

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

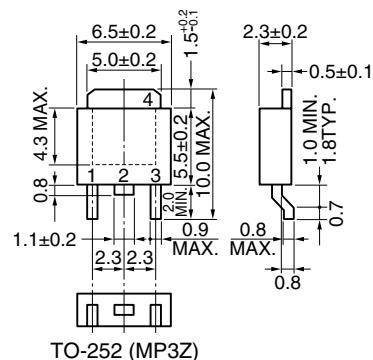
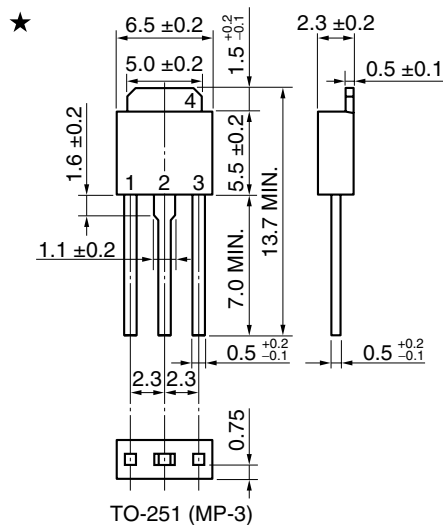
#### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C)

Parameter	Symbol	Ratings	Unit
Collector to base voltage	V <sub>CB0</sub>	-100	V
Collector to emitter voltage	V <sub>CEO</sub>	-60	V
Emitter to base voltage	V <sub>EBO</sub>	-7.0	V
Collector current (DC)	I <sub>C(DC)</sub>	-5.0	A
Collector current (pulse)	I <sub>C(pulse)</sub> <sup>Note 1</sup>	-10	A
Base current (DC)	I <sub>B(DC)</sub>	-2.5	A
Total power dissipation (T <sub>c</sub> = 25°C)	P <sub>T</sub>	18	W
Total power dissipation (T <sub>a</sub> = 25°C)	P <sub>T</sub>	1.0 <sup>Note 2</sup> , 2.0 <sup>Note 3</sup>	W
Junction temperature	T <sub>j</sub>	150	°C
Storage temperature	T <sub>stg</sub>	-55 to +150	°C

- Notes 1.** PW ≤ 300 μs, Duty Cycle ≤ 10%
- 2.** Printing board mounted
- 3.** 7.5 mm<sup>2</sup> × 0.7 mm ceramic board mounted

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#### PACKAGE DRAWINGS (Unit: mm)



#### ELECTRODE CONNECTION

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

**ELECTRICAL CHARACTERISTICS (TA = 25°C)**

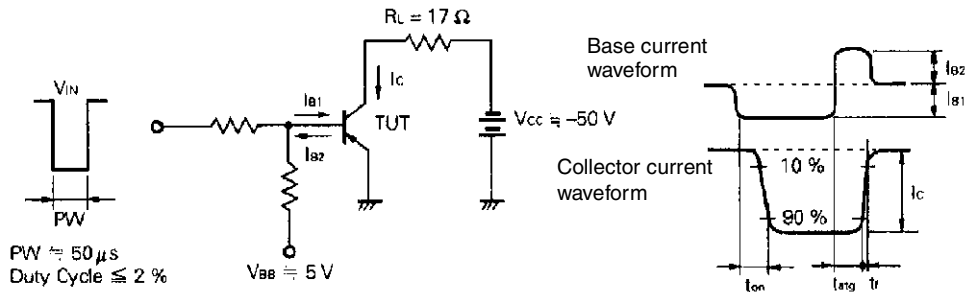
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Collector to emitter voltage	$V_{CEO(SUS)}$	$I_C = -3.0\text{ A}, I_B = -0.3\text{ A}, L = 1\text{ mH}$	-60			V
Collector to emitter voltage	$V_{CEX(SUS)}$	$I_C = -3.0\text{ A}, I_{B2} = -I_{B1} = -0.3\text{ A}, V_{BE(OFF)} = 1.5\text{ V}, L = 180\text{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

**Note** Pulse test  $PW \leq 350\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2\%/Pulsed$

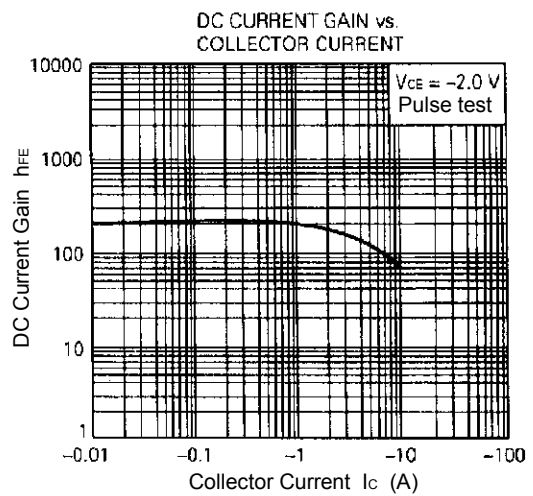
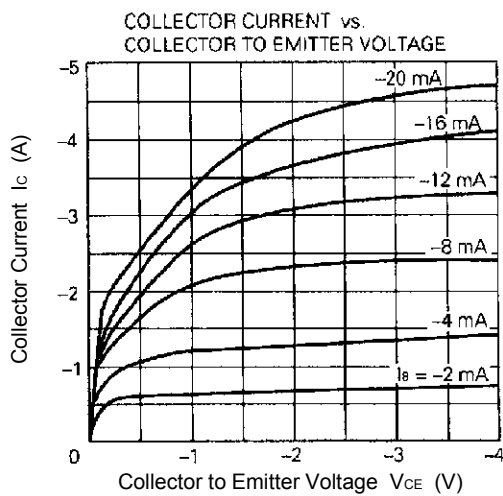
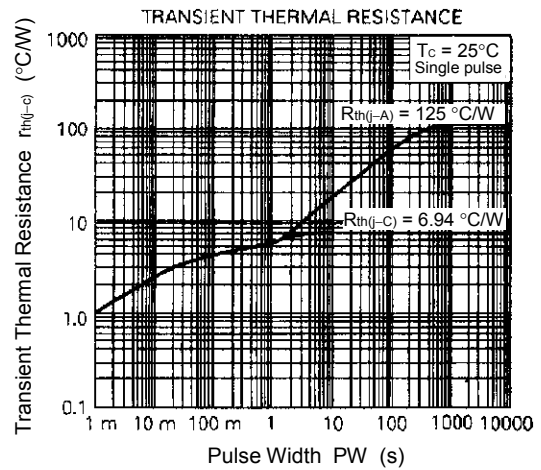
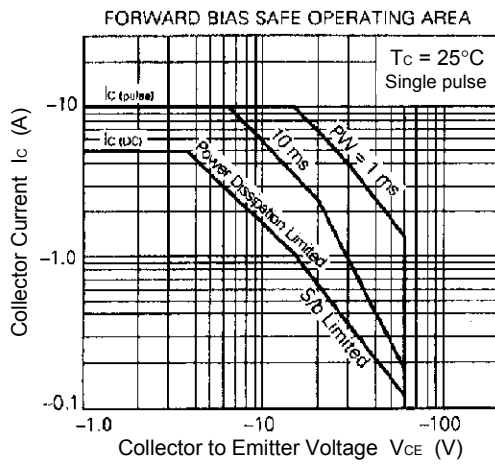
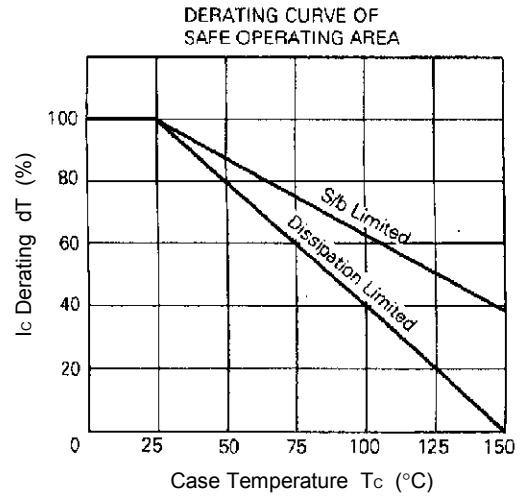
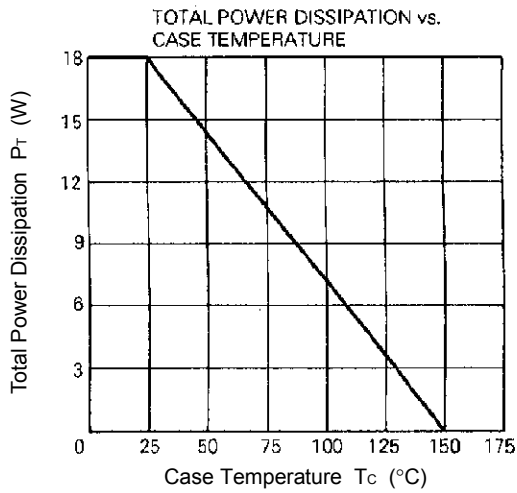
**hFE CLASSIFICATION**

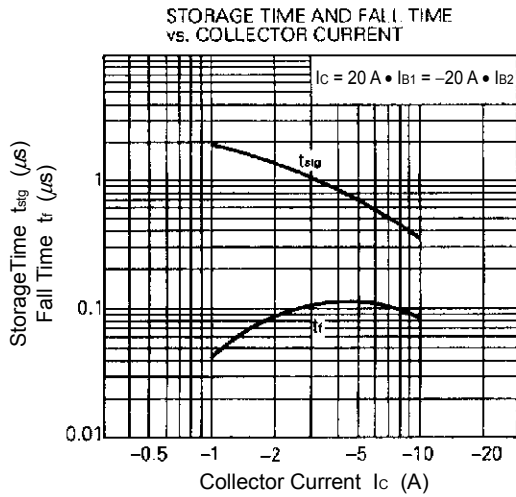
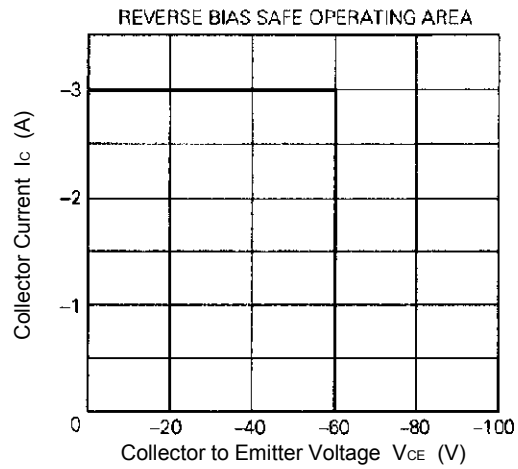
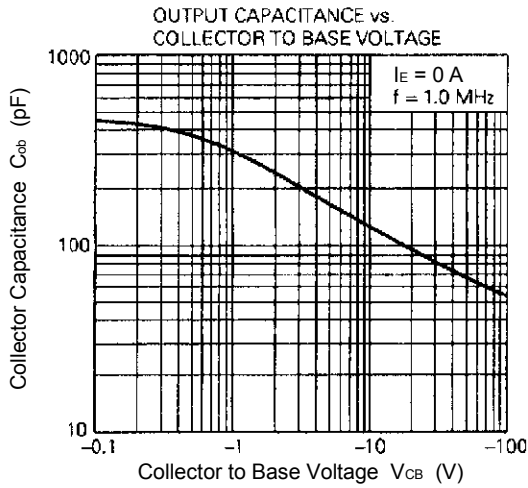
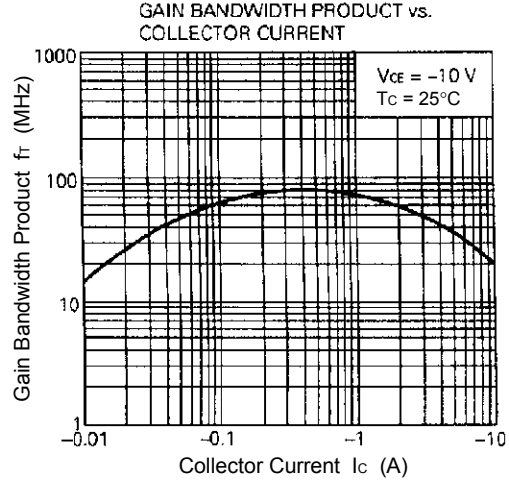
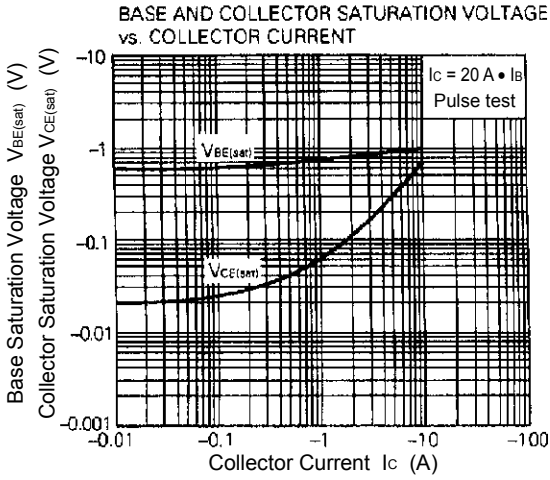
Marking	M	L	K
$h_{FE2}$	100 to 200	150 to 300	200 to 400

**SWITCHING TIME TEST CIRCUIT**



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





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