BCT4157

Low-Voltage, 2.5Ω, 300MHz SPDT Analog Switch

General Description

The BCT4157 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, 1.65V to 5.5V, the BCT4157 has a maximum ON resistance of 4.5-ohms at 2.7V, and 3.5-ohms at 4.5V.

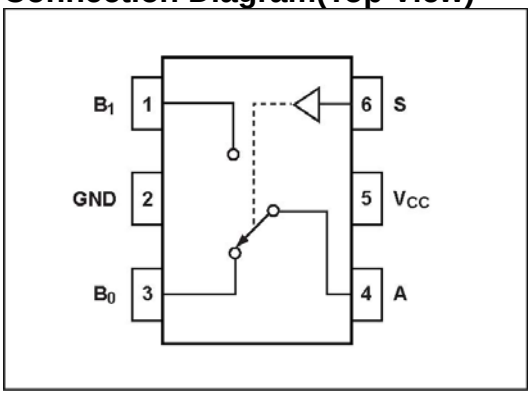
Break-before-make switching prevents both switches being enabled simultaneously. This eliminates signal disruption during switching.

The control input, S, tolerates input drive signals up to 5.5V, independent of supply voltage. BCT4157 is an improved direct replacement for the FSA3157/NC7SB3157

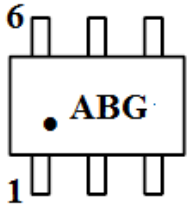
Applications

Cell Phones
PDAs
Portable Instrumentation
Battery Powered Communications
Computer Peripherals

Connection Diagram(Top View)



Marking Digram



Features

♦CMOS Technology for Bus and Analog Applications
♦ Low ON Resistance: 2.5-ohms @ 4.5V
♦ Wide VCC Range: 1.65V to 5.5V
♦ Rail-to-Rail Signal Range
♦ Control Input Overvoltage Tolerance: 5.5V min.
♦ High Off Isolation: 57dB at 10MHz
♦ 54dB (10MHz) Crosstalk Rejection Reduces Signal Distortion
♦ Break-Before-Make Switching
♦ High Bandwidth: 300 MHz
♦ Extended Industrial Temperature Range: –40°C to 85°C
♦ Packaging (Pb-free & Green available):
- 6-pin SC70
- 6-pin TDFN 1.45X1

Pin Description

Pin Number	Name	Description
1	B1	Data Port
2	GND	Ground
3	B0	Data Port (Normally Closed)
4	A	Common Output/Data Port
5	VCC	Positive Power Supply
6	S	Logic Control

Logic Function Table

Logic Input (S)	Function
0	B0 Connected to A
1	B1 Connected to A

ORDERING INFORMATION

Ordering Code	Package Description	Temp Range	Top Marking
BCT4157EXT	6-pin SC70	–40°C to +85°C	ABG
BCT4157ETT	6-pin TDFN 1.45X1	–40°C to +85°C	ABX

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ABSOLUTE MAXIMUM RATINGS(1)

VCC, S to GND……..–0.5V to +7V
All Other Pins to GND (2)……..–0.3V to (V_{CC} +0.3V)
DC V_{CC} or Ground Current (I_{CC}/I_{GND}).....±100mA
Continuous Current (B0,B1,A)..... ±400mA
Storage Temperature Range ……..... –65°C to +150°C
Junction Temperature …….. ..... 150°C
Lead Temperature (Soldering, 10s) ... . 260°C
Power Dissipation (P_D) @ +85°C 180mW

RECOMMENDED OPERATING CONDITIONS(3)

Supply Voltage Operating (V_{CC})……1.65V to 5.5V
Control Input Voltage (S)……..0V to V_{CC}
Switch Voltage (B0,B1, A)……0V to V_{CC}
Operating Temperature (T_A)……..–40°C to +85°C
Thermal Resistance (θJA)……..350°C/W

Note 1: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.
Note 2:The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.
Note 3:Control input must be held HIGH or LOW; it must not float.

DC ELECTRICAL CHARACTERISTICS (T_A = 25°C)

Parameter	Description	Test Conditions	Supply Voltage	Temp (ºC)	Min.	Typ	Max.	Units
V_{IAR}	Analog Input Signal Range		V_{CC}	T_A = 25°C & –40°C to 85°C	0		V_{CC}	V
R_{ON}	ON Resistance(4)	I_A = 100mA, B_0 or B_1=1.5V	2.7V	T_A = 25°C		3	4.5	Ω
R_{ON}	ON Resistance(4)	I_A = 100mA, B_0 or B_1=3.5V	4.5V	T_A = 25°C		2.5	3.5	
ΔR_{ON}	ON Resistance Match Between Channels(4,5)	I_{out} = 100mA, B_0=B_1=1.5V	2.7V	T_A = 25°C			0.15	Ω
R_{ONF}	ON Resistance(4,6) Flatness	I(A) = -100mA; B0 or B1= 0V, 1.5V, 1.5V	2.7V	T_A = 25°C			1.5	Ω
R_{ONF}	ON Resistance(4,6) Flatness	I(A) = -100mA; B0 or B1= 0V, 1.5V, 3.0V,	4.5V	T_A = 25°C			0.5	Ω
I_{ON}	ON State Leakage Current	S=0V or Vcc, A= 1V, 4.5V or floating; B0 or B1 = 1V,4.5V or floating	5.5V	T_A = 25°C	-20		20	nA
I_{OFF}	ON State Leakage Current	S= 0V or Vcc, A = 1V, 4.5V or floating; B0 or B1 = 4.5V, 1V or floating	5.5V	T_A = 25°C	-20		20	nA
V_{IH}	Input High Voltage (S)	Logic High Level	V_{CC} = 1.65V to 1.95V	T_A = 25°C & –40°C to 85°C	0.75 V_{CC}			V
			V_{CC} = 2.3V to 5.5V		0.7 V_{CC}			
V_{IL}	Input Low Voltage (S)	Logic Low Level	V_{CC} = 1.65V to 1.95V				0.25 V_{CC}	V
			V_{CC} = 2.3V to 5.5V				0.25 V_{CC}	

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DC ELECTRICAL CHARACTERISTICS (TA = - 40°C to +85°C)

I_{IN}	Input Leakage Current (S)	0 ≤V_{IN} ≤5.5V	V_{CC} = 0V to 5.5V	T_A = 25°C			±0.1	uA
				T_A = –40°C to 85°C			±1.0	
I_{VCC}	Quiescent Supply Current	All channels ON or OFF, V_{IN} = V_{CC} or GND, I_{OUT} = 0	V_{CC} = 5.5V	T_A = 25°C			1	
				T_A = –40°C to 85°C			10	

Note 4: Measured by voltage drop between A and B0 or B1 pins at the indicated current through the device. ON resistance is determined by the lower of the voltages on two ports (A or B)
Note 5: ΔR_{ON} = R_{ON} max – R_{ON} min. measured at identical V_{CC}, temperature and voltage levels.
Note 6: Flatness is defined as difference between maximum and minimum value of ON resistance over the specified range of conditions..

CAPACITANCE

Parameter	Description	Test Conditions	Supply Voltage	Temp (ºC)	Min.	Typ	Max.	Units
C_{IN}	Control Input		V_{CC} = 5.0V	T_A = 25°C		2.3		pF
C_{IO-B}	For Bn Port,Switch OFF	f= 1 MHz(7) See test circuit diagrams 7 and 8				6.5		
C_{IOA-ON}	For A Port, Switch ON					18.5		

SWITCH AND AC CHARACTERISTICS

Parameter	Description	Test Conditions	Supply Voltage	Temp (ºC)	Min.	Typ	Max.	Units
t_{PLH} t_{PHL}	Propagation Delay: A to Bn	See test circuit diagrams 1 and 2. V_I Open (8)	V_{CC}= 2.3V to 2.7V	T_A = 25°C & –40 to 85°C		1.2		ns
			V_{CC} = 3.0V to 3.6V			0.8		
			V_{CC}= 4.5V to 5.5V			0.3		
t_{PZL} t_{PZH}	Output Enable Turn ON Time: A to Bn	diagrams 1 & 2. See test circuit V_I = 2V_{CC} for T_{PZL}, V_I = 0V for t_{PZH}	V_{CC}= 1.65V to 1.95V	T_A = 25°C		23		
			V_{CC}= 2.3V to 2.7V			13		
			V_{CC}= 3.0V to 3.6V			6.9		
			V_{CC}= 4.5V to 5.5V			5.2		
t_{PZL} t_{PZH}	OUTPUT ENABLE TURN NOTIME: A TO BN	See test circuit diagrams 1 and 2. V_I = 2V_{CC} for T_{PZL}, V_I = 0V for t_{PZH}	V_{CC} = 2.5V	T_A = 25°C & –40 to 85°C		24		
			V_{CC} = 3.3V			14		
			V_{CC} = 3.0V to 3.6V			7.6		
			V_{CC} = 4.5V to 5.5V			5.7		

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t_{PLZ} t_{PHZ}	Output Disable Turn OFF Time: A to Bn	See test circuit diagrams 1 and 2. $V_I = 2V_{CC}$ for T_{PZL}, $V_I = 0V$ for t_{PZH}	V_{CC} = 1.65V to 1.95V	T_A = 25°C		12.5		ns
			V_{CC} = 2.3V to 2.7V			7		
			V_{CC} = 3.0V to 3.6V			5		
			V_{CC} = 4.5V to 5.5V			3.5		
t_{PLZ} t_{PHZ}	Output Disable Turn OFF Time: A to Bn	See test circuit diagrams 1 and 2. $V_I = 2V_{CC}$ for T_{PZL}, $V_I = 0V$ for t_{PZH}	V_{CC} = 2.5V	T_A = –40 to 85°C		13		
			V_{CC} = 3.3V			7.5		
			V_{CC} = 3.0V to 3.6V			5.3		
			V_{CC} = 4.5V to 5.5V			3.8		
t_{BM}	Break Before Make Time	See test circuit diagram 3.(9)	V_{CC} = 2.5V	T_A = 25°C & –40 to 85°C	0.5			
			V_{CC} = 3.3V		0.5			
			V_{CC} = 3.0V to 3.6V		0.5			
			VCC = 4.5V to 5.5V		0.5			
Q	Charge Injection	C_L = 0.1nF, V_{GEN} = 0V, R_{GEN} = 0Ω. See test circuit 4.	V_{CC} = 5.0V	T_A = 25°C		7		pC
			VCC = 3.3V			3		
OIRR	Off Isolation	R_L = 50Ω, V_{GEN} = 0V, R_{GEN} = 0Ω. See test circuit 5. (10)	V_{CC} = 1.65V to 5.5V	T_A = 25°C		–57		dB
X_{TALK}	Crosstalk Isolation	See test circuit 6.	V_{CC} = 1.65V to 5.5V	T_A = 25°C		–54		
f_{3dB}	–3dB Bandwidth	See test circuit 9	V_{CC} = 1.65V to 5.5V	T_A = 25°C		300		MHz

Note 7: .TA = 25°C, f = 1MHz. Capacitance is characterized but not tested in production.
Note 8: Guaranteed by design but not production tested. The device contributes no other propagation delay other than the RC delay of the switch ON resistance and the 50pF load capacitance, when driven by an ideal voltage source with zero output impedance.
Note 9: Guaranteed by design.
Note 10: Off Isolation = 20 Log10 [V_A / V_{Bn}] and is measured in dB.

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TEST CIRCUITS AND TIMING DIAGRAMS

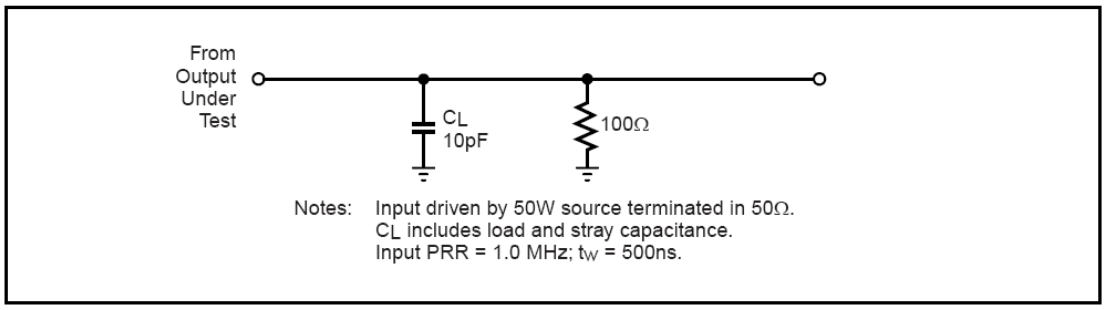

Figure 1. AC Test Circuit

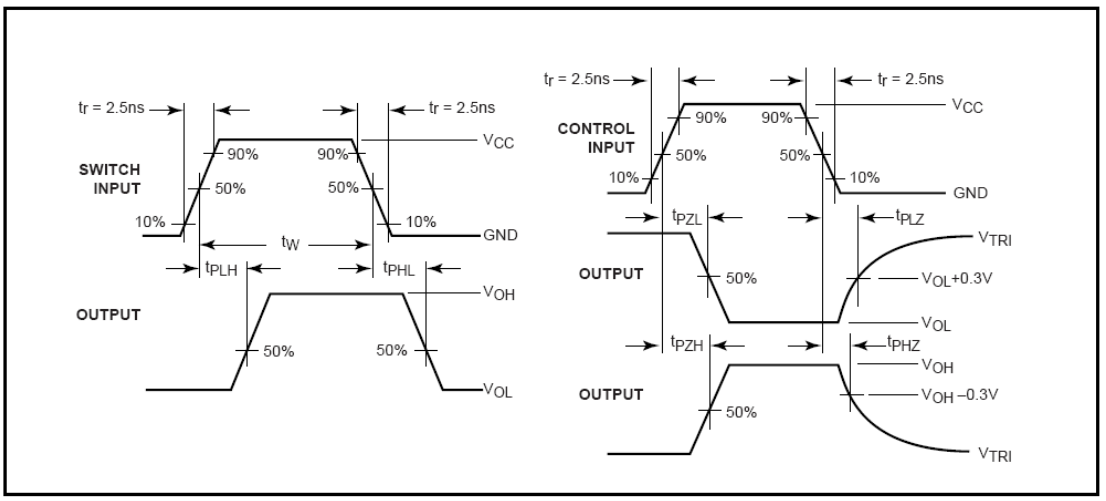

Figure 2. AC Waveforms

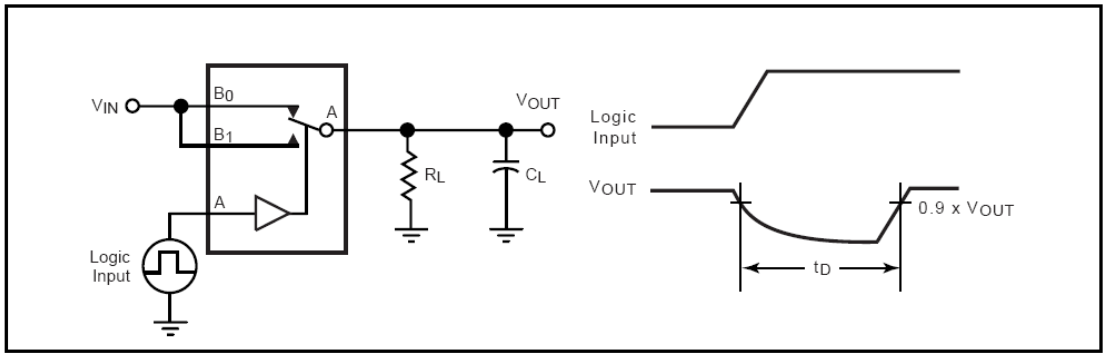

Figure 3. Break Before Make Interval Timing

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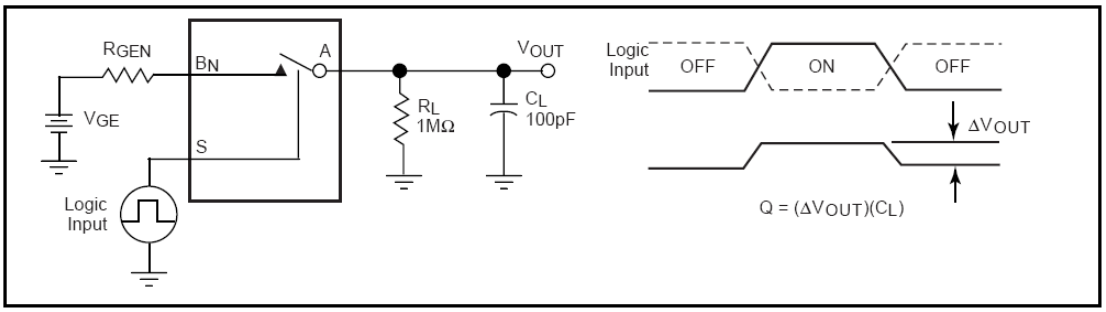

Figure 4. Charge Injection Test

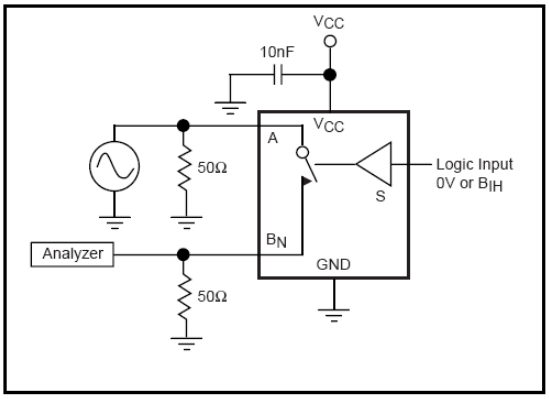

Figure 5. Off Isolation

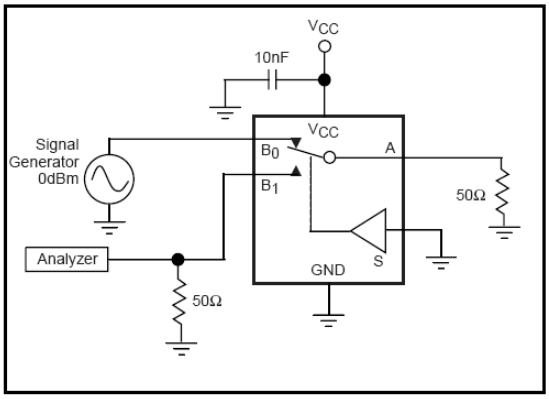

Figure 6. Crosstalk

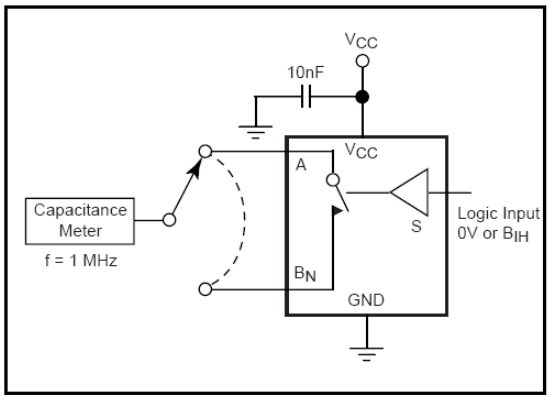

Figure 7. Channel Off Capacitance

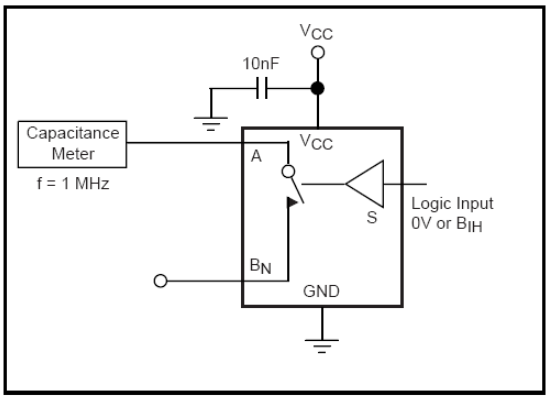

Figure 8. Channel On Capacitance

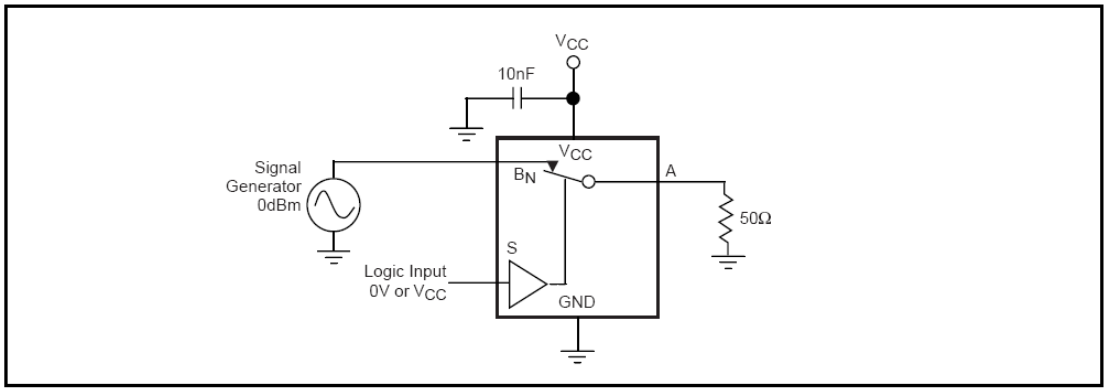

Figure 9. Bandwidth

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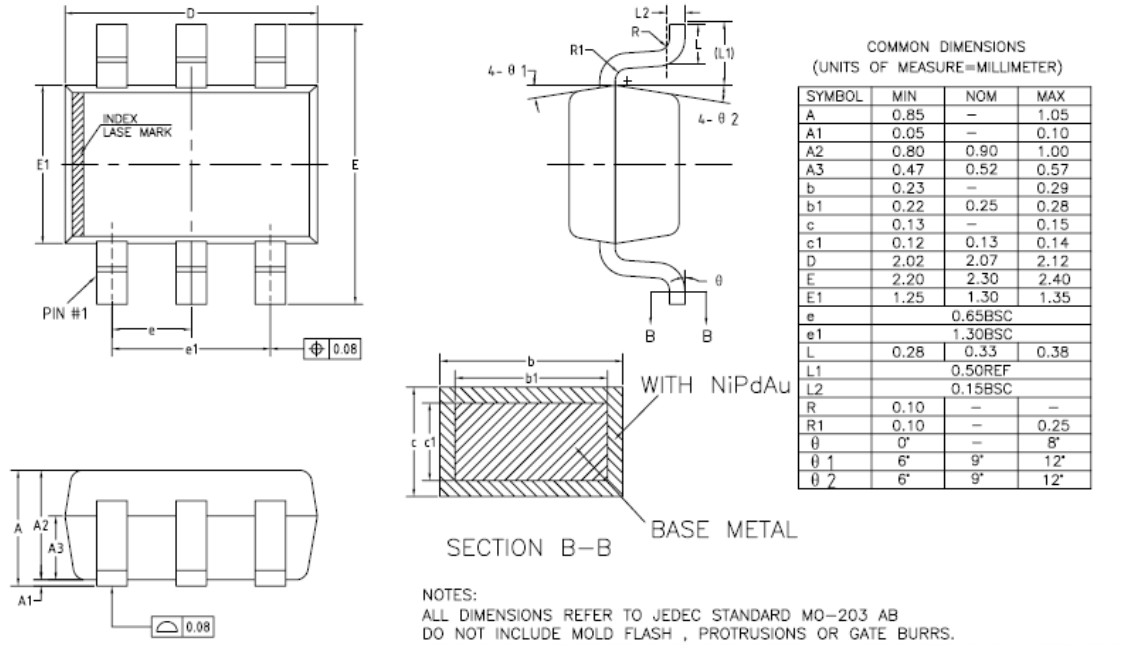
Packaging Mechanical: 6-Pin SC70 (C)



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.85	–	1.05
A1	0.05	–	0.10
A2	0.80	0.90	1.00
A3	0.47	0.52	0.57
b	0.23	–	0.29
b1	0.22	0.25	0.28
c	0.13	–	0.15
c1	0.12	0.13	0.14
D	2.02	2.07	2.12
E	2.20	2.30	2.40
E1	1.25	1.30	1.35
e		0.65BSC	
e1		1.30BSC	
L	0.28	0.33	0.38
L1		0.50REF	
L2		0.15BSC	
R	0.10	–	–
R1	0.10	–	0.25
θ	0°	–	8°
θ 1	6°	9°	12°
θ 2	6°	9°	12°

NOTES:
ALL DIMENSIONS REFER TO JEDEC STANDARD MO–203 AB
DO NOT INCLUDE MOLD FLASH , PROTRUSIONS OR GATE BURRS.
MOLD FLASH , PROTRUSIONS OR GATE BURRS WILL NOT EXCEED 0.15mm PER SIDE.

Packaging Mechanical: 6-Pin TDFN