# Small Plastic Package, Dual SPDT Analog Switch

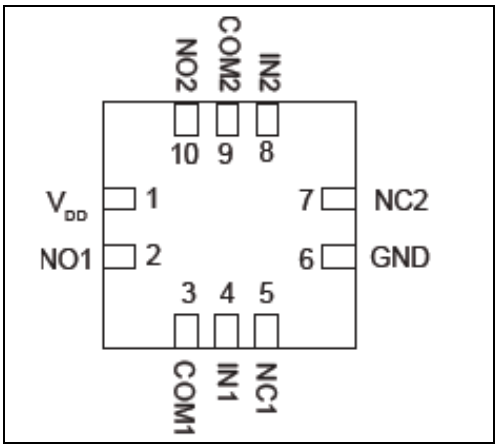
## Features

- CMOS Technology for Bus and Analog Applications
- Low On-Resistance: 0.45Ω
- Wide $V_{DD}$ Range: 1.65V 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℃ to 85℃
- 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)

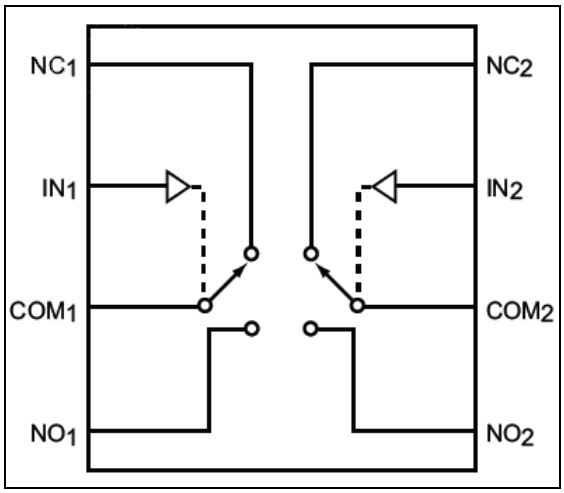



## Description

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, 1.65V 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.

## Functional Block Diagram




## Pin Description

| Pin no | 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) |

## Logic 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℃ to +150℃
Ambient Temperature with Power Applied.....-40℃ to +85℃
Supply Voltage $V_{DD}$…….-0.5Vto +4.6V
Control Input Voltage $V_{INx}$…….0Vto +4.6V
DC Input Voltage $V_{INPUT}$……-0.5Vto +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 | - | 1.65 | - | 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 | ℃ |
| $t_r$, $t_f$ | 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 ℃ to 85 ℃, unless otherwise noted. Typical values are at 3.0V and +25 ℃.)

| Parameter | Symbol | Test Conditions | | TEMP | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|---|
| **ANALOG SWITCH** | | | | | | | | |
| Analog Signal Range | $V_{NO}$, $V_{NC}$, $V_{COM}$ | - | | -40 ℃ to 85 ℃ | 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 ℃ | - | 0.55 | 0.9 | Ω |
| | | | | -40 ℃ to 85 ℃ | - | 0.55 | 1 | |
| On-Resistance Match Between Channels | $\Delta R_{ON}$ | $V_{DD}$ = 2.7V, $I_{COM}$ = 100mA, $V_{NO}$ or $V_{NC}$ =1V, *Test Circuit 1* | | +25 ℃ | - | 0.05 | 0.22 | Ω |
| | | | | -40 ℃ to 85 ℃ | - | 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 ℃ | - | 0.1 | 0.22 | Ω |
| | | | | -40 ℃ to 85 ℃ | - | 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 ℃ to 85 ℃ | - | - | 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 ℃ to 85 ℃ | - | - | 1 | µA |
| **DIGITAL INPUTS** | | | | | | | | |
| Input Logic High | $V_{IH}$ | - | | -40 ℃ to 85 ℃ | 1.2 | - | - | V |
| Input Logic Low | $V_{IL}$ | - | | -40 ℃ to 85 ℃ | - | - | 0.5 | V |
| IN Input Leakage Current | $I_{IN}$ | $V_{DD}$ = 2.7V, $V_{IN}$=0 or 2.7V | | -40 ℃ to 85 ℃ | - | - | 1 | µA |
| **DYNAMIC CHARACTERISTICS** | | | | | | | | |
| Turn-On Time | $t_{ON}$ | $V_{IH}$=1.5V, $V_{IL}$=0V, *See Test Circuit Figure 2.* | | +25 ℃ | - | 16 | - | ns |
| Turn-Off Time | $t_{OFF}$ | $V_{IH}$=1.5V, $V_{IL}$=0V, *See Test Circuit Figure 2.* | | +25 ℃ | - | 60 | - | ns |
| Break-Before-Make Delay | $t_D$ | $V_{IH}$=1.5V, $V_{IL}$=0V, *See Test Circuit Figure 3.* | | +25 ℃ | - | 10 | - | ns |
| 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 ℃ | - | -81 | - | dB |
| | | | 1MHz | +25 ℃ | - | -61 | - | |
| | | | 10MHz | +25 ℃ | - | -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 ℃ | - | -108 | - | dB |
| | | | 1MHz | +25 ℃ | - | -110 | - | |
| | | | 10MHz | +25 ℃ | - | -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 ℃ | - | 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 ℃ | - | 35 | - | pC |

**+4.2V Supply** ($V_{DD}$ = 4.2V, $T_A$ = –40℃ to 85℃, unless otherwise noted. Typical values are at 4.2V and +25℃.)

| Parameter | Symbol | Test Conditions | | TEMP | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|---|
| **ANALOG SWITCH** | | | | | | | | |
| Analog Signal Range | $V_{NO}$, $V_{NC}$, $V_{COM}$ | - | | -40 ℃ to 85 ℃ | 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 ℃ | - | 0.45 | 0.75 | Ω |
| | | | | -40 ℃ to 85 ℃ | - | 0.45 | 0.85 | |
| On-Resistance Match Between Channels | $\Delta R_{ON}$ | $V_{DD}$ = 4.2V, $I_{COM}$ = 100mA, $V_{NO}$ or $V_{NC}$ =1V, *Test Circuit 1* | | +25 ℃ | - | 0.05 | 0.18 | Ω |
| | | | | -40 ℃ to 85 ℃ | - | 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 ℃ | - | 0.1 | 0.22 | Ω |
| | | | | -40 ℃ to 85 ℃ | - | 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 ℃ to 85 ℃ | - | - | 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, $V_{CO}$M = 3V/0.3V, or floating | | -40 ℃ to 85 ℃ | - | - | 1 | µA |
| **DIGITAL INPUTS** | | | | | | | | |
| Input Logic High | $V_{IH}$ | - | | -40 ℃ to 85 ℃ | 1.2 | - | - | V |
| Input Logic Low | $V_{IL}$ | - | | -40 ℃ to 85 ℃ | - | - | 0.5 | |
| IN Input Leakage Current | $I_{IN}$ | $V_{DD}$ = 4.2V, $V_{IN}$=0 or 4.2V | | -40 ℃ to 85 ℃ | - | - | 1 | µA |
| **DYNAMIC CHARACTERISTICS** | | | | | | | | |
| Turn-On Time | $t_{ON}$ | $V_{IH}$=3V, $V_{IL}$=0V, *See Test Circuit Figure 2.* | | +25 ℃ | - | 13 | - | ns |
| Turn-Off Time | $t_{OFF}$ | $V_{IH}$=3V, $V_{IL}$=0V, *See Test Circuit Figure 2.* | | +25 ℃ | - | 38 | - | ns |
| Break-Before-Make Delay | $t_D$ | $V_{IH}$=3V, $V_{IL}$=0V, *See Test Circuit Figure 3.* | | +25 ℃ | - | 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 ℃ | - | -83 | - | dB |
| | | | 1MHz | +25 ℃ | - | -61 | - | |
| | | | 10MHz | +25 ℃ | - | -39 | - | |
| Channel-to-channel Crosstalk | $X_{TALK}$ | $V_{BIAS}$ = 2.1V, $V_{IN}$=0dBm, $V_{IH}$=3V, $V_{IL}$=0V *See Test Circuit Figure 6.* | 100kHz | +25 ℃ | - | -108 | - | dB |
| | | | 1MHz | +25 ℃ | - | -110 | - | |
| | | | 10MHz | +25 ℃ | - | -90 | - | |
| 3dB Bandwidth | $f_{3dB}$ | $V_{BIAS}$ = 2.1V, $V_{IN}$=0dBm, $V_{IH}$=3V, $V_{IL}$=0V. *See Test Circuit Figure 7.* | | +25 ℃ | - | 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 ℃ | - | 50 | - | pC |
| **POWER REQUIREMENTS** | | | | | | | | |
| Power Supply Range | $V_{DD}$ | - | | -40 ℃ to 85 ℃ | 1.65 | - | 4.2 | V |
| Power Supply Current | $I_{CC}$ | $V_{DD}$=4.2V, $V_{IN}$=0V or $V_{DD}$ | | -40 ℃ to 85 ℃ | - | - | 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

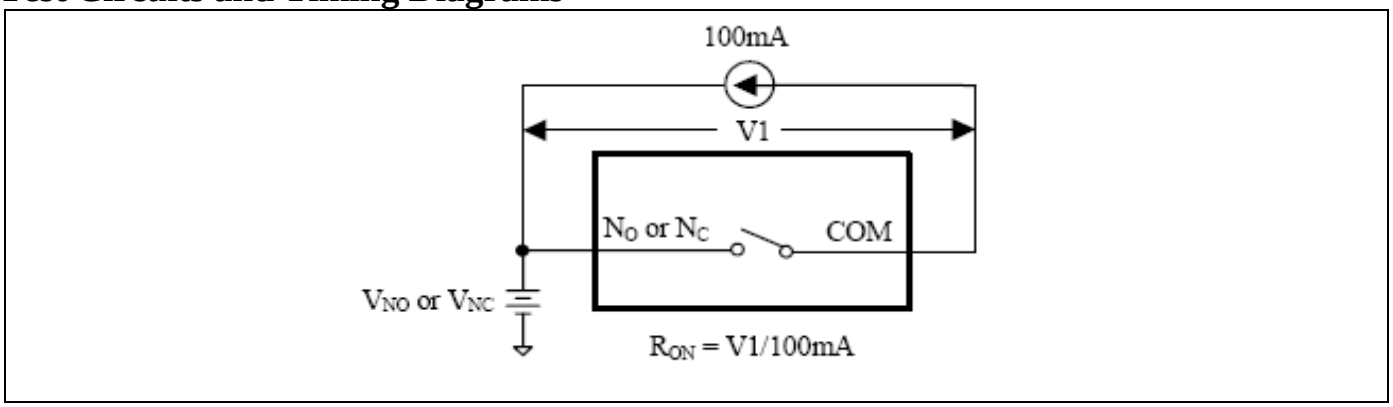



**Figure 1. On Resistance**

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

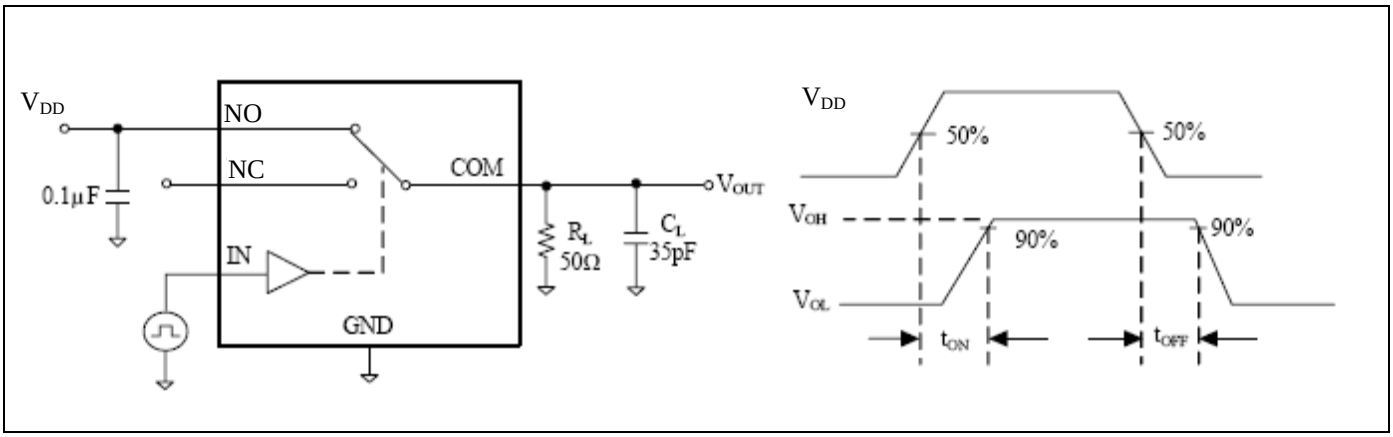



**Figure 2. Switching Times**

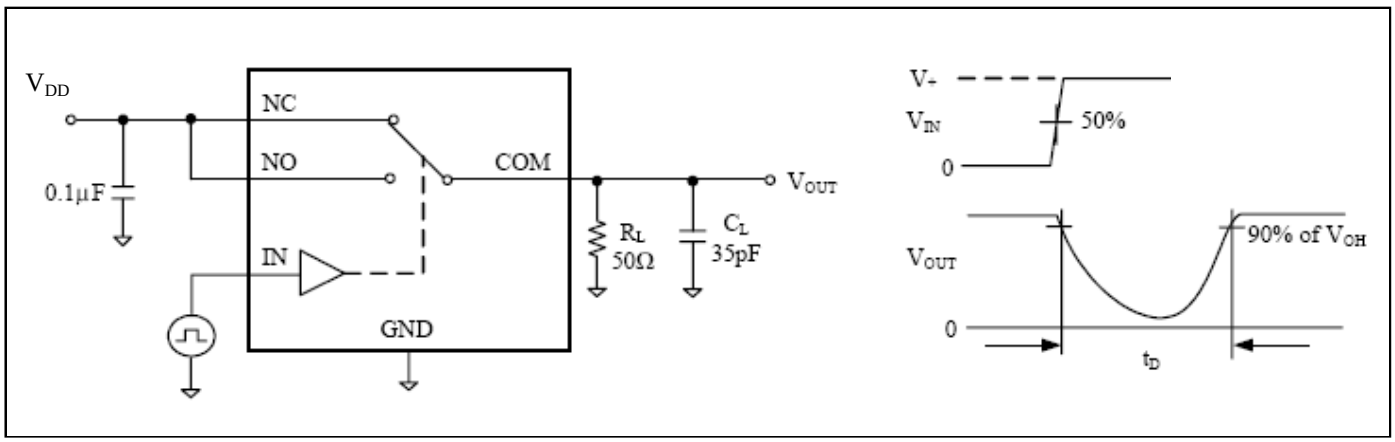



**Figure 3. Break Before Make Interval Timing**

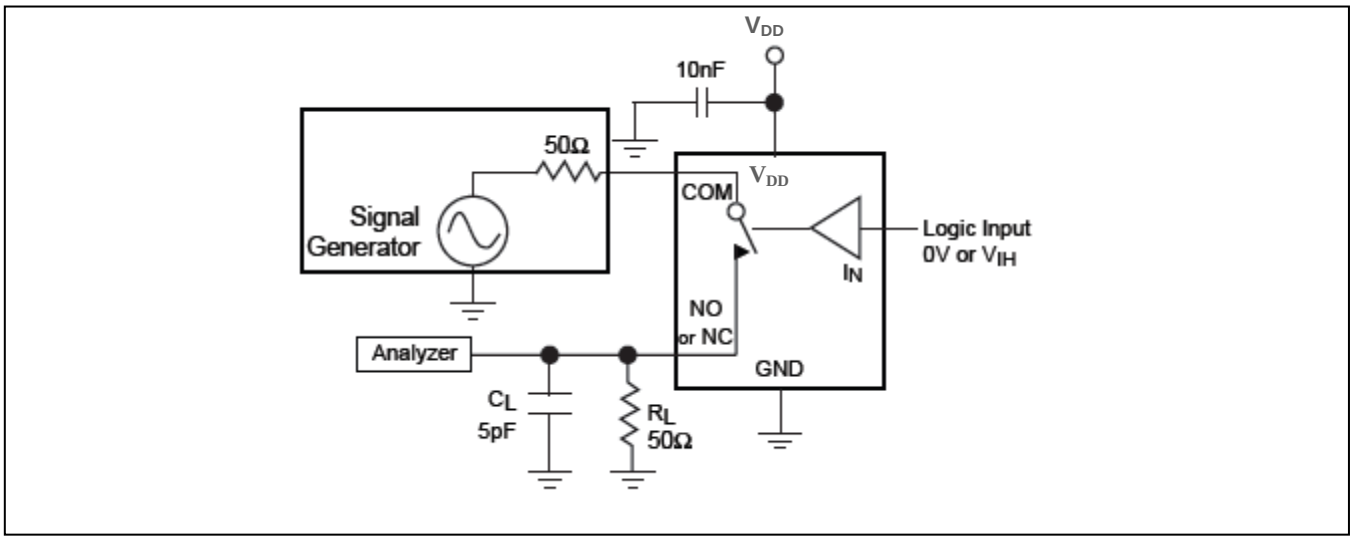



**Figure 4. COM-NC/NO Isolation**

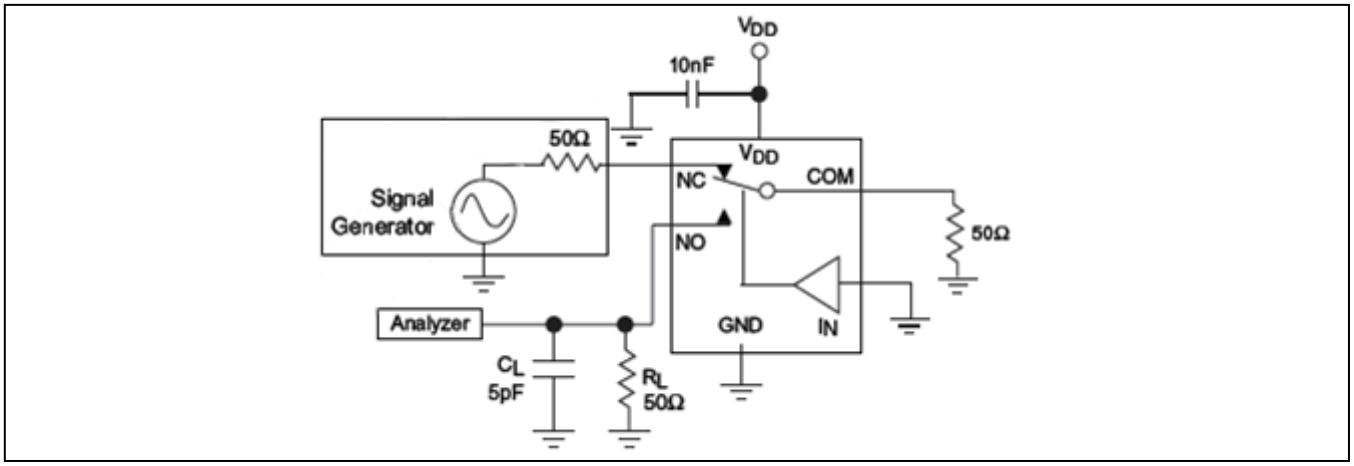



**Figure 5. NC-NO Isolation**

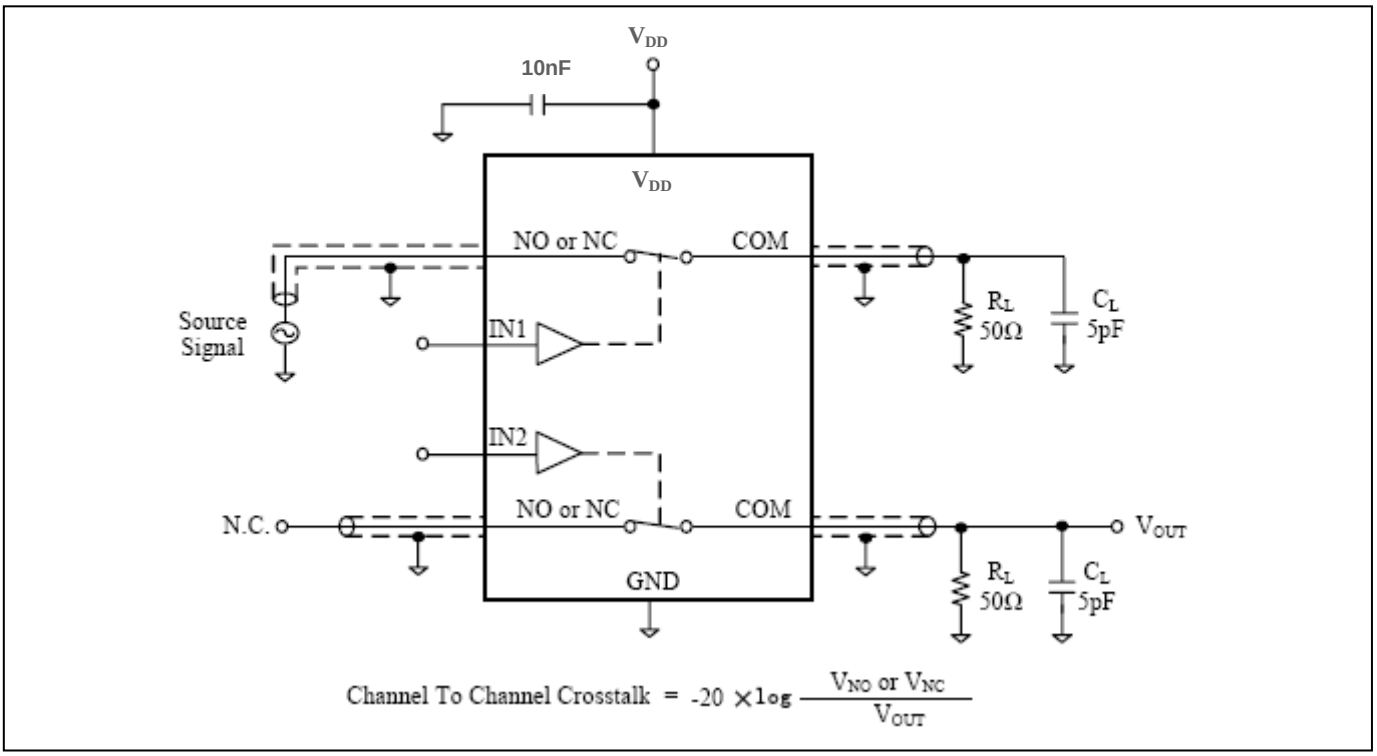



**Figure 6. Channel-to-Channel Crosstalk**

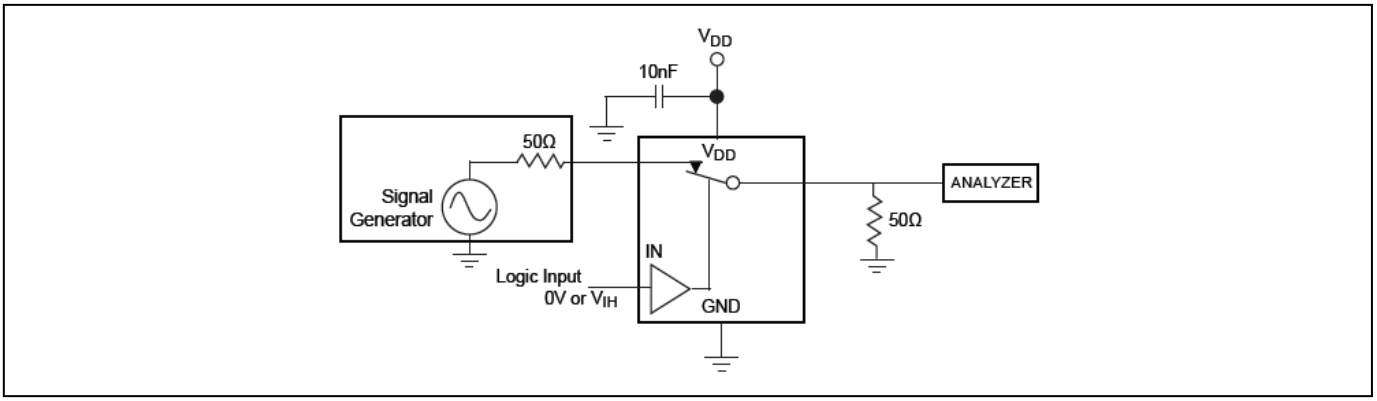



**Figure 7. Bandwidth**

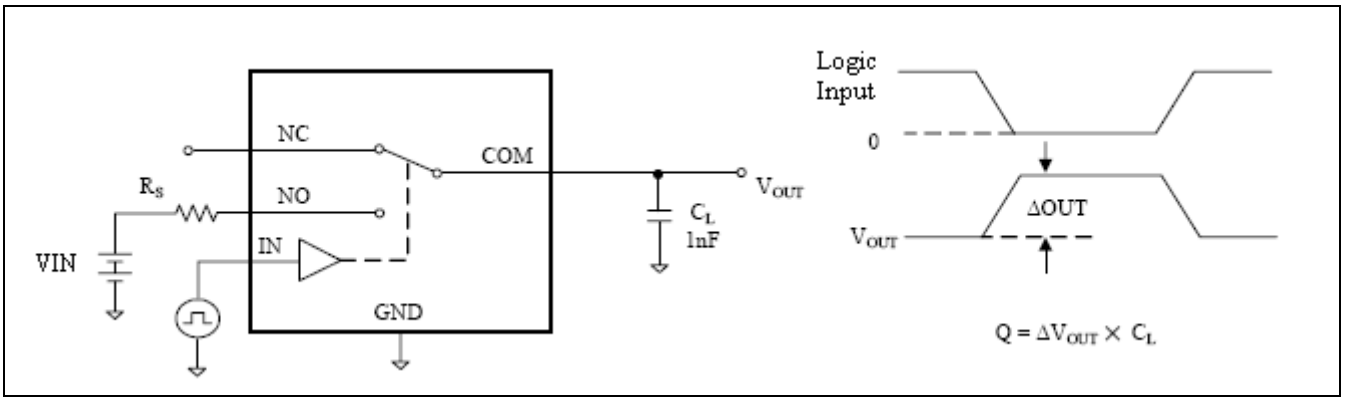



**Figure 8. Charge Injection**

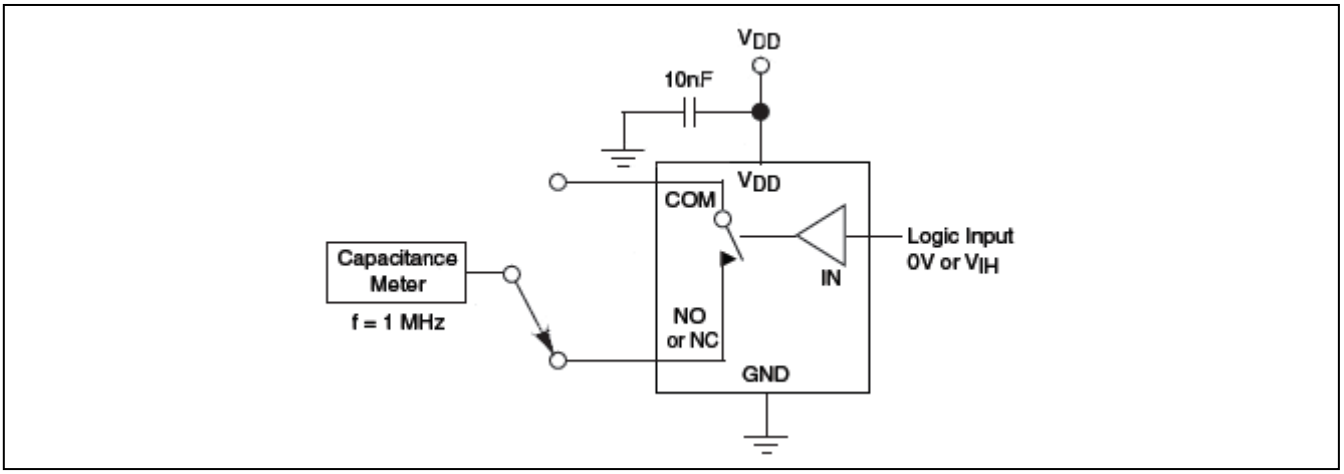



**Figure 9. Channel Off Capacitance**

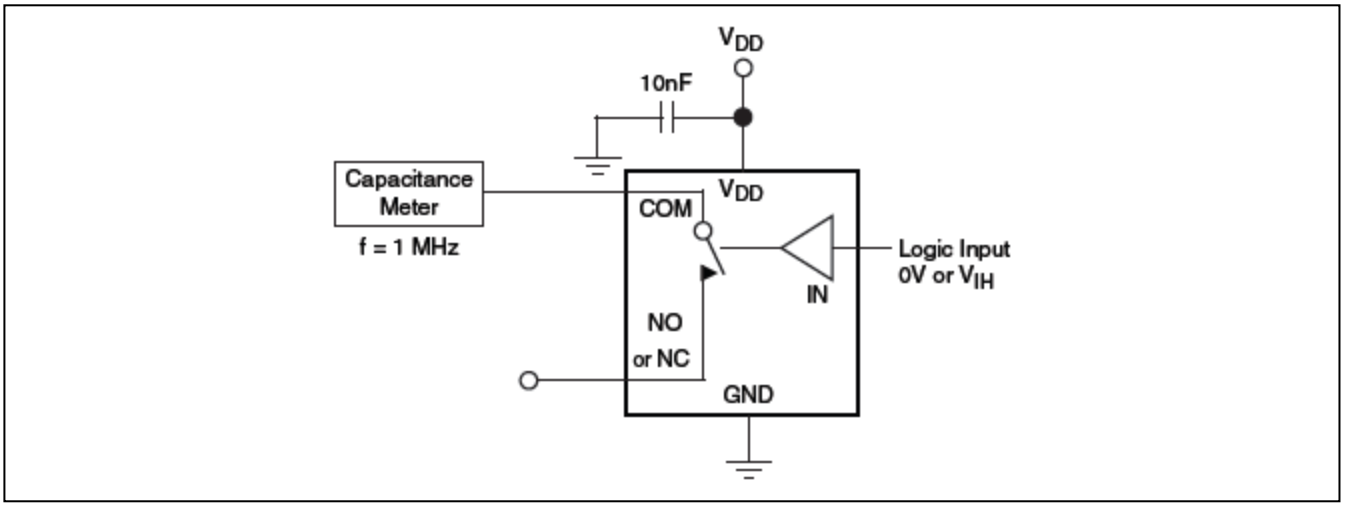
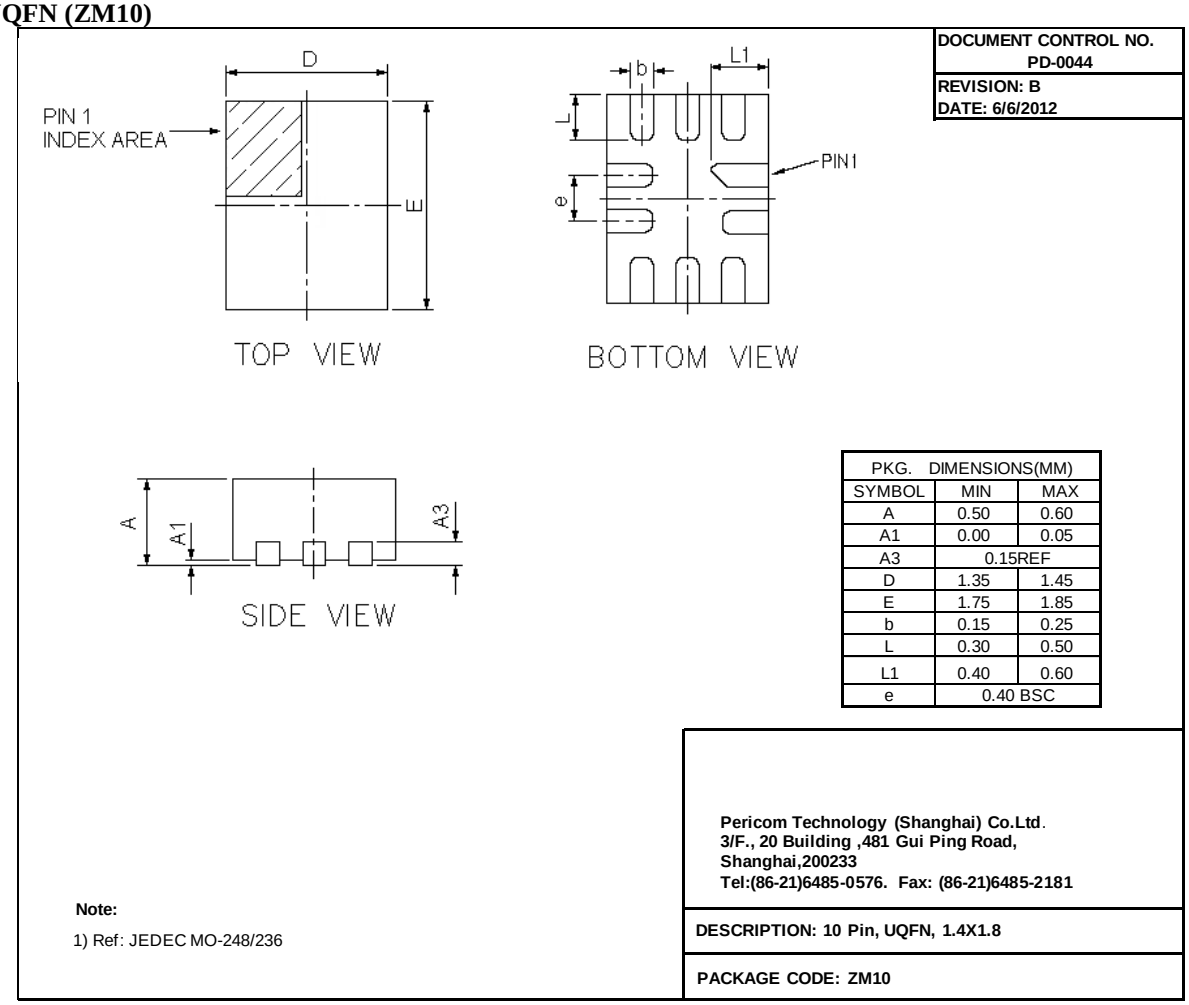


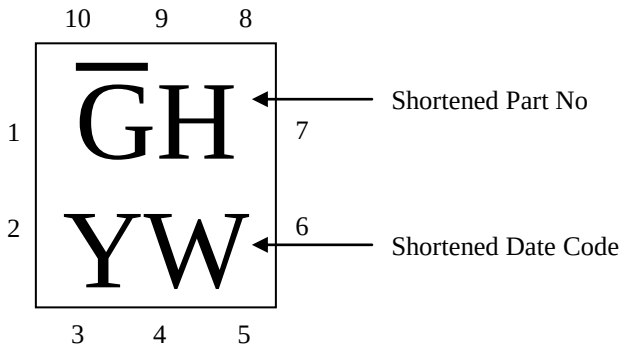

**Figure 10. Channel On Capacitance**

# Mechanical Information

**10-pin UQFN (ZM10)**




## Marking Description




# Ordering Information

| Part Number | Packaging Code | Package |
|---|---|---|
| PI3A223ZME | ZM | Lead Free and Green UQFN-10 |

**Notes:**

- E = Pb-free and Green
- Adding X Suffix= Tape/Reel