



**< 0.4 Ω CMOS 1.8 V to 5.5 V,
SPST Switches**

ADG801/ADG802

FEATURES

0.4 Ω Max ON Resistance @ 125°C
0.08 Ω Max ON Resistance Flatness @ 125°C
1.8 V to 5.5 V Single Supply
Automotive Temperature Range -40°C to +125°C
400 mA Current Carrying Capability
Tiny 6-Lead SOT-23 and 8-Lead μ SOIC Packages
35 ns Switching Times
Low Power Consumption
TTL/CMOS-Compatible Inputs
Pin Compatible with ADG701/ADG702

APPLICATIONS

Power Routing
Cellular Phones
Modems
PCMCIA Cards
Hard Drives
Data Acquisition Systems
Communication Systems
Relay Replacement
Battery-Powered Systems

GENERAL DESCRIPTION

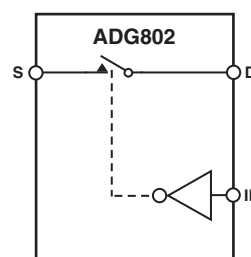
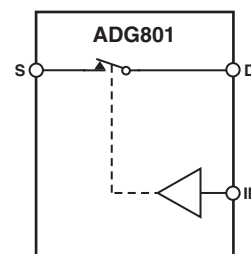
The ADG801/ADG802 are monolithic CMOS, SPST (Single Pole, Single Throw) switches with On Resistance of less than 0.4 Ω . These switches are designed on an advanced submicron process that provides extremely low On Resistance, high switching speed, and low leakage currents.

The low On Resistance of < 0.4 Ω means these parts are ideal for applications where low On Resistance switching is critical.

The ADG801 is a normally open (NO) switch, while the ADG802 is normally closed (NC). Each switch conducts equally well in both directions when On.

The ADG801 and ADG802 are available in 6-lead SOT-23 and 8-lead μ SOIC packages.

FUNCTIONAL BLOCK DIAGRAMS



SWITCHES SHOWN FOR A LOGIC "1" INPUT

PRODUCT HIGHLIGHTS

1. Low On Resistance (0.25 Ω typical)
2. 1.8 V to 5.5 V single-supply operation
3. Tiny 6-lead SOT-23 and 8-lead μ SOIC packages
4. 400 mA current carrying capability
5. Automotive temperature range -40°C to +125°C
6. Pin-compatible with ADG701 (ADG801)
Pin-compatible with ADG702 (ADG802)

REV. 0

Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices.

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781/329-4700
Fax: 781/326-8703
www.analog.com
© Analog Devices, Inc., 2002

ADG801/ADG802—SPECIFICATIONS¹ ($V_{DD} = 5\text{ V} \pm 10\%$, $GND = 0\text{ V}$. All specifications -40°C to $+125^{\circ}\text{C}$, unless otherwise noted.)

Parameter	25°C	-40°C to $+85^{\circ}\text{C}$	-40°C to $+125^{\circ}\text{C}$ ²	Unit	Test Conditions/Comments
ANALOG SWITCH					
Analog Signal Range			0 V to V_{DD}	V	
On Resistance (R_{ON})	0.25 0.3	0.35	0.4	Ω typ Ω max	$V_S = 0\text{ V}$ to V_{DD} ; $I_S = 100\text{ mA}$; Test Circuit 1
On Resistance Flatness ($R_{FLAT(ON)}$)	0.05	0.07	0.08	Ω typ Ω max	$V_S = 0\text{ V}$ to V_{DD} ; $I_S = 100\text{ mA}$
LEAKAGE CURRENTS					
Source OFF Leakage I_S (OFF)	± 0.01 ± 0.25	± 3	± 30	nA typ nA max	$V_{DD} = 5.5\text{ V}$ $V_S = 4.5\text{ V}/1\text{ V}$, $V_D = 1\text{ V}/4.5\text{ V}$; Test Circuit 2
Drain OFF Leakage I_D (OFF)	± 0.01 ± 0.25	± 3	± 30	nA typ nA max	$V_S = 4.5\text{ V}/1\text{ V}$, $V_D = 1\text{ V}/4.5\text{ V}$; Test Circuit 2
Channel ON Leakage I_D , I_S (ON)	± 0.01 ± 0.25	± 3	± 30	nA typ nA max	$V_S = V_D = 1\text{ V}$, or 4.5 V ; Test Circuit 3
DIGITAL INPUTS					
Input High Voltage, V_{INH}			2.0	V min	
Input Low Voltage, V_{INL}			0.8	V max	
Input Current I_{INL} or I_{INH}	0.005		± 0.1	μA typ μA max	$V_{IN} = V_{INL}$ or V_{INH}
C_{IN} , Digital Input Capacitance	5			pF typ	
DYNAMIC CHARACTERISTICS³					
t_{ON}	35 45	50	55	ns typ ns max	$R_L = 50\ \Omega$, $C_L = 35\text{ pF}$ $V_S = 3\text{ V}$; Test Circuit 4
t_{OFF}	9 15	18	21	ns typ ns max	$R_L = 50\ \Omega$, $C_L = 35\text{ pF}$ $V_S = 3\text{ V}$; Test Circuit 4
Charge Injection	50			pC typ	$V_S = 2.5\text{ V}$, $R_S = 0\ \Omega$; $C_L = 1\text{ nF}$; Test Circuit 5
Off Isolation	-61			dB typ	$R_L = 50\ \Omega$, $C_L = 5\text{ pF}$; $f = 100\text{ kHz}$; Test Circuit 6
Bandwidth -3 dB	12			MHz typ	$R_L = 50\ \Omega$, $C_L = 5\text{ pF}$; Test Circuit 7
C_S (OFF)	180			pF typ	$f = 1\text{ MHz}$
C_D (OFF)	180			pF typ	$f = 1\text{ MHz}$
C_D , C_S (ON)	420			pF typ	$f = 1\text{ MHz}$
POWER REQUIREMENTS					
I_{DD}	0.001	1.0	2.0	μA typ μA max	$V_{DD} = 5.5\text{ V}$ Digital Inputs = 0 V or 5.5 V

NOTES

¹Temperature range is as follows: Automotive Temperature Range: -40°C to $+125^{\circ}\text{C}$.

²On Resistance parameters tested with $I_S = 10\text{ mA}$.

³Guaranteed by design, not subject to production test.

Specifications subject to change without notice.

SPECIFICATIONS¹

(V_{DD} = 2.7 V to 3.6 V, GND = 0 V. All specifications –40°C to +125°C, unless otherwise noted.)

Parameter	25°C	–40°C to +85°C	–40°C to +125°C ²	Unit	Test Conditions/Comments
ANALOG SWITCH					
Analog Signal Range			0 V to V _{DD}	V	
On Resistance (R _{ON})	0.4			Ω typ	V _S = 0 V to V _{DD} , I _S = 100 mA;
	0.6	0.65	0.7	Ω max	Test Circuit 1
On Resistance Flatness (R _{FLAT(ON)})	0.1	0.1	0.1	Ω typ	V _S = 0 V to V _{DD} , I _S = 100 mA
LEAKAGE CURRENTS					
Source OFF Leakage I _S (OFF)	±0.01			nA typ	V _{DD} = 3.6 V
	±0.25	±3	±30	nA max	V _S = 3.3 V/1 V, V _D = 1 V/3.3 V;
Drain OFF Leakage I _D (OFF)	±0.01			nA typ	Test Circuit 2
	±0.25	±3	±30	nA max	V _S = 3.3 V/1 V, V _D = 1 V/3.3 V;
Channel On Leakage I _D , I _S (ON)	±0.01			nA typ	Test Circuit 2
	±0.25	±3	±30	nA max	V _S = V _D = 1 V, or 3.3 V;
					Test Circuit 3
DIGITAL INPUTS					
Input High Voltage, V _{INH}			2.0	V min	
Input Low Voltage, V _{INL}			0.8	V max	
Input Current					
I _{INL} or I _{INH}	0.005			μA typ	V _{IN} = V _{INL} or V _{INH}
			±0.1	μA max	
C _{IN} , Digital Input Capacitance	5			pF typ	
DYNAMIC CHARACTERISTICS³					
t _{ON}	40			ns typ	R _L = 50 Ω, C _L = 35 pF
	55	60	65	ns max	V _S = 1.5 V; Test Circuit 4
t _{OFF}	9			ns typ	R _L = 50 Ω, C _L = 35 pF
	15	18	21	ns max	V _S = 1.5 V; Test Circuit 4
Charge Injection	10			pC typ	V _S = 1.5 V, R _S = 0 Ω, C _L = 1 nF;
					Test Circuit 5
Off Isolation	–61			dB typ	R _L = 50 Ω, C _L = 5 pF, f = 100 kHz,
					Test Circuit 6
Bandwidth –3 dB	12			MHz typ	R _L = 50 Ω, C _L = 5 pF; Test Circuit 7
C _S (OFF)	180			pF typ	f = 1 MHz
C _D (OFF)	180			pF typ	f = 1 MHz
C _D , C _S (ON)	420			pF typ	f = 1 MHz
POWER REQUIREMENTS					
I _{DD}	0.001			μA typ	V _{DD} = 3.6 V
		1.0	2.0	μA max	Digital Inputs = 0 V or 3.6 V

NOTES

¹Temperature range is as follows: Automotive Temperature Range: –40°C to +125°C.²On Resistance parameters tested with I_S = 10 mA.³Guaranteed by design, not subject to production test.

Specifications subject to change without notice.

ADG801/ADG802

ABSOLUTE MAXIMUM RATINGS¹

(T_A = 25°C unless otherwise noted.)

V _{DD} to GND	–0.3 V to +7 V
Analog Inputs ²	–0.3 V to V _{DD} +0.3 V or 30 mA, Whichever Occurs First
Digital Inputs ²	–0.3 V to V _{DD} +0.3 V or 30 mA, Whichever Occurs First
Continuous Current, S or D	400 mA
Peak Current, S or D	800 mA (Pulsed at 1 ms, 10% Duty Cycle Max)
Operating Temperature Range Automotive	–40°C to +125°C
Storage Temperature Range	–65°C to +150°C
Junction Temperature (T _{Jmax})	150°C
Package Power Dissipation	(T _{Jmax} – T _A)/θ _{JA}
μSOIC Package	
θ _{JA} Thermal Impedance	206°C/W
θ _{JC} Thermal Impedance	44°C/W
SOT-23 Package (4-Layer Board)	
θ _{JA} Thermal Impedance	119°C/W
Lead Temperature, Soldering (10 seconds)	300°C
IR Reflow, Peak Temperature (<20 seconds)	235°C

NOTES

¹Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those listed in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Only one absolute maximum rating may be applied at any one time.

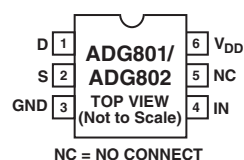
²Overvoltages at IN, S, or D will be clamped by internal diodes. Current should be limited to the maximum ratings given.

Table I. Truth Table

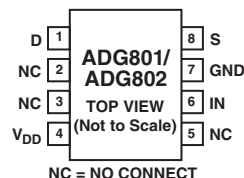
ADG801 In	ADG802 In	Switch Condition
0	1	OFF
1	0	ON

PIN CONFIGURATIONS

6-Lead Plastic Surface-Mount (SOT-23) (RT-6)



8-Lead Small Outline μSOIC (RM-8)



ORDERING GUIDE

Model	Temperature Range	Brand ¹	Package Descriptions	Package Options
ADG801BRT	–40°C to +125°C	SLB	SOT-23 (Plastic Surface-Mount)	RT-6 ²
ADG801BRM	–40°C to +125°C	SLB	μSOIC (Small Outline)	RM-8
ADG802BRT	–40°C to +125°C	SMB	SOT-23 (Plastic Surface-Mount)	RT-6 ²
ADG802BRM	–40°C to +125°C	SMB	μSOIC (Small Outline)	RM-8

¹Branding on SOT-23 and μSOIC packages is limited to three characters due to space constraints.

²Contact factory for availability.

CAUTION

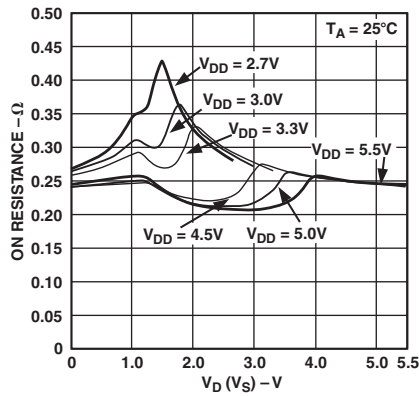
ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the ADG801/ADG802 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high-energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.



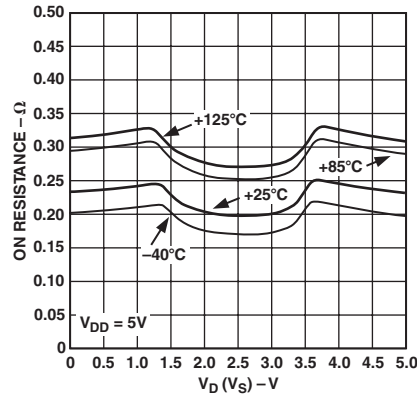
TERMINOLOGY

V_{DD}	Most Positive Power Supply Potential
I_{DD}	Positive Supply Current
GND	Ground (0 V) Reference
S	Source Terminal. May be an input or output.
D	Drain Terminal. May be an input or output.
IN	Logic Control Input
$V_D (V_S)$	Analog Voltage on Terminals D and S
R_{ON}	Ohmic Resistance Between D and S
$R_{FLAT(ON)}$	The difference between the maximum and minimum value of On Resistance as measured over the specified analog signal range.
I_S (OFF)	Source Leakage Current with the Switch OFF
I_D (OFF)	Drain Leakage Current with the Switch OFF
I_D, I_S (ON)	Channel Leakage Current with the Switch ON
V_{INL}	Maximum Input Voltage for Logic “0”
V_{INH}	Minimum Input Voltage for Logic “1”
$I_{INL} (I_{INH})$	Input Current of the Digital Input
C_S (OFF)	OFF Switch Source Capacitance. Measured with reference to ground.
C_D (OFF)	OFF Switch Drain Capacitance. Measured with reference to ground.
C_D, C_S (ON)	ON Switch Capacitance. Measured with reference to ground.
C_{IN}	Digital Input Capacitance
t_{ON}	Delay between applying the Digital Control Input and the Output Switching ON. See Test Circuit 4.
t_{OFF}	Delay between applying the Digital Control Input and the Output Switching OFF.
Charge Injection	A measure of the glitch impulse transferred from the Digital Input to the Analog Output during switching.
Off Isolation	A measure of unwanted signal coupling through an OFF switch.
Bandwidth	The frequency at which the output is attenuated by 3 dBs.
On Response	The frequency response of the ON switch
Insertion Loss	The loss due to the On Resistance of the switch

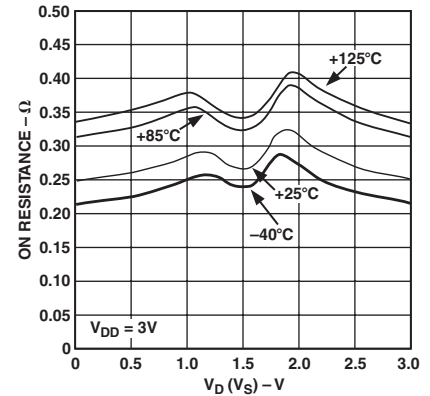
ADG801/ADG802—Typical Performance Characteristics



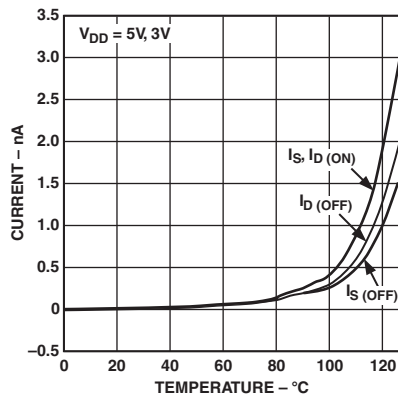
TPC 1. On Resistance vs. $V_D (V_S)$



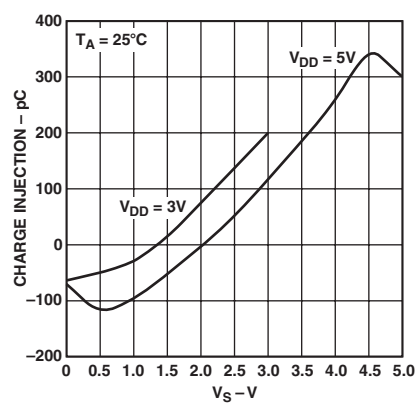
TPC 2. On Resistance vs. $V_D (V_S)$ for Different Temperatures



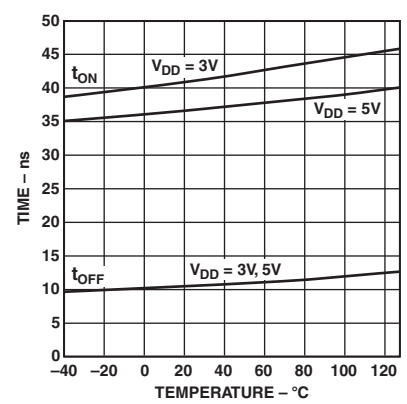
TPC 3. On Resistance vs. $V_D (V_S)$ for Different Temperatures



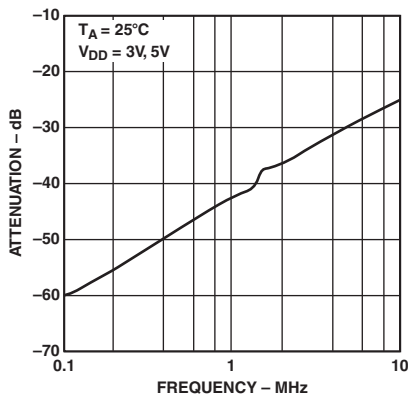
TPC 4. Leakage Currents vs. Temperature



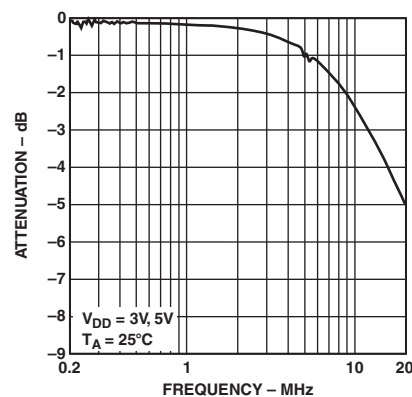
TPC 5. Charge Injection vs. Source Voltage



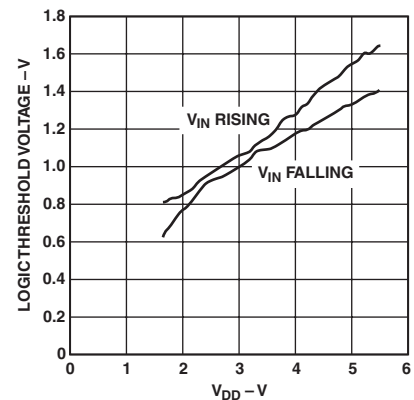
TPC 6. t_{ON}/t_{OFF} Times vs. Temperature



TPC 7. Off Isolation vs. Frequency

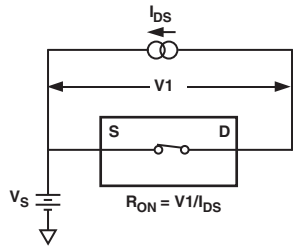


TPC 8. On Response vs. Frequency

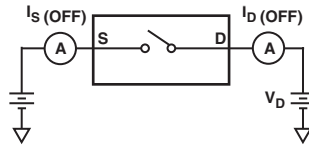


TPC 9. Logic Threshold Voltage vs. Supply Voltage

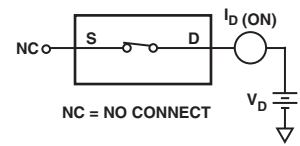
Test Circuits



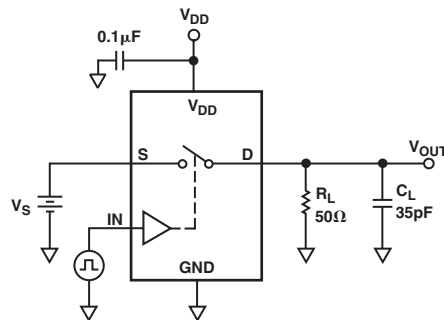
Test Circuit 1. On Resistance



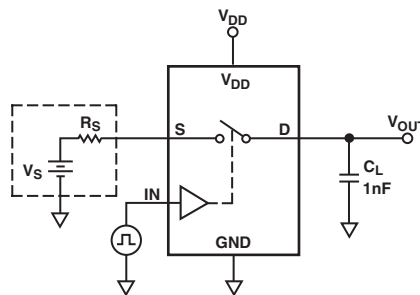
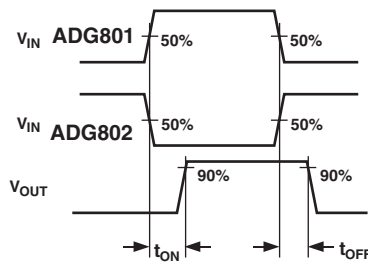
Test Circuit 2. Off Leakage



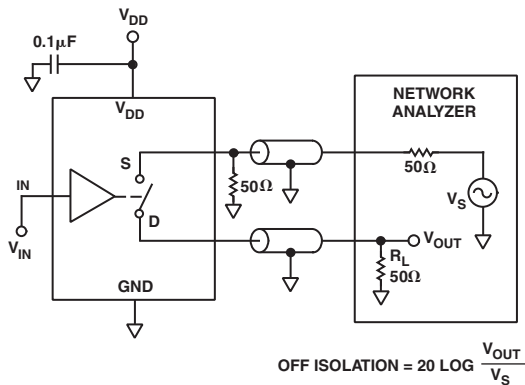
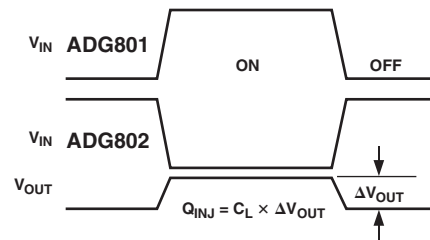
Test Circuit 3. On Leakage



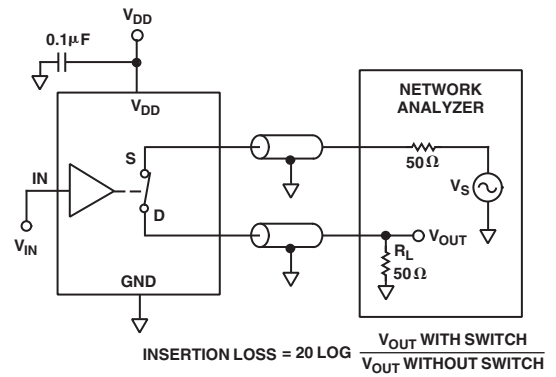
Test Circuit 4. Switching Times



Test Circuit 5. Charge Injection



Test Circuit 6. Off Isolation



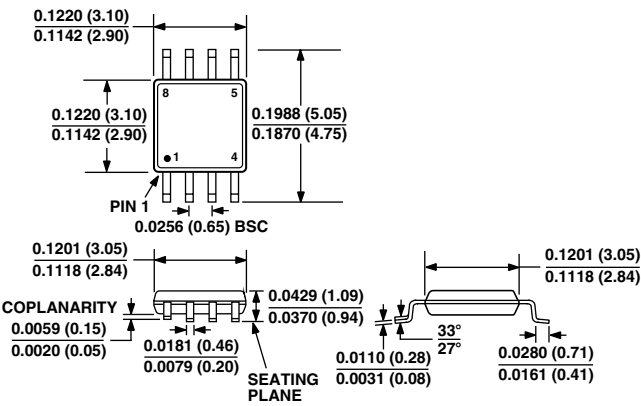
Test Circuit 7. Bandwidth

ADG801/ADG802

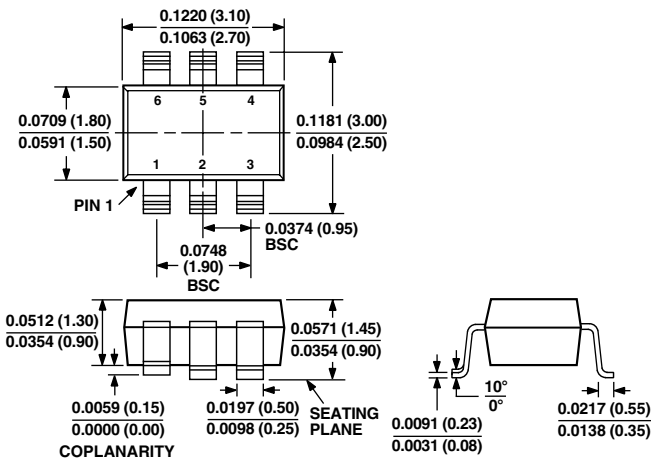
OUTLINE DIMENSIONS

Dimensions shown in inches and (mm)

8-Lead μ SOIC
(RM-8)



6-Lead SOT-23
(RT-6)



C02800-0-5/02(0)

PRINTED IN U.S.A.