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.
- Low voltage, 1.65 V CMOS/TTL compatible
- 720 MHz, -3 dB bandwidth
- Fully specified with single supply operation at 12 V
- 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)
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free

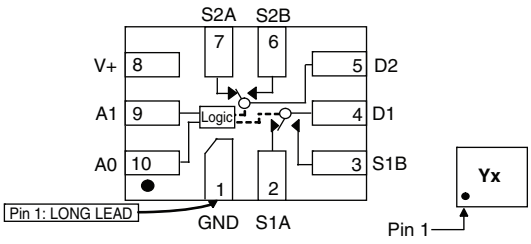
RoHS COMPLIANT

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

Note

- -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

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		-40 °C to 85 °C		Unit
					Min. [d]	Max. [d]	Min. [d]	Max. [d]	
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	83	-	110	-	110	Ω
			Full	-	-	140	-	125	
On-Resistance Match	ΔR_{on}	I_S = 1 mA, V_D = +11.3 V	Room	2	-	4	-	4	
			Full	-	-	9	-	6	
On-Resistance Flatness	$R_{FLATNESS}$	I_S = 1 mA, V_D = 0.7 V, 6.5 V, 11.3 V	Room	33	-	45	-	45	
			Full	-	-	55	-	50	
Switch Off Leakage Current	$I_{S(off)}$	V+ = 12 V, V_D = 1 V/11 V, V_S = 11 V/1 V	Room	± 0.01	-1	1	-1	1	nA
			Full	-	-18	18	-2	2	
	$I_{D(off)}$		Room	± 0.01	-1	1	-1	1	
			Full	-	-18	18	-2	2	
Channel On Leakage Current	$I_{D(on)}$	V+ = 12 V, V_D = V_S 11 V/1 V	Room	± 0.01	-1	1	-1	1	
			Full	-	-18	18	-2	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

SPECIFICATIONS

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		-40 °C to 85 °C		Unit
					Min. [d]	Max. [d]	Min. [d]	Max. [d]	
Dynamic Characteristics									
Turn-On Time	t_{on}	R_L = 300 Ω, C_L = 35 pF see figure 1, 2	Room	30	-	70	-	70	ns
			Full	-	-	90	-	80	
Turn-Off Time	t_{off}		Room	15	-	55	-	55	
			Full	-	-	75	-	65	
Break-Before-Make	t_{BBM}		Room	15	5	-	5	-	
			Full	-	2	-	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
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	0.001	-	0.5	-	0.5	µA
			Full	-	-	1	-	1	
Ground Current	I_{GND}		Room	-0.001	-0.5	-	-0.5	-	
			Full	-	-1	-	-1	-	

SPECIFICATIONS

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		-40 °C to 85 °C		Unit
					Min. [d]	Max. [d]	Min. [d]	Max. [d]	
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	120	-	170	-	170	Ω
			Full	-	-	250	-	200	
On-Resistance Match	ΔR_{on}		Room	3	-	5	-	5	
			Full	-	-	12	-	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	± 0.01	-1	1	-1	1	nA
			Full	-	-18	18	-2	2	
	$I_{D(off)}$		Room	± 0.01	-1	1	-1	1	
			Full	-	-18	18	-2	2	
Channel On Leakage Current	$I_{D(on)}$	V+ = 5.5 V, V_S = V_D = 1 V/4.5 V	Room	± 0.01	-1	1	-1	1	
			Full	-	-18	18	-2	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

SPECIFICATIONS

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		-40 °C to 85 °C		Unit
					Min. [d]	Max. [d]	Min. [d]	Max. [d]	
Dynamic Characteristics									
Turn-On Time	t_{on}	R_L = 300 Ω, C_L = 35 pF see figure 1, 2	Room	55	-	-	-	-	ns
			Full	-	-	-	-	-	
Turn-Off Time	t_{off}		Room	30	-	-	-	-	
			Full	-	-	-	-	-	
Break-Before-Make-Time	t_{BMM}		Room	36	-	-	-	-	
			Full	-	-	-	-	-	
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	0.001	-	0.5	-	0.5	µA
			Full	-	-	1	-	1	
Ground Current	I_{GND}		Room	-0.001	-0.5	-	-0.5	-	
			Full	-	-1	-	-1	-	

SPECIFICATIONS

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		-40 °C to 85 °C		Unit
					Min. [d]	Max. [d]	Min. [d]	Max. [d]	
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	200	-	245	-	245	Ω
			Full	-	-	325	-	290	
On-Resistance Match	ΔR_{on}		Room	5	-	6	-	6	
			Full	-	-	13	-	11	
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	± 0.01	-1	1	-1	1	nA
			Full	-	-18	18	-2	2	
	$I_{D(off)}$		Room	± 0.01	-1	1	-1	1	
			Full	-	-18	18	-2	2	
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	± 0.01	-1	1	-1	1	
			Full	-	-18	18	-2	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	3.1	-	-	-	-	pF

SPECIFICATIONS

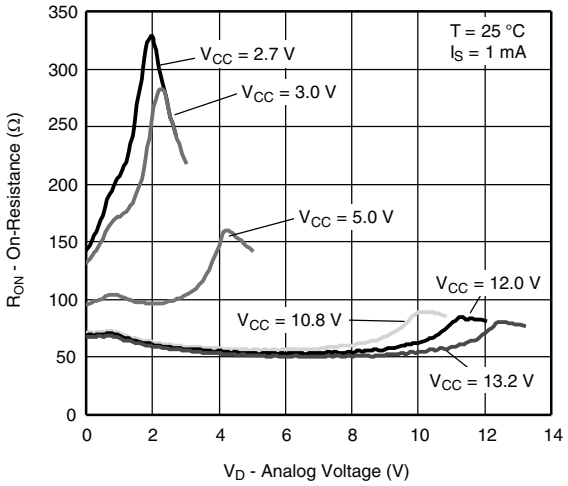
Parameter	Symbol	Test Conditions Unless Otherwise Specified V+ = 3 V, $V_{A0, A1}$ = 1.4 V, 0.5 V [a]	Temp.[b]	Typ. [c]	-40 °C to 125 °C		-40 °C to 85 °C		Unit
					Min. [d]	Max. [d]	Min. [d]	Max. [d]	
Dynamic Characteristics									
Enable Turn-On Time	t_{on}	R_L = 300 Ω, C_L = 35 pF see figure 1, 2	Room	96	-	-	-	-	ns
			Full	-	-	-	-	-	
Enable Turn-Off Time	t_{off}		Room	60	-	-	-	-	
			Full	-	-	-	-	-	
Break-Before-Make-Time	t_{BMM}		Room	77	-	-	-	-	
			Full	-	-	-	-	-	
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	-	-	-	-	
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	-	-	-	-	
Power Supplies									
Power Supply Current	I+	V_{IN} = 0 V, or V+	Room	0.001	-	0.5	-	0.5	µA
			Full	-	-	1	-	1	
Ground Current	I_{GND}		Room	-0.001	-0.5	-	-0.5	-	
			Full	-	-1	-	-1	-	

Notes

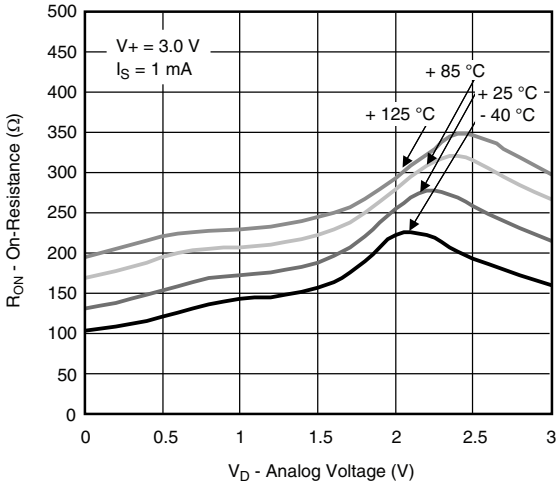
a. V_{IN} = input voltage to perform proper function.
b. Room = 25 °C, Full = as determined by the operating temperature.
c. Typical value are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
d. The algebraic convention whereby the most negative value is a minimum and the most positive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

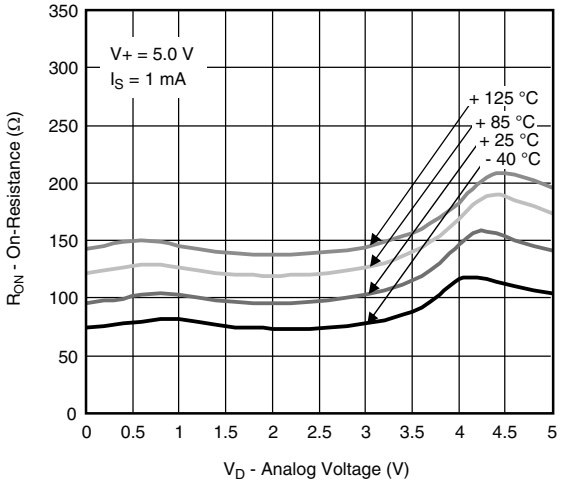
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



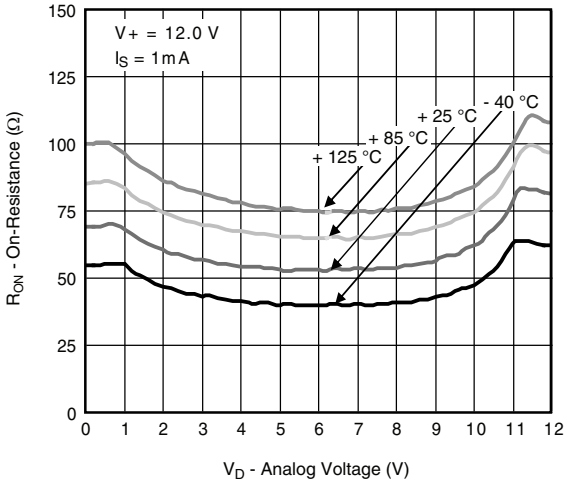
On-Resistance vs. Single Supply Voltage



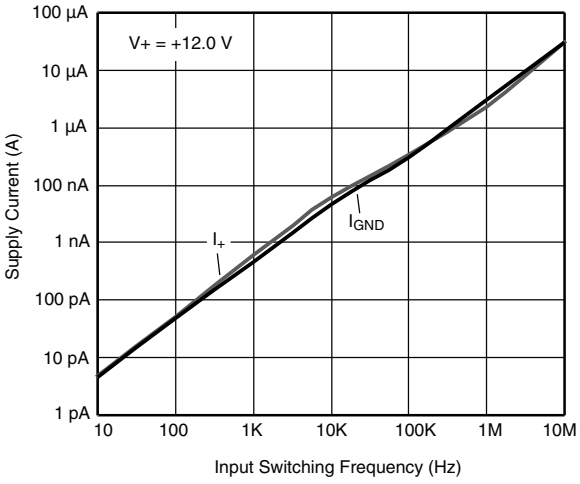
On-Resistance vs. Analog Voltage and Temperature



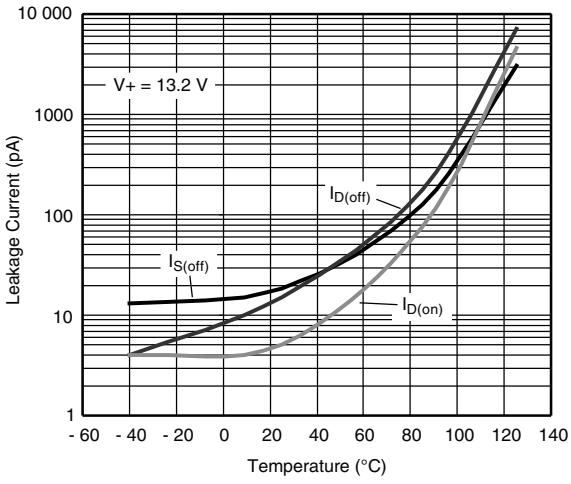
On-Resistance vs. Analog Voltage and Temperature



On-Resistance vs. Analog Voltage and Temperature

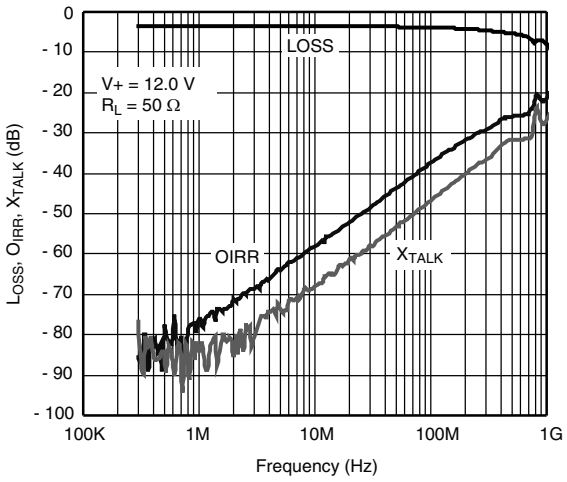


Supply Current vs. Input Switching Frequency

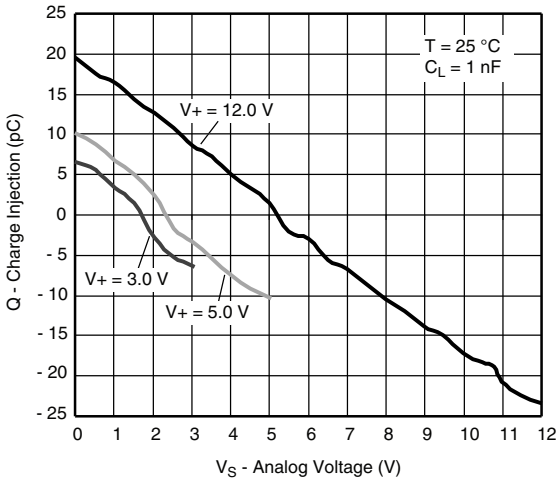


Leakage Current vs. Temperature

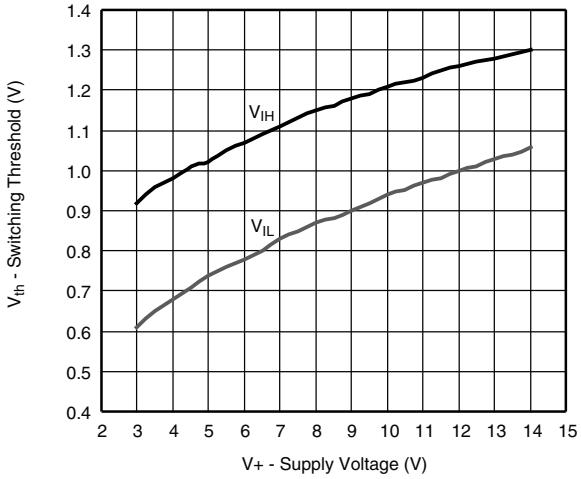
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Insertion Loss, Off-Isolation, Crosstalk vs. Frequency



Charge Injection vs. Analog voltage



Switching Threshold vs. Supply Voltage

TEST CIRCUITS

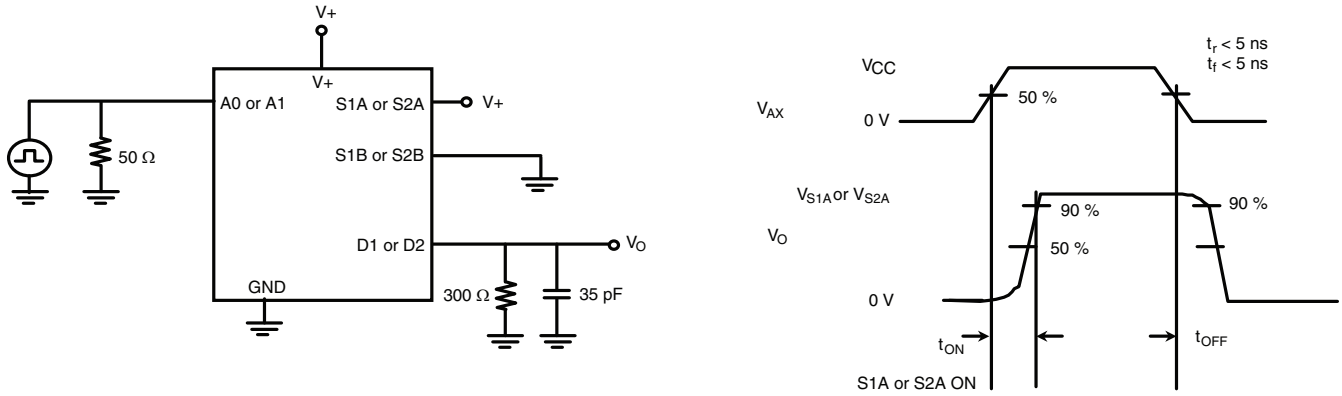


Figure 1. Enable Switching Time

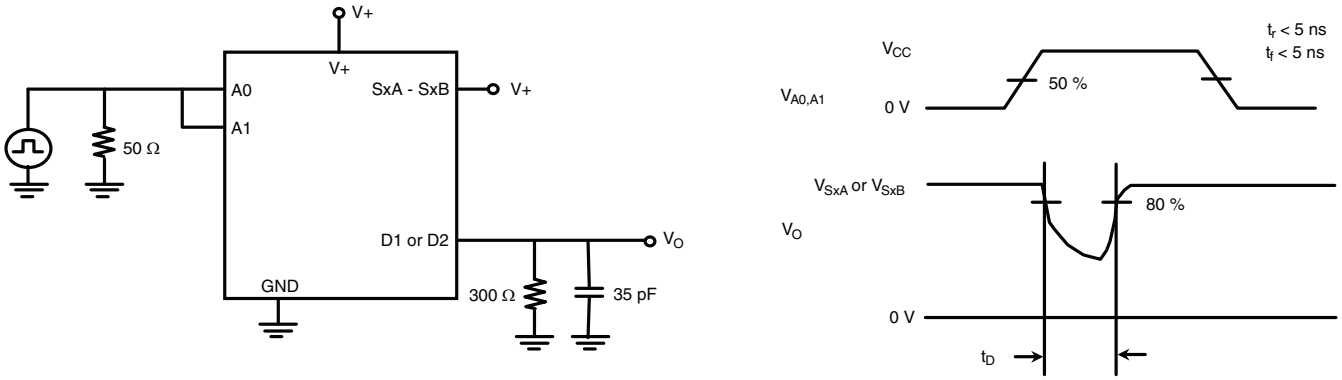


Figure 2. Break-Before-Make

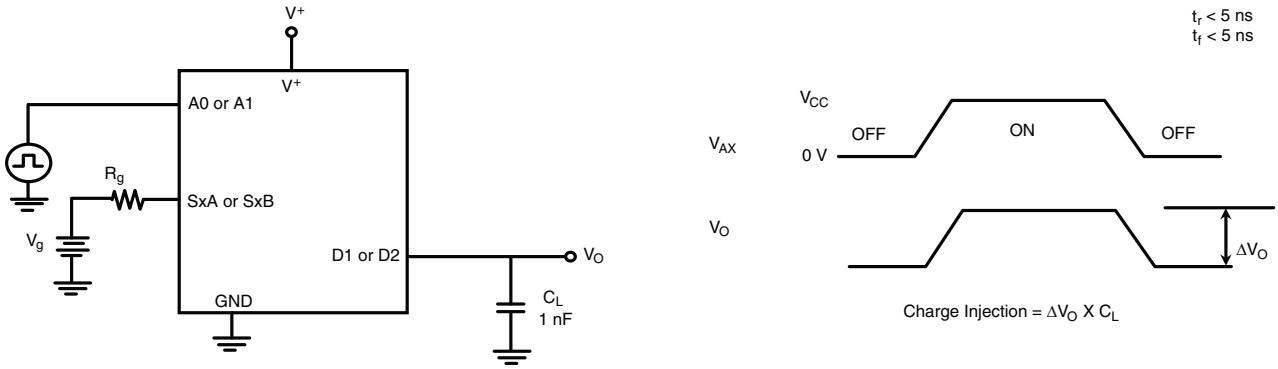


Figure 3. Charge Injection

TEST CIRCUITS

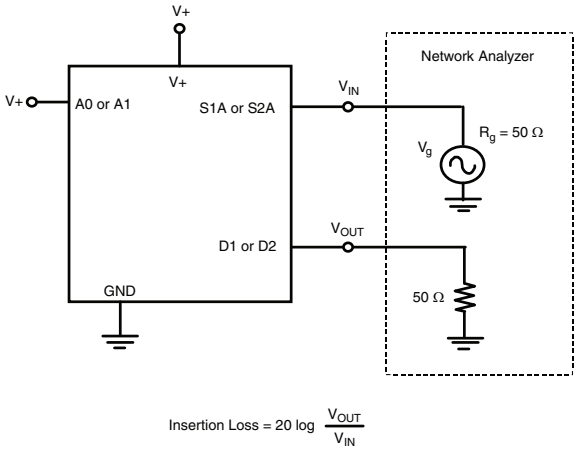


Figure 4. Insertion Loss

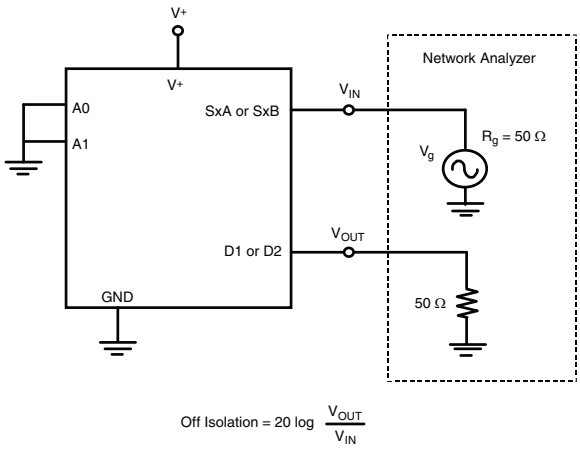


Figure 5. Off-Isolation

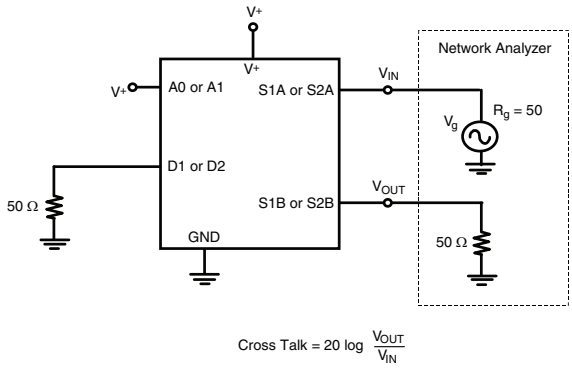


Figure 6. Crosstalk

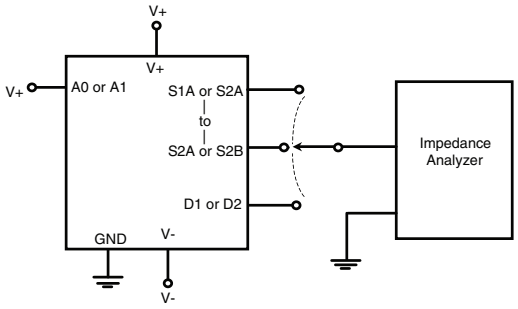
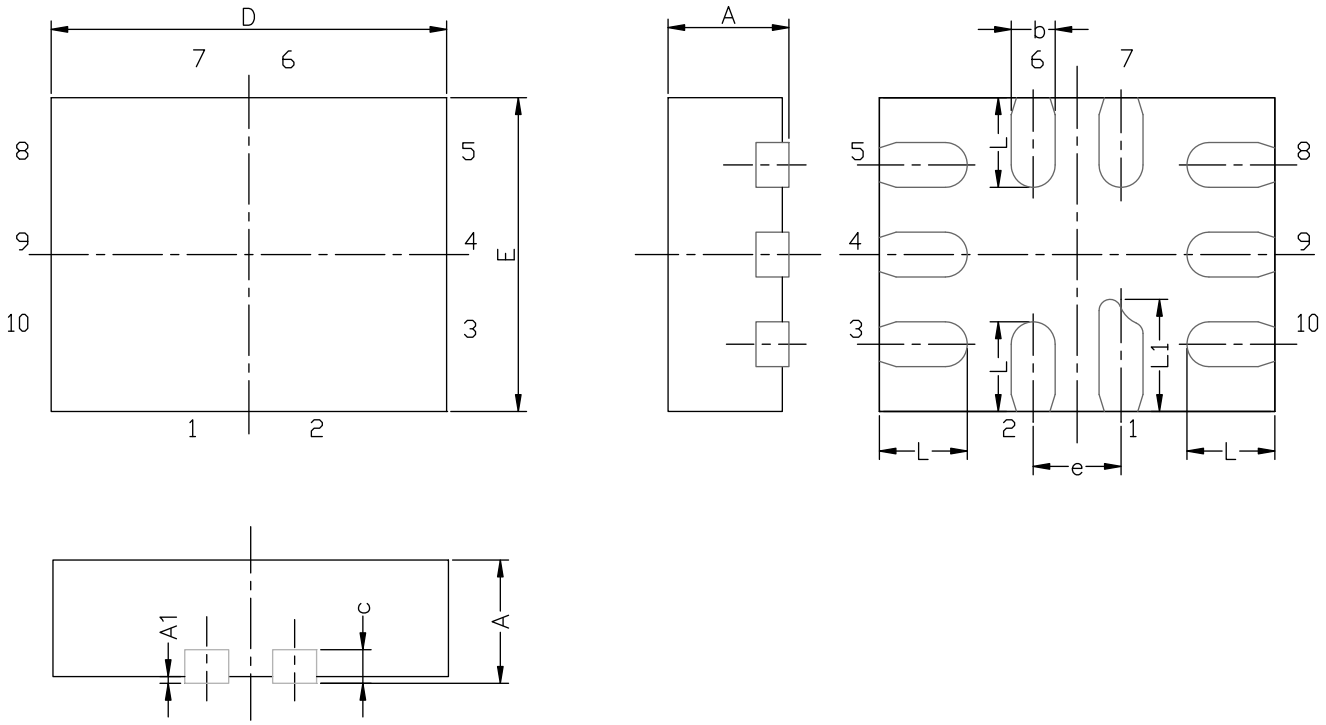


Figure 7. Source/Drain Capacitance

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	0.45	0.55	0.60	0.0177	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	0.150 or 0.127 REF (1)			0.006 or 0.005 REF (1)		
D	1.70	1.80	1.90	0.067	0.071	0.075
E	1.30	1.40	1.50	0.051	0.055	0.059
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

Note

(1) The dimension depends on the leadframe that assembly house used.

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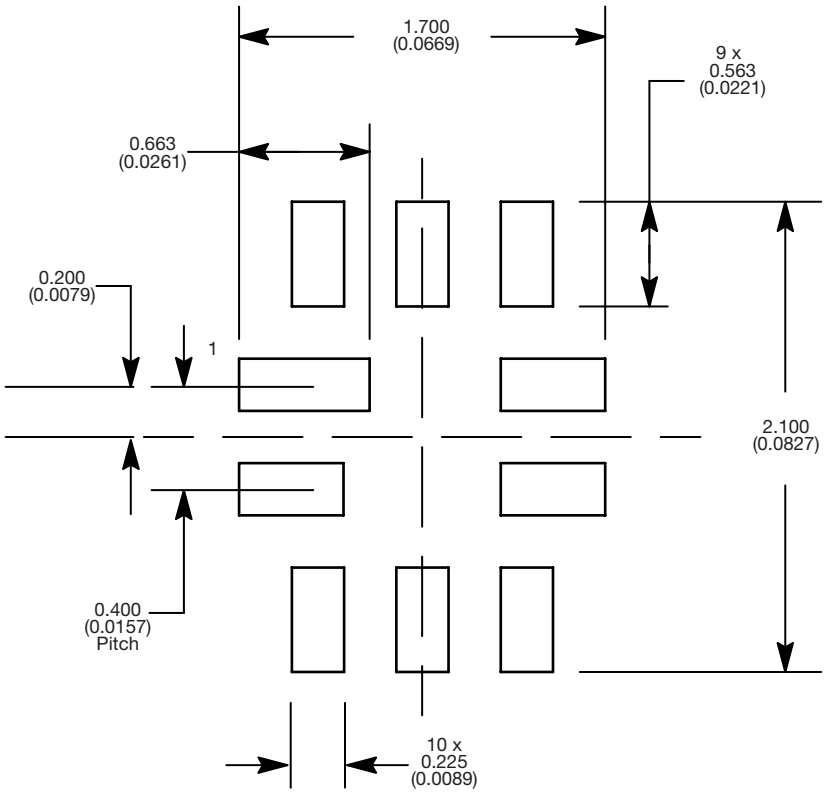
DWG: 5957

RECOMMENDED MINIMUM PADS FOR MINI QFN 10L



Mounting Footprint
Dimensions in mm (inch)

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