

Small Plastic Package, Dual SPDT Analog Switch

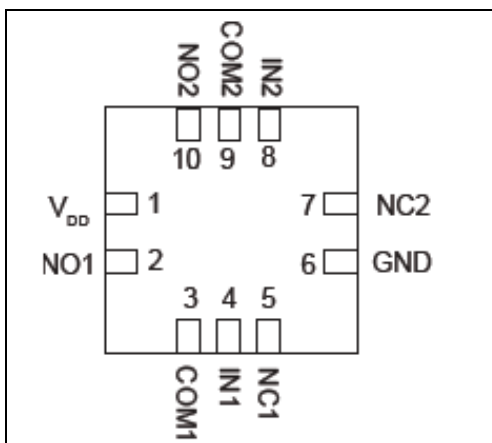
Features

- CMOS Technology for Bus and Analog Applications
- Low On-Resistance: 0.45Ω
- Wide V_{DD} Range: 1.8V to 4.2V
- Rail-to-Rail Signal Range
- High Off Isolation: -83dB @ 100kHz
- Crosstalk Rejection Reduces Signal Distortion: -108dB @ 100kHz
- Break-Before-Make Switching
- Extended Industrial Temperature Range: -40°C to 85°C
- ESD protection : 4kV(HBM)
- Packaging (Pb-free & Green):
 - -10-pin UQFN (ZM), 1.4mm x 1.8mm

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

Pin Configuration (Top view)

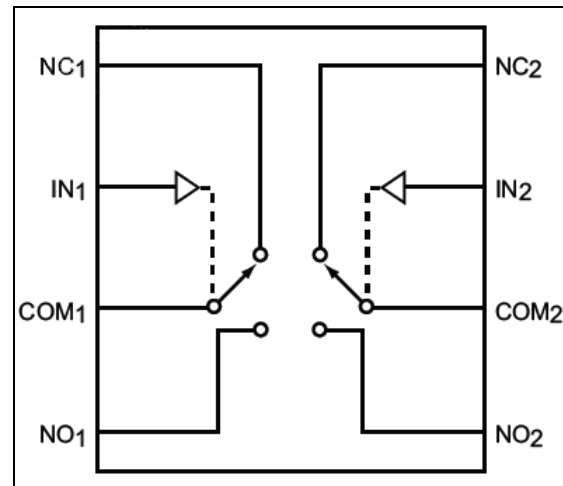


Description

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, 1.8V to 4.2V, the PI3A223 has an On-Resistance of 0.45Ω at +4.2V.

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

Block Diagram



Pin Description

| Pin# | Name | Description |
|------|-----------------|-----------------------------|
| 1 | V _{DD} | Positive Power Supply |
| 2 | NO1 | Data Port (Normally open) |
| 3 | COM1 | Common Output / Data Port |
| 4 | IN1 | Logic Control |
| 5 | NC1 | Data Port (Normally closed) |
| 6 | GND | Ground |
| 7 | NC2 | Data Port (Normally closed) |
| 8 | IN2 | Logic Control |
| 9 | COM2 | Common Output / Data Port |
| 10 | NO2 | Data Port (Normally open) |

Function Table

| Logic Input (IN _x) | Function |
|--------------------------------|---|
| 0 | NC _x Connected to COM _x |
| 1 | NO _x Connected to COM _x |

Note: x = 1 or 2

Maximum Ratings

| | |
|--|-----------------|
| Storage Temperature..... | -65°C to +150°C |
| Ambient Temperature with Power Applied..... | -40°C to +85°C |
| Supply Voltage V_{DD} | -0.5V to +4.6V |
| Control Input Voltage V_{INx} | 0V to +4.6V |
| DC Input Voltage V_{INPUT} | -0.5V to +4.6V |
| 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 |
| ESD(HBM) | 4kV |

Note:

Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability. 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.

Recommended Operating Conditions

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|-------------|--------------------------|------------|------|------|----------|------|
| V_{DD} | Operating Voltage | - | 1.8 | - | 4.2 | V |
| V_{IN} | Control Input Voltage | - | 0 | - | V_{DD} | V |
| V_{INPUT} | Switch Input Voltage | - | -0.3 | - | 4.2 | V |
| T_A | Operating Temperature | - | -40 | 25 | 85 | °C |
| t_r, t_f | Input Rise and Fall Time | - | 0 | - | 10 | ns/V |

DC Electrical Characteristics

+3.0V Supply ($V_{DD} = 2.7V$ to $3.6V$, $V_{IH} = +1.6V$, $V_{IL} = +0.4V$, $T_A = -40°C$ to $85°C$, unless otherwise noted. Typical values are at $3.0V$ and $+25°C$.)

| Parameter | Symbol | Test Conditions | TEMP | Min. | Typ. | Max. | Units |
|--------------------------------------|---------------------------------------|---|-----------------|------|------|----------|-------|
| ANALOG SWITCH | | | | | | | |
| Analog Signal Range | V_{NO}, V_{NC}, V_{COM} | - | -40 °C to 85 °C | 0 | - | V_{DD} | V |
| On-Resistance | R_{ON} | $V_{DD} = 2.7V, I_{COM} = 100mA, V_{NO}$ or $V_{NC} = 1V, Test Circuit 1$ | +25 °C | - | 0.55 | 0.9 | Ω |
| | | | -40 °C to 85 °C | - | 0.55 | 1 | |
| On-Resistance Match Between Channels | ΔR_{ON} | $V_{DD} = 2.7V, I_{COM} = 100mA, V_{NO}$ or $V_{NC} = 1V, Test Circuit 1$ | +25 °C | - | 0.05 | 0.22 | Ω |
| | | | -40 °C to 85 °C | - | 0.05 | 0.25 | |
| On-Resistance Flatness | R_{ONF} | $V_{DD} = 2.7V, I_{COM} = 100mA, V_{NO}$ or $V_{NC} = 1V, 2.5V, Test Circuit 1$ | +25 °C | - | 0.1 | 0.22 | Ω |
| | | | -40 °C to 85 °C | - | 0.1 | 0.26 | |
| Source Off Leakage Current | $I_{OFF(NO)}$ or $I_{OFF(NC)}$ | $V_{DD} = 3.6V, V_{NO}$ or $V_{NC} = 3.3V/0.3V, V_{COM} = 0.3V/3.3V$ | -40 °C to 85 °C | - | - | 1 | μA |
| Channel On Leakage Current | $I_{NC(ON)}, I_{NO(ON)}, I_{COM(ON)}$ | $V_{DD} = 3.6V, V_{NO}$ or $V_{NC} = 3V/0.3V, V_{COM} = 3V/0.3V, or floating$ | -40 °C to 85 °C | - | - | 1 | |
| DIGITAL INPUTS | | | | | | | |
| Input Logic High | V_{IH} | - | -40 °C to 85 °C | 1.2 | - | - | V |
| Input Logic Low | V_{IL} | - | -40 °C to 85 °C | - | - | 0.5 | |
| IN Input Leakage Current | I_{IN} | $V_{DD} = 2.7V, V_{IN} = 0$ or $2.7V$ | -40 °C to 85 °C | - | - | 1 | μA |
| DYNAMIC CHARACTERISTICS | | | | | | | |
| Turn-On Time | t_{ON} | $V_{IH} = 1.5V, V_{IL} = 0V, See Test Circuit Figure 2.$ | +25 °C | - | 16 | - | ns |
| Turn-Off Time | t_{OFF} | $V_{IH} = 1.5V, V_{IL} = 0V, See Test Circuit Figure 2.$ | +25 °C | - | 60 | - | ns |
| Break-Before-Make | t_D | $V_{IH} = 1.5V, V_{IL} = 0V,$ | +25 °C | - | 10 | - | ns |

| Parameter | Symbol | Test Conditions | TEMP | Min. | Typ. | Max. | Units | |
|---|-------------|--|--------|-------|------|------|-------|----|
| Delay | | See Test Circuit Figure 3. | | | | | | |
| COM-NC/NO and NC-NO Isolations | O_{ISO} | $V_{BIAS}=1.5V, V_{IN}=0dBm, V_{IH}=1.5V, V_{IL}=0V$. See Test Circuit Figure 4 & Figure 5. | 100kHz | +25°C | - | -81 | - | dB |
| | | | 1MHz | +25°C | - | -61 | - | |
| | | | 10MHz | +25°C | - | -39 | - | |
| Channel-to-Channel Crosstalk | X_{TALKD} | $V_{BIAS} = 1.5V, V_{DD}=0dBm, V_{IH}=1.5V, V_{IL}=0V$ See Test Circuit Figure 6. | 100kHz | +25°C | - | -108 | - | dB |
| | | | 1MHz | +25°C | - | -110 | - | |
| | | | 10MHz | +25°C | - | -90 | - | |
| 3dB Bandwidth | f_{3dB} | $V_{BIAS} = 1.5V, V_{IN}=0dBm, V_{IH}=1.5V, V_{IL}=0V$. See Test Circuit Figure 7. | +25°C | - | 79 | - | MHz | |
| Charge Injection Select Input to Common I/O | Q | $V_{IN} = GND, R_S = 0, C_L = 1nF, V_{IH}=1.5V, V_{IL}=0V$ See Test Circuit Figure 8. | +25°C | - | 35 | - | pC | |

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

| Parameter | Symbol | Test Conditions | TEMP | Min. | Typ. | Max. | Units | |
|--------------------------------------|---------------------------------------|--|-----------------|-------|------|----------|-------|----|
| ANALOG SWITCH | | | | | | | | |
| Analog Signal Range | V_{NO}, V_{NC}, V_{COM} | - | -40 °C to 85 °C | 0 | - | V_{DD} | V | |
| On-Resistance | R_{ON} | $V_{DD} = 4.2V, I_{COM} = 100mA, V_{NO}$ or $V_{NC}=1V$, Test Circuit 1 | +25°C | - | 0.45 | 0.75 | Ω | |
| | | | -40 °C to 85 °C | - | 0.45 | 0.85 | | |
| On-Resistance Match Between Channels | ΔR_{ON} | $V_{DD} = 4.2V, I_{COM} = 100mA, V_{NO}$ or $V_{NC}=1V$, Test Circuit 1 | +25°C | - | 0.05 | 0.18 | Ω | |
| | | | -40 °C to 85 °C | - | 0.05 | 0.23 | | |
| On-Resistance Flatness | R_{ONF} | $V_{DD} = 4.2V, I_{COM} = 100mA, V_{NO}$ or $V_{NC} = 1V, 2.5V$, Test Circuit 1 | +25°C | - | 0.1 | 0.22 | Ω | |
| | | | -40 °C to 85 °C | - | 0.1 | 0.26 | | |
| Source Off Leakage Current | $I_{OFF(NO)}$ or $I_{OFF(NC)}$ | $V_{DD}= 4.2V, V_{NO}$ or $V_{NC} = 3.3V/0.3V, V_{COM} = 0.3V/3V$ | -40 °C to 85 °C | - | - | 1 | μA | |
| Channel On Leakage Current | $I_{NC(ON)}, I_{NO(ON)}, I_{COM(ON)}$ | $V_{DD} = 4.2V, V_{NO}$ or $V_{NC} = 3V/0.3V, V_{COM} = 3V/0.3V$, or floating | -40 °C to 85 °C | - | - | 1 | | |
| DIGITAL INPUTS | | | | | | | | |
| Input Logic High | V_{IH} | - | -40 °C to 85 °C | 1.2 | - | - | V | |
| Input Logic Low | V_{IL} | - | -40 °C to 85 °C | - | - | 0.5 | | |
| IN Input Leakage Current | I_{IN} | $V_{DD} = 4.2V, V_{IN}=0$ or $4.2V$ | -40 °C to 85 °C | - | - | 1 | μA | |
| DYNAMIC CHARACTERISTICS | | | | | | | | |
| Turn-On Time | t_{ON} | $V_{IH}=3V, V_{IL}=0V$, See Test Circuit Figure 2. | +25°C | - | 13 | - | ns | |
| Turn-Off Time | t_{OFF} | $V_{IH}=3V, V_{IL}=0V$, See Test Circuit Figure 2. | +25°C | - | 38 | - | ns | |
| Break-Before-Make Delay | t_D | $V_{IH}=3V, V_{IL}=0V$, See Test Circuit Figure 3. | +25°C | - | 8 | - | ns | |
| COM-NC/NO and NC-NO Isolations | O_{ISO} | $V_{BIAS} = 2.1V, V_{IN}=0dBm, V_{IH}=3V, V_{IL}=0V$. See Test Circuit Figure 4 & Figure 5. | 100kHz | +25°C | - | -83 | - | dB |
| | | | 1MHz | +25°C | - | -61 | - | |
| | | | 10MHz | +25°C | - | -39 | - | |
| Channel-to-channel Crosstalk | X_{TALK} | $V_{BIAS} = 2.1V, V_{IN}=0dBm, V_{IH}=3V, V_{IL}=0V$ See Test Circuit | 100kHz | +25°C | - | -108 | - | dB |
| | | | 1MHz | +25°C | - | -110 | - | |

PI3A223

| Parameter | Symbol | Test Conditions | TEMP | Min. | Typ. | Max. | Units |
|---|-----------|--|-----------------|--------|------|------|---------|
| | | Figure 6. | 10MHz | +25 °C | - | -90 | - |
| 3dB Bandwidth | f_{3dB} | $V_{BIAS} = 2.1V, V_{IN}=0dBm, V_{IH}=3V, V_{IL}=0V$. See Test Circuit Figure 7. | +25 °C | - | 84 | - | MHz |
| Charge Injection Select Input to Common I/O | Q | $V_{IN} = GND, R_S = 0, C_L = 1nF, V_{IH}=3V, V_{IL}=0V$ See Test Circuit Figure 8. | +25 °C | - | 50 | - | pC |
| POWER REQUIREMENTS | | | | | | | |
| Power Supply Range | V_{DD} | - | -40 °C to 85 °C | 1.8 | - | 4.2 | V |
| Power Supply Current | I_{CC} | $V_{DD}=4.2V, V_{IN}=0V$ or V_{DD} | -40 °C to 85 °C | - | - | 1 | μA |

Capacitance

| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|--------------------|---------------|--|------|------|------|-------|
| NC Off Capacitance | $C_{NC(OFF)}$ | $f = 1MHz$, See Test Circuit Figure 9. | - | 20 | - | pF |
| NO Off Capacitance | $C_{NO(OFF)}$ | $f = 1MHz$, See Test Circuit Figure 9. | - | 20 | - | |
| NC On Capacitance | $C_{NC(ON)}$ | $f = 1MHz$, See Test Circuit Figure 10. | - | 55 | - | |
| NO On Capacitance | $C_{NO(ON)}$ | $f = 1MHz$, See Test Circuit Figure 10. | - | 55 | - | |

Test Circuits and Timing Diagrams

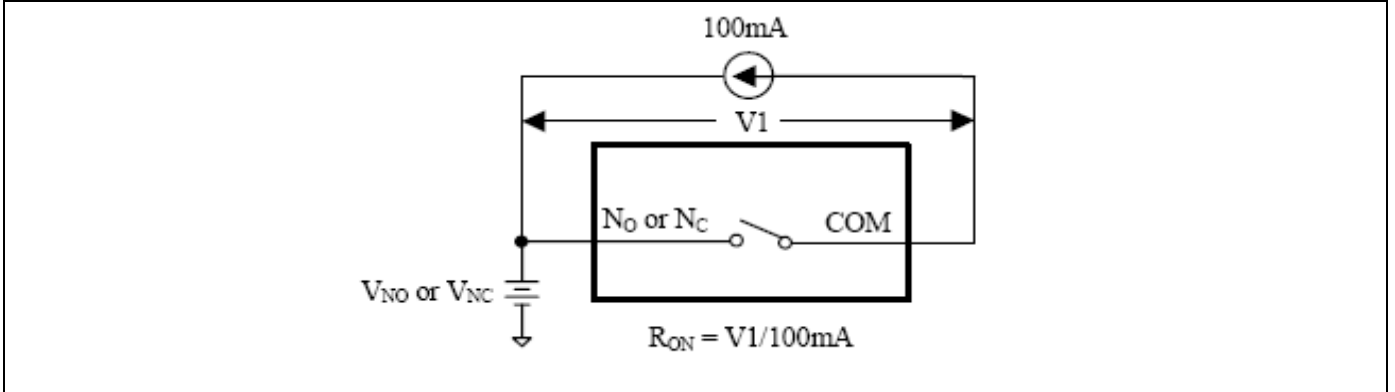


Figure 1. On Resistance

Notes:

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

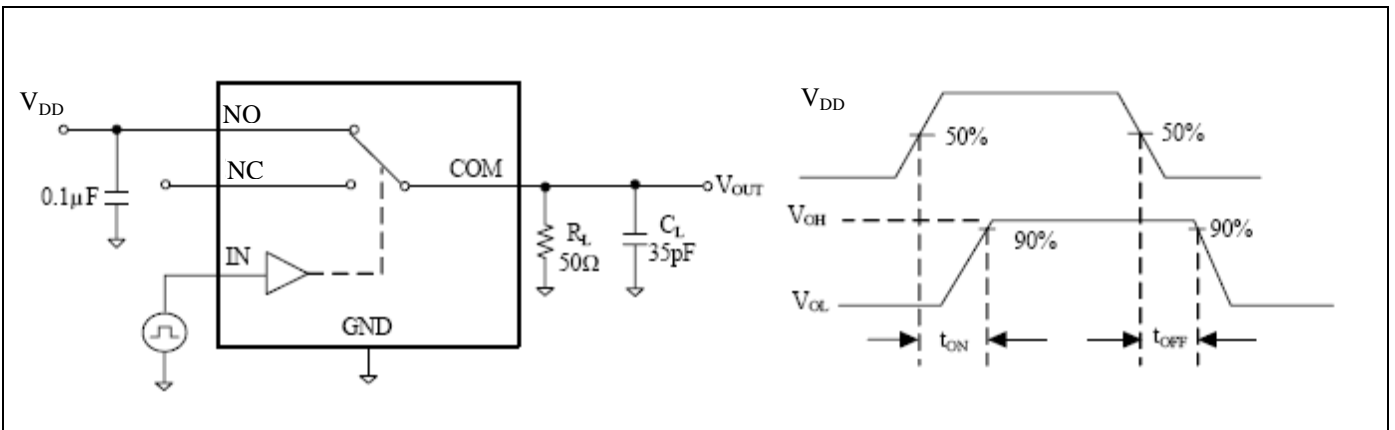


Figure 2. Switching Times

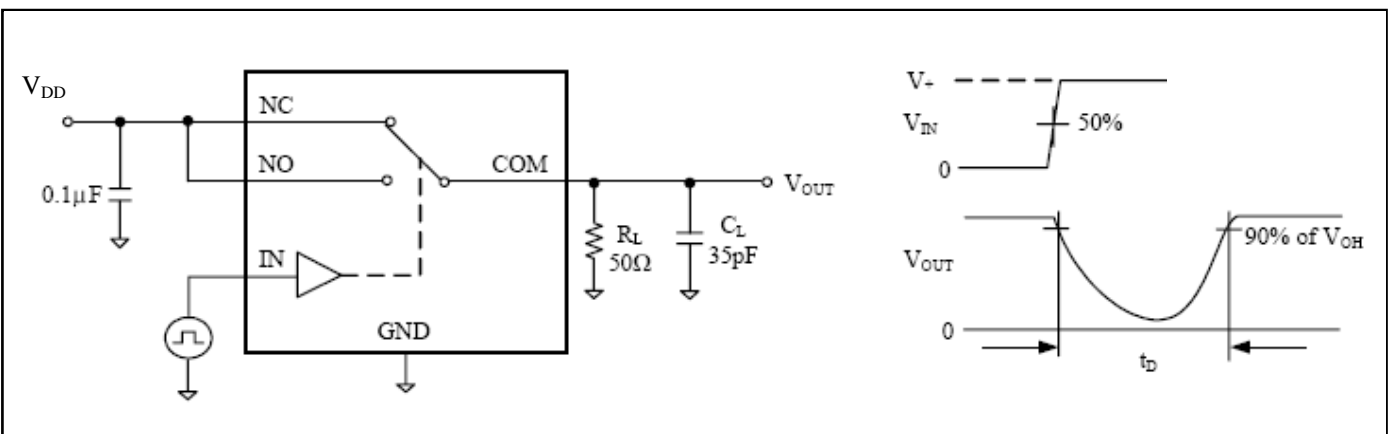


Figure 3. Break Before Make Interval Timing

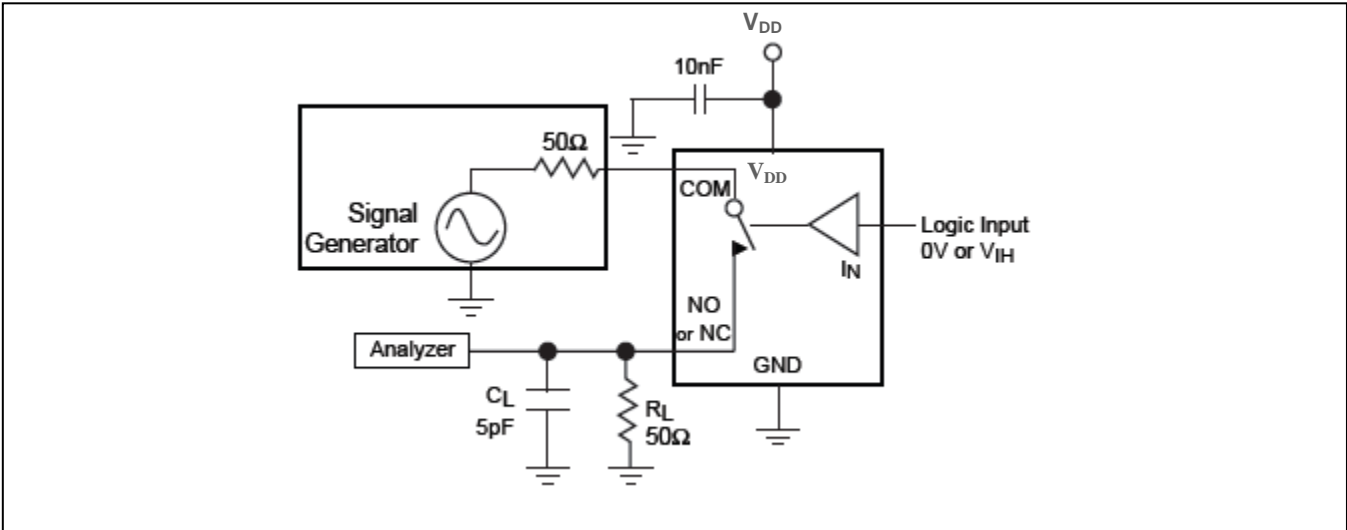


Figure 4. COM-NC/NO Isolation

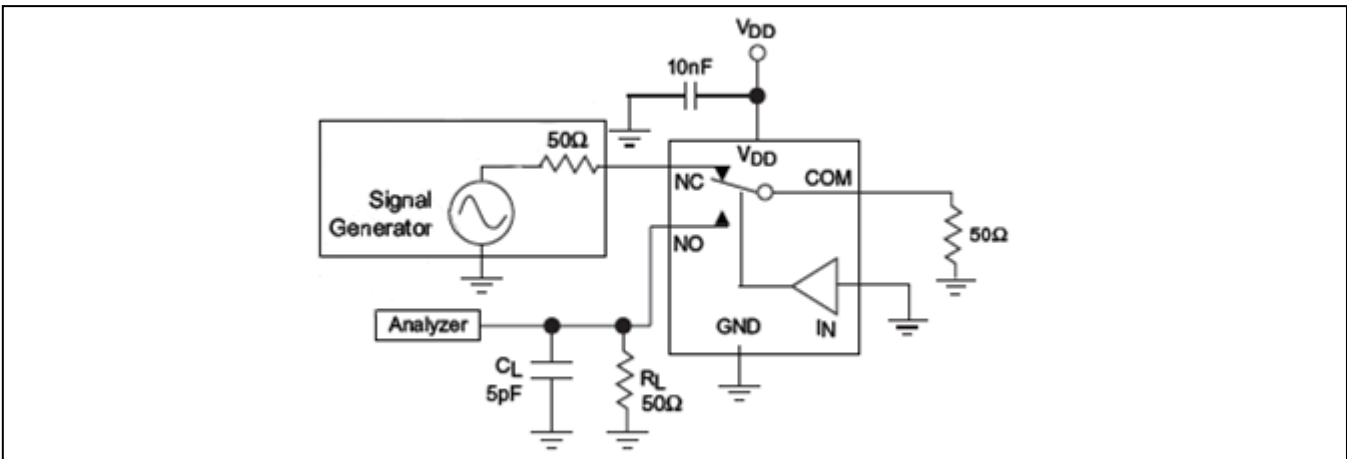


Figure 5. NC-NO Isolation

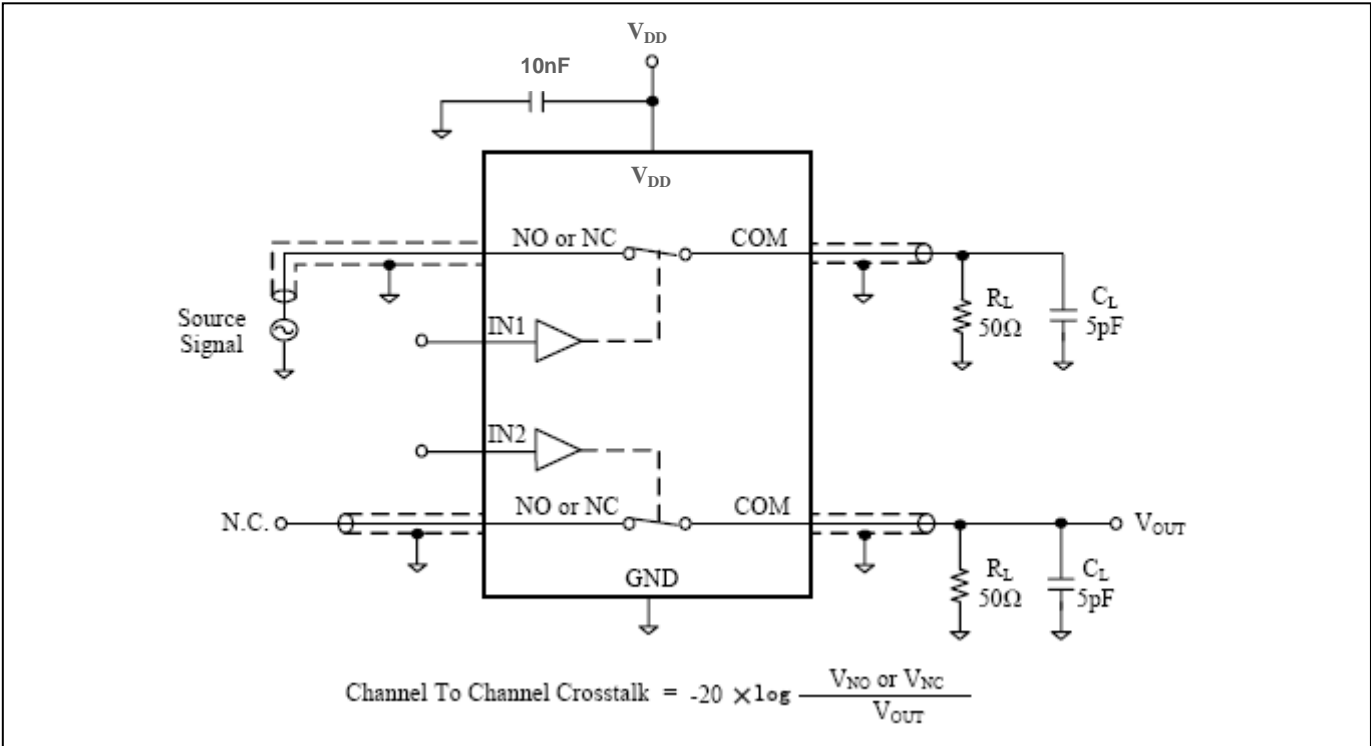


Figure 6. Channel-to-Channel Crosstalk

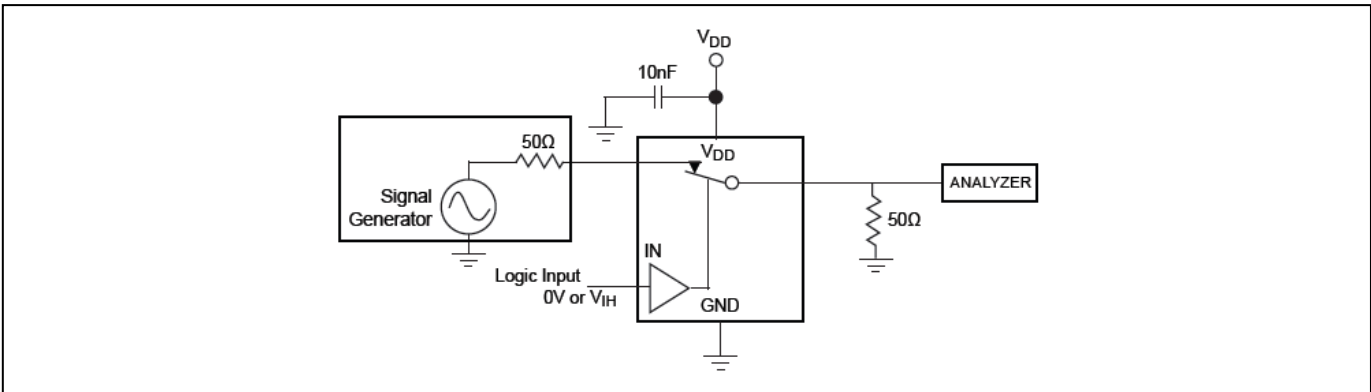


Figure 7. Bandwidth

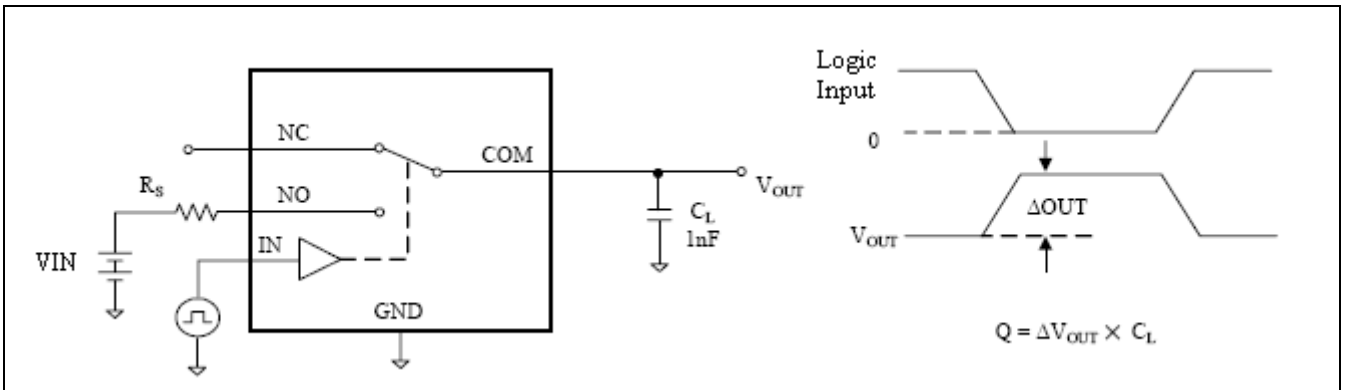


Figure 8. Charge Injection

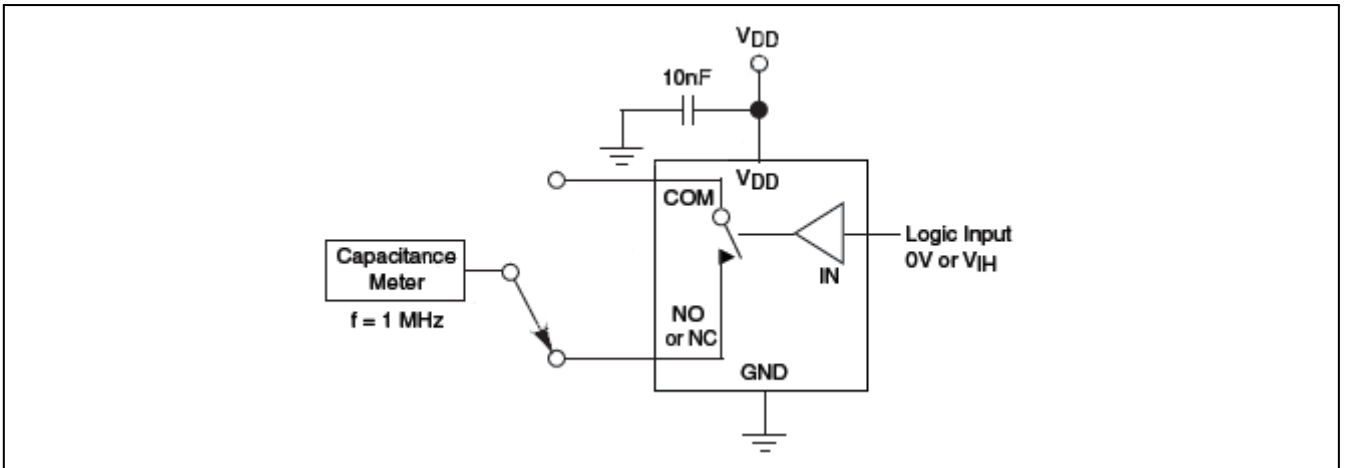


Figure 9. Channel Off Capacitance

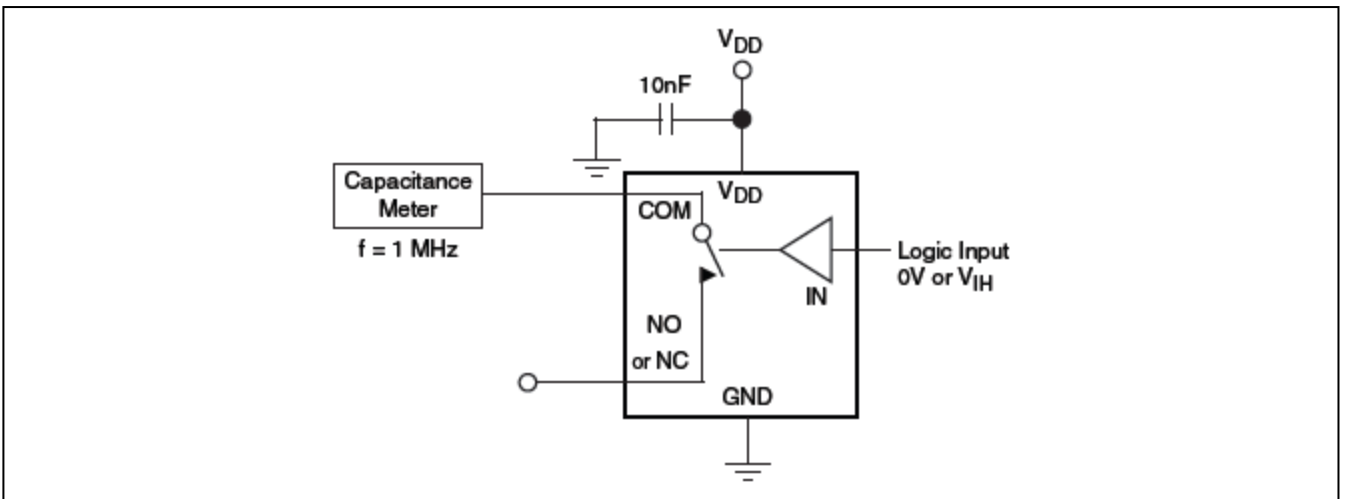
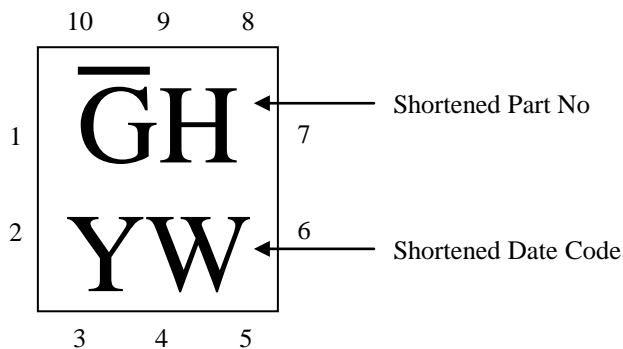


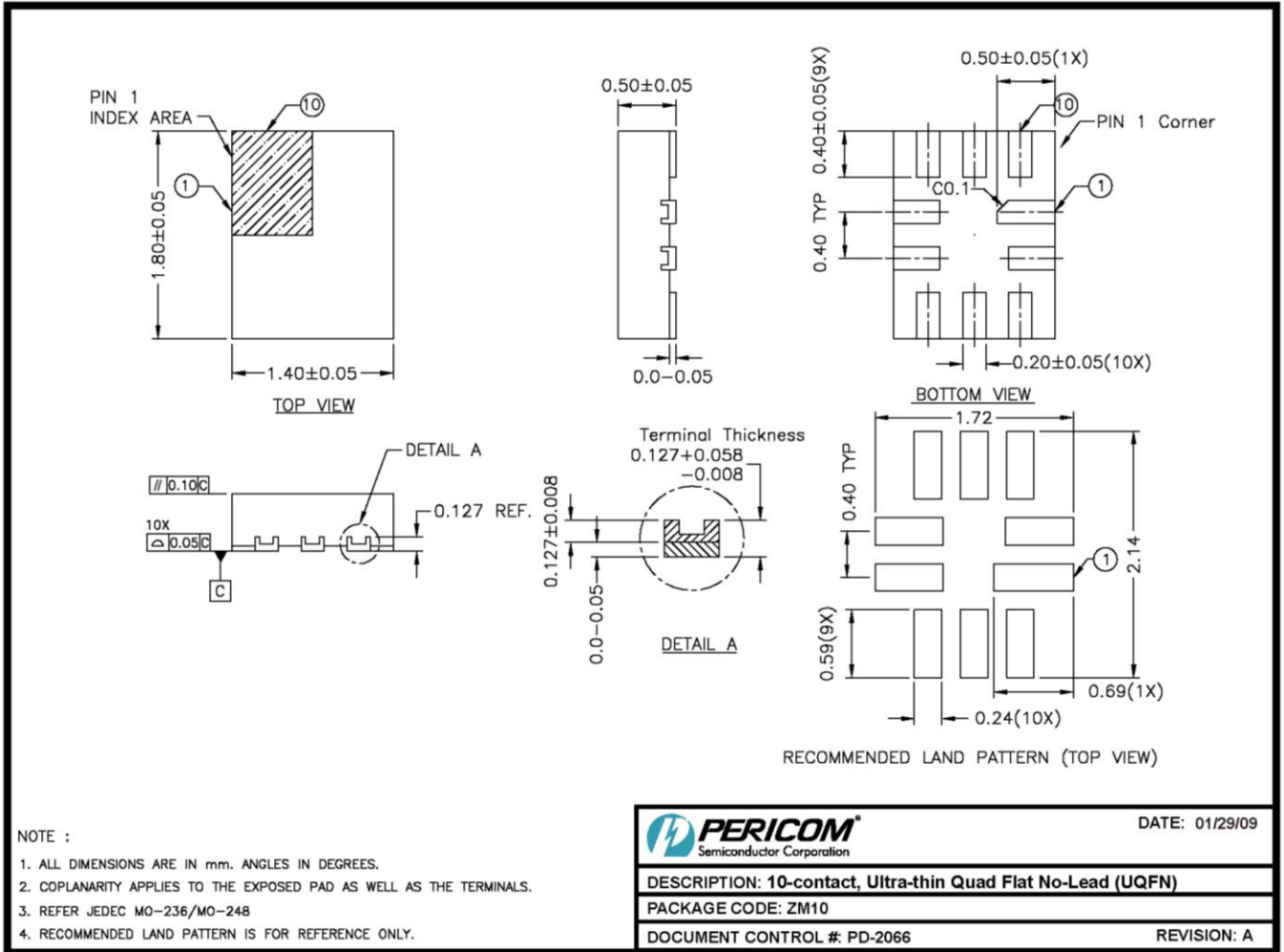
Figure 10. Channel On Capacitance

Part Marking

ZM Package



Packaging Mechanical
10-UQFN (ZM)



09-0072

For latest package info.

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

Ordering Information

| Part Number | Packaging Code | Package Description |
|-------------|----------------|---|
| PI3A223ZMEX | ZM | 10-Contact, Ultra-thin Quad Flat No-Lead (UQFN) |

Notes:

- EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant. All applicable RoHS exemptions applied.
- See <http://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
- Thermal characteristics can be found on the company web site at www.diodes.com/design/support/packaging/
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- X suffix = Tape/Reel

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