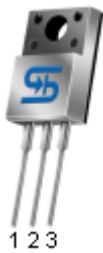


# TSC236

## High Voltage NPN Transistor

**TO-220**

**ITO-220**

**Pin Definition:**

1. Base
2. Collector
3. Emitter

**PRODUCT SUMMARY**

|                                 |                                  |
|---------------------------------|----------------------------------|
| <b><math>BV_{CEO}</math></b>    | 400V                             |
| <b><math>BV_{CBO}</math></b>    | 700V                             |
| <b><math>I_C</math></b>         | 4A                               |
| <b><math>V_{CE(SAT)}</math></b> | 1.3V @ $I_C / I_B = 2.5A / 0.6A$ |

**Features**

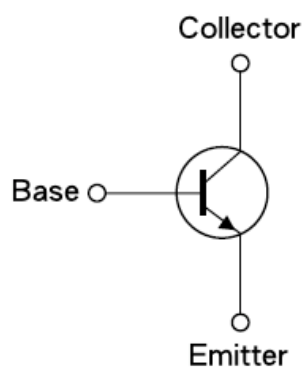
- High Voltage
- High Speed Switching

**Structure**

- Silicon Triple Diffused Type
- NPN Silicon Transistor

**Ordering Information**

| Part No.    | Package | Packing      |
|-------------|---------|--------------|
| TSC236CZ C0 | TO-220  | 50pcs / Tube |
| TSC236CI C0 | ITO-220 | 50pcs / Tube |

**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                                | DC      | $I_C$     | 4            | A                |
|                                                  | Pulse   |           | 8            |                  |
| Base Current                                     | DC      | $I_B$     | 2            | A                |
|                                                  | Pulse   |           | 4            |                  |
| Total Power Dissipation                          | TO-220  | $P_{tot}$ | 75           | W                |
|                                                  | ITO-220 |           | 30           |                  |
| Operating Junction Temperature                   |         | $T_J$     | +150         | $^\circ\text{C}$ |
| Operating Junction and Storage Temperature Range |         | $T_{STG}$ | - 55 to +150 | $^\circ\text{C}$ |

Note: Single Pulse.  $P_W = 300\mu\text{S}$ , Duty  $\leq 2\%$

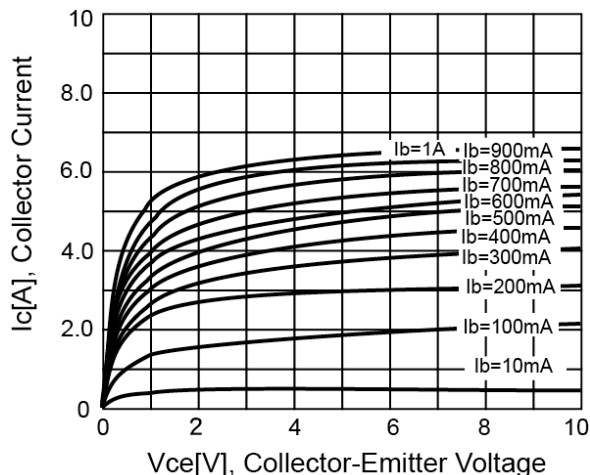
**Electrical Specifications** (Ta = 25°C unless otherwise noted)

| 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       | $I_E=0.1\text{mA}, I_C=0$                                                                                       | $BV_{EBO}$     | 9   | --  | --  | V    |
| Collector Cutoff Current             | $V_{CE}=400\text{V}, I_B=0$                                                                                     | $I_{CEO}$      | --  | --  | 250 | uA   |
| Collector Cutoff Current             | $V_{CB}=700\text{V}, I_E=0$                                                                                     | $I_{CBO}$      | --  | --  | 1   | mA   |
| Emitter Cutoff Current               | $V_{EB}=9\text{V}, I_C=0$                                                                                       | $I_{EBO}$      | --  | --  | 1   | mA   |
| Collector-Emitter Saturation Voltage | $I_C=0.8\text{A}, I_B=0.1\text{A}$                                                                              | $V_{CE(SAT)1}$ | --  | --  | 1.1 | V    |
|                                      | $I_C=2.5\text{A}, I_B=0.6\text{A}$                                                                              | $V_{CE(SAT)2}$ | --  | --  | 1.3 |      |
| Base-Emitter Saturation Voltage      | $I_C=1\text{A}, I_B=0.2\text{A}$                                                                                | $V_{BE(SAT)1}$ | --  | --  | 1.2 | V    |
|                                      | $I_C=2.5\text{A}, I_B=0.5\text{A}$                                                                              | $V_{BE(SAT)2}$ | --  | --  | 1.3 |      |
| DC Current Gain                      | $V_{CE}=5\text{V}, I_C=10\text{mA}$                                                                             | $h_{FE}$       | 15  | --  | 32  |      |
|                                      | $V_{CE}=5\text{V}, I_C=2.5\text{A}$                                                                             |                | 8   | --  | 28  |      |
| Dynamic                              |                                                                                                                 |                |     |     |     |      |
| Frequency                            | $V_{CE}=10\text{V}, I_C=0.5\text{A}$                                                                            | $f_T$          | 4   | --  | --  | MHz  |
| Output Capacitance                   | $V_{CB}=10\text{V}, f=0.1\text{MHz}$                                                                            | $C_{ob}$       | --  | 65  | --  | pF   |
| Resistive Load                       |                                                                                                                 |                |     |     |     |      |
| Turn On Time                         | $V_{CC}=125\text{V}, I_C=2\text{A},$<br>$I_{B1}=I_{B2}=0.4\text{A}, t_P=25\mu\text{S}$<br>Duty Cycle $\leq 1\%$ | $t_{ON}$       | --  | 0.2 | 0.5 | uS   |
| Storage Time                         |                                                                                                                 | $t_{STG}$      | --  | 2.2 | 3   | uS   |
| Fall Time                            |                                                                                                                 | $t_f$          | --  | 0.2 | 0.5 | uS   |

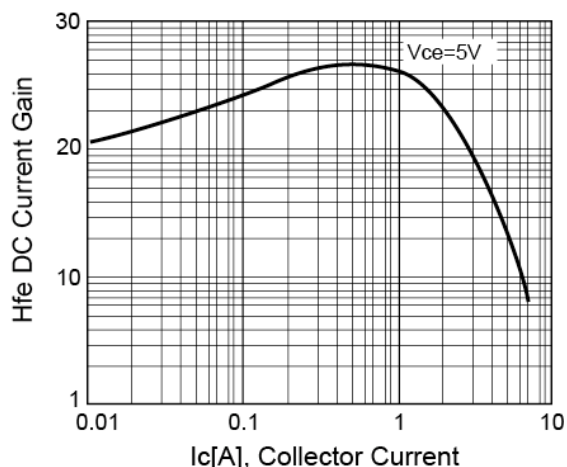
Note: pulse test: pulse width  $\leq 300\mu\text{S}$ , duty cycle  $\leq 2\%$

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

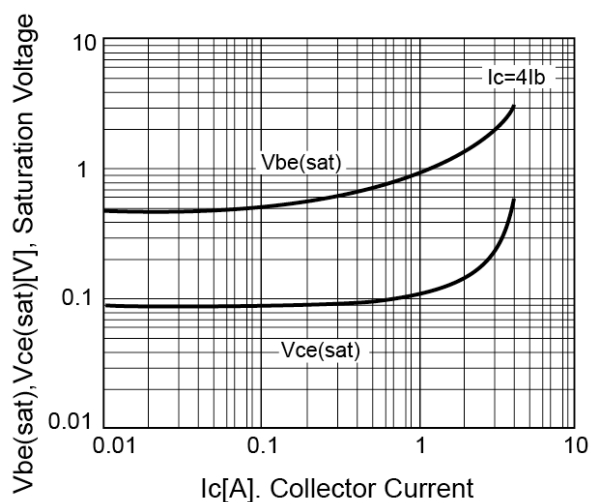
**Figure 1. Static Characteristics**



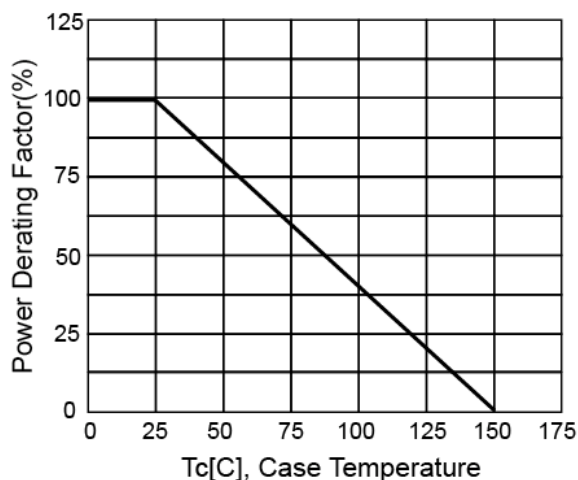
**Figure 2. DC Current Gain**



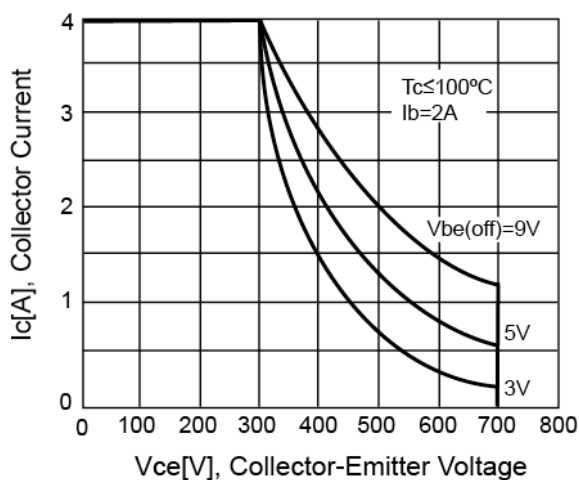
**Figure 3.  $V_{ce(sat)}$  v.s.  $V_{be(sat)}$**



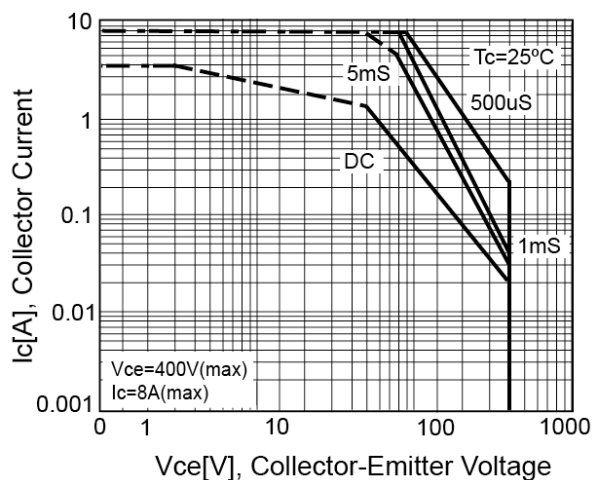
**Figure 4. Power Derating**



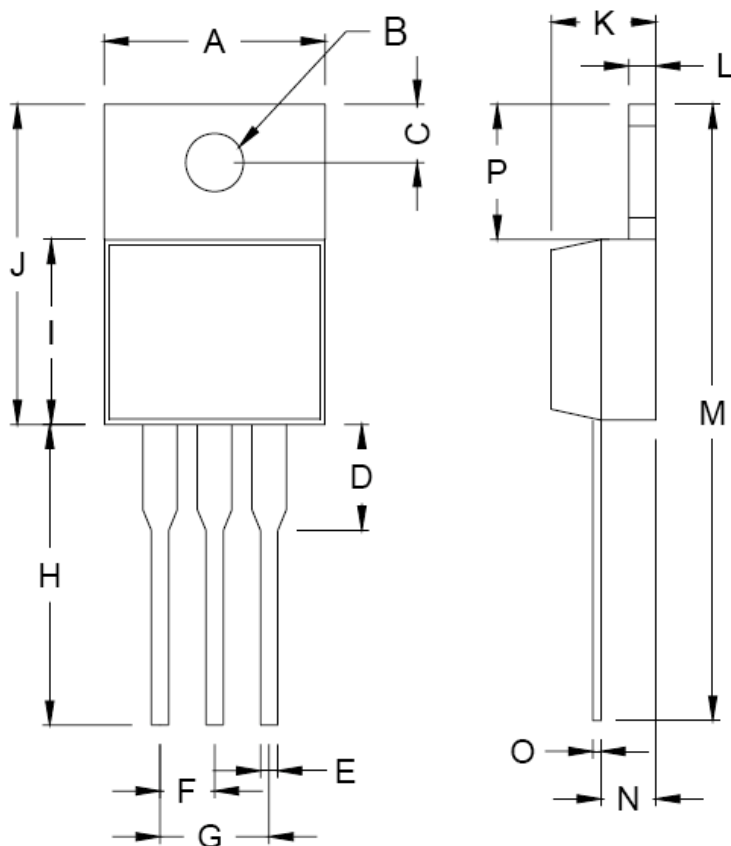
**Figure 5. Reverse Bias SOA**



**Figure 6. Safety Operating Area**

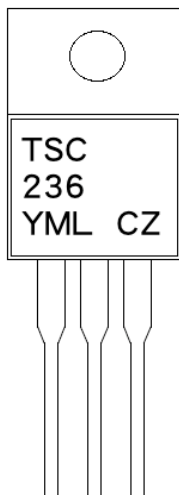


## TO-220 Mechanical Drawing



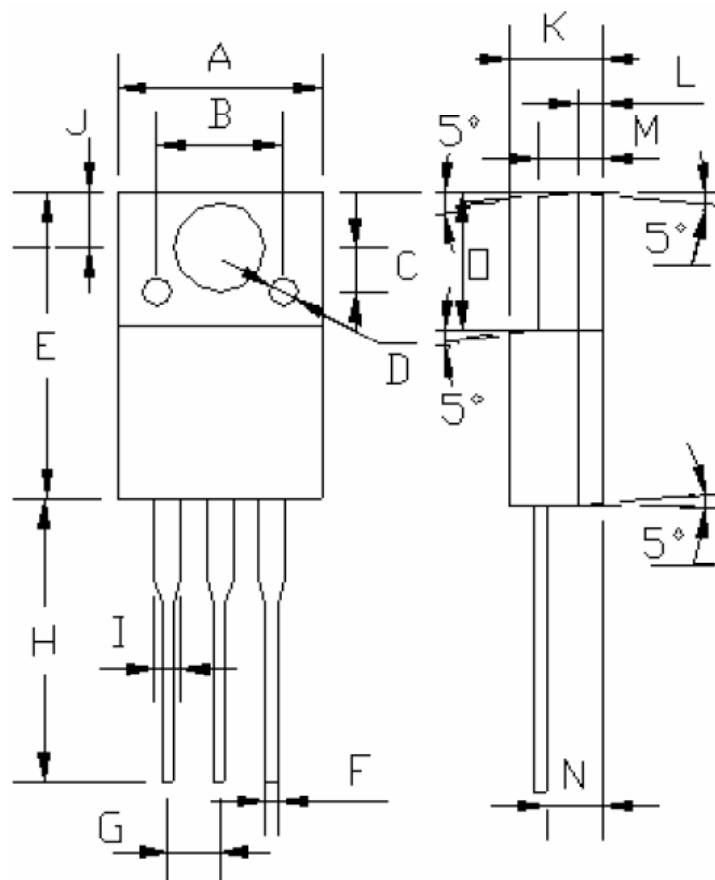
| DIM | TO-220 DIMENSION |        |        |       |
|-----|------------------|--------|--------|-------|
|     | MILLIMETERS      |        | INCHES |       |
|     | MIN              | MAX    | MIN    | MAX   |
| A   | 9.31             | 10.550 | 0.366  | 0.415 |
| B   | 3.740            | 3.910  | 0.147  | 0.154 |
| C   | 2.440            | 2.940  | 0.096  | 0.116 |
| D   | 2.22             | 3.22   | 0.087  | 0.127 |
| E   | 0.78             | 0.98   | 0.030  | 0.038 |
| F   | 2.34             | 2.65   | 0.092  | 0.104 |
| G   | 4.69             | 5.31   | 0.184  | 0.209 |
| H   | 12.32            | 13.88  | 0.485  | 0.546 |
| I   | 8.74             | 9.26   | 0.344  | 0.364 |
| J   | 15.07            | 16.07  | 0.593  | 0.632 |
| K   | 4.35             | 4.65   | 0.171  | 0.183 |
| L   | 1.16             | 1.40   | 0.045  | 0.055 |
| M   | 27.39            | 30.35  | 1.078  | 1.194 |
| N   | 1.785            | 2.675  | 0.070  | 0.105 |
| O   | 1.50             | 1.75   | 0.059  | 0.068 |
| P   | 5.75             | 7.65   | 0.226  | 0.301 |

## Marking Diagram



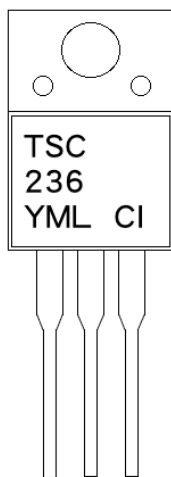
- Y = Year Code  
M = Month Code  
(A=Jan, B=Feb, C=Mar, D=Apr, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)  
L = Lot Code

### ITO-220 Mechanical Drawing



| ITO-220 DIMENSION |             |       |              |       |
|-------------------|-------------|-------|--------------|-------|
| DIM               | MILLIMETERS |       | INCHES       |       |
|                   | MIN         | MAX   | MIN          | MAX   |
| A                 | 9.96        | 10.36 | 0.392        | 0.407 |
| B                 | 6.20 (typ.) |       | 0.244 (typ.) |       |
| C                 | 2.20 (typ.) |       | 0.087 (typ.) |       |
| D                 | 1.40 (typ.) |       | 0.055 (typ.) |       |
| E                 | 15.07       | 16.07 | 0.593        | 0.632 |
| F                 | 0.80 (typ.) |       | 0.031 (typ.) |       |
| G                 | 2.44        | 2.64  | 0.096        | 0.104 |
| H                 | 13.08       | 13.48 | 0.514        | 0.530 |
| I                 | 1.47 (max.) |       | 0.057 (max.) |       |
| J                 | 3.20        | 3.40  | 0.125        | 0.133 |
| K                 | 4.60        | 4.80  | 0.181        | 0.188 |
| L                 | 1.15 (typ.) |       | 0.045 (typ.) |       |
| M                 | 2.44        | 2.64  | 0.096        | 0.104 |
| N                 | 2.60        | 2.80  | 0.102        | 0.110 |
| O                 | 6.55        | 6.65  | 0.258        | 0.262 |

### Marking Diagram



- Y** = Year Code  
**M** = Month Code  
 (A=Jan, B=Feb, C=Mar, D=Apr, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)  
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# TSC236

## High Voltage NPN Transistor

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