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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## Features

- $BV_{CEO}$ > -60V
- $I_C$ = -4A Continuous Collector Current
- Low Saturation Voltage $V_{CE(sat)}$ < -75mV @ 1A
- $R_{CE(sat)}$ = 45mΩ
- $h_{FE}$ Characterised up to 4A
- High $h_{FE}$ Min 160 @ 1A
- 1.5W Power Dissipation
- Complementary NPN type: NK-ZXTN19060CFF

## Mechanical Data

- Case: SOT23F
- Case 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 e3
- Weight: 0.012 grams (Approximate)

## Description

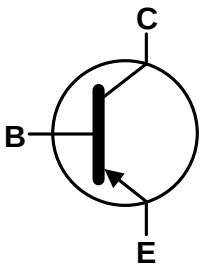
This medium voltage PNP transistor is designed for applications requiring high-gain and low-saturation voltage. The SOT23F package is PIN compatible with the industry standard SOT23 footprint while offering a lower profile and higher power dissipation for applications where power density is of utmost importance.

## Applications

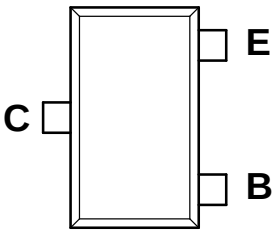
- High-Side Driver
- Motor Drive
- Load Disconnect Switch

SOT23F

Top View




Device Symbol




Top View
Pin Configuration

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

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | -60 | V |
| Collector-Emitter Voltage | $V_{CEO}$ | -60 | V |
| Emitter-Collector Voltage (Reverse Blocking) | $V_{ECO}$ | -7 | V |
| Emitter-Base Voltage | $V_{EBO}$ | -7 | V |
| Continuous Collector Current | $I_C$ | -4 | A |
| Peak Pulse Current | $I_{CM}$ | -7 | A |
| Base Current | $I_B$ | -1 | A |

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

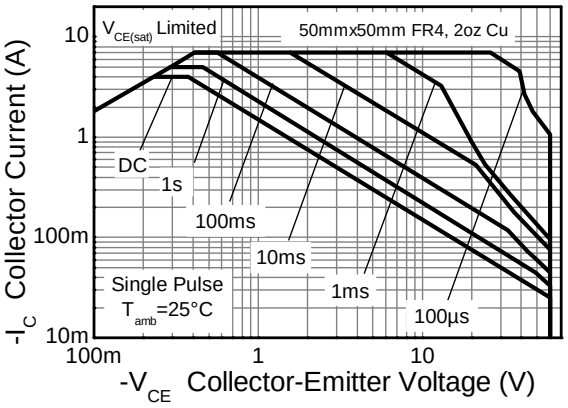
| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Power Dissipation<br>Linear Derating Factor | (Note 5) | $P_D$ | 0.84<br>6.72 | W<br>mW/°C |
| | (Note 6) | | 1.34<br>10.72 | |
| | (Note 7) | | 1.50<br>12.0 | |
| | (Note 8) | | 2.0<br>16.0 | |
| Thermal Resistance, Junction to Ambient | (Note 5) | $R_{\theta JA}$ | 149 | °C/W |
| | (Note 6) | | 93 | |
| | (Note 7) | | 83 | |
| | (Note 8) | | 60 | |
| Thermal Resistance, Junction to Lead | (Note 9) | $R_{\theta JL}$ | 43.77 | °C/W |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

## ESD Ratings (Note 10)

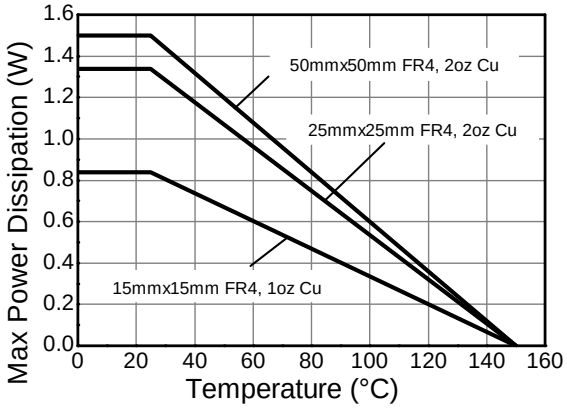
| Characteristic | Symbol | Value | Unit | JEDEC Class |
|---|---|---|---|---|
| Electrostatic Discharge - Human Body Model | ESD HBM | 4,000 | V | 3A |
| Electrostatic Discharge - Machine Model | ESD MM | 400 | V | C |

Notes:
5. 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.
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 50mm x 50mm 2oz copper.
8. Same as Note 7, whilst measured at t < 5 seconds.
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.

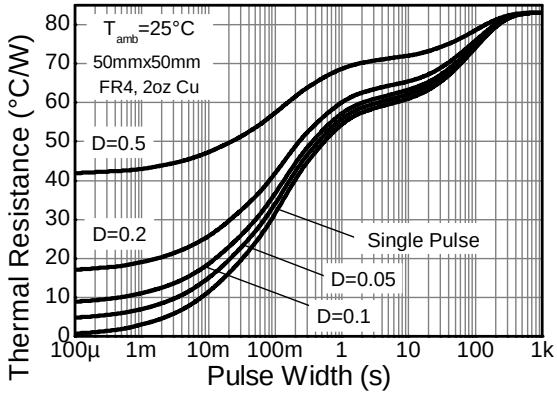
## Thermal Characteristics and Derating Information



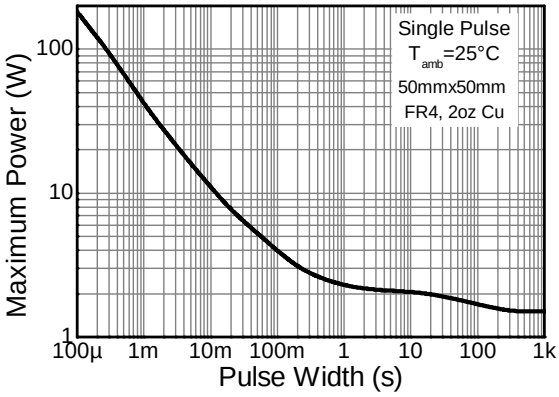

**Safe Operating Area**




**Derating Curve**




**Transient Thermal Impedance**



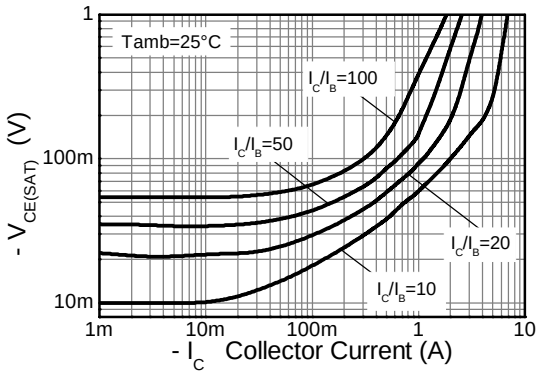

**Pulse Power Dissipation**

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

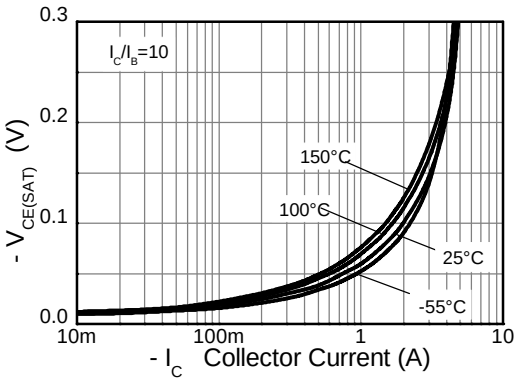
| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Collector-Base Breakdown Voltage | $BV_{CBO}$ | -60 | -110 | — | V | $I_C$ = -100μA |
| Collector-Emitter Breakdown Voltage (Base Open) (Note 11) | $BV_{CEO}$ | -60 | -90 | — | V | $I_C$ = -10mA |
| Emitter-Base Breakdown Voltage | $BV_{EBO}$ | -7 | -8.4 | — | V | $I_E$ = -100μA |
| Emitter-Collector Breakdown Voltage (Reverse Blocking) | $BV_{ECX}$ | -7 | -8.4 | — | V | $I_E$ = -100μA; $R_{BC}$ < 1kΩ or 0.25V < $V_{BC}$ < -0.25V |
| Emitter-Collector Breakdown Voltage (base open) | $BV_{ECO}$ | -7 | -8.8 | — | V | $I_E$ = -100μA |
| Collector-Base Cut-Off Current | $I_{CBO}$ | — | <-1<br>— | -50<br>-0.5 | nA<br>μA | $V_{CB}$ = -60V<br>$V_{CB}$ = -60V, $T_A$ = +100°C |
| Emitter-Base Cut-Off Current | $I_{EBO}$ | — | <-1 | -50 | nA | $V_{EB}$ = -5.6V |
| **ON CHARACTERISTICS (Note 11)** | | | | | | |
| Static Forward Current Transfer Ratio | $h_{FE}$ | 200<br>160<br>30 | 350<br>280<br>50 | 500<br>—<br>— | — | $I_C$ = -100mA, $V_{CE}$ = -2V<br>$I_C$ = -1A, $V_{CE}$ = -2V<br>$I_C$ = -4A, $V_{CE}$ = -2V |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | — | -60<br>-140<br>-180 | -75<br>-200<br>-270 | mV | $I_C$ = -1A, $I_B$ = -100mA<br>$I_C$ = -1A, $I_B$ = -20mA<br>$I_C$ = -4A, $I_B$ = -400mA |
| Base-Emitter Saturation Voltage | $V_{BE(sat)}$ | — | -935 | -1,050 | mV | $I_C$ = -4A, $I_B$ = -400mA |
| Base-Emitter On Voltage | $V_{BE(on)}$ | — | -835 | -950 | mV | $I_C$ = -4A, $V_{CE}$ = -2V |
| **SMALL SIGNAL CHARACTERISTICS** | | | | | | |
| Transition Frequency | $f_T$ | — | 180 | — | MHz | $I_C$ = -50mA, $V_{CE}$ = -10V, f = 50MHz |
| Output Capacitance | $C_{obo}$ | — | 29.5 | 40 | pF | $V_{CB}$ = -10V, f = 1MHz |
| Delay Time | $t_d$ | — | 24.3 | — | ns | $V_{CC}$ = -10V, $I_C$ = -500mA, $I_{B1}$ = -$I_{B2}$ = -50mA |
| Rise Time | $t_r$ | — | 13.2 | — | ns | |
| Storage Time | $t_s$ | — | 456 | — | ns | |
| Fall Time | $t_f$ | — | 68.2 | — | ns | |

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

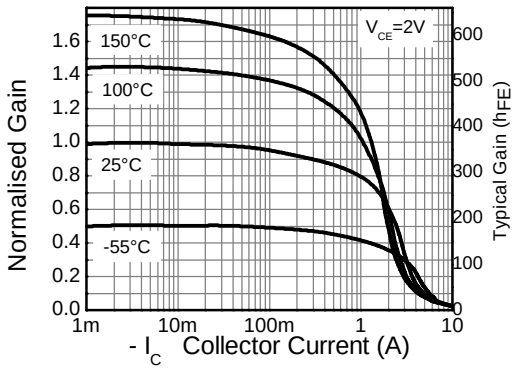
## Typical Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)



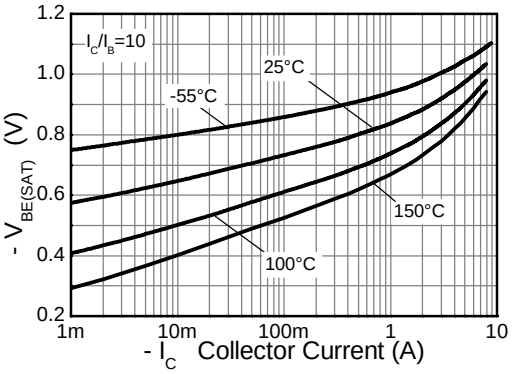

**$V_{CE(SAT)}$ v $I_C$**



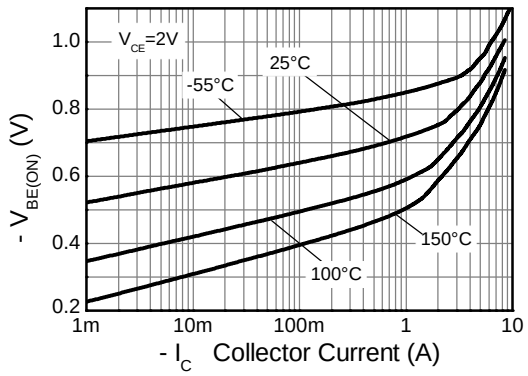

**$V_{CE(SAT)}$ v $I_C$**



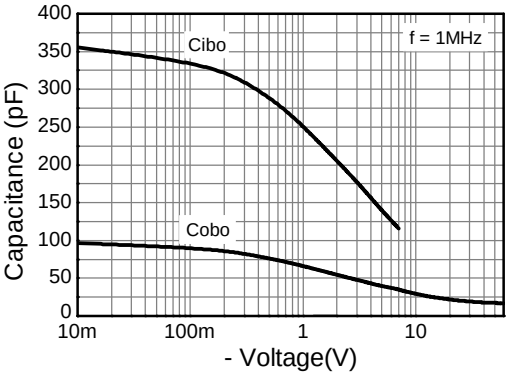

**$h_{FE}$ v $I_C$**




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



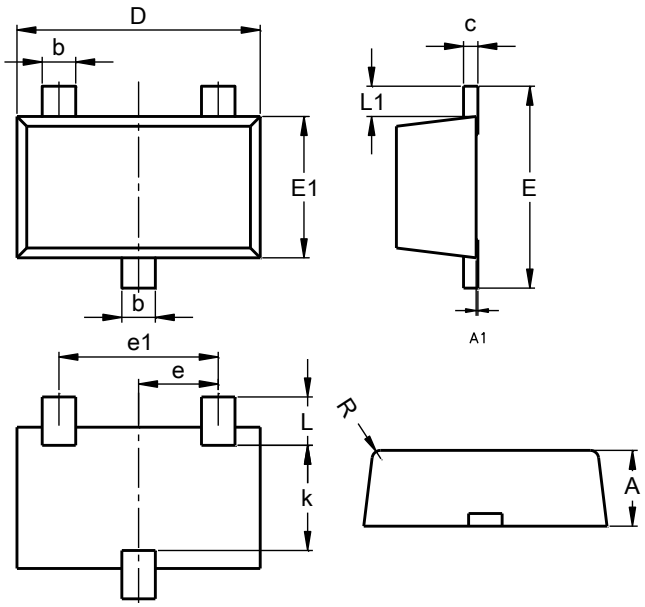

**$V_{BE(ON)}$ v $I_C$**




**Capacitance v Voltage**

## Package Outline Dimensions

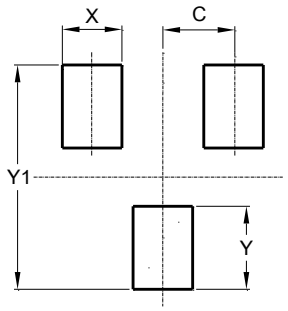
**SOT23F**




| SOT23F | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.80 | 1.00 | 0.90 |
| **b** | 0.35 | 0.50 | 0.44 |
| **c** | 0.10 | 0.20 | 0.16 |
| **D** | 2.80 | 3.00 | 2.90 |
| **e** | 0.95 REF | | |
| **e1** | 0.190 REF | | |
| **E** | 2.30 | 2.50 | 2.40 |
| **E1** | 1.50 | 1.70 | 1.65 |
| **k** | 1.20 | - | - |
| **L** | 0.30 | 0.65 | 0.50 |
| **L1** | 0.30 | 0.50 | 0.40 |
| **R** | 0.05 | 0.15 | - |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

**SOT23F**




| Dimensions | Value (in mm) |
|---|---|
| **C** | 0.95 |
| **X** | 0.80 |
| **Y** | 1.110 |
| **Y1** | 3.000 |