

Small Plastic Package, Dual SPDT Analog Switch

**Features**

- CMOS Technology for Bus and Analog Applications
- Low On-Resistance: 0.6Ω
- Wide V<sub>DD</sub> Range: 2.7V to 4.2V ±10%
- Rail-to-Rail Signal Range
- High Off Isolation: -75dB @ 100kHz
- Crosstalk Rejection Reduces Signal Distortion: -77dB @ 100kHz
- Break-Before-Make Switching
- Extended Industrial Temperature Range: -40°C to 85°C
- Packaging (Pb-free & Green):
  - 10-contact TQFN (ZL10)
  - 10-contact TQFN (ZM10)

**Applications**

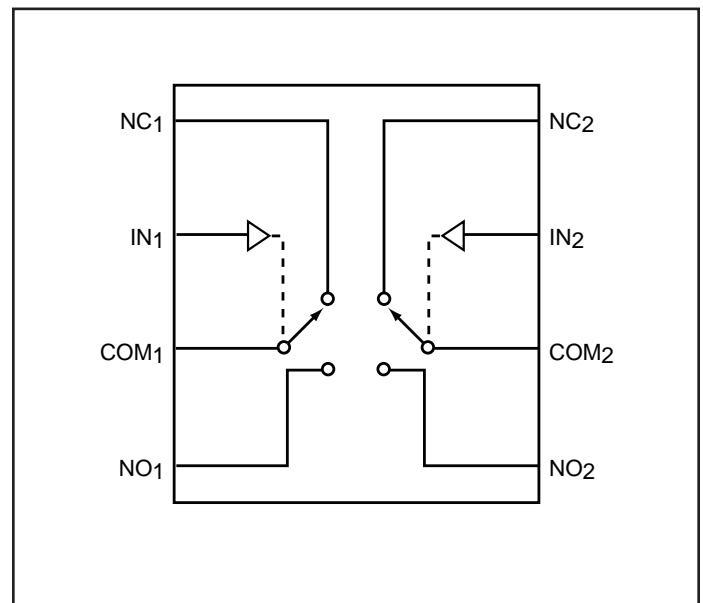
- Cell Phones
- PDAs
- MP3 players
- Portable Instrumentation
- Computer Peripherals
- Speaker Headset Switching
- Power Routing
- Relay Replacement
- Audio and Video Signal Routing
- PCMCIA Cards
- Modems

**Description**

Pericom Semiconductor's PI3A223 is a dual, fast single-pole double throw (SPDT) CMOS switch. It can be used as an analog switch or as a low-delay bus switch. Specified over a wide operating power supply voltage, 2.7V to 4.2V, the PI3A223 has an On-Resistance of 0.6Ω at +2.7V.

Break-before-make switching prevents both switches being enabled simultaneously. This eliminates signal disruption during switching.

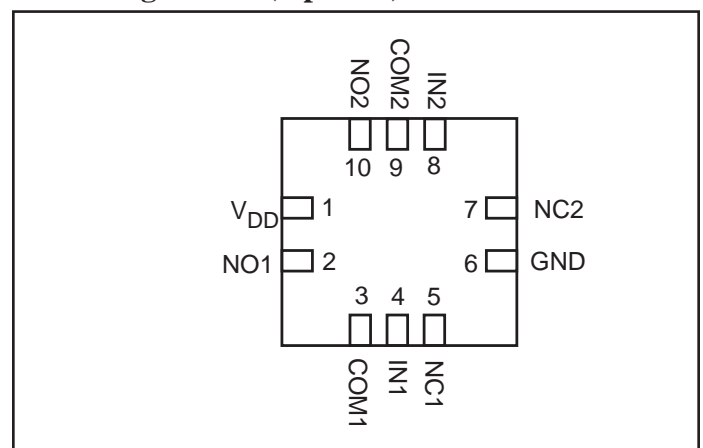
**Functional Block Diagram**



**Pin Description**

Pin #	Name	Description
2, 10	NO <sub>X</sub>	Data Port (Normally open)
6	GND	Ground
5, 7	NC <sub>X</sub>	Data Port (Normally closed)
3, 9	COM <sub>X</sub>	Common Output / Data Port
1	V <sub>DD</sub>	Positive Power Supply
4, 8	IN <sub>X</sub>	Logic Control

**Pin Configuration (top view)**



**Logic Function Table**

Logic Input (IN <sub>X</sub> )	Function
0	NC <sub>X</sub> Connected to COM <sub>X</sub>
1	NO <sub>X</sub> Connected to COM <sub>X</sub>

Note: x = 1 or 2

**Absolute Maximum Ratings<sup>(1)</sup>**

Supply Voltage V <sub>DD</sub> .....	-0.5V to 4.6V
Control Input Voltage (V <sub>INx</sub> ) .....	0V to 5V
DC Input Voltage (V <sub>INPUT</sub> ) <sup>(2)</sup> .....	-0.5V to 4.6V
Continuous Current NO_NC_COM_ .....	±300mA
Peak Current NO_NC_COM_ .....	±400mA
(pulsed at 1ms 50% duty cycle) .....	
Peak Current NO_NC_COM_ .....	±500mA
(pulsed at 1ms 10% duty cycle) .....	
Storage Temperature Range (T <sub>STG</sub> ) .....	-65°C to +150°C
Junction Temperature under Bias (T <sub>J</sub> ) .....	150°C
Junction Lead Temperature (T <sub>L</sub> ) .....	
(Soldering, 10 seconds) .....	260°C
Power Dissipation (P <sub>D</sub> ) @ +85°C .....	250mW

**Recommended Operating Conditions<sup>(3)</sup>**

Supply Voltage Operating (V <sub>DD</sub> ) .....	2.7V to 4.2V ±10%
Control Input Voltage (V <sub>IN</sub> ) .....	0V to V <sub>DD</sub>
Switch Input Voltage (V <sub>INPUT</sub> ) .....	-0.3V to V <sub>DD</sub>
Operating Temperature (T <sub>A</sub> ) .....	-40°C to +85°C
Input Rise and Fall Time (t <sub>r</sub> ,t <sub>f</sub> ) .....	
Control Input V <sub>DD</sub> = 2.3V - 3.6V .....	0ns/V to 10ns/V
Thermal Resistance (θ <sub>JA</sub> ) .....	350°C/W
Lead Temperature (soldering 10s) .....	+300°C
Bump Temperature (soldering notes) .....	
Infared (15s) .....	+220°C
Vapor Phase (60ns) .....	+215°C

**Notes:**

1. "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied.
2. The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.
3. Control input must be held HIGH or LOW; it must not float.

### DC Electrical Characteristics +3V Supply

( $V_{DD} = 2.7V$  to  $3.3V$ ,  $T_A = -40^{\circ}C$  to  $85^{\circ}C$ , unless otherwise noted. Typical values are at  $3V$  and  $+25^{\circ}C$ .)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
<b>Analog Switch</b>						
Analog Signal Range	$V_{NO}, V_{NC}, V_{COM}$		-0.3		$V_{DD}$	V
NC On-Resistance	$R_{ON(NC)}$	$V_{DD} = 2.7V, I_{COM} = 100mA,$ $V_{NC} = 0$ to $V_{CC}$		0.6	0.8	$\Omega$
NO On-Resistance	$R_{ON(NO)}$	$V_{DD} = 2.7V, I_{COM} = 100mA,$ $V_{NO} = 0$ to $V_{CC}$		0.6	0.8	
On-Resistance Match Between Channels	$\Delta R_{ON}$	$V_{DD} = 2.7V, I_{COM} = 100mA,$ $V_{NO}$ or $V_{NC} = 1.5V$		0.01	0.06	
NC On-Resistance Flatness	$R_{ONF(NC)}$	$V_{DD} = 2.7V, I_{COM} = 100mA,$ $V_{NC} = 0$ to $V_{CC}$			0.2	
NO On-Resistance Flatness	$R_{ONF(NO)}$	$V_{DD} = 2.7V, I_{COM} = 100mA,$ $V_{NO} = 0$ to $V_{CC}$			0.2	
NO or NC Off Leakage Current	$I_{OFF(NO)}$ or $I_{OFF(NC)}$	$V_{DD} = 3.3V, V_{NO}$ or $V_{NC} = 3V, 0.3V, V_{COM} = 0.3V, 3V$	-400		400	
COM On Leakage Current	$I_{COM(ON)}$	$V_{DD} = 3.3V, V_{NO}$ or $V_{NC} = 3V, 0.3V, V_{COM} = 3V, 0.3V,$ or floating	-160		160	%
Total Harmonic Distortion	THD	Load = $16\Omega$ , $V_{DD} = 2.7V, V_{input} = 1.5V_{pp}$ , Frequency = 20Hz to 20KHz		0.03		
Total Harmonic Distortion	THD	Load = $8\Omega$ , $V_{DD} = 2.7V, V_{input} = 1.5V_{pp}$ , Frequency = 20Hz to 20KHz		0.035		
<b>Digital I/O</b>						
Input Logic High	$V_{IH}$		1.3			V
Input Logic Low	$V_{IL}$				0.6	
Input Hysteresis	$V_H$	$V_{DD} = 3.3V$		100		mV
IN Input Leakage Current	$I_{IN}$	$V_{IN} = 0$ or $V_{CC}$	-0.5		0.5	$\mu A$
Supply Current	$I_{CC}$	$V_{DD} = 3.6V, V_{IN} = 0$ or $V_{DD}$		3	7	

### DC Electrical Characteristics +4.2V Supply

( $V_{DD} = 4.2V$ ,  $T_A = -40^{\circ}C$  to  $85^{\circ}C$ , unless otherwise noted. Typical values are at  $+25^{\circ}C$ .)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
<b>Analog Switch</b>						
Analog Signal Range	$V_{NO}, V_{NC}, V_{COM}$		-0.3		$V_{DD}$	V
NC On-Resistance	$R_{ON(NC)}$	$V_{DD} = 4.2V, I_{COM} = 100mA, V_{NC} = 0$ to $V_{DD}$		0.6	0.8	$\Omega$
NO On-Resistance	$R_{ON(NO)}$	$V_{DD} = 4.2V, I_{COM} = 100mA, V_{NO} = 0$ to $V_{DD}$		0.6	0.8	
On-Resistance Match Between Channels	$\Delta R_{ON}$	$V_{DD} = 4.2V, I_{COM} = 100mA, V_{NO}$ or $V_{NC} = 1.5V$		0.01	0.06	
NC On-Resistance Flatness	$R_{ONF(NC)}$	$V_{DD} = 4.2V, I_{COM} = 100mA, V_{NC} = 0$ to $V_{DD}$			0.2	
NO On-Resistance Flatness	$R_{ONF(NO)}$	$V_{DD} = 4.2V, I_{COM} = 100mA, V_{NO} = 0$ to $V_{DD}$			0.2	
NO or NC Off Leakage Current	$I_{OFF(NO)}$ or $I_{OFF(NC)}$	$V_{DD} = 4.2V, V_{NO}$ or $V_{NC} = 3V, 0.3V, V_{COM} = 0.3V, 3V$	-400		400	
COM On Leakage Current	$I_{COM(ON)}$	$V_{DD} = 4.2V, V_{NO}$ or $V_{NC} = 3V, 0.3V, V_{COM} = 3V, 0.3V$ , or floating	-160		160	
Total Harmonic Distortion	THD	Load = $16\Omega$ , $V_{DD} = 4.2V, V_{input} = 2.0V_{pp}$ , Frequency = 20Hz to 20KHz		0.06		%
Total Harmonic Distortion	THD	Load = $8\Omega$ , $V_{DD} = 4.2V, V_{input} = 2.0V_{pp}$ , Frequency = 20Hz to 20KHz		0.065		
<b>Digital I/O</b>						
Input Logic High	$V_{IH}$		1.3			V
Input Logic Low	$V_{IL}$				0.6	
Input Hysteresis	$V_H$	$V_{DD} = 4.2V$		100		mV
IN Input Leakage Current	$I_{IN}$	$V_{IN} = 0$ or $V_{DD}$	-0.5		0.5	$\mu A$
Supply Current	$I_{CC}$	$V_{DD} = 4.2V, V_{IN} = 0$ or $V_{DD}$		3.5	10	

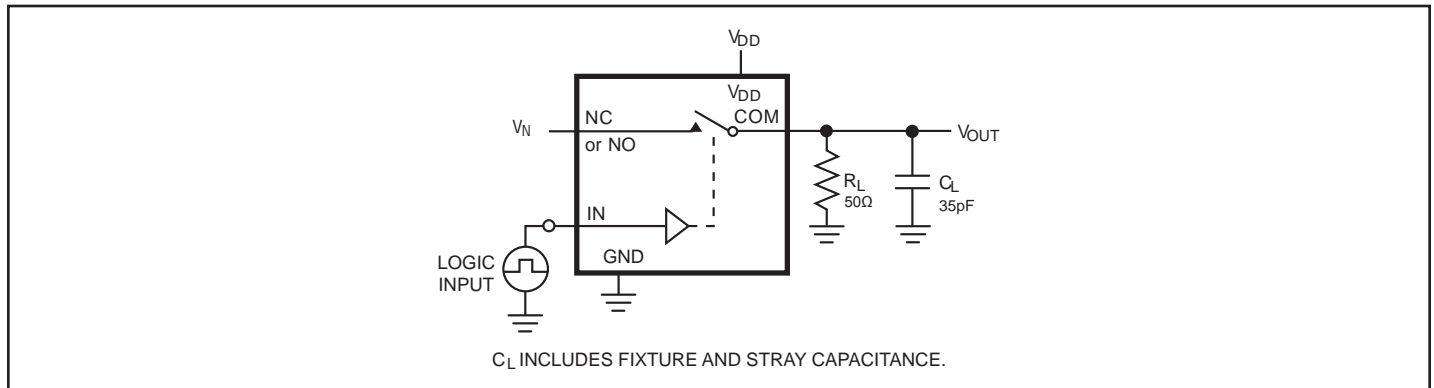
### Switch and AC Characteristics

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Turn-On Time	t <sub>ON</sub>	V <sub>DD</sub> = 2.7V, V <sub>NO</sub> or V <sub>NC</sub> = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, See Test Circuit Figure 1 & 2.		15	25	ns
Turn-Off Time	t <sub>OFF</sub>	V <sub>DD</sub> = 2.7V, V <sub>NO</sub> or V <sub>NC</sub> = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, See Test Circuit Figure 1 & 2.		4	10	
Break-Before-Make Delay	t <sub>BBM</sub>	V <sub>DD</sub> = 2.7V, V <sub>NO</sub> or V <sub>NC</sub> = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, See Test Circuit Figure 3.			20	
Charge Injection	Q	COM = 0, R <sub>S</sub> = 0, C <sub>L</sub> = 1nF, V <sub>DD</sub> = 3.3V or 4.2V See Test Circuit Figure 4.		55		pC
Off-Isolation	O <sub>IRR</sub>	C <sub>L</sub> = 5pF, R <sub>L</sub> = 50Ω, f = 100kHz, V <sub>COM</sub> = 1 V <sub>RMS</sub> , V <sub>DD</sub> = 3.3V See Test Circuit Figure 5.		-77		dB
Crosstalk	X <sub>TALK</sub>	C <sub>L</sub> = 5pF, R <sub>L</sub> = 50Ω, f = 100kHz, V <sub>COM</sub> = 1 V <sub>RMS</sub> , V <sub>DD</sub> = 3.3V See Test Circuit Figure 6.		-77		
3dB Bandwidth	f <sub>3dB</sub>	See Test Circuit Figure 9., V <sub>DD</sub> = 3.3V		65		MHz

### Capacitance

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
NC Off Capacitance	C <sub>NC (OFF)</sub>	f = 1MHz, See Test Circuit Figure 7.		31		pF
NO Off Capacitance	C <sub>NO (OFF)</sub>	f = 1MHz, See Test Circuit Figure 7.		31		
NC On Capacitance	C <sub>NC (ON)</sub>	f = 1MHz, See Test Circuit Figure 8.		90		
NO On Capacitance	C <sub>NO (ON)</sub>	f = 1MHz, See Test Circuit Figure 8.		90		

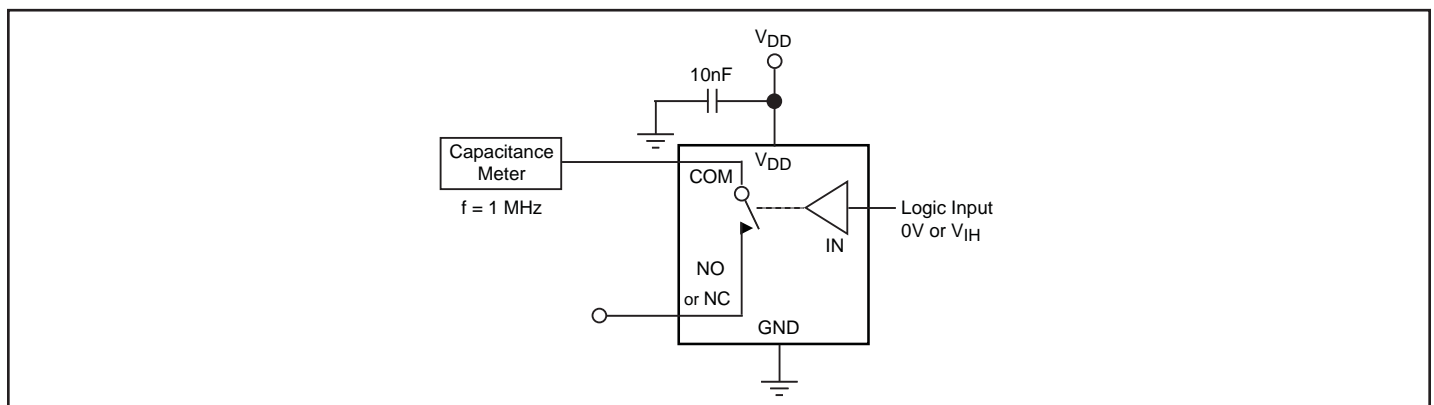
**Test Circuits and Timing Diagrams**



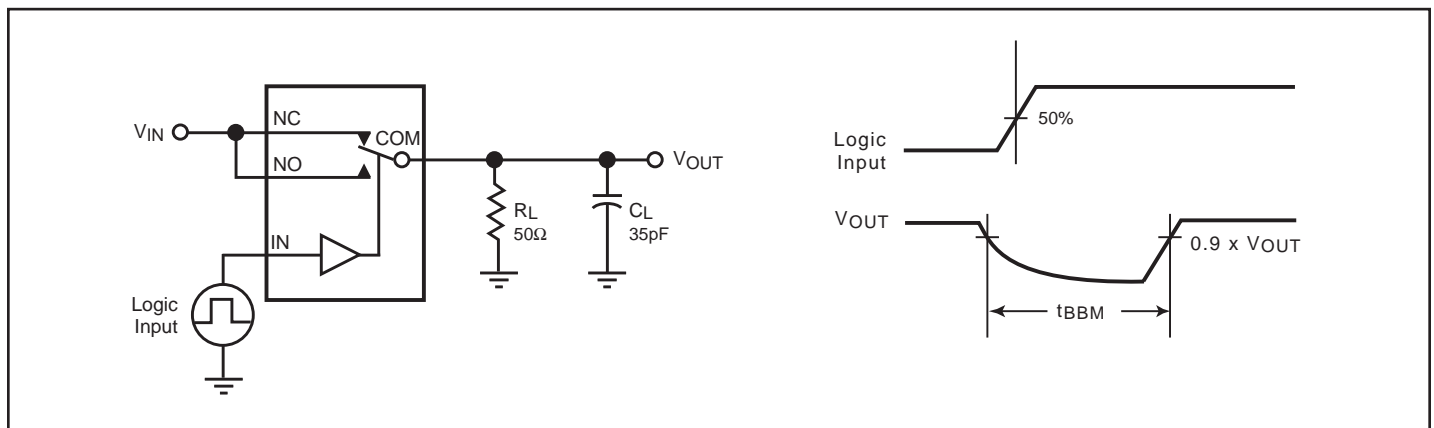
**Figure 1. AC Test Circuit**

**Note:**

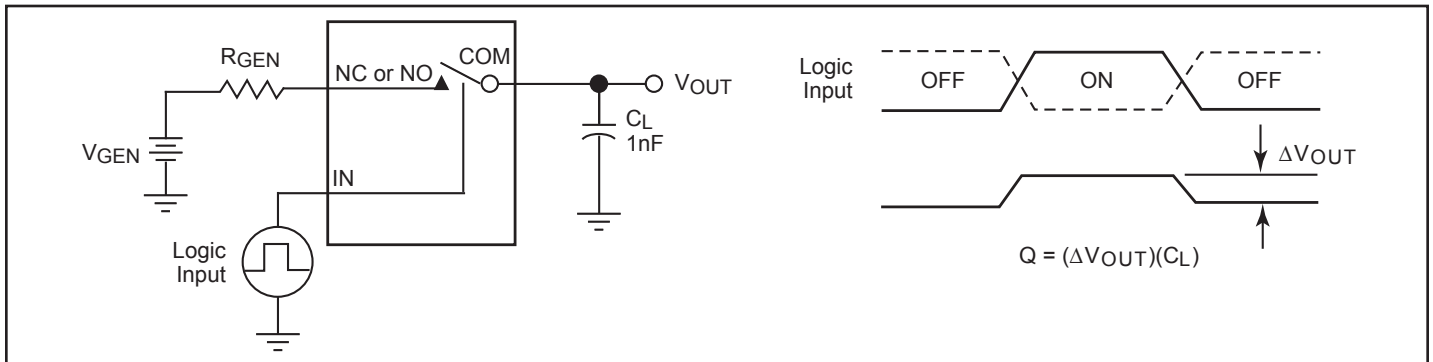
1. Unused input (NC or NO) must be grounded.



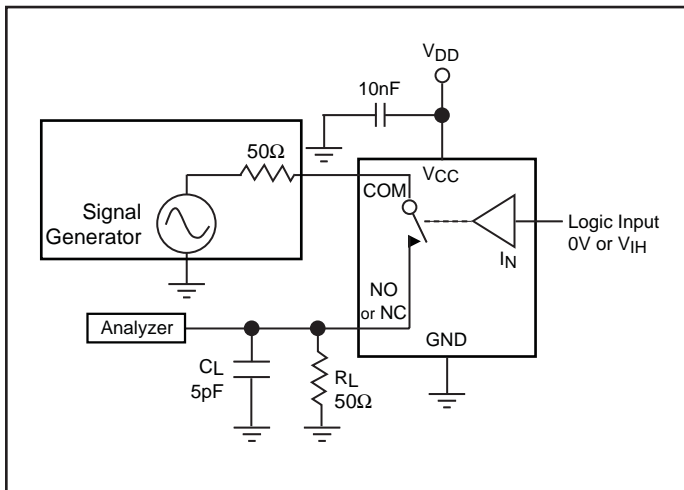
**Figure 2. AC Waveforms**



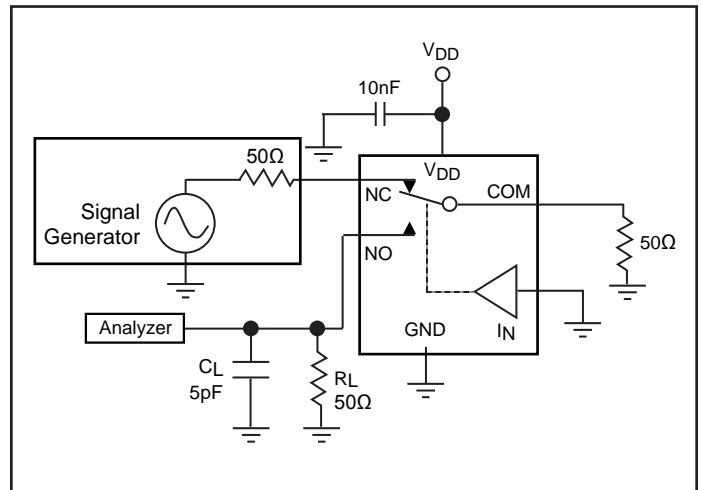
**Figure 3. Break Before Make Interval Timing**



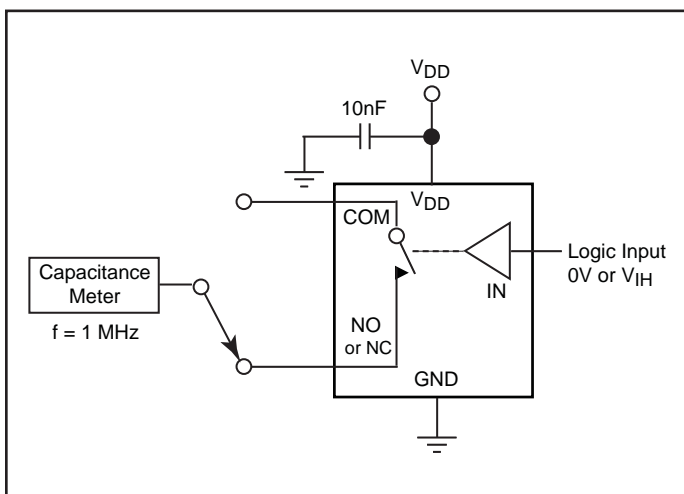
**Figure 4. Charge Injection Test**



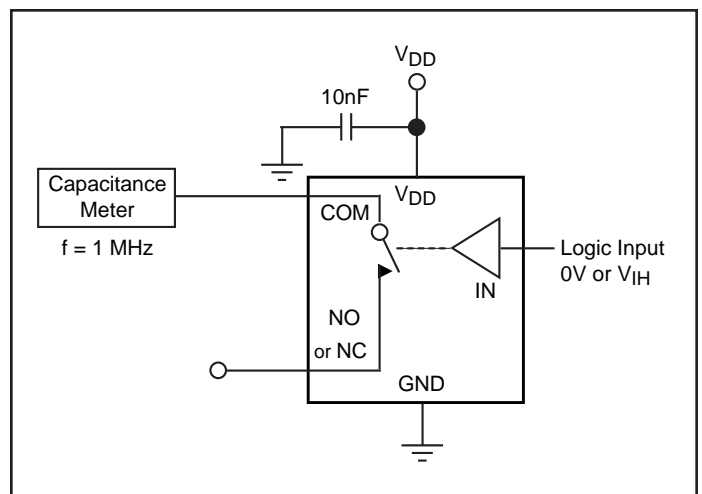
**Figure 5. Off Isolation**



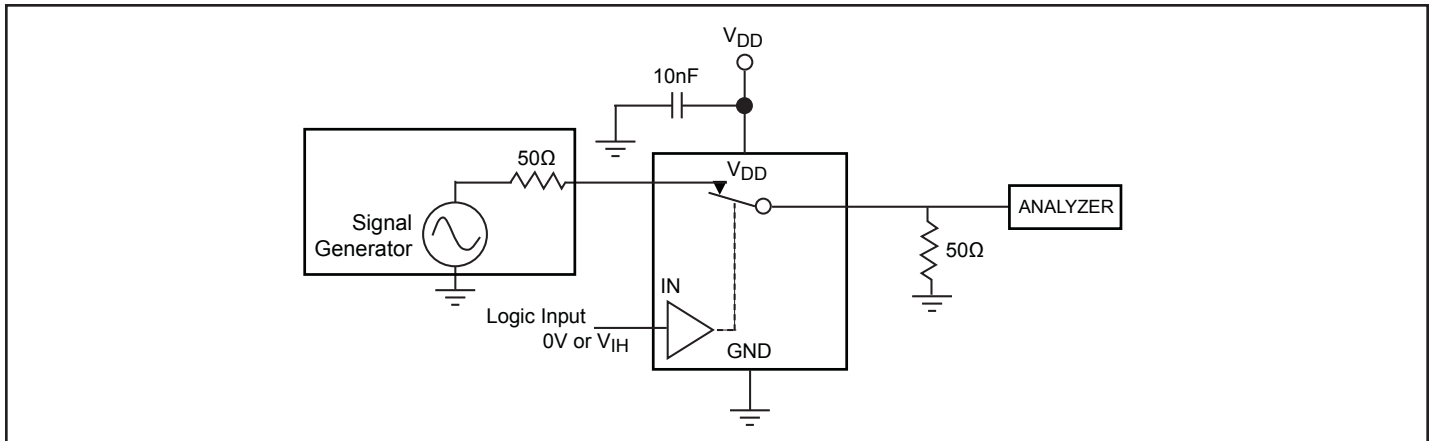
**Figure 6. Crosstalk**



**Figure 7. Channel Off Capacitance**



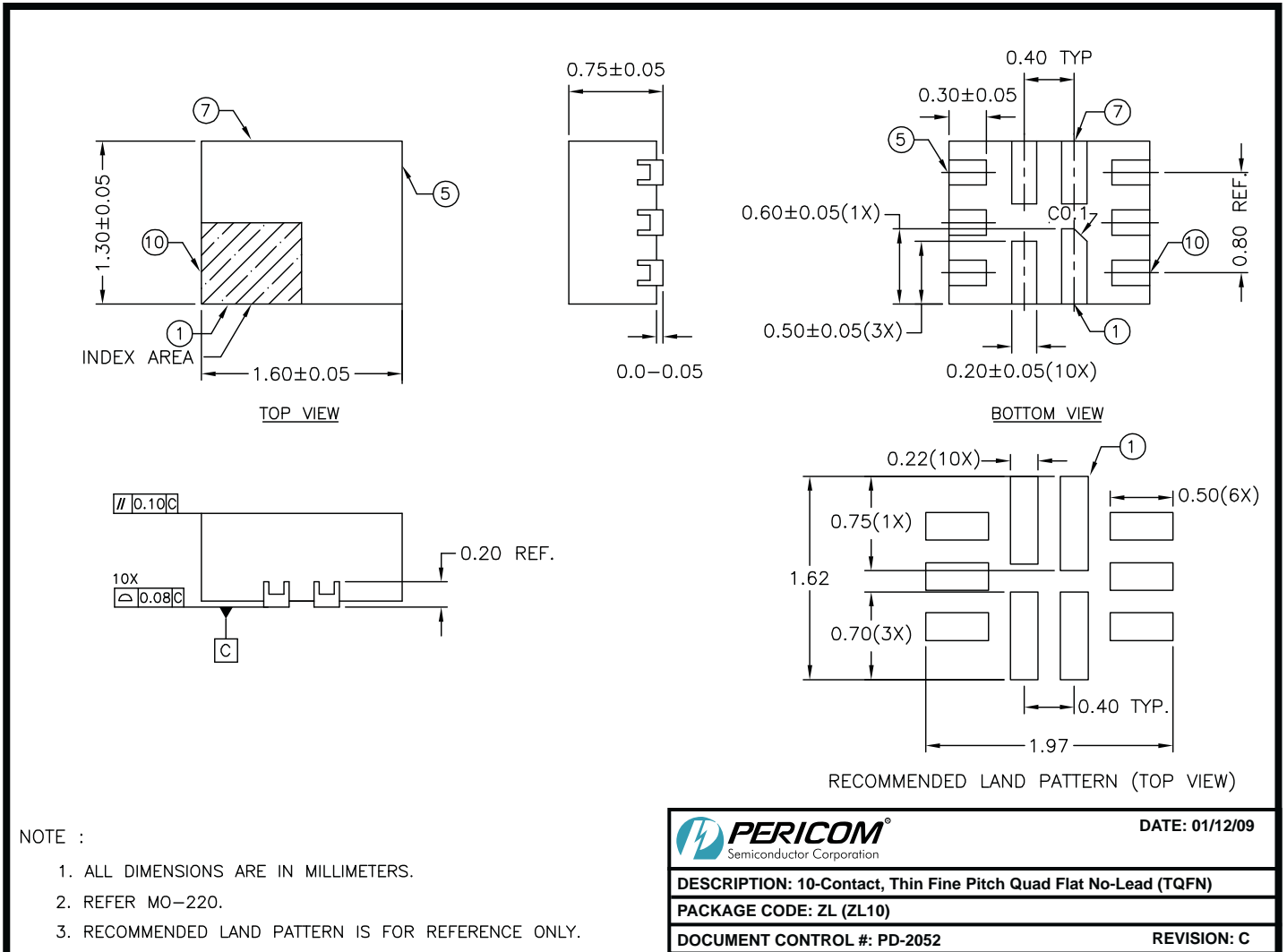
**Figure 8. Channel On Capacitance**



**Figure 9. Bandwidth**

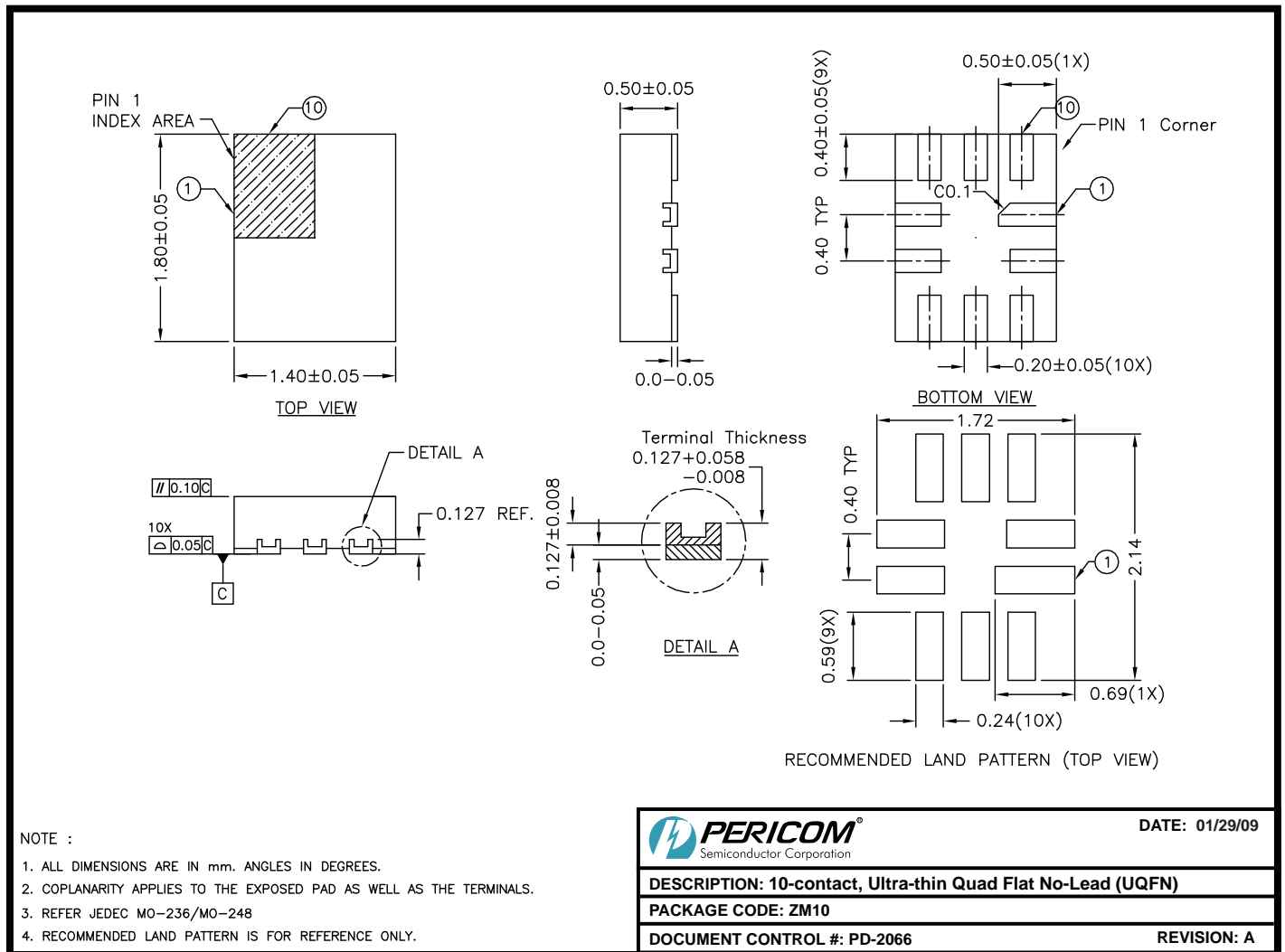


Packaging Mechanical: 10-pin TQFN (ZL)



09-0031

Packaging Mechanical: 10-pin TQFN (ZM10)



09-0072

**Ordering Information**

Ordering Code	Packaging Code	Package Type	Top Mark
PI3A223ZLE	ZL	1.3x1.6M Pb-Free & Green, 10-contact TQFN	GD
PI3A223ZME	ZM	1.4 X 1.8, Pb-Free & Green, 10-contact TQFN	GD

**Notes:**

- Thermal characteristics can be found on the company web site at [www.pericom.com/packaging/](http://www.pericom.com/packaging/)
- E = Pb-free & Green
- X suffix = Tape/Reel