Low Power, High Voltage SPST Analog Switches

DESCRIPTION

The DG447 and DG448 are dual supply single-pole/single-throw (SPST) switches. On resistance is 25 Ω maximum and flatness is 2.2 Ω max over the specified analog signal range. These analog switches were designed to provide high speed, low error switching of precision analog signals. The primary application areas are in the routing and switching in telecommunications and test equipment. Combining low power, low leakages, low on-resistance and small physical size, the DG477/448 are also ideally suited for portable and battery powered industrial and military equipment.

The DG477 has one normally closed switch, while the DG448 switch is normally open. They operate either from a single + 7 V to 36 V supply or from dual ± 4.5 V to ± 20 V supplies. They are offered in the very popular, small T6SOP6 package.

FEATURES

- ± 15 V Analog Signal Range
- On-Resistance - $r_{DS(on)}$: 25 Ω max
- Fast Switching Action - T_{ON}: 100 ns
- V_L Logic Supply Not Required
- TTL CMOS Input Compatible
- Rail To Rail Signal Handling
- Dual Or Single Supply Operation

Pb-free
RoHS
COMPLIANT

BENEFITS

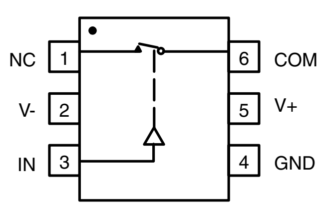
- Wide Dynamic Range
- Low Signal Errors and Distortion
- Break-Before-Make Switching Action
- Simple Interfacing
- Reduced Board Space
- Improved Reliability

APPLICATIONS

- Precision Test Equipment
- Precision Instrumentation
- Communications Systems
- PBX, PABX Systems
- Audio Equipment
- Redundant Systems
- PC Multimedia Boards
- Hard Disc Drives

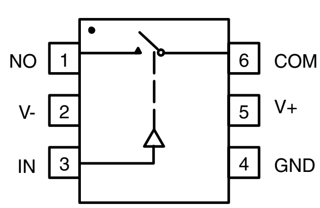
FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION

DG447



TSOP6

DG448



TSOP6

TRUTH TABLE

Logic	DG447	DG448
0	ON	OFF
1	OFF	ON

Logic "0" ≤ 0.8 V
Logic "1" ≥ 2.4 V

Device Marking:
DG447DV = G5xxx
DG448DV = G6xxx

ORDERING INFORMATION		
Temp Range	**Package**	**Part Number**
DG447/DG448		
- 40 to 85 °C	6-Pin TSOP	DG447DV-T1-E3
		DG448DV-T1-E3

ABSOLUTE MAXIMUM RATINGS T_A = 25 °C, unless otherwise noted				
Parameter Referenced To V-		**Symbol**	**Limit**	**Unit**
V+			44	V
GND			25	
Digital Inputs[a], $V_{no/nc}$, V_{COM}			(V-) - 2 V to (V+) + 2 V or 30 mA, whichever occurs first	
Current , (Any Terminal) Continuous			30	mA
Current (NO or NC or COM) Pulsed at 1 ms, 10 % duty cycle			100	
Storage Temperature			- 65 to 150	°C
Power Dissipation (Package)[b]	6-Pin TSOP[c]		570	mW

Notes:
a. Signals on NO, NC, COM, or IN 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 7 mW/°C above 70 °C.

SPECIFICATIONS[a]							
Parameter	**Symbol**	**Test Conditions Unless Otherwise Specified** $V+ = 15$ V, $V- = -15$ V $V_{IN} = 2.4$ V, 0.8 V[f]	**Temp**[b]	**D Suffix** - 40 to 85 °C **Min**[d]	 **Typ**[c]	 **Max**[d]	**Unit**
Analog Switch							
Analog Signal Range[e]	V_{ANALOG}		Full	- 15		15	V
Drain-Source On-Resistance	r_{ON}	$I_{no/nc} = 10$ mA, $V_{COM} = 10$ V $V+ = 13.5$ V, $V- = -13.5$ V	Room Full		17	25 30	Ω
On-Resistance Flatness	r_{ON} Flatness	$I_{no/nc} = 10$ mA, $V_{COM} = \pm 5$ V, 0 V $V+ = 13.5$ V, $V- = -13.5$ V	Room Full		0.8	2.2 3	Ω
Switch Off Leakage Current	$I_{no/nc(off)}$	$V+ = 16.5$, $V- = -16.5$ V $V_{COM} = \pm 15.5$ V $V_{no/nc} = -/+ 15.5$ V	Room Full	- 1 - 10	- 0.1	1 10	nA
	$I_{COM(off)}$		Room Full	- 1 - 10	- 0.1	1 10	nA
Channel On Leakage Current	$I_{COM(on)}$	$V+ = 16.5$ V, $V- = -16.5$ $V_{COM} = V_{no/nc} = \pm 15.5$ V	Room Full	- 1 - 10	- 0.1	1 10	nA
Digital Control							
Input, High Voltage	I_{INH}		Full	2.4			V
Input, Low Voltage	I_{INL}		Full			0.8	V
Input Capacitance[e]	C_{IN}		Room		5		pF
Input Current	I_{IN}	$V_{IN} = 0$ or 5 V		- 1		1	µA
Dynamic Characteristics							
Turn-On Time	t_{ON}	$R_L = 300\ \Omega$, $C_L = 35$ pF $V_{no/nc} = \pm 10$ V	Room Full		100	130 140	ns
Turn-Off Time	t_{OFF}		Room Full		50	95 110	ns
Charge Injection[e]	Q	$C_L = 1$ nF, $V_{gen} = 0$ V, $R_{gen} = 0\ \Omega$	Room		2		pC
Off-Isolation[e]	OIRR	$C_L = 5$ pF, $R_L = 50\ \Omega$, f = 1 MHz	Room		- 72		dB
Source Off Capacitance[e]	$C_{S(off)}$	f = 1 MHz	Room		19		pF
Drain Off Capacitance[e]	$C_{D(off)}$		Room		8		pF
Channel On Capacitance[e]	$C_{D(on)}$	f = 1 MHz	Room		30		pF
Power Supplies							
Positive Supply Current	I+	$V+ = 16.5$ V, $V- = -16.5$ V $V_{IN} = 0$ or 5 V	Room Full		16	30 50	µA
Negative Supply Current	I-		Room Full	- 1 - 10	- 0.02		µA

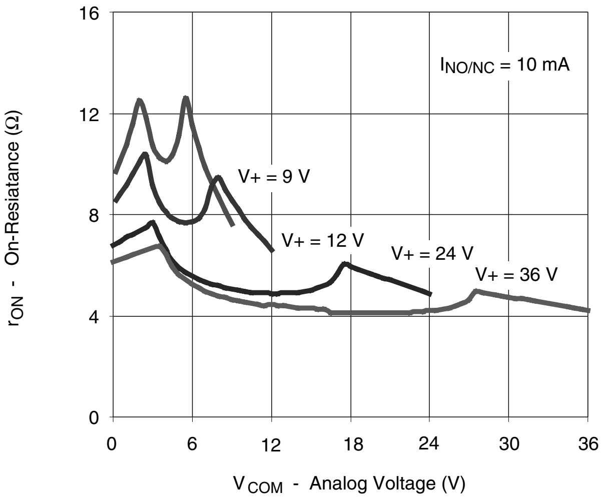
SPECIFICATIONS[a]

Parameter	Symbol	Test Conditions Unless Otherwise Specified $V+ = 12$ V, $V- = 0$ V $V_{IN} = 2.4$ V, 0.8 V[f]	Temp[b]	D Suffix - 40 to 85 °C Min[d]	Typ[c]	Max[d]	Unit
Analog Switch							
Analog Signal Range[e]	V_{ANALOG}		Full	0		12	V
Drain-Source On-Resistance	r_{ON}	$I_{no/nc} = -10$ mA, $V_{COM} = 8$ V $V+ = 10.8$ V	Room Full		32	45 60	Ω
On-Resistance Flatness	r_{ON} Flatness	$I_{no/nc} = 10$ mA, $V_{COM} = 2, 6, 8$ V $V+ = 10.8$ V	Room Full		2	6 8	Ω
Dynamic Characteristics							
Turn-On Time	t_{ON}	$V_{NO, NC} = \pm 10$ V, $R_L = 300$ Ω, $C_L = 35$ pF	Room Full		140	175 225	nS
Turn-Off Time	t_{OFF}		Room Full		50	120 150	
Charge Injection[e]	Q	$C_L = 10$ nF, $V_{gen} = 0$ V, $R_{gen} = 0$ Ω	Room		10		pC
Power Supplies							
Positive Supply Current	I+	$V+ = 13.2$ V, $V_{IN} = 0$ V, 5 V	Room Full		22	50 75	μA

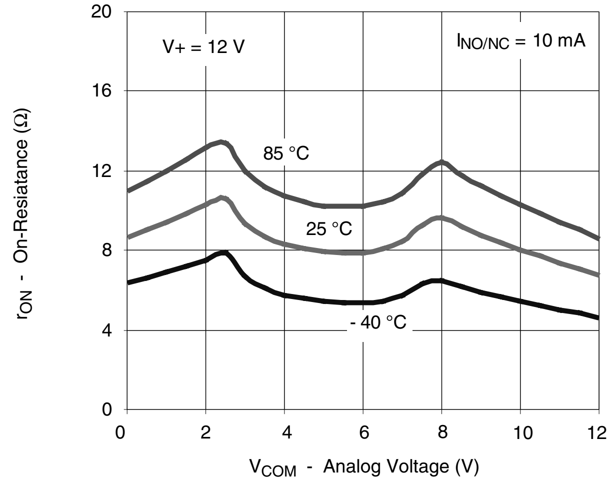
Notes:
a. Refer to PROCESS OPTION FLOWCHART.
b. Room = 25 °C, Full = as determined by the operating temperature suffix.
c. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
d. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
e. Guaranteed by design, not subject to production test.
f. 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.

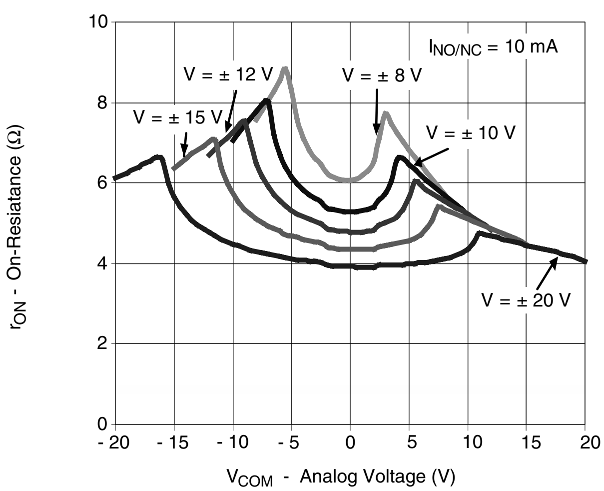
TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



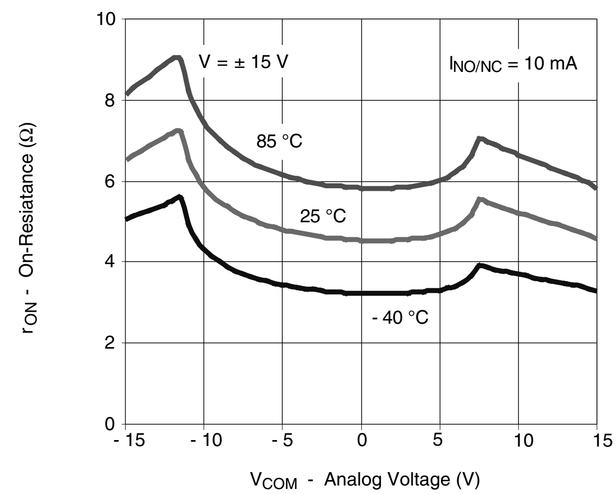
r_{ON} vs. V_{COM} and Single Supply Voltage



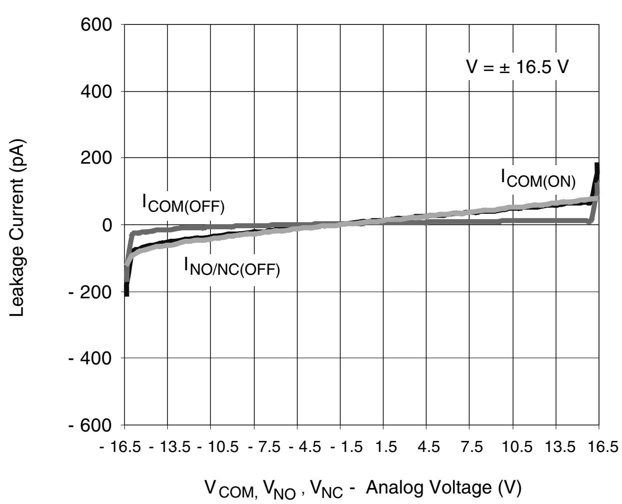
r_{ON} vs. Analog Voltage and Temperature



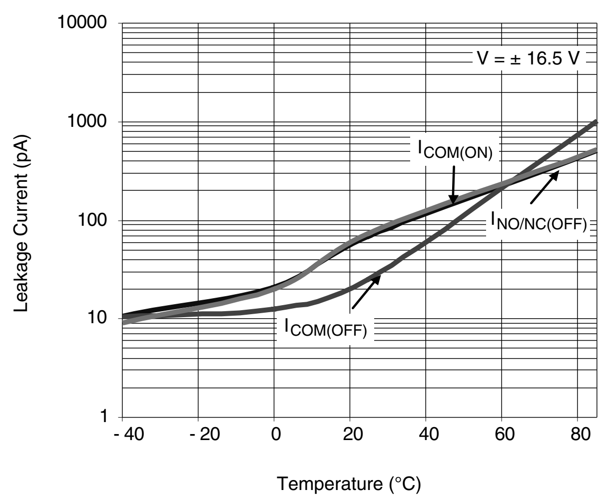
r_{ON} vs. V_{COM} and Dual Supply Voltage



r_{ON} vs. Analog Voltage and Temperature

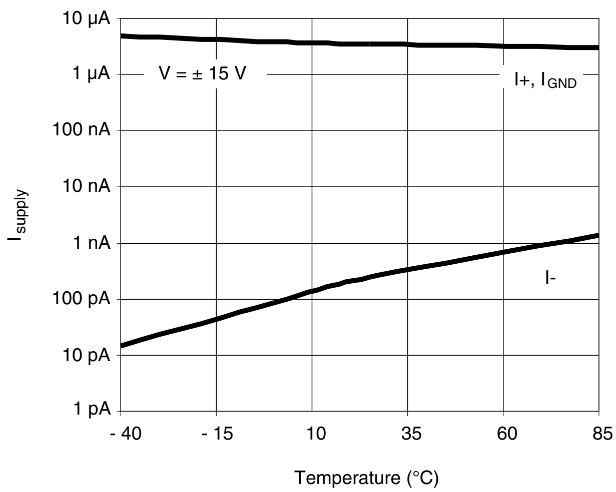


Leakage vs. Analog Voltage

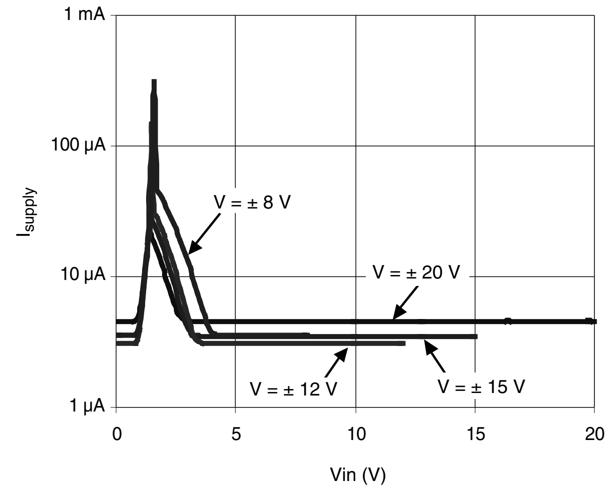


Leakage Current vs. Temperature

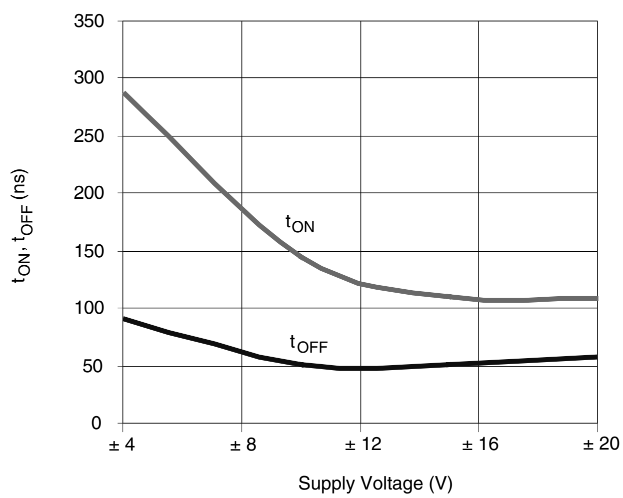
TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



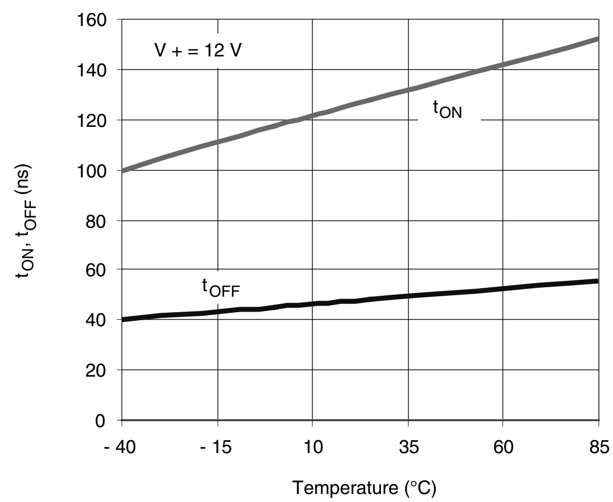
Supply Current vs. Temperature



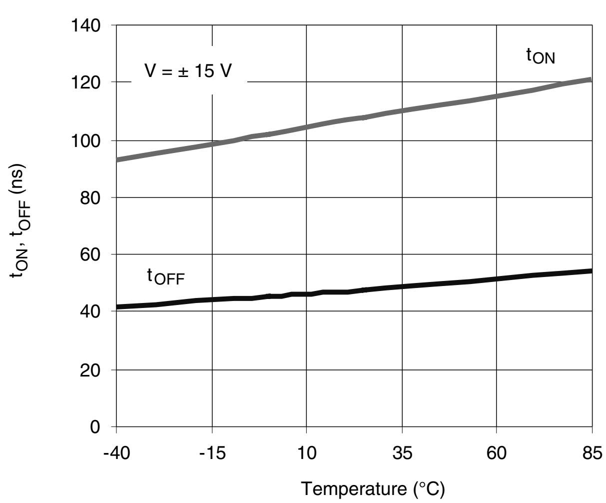
Supply Current vs. V_{IN}



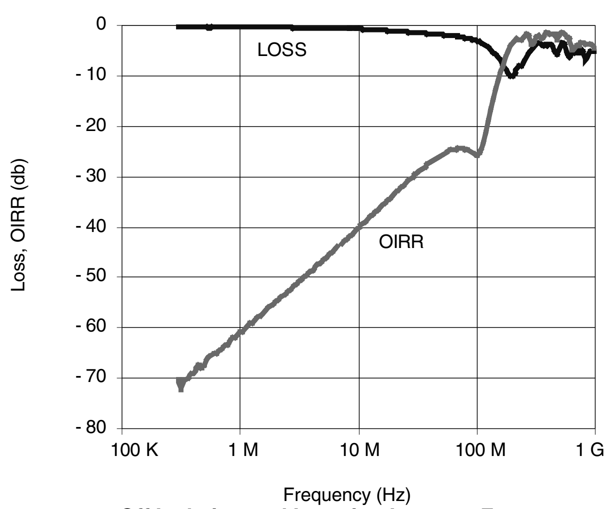
Switching Time vs. Supply Voltages



Switching Time vs. Temperature

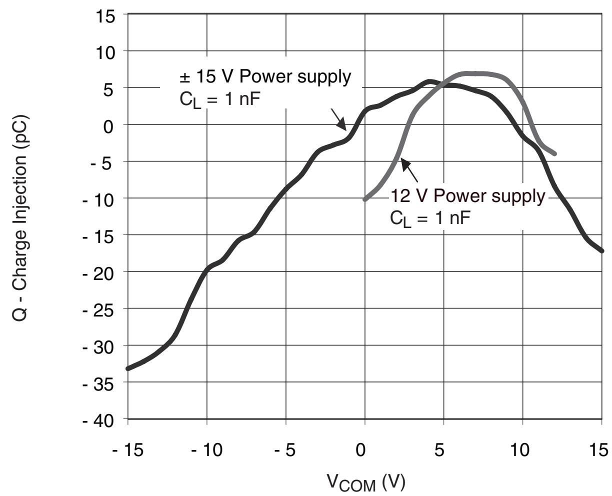


Switching Time vs. Temperature

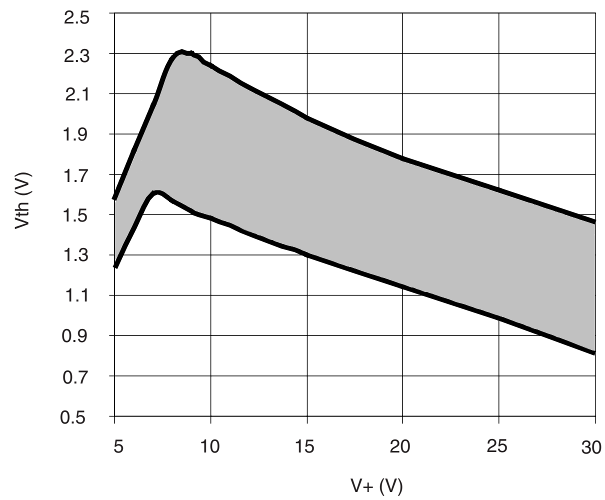


Off Isolation and Insertion Loss vs. Frequency

TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



Charge Injection vs. Analog Voltage



Input Switching Threshold vs. Supply Voltage

TEST CIRCUITS

V_O is the steady state output with the switch on.

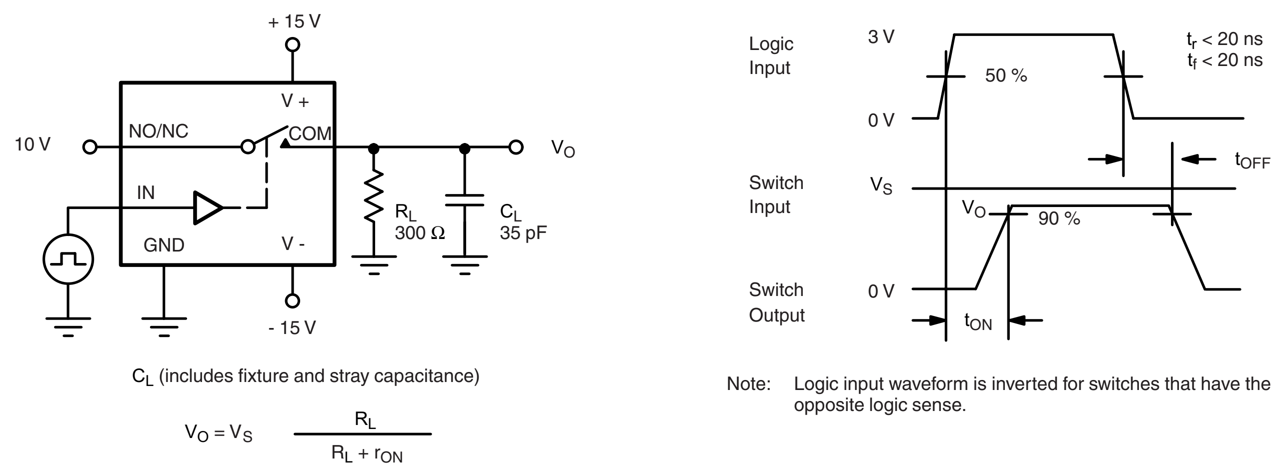


Figure 1. Switching Time

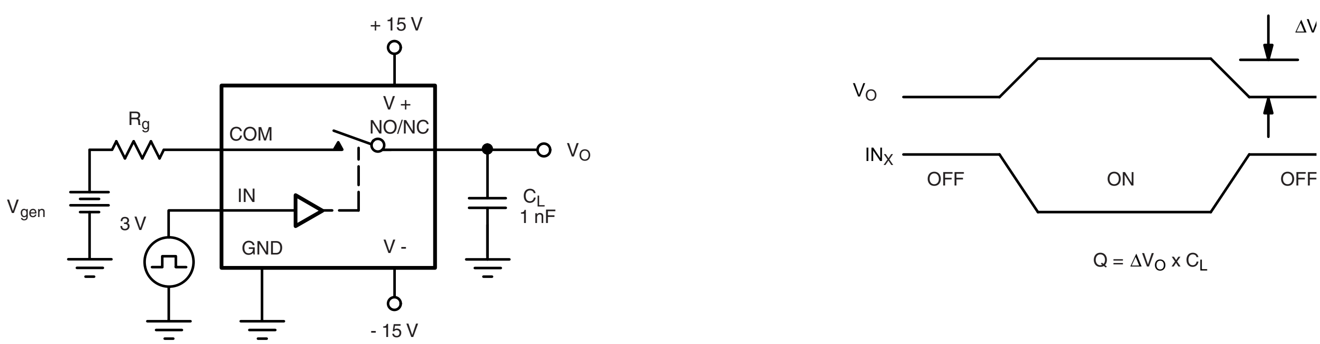
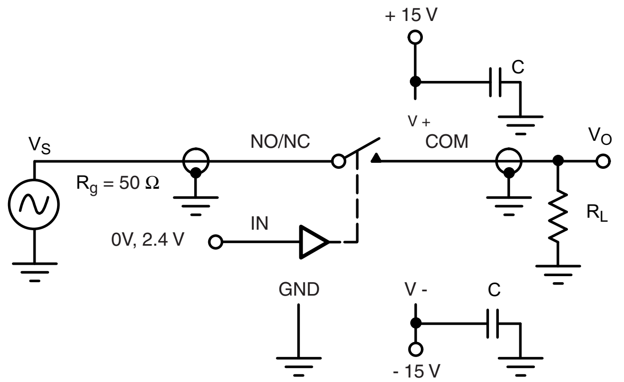


Figure 2. Charge Injection

TEST CIRCUITS

V_O is the steady state output with the switch on.



$$\text{Off Isolation} = 20 \log \left| \frac{V_O}{V_S} \right|$$

Figure 3. Off Isolation

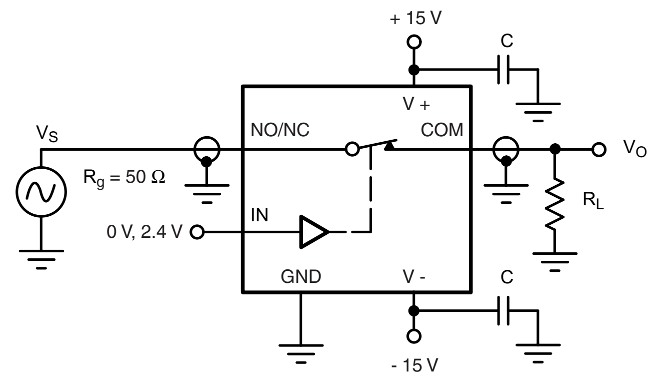


Figure 4. Insertion Loss

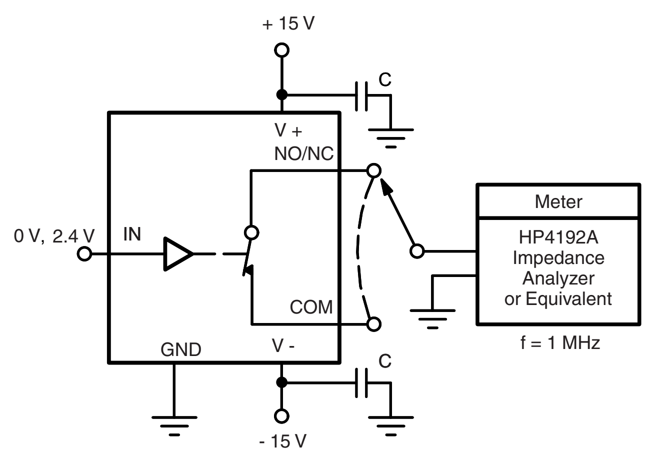


Figure 5. Source/Drain Capacitances

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