

Bipolar Transistor

(-)100 V, (-)2 A, Low $V_{CE(sat)}$, (PNP)NPN
Single TP/TP-FA

2SA1593 / 2SC4135

Features

- Adoption of FBET, MBIT Process
- Fast Switching Speed
- Small and Slim Package Permitting 2SA1593 / 2SC4135 – Applied Sets to be Made More Compact
- High Breakdown Voltage and Large Current Capacity

Applications

- Power Supplies, Relay Drivers, Lamp Drivers

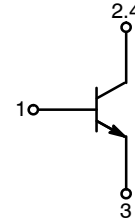
SPECIFICATIONS (): 2SA1593

ABSOLUTE MAXIMUM RATINGS at $T_a = 25^\circ\text{C}$

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}	–	(-)6.0	V
Collector Current	I_C	–	(-)2.0	A
Collector Current (Pulse)	I_{CP}	–	(-)3.0	A
Collector Dissipation	P_C	–	1.0	W
		$T_C = 25^\circ\text{C}$	15	W
Junction Temperature	T_j	–	150	$^\circ\text{C}$
Storage Temperature	T_{stg}	–	– 55 to +150	$^\circ\text{C}$

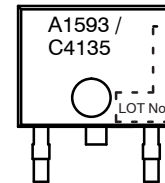
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

ELECTRICAL CONNECTION



DPAK / TP-FA
CASE 369AH

MARKING DIAGRAM



ORDERING INFORMATION

Device	Package	Shipping [†]
2SA1593S-TL-E	DPAK / TP-FA	700 / Tape & Reel
2SC4135T-TL-E	DPAK / TP-FA	700 / 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.

ELECTRICAL CHARACTERISTICS (at $T_a = 25^\circ\text{C}$)

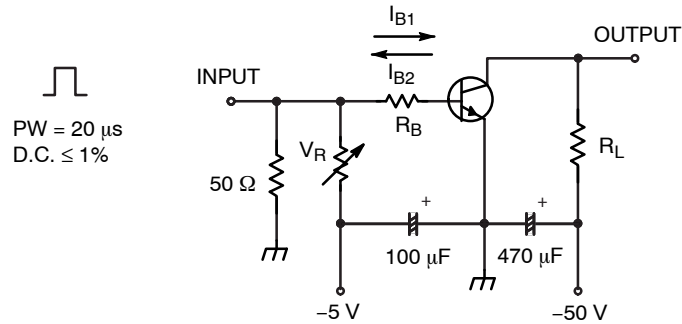
Parameter	Symbol	Conditions	Ratings			Unit
			Min	Typ	Max	
Collector Cutoff Current	I_{CBO}	$V_{CB} = (-)100\text{ V}$, $I_E = 0\text{ A}$	–	–	$(-)100$	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = (-)4\text{ V}$, $I_C = 0\text{ A}$	–	–	$(-)100$	nA
DC Current Gain	h_{FE}	$V_{CE} = (-)5\text{ V}$, $I_C = (-)100\text{ mA}$	100*	–	400*	
Gain-Bandwidth Product	f_T	$V_{CE} = (-)10\text{ V}$, $I_C = (-)100\text{ mA}$	–	120	–	MHz
Output Capacitance	C_{ob}	$V_{CB} = (-)10\text{ V}$, $f = 1\text{ MHz}$	–	(25)16	–	pF
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = (-)1\text{ A}$, $I_B = (-)100\text{ mA}$	–	$(-0.22)0.13$	$(-0.6)0.4$	mV
Base-to-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = (-)1\text{ A}$, $I_B = (-)100\text{ mA}$	–	$(-)0.85$	$(-)1.2$	V
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = (-)10\text{ }\mu\text{A}$, $I_E = 0\text{ A}$	$(-)120$	–	–	V
Collector-to-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 1\text{ mA}$, $R_{BE} = \infty$	$(-)100$	–	–	V
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\text{ }\mu\text{A}$, $I_C = 0\text{ A}$	$(-)6$	–	–	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

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 2SA1593/ 2SC4135 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



$$I_C = 10I_{B1} = -10I_{B2} = 0.7\text{ A}$$

(For PNP, the polarity is reversed)

Figure 1. Test Circuit

TYPICAL CHARACTERISTICS

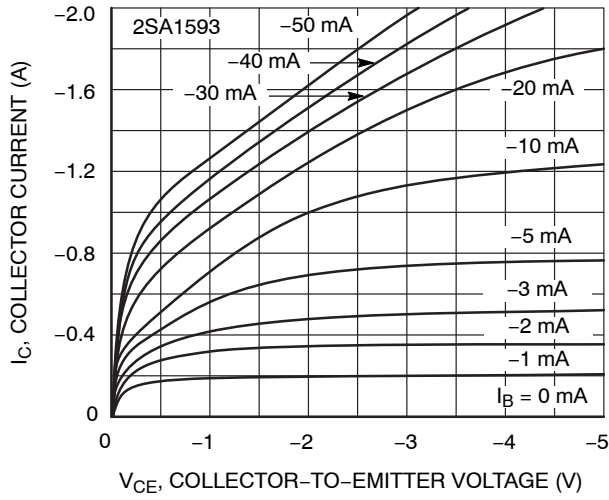


Figure 2. $I_C - V_{CE}$

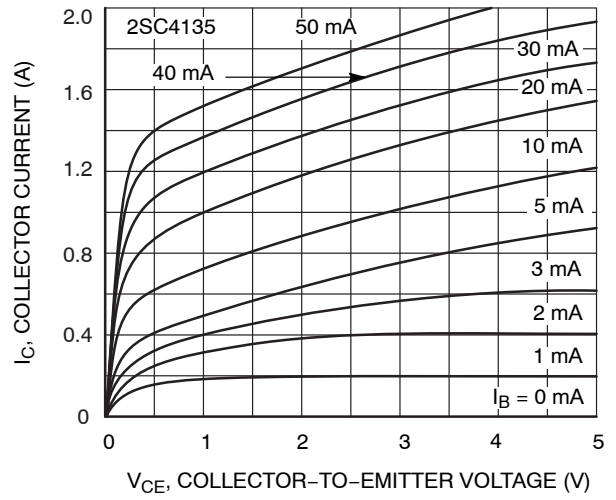


Figure 3. $I_C - V_{CE}$

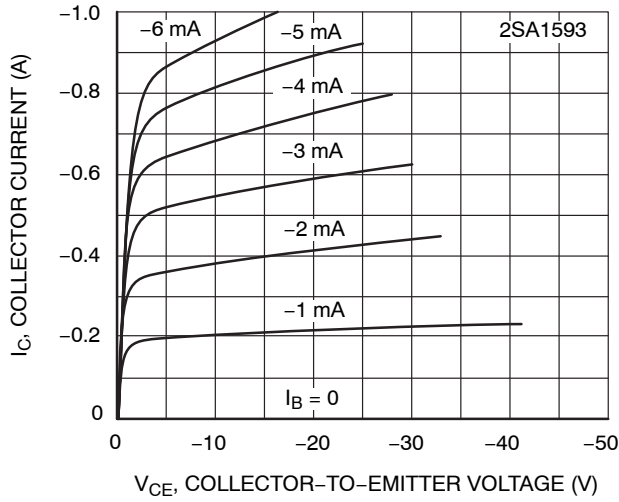


Figure 4. $I_C - V_{CE}$

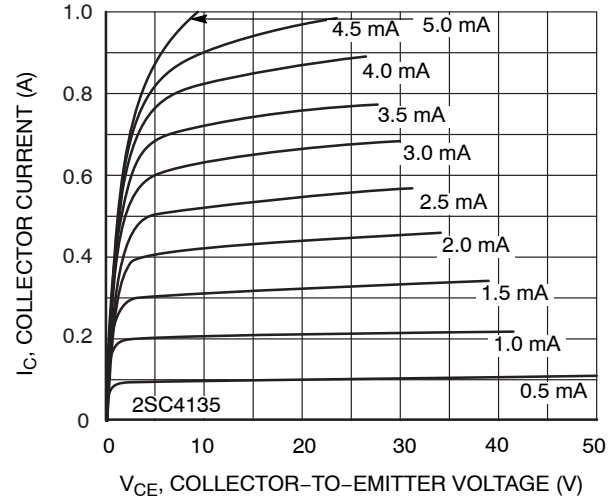


Figure 5. $I_C - V_{CE}$

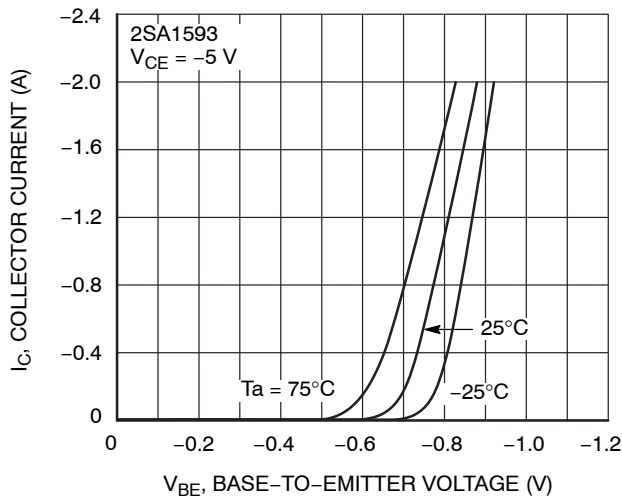


Figure 6. $I_C - V_{BE}$

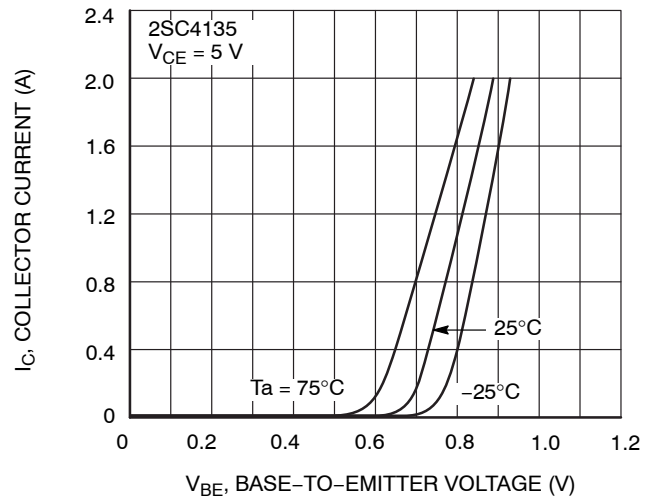


Figure 7. $I_C - V_{BE}$

2SA1593 / 2SC4135

TYPICAL CHARACTERISTICS (CONTINUED)

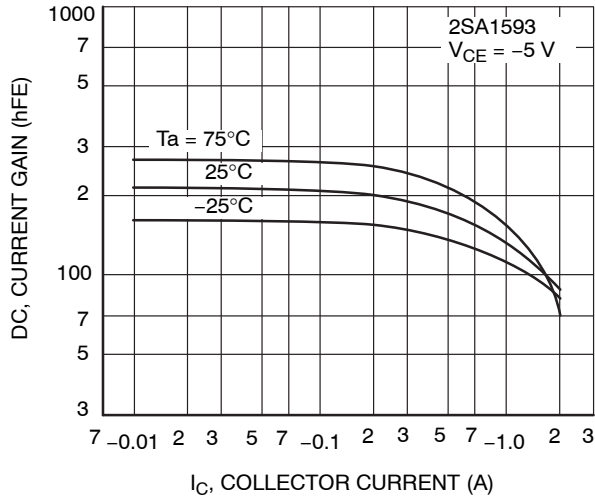


Figure 8. $h_{FE} - I_C$

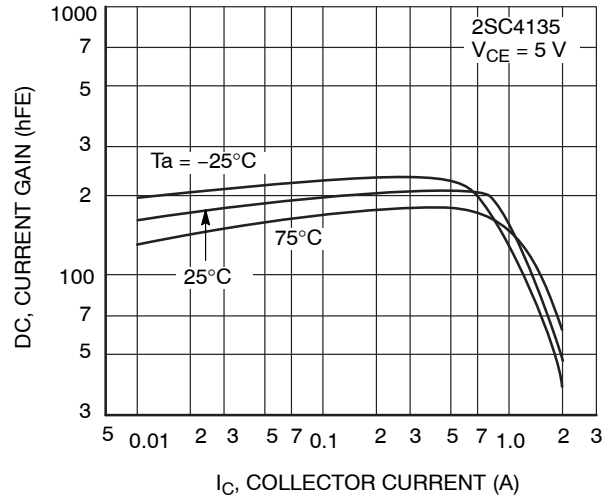


Figure 9. $h_{FE} - I_C$

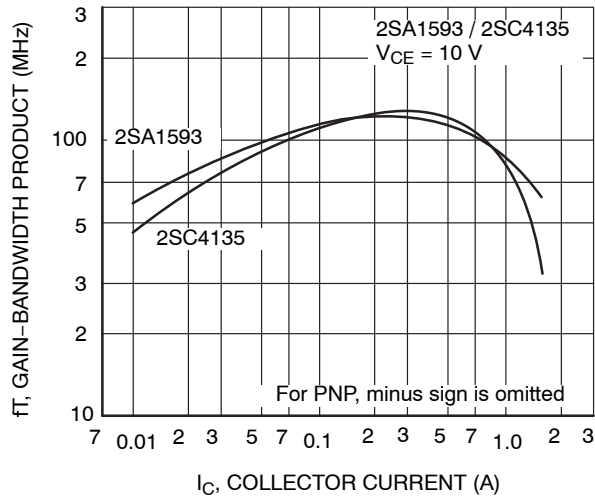


Figure 10. $f_T - I_C$

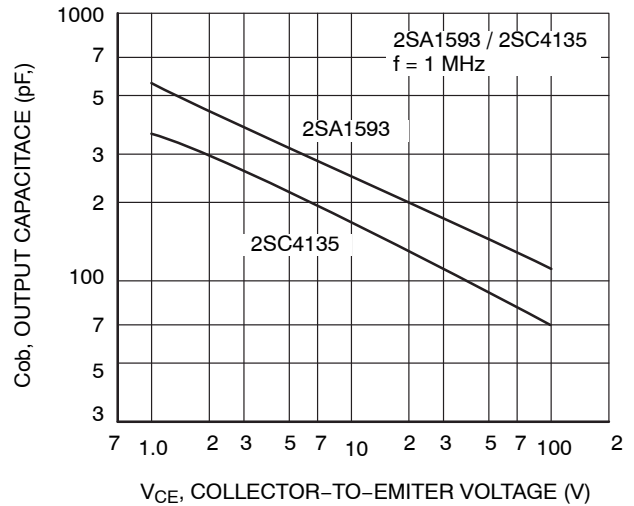


Figure 11. $C_{ob} - V_{CE}$

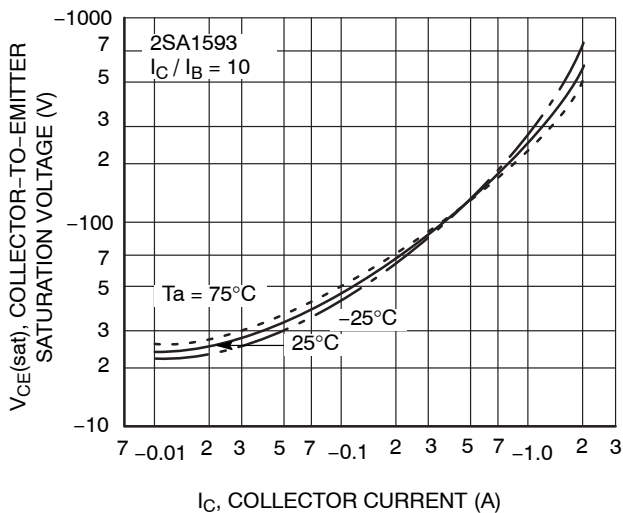


Figure 12. $V_{CE(sat)} - I_C$

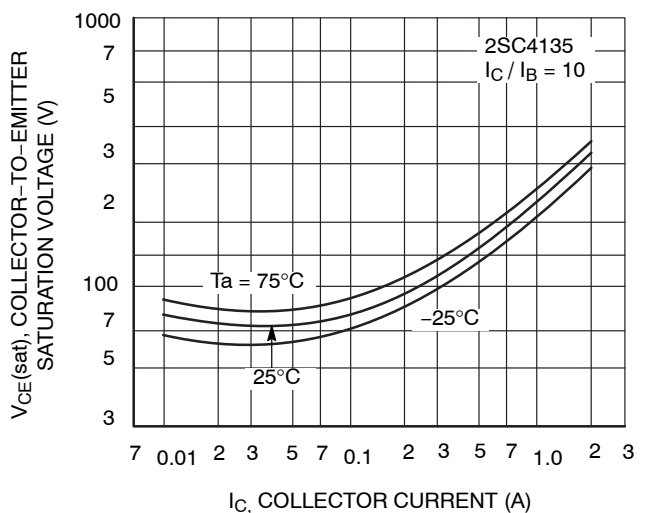


Figure 13. $V_{CE(sat)} - I_C$

TYPICAL CHARACTERISTICS (CONTINUED)

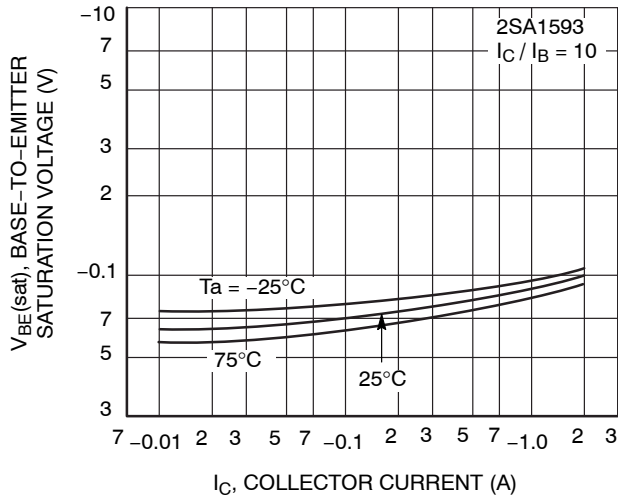


Figure 14. $V_{BE(sat)} - I_C$

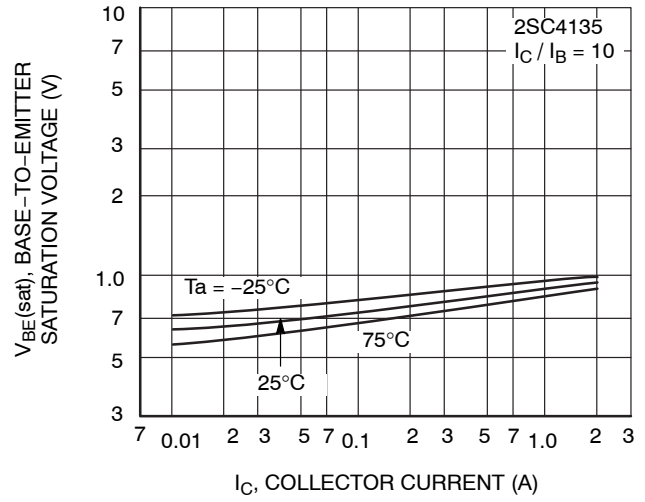


Figure 15. $V_{BE(sat)} - I_C$

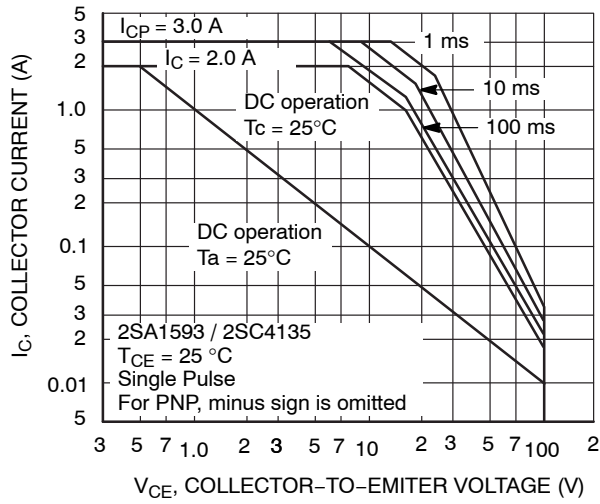


Figure 16. ASO

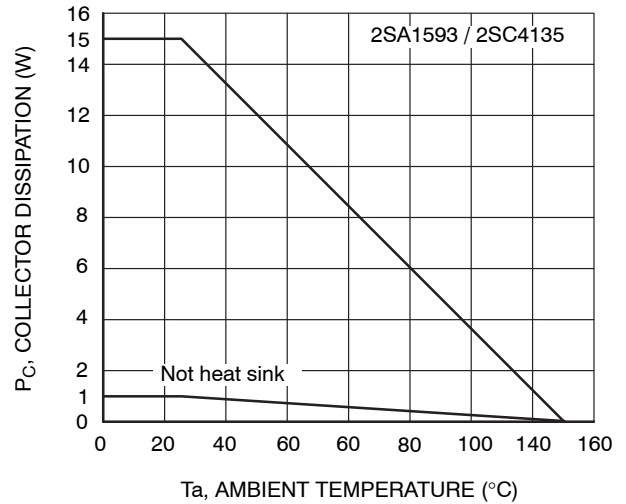
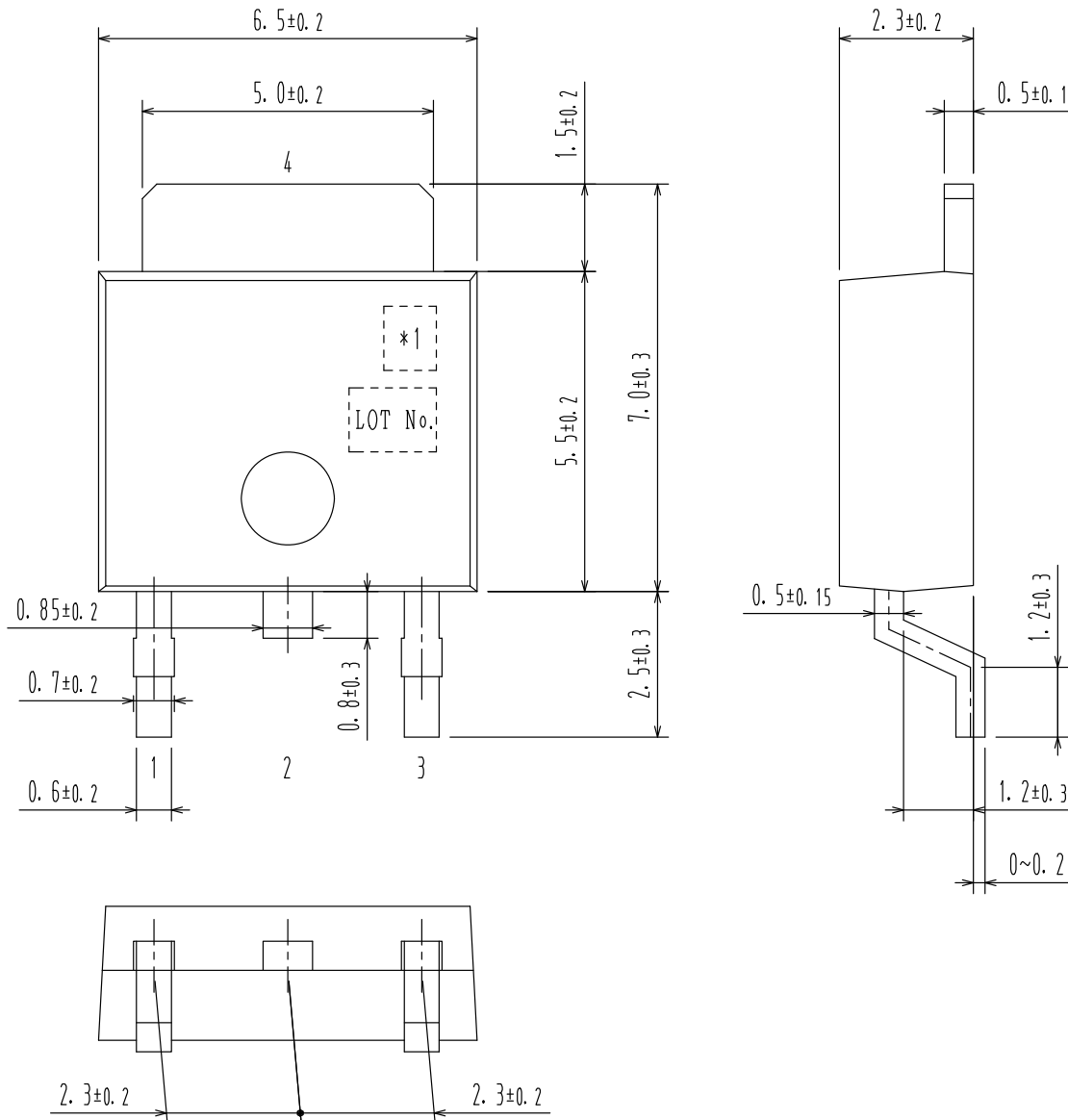


Figure 17. $P_C - T_a$

DPAK / TP-FA
CASE 369AH
ISSUE O

DATE 30 JAN 2012



Pin 2 is idle pin with electrical designation only carried.

	1:
	2:
	3:
*1:Lot indication	4:

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