

# 1-Ω SPDT ANALOG SWITCH

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

Check for Samples: [TS5A3159A](#)

### FEATURES

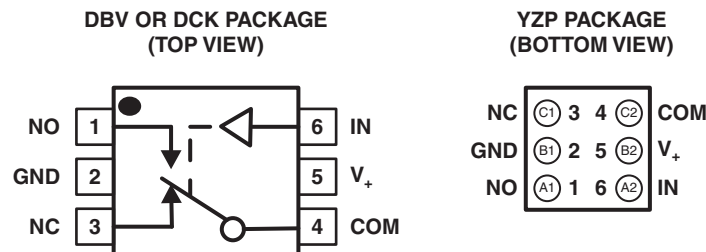
- Isolation in Power-Down Mode,  $V_+ = 0$
- Pin Compatible With TS5A3159
- Specified Break-Before-Make Switching
- Low On-State Resistance (1 Ω)
- Control Inputs Are 5.5-V Tolerant
- Low Charge Injection
- Excellent On-State Resistance Matching
- Low Total Harmonic Distortion (THD)
- 1.65-V to 5.5-V Single-Supply Operation
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Performance Tested Per JESD
  - 2000-V Human-Body Model (A114-B, Class II)
  - 1000-V Charged-Device Model (C101)

### APPLICATIONS

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

### DESCRIPTION

The TS5A3159A is a single-pole double-throw (SPDT) analog switch that is designed to operate from 1.65 V to 5.5 V. The device offers low on-state resistance and excellent on-state resistance matching with the break-before-make feature, to prevent signal distortion during the transferring of a signal from one channel to another. The device has an excellent total harmonic distortion (THD) performance and consumes very low power. These features make this device suitable for portable audio applications.



NO – Normally open  
NC – Normally closed

**FUNCTION TABLE**

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



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

**SUMMARY OF CHARACTERISTICS<sup>(1)</sup>**

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

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

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

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

**Absolute Minimum and Maximum Ratings<sup>(1) (2)</sup>**

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

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

- (1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum
- (3) All voltages are with respect to ground, unless otherwise specified.
- (4) The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (5) This value is limited to 5.5 V maximum.
- (6) Pulse at 1-ms duration <10% duty cycle
- (7) The package thermal impedance is calculated in accordance with JESD 51-7.
- (8) The lifetime of the device will be reduced if the device operates continually at this temperature.

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

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

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

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

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

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

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

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

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

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

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

**Electrical Characteristics for 3.3-V Supply<sup>(1)</sup> (Continued)**
 $V_+ = 3\text{ V to }3.6\text{ V}$ ,  $T_A = -40^\circ\text{C to }85^\circ\text{C}$  (unless otherwise noted)

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

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

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

V<sub>+</sub> = 2.3 V to 2.7, T<sub>A</sub> = –40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	T <sub>A</sub>	V <sub>+</sub>	MIN	TYP	MAX	UNIT
<b>Analog Switch</b>								
Analog signal range	V <sub>COM</sub> , V <sub>NO</sub> , V <sub>NC</sub>				0		V <sub>+</sub>	V
Peak on resistance	r <sub>peak</sub>	0 ≤ (V <sub>NO</sub> or V <sub>NC</sub> ) ≤ V <sub>+</sub> , I <sub>COM</sub> = –8 mA,	Switch on, See Figure 15	25°C	2.3 V	1.8	2.5	Ω
				Full				
On-state resistance	r <sub>on</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 1.8 V, I <sub>COM</sub> = –8 mA,	Switch on, See Figure 15	25°C	2.3 V	1.5	2	Ω
				Full				
On-state resistance match between channels	Δr <sub>on</sub>	V <sub>NO</sub> or V <sub>NC</sub> = 1.8 V, I <sub>COM</sub> = –8 mA,	Switch on, See Figure 15	25°C	2.3 V	0.15	0.2	Ω
				Full				
On-state resistance flatness	r <sub>on(flat)</sub>	0 ≤ (V <sub>NO</sub> or V <sub>NC</sub> ) ≤ V <sub>+</sub> , I <sub>COM</sub> = –8 mA,	Switch on, See Figure 15	25°C	2.3 V	0.6		Ω
		V <sub>NO</sub> or V <sub>NC</sub> = 0.8 V, 1.8 V, I <sub>COM</sub> = –8 mA,	Switch on, See Figure 15	25°C				
NC, NO off leakage current	I <sub>NC(OFF)</sub> , I <sub>NO(OFF)</sub>	V <sub>NC</sub> or V <sub>NO</sub> = 0.5 V, V <sub>COM</sub> = 0.5 V to 2.3 V, or V <sub>NC</sub> or V <sub>NO</sub> = 2.3 V, V <sub>COM</sub> = 0.5 V to 2.3 V,	Switch off, See Figure 16	25°C	2.7 V	–20	2	20
				Full				
NC, NO on leakage current	I <sub>NC(ON)</sub> , I <sub>NO(ON)</sub>	V <sub>NC</sub> or V <sub>NO</sub> = 0 to 3.6 V, V <sub>COM</sub> = 3.6 V to 0,	Switch off, See Figure 16	25°C	0 V	–1	0.1	1
				Full				
COM off leakage current	I <sub>COM(PWROFF)</sub>	V <sub>NC</sub> or V <sub>NO</sub> = 2.7 V to 0, V <sub>COM</sub> = 0 to 2.7 V,	Switch off, See Figure 16	25°	0 V	–1	0.1	10
				Full				
COM on leakage current	I <sub>COM(ON)</sub>	V <sub>NC</sub> or V <sub>NO</sub> = Open, V <sub>COM</sub> = 0.5 V, or V <sub>NC</sub> or V <sub>NO</sub> = Open, V <sub>COM</sub> = 2.2 V,	Switch on, See Figure 17	25°C	2.7 V	–10	2	10
				Full				
<b>Digital Input (IN)</b>								
Input logic high	V <sub>IH</sub>			Full		1.8	5.5	V
Input logic low	V <sub>IL</sub>			Full		0	0.6	
Input leakage current	I <sub>IH</sub> , I <sub>IL</sub>	V <sub>I</sub> = 5.5 V or 0		25°C	2.7 V	–2	2	nA
				Full				

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



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

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

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

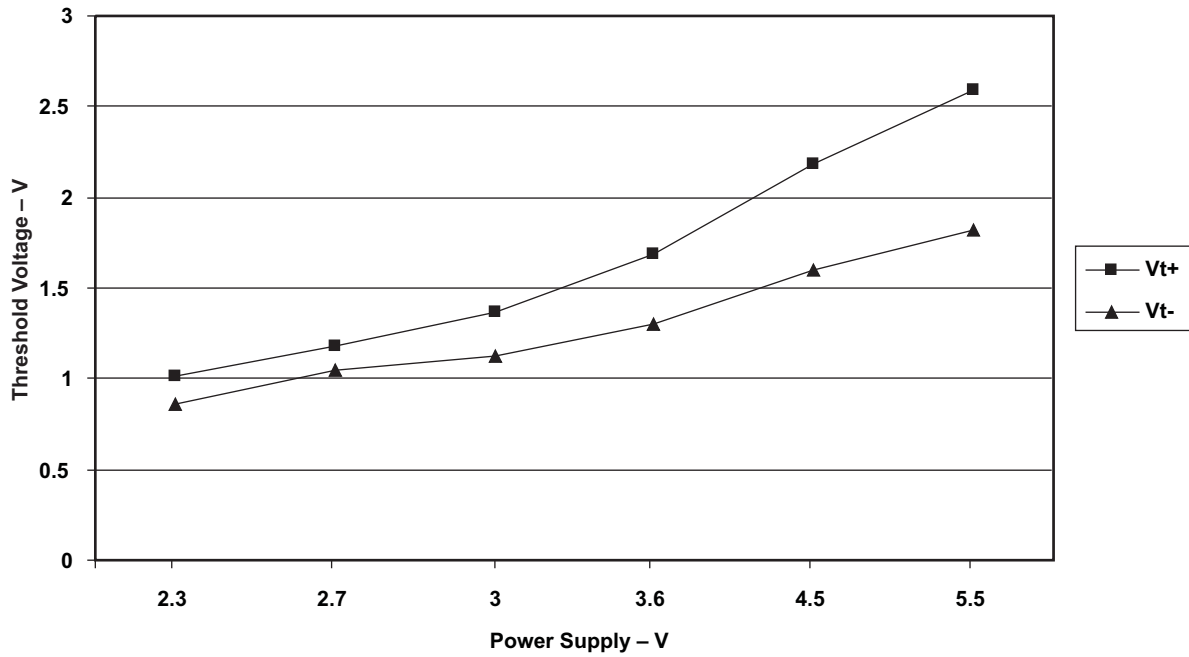


Figure 1. Logic Threshold vs Power Supply

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

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

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

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

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

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

TYPICAL PERFORMANCE

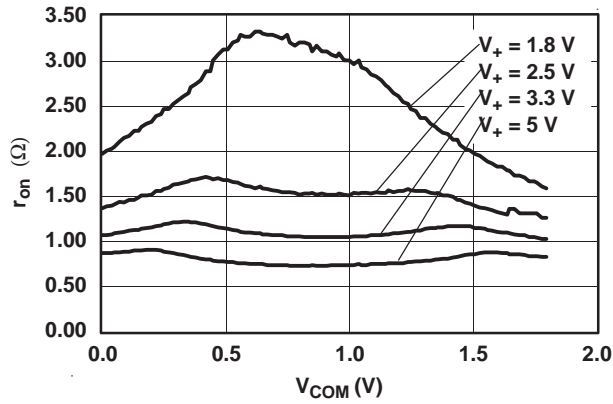


Figure 2.  $r_{on}$  vs  $V_{COM}$

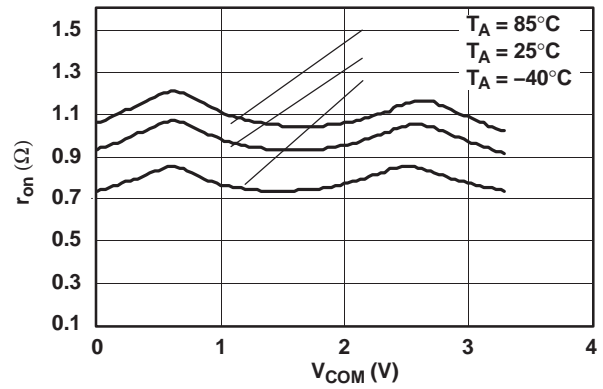


Figure 3.  $r_{on}$  vs  $V_{COM}$  ( $V_+ = 3.3$  V)

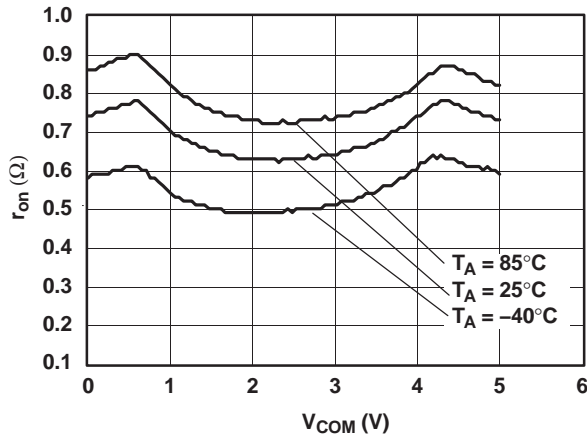


Figure 4.  $r_{on}$  vs  $V_{COM}$  ( $V_+ = 5$  V)

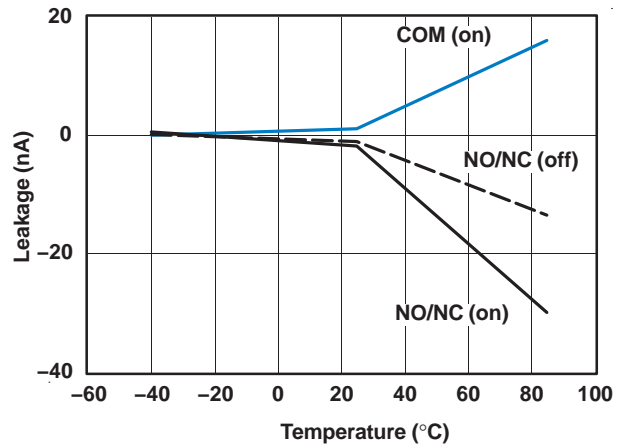


Figure 5. Leakage Current vs Temperature ( $V_+ = 3.3$  V)

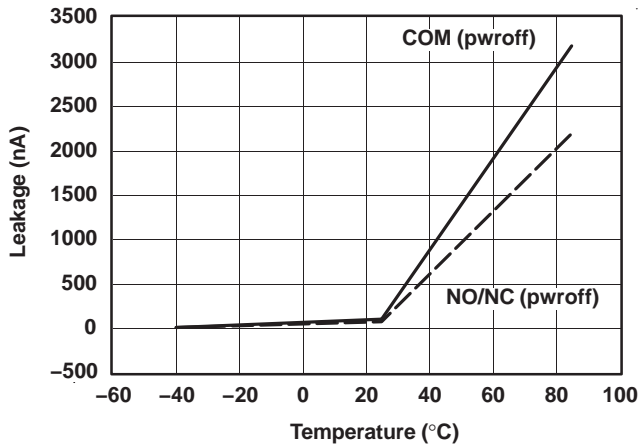


Figure 6. Leakage Current vs Temperature ( $V_+ = 5$  V)

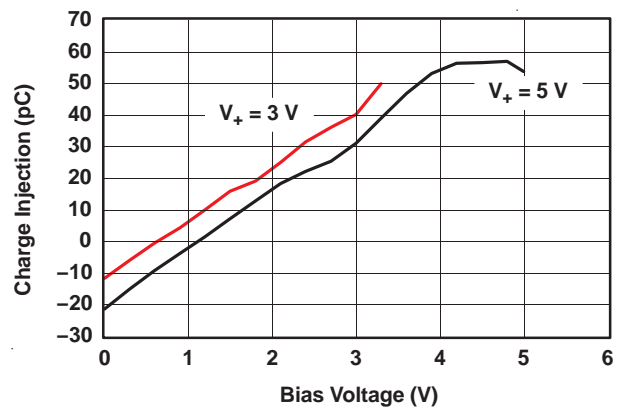


Figure 7. Charge Injection vs Bias Voltage

TYPICAL PERFORMANCE (continued)

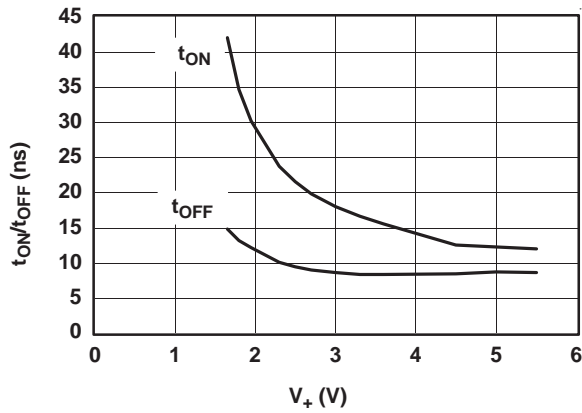


Figure 8. t<sub>ON</sub> and t<sub>OFF</sub> vs Supply Voltage

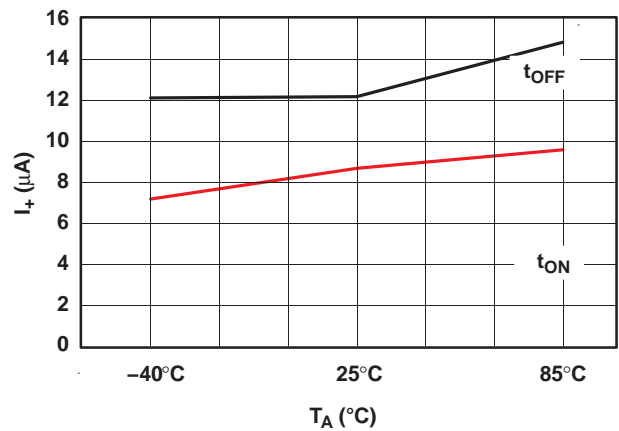


Figure 9. I<sub>+</sub> vs Temperature

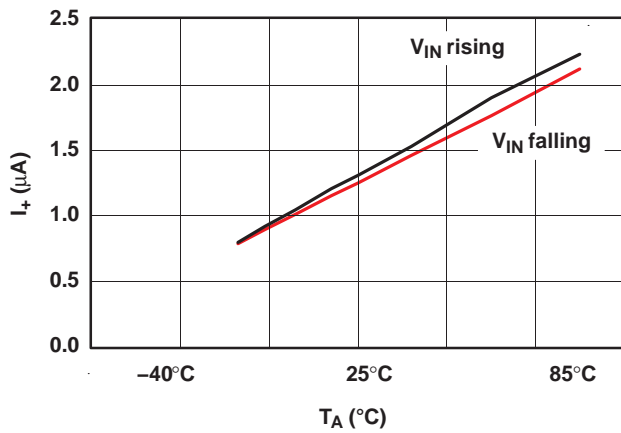


Figure 10. I<sub>+</sub> vs Temperature

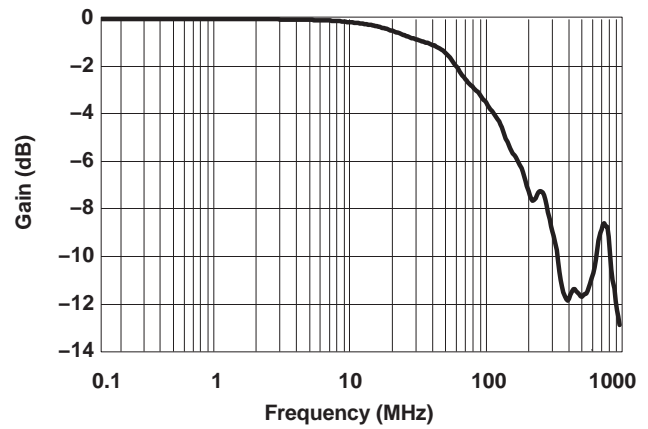


Figure 11. Bandwidth (V<sub>+</sub> = 5 V)

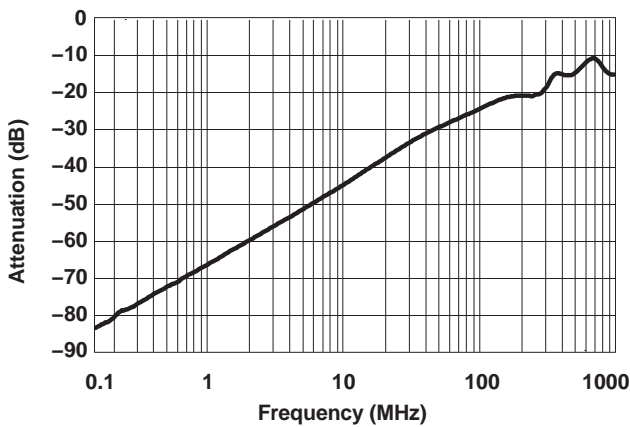


Figure 12. Attenuation vs Frequency

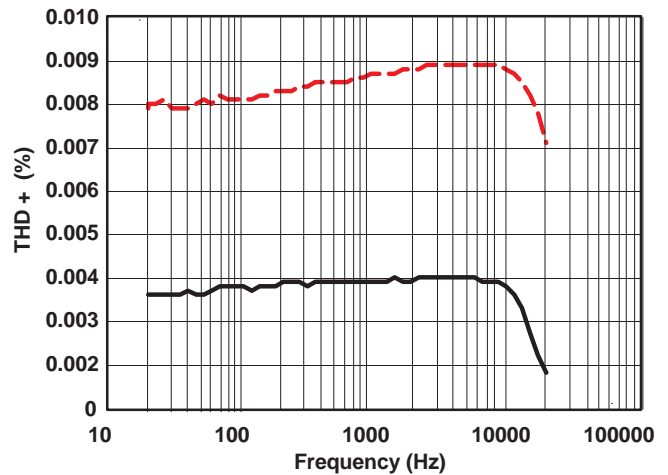
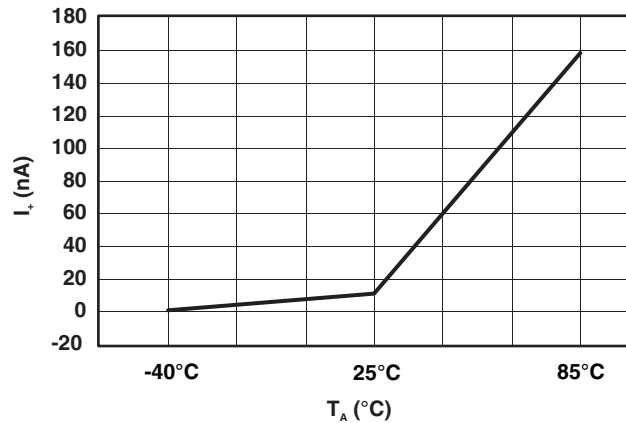


Figure 13. Total Harmonic Distortion vs Frequency (V<sub>+</sub> = 5 V)

**TYPICAL PERFORMANCE (continued)**



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

**PIN DESCRIPTION**

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

## PARAMETER DESCRIPTION

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



PARAMETER MEASUREMENT INFORMATION

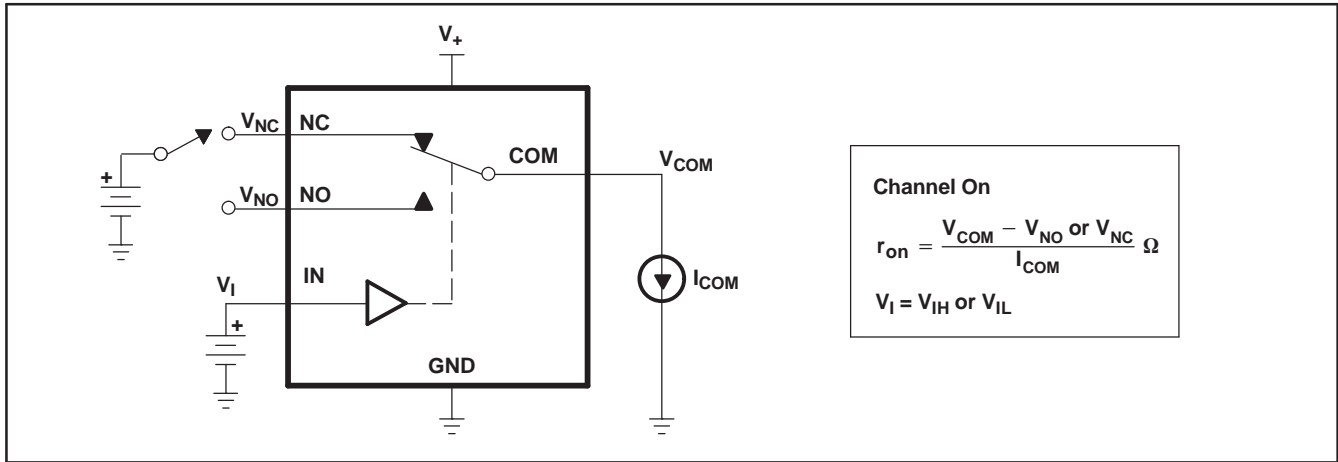


Figure 15. On-State Resistance ( $r_{on}$ )

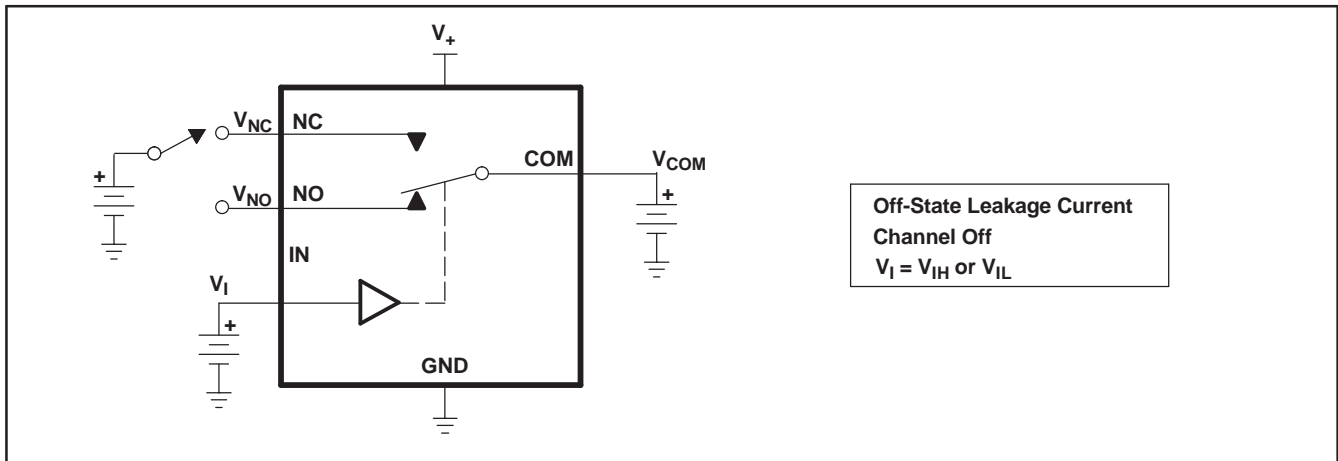


Figure 16. OFF-State Leakage Current ( $I_{NC(OFF)}$ ,  $I_{NC(PWROFF)}$ ,  $I_{NO(OFF)}$ ,  $I_{NO(PWROFF)}$ ,  $I_{COM(OFF)}$ ,  $I_{COM(PWROFF)}$ )

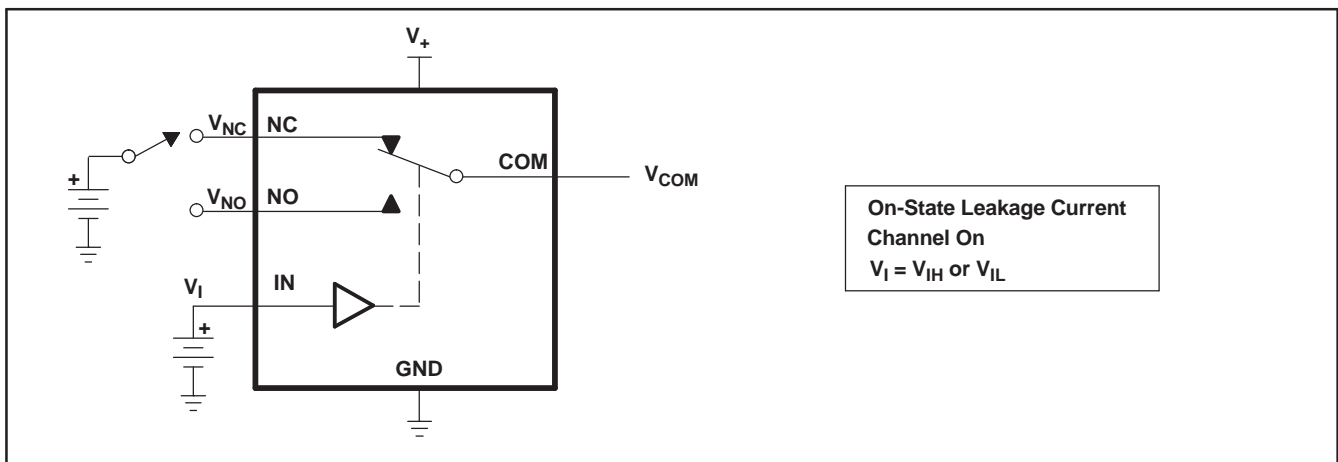


Figure 17. On-State Leakage Current ( $I_{COM(ON)}$ ,  $I_{NC(ON)}$ ,  $I_{NO(ON)}$ )

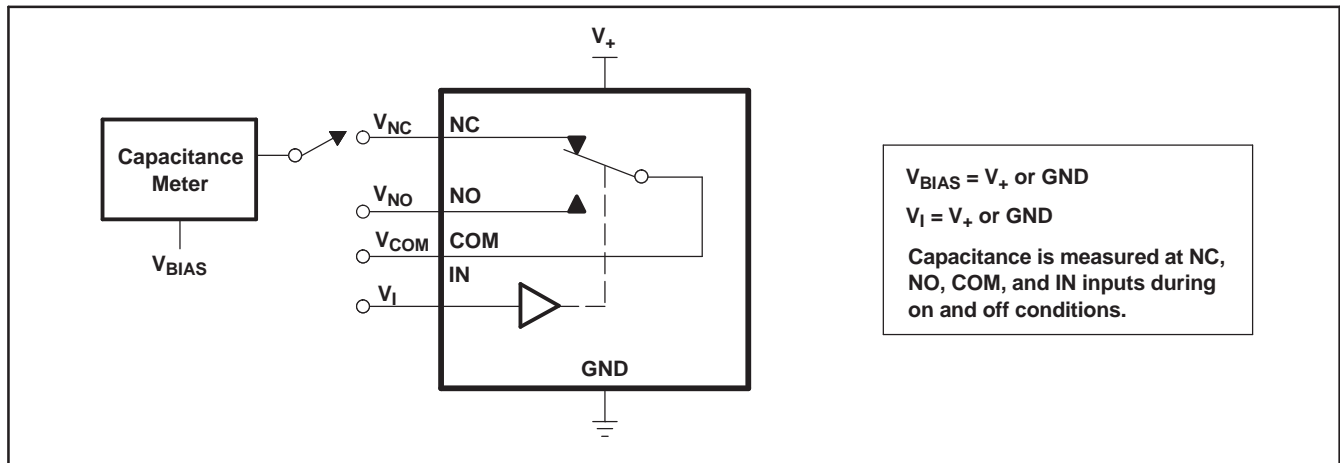
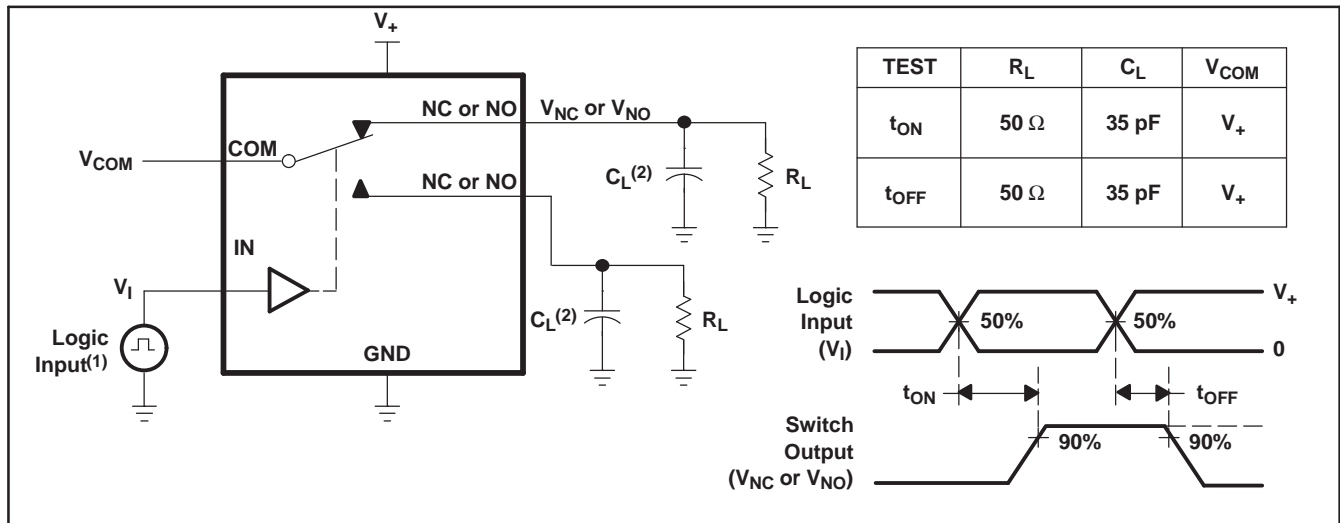
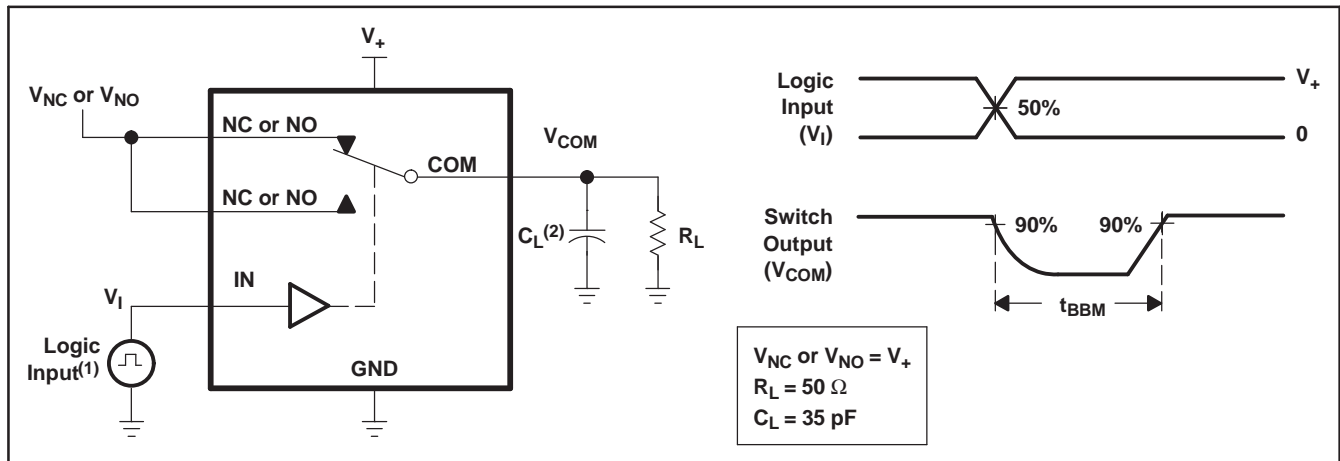


Figure 18. Capacitance ( $C_I$ ,  $C_{COM(ON)}$ ,  $C_{NC(OFF)}$ ,  $C_{NO(OFF)}$ ,  $C_{NC(ON)}$ ,  $C_{NO(ON)}$ )



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

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



- A. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz,  $Z_0 = 50 \Omega$ ,  $t_r < 5$  ns,  $t_f < 5$  ns.
- B.  $C_L$  includes probe and jig capacitance.

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

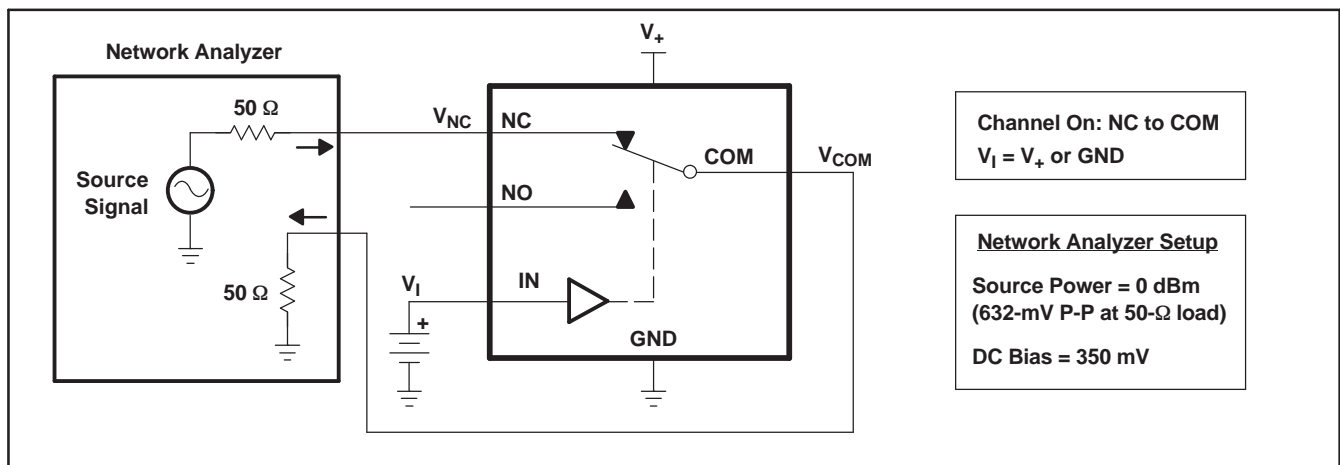


Figure 21. Bandwidth (BW)

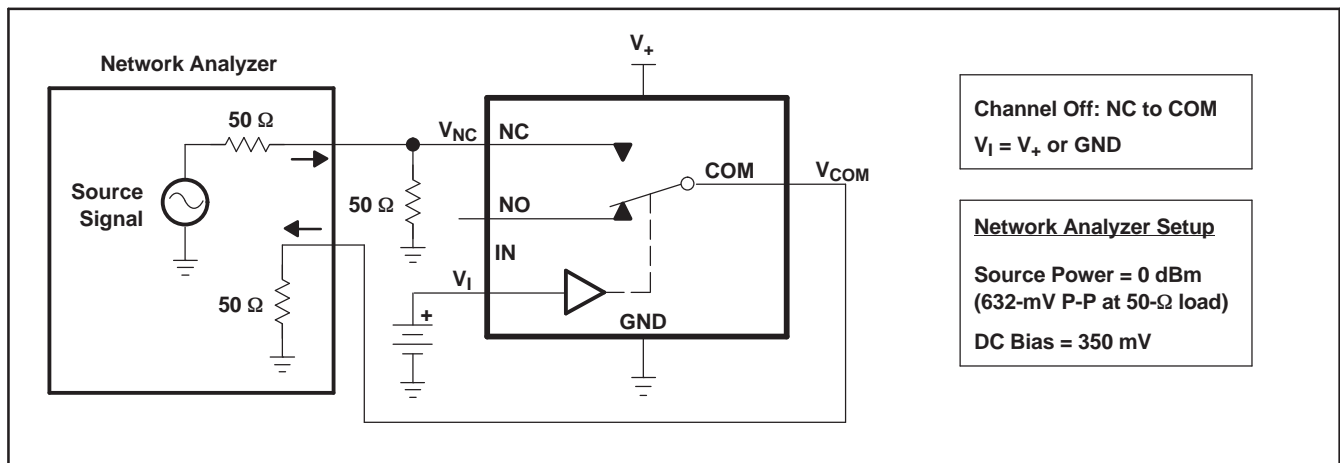


Figure 22. OFF Isolation (OISO)

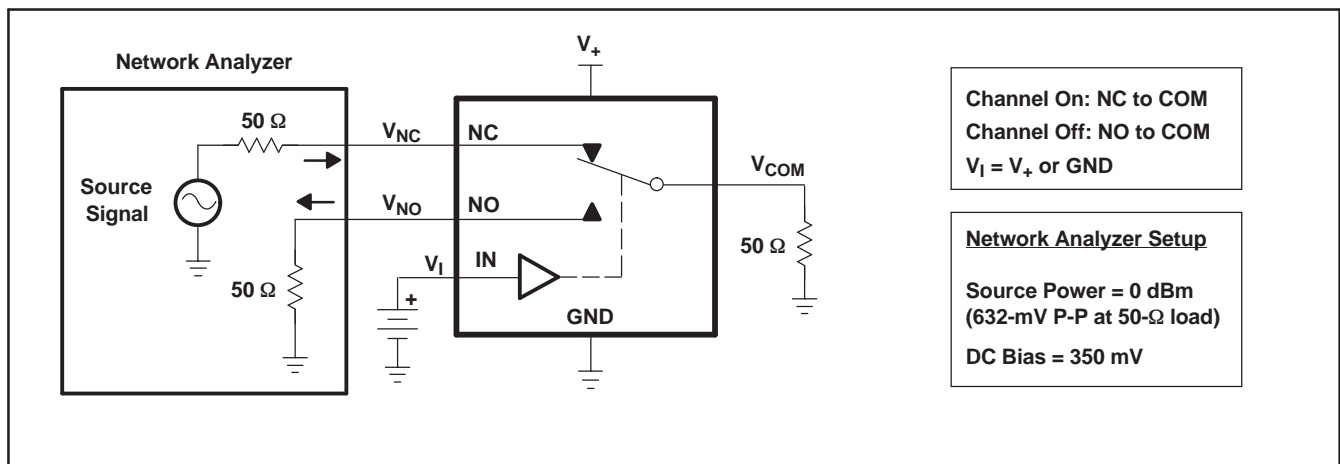
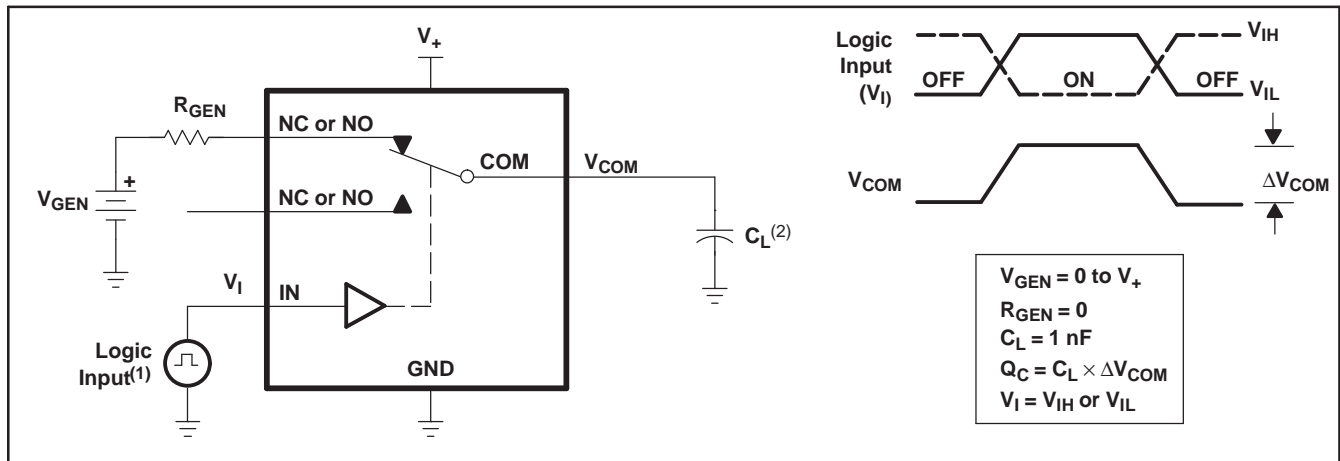
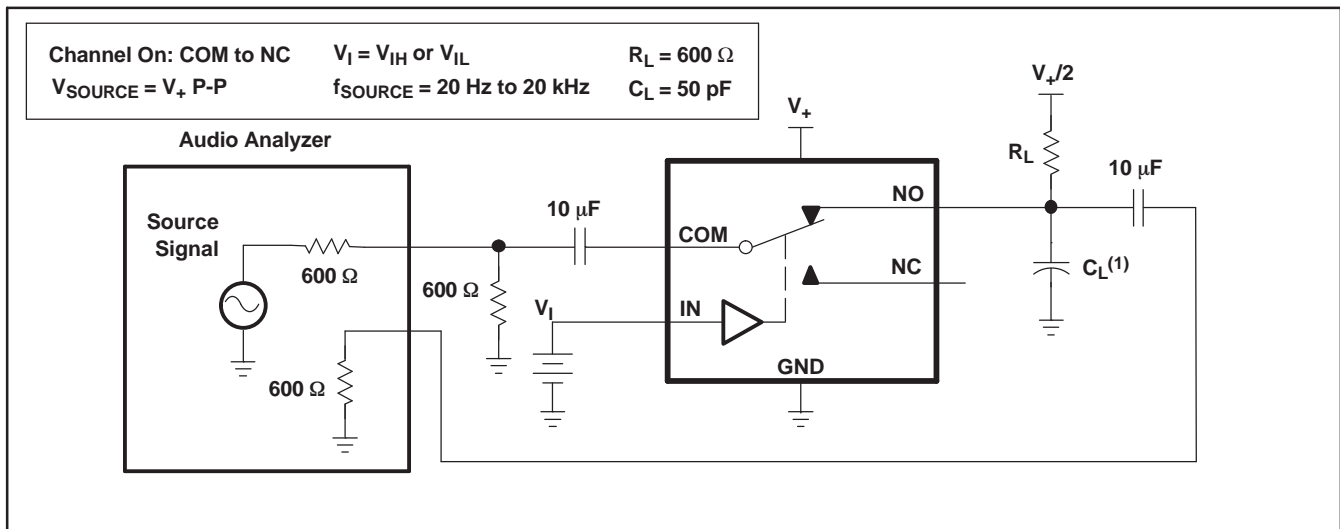


Figure 23. Crosstalk ( $X_{TALK}$ )



- A. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz,  $Z_0 = 50 \Omega$ ,  $t_r < 5$  ns,  $t_f < 5$  ns.
- B.  $C_L$  includes probe and jig capacitance.

Figure 24. Charge Injection ( $Q_C$ )



- A.  $C_L$  includes probe and jig capacitance.

Figure 25. Total Harmonic Distortion (THD)

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TS5A3159ADBVR	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JAJK ~ JAJR)	<a href="#">Samples</a>
TS5A3159ADBVRE4	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JAJK ~ JAJR)	<a href="#">Samples</a>
TS5A3159ADBVRG4	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JAJK ~ JAJR)	<a href="#">Samples</a>
TS5A3159ADBVT	ACTIVE	SOT-23	DBV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JAJK ~ JAJR)	<a href="#">Samples</a>
TS5A3159ADBVTE4	ACTIVE	SOT-23	DBV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JAJK ~ JAJR)	<a href="#">Samples</a>
TS5A3159ADBVTE4	ACTIVE	SOT-23	DBV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JAJK ~ JAJR)	<a href="#">Samples</a>
TS5A3159ADCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JJK ~ JJR)	<a href="#">Samples</a>
TS5A3159ADCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JJK ~ JJR)	<a href="#">Samples</a>
TS5A3159ADCKRG4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JJK ~ JJR)	<a href="#">Samples</a>
TS5A3159ADCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JJK ~ JJR)	<a href="#">Samples</a>
TS5A3159ADCKTE4	ACTIVE	SC70	DCK	6		TBD	Call TI	Call TI	-40 to 85		<a href="#">Samples</a>
TS5A3159ADCKTG4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(JJK ~ JJR)	<a href="#">Samples</a>
TS5A3159AYZPR	ACTIVE	DSBGA	YZP	6	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	(JJ2 ~ JJ7 ~ JJN)	<a href="#">Samples</a>

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

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

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

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

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

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

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

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

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

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

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

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

(4) 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.

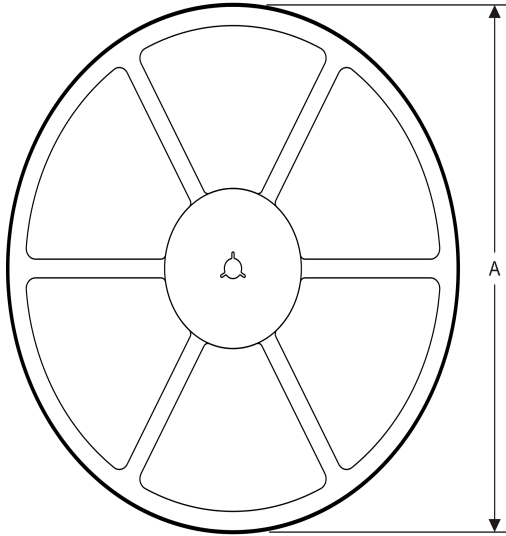
(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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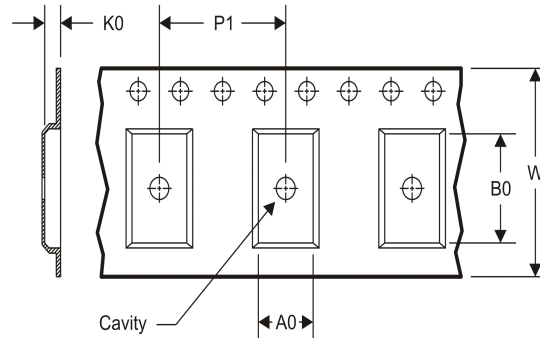
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**TAPE AND REEL INFORMATION**

**REEL DIMENSIONS**



**TAPE DIMENSIONS**



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

**TAPE AND REEL INFORMATION**

\*All dimensions are nominal

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



**TAPE AND REEL BOX DIMENSIONS**

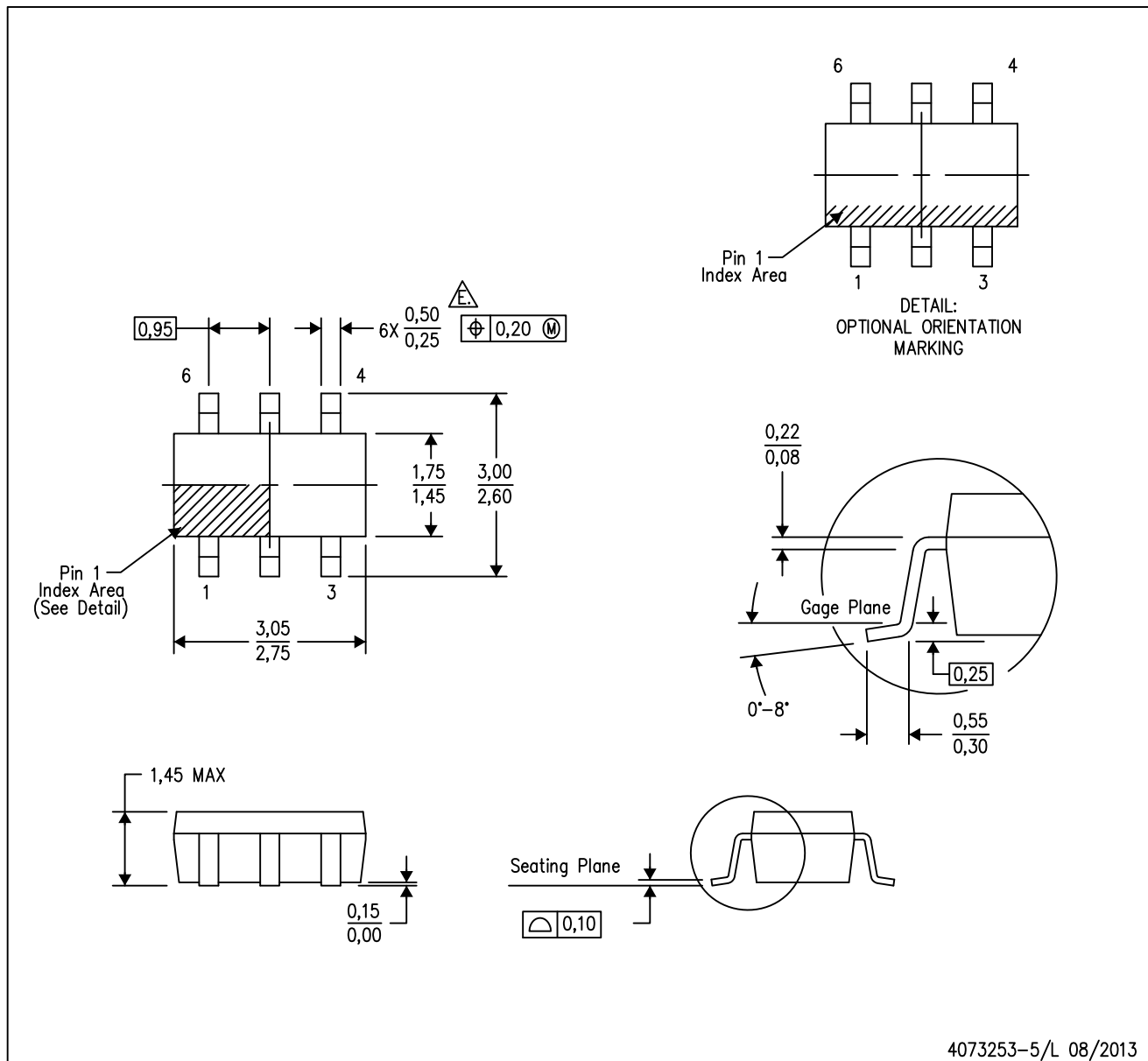

\*All dimensions are nominal


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

# MECHANICAL DATA

DBV (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
  - D. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
-  Falls within JEDEC MO-178 Variation AB, except minimum lead width.

DBV (R-PDSO-G6)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
  - D. Publication IPC-7351 is recommended for alternate designs.
  - E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

DCK (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
  - D. Falls within JEDEC MO-203 variation AB.

DCK (R-PDSO-G6)

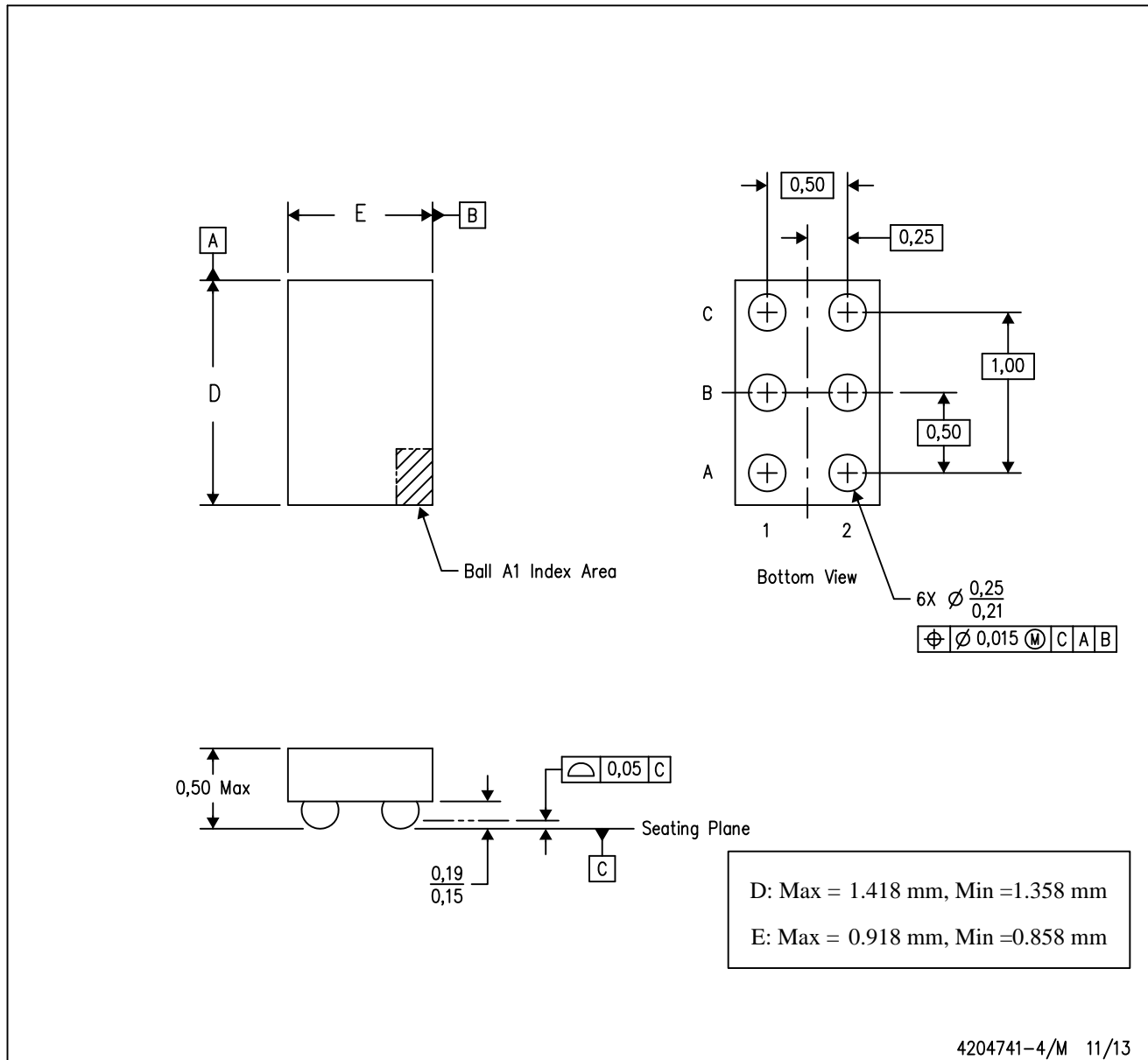
PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
  - Publication IPC-7351 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

YZP (R-XBGA-N6)

DIE-SIZE BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. NanoFree™ package configuration.

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