Low-Voltage Dual-SPDT (0.5Ω) Analog Switch with Negative Swing Audio Capability

Features

- Negative Signal Handling Capability at all Ports
- Low On-Resistance: 0.5Ω at 3.0V Supply
- 0.25Ω Maximum R_{ON} Flatness for 3.0V Supply
- -3dB Bandwidth: 85MHz
- Low-ICCT Current Over an Expanded Control Input Range
- Wide VDD Range: 1.65V to 4.3V
- Power-off Protection on Common Ports
- Rail-to-Rail Signal Range
- High Off Isolation: -80dB @ 100kHz
- Crosstalk Rejection Reduces Signal Distortion: -80dB @ 100kHz
- Extended Industrial Temperature Range: –40°C to 85°C
- Packaging (Pb-free & Green):
  –10-contact UQFN (ZM10)

Description

PI3A268C is a dual, fast single-pole double throw (SPDT) CMOS switch with negative signal handling capability at all ports. It can be used as an analog switch or as a low-delay bus switch. Operating over a wide power supply voltage ranges from 1.65V to 4.3V, PI3A268C processes a low on-resistance and distortion.

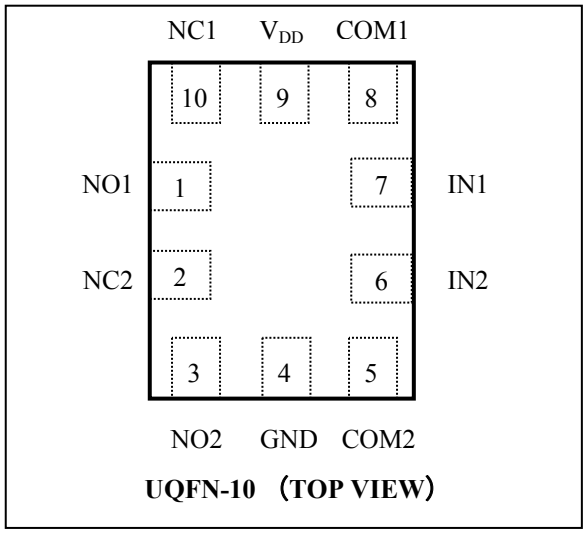
Break-before-make switching prevents both switches being enabled simultaneously. This eliminates signal disruption during switching.

PI3A268C dissipates a very low supply current even when the control voltage is lower than supply. This feature suits mobile handset applications by allowing direct interface with the general-purpose I/Os of baseband processors with minimal battery consumption.

Application

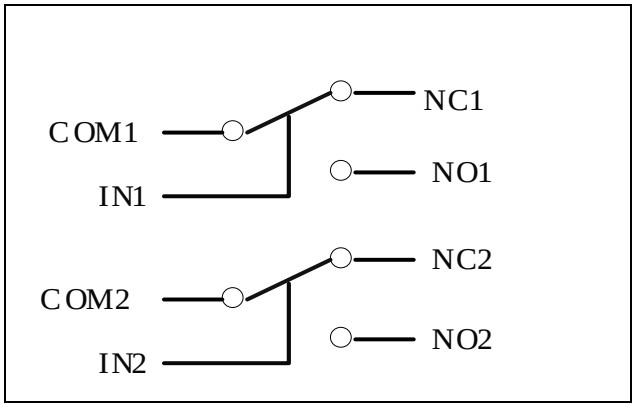
- Cell Phones, PDAs, MP3 Players
- Portable Instrumentation
- Computer Peripherals
- Speaker Headset Switching
- Power Routing
- Relay Replacement
- Audio and Video Signal Routing
- PCMCIA Cards
- Modems

Pin Assignment



UQFN-10 （TOP VIEW）

Functional Block Diagram



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}……..-0.5Vto +4.6V
DC Input Voltage V_{INPUT}……V_{DD} -4.6V to V_{DD} +0.3V
Continuous Current NO_NC_COM_……..……±350mA
Peak Current NO_NC_COM_
(pulsed at 1ms 50% duty cycle) ……..….. ±400mA
Peak Current NO_NC_COM_
(pulsed at 1ms 10% duty cycle) …….…….. ±500mA

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.
Control input must be held HIGH or LOW; it must not float.

Pin Description

Pin	Name	Description
1, 3	NO_X	Data Ports (Normally open)
4	GND	Ground
2, 10	NC_X	Data Ports (Normally closed)
5, 8	COM_X	Common Output / Data Ports
9	V_{DD}	Positive Power Supply
6, 7	IN_X	Logic Control Pins

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

Recommended Operating Conditions

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{DD}	Operating Voltage	-	1.65	-	4.3	V
V_{IN}	Control Input Voltage	-	0	-	4.3	V
V_{INPUT}	Switch Input Voltage	-	V_{DD}-4.6V	-	V_{DD}	V
T_A	Operating Temperature	-	-40	25	85	°C
t_r, t_f	Input Rise and Fall Time	-	0	-	10	ns/V

Electrical Characteristics

(T_A = –40°C to 85°C, unless otherwise noted. Typical values are at V_{DD}=3.0V and +25°C.)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
ANALOG SWITCH						
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}		V_{DD} - 4.6	-	V_{DD}	V
On-Resistance	R_{ON}	V_{DD} = 4.3V, I_{COM} = 100mA, V_{NO} or V_{NC} = -0.3V/0V/0.7V/3.6V/4.3V *Test Circuit Figure 1*	-	0.40	-	Ω
		V_{DD} = 3.0V, I_{COM} = 100mA, V_{NO} or V_{NC} = -1.6V/0V/0.7V/2.3V/3.0V *Test Circuit Figure 1*	-	0.50	0.8	
		V_{DD} = 2.3V, I_{COM} = 100mA, V_{NO} or V_{NC} = -2.3V/0V/0.7V/1.6V/2.3V *Test Circuit Figure 1*	-	0.60	-	
		V_{DD} = 1.65V, I_{COM} = 100mA, V_{NO} or V_{NC} = -2.95V/0V/1.65V *Test Circuit Figure 1*	-	1.00	-	
On-Resistance Match Between Channels	ΔR_{ON}	V_{DD} = 4.3V, I_{COM} = 100mA, V_{NO} or V_{NC} =0.7V, *Test Circuit Figure 1*	-	0.04	0.13	Ω
		V_{DD} = 3.0V, I_{COM} = 100mA, V_{NO} or V_{NC} =0.7V, *Test Circuit Figure 1*	-	0.06	0.13	
		V_{DD} = 2.3V, I_{COM} = 100mA, V_{NO} or V_{NC} =0.7V, *Test Circuit Figure 1*	-	-	0.12	
		V_{DD} = 1.65V, I_{COM} = 100mA, V_{NO} or V_{NC} =0.7V, *Test Circuit Figure 1*	-	-	1.0	
On-Resistance Flatness	R_{ONF}	V_{DD} = 4.3V, I_{COM} = 100mA, V_{NO} or V_{NC} = -0.3V, 0V, 4.3V, *Test Circuit Figure 1*	-	-	0.25	Ω
		V_{DD} = 3.0V, I_{COM} = 100mA, V_{NO} or V_{NC} = -1.6V, 0V, 3.0V, *Test Circuit Figure 1*	-	-	0.25	
		V_{DD} = 2.3V, I_{COM} = 100mA, V_{NO} or V_{NC} = -2.3V, 0V, 2.3V, *Test Circuit Figure 1*	-	0.5	-	
		V_{DD} = 1.65V, I_{COM} = 100mA, V_{NO} or V_{NC} =-2.95V, 0V, 1.65V, *Test Circuit Figure 1*	-	0.6	-	
Power-Off Leakage Current (Common Port)	I_{OFF}	Common Port (COM1, COM2), V_{IN}=0 to 4.3V, V_{DD}=0V, NC, NO floating	-1	-	1	µA
Source-Off Leakage Current	$I_{OFF\ (NO)}$ or $I_{OFF\ (NC)}$	V_{DD}=3.0V, V_{NO} or V_{NC} = -1.6V and 3.0V	-0.25	-	0.25	µA
Channel On Leakage Current	$I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM\ (ON)}$	V_{DD}=3.0V, V_{NO} or V_{NC} = -1.6V and 3.0V	-0.15	-	0.15	
Supply Current	I_{CC}	V_{DD}=4.3V, V_{IN}=0 or V_{DD}	-0.5	-	0.5	µA
Increase in I_{CC} per Input	I_{CCT}	V_{DD}=4.3V, Input at 2.6V	-	3	10.0	
		V_{DD}=4.3V, Input at 1.8V	-	7	15.0	
DIGITAL INPUTS						
Input Logic High	V_{IH}	V_{DD}=3.60V to 4.3V	1.70	-	-	V
		V_{DD}=3.00V to 3.60V	1.50	-	-	
		V_{DD}=2.70V to 3.00V	1.35	-	-	
		V_{DD}=2.30V to 2.70V	1.30	-	-	
		V_{DD}=1.65V to 2.30V	0.90	-	-	
Input Logic Low	V_{IL}	V_{DD}=3.60V to 4.30V	-	-	0.6	
		V_{DD}=2.70V to 3.60V	-	-	0.5	
		V_{DD}=2.30V to 2.70V	-	-	0.4	
		V_{DD}=1.65V to 2.30V	-	-	0.4	
IN Input Leakage Current	I_{IN}	V_{IN}=0 or V_{DD}	-0.5	-	0.5	µA
To be continued.						

Continuously.						
Parameter	**Symbol**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
DYNAMIC CHARACTERISTICS						
Turn-On Time	t_{ON}	V_{DD}=3.60V to 4.30V, V_{IH}=1.5V, V_{IL}=0V, R_L=50Ω, C_L=35pF. *See Test Circuit Figure 2.*	-	-	50	ns
		V_{DD}=2.70V to 3.60V, V_{IH}=1.5V, V_{IL}=0V, R_L=50Ω, C_L=35pF. *See Test Circuit Figure 2.*	-	-	50	
		V_{DD}=2.30V to 2.70V, V_{IH}=1.5V, V_{IL}=0V, R_L=50Ω, C_L=35pF. *See Test Circuit Figure 2.*	-	-	50	
		V_{DD}=1.65V to 2.30V, V_{IH}=1.5V, V_{IL}=0V, R_L=50Ω, C_L=35pF. *See Test Circuit Figure 2.*	-	40	-	
Turn-Off Time	t_{OFF}	V_{DD}=3.60V to 4.30V, V_{IH}=1.5V, V_{IL}=0V, R_L=50Ω, C_L=35pF. *See Test Circuit Figure 2.*	-	-	50	ns
		V_{DD}=2.70V to 3.60V, V_{IH}=1.5V, V_{IL}=0V, R_L=50Ω, C_L=35pF. *See Test Circuit Figure 2.*	-	-	55	
		V_{DD}=2.30V to 2.70V, V_{IH}=1.5V, V_{IL}=0V, R_L=50Ω, C_L=35pF.*See Test Circuit Figure 2.*	-	-	60	
		V_{DD}=1.65V to 2.30V, V_{IH}=1.5V, V_{IL}=0V, R_L=50Ω, C_L=35pF. *See Test Circuit Figure 2.*	-	60	-	
Break-Before-Make Delay	t_{BBM}	V_{DD}=3.60V to 4.30V, V_{IH}=1.5V, R_L=50Ω, C_L=35pF. *See Test Circuit Figure 3.*	-	6	-	ns
		V_{DD}=2.70V to 3.60V, V_{IH}=1.5V, R_L=50Ω, C_L=35pF. *See Test Circuit Figure 3.*	-	7	-	
		V_{DD}=2.30V to 2.70V, V_{IH}=1.5V, R_L=50Ω, C_L=35pF. *See Test Circuit Figure 3.*	-	10	-	
		V_{DD}=1.65V to 2.30V, V_{IH}=1.5V, R_L=50Ω, C_L=35pF. *See Test Circuit Figure 3.*	-	21	-	
NC-NO and COM-NC/NO Off-Isolation	O_{ISO}	V_{DD}=1.65V to 4.3V, V_{BIAS} =1.5V, V_{IN}=0dBm, V_{IH}=1.5V, V_{IL}=0V. 100kHz *See Test Circuit Figure 4 and Figure 5*	-	-80	-	dB
Channel-to-Channel Crosstalk	X_{TALKD}	V_{DD}=1.65V to 4.3V, V_{BIAS}=1.5V, V_{IN}=0dBm,V_{IH}=1.5V, V_{IL}=0V 100kHz *See Test Circuit Figure 6*	-	-80	-	dB
3dB Bandwidth	f_{3dB}	V_{DD}=1.65V to 4.3V, V_{IN}=0dBm, V_{IH}=1.5V, V_{IL}=0V. *See Test Circuit Figure 7.*	-	85	-	MHz
Charge Injection Select Input to Common I/O	Q	V_{DD}=1.65V to 4.30V, V_{IN} = GND, R_S = 0, C_L = 1nF, V_{IH}=1.5V, V_{IL}=0V *See Test Circuit Figure 8.*	-	52	-	pC
Total Harmonic Distortion	THD	V_{DD}=1.65V to 4.30V, f=20Hz to 20kHz, R_L=32Ω, V_{IN}=2V_{PP}, V_{BIAS}=0V	-	0.06	-	%

Capacitance

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Control Pin Input Capacitance	C_{IN}	V_{DD}=0V, f=1MHz,	-	6	-	pF
NC Off Capacitance	$C_{NC\ (OFF)}$	V_{DD}=3.3V, f = 1MHz, See Test Circuit Figure 9.	-	21	-	
NO Off Capacitance	$C_{NO\ (OFF)}$	V_{DD}=3.3V, f = 1MHz, See Test Circuit Figure 9.	-	21	-	
NC On Capacitance	$C_{NC\ (ON)}$	V_{DD}=3.3V, f = 1MHz, See Test Circuit Figure 10.	-	65	-	
NO On Capacitance	$C_{NO\ (ON)}$	V_{DD}=3.3V, f = 1MHz, See Test Circuit Figure 10.	-	65	-	

Test Circuits and Timing Diagrams

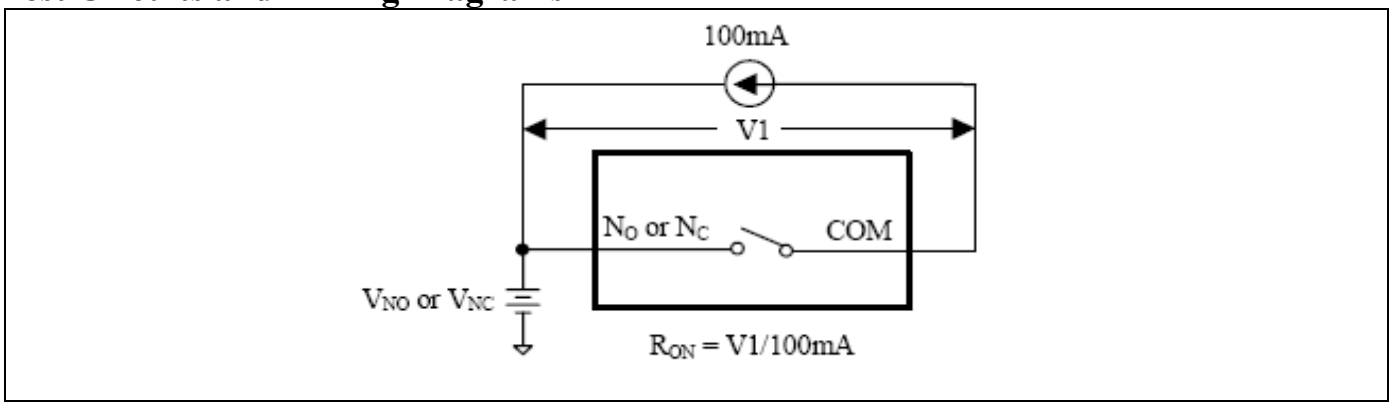


Figure 1. On Resistance

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

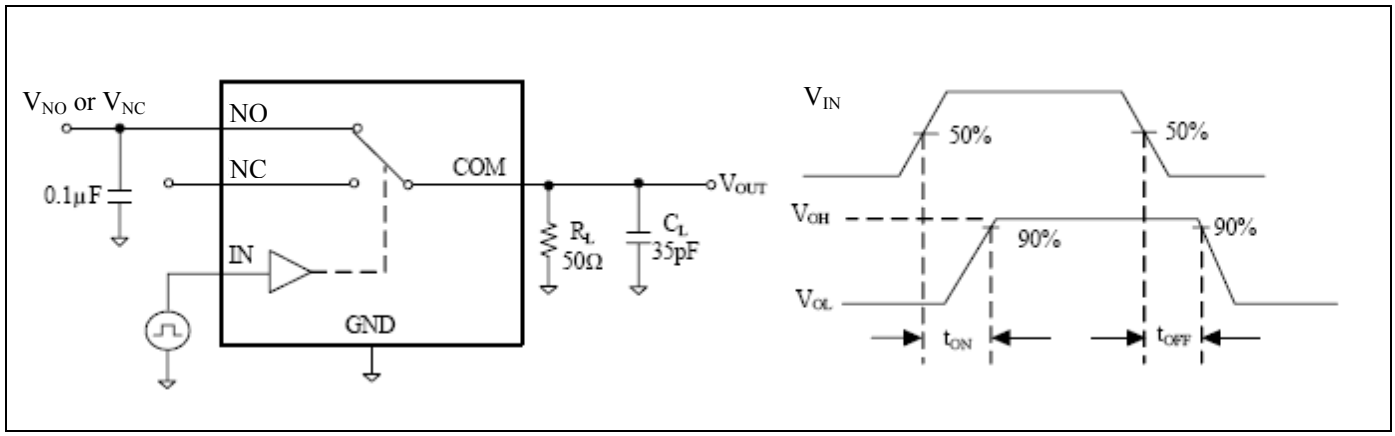


Figure 2. Switching Times

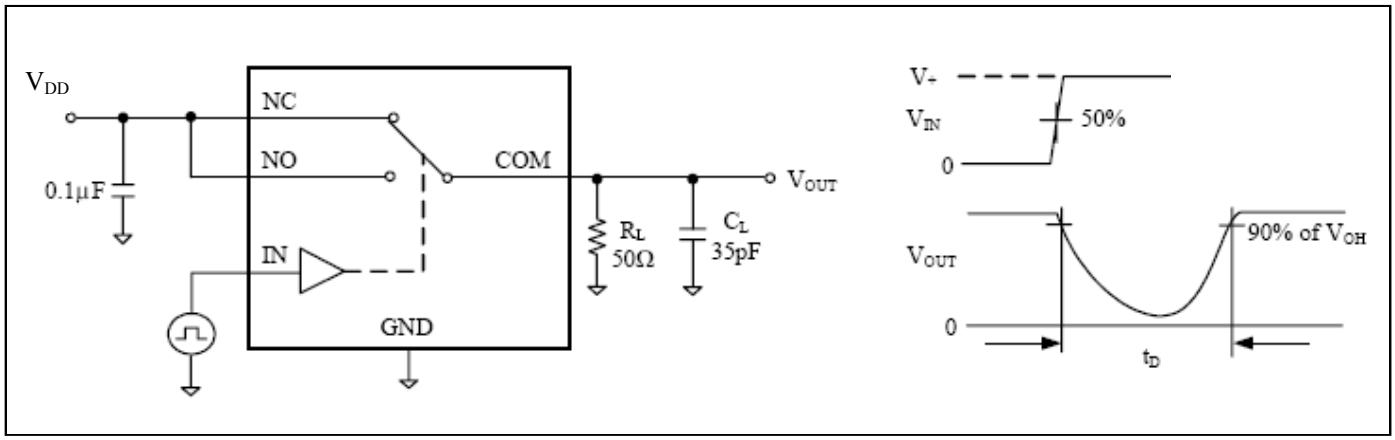


Figure 3. Break Before Make Interval Timing

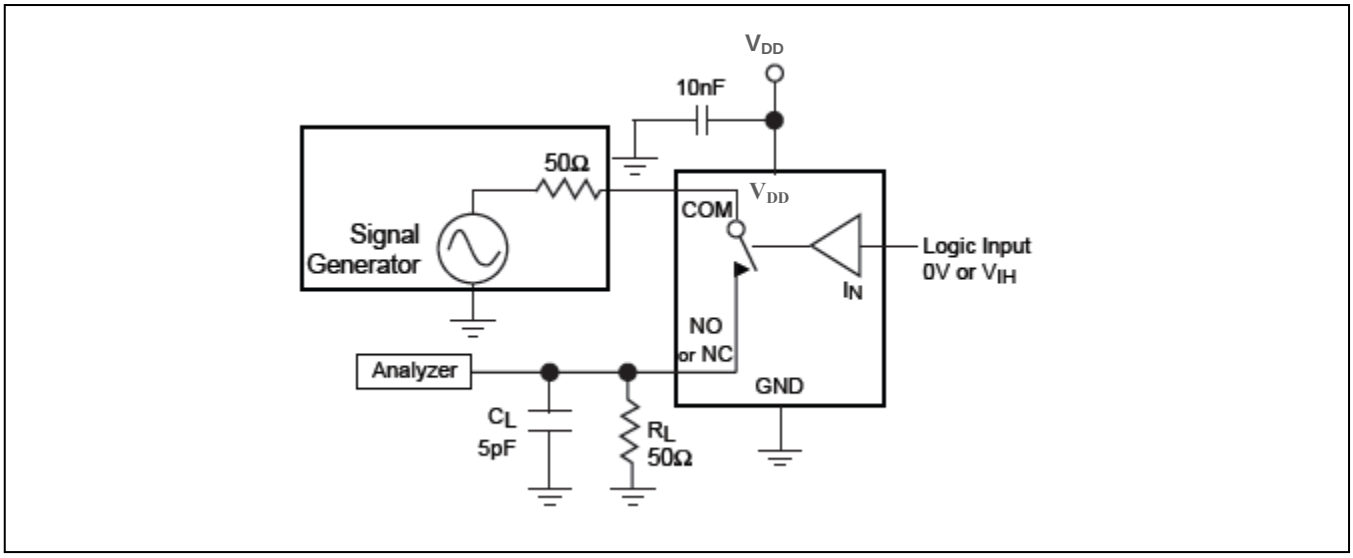


Figure 4. COM-NC/NO Isolation

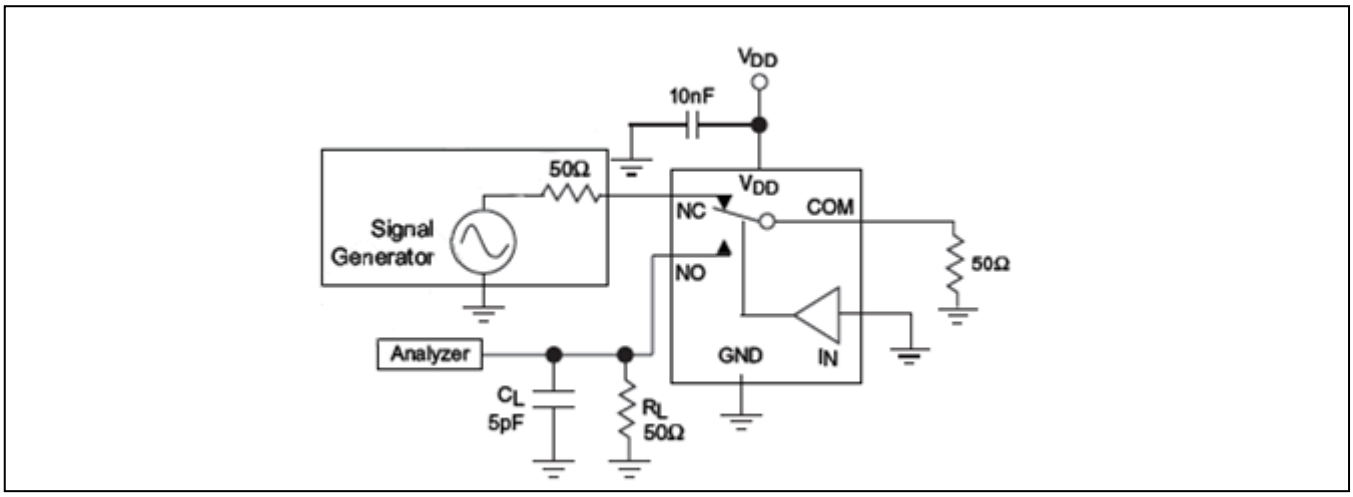


Figure 5. NC-NO Isolation

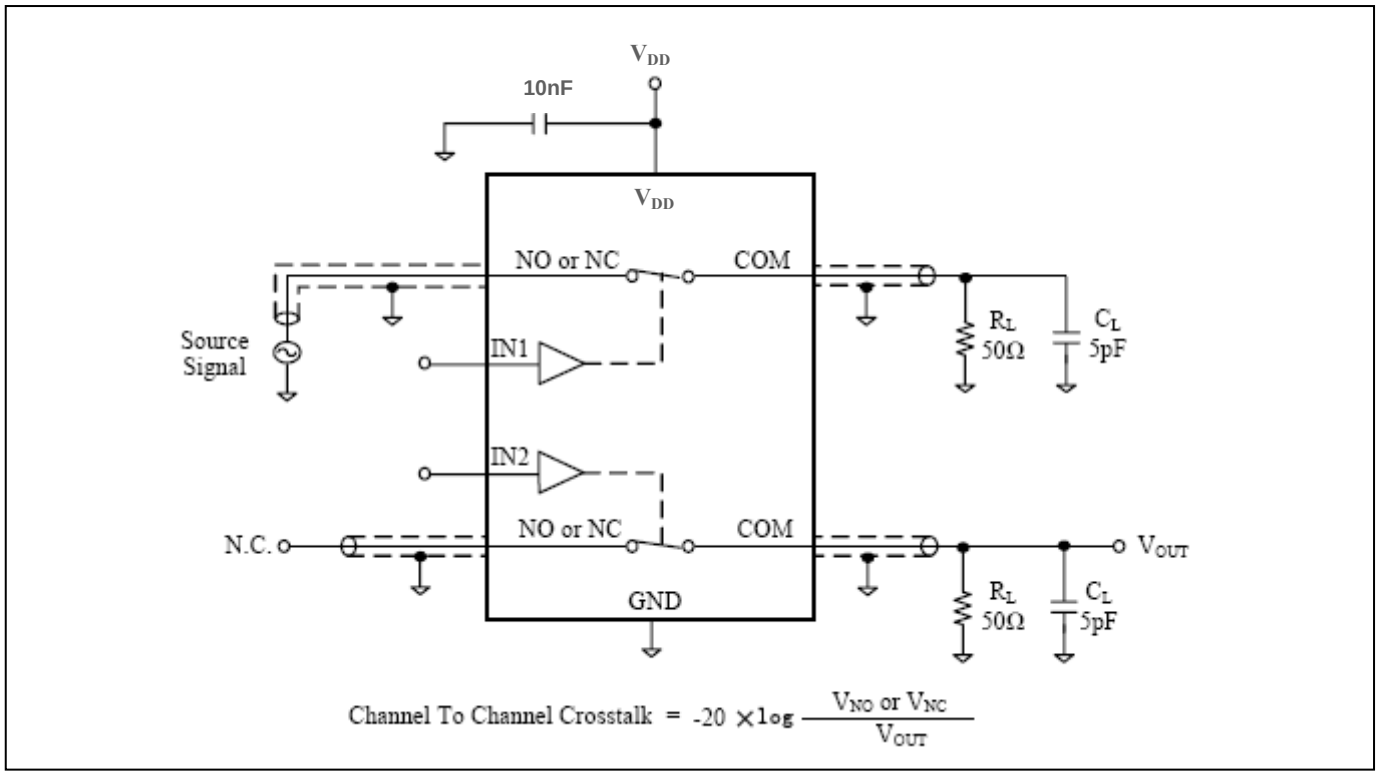


Figure 6. Channel-to-Channel Crosstalk

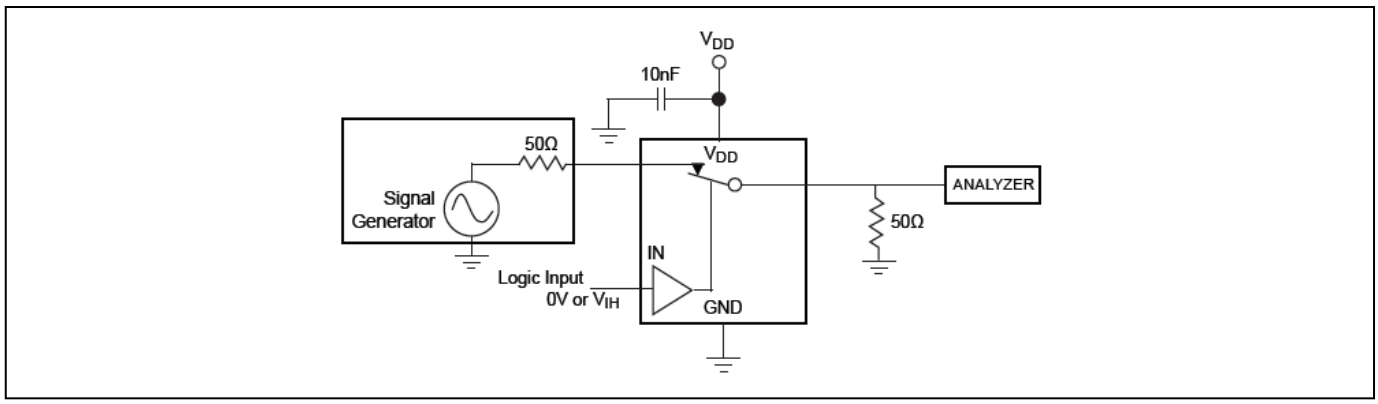


Figure 7. Bandwidth

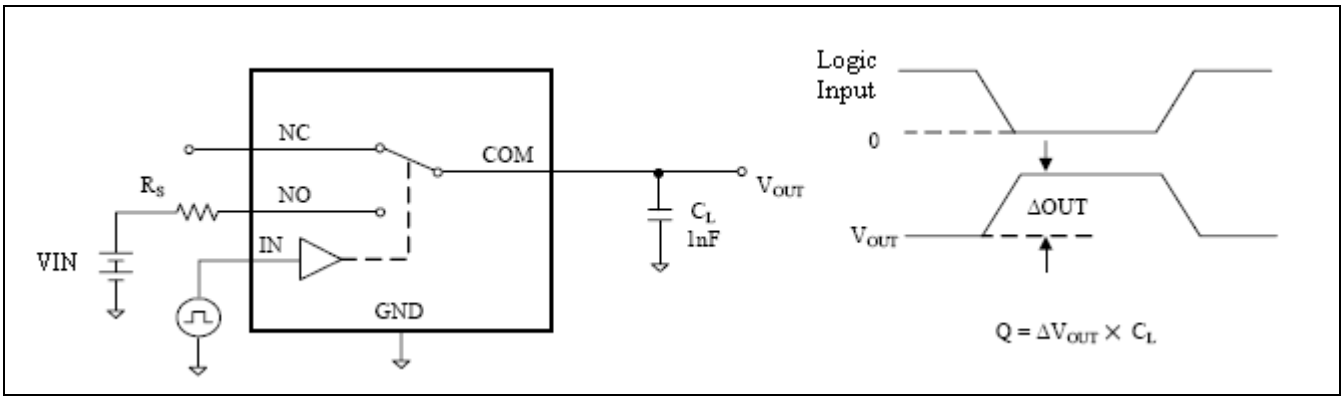


Figure 8. Charge Injection

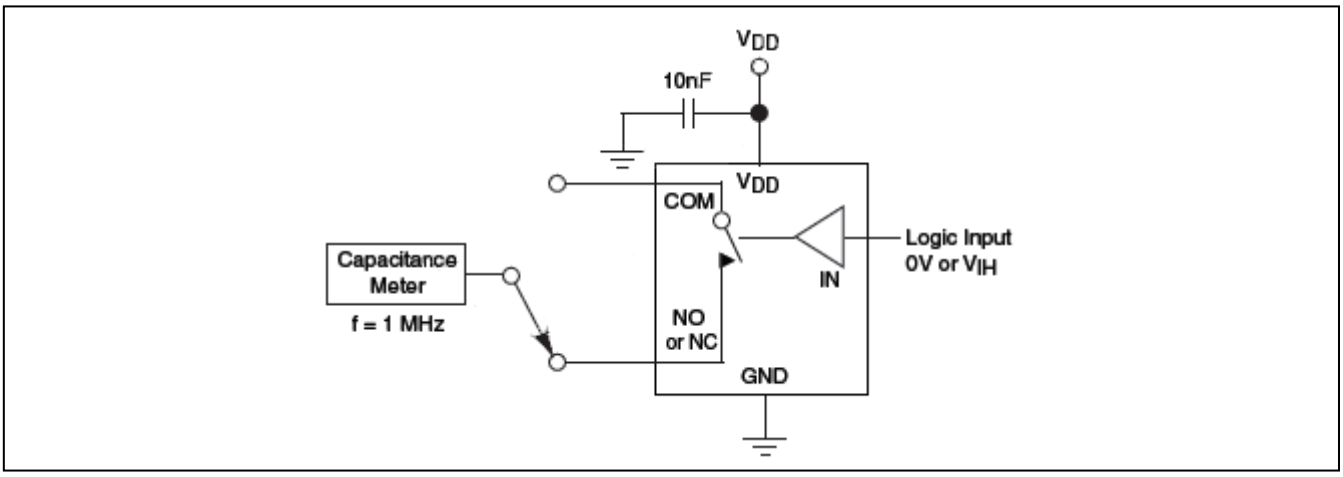


Figure 9. Channel Off Capacitance

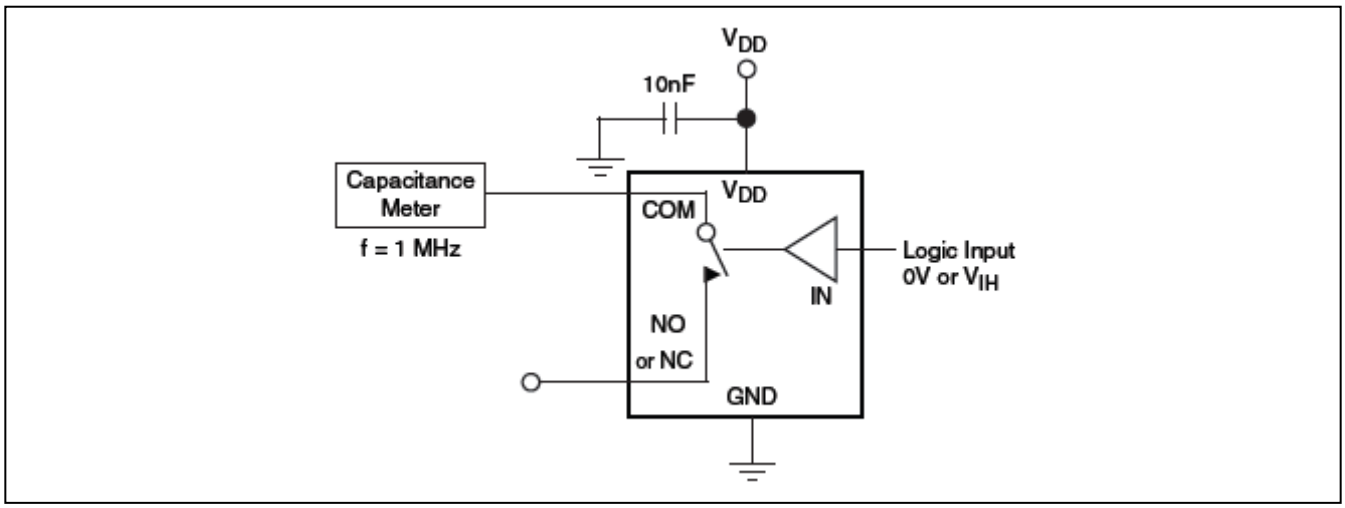
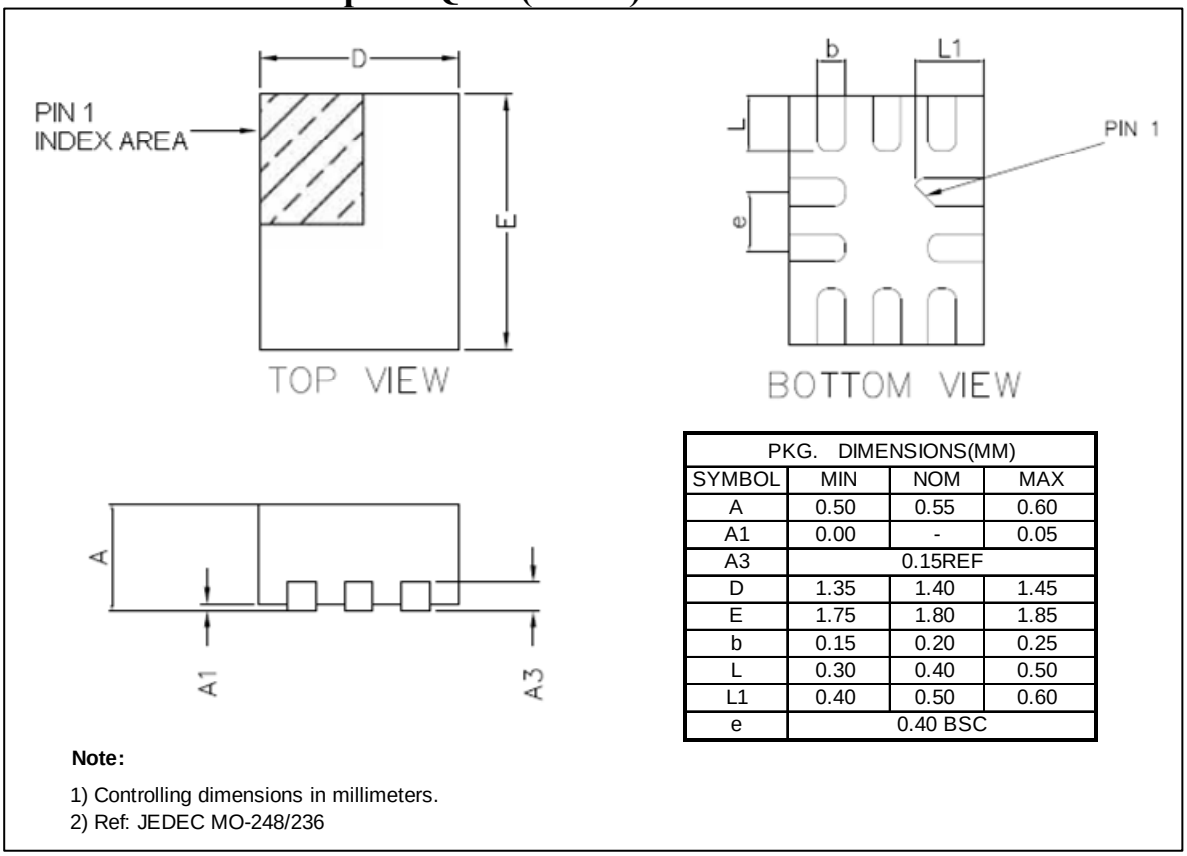


Figure 10. Channel On Capacitance

Mechanical Information 10-pin UQFN (ZM10)

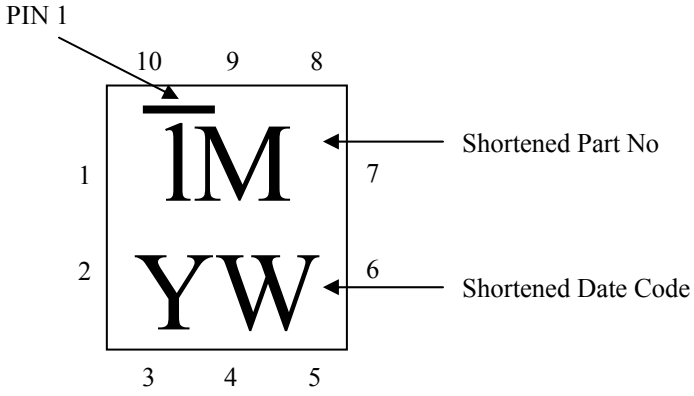


PKG. DIMENSIONS(MM)			
SYMBOL	MIN	NOM	MAX
A	0.50	0.55	0.60
A1	0.00	-	0.05
A3		0.15REF	
D	1.35	1.40	1.45
E	1.75	1.80	1.85
b	0.15	0.20	0.25
L	0.30	0.40	0.50
L1	0.40	0.50	0.60
e		0.40 BSC	

Note:

1) Controlling dimensions in millimeters.
2) Ref: JEDEC MO-248/236

Marking Description



Ordering Information

Part Number	Package Code	Package
PI3A268CZME	ZM	Lead Free and Green UQFN-10 (ZM10)

Notes:

- E = Pb-free and Green
- X Suffix= Tape and reel

Mouser Electronics

Authorized Distributor

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PI3A268CZMEX