NEC

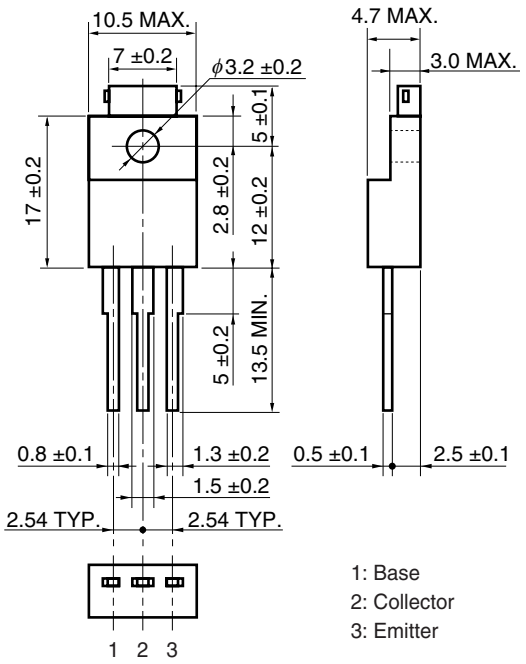
# SILICON POWER TRANSISTOR
# 2SC4336

## NPN SILICON EPITAXIAL TRANSISTOR FOR HIGH-SPEED SWITCHING

### DESCRIPTION

The 2SC4336 is a mold power transistor developed for high-speed switching and features a very low collector-to-emitter saturation. This transistor is ideal for use in switching power supplies, DC/DC converters, motor drivers, solenoid drivers, and other low-voltage power supply devices, as well as for high-current switching.

### PACKAGE DRAWING (Unit: mm)




### FEATURES

- Mold package that does not require an insulating board or insulation bushing
- Fast switching speed
- Low collector-to-emitter saturation voltage

  $V_{CE(sat)}$ ≤ 0.3 V MAX. ($I_C$ = 6.0 A)

### ORDERING INFORMATION

| PART NUMBER | PACKAGE |
|---|---|
| 2SC4336 | Isolated TO-220 (MP-45) |

### ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°C)

| | | | |
|---|---|---|---|
| Collector to base voltage | $V_{CBO}$ | 100 | V |
| Collector to emitter voltage | $V_{CEO}$ | 100 | V |
| Emitter to base voltage | $V_{EBO}$ | 7.0 | V |
| Collector current (DC) | $I_{C(DC)}$ | 10 | A |
| Collector current (pulse) **Note** | $I_{C(pulse)}$ | 20 | A |
| Base current (DC) | $I_{B(DC)}$ | 6.0 | A |
| Total power dissipation ($T_C$ = 25°C) | $P_T$ | 30 | W |
| Total power dissipation ($T_A$ = 25°C) | $P_T$ | 2.0 | W |
| Junction temperature | $T_j$ | 150 | °C |
| Storage temperature | $T_{stg}$ | −55 to +150 | °C |

**Note** PW ≤ 300 μs, Duty Cycle ≤ 10%



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## ELECTRICAL CHARACTERISTICS ($T_A$ = 25°C)

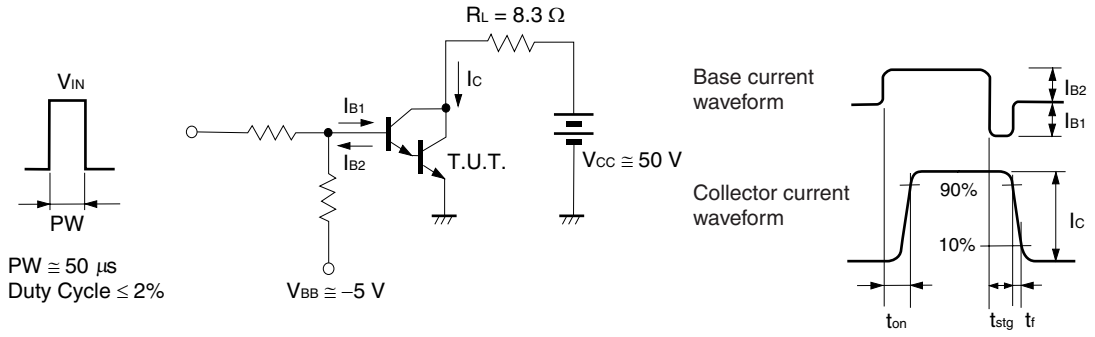
| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Collector to Emitter Voltage | $V_{CEO(SUS)}$ | $I_C$ = 5.0 A, $I_B$ = 0.6 A, L = 1 mH | 100 | | | V |
| | $V_{CEX(SUS)}$ | $I_C$ = 5.0 A, $I_{B1}$ = $-I_{B2}$ = 0.6 A, $V_{BE(OFF)}$ = −1.5 V, L = 180 μH, clamped | 100 | | | V |
| Collector Cut-off Current | $I_{CBO}$ | $V_{CB}$ = 100 V, $I_E$ = 0 | | | 10 | μA |
| | $I_{CER}$ | $V_{CE}$ = 100 V, $R_{BE}$ = 50 Ω, $T_A$ = 125°C | | | 1.0 | mA |
| | $I_{CEX1}$ | $V_{CE}$ = 100 V, $V_{BE(OFF)}$ = −1.5 V | | | 10 | μA |
| | $I_{CEX2}$ | $V_{CE}$ = 100 V, $V_{BE(OFF)}$ = −1.5 V, $T_A$ = 125°C | | | 1.0 | mA |
| Emitter Cut-off Current | $I_{EBO}$ | $V_{EB}$ = 5.0 V, $I_C$ = 0 | | | 10 | μA |
| DC Current Gain **Note** | $h_{FE1}$ | $V_{CE}$ = 2.0 V, $I_C$ = 1.0 A | 100 | | | |
| | $h_{FE2}$ | $V_{CE}$ = 2.0 V, $I_C$ = 2.0 A | 100 | 200 | 400 | |
| | $h_{FE3}$ | $V_{CE}$ = 2.0 V, $I_C$ = 6.0 A | 60 | | | |
| Collector Saturation Voltage **Note** | $V_{CE(sat)1}$ | $I_C$ = 6.0 A, $I_B$ = 0.3 A | | | 0.3 | V |
| | $V_{CE(sat)2}$ | $I_C$ = 8.0 A, $I_B$ = 0.4 A | | | 0.5 | V |
| Base Saturation Voltage **Note** | $V_{BE(sat)1}$ | $I_C$ = 6.0 A, $I_B$ = 0.3 A | | | 1.2 | V |
| | $V_{BE(sat)2}$ | $I_C$ = 8.0 A, $I_B$ = 0.4 A | | | 1.5 | V |
| Collector Capacitance | $C_{ob}$ | $V_{CB}$ = 10 V, $I_E$ = 0, f = 1.0 MHz | | 120 | | pF |
| Gain Bandwidth Product | $f_T$ | $V_{CE}$ = 10 V, $I_C$ = 0.5 A | | 150 | | MHz |
| Turn-on Time | $t_{on}$ | $I_C$ = 6.0 A, $R_L$ = 8.3 Ω, $I_{B1}$ = $-I_{B2}$ = 0.3 A, $V_{CC}$ ≅ 50 V Refer to the test circuit. | | | 0.3 | μs |
| Storage Time | $t_{stg}$ | | | | 1.5 | μs |
| Fall Time | $t_f$ | | | | 0.3 | μs |

**Note** Pulsed: PW ≤ 350 μs, Duty Cycle ≤ 2%

## $h_{FE}$ CLASSIFICATION

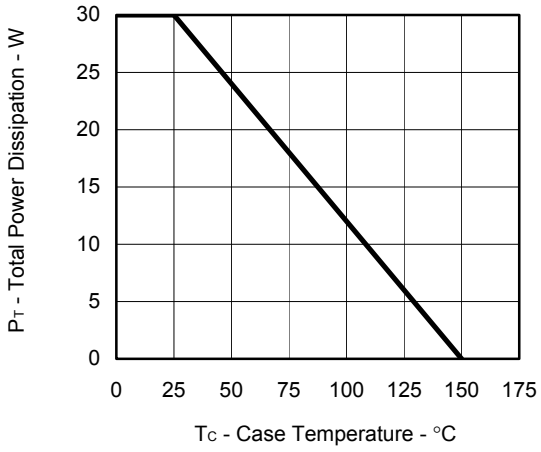
| Marking | M | L | K |
|---|---|---|---|
| $h_{FE2}$ | 100 to 200 | 150 to 300 | 200 to 400 |

## SWITCHING TIME ($t_{on}$, $t_{stg}$, $t_f$) TEST CIRCUIT

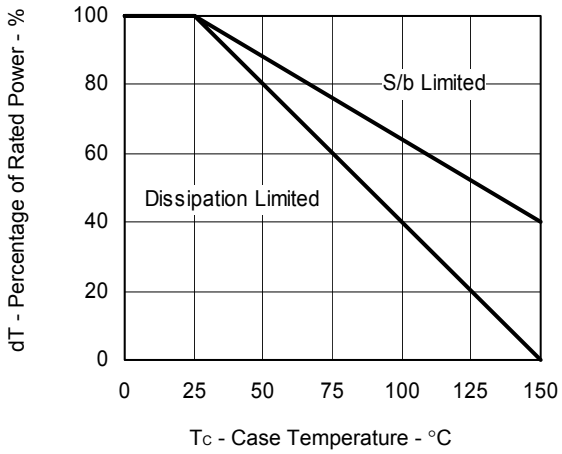


## TYPICAL CHARACTERISTICS ($T_A$ = 25°C)

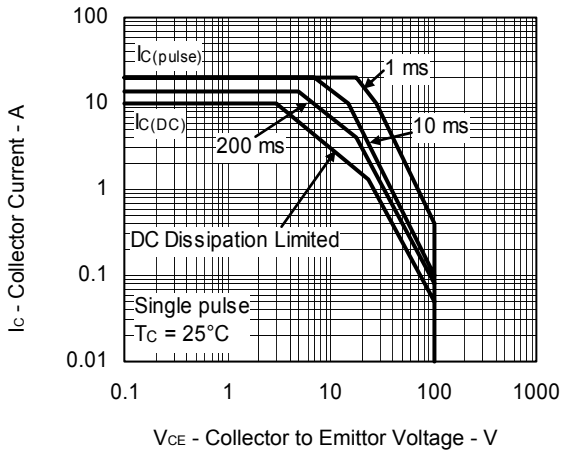
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



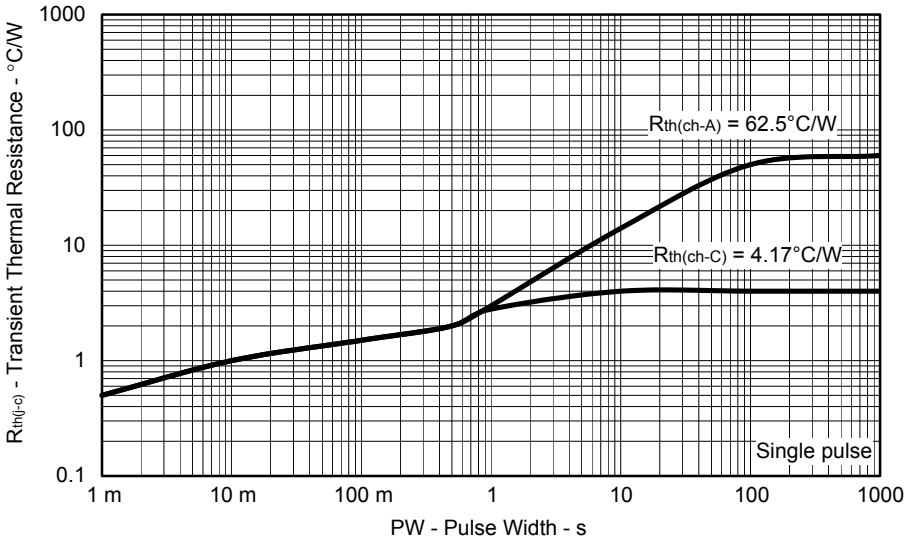

DERATING CURVE OF SAFE OPERATING AREA



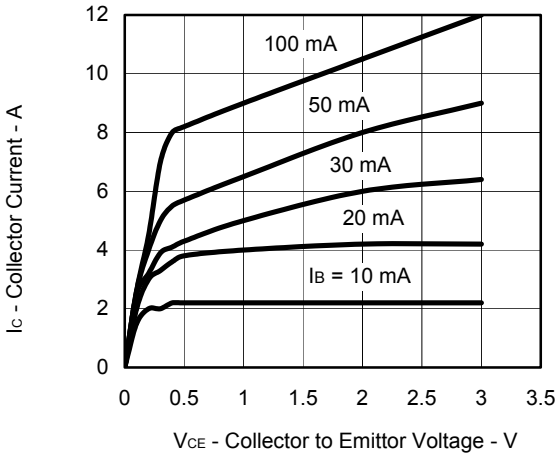

FORWARD BIAS SAFE OPERATING AREA



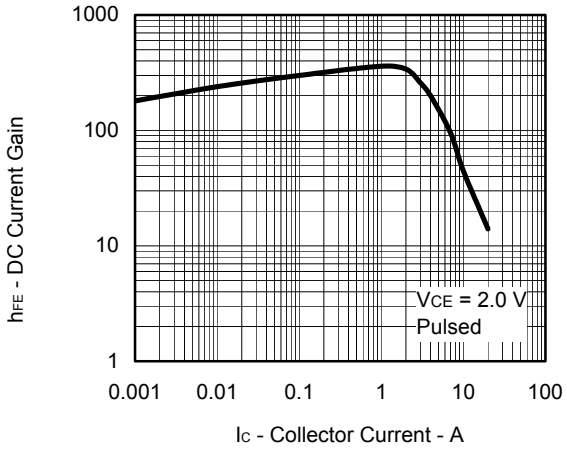

TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



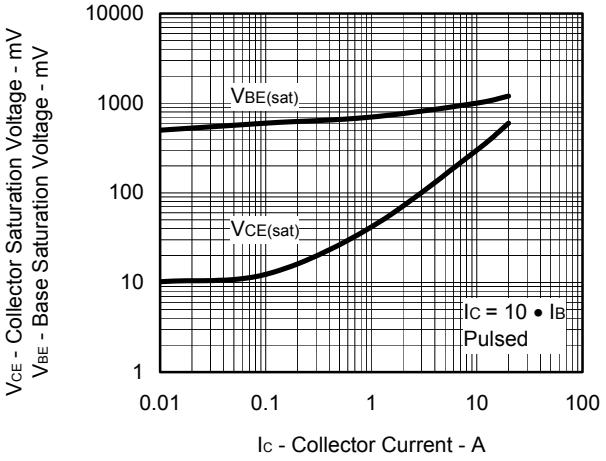
COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE



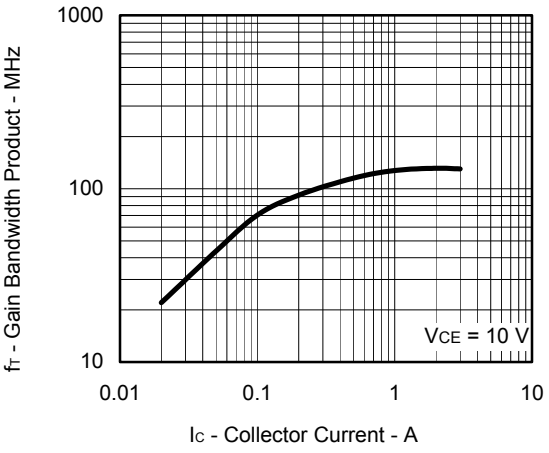

DC CURRENT GAIN vs.
COLLECTOR CURRENT



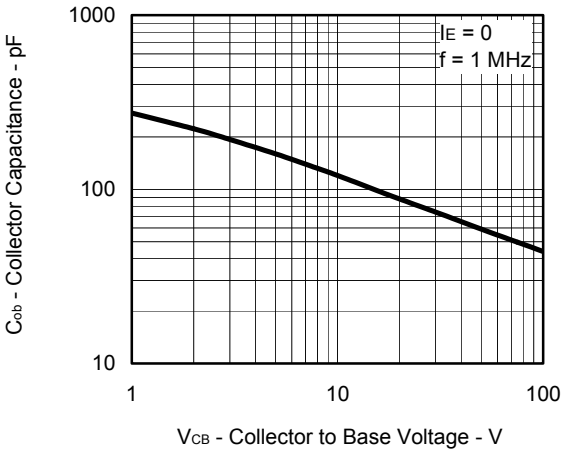

COLLECTOR SATURATION VOLTAGE AND BASE SATURATION VOLTAGE vs. COLLECTOR CURRENT



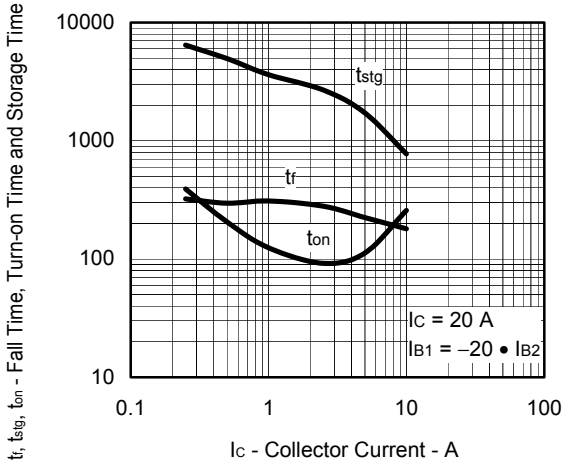

GAIN BANDWIDTH PRODUCT vs.
COLLECTOR CURRENT




COLLECTOR CAPACITANCE vs.
COLLECTOR TO BASE VOLTAGE




TURN ON TIME, STORAGE TIME AND FALL TIME
vs. COLLECTOR CURRENT



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