

## Single 4:1 Low $r_{ON}$ Multiplexers

### FEATURES

- Low Voltage Operation (1.8 to 5.5 V)
- Low On-Resistance -  $r_{DS(on)}$ : 4  $\Omega$
- Off-Isolation and Crosstalk: -55 dB @ 10 MHz
- Fast Switch - 25 ns  $t_{ON}$
- Low Charge Injection -  $Q_{INJ}$ : 4.7 pC
- Low Power Consumption - 4  $\mu$ W

### BENEFITS

- High Accuracy
- High Bandwidth
- TTL and Low Voltage Logic Compatibility
- Low Power Consumption
- Reduced PCB Space

### APPLICATIONS

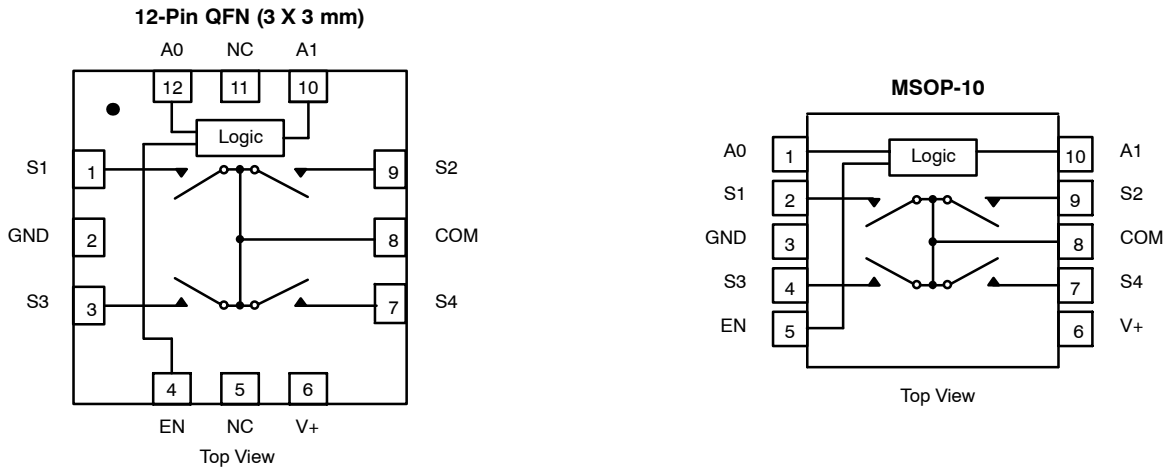
- Mixed Signal Routing
- Portable and Battery Operated Systems
- Low Voltage Data Acquisition
- Modems
- PCMCIA Cards

### DESCRIPTION

The DG2034 is a low voltage, low  $r_{ON}$ , high bandwidth single 4 to 1 analog multiplexer designed for high performance switching of analog and video signals. Combining low power; fast switching; low on-resistance, flatness and matching; and small physical size, the DG2034 is ideal for portable and battery applications.

Built on Vishay Siliconix's low voltage CMOS process, the DG2034 has an epitaxial layer which prevents latchup. Break-before-make is guaranteed.

### FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



TRUTH TABLE			
A1	A0	EN	ON Switch
X	X	0	None
0	0	1	S1
0	1	1	S2
1	0	1	S3
1	1	1	S4

ORDERING INFORMATION		
Temp Range	Package	Part Number
-40 to 85°C	MSOP-10	DG2034DQ
	12-Pin QFN (3 x 3 mm)	DG2034DN



**ABSOLUTE MAXIMUM RATINGS**

Reference to GND

V+	-0.3 to +6 V
A <sub>X</sub> , E <sub>N</sub> , S <sub>X</sub> , COM <sup>a</sup>	-0.3 to (V+ + 0.3 V)
Continuous Current (Any terminal)	±50 mA
Peak Current (Pulsed at 1ms, 10% duty cycle)	±100 mA
Power Dissipation (Package) <sup>b</sup>	
QFN-12 (3 x 3 mm) <sup>c</sup>	850 mW
MSOP-10	320 mW

Storage Temperature (D Suffix) . . . . . -65 to 150°C

Notes:

- a. Signals on S<sub>X</sub>, D<sub>X</sub>, EN or A<sub>X</sub> exceeding V+ or 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 Otherwise Unless Specified V+ = 3 V, ±10%, V <sub>AL</sub> = 0.4, V <sub>AH</sub> = 2.0 V <sup>e</sup>	Temp <sup>a</sup>	Limits -40 to 85°C			Unit
				Min <sup>c</sup>	Typ <sup>b</sup>	Max <sup>c</sup>	
<b>Analog Switch</b>							
Analog Signal Range <sup>d</sup>	V <sub>ANALOG</sub>		Full	0		V+	V
On-Resistance	r <sub>ON</sub>	V+ = 2.7 V, V <sub>COM</sub> = 0.5 V/1.5 V/2.0 V I <sub>S</sub> = 10 mA	Room		4	7	Ω
r <sub>ON</sub> Match	Δr <sub>ON</sub>		Full			9	
r <sub>ON</sub> Flatness <sup>d, f</sup>	r <sub>ON</sub> Flatness		Room		0.1	0.3	
Off Leakage Current <sup>g</sup>	I <sub>S(off)</sub>	V+ = 3.3 V, V <sub>S</sub> = 1 V / 3 V V <sub>COM</sub> = 3 V / 1 V, V <sub>EN</sub> = 0 V	Room	-1	0.3	1	nA
COM Off Leakage Current <sup>g</sup>	I <sub>COM(off)</sub>		Full	-10		10	
Channel-On Leakage Current <sup>g</sup>	I <sub>COM(on)</sub>		Room	-1	0.3	1	
		V+ = 3.3 V V <sub>COM</sub> = V <sub>S</sub> = 1 V / 3 V	Full	-10		10	
<b>Digital Control</b>							
Input Current <sup>d</sup>	I <sub>A</sub> or I <sub>EN</sub>	V <sub>A/EN</sub> = 0 or V+, See Truth Table	Full	-1.0		1.0	μA
Input High Voltage <sup>d</sup>	V <sub>AH</sub> or V <sub>ENH</sub>		Full	2.0			V
Input Low Voltage <sup>d</sup>	V <sub>AL</sub> or V <sub>ENL</sub>		Full			0.4	
<b>Dynamic Characteristics</b>							
Turn-On Time	t <sub>ON</sub>	V <sub>S</sub> = 1.5 V, R <sub>L</sub> = 300 Ω	Room		25	35	ns
Turn-Off Time	t <sub>OFF</sub>		Full			45	
Break-Before-Make Time <sup>d</sup>	t <sub>D</sub>		Room		10.5		
Transition Time	t <sub>trans</sub>	V <sub>S</sub> = 1.5 V/0 V, V <sub>S</sub> = 0 V/1.5 V, R <sub>L</sub> = 300 Ω	Room		30	45	pC
Charge Injection <sup>d</sup>	Q <sub>INJ</sub>	C <sub>L</sub> = 1 nF, V <sub>gen</sub> = 0 V, R <sub>gen</sub> = 0 Ω	Full			55	
Off-Isolation <sup>d</sup>	OIRR	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	f = 1 MHz	Room		-73	dB
			f = 10 MHz	Room		-54	
Channel-to-Channel Crosstalk <sup>d</sup>	X <sub>TALK</sub>	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	f = 1 MHz	Room		-77	
			f = 10 MHz	Room		-59	
Off Capacitance <sup>d</sup>	C <sub>S(off)</sub>	V+ = 2.7 V, f = 1 MHz	Room		14		pF
COM Off Capacitance <sup>d</sup>	C <sub>COM(off)</sub>		Room		46		
COM On Capacitance <sup>d</sup>	C <sub>COM(on)</sub>		Room		67		
<b>Power Supply</b>							
Power Supply Range	V+			2.7		3.3	V
Power Supply Current <sup>d</sup>	I+	V+ = 3.3 V, V <sub>A/EN</sub> = 0 or 3.3 V, See Truth Table	Full			1.0	μA

Notes:

- a. Room = 25°C, Full = as determined by the operating suffix.
- b. Typical values are for design aid only, not guaranteed nor subject to production testing.
- c. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- d. Guarantee by design, not subjected to production test.
- e. V<sub>A</sub>, E<sub>N</sub> = input voltage to perform proper function.
- f. Difference of min and max values.
- g. Guaranteed by 5 V testing.



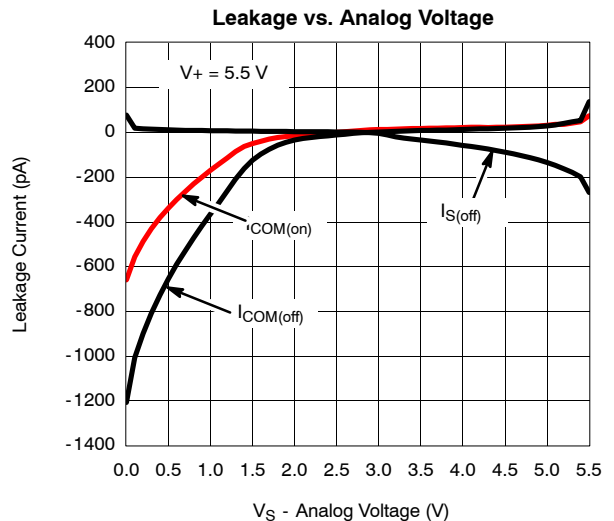
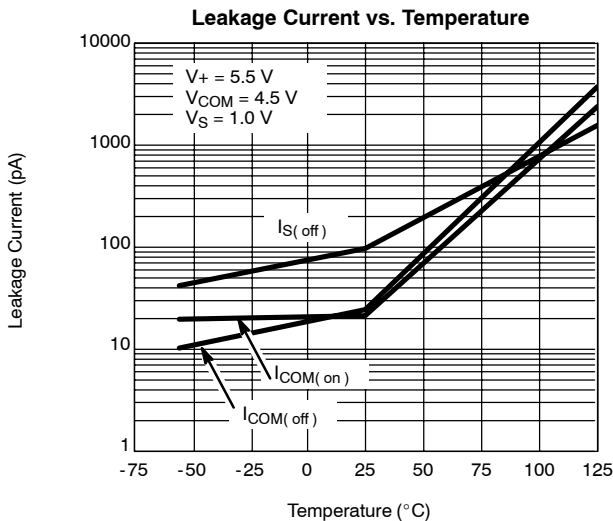
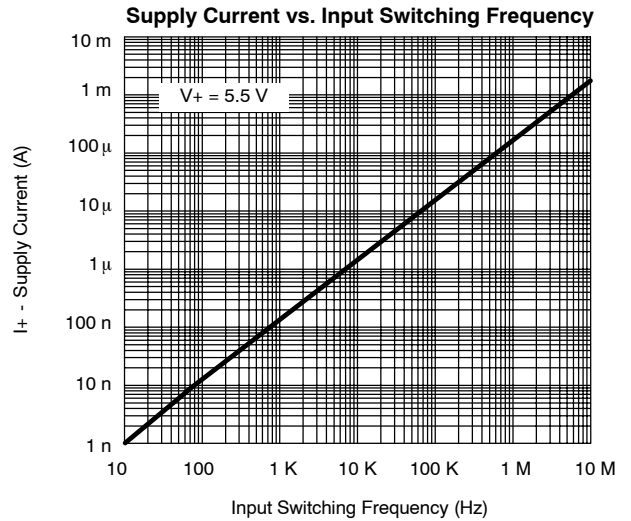
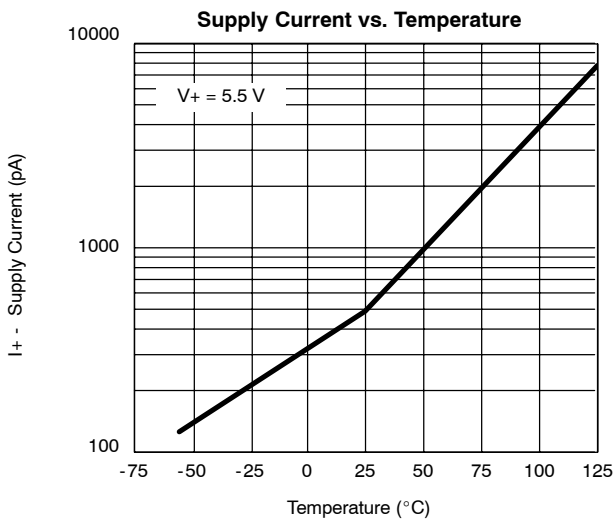
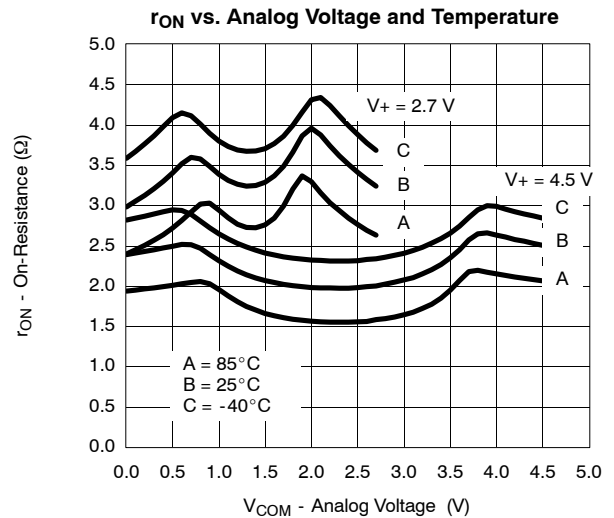
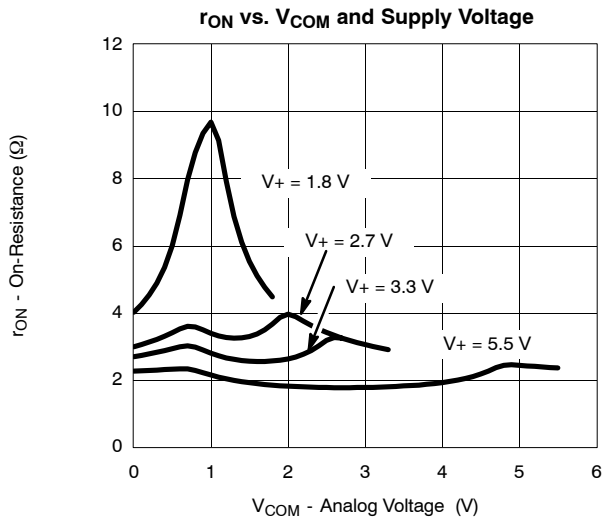
SPECIFICATIONS (V+ = 5 V)							
Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 5 V, ±10%, VAL = 0.8 or VAH = 2.4 V <sup>e</sup>	Temp <sup>a</sup>	Limits -40 to 85°C			Unit
				Min <sup>c</sup>	Typ <sup>b</sup>	Max <sup>c</sup>	
<b>Analog Switch</b>							
Analog Signal Range <sup>d</sup>	V <sub>ANALOG</sub>		Full	0		V+	V
On-Resistance	r <sub>ON</sub>	V+ = 4.5 V, V <sub>COM</sub> = 1.5 V/2.5 V/3.5 V I <sub>S</sub> = 10 mA	Room		3	5.5	Ω
r <sub>ON</sub> Match	Δr <sub>ON</sub>		Full			7	
r <sub>ON</sub> Flatness <sup>d, f</sup>	r <sub>ON</sub> Flatness		Room		0.16	0.5	
Off Leakage Current	I <sub>S(off)</sub>	V+ = 5.5 V, V <sub>S</sub> = 1 V / 4.5 V V <sub>COM</sub> = 4.5 V / 1 V, V <sub>EN</sub> = 0 V	Room	-1	0.5	1	nA
COM Off Leakage Current	I <sub>COM(off)</sub>		Full	-10		10	
Channel-On Leakage Current	I <sub>COM(on)</sub>	V+ = 5.5 V, V <sub>COM</sub> = V <sub>S</sub> = 1 V / 4.5 V	Room	-1	0.5	1	
			Full	-10		10	
<b>Digital Control</b>							
Input Current <sup>d</sup>	I <sub>AH</sub> or I <sub>ENH</sub>	V <sub>A</sub> or V <sub>EN</sub> = 0 or V+, See Truth Table	Full	-1.0		1.0	μA
Input High Voltage <sup>d</sup>	V <sub>AH</sub> or V <sub>ENH</sub>		Full	2.4			V
Input Low Voltage <sup>d</sup>	V <sub>AL</sub> or V <sub>ENL</sub>		Full			0.8	
<b>Dynamic Characteristics</b>							
Turn-On Time	t <sub>ON</sub>	V <sub>S</sub> = 3.0 V, R <sub>L</sub> = 300 Ω	Room		18	30	ns
Turn-Off Time	t <sub>OFF</sub>		Full			40	
Break-Before-Make Time <sup>d</sup>	t <sub>D</sub>		Room		10.5		
Transition Time	t <sub>trans</sub>	V <sub>S</sub> = 3 V/0 V, V <sub>S</sub> = 0 V/3 V, R <sub>L</sub> = 300 Ω	Room		25	40	ns
			Full			50	
Off-Isolation <sup>d</sup>	OIRR	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	f = 1 MHz	Room		-73	dB
			f = 10 MHz	Room		-53.5	
Channel-to-Channel Crosstalk <sup>d</sup>	X <sub>TALK</sub>	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	f = 1 MHz	Room		-77	
			f = 10 MHz	Room		-60.2	
Charge Injection <sup>d</sup>	Q <sub>INJ</sub>	C <sub>L</sub> = 1 nF, V <sub>gen</sub> = 0 V, R <sub>gen</sub> = 0 Ω	Room		-4.4		pC
Off Capacitance <sup>d</sup>	C <sub>S(off)</sub>	V+ = 5.0 V, f = 1 MHz	Room		13		pF
COM Off Capacitance <sup>d</sup>	C <sub>COM(off)</sub>		Room		43		
COM On Capacitance <sup>d</sup>	C <sub>COM(on)</sub>		Room		64		
<b>Power Supply</b>							
Power Supply Range	V+			4.5		5.5	V
Power Supply Current	I+	V+ = 5.5 V, V <sub>A/EN</sub> = 0 or 5.5 V, See Truth Table	Full			1.0	μA

Notes:

- Room = 25°C, Full = as determined by the operating suffix.
- Typical values are for design aid only, not guaranteed nor subject to production testing.
- The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- Guarantee by design, not subjected to production test.
- V<sub>A</sub>, E<sub>N</sub> = input voltage to perform proper function.
- Difference of min and max values.

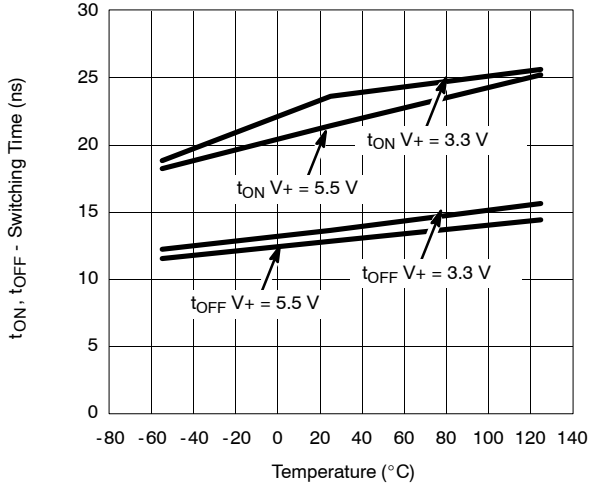


**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)**

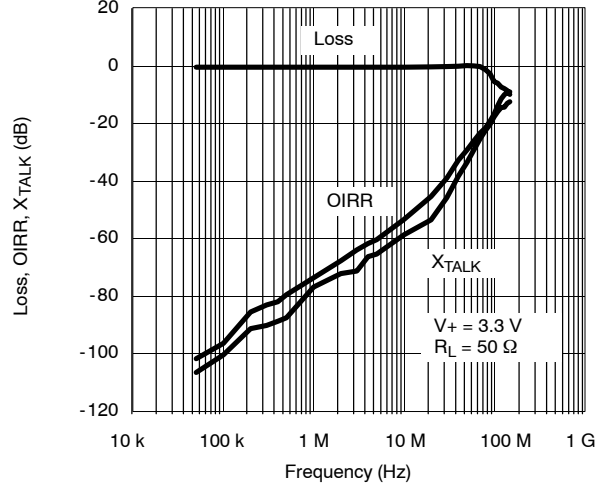


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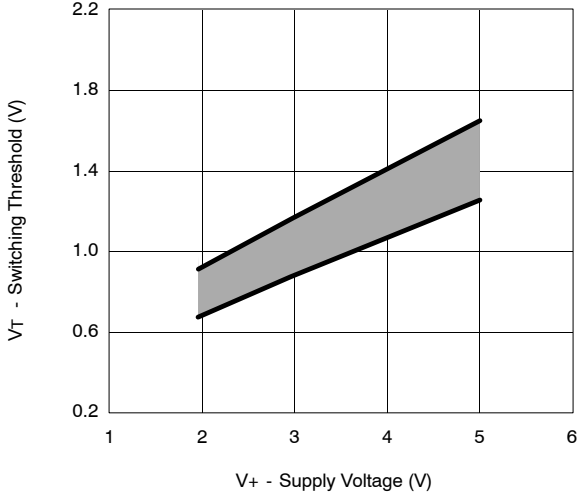
Switching Time vs. Temperature



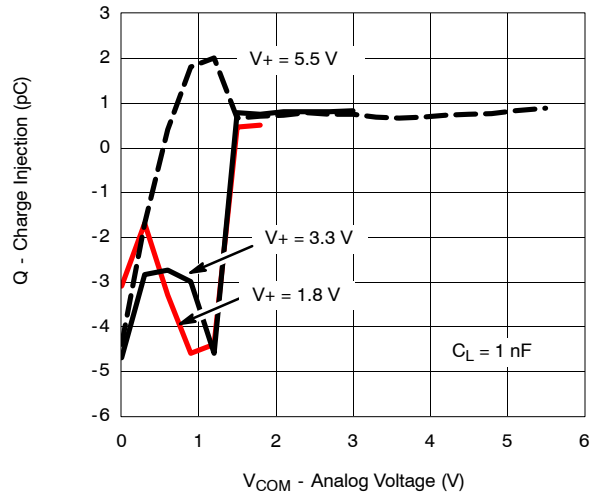
Insertion Loss, Off -Isolation Crosstalk vs. Frequency



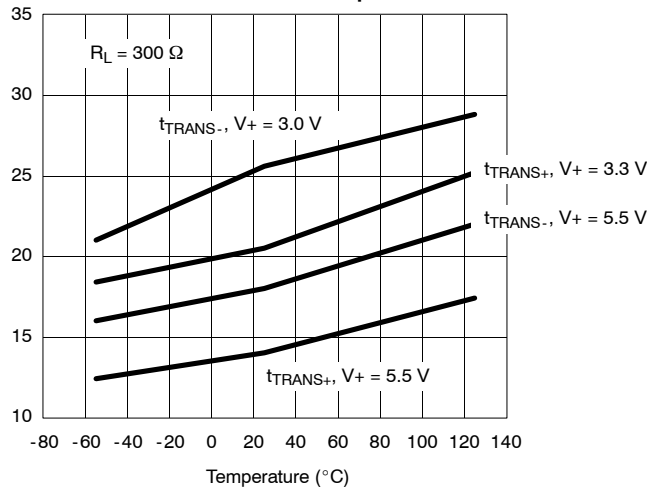
Switching Threshold vs. Supply Voltage



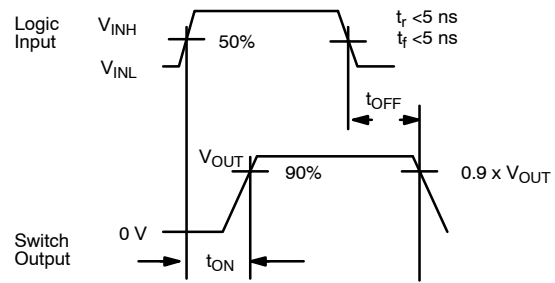
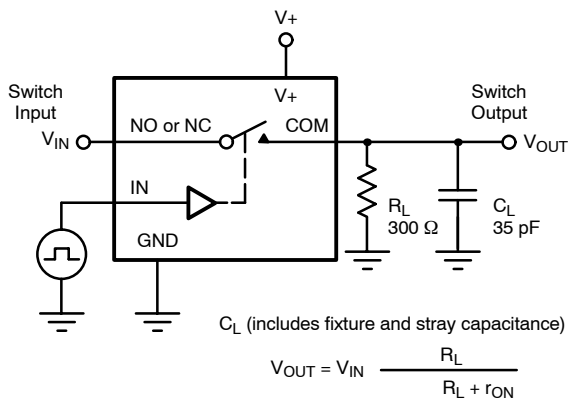
Charge Injection vs. Analog Voltage



Transistion Time vs. Temperature



**TEST CIRCUITS**



Note: Logic input waveform is inverted for switches that have the opposite logic sense control

Figure 2. Switching Time

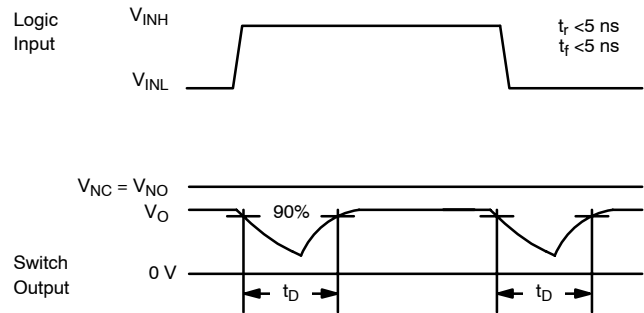
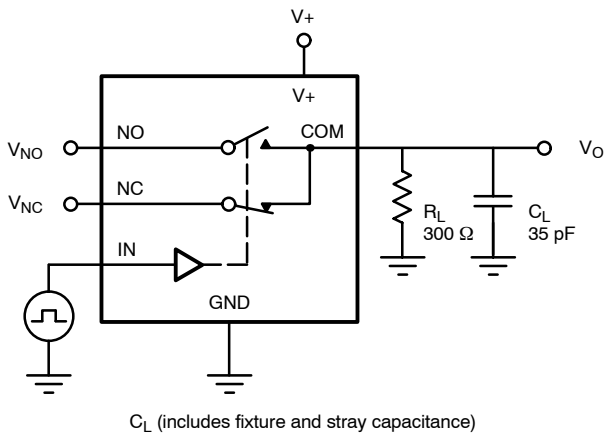


Figure 3. Break-Before-Make

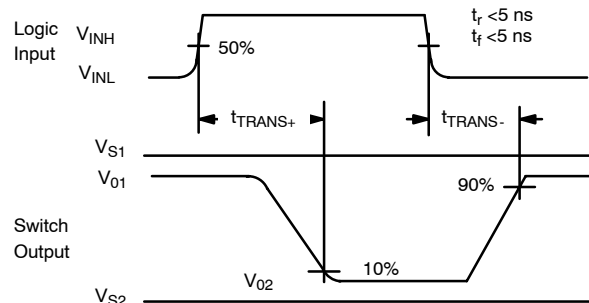
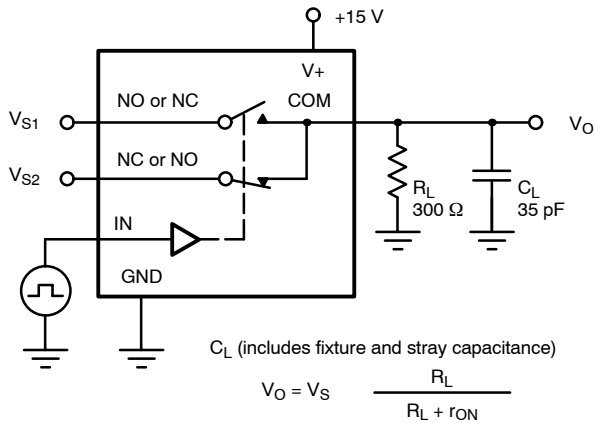


Figure 4. Transition Time

**TEST CIRCUITS**

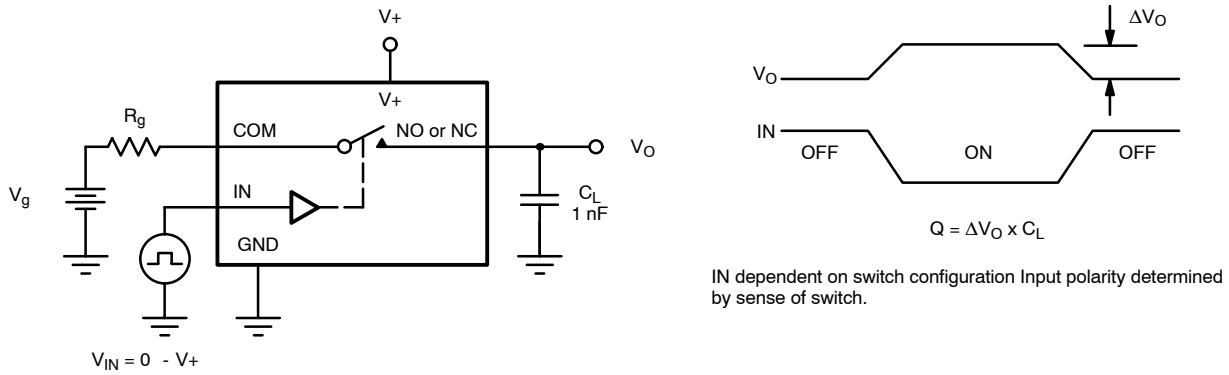


Figure 5. Charge Injection

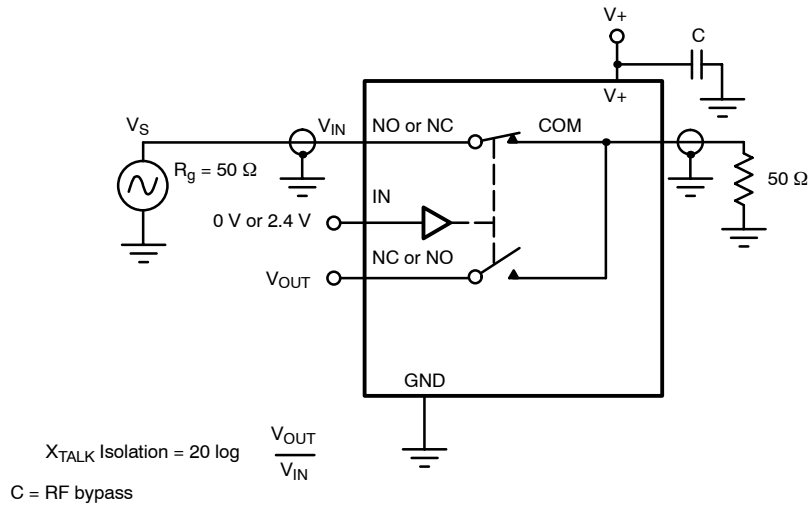


Figure 6. Crosstalk

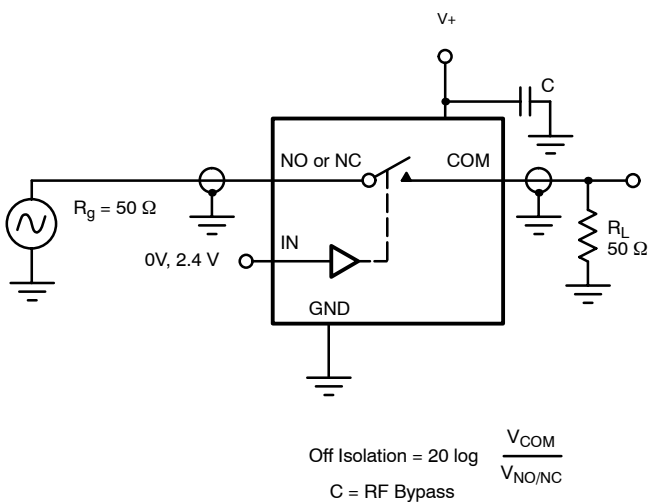


Figure 7. Off Isolation

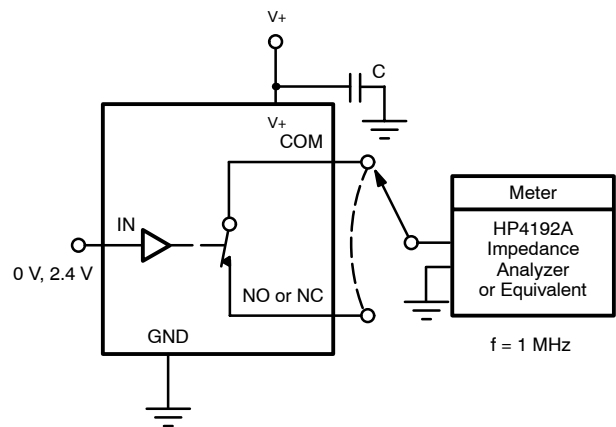


Figure 8. Source/Drain Capacitances