



# Low Capacitance, Low Charge Injection, 4- / 8-Channel, Triple SPDT, ± 5 V / 12 V / 5 V / 3 V Analog Multiplexers

## DESCRIPTION

The DG4051E, DG4052E, and DG4053E are high precision CMOS analog multiplexers. The DG4051E is an 8-channel multiplexer, the DG4052E is a dual 4-channel multiplexer, and the DG4053E is a triple 2-channel multiplexer or triple SPDT.

The DG4051E, DG4052E, and DG4053E feature low leakage, parasitic capacitance, and low charge injection of 0.3 pC over the full voltage range. These devices are ideal for high precision signal switching and multiplexing.

Designed to operate from a 3 V to 16 V single supply or from a ± 3 V to ± 8 V dual supplies, the DG4051E, DG4052E, and DG4053E are fully specified at 3 V, 5 V, 12 V and ± 5 V. All control logic inputs have guaranteed 2 V logic high limit when operating from 5 V or ± 5 V supplies and 1.4 V when operating from a 3 V supply.

All switches conduct equally well in both directions, offering rail to rail analog signal switching and can be used both as multiplexers as well as de-multiplexers.

The DG4051E, DG4052E, and DG4053E operating temperature is specified from -40 °C to +125 °C and are available in 16 pin TSSOP and the ultra compact 1.8 mm x 2.6 mm miniQFN16 packages.

## BENEFITS

- Wide operation voltage range
- Low charge injection
- Low parasitic capacitance
- Compact package option

## FEATURES

- 3 V to 16 V single supply or ± 3 to ± 8 V dual supply operation
- Low parasitic capacitance:
  - $C_{D(ON)}$ : 8.5 pF / typ. (DG4053E)
  - $C_{S(OFF)}$ : 2.0 pF / typ. (DG4053E)
- Less than 0.3 pC charge injection over the full signal swing range
- Low leakage: < 50 pA, typ.
- Fast switching  $t_{ON}$ : 35 ns, typ.
- 3 V logic compatible for control
- Bi-directional rail to rail signal switching
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



RoHS COMPLIANT

## APPLICATIONS

- Automatic test equipment
- Process control and automation
- Data acquisition systems
- Meters and instruments
- Medical and healthcare systems
- Communication systems
- Audio and video signal routing
- Relay replacement
- Battery powered systems

## FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



ENABLE = LO, all switches are controlled by addr pins.  
ENABLE = HI, all switches are off.

**FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION**


TRUTH TABLE						
ENABLE INPUT	SELECT INPUTS			ON SWITCHES		
	C	B	A	DG4051E	DG4052E	DG4053E
H	X	X	X	All switches open	All switches open	All switches open
L	L	L	L	X to X0	X to X0, Y to Y0	X to X0, Y to Y0, Z to Z0
L	L	L	H	X to X1	X to X1, Y to Y1	X to X1, Y to Y0, Z to Z0
L	L	H	L	X to X2	X to X2, Y to Y2	X to X0, Y to Y1, Z to Z0
L	L	H	H	X to X3	X to X3, Y to Y3	X to X1, Y to Y1, Z to Z0
L	H	L	L	X to X4	X to X0, Y to Y0	X to X0, Y to Y0, Z to Z1
L	H	L	H	X to X5	X to X1, Y to Y1	X to X1, Y to Y0, Z to Z1
L	H	H	L	X to X6	X to X2, Y to Y2	X to X0, Y to Y1, Z to Z1
L	H	H	H	X to X7	X to X3, Y to Y3	X to X1, Y to Y1, Z to Z1

ORDERING INFORMATION				
TEMPERATURE RANGE	CONFIGURATION	PACKAGE	PART NUMBER	MIN. ORDER / PACKAGING QUANTITY
-40 °C to +125 °C <sup>a</sup> Lead (Pb)-Free	DG4051E	16-pin TSSOP	DG4051EEQ-T1-GE3	Tape and reel 3000 units
		16-pin SOIC	DG4051EEY-T1-GE3	Tape and reel 2500 units
		16-pin miniQFN	DG4051EEN-T1-GE4	Tape and reel 3000 units
	DG4052E	16-pin TSSOP	DG4052EEQ-T1-GE3	Tape and reel 3000 units
		16-pin SOIC	DG4052EEY-T1-GE3	Tape and reel 2500 units
		16-pin miniQFN	DG4052EEN-T1-GE4	Tape and reel 3000 units
	DG4053E	16-pin TSSOP	DG4053EEQ-T1-GE3	Tape and reel 3000 units
		16-pin SOIC	DG4053EEY-T1-GE3	Tape and reel 2500 units
		16-pin miniQFN	DG4053EEN-T1-GE4	Tape and reel 3000 units

**Note**

a. -40 °C to +85 °C datasheet limits apply.



ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted)			
PARAMETER	LIMIT		UNIT
V+ to V-	-0.3 to +18		V
GND to V-	-18		
Digital Inputs <sup>a</sup> , V <sub>S</sub> , V <sub>D</sub>	(V-) - 0.3 to (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 <sup>b</sup>	16-pin TSSOP <sup>c</sup>	450	mW
	16-pin miniQFN <sup>d, f</sup>	525	
	16-pin narrow SOIC <sup>e</sup>	640	
Thermal Resistance <sup>b</sup>	16-pin TSSOP <sup>c</sup>	178	°C/W
	16-pin miniQFN <sup>d, f</sup>	152	
	16-pin narrow SOIC <sup>e</sup>	125	
ESD Human Body Model (HBM); per ANSI / ESDA / JEDEC <sup>®</sup> JS-001	2500		V
Latch Up Current, per JESD78D	400		mA

**Notes**

- a. Signals on SX, DX, or INX 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 5.6 mW/°C above 70 °C.
- d. Derate 6.6 mW/°C above 70 °C.
- e. Derate 8.0 mW/°C above 70 °C.
- f. Manual soldering with iron is not recommended for leadless components. The miniQFN-16 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.

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.

SPECIFICATIONS FOR DUAL SUPPLIES									
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 5 V, V- = -5 V V <sub>IN(A, B, C, and enable)</sub> = 2 V, 0.8 V <sup>a</sup>	TEMP. <sup>b</sup>	TYP. <sup>c</sup>	-40 °C to +125 °C		-40 °C to +85 °C		UNIT
					MIN. <sup>d</sup>	MAX. <sup>d</sup>	MIN. <sup>d</sup>	MAX. <sup>d</sup>	
<b>Analog Switch</b>									
Analog Signal Range <sup>e</sup>	V <sub>ANALOG</sub>		Full	-	-5	5	-5	5	V
On-Resistance	R <sub>ON</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = -3 V, 0 V, 3 V	Room	68	-	78	-	78	Ω
			Full	-	-	106	-	97	
On-Resistance Match	ΔR <sub>ON</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = ± 3 V	Room	0.91	-	6	-	6	Ω
			Full	-	-	6	-	6	
On-Resistance Flatness	R <sub>FLATNESS</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = -3 V, 0 V, 3 V	Room	10	-	17	-	17	Ω
			Full	-	-	20	-	19	
Switch Off Leakage Current	I <sub>S(off)</sub>	V+ = 5.5 V, V- = -5.5 V, V <sub>D</sub> = ± 4.5 V, V <sub>S</sub> = ± 4.5 V	Room	± 0.05	-1	1	-1	1	nA
			Full	-	-50	50	-5	5	
	Room		± 0.05	-1	1	-1	1		
	Full		-	-50	50	-5	5		
Channel On Leakage Current	I <sub>D(on)</sub>	V+ = 5.5 V, V- = -5.5 V, V <sub>S</sub> = V <sub>D</sub> = ± 4.5 V	Room	± 0.05	-1	1	-1	1	nA
			Full	-	-50	50	-5	5	
<b>Digital Control</b>									
Input Current, V <sub>IN</sub> Low	I <sub>IL</sub>	V <sub>IN(A, B, C, and enable)</sub> under test = 0.6 V	Full	0.02	-1	1	-1	1	μA
Input Current, V <sub>IN</sub> High	I <sub>IH</sub>	V <sub>IN(A, B, C, and enable)</sub> under test = 2 V	Full	0.02	-1	1	-1	1	
Input Capacitance <sup>e</sup>	C <sub>IN</sub>	f = 1 MHz	Room	3.4	-	-	-	-	pF



SPECIFICATIONS FOR DUAL SUPPLIES											
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 5 V, V- = -5 V VIN(A, B, C, and enable) = 2 V, 0.8 V <sup>a</sup>	TEMP. <sup>b</sup>	TYP. <sup>c</sup>	-40 °C to +125 °C		-40 °C to +85 °C		UNIT		
					MIN. <sup>d</sup>	MAX. <sup>d</sup>	MIN. <sup>d</sup>	MAX. <sup>d</sup>			
<b>Dynamic Characteristics</b>											
Off Isolation <sup>e</sup>	OIRR	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 1 pF	f = 100 kHz	Room	-106	-	-	-	-	dB	
Channel-to-Channel Crosstalk <sup>e</sup>	X <sub>TALK</sub>		f = 10 MHz	Room	-68	-	-	-	-		
			f = 100 MHz	Room	-49	-	-	-	-		
		f = 100 kHz	Room	-105	-	-	-	-			
Bandwidth, 3 dB	BW	R <sub>L</sub> = 50 Ω	DG4051E	Room	308	-	-	-	-		MHz
			DG4052E	Room	353	-	-	-	-		
			DG4053E	Room	930	-	-	-	-		
Transition Time	t <sub>TRANS</sub>	R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF see Fig. 1, 2, 3	Room	72	-	112	-	112	ns		
Enable Turn-On Time	t <sub>ON</sub>		Full	-	-	139	-	131			
Enable Turn-Off Time	t <sub>OFF</sub>		Room	35	-	75	-	75			
			Full	-	-	86	-	80			
Break-Before-Make Time Delay	t <sub>D</sub>		Room	48	-	88	-	88			
			Full	-	-	97	-	95			
Charge Injection <sup>e</sup>	Q	V <sub>g</sub> = 0 V, R <sub>g</sub> = 0 Ω, C <sub>L</sub> = 1 nF	Room	0.38	-	-	-	-	pC		
Source Off Capacitance <sup>e</sup>	C <sub>S(off)</sub>	f = 1 MHz	DG4051E	Room	2.2	-	-	-	-	pF	
			DG4052E	Room	2.1	-	-	-	-		
			DG4053E	Room	2	-	-	-	-		
Drain Off Capacitance <sup>e</sup>	C <sub>D(off)</sub>	f = 1 MHz	DG4051E	Room	9.2	-	-	-	-		
			DG4052E	Room	4.8	-	-	-	-		
			DG4053E	Room	3.1	-	-	-	-		
Channel On Capacitance <sup>e</sup>	C <sub>D(on)</sub>	f = 1 MHz	DG4051E	Room	14.9	-	-	-	-		
			DG4052E	Room	10	-	-	-	-		
			DG4053E	Room	8.5	-	-	-	-		
Total Harmonic Distortion <sup>e</sup>	THD	Signal = 5 V <sub>RMS</sub> , 20 Hz to 20 kHz, R <sub>L</sub> = 600 Ω	Room	0.065	-	-	-	-	%		
<b>Power Supplies</b>											
Power Supply Current	I+	V+ = 5 V, V- = -5 V VIN(A, B, C, and enable) = 0 V or 5 V	Room	0.05	-	1	-	1	μA		
Negative Supply Current	I-		Full	-	-	10	-	10			
			Room	-0.05	-1	-	-1	-			
Ground Current	I <sub>GND</sub>		Full	-	-10	-	-10	-			
			Room	-0.05	-1	-	-1	-			
			Full	-	-10	-	-10	-			



SPECIFICATIONS FOR UNIPOLAR SUPPLIES										
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 12 V, V- = 0 V VIN(A, B, C, and enable) = 2 V, 0.8 V <sup>a</sup>	TEMP. <sup>b</sup>	TYP. <sup>c</sup>	-40 °C to +125 °C		-40 °C to +85 °C		UNIT	
					MIN. <sup>d</sup>	MAX. <sup>d</sup>	MIN. <sup>d</sup>	MAX. <sup>d</sup>		
<b>Analog Switch</b>										
Analog Signal Range <sup>e</sup>	V <sub>ANALOG</sub>		Full	-	0	12	0	12	V	
On-Resistance	R <sub>ON</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = 0.7 V, 11.3 V	Room	85	-	103	-	103	Ω	
			Full	-	-	133	-	125		
On-Resistance Match	ΔR <sub>ON</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = 11.3 V	Room	1.24	-	8	-	8	Ω	
			Full	-	-	8	-	8		
On-Resistance Flatness	R <sub>FLATNESS</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = 0.7 V, 11.3 V	Room	27	-	37	-	37	Ω	
			Full	-	-	44	-	43		
Switch Off Leakage Current	I <sub>S(off)</sub>	V+ = 13.2 V, V- = 0 V V <sub>D</sub> = 1 V / 12.2 V, V <sub>S</sub> = 12.2 V / 1 V	Room	± 0.05	-1	1	-1	1	nA	
			Full	-	-50	50	-5	5		
	Room		± 0.05	-1	1	-1	1			
	Full		-	-50	50	-5	5			
Channel On Leakage Current	I <sub>D(on)</sub>	V+ = 13.2 V, V- = 0 V V <sub>D</sub> = V <sub>S</sub> = 1 V / 12.2 V	Room	± 0.05	-1	1	-1	1	nA	
			Full	-	-50	50	-5	5		
<b>Digital Control</b>										
Input Current, V <sub>IN</sub> Low	I <sub>L</sub>	V <sub>IN(A, B, C, and enable)</sub> under test = 0.8 V	Full	0.02	-1	1	-1	1	μA	
Input Current, V <sub>IN</sub> High	I <sub>H</sub>	V <sub>IN(A, B, C, and enable)</sub> under test = 2 V	Full	0.02	-1	1	-1	1		
<b>Dynamic Characteristics</b>										
Transition Time	t <sub>TRANS</sub>	R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF see Fig. 1, 2, 3	Room	43	-	83	-	83	ns	
			Full	-	-	95	-	90		
Enable Turn-On Time	t <sub>ON</sub>		Room	22	-	62	-	62		
			Full	-	-	71	-	67		
Enable Turn-Off Time	t <sub>OFF</sub>		Room	47	-	87	-	87		
			Full	-	-	94	-	93		
Break-Before-Make Time Delay	t <sub>D</sub>		Room	25	1	-	1	-		
			Full	-	-	-	-	-		
Charge Injection <sup>e</sup>	Q		V <sub>g</sub> = 0 V, R <sub>g</sub> = 0 Ω, C <sub>L</sub> = 1 nF	Full	-	-	-	-		pC
Off Isolation <sup>e</sup>	OIRR		R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 1 pF f = 100 kHz	Room	-	-	-	-		-
Channel-to-Channel Crosstalk <sup>e</sup>	X <sub>TALK</sub>	Room		-	-	-	-	-		
Source Off Capacitance <sup>e</sup>	C <sub>S(off)</sub>	f = 1 MHz	DG4051E	Room	-	-	-	-	pF	
			DG4052E	Room	-	-	-	-		
			DG4053E	Room	-	-	-	-		-
Drain Off Capacitance <sup>e</sup>	C <sub>D(off)</sub>	f = 1 MHz	DG4051E	Room	-	-	-	-	pF	
			DG4052E	Room	-	-	-	-		
			DG4053E	Room	-	-	-	-		-
Channel On Capacitance <sup>e</sup>	C <sub>D(on)</sub>	f = 1 MHz	DG4051E	Room	-	-	-	-	pF	
			DG4052E	Room	-	-	-	-		
			DG4053E	Room	-	-	-	-		-
<b>Power Supplies</b>										
Power Supply Current	I+	V <sub>IN(A, B, C, and enable)</sub> = 0 V or 5 V	Room	0.05	-	1	-	1	μA	
			Full	-	-	10	-	10		
Negative Supply Current	I-		Room	-0.05	-1	-	-1	-		
			Full	-	-10	-	-10	-		
Ground Current	I <sub>GND</sub>		Room	-0.05	-1	-	-1	-		
			Full	-	-10	-	-10	-		



SPECIFICATIONS FOR UNIPOLAR SUPPLIES											
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V <sub>+</sub> = 5 V, V <sub>-</sub> = 0 V V <sub>IN(A, B, C, and enable)</sub> = 2 V, 0.8 V <sup>a</sup>	TEMP. <sup>b</sup>	TYP. <sup>c</sup>	-40 °C to +125 °C		-40 °C to +85 °C		UNIT		
					MIN. <sup>d</sup>	MAX. <sup>d</sup>	MIN. <sup>d</sup>	MAX. <sup>d</sup>			
<b>Analog Switch</b>											
Analog Signal Range <sup>e</sup>	V <sub>ANALOG</sub>		Full	-	0	5	0	5	V		
On-Resistance	R <sub>ON</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = 0 V, 3.5 V	Room	125	-	147	-	147	Ω		
			Full	-	-	176	-	168			
On-Resistance Match	ΔR <sub>ON</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = 3.5 V	Room	1.3	-	8	-	8	Ω		
			Full	-	-	8	-	8			
On-Resistance Flatness	R <sub>FLATNESS</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = 0 V, 3 V	Room	21	-	31	-	31	Ω		
			Full	-	-	25	-	29			
Switch Off Leakage Current	I <sub>S(off)</sub>	V <sub>+</sub> = 5.5 V, V <sub>-</sub> = 0 V V <sub>D</sub> = 1 V / 4.5 V, V <sub>S</sub> = 4.5 V / 1 V	Room	± 0.03	-1	1	-1	1	nA		
			Full	-	-50	50	-5	5			
	I <sub>D(off)</sub>		Room	± 0.03	-1	1	-1	1			
			Full	-	-50	50	-5	5			
Channel On Leakage Current	I <sub>D(on)</sub>	V <sub>+</sub> = 5.5 V, V <sub>-</sub> = 0 V V <sub>D</sub> = V <sub>S</sub> = 1 V / 4.5 V	Room	± 0.03	-1	1	-1	1			
			Full	-	-50	50	-5	5			
<b>Digital Control</b>											
Input Current, V <sub>IN</sub> Low	I <sub>L</sub>	V <sub>IN(A, B, C, and enable)</sub> under test = 0.6 V	Full	0.02	-1	1	-1	1	μA		
Input Current, V <sub>IN</sub> High	I <sub>H</sub>	V <sub>IN(A, B, C, and enable)</sub> under test = 2 V	Full	0.02	-1	1	-1	1			
<b>Dynamic Characteristics</b>											
Transition Time	t <sub>TRANS</sub>	R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF see Fig. 1, 2, 3	Room	95	-	135	-	135	ns		
			Full	-	-	169	-	148			
Enable Turn-On Time	t <sub>ON</sub>		Room	56	-	96	-	96			
			Full	-	-	117	-	107			
Enable Turn-Off Time	t <sub>OFF</sub>		Room	55	-	95	-	95			
			Full	-	-	110	-	103			
Break-Before-Make Time Delay	t <sub>D</sub>		Room	-	12	-	12	-			
			Full	-	-	-	-	-			
Charge Injection <sup>e</sup>	Q		V <sub>g</sub> = 0 V, R <sub>g</sub> = 0 Ω, C <sub>L</sub> = 1 nF	Full	0.32	-	-	-		-	pC
Off Isolation <sup>e</sup>	OIRR		R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 1 pF f = 100 kHz	Room	-86	-	-	-		-	dB
Channel-to-Channel Crosstalk <sup>e</sup>	X <sub>TALK</sub>	Room		-105	-	-	-	-			
Source Off Capacitance <sup>e</sup>	C <sub>S(off)</sub>	f = 1 MHz	DG4051E	Room	2.4	-	-	-	-		
			DG4052E	Room	2.4	-	-	-	-		
			DG4053E	Room	2.3	-	-	-	-		
Drain Off Capacitance <sup>e</sup>	C <sub>D(off)</sub>	f = 1 MHz	DG4051E	Room	10.1	-	-	-	-		
			DG4052E	Room	5.3	-	-	-	-		
			DG4053E	Room	3.4	-	-	-	-		
Channel On Capacitance <sup>e</sup>	C <sub>D(on)</sub>	f = 1 MHz	DG4051E	Room	15.9	-	-	-	-		
			DG4052E	Room	10.6	-	-	-	-		
			DG4053E	Room	8.9	-	-	-	-		
<b>Power Supplies</b>											
Power Supply Current	I <sub>+</sub>	V <sub>IN(A, B, C, and enable)</sub> = 0 V or 5 V	Room	0.05	-	1	-	1	μA		
			Full	-	-	10	-	10			
Negative Supply Current	I <sub>-</sub>		Room	-0.05	-1	-	-1	-			
			Full	-	-10	-	-10	-			
Ground Current	I <sub>GND</sub>		Room	-0.05	-1	-	-1	-			
			Full	-	-10	-	-10	-			



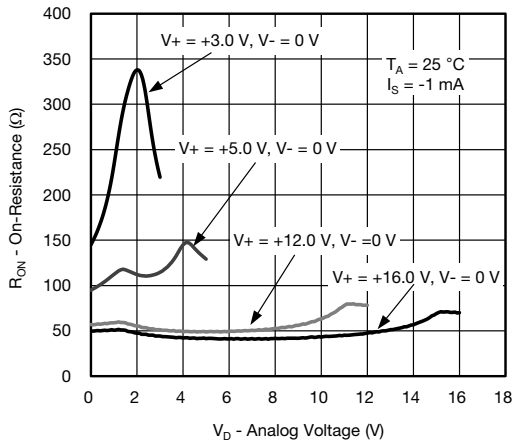
SPECIFICATIONS FOR UNIPOLAR SUPPLIES											
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V <sub>+</sub> = 3 V, V <sub>-</sub> = 0 V V <sub>IN(A, B, C, and enable)</sub> = 1.4 V, 0.6 V <sup>a</sup>	TEMP. <sup>b</sup>	TYP. <sup>c</sup>	-40 °C to +125 °C		-40 °C to +85 °C		UNIT		
					MIN. <sup>d</sup>	MAX. <sup>d</sup>	MIN. <sup>d</sup>	MAX. <sup>d</sup>			
<b>Analog Switch</b>											
Analog Signal Range <sup>e</sup>	V <sub>ANALOG</sub>		Full	-	0	3	0	3	V		
On-Resistance	R <sub>ON</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = 1.5 V	Room	221	-	-	-	-	Ω		
			Full	-	-	-	-	-			
Switch Off Leakage Current	I <sub>S(off)</sub>	V <sub>+</sub> = 3.3 V, V <sub>-</sub> = 0 V V <sub>D</sub> = 0.3 V / 3 V, V <sub>S</sub> = 3 V / 0.3 V	Room	± 0.02	-1	1	-1	1	nA		
			Full	-	-50	50	-5	5			
	I <sub>D(off)</sub>		Room	± 0.02	-1	1	-1	1			
			Full	-	-50	50	-5	5			
Channel On Leakage Current	I <sub>D(on)</sub>	V <sub>+</sub> = 3.3 V, V <sub>-</sub> = 0 V V <sub>D</sub> = V <sub>S</sub> = 0.3 V / 3 V	Room	± 0.02	-1	1	-1	1			
			Full	-	-50	50	-5	5			
<b>Digital Control</b>											
Input Current, V <sub>IN</sub> Low	I <sub>L</sub>	V <sub>IN(A, B, C, and enable)</sub> under test = 0.6 V	Full	0.02	-1	1	-1	1	μA		
Input Current, V <sub>IN</sub> High	I <sub>H</sub>	V <sub>IN(A, B, C, and enable)</sub> under test = 1.4 V	Full	0.02	-1	1	-1	1			
<b>Dynamic Characteristics</b>											
Transition Time	t <sub>TRANS</sub>	R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF see Fig. 1, 2, 3	Room	200	-	-	-	-	ns		
			Full	-	-	-	-	-			
Enable Turn-On Time	t <sub>ON</sub>		Room	130	-	-	-	-			
			Full	-	-	-	-	-			
Enable Turn-Off Time	t <sub>OFF</sub>		Room	78	-	-	-	-			
			Full	-	-	-	-	-			
Break-Before-Make Time Delay	t <sub>D</sub>		Room	130	-	-	-	-			
			Full	-	-	-	-	-			
Charge Injection <sup>e</sup>	Q		V <sub>g</sub> = 0 V, R <sub>g</sub> = 0 Ω, C <sub>L</sub> = 1 nF	Room	0.34	-	-	-		-	pC
Off Isolation <sup>e</sup>	OIRR		R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 1 pF f = 100 kHz	Room	-88	-	-	-		-	dB
Channel-to-Channel Crosstalk <sup>e</sup>	X <sub>TALK</sub>	Room		-105	-	-	-	-			
Source Off Capacitance <sup>e</sup>	C <sub>S(off)</sub>	f = 1 MHz	DG4051E	Room	2.6	-	-	-	-		
			DG4052E	Room	2.6	-	-	-	-		
			DG4053E	Room	2.5	-	-	-	-		
Drain Off Capacitance <sup>e</sup>	C <sub>D(off)</sub>	f = 1 MHz	DG4051E	Room	10.7	-	-	-	-		
			DG4052E	Room	5.7	-	-	-	-		
			DG4053E	Room	3.6	-	-	-	-		
Channel On Capacitance <sup>e</sup>	C <sub>D(on)</sub>	f = 1 MHz	DG4051E	Room	16.4	-	-	-	-		
			DG4052E	Room	10.9	-	-	-	-		
			DG4053E	Room	9.1	-	-	-	-		
<b>Power Supplies</b>											
Power Supply Current	I <sub>+</sub>	V <sub>IN(A, B, C, and enable)</sub> = 0 V or 3 V	Room	0.05	-	1	-	1	μA		
			Full	-	-	10	-	10			
Negative Supply Current	I <sub>-</sub>		Room	-0.05	-1	-	-1	-			
			Full	-	-10	-	-10	-			
Ground Current	I <sub>GND</sub>		Room	-0.05	-1	-	-1	-			
			Full	-	-10	-	-10	-			

**Notes**

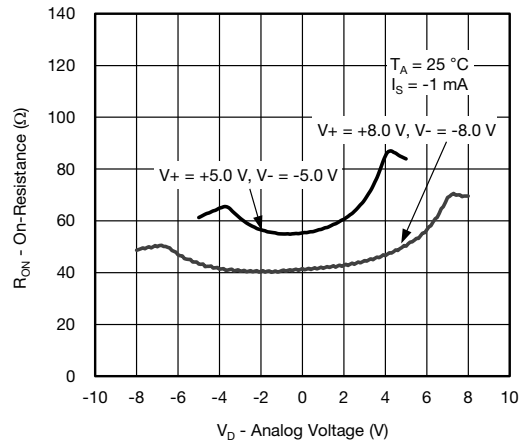
- a. V<sub>IN</sub> = input voltage to perform proper function.
- b. Room = 25 °C, full = as determined by the operating temperature suffix.
- c. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- d. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this datasheet.
- e. Guaranteed by design, not subject to production test.



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



On-Resistance vs. Analog Voltage (Single Supply)



On-Resistance vs. Analog Voltage (Dual Supply)



On-Resistance vs. Analog Voltage (Temperature)



On-Resistance vs. Analog Voltage (Temperature)



On-Resistance vs. Analog Voltage (Temperature)

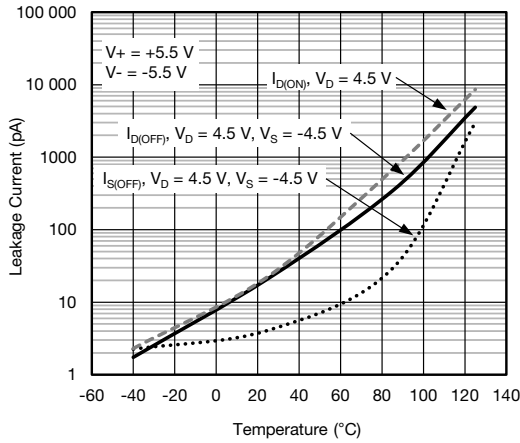


Supply Current vs. Input Switching Frequency

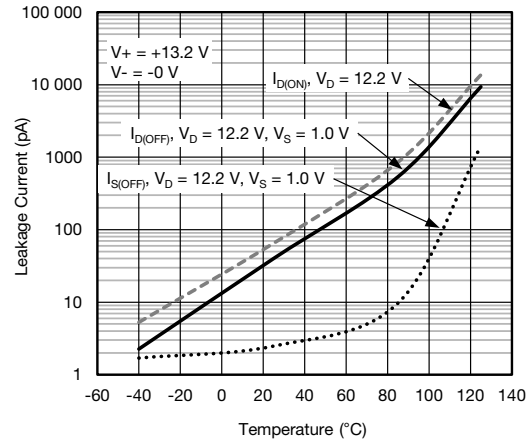




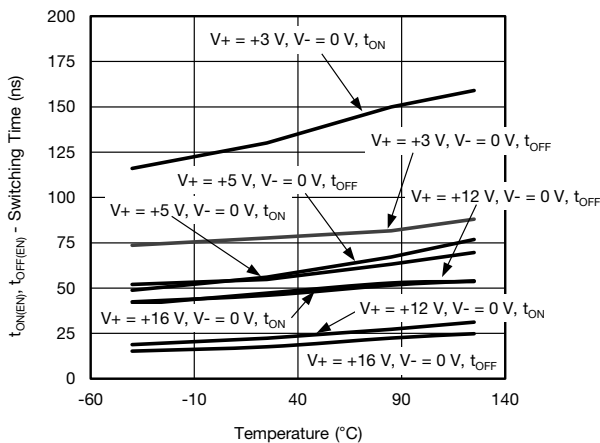
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



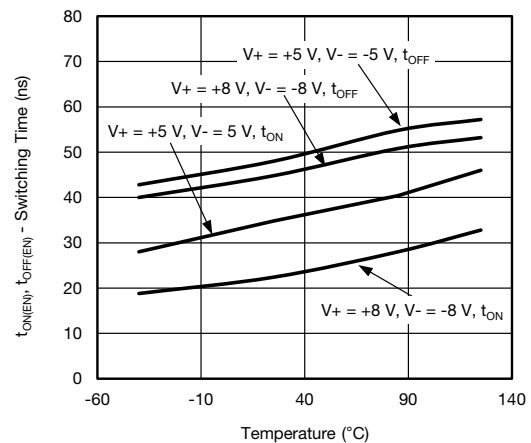
Leakage Current vs. Temperature



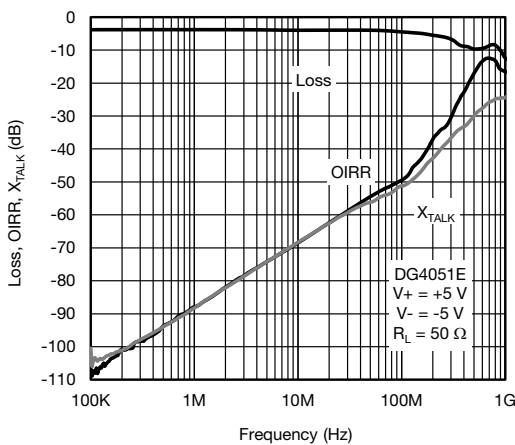
Leakage Current vs. Temperature



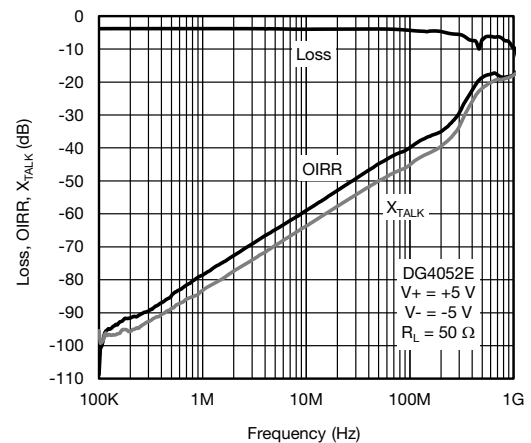
Switching Time vs. Temperature (Single Supply)



Switching Time vs. Temperature (Dual Supply)



DG4051E Insertion Loss, Off-Isolation, Crosstalk vs. Frequency



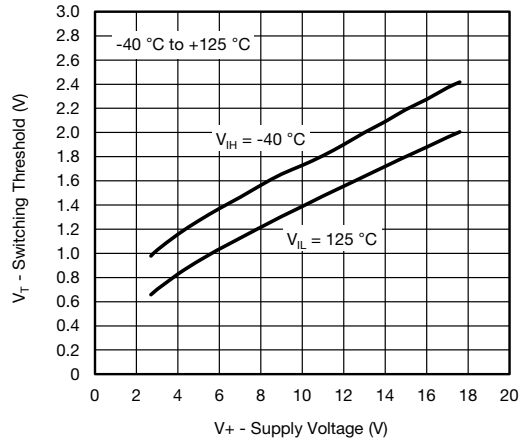
DG4052E Insertion Loss, Off-Isolation, Crosstalk vs. Frequency



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



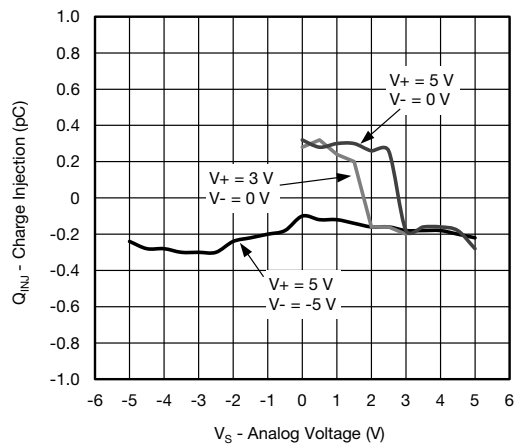
DG4053E Insertion Loss, Off-Isolation, Crosstalk vs. Frequency



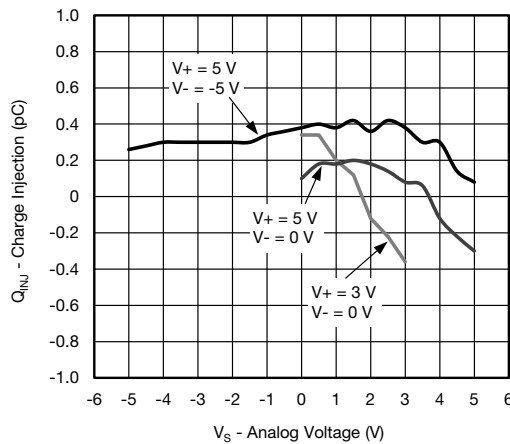
Switching Threshold vs. V+ Supply Voltage



DG4051E Charge Injection vs. Analog Voltage

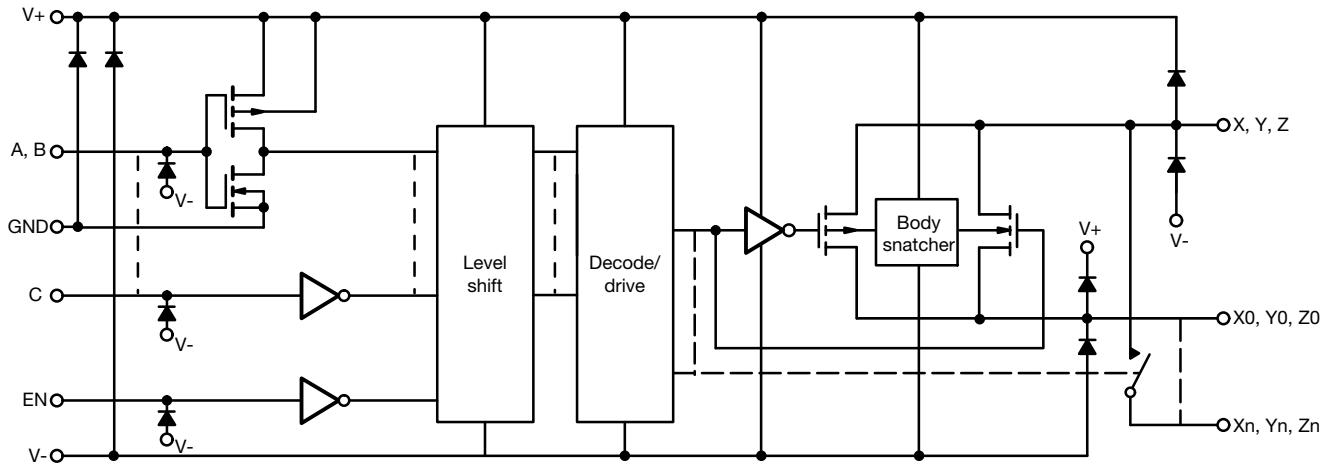


DG4053E Charge Injection vs. Analog Voltage



DG4052E Charge Injection vs. Analog Voltage

**SCHEMATIC DIAGRAM** (Typical Channel)



**TEST CIRCUITS**

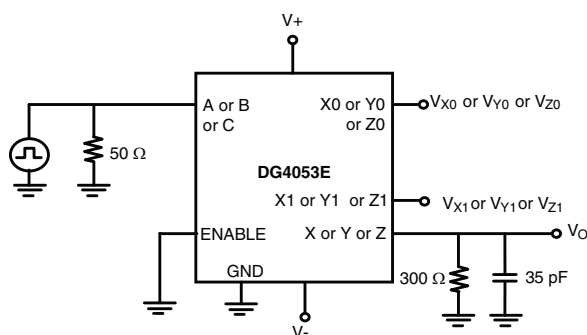
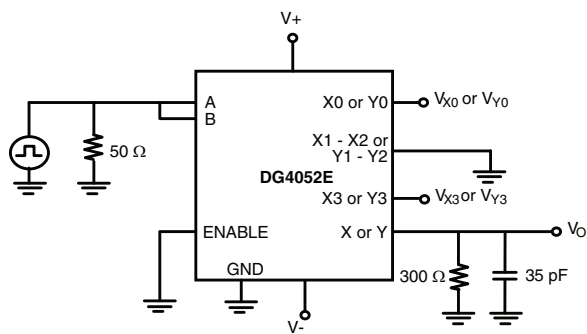
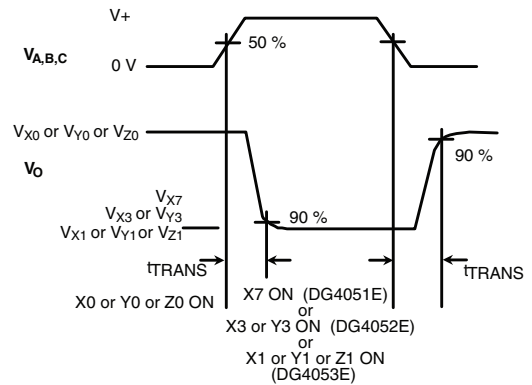
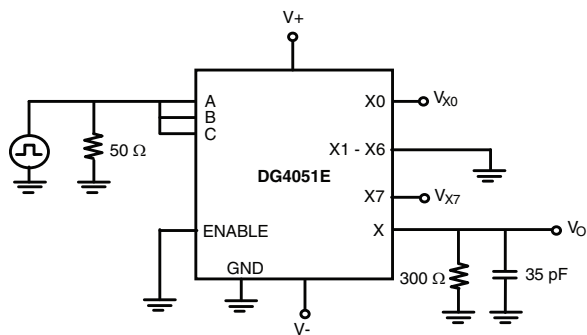


Fig. 1 - Transition Time

TEST CIRCUITS



Fig. 2 - Enable Switching Time

TEST CIRCUITS

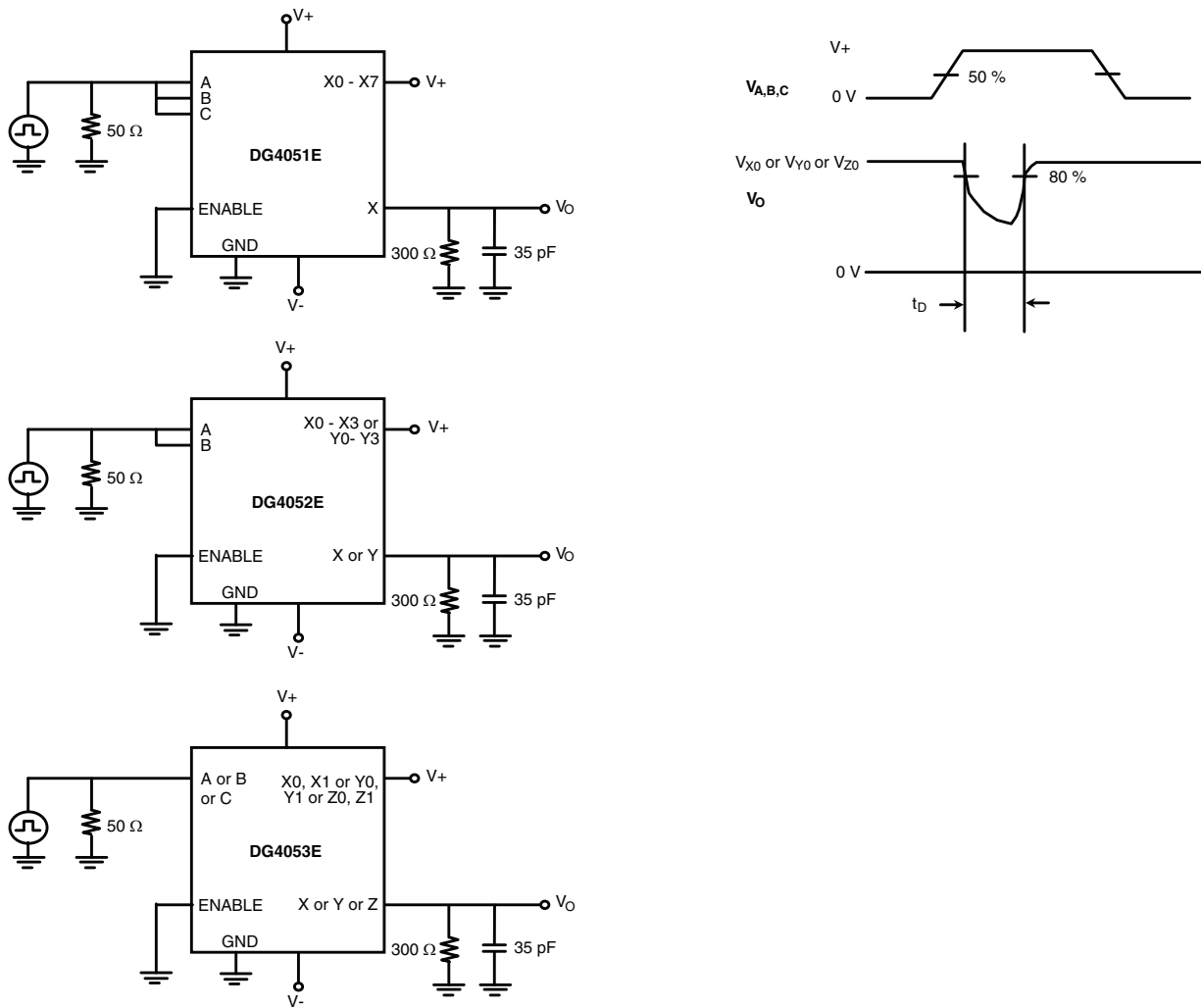


Fig. 3 - Break-Before-Make

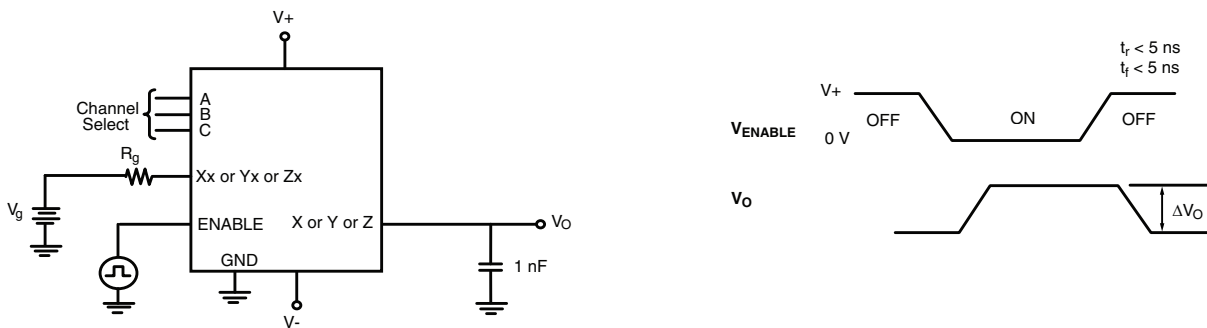


Fig. 4 - Charge Injection

TEST CIRCUITS



Fig. 5 - Insertion Loss



Fig. 7 - Off Isolation



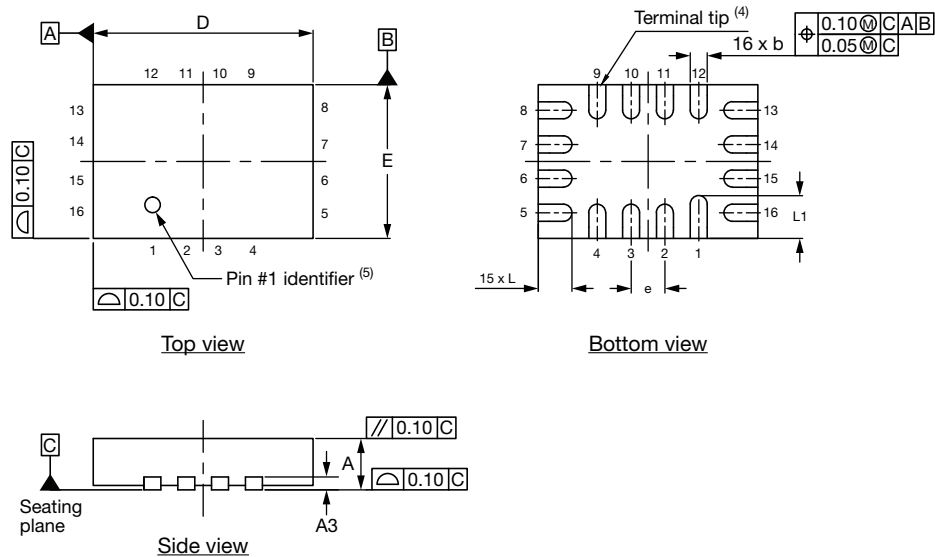
Fig. 6 - Crosstalk



Fig. 8 - Source, Drain Capacitance

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## Thin miniQFN16 Case Outline



DIMENSIONS	MILLIMETERS <sup>(1)</sup>			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.50	0.55	0.60	0.020	0.022	0.024
A1	0	-	0.05	0	-	0.002
A3	0.15 ref.			0.006 ref.		
b	0.15	0.20	0.25	0.006	0.008	0.010
D	2.50	2.60	2.70	0.098	0.102	0.106
e	0.40 BSC			0.016 BSC		
E	1.70	1.80	1.90	0.067	0.071	0.075
L	0.35	0.40	0.45	0.014	0.016	0.018
L1	0.45	0.50	0.55	0.018	0.020	0.022
N <sup>(3)</sup>	16			16		
Nd <sup>(3)</sup>	4			4		
Ne <sup>(3)</sup>	4			4		

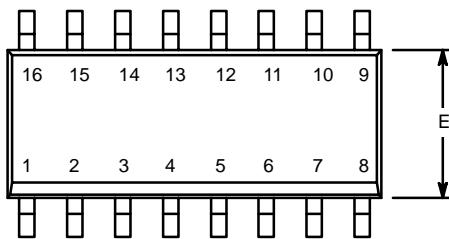
**Notes**

- (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: T16-0226-Rev. B, 09-May-16  
 DWG: 6023

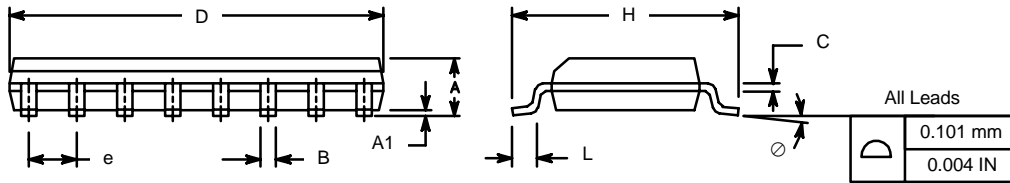


**SOIC (NARROW): 16-LEAD**  
JEDEC Part Number: MS-012



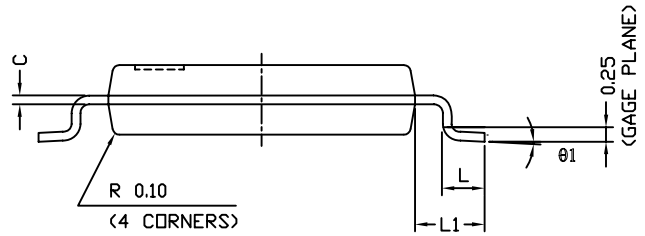
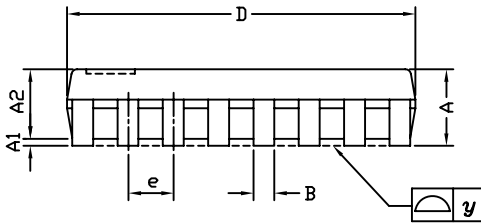
Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A <sub>1</sub>	0.10	0.20	0.004	0.008
B	0.38	0.51	0.015	0.020
C	0.18	0.23	0.007	0.009
D	9.80	10.00	0.385	0.393
E	3.80	4.00	0.149	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
L	0.50	0.93	0.020	0.037
∅	0°	8°	0°	8°

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





## TSSOP: 16-LEAD



Symbols	DIMENSIONS IN MILLIMETERS		
	Min	Nom	Max
A	-	1.10	1.20
A1	0.05	0.10	0.15
A2	-	1.00	1.05
B	0.22	0.28	0.38
C	-	0.127	-
D	4.90	5.00	5.10
E	6.10	6.40	6.70
E1	4.30	4.40	4.50
e	-	0.65	-
L	0.50	0.60	0.70
L1	0.90	1.00	1.10
y	-	-	0.10
theta1	0°	3°	6°

ECN: S-61920-Rev. D, 23-Oct-06  
DWG: 5624



## RECOMMENDED MINIMUM PAD FOR TSSOP-16



Recommended Minimum Pads  
Dimensions in inches (mm)

**RECOMMENDED MINIMUM PADS FOR MINI QFN 16L**



Mounting Footprint  
Dimensions in mm (inch)

## RECOMMENDED MINIMUM PADS FOR SO-16



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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