PI5A4599A

SOTINY™ Low Resistance, Low-Voltage Single-Supply SPDT Switch

Features

- Low On-Resistance: 10 ohms max.
- R_{ON} Matching: 2 ohms max.
- R_{ON} Flatness: 3.5 ohms max.
- Low 0.5nA Input Leakage at 25 °C
- 2V to 6V Single-Supply Operation
- Fast Switching Time
  - 15ns t_{ON}
  - 7ns t_{OFF}
- Break-Before-Make Switching Guaranteed
- 5pC max Charge Injection
- 225MHz Channel Bandwidth
- 76dB Off-Isolation at 1MHz
- TTL/CMOS Logic Compatible
- Low Power Consumption: 5µW
- Improved Direct Replacement for MAX4599
- Packages available:
  – 6-pin Small Compact SC70
  – 6-pin Small Outline Transistor SOT23

Applications

- Communication Circuits
- Cellular Phones
- Audio and Video Signal Routing
- Portable Battery-Operated Equipment
- Data Acquisition Systems
- Computer Peripherals
- Telecommunications
- Relay Replacement
- Wireless Terminals and Peripherals

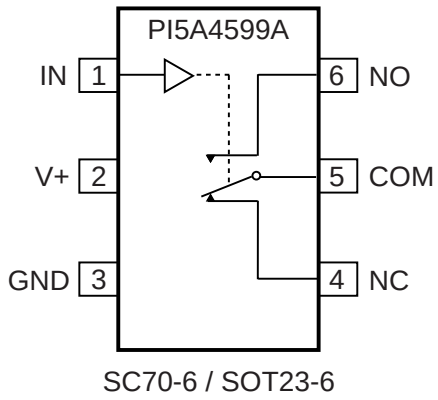
Description

The PI5A4599A is an improved, direct replacement for the MAX4599 single-pole, double-throw (SPDT) analog switch. Improved specifications include a low maximum ON resistance of 10 ohms and fast switching times (t_{ON} = 15ns max., t_{OFF} = 7ns max.) with 5V supply operation. With a 2.5V supply, resistance is a low 40 ohms max.

Specifications are given for 2.5V, 3.3V and 5V power supply operation. Operating voltage range is 2.0V to 6.0V.

To minimize PC board area use, the PI5A4599A is available in a compact 6-pin SC70 package. Operating temperature range is –40°C to 85°C.

Functional Diagram, Pin Configuration



SC70-6 / SOT23-6

Top View
Switches shown for Logic "0" input

Truth Tables

	PI5A4599A	
Logic	**NC**	**NO**
0	ON	OFF
1	OFF	ON

Absolute Maximum Ratings

Voltages Referenced to Gnd
V+ ..... –0.5V to +7V

V_{IN}, V_{COM}, V_{NC}, V_{NO} (Note 1) ..... –0.5V to V_{CC} +2V
or 30mA, whichever occurs first

Current (any terminal) ..... ±30mA

Peak Current, COM, NO, NC
(Pulsed at 1ms, 10% duty cycle) ..... ±30mA

Thermal Information

Continuous Power Dissipation

SC70-6 (derate 3.1mW/ºC above +70ºC) 245mW

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

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

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_{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}		Full	0		V+	V
On Resistance	R_{ON}	V+ = 4.5V, I_{COM} = -30mA, V_{NO} or V_{NC} = +2.5V	25		7	8	ohm
			Full			10	
On-Resistance Match Between Channels(4)	ΔR_{ON}		25		0.1	0.5	
			Full			1	
On-Resistance Flatness(5)	$R_{FLAT(ON)}$	V+ = 5V, I_{COM} = -30mA, V_{NO} or V_{NC} = 1V, 2.5V, 4V	25		2.72	3.5	
			Full			4	
NO or NC Off Leakage Current(6)	$I_{NO(OFF)}$ or $I_{NC(OFF)}$	V+ = 5.5V, V_{COM} = 0V, V_{NO} or V_{NC} = 4.5V	25	–0.5	0.18	0.5	nA
			Full	–5		5	
COM Off Leakage Current(6)	$I_{COM(OFF)}$	V+ = 5.5V, V_{COM} = + 4.5V, V_{NO} or V_{NC} = ± 0V	25	–1.0	0.20	1.0	
			Full	–10		10	
COM On Leakage Current(6)	$I_{COM(ON)}$	V+ = 5.5V , V_{COM} = +4.5V V_{NO} or V_{NC} = +4.5V	25	–1.0	0.20	1.0	
			Full	10		10	

Electrical Specifications - Single +5V Supply (continued)

(V+ = +5V ± 10%, GND = 0V, V_{INH} = 2.4V, V_{INL} = 0.8V)

Parameter	Symbol	Conditions	Temp(°C)	Min.(1)	Typ.(2)	Max.(1)	Units
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 Voltage High	I_{INH}	V_{IN} = 2.4V, all others = 0.8V		–1	0.005	1	µA
Input Current with Voltage Low	I_{INL}	V_{IN} = 0.8V, all others = 2.4V		–1	0.005	1	
Dynamic							
Turn-On Time	t_{ON}	V_{CC} = 5V, Figure 1	25		7	15	ns
			Full			20	
Turn-Off Time	t_{OFF}		25		1	7	
			Full			10	
Break-Before-Make	t_{BBM}	Figure 3	25			10	
			Full	5			
Charge Injection(3)	Q	C_L = 1nF, V_{GEN} = 0V, R_{GEN} = 0 ohm, Figure 2	25		1.5	5	pC
Off Isolation	OIRR	R_L = 50 ohms, C_L = 5pF, f = 1MHz, Figure 4			80		dB
Crosstalk(8)	X_{TALK}	R_L = 50 ohms, C_L = 5pF, f = 1MHz, Figure 5			80		
NC or NO Capacitance	$C_{(OFF)}$	f = 1MHz, Figure 6			5.0		pF
COM Off Capacitance	$C_{COM(OFF)}$				5.0		
COM On Capacitance	$C_{COM(ON)}$	f = 1MHz, Figure 7			13		
–3dB Bandwidth	BW	R_L = 50 ohms, Figure 8	Full		300		MHz
Supply							
Power-Supply Range	V+		Full	2		6	V
Positve Supply Current	I+	V_{CC} = 5.5V, V_{IN} = 0V or V+				1	µA

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.
8. Between any two switches. See Figure 4.

Electrical Specifications - Single +3.3V Supply

(V+ = +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+	V
On-Resistance	R_{ON}	V+ = 3V, I_{COM} = –30mA, V_{NO} or V_{NC} = 1.5V	25		12	14.0	Ω
			Full			17	
On-Resistance Match Between Channels(4)		V+ = 3.3V, I_{COM} = –30mA, V_{NO} or V_{NC} = 0.8V, 2.5V	25		0.2	0.5	
			Full			1	
On-Resistance Flatness(3,5)	$R_{FLAT(ON)}$		25		0.5	4	
			Full			5	
Dynamic							
Turn-On Time	t_{ON}	V+ =3.3V, V_{NO} or V_{NC} = 1.5V, Figure 1	25		15	25	ns
			Full			40	
Turn-Off Time	t_{OFF}		25		1.5	12	
			Full			20	
Break-Before-Make	t_{BBM}	Figure 3	25		10		
			Full	5			
Charge Injection(3)	Q	C_L = 1nF, V_{GEN} = 0V, R_{GEN} = 0V, Figure 2	25		1.3	5	pC
Supply							
Positive Supply Current	I+	V+ = 3.6V, V_{IN} = 0V or V+ All Channels on or off	Full			1	µA
Logic Input							
Input High Voltage	V_{IH}	Guaranteed logic high level	Full	2			V
Input Low Voltage	V_{IL}	Guaranteed logic low level	Full			0.8	
Input High Current	I_{INH}	V_{IN} = 2.4V, all others = 0.8V	Full	–1		1	µA
Input Low Current	I_{INL}	V_{IN} = 0.8V, all others = 2.4V	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.
6. Leakage parameters are 100% tested at maximum rated hot temperature and guaranteed by correlation at +25°C.
7. Off Isolation = $20\log_{10}$ [V_{COM} / (V_{NO} or V_{NC})]. See Figure 4.
8. Between any two switches. See Figure 5.

Electrical Specifications - Single +2.5V Supply

(V+ = +2.5V ± 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+	V
On-Resistance	R_{ON}	V+ = 2.5V, I_{COM} = –30mA, V_{NO} or V_{NC} = 1.5V	25		20	22	Ω
			Full			26	
On-Resistance Match Between Channels(4)	ΔR_{ON}	V+ = 2.5V, I_{COM} = –30mA, V_{NO} or V_{NC} = 0.8V, 2.5V	25		0.3	0.5	
			Full			1	
On-Resistance Flatness(3,5)	$R_{FLAT(ON)}$		25		0.5	5	
			Full			6	
Dynamic							
Turn-On Time	t_{ON}	V+ = 2.5V, V_{NO} or V_{NC} = 1.5V, Figure 1	25		20	30	ns
			Full		–	45	
Turn-Off Time	t_{OFF}		25			20	
			Full		–	30	
Break-Before-Make	t_{BBM}	Figure 3	25		10		
			Full	5			
Charge Injection(3)	Q	C_L = 1nF, V_{GEN} = 0V, R_{GEN} = 0V, Figure 2	25		0.9	5	pC
Supply							
Positive Supply Current	I+	V+ = 2.5V, V_{IN} = 0V or V+ All Channels on or off	Full			1	µA
Logic Input							
Input High Voltage	V_{IH}	Guaranteed logic high level	Full	2			V
Input Low Voltage	V_{IL}	Guaranteed logic low level	Full			0.8	
Input High Current	I_{INH}	V_{IN} = 2.4V, all others = 0.8V	Full	–1		1	µA
Input Low Current	I_{INL}	V_{IN} = 0.8V, all others = 2.4V	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.
6. Leakage parameters are 100% tested at maximum rated hot temperature and guaranteed by correlation at +25°C.
7. Off Isolation = $20\log_{10}$ [V_{COM} / (V_{NO} or V_{NC})]. See Figure 4.
8. Between any two switches. See Figure 5.

Test Circuits/Timing Diagrams

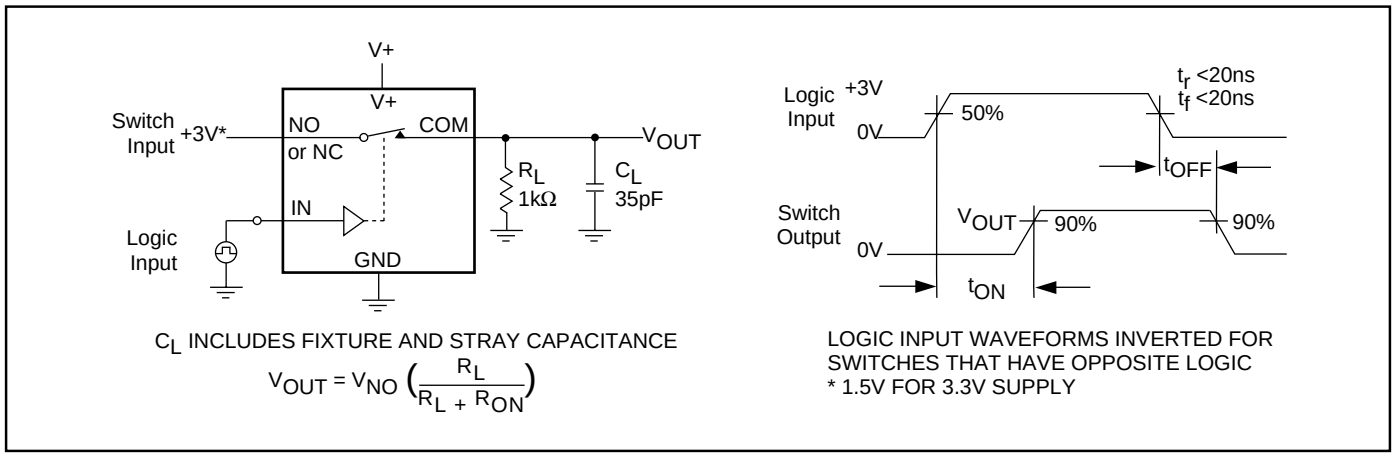


Figure 1. Switching Time

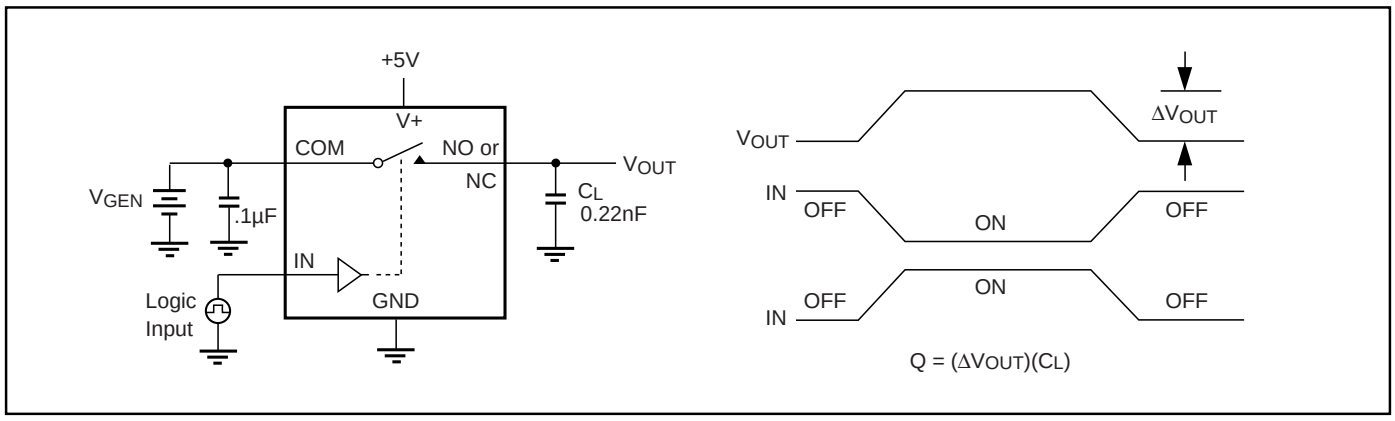


Figure 2. Charge Injection

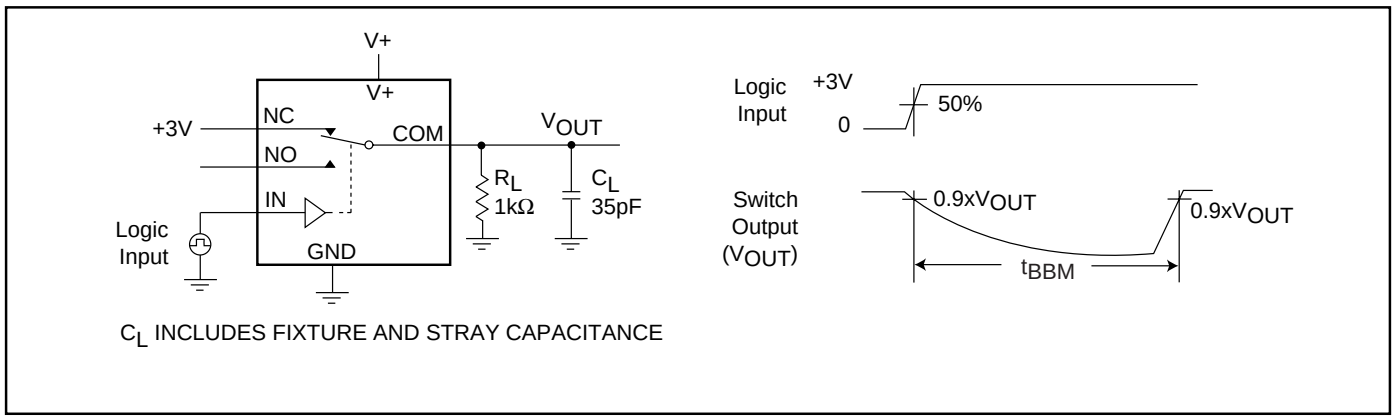


Figure 3. Break-Before-Make Interval

Test Circuits/Timing Diagrams (continued)

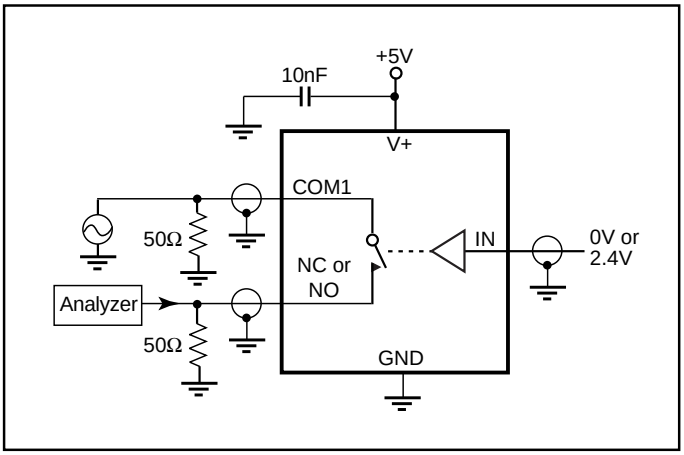


Figure 4. Off Isolation/On-Channel Bandwidth

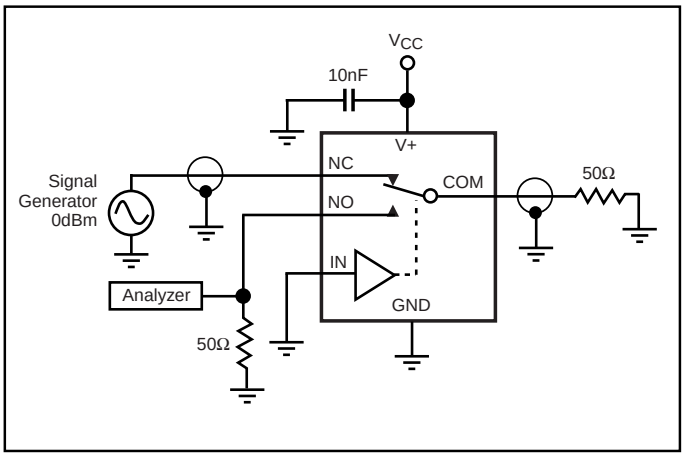


Figure 5. Crosstalk

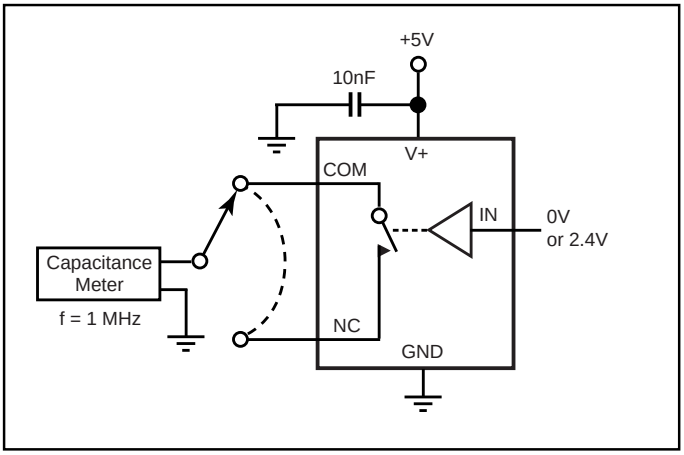


Figure 6. Channel-Off Capacitance

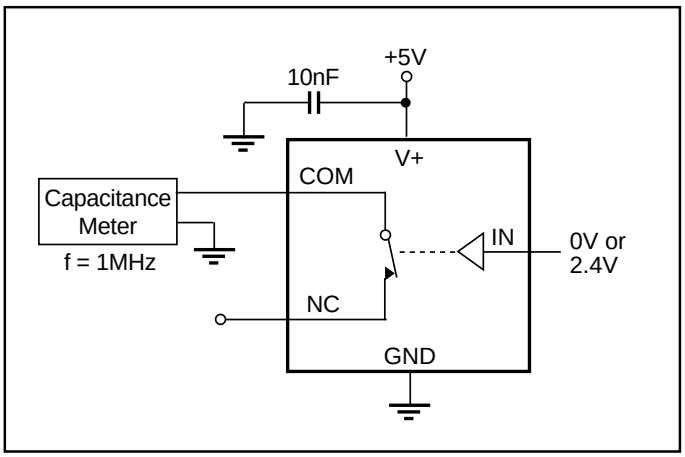


Figure 7. Channel-On Capacitance

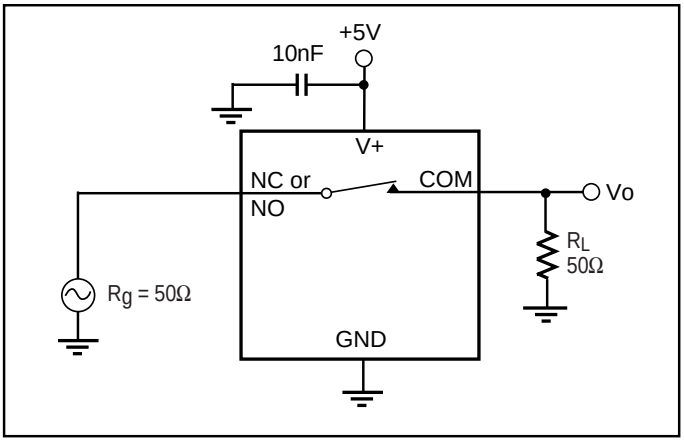
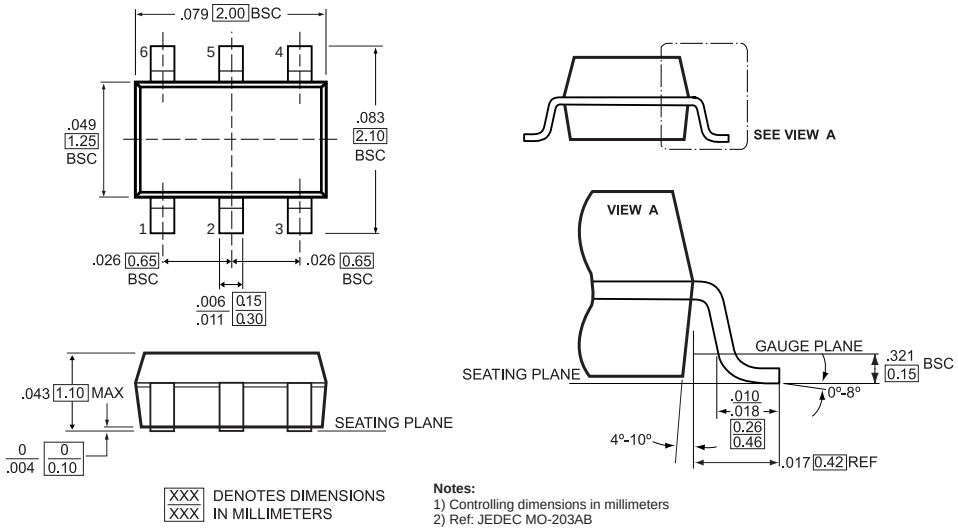
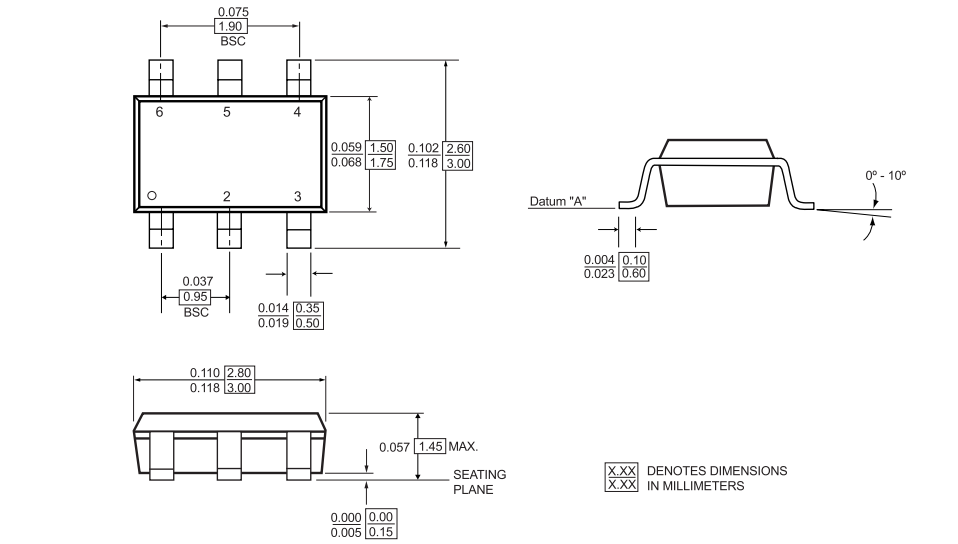


Figure 8. Bandwidth

6-Pin SC70 Package (C)



6-Pin SOT23 Package (T)



Ordering Information

P/N	Package
PI5A4599ATX	SOT23-6
PI5A4599ACX	SC70-6