

# 0.3 pC Charge Injection, 100 pA Leakage CMOS $\pm 5\text{ V} / 5\text{ V} / 3\text{ V}$ 4-Channel Multiplexer

## DESCRIPTION

The DG604E is an analog 4-channel CMOS, multiplexer, designed to operate from a +3 V to +16 V single supply, or from  $\pm 3\text{ V}$  to  $\pm 8\text{ V}$ , dual supplies. The DG604E is fully specified at +3 V, +5 V and  $\pm 5\text{ V}$ .

The DG604E offers ultralow charge injection less than  $\pm 0.4\text{ pC}$  over the entire signal range and leakage currents of 16 pA typical at 25 °C. It offers on resistance of 64  $\Omega$  typ., and low parasitic capacitance of 4.2 pF source off, and 11 pF Drain on. The part is ideal for analog front end, data acquisition and sample and hold designs providing fast and precision signal switching.

The DG604E switches one of four inputs to a common output as determined by the 3-bit binary address lines: A0, A1, and EN. Each switch conducts equally well in both directions when on, blocks input voltages up to the supply level when off, and exhibits break before make switching action.

All control logic inputs have guaranteed 2 V logic high limits when operating from +5 V or  $\pm 5\text{ V}$  supplies and 1.4 V when operating from a 3 V supply.

The DG604E operating temperature range is specified from -40 °C to +125 °C. It is available in 14 lead TSSOP and the space saving 1.8 mm x 2.6 mm miniQFN package.

## FEATURES

- Ultra low charge injection (less than  $\pm 0.4\text{ pC}$ , typ. over the full analog signal range)
- Leakage current < 0.5 nA max. at 85 °C (for DG604EEQ-T1-GE4)
- Low switch capacitance ( $C_{S(off)}$ , 4.2 pF typ.)
- Fully specified with single supply operation at 3 V, 5 V, and dual supplies at  $\pm 5\text{ V}$
- CMOS / TTL compatible
- 414 MHz, -3 dB bandwidth
- Excellent isolation and crosstalk performance (typ. > -60 dB at 10 MHz)
- Fully specified from -40 °C to +85 °C and -40 °C to +125 °C
- 14 pin TSSOP and 16 pin miniQFN package (1.8 mm x 2.6 mm)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

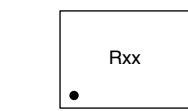


**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

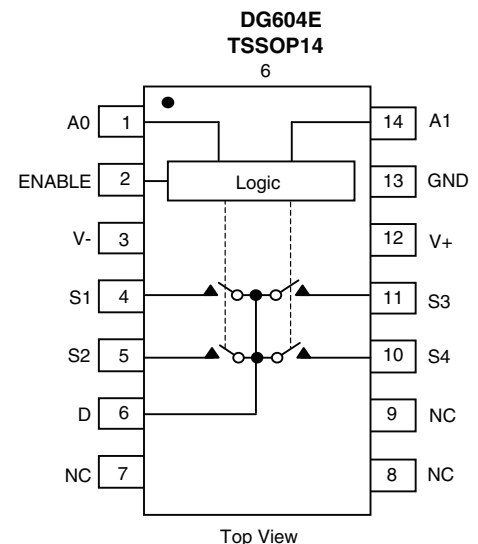
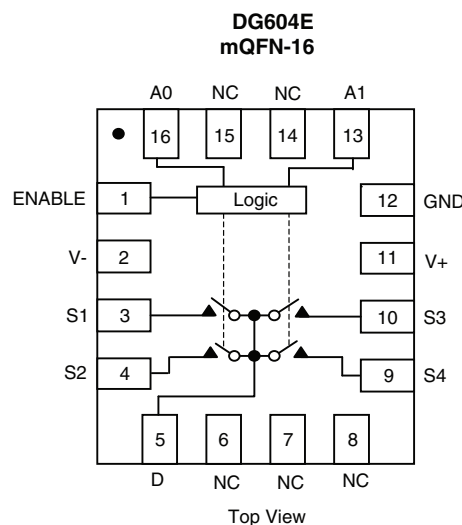
## APPLICATIONS

- Data acquisition systems
- Medical instruments
- Precision instruments
- Communications systems
- Automated test equipment
- Sample and hold circuit
- Relay replacement

## FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



Device Marking: Rxx for DG604E (miniQFN16)  
xx = Date/Lot Traceability Code





TRUTH TABLE			
ENABLE INPUT	SELECTED INPUT		ON SWITCHES
	A1	A0	DG604E
L	X	X	All switches open
H	L	L	D to S1
H	L	H	D to S2
H	H	L	D to S3
H	H	H	D to S4

ORDERING INFORMATION		
TEMP. RANGE	PACKAGE	PART NUMBER
-40 °C to +125 °C <sup>a</sup>	14 pin TSSOP	DG604EEQ-T1-GE4
	16 pin miniQFN	DG604EEN-T1-GE4

**Note**

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

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25\text{ °C}$ , unless otherwise noted)			
PARAMETER		LIMIT	UNIT
V <sub>+</sub> to V <sub>-</sub>		-0.3 to +18	V
GND to V <sub>-</sub>		18	
V <sub>S</sub> , V <sub>D</sub>		(V <sub>-</sub> ) -0.3 to (V <sub>+</sub> ) + 0.3 or 30 mA, whichever occurs first	
Digital inputs <sup>a</sup>		(GND) -0.3 to (V <sub>+</sub> ) + 0.3	
Continuous current (any terminal)		30	mA
Peak current, S or D (pulsed 1 ms, 10 % duty cycle)		100	
Storage temperature		-65 to +150	°C
Power dissipation (package) <sup>b</sup>	14 pin TSSOP <sup>c</sup>	450	mW
	16 pin miniQFN <sup>d, e</sup>	525	
Thermal resistance (package) <sup>b</sup>	14 pin TSSOP	178	°C/W
	16 pin miniQFN	152	
ESED / HBM	EIA / JESD22-A114-A	2K	V
ESD / CDM	EIA / JESD22-C101-A	1K	
Latch up	JESD78	300	mA

**Notes**

- Signals on S<sub>x</sub>, D<sub>x</sub>, or IN<sub>x</sub> exceeding V<sub>+</sub> or V<sub>-</sub> will be clamped by internal diodes. Limit forward diode current to maximum current ratings
- All leads welded or soldered to PC board
- Derate 5.6 mW/°C above 70 °C
- Derate 6.6 mW/°C above 70 °C
- 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



SPECIFICATIONS FOR DUAL SUPPLIES (V+ = 5 V, V- = -5 V)									
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 5 V, V- = -5 V VIN A0, A1, 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	-	-5	5	-5	5	V
Drain-source On-resistance	R <sub>DS(on)</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = -3 V, 0 V, +3 V	Room	64	-	101	-	101	Ω
			Full	-	-	135	-	119	
On-resistance match	ΔR <sub>DS(on)</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = ± 3 V	Room	0.5	-	5	-	5	
			Full	-	-	7	-	6	
On-resistance flatness	R <sub>flat(on)</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = -3 V, 0 V, +3 V	Room	15	-	20	-	20	
			Full	-	-	25	-	23	
Switch off leakage current (for 14 pin TSSOP)	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	± 0.003	-0.1	0.1	-0.1	0.1	nA
			Full	-	-18	18	-0.5	0.5	
	I <sub>D(off)</sub>		Room	± 0.009	-0.1	0.1	-0.1	0.1	
			Full	-	-18	18	-0.5	0.5	
Switch on leakage current (for 14 pin TSSOP)	I <sub>D(on)</sub>	V+ = 5.5 V, V- = -5.5 V, V <sub>D</sub> = V <sub>S</sub> = ± 4.5 V	Room	± 0.016	-0.1	0.1	-0.1	0.1	
			Full	-	-18	18	-0.5	0.5	
Switch off leakage current (for 16 pin miniQFN)	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	± 0.003	-1	1	-1	1	
			Full	-	-18	18	-2	2	
	I <sub>D(off)</sub>		Room	± 0.009	-1	1	-1	1	
			Full	-	-18	18	-2	2	
Switch on leakage current (for 16 pin miniQFN)	I <sub>D(on)</sub>	V+ = 5.5 V, V- = -5.5 V, V <sub>D</sub> = V <sub>S</sub> = ± 4.5 V	Room	± 0.016	-1	1	-1	1	
			Full	-	-18	18	-2	2	
<b>Digital Control</b>									
Input current, V <sub>IN</sub> low	I <sub>IL</sub>	V <sub>IN</sub> A0, A1 and ENABLE Under test = 0.8 V	Full	0.00001	-0.1	0.1	-0.1	0.1	μA
Input current, V <sub>IN</sub> high	I <sub>IH</sub>	V <sub>IN</sub> A0, A1 and ENABLE Under test = 2 V	Full	0.00001	-0.1	0.1	-0.1	0.1	
Input capacitance	C <sub>IN</sub>	f = 1 MHz	Room	5	-	-	-	-	pF
<b>Dynamic Characteristics</b>									
Transition time	t <sub>TRANS</sub>	V <sub>S(CLOSE)</sub> = 3 V, V <sub>S(OPEN)</sub> = 0 V, R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF	Room	29	-	67	-	67	ns
			Full	-	-	87	-	82	
Turn-on time	t <sub>ON</sub>	R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF V <sub>S</sub> = ± 3 V	Room	26	-	54	-	54	
			Full	-	-	61	-	58	
Turn-off time	t <sub>OFF</sub>		Room	22	-	52	-	52	
			Full	-	-	70	-	57	
Break-before-make time	t <sub>BBM</sub>	V <sub>S</sub> = 3 V R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF	Room	7	-	-	-	-	
			Full	-	2	-	2	-	
Charge injection <sup>e</sup>	Q <sub>INJ</sub>	V <sub>GEN</sub> = 0 V, R <sub>GEN</sub> = 0 Ω, C <sub>L</sub> = 1 nF	Room	-0.3	-	-	-	-	pC
Off isolation <sup>e</sup>	OIRR	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF, f = 10 MHz	Room	-67	-	-	-	-	dB
Bandwidth <sup>e</sup>	BW	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	Room	414	-	-	-	-	MHz
Channel-to-channel crosstalk <sup>e</sup>	X <sub>TALK</sub>	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF, f = 10 MHz	Room	-65	-	-	-	-	dB
Source off capacitance <sup>e</sup>	C <sub>S(off)</sub>	f = 1 MHz	Room	4.2	-	-	-	-	pF
Drain off capacitance <sup>e</sup>	C <sub>D(off)</sub>		Room	6.8	-	-	-	-	
Drain on capacitance <sup>e</sup>	C <sub>D(on)</sub>		Room	11	-	-	-	-	



SPECIFICATIONS FOR DUAL SUPPLIES (V+ = 5 V, V- = -5 V)									
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 5 V, V- = -5 V VIN A0, A1, 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>Power Supply</b>									
Power supply current	I+	VIN = 0 V or V+	Room	0.0004	-	0.5	-	0.5	μA
			Full	-	-	1	-	1	
Negative supply current	I-		Room	-0.0004	-0.5	-	-0.5	-	
			Full	-	-1	-	-1	-	
Ground current	IGND		Room	-0.0004	-0.5	-	-0.5	-	
			Full	-	-1	-	-1	-	

**Notes**

- a. Signals on S<sub>X</sub>, D<sub>X</sub>, or IN<sub>X</sub> 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. 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



SPECIFICATIONS FOR SINGLE SUPPLY (V+ = 5 V, V- = 0 V)											
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 5 V, V- = 0 V VIN A0, A1, 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	5	0	5	V		
Drain-source On-resistance	R <sub>DS(on)</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = +3.5 V	Room	134	-	181	-	181	Ω		
			Full	-	-	232	-	208			
On-resistance match	ΔR <sub>DS(on)</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = +3.5 V	Room	1.4	-	7	-	7	Ω		
			Full	-	-	9	-	8			
On-resistance flatness	R <sub>flat(on)</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = 0 V, +3.5 V	Room	36	-	50	-	50	Ω		
			Full	-	-	54	-	52			
Switch off leakage current (for 14 pin TSSOP)	I <sub>S(off)</sub>	V+ = 5.5 V, V- = 0 V V <sub>D</sub> = 1 V / 4.5 V, V <sub>S</sub> = 4.5 V / 1 V	Room	± 0.002	-0.1	0.1	-0.1	0.1	nA		
			Full	-	-18	18	-0.5	0.5			
	I <sub>D(off)</sub>		Room	± 0.007	-0.1	0.1	-0.1	0.1			
			Full	-	-18	18	-0.5	0.5			
Switch on leakage current (for 14 pin TSSOP)	I <sub>D(on)</sub>	V+ = 5.5 V, V- = 0 V V <sub>D</sub> = V <sub>S</sub> = 1 V / 4.5 V	Room	± 0.01	-0.1	0.1	-0.1	0.1			
			Full	-	-18	18	-0.5	0.5			
Switch off leakage current (for 16 pin miniQFN)	I <sub>S(off)</sub>		V+ = 5.5 V, V- = 0 V V <sub>D</sub> = 1 V / 4.5 V, V <sub>S</sub> = 4.5 V / 1 V	Room	± 0.002	-1	1	-1		1	
				Full	-	-18	18	-2		2	
I <sub>D(off)</sub>	Room	± 0.007		-1	1	-1	1				
	Full	-		-18	18	-2	2				
Switch on leakage current (for 16 pin miniQFN)	I <sub>D(on)</sub>	V+ = 5.5 V, V- = 0 V, V <sub>D</sub> = V <sub>S</sub> = 1 V / 4.5 V	Room	± 0.01	-1	1	-1	1			
			Full	-	-18	18	-2	2			
<b>Digital Control</b>											
Input current, V <sub>IN</sub> low	I <sub>IL</sub>		V <sub>IN</sub> A0, A1, and ENABLE Under test = 0.8 V	Full	0.00001	-0.1	0.1	-0.1	0.1	μA	
Input current, V <sub>IN</sub> high	I <sub>IH</sub>	V <sub>IN</sub> A0, A1, and ENABLE Under test = 2 V	Full	0.00001	-0.1	0.1	-0.1	0.1	μA		
Input capacitance	C <sub>IN</sub>	f = 1 MHz	Room	5	-	-	-	-	pF		
<b>Dynamic Characteristics</b>											
Transition time	t <sub>TRANS</sub>	V <sub>S(CLOSE)</sub> = 3 V, V <sub>S(OPEN)</sub> = 0 V, R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF	Room	47	-	70	-	70	ns		
			Full	-	-	116	-	91			
Turn-on time	t <sub>ON</sub>		Room	32	-	52	-	52			
			Full	-	-	63	-	57			
Turn-off time	t <sub>OFF</sub>		Room	26	-	46	-	46			
			Full	-	-	61	-	55			
Break-before-make-time	t <sub>BMM</sub>		Room	22	-	-	-	-			
			Full	-	3	-	3	-			
Charge injection <sup>e</sup>	Q <sub>IINJ</sub>		C <sub>L</sub> = 1 nF, R <sub>GEN</sub> = 0 Ω, V <sub>GEN</sub> = 0 V	Full	-0.03	-	-	-		-	pC
Off-isolation <sup>e</sup>	OIRR		f = 10 MHz, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	Room	-66	-	-	-		-	dB
Channel-to-channel crosstalk <sup>e</sup>	X <sub>TALK</sub>	Room		-64	-	-	-	-			
Bandwidth <sup>e</sup>	BW	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	Room	358	-	-	-	-	MHz		
Source off capacitance <sup>e</sup>	C <sub>S(off)</sub>	f = 1 MHz	Room	4.4	-	-	-	-	pF		
Drain off capacitance <sup>e</sup>	C <sub>D(off)</sub>			7.3	-	-	-	-			
Drain on capacitance <sup>e</sup>	C <sub>D(on)</sub>			12	-	-	-	-			



SPECIFICATIONS FOR SINGLE SUPPLY (V+ = 5 V, V- = 0 V)									
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 5 V, V- = 0 V VIN A0, A1, 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>Power Supply</b>									
Power supply current	I+	VIN = 0 V or V+	Room	0.0002	-	0.5	-	0.5	μA
			Full	-	-	1	-	1	
Negative supply current	I-		Room	-0.0002	-0.5	-	-0.5	-	
			Full	-	-1	-	-1	-	
Ground current	IGND		Room	-0.0002	-0.5	-	-0.5	-	
			Full	-	-1	-	-1	-	

**Notes**

- a. Signals on S<sub>X</sub>, D<sub>X</sub>, or IN<sub>X</sub> 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. 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



SPECIFICATIONS FOR SINGLE SUPPLY (V+ = 3 V, V- = 0 V)											
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 3 V, V- = 0 V VIN A0, A1, AND ENABLE = 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	-	-	3	-	3	V		
Drain-source On-resistance	R <sub>DS(on)</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = +1.5 V	Room	319	-	416	-	416	Ω		
			Full	-	-	478	-	453			
On-resistance match	ΔR <sub>DS(on)</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = +1.5 V	Room	7	-	15	-	15	Ω		
			Full	-	-	17	-	16			
Switch off leakage current (for 14 pin TSSOP)	I <sub>S(off)</sub>	V+ = 3.3 V, V- = 0 V V <sub>D</sub> = 1 V / 3 V, V <sub>S</sub> = 3 V / 1 V	Room	± 0.001	-0.1	0.1	-0.1	0.1	nA		
			Full	-	-18	18	-0.5	0.5			
	I <sub>D(off)</sub>		Room	± 0.006	-0.1	0.1	-0.1	0.1			
			Full	-	-18	18	-0.5	0.5			
Switch on leakage current (for 14 pin TSSOP)	I <sub>D(on)</sub>	V+ = 3.3 V, V- = 0 V V <sub>D</sub> = V <sub>S</sub> = 1 V / 3 V	Room	± 0.006	-0.1	0.1	-0.1	0.1			
			Full	-	-18	18	-0.5	0.5			
Switch off leakage current (for 16 pin miniQFN)	I <sub>S(off)</sub>		V+ = 3.3 V, V- = 0 V V <sub>D</sub> = 1 V / 3 V, V <sub>S</sub> = 3 V / 1 V	Room	± 0.001	-1	1	-1		1	
				Full	-	-18	18	-2		2	
I <sub>D(off)</sub>	Room	± 0.006		-1	1	-1	1				
	Full	-		-18	18	-2	2				
Switch on leakage current (for 16 pin miniQFN)	I <sub>D(on)</sub>	V+ = 3.3 V, V- = 0 V, V <sub>D</sub> = V <sub>S</sub> = 1 V / 3 V	Room	± 0.006	-1	1	-1	1			
			Full	-	-18	18	-2	2			
<b>Digital Control</b>											
Input current, V <sub>IN</sub> low	I <sub>IL</sub>		V <sub>IN</sub> A0, A1 and ENABLE under test = 0.6 V	Full	0.000008	-1	1	-1	1	μA	
Input current, V <sub>IN</sub> high	I <sub>IH</sub>	V <sub>IN</sub> A0, A1 and ENABLE under test = 1.4 V	Full	0.000008	-1	1	-1	1	μA		
Input capacitance	C <sub>IN</sub>	f = 1 MHz	Room	5	-	-	-	-	pF		
<b>Dynamic Characteristics</b>											
Transition time	t <sub>TRANS</sub>	V <sub>S(CLOSE)</sub> = 3 V, V <sub>S(OPEN)</sub> = 0 V, R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF	Room	138	-	163	-	163	ns		
			Full	-	-	197	-	195			
Turn-on time	t <sub>ON</sub>		Room	95	-	117	-	117			
			Full	-	-	145	-	135			
Turn-off time	t <sub>OFF</sub>		Room	55	-	76	-	76			
			Full	-	-	98	-	90			
Break-before-make-time	t <sub>BMM</sub>		Room	58	-	-	-	-			
			Full	-	5	-	5	-			
Charge injection <sup>e</sup>	Q <sub>INJ</sub>		C <sub>L</sub> = 1 nF, R <sub>GEN</sub> = 0 Ω, V <sub>GEN</sub> = 0 V	Full	0.01	-	-	-		-	pC
Off-isolation <sup>e</sup>	OIRR		f = 10 MHz, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	Room	-66	-	-	-		-	dB
Channel-to-channel crosstalk <sup>e</sup>	X <sub>TALK</sub>	Room		-64	-	-	-				
Bandwidth <sup>e</sup>	BW	Room		318	-	-	-	-	MHz		
Source off capacitance <sup>e</sup>	C <sub>S(off)</sub>	f = 1 MHz	Room	4.6	-	-	-	-	pF		
Drain off capacitance <sup>e</sup>	C <sub>D(off)</sub>		Room	7.7	-	-	-	-			
Channel on capacitance <sup>e</sup>	C <sub>D(on)</sub>		Room	12.6	-	-	-	-			



**SPECIFICATIONS FOR SINGLE SUPPLY (V+ = 3 V, V- = 0 V)**

PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 3 V, V- = 0 V VIN A0, A1, AND ENABLE = 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>Power Supply</b>									
Power supply current	I+	VIN = 0 V or V+	Room	0.0001	-	0.5	-	0.5	μA
			Full	-	-	1	-	1	
Negative supply current	I-		Room	-0.0001	-0.5	-	-0.5	-	
			Full	-	-1	-	-1	-	
Ground current	IGND		Room	-0.0001	-0.5	-	-0.5	-	
			Full	-	-1	-	-1	-	

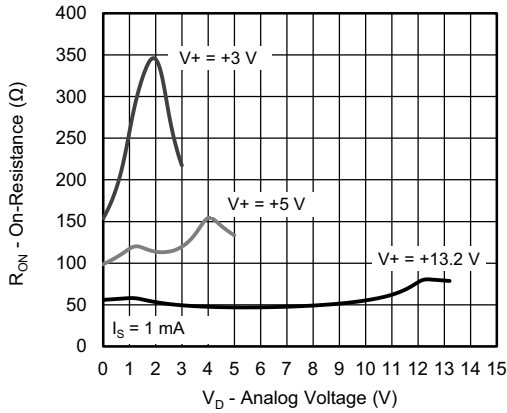
**Notes**

- a. Signals on S<sub>X</sub>, D<sub>X</sub>, or IN<sub>X</sub> 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. 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

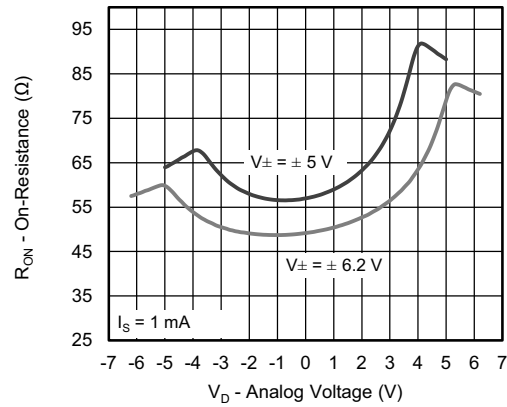
*Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*



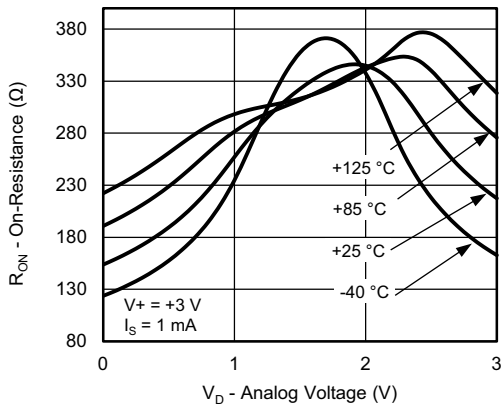
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



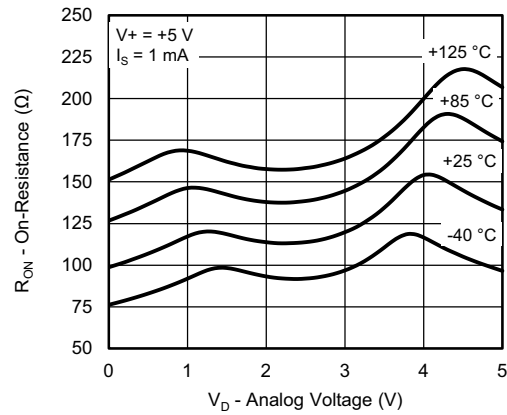
**On-Resistance vs.  $V_D$  (Single Supply Voltage)**



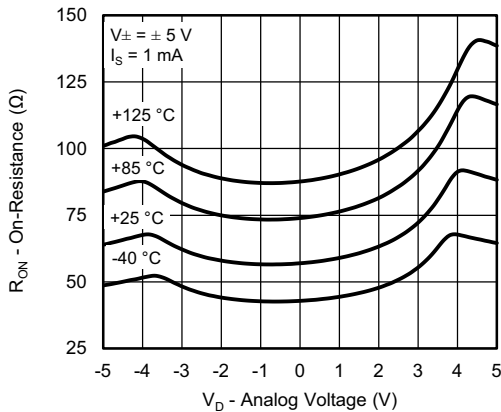
**On-Resistance vs.  $V_D$  (Dual Supply Voltage)**



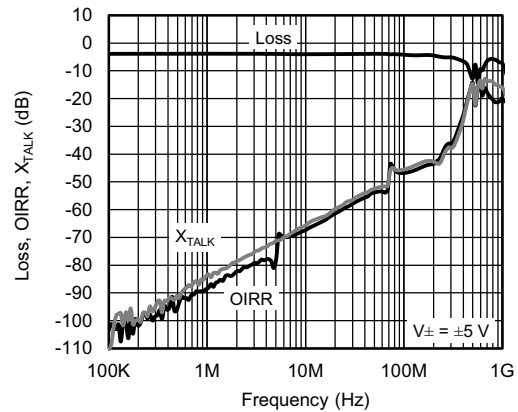
**On-Resistance vs. Analog Voltage and Temperature**



**On-Resistance vs. Analog Voltage and Temperature**

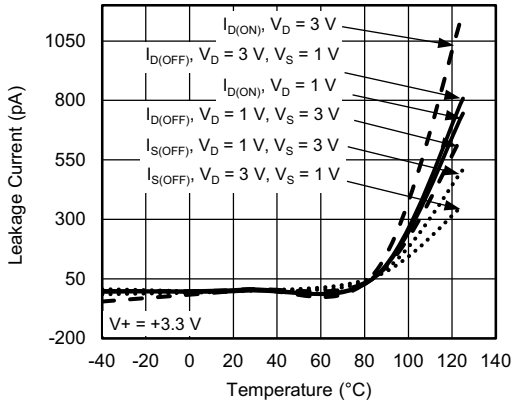


**On-Resistance vs. Analog Voltage and Temperature**

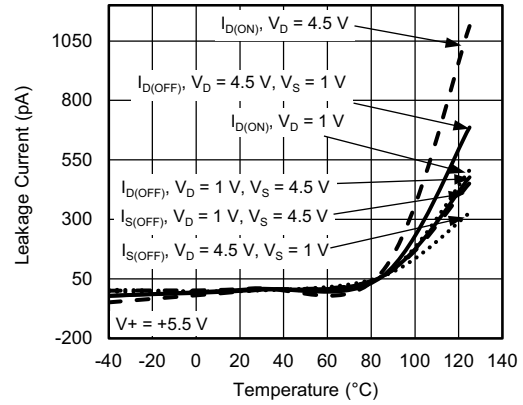


**Insertion Loss, Off-Isolation, Crosstalk vs. Frequency**

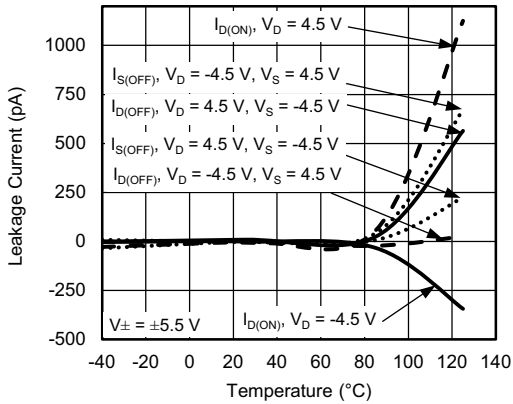
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



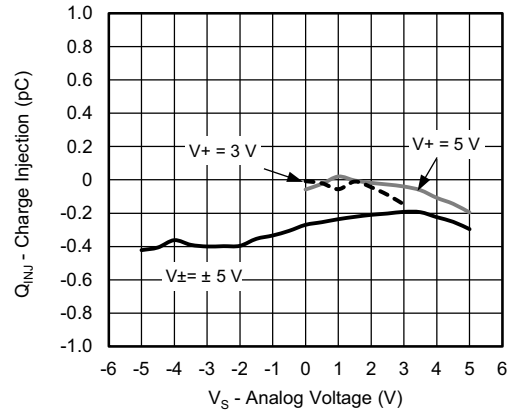
**Leakage Current vs. Temperature**



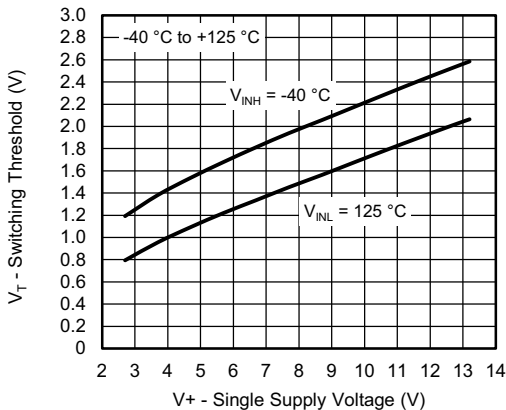
**Leakage Current vs. Temperature**



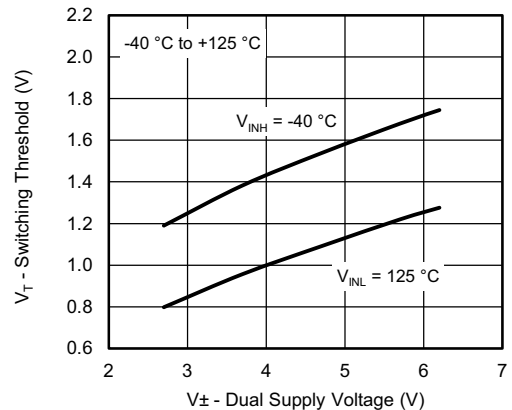
**Leakage Current vs. Temperature**



**Charge Injection vs. Analog Voltage**



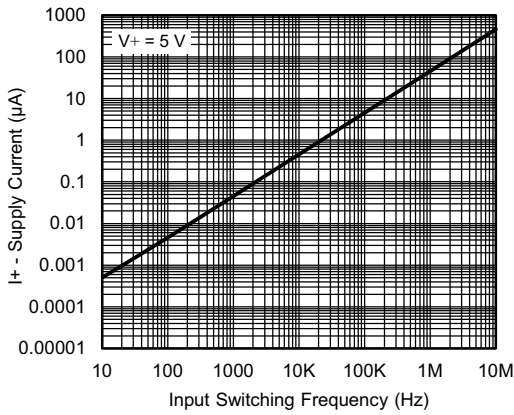
**Switching Threshold vs. Supply Voltage**



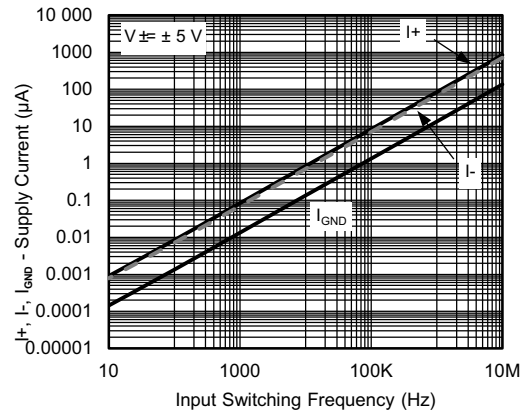
**Switching Threshold vs. Supply Voltage**



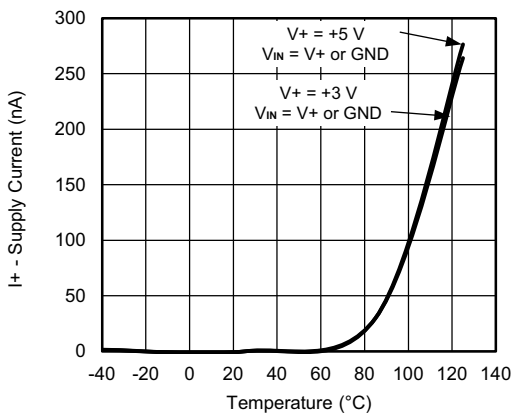
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



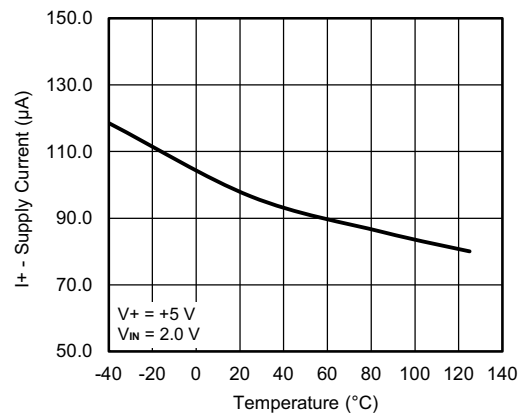
Supply Current vs. Switching Frequency



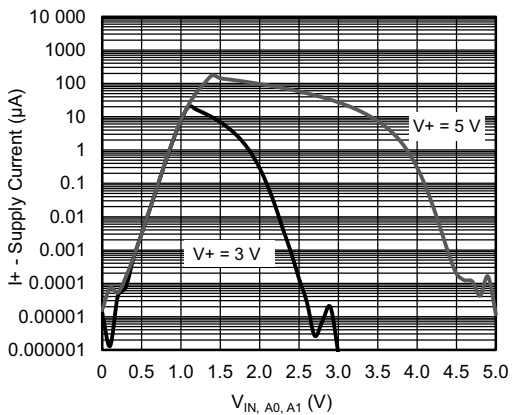
Supply Current vs. Switching Frequency



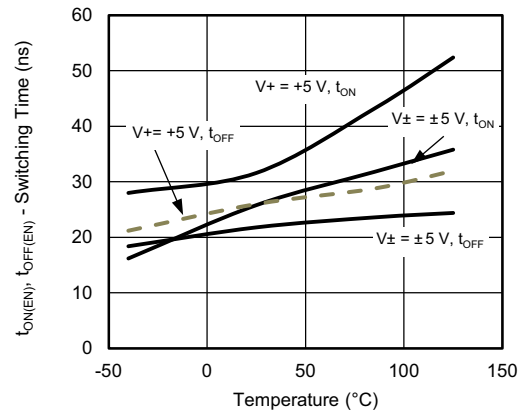
Supply Current vs. Temperature



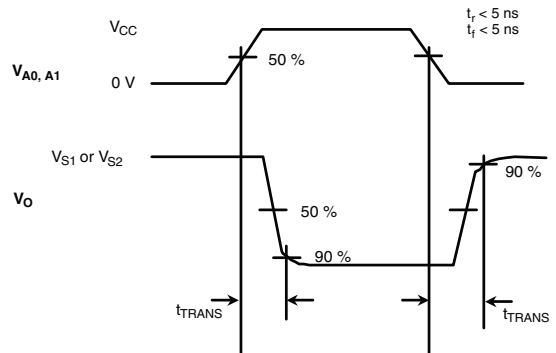
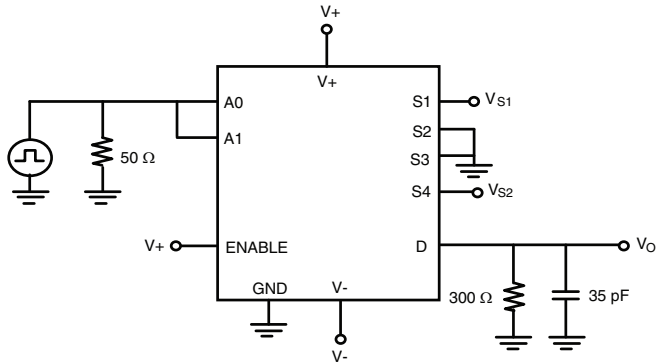
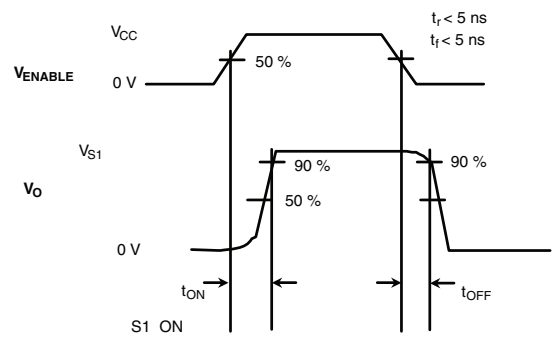
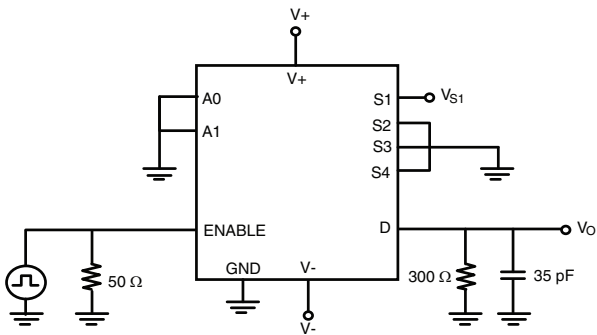
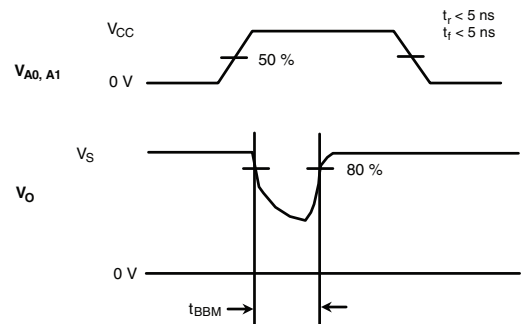
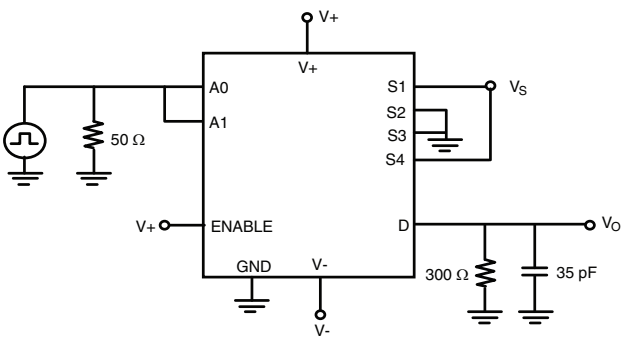
Supply Current vs. Temperature



Supply Current vs. Enable Input Voltage



Switching Time vs. Temperature

**TEST CIRCUITS**

**Fig. 1 - Transition Time**

**Fig. 2 - Enable Switching Time**

**Fig. 3 - Break-Before-Make**

TEST CIRCUITS

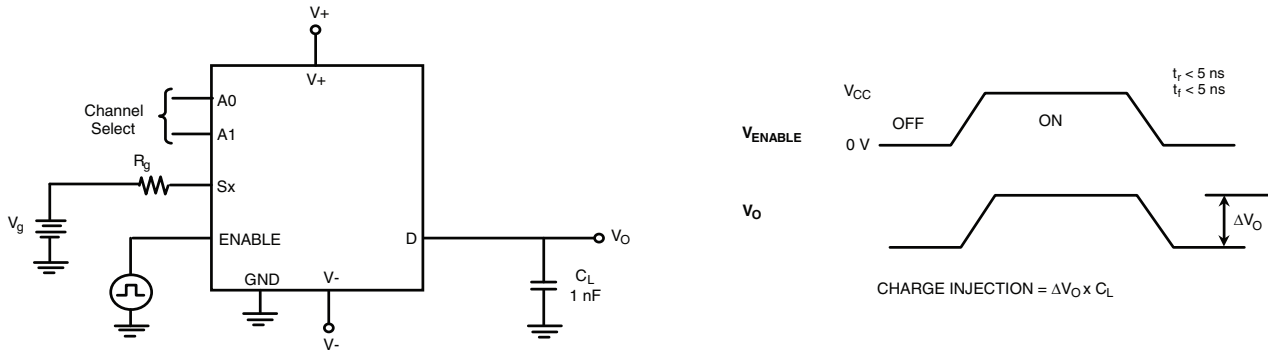


Fig. 4 - Charge Injection

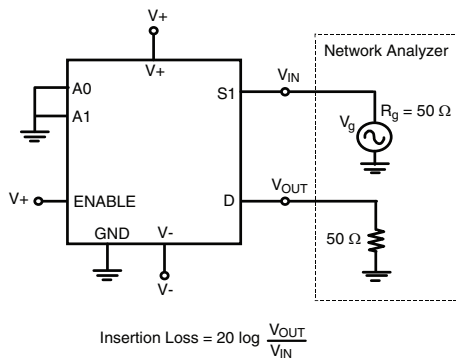


Fig. 5 - Insertion Loss

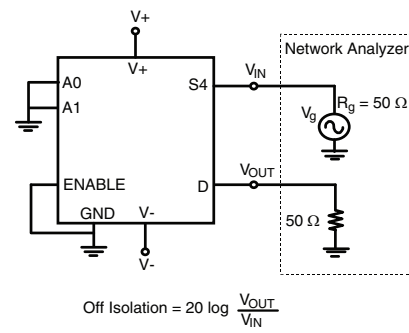


Fig. 6 - Off-Isolation

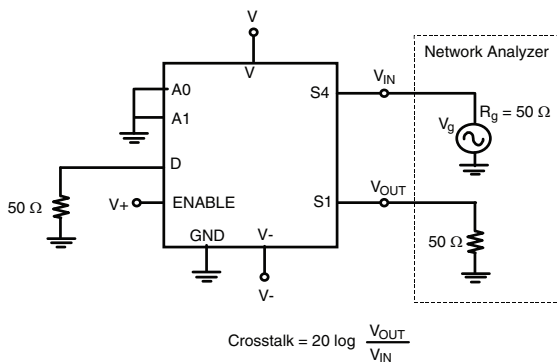


Fig. 7 - Crosstalk

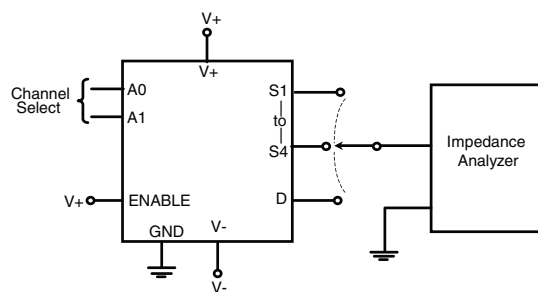
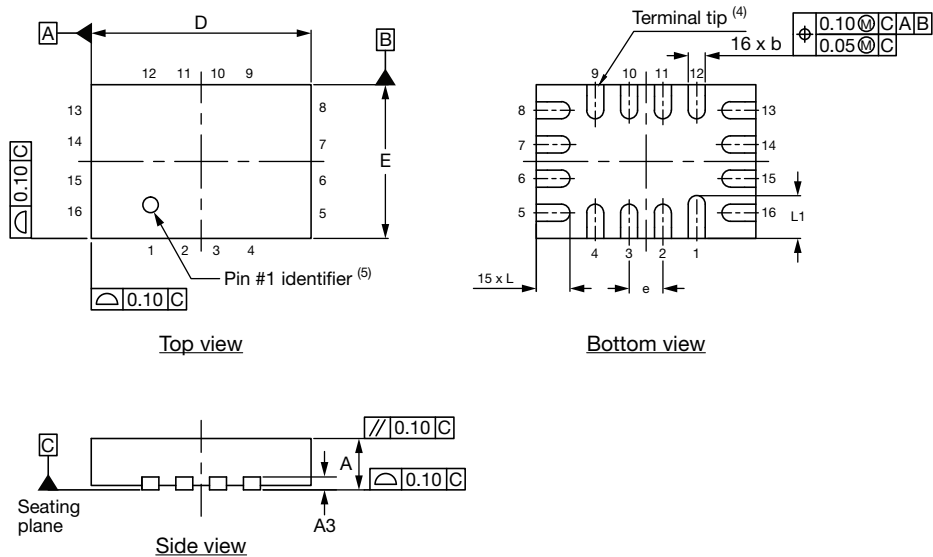


Fig. 8 - Source / Drain Capacitance

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## Thin miniQFN16 Case Outline



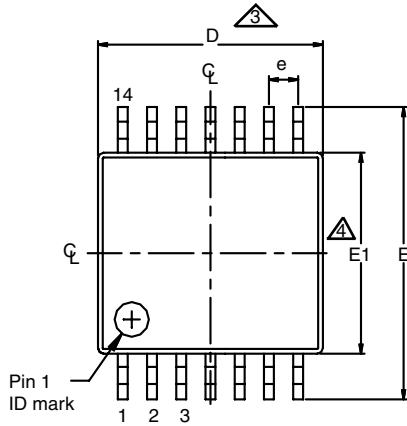
DIMENSIONS	MILLIMETERS <sup>(1)</sup>			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.50	0.55	0.60	0.020	0.022	0.024
A1	0	-	0.05	0	-	0.002
A3	0.15 ref.			0.006 ref.		
b	0.15	0.20	0.25	0.006	0.008	0.010
D	2.50	2.60	2.70	0.098	0.102	0.106
e	0.40 BSC			0.016 BSC		
E	1.70	1.80	1.90	0.067	0.071	0.075
L	0.35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

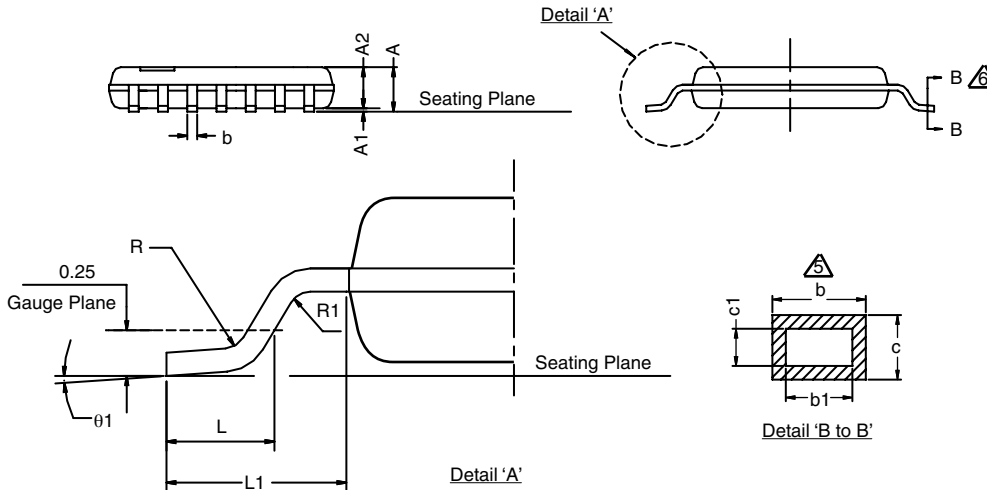
ECN: T16-0226-Rev. B, 09-May-16  
DWG: 6023

### 14L TSSOP



**Notes:**

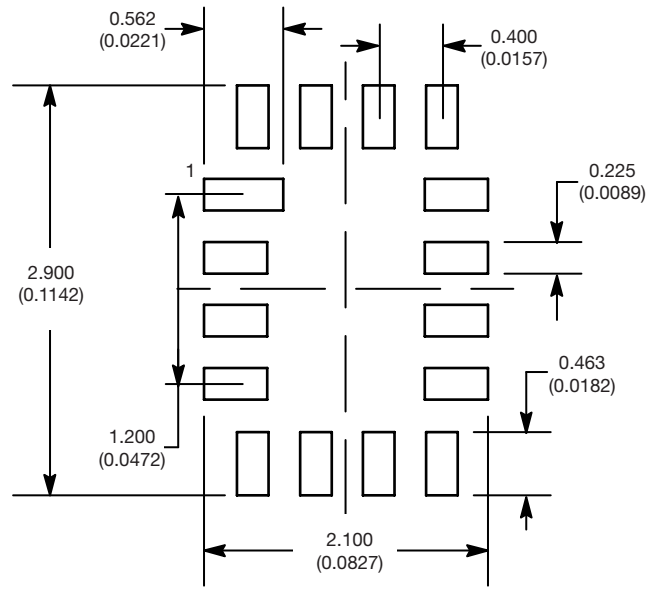
1. All dimensions are in millimeters (angles in degrees)
2. Dimensioning and tolerancing per ANSI Y14.5M-1982
- ⚠ Dimension 'D' does not include mold flash, protrusions or gate burrs
- ⚠ Dimension 'E1' does not include internal flash or protrusion
- ⚠ Dimension 'b' does not include dambar protrusion
- ⚠ Cross section B to B to be determined at 0.10 mm to 0.25 mm from the lead tip



SYMBOL	MINIMUM	NOMINAL	MAXIMUM
A	-	-	1.20
A1	0.05	-	0.15
A2	0.80	0.90	1.05
D	4.9	5.0	5.1
E1	4.3	4.4	4.5
E	6.2	6.4	6.6
L	0.45	0.60	0.75
R	0.09	-	-
R1	0.09	-	-
b	0.19	-	0.30
b1	0.19	0.22	0.25
c	0.09	-	0.20
c1	0.09	-	0.16
θ1	0°	-	8°
L1		1.0 ref.	
e		0.65 BSC	

ECN: T-07766-Rev. A, 14-Jan-08  
DWG: 5962

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



Mounting Footprint  
Dimensions in mm (inch)





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