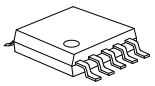
UDS22364 **Advance** ***CMOS IC***

0.65Ω DUAL SPDT ANALOG SWITCHES WITH NEGATIVE SIGNALING CAPABILITY



SSOP-10

■ DESCRIPTION

The UTC **UDS22364** is single-pole double-throw (SPDT) analog switches designed to operate from 2.3V to 5.5V. The devices feature negative signal capability that allows signals below ground to pass through the switch without distortion. Additionally, the UTC **UDS22364** includes an internal shunt switch, which automatically discharges any capacitance at the NC or NO terminals when they are unconnected to COM. This reduces the audible click/pop noise when switching between two sources. The break-before-make feature prevents signal distortion during the transferring of a signal from one path to another. Low ON-state resistance, excellent channel-to-channel ON-state resistance matching, and minimal total harmonic distortion (THD) performance are ideal for audio applications.

■ FEATURES

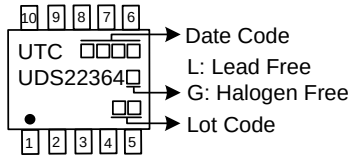
* Specified Break-Before-Make Switching
* Negative Signaling Capability: Maximum Swing From -2.75V to 2.75V (V_+ = 2.75V)
* Internal Shunt Switch Prevents Audible Click-and-Pop When Switching Between Two Sources
* Low ON-State Resistance (0.65Ω Typical)
* Low Charge Injection
* Excellent ON-State Resistance Matching
* 2.3V to 5.5V Power Supply (V_+)

■ ORDERING INFORMATION

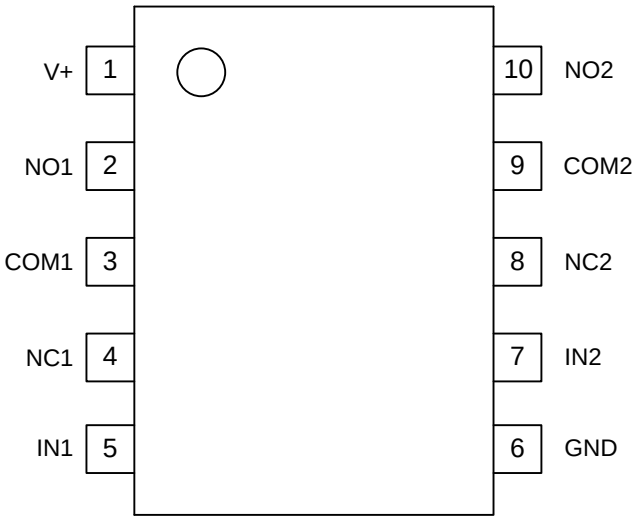
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UDS22364L-R10-R	UDS22364G-R10-R	SSOP-10	Tape Reel

UDS22364G-R10-R (1)Packing Type (2)Package Type (3)Green Package	(1) R: Tape Reel (2) R10: SSOP-10, SM2: MSOP-10 (3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	I/O	DESCRIPTION
1	V_+	I	Supply Power
2	NO1	I/O	Normally open (NO) signal path, switch 1
3	COM1	I/O	Common signal path, switch 1
4	NC1	I/O	Normally closed (NC) signal path, switch 1
5	IN1	I	Digital control pin to connect COM1 to NO1, switch 1
6	GND		Ground
7	IN2	I	Digital control pin to connect COM2 to NO2, switch 2
8	NC2	I/O	Normally closed (NC) signal path, switch 2
9	COM2	I/O	Common signal path, switch 2
10	NO2	I/O	Normally open (NO) signal path, switch 2

■ FUNCTION TABLE

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

■ BLOCK DIAGRAM

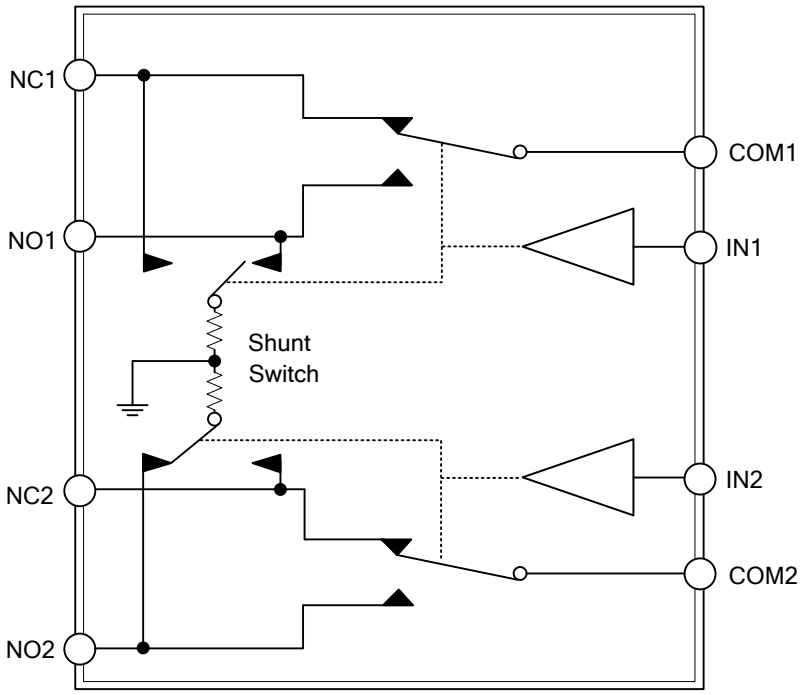


Table 1. INPUT/OUTPUT SIGNAL SWING

SUPPLY VOLTAGE, V_+	MINIMUM (V_{NC} , V_{NO} , V_{COM}) = V_+ - 5.5	MAXIMUM (V_{NC} , V_{NO} , V_{COM}) = V_+
5.5V	0V	5.5V
4.2V	-1.3V	4.2V
3.3V	-2.2V	3.3V
3V	-2.5V	3V
2.5V	-3V	2.5V

■ ABSOLUTE MAXIMUM RATING (Note 1, 2)

(Over operating free-air temperature range unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage Range (Note 3)		V_+	-0.5 ~ 6	V
Analog Voltage Range (Note 3, 4, 5)		V_{NC} V_{NO} V_{COM}	V_+-6 ~ V_++0.5	V
Analog Port Diode Current	V_{NC}, V_{NO}, V_{COM}<0 Or V_{NC}, V_{NO}, V_{COM}> V_+	$I_{I/OK}$	-50 ~ 50	mA
ON-State Switch Current	V_{NC}, V_{NO}, V_{COM}=0 to V_+	I_{NC}	-150 ~ 150	mA
ON-State Peak Switch Current		I_{NO} I_{COM}	-300 ~ 300	mA
Digital Input Voltage Range		V_I	-0.5 ~ 6.5	V
Digital Input Clamp Current (Note 3, 4)	V_I<0	I_{IK}	-50 ~ 50	mA
Continuous Current through V_+ or GND		I_+, I_{GND}	-100 ~ 100	mA
Storage Temperature Range		T_{STG}	-65 ~ +150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation 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 5.5V maximum.

■ RECOMMENDED OPERATING COMDITIONS

(Over operating free-air temperature range unless otherwise specified)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Supply Voltage	V_{CC}	2.3		5.5	V
Signal Path Voltage	V_{NC} V_{NO} V_{COM}	V_{CC} - 5.5		V_{CC}	V
Digital Control	V_{IN}	GND		V_{CC}	V

■ ELECTRICAL CHARACTERISTICS FOR 2.5V SUPPLY (Note 1)

(V_+ = 2.3V~2.7V, T_A = 25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
ANALOG SWITCH						
Analog Signal Range	V_{COM}, V_{NO}, V_{NC}		V_+ - 5.5		V_+	V
ON-State Resistance	R_{ON}	V_+=2.7V, V_{NC} or V_{NO}=V_+,1.5V, V_+—5.5V, COM to NO or NC, I_{COM}=-100mA, See Figure1		0.65	0.94	Ω
ON-State Resistance Match Between Channels	Δ R_{ON}	V_+=2.7V, V_{NC} or V_{NO}=1.5V, COM to NO or NC, I_{COM}=-100mA See Figure1		0.023	0.11	Ω
ON-State Resistance Flatness	$R_{ON(flat)}$	V_+=2.7V, V_{NC} or V_{NO}=V_+,1.5V, V_+—5.5V, COM to NO or NC, I_{COM}=-100mA, See Figure1		0.18	0.46	Ω
Shunt Switch Resistance	R_{SH}	V_+=2.7V, I_{NO} or I_{NC}=10mA		25	50	Ω
COM ON Leakage Current	$I_{COM(ON)}$	V_+=2.7V, V_{NC} and V_{NO}=Open V_{COM}=V_+,V_+—5.5V, See Figure3	-50		50	nA
DIGITAL CONTROL INPUTS (IN) (NOTE 2)						
Input Logic High	V_{IH}		1.4		5.5	V
Input Logic Low	V_{IL}				0.4	V
Input Leakage Current	I_{IH} , I_{IL}	V_+=2.7V, V_{IN}=V_+ or 0	-250		250	nA
DYNAMIC						
Turn-On Time	t_{ON}	V_+=2.5V, V_{COM}=V_+,C_L=35pF R_L=300Ω, See Figure5		44	80	ns
Turn-Off Time	t_{OFF}	V_+=2.5V, V_{COM}=V_+, C_L=35pF, R_L=300Ω, See Figure5		22	70	ns
Break-Before-Make Time	t_{BBM}	V_+=2.5V, See Figure6	1	7		ns
Charge Injection	Q_C	V_+=2.5V, V_{GEN}=0, C_L=1nF, R_{GEN}=0, See Figure10		215		pC
NC, NO, COM ON Capacitance	$C_{COM(ON)}$	V_+=2.5V, V_{COM}=V_+ or GND Switch ON, f=10MHz, See Figure4		370		pF
Digital Input Capacitance	C_I	V_+=2.5V, V_I=V_+ or GND, See Figure4		2.6		pF
Bandwidth	BW	V_+=2.5V, R=50Ω, -3dB, See Figure7		17		MHz
OFF Isolation	O_{ISO}	V_+=2.5V, f=100kHz,R_L=50Ω See Figure8		-66		dB
Crosstalk	X_{TALK}	V_+=2.5V, f=100kHz, R_L=50Ω, See Figure9		-75		dB
Total Harmonic Distortion	THD	V_+=2.5V, R_L=600Ω, f=20Hz~20kHz, C_L=15pF, See Figure11		0.01		%
SUPPLY						
Positive Supply Current	I_+	V_+=2.7V, V_I=V_+ or GND		0.2	1.1	μA
	I_+	V_+=2.7V, V_I=V_+ - 5.5V			3.3	μA

Notes: 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.

■ ELECTRICAL CHARACTERISTICS FOR 3.3V SUPPLY (Note 1)

(V_+ = 3V~3.6V, T_A = 25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
ANALOG SWITCH						
Analog Signal Range	V_{COM}, V_{NO}, V_{NC}		V_+ - 5.5		V_+	V
ON-State Resistance	R_{ON}	V_+=3V, V_{NC} or V_{NO}=V_+,1.5V, V_+-5.5V, COM to NO or NC I_{COM}=-100mA, See Figure1		0.61	0.87	Ω
ON-State Resistance Match Between Channels	$\triangle R_{ON}$	V_+=3V, V_{NC} or V_{NO}=1.5V, COM to NO or NC I_{COM}=-100mA, See Figure1		0.024	0.13	Ω
ON-State Resistance Flatness	$R_{ON(flat)}$	V_+=3V, V_{NC} or V_{NO}=V_+,1.5V, V_+-5.5V, COM to NO or NC, I_{COM}=-100mA, See Figure1		0.12	0.46	Ω
Shunt Switch Resistance	R_{SH}	V_+=3V, I_{NO} or I_{NC}=10mA		25	37	Ω
COM ON Leakage Current	$I_{COM(ON)}$	V_+=3.6V, V_{NC} and V_{NO}=Open, V_{COM}=V_+,V_+-5.5V, See Figure3	-50		50	nA
DIGITAL CONTROL INPUTS (IN) (NOTE 2)						
Input Logic High	V_{IH}		1.4		5.5	V
Input Logic Low	V_{IL}				0.6	V
Input Leakage Current	I_{IH} , I_{IL}	V_+=3.6V, V_{IN}=V_+ or 0	-250		250	nA
DYNAMIC						
Turn-On Time	t_{ON}	V_+=3.3V, V_{COM}=V_+, C_L=35pF, R_L=300Ω, See Figure5		34	80	ns
Turn-Off Time	t_{OFF}	V_+=3.3V, V_{COM}=V_+, C_L=35pF, R_L=300Ω, See Figure5		19	70	ns
Break-Before-Make Time	t_{BBM}	V_+=3.3V, See Figure6	1	7		ns
Charge Injection	Q_C	V_+=3.3V, V_{GEN}=0, C_L=1nF, R_{GEN}=0 See Figure10		300		pC
NC, NO, COM ON Capacitance	$C_{COM(ON)}$	V_+=3.3V, V_{COM}=V_+ or GND, f=10MHz See Figure4		370		pF
Digital Input Capacitance	C_I	V_+=3.3V, V_I=V_+ or GND, See Figure4		2.6		pF
Bandwidth	BW	V_+=3.3V, R=50Ω,-3dB Switch ON, See Figure7		17.5		MHz
OFF Isolation	O_{ISO}	V_+=3.3V, R_L=50Ω, f=100kHz See Figure8		-68		dB
Crosstalk	X_{TALK}	V_+=3.3V, R_L=50Ω, f=100kHz See Figure9		-76		dB
Total Harmonic Distortion	THD	V_+=3.3V, R_L=600Ω, f=20Hz~20kHz, C_L=15pF, See Figure11		0.008		%
SUPPLY						
Positive Supply Current	I_+	V_+=3.6V, V_I=V_+ or GND		0.1	1.2	μA
	I_+	V_+=3.6V, V_I=V_+ - 5.5V			3.4	μA

Notes: 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.

■ ELECTRICAL CHARACTERISTICS FOR 5V SUPPLY (Note 1)

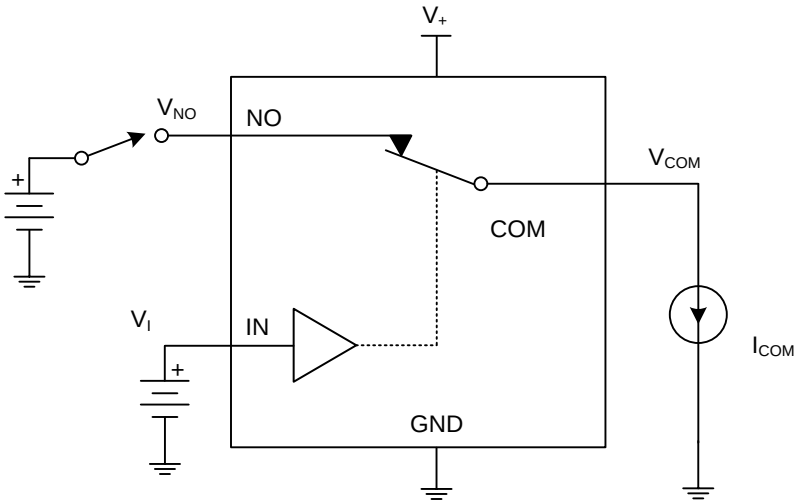
(V_+ =4.5V~5.5V, T_A = 25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
ANALOG SWITCH						
Analog Signal Range	V_{COM}, V_{NO}, V_{NC}		V_+ - 5.5		V_+	V
ON-State Resistance	R_{ON}	V_+=4.5V, V_{NC} or V_{NO}=V_+1.6V, V_+-5.5V, COM to NO or NC, I_{COM}=-100mA, , See Figure1		0.52	0.74	Ω
ON-State Resistance Match Between Channels	△R_{ON}	V_+=4.5V, V_{NC} or V_{NO}=1.6V COM to NO or NC, I_{COM}=-100mA See Figure1		0.04	0.23	Ω
ON-State Resistance Flatness	$R_{ON(flat)}$	V_+=4.5V, V_{NC} or V_{NO}=V_+,1.6V, V_+-5.5V, COM to NO or NC, I_{COM}=-100mA, See Figure1		0.076	0.46	Ω
Shunt Switch Resistance	R_{SH}	V_+=4.5V, I_{NO} or I_{NC}=10mA		16	36	Ω
COM ON Leakage Current	$I_{COM(ON)}$	V_{NC} and V_{NO}=Open, V_{COM}=V_+,V_+-5.5V, See Figure3	-50		50	nA
DIGITAL CONTROL INPUTS (IN) (NOTE 2)						
Input Logic High	V_{IH}		2.4		5.5	V
Input Logic Low	V_{IL}				0.8	V
Input Leakage Current	I_{IH} , I_{IL}	V_+=5.5V, V_{IN}=V_+ or 0	-250		250	nA
DYNAMIC						
Turn-On Time	t_{ON}	V_+=5V, V_{COM}=V_+,C_L=35pF, R_L=300Ω, See Figure5		27	80	ns
Turn-Off Time	t_{OFF}	V_+=5V, V_{COM}=V_+,C_L=35pF, R_L=300Ω, See Figure5		13	70	ns
Break-Before-Make Time	t_{BBM}	V_+=5V, V_{NC}=V_{NO}=V_+/2C_L=35pF, R_L=300Ω, See Figure6	1	3.5		ns
Charge Injection	Q_C	V_+=5V, V_{GEN}=0,C_L=1nF, R_{GEN}=0 See Figure10		500		pC
NC, NO, COM ON Capacitance	$C_{COM(ON)}$	V_+=5V, V_{COM}=V_+ or GND, See Figure4		370		pF
Digital Input Capacitance	C_I	V_+=5V, V_I=V_+ or GND, See Figure4		2.6		pF
Bandwidth	BW	V_+=5V, R=50Ω, See Figure7		18.3		MHz
OFF Isolation	O_{ISO}	V_+=5V, R_L=50Ω, f=100kHz See Figure8		-70		dB
Crosstalk	X_{TALK}	V_+=5V, R_L=50Ω, f=100kHz See Figure9		-78		dB
Total Harmonic Distortion	THD	V_+=5V, R_L=600Ω, f=20Hz~20kHz, C_L=15pF, See Figure11		0.009		%
SUPPLY						
Positive Supply Current	I_+	V_+=5.5V, V_I=V_+ or GND		0.2	1.3	μA
	I_+	V_I=V_+ - 5.5V			5	μA

Notes: 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.

■ PARAMETER MEASUREMENT INFORMATION

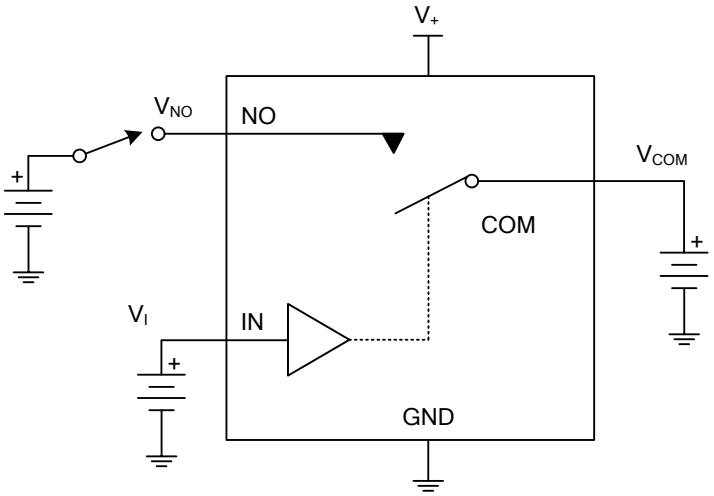


Channel ON

$R_{ON} = \frac{V_{COM} - V_{NO}}{I_{COM}} \Omega$

$V_{IN} = V_{IH}$ or V_{IL}

Figure 1. ON-State Resistance (R_{ON})



OFF-State Leakage Current
Channel OFF
$V_I = V_{IH}$ or V_{IL}

Figure 2. OFF-State Leakage Current ($I_{COM(OFF)}$, $I_{NO(OFF)}$)

■ PARAMETER MEASUREMENT INFORMATION (Cont.)

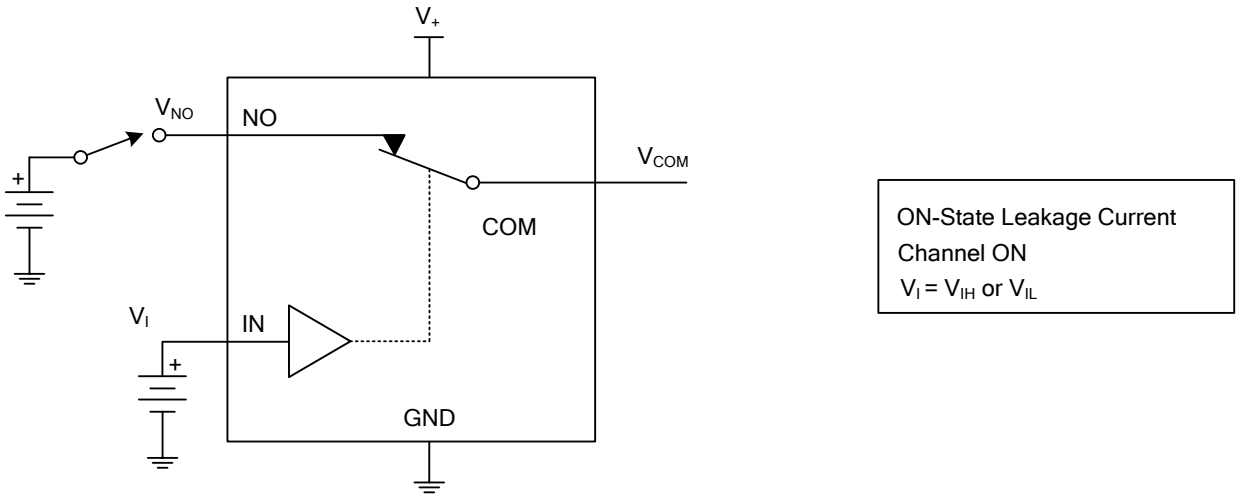


Figure 3. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NO(ON)}$)

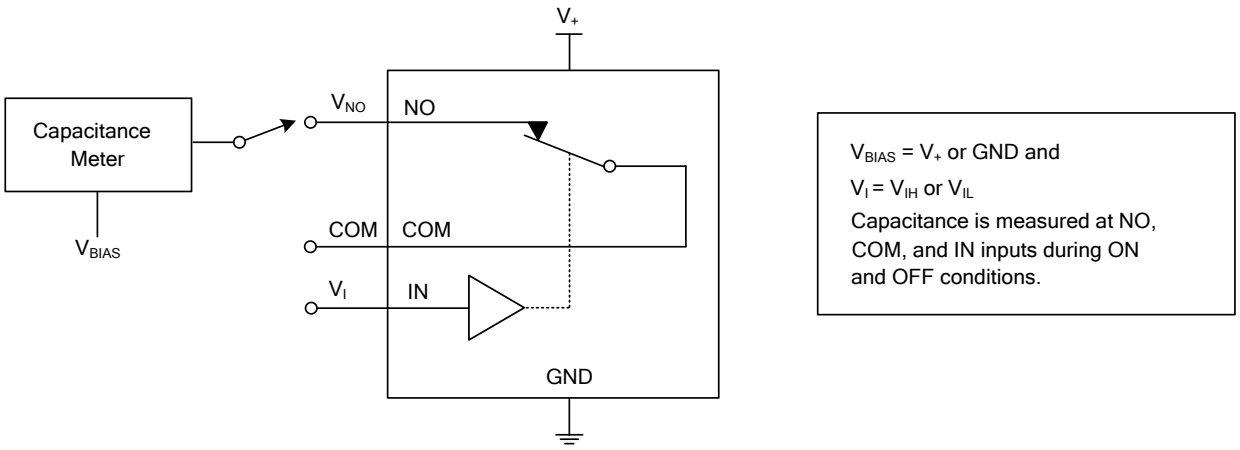
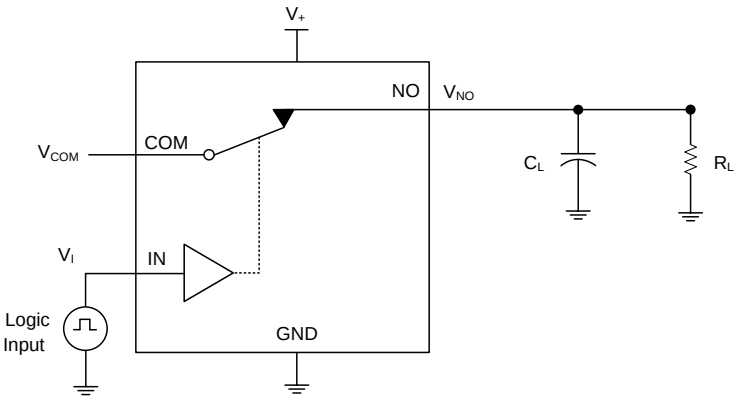
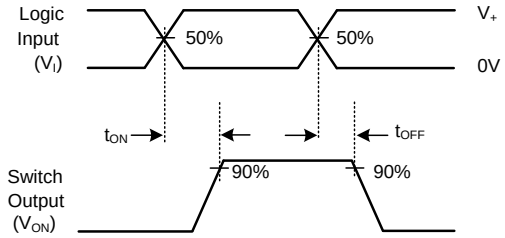


Figure 4. Capacitance (C_I, $C_{COM(OFF)}$, $C_{COM(ON)}$, $C_{NO(OFF)}$, $C_{NO(ON)}$)

■ PARAMETER MEASUREMENT INFORMATION (Cont.)

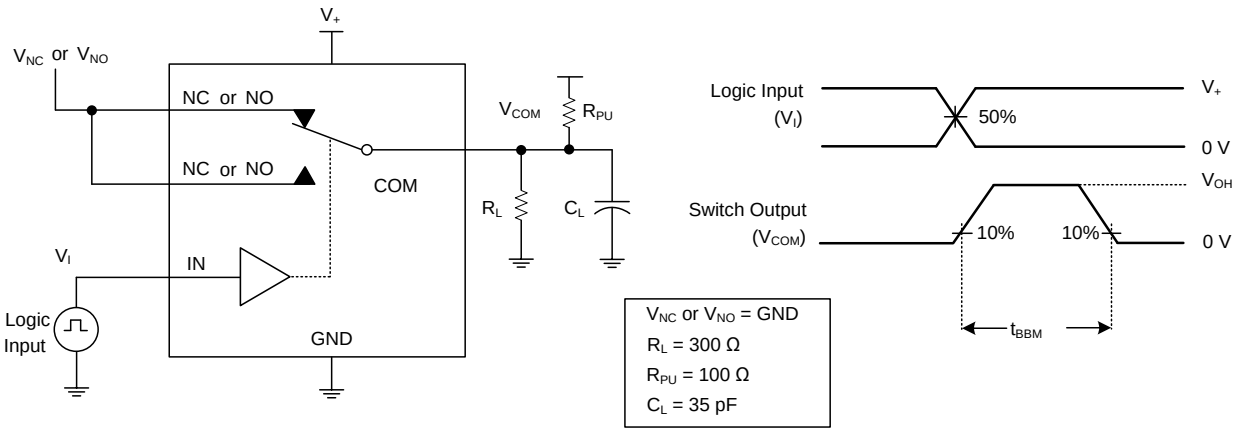


TEST	R_L	C_L	V_{COM}
t_{ON}	300 Ω	35 pF	V_+
t_{OFF}	300 Ω	35 pF	V_+



Notes: 1. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10MHz, Z_O=50Ω, t_r<5ns, t_f<5ns.
2. C_L includes probe and jig capacitance.

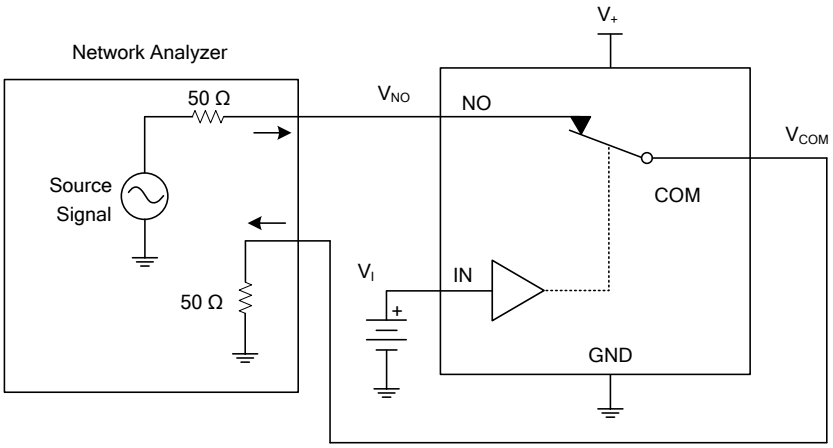
Figure 5. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})



Notes: 1. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10MHz, Z_O=50Ω, t_r<5ns, t_f<5ns.
2. C_L includes probe and jig capacitance.

Figure 6. Break-Before-Make Time (t_{BBM})

■ PARAMETER MEASUREMENT INFORMATION (Cont.)

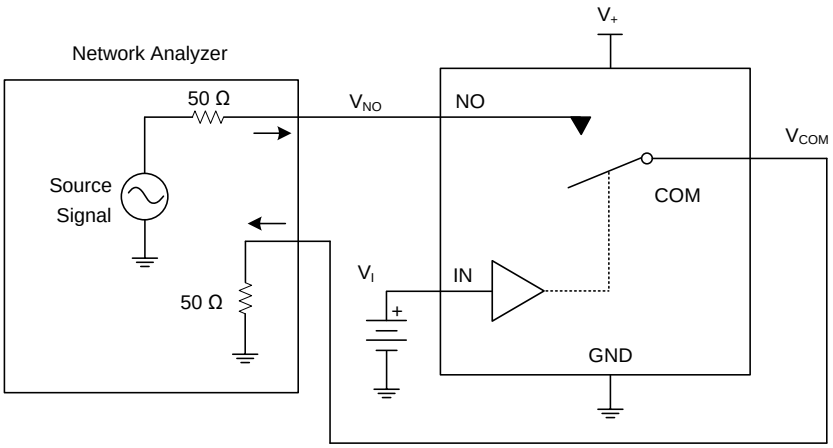


Channel ON: NO to COM
$V_I = V_{IH}$ or V_{IL}

Network Analyzer Setup

Source Power = 0 dBM
(632-mV P-P at 50-Ω load
DC Bias = 350 mV

Figure 7. Bandwidth (BW)

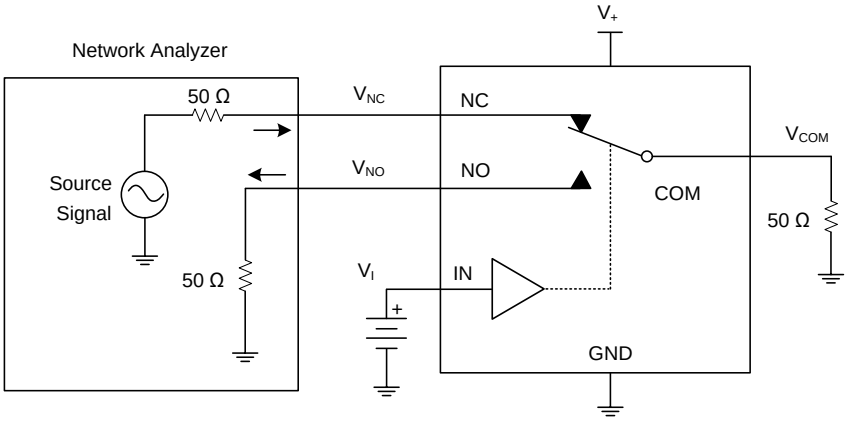


Channel OFF: NO to COM
$V_I = V_{IH}$ or V_{IL}

Network Analyzer Setup

Source Power = 0 dBM
(632-mV P-P at 50-Ω load
DC Bias = 350 mV

Figure 8. OFF Isolation (O_{ISO})



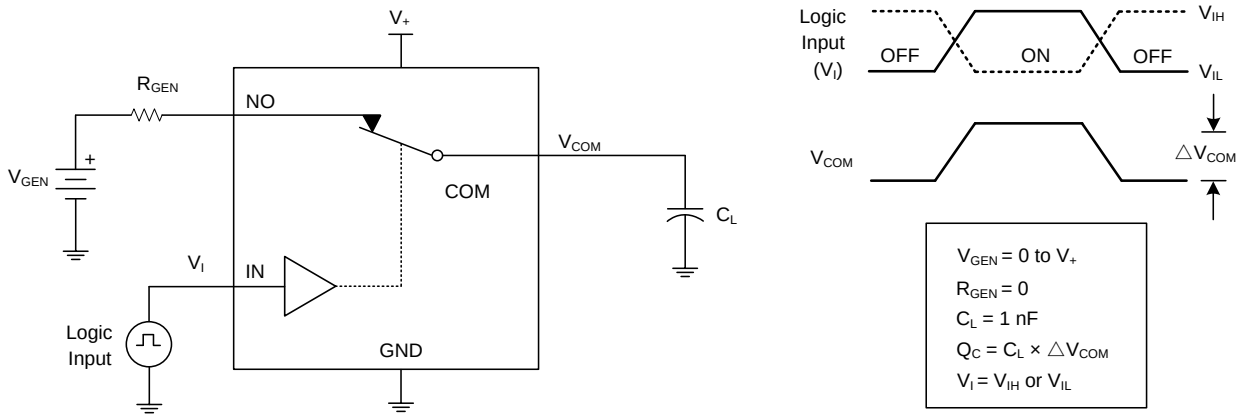
Channel ON: NC to COM
Channel OFF: NO to COM
$V_I = V_{IH}$ or V_{IL}

Network Analyzer Setup

Source Power = 0 dBM
(632-mV P-P at 50-Ω load
DC Bias = 350 mV

Figure 9. Crosstalk (X_{TALK})

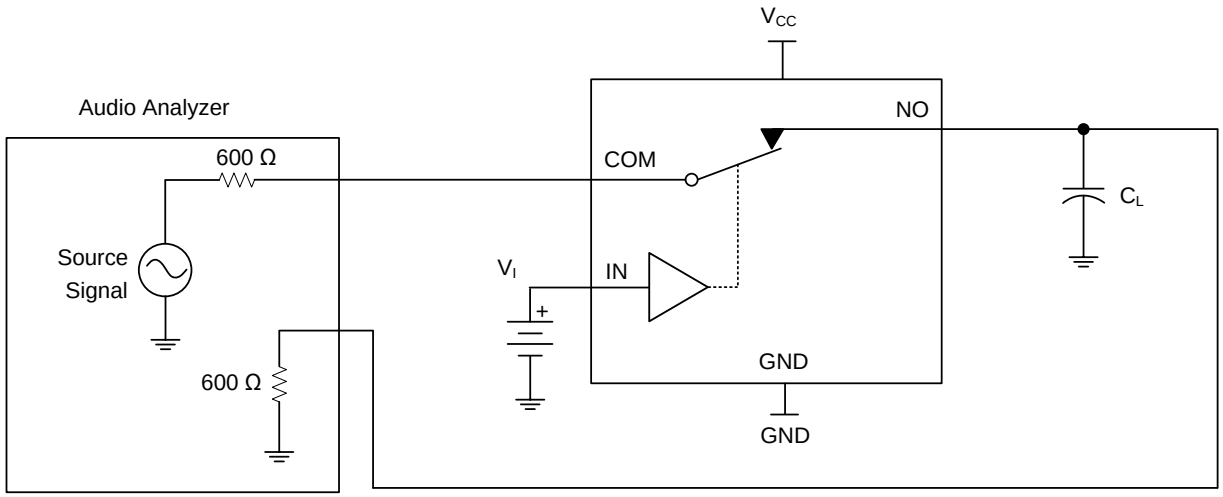
■ PARAMETER MEASUREMENT INFORMATION (Cont.)



Notes: 1. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10MHz, Z_O=50Ω, t_r<5ns, t_f<5ns.
2. C_L includes probe and jig capacitance.

Figure 10. Charge Injection (Q_C)

Channel ON: COM to NO	V_I = V_{IH} or V_{IL}	R_L = 600 Ω
V_{SOURCE} = 0.5V + P-P	f_{SOURCE} = 20Hz to 20kHz	C_L = 50 pF



Note: C_L includes probe and jig capacitance.

Figure 11. Total Harmonic Distortion (THD)