

# Bipolar Transistor

(-50 V, (-)5 A, Low  $V_{CE(sat)}$ ,  
(PNP)NPN Single TP/TP-FA

## 2SB1203/2SD1803

### Features

- Low Collector-to-Emitter Saturation Voltage
- Excellent Linearity of  $h_{FE}$
- Small and Slim Package Making It Easy to Make  
2SB1203/2SD1803–Applied Sets Smaller
- High Current and High  $f_T$
- Fast Switching Speed

### Applications

- Relay Drivers, High-Speed Inverters, Converters, and Other General High-Current Switching Applications

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

Symbol	Parameter	Condition	Rating	Unit
$V_{CBO}$	Collector-to-Base Voltage		(-)60	V
$V_{CEO}$	Collector-to-Emitter Voltage		(-)50	V
$V_{EBO}$	Emitter-to-Base Voltage		(-)6	V
$I_C$	Collector Current		(-)5	A
$I_{CP}$	Collector Current (Pulse)		(-)8	A
$P_C$	Collector Dissipation		1	W
		$T_c = 25^\circ\text{C}$	20	W
$T_J$	Junction Temperature		150	$^\circ\text{C}$
$T_{stg}$	Storage Temperature		-55 to +150	$^\circ\text{C}$

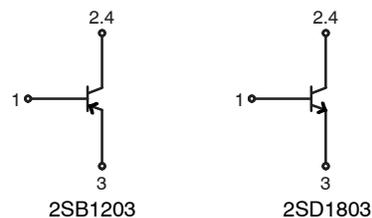
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



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### ELECTRICAL CONNECTION

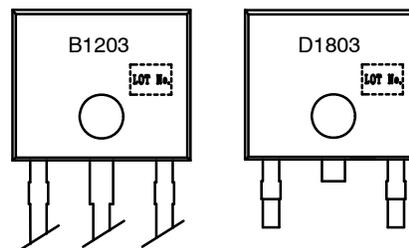


IPAK / TP  
CASE 369AJ



DPAK / TP-FA  
CASE 369AH

### MARKING DIAGRAM



### ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

## 2SB1203/2SD1803

### ELECTRICAL CHARACTERISTICS (at $T_A = 25^\circ\text{C}$ )

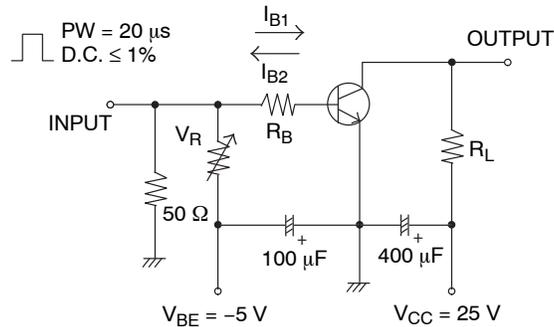
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	Collector Cutoff Current	$V_{CB} = (-)40\text{ V}, I_E = 0\text{ A}$			(-1)	$\mu\text{A}$
$I_{EBO}$	Emitter Cutoff Current	$V_{EB} = (-)4\text{ V}, I_C = 0\text{ A}$			(-1)	$\mu\text{A}$
$h_{FE1}$	DC Current Gain	$V_{CE} = (-)2\text{ V}, I_C = (-)0.5\text{ A}$	70 (Note 1)		400 (Note 1)	
$h_{FE2}$		$V_{CE} = (-)2\text{ V}, I_C = (-)4\text{ A}$	35			
$f_T$	Gain-Bandwidth Product	$V_{CE} = (-)5\text{ V}, I_C = (-)1\text{ A}$		(130)180		MHz
$C_{ob}$	Output Capacitance	$V_{CB} = (-)10\text{ V}, f = 1\text{ MHz}$		(60)40		pF
$V_{CE(sat)}$	Collector-to-Emitter Saturation Voltage	$I_C = (-)3\text{ A}, I_B = (-)0.15\text{ A}$		(-280)220	(-550)400	mV
$V_{BE(sat)}$	Base-to-Emitter Saturation Voltage	$I_C = (-)3\text{ A}, I_B = (-)0.15\text{ A}$		(-)0.95	(-)1.3	V
$V_{(BR)CBO}$	Collector-to-Base Breakdown Voltage	$I_C = (-)10\text{ }\mu\text{A}, I_E = 0\text{ A}$	(-)60			V
$V_{(BR)CEO}$	Collector-to-Emitter Breakdown Voltage	$I_C = (-)1\text{ mA}, R_{BE} = \infty$	(-)50			V
$V_{(BR)EBO}$	Emitter-to-Base Breakdown Voltage	$I_E = (-)10\text{ }\mu\text{A}, I_C = 0\text{ A}$	(-)6			V
$t_{on}$	Turn-On Time	See Specified Test Circuit		(50)50		ns
$t_{stg}$	Storage Time			(450)500		ns
$t_f$	Fall Time			(20)20		ns

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. The 2SB1203/2SD1803 are classified by 0.5 A  $h_{FE}$  as follows:

Rank	Q	R	S	T
$h_{FE}$	70 to 140	100 to 200	140 to 280	200 to 400

### Switching Time Test Circuit



$I_C = 10\text{ mA}, I_{B1} = -10\text{ mA}, I_{B2} = 2\text{ mA}$   
For PNP, the polarity is reversed.

# 2SB1203/2SD1803

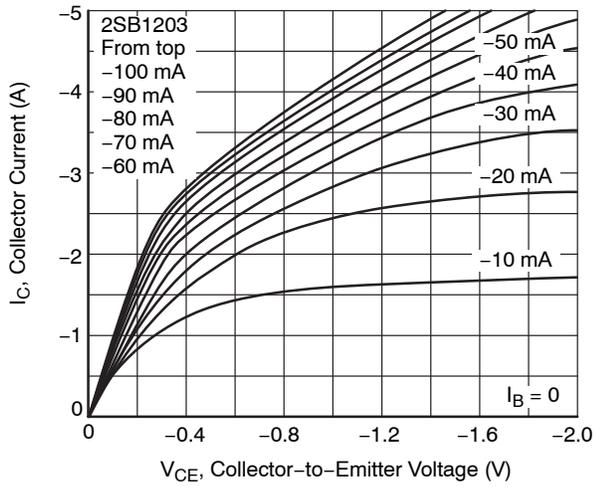


Figure 1.  $I_C - V_{CE}$

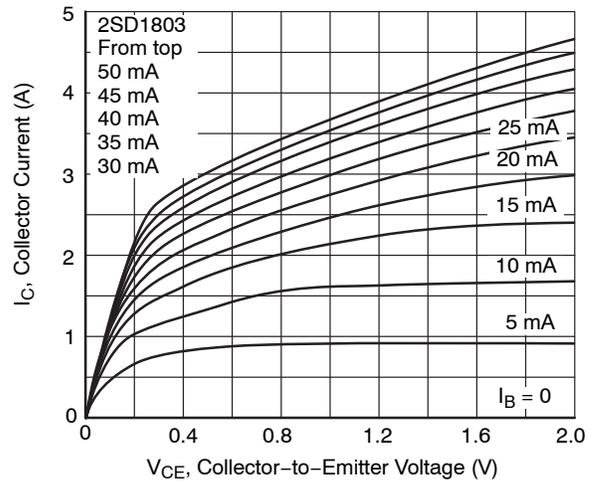


Figure 2.  $I_C - V_{CE}$

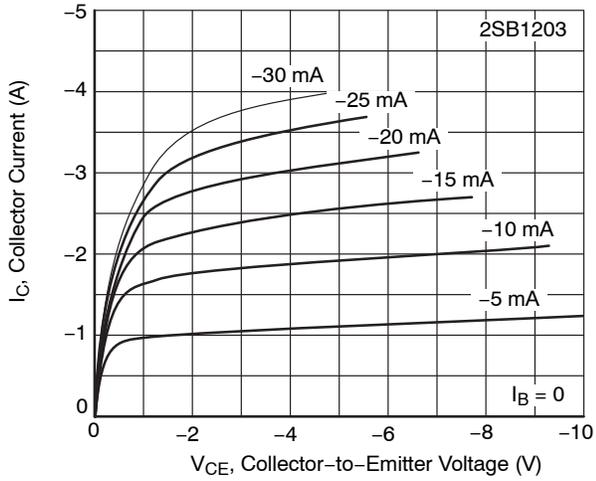


Figure 3.  $I_C - V_{CE}$

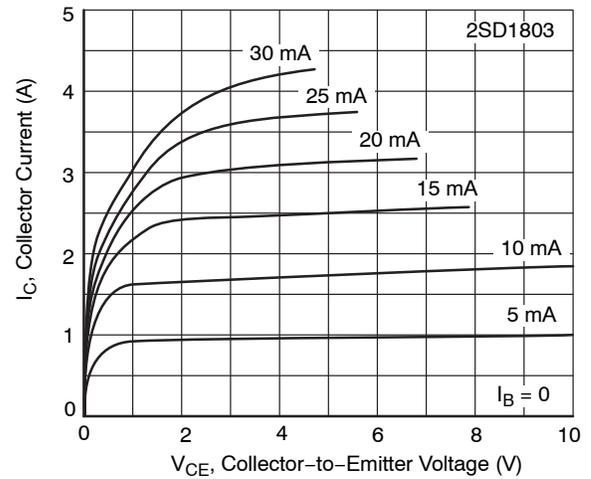


Figure 4.  $I_C - V_{CE}$

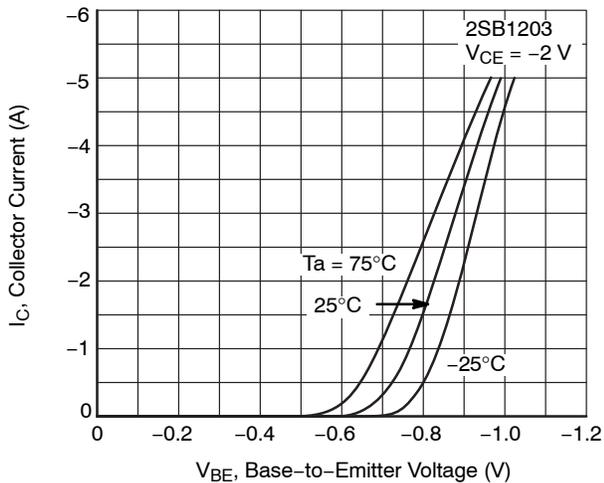


Figure 5.  $I_C - V_{BE}$

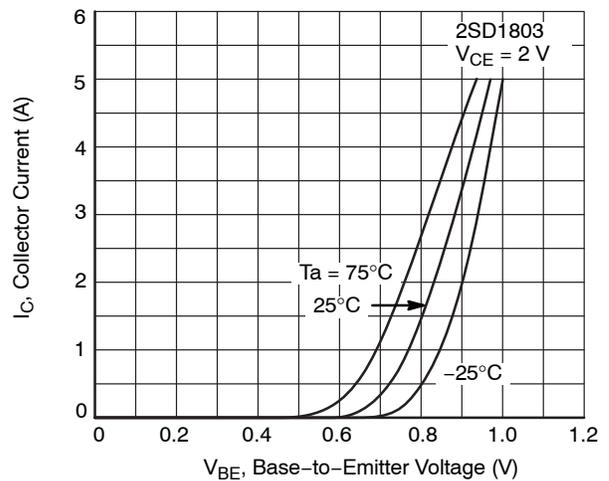


Figure 6.  $I_C - V_{BE}$

# 2SB1203/2SD1803

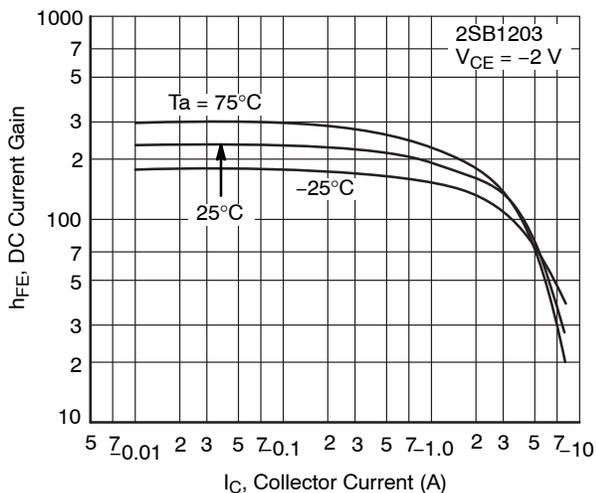


Figure 7. h<sub>FE</sub> - I<sub>C</sub>

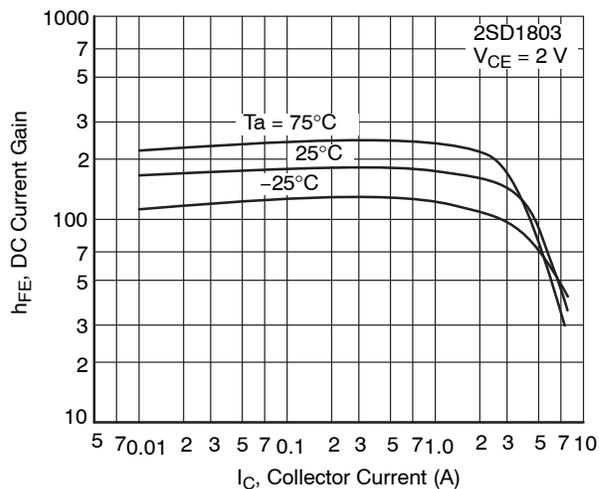


Figure 8. h<sub>FE</sub> - I<sub>C</sub>

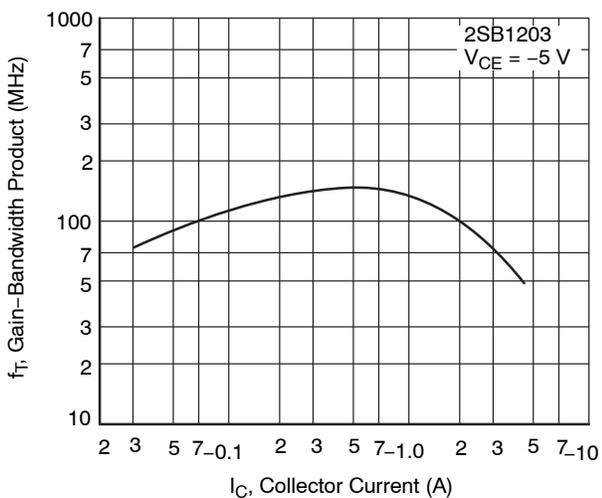


Figure 9. f<sub>T</sub> - I<sub>C</sub>

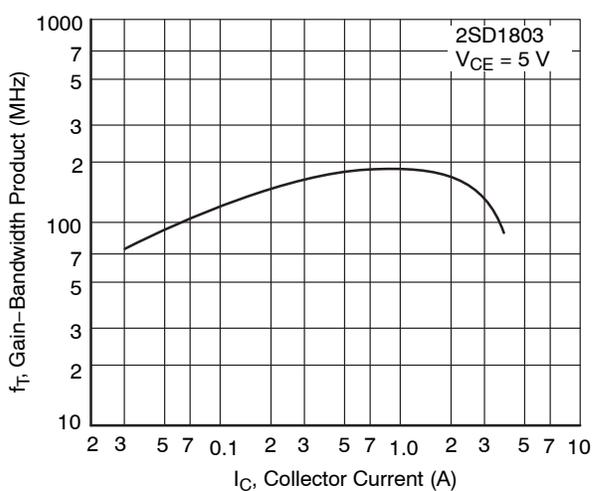


Figure 10. f<sub>T</sub> - I<sub>C</sub>

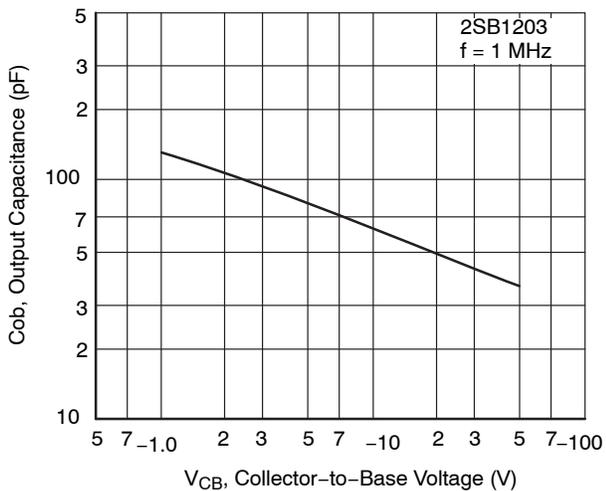


Figure 11. C<sub>ob</sub> - V<sub>CB</sub>

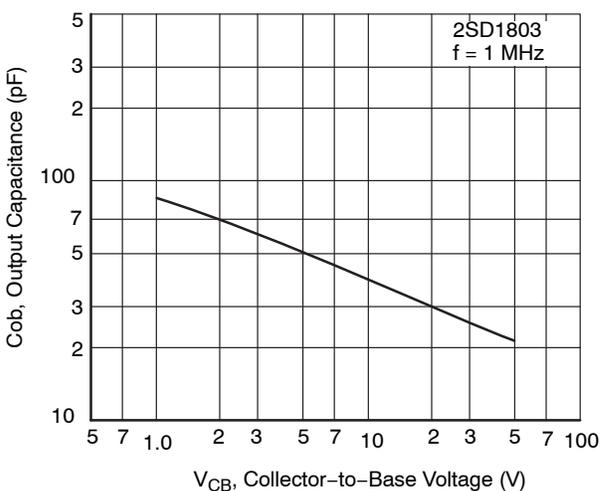


Figure 12. C<sub>ob</sub> - V<sub>CB</sub>

# 2SB1203/2SD1803

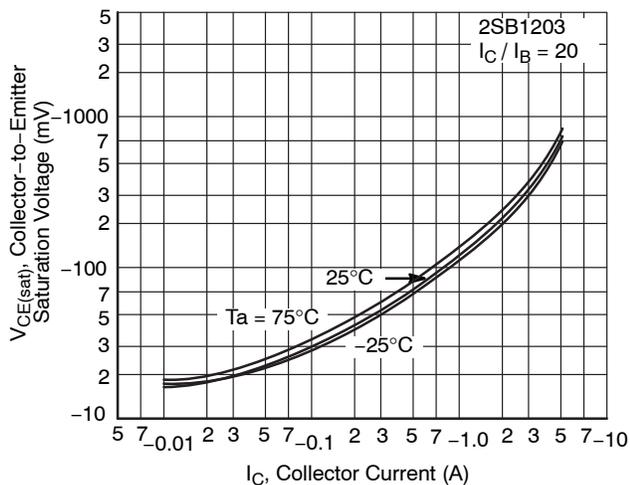


Figure 13.  $V_{CE(sat)} - I_C$

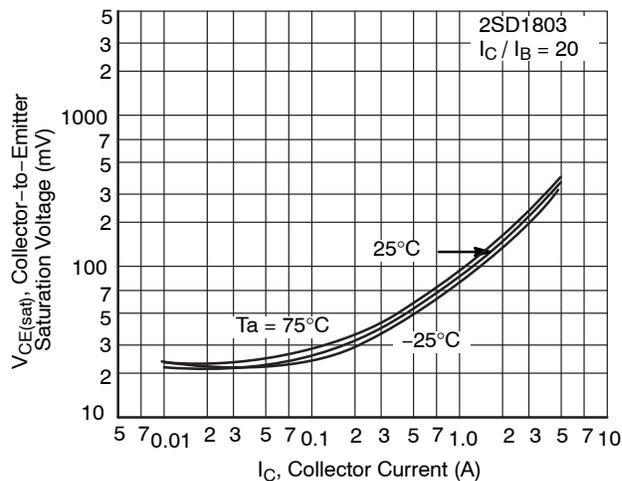


Figure 14.  $V_{CE(sat)} - I_C$

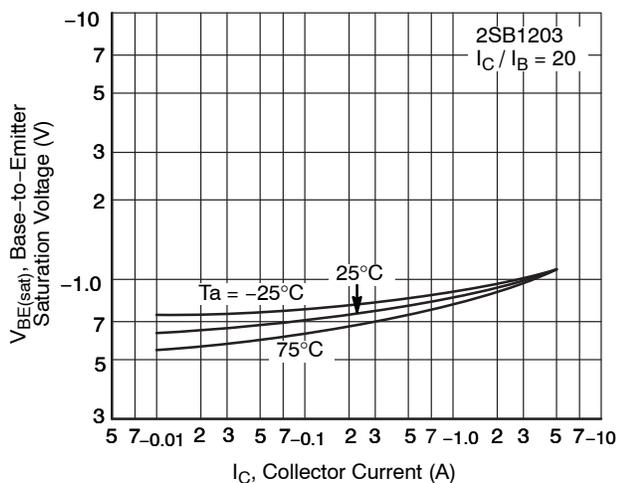


Figure 15.  $V_{BE(sat)} - I_C$

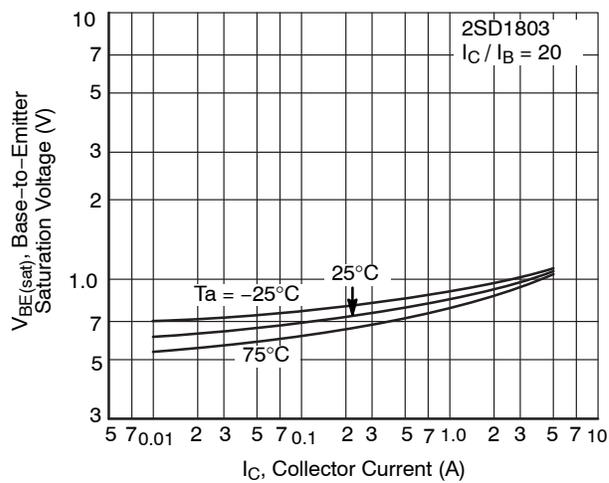


Figure 16.  $V_{BE(sat)} - I_C$

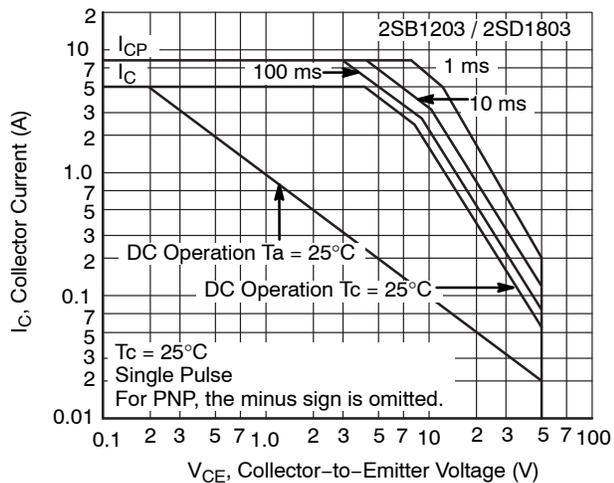


Figure 17. ASO

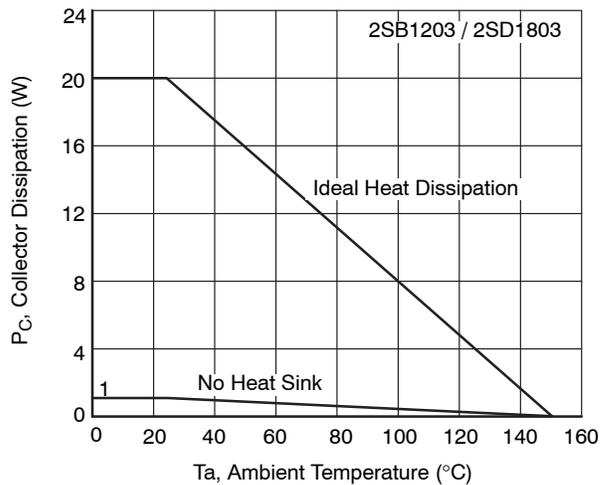


Figure 18.  $P_C - T_a$

## 2SB1203/2SD1803

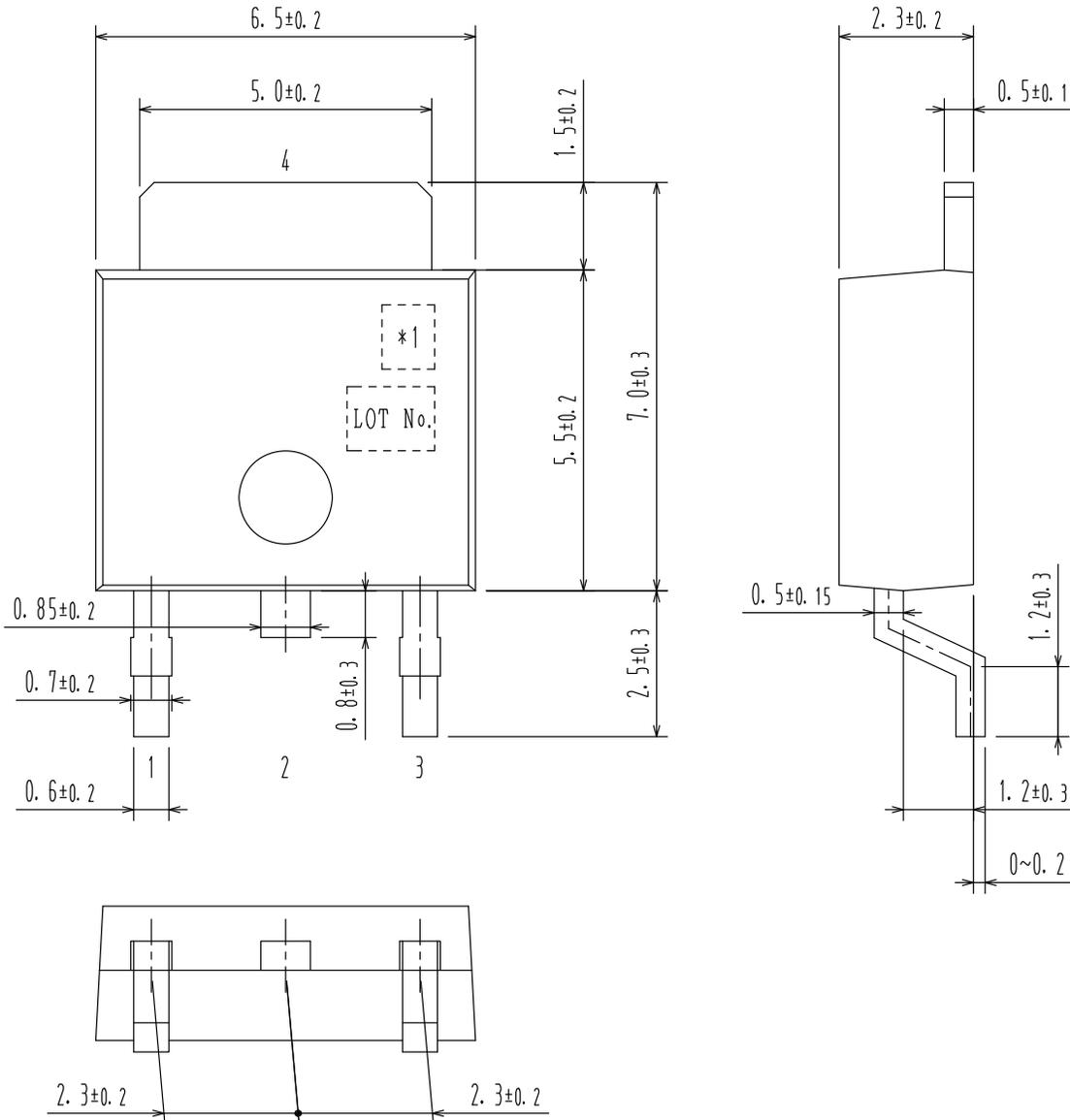
### ORDERING INFORMATION

Device	Package	Shipping	memo
2SB1203S-E	TP	500pcs./bag	Pb Free
2SB1203S-H	TP	500pcs./bag	Pb Free and Halogen Free
2SB1203T-H	TP	500pcs./bag	Pb Free and Halogen Free
2SD1803S-E	TP	500pcs./bag	Pb Free
2SD1803S-H	TP	500pcs./bag	Pb Free and Halogen Free
2SD1803T-E	TP	500pcs./bag	Pb Free
2SD1803T-H	TP	500pcs./bag	Pb Free and Halogen Free
2SB1203S-TL-E	TP-FA	700pcs./bag	Pb Free
2SB1203S-TL-H	TP-FA	700pcs./bag	Pb Free and Halogen Free
2SB1203T-TL-E	TP-FA	700pcs./bag	Pb Free
2SB1203T-TL-H	TP-FA	700pcs./bag	Pb Free and Halogen Free
2SD1803S-TL-E	TP-FA	700pcs./bag	Pb Free
2SD1803S-TL-H	TP-FA	700pcs./bag	Pb Free and Halogen Free
2SD1803T-TL-E	TP-FA	700pcs./bag	Pb Free
2SD1803T-TL-H	TP-FA	700pcs./bag	Pb Free and Halogen Free

**MECHANICAL CASE OUTLINE**  
**PACKAGE DIMENSIONS**

**DPAK / TP-FA**  
**CASE 369AH**  
**ISSUE O**

DATE 30 JAN 2012



Pin 2 is idle pin with electrical designation only carried.

- 1:
- 2:
- 3:
- \*1: Lot indication 4:

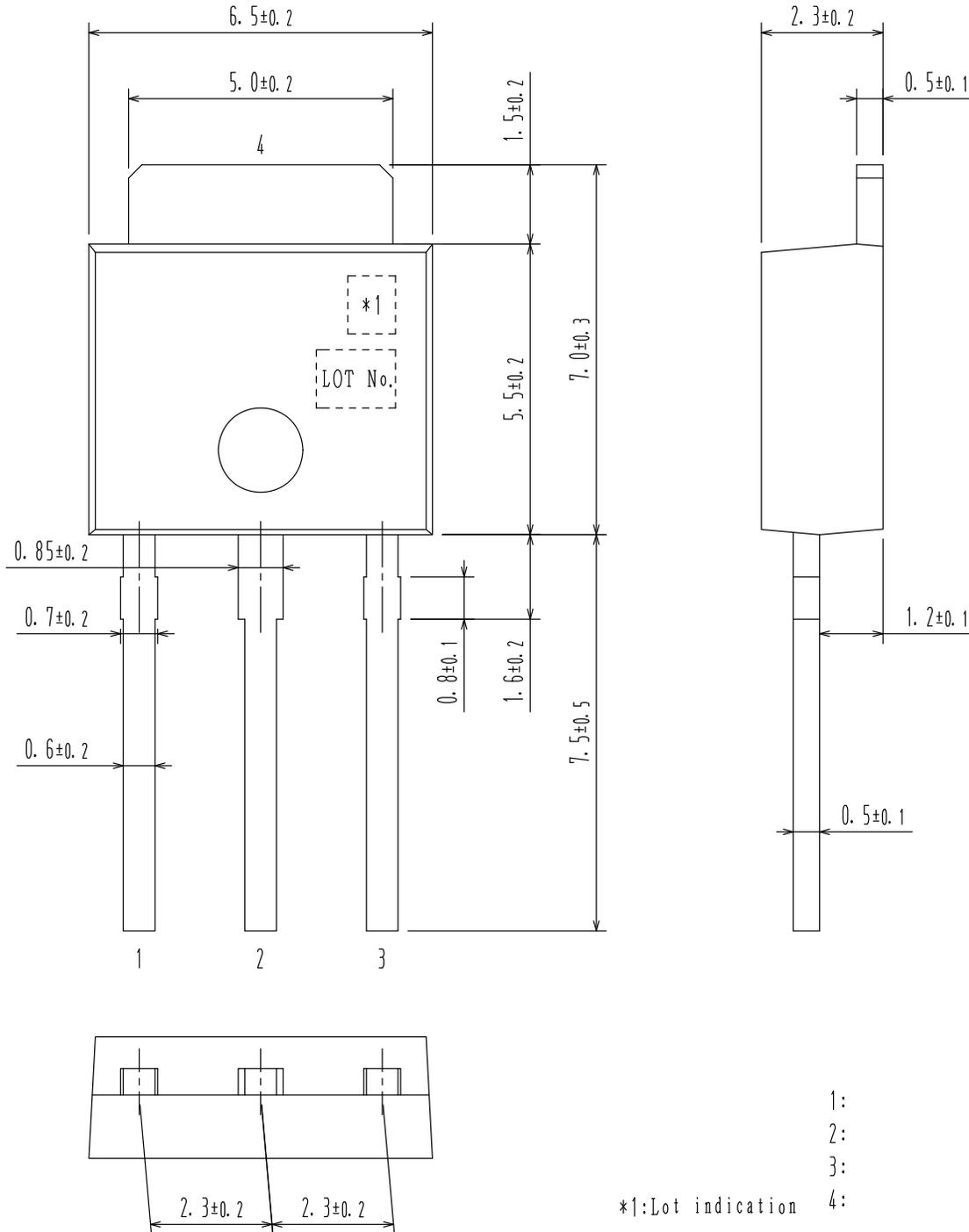
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**MECHANICAL CASE OUTLINE**  
**PACKAGE DIMENSIONS**

**IPAK / TP**  
**CASE 369AJ**  
**ISSUE O**

DATE 30 JAN 2012



- 1:
- 2:
- 3:
- 4:

\*1: Lot indication

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