



# BCT4157

## Low-Voltage, 2.8Ω SPDT Analog Switch

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### 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 9.0-ohms at 2.7V, & 4.5-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.

### FEATURES

- CMOS Technology for Bus and Analog Applications
- Low ON Resistance: 2.8ohms @ 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)

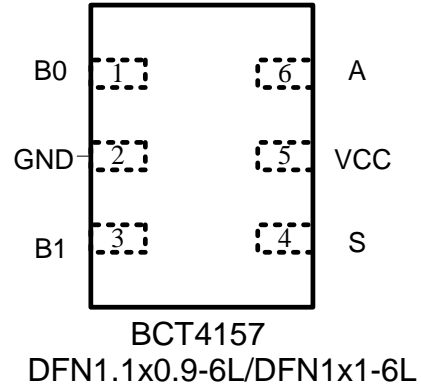
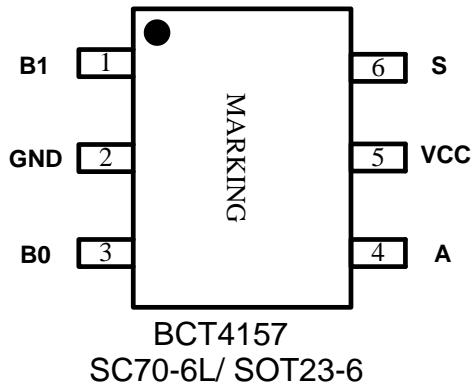
### APPLICATIONS

Cell Phones  
PDAs  
Portable Instrumentation  
Battery Powered Communications  
Computer Peripherals

### ORDERING INFORMATION

Ordering Code	Package Description	Temp Range	Top Marking	QTY/Reel
BCT4157EXT-TR	SC70-6L	-40°C to +85°C	ABG	3000
BCT4157ELT-TR	DFN 1.1x0.9-6L	-40°C to +85°C	ABG	3000
BCT4157EUT-TR	SOT23-6	-40°C to +85°C	AUG	3000
BCT4157ETT-TR	DFN1x1-6L	-40°C to +85°C	AUG	10000

#### PIN CONFIGURATION (Top View)



#### PIN DESCRIPTION

Pin		Name	Description
BCT4157 SC70-6L SOT23-6	BCT4157 DFN1.1x0.9 DFN1x1-6L		
6	4	S	Logic Control
5	5	Vcc	Positive Power Supply
4	6	A	Common Output/Data Port
3	1	B0	Data Port (Normally Closed)
2	2	GND	Ground
1	3	B1	Data Port

#### Logic Function Table

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



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#### ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

Supply Voltage VCC.....	−0.5V to +7V
DC Switch Voltage (VS) <sup>(2)</sup> .....	−0.5V to VCC +0.5V
DC Input Voltage (VIN) <sup>(2)</sup> .....	−0.5V to +7.0V
DC VCC or Ground Current (ICC/IGND).....	±100mA
DC Output Current (VOUT) .....	128mA
Storage Temperature Range (TSTG).....	−65°C to +150°C
Junction Temperature under Bias (TJ) .....	150°C
Junction Lead Temperature (TL) (Soldering, 10 seconds) .....	260°C
Power Dissipation (PD) @ +85°C	
SC70-6L/DFN 1.1x0.9-6L/DFN1x1-6L.....	186mW
SOT23-6.....	250mW
ESD HBM (human body model) .....	±4KV

#### RECOMMENDED OPERATING CONDITIONS<sup>(3)</sup>

Supply Voltage Operating (VCC).....	1.65V to 5.5V
Control Input Voltage (VIN).....	0V to VCC
Switch Input Voltage (VIN).....	0V to VCC
Output Voltage (VOUT).....	0V to VCC
Operating Temperature (TA).....	−40°C to +85°C
Thermal Resistance (θJA)	
SC70-6L/DFN 1.1x0.9-6L/DFN1x1-6L.....	350°C/W
SOT23-6.....	260°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 (TA = - 40°C to +85°C)

Parameter	Description	Test Conditions	Supply Voltage	Temp (°C)	Min	Typ	Max	Units
V <sub>IAR</sub>	Analog Input Signal Range		V <sub>CC</sub>	T <sub>A</sub> = 25°C & -40°C to 85°C	0		V <sub>CC</sub>	V
R <sub>ON</sub>	ON Resistance <sup>(4)</sup>	I <sub>out</sub> = 100mA, B <sub>0</sub> or B <sub>1</sub> =1.5V	2.7V	T <sub>A</sub> = 25°C		4.5	9.0	Ω
R <sub>ON</sub>	ON Resistance <sup>(4)</sup>	I <sub>out</sub> = 100mA, B <sub>0</sub> or B <sub>1</sub> =1.5V	4.5V	T <sub>A</sub> = 25°C		2.8	4.5	
ΔR <sub>ON</sub>	ON Resistance Match Between Channels <sup>(4,5,6)</sup>	I <sub>out</sub> = 100mA, B <sub>0</sub> =B <sub>1</sub> =1.5V	2.7V	T <sub>A</sub> = 25°C			0.75	Ω
R <sub>ONF</sub>	ON Resistance <sup>(4,5,7)</sup> Flatness	I(A) = -100mA; B <sub>0</sub> or B <sub>1</sub> = 0V, 1.5V, 2.3V	2.7V	T <sub>A</sub> = 25°C		1.5		Ω
R <sub>ONF</sub>	ON Resistance <sup>(4,5,7)</sup> Flatness	I(A) = -100mA; B <sub>0</sub> or B <sub>1</sub> = 0V, 1.5V, 3.0V,	4.5V	T <sub>A</sub> = 25°C		0.5		
V <sub>IH</sub>	Input High Voltage	Logic High Level	V <sub>CC</sub> = 1.65V to 5.5V	T <sub>A</sub> = 25°C & -40°C to 85°C	1.0			V
V <sub>IL</sub>	Input Low Voltage	Logic Low Level	V <sub>CC</sub> = 1.65V to 5.5V	T <sub>A</sub> = 25°C & -40°C to 85°C			0.5	V

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

Parameter	Description	Test Conditions	Supply Voltage	Temp (°C)	Min	Typ	Max	Units
I <sub>IN</sub>	Input Leakage Current	0 ≤ V <sub>IN</sub> ≤ 5.5V	V <sub>CC</sub> = 0V to 5.5V	T <sub>A</sub> = 25°C			±0.1	μA
				T <sub>A</sub> = -40°C to 85°C			±1.0	
I <sub>OFF</sub>	OFF State Leakage Current	A=1V, 4.5V, B <sub>0</sub> or B <sub>1</sub> =4.5V, 1V	V <sub>CC</sub> = 5.5V	T <sub>A</sub> = 25°C	-2.0		2.0	
I <sub>CC</sub>	Quiescent Supply Current	All channels ON or OFF, V <sub>IN</sub> = V <sub>CC</sub> or GND, I <sub>OUT</sub> = 0	V <sub>CC</sub> = 5.5V	T <sub>A</sub> = 25°C			1	
				T <sub>A</sub> = -40°C to 85°C			10	

Note 4: Measured by voltage drop between A and B 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: Parameter is characterized but not tested in production.

Note 6: ΔR<sub>ON</sub> = R<sub>ON</sub> max – R<sub>ON</sub> min. measured at identical V<sub>CC</sub>, temperature and voltage levels.

Note 7: Flatness is defined as difference between maximum and minimum value of ON resistance over the specified range of conditions..

Note 8: Guaranteed by design.



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### SPDT Analog Switch

#### CAPACITANCE<sup>(12)</sup>

Parameter	Description	Test Conditions	Supply Voltage	Temp (°C)	Min	Typ	Max	Units
C <sub>IN</sub>	Control Input	f = 1 MHz <sup>(12)</sup>	V <sub>CC</sub> = 5.0V	T <sub>A</sub> = 25°C		2.3		pF
C <sub>IO-B</sub>	For B Port, Switch OFF					6.5		
C <sub>IOA-ON</sub>	For A Port, Switch ON					18.5		

#### SWITCH AND AC CHARACTERISTICS

Parameter	Description	Test Conditions	Supply Voltage	Temp (°C)	Min.	Typ	Max	Units
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay: A to Bn	See test circuit diagrams 1 and 2. V <sub>I</sub> Open <sup>(10)</sup>	V <sub>CC</sub> = 2.3V to 2.7V	T <sub>A</sub> = 25°C & -40 to 85°C		1.2		ns
			V <sub>CC</sub> = 3.0V to 3.6V			0.8		
			V <sub>CC</sub> = 4.5V to 5.5V			0.3		
t <sub>PZL</sub> t <sub>PZH</sub>	Output Enable Turn ON Time: A to Bn	diagrams 1 & 2. See test circuit V <sub>I</sub> = V <sub>CC</sub> for t <sub>PZH</sub> , V <sub>I</sub> = 0V for t <sub>PZL</sub>	V <sub>CC</sub> = 1.65V to 1.95V	T <sub>A</sub> = 25°C	7		160	
			V <sub>CC</sub> = 2.3V to 2.7V		3.5		90	
			V <sub>CC</sub> = 3.0V to 3.6V		2.5		70	
			V <sub>CC</sub> = 4.5V to 5.5V		1.7		60	
t <sub>PZL</sub> t <sub>PZH</sub>	Output Enable Turn ON Time: A TO Bn	See test circuit diagrams 1 and 2. V <sub>I</sub> = V <sub>CC</sub> for t <sub>PZH</sub> , V <sub>I</sub> = 0V for t <sub>PZL</sub>	V <sub>CC</sub> = 2.5V	T <sub>A</sub> = -40 to 85°C			33	
			V <sub>CC</sub> = 3.3V				28	
			V <sub>CC</sub> = 3.0V to 3.6V				28	
			V <sub>CC</sub> = 4.5V to 5.5V				22	

#### SWITCH AND AC CHARACTERISTICS(Continued)

Parameter	Description	Test Conditions	Supply Voltage	Temp (°C)	Min	Typ	Max	Units
t <sub>PLZ</sub> t <sub>PHZ</sub>	Output Disable Turn OFF Time: A to Bn	See test circuit diagrams 1 and 2. V <sub>I</sub> = V <sub>CC</sub> for t <sub>PHZ</sub> , V <sub>I</sub> = 0V for t <sub>PLZ</sub>	V <sub>CC</sub> = 1.65V to 1.95V	T <sub>A</sub> = 25°C	20		160	ns
			V <sub>CC</sub> = 2.3V to 2.7V		10		90	
			V <sub>CC</sub> = 3.0V to 3.6V		7		70	
			V <sub>CC</sub> = 4.5V to 5.5V		5		60	
t <sub>PLZ</sub> t <sub>PHZ</sub>	Output Disable Turn OFF Time: A to Bn	See test circuit diagrams 1 and 2. V <sub>I</sub> = V <sub>CC</sub> for t <sub>PHZ</sub> , V <sub>I</sub> = 0V for t <sub>PLZ</sub>	V <sub>CC</sub> = 2.5V	T <sub>A</sub> = -40 to 85°C			33	
			V <sub>CC</sub> = 3.3V				28	
			V <sub>CC</sub> = 3.0V to 3.6V				28	
			V <sub>CC</sub> = 4.5V to 5.5V				22	
t <sub>BM</sub>	Break Before Make Time	See test circuit diagram 9. <sup>(9)</sup>	V <sub>CC</sub> = 2.5V	T <sub>A</sub> = 25°C & -40 to 85°C	0.5			
			V <sub>CC</sub> = 3.3V		0.5			
			V <sub>CC</sub> = 3.0V to 3.6V		0.5			
			V <sub>CC</sub> = 4.5V to 5.5V		0.5			
Q	Charge Injection	C <sub>L</sub> = 0.1nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω. See test circuit 4.	V <sub>CC</sub> = 5.0V	T <sub>A</sub> = 25°C		7		pC
			V <sub>CC</sub> = 3.3V			3		
OIRR	Off Isolation	R <sub>L</sub> = 50Ω, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω. See test circuit 5. <sup>(11)</sup>	V <sub>CC</sub> = 1.65V to 5.5V	T <sub>A</sub> = 25°C		-57		dB
X <sub>TALK</sub>	Crosstalk Isolation	See test circuit 6.	V <sub>CC</sub> = 1.65V to 5.5V	T <sub>A</sub> = 25°C		-54		
f <sub>3dB</sub>	-3dB Bandwidth	See test circuit 9	V <sub>CC</sub> = 1.65V to 5.5V	T <sub>A</sub> = 25°C		300		MHz

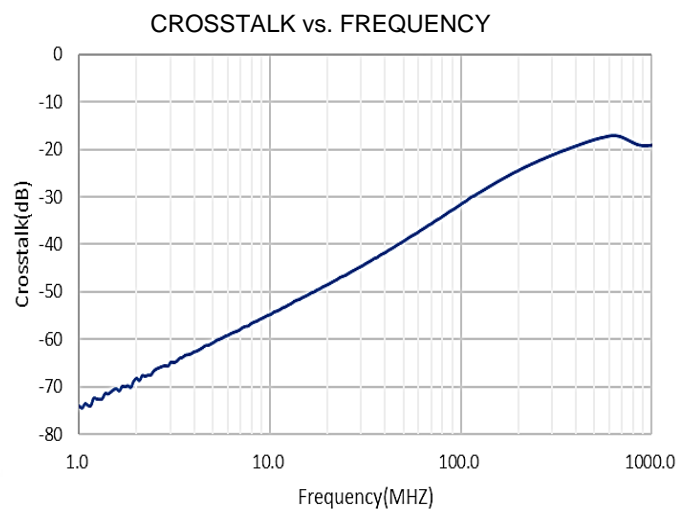
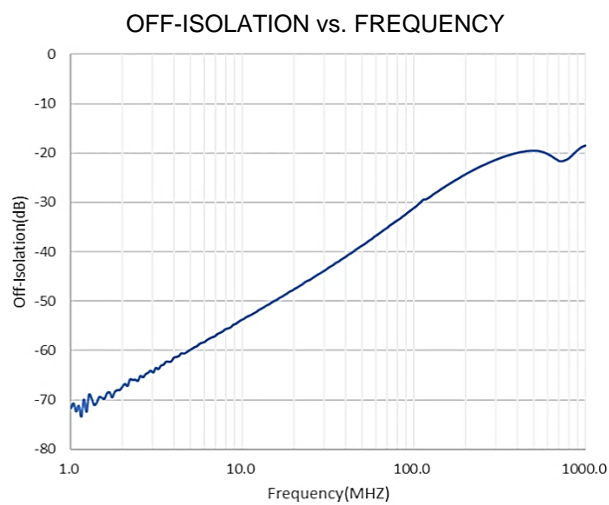
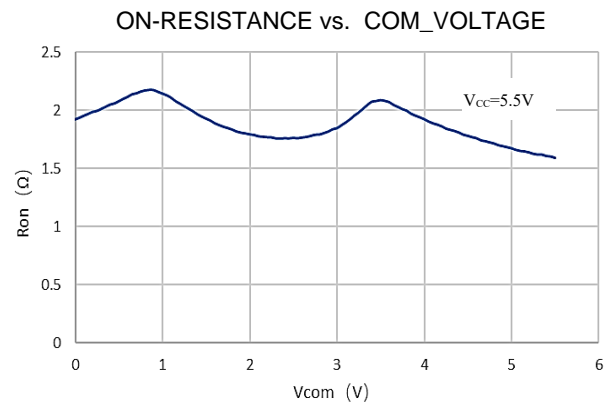
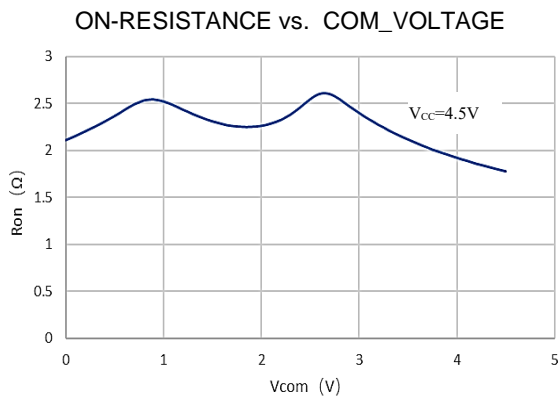
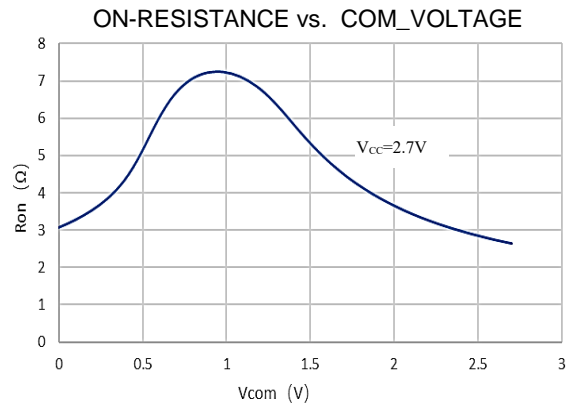
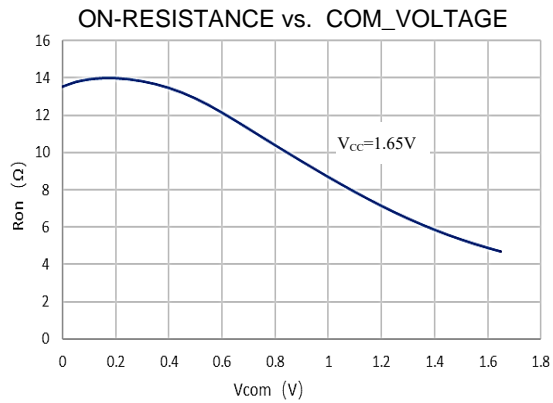
Note 9: Guaranteed by design

Note 10: 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.

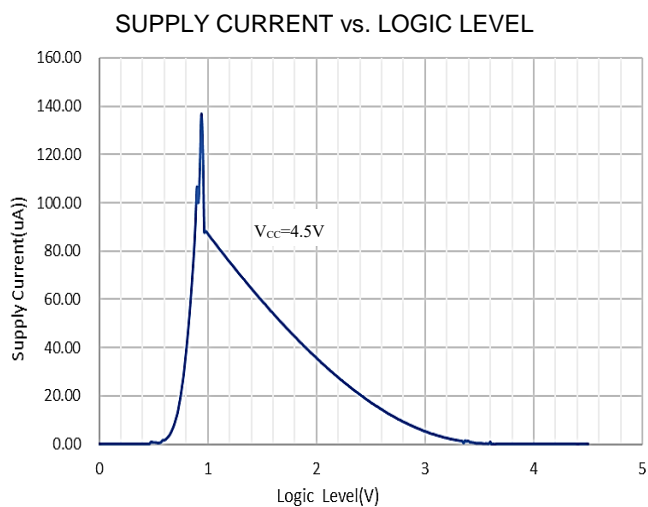
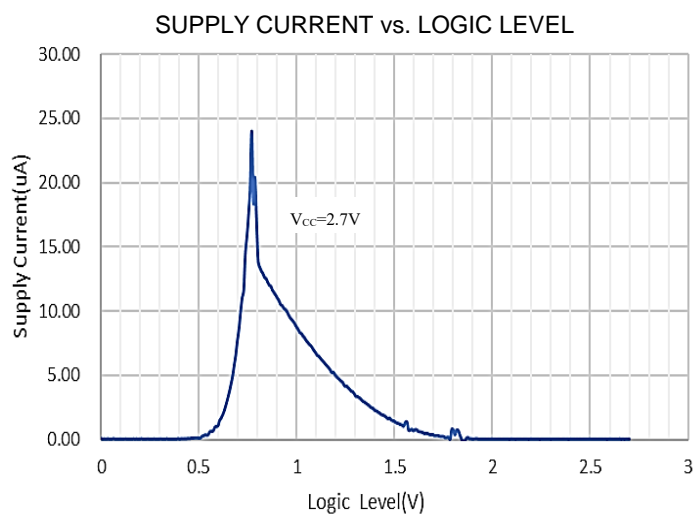
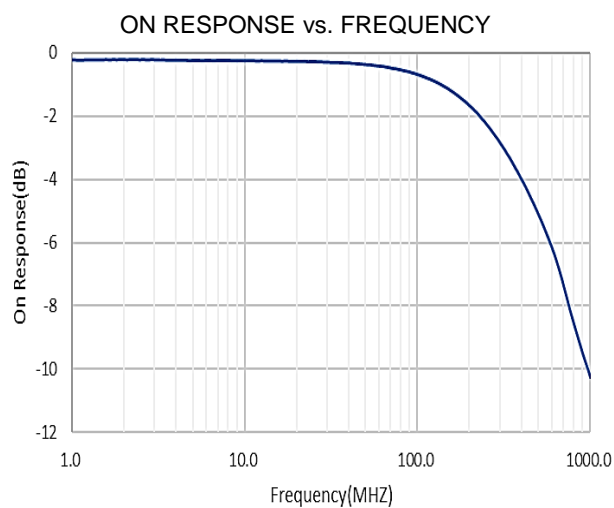
Note 11: Off Isolation = 20 Log<sub>10</sub> [ V<sub>A</sub> / V<sub>Bn</sub> ] and is measured in dB.

Note 12: T<sub>A</sub> = 25°C, f = 1MHz. Capacitance is characterized but not tested in production.

## Typical Operating Characteristics



#### Typical Operating Characteristics(Continued)





## TEST CIRCUITS AND TIMING DIAGRAMS

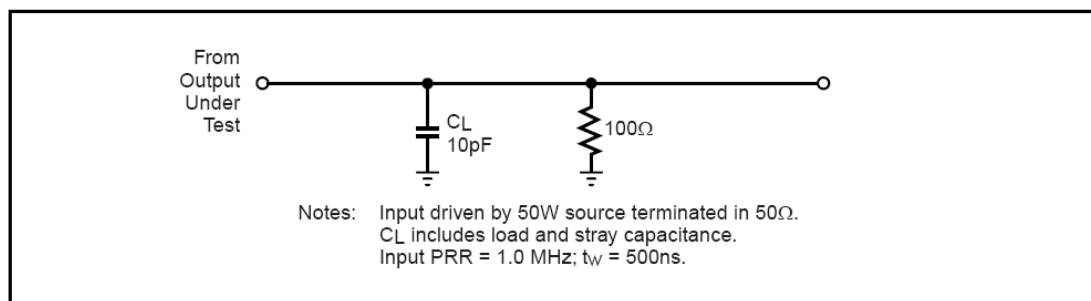


Figure 1. AC Test Circuit

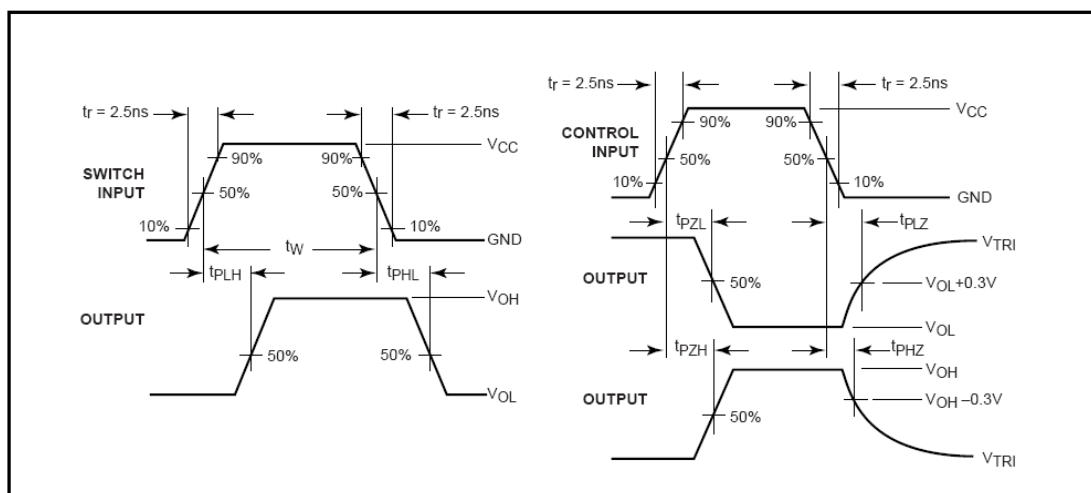


Figure 2. AC Waveforms

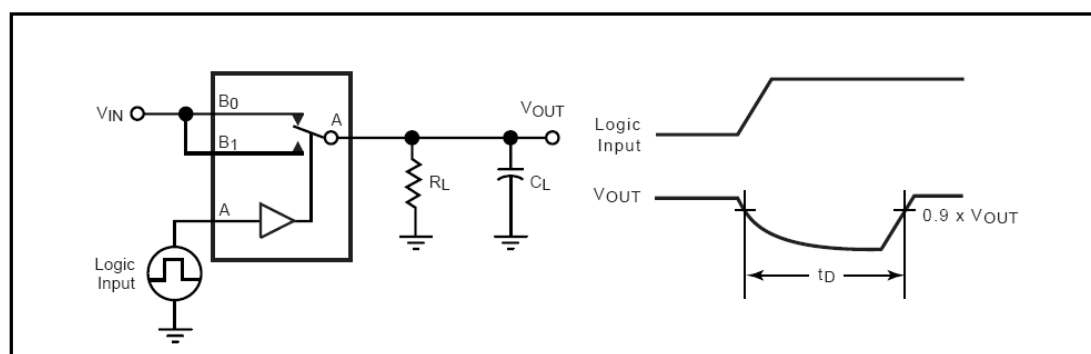


Figure 3. Break Before Make Interval Timing

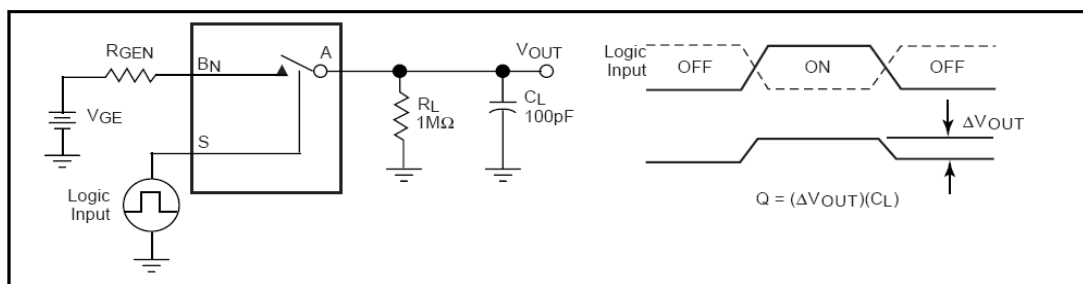


Figure 4. Charge Injection Test

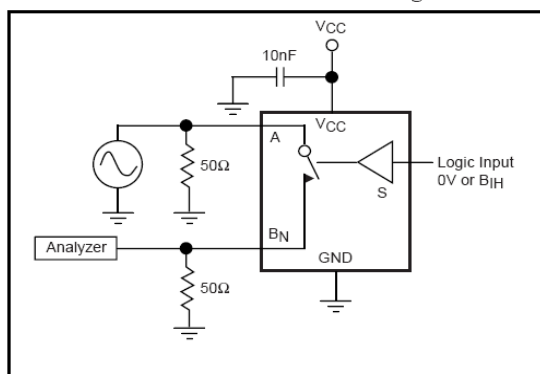


Figure 5. Off Isolation

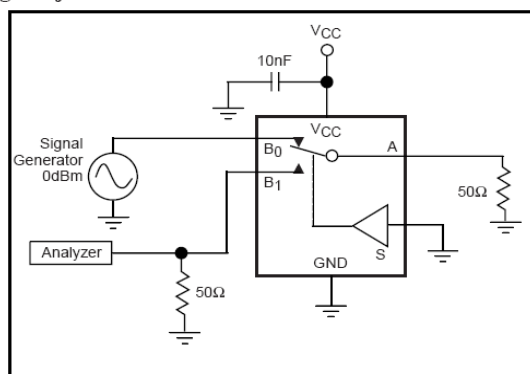


Figure 6. Crosstalk

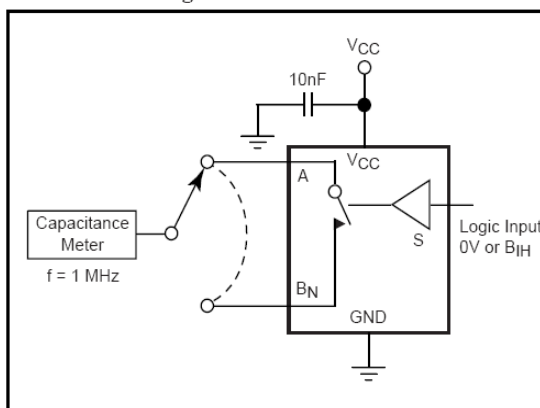


Figure 7. Channel Off Capacitance

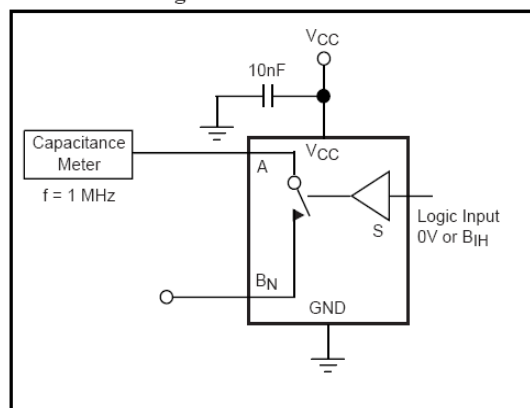


Figure 8. Channel On Capacitance

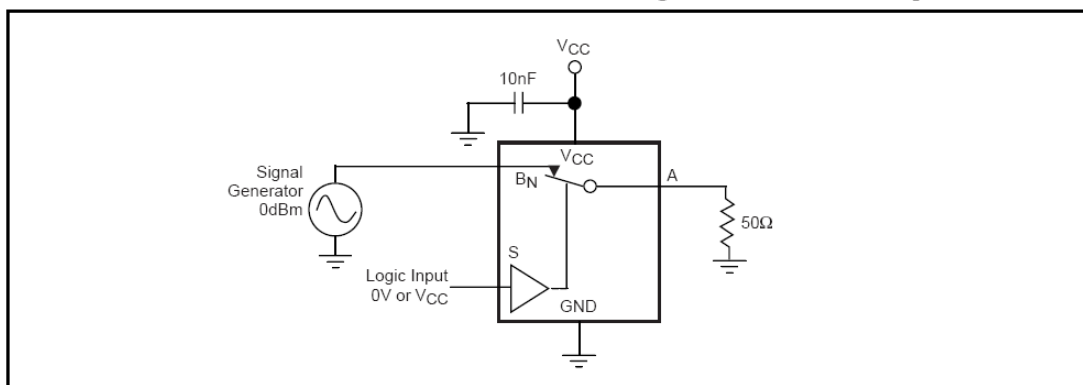
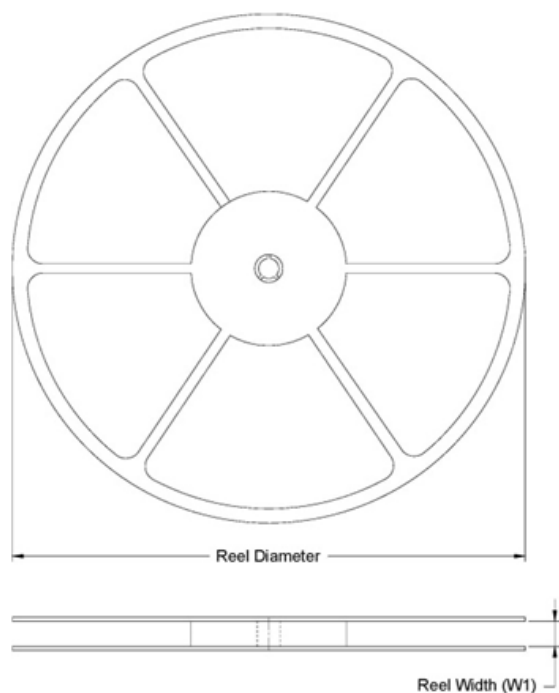


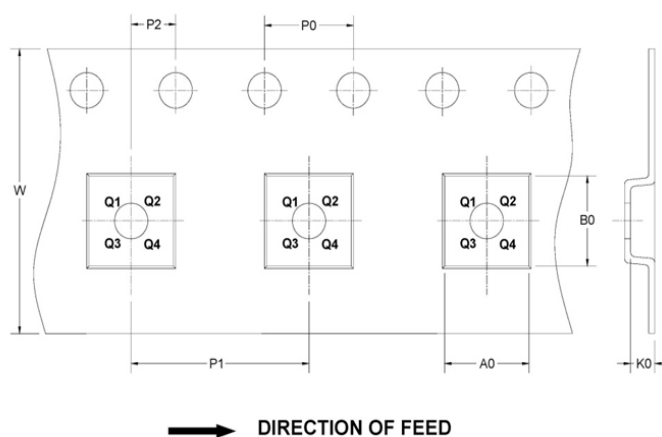
Figure 9. Bandwidth

### TAPE AND REEL INFORMATION

#### REEL DIMENSIONS



#### TAPE DIMENSIONS

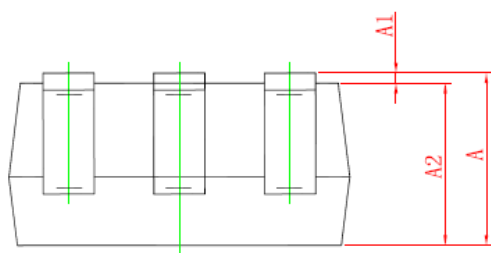
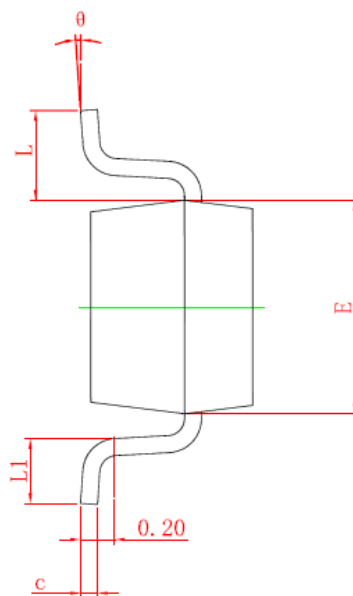
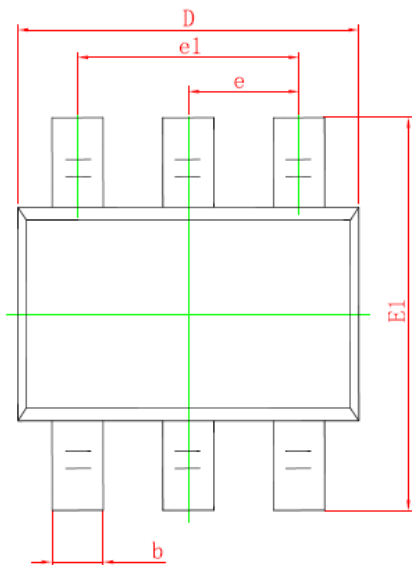


- Notes: 1. The above picture is for reference only, please refer to the value in the table below for the actual size.  
2. For Pin 1 Orientation, please check the physical reel before use.

### KEY PARAMETER LIST OF TAPE AND REEL

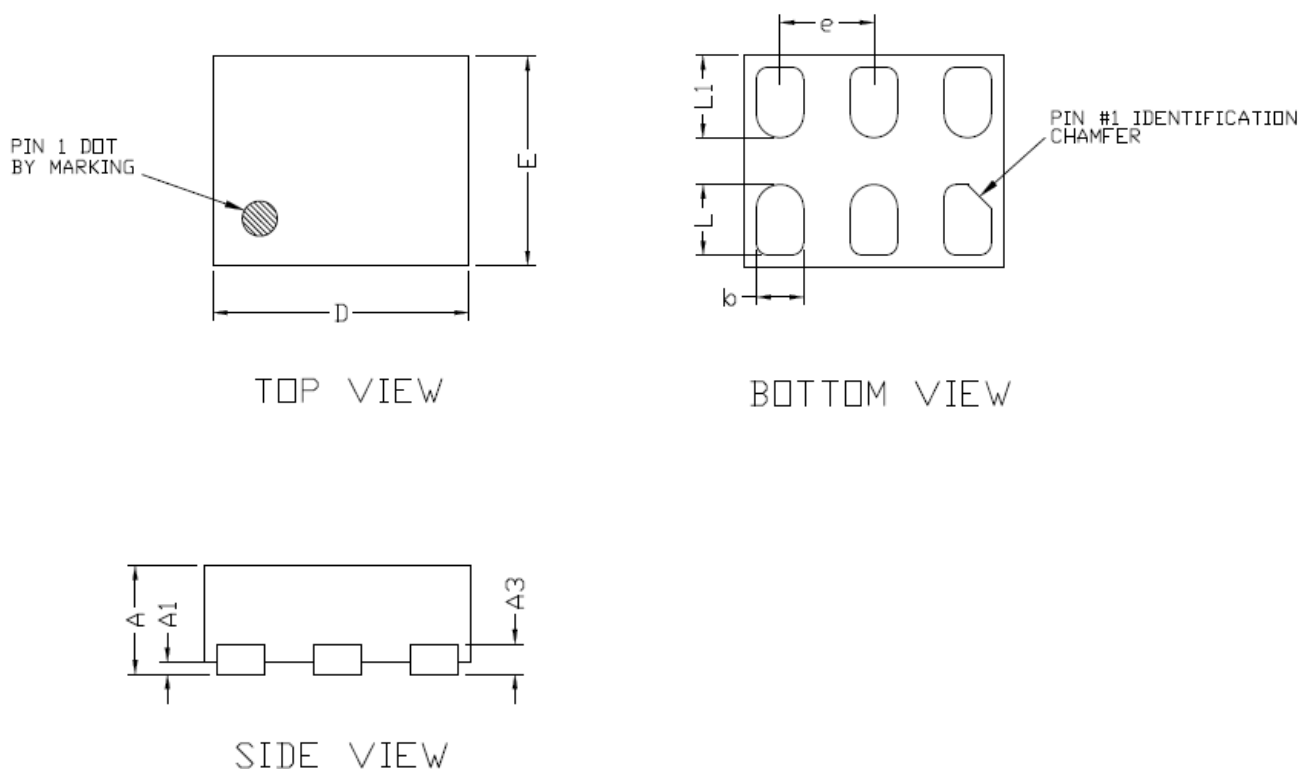
Device Name	Package Type	Reel Diameter	Unit: mm								Pin 1 Quadrant	Reel Q'ty
			Reel Width W1	A0	B0	K0	P0	P1	P2	W		
BCT4157EXT-TR	SC70-6L	7"	9.5	2.30	2.50	1.20	4	4	2	8	Q3	3000
BCT4157ELT-TR	DFN1.1x0.9-6L	7"	9.5	1.05	1.25	0.6	4	4	2	8	Q1	3000
BCT4157EUT-TR	SOT23-6	7"	9.5	3.18	3.28	1.32	4	4	2	8	Q3	3000

#### Packaging Mechanical: SC70-6L



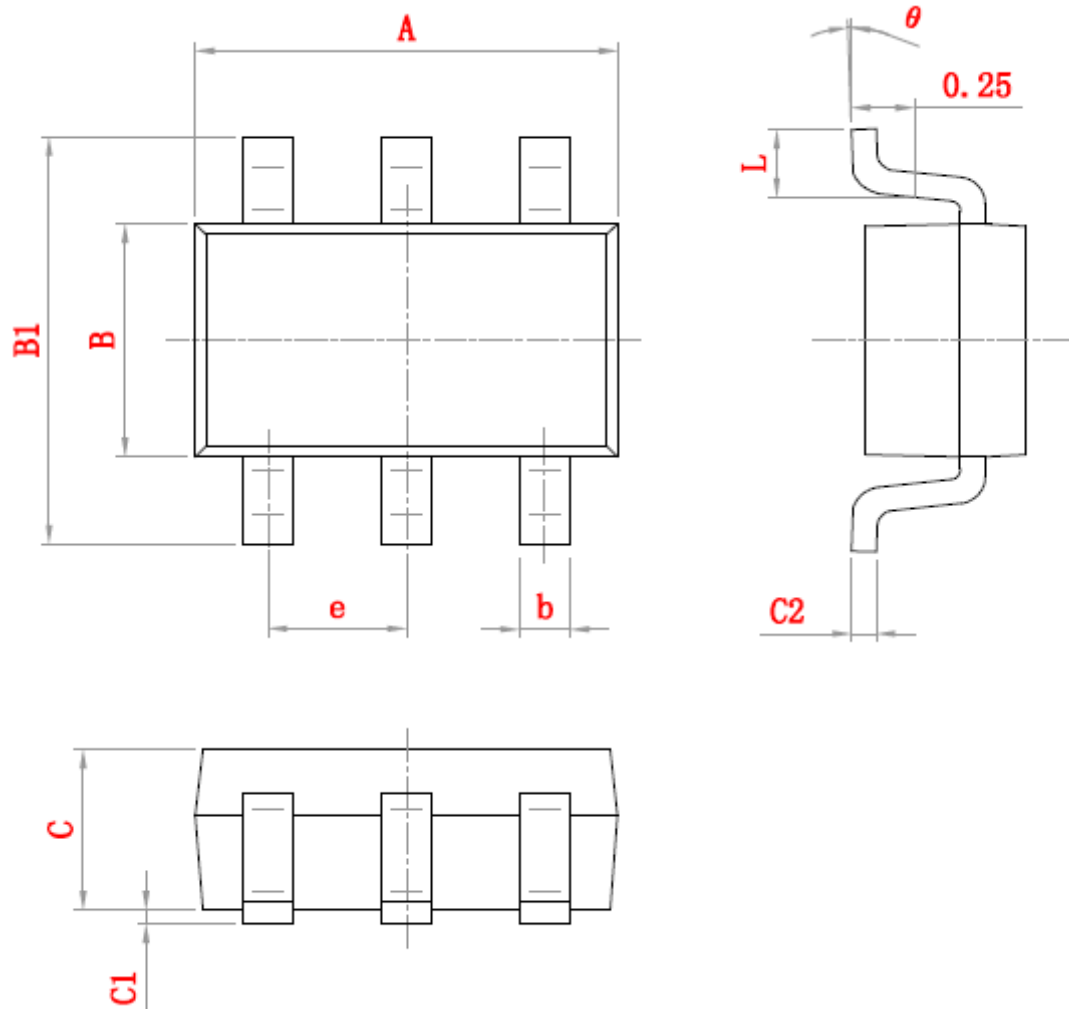
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.110	0.175	0.004	0.007
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650 TYP.		0.026 TYP.	
e1	1.200	1.400	0.047	0.055
L	0.525 REF.		0.021 REF.	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

#### Packaging Mechanical: DFN 1.1x0.9-6L



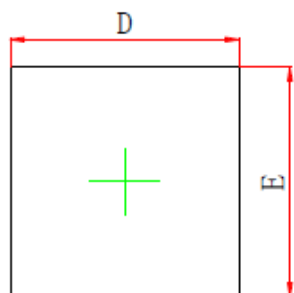
COMMON DIMENSIONS(MM)			
PKG.	X1:EXTREME THIN		
REF.	MIN.	NOM.	MAX
A	0.40	—	0.50
A1	0.00	—	0.05
A3	0.125 REF.		
D	1.05	1.10	1.15
E	0.85	0.90	0.95
b	0.15	0.20	0.25
L	0.25	0.30	0.35
L1	0.30	0.35	0.40
e	0.40 BSC		

### Packaging Mechanical: SOT23-6

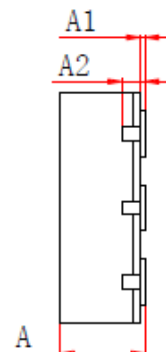


Symbols	Dimmensions in millimeters	
	Min.	Max.
A	2.82	3.02
e	0.95 (BSC)	
b	0.28	0.45
B	1.50	1.70
B1	2.60	3.00
C	1.05	1.15
C1	0.03	0.15
C2	0.12	0.23
L	0.35	0.55
θ	0°	8°

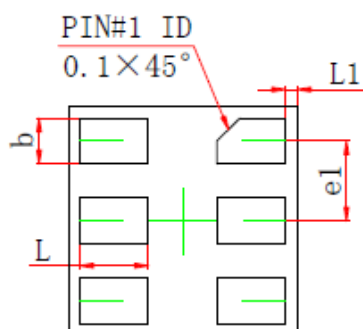
#### Packaging Mechanical: DFN1x1-6L



TOP VIEW  
顶视图



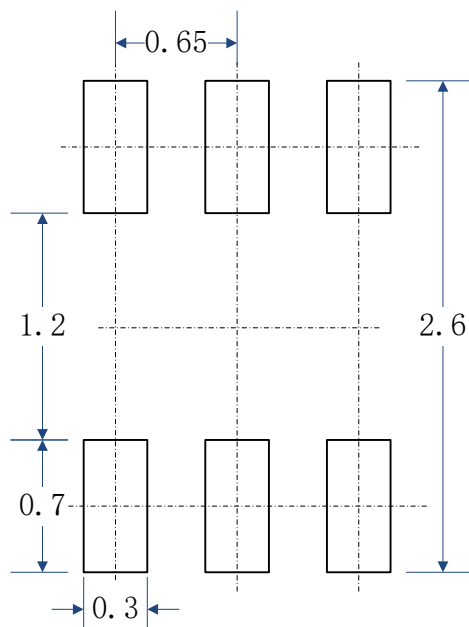
SIDE VIEW  
侧视图



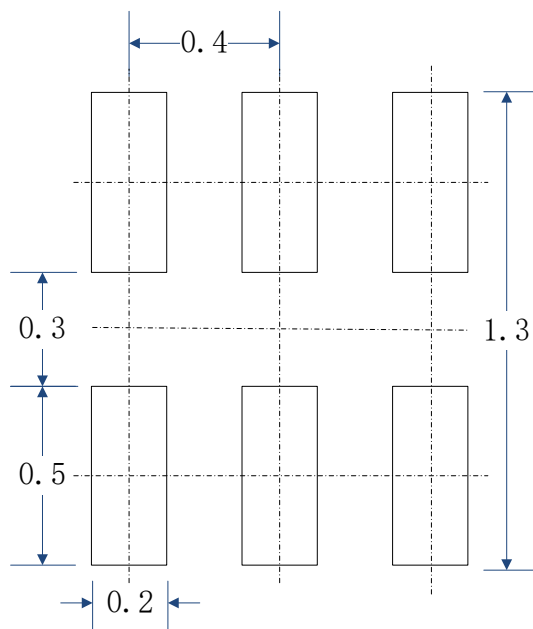
BOTTOM VIEW  
背视图

Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nor.	Max.	Min.	Nor.	Max.
A	0.340	0.370	0.400	0.013	0.015	0.016
A1	0.000	-	0.050	0.000	-	0.002
A2	0.100REF.			0.004REF.		
D	0.950	1.000	1.050	0.037	0.039	0.041
E	0.950	1.000	1.050	0.037	0.039	0.041
b	0.150	0.200	0.250	0.006	0.008	0.010
e1	0.350TYP.			0.014TYP.		
L	0.250	0.300	0.350	0.010	0.012	0.014
L1	0.050REF.			0.002REF.		

#### PCB Layout Pattern:



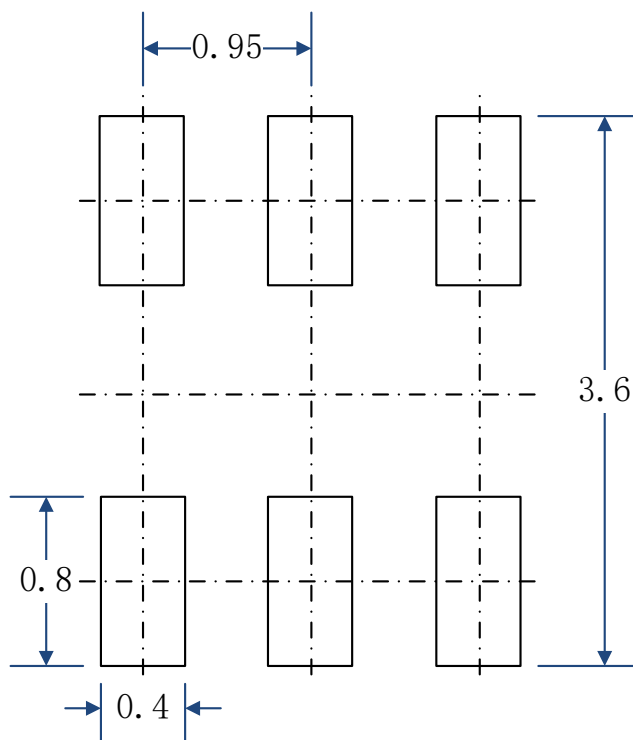
**SC70-6L RECOMMENDED PCB LAYOUT PATTERN** (Unit: mm)



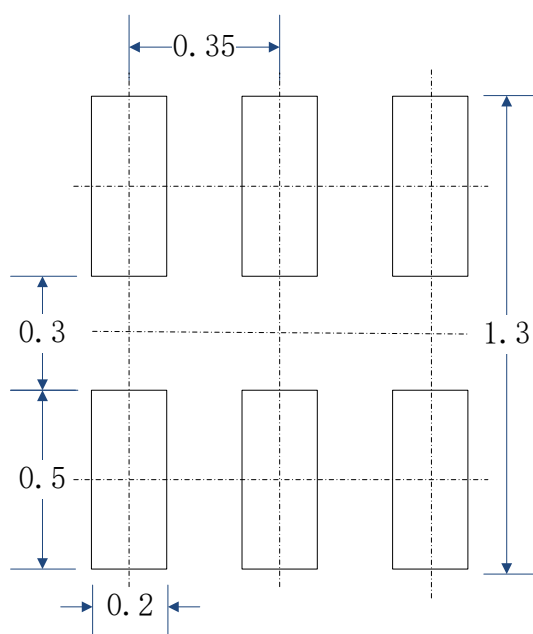
**DFN1.1x0.9-6L RECOMMENDED PCB LAYOUT PATTERN** (Unit: mm)



#### PCB Layout Pattern (Continued):



**SOT23-6 RECOMMENDED PCB LAYOUT PATTERN** (Unit: mm)



**DFN1x1-6L RECOMMENDED PCB LAYOUT PATTERN** (Unit: mm)