| NO OFF leakage current | $I_{NO(OFF)}$ | $V_{NO} = 0.3\text{ V}$, $V_{COM} = 1.65\text{ V}$, or $V_{NO} = 1.65\text{ V}$, $V_{COM} = 0.3\text{ V}$, | Switch OFF, See Figure 17 | 25°C | 1.95 V | -30 | -6 | 30 | nA |
| | | | | Full | | -40 | | 40 | |
| COM OFF leakage current | $I_{COM(OFF)}$ | $V_{COM} = 0.3\text{ V}$, $V_{NO} = 1.65\text{ V}$, or $V_{COM} = 1.65\text{ V}$, $V_{NO} = 0.3\text{ V}$, | Switch OFF, See Figure 17 | 25°C | 1.95 V | -50 | -7 | 50 | nA |
| | | | | Full | | -50 | | 50 | |
| NO ON leakage current | $I_{NO(ON)}$ | $V_{NO} = 0.3\text{ V}$, $V_{COM} = \text{Open}$, or $V_{NO} = 1.65\text{ V}$, $V_{COM} = \text{Open}$, | Switch ON, See Figure 18 | 25°C | 1.95 V | -40 | 7 | 40 | nA |
| | | | | Full | | -40 | | 40 | |
| COM ON leakage current | $I_{COM(ON)}$ | $V_{COM} = 0.3\text{ V}$, $V_{NO} = \text{Open}$, or $V_{COM} = 1.65\text{ V}$, $V_{NO} = \text{Open}$, | Switch ON, See Figure 18 | 25°C | 1.95 V | -70 | -8.5 | 70 | nA |
| | | | | Full | | -70 | | 70 | |
| Digital Control Input (IN) | | | | | | | | | |
| Input logic high | V_{IH} | | Full | | $V_{CC} \times 0.65$ | | 5.5 | V | |
| Input logic low | V_{IL} | | Full | | 0 | $V_{CC} \times 0.35$ | | V | |
| Input leakage current | I_{IH}, I_{IL} | $V_{IN} = 5.5\text{ V or }0$ | 25°C | 1.95 V | -0.1 | 0.05 | 0.1 | μA | |
| | | | Full | | -1 | | 1 | | |

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

| PARAMETER | SYMBOL | TEST CONDITIONS | T_A | V_{CC} | MIN | TYP | MAX | UNIT | |
|------------------------------|----------------|---|-------|------------------------|-----|------|------|------|---------------|
| Dynamic | | | | | | | | | |
| Turn-on time | t_{ON} | $V_{COM} = 1.3\text{ V}$, $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$, See Figure 20 | 25°C | 1.8 V | 9.3 | 10.4 | 11.5 | ns | |
| | | | Full | 1.65 V to 1.95 V | 6.8 | | 12.9 | | |
| Turn-off time | t_{OFF} | $V_{COM} = 1.3\text{ V}$, $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$, See Figure 20 | 25°C | 1.8 V | 3.3 | 4.3 | 5.2 | ns | |
| | | | Full | 1.65 V to 1.95 V | 2.4 | | 6.5 | | |
| Charge injection | Q_C | $V_{GEN} = 0$, $R_{GEN} = 0$, $C_L = 0.1\text{ nF}$, See Figure 24 | 25°C | 1.8 V | | 0.5 | | pC | |
| NO OFF capacitance | $C_{NO(OFF)}$ | $V_{NO} = V_{CC}$ or GND, Switch OFF, See Figure 19 | 25°C | 1.8 V | | 6 | | pF | |
| COM OFF capacitance | $C_{COM(OFF)}$ | $V_{COM} = V_{CC}$ or GND, Switch OFF, See Figure 19 | 25°C | 1.8 V | | 6 | | pF | |
| NO ON capacitance | $C_{NO(ON)}$ | $V_{NO} = V_{CC}$ or GND, Switch ON, See Figure 19 | 25°C | 1.8 V | | 14.5 | | pF | |
| COM ON capacitance | $C_{COM(ON)}$ | $V_{COM} = V_{CC}$ or GND, Switch ON, See Figure 19 | 25°C | 1.8 V | | 14.5 | | pF | |
| Digital input capacitance | C_{IN} | $V_{IN} = V_{CC}$ or GND, See Figure 19 | 25°C | 1.8 V | | 3 | | pF | |
| Bandwidth | BW | $R_L = 50\ \Omega$, Switch ON, See Figure 21 | 25°C | 1.8 V | | 293 | | MHz | |
| OFF isolation | O_{ISO} | $R_L = 50\ \Omega$, $f = 10\text{ MHz}$, Switch OFF, See Figure 22 | 25°C | 1.8 V | | -68 | | dB | |
| Crosstalk | X_{TALK} | $R_L = 50\ \Omega$, $f = 10\text{ MHz}$, Switch ON, See Figure 23 | 25°C | 1.8 V | | -66 | | dB | |
| Total harmonic distortion | THD | $R_L = 10\text{ k}\Omega$, $C_L = 50\text{ pF}$, $f = 20\text{ Hz to }20\text{ kHz}$, See Figure 25 | 25°C | 1.8 V | | 2.7% | | | |
| Supply | | | | | | | | | |
| Positive supply current | I_{CC} | $V_{IN} = V_{CC}$ or GND, Switch ON or OFF | 25°C | 1.95 V | 0.1 | | | 1 | μA |
| | | | Full | | | | | 5 | |

6.9 Typical Performance

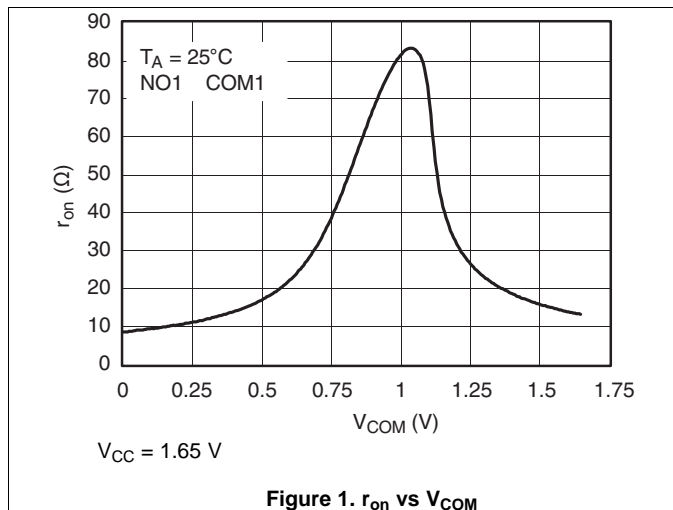


Figure 1. r_{on} vs V_{COM}

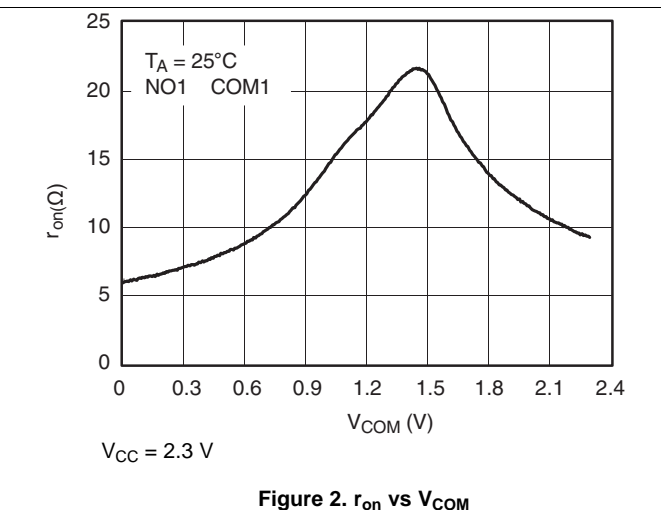


Figure 2. r_{on} vs V_{COM}

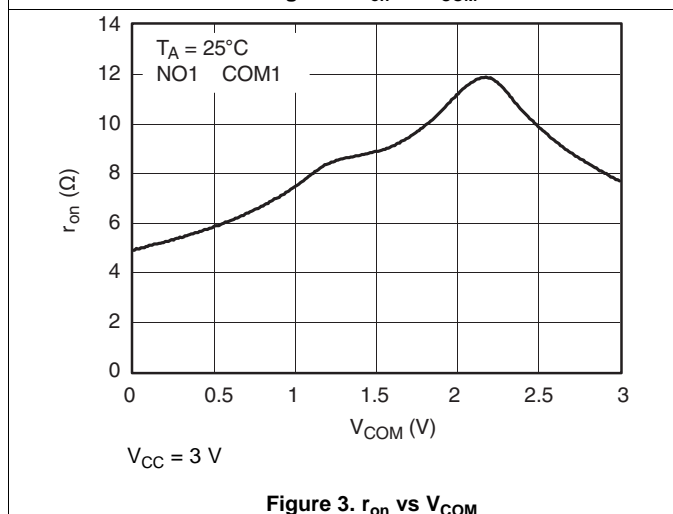


Figure 3. r_{on} vs V_{COM}

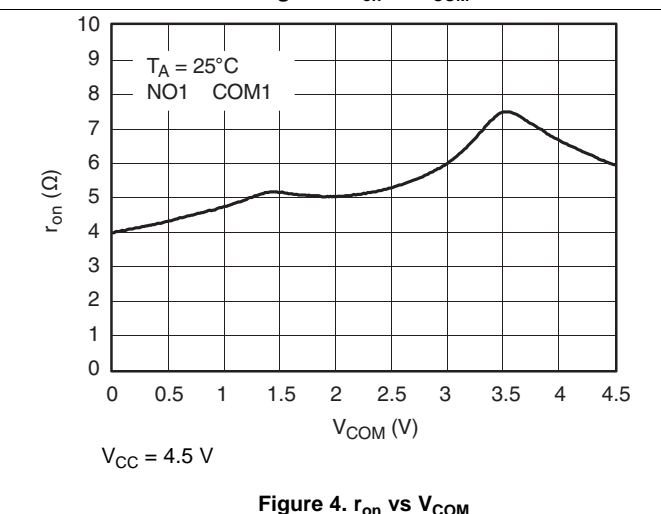


Figure 4. r_{on} vs V_{COM}

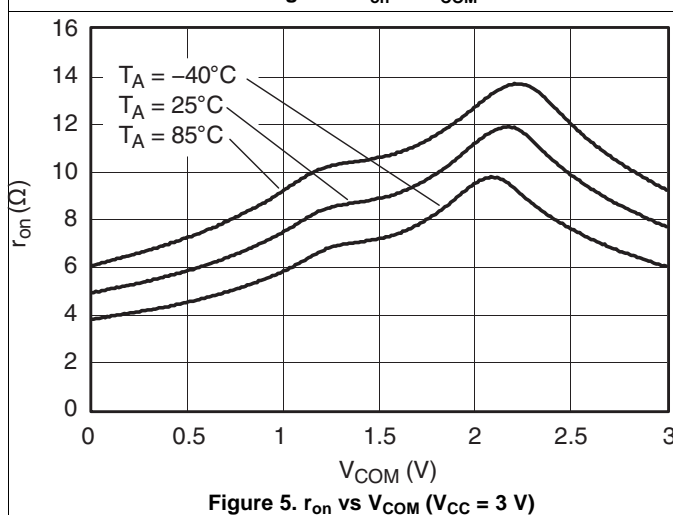


Figure 5. r_{on} vs V_{COM} ($V_{CC} = 3$ V)

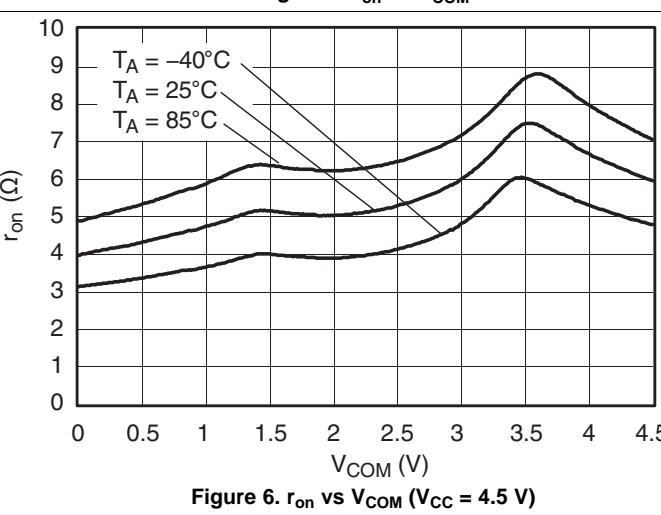


Figure 6. r_{on} vs V_{COM} ($V_{CC} = 4.5$ V)

Typical Performance (continued)

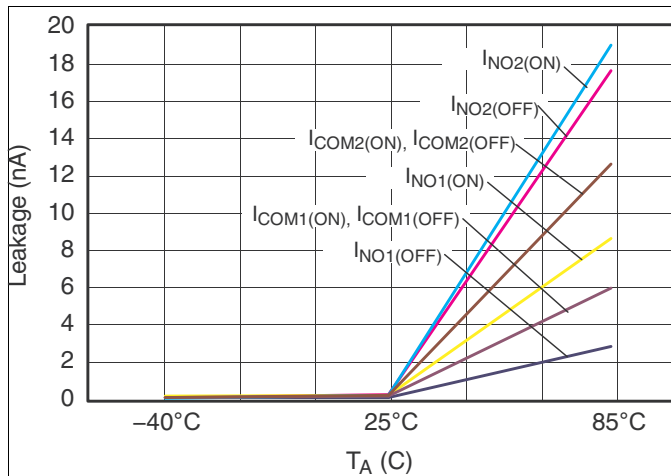


Figure 7. Leakage Current vs Temperature

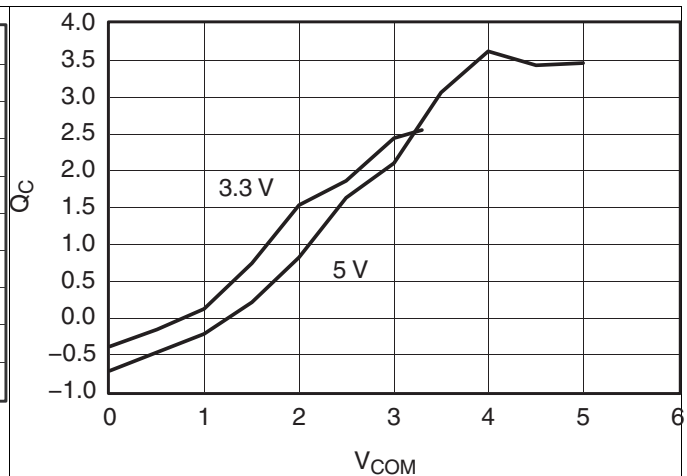


Figure 8. Charge Injection (QC) vs VCOM

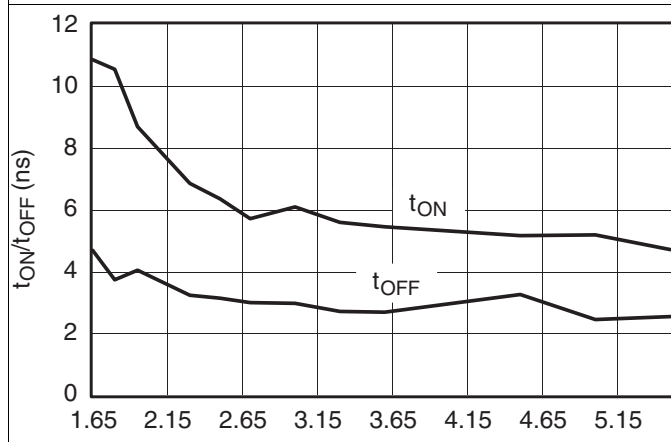


Figure 9. tON and tOFF vs VCC

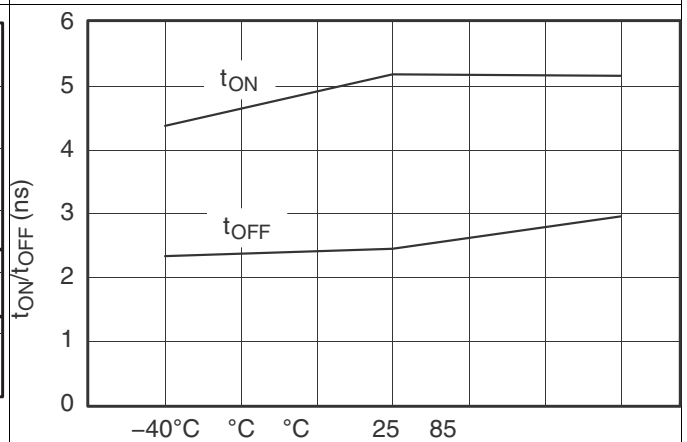


Figure 10. tON and tOFF vs Temperature (VCC = 5 V)

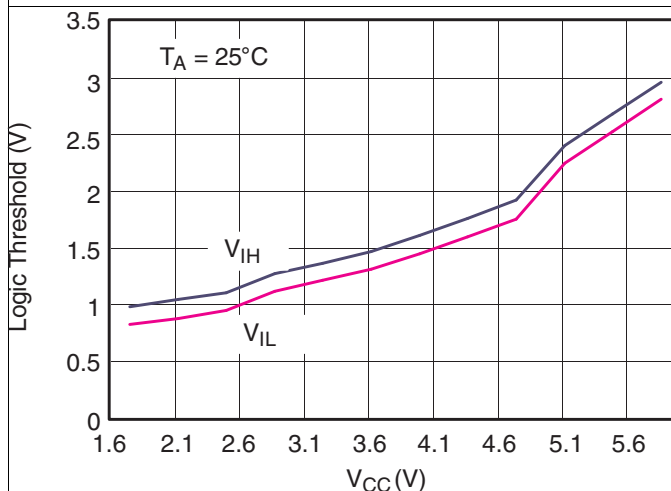


Figure 11. Logic Threshold vs VCC

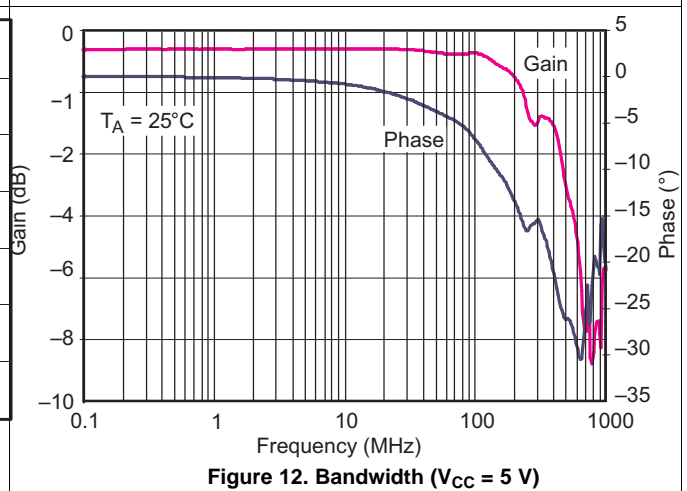


Figure 12. Bandwidth (VCC = 5 V)

Typical Performance (continued)

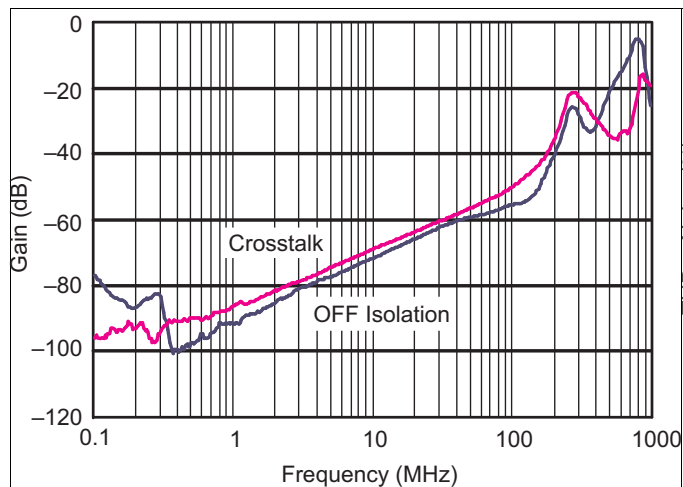


Figure 13. OFF Isolation and Crosstalk ($V_{CC} = 5\text{ V}$)

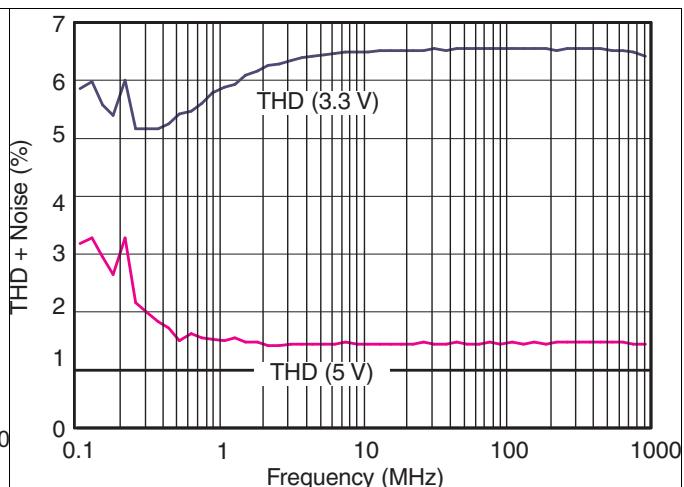


Figure 14. Total Harmonic Distortion vs Frequency

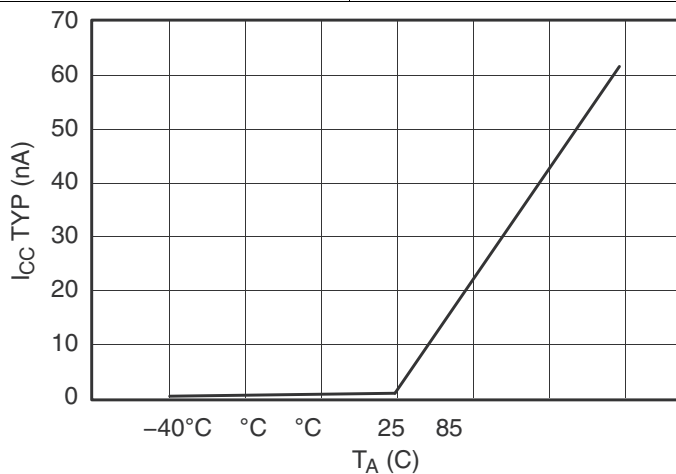


Figure 15. Power-Supply Current vs Temperature ($V_{CC} = 5\text{ V}$)

7 Parameter Measurement Information

Table 1. Parameter Description

| SYMBOL | DESCRIPTION |
|------------------|--|
| V_{COM} | Voltage at COM |
| V_{NO} | Voltage at NO |
| r_{on} | Resistance between COM and NO ports when the channel is ON |
| Δr_{on} | Difference of r_{on} between channels in a specific device |
| $r_{on(Flat)}$ | Difference between the maximum and minimum value of r_{on} 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 |
| $I_{NO(ON)}$ | Leakage current measured at the NO port, with the corresponding channel (NO to COM) in the ON state and the output (COM) open |
| $I_{COM(OFF)}$ | Leakage current measured at the COM port, with the corresponding channel (COM to NO) in the OFF state |
| $I_{COM(ON)}$ | Leakage current measured at the COM port, with the corresponding channel (COM to NO) in the ON state and the output (NO) open |
| 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_{IN} | Voltage at the control input (IN) |
| I_{IH}, I_{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. |
| 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 |
| $C_{COM(OFF)}$ | Capacitance at the COM port when the corresponding channel (COM to NO) is OFF |
| $C_{COM(ON)}$ | Capacitance at the COM port when the corresponding channel (COM to NO) is ON |
| C_{IN} | Capacitance of 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 (NO to COM) in the OFF state. |
| X_{TALK} | Crosstalk is a measurement of unwanted signal coupling from an ON channel to an adjacent ON channel (NC1 to NC2). This is measured in a specific frequency and in dB. |
| BW | Bandwidth of the switch. This is the frequency in which the gain of an ON channel is –3 dB below the DC gain. |
| THD | Total harmonic distortion is defined as the ratio of the root mean square (RMS) value of the second, third, and higher harmonics to the magnitude of fundamental harmonic. |
| I_{CC} | Static power-supply current with the control (IN) pin at V_{CC} or GND |

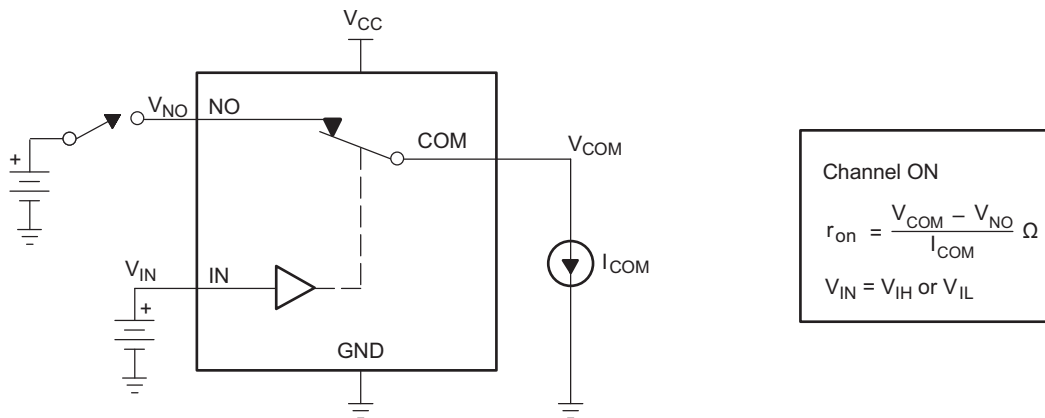


Figure 16. ON-State Resistance (r_{on})

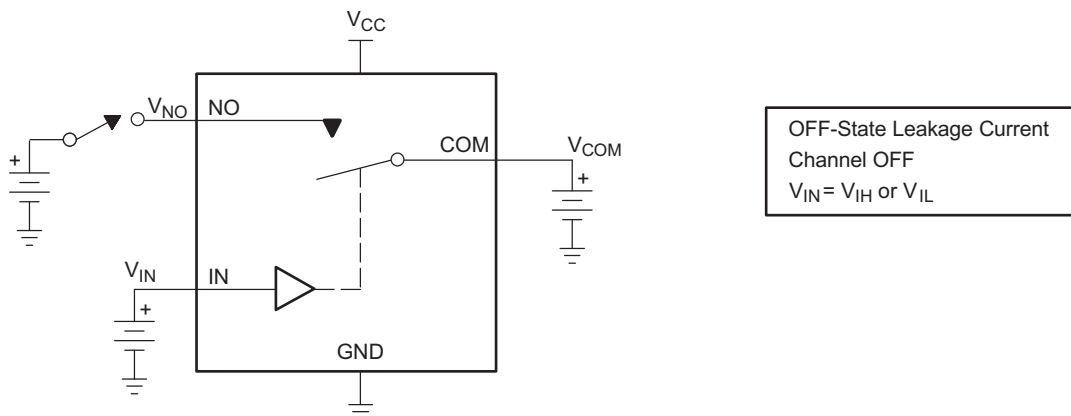


Figure 17. OFF-State Leakage Current ($I_{COM(OFF)}$, $I_{NO(OFF)}$)

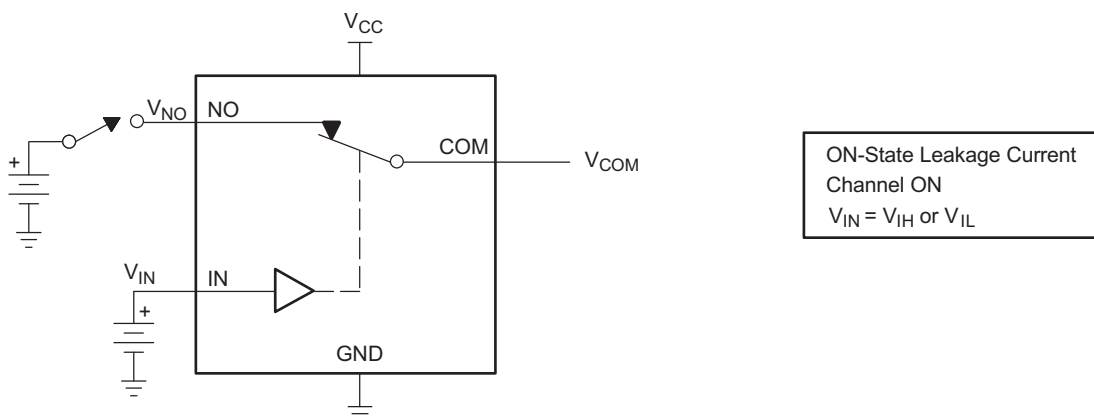


Figure 18. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NO(ON)}$)

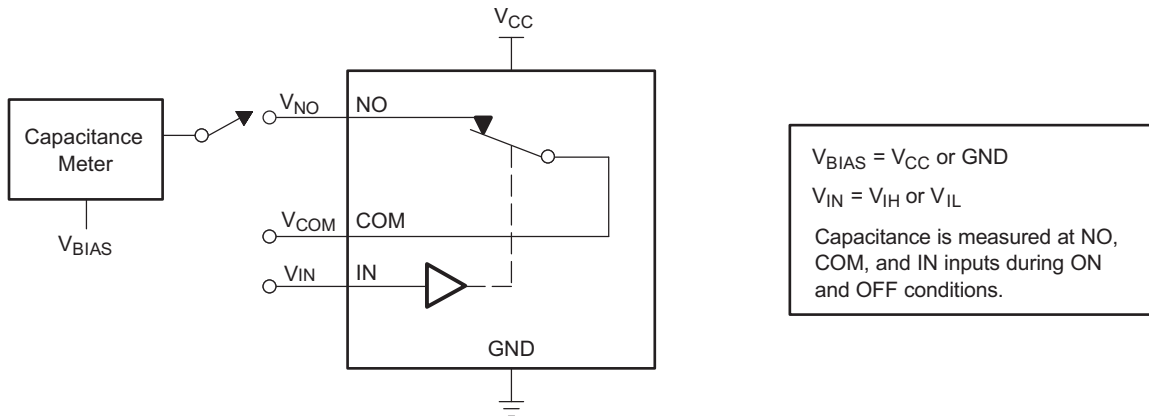
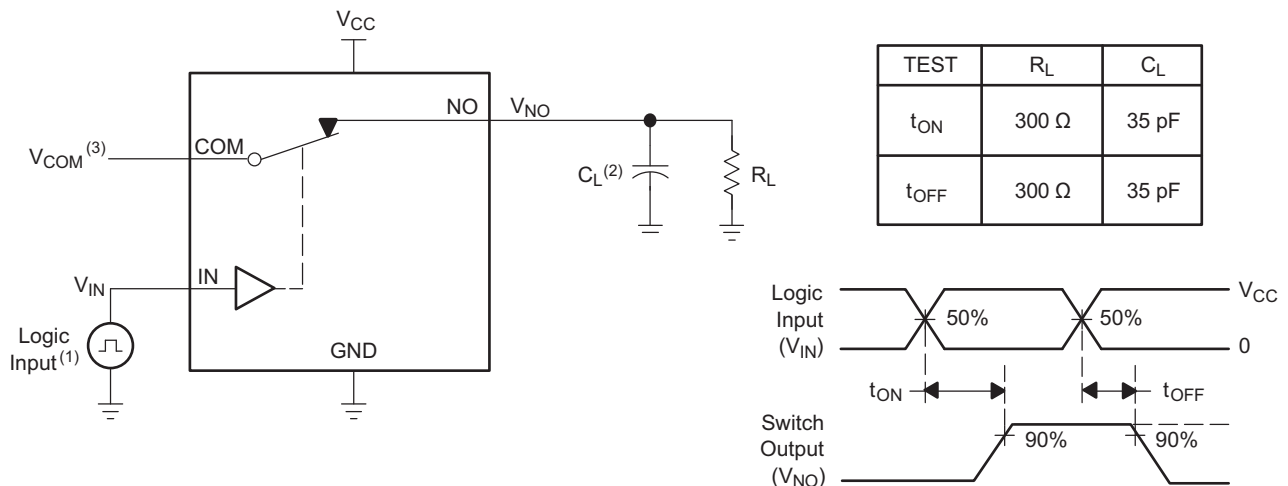


Figure 19. Capacitance (C_{IN} , $C_{COM(OFF)}$, $C_{COM(ON)}$, $C_{NO(OFF)}$, $C_{NO(ON)}$)



- (1) 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.
- (2) C_L includes probe and jig capacitance.
- (3) See [Electrical Characteristics tables](#) for V_{COM} .

Figure 20. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

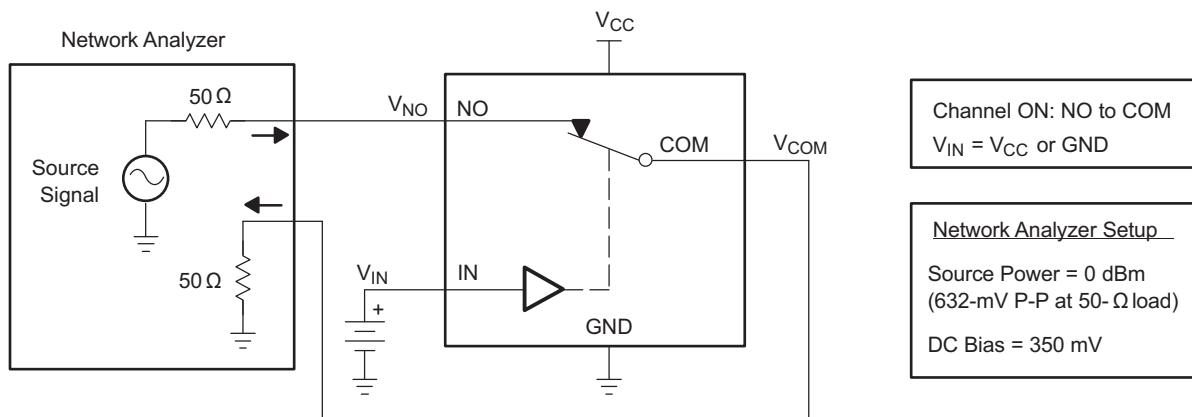


Figure 21. Bandwidth (BW)

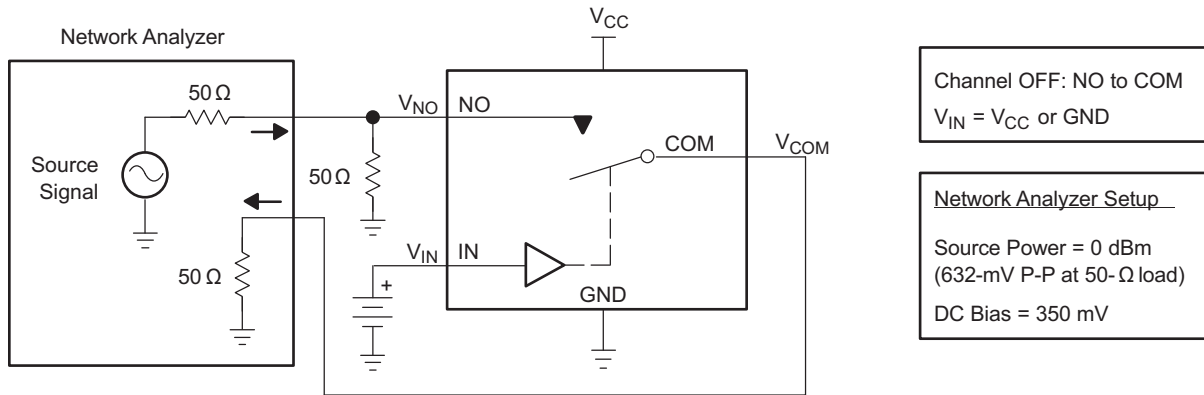


Figure 22. OFF Isolation (O_{ISO})

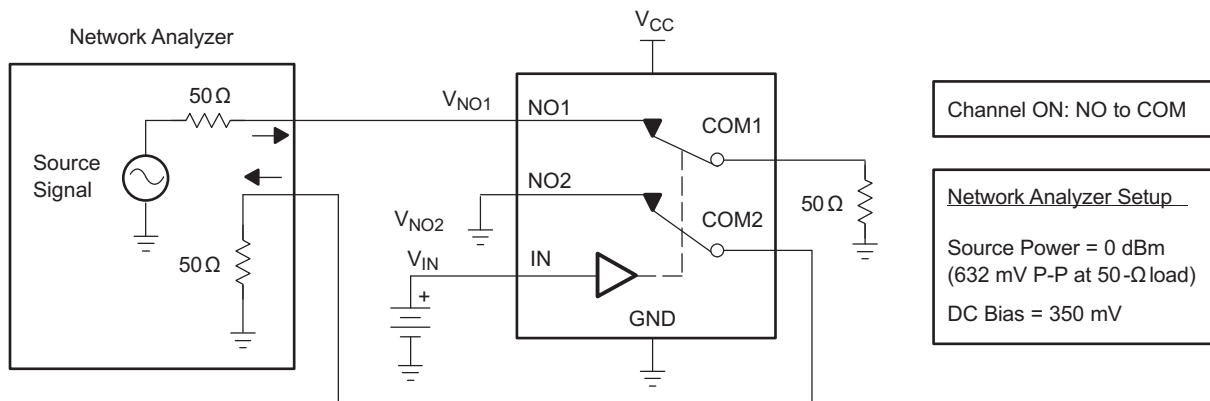
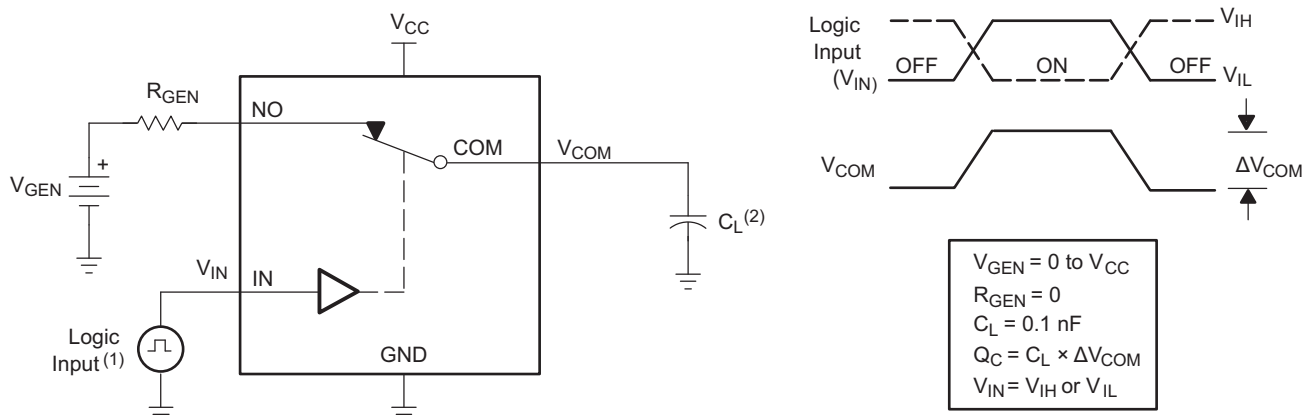
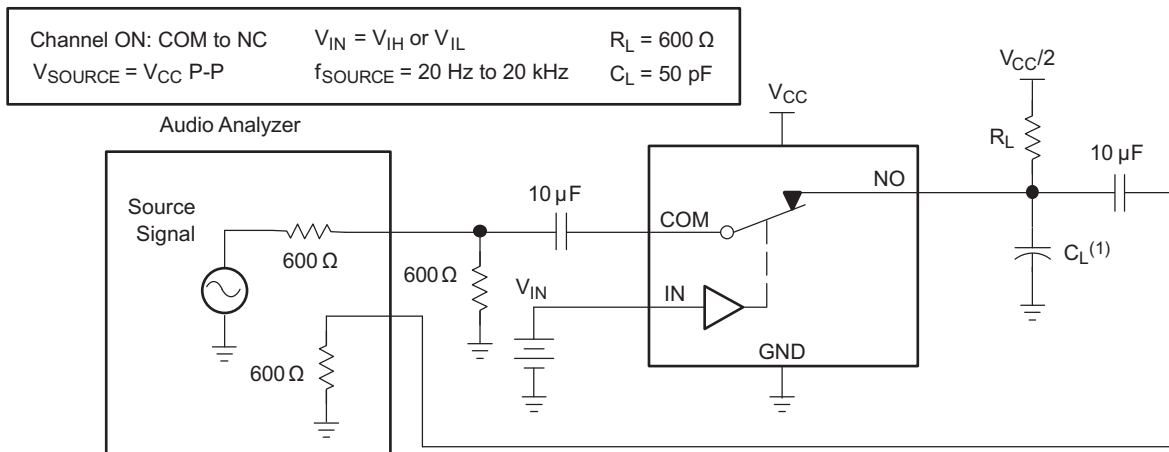


Figure 23. Crosstalk (X_{TALK})



- (1) 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.
- (2) C_L includes probe and jig capacitance.

Figure 24. Charge Injection (Q_C)



(1) C_L includes probe and jig capacitance.

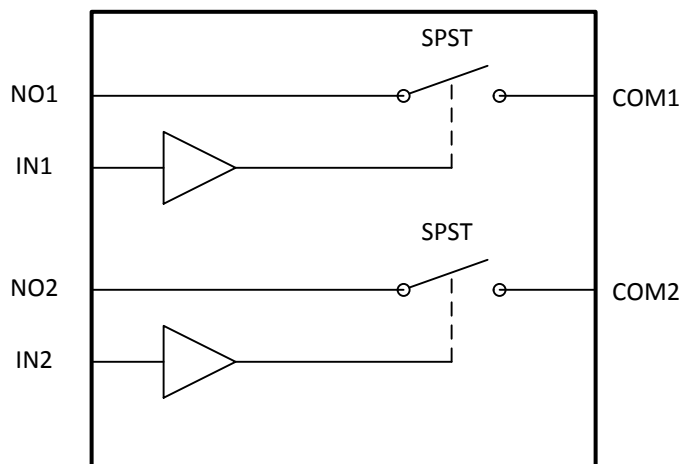
Figure 25. Total Harmonic Distortion (THD)

8 Detailed Description

8.1 Overview

The TS5A2066 device is a 2-channel single-pole single-throw (1:1 SPST) analog switch that is designed to operate from 1.65 V to 5.5 V. This device can handle both digital and analog signals, and signals up to V_{CC} can be transmitted in either direction

8.2 Functional Block Diagram



8.3 Feature Description

5-V tolerant control inputs allow 5-V logic levels to be present on the IN pin irrespective of the voltage on VCC pin.

Low ON-resistance and THD performance allows minimal signal distortion through device.

8.4 Device Functional Modes

Table 2 shows the functional modes for TS5A23166.

Table 2. Function Table

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

9 Application and Implementation

NOTE

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

9.1 Application Information

The TS5A2066 2-channel, 1:1 SPST analog switch is a basic component that could be used in any electrical system design that signal isolation.

9.2 Typical Application

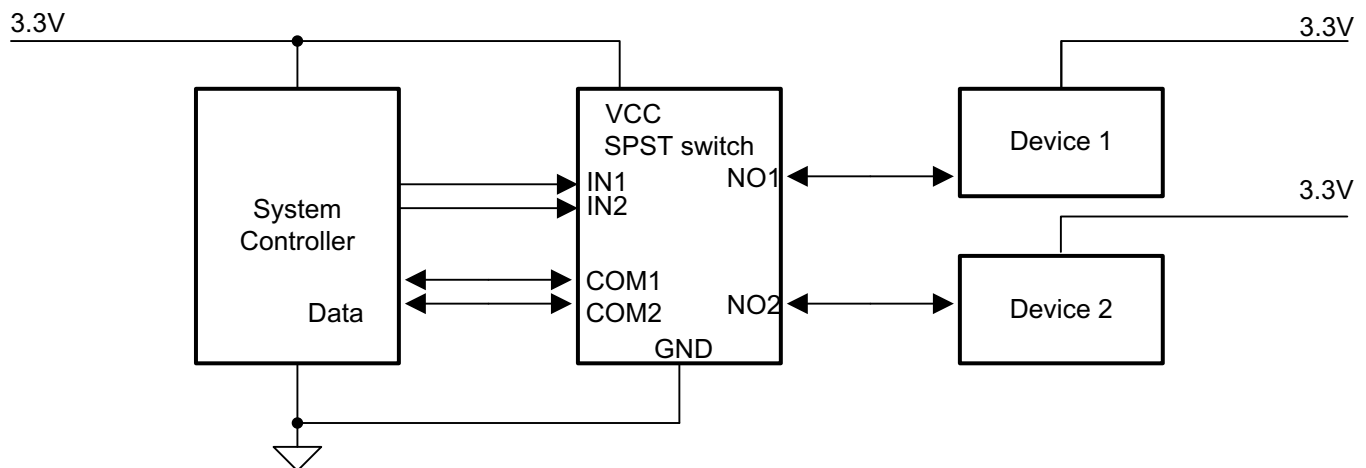


Figure 26. Typical Application Circuit

9.2.1 Design Requirements

Ensure that all of the signals passing through the switch are within the specified ranges in the recommended operating conditions to ensure proper performance.

9.2.2 Detailed Design Procedure

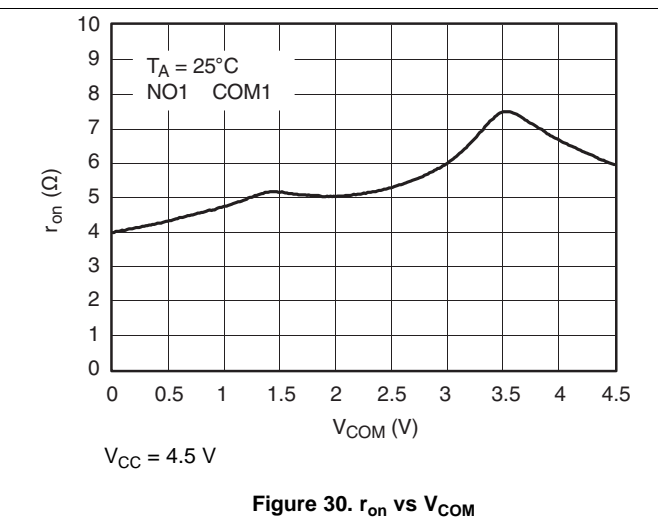
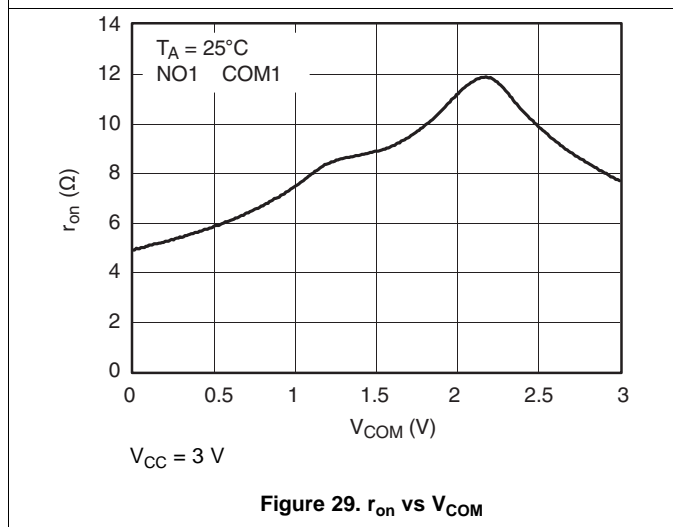
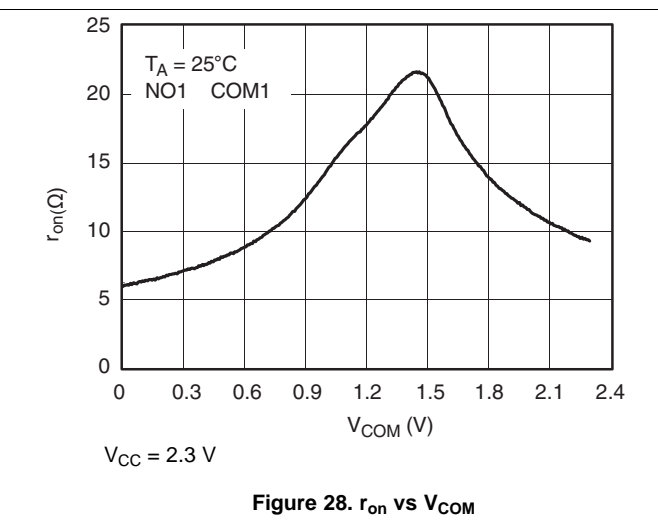
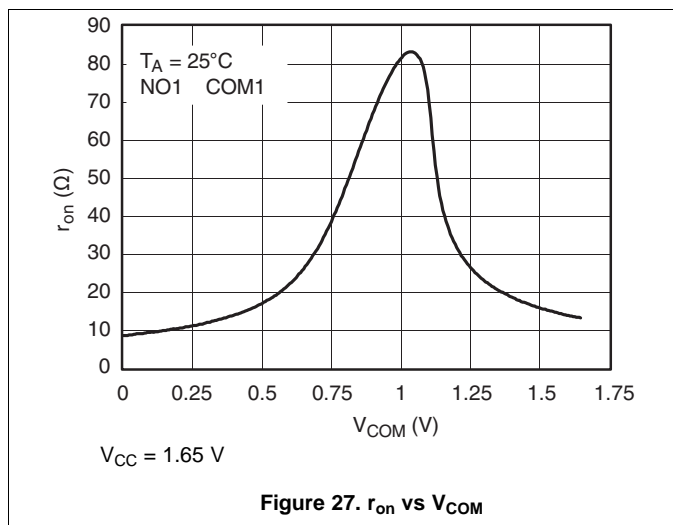
The TS5A2066 can be properly operated without any external components.

Unused signal path pins COM or NO maybe left floating or connected to ground through a 50-Ω resistor to prevent signal reflections back into the device.

TI recommends that the digital control pins (INX) be pulled up to VCC or down to GND to avoid undesired switch positions that could result from the floating pin. Leaving the logic pins floating may increase I_{CC} . Refer to the TI application report, [Implications of Slow or Floating CMOS Inputs \(SCBA004\)](#), for further details.

Typical Application (continued)

9.2.3 Application Curves



10 Power Supply Recommendations

Proper power-supply sequencing is recommended for all CMOS devices. Do not exceed the absolute maximum ratings, because stresses beyond the listed ratings can cause permanent damage to the device. Always sequence VCC on first, followed by NO, NC, or COM. Although it is not required, power-supply bypassing improves noise margin and prevents switching noise propagation from the VCC supply to other components. A 0.1- μ F capacitor, connected from VCC to GND, is adequate for most applications. Copyright

11 Layout

11.1 Layout Guidelines

High-speed switches require proper layout and design procedures for optimum performance. Reduce stray inductance and capacitance by keeping traces short and wide. Ensure that bypass capacitors are as close to the device as possible. Use large ground planes where possible. Use large ground planes where possible.

11.2 Layout Example

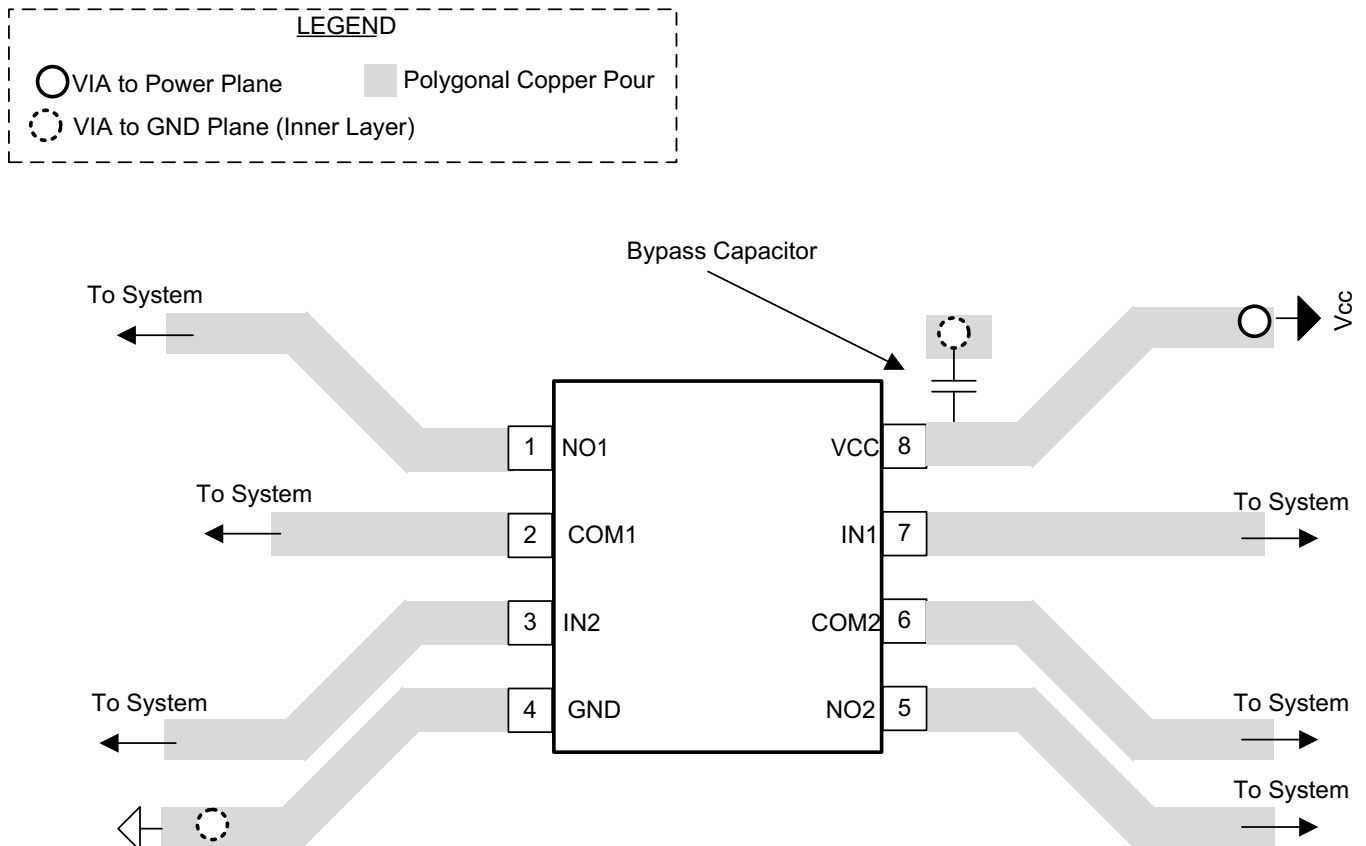


Figure 31. Layout Example

12 Device and Documentation Support

12.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

12.2 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

TI E2E™ Online Community *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

12.3 Trademarks

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

12.4 Electrostatic Discharge Caution



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

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

12.5 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| TS5A2066DCTR | ACTIVE | SM8 | DCT | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | JAG Z | Samples |
| TS5A2066DCUR | ACTIVE | VSSOP | DCU | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | JAGR | Samples |
| TS5A2066DCURE4 | ACTIVE | VSSOP | DCU | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | JAGR | Samples |
| TS5A2066DCURG4 | ACTIVE | VSSOP | DCU | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | JAGR | Samples |
| TS5A2066YZPR | ACTIVE | DSBGA | YZP | 8 | 3000 | RoHS & Green | SNAGCU | Level-1-260C-UNLIM | -40 to 85 | J4N | 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.

OBSELETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

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

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TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

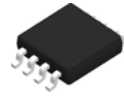

*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TS5A2066DCTR | SM8 | DCT | 8 | 3000 | 180.0 | 13.0 | 3.35 | 4.5 | 1.55 | 4.0 | 12.0 | Q3 |
| TS5A2066DCUR | VSSOP | DCU | 8 | 3000 | 180.0 | 8.4 | 2.25 | 3.35 | 1.05 | 4.0 | 8.0 | Q3 |
| TS5A2066DCURG4 | VSSOP | DCU | 8 | 3000 | 180.0 | 8.4 | 2.25 | 3.35 | 1.05 | 4.0 | 8.0 | Q3 |
| TS5A2066YZPR | DSBGA | YZP | 8 | 3000 | 178.0 | 9.2 | 1.02 | 2.02 | 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) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TS5A2066DCTR | SM8 | DCT | 8 | 3000 | 182.0 | 182.0 | 20.0 |
| TS5A2066DCUR | VSSOP | DCU | 8 | 3000 | 202.0 | 201.0 | 28.0 |
| TS5A2066DCURG4 | VSSOP | DCU | 8 | 3000 | 202.0 | 201.0 | 28.0 |
| TS5A2066YZPR | DSBGA | YZP | 8 | 3000 | 220.0 | 220.0 | 35.0 |



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NOTES:

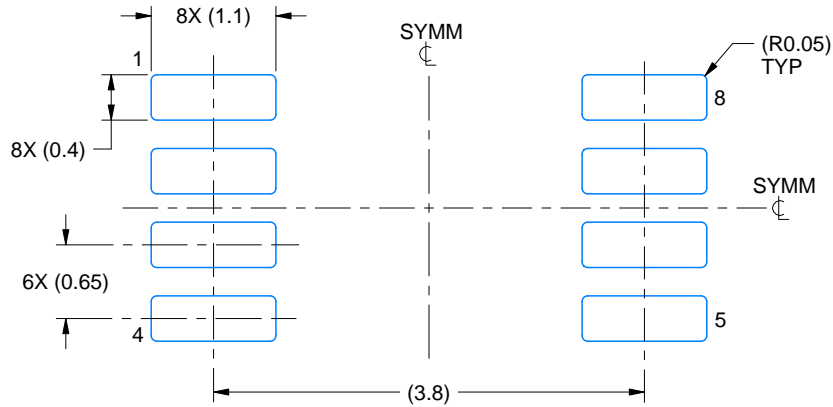
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate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

EXAMPLE BOARD LAYOUT

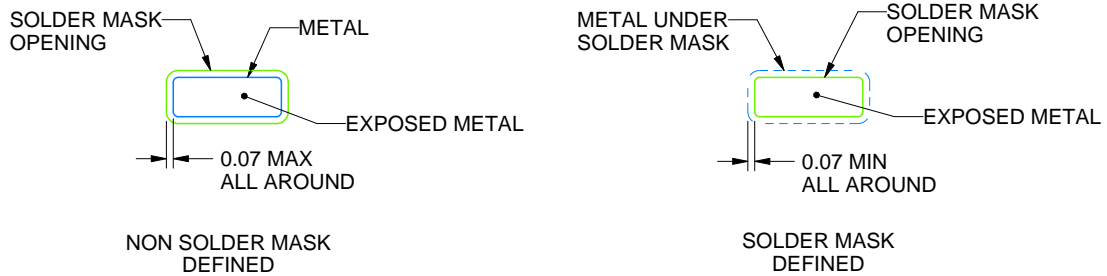
DCT0008A

SSOP - 1.3 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

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NOTES: (continued)

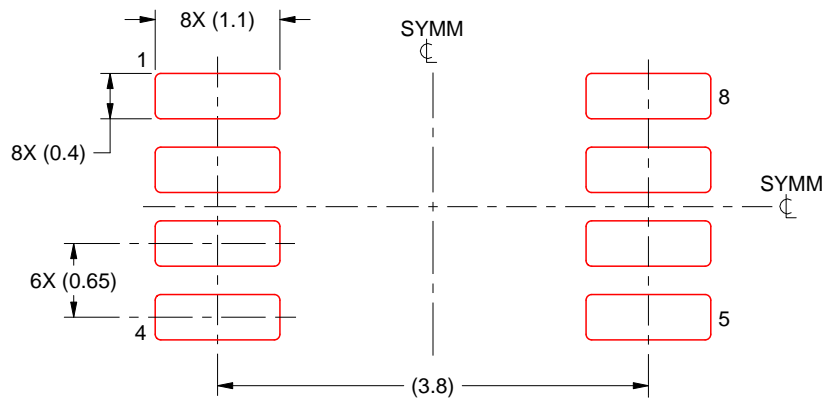
- 5. Publication IPC-7351 may have alternate designs.
- 6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DCT0008A

SSOP - 1.3 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

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NOTES: (continued)

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

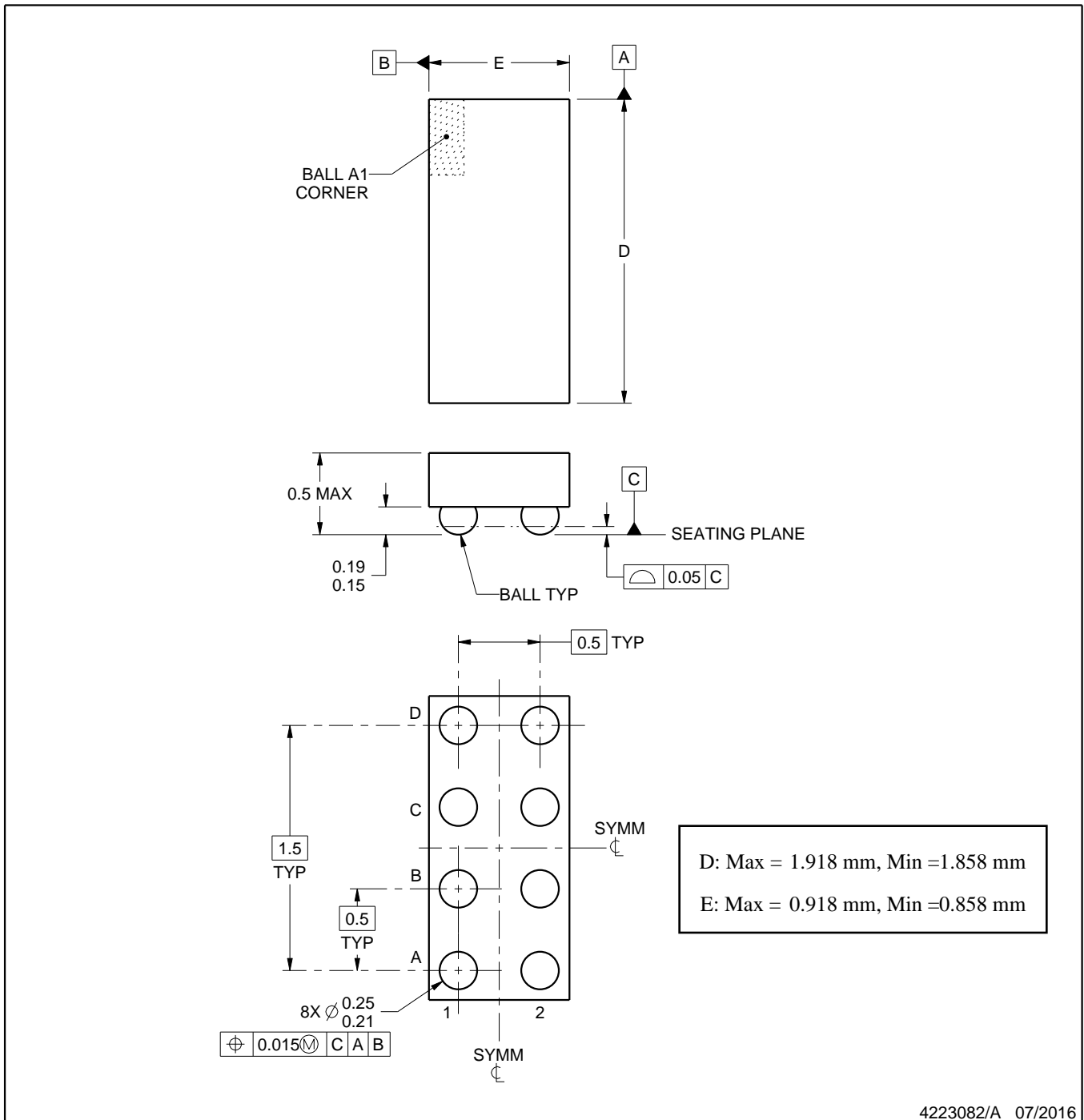
YZP0008



PACKAGE OUTLINE

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



4223082/A 07/2016

NOTES:

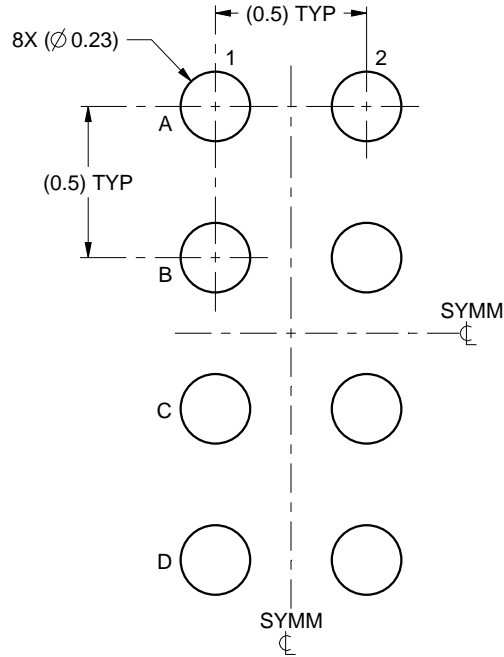
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

EXAMPLE BOARD LAYOUT

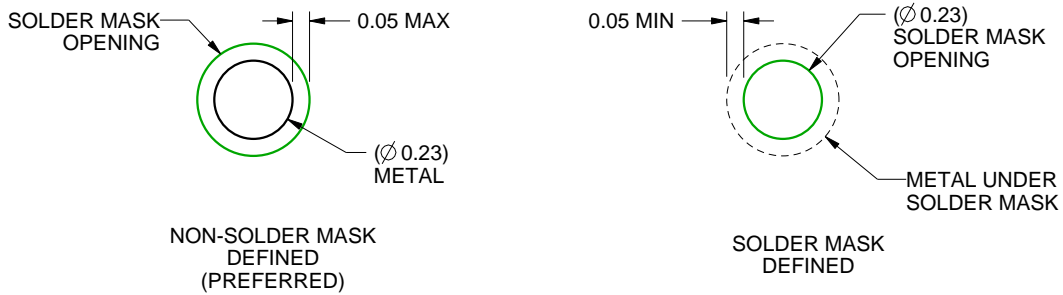
YZP0008

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE
SCALE:40X



SOLDER MASK DETAILS
NOT TO SCALE

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NOTES: (continued)

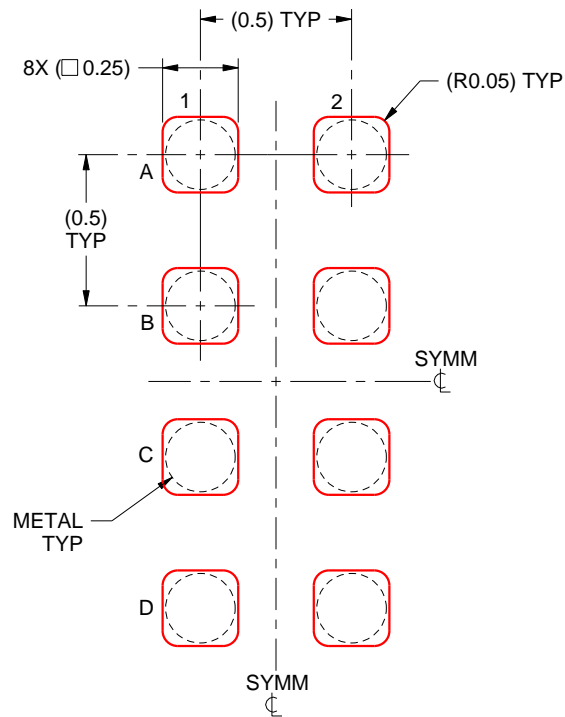
3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SNVA009 (www.ti.com/lit/snva009).

EXAMPLE STENCIL DESIGN

YZP0008

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE:40X

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NOTES: (continued)

4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release.

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.

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