

Low Power, High Voltage SPST Analog Switches

DESCRIPTION

The DG447, 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, DG448 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 TSOP6 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
- Compliant to RoHS Directive 2002/95/EC


RoHS
COMPLIANT

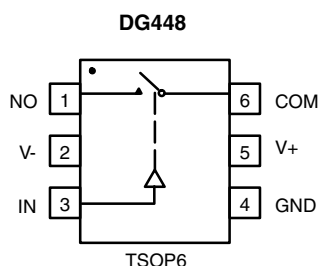
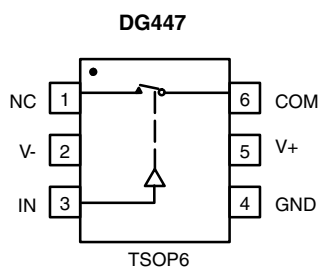
BENEFITS

- 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



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 °C to 85 °C	6-pin TSOP	DG447DV-T1-E3
		DG448DV-T1-E3

ABSOLUTE MAXIMUM RATINGS ($T_A = 25\text{ °C}$, unless otherwise noted)

Parameter Referenced to V-	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 VIN = 2.4 V, 0.8 V ^f	Temp. ^b	D Suffix - 40 °C to 85 °C			Unit
				Min. ^d	Typ. ^c	Max. ^d	
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} = ± 5 V, 0 V V+ = 13.5 V, V- = - 13.5 V	Room Full		0.8	2.2 3	
Switch Off Leakage Current	I _{no/nc(off)}	V+ = 16.5, V- = - 16.5 V V _{COM} = ± 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	
Channel On Leakage Current	I _{COM(on)}	V+ = 16.5 V, V- = - 16.5 V _{COM} = V _{no/nc} = ± 15.5 V	Room Full	- 1 - 10	- 0.1	1 10	
Digital Control							
Input, High Voltage	I _{INH}		Full	2.4			V
Input, Low Voltage	I _{INL}		Full			0.8	
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 Ω, C _L = 35 pF V _{no/nc} = ± 10 V	Room Full		100	130 140	ns
Turn-Off Time	t _{OFF}		Room Full		50	95 110	
Charge Injection ^e	Q	C _L = 10 nF, V _{gen} = 0 V, R _{gen} = 0 Ω	Room		10		pC
Off-Isolation ^e	OIRR	C _L = 5 pF, R _L = 50 Ω, 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		
Channel On Capacitance ^e	C _{D(on)}	f = 1 MHz	Room		30		
Power Supplies							
Positive Supply Current	I+	V+ = 16.5 V, V- = - 16.5 V VIN = 0 or 5 V	Room Full		16	30 50	μA
Negative Supply Current	I-		Room Full	- 1 - 10	- 0.02		

**SPECIFICATIONS^a**

Parameter	Symbol	Test Conditions Unless Otherwise Specified V+ = 12 V, V- = 0 V VIN = 2.4 V, 0.8 V ^f	Temp. ^b	D Suffix - 40 °C to 85 °C			Unit
				Min. ^d	Typ. ^c	Max. ^d	
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} = ± 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		12		pC
Power Supplies							
Positive Supply Current	I+	V+ = 13.2 V, VIN = 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.

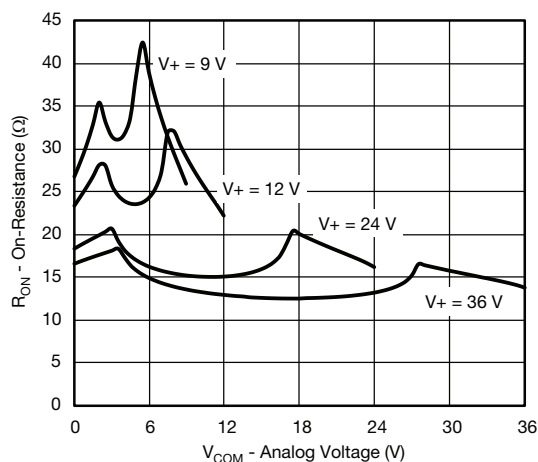
d. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.

e. Guaranteed by design, not subject to production test.

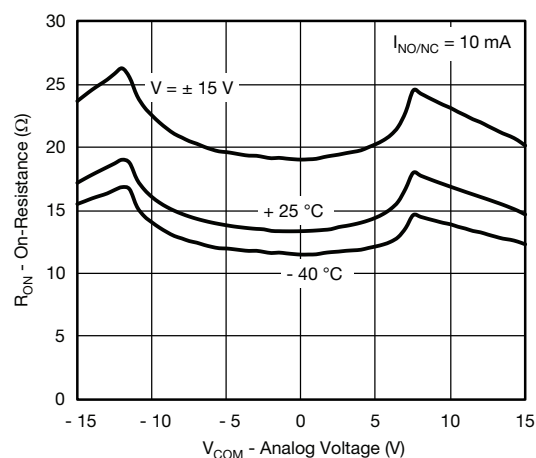
f. V_{IN} = input voltage to perform proper function.

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.

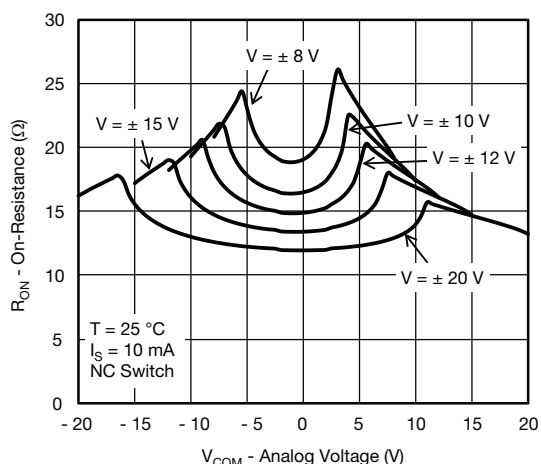
TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise noted)



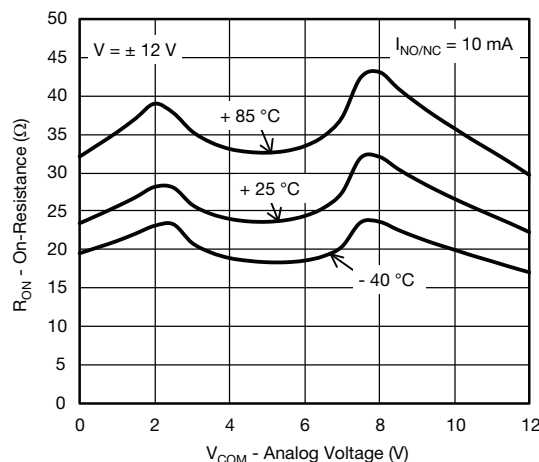
R_{ON} vs. V_{COM} and Single Supply Voltage



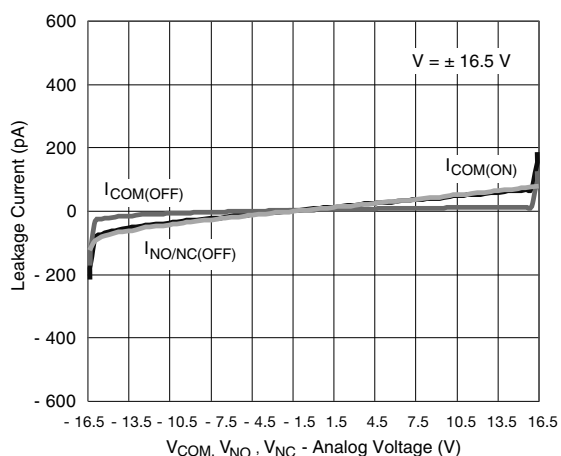
R_{ON} vs. Analog Voltage and Temperature



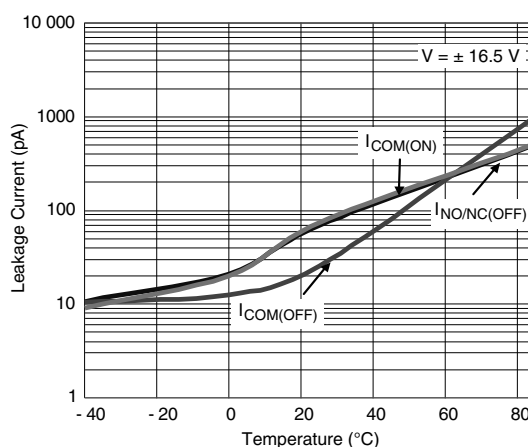
R_{ON} vs. V_{COM} and Dual Supply Voltage



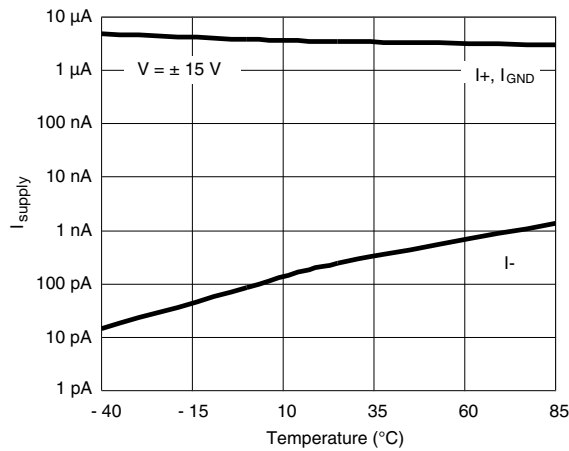
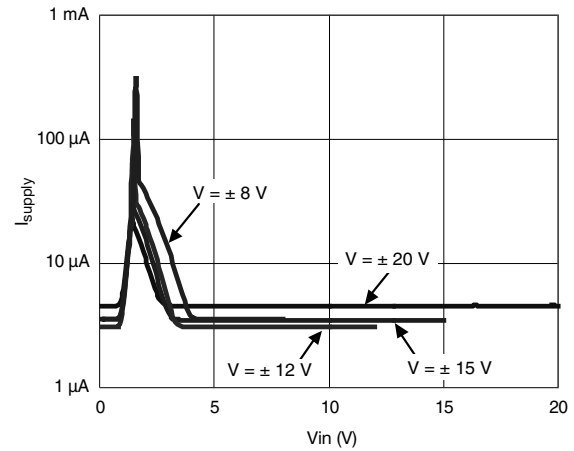
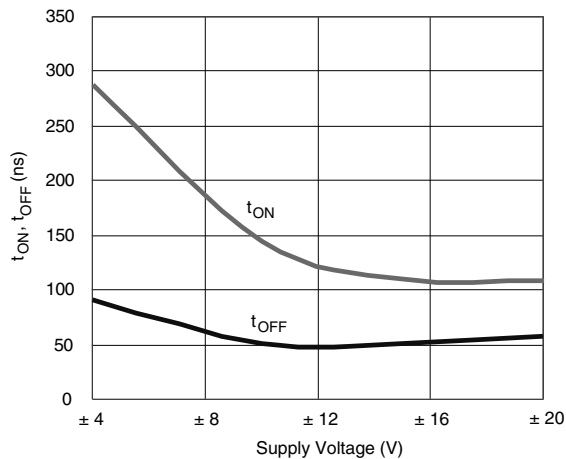
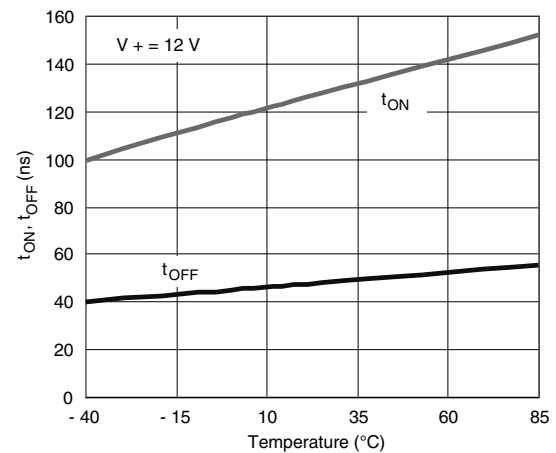
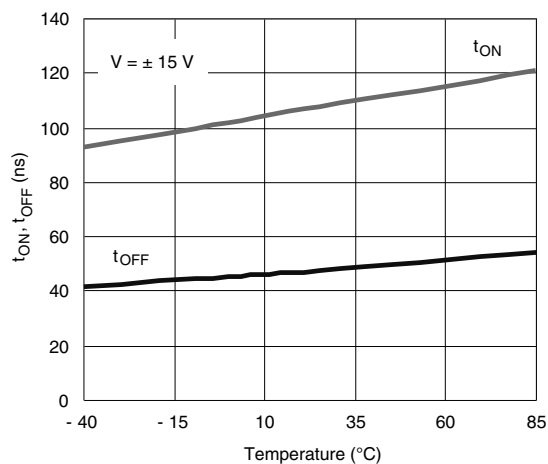
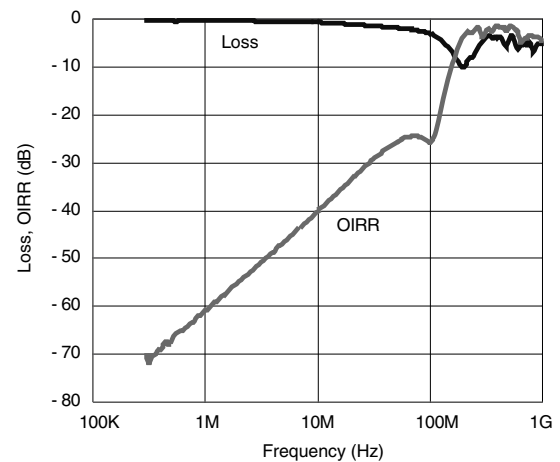
R_{ON} vs. Analog Voltage and Temperature



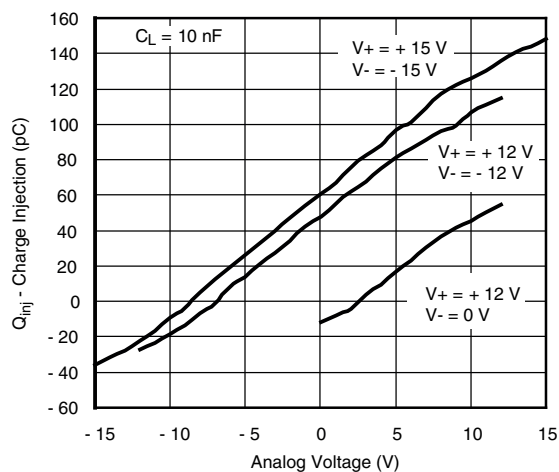
Leakage vs. Analog Voltage



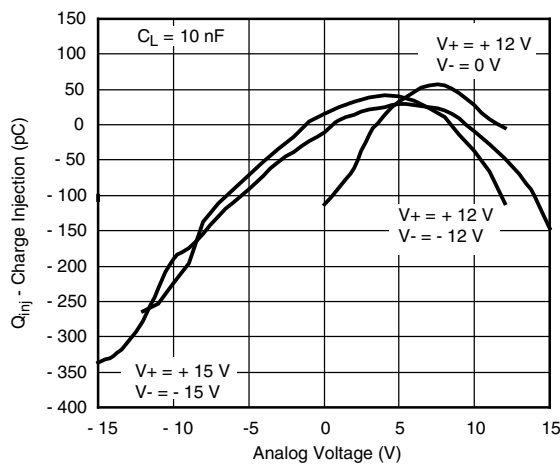
Leakage Current vs. Temperature

TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, 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

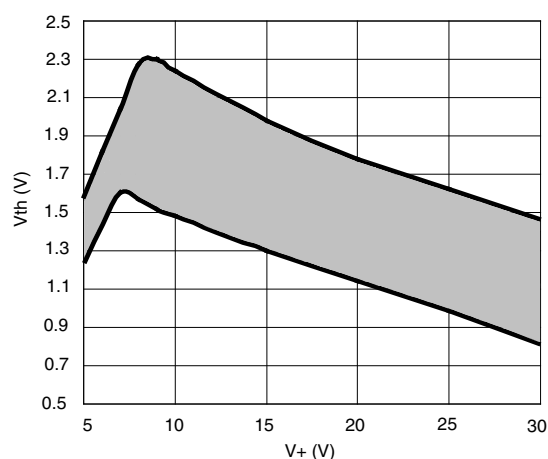
TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise noted)



Charge Injection vs. Analog Voltage
(Measured at COM pin)



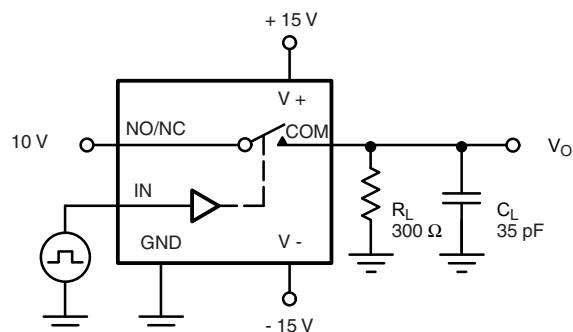
Charge Injection vs. Analog Voltage
(Measured at NC or NO pin)



Input Switching Threshold vs. Supply Voltage

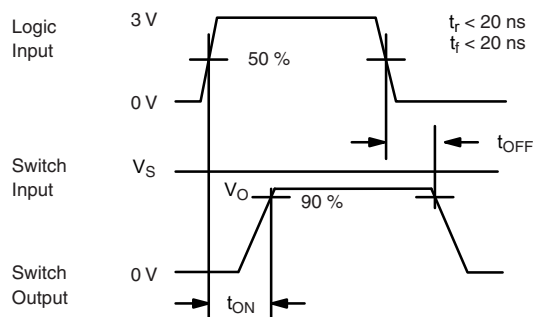
TEST CIRCUITS

V_O is the steady state output with the switch on.



C_L (includes fixture and stray capacitance)

$$V_O = V_S \frac{R_L}{R_L + r_{ON}}$$



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

Figure 1. Switching Time

TEST CIRCUITS

V_O is the steady state output with the switch on.

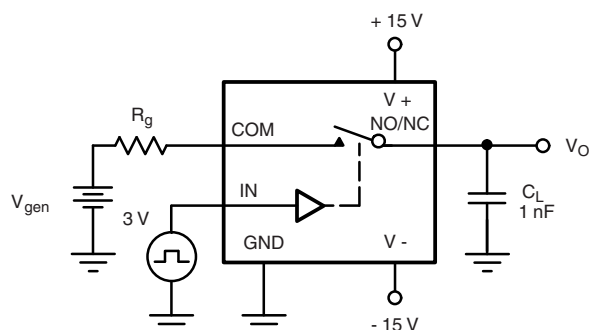


Figure 2. Charge Injection

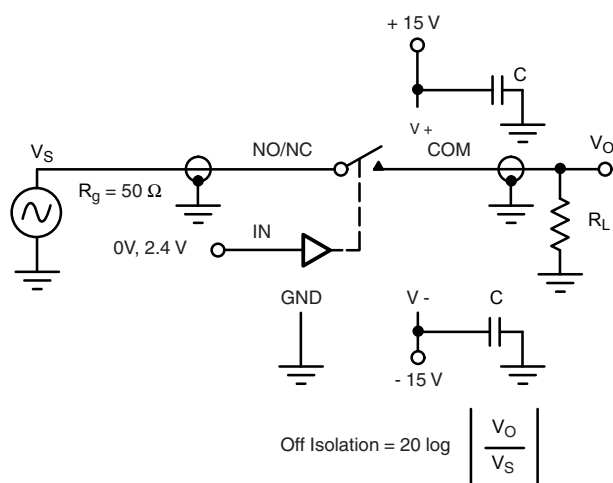


Figure 3. Off Isolation

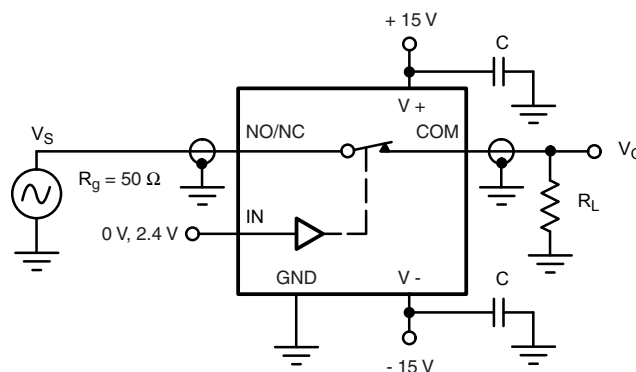


Figure 4. Insertion Loss

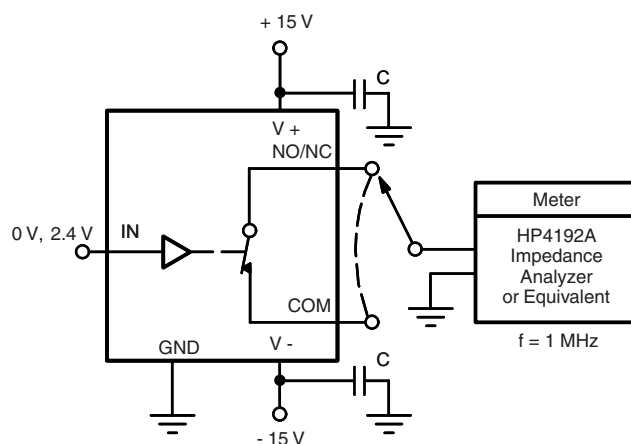
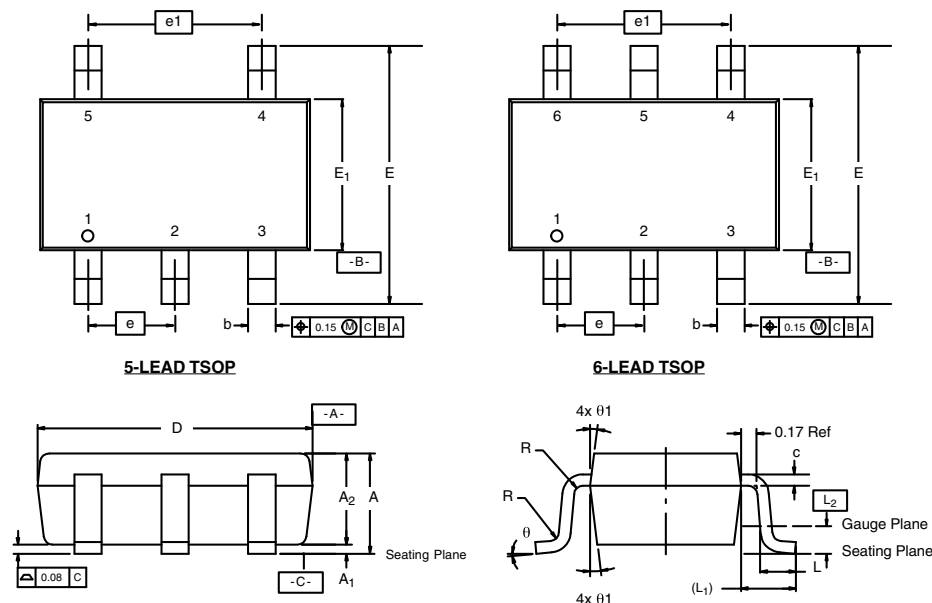


Figure 5. Source/Drain Capacitances

TSOP: 5/6-LEAD
JEDEC Part Number: MO-193C

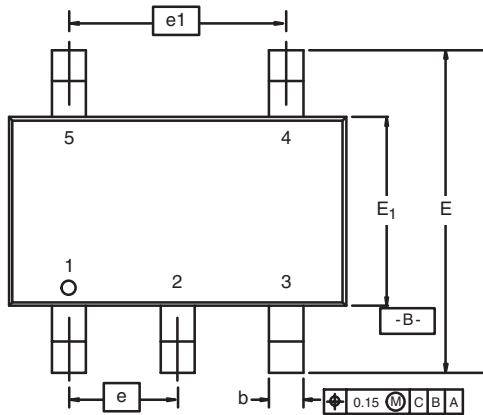


DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.91	-	1.10	0.036	-	0.043
A ₁	0.01	-	0.10	0.0004	-	0.004
A ₂	0.90	-	1.00	0.035	0.038	0.039
b	0.30	0.32	0.45	0.012	0.013	0.018
c	0.10	0.15	0.20	0.004	0.006	0.008
D	2.95	3.05	3.10	0.116	0.120	0.122
E	2.70	2.85	2.98	0.106	0.112	0.117
E ₁	1.55	1.65	1.70	0.061	0.065	0.067
e	0.95 BSC			0.0374 BSC		
e ₁	1.80	1.90	2.00	0.071	0.075	0.079
L	0.32	-	0.50	0.012	-	0.020
L ₁	0.60 Ref.			0.024 Ref.		
L ₂	0.25 BSC			0.010 BSC		
R	0.10	-	-	0.004	-	-
θ	0°	4°	8°	0°	4°	8°
θ ₁	7° Nom.			7° Nom.		

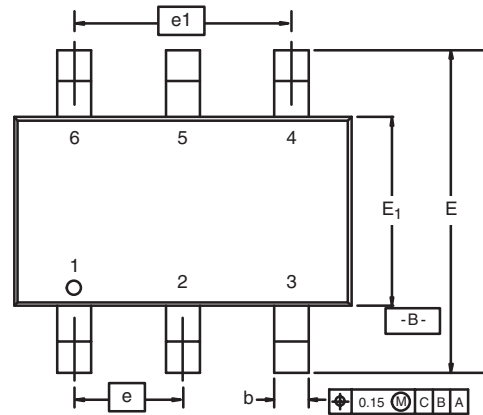
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TSOP: 5/6-LEAD

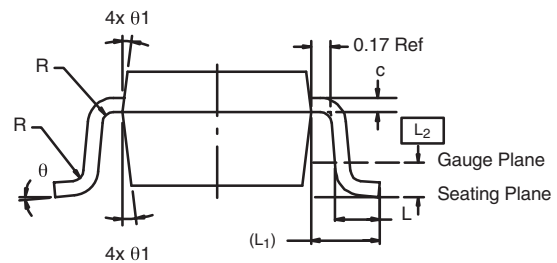
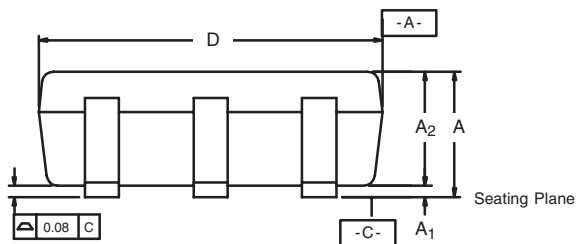
JEDEC Part Number: MO-193C



5-LEAD TSOP



6-LEAD TSOP



Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.91	-	1.10	0.036	-	0.043
A ₁	0.01	-	0.10	0.0004	-	0.004
A ₂	0.90	-	1.00	0.035	0.038	0.039
b	0.30	0.32	0.45	0.012	0.013	0.018
c	0.10	0.15	0.20	0.004	0.006	0.008
D	2.95	3.05	3.10	0.116	0.120	0.122
E	2.70	2.85	2.98	0.106	0.112	0.117
E ₁	1.55	1.65	1.70	0.061	0.065	0.067
e	0.95 BSC			0.0374 BSC		
e ₁	1.80	1.90	2.00	0.071	0.075	0.079
L	0.32	-	0.50	0.012	-	0.020
L ₁	0.60 Ref			0.024 Ref		
L ₂	0.25 BSC			0.010 BSC		
R	0.10	-	-	0.004	-	-
θ	0°	4°	8°	0°	4°	8°
θ ₁	7° Nom			7° Nom		
ECN: C-06593-Rev. I, 18-Dec-06						
DWG: 5540						



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