

Low Power, High Voltage SPST Analog Switches

DESCRIPTION

The DG447, DG448 are dual supply single-pole/single-throw (SPST) switches. On resistance is $25\ \Omega$ maximum and flatness is $2.2\ \Omega$ 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 DG447, DG448 are also ideally suited for portable and battery powered industrial and military equipment.

The DG447 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.

BENEFITS

- Wide dynamic range
- Low signal errors and distortion
- Break-before-make switching action
- Simple interfacing
- Reduced board space
- Improved reliability

FEATURES

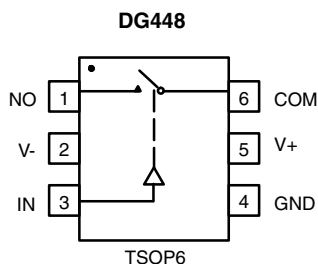
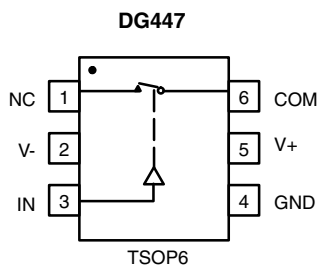
- ± 15 V analog signal range
- On-resistance - $R_{DS(on)}$: $25\ \Omega$ max.
- Fast switching action - t_{on} : 100 ns
- V_L logic supply not required
- TTL CMOS input compatible
- Rail to rail signal handling
- Dual or single supply operation
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

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

Note

- 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 °C, unless otherwise noted)			
PARAMETER			UNIT
V+	44		V
GND	25		
Digital inputs ^a , V _{NO/NC} , V _{COM}	(V-) - 2 to (V+) + 2 or 30 mA, whichever occurs first		
Continuous current (any terminal)	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 SPECIFIED V+ = 15 V, V- = -15 V, V _{IN} = 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	-	17	25	Ω
			Full	-	-	30	
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	-	0.8	2.2	Ω
			Full	-	-	3	
Switch off leakage current	I _{NO/NC(off)}	V+ = 16.5 V, V- = -16.5 V, V _{COM} = ± 15.5 V, V _{NO/NC} = -/+ 15.5 V	Room	-1	-0.1	1	nA
			Full	-10	-	10	
	Room		-1	-0.1	1		
	Full		-10	-	10		
Channel on leakage current	I _{COM(on)}	V+ = 16.5 V, V- = -16.5 V, V _{COM} = V _{NO/NC} = ± 15.5 V	Room	-1	-0.1	1	nA
			Full	-10	-	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 V 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	-	100	130	ns
			Full	-	-	140	
Turn-off time	t _{off}		Room	-	50	95	
			Full	-	-	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)}		Room	-	30	-	
Power Supplies							
Positive supply current	I+	V+ = 16.5 V, V- = -16.5 V, V _{IN} = 0 V or 5 V	Room	-	16	30	μA
			Full	-	-	50	
Negative supply current	I-		Room	-1	-0.02	-	
			Full	-10	-	-	



SPECIFICATIONS ^a							
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS SPECIFIED $V_+ = 12\text{ V}$, $V_- = 0\text{ V}$, $V_{IN} = 2.4\text{ V}$, 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}	$I_{NO/NC} = -10\text{ mA}$, $V_{COM} = 8\text{ V}$, $V_+ = 10.8\text{ V}$	Room	-	32	45	Ω
			Full	-	-	60	
On-resistance flatness	R_{ON} flatness	$I_{NO/NC} = 10\text{ mA}$, $V_{COM} = 2\text{ V}$, 6 V , 8 V $V_+ = 10.8\text{ V}$	Room	-	2	6	Ω
			Full	-	-	8	
Dynamic Characteristics							
Turn-on time	t_{on}	$V_{NO, NC} = \pm 10\text{ V}$, $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$	Room	-	140	175	ns
			Full	-	-	225	
Turn-off time	t_{off}		Room	-	50	120	
			Full	-	-	150	
Charge injection ^e	Q	$C_L = 10\text{ nF}$, $V_{gen} = 0\text{ V}$, $R_{gen} = 0\ \Omega$	Room	-	12	-	pC
Power Supplies							
Positive supply current	I+	$V_+ = 13.2\text{ V}$, $V_{IN} = 0\text{ V}$, 5 V	Room	-	22	50	μA
			Full	-	-	75	

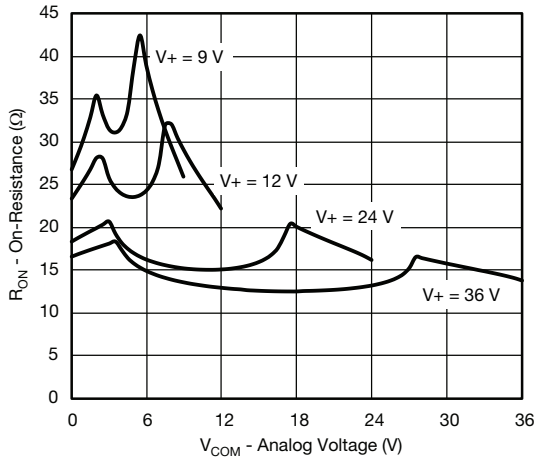
Notes

- Refer to PROCESS OPTION FLOWCHART
- Room = 25 °C, full = as determined by the operating temperature 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 datasheet
- Guaranteed by design, not subject to production test
- V_{IN} = input voltage to perform proper function

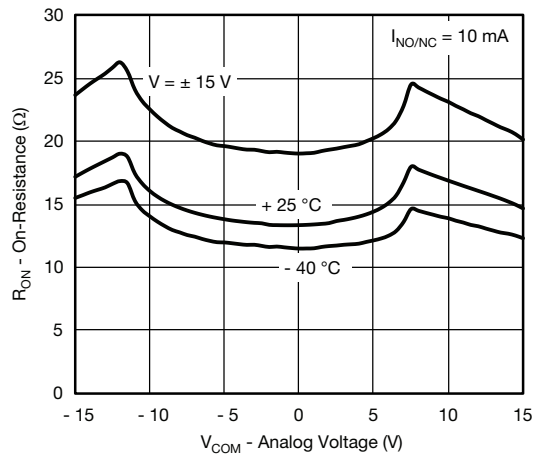
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



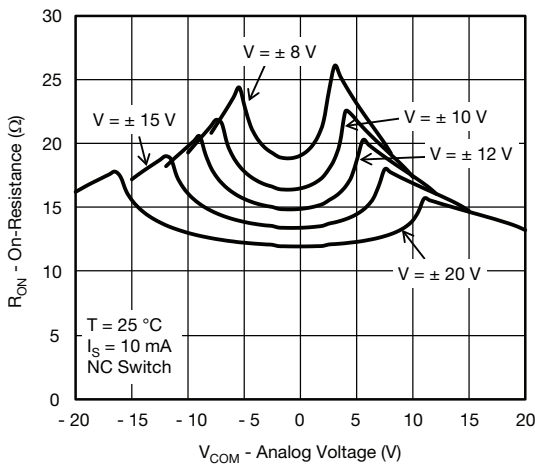
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



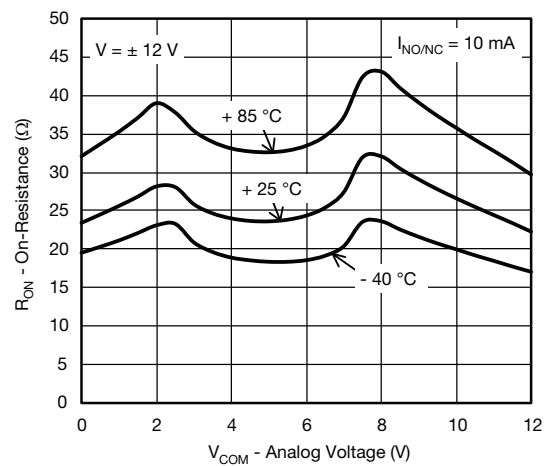
RON vs. VCOM and Single Supply Voltage



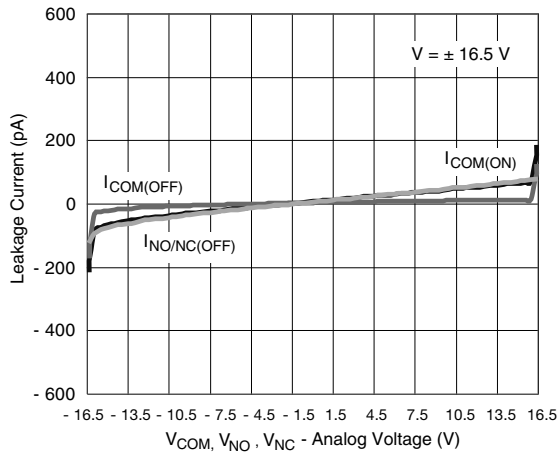
RON vs. Analog Voltage and Temperature



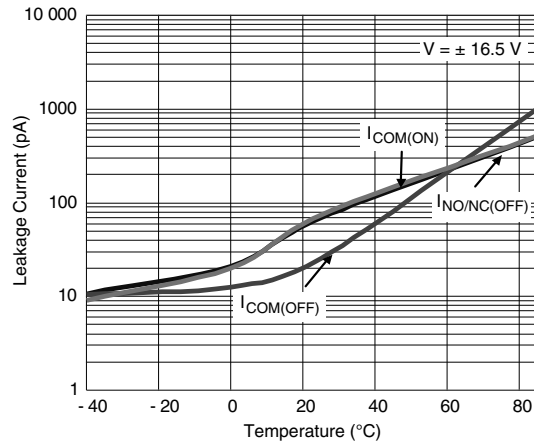
RON vs. VCOM and Dual Supply Voltage



RON vs. Analog Voltage and Temperature



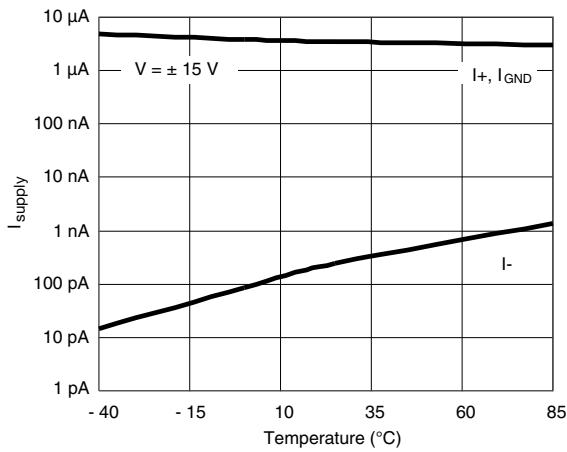
Leakage vs. Analog Voltage



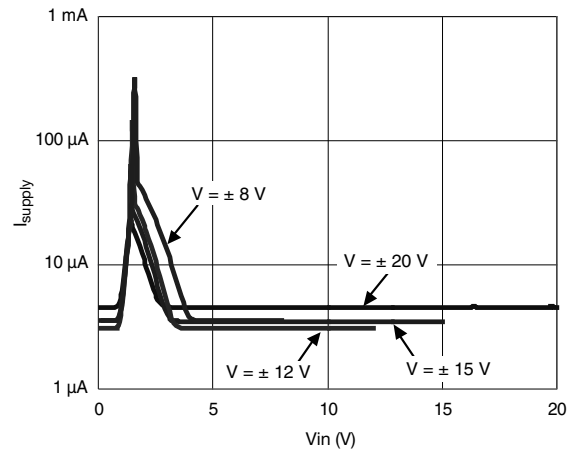
Leakage Current vs. Temperature



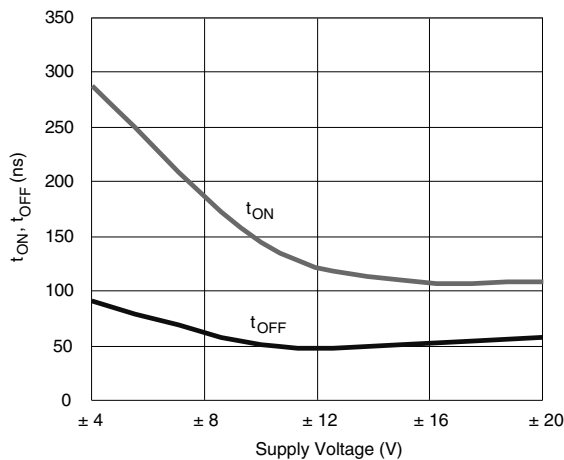
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



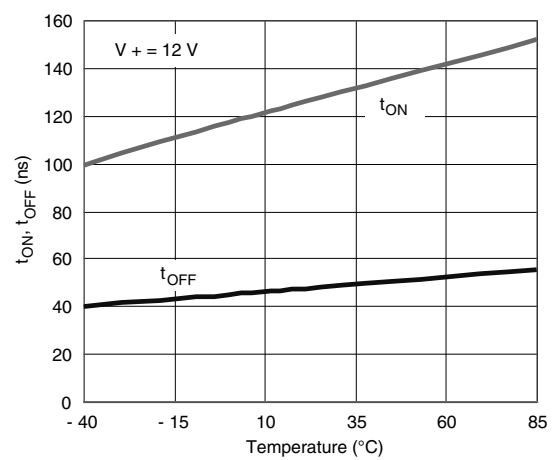
Supply Current vs. Temperature



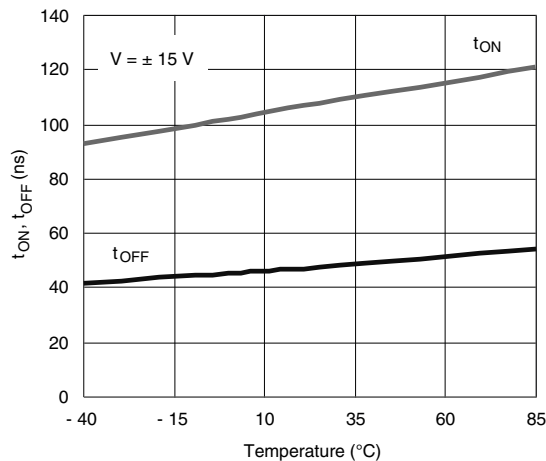
Supply Current vs. V_{IN}



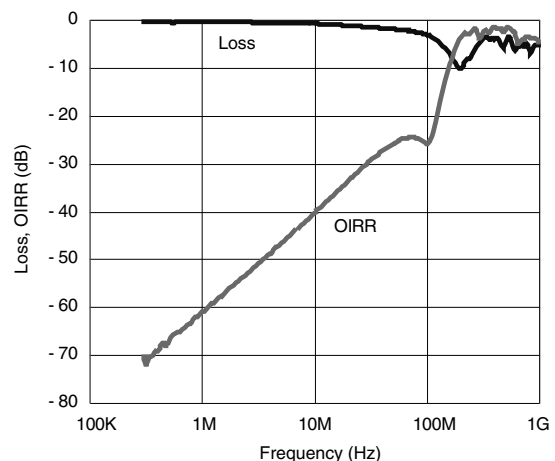
Switching Time vs. Supply Voltages



Switching Time vs. Temperature

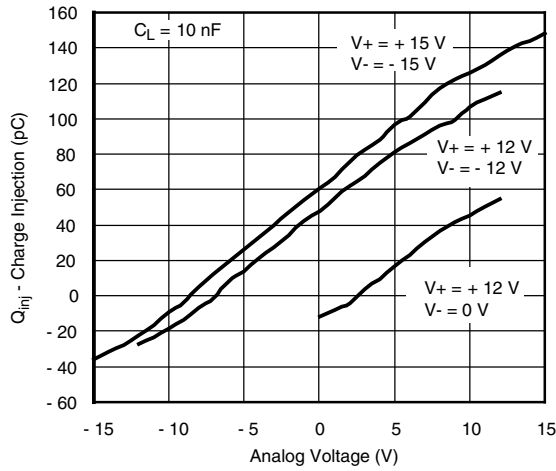


Switching Time vs. Temperature

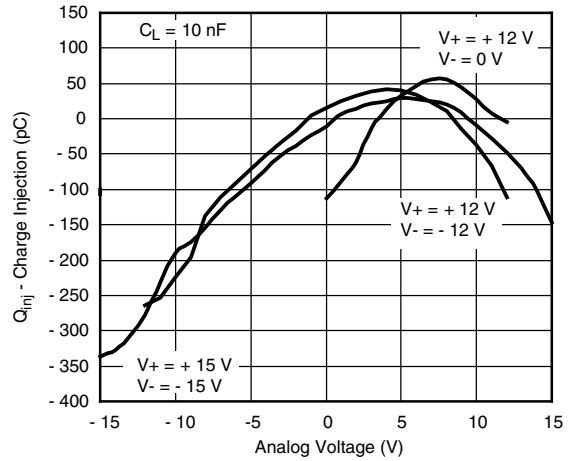


Off Isolation and Insertion Loss vs. Frequency

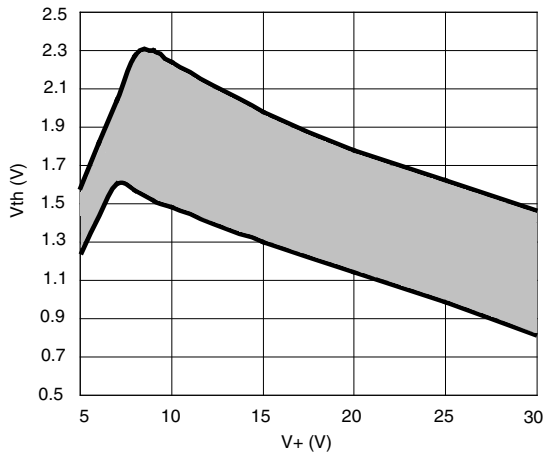
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



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



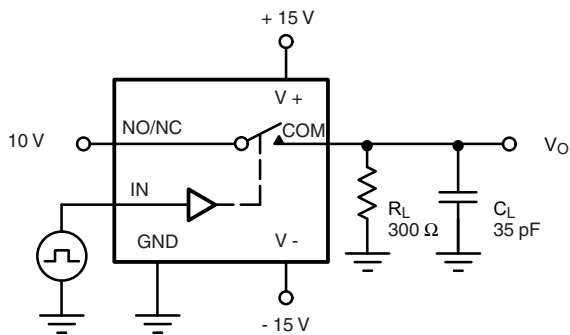
Charge Injection vs. Analog Voltage (Measured at NC or NO pin)



Input Switching Threshold vs. Supply Voltage

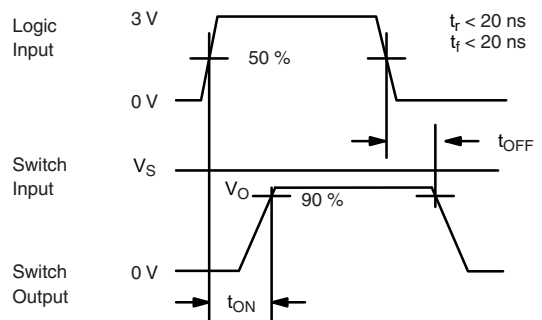
TEST CIRCUITS

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.

Fig. 1 - Switching Time

TEST CIRCUITS

V_O is the steady state output with the switch on.

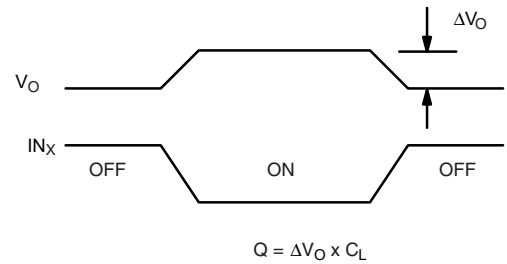
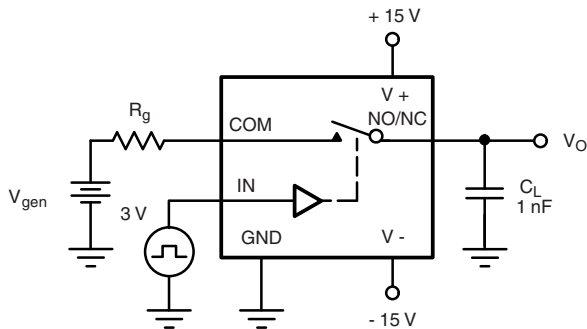


Fig. 2 - Charge Injection

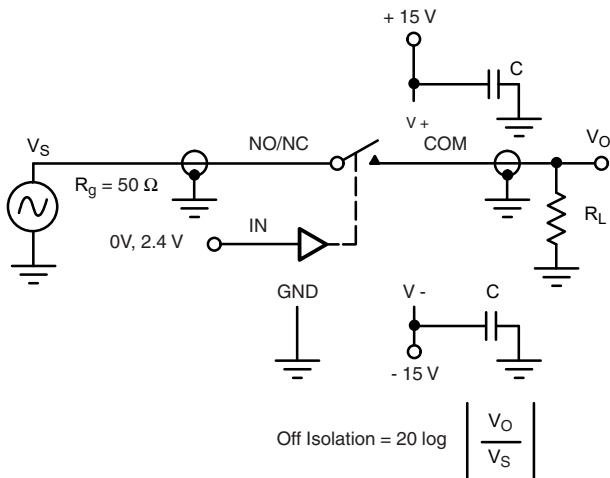


Fig. 3 - Off Isolation

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

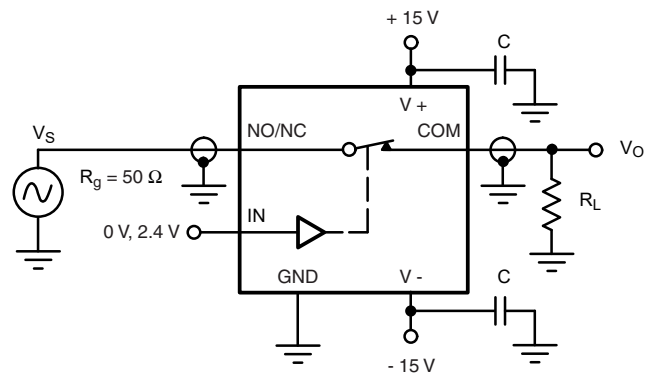


Fig. 4 - Insertion Loss

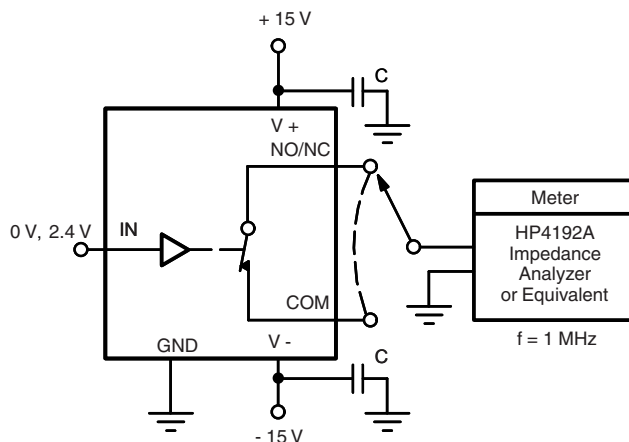


Fig. 5 - Source/Drain Capacitances

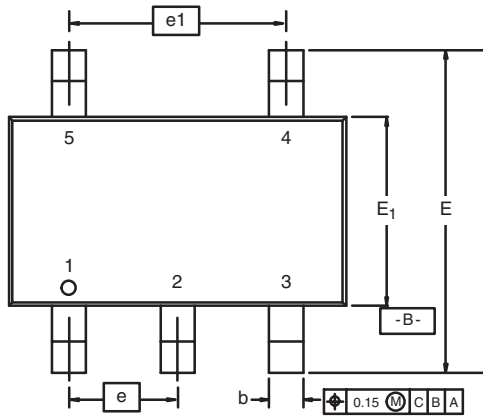


PRODUCT SUMMARY		
Part number	DG447	DG448
Status code	2	2
Configuration	SPST x 1, NO	SPST x 1, NO
Single supply min. (V)	7	7
Single supply max. (V)	36	36
Dual supply min. (V)	4.5	4.5
Dual supply max. (V)	22	22
On-resistance (Ω)	32	32
Charge injection (pC)	12	12
Source on capacitance (pF)	30	30
Source off capacitance (pF)	8	8
Leakage switch on typ. (nA)	0.1	0.1
Leakage switch off max. (nA)	1	1
-3 dB bandwidth (MHz)	-	-
Package	TSOP-6	TSOP-6
Functional circuit / applications	Multi purpose, instrumentation, medical and healthcare	Multi purpose, instrumentation, medical and healthcare
Interface	Parallel	Parallel
Single supply operation	Yes	Yes
Dual supply operation	Yes	Yes
Turn on time max. (ns)	130	130
Crosstalk and off isolation	-72	-72

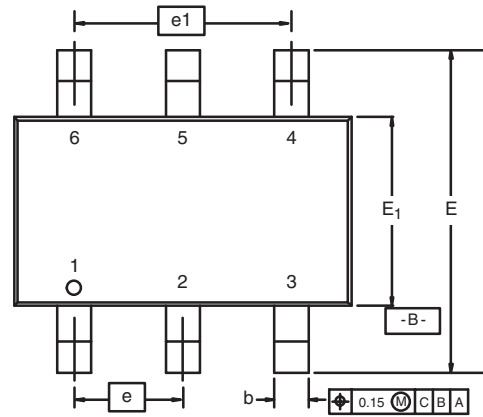
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TSOP: 5/6-LEAD

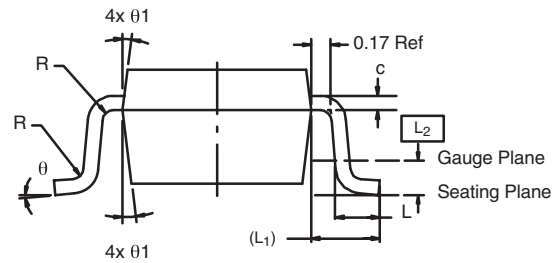
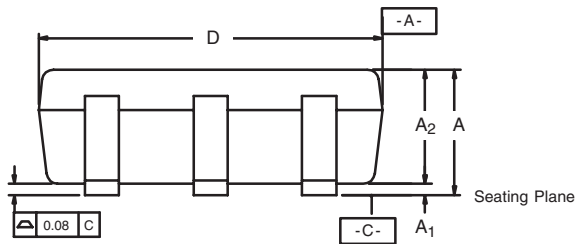
JEDEC Part Number: MO-193C



5-LEAD TSOP



6-LEAD TSOP



Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.91	-	1.10	0.036	-	0.043
A₁	0.01	-	0.10	0.0004	-	0.004
A₂	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
E₁	1.55	1.65	1.70	0.061	0.065	0.067
e	0.95 BSC			0.0374 BSC		
e₁	1.80	1.90	2.00	0.071	0.075	0.079
L	0.32	-	0.50	0.012	-	0.020
L₁	0.60 Ref			0.024 Ref		
L₂	0.25 BSC			0.010 BSC		
R	0.10	-	-	0.004	-	-
θ	0°	4°	8°	0°	4°	8°
θ₁	7° Nom			7° Nom		
ECN: C-06593-Rev. I, 18-Dec-06						
DWG: 5540						



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