

**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>         | 0.2A                              |
| <b><math>V_{CE(SAT)}</math></b> | 0.5V @ $I_C / I_B = 100mA / 10mA$ |

### Features

- High Voltage
- High Speed Switching

### Structure

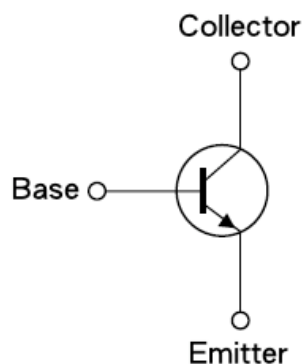
- Silicon Triple Diffused Type
- NPN Silicon Transistor

### Ordering Information

| Part No.      | Package | Packing      |
|---------------|---------|--------------|
| TS13002CT B0  | TO-92   | 1Kpcs / Bulk |
| TS13002CT B0G | TO-92   | 1Kpcs / Bulk |
| TS13002CT A3  | TO-92   | 2Kpcs / Ammo |
| TS13002CT A3G | TO-92   | 2Kpcs / Ammo |

Note: "G" denote for Green Product

### Block Diagram



### Absolute Maximum Rating (Ta = 25°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                                | DC        | 0.2          | A    |
|                                                  | Pulse     | 0.5          |      |
| Collector Power Dissipation                      | $P_D$     | 0.6          | W    |
| Operating Junction Temperature                   | $T_J$     | +150         | °C   |
| Operating Junction and Storage Temperature Range | $T_{STG}$ | - 55 to +150 | °C   |

### Thermal Performance

| Parameter                              | Symbol         | Limit | Unit |
|----------------------------------------|----------------|-------|------|
| Junction to Ambient Thermal Resistance | $R\theta_{JA}$ | 122   | °C/W |

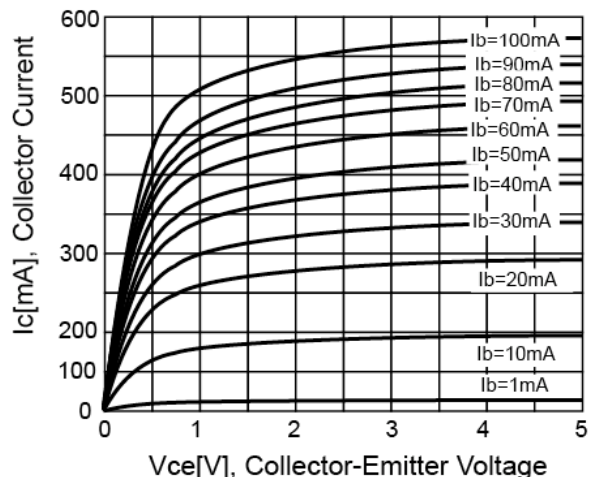
**Electrical Specifications** ( $T_a = 25^{\circ}\text{C}$  unless otherwise noted)

| Parameter                               | Conditions                                                                                                                      | Symbol         | Min | Typ  | Max | Unit |
|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|----------------|-----|------|-----|------|
| Static                                  |                                                                                                                                 |                |     |      |     |      |
| 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                         | $V_{CE} = 10\text{V}, I_C = 10\text{mA}$                                                                                        | $h_{FE1}$      | 10  | --   | 40  |      |
|                                         | $V_{CE} = 10\text{V}, I_C = 100\text{mA}$                                                                                       | $h_{FE2}$      | 20  | --   | 40  |      |
|                                         | $V_{CE} = 10\text{V}, I_C = 200\text{mA}$                                                                                       | $h_{FE3}$      | 10  | --   | 40  |      |
| Dynamic                                 |                                                                                                                                 |                |     |      |     |      |
| 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   |
| Resistive Load Switching Time (Ratings) |                                                                                                                                 |                |     |      |     |      |
| Rise Time                               | $V_{CC} = 125\text{V}, I_C = 100\text{mA},$<br>$I_{B1} = I_{B2} = 20\text{mA},$<br>$t_p = 25\text{uS}$<br>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   |

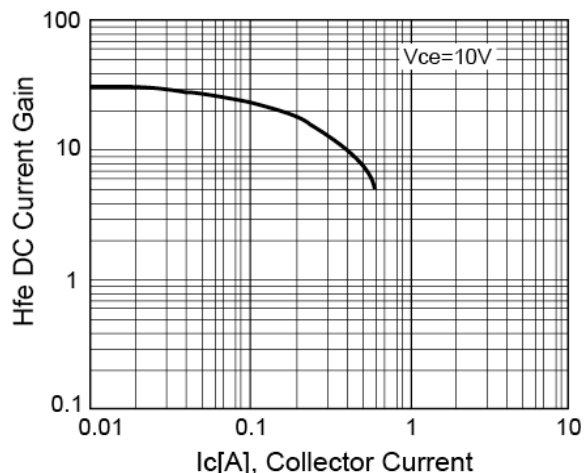
Note : pulse test: pulse width  $\leq 5\text{mS}$ , duty cycle  $\leq 10\%$

**Electrical Characteristics Curve** ( $T_a = 25^\circ\text{C}$ , unless otherwise noted)

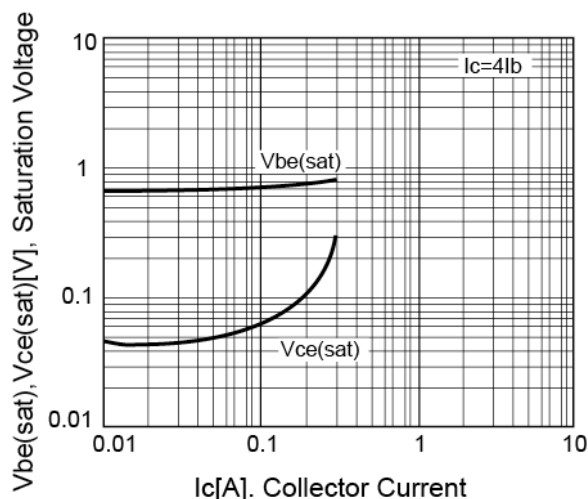
**Figure 1. Static Characteristics**



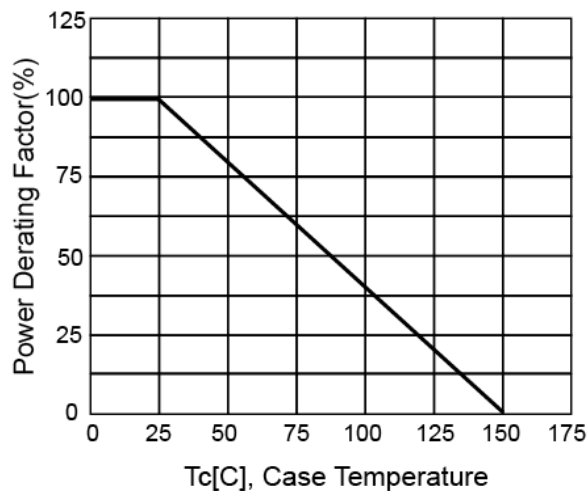
**Figure 2. DC Current Gain**



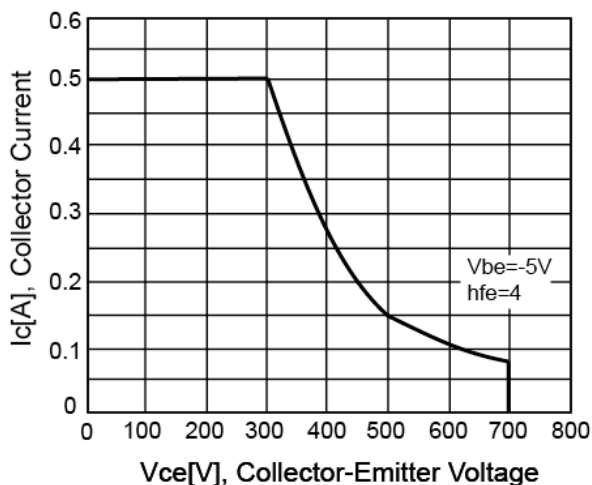
**Figure 3.  $V_{ce(sat)}$  v.s.  $V_{be(sat)}$**



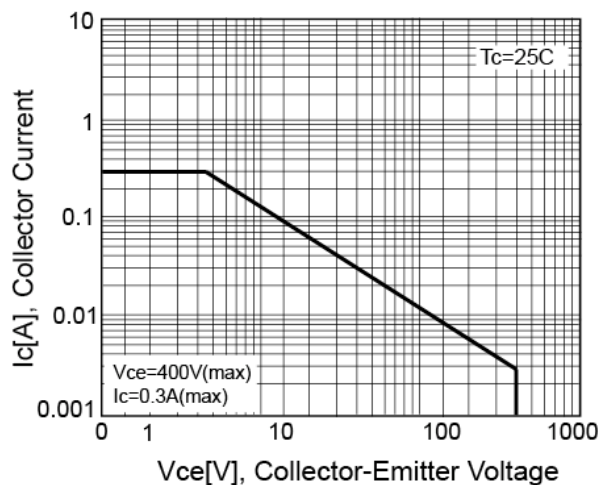
**Figure 4. Power Derating**



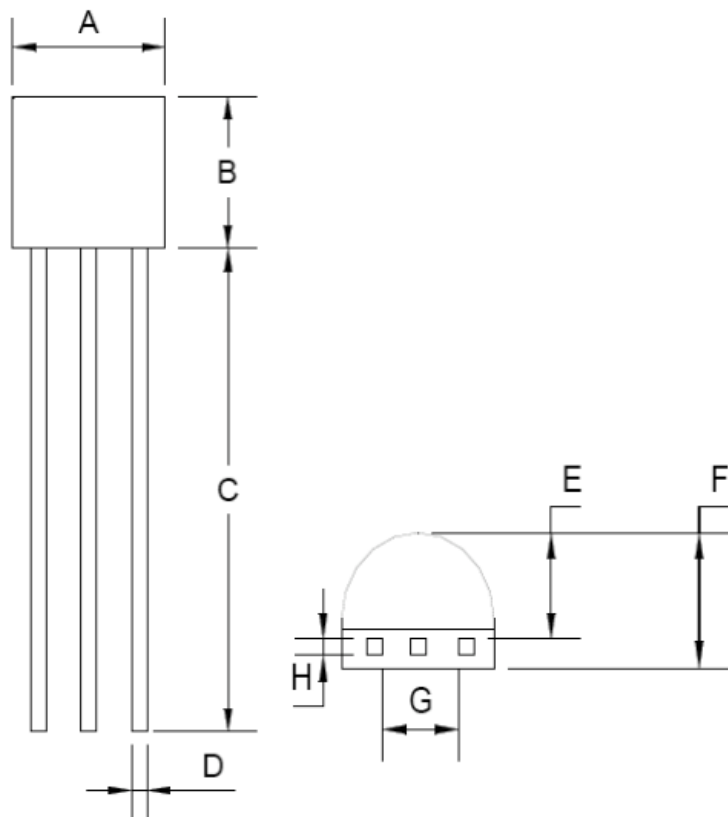
**Figure 5. Reverse Bias SOA**



**Figure 6. Safety Operating Area**

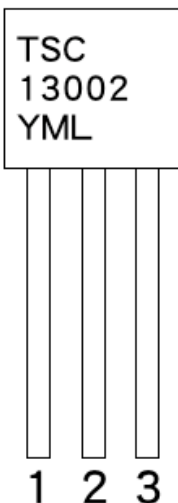


## TO-92 Mechanical Drawing



| 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               | 14.30(typ)  |      | 0.563(typ) |       |
| D               | 0.43        | 0.49 | 0.017      | 0.019 |
| E               | 2.19        | 2.81 | 0.086      | 0.111 |
| F               | 3.30        | 3.70 | 0.130      | 0.146 |
| G               | 2.42        | 2.66 | 0.095      | 0.105 |
| H               | 0.37        | 0.43 | 0.015      | 0.017 |

## Marking Diagram



**Y** = Year Code  
**M** = Month Code  
 (A=Jan, B=Feb, C=Mar, D=Apl, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)  
**L** = Lot Code

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