TAIWAN SEMICONDUCTOR

RoHS COMPLIANCE

# TS13003

## High Voltage NPN Transistor

**TO-92**


**Pin Definition:**
1. Emitter
2. Collector
3. Base

**TO-126**


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1. Emitter
2. Collector
3. Base

## PRODUCT SUMMARY

| | |
|---|---|
| $BV_{CEO}$ | 400V |
| $BV_{CBO}$ | 700V |
| $I_C$ | 1.5A |
| $V_{CE(SAT)}$ | 0.8V @ $I_C$ / $I_B$ = 0.5A / 0.1A |

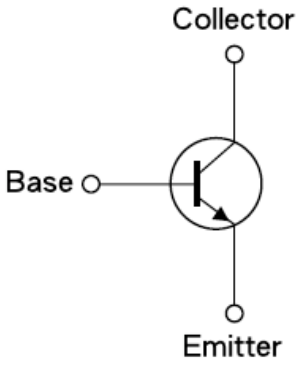
## Features

- High Voltage
- High Speed Switching

## Structure

- Silicon Triple Diffused Type
- NPN Silicon Transistor

## Block Diagram




## Ordering Information

| Part No. | Package | Packing |
|---|---|---|
| TS13003CT B0 | TO-92 | 1Kpcs / Bulk |
| TS13003CT B0G | TO-92 | 1Kpcs / Bulk |
| TS13003CT A3 | TO-92 | 2Kpcs / Ammo |
| TS13003CT A3G | TO-92 | 2Kpcs / Ammo |
| TS13003CK B0 | TO-126 | 1Kpcs / Bulk |

Note: “G” denote for Sb Free

## 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 | $I_C$ | 1.5 | A |
| | Pulse | | 3 | |
| Total Power Dissipation @ Tc= 25°C | TO-92 | $P_{tot}$ | 1.5 | W |
| | TO-126 | | 30 | |
| 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 | TO-92 | $R\Theta_{JA}$ | 122 | °C/W |
| | TO-126 | | 90 | |

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

| Parameter | Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Static** | | | | | | |
| Collector-Base Voltage | $I_C$ = 1mA, $I_B$ = 0 | $BV_{CBO}$ | 700 | -- | -- | V |
| Collector-Emitter Breakdown Voltage | $I_C$ = 10mA, $I_E$ = 0 | $BV_{CEO}$ | 400 | -- | -- | V |
| Emitter-Base Breakdown Voltage | $I_E$ = 1mA, $I_C$ = 0 | $BV_{EBO}$ | 9 | -- | -- | V |
| Collector Cutoff Current | $V_{CB}$ = 700V, $I_E$ = 0 | $I_{CBO}$ | -- | -- | 1 | uA |
| Emitter Cutoff Current | $V_{EB}$ = 9V, $I_C$ = 0 | $I_{EBO}$ | -- | -- | 1 | uA |
| Collector-Emitter Saturation Voltage* | $I_C$ / $I_B$ = 0.5A / 0.1A | $V_{CE(SAT)1}$ | -- | 0.25 | 0.5 | V |
| | $I_C$ / $I_B$ = 1.0A / 0.25A | $V_{CE(SAT)2}$ | -- | 0.5 | 1 | |
| | $I_C$ / $I_B$ = 1.5A / 0.5A | $V_{CE(SAT)3}$ | -- | 1.2 | 3 | |
| Base-Emitter Saturation Voltage* | $I_C$ / $I_B$ = 0.5A / 0.1A | $V_{BE(SAT)1}$ | -- | -- | 1 | V |
| | $I_C$ / $I_B$ = 1.0A / 0.25A | $V_{BE(SAT)2}$ | -- | -- | 1.2 | |
| DC Current Gain* | $V_{CE}$ = 5V, $I_C$ = 10mA | $h_{FE}$ | 6 | -- | 40 | |
| | $V_{CE}$ = 10V, $I_C$ = 400mA | | 20 | -- | 40 | |
| | $V_{CE}$ = 2V, $I_C$ = 1A | | 8 | -- | 40 | |
| **Dynamic Characteristics** | | | | | | |
| Frequency | $V_{CE}$ = 10V, $I_C$ = 0.1A | $f_T$ | 4 | -- | -- | MHz |
| Output Capacitance | $V_{CB}$ = 10V, f = 0.1MHz | Cob | -- | 21 | -- | pF |
| **Resistive Load Switching Time (Ratings)** | | | | | | |
| Delay Time | $V_{CC}$ = 125V, $I_C$ = 1A, $I_{B1}$ = $I_{B2}$ = 0.2A, $t_p$ = 25uS Duty Cycle ≤1% | $t_d$ | -- | 0.05 | 0.2 | uS |
| Rise Time | | $t_r$ | -- | 0.5 | 1 | uS |
| Storage Time | | $t_{STG}$ | -- | 2 | 4 | uS |
| Fall Time | | $t_f$ | -- | 0.4 | 0.7 | uS |

* Note: pulse test: pulse width ≤300uS, duty cycle ≤2%

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

**Figure 1. Static Characteristics**

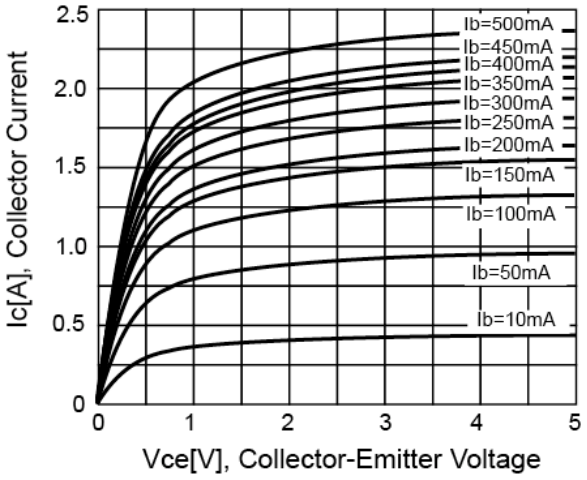



**Figure 2. DC Current Gain**

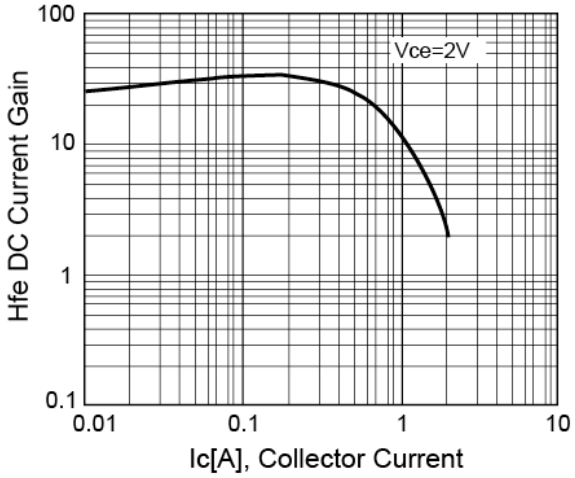



**Figure 3. $V_{CE(SAT)}$ v.s. $V_{BE(SAT}$**

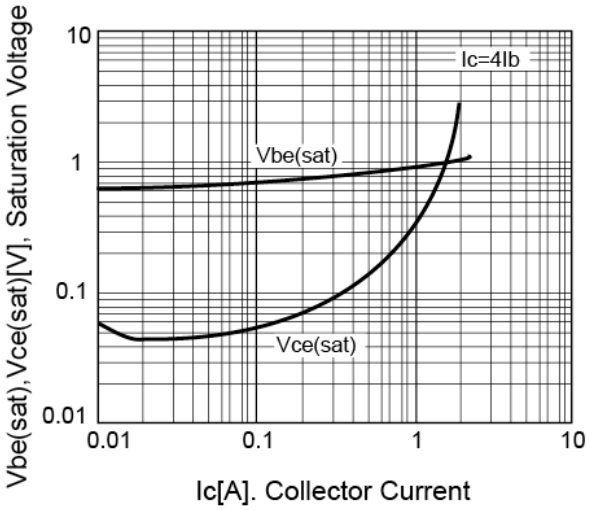



**Figure 4. Power Derating**

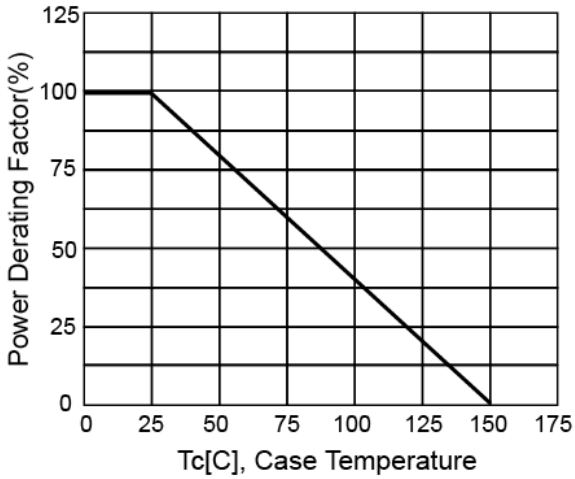



**Figure 5. Reverse Bias SOA**

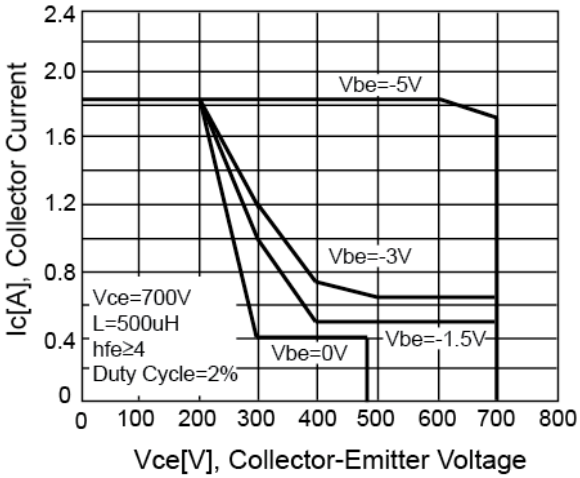
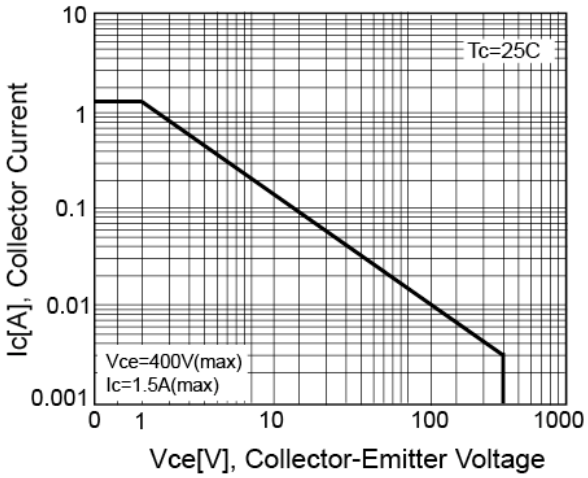



**Figure 6. Safety Operating Area**



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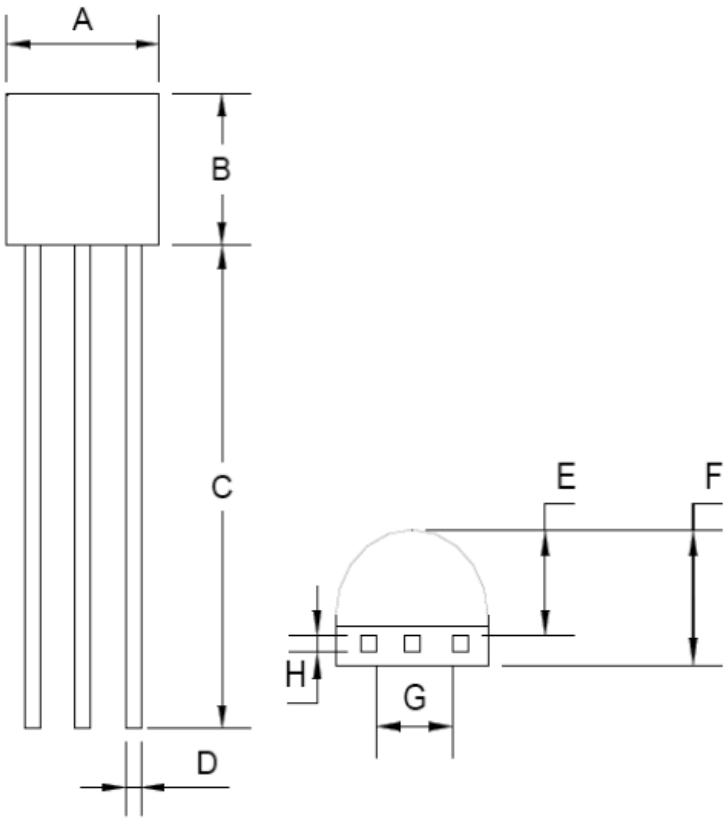
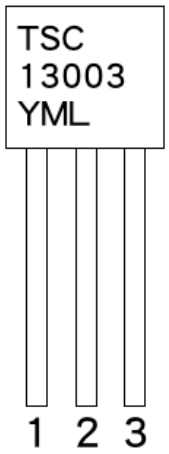
## TO-92 Mechanical Drawing




| 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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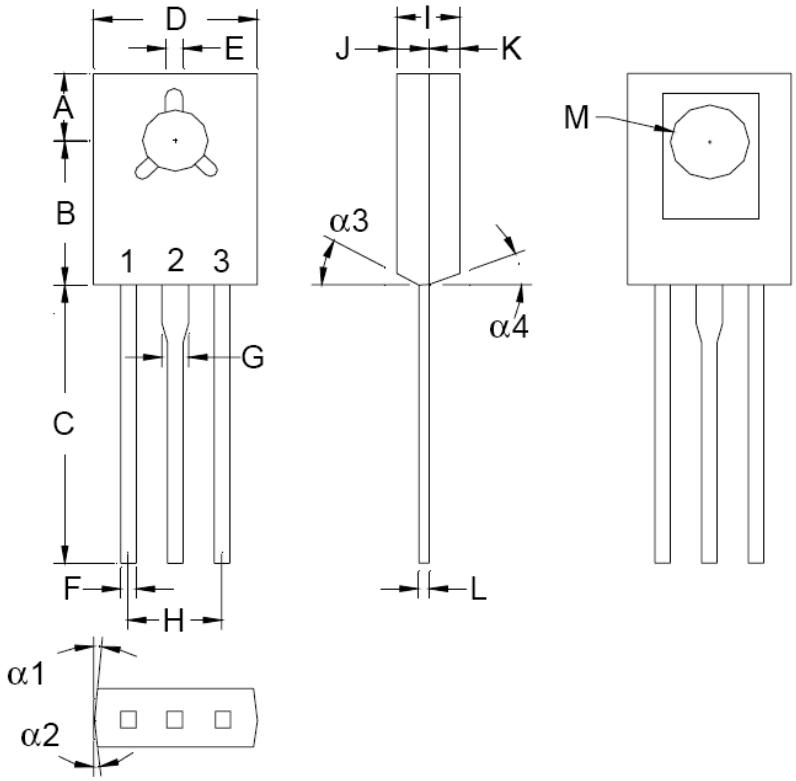
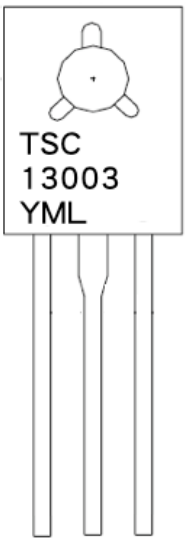
## TO-126 Mechanical Drawing




| TO-126 DIMENSION | | | | |
|---|---|---|---|---|
| DIM | MILLIMETERS | | INCHES | |
| | MIN | MAX | MIN | MAX |
| ∝1 | -- | 3ºC | -- | 3ºC |
| ∝2 | -- | 3ºC | -- | 3ºC |
| ∝3 | -- | 3ºC | -- | 3ºC |
| ∝4 | -- | 3ºC | -- | 3ºC |
| A | 0.150 | 0.153 | 3.81 | 3.91 |
| B | 0.275 | 0.279 | 6.99 | 7.09 |
| C | 0.531 | 0.610 | 13.50 | 15.50 |
| D | 0.285 | 0.303 | 7.52 | 7.72 |
| E | 0.034 | 0.041 | 0.95 | 1.05 |
| F | 0.028 | 0.031 | 0.71 | 0.81 |
| G | 0.048 | 0.052 | 1.22 | 1.32 |
| H | 0.170 | 0.189 | 4.34 | 4.80 |
| I | 0.095 | 0.105 | 2.41 | 2.66 |
| J | 0.045 | 0.055 | 1.14 | 1.39 |
| K | 0.045 | 0.055 | 1.14 | 1.39 |
| L | -- | 0.021 | -- | 0.55 |
| M | 0.137 | 0.152 | 3.50 | 3.86 |

## Marking Diagram

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