

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_{DD} 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_{DD} Range: 1.5V to 4.2V $\pm 10\%$
- 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)

Applications

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

Pin Description

| Pin Number | Name ^(1,2,3) | Description |
|------------|-------------------------|--------------------------------------|
| 8, 11 | NO _x | Data Port (Normally Open) |
| 3, 6 | GND _x | Ground |
| 2, 5 | NC _x | Data Port (Normally Closed) |
| 1, 4 | COM _x | Common Output/Data Port |
| 9, 12 | V_{DDx} | Positive Power Supply ⁽¹⁾ |
| 7, 10 | IN _x | Logic Control |

Notes:

1. X = 0 or 1
2. V_{DD0} and V_{DD1} are not internally connected. Each must be powered separately.
3. GND₀ and GND₁ are not internally connected. Each must be powered separately.

Description

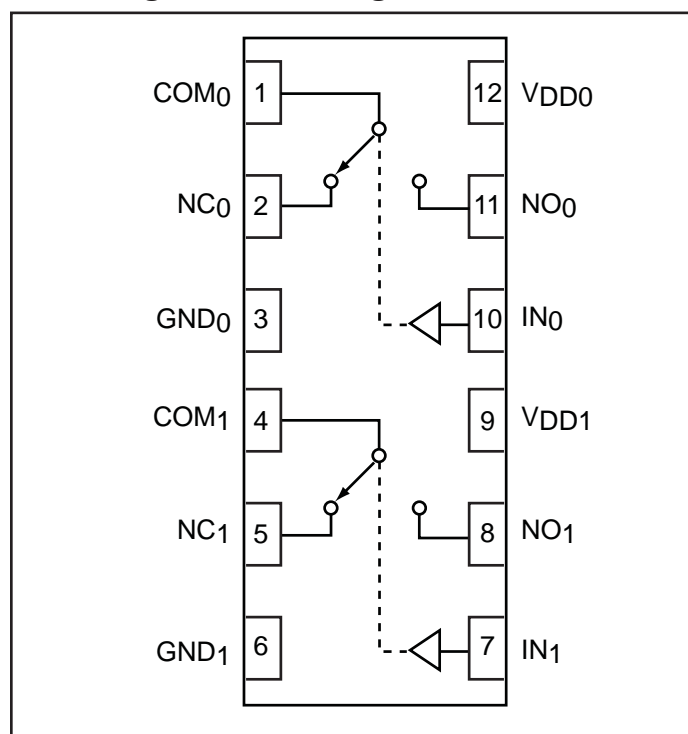
The PI3A3160C is a high-bandwidth, fast Dual single-pole double-throw (SPDT) CMOS switch. It can be used as an analog switch or as a low-delay bus switch. Specified over a wide operating power supply voltage range, 1.5V to 4.2V $\pm 10\%$, the switch has a typical On-Resistance of 0.8Ω at 3.3V.

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 _x Connected to COM _x |
| 1 | NO _x Connected to COM _x |

Absolute Maximum Ratings

Voltages Referenced to GND

V_{DD} -0.5V to 4.6V

V_{IN} , V_{COM} , V_{NC} , V_{NO} ⁽¹⁾ -1.5V to $V_{DD} + 0.3V$
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_{DD} 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

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

| Parameter | Symbol | Conditions | Min. ⁽¹⁾ | Typ. ⁽²⁾ | Max. ⁽¹⁾ | Units |
|---|-----------------------------------|--|---------------------|---------------------|---------------------|-------|
| Analog Switch | | | | | | |
| Analog Signal Range ⁽³⁾ | V_{ANALOG} | | -1.0 | | V_{DD} | V |
| On-Resistance | R_{ON} | $V_{DD} = 2.7V$, $I_{COM} = 100mA$, V_{NO} or $V_{NC} = +1.5V$ | | | 1.3 | Ω |
| On-Resistance Match Between Channels ⁽⁴⁾ | ΔR_{ON} | | | | 0.15 | |
| On-Resistance Flatness ⁽⁵⁾ | $R_{FLAT(ON)}$ | $V_{DD} = 2.7V$, $I_{COM} = 100mA$, V_{NO} or $V_{NC} = 0.8V, 2.0V$ | | | 0.1 | |
| NO or NC Off Leakage Current ⁽⁶⁾ | $I_{NO(OFF)}$ or $I_{NC(OFF)}$ | $V_{DD} = 3.3V$, $V_{COM} = 0V$, V_{NO} or $V_{NC} = +2.0V$ | -2 | | 2 | μA |
| COM On Leakage Current ⁽⁶⁾ | $I_{COM(ON)}$ | $V_{DD} = 3.3V$, $V_{COM} = +2.0V$, V_{NO} or $V_{NC} = +2.0V$ | -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.
 $T_A = 40^\circ C$ to $+85^\circ C$.
2. Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.
Typical values are tested w $T_A = 25^\circ C$
3. Guaranteed by design.
4. $\Delta R_{ON} = R_{ON} \text{ max.} - R_{ON} \text{ min.}$
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 $+25^\circ C$.

Electrical Specifications - Single +3.3V Supply (continued)

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

| Parameter | Symbol | Conditions | Min. ⁽¹⁾ | Typ. ⁽²⁾ | Max. ⁽¹⁾ | Units |
|---------------------------------|-----------------------------|---|---------------------|---------------------|---------------------|-------|
| Logic Input | | | | | | |
| 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 _{DD} , all others = 0V | −1 | | 1 | μA |
| Input Current with Voltage Low | I _{INL} | V _{IN} = 0V, all others = V _{DD} | −1 | | 1 | |
| Dynamic | | | | | | |
| Turn-On-Time | t _{ON} | V _{DD} = 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 ⁽³⁾ | Q | C _L = 1nF, V _{GEN} = 0V, R _{GEN} = 0Ω, Figure 2 | | 110 | | pC |
| Off Isolation ⁽⁴⁾ | O _{IRR} | R _L = 50Ω, f = 1 MHz, Figure 4 | | -50 | | dB |
| CrossTalk ⁽⁵⁾ | X _{TALK} | R _L = 50Ω, 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 |
| Supply | | | | | | |
| Power Supply Range | V _{DD} | | 1.5 | | 4.6 | V |
| Positive Supply Current | I _{CC} | V _{DD} = 4.6V, V _{IN} = 0V or V _{DD} | 210 | 280 | 350 | μA |

Notes:

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- 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
 $(V_{DD} = +2.5V \pm 10\%, GND = 0V, V_{IH} = 1.4V, V_{IL} = 0.5V)$

| Parameter | Symbol | Conditions | Min. ⁽¹⁾ | Typ. ⁽²⁾ | Max. ⁽¹⁾ | Units |
|---|-----------------------|--|---------------------|---------------------|---------------------|-------|
| Analog Switch | | | | | | |
| Analog Signal Range ⁽³⁾ | V _{ANALOG} | | -1 | | V _{DD} | V |
| On-Resistance | R _{ON} | V _{DD} = 2.5V, I _{COM} = −8mA, V _{NO} or V _{NC} = 1.8V | | 0.9 | | Ω |
| On-Resistance Match Between Channels ⁽⁴⁾ | ΔR _{ON} | V _{DD} =2.5V, I _{COM} = −8mA, V _{NO} or V _{NC} = 0.8V, 1.8V | | 0.1 | | |
| On-Resistance Flatness ⁽⁵⁾ | R _{FLAT(ON)} | | | 0.01 | | |
| Dynamic | | | | | | |
| Turn-On-Time | t _{ON} | V _{DD} = 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 ⁽³⁾ | Q | C _L =1nF, V _{GEN} = 0V, R _{GEN} = 0V, Figure 2 | | 90 | | pC |
| Supply | | | | | | |
| Positive Supply Current | I _{CC} | V _{DD} = 2.75V, V _{IN} = 0V or V _{DD} All Channels on or off | 120 | 160 | 200 | μA |
| Logic Input | | | | | | |
| 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 _{DD} , all others = 0V | −1 | | 1 | μA |
| Input Low Current | I _{INL} | V _{IN} = 0V, all others = V _{DD} | −1 | | 1 | |

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

Notes:

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- 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

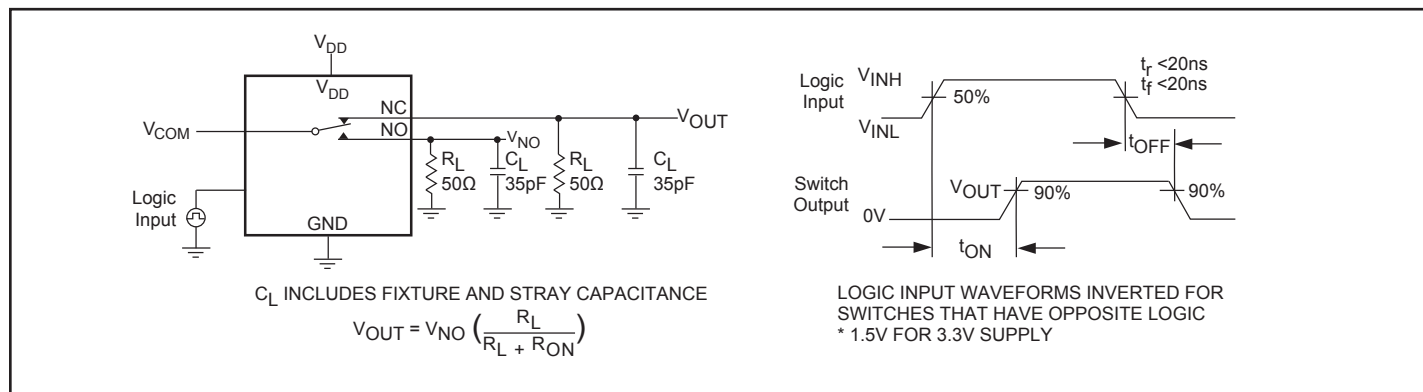


Figure 1. Switching Time

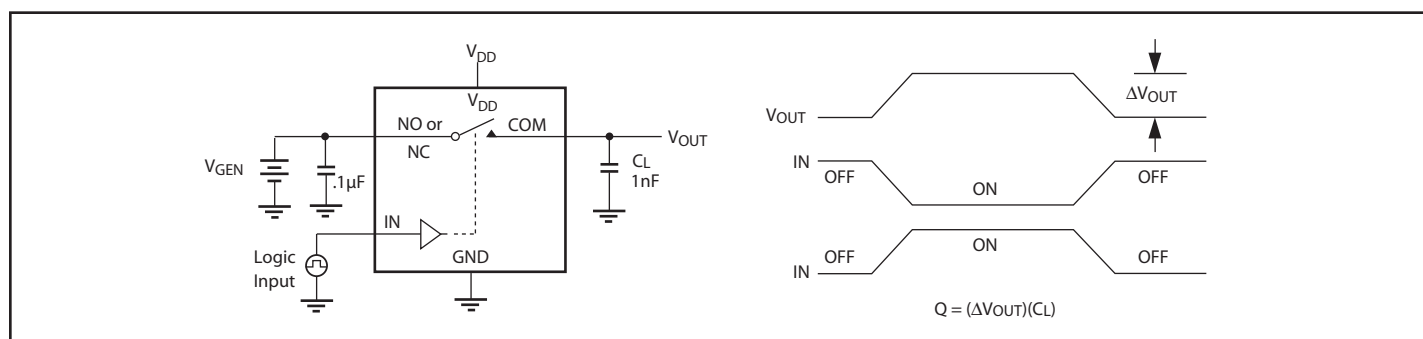


Figure 2. Charge Injection

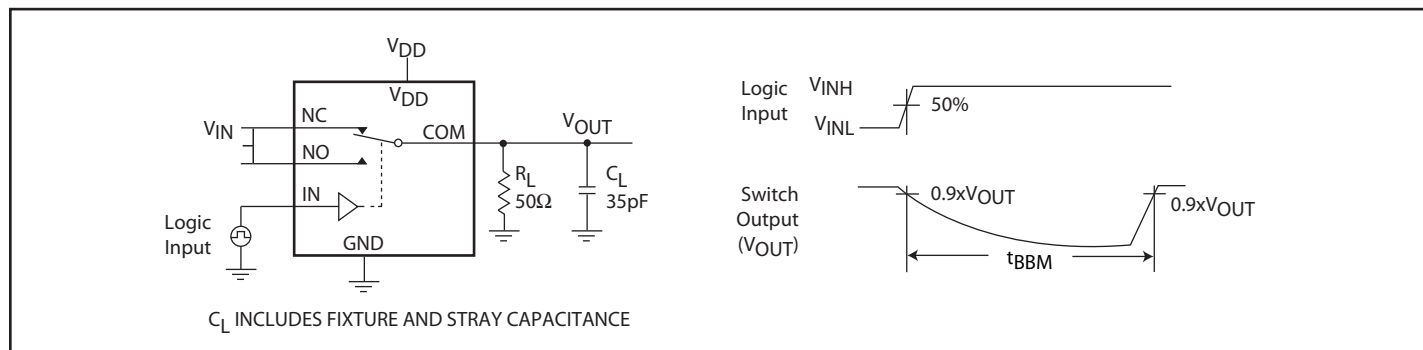


Figure 3. Break-Before-Make Interval

Test Circuits/Timing Diagrams (continued)

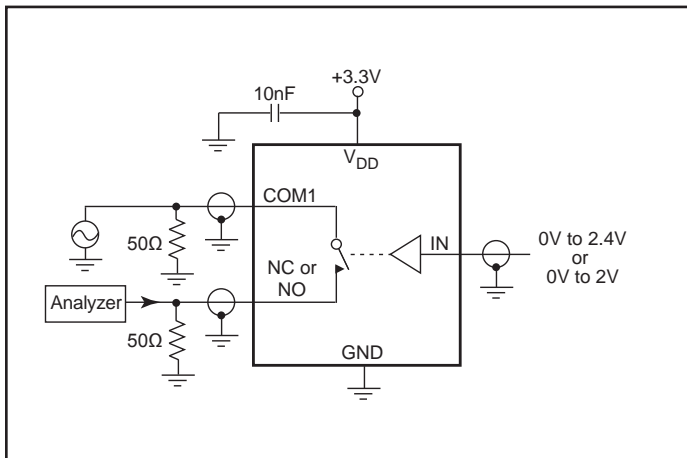


Figure 4. Off Isolation/On-Channel Bandwidth

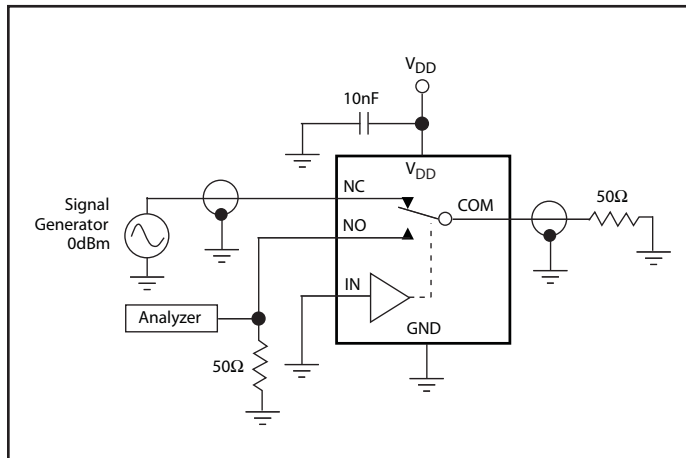


Figure 5. Crosstalk

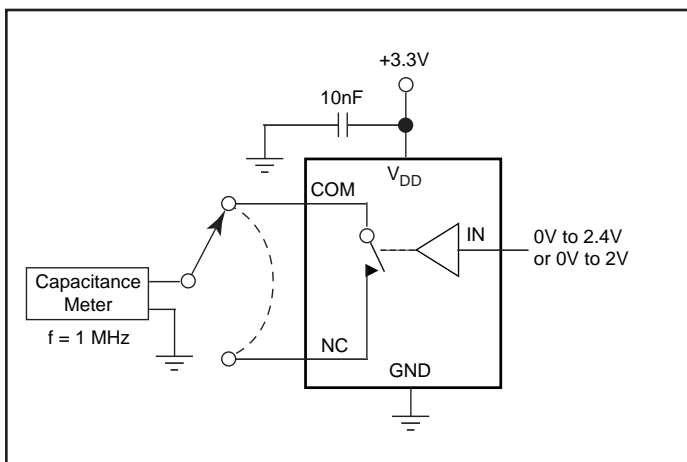


Figure 6. Channel-Off Capacitance

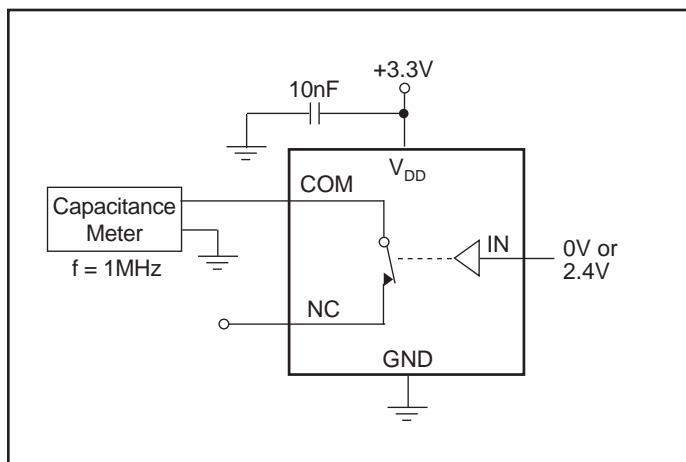


Figure 7. Channel-On Capacitance

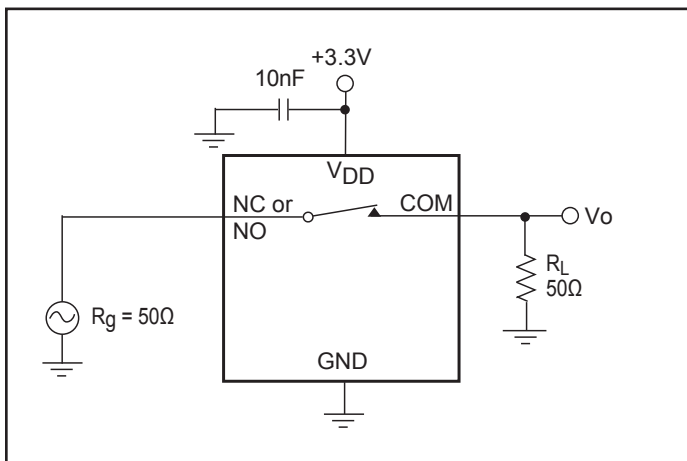
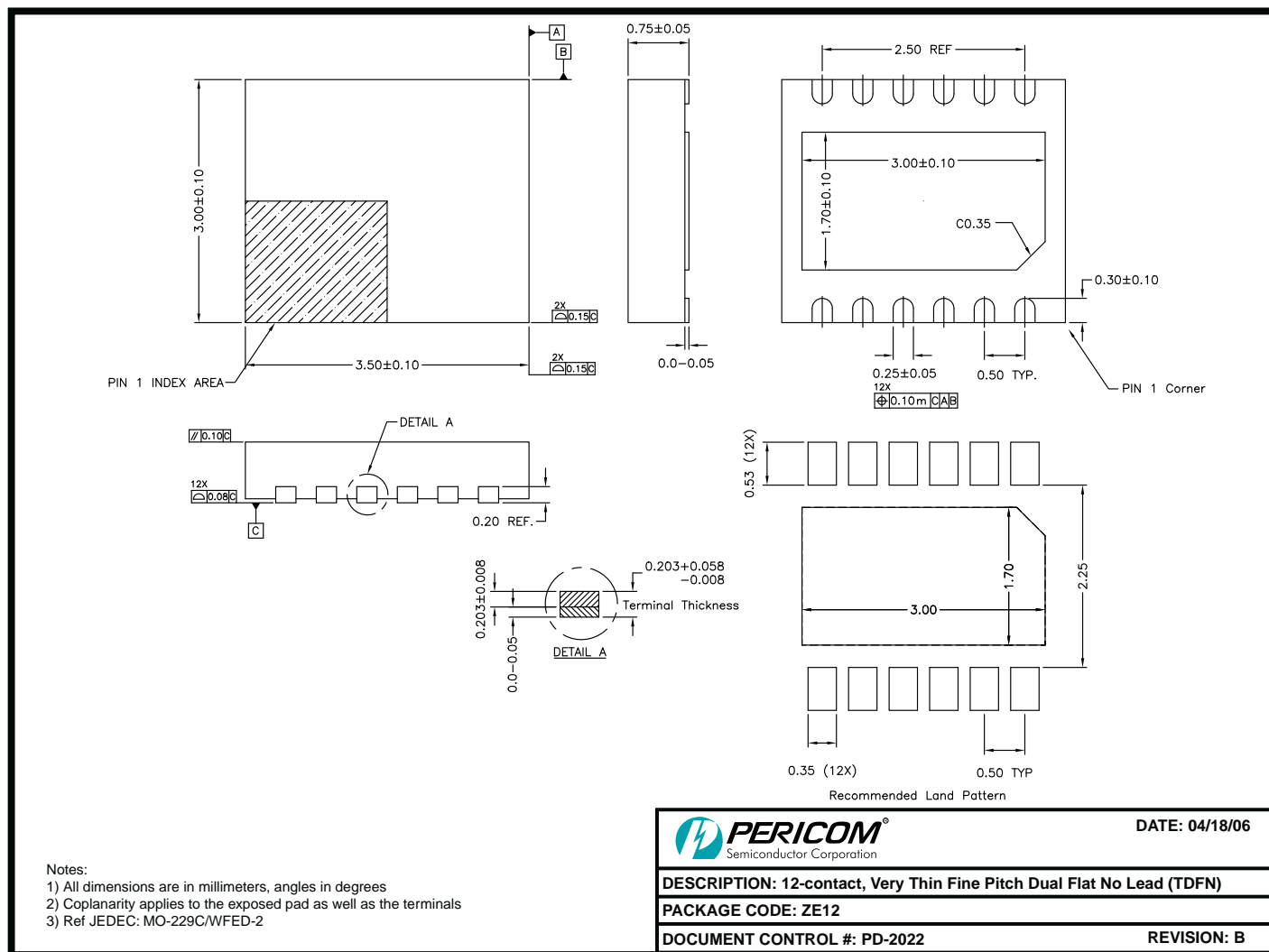


Figure 8. Bandwidth

Packaging Mechanical: 12-Contact TDFN (ZE)



06-0360

Note:

- For latest package info, please check: <http://www.pericom.com/products/packaging/mechanicals.php>

Ordering Information

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

Notes:

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