Small Plastic Package, Dual SPDT Analog Switch

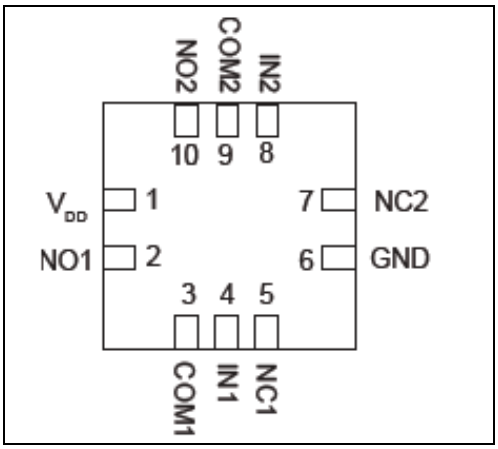
Features

- 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)

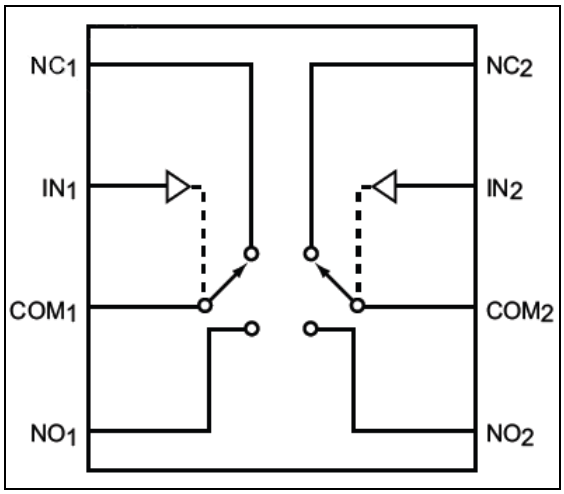


Description

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℃ 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	-	1.8	-	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	℃
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	ΔR_{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	
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} = 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	t_D	V_{IH}=1.5V, V_{IL}=0V,	+25℃	-	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℃	-	-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	ΔR_{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	
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* 100kHz	+25℃	-	-108	-	dB
		1MHz	+25℃	-	-110	-	

Parameter	Symbol	Test Conditions		TEMP	Min.	Typ.	Max.	Units
		Figure 6.	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 ℃	1.8	-	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

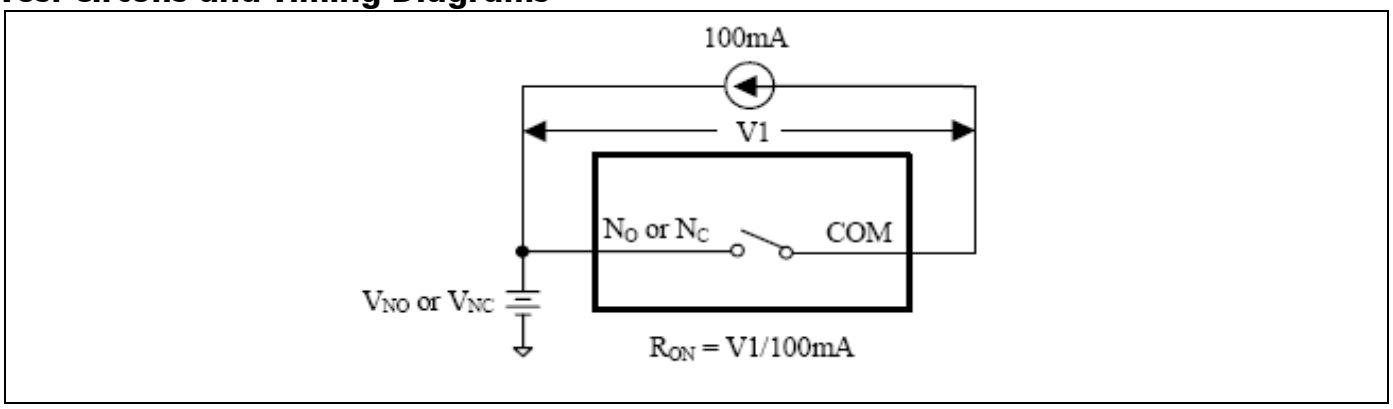


Figure 1. On Resistance

Notes:

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

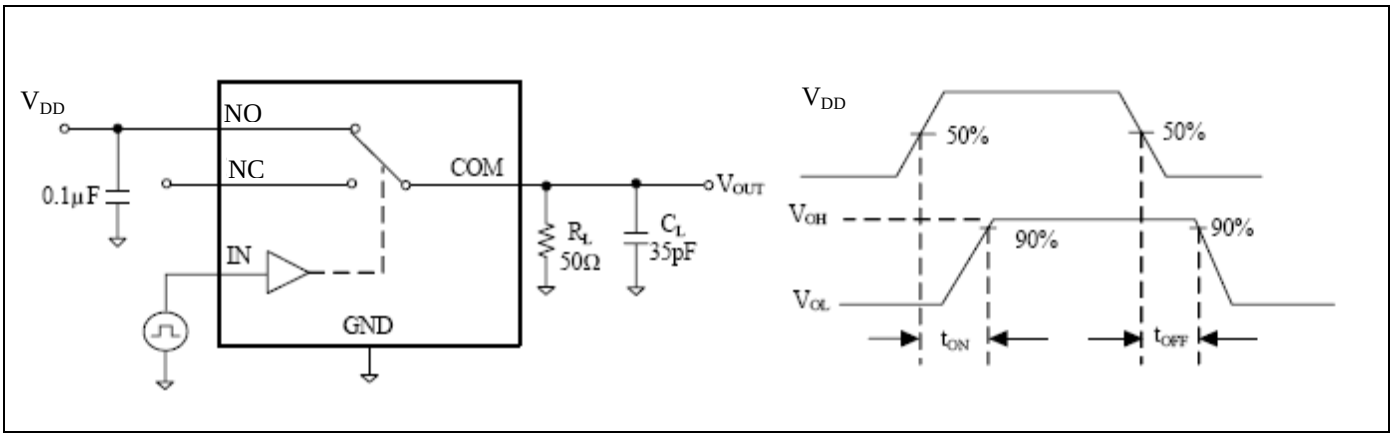


Figure 2. Switching Times

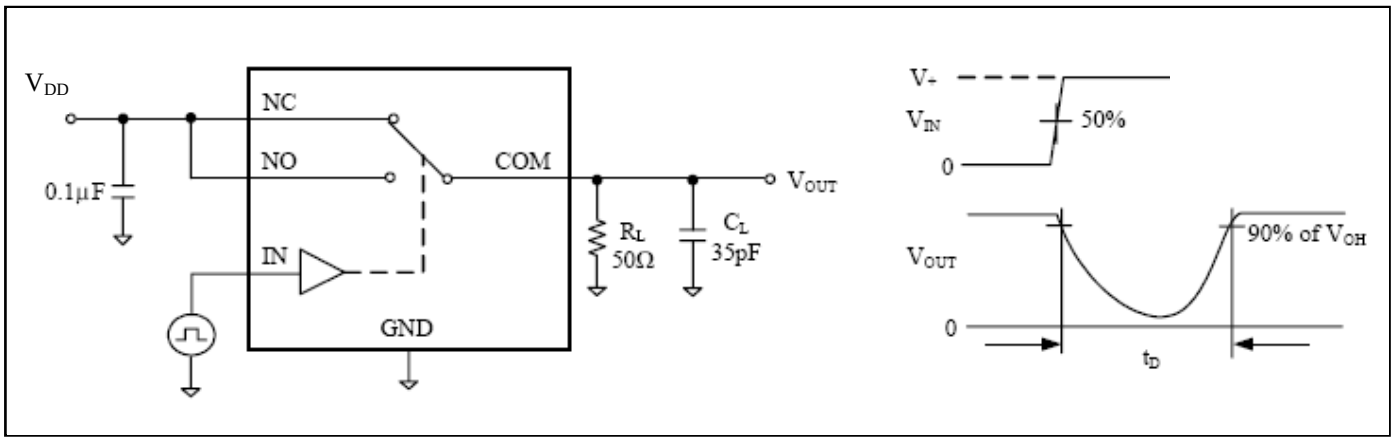


Figure 3. Break Before Make Interval Timing

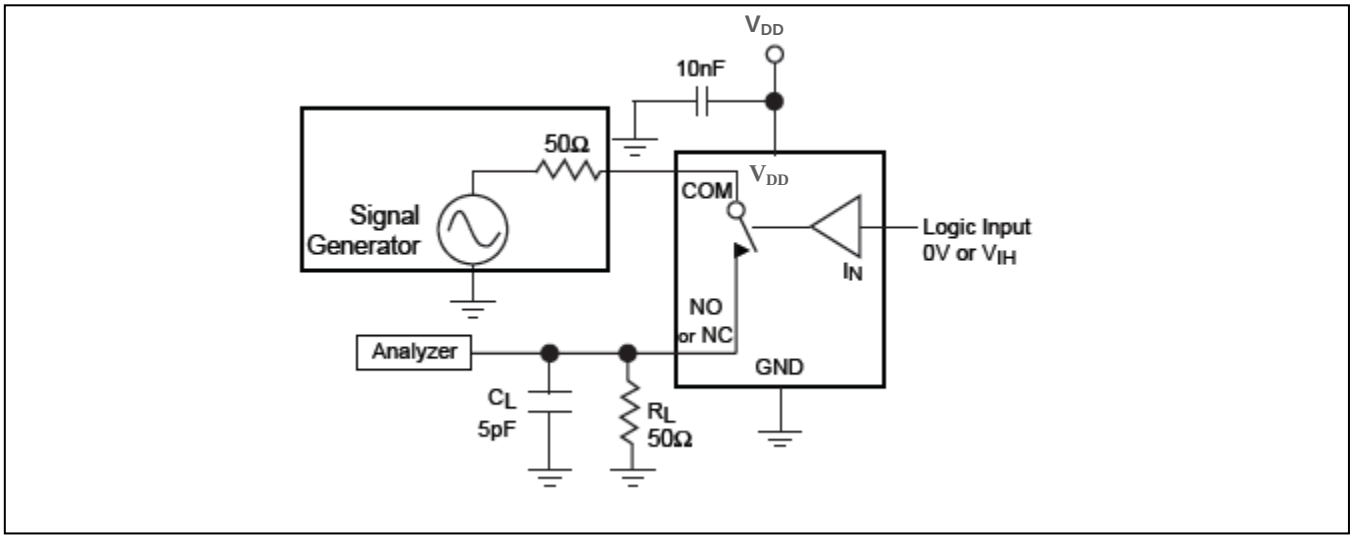


Figure 4. COM-NC/NO Isolation

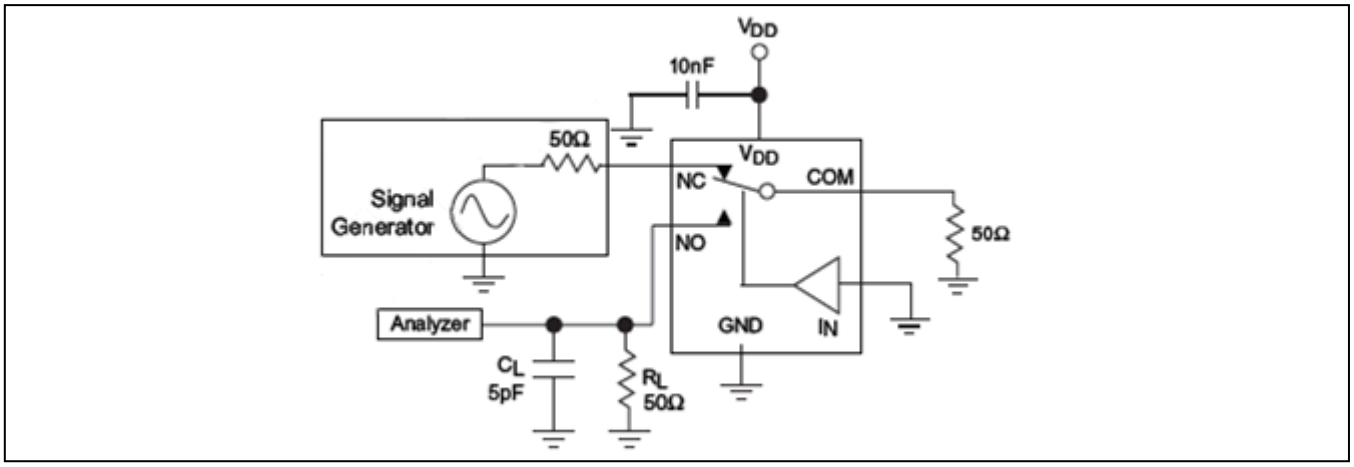


Figure 5. NC-NO Isolation

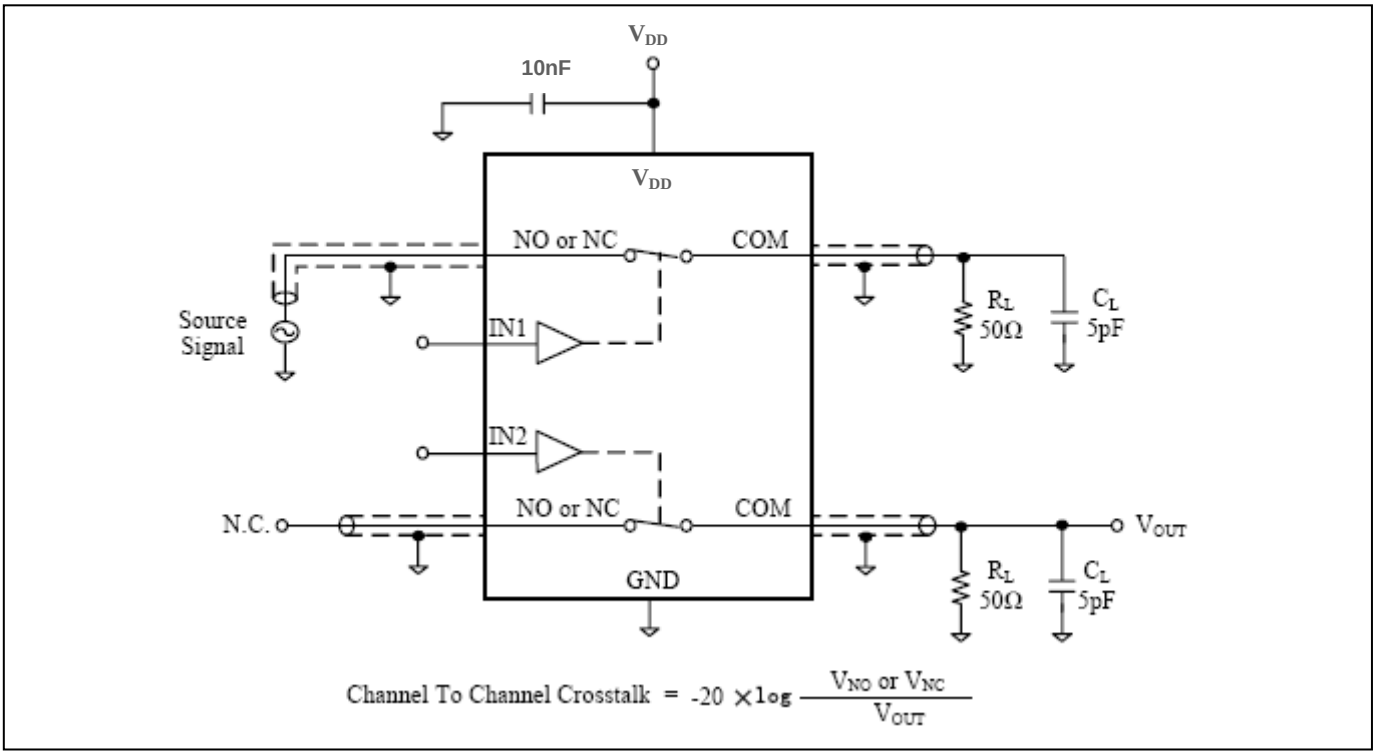


Figure 6. Channel-to-Channel Crosstalk

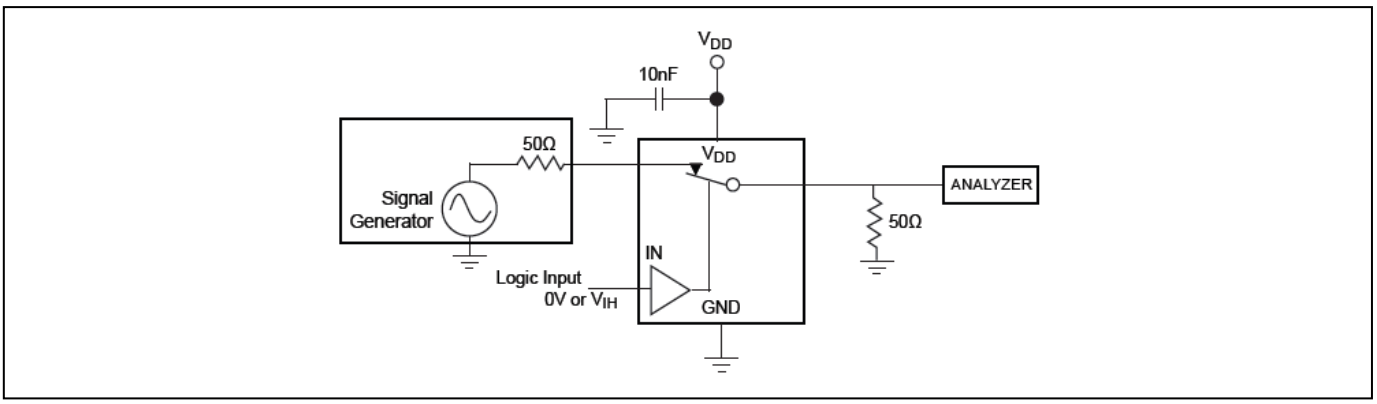


Figure 7. Bandwidth

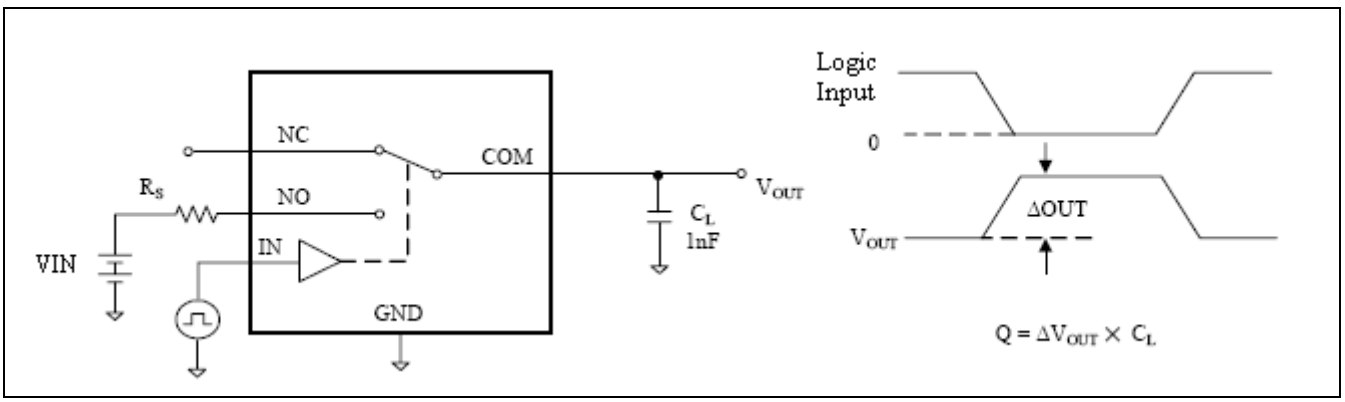


Figure 8. Charge Injection

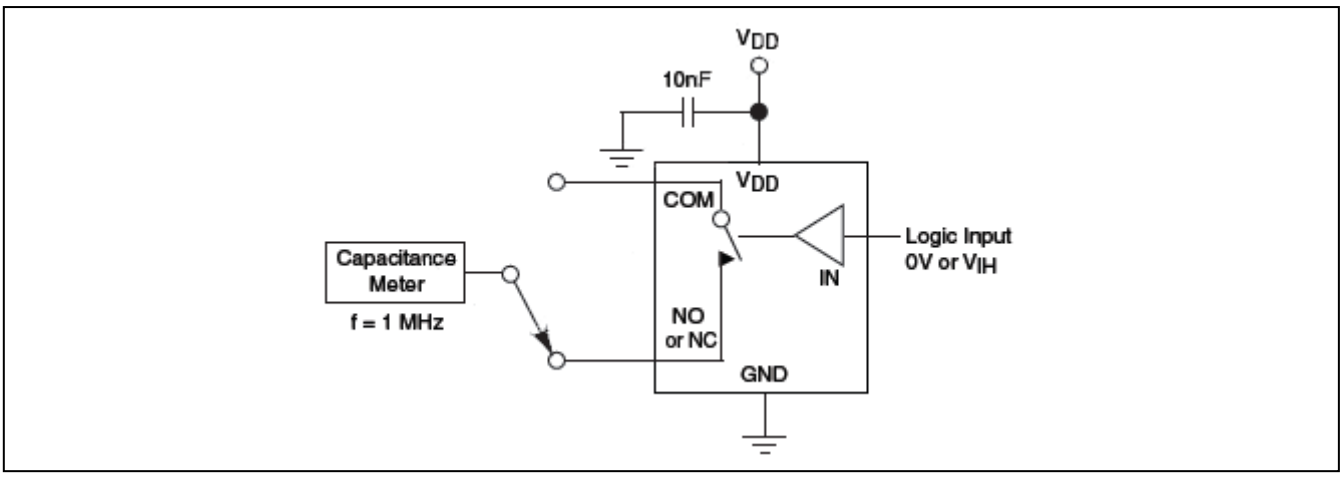


Figure 9. Channel Off Capacitance

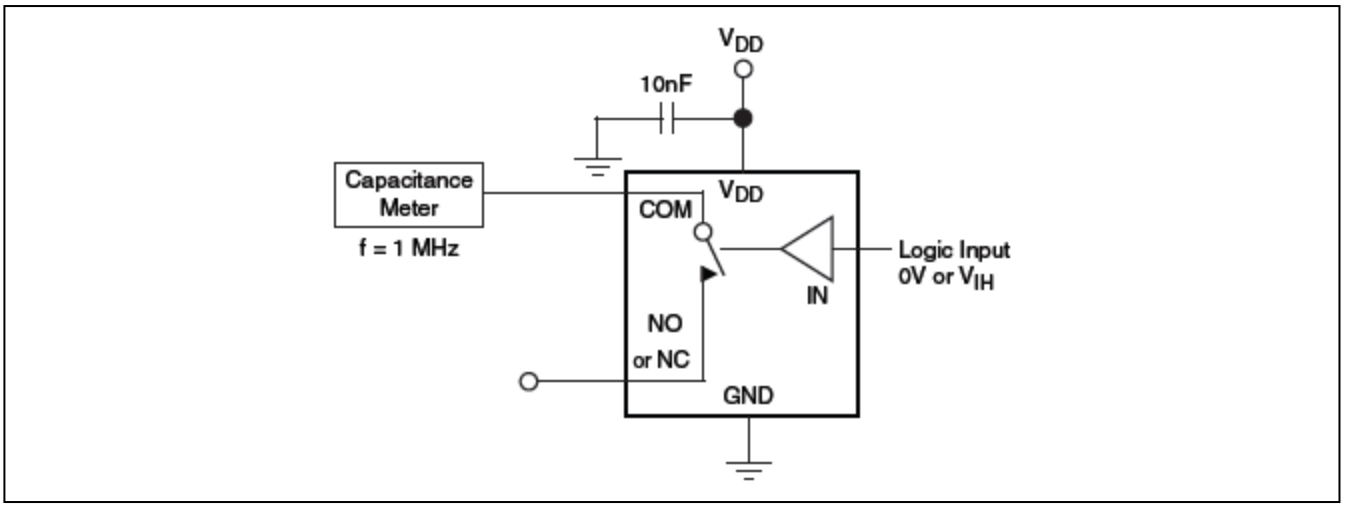
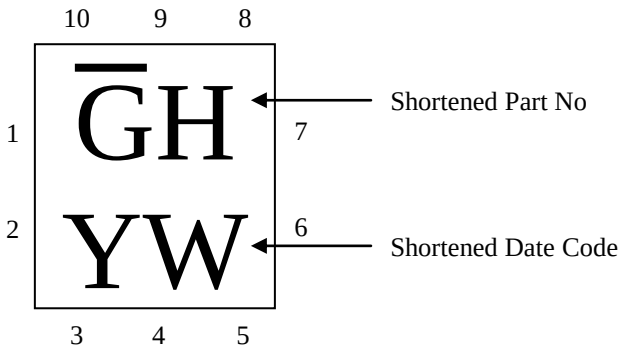


Figure 10. Channel On Capacitance

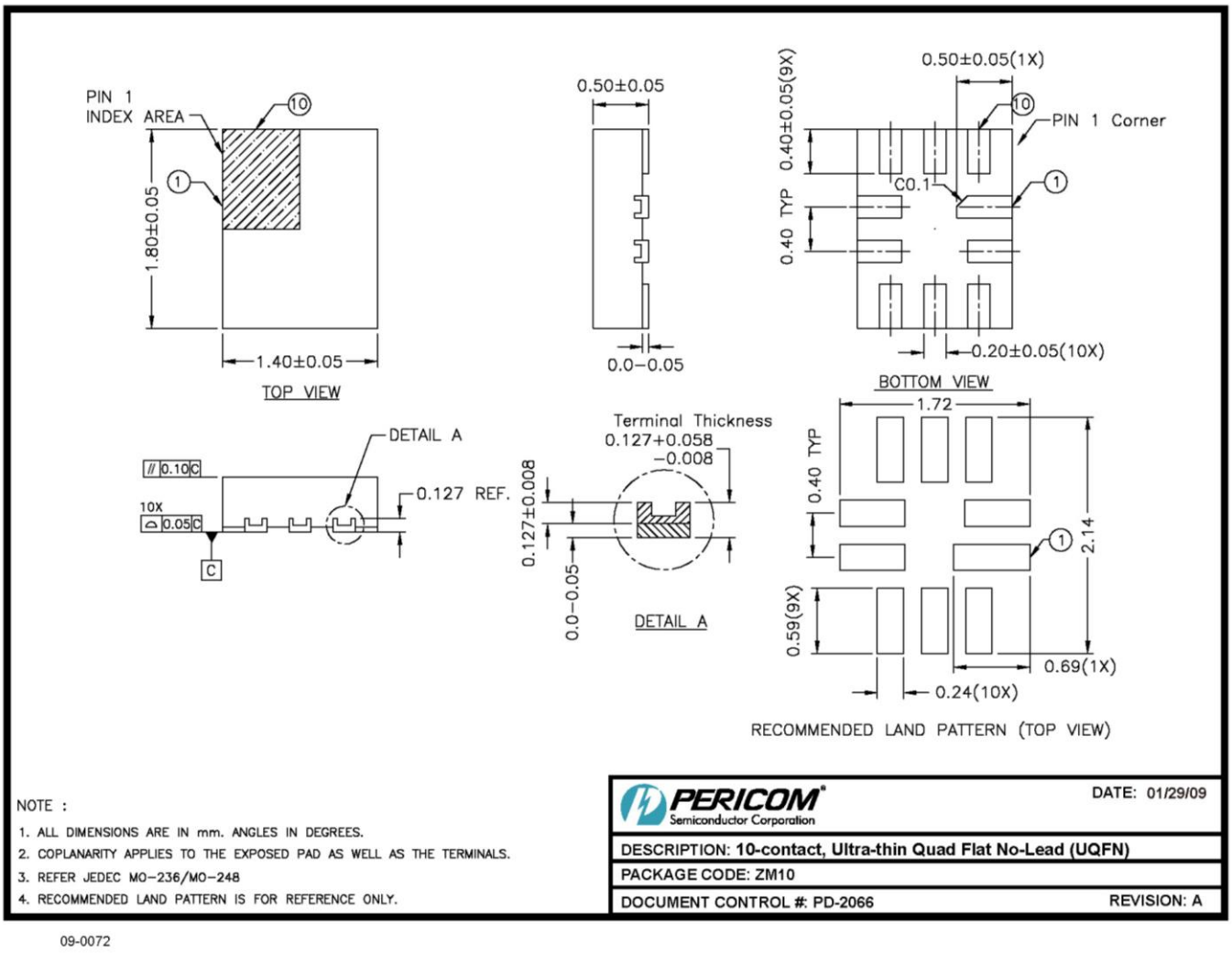
Part Marking

ZM Package



Packaging Mechanical

10-UQFN (ZM)



For latest package info.

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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.
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