

**3.0V, SOTiny™ 0.8Ω Dual SPDT Analog Switch with -1.0V to 4.2V Operating Range**
**Features**

- Analog Signal Range: -1.0V to V<sub>CC</sub> when switch is “ON”
- -1.0V Undershoot Protection when switch is “OFF”
- CMOS Technology for Bus and Analog Applications
- Low On-Resistance: 0.8Ω (+3.3V Supply)
- Wide V<sub>CC</sub> Range: 1.5V to 4.2V ±10%
- Low Power Consumption : 5μW
- Rail-to-Rail switching throughout Signal Range
- Fast Switching Speed: 50ns max. at 3.3V
- High Off Isolation: -50dB at 1 MHz
- -45dB (1 MHz) Crosstalk Rejection Reduces Signal Distortion
- Break-Before-Make Switching
- Extended Industrial Temperature Range: -40°C to 85°C
- Packaging: (Pb-free & Green)
  - 12-contact TDFN (ZE)
  - 12-contact TDFN (ZG)

**Applications**

- Cell Phones
- PDAs
- Portable Instrumentation
- Battery Powered Communications
- Computer Peripherals

**Pin Description**

Pin Number	Name <sup>(1,2,3)</sup>	Description
8, 11	NO <sub>x</sub>	Data Port (Normally Open)
3, 6	GND <sub>x</sub>	Ground
2, 5	NC <sub>x</sub>	Data Port (Normally Closed)
1, 4	COM <sub>x</sub>	Common Output/Data Port
9, 12	V <sub>CC<sub>x</sub></sub>	Positive Power Supply <sup>(1)</sup>
7, 10	IN <sub>x</sub>	Logic Control

**Notes:**

1. X = 0 or 1
2. V<sub>CC0</sub> and V<sub>CC1</sub> are not internally connected. Each must be powered separately.
3. GND<sub>0</sub> and GND<sub>1</sub> are not internally connected. Each must be powered separately.

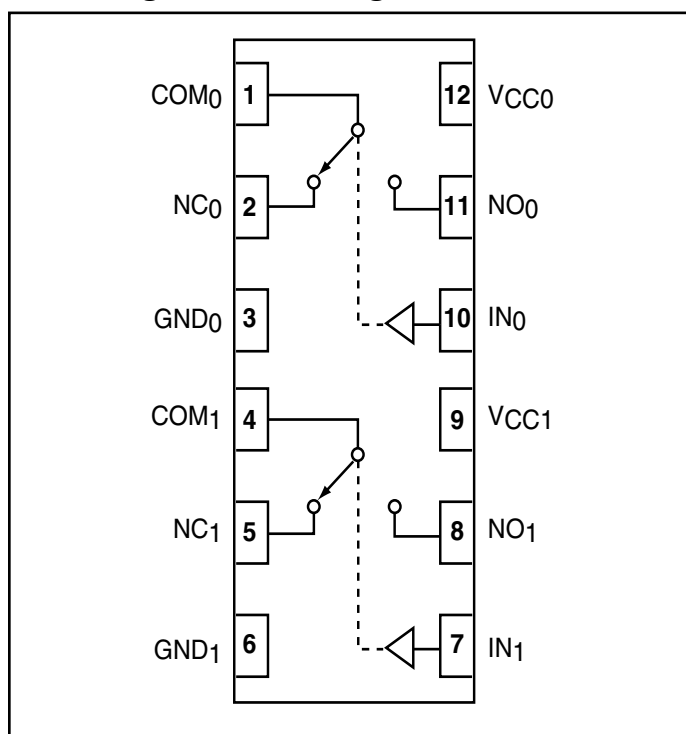
**Description**

The PI3A3160C is a high-bandwidth, fast Dual 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, 1.5V to 4.2V ±10%, the switch has a typical On-Resistance of 0.8Ω at 3.3V.

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

Control inputs, IN, tolerates input drive signals up to 3.3V, independent of supply voltage.

PI3A3160C is a lower voltage and On-Resistance replacement for the PI5A3158.

**Block Diagram / Pin Configuration**

**Function Table**

Logic Input	Function
0	NC <sub>x</sub> Connected to COM <sub>x</sub>
1	NO <sub>x</sub> Connected to COM <sub>x</sub>

### Absolute Maximum Ratings

Voltages Referenced to GND

V <sub>CC</sub> .....	-0.5V to 4.6V
V <sub>IN</sub> , V <sub>COM</sub> , V <sub>NC</sub> , V <sub>NO</sub> <sup>(1)</sup> .....	-1.5V to V <sub>CC</sub> +0.3V or 30mA, whichever occurs first
Current (any terminal).....	±200mA
Peak Current, COM, NO, NC (Pulsed at 1ms, 10% duty cycle).....	±400mA
Temp Range .....	-40°C to + 85°C

### Thermal Information

Continuous Power Dissipation	
TDFN-12 (derate 7.1mW/°C above +70°C).....	0.5W
Storage Temperature .....	-65°C to +150°C
Lead Temperature (soldering, 10s) .....	+300°C

#### Notes:

1. Signals on NC, NO, COM, or IN exceeding V<sub>CC</sub> or GND are clamped by internal diodes. Limit forward diode current to 30mA.

**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.

### Electrical Specifications - Single +3.3V Supply

(V<sub>CC</sub> = +3.3V ± 10%, GND = 0V, V<sub>IH</sub> = 1.4V, V<sub>IL</sub> = 0.5V)

Parameter	Symbol	Conditions	Min. <sup>(1)</sup>	Typ. <sup>(2)</sup>	Max. <sup>(1)</sup>	Units
<b>Analog Switch</b>						
Analog Signal Range <sup>(3)</sup>	V <sub>ANALOG</sub>		-1.0		V <sub>CC</sub>	V
On-Resistance	R <sub>ON</sub>	V <sub>CC</sub> = 2.7V, I <sub>COM</sub> = 100mA, V <sub>NO</sub> or V <sub>NC</sub> = +1.5V			1.3	Ω
On-Resistance Match Between Channels <sup>(4)</sup>	ΔR <sub>ON</sub>				0.15	
On-Resistance Flatness <sup>(5)</sup>	R <sub>FLAT(ON)</sub>	V <sub>CC</sub> = 2.7V, I <sub>COM</sub> = 100mA, V <sub>NO</sub> or V <sub>NC</sub> = 0.8V, 2.0V			0.1	
NO or NC Off Leakage Current <sup>(6)</sup>	I <sub>NO(OFF)</sub> or I <sub>NC(OFF)</sub>	V <sub>CC</sub> = 3.3V, V <sub>COM</sub> = 0V, V <sub>NO</sub> or V <sub>NC</sub> = +2.0V	-2		2	μA
COM On Leakage Current <sup>(6)</sup>	I <sub>COM(ON)</sub>	V <sub>CC</sub> = 3.3V, V <sub>COM</sub> = +2.0V, V <sub>NO</sub> or V <sub>NC</sub> = +2.0V	-2		2	

#### Notes:

1. The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet. T<sub>A</sub> = 40°C to +85°C.
2. Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing. Typical values are tested w T<sub>A</sub> = 25°C
3. Guaranteed by design.
4. ΔR<sub>ON</sub> = R<sub>ON</sub> max. - R<sub>ON</sub> min.
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°C.

**Electrical Specifications - Single +3.3V Supply (continued)**

( $V_{CC} = +3.3V \pm 10\%$ ,  $GND = 0V$ ,  $V_{IH} = 1.4V$ ,  $V_{IL} = 0.5V$ )

Parameter	Symbol	Conditions	Min. <sup>(1)</sup>	Typ. <sup>(2)</sup>	Max. <sup>(1)</sup>	Units
<b>Logic Input</b>						
Input High Voltage	$V_{IH}$	Guaranteed Logic High Level	1.4			V
Input Low Voltage	$V_{IL}$	Guaranteed Logic LowLevel			0.5	
Input Current with Voltage High	$I_{INH}$	$V_{IN} = V_{CC}$ , all others = 0V	-1		1	$\mu A$
Input Current with Voltage Low	$I_{INL}$	$V_{IN} = 0V$ , all others = $V_{CC}$	-1		1	
<b>Dynamic</b>						
Turn-On-Time	$t_{ON}$	$V_{CC} = 3.3V$ , $V_{NO}$ or $V_{NC} = 2.0V$ , Figure 1			50	ns
Turn-Off-Time	$t_{OFF}$				50	
Break-Before-Make	$t_{BBM}$	Figure 3	1		20	
Charge Injection <sup>(3)</sup>	Q	$C_L = 1nF$ , $V_{GEN} = 0V$ , $R_{GEN} = 0\Omega$ , Figure 2		110		pC
Off Isolation <sup>(4)</sup>	$O_{IRR}$	$R_L = 50\Omega$ , $f = 1$ MHz, Figure 4		-50		dB
CrossTalk <sup>(5)</sup>	$X_{TALK}$	$R_L = 50\Omega$ , $f = 1$ MHz, Figure 5				
NC or NO OffCapacitance	$C_{NC/NO}$ (OFF)	$f = 1$ MHz, Figure 6		35		pF
COM On Capacitance	$C_{COM(ON)}$	$f = 1$ MHz, Figure 7		110		
Control Input Capacitance	$C_{IN}$	$f = 1$ MHz		1		
-3dB Bandwidth	$B_W$	NO or NC to COM		65		MHz
<b>Supply</b>						
Power Supply Range	$V_{CC}$		1.5		4.6	V
Positive Supply Current	$I_{CC}$	$V_{CC} = 4.6V$ , $V_{IN} = 0V$ or $V_{CC}$	210	280	350	$\mu A$

**Notes:**

- The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.  $T_A = 40^\circ C$  to  $+85^\circ C$ .
- Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing. Typical values are tested w  $T_A = 25^\circ C$
- Guaranteed by design..
- Off Isolation =  $20\log_{10} [ V_{COM} / (V_{NO} \text{ or } V_{NC}) ]$ . See Figure 4.
- Between any two switches. See Figure 5.

**Electrical Specifications - Single +2.5V Supply**
 $(V_{CC} = +2.5V \pm 10\%, GND = 0V, V_{IH} = 1.4V, V_{IL} = 0.5V)$ 

Parameter	Symbol	Conditions	Min. <sup>(1)</sup>	Typ. <sup>(2)</sup>	Max. <sup>(1)</sup>	Units
<b>Analog Switch</b>						
Analog Signal Range <sup>(3)</sup>	$V_{ANALOG}$		-1		$V_{CC}$	V
On-Resistance	$R_{ON}$	$V_{CC} = 2.5V, I_{COM} = -8mA,$ $V_{NO}$ or $V_{NC} = 1.8V$		0.9		Ω
On-Resistance Match Between Channels <sup>(4)</sup>	$\Delta R_{ON}$	$V_{CC} = 2.5V, I_{COM} = -8mA,$ $V_{NO}$ or $V_{NC} = 0.8V, 1.8V$		0.1		
On-Resistance Flatness <sup>(5)</sup>	$R_{FLAT(ON)}$			0.01		
<b>Dynamic</b>						
Turn-On-Time	$t_{ON}$	$V_{CC} = 2.5V,$ $V_{NO}$ or $V_{NC} = 1.8V,$ Figure 1			50	ns
Turn-Off-Time	$t_{OFF}$					
Break-Before-Make	$t_{BBM}$	Figure 3	1		20	
Charge Injection <sup>(3)</sup>	Q	$C_L = 1nF, V_{GEN} = 0V,$ $R_{GEN} = 0V,$ Figure 2		90		pC
<b>Supply</b>						
Positive Supply Current	$I_{CC}$	$V_{CC} = 2.75V, V_{IN} = 0V$ or $V_{CC}$ All Channels on or off	120	160	200	μA
<b>Logic Input</b>						
Input High Voltage	$V_{IH}$	Guaranteed Logic High Level	1.4			V
Input Low Voltage	$V_{IL}$	Guaranteed Logic Low Level			0.5	
Input High Current	$I_{INH}$	$V_{IN} = V_{CC},$ all others = 0V	-1		1	μA
Input Low Current	$I_{INL}$	$V_{IN} = 0V,$ all others = $V_{CC}$	-1		1	

Parameter	Symbol	Conditions	Min. <sup>(1)</sup>	Typ. <sup>(2)</sup>	Max. <sup>(1)</sup>	Units
Positive Supply Current	$I_{CC}$	$V_{CC} = 1.5V, V_{IN} = 0V$ or $V_{CC}$	70	350	400	μA

**Notes:**

- The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.  
 $T_A = 40^\circ C$  to  $+85^\circ C$ .
- Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.  
Typical values are tested w  $T_A = 25^\circ C$
- Guaranteed by design.
- $\Delta R_{ON} = R_{ON} \text{ max.} - R_{ON} \text{ min.}$
- Flatness is defined as the difference between the maximum and minimum value of On-Resistance measured.

### Test Circuits/Timing Diagrams

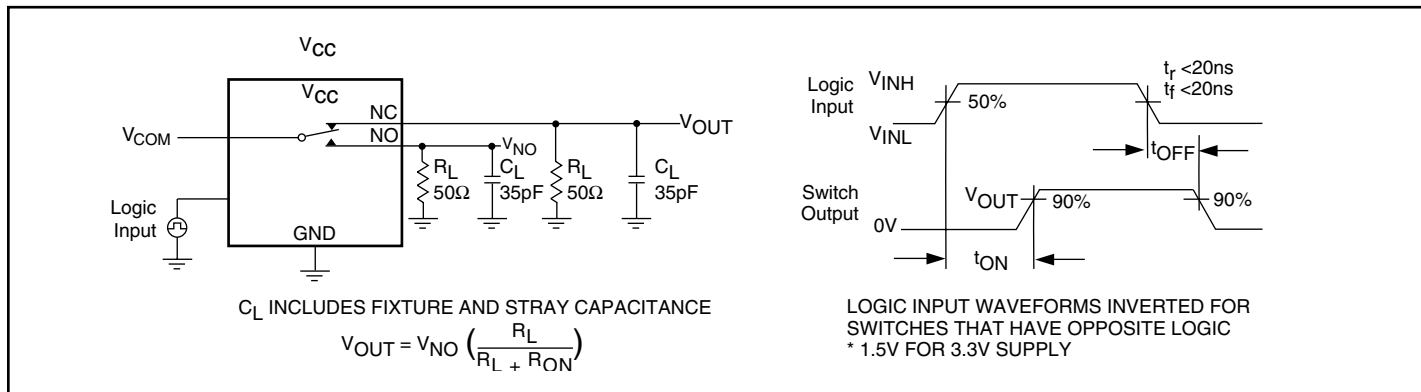


Figure 1. Switching Time

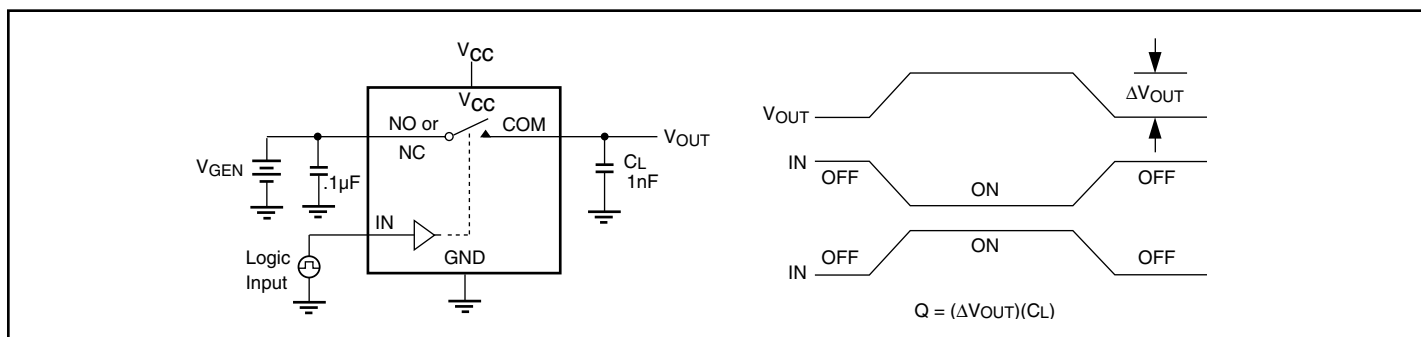


Figure 2. Charge Injection

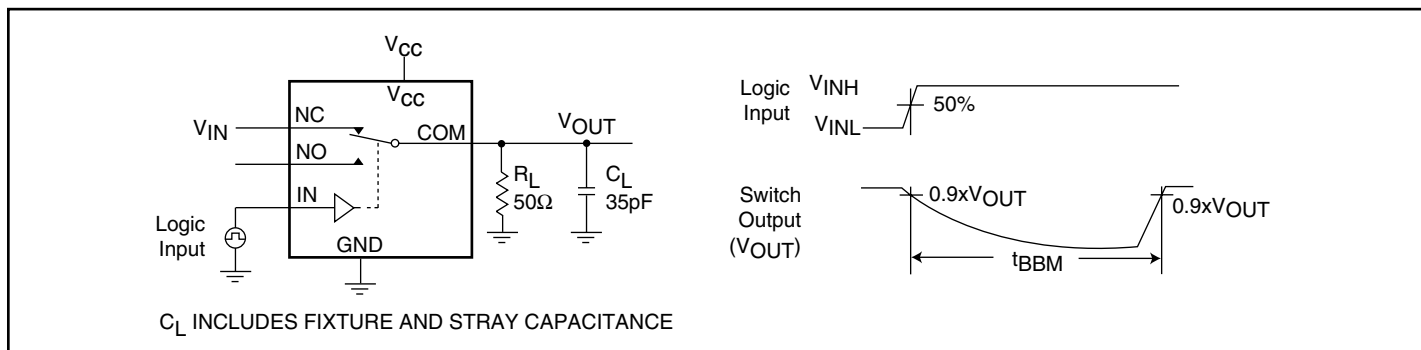


Figure 3. Break-Before-Make Interval

Test Circuits/Timing Diagrams (continued)

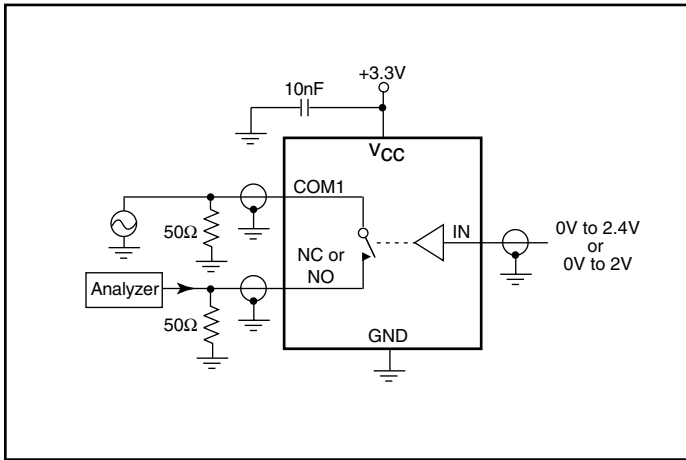


Figure 4. Off Isolation/On-Channel Bandwidth

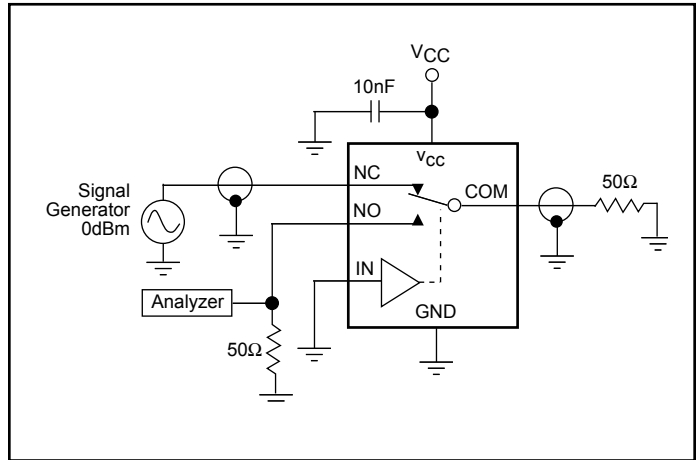


Figure 5. Crosstalk

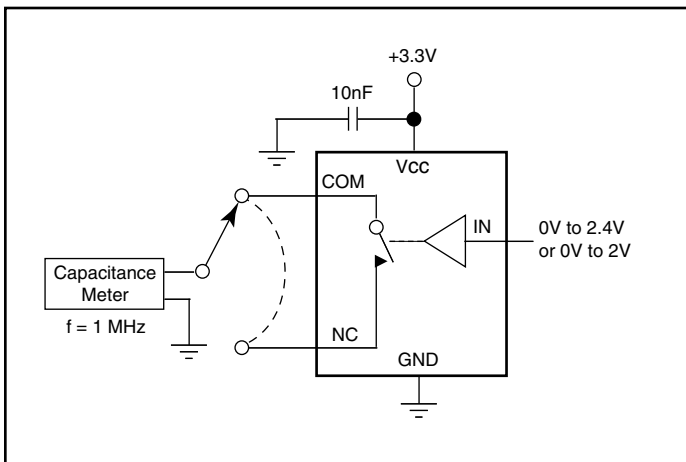


Figure 6. Channel-Off Capacitance

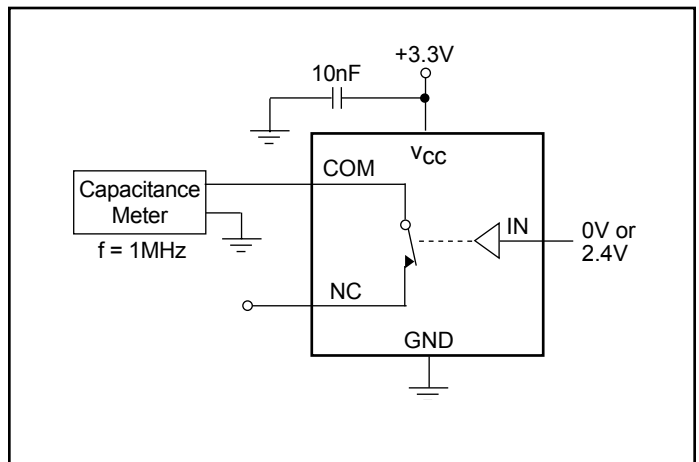


Figure 7. Channel-On Capacitance

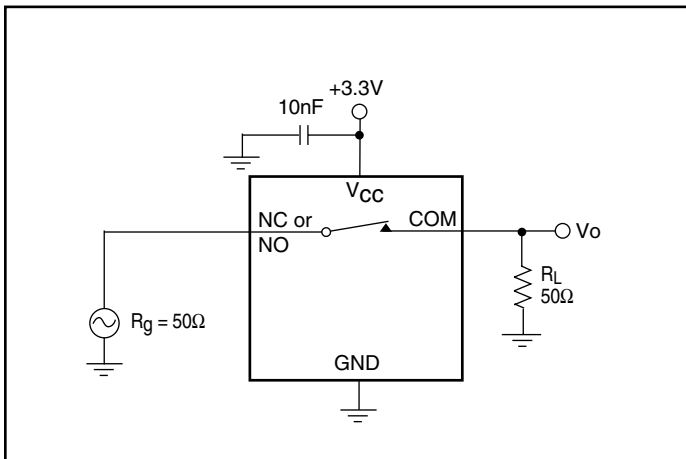
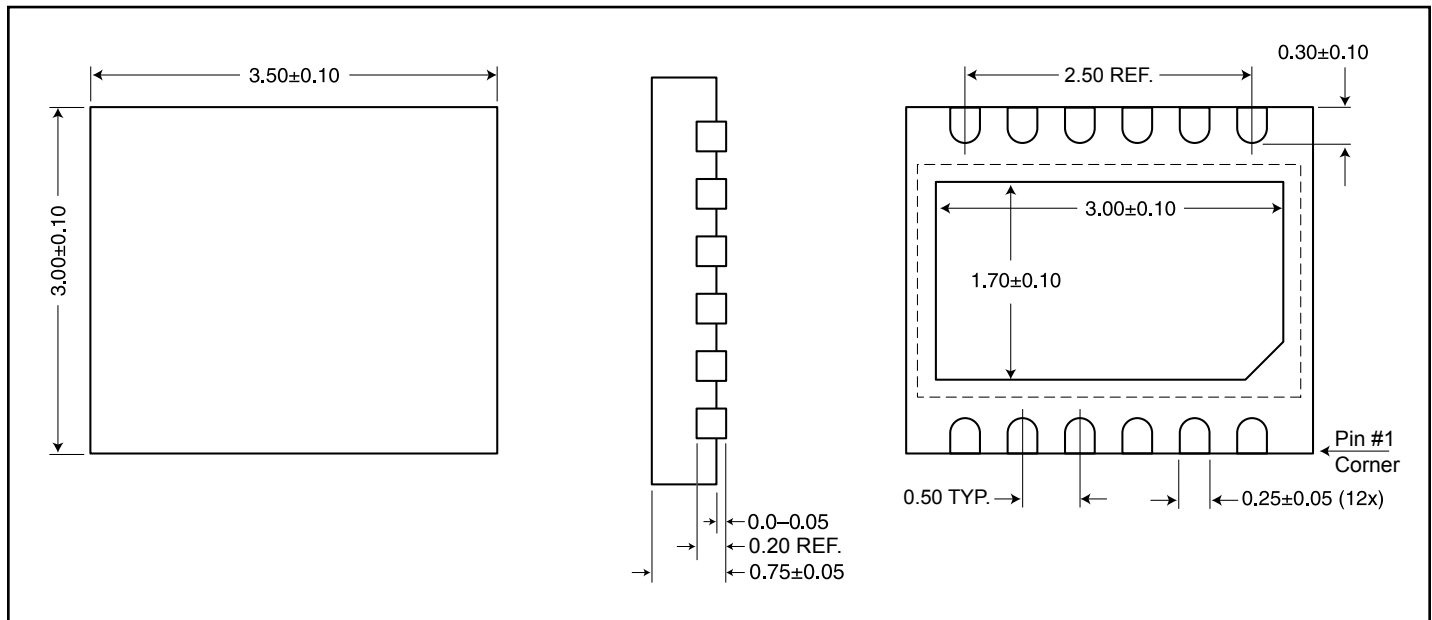
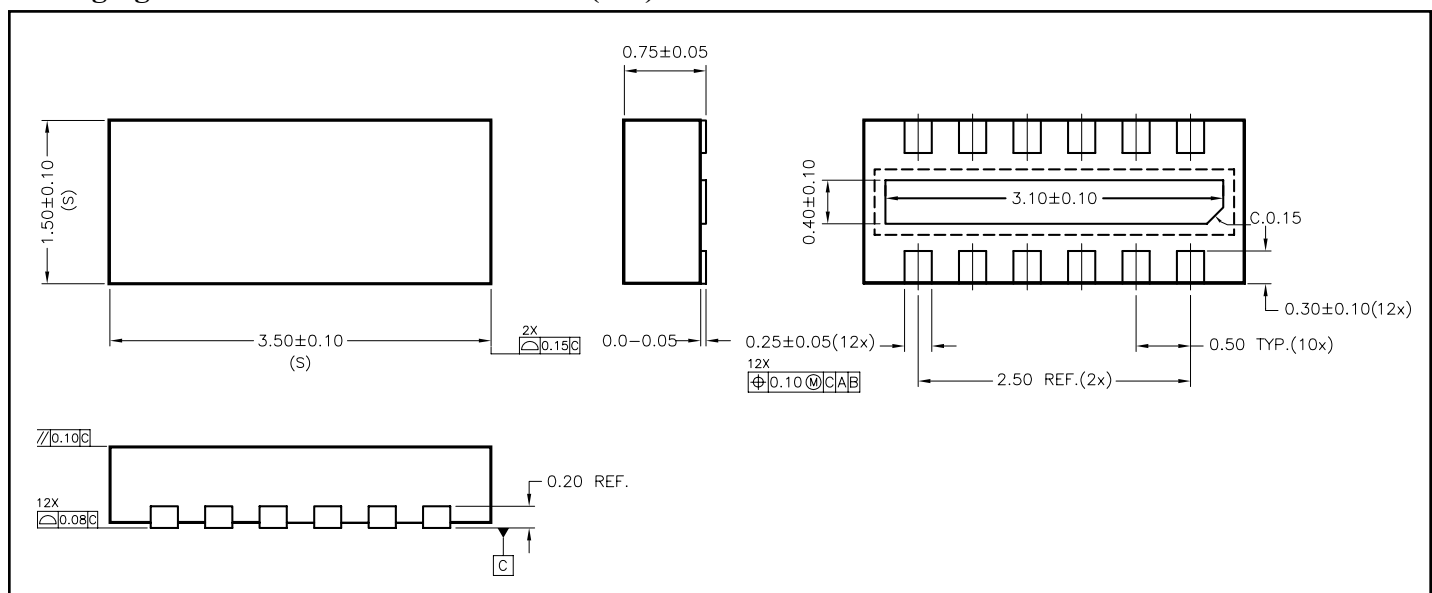


Figure 8. Bandwidth

**Packaging Mechanical: 12-Contact TDFN (ZE)**



**Packaging Mechanical: 12-Contact TDFN (ZG)**



**Ordering Information**

Ordering Code	Package Code	Package Type	Top Mark
PI3A3160CZEEX	ZE	Pb-free & Green, 12-contact TDFN	YH
PI3A3160CZGEX	ZG	Pb-free & Green, 12-contact TDFN	YH

**Notes:**

- Thermal characteristics can be found on the company web site at [www.pericom.com/packaging/](http://www.pericom.com/packaging/)
- E = Pb-free and Green
- X suffix = Tape/Reel