Ordering number : EN2005C

2SA1416/2SC3646

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

ON Semiconductor®
http://onsemi.com

Features
- Adoption of FBET, 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

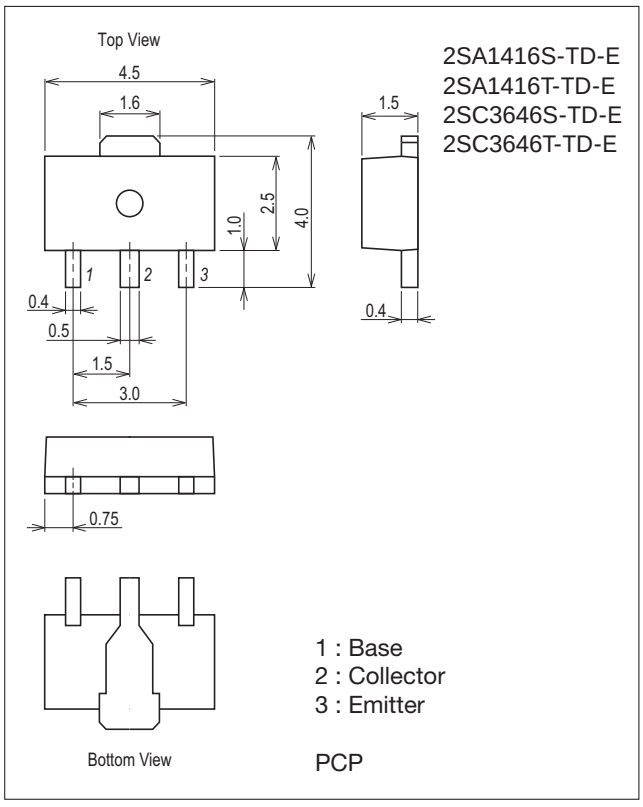
Specifications ( ) : 2SA1416

Absolute Maximum Ratings at Ta=25°C

Parameter	Symbol	Conditions	Ratings	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
		When mounted on ceramic substrate (250mm^2×0.8mm)	1.3	W
Junction Temperature	Tj		150	°C
Storage Temperature	Tstg		–55 to +150	°C

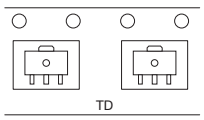
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Package Dimensions
unit : mm (typ)
7007B-004

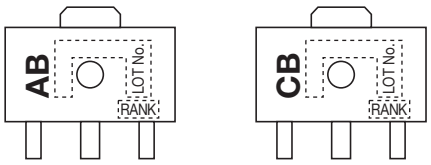


Product & Package Information
- Package : PCP
- JEITA, JEDEC : SC-62, SOT-89, TO-243
- Minimum Packing Quantity : 1,000 pcs./reel

Packing Type: TD

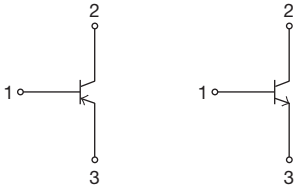


Marking



2SA1416 2SC3646

Electrical Connection



2SA1416 2SC3646

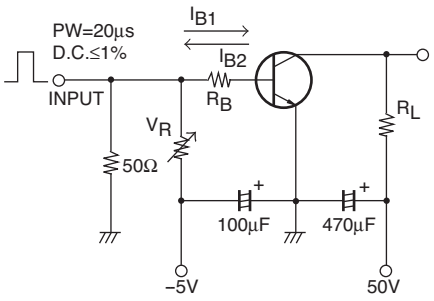
Electrical Characteristics at Ta=25°C

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Collector Cutoff Current	I_{CBO}	V_{CB}=(−)100V, I_E=0A			(−)100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=(−)4V, I_C=0A			(−)100	nA
DC Current Gain	h_{FE}	V_{CE}=(−)5V, I_C=(−)100mA	100*		400*	
Gain-Bandwidth Product	f_T	V_{CE}=(−)10V, I_C=(−)100mA		120		MHz
Output Capacitance	Cob	V_{CB}=(−)10V, f=1MHz		(13)8.5		pF
Collector-to-Emitter Saturation Voltage	V_{CE}(sat)	I_C=(−)400mA, I_B=(−)40mA		(−0.2)0.1	(−0.6)0.4	V
Base-to-Emitter Saturation Voltage	V_{BE}(sat)	I_C=(−)400mA, I_B=(−)40mA		(−)0.85	(−)1.2	V
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C=(−)10μA, I_E=0A	(−)120			V
Collector-to-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=(−)1mA, R_{BE}=∞	(−)100			V
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E=(−)10μA, I_C=0A	(−)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

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

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

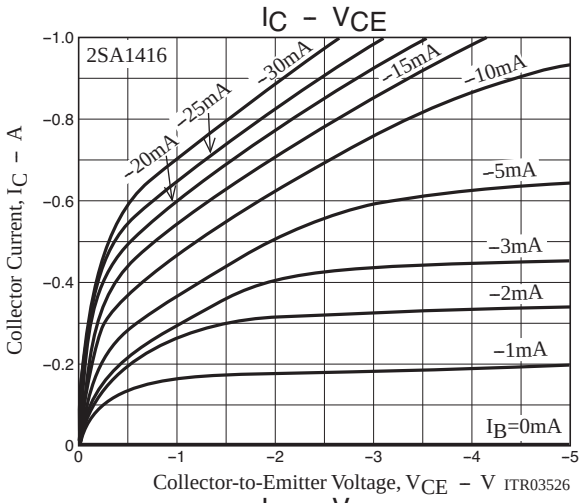
Switching Time Test Circuit

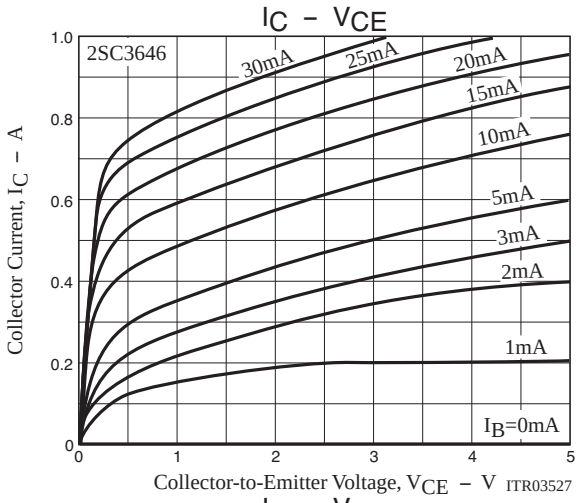


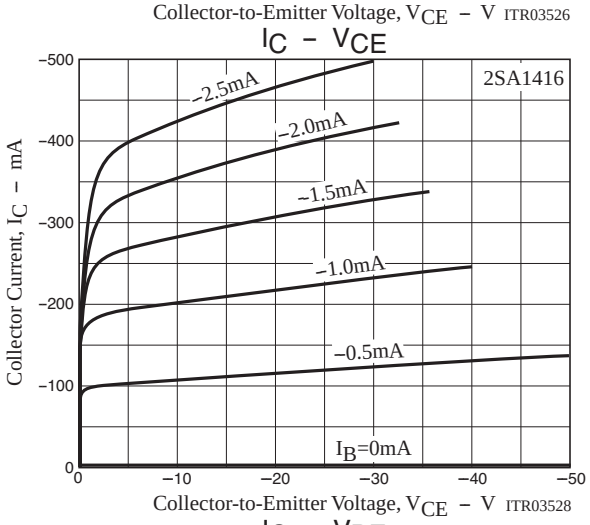
I_C=10I_{B1}=−10I_{B2}=400mA
(For PNP, the polarity is reversed)

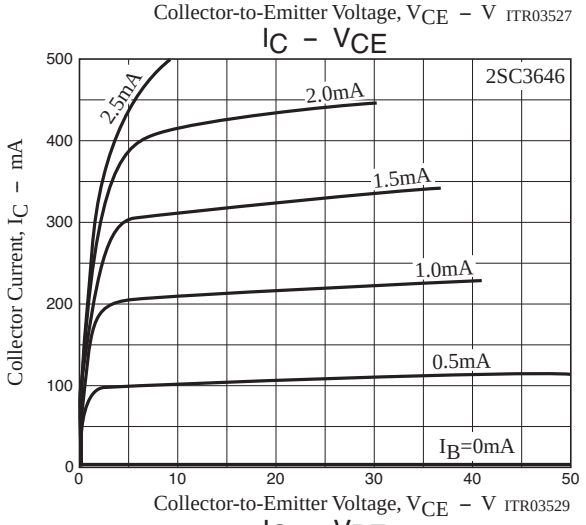
Ordering Information

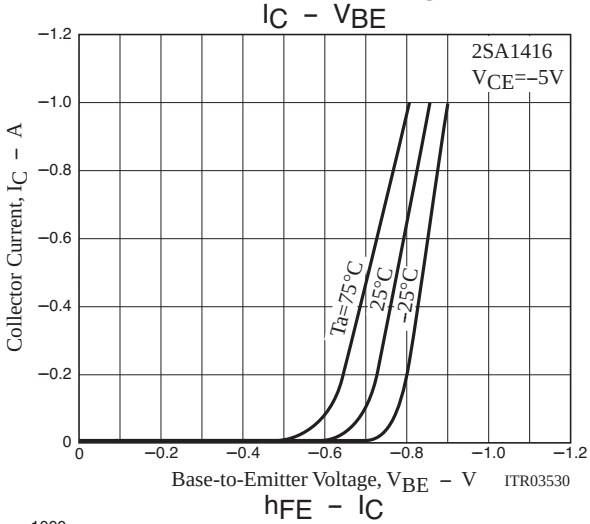
Device	Package	Shipping	memo
2SA1416S-TD-E	PCP	1,000pcs./reel	Pb Free
2SA1416T-TD-E	PCP	1,000pcs./reel	
2SC3646S-TD-E	PCP	1,000pcs./reel	
2SC3646T-TD-E	PCP	1,000pcs./reel	

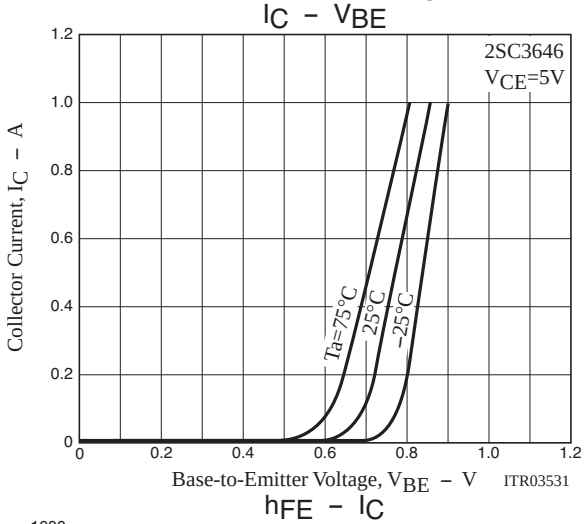

IC – VCE
2SA1416
–30mA
–25mA
–20mA
–15mA
–10mA
–5mA
–3mA
–2mA
–1mA
IB=0mA
Collector Current, IC – A
Collector-to-Emitter Voltage, VCE – V
ITR03526

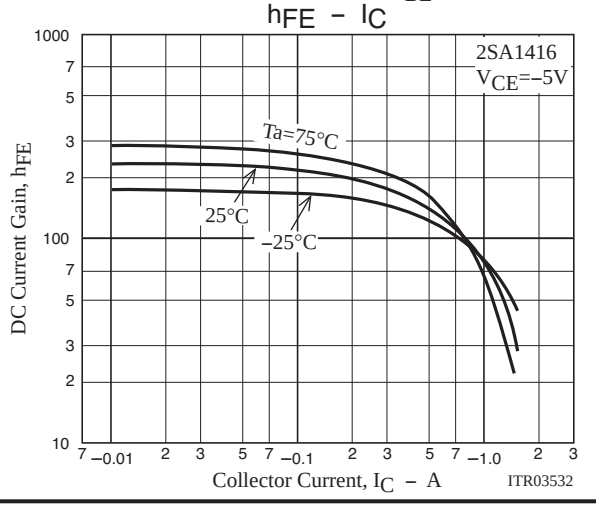

IC – VCE
2SC3646
30mA
25mA
20mA
15mA
10mA
5mA
3mA
2mA
1mA
IB=0mA
Collector Current, IC – A
Collector-to-Emitter Voltage, VCE – V
ITR03527

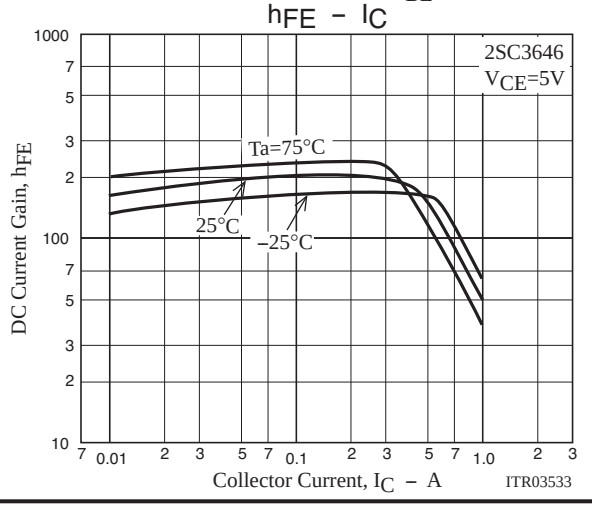

IC – VCE
2SA1416
–2.5mA
–2.0mA
–1.5mA
–1.0mA
–0.5mA
IB=0mA
Collector Current, IC – mA
Collector-to-Emitter Voltage, VCE – V
ITR03528

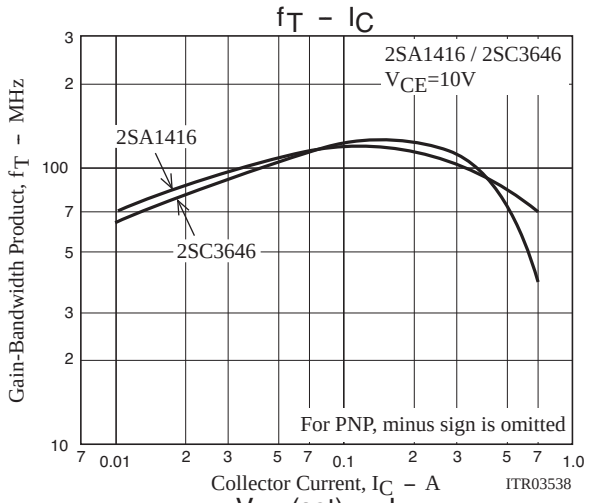

IC – VCE
2SC3646
2.5mA
2.0mA
1.5mA
1.0mA
0.5mA
IB=0mA
Collector Current, IC – mA
Collector-to-Emitter Voltage, VCE – V
ITR03529

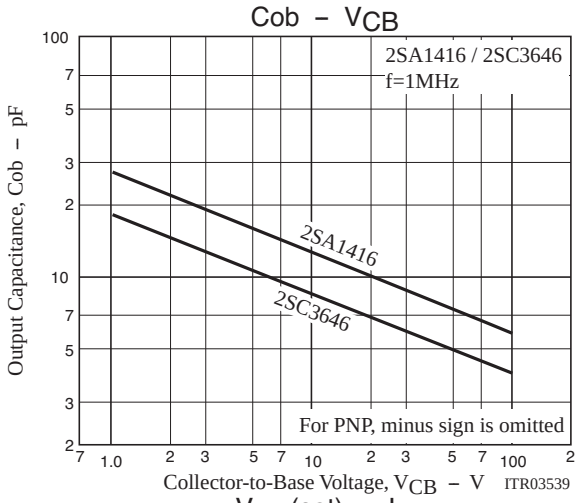

IC – VBE
2SA1416
VCE=–5V
Ta=75°C
25°C
–25°C
Collector Current, IC – A
Base-to-Emitter Voltage, VBE – V
ITR03530

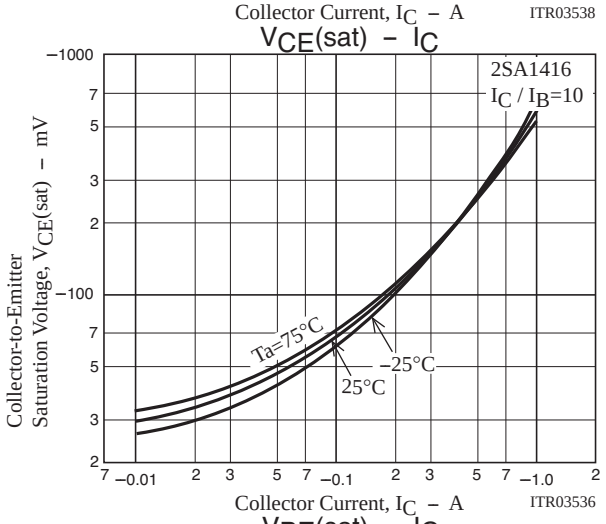

IC – VBE
2SC3646
VCE=5V
Ta=75°C
25°C
–25°C
Collector Current, IC – A
Base-to-Emitter Voltage, VBE – V
ITR03531

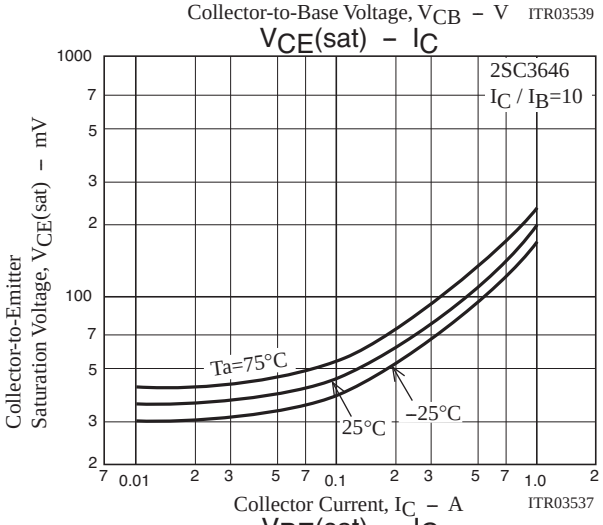

hFE – IC
2SA1416
VCE=–5V
Ta=75°C
25°C
–25°C
DC Current Gain, hFE
Collector Current, IC – A
ITR03532

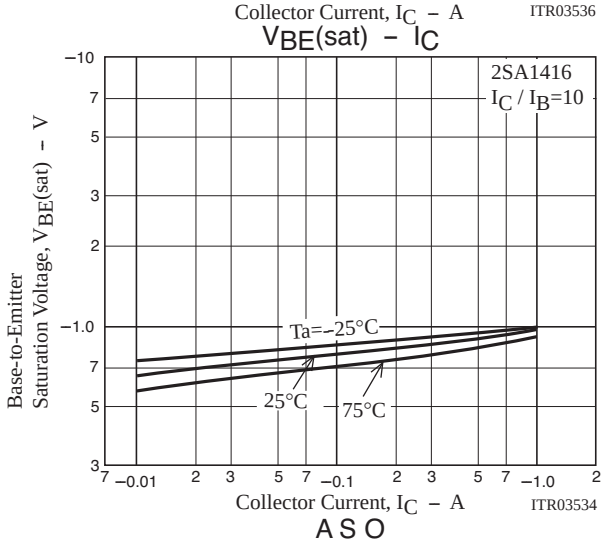

hFE – IC
2SC3646
VCE=5V
Ta=75°C
25°C
–25°C
DC Current Gain, hFE
Collector Current, IC – A
ITR03533

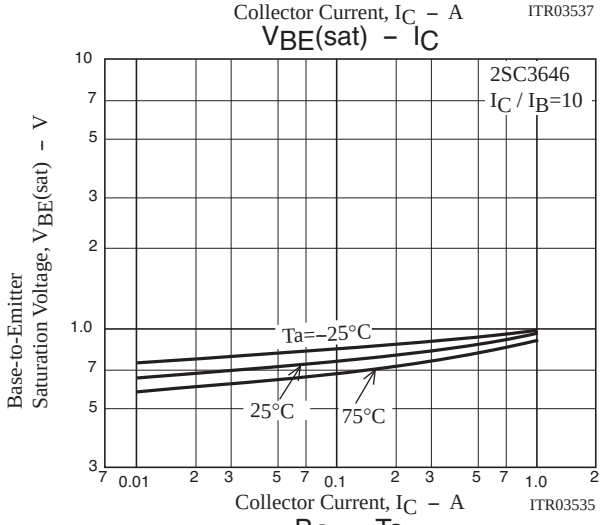

fT – IC
2SA1416 / 2SC3646
VCE=10V
2SA1416
2SC3646
For PNP, minus sign is omitted
Gain-Bandwidth Product, fT – MHz
Collector Current, IC – A
ITR03538

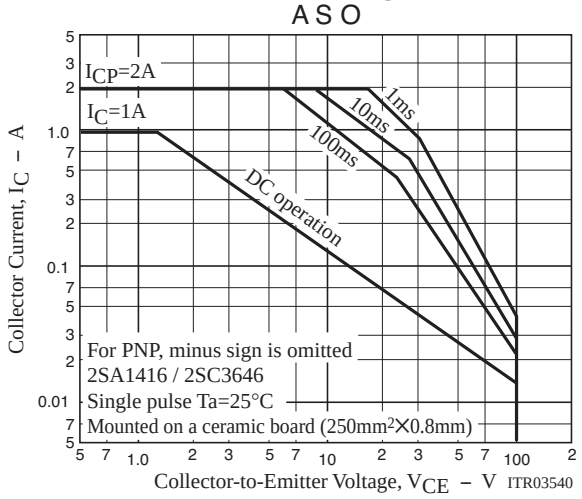

Cob – VCB
2SA1416 / 2SC3646
f=1MHz
2SA1416
2SC3646
For PNP, minus sign is omitted
Output Capacitance, Cob – pF
Collector-to-Base Voltage, VCB – V
ITR03539

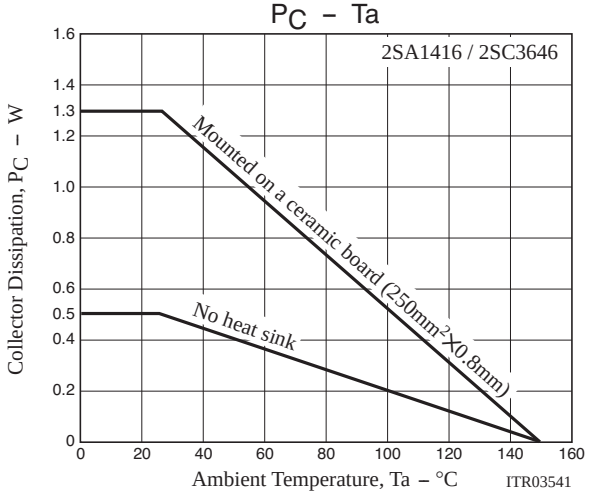

VCE(sat) – IC
2SA1416
IC / IB=10
Ta=75°C
25°C
–25°C
Collector-to-Emitter Saturation Voltage, VCE(sat) – mV
Collector Current, IC – A
ITR03536


VCE(sat) – IC
2SC3646
IC / IB=10
Ta=75°C
25°C
–25°C
Collector-to-Emitter Saturation Voltage, VCE(sat) – mV
Collector Current, IC – A
ITR03537


VBE(sat) – IC
2SA1416
IC / IB=10
Ta=–25°C
25°C
75°C
Base-to-Emitter Saturation Voltage, VBE(sat) – V
Collector Current, IC – A
ITR03534


VBE(sat) – IC
2SC3646
IC / IB=10
Ta=–25°C
25°C
75°C
Base-to-Emitter Saturation Voltage, VBE(sat) – V
Collector Current, IC – A
ITR03535


A S O
ICP=2A
IC=1A
1ms
10ms
100ms
DC operation
For PNP, minus sign is omitted
2SA1416 / 2SC3646
Single pulse Ta=25°C
Mounted on a ceramic board (250mm²×0.8mm)
Collector Current, IC – A
Collector-to-Emitter Voltage, VCE – V
ITR03540


PC – Ta
2SA1416 / 2SC3646
Mounted on a ceramic board (250mm²×0.8mm)
No heat sink
Collector Dissipation, PC – W
Ambient Temperature, Ta – °C
ITR03541

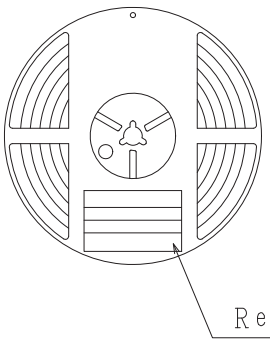
Bag Packing Specification

2SA1416S-TD-E, 2SA1416T-TD-E, 2SC3646S-TD-E, 2SC3646T-TD-E

1. Packing Format

Package Name	Carrier Tape Type	Maximum Number of devices contained (pcs)			Packing format	
		Reel	Inner box	Outer box	Inner BOX (C-1)	Outer BOX (A-7)
PCP	PCP	1,000	4,000	24,000	4 reels contained Dimensions:mm (external) 183×72×185	6 inner boxes contained Dimensions:mm (external) 440×195×210

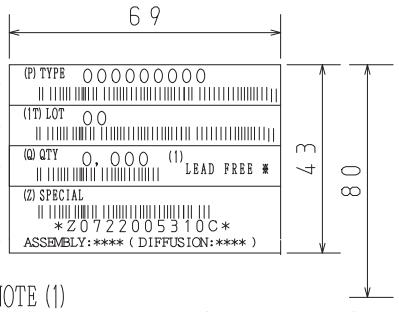
Packing method



Type No.
LOT No.
Quantity
Origin

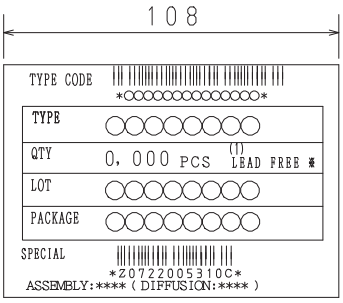
Reel label

Reel label, Inner box label
(unit:mm)



Outer box label

It is a label at the time of factory shipments. The form of a label may change in physical distribution process.

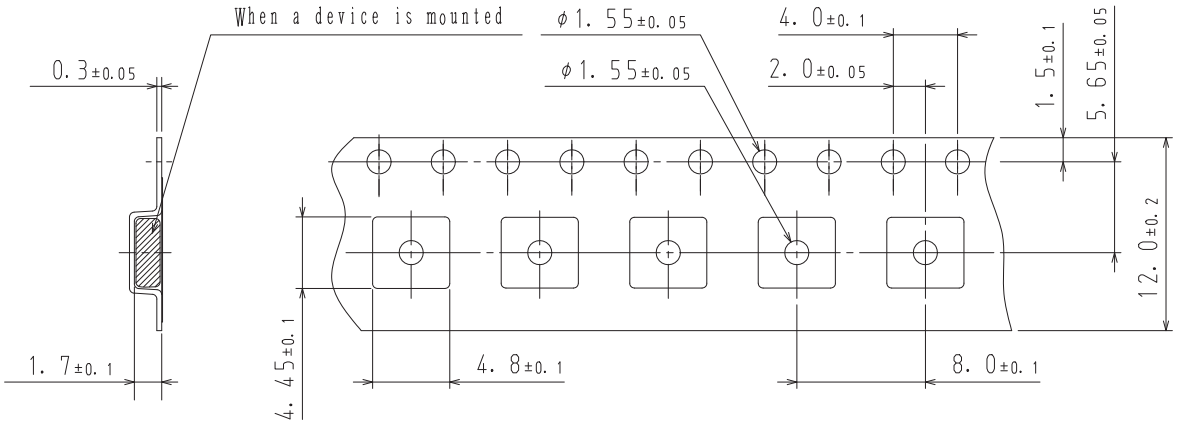


NOTE (1)
The LEAD FREE ※ description shows that the surface treatment of the terminal is lead free.

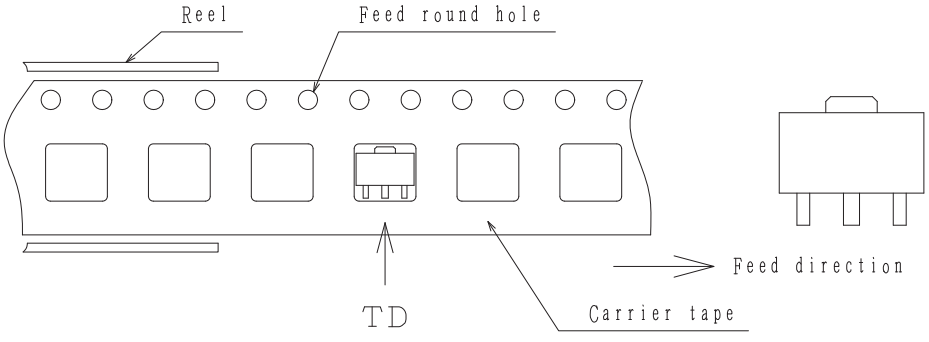
Label	JEITA Phase
LEAD FREE 3	JEITA Phase 3A
LEAD FREE 4	JEITA Phase 3

2. Taping configuration

2-1. Carrier tape size (unit:mm)



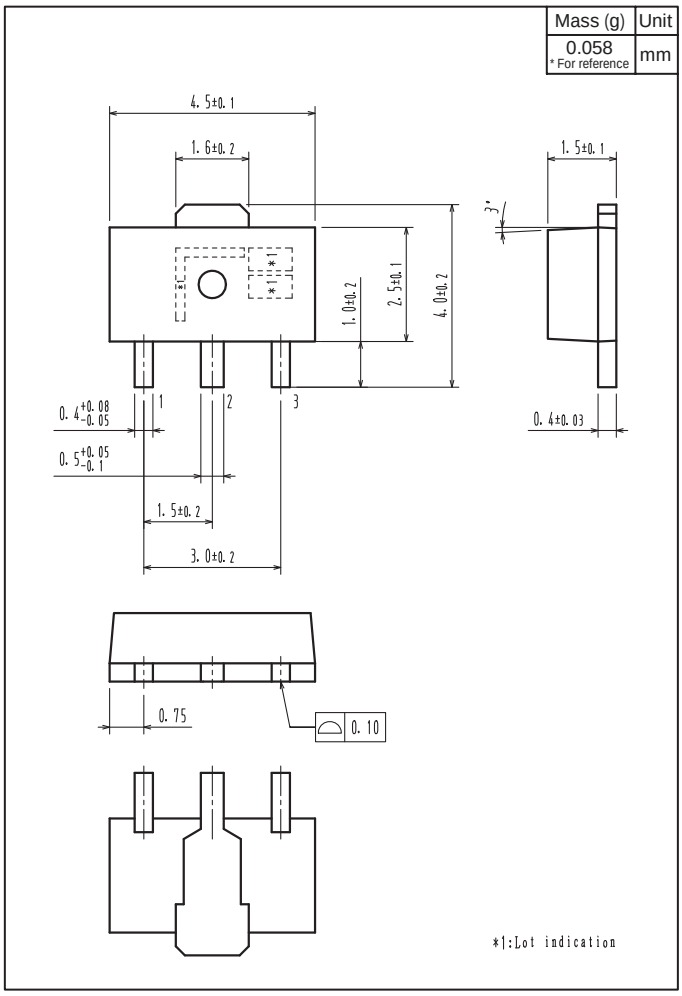
2-2. Device placement direction



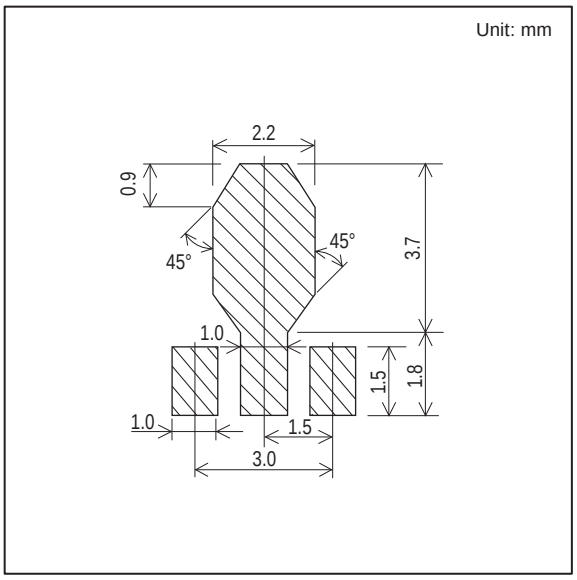
Those with pin 1 index on the feed hole side·····TD

Outline Drawing

2SA1416S-TD-E, 2SA1416T-TD-E, 2SC3646S-TD-E, 2SC3646T-TD-E



Land Pattern Example



ON Semiconductor and the ON logo are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC 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. "Typical" parameters which may be provided in SCILLC 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. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC 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 SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.