

To our customers,

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## Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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# DATA SHEET



# SILICON POWER TRANSISTOR 2SA1648, 1648-Z

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

### ABSOLUTE MAXIMUM RATINGS (TA = 25°C)

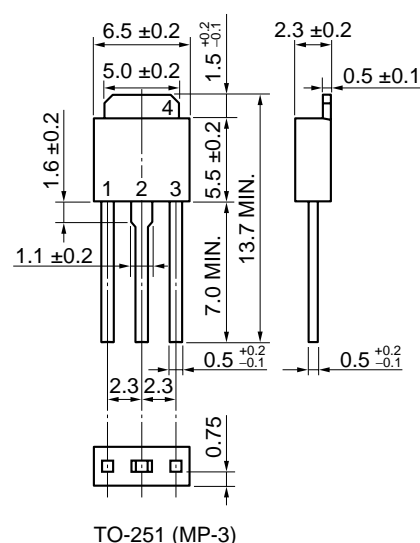
Parameter	Symbol	Ratings	Unit
Collector to base voltage	$V_{CBO}$	-100	V
Collector to emitter voltage	$V_{CEO}$	-60	V
Base to emitter voltage	$V_{EBO}$	-7.0	V
Collector current (DC)	$I_{C(DC)}$	-5.0	A
Collector current (pulse)	$I_{C(pulse)}$ <sup>Note 1</sup>	-10	A
Base current (DC)	$I_{B(DC)}$	-2.5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

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

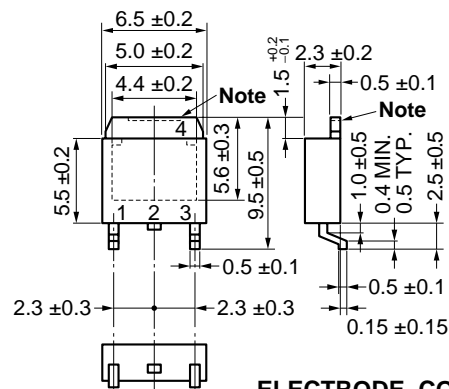
**2.** Printing board mounted

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

### PACKAGE DRAWINGS (Unit: mm)



<R>



### ELECTRODE CONNECTION

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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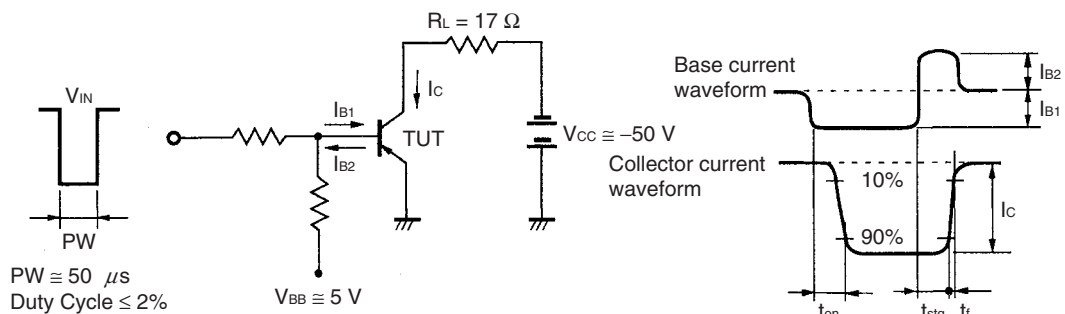
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Collector to emitter voltage	V <sub>CE0(SUS)</sub>	I <sub>C</sub> = -3.0 A, I <sub>B</sub> = -0.3 A, L = 1 mH	-60			V
Collector to emitter voltage	V <sub>CEx(SUS)</sub>	I <sub>C</sub> = -3.0 A, I <sub>B2</sub> = -I <sub>B1</sub> = -0.3 A, V <sub>BE(OFF)</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>T</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

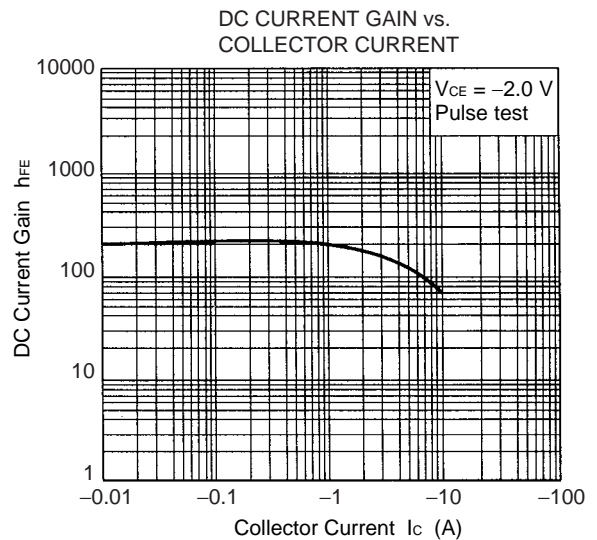
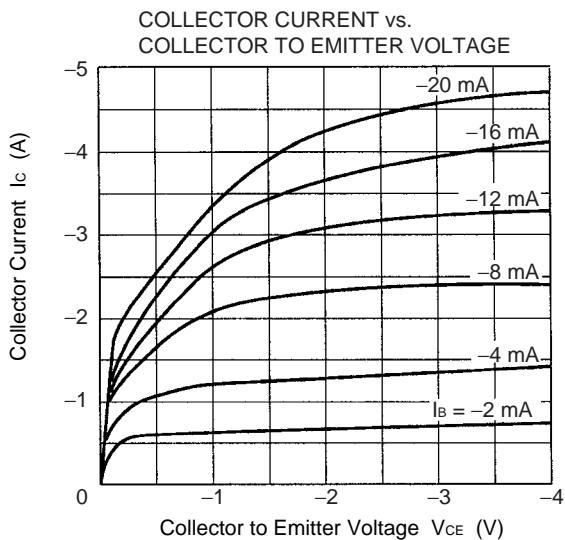
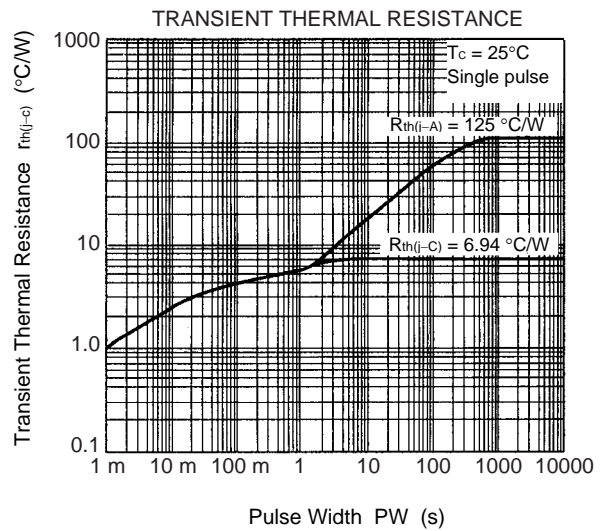
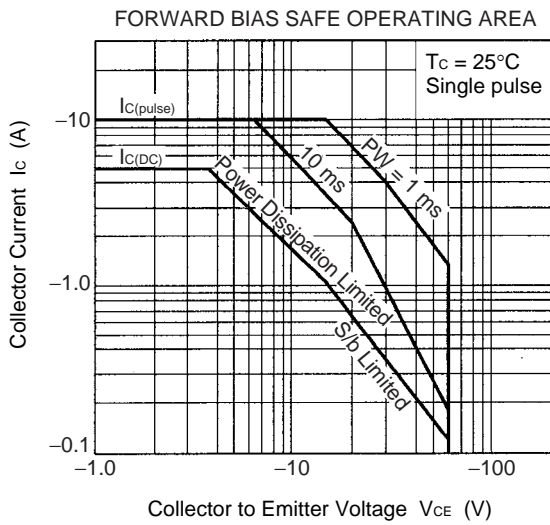
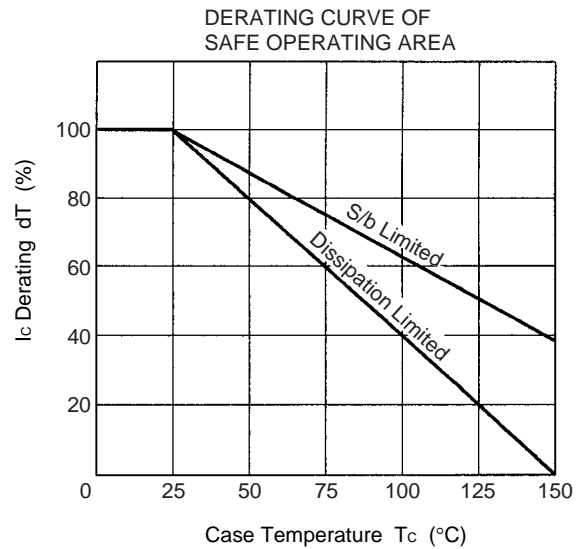
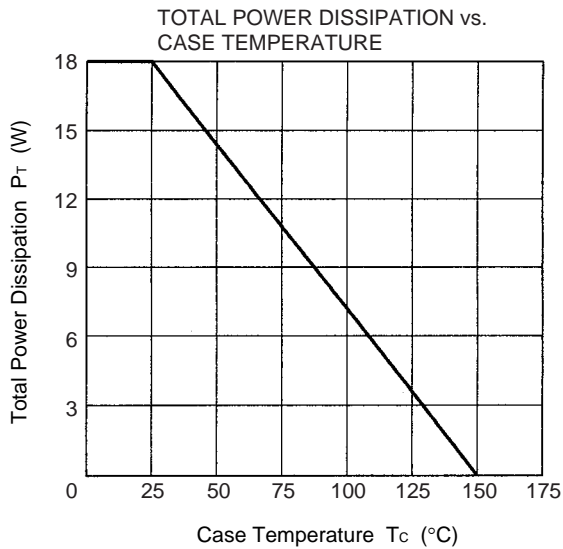
**h<sub>FE</sub> CLASSIFICATION**

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

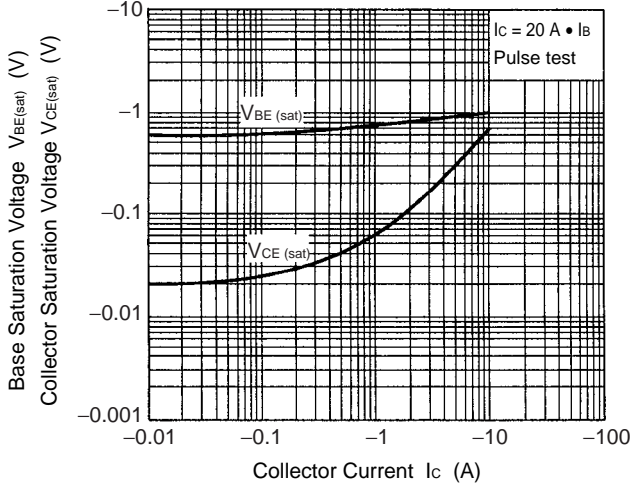
**SWITCHING TIME TEST CIRCUIT**



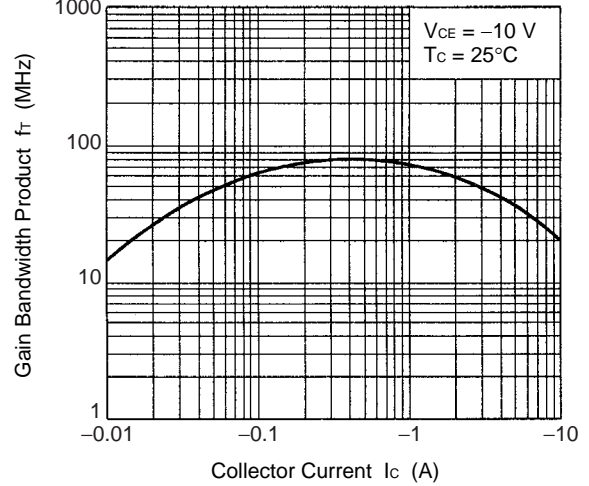
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)



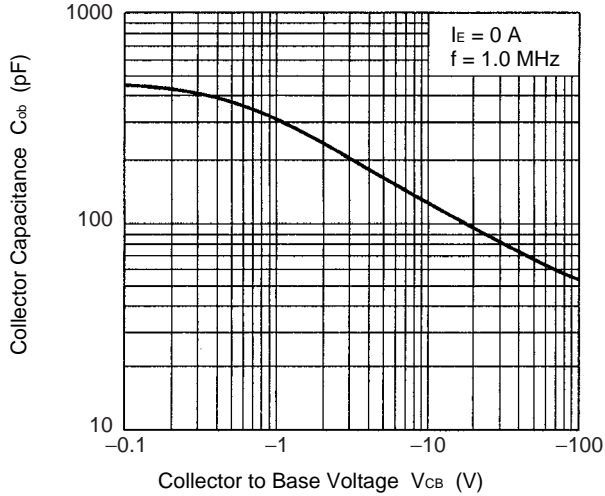
BASE AND COLLECTOR SATURATION VOLTAGE vs. COLLECTOR CURRENT



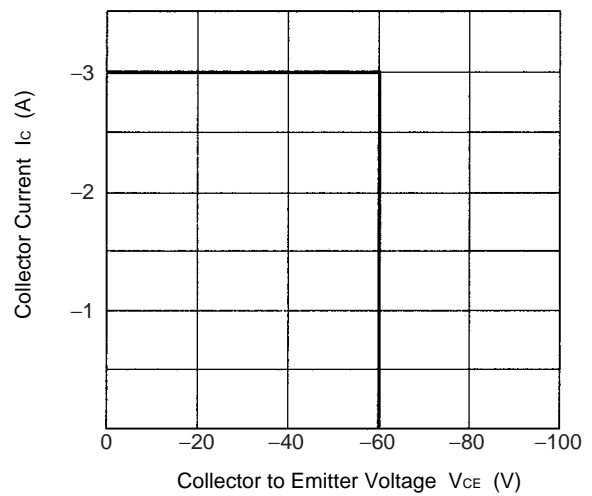
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



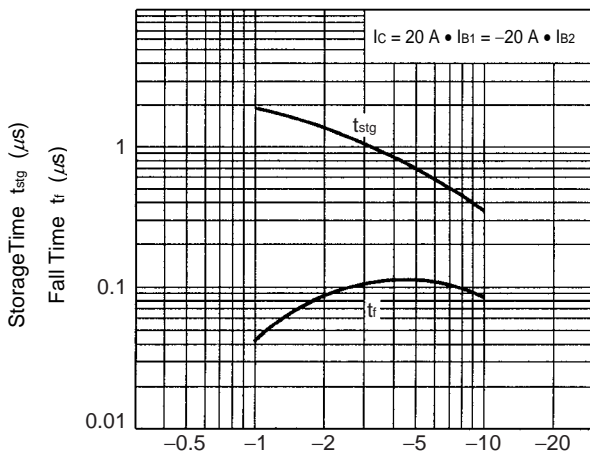
OUTPUT CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



REVERSE BIAS SAFE OPERATING AREA



STORAGE TIME AND FALL TIME vs. COLLECTOR CURRENT



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