PI5A125

Single Wide Bandwidth Analog Switch

Features

- Single-Supply Operation (+2V to +6V)
- Rail-to-Rail Analog Signal Dynamic Range
- Low On-Resistance (6-Ohm typical with 5V supply) Minimizes Distortion and Error Voltages
- On-Resistance Flatness, 3-Ohm typical
- Low Charge Injection Reduces Glitch Errors. Q = 4pC (typical)
- Replaces Mechanical Relays
- High Speed: t_{ON} = 10ns typical
- Wide –3dB Bandwidth: 300 MHz (typical)
- High-Current Channel Capability: >100mA
- TTL/CMOS Logic Compatible
- Low Power Consumption (0.5µW typical)
- Small outline transistor package minimizes board area – 65 mil wide SOT23-5 (T5)

Description

The PI5A125 is a single analog switch designed for single-supply operation. This high-precision device is ideal for low-distortion audio, video, signal switching and routing.

The PI5A125 is a single-pole single-throw (SPST), normally closed (NC) switch. The switch is open when $\overline{OE}$ is HIGH.

This switch conducts current equally well in either direction when on. When off, it blocks voltages up to V_{CC}.

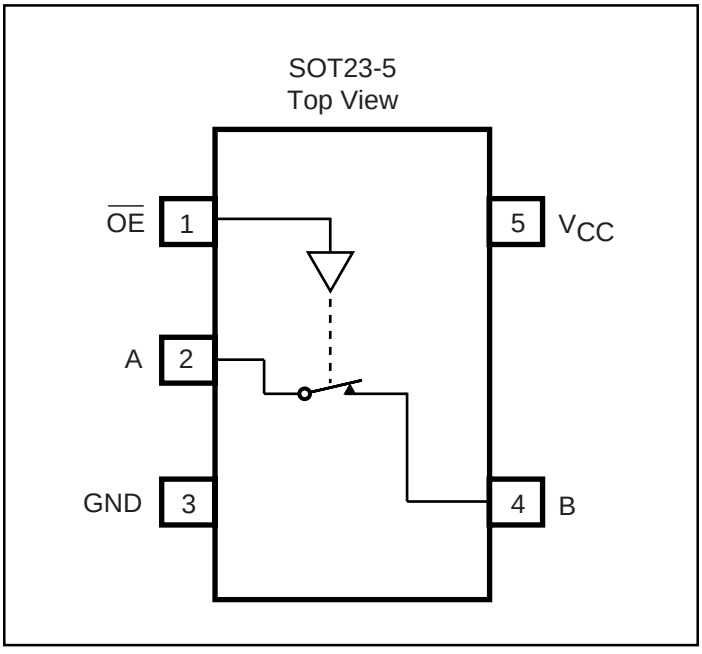
The PI5A125 is fully specified with +5V, and +3.3V supplies. With +5V, it guarantees <10-ohms ON-resistance. ON-resistance flatness is less than 5-ohms over the specified range. The switch also guarantees fast switching speeds (t_{ON} <20ns).

This product is available in a 5-pin SOT23 plastic package for operation over the industrial (–40°C to +85°C) temperature range.

Applications

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

Functional Diagram, Pin Configuration



Truth Table

$\overline{OE}$	PI5A125
0	ON
1	OFF

Switch shown for Logic "0" input

Electrical Specifications - Single +5V Supply (V_{CC} = +5V ±10%, GND = 0V, V_{INH} = 2.4V, V_{INL} = 0.8V)

Description	Parameter	Conditions	Temp. (°C)	Min.(2)	Typ.(1)	Max.(2)	Units
Analog Switch							
Analog Signal Range (3)	V_{ANALOG}		Full	0		V_{CC}	V
On-Resistance	R_{ON}	V_{CC} = 4.5V, I_B = –30 mA, V_A = +2.5V	25		8	10	Ω
			Full			12	
On-Resistance Flatness(5)	$R_{FLAT(ON)}$	V_{CC} = 5V, I_B = –30 mA, V_A = 1V, 2.5V, 4V	25		2.5	3.5	
			Full			4	
Off Leakage Current(6)	$I_{A(OFF)}$ or $I_{B(OFF)}$	V_{CC} = 5.5V, V_B = 0V, V_A = 4.5V	25		0.20		nA
			Full	–80		80	
On Leakage Current(6)	$I_{A(ON)}$ or $I_{B(ON)}$	V+ = 5.5V, V_B = V_A = +4.5V	25		0.20		
			Full	–80		80	
Logic Input							
Input High Voltage	V_{IH}	Guaranteed Logic High Level	Full	2			V
Input Low Voltage	V_{IL}	Guaranteed Logic Low Level				0.8	
Input Current with Input Voltage High	I_{INH}	V_{IN} =2.4V, all others = 0.8V		–1	0.005	1	µA
Input Current with Input Voltage Low	I_{INL}	V_{IN} =0.8V, all others = 2.4V					
Dynamic							
Turn-On Time	t_{ON}	V_{CC} = 5V, see Figure 1	25		7	15	nc
			Full			20	
Turn-Off Time	t_{OFF}	V_{COM} = ±3V, see Figure 2	25		1	7	
			Full		2	5	
Charge Injection (3)	Q	C_L = 1nF, V_{GEN} = 0V, R_{GEN} = 0Ω, see Figure 2	25			10	pC
Off Isolation	OIRR	R_L = 50Ω, C_L = 5pF, f = 10 MHz, see Figure 3					dB
A or B Off Capacitance	$C_{(OFF)}$	f = 1kHz, see Figure 4			5.5		pF
On Capacitance	$C_{(ON)}$	f = 1kHz, see Figure 5			5.5		
-3dB Bandwidth	BW	R_L = 50Ω, see Figure 6			300		MHz
Supply							
Power-Supply Range	V_{CC}		Full	2		6	V
Positive Supply Current	I_{CC}	V+ = 5.5V, V_{IN} = 0V or V_{CC}, All channels on or off				1	µA

Absolute Maximum Ratings

Voltages Referenced to GND
V_{CC} ..... –0.5V to +7V
V_{OE}, V_A, V_B(1) ..... –0.5V to V_{CC} +2V
..... or 30mA, whichever occurs first
Current (any terminal except A, B) 30mA
Current: A,B (pulsed at 1ms, 10% duty cycle) 120mA

Thermal Information

Continuous Power Dissipation
SOT23-5 (derate 7mW/ºC above +70ºC) 550mW
Storage Temperature ..... -65ºC to +150ºC
Lead Temperature (soldering, 10s) ..... +300ºC

Note 1:
Signals on $\overline{OE}$, A, B exceeding Vcc 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_{INH} = 2.4V, V_{INL} = 0.8V)

Parameter	Symbol	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} =3V, I_B =-30mA, V_A =1.5V	25		12	18	Ω
			Full			22	
On-Resistance Flatness(3,5)	$R_{FLAT(ON)}$	V_{CC} = 3.3V, I_B = -30mA, V_A = 0.8V, 2.5V	25		0.5	4	
			Full			5	
Dynamic							
Turn-On Time	t_{ON}	V_{CC} =3.3V to VNO or VNC = 1.5V, Fig.1	25		15	25	ns
			Full			40	
Turn-Off Time	t_{OFF}		25		1.5	12	
			Full			20	
Charge Injection(3)	Q	C_L =1nf, V_{GEN} = 0V, R_{GEN} = 0V, Fig.2	25		1.3	10	pC
Supply							
I_{CC}	Positive Supply Current	V_{CC} = 3.6V, Vin = 0V or V_{CC} All channels on or off	Full			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. $\Delta R_{ON} = R_{ON}$ 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 = $20\log_{10} V_B / V_A$. See Figure 3.

Test Circuits/Timing Diagrams

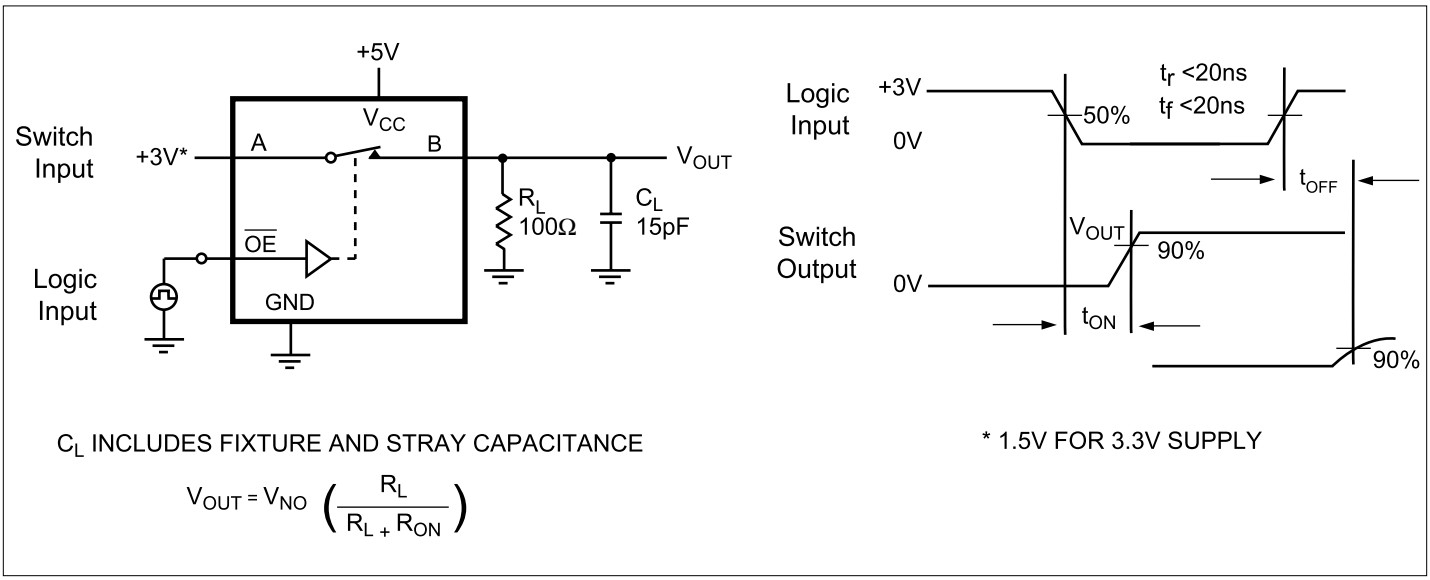


Figure 1. Switching Time

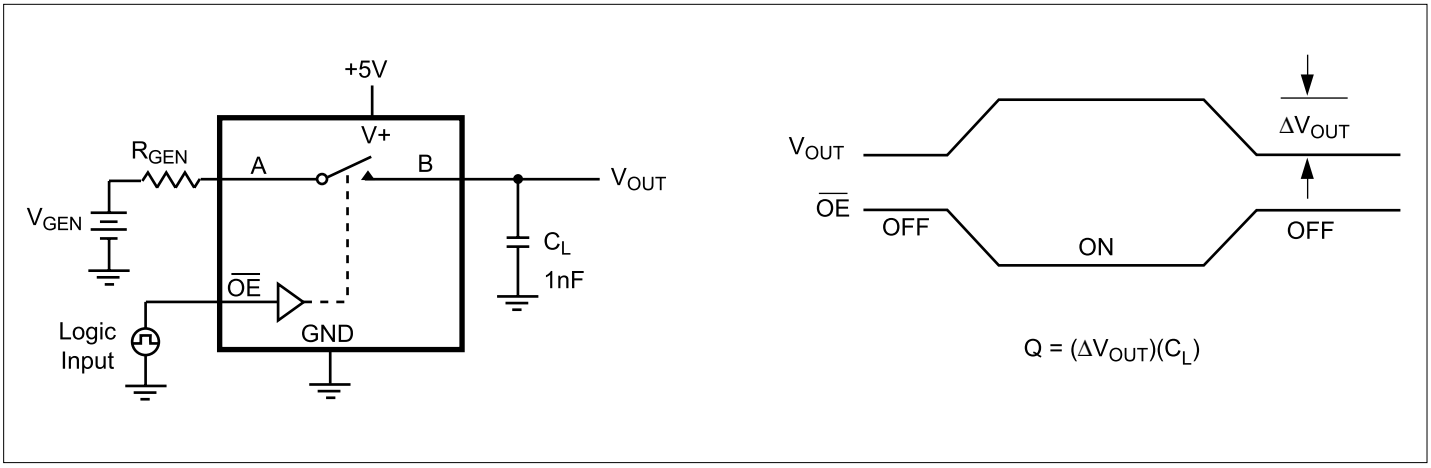


Figure 2. Charge Injection

Test Circuits/Timing Diagrams (continued)

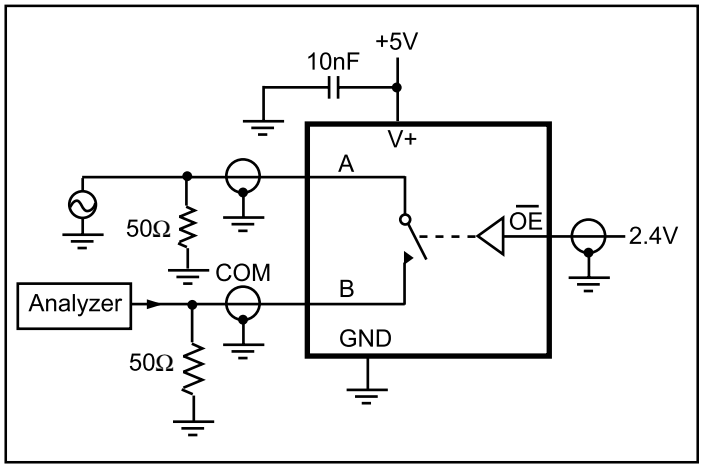


Figure 3. Off Isolation

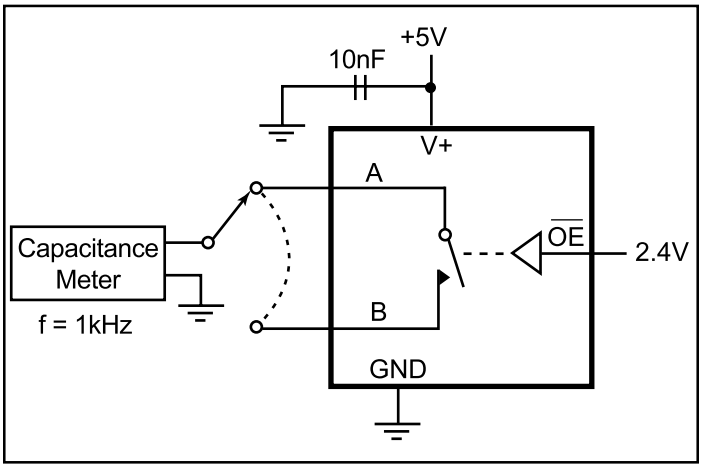


Figure 4. Channel-Off Capacitance

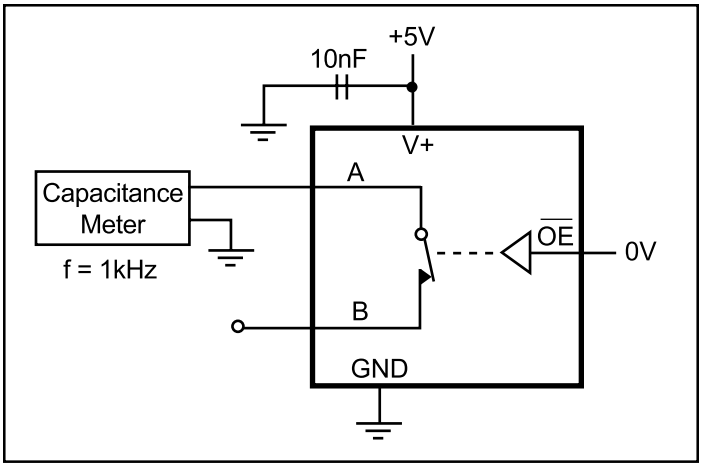


Figure 5. Channel-On Capacitance

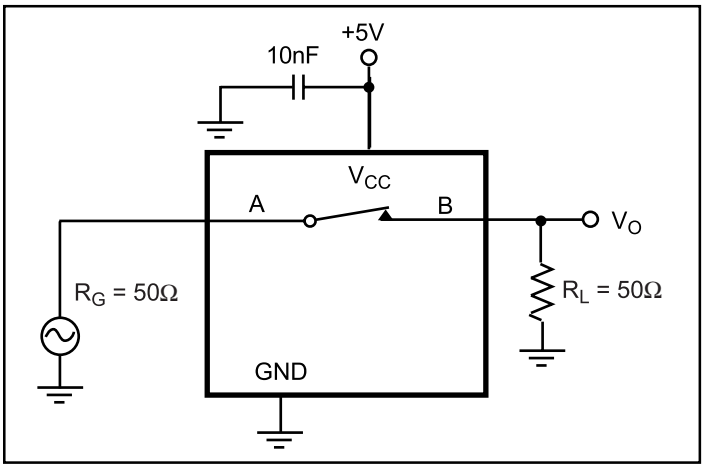
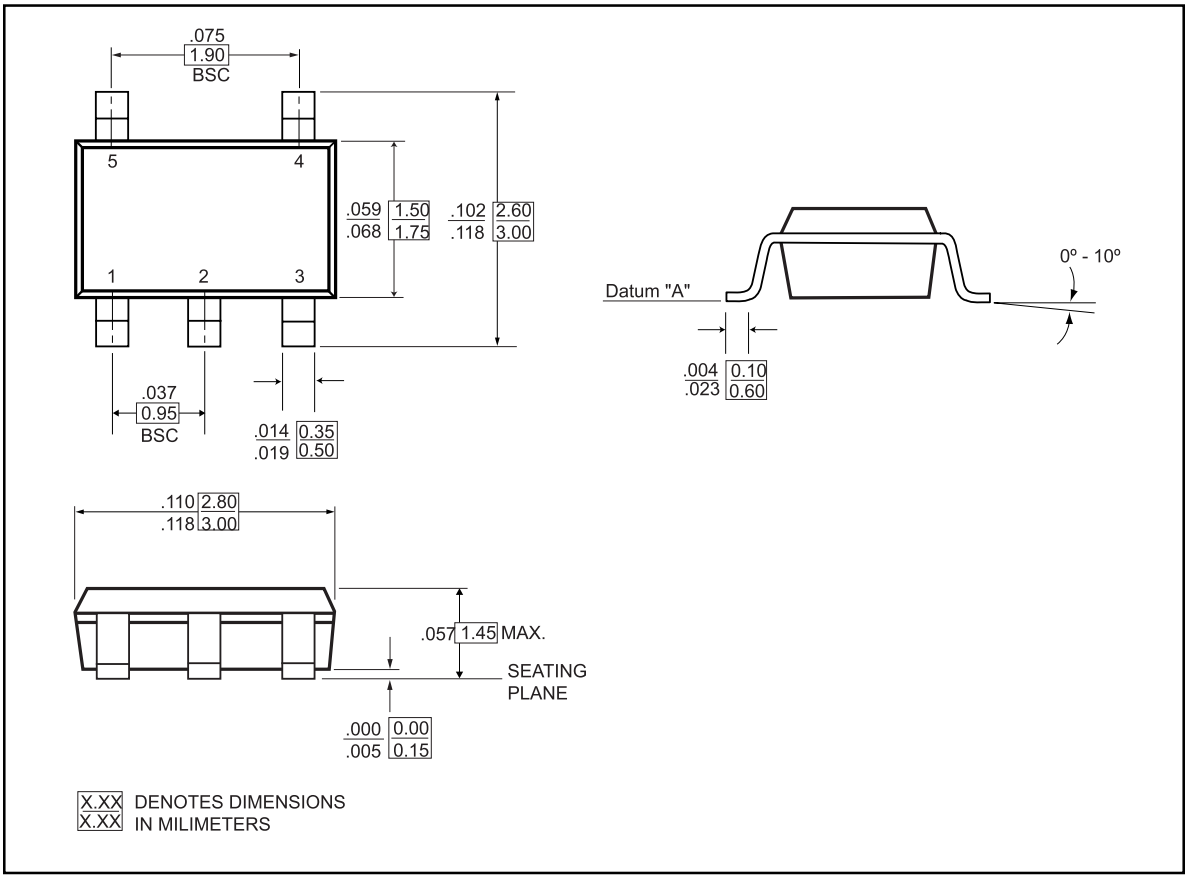


Figure 6. Bandwidth

Small Outline Transistor Package - SOT23-5 (T5)



Ordering Information

P/N	Package
PI5A125TX	SOT23-5