Bipolar Transistor

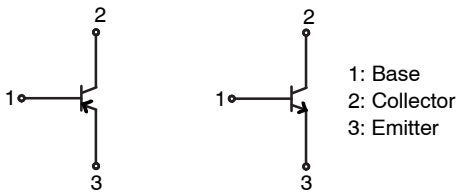
(–)100 V, (–)1 A, Low V_{CE}(sat), (PNP)NPN Single PCP

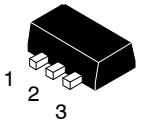
2SA1416, 2SC3646

Features

- Adoption of FBET and MBIT Processes
- High Breakdown Voltage and Large Current Capacity
- Fast Switching Speed
- Ultrasmall Size Making it Easy to Provide High−Density Small−Sized Hybrid IC's
- These Devices are Pb−Free and are RoHS Compliant

ELECTRICAL CONNECTION





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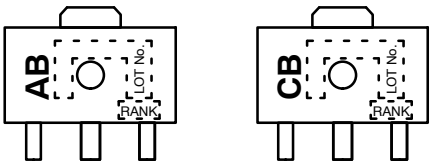
MARKING DIAGRAM



SPECIFICATIONS ( ): 2SA1416
ABSOLUTE MAXIMUM RATINGS at Ta = 25°C

Parameter	Symbol	Value	Unit
Collector to Base Voltage	V_{CBO}	(−) 120	V
Collector to Emitter Voltage	V_{CEO}	(−) 100	V
Emitter to Base Voltage	V_{EBO}	(−) 6	V
Collector Current	I_C	(−) 1	A
Collector Current (Pulse)	I_{CP}	(−) 2	A
Collector Dissipation	P_C	500	mW
Collector Dissipation (Note 1)		1.3	W
Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	−55 to +150	°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.
1. Surface mounted on ceramic substrate (250 mm^2 x 0.8 mm).

ORDERING INFORMATION

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

ELECTRICAL CHARACTERISTICS at T_A = 25°C

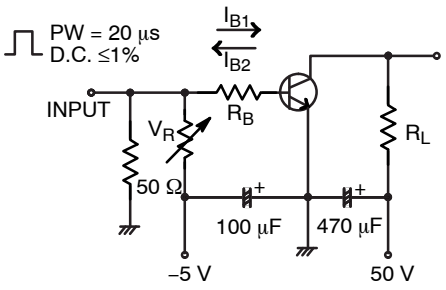
Parameter	Symbol	Conditions	Ratings			Unit
			Min	Typ	Max	
Collector Cutoff Current	I_{CBO}	V_{CB} = (-)100 V, I_E = 0 A			(-)100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB} = (-)4V, I_C = 0 A			(-)100	nA
DC Current Gain	h_{FE}	V_{CE} = (-)5 V, I_C = (-)100 mA	100*		400*	
Gain−Bandwidth Product	f_T	V_{CE} = (-)10 V, I_C = (-)100 mA		120		MHz
Output Capacitance	Cob	V_{CB} = (-)10 V, f = 1 MHz		(13)8.5		pF
Collector to Emitter Saturation Voltage	V_{CE}(sat)	I_C = (-)400 mA, I_B = (-)40 mA		(−0.2)0.1	(-0.6)0.4	V
Base to Emitter Saturation Voltage	V_{BE}(sat)	I_C = (-)400 mA, I_B = (-)−40 mA		(-)0.85	(-)1.2	V
Collector to Base Breakdown Voltage	$V_{(BR)CBO}$	I_C = (-)10 μA, I_E = 0 A	(-)120			V
Collector to Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C = (-)1 mA, R_{BE} = ∞	(-)100			V
Emitter to Base Breakdown Voltage	$V_{(BR)EBO}$	I_E = (-)10 μA, I_C = 0 A	(-)6			V
Turn−On Time	t_{on}	See specified Test Circuit		(80)80		ns
Storage Time	t_{stg}			(700)850		ns
Fall Time	t_f			(40)50		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.

*The 2SA1416/2SC3646 are classified by 100 mA h_{FE} as follows :

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

Switching Time Test Circuit



I_C = 10 I_{B1} = −10 I_{B2} = 400 mA
(For PNP, the polarity is reversed)

TYPICAL CHARACTERISTICS

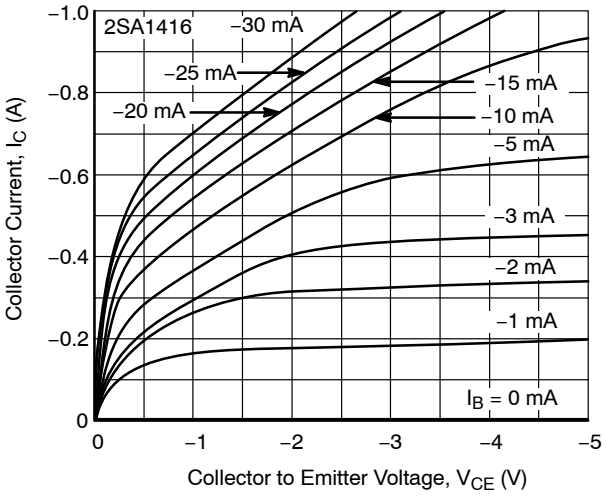


Figure 1. I_C – V_{CE}

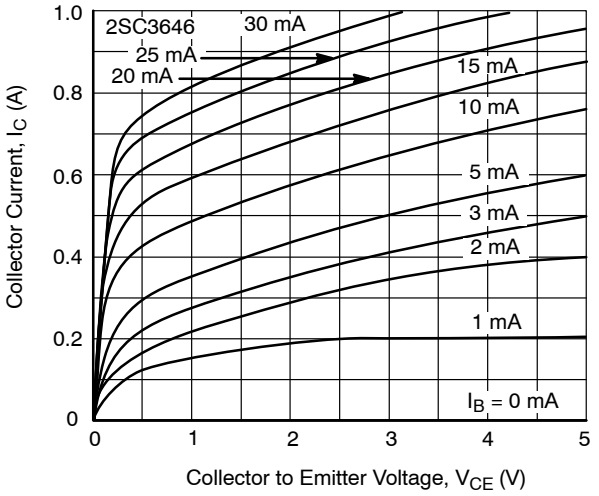


Figure 2. I_C – V_{CE}

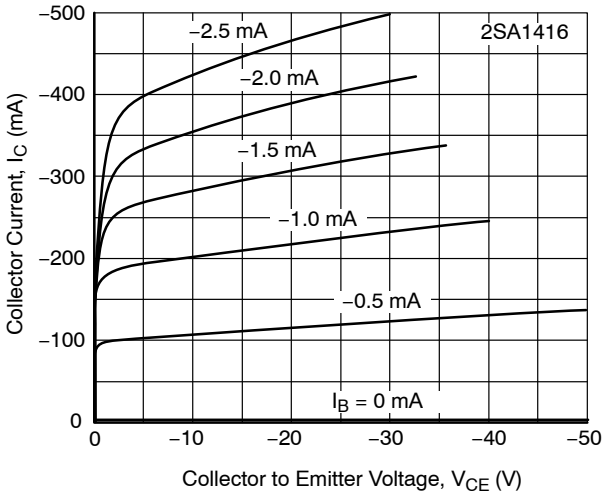


Figure 3. I_C – V_{CE}

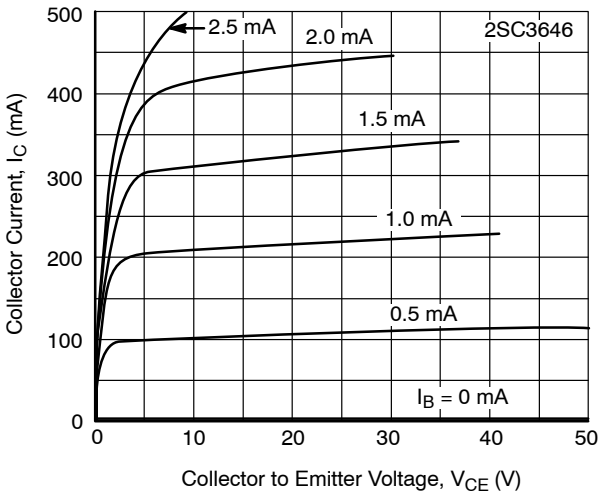


Figure 4. I_C – V_{CE}

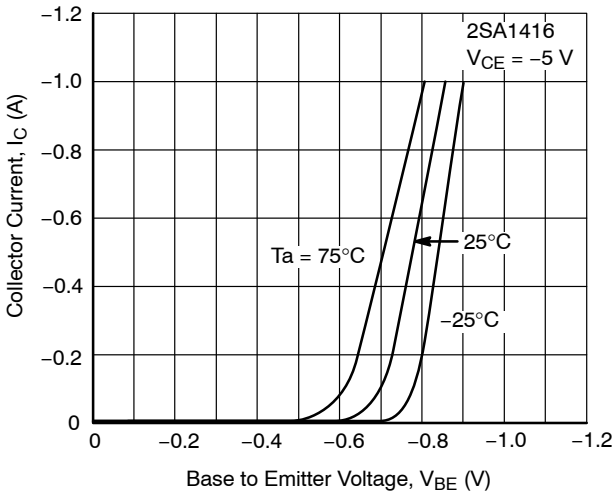


Figure 5. I_C – V_{BE}

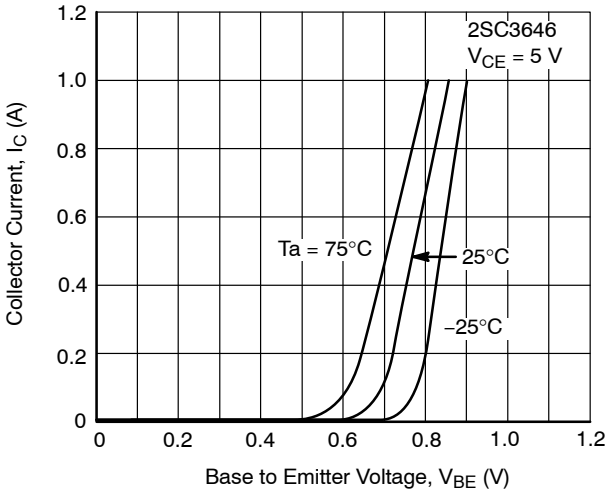


Figure 6. I_C – V_{BE}

TYPICAL CHARACTERISTICS (continued)

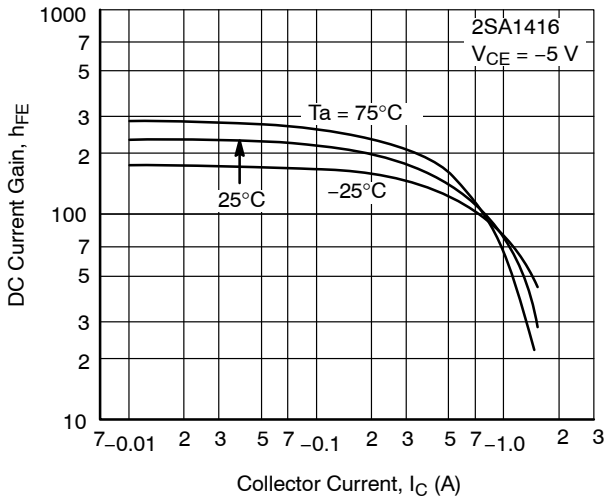


Figure 7. h_{FE} – I_C

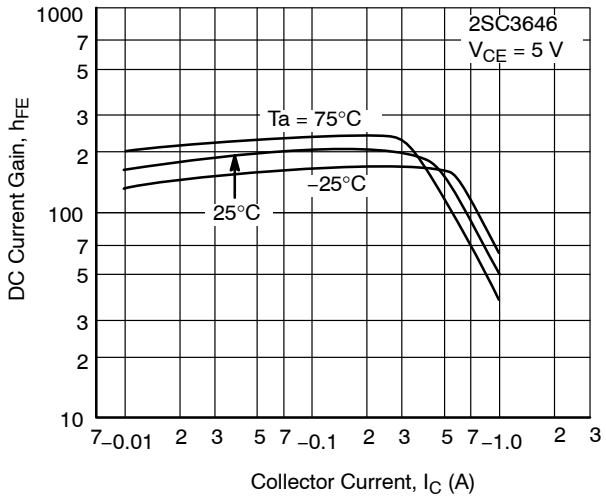


Figure 8. h_{FE} – I_C

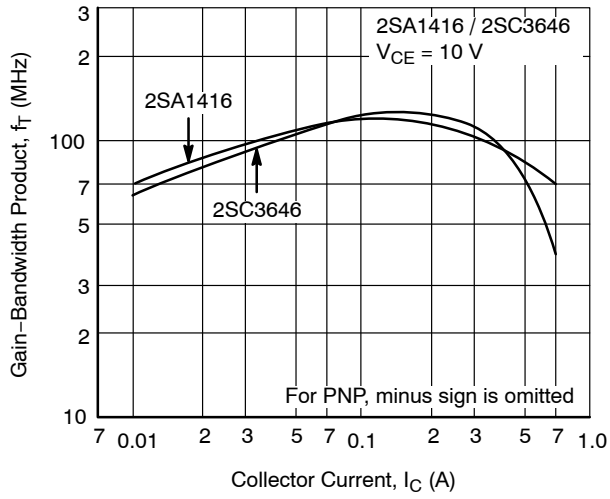


Figure 9. f_T – I_C

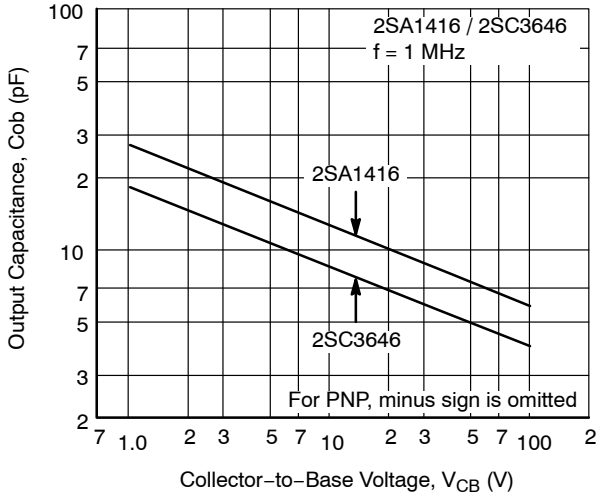


Figure 10. Cob – V_{CB}

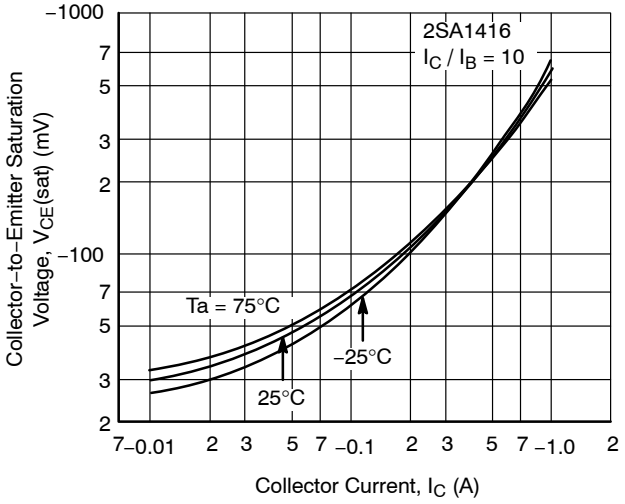


Figure 11. $V_{CE(sat)}$ – I_C

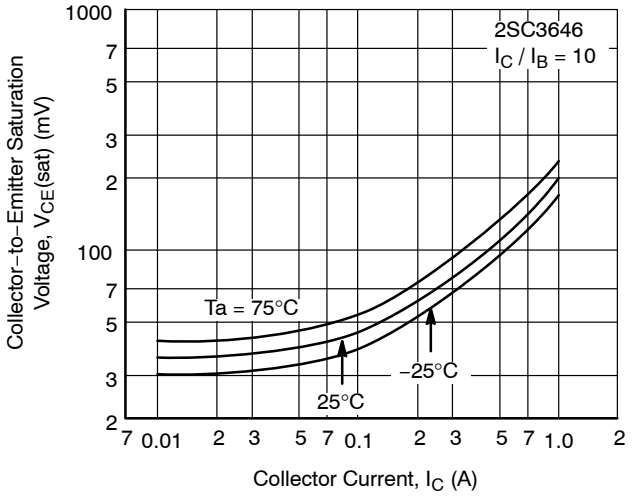


Figure 12. $V_{CE(sat)}$ – I_C

TYPICAL CHARACTERISTICS (continued)

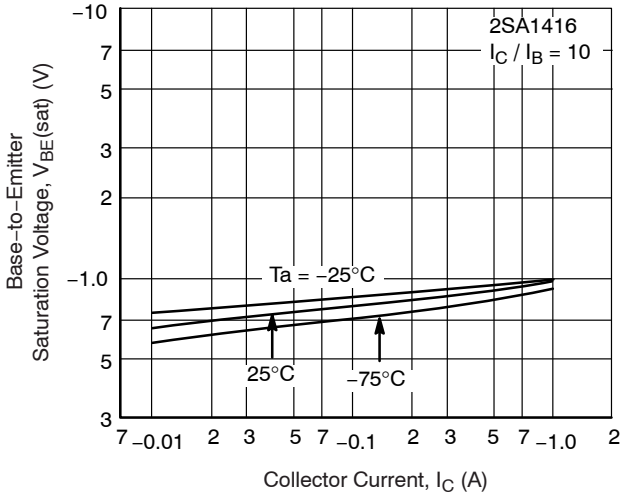


Figure 13. V_{BE}(sat) − I_C

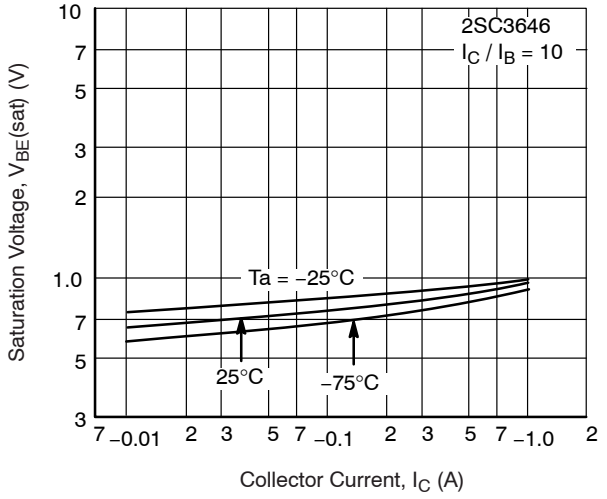


Figure 14. V_{BE}(sat) − I_C

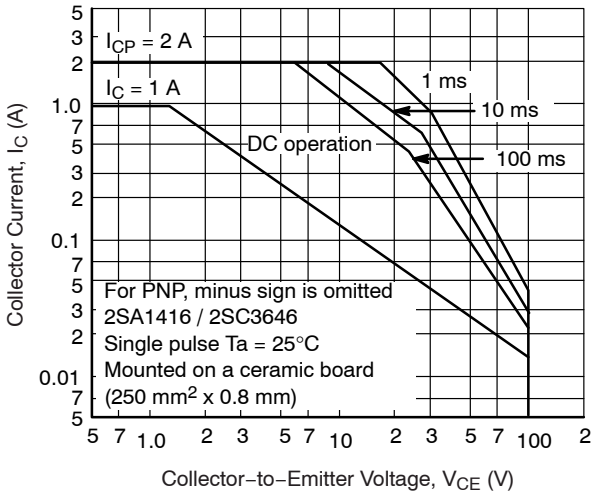


Figure 15. ASO

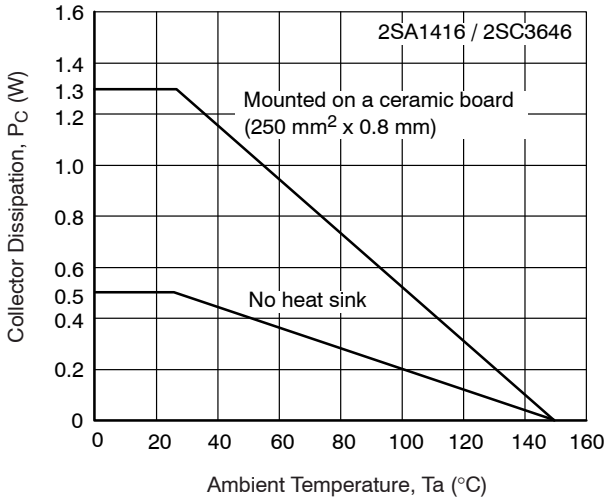


Figure 16. P_C − Ta

ORDERING INFORMATION

Device	Marking	Package	Shipping†
2SA1416S−TD−E	AB	SOT−89 / PCP−1 (Pb−Free)	1000 / Tape & Reel
2SA1416T−TD−E			
2SC3646S−TD−E	CB		
2SC3646T−TD−E			

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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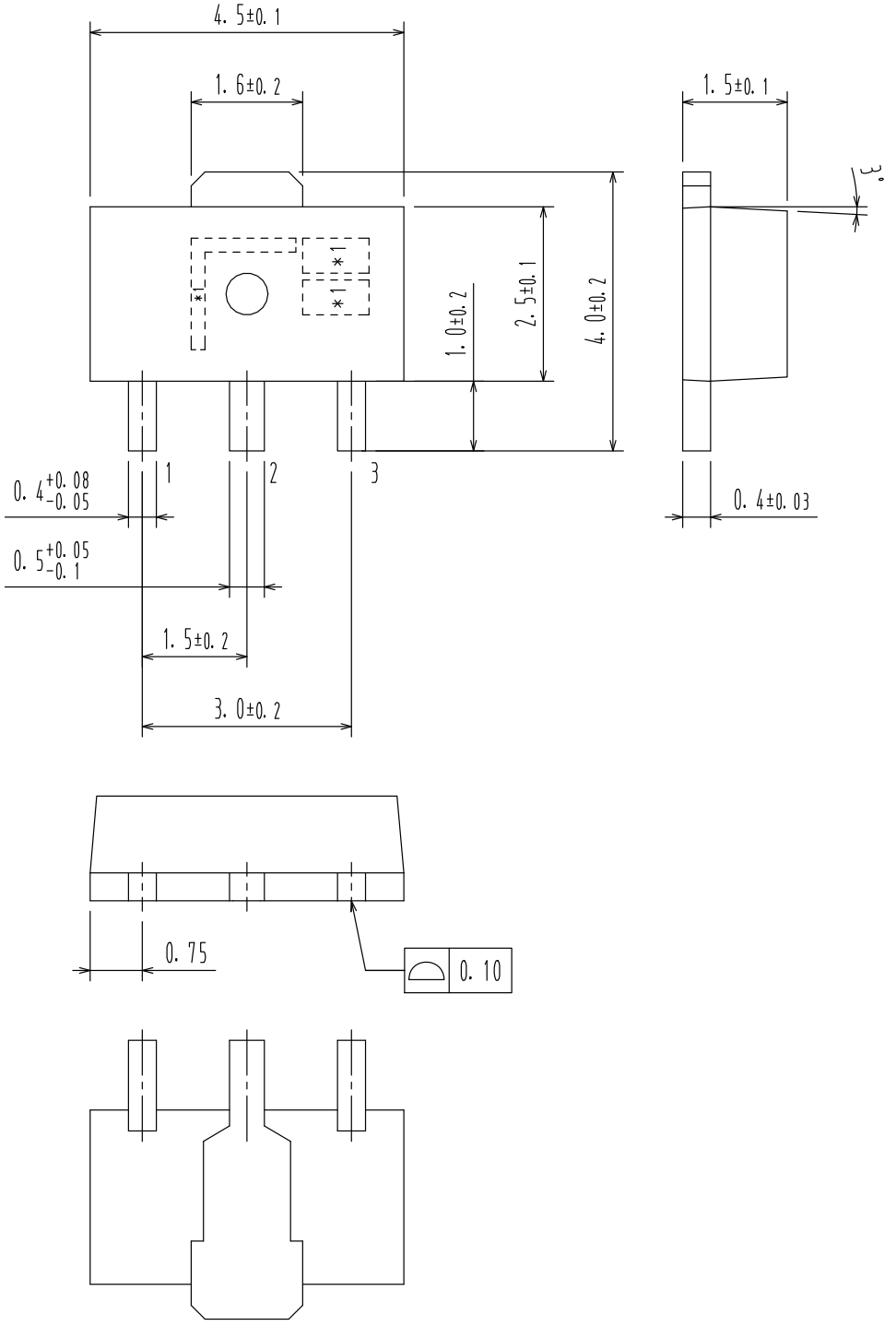

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