# 3.0V, SOTINY™ Single-Supply 0.4Ω SPST (NC) CMOS Analog Switch

## Features

- Low On-Resistance: 0.4Ω Max (+2.7V Supply)
- 0.16Ω Max. On-Resistance Flatness at +25°C
- Fast Switching: 10ns Max.
- +1.1V to +3.6V Single-Supply Operation
- TTL/CMOS-Logic Compatible
- –25dB Off-Isolation at 100KHz
- 1nA Max. Off-Leakage at +25°C
- Packaging (available Pb-free):
  – 5-pin Small Compact SOT-23
  – 6-pin Ultra Compact Thin Dual in-line Flat No Lead TDFN

## Applications

- Cellular Phones • Communications Circuits
- Battery-Operated Equipment • DSL Modems
- Audio and Video Signal Routing • PCMCIA Cards

## Pin Description

| TDFN | SOT-23 | Name | Function |
|---|---|---|---|
| 1 | 1 | COM | Analog Switch, Common |
| 2 | 2 | NC | Analog Switch, Normally Closed |
| 3 | 3 | GND | Ground |
| 4 | 4 | IN | Digital Control Input |
| 6 | 5 | $V_{CC}$ | Positive Supply Voltage |
| 5 | - | N.C. | No Internal Connection |

**Note:**
NC and COM pins are identical and interchangeable. Any pin may be considered as an input or an output; signals pass.

## Truth Table

| Input | Switch State |
|---|---|
| LOW | ON |
| HIGH | OFF |

## Description

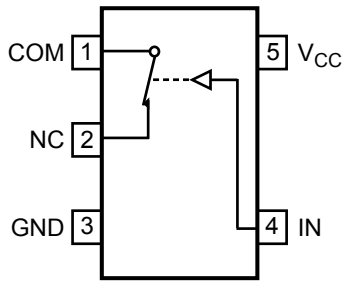
PI3A4627 is a single-pole/single-throw (SPST) normally closed (NC) analog switch that operates from a single +1.5V to +3.6V supply.

The switch has 0.4Ω Max On-Resistance ($R_{ON}$), with 0.1Ω Max $R_{ON}$ flatness over the analog signal range when powered from a +3.0V supply. Leakage currents are less than 2nA and fast switching times are less than 10ns.

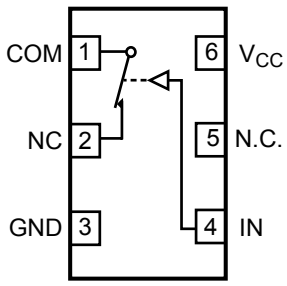
To minimize PC board area use, the device is available in the ultra compact TDFN, and the small compact SOT-23 packages.

## Functional Block Diagrams/Pin Configurations

Top Views




SOT23




TDFN

N.C. = No Internal Connection

Switches shown for Logic "0" input

## Absolute Maximum Ratings

Voltages Referenced to GND

$V_{CC}$ ..... –0.5V to +3.6V

$V_{IN}$, $V_{COM}$, $V_{NC}$, $V_{NO}$ (Note 1) ..... –0.5V to $V_{CC}$ +0.3V or 30mA, whichever occurs first

Current (any terminal) ..... ±200mA

Peak Current, COM, NO, NC (Pulsed at 1ms, 10% duty cycle) ..... ±400mA

## Thermal Information

Continuous Power Dissipation

SOT-23 (derate 7.1mW/ºC above +70ºC) ..... 0.5W

Storage Temperature ..... –65ºC to +150ºC

Lead Temperature (soldering, 10s) ..... +300ºC

**Note 1:** Signals on NC, NO, COM, or IN exceeding $V_{CC}$ 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

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

| Description | Parameters | Test Conditions | Temp.(°C) | Min.(1) | Typ.(2) | Max.(1) | Units |
|---|---|---|---|---|---|---|---|
| Analog Switch | | | | | | | |
| Analog Signal Range(3) | $V_{ANALOG}$ | | Full | 0 | | $V_{CC}$ | V |
| On Resistance | $R_{ON}$ | $V_{CC}$ = 2.7V, $I_{COM}$ = 100mA, $V_{NO}$ or $V_{NC}$ = 1.5V | 25 | | | 0.4 | Ω |
| | | | Full | | | 0.4 | |
| On-Resistance Match Between Channels (4) | $\Delta R_{ON}$ | | 25 | | | 0.05 | |
| | | | Full | | | 0.06 | |
| On-Resistance Flatness(5) | $R_{FLAT(ON)}$ | $V_{CC}$ =2.7V, $I_{COM}$ = 100mA, $V_{NO}$ or $V_{NC}$ = 0.8V, 2.0V | 25 | | | 0.1 | |
| | | | Full | | | 0.1 | |
| | | | | | | | |
| NO or NC Off Leakage Current(6) | $I_{COM(OFF)}$ or $I_{NC(OFF)}$ | $V_{CC}$ =3.3V, $V_{COM}$ = 0V, $V_{NO}$ or $V_{NC}$ = +2.0V | 25 | –1 | | 1 | nA |
| | | | Full | –20 | | 10 | |
| COM On Leakage Current(6) | $I_{COM(ON)}$ | $V_{CC}$ =3.3V, $V_{COM}$ = +2.0V $V_{NO}$ or $V_{NC}$ = +2.0V | 25 | –2 | | 2 | |
| | | | Full | –20 | | 20 | |

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

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

| Description | Parameters | Test Conditions | Temp (°C) | Min.(1) | Typ.(2) | Max.(1) | Units |
|---|---|---|---|---|---|---|---|
| **Logic Input** | | | | | | | |
| Input High Voltage | $V_{IH}$ | Guaranteed logic High Level | Full | 1.4 | | | V |
| Input Low Voltage | $V_{IL}$ | Guaranteed logic Low Level | | | | 0.5 | |
| Input Current with Voltage High | $I_{INH}$ | $V_{IN}$ = 1.4V, all others = 0.5V | | –1 | | 1 | µA |
| Input Current with Voltage Low | $I_{INL}$ | $V_{IN}$ = 0.5V, all other = 1.4V | | –1 | | 1 | |
| **Dynamic** | | | | | | | |
| Turn-On Time | $t_{ON}$ | $V_{CC}$ = 3.3V, $V_{NO}$ or $V_{NC}$ = 2.0V, Figure 1 | 25 | | | 10 | ns |
| | | | Full | | | 10 | |
| Turn-Off Time | $t_{OFF}$ | | 25 | | | 10 | |
| | | | Full | | | 10 | |
| Charge Injection(3) | Q | $C_L$ = 1nF, $V_{GEN}$ = 0V, $R_{GEN}$ = 0Ω, Figure 2 | 25 | | 50 | | pC |
| Off Isolation(7) | $O_{IRR}$ | $R_L$ = 50Ω, f = 100KHz, Figure 3 | | | -25 | | dB |
| NC or NO Capacitance | $C_{(OFF)}$ | f = 1MHz, Figure 4 | | | 130 | | pF |
| COM Off Capacitance | $C_{COM(OFF)}$ | | | | 130 | | |
| COM On Capacitance | $C_{COM(ON)}$ | f = 1MHz, Figure 4 | | | 270 | | |
| **Supply** | | | | | | | |
| Power-Supply Range | $V_{CC}$ | | Full | 1.5 | | 3.6 | V |
| Positve Supply Current | $I_{CC}$ | $V_{CC}$ = 3.6V, $V_{IN}$ = 0V or $V_{CC}$ | | | | 100 | nA |

**Notes:**

1. The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.
2. Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.
3. Guaranteed by design.
4. $\Delta R_{ON} = R_{ON}$ Max. - $R_{ON}$ 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 +25ºC.
7. Off Isolation = $20\log_{10}$ [ $V_{COM}$ / ($V_{NO}$ or $V_{NC}$) ]. See Figure 3.

## Electrical Specifications - Single +2.5V Supply

($V_{CC}$ = +2.5V ± 10%, GND = 0V, $V_{IH}$ = 1.4V, $V_{IL}$ = 0.5V)

| Description | Parameters | Test Conditions | Temp.(°C) | Min.(1) | Typ.(2) | Max.(1) | Units |
|---|---|---|---|---|---|---|---|
| **Analog Switch** | | | | | | | |
| Analog Signal Range(3) | $V_{ANALOG}$ | | | 0 | | $V_{CC}$ | V |
| On Resistance | $R_{ON}$ | $V_{CC}$ = 2.5V, $I_{COM}$ = –8mA, $V_{NO}$ or $V_{NC}$ = 1.8V | 25 | | | 0.4 | Ω |
| | | | Full | | | 0.4 | |
| On-Resistance Match Between Channels (4) | $\Delta R_{ON}$ | $V_{CC}$ = 2.5V, $I_{COM}$ = –8mA, $V_{NO}$ or $V_{NC}$ = 0.8V 1.8V | 25 | | | 0.05 | |
| | | | Full | | | 0.06 | |
| On-Resistance Flatness(5) | $R_{FLAT(ON)}$ | | 25 | | | 0.1 | |
| | | | Full | | | 0.1 | |
| **Dynamic** | | | | | | | |
| Turn-On Time | $t_{ON}$ | $V_{CC}$ = 2.5V, $V_{NO}$ or $V_{NC}$ = 1.8V, Figure 1 | 25 | | | 10 | ns |
| | | | Full | | | 15 | |
| Turn-Off Time | $t_{OFF}$ | | 25 | | | 10 | |
| | | | Full | | | 10 | |
| Charge Injection(3) | Q | $C_L$ = 1nF, $V_{GEN}$ = 0V, $R_{GEN}$ = 0V, Figure 2 | 25 | | 42 | | pC |
| **Logic Input** | | | | | | | |
| Input HIGH Voltage | $V_{IH}$ | Guaranteed logic high level | Full | 1.4 | | | V |
| Input LOW Voltage | $V_{IL}$ | Guaranteed logic Low level | Full | | | 0.5 | |
| Input HIGH Current | $I_{INH}$ | $V_{IN}$ = 1.4V, all others = 0.5V | Full | –1 | | 1 | µA |
| Input HIGH Current | $I_{INL}$ | $V_{IN}$ = 0.5V, all others = 1.4V | Full | –1 | | 1 | |

**Notes:**

1. The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.
2. Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.
3. Guaranteed by design.
4. $\Delta R_{ON} = R_{ON}$ max. - $R_{ON}$ min.
5. Flatness is defined as the difference between the maximum and minimum value of On-resistance measured.

## Electrical Specifications - Single +1.8V Supply

($V_{CC}$ = +1.8V ± 10%, GND = 0V, $V_{IH}$ = 1.4V, $V_{IL}$ = 0.5V)

| Description | Parameters | Test Conditions | Temp.(°C) | Min.(1) | Typ.(2) | Max.(1) | Units |
|---|---|---|---|---|---|---|---|
| **Analog Switch** | | | | | | | |
| Analog Signal Range(3) | $V_{ANALOG}$ | | | 0 | | $V_{CC}$ | V |
| On-Resistance | $R_{ON}$ | $V_{CC}$ = 1.8V, $I_{COM}$ = –4mA, $V_{NO}$ or $V_{NC}$ = 1.5V | 25 | | | 0.4 | Ω |
| | | | Full | | | 0.8 | |
| On-Resistance Match Between Channels (4) | $\Delta R_{ON}$ | $V_{CC}$ = 1.8V, $I_{COM}$ = –4mA, $V_{NO}$ or $V_{NC}$ = 0.8V, 1.5V | 25 | | | 0.05 | |
| | | | Full | | | 0.06 | |
| On-Resistance Flatness(5) | $R_{FLAT(ON)}$ | | 25 | | | 0.4 | |
| | | | Full | | | 0.6 | |
| **Dynamic** | | | | | | | |
| Turn-On Time | $t_{ON}$ | $V_{CC}$ = 1.8V, $V_{NO}$ or $V_{NC}$ = 1.5V, Figure 1 | 25 | | | 15 | ns |
| | | | Full | | | 15 | |
| Turn-Off Time | $t_{OFF}$ | | 25 | | | 10 | |
| | | | Full | | | 15 | |
| Charge Injection(3) | Q | $C_L$ = 1nF, $V_{GEN}$ = 0V, $R_{GEN}$ = 0V, Figure 2 | 25 | | 29 | | pC |
| **Logic Input** | | | | | | | |
| Input HIGH Voltage | $V_{IH}$ | Guaranteed logic high level | Full | 1.4 | | | V |
| Input LOW Voltage | $V_{IL}$ | Guaranteed logic Low level | Full | | | 0.5 | |
| Input HIGH Current | $I_{INH}$ | $V_{IN}$ =1.4V, all others = 0.5V | Full | –1 | | 1 | µA |
| Input HIGH Current | $I_{INL}$ | $V_{IN}$ =0.5V, all others =1.4V | Full | –1 | | 1 | |

**Notes:**

1. The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.
2. Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.
3. Guaranteed by design.
4. $\Delta R_{ON} = R_{ON}$ max. - $R_{ON}$ min.
5. Flatness is defined as the difference between the maximum and minimum value of On-resistance measured.

## Test Circuits/Timing Diagrams

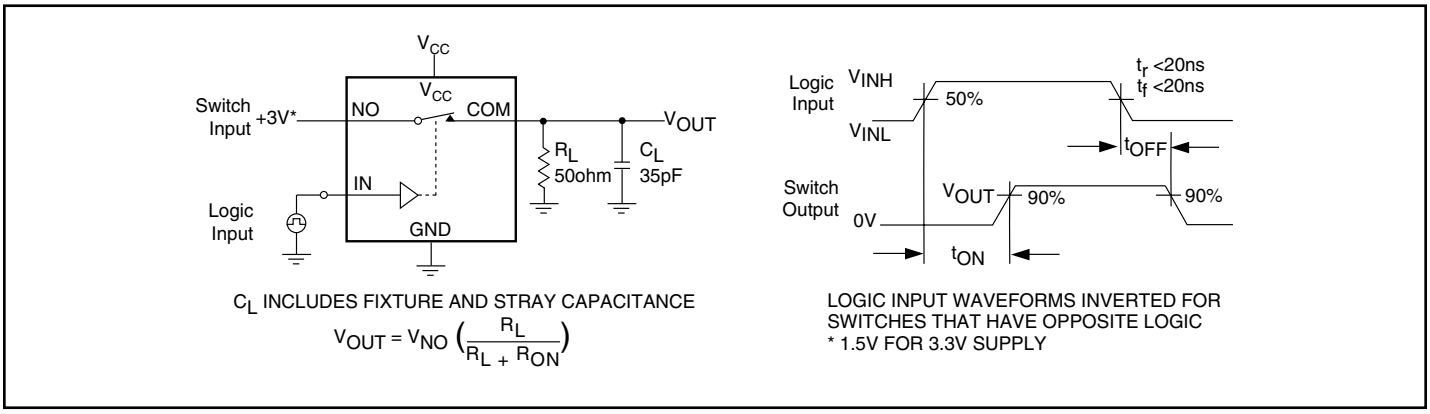



**Figure 1. Switching Time**

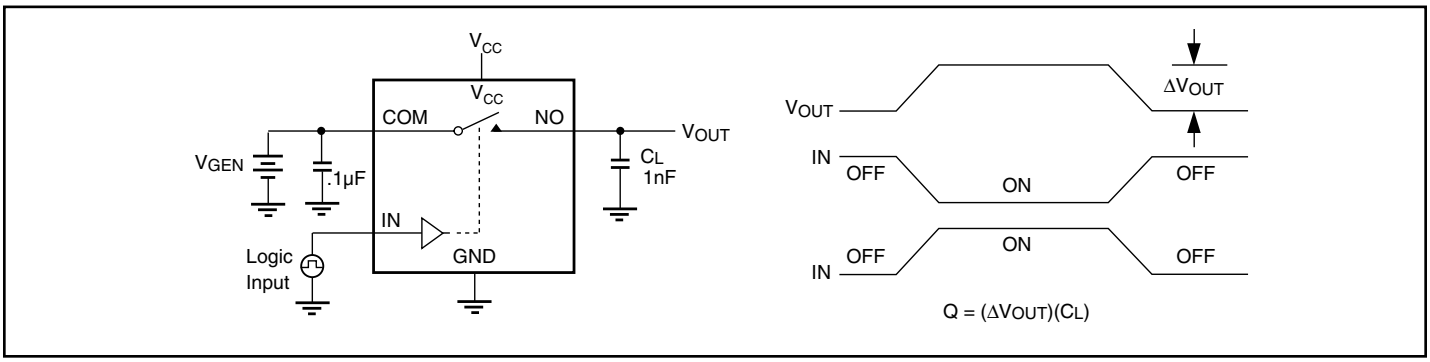



**Figure 2. Charge Injection**

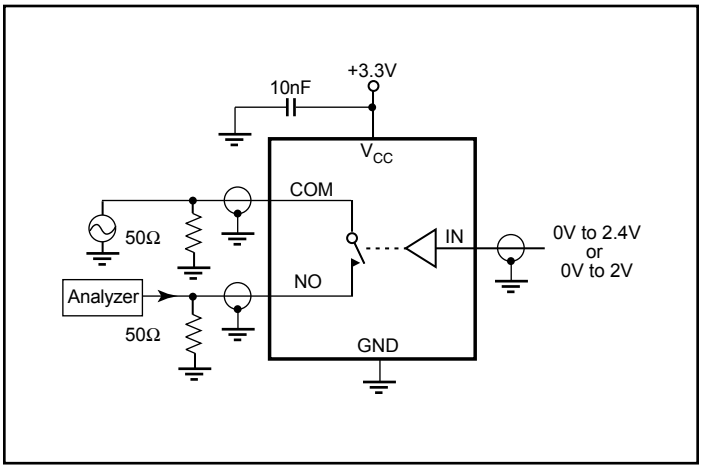



**Figure 3. Off Isolation**

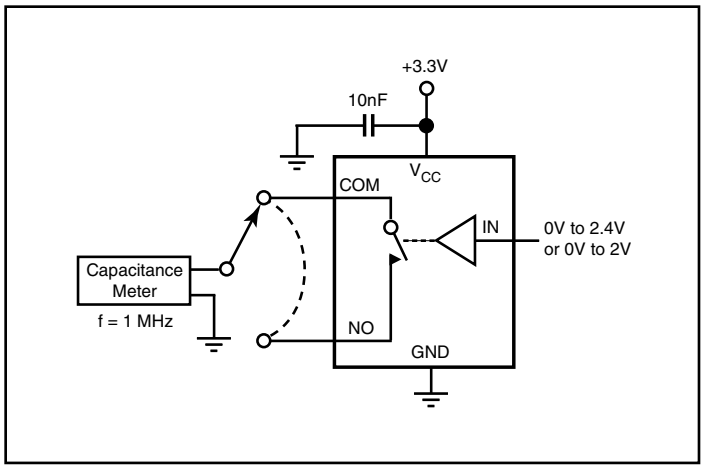
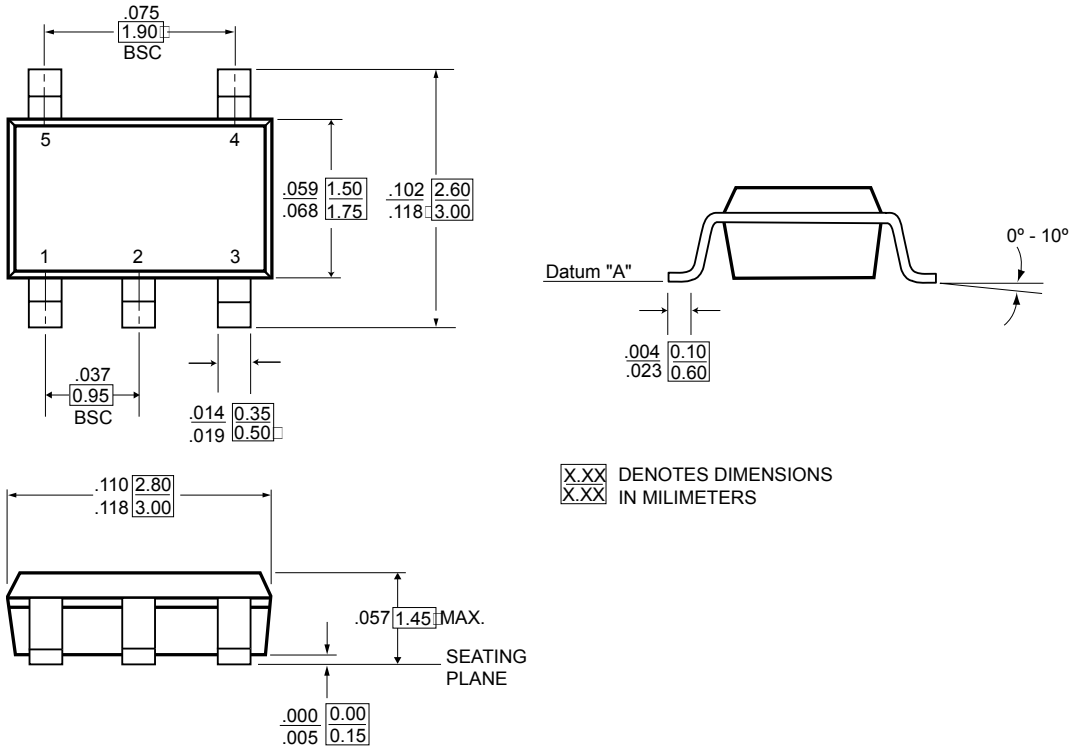
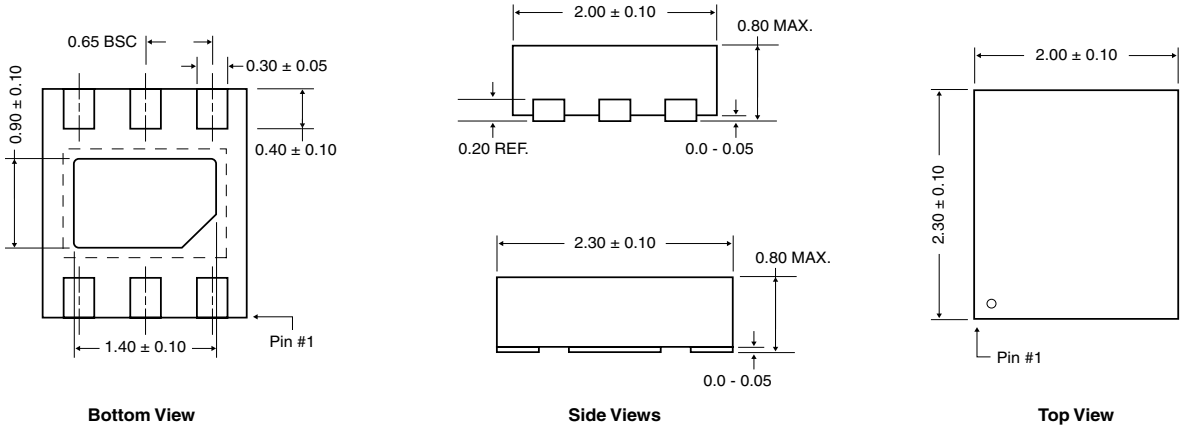



**Figure 4. Channel On/Off Capacitance**

## Packaging Mechanical: 5-Pin SOT-23 (T) Package




## Packaging Mechanical: 6-Pin TDFN (ZC) Package



## Ordering Information

| Ordering Code | Package Code | PackageType | Package Top Mark |
|---|---|---|---|
| PI3A4627TX | T | 5-pin Small Compact SOT-23 | ZC |
| PI3A4627TEX | T | Pb-free & Green, 5-pin Small Compact SOT-23 | ZC |
| PI3A4627ZCEX | ZC | Pb-free & Green, 6-pin Ultra Compact TDFN | ZC |

**Notes:**
1. Thermal characteristics can be found on the company web site at http://www.pericom.com/packaging/
2. X = Tape/Reel