

# Bipolar Transistor

**(-)100 V, (-)2 A, Low  $V_{CE(sat)}$ ,  
(PNP) NPN Single PCP**

## 2SA1417, 2SC3647

### Features

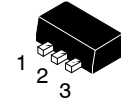
- Adoption of FBET, MBIT Processes
- High Breakdown Voltage and Large Current Capacity
- Ultrasmall Size Making it Easy to Provide High-density Small-sized Hybrid ICs
- These Devices are Pb-Free and Halide Free

### SPECIFICATIONS ( ): 2SA1417

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

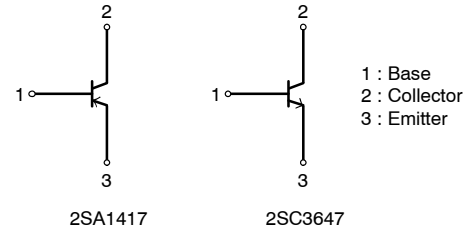
Symbol	Parameter	Conditions	Ratings	Unit
$V_{CBO}$	Collector-to-Base Voltage		(-)120	V
$V_{CEO}$	Collector-to-Emitter Voltage		(-)100	V
$V_{EBO}$	Emitter-to-Base Voltage		(-)6	V
$I_C$	Collector Current		(-)2	A
$I_{CP}$	Collector Current (Pulse)		(-)3	A
$P_C$	Collector Dissipation	When mounted on ceramic substrate (250 mm <sup>2</sup> x 0.8 mm)	500	mW
			1.5	W
$T_j$	Junction Temperature		150	°C
$T_{stg}$	Storage Temperature		- 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.

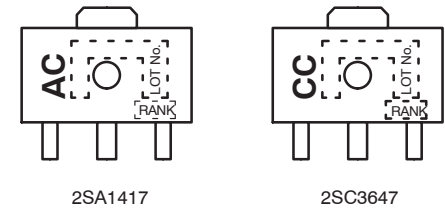


SOT-89-3  
CASE 419AU

### ELECTRICAL CONNECTION



### MARKING DIAGRAM



### ORDERING INFORMATION

Device	Package	Shipping†
2SA1417S-TD-E	PCP (Pb-Free)	1000 / Tape & Reel
2SA1417T-TD-E	PCP (Pb-Free)	1000 / Tape & Reel
2SC3647S-TD-E	PCP (Pb-Free)	1000 / Tape & Reel
2SC3647T-TD-E	PCP (Pb-Free)	1000 / Tape & Reel

†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](#).

## 2SA1417, 2SC3647

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

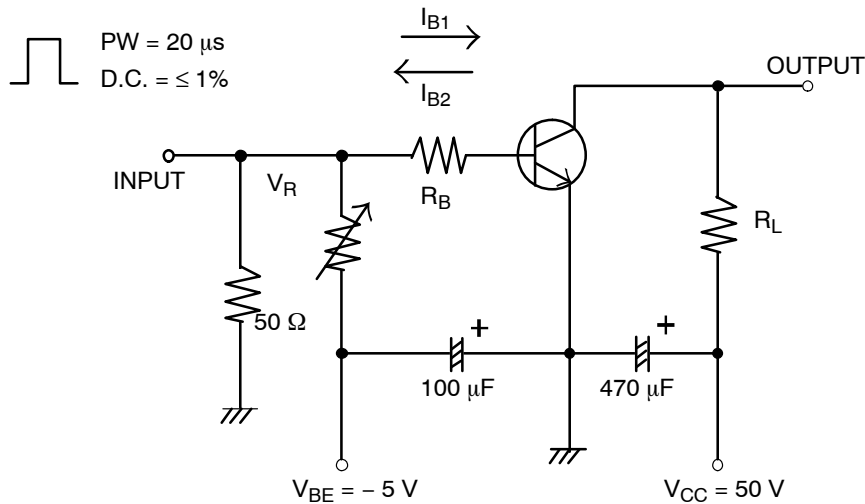
Symbol	Parameter	Conditions	Ratings			Unit
			Min	Typ	Max	
I <sub>CBO</sub>	Collector Cutoff Current	V <sub>CB</sub> = (-)100 V, I <sub>E</sub> = 0 A	-	-	(-)100	nA
I <sub>EBO</sub>	Emitter Cutoff Current	V <sub>EB</sub> = (-)4 V, I <sub>C</sub> = 0 A	-	-	(-)100	nA
h <sub>FE</sub>	DC Current Gain	V <sub>CE</sub> = (-)5 V, I <sub>C</sub> = (-)100 mA	100*	-	400*	-
f <sub>T</sub>	Gain-Bandwidth Product	V <sub>CE</sub> = (-)10 V, I <sub>C</sub> = (-)100 mA	-	120	-	MHz
C <sub>ob</sub>	Output Capacitance	V <sub>CB</sub> = (-)10 V, f = 1 MHz	-	(25)16	-	pF
V <sub>CE(sat)</sub>	Collector-to-Emitter Saturation Voltage	I <sub>C</sub> = (-)1 A, I <sub>B</sub> = (-)100 mA	-	(-0.22) 0.13	(-0.6) 0.4	V
V <sub>BE(sat)</sub>	Base-to-Emitter Saturation Voltage	I <sub>C</sub> = (-)1 A, I <sub>B</sub> = (-)100 mA	-	(-)0.85	(-)1.2	V
V <sub>(BR)CBO</sub>	Collector-to-Base Breakdown Voltage	I <sub>C</sub> = (-)10 μA, I <sub>E</sub> = 0 A	(-)120	-	-	V
V <sub>(BR)CEO</sub>	Collector-to-Emitter Breakdown Voltage	I <sub>C</sub> = (-)1 mA, R <sub>BE</sub> = ∞	(-)100	-	-	V
V <sub>(BR)EBO</sub>	Emitter-to-Base Breakdown Voltage	I <sub>E</sub> = (-)10 μA, I <sub>C</sub> = 0 A	(-)6	-	-	V
t <sub>on</sub>	Turn-On Time	See specified Test Circuit.	-	(80)80	-	ns
t <sub>stg</sub>	Storage Time		-	(750)1000	-	ns
t <sub>f</sub>	Fall Time		-	(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 2SA1417/2SC3647 are Classified by 100 mA h<sub>FE</sub> as Follows:

Rank	R	S	T
h <sub>FE</sub>	100 to 200	140 to 280	200 to 400

### SWITCHING TIME TEST CIRCUIT



I<sub>C</sub> = 10 I<sub>B1</sub> = -10 I<sub>B2</sub> = 0.7 A  
For PNP, the polarity is reversed.

**Figure 1. Switching Time Test Circuit**

TYPICAL CHARACTERISTICS

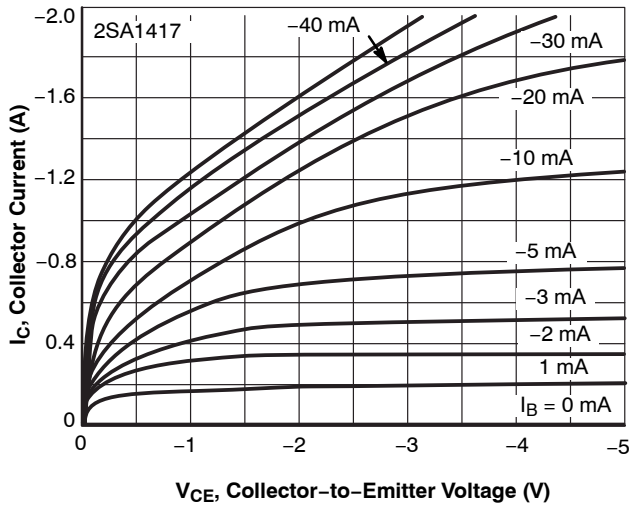


Figure 2.  $I_C - V_{CE}$

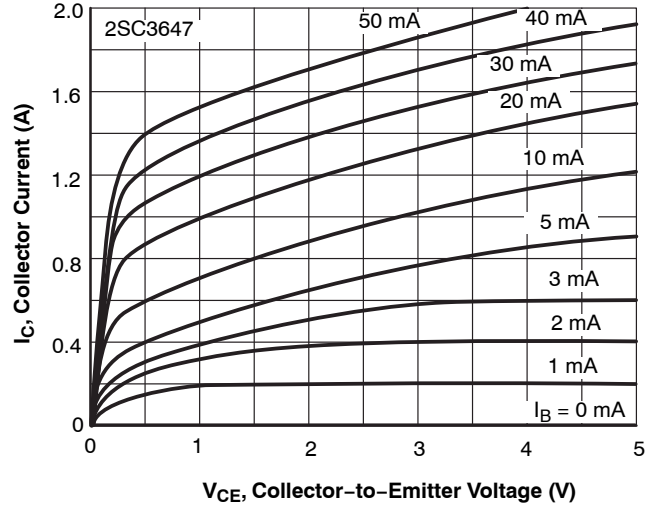


Figure 3.  $I_C - V_{CE}$

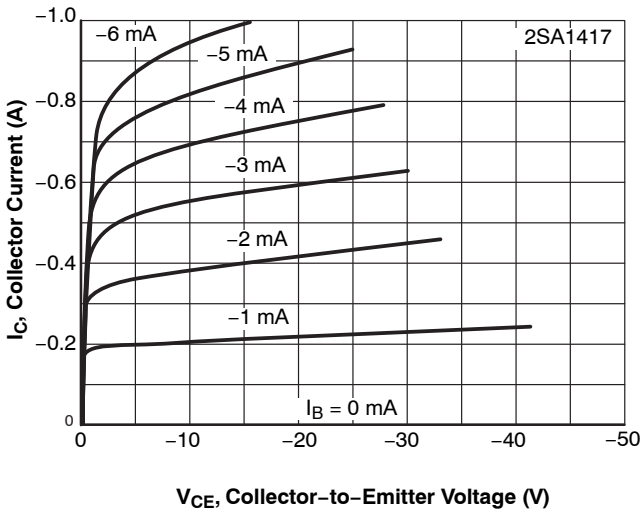


Figure 4.  $I_C - V_{CE}$

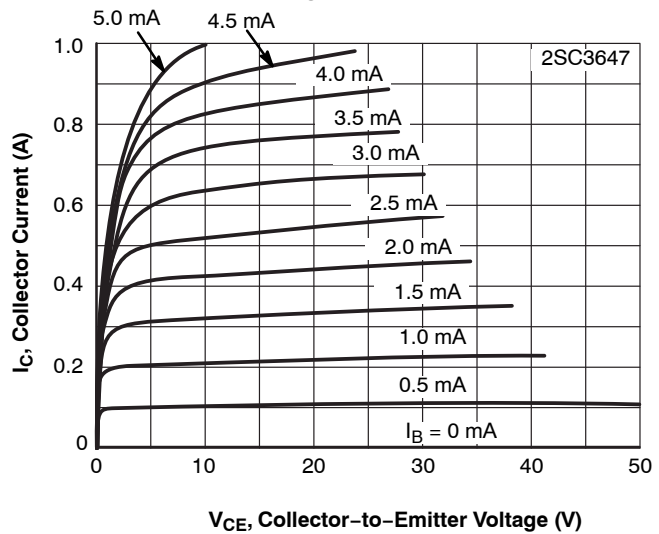


Figure 5.  $I_C - V_{CE}$

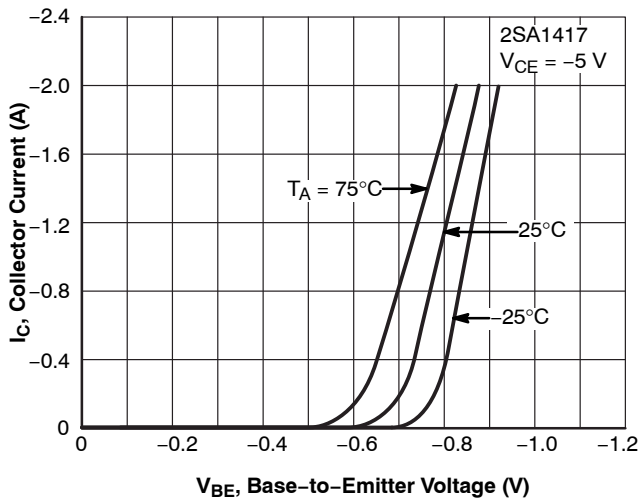


Figure 6.  $I_C - V_{BE}$

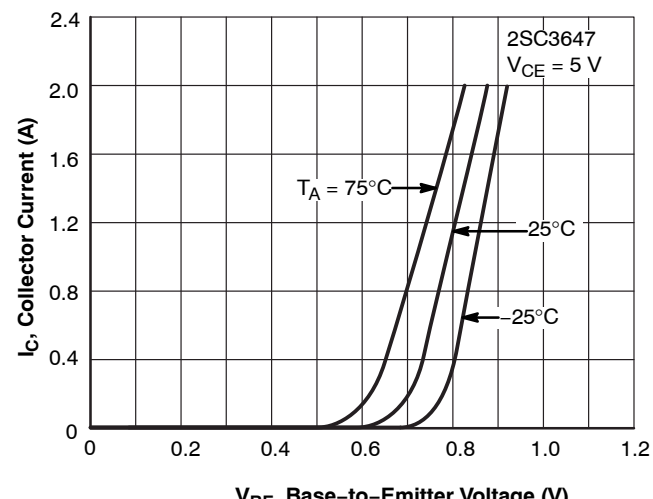


Figure 7.  $I_C - V_{BE}$

# 2SA1417, 2SC3647

## TYPICAL CHARACTERISTICS (continued)

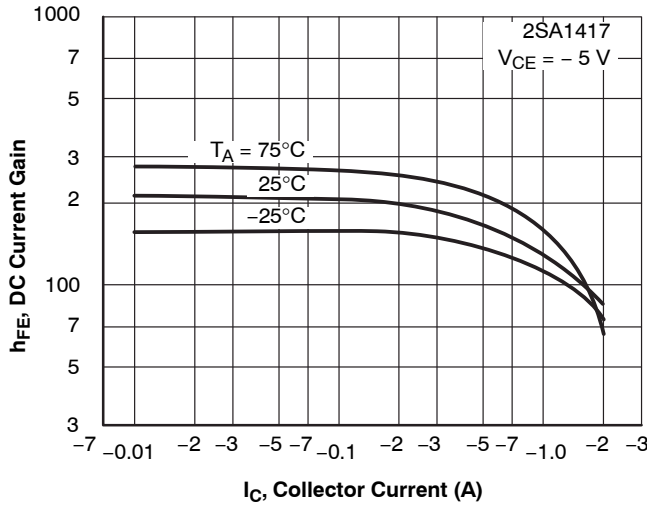


Figure 8.  $h_{FE} - I_C$

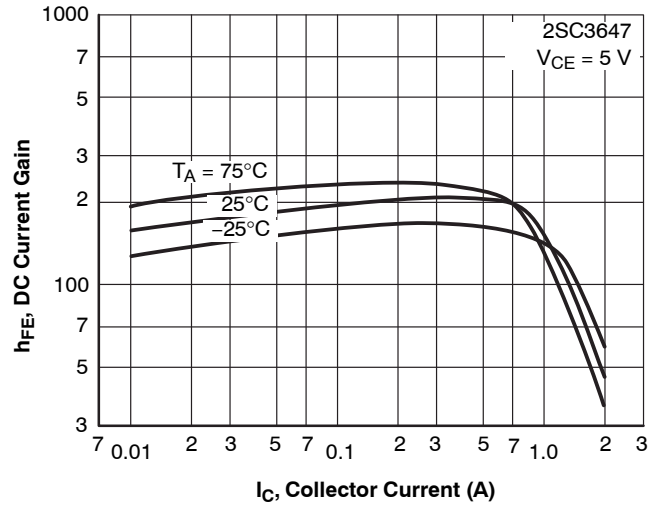


Figure 9.  $h_{FE} - I_C$

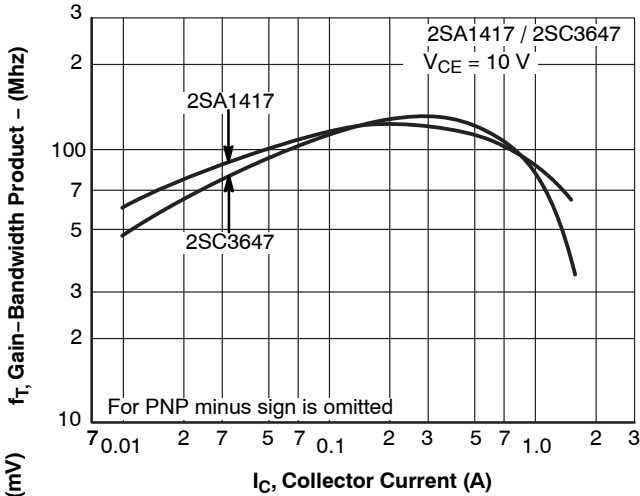


Figure 10.  $f_T - I_C$

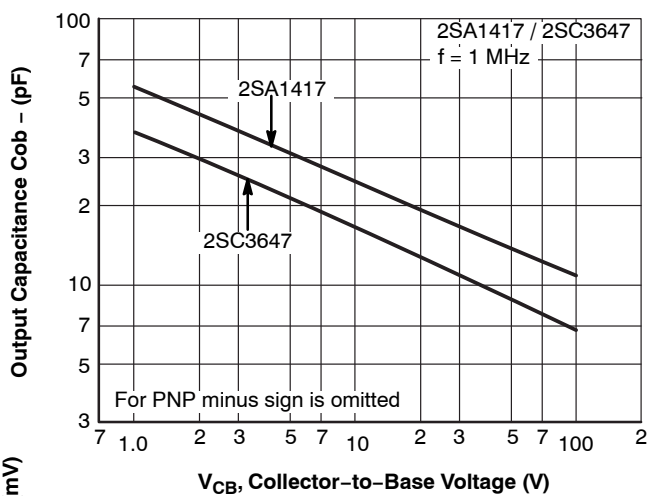


Figure 11.  $C_{ob} - V_{CB}$

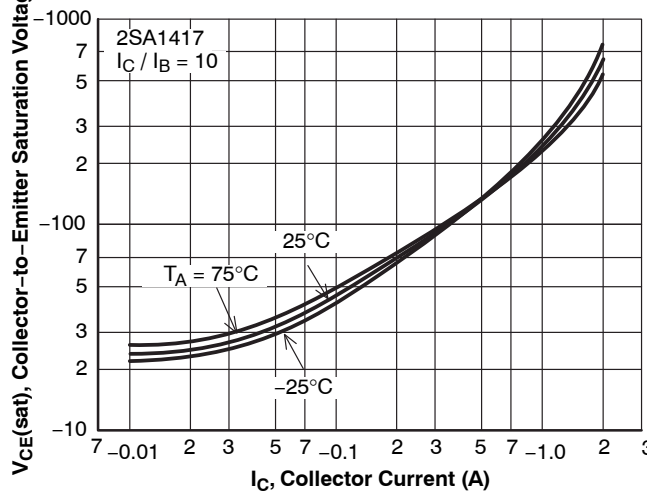


Figure 12.  $V_{CE(sat)} - I_C$

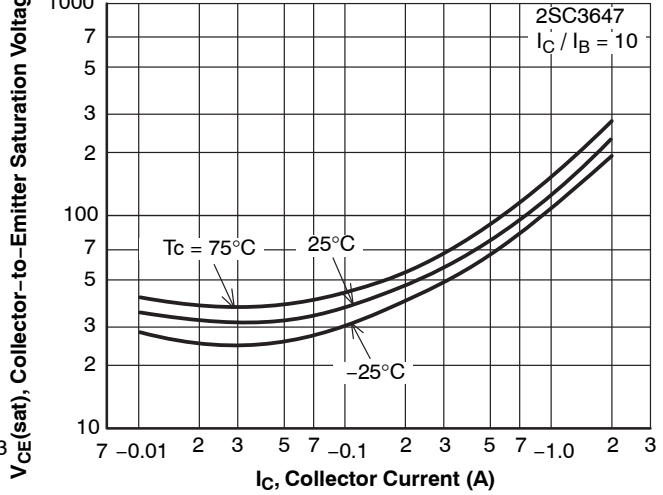


Figure 13.  $V_{CE(sat)} - I_C$

# 2SA1417, 2SC3647

## TYPICAL CHARACTERISTICS (continued)

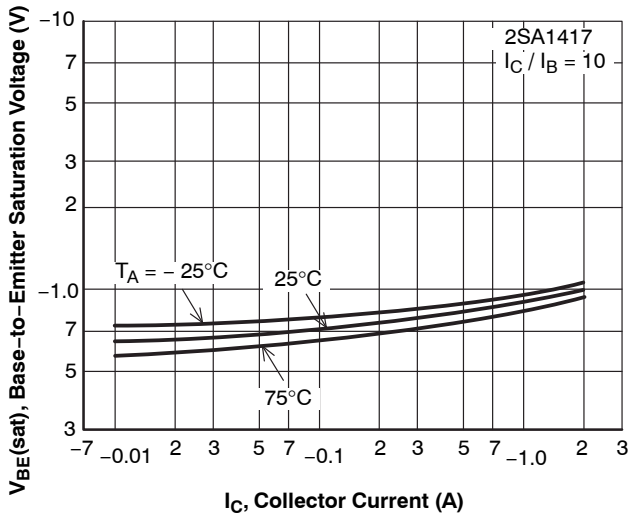


Figure 14.  $V_{BE}(\text{sat}) - I_C$

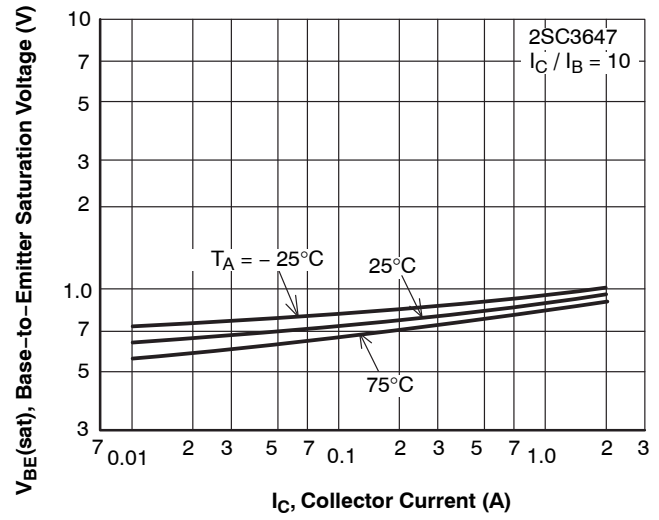


Figure 15.  $V_{BE}(\text{sat}) - I_C$

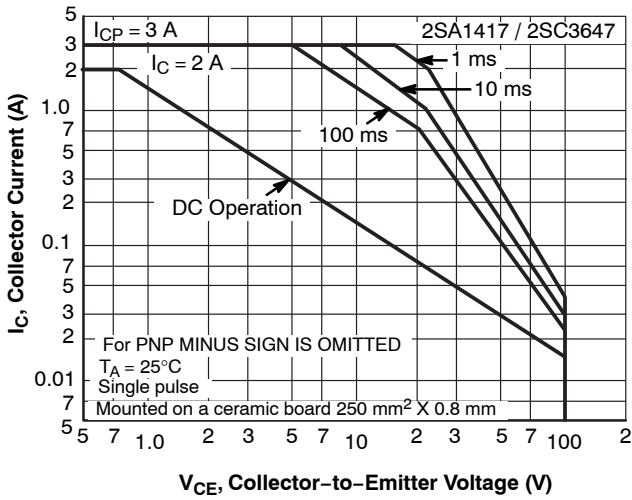


Figure 16. A S O

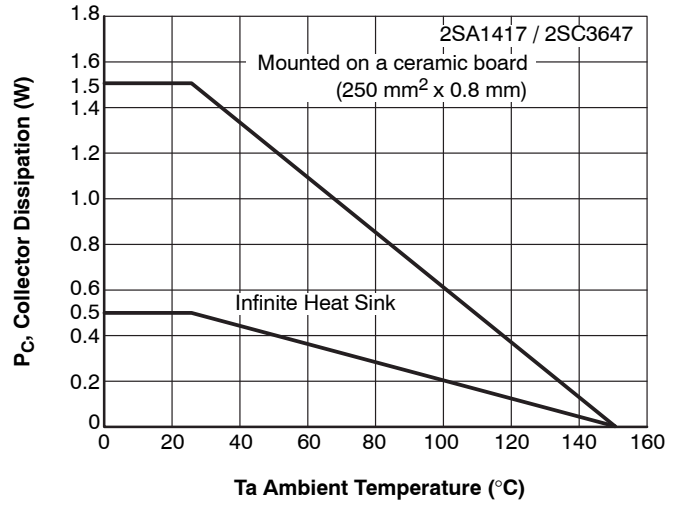


Figure 17.  $P_C - T_a$

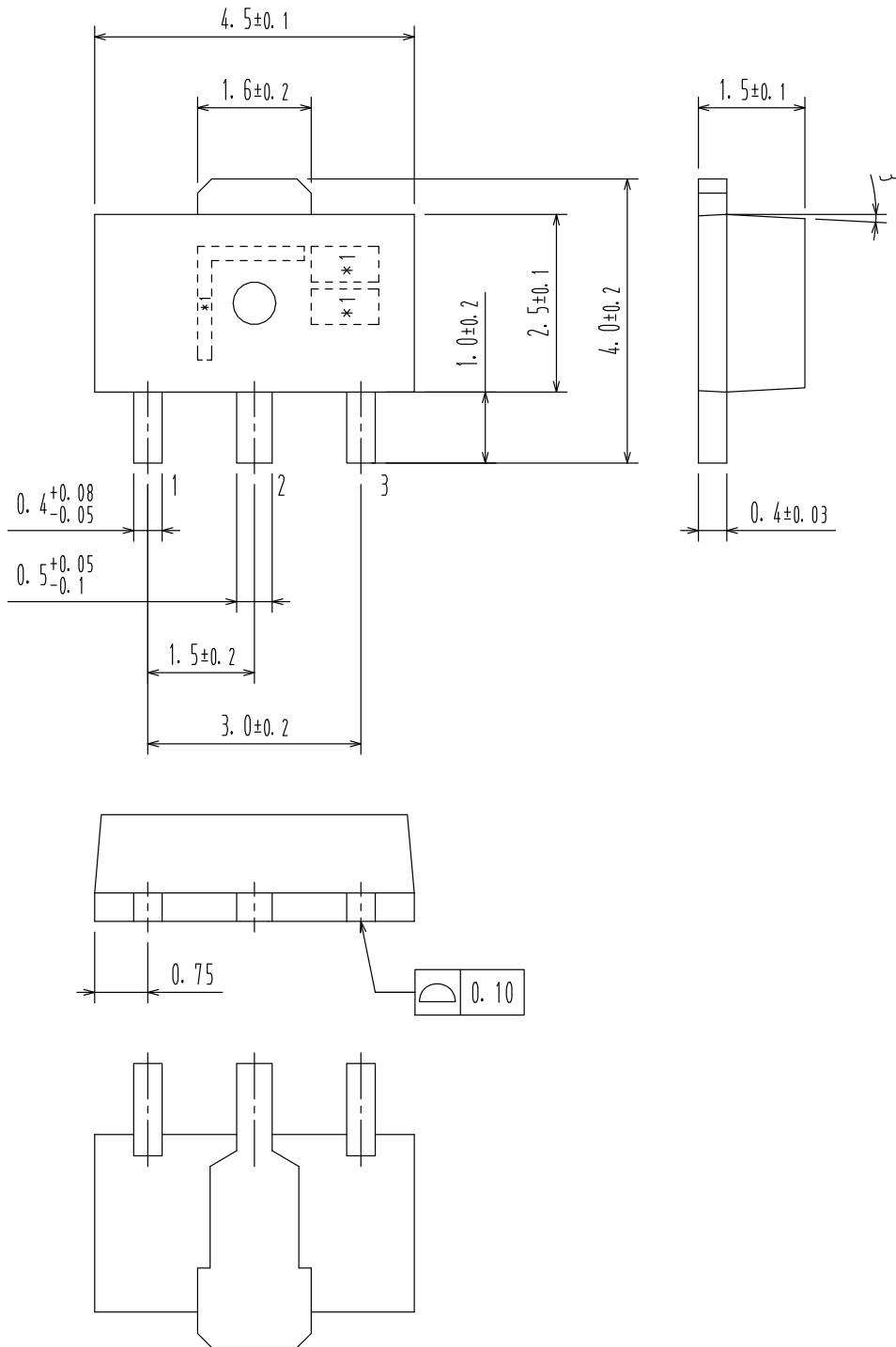
**MECHANICAL CASE OUTLINE**  
**PACKAGE DIMENSIONS**

ON Semiconductor®



**SOT-89 / PCP-1**  
**CASE 419AU**  
**ISSUE O**

DATE 30 APR 2012



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