优尚

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 requirements.

## Features

- $BV_{CEO}$ > -120V
- $BV_{CBO}$ > -140V
- $I_C$ = -2A High Continuous Current
- $h_{FE}$ > 2k for High Gain @ -2A

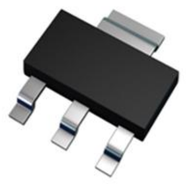
## Mechanical Data

- Case: SOT223
- Case 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 e3
- Weight: 0.112 grams (Approximate)

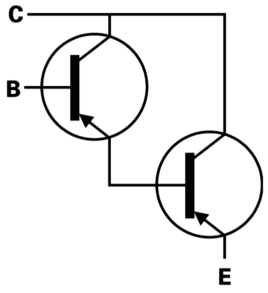
## Applications

- Lamp
- Relay
- Solenoid Driving

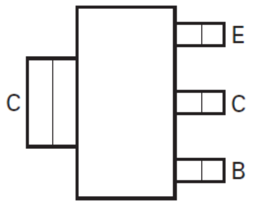
SOT223



Top View



Device Symbol



Top View
Pin-Out

## Absolute Maximum Ratings (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | -140 | V |
| Collector-Emitter Voltage | $V_{CEO}$ | -120 | V |
| Emitter-Base Voltage | $V_{EBO}$ | -12 | V |
| Continuous Collector Current | $I_C$ | -2 | A |
| Peak Pulse Current | $I_{CM}$ | -4 | A |

## Thermal Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

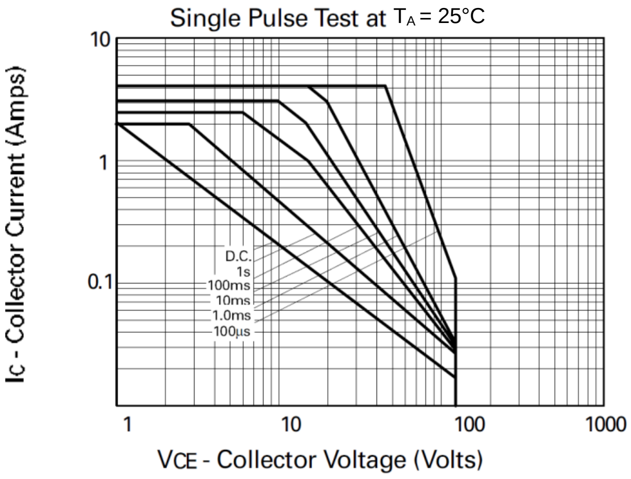
| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Power Dissipation | (Note 5) | $P_D$ | 3.0 | W |
| | (Note 6) | | 2.0 | |
| | (Note 7) | | 1.6 | |
| | (Note 8) | | 1.2 | |
| Thermal Resistance, Junction to Ambient | (Note 5) | $R_{\theta JA}$ | 41.7 | °C/W |
| | (Note 6) | | 62.5 | |
| | (Note 7) | | 78.1 | |
| | (Note 8) | | 104 | |
| Thermal Resistance Junction to Lead | (Note 9) | $R_{\theta JL}$ | 12.9 | |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

## ESD Ratings (Note 10)

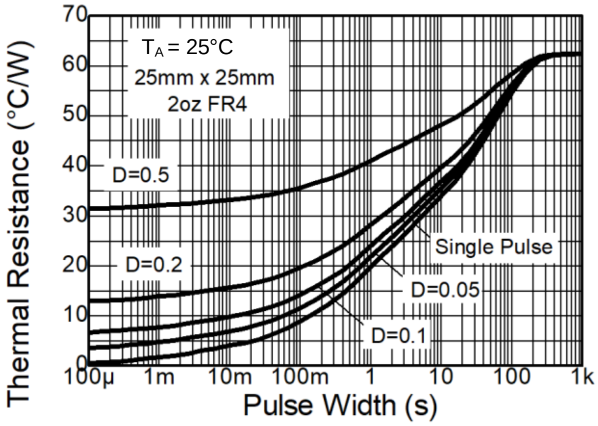
| Characteristic | Symbol | Value | Unit | JEDEC Class |
|---|---|---|---|---|
| Electrostatic Discharge - Human Body Model | ESD HBM | 2,000 | V | 2 |
| Electrostatic Discharge - Machine Model | ESD MM | ≥ 200 | V | B |

Notes:
5. For a device mounted with the collector lead on 50mm x 50mm 2oz copper that is on a single-sided 1.6mm FR-4 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 25mm x 25mm 2oz copper.
7. Same as Note 5, except the device is mounted on 25mm x 25mm 1oz copper.
8. Same as Note 5, except the device is mounted on minimum recommended pad layout.
9. Thermal resistance from junction to solder-point (at the end of the collector lead).
10. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

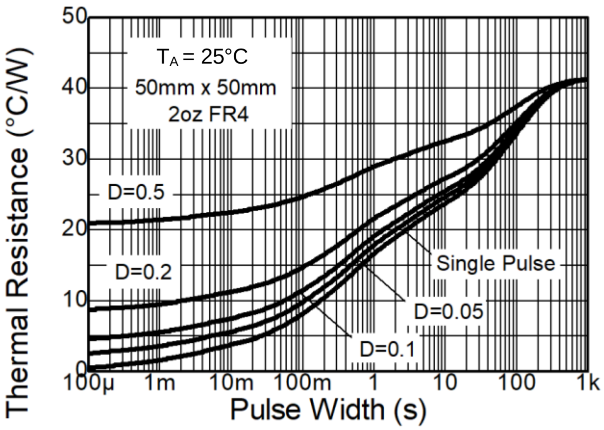
## Thermal Characteristics and Derating Information



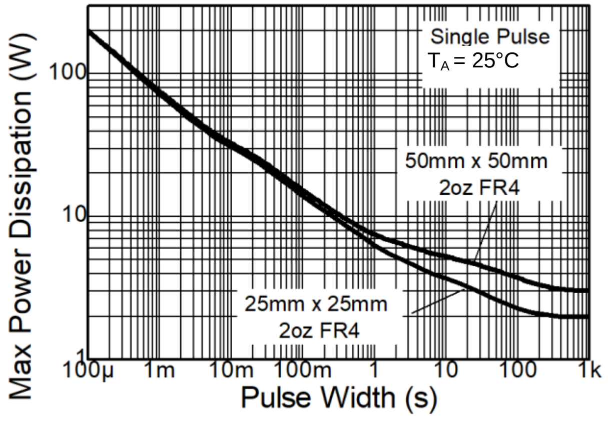
**Safe Operating Area**



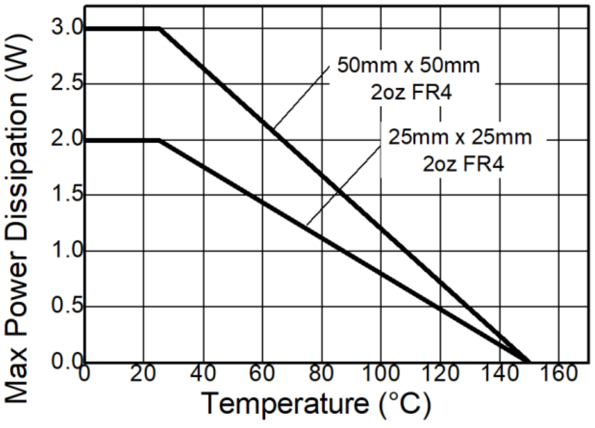
**Transient Thermal Impedance**



**Transient Thermal Impedance**



**Pulse Power Dissipation**



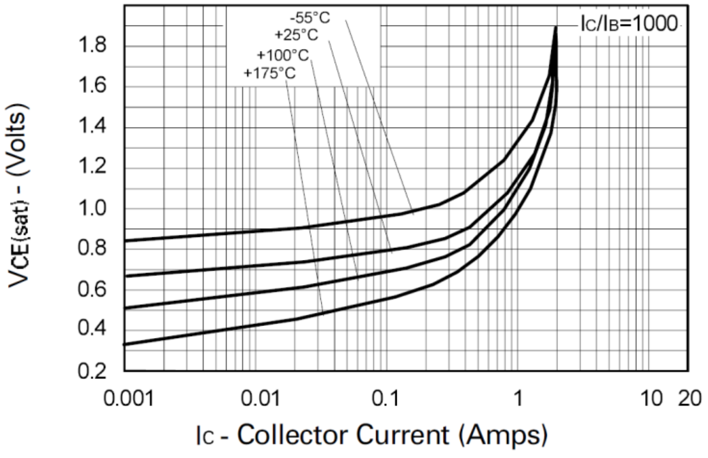
**Derating Curve**

## Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

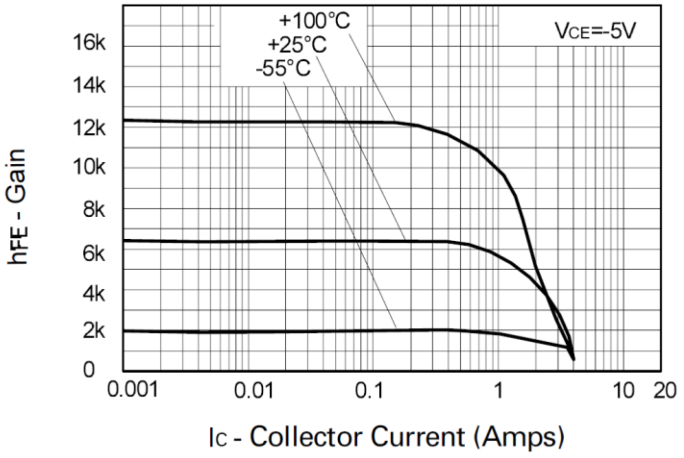
| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Collector-Base Breakdown Voltage | $BV_{CBO}$ | -140 | — | — | V | $I_C$ = -100µA |
| Collector-Emitter Breakdown Voltage (Note 11) | $BV_{CEO}$ | -120 | — | — | V | $I_C$ = -10mA |
| Emitter-Base Breakdown Voltage | $BV_{EBO}$ | -12 | — | — | V | $I_E$ = -100µA |
| Collector-Base Cut-Off Current | $I_{CBO}$ | — | — | -100 | nA | $V_{CB}$ = -120V |
| | | | | -10 | µA | $V_{CB}$ = -120V, $T_A$ = +100°C |
| Collector-Emitter Cut-Off Current | $I_{CES}$ | — | — | -10 | µA | $V_{CE}$ = -80V |
| Emitter Cut-Off Current | $I_{EBO}$ | — | — | -100 | nA | $V_{EB}$ = -8V |
| DC Current Gain (Note 11) | $h_{FE}$ | 3,000 | — | — | — | $I_C$ = -10mA, $V_{CE}$ = -5V |
| | | 3,000 | — | — | | $I_C$ = -100mA, $V_{CE}$ = -5V |
| | | 3,000 | — | 30,000 | | $I_C$ = -1A, $V_{CE}$ = -5V |
| | | 2,000 | — | — | | $I_C$ = -2A, $V_{CE}$ = -5V |
| Collector-Emitter Saturation Voltage (Note 11) | $V_{CE(sat)}$ | — | — | -1.3 | V | $I_C$ = -1A, $I_B$ = -1mA |
| | | — | — | -2.5 | | $I_C$ = -2A, $I_B$ = -2mA |
| Base-Emitter Saturation Voltage (Note 11) | $V_{BE(sat)}$ | — | — | -1.8 | V | $I_C$ = -1A, $I_B$ = -10mA |
| Base-Emitter Turn-On Voltage (Note 11) | $V_{BE(on)}$ | — | — | -1.7 | V | $I_C$ = -1A, $V_{CE}$ = -5V |
| Output Capacitance | $C_{obo}$ | — | 15 | — | pF | $V_{EB}$ = -10V, f = 1MHz |
| Current Gain-Bandwidth Product | $f_T$ | — | 160 | — | MHz | $V_{CE}$ = -10V, $I_C$ = -100mA, f = 20MHz |
| Turn-On Time | $t_{ON}$ | — | 0.6 | — | µs | $V_{CC}$ = -10V, $I_C$ = -500mA<br>$I_{B1}$ = -$I_{B2}$ = -0.5mA |
| Turn-Off Time | $t_{OFF}$ | — | 0.8 | — | µs | |

Note: 11. Measured under pulsed conditions. Pulse width ≤ 300 µs. Duty cycle ≤ 2%.

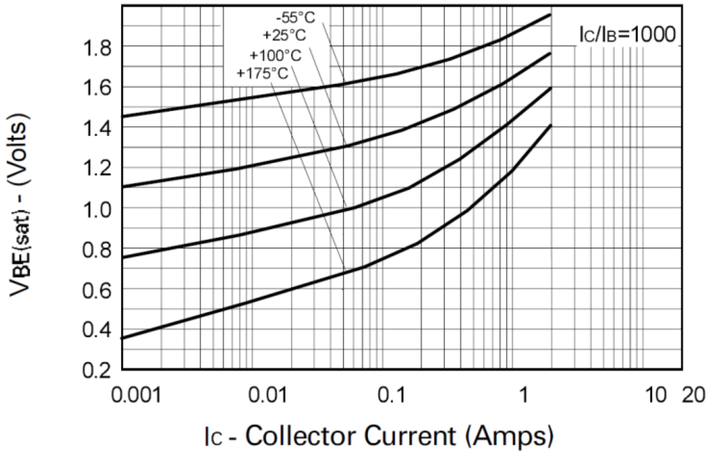
## Typical Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)



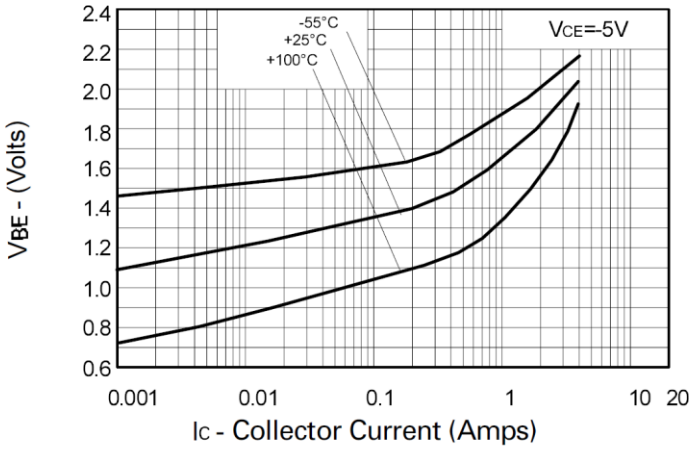
**$V_{CE(sat)}$ v $I_C$**



**$h_{FE}$ v $I_C$**



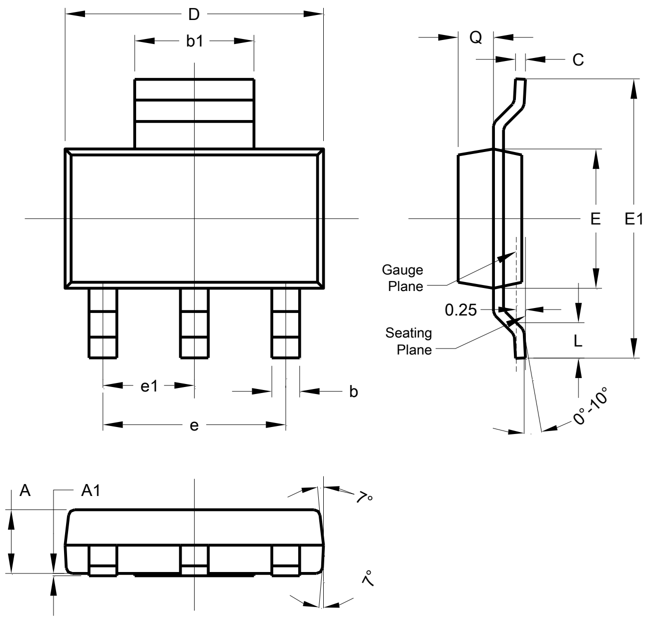
**$V_{BE(sat)}$ v $I_C$**



**$V_{BE(on)}$ v $I_C$**

## Package Outline Dimensions

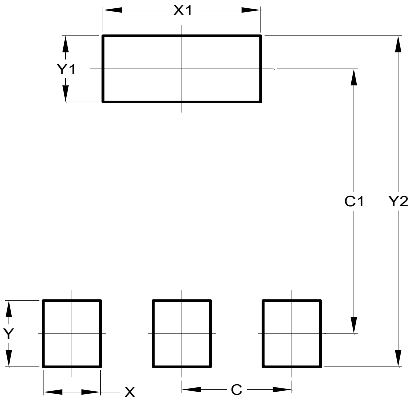
**SOT223**



| SOT223 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 1.55 | 1.65 | 1.60 |
| **A1** | 0.010 | 0.15 | 0.05 |
| **b** | 0.60 | 0.80 | 0.70 |
| **b1** | 2.90 | 3.10 | 3.00 |
| **C** | 0.20 | 0.30 | 0.25 |
| **D** | 6.45 | 6.55 | 6.50 |
| **E** | 3.45 | 3.55 | 3.50 |
| **E1** | 6.90 | 7.10 | 7.00 |
| **e** | — | — | 4.60 |
| **e1** | — | — | 2.30 |
| **L** | 0.85 | 1.05 | 0.95 |
| **Q** | 0.84 | 0.94 | 0.89 |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

**SOT223**



| Dimensions | Value (in mm) |
|---|---|
| **C** | 2.30 |
| **C1** | 6.40 |
| **X** | 1.20 |
| **X1** | 3.30 |
| **Y** | 1.60 |
| **Y1** | 1.60 |
| **Y2** | 8.00 |

For high voltage applications, the appropriate industry sector guidelines should be considered with regards to creepage and clearance distances between device terminals and PCB tracking.