

## Dual, Wide Bandwidth Analog Switches

### Features

- Single-Supply Operation (+2V to +6V)
- Rail-to-Rail Analog Signal Dynamic Range
- Low On-Resistance (6Ω typ. with 5V supply)  
Minimizes Distortion and Error Voltages
- On-Resistance Flatness, 3Ω typ.
- Low Charge Injection Reduces Glitch Errors. Q = 4pC typ.
- High Speed. t<sub>ON</sub> = 10ns typ.
- Wide -3dB Bandwidth: 230 MHz
- High-Current Channel Capability: >100mA
- TTL/CMOS Logic Compatible
- Low Power Consumption (0.5μW typ.)
- Small MSOP-8 package minimizes board area

### Applications

- Audio, Video Switching and Routing
- Battery-Powered Communication Systems
- Computer Peripherals
- Telecommunications
- Portable Instrumentation
- Mechanical Relay Replacement
- Cell Phones
- PDAs

### Description

The PI5A126/PI5A127 are dual SPST (single-pole single-throw) analog switches designed for single supply operation. These high-precision devices are ideal for low-distortion audio, video, signal switching and routing.

The PI5A126 is a normally open (NO) switch. The switch is open when IN is LOW. The PI5A127 is a normally closed (NC) switch. Each switch conducts current equally well in either direction when on. When off, they block voltages up to V+.

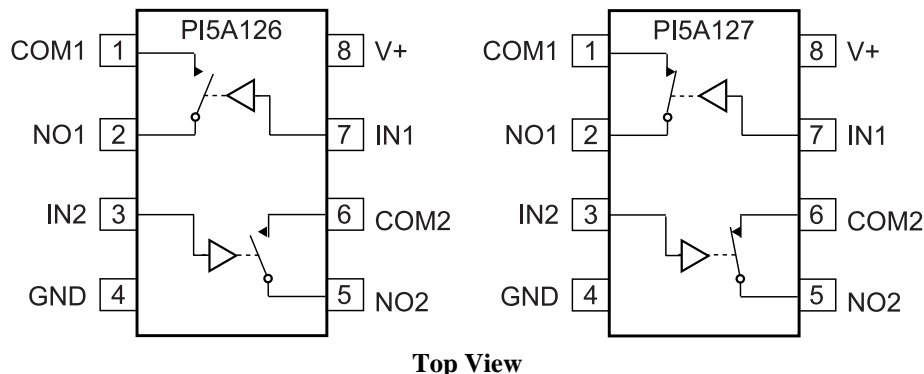
These switches are fully specified with +5V and +3.3V supplies. With +5V, they guarantee <10Ω on-resistance. On-resistance matching between channels is within 2Ω. On-resistance flatness is less than 5Ω over the specified range. These switches also guarantee fast switching speeds (t<sub>ON</sub> < 20ns).

These products are available in 8-pin SOIC and MSOP plastic packages for operation over the industrial temperature range (-40°C to +85°C).

### Ordering Information

| P/N      | Package       |
|----------|---------------|
| PI5A126W | Narrow SOIC-8 |
| PI5A126U | MSOP-8        |
| PI5A127W | Narrow SOIC-8 |
| PI5A127U | MSOP-8        |

### Functional Diagrams, Pin Configurations and Truth Tables



| Logic | PI5A126 | PI5A127 |
|-------|---------|---------|
| 1     | ON      | OFF     |
| 0     | OFF     | ON      |

Switches shown for logic "0" input

### Absolute Maximum Ratings

Voltages Referenced to GND

|   |       |  |
|---|-------|--|
| V+  | ..... | -0.5V to +7V                                       |
| V <sub>IN</sub> , V <sub>COM</sub> , V <sub>NC</sub> , V <sub>NO</sub> (Note 1) | ..... | -0.5V to V+ +2V<br>or 30mA, whichever occurs first |
| Current (any terminal except COM, NO, NC)                                       | ..... | 30mA   |
| Current, COM, NO, NC  | ..... | 100mA  |
| (Pulsed at 1ms, 10% duty cycle)   | ..... | 120mA  |

### Thermal Information

Continuous Power Dissipation

|                                   |       |                 |
|-----------------------------------|-------|-----------------|
| -6 (derate 7mW/°C above +70°C)    | ..... | 550mW           |
| Storage Temperature               | ..... | -65°C to +150°C |
| Lead Temperature (soldering, 10s) | ..... | +300°C          |

**Note 1:**

Signals on NC, NO, COM, or IN exceeding V+ 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 +5V Supply

(V+ = +5V ±10%, GND = 0V, V<sub>INH</sub> = 2.4V, V<sub>INL</sub> = 0.8V)

| Parameter   | Symbol  | Conditions   | Temp. (°C) | Min. <sup>(2)</sup> | Typ. <sup>(1)</sup> | Max. <sup>(2)</sup> | Units |
|---|---|--|------------|---------------------|---------------------|---------------------|-------|
| <b>Analog Switch</b>                                |   |  |            |                     |                     |                     |       |
| Analog Signal Range <sup>(3)</sup>                  | V <sub>ANALOG</sub>                             |  | Full       | 0                   |                     | V+                  | V     |
| On Resistance                                       | R <sub>ON</sub>                                 | V+ = 4.5V, I <sub>COM</sub> = -30mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = +2.5V         | 25         |                     | 7.2                 | 10                  | Ω     |
| On-Resistance Match Between Channels <sup>(4)</sup> | ΔR <sub>ON</sub>                                |  | Full       |                     |                     | 12                  |       |
| On-Resistance Flatness <sup>(5)</sup>               | R <sub>FLAT(ON)</sub>                           | V+ = 5V,<br>I <sub>COM</sub> = -30mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 1V, 2.5V, 4V | 25         |                     | 2.72                | 3.5                 |       |
|   |   |  | Full       |                     |                     | 4                   |       |
| NO or NC Off Leakage Current <sup>(6)</sup>         | I <sub>NO(OFF)</sub> or<br>I <sub>NC(OFF)</sub> | V+ = 5.5V, V <sub>COM</sub> = 0V,<br>V <sub>NO</sub> or V <sub>NC</sub> = 4.5V             | 25         |                     | 0.18                |                     | nA    |
|   |   |  | Full       | -200                |                     | 200                 |       |
| COM Off Leakage Current <sup>(6)</sup>              | I <sub>COM(OFF)</sub>                           | V+ = 5.5V,<br>V <sub>COM</sub> = +4.5V, V <sub>NO</sub><br>or V <sub>NC</sub> = ± 0V       | 25         |                     | 0.20                |                     |       |
|   |   |  | Full       | -200                |                     | 200                 |       |
| COM On Leakage Current <sup>(6)</sup>               | I <sub>COM(ON)</sub>                            | V+ = 5.5V, V <sub>COM</sub> = +4.5V<br>V <sub>NO</sub> or V <sub>NC</sub> = +4.5V          | 25         |                     | 0.20                |                     |       |
|   |   |  | Full       | -200                |                     | 200                 |       |

**Electrical Specifications - Single +5V Supply** (continued)

(V+ = +5V ±10%, GND = 0V, V<sub>INH</sub> = 2.4V, V<sub>INL</sub> = 0.8V)

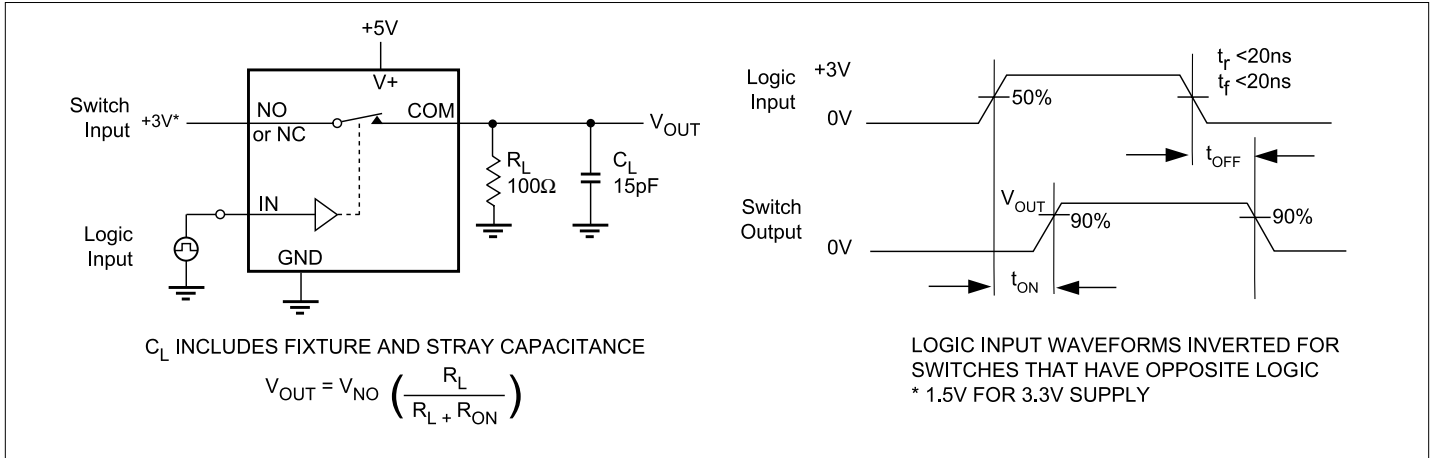
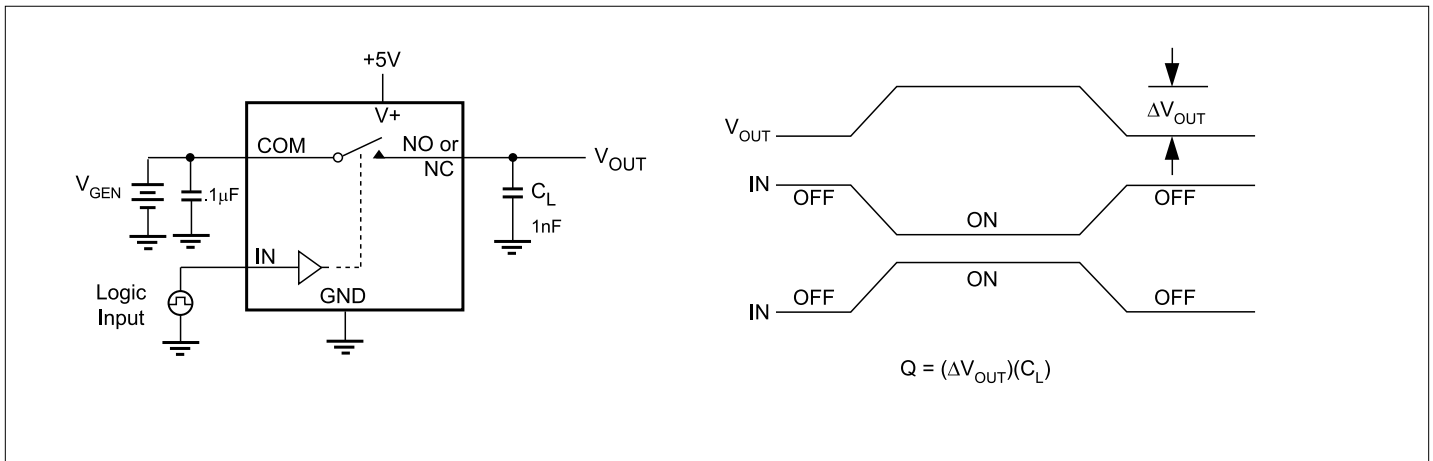
| Parameter                       | Symbol                 | Conditions  | Temp(°C) | Min. <sup>(1)</sup> | Typ. <sup>(2)</sup> | Max. <sup>(1)</sup> | Units |
|---------------------------------|------------------------|---|----------|---------------------|---------------------|---------------------|-------|
| <b>Logic Input</b>              |                        |   |          |                     |                     |                     |       |
| Input High Voltage              | V <sub>IH</sub>        | Guaranteed logic High Level   | Full     | 2                   |                     |                     | V     |
| Input Low Voltage               | V <sub>IL</sub>        | Guaranteed logic Low Level  |          |                     |                     | 0.8                 |       |
| Input Current with Voltage High | I <sub>INH</sub>       | V <sub>IN</sub> = 2.4V, all others = 0.8V                                       |          | -1                  | 0.005               | 1                   |       |
| Input Current with Voltage Low  | I <sub>INL</sub>       | V <sub>IN</sub> = 0.8V, all others = 2.4V                                       |          | -1                  | 0.005               | 1                   |       |
| <b>Dynamic</b>                  |                        |   |          |                     |                     |                     |       |
| Turn-On Time                    | t <sub>ON</sub>        | V <sub>CC</sub> = 5V, Figure 1  | 25       |                     | 7                   | 15                  | ns    |
|                                 |                        |   | Full     |                     |                     | 20                  |       |
| Turn-Off Time                   | t <sub>OFF</sub>       |   | 25       |                     | 1                   | 7                   |       |
|                                 |                        |   | Full     |                     |                     | 10                  |       |
| Charge Injection <sup>(3)</sup> | Q                      | C <sub>L</sub> = 1nF, V <sub>gen</sub> = 0V,<br>R <sub>gen</sub> = 0Ω, Figure 2 | 25       |                     | 1.6                 | 10                  | pC    |
| Off Isolation                   | OIRR                   | R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF,<br>f = 10MHz, Figure 3              |          |                     | -43                 |                     | dB    |
| Crosstalk                       | Xtalk                  | R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF,<br>f = 10 MHz, Figure 4             |          |                     | -43                 |                     |       |
| NC or NO Capacitance            | C(off)                 | f = 1kHz, Figure 5  |          |                     | 5.5                 |                     | pF    |
| COM Off Capacitance             | C <sub>com</sub> (off) |   |          |                     | 5.5                 |                     |       |
| COM On Capacitance              | C <sub>com</sub> (on)  |   |          | f = 1kHz, Figure 6  |                     | 13                  |       |
| -3dB Bandwidth                  | BW                     | R <sub>L</sub> = 50Ω, Figure 7  |          | Full                |                     | 326                 |       |
| Distortion                      | D                      | R <sub>L</sub> = 10   |          |                     | 0.2                 |                     | %     |
| <b>Supply</b>                   |                        |   |          |                     |                     |                     |       |
| Power-Supply Range              | V+                     |   | Full     | 2                   |                     | 6                   | V     |
| Positive Supply Current         | I+                     | V+ = 5.5V, V <sub>IN</sub> = 0V<br>or V <sub>CC</sub> , V+                      |          |                     |                     | 1                   | μA    |

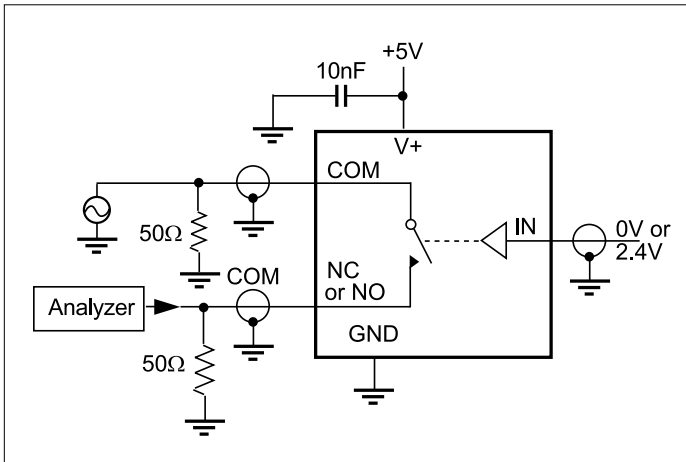
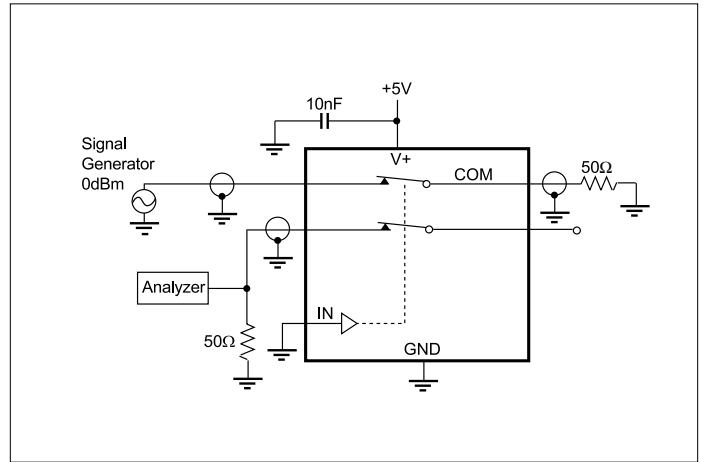
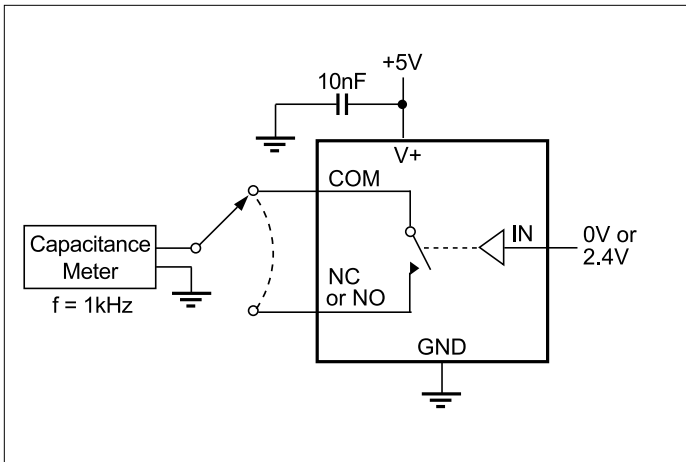
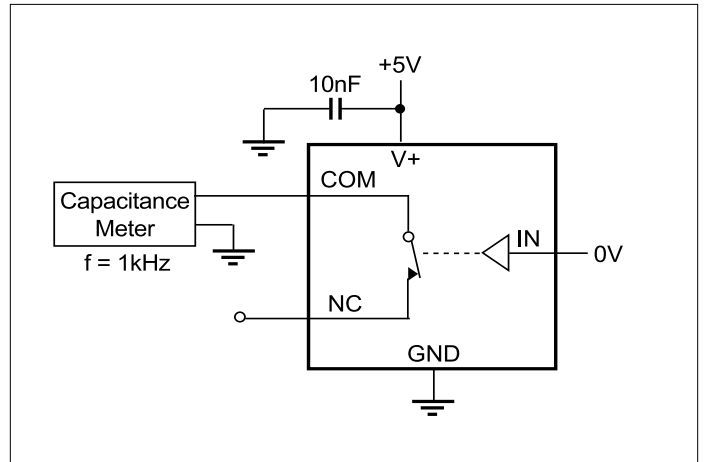
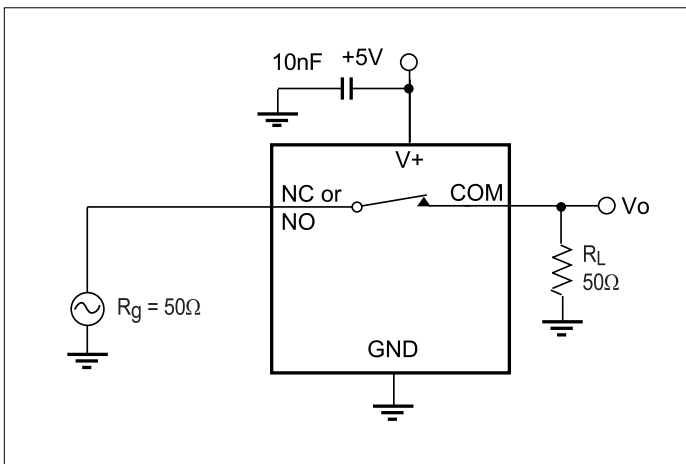
**Notes:**

1. The algebraic convention, where the most negative value is a minimum and the 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. 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.
7. Off Isolation = 20log<sub>10</sub> [ V<sub>COM</sub> / (V<sub>NO</sub> or V<sub>NC</sub>) ]. See Figure 3.

**Electrical Specifications - Single +3.3V Supply** ( $V^+ = +3.3V \pm 10\%$ ,  $GND = 0V$ ,  $V_{INH} = 2.4V$ ,  $V_{INL} = 0.8V$ )

| Parameter  | Symbol          | Conditions  | Temp.(°C) | Min. <sup>(1)</sup> | Typ. <sup>(2)</sup> | Max. <sup>(1)</sup> | Units    |
|--|-----------------|---|-----------|---------------------|---------------------|---------------------|----------|
| <b>Analog Switch</b>                                   |                 |   |           |                     |                     |                     |          |
| Analog Signal Range <sup>(3)</sup>                     | $V_{ANALOG}$    |   |           | 0                   |                     | $V^+$               | V        |
| On-Resistance  | $R_{ON}$        | $V^+ = 3V$ , $I_{COM} = -30mA$ ,<br>$V_{NO}$ or $V_{NC} = 1.5V$         | 25        |                     | 12                  | 18                  | $\Omega$ |
|  |                 |   | Full      |                     |                     | 22                  |          |
| On-Resistance Match<br>Between Channels <sup>(4)</sup> | $\Delta R_{ON}$ | $V^+ = 3.3V$ , $I_{COM} = -30mA$ ,<br>$V_{NO}$ or $V_{NC} = 0.8V, 2.5V$ | 25        |                     | 1                   | 1                   |          |
|  |                 |   | Full      |                     |                     | 2                   |          |
| On-Resistance<br>Flatness <sup>(3,5)</sup>             | $R_{FLAT(ON)}$  | $V^+ = 3.3V$ , $I_{COM} = -30mA$ ,<br>$V_{NO}$ or $V_{NC} = 0.8V, 2.5V$ | 25        |                     | 3.5                 | 4                   |          |
|  |                 |   | Full      |                     |                     | 5                   |          |
| <b>Dynamic</b>   |                 |   |           |                     |                     |                     |          |
| Turn-On Time   | $t_{ON}$        | $V^+ = 3.3V$ , $V_{NO}$<br>or $V_{NC} = 1.5V$ , Figure 1                | 25        |                     | 14                  | 25                  | ns       |
|  |                 |   | Full      |                     |                     | 40                  |          |
| Turn-Off Time  | $t_{OFF}$       |   | 25        |                     | 4.5                 | 12                  |          |
|  |                 |   | Full      |                     |                     | 20                  |          |
| Charge Injection <sup>(3)</sup>                        | $Q$             | $C_L = 1nF$ , $V_{GEN} = 0V$ ,<br>$R_{GEN} = 0V$ , Figure 2             | 25        |                     | 1.3                 | 10                  | pC       |
| <b>Supply</b>  |                 |   |           |                     |                     |                     |          |
| Supply Current   | $I^+$           | $V^+ = 3.6V$ , $V_{IN} = 0V$ or $V^+$<br>All Channels on or off         | Full      |                     |                     | 1                   | $\mu A$  |

**Test Circuits/Timing Diagrams**

**Figure 1. Switching Time**

**Figure 2. Charge Injection**

**Test Circuits/Timing Diagrams (continued)**

**Figure 3. Off Isolation**

**Figure 4. Crosstalk**

**Figure 5. Channel-Off Capacitance**

**Figure 6. Channel-On Capacitance**

**Figure 7. Bandwidth**