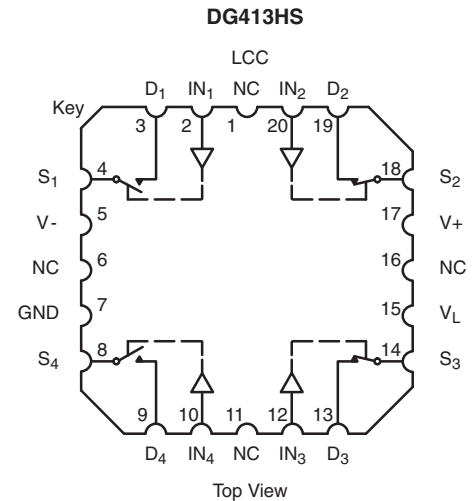
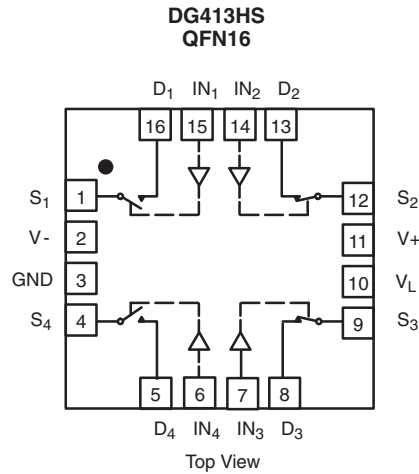
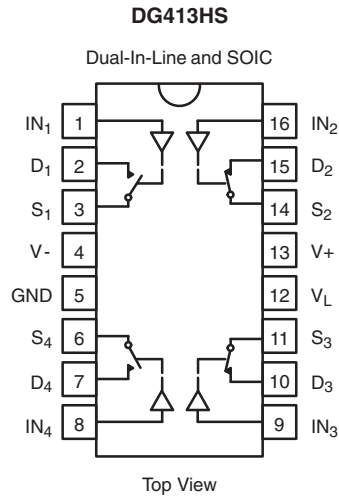


FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



TRUTH TABLE		
Logic	SW ₁ , SW ₄	SW ₂ , SW ₃
0	OFF	ON
1	ON	OFF

ORDERING INFORMATION		
Temp. Range	Package	Part Number
DG411HS, DG412HS		
- 40 °C to 85 °C	16-Pin Plastic DIP	DG411HSDJ DG411HSDJ-E3
		DG412HSDJ DG412HSDJ-E3
	16-Pin Narrow SOIC	DG411HSDY DG411HSDY-E3 DG411HSDY-T1 DG411HSDY-T1-E3
		DG412HSDY DG412HSDY-E3 DG412HSDY-T1 DG412HSDY-T1-E3
		DG411HSDN-T1-E4 DG412HSDN-T1-E4
	16-Pin QFN 4 x 4 mm (Variation 1)	
DG413HS		
- 40 °C to 85 °C	16-Pin Plastic DIP	DG413HSDJ DG413HSDJ-E3
	16-Pin Narrow SOIC	DG413HSDY DG413HSDY-E3 DG413HSDY-T1 DG413HSDY-T1-E3
		DG413HSDN-T1-E4
		DG413HSDN-T1-E4
16-Pin QFN 4 x 4 mm (Variation 1)	DG413HSDN-T1-E4	



ABSOLUTE MAXIMUM RATINGS			
Parameter		Limit	Unit
V+ to V-		44	V
GND to V-		25	
V _L		(GND - 0.3) to (V+) + 0.3	
Digital Inputs ^a , V _S , V _D		(V-) - 2 to (V+) + 2 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	(AK, AZ Suffix)	- 65 to 150	°C
	(DJ, DY, DN Suffix)	- 65 to 125	
Power Dissipation (Package) ^b	16-Pin Plastic DIP ^c	470	mW
	16-Pin Narrow SOIC ^d	600	
	16-Pin CerDIP ^e	900	
	LCC-20 ^e	900	
	16-Pin (4 x 4 mm) QFN ^f	1880	

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. All leads welded or soldered to PC board.
- c. Derate 6 mW/°C above 25 °C.
- d. Derate 7.6 mW/°C above 75 °C.
- e. Derate 12 mW/°C above 75 °C.
- f. Derate 23.5 mW/°C above 70 °C.

SPECIFICATIONS ^a									
Parameter	Symbol	Test Conditions Unless Specified V+ = 15 V, V- = - 15 V V _L = 5 V, V _{IN} = 2.4 V, 0.8 V ^f	Temp. ^b	Typ. ^c	A Suffix - 55 °C to 125 °C		D Suffix - 40 °C to 85 °C		Unit
					Min. ^d	Max. ^d	Min. ^d	Max. ^d	
Analog Switch									
Analog Signal Range ^e	V _{ANALOG}		Full		- 15	15	- 15	15	V
Drain-Source On-Resistance	R _{DS(on)}	V+ = 13.5 V, V- = - 13.5 V I _S = - 10 mA, V _D = ± 8.5 V	Room Full	25		35 45		35 45	Ω
Switch Off Leakage Current	I _{S(off)}	V+ = 16.5 V, V- = - 16.5 V V _D = ± 15.5 mA, V _S = ± 15.5 V	Room Full	± 0.1	- 0.25 - 20	0.25 20	- 0.25 - 5	0.25 5	nA
	I _{D(off)}		Room Full	± 0.1	- 0.25 - 20	0.25 20	- 0.25 - 5	0.25 5	
Channel On Leakage Current	I _{D(on)}	V+ = 16.5 V, V- = - 16.5 V V _D = V _S = ± 15.5 V	Room Full	± 0.1	- 0.4 - 40	0.4 40	- 0.4 - 10	0.4 10	
Digital Control									
Input Current, V _{IN} Low	I _{IL}	V _{IN} under test = 0.8 V	Full	0.005	- 0.5	0.5	- 0.5	0.5	μA
Input Current, V _{IN} High	I _{IH}	V _{IN} under test = 2.4 V	Full	0.005	- 0.5	0.5	- 0.5	0.5	
Input Capacitance ^e	C _{IN}	f = 1 MHz	Room	5					pF
Dynamic Characteristics									
Turn-On Time	t _{ON}	R _L = 300 Ω, C _L = 35 pF V _S = ± 10 V, see figure 2	Room Full	68		105 127		105 116	ns
Turn-Off Time	t _{OFF}		Room Full	42		80 94		80 90	
Break-Before-Make Time Delay	t _D	DG413HS only, V _S = 10 V R _L = 300 Ω, C _L = 35 pF	Room	20					
Charge Injection ^e	Q	V _g = 0 V, R _g = 0 Ω, C _L = 10 nF	Room	22					pC

SPECIFICATIONS ^a									
Parameter	Symbol	Test Conditions Unless Specified $V_+ = 15\text{ V}$, $V_- = -15\text{ V}$ $V_L = 5\text{ V}$, $V_{IN} = 2.4\text{ V}$, 0.8 V^f	Temp. ^b	Typ. ^c	A Suffix - 55 °C to 125 °C		D Suffix - 40 °C to 85 °C		Unit
					Min. ^d	Max. ^d	Min. ^d	Max. ^d	
Dynamic Characteristics (Cont'd)									
Off Isolation ^e	OIRR	$R_L = 50\ \Omega$, $C_L = 5\text{ pF}$ $f = 1\text{ MHz}$	Room	- 91					dB
Channel-to-Channel Crosstalk ^e	X_{TALK}		Room	- 88					
Source Off Capacitance ^e	$C_{S(off)}$	$f = 1\text{ MHz}$	Room	12					pF
Drain Off Capacitance ^e	$C_{D(off)}$		Room	12					
Channel On Capacitance ^e	$C_{D(on)}$		Room	30					
Power Supplies									
Positive Supply Current	I_+	$V_+ = 16.5\text{ V}$, $V_- = -16.5\text{ V}$ $V_{IN} = 0\text{ or }5\text{ V}$	Room Full	0.0001		1 5		1 5	μA
Negative Supply Current	I_-		Room Full	- 0.0001	- 1 - 5		- 1 - 5		
Logic Supply Current	I_L		Room Full	0.0001		1 5		1 5	
Ground Current	I_{GND}		Room Full	- 0.0001	- 1 - 5		- 1 - 5		

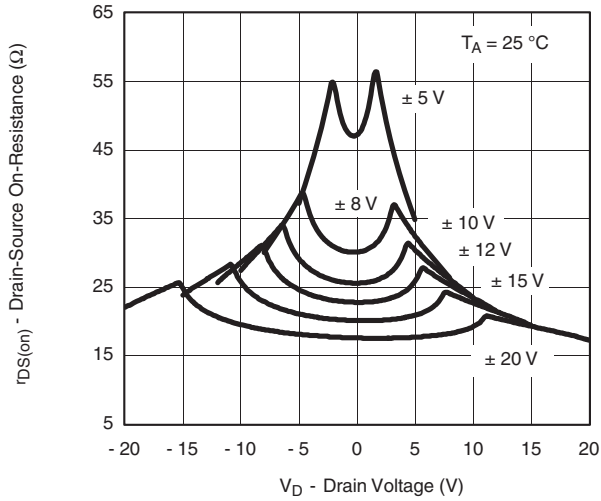
SPECIFICATIONS ^a (for Unipolar Supplies)									
Parameter	Symbol	Test Conditions Unless Specified $V_+ = 12\text{ V}$, $V_- = 0\text{ V}$ $V_L = 5\text{ V}$, $V_{IN} = 2.4\text{ V}$, 0.8 V^f	Temp. ^b	Typ. ^c	A Suffix - 55 °C to 125 °C		D Suffix - 40 °C to 85 °C		Unit
					Min. ^d	Max. ^d	Min. ^d	Max. ^d	
Analog Switch									
Analog Signal Range ^e	V_{ANALOG}		Full			12		12	V
Drain-Source On-Resistance	$R_{DS(on)}$	$V_+ = 10.8\text{ V}$, $I_S = -10\text{ mA}$ $V_D = 3\text{ V}$, 8 V	Room Full	49		80 100		80 100	Ω
Dynamic Characteristics									
Turn-On Time	t_{ON}	$R_L = 300\ \Omega$, $C_L = 35\text{ pF}$ $V_S = 8\text{ V}$, see figure 2	Room Hot	95		140 180		140 160	ns
Turn-Off Time	t_{OFF}		Room Hot	36		70 79		70 74	
Break-Before-Make Time Delay	t_D	DG413HS only, $V_S = 8\text{ V}$ $R_L = 300\ \Omega$, $C_L = 35\text{ pF}$	Room	60					
Charge Injection	Q	$V_g = 6\text{ V}$, $R_g = 0\ \Omega$, $C_L = 1\text{ nF}$	Room	60					pC
Power Supplies									
Positive Supply Current	I_+	$V_+ = 13.2\text{ V}$, $V_{IN} = 0\text{ or }5\text{ V}$	Room Hot	0.0001		1 5		1 5	μA
Negative Supply Current	I_-		Room Hot	- 0.0001	- 1 - 5		- 1 - 5		
Logic Supply Current	I_L		Room Hot	0.0001		1 5		1 5	
Ground Current	I_{GND}		Room Hot	- 0.0001	- 1 - 5		- 1 - 5		

Notes:

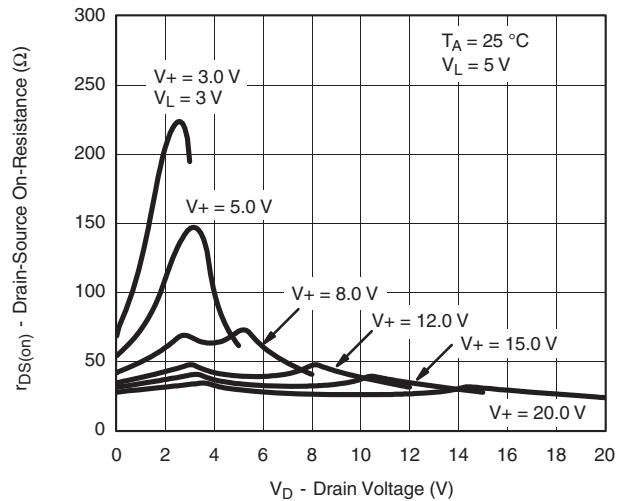
- Refer to PROCESS OPTION FLOWCHART.
- Room = 25 °C, Full = as determined by the operating temperature suffix.
- Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- Guaranteed by design, not subject to production test.
- 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.

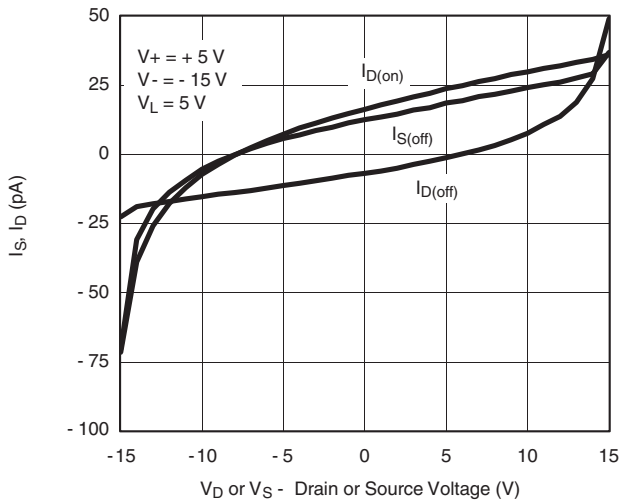
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



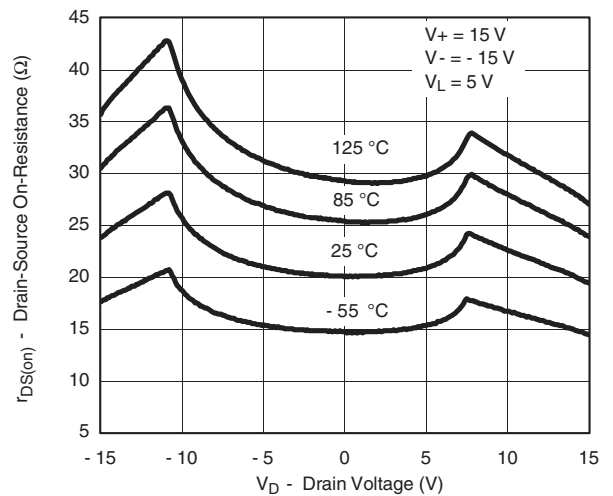
On-Resistance vs. V_D and Dual Supply Voltage



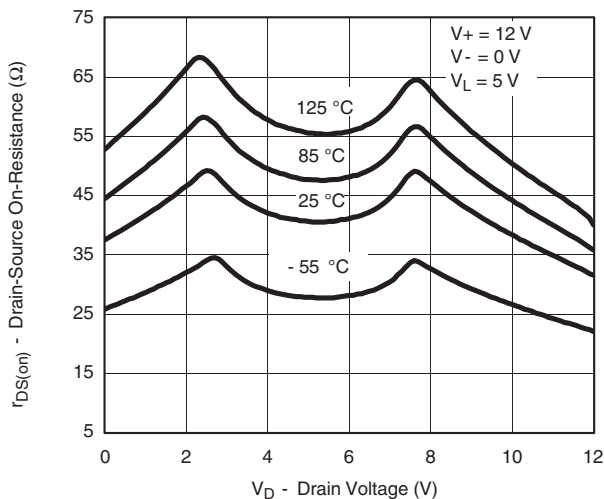
On-Resistance vs. V_D and Unipolar Supply Voltage



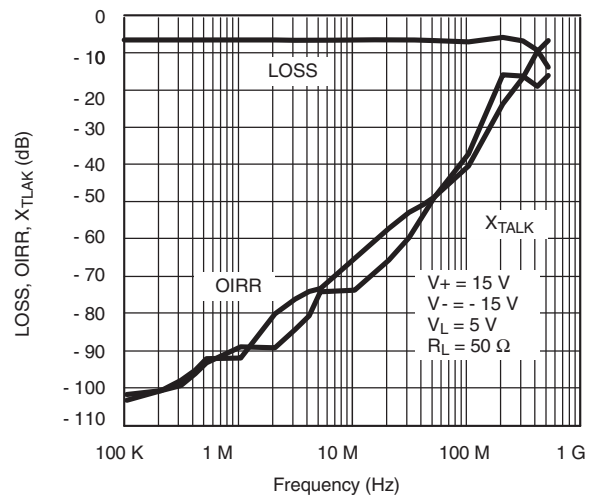
Leakage Current vs. Analog Voltage



On-Resistance vs. V_D and Temperature

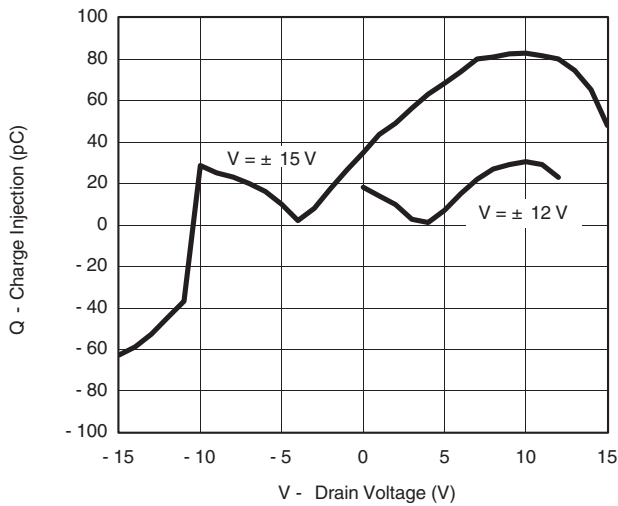


On-Resistance vs. V_D and Temperature

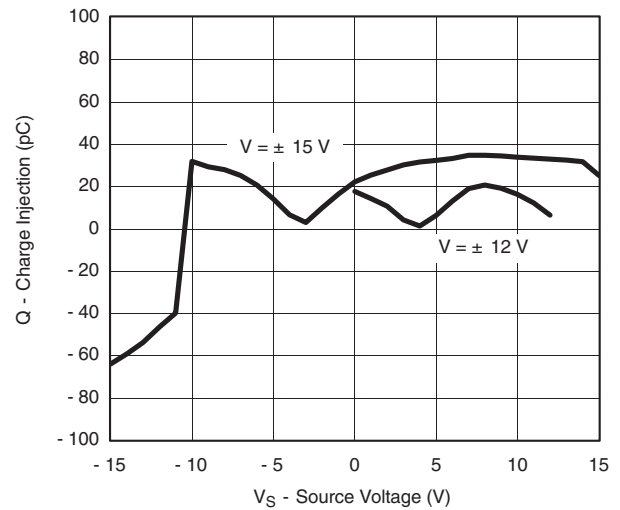


Insertion Loss, Off-Isolation, Crosstalk vs. Frequency

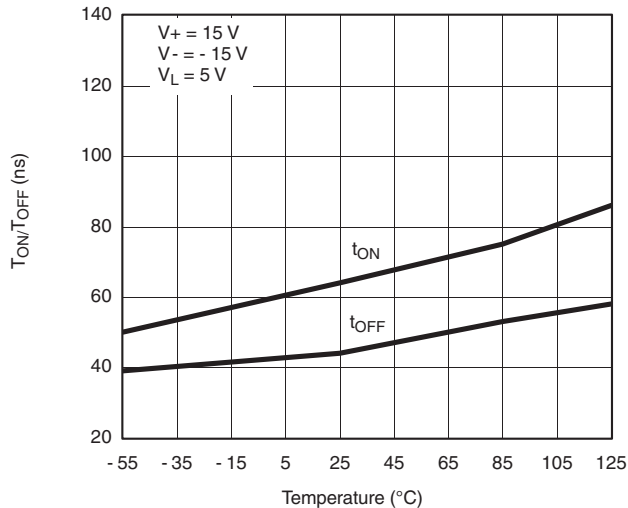
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



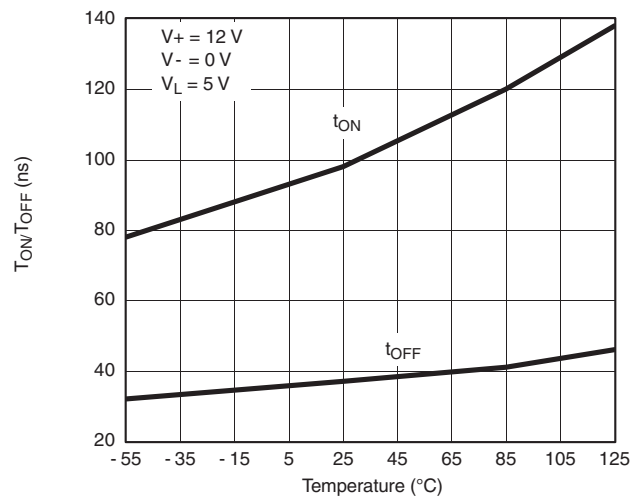
Charge Injection vs. Analog Voltage



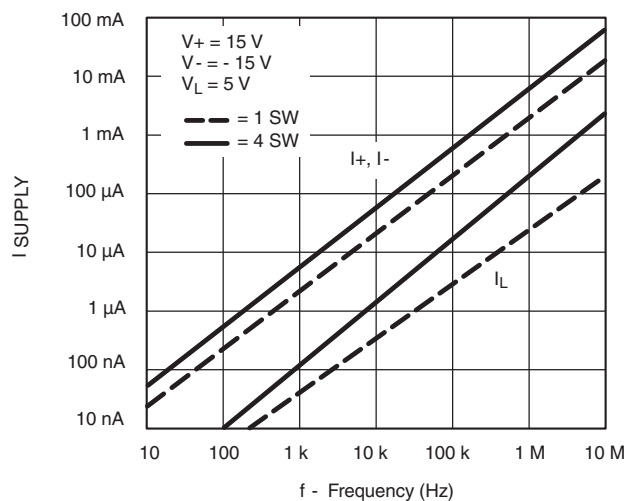
Charge Injection vs. Analog Voltage



Switching Time vs. Temperature



Switching Time vs. Temperature



Supply Current vs. Input Switching Frequency

SCHEMATIC DIAGRAM (Typical Channel)

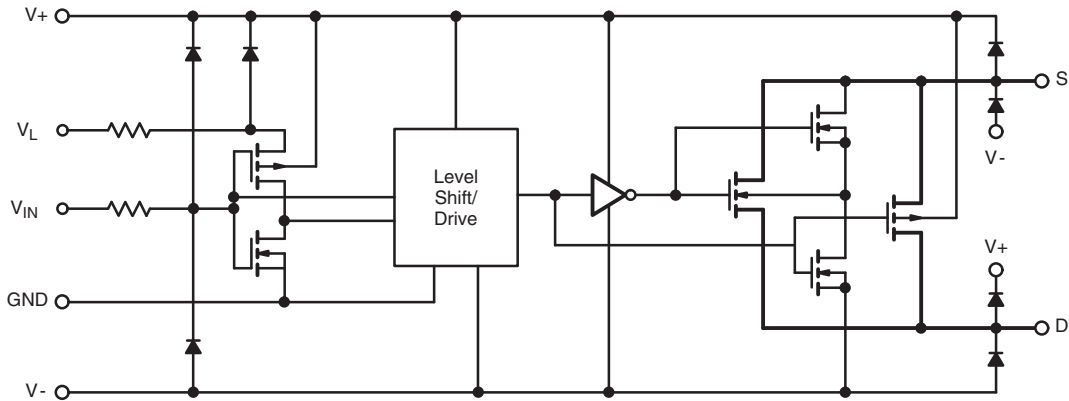
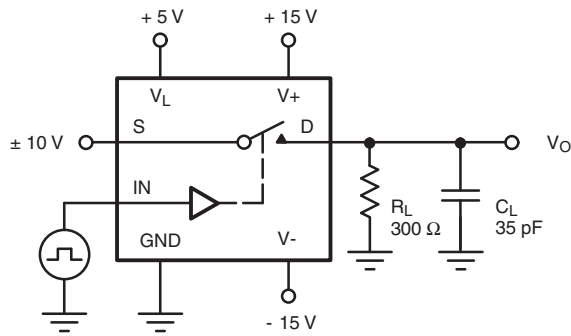


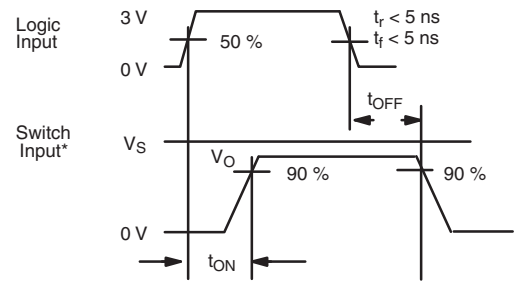
Figure 1.

TEST CIRCUITS



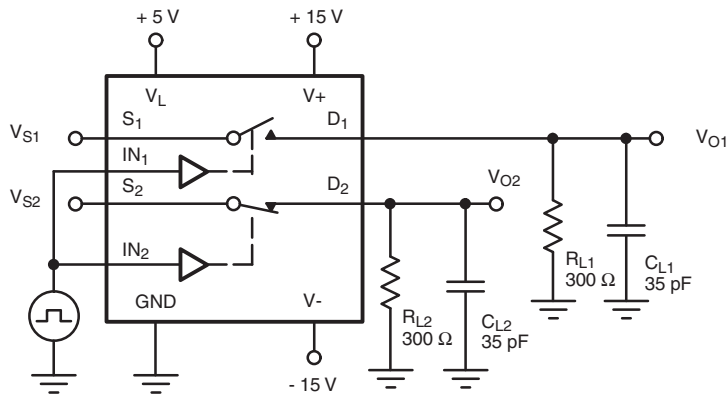
C_L (includes fixture and stray capacitance)

$$V_O = V_S \frac{R_L}{R_L + r_{DS(on)}}$$



Note: Logic input waveform is inverted for switches that have the opposite logic sense control

Figure 2. Switching Time



C_L (includes fixture and stray capacitance)

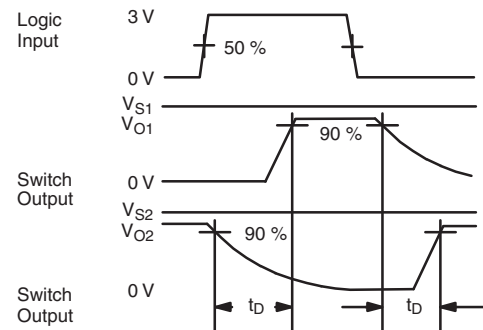


Figure 3. Break-Before-Make (DG413HS)

TEST CIRCUITS

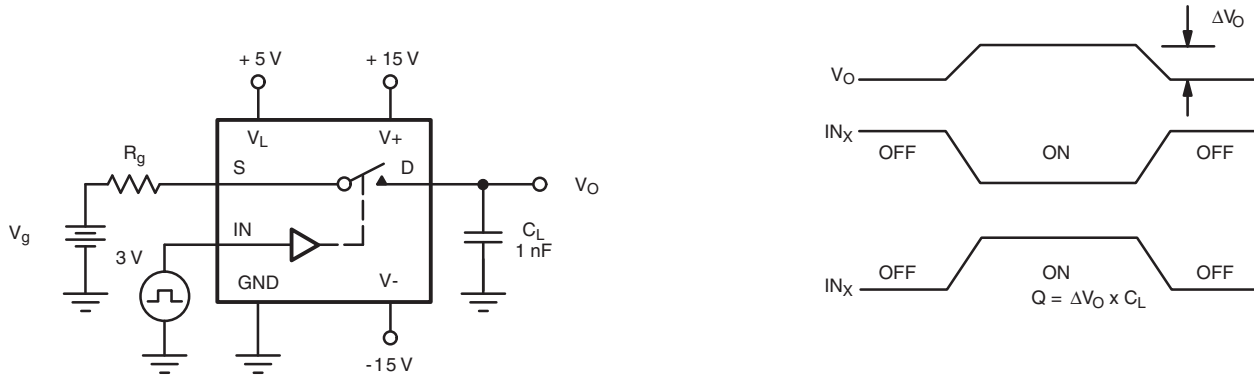


Figure 4. Charge Injection

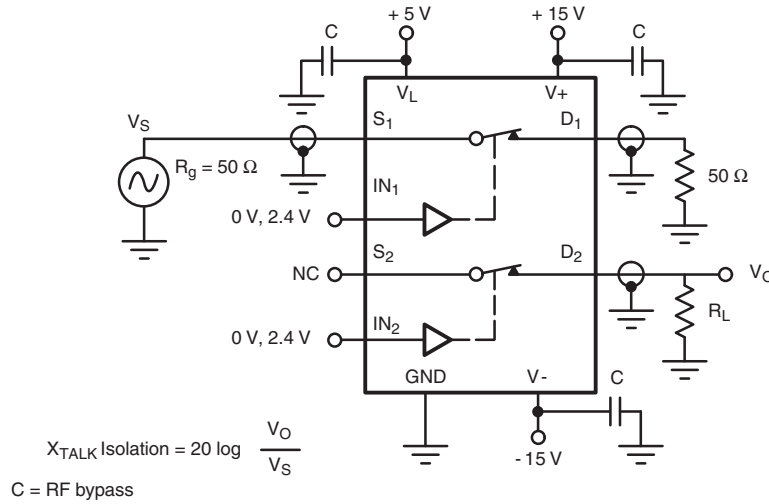


Figure 5. Crosstalk

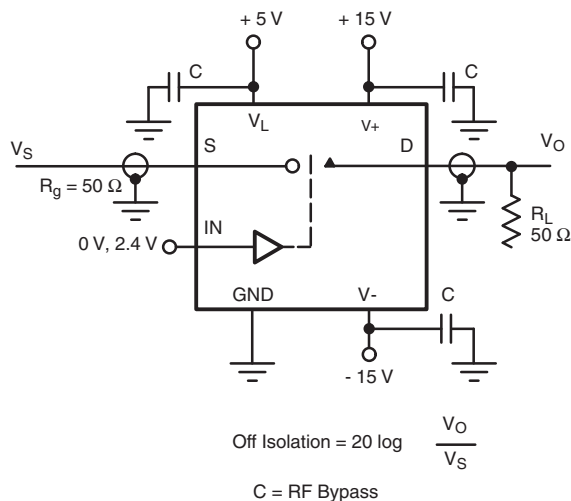


Figure 6. Off-Isolation

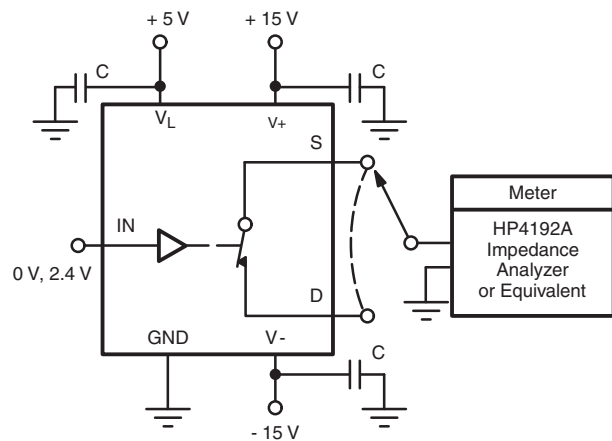
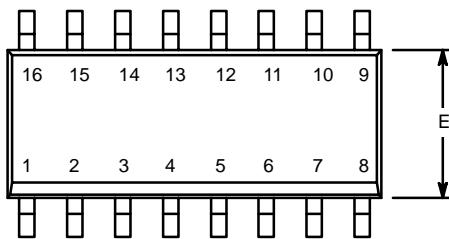


Figure 7. Source/Drain Capacitances

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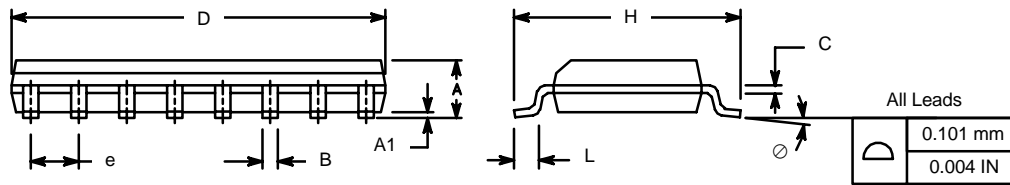


SOIC (NARROW): 16-LEAD
JEDEC Part Number: MS-012



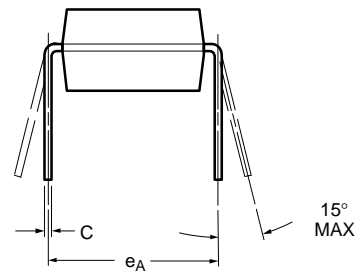
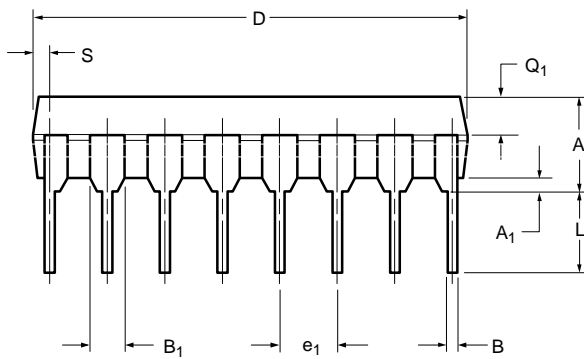
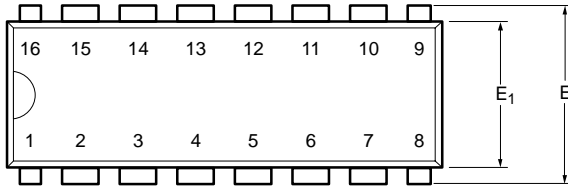
Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A ₁	0.10	0.20	0.004	0.008
B	0.38	0.51	0.015	0.020
C	0.18	0.23	0.007	0.009
D	9.80	10.00	0.385	0.393
E	3.80	4.00	0.149	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
L	0.50	0.93	0.020	0.037
∅	0°	8°	0°	8°

ECN: S-03946—Rev. F, 09-Jul-01
DWG: 5300





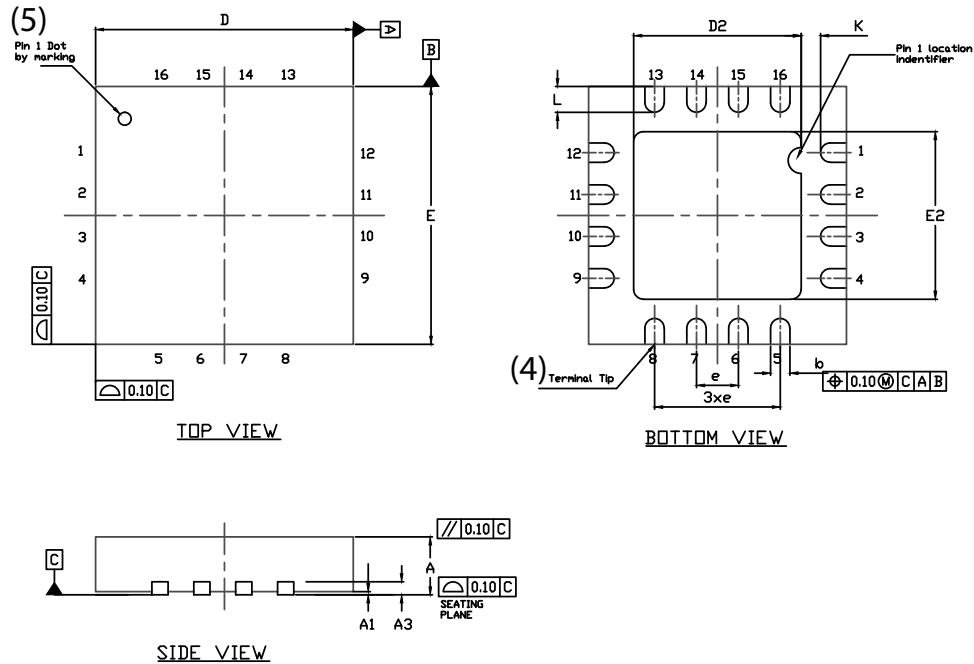
PDIP: 16-LEAD



Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	3.81	5.08	0.150	0.200
A₁	0.38	1.27	0.015	0.050
B	0.38	0.51	0.015	0.020
B₁	0.89	1.65	0.035	0.065
C	0.20	0.30	0.008	0.012
D	18.93	21.33	0.745	0.840
E	7.62	8.26	0.300	0.325
E₁	5.59	7.11	0.220	0.280
e₁	2.29	2.79	0.090	0.110
e_A	7.37	7.87	0.290	0.310
L	2.79	3.81	0.110	0.150
Q₁	1.27	2.03	0.050	0.080
S	0.38	1.52	.015	0.060

ECN: S-03946—Rev. D, 09-Jul-01
DWG: 5482

QFN 4x4-16L Case Outline



DIM	VARIATION 1						VARIATION 2					
	MILLIMETERS ⁽¹⁾			INCHES			MILLIMETERS ⁽¹⁾			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.75	0.85	0.95	0.029	0.033	0.037	0.75	0.85	0.95	0.029	0.033	0.037
A1	0	-	0.05	0	-	0.002	0	-	0.05	0	-	0.002
A3	0.20 ref.			0.008 ref.			0.20 ref.			0.008 ref.		
b	0.25	0.30	0.35	0.010	0.012	0.014	0.25	0.30	0.35	0.010	0.012	0.014
D	4.00 BSC			0.157 BSC			4.00 BSC			0.157 BSC		
D2	2.0	2.1	2.2	0.079	0.083	0.087	2.5	2.6	2.7	0.098	0.102	0.106
e	0.65 BSC			0.026 BSC			0.65 BSC			0.026 BSC		
E	4.00 BSC			0.157 BSC			4.00 BSC			0.157 BSC		
E2	2.0	2.1	2.2	0.079	0.083	0.087	2.5	2.6	2.7	0.098	0.102	0.106
K	0.20 min.			0.008 min.			0.20 min.			0.008 min.		
L	0.5	0.6	0.7	0.020	0.024	0.028	0.3	0.4	0.5	0.012	0.016	0.020
N ⁽³⁾	16			16			16			16		
Nd ⁽³⁾	4			4			4			4		
Ne ⁽³⁾	4			4			4			4		

Notes

- (1) Use millimeters as the primary measurement.
- (2) Dimensioning and tolerances conform to ASME Y14.5M. - 1994.
- (3) N is the number of terminals. Nd and Ne is the number of terminals in each D and E site respectively.
- (4) Dimensions b applies to plated terminal and is measured between 0.15 mm and 0.30 mm from terminal tip.
- (5) The pin 1 identifier must be existed on the top surface of the package by using identification mark or other feature of package body.
- (6) Package warpage max. 0.05 mm.

ECN: S13-0893-Rev. B, 22-Apr-13
 DWG: 5890

RECOMMENDED MINIMUM PADS FOR SO-16



Recommended Minimum Pads
Dimensions in Inches/(mm)

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