Low-Voltage, Sub-Ohm, SPDT Analog Switch

DESCRIPTION

The DG2711 is a sub-ohm single-pole/double-throw monolithic CMOS analog switch designed for high performance switching of analog signals. Combining low power, high speed (t_{ON}: 25 ns, t_{OFF}: 14 ns), low on-resistance ($R_{DS(on)}$: 0.44 Ω) and small physical size (SC70), the DG2711 is ideal for portable and battery powered applications requiring high performance and efficient use of board space.

The DG2711 is built on Vishay Siliconix's low voltage submicron CMOS process. An epitaxial layer prevents latchup. Break-before-make is guaranteed for DG2711.

Each switch conducts equally well in both directions when on, and blocks up to the power supply level when off.

As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with the lead (Pb)-free device terminations. For analog switching products manufactured with 100 % matte tin device terminations, the lead (Pb)-free "-E3" suffix is being used as a designator.

FEATURES

- Low voltage operation (1.6 V to 3.6 V)
- Low on-resistance - $R_{DS(on)}$: 0.44 Ω typ.
- Fast switching - t_{ON}: 25 ns, t_{OFF}: 14 ns
- Low leakage
- TTL/CMOS compatible
- 6-pin SC-70 package
- Compliant to RoHS directive 2002/95/EC

Pb-free
RoHS COMPLIANT

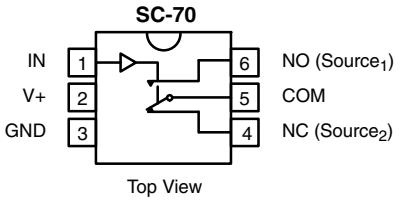
BENEFITS

- Reduced power consumption
- Simple logic interface
- High accuracy
- Reduce board space

APPLICATIONS

- Cellular phones
- Communication systems
- Portable test equipment
- Battery operated systems
- Sample and hold circuits

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



Top View

Device Marking: E9xx

TRUTH TABLE		
Logic	**NC**	**NO**
0	ON	OFF
1	OFF	ON

ORDERING INFORMATION		
Temp. Range	**Package**	**Part Number**
- 40 to 85 °C	SC70-6	DG2711DL-T1-E3

ABSOLUTE MAXIMUM RATINGS

Parameter		Limit	Unit
Reference V+ to GND		- 0.3 to + 4	V
IN, COM, NC, NO[a]		- 0.3 to (V+ + 0.3)	
Continuous Current (NO, NC and COM Pins)		± 200	mA
Peak Current (Pulsed at 1 ms, 10 % duty cycle)		± 300	
Storage Temperature	(D Suffix)	- 65 to 150	°C
Power Dissipation (Packages)[b]	6-Pin SO70[c]	250	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 3.1 mW/°C above 70 °C.

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.

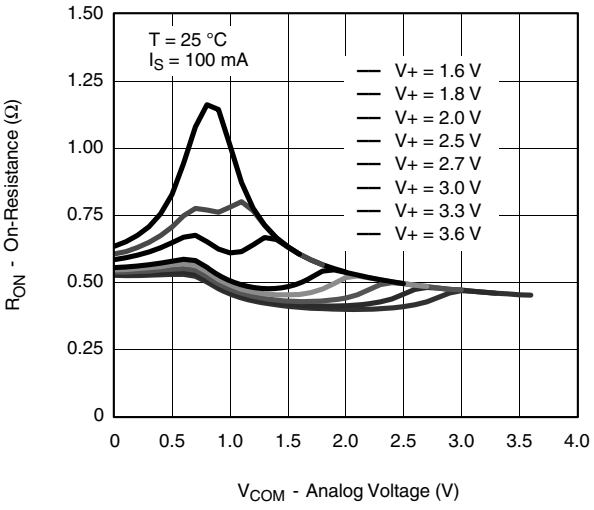
SPECIFICATIONS (V+ = 1.8 V)

Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 1.8 V, ± 10 %, V_{IN} = 0.4 V or 1.0 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+ = 1.8 V, V_{COM} = 0.9 V I_{NO}, I_{NC} = 100 mA	Room Full		0.8	2.0 2.5	Ω
Switch Off Leakage Current[f]	$I_{NO(off)}$ $I_{NC(off)}$	V+ = 2.2 V, V_{NO}, V_{NC} = 0.2 V/2 V, V_{COM} = 2 V/0.2 V	Room Full[d]	- 1 - 10		1 10	nA
	$I_{COM(off)}$		Room Full[d]	- 1 - 10		1 10	
Channel-On Leakage Current[f]	$I_{COM(on)}$	V+ = 2.2 V, V_{NO}, V_{NC} = V_{COM} = 0.2 V/2 V	Room Full[d]	- 1 - 10		1 10	
Digital Control							
Input High Voltage	V_{INH}		Full	1.0			V
Input Low Voltage	V_{INL}		Full			0.4	
Input Capacitance[d]	C_{in}		Full		5		pF
Input Current[f]	I_{INL} or I_{INH}	V_{IN} = 0 or V+	Full	- 1		1	µA
Dynamic Characteristics							
Turn-On Time[d]	t_{ON}	V_{NO} or V_{NC} = 1.5 V, R_L = 300 Ω, C_L = 35 pF Figures1 and 2	Room Full[d]		36	60 62	ns
Turn-Off Time[d]	t_{OFF}		Room Full		22	42 44	
Break-Before-Make Time[d]	t_d		Room	3			
Charge Injection[d]	Q_{INJ}	C_L = 1 nF, V_{GEN} = 0 V, R_{GEN} = 0 Ω, figure 3	Room		20		pC
Off-Isolation[d]	OIRR	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz	Room		- 56		dB
Crosstalk[d]	X_{TALK}		Room		- 56		
NO, NC Off Capacitance[d]	$C_{NO(off)}$ $C_{NC(off)}$	V_{IN} = 0 or V+, f = 1 MHz	Room		73		pF
Channel-On Capacitance[d]	C_{ON}		Room		167		

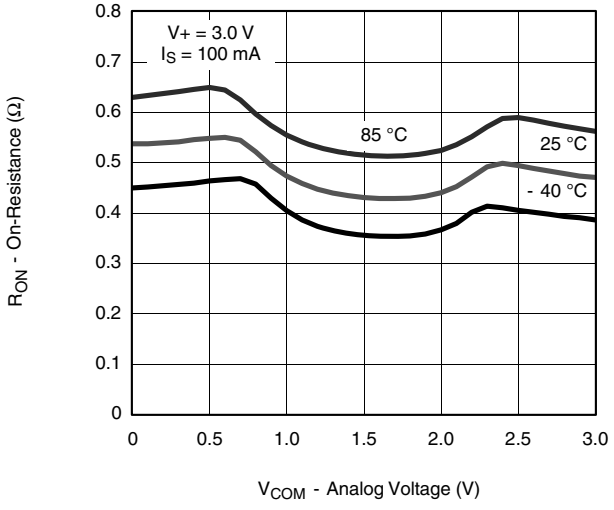
SPECIFICATIONS (V+ = 3.0 V)							
Parameter	**Symbol**	**Test Conditions Otherwise Unless Specified** V+ = 3 V, ± 10 %, V_{IN} = 0.5 V or 1.4 V[e]	**Temp.[a]**	**Limits - 40 °C to 85 °C Min.[b]**	**Typ.[c]**	**Max.[b]**	**Unit**
Analog Switch							
Analog Signal Range[d]	V_{NO}, V_{NC}, V_{COM}		Full	0		V+	V
On-Resistance	R_{ON}	V+ = 2.7 V, V_{COM} = 1.5 V I_{NO}, I_{NC} = 100 mA	Room Full		0.44	0.6 0.7	Ω
R_{ON} Flatness	R_{ON} Flatness	V+ = 2.7 V, V_{COM} = 0.6 V, 1.5 V I_{NO}, I_{NC} = 100 mA	Room		0.14	0.2	
R_{ON} Match	ΔR_{ON}	V+ = 2.7 V, V_{COM} = 1.5 V I_{NO}, I_{NC} = 100 mA	Room			0.07	
Switch Off Leakage Current	$I_{NO(off)}$ $I_{NC(off)}$	V+ = 3.3 V, V_{NO}, V_{NC} = 0.3 V/3 V, V_{COM} = 3 V/0.3 V	Room Full	- 1 - 10		1 10	nA
	$I_{COM(off)}$		Room Full	- 1 - 10		1 10	
Channel-On Leakage Current	$I_{COM(on)}$	V+ = 3.3 V, V_{NO}, V_{NC} = V_{COM} = 0.3 V/3 V	Room Full	- 1 - 10		1 10	
Digital Control							
Input High Voltage	V_{INH}		Full	1.4			V
Input Low Voltage	V_{INL}		Full			0.5	
Input Capacitance[d]	C_{in}		Full		5		pF
Input Current[f]	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} = 1.5 V, R_L = 300 Ω, C_L = 35 pF figures 1 and 2	Room Full		25	46 48	ns
Turn-Off Time	t_{OFF}		Room Full		14	38 40	
Break-Before-Make Time	t_d		Room	1			
Charge Injection[d]	Q_{INJ}	C_L = 1 nF, V_{GEN} = 0 V, R_{GEN} = 0 Ω, figure 3	Room		28		pC
Off-Isolation[d]	OIRR	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz	Room		- 56		dB
Crosstalk[d]	X_{TALK}		Room		- 56		
NO, NC Off Capacitance[d]	$C_{NO(off)}$ $C_{NC(off)}$	V_{IN} = 0 or V+, f = 1 MHz	Room		70		pF
Channel-On Capacitance[d]	C_{ON}		Room		163		
Power Supply							
Power Supply Range	V+			1.6		3.6	V
Power Supply Current	I+	V+ = 3.6 V, V_{IN} = 0 or V+			0.01	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, nor subjected to production test.
e. V_{IN} = input voltage to perform proper function.
f. Guaranteed by 3 V leakage testing, not production tested.

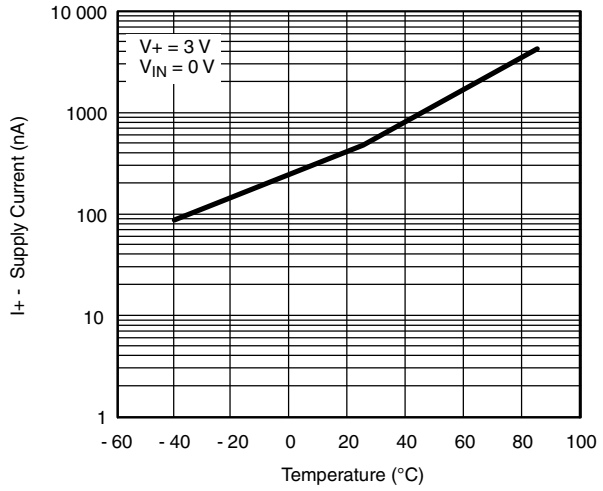
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



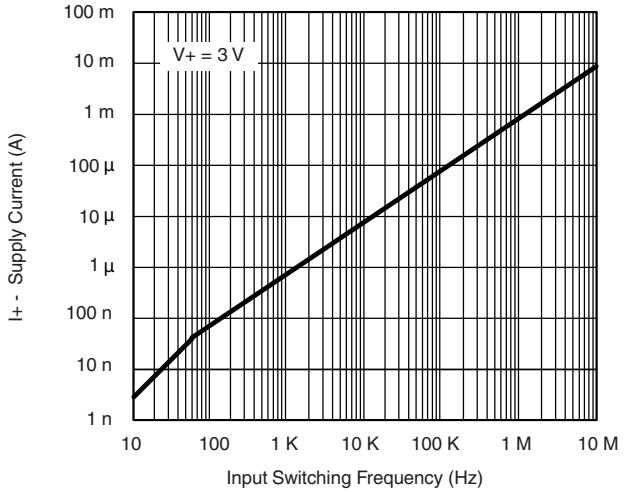
R_{ON} vs. V_{COM} and Single Supply Voltage



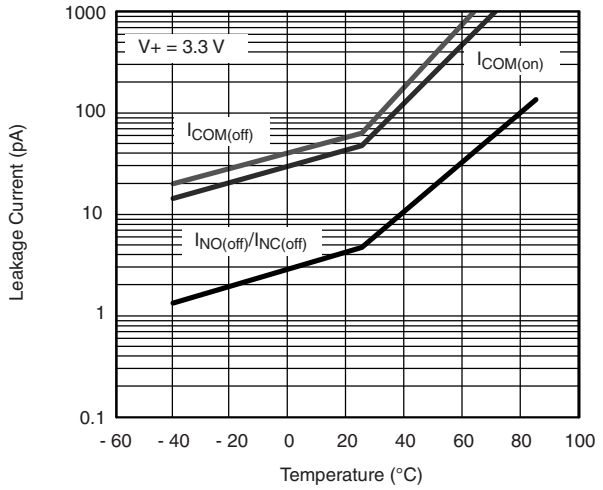
R_{ON} vs. Analog Voltage and Temperature



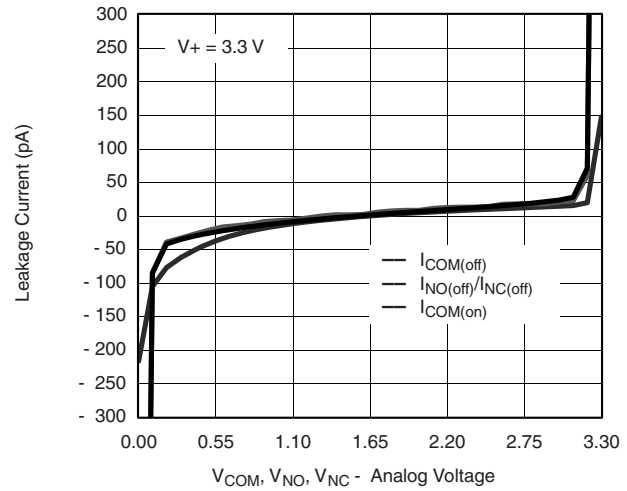
Supply Current vs. Temperature



Supply Current vs. Input Switching Frequency

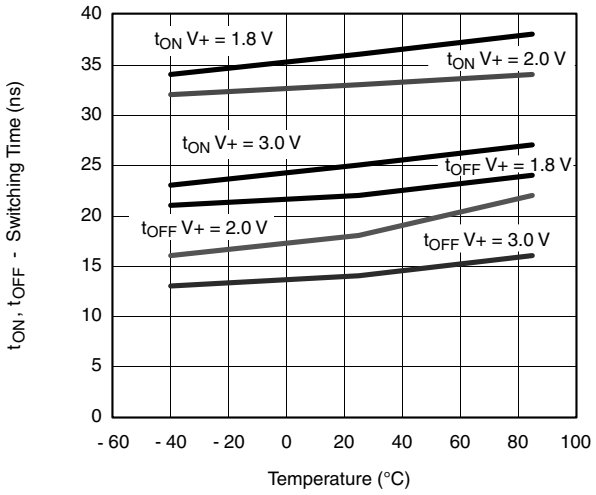


Leakage Current vs. Temperature

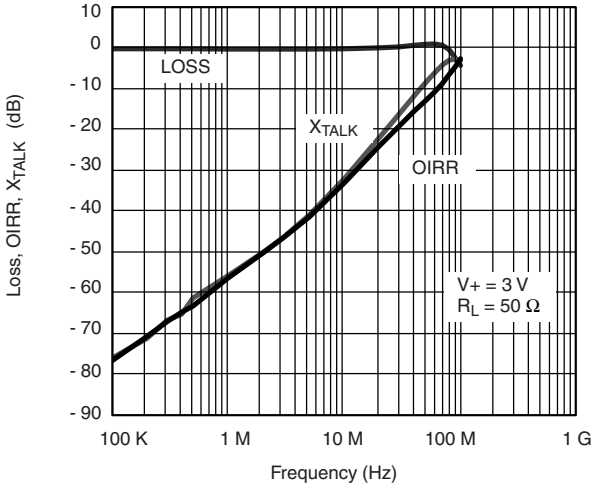


Leakage vs. Analog Voltage

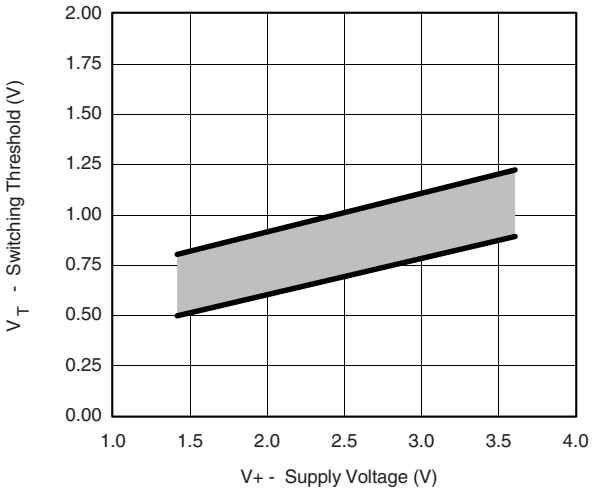
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



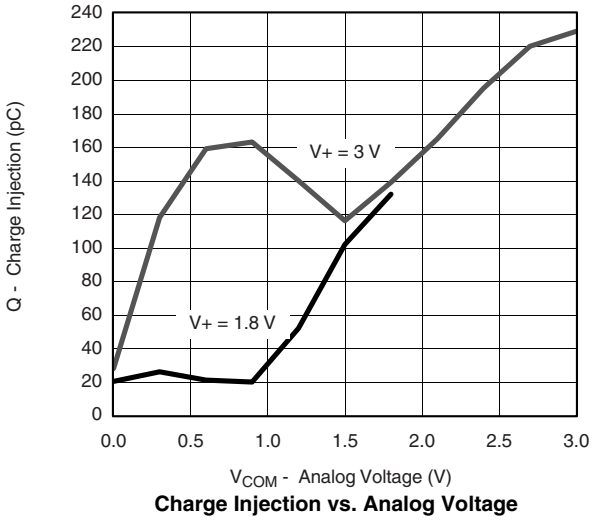
Switching Time vs. Temperature



Insertion Loss, Off-Isolation, Crosstalk vs. Frequency

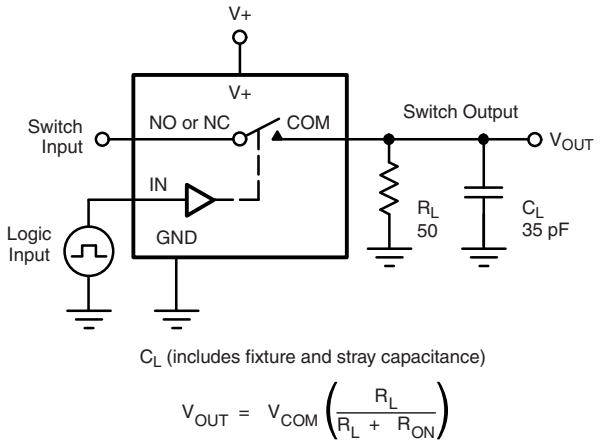


Switching Threshold vs. Supply Voltage



Charge Injection vs. Analog Voltage

TEST CIRCUITS



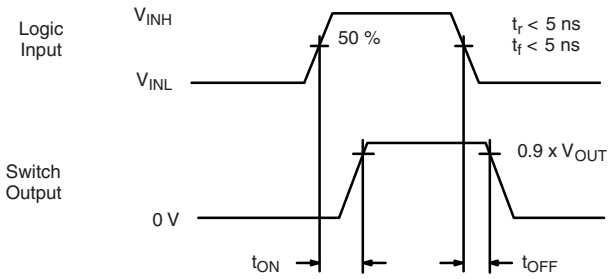
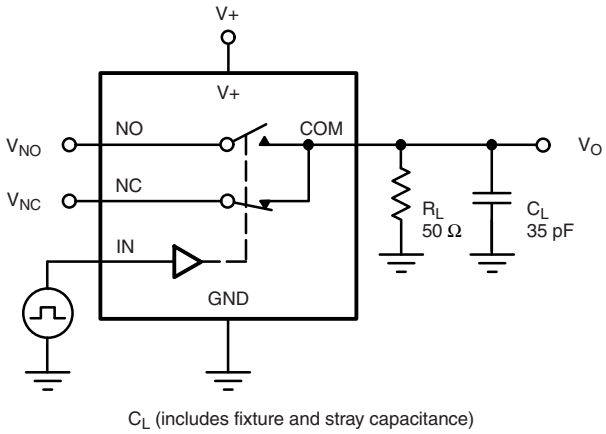


Figure 1. Switching Time



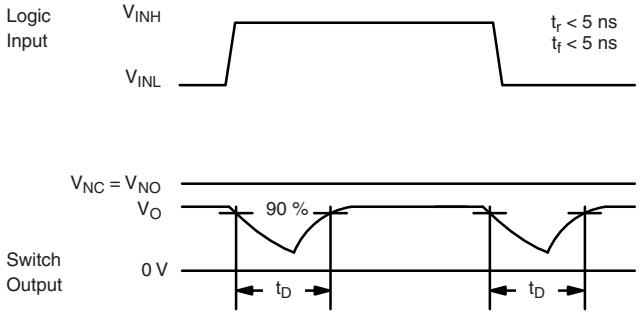
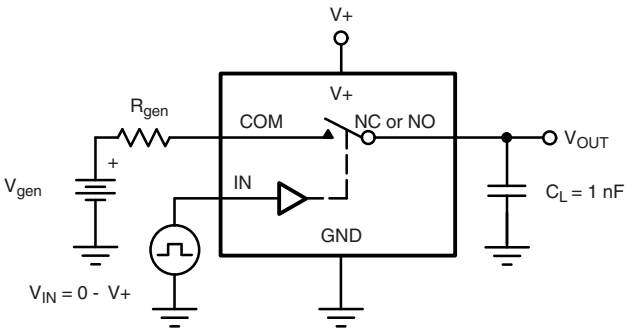
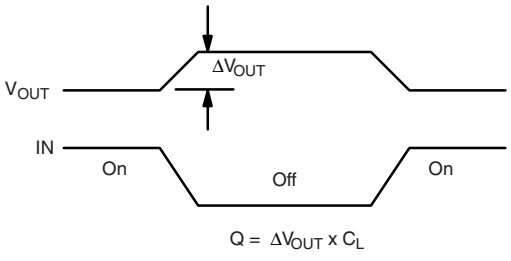


Figure 2. Break-Before-Make Interval





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

Figure 3. Charge Injection

TEST CIRCUITS

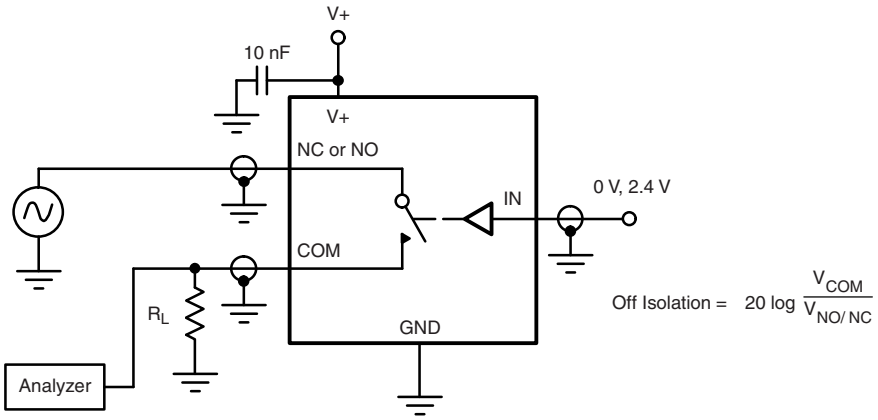


Figure 4. Off-Isolation

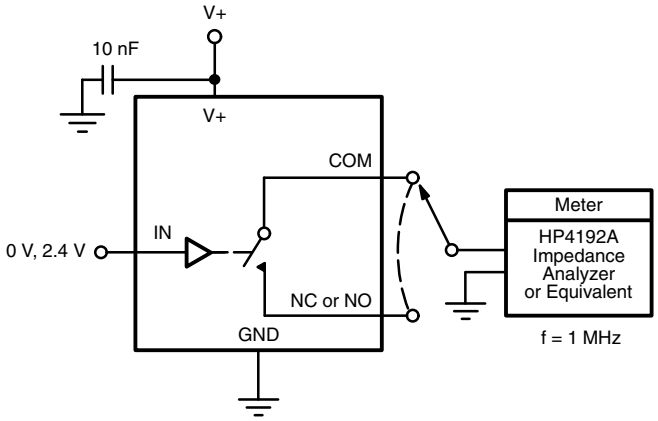
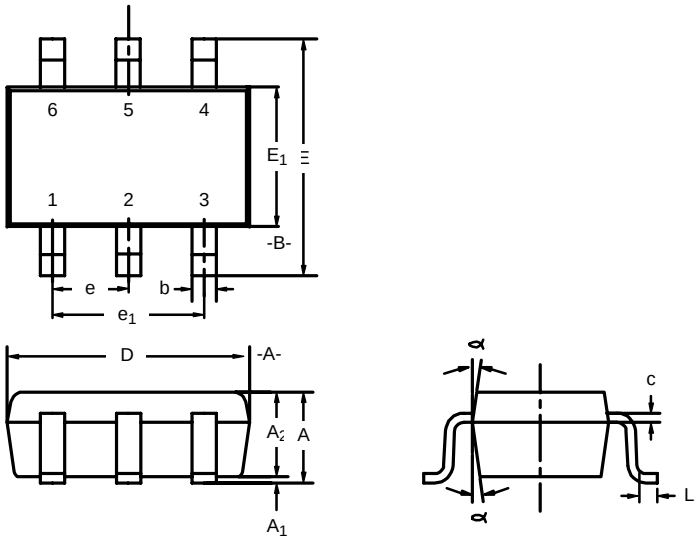


Figure 5. Channel Off/On Capacitance

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SC-70: 6-LEADS



Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.90	–	1.10	0.035	–	0.043
A_1	–	–	0.10	–	–	0.004
A_2	0.80	–	1.00	0.031	–	0.039
b	0.15	–	0.30	0.006	–	0.012
c	0.10	–	0.25	0.004	–	0.010
D	1.80	2.00	2.20	0.071	0.079	0.087
E	1.80	2.10	2.40	0.071	0.083	0.094
E_1	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65BSC			0.026BSC		
e_1	1.20	1.30	1.40	0.047	0.051	0.055
L	0.10	0.20	0.30	0.004	0.008	0.012
α	7°Nom			7°Nom		

ECN: S-03946—Rev. B, 09-Jul-01
DWG: 5550

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