Low Voltage, 0.6 Ω, Dual SPDT Analog Switch

DESCRIPTION

The DG2735/2736 are low voltage, low on-resistance, dual single-pole/double-throw (SPDT) monolithic CMOS analog switches designed for high performance switching of analog signals. Combining low-power, high speed, low on-resistance, and small package size, the DG2735/2736 are ideal for portable and battery power applications.

The DG2735/2736 have an operation range from 1.65 V to 4.3 V single supply. The DG2735 has two separate control pins with for the separated two SPDT switched. The DG2736 has an EN pin. All switches are at high impedance mode when the EN is high.

The DG2735/2736 are guaranteed 1.65 V logic compatible, allowing the easy interface with low voltage DSP or MCU control logic and ideal for one cell Li-ion battery direct power.

The switch conducts signals within power rails equally well in both directions when on, and blocks up to the power supply level when off. Break-before-make is guaranteed.

The DG2735/2736 are built on Vishay Siliconix's sub micron CMOS low voltage process technology and provides greater than 300 mA latch-up protection, as tested per JESD78.

As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with lead (Pb)-free device terminations. DG2735/2736 are offered in a miniQFN package. The miniQFN package has a nickel-palladium-gold device termination and is represented by the lead (Pb)-free "-E4" suffix. The nickel-palladium-gold device terminations meet all JEDEC standards for reflow and MSL ratings.

FEATURES

- Low Voltage Operation (1.65 V to 4.3 V)
- Low On-Resistance - r_{ON}: 0.6 Ω at 2.7 V
- Fast Switching: T_{ON} = 55 ns at 2.7 V
- T_{OFF} = 40 ns at 2.7 V
- Latch-Up Current > 300 mA (JESD78)

Pb-free

RoHS
COMPLIANT

BENEFITS

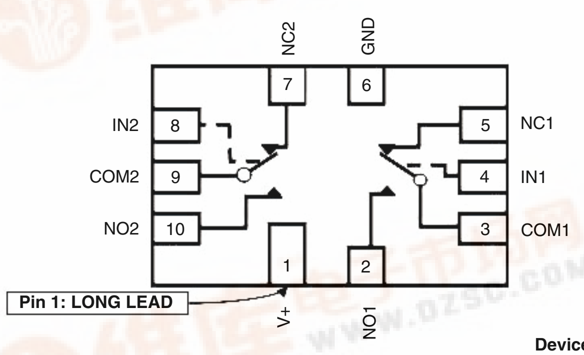
- Reduced Power Consumption
- High Accuracy
- Reduce Board Space
- TTL/1.65 V Logic Compatible

APPLICATIONS

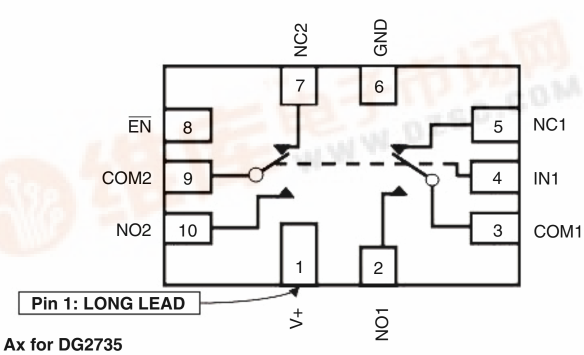
- Cellular Phones
- Speaker Headset Switching
- Audio and Video Signal Routing
- PCMCIA Cards
- Battery Operated Systems
- Portable media player
  Handheld test instruments

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION

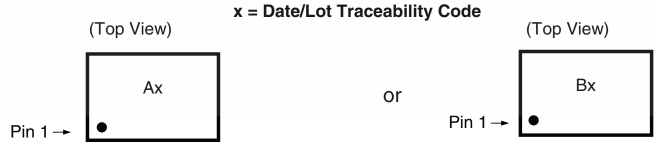
DG2735
miniQFN-10L



DG2736
miniQFN-10L



Device Marking: Ax for DG2735
Bx for DG2736
x = Date/Lot Traceability Code



Note: Pin 1 has long lead

TRUTH TABLE

Logic	EN (DG2736 only)	NC1, 2	NO1, 2
0	1	OFF	OFF
1	1	OFF	OFF
0	0	ON	OFF
1	0	OFF	ON

ORDERING INFORMATION

Temp Range	Package	Part Number
- 40 to 85°C	miniQFN10	DG2735DN-T1-E4 DG2736DN-T1-E4

ABSOLUTE MAXIMUM RATINGS T_A = 25 °C, unless otherwise noted

Parameter		Symbol	Limit	Unit
Reference to GND	V+		- 0.3 to 5.0	V
	IN, COM, NC, NO[a]		- 0.3 to (V+ + 0.3)	
Current (Any terminal except NO, NC or COM)			30	mA
Continuous Current (NO, NC, or COM)			± 250	
Peak Current (Pulsed at 1 ms, 10 % duty cycle)			± 500	
Storage Temperature (D Suffix)			- 65 to 150	°C
Power Dissipation (Packages)[b]	miniQFN10[c]		208	mW

Notes:
a. Signals on NC, NO, or COM or IN exceeding V+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
b. All leads welded or soldered to PC Board.
c. Derate 4.0 mW/C above 70 °C.

SPECIFICATIONS (V+ = 3 V)

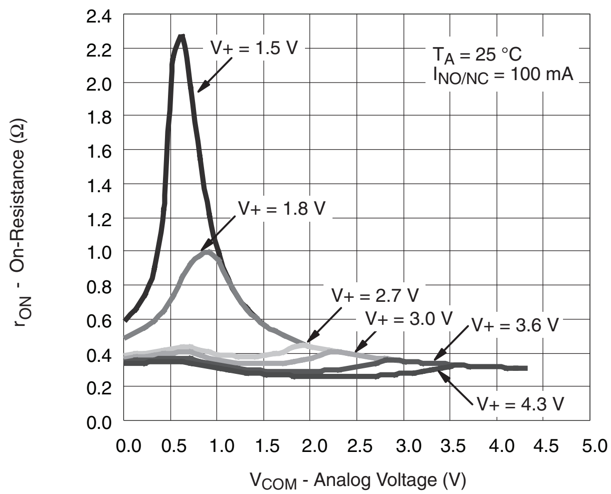
Parameter	Symbol	Test Conditions Unless Otherwise Specified V+ = 3 V, ± 10 %, V_{IN} = 0.4 V or 1.65 V[e]	Temp[a]	Limits - 40 to 85 °C Min[b]	Typ[c]	Max[b]	Unit
Analog Switch							
Analog Signal Range[d]	V_{analog}	$r_{DS(on)}$	Full	0		V+	V
On-Resistance	$r_{DS(on)}$	V+ = 2.7 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 0.5 V	Room		0.5	0.6	Ω
		V+ = 2.7 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 1.5 V					
		V+ = 2.7 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 0.5 V	Full		0.5		
		V+ = 2.7 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 1.5 V					
		V+ = 4.3 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 0.9 V	Room		0.4	0.5	
		V+ = 4.3 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 2.5 V			0.3		
		V+ = 4.3 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 0.9 V	Full		0.5		
		V+ = 4.3 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 2.5 V					
r_{ON} Match[d]	Δr_{ON}	V+ = 2.7 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 0.5 V, 1.5 V	Room		0.06	0.08	
		V+ = 4.3 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 0.9 V, 2.5 V					
r_{ON} resistance flatness[d]	r_{ON} flatness	V+ = 2.7 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 0.5 V, 1.5 V	Room			0.15	
Switch Off Leakage Current	$I_{NO/NC(off)}$	V+ = 4.3 V, $V_{NO/NC}$ = 0.3 V/4.0 V, V_{COM} = 4.0 V/0.3 V	Room	- 2		2	nA
			Full	- 10		10	
	$I_{COM(off)}$		Room	- 2		2	
			Full	- 10		10	
Channel-On Leakage Current	$I_{COM(on)}$	V+ = 4.3 V, $V_{NO/NC}$ = V_{COM} = 4.0 V/0.3 V	Room	- 5		5	
			Full	- 20		20	
Digital Control							
Input High Voltage	V_{INH}		Full	1.65			V
Input Low Voltage	V_{INL}		Full			0.4	
Input Capacitance	C_{IN}		Full		6		pF
Input Current	I_{INL} or I_{INH}	V_{IN} = 0 or V+	Full	- 1		1	µA
Dynamic Characteristics							
Break-Before-Make Time[e]	t_{BBM}	V+ = 3.6 V, V_{NO}, V_{NC} = 1.5 V, R_L = 50 Ω, C_L = 35 pF	Room	1	5		ns
Turn-On Time[e]	t_{ON}		Room		50	78	
			Full			80	
Turn-Off Time[e]	t_{OFF}		Room		35	58	
			Full			60	
Enable Turn-On Time[e] DG2736 (EN)	$t_{ON(EN)}$		Room		50	78	
			Full			80	
Enable Turn-Off Time[e] DG2736 (EN)	$t_{OFF(EN)}$		Room		35	58	
			Full			60	
Off-Isolation[d]	O_{IRR}	R_L = 50 Ω, C_L = 5 pF, f = 100 kHz	Room		- 70		dB
Crosstalk[d]	X_{TALK}				- 70		
3dB bandwith[d]		R_L = 50 Ω, C_L = 5 pF	Room		50		MHz
NO, NC Off Capacitance[d]	$C_{NO(off)}$	V_{IN} = 0 V, or V+, f = 1 MHz	Room		55		pF
	$C_{NC(off)}$				55		
Channel On Capacitance[d]	$C_{NO(on)}$				130		
	$C_{NC(on)}$				130		

SPECIFICATIONS (V+ = 3 V)							
Parameter	Symbol	Test Conditions Unless Otherwise Specified V+ = 3 V, ± 10 %, V_{IN} = 0.4 V or 1.65 V[e]	Temp[a]	Limits - 40 to 85 °C Min[b]	Typ[c]	Max[b]	Unit
Power Supply							
Power Supply Range	V+			1.65		4.3	V
Power Supply Current	I+	V_{IN} = 0 or V+	Full			1.0	µA

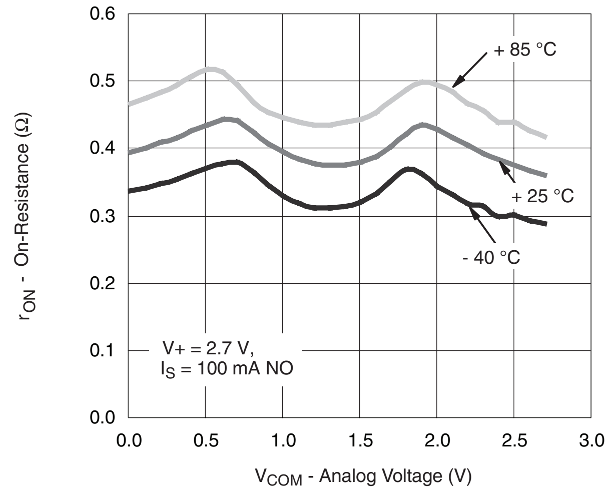
Notes:
a. Room = 25 °C, Full = as determined by the operating suffix.
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
c. Typical values are for design aid only, not guaranteed nor subject to production testing.
d. Guarantee by design, not subjected to production test.
e. V_{IN} = input voltage to perform proper function.

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 in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

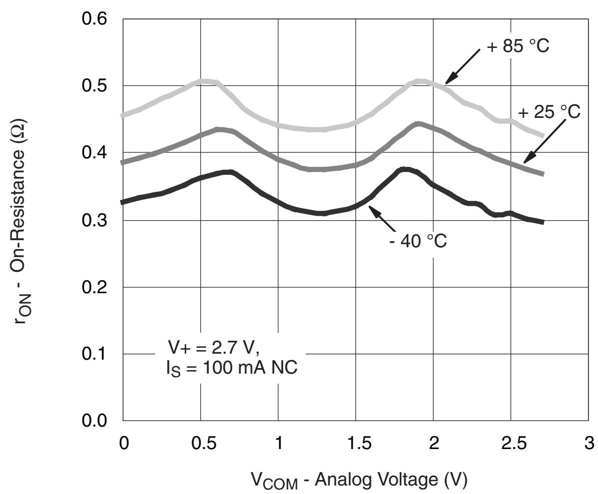
TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



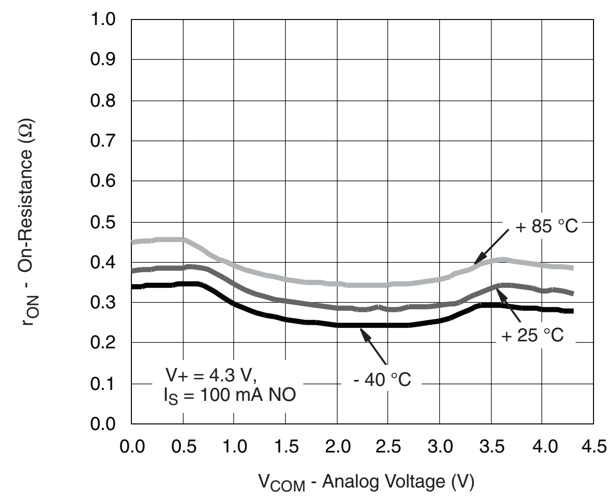
r_{ON} vs. V_{COM} and Supply Voltage



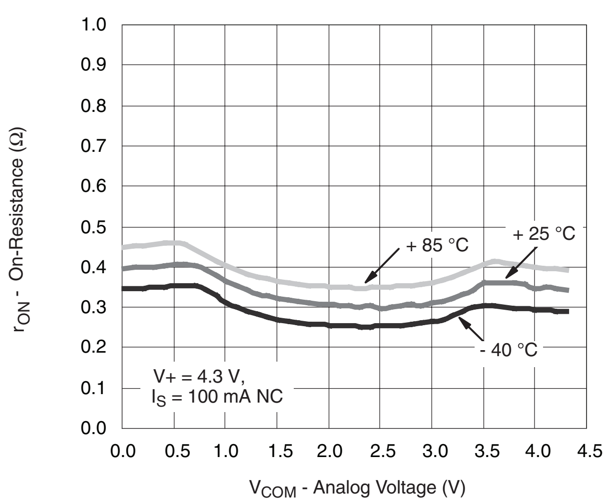
r_{ON} vs. Analog Voltage and Temperature



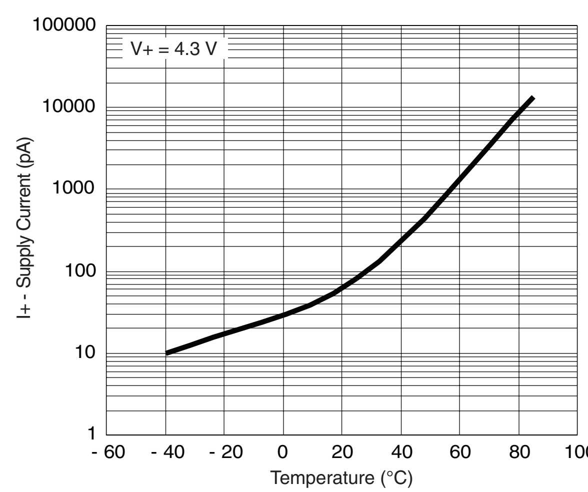
r_{ON} vs. Analog Voltage and Temperature



r_{ON} vs. Analog Voltage and Temperature

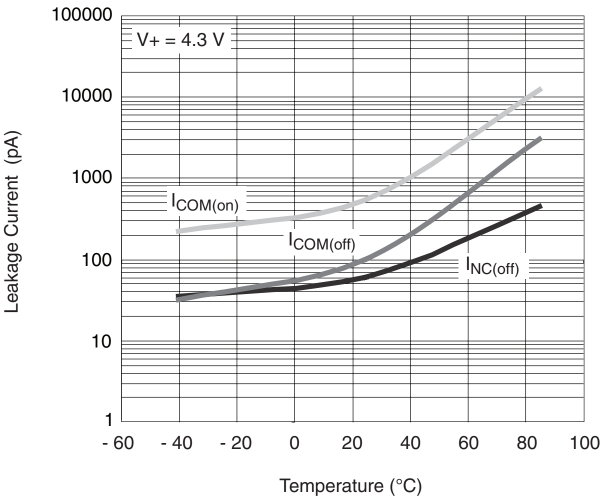


r_{ON} vs. Analog Voltage and Temperature

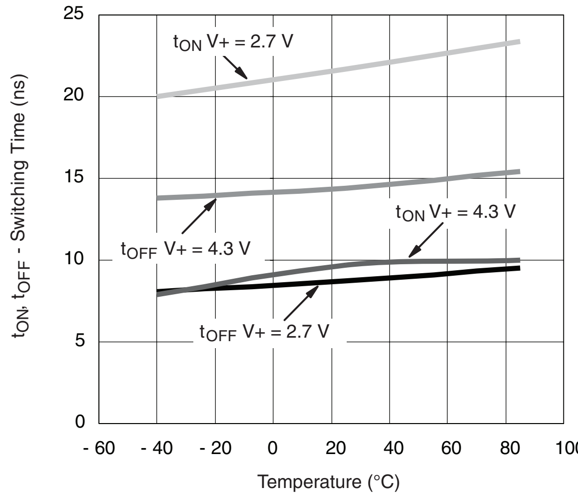


Supply Current vs. Temperature

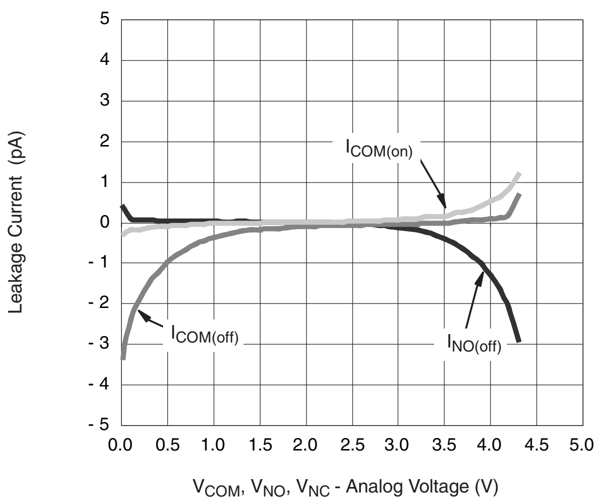
TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



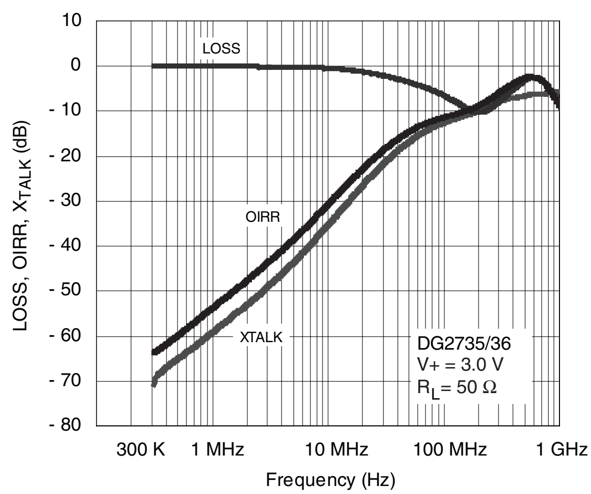
Leakage Current vs. Temperature



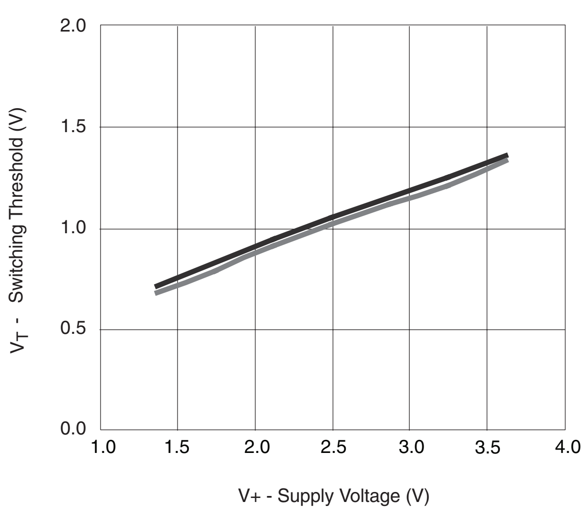
Switching Time vs. Temperature



Leakage vs. Analog Voltage

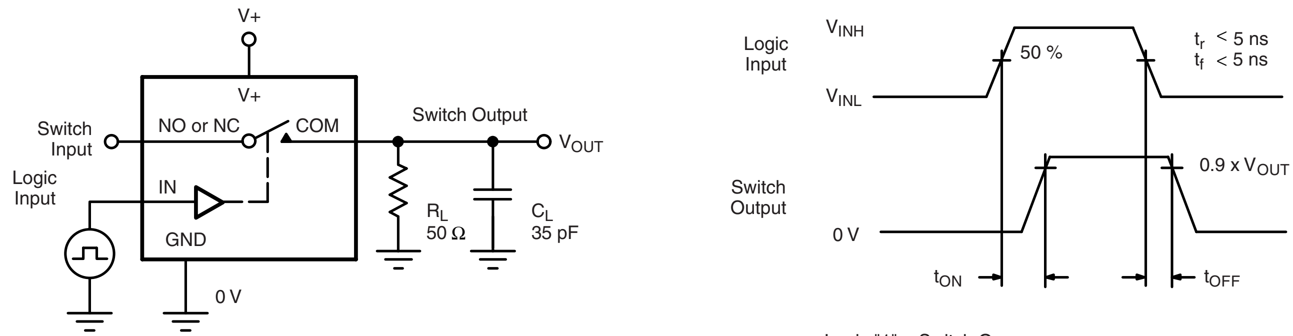


Insertion Loss, Off-Isolation Crosstalk vs. Frequency



Switching Threshold vs. Supply Voltage

TEST CIRCUITS

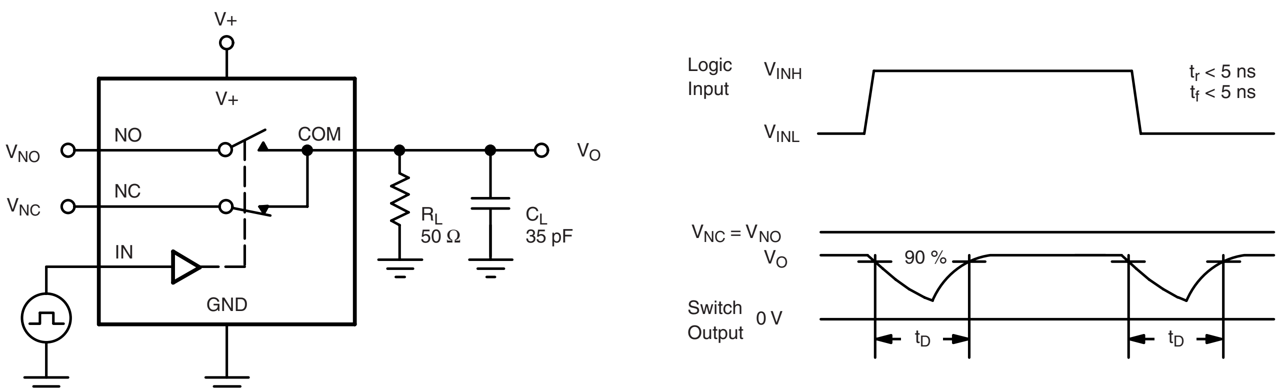


C_L (includes fixture and stray capacitance)

$$V_{OUT} = V_{COM}\left(\frac{R_L}{R_L + R_{ON}}\right)$$

Logic "1" = Switch On
Logic input waveforms inverted for switches that have the opposite logic sense.

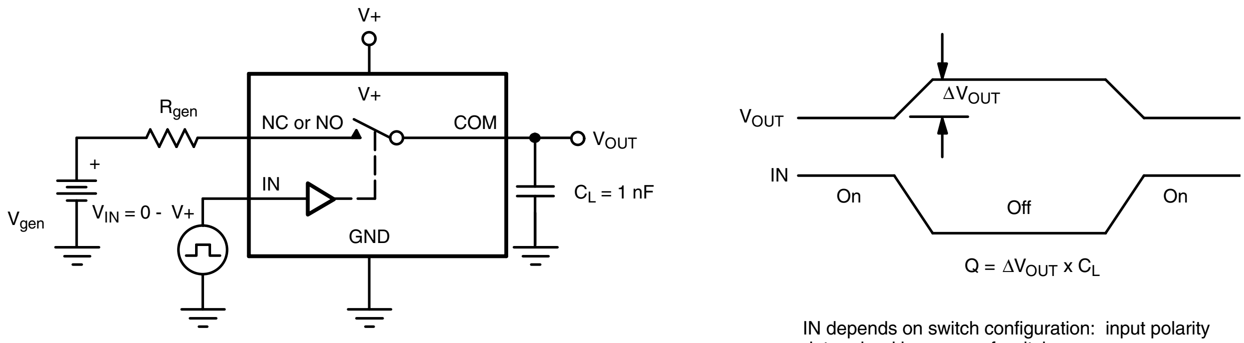
Figure 1. Switching Time



C_L (includes fixture and stray capacitance)

Figure 2. Break-Before-Make Interval

TEST CIRCUITS



IN depends on switch configuration: input polarity determined by sense of switch.

Figure 3. Charge Injection

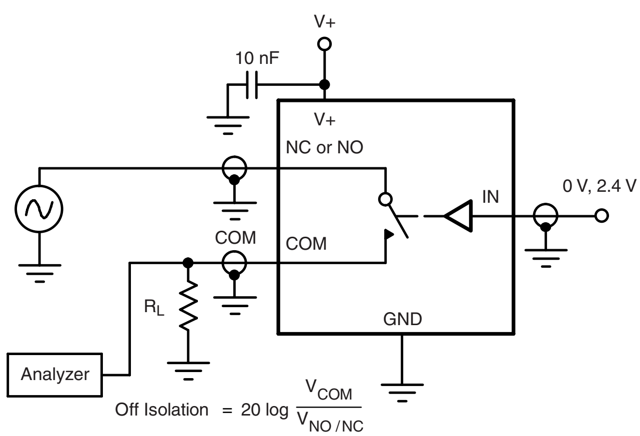


Figure 4. Off-Isolation

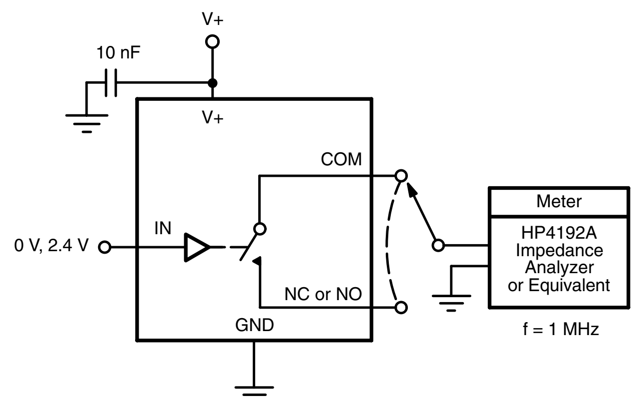


Figure 5. Channel Off/On Capacitance

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