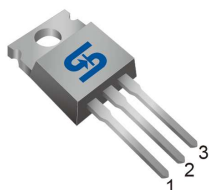


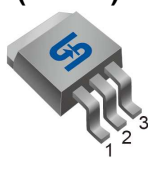
TO-220



ITO-220



TO-263  
(D<sup>2</sup>PAK)



**Pin Definition:**

1. Base
2. Collector
3. Emitter

**PRODUCT SUMMARY**

|               |                              |
|---------------|------------------------------|
| $BV_{CEO}$    | 400V                         |
| $BV_{CBO}$    | 700V                         |
| $I_C$         | 8A                           |
| $V_{CE(SAT)}$ | 1.5V @ $I_C / I_B = 5A / 1A$ |

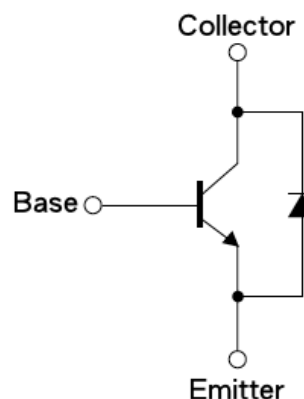
**Features**

- 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           |
|--------------|---------|-------------------|
| TSC148DCZ C0 | TO-220  | 50pcs / Tube      |
| TSC148DCI C0 | ITO-220 | 50pcs / Tube      |
| TSC148DCM RN | TO-263  | 800pcs / 13" Reel |

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

| Parameter                              | Symbol         | Limit       | Unit        |
|--|----------------|-------------|-------------|
| Collector-Base Voltage                 | $V_{CBO}$      | 700         | V           |
| Collector-Emitter Voltage              | $V_{CEO}$      | 400         | V           |
| Emitter-Base Voltage                   | $V_{EBO}$      | 9           | V           |
| Collector Current                      | $I_C$          | 8           | A           |
| Collector Peak Current ( $t_p < 5ms$ ) | $I_{CM}$       | 16          | A           |
| Base Current                           | $I_B$          | 4           | A           |
| Base Peak Current ( $t_p < 5ms$ )      | $I_{BM}$       | 8           | A           |
| Total Dissipation @ $T_c=25^{\circ}C$  | TO-220, TO-263 | 80          | W           |
|  | ITO-220        | 36          | W           |
| Maximum Operating Junction Temperature | $T_J$          | +150        | $^{\circ}C$ |
| Storage Temperature Range              | $T_{STG}$      | -65 to +150 | $^{\circ}C$ |

### Thermal Performance

| Parameter                                |         | Symbol         | Limit | Unit |
|--|---------|----------------|-------|------|
| Thermal Resistance - Junction to Case    | TO-220  | $R\theta_{JC}$ | 1.78  | °C/W |
|  | ITO-220 |                | 5     |      |
|  | TO-263  |                | 1.78  |      |
| Thermal Resistance - Junction to Ambient | TO-220  | $R\theta_{JA}$ | 62.5  | °C/W |
|  | ITO-220 |                | 62.5  |      |
|  | TO-263  |                | 62.5  |      |

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

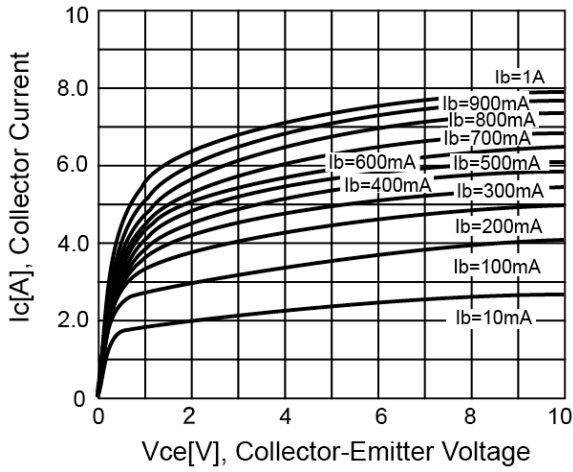
| Parameter   | Conditions   | Symbol         | Min | Typ | Max | Unit |
|---|--|----------------|-----|-----|-----|------|
| <b>Static</b>                                     |  |                |     |     |     |      |
| Collector-Base Voltage                            | $I_C = 1\text{mA}, I_B = 0$  | $BV_{CBO}$     | 700 | --  | --  | V    |
| Collector-Emitter Breakdown Voltage <sup>a</sup>  | $I_C = 1\text{mA}, I_E = 0$  | $BV_{CEO}$     | 400 | --  | --  | V    |
| Emitter-Base Breakdown Voltage                    | $I_E = 0.1\text{mA}, I_C = 0$  | $BV_{EBO}$     | 9   | --  | --  | V    |
| Collector Cutoff Current                          | $V_{CB} = 700\text{V}, I_E = 0$  | $I_{CBO}$      | --  | --  | 10  | uA   |
| Collector Cutoff Current                          | $V_{CE} = 400\text{V}, I_E = 0$  | $I_{CEO}$      | --  | --  | 100 | uA   |
| Emitter Cutoff Current                            | $V_{EB} = 9\text{V}, I_C = 0$  | $I_{EBO}$      | --  | --  | 100 | uA   |
| Collector-Emitter Saturation Voltage <sup>a</sup> | $I_C = 2\text{A}, I_B = 0.4\text{A}$   | $V_{CE(SAT)1}$ | --  | --  | 0.8 | V    |
|   | $I_C = 5\text{A}, I_B = 1\text{A}$   | $V_{CE(SAT)2}$ | --  | --  | 1.5 |      |
|   | $I_C = 8\text{A}, I_B = 2\text{A}$   | $V_{CE(SAT)3}$ | --  | --  | 2   |      |
| Base-Emitter Saturation Voltage <sup>a</sup>      | $I_C = 4\text{A}, I_B = 0.4\text{A}$   | $V_{BE(SAT)1}$ | --  | --  | 1.2 | V    |
|   | $I_C = 5\text{A}, I_B = 1\text{A}$   | $V_{BE(SAT)2}$ | --  | --  | 1.6 |      |
| DC Current Gain                                   | $V_{CE} = 5\text{V}, I_C = 2\text{A}$  | Hfe            | 18  | --  | 40  |      |
|   | $V_{CE} = 5\text{V}, I_C = 5\text{A}$  |                | 8   | --  | 25  |      |
| Diode Forward Voltage                             | $I_f = 3\text{A}$  | Vf             | --  | --  | 2   | V    |
| <b>Resistive Load Switching Time (Ratings)</b>    |  |                |     |     |     |      |
| Turn On Time                                      | $V_{CC} = 125\text{V}, I_C = 5\text{A},$<br>$I_{B1} = I_{B2} = 1\text{A},$<br>$t_p = 25\text{uS}$<br>Duty Cycle < 1% | $t_{ON}$       | --  | --  | 0.6 | uS   |
| Storage Time                                      |  | $t_{STG}$      | --  | 1.3 | 1.6 | uS   |
| Fall Time   |  | $t_f$          | --  | --  | 0.3 | uS   |

Notes:

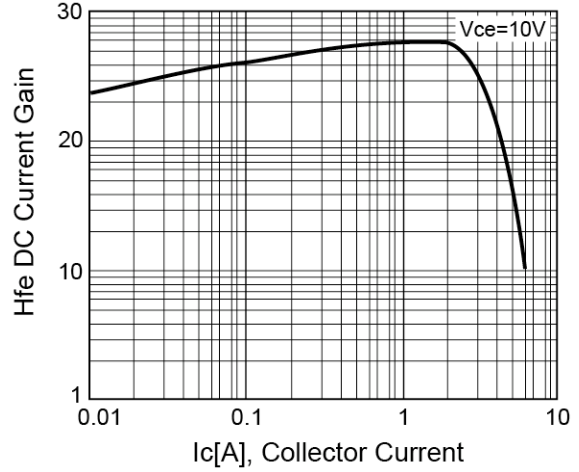
a. Pulsed duration = 300uS, duty cycle ≤ 2%

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

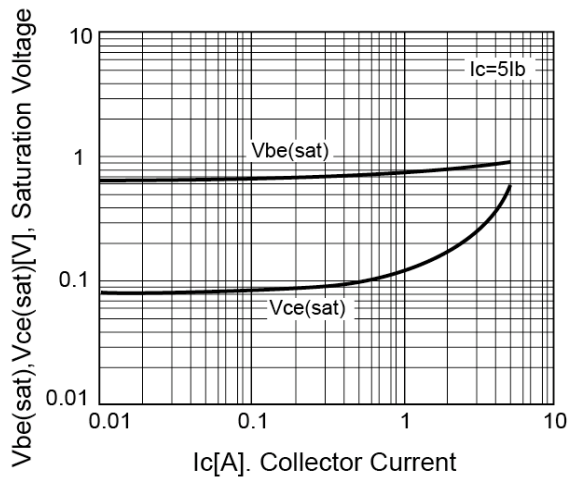
**Figure 1. Static Characteristics**



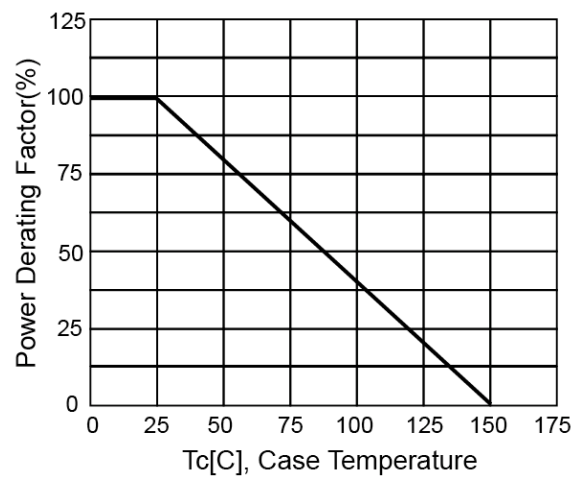
**Figure 2. DC Current Gain**



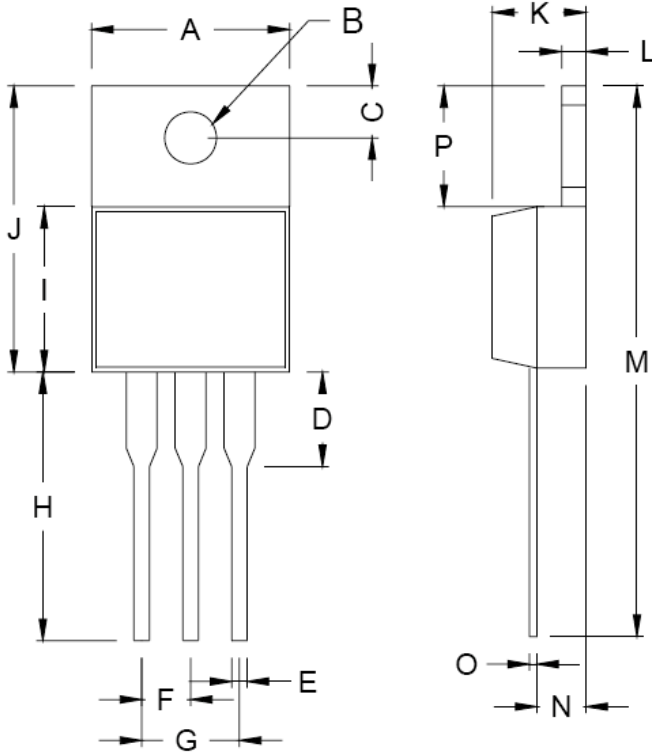
**Figure 3. Vce(sat) v.s. Vbe(sat)**



**Figure 4. Power Derating**

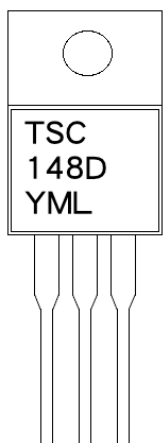


**TO-220 Mechanical Drawing**



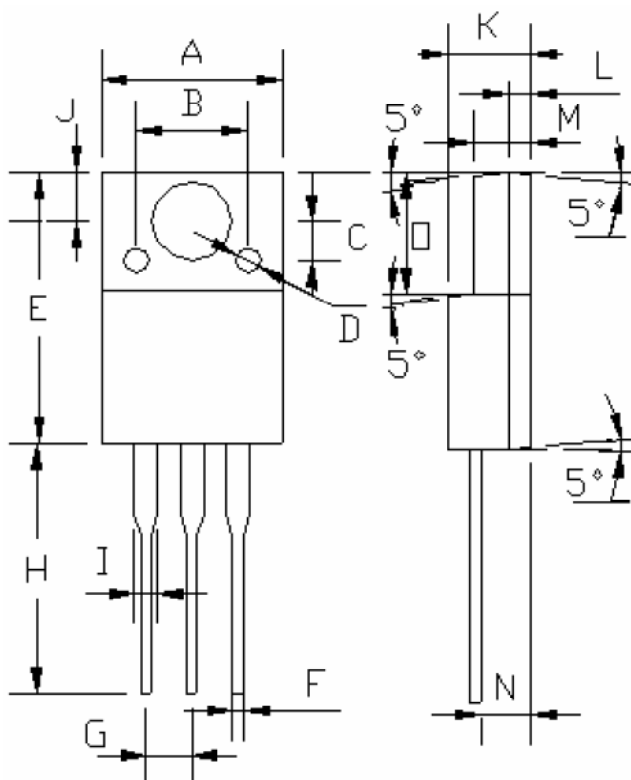
| TO-220 DIMENSION |             |        |        |       |
|------------------|-------------|--------|--------|-------|
| DIM              | MILLIMETERS |        | INCHES |       |
|                  | MIN         | MAX    | MIN    | MAX   |
| A                | 9.31        | 10.550 | 0.366  | 0.415 |
| 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**



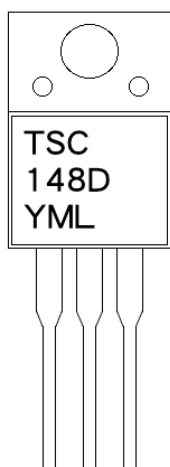
- Y = Year Code
- M = Month Code
- (A=Jan, B=Feb, C=Mar, D=Apr, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)
- L = Lot Code

**ITO-220 Mechanical Drawing**



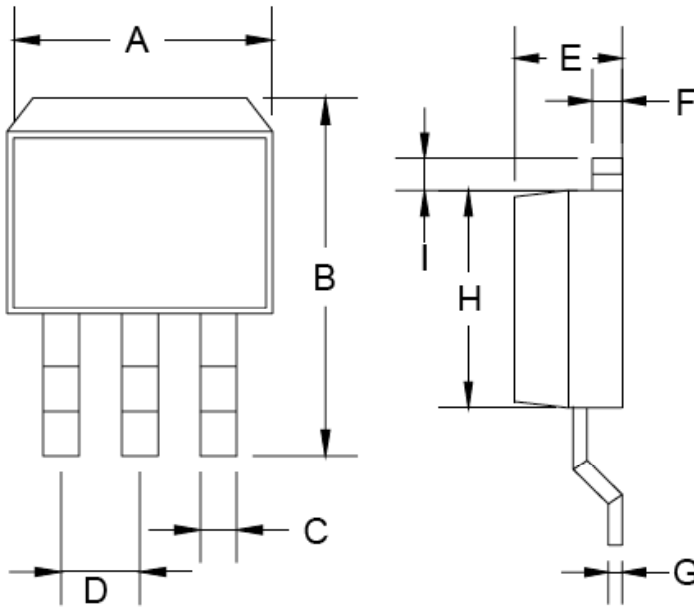
| ITO-220 DIMENSION |             |       |              |       |
|-------------------|-------------|-------|--------------|-------|
| DIM               | MILLIMETERS |       | INCHES       |       |
|                   | MIN         | MAX   | MIN          | MAX   |
| A                 | 9.96        | 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**



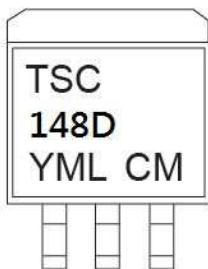
- Y** = Year Code
- M** = Month Code  
(A=Jan, B=Feb, C=Mar, D=Apl, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)
- L** = Lot Code

### TO-263 Mechanical Drawing



| DIM | TO-263 DIMENSION |        |        |       |
|-----|------------------|--------|--------|-------|
|     | MILLIMETERS      |        | INCHES |       |
|     | MIN              | MAX    | MIN    | MAX   |
| A   | 10.000           | 10.500 | 0.394  | 0.413 |
| B   | 14.605           | 15.875 | 0.575  | 0.625 |
| C   | 0.508            | 0.991  | 0.020  | 0.039 |
| D   | 2.420            | 2.660  | 0.095  | 0.105 |
| E   | 4.064            | 4.830  | 0.160  | 0.190 |
| F   | 1.118            | 1.400  | 0.045  | 0.055 |
| G   | 0.450            | 0.730  | 0.018  | 0.029 |
| H   | 8.280            | 8.800  | 0.325  | 0.346 |
| I   | 1.140            | 1.400  | 0.044  | 0.055 |
| J   | 1.480            | 1.520  | 0.058  | 0.060 |

### 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

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