



**THE DATASHEET OF  
TS5A3359DCUR**



## TS5A3359 1-Ω SP3T Bidirectional Analog Switch 5-V/3.3-V Single-Channel 3:1 Multiplexer and Demultiplexer

### 1 Features

- Isolation in Power-Down Mode,  $V_{CC} = 0$
- Specified Break-Before-Make Switching
- Low ON-State Resistance (1 Ω)
- Control Inputs Are 5.5-V Tolerant
- Low Charge Injection (5 pC  $V_{CC} = 1.8$  V)
- 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

- 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

### 3 Description

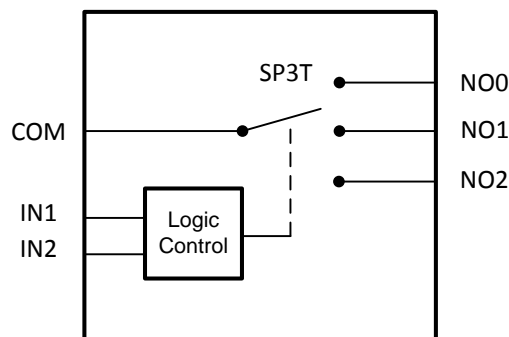
The TS5A3359 device is a bidirectional, single channel, single-pole triple-throw (SP3T) analog switch that is designed to operate from 1.65 V to 5.5 V. This device provides a signal switching solution while maintaining excellent signal integrity, which makes the TS5A3359 suitable for a wide range of applications in various markets including personal electronics, test and measurement equipment, and portable instrumentation. The device maintains the signal integrity by its low ON-state resistance, excellent ON-state resistance matching, and total harmonic distortion (THD) performance. To prevent signal distortion during the transferring of a signal from one channel to another, the TS5A3359 device also has a specified break-before-make feature. The device consumes very low power and provides isolation when  $V_{CC} = 0$ .

#### Device Information<sup>(1)</sup>

PART NUMBER	PACKAGE	BODY SIZE (NOM)
TS5A33591	US8 (8)	2.30 mm × 2.00 mm
	DSBGA (8)	0.00 mm × 0.00 mm

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

#### Simplified Schematic



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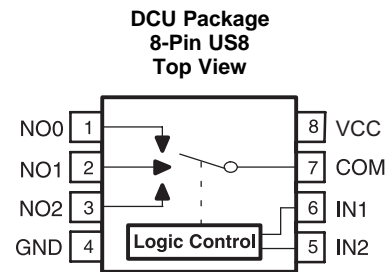
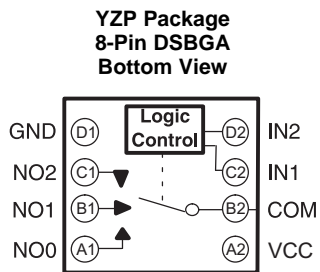
## 4 Revision History

Changes from Revision D (May 2015) to Revision E	Page
• Added $T_J$ Junction Temperature to the <i>Absolute Maximum Ratings</i> .....	4
• Changed Input leakage current UNIT value From: $\mu$ A To: nA in <i>Electrical Characteristics for 5-V Supply</i> .....	5

Changes from Revision C (June 2008) to Revision D	Page
• Added <i>ESD Ratings</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
• Changed YZP pinout numbering. ....	3

## 5 Pin Configuration and Functions



### Pin Functions

NAME	PIN		I/O	DESCRIPTION
	DCU	YZP		
NO0	1	A1	I/O	Normally open
NO1	2	B1	I/O	Normally open
NO2	3	C1	I/O	Normally open
GND	4	D1	—	Ground
IN2	5	D2	I	Digital control to connect COM to NO
IN1	6	C2	I	Digital control to connect COM to NO
COM	7	B2	I/O	Common
VCC	8	A2	—	Power supply

## 6 Specifications

### 6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)(2)</sup>

		MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage <sup>(3)</sup>	-0.5	6.5	V
V <sub>NO</sub> V <sub>COM</sub>	Analog voltage <sup>(3) (4) (5)</sup>	-0.5	V <sub>CC</sub> + 0.5	V
I <sub>K</sub>	Analog port diode current	V <sub>NO</sub> , V <sub>COM</sub> < 0		mA
I <sub>NO</sub> I <sub>COM</sub>	On-state switch current	V <sub>NO</sub> , V <sub>COM</sub> = 0 to V <sub>CC</sub>		mA
V <sub>I</sub>	Digital input voltage <sup>(3) (4)</sup>	-0.5	6.5	V
I <sub>IK</sub>	Digital input clamp current	V <sub>I</sub> < 0		mA
I <sub>CC</sub>	Continuous current through V <sub>CC</sub>		100	mA
I <sub>GND</sub>	Continuous current through GND	-100	100	mA
T <sub>stg</sub>	Storage temperature	-65	150	°C
T <sub>J</sub>	Junction temperature		150	°C

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum
- (3) All voltages are with respect to ground, unless otherwise specified.
- (4) 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 <sub>(ESD)</sub>	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins <sup>(1)</sup>	V
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins <sup>(2)</sup>	
		±2000	
		±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 <sub>CC</sub>	Analog voltage	1.65	5.5	V
V <sub>NO</sub> V <sub>COM</sub>		0	V <sub>CC</sub>	V
V <sub>I</sub>	Digital input voltage	0	V <sub>CC</sub>	V

### 6.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>	TS5A3359		UNIT	
	DCU (US8)	YZP (DSBGA)		
	8 PINS	8 PINS		
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	204.2	105.8	°C/W
R <sub>θJC(top)</sub>	Junction-to-case (top) thermal resistance	76.2	1.6	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	82.9	10.8	°C/W
ψ <sub>JT</sub>	Junction-to-top characterization parameter	7.6	3.1	°C/W
ψ <sub>JB</sub>	Junction-to-board characterization parameter	82.5	10.8	°C/W

- (1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, [SPRA953](#).

## 6.5 Electrical Characteristics for 5-V Supply

 $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$ ,  $T_A = -40^\circ\text{C to } 85^\circ\text{C}$  (unless otherwise noted)<sup>(1)</sup>

PARAMETER		TEST CONDITIONS		$T_A$	$V_{CC}$	MIN	TYP	MAX	UNIT	
<b>ANALOG SWITCH</b>										
Analogue signal range	$V_{COM}, V_{NO}$					0		$V_{CC}$	V	
Peak ON resistance	$r_{peak}$	$0 \leq (V_{NO}) \leq V_{CC}$ , $I_{COM} = -100 \text{ mA}$ ,	Switch ON, See Figure 18	25°C	4.5 V		0.8	1.1	$\Omega$	
				Full			1.5			
ON-state resistance	$r_{on}$	$V_{NO} = 2.5 \text{ V}$ , $I_{COM} = -100 \text{ mA}$ ,	Switch ON, See Figure 18	25°C	4.5 V		0.7	0.9	$\Omega$	
				Full			1.1			
ON-state resistance match between channels	$\Delta r_{on}$	$V_{NO} = 2.5 \text{ V}$ , $I_{COM} = -100 \text{ mA}$ ,	Switch ON, See Figure 18	25°C	4.5 V		0.1	0.1	$\Omega$	
				Full			0.1			
ON-state resistance flatness	$r_{on(Flat)}$	$0 \leq (V_{NO}) \leq V_{CC}$ , $I_{COM} = -100 \text{ mA}$ ,	Switch ON, See Figure 18	25°C	4.5 V		0.15		$\Omega$	
				25°C			0.1	0.25		
				Full			0.25			
NO OFF leakage current	$I_{NO(OFF)}$	$V_{NO} = 1 \text{ V or } 4.5 \text{ V}$ , $V_{COM} = 1 \text{ V to } 4.5 \text{ V}$ ,	Switch OFF, See Figure 19	25°C	5.5 V		-20	5	20	nA
				Full			-150	150		
	$I_{NO(PWROFF)}$	$V_{NO} = 0 \text{ to } 5.5 \text{ V}$ , $V_{COM} = 5.5 \text{ V to } 0$ ,	Switch OFF, See Figure 19	25°C	0 V		-1	0.8	1	$\mu\text{A}$
				Full			-25	25		
NO ON leakage current	$I_{NO(ON)}$	$V_{NO} = 1 \text{ V or } 4.5 \text{ V}$ , $V_{COM} = \text{Open}$ ,	Switch ON, See Figure 19	25°C	5.5 V		-30	5	30	nA
				Full			-220	220		
COM OFF leakage current	$I_{COM(OFF)}$	$V_{NO} = 4.5 \text{ V or } 1 \text{ V}$ , $V_{COM} = 1 \text{ V or } 4.5 \text{ V}$ ,	Switch OFF, See Figure 19	25°C	5.5 V		-25	8	25	nA
				Full			-250	250		
	$I_{COM(PWROFF)}$	$V_{COM} = 0 \text{ to } 5.5 \text{ V}$ , $V_{NO} = 5.5 \text{ V to } 0$ ,	Switch OFF, See Figure 19	25°C	0 V		-8	0.1	8	$\mu\text{A}$
				Full			-50	50		
COM ON leakage current	$I_{COM(ON)}$	$V_{NO} = \text{Open}$ , $V_{COM} = 1 \text{ V or } 4.5 \text{ V}$ ,	Switch ON, See Figure 19	25°C	5.5 V		-30	5	30	nA
				Full			-220	220		
<b>DIGITAL CONTROL INPUTS (IN1, IN2)<sup>(2)</sup></b>										
Input logic high	$V_{IH}$			Full		2.4		5.5	V	
Input logic low	$V_{IL}$			Full		0		0.8	V	
Input leakage current	$I_{IH}, I_{IL}$	$V_I = 5.5 \text{ V or } 0$		25°C	5.5 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

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

**Electrical Characteristics for 5-V Supply (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)<sup>(1)</sup>

PARAMETER		TEST CONDITIONS		$T_A$	$V_{CC}$	MIN	TYP	MAX	UNIT
<b>DYNAMIC</b>									
Turnon time	$t_{ON}$	$V_{COM} = V_{CC}$ , $R_L = 50\ \Omega$ ,	$C_L = 35\text{ pF}$ , See <a href="#">Figure 22</a>	25°C	5 V	1	2.5	21	ns
				Full	4.5 V to 5.5 V	1		23.5	
Turnoff time	$t_{OFF}$	$V_{COM} = V_{CC}$ , $R_L = 50\ \Omega$ ,	$C_L = 35\text{ pF}$ , See <a href="#">Figure 22</a>	25°C	5 V	1	6	10.5	ns
				Full	4.5 V to 5.5 V	1		12	
Break-before-make time	$t_{BBM}$	$V_{NO} = V_{CC}$ , $R_L = 50\ \Omega$ ,	$C_L = 35\text{ pF}$ , See <a href="#">Figure 23</a>	25°C	5 V	0.5	8.5	18	ns
				Full	4.5 V to 5.5 V	0.5		23	
Charge injection	$Q_C$	$V_{GEN} = 0$ , $R_{GEN} = 0$ ,	$C_L = 1\text{ nF}$ , See <a href="#">Figure 27</a>	25°C	5 V		20		pC
NO OFF capacitance	$C_{NO(OFF)}$	$V_{NO} = V_{CC}$ or GND, Switch OFF,	See <a href="#">Figure 21</a>	25°C	5 V		18		pF
COM OFF capacitance	$C_{COM(OFF)}$	$V_{COM} = V_{CC}$ or GND, Switch OFF,	See <a href="#">Figure 21</a>	25°C	2.5 V		54		pF
NO ON capacitance	$C_{NO(ON)}$	$V_{NO} = V_{CC}$ or GND, Switch ON,	See <a href="#">Figure 21</a>	25°C	5 V		78		pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_{CC}$ or GND, Switch ON,	See <a href="#">Figure 21</a>	25°C	5 V		78		pF
Digital input capacitance	$C_I$	$V_I = V_{CC}$ or GND,	See <a href="#">Figure 21</a>	25°C	5 V		2.5		pF
Bandwidth	BW	$R_L = 50\ \Omega$ , Switch ON,	See <a href="#">Figure 24</a>	25°C	5 V		75		MHz
OFF isolation	$O_{ISO}$	$R_L = 50\ \Omega$ , $f = 1\text{ MHz}$ ,	Switch OFF, See <a href="#">Figure 25</a>	25°C	5 V		-64		dB
Crosstalk	$X_{TALK}$	$R_L = 50\ \Omega$ , $f = 1\text{ MHz}$ ,	Switch ON, See <a href="#">Figure 26</a>	25°C	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 <a href="#">Figure 28</a>	25°C	5 V		0.005%		
<b>SUPPLY</b>									
Positive supply current	$I_{CC}$	$V_I = V_{CC}$ or GND,	Switch ON or OFF	25°C	5.5 V		16	50	nA
				Full				1200	

## 6.6 Electrical Characteristics for 3.3-V Supply

 $V_{CC} = 3\text{ V to }3.6\text{ V}$ ,  $T_A = -40^\circ\text{C to }85^\circ\text{C}$  (unless otherwise noted)<sup>(1)</sup>

PARAMETER		TEST CONDITIONS		$T_A$	$V_{CC}$	MIN	TYP	MAX	UNIT		
<b>ANALOG SWITCH</b>											
Analogue signal range	$V_{COM}, V_{NO}$					0		$V_{CC}$	V		
Peak ON resistance	$r_{peak}$	$0 \leq (V_{NO}) \leq V_{CC}$ , $I_{COM} = -100\text{ mA}$ ,	Switch ON, See <a href="#">Figure 18</a>	25°C	3 V		1.3	1.6	$\Omega$		
				Full						2	
ON-state resistance	$r_{on}$	$V_{NO} = 2\text{ V}$ , $I_{COM} = -100\text{ mA}$ ,	Switch ON, See <a href="#">Figure 18</a>	25°C	3 V		1.2	1.6	$\Omega$		
				Full						1.8	
ON-state resistance match between channels	$\Delta r_{on}$	$V_{NO} = 2\text{ V}, 0.8\text{ V}$ , $I_{COM} = -100\text{ mA}$ ,	Switch ON, See <a href="#">Figure 18</a>	25°C	3 V		0.1	0.15	$\Omega$		
				Full						0.15	
ON-state resistance flatness	$r_{on(flat)}$	$0 \leq (V_{NO}) \leq V_{CC}$ , $I_{COM} = -100\text{ mA}$ ,	Switch ON, See <a href="#">Figure 18</a>	25°C	3 V		0.2		$\Omega$		
				25°C						0.2	0.35
				Full							
NO OFF leakage current	$I_{NO(OFF)}$	$V_{NO} = 1\text{ V or }3\text{ V}$ , $V_{COM} = 1\text{ V to }3\text{ V}$ ,	Switch OFF, See <a href="#">Figure 19</a>	25°C	3.6 V		-15	3	15		
				Full						-30	30
NO OFF leakage current	$I_{NO(PWROFF)}$	$V_{NO} = 0\text{ to }3.6\text{ V}$ , $V_{COM} = 3.6\text{ V to }0$ ,	Switch OFF, See <a href="#">Figure 19</a>	25°C	0 V		-1	0.2	1		
				Full						-10	10
NO ON leakage current	$I_{NO(ON)}$	$V_{NO} = 1\text{ V or }3\text{ V}$ , $V_{COM} = \text{Open}$ ,	Switch ON, See <a href="#">Figure 19</a>	25°C	3.6 V		-15	3	15		
				Full						-40	40
COM OFF leakage current	$I_{COM(OFF)}$	$V_{NO} = 0\text{ V to }3.6\text{ V}$ , $V_{COM} = 1\text{ V or }3.6\text{ V to }0$ , $V_{COM} = 3\text{ V}$ ,	Switch OFF, See <a href="#">Figure 19</a>	25°C	3.6 V		-15	3	15		
				Full						-75	75
				25°C						0 V	
Full	-20	20									
COM ON leakage current	$I_{COM(ON)}$	$V_{NO} = \text{Open}$ , $V_{COM} = 1\text{ V or }3\text{ V}$ ,	Switch ON, See <a href="#">Figure 19</a>	25°C	3.6 V		-15	4	15		
				Full						-40	40
<b>DIGITAL CONTROL INPUTS (IN1, IN2)<sup>(2)</sup></b>											
Input logic high	$V_{IH}$			Full			2	5.5	V		
Input logic low	$V_{IL}$			Full			0	0.8	V		
Input leakage current	$I_{IH}, I_{IL}$	$V_I = 5.5\text{ V or }0$		25°C	3.6 V		-2	2	$\text{nA}$		
				Full						-20	20

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

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

**Electrical Characteristics for 3.3-V Supply (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)<sup>(1)</sup>

PARAMETER		TEST CONDITIONS		$T_A$	$V_{CC}$	MIN	TYP	MAX	UNIT
<b>DYNAMIC</b>									
Turnon time	$t_{ON}$	$V_{COM} = V_{CC}$ , $R_L = 50\ \Omega$ ,	$C_L = 35\ \text{pF}$ , See <a href="#">Figure 22</a>	25°C	3.3 V	1	16	30.5	ns
				Full	3 V to 3.6 V	1		34	
Turnoff time	$t_{OFF}$	$V_{COM} = V_{CC}$ , $R_L = 50\ \Omega$ ,	$C_L = 35\ \text{pF}$ , See <a href="#">Figure 22</a>	25°C	3.3 V	1	6	11.5	ns
				Full	3 V to 3.6 V	1		12.5	
Break-before-make time	$t_{BBM}$	$V_{NO} = V_{CC}$ , $R_L = 50\ \Omega$ ,	$C_L = 35\ \text{pF}$ , See <a href="#">Figure 23</a>	25°C	3.3 V	0.5	13	26	ns
				Full	3 V to 3.6 V	0.5		30	
Charge injection	$Q_C$	$V_{GEN} = 0$ , $R_{GEN} = 0$ ,	$C_L = 1\ \text{nF}$ , See <a href="#">Figure 27</a>	25°C	3.3 V		12		pC
NO OFF capacitance	$C_{NO(OFF)}$	$V_{NO} = V_{CC}$ or GND, Switch OFF,	See <a href="#">Figure 21</a>	25°C	3.3 V		18		pF
COM OFF capacitance	$C_{COM(OFF)}$	$V_{COM} = V_{CC}$ or GND, Switch OFF,	See <a href="#">Figure 21</a>	25°C	3.3 V		55		pF
NO ON capacitance	$C_{NO(ON)}$	$V_{NO} = V_{CC}$ or GND, Switch ON,	See <a href="#">Figure 21</a>	25°C	3.3 V		78		pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_{CC}$ or GND, Switch ON,	See <a href="#">Figure 21</a>	25°C	3.3 V		78		pF
Digital input capacitance	$C_I$	$V_I = V_{CC}$ or GND,	See <a href="#">Figure 21</a>	25°C	3.3 V		2.5		pF
Bandwidth	BW	$R_L = 50\ \Omega$ , Switch ON,	See <a href="#">Figure 24</a>	25°C	3.3 V		73		MHz
OFF isolation	$O_{ISO}$	$R_L = 50\ \Omega$ , $f = 1\ \text{MHz}$ ,	Switch OFF, See <a href="#">Figure 25</a>	25°C	3.3 V		-64		dB
Crosstalk	$X_{TALK}$	$R_L = 50\ \Omega$ , $f = 1\ \text{MHz}$ ,	Switch ON, See <a href="#">Figure 26</a>	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 <a href="#">Figure 28</a>	25°C	3.3 V		0.01%		
<b>SUPPLY</b>									
Positive supply current	$I_{CC}$	$V_I = V_{CC}$ or GND,	Switch ON or OFF	25°C	3.6 V		2	20	nA
				Full				350	

## 6.7 Electrical Characteristics for 2.5-V Supply

 $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$ ,  $T_A = -40^\circ\text{C to } 85^\circ\text{C}$  (unless otherwise noted)<sup>(1)</sup>

PARAMETER		TEST CONDITIONS		$T_A$	$V_{CC}$	MIN	TYP	MAX	UNIT	
<b>ANALOG SWITCH</b>										
Analogue signal range	$V_{COM}, V_{NO}$					0		$V_{CC}$	V	
Peak ON resistance	$r_{peak}$	$0 \leq (V_{NO}) \leq V_{CC}$ , $I_{COM} = -8 \text{ mA}$ ,	Switch ON, See Figure 18	25°C	2.3 V		1.8	2.5	$\Omega$	
				Full			2.7			
ON-state resistance	$r_{on}$	$V_{NO} = 1.8 \text{ V}$ , $I_{COM} = -8 \text{ mA}$ ,	Switch ON, See Figure 18	25°C	2.3 V		1.5	2	$\Omega$	
				Full			2.4			
ON-state resistance match between channels	$\Delta r_{on}$	$V_{NO} = 1.8 \text{ V}$ , $I_{COM} = -8 \text{ mA}$ ,	Switch ON, See Figure 18	25°C	2.3 V			0.2	$\Omega$	
				Full			0.2			
ON-state resistance flatness	$r_{on(flat)}$	$0 \leq (V_{NO}) \leq V_{CC}$ , $I_{COM} = -8 \text{ mA}$ ,	Switch ON, See Figure 18	25°C	2.3 V		0.6		$\Omega$	
				25°C			0.6	1		
				Full				1		
NO OFF leakage current	$I_{NO(OFF)}$	$V_{NO} = 0.5 \text{ V or } 2.3 \text{ V}$ , $V_{COM} = 0.5 \text{ V to } 2.3 \text{ V}$ ,	Switch OFF, See Figure 19	25°C	2.7 V		-15	3	15	nA
				Full			-30	30		
NO OFF leakage current	$I_{NO(PWROFF)}$	$V_{NO} = 0 \text{ to } 2.7 \text{ V}$ , $V_{COM} = 2.7 \text{ V to } 0$ ,	Switch OFF, See Figure 19	25°C	0 V		-1	0.1	1	$\mu\text{A}$
				Full			-10	10		
NO ON leakage current	$I_{NO(ON)}$	$V_{NO} = 0.5 \text{ V or } 2.3 \text{ V}$ , $V_{COM} = \text{Open}$ ,	Switch ON, See Figure 19	25°C	2.7 V		-15	3	15	nA
				Full			-35	35		
COM OFF leakage current	$I_{COM(OFF)}$	$V_{NO} = 0.3 \text{ V to } 2.3 \text{ V}$ , $V_{COM} = 0.5 \text{ V or } 2.3 \text{ V}$ ,	Switch OFF, See Figure 19	25°C	2.7 V		-15	3	15	nA
				Full			-60	60		
COM OFF leakage current	$I_{COM(PWROFF)}$	$V_{COM} = 0 \text{ to } 2.7 \text{ V}$ , $V_{NO} = 2.7 \text{ V to } 0$ ,	Switch OFF, See Figure 19	25°C	0 V		-1	0.1	1	$\mu\text{A}$
				Full			-10	10		
COM ON leakage current	$I_{COM(ON)}$	$V_{NO} = \text{Open}$ , $V_{COM} = 0.5 \text{ V or } 2.2 \text{ V}$ ,	Switch ON, See Figure 19	25°C	2.7 V		-15	3.5	15	nA
				Full			-40	40		
<b>DIGITAL CONTROL INPUTS (IN1, IN2)<sup>(2)</sup></b>										
Input logic high	$V_{IH}$			Full			1.8	5.5	V	
Input logic low	$V_{IL}$			Full			0	0.6	V	
Input leakage current	$I_{IH}, I_{IL}$	$V_I = 5.5 \text{ V or } 0$		25°C	2.7 V		1	1	nA	
				Full			10	10		

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

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

**Electrical Characteristics for 2.5-V Supply (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)<sup>(1)</sup>

PARAMETER		TEST CONDITIONS		$T_A$	$V_{CC}$	MIN	TYP	MAX	UNIT
<b>DYNAMIC</b>									
Turnon time	$t_{ON}$	$V_{COM} = V_{CC}$ , $R_L = 50 \Omega$ ,	$C_L = 35 \text{ pF}$ , See <a href="#">Figure 22</a>	25°C	2.5 V	2	4.5	43	ns
				Full	2.3 V to 2.7 V	2		47.5	
Turnoff time	$t_{OFF}$	$V_{COM} = V_{CC}$ , $R_L = 50 \Omega$ ,	$C_L = 35 \text{ pF}$ , See <a href="#">Figure 22</a>	25°C	2.5 V	2	8.5	11	ns
				Full	2.3 V to 2.7 V	2		12.5	
Break-before-make time	$t_{BBM}$	$V_{NO} = V_{CC}$ , $R_L = 50 \Omega$ ,	$C_L = 35 \text{ pF}$ , See <a href="#">Figure 23</a>	25°C	2.5 V	0.5	18.5	38.5	ns
				Full	2.3 V to 2.7 V	0.5		43	
Charge injection	$Q_C$	$V_{GEN} = 0$ , $R_{GEN} = 0$ ,	$C_L = 1 \text{ nF}$ , See <a href="#">Figure 27</a>	25°C	2.5 V		8		pC
NO OFF capacitance	$C_{NO(OFF)}$	$V_{NO} = V_{CC}$ or GND, Switch OFF,	See <a href="#">Figure 21</a>	25°C	2.5 V		18.5		pF
COM OFF capacitance	$C_{COM(OFF)}$	$V_{COM} = V_{CC}$ or GND, Switch OFF,	See <a href="#">Figure 21</a>	25°C	2.5 V		55		pF
NO ON capacitance	$C_{NO(ON)}$	$V_{NO} = V_{CC}$ or GND, Switch ON,	See <a href="#">Figure 21</a>	25°C	2.5 V		78		pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_{CC}$ or GND, Switch ON,	See <a href="#">Figure 21</a>	25°C	2.5 V		78		pF
Digital input capacitance	$C_I$	$V_I = V_{CC}$ or GND,	See <a href="#">Figure 21</a>	25°C	2.5 V		3		pF
Bandwidth	BW	$R_L = 50 \Omega$ , Switch ON,	See <a href="#">Figure 24</a>	25°C	2.5 V		73		MHz
OFF isolation	$O_{ISO}$	$R_L = 50 \Omega$ , $f = 1 \text{ MHz}$ ,	Switch OFF, See <a href="#">Figure 25</a>	25°C	2.5 V		-64		dB
Crosstalk	$X_{TALK}$	$R_L = 50 \Omega$ , $f = 1 \text{ MHz}$ ,	Switch ON, See <a href="#">Figure 26</a>	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 <a href="#">Figure 28</a>	25°C	2.5 V		0.03%		
<b>SUPPLY</b>									
Positive supply current	$I_{CC}$	$V_I = V_{CC}$ or GND,	Switch ON or OFF	25°C	2.7 V		1	10	nA
				Full			250		

## 6.8 Electrical Characteristics for 1.8-V Supply

 $V_{CC} = 1.65\text{ V to }1.95\text{ V}$ ,  $T_A = -40^\circ\text{C to }85^\circ\text{C}$  (unless otherwise noted)<sup>(1)</sup>

PARAMETER		TEST CONDITIONS		$T_A$	$V_{CC}$	MIN	TYP	MAX	UNIT
<b>ANALOG SWITCH</b>									
Analogue signal range	$V_{COM}, V_{NO}$					0		$V_{CC}$	V
Peak ON resistance	$r_{peak}$	$0 \leq (V_{NO}) \leq V_{CC}$ , $I_{COM} = -2\text{ mA}$ ,	Switch ON, See <a href="#">Figure 18</a>	25°C	1.65 V	5			$\Omega$
				Full		30			
ON-state resistance	$r_{on}$	$V_{NO} = 1.5\text{ V}$ , $I_{COM} = -2\text{ mA}$ ,	Switch ON, See <a href="#">Figure 18</a>	25°C	1.65 V	2	2.5	3.5	$\Omega$
				Full					
ON-state resistance match between channels	$\Delta r_{on}$	$V_{NO} = 1.5\text{ V}$ , $I_{COM} = -2\text{ mA}$ ,	Switch ON, See <a href="#">Figure 18</a>	25°C	1.65 V	0.15	0.4	0.4	$\Omega$
				Full					
ON-state resistance flatness	$r_{on(Flat)}$	$0 \leq (V_{NO}) \leq V_{CC}$ , $I_{COM} = -2\text{ mA}$ ,	Switch ON, See <a href="#">Figure 18</a>	25°C	1.65 V	5			$\Omega$
				25°C		4.5			
				Full		5			
NO OFF leakage current	$I_{NO(OFF)}$	$V_{NO} = 0.3\text{ V or }1.65\text{ V}$ , $V_{COM} = 0.3\text{ V to }1.65\text{ V}$ ,	Switch OFF, See <a href="#">Figure 19</a>	25°C	1.95 V	-15	3	15	nA
				Full		-30 30			
	$I_{NO(PWROFF)}$	$V_{NO} = 0\text{ to }1.95\text{ V}$ , $V_{COM} = 1.95\text{ V to }0$ ,	Switch OFF, See <a href="#">Figure 19</a>	25°C	0 V	-1	0.1	1	$\mu\text{A}$
				Full		-15 15			
NO ON leakage current	$I_{NO(ON)}$	$V_{NO} = 0.3\text{ V or }1.65\text{ V}$ , $V_{COM} = \text{Open}$ ,	Switch ON, See <a href="#">Figure 19</a>	25°C	1.95 V	-15	3	15	nA
				Full		-30 30			
COM OFF leakage current	$I_{COM(OFF)}$	$V_{NO} = 0.3\text{ V to }1.65\text{ V}$ , $V_{COM} = 0.3\text{ V or }1.65\text{ V}$ ,	Switch OFF, See <a href="#">Figure 19</a>	25°C	1.95 V	-15	3	15	nA
				Full		-50 50			
	$I_{COM(PWROFF)}$	$V_{COM} = 0\text{ to }1.95\text{ V}$ , $V_{NO} = 1.95\text{ V to }0$ ,	Switch OFF, See <a href="#">Figure 19</a>	25°C	0 V	-1	0.1	1	$\mu\text{A}$
				Full		-10 10			
COM ON leakage current	$I_{COM(ON)}$	$V_{NO} = \text{Open}$ , $V_{COM} = 0.3\text{ V or }1.65\text{ V}$ ,	Switch ON, See <a href="#">Figure 19</a>	25°C	1.95 V	-15	3	15	nA
				Full		-30 30			
<b>DIGITAL CONTROL INPUTS (IN1, IN2)<sup>(2)</sup></b>									
Input logic high	$V_{IH}$			Full		1.5		5.5	V
Input logic low	$V_{IL}$			Full		0		0.6	V
Input leakage current	$I_{IH}, I_{IL}$	$V_I = 5.5\text{ V or }0$		25°C	1.95 V	-2		2	nA
				Full		-20 20			

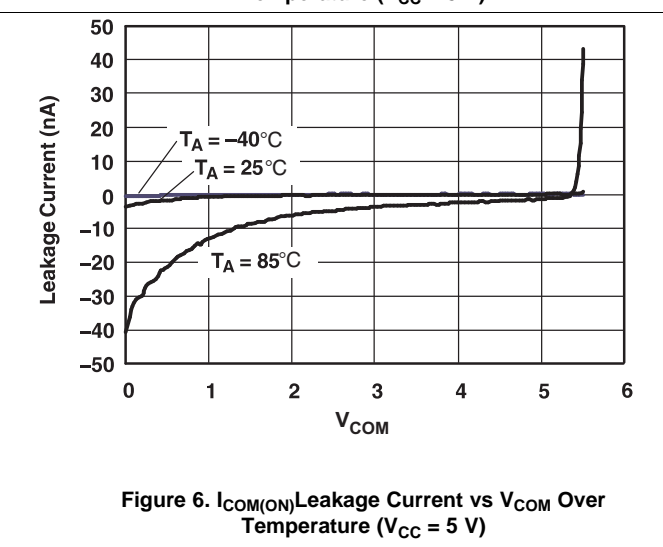
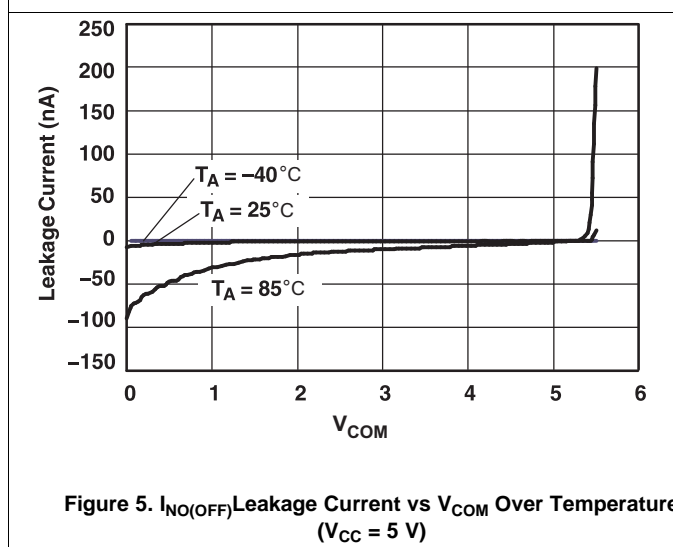
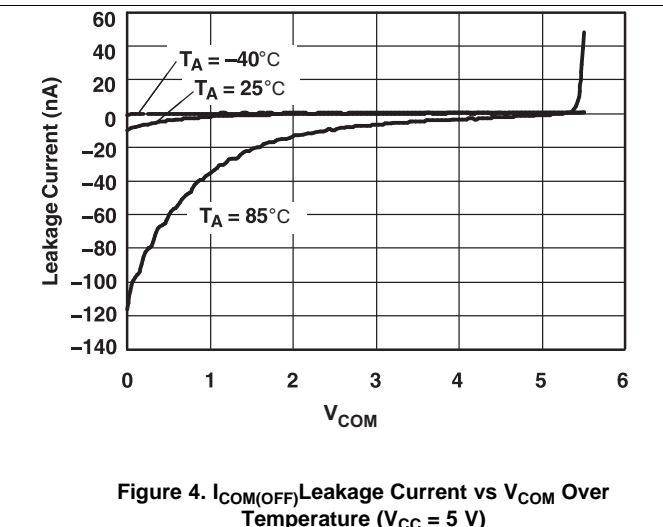
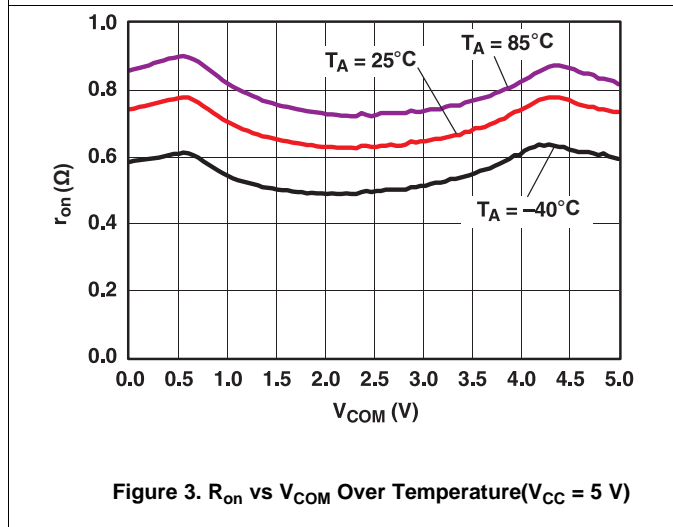
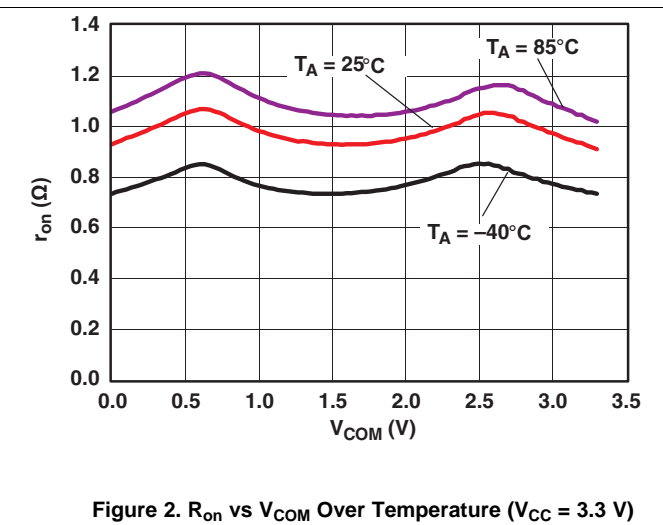
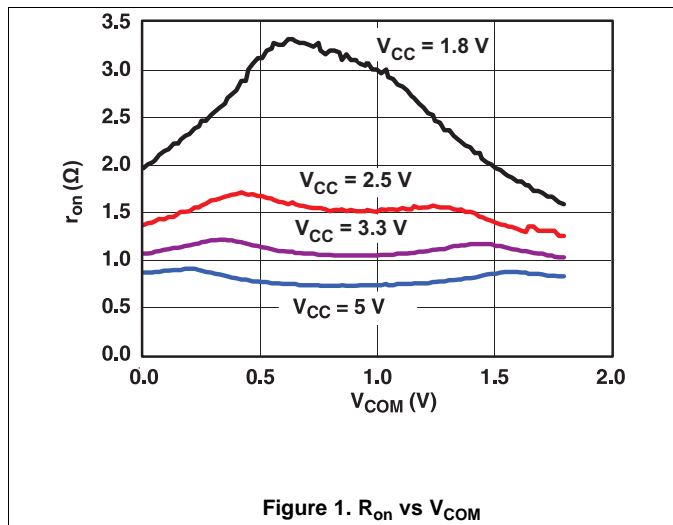
(1) The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum

(2) All unused digital inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, [SCBA004](#).

**Electrical Characteristics for 1.8-V Supply (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)<sup>(1)</sup>

PARAMETER		TEST CONDITIONS		$T_A$	$V_{CC}$	MIN	TYP	MAX	UNIT
<b>DYNAMIC</b>									
Turnon time	$t_{ON}$	$V_{COM} = V_{CC}$ , $R_L = 50\ \Omega$ ,	$C_L = 35\ \text{pF}$ , See <a href="#">Figure 22</a>	25°C	1.8 V	3	38.5	85	ns
				Full	1.65 V to 1.95 V	3		90	
Turnoff time	$t_{OFF}$	$V_{COM} = V_{CC}$ , $R_L = 50\ \Omega$ ,	$C_L = 35\ \text{pF}$ , See <a href="#">Figure 22</a>	25°C	1.8 V	2	8.5	16	ns
				Full	1.65 V to 1.95 V	2		18	
Break-before-make time	$t_{BBM}$	$V_{NO} = V_{CC}$ , $R_L = 50\ \Omega$ ,	$C_L = 35\ \text{pF}$ , See <a href="#">Figure 23</a>	25°C	1.8 V	1	33	75	ns
				Full	1.65 V to 1.95 V	1		80	
Charge injection	$Q_C$	$V_{GEN} = 0$ , $R_{GEN} = 0$ ,	$C_L = 1\ \text{nF}$ , See <a href="#">Figure 27</a>	25°C	1.8 V		5		pC
NO OFF capacitance	$C_{NO(OFF)}$	$V_{NO} = V_{CC}$ or GND, Switch OFF,	See <a href="#">Figure 21</a>	25°C	1.8 V		18.5		pF
COM OFF capacitance	$C_{COM(OFF)}$	$V_{COM} = V_{CC}$ or GND, Switch OFF,	See <a href="#">Figure 21</a>	25°C	1.8 V		55		pF
NO ON capacitance	$C_{NO(ON)}$	$V_{NO} = V_{CC}$ or GND, Switch ON,	See <a href="#">Figure 21</a>	25°C	1.8 V		78		pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_{CC}$ or GND, Switch ON,	See <a href="#">Figure 21</a>	25°C	1.8 V		78		pF
Digital input capacitance	$C_I$	$V_I = V_{CC}$ or GND,	See <a href="#">Figure 21</a>	25°C	1.8 V		3		pF
Bandwidth	BW	$R_L = 50\ \Omega$ , Switch ON,	See <a href="#">Figure 24</a>	25°C	1.8 V		73		MHz
OFF isolation	$O_{ISO}$	$R_L = 50\ \Omega$ , $f = 1\ \text{M Hz}$ ,	Switch OFF, See <a href="#">Figure 25</a>	25°C	1.8 V		-64		dB
Crosstalk	$X_{TALK}$	$R_L = 50\ \Omega$ , $f = 1\ \text{MHz}$ ,	Switch ON, See <a href="#">Figure 26</a>	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 <a href="#">Figure 28</a>	25°C	1.8 V		0.08%		
<b>SUPPLY</b>									
Positive supply current	$I_{CC}$	$V_I = V_{CC}$ or GND,	Switch ON or OFF	25°C	1.95 V	1			nA
				Full		200			

### 6.9 Typical Characteristics



Typical Characteristics (continued)

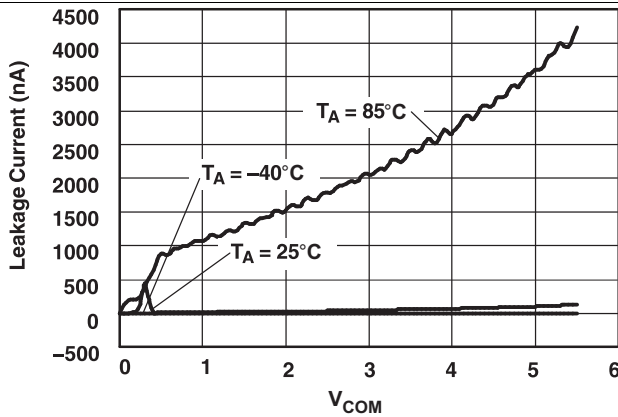


Figure 7.  $I_{COM(PWROFF)}$  Leakage Current vs  $V_{COM}$  Over Temperature ( $V_{CC} = 0\text{ V}$ )

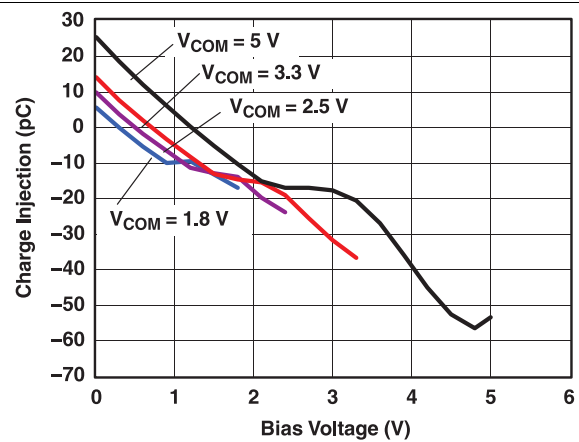


Figure 8. Charge Injection ( $Q_C$ ) vs  $V_{COM}$

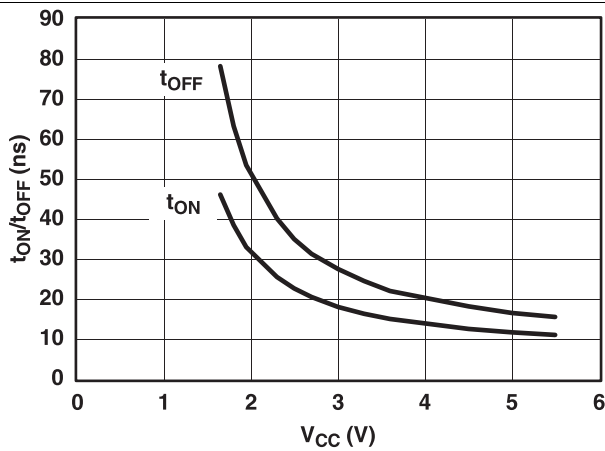


Figure 9.  $t_{ON}$  and  $t_{OFF}$  vs Supply Voltage

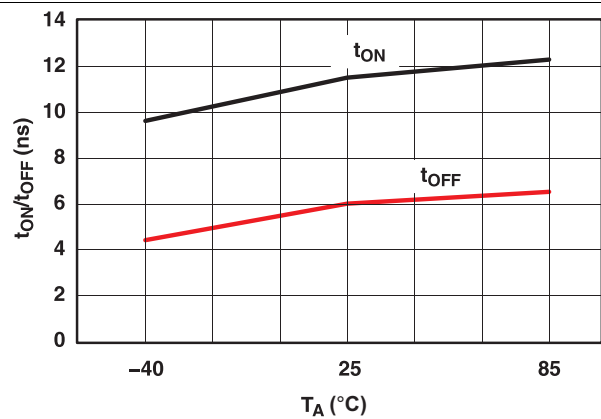


Figure 10.  $T_{ON}$  and  $T_{OFF}$  vs Temperature

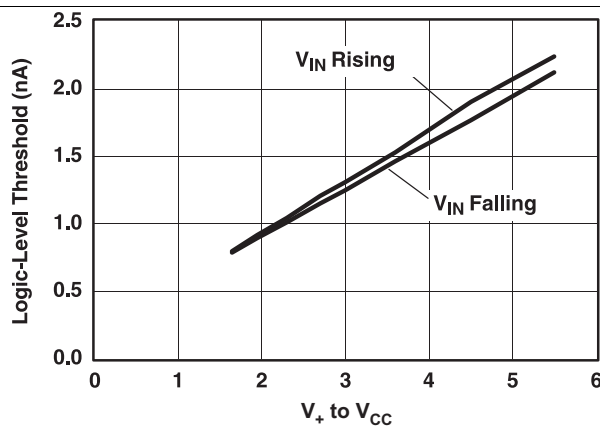


Figure 11. Logic-Level Threshold vs  $V_{CC}$

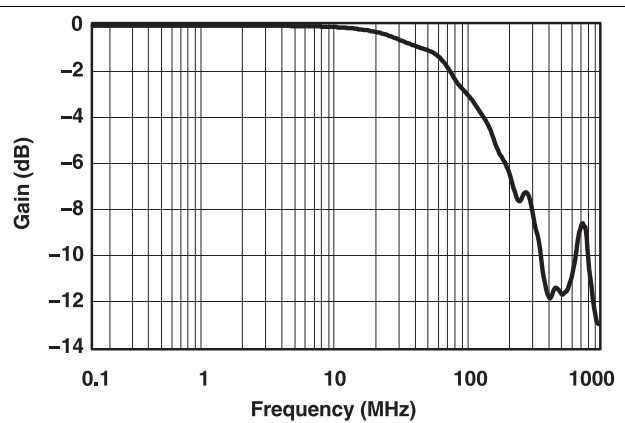
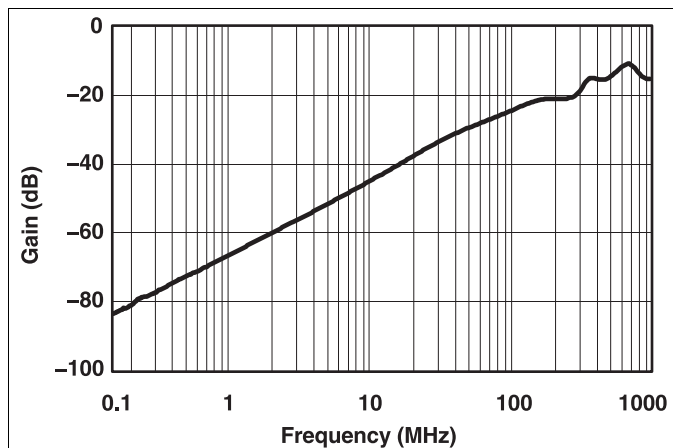
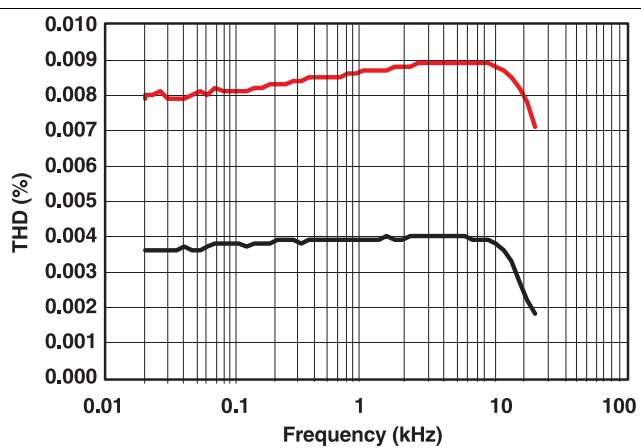


Figure 12. Bandwidth ( $V_{CC} = 5\text{ V}$ )

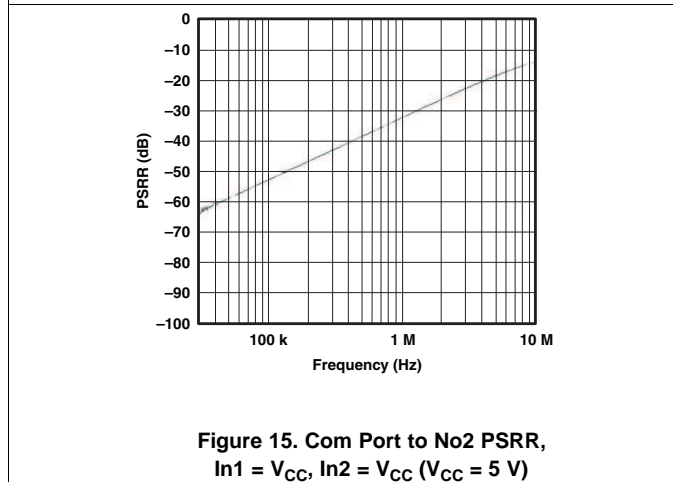
**Typical Characteristics (continued)**



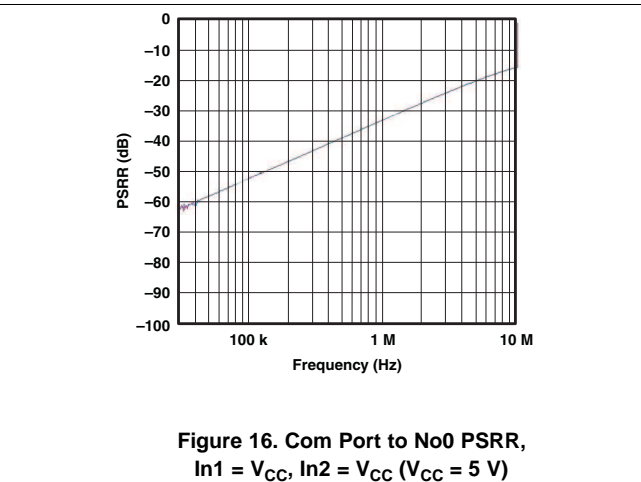
**Figure 13. Off Isolation ( $V_{CC} = 5\text{ V}$ )**



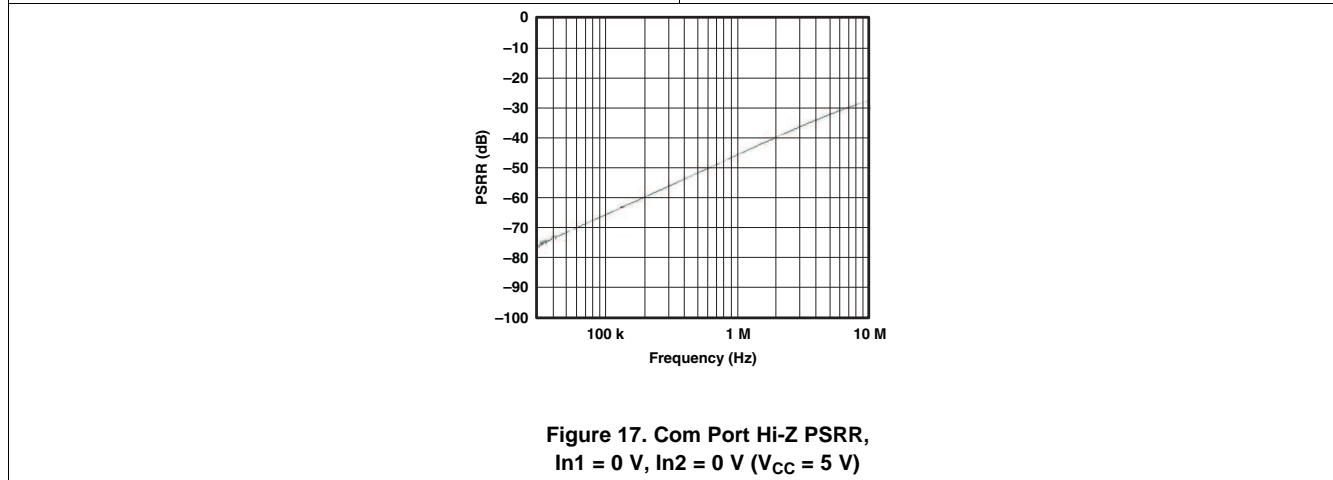
**Figure 14. Total Harmonic Distortion vs Frequency ( $V_{CC} = 5\text{ V}$ )**



**Figure 15. Com Port to No2 PSRR,  $In1 = V_{CC}$ ,  $In2 = V_{CC}$  ( $V_{CC} = 5\text{ V}$ )**



**Figure 16. Com Port to No0 PSRR,  $In1 = V_{CC}$ ,  $In2 = V_{CC}$  ( $V_{CC} = 5\text{ V}$ )**



**Figure 17. Com Port Hi-Z PSRR,  $In1 = 0\text{ V}$ ,  $In2 = 0\text{ V}$  ( $V_{CC} = 5\text{ V}$ )**

## 7 Parameter Measurement Information

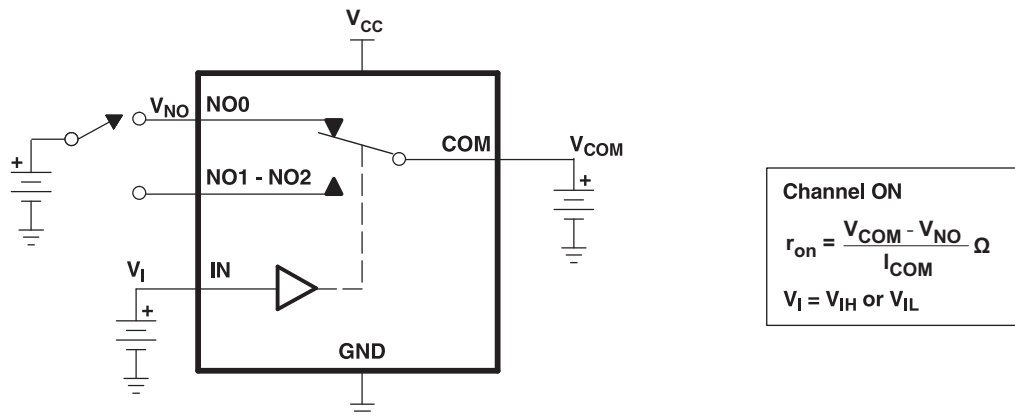


Figure 18. ON-State Resistance ( $R_{on}$ )

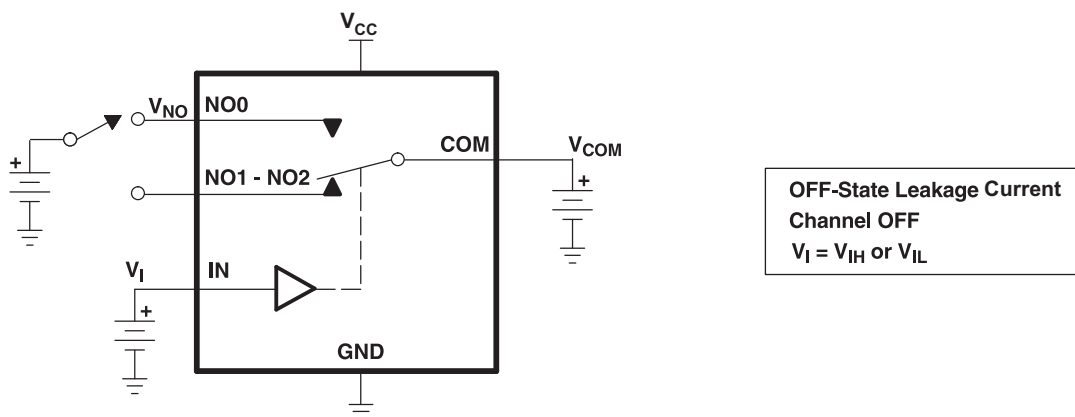


Figure 19. OFF-State Leakage Current ( $I_{NC(OFF)}$ ,  $I_{NO(OFF)}$ ,  $I_{NO(PWROFF)}$ ,  $I_{COM(OFF)}$ ,  $I_{COM(PWROFF)}$ )

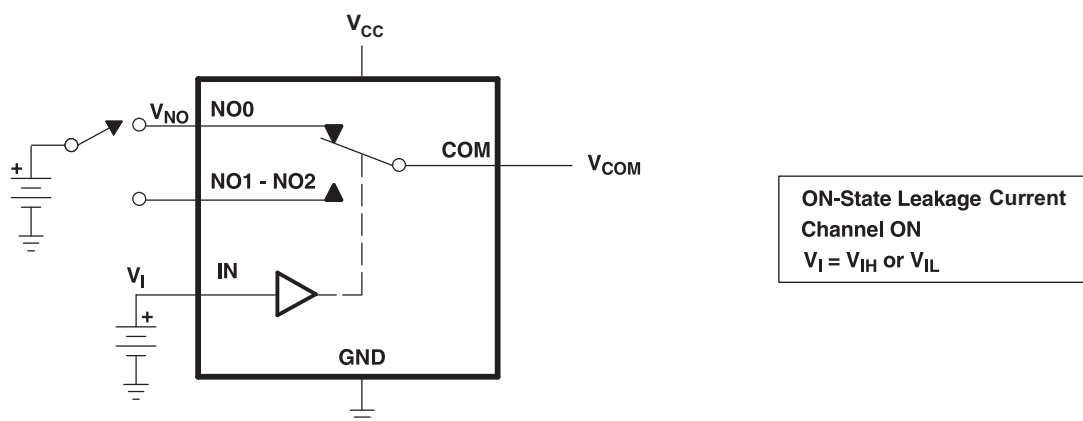


Figure 20. ON-State Leakage Current ( $I_{COM(ON)}$ ,  $I_{NO(ON)}$ )

Parameter Measurement Information (continued)

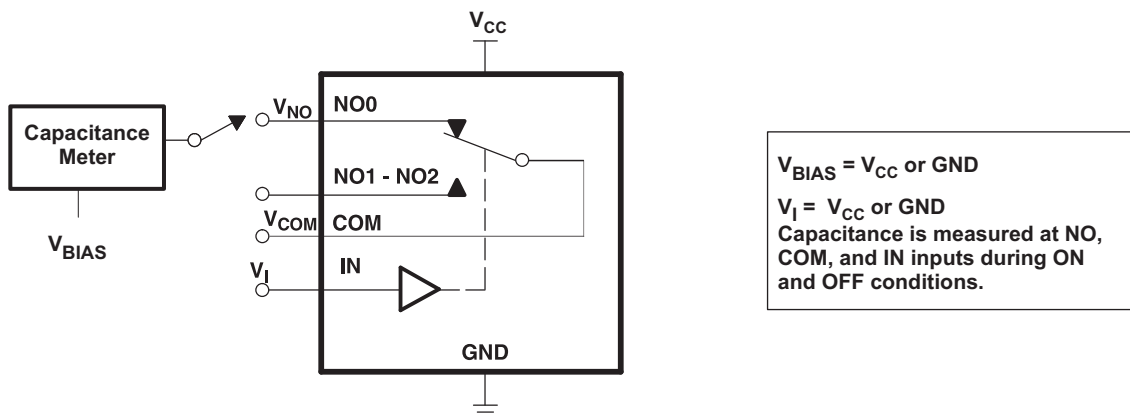
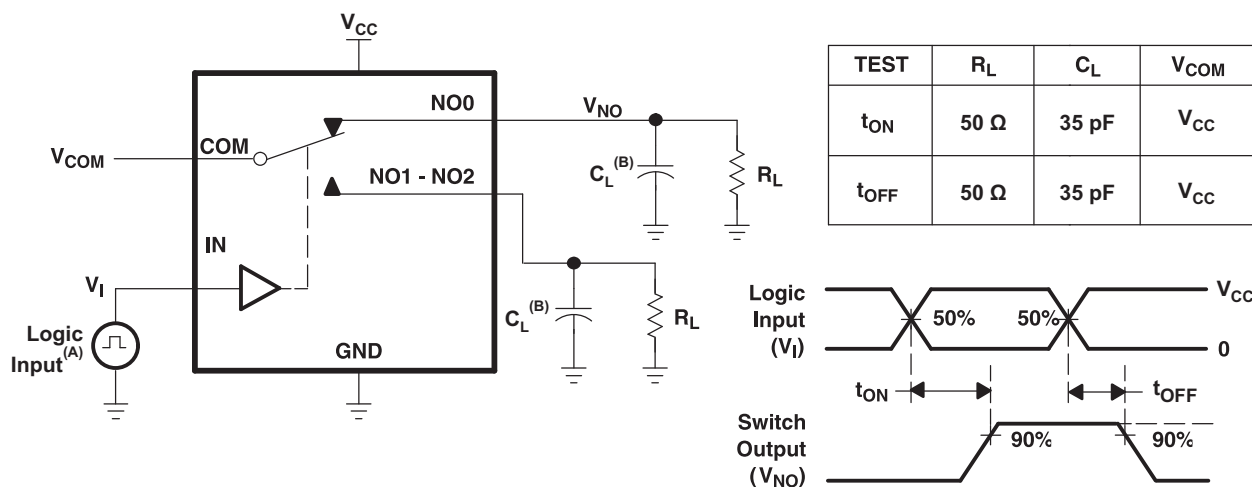


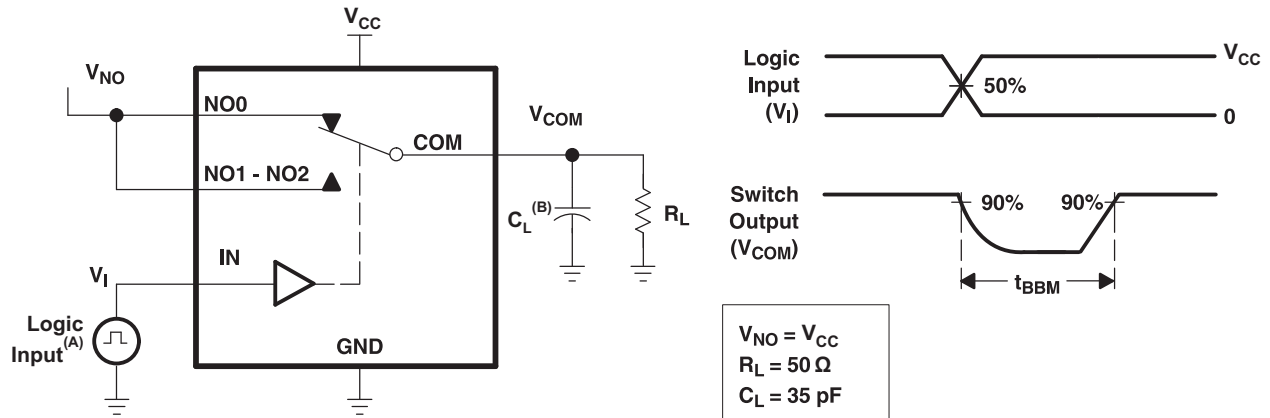
Figure 21. Capacitance ( $C_I$ ,  $C_{COM(ON)}$ ,  $C_{NO(OFF)}$ ,  $C_{COM(OFF)}$ ,  $C_{NO(ON)}$ )



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

Figure 22. Turnon ( $t_{ON}$ ) and Turnoff Time ( $t_{OFF}$ )

Parameter Measurement Information (continued)



- A. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz, Z<sub>O</sub> = 50  $\Omega$ , t<sub>r</sub> < 5 ns, t<sub>f</sub> < 5 ns.
- B. C<sub>L</sub> includes probe and jig capacitance.

Figure 23. Break-Before-Make Time (t<sub>BBM</sub>)

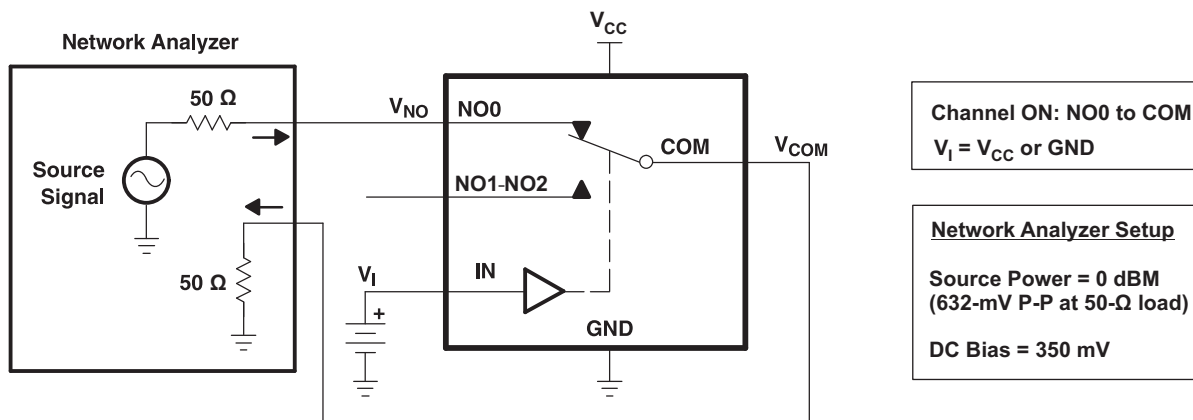


Figure 24. Bandwidth (BW)

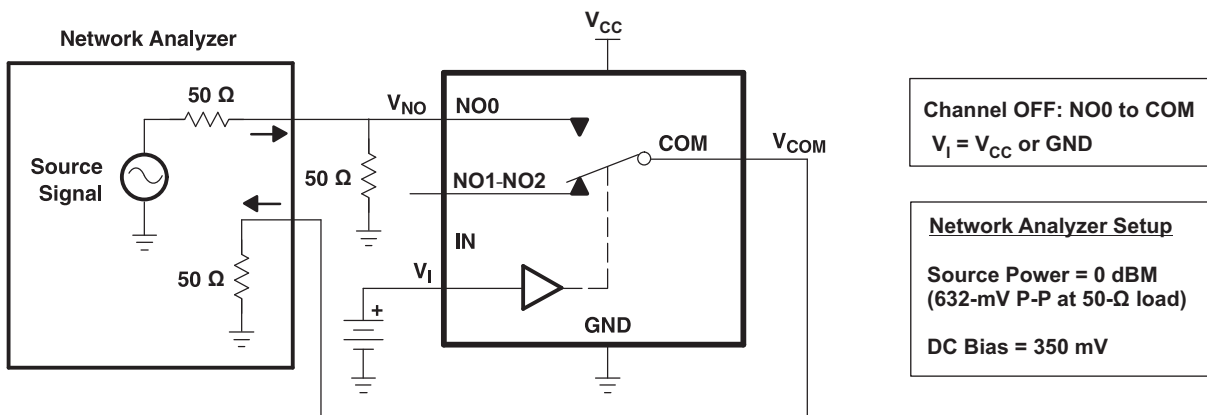


Figure 25. Off Isolation (O<sub>ISO</sub>)

Parameter Measurement Information (continued)

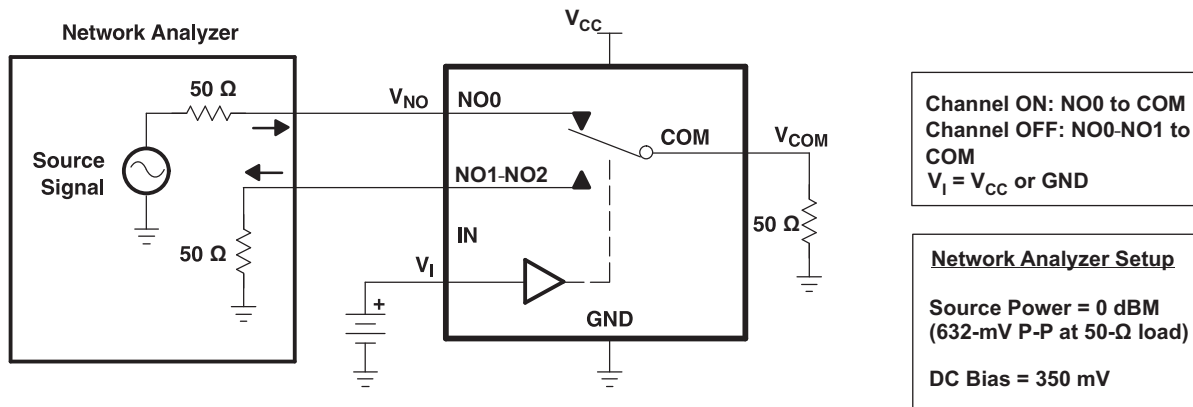
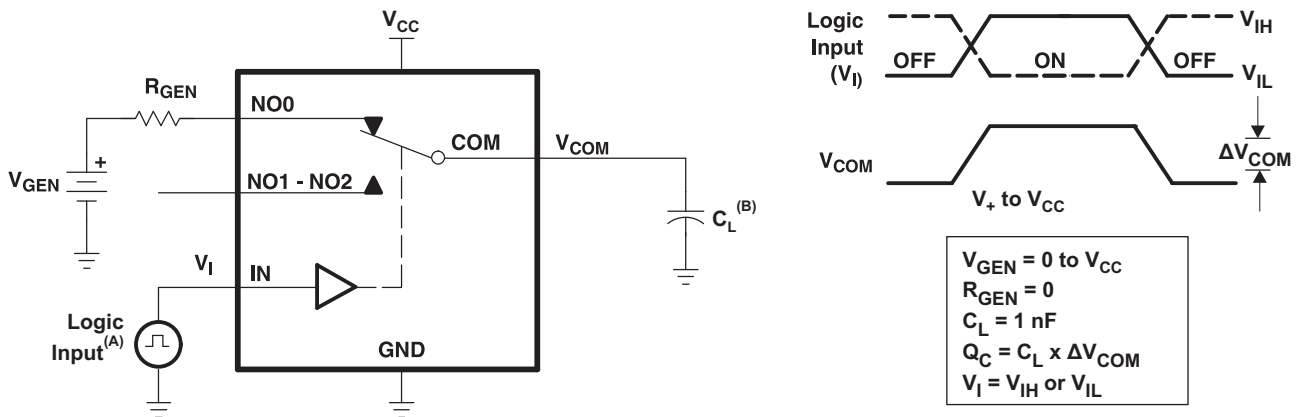
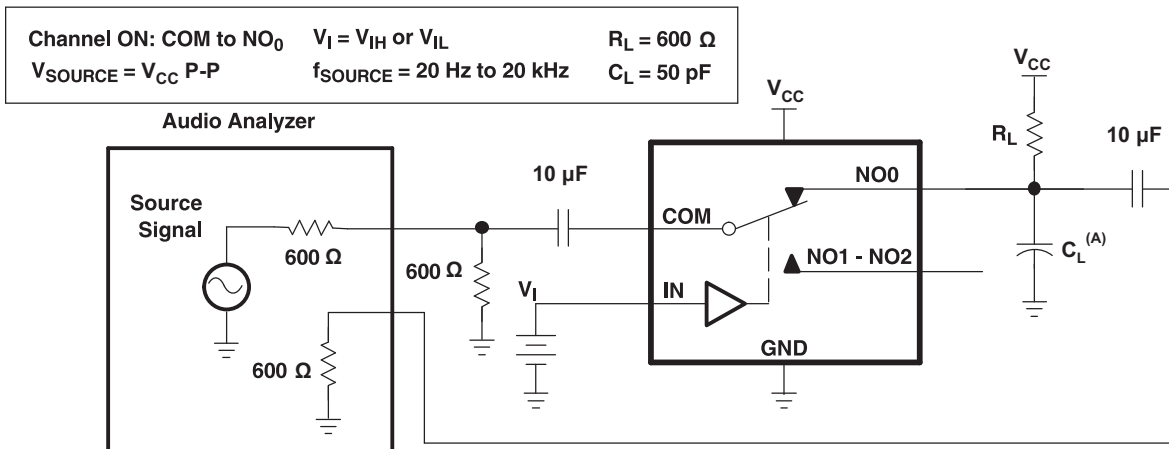


Figure 26. Crosstalk ( $X_{TALK}$ )



- A. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz, Z<sub>O</sub> = 50 Ω, t<sub>r</sub> < 5 ns, t<sub>f</sub> < 5 ns.
- B. C<sub>L</sub> includes probe and jig capacitance.

Figure 27. Charge Injection ( $Q_C$ )



- A. C<sub>L</sub> includes probe and jig capacitance.

Figure 28. Total Harmonic Distortion (THD)

**Table 1. Parameter Description**

SYMBOL	DESCRIPTION
$V_{COM}$	Voltage at COM
$V_{NO}$	Voltage at NO
$r_{on}$	Resistance between COM and NC or COM and NO ports when the channel is ON
$r_{peak}$	Peak ON-state resistance over a specified voltage range
$\Delta r_{on}$	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
$I_{NO(PWROFF)}$	Leakage current measured at the NO port during the power-down condition, $V_{CC} = 0$ .
$I_{NO(ON)}$	Leakage current measured at the NO port, with the corresponding channel (NO to COM) in the ON state and the output (COM) open
$I_{COM(ON)}$	Leakage current measured at the COM port, with the corresponding channel (COM to NO or COM to NC) in the ON state and the output (NC or NO) open
$I_{COM(OFF)}$	Leakage current measured at the COM port during the power-down condition, $V_{CC} = 0$
$I_{COM(PWROFF)}$	Leakage current measured at the COM port during the power-down condition, $V_{CC} = 0$ .
$V_{IH}$	Minimum input voltage for logic high for the control input (IN)
$V_{IL}$	Maximum input voltage for logic low for the control input (IN)
$V_I$	Voltage at the control input (IN)
$I_{IH}, I_{IL}$	Leakage current measured at the control input (IN)
$t_{ON}$	Turnon time for the switch. This parameter is measured under the specified range of conditions and by the propagation delay between the digital control (IN) signal and analog output (COM or NO) signal when the switch is turning ON.
$t_{OFF}$	Turnoff time for the switch. This parameter is measured under the specified range of conditions and by the propagation delay between the digital control (IN) signal and analog output (COM or NO) signal when the switch is turning OFF.
$t_{BBM}$	Break-before-make time. This parameter is measured under the specified range of conditions and by the propagation delay between the output of two adjacent analog channels (NC and NO) when the control signal changes state.
$Q_C$	Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NO or COM) output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control input. Charge injection, $Q_C = C_L \times \Delta V_{COM}$ . $C_L$ is the load capacitance and $\Delta V_{COM}$ is the change in analog output voltage.
$C_{NO(OFF)}$	Capacitance at the NO port when the corresponding channel (NO to COM) is OFF
$C_{NO(ON)}$	Capacitance at the NO port when the corresponding channel (NO to COM) is ON
$C_{COM(ON)}$	Capacitance at the COM port when the corresponding channel (COM to NO) is ON
$C_{COM(OFF)}$	Capacitance at the COM port when the corresponding channel (COM to NO) is OFF
$C_I$	Capacitance of control input (IN)
$O_{ISO}$	OFF isolation of the switch is a measurement of OFF-state switch impedance. This is measured in dB in a specific frequency, with the corresponding channel (NC to COM or NO to COM) in the OFF state.
$X_{TALK}$	Crosstalk is a measurement of unwanted signal coupling from an ON channel to an OFF channel (NC to NO or NO to NC). This is measured in a specific frequency and in dB.
BW	Bandwidth of the switch. This is the frequency in which the gain of an ON channel is –3 dB less than the DC gain.
THD	Total harmonic distortion describes the signal distortion caused by the analog switch. This is defined as the ratio of root mean square (RMS) value of the second, third, and higher harmonic to the absolute magnitude of the fundamental harmonic.
$I_{CC}$	Static power-supply current with the control (IN) pin at $V_{CC}$ or GND

**Table 2. Summary of Characteristics<sup>(1)</sup>**

PARAMETER	CHARACTERISTIC
Configuration	Triple 3:1 Multiplexer/ Demultiplexer (1 × SP3T)
Number of channels	1
ON-state resistance ( $r_{on}$ )	1.1 $\Omega$
ON-state resistance match ( $\Delta r_{on}$ )	0.1 $\Omega$
ON-state resistance flatness ( $r_{on(flat)}$ )	0.15 $\Omega$
Turnon/turnoff time ( $t_{ON}/t_{OFF}$ )	40 ns/35 ns
Break-before-make time ( $t_{BBM}$ )	1 ns
Charge injection ( $Q_C$ )	40 pC
Bandwidth (BW)	100 MHz
OFF isolation ( $O_{ISO}$ )	–65 dB at 10 MHz
Crosstalk ( $X_{TALK}$ )	–66 dB at 10 MHz
Total harmonic distortion (THD)	0.01%
Leakage current ( $I_{COM(OFF)}/I_{NO(OFF)}$ )	$\pm 20 \mu A$
Power supply current ( $I_{CC}$ )	0.1 $\mu A$
Package options	8-pin DCU or YZP

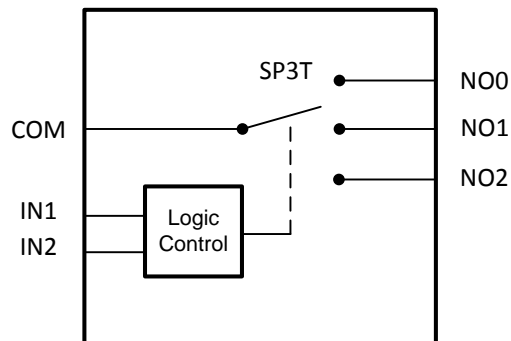
(1)  $V_{CC} = 5 V$ ,  $T_A = 25^\circ C$

## 8 Detailed Description

### 8.1 Overview

The TS5A3359 is a bidirectional, single-channel, single-pole triple-throw (SP3T) analog switch that is designed to operate from 1.65 V to 5.5 V. This device provides a signal switching solution while maintaining excellent signal integrity, which makes the TS5A3359 suitable for a wide range of applications in various markets including personal electronics, portable instrumentation, and test and measurement equipment. The device maintains the signal integrity by its low ON-state resistance, excellent ON-state resistance matching, and total harmonic distortion (THD) performance. To prevent signal distortion during the transferring of a signal from one channel to another, the TS5A3359 device also has a specified break-before-make feature. The device consumes very low power and provides isolation when  $V_{CC} = 0$ .

### 8.2 Functional Block Diagram



### 8.3 Feature Description

Isolation in Power-Down Mode,  $V_{CC} = 0$

When power is not supplied to the VCC pin,  $V_{CC} = 0$ , the signal paths NO and COM are high impedance. This is specified in the electrical characteristics table under the COM and NO OFF leakage current when  $V_{CC} = 0$ . Because the device is high impedance when it is not powered, you may connect other signals to the signal chain without interference of the TS5A3359.

### 8.4 Device Functional Modes

**Table 3. Function Table**

IN2	IN1	COM TO NO, NO TO COM
L	L	OFF
L	H	COM = NO0
H	L	COM = NO1
H	H	COM = NO2

## 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 TS5A3359 switch is bidirectional, so the NO and COM pins can be used as either inputs or outputs. This switch is typically used when there is only one signal path that needs to be able to communicate to 3 different signal paths.

### 9.2 Typical Application

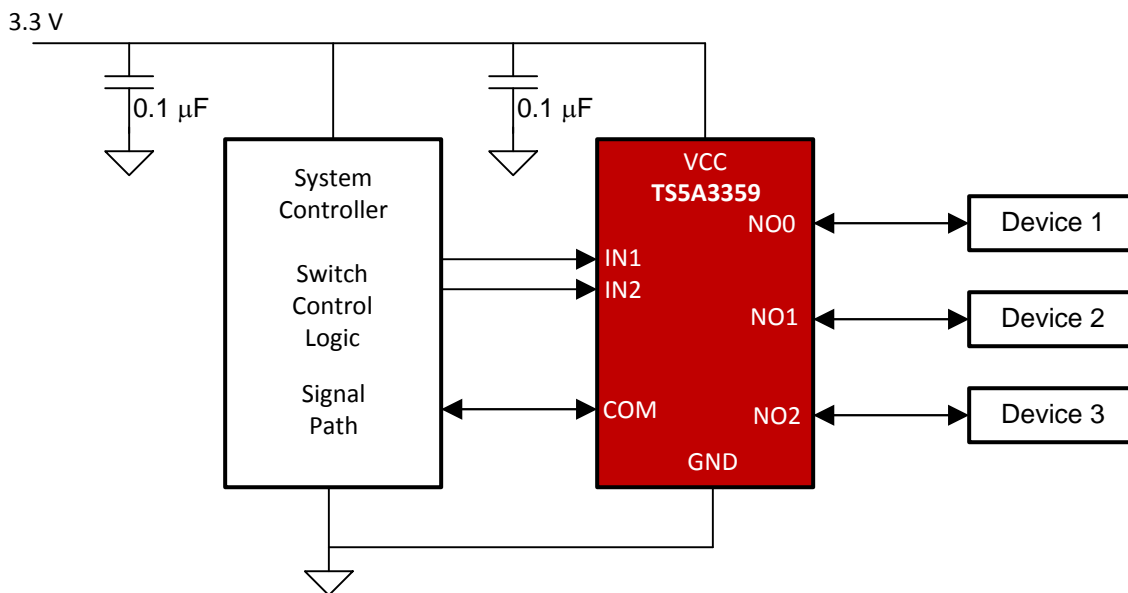


Figure 29. Typical Application Schematic

#### 9.2.1 Design Requirements

The TS5A3359 device can be properly operated without any external components. However, TI recommends connecting unused pins to ground through a 50-Ω resistor to prevent signal reflections back into the device. TI also recommends pulling up the digital control pins (IN1 and IN2) to VCC or pulling down to GND to avoid undesired switch positions that could result from the floating pin.

Select the appropriate supply voltage to cover the entire voltage swing of the signal passing through the switch because the TS5A3359 input and output signal swing through NO and COM are dependent on the supply voltage  $V_{CC}$ . For example, if the desired signal level to pass through the switch is 5 V,  $V_{CC}$  must be greater than or equal to 5 V.  $V_{CC} = 3.3$  V would not be valid for passing a 5-V signal since the Analog signal voltage cannot exceed the supply.

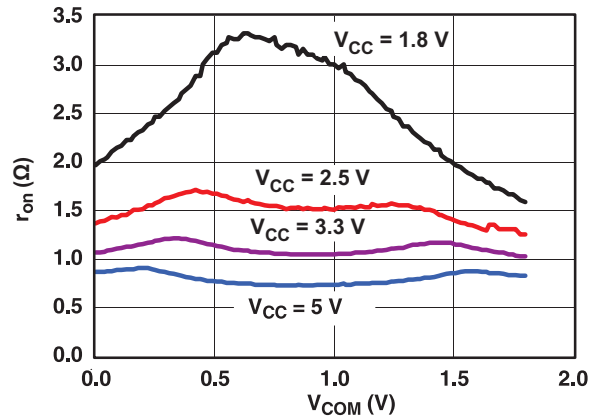
#### 9.2.2 Detailed Design Procedure

The TS5A3359 device can be properly operated without any external components. However, TI recommends connecting unused pins to ground through a 50-Ω resistor to prevent signal reflections back into the device. TI also recommends pulling up the digital control pins (IN1 and IN2) to VCC or pulling down to GND to avoid undesired switch positions that could result from the floating pin.

### Typical Application (continued)

Select the appropriate supply voltage to cover the entire voltage swing of the signal passing through the switch because the TS5A3359 input/output signal swing through NO and COM are dependant of the supply voltage  $V_{CC}$ .

#### 9.2.3 Application Curve



**Figure 30.  $R_{on}$  vs  $V_{COM}$**

## 10 Power Supply Recommendations

TI recommends proper power-supply sequencing for all CMOS devices. Do not exceed the absolute maximum ratings, because stresses beyond the listed ratings can cause permanent damage to the device. Always sequence VCC on first, followed by NO 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- $\mu$ F capacitor, connected from VCC to GND, is adequate for most applications.

## 11 Layout

### 11.1 Layout Guidelines

TI recommends following common printed-circuit board layout guidelines to ensure reliability of the device.

- Bypass capacitors should be used on power supplies.
- Short trace lengths should be used to avoid excessive loading.

### 11.2 Layout Example

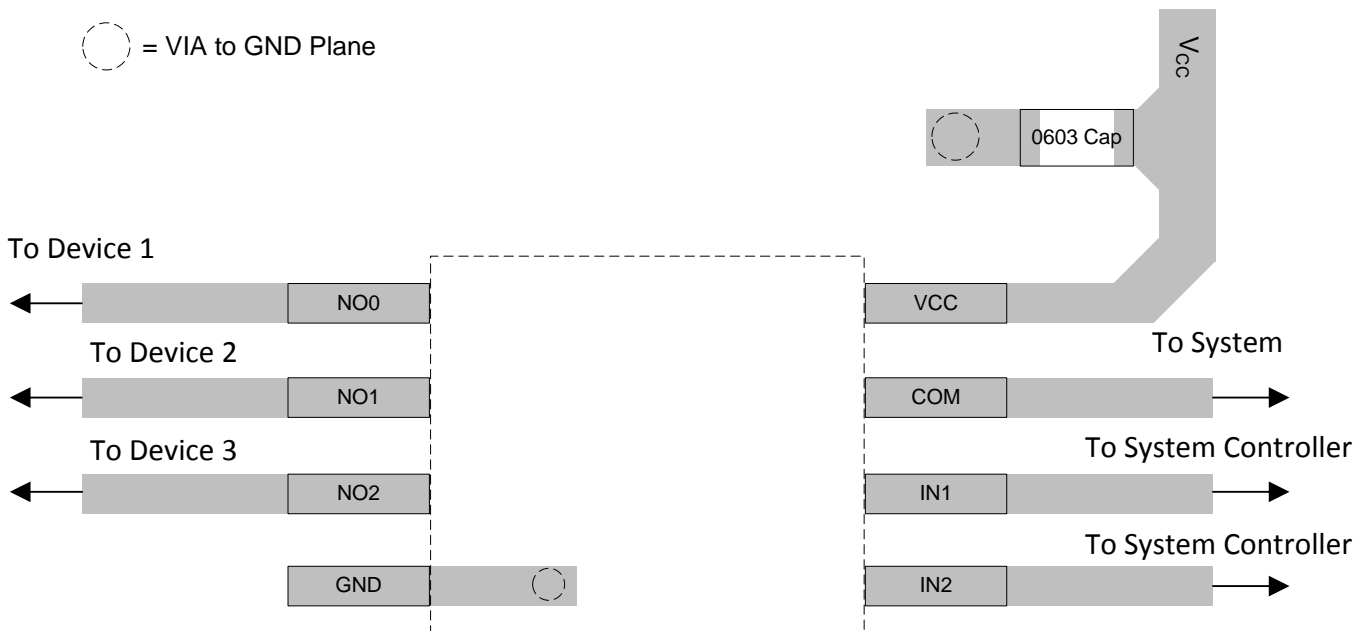


Figure 31. Recommended Layout

## 12 Device and Documentation Support

### 12.1 Community Resource

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](http://e2e.ti.com), you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

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

### 12.2 Trademarks

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

### 12.3 Electrostatic Discharge Caution



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

### 12.4 Glossary

[SLYZ022](#) — *TI Glossary*.

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

## 13 Mechanical, Packaging, and Orderable Information

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

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TS5A3359DCUR	ACTIVE	VSSOP	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(AL, JALR) JZ	<a href="#">Samples</a>
TS5A3359DCUT	ACTIVE	VSSOP	DCU	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(AL, JALR) JZ	<a href="#">Samples</a>
TS5A3359DCUTG4	ACTIVE	VSSOP	DCU	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(AL, JALR) JZ	<a href="#">Samples</a>
TS5A3359YZPR	ACTIVE	DSBGA	YZP	8	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	(J9, J97)	<a href="#">Samples</a>
TS5A3359YZPRB	OBSOLETE	DSBGA	YZP	8		TBD	Call TI	Call TI		J97	

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

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

(2) **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.

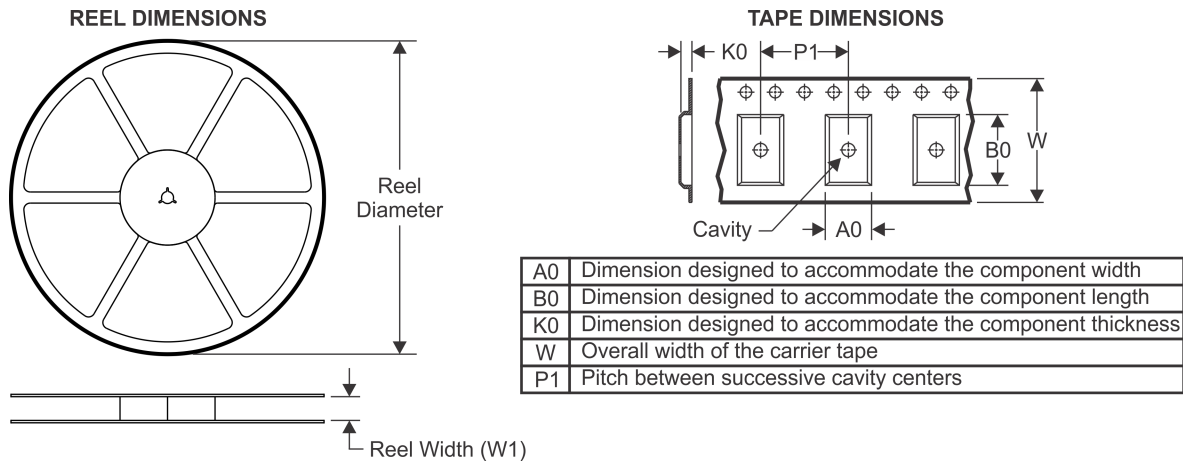
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

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

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

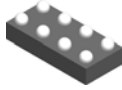
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TS5A3359DCUR	VSSOP	DCU	8	3000	180.0	8.4	2.25	3.35	1.05	4.0	8.0	Q3
TS5A3359YZPR	DSBGA	YZP	8	3000	180.0	8.4	1.02	2.02	0.63	4.0	8.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TS5A3359DCUR	VSSOP	DCU	8	3000	202.0	201.0	28.0
TS5A3359YZPR	DSBGA	YZP	8	3000	210.0	185.0	35.0

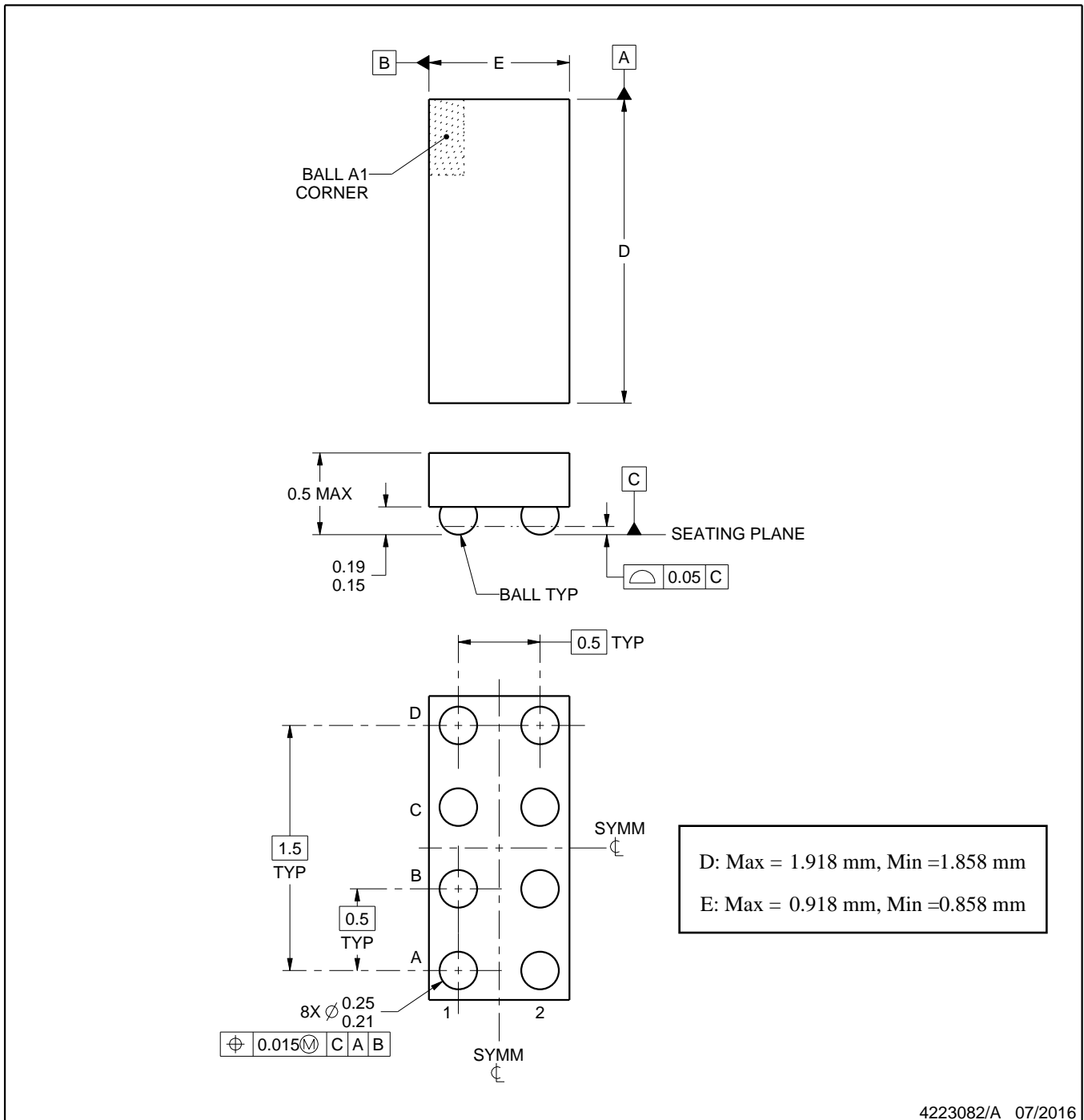
YZP0008



# PACKAGE OUTLINE

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



4223082/A 07/2016

NOTES:

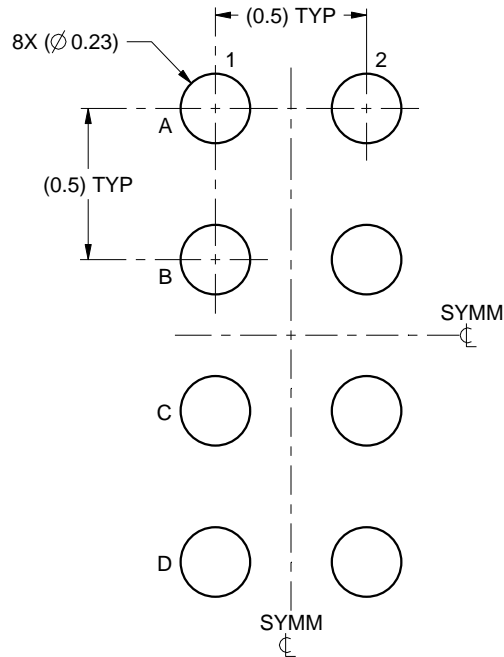
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

# EXAMPLE BOARD LAYOUT

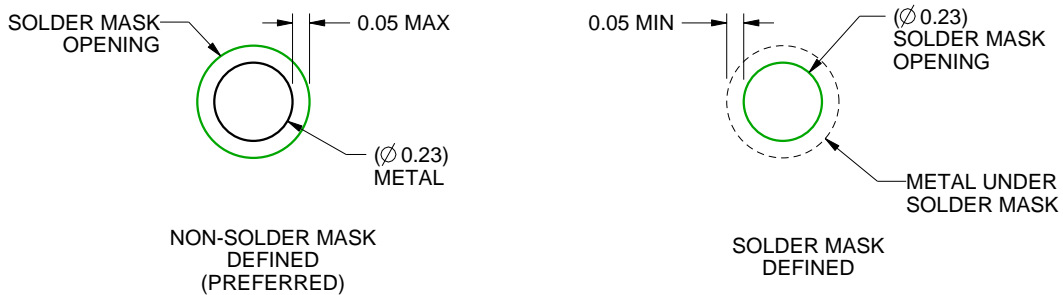
YZP0008

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE  
SCALE:40X



SOLDER MASK DETAILS  
NOT TO SCALE

4223082/A 07/2016

NOTES: (continued)

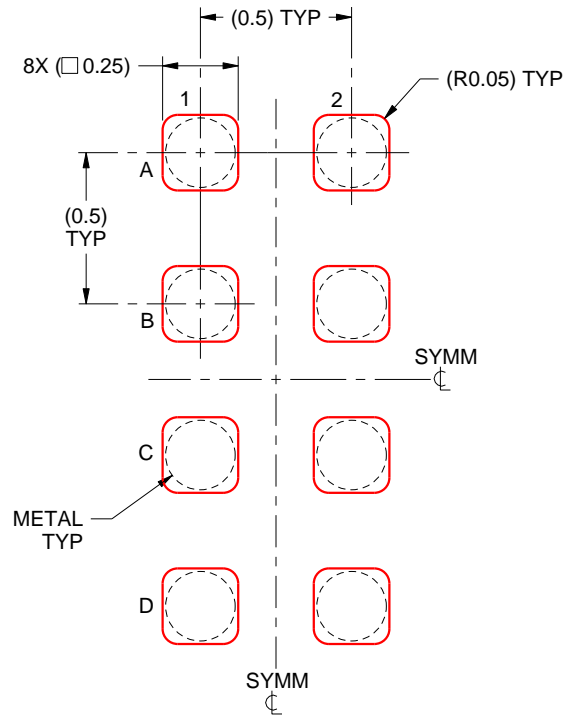
3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SNVA009 ([www.ti.com/lit/snva009](http://www.ti.com/lit/snva009)).

# 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

4223082/A 07/2016

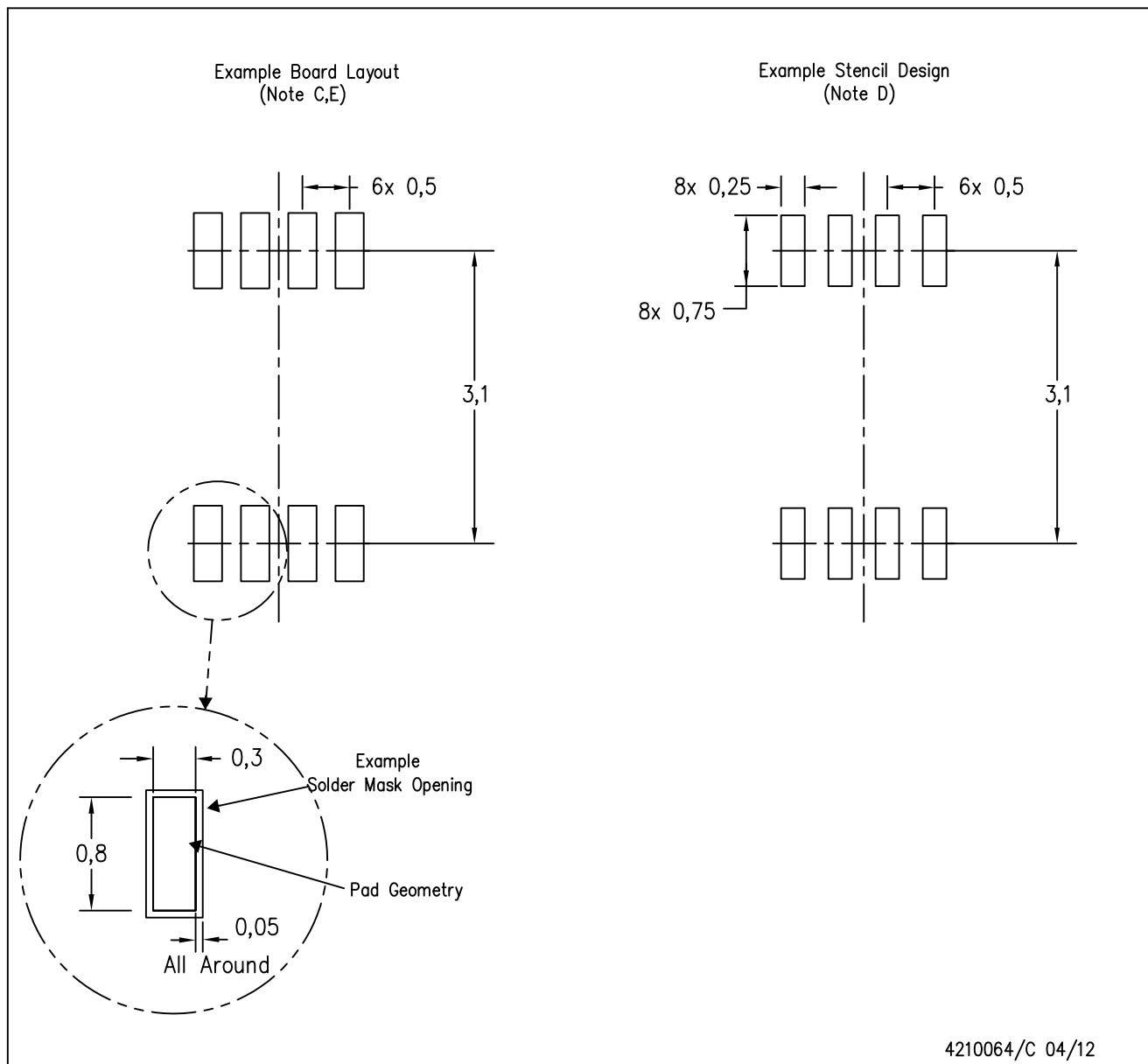
NOTES: (continued)

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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