Ordering number : EN2511B

SANYO Semiconductors

DATA SHEET

An ON Semiconductor Company

2SA1593/2SC4135 — High-Voltage Switching Applications

PNP/NPN Epitaxial Planar Silicon Transistors

Applications

- Power supplies, relay derivers, lamp drivers

Features

- Adoption of FBET, MBIT processes
- High breakdown voltage and large current capacity
- Fast switching speed
- Small and slim package permitting 2SA1593/2SC4135-applied sets to be made more compact

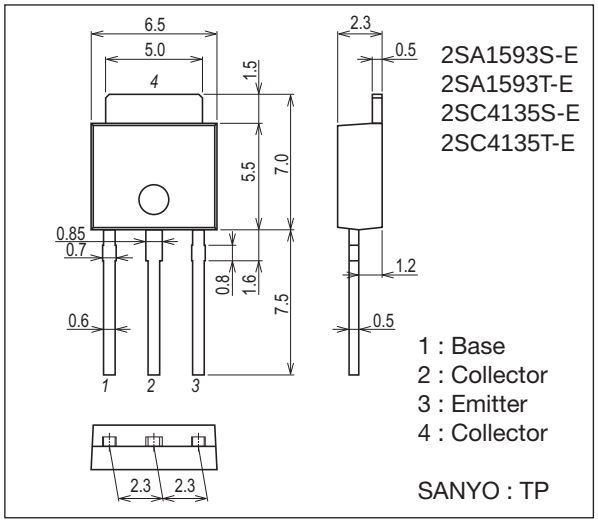
Specifications ( ): 2SA1593

Absolute Maximum Ratings at Ta=25°C

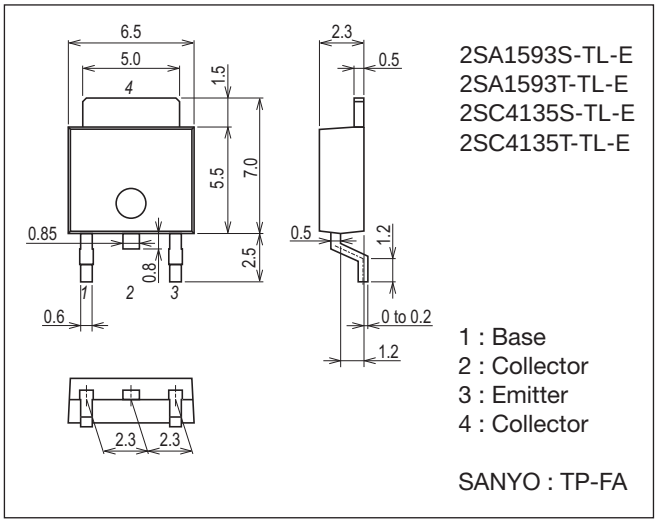
Parameter	Symbol	Conditions	Ratings	Unit
Collector-to-Base Voltage	V_{CBO}		(–)120	V
Collector-to-Emitter Voltage	V_{CEO}		(–)100	V
Emitter-to-Base Voltage	V_{EBO}		(–)6	V
Collector Current	I_C		(–)2	A
Collector Current (Pulse)	I_{CP}		(–)3	A

Continued on next page.

Package Dimensions unit : mm (typ)
7518-003



Package Dimensions unit : mm (typ)
7003-003

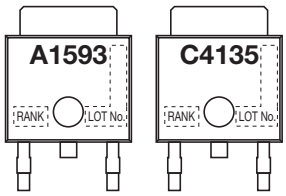


Product & Package Information

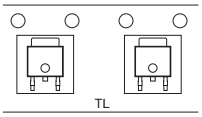
- Package : TP
- JEITA, JEDEC : SC-64, TO-251
- Minimum Packing Quantity : 500 pcs./bag

- Package : TP-FA
- JEITA, JEDEC : SC-63, TO-252
- Minimum Packing Quantity : 700 pcs./reel

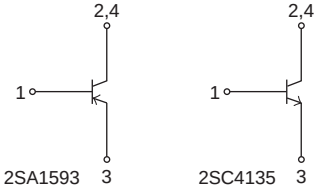
Marking (TP, TP-FA)



Packing Type (TP-FA) : TL



Electrical Connection



Continued from preceding page.

Parameter	Symbol	Conditions	Ratings	Unit
Collector Dissipation	P_C		1	W
		Tc=25°C	15	W
Junction Temperature	Tj		150	°C
Storage Temperature	Tstg		−55 to +150	°C

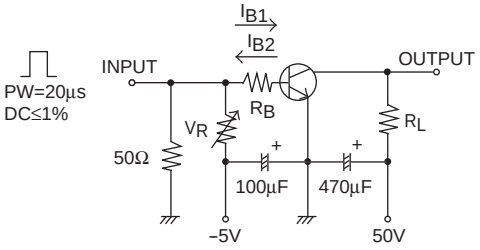
Electrical Characteristics at Ta=25°C

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 2SA1593/2SC4135 are classified by 100mA h_{FE} as follows :

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

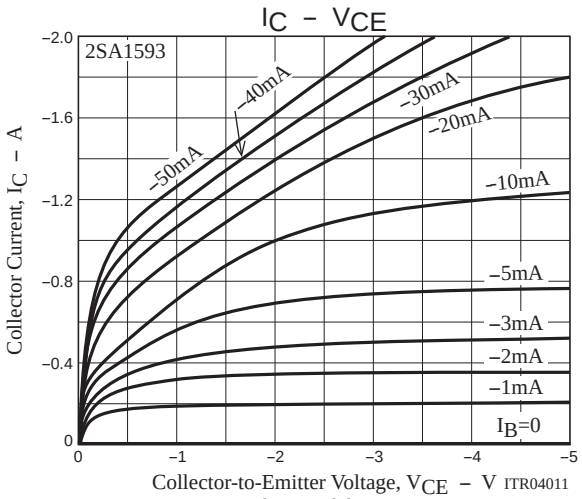
Switching Time Test Circuit

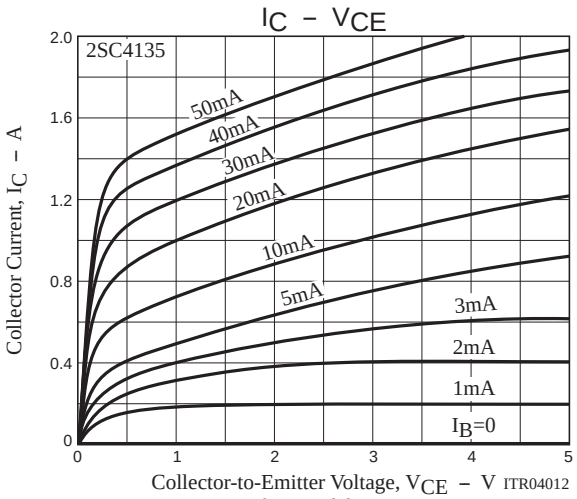


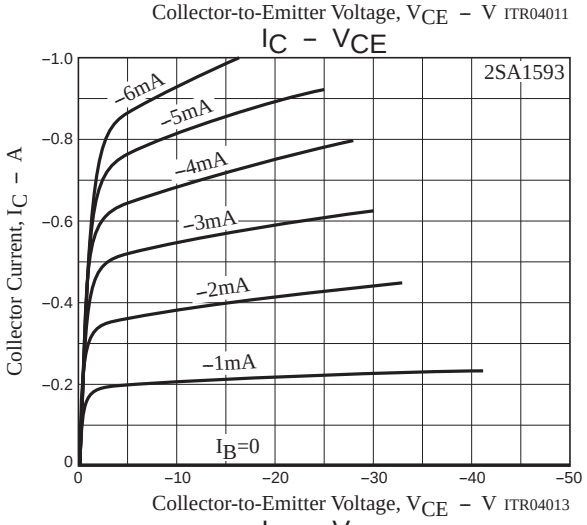
I_C=10I_{B1}= −10I_{B2}=0.7A
(For PNP, the polarity is reversed)

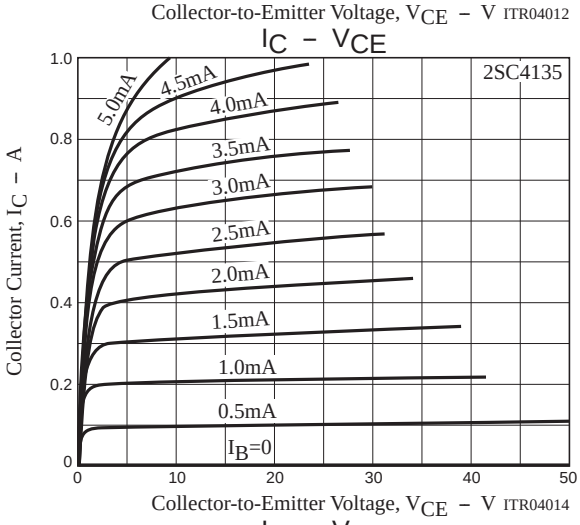
Ordering Information

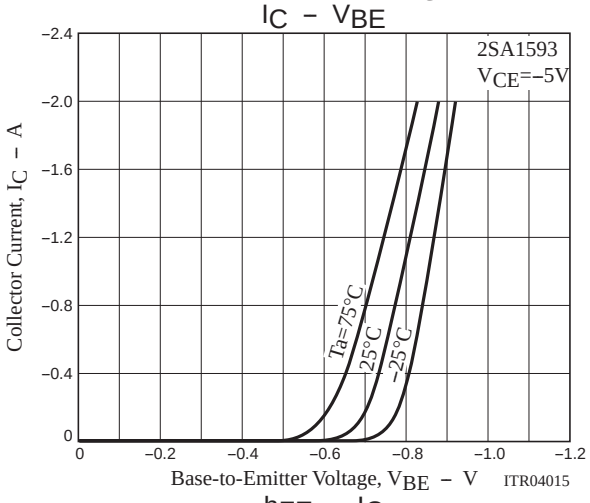
Device	Package	Shipping	memo
2SA1593S-E	TP	500pcs./bag	Pb Free
2SA1593T-E	TP	500pcs./bag	
2SC4135S-E	TP	500pcs./bag	
2SC4135T-E	TP	500pcs./bag	
2SA1593S-TL-E	TP-FA	700pcs./reel	
2SA1593T-TL-E	TP-FA	700pcs./reel	
2SC4135S-TL-E	TP-FA	700pcs./reel	
2SC4135T-TL-E	TP-FA	700pcs./reel	

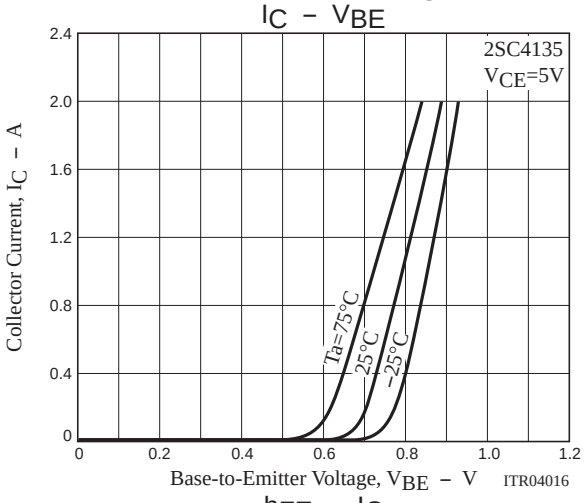

IC – VCE
2SA1593
–40mA
–30mA
–50mA
–20mA
–10mA
–5mA
–3mA
–2mA
–1mA
IB=0
Collector Current, IC – A
Collector-to-Emitter Voltage, VCE – V
ITR04011

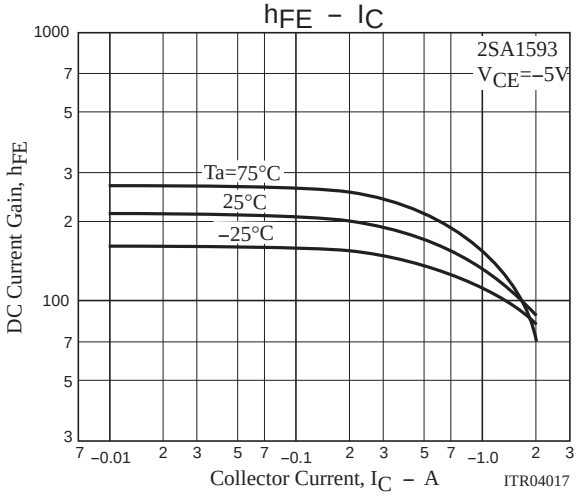

IC – VCE
2SC4135
50mA
40mA
30mA
20mA
10mA
5mA
3mA
2mA
1mA
IB=0
Collector Current, IC – A
Collector-to-Emitter Voltage, VCE – V
ITR04012

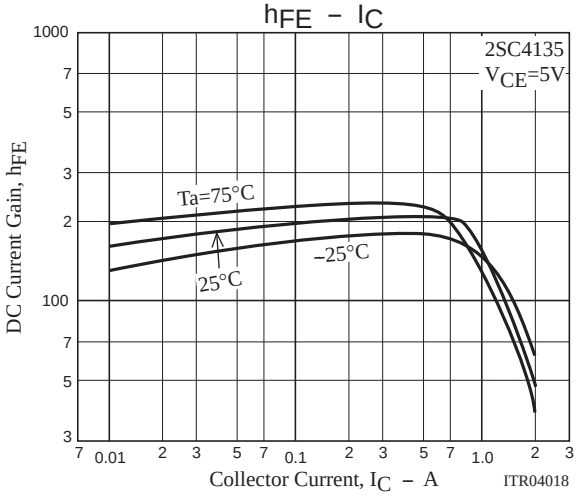

IC – VCE
2SA1593
–6mA
–5mA
–4mA
–3mA
–2mA
–1mA
IB=0
Collector Current, IC – A
Collector-to-Emitter Voltage, VCE – V
ITR04013

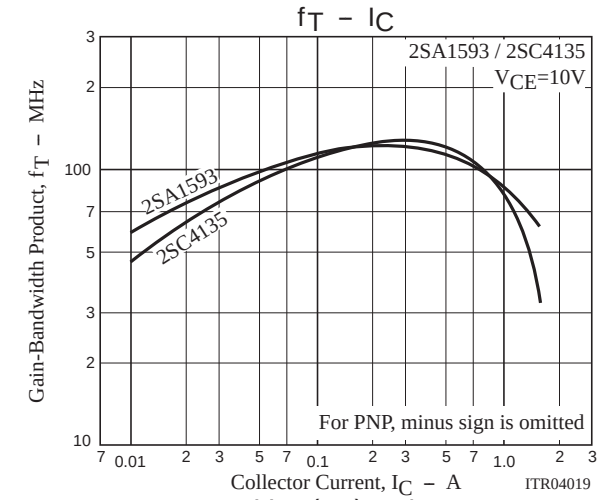

IC – VCE
2SC4135
5.0mA
4.5mA
4.0mA
3.5mA
3.0mA
2.5mA
2.0mA
1.5mA
1.0mA
0.5mA
IB=0
Collector Current, IC – A
Collector-to-Emitter Voltage, VCE – V
ITR04014

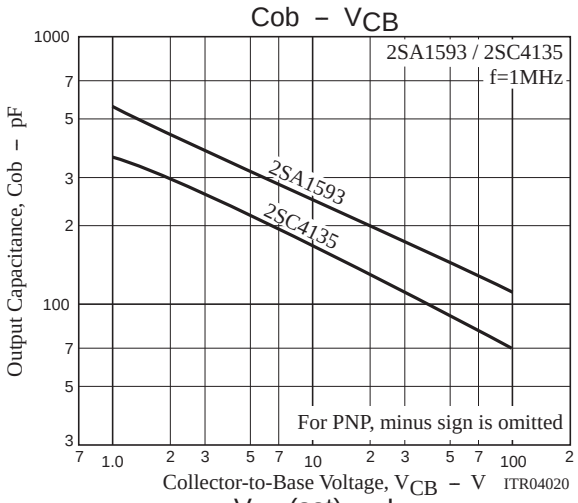

IC – VBE
2SA1593
VCE=–5V
Ta=75°C
25°C
–25°C
Collector Current, IC – A
Base-to-Emitter Voltage, VBE – V
ITR04015

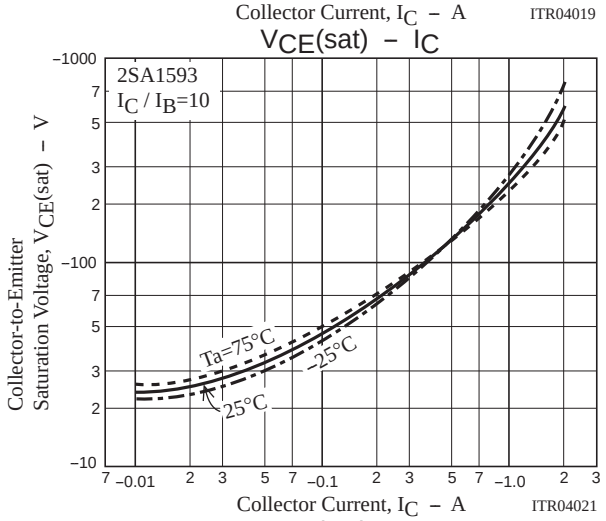

IC – VBE
2SC4135
VCE=5V
Ta=75°C
25°C
–25°C
Collector Current, IC – A
Base-to-Emitter Voltage, VBE – V
ITR04016

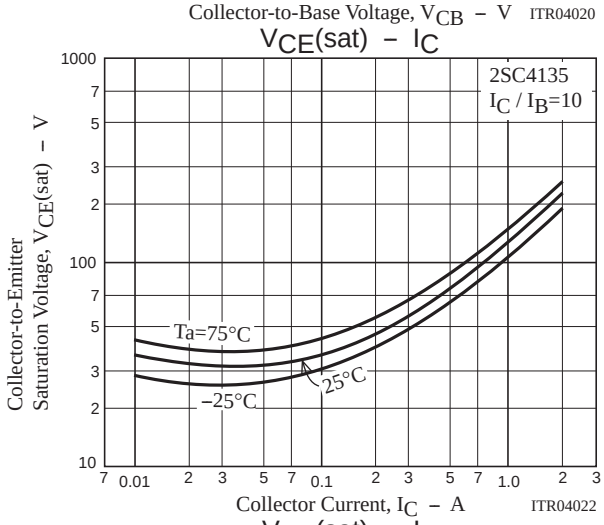

hFE – IC
2SA1593
VCE=–5V
Ta=75°C
25°C
–25°C
DC Current Gain, hFE
Collector Current, IC – A
ITR04017

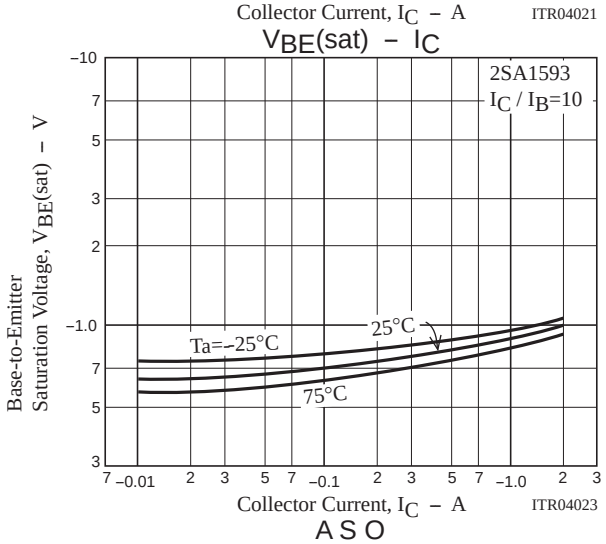

hFE – IC
2SC4135
VCE=5V
Ta=75°C
25°C
–25°C
DC Current Gain, hFE
Collector Current, IC – A
ITR04018

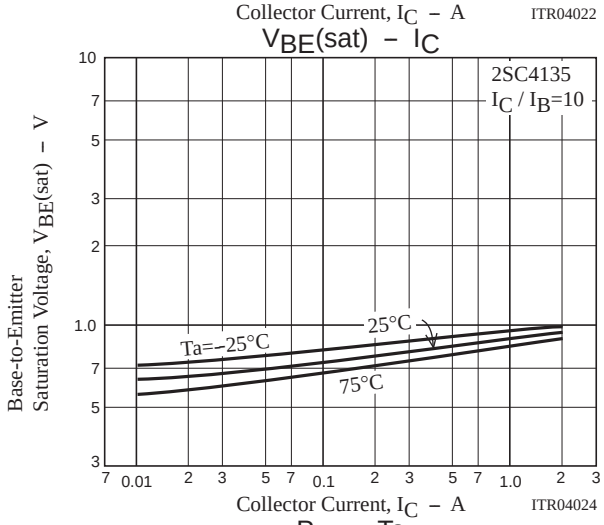

fT – IC
2SA1593 / 2SC4135
VCE=10V
2SA1593
2SC4135
For PNP, minus sign is omitted
Gain-Bandwidth Product, fT – MHz
Collector Current, IC – A
ITR04019

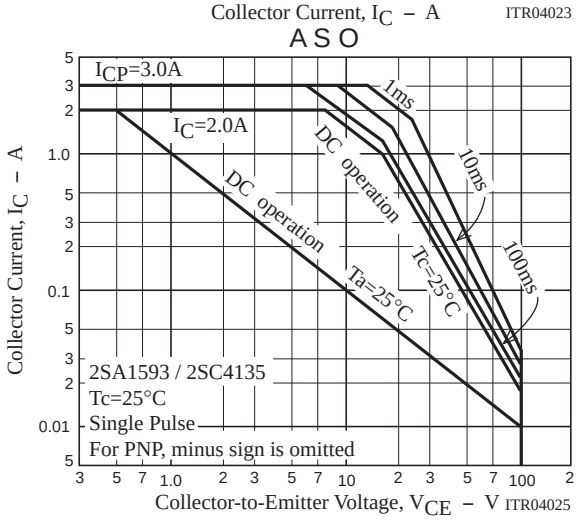

Cob – VCB
2SA1593 / 2SC4135
f=1MHz
2SA1593
2SC4135
For PNP, minus sign is omitted
Output Capacitance, Cob – pF
Collector-to-Base Voltage, VCB – V
ITR04020

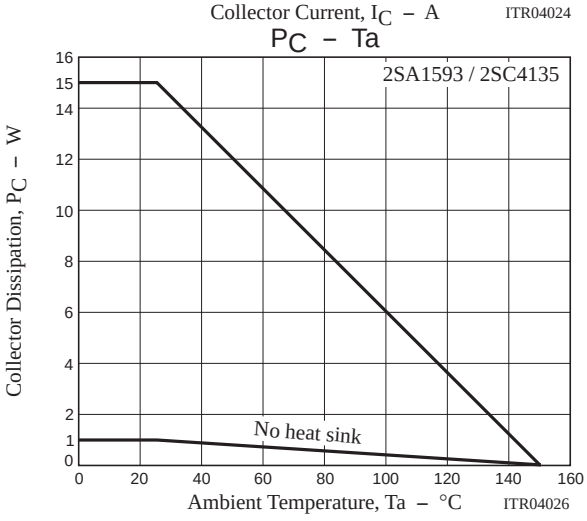

VCE(sat) – IC
2SA1593
IC / IB=10
Ta=75°C
25°C
–25°C
Collector-to-Emitter Saturation Voltage, VCE(sat) – V
Collector Current, IC – A
ITR04021


VCE(sat) – IC
2SC4135
IC / IB=10
Ta=75°C
25°C
–25°C
Collector-to-Emitter Saturation Voltage, VCE(sat) – V
Collector Current, IC – A
ITR04022


VBE(sat) – IC
2SA1593
IC / IB=10
Ta=–25°C
25°C
75°C
Base-to-Emitter Saturation Voltage, VBE(sat) – V
Collector Current, IC – A
ITR04023


VBE(sat) – IC
2SC4135
IC / IB=10
Ta=–25°C
25°C
75°C
Base-to-Emitter Saturation Voltage, VBE(sat) – V
Collector Current, IC – A
ITR04024


A S O
ICP=3.0A
IC=2.0A
1ms
10ms
100ms
DC operation
DC operation
Tc=25°C
Ta=25°C
2SA1593 / 2SC4135
Tc=25°C
Single Pulse
For PNP, minus sign is omitted
Collector Current, IC – A
Collector-to-Emitter Voltage, VCE – V
ITR04025


PC – Ta
2SA1593 / 2SC4135
No heat sink
Collector Dissipation, PC – W
Ambient Temperature, Ta – °C
ITR04026

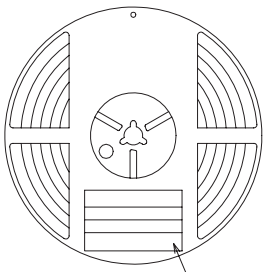
Taping Specification

2SA1593S-TL-E, 2SA1593T-TL-E, 2SC4135S-TL-E, 2SC4135T-TL-E

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)
TP-FA	TP	700	2,100	12,600	3 reels contained Dimensions:mm (external) 183×72×185	6 inner boxes contained Dimensions:mm (external) 440×195×210

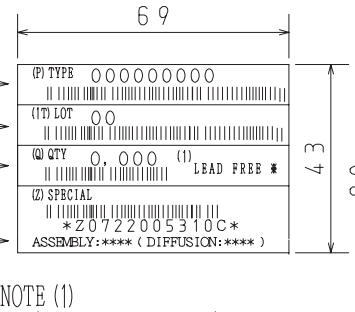
Packing method



Reel label

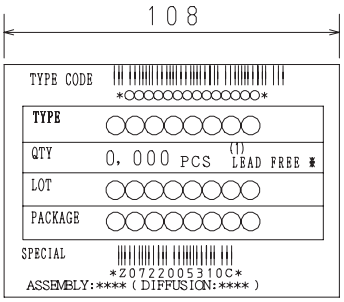
Reel label, Inner box label

(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.

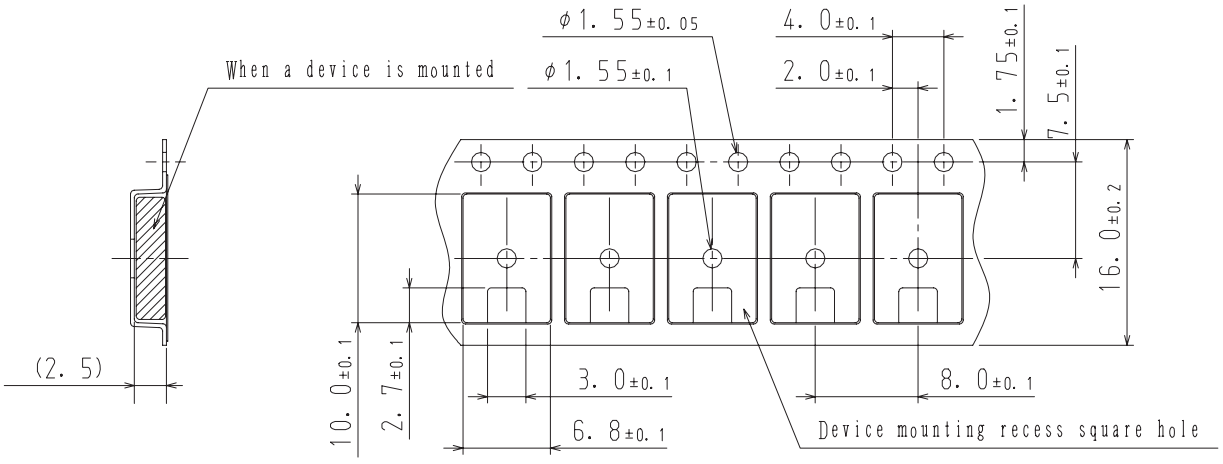


NOTE (1)
The LEAD FREE ※ description shows that the surface treatment of the terminal is lead free.

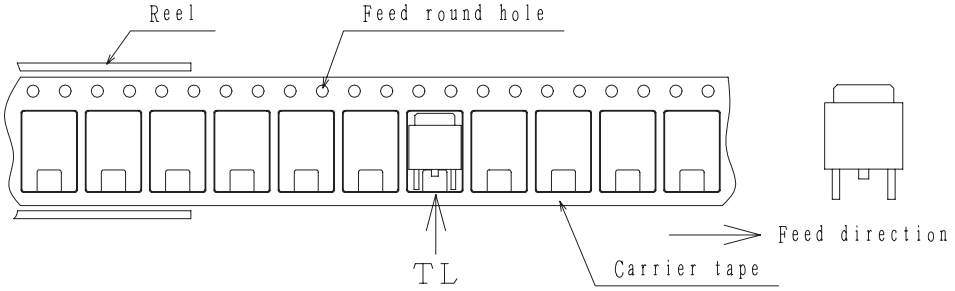
Label	JEITA Phase
LEAD FREE 3	JEITA Phase 3A
LEAD FREE 4	JEITA Phase 3

Taping configuration

1. Carrier tape size (unit:mm)



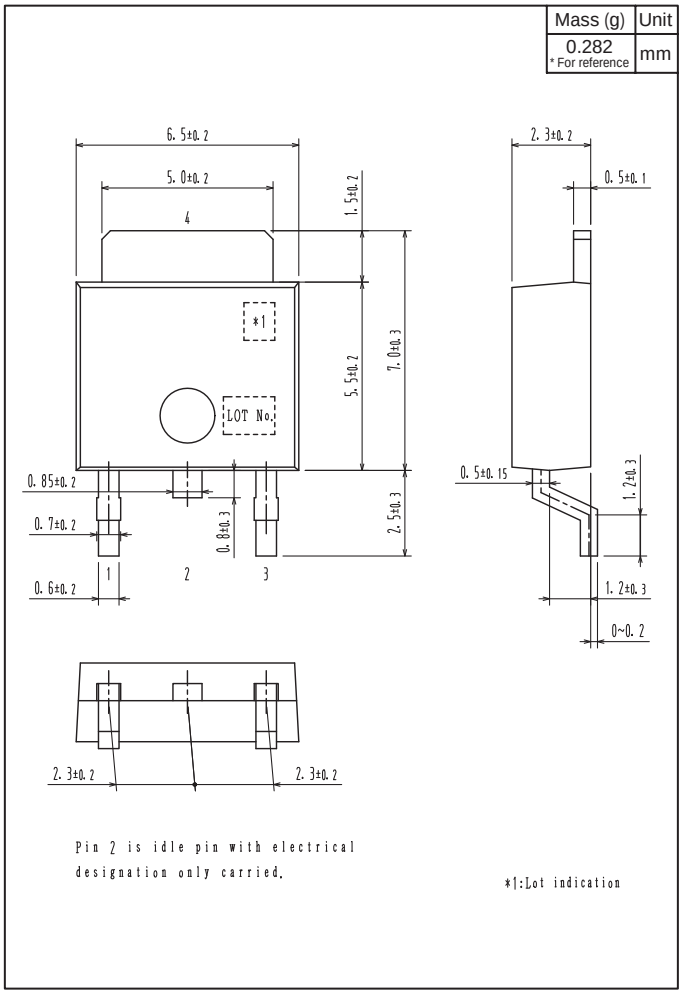
2. Device placement direction



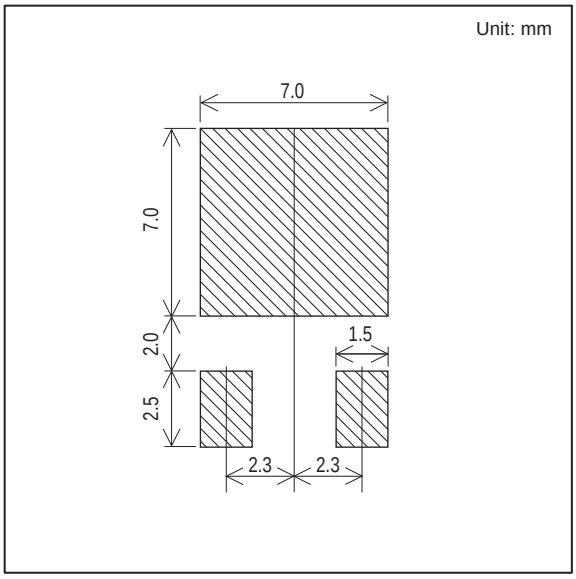
Those with one electrode terminal on the feed hole side·····TL

Outline Drawing

2SA1593S-TL-E, 2SA1593T-TL-E, 2SC4135S-TL-E, 2SC4135T-TL-E



Land Pattern Example



Bag Packing Specification

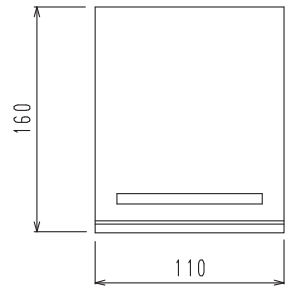
2SA1593S-E, 2SA1593T-E, 2SC4135S-E, 2SC4135T-E

1. Packing Format

Package Name	Maximum Number of devices contained (pcs)			
	Bag	Inner box	Outer box	
TP		B-1	A-1	A-2
	500	10,000	50,000	30,000
	Packing format (Dimensions: mm (external))			
	Inner box		Outer box	
	B-1		A-1	A-2
	445×225×55		470×250×300	470×250×190

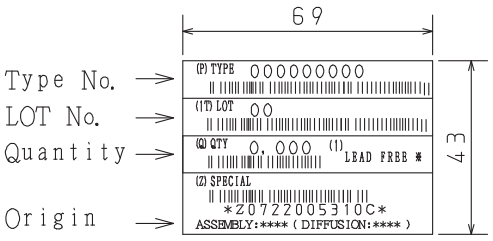
2. Bag dimensions

(unit: mm)



3. Bag label, Inner box label

(unit: mm)



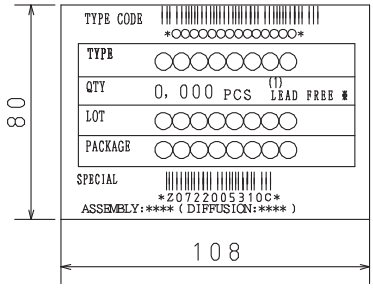
NOTE (1)
The LEAD FREE ※ description shows that the surface treatment of the terminal is lead free.

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

4. Outer box label

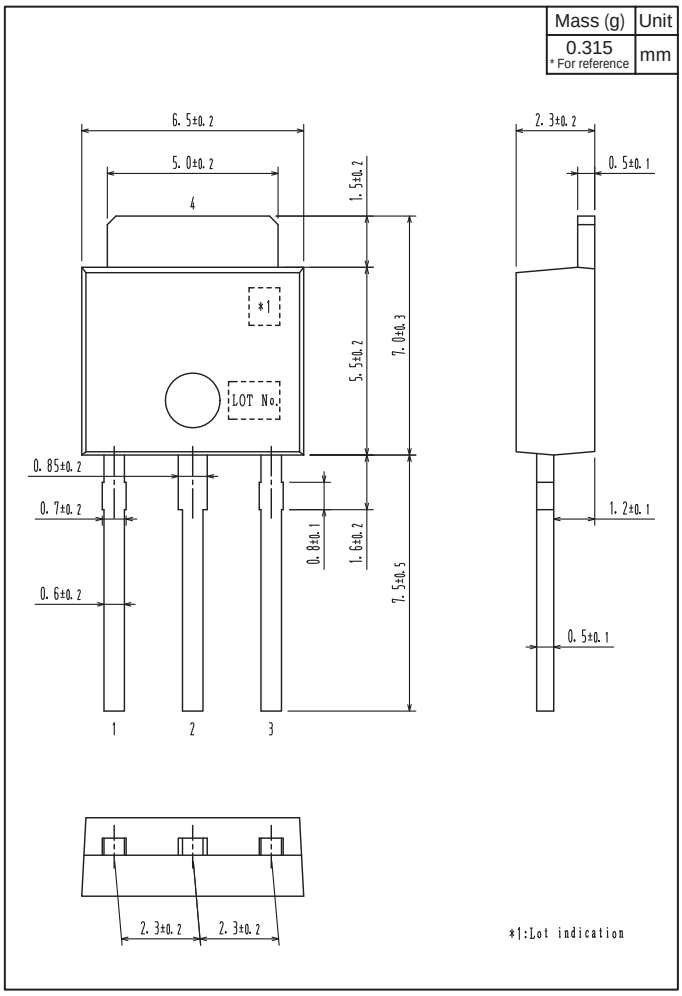
(unit: mm)

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



Outline Drawing

2SA1593S-E, 2SA1593T-E, 2SC4135S-E, 2SC4135T-E



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