Dual SPDT Analog Switch

DESCRIPTION

The DG9636 is a CMOS, dual SPDT analog switch designed to operate from + 2.7 V to + 12 V, single supply. All control logic inputs have a guaranteed 1.65 V logic HIGH threshold when operation from a + 12 V power supply. This makes the DG9636 ideally suited to interface directly with low voltage micro-processor control signals.

Processed with high density CMOS technology, the DG9636 has a 83 Ω channel ON resistance while providing ultra low parasitic capacitance of 2 pF for $CS_{(OFF)}$ and 7 pF for $CD_{(ON)}$. Other performance features are: 720 MHz - 3 dB bandwidth, - 67 dB Cross Talk and - 58 dB Off isolation at 10 MHz frequency.

Key applications for the DG9636 are logic level translation, pulse generator, and high speed or low noise signal switching in precision instrumentations and portable device designs.

The DG9636 is available in space saving 1.4 mm x 1.8 mm miniQFN10 package.

As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with lead (Pb)-free device termination. The miniQFN-10 package has a nickel-palladium-gold device termination and is represented by the lead (Pb)-free "-E4" suffix to the ordering part number. The nickel-palladium-gold device terminations meet all JEDEC standards for reflow and MSL rating.

FEATURES

- Leakage current < 0.5 nA max. at 85 °C
- Low switch capacitance (C_{soff}, 2 pF typ.)
- $R_{DS(on)}$ - 83 Ω max.
- Fully specified with single supply operation at 12 V
- Low voltage, 1.65 V CMOS/TTL compatible
- 720 MHz, - 3 dB bandwidth
- Excellent isolation and crosstalk performance (typ. > - 60 dB at 10 MHz)
- Fully specified from - 40 °C to 85 °C and - 40 °C to + 125 °C
- Latch-up current 300 mA per JESD78
- Lead (Pb)-free low profile miniQFN-10 (1.4 mm x 1.8 mm x 0.55 mm)
- Compliant to RoHS Directive 2002/95/EC

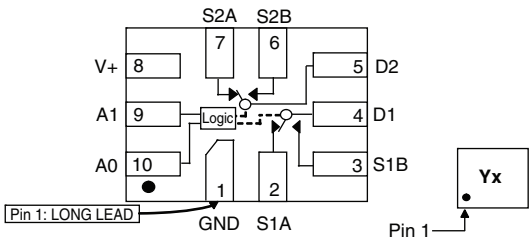
Pb-free
RoHS COMPLIANT

APPLICATIONS

- High-end data acquisition
- Medical instruments
- Precision instruments
- High speed communications applications
- Automated test equipment
- Sample and hold applications

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION

DG9636
miniQFN - 10L



Top View

Device marking: Yx for DG9636
x = Date/Lot Traceability Code

TRUTH TABLE		
Selected Input		On Switches
A1	A0	DG9636
X	0	D1 to S1A
X	1	D1 to S1B
0	X	D2 to S2A
1	X	D2 to S2B

ORDERING INFORMATION

Temp. Range	Package	Part Number
- 40 °C to 125 °C	10 pin miniQFN	DG9636EN-T1-E4
- 40 °C to 85 °C	10 pin miniQFN	DG9636DN-T1-E4

Notes:
• - 40 °C to 85 °C datasheet limits apply.

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise noted)

Parameter		Limit	Unit
V+ to GND		14	V
Digital Inputs[a], V_S, V_D		(V+) + 0.3 or 30 mA, whichever occurs first	
Continuous Current (Any Terminal)		30	mA
Peak Current, S or D (Pulsed 1 ms, 10 % Duty Cycle)		100	
Storage Temperature		- 65 to 150	°C
Power Dissipation (Package)[b]	10 pin miniQFN[c, d]	208	mW
Thermal Resistance (Package)[b]	10 pin miniQFN	357	°C/W

Notes:
a. Signals on SX, DX, or AX 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 2.6 mW/°C above 70 °C.
d. Manual soldering with iron is not recommended for leadless components. The miniQFN-10 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper lip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.

SPECIFICATIONS FOR DUAL SUPPLIES

Parameter	Symbol	Test Conditions Unless Otherwise Specified V+ = 12 V, $V_{A0, A1}$ = 1.65 V, 0.5 V[a]	Temp.[b]	Typ.[c]	- 40 °C to 125 °C Min.[d]	- 40 °C to 125 °C Max.[d]	- 40 °C to 85 °C Min.[d]	- 40 °C to 85 °C Max.[d]	Unit
Analog Switch									
Analog Signal Range[e]	V_{ANALOG}		Full			12		12	V
On-Resistance	$R_{DS(on)}$	I_S = 1 mA, V_D = + 11.3 V	Room Full	83		110 140		110 125	Ω
On-Resistance Match	ΔR_{ON}	I_S = 1 mA, V_D = + 11.3 V	Room Full	2		4 9		4 6	
On-Resistance Flatness	$R_{FLATNESS}$	I_S = 1 mA, V_D = 0.7 V, 6.5 V, 11.3 V	Room Full	33		45 55		45 50	
Switch Off Leakage Current	$I_{S(off)}$	V+ = 12 V, V_D = 1 V/11 V, V_S = 11 V/1 V	Room Full	± 0.01	- 1 - 18	1 18	- 1 - 2	1 2	nA
	$I_{D(off)}$		Room Full	± 0.01	- 1 - 18	1 18	- 1 - 2	1 2	
Channel On Leakage Current	$I_{D(on)}$	V+ = 12 V, V_D = V_S 11 V/1 V	Room Full	± 0.01	- 1 - 18	1 18	- 1 - 2	1 2	
Digital Control									
Input Current, V_{IN} Low	I_{IL}	V_{AX} = 0.5 V	Full	0.005	- 0.1	0.1	- 0.1	0.1	µA
Input Current, V_{IN} High	I_{IH}	V_{AX} = 1.65 V	Full	0.005	- 0.1	0.1	- 0.1	0.1	
Input Capacitance[e]	C_{IN}	f = 1 MHz	Room	3					pF
Dynamic Characteristics									
Turn-On Time	t_{ON}	R_L = 300 Ω, C_L = 35 pF see figure 1, 2	Room Full	30		70 90		70 80	ns
Turn-Off Time	t_{OFF}		Room Full	15		55 75		55 65	
Break-Before-Make	t_{BBM}		Room Full	15	5 2		5 2		
Charge Injection[e]	Q_{INJ}	V_g = 0 V, R_g = 0 Ω, C_L = 1 nF	Room	23.5					pC
Off Isolation[e]	OIRR	R_L = 50 Ω, C_L = 5 pF, f = 10 MHz	Room	- 58					dB
Bandwidth[e]	BW	R_L = 50 Ω	Room	720					MHz
Channel-to-Channel Crosstalk[e]	X_{TALK}	R_L = 50 Ω, C_L = 5 pF, f = 10 MHz	Room	- 67					dB

SPECIFICATIONS FOR DUAL SUPPLIES

Parameter	Symbol	Test Conditions Unless Otherwise Specified V+ = 12 V, $V_{A0, A1}$ = 1.65 V, 0.5 V[a]	Temp.[b]	Typ.[c]	- 40 °C to 125 °C Min.[d]	- 40 °C to 125 °C Max.[d]	- 40 °C to 85 °C Min.[d]	- 40 °C to 85 °C Max.[d]	Unit
Dynamic Characteristics									
Source Off Capacitance[e]	$C_{S(off)}$	f = 1 MHz	Room	2					pF
Channel On Capacitance[e]	$C_{D(on)}$		Room	7.7					
Total Harmonic Distortion[e]	THD	Signal = 1 V_{RMS}, 20 Hz to 20 kHz, R_L = 600 Ω	Room	0.01					%
Power Supplies									
Power Supply Current	I+	V_{IN} = 0 V, or V+	Room Full	0.001		0.5 1		0.5 1	µA
Ground Current	I_{GND}		Room Full	- 0.001	- 0.5 - 1		- 0.5 - 1		

SPECIFICATIONS FOR SINGLE SUPPLY

Parameter	Symbol	Test Conditions Unless Otherwise Specified V+ = 5 V, $V_{A0, A1}$ = 1.4 V, 0.5 V[a]	Temp.[b]	Typ.[c]	- 40 °C to 125 °C Min.[d]	- 40 °C to 125 °C Max.[d]	- 40 °C to 85 °C Min.[d]	- 40 °C to 85 °C Max.[d]	Unit
Analog Switch									
Analog Signal Range[e]	V_{ANALOG}		Full			5		5	V
On-Resistance	$R_{DS(on)}$	I_S = 1 mA, V_D = + 3.5 V	Room Full	120		170 250		170 200	Ω
On-Resistance Match	ΔR_{ON}	I_S = 1 mA, V_D = + 3.5 V	Room Full	3		5 12		5 10	
Switch Off Leakage Current	$I_{S(off)}$	V+ = 5.5 V, V_D = 1 V/4.5 V, V_S = 4.5 V/1 V	Room Full	± 0.01	- 1 - 18	1 18	- 1 - 2	1 2	nA
	$I_{D(off)}$		Room Full	± 0.01	- 1 - 18	1 18	- 1 - 2	1 2	
Channel On Leakage Current	$I_{D(on)}$	V+ = 5.5 V, V_S = V_D = 1 V/4.5 V	Room Full	± 0.01	- 1 - 18	1 18	- 1 - 2	1 2	
Digital Control									
Input Current, V_{IN} Low	I_L	V_{AX} = 0.5 V	Full	0.005	- 0.1	0.1	- 0.1	0.1	µA
Input Current, V_{IN} High	I_H	V_{AX} = 1.4 V	Full	0.005	- 0.1	0.1	- 0.1	0.1	
Input Capacitance	C_{IN}	f = 1 MHz	Room	3					pF
Dynamic Characteristics									
Turn-On Time	t_{ON}	R_L = 300 Ω, C_L = 35 pF see figure 1, 2	Room Full	55					ns
Turn-Off Time	t_{OFF}		Room Full	30					
Break-Before-Make-Time	t_{BMM}		Room Full	36					
Charge Injection[e]	Q_{INJ}	C_L = 1 nF, R_{GEN} = 0 Ω, V_{GEN} = 0 V	Full	10					pC
Off-Isolation[e]	OIRR	f = 10 MHz, R_L = 50 Ω, C_L = 5 pF	Room	- 58					dB
Crosstalk[e]	X_{TALK}		Room	- 68					
Bandwidth[e]	BW	R_L = 50 Ω	Room	610					MHz
Total Harmonic Distortion[e]	THD	Signal = 1 V_{RMS}, 20 Hz to 20 kHz, R_L = 600 Ω	Room	2.2					%
Source Off Capacitance[e]	$C_{S(off)}$	f = 1 MHz	Room	2.1					pF
Channel On Capacitance[e]	$C_{D(on)}$			8.1					
Power Supplies									
Power Supply Current	I+	V_{IN} = 0 V, or V+	Room Full	0.001		0.5 1		0.5 1	µA
Ground Current	I_{GND}		Room Full	- 0.001	- 0.5 - 1		- 0.5 - 1		

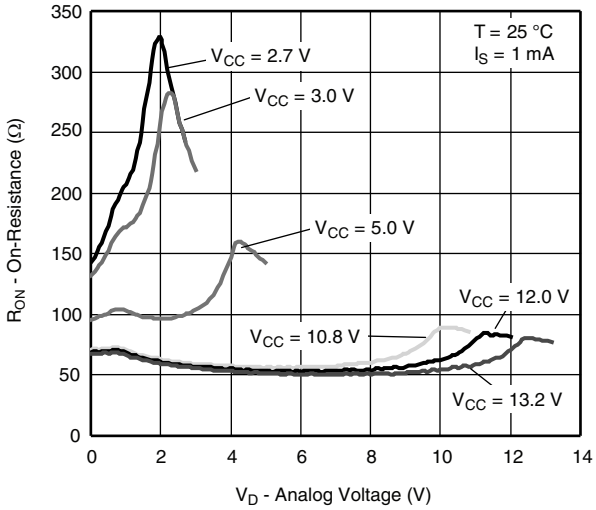
SPECIFICATIONS FOR SINGLE SUPPLY

Parameter	Symbol	Test Conditions Unless Otherwise Specified V+ = 3 V, $V_{A0, A1}$ = 1.4 V, 0.5 V[a]	Temp.[b]	Typ.[c]	- 40 °C to + 125 °C Min.[d]	- 40 °C to + 125 °C Max.[d]	- 40 °C to + 85 °C Min.[d]	- 40 °C to + 85 °C Max.[d]	Unit
Analog Switch									
Analog Signal Range[e]	V_{ANALOG}		Full			3		3	V
On-Resistance	$R_{DS(ON)}$	I_S = 1 mA, V_D = + 1.5 V	Room Full	200		245 325		245 290	Ω
On-Resistance Match	ΔR_{ON}	I_S = 1 mA, V_D = + 1.5 V	Room Full	5		6 13		6 11	Ω
Switch Off Leakage Current (for 16 pin miniQFN)	$I_{S(off)}$	V+ = 3.3 V, V- = 0 V V_D = 1 V/3 V, V_S = 3 V/1 V	Room Full	± 0.01	- 1 - 18	1 18	- 1 - 2	1 2	nA
	$I_{D(off)}$		Room Full	± 0.01	- 1 - 18	1 18	- 1 - 2	1 2	nA
Channel On Leakage Current (for 16 pin miniQFN)	$I_{D(on)}$	V+ = 3.3 V, V- = 0 V, V_S = V_D = 1 V/3 V	Room Full	± 0.01	- 1 - 18	1 18	- 1 - 2	1 2	nA
Digital Control									
Input Current, V_{IN} Low	I_L	V_{AX} = 0.5 V	Full	0.005	- 0.1	0.1	- 0.1	0.1	µA
Input Current, V_{IN} High	I_H	V_{AX} = 1.4 V	Full	0.005	- 0.1	0.1	- 0.1	0.1	µA
Input Capacitance	C_{IN}	f = 1 MHz	Room	3.1					pF
Dynamic Characteristics									
Enable Turn-On Time	t_{ON}	R_L = 300 Ω, C_L = 35 pF see figure 1, 2	Room Full	96					ns
Enable Turn-Off Time	t_{OFF}		Room Full	60					ns
Break-Before-Make-Time	t_{BMM}		Room Full	77					ns
Charge Injection[e]	Q_{INJ}	C_L = 1 nF, R_{GEN} = 0 Ω, V_{GEN} = 0 V	Full	6.6					pC
Off-Isolation[e]	OIRR	f = 10 MHz, R_L = 50 Ω, C_L = 5 pF	Room	- 57					dB
Crosstalk[e]	X_{TALK}		Room	- 69					dB
Bandwidth[e]	BW	R_L = 50 Ω	Room	525					MHz
Total Harmonic Distortion[e]	THD	Signal = 1 V_{RMS}, 20 Hz to 20 kHz, R_L = 600 Ω	Room	2.2					%
Source Off Capacitance[e]	$C_{S(off)}$	f = 1 MHz	Room	2.1					pF
Channel On Capacitance[e]	$C_{D(on)}$			8.3					pF
Power Supplies									
Power Supply Current	I+	V_{IN} = 0 V, or V+	Room Full	0.001		0.5 1		0.5 1	µA
Ground Current	I_{GND}		Room Full	- 0.001	- 0.5 - 1		- 0.5 - 1		µA

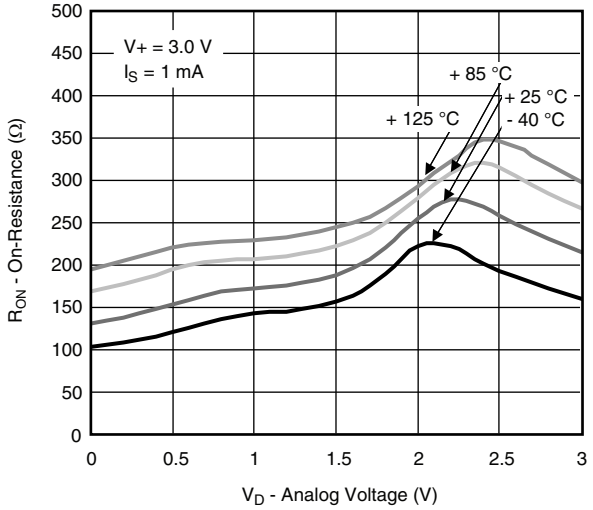
Notes:
a. V_{IN} = input voltage to perform proper function.
b. Room = 25 °C, Full = as determined by the operating temperature.
c. Typical value are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
d. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this datasheet.
e. Guaranteed by design, not subject to production test.

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.

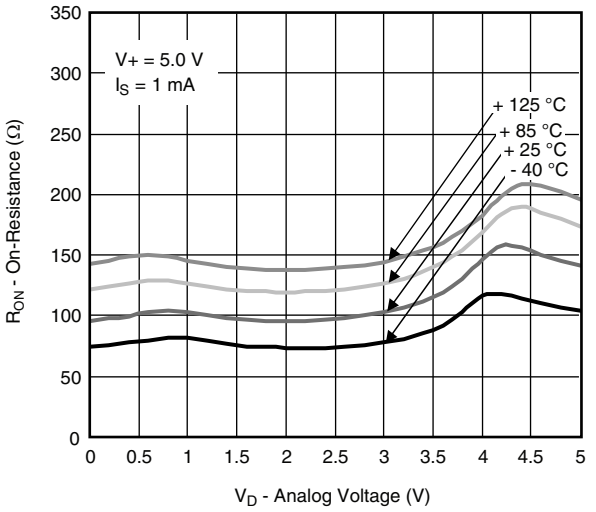
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



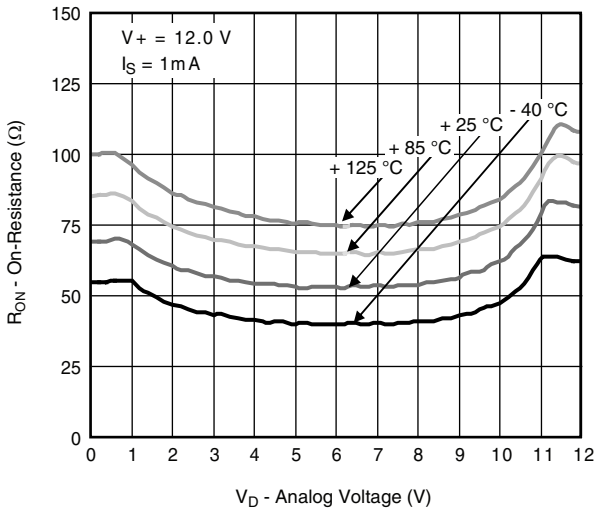
On-Resistance vs. Single Supply Voltage



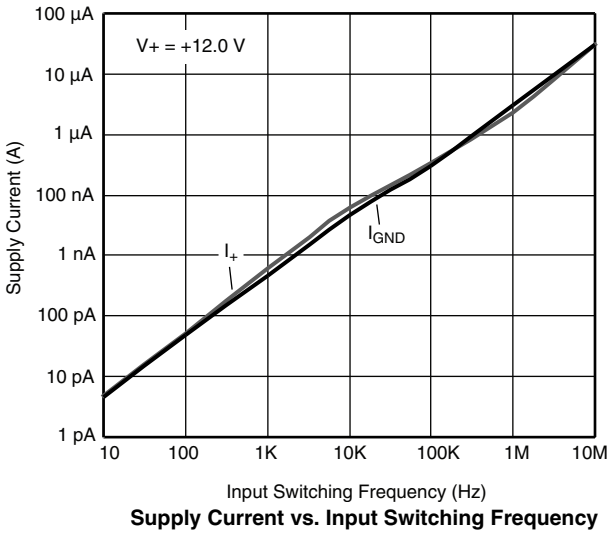
On-Resistance vs. Analog Voltage and Temperature



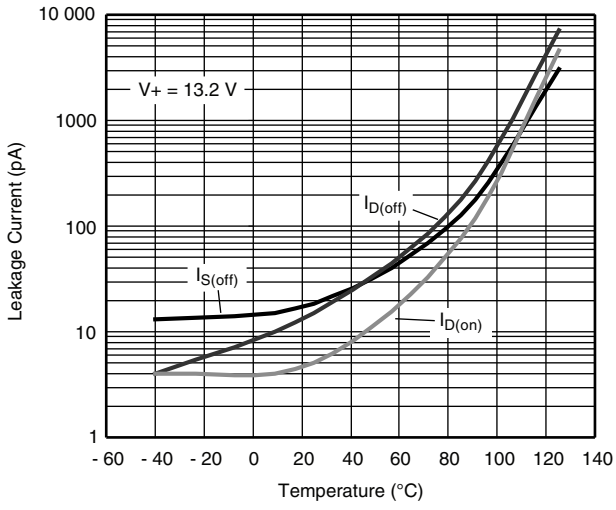
On-Resistance vs. Analog Voltage and Temperature



On-Resistance vs. Analog Voltage and Temperature

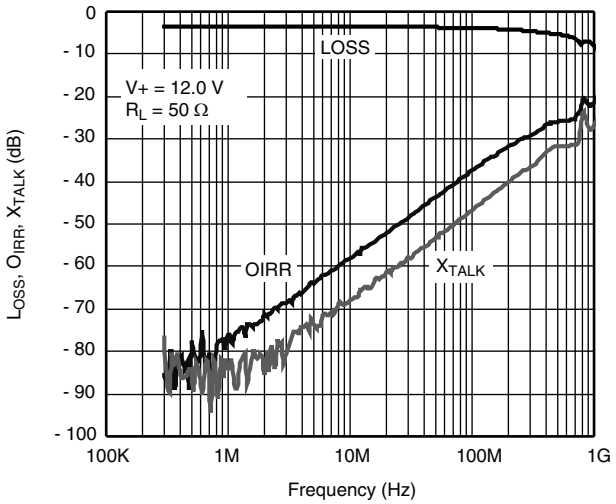


Supply Current vs. Input Switching Frequency

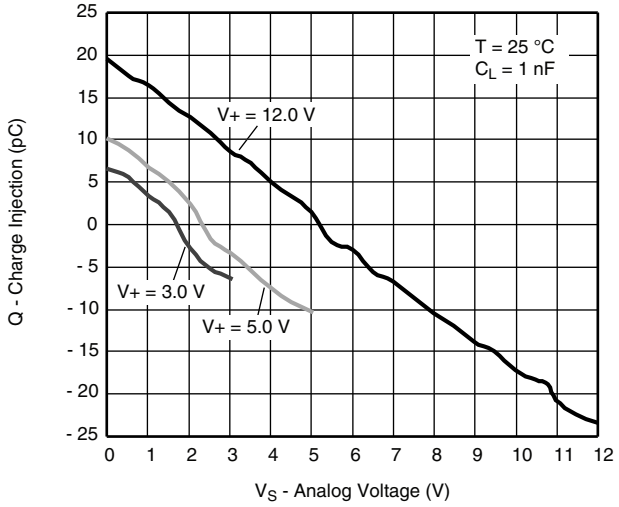


Leakage Current vs. Temperature

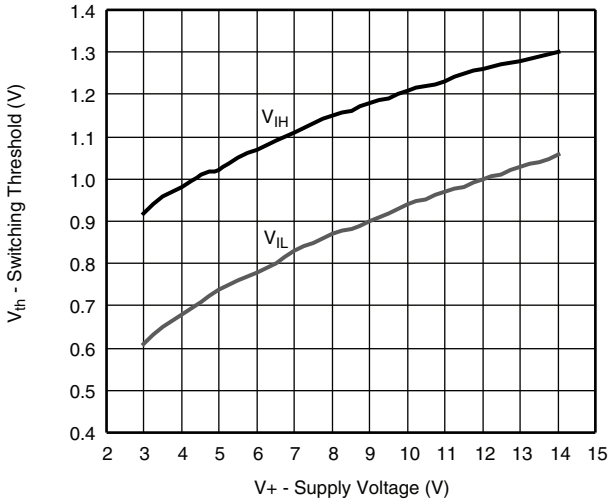
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Insertion Loss, Off-Isolation, Crosstalk vs. Frequency



Charge Injection vs. Analog voltage



Switching Threshold vs. Supply Voltage

TEST CIRCUITS

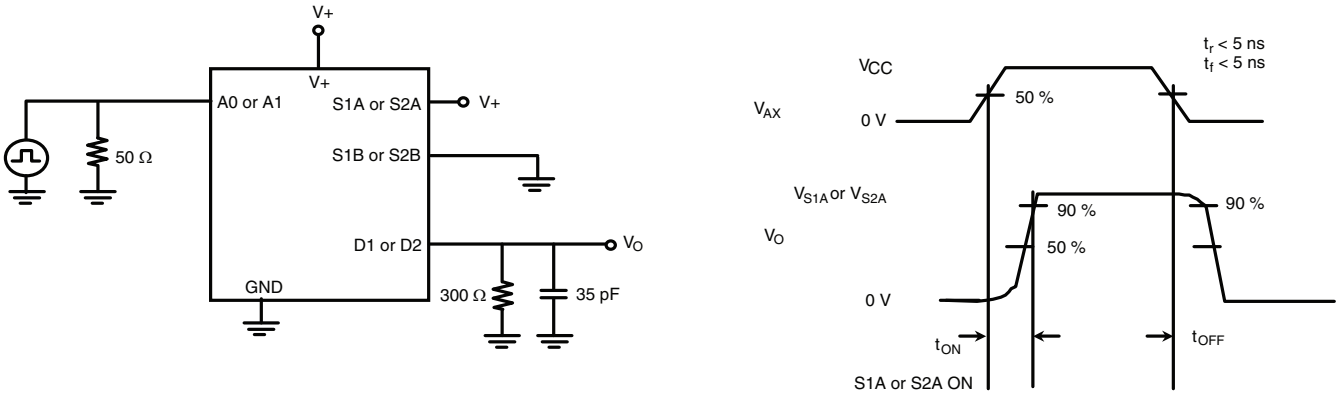


Figure 1. Enable Switching Time

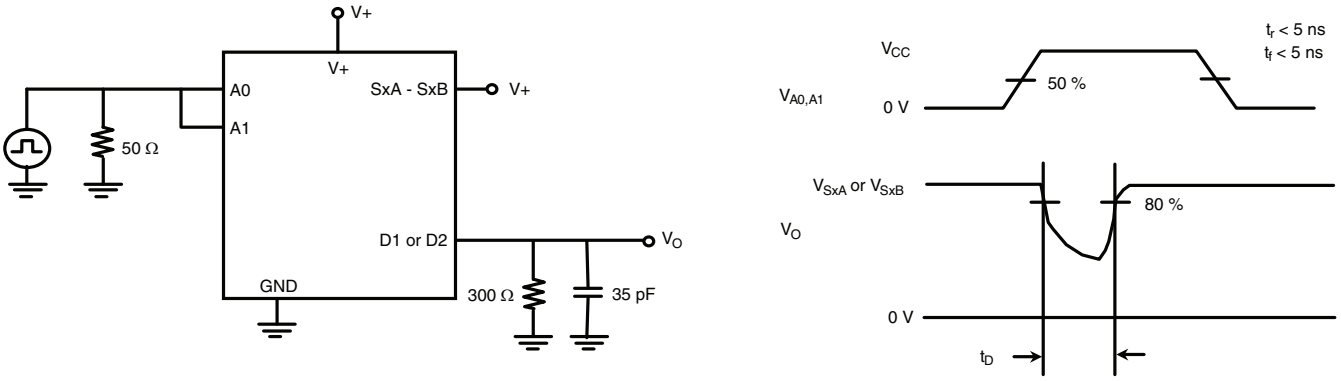


Figure 2. Break-Before-Make

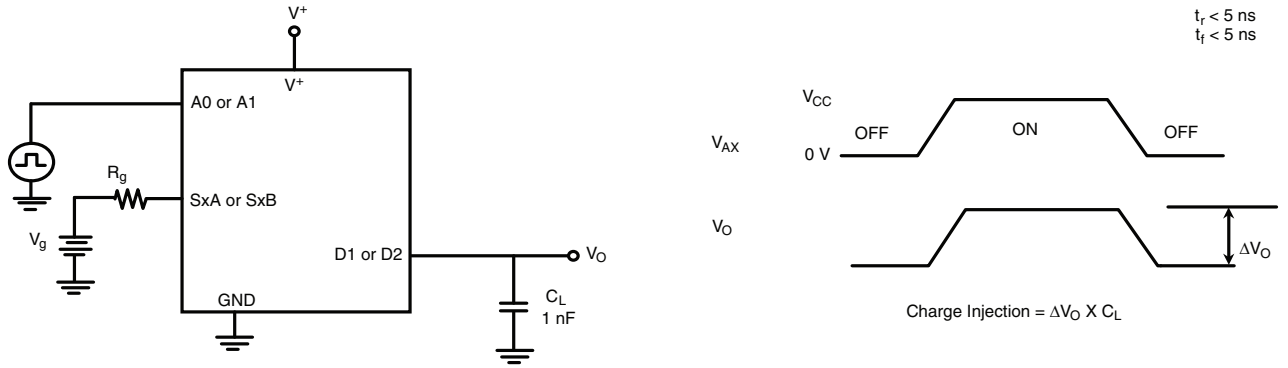


Figure 3. Charge Injection

TEST CIRCUITS

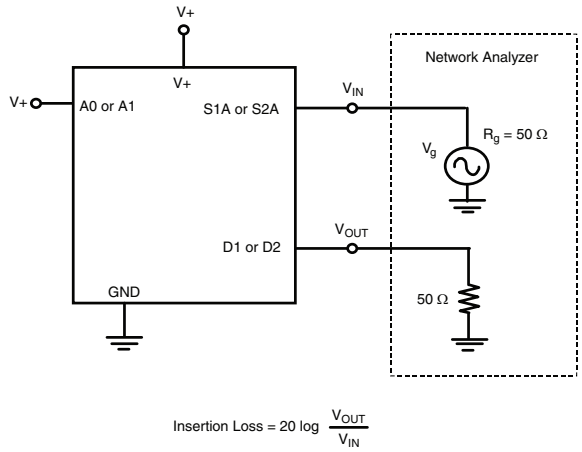


Figure 4. Insertion Loss

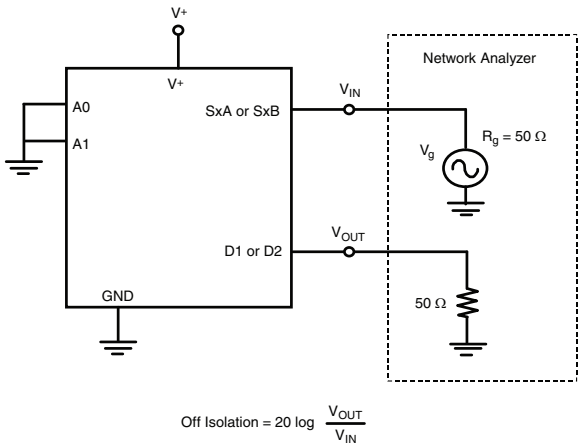


Figure 5. Off-Isolation

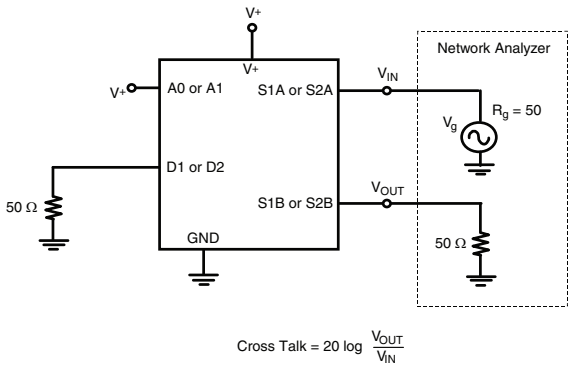


Figure 6. Crosstalk

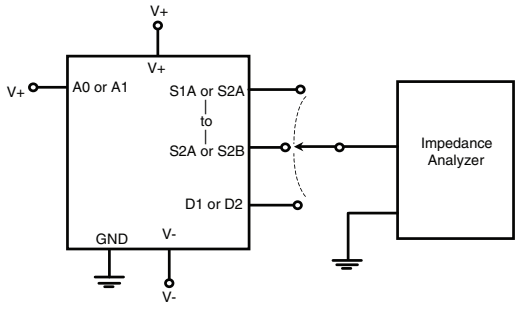
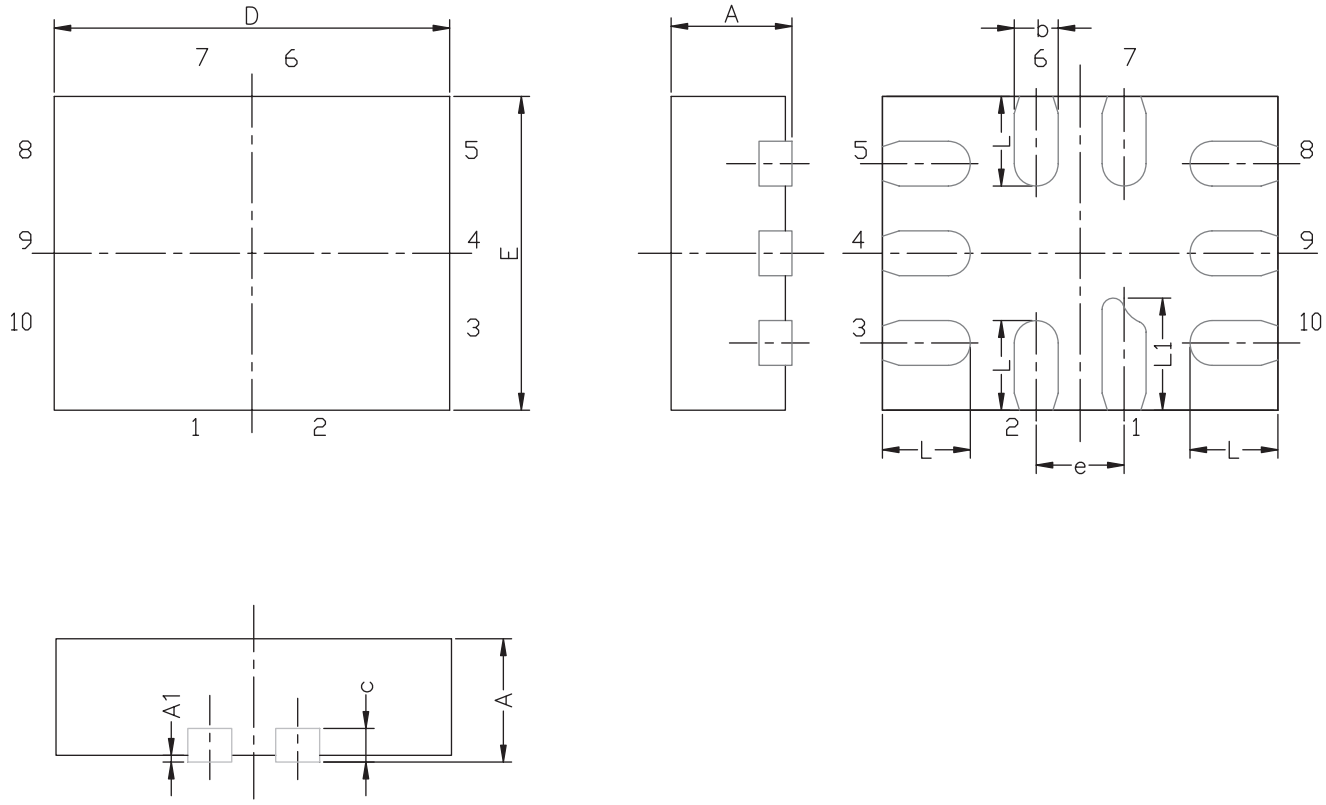


Figure 7. Source/Drain Capacitance

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?65159.

MINI QFN-10L 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	1.75	1.80	1.85	0.069	0.071	0.073
E	1.35	1.40	1.45	0.053	0.055	0.057
e	0.40 BSC			0.016 BSC		
L	0.35	0.40	0.45	0.014	0.016	0.018
L1	0.45	0.50	0.55	0.0177	0.0197	0.0217

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DWG: 5957

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