Ordering number : EN2006D

SANYO Semiconductors

DATA SHEET

An ON Semiconductor Company

# 2SA1417/2SC3647 — High-Voltage Switching Applications

PNP / NPN Epitaxial Planar Silicon Transistor

## 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 ICs

## Specifications ( ) : 2SA1417

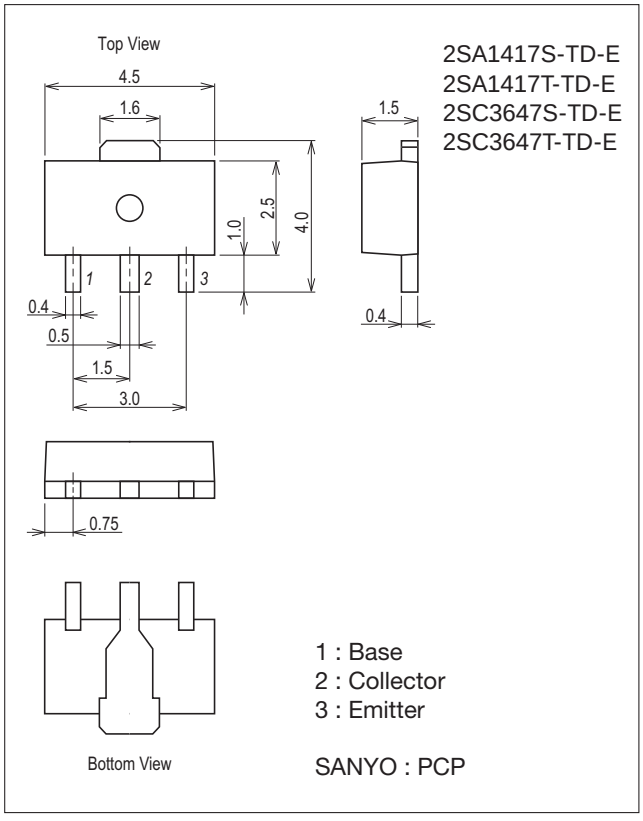
### Absolute Maximum Ratings at Ta=25°C

| 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 | $I_C$ | | (–)2 | A |
| Collector Current (Pulse) | $I_{CP}$ | | (–)3 | A |
| Collector Dissipation | $P_C$ | | 500 | mW |
| | | When mounted on ceramic substrate (250mm$^2$×0.8mm) | 1.5 | W |
| Junction Temperature | Tj | | 150 | °C |
| Storage Temperature | Tstg | | –55 to +150 | °C |

### Package Dimensions

unit : mm (typ)

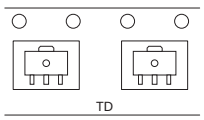
7007B-004



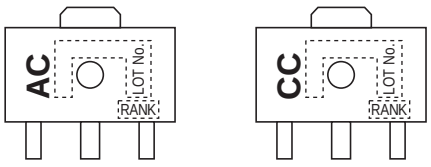

### Product & Package Information

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

### Packing Type: TD

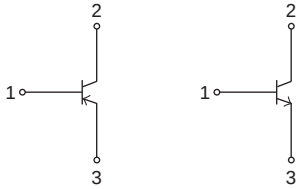



### Marking




2SA1417 2SC3647

### Electrical Connection




2SA1417 2SC3647

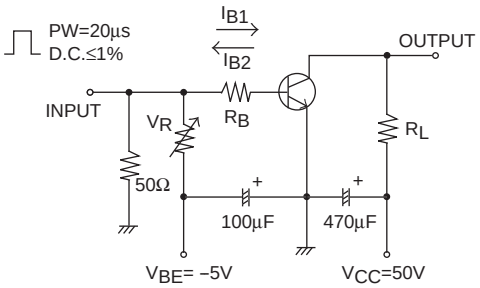
## Electrical Characteristics at Ta=25°C

| 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 | | (25)16 | | pF |
| Collector-to-Emitter Saturation Voltage | $V_{CE}$(sat) | $I_C$=(−)1A, $I_B$=(−)100mA | | (−0.22)0.13 | (−0.6)0.4 | V |
| Base-to-Emitter Saturation Voltage | $V_{BE}$(sat) | $I_C$=(−)1A, $I_B$=(−)100mA | | (−)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 | $t_{stg}$ | | | (750)1000 | | ns |
| Fall Time | $t_f$ | | | (40)50 | | ns |

* : The 2SA1417 / 2S3647 are classified by 100mA $h_{FE}$ as follws :

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

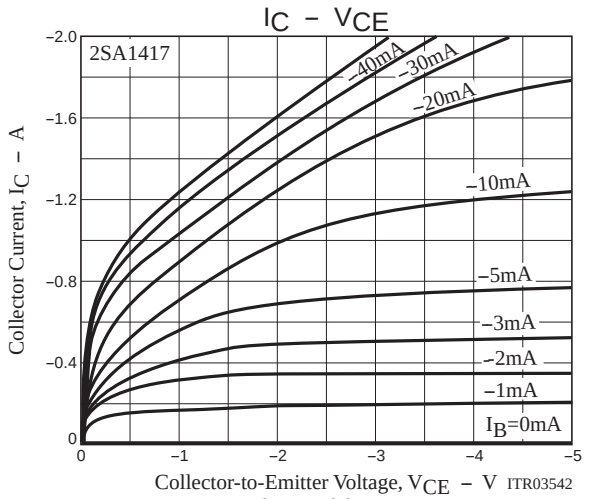
## Switching Time Test Circuit

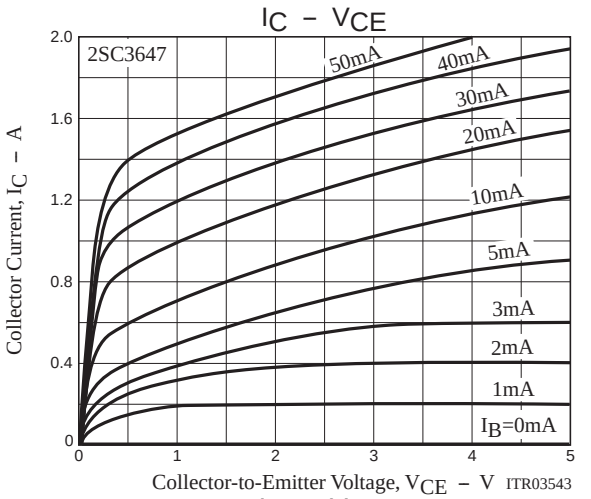


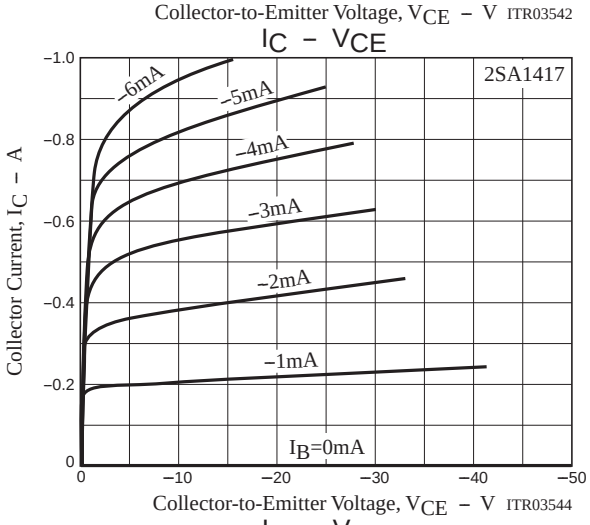

$I_C$=10$I_{B1}$= −10$I_{B2}$=0.7A
For PNP, the polarity is reversed.

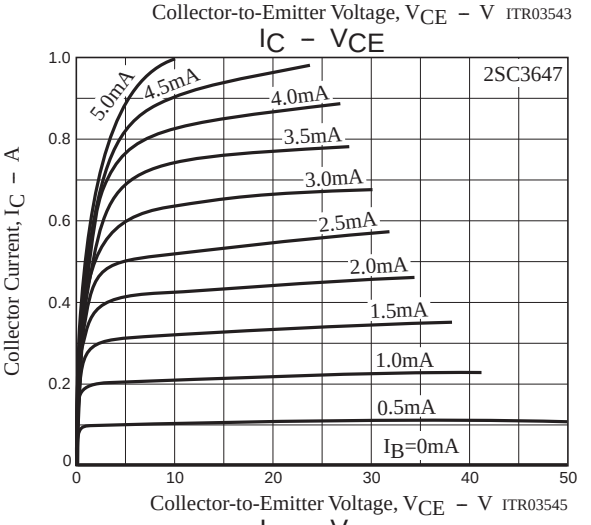
## Ordering Information

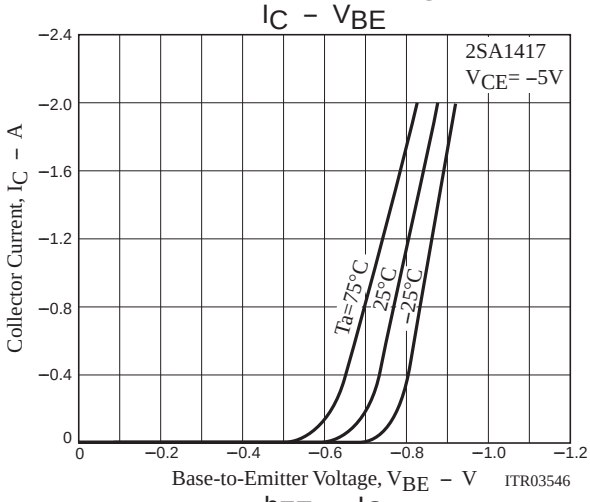
| Device | Package | Shipping | memo |
|---|---|---|---|
| 2SA1417S-TD-E | PCP | 1,000pcs./reel | Pb Free |
| 2SA1417T-TD-E | PCP | 1,000pcs./reel | |
| 2SC3647S-TD-E | PCP | 1,000pcs./reel | |
| 2SC3647T-TD-E | PCP | 1,000pcs./reel | |

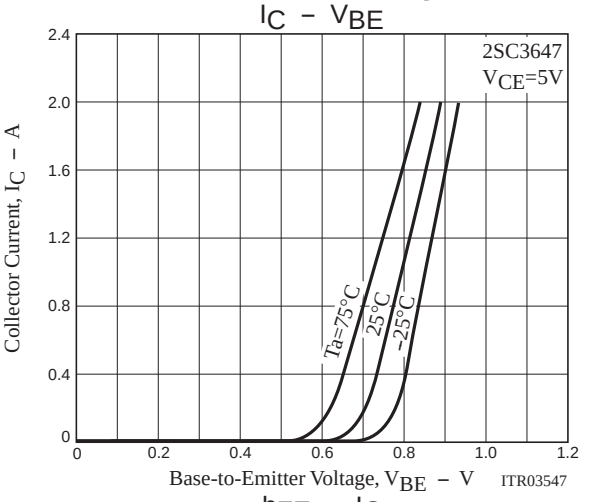

IC – VCE
2SA1417
–40mA
–30mA
–20mA
–10mA
–5mA
–3mA
–2mA
–1mA
IB=0mA
Collector Current, IC – A
Collector-to-Emitter Voltage, VCE – V
ITR03542

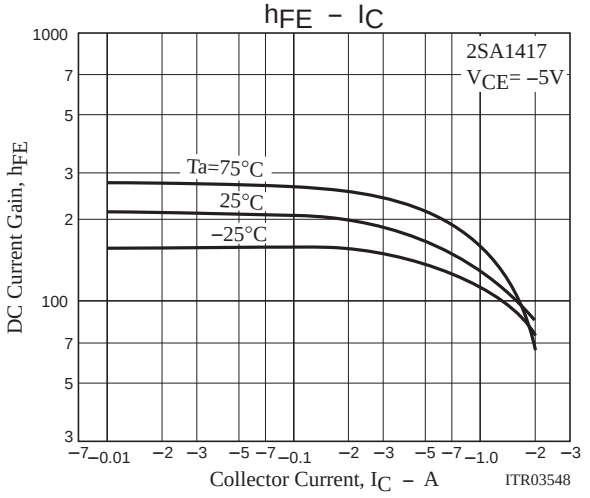

IC – VCE
2SC3647
50mA
40mA
30mA
20mA
10mA
5mA
3mA
2mA
1mA
IB=0mA
Collector Current, IC – A
Collector-to-Emitter Voltage, VCE – V
ITR03543

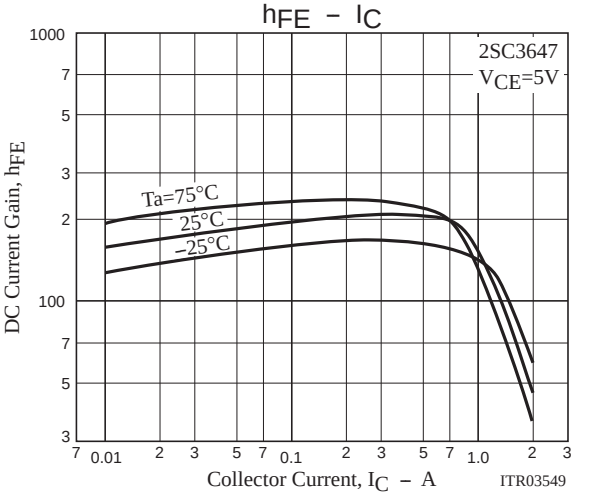

IC – VCE
2SA1417
–6mA
–5mA
–4mA
–3mA
–2mA
–1mA
IB=0mA
Collector Current, IC – A
Collector-to-Emitter Voltage, VCE – V
ITR03544

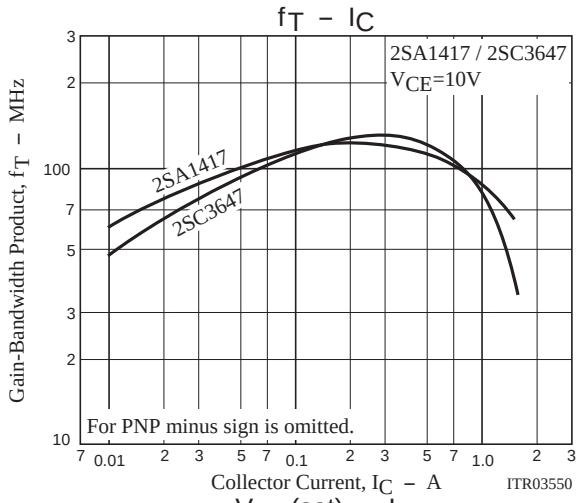

IC – VCE
2SC3647
5.0mA
4.5mA
4.0mA
3.5mA
3.0mA
2.5mA
2.0mA
1.5mA
1.0mA
0.5mA
IB=0mA
Collector Current, IC – A
Collector-to-Emitter Voltage, VCE – V
ITR03545

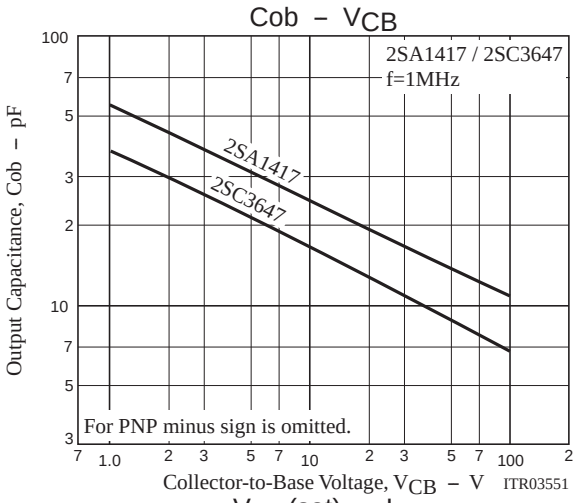

IC – VBE
2SA1417
VCE= –5V
Ta=75°C
25°C
–25°C
Collector Current, IC – A
Base-to-Emitter Voltage, VBE – V
ITR03546

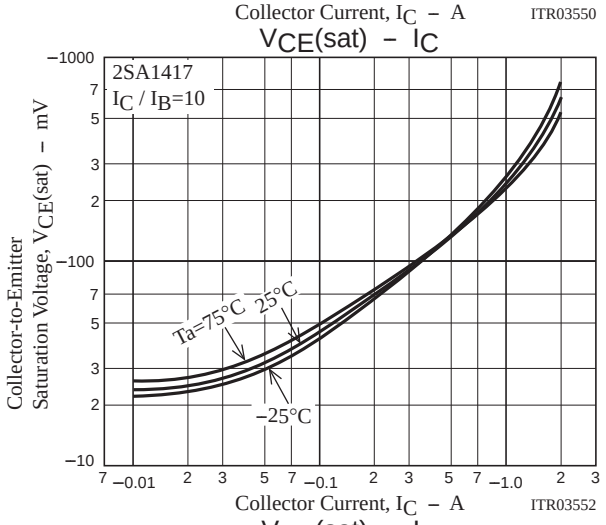

IC – VBE
2SC3647
VCE=5V
Ta=75°C
25°C
–25°C
Collector Current, IC – A
Base-to-Emitter Voltage, VBE – V
ITR03547

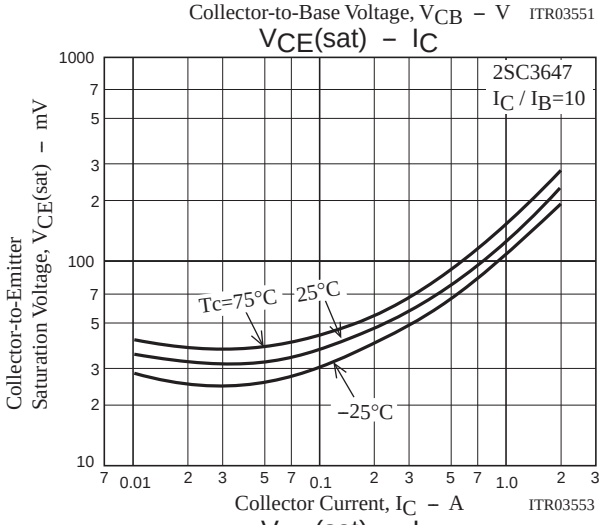

hFE – IC
2SA1417
VCE= –5V
Ta=75°C
25°C
–25°C
DC Current Gain, hFE
Collector Current, IC – A
ITR03548

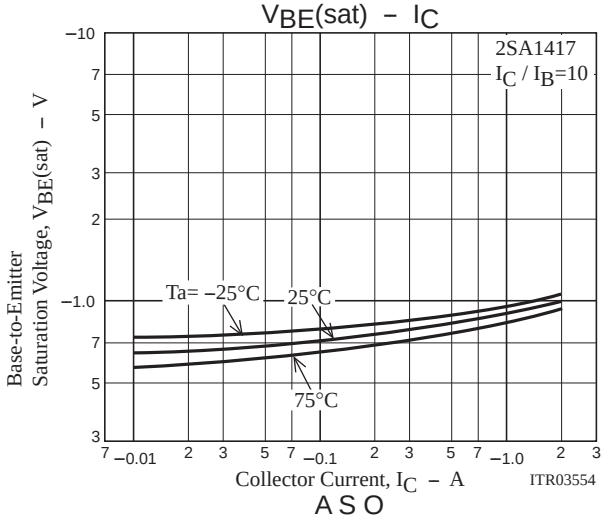

hFE – IC
2SC3647
VCE=5V
Ta=75°C
25°C
–25°C
DC Current Gain, hFE
Collector Current, IC – A
ITR03549

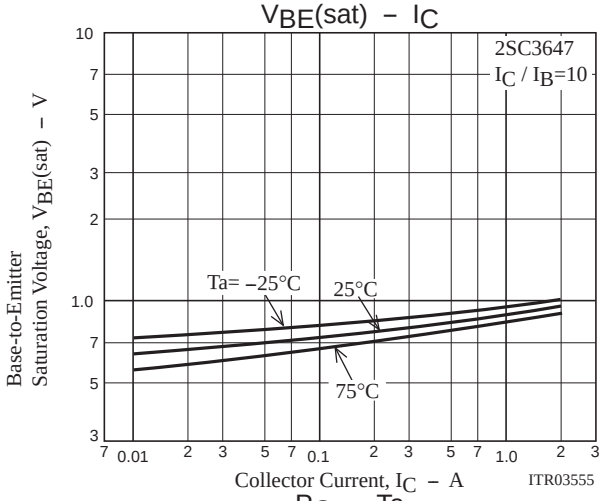

fT – IC
2SA1417 / 2SC3647
VCE=10V
2SA1417
2SC3647
For PNP minus sign is omitted.
Gain-Bandwidth Product, fT – MHz
Collector Current, IC – A
ITR03550

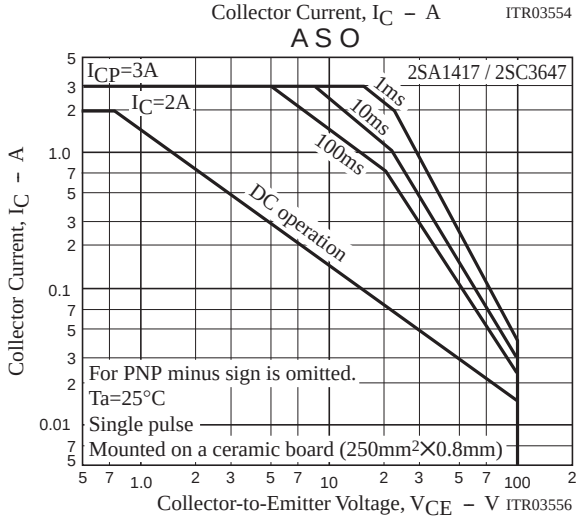

Cob – VCB
2SA1417 / 2SC3647
f=1MHz
2SA1417
2SC3647
For PNP minus sign is omitted.
Output Capacitance, Cob – pF
Collector-to-Base Voltage, VCB – V
ITR03551

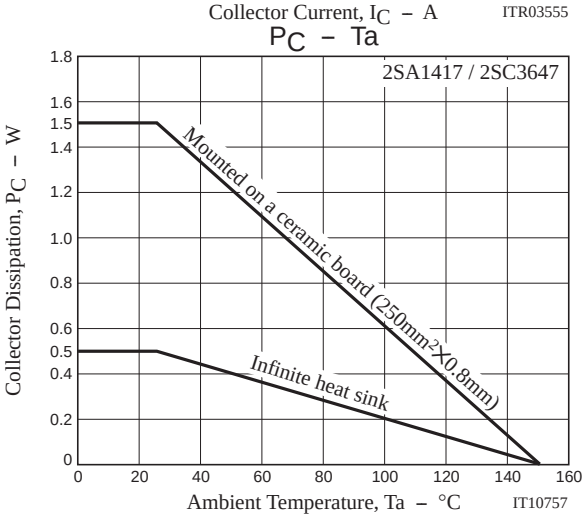

VCE(sat) – IC
2SA1417
IC / IB=10
Ta=75°C
25°C
–25°C
Collector-to-Emitter Saturation Voltage, VCE(sat) – mV
Collector Current, IC – A
ITR03552


VCE(sat) – IC
2SC3647
IC / IB=10
Tc=75°C
25°C
–25°C
Collector-to-Emitter Saturation Voltage, VCE(sat) – mV
Collector Current, IC – A
ITR03553


VBE(sat) – IC
2SA1417
IC / IB=10
Ta= –25°C
25°C
75°C
Base-to-Emitter Saturation Voltage, VBE(sat) – V
Collector Current, IC – A
ITR03554


VBE(sat) – IC
2SC3647
IC / IB=10
Ta= –25°C
25°C
75°C
Base-to-Emitter Saturation Voltage, VBE(sat) – V
Collector Current, IC – A
ITR03555


A S O
ICP=3A
IC=2A
2SA1417 / 2SC3647
1ms
10ms
100ms
DC operation
For PNP minus sign is omitted.
Ta=25°C
Single pulse
Mounted on a ceramic board (250mm²×0.8mm)
Collector Current, IC – A
Collector-to-Emitter Voltage, VCE – V
ITR03556


PC – Ta
2SA1417 / 2SC3647
Mounted on a ceramic board (250mm²×0.8mm)
Infinite heat sink
Collector Dissipation, PC – W
Ambient Temperature, Ta – °C
IT10757

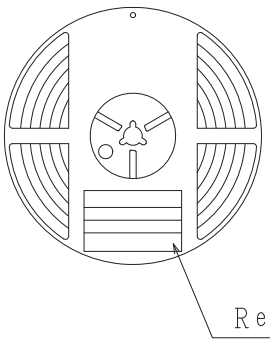
**Embossed Taping Specification**

2SA1417S-TD-E, 2SA1417T-TD-E, 2SC3647S-TD-E, 2SC3647T-TD-E

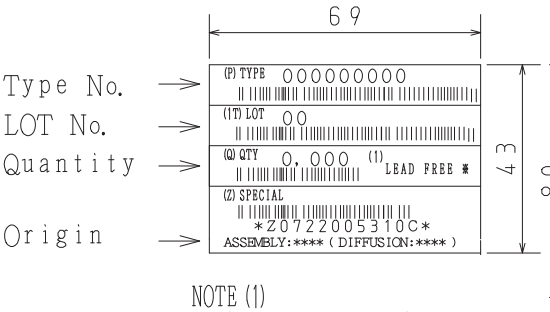
## 1. Packing Format

| 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<br>Dimensions:mm (external)<br>183×72×185 | 6 inner boxes contained<br>Dimensions:mm (external)<br>440×195×210 |

Packing method

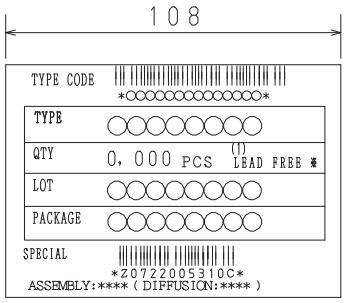



Reel label, Inner box label (unit:mm)




Outer box label

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

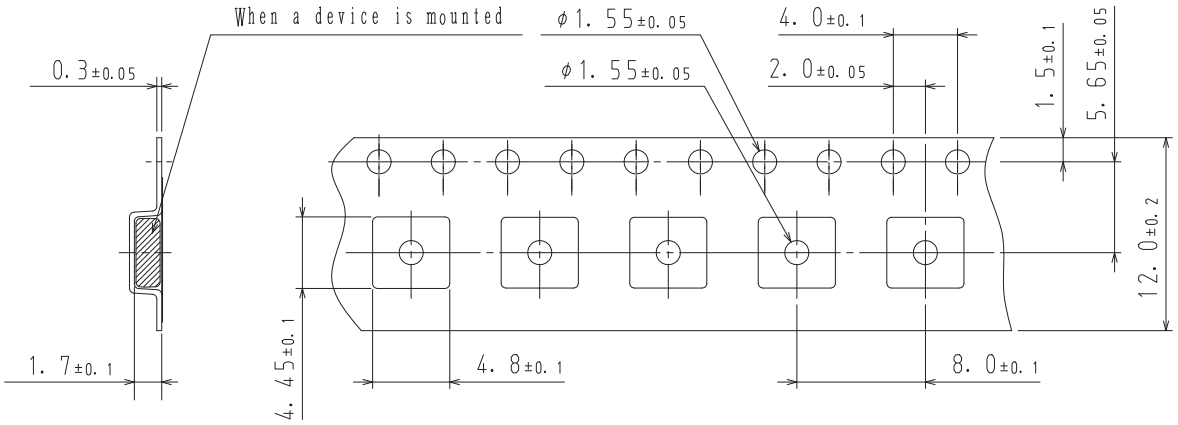



NOTE (1)
The LEAD FREE ※ description shows that the surface treatment of the terminal is lead free.

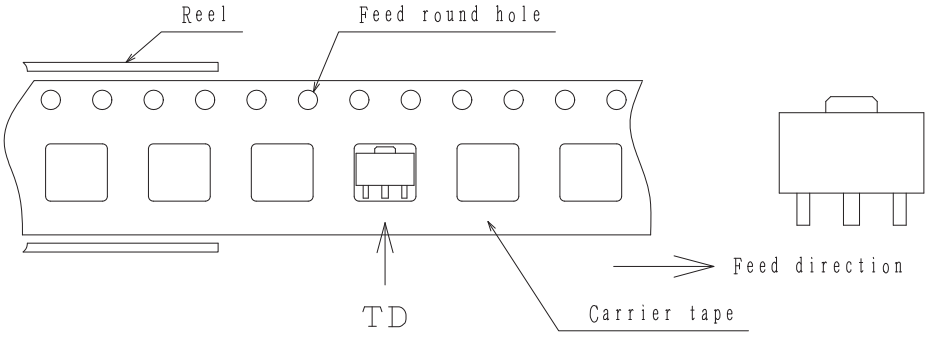
| Label | JEITA Phase |
|---|---|
| LEAD FREE 3 | JEITA Phase 3A |
| LEAD FREE 4 | JEITA Phase 3 |

## 2. Taping configuration

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



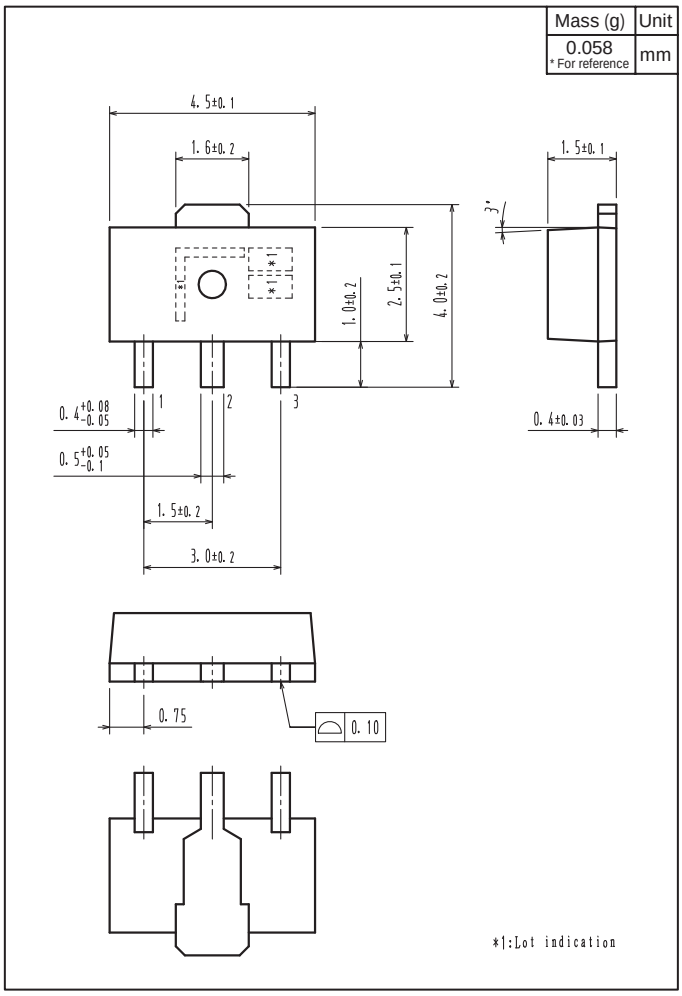

### 2-2. Device placement direction



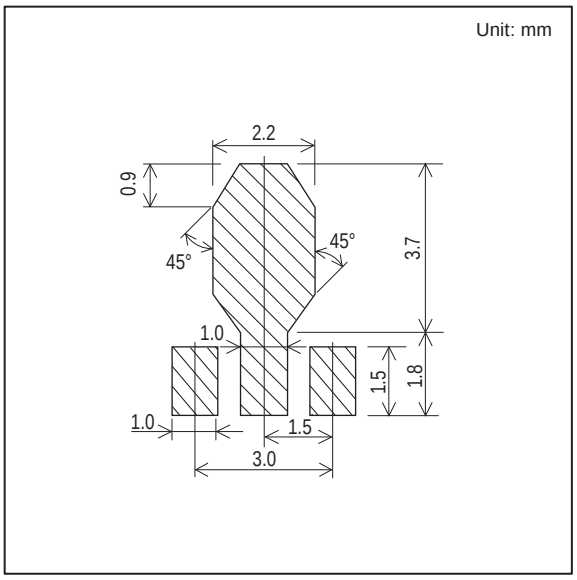

Those with pin 1 index on the feed hole side·····TD

## Outline Drawing

2SA1417S-TD-E, 2SA1417T-TD-E, 2SC3647S-TD-E, 2SC3647T-TD-E




## Land Pattern Example



Стандарт Электрон Связь

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

**Наши контакты:**

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**Электронная почта:** sales@st-electron.ru

**Адрес:** 198099, Санкт-Петербург,
Промышленная ул, дом № 19, литера Н,
помещение 100-Н Офис 331