Precision 8-Ch/Dual 4-Ch Low Voltage Analog Multiplexers

DESCRIPTION

The DG3408, DG3409 uses BiCMOS wafer fabrication technology that allows the DG3408/3409 to operate on single and dual supplies. Single supply voltage ranges from 3 V to 12 V while dual supply operation is recommended with ± 3 V to ± 6 V.

The DG3408 is an 8-channel single-ended analog multiplexer designed to connect one of eight inputs to a common output as determined by a 3-bit binary address (A_0, A_1, A_2). The DG3409 is a dual 4-channel differential analog multiplexer designed to connect one of four differential inputs to a common dual output as determined by its 2-bit binary address (A_0, A_1). Break-before-make switching action to protect against momentary crosstalk between adjacent channels.

FEATURES

- 2.7 V to 12 V single supply or ± 3 to ± 6 V dual supply operation
- Low on-resistance - R_{ON}: 3.9 Ω typ.
- Fast switching: t_{ON} - 42 ns, t_{OFF} - 24 ns
- Break-before-make guaranteed
- Low leakage
- TTL, CMOS, LV logic (3 V) compatible
- 2000 V ESD protection (HBM)
- MICRO FOOT® package
- Lead (Pb)-free solder bumps
- **Compliant to RoHS Directive 2002/95/EC**

Pb-free
RoHS COMPLIANT

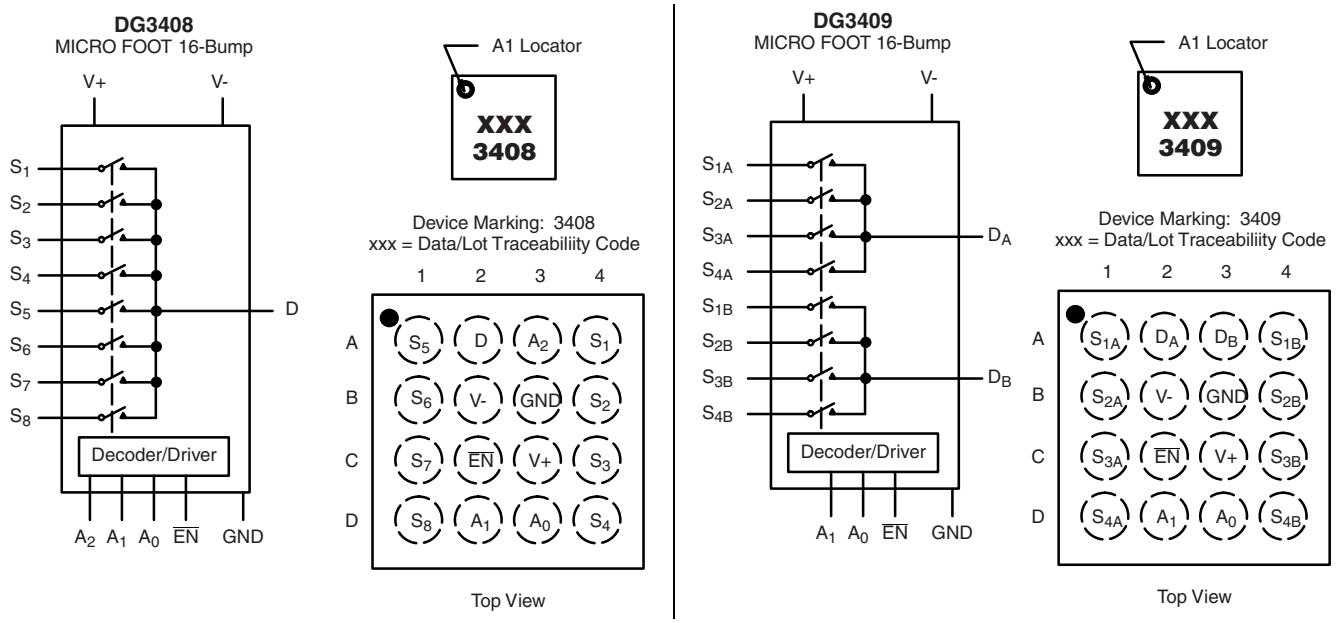
BENEFITS

- High accuracy
- Single and dual power rail capacity
- Wide operating voltage range
- Simple logic interface

APPLICATIONS

- Data acquisition systems
- Battery operated equipment
- Portable test equipment
- Sample and hold circuits
- Communication systems
- SDSL, DSLAM
- Audio and video signal routing

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



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TRUTH TABLE (DG3408)				
A_2	A_1	A_0	$\overline{EN}$	On Switch
X	X	X	1	None
0	0	0	0	1
0	0	1	0	2
0	1	0	0	3
0	1	1	0	4
1	0	0	0	5
1	0	1	0	6
1	1	0	0	7
1	1	1	0	8

TRUTH TABLE (DG3409)			
A_1	A_0	$\overline{EN}$	On Switch
X	X	1	None
0	0	0	1
0	1	0	2
1	0	0	3
1	1	0	4

X = Do not care

For low and high voltage levels for V_{AX} and V_{EN} consult “Digital Control” Parameters for Specific V+ operation. See Specifications Tables for:

Single Supply 12 V
Dual Supply V+ = 5 V, V- = - 5 V
Single Supply 5 V
Single Supply 3 V

ORDERING INFORMATION (DG3408)		
Temperature Range	Package	Part Number
- 40 °C to 85 °C	MICRO FOOT: 16-Bump (4 x 4, 0.5 mm Pitch, 238 µm Bump Height)	DG3408DB-T2-E1 (Lead (Pb)-free)

ORDERING INFORMATION (DG3409)		
Temperature Range	Package	Part Number
- 40 °C to 85 °C	MICRO FOOT: 16-Bump (4 x 4, 0.5 mm Pitch, 238 µm Bump Height)	DG3409DB-T2-E1 (Lead (Pb)-free)

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise noted)			
Parameter		Limit	Unit
Voltage Referenced V+ to V-		14	V
GND		7	
Digital Inputs[a], V_S, V_D		(V-) - 0.3 V to (V) + 0.3 V	
Current (Any Terminal Except S or D)		30	mA
Continuous Current, S or D)		100	
Peak Current, S or D (Pulsed at 1 ms, 10 % duty cycle max).		200	
Package Solder Reflow Conditions[b]	IR/Convection	250	°C
Storage Temperature		- 65 to 150	
Power Dissipation (Package)[c], (T_A = 70 °C)	16-Bump (4 x 4 mm) MICRO FOOT[d]	719	mW

Notes:
a. Signals on S_X, D_X or IN_X exceeding V+ or V- will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
b. Refer to IPC/JEDEC (J-STD-020).
c. All bumps soldered or welded to PC board.
d. Derate 9 mW/°C above 70 °C.

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SPECIFICATIONS (Single Supply 12 V)							
Parameter	**Symbol**	**Test Conditions Unless Otherwise Specified** V+ = 12 V, ± 10 %, V- = 0 V V_A, $V_{\overline{EN}}$ = 0.8 V or 2.4 V[f]	**Temp.[b]**	**Limits** - 40 °C to 85 °C **Min.[c]**	**Typ.[d]**	**Max.[c]**	**Unit**
Analog Switch							
Analog Signal Range[e]	V_{ANALOG}		Full	0		12	V
On-Resistance	R_{ON}	V+ = 10.8 V, V_D = 2 V or 9 V, I_S = 50 mA Sequence Each Switch On	Room Full		4	7 7.5	Ω
R_{ON} Match Between Channels[g]	ΔR_{ON}	V+ = 10.8 V, V_D = 2 V or 9 V, I_S = 50 mA	Room			3.6	Ω
On-Resistance Flatness[i]	R_{ON} Flatness	V+ = 10.8 V, V_D = 2 V or 9 V, I_S = 50 mA	Room			8	Ω
Switch Off Leakage Current	$I_{S(off)}$	$V_{\overline{EN}}$ = 2.4 V, V_D = 11 V or 1 V, V_S = 1 V or 11 V	Room Full	- 2 - 20		2 20	nA
	$I_{D(off)}$	$V_{\overline{EN}}$ = 2.4 V, V_D = 11 V or 1 V, V_S = 1 V or 11 V	Room Full	- 2 - 20		2 20	nA
Channel On Leakage Current	$I_{D(on)}$	$V_{\overline{EN}}$ = 0 V, V_S = V_D = 1 V or 11 V	Room Full	- 2 - 20		2 20	nA
Digital Control							
Logic High Input Voltage	V_{INH}		Full	2.4			V
Logic Low Input Voltage	V_{INL}		Full			0.8	V
Input Current	I_{IN}	V_{AX} = $V_{\overline{EN}}$ = 2.4 V or 0.8 V	Full	- 1		1	µA
Dynamic Characteristics							
Transition Time	t_{TRANS}	V_{S1} = 8 V, V_{S8} = 0 V, (DG3408) V_{S1b} = 8 V, V_{S4b} = 0 V, (DG3409) see figure 2	Room Full		42	71 75	ns
Break-Before-Make Time	t_{BBM}	$V_{S(all)}$ = V_{DA} = 5 V see figure 4	Room Full	2	24		ns
Enable Turn-On Time	$t_{ON(\overline{EN})}$	V_{AX} = 0 V, V_{S1} = 5 V (DG3408) V_{AX} = 0 V, V_{S1b} = 5 V (DG3409) see figure 3	Room Full		42	70 75	ns
Enable Turn-Off Time	$t_{OFF(\overline{EN})}$	V_{AX} = 0 V, V_{S1} = 5 V (DG3408) V_{AX} = 0 V, V_{S1b} = 5 V (DG3409) see figure 3	Room Full		24	44 46	ns
Charge Injection[e]	Q	C_L = 1 nF, V_{GEN} = 0 V, R_{GEN} = 0 Ω	Room		29		pC
Off Isolation[e, h]	OIRR	f = 100 kHz, R_L = 1 kΩ	Room		- 80		dB
Crosstalk[e]	X_{TALK}	f = 100 kHz, R_L = 1 kΩ	Room		- 85		dB
Source Off Capacitance[e]	$C_{S(off)}$	f = 1 MHz, V_S = 0 V, $V_{\overline{EN}}$ = 2.4 V DG3408	Room		21		pF
		DG3409	Room		23		pF
Drain Off Capacitance[e]	$C_{D(off)}$	f = 1 MHz, V_D = 0 V, $V_{\overline{EN}}$ = 2.4 V DG3408	Room		211		pF
		DG3409	Room		112		pF
Drain On Capacitance[e]	$C_{D(on)}$	f = 1 MHz, V_D = 0 V, $V_{\overline{EN}}$ = 0 V DG3408	Room		238		pF
		DG3409	Room		137		pF
Power Supplies							
Power Supply Current	I+	$V_{\overline{EN}}$ = V_A = 0 V or V+	Room			1	µA

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SPECIFICATIONS (Dual Supply V+ = 5 V, V- = - 5 V)							
Parameter	**Symbol**	**Test Conditions Unless Otherwise Specified** V+ = 5 V, V- = - 5 V, ± 10 % V_A, $V_{\overline{EN}}$ = 0.8 V or 2 V[f]	**Temp.[b]**	**Limits** - 40 °C to 85 °C **Min.[c]**	**Typ.[d]**	**Max.[c]**	**Unit**
Analog Switch							
Analog Signal Range[e]	V_{ANALOG}		Full	- 5		5	V
On-Resistance	R_{ON}	V+ = 4.5 V, V- = - 4.5 V, V_D = ± 3.5 V, I_S = 50 mA, sequence each switch on	Room Full		5	8 8.5	Ω
R_{ON} Match Between Channels[g]	ΔR_{ON}	V+ = 4.5 V, V- = - 4.5 V, V_D = ± 3.5 V, I_S = 50 mA	Room			3.6	Ω
On-Resistance Flatness[i]	R_{ON} Flatness		Room			8.2	Ω
Switch Off Leakage Current[a]	$I_{S(off)}$	V+ = 5.5, V- = - 5.5 V $V_{\overline{EN}}$ = 2.4 V, V_D = ± 4.5 V, V_S = ± 4.5 V	Room Full	- 2 - 20		2 20	nA
	$I_{D(off)}$		Room Full	- 2 - 20		2 20	nA
Channel On Leakage Current[a]	$I_{D(on)}$	V+ = 5.5 V, V- = - 5.5 V $V_{\overline{EN}}$ = 0 V, V_D = ± 4.5 V, V_S = ± 4.5 V	Room Full	- 2 - 20		2 20	nA
Digital Control							
Logic High Input Voltage	V_{INH}		Full	2			V
Logic Low Input Voltage	V_{INL}		Full			0.8	V
Input Current[a]	I_{IN}	V_{AX} = V_{EN} = 2 V or 0.8 V	Full	- 1		1	µA
Dynamic Characteristics							
Transition Time[e]	t_{TRANS}	V_{S1} = 3.5 V, V_{S8} = - 3.5 V, (DG3408) V_{S1b} = 3.5 V, V_{S4b} = - 3.5 V, (DG3409) see figure 2	Room Full		68	89 94	ns
Break-Before-Make Time[e]	t_{BBM}	$V_{S(all)}$ = V_{DA} = 3.5 V see figure 4	Room Full	1	16		ns
Enable Turn-On Time[e]	$t_{ON(\overline{EN})}$	V_{AX} = 0 V, V_{S1} = 3.5 V (DG3408) V_{AX} = 0 V, V_{S1b} = 3.5 V (DG3409) see figure 3	Room Full		68	88 94	ns
Enable Turn-Off Time[e]	$t_{OFF(\overline{EN})}$		Room Full		58	78 81	ns
Source Off Capacitance[e]	$C_{S(off)}$	f = 1 MHz, V_S = 0 V, $V_{\overline{EN}}$ = 2 V — DG3408	Room		23		pF
		DG3409	Room		23		pF
Drain Off Capacitance[e]	$C_{D(off)}$	f = 1 MHz, V_D = 0 V, $V_{\overline{EN}}$ = 2 V — DG3408	Room		223		pF
		DG3409	Room		113		pF
Drain On Capacitance[e]	$C_{D(on)}$	f = 1 MHz, V_D = 0 V, $V_{\overline{EN}}$ = 0 V — DG3408	Room		246		pF
		DG3409	Room		137		pF
Power Supplies							
Power Supply Current	I+	$V_{\overline{EN}}$ = V_A = 0 V or V+	Room			1	µA
	I-		Room	- 1			µA

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SPECIFICATIONS (Single Supply 5 V)								
Parameter	**Symbol**	**Test Conditions Unless Otherwise Specified** V+ = 5 V, ± 10 %, V- = 0 V V_A, $V_{\overline{EN}}$ = 0.8 V or 2 V[f]		**Temp.[b]**	**Limits** - 40 °C to 85 °C **Min.[c]**	**Typ.[d]**	**Max.[c]**	**Unit**
Analog Switch								
Analog Signal Range[e]	V_{ANALOG}			Full	0		5	V
On-Resistance	R_{ON}	V+ = 4.5 V, V_D or V_S = 1 V or 3.5 V, I_S = 50 mA		Room Full		7	10.5 11	Ω
R_{ON} Match Between Channels[g]	ΔR_{ON}	V+ = 4.5 V, V_D = 1 V or 3.5 V, I_S = 50 mA		Room			3.6	
On-Resistance Flatness[i]	R_{ON} Flatness			Room			9	
Switch Off Leakage Current[a]	$I_{S(off)}$	V+ = 5.5 V V_S = 1 V or 4 V, V_D = 4 V or 1 V		Room Full	- 2 - 20		2 20	nA
	$I_{D(off)}$			Room Full	- 2 - 20		2 20	
Channel On Leakage Current[a]	$I_{D(on)}$	V+ = 5.5 V V_D = V_S = 1 V or 4 V, sequence each switch on		Room Full	- 2 - 20		2 20	
Digital Control								
Logic High Input Voltage	V_{INH}	V+ = 5 V		Full	2			V
Logic Low Input Voltage	V_{INL}			Full			0.8	
Input Current[a]	I_{IN}	V_{AX} = $V_{\overline{EN}}$ = 2 V or 0.8 V		Full	- 1		1	µA
Dynamic Characteristics								
Transition Time[e]	t_{TRANS}	V_{S1} = 3.5 V, V_{S8} = 0 V, (DG3408) V_{S1b} = 3.5 V, V_{S4b} = 0 V, (DG3409) see figure 2		Room Full		73	94 104	ns
Break-Before-Make Time[e]	t_{OPEN}	$V_{S(all)}$ = V_{DA} = 3.5 V see figure 4		Room Full	2	29		
Enable Turn-On Time[e]	$t_{ON(\overline{EN})}$	V_{AX} = 0 V, V_{S1} = 3.5 V (DG3408) V_{AX} = 0 V, V_{S1b} = 3.5 V (DG3409) see figure 3		Room Full		74	94 104	
Enable Turn-Off Time[e]	$t_{OFF(\overline{EN})}$			Room Full		38	57 61	
Charge Injection[e]	Q	C_L = 1 nF, R_{GEN} = 0 Ω, V_{GEN} = 0 V		Room		20		pC
Off Isolation[e, h]	OIRR	R_L = 1 kΩ, f = 100 kHz		Room		- 81		dB
Crosstalk[e]	X_{TALK}			Room		- 85		
Source Off Capacitance[e]	$C_{S(off)}$	f = 1 MHz, V_S = 0 V, $V_{\overline{EN}}$ = 0 V	DG3408	Room		22		pF
			DG3409	Room		24		
Drain Off Capacitance[e]	$C_{D(off)}$	f = 1 MHz, V_D = 0 V, $V_{\overline{EN}}$ = 2 V	DG3408	Room		223		
			DG3409	Room		113		
Drain On Capacitance[e]	$C_{D(on)}$	f = 1 MHz, V_D = 0 V, $V_{\overline{EN}}$ = 0 V	DG3408	Room		244		
			DG3409	Room		143		
Power Supplies								
Power Supply Current	I+	$V_{\overline{EN}}$ = V_A = 0 V or V+		Room			1	µA

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SPECIFICATIONS (Single Supply 3 V)								
Parameter	Symbol	Test Conditions Unless Otherwise Specified V+ = 3 V, ± 10 %, V- = 0 V $V_{\overline{EN}}$ = 0.4 V or 1.8 V[f]		Temp.[b]	Limits - 40 °C to 85 °C Min.[c]	Typ.[d]	Max.[c]	Unit
Analog Switch								
Analog Signal Range[e]	V_{ANALOG}			Full	0		3	V
On-Resistance	R_{ON}	V+ = 2.7 V, V_D = 0.5 or 2.2 V, I_S = 5 mA		Room Full		12	25.5 26.5	Ω
R_{ON} Match Between Channels[g]	ΔR_{ON}	V+ = ± 2.7 V, V_D = 0.5 V or 2.2 V, I_S = 5 mA		Room			3.6	Ω
On-Resistance Flatness[i]	R_{ON} Flatness	V+ = ± 2.7 V, V_D = 0.5 V or 2.2 V, I_S = 5 mA		Room			13	Ω
Switch Off Leakage Current[a]	$I_{S(off)}$	V+ = 3.3 V V_S = 2 or 1 V, V_D = 1 or 2 V		Room Full	- 2 - 20		2 20	nA
	$I_{D(off)}$	V+ = 3.3 V V_S = 2 or 1 V, V_D = 1 or 2 V		Room Full	- 2 - 20		2 20	nA
Channel On Leakage Current[a]	$I_{D(on)}$	V+ = 3.3 V V_D = V_S = 1 or 2 V, sequence each switch on		Room Full	- 2 - 20		2 20	nA
Digital Control								
Logic High Input Voltage	V_{INH}			Full	1.8			V
Logic Low Input Voltage	V_{INL}			Full			0.4	V
Input Current[a]	I_{IN}	V_{AX} = $V_{\overline{EN}}$ = 1.8 V or 0.4 V		Full	- 1		1	µA
Dynamic Characteristics								
Transition Time	t_{TRANS}	V_{S1} = 1.5 V, V_{S8} = 0 V, (DG3408) V_{S1b} = 1.5 V, V_{S4b} = 0 V, (DG3409) see figure 2		Room Full		140	165 182	ns
Break-Before-Make Time	t_{BBM}	$V_{S(all)}$ = V_{DA} = 1.5 V see figure 4		Room Full	2	63		ns
Enable Turn-On Time	$t_{ON(\overline{EN})}$	V_{AX} = 0 V, V_{S1} = 1.5 V (DG3408) V_{AX} = 0 V, V_{S1b} = 1.5 V (DG3409) see figure 3		Room Full		140	162 178	ns
Enable Turn-Off Time	$t_{OFF(\overline{EN})}$	V_{AX} = 0 V, V_{S1} = 1.5 V (DG3408) V_{AX} = 0 V, V_{S1b} = 1.5 V (DG3409) see figure 3		Room Full		76	97 104	ns
Charge Injection[e]	Q	C_L = 1 nF, R_{GEN} = 0, V_{GEN} = 0 V		Room		7		pC
Off Isolation[e, h]	OIRR	f = 100 kHz, R_L = 1 kΩ		Room		- 81		dB
Crosstalk[e]	X_{TALK}	f = 100 kHz, R_L = 1 kΩ		Room		- 85		dB
Source Off Capacitance[e]	$C_{S(off)}$	f = 1 MHz, V_S = 0 V, $V_{\overline{EN}}$ = 1.8 V	DG3408	Room		23		pF
			DG3409	Room		25		pF
Drain Off Capacitance[e]	$C_{D(off)}$	f = 1 MHz, V_D = 0 V, $V_{\overline{EN}}$ = 1.8 V	DG3408	Room		230		pF
			DG3409	Room		120		pF
Drain On Capacitance[e]	$C_{D(on)}$	f = 1 MHz, V_D = 0 V, $V_{\overline{EN}}$ = 0 V	DG3408	Room		256		pF
			DG3409	Room		147		pF
Power Supplies								
Power Supply Current	I+	$V_{\overline{EN}}$ = V_A = 0 V or V+		Room			1	µA

Notes:
a. Leakage parameters are guaranteed by worst case test condition and not subject to production test.
b. Room = 25 °C, Full = as determined by the operating temperature suffix.
c. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
d. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
e. Guaranteed by design, not subject to production test.
f. V_{IN} = input voltage to perform proper function.
g. ΔR_{DON} = R_{DON} Max - R_{DON} Min.
h. Worst case isolation occurs on Channel 4 due to proximity to the drain pin.
i. R_{DON} flatness is measured as the difference between the minimum and maximum measured values across a defined Analog signal.

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.

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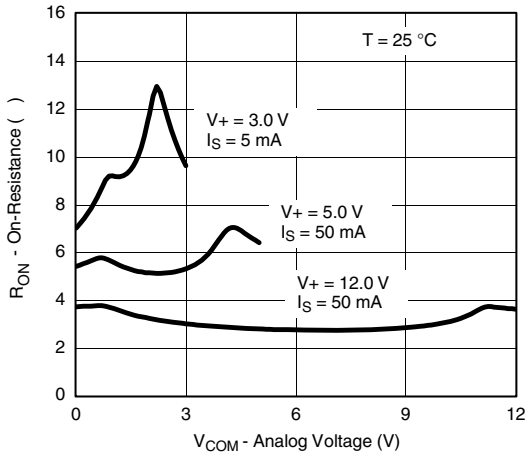
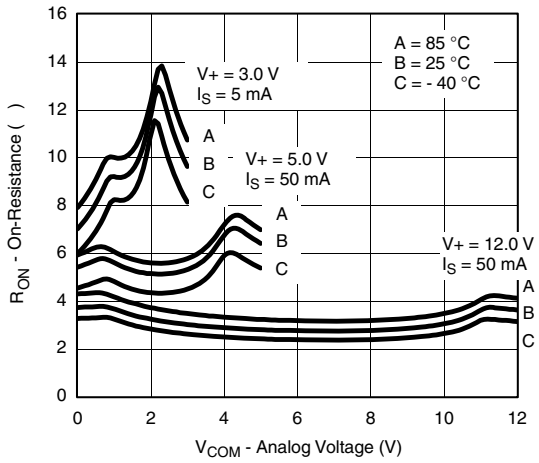
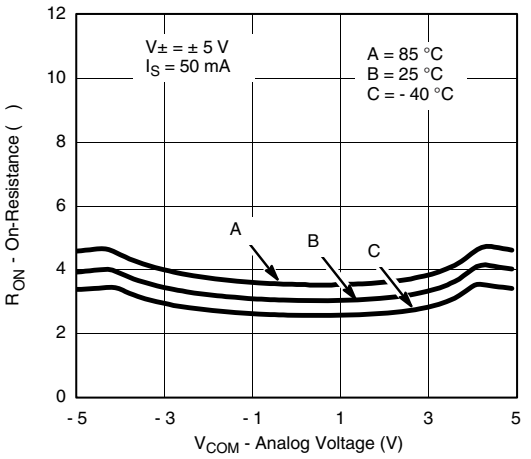
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



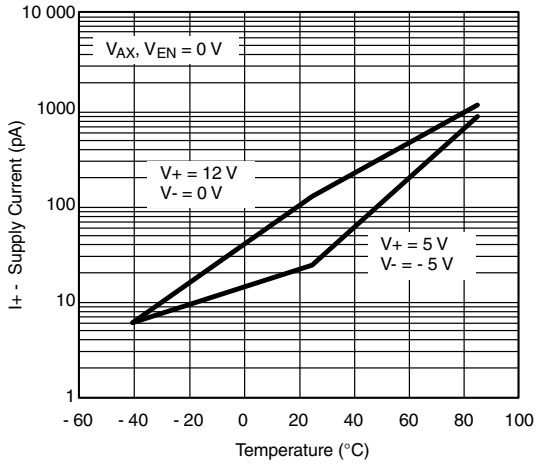
R_{ON} vs. V_{COM} and Single Supply Voltage



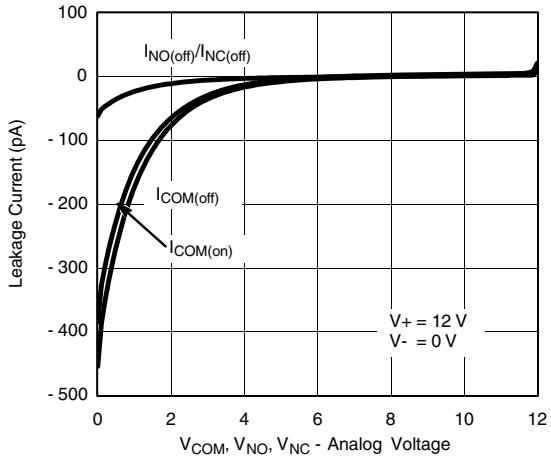
R_{ON} vs. Analog Voltage and Temperature



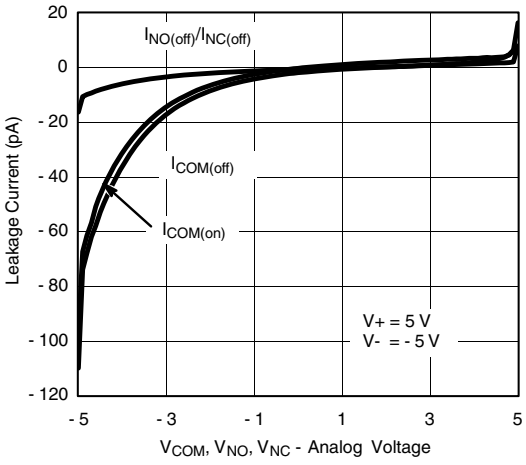
R_{ON} vs. Analog Voltage and Temperature



Supply Current vs. Temperature



Leakage Current vs. Analog Voltage



Leakage Current vs. Analog Voltage

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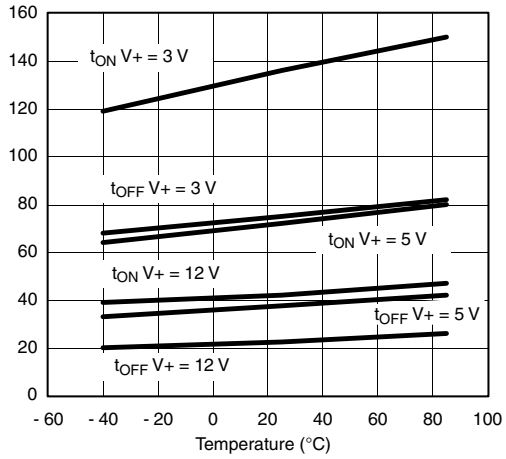
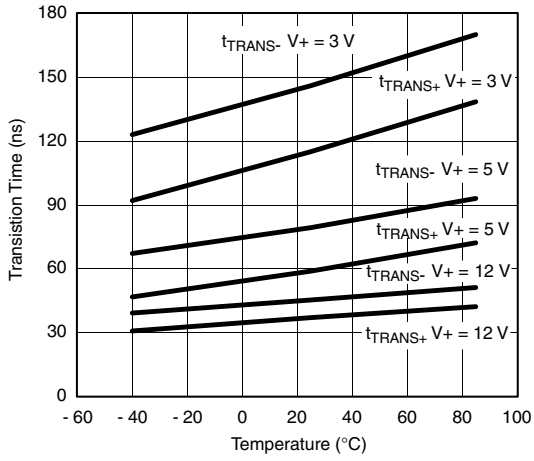
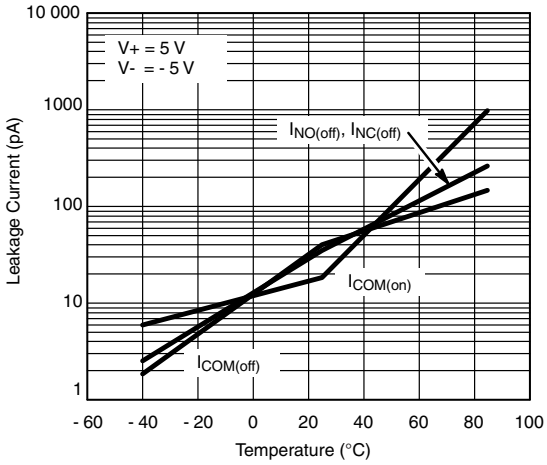
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



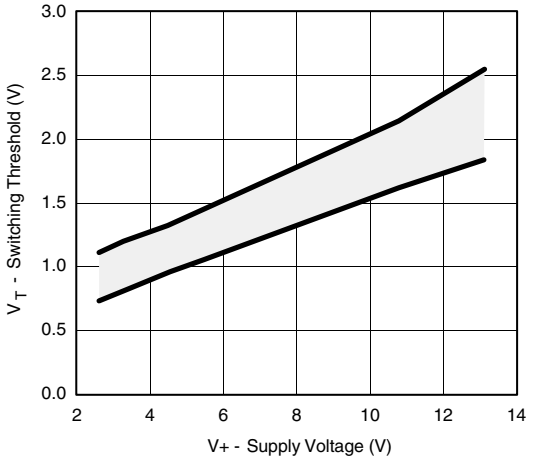
Switching Time vs. Temperature and Single Supply Voltage



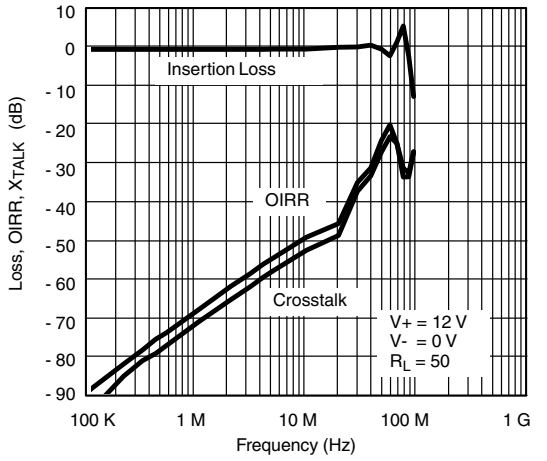
Transition Time vs. Temperature and Single Supply Voltage



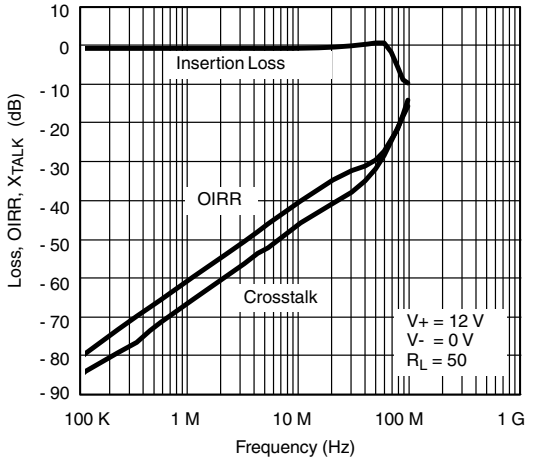
Leakage Current vs. Temperature



Switching Threshold vs. Supply Voltage



Insertion Loss, Off Isolation and Crosstalk vs. Frequency (DG3408)



Insertion Loss, Off Isolation and Crosstalk vs. Frequency (DG3409)

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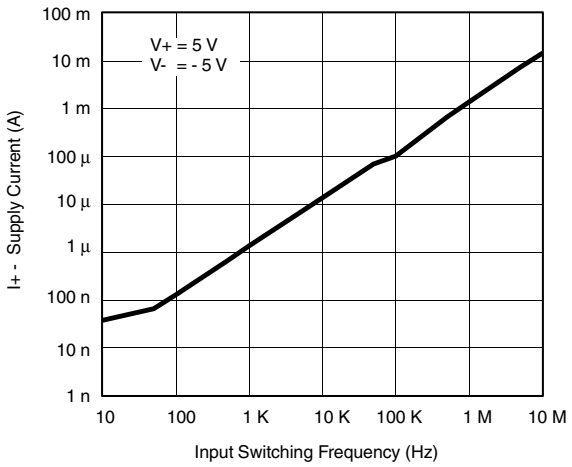
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Supply Current vs. Input Switching Frequency

SCHEMATIC DIAGRAM (Typical Channel)

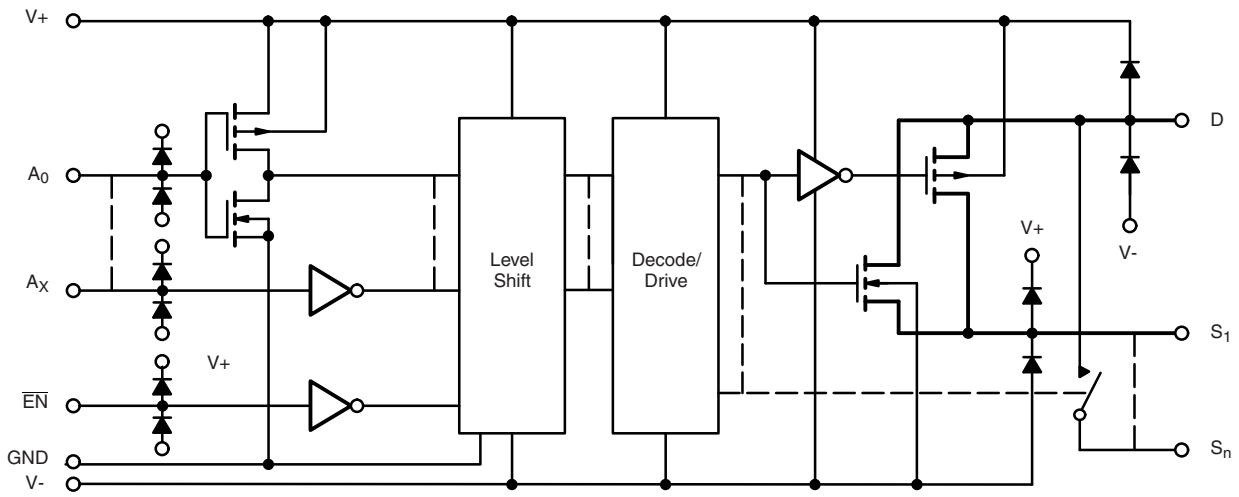


Figure 1.

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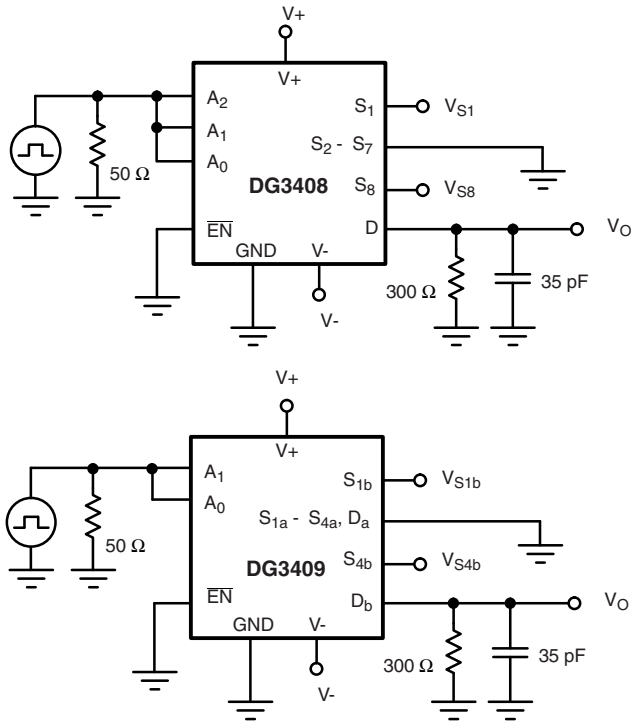
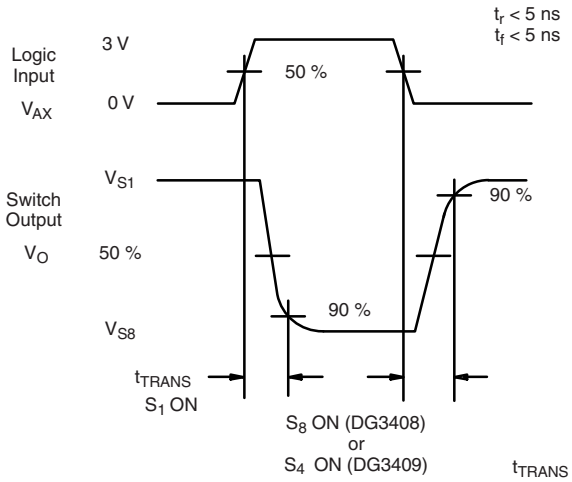
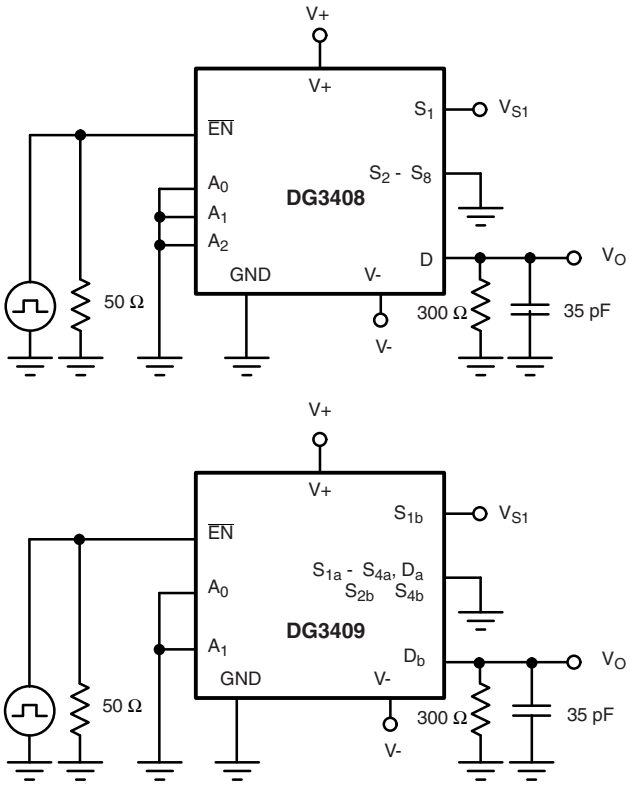
TEST CIRCUITS

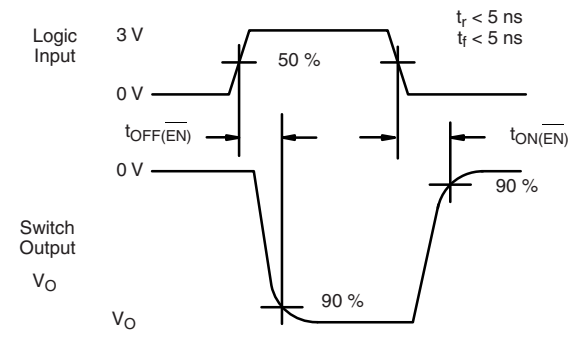




Return to Specifications:
Single Supply 12 V
Dual Supply V+ = 5 V, V- = - 5 V
Single Supply 5 V
Single Supply 3 V

Figure 2. Transition Time





Return to Specifications:
Single Supply 12 V
Dual Supply V+ = 5 V, V- = - 5 V
Single Supply 5 V
Single Supply 3 V

Figure 3. Enable Switching Time

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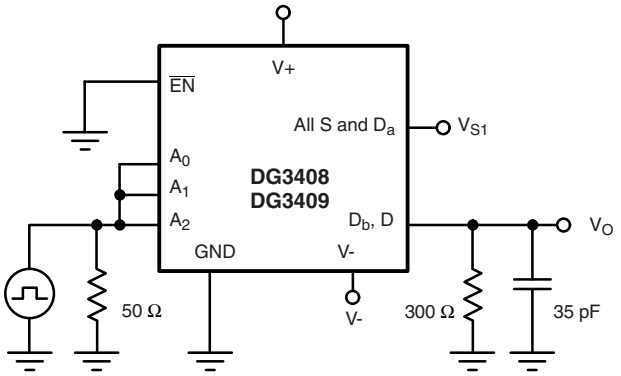
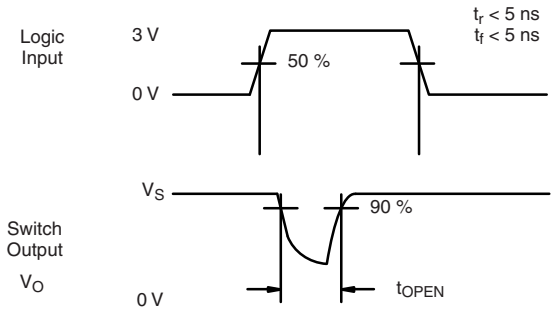
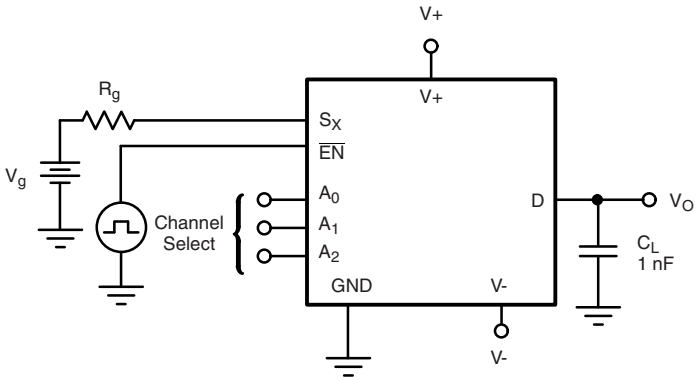
TEST CIRCUITS

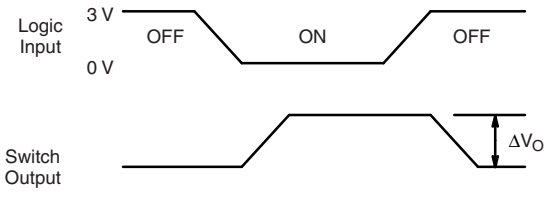




Return to Specifications:
Single Supply 12 V
Dual Supply V+ = 5 V, V- = - 5 V
Single Supply 5 V
Single Supply 3 V

Figure 4. Break-Before-Make Interval





ΔVO is the measured voltage due to charge transfer error Q, when the channel turns off.

$$Q = C_L \times \Delta V_O$$

Figure 5. Charge Injection

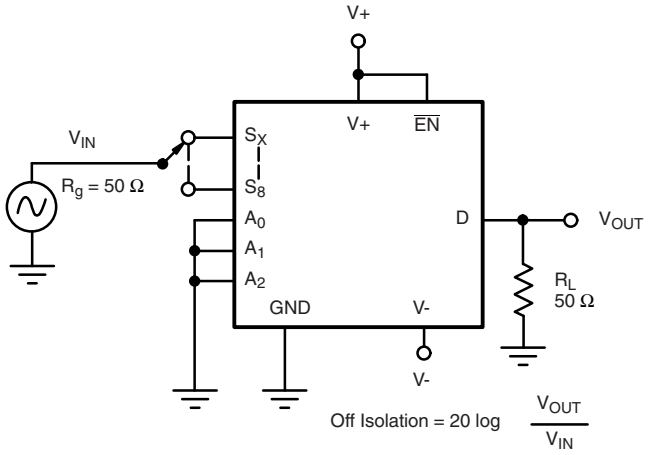


Figure 6. Off Isolation

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TEST CIRCUITS

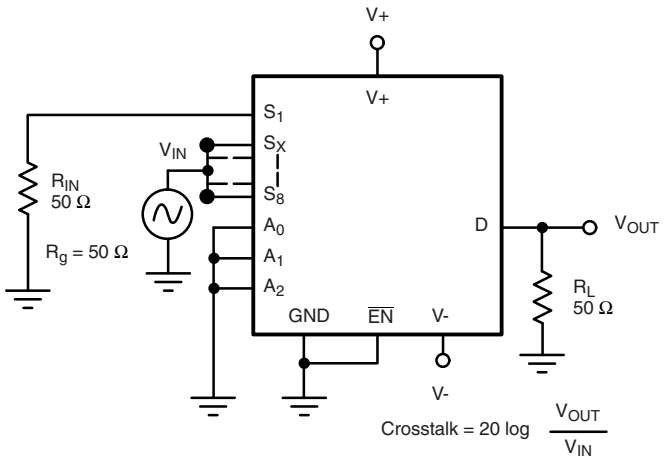

Figure 7. Crosstalk

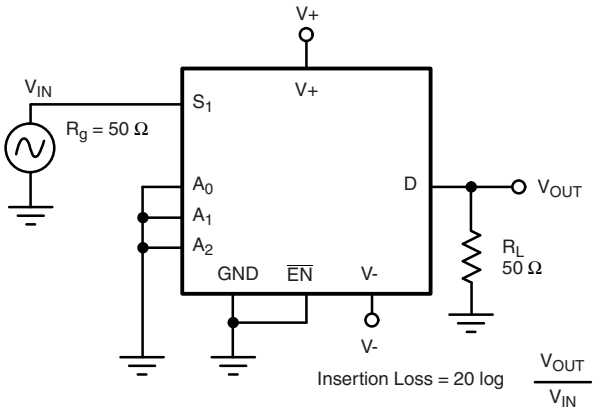

Figure 8. Insertion Loss

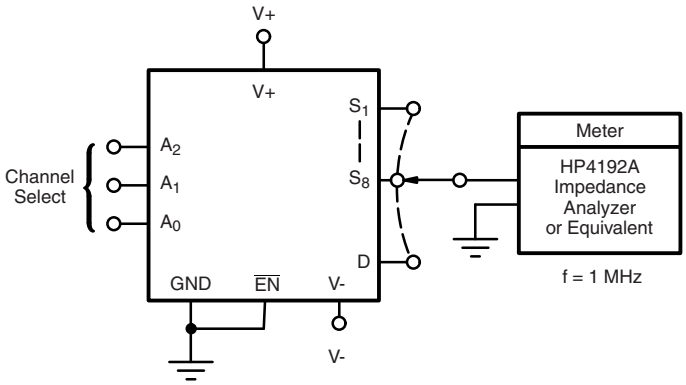

Figure 9. Source Drain Capacitance

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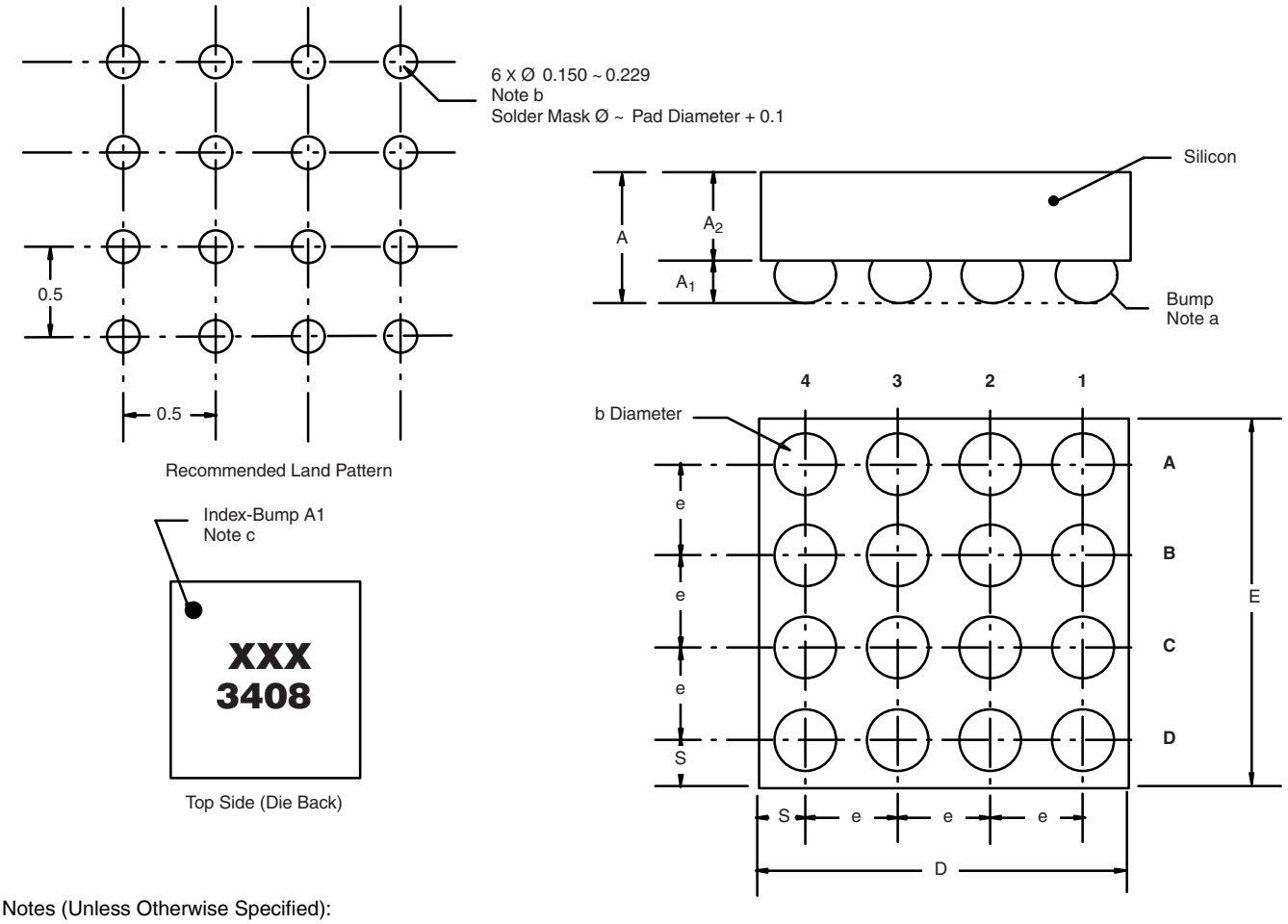
PACKAGE OUTLINE

MICRO FOOT: 16-BUMP (4 x 4, 0.5 mm PITCH, 0.238 mm BUMP HEIGHT)



Notes (Unless Otherwise Specified):
a. Bump is Lead Free Sn/Ag/Cu.
b. Non-solder mask defined copper landing pad.
c. Laser Mark on silicon die back; back-lapped, no coating. Shown is not actual marking; sample only.

Dim.	Millimeters[a]		Inches	
	Min.	Max.	Min.	Max.
A	0.688	0.753	0.0271	0.0296
A_1	0.218	0.258	0.0086	0.0102
A_2	0.470	0.495	0.0185	0.0195
b	0.306	0.346	0.0120	0.0136
D	1.980	2.020	0.0780	0.0795
E	1.980	2.020	0.0780	0.0795
e	0.5 BASIC		0.0197 BASIC	
S	0.230	0.270	0.0091	0.0106

Notes:

a. Use millimeters as the primary measurement.

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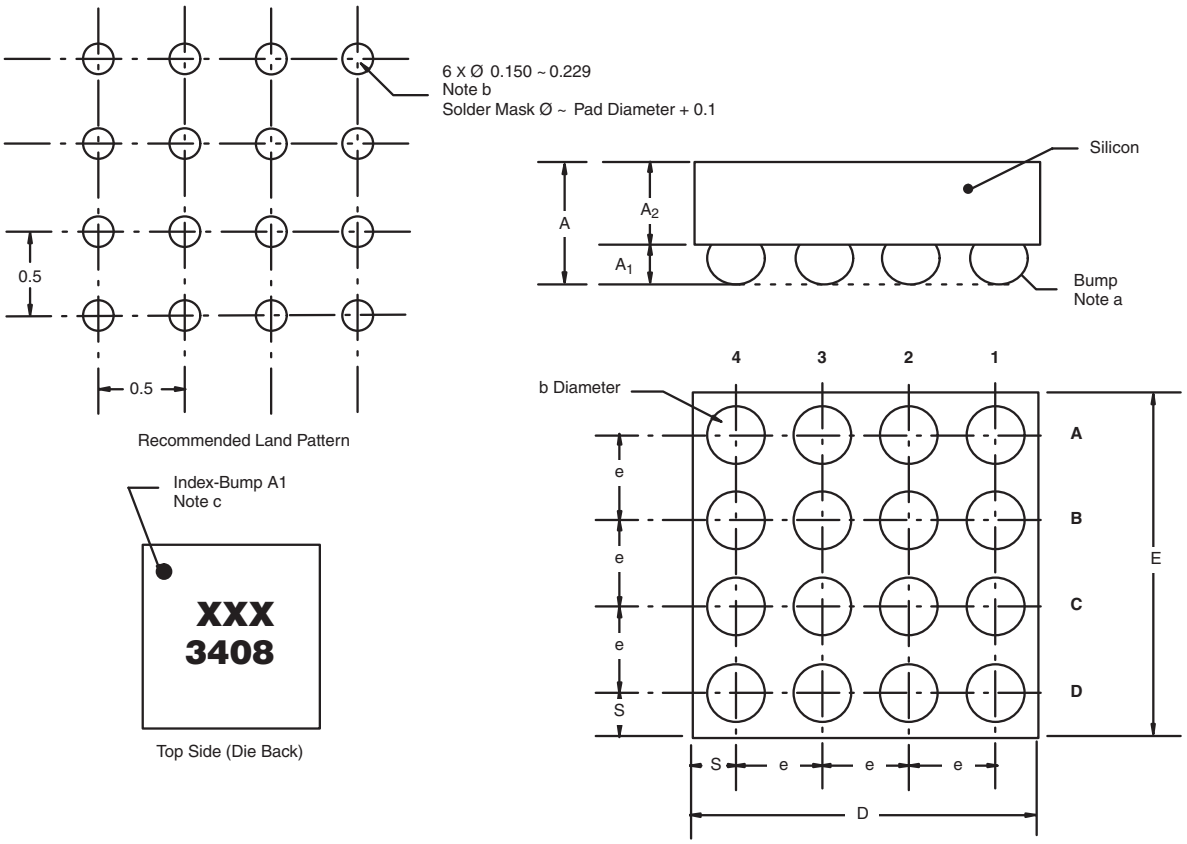
MICRO FOOT: 16-BUMP (4 mm x 4 mm, 0.5 mm PITCH, 0.238 mm BUMP HEIGHT)



Notes

(unless otherwise specified)

a. Bump is lead (Pb)-free Sn/Ag/Cu.

b. Non-solder mask defined copper landing pad.

c. Laser mark on silicon die back; back-lapped, no coating. Shown is not actual marking; sample only.

DIM.	MILLIMETERS[a]		INCHES	
	MIN.	MAX.	MIN.	MAX.
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Note

a. Use millimeters as the primary measurement.

ECN: S11-1065-Rev. A, 13-Jun-11
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