

Low Voltage, 1 Ω Single SPDT Analog Switch (1:2 Multiplexer) with Power Down Protection

DESCRIPTION

The DG4157 is a high performance single pole double throw analog switch designed for 1.65 V to 5.5 V operation with single power rail.

Fabricated with high density CMOS technology, the device achieves low on resistance as 1 Ω at 4.5 V power supply and fast switching speed. The - 3 dB bandwidth is typically 117 MHz.

The DG4157 features break before make switch performance, and guarantees logic high control input threshold as low as 1.4 V over the range up to 5.5 V.

It can handle both analog and digital signals and permits signals with amplitudes of up to V_{CC} to be transmitted in either direction.

Power down protection circuit is built in to prevent abnormal current path through signal pins during power down condition.

Each output pin (A, B₀, or B₁) can withstand greater than 8 kV (human body model).

It is available in both SC-70-6 and miniQFN6 packages.

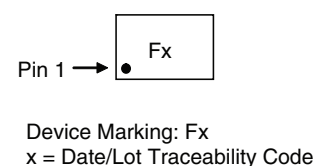
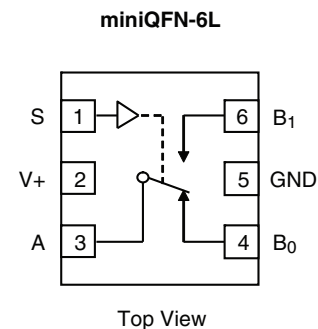
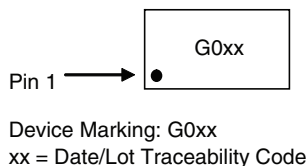
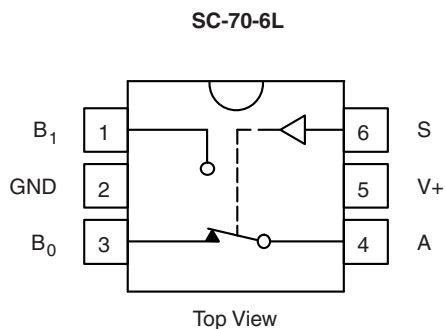
The features make it an ideal part for the switching of audio, video, and data stream.

FEATURES

- Direct cross of industry standard xxx4157
- 1.65 V to 5.5 V operation voltage range
- Guaranteed 1.4 V logic high input threshold at $V_{CC} = 5.5$ V
- 117 MHz, - 3 dB bandwidth
- Low on-resistance
- Power down protection
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



TRUTH TABLE	
LOGIC INPUT (S)	FUNCTION
0	B ₀ Connected to A
1	B ₁ Connected to A

ORDERING INFORMATION		
TEMP. RANGE	PACKAGE	PART NUMBER
-40 °C to +85 °C	SC-70-6L	DG4157DL-T1-E3
	miniQFN-6L	DG4157DN-T1-E4



ABSOLUTE MAXIMUM RATINGS			
PARAMETER		LIMIT	UNIT
Reference V+ to GND		-0.3 to +6	V
S, A, B ^a		-0.3 to (V+ + 0.3)	
Continuous Current (Any terminal)		± 200	mA
Peak Current (Pulsed at 1 ms, 10 % duty cycle)		± 400	
Storage Temperature	D Suffix	-65 to +150	°C
Power Dissipation (Packages) ^b	SC-70-6L ^c	250	mW
	miniQFN-6L ^d	160	

Notes

- a. Signals on A, or B or S 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.
- d. Derate 2 mW/°C above 70 °C.

SPECIFICATIONS							
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 3 V, V _{IN} = 0 V or V+ ^e	TEMP. ^a	LIMITS -40 °C to +85 °C			UNIT
				MIN. ^b	TYP. ^c	MAX. ^b	
DC Characteristics							
On Resistance	R _{ON}	V+ = 2.7 V, B ₀ or B ₁ = 1.5 V, I _O = 100 mA	Room	-	1.7	2.5	Ω
			Full	-	-	3	
		V+ = 4.5 V, B ₀ or B ₁ = 3.5 V, I _O = 100 mA	Room	-	0.95	1.2	
			Full	-	-	1.4	
On Resistance Flatness	R _{FLATNESS}	V+ = 2.7 V, B ₀ or B ₁ = 0.75 V, 1.5 V, I _O = 100 mA	Room	-	0.2	-	
			Full	-	-	0.4	
		V+ = 4.5 V, B ₀ or B ₁ = 1 V, 3.5 V, I _O = 100 mA	Room	-	0.14	0.3	
On Resistance Match	ΔR _{ON}	V+ = 2.7 V, B ₀ or B ₁ = 1.5 V, I _O = 100 mA	Room	-	0.04	-	
			Full	-	-	0.15	
		V+ = 4.5 V, B ₀ or B ₁ = 3.5 V, I _O = 100 mA	Room	-	0.05	0.12	
			Full	-	-	0.15	
Switch Off Leakage Current	I _{OFF}	V+ = 5.5 V, A = 1 V, 4.5 V B ₀ or B ₁ = 4.5 V, 1 V or floating	Room	-2	-	2	nA
Switch On Leakage Current	I _{ON}		Full	-20	-	20	
			Room	-4	-	4	
			Full	-40	-	40	
Digital Control							
Input, High Voltage	V _{INH}	V+ = 2.7 V to 5.5 V	Full	1.4	-	-	V
Input, Low Voltage	V _{INL}		Full	-	-	0.4	
Input Current	I _{INH} , I _{INL}	V _{IN} = 0 or V+	Full	-1	-	1	μA
Power Supply							
Power Supply Range	V+		Full	1.65	-	5.5	V
Quiescent Supply Current	I+	V+ = 5.5 V, V _{IN} = 0 V, 5.5 V	Room	-	0.05	0.5	μA
			Full	-	-	1	



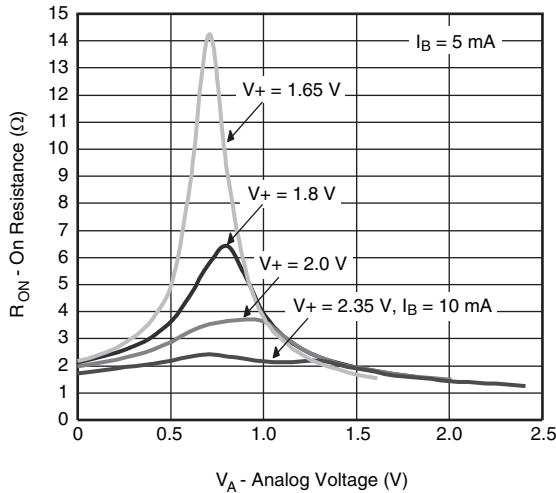
SPECIFICATIONS							
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED $V_+ = 3\text{ V}$, $V_{IN} = 0\text{ V}$ or V_+^e	TEMP. ^a	LIMITS -40 °C to +85 °C			UNIT
				MIN. ^b	TYP. ^c	MAX. ^b	
AC Characteristics							
Turn-On Time ^d	t_{ON}	$V_+ = 2.7\text{ V}$, B_0 or $B_1 = 1.5\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$	Room	-	40	55	ns
			Full	-	-	60	
		$V_+ = 4.5\text{ V}$, B_0 or $B_1 = 1.5\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$	Room	-	22	37	
			Full	-	-	40	
Turn-Off Time ^d	t_{OFF}	$V_+ = 2.7\text{ V}$, B_0 or $B_1 = 1.5\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$	Room	-	12	27	
			Full	-	-	30	
		$V_+ = 4.5\text{ V}$, B_0 or $B_1 = 1.5\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$	Room	-	8	23	
			Full	-	-	25	
Break-Before-Make Time ^d	t_{BBM}	$V_+ = 2.7\text{ V}$, $B_0 = B_1 = 1.5\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$	Room	1	26	-	
				1	15	-	
Charge Injection ^d	Q	$C_L = 1\text{ nF}$, $R_{GEN} = 0\ \Omega$, $V_{GEN} = 0\text{ V}$	Room	-	50	-	pC
Off Isolation ^d	OIRR	$R_L = 50\ \Omega$, $f = 1\text{ MHz}$	Room	-	-58	-	dB
		$R_L = 50\ \Omega$, $f = 10\text{ MHz}$		-	-31	-	
Crosstalk ^d	X_{TALK}	$R_L = 50\ \Omega$, $C_L = 5\text{ pF}$, $f = 1\text{ MHz}$	Room	-	-63	-	
		$R_L = 50\ \Omega$, $C_L = 5\text{ pF}$, $f = 10\text{ MHz}$		-	-36	-	
Bandwidth ^d	BW	$R_L = 50\ \Omega$	Room	-	117	-	MHz
Total Harmonic Distortion ^d	THD	$R_L = 600\ \Omega$, $V_{IN} = 0.5\text{ V}$, $f = 20\text{ kHz}$ to 20 kHz	Room	-	0.02	-	%
Capacitance							
BX Port Off Capacitance ^d	$C_{B(OFF)}$	$R_L = 50\ \Omega$, $C_L = 5\text{ pF}$, $f = 1\text{ MHz}$	Room	-	20	-	pF
A Port On Capacitance ^d	$C_{A(ON)}$		Room	-	57	-	
Control Pin Capacitance ^d	C_{IN}		Room	-	5	-	

Notes

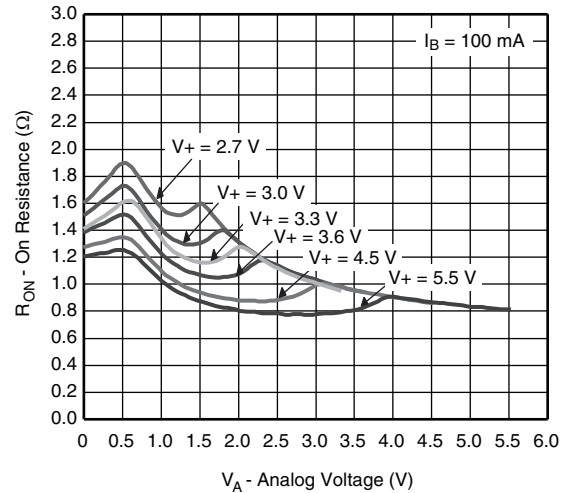
- a. Room = 25 °C, Full = as determined by the operating suffix.
- b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- c. Typical values are for design aid only, not guaranteed nor subject to production testing.
- d.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

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.

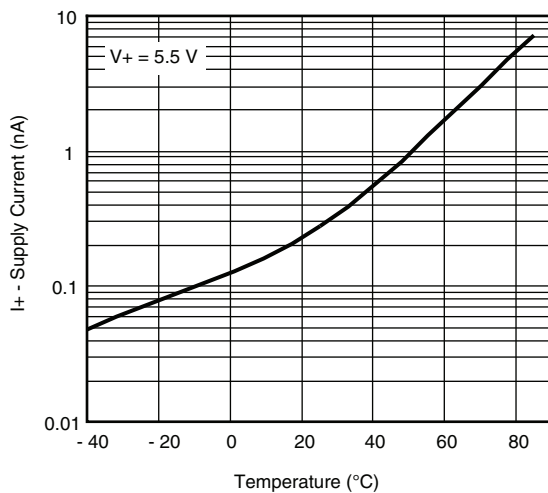
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



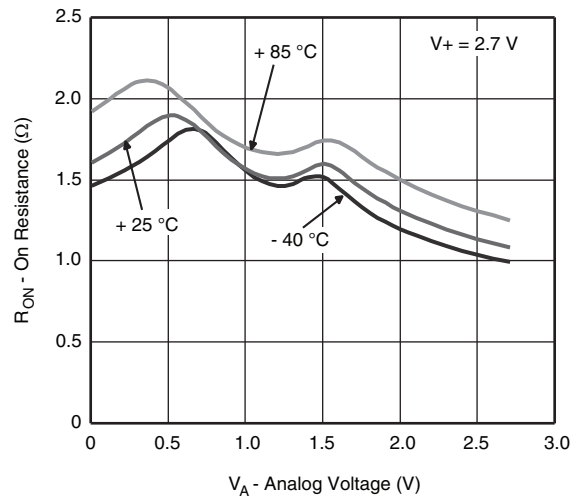
RON vs. VA and Supply Voltage



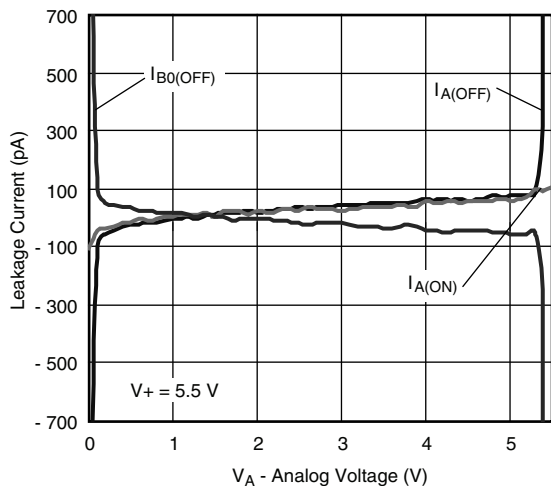
RON vs. VA and Supply Voltage



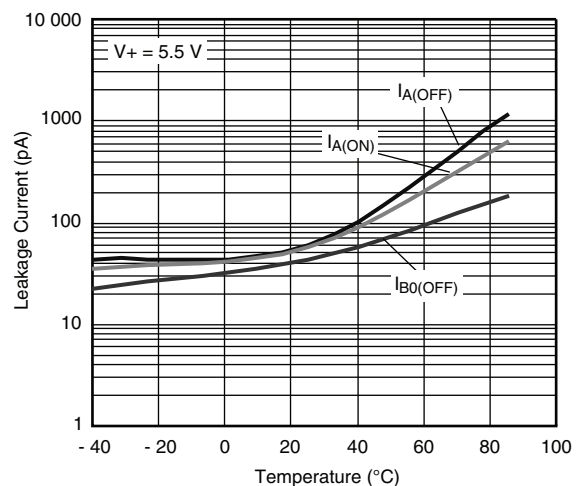
Supply Current vs. Temperature



RON vs. VD and Temperature

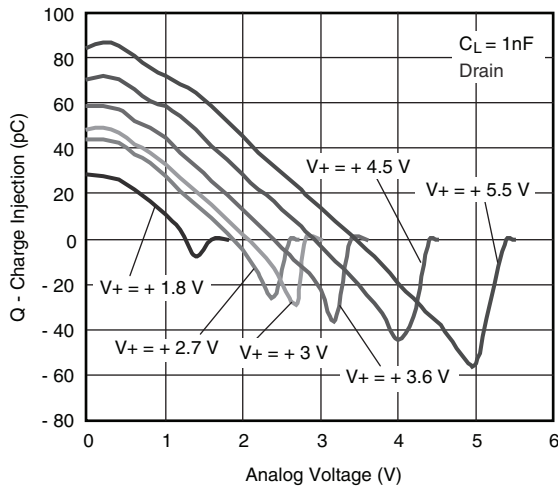


Leakage vs. Analog Voltage

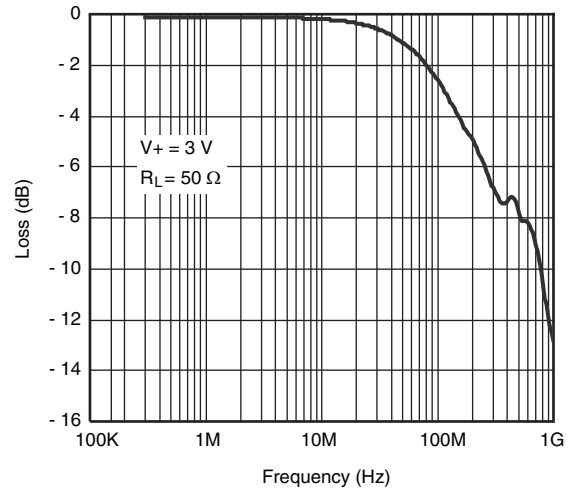


Leakage Current vs. Temperature

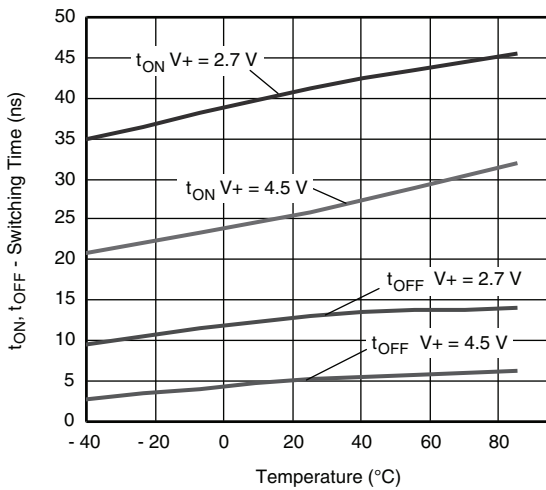
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



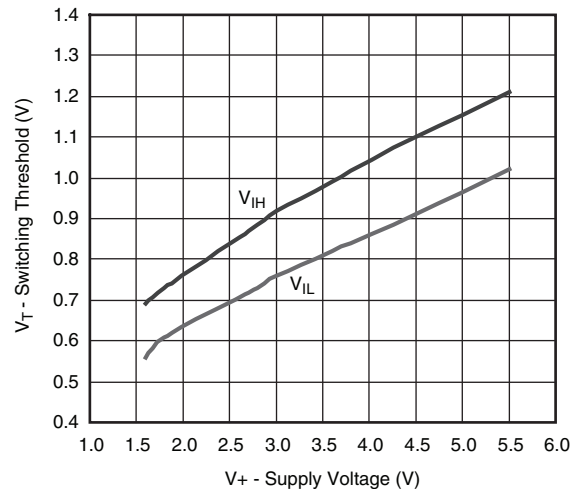
Charge Injection vs. Analog Voltage



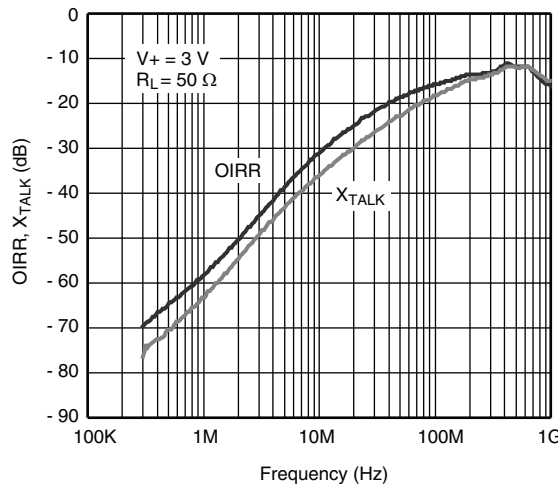
Insertion Loss vs. Frequency



Switching Time vs. Temperature

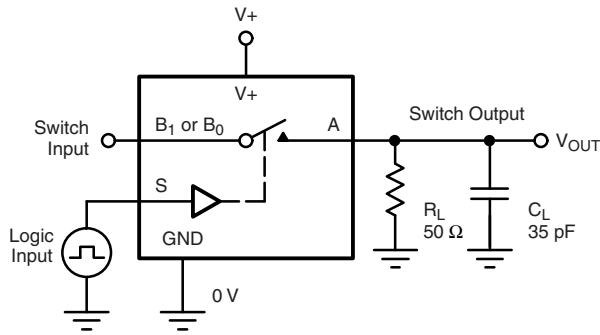


Switching Threshold vs. Supply Voltage



Off-Isolation and Crosstalk vs. Frequency

TEST CIRCUITS



C_L (includes fixture and stray capacitance)

$$V_{OUT} = V_A \left(\frac{R_L}{R_L + R_{ON}} \right)$$

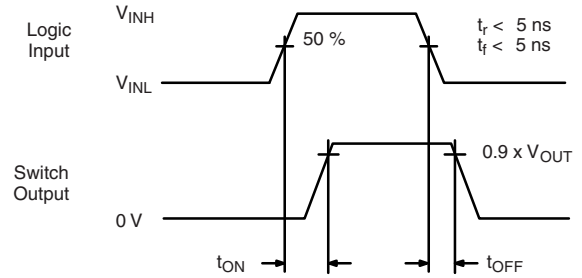
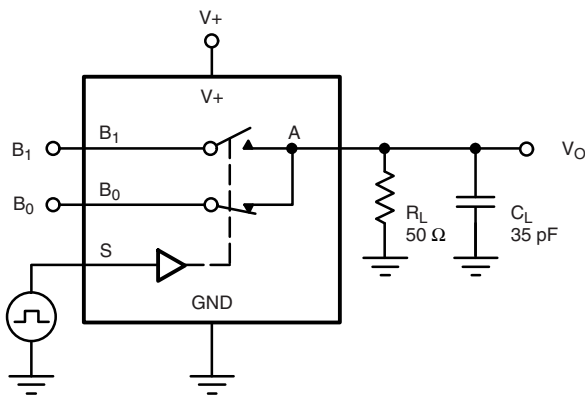


Fig. 1 - Switching Time



C_L (includes fixture and stray capacitance)

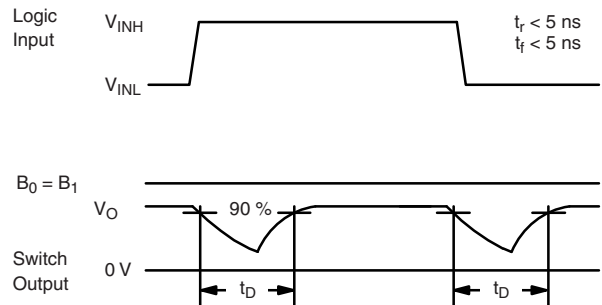
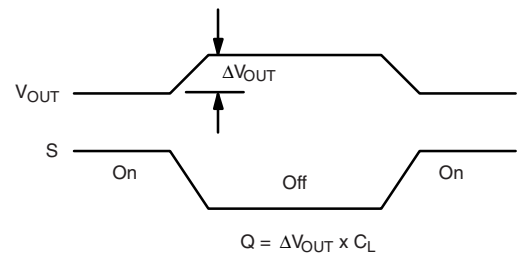
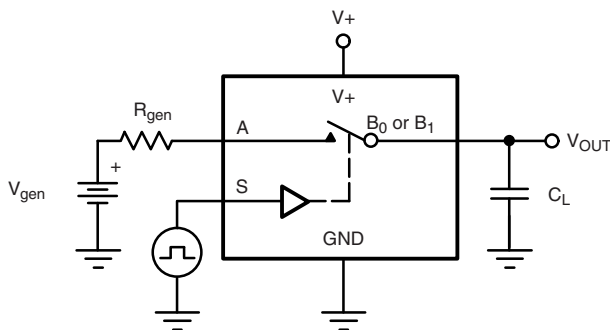
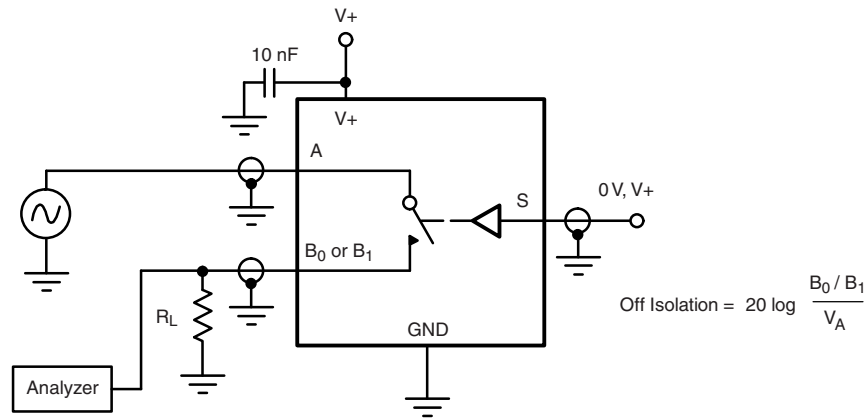
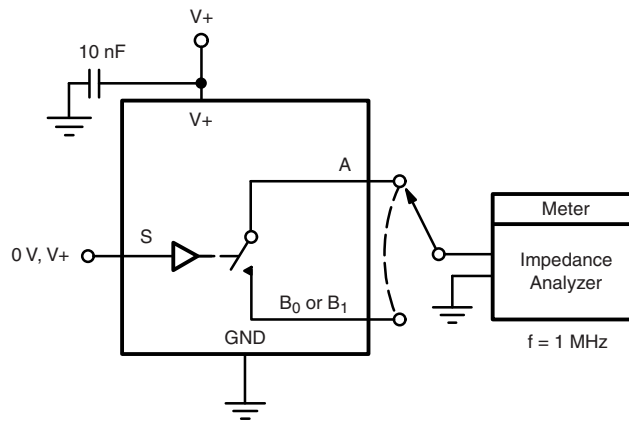


Fig. 2 - Break-Before-Make Interval



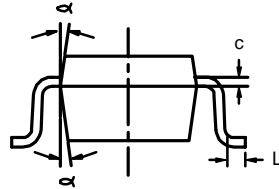
S depends on switch configuration: input polarity determined by sense of switch.

Fig. 3 - Charge Injection

TEST CIRCUITS

Fig. 4 - Off-Isolation

Fig. 5 - Channel Off/On Capacitance

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?68800.

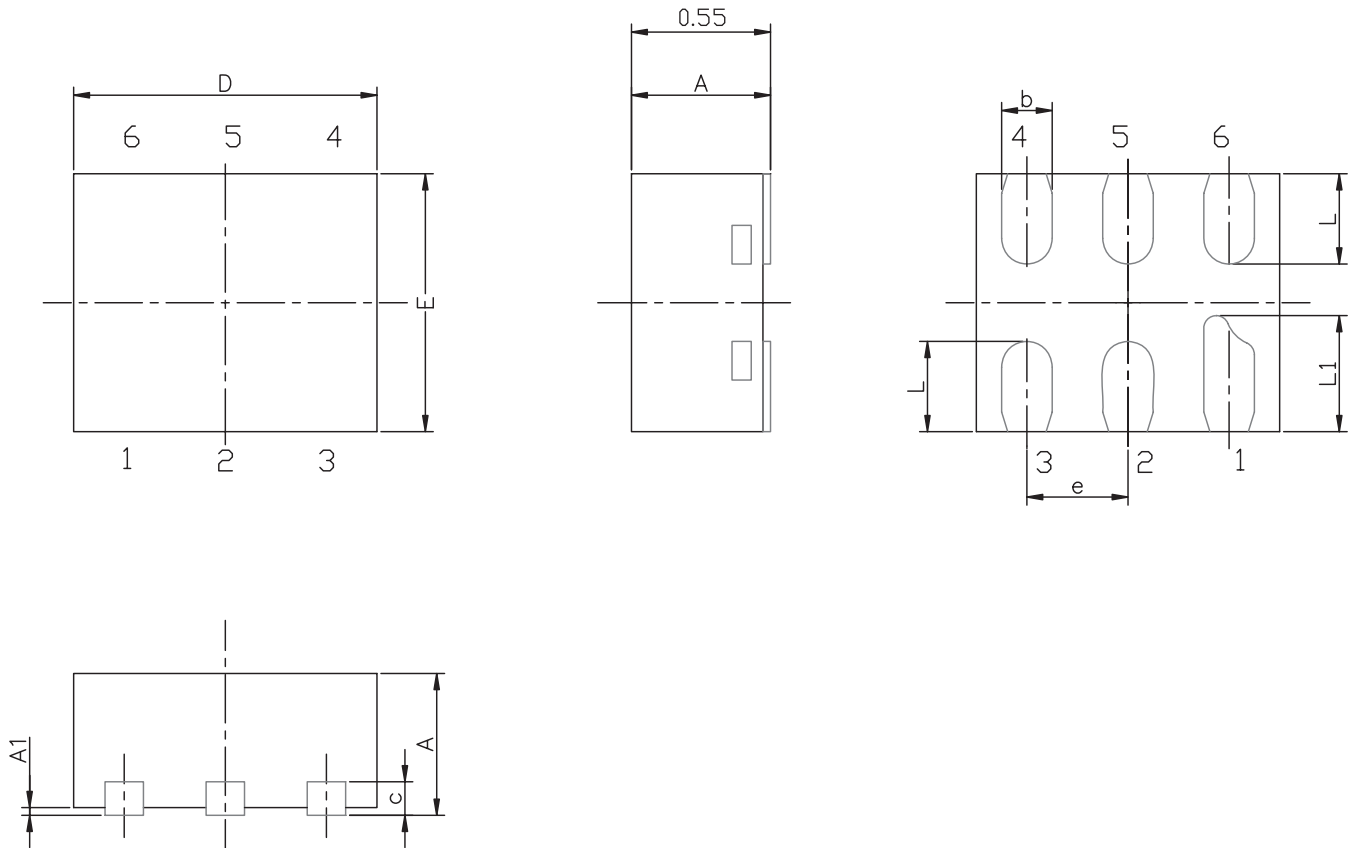
SC-70: 6-LEADS



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

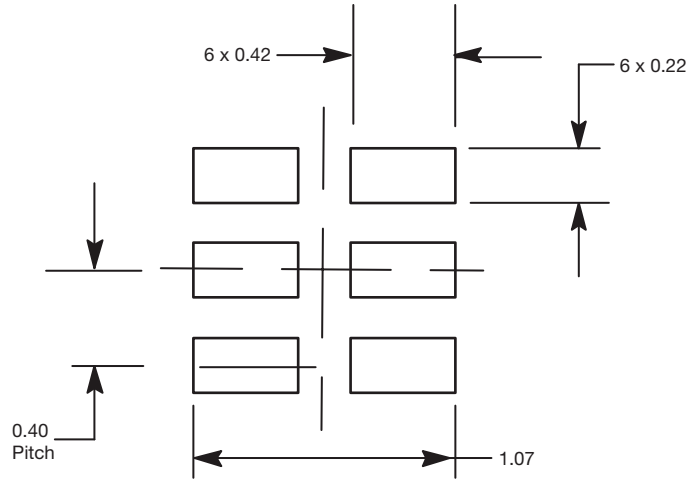
MINI QFN-6L CASE OUTLINE



DIM	MILLIMETERS			INCHES		
	MIN.	NAM.	MAX.	MIN.	NAM.	MAX.
A	0.50	0.55	0.60	0.0197	0.0217	0.0236
A1	0.00	-	0.05	0.000	-	0.002
b	0.15	0.20	0.25	0.006	0.008	0.010
c	0.15 REF			0.006 REF		
D	1.15	1.20	1.25	0.045	0.047	0.049
E	0.95	1.00	1.05	0.037	0.039	0.041
e	0.40 BSC			0.016 BSC		
L	0.30	0.35	0.40	0.012	0.014	0.016
L1	0.40	0.45	0.50	0.016	0.018	0.020

ECN T-07039-Rev. A, 12-Feb-07
 DWG: 5958

RECOMMENDED MINIMUM PADS FOR MINI QFN 6L



Mounting Footprint
Dimensions in mm



Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.