DATA SHEET

NEC

SILICON POWER TRANSISTOR
2SA1648,1648-Z

PNP SILICON EPITAXIAL TRANSISTOR FOR HIGH-SPEED SWITCHING

The 2SA1648 is a mold power transistor developed for high-speed switching and features a very low collector-to-emitter saturation voltage.

This transistor is ideal for use in switching regulators, DC/DC converters, motor drivers, solenoid drivers, and other low-voltage power supply devices, as well as for high-current switching.

FEATURES

- Available for high-current control in small dimension
- Z type is a lead processed product and is deal for mounting a hybrid IC.
- Mold package that does not require an insulating board or insulation bushing
- Low collector saturation voltage:
  $V_{CE(sat)1}$ = –0.3 V MAX. (I_C = –3.0 A)
- Fast switching speed:
  t_f = 0.3 μs MAX. (I_C = –3.0 A)
- High DC current gain and excellent linearity

PACKAGE DRAWINGS (Unit: mm)

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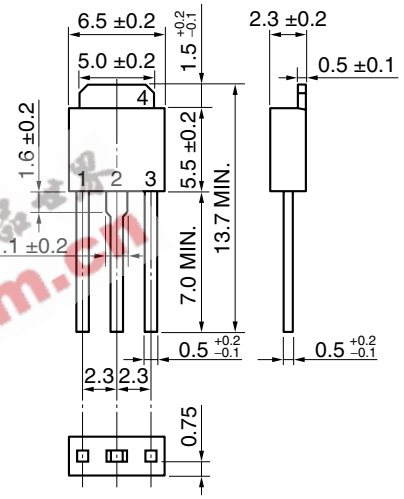
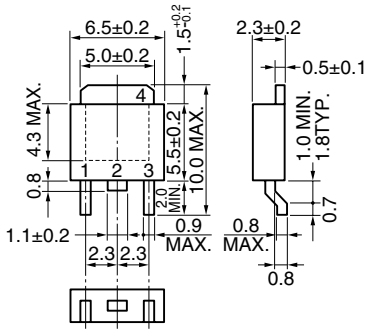


TO-251 (MP-3)



TO-252 (MP3Z)

ELECTRODE CONNECTION

1. Base
2. Collector
3. Emitter
4. Collector (Fin)

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}	–60	V
Emitter to base voltage	V_{EBO}	–7.0	V
Collector current (DC)	$I_{C(DC)}$	–5.0	A
Collector current (pulse)	$I_{C(pulse)}$ Note 1	–10	A
Base current (DC)	$I_{B(DC)}$	–2.5	A
Total power dissipation (Tc = 25°C)	P_T	18	W
Total power dissipation (Ta = 25°C)	P_T	1.0 Note 2, 2.0 Note 3	W
Junction temperature	T_j	150	°C
Storage temperature	T_{stg}	–55 to +150	°C

Notes 1. PW ≤ 300 μs, Duty Cycle ≤ 10%

2. Printing board mounted

3. 7.5 mm^2 × 0.7 mm ceramic board mounted

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Document No. D16121EJ3V0DS00 (3rd edition)
Date Published August 2004 NS CP(K)
Printed in Japan

The mark ★ shows major revised points.

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ELECTRICAL CHARACTERISTICS (T_A = 25°C)

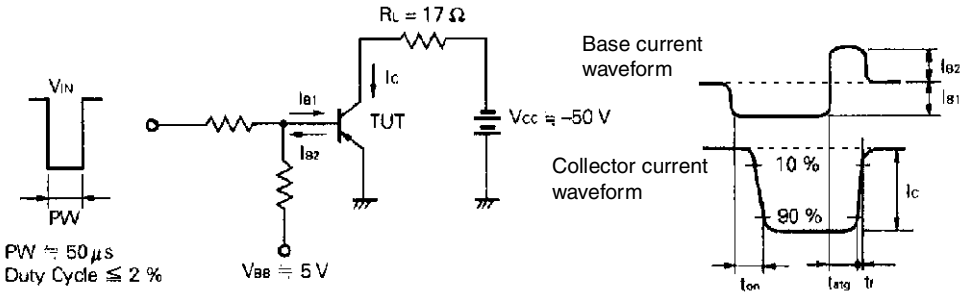
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Collector to emitter voltage	$V_{CEO(SUS)}$	I_C = –3.0 A, I_B = –0.3 A, L = 1 mH	–60			V
Collector to emitter voltage	$V_{CEX(SUS)}$	I_C = –3.0 A, I_{B2} = –I_{B1} = –0.3 A, $V_{BE(OFF)}$ = 1.5 V, L = 180 μH, clamped	–60			V
Collector cutoff current	I_{CBO}	V_{CE} = –60 V, I_E = 0 A			–10	μA
Collector cutoff current	I_{CER}	V_{CE} = –60 V, R_{BE} = 50 Ω, T_A = 125°C			–1.0	mA
Collector cutoff current	I_{CEX1}	V_{CE} = –60 V, $V_{BE(OFF)}$ = 1.5 V			–10	μA
Collector cutoff current	I_{CEX2}	V_{CE} = –60 V, $V_{BE(OFF)}$ = 1.5 V, T_A = 125°C			–1.0	mA
Emitter cutoff current	I_{EBO}	V_{EB} = –5.0 V, I_C = 0 A			–10	μA
DC current gain	h_{FE1} Note	V_{CE} = –2.0 V, I_C = –0.5 A	100			
DC current gain	h_{FE2} Note	V_{CE} = –2.0 V, I_C = –1.0 A	100	200	400	
DC current gain	h_{FE3} Note	V_{CE} = –2.0 V, I_C = –3.0 A	60			
Collector saturation voltage	$V_{CE(sat)1}$ Note	I_C = –3.0 A, I_B = –0.15 A			–0.3	V
Collector saturation voltage	$V_{CE(sat)2}$ Note	I_C = –4.0 A, I_B = –0.2 A			–0.5	V
Base saturation voltage	$V_{BE(sat)1}$ Note	I_C = –3.0 A, I_B = –0.15 A			–1.2	V
Base saturation voltage	$V_{BE(sat)2}$ Note	I_C = –4.0 A, I_B = –0.2 A			–1.5	V
Collector capacitance	C_{ob}	V_{CB} = –10 V, I_E = 0 A, f = 1.0 MHz		80		pF
Gain bandwidth product	f_T	V_{CE} = –10 V, I_C = 0.5 A		90		MHz
Turn-on time	t_{on}	I_C = –3.0 A, R_L = 17 Ω, I_{B1} = –I_{B2} = –0.15 A, V_{CC} ≒ –50 V Refer to **SWITCHING TIME TEST CIRCUIT**.			0.3	μs
Storage time	t_{stg}				1.5	μs
Fall time	t_f				0.3	μs

Note Pulse test PW ≤ 350 μs, Duty Cycle ≤ 2%/Pulsed

h_{FE} CLASSIFICATION

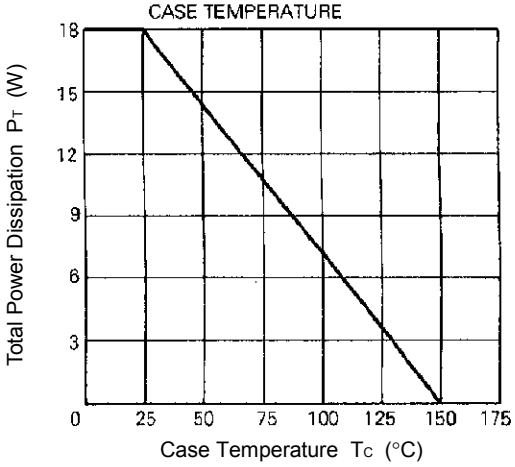
Marking	M	L	K
h_{FE2}	100 to 200	150 to 300	200 to 400

SWITCHING TIME TEST CIRCUIT

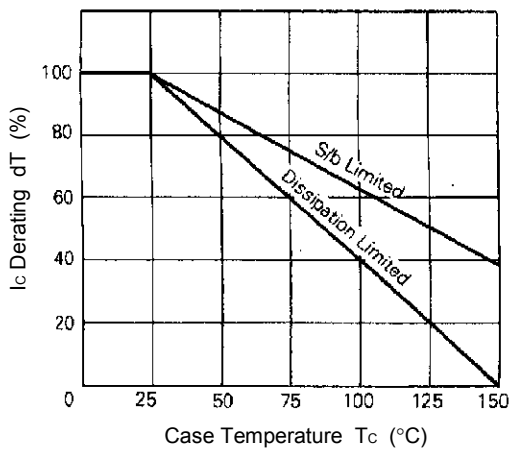


TYPICAL CHARACTERISTICS (T_A = 25°C)

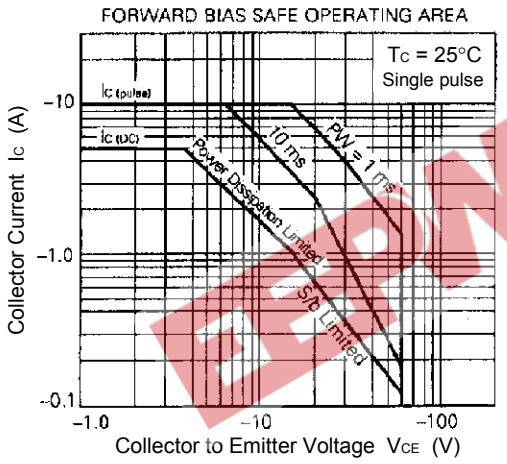
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



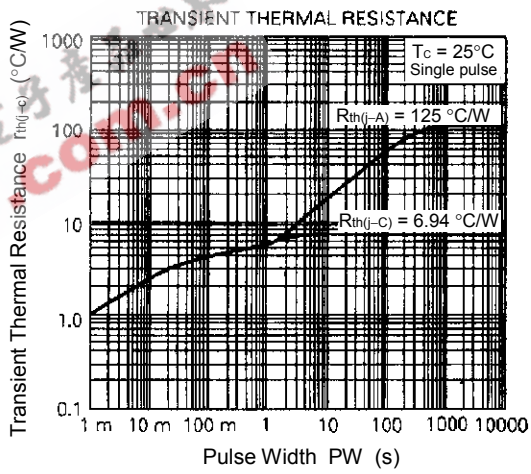
DERATING CURVE OF SAFE OPERATING AREA



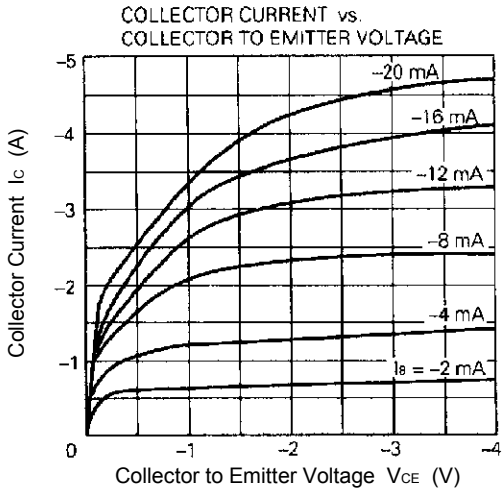
FORWARD BIAS SAFE OPERATING AREA



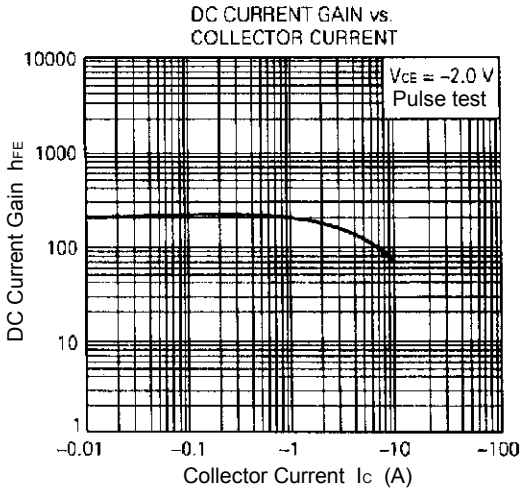
TRANSIENT THERMAL RESISTANCE



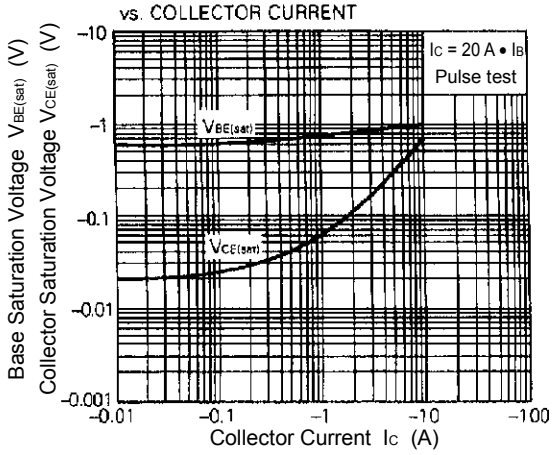
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



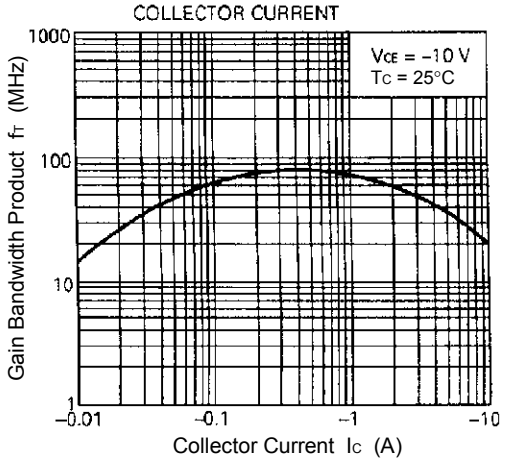
DC CURRENT GAIN vs. COLLECTOR CURRENT



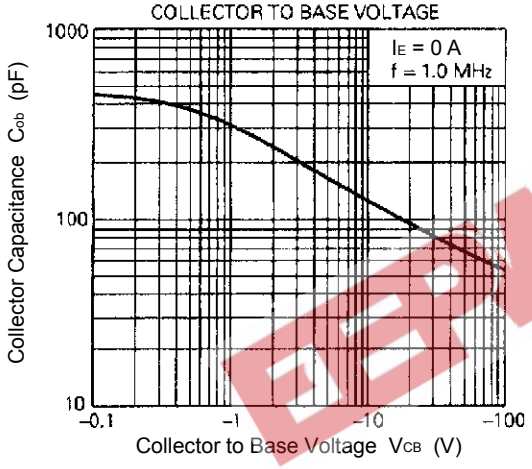
BASE AND COLLECTOR SATURATION VOLTAGE vs. COLLECTOR CURRENT



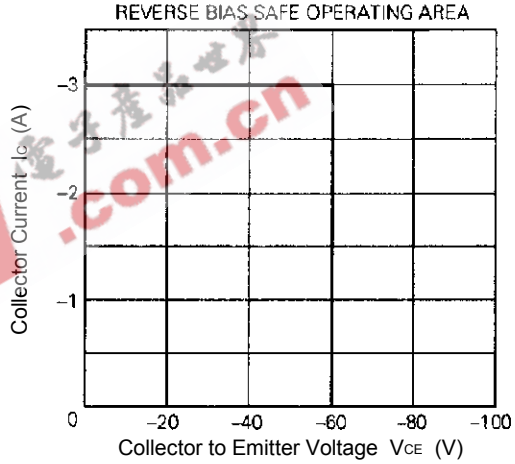
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



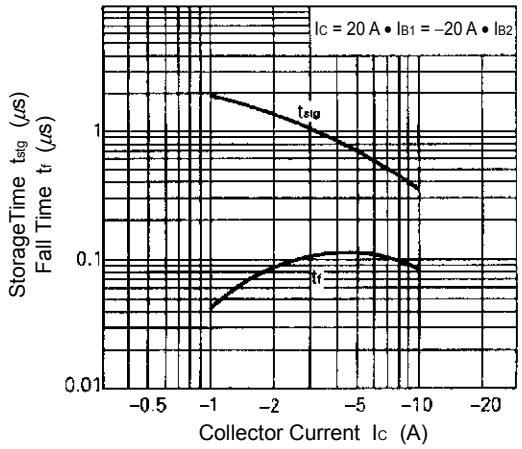
OUTPUT CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



REVERSE BIAS SAFE OPERATING AREA



STORAGE TIME AND FALL TIME vs. COLLECTOR CURRENT



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