

# **Powered-off Protection, High Speed, 1.65 V to 5.5 V, SPDT Analog Switch (2:1 Multiplexer / Demultiplexer Bus Switch)**

## **DESCRIPTION**

The DG3157E is a high speed single-pole double-throw analog switch designed for +1.65 V to +5.5 V single power rail operation.

Fabricated with high density CMOS technology, the DG3157E achieves low on-resistance, fast switching speed, and high bandwidth while maintains low power consumption.

The DG3157E can handle both analog and digital signals and permits signals with amplitudes of up to  $V_+$  to be transmitted in either direction.

When the select pin is low,  $B_0$  is connected to the output A pin. When the select pin is high,  $B_1$  is connected to the output A pin. The path that is open will have a high impedance state with respect to the output. Break before make switching performance is guaranteed.

A powered-off protection circuit is built into the switch to prevent an abnormal current flow from COM pin to  $V_+$  during the power-down condition. Each output pin can withstand greater than 7 kV (human body model).

Operation temperature is specified from -40 °C to +85 °C. The DG3157E is available in the compact SC-70-6L package.

## **FEATURES**

- Direct cross to industry standard SN74LVC1G3157, NC7SB3157, NLASB3157, PI5A3157, and STG3157
- Low switch on-resistance (6  $\Omega$ )
- +1.65 V to +5.5 V single supply operation
- Powered-off protection
- Control logic inputs can go over  $V_+$  up to 5.5 V
- Low parasitic capacitance, 7 pF at switch off
- Break before make switching
- Latch-up performance exceeds 200 mA per JESD 78
- High ESD rating
  - 7000 V human body model (JS-001)
  - 1000 V charge device model (JS-002)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

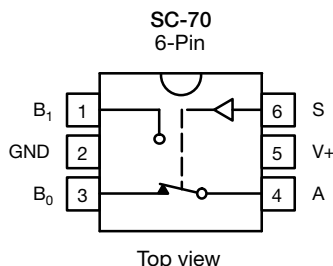


**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

## **APPLICATIONS**

- Battery powered devices
- Consumer and computing
- Instrumentation
- Medical equipment
- Control and automation

## **FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION**



Device marking: H0

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-70-6	DG3157EDL-T1-GE3 (halogen-free)

**ABSOLUTE MAXIMUM RATINGS**

PARAMETER		LIMIT	UNIT
V+, A, B <sub>0</sub> , B <sub>1</sub> , S reference to GND		-0.3 to 6	V
Continuous current (any terminal)		± 50	mA
Peak current (pulsed at 1 ms, 10 % duty cycle)		± 200	
Storage temperature	D suffix	-65 to +150	°C
Power dissipation (packages) <sup>a</sup>	6-pin SC-70 <sup>b</sup>	250	mW
ESD / HBM	JS-001	7000	V
ESD / CDM	JS-002	1000	
Latch up	Per JESD78 with 1.5 x V <sub>abs</sub> max. clamp	200	mA

**Notes**

a. All leads welded or soldered to PC board

b. 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**

PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V <sub>S</sub> = 0.25 V+ or 0.75 V+, V+ = 1.65 V to 1.95 V <sup>e</sup> V <sub>S</sub> = 0.2 V+ or 0.65 V+, V+ = 2.3 V to 5.5 V <sup>e</sup>	TEMP. <sup>a</sup>	LIMITS -40 °C to +85 °C			UNIT	
				MIN. <sup>b</sup>	TYP. <sup>c</sup>	MAX. <sup>b</sup>		
DC Characteristics								
High level input voltage	V <sub>SH</sub>	V+ = 1.65 V to 1.95 V	Full	0.75 V+	-	-	V	
		V+ = 2.3 V to 5.5 V	Full	0.65 V+	-	-		
Low level input voltage	V <sub>SL</sub>	V+ = 1.65 V to 1.95 V	Full	-	-	0.25 V+	V	
		V+ = 2.3 V to 5.5 V	Full	-	-	0.2 V+		
On resistance	R <sub>ON</sub>	V+ = 4.5 V	V <sub>BN</sub> = 0 V, I <sub>A</sub> = 30 mA	Full	-	8	11	Ω
			V <sub>BN</sub> = 2.3 V, I <sub>A</sub> = -30 mA	Full	-	6	9	
			V <sub>BN</sub> = 4.5 V, I <sub>A</sub> = -30 mA	Full	-	7	9	
		V+ = 3 V	V <sub>BN</sub> = 0 V, I <sub>A</sub> = 24 mA	Full	-	10	14	
			V <sub>BN</sub> = 3 V, I <sub>A</sub> = -24 mA	Full	-	9	12	
		V+ = 2.3 V	V <sub>BN</sub> = 0 V, I <sub>A</sub> = 8 mA	Full	-	13	18	
			V <sub>BN</sub> = 2.3 V, I <sub>A</sub> = -8 mA	Full	-	12	16	
		V+ = 1.65 V	V <sub>BN</sub> = 0 V, I <sub>A</sub> = 4 mA	Full	-	20	26	
			V <sub>BN</sub> = 1.65 V, I <sub>A</sub> = -4 mA	Full	-	18	23	
		On resistance flatness	R <sub>FLAT</sub>	0 < V <sub>BN</sub> < V+	V+ = 4.5 V, I <sub>A</sub> = -30 mA	Room	-	
V+ = 3 V, I <sub>A</sub> = -24 mA	Room				-	4	-	
V+ = 2.3 V, I <sub>A</sub> = -8 mA	Room				-	10	-	
V+ = 1.65 V, I <sub>A</sub> = -4 mA	Room				-	58	-	
On resistance matching between channels	ΔR <sub>ON</sub>				V+ = 4.5 V, V <sub>BN</sub> = 3.15 V, I <sub>A</sub> = -30 mA	Room	-	0.09
		V+ = 3 V, V <sub>BN</sub> = 2.1 V, I <sub>A</sub> = -24 mA	Room	-	0.13	-		
		V+ = 2.3 V, V <sub>BN</sub> = 1.6 V, I <sub>A</sub> = -8 mA	Room	-	0.15	-		
		V+ = 1.65 V, V <sub>BN</sub> = 1.15 V, I <sub>A</sub> = -4 mA	Room	-	0.16	-		
Input leakage current	I <sub>S</sub>	V+ = 5.5 V, V <sub>S</sub> = 5.5 V	Room	-0.1	-	0.1	μA	
			Full	-1	-	1		
Off stage switch leakage	I <sub>BN(off)</sub>	V+ = 5.5 V, V <sub>A</sub> = 1 V / 4.5 V, V <sub>B</sub> = 4.5 V / 1 V	Room	-0.1	-	0.1		
			Full	-1	-	1		
On state switch leakage	I <sub>BN(on)</sub>	V+ = 5.5 V, V <sub>A</sub> = V <sub>B</sub> = 1 V or 4.5 V	Room	-0.1	-	0.1		
			Full	-1	-	1		
Power down leakage	I <sub>PD</sub>	V+ = 0 V, V <sub>A</sub> = 5 V, B <sub>0</sub> , B <sub>1</sub> open, V <sub>S</sub> = GND	Full	-	-	5		
		V+ = 0 V, V <sub>B0</sub> , V <sub>B1</sub> = 5 V, A open, V <sub>S</sub> = GND	Full	-	-	5		
Power Supply								
Power supply range	V+		Full	1.65	-	5.5	V	
Quiescent supply current	I+	V+ = 5.5 V, V <sub>S</sub> = V+ or GND	Room	-	-	1	μA	
			Full	-	-	5		

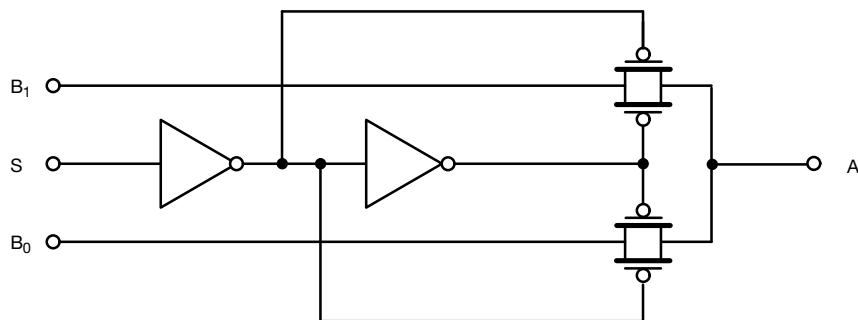
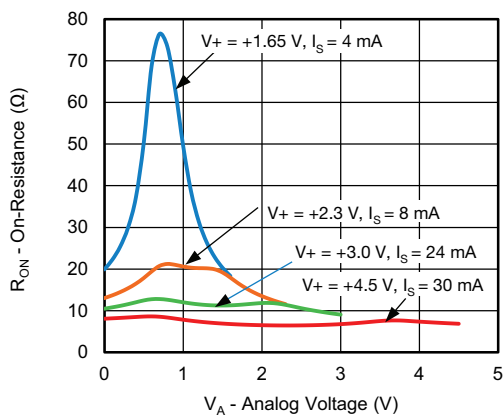
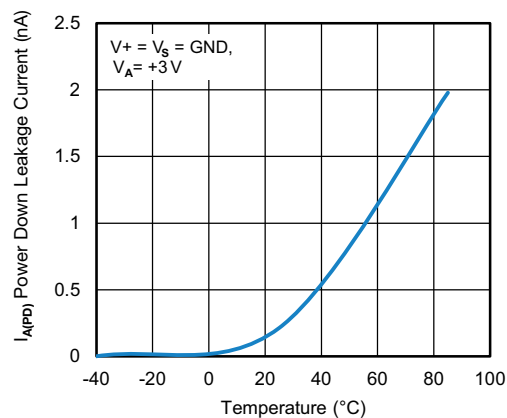
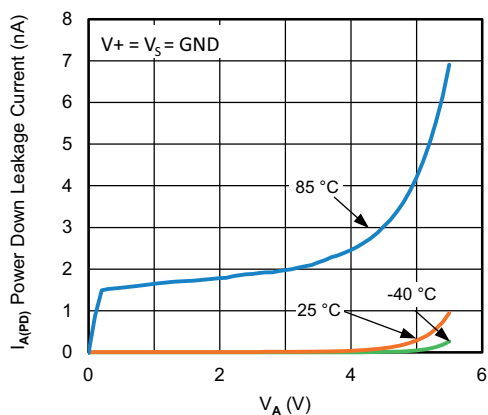


## SPECIFICATIONS

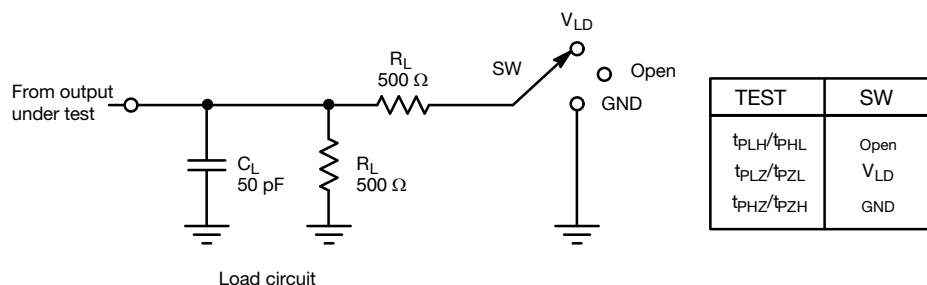
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED $V_S = 0.25\text{ V}+$ or $0.75\text{ V}+$ , $V+ = 1.65\text{ V}$ to $1.95\text{ V}^e$ $V_S = 0.2\text{ V}+$ or $0.65\text{ V}+$ , $V+ = 2.3\text{ V}$ to $5.5\text{ V}^e$	TEMP. <sup>a</sup>	LIMITS -40 °C to +85 °C			UNIT
				MIN. <sup>b</sup>	TYP. <sup>c</sup>	MAX. <sup>b</sup>	
AC Electrical Characteristics <sup>e</sup>							
Prop delay time <sup>f</sup>	$t_{PHL}/t_{PLH}$	$V_A = 0\text{ V}$ , see Fig. 3	$V+ = 1.65\text{ V}$ to $1.95\text{ V}$	Full	-	4	ns
			$V+ = 2.3\text{ V}$ to $2.7\text{ V}$	Full	-	3	
			$V+ = 3\text{ V}$ to $3.6\text{ V}$	Full	-	2	
			$V+ = 4.5\text{ V}$ to $5.5\text{ V}$	Full	-	2	
Output enable time <sup>f</sup>	$t_{PZL}/t_{PZH}$	$V_{LOAD} = 2 \times V+$ for $t_{PZL}$ , $V_{LOAD} = 0\text{ V}$ for $t_{PZH}$ , see Fig. 4	$V+ = 1.65\text{ V}$ to $1.95\text{ V}$	Room	-	32	
				Full	-	34	
			$V+ = 2.3\text{ V}$ to $2.7\text{ V}$	Room	-	22	
				Full	-	23	
			$V+ = 3\text{ V}$ to $3.6\text{ V}$	Room	-	19	
				Full	-	20	
			$V+ = 4.5\text{ V}$ to $5.5\text{ V}$	Room	-	16	
				Full	-	16	
Output disable time <sup>f</sup>	$t_{PLZ}/t_{PHZ}$	$V_{LOAD} = 2 \times V+$ for $t_{PLZ}$ , $V_{LOAD} = 0\text{ V}$ for $t_{PHZ}$ , see Fig. 4	$V+ = 1.65\text{ V}$ to $1.95\text{ V}$	Room	-	22	
				Full	-	23	
			$V+ = 2.3\text{ V}$ to $2.7\text{ V}$	Room	-	18	
				Full	-	19	
			$V+ = 3\text{ V}$ to $3.6\text{ V}$	Room	-	16	
				Full	-	16	
			$V+ = 4.5\text{ V}$ to $5.5\text{ V}$	Room	-	13	
				Full	-	14	
Break-before-make time <sup>d</sup>	$t_{BBM}$	$V+ = 1.65\text{ V}$ to $1.95\text{ V}$	Full	0.5	-	-	
		$V+ = 2.3\text{ V}$ to $2.7\text{ V}$	Full	0.5	-	-	
		$V+ = 3\text{ V}$ to $3.65\text{ V}$	Full	0.5	-	-	
		$V+ = 4.5\text{ V}$ to $5.5\text{ V}$	Full	0.5	-	-	
Charge injection <sup>d</sup>	Q	$C_L = 0.1\text{ nF}$ , $V_{GEN} = 0\text{ V}$ $R_{GEN} = 0\text{ }\Omega$	$V+ = 5\text{ V}$	Room	-	1.3	pC
			$V+ = 3.3\text{ V}$	Room	-	0.5	
Analog Switch Characteristics							
Off isolation <sup>d</sup>	OIRR	$R_L = 50\text{ }\Omega$ , $f = 10\text{ MHz}$	Room	-	-61	-	dB
Crosstalk <sup>d</sup>	$X_{TALK}$		Room	-	-61	-	
-3 dB bandwidth <sup>d</sup>	BW	$R_L = 50\text{ }\Omega$	Room	-	580	-	MHz
Capacitance							
Control pin capacitance <sup>d</sup>	$C_{IN}$	$V+ = 0\text{ V}$	Room	-	6	-	pF
B port off capacitance <sup>d</sup>	$C_{IO-B}$	$V+ = 5\text{ V}$	Room	-	7	-	
A port capacitance when switch enable <sup>d</sup>	$C_{IO-A(on)}$		Room	-	12	-	

## Notes

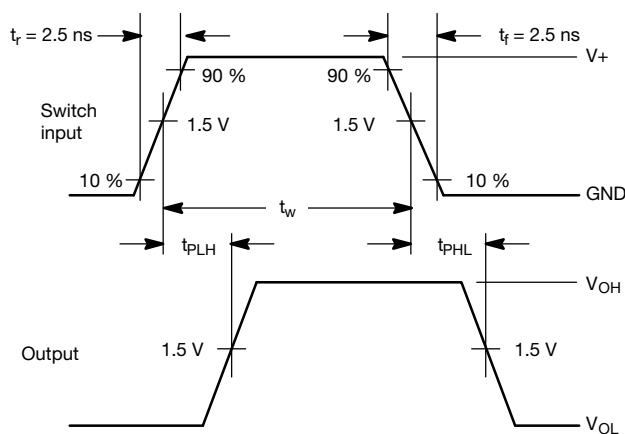
- a. Room = 25 °C, full = as determined by the operating suffix
- b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this datasheet
- c. Typical values are for design aid only, not guaranteed nor subject to production testing
- d. Guarantee by design, nor subjected to production test
- e.  $V_S$  = input voltage to perform proper function
- f. Guaranteed by design and not production tested. The bus switch propagation delay is a function of the RC time constant contributed by the on-resistance and the specified load capacitance with an ideal voltage source (zero output impedance) driving the switch

**LOGIC DIAGRAM POSITIVE LOGIC**

**Fig. 1**
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

 **$R_{ON}$  vs.  $V_A$  vs.  $V_+$** 

**Power Down Leakage Current vs. Temperature**

**Power Down Leakage Current vs.  $V_A$**

## AC LOADING AND WAVEFORMS

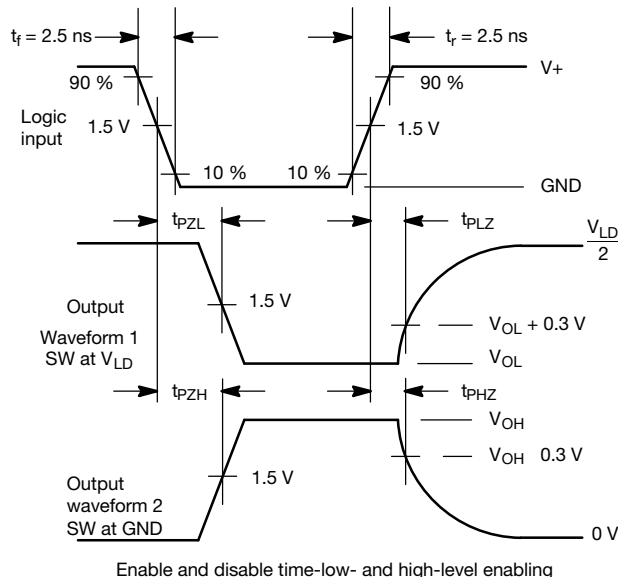


**Fig. 2 - AC Test Circuit**



Propagation delay times

**Fig. 3 - AC Waveforms**

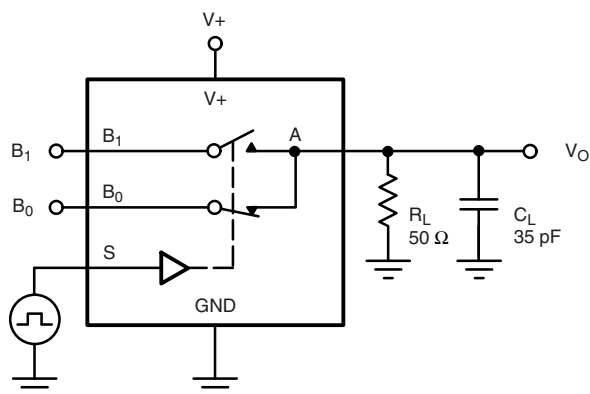


**Fig. 4 - AC Waveforms**

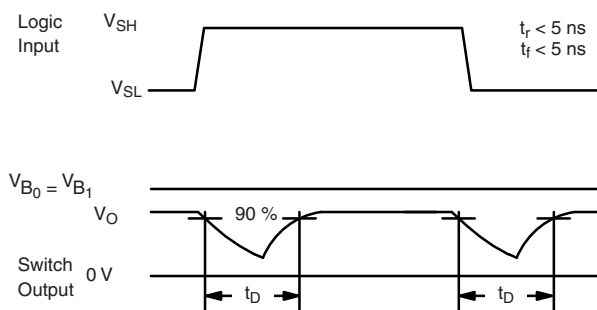
### Notes

- $C_L$  includes probe and jig capacitance
- Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control
- Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$
- The outputs are measured one at a time with one transition per measurement
- $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$
- $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{dis}$
- $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{dis}$
- $V_{LD} = 2 \text{ V}+$

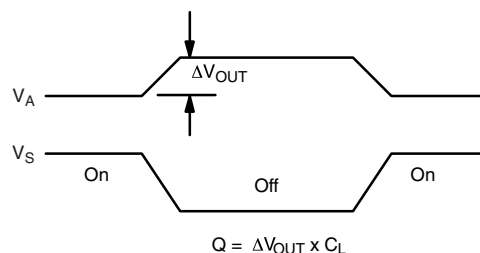
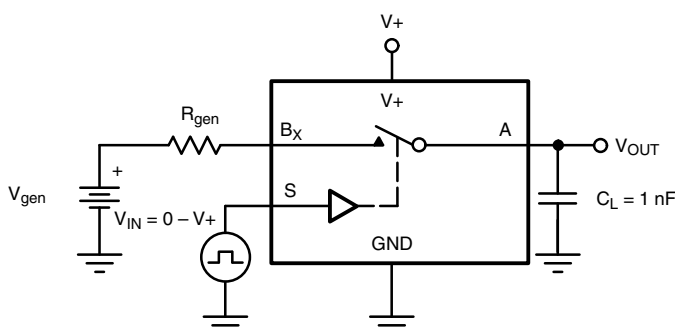
# TEST CIRCUITS



$C_L$  (includes fixture and stray capacitance)

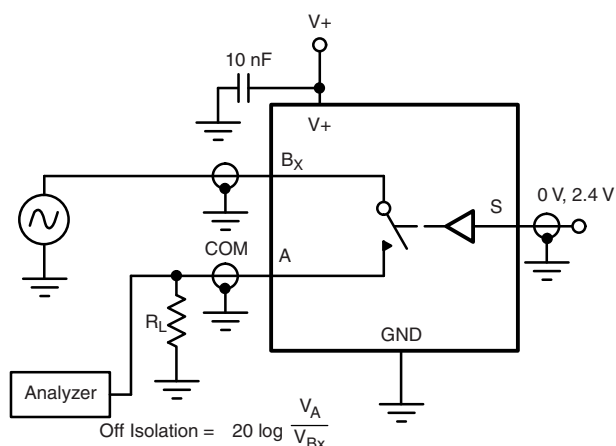


**Fig. 5 - Break-Before-Make Interval**

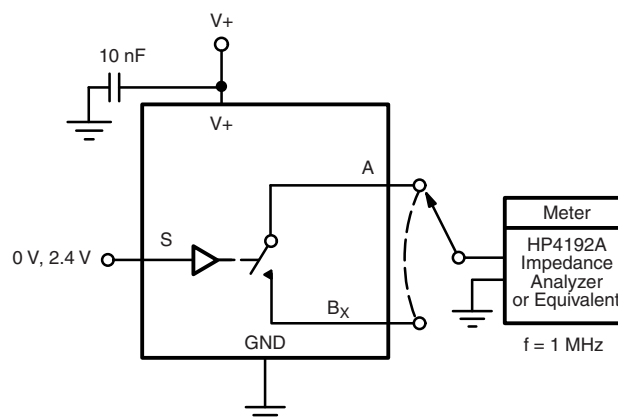


IN depends on switch configuration: input polarity determined by sense of switch.

**Fig. 6 - Charge Injection**



**Fig. 7 - Off-Isolation**



**Fig. 8 - 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?76387](http://www.vishay.com/ppg?76387).



## 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.



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.