

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.

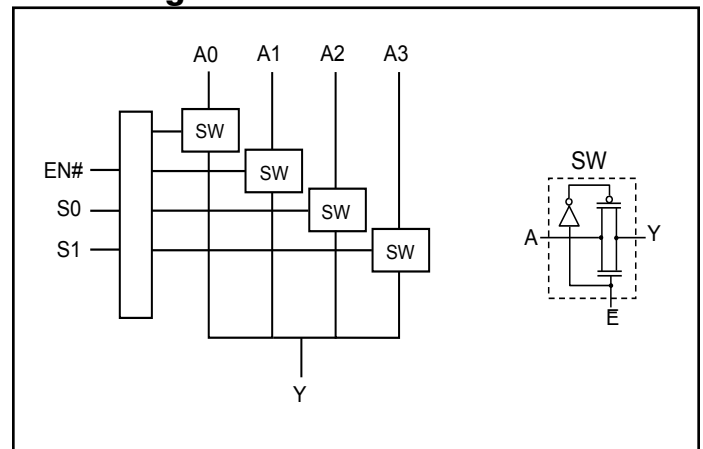
Truth Table⁽¹⁾

Enable	Select		Function
	S ₁	S ₀	
L	X	X	Y=A _x , Hi-Z
H	L	L	Y = A ₀ ; A ₁ , A ₂ , A ₃ = Hi-Z
H	L	H	Y = A ₁ ; A ₀ , A ₂ , A ₃ = Hi-Z
H	H	L	Y = A ₂ ; A ₀ , A ₁ , A ₃ = Hi-Z
H	H	H	Y = A ₃ ; A ₀ , A ₁ , A ₂ = Hi-Z

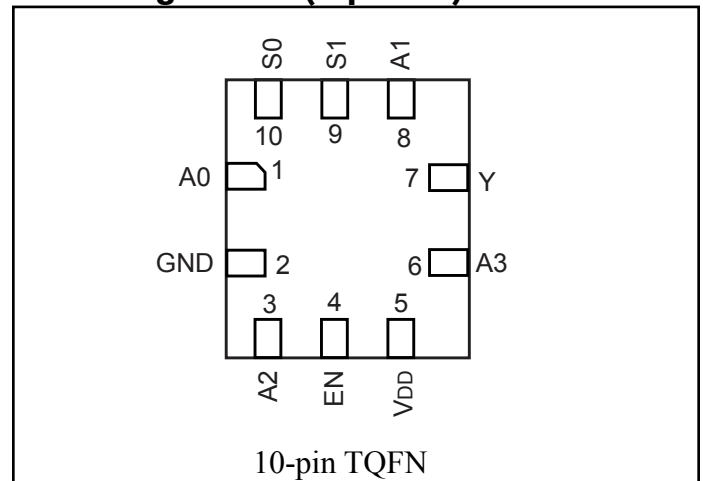
Pin Description

Pin Name	Description
A _N	Data I/O
S ₀₋₁	Select Inputs
EN	Enable
Y	Data I/O Common
GND	Ground
V _{DD}	Power

Block Diagram



Pin Configuration (top view)



Absolute Maximum Ratings⁽¹⁾

Supply Voltage V_{DD}	-0.5V to 4.2V
Control Input Voltage (V_{INx})	0V to 5V
DC Input Voltage (V_{INPUT}) ⁽²⁾	-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⁽³⁾

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 (θ_{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. ⁽²⁾	Max.	Units
Analog Switch						
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
ΔR_{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		%
Control Inputs⁽¹⁾						
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	$V_{DD} = Max.$, $V_{IN} = V_{DD}$			±1	μA
I_{IL}	Input LOW Current	$V_{DD} = Max.$, $V_{IN} = GND$			±1	
I_{OZH}	High Impedance Output Current	$0 \leq I_N$, $Y_N \leq V_{DD}$			±1	
V_{IK}	Clamp Diode Voltage	$V_{DD} = Min.$, $I_{IN} = -18mA$			-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 ⁽¹⁾		Min.	Typ. ⁽²⁾	Max.	Units
I _{CC}	Quiescent Power Supply Current	V _{DD} = Max.	V _{IN} = GND or V _{DD}		0.1	9.0	μA

Notes:

- Control inputs only; A and Y pins do not contribute to I_{CC}.
- Typical values are at V_{DD} = 1.8V, T_A = 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_{DD} = 3.3V, T_A = -40°C to 85°C, unless otherwise noted.)

Parameter	Description	Test Conditions	Min.	Typ. ⁽²⁾	Max.	Units
Analog Switch						
Y, Ax	Analog Signal Range		-0.3		V _{DD}	V
R _{ON}	On-Resistance	I _Y = 100mA, V _{IN} = 0 to V _{DD}			5	Ω
ΔR _{ON}	On-Resistance Match Between Channels	I _Y = 100mA, V _{IN} = 0.5V _{DD}			0.2	
R _{ONF}	On-Resistance Flatness	I _Y = 100mA, V _{IN} = 0 to V _{DD}			0.6	
THD	Total Harmonic Distortion	Load = 100KΩ, V _{IN} = 0.5V _{DD} , Frequency = 20Hz to 20KHz		0.03		%
Control Inputs⁽¹⁾						
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} = Max., V _{IN} = V _{DD}			±1	μA
I _{IL}	Input LOW Current	V _{DD} = Max., V _{IN} = GND			±1	
I _{OZH}	High Impedance Output Current	0 ≤ I _N , Y _N ≤ V _{DD}			±1	
V _{IK}	Clamp Diode Voltage	V _{DD} = Min., I _{IN} = -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_{DD} = 3.3V, T_A = 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 ⁽¹⁾		Min.	Typ. ⁽²⁾	Max.	Units
I _{CC}	Quiescent Power Supply Current	V _{DD} = Max.	V _{IN} = GND or V _{DD}		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_{DD} = 3.3V, +25°C ambient.
- Control inputs only; A and Y pins do not contribute to I_{CC}.

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

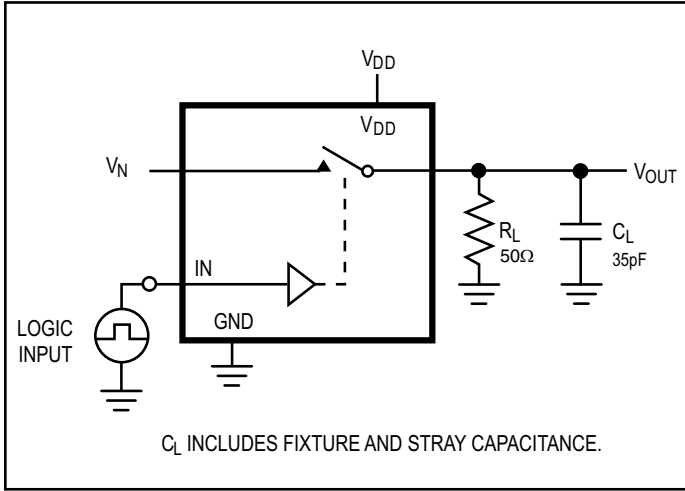


Figure 1. AC Test Circuit

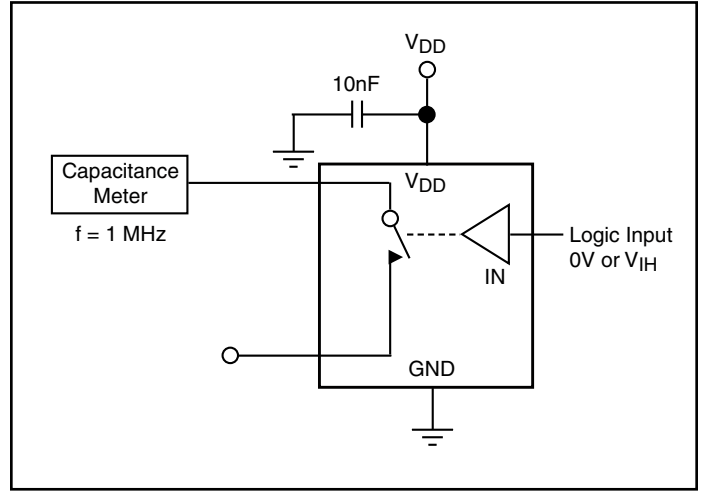


Figure 2. AC Waveforms

Notes:

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

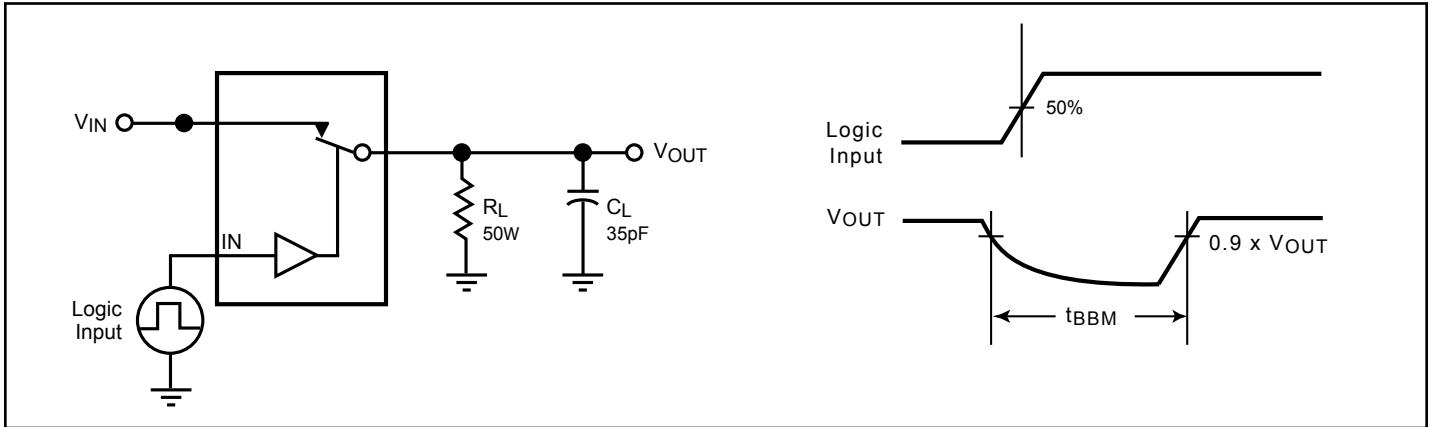


Figure 3. Break Before Make Interval Timing

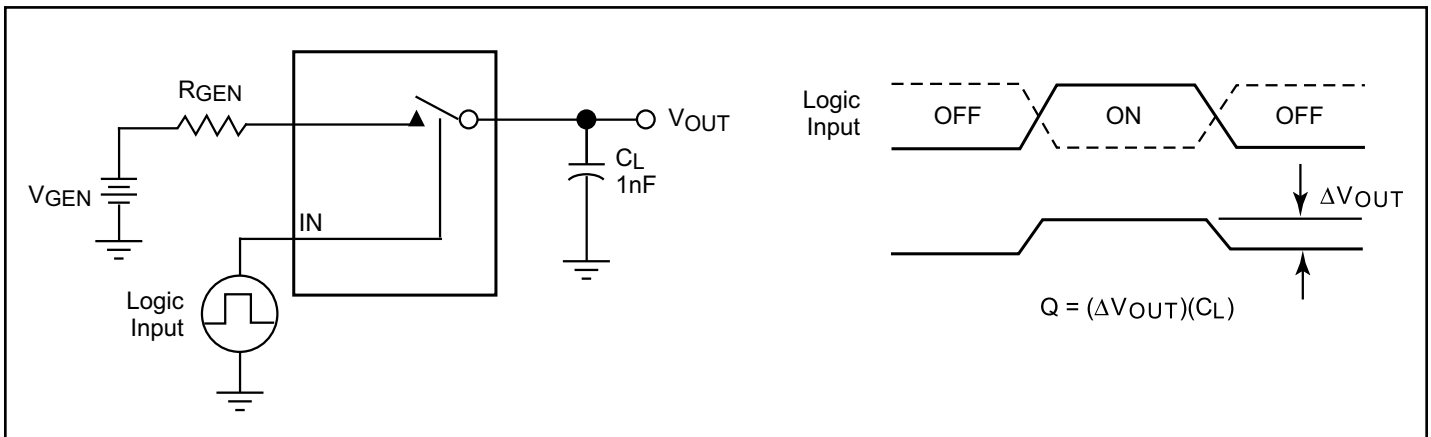


Figure 4. Charge Injection Test

PI3A114-A

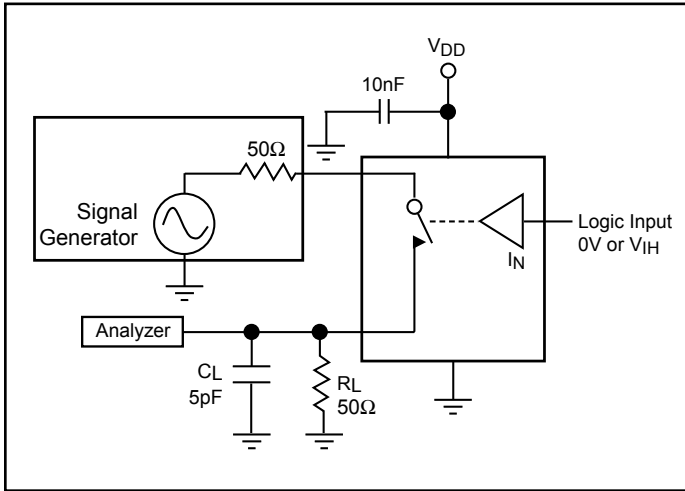


Figure 5. Off Isolation

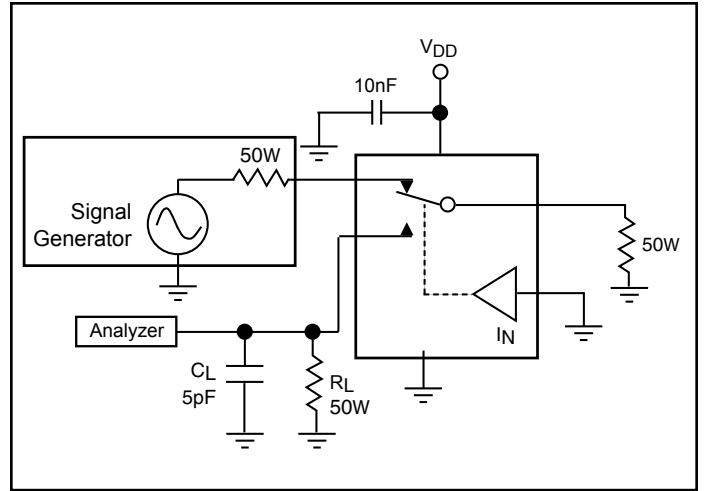


Figure 6. Crosstalk

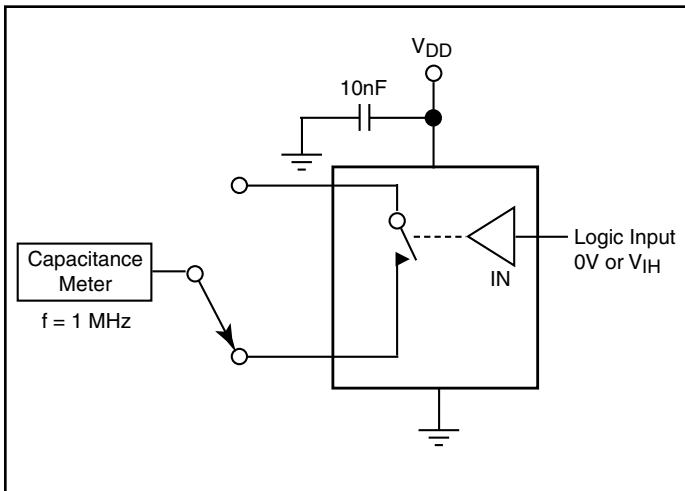


Figure 7. Channel Off Capacitance

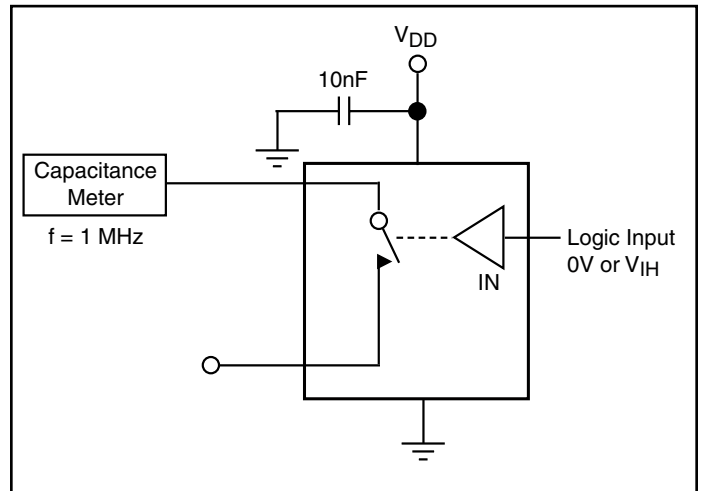


Figure 8. Channel On Capacitance

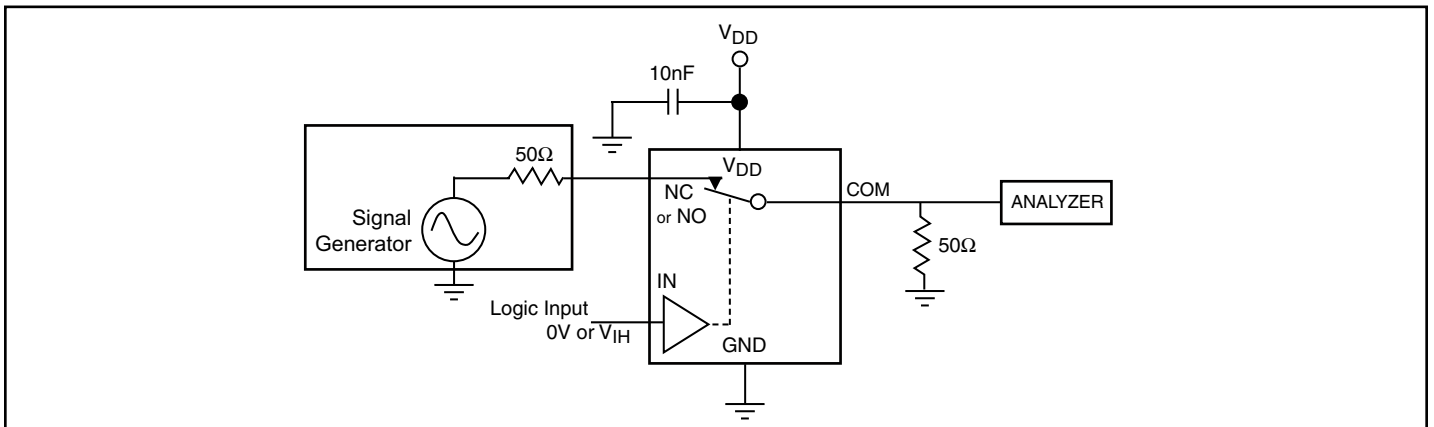
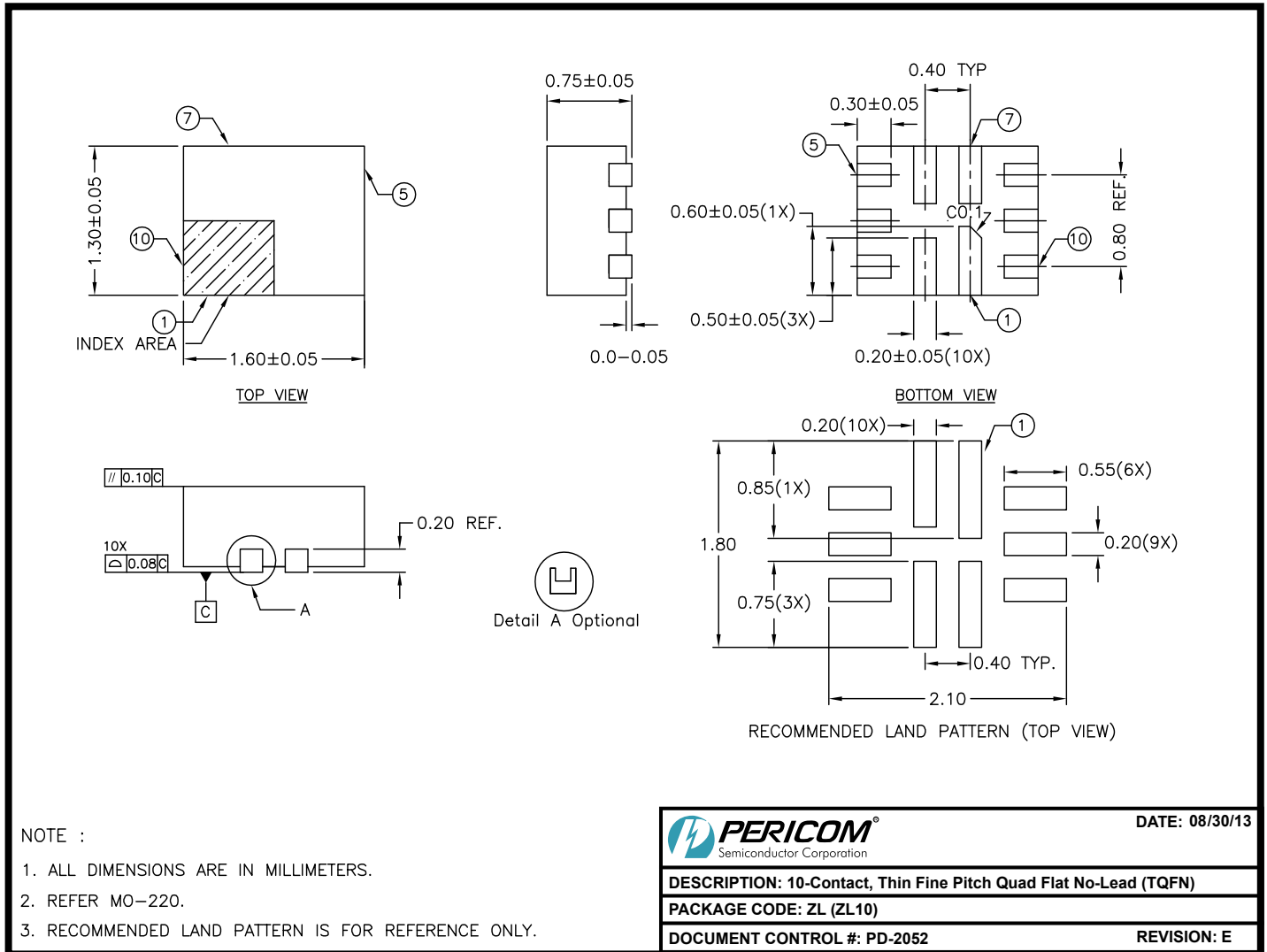


Figure 9. Bandwidth

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/
- E = Pb-free and Green
- X suffix = Tape/Reel

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