



YOUSHANG SEMICONDUCTOR

**设计研发新型功率器件**

**各类小信号开关**

**中低压及高压大电流等场效应管**

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## Description

This bipolar junction transistor (BJT) is designed to meet the stringent requirements of automotive applications.

## Features

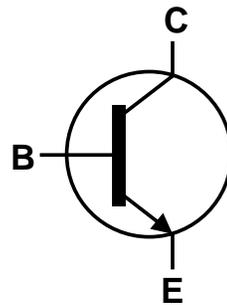
- Complementary PNP Type Available (DIODES™ NK-MMBT3906Q)
- Ideal for Medium Power Amplification and Switching

## Mechanical Data

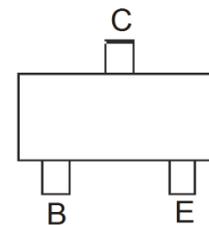
- Package: SOT23
- Package Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads. Solderable per MIL-STD-202, Method 208 ③
- Weight: 0.008 grams (Approximate)



Top View



Device Symbol



Top View  
Pin-Out

### Absolute Maximum Ratings (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	$V_{CBO}$	60	V
Collector-Emitter Voltage	$V_{CEO}$	40	V
Emitter-Base Voltage	$V_{EBO}$	6	V
Collector Current	$I_C$	200	mA

### Thermal Characteristics (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

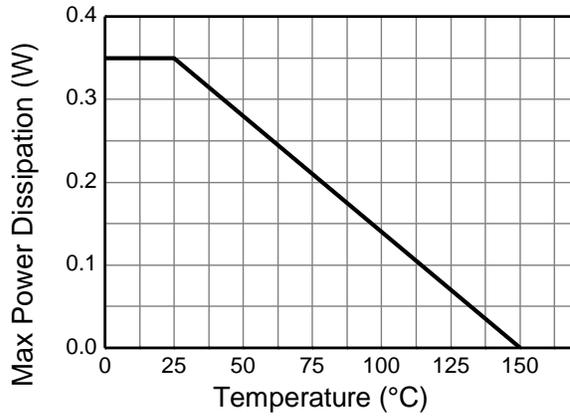
Characteristic	Symbol	Value	Unit
Power Dissipation	$P_D$	(Note 5)	310
		(Note 6)	350
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	(Note 5)	403
		(Note 6)	357
Thermal Resistance, Junction to Leads	$R_{\theta JL}$	350	$^\circ\text{C/W}$
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

### ESD Ratings (Note 8)

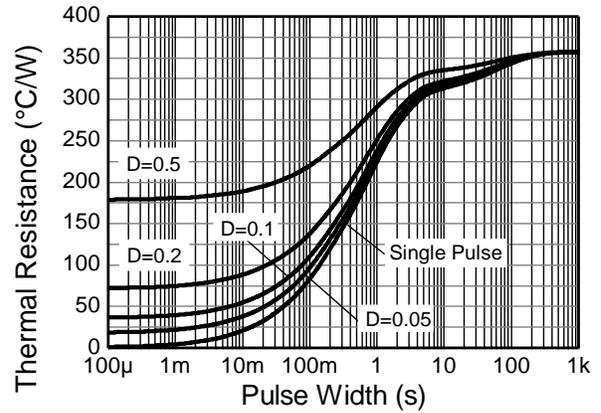
Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge - Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge - Machine Model	ESD MM	400	V	C

- Notes:
5. For a device mounted on minimum recommended pad layout 1oz copper that is on a single-sided FR4 PCB; device is measured under still air conditions whilst operating in a steady-state.
  6. Same as Note 5, except the device is mounted on 15 mm x 15mm 1oz copper.
  7. Thermal resistance from junction to solder-point (at the end of the leads).
  8. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

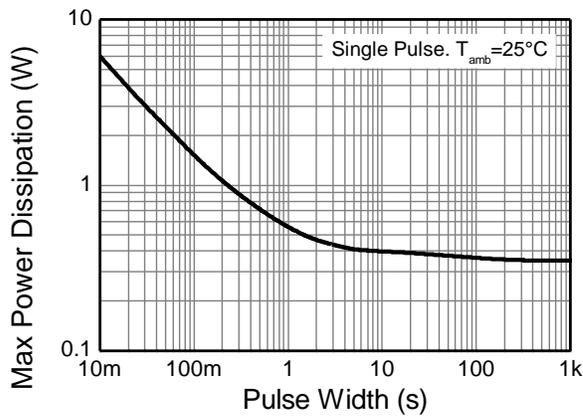
## Thermal Characteristics and Derating Information



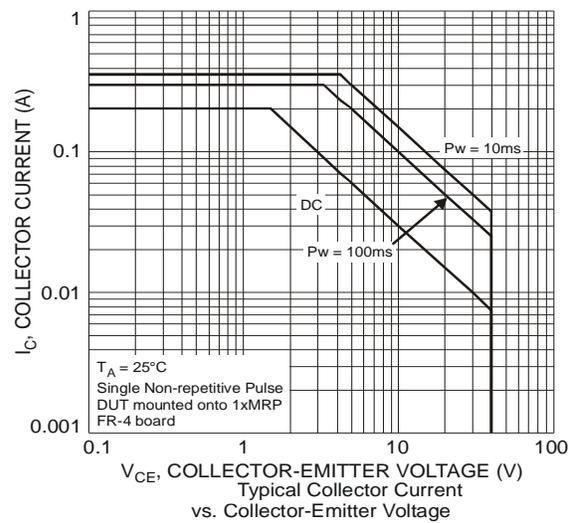
**Derating Curve**



**Transient Thermal Impedance**



**Pulse Power Dissipation**



**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Max	Unit	Test Condition	
<b>OFF CHARACTERISTICS</b>						
Collector-Base Breakdown Voltage	BV <sub>CBO</sub>	60	—	V	I <sub>C</sub> = 10μA, I <sub>E</sub> = 0	
Collector-Emitter Breakdown Voltage (Note 9)	BV <sub>CEO</sub>	40	—	V	I <sub>C</sub> = 10mA, I <sub>B</sub> = 0	
Emitter-Base Breakdown Voltage	BV <sub>EBO</sub>	6.0	—	V	I <sub>E</sub> = 10μA, I <sub>C</sub> = 0	
Collector Cut-Off Current	I <sub>CEX</sub>	—	50	nA	V <sub>CE</sub> = 30V, V <sub>EB(off)</sub> = 3.0V	
Base Cut-Off Current	I <sub>BL</sub>	—	50	nA	V <sub>CE</sub> = 30V, V <sub>EB(off)</sub> = 3.0V	
Emitter Base Cut-Off Current	I <sub>EBO</sub>	—	50	nA	V <sub>EB</sub> = 6V	
Collector-Base Cut-Off Current	I <sub>CBO</sub>	—	50	nA	V <sub>CB</sub> = 48V	
<b>ON CHARACTERISTICS (Note 9)</b>						
DC Current Gain	h <sub>FE</sub>	40	—	—	I <sub>C</sub> = 100μA, V <sub>CE</sub> = 1.0V	
		70	—			
		100	300			I <sub>C</sub> = 1.0mA, V <sub>CE</sub> = 1.0V
		60	—			I <sub>C</sub> = 10mA, V <sub>CE</sub> = 1.0V
		30	—			I <sub>C</sub> = 50mA, V <sub>CE</sub> = 1.0V
Collector-Emitter Saturation Voltage	V <sub>CE(sat)</sub>	—	0.20 0.30	V	I <sub>C</sub> = 10mA, I <sub>B</sub> = 1.0mA I <sub>C</sub> = 50mA, I <sub>B</sub> = 5.0mA	
Base-Emitter Saturation Voltage	V <sub>BE(sat)</sub>	0.65	0.85 0.95	V	I <sub>C</sub> = 10mA, I <sub>B</sub> = 1.0mA I <sub>C</sub> = 50mA, I <sub>B</sub> = 5.0mA	
<b>SMALL SIGNAL CHARACTERISTICS</b>						
Output Capacitance	C <sub>OBO</sub>	—	4.0	pF	V <sub>CB</sub> = 5.0V, f = 1.0MHz, I <sub>E</sub> = 0	
Input Capacitance	C <sub>IBO</sub>	—	8.0	pF	V <sub>EB</sub> = 0.5V, f = 1.0MHz, I <sub>C</sub> = 0	
Input Impedance	h <sub>iE</sub>	1.0	10	kΩ	V <sub>CE</sub> = 10V, I <sub>C</sub> = 1.0mA, f = 1.0kHz	
Voltage Feedback Ratio	h <sub>RE</sub>	0.5	8.0	x 10 <sup>-4</sup>		
Small Signal Current Gain	h <sub>FE</sub>	100	400	—		
Output Admittance	h <sub>oE</sub>	1.0	40	μS		
Current Gain-Bandwidth Product	f <sub>T</sub>	300	—	MHz		
Noise Figure	NF	—	5.0	dB	V <sub>CE</sub> = 5.0V, I <sub>C</sub> = 100μA, R <sub>S</sub> = 1.0kΩ, f = 1.0kHz	
<b>SWITCHING CHARACTERISTICS</b>						
Delay Time	t <sub>d</sub>	—	35	ns	V <sub>CC</sub> = 3.0V, I <sub>C</sub> = 10mA, V <sub>BE(OFF)</sub> = -0.5V, I <sub>B1</sub> = 1.0mA	
Rise Time	t <sub>r</sub>	—	35	ns		
Storage Time	t <sub>s</sub>	—	200	ns	V <sub>CC</sub> = 3.0V, I <sub>C</sub> = 10mA, I <sub>B1</sub> = I <sub>B2</sub> = 1.0mA	
Fall Time	t <sub>f</sub>	—	50	ns		

Note: 9. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.

**Typical Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

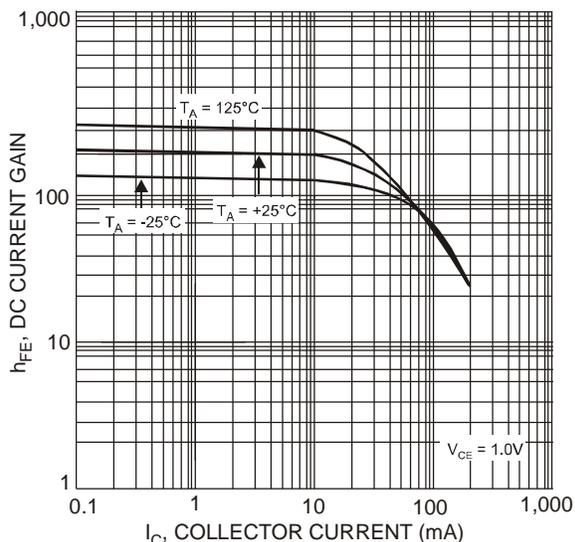


Fig. 1 Typical DC Current Gain vs. Collector Current

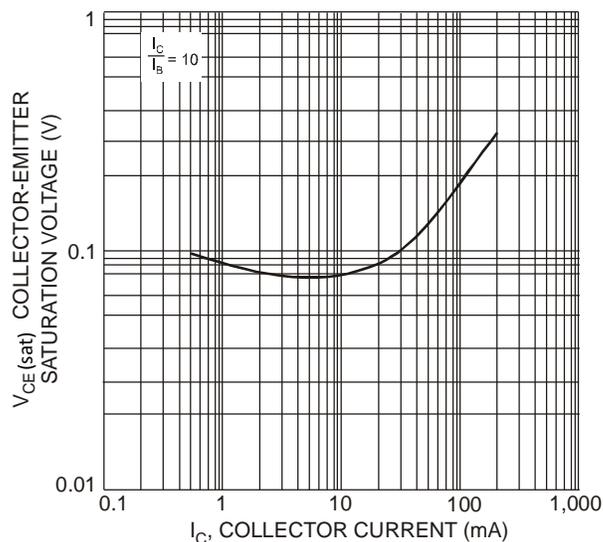


Fig. 2 Typical Collector-Emitter Saturation Voltage vs. Collector Current

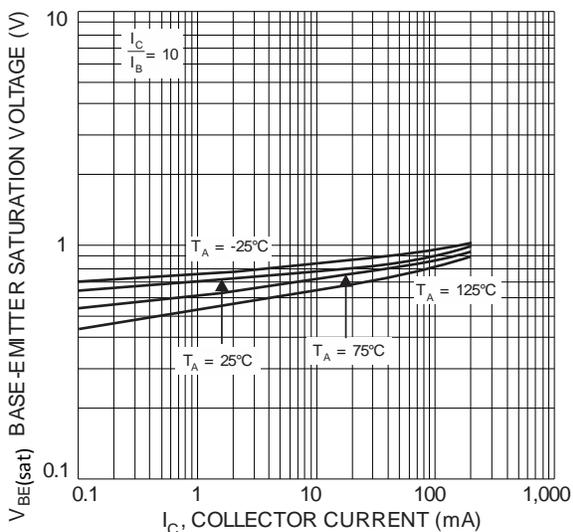


Fig. 3 Typical Base-Emitter Saturation Voltage vs. Collector Current

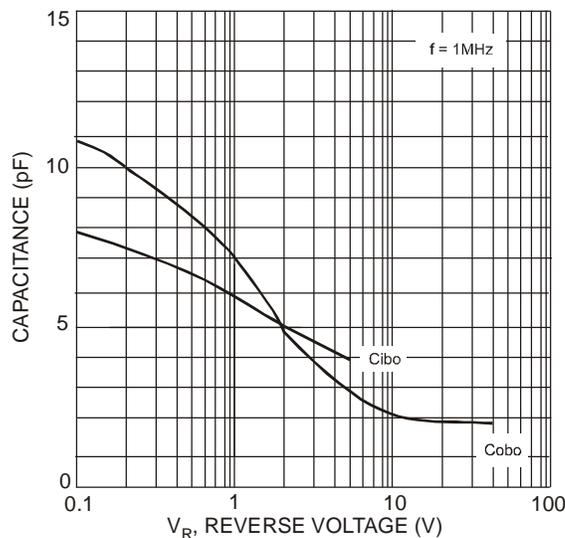
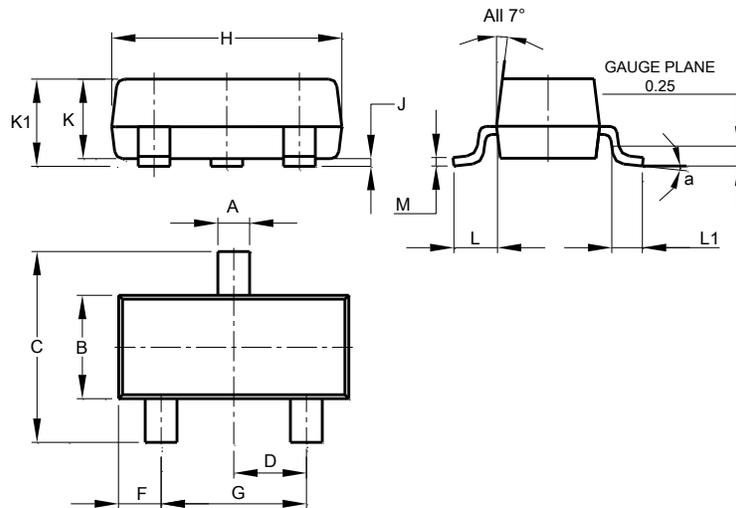


Fig. 4 Typical Capacitance Characteristics

## Package Outline Dimensions

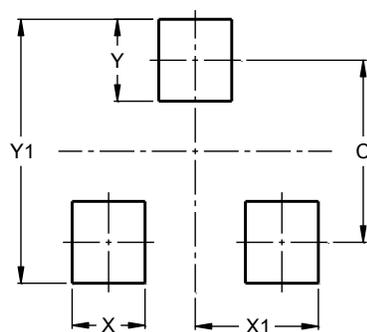
SOT23



SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	0°	8°	--
All Dimensions in mm			

## Suggested Pad Layout

SOT23



Dimensions	Value (in mm)
C	2.0
X	0.8
X1	1.35
Y	0.9
Y1	2.9