Low Voltage, 0.6 Ω, Dual SPDT Analog Switch

DESCRIPTION

The DG2735A is a low voltage, low on-resistance, dual single-pole/double-throw (SPDT) monolithic CMOS analog switch designed for high performance switching of analog signals. Combining low-power, high speed, low on-resistance, and small package size, the DG2735A, is ideal for portable and battery powered applications.

The DG2735A has an operation range from 1.65 V to 5.5 V single supply. The DG2735A has two separate control pins for independent control of the two SPDT switches.

The DG2735A is guaranteed 1.65 V logic compatible, allowing easy interface with low voltage DSP or MCU control logic and ideal for one cell Li-ion battery direct power.

The switch conducts signals within the power rails equally well in both directions when on, and blocks up to the power supply level when off. Break-before-make is guaranteed.

The DG2735A is built on Vishay Siliconix's sub micron CMOS low voltage process technology and provides greater than 400 mA latch-up protection, as tested per JESD78A.

As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with lead (Pb)-free device terminations. DG2735A is offered in a miniQFN package. The miniQFN package has a nickel-palladium-gold device termination and is represented by the lead (Pb)-free "-GE4" suffix. The nickel-palladium-gold device terminations meet all JEDEC® standards for reflow and MSL ratings.

FEATURES

- Low voltage operation (1.65 V to 5.5 V)
- Low on-resistance - R_{ON}: 0.5 Ω at 2.7 V
- Fast switching: t_{ON} = 55 ns at 2.7 V
- T_{OFF} = 15 ns at 2.7 V
- Latch-up current > 400 mA (JESD78)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

HALOGEN FREE

BENEFITS

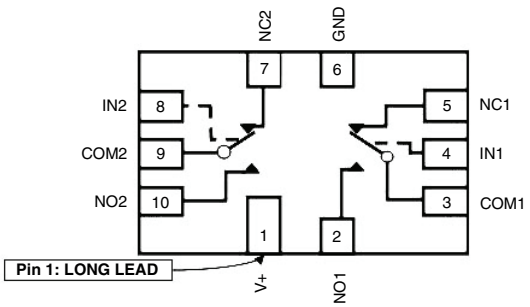
- Reduced power consumption
- High accuracy
- Reduce board space
- TTL/1.65 V logic compatible

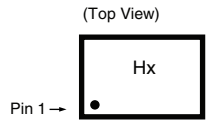
APPLICATIONS

- Cellular phones
- Speaker headset switching
- Audio and video signal routing
- PCMCIA cards
- Battery operated systems
- Portable media players
- Handheld test instruments

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION

DG2735A
miniQFN-10L





Note: Pin 1 has long lead

Device Marking: Hx for DG2735A
x = Date/Lot Traceability Code

TRUTH TABLE		
LOGIC	**NC1, 2**	**NO1, 2**
0	ON	OFF
1	OFF	ON

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ORDERING INFORMATION

PART NUMBER	CONFIGURATION	SWITCH FUNCTION	TEMP. RANGE	PACKAGE	REEL QUANTITY
DG2735ADN-T1-GE4	Dual DPST	NC / NO	-40 °C to +85 °C	miniQFN10, 1.4 mm x 1.8 mm	3000

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise noted)

PARAMETER		SYMBOL	LIMIT	UNIT
Reference to GND	V+		-0.3 V to +6 V	V
	IN, COM, NC, NO [a]		-0.3 V to (V+ + 0.3)	
Current (Any terminal except NO, NC or COM)			30	mA
Continuous Current (NO, NC, or COM)			± 300	
Peak Current (Pulsed at 1 ms, 10 % duty cycle)			± 500	
Storage Temperature (D Suffix)			-65 to +150	°C
Power Dissipation (Packages) [b]	miniQFN10 [c]		208	mW
Latch Up Current		JESD78A	>400	mA
ESD - HBM		ANSI / ESDA / JEDEC JS-001	>5000	V
ESD - CDM		JESD22-C101	>1000	
ESD - MM		JESD22-A115	>200	

Notes

a. Signals on NC, NO, or COM or IN exceeding 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 4 mW/C above 70 °C.

SPECIFICATIONS (V+ = 3 V)

PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 3 V, ± 10 %, V_{IN} = 0.4 V or 1.65 V [e]	TEMP.[a]	LIMITS -40 °C to +85 °C MIN. [b]	TYP. [c]	MAX. [b]	UNIT
Analog Switch							
Analog Signal Range [d]	V_{analog}	$R_{DS(on)}$	Full	0	-	V+	V
On-Resistance	$R_{DS(on)}$	V+ = 2.7 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 0.5 V	Room	-	0.5	0.7	Ω
		V+ = 2.7 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 1.5 V					
		V+ = 2.7 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 0.5 V	Full	-	0.6	-	
		V+ = 2.7 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 1.5 V					
		V+ = 5.5 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 0.9 V	Room	-	0.3	0.5	
		V+ = 5.5 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 2.5 V			0.25		
		V+ = 5.5 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 0.9 V	Full	-	0.4	-	
		V+ = 5.5 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 2.5 V					
R_{ON} Match [d]	ΔR_{ON}	V+ = 2.7 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 0.5 V, 1.5 V	Room	-	0.06	0.08	
		V+ = 5.5 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 0.9 V, 2.5 V					
R_{ON} resistance flatness [d]	R_{ON} flatness	V+ = 2.7 V, $I_{NO/NC}$ = 100 mA, V_{COM} = 0.5 V, 1.5 V	Room	-	-	0.15	
Switch Off Leakage Current	$I_{NO/NC(off)}$	V+ = 5 V, $V_{NO/NC}$ = 0.5 V/4.5 V, V_{COM} = 4.5 V/0.5 V	Room	-8	-	8	nA
			Full	-50	-	50	
	$I_{COM(off)}$		Room	-8	-	8	
			Full	-50	-	50	
Channel-On Leakage Current	$I_{COM(on)}$	V+ = 5 V, $V_{NO/NC}$ = V_{COM} = 4.5 V/0.5 V	Room	-10	-	10	
			Full	-50	-	50	

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SPECIFICATIONS (V+ = 3 V)							
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 3 V, ± 10 %, V_{IN} = 0.4 V or 1.65 V [e]	TEMP.[a]	LIMITS -40 °C to +85 °C			UNIT
				MIN. [b]	TYP. [c]	MAX. [b]	
Digital Control							
Input High Voltage	V_{INH}		Full	1.65	-	-	V
Input Low Voltage	V_{INL}		Full	-	-	0.4	
Input Capacitance	C_{IN}		Full	-	6	-	pF
Input Current	I_{INL} or I_{INH}	V_{IN} = 0 or V+	Full	-1	-	1	µA
Dynamic Characteristics							
Break-Before-Make Time [e]	t_{BBM}	V+ = 3.6 V, V_{NO}, V_{NC} = 1.5 V, R_L = 50 Ω, C_L = 35 pF	Room	1	15	-	ns
Turn-On Time [e]	t_{ON}		Room	-	28	78	
			Full	-	-	80	
Turn-Off Time [e]	t_{OFF}		Room	-	13	58	
			Full	-	-	60	
Off-Isolation [d]	OIRR	R_L = 50 Ω, C_L = 5 pF, f = 100 kHz	Room	-	-70	-	dB
Crosstalk [d]	X_{TALK}			-	-90	-	
3dB bandwidth [d]		R_L = 50 Ω, C_L = 5 pF	Room	-	120	-	MHz
NO, NC Off Capacitance [d]	$C_{NO(off)}$	V_{IN} = 0 V, or V+, f = 1 MHz	Room	-	40	-	pF
	$C_{NC(off)}$			-	40	-	
Channel On Capacitance [d]	$C_{NO(on)}$			-	120	-	
	$C_{NC(on)}$			-	120	-	
Power Supply							
Power Supply Range	V+		-	1.65	-	5.5	V
Power Supply Current	I+	V_{IN} = 0 or V+	Full	-	-	1	µA

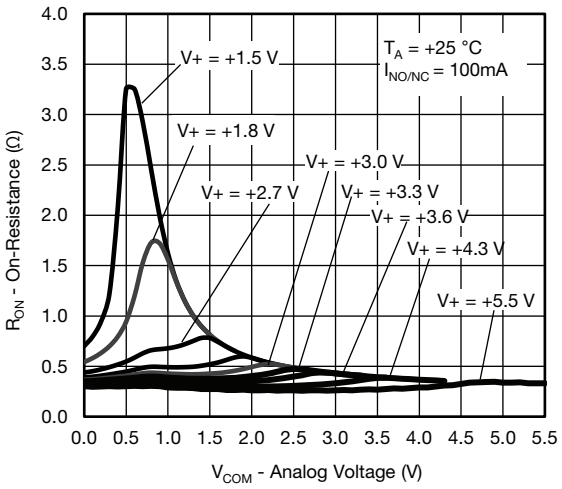
Notes

a. Room = 25 °C, Full = as determined by the operating suffix.
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
c. Typical values are for design aid only, not guaranteed nor subject to production testing.
d. Guarantee by design, not subjected to production test.
e. V_{IN} = input voltage to perform proper function.

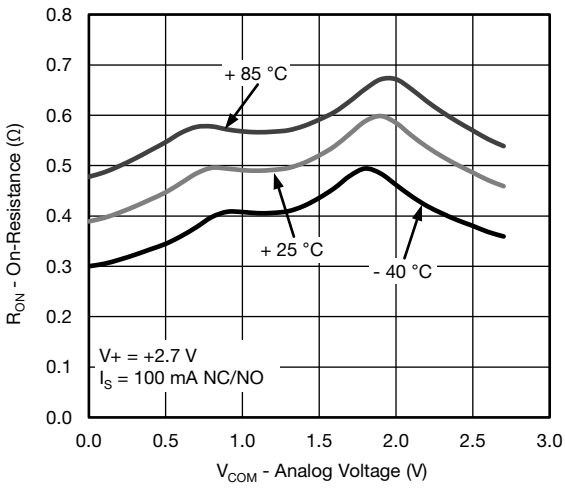
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

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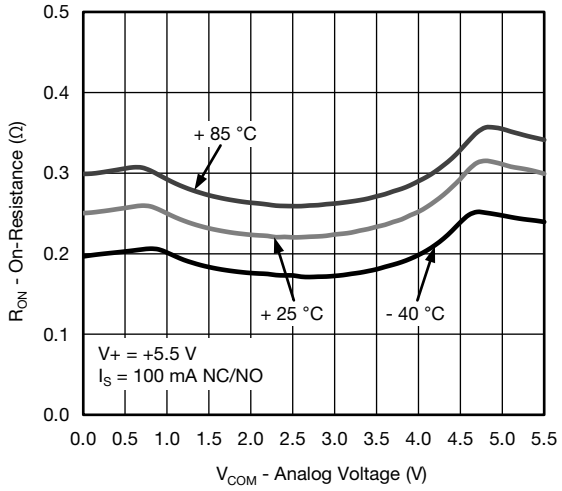
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



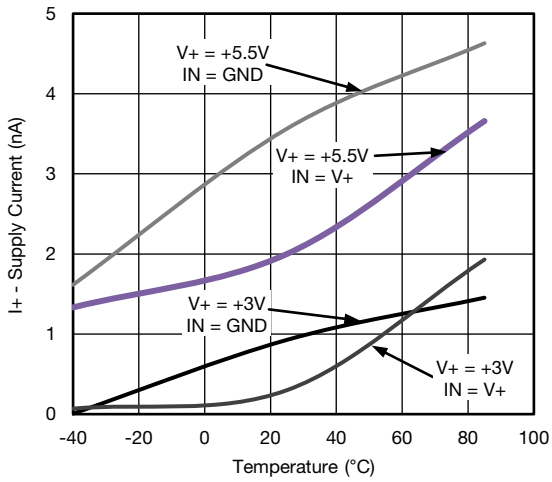
R_{ON} vs. V_{COM} and Supply Voltage



R_{ON} vs. Analog Voltage and Temperature



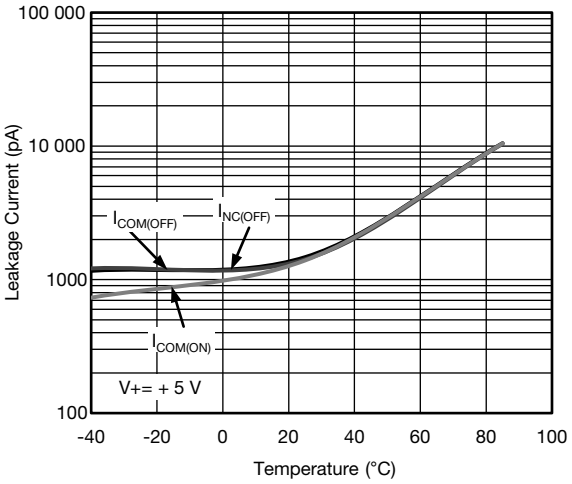
R_{ON} vs. Analog Voltage and Temperature



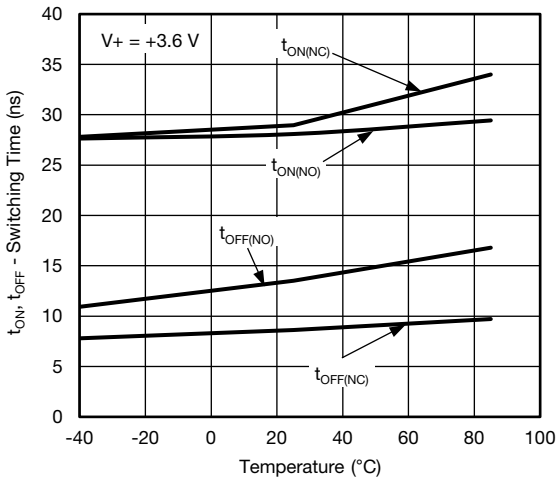
Supply Current vs. Temperature

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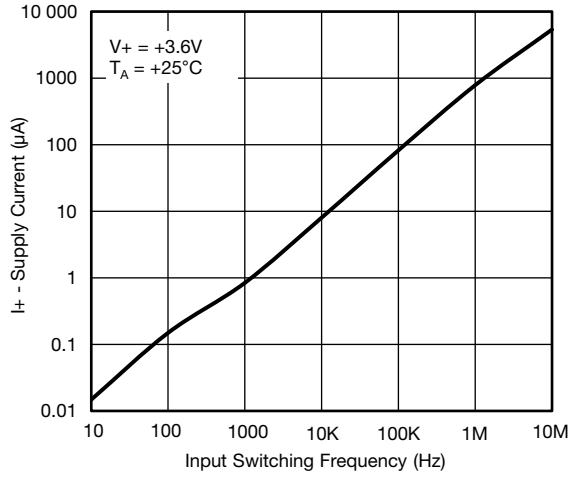
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



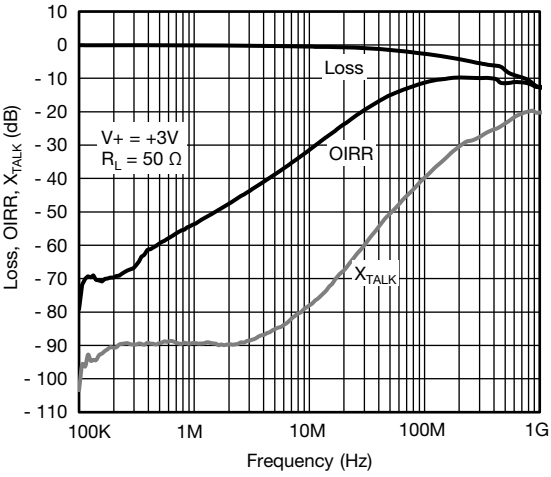
Leakage Current vs. Temperature



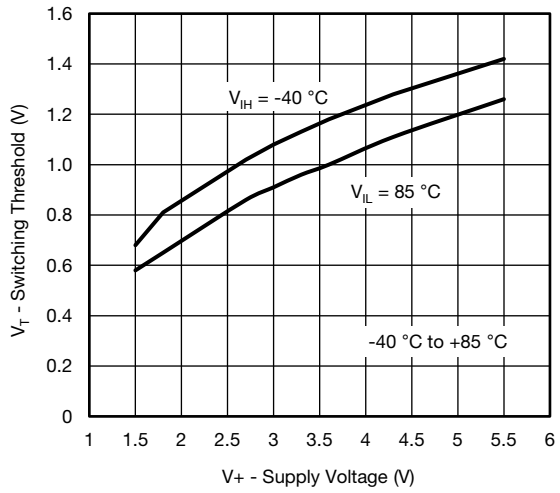
Switching Time vs. Temperature



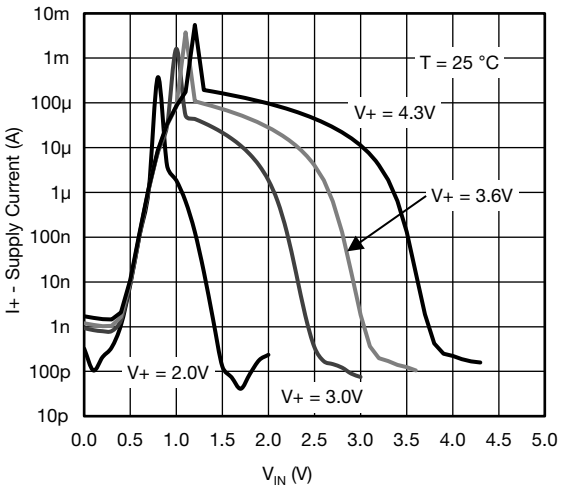
Supply Current vs. Switching Frequency



Insertion Loss, Off-Isolation Crosstalk vs. Frequency



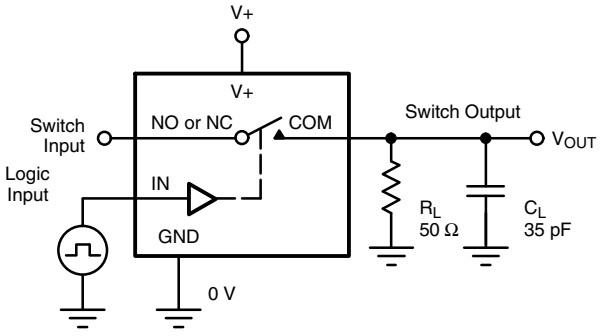
Switching Threshold vs. Supply Voltage



Supply Current vs. V_{IN}

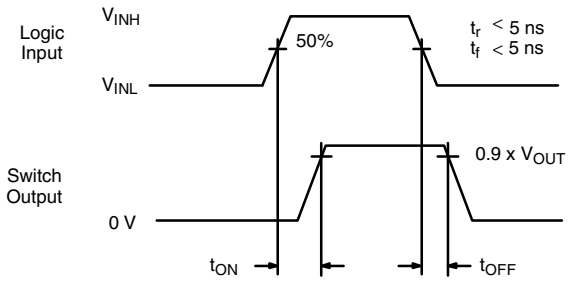
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TEST CIRCUITS



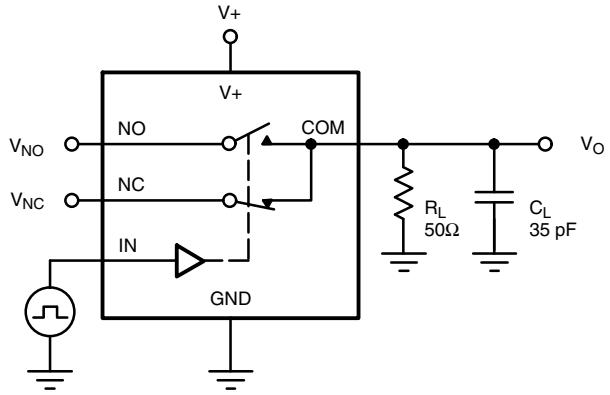
C_L (includes fixture and stray capacitance)

$$V_{OUT} = V_{COM}\left(\frac{R_L}{R_L + R_{ON}}\right)$$



Logic "1" = Switch On
Logic input waveforms inverted for switches that have the opposite logic sense.

Fig. 1 - Switching Time



C_L (includes fixture and stray capacitance)

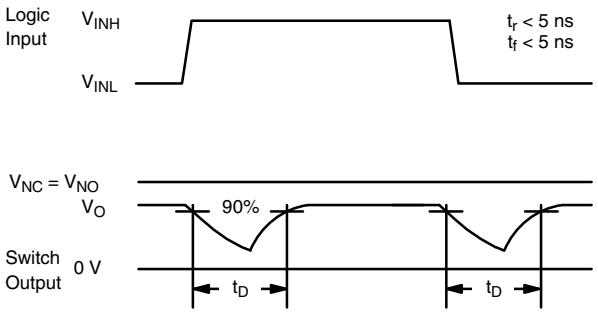
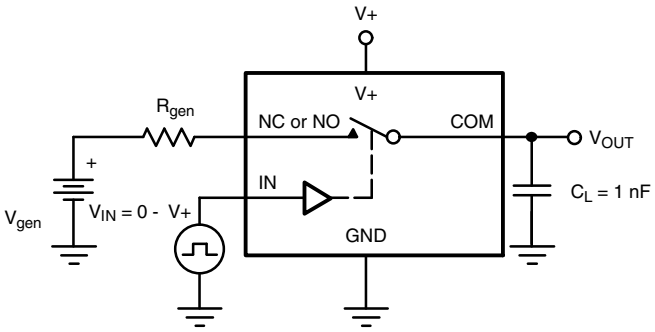
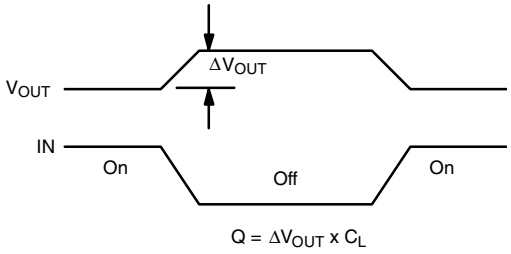


Fig. 2 - Break-Before-Make Interval

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TEST CIRCUITS





IN depends on switch configuration: input polarity determined by sense of switch.

Fig. 3 - Charge Injection

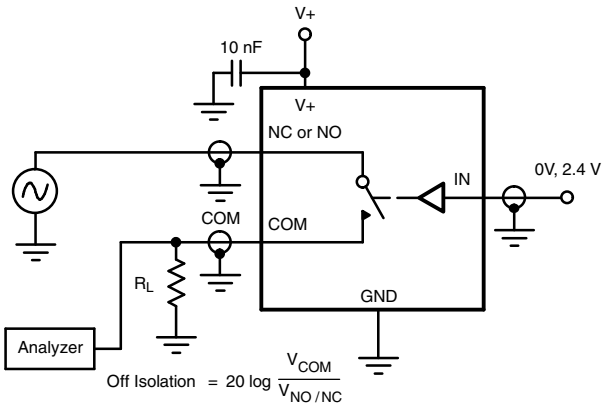


Fig. 4 - Off-Isolation

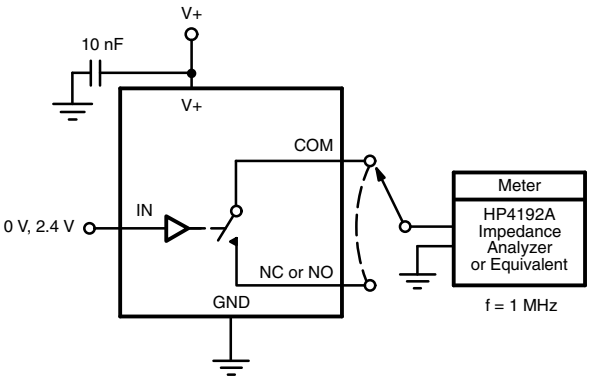
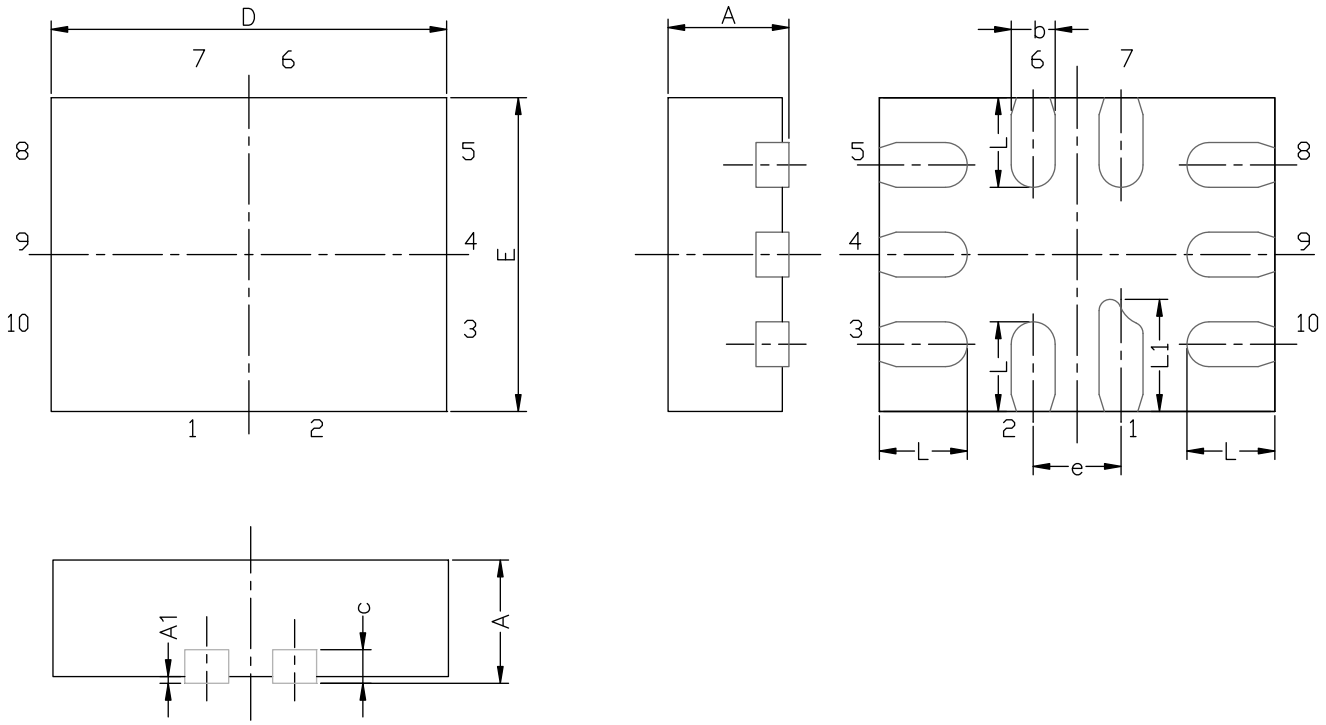


Fig. 5 - Channel Off/On Capacitance

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MINI QFN-10L CASE OUTLINE



DIM	MILLIMETERS			INCHES		
	MIN.	NAM.	MAX.	MIN.	NAM.	MAX.
A	0.45	0.55	0.60	0.0177	0.0217	0.0236
A1	0.00	-	0.05	0.000	-	0.002
b	0.15	0.20	0.25	0.006	0.008	0.010
c	0.150 or 0.127 REF (1)			0.006 or 0.005 REF (1)		
D	1.70	1.80	1.90	0.067	0.071	0.075
E	1.30	1.40	1.50	0.051	0.055	0.059
e	0.40 BSC			0.016 BSC		
L	0.35	0.40	0.45	0.014	0.016	0.018
L1	0.45	0.50	0.55	0.0177	0.0197	0.0217

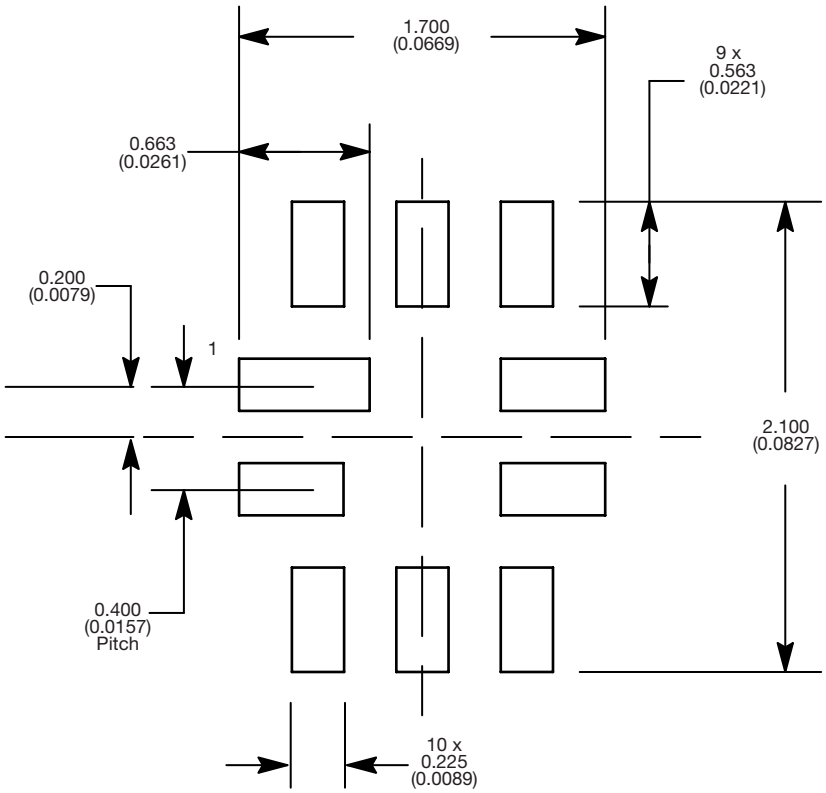
Note

(1) The dimension depends on the leadframe that assembly house used.

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DWG: 5957

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RECOMMENDED MINIMUM PADS FOR MINI QFN 10L



Mounting Footprint
Dimensions in mm (inch)

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