



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

- $BV_{CEX} > 150V$
- $BV_{CEO} > 60V$
- $BV_{ECO} > 6V$
- $I_C = 5A$  Continuous Collector Current
- $V_{CE(sat)} < 70mV @ 1A$
- $R_{CE(sat)} = 48m\Omega$  for a Low Equivalent On-Resistance
- Very Low Saturation Voltages
- Excellent hFE Characteristics
- 6V Reverse Blocking Capability

## Mechanical Data

- Package: SOT89
- Package Material: Molded Plastic. "Green" Molding Compound. UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 
- Weight: 0.055 grams (Approximate)

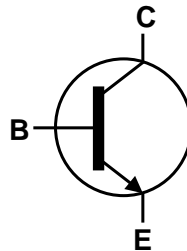
## Applications

- Motor driving (including DC fans)
- Solenoid, relays and actuator drivers
- DC-DC modules
- Power switches
- MOSFET gate drivers

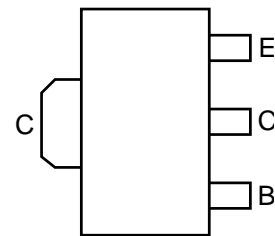


SOT89

Top View



Equivalent Circuit



Top View  
Pin-Out

### Absolute Maximum Ratings (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V <sub>CB0</sub>	150	V
Collector-Emitter Voltage (Forward Blocking)	V <sub>CEX</sub>	150	V
Collector-Emitter Voltage	V <sub>CEO</sub>	60	V
Emitter-Collector Voltage (Reverse Blocking)	V <sub>ECO</sub>	6	V
Emitter-Base Voltage	V <sub>EBO</sub>	7	V
Continuous Collector Current	I <sub>C</sub>	5	A
Base Current	I <sub>B</sub>	1	A
Peak Pulse Current	I <sub>CM</sub>	10	A

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

Characteristic	Symbol	Value	Unit
Power Dissipation	P <sub>D</sub>	(Note 5)	1.1
		(Note 6)	1.8
		(Note 7)	2.4
		(Note 8)	4.46
Thermal Resistance, Junction to Ambient Air	R <sub>θJA</sub>	(Note 5)	117
		(Note 6)	68
		(Note 7)	51
		(Note 8)	28
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	11.5	°C/W
Thermal Resistance, Junction to Lead	R <sub>θJL</sub>	8	
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

### ESD Ratings (Note 11)

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:
- For a device mounted with the exposed collector pad on 15mm x 15mm 1oz copper that is on a single-sided 1.6mm FR4 PCB; device is measured under still air conditions whilst operating in a steady-state.
  - Same as Note 4, except the device is mounted on 25mm x 25mm 2oz copper.
  - Same as Note 4, except the device is mounted on 50mm x 50mm 2oz copper.
  - Same as Note 6 measured at t < 5 seconds.
  - Device mounted on FR-4 PCB with minimum recommended pad layout.
  - Thermal resistance from junction to solder-point (on the exposed collector pad).
  - Refer to JEDEC specification JESD22-A114 and JESD22-A115.

## Thermal Characteristics and Derating Information

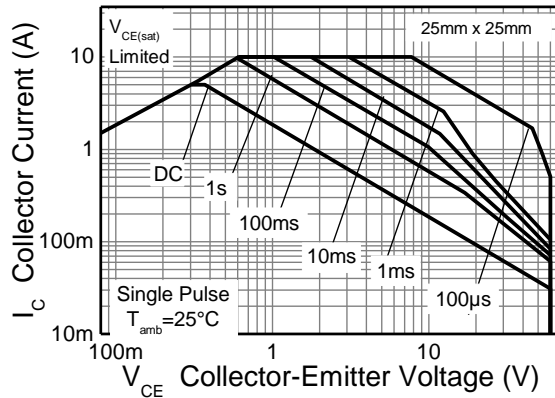


Figure 1. Safe Operating Area

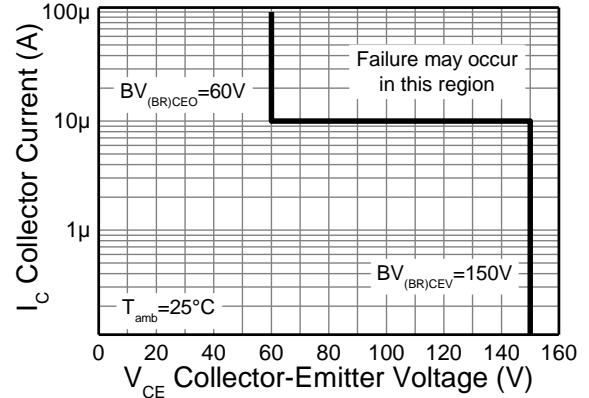


Figure 2. Safe Operating Area

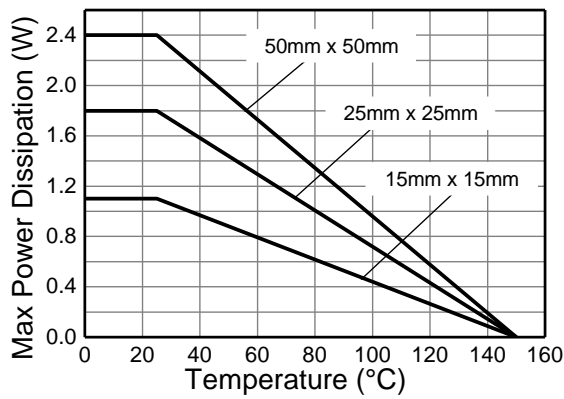
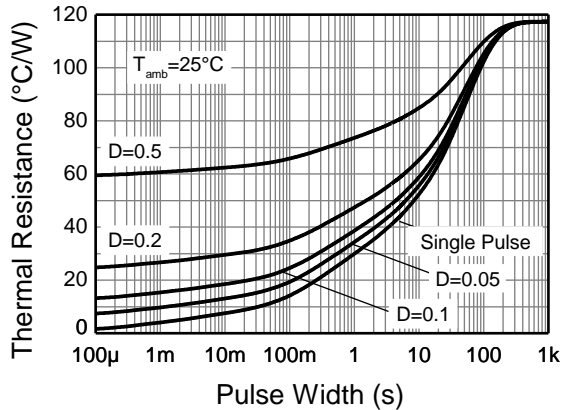
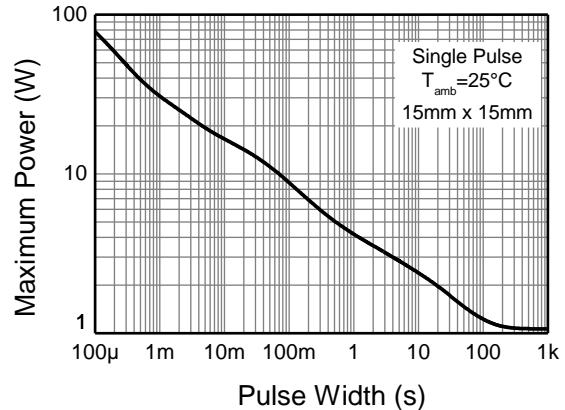


Figure 3. Derating Curve

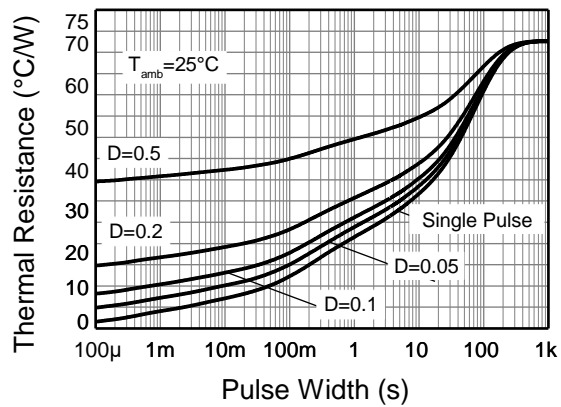
**Thermal Characteristics and Derating Information** (continued)



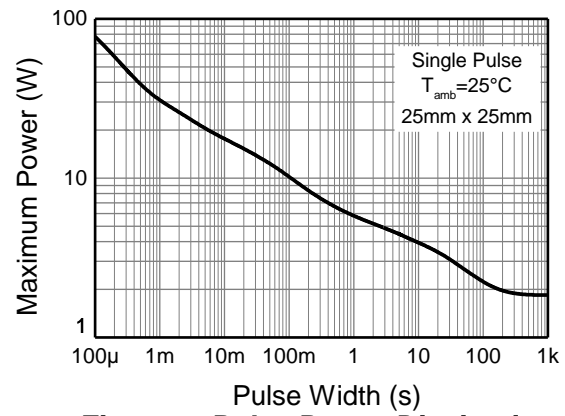
**Figure 4. Transient Thermal Impedance**



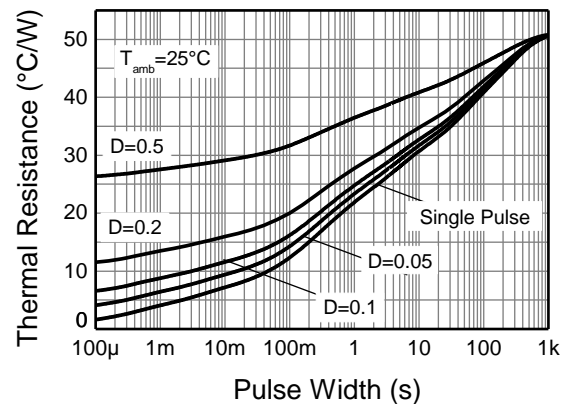
**Figure 5. Pulse Power Dissipation**



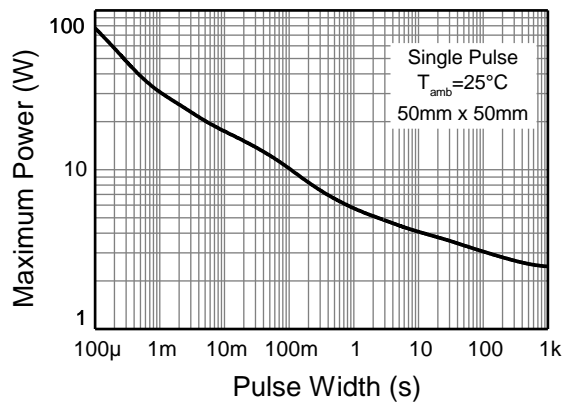
**Figure 6. Transient Thermal Impedance**



**Figure 7. Pulse Power Dissipation**



**Figure 8. Transient Thermal Impedance**



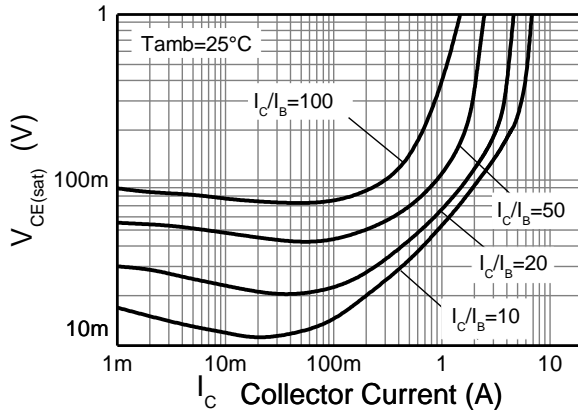
**Figure 9. Pulse Power Dissipation**

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

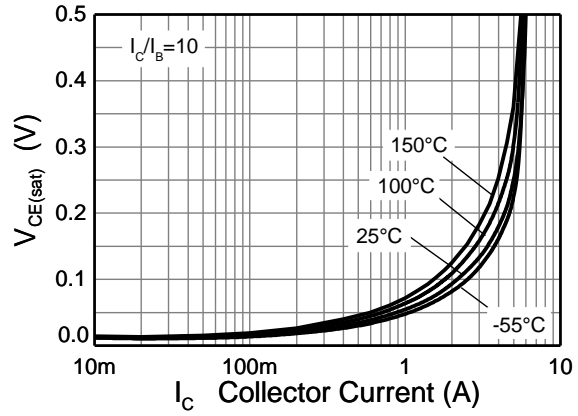
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Collector-Base Breakdown Voltage	$BV_{CB0}$	150	190	—	V	$I_C = 100\mu\text{A}$
Collector-Emitter Breakdown Voltage (Forward Blocking)	$BV_{CEX}$	150	190	—	V	$I_C = 100\mu\text{A}$ , $R_{BE} \leq 1\text{k}\Omega$ or $-1\text{V} < V_{BE} < 0.25\text{V}$
Collector-Emitter Breakdown Voltage (Note 12)	$BV_{CEO}$	60	80	—	V	$I_C = 10\text{mA}$
Emitter-Base Breakdown Voltage	$BV_{EBO}$	7	8.0	—	V	$I_E = 100\mu\text{A}$
Emitter-Collector Breakdown Voltage (Reverse Blocking)	$BV_{ECX}$	6	8	—	V	$I_E = 100\mu\text{A}$ , $R_{BC} \leq 1\text{k}\Omega$ or $-0.25\text{V} < V_{BC} < 0.25\text{V}$
Emitter-Collector Breakdown Voltage (Base Open)	$BV_{ECO}$	6	7	—	V	$I_E = 100\mu\text{A}$
Collector-Base Cutoff Current	$I_{CBO}$	—	1	50 20	nA $\mu\text{A}$	$V_{CB} = 120\text{V}$ $V_{CB} = 120\text{V}$ , $T_A = +100^\circ\text{C}$
Collector-Emitter Cutoff Current	$I_{CEX}$	—	—	100	nA	$V_{CE} = 120\text{V}$ , $R_{BE} \leq 1\text{k}\Omega$ or $-1\text{V} < V_{BE} < 0.25\text{V}$
Emitter-Base Cutoff Current	$I_{EBO}$	—	1	50	nA	$V_{EB} = 5.6\text{V}$
Collector-Emitter Saturation Voltage (Note 12)	$V_{CE(sat)}$	—	55 70 185 240	70 90 230 305	mV	$I_C = 1\text{A}$ , $I_B = 100\text{mA}$ $I_C = 1\text{A}$ , $I_B = 50\text{mA}$ $I_C = 4\text{A}$ , $I_B = 400\text{mA}$ $I_C = 5\text{A}$ , $I_B = 500\text{mA}$
Base-Emitter Saturation Voltage (Note 12)	$V_{BE(sat)}$	—	1.2	1.1	V	$I_C = 5\text{A}$ , $I_B = 500\text{mA}$
Base-Emitter Turn-On Voltage (Note 12)	$V_{BE(on)}$	—	0.96	1.05	V	$I_C = 5\text{A}$ , $V_{CE} = 2\text{V}$
DC Current Gain (Note 12)	$h_{FE}$	100 90 45 —	200 180 90 20	300 — — —	—	$I_C = 10\text{mA}$ , $V_{CE} = 2\text{V}$ $I_C = 1\text{A}$ , $V_{CE} = 2\text{V}$ $I_C = 2\text{A}$ , $V_{CE} = 50\text{V}$ $I_C = 5\text{A}$ , $V_{CE} = 5\text{V}$
Transitional Frequency	$f_T$	—	185	—	MHz	$I_C = 100\text{mA}$ , $V_{CE} = 5\text{V}$ $f = 100\text{MHz}$
Output Capacitance	$C_{obo}$	—	11.5	20	pF	$V_{CB} = 10\text{V}$ , $f = 1\text{MHz}$
Delay Time	$t_d$	—	16	—	ns	$V_{CC} = 10\text{V}$ , $I_{CC} = 500\text{mA}$ $I_{B1} = -I_{B2} = 50\text{mA}$
Rise Time	$t_r$	—	15	—	ns	
Storage Time	$t_s$	—	509	—	ns	
Fall Time	$t_f$	—	57	—	ns	

 Note: 12. Measured under pulsed conditions. Pulse width  $\leq 300\mu\text{s}$ . Duty cycle  $\leq 2\%$ .

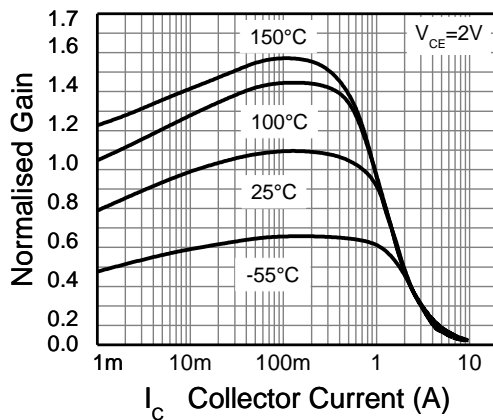
**Typical Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)



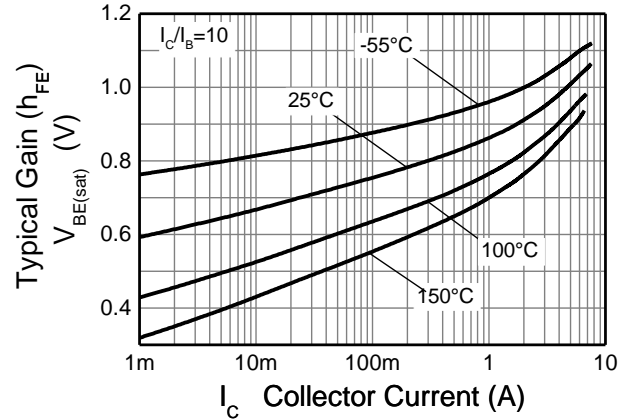
**Figure 10.  $V_{CE(sat)} \ v \ I_C$**



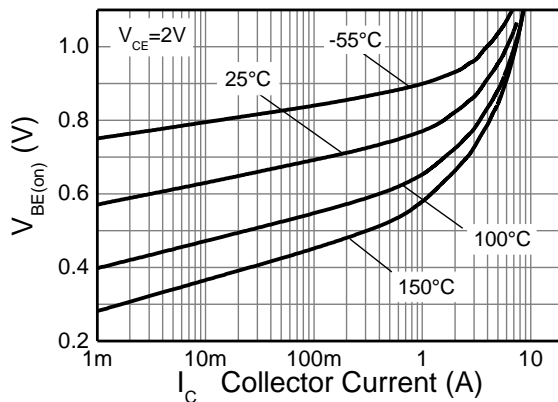
**Figure 11.  $V_{CE(sat)} \ v \ I_C$**



**Figure 12.  $h_{FE} \ v \ I_C$**



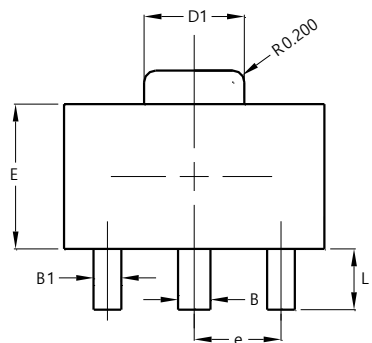
**Figure 13.  $V_{BE(sat)} \ v \ I_C$**



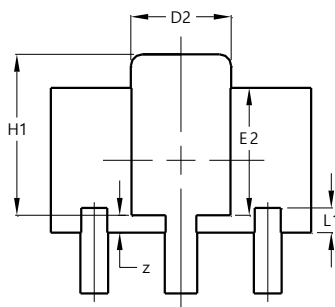
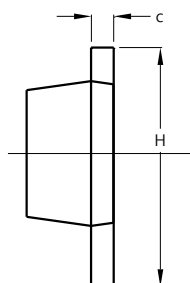
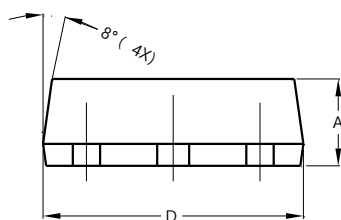
**Figure 14.  $V_{BE(on)} \ v \ I_C$**

### Package Outline Dimensions

SOT89



TOP VIEW

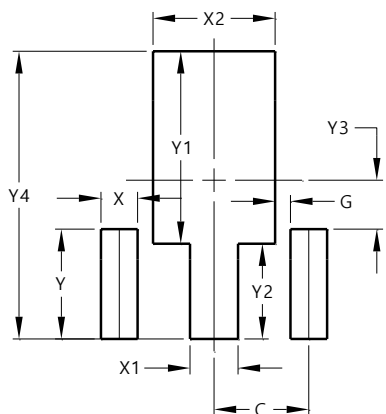


BOTTOM VIEW

SOT89			
Dim	Min	Max	Typ
A	1.40	1.60	1.50
B	0.50	0.62	0.56
B1	0.42	0.54	0.48
c	0.35	0.43	0.38
D	4.40	4.60	4.50
D1	1.62	1.83	1.733
D2	1.61	1.81	1.71
E	2.40	2.60	2.50
E2	2.05	2.35	2.20
e	-	-	1.50
H	3.95	4.25	4.10
H1	2.63	2.93	2.78
L	0.90	1.20	1.05
L1	0.327	0.527	0.427
z	0.20	0.40	0.30
All Dimensions in mm			

### Suggested Pad Layout

SOT89



Dimensions	Value (in mm)
C	1.500
G	0.244
X	0.580
X1	0.760
X2	1.933
Y	1.730
Y1	3.030
Y2	1.500
Y3	0.770
Y4	4.530