

**TO-92**



**Pin Definition:**

1. Emitter
2. Collector
3. Base

**PRODUCT SUMMARY**

<b><math>BV_{CEO}</math></b>	400V
<b><math>BV_{CBO}</math></b>	700V
<b><math>I_C</math></b>	0.3A
<b><math>V_{CE(SAT)}</math></b>	1.5V @ $I_C / I_B = 200mA / 20mA$

**Features**

- High Voltage
- High Speed Switching

**Structure**

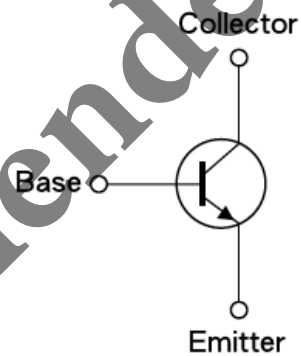
- Silicon Triple Diffused Type
- NPN Silicon Transistor

**Ordering Information**

Part No.	Package	Packing
TS13002ACT B0G	TO-92	1Kpcs / Bulk
TS13002ACT A3G	TO-92	2Kpcs / Ammo

Note: "G" denote for Green Product

**Block Diagram**



**Absolute Maximum Rating** ( $T_a = 25^\circ\text{C}$  unless otherwise noted)

Parameter	Symbol	Limit	Unit
Collector-Base Voltage	$V_{CBO}$	700V	V
Collector-Emitter Voltage	$V_{CEO}$	400V	V
Emitter-Base Voltage	$V_{EBO}$	9	V
Collector Current	$I_C$	DC	0.3
		Pulse	0.5
Collector Power Dissipation	$P_D$	0.6	W
Operating Junction Temperature	$T_J$	+150	$^\circ\text{C}$
Operating Junction and Storage Temperature Range	$T_{STG}$	- 55 to +150	$^\circ\text{C}$

**Thermal Performance**

Parameter	Symbol	Limit	Unit
Junction to Ambient Thermal Resistance	$R_{\theta JA}$	122	$^\circ\text{C/W}$

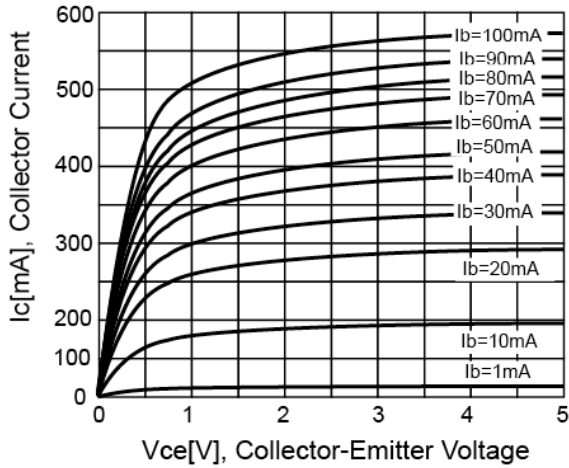
**Electrical Specifications** (Ta = 25°C unless otherwise noted)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b>						
Collector-Base Voltage	$I_C = 1\text{mA}, I_B = 0$	$BV_{CBO}$	700	--	--	V
Collector-Emitter Breakdown Voltage	$I_C = 10\text{mA}, I_E = 0$	$BV_{CEO}$	400	--	--	V
Emitter-Base Breakdown Voltage	$I_E = 1\text{mA}, I_C = 0$	$BV_{EBO}$	9	--	--	V
Collector Cutoff Current	$V_{CB} = 700\text{V}, I_E = 0$	$I_{CBO}$	--	--	1	uA
Emitter Cutoff Current	$V_{EB} = 7\text{V}, I_C = 0$	$I_{EBO}$	--	--	1	uA
Collector-Emitter Saturation Voltage	$I_C / I_B = 50\text{mA} / 10\text{mA}$	$V_{CE(SAT)1}$	--	0.2	0.4	V
	$I_C / I_B = 100\text{mA} / 10\text{mA}$	$V_{CE(SAT)2}$	--	0.45	1	
	$I_C / I_B = 200\text{mA} / 20\text{mA}$	$V_{CE(SAT)3}$	--	1	1.5	
Base-Emitter Saturation Voltage	$I_C / I_B = 50\text{mA} / 10\text{mA}$	$V_{BE(SAT)1}$	--	--	1	V
	$I_C / I_B = 100\text{mA} / 10\text{mA}$	$V_{BE(SAT)2}$	--	--	1.2	
DC Current Gain	$V_{CE} = 10\text{V}, I_C = 10\text{mA}$	$h_{FE1}$	15	--	40	
	$V_{CE} = 10\text{V}, I_C = 100\text{mA}$	$h_{FE2}$	25	--	40	
	$V_{CE} = 10\text{V}, I_C = 280\text{mA}$	$h_{FE3}$	12	--	24	
<b>Dynamic</b>						
Frequency	$V_{CE} = 10\text{V}, I_C = 0.1\text{A}$	$f_T$	4	--	--	MHz
Output Capacitance	$V_{CB} = 10\text{V}, f = 0.1\text{MHz}$	$C_{ob}$	--	21	--	pF
<b>Resistive Load Switching Time (Ratings)</b>						
Rise Time	$V_{CC} = 125\text{V}, I_C = 100\text{mA},$ $I_{B1} = I_{B2} = 20\text{mA},$ $t_p = 25\text{uS}$ Duty Cycle $\leq 1\%$	$t_r$	--	1.1	--	uS
Storage Time		$t_{STG}$	--	2	4	uS
Fall Time		$t_f$	--	0.2	0.7	uS

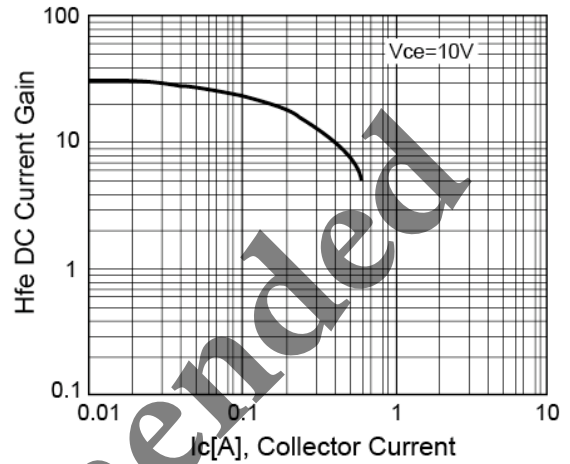
Note : pulse test: pulse width  $\leq 5\text{mS}$ , duty cycle  $\leq 10\%$

**Electrical Characteristics Curve** (Ta = 25°C, unless otherwise noted)

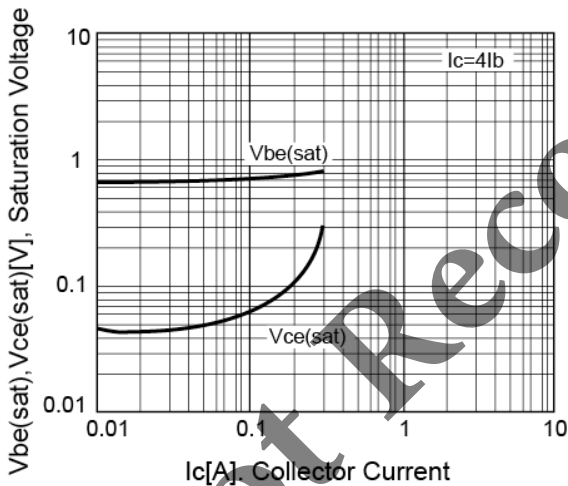
**Figure 1. Static Characteristics**



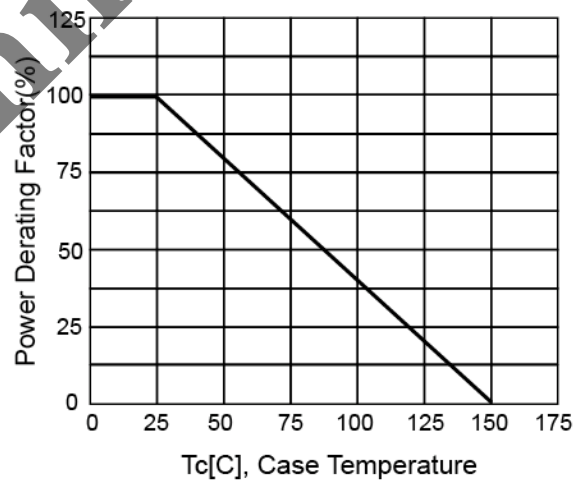
**Figure 2. DC Current Gain**



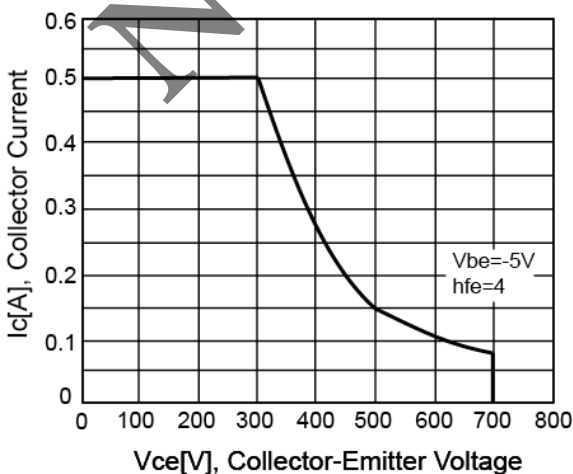
**Figure 3. V<sub>CE(SAT)</sub> V.S. V<sub>BE(SAT)</sub>**



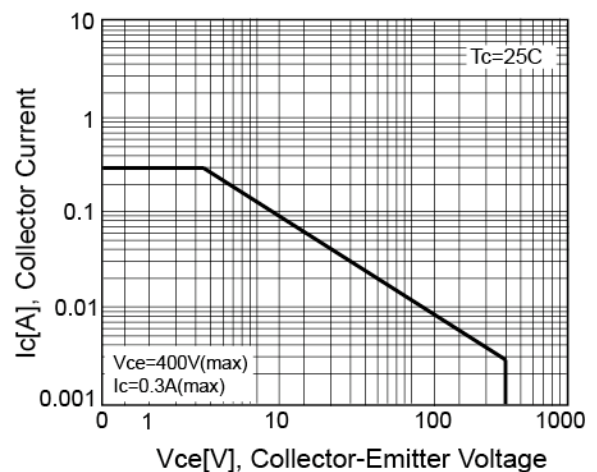
**Figure 4. Power Derating**



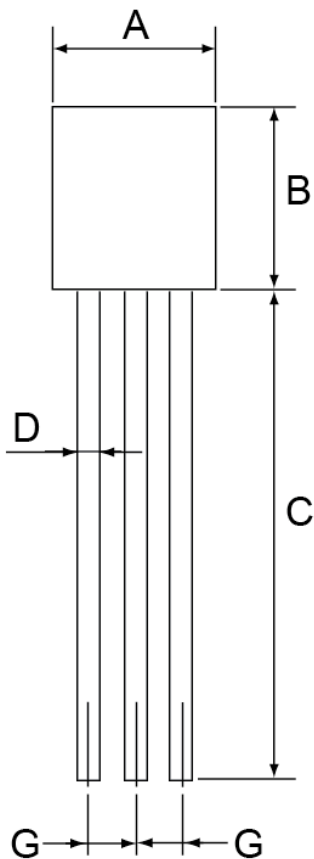
**Figure 5. Reverse Bias SOA**



**Figure 6. Safety Operating Area**

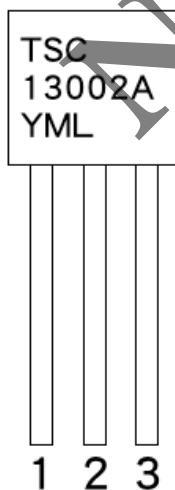


**TO-92 Mechanical Drawing**



TO-92 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.70	0.169	0.185
B	4.30	4.70	0.169	0.185
C	13.53 (typ)		0.532 (typ)	
D	0.39	0.49	0.015	0.019
E	1.18	1.28	0.046	0.050
F	3.30	3.70	0.130	0.146
G	1.27	1.31	0.050	0.051
H	0.33	0.43	0.013	0.017

**Marking Diagram**



- Y = Year Code
- M = Month Code for Halogen Free Product
  - O =Jan
  - P =Feb
  - Q =Mar
  - R =Apr
  - S =May
  - T =Jun
  - U =Jul
  - V =Aug
  - W =Sep
  - X =Oct
  - Y =Nov
  - Z =Dec
- L = Lot Code

**Not Recommended**

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