

### PNP SILICON EPITAXIAL TRANSISTOR FOR HIGH-SPEED SWITCHING

#### DESCRIPTION

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:  
 $V_{CE(sat)1} = -0.3 \text{ V MAX. (I}_c = -3.0 \text{ A)}$
- Fast switching speed:  
 $t_r = 0.3 \mu\text{s MAX. (I}_c = -3.0 \text{ A)}$
- High DC current gain and excellent linearity

#### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

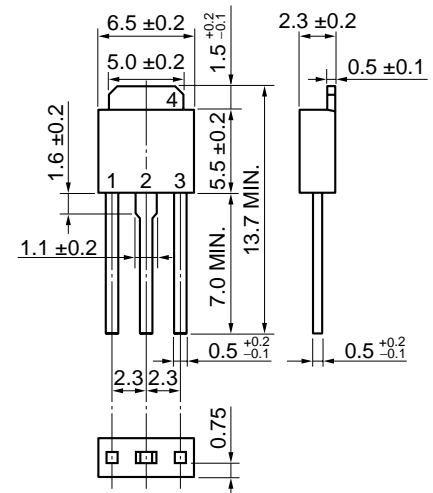
Parameter	Symbol	Ratings	Unit
Collector to base voltage	$V_{CBO}$	-100	V
Collector to emitter voltage	$V_{CEO}$	-60	V
Base to emitter voltage	$V_{EBO}$	-7.0	V
Collector current (DC)	$I_{C(DC)}$	-5.0	A
Collector current (pulse)	$I_{C(pulse)}$ <sup>Note 1</sup>	-10	A
Base current (DC)	$I_{B(DC)}$	-2.5	A
Total power dissipation ( $T_c = 25^\circ\text{C}$ )	$P_T$	18	W
Total power dissipation ( $T_A = 25^\circ\text{C}$ )	$P_T$	1.0 <sup>Note 2</sup> , 2.0 <sup>Note 3</sup>	W
Junction temperature	$T_j$	150	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$

**Notes 1.**  $PW \leq 300 \mu\text{s}$ , Duty Cycle  $\leq 10\%$

**2.** Printing board mounted

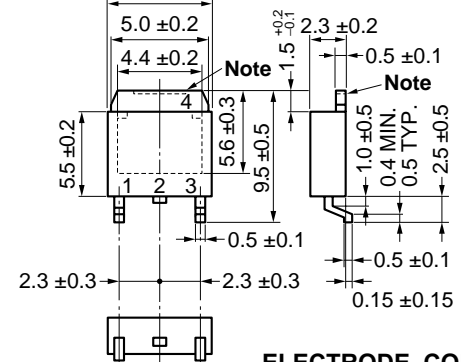
**3.**  $7.5 \text{ cm}^2 \times 0.7 \text{ mm}$  ceramic board mounted

#### PACKAGE DRAWINGS (Unit: mm)



TO-251 (MP-3)

<R>



#### ELECTRODE CONNECTION

- TO-252 (MP-3Z)
1. Base
  2. Collector
  3. Emitter
  4. Collector Fin

**Note** The depth of notch at the top of the fin is from 0 to 0.2 mm.

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**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

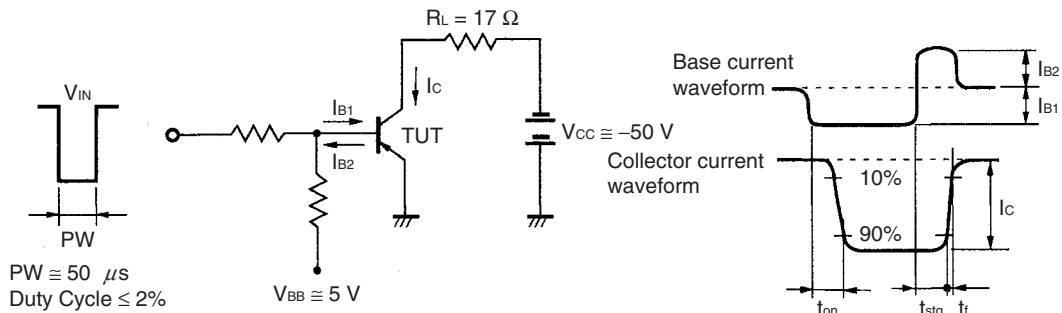
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Collector to emitter voltage	V <sub>CE0(SUS)</sub>	I <sub>C</sub> = -3.0 A, I <sub>B</sub> = -0.3 A, L = 1 mH	-60			V
Collector to emitter voltage	V <sub>CEx(SUS)</sub>	I <sub>C</sub> = -3.0 A, I <sub>B2</sub> = -I <sub>B1</sub> = -0.3 A, V <sub>BE(OFF)</sub> = 1.5 V, L = 180 μH, clamped	-60			V
Collector cutoff current	I <sub>CBO</sub>	V <sub>CE</sub> = -60 V, I <sub>E</sub> = 0 A			-10	μA
Collector cutoff current	I <sub>CER</sub>	V <sub>CE</sub> = -60 V, R <sub>BE</sub> = 50 Ω, T <sub>A</sub> = 125°C			-1.0	mA
Collector cutoff current	I <sub>CEx1</sub>	V <sub>CE</sub> = -60 V, V <sub>BE(OFF)</sub> = 1.5 V			-10	μA
Collector cutoff current	I <sub>CEx2</sub>	V <sub>CE</sub> = -60 V, V <sub>BE(OFF)</sub> = 1.5 V, T <sub>A</sub> = 125°C			-1.0	mA
Emitter cutoff current	I <sub>EBO</sub>	V <sub>EB</sub> = -5.0 V, I <sub>C</sub> = 0 A			-10	μA
DC current gain	h <sub>FE1</sub> <sup>Note</sup>	V <sub>CE</sub> = -2.0 V, I <sub>C</sub> = -0.5 A	100			
DC current gain	h <sub>FE2</sub> <sup>Note</sup>	V <sub>CE</sub> = -2.0 V, I <sub>C</sub> = -1.0 A	100	200	400	
DC current gain	h <sub>FE3</sub> <sup>Note</sup>	V <sub>CE</sub> = -2.0 V, I <sub>C</sub> = -3.0 A	60			
Collector saturation voltage	V <sub>CE(sat)1</sub> <sup>Note</sup>	I <sub>C</sub> = -3.0 A, I <sub>B</sub> = -0.15 A			-0.3	V
Collector saturation voltage	V <sub>CE(sat)2</sub> <sup>Note</sup>	I <sub>C</sub> = -4.0 A, I <sub>B</sub> = -0.2 A			-0.5	V
Base saturation voltage	V <sub>BE(sat)1</sub> <sup>Note</sup>	I <sub>C</sub> = -3.0 A, I <sub>B</sub> = -0.15 A			-1.2	V
Base saturation voltage	V <sub>BE(sat)2</sub> <sup>Note</sup>	I <sub>C</sub> = -4.0 A, I <sub>B</sub> = -0.2 A			-1.5	V
Collector capacitance	C <sub>ob</sub>	V <sub>CB</sub> = -10 V, I <sub>E</sub> = 0 A, f = 1.0 MHz		80		pF
Gain bandwidth product	f <sub>r</sub>	V <sub>CE</sub> = -10 V, I <sub>C</sub> = 0.5 A		90		MHz
Turn-on time	t <sub>on</sub>	I <sub>C</sub> = -3.0 A, R <sub>L</sub> = 17 Ω, I <sub>B1</sub> = -I <sub>B2</sub> = -0.15 A, V <sub>CC</sub> ≅ -50 V Refer to <b>SWITCHING TIME TEST CIRCUIT.</b>			0.3	μs
Storage time	t <sub>stg</sub>				1.5	μs
Fall time	t <sub>f</sub>				0.3	μs

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

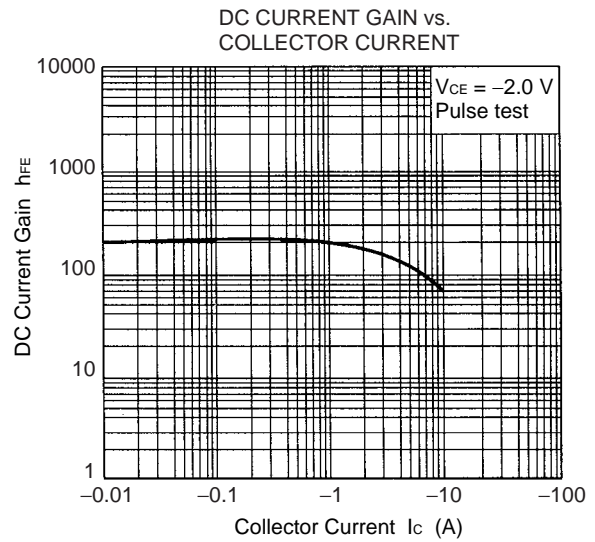
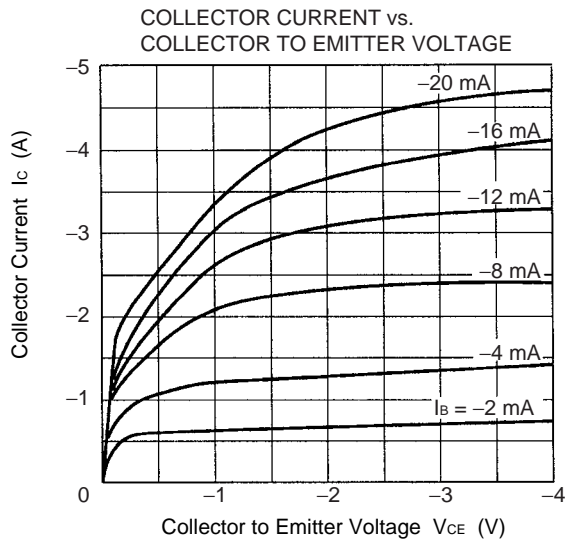
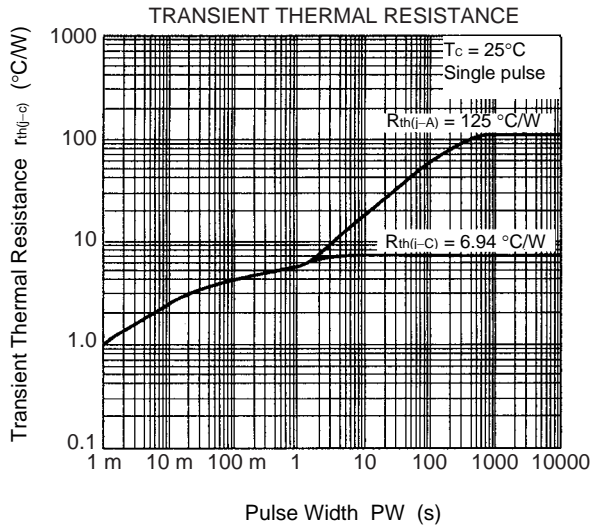
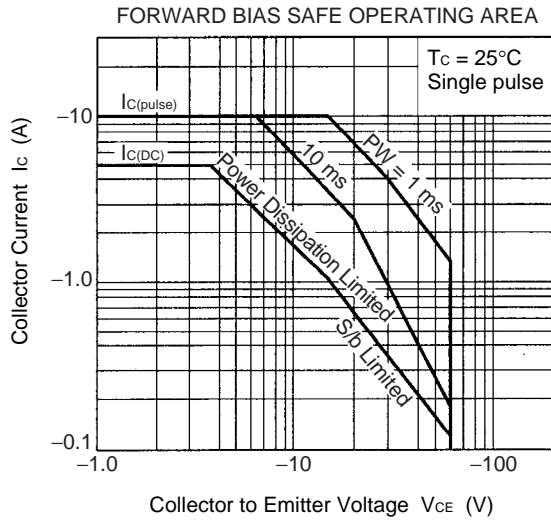
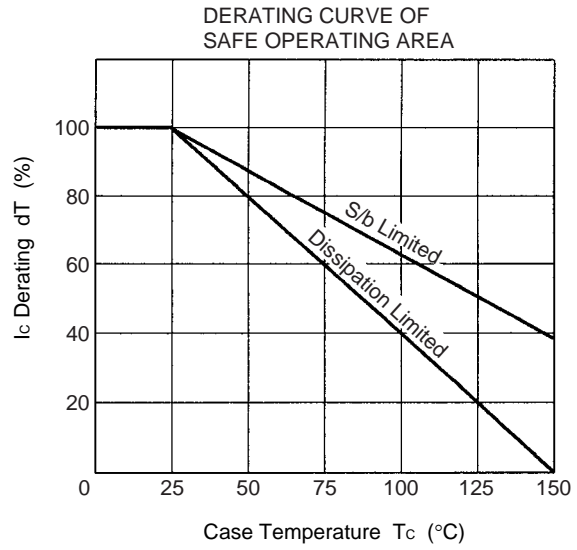
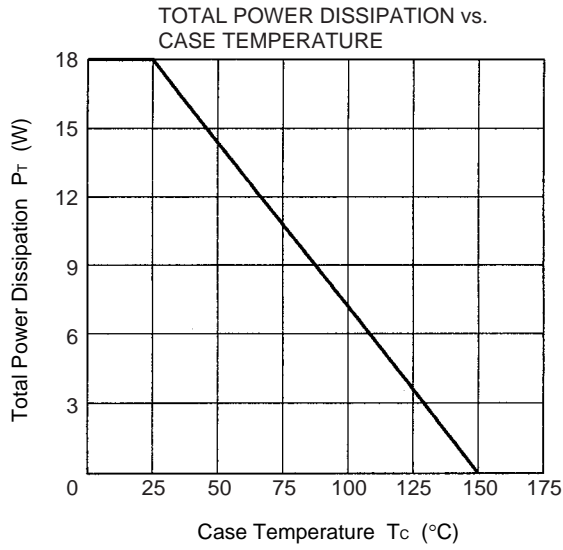
**h<sub>FE</sub> CLASSIFICATION**

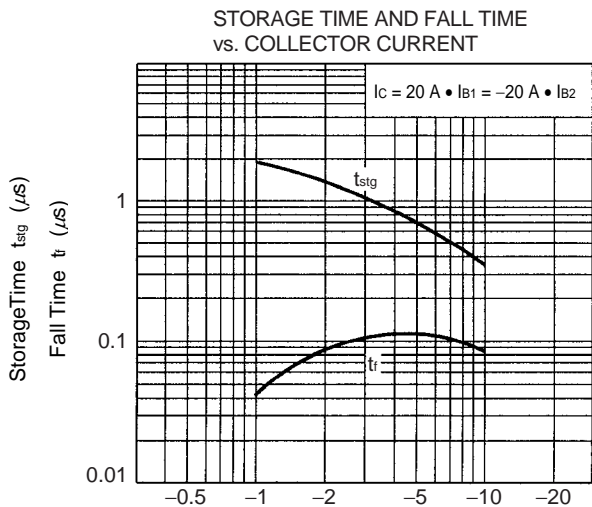
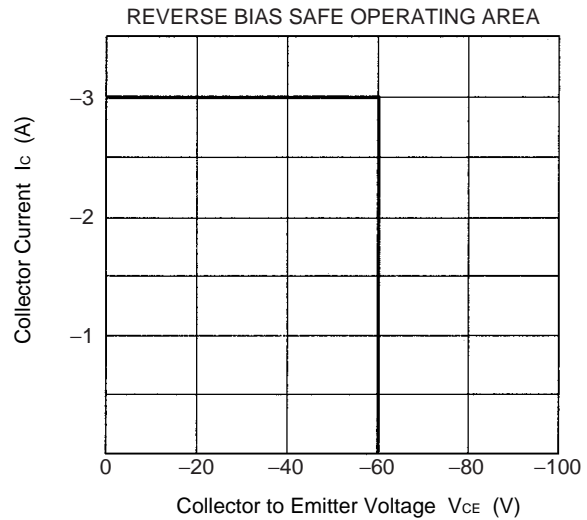
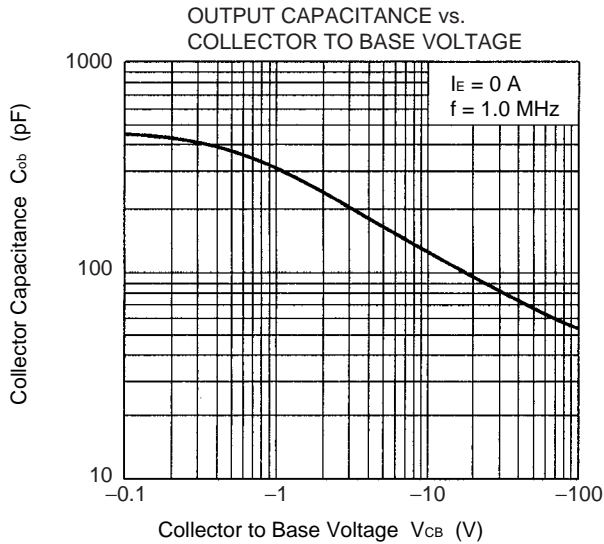
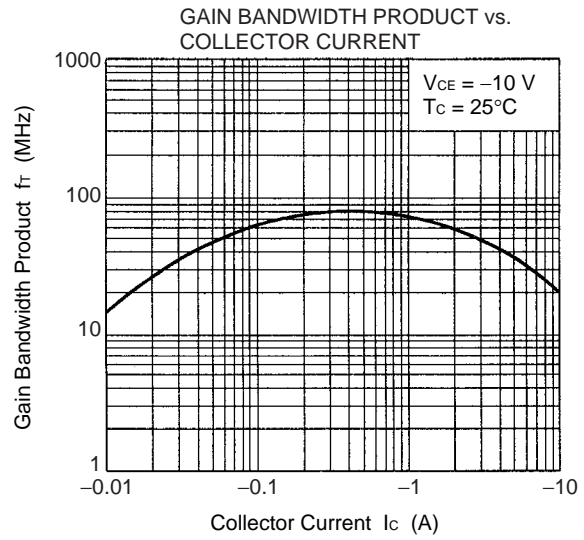
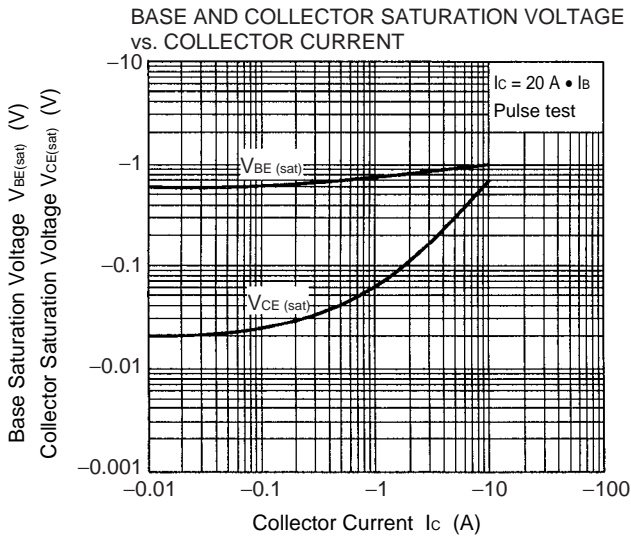
Marking	M	L	K
h <sub>FE2</sub>	100 to 200	150 to 300	200 to 400

**SWITCHING TIME TEST CIRCUIT**



TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)





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