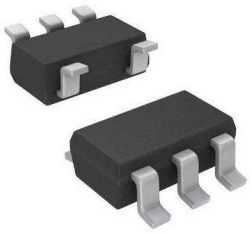
Low Voltage, High Precision Push-pull Comparator

PRODUCT DESCRIPTION

The MS751 is a low noise, low input offset voltage and high precision comparator. The input offset voltage is 200μV typical value at room temperature, and maximum value is 1mV over total temperature range. The MS751 provides CMOS input and push-pull output. Therefore, the MS751 has very low bias current and high input impedance without need for pull-up resistor.

The MS751 is featured by small outline package, low power dissipation and high performance, which are applicable to handheld and battery-powered systems.



SOT23-5

FEATURES

- Input Offset Voltage : 0.2mV, 1mV Maximum
- Input Bias Current : 0.2pA
- Propagation Delay : 120ns
- Low Power Dissipation :300μA
- Common-mode Rejection Ratio (CMRR) : 100dB
- Power Supply Rejection Ratio (PSRR) : 110dB
- Push-pull Output
- Operating Temperature Range : -40°C~ 125°C
- Operating Voltage Range : 2.7V~ 5V
- Small Outline Package : SOT23-5

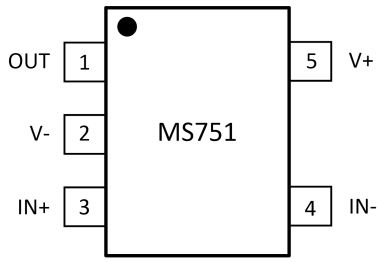
APPLICATIONS

- Handheld And Battery-Powered Systems
- Scanner
- Set Top Box
- High-speed Differential Linear Receiver
- Window Comparator
- Zero Overlapping Monitor
- High-speed Sample Circuit

PRODUCT SPECIFICATION

Part Number	Package	Marking
MS751	SOT23-5	751

PIN CONFIGURATION



PIN DESCRIPTION

Pin	Name	Type	Description
1	OUT	O	Output
2	V-	-	Negative Power Supply
3	IN+	I	Positive Input
4	IN-	I	Negative Input
5	V+	-	Positive Power Supply

ABSOLUTE MAXIMUM RATINGS

Any exceeding absolute maximum rating application causes permanent damage to device. Because long-time absolute operation state affects device reliability. Absolute ratings just conclude from a series of extreme tests. It doesn't represent chip can operate normally in these extreme conditions.

Parameter	Symbol	Range	Unit
Power Supply	V+ to V-	5.5 Maximum	V
ESD Voltage (HBM) [1]		2000	V
ESD Voltage(MM) [1]		200	V
Differential Input Voltage	V_{ID}	Power Supply	V
Operating Temperature	T_A	-40 ~ 125	°C
Storage Temperature	T_{stg}	-65 ~ 150	°C
Junction Temperature		150	°C
Lead Temperature(10s)		260	°C

Note 1: Unless otherwise noted, ESD HBM model is 1.5kΩ resistor is series with 100pF capacitor, while MM model is 200pF capacitor.

ELECTRICAL CHARACTERISTICS

Unless otherwise noted, T_J = 25°C, V_{CM} = V+/2, V+ = 2.7V, V- = 0V.
Boldface indicates the maximum over temperature range [2].

Parameter		Symbol	Condition	Min	Typ	Max	Unit
Input Offset Voltage		V_{OS}			0.2	**1.0**	mV
Input Bias Current		I_B			0.2	50	pA
Input Offset Current		I_{OS}			0.01	5	pA
Common-mode Rejection Ratio		CMRR	0V < V_{CM} < V_{CC}-1.3V	80	100		dB
Common-mode Input		CMVR	V+ = 2.7V to 5V			-0.3 to 1.5	V
Power Supply Rejection Ratio		PSRR	CMRR > 50dB	80	110		dB
Output Voltage	High-level	V_{OH}	I_L = 2mA, V_{ID} = 200mA	V+-0.35	V+-0.1		V
	Low-level	V_{OL}	I_L = -2mA, V_{ID} = -200mA		90	250	mV
Output Short-circuit Current [1]		I_{SC}	V_O = 1.35, V_{ID} = 200mA	6.0	20		mA
			V_O = 1.35, V_{ID} = -200mA	6.0	15		
Power Supply Current		I_S			275	700	µA
Propagation Delay R_L = 5.1kΩ, C_L = 50pF		t_{PD}	Overdrive Voltage = 5mV		270		ns
			Overdrive Voltage = 10mV		205		
			Overdrive Voltage = 50mV		120		
Propagation Delay Skew		t_{SKEW}			5		ns
Rise Time		t_r	10% to 90%		1.7		ns
Fall Time		t_f	90% to 10%		1.8		ns

Unless otherwise noted, T_J= 25°C, V_{CM} = V+/2, V+ = 5V, V- = 0V,
Boldface indicates the maximum over temperature range [2].

Parameter		Symbol	Condition	Min	Typ	Max	Unit
Input Offset Voltage		V_{OS}			0.2	**1.0**	mV
Input Bias Current		I_B			0.2	50	pA
Input Offset Current		I_{OS}			0.01	5	pA
Common-mode Rejection Ratio		CMRR	0V < V_{CM} < V_{CC}-1.3V	80	100		dB
Common-mode Input		CMVR	V+ = 2.7V to 5V			-0.3 to 3.8	V
Power Supply Rejection Ratio		PSRR	CMRR > 50dB	80	110		dB
Output Voltage	High-level	V_{OH}	I_L = 4mA, V_{ID} = 200mA	V+-0.35	V+-0.1		V
	Low-level	V_{OL}	I_L = -4mA, V_{ID} = -200mA		120	250	mV
Output Short-circuit Current [1]		I_{SC}	V_O = 2.5, V_{ID} = 200mA	6.0	60		mA
			V_O = 2.5, V_{ID} = -200mA	6.0	40		
Power Supply Current		I_S			225	700	μA
Propagation Delay R_L = 5.1kΩ, C_L = 50pF		t_{PD}	Overdrive Voltage = 5mV		225		ns
			Overdrive Voltage = 10mV		190		
			Overdrive Voltage = 50mV		120		
Propagation Delay Skew		t_{SKEW}			5		ns
Rise Time		t_r	10% to 90%		1.7		ns
Fall Time		t_f	90% to 10%		1.5		ns

Note:

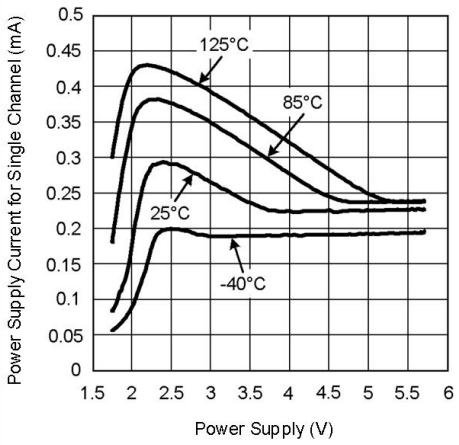
1. Electrical characteristics are only factory test values at specified temperature. The self-heating of device is very small when factory tests, so T_J=T_A. However, the characteristics are not assured when T_J>T_A due of self-heating in application.

2. Maximum temperature range : -40°C ~ 125°C.

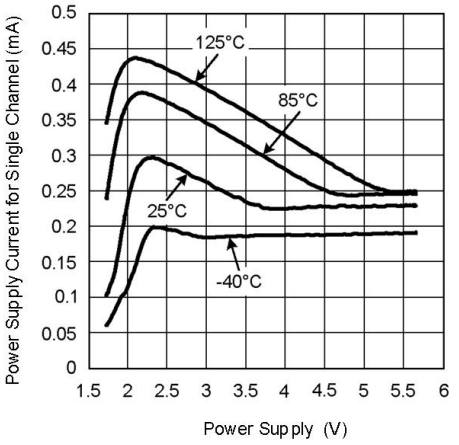
CHARACTERISTICS CURVES

Unless otherwise noted, Vs=Vcc=(V+)-(V-)

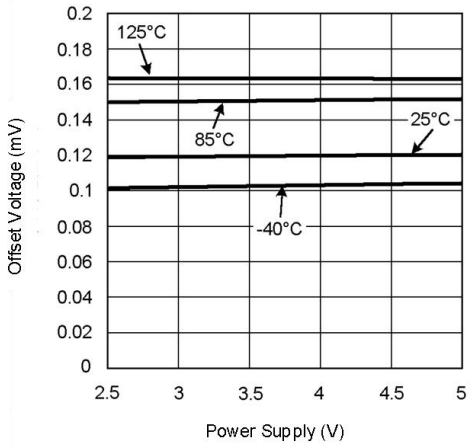
Power Supply Current VS. Power Supply (Vo=High)



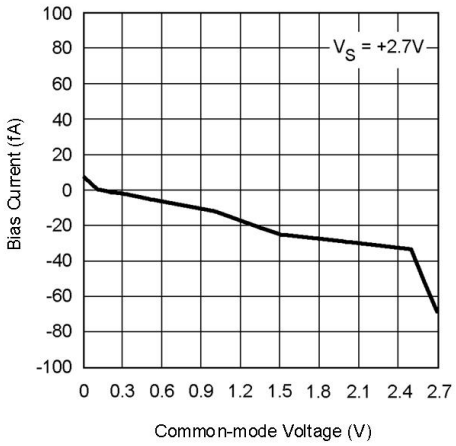
Power Supply Current VS. Power Supply (Vo=Low)



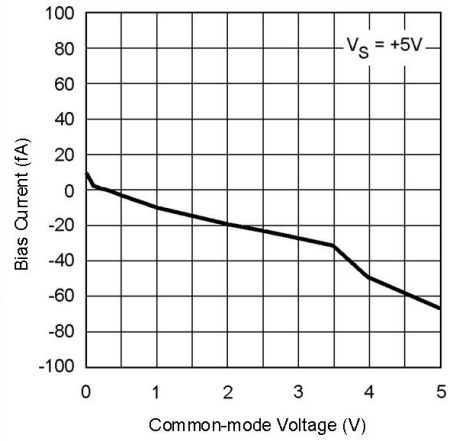
Offset Voltage VS. Power Supply



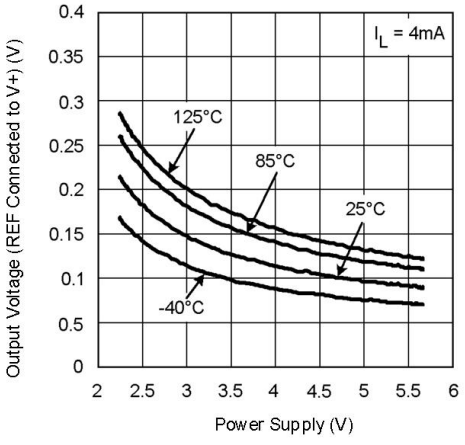
Bias Current VS. Common-mode Voltage @25°C



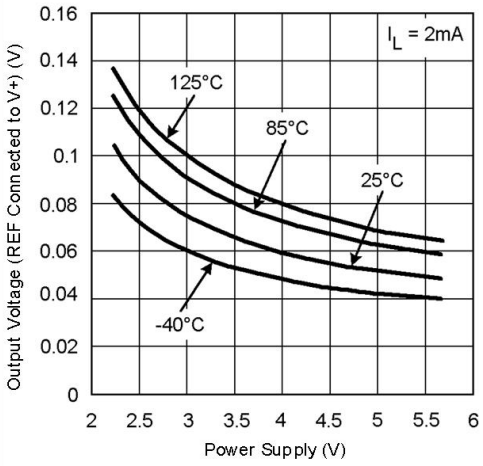
Bias Current VS. Common-mode Voltage @25°C



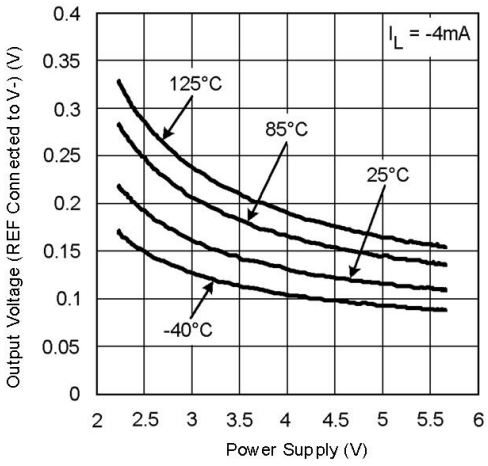
Output Voltage VS. Power Supply



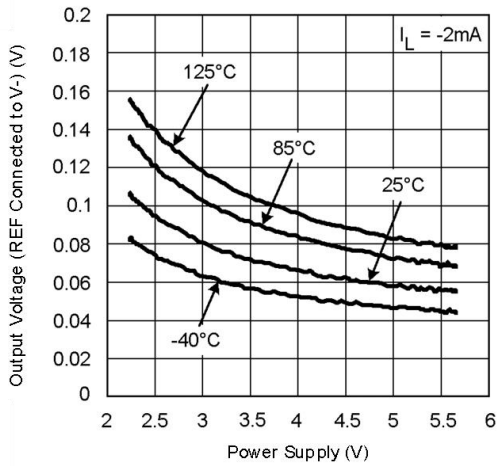
Output Voltage VS. Power Supply



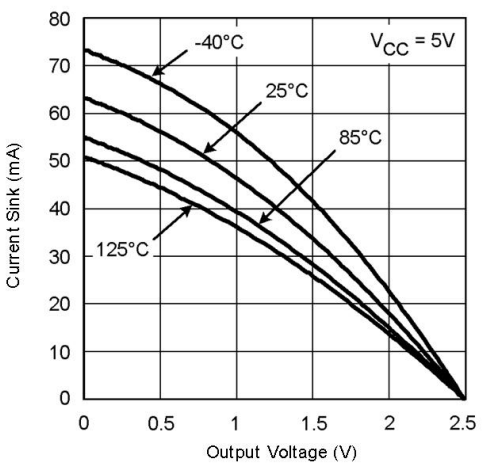
Output Voltage VS. Power Supply



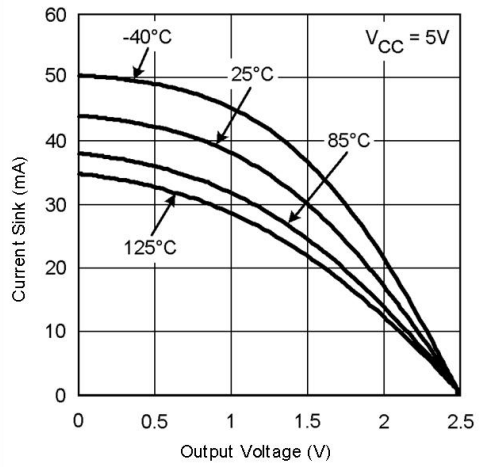
Output Voltage VS. Power Supply



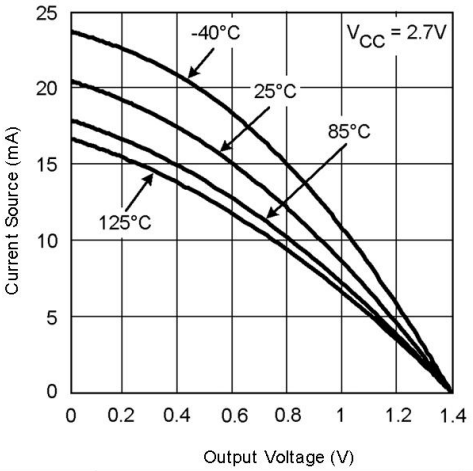
Current Sink VS. Output Voltage



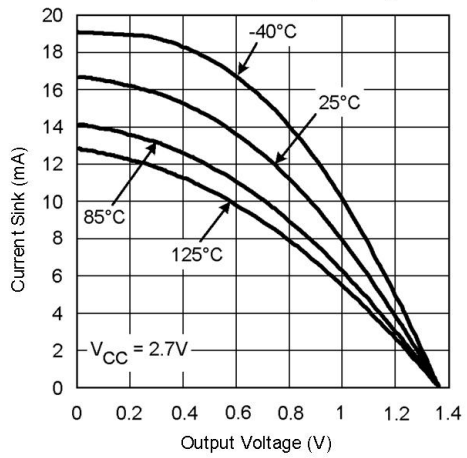
Current Sink VS. Output Voltage



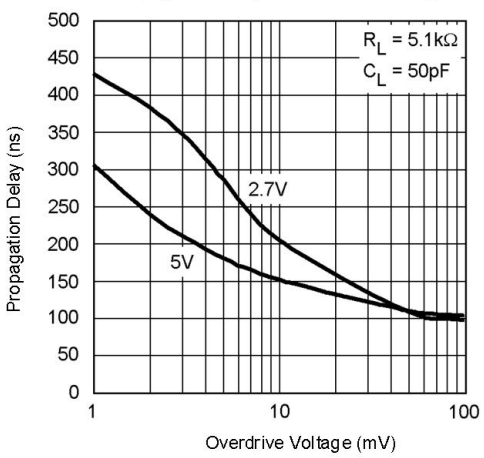
Current Source VS. Output Voltage



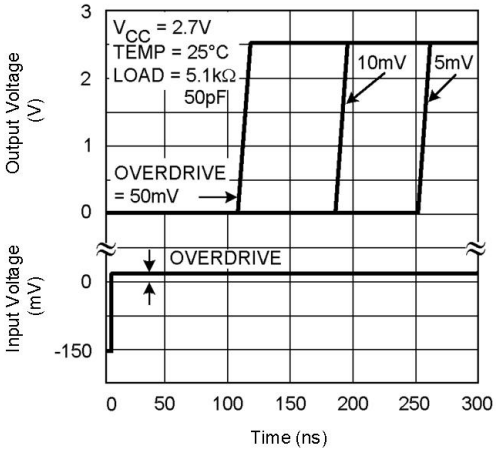
Current Sink VS. Output Voltage



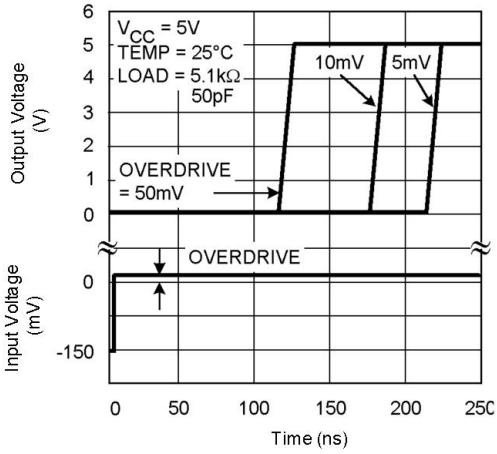
Propagation Delay VS. Overdrive Voltage



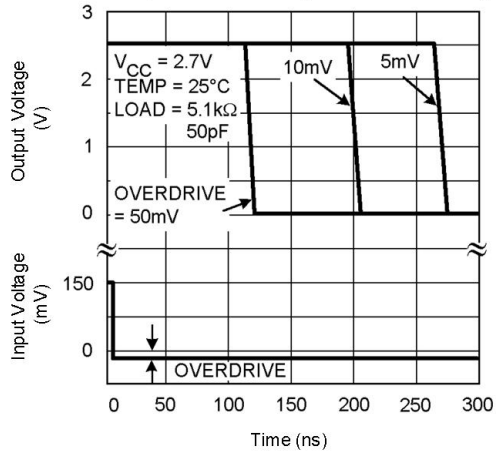
Response Time VS. Positive Overdrive Voltage



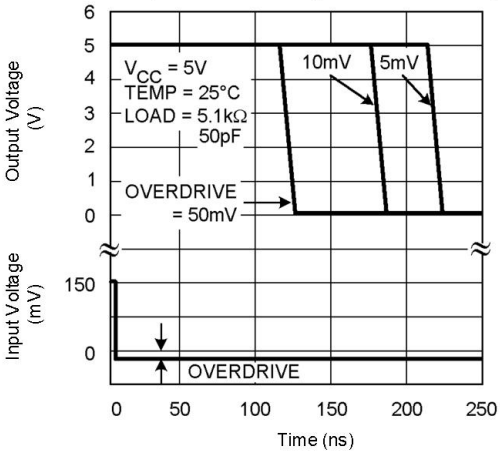
Response Time VS. Positive Overdrive Voltage



Response Time VS. Negative Overdrive Voltage



Response Time VS. Negative Overdrive Voltage



APPLICATIONS

Simple Comparator

A simple comparator circuit is used to convert input analog signal to digital output signal. The comparator compares non-inverting input voltage (VIN) with reference voltage on inverting terminal (VREF). If VIN < VREF, output is low; If VIN > VREF, output is high.

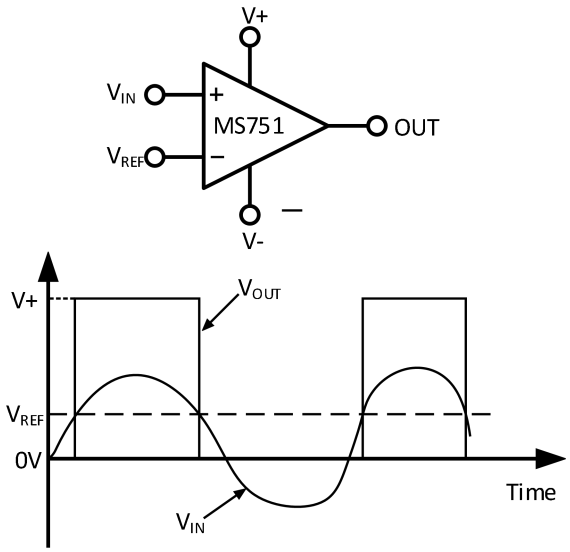


Figure 1. Simple Comparator

Hysteresis

If differential input of simple comparator approaches to the offset voltage, swing or noise swing will occur on the comparator output. The phenomenon occur easily when one input voltage is equal to or close to another input voltage. Hysteresis could solve the problem by generating two comparing threshold values (one for rising process, the other for falling process). The hysteresis value is the difference between two thresholds. When two inputs are very near, hysteresis could make one voltage exceed the other one quickly. Thus input voltage is moved out of the region of output swing.

Hysteresis could be achieved by two resistors connected to non-inverting terminal, making up positive feedback. When VIN rises to VIN1, output becomes from low to high. VIN1 is calculated by following formula:

$$V_{IN1} = V_{REF} \cdot \frac{R_1 + R_2}{R_2}$$

When VIN falls to VIN2, output becomes from high to low. VIN2 is calculated by following formula:

$$V_{IN2} = V_{REF} \cdot \frac{R_1 + R_2}{R_2} - V_{CC} \cdot \frac{R_1}{R_2}$$

Hysteresis value is the difference between VIN1 and VIN2:

$$\Delta VIN = V_{IN1} - V_{IN2} = V_{CC} \cdot \frac{R_1}{R_2}$$

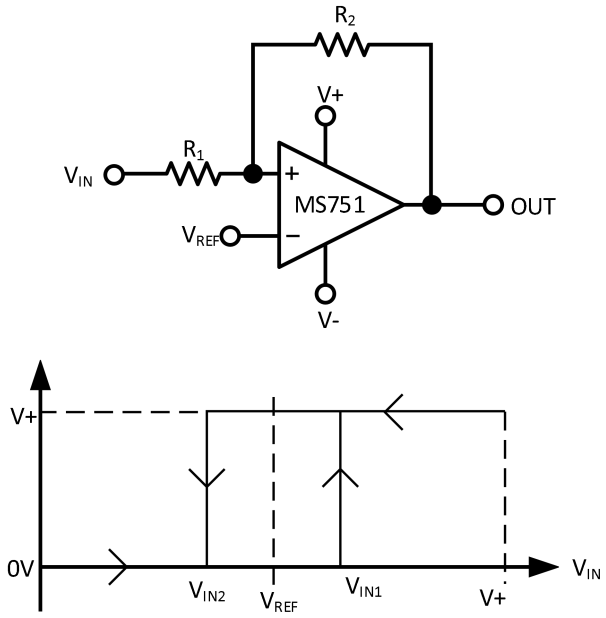


Figure 2. Non-inverting Hysteresis Comparator Circuit

Input

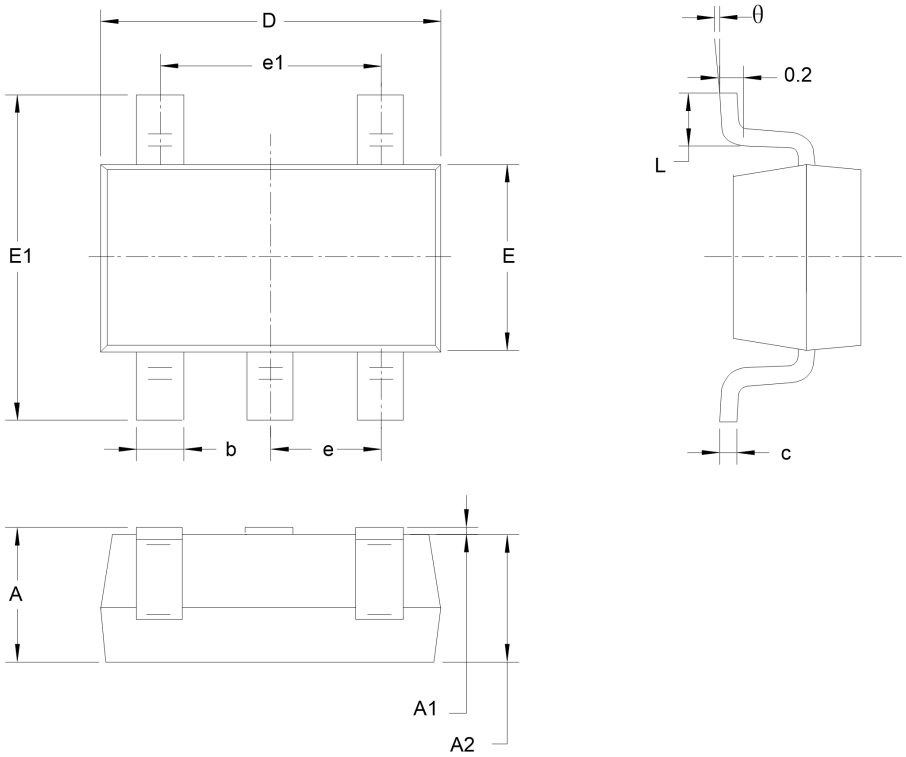
The input bias current approaches to zero, which allows using high impedance circuit with no need for considering impedance match. And small capacitance R–C timing circuit could be used, reducing the use of capacitor and board space.

Board Layout and Bypass

Even though the MS751 is stable and has certain anti-interference ability, it is important to apply appropriate bypass capacitor and ground trace. Applying 0.1μF ceramic capacitor could provide clean power supply. The shortest signal trace can reduce stray capacitance.

PACKAGE OUTLINE DIMENSIONS

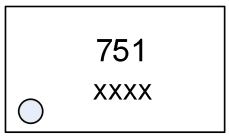
SOT23-5



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0º	8 º	0 º	8 º

MARKING and PACKAGING SPECIFICATIONS

1. Marking Drawing Description



Product Name : 751

Product Code : XXXX

2. Marking Drawing Demand

Laser printing, contents in the middle, font type Arial.

3. Packaging Specifications

Device	Package	Piece/Reel	Reel/Box	Piece /Box	Box/Carton	Piece/Carton
MS751	SOT23-5	3000	10	30000	4	120000

STATEMENT

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- The process of improving product is endless. And our company would sincerely provide more excellent product for customer.

MOS CIRCUIT OPERATION PRECAUTIONS

Static electricity can be generated in many places. The following precautions can be taken to effectively prevent the damage of MOS circuit caused by electrostatic discharge:

1. The operator shall ground through the anti-static wristband.
2. The equipment shell must be grounded.
3. The tools used in the assembly process must be grounded.
4. Must use conductor packaging or anti-static materials packaging or transportation.

 +86-571-89966911

 Rm701, No.9 Building, No. 1 WeiYe Road, Puyan Street, Binjiang District, Hangzhou, Zhejiang

 http:// www.relmon.com