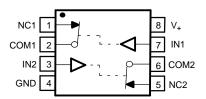
FEATURES

- Isolation in Powered-Off Mode, V₁ = 0
- Low ON-State Resistance (0.9 Ω)
- Control Inputs Are 5.5-V Tolerant
- Low Charge Injection
- 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)

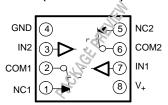
SSOP OR VSSOP PACKAGE (TOP VIEW)



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

YEA, YEP, YZA, OR YZP PACKAGE (BOTTOM VIEW)



DESCRIPTION/ORDERING INFORMATION

The TS5A23167 is a dual single-pole single-throw (SPST) analog switch that is designed to operate from 1.65 V to 5.5 V. The device offers a low ON-state resistance. The device has excellent total harmonic distortion (THD) performance and consumes very low power. These features make this device suitable for portable audio applications.

ORDERING INFORMATION

T _A	PACKAGE ⁽¹⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING (2)
	NanoStar™ – WCSP (DSBGA) 0.23-mm Large Bump – YEP	Tape and reel	TS5A23167YEPR	PACKAGE PREVIEW
-40°C to 85°C	NanoFree™ – WCSP (DSBGA) 0.23-mm Large Bump – YZP (Pb-free)	Tape and reel	TS5A23167YZPR	PACKAGE PREVIEW
	SSOP - DCT	Tape and reel	TS5A23167DCTR	PACKAGE PREVIEW
	VSSOP - DCU (Pb-free)	Tape and reel	TS5A23167DCUR	JAP_

- (1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.
- (2) DCT: The actual top-side marking has three additional characters that designate the year, month, and assembly/test site.
 DCU: The acutal top-side marking has one additional character that designates the assembly/test site.
 YEP/YZP: The actual top-side marking has three preceding characters to denote year, month, and sequence code, and one following character to designate the assembly/test site. Pin 1 identifier indicates solder-bump composition (1 = SnPb, = Pb-free).



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



SUMMARY OF CHARACTERISTICS⁽¹⁾

Configuration	Dual Single Pole Single Throw (2 × SPST)
Number of channels	2
ON-state resistance (r _{on})	0.9 Ω
ON-state resistance match (Δr _{on})	0.1 Ω
ON-state resistance flatness (r _{on(flat)})	0.25 Ω
Turn-on/turn-off time (t _{ON} /t _{OFF})	7.5 ns/9 ns
Charge injection (Q _C)	6 pC
Bandwidth (BW)	150 MHz
OFF isolation (O _{ISO})	-62 dB at 1 MHz
Crosstalk (X _{TALK})	-85 dB at 1 MHz
Total harmonic distortion (THD)	0.005%
Leakage current (I _{COM(OFF)})	±20 nA
Power-supply current (I ₊)	0.1 μΑ
Package option	8-pin VSSOP

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

FUNCTION TABLE

IN	NC TO COM, COM TO NC
L	ON
Н	OFF



Absolute Maximum Ratings (1)(2)

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

			MIN	MAX	UNIT
V ₊	Supply voltage range (3)		-0.5	6.5	V
$V_{NC} V_{COM}$	Analog voltage range (3) (4) (5)		-0.5	V ₊ + 0.5	V
I _K	Analog port diode current	$V_{NC}, V_{COM} < 0$	-50		mA
I _{NC}	On-state switch current	V V 0 to V	-200	200	mA
I _{COM}	On-state peak switch current ⁽⁶⁾	V_{NC} , $V_{COM} = 0$ to V_{+}	-400	400	mA
VI	Digital input voltage range (3) (4)	·	-0.5	6.5	V
I _{IK}	Digital clamp current	V _I < 0	-50		mA
I ₊	Continuous current through V ₊	·		100	mA
I _{GND}	Continuous current through GND		-100	100	mA
		DCT package		220	
	Deal and the good investigation (7)	DCU package		227	0000
θ_{JA}	Package thermal impedance ⁽⁷⁾	YEA/YZA package		140	°C/W
		YEP/YZP package		102	
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. The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum

All voltages are with respect to ground, unless otherwise specified.

The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

This value is limited to 5.5 V maximum.

Pulse at 1-ms duration < 10% duty cycle.

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

TS5A23167 0.9- Ω DUAL SPST ANALOG SWITCH 5-V/3.3-V 2-CHANNEL ANALOG SWITCH





Electrical Characteristics for 5-V Supply⁽¹⁾

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

PARAMETER	SYMBOL	TEST CONDIT	TIONS	T _A	٧,	MIN	TYP	MAX	UNIT
Analog Switch								,	
Analog signal range	V _{COM} , V _{NC}					0		V ₊	V
Peak ON resistance	r .	$0 \le V_{NC} \le V_+,$ $I_{COM} = -100 \text{ mA},$	Switch ON,	25°C	4.5 V		0.9	1.1	Ω
reak ON lesistatice	r _{peak}	$I_{COM} = -100 \text{ mA},$	See Figure 13	Full	4.5 V			1.2	22
ON-state resistance	r	$V_{NC} = 2.5 V,$	Switch ON,	25°C	4.5 V		0.75	0.9	Ω
OIV state resistance	r _{on}	$I_{COM} = -100 \text{ mA},$	See Figure 13	Full	4.5 V			1	22
ON-state resistance		V _{NC} = 2.5 V,	Switch ON,	25°C	45.77		0.04	0.1	0
match between channels	Δr_{on}	$I_{COM} = -100 \text{ mA},$	See Figure 13	Full	4.5 V			0.1	Ω
ON-state resistance		$0 \le V_{NC} \le V_+,$ $I_{COM} = -100 \text{ mA},$	Switch ON, See Figure 13	25°C			0.2		
flatness	r _{on(flat)}	V _{NC} = 1 V, 1.5 V, 2.5 V,	Switch ON,	25°C	4.5 V		0.15	0.25	Ω
		$I_{COM} = -100 \text{ mA},$	See Figure 13	Full				0.25	
		V _{NC} = 1 V,		25°C		0 V	4	20	
NC OFF leakage current	I _{NC(OFF)}	$V_{COM} = 4.5 \text{ V},$ or $V_{NC} = 4.5 \text{ V},$ $V_{COM} = 1 \text{ V},$	Switch OFF, See Figure 14	Full	5.5 V	-150		150	nA
		$V_{NC} = 0 \text{ to } 5.5 \text{ V},$	Switch OFF,	25°C	2.17	-10	0.2	10	
	I _{NC(PWROFF)}		See Figure 14	Full	0 V	-50		50	μΑ
		$V_{COM} = 1 V$,		25°C		0 V	4	20	
COM OFF leakage current	I _{COM(OFF)}	$V_{NC} = 4.5 \text{ V},$ or $V_{COM} = 4.5 \text{ V},$ $V_{NC} = 1 \text{ V},$	Switch OFF, See Figure 14	Full	5.5 V	-150		150	nA
	1	$V_{COM} = 0 \text{ to } 5.5 \text{ V},$	Switch OFF,	25°C	0 V	-10	0.2	10	μΑ
	I _{COM(PWROFF)}	$V_{NC} = 5.5 \text{ V to 0},$	See Figure 14	Full	O V	-50		50	μΛ
		$V_{NC} = 1 V$		25°C		-5	0.4	5	
NC ON leakage current	I _{NC(ON)}	$V_{COM} = Open,$ or $V_{NC} = 4.5 \text{ V},$ $V_{COM} = Open,$	Switch ON, See Figure 15	Full	5.5 V	-50		50	nA
		$V_{COM} = 1 V$,		25°C		-5	0.4	5	
COM ON leakage current	I _{COM(ON)}	$V_{NC} = \text{Open},$ or $V_{COM} = 4.5 \text{ V},$ $V_{NC} = \text{Open},$	Switch ON, See Figure 15	Full	5.5 V	-50		50	nA
Digital Control Input	s (IN1, IN2) ⁽²⁾								
Input logic high	V _{IH}			Full		2.4		5.5	V
Input logic low	V _{IL}			Full		0		8.0	V
Input leakage	1 1	V _I = 5.5 V or 0		25°C	5.5 V	-2	0.3	2	nA
current	I _{IH} , I _{IL}	v ₁ = 5.5 v 0i 0		Full	5.5 V	-20		20	ПА

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

⁽²⁾ All unused digital inputs of the device must be held at V₊ or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.



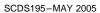
Electrical Characteristics for 5-V Supply⁽¹⁾ (continued)

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

PARAMETER	SYMBOL	TEST CO	ONDITIONS	TA	V+	MIN	TYP	MAX	UNIT
Dynamic				•	•			'	
		V V	0 25 -5	25°C	5 V	1	4.5	7.5	
Turn-on time	t _{ON}	$V_{COM} = V_+,$ $R_L = 50 \Omega,$	C _L = 35 pF, See Figure 17	Full	4.5 V to 5.5 V	1		9	ns
		V V	0 25 -5	25°C	5 V	4.5	8	11	
Turn-off time	t _{OFF}	$V_{COM} = V_+,$ $R_L = 50 \Omega,$	C _L = 35 pF, See Figure 17	Full	4.5 V to 5.5 V	3.5		13	ns
Charge injection	Q _C	$V_{GEN} = 0,$ $R_{GEN} = 0$,	C _L = 1 nF, See Figure 21	25°C	5 V		6		рС
NC OFF capacitance	C _{NC(OFF)}	V _{NC} = V ₊ or GND, Switch OFF,	See Figure 16	25°C	5 V		19		pF
COM OFF capacitance	C _{COM(OFF)}	V _{COM} = V ₊ or GND, Switch OFF,	See Figure 16	25°C	5 V		18		pF
NC ON capacitance	C _{NC(ON)}	V _{NC} = V ₊ or GND, Switch ON,	See Figure 16	25°C	5 V		35.5		pF
COM ON capacitance	C _{COM(ON)}	V _{COM} = V ₊ or GND, Switch ON,	See Figure 16	25°C	5 V		35.5		pF
Digital input capacitance	Cı	$V_I = V_+ \text{ or GND},$	See Figure 16	25°C	5 V		2		pF
Bandwidth	BW	$R_L = 50 \Omega$, Switch ON,	See Figure 18	25°C	5 V		150		MHz
OFF isolation	O _{ISO}	$R_L = 50 \Omega$, f = 1 MHz,	Switch OFF, See Figure 19	25°C	5 V		-62		dB
Crosstalk	X _{TALK}	$R_L = 50 \Omega$, f = 1 MHz,	Switch ON, See Figure 20	25°C	5 V		-85		dB
Total harmonic distortion	THD	$R_L = 600 \Omega,$ $C_L = 50 pF,$	f = 20 Hz to 20 kHz, See Figure 22	25°C	5 V		0.00		%
Supply				•	•			'	
Positive supply		V V as CND	Constab ON as OFF	25°C	5.5.V		0.01	0.1	^
current	I ₊	$V_1 = V_+ \text{ or GND},$	Switch ON or OFF	Full	5.5 V			1	μΑ

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

TS5A23167 0.9- Ω DUAL SPST ANALOG SWITCH 5-V/3.3-V 2-CHANNEL ANALOG SWITCH





Electrical Characteristics for 3.3-V Supply⁽¹⁾

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

PARAMETER	SYMBOL	TEST CON	TEST CONDITIONS		V ₊	MIN	TYP	MAX	UNIT
Analog Switch								,	
Analog signal range	V _{COM} , V _{NC}					0		V ₊	V
Peak ON resistance	_	$0 \le V_{NC} \le V_+$	Switch ON,	25°C	3 V		1.3	1.6	Ω
Peak On resistance	r _{peak}	$I_{COM} = -100 \text{ mA},$	See Figure 13	Full	3 V			1.8	52
ON-state resistance	_	$V_{NC} = 2 V$,	Switch ON,	25°C	3 V		1.1	1.5	Ω
ON-State resistance	r _{on}	$I_{COM} = -100 \text{ mA},$	See Figure 13	Full	3 V			1.7	22
ON-state resistance		V _{NC} = 2 V, 0.8 V,	Switch ON,	25°C			0.04	0.1	
match between channels	$\Delta r_{\sf on}$	$I_{COM} = -100 \text{ mA},$	See Figure 13	Full	3 V			0.1	Ω
ON-state resistance		$0 \le V_{NC} \le V_+,$ $I_{COM} = -100 \text{ mA},$	Switch ON, See Figure 13	25°C	0.1/		0.3		
flatness	r _{on(flat)}	$V_{NC} = 2 V, 0.8 V,$	Switch ON,	25°C	3 V		0.15	0.25	Ω
		$I_{COM} = -100 \text{ mA},$	See Figure 13	Full				0.25	
		$V_{NC} = 1 V$,		25°C		- 5	0.5	5	
NC OFF leakage current	I _{NC(OFF)}	$V_{COM} = 3 \text{ V},$ or $V_{NC} = 3 \text{ V},$ $V_{COM} = 1 \text{ V},$	Switch OFF, See Figure 14	Full	3.6 V	-50		50	nA
-		$V_{NC} = 0 \text{ to } 3.6 \text{ V},$	Switch OFF,	25°C	0.1/	-5	0.1	5	^
	I _{NC(PWROFF)}	$V_{COM} = 3.6 \text{ V to 0},$	See Figure 14	Full	0 V	-25		25	μΑ
		$V_{COM} = 1 V$,		25°C		-5	0.5	5	
COM OFF leakage current	I _{COM(OFF)}	$\begin{aligned} &V_{NC}=3\ V,\\ ∨\\ &V_{COM}=3\ V,\\ &V_{NC}=1\ V, \end{aligned}$	Switch OFF, See Figure 14	Full	3.6 V	-50		50	nA
	1	$V_{COM} = 0 \text{ to } 3.6 \text{ V},$	Switch OFF,	25°C	0 V	- 5	0.1	5	^
	I _{COM(PWROFF)}	$V_{NC} = 3.6 \text{ V to } 0,$	See Figure 14	Full	0 0	-25		25	μΑ
		V _{NC} = 1 V,		25°C		-2	0.3	2	
NC ON leakage current	I _{NC(ON)}	$V_{COM} = Open,$ or $V_{NC} = 3 V,$ $V_{COM} = Open,$	Switch ON, See Figure 15	Full	3.6 V	-20		20	nA
		$V_{COM} = 1 V$,		25°C		-2	0.3	2	
COM ON leakage current	I _{COM(ON)}	$V_{NC} = Open,$ or $V_{COM} = 3 V,$ $V_{NC} = Open,$	Switch ON, See Figure 15	Full	3.6 V	-20		20	nA
Digital Control Inputs	(IN1, IN2) ⁽²⁾								
Input logic high	V _{IH}			Full		2		5.5	V
Input logic low	V _{IL}			Full		0		8.0	V
Input leakage current	I _{IH} , I _{IL}	V _I = 5.5 V or 0		25°C Full	3.6 V	-2 -20	0.3	20	nA

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

⁽²⁾ All unused digital inputs of the device must be held at V₊ or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.



Electrical Characteristics for 3.3-V Supply⁽¹⁾ (continued)

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

PARAMETER	SYMBOL	TEST CO	ONDITIONS	T _A	V+	MIN	TYP	MAX	UNIT
Dynamic									
		V V	0 25 -5	25°C	3.3 V	1.5	5	9.5	
Turn-on time	t _{ON}	$V_{COM} = V_+,$ $R_L = 50 \Omega,$	C _L = 35 pF, See Figure 17	Full	3 V to 3.6 V	1.0		10	ns
		V - V	C = 25 pE	25°C	3.3 V	4.5	8.5	11	
Turn-off time	t _{OFF}	$V_{COM} = V_+,$ $R_L = 50 \Omega,$	C _L = 35 pF, See Figure 17	Full	3 V to 3.6 V	3		12.5	ns
Charge injection	Q_{C}	$V_{GEN} = 0,$ $R_{GEN} = 0,$	C _L = 1 nF, See Figure 21	25°C	3.3 V		6		рС
NC OFF capacitance	C _{NC(OFF)}	V _{NC} = V ₊ or GND, Switch OFF,	See Figure 16	25°C	3.3 V		19.5		pF
COM OFF capacitance	C _{COM(OFF)}	V _{COM} = V ₊ or GND, Switch OFF,	See Figure 16	25°C	3.3 V		18.5		pF
NC ON capacitance	C _{NC(ON)}	V _{NC} = V ₊ or GND, Switch ON,	See Figure 16	25°C	3.3 V		36		pF
COM ON capacitance	C _{COM(ON)}	V _{COM} = V ₊ or GND, Switch ON,	See Figure 16	25°C	3.3 V		36		pF
Digital input capacitance	C _I	$V_I = V_+ \text{ or GND},$	See Figure 16	25°C	3.3 V		2		pF
Bandwidth	BW	$R_L = 50 \Omega$, Switch ON,	See Figure 18	25°C	3.3 V		150		MHz
OFF isolation	O _{ISO}	$R_L = 50 \Omega$, f = 1 MHz,	Switch OFF, See Figure 19	25°C	3.3 V		-62		dB
Crosstalk	X _{TALK}	$R_L = 50 \Omega$, f = 1 MHz,	Switch ON, See Figure 20	25°C	3.3 V		-85		dB
Total harmonic distortion	THD	$R_L = 600 \Omega,$ $C_L = 50 pF,$	f = 20 Hz to 20 kHz, See Figure 22	25°C	3.3 V		0.01		%
Supply	•				•			•	
Positive supply		V V or CND	Switch ON or OFF	25°C	261/		0.001	0.05	^
current	I ₊	$V_1 = V_+ \text{ or GND},$	Switch ON or OFF	Full	3.6 V			0.3	μΑ

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

TS5A23167 0.9- Ω DUAL SPST ANALOG SWITCH 5-V/3.3-V 2-CHANNEL ANALOG SWITCH





Electrical Characteristics for 2.5-V Supply⁽¹⁾

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

PARAMETER	SYMBOL	TEST CON	DITIONS	T _A	V ₊	MIN	TYP	MAX	UNIT	
Analog Switch								'		
Analog signal range	V _{COM} , V _{NC}				2.3 V	0		V ₊	V	
Peak ON resistance		$0 \le V_{NC} \le V_+$	Switch ON,	25°C	2.3 V		1.8	2.4	Ω	
Peak On resistance	r _{peak}	$I_{COM} = -100 \text{ mA},$	See Figure 13	Full	2.3 V			2.6	22	
ON-state resistance	_	$V_{NC} = 2 V$,	Switch ON,	25°C	2.3 V		1.2	2.1	Ω	
ON-State resistance	r _{on}	$I_{COM} = -100 \text{ mA},$	See Figure 13	Full	2.3 V			2.4	22	
ON-state resistance		V _{NC} = 2 V, 0.8 V,	Switch ON,	25°C			0.04	0.15		
match between channels	$\Delta r_{\sf on}$	$I_{COM} = -100 \text{ mA},$	See Figure 13	Full	2.3 V			0.15	Ω	
ON-state resistance	_	$0 \le V_{NC} \le V_+,$ $I_{COM} = -100 \text{ mA},$	Switch ON, See Figure 13	25°C	0.01/		0.7		-	
flatness	r _{on(flat)}	$V_{NC} = 2 V, 0.8 V,$	Switch ON,	25°C	2.3 V		0.4	0.6	Ω	
		$I_{COM} = -100 \text{ mA},$	See Figure 13	Full				0.6		
		$V_{NC} = 1 V$		25°C		- 5	0.3	5		
NC OFF leakage current	I _{NC(OFF)}	$V_{COM} = 3 \text{ V},$ or $V_{NC} = 3 \text{ V},$ $V_{COM} = 1 \text{ V},$	Switch OFF, See Figure 14	Full	2.7 V	-50		50	nA	
-			$V_{NC} = 0 \text{ to } 3.6 \text{ V},$	Switch OFF,	25°C	0.1/	-2	0.05	2	^
	I _{NC(PWROFF)}	$V_{COM} = 3.6 \text{ V to 0},$	See Figure 14	Full	0 V	-15		15	μΑ	
		$V_{COM} = 1 V$,		25°C		-5	0.3	5		
COM OFF leakage current	I _{COM(OFF)}	$V_{NC} = 3 V$, or $V_{COM} = 3 V$, $V_{NC} = 1 V$,	Switch OFF, See Figure 14	Full	2.7 V	-50		50	nA	
	1	$V_{COM} = 0 \text{ to } 3.6 \text{ V},$	Switch OFF,	25°C	0 V	-2	0.05	2	^	
	I _{COM(PWROFF)}	$V_{NC} = 3.6 \text{ V to } 0,$	See Figure 14	Full	0 0	-15		15	μΑ	
		$V_{NC} = 1 V$,		25°C		-2	0.3	2		
NC ON leakage current	I _{NC(ON)}	$V_{COM} = Open,$ or $V_{NC} = 3 V,$ $V_{COM} = Open,$	Switch ON, See Figure 15	Full	2.7 V	-20		20	nA	
		$V_{COM} = 1 V$,		25°C		-2	0.3	2		
COM ON leakage current	I _{COM(ON)}	$V_{NC} = Open,$ or $V_{COM} = 3 V,$ $V_{NC} = Open,$	Switch ON, See Figure 15	Full	2.7 V	-20		20	nA	
Digital Control Inputs	(IN1, IN2) ⁽²⁾									
Input logic high	V _{IH}			Full		1.8		5.5	V	
Input logic low	V _{IL}			Full		0		0.6	V	
Input leakage current	I _{IH} , I _{IL}	V _I = 5.5 V or 0		25°C Full	2.7 V	-2 -20	0.3	20	nA	

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

⁽²⁾ All unused digital inputs of the device must be held at V₊ or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.



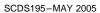
Electrical Characteristics for 2.5-V Supply⁽¹⁾ (continued)

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

PARAMETER	SYMBOL	TEST CO	ONDITIONS	T _A	V+	MIN	TYP	MAX	UNIT
Dynamic									
		\/ \/	0 25 - 5	25°C	2.5 V	2	6	10	
Turn-on time	t _{ON}	$V_{COM} = V_+,$ $R_L = 50 \Omega,$	C _L = 35 pF, See Figure 17	Full	2.3 V to 2.7 V	1		12	ns
		V - V	C = 25 pE	25°C	2.5 V	4.5	8	12.5	
Turn-off time	t _{OFF}	$V_{COM} = V_+,$ $R_L = 50 \Omega,$	C _L = 35 pF, See Figure 17	Full	2.3 V to 2.7 V	3		15	ns
Charge injection	$Q_{\mathbb{C}}$	$V_{GEN} = 0,$ $R_{GEN} = 0,$	$C_L = 1 \text{ nF},$ See Figure 21	25°C	2.5 V		4		рС
NC OFF capacitance	C _{NC(OFF)}	V _{NC} = V ₊ or GND, Switch OFF,	See Figure 16	25°C	2.5 V		19.5		pF
COM OFF capacitance	C _{COM(OFF)}	V _{COM} = V ₊ or GND, Switch OFF,	See Figure 16	25°C	2.5 V		18.5		pF
NC ON capacitance	C _{NC(ON)}	V _{NC} = V ₊ or GND, Switch ON,	See Figure 16	25°C	2.5 V		36.5		pF
COM ON capacitance	C _{COM(ON)}	V _{COM} = V ₊ or GND, Switch ON,	See Figure 16	25°C	2.5 V		36.5		pF
Digital input capacitance	C _I	$V_I = V_+ \text{ or GND},$	See Figure 16	25°C	2.5 V		2		pF
Bandwidth	BW	$R_L = 50 \Omega$, Switch ON,	See Figure 18	25°C	2.5 V		150		MHz
OFF isolation	O _{ISO}	$R_L = 50 \Omega$, f = 1 MHz,	Switch OFF, See Figure 19	25°C	2.5 V		-62		dB
Crosstalk	X _{TALK}	$R_L = 50 \Omega$, f = 1 MHz,	Switch ON, See Figure 20	25°C	3.3 V		-85		dB
Total harmonic distortion	THD	$R_L = 600 \Omega,$ $C_L = 50 pF,$	f = 20 Hz to 20 kHz, See Figure 22	25°C	2.5 V		0.02		%
Supply	•				•	•		•	
Positive supply		V V or CND	Switch ON or OFF	25°C	271/		0.001	0.02	^
current	I ₊	$V_I = V_+ \text{ or GND},$	Switch ON or OFF	Full	2.7 V			0.25	μΑ

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

TS5A23167 0.9- Ω DUAL SPST ANALOG SWITCH 5-V/3.3-V 2-CHANNEL ANALOG SWITCH





Electrical Characteristics for 1.8-V Supply⁽¹⁾

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

PARAMETER	SYMBOL	TEST CON	DITIONS	TA	V ₊	MIN	TYP	MAX	UNIT
Analog Switch									
Analog signal range	V _{COM} , V _{NC}					0		V ₊	V
Peak ON resistance	r	$0 \le V_{NC} \le V_+,$ $I_{COM} = -100 \text{ mA},$	Switch ON,	25°C	1.65 V		4.2	25	Ω
reak ON Tesistance	r _{peak}	$I_{COM} = -100 \text{ mA},$	See Figure 13	Full	1.05 V			30	52
ON-state resistance	r	$V_{NC} = 2 V$,	Switch ON,	25°C	1.65 V		1.6	3.9	Ω
ON-State resistance	r _{on}	$I_{COM} = -100 \text{ mA},$	See Figure 13	Full	1.05 V			4.0	52
ON-state resistance		V _{NC} = 2 V, 0.8 V,	Switch ON,	25°C	4.05.1/		0.04	0.2	
match between channels	$\Delta {\sf r}_{\sf on}$	$I_{COM} = -100 \text{ mA},$	See Figure 13	Full	1.65 V			0.2	Ω
ON-state resistance		$0 \le V_{NC} \le V_+,$ $I_{COM} = -100 \text{ mA},$	Switch ON, See Figure 13	25°C			2.8		
flatness	r _{on(flat)}	$V_{NC} = 2 \text{ V}, 0.8 \text{ V},$	Switch ON,	Switch ON, 25°C 1.65 V			4.1	22	Ω
		$I_{COM} = -100 \text{ mA},$	See Figure 13	Full				27	
		$V_{NC} = 1 V$		25°C		- 5		5	
NC OFF leakage current	I _{NC(OFF)}	$V_{COM} = 3 \text{ V},$ or $V_{NC} = 3 \text{ V},$ $V_{COM} = 1 \text{ V},$	Switch OFF, See Figure 14	Full	1.95 V	-50		50	nA
		$V_{NC} = 0 \text{ to } 3.6 \text{ V},$	Switch OFF,	25°C	0.17	-2		2	
	I _{NC(PWROFF)}	$V_{COM} = 3.6 \text{ V to } 0,$	See Figure 14	Full	0 V	-10		10	μΑ
		$V_{COM} = 1 V$,		25°C		-5		5	
COM OFF leakage current	I _{COM(OFF)}	$\begin{split} &V_{NC}=3\ V,\\ ∨\\ &V_{COM}=3\ V,\\ &V_{NC}=1\ V, \end{split}$	Switch OFF, See Figure 14	Full	1.95 V	-50		50	nA
	-	$V_{COM} = 0 \text{ to } 3.6 \text{ V},$	Switch OFF,	25°C	0 V	-2		2	^
	I _{COM(PWROFF)}	$V_{NC} = 3.6 \text{ V to 0},$	See Figure 14	Full	0 0	-10		10	μΑ
		$V_{NC} = 1 V$		25°C		-2		2	
NC ON leakage current	I _{NC(ON)}	$V_{COM} = Open,$ or $V_{NC} = 3 V,$ $V_{COM} = Open,$	Switch ON, See Figure 15	Full	1.95 V	-20		20	nA
		$V_{COM} = 1 V$,		25°C		-2		2	
COM ON leakage current	I _{COM(ON)}	$V_{NC} = Open,$ or $V_{COM} = 3 V,$ $V_{NC} = Open,$	Switch ON, See Figure 15	Full	1.95 V	-20		20	nA
Digital Control Inputs	(IN1, IN2) ⁽²⁾	•						,	
Input logic high	V_{IH}			Full		1.5		5.5	٧
Input logic low	V _{IL}			Full		0		0.6	V
Input lookaga aurrant	1 1	V - 5 5 V or 0		25°C	1.05.\/	-2	0.3	2	nΛ
Input leakage current	I _{IH} , I _{IL}	$V_1 = 5.5 \text{ V or } 0$		Full	1.95 V	-20		20	nA

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

⁽²⁾ All unused digital inputs of the device must be held at V₊ or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.



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

PARAMETER	SYMBOL	TEST CO	NDITIONS	T _A	V+	MIN	TYP	MAX	UNIT
Dynamic				·					
		V - V	C _L = 35 pF,	25°C	1.8 V	3	9	18	
Turn-on time	t _{ON}	$V_{COM} = V_+,$ $R_L = 50 \Omega,$	See Figure 17	Full	1.65 V to 1.95 V	1		20	ns
		\/ - \/	$C_1 = 35 \text{ pF},$	25°C	1.8 V	5	10	15.5	
Turn-off time	t _{OFF}	$V_{COM} = V_+,$ $R_L = 50 \Omega,$	See Figure 17	Full	1.65 V to 1.95 V	4		18.5	ns
Charge injection	Q_{C}	$V_{GEN} = 0,$ $R_{GEN} = 0,$	C _L = 1 nF, See Figure 21	25°C	1.8 V		2		рС
NC OFF capacitance	C _{NC(OFF)}	$V_{NC} = V_{+}$ or GND, Switch OFF,	See Figure 16	25°C	1.8 V		19.5		pF
COM OFF capacitance	C _{COM(OFF)}	V _{COM} = V ₊ or GND, Switch OFF,	See Figure 16	25°C	1.8 V		18.5		pF
NC ON capacitance	C _{NC(ON)}	V _{NC} = V ₊ or GND, Switch ON,	See Figure 16	25°C	1.8 V		36.5		pF
COM ON capacitance	C _{COM(ON)}	V _{COM} = V ₊ or GND, Switch ON,	See Figure 16	25°C	1.8 V		36.5		pF
Digital input capacitance	C _I	$V_I = V_+ \text{ or GND},$	See Figure 16	25°C	1.8 V		2		pF
Bandwidth	BW	$R_L = 50 \Omega$, Switch ON,	See Figure 18	25°C	1.8 V		150		MHz
OFF isolation	O _{ISO}	$R_L = 50 \Omega$, f = 1 MHz,	Switch OFF, See Figure 19	25°C	1.8 V		-62		dB
Crosstalk	X _{TALK}	$R_L = 50 \Omega$, f = 1 MHz,	Switch ON, See Figure 20	25°C	1.8 V		-85		dB
Total harmonic distortion	THD	$R_L = 600 \ \Omega,$ $C_L = 50 \ pF,$	f = 20 Hz to 20 kHz See Figure 22	25°C	1.8 V		0.05 5		%
Supply									
Positive supply current	I ₊	$V_1 = V_+ \text{ or GND},$	Switch ON or OFF	25°C	1.95 V		0.00	0.01	μΑ
Curcil				Full				0.15	

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

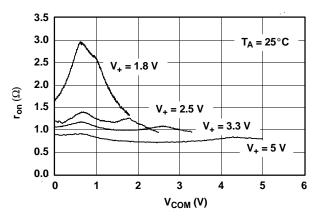


Figure 1. ron vs V_{COM}

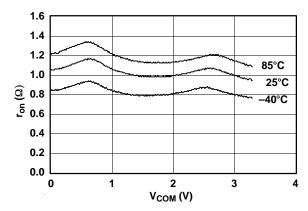


Figure 2. r_{on} vs V_{COM} ($V_{+} = 3.3 \text{ V}$)

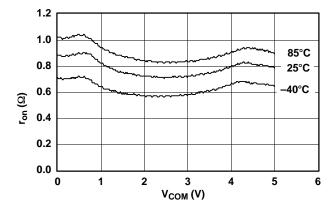
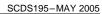


Figure 3. r_{on} vs V_{COM} ($V_{+} = 5$ V)





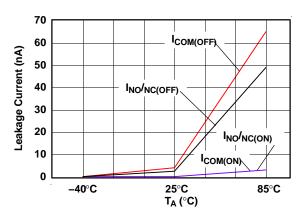


Figure 4. Leakage Current vs Temperature $(V_+ = 5 V)$

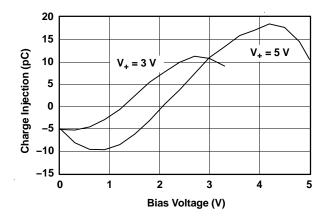


Figure 5. Charge Injection (Q_C) vs V_{COM}

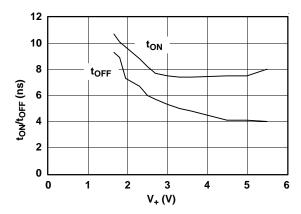


Figure 6. t_{ON} and t_{OFF} vs Supply Voltage

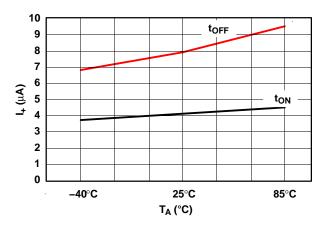


Figure 7. t_{ON} and t_{OFF} vs Temperature (V₊ = 5 V)

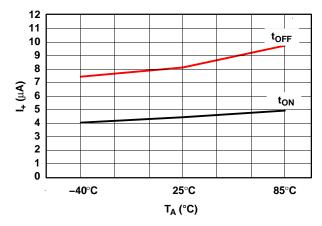


Figure 8. t_{ON} and t_{OFF} vs Temperature (V₊ = 5 V)

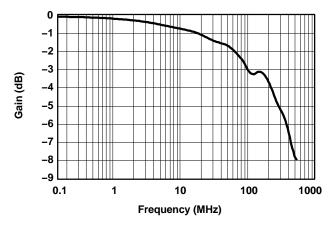


Figure 9. Bandwidth (Gain vs Frequency) ($V_{+} = 5 \text{ V}$)



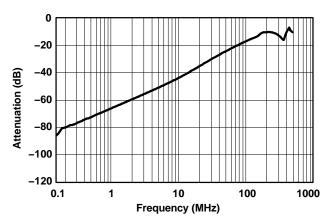


Figure 10. OFF Isolation vs Frequency

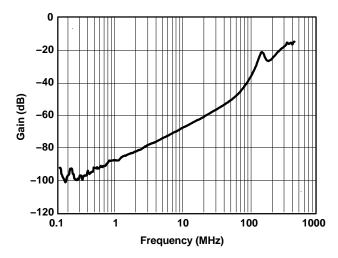


Figure 11. Gain vs Frequency

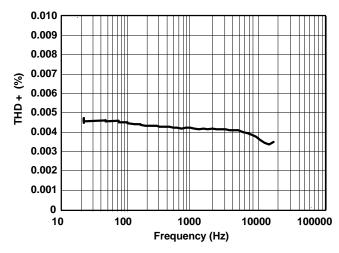


Figure 12. Total Harmonic Distortion vs Frequency $(V_{+} = 5 \text{ V})$

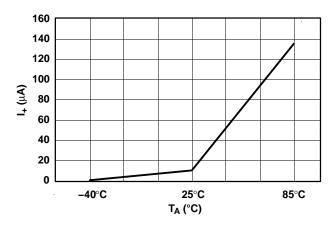


Figure 13. Power-Supply Current vs Temperature $(V_{+} = 5 V)$

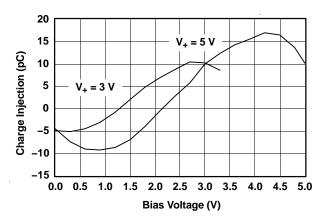


Figure 14. Charge Injection (Q_C) vs V_{COM}

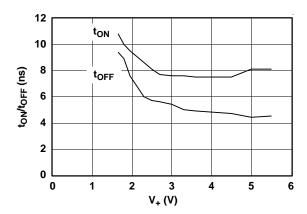


Figure 15. toN and toFF vs Supply Voltage



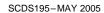
PIN DESCRIPTION

PIN NUMBER	NAME	DESCRIPTION
1	NC1	Normally closed
2	COM1	Common
3	IN2	Digital control pin to connect COM to NC
4	GND	Digital ground
5	NC2	Normally closed
6	COM2	Common
7	IN1	Digital control pin to connect COM to NC
8	V ₊	Power Supply



PARAMETER DESCRIPTION

Inc(PWROFF) Input and output conditions Inc(PWROFF) Leakage current measured at the NC port during the power-down condition, V ₊ = 0 IcoM(OFF) Leakage current measured at the COM port, with the corresponding channel (COM to NC) in the OFF state under worst-case input and output conditions IcoM(PWROFF) Leakage current measured at the COM port during the power-down condition, V ₊ = 0 Inc(OM) Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the ON state and the output (COM) open Leakage current measured at the COM port, with the corresponding channel (NC to COM) in the ON state and the output (NC) open Leakage current measured at the COM port, with the corresponding channel (COM to NC) in the ON state and the output (NC) open V _{IH} Minimum input voltage for logic high for the control input (IN) V _{IL} Maximum input voltage for logic low for the control input (IN) V _I Voltage at the control input (IN) I _{IH} , I _{IL} Leakage current measured at the control input (IN) Turn-on time for the switch. This parameter is measured under the specified range of conditions and by the propagatidelay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning ON. Turn-off time for the switch. This parameter is measured under the specified range of conditions and by the propagatidelay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning OFF. Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (INC or COM output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control input (INC) induced the control input (INC) in the control input (INC) in Complete injection, Q _C = C ₁ × Δ ∨ _{COM} , C _L is the load capacitance, and Δ ∨ _{COM} is the change in analog output voltage. C _{NCCOFF}) Capacitance at the NC port when the corresponding channel (NC to COM) is OFF C _{DOCOMION}) Capacitance at the COM port when	SYMBOL	DESCRIPTION			
Resistance between COM and NC ports when the channel is ON	V _{COM}	Voltage at COM			
F _{peak} Peak on-state resistance over a specified voltage range f _{on.h} Difference of r _{on} between channels in a specific device f _{on(ltat)} Difference between the maximum and minimum value of r _{on} in a channel over the specified range of conditions lhc(OFF) Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the OFF state under wors input and output conditions lhc(PWROFF) Leakage current measured at the NC port during the power-down condition, V ₊ = 0 lcoM(OFF) Leakage current measured at the COM port, with the corresponding channel (COM to NC) in the OFF state under worst-case input and output conditions lcoM(PWROFF) Leakage current measured at the COM port during the power-down condition, V ₊ = 0 lnc(ON) Leakage current measured at the COM port during the power-down condition, V ₊ = 0 lnc(ON) Leakage current measured at the COM port, with the corresponding channel (NC to COM) in the ON state and the output (COM) open lcoM(ON) Leakage current measured at the COM port, with the corresponding channel (NC to COM) in the ON state and the output (NC) open lcoM(NC) open lcoM(NC) open lcoM(NC) Maximum input voltage for logic low for the control input (IN) lih. lil. Leakage current measured at the control input (IN) low lcome at the control input (IN) low lcome at the control input (IN) lcome lcome at the lcome at the control input (IN) lcome lcome at the lcome at the control input (IN) lcome lcome at the lcome at the control input (IN) signal and analog output (COM or NC) signal when the switch is turning ON. lcome lcome at the lcome at	V _{NC}	Voltage at NC			
Ton∆ Difference of r₀n between channels in a specific device r₀n(flatt) Difference between the maximum and minimum value of r₀n in a channel over the specified range of conditions lNc(OFF) Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the OFF state under wors input and output conditions lNc(PWROFF) Leakage current measured at the NC port during the power-down condition, V₂ = 0 Leakage current measured at the COM port, with the corresponding channel (COM to NC) in the OFF state under wors input and output conditions Leakage current measured at the COM port during the power-down condition, V₂ = 0 Leakage current measured at the COM port during the power-down condition, V₂ = 0 Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the ON state and the output (COM) open Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the ON state and the output (NC) open Leakage current measured at the COM port, with the corresponding channel (COM to NC) in the ON state and the output (NC) open Leakage current measured at the COM port, with the corresponding channel (COM to NC) in the ON state and the output (NC) open Leakage current measured at the control input (IN) VI, Maximum input voltage for logic logic for the control input (IN) VI, Voltage at the control input (IN) Turn-on time for the switch. This parameter is measured under the specified range of conditions and by the propagatidelay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning ON. Turn-off time for the switch. This parameter is measured under the specified range of conditions and by the propagatidelay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning ON. Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NC or COM output. This is measured in coulomb (C) and measured by the total charge induced du	r _{on}	Resistance between COM and NC ports when the channel is ON			
f _{cn∆} Difference of r _{cn} between channels in a specific device r _{cn(flat)} Difference between the maximum and minimum value of r _{cn} 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 wors input and output conditions I _{NC(PWROFF)} Leakage current measured at the COM port, with the corresponding channel (COM to NC) in the OFF state under worst-case input and output conditions I _{COM(PWROFF)} Leakage current measured at the COM port during the power-down condition, V ₊ = 0 I _{NC(ON)} Leakage current measured at the COM 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) open I _{NC(ON)} Leakage current measured at the COM port, with the corresponding channel (NC to COM) in the ON state and the output (NC) open V _I Minimum input voltage for logic high for the control input (IN) V _I Voltage at the control input (IN) V _I Voltage at the control input (IN) V _I Voltage at the control input (IN) t _{OFF} Turn-on time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switc	r _{peak}	Peak on-state resistance over a specified voltage range			
I _{NC(OFF)} Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the OFF state under wors input and output conditions Leakage current measured at the NC port during the power-down condition, V ₊ = 0 Leakage current measured at the COM port, with the corresponding channel (COM to NC) in the OFF state under worst-case input and output conditions Leakage current measured at the COM port during the power-down condition, V ₊ = 0 Leakage current measured at the COM port during the power-down condition, V ₊ = 0 Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the ON state and the outp (COM) open Leakage current measured at the COM port, with the corresponding channel (COM to NC) in the ON state and the outp (COM) open V _{IH} Minimum input voltage for logic high for the control input (IN) V _{IL} Maximum input voltage for logic low for the control input (IN) V _I Voltage at the control input (IN) I _H , I _{IL} Leakage current measured at the control input (IN) Turn-on time for the switch. This parameter is measured under the specified range of conditions and by the propagatit delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning ON. Turn-off time for the switch. This parameter is measured under the specified range of conditions and by the propagatit delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning OFF. Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NC or COM output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control input (IN) charge injection, Q _C = C _L Δ V _{COM} , C _L is the load capacitance, and ΔV _{COM} is the change in analog output voltage. C _{CCOM(OFF}) Capacitance at the NC port when the corresponding channel (NC to COM) is ON C ₂ Capacitance at the COM port when the corresponding channel (NC to C		Difference of r _{on} between channels in a specific device			
InC(OFF) input and output conditions InC(PWROFF) Leakage current measured at the NC port during the power-down condition, V ₊ = 0 IcoM(OFF) Leakage current measured at the COM port, with the corresponding channel (COM to NC) in the OFF state under worst-case input and output conditions IcoM(PWROFF) Leakage current measured at the COM port during the power-down condition, V ₊ = 0 InC(OM) Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the ON state and the output (COM) open Leakage current measured at the COM port, with the corresponding channel (NC to COM) in the ON state and the output (NC) open V _{IH} Minimum input voltage for logic high for the control input (IN) V _{IL} Maximum input voltage for logic low for the control input (IN) V _I Voltage at the control input (IN) I _{Iht} , I _{IL} Leakage current measured at the control input (IN) Turn-on time for the switch. This parameter is measured under the specified range of conditions and by the propagatidelay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning ON. Turn-off time for the switch. This parameter is measured under the specified range of conditions and by the propagatidelay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning OFF. Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (INC or COM output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control input (IN). Charge injection, Q _C = C ₁ × Δ ∨ _{COM} , C _L is the load capacitance, and Δ ∨ _{COM} is the change in analog output voltage. CNC(OFF) Capacitance at the NC port when the corresponding channel (NC to COM) is OFF Capacitance at the NC port when the corresponding channel (NC to COM) is ON Capacitance at the COM port when the corresponding channel (NC to COM) is ON Capacitance at the COM port when the corresponding channel (NC to COM) is	r _{on(flat)}	Difference between the maximum and minimum value of ron in a channel over the specified range of conditions			
Leakage current measured at the COM port, with the corresponding channel (COM to NC) in the OFF state under worst-case input and output conditions Leakage current measured at the COM port during the power-down condition, V ₊ = 0 Leakage current measured at the NC port, with the corresponding channel (NC to COM) in the ON state and the outp (COM) open Leakage current measured at the COM port, with the corresponding channel (COM to NC) in the ON state and the outp (NC) open V _{IH} Minimum input voltage for logic high for the control input (IN) V _{IL} Maximum input voltage for logic low for the control input (IN) V _I Voltage at the control input (IN) I _{IH} , I _{IL} Leakage current measured at the control input (IN) Turn-on time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning ON. tope Turn-off time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning OFF. Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NC or COM output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control input (IN). Charge injection, Q _C = C _L × Δ V _{COM} , C _L is the load capacitance, and ΔV _{COM} 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 _{COM(ON)} Capacitance at the COM port when the corresponding channel (NC to COM) is ON C ₁ Capacitance at the COM port when the corresponding channel (NC to COM) is ON C ₂ Capacitance at the COM port when the corresponding channel (NC to COM) is ON C ₃ Compacitance at the COM port when the corresponding channel (NC to COM) is ON C ₄ Capacitance at the COM port when the correspo	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			
ICOM(OFF) worst-case input and output conditions I _{COM(PWROFF)} Leakage current measured at the COM port during the power-down condition, V₁ = 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) open I _{COM(ON)} Leakage current measured at the COM port, with the corresponding channel (COM to NC) in the ON state and the output (NC) open V _{IH} Minimum input voltage for logic high for the control input (IN) V _{IL} Maximum input voltage for logic low for the control input (IN) V _I Voltage at the control input (IN) I _{IH} , I _{IL} Leakage current measured at the control input (IN) I _{ON} Turn-on time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning ON. toFF Turn-off time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning OFF. Q _C Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (INC or COM) output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control input (IN) charge injection, Q _C = Q ₁ ×Δ V _{COM} , Q _L is the load capacitance, and ΔV _{COM} is the chan	I _{NC(PWROFF)}	Leakage current measured at the NC 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 outp (COM) open I _{COM(ON)} Leakage current measured at the COM port, with the corresponding channel (COM to NC) in the ON state and the outp (NC) open V _{IH} Minimum input voltage for logic high for the control input (IN) V _{IL} Maximum input voltage for logic low for the control input (IN) V _I Voltage at the control input (IN) I _{IH} , I _{IL} Leakage current measured at the control input (IN) toN Turn-on time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning ON. toFF Turn-off time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning OFF. Q _C Charge injection is a measured in coulomb (C) and measured by the total charge induced due to switching of the control input (IN) signal and analog output (COM or NC) signal when the analog (NC or COM output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control input (IN) charge injection, Q _C = C _L ×Δ V _{COM} , C _L is the load capacitance, and ΔV _{COM} is the change in analog output voltage. C _{NC(OFF)} Capacitance at the NC port when the corresponding channel (NC to COM) is OFF	I _{COM(OFF)}				
Incom(ON) (COM) open Leakage current measured at the COM port, with the corresponding channel (COM to NC) in the ON state and the out (NC) open V _{IH} Minimum input voltage for logic high for the control input (IN) V _{IL} Maximum input voltage for logic low for the control input (IN) V _{IL} Maximum input voltage for logic low for the control input (IN) I _{IH} , I _{IL} Leakage current measured at the control input (IN) ton Turn-on time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning ON. Turn-off time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning OFF. Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NC or COM output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control input (IN) Charge injection, Q _C = C _L ×Δ V _{COM} , C _L is the load capacitance, and ΔV _{COM} 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 _{COM(OFF)} Capacitance at the NC port when the corresponding channel (NC to COM) is ON C _{COM(ON)} Capacitance at the COM port when the corresponding channel (NC to COM) is ON C _{COM(ON)} Capacitance at the COM port when the corresponding channel (NC to COM) is ON C _{COM(ON)} 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) in the OFF state.	I _{COM(PWROFF)}	Leakage current measured at the COM port during the power-down condition, $V_{+} = 0$			
ICOM(ON)	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) open			
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) toN Turn-on time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning ON. toFF Turn-off time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning OFF. Q _C Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NC or COM) output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control input (IN). Q _C Charge injection, Q _C = C _L ×Δ V _{COM} , C _L is the load capacitance, and ΔV _{COM} 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 _{COM(OFF)} Capacitance at the COM port when the corresponding channel (NC to COM) is ON C _{COM(ON)} Capacitance at the NC port when the corresponding channel (NC to COM) is ON C _{COM(ON)} Capacitance at the COM port when the corresponding channel (NC to COM) in the OFF state. O _{ISO} OFF isolation of the switch is a	I _{COM(ON)}	Leakage current measured at the COM port, with the corresponding channel (COM to NC) in the ON state and the output (NC) open			
V _I Voltage at the control input (IN) I _{IH} , I _{IL} Leakage current measured at the control input (IN) toN Turn-on time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning ON. toFF Turn-off time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning OFF. Q _C Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NC or COM output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control input (IN) charge injection, Q _C = C _L ×Δ V _{COM} , C _L is the load capacitance, and ΔV _{COM} 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 _{COM(OFF)} Capacitance at the COM port when the corresponding channel (NC to COM) is ON C _{COM(ON)} Capacitance at the COM port when the corresponding channel (NC to COM) is ON C _{COM(ON)} 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 (NC1 to COM) in the OFF state.	V_{IH}	Minimum input voltage for logic high for the control input (IN)			
I _{IH} , I _{IL} Leakage current measured at the control input (IN) Turn-on time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning ON. Turn-off time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning OFF. Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NC or COM output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control input to the analog (NC 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 ×Δ V _{COM} , C _L is the load capacitance, and ΔV _{COM} 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 _{COM(OFF)} Capacitance at the COM port when the corresponding channel (COM to NC) is ON C _{COM(ON)} Capacitance at the COM port when the corresponding channel (NC to COM) is ON C _{COM(ON)} Capacitance at the COM port when the corresponding channel (COM to NC) is ON C _{COM(ON)} O _{FF} 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) in the OFF state.	V_{IL}	Maximum input voltage for logic low for the control input (IN)			
Turn-on time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning ON. Turn-off time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning OFF. Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NC 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 ×Δ V _{COM} , C _L is the load capacitance, and ΔV _{COM} 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 _{COM(OFF)} Capacitance at the COM port when the corresponding channel (COM to NC) is ON C _{COM(ON)} Capacitance at the COM port when the corresponding channel (COM to NC) is ON C _{COM(ON)} Capacitance at the COM port when the corresponding channel (COM to NC) is ON C _{COM(ON)} 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) in the OFF state.	V_{I}	Voltage at the control input (IN)			
delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning ON. Turn-off time for the switch. This parameter is measured under the specified range of conditions and by the propagati delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning OFF. Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NC 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 ×Δ V _{COM} , C _L is the load capacitance, and ΔV _{COM} 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 _{COM(OFF)} Capacitance at the COM port when the corresponding channel (NC to COM) is ON C _{COM(ON)} Capacitance at the COM port when the corresponding channel (COM to NC) is ON C _{COM(ON)} Capacitance at the COM port when the corresponding channel (COM to NC) is ON C _{COM(ON)} 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) in the OFF state.	$I_{IH},\ I_{IL}$	Leakage current measured at the control input (IN)			
delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning OFF. Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NC 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 ×Δ V _{COM} , C _L is the load capacitance, and ΔV _{COM} 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 _{COM(ON)} Capacitance at the NC port when the corresponding channel (NC to COM) is ON C _{COM(ON)} Capacitance at the COM port when the corresponding channel (COM to NC) is ON C _{COM(ON)} Capacitance at the COM port when the corresponding channel (COM to NC) is ON 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) in the OFF state.	t _{ON}	Turn-on time for the switch. This parameter is measured under the specified range of conditions and by the propagation delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning ON.			
QC output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control incomplete Charge injection, Q _C = C _L ×Δ V _{COM} , C _L is the load capacitance, and ΔV _{COM} 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 _{COM(OFF)} Capacitance at the COM port when the corresponding channel (NC to COM) is OFF C _{NC(ON)} Capacitance at the NC port when the corresponding channel (NC to COM) is ON C _{COM(ON)} Capacitance at the COM port when the corresponding channel (COM to NC) is ON 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) in the OFF state.	t _{OFF}	Turn-off time for the switch. This parameter is measured under the specified range of conditions and by the propagation delay between the digital control (IN) signal and analog output (COM or NC) signal when the switch is turning OFF.			
C _{COM(OFF)} Capacitance at the COM port when the corresponding channel (COM to NC) is OFF C _{NC(ON)} Capacitance at the NC port when the corresponding channel (NC to COM) is ON C _{COM(ON)} Capacitance at the COM port when the corresponding channel (COM to NC) is ON 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) in the OFF state.	Q _C	Charge injection is a measurement of unwanted signal coupling from the control (IN) input to the analog (NC or COM) output. This is measured in coulomb (C) and measured by the total charge induced due to switching of the control input. Charge injection, $Q_C = C_L \times \Delta V_{COM}$, C_L is the load capacitance, and ΔV_{COM} is the change in analog output voltage.			
C _{COM(OFF)} Capacitance at the COM port when the corresponding channel (COM to NC) is OFF C _{NC(ON)} Capacitance at the NC port when the corresponding channel (NC to COM) is ON C _{COM(ON)} Capacitance at the COM port when the corresponding channel (COM to NC) is ON 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) in the OFF state.	C _{NC(OFF)}	Capacitance at the NC port when the corresponding channel (NC to COM) is OFF			
C _{COM(ON)} Capacitance at the COM port when the corresponding channel (COM to NC) is ON 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) in the OFF state. Crosstalk is a measurement of unwanted signal coupling from an ON channel to an adjacent ON channel (NC1 to NC)		Capacitance at the COM port when the corresponding channel (COM to NC) is OFF			
C ₁ 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) in the OFF state. Crosstalk is a measurement of unwanted signal coupling from an ON channel to an adjacent ON channel (NC1 to NC)	C _{NC(ON)}	Capacitance at the NC port when the corresponding channel (NC to COM) is ON			
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) in the OFF state. Crosstalk is a measurement of unwanted signal coupling from an ON channel to an adjacent ON channel (NC1 to NC)	C _{COM(ON)}	Capacitance at the COM port when the corresponding channel (COM to NC) is ON			
frequency, with the corresponding channel (NC to COM) in the OFF state. Crosstalk is a measurement of unwanted signal coupling from an ON channel to an adjacent ON channel (NC1 to NC	C _I	Capacitance of control input (IN)			
Crosstalk is a measurement of unwanted signal coupling from an ON channel to an adjacent ON channel (NC1 to NC	O _{ISO}				
This is measured in a specific frequency and in dB.	X _{TALK}	Crosstalk is a measurement of unwanted signal coupling from an ON channel to an adjacent ON channel (NC1 to NC2). This is measured in a specific frequency and in dB.			
BW Bandwidth of the switch. This is the frequency in which the gain of an ON channel is –3 dB below the DC gain.	BW	Bandwidth of the switch. This is the frequency in which the gain of an ON channel is -3 dB below the DC gain.			
Total harmonic distortion describes the signal distortion caused by the analog switch. This is defined as the ratio of romean square (RMS) value of the second, third, and higher harmonic to the absolute magnitude of the fundamental harmonic.	THD				
I ₊ Static power-supply current with the control (IN) pin at V ₊ or GND	l ₊	Static power-supply current with the control (IN) pin at V ₊ or GND			





PARAMETER MEASUREMENT INFORMATION

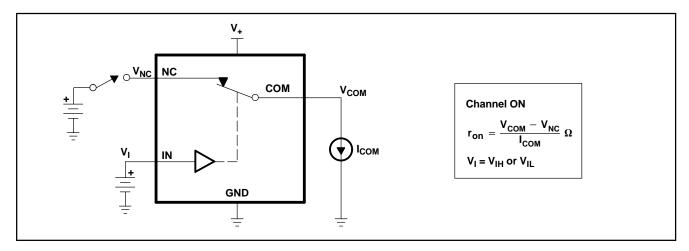


Figure 16. ON-State Resistance (ron)

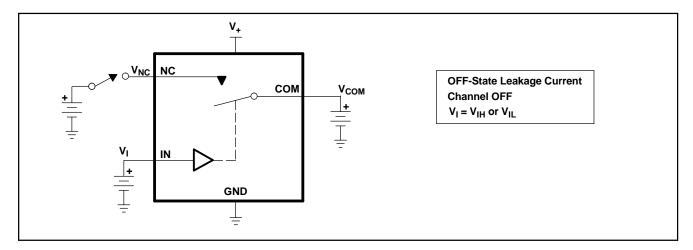


Figure 17. OFF-State Leakage Current ($I_{COM(OFF)}$, $I_{NC(OFF)}$, $I_{COM(PWROFF)}$, $I_{NC(PWR(FF))}$

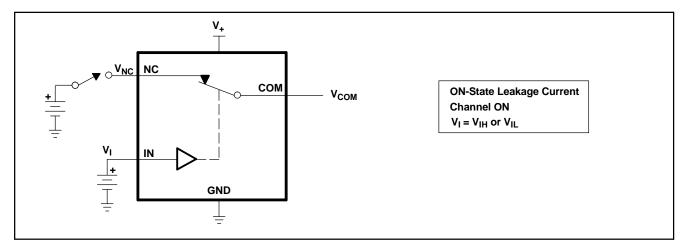


Figure 18. ON-State Leakage Current (I_{COM(ON)}, I_{NC(ON)})



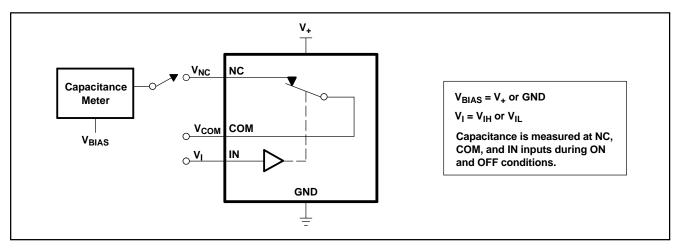


Figure 19. Capacitance (C_I, $C_{COM(OFF)}$, $C_{COM(ON)}$, $C_{NC(OFF)}$, $C_{NC(ON)}$)

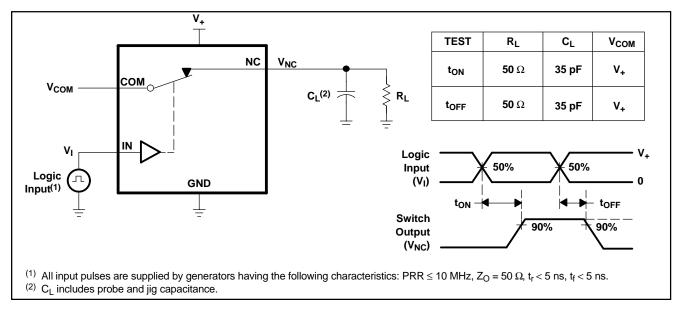


Figure 20. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})





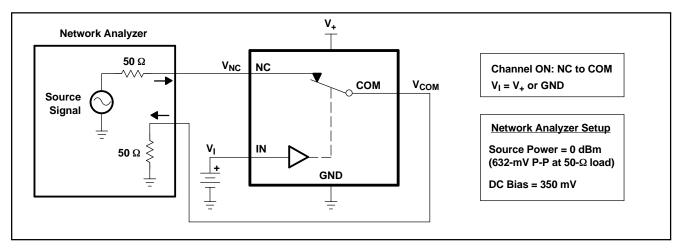


Figure 21. Bandwidth (BW)

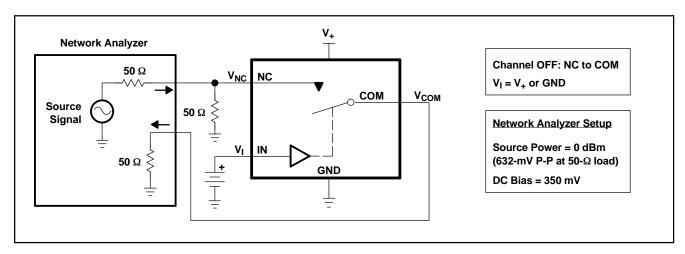


Figure 22. OFF Isolation (O_{ISO})

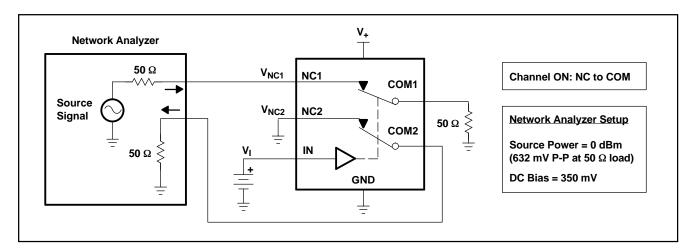


Figure 23. Crosstalk (X_{TALK})



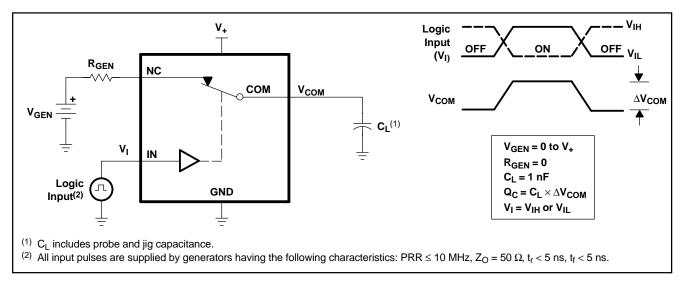


Figure 24. Charge Injection (Q_C)

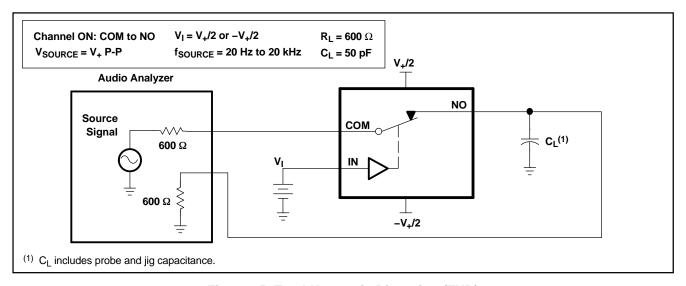


Figure 25. Total Harmonic Distortion (THD)



PACKAGE OPTION ADDENDUM

3-Jun-2005

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TS5A23167DCUR	ACTIVE	US8	DCU	8	3000	Pb-Free (RoHS)	CU NIPDAU	Level-1-260C-UNLIM
TS5A23167DCURE4	ACTIVE	US8	DCU	8	3000	Pb-Free (RoHS)	CU NIPDAU	Level-1-260C-UNLIM

⁽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) 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.

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)

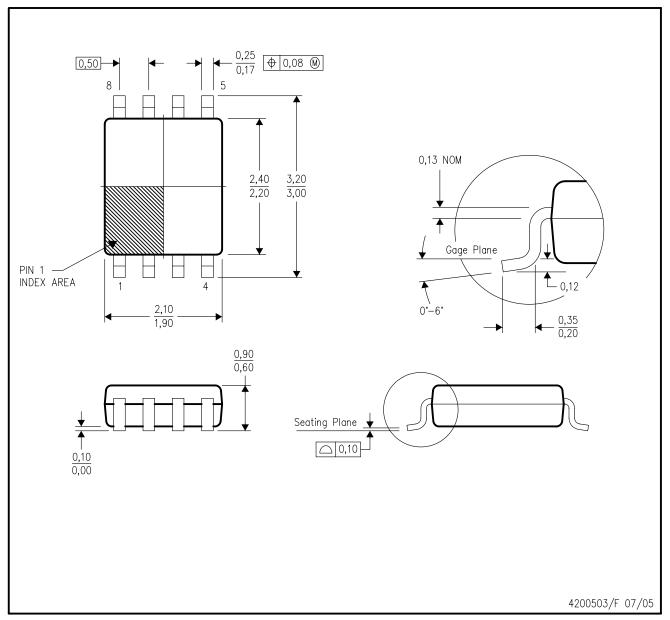
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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

DCU (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE (DIE DOWN)



NOTES:

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



IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

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

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

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

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

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments

Post Office Box 655303 Dallas, Texas 75265

Copyright © 2005, Texas Instruments Incorporated