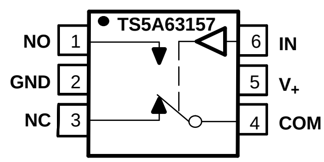
FEATURES

- **Overshoot and Undershoot Voltage Protection**
- **Isolation in Powered-Off Mode, $V_+ = 0$**
- **Specified Break-Before-Make Switching**
- **Low ON-State Resistance (12 Ω)**
- **Control Inputs Are 5-V Tolerant**
- **Low Charge Injection**
- **Excellent ON-State Resistance Matching**
- **Low Total Harmonic Distortion (THD)**
- **1.65-V to 5.5-V Single-Supply Operation**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**
- **ESD Performance Tested Per JESD 22**
  - **2000-V Human-Body Model (A114-B, Class II)**
  - **1000-V Charged-Device Model (C101)**

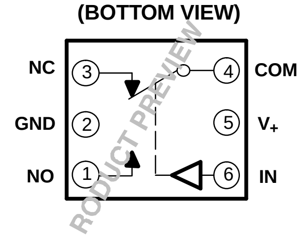
APPLICATIONS

- **Sample-and-Hold Circuits**
- **Battery-Powered Equipment**
- **Audio and Video Signal Routing**
- **Communication Circuits**

SOT-23 OR SC-70 PACKAGE
(TOP VIEW)



YEP OR YZP PACKAGE
(BOTTOM VIEW)



DESCRIPTION/ORDERING INFORMATION

The TS5A63157 is a single-pole, double-throw (SPDT) analog switch designed to operate from 1.65 V to 5.5 V. This device can handle both digital and analog signals. Signals up to V_+ (peak) can be transmitted in either direction.

TI has integrated overshoot and undershoot protection circuitry. The TS5A63157 senses overshoot and undershoot events at the I/Os and responds by preventing voltage differentials from developing and turning the switch on.

SUMMARY OF CHARACTERISTICS
V_+ = 5 V, T_A = 25°C

Configuration	Single 2:1 Multiplexer/ Demultiplexer (1 × SPDT)
Number of channels	1
ON-state resistance (r_{on})	12 Ω
ON-state resistance match (Δr_{on})	0.15 Ω
ON-state resistance flatness ($r_{on(flat)}$)	6 Ω
Turn-on/turn-off time (t_{ON}/t_{OFF})	5.7 ns/3.8 ns
Break-before-make time (t_{BBM})	0.5 ns
Charge injection (Q_C)	7 pC
Bandwidth (BW)	250 MHz
OFF isolation (O_{ISO})	–57 dB at 10 MHz
Crosstalk (X_{TALK})	–54 dB at 10 MHz
Total harmonic distortion (THD)	0.01%
Leakage current ($I_{NO(OFF)}/I_{NC(OFF)}$)	±1 μA
Power-supply current (I_+)	10 μA
Undershoot protection	–2 V
Overshoot protection	V_+ + 2 V
Package options	6-pin SOT-23, SC-70, and DSBGA

ORDERING INFORMATION

T_A	PACKAGE(1)		ORDERABLE PART NUMBER	TOP-SIDE MARKING(2)
–40°C to 85°C	NanoStar™ – WCSP (DSBGA) 0.23-mm Large Bump – YEP	Tape and reel	TS5A63157YEPR(3)	PREVIEW
	NanoFree™ – WCSP (DSBGA) 0.23-mm Large Bump – YZP (Pb-free)	Tape and reel	TS5A63157YZPR(3)	
	SOT (SOT-23) – DBV	Tape and reel	TS5A63157DBVR	JBE_
	SOT (SC-70) – DCK	Tape and reel	TS5A63157DCKR	J7_

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.
(2) DBV/DCK: The actual 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).
(3) Package preview

FUNCTION TABLE

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

Absolute Minimum and Maximum Ratings[1][2]

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

			MIN	MAX	UNIT
V_+	Supply voltage range[3]		–0.5	6.5	V
V_{NO} V_{NC} V_{COM}	Analog voltage range[3][4][5]		–0.5	V_+ + 0.5	V
I_K	Analog port diode current	V_{NC}, V_{NO}, V_{COM} < 0 or V_{NO}, V_{NC}, V_{COM} > V_+	–50	50	mA
I_{NO} I_{NC} I_{COM}	On-state switch current	V_{NC}, V_{NO}, V_{COM} = 0 to V_+	–50	50	mA
V_I	Digital input voltage range[3][4]		–0.5	6.5	V
I_{IK}	Digital input clamp current	V_I < 0	–50		mA
I_+	Continuous current through V_+		–100	100	mA
I_{GND}	Continuous current through GND		–100	100	mA
θ_{JA}	Package thermal impedance	DBV package[6]		206	°C/W
		DCK package[6]		252	
		YEA/YZA package[6]		143	
		YEP/YZP package[7]		123	
T_{stg}	Storage temperature range		–65	150	°C

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.
(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) The package thermal impedance is calculated in accordance with JESD 51-7.
(7) The package thermal impedance is calculated in accordance with JESD 51-5.

Electrical Characteristics for 5-V Supply

V_+ = 4.5 V to 5.5 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Analog Switch									
Analog signal range	V_{COM}, V_{NO}, V_{NC}					0		V_+	V
Voltage undershoot	V_{IKU}	0 ≥ (I_{NC}, I_{NO}, or I_{COM}) ≥ – 50 mA			5.5 V			–2	V
Peak ON-state resistance	r_{peak}	0 ≤ (V_{NO} or V_{NC}) ≤ V_+, I_{COM} = –30 mA,	Switch ON, See Figure 13	25°C	4.5 V		4.6	11	Ω
				Full				13	
ON-state resistance	r_{on}	V_{NO} or V_{NC} = 0, I_{COM} = 30 mA	Switch ON, See Figure 13	25°C	4.5 V		4	6.5	Ω
				Full				8	
		V_{NO} or V_{NC} = 2.4 V, I_{COM} = –30 mA		25°C			4	8	
				Full				10	
		V_{NO} or V_{NC} = 4.5 V, I_{COM} = –30 mA		25°C			5.5	10	
				Full				12	
ON-state resistance match between channels	Δr_{on}	V_{NO} or V_{NC} = 3.15 V, I_{COM} = –30 mA,	Switch ON, See Figure 13	25°C	4.5 V		0.1	0.14	Ω
				Full				0.15	
ON-state resistance flatness	$r_{on(flat)}$	0 ≤ (V_{NO} or V_{NC}) ≤ V_+, I_{COM} = –30 mA,	Switch ON, See Figure 13	25°C	4.5 V		1.5	2	Ω
				Full				4	
NC, NO OFF leakage current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_{NC} or V_{NO} = 0 to V_+, V_{COM} = V_+ to 0	Switch OFF, See Figure 14	25°C	5.5 V		0.001	0.03	μA
				Full				0.05	
	$I_{NC(PWROFF)}$, $I_{NOPWROFF)}$	V_{NC} or V_{NO} = 0 to 5.5 V, V_{COM} = 5.5 V to 0,	Switch OFF, See Figure 14	25°C	0		0.15	1	
				Full				5	
COM OFF leakage current	$I_{COM(PWROFF)}$	V_{COM} = 0 to 5.5 V, V_{NC} or V_{NO} = 5.5 V to 0,	Switch ON, See Figure 14	25°C	0		0.2	1	μA
				Full				10	
NC, NO ON leakage current	$I_{NC(ON)}$, $I_{NO(ON)}$	V_{NC} or V_{NO} = 0 to V_+, V_{COM} = Open,	Switch ON, See Figure 15	25°C	5.5 V		0.001	0.01	μA
				Full				0.02	
COM ON leakage current	$I_{COM(ON)}$	V_{NC} or V_{NO} = Open, V_{COM} = 0 to V_+,	Switch ON, See Figure 15	25°C	5.5 V		0.003	0.03	μA
				Full				0.05	
Digital Control Input (IN)									
Input logic high	V_{IH}			Full		$V_+ \times 0.7$		5.5	V
Input logic low	V_{IL}			Full		0		$V_+ \times 0.3$	V
Input leakage current	I_{IH}, I_{IL}	V_I = 5.5 V or 0		25°C	5.5 V		0.05	0.1	μA
				Full				0.02	

Electrical Characteristics for 5-V Supply (continued)

V_+ = 4.5 V to 5.5 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Dynamic									
Turn-on time	t_{ON}	V_{COM} = V_+ or GND, R_L = 500 Ω,	C_L = 50 pF, See Figure 17	25°C	5 V	2	3.4	5	ns
				Full	4.5 V to 5.5 V	2		5.5	
Turn-off time	t_{OFF}	V_{COM} = V_+ or GND, R_L = 500 Ω,	C_L = 50 pF, See Figure 17	25°C	5 V	1	2.8	3.4	ns
				Full	4.5 V to 5.5 V	1		3.8	
Output voltage during undershoot	V_{OUTU}	See Figure 18				2.5	V_{OH} – 0.3		V
Output voltage during overshoot	V_{OUTO}	See Figure 18					V_{OL} + 0.3	2	V
Break-before-make time	t_{BBM}	V_{NC} = V_{NO} = V_+/2, R_L = 50 Ω,	C_L = 50 pF, See Figure 19	25°C	5 V	0.5	5	12	ns
				Full	4.5 V to 5.5 V	0.5		14	
Charge injection	Q_C	V_{GEN} = 0, R_{GEN} = 0,	C_L = 0.1 nF, See Figure 23	25°C	5 V		–21		pC
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or V_{NO} = V_+ or GND, Switch OFF,	See Figure 16	25°C	5 V		5		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or V_{NO} = V_+ or GND, Switch ON,	See Figure 16	25°C	5 V		14.5		pF
COM ON capacitance	$C_{COM(ON)}$	V_{COM} = V_+ or GND, Switch ON,	See Figure 16	25°C	5 V		14.5		pF
Digital input capacitance	C_I	V_I = V_+ or GND,	See Figure 16	25°C	5 V		2.5		pF
Bandwidth	BW	R_L = 50 Ω, Switch ON,	See Figure 20	25°C	5 V		371		MHz
OFF isolation	O_{ISO}	R_L = 50 Ω, f = 10 MHz,	Switch OFF, See Figure 21	25°C	5 V		–61		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 10 MHz,	Switch ON, See Figure 22	25°C	5 V		–61		dB
Total harmonic distortion	THD	R_L = 600 Ω, C_L = 50 pF,	f = 20 Hz to 20 kHz, See Figure 24	25°C	5 V		0.06		%
Supply									
Positive supply current	I_+	V_I = V_+ or GND,	Switch ON or OFF	25°C	5.5 V		0.01	0.1	µA
				Full				0.75	

Electrical Characteristics for 3.3-V Supply

V_+ = 3 V to 3.6 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Analog Switch									
Analog signal range	V_{COM}, V_{NO}, V_{NC}					0		V_+	V
Voltage undershoot	V_{IKU}	0 ≥ (I_{NC}, I_{NO}, or I_{COM}) ≥ – 50 mA			3.6 V				V
Peak ON-state resistance	r_{peak}	0 ≤ (V_{NO} or V_{NC}) ≤ V_+, I_{COM} = –24 mA,	Switch ON, See Figure 13	25°C	3 V		6.4	14	Ω
				Full				18	
ON-state resistance	r_{on}	V_{NO} or V_{NC} = 0, I_{COM} = 24 mA	Switch ON, See Figure 13	25°C	3 V		4.8	8	Ω
				Full				10	
		V_{NO} or V_{NC} = 3 V, I_{COM} = –24 mA		25°C			6.3	12	
				Full				15	
ON-state resistance match between channels	Δr_{on}	V_{NO} or V_{NC} = 2.1 V, I_{COM} = –24 mA,	Switch ON, See Figure 13	25°C	3 V		0.1	0.2	Ω
				Full				0.2	
ON-state resistance flatness	$r_{on(flat)}$	0 ≤ (V_{NO} or V_{NC}) ≤ V_+, I_{COM} = –24 mA,	Switch ON, See Figure 13	25°C	3 V		2.8	4	Ω
				Full				7	
NC, NO OFF leakage current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_{NC} or V_{NO} = 0 to V_+, V_{COM} = V_+ to 0	Switch OFF, See Figure 14	25°C	3.6 V		0	0.03	µA
				Full				0.05	
	$I_{NC(PWROFF)}$, $I_{NOPWROFF)}$	V_{NC} or V_{NO} = 0 to 3.6 V, V_{COM} = 3.6 V to 0,	Switch OFF, See Figure 14	25°C	0		0.15	0.05	
				Full				2	
COM OFF leakage current	$I_{COM(PWROFF)}$	V_{COM} = 0 to 3.6 V, V_{NC} or V_{NO} = 3.6 V to 0,	Switch ON, See Figure 14	25°C	0		0.2	0.05	µA
				Full				5	
NC, NO ON leakage current	$I_{NC(ON)}$, $I_{NO(ON)}$	V_{NC} or V_{NO} = 0 to V_+, V_{COM} = Open,	Switch ON, See Figure 15	25°C	3.6 V	–0.1	0.05	0.1	µA
				Full		–1		1	
COM ON leakage current	$I_{COM(ON)}$	V_{NC} or V_{NO} = Open, V_{COM} = 0 to V_+,	Switch ON, See Figure 15	25°C	3.6 V		0.003	0.03	µA
				Full				0.05	
Digital Control Input (IN)									
Input logic high	V_{IH}			Full		$V_+ \times 0.7$		5.5	V
Input logic low	V_{IL}			Full		0		$V_+ \times 0.3$	V
Input leakage current	I_{IH}, I_{IL}	V_I = 5.5 V or 0		25°C	3.6 V		0.005	0.01	µA
				Full				0.02	

Electrical Characteristics for 3.3-V Supply (continued)

V_+ = 3 V to 3.6 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Dynamic									
Turn-on time	t_{ON}	$V_{COM} = V_+$ or GND, R_L = 500 Ω,	C_L = 50 pF, See Figure 17	25°C	3.3 V	2	4.3	6.6	ns
				Full	3 V to 3.6 V	2		7	
Turn-off time	t_{OFF}	$V_{COM} = V_+$ or GND, R_L = 500 Ω,	C_L = 50 pF, See Figure 17	25°C	3.3 V	1	3.3	6.3	ns
				Full	3 V to 3.6 V	1		7	
Output voltage during undershoot	V_{OUTU}	See Figure 18				2.5	V_{OH} – 0.3		V
Output voltage during overshoot	V_{OUTO}	See Figure 18					V_{OL} + 0.3	2	V
Break-before-make time	t_{BBM}	$V_{NC} = V_{NO} = V_+/2$, R_L = 50 Ω,	C_L = 50 pF, See Figure 19	25°C	3.3 V	0.5	7	17	ns
				Full	3 V to 3.6 V	0.5		19.5	
Charge injection	Q_C	V_{GEN} = 0, R_{GEN} = 0,	C_L = 0.1 nF, See Figure 23	25°C	3.3 V		–11.5		pC
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch OFF,	See Figure 16	25°C	3.3 V		5		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch ON,	See Figure 16	25°C	3.3 V		15		pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_+$ or GND, Switch ON,	See Figure 16	25°C	3.3 V		15		pF
Digital input capacitance	C_I	$V_I = V_+$ or GND,	See Figure 16	25°C	3.3 V		2.5		pF
Bandwidth	BW	R_L = 50 Ω, Switch ON,	See Figure 20	25°C	3.3 V		370		MHz
OFF isolation	O_{ISO}	R_L = 50 Ω, f = 10 MHz,	Switch OFF, See Figure 21	25°C	3.3 V		–60		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 10 MHz,	Switch ON, See Figure 22	25°C	3.3 V		–60		dB
Total harmonic distortion	THD	R_L = 600 Ω, C_L = 50 pF,	f = 20 Hz to 20 kHz, See Figure 24	25°C	3.3 V		0.1		%
Supply									
Positive supply current	I_+	$V_I = V_+$ or GND,	Switch ON or OFF	25°C	3.6 V		0.05	0.1	µA
				Full				0.6	

Electrical Characteristics for 2.5-V Supply

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

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Analog Switch									
Analog signal range	V_{COM}, V_{NO}, V_{NC}					0		V_+	V
Voltage undershoot	V_{IKU}	0 mA ≥ (I_{NC}, I_{NO}, or I_{COM}) ≥ – 50 mA			2.7 V				V
Peak ON-state resistance	r_{peak}	0 ≤ (V_{NO} or V_{NC}) ≤ V_+, I_{COM} = –8 mA,	Switch ON, See Figure 13	25°C	2.3 V		9.2	30	Ω
				Full				35	
ON-state resistance	r_{on}	V_{NO} or V_{NC} = 0, I_{COM} = 8 mA	Switch ON, See Figure 13	25°C	2.3 V		5.4	8.5	Ω
				Full				12	
		V_{NO} or V_{NC} = 2.3 V, I_{COM} = –8 mA		25°C			8.6	15.5	
				Full				25	
ON-state resistance match between channels	Δr_{on}	V_{NO} or V_{NC} = 1.6 V, I_{COM} = –8 mA,	Switch ON, See Figure 13	25°C	2.3 V		0.05	0.3	Ω
				Full				0.5	
ON-state resistance flatness	$r_{on(flat)}$	0 ≤ (V_{NO} or V_{NC}) ≤ V_+, I_{COM} = –8 mA,	Switch ON, See Figure 13	25°C	2.3 V		5	9	Ω
				Full				15	
NC, NO OFF leakage current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_{NC} or V_{NO} = 0 to V_+, V_{COM} = V_+ to 0,	Switch OFF, See Figure 14	25°C	2.7 V		0	0.03	µA
				Full				0.05	
	$I_{NC(PWROFF)}$, $I_{NOPWROFF)}$	V_{NC} or V_{NO} = 0 to 2.7 V, V_{COM} = 2.7 V to 0,	Switch OFF, See Figure 14	25°C	0		0.15	0.05	
				Full				0.75	
COM OFF leakage current	$I_{COM(PWROFF)}$	V_{COM} = 0 to 2.7 V, V_{NC} or V_{NO} = 2.7 V to 0,	Switch ON, See Figure 14	25°C	0		0.2	0.5	µA
				Full				1	
NC, NO ON leakage current	$I_{NC(ON)}$, $I_{NO(ON)}$	V_{NC} or V_{NO} = 0 to V_+, V_{COM} = Open,	Switch ON, See Figure 15	25°C	2.7 V		0.001	0.01	µA
				Full				0.02	
COM ON leakage current	$I_{COM(ON)}$	V_{NC} or V_{NO} = Open, V_{COM} = 0 to V_+,	Switch ON, See Figure 15	25°C	2.7 V		0.003	0.03	µA
				Full				0.05	
Digital Control Input (IN)									
Input logic high	V_{IH}			Full		$V_+ \times 0.75$		5.5	V
Input logic low	V_{IL}			Full		0		$V_+ \times 0.25$	V
Input leakage current	I_{IH}, I_{IL}	V_I = 5.5 V or 0		25°C	2.7 V		0.005	0.01	µA
				Full				0.02	

Electrical Characteristics for 2.5-V Supply (continued)

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

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Dynamic									
Turn-on time	t_{ON}	$V_{COM} = V_+$ or GND, R_L = 500 Ω,	C_L = 50 pF, See Figure 17	25°C	2.5 V	3	5.8	9.6	ns
				Full	2.3 V to 2.7 V	3		12	
Turn-off time	t_{OFF}	$V_{COM} = V_+$ or GND, R_L = 500 Ω,	C_L = 50 pF, See Figure 17	25°C	2.5 V	1.5	4.5	7.3	ns
				Full	2.3 V to 2.7 V	1.5		7.5	
Output voltage during undershoot	V_{OUTU}	See Figure 18				2.5	V_{OH} – 0.3		V
Output voltage during overshoot	V_{OUTO}	See Figure 18					V_{OL} + 0.3	2	V
Break-before-make time	t_{BBM}	$V_{NC} = V_{NO} = V_+/2$, R_L = 50 Ω,	C_L = 50 pF, See Figure 19	25°C	2.5 V	0.5	10	25	ns
				Full	2.3 V to 2.7 V	0.5		28.5	
Charge injection	Q_C	V_{GEN} = 0, R_{GEN} = 0,	C_L = 0.1 nF, See Figure 23	25°C	2.5 V		–8		pC
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch OFF,	See Figure 16	25°C	2.5 V		5		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch ON,	See Figure 16	25°C	2.5 V		15		pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_+$ or GND, Switch ON,	See Figure 16	25°C	2.5 V		15		pF
Digital input capacitance	C_I	$V_I = V_+$ or GND,	See Figure 16	25°C	2.5 V		2.5		pF
Bandwidth	BW	R_L = 50 Ω, Switch ON,	See Figure 20	25°C	2.5 V		367		MHz
OFF isolation	O_{ISO}	R_L = 50 Ω, f = 10 MHz,	Switch OFF, See Figure 21	25°C	2.5 V		–60		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 10 MHz,	Switch ON, See Figure 22	25°C	2.5 V		–60		dB
Total harmonic distortion	THD	R_L = 600 Ω, C_L = 50 pF,	f = 20 Hz to 20 kHz, See Figure 24	25°C	2.5 V		0.15		%
Supply									
Positive supply current	I_+	$V_I = V_+$ or GND,	Switch ON or OFF	25°C	2.7 V		0.05	0.1	nA
				Full				0.5	

Electrical Characteristics for 1.8-V Supply

V_+ = 1.65 V to 1.95 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Analog Switch									
Analog signal range	V_{COM}, V_{NO}, V_{NC}					0		V_+	V
Voltage undershoot	V_{IKU}	0 ≥ (I_{NC}, I_{NO}, or I_{COM}) ≥ – 50 mA			1.95 V				V
Peak ON-state resistance	r_{peak}	0 ≤ (V_{NO} or V_{NC}) ≤ V_+, I_{COM} = –4 mA,	Switch ON, See Figure 13	25°C	1.65 V		13.8	60	Ω
				Full				120	
ON-state resistance	r_{on}	V_{NO} or V_{NC} = 0, I_{COM} = 4 mA	Switch ON, See Figure 13	25°C	1.65 V		5.9	15	Ω
				Full				15	
		V_{NO} or V_{NC} = 1.65 V, I_{COM} = –4 mA		25°C			12.8	40	
				Full				45	
ON-state resistance match between channels	Δr_{on}	V_{NO} or V_{NC} = 1.15 V, I_{COM} = –4 mA,	Switch ON, See Figure 13	25°C	1.65 V		0.1	0.5	Ω
				Full				0.8	
ON-state resistance flatness	$r_{on(flat)}$	0 ≤ (V_{NO} or V_{NC}) ≤ V_+, I_{COM} = –4 mA,	Switch ON, See Figure 13	25°C	1.65 V		26.5	60	Ω
				Full				80	
NC, NO OFF leakage current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_{NC} or V_{NO} = 0 to V_+, V_{COM} = V_+ to 0,	Switch OFF, See Figure 14	25°C	1.95 V		0	0.03	μA
				Full				0.05	
	$I_{NC(PWROFF)}$, $I_{NOPWROFF)}$	V_{NC} or V_{NO} = 0 to 1.95 V, V_{COM} = 1.95 V to 0,	Switch OFF, See Figure 14	25°C	0		0.15	0.05	
				Full				0.75	
COM OFF leakage current	$I_{COM(PWROFF)}$	V_{COM} = 0 to 1.95 V, V_{NC} or V_{NO} = 1.95 V to 0,	Switch ON, See Figure 14	25°C	0		0.2	0.5	μA
				Full				1	
NC, NO ON leakage current	$I_{NC(ON)}$, $I_{NO(ON)}$	V_{NC} or V_{NO} = 0 to V_+, V_{COM} = Open,	Switch ON, See Figure 15	25°C	1.95 V		0.001	0.01	μA
				Full				0.02	
COM ON leakage current	$I_{COM(ON)}$	V_{NC} or V_{NO} = Open, V_{COM} = 0 to V_+,	Switch ON, See Figure 15	25°C	1.95 V		0.003	0.03	μA
				Full				0.05	
Digital Control Input (IN)									
Input logic high	V_{IH}			Full		$V_+ \times 0.75$		5.5	V
Input logic low	V_{IL}			Full		0		$V_+ \times 0.25$	V
Input leakage current	I_{IH}, I_{IL}	V_I = 5.5 V or 0		25°C	1.95 V		0.005	0.01	μA
				Full				0.02	

Electrical Characteristics for 1.8-V Supply (continued)

V_+ = 1.65 V to 1.95 V, T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		T_A	V_+	MIN	TYP	MAX	UNIT
Dynamic									
Turn-on time	t_{ON}	$V_{COM} = V_+$ or GND, R_L = 500 Ω,	C_L = 50 pF, See Figure 17	25°C	1.8 V		9.5	23	ns
				Full	1.65 V to 1.95 V			24	
Turn-off time	t_{OFF}	$V_{COM} = V_+$ or GND, R_L = 500 Ω,	C_L = 50 pF, See Figure 17	25°C	1.8 V		5.9	10	ns
				Full	1.65 V to 1.95 V			12	
Output voltage during undershoot	V_{OUTU}	See Figure 18				2.5	V_{OH} – 0.3		V
Output voltage during overshoot	V_{OUTO}	See Figure 18					V_{OL} + 0.3	2	V
Break-before-make time	t_{BBM}	$V_{NC} = V_{NO} = V_+/2$, R_L = 50 Ω,	C_L = 50 pF, See Figure 19	25°C	1.8 V	0.5	18	50	ns
				Full	1.65 V to 1.95 V	0.5		55	
Charge injection	Q_C	V_{GEN} = 0, R_{GEN} = 0,	C_L = 0.1 nF, See Figure 23	25°C	1.8 V		–5		pC
NC, NO OFF capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch OFF,	See Figure 16	25°C	1.8 V		5.5		pF
NC, NO ON capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or $V_{NO} = V_+$ or GND, Switch ON,	See Figure 16	25°C	1.8 V		15.5		pF
COM ON capacitance	$C_{COM(ON)}$	$V_{COM} = V_+$ or GND, Switch ON,	See Figure 16	25°C	1.8 V		15.5		pF
Digital input capacitance	C_I	$V_I = V_+$ or GND,	See Figure 16	25°C	1.8 V		2.5		pF
Bandwidth	BW	R_L = 50 Ω, Switch ON,	See Figure 20	25°C	1.8 V		369		MHz
OFF isolation	O_{ISO}	R_L = 50 Ω, f = 10 MHz,	Switch OFF, See Figure 21	25°C	1.8 V		–60		dB
Crosstalk	X_{TALK}	R_L = 50 Ω, f = 10 MHz,	Switch ON, See Figure 22	25°C	1.8 V		–60		dB
Total harmonic distortion	THD	R_L = 600 Ω, C_L = 50 pF,	f = 20 Hz to 20 kHz, See Figure 24	25°C	1.8 V		0.4		%
Supply									
Positive supply current	I_+	$V_I = V_+$ or GND,	Switch ON or OFF	25°C	1.95 V		0.05	0.06	µA
				Full				0.3	

TYPICAL PERFORMANCE

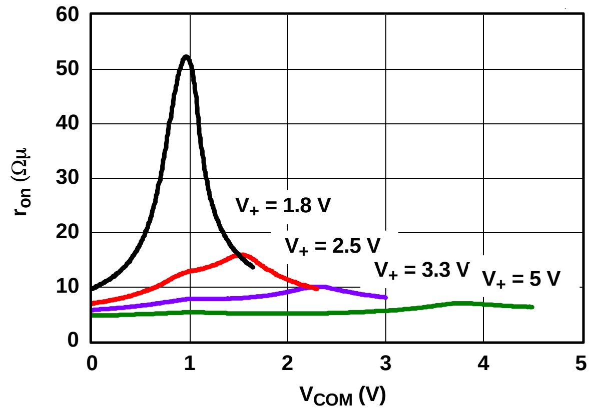


Figure 1. r_{on} vs V_{COM}

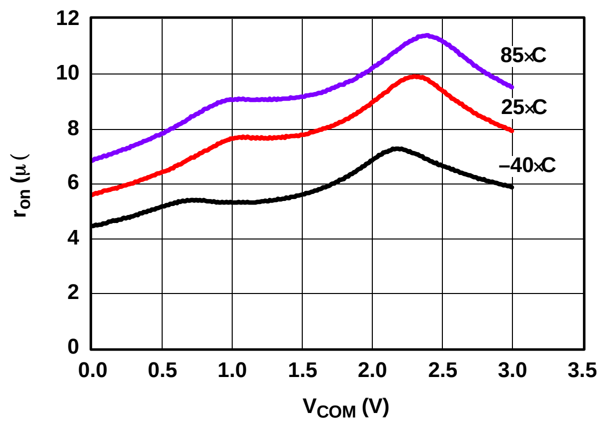


Figure 2. r_{on} vs V_{COM} ($V_+ = 3$ V)

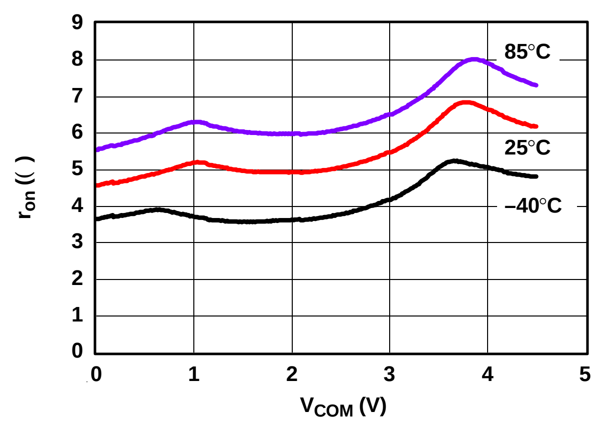


Figure 3. r_{on} vs V_{COM} ($V_+ = 5$ V)

TYPICAL PERFORMANCE (continued)

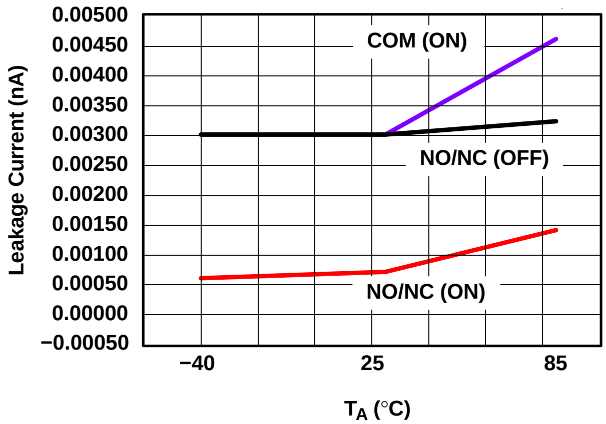


Figure 4. Leakage Current vs Temperature (V_+ = 5.5 V)

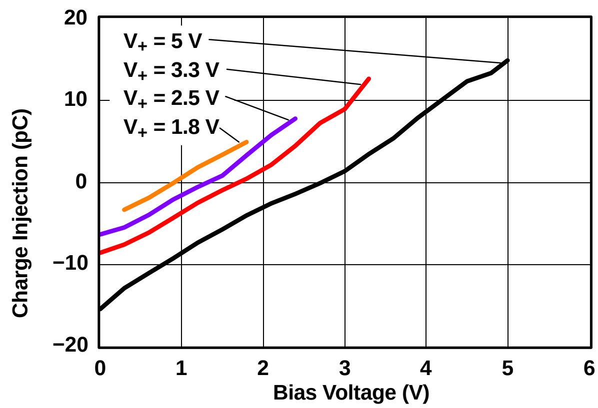


Figure 5. Charge Injection (Q_C) vs V_{COM}

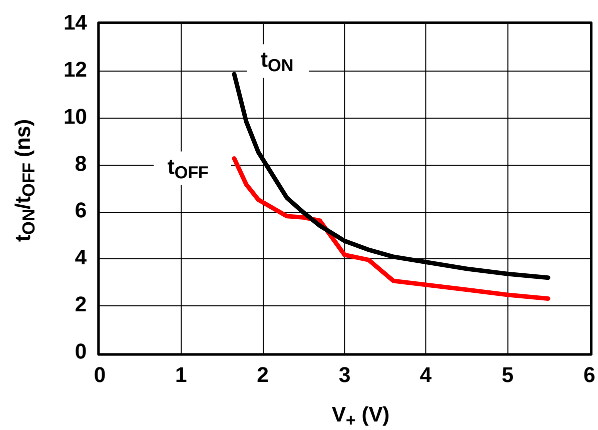


Figure 6. t_{ON} and t_{OFF} vs Supply Voltage

TYPICAL PERFORMANCE (continued)

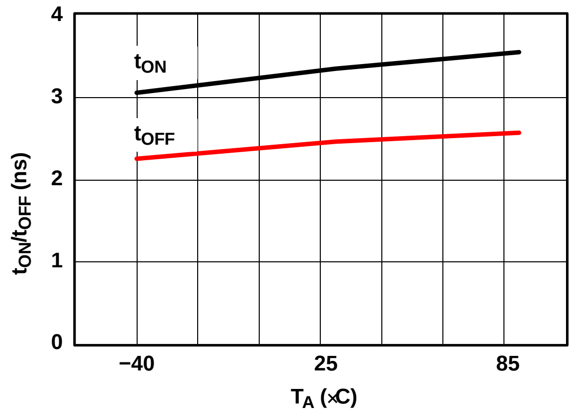


Figure 7. t_{ON} and t_{OFF} vs Temperature (V_+ = 5 V)

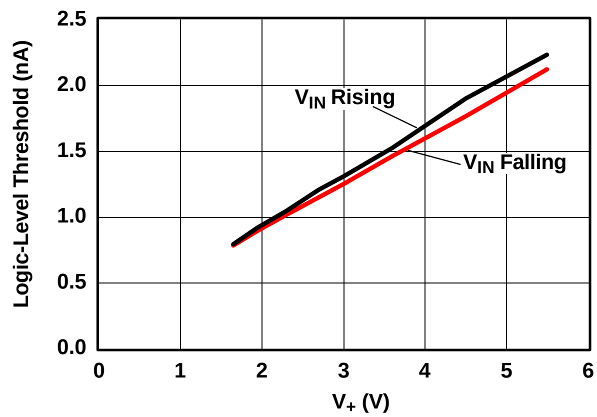


Figure 8. Logic-Level Threshold vs V_+

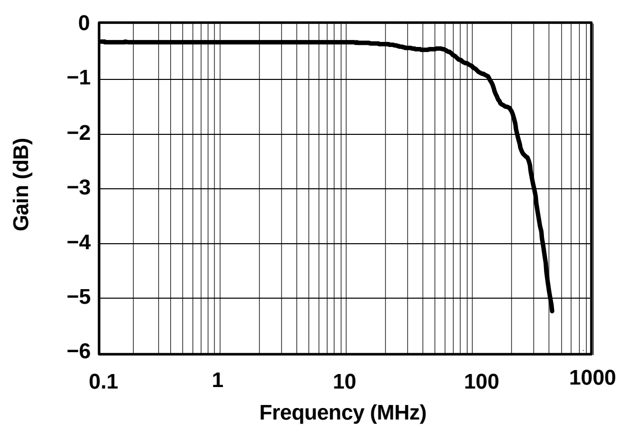


Figure 9. Bandwidth (V_+ = 3.3 V)

TYPICAL PERFORMANCE (continued)

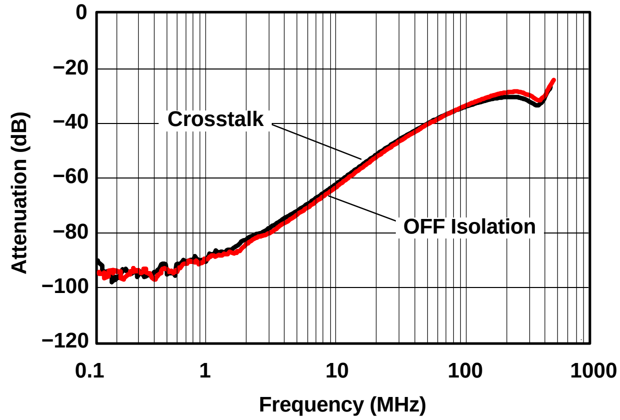


Figure 10. OFF Isolation and Crosstalk (V_+ = 3.3 V)

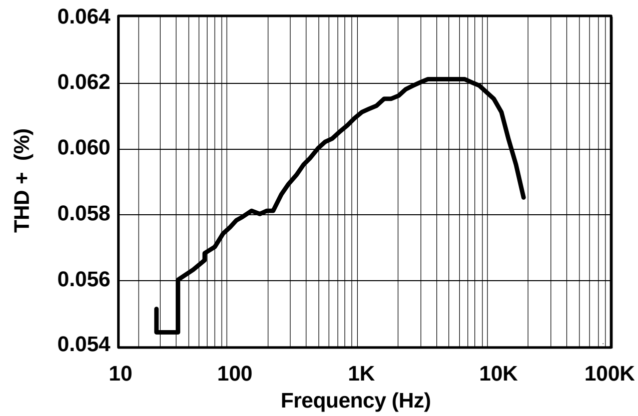


Figure 11. Total Harmonic Distortion (THD) vs Frequency (V_+ = 3.3 V)

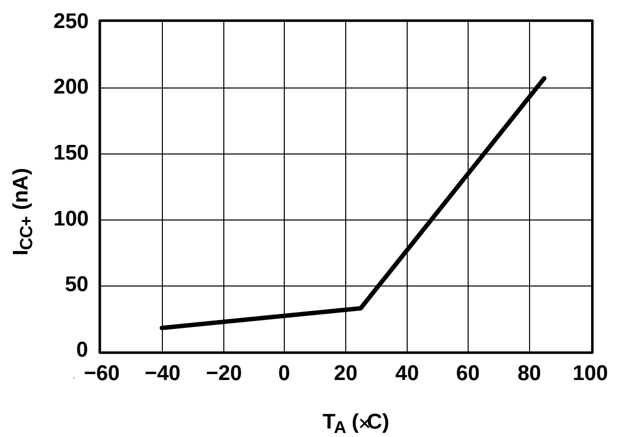


Figure 12. Power-Supply Current vs Temperature (V_+ = 5 V)

PIN DESCRIPTION

PIN 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 or NC

PARAMETER DESCRIPTION

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

PARAMETER MEASUREMENT INFORMATION

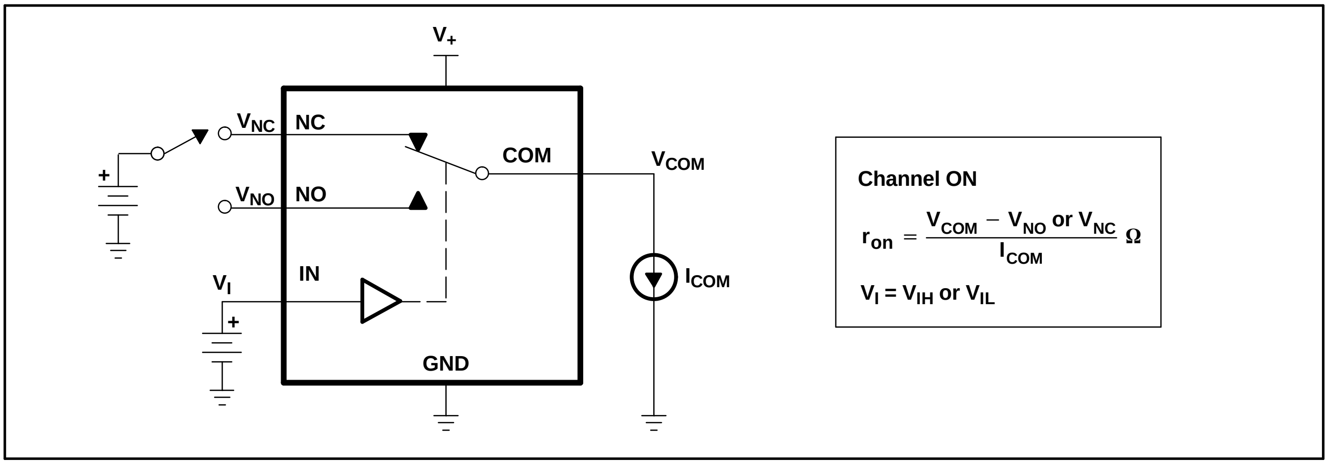


Figure 13. ON-State Resistance (r_{on})

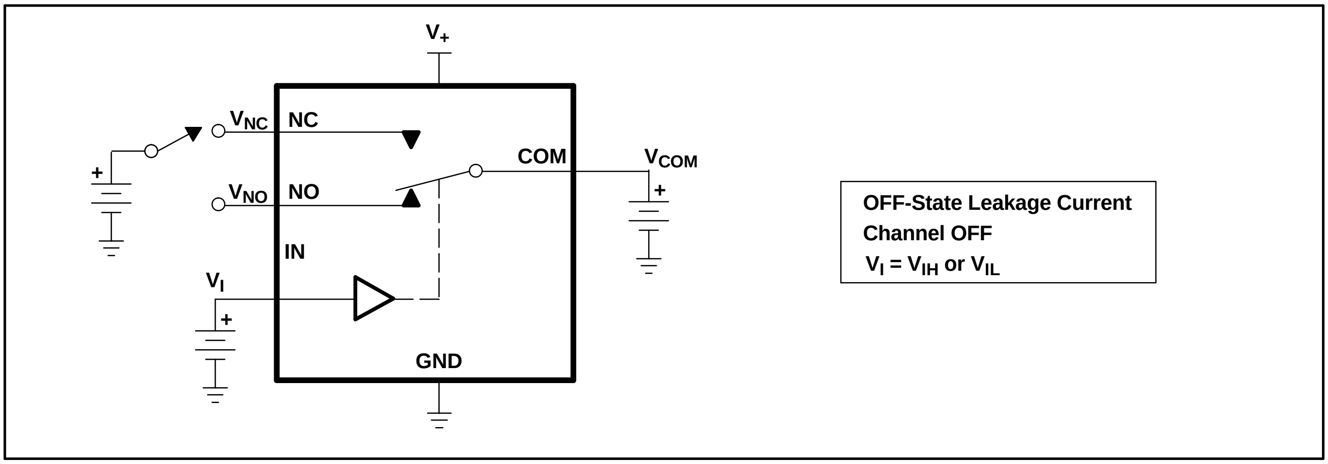


Figure 14. OFF-State Leakage Current
($I_{NC(OFF)}$, $I_{NC(PWROFF)}$, $I_{NO(OFF)}$, $I_{NO(PWROFF)}$, $I_{COM(OFF)}$, $I_{COM(PWROFF)}$)

PARAMETER MEASUREMENT INFORMATION (continued)

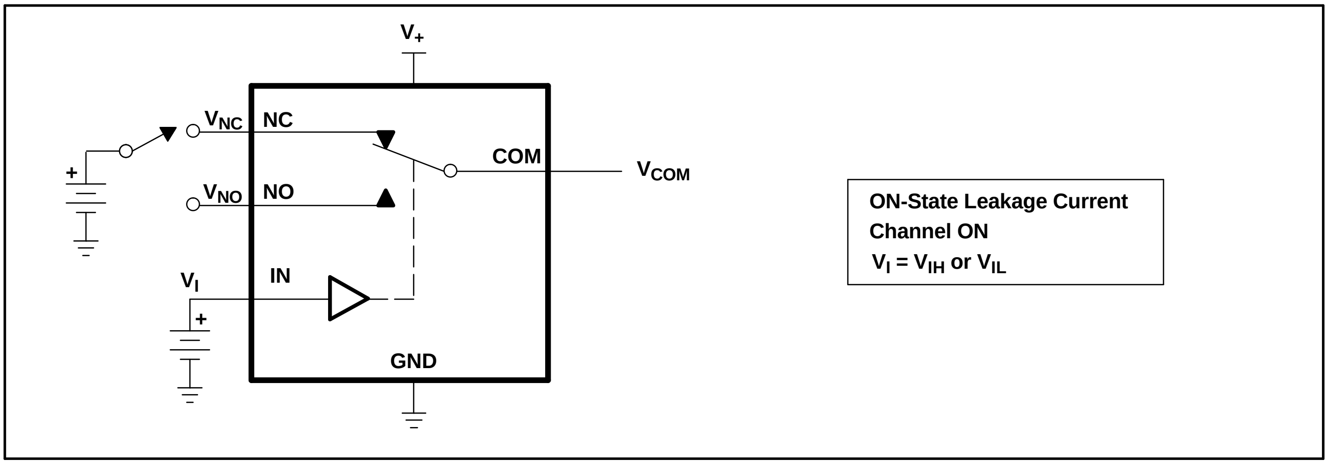


Figure 15. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NC(ON)}$, $I_{NO(ON)}$)

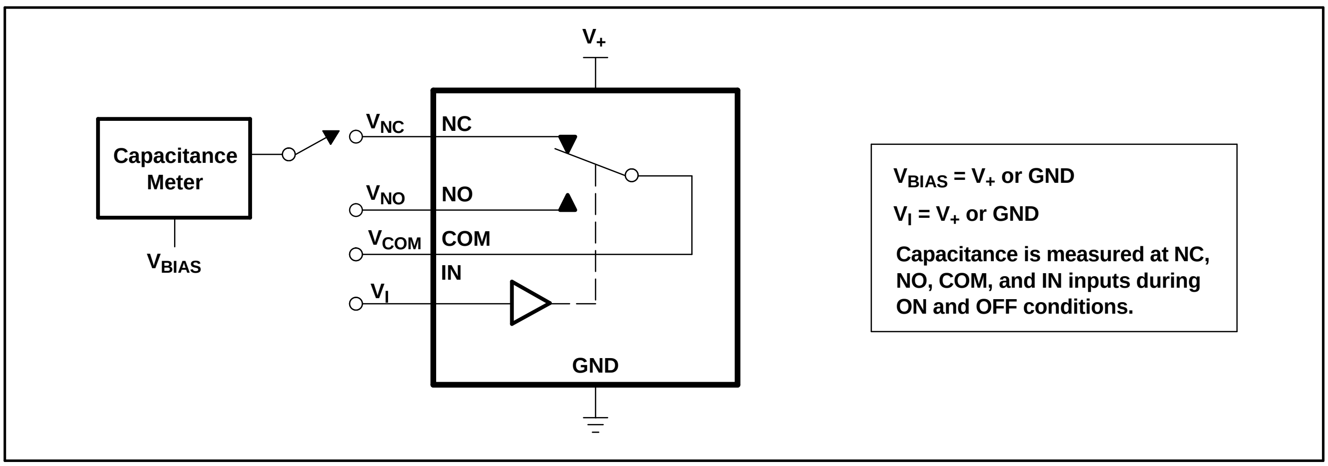
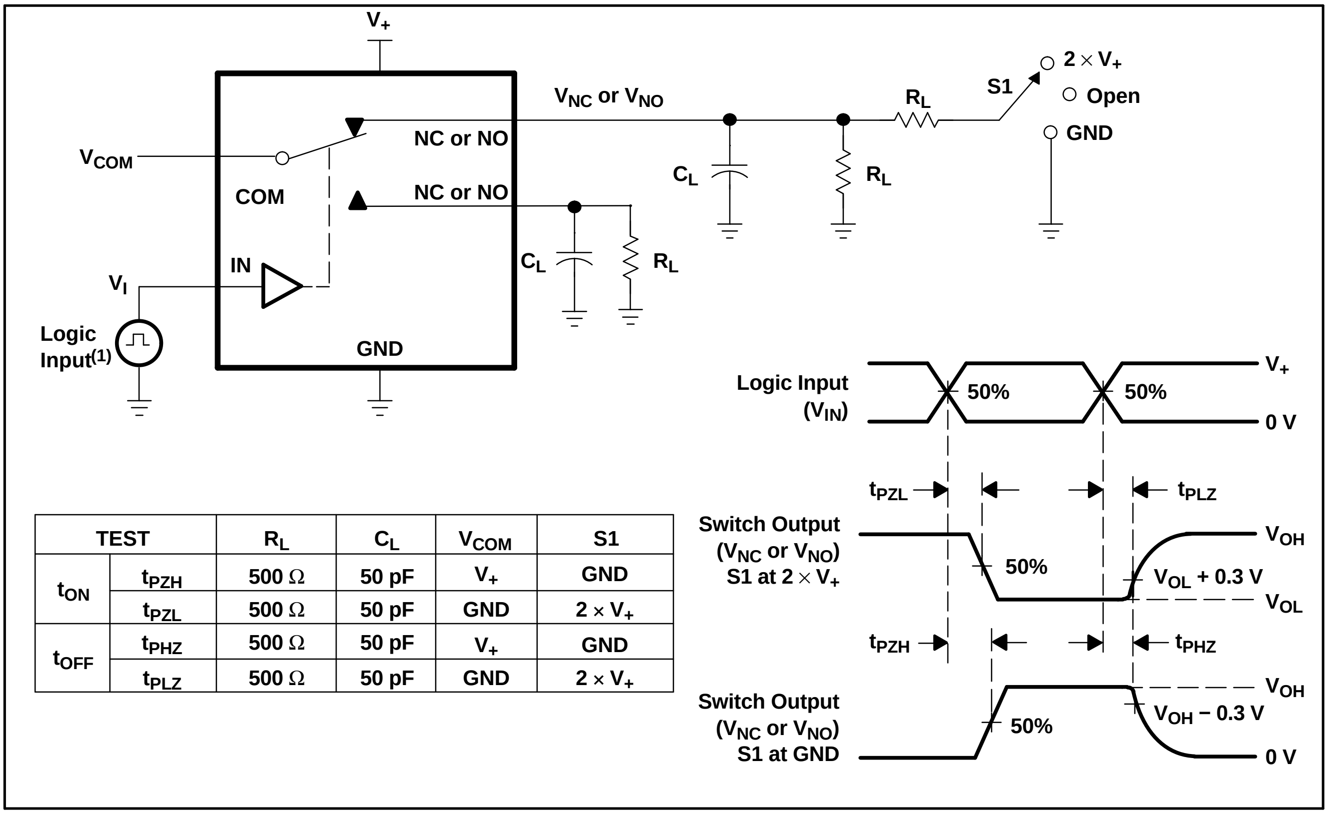


Figure 16. Capacitance (C_{IN}, $C_{COM(ON)}$, $C_{NC(OFF)}$, $C_{NO(OFF)}$, $C_{NC(ON)}$, $C_{NO(ON)}$)

PARAMETER MEASUREMENT INFORMATION (continued)

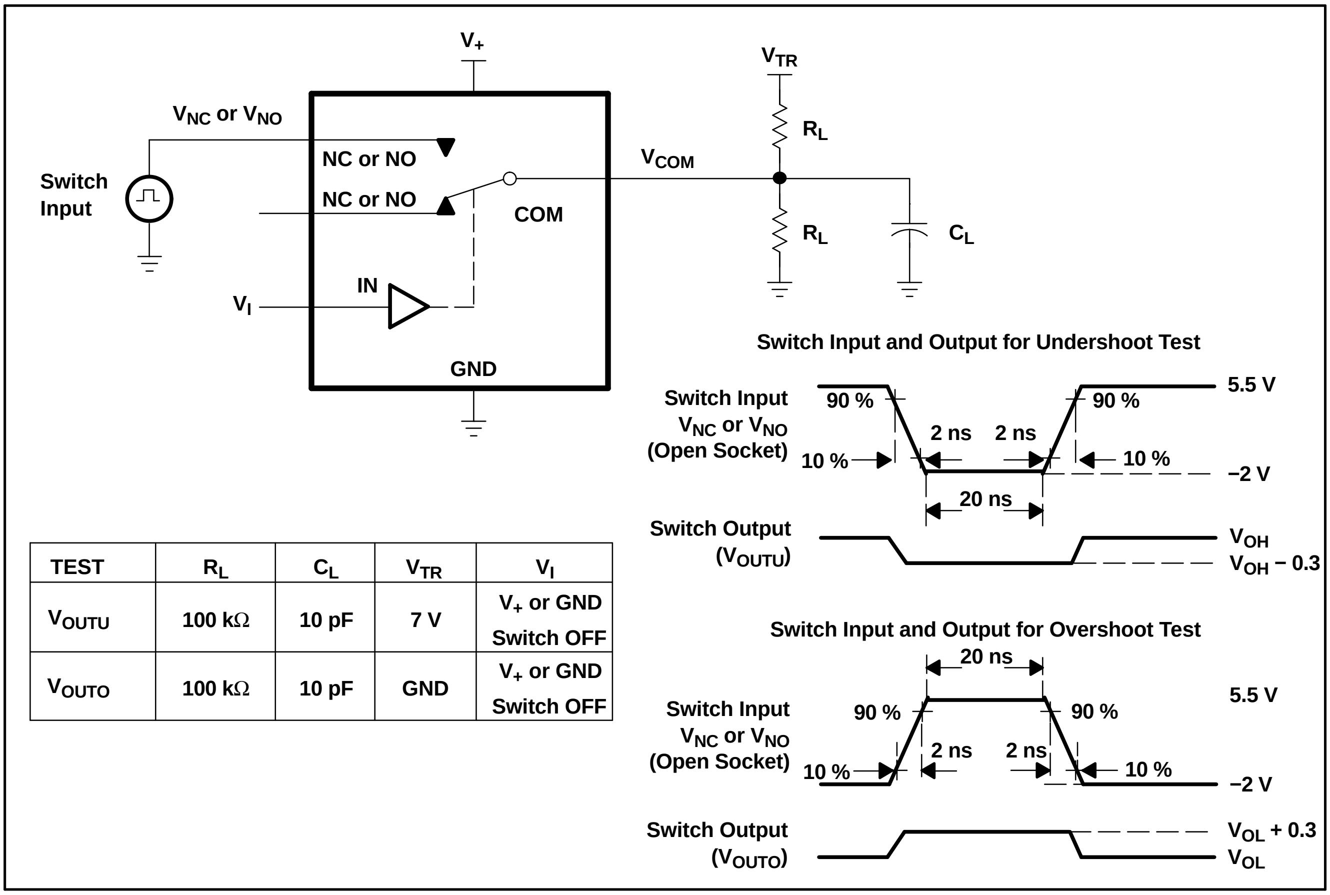


TEST		R_L	C_L	V_{COM}	S1
t_{ON}	t_{PZH}	500 Ω	50 pF	V_+	GND
	t_{PZL}	500 Ω	50 pF	GND	2 × V_+
t_{OFF}	t_{PHZ}	500 Ω	50 pF	V_+	GND
	t_{PLZ}	500 Ω	50 pF	GND	2 × V_+

(1) All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r < 5 ns, t_f < 5 ns.

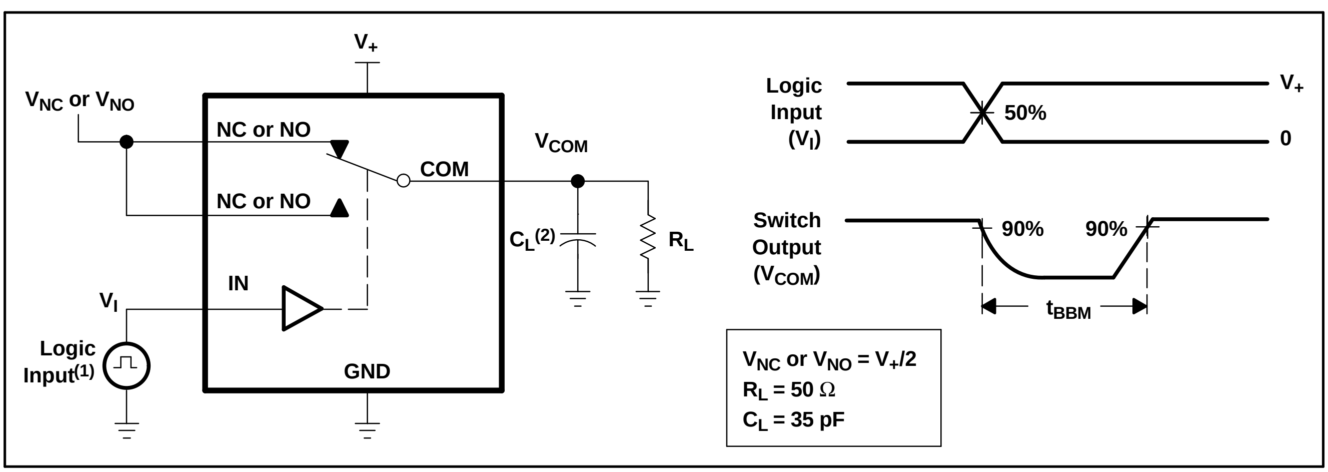
Figure 17. Turn-On (t_{ON}) and Turn-Off (t_{OFF}) Time

PARAMETER MEASUREMENT INFORMATION (continued)



TEST	R_L	C_L	V_{TR}	V_I
V_{OUTU}	100 kΩ	10 pF	7 V	V_+ or GND Switch OFF
V_{OUTO}	100 kΩ	10 pF	GND	V_+ or GND Switch OFF

Figure 18. Undershoot and Overshoot Test



(1) All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r < 5 ns, t_f < 5 ns.

(2) C_L includes probe and jig capacitance.

Figure 19. Break-Before-Make (t_{BBM}) Time

PARAMETER MEASUREMENT INFORMATION (continued)

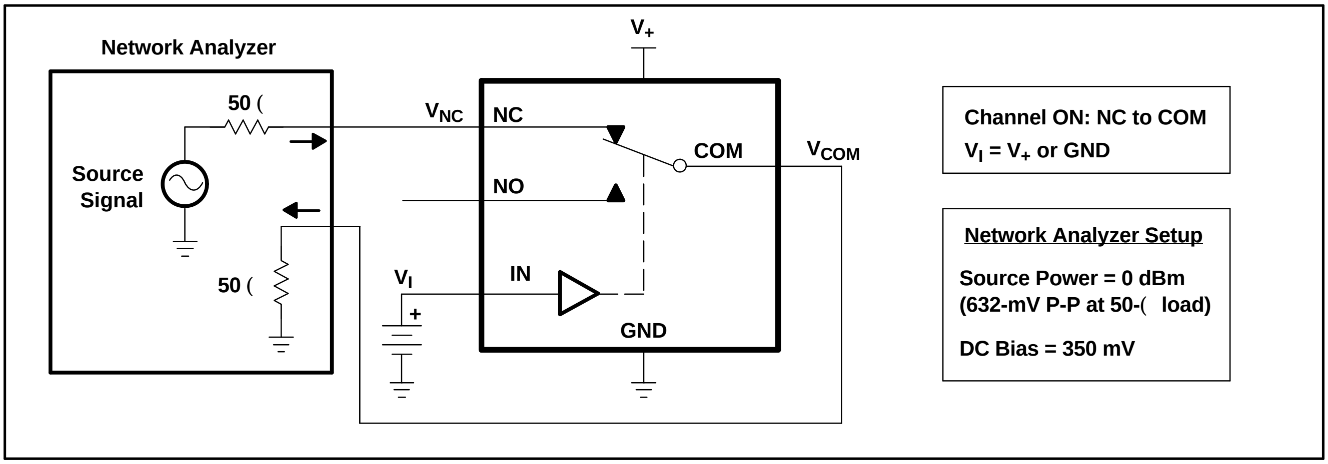


Figure 20. Bandwidth (BW)

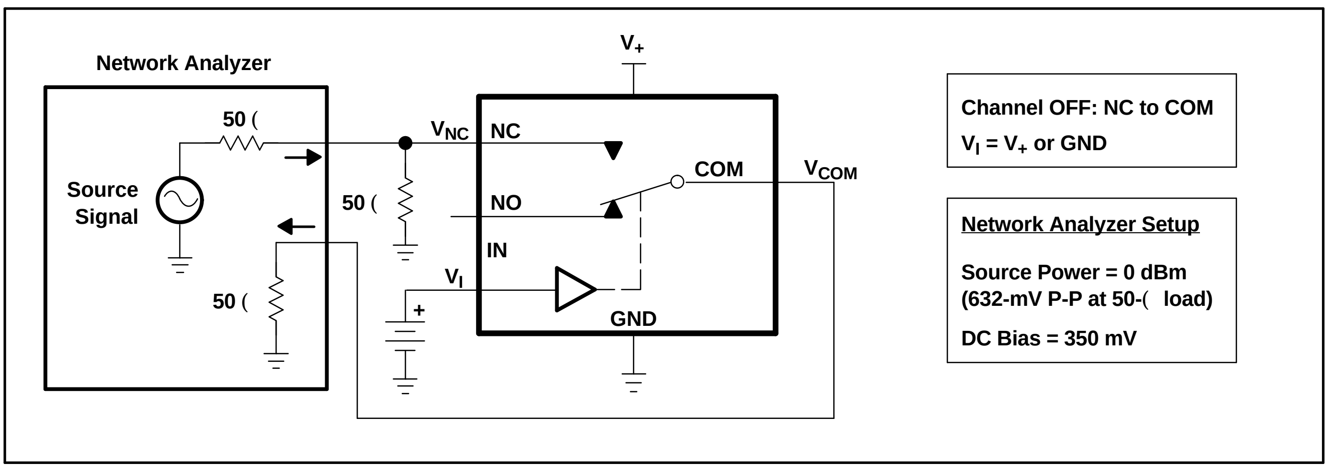


Figure 21. OFF Isolation (O_{ISO})

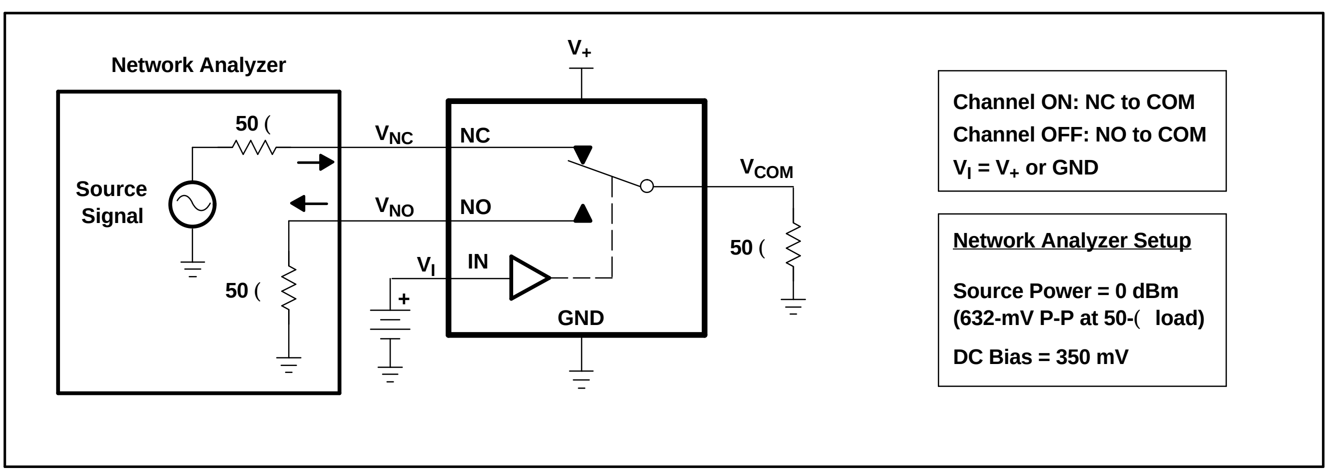
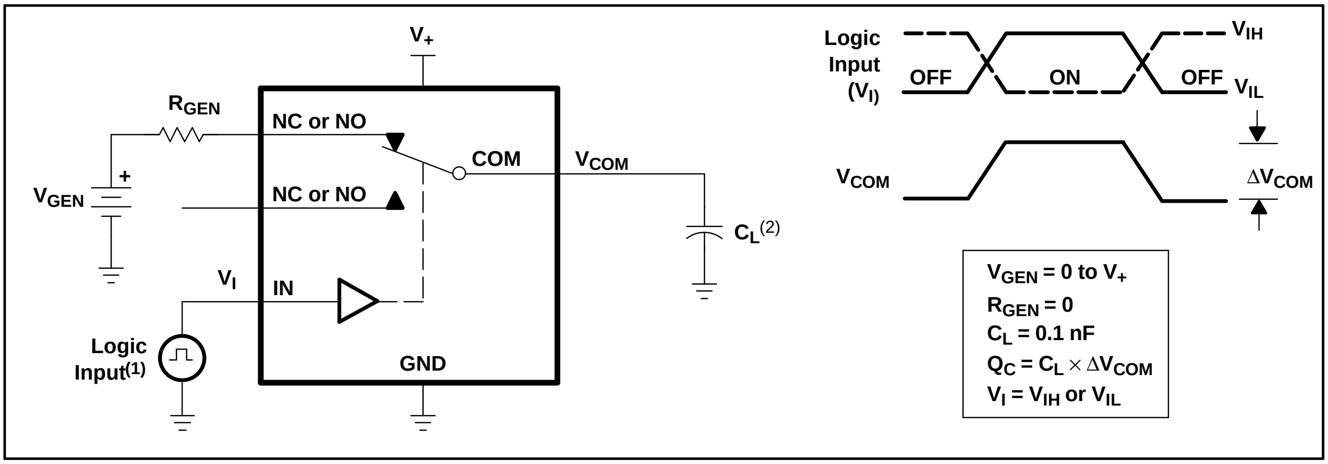


Figure 22. Crosstalk (X_{TALK})

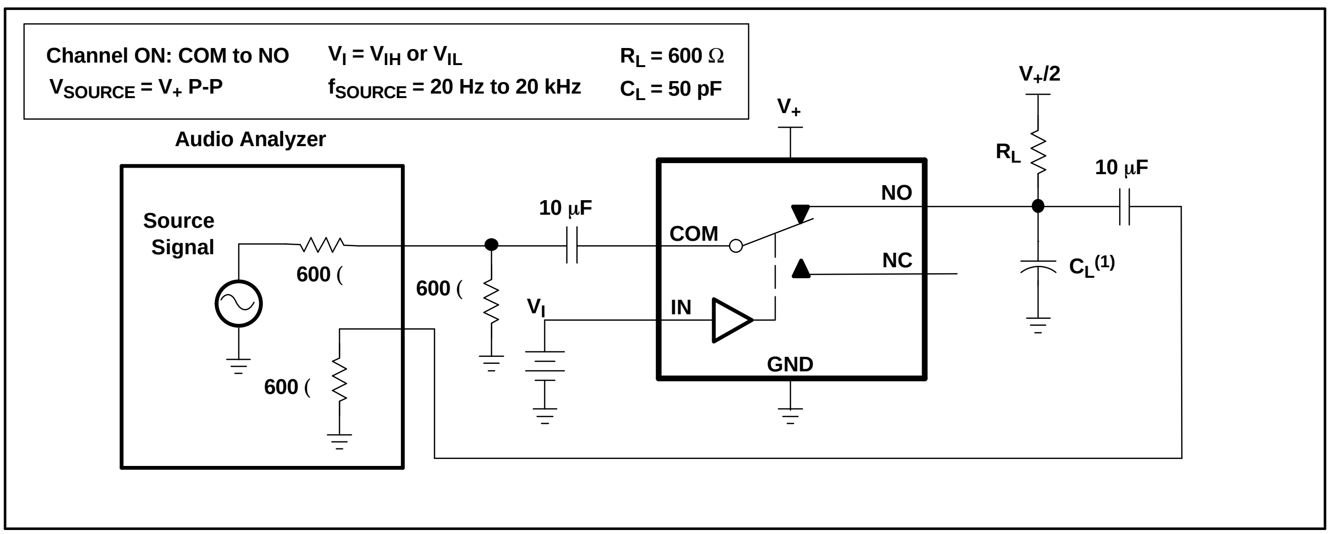
PARAMETER MEASUREMENT INFORMATION (continued)



(1) All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r < 5 ns, t_f < 5 ns.

(2) C_L includes probe and jig capacitance.

Figure 23. Charge Injection (Q_C)



(1) C_L includes probe and jig capacitance.

Figure 24. Total Harmonic Distortion (THD)

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
TS5A63157DBVR	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS5A63157DBVRE4	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS5A63157DCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TS5A63157DCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	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), 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.

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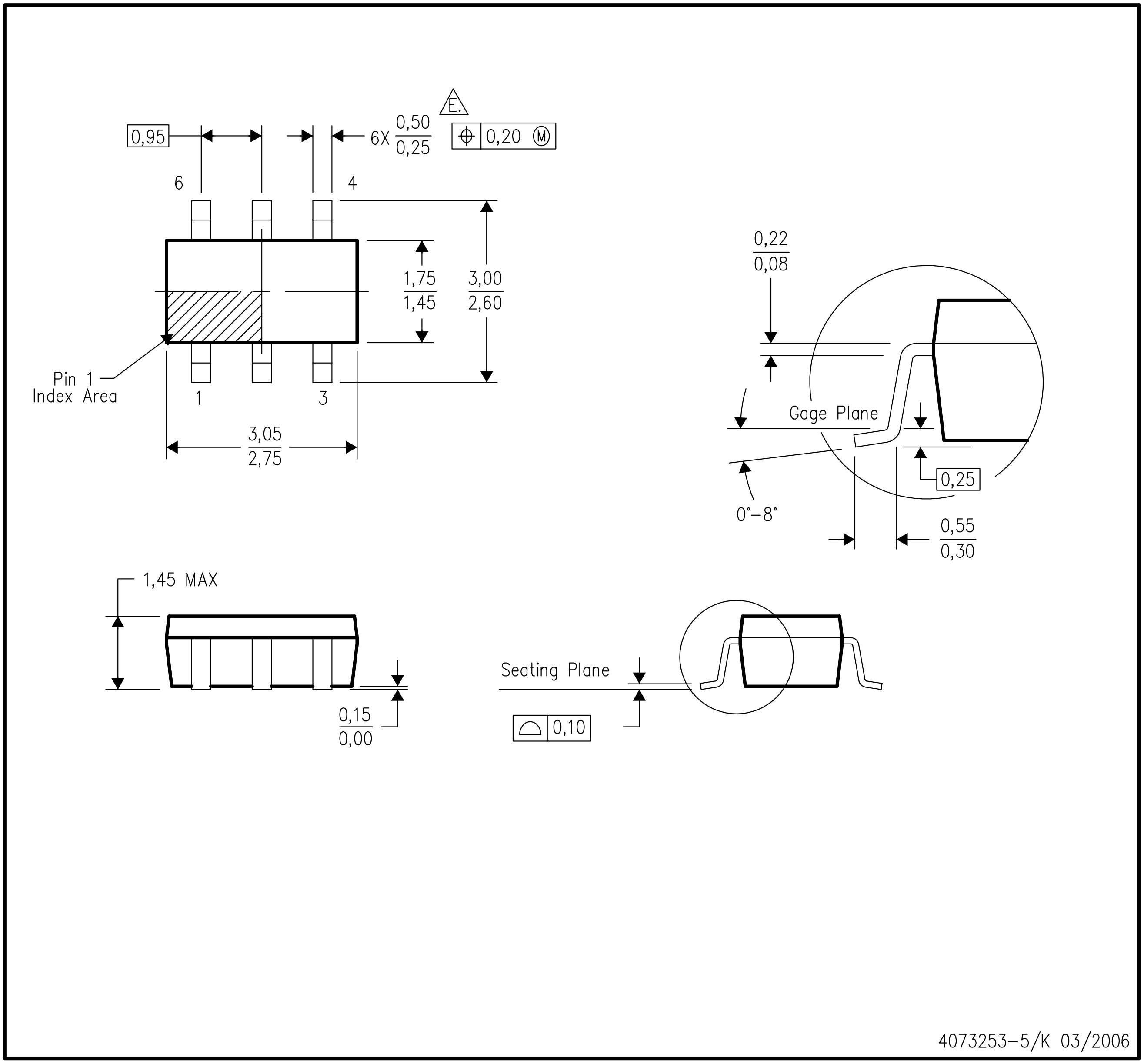
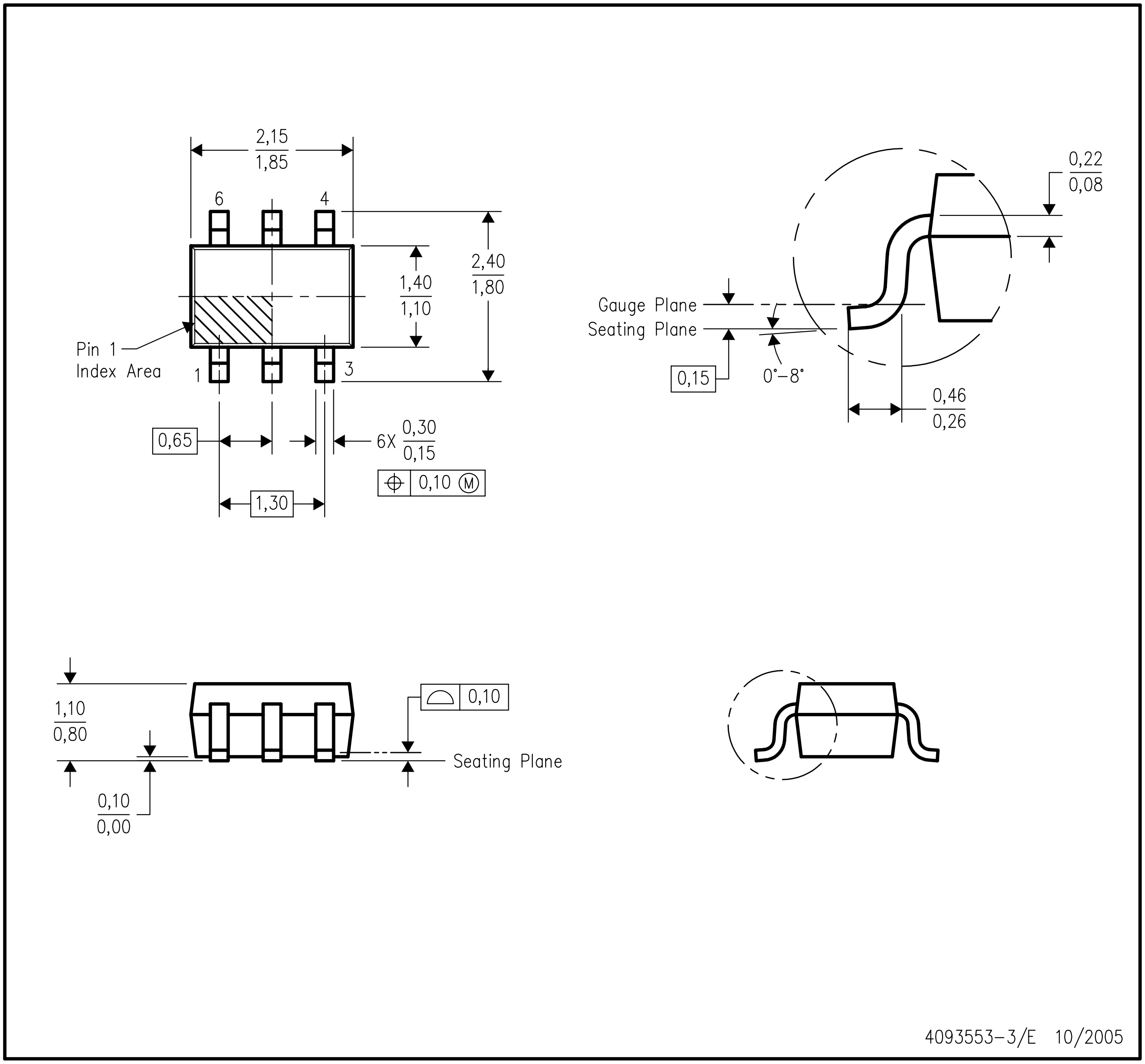
DBV (R–PDSO–G6) PLASTIC SMALL–OUTLINE PACKAGE



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.
E. Falls within JEDEC MO–178 Variation AB, except minimum lead width.

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.

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