

# MAXIM

## Improved, Quad, SPST Analog Switches

DG411/DG412/DG413

### General Description

Maxim's redesigned DG411/DG412/DG413 analog switches now feature low on-resistance matching between switches ( $3\Omega$  max) and guaranteed on-resistance flatness over the signal range ( $\Delta 4\Omega$  max). These low on-resistance switches conduct equally well in either direction. They guarantee low charge injection, low power consumption, and an ESD tolerance of 2000V minimum per Method 3015.7. The new design offers lower off-leakage current over temperature (less than 5nA at +85°C).

The DG411/DG412/DG413 are quad, single-pole/single-throw (SPST) analog switches. The DG411 is normally closed (NC), and the DG412 is normally open (NO). The DG413 has two NC switches and two NO switches. Switching times are less than 150ns max for  $t_{ON}$  and less than 100ns max for  $t_{OFF}$ . These devices operate from a single +10V to +30V supply, or bipolar  $\pm 4.5V$  to  $\pm 20V$  supplies. Maxim's improved DG411/DG412/DG413 are fabricated with a 44V silicon-gate process.

### Applications

Sample-and-Hold Circuits	Communication Systems
Test Equipment	Battery-Operated Systems
Heads-Up Displays	PBX, PABX
Guidance & Control Systems	Audio Signal Routing
Military Radios	

### New Features

- ◆ Plug-In Upgrade for Industry-Standard DG411/DG412/DG413
- ◆ Improved  $R_{DS(ON)}$  Match Between Channels ( $3\Omega$  max)
- ◆ Guaranteed  $R_{FLAT(ON)}$  Over Signal Range ( $\Delta 4\Omega$ )
- ◆ Improved Charge Injection (10pC max)
- ◆ Improved Off-Leakage Current Over Temperature (<5nA at +85°C)
- ◆ Withstand Electrostatic Discharge (2000V min) per Method 3015.7

### Existing Features

- ◆ Low  $R_{DS(ON)}$  ( $35\Omega$  max)
- ◆ Single-Supply Operation +10V to +30V
- ◆ Bipolar-Supply Operation  $\pm 4.5V$  to  $\pm 20V$
- ◆ Low Power Consumption ( $35\mu W$  max)
- ◆ Rail-to-Rail Signal Handling
- ◆ TTL/CMOS-Logic Compatible

### Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
DG411CJ	0°C to +70°C	16 Plastic DIP
DG411CUE	0°C to +70°C	16 TSSOP
DG411CY	0°C to +70°C	16 Narrow SO
DG411C/D	0°C to +70°C	Dice*

Ordering Information continued at end of data sheet.

\*Contact factory for dice specifications.

### Pin Configurations/Functional Diagrams/Truth Tables

TOP VIEW

**DIP/SO/TSSOP**

DG411	
LOGIC	SWITCH
0	ON
1	OFF

**DIP/SO/TSSOP**

DG412	
LOGIC	SWITCH
0	OFF
1	ON

**DIP/SO/TSSOP**

LOGIC	DG413	
	SWITCHES 1, 4	SWITCHES 2, 3
0	OFF	ON
1	ON	OFF

SWITCHES SHOWN FOR LOGIC "0" INPUT

Pin Configurations continued at end of data sheet.

# Improved, Quad, SPST Analog Switches

## ABSOLUTE MAXIMUM RATINGS

(Voltage Referenced to V-)

V+ .....	44V
GND .....	25V
V <sub>L</sub> .....	(GND -0.3V) to (V+ +0.3V)
Digital Inputs, V <sub>S</sub> , V <sub>D</sub> (Note 1) .....	(V- -2V) to (V+ +2V) or 30mA (whichever occurs first)
Continuous Current (any terminal) .....	30mA
Peak Current (pulsed at 1ms, 10% duty cycle max) .....	100mA

Continuous Power Dissipation (T<sub>A</sub> = +70°C)

16-Pin Plastic DIP (derate 10.53mW/°C above +70°C) ..	842mW
16-Pin Narrow SO (derate 8.70mW/°C above +70°C) ..	696mW
16-Pin CERDIP (derate 10.00mW/°C above +70°C) .....	800mW
16-Pin TSSOP (derate 6.7mW/°C above +70°C) .....	457mW
16-Pin QFN (derate 19.2mW/°C above +70°C) .....	1538mW

Operating Temperature Ranges

DG41_C_ .....	0°C to +70°C
DG41_D_ .....	-40°C to +85°C
DG41_AK_ .....	-55°C to +125°C
Storage Temperature Range .....	-65°C to +150°C
Lead Temperature (soldering, 10s) .....	+300°C

**Note 1:** Signals on S, D, or IN exceeding V+ or V- are clamped by internal diodes. Limit forward current to maximum current rating.

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.

## ELECTRICAL CHARACTERISTICS—Dual Supplies

(V+ = 15V, V- = -15V, V<sub>L</sub> = 5V, GND = 0V, V<sub>INH</sub> = 2.4V, V<sub>INL</sub> = 0.8V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP (Note 2)	MAX	UNITS	
<b>SWITCH</b>								
Analog Signal Range	V <sub>ANALOG</sub>	(Note 3)		-15		15	V	
Drain-Source On-Resistance	r <sub>DS(ON)</sub>	V+ = 13.5V, V- = -13.5V, V <sub>D</sub> = ±8.5V, I <sub>S</sub> = -10mA	T <sub>A</sub> = +25°C	C, D	17	45	Ω	
				A	17	30		
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>			45		
On-Resistance Match Between Channels (Note 4)	Δr <sub>DS(ON)</sub>	V+ = 15V, V- = -15V, V <sub>D</sub> = ±10V, I <sub>S</sub> = -10mA	T <sub>A</sub> = +25°C			3	Ω	
						5		
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>					
On-Resistance Flatness (Note 4)	r <sub>FLAT(ON)</sub>	V+ = 15V, V- = -15V, V <sub>D</sub> = ±5V, 0V, I <sub>S</sub> = -10mA	T <sub>A</sub> = +25°C			4	Ω	
						6		
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>					
Source Off-Leakage Current (Note 7)	I <sub>S(OFF)</sub>	V+ = 16.5V, V- = -16.5V, V <sub>D</sub> = ±15.5V, V <sub>S</sub> = ∓15.5V	T <sub>A</sub> = +25°C	C, D, A	-0.25	-0.10	0.25	nA
				C, D	-5		5	
				A	-10		10	
Drain Off-Leakage Current (Note 7)	I <sub>D(OFF)</sub>	V+ = 16.5V, V- = -16.5V, V <sub>D</sub> = ±15.5V, V <sub>S</sub> = ∓15.5V	T <sub>A</sub> = +25°C	C, D, A	-0.25	-0.10	0.25	nA
				C, D	-5		5	
				A	-10		10	
Drain On-Leakage Current (Note 7)	I <sub>D(ON)</sub> + I <sub>S(ON)</sub>	V+ = 16.5V, V- = -16.5V, V <sub>D</sub> = ±15.5V, V <sub>S</sub> = ∓15.5V	T <sub>A</sub> = +25°C	C, D, A	-0.4	-0.1	0.4	nA
				C, D	-20		20	
				A	-40		40	

# Improved, Quad, SPST Analog Switches

**DG411/DG412/DG413**

## ELECTRICAL CHARACTERISTICS—Dual Supplies (continued)

(V<sub>+</sub> = 15V, V<sub>-</sub> = -15V, V<sub>L</sub> = 5V, GND = 0V, V<sub>INH</sub> = 2.4V, V<sub>INL</sub> = 0.8V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP (Note 2)	MAX	UNITS	
<b>INPUT</b>							
Input Current with Input Voltage High	I <sub>INH</sub>	IN = 2.4V, all others = 0.8V	-0.500	0.005	0.500	μA	
Input Current with Input Voltage Low	I <sub>INL</sub>	IN = 0.8V, all others = 2.4V	-0.500	0.005	0.500	μA	
<b>SUPPLY</b>							
Power-Supply Range			±4.5		±20.0	V	
Positive Supply Current	I <sub>+</sub>	All channels on or off, V <sub>+</sub> = 16.5V, V <sub>-</sub> = -16.5V, V <sub>IN</sub> = 0V or 5V	T <sub>A</sub> = +25°C	-1	0.0001	1	μA
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	-5		5	
Negative Supply Current	I <sub>-</sub>	All channels on or off, V <sub>+</sub> = 16.5V, V <sub>-</sub> = -16.5V, V <sub>IN</sub> = 0V or 5V	T <sub>A</sub> = +25°C	-1	-0.0001	1	μA
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	-5		5	
Logic Supply Current	I <sub>L</sub>	All channels on or off, V <sub>+</sub> = 16.5V, V <sub>-</sub> = -16.5V, V <sub>IN</sub> = 0V or 5V	T <sub>A</sub> = +25°C	-1	0.0001	1	μA
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	-5		5	
Ground Current	I <sub>GND</sub>	All channels on or off, V <sub>+</sub> = 16.5V, V <sub>-</sub> = -16.5V, V <sub>IN</sub> = 0V or 5V	T <sub>A</sub> = +25°C	-1	-0.0001	1	μA
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	-5		5	
<b>DYNAMIC</b>							
Turn-On Time	t <sub>ON</sub>	V <sub>D</sub> = ±10V, Figure 2	T <sub>A</sub> = +25°C	110	175	ns	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>		220		
Turn-Off Time	t <sub>OFF</sub>	V <sub>D</sub> = ±10V, Figure 2	T <sub>A</sub> = +25°C	100	145	ns	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>		160		
Break-Before-Make Time Delay	t <sub>D</sub>	DG413 only, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Figure 3	T <sub>A</sub> = +25°C	25		ns	
Charge Injection (Note 3)	Q	C <sub>L</sub> = 1.0nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω, Figure 4	T <sub>A</sub> = +25°C	5	10	pC	
Off-Isolation (Note 5)	OIRR	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, f = 1MHz, Figure 5	T <sub>A</sub> = +25°C	68		dB	
Crosstalk (Note 6)		R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, f = 1MHz, Figure 6	T <sub>A</sub> = +25°C	85		dB	
Source Off-Capacitance	C <sub>S(OFF)</sub>	f = 1MHz, Figure 7	T <sub>A</sub> = +25°C	9		pF	
Drain Off-Capacitance	C <sub>D(OFF)</sub>	f = 1MHz, Figure 7	T <sub>A</sub> = +25°C	9		pF	
Drain On-Capacitance	C <sub>D(ON)</sub> + C <sub>S(ON)</sub>	f = 1MHz, Figure 8	T <sub>A</sub> = +25°C	35		pF	

# Improved, Quad, SPST Analog Switches

## ELECTRICAL CHARACTERISTICS—Single Supply

(V+ = 12V, V- = 0V, VL = 5V, GND = 0V, VINH = 2.4V, VINL = 0.8V, TA = TMIN to TMAX, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP (Note 2)	MAX	UNITS
<b>SWITCH</b>							
Analog Signal Range	VANALOG	(Note 3)		0		12	V
Drain-Source On-Resistance	RDS(ON)	V+ = 10.8V, VD = 3.8V, IS = -10mA	TA = +25°C		40	80	Ω
			TA = TMIN to TMAX			100	
<b>SUPPLY</b>							
Positive Supply Current	I+	All channels on or off, V+ = 13.2V, VIN = 0V or 5V	TA = +25°C	-1	0.0001	1	μA
			TA = TMAX	-5		5	
Negative Supply Current	I-	All channels on or off, V+ = 13.2V, VIN = 0V or 5V	TA = +25°C	-1	0.0001	1	μA
			TA = TMAX	-5		5	
Logic Supply Current	IL	All channels on or off, VL = 5.25V, VIN = 0V or 5V	TA = +25°C	-1	0.0001	1	μA
			TA = TMAX	-5		5	
Ground Current	IGND	All channels on or off, VL = 5.25V, VIN = 0V or 5V	TA = +25°C	-1	-0.0001	1	μA
			TA = TMAX	-5		5	
<b>DYNAMIC</b>							
Turn-On Time	tON	VS = 8V, Figure 2	TA = +25°C		175	250	ns
			TA = TMIN to TMAX			315	
Turn-Off Time	tOFF	VS = 8V, Figure 2	TA = +25°C		95	125	ns
			TA = TMIN to TMAX			140	
Break-Before-Make Time Delay	tD	DG413 only, RL = 300Ω, CL = 35pF, Figure 3	TA = +25°C		25		ns
Charge Injection (Note 3)	Q	CL = 1.0nF, VGEN = 0V, RGEN = 0V, Figure 4	TA = +25°C		5	10	pC

**Note 2:** The algebraic convention, where the most negative value is a minimum and the most positive value a maximum, is used in this data sheet.

**Note 3:** Guaranteed by design.

**Note 4:**  $\Delta R_{ON} = \Delta R_{ON\ max} - \Delta R_{ON\ min}$ . On-resistance match between channels and flatness are guaranteed only with bipolar-supply operation. Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured at the extremes of the specified analog signal range.

**Note 5:** Off-Isolation =  $20 \log (V_D/V_S)$ ,  $V_D$  = output,  $V_S$  = input to off switch. See Figure 5.

**Note 6:** Between any two switches. See Figure 6.

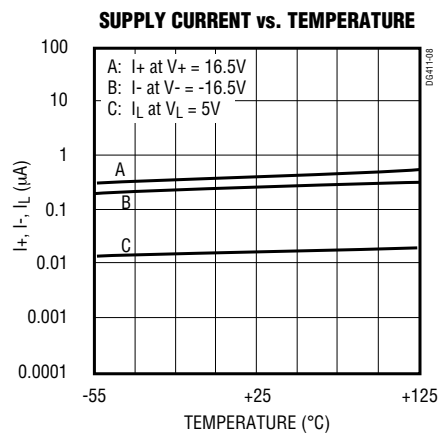
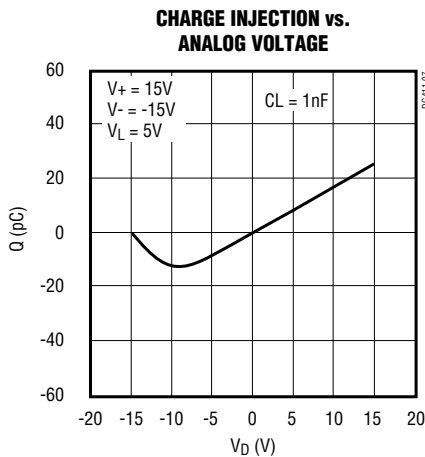
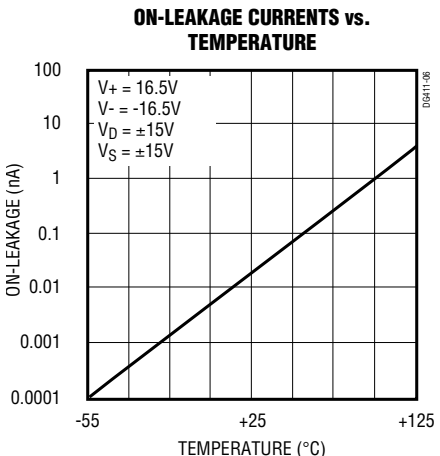
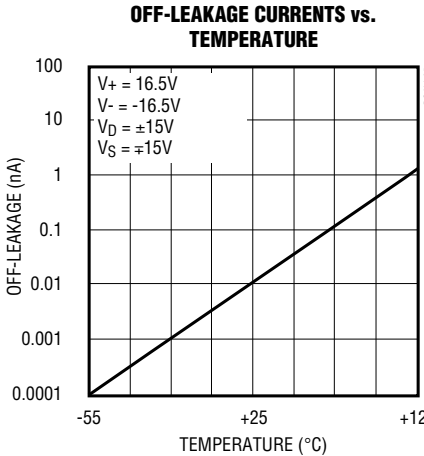
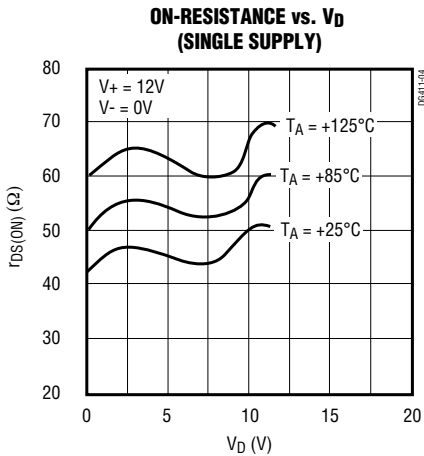
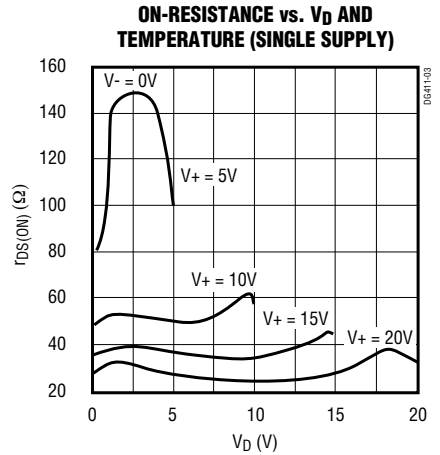
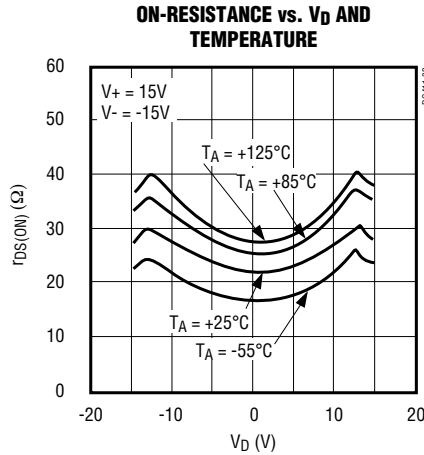
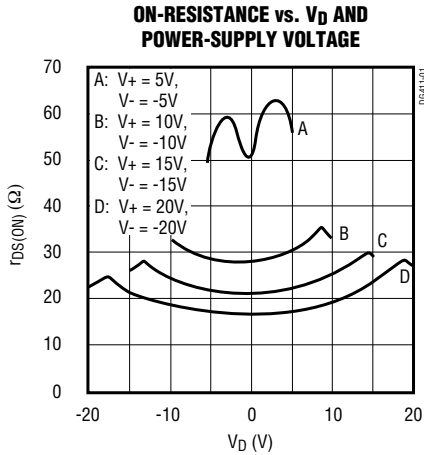
**Note 7:** Leakage parameters  $I_{S(OFF)}$ ,  $I_{D(OFF)}$ , and  $I_{D(ON)}$  are 100% tested at the maximum-rated hot temperature and guaranteed by correlation at +25°C.

# Improved, Quad, SPST Analog Switches

## Typical Operating Characteristics

( $T_A = +25^\circ\text{C}$ , unless otherwise noted.)

DG411/DG412/DG413



# Improved, Quad, SPST Analog Switches

## Pin Description

PIN		NAME	FUNCTION
DIP/SO/TSSOP	QFN		
1, 16, 9, 8	15, 14, 7, 6	IN1–IN4	Input
2, 15, 10, 7	16, 13, 8, 5	D1–D4	Analog Switch Drain Terminal
3, 14, 11, 6	1, 12, 9, 4	S1–S4	Analog Switch Source Terminal
4	2	V-	Negative-Supply Voltage Input
5	3	GND	Ground
12	10	V <sub>L</sub>	Logic Supply Voltage
13	11	V+	Positive-Supply Voltage Input—Connected to Substrate

## Applications Information

### Operation with Supply Voltages Other Than 15V

Using supply voltages other than 15V will reduce the analog signal range. The DG411/DG412/DG413 switches operate with  $\pm 4.5\text{V}$  to  $\pm 20\text{V}$  bipolar supplies or with a  $+10\text{V}$  to  $+30\text{V}$  single supply; connect V- to 0V when operating with a single supply. Also, all device types can operate with unbalanced supplies such as  $+24\text{V}$  and  $-5\text{V}$ . V<sub>L</sub> must be connected to  $+5\text{V}$  to be TTL compatible, or to V+ for CMOS-logic level inputs. The *Typical Operating Characteristics* graphs show typical on-resistance with  $\pm 15\text{V}$ ,  $\pm 10\text{V}$ , and  $\pm 5\text{V}$  supplies. (Switching times increase by a factor of two or more for operation at  $\pm 5\text{V}$ .)

### Overvoltage Protection

Proper power-supply sequencing is recommended for all CMOS devices. Do not exceed the absolute maximum ratings because stresses beyond the listed ratings may cause permanent damage to the devices. Always sequence V+ on first, followed by V<sub>L</sub>, V-, and logic inputs. If power-supply sequencing is not possible, add two small, external signal diodes in series with supply pins for overvoltage protection (Figure 1).

Adding diodes reduces the analog signal range to 1V below V+ and 1V below V-, without affecting low switch resistance and low leakage characteristics. Device operation is unchanged, and the difference between V+ and V- should not exceed  $+44\text{V}$ .

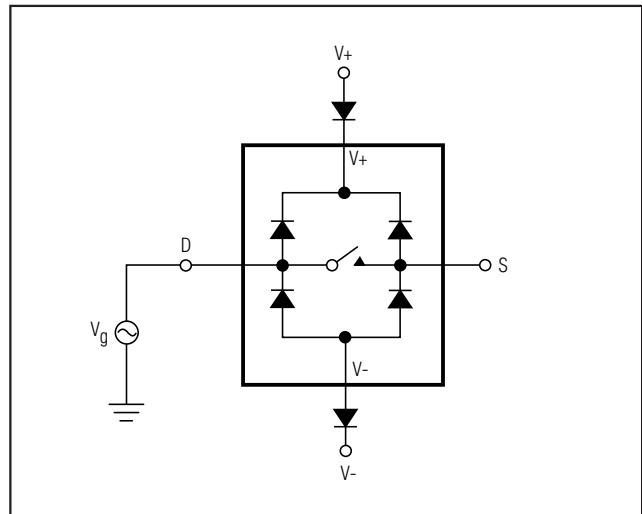


Figure 1. Overvoltage Protection Using External Blocking Diodes

# Improved, Quad, SPST Analog Switches

## Timing Diagrams/Test Circuits

DG411/DG412/DG413

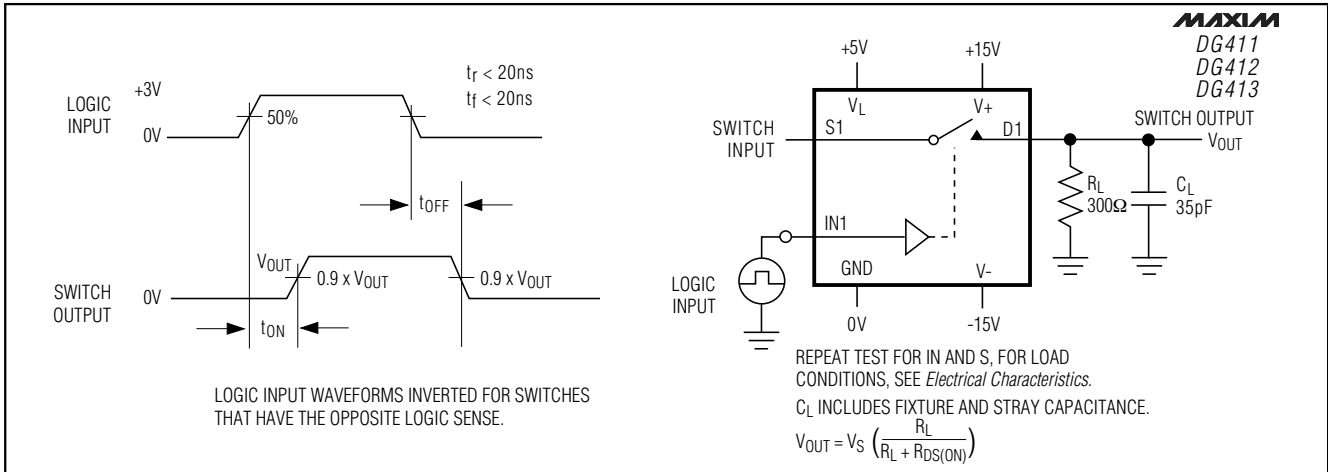


Figure 2. Switching-Time

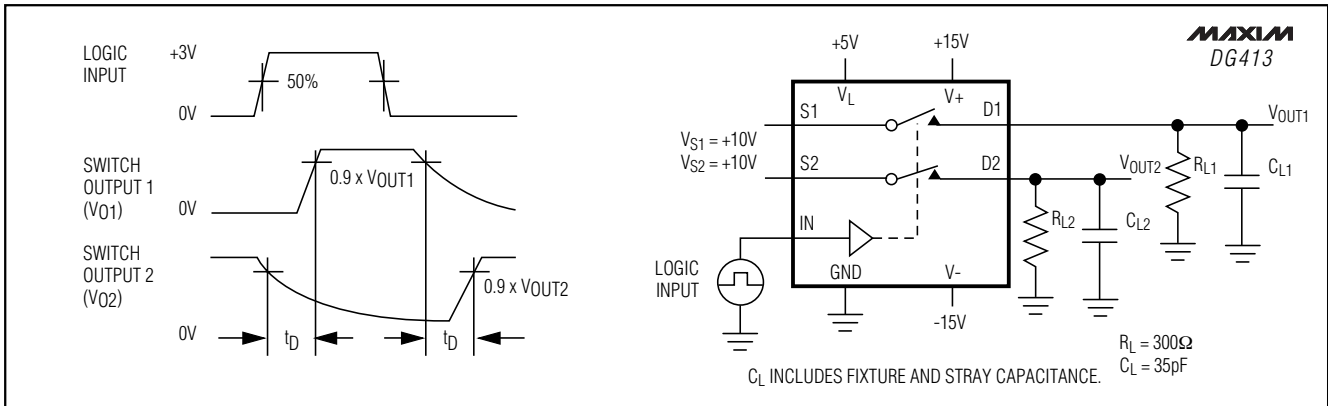


Figure 3. DG413 Break-Before-Make

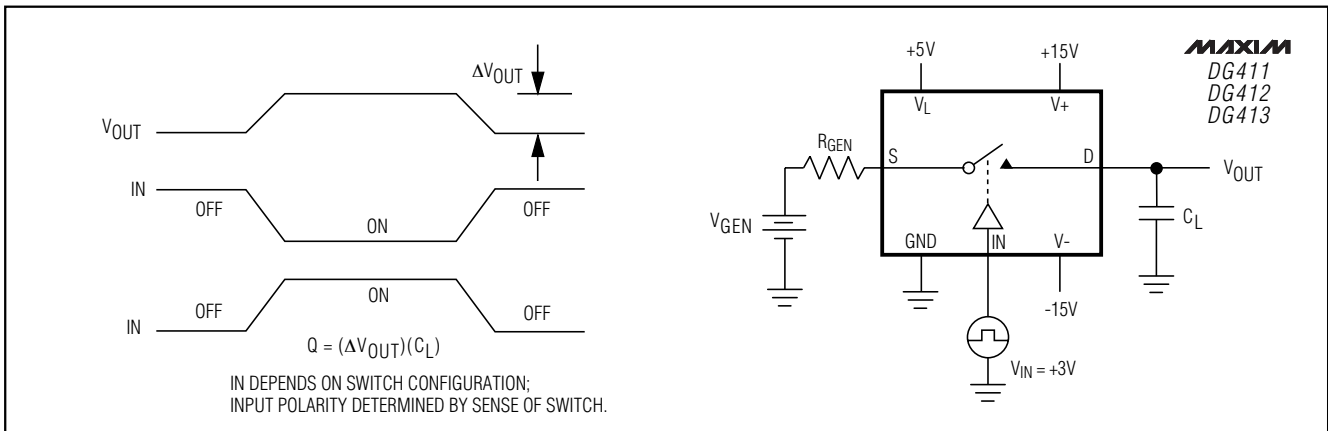


Figure 4. Charge-Injection

# Improved, Quad, SPST Analog Switches

## Timing Diagrams/Test Circuits (continued)

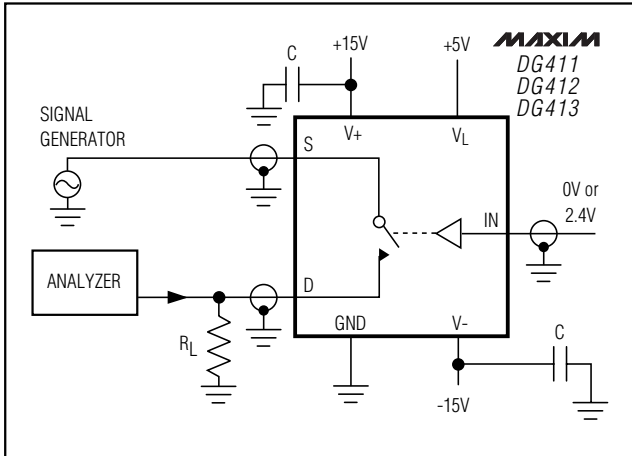


Figure 5. Off-Isolation

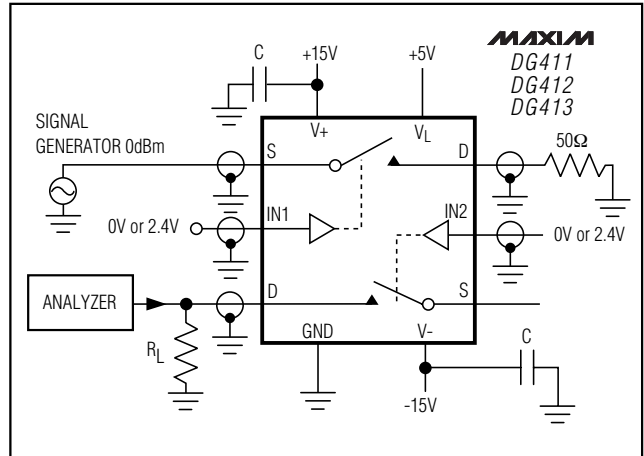


Figure 6. Crosstalk

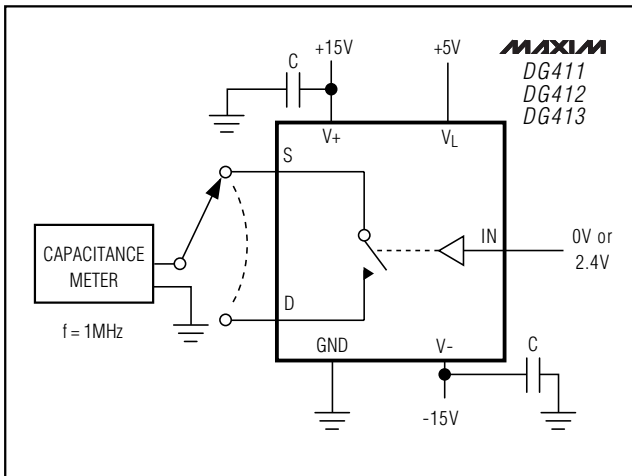


Figure 7. Channel Off-Capacitance

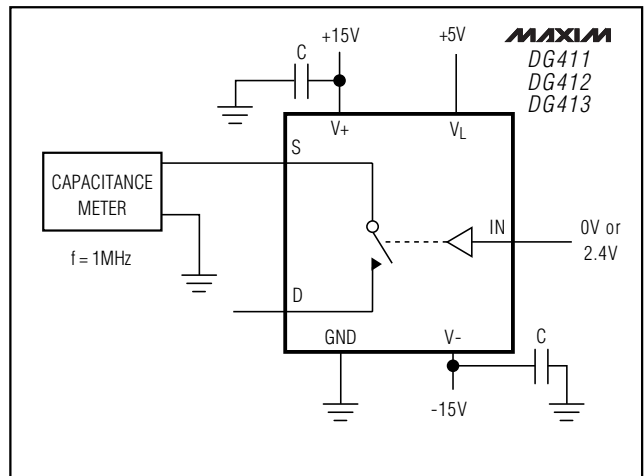


Figure 8. Channel On-Capacitance



# Improved, Quad, SPST Analog Switches

DG411/DG412/DG413

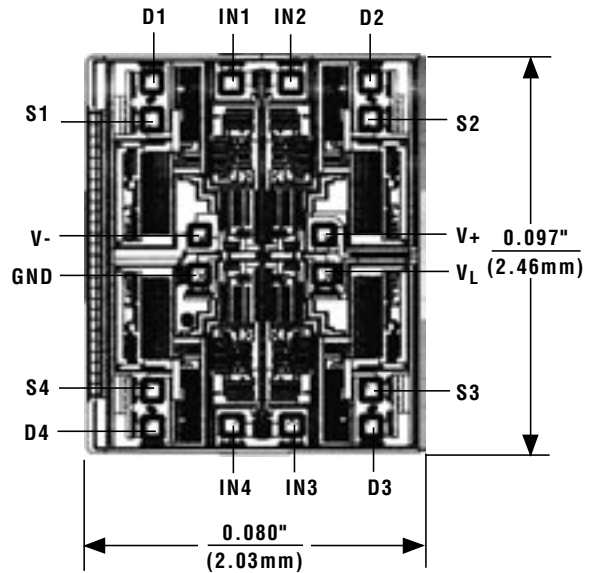
## Ordering Information (continued)

PART	TEMP RANGE	PIN-PACKAGE
DG411EGE	-40°C to +85°C	16 QFN
DG411DJ	-40°C to +85°C	16 Plastic DIP
DG411DY	-40°C to +85°C	16 Narrow SO
DG411DK	-40°C to +85°C	16 CERDIP
DG411AK	-55°C to +125°C	16 CERDIP**
<b>DG412CJ</b>	0°C to +70°C	16 Plastic DIP
DG412CUE	0°C to +70°C	16 TSSOP
DG412CY	0°C to +70°C	16 Narrow SO
DG412C/D	0°C to +70°C	Dice*
DG412DJ	-40°C to +85°C	16 Plastic DIP
DG412EGE	-40°C to +85°C	16 QFN
DG412DY	-40°C to +85°C	16 Narrow SO
DG412DK	-40°C to +85°C	16 CERDIP
DG412AK	-55°C to +125°C	16 CERDIP**
<b>DG413CJ</b>	0°C to +70°C	16 Plastic DIP
DG413CUE	0°C to +70°C	16 TSSOP
DG413CY	0°C to +70°C	16 Narrow SO
DG413C/D	0°C to +70°C	Dice*
DE413EGE	-40°C to +85°C	16 QFN
DG413DJ	-40°C to +85°C	16 Plastic DIP
DG413DY	-40°C to +85°C	16 Narrow SO
DG413DK	-40°C to +85°C	16 CERDIP
DG413AK	-55°C to +125°C	16 CERDIP**

\* Contact factory for dice specifications.

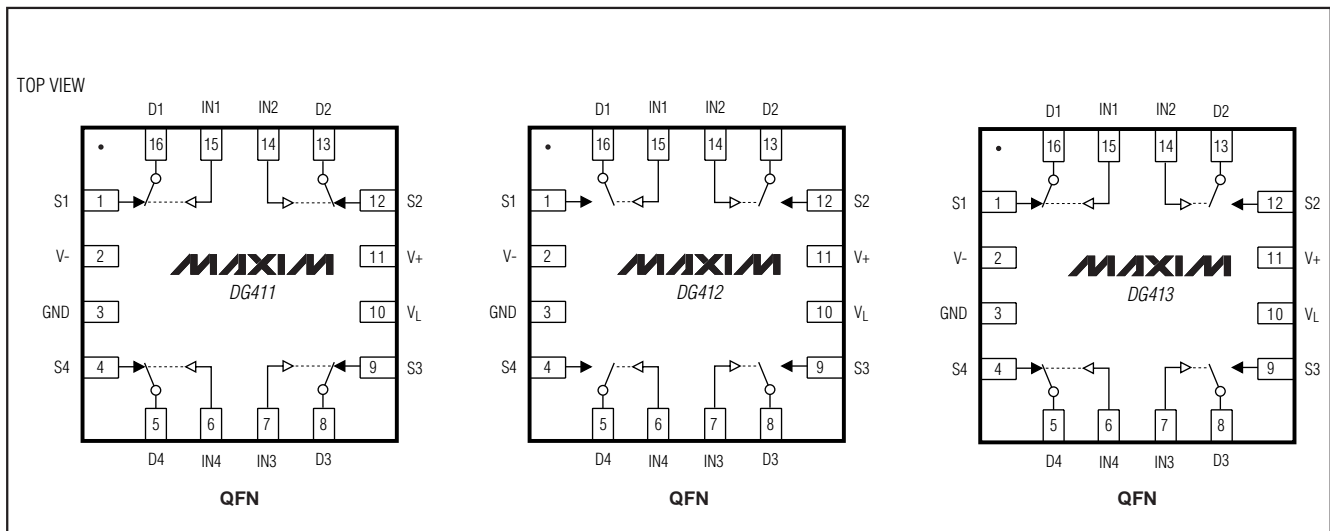
\*\*Contact factory for availability and processing to MIL-STD-883B.

## Chip Topography



TRANSISTOR COUNT: 136  
SUBSTRATE CONNECTED TO V+

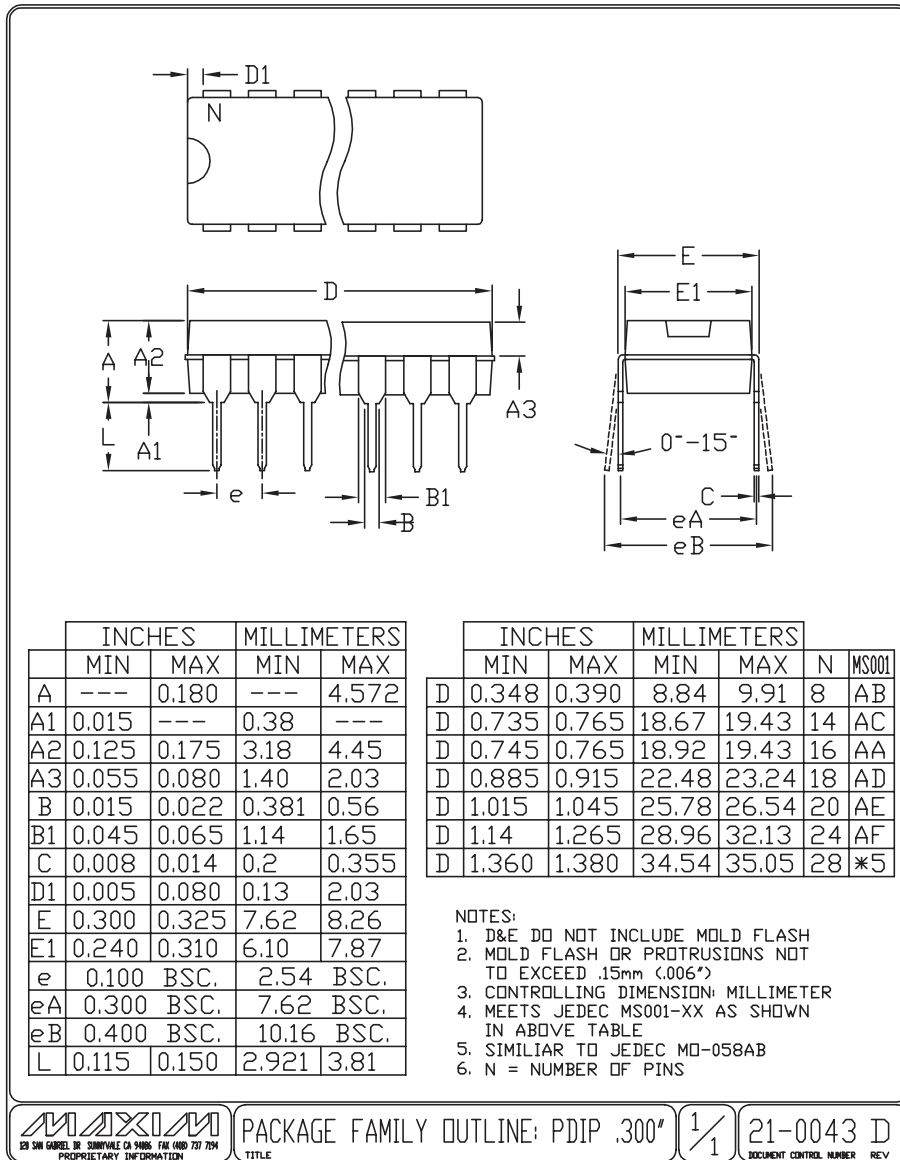
## Pin Configurations/Functional Diagrams (continued)



# Improved, Quad, SPST Analog Switches

## Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).)



# Improved, Quad, SPST Analog Switches

## Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).)

DG411/DG412/DG413

SOICN.EPS

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
B	0.014	0.019	0.35	0.49
C	0.007	0.010	0.19	0.25
e	0.050 BSC		1.27 BSC	
E	0.150	0.157	3.80	4.00
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27

VARIATIONS:

DIM	INCHES		MILLIMETERS		N	MS012
	MIN	MAX	MIN	MAX		
D	0.189	0.197	4.80	5.00	8	AA
D	0.337	0.344	8.55	8.75	14	AB
D	0.386	0.394	9.80	10.00	16	AC

**NOTES:**

1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15mm (.006").
3. LEADS TO BE COPLANAR WITHIN 0.10mm (.004").
4. CONTROLLING DIMENSION: MILLIMETERS.
5. MEETS JEDEC MS012.
6. N = NUMBER OF PINS.

**DALLAS SEMICONDUCTOR** **MAXIM**

PROPRIETARY INFORMATION

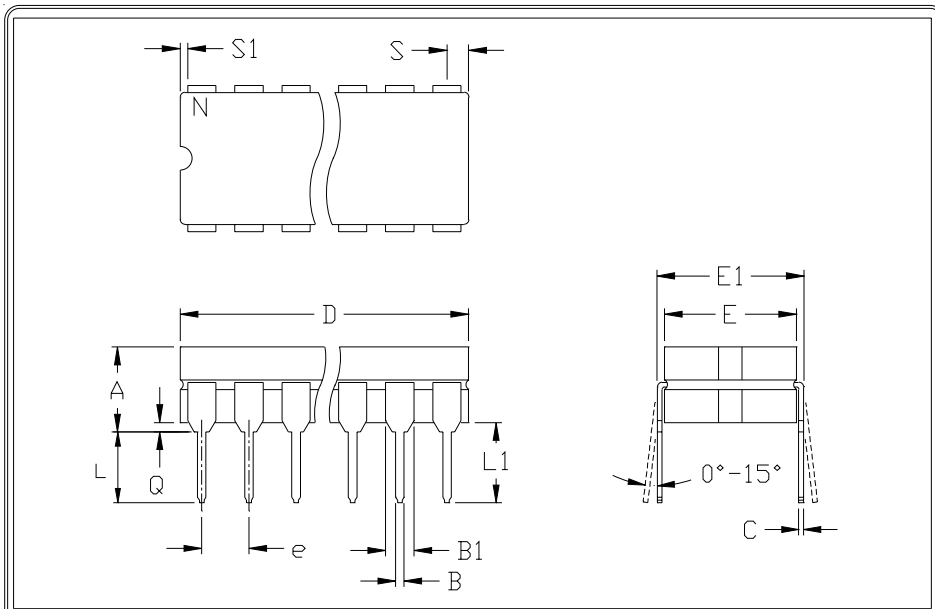
TITLE: PACKAGE OUTLINE, .150" SOIC

APPROVAL	DOCUMENT CONTROL NO. 21-0041	REV. B	1/1
----------	---------------------------------	-----------	-----

# Improved, Quad, SPST Analog Switches

## Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).)



	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	---	0.200	---	5.08
B	0.014	0.023	0.36	0.58
B1	0.038	0.065	0.97	1.65
C	0.008	0.015	0.20	0.38
E	0.220	0.310	5.59	7.87
E1	0.290	0.320	7.37	8.13
e	0.100		2.54	
L	0.125	0.200	3.18	5.08
L1	0.150	---	0.00	---
Q	0.015	0.070	0.38	1.78
S	---	0.098	---	2.49
S1	0.005	---	0.13	---

	INCHES		MILLIMETERS		N	CASE
	MIN	MAX	MIN	MAX		
D	---	0.405	---	10.29	8	P:D4
D	---	0.785	---	19.94	14	C:D1
D	---	0.840	---	21.34	16	E:D2
D	---	0.960	---	24.38	18	V:D6
D	---	1.060	---	26.92	20	R:D8
D	---	1.280	---	32.51	24	L:D9

- NOTES:  
 1. CONTROLLING DIMENSION: INCH  
 2. MEETS 1835 CASE OUTLINE CONFIGURATION #1 AS SHOWN IN ABOVE TABLE  
 3. N = NUMBER OF PINS

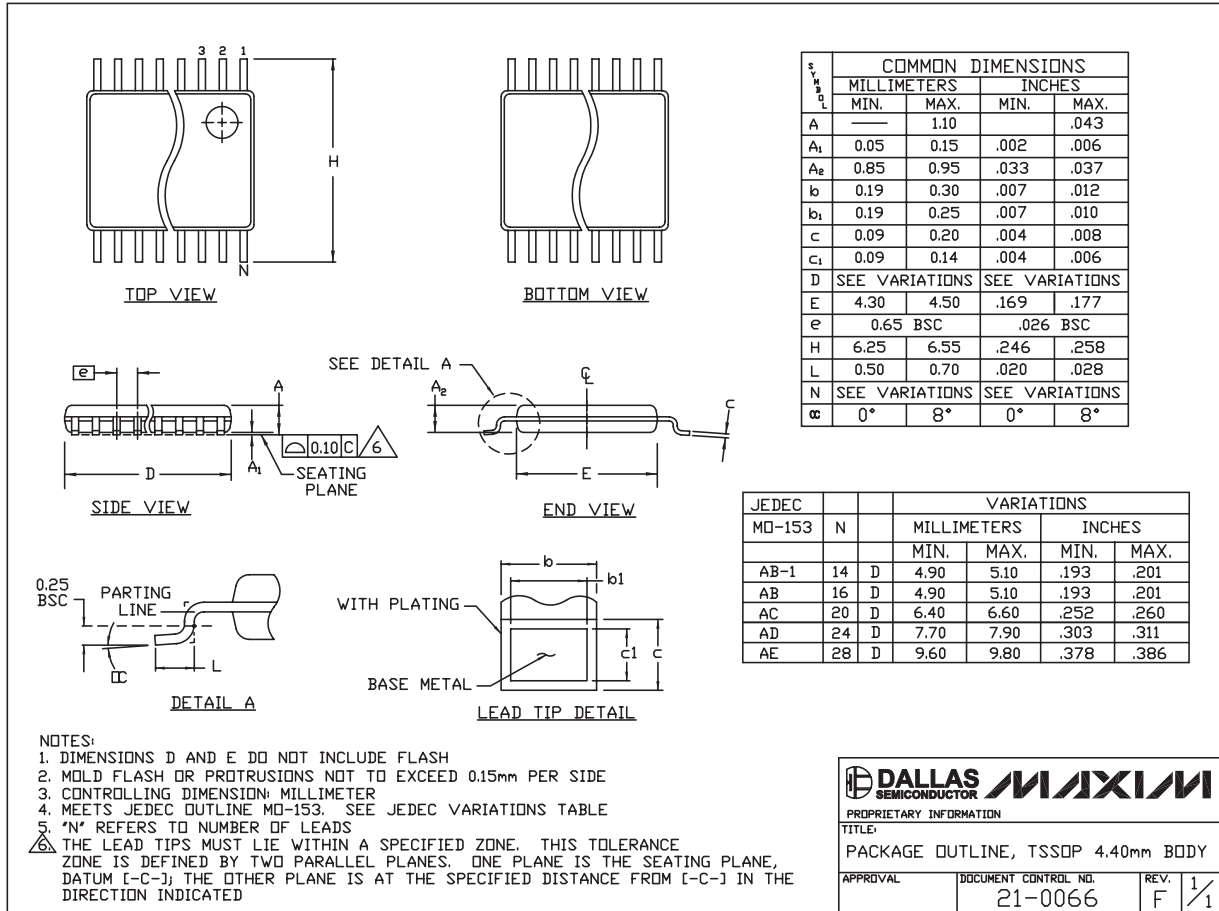
 <small>120 SAN GABRIEL DR. SAN RAFAEL, CA 94903 FAX (415) 737-7594</small> <small>PROPRIETARY INFORMATION</small>	PACKAGE FAMILY OUTLINE: CDIP .300"		21-0045 A
			<small>DOCUMENT CONTROL NUMBER REV</small>

# Improved, Quad, SPST Analog Switches

## Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).)

DG411/DG412/DG413

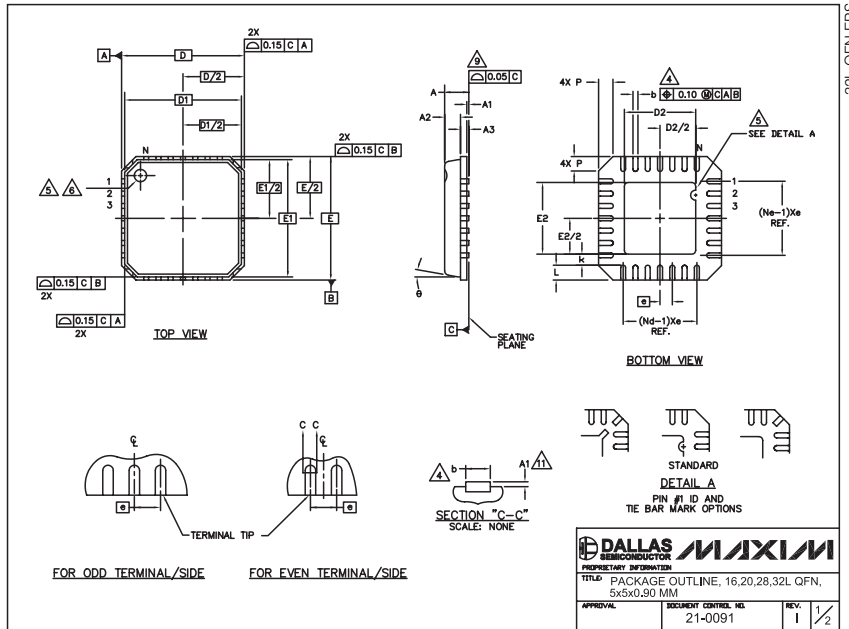


TSSOP4.40mm.EPS

# Improved, Quad, SPST Analog Switches

## Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).)



PKG SYMBOL	16L 5x5				20L 5x5				28L 5x5				32L 5x5			
	MIN.	NOM.	MAX.		MIN.	NOM.	MAX.		MIN.	NOM.	MAX.		MIN.	NOM.	MAX.	
A	0.80	0.90	1.00		0.80	0.90	1.00		0.80	0.90	1.00		0.80	0.90	1.00	
A1	0.00	0.01	0.05		0.00	0.01	0.05		0.00	0.01	0.05		0.00	0.01	0.05	
A2	0.00	0.65	1.00		0.00	0.65	1.00		0.00	0.65	1.00		0.00	0.65	1.00	
A3	0.20 REF				0.20 REF				0.20 REF				0.20 REF			
b	0.28	0.33	0.40		0.23	0.28	0.35		0.18	0.23	0.30		0.18	0.23	0.30	
D	4.90	5.00	5.10		4.90	5.00	5.10		4.90	5.00	5.10		4.90	5.00	5.10	
D1	4.75 BSC				4.75 BSC				4.75 BSC				4.75 BSC			
E	4.90	5.00	5.10		4.90	5.00	5.10		4.90	5.00	5.10		4.90	5.00	5.10	
E1	4.75 BSC				4.75 BSC				4.75 BSC				4.75 BSC			
e	0.80 BSC				0.65 BSC				0.50 BSC				0.50 BSC			
k	0.25	-	-		0.25	-	-		0.25	-	-		0.25	-	-	
L	0.35	0.55	0.75		0.35	0.55	0.75		0.35	0.55	0.75		0.30	0.40	0.50	
N	16				20				28				32			
ND	4				5				7				8			
NE	4				5				7				8			
P	0.00	0.42	0.60		0.00	0.42	0.60		0.00	0.42	0.60		0.00	0.42	0.60	
ø	0"				12"				0"				12"			

PKG CODES	D2			E2		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
G1655-3	2.95	3.10	3.25	2.95	3.10	3.25
G2055-1	2.55	2.70	2.85	2.55	2.70	2.85
G2055-2	2.95	3.10	3.25	2.95	3.10	3.25
G2855-1	2.55	2.70	2.85	2.55	2.70	2.85
G2855-2	2.95	3.10	3.25	2.95	3.10	3.25
G3255-1	2.95	3.10	3.25	2.95	3.10	3.25

**NOTES:**

1. DIE THICKNESS ALLOWABLE IS 0.305mm MAXIMUM (.012 INCHES MAXIMUM)
2. DIMENSIONING & TOLERANCES CONFORM TO ASME Y14.5M - 1994.
3. N IS THE NUMBER OF TERMINALS.
4. Nd IS THE NUMBER OF TERMINALS IN X-DIRECTION & Ne IS THE NUMBER OF TERMINALS IN Y-DIRECTION.
5. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.20 AND 0.25mm FROM TERMINAL TIP.
6. THE PIN #1 IDENTIFIER MUST BE EXISTED ON THE TOP SURFACE OF THE PACKAGE BY USING INDENTATION MARK OR INK/LASER MARKED. DETAILS OF PIN #1 IDENTIFIER IS OPTIONAL, BUT MUST BE LOCATED WITHIN ZONE INDICATED.
7. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
8. ALL DIMENSIONS ARE IN MILLIMETERS.
9. PACKAGE WARPAGE MAX 0.05mm.
10. APPLIED FOR EXPOSED PAD AND TERMINALS. EXCLUDE EMBEDDED PART OF EXPOSED PAD FROM MEASURING.
11. MEETS JEDEC MO220; EXCEPT DIMENSION "b".
12. APPLIED FOR EXPOSED PAD AND TERMINALS. EXCLUDE EMBEDDING PART OF EXPOSED PAD FROM MEASURING.
13. THIS PACKAGE OUTLINE APPLIES TO ANVIL SINGULATION (STEPPED SIDES).

**DALLAS MAXIM SEMICONDUCTOR**  
PROPRIETARY INFORMATION  
TITLED PACKAGE OUTLINE, 16,20,28,32L OFN, 5x5x0,90 MM  
APPROVAL: \_\_\_\_\_ REVISION CONTROL: 21-0091 REV: I 1/2

Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.