Bipolar Transistor

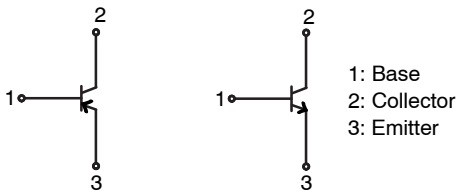
(–)100 V, (–)1 A, Low V_{CE}(sat), (PNP)NPN Single PCP

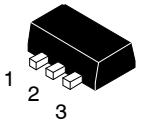
2SA1416, 2SC3646

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

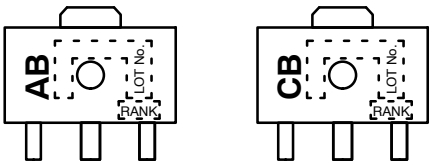
ELECTRICAL CONNECTION





SOT−89 / PCP−1
CASE 419AU

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.

© Semiconductor Components Industries, LLC, 2005

ELECTRICAL CHARACTERISTICS at T_A = 25°C

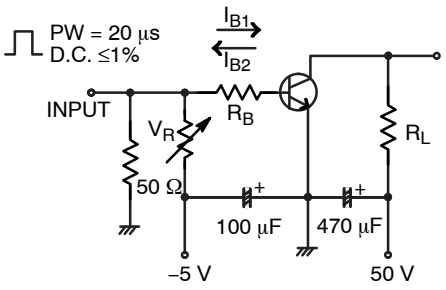
Parameter	Symbol	Conditions	Ratings			Unit
			Min	Typ	Max	
Collector Cutoff Current	I_{CBO}	V_{CB} = (-)100 V, I_E = 0 A			(-)100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB} = (-)4V, I_C = 0 A			(-)100	nA
DC Current Gain	h_{FE}	V_{CE} = (-)5 V, I_C = (-)100 mA	100*		400*	
Gain−Bandwidth Product	f_T	V_{CE} = (-)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

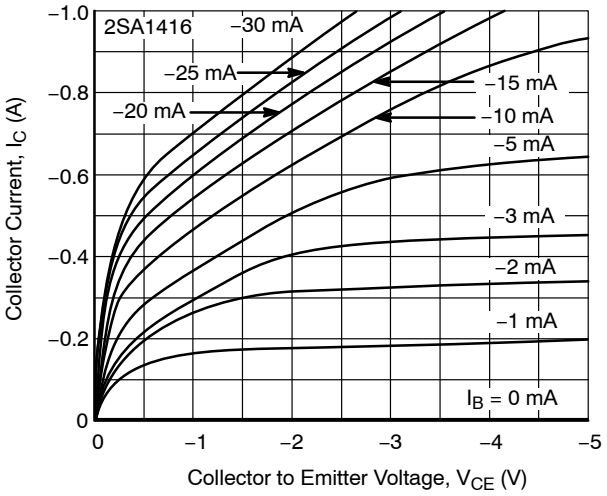


Figure 1. I_C – V_{CE}

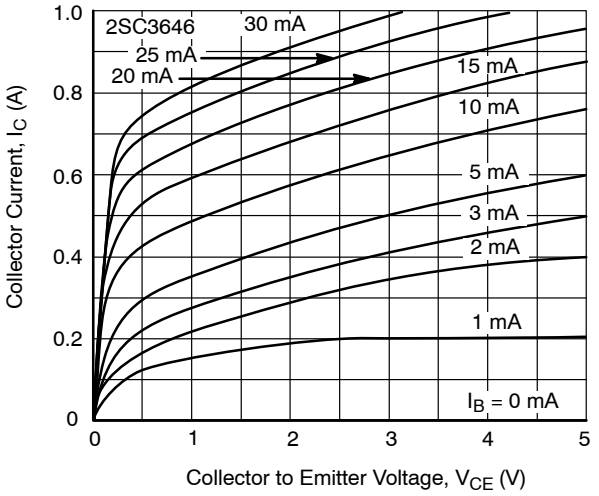


Figure 2. I_C – V_{CE}

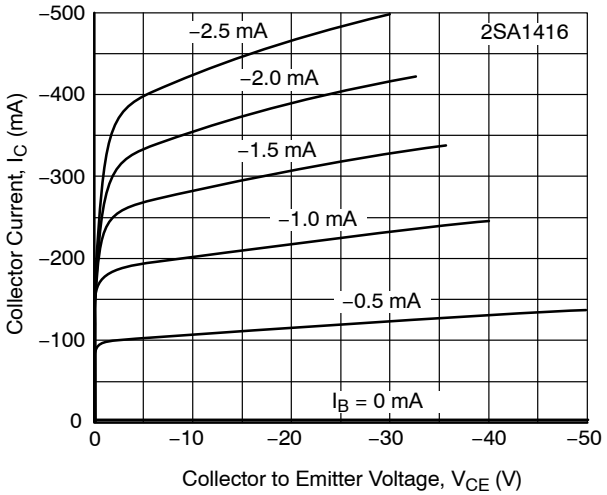


Figure 3. I_C – V_{CE}

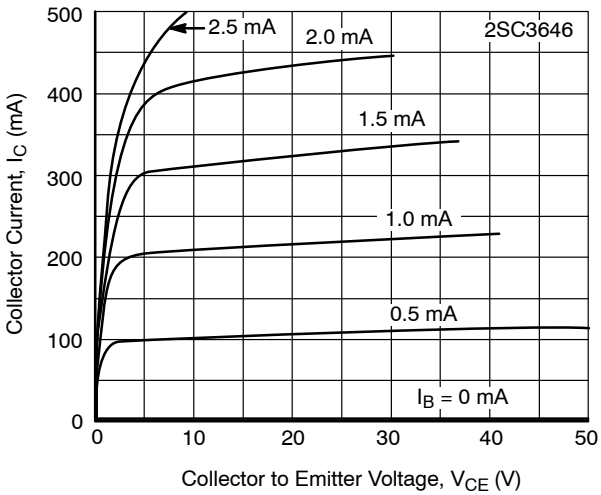


Figure 4. I_C – V_{CE}

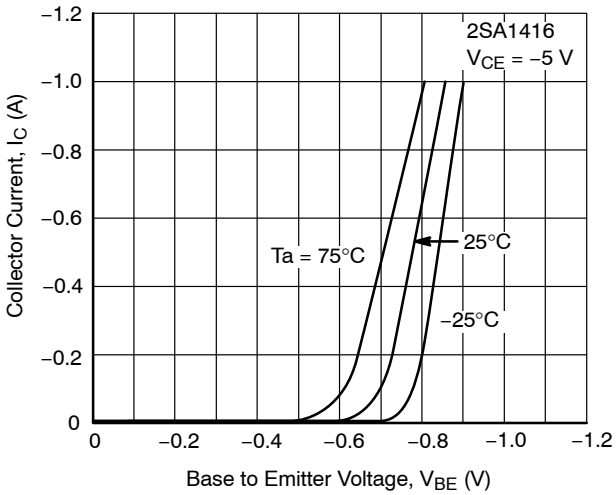


Figure 5. I_C – V_{BE}

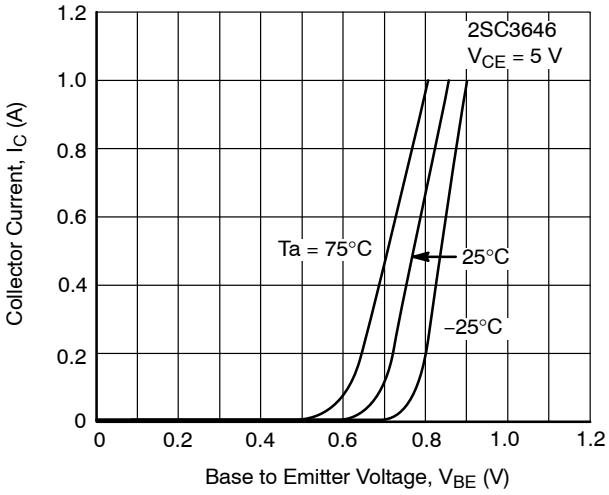


Figure 6. I_C – V_{BE}

TYPICAL CHARACTERISTICS (continued)

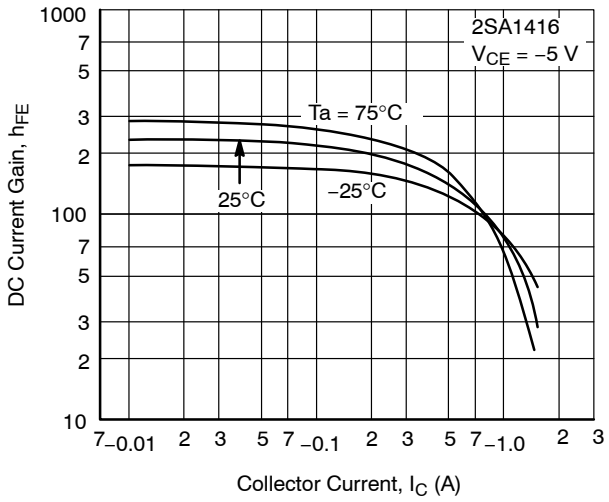


Figure 7. h_{FE} – I_C

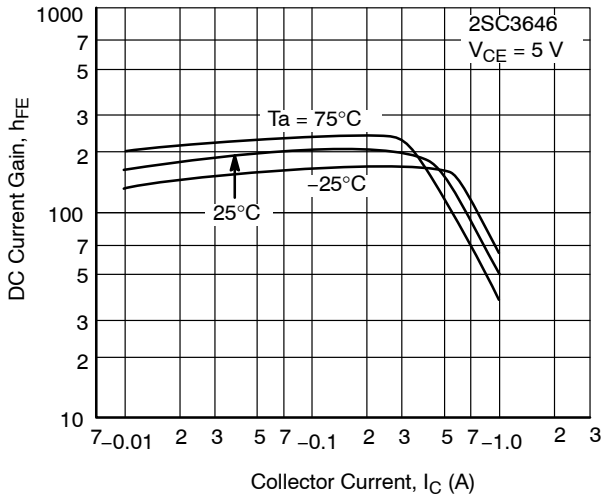


Figure 8. h_{FE} – I_C

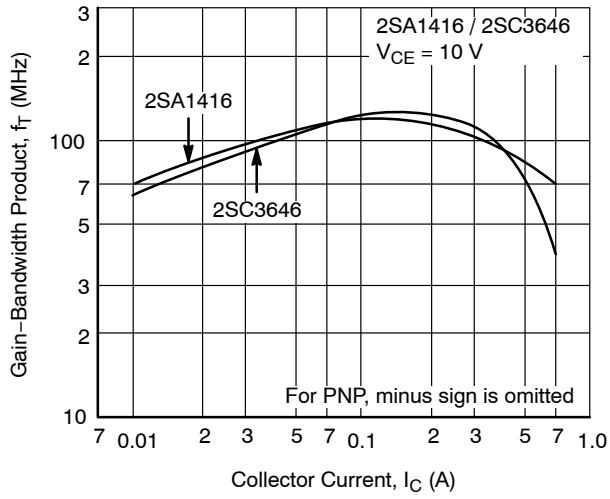


Figure 9. f_T – I_C

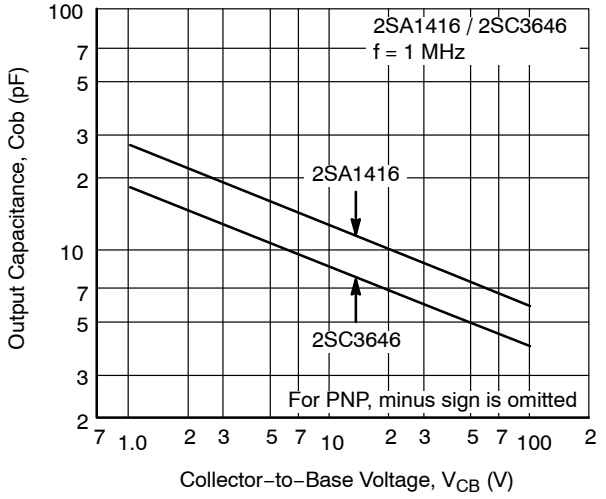


Figure 10. Cob – V_{CB}

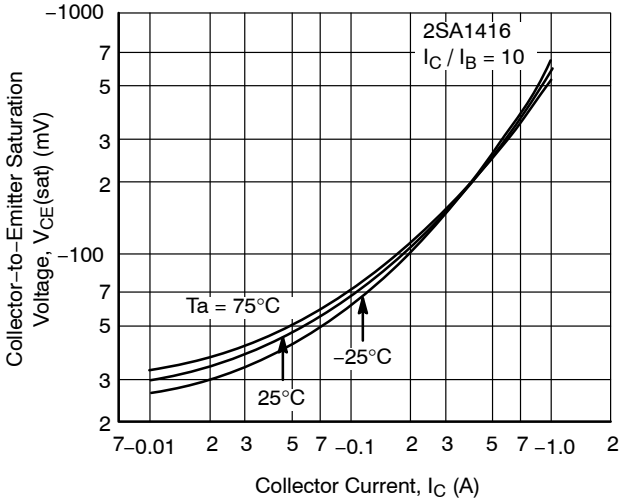


Figure 11. $V_{CE(sat)}$ – I_C

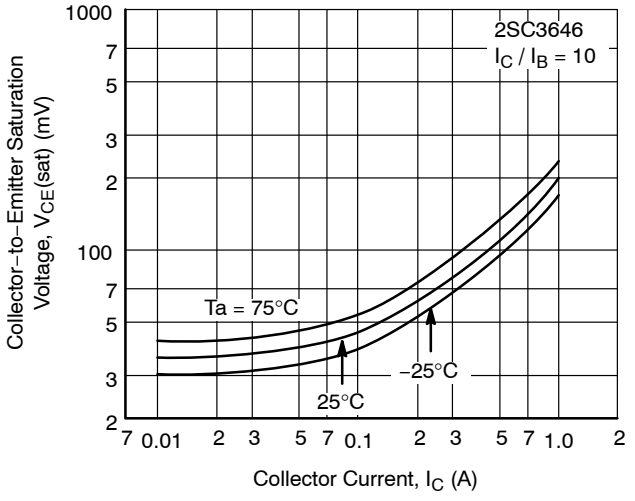


Figure 12. $V_{CE(sat)}$ – I_C

TYPICAL CHARACTERISTICS (continued)

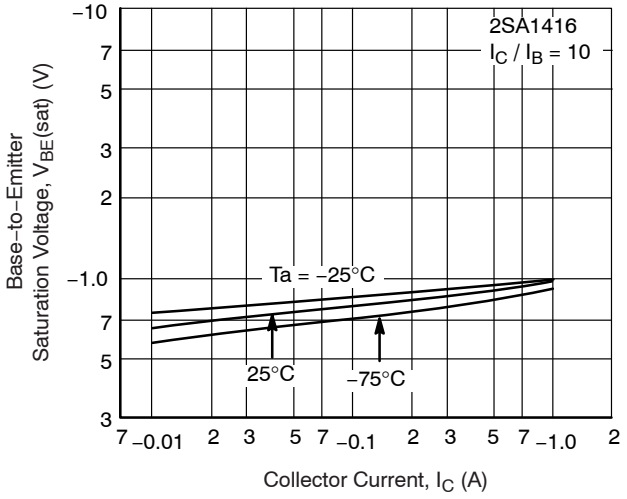


Figure 13. V_{BE}(sat) − I_C

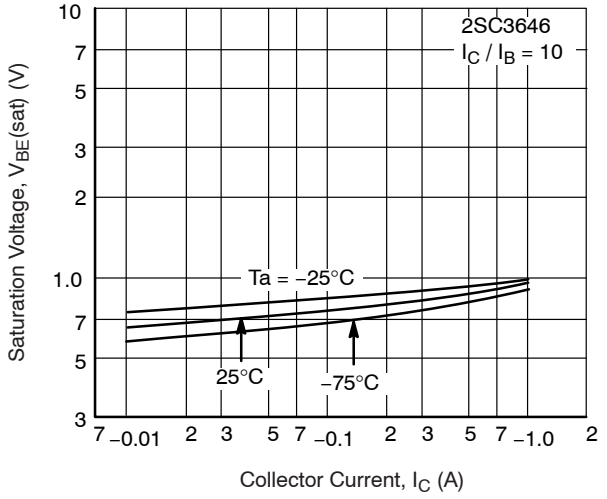


Figure 14. V_{BE}(sat) − I_C

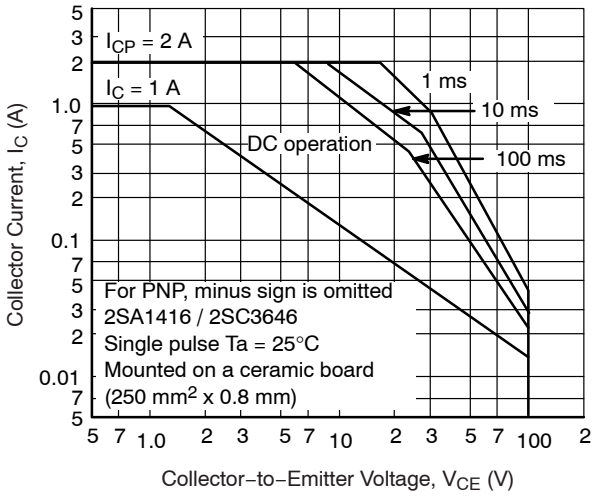


Figure 15. ASO

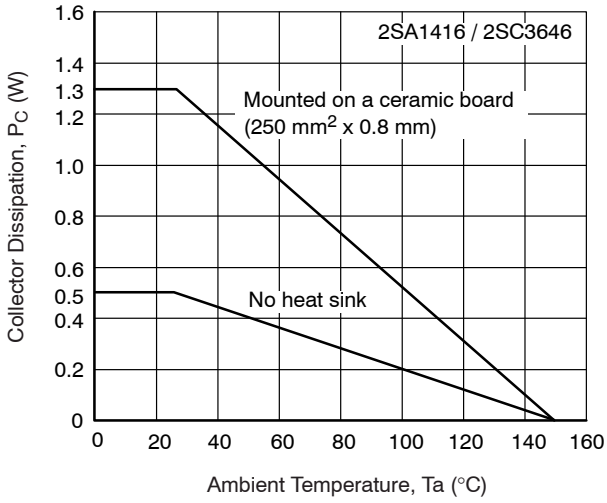


Figure 16. P_C − Ta

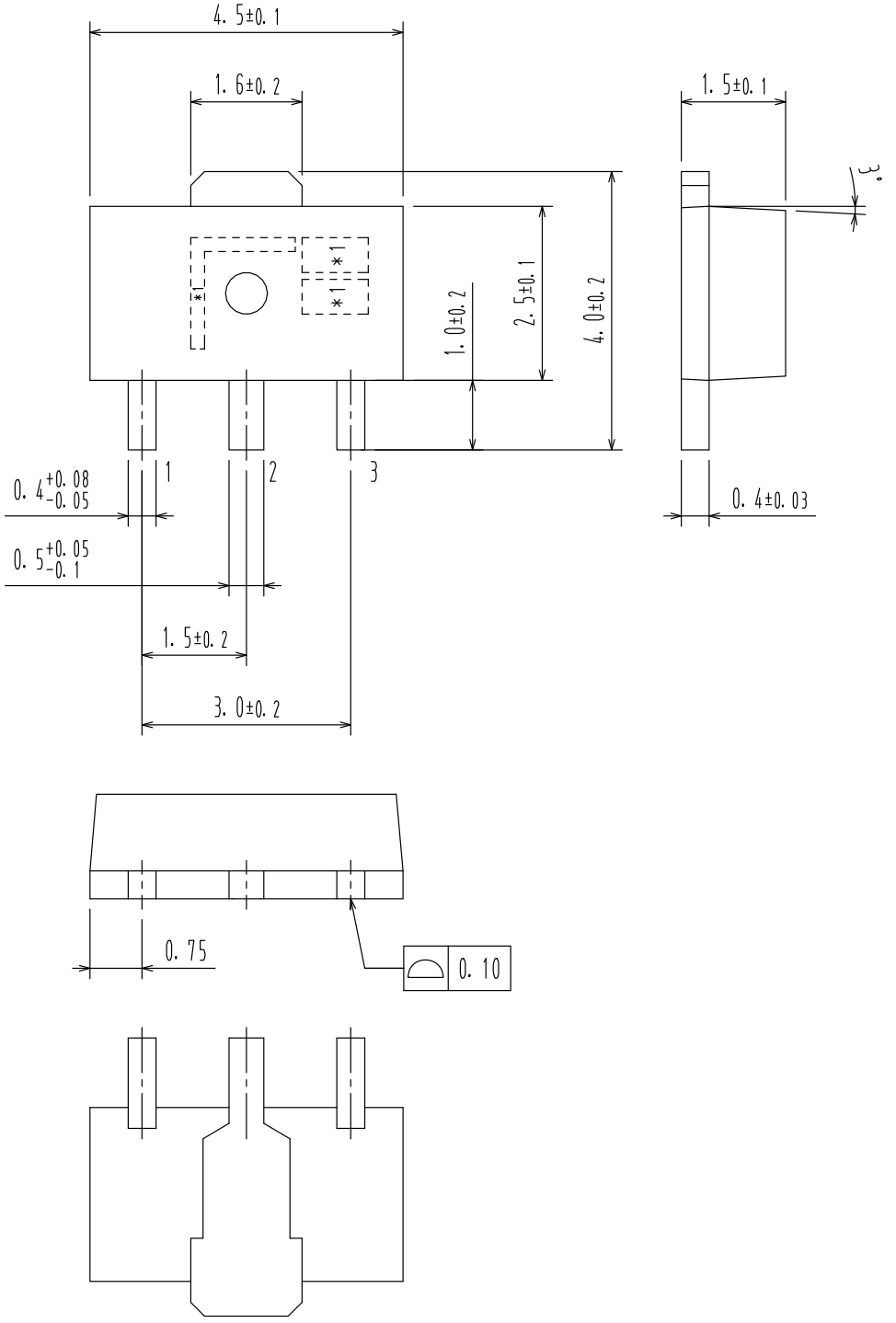
ORDERING INFORMATION

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.

SOT−89 / PCP−1
CASE 419AU
ISSUE O

DATE 30 APR 2012



DOCUMENT NUMBER:	**98AON79746E**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	**SOT−89 / PCP−1**	**PAGE 1 OF 1**

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba **onsemi** or its subsidiaries in the United States and/or other countries. **onsemi** reserves the right to make changes without further notice to any products herein. **onsemi** makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. **onsemi** does not convey any license under its patent rights nor the rights of others.

onsemi, , and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent−Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as−is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical−documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support
For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales