

PI3A412

0.4Ω, 3.3V, Quad SPDT Analog Switch

Features

- CMOS Technology for Bus and Analog Applications
- Low On-Resistance: 0.4Ω (+2.7V Supply)
- Wide VCC Range: +1.6V to +4.2V
- 1.8V Logic Control Tolerable
- Rail-to-Rail switching throughout Signal Range
- Fast Switching Speed: 20ns TYP. at 3.3V
- High Off Isolation: -65dB
- Crosstalk Rejection: -65dB
- Extended Industrial Temperature Range: -40°C to 85°C
- 3kV HBM ESD protection
- Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)
- Halogen and Antimony Free. "Green" Device (Note 3)
- For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please [contact us](mailto:contact@diodes.com) or your local Diodes representative.
<https://www.diodes.com/quality/product-definitions/>
- Packaging: (Pb-free & Green)
 - 16-contact TQFN (ZH), 3.0mm x 3.0mm

Applications

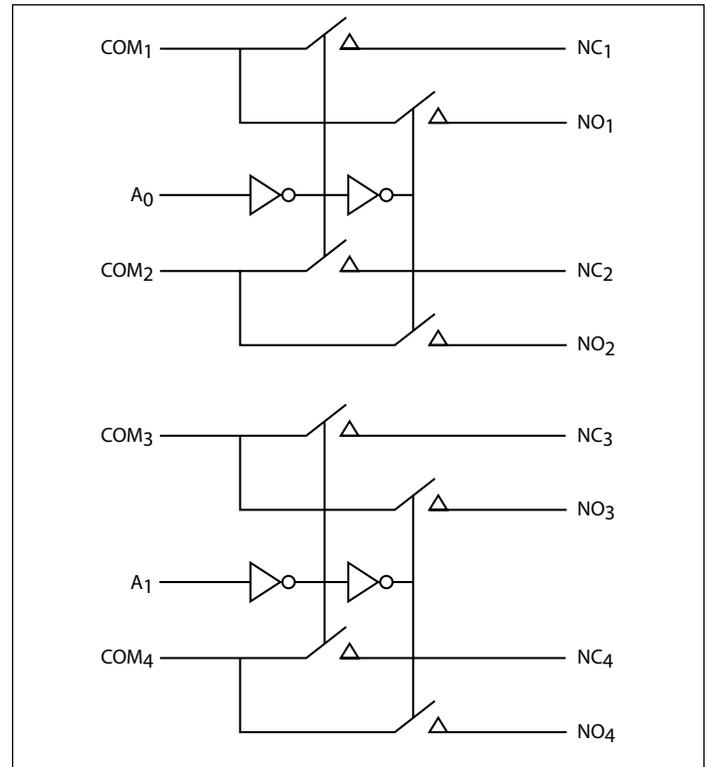
- Cell Phones
- PDAs
- Portable Instrumentation
- Battery Powered Communications
- Computer Peripherals
- Audio & Video Signal Routing
- PCMCIA Cards
- Modems
- Hard Drives
- JTAG Testing

Description

The PI3A412 is a quad 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 range, +1.6V to +4.2V, the switch has an On-Resistance of 0.4Ω at 2.7V.

Control inputs, Ax, tolerates input drive signals up to 5V, independent of supply voltage.

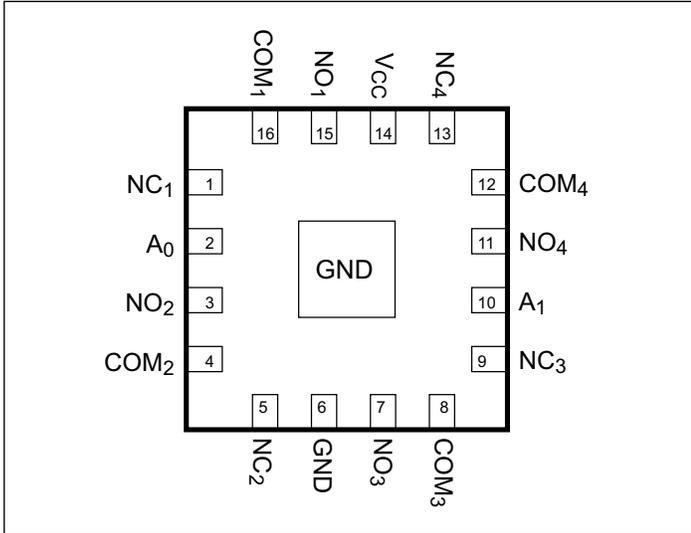
Block Diagram



Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Pin Configuration



Pin Description

Pin #	Pin Name	Description
4, 8, 12, 16	COM _X	Common Output / Data Port
1, 5, 9, 13	NC _X	Data Port (normally connect)
3, 7, 11, 15	NO _X	Data Port (normally open)
2, 10	A ₀ , A ₁	Logic Input Control
6	GND	Ground
14	VCC	Positive Power Supply

Notes :

- X = 1, 2, 3, or 4

Function Tables

A ₀	Function	A ₁	Function
0	NC _X Connected to COM _X	0	NC _Y Connected to COM _Y
1	NO _X Connected to COM _X	1	NO _Y Connected to COM _Y

Notes :

- X = 1 or 2
- Y = 3 or 4

PI3A412

<p>Absolute Maximum Ratings</p> <p>Voltages Referenced to GND</p> <p>V_{CC} 1.5V to +4.6V</p> <p>$V_{NOx}, V_{NCx}, V_{COMx}, V_{Ax}$ ⁽¹⁾ -0.5V to V_+ +0.3V or 30mA, whichever occurs first</p> <p>Current (any terminal)..... ±400mA</p> <p>Peak Current, $V_{NC} + V_{NO}$ (Pulsed at 1ms, 10% duty cycle)..... ±500mA</p>	<p>Thermal Information</p> <p>Continuous Power Dissipation</p> <p>16-pin Thin QFN (derate 7.1mW/°C above +70°C)..... 0.5W</p> <p>Storage Temperature -65°C to +150°C</p> <p>Lead Temperature (soldering, 10s) +300°C</p>
<p>Note 1: Signals on NC, NO, COM, or A exceeding V_{CC} or GND are clamped by internal diodes. Limit forward diode current to 30mA.</p> <p>Caution: Stresses beyond those listed under “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.</p>	

Electrical Specifications - Single +3.3V Supply

($V_{CC} = +3.3V \pm 10\%$, $GND = 0V$, $V_{IH} = 1.3V$, $V_{IL} = 0.5V$) ($T_A = -40^\circ C$ to $+85^\circ C$)

Symbol	Parameter	Conditions	Min. ⁽¹⁾	Typ. ⁽²⁾	Max. ⁽¹⁾	Units
V_{ANALOG}	Analog Signal Range ⁽³⁾		0		V_{CC}	V
R_{ON}	On Resistance	$V_{CC} = 2.7V, I_{COM} = 100mA, V_{IN} = +1.5V$		0.4	0.6	Ω
ΔR_{ON}	On-Resistance Match Between Channels ⁽⁴⁾			0.08	0.09	
$R_{FLAT(ON)}$	On-Resistance Flatness ⁽⁵⁾	$V_{CC} = 2.7V, I_{COMx} = 100mA, V_{IN} = 0.8V, 2.0V$		0.1	0.15	
I_{NC} (off) or I_{NO} (off)	Off Leakage Current ⁽⁶⁾	$V_{CC} = 3.6V, V_{NO}$ or $V_{NC} = 0.3V, 3.3V$	-400		400	nA
I_{COMx} (on)	On Leakage Current ⁽⁶⁾	$V_{CC} = 3.6V, V_{COMx} = 0.3V, 3.3V$	-400		400	

Notes:

1. The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.
2. Typical values are $T_A = 25^\circ C$, $V_{CC} = 3.3V$ unless otherwise specified.
3. Guaranteed by design.
4. $\Delta R_{ON} = R_{ON}$ match between channels
5. Flatness is defined as the difference between the maximum and minimum value of On-Resistance measured.
6. Leakage parameters are 100% tested at maximum rated hot temperature and guaranteed by correlation at $+25^\circ C$.

Electrical Specifications - Single +4.2V Supply

($V_{CC} = +4.2V$, $GND = 0V$, $V_{IH} = 1.6V$, $V_{IL} = 0.7V$) ($T_A = -40^{\circ}C$ to $+85^{\circ}C$)

Symbol	Parameter	Conditions	Min. ⁽¹⁾	Typ. ⁽²⁾	Max. ⁽¹⁾	Units
V_{ANALOG}	Analog Signal Range ⁽³⁾		0		V_{CC}	V
R_{ON}	On Resistance	$V_{CC} = 4.0V$, $I_{COMx} = 100mA$, $V_{IN} = +1.5V$		0.4	0.6	Ω
ΔR_{ON}	On-Resistance Match Between Channels ⁽⁴⁾			0.08	0.09	
$R_{FLAT(ON)}$	On-Resistance Flatness ⁽⁵⁾		$V_{CC} = 4.0V$, $I_{COMx} = 100mA$, $V_{IN} = 0.8V, 2.0V$		0.1	
I_{NC} (off) or I_{NO} (off)	Off Leakage Current ⁽⁶⁾	$V_{CC} = 4.2V$, V_{NO} or $V_{NC} = 0.3V, 3.3V$	-500		500	nA
I_{COMx} (on)	On Leakage Current ⁽⁶⁾	$V_{CC} = 4.2V$, $V_{COMx} = 0.3V, 3.3V$	-500		500	

Notes:

1. The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.
2. Typical values are $T_A = 25^{\circ}C$, $V_{CC} = 4.2V$ unless otherwise specified.
3. Guaranteed by design.
4. $\Delta R_{ON} = R_{ON}$ match between channels
5. Flatness is defined as the difference between the maximum and minimum value of On-Resistance measured.
6. Leakage parameters are 100% tested at maximum rated hot temperature and guaranteed by correlation at $+25^{\circ}C$.

Electrical Specifications - Single +4.2V Supply

 ($V_{CC} = +4.2V$, $GND = 0V$, $V_{IH} = 1.6V$, $V_{IL} = 0.7V$) ($T_A = -40^{\circ}C$ to $+85^{\circ}C$)

Parameter	Description	Test Conditions	Min. ⁽¹⁾	Typ. ⁽²⁾	Max. ⁽¹⁾	Unit
Logic Input						
V_{IH}	Input High Voltage	Guaranteed logic High Level	1.6			V
V_{IL}	Input Low Voltage	Guaranteed logic Low Level			0.7	
I_{AH}	Input Current with Voltage High	$V_A = 1.4V$, all others = $0.5V$	-1		1	μA
I_{AL}	Input Current with Voltage Low	$V_A = 0.5V$, all other = $1.4V$	-1		1	
Dynamic						
t_{ON}	Turn-On Time	$V_{CC} = 4.2V$, $V_{COM} = 2.0V$, Figure 1 & 2		20	25	ns
t_{OFF}	Turn-Off Time			12	15	
t_{BBM}	Break-Before-Make	$V_{IN} = 1.5V$, $R_L = 50\Omega$, $C_L = 35pF$, See Figure 3	1	12	15	
Q	Charge Injection ⁽³⁾	$C_L = 1nF$, $V_{GEN} = 0V$, $R_{GEN} = 0\Omega$, Figure 4		100		pC
O_{IRR}	Off Isolation ⁽⁴⁾	$R_L = 50\Omega$, $f = 100kHz$, Figure 5		-65		dB
X_{TALK}	Cross Talk ⁽⁵⁾	$R_L = 50\Omega$, $f = 100kHz$, Figure 6		-65		
f_{3db}	3dB Bandwidth	See Test Circuit Figure 9		40		MHz
$C_{NC(OFF)}$	Off Capacitance	$f = 1 MHz$, Figure 7		50		pF
$C_{NO(OFF)}$	Off Capacitance			50		
C_{ON}	On Capacitance	$f = 1 MHz$, Figure 8		135		
Supply						
V_{CC}	Power-Supply Range		1.5		4.4	V
I_{CC}	Positive Supply Current	$V_{CC} = 4.2V$, $V_A = 0V$ or V_{CC}			40	μA

Notes:

- The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.
- Typical values are $T_A = 25^{\circ}C$, $V_{CC} = 4.2V$ unless otherwise specified.
- Guaranteed by design.
- Off Isolation = $20\log_{10} [(V_{NO} \text{ or } V_{NC}) / V_{COM}]$. See Figure 5.
- Between any two switches. See Figure 6.

Electrical Specifications - Single +3.3V Supply

($V_{CC} = +3.3V \pm 10\%$, $GND = 0V$, $V_{IH} = 1.3V$, $V_{IL} = 0.5V$) ($T_A = -40^\circ C$ to $+85^\circ C$)

Parameters	Description	Test Conditions	Min. ⁽¹⁾	Typ. ⁽²⁾	Max. ⁽¹⁾	Units
Logic Input						
V_{IH}	Input High Voltage	Guaranteed logic High Level	1.3			V
V_{IL}	Input Low Voltage	Guaranteed logic Low Level			0.5	
I_{AH}	Input Current with Voltage High	$V_A = 1.4V$, all others = $0.5V$	-1		1	μA
I_{AL}	Input Current with Voltage Low	$V_A = 0.5V$, all other = $1.4V$	-1		1	
Dynamic						
t_{ON}	Turn-On Time	$V_{CC} = 3.3V$, $V_{COM} = 2.0V$, Figure 1 & 2		20	25	ns
t_{OFF}	Turn-Off Time			12	15	
t_{BBM}	Break-Before-Make	$V_{IN} = 1.5V$, $R_L = 50\Omega$, $C_L = 35pF$, See Figure 3	1	12	15	
Q	Charge Injection ⁽³⁾	$C_L = 1nF$, $V_{GEN} = 0V$, $R_{GEN} = 0\Omega$, Figure 4		100		pC
O_{IRR}	Off Isolation ⁽⁴⁾	$R_L = 50\Omega$, $f = 100kHz$, Figure 5		-65		dB
X_{TALK}	Cross Talk ⁽⁵⁾	$R_L = 50\Omega$, $f = 100kHz$, Figure 6		-65		
f_{3db}	3dB Bandwidth	See Test Circuit Figure 9		40		MHz
$C_{NC(OFF)}$	Off Capacitance	$f = 1 MHz$, Figure 7		50		pF
$C_{NO(OFF)}$	Off Capacitance			50		
C_{ON}	On Capacitance	$f = 1 MHz$, Figure 8		135		

Notes:

1. The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.
2. Typical values are $V_{CC} = 3.3V$ unless otherwise specified.
3. Guaranteed by design.
4. Off Isolation = $20\log_{10} [(V_{NO} \text{ or } V_{NC}) / V_{COM}]$. See Figure 5.
5. Between any two switches. See Figure 6.

Test Circuits and Timing Diagrams

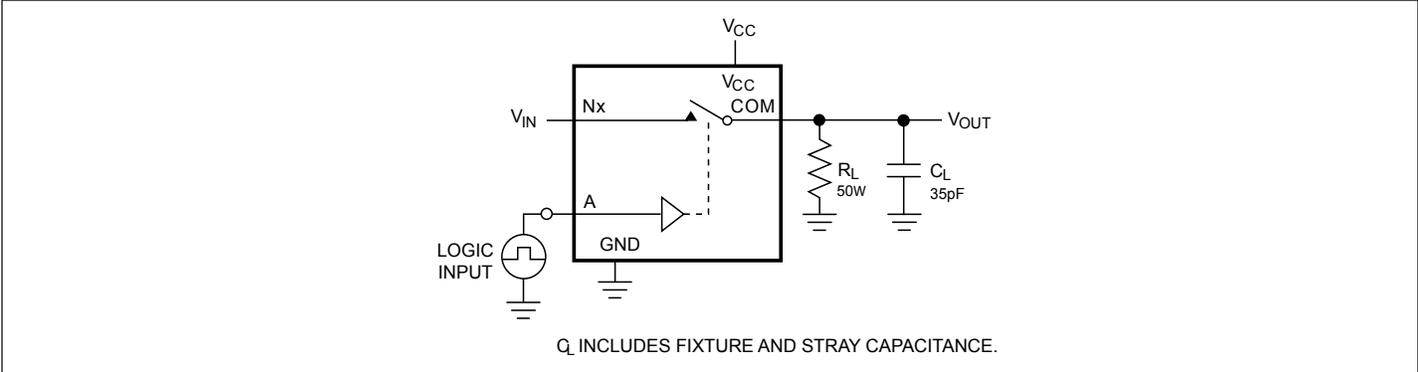


Figure 1. AC Test Circuit

Notes:

Unused N_x inputs must be grounded.

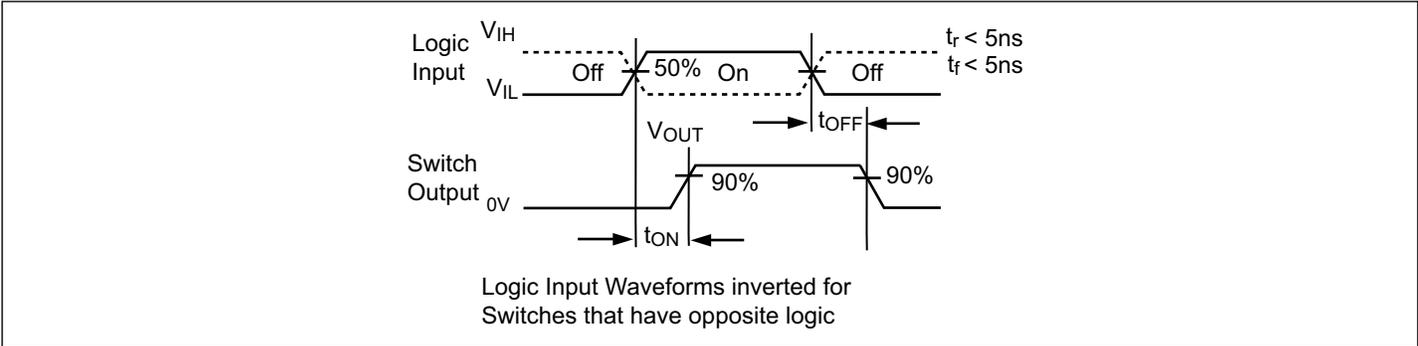


Figure 2. AC Waveforms

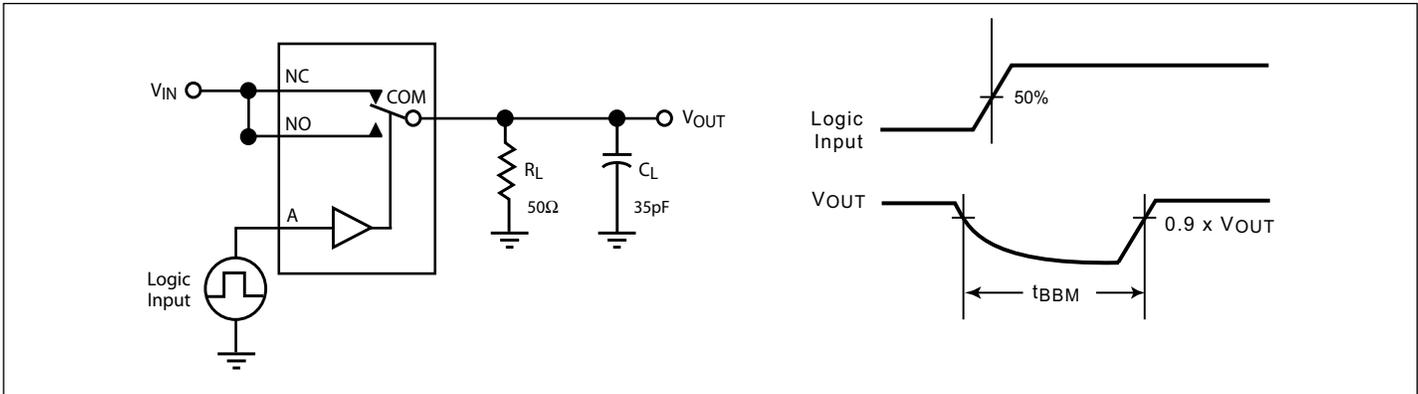


Figure 3. Break Before Make Interval Timing

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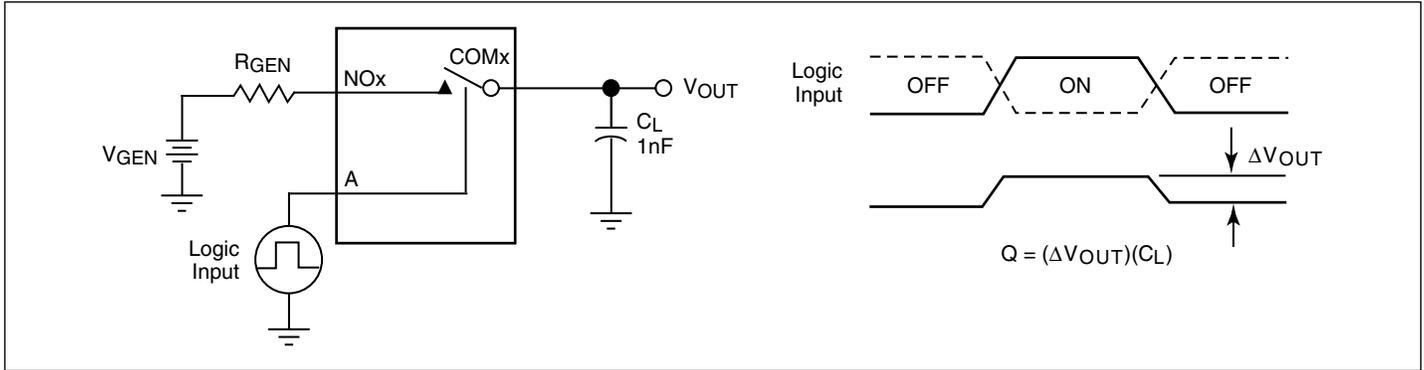


Figure 4. Charge Injection Test

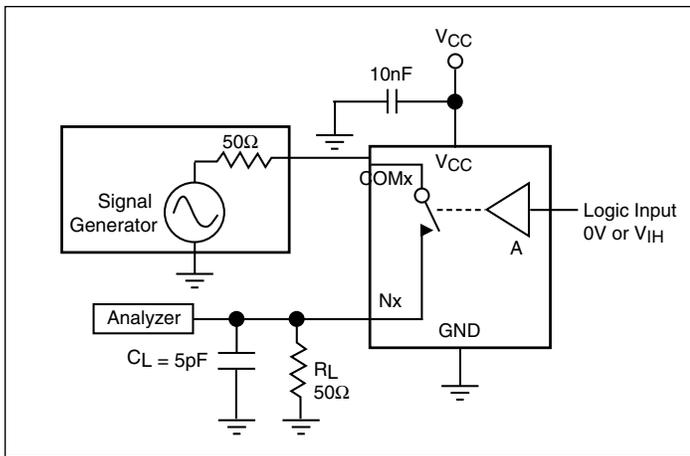


Figure 5. Off Isolation

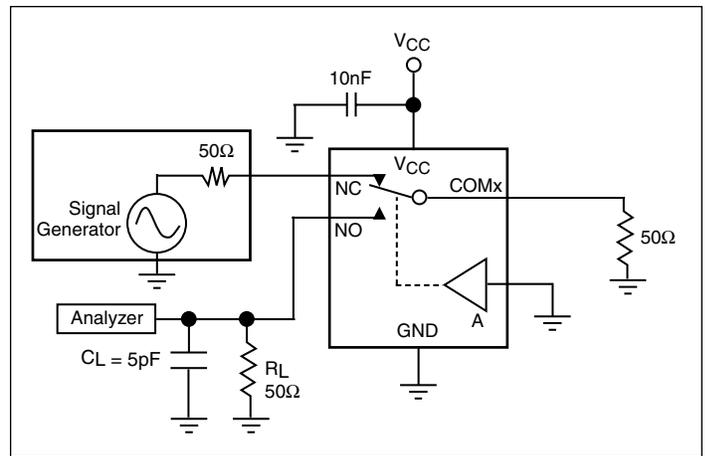


Figure 6. Crosstalk

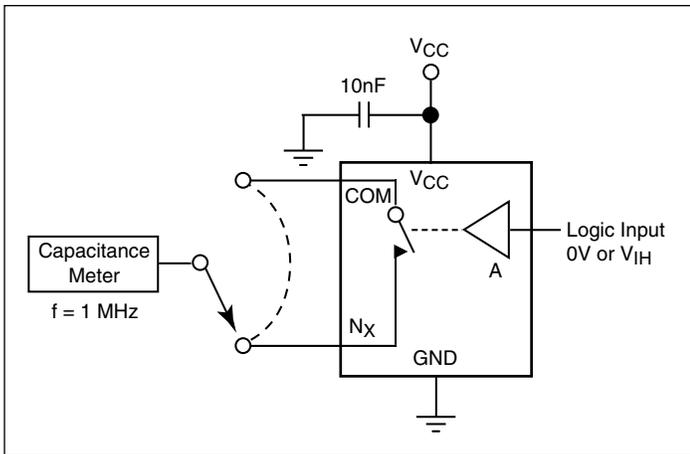


Figure 7. Channel Off Capacitance

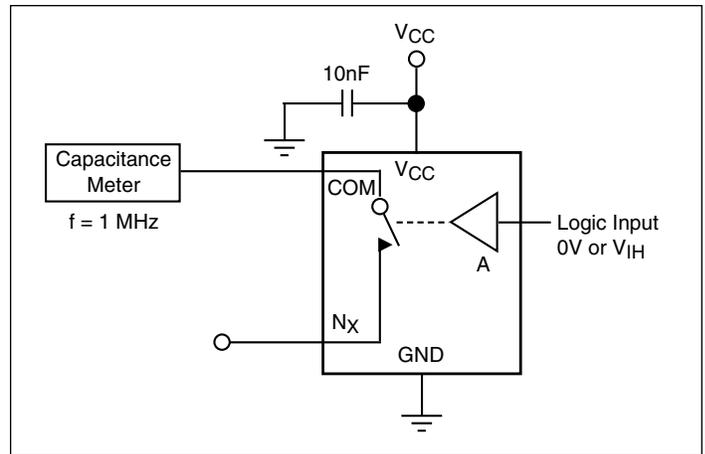


Figure 8. Channel On Capacitance

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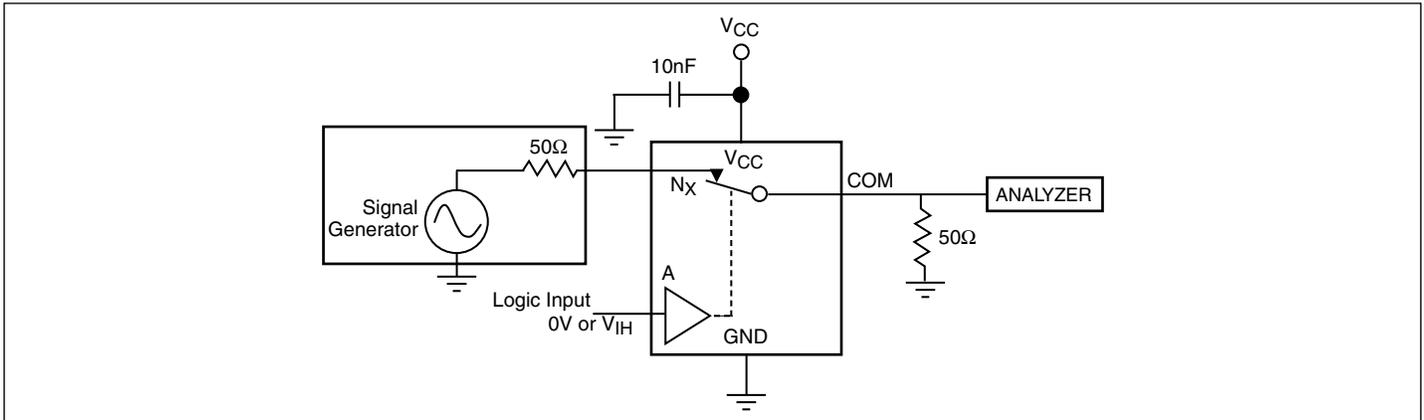


Figure 9. Bandwidth

Part Marking



PI3A412ZHE = A4ZHE

Z: Die Rev

Y: Date Code (Year)

W: Date Code (Workweek)

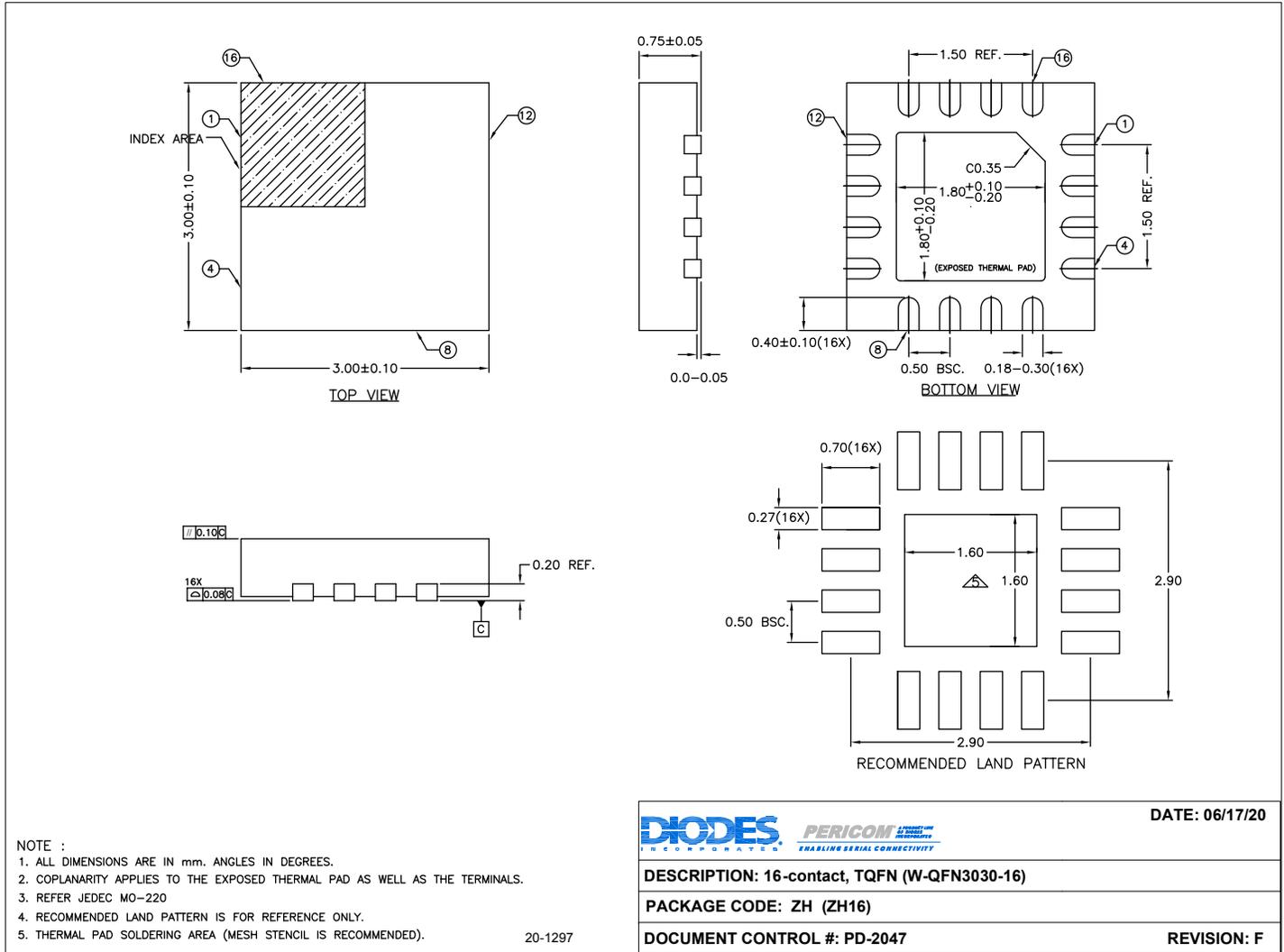
1st X: Assembly Site Code

2nd X: Fab Site Code

Bar above Fab Code means Cu wire

PI3A412

Packaging Mechanical: 16-TQFN (ZH)



For latest package info.

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

Ordering Information

Ordering Code	Package Code	Package Description
PI3A412ZHEX	ZH	16-contact, W-QFN3030-16 (TQFN)

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. E = Pb-free and Green
5. X suffix = Tape/Reel

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