

**Low-Voltage, 4:1 Mux/Demux with Low-Swing Control Inputs**

**Features**

- CMOS Technology for Analog Applications
- Low-swing control inputs
- Low On-Resistance
- Wide  $V_{DD}$  Range: 1.8V to 3.3V
- Rail-to-Rail Signal Range
- Near zero propagation delay
- Fast Switching Speed
- Ultra-low quiescent power
- High Off Isolation: -95dB @ 100kHz
- Crosstalk Rejection Reduces Signal Distortion: -90dB @ 100kHz
- Packaging (Pb-free & Green): -10-contact TQFN (1.6x1.3)

**Description**

Diodes' PI3A114-A is a one-to-four bidirectional multiplier-demultiplier. Specified over a wide operating power supply voltage of 1.8 to 3.3V, the PI3A114-A offer good signal linearity. The PI3A114-A offers low-swing input voltage on the EN, S1 and S0 inputs allowing the device to operate at 3.3V, and pass 3.3V channel data, while being controlled from a 1.8V device.

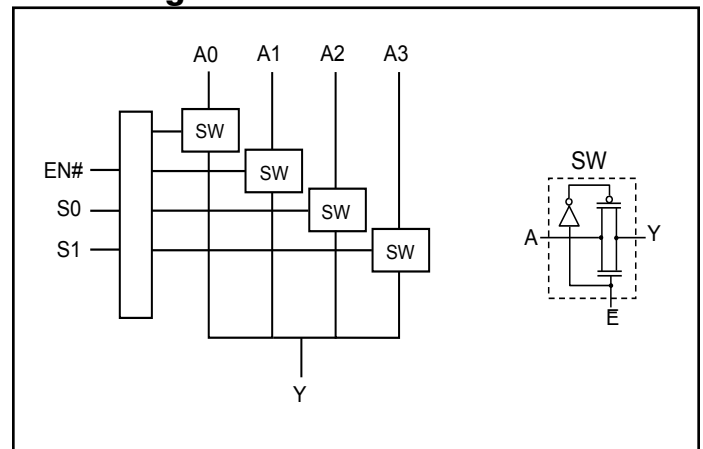
**Truth Table<sup>(1)</sup>**

Enable	Select		Function
	S <sub>1</sub>	S <sub>0</sub>	
L	X	X	Y=A <sub>x</sub> , Hi-Z
H	L	L	Y = A <sub>0</sub> ; A <sub>1</sub> , A <sub>2</sub> , A <sub>3</sub> = Hi-Z
H	L	H	Y = A <sub>1</sub> ; A <sub>0</sub> , A <sub>2</sub> , A <sub>3</sub> = Hi-Z
H	H	L	Y = A <sub>2</sub> ; A <sub>0</sub> , A <sub>1</sub> , A <sub>3</sub> = Hi-Z
H	H	H	Y = A <sub>3</sub> ; A <sub>0</sub> , A <sub>1</sub> , A <sub>2</sub> = Hi-Z

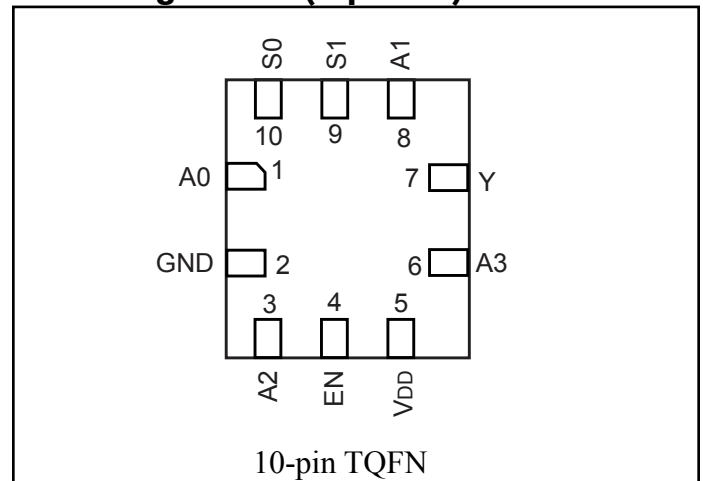
**Pin Description**

Pin Name	Description
A <sub>N</sub>	Data I/O
S <sub>0-1</sub>	Select Inputs
EN	Enable
Y	Data I/O Common
GND	Ground
V <sub>DD</sub>	Power

**Block Diagram**



**Pin Configuration (top view)**



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

Supply Voltage $V_{DD}$	-0.5V to 4.2V
Control Input Voltage ( $V_{INx}$ )	0V to 5V
DC Input Voltage ( $V_{INPUT}$ ) <sup>(2)</sup>	-0.5V to 4.2V
Continuous Current NO_NC_COM_	±300mA
Peak Current NO_NC_COM_ (pulsed at 1ms 50% duty cycle)	±400mA
Peak Current NO_NC_COM_ (pulsed at 1ms 10% duty cycle)	±500mA
Storage Temperature Range ( $T_{STG}$ )	-65°C to +150°C
Junction Temperature under Bias ( $T_J$ )	150°C
Junction Lead Temperature ( $T_L$ ) (Soldering, 10 seconds)	260°C
Power Dissipation ( $P_D$ ) @ +85°C	250mW

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

Supply Voltage Operating ( $V_{DD}$ )	1.8V to 3.3V ±5%
Control Input Voltage ( $V_{IN}$ )	0V to $V_{DD}$
Switch Input Voltage ( $V_{INPUT}$ )	-0.3V to $V_{DD}$
Operating Temperature ( $T_A$ )	-40°C to +85°C
Input Rise and Fall Time ( $t_r, t_f$ )	
Control Input $V_{DD} = 2.3V - 3.6V$	0ns/V to 10ns/V
Thermal Resistance ( $\theta_{JA}$ )	350°C/W

**Notes:**

- "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.
- The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.
- Control input must be held HIGH or LOW; it must not float.

### DC Electrical Characteristics + 1.8V Supply

( $V_{DD} = 1.8V$ ,  $T_A = -40^\circ C$  to  $85^\circ C$ , unless otherwise noted.)

Parameter	Description	Test Conditions	Min.	Typ. <sup>(2)</sup>	Max.	Units
<b>Analog Switch</b>						
Y, Ax	Analog Signal Range		-0.3		$V_{DD}$	V
$R_{ON}$	On-Resistance	$I_Y = 100mA$ , $V_{IN} = 0$ to $V_{DD}$			9	Ω
$\Delta R_{ON}$	On-Resistance Match Between Channels	$I_Y = 100mA$ , $V_{IN} = 0.5V_{DD}$			0.6	
$R_{ONF}$	On-Resistance Flatness	$I_Y = 100mA$ , $V_{IN} = 0$ to $V_{DD}$			5	
THD	Total Harmonic Distortion	Load = 100KΩ, $V_{IN} = 0.5V_{DD}$ , Frequency = 20Hz to 20KHz		0.03		%
<b>Control Inputs<sup>(1)</sup></b>						
$V_{IH}$	Input HIGH Voltage	Guaranteed Logic HIGH Level	1.5			V
$V_{IL}$	Input LOW Voltage	Guaranteed Logic LOW Level	-0.5		0.8	
$I_{IH}$	Input HIGH Current	$V_{DD} = \text{Max.}$ , $V_{IN} = V_{DD}$			±1	μA
$I_{IL}$	Input LOW Current	$V_{DD} = \text{Max.}$ , $V_{IN} = GND$			±1	
$I_{OZH}$	High Impedance Output Current	$0 \leq I_N$ , $Y_N \leq V_{DD}$			±1	
$V_{IK}$	Clamp Diode Voltage	$V_{DD} = \text{Min.}$ , $I_{IN} = -18mA$			-1.2	V

**Notes:**

- For digital control inputs EN, S0, S1.
- Typical values are at  $V_{DD} = 1.8V$ ,  $T_A = 25^\circ C$  ambient and maximum loading.
- For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
- Measured by the voltage drop between A and Y pin at indicated current through the switch. On-Resistance is determined by the lower of the voltages on the two (I,Y) pins.

### Power Supply Characteristics +1.8V Supply

Parameters	Description	Test Conditions <sup>(1)</sup>		Min.	Typ. <sup>(2)</sup>	Max.	Units
I <sub>CC</sub>	Quiescent Power Supply Current	V <sub>DD</sub> = Max.	V <sub>IN</sub> = GND or V <sub>DD</sub>		0.1	9.0	μA

**Notes:**

- Control inputs only; A and Y pins do not contribute to I<sub>CC</sub>.
- Typical values are at V<sub>DD</sub> = 1.8V, T<sub>A</sub> = 25°C ambient and maximum loading.
- For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device.

### DC Electrical Characteristics +3.3V Supply

 (V<sub>DD</sub> = 3.3V, T<sub>A</sub> = -40°C to 85°C, unless otherwise noted.)

Parameter	Description	Test Conditions	Min.	Typ. <sup>(2)</sup>	Max.	Units
<b>Analog Switch</b>						
Y, Ax	Analog Signal Range		-0.3		V <sub>DD</sub>	V
R <sub>ON</sub>	On-Resistance	I <sub>Y</sub> = 100mA, V <sub>IN</sub> = 0 to V <sub>DD</sub>			5	Ω
ΔR <sub>ON</sub>	On-Resistance Match Between Channels	I <sub>Y</sub> = 100mA, V <sub>IN</sub> = 0.5V <sub>DD</sub>			0.2	
R <sub>ONF</sub>	On-Resistance Flatness	I <sub>Y</sub> = 100mA, V <sub>IN</sub> = 0 to V <sub>DD</sub>			0.6	
THD	Total Harmonic Distortion	Load = 100KΩ, V <sub>IN</sub> = 0.5V <sub>DD</sub> , Frequency = 20Hz to 20KHz		0.03		%
<b>Control Inputs<sup>(1)</sup></b>						
V <sub>IH</sub>	Input HIGH Voltage	Guaranteed Logic HIGH Level	1.5			V
V <sub>IL</sub>	Input LOW Voltage	Guaranteed Logic LOW Level	-0.5		0.8	
I <sub>IH</sub>	Input HIGH Current	V <sub>DD</sub> = Max., V <sub>IN</sub> = V <sub>DD</sub>			±1	μA
I <sub>IL</sub>	Input LOW Current	V <sub>DD</sub> = Max., V <sub>IN</sub> = GND			±1	
I <sub>OZH</sub>	High Impedance Output Current	0 ≤ I <sub>N</sub> , Y <sub>N</sub> ≤ V <sub>DD</sub>			±1	
V <sub>IK</sub>	Clamp Diode Voltage	V <sub>DD</sub> = Min., I <sub>IN</sub> = -18mA			-1.2	V

**Notes:**

- For digital control inputs EN, S0, S1.
- For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device.
- Typical values are at V<sub>DD</sub> = 3.3V, T<sub>A</sub> = 25°C ambient and maximum loading.
- Measured by the voltage drop between A and Y pin at indicated current through the switch. On-Resistance is determined by the lower of the voltages on the two (I,Y) pins.

### Power Supply Characteristics, 3.3V Supply

Parameters	Description	Test Conditions <sup>(1)</sup>		Min.	Typ. <sup>(2)</sup>	Max.	Units
I <sub>CC</sub>	Quiescent Power Supply Current	V <sub>DD</sub> = Max.	V <sub>IN</sub> = GND or V <sub>DD</sub>		0.1	9.0	μA

**Notes:**

- For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device.
- Typical values are at V<sub>DD</sub> = 3.3V, +25°C ambient.
- Control inputs only; A and Y pins do not contribute to I<sub>CC</sub>.

### Switch and AC Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{ON}$	Turn-On Time	$V_{DD} = 2.7V$ , $V_{IN} = 1.5V$ , $R_L = 50\Omega$ , $C_L = 35pF$ , See Test Circuit Figure 1 & 2.		5	15	ns
$t_{OFF}$	Turn-Off Time	$V_{DD} = 2.7V$ , $V_{IN} = 1.5V$ , $R_L = 50\Omega$ , $C_L = 35pF$ , See Test Circuit Figure 1 & 2.		35	50	
Q	Charge Injection	$COM = 0$ , $R_S = 0$ , $C_L = 1nF$ , $V_{DD} = 3.3V$ See Test Circuit Figure 4.		15		pC
$O_{IRR}$	Off-Isolation	$C_L = 5pF$ , $R_L = 50\Omega$ , $f = 100kHz$ , $V_{IN} = 1 V_{RMS}$ , $V_{DD} = 3.3V$ See Test Circuit Figure 5.		-95		dB
$X_{TALK}$	Crosstalk	$C_L = 5pF$ , $R_L = 50\Omega$ , $f = 100kHz$ , $V_{IN} = 1 V_{RMS}$ , $V_{DD} = 3.3V$ See Test Circuit Figure 6.		-90		
$f_{3dB}$	3dB Bandwidth	See Test Circuit Figure 9., $V_{DD} = 3.3V$		250		MHz
$t_{pd}^{(1)}$	Propogation delay	$C_L = 5pF$ , $R_L = 500\Omega$			0.25	ns

**Note:**

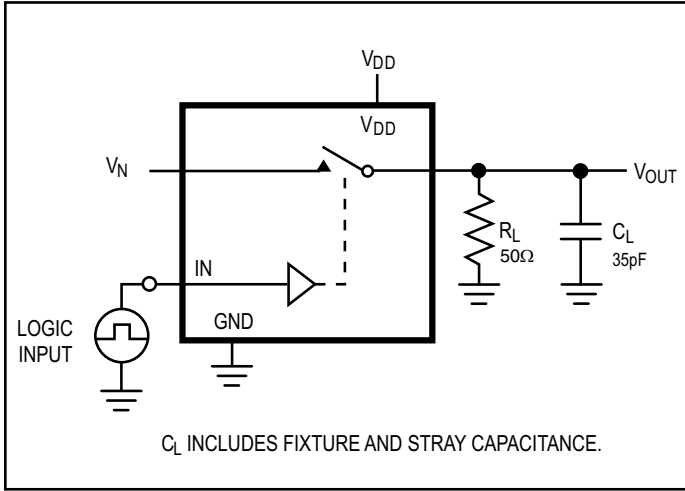
1. This Parameter is not production tested.

### Capacitance

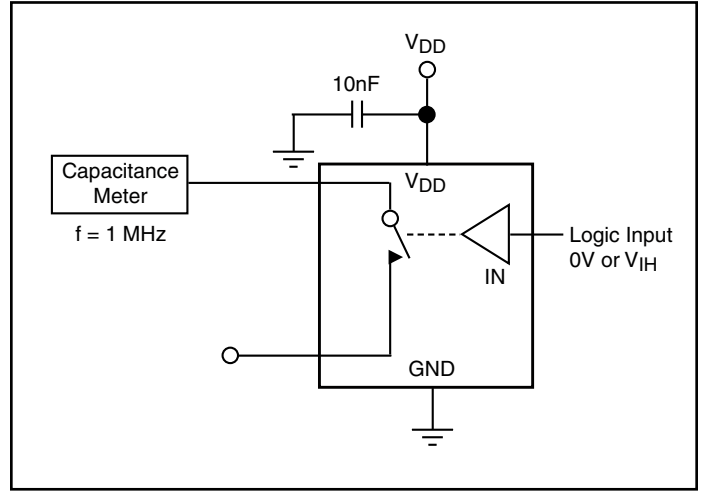
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$C_{NC (OFF)}$	Off Capacitance	$f = 1MHz$ , See Test Circuit Figure 7.		15		pF
$C_{NC (ON)}$	On Capacitance	$f = 1MHz$ , See Test Circuit Figure 8.		25		

**PI3A114-A**

**Test Circuits and Timing Diagrams**



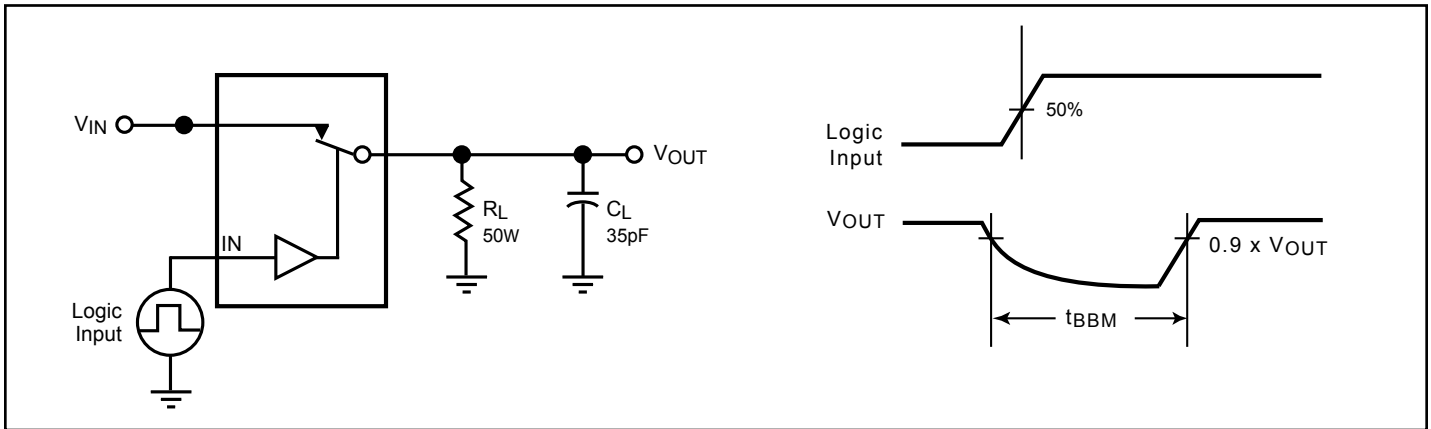
**Figure 1. AC Test Circuit**



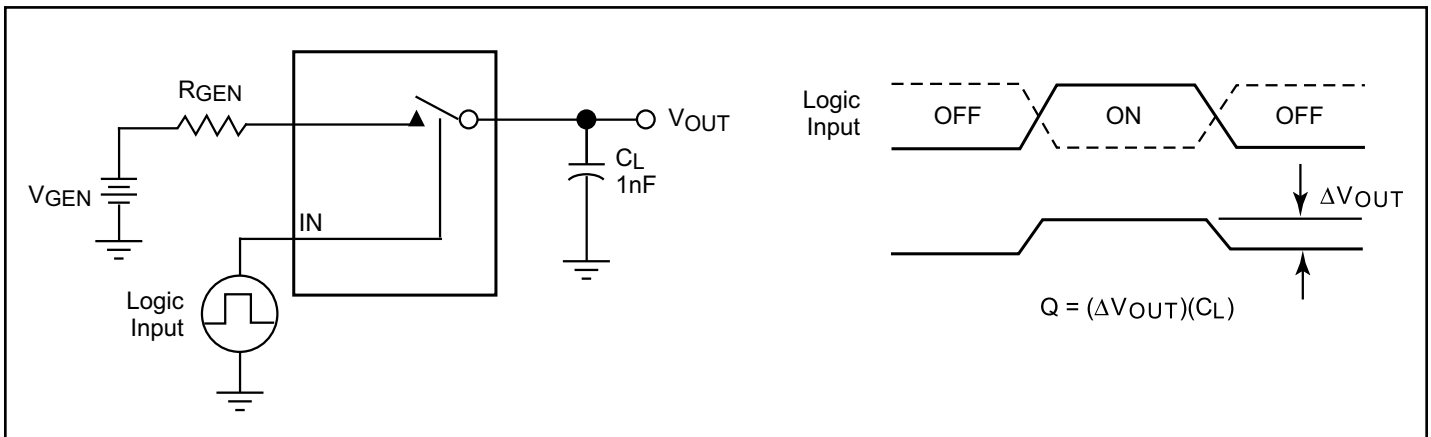
**Figure 2. AC Waveforms**

**Notes:**

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

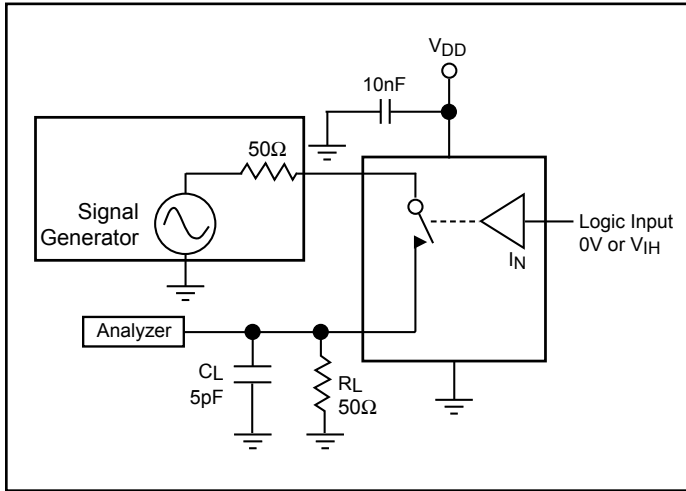


**Figure 3. Break Before Make Interval Timing**

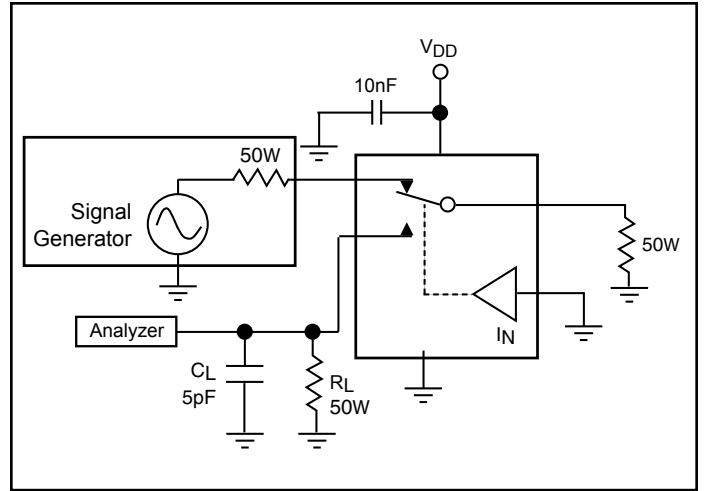


**Figure 4. Charge Injection Test**

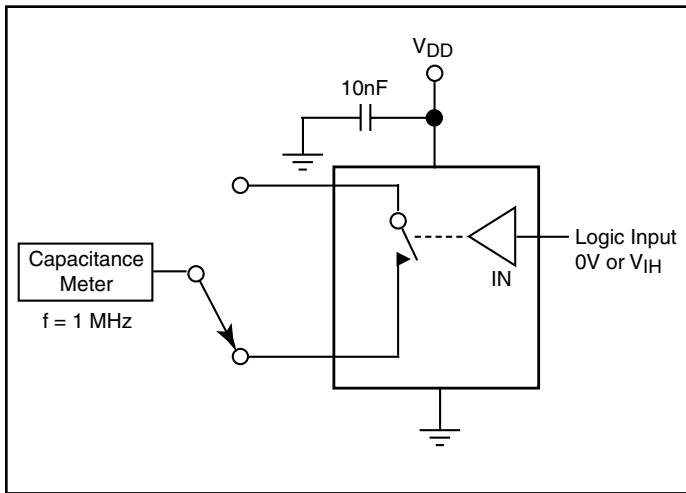
**PI3A114-A**



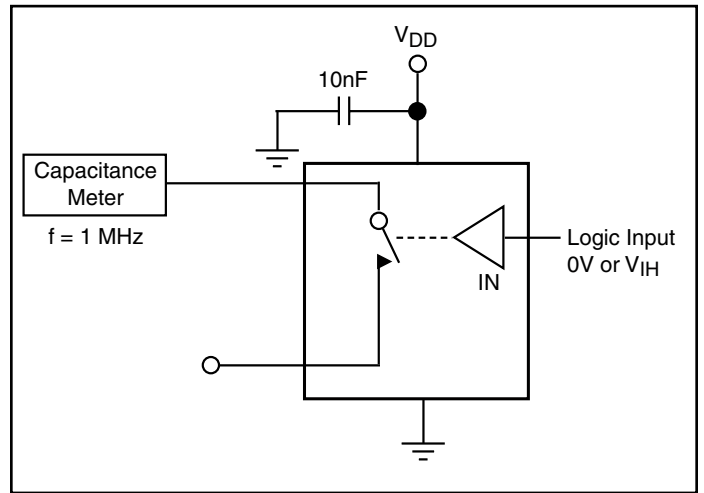
**Figure 5. Off Isolation**



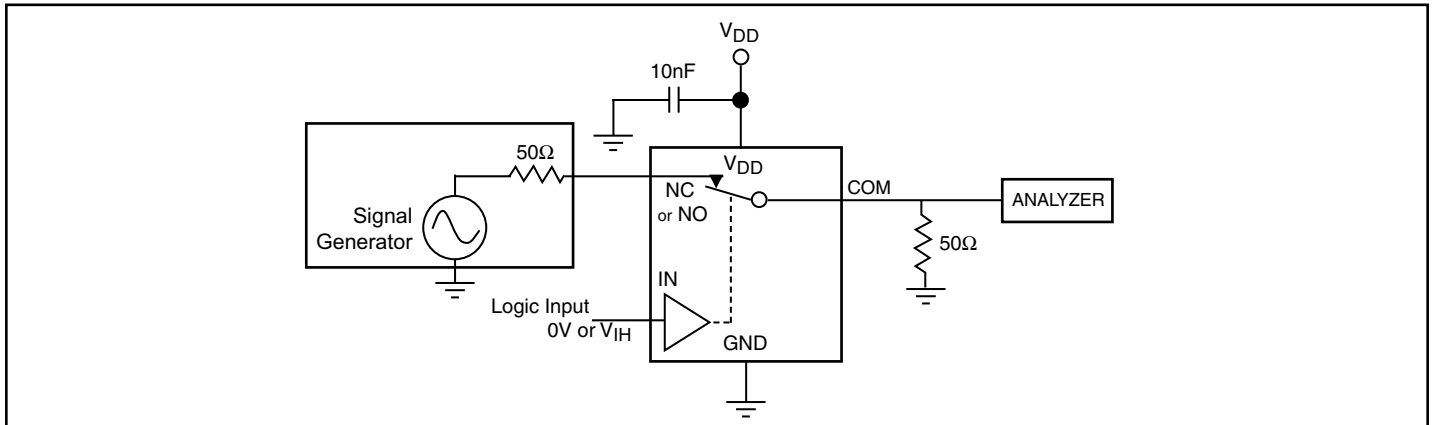
**Figure 6. Crosstalk**



**Figure 7. Channel Off Capacitance**

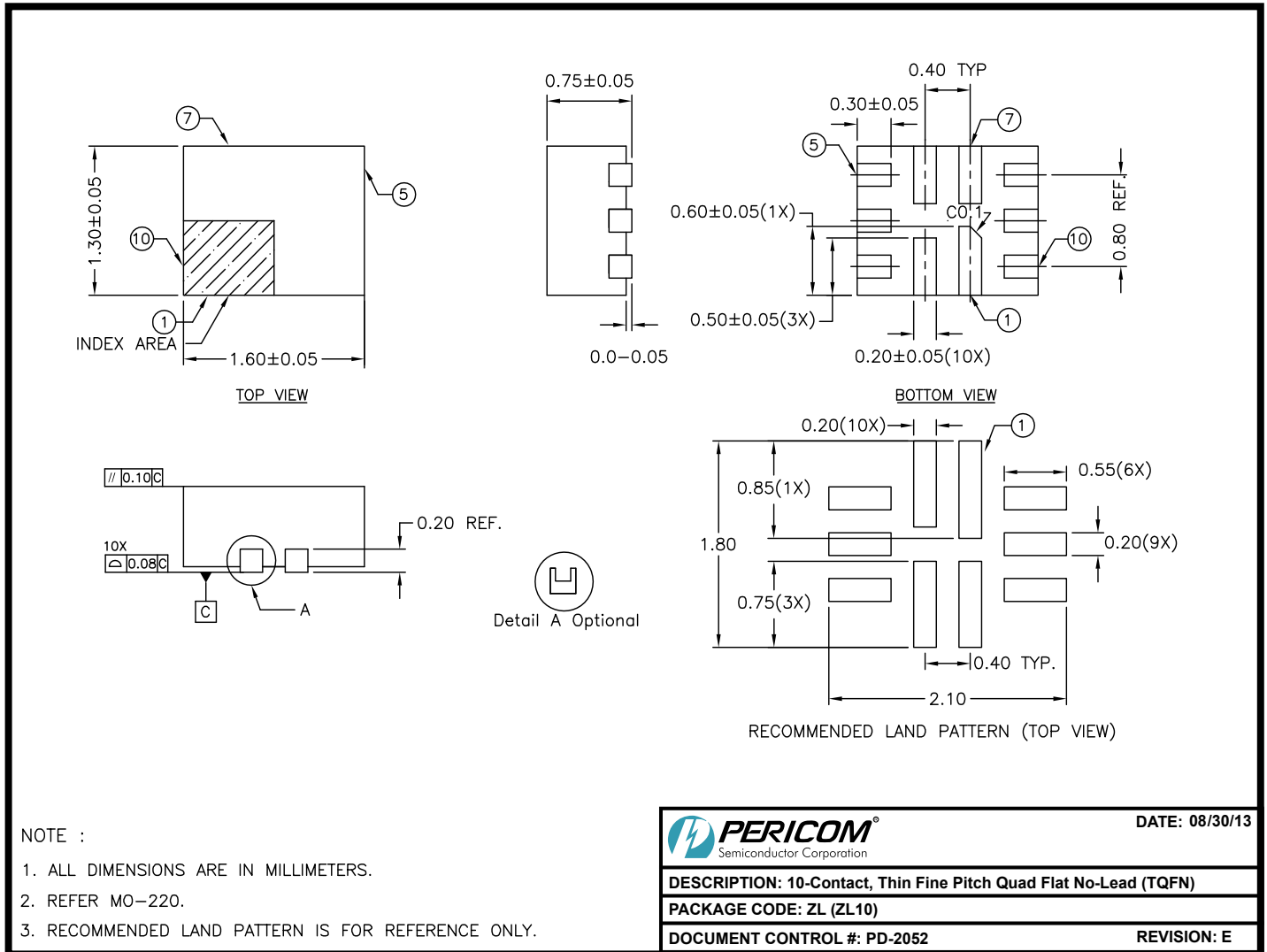


**Figure 8. Channel On Capacitance**



**Figure 9. Bandwidth**

**Packaging Mechanical: 10-pin TQFN (ZL)**



13-0175

**For latest package info.**

please check: <http://www.diodes.com/design/support/packaging/pericom-packaging/packaging-mechanicals-and-thermal-characteristics/>

**Ordering Information**

Ordering Code	Packaging Code	Package Type	Top Mark
PI3A114-AZLEX	ZL	10-Contact, Thin Fine Pitch Quad Flat No-Lead (TQFN)	CR

**Notes:**

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

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