NEC

# SILICON POWER TRANSISTOR
# 2SD2165

## NPN SILICON EPITAXIAL TRANSISTOR FOR LOW-FREQUENCY POWER AMPLIFIERS AND LOW-SPEED SWITCHING

The 2SD2165 is a single power transistor developed especially for high $h_{FE}$. This transistor is ideal for simplifying drive circuits and reducing power dissipation because its $h_{FE}$ is as high as that of Darlington transistors, but it is a single transistor.

In addition, this transistor features a small resin-molded insulation package, thus contributing to high-density mounting and mounting cost reduction.

### FEATURES

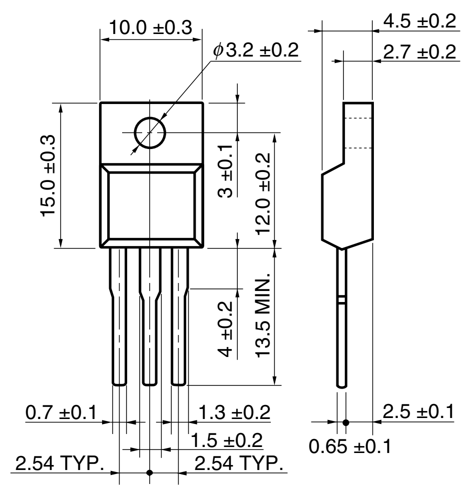
- High $h_{FE}$ and low $V_{CE(sat)}$:
  $h_{FE} \cong 1,300$ TYP. ($V_{CE} = 5.0$ V, $I_C = 1.0$ A)
  $V_{CE(SAT)} \cong 0.3$ V TYP. ($I_C = 3.0$ A, $I_B = 30$ mA)
- Mold package that does not require an insulating board or insulation bushing

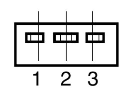
### ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°C)

| Parameter | Symbol | Ratings | Unit |
|---|---|---|---|
| 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) | $I_{C(DC)}$ | 6.0 | A |
| Collector current (pulse) | $I_{C(pulse)}$ | 10 [Note] | A |
| Base current (DC) | $I_{B(DC)}$ | 1.0 | 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 $\mu$s, duty cycle ≤ 10%

### PACKAGE DRAWING (UNIT: mm)




Electrode Connection
1. Base
2. Collector
3. Emitter

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**The mark ★ shows major revised points.**

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

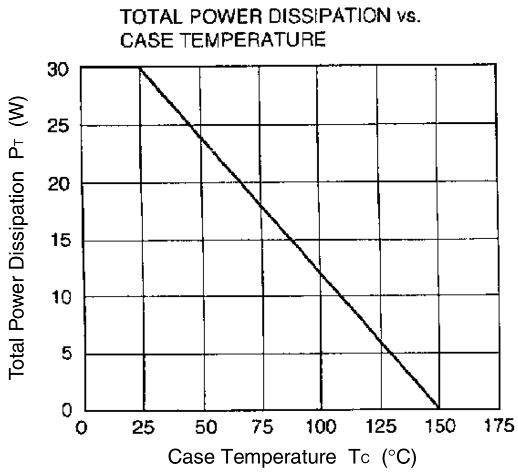
| | Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|---|
| | Collector cutoff current | $I_{CBO}$ | $V_{CB}$ = 60 V, $I_E$ = 0 A | | | 10 | μA |
| | Emitter cutoff current | $I_{EBO}$ | $V_{EB}$ = 7.0 V, $I_C$ = 0 A | | | 10 | μA |
| | DC current gain | $h_{FE1}$ | $V_{CE}$ = 5.0 V, $I_C$ = 1.0 A Note | 800 | 1,300 | 3,200 | |
| | DC current gain | $h_{FE2}$ | $V_{CE}$ = 5.0 V, $I_C$ = 3.0 A Note | 500 | 1,000 | | |
| ★ | Collector saturation voltage | $V_{CE(sat)}$ | $I_C$ = 3.0 A, $I_B$ = 30 mA Note | | 0.3 | 1.0 | V |
| | Base saturation voltage | $V_{BE(sat)}$ | $I_C$ = 3.0 A, $I_B$ = 30 mA Note | | | 1.2 | V |
| | Gain bandwidth product | $f_T$ | $V_{CE}$ = 5.0 V, $I_C$ = 0.1 A | | 110 | | MHz |
| | Collector capacitance | $C_{ob}$ | $V_{CB}$ = 10 V, $I_E$ = 0 A, f = 1.0 MHz | | 50 | | pF |

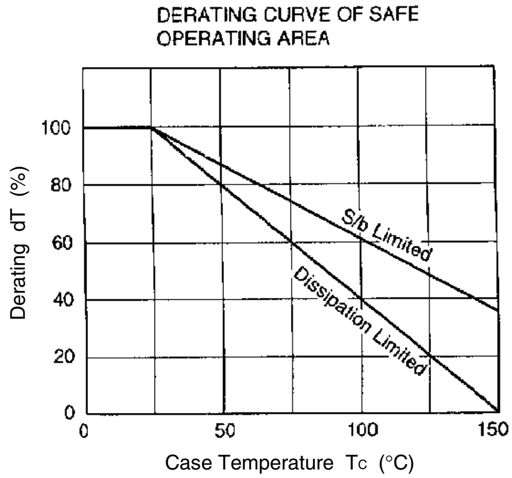
**Note** Pulse test PW ≤ 350 μs, duty cycle ≤ 2%

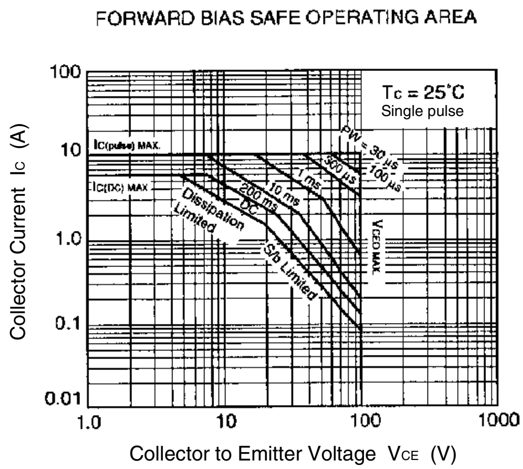
## $h_{FE1}$ CLASSIFICATION

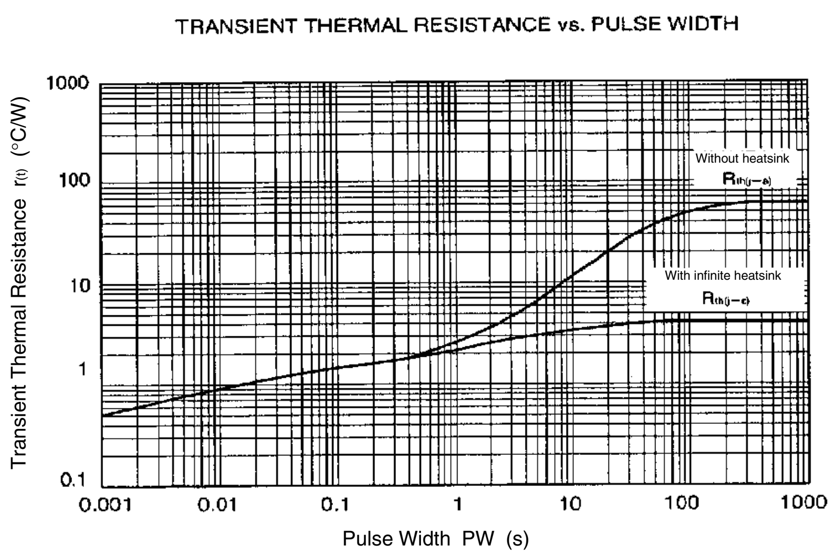
| Marking | M | L | K |
|---|---|---|---|
| $h_{FE1}$ | 800 to 1,600 | 1,000 to 2,000 | 1,600 to 3,200 |

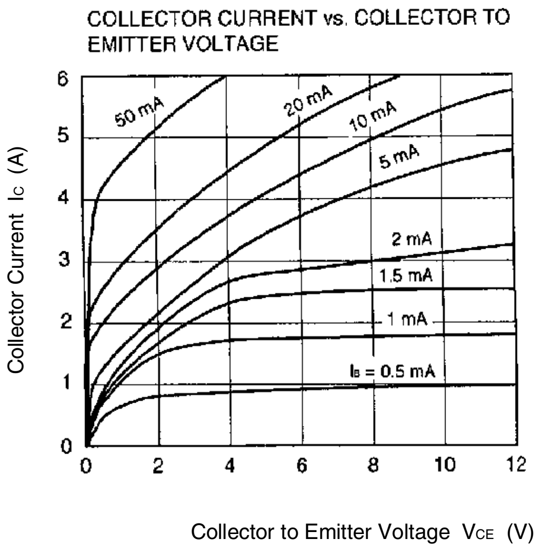
## TYPICAL CHARACTERISTICS ($T_A$ = 25°C)

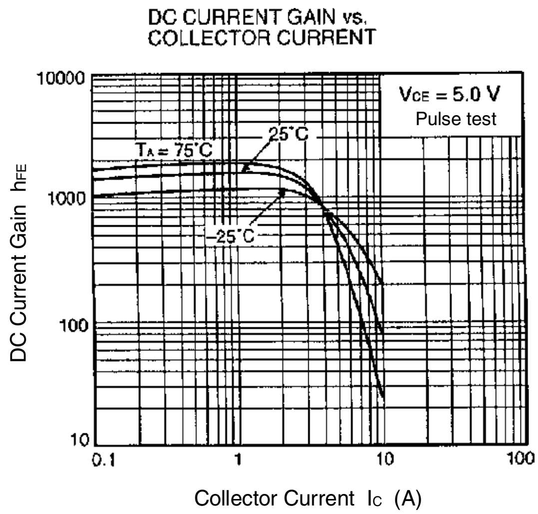


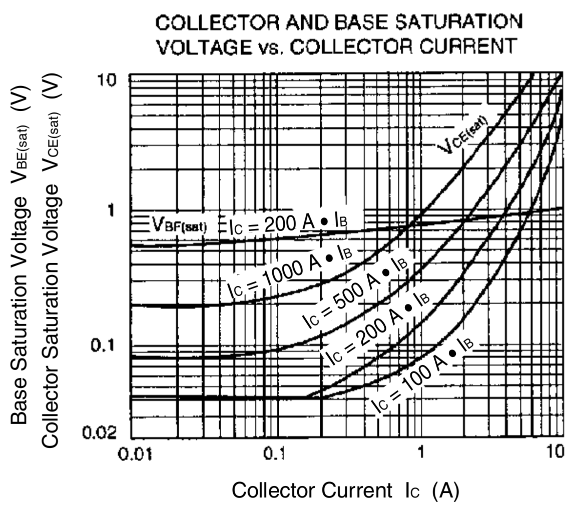



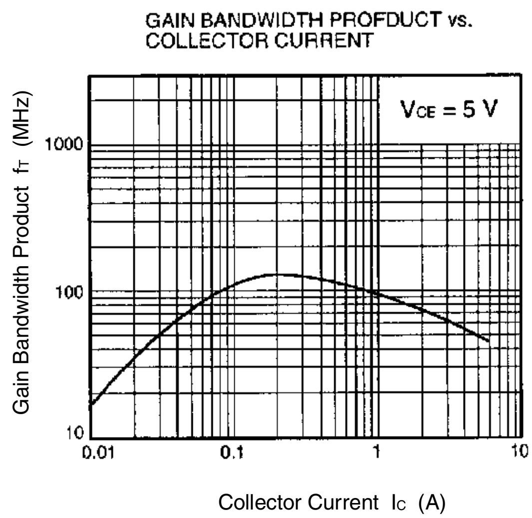



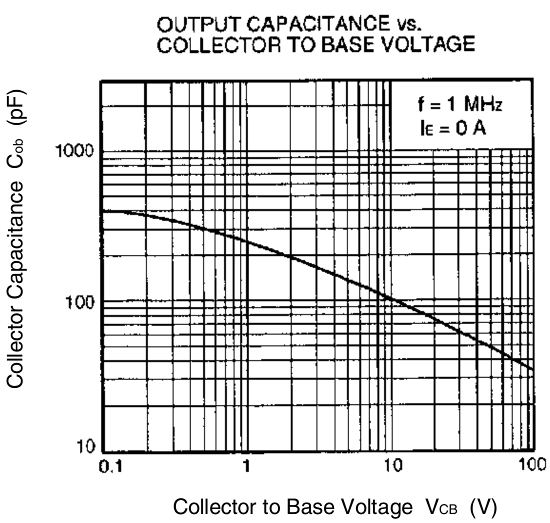




COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE
50 mA
20 mA
10 mA
5 mA
2 mA
1.5 mA
1 mA
IB = 0.5 mA
Collector Current IC (A)
Collector to Emitter Voltage VCE (V)


DC CURRENT GAIN vs. COLLECTOR CURRENT
VCE = 5.0 V
Pulse test
TA = 75°C
25°C
−25°C
DC Current Gain hFE
Collector Current IC (A)


COLLECTOR AND BASE SATURATION VOLTAGE vs. COLLECTOR CURRENT
VCE(sat)
VBE(sat) IC = 200 A • IB
IC = 1000 A • IB
IC = 500 A • IB
IC = 200 A • IB
IC = 100 A • IB
Base Saturation Voltage VBE(sat) (V)
Collector Saturation Voltage VCE(sat) (V)
Collector Current IC (A)


GAIN BANDWIDTH PROFDUCT vs. COLLECTOR CURRENT
VCE = 5 V
Gain Bandwidth Product fT (MHz)
Collector Current IC (A)


OUTPUT CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE
f = 1 MHz
IE = 0 A
Collector Capacitance Cob (pF)
Collector to Base Voltage VCB (V)