PERICOM®

PI5A3159

SOTINY™ 1Ω Low-Voltage SPDT Analog Switch

Features

- CMOS Technology for Bus and Analog Applications
- Low On-Resistance: 2Ω at 3.0V
- Wide V_{DD} Range: +1.8V to +5.5V
- Low Power Consumption : 5µW
- Rail-to-Rail switching throughout Signal Range
- Fast Switching Speed: 30ns max. at 5V
- High Off Isolation: –24dB at 10MHz
- –57dB (1 MHz) Crosstalk Rejection Reduces Signal Distortion
- Break-Before-Make Switching
- Extended Industrial Temperature Range: –40°C to 85°C
- Low On-Resistance Replacement for NC7SB3157
- Packaging (Pb-free & Green available):
  - 6-pin SOT23 (T)

Applications

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

Description

The PI5A3159 is a high-bandwidth, fast 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, 1.8V to 5.5V, the PI5A3159 has a maximum On-Resistance of 4Ω at 1.8V, 2.4Ω at 2.3V & 1Ω at 4.5V.

Break-before-make switching prevents both switches being enabled simultaneously. This eliminates signal disruption during switching.

Control input, S, tolerates input drive signals up to 5.5V, independent of supply voltage.

PI5A3159 is a low On-Resistance replacement for the PI5A3157 and NC7SB3157.

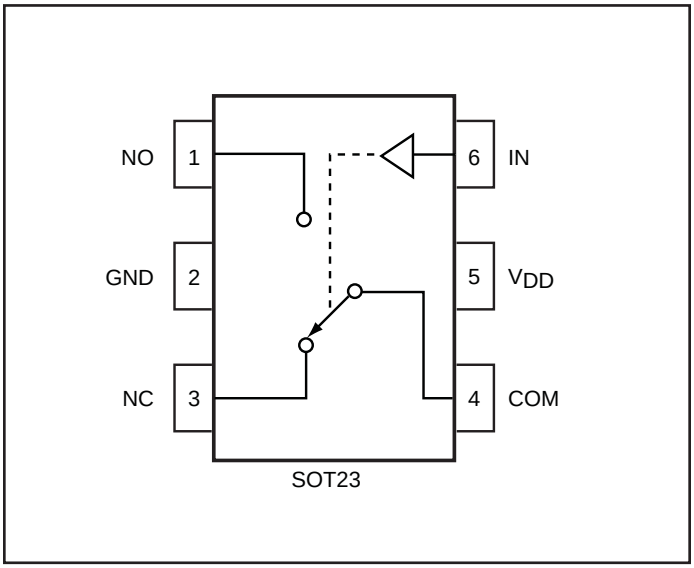
Pin Description

SOT23	Name	Description
1	NO	Data Port
2	GND	Ground
3	NC	Data Port (Normally Closed)
4	COM	Common Output/Data Port
5	V_{DD}	Positive Power Supply
6	IN	Logic Control

Logic Function Table

Logic Input(s)	Function
0	NC Connected to COM
1	NO Connected to COM

Connection Diagrams



Absolute Maximum Ratings

Voltages Referenced to GND
V_{DD} ..... –0.5V to +5.5V

V_{IN}, V_{COM}, V_{NC}, V_{NO} (1) .....–0.5V to V_+ +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

SOT23 (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_{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 +5V Supply

(V_{DD} = +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, 4)	V_{ANALOG}		Full	0		V_{DD}	V
On-Resistance	R_{ON}	V_{DD} = 4.5V, I_{COM} = -30mA, V_{NO} or V_{NC} = +2.5V	25		0.70	0.90	Ω
			Full			1.1	
On-Resistance Match Between Channels(5)	ΔR_{ON}		25		0.03	0.05	
			Full			0.10	
On-Resistance Flatness(6)	$R_{FLAT(ON)}$	V_{DD} = 4.5V, I_{COM} = -30mA, V_{NO} or V_{NC} = 1V, 1.5V, 2.5V	25		0.08	0.12	
			Full			0.15	
NO or NC Off Leakage Current (7)	$I_{NO(OFF)}$ or $I_{NC(OFF)}$	V_{DD} = 5.5V, V_{COM} = 0V, V_{NO} or V_{NC} = 4.5V	25	2	0.01	2	nA
			Full	-20		20	
COM On Leakage Current(7)	$I_{COM(ON)}$	V_{DD} = 5.5V, V_{COM} = 4.5V, V_{NO} or V_{NC} = 4.5V	25	-4		4	
			Full	-40	0.3	40	

Electrical Specifications - Single +5V Supply (continued)

(V_{DD} = + 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							
Input HIGH Voltage	V_{IH}	Guaranteed Logic HIGH level		2.0			V
Input LOW Voltage	V_{IL}	Guaranteed Logic LOW level				0.8	
Input Current with HIGH Voltage	I_{INH}	V_{IN} = 2.4V, all others = 0.8V		-1	0.005	1	µA
Input Current with LOW Voltage	I_{INL}	V_{IN} = 0.8V, all others = 2.4V		-1	0.005	1	
Dynamic							
Turn-On-Time	t_{ON}	V_{DD} = 5V, See Fig. 1	25		20	35	ns
			Full			40	
Turn-Off-Time	t_{OFF}		25		15	20	
			Full			35	
Break-Before-Make	t_{BBM}	See Fig. 3	25	1	12	14.5	
			Full	1	17.5		
Charge Injection(3)	Q	C_L -1nF, V_{GEN} = 0V, R_{GEN} = 0V, See Fig 2	25		40		pC
Off Isolation	O_{IRR}	R_L = 50Ω, f = 1MHz, See Fig 4			-57		dB
CrossTalk(9)	X_{TALK}	R_L = 50Ω, f = 1MHz, See Fig 4			36		
NC or NO Capacitance	$C_{NC/NO(OFF)}$	f = 1MHz, See Fig 6			42		pF
COM On Capacitance	$C_{COM(ON)}$	f = 1MHz, See Fig 7			98		
Supply							
Power-Supply Range	V_{DD}		Full	1.8		5.5	V
Positive Supply Current	1_{CC}	V_{DD} = 5.5V, V_{IN} = 0V or V_{DD}, All Channels ON or OFF	Full		0.5	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. Device is NOT guaranteed to function per the datasheet specification outside of 0 to V_{DD} range.
5. $\Delta R_{ON} = R_{ON}$ max. - R_{ON} min.
6. Flatness is defined as the difference between the maximum and minimum value of On-resistance measured.
7. Leakage parameters are 100% tested at maximum rated hot temperature and guaranteed by correlation at +25ºC.
8. Off Isolation = $20\log_{10}$ [V_{COM} / (V_{NO} or V_{NC})]. See Figure 4.
9. Between any two switches. See Figure 5.

Electrical Specifications - Single +3.3V Supply

(V_{DD} = +3.3V ± 10%, GND = 0V, V_{INH} = 2.0V, V_{INL} = 0.6V)

Parameter	Symbol	Conditions	Temp(°C)	Min(1)	Typ(2)	Max(1)	Units
Analog Switch							
Analog Signal Range(3)	V_{ANALOG}			0		V_{DD}	V
On-Resistance	R_{ON}	V_{DD} = 3V, I_{COM} = -24mA, V_{NO} or V_{NC} = 2.0V	25		1.4	1.8	Ω
			Full			2.2	
On-Resistance Match Between Channels(4)	ΔR_{ON}	V_{DD} = 3.3V, I_{COM} = -24mA, V_{NO} or V_{NC} = 0.8V, 2.0V	25		0.04	0.05	
			Full		0.11		
On-Resistance Flatness	$R_{FLAT(ON)}$		25		0.17	0.2	
			Full		0.25		
Dynamic							
Turn-On-Time	t_{ON}	V_{DD} = 5V, See Fig. 1	25		30	40	ns
			Full			55	
Turn-Off-Time	t_{OFF}		25		20	25	
			Full			40	
Break-Before-Make	t_{BBM}	See Fig. 3	25	1	21	29	
Charge Injection(3)	Q	C_L -1nF, V_{GEN} = 0V, R_{GEN} = 0V, See Fig 2	25		30		pC
Supply							
Positive Supply Current	1_{CC}	V_{DD} = 3.6V, V_{IN} = 0V or V_{DD}, All Channels ON or OFF	Full		0.5	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			0.6	
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.

Electrical Specifications - Single +2.5V Supply

(V_{DD} = +2.5V ± 10%, GND = 0V, V_{INH} = 1.8V, V_{INL} = 0.6V)

Parameter	Symbol	Conditions	Temp(°C)	Min(1)	Typ(2)	Max(1)	Units
Analog Switch							
Analog Signal Range(3)	V_{ANALOG}			0		V_{DD}	V
On-Resistance	R_{ON}	V_{DD} = 1.8V, I_{COM} = -2mA, V_{NO} or V_{NC} = 1.5V	25		1.6	2	Ω
			Full			2.7	
On-Resistance Match Between Channels(4)	ΔR_{ON}	V_{DD} = 1.8V, I_{COM} = -2mA, V_{NO} or V_{NC} = 0.8V, 1.5V	25		0.13	0.16	
			Full		0.2		
On-Resistance Flatness	$R_{FLAT(ON)}$		25		0.25	0.3	
			Full		0.45		
Dynamic							
Turn-On-Time	t_{ON}	V_{DD} = 2.5V, V_{NO} or V_{NC} = 1.8V, See Fig. 1	25		40	55	ns
			Full			70	
Turn-Off-Time	t_{OFF}		25		30	40	
			Full			55	
Break-Before-Make	t_{BBM}	See Fig. 3	25	1	33	39	
Make-Before-Break	t_{MBB}	See Fig. 4	25	1	9	13	
Charge Injection(3)	Q	C_L -1nF, V_{GEN} = 0V, R_{GEN} = 0V, See Fig 2	25		20		pC
Supply							
Positive Supply Current	1_{CC}	V_{DD} = 2.75V, V_{IN} = 0V or V_{DD}, All Channels ON or OFF	Full		0.5	1	µA
Logic Input							
Input HIGH Voltage	V_{IH}	Guaranteed Logic HIGH level	Full	1.8			V
Input LOW Voltage	V_{IL}	Guaranteed Logic LOW level	Full			0.6	
Input HIGH Current	I_{INH}	V_{IN} = 2.0V, all others = 0.8V	Full	-1		1	µA
Input LOW Current	I_{INL}	V_{IN} = 0.8V, all others = 2.0V	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

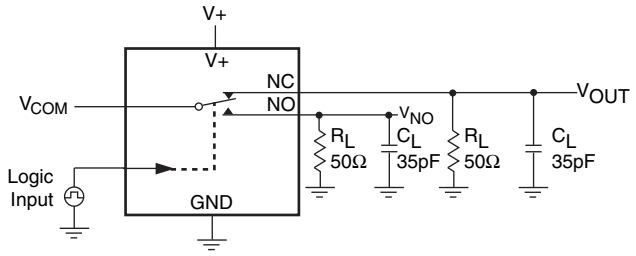
(V_{DD} = +1.8V ± 10%, GND = 0V, V_{INH} = 1.5V, V_{INL} = 0.6V)

Parameter	Symbol	Conditions	Temp(°C)	Min(1)	Typ(2)	Max(1)	Units
Analog Switch							
Analog Signal Range(3)	V_{ANALOG}			0		V_{DD}	V
On-Resistance	R_{ON}	V_{DD} = 1.8V, I_{COM} = -2mA, V_{NO} or V_{NC} = 1.5V	25		2.8	4	Ω
			Full			5	
On-Resistance Match Between Channels(4)	ΔR_{ON}	V_{DD} = 1.8V, I_{COM} = -2mA, V_{NO} or V_{NC} = 0.6V, 1.5V	25		0.44	0.6	
			Full		0.7		
On-Resistance Flatness	$R_{FLAT(ON)}$		25		0.5	0.6	
			Full		0.9		
Dynamic							
Turn-On-Time	t_{ON}	V_{DD} = 1.8V, V_{NO} or V_{NC} = 1.5V, See Fig. 1	25		65	70	ns
			Full			95	
Turn-Off-Time	t_{OFF}		25		40	55	
			Full			70	
Break-Before-Make	t_{BBM}	See Fig. 3	25	1	60	72	
Charge Injection(3)	Q	C_L -1nF, V_{GEN} = 0V, R_{GEN} = 0V, See Fig 2	25		10		pC
Supply							
Positive Supply Current	1_{CC}	V_{DD} = 2.0, V_{IN} = 0V or V_{DD}, All Channels ON or OFF	Full		0.5	1	µA
Logic Input							
Input HIGH Voltage	V_{IH}	Guaranteed Logic HIGH level	Full	1.8			V
Input LOW Voltage	V_{IL}	Guaranteed Logic LOW level	Full			0.6	
Input HIGH Current	I_{INH}	V_{IN} = 1.5V, all others = 0.8V	Full	-1		1	µA
Input LOW Current	I_{INL}	V_{IN} = 0.8V, all others = 1.5V	Full	-1		1	

Notes:

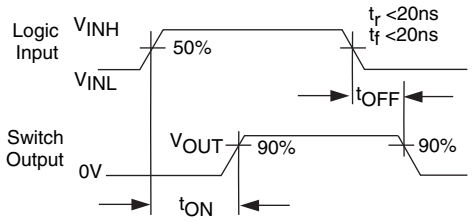
1. The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.
2. Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.
3. Guaranteed by design.
4. $\Delta R_{ON} = R_{ON}$ max. - R_{ON} min.
5. Flatness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

Test Circuits/Timing Diagrams



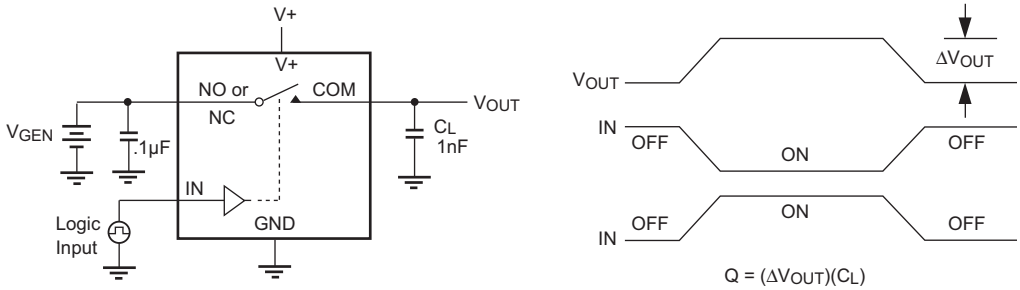
C_L INCLUDES FIXTURE AND STRAY CAPACITANCE

$$V_{OUT} = V_{NO}\left(\frac{R_L}{R_L + R_{ON}}\right)$$



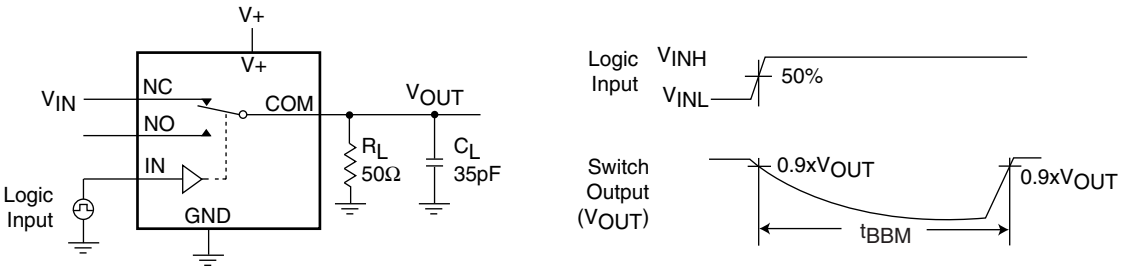
LOGIC INPUT WAVEFORMS INVERTED FOR SWITCHES THAT HAVE OPPOSITE LOGIC
* 1.5V FOR 3.3V SUPPLY

Figure 1. Switching Time



$Q = (\Delta V_{OUT})(C_L)$

Figure 2. Charge Injection



C_L INCLUDES FIXTURE AND STRAY CAPACITANCE

Figure 3. Break-Before-Make Interval

Test Circuits/Timing Diagrams (continued)

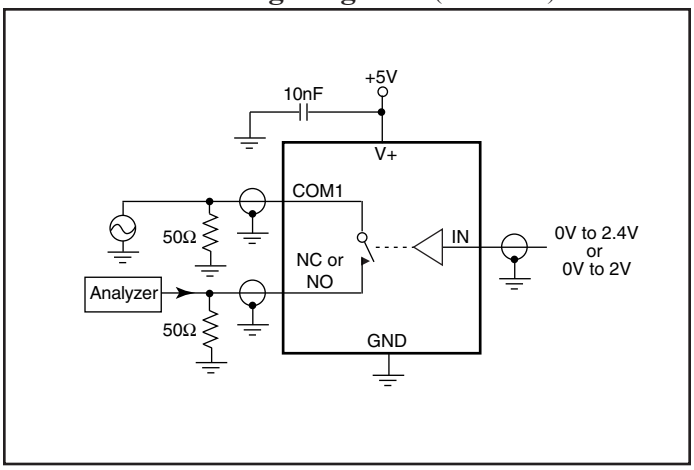


Figure 4. Off Isolation/On-Channel Bandwidth

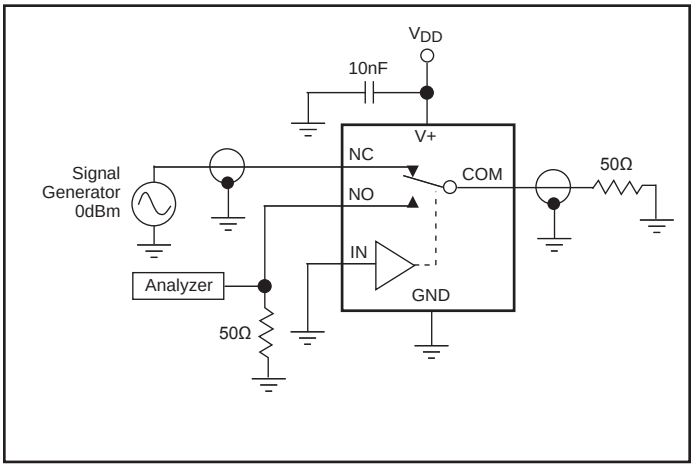


Figure 5. Crosstalk

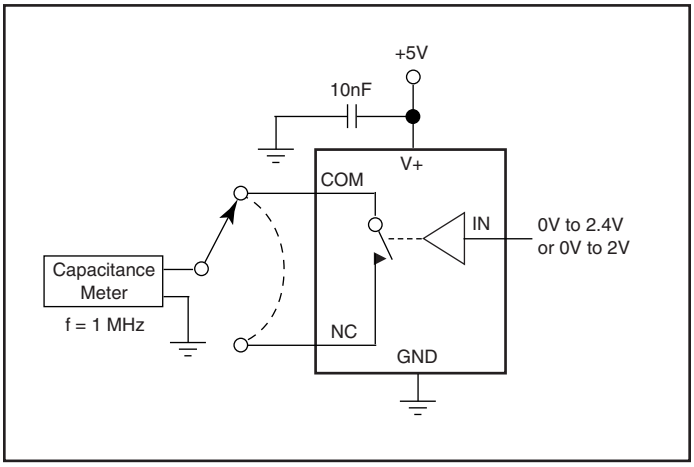


Figure 6. Channel-Off Capacitance

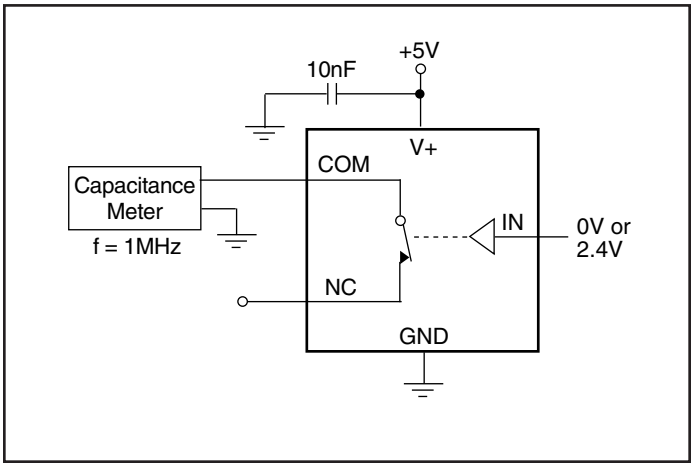


Figure 7. Channel-On Capacitance

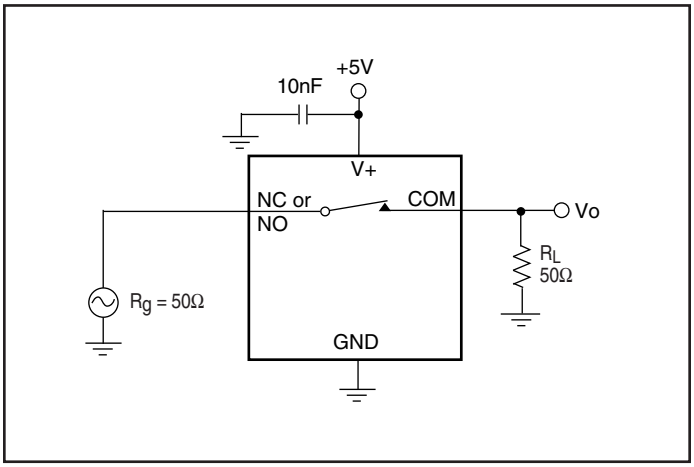
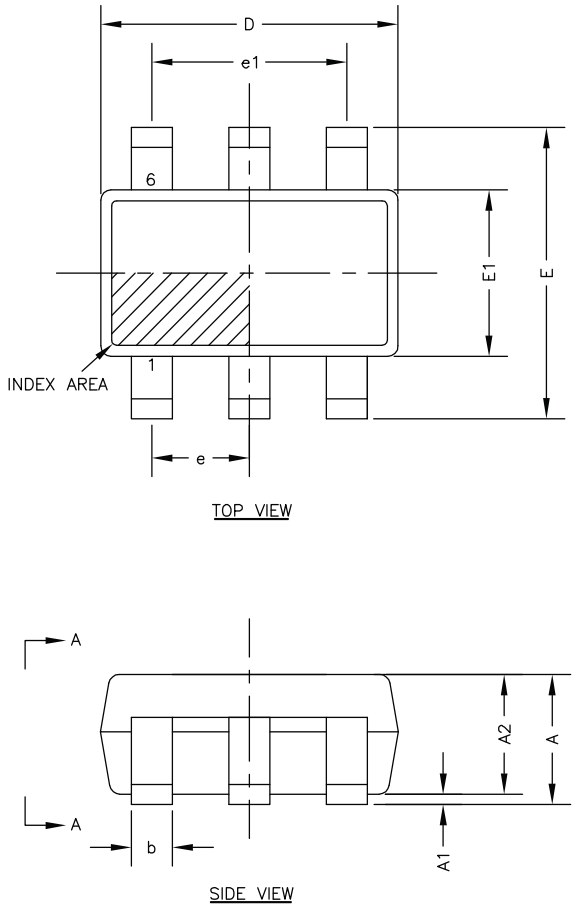


Figure 8. Bandwidth

Packaging Mechanical: 6-Pin SOT23(T)



SYMBOLS	MIN.	NOM.	MAX.
A	–	–	1.45
A1	0.00	–	0.15
A2	0.90	1.15	1.30
b	0.35	––	0.50
c	0.08	––	0.22
D	2.80	2.90	3.00
E	2.60	2.80	3.00
E1	1.50	1.60	1.75
L	0.30	0.45	0.60
L1	0.60 REF		
R	0.10	––	––
R1	0.10	––	0.25
θ	0°	4°	8°
e	0.95 BSC		
e1	1.90 BSC		

NOTE :
1. ALL DIMENSIONS IN MILLIMETERS. ANGLES IN DEGREES.
2. DIMENSIONS EXCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
3. REFER EIAJ SC74A AND JEDEC MO–178.

PERICOM Enabling Serial Connectivity

DATE: 10/19/09

DESCRIPTION: 6-pin, Small Outline Transistor Plastic Package (SOT23)

PACKAGE CODE: T (T6)

DOCUMENT CONTROL #: PD-1912 REVISION: C

09-0131

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

Ordering Information

Ordering Code	Package Code	Package Description	Top Marking
PI5A3159TEX	T	6-pin SOT23	ZL

Notes:
1. This product has always shipped as only a lead free product, but since it was introduced prior to Pericom's strategy of adding an E to all Green/ Lead free parts many customers order it without the E suffix. Please migrate new designs and qualification to include the E suffix. Pericom at this point in time will continue to offer devices marked both ways, but may at a later date eliminate the non-E part number.
2. Thermal Characteristics can be found on the world wide web at www.pericom.com/packaging/
3. Number of transistors : 753
4. X = Tape and reel