



**TO-251  
(IPAK)**



**TO-252  
(DPAK)**



**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> | 1.5V @ $I_C / I_B = 4A / 1A$ |

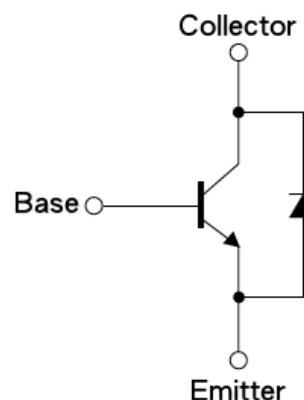
### Features

- Build-in Free-wheeling Diode Makes Efficient Anti-saturation Operation
- No Need to Interest an hfe Value Because of Low Variable Storage-time Spread Even Though Corner Spirit Product.
- Low Base Drive Requirement
- Suitable for Half Bridge Light Ballast Application

### Structure

- Silicon Triple Diffused Type
- NPN Silicon Transistor
- Integrated Anti-parallel Collector-Emitter Diode

### Block Diagram



### Ordering Information

| Part No.      | Package | Packing            |
|---------------|---------|--------------------|
| TSC5304DCP RO | TO-252  | 2.5Kpcs / 13" Reel |
| TSC5304DCH C5 | TO-251  | 75pcs / Tube       |

### Absolute Maximum Rating (Ta = 25°C unless otherwise noted)

| Parameter                               | Symbol     | Limit       | Unit |
|-----------------------------------------|------------|-------------|------|
| Collector-Base Voltage                  | $V_{CBO}$  | 700         | V    |
| Collector-Emitter Voltage @ $V_{BE}=0V$ | $V_{CES}$  | 700         | V    |
| Collector-Emitter Voltage               | $V_{CEO}$  | 400         | V    |
| Emitter-Base Voltage                    | $V_{EBO}$  | 9           | V    |
| Collector Current                       | $I_C$      | 4           | A    |
| Collector Peak Current (tp <5ms)        | $I_{CM}$   | 8           | A    |
| Base Current                            | $I_B$      | 2           | A    |
| Base Peak Current (tp <5ms)             | $I_{BM}$   | 4           | A    |
| Power Total Dissipation @ Tc=25°C       | $P_{DTOT}$ | 35          | W    |
| Maximum Operating Junction Temperature  | $T_J$      | +150        | °C   |
| Storage Temperature Range               | $T_{STG}$  | -55 to +150 | °C   |

### Thermal Performance

| Parameter                                | Symbol         | Limit | Unit                 |
|------------------------------------------|----------------|-------|----------------------|
| Thermal Resistance - Junction to Case    | $R\theta_{JC}$ | 3.57  | $^{\circ}\text{C/W}$ |
| Thermal Resistance - Junction to Ambient | $R\theta_{JA}$ | 68    | $^{\circ}\text{C/W}$ |

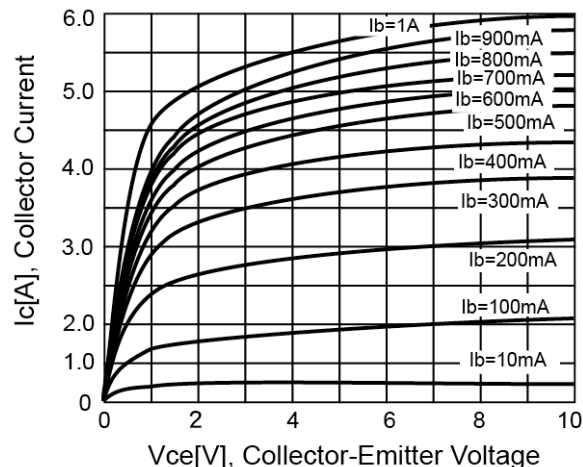
### Electrical Specifications (Ta = 25°C unless otherwise noted)

| 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             | $V_{CB} = 700\text{V}, I_E = 0$                                                             | $I_{CBO}$      | --  | --   | 100 | $\mu\text{A}$ |
| Collector Cutoff Current             | $V_{CE} = 400\text{V}, I_B = 0$                                                             | $I_{CEO}$      | --  | --   | 250 | $\mu\text{A}$ |
| Emitter Cutoff Current               | $V_{EB} = 7\text{V}, I_C = 0$                                                               | $I_{EBO}$      | --  | --   | 10  | $\mu\text{A}$ |
| Collector-Emitter Saturation Voltage | $I_C = 0.5\text{A}, I_B = 0.1\text{A}$                                                      | $V_{CE(SAT)1}$ | --  | 0.25 | 0.7 | V             |
|                                      | $I_C = 1\text{A}, I_B = 0.2\text{A}$                                                        | $V_{CE(SAT)2}$ | --  | 0.5  | 1   |               |
|                                      | $I_C = 2.5\text{A}, I_B = 0.5\text{A}$                                                      | $V_{CE(SAT)3}$ | --  | 1.2  | 1.5 |               |
|                                      | $I_C = 4\text{A}, I_B = 1\text{A}$                                                          | $V_{CE(SAT)4}$ | --  | 0.5  | --  |               |
| Base-Emitter Saturation Voltage      | $I_C = 1\text{A}, I_B = 0.2\text{A}$                                                        | $V_{BE(SAT)1}$ | --  | --   | 1.1 | V             |
|                                      | $I_C = 2\text{A}, I_B = 0.5\text{A}$                                                        | $V_{BE(SAT)2}$ | --  | --   | 1.2 |               |
| DC Current Gain                      | $V_{CE} = 5\text{V}, I_C = 10\text{mA}$                                                     | Hfe            | 10  | --   | --  |               |
|                                      | $V_{CE} = 5\text{V}, I_C = 1\text{A}$                                                       |                | 17  | --   | 27  |               |
|                                      | $V_{CE} = 5\text{V}, I_C = 2\text{A}$                                                       |                | 12  | --   | 32  |               |
| Forward Voltage Drop                 | $I_F = 2\text{A}$                                                                           | Vf             | --  | --   | 2   | V             |
| Turn On Time                         | $V_{CC} = 250\text{V}, I_C = 1\text{A}, I_{B1} = I_{B2} = 0.2\text{A}, t_p = 25\mu\text{s}$ | $t_{ON}$       | --  | 0.2  | 0.6 | $\mu\text{s}$ |
| Storage Time                         |                                                                                             | $t_{STG}$      | --  | 3.0  | 4.5 | $\mu\text{s}$ |
| Fall Time                            | Duty Cycle < 1%                                                                             | $t_f$          | --  | 0.2  | 0.3 | $\mu\text{s}$ |

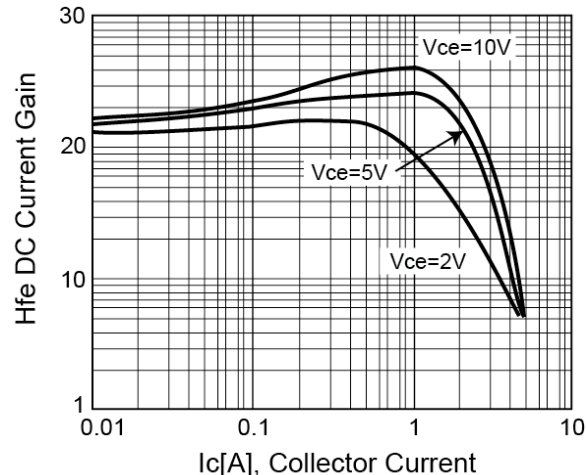
Notes: Pulsed duration = 380 $\mu\text{s}$ , duty cycle  $\leq 2\%$

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

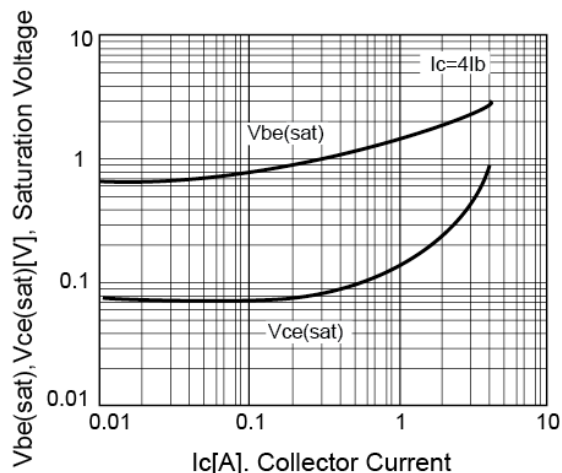
**Figure 1. Static Characteristics**



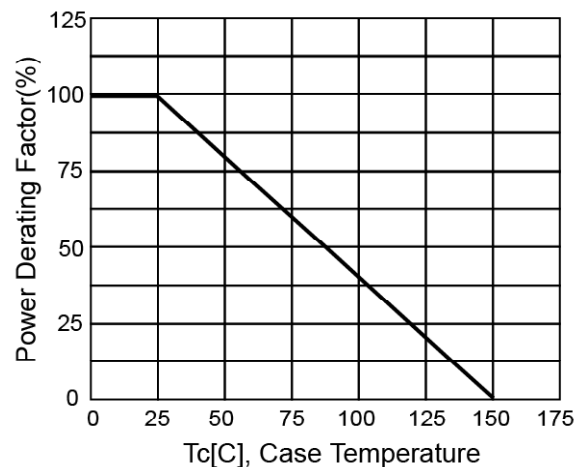
**Figure 2. DC Current Gain**



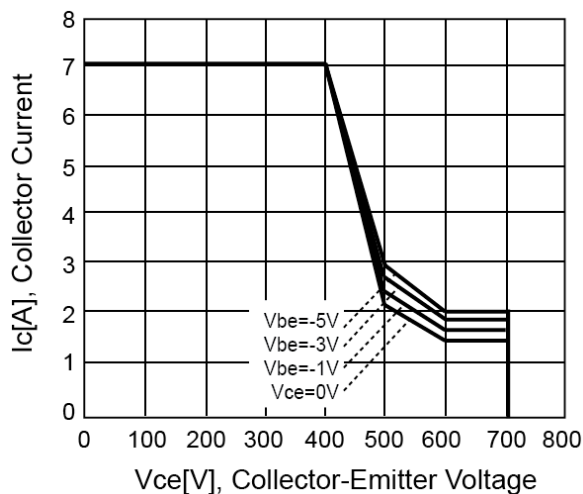
**Figure 3.  $V_{ce(sat)}$  v.s.  $V_{be(sat)}$**



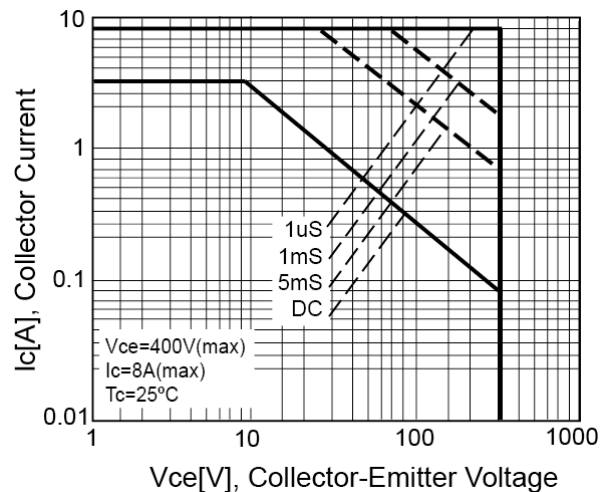
**Figure 4. Power Derating**



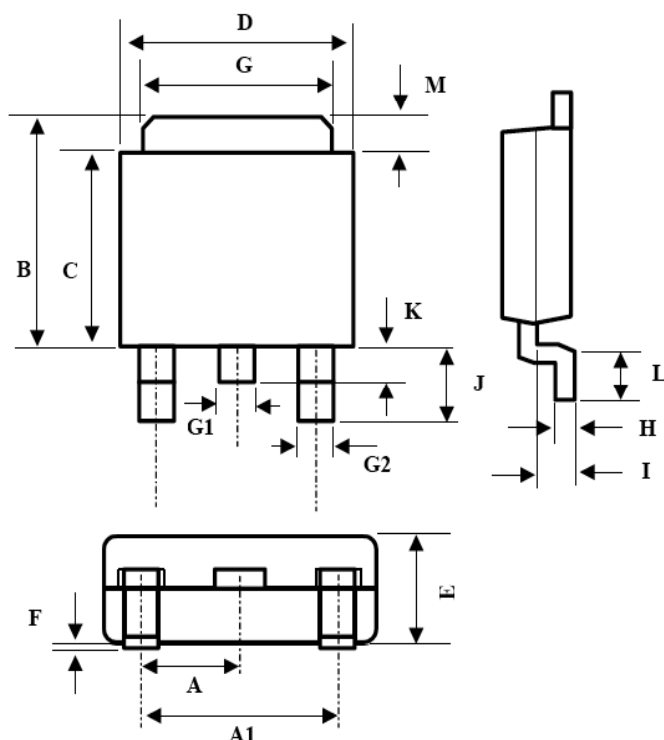
**Figure 5. Reverse Bias SOA**



**Figure 6. Safety Operating Area**

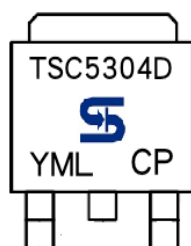


### SOT-252 Mechanical Drawing



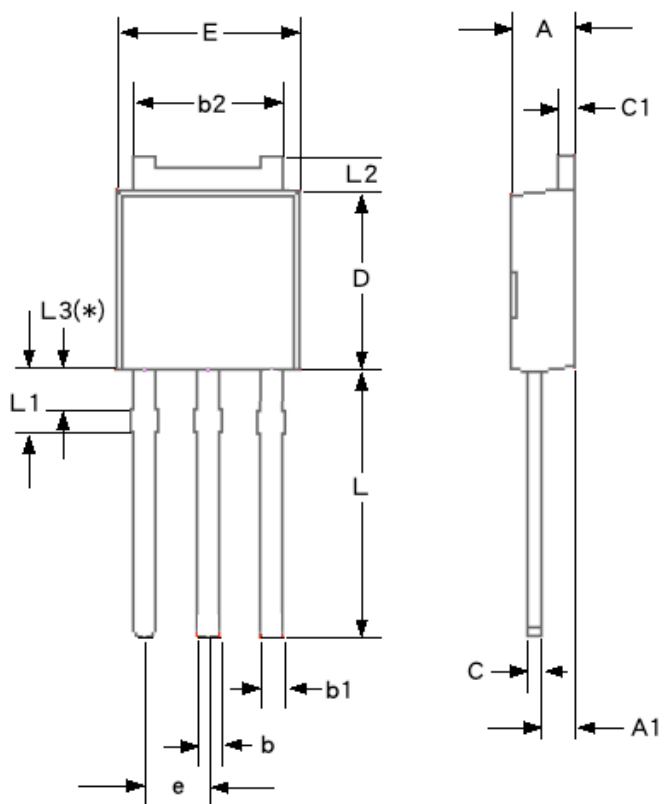
| TO-252 DIMENSION |             |       |           |       |
|------------------|-------------|-------|-----------|-------|
| DIM              | MILLIMETERS |       | INCHES    |       |
|                  | MIN         | MAX   | MIN       | MAX   |
| A                | 2.290 BSC   |       | 0.090 BSC |       |
| A1               | 4.600 BSC   |       | 0.180 BSC |       |
| B                | 7.000       | 7.200 | 0.275     | 0.283 |
| C                | 6.000       | 6.200 | 0.236     | 0.244 |
| D                | 6.400       | 6.604 | 0.252     | 0.260 |
| E                | 2.210       | 2.387 | 0.087     | 0.094 |
| F                | 0.010       | 0.127 | 0.000     | 0.005 |
| G                | 5.232       | 5.436 | 0.206     | 0.214 |
| G1               | 0.814       | 0.889 | 0.032     | 0.035 |
| G2               | 0.814       | 0.889 | 0.032     | 0.035 |
| H                | 0.508 REF   |       | 0.020 REF |       |
| I                | 0.900       | 1.500 | 0.035     | 0.059 |
| J                | 2.743 REF   |       | 0.108 REF |       |
| K                | 0.660       | 0.094 | 0.026     | 0.037 |
| L                | 1.397       | 1.651 | 0.055     | 0.065 |
| M                | 1.100 REF   |       | 0.043 REF |       |

### Marking Diagram



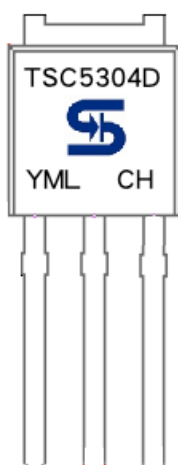
**Y** = Year Code  
**M** = Month Code  
 (A=Jan, B=Feb, C=Mar, D=Apl, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)  
**L** = Lot Code

### SOT-251 Mechanical Drawing



| TO-251 DIMENSION |             |       |            |        |
|------------------|-------------|-------|------------|--------|
| DIM              | MILLIMETERS |       | INCHES     |        |
|                  | MIN         | MAX   | MIN        | MAX    |
| A                | 2.190       | 2.380 | 0.0862     | 0.0937 |
| A1               | 0.890       | 1.140 | 0.0350     | 0.0449 |
| b                | 0.640       | 0.890 | 0.0252     | 0.0350 |
| b1               | 0.760       | 1.140 | 0.0299     | 0.0449 |
| b2               | 5.210       | 5.460 | 0.2051     | 0.2150 |
| C                | 0.460       | 0.580 | 0.0181     | 0.0228 |
| C1               | 0.460       | 0.580 | 0.0181     | 0.0228 |
| D                | 5.970       | 6.100 | 0.2350     | 0.2402 |
| E                | 6.350       | 6.730 | 0.2500     | 0.2650 |
| e                | 2.280 BSC   |       | 0.0898 BSC |        |
| L                | 8.890       | 9.650 | 0.3500     | 0.3799 |
| L1               | 1.910       | 2.280 | 0.0752     | 0.0898 |
| L2               | 0.890       | 1.270 | 0.0350     | 0.0500 |
| L3               | 1.150       | 1.520 | 0.0453     | 0.0598 |

### Marking Diagram



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