

## 0.3 pC Charge Injection, 100 pA Leakage CMOS $\pm 5\text{ V} / 5\text{ V} / 3\text{ V}$ Dual SPDT Analog Switch

### DESCRIPTION

The DG636E is a dual SPDT CMOS, analog switch, 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 DG636E is fully specified at +3 V, +5 V, and  $\pm 5\text{ V}$ .

The DG636E offers ultralow charge injection less than  $\pm 0.4\text{ pC}$  over the entire signal range and leakage currents of 13 pA typical at 25 °C. It offers on resistance of 63  $\Omega$  typ., and low parasitic capacitance of 3.7 pF source off, and 8.4 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 DG636E switches one of two 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 DG636E 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

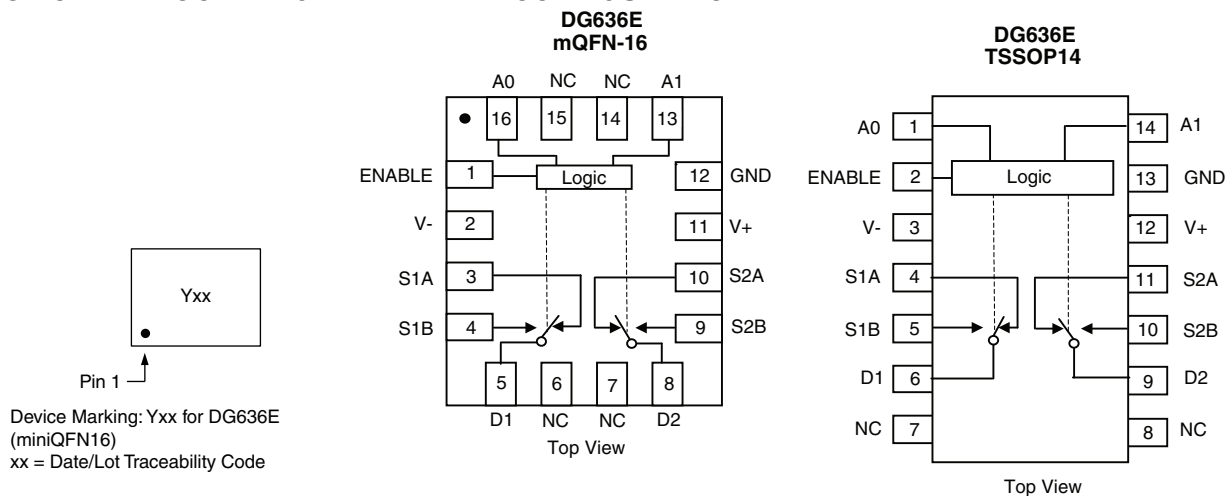
- Ultra low charge injection (Less than  $\pm 0.3\text{ pC}$ , typ. over the full analog signal range)
- Leakage current  $< 0.5\text{ nA}$  max. at 85 °C (for DG636EEQ-T1-GE4)
- Low switch capacitance ( $C_{S(off)}$ , 3.7 pF typ.)
- Fully specified with single supply operation at 3 V, 5 V, and dual supplies at  $\pm 5\text{ V}$
- CMOS / TTL compatible
- 700 MHz, -3 dB bandwidth
- Excellent isolation and crosstalk performance (typ.  $> -60\text{ dB}$  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)



### 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



ENABLE = Hi, all switches are controlled by addr pins. ENABLE = Lo, all switches are off.



TRUTH TABLE			
ENABLE INPUT	SELECTED INPUT		ON SWITCHES
	A1	A0	DG636E
L	X	X	All Switches Open
H	L	L	D1 to S1A, D2 to S2A
H	L	H	D1 to S1B, D2 to S2A
H	H	L	D1 to S1A, D2 to S2B
H	H	H	D1 to S1B, D2 to S2B

ORDERING INFORMATION		
TEMP. RANGE	PACKAGE	PART NUMBER
-40 °C to +125 °C <sup>a</sup>	14 pin TSSOP	DG636EEQ-T1-GE4
	16 pin miniQFN	DG636EEN-T1-GE4

**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 <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	63	-	96	-	96	Ω
			Full	-	-	129	-	115	
On-resistance match	ΔR <sub>DS(on)</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = ± 3 V	Room	0.3	-	2	-	2	
			Full	-	-	4	-	3	
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	-	19	-	19	
			Full	-	-	24	-	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	± 0.0004	-0.1	0.1	-0.1	0.1	nA
			Full	-	-18	18	-0.5	0.5	
	I <sub>D(off)</sub>		Room	± 0.001	-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	± 0.013	-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	± 0.0004	-1	1	-1	1	
			Full	-	-18	18	-2	2	
	I <sub>D(off)</sub>		Room	± 0.001	-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	± 0.013	-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	26	-	52	-	52	ns
			Full	-	-	62	-	59	
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	24	-	46	-	46	
			Full	-	-	58	-	52	
Turn-off time	t <sub>OFF</sub>		Room	19	-	55	-	55	
			Full	-	-	61	-	59	
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	5	-	-	-	-	
			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	-0.33	-	-	-	-	pC
Off isolation <sup>e</sup>	OIRR	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF, f = 10 MHz	Room	-63	-	-	-	-	dB
Bandwidth <sup>e</sup>	BW	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	Room	700	-	-	-	-	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	-62	-	-	-	-	dB
Source off capacitance <sup>e</sup>	C <sub>S(off)</sub>	f = 1 MHz	Room	3.7	-	-	-	-	pF
Drain off capacitance <sup>e</sup>	C <sub>D(off)</sub>		Room	4.4	-	-	-	-	
Drain on capacitance <sup>e</sup>	C <sub>D(on)</sub>		Room	8.4	-	-	-	-	



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	-	-	5	-	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	131	-	176	-	176	Ω		
			Full	-	-	224	-	203			
On-resistance match	ΔR <sub>DS(on)</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = +3.5 V	Room	0.2	-	3.4	-	3.4	Ω		
			Full	-	-	5	-	4			
On-resistance flatness	R <sub>flat(on)</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = 0 V, +3.5 V	Room	34	-	52	-	52	Ω		
			Full	-	-	58	-	56			
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	± 0.0002	-0.1	0.1	-0.1	0.1	nA		
			Full	-	-18	18	-0.5	0.5			
	I <sub>D(off)</sub>		Room	± 0.0004	-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	± 0.0003	-0.1	0.1	-0.1	0.1			
			Full	-	-18	18	-0.5	0.5			
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	± 0.0002	-1	1	-1	1			
			Full	-	-18	18	-2	2			
I <sub>D(off)</sub>		Room	± 0.0004	-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	± 0.0003	-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	43	-	70	-	70	ns		
			Full	-	-	161	-	124			
Turn-on time	t <sub>ON</sub>		Room	33	-	55	-	55			
			Full	-	-	82	-	61			
Turn-off time	t <sub>OFF</sub>		Room	23	-	45	-	45			
			Full	-	-	52	-	50			
Break-before-make-time	t <sub>BMM</sub>		Room	17	-	-	-	-			
			Full	-	3	-	3	-			
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	-0.04	-	-	-		-	pC
Off-isolation <sup>e</sup>	OIRR		f = 10 MHz, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	Room	-64	-	-	-		-	dB
Channel-to-channel crosstalk <sup>e</sup>	X <sub>TALK</sub>	Room		-63	-	-	-	-			
Bandwidth <sup>e</sup>	BW	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	Room	587	-	-	-	-	MHz		
Source off capacitance <sup>e</sup>	C <sub>S(off)</sub>	f = 1 MHz	Room	4	-	-	-	-	pF		
Drain off capacitance <sup>e</sup>	C <sub>D(off)</sub>			4.7	-	-	-	-			
Drain on capacitance <sup>e</sup>	C <sub>D(on)</sub>			9	-	-	-	-			



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	309	-	428	-	428	Ω		
			Full	-	-	521	-	484			
On-resistance match	ΔR <sub>DS(on)</sub>	I <sub>S</sub> = 1 mA, V <sub>D</sub> = +1.5 V	Room	3	-	12	-	12	Ω		
			Full	-	-	18	-	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	± 0.0002	-0.1	0.1	-0.1	0.1	nA		
			Full	-	-18	18	-0.5	0.5			
	I <sub>D(off)</sub>		Room	± 0.0002	-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	± 0.0002	-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	± 0.0002	-1	1	-1		1	
				Full	-	-18	18	-2		2	
I <sub>D(off)</sub>	Room	± 0.0002		-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	± 0.0002	-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	0.000006	-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	0.000006	-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	116	-	149	-	149	ns		
			Full	-	-	187	-	174			
Turn-on time	t <sub>ON</sub>		Room	115	-	138	-	138			
			Full	-	-	163	-	158			
Turn-off time	t <sub>OFF</sub>		Room	49	-	71	-	71			
			Full	-	-	81	-	77			
Break-before-make time	t <sub>BMM</sub>		Room	55	-	-	-	-			
			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	0.04	-	-	-		-	pC
Off-isolation <sup>e</sup>	OIRR		f = 10 MHz, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF	Room	-64	-	-	-		-	dB
Channel-to-channel crosstalk <sup>e</sup>	X <sub>TALK</sub>	Room		-64	-	-	-				
Bandwidth <sup>e</sup>	BW	Room		453	-	-	-	-	MHz		
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	4.9	-	-	-	-			
Drain on capacitance <sup>e</sup>	C <sub>D(on)</sub>		Room	9.4	-	-	-	-			



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	-	

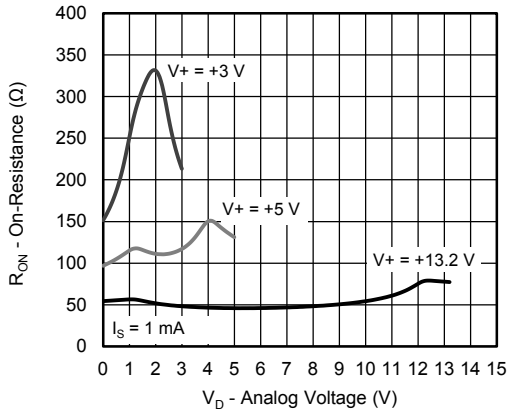
**Notes**

- 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

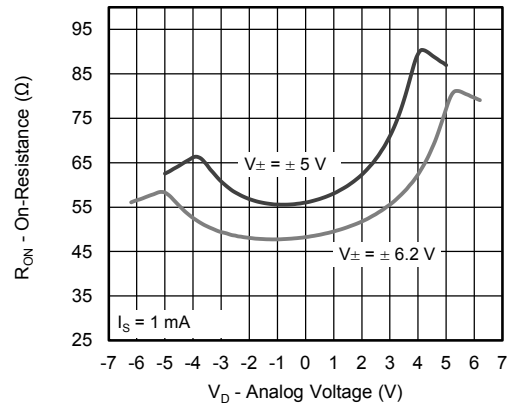
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



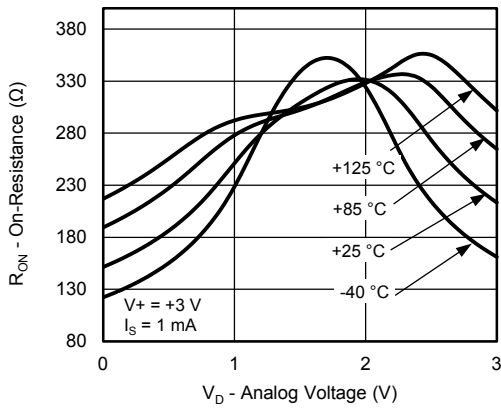
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



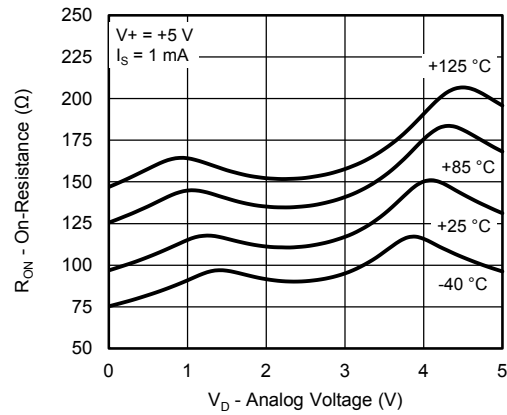
**On-Resistance vs.  $V_D$  (Single Supply Voltage)**



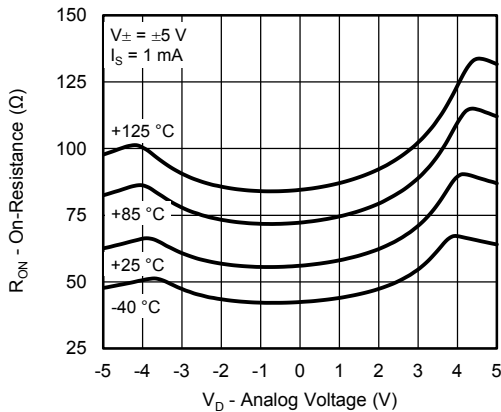
**On-Resistance vs.  $V_D$  (Dual Supply Voltage)**



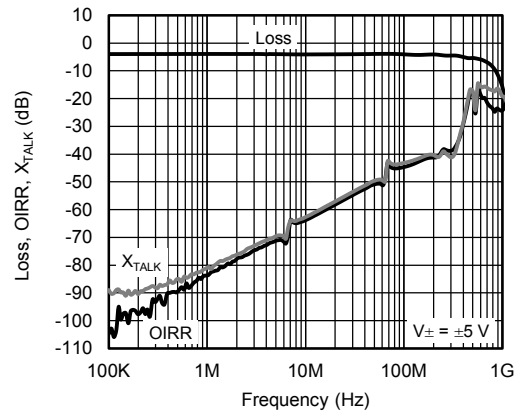
**On-Resistance vs. Analog Voltage and Temperature**



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

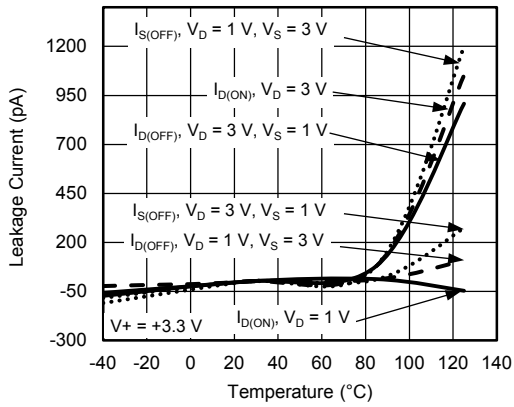


**On-Resistance vs. Analog Voltage and Temperature**

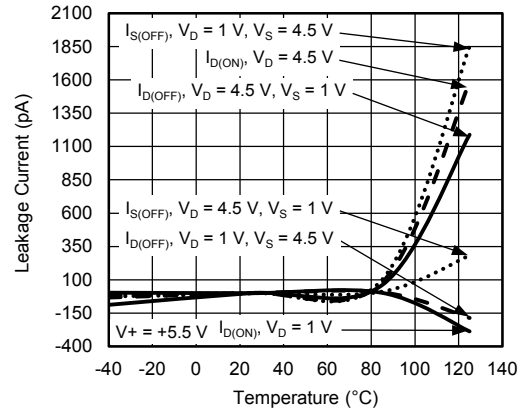


**Insertion Loss, Off-Isolation, Crosstalk vs. Frequency**

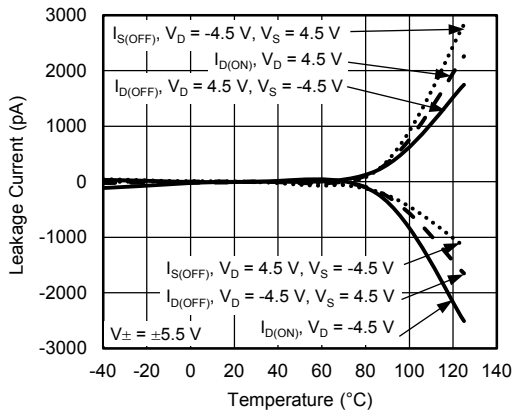
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



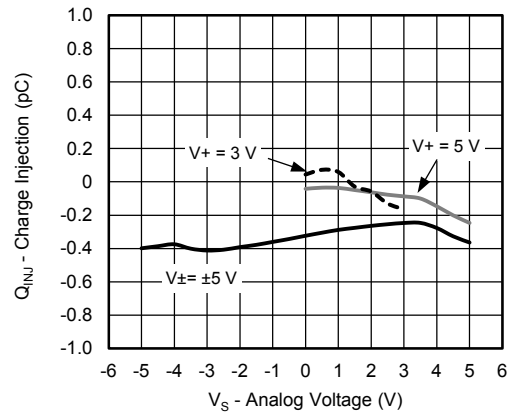
Leakage Current vs. Temperature



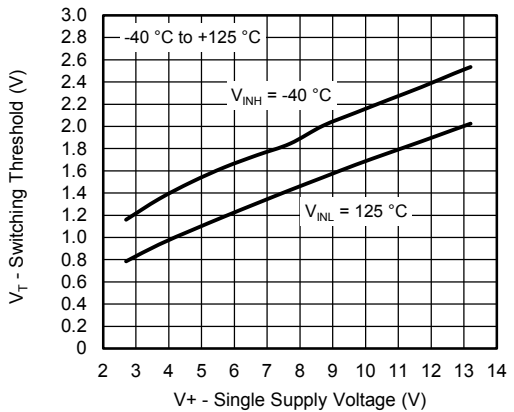
Leakage Current vs. Temperature



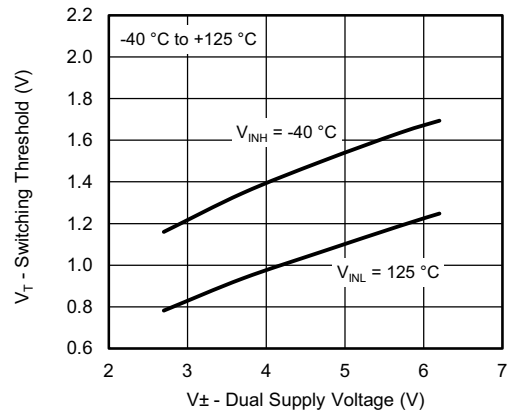
Leakage Current vs. Temperature



Charge Injection vs. Analog Voltage

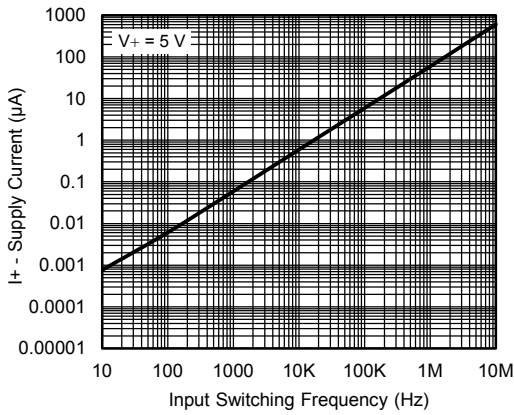


Switching Threshold vs. Supply Voltage

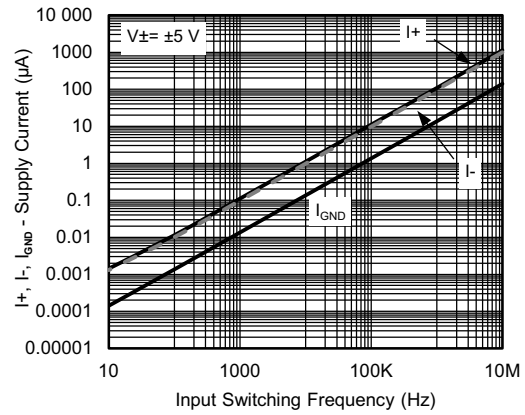


Switching Threshold vs. Supply Voltage

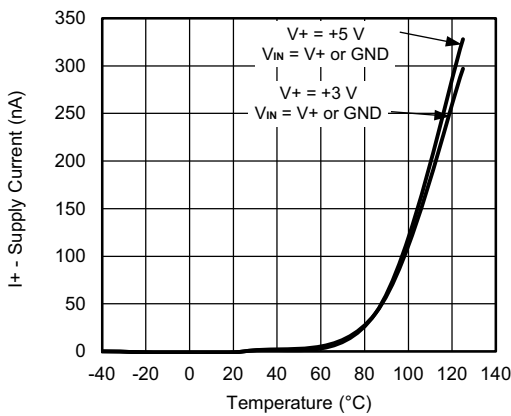
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



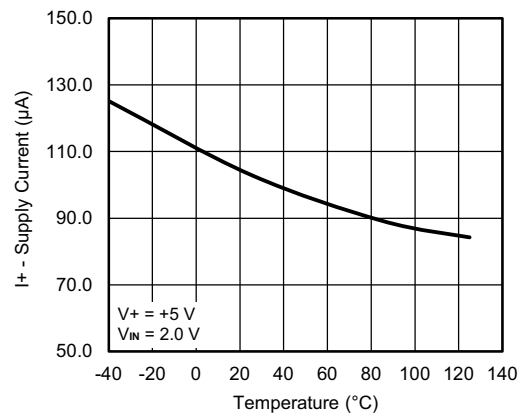
Supply Current vs. Switching Frequency



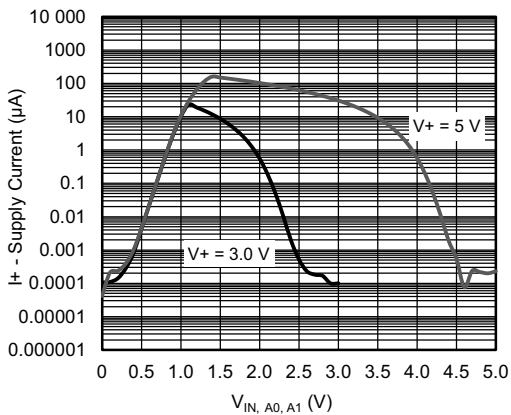
Supply Current vs. Switching Frequency



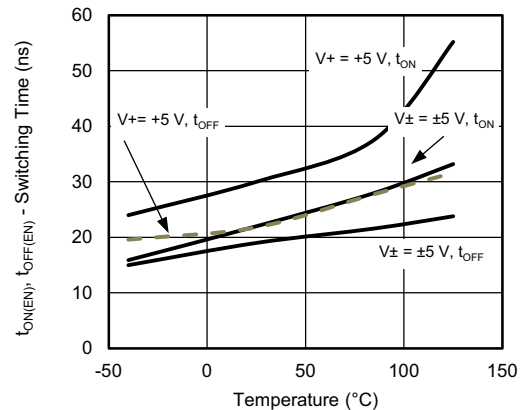
Supply Current vs. Temperature



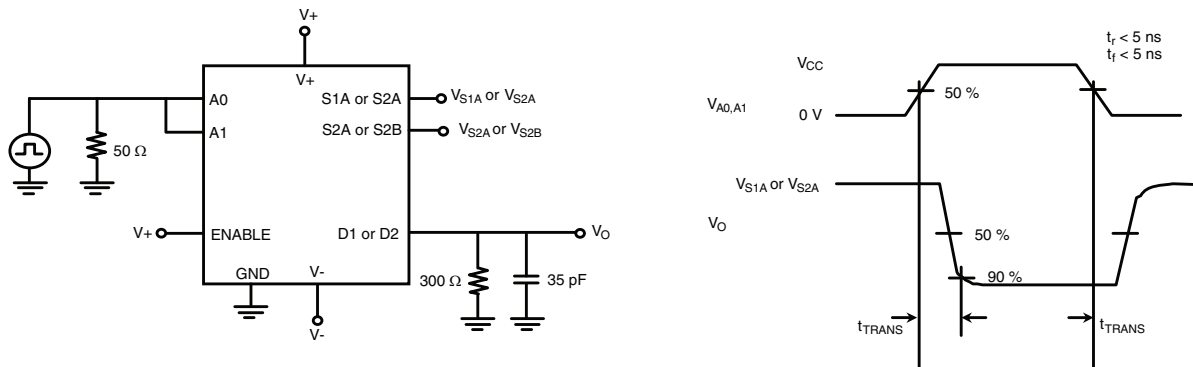
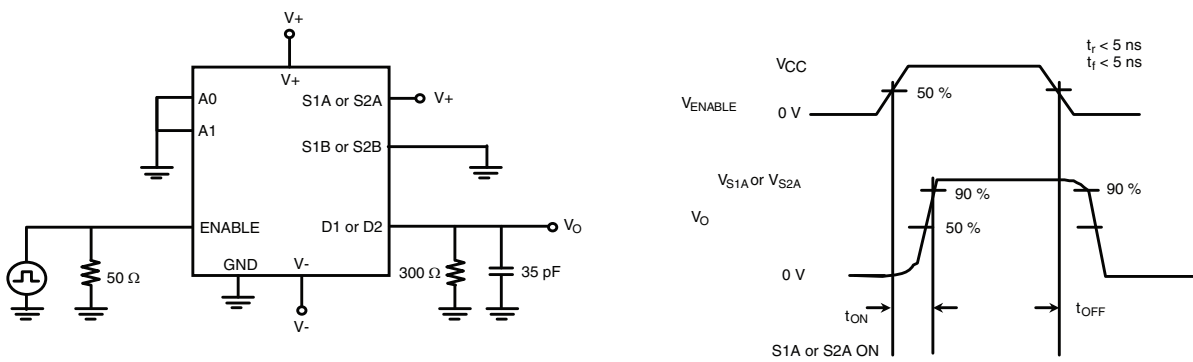
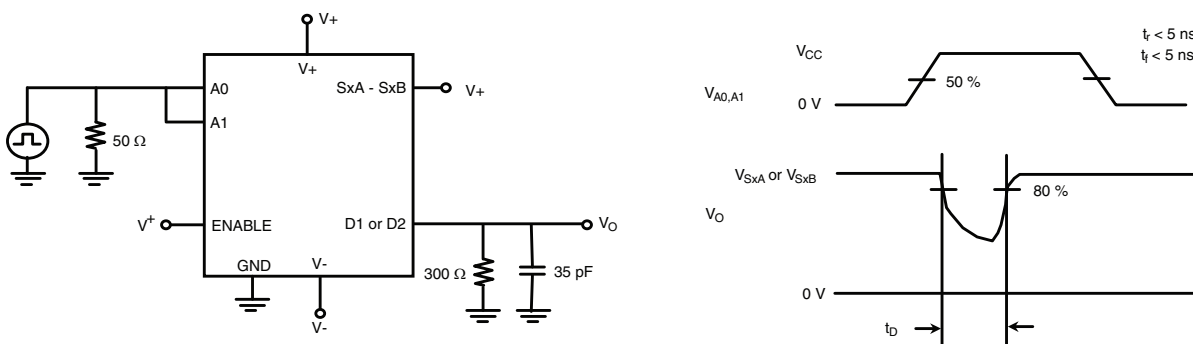
Supply Current vs. Temperature



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

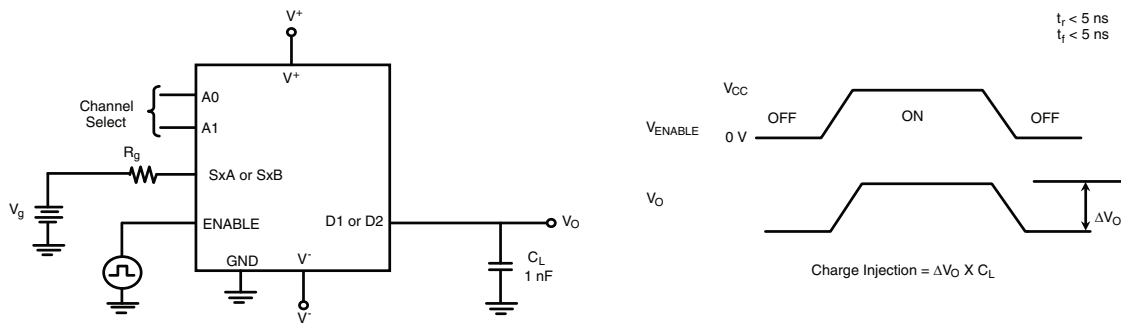
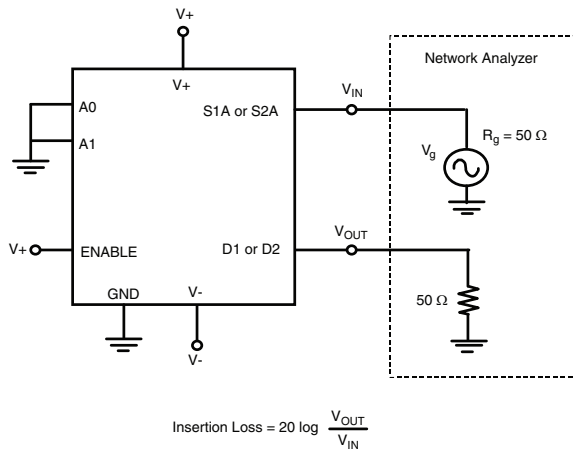
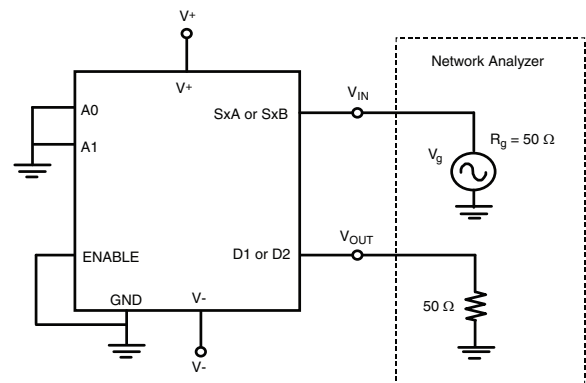


Fig. 4 - Charge Injection



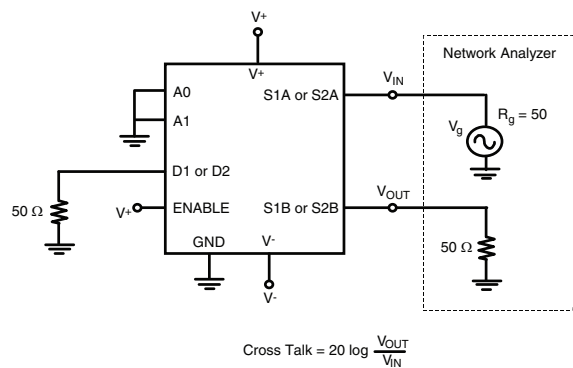
$$\text{Insertion Loss} = 20 \log \frac{V_{\text{OUT}}}{V_{\text{IN}}}$$

Fig. 5 - Insertion Loss



$$\text{Off Isolation} = 20 \log \frac{V_{\text{OUT}}}{V_{\text{IN}}}$$

Fig. 7 - Off-Isolation



$$\text{Cross Talk} = 20 \log \frac{V_{\text{OUT}}}{V_{\text{IN}}}$$

Fig. 6 - Crosstalk

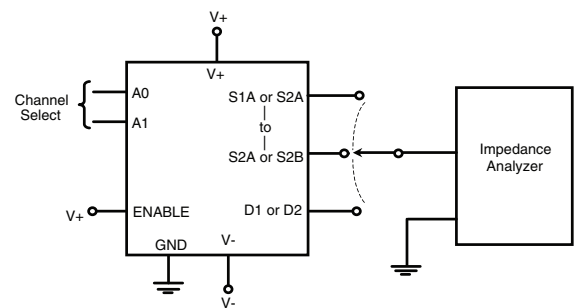
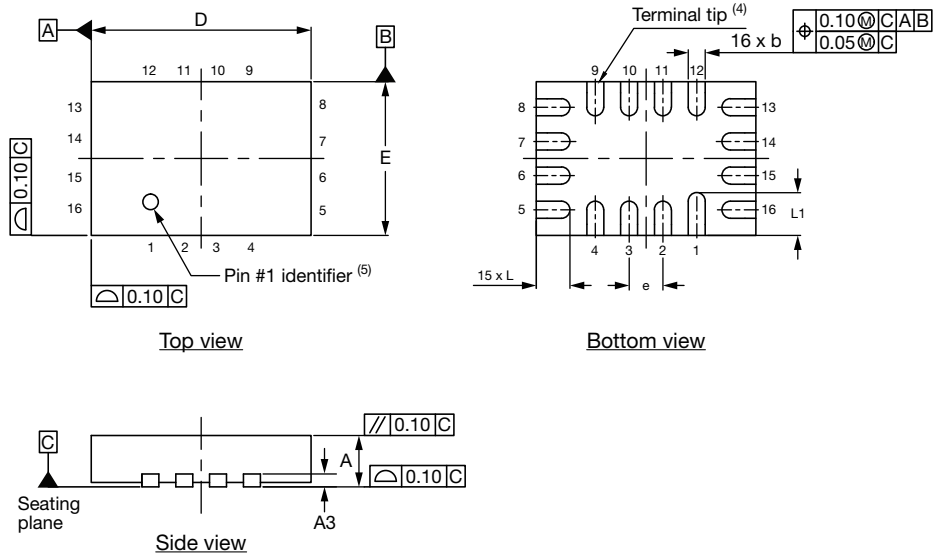


Fig. 8 - Source / Drain Capacitance

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## Thin miniQFN16 Case Outline



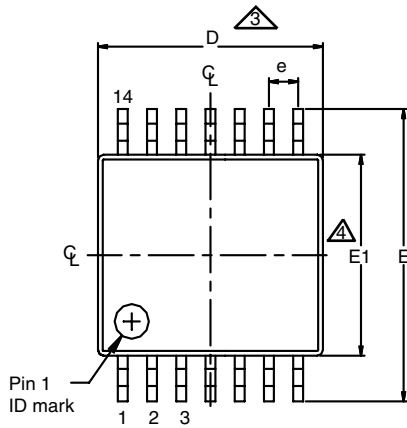
DIMENSIONS	MILLIMETERS <sup>(1)</sup>			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.50	0.55	0.60	0.020	0.022	0.024
A1	0	-	0.05	0	-	0.002
A3	0.15 ref.			0.006 ref.		
b	0.15	0.20	0.25	0.006	0.008	0.010
D	2.50	2.60	2.70	0.098	0.102	0.106
e	0.40 BSC			0.016 BSC		
E	1.70	1.80	1.90	0.067	0.071	0.075
L	0.35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

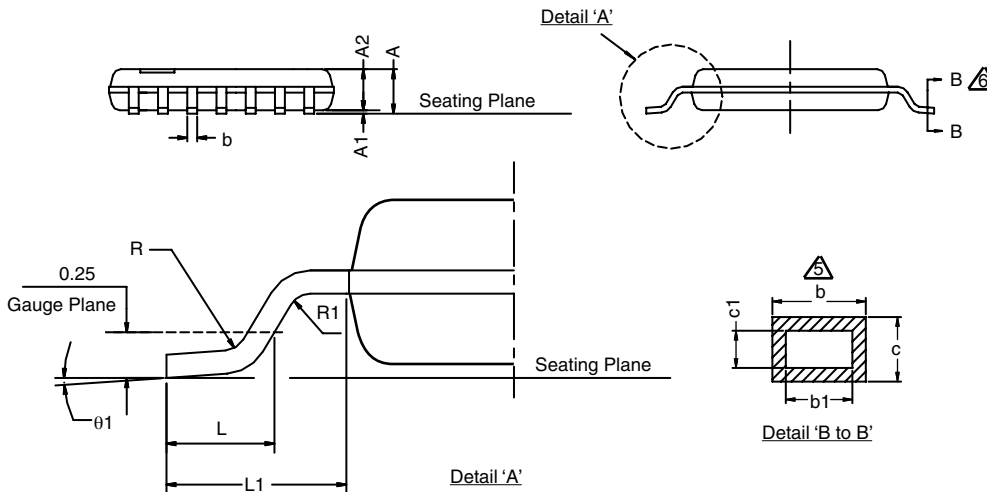
ECN: T16-0226-Rev. B, 09-May-16  
DWG: 6023

### 14L TSSOP



**Notes:**

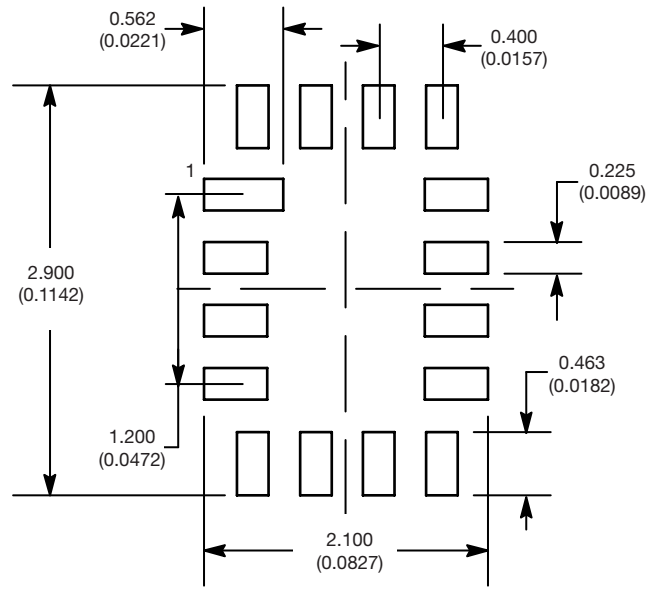
1. All dimensions are in millimeters (angles in degrees)
2. Dimensioning and tolerancing per ANSI Y14.5M-1982
- ⚠ Dimension 'D' does not include mold flash, protrusions or gate burrs
- ⚠ Dimension 'E1' does not include internal flash or protrusion
- ⚠ Dimension 'b' does not include dambar protrusion
- ⚠ 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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