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 Applications.

## Features

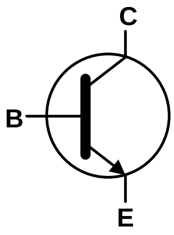
- $BV_{CEO} > 75V$
- $I_C$= 4.5A High Continuous Collector Current
- $I_{CM}$ = 10A Peak Pulse Current
- Low Saturation Voltage $V_{CE(sat)} < 120mV$ @ 1A
- $h_{FE} > 300$ @ $I_C$=1A for a High Gain Hold-Up
- $R_{CE(sat)}$ = 78mΩ at 4.5A for a Low Equivalent On-Resistance

## Mechanical Data

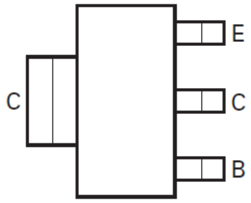
- Case: SOT223
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish—Matte Tin Plated Leads. Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.112 grams (Approximate)

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 | $V_{CBO}$ | 150 | V |
| Collector-Emitter Voltage | $V_{CEO}$ | 75 | V |
| Emitter-Base Voltage | $V_{EBO}$ | 7 | V |
| Continuous Collector Current | $I_C$ | 4.5 | A |
| Continuous Base Current | $I_B$ | 500 | mA |
| Peak Pulse Collector Current | $I_{CM}$ | 10 | A |

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

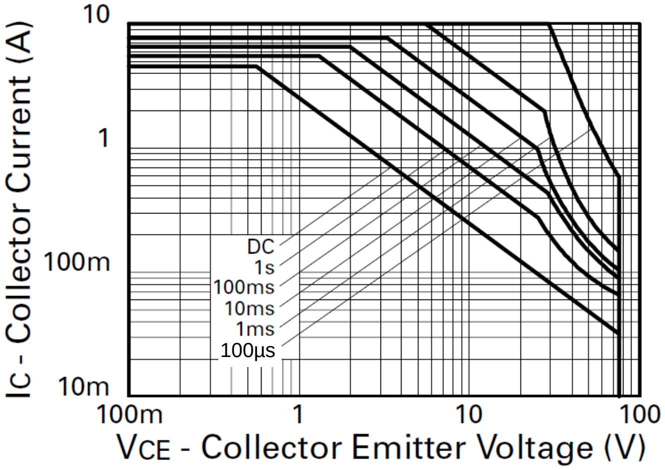
| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Power Dissipation | (Note 6) | $P_D$ | 3.0 | W |
| | (Note 7) | | 2.0 | |
| | (Note 8) | | 1.6 | |
| | (Note 9) | | 1.2 | |
| Thermal Resistance, Junction to Ambient | (Note 6) | $R_{\theta JA}$ | 41.7 | °C/W |
| | (Note 7) | | 62.5 | |
| | (Note 8) | | 78.1 | |
| | (Note 9) | | 104 | |
| Thermal Resistance Junction to Lead | (Note 10) | $R_{\theta JL}$ | 10.9 | |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

## ESD Ratings (Note 11)

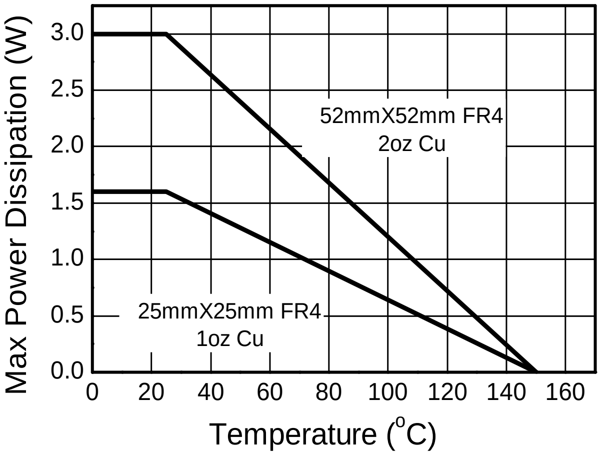
| Characteristic | Symbol | Value | Unit | JEDEC Class |
|---|---|---|---|---|
| Electrostatic Discharge—Human Body Model | ESD HBM | 4000 | V | 3A |
| Electrostatic Discharge—Machine Model | ESD MM | 400 | V | C |

Notes:
6. For a device mounted with the collector lead on 52mm x 52mm 2oz copper that is on a single-sided 1.6mm FR4 PCB; device is measured under still air conditions whilst operating in a steady-state.
7. Same as Note 6, except the device is mounted on 25mm x 25mm 2oz copper.
8. Same as Note 6, except the device is mounted on 25mm x 25mm 1oz copper.
9. Same as Note 6, except the device is mounted on minimum recommended pad layout.
10. Thermal resistance from junction to solder-point (at the end of the collector lead).
11. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

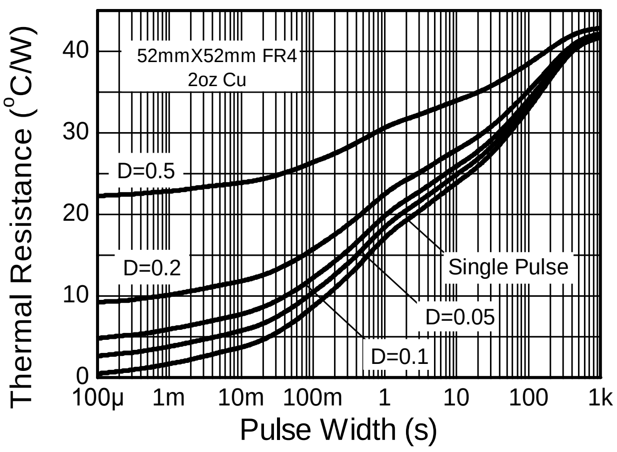
## Thermal Characteristics and Derating Information



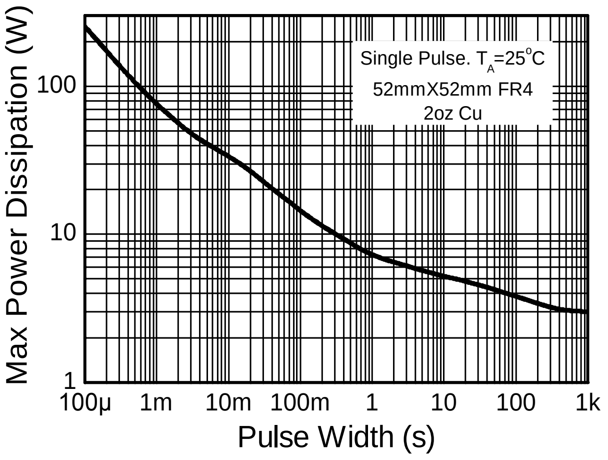
**Safe Operating Area**



**Derating Curve**



**Transient Thermal Impedance**



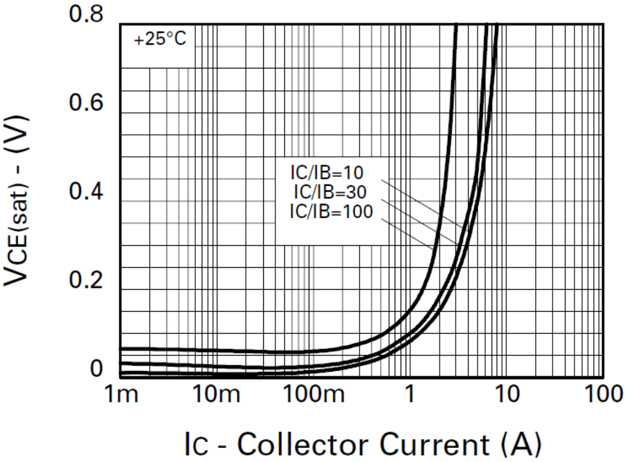
**Pulse Power Dissipation**

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

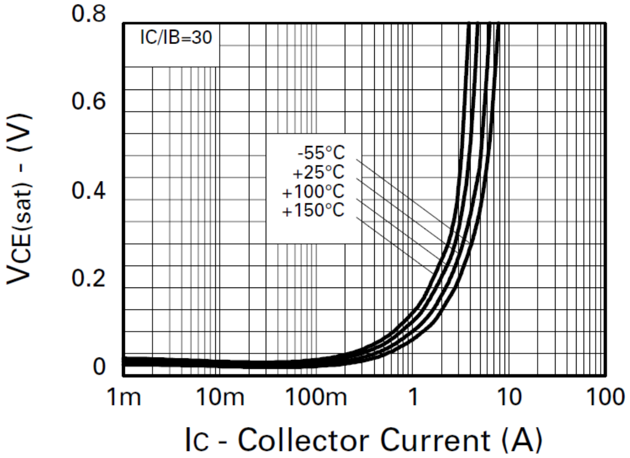
| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Collector-Base Breakdown Voltage | $BV_{CBO}$ | 150 | 250 | — | V | $I_C$ = 100µA |
| Collector-Emitter Breakdown Voltage | $BV_{CES}$ | 150 | 250 | — | V | $I_C$ = 100µA |
| Collector-Emitter Breakdown Voltage (Note 12) | $BV_{CEO}$ | 75 | 100 | — | V | $I_C$ = 10mA |
| Collector-Emitter Breakdown Voltage | $BV_{CEV}$ | 150 | 250 | — | V | $I_C$ = 100µA, $V_{EB}$ = 1V |
| Emitter-Base Breakdown Voltage | $BV_{EBO}$ | 7.0 | 8.8 | — | V | $I_E$ = 100µA |
| Collector Cutoff Current | $I_{CBO}$ | — | 0.9 | 10 | nA | $V_{CB}$ = 120V |
| Collector Cutoff Current | $I_{CES}$ | — | 1.5 | 10 | nA | $V_{CES}$ = 120V |
| Emitter Cutoff Current | $I_{EBO}$ | — | 0.3 | 10 | nA | $V_{EB}$ = 4V |
| DC Current Transfer Static Ratio (Note 12) | $h_{FE}$ | 270 | 440 | — | — | $I_C$ = 10mA, $V_{CE}$ = 2V |
| | | 300 | 450 | 1,200 | | $I_C$ = 0.5A, $V_{CE}$ = 2V |
| | | 300 | 450 | — | | $I_C$ = 1A, $V_{CE}$ = 2V |
| | | 40 | 60 | — | | $I_C$ = 4.5A, $V_{CE}$ = 2V |
| | | — | 20 | — | | $I_C$ = 10A, $V_{CE}$ = 2V |
| Collector-Emitter Saturation Voltage (Note 12) | $V_{CE(sat)}$ | — | 21 | 30 | mV | $I_C$ = 0.2A, $I_B$ = 20mA |
| | | — | 55 | 75 | | $I_C$ = 0.5A, $I_B$ = 20mA |
| | | — | 150 | 200 | | $I_C$ = 1A, $I_B$ = 10mA |
| | | — | 160 | 210 | | $I_C$ = 2A, $I_B$ = 100mA |
| | | — | 350 | 440 | | $I_C$ = 4.5A, $I_B$ = 200mA |
| Base-Emitter Saturation Voltage (Note 12) | $V_{BE(sat)}$ | — | 900 | 1,000 | mV | $I_C$ = 3A, $I_B$ = 100mA |
| Base-Emitter Turn-On Voltage (Note 12) | $V_{BE(on)}$ | — | 825 | 950 | mV | $I_C$ = 3A, $V_{CE}$ = 2V |
| Transitional Frequency (Note 12) | $f_T$ | — | 140 | — | MHz | $I_C$ = 50mA, $V_{CE}$ = 10V, f = 100MHz |
| Output Capacitance | $C_{obo}$ | — | 21 | 30 | pF | $V_{CB}$ = 10V, f = 1MHz |
| Switching Time | $t_{on}$ | — | 162 | — | ns | $V_{CC}$ = 50V, $I_C$ = 2A, $I_{B1}$ = $I_{B2}$ = ±20mA |
| | $t_{off}$ | — | 900 | — | ns | |

Note: 12. Measured under pulsed conditions. Pulse width ≤ 300µs. Duty cycle ≤ 2%.

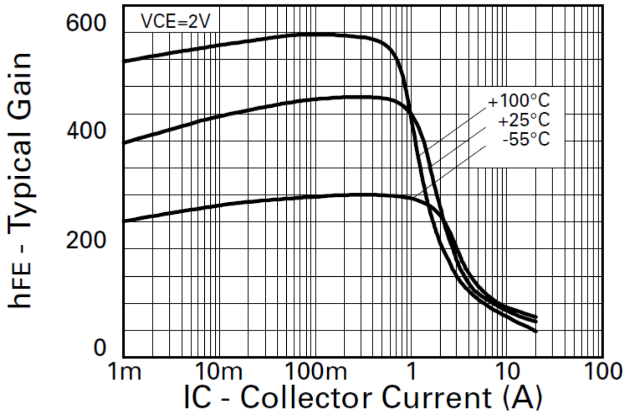
## Typical Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)



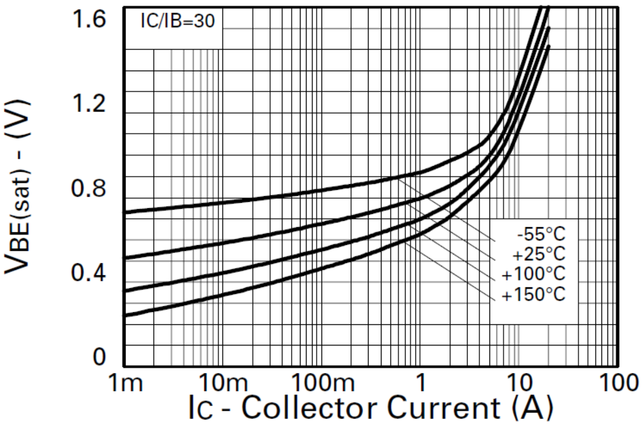
**VCE(sat) v IC**



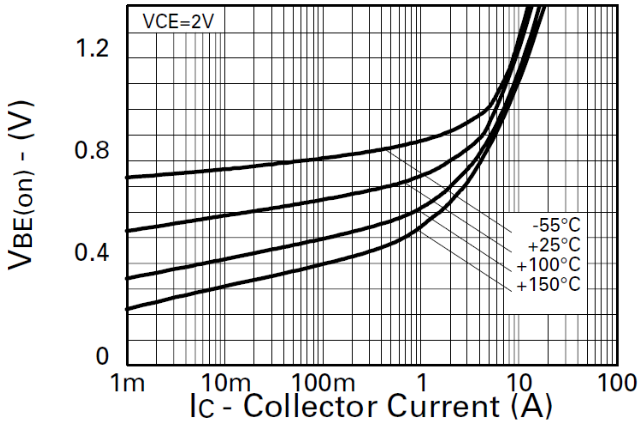
**VCE(sat) v IC**



**hFE v IC**



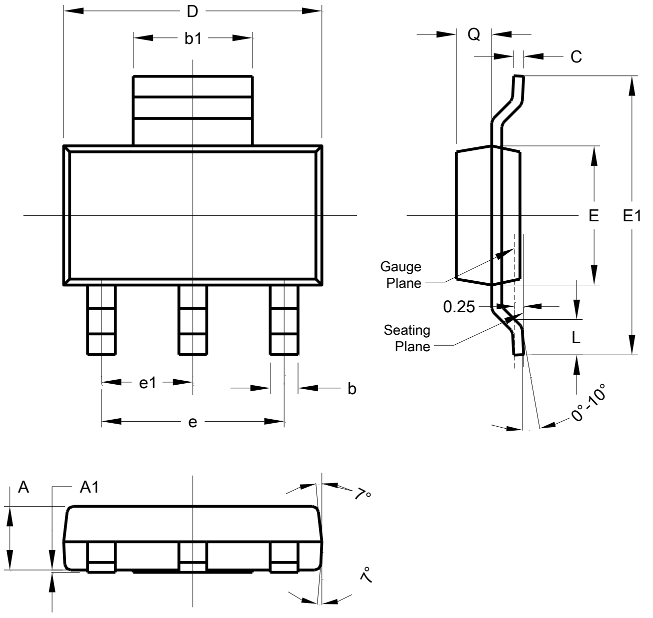
**VBE(sat) v IC**



**VBE(on) v IC**

## Package Outline Dimensions

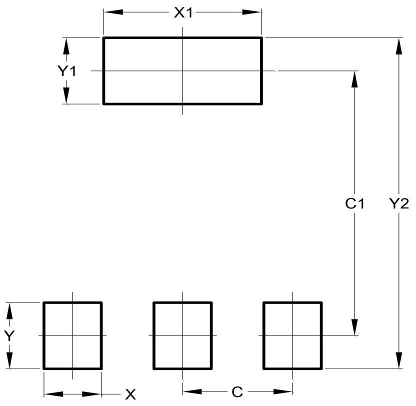
**SOT223**



| 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 |