Low Voltage, 4.5 Ω Dual SPST Switches

DESCRIPTION

The DG721, DG722, and DG723 are monolithic dual SPST switches designed to switch both analog and digital signals.

Fabricated with advance submicron CMOS process, the switches provide high precision low ON resistance, low leakage current, low parasitic capacitance, and low charge injection. They are designed to operate from a single 1.8 V to 5.5 V power supply with low power dissipation.

The DG721, DG722, and DG723 are packaged in MSOP8. They provide the flexibility of various control logic configuration.

The DG721, DG722, and DG723 are the ideal switches for use in low voltage instruments and healthcare devices, fitting the circuits of low voltage ADC and DAC, analog front end gain control, and signal path control.

As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with lead (Pb)-free device termination. The MSOP8 package has tin device termination and is represented by "-E3". Both device terminations meet all JEDEC standards for reflow and MSL rating.

As a further sign of Vishay Siliconix's commitment, the DG721, DG722, and DG723 are fully RoHS compliant and halogen-free.

FEATURES

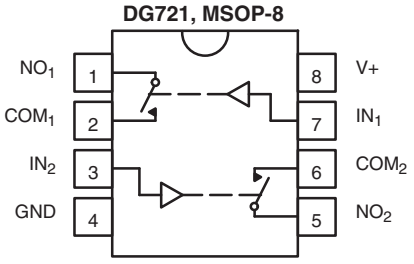
- 1.8 V to 5.5 V single power supply
- 2.5 Ω switch on resistance
- > 300 MHz, - 3 dB bandwidth
- Latch-up current > 300 mA (JESD78)
- Space saving packages
  - MSOP8
- Low voltage control logic

Pb-free
RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

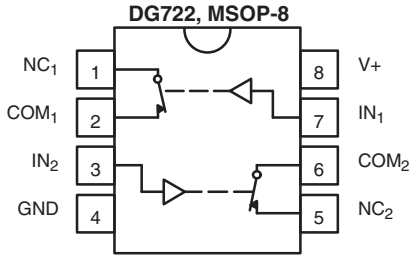
- Communication systems
- Handheld healthcare and instruments
- Switch audio, video, and USB full speed
- Cellular phones
- Portable media players and GPS

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION DG721, DG722



Top View

Device Marking: 721



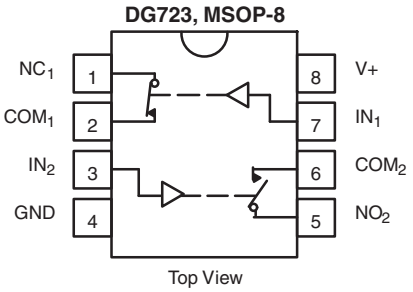
Top View

Device Marking: 722

TRUTH TABLE DG721	
Logic	**Switch**
0	Off
1	On

TRUTH TABLE DG722	
Logic	**Switch**
0	On
1	Off

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION DG723



Device Marking: 723

TRUTH TABLE DG723		
Logic	**Switch-1**	**Switch-2**
0	On	Off
1	Off	On

ORDERING INFORMATION		
Temperature Range	**Package**	**Part Number**
- 40 °C to 85 °C	MSOP-8	DG721DQ-T1-GE3
		DG722DQ-T1-GE3
		DG723DQ-T1-GE3

ABSOLUTE MAXIMUM RATINGS			
Parameter		**Limit**	**Unit**
Referenced V+ to GND		- 0.3 to 6.0	V
IN, COM, NC, NO[a]		- 0.3 to (V+ + 0.3)	
Continuous Current (Any Terminal)		± 50	mA
Peak Current (Pulsed at 1 ms, 10 % duty cycle)		± 200	
Storage Temperature (D Suffix)		- 65 to 150	°C
Power Dissipation (Packages)[b]	MSOP-8[c]	320	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 6.5 mW/°C above 25 °C.

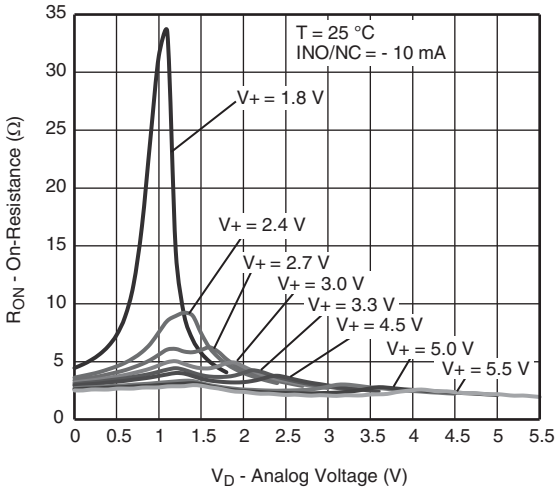
SPECIFICATIONS V+ = 3.0 V							
Parameter	**Symbol**	**Test Conditions Otherwise Unless Specified** V+ = 3 V, ± 10 %, V_{IN} = 0.4 or 1.5 V[e]	**Temp.[a]**	**Limits** - 40 °C to 85 °C **Min.[b]**	**Typ.[c]**	**Max.[b]**	**Unit**
Analog Switch							
Analog Signal Range[d]	V_{NO}, V_{NC} V_{COM}		Full	0		V+	V
On-Resistance	R_{ON}	V+ = 2.7 V, V_{COM} = 0 V to V+, I_{NO}, I_{NC} = - 10 mA	Room Full		6.5	 9	Ω
R_{ON} Flatness[d]	R_{ON} Flatness	V+ = 2.7 V, V_{COM} = 1.1 V to 1.6 V, I_{NO}, I_{NC} = - 10 mA	Room		3.3		
R_{ON} Match[d]	R_{ON} Match	V+ = 2.7 V, V_D = 1.1 V to 1.6 V, I_D = - 10 mA	Room Full		0.3	 0.9	
Switch Off Leakage Current	$I_{NO(off)}$ $I_{NC(off)}$	V+ = 3.3 V V_{NO}, V_{NC} = 1 V/3 V, V_{COM} = 3 V/1 V	Room Full	- 0.25 - 0.35		0.25 0.35	nA
	$I_{COM(off)}$		Room Full	- 0.25 - 0.35		0.25 0.35	
Channel-On Leakage Current	$I_{COM(on)}$	V+ = 3.3 V, V_{NO}, V_{NC} = V_{COM} = 1 V/3 V	Room Full	- 0.25 - 0.35		0.25 0.35	
Digital Control							
Input High Voltage	V_{INH}		Full	2			V
Input Low Voltage	V_{INL}		Full			0.4	
Input Capacitance[d]	C_{in}	f = 1 MHz	Full		2.4		pF
Input Current	I_{INL} or I_{INH}	V_{IN} = 0 or V+	Full	- 1		1	µA
Dynamic Characteristics							
Turn-On Time	t_{ON}	V_{NO} or V_{NC} = 2.0 V, R_L = 300 Ω, C_L = 35 pF Figures 1 and 2	Room Full		16	 55	ns
Turn-Off Time	t_{OFF}		Room Full		7	 40	
Charge Injection[d]	Q_{INJ}	C_L = 1 nF, V_{GEN} = 0 V, R_{GEN} = 0 Ω, Figure 3	Room		1.8		pC
Bandwidth[d]	BW	V+ = 3.0 V, R_L = 50 Ω, C_L = 5 pF, - 3dB	Room		319		MHz
Off-Isolation[d]	OIRR	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz	Room		- 67		dB
Crosstalk[d]	X_{TALK}		Room		- 92		
Off-Isolation[d]	OIRR	R_L = 50 Ω, C_L = 5 pF, f = 10 MHz	Room		- 47		
Crosstalk[d]	X_{TALK}		Room		- 90		
Source-Off Capacitance[d]	$C_{NC/NO(off)}$	V_{IN} = 0 or V+, f = 1 MHz	Room		8		pF
Drain-Off Capacitance[d]	$C_{COM(off)}$		Room		9		
Channel-On Capacitance[d]	C_{ON}		Room		22		
Power Supply							
Power Supply Current	I+	V_{IN} = 0 or V+, V+ = 3.3 V				1.0	µA

SPECIFICATIONS V+ = 5.0 V							
Parameter	**Symbol**	**Test Conditions Otherwise Unless Specified** V+ = 5 V, ± 10 %, V_{IN} = 0.8 or 2.4 V[e]	**Temp.[a]**	**Limits - 40 °C to 85 °C Min.[b]**	**Typ.[c]**	**Max.[b]**	**Unit**
Analog Switch							
Analog Signal Range[d]	V_{NO}, V_{NC} V_{COM}		Full	0		V+	V
On-Resistance	R_{ON}	V+ = 4.5 V, V_{COM} = 0 V to V+, I_{NO}, I_{NC} = 10 mA	Room Full		2.5	4.5 5	Ω
R_{ON} Flatness[d]	R_{ON} Flatness	V+ = 4.5 V, V_{COM} = 1.3 V to 3.0 V, I_{NO}, I_{NC} = 10 mA	Room		0.85	1.5	
R_{ON} Match[d]	R_{ON} Match	V+ = 4.5 V, I_D = 10 mA, V_{COM} = 1.3 V to 3.0 V	Room		0.2	0.9	
Switch Off Leakage Current	$I_{NO(off)}$ $I_{NC(off)}$	V+ = 5.5 V V_{NO}, V_{NC} = 1 V/4.5 V, V_{COM} = 4.5 V/1 V	Room Full	- 0.25 - 0.35		0.25 0.35	nA
	$I_{COM(off)}$		Room Full	- 0.25 - 0.35		0.25 0.35	
Channel-On Leakage Current	$I_{COM(on)}$	V+ = 5.5 V V_{NO}, V_{NC} = V_{COM} = 1 V/4.5 V	Room Full	- 0.25 - 0.35		0.25 0.35	
Digital Control							
Input High Voltage	V_{INH}		Full	2.4			V
Input Low Voltage	V_{INL}		Full			0.8	
Input Capacitance	C_{in}	f = 1 MHz	Full		2.2		pF
Input Current	I_{INL} or I_{INH}	V_{IN} = 0 or V+	Full	- 0.1	0.005	0.1	µA
Dynamic Characteristics							
Turn-On Time[d]	t_{ON}	V_{NO} or V_{NC} = 3 V, R_L = 300 Ω, C_L = 35 pF Figures 1 and 2	Room Full		17	30 40	ns
Turn-Off Time[d]	t_{OFF}		Room Full		9	 35	
Charge Injection[d]	Q_{INJ}	C_L = 1 nF, V_{GEN} = 0 V, R_{GEN} = 0 Ω, Figure 3	Room		2.2		pC
Bandwidth[d]	BW	V+ = 5 V, R_L = 50 Ω, C_L = 5 pF, - 3 dB	Room		366		MHz
Off-Isolation[d]	OIRR	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz	Room		- 67		dB
Crosstalk[d]	X_{TALK}		Room		- 90		
Off-Isolation[d]	OIRR	R_L = 50 Ω, C_L = 5 pF, f = 10 MHz	Room		- 47		
Crosstalk[d]	X_{TALK}		Room		- 90		
Source-Off Capacitance[d]	$C_{NC/NO(off)}$	V_{IN} = 0 or V+, f = 1 MHz	Room		8		pF
Drain-Off Capacitance[d]	$C_{COM(off)}$		Room		9		
Channel-On Capacitance[d]	C_{ON}		Room		22		
Power Supply							
Power Supply Range	V+			2.6		4.3	V
Power Supply Current	I+	V_{IN} = 0 or V+, V+ = 5.5 V	Full			2	µA

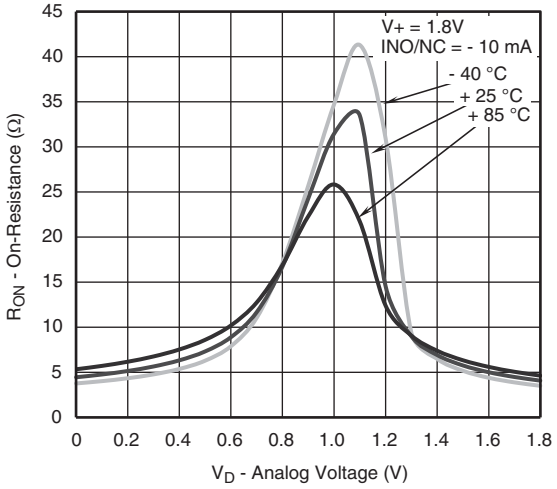
Notes:
a. Room = 25 °C, Full = as determined by the operating suffix.
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
c. Typical values are for design aid only, not guaranteed nor subject to production testing.
d. Guarantee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

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.

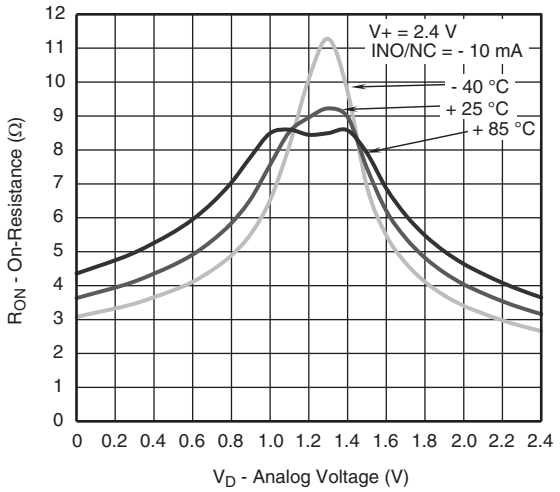
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



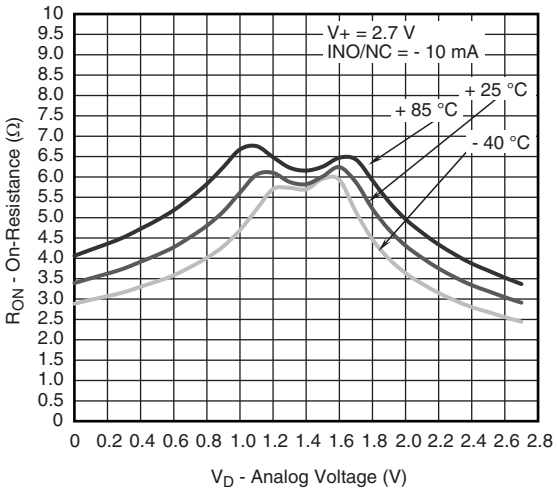
R_{ON} vs. V_D and Single Supply Voltage



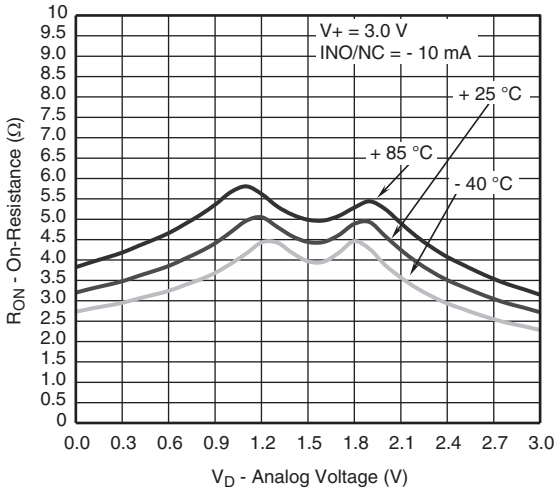
R_{ON} vs. Analog Voltage and Temperature



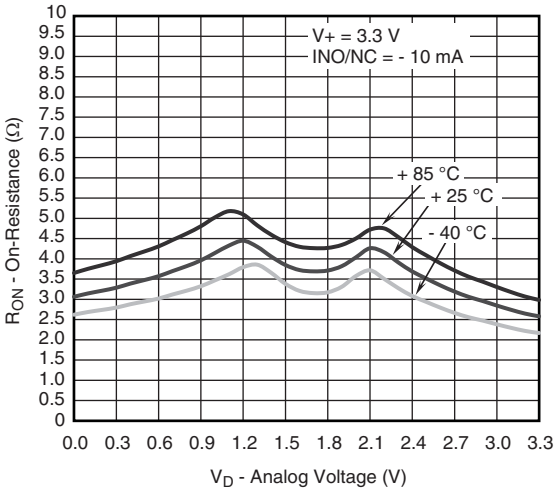
R_{ON} vs. Analog Voltage and Temperature



R_{ON} vs. Analog Voltage and Temperature

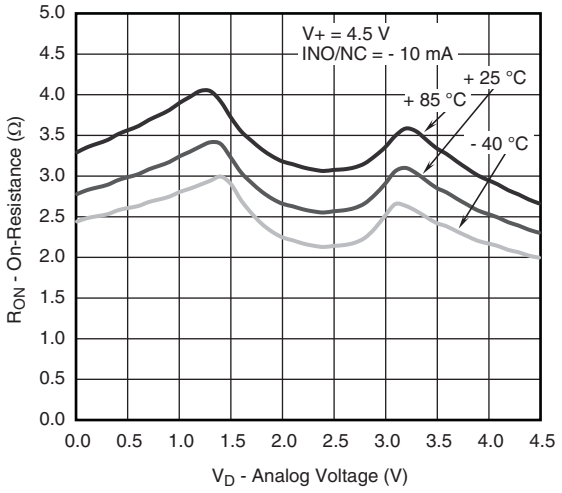


R_{ON} vs. Analog Voltage and Temperature

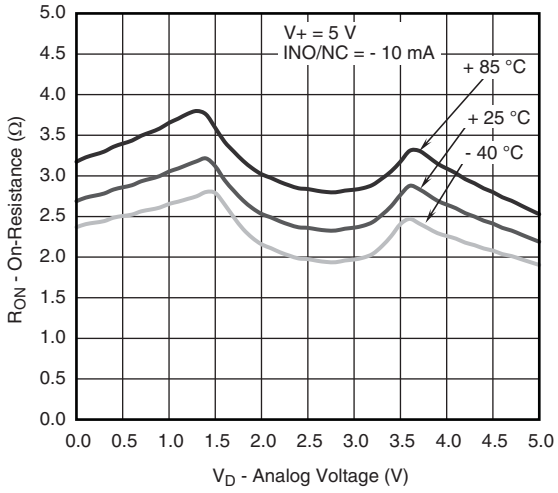


R_{ON} vs. Analog Voltage and Temperature

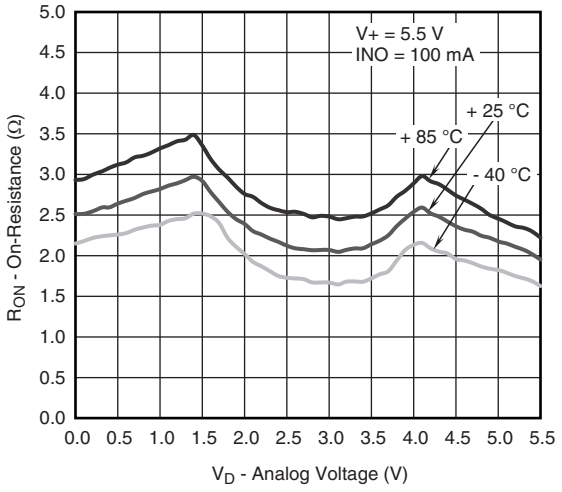
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



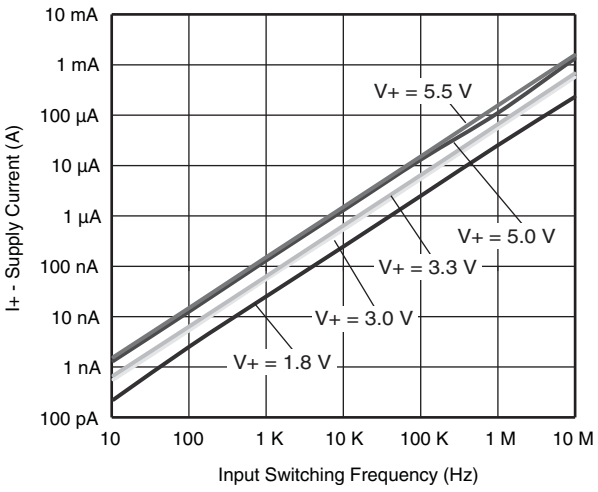
R_{ON} vs. Analog Voltage and Temperature



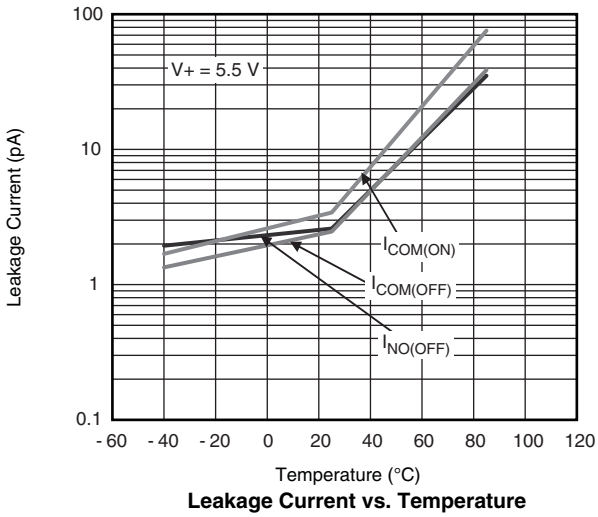
R_{ON} vs. Analog Voltage and Temperature



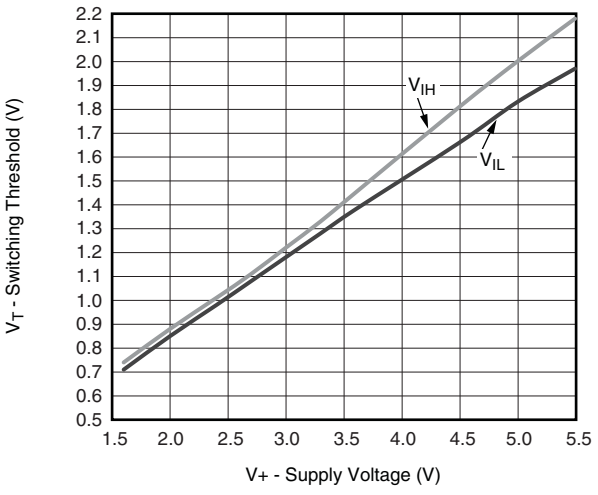
R_{ON} vs. Analog Voltage and Temperature



Supply Current vs. Input Switching Frequency

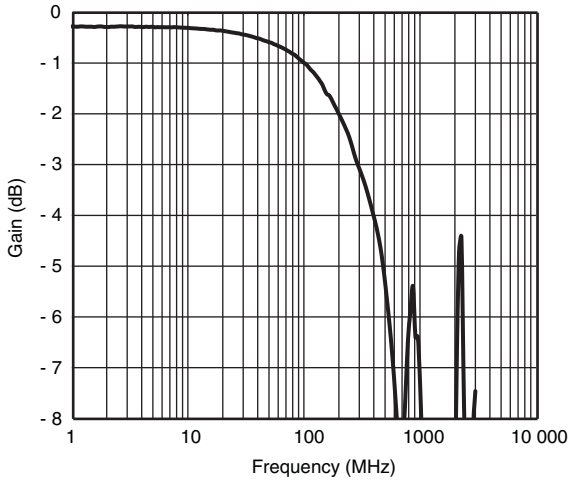


Leakage Current vs. Temperature

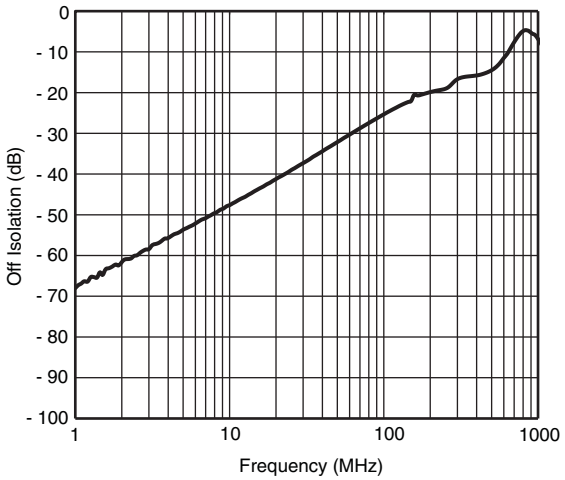


Switching Threshold vs. Supply Voltage

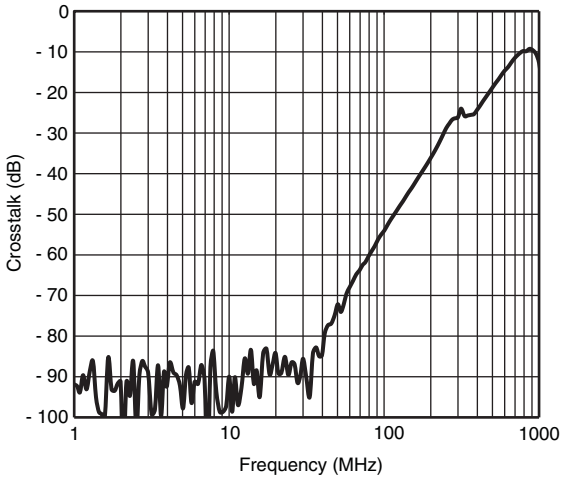
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



Frequency Response

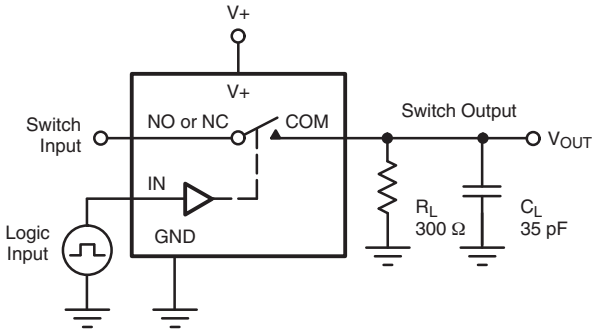


Frequency Response



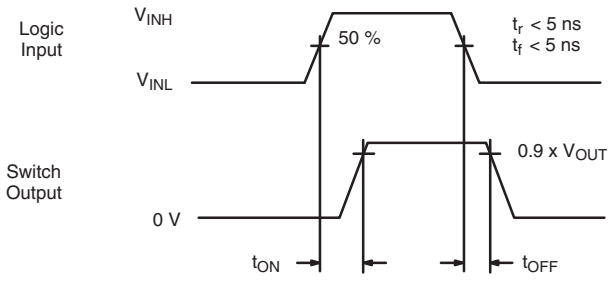
Frequency Response

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

TEST CIRCUITS

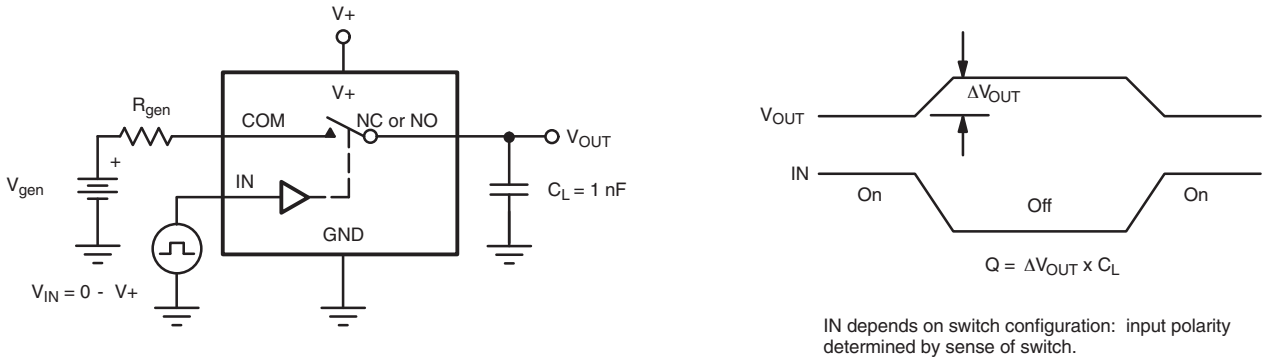


Figure 2. Charge Injection

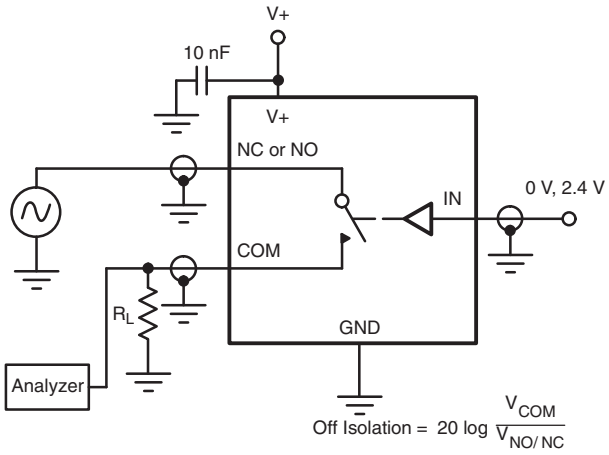


Figure 3. Off-Isolation

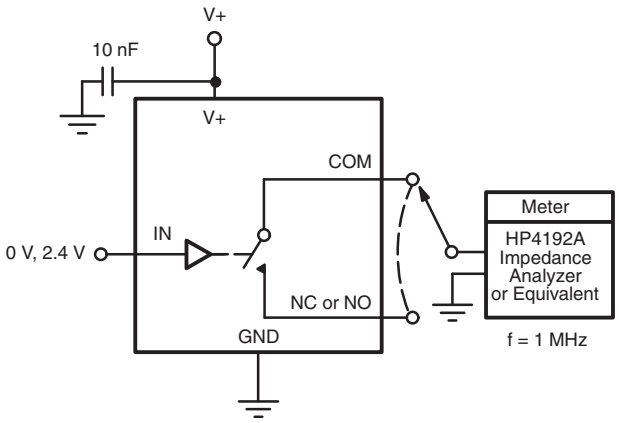


Figure 4. Channel Off/On Capacitance

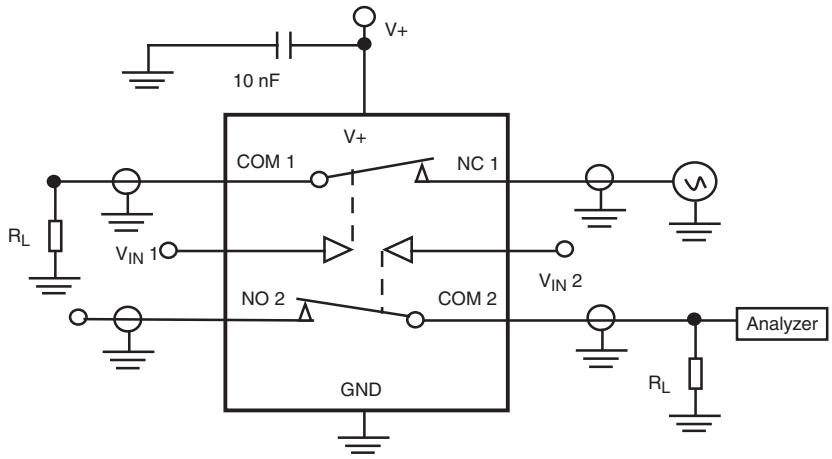


Figure 5. Channel to Channel Crosstalk

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