

## 2:1 Multiplexer

### DESCRIPTION

The 3157 is an advanced CMOS analog switch fabricated with silicon gate CMOS technology. It achieves very low propagation delay while maintaining CMOS low power dissipation. Analog and digital voltages that may vary across the full power-supply range (from  $V_{CC}$  to GND).

The Select pin has over voltage protection that allows voltages above  $V_{CC}$ , up to 7.0 V to be present on the pin without damage or disruption of operation of the part, regardless of the operating voltage.

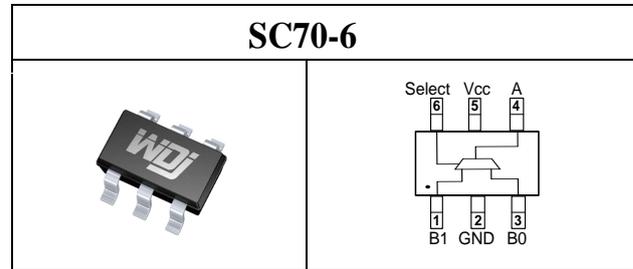
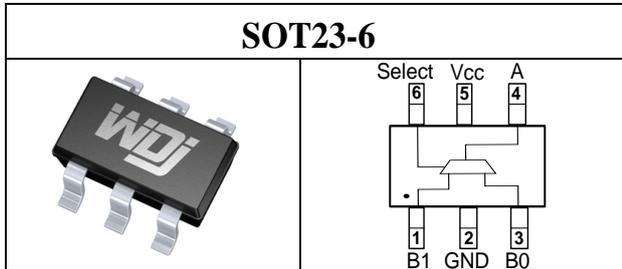
### FEATURES

- Low power dissipation
- High speed
- Standard CMOS logic levels
- High bandwidth, improved linearity
- Switches Standard NTSC/PAL Video, Audio, SPDIF and HDTV
- be used for Clock Switching, Data Mux'ing, etc.
- Low  $R_{DS(ON)}$
- Break Before Make Circuitry, Prevents Inadvertent Shorts
- Operating temperature  $-55^{\circ}\text{C} \sim +125^{\circ}\text{C}$
- package : SC70-6, SOT23-6

### ORDER INFORMATION

Model	Package	Ordering Number	Packing Option
SN74LVC1G3157	SC70-6	SN74LVC1G3157DCKRW	Tape and Reel, 3000
	SOT23-6	SN74LVC1G3157DBVRW	Tape and Reel, 3000

## PIN CONFIGURATION (Top View)



## PIN DESCRIPTIONS

Pin	I/O	Pin Function
A, B <sub>0</sub> , B <sub>1</sub>	I/O	Data port
Select	I	Controlling choice
V <sub>CC</sub>	/	Power supply port
GND	/	Ground

## FUNCTIONS DESCRIPTION

Select input port	Function
L	B <sub>0</sub> Connected to A
H	B <sub>1</sub> Connected to A

## ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Supply Voltage	$V_{CC}$	-0.5 ~ +7.0	V
DC Switch Voltage <sup>(1)</sup>	$V_S$	-0.5 ~ $V_{CC}+0.5$	V
DC Input Voltage <sup>(1)</sup>	$V_{IN}$	-0.5 ~ +7.0	V
DC Input Diode Current @ $V_{IN} < 0$ V	$I_{IK}$	-50	mA
DC Output Current	$I_{out}$	128	mA
DC $V_{CC}$ or Ground Current	$I_{CC}/I_{GND}$	100	mA
Storage Temperature Range	$T_{stg}$	-65 ~ +150	°C
Junction Temperature Under Bias	$T_J$	150	°C
Junction Lead Temperature (Soldering, 10 Seconds)	$T_L$	260	°C
Power Dissipation @ +85°C	$P_D$	180	mW

**NOTE:**

Stresses beyond those listed under “ABSOLUTE MAXIMUM RATINGS” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

1. The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

## CAUTION

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. QCSEMI recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

QCSEMI reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact sales office to get the latest datasheet.

**RECOMMENDED OPERATING CONDITIONS <sup>(2)</sup>**

Characteristic		Symbol	Min	Max	Unit
Supply Voltage Operating		$V_{CC}$	1.65	5.5	V
Select Input Voltage		$V_{IN}$	0	$V_{CC}$	V
Switch Input Voltage		$V_{IN}$	0	$V_{CC}$	V
Output Voltage		$V_{OUT}$	0	$V_{CC}$	V
Operating Temperature		$T_A$	-55	+125	°C
Input Rise and Fall Time	Control Input $V_{CC} = 2.3\text{ V} \sim 3.6\text{ V}$	tr,tf	0	10	ns/V
	Control Input $V_{CC} = 4.5\text{ V} \sim 5.5\text{ V}$		0	5.0	

Note:

2. Select input must be held HIGH or LOW, it must not float.

**ELECTRICAL CHARACTERISTICS**

Symbol	Parameter	Test Conditions	V <sub>CC</sub>	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°C ~ +85°C		Unit
				Min	Typ	Max	Min	Max	
<b>DC ELECTRICAL CHARACTERISTICS</b>									
V <sub>IH</sub>	High Level Input Voltage		1.65 ~ 1.95				0.75V <sub>CC</sub>		V
			2.3 ~ 2.8				1.5		
			3 ~ 4.2				2.4		
			4.5 ~ 5.5				0.6V <sub>CC</sub>		
V <sub>IL</sub>	Low Level Input Voltage		1.65 ~ 1.95				0.25V <sub>CC</sub>		V
			2.3 ~ 2.8				0.4		
			3 ~ 5.5				0.3V <sub>CC</sub>		
I <sub>IN</sub>	Input Leakage Current	0 < V <sub>IN</sub> < 5.5 V	0 ~ 5.5		±0.05	±0.1		±1	µA
I <sub>OFF</sub>	OFF State Leakage Current	0 < A, B < V <sub>CC</sub>	1.65 ~ 5.5		±0.05	±0.1		±1	µA
I <sub>CC</sub>	Quiescent Supply	V <sub>IN</sub> = V <sub>CC</sub> or GND I <sub>OUT</sub> = 0	5.5			1.0		10	µA
	Analog Signal Range		V <sub>CC</sub>	0		V <sub>CC</sub>	0	V <sub>CC</sub>	V
R <sub>ON</sub>	Switch On Resistance <sup>(3)</sup>	V <sub>IN</sub> = 0 V, I <sub>O</sub> = 30 mA	4.5		3.0			7.0	Ω
		V <sub>IN</sub> = 2.4 V, I <sub>O</sub> = -30 mA			5.0			12	Ω
		V <sub>IN</sub> = 4.5 V, I <sub>O</sub> = -30 mA			7.0			15	Ω
		V <sub>IN</sub> = 0 V, I <sub>O</sub> = 24 mA	3.0		4.0			9.0	Ω
		V <sub>IN</sub> = 3 V, I <sub>O</sub> = -24 mA			10			20	Ω
		V <sub>IN</sub> = 0 V, I <sub>O</sub> = 8 mA	2.3		5.0			12	Ω
		V <sub>IN</sub> = 2.3 V, I <sub>O</sub> = -8 mA			13			30	Ω
		V <sub>IN</sub> =0V, I <sub>O</sub> =4 mA	1.65		6.5			20	Ω
		V <sub>IN</sub> = 1.65 V, I <sub>O</sub> = -4 mA			17			50	Ω
R <sub>RANGE</sub>	On Resistance Over Signal Range <sup>(3)(7)</sup>	I <sub>A</sub> = -30 mA 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	4.5					25	Ω
		I <sub>A</sub> = -24 mA 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	3					50	Ω

**ELECTRICAL CHARACTERISTICS (continued)**

Symbol	Parameter	Test Conditions	V <sub>CC</sub>	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°C ~ +85°C		Unit
				Min	Typ	Max	Min	Max	
R <sub>RANGE</sub>	On Resistance Over Signal Range <sup>(3)(7)</sup>	I <sub>A</sub> = -8 mA 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	2.3					100	Ω
		I <sub>A</sub> = -4 mA 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	1.65					300	Ω
ΔR <sub>ON</sub>	On Resistance Match Between Channels <sup>(3)(4)(5)</sup>	I <sub>A</sub> = -30 mA V <sub>Bn</sub> = 3.15	4.5		0.15				Ω
		I <sub>A</sub> = -24 mA V <sub>Bn</sub> = 2.1	3		0.2				Ω
		I <sub>A</sub> = -8 mA V <sub>Bn</sub> = 1.6	2.3		0.5				Ω
		I <sub>A</sub> = -4 mA V <sub>Bn</sub> = 1.15	1.65		0.5				Ω
R <sub>FLAT</sub>	On Resistance Flatness <sup>(3)(4)(6)</sup>	I <sub>A</sub> = -30 mA 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	5		6.0				Ω
		I <sub>A</sub> = -24 mA 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	3.3		12				Ω
		I <sub>A</sub> = -8 mA 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	2.5		28				Ω
		I <sub>A</sub> = -4 mA 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	1.8		125				Ω

**AC ELECTRICAL CHARACTERISTICS**

t <sub>PHL</sub> t <sub>PLH</sub>	Propagation Delay Bus to Bus <sup>(8)</sup>	Figure 1 V <sub>I</sub> = OPEN	1.65 ~ 1.95						nS
			2.3 ~ 2.7					1.2	nS
			3.0 ~ 3.5					0.8	nS
			4.5 ~ 5.5					0.3	nS
t <sub>PZL</sub> t <sub>PZH</sub>	Output Enable Time, Turn On Time (A to Bn)	Figure 1 V <sub>I</sub> = 2*V <sub>CC</sub> for t <sub>PZL</sub> , V <sub>I</sub> = 0 V for t <sub>PZH</sub>	1.65 ~ 1.95			23	7.0	24	nS
			2.3 ~ 2.7			13	3.5	14	nS
			3.0 ~ 3.5			6.9	2.5	7.6	nS
			4.5 ~ 5.5			5.2	1.7	5.7	nS
t <sub>PLZ</sub> t <sub>PHZ</sub>	Output Disable Time, Turn Off Time (A Port to B Port)	Figure 1 V <sub>I</sub> = 2*V <sub>CC</sub> for t <sub>PLZ</sub> , V <sub>I</sub> = 0 V for t <sub>PHZ</sub>	1.65 ~ 1.95			12.5	3.0	13	nS
			2.3 ~ 2.7			7.0	2.0	7.5	nS
			3.0 ~ 3.5			5.0	1.5	5.3	nS
			4.5 ~ 5.5			3.5	0.8	3.8	nS

**ELECTRICAL CHARACTERISTICS (continued)**

Symbol	Parameter	Test Conditions	V <sub>CC</sub>	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°C ~ +85°C		Unit
				Min	Typ	Max	Min	Max	
t <sub>B-M</sub>	Break Before Make Time <sup>(7)</sup>	Figure 2 , C <sub>L</sub> = 50 pF , R <sub>L</sub> = 600 Ω	1.65 ~ 1.95				0.5		nS
			2.3 ~ 2.7				0.5		nS
			3.0 ~ 3.5				0.5		nS
			4.5 ~ 5.5				0.5		nS
Q	Charge Injection <sup>(7)</sup>	Figure 3, C <sub>L</sub> = 0.1 nF , V <sub>GEN</sub> = 0 V , R <sub>GEN</sub> = 0 Ω	5.0		7.0				pC
			3.3		3.0				pC
OIRR	Off Isolation <sup>(9)</sup>	Figure 4, R <sub>L</sub> = 50 Ω, f = 10MHz	1.65 ~ 5.5		-57				dB
Xtalk	Crosstalk	Figure 5, R <sub>L</sub> = 50 Ω , f = 10MHz	1.65 ~ 5.5		-54				dB
BW	-3 dB Bandwidth	Figure 8, R <sub>L</sub> = 50 Ω	1.65 ~ 5.5		350M				Hz
THD	Total Harmonic Distortion <sup>(7)</sup>	R <sub>L</sub> = 600 Ω, 0.5V <sub>P-P</sub> f = 600 Hz ~ 20 kHz	5.0		0.011				%
C <sub>IN</sub>	Select Pin Input Capacitance <sup>(10)</sup>		0		2.3				pF
C <sub>IO-B</sub>	B Port Off Capacitance <sup>(10)</sup>	Figure 6	5.0		5.0				pF
C <sub>IOA-ON</sub>	A Port Capacitance when Switch is Enabled <sup>(10)</sup>	Figure 7	5.0		15.5				pF

Note:

3. Measured by the voltage drop between A and B pins at the indicated current through the switch. On Resistance is determined by the lower of the voltages on the two (A or B Ports).
4. Parameter is characterized but not tested in production.
5.  $\Delta R_{ON} = R_{ON\ max} - R_{ON\ min}$  measured at identical  $V_{CC}$ , temperature and voltage levels.
6. Flatness is defined as the difference between the maximum and minimum value of On Resistance over the specified range of conditions.
7. Guaranteed by Design.
8. This parameter is guaranteed by design but not tested. The bus switch contributes no propagation delay other than the RC delay of the On Resistance of the switch and the 50 pF load capacitance, when driven by an ideal voltage source (zero output impedance).
9. Off Isolation =  $20 \log_{10} [V_A/V_{Bn}]$ .
10.  $T_A = +25^\circ\text{C}$ ,  $f = 1\ \text{MHz}$ , Capacitance is characterized but not tested in production.

**TEST CIRCUITS**

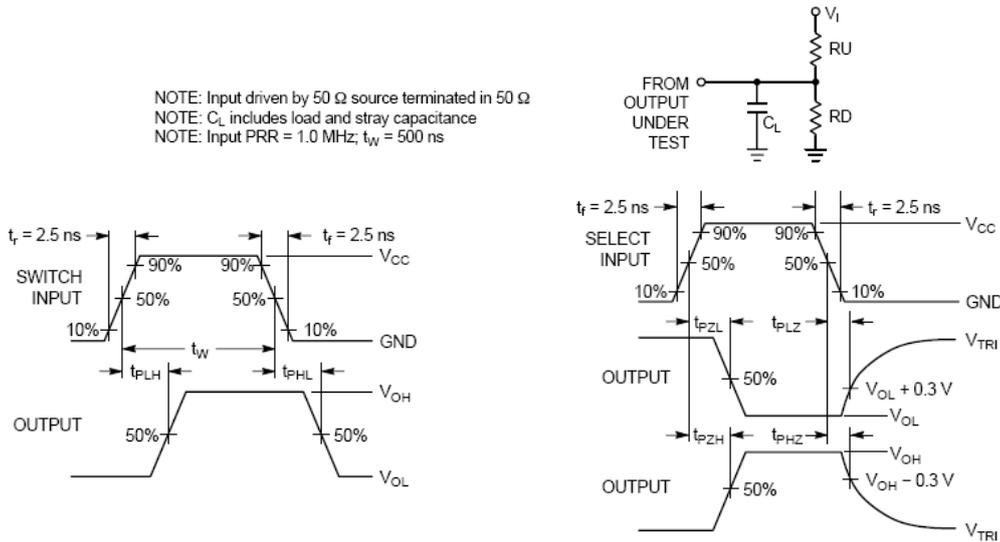


Figure 1. AC Test Circuit ,AC Waveforms



Figure 2. Break Before Make Interval Timing

TEST CIRCUITS (continued)

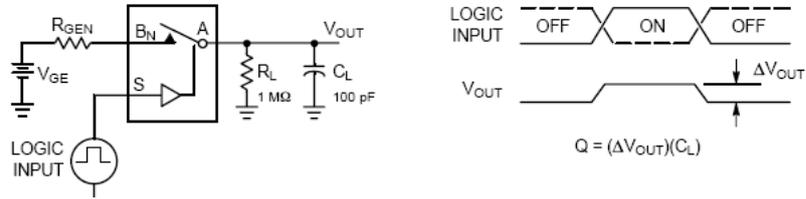


Figure 3. Charge Injection Test

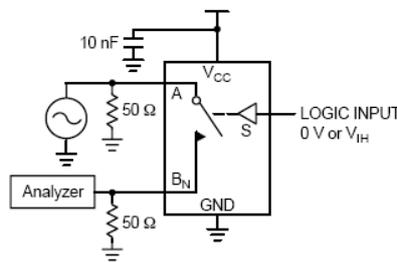


Figure 4. Off Isolation

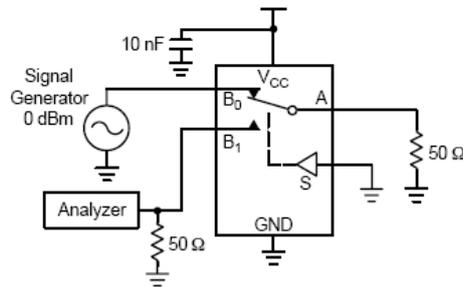


Figure 5. Crosstalk

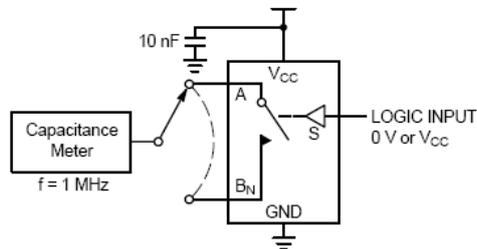


Figure 6. Channel Off Capacitance

TEST CIRCUITS (continued)

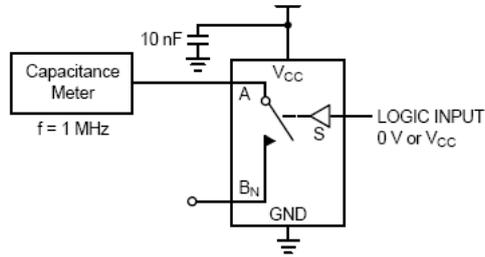


Figure 7. Channel On Capacitance

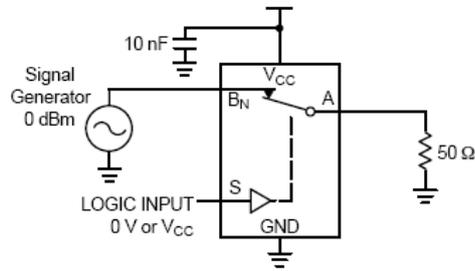
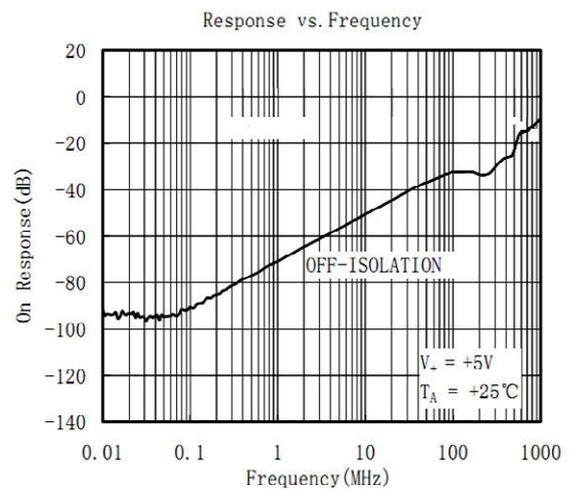
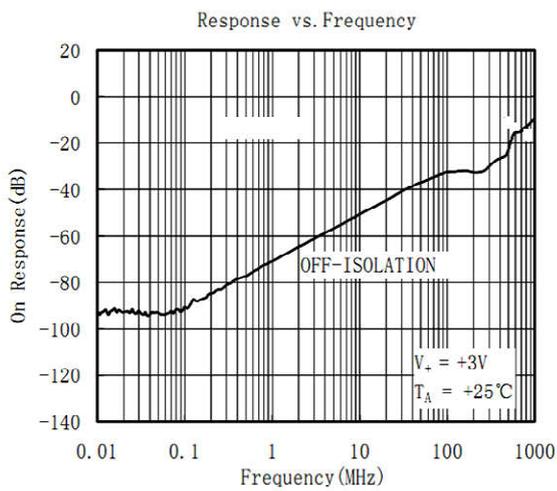
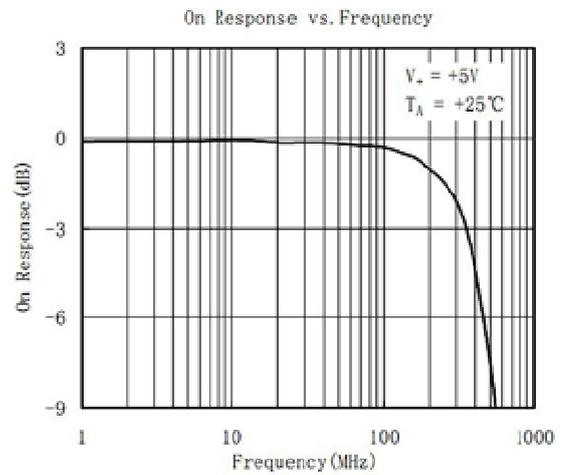
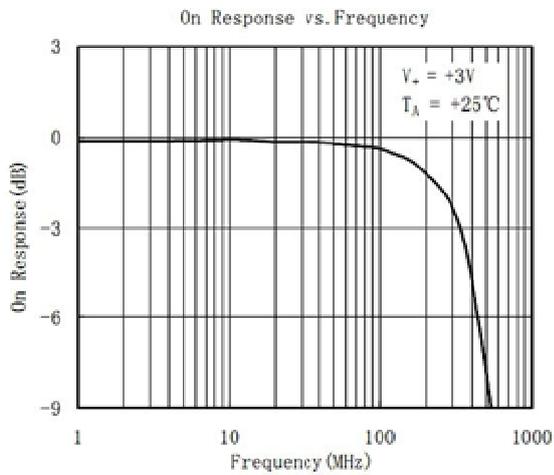


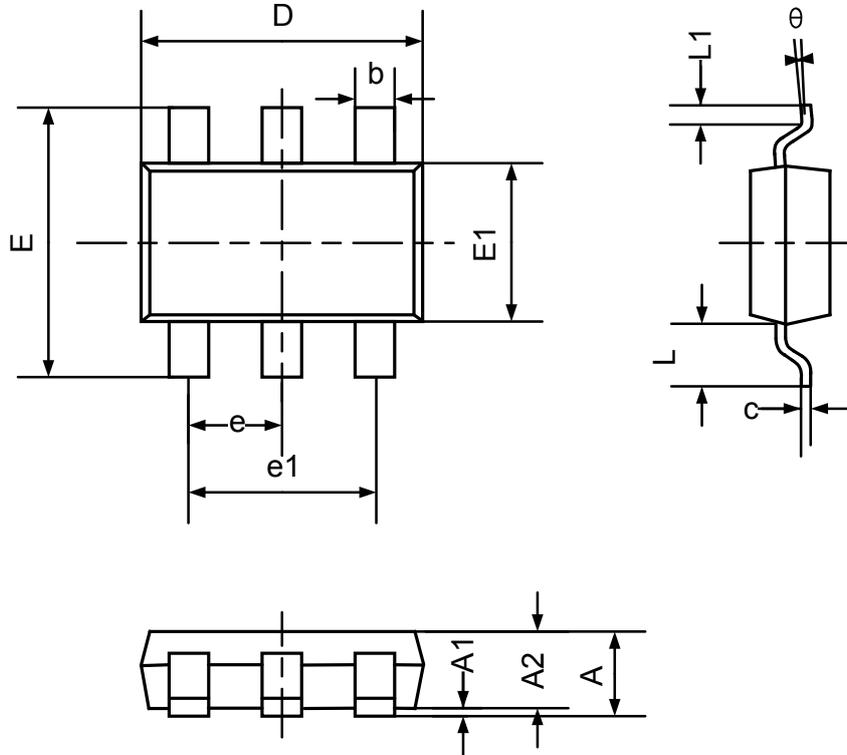
Figure 8. Bandwidth

## TYPICAL PERFORMANCE CHARACTERISTICS



**PACKAGE OUTLINE**

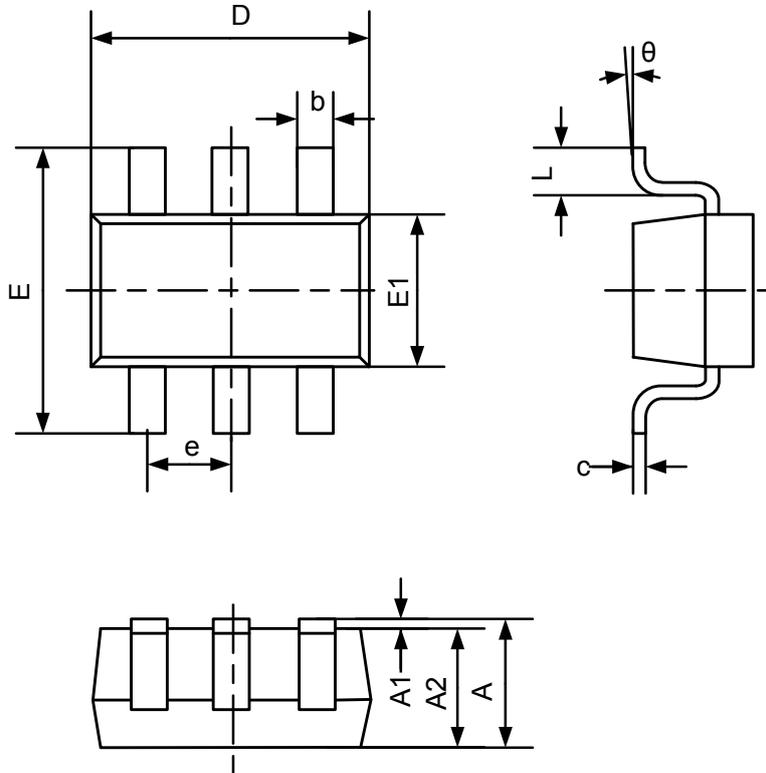
SC70-6



Symbol	Dimensions in Millimeters	
	Min	Max
A	0.85	1.05
A1	0.00	0.10
A2	0.80	1.00
b	0.15	0.35
c	0.08	0.22
D	2.02	2.12
E	2.20	2.40
E1	1.25	1.35
e	0.65BSC	
e1	1.30BSC	
L	0.50REF	
L1	0.28	0.38
$\theta$	0°	8°

**PACKAGE OUTLINE**

SOT23-6



Symbol	Dimensions in Millimeters		
	Min	Nom	Max
A			1.240
A1	0.010	0.050	0.090
A2	1.050	1.100	1.150
b	0.300	0.350	0.400
c	0.117		0.157
D	2.870	2.920	2.970
E	2.720	2.800	2.880
E1	1.550	1.600	1.650
e	0.950BSC		
e1	1.900BSC		
L	0.320	0.400	0.480
$\theta$	0°		5°

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