

| <div>TSC</div> <div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <div>TS13003HV</div> <div>High Voltage NPN Transistor</div>     |                                                                                                                                                                                                                                           |      |           |            |         |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|------------|---------|----------------|------------------------|-----------|----------------|-----------|---------------------------|-----------|------|---|----------------------|-----------|------------------------|-----------------------|-------------------|-----|-------|-----|---|-------------------------------------|-----------------------|------------|-----------------------------|-------|-----|---|--------------------------------|----------------------|------------|----|--------------------------------------------------|-----------|--------------|--------------------------|--------------------------|-----------|----|----|----|----|------------------------|-------------------------|-----------|----|----|-----|----|--------------------------------------|---------------------------|----------------|----|----|-----|---|---------------------------|----------------|----|----|-----|-----------------|----------------------------|----------|----|----|----|--|----------------------------|----|----|----|----------------------------|---|----|----|-----------|----------------------------|-------|---|----|----|-----|--------------------|----------------------------|----------|----|----|----|----|--------------|-----------------------------------------------------------------|----------|----|-----|----|----|--------------|-----------|----|----|---|----|-----------|-------|----|----|-----|----|
| <div>TO-92</div> <div></div> <div>1 2 3</div> <div>Pin assignment:<br/>1. Emitter<br/>2. Collector<br/>3. Base</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                 | <div><math>BV_{CEO} = 530V</math></div> <div><math>BV_{CBO} = 900V</math></div> <div><math>I_c = 1.5A</math></div> <div><math>V_{CE(SAT)}, = 0.5V @ I_c / I_b = 0.5A / 0.1A</math></div>                                                  |      |           |            |         |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| <div>Features</div> <div><div>✧ High voltage.</div><div>✧ High speed switching</div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                 | <div>Ordering Information</div> <table><tr><th>Part No.</th><th>Packing</th><th>Package</th></tr><tr><td>TS13003HVCT B0</td><td>Bulk Pack</td><td>TO-92</td></tr><tr><td>TS13003HVCT A3</td><td>Ammo Pack</td><td>TO-92</td></tr></table> |      | Part No.  | Packing    | Package | TS13003HVCT B0 | Bulk Pack              | TO-92     | TS13003HVCT A3 | Ammo Pack | TO-92                     |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Part No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Packing                                                         | Package                                                                                                                                                                                                                                   |      |           |            |         |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| TS13003HVCT B0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Bulk Pack                                                       | TO-92                                                                                                                                                                                                                                     |      |           |            |         |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| TS13003HVCT A3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Ammo Pack                                                       | TO-92                                                                                                                                                                                                                                     |      |           |            |         |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| <div>Structure</div> <div><div>✧ Silicon triple diffused type.</div><div>✧ NPN silicon transistor</div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                 |                                                                                                                                                                                                                                           |      |           |            |         |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| <div>Absolute Maximum Rating (Ta = 25 °C unless otherwise noted)</div> <table><tr><th>Parameter</th><th>Symbol</th><th>Limit</th><th>Unit</th></tr><tr><td>Collector-Base Voltage</td><td><math>V_{CBO}</math></td><td>900V</td><td>V</td></tr><tr><td>Collector-Emitter Voltage</td><td><math>V_{CEO}</math></td><td>530V</td><td>V</td></tr><tr><td>Emitter-Base Voltage</td><td><math>V_{EBO}</math></td><td>10</td><td>V</td></tr><tr><td rowspan="2">Collector Current</td><td>DC</td><td><math>I_C</math></td><td>1.5</td><td rowspan="2">A</td></tr><tr><td>Pulse</td><td></td><td>3</td></tr><tr><td>Collector Power Dissipation</td><td><math>P_D</math></td><td>0.6</td><td>W</td></tr><tr><td>Operating Junction Temperature</td><td><math>T_J</math></td><td>+150</td><td>°C</td></tr><tr><td>Operating Junction and Storage Temperature Range</td><td><math>T_{STG}</math></td><td>- 55 to +150</td><td>°C</td></tr></table> <div>Note: 1. Single pulse, Pw = 300uS, Duty &lt;= 2%</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                 |                                                                                                                                                                                                                                           |      | Parameter | Symbol     | Limit   | Unit           | Collector-Base Voltage | $V_{CBO}$ | 900V           | V         | Collector-Emitter Voltage | $V_{CEO}$ | 530V | V | Emitter-Base Voltage | $V_{EBO}$ | 10                     | V                     | Collector Current | DC  | $I_C$ | 1.5 | A | Pulse                               |                       | 3          | 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                       |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Symbol                                                          | Limit                                                                                                                                                                                                                                     | Unit |           |            |         |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Collector-Base Voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | $V_{CBO}$                                                       | 900V                                                                                                                                                                                                                                      | V    |           |            |         |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Collector-Emitter Voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | $V_{CEO}$                                                       | 530V                                                                                                                                                                                                                                      | V    |           |            |         |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Emitter-Base Voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | $V_{EBO}$                                                       | 10                                                                                                                                                                                                                                        | V    |           |            |         |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Collector Current                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | DC                                                              | $I_C$                                                                                                                                                                                                                                     | 1.5  | A         |            |         |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Pulse                                                           |                                                                                                                                                                                                                                           | 3    |           |            |         |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| 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   |           |            |         |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| <div>Electrical Characteristics (Ta = 25 °C unless otherwise noted)</div> <table><tr><th>Parameter</th><th>Conditions</th><th>Symbol</th><th>Min</th><th>Typ</th><th>Max</th><th>Unit</th></tr><tr><td colspan="7">Static</td></tr><tr><td>Collector-Base Voltage</td><td><math>I_C = 10mA, I_B = 0</math></td><td><math>BV_{CBO}</math></td><td>900</td><td>--</td><td>--</td><td>V</td></tr><tr><td>Collector-Emitter Breakdown Voltage</td><td><math>I_C = 10mA, I_E = 0</math></td><td><math>BV_{CEO}</math></td><td>530</td><td>--</td><td>--</td><td>V</td></tr><tr><td>Emitter-Base Breakdown Voltage</td><td><math>I_E = 1mA, I_C = 0</math></td><td><math>BV_{EBO}</math></td><td>9</td><td>--</td><td>--</td><td>V</td></tr><tr><td>Collector Cutoff Current</td><td><math>V_{CB} = 800V, I_E = 0</math></td><td><math>I_{CBO}</math></td><td>--</td><td>--</td><td>10</td><td>uA</td></tr><tr><td>Emitter Cutoff Current</td><td><math>V_{EB} = 10V, I_C = 0</math></td><td><math>I_{EBO}</math></td><td>--</td><td>--</td><td>0.5</td><td>uA</td></tr><tr><td rowspan="2">Collector-Emitter Saturation Voltage</td><td><math>I_C / I_B = 1.5A / 0.5A</math></td><td><math>V_{CE(SAT)1}</math></td><td>--</td><td>--</td><td>2.5</td><td rowspan="2">V</td></tr><tr><td><math>I_C / I_B = 0.5A / 0.1A</math></td><td><math>V_{CE(SAT)2}</math></td><td>--</td><td>--</td><td>0.8</td></tr><tr><td rowspan="3">DC Current Gain</td><td><math>V_{CE} = 10V, I_C = 10uA</math></td><td rowspan="3"><math>h_{FE}</math></td><td>15</td><td>--</td><td>40</td><td rowspan="3"></td></tr><tr><td><math>V_{CE} = 10V, I_C = 0.4A</math></td><td>20</td><td>--</td><td>40</td></tr><tr><td><math>V_{CE} = 10V, I_C = 1.0A</math></td><td>6</td><td>--</td><td>40</td></tr><tr><td>Frequency</td><td><math>V_{CE} = 10V, I_C = 0.1A</math></td><td><math>f_T</math></td><td>4</td><td>--</td><td>--</td><td>MHz</td></tr><tr><td>Output Capacitance</td><td><math>V_{CB} = 10V, f = 0.1MHz</math></td><td><math>C_{ob}</math></td><td>--</td><td>21</td><td>--</td><td>pF</td></tr><tr><td>Turn On Time</td><td rowspan="3"><math>V_{CC} = 125V, I_C = 1A,</math><br/><math>I_{B1} = 0.2A, I_{B2} = - 0.2A,</math></td><td><math>t_{ON}</math></td><td>--</td><td>1.1</td><td>--</td><td>uS</td></tr><tr><td>Storage Time</td><td><math>t_{STG}</math></td><td>--</td><td>--</td><td>4</td><td>uS</td></tr><tr><td>Fall Time</td><td><math>t_f</math></td><td>--</td><td>--</td><td>0.7</td><td>uS</td></tr></table> |                                                                 |                                                                                                                                                                                                                                           |      | Parameter | Conditions | Symbol  | Min            | Typ                    | Max       | Unit           | Static    |                           |           |      |   |                      |           | Collector-Base Voltage | $I_C = 10mA, I_B = 0$ | $BV_{CBO}$        | 900 | --    | --  | V | Collector-Emitter Breakdown Voltage | $I_C = 10mA, I_E = 0$ | $BV_{CEO}$ | 530                         | --    | --  | V | Emitter-Base Breakdown Voltage | $I_E = 1mA, I_C = 0$ | $BV_{EBO}$ | 9  | --                                               | --        | V            | Collector Cutoff Current | $V_{CB} = 800V, I_E = 0$ | $I_{CBO}$ | -- | -- | 10 | uA | Emitter Cutoff Current | $V_{EB} = 10V, I_C = 0$ | $I_{EBO}$ | -- | -- | 0.5 | uA | Collector-Emitter Saturation Voltage | $I_C / I_B = 1.5A / 0.5A$ | $V_{CE(SAT)1}$ | -- | -- | 2.5 | V | $I_C / I_B = 0.5A / 0.1A$ | $V_{CE(SAT)2}$ | -- | -- | 0.8 | DC Current Gain | $V_{CE} = 10V, I_C = 10uA$ | $h_{FE}$ | 15 | -- | 40 |  | $V_{CE} = 10V, I_C = 0.4A$ | 20 | -- | 40 | $V_{CE} = 10V, I_C = 1.0A$ | 6 | -- | 40 | Frequency | $V_{CE} = 10V, I_C = 0.1A$ | $f_T$ | 4 | -- | -- | MHz | Output Capacitance | $V_{CB} = 10V, f = 0.1MHz$ | $C_{ob}$ | -- | 21 | -- | pF | Turn On Time | $V_{CC} = 125V, I_C = 1A,$<br>$I_{B1} = 0.2A, I_{B2} = - 0.2A,$ | $t_{ON}$ | -- | 1.1 | -- | uS | Storage Time | $t_{STG}$ | -- | -- | 4 | uS | Fall Time | $t_f$ | -- | -- | 0.7 | uS |
| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Conditions                                                      | Symbol                                                                                                                                                                                                                                    | Min  | Typ       | Max        | Unit    |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Static                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                 |                                                                                                                                                                                                                                           |      |           |            |         |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Collector-Base Voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | $I_C = 10mA, I_B = 0$                                           | $BV_{CBO}$                                                                                                                                                                                                                                | 900  | --        | --         | V       |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Collector-Emitter Breakdown Voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | $I_C = 10mA, I_E = 0$                                           | $BV_{CEO}$                                                                                                                                                                                                                                | 530  | --        | --         | V       |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Emitter-Base Breakdown Voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | $I_E = 1mA, I_C = 0$                                            | $BV_{EBO}$                                                                                                                                                                                                                                | 9    | --        | --         | V       |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Collector Cutoff Current                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | $V_{CB} = 800V, I_E = 0$                                        | $I_{CBO}$                                                                                                                                                                                                                                 | --   | --        | 10         | uA      |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Emitter Cutoff Current                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | $V_{EB} = 10V, I_C = 0$                                         | $I_{EBO}$                                                                                                                                                                                                                                 | --   | --        | 0.5        | uA      |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Collector-Emitter Saturation Voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | $I_C / I_B = 1.5A / 0.5A$                                       | $V_{CE(SAT)1}$                                                                                                                                                                                                                            | --   | --        | 2.5        | V       |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $I_C / I_B = 0.5A / 0.1A$                                       | $V_{CE(SAT)2}$                                                                                                                                                                                                                            | --   | --        | 0.8        |         |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| DC Current Gain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $V_{CE} = 10V, I_C = 10uA$                                      | $h_{FE}$                                                                                                                                                                                                                                  | 15   | --        | 40         |         |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
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| Frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | $V_{CE} = 10V, I_C = 0.1A$                                      | $f_T$                                                                                                                                                                                                                                     | 4    | --        | --         | MHz     |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Output Capacitance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | $V_{CB} = 10V, f = 0.1MHz$                                      | $C_{ob}$                                                                                                                                                                                                                                  | --   | 21        | --         | pF      |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Turn On Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | $V_{CC} = 125V, I_C = 1A,$<br>$I_{B1} = 0.2A, I_{B2} = - 0.2A,$ | $t_{ON}$                                                                                                                                                                                                                                  | --   | 1.1       | --         | uS      |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Storage Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                 | $t_{STG}$                                                                                                                                                                                                                                 | --   | --        | 4          | uS      |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |
| Fall Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                 | $t_f$                                                                                                                                                                                                                                     | --   | --        | 0.7        | uS      |                |                        |           |                |           |                           |           |      |   |                      |           |                        |                       |                   |     |       |     |   |                                     |                       |            |                             |       |     |   |                                |                      |            |    |                                                  |           |              |                          |                          |           |    |    |    |    |                        |                         |           |    |    |     |    |                                      |                           |                |    |    |     |   |                           |                |    |    |     |                 |                            |          |    |    |    |  |                            |    |    |    |                            |   |    |    |           |                            |       |   |    |    |     |                    |                            |          |    |    |    |    |              |                                                                 |          |    |     |    |    |              |           |    |    |   |    |           |       |    |    |     |    |

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

## Electrical Characteristics Curve

Figure 1. Static Characteristic

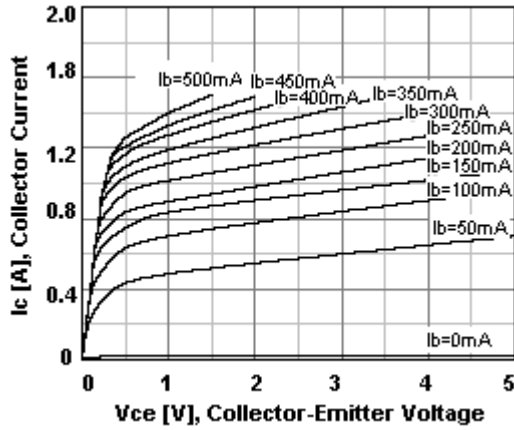


Figure 2. DC Current Gain

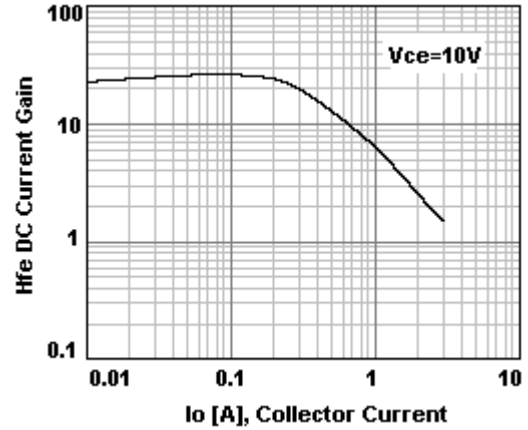


Figure 3.  $V_{ce(sat)}$  v.s.  $V_{be(sat)}$

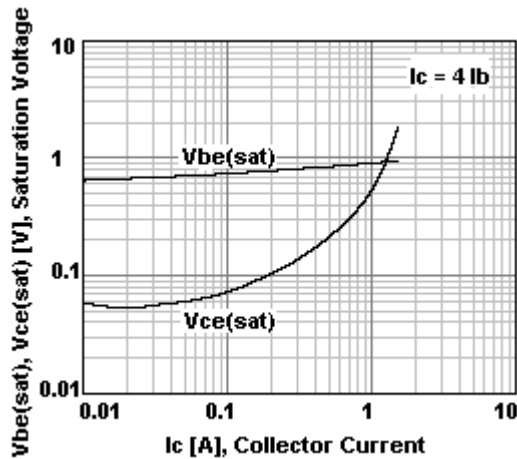


Figure 4. Switching Time

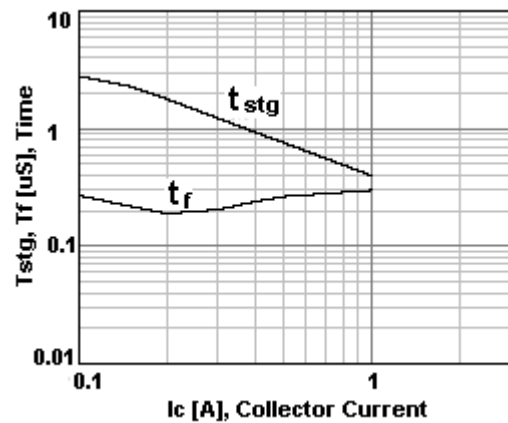


Figure 5. Safe Operating Area

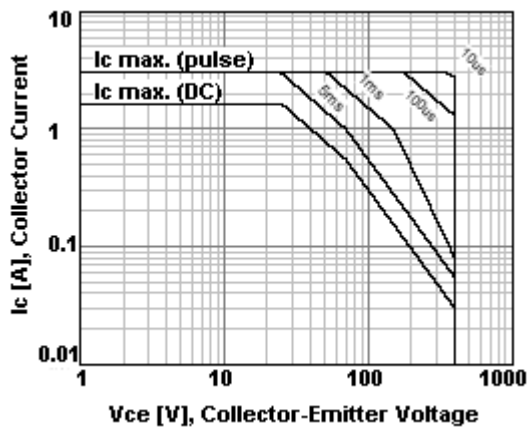
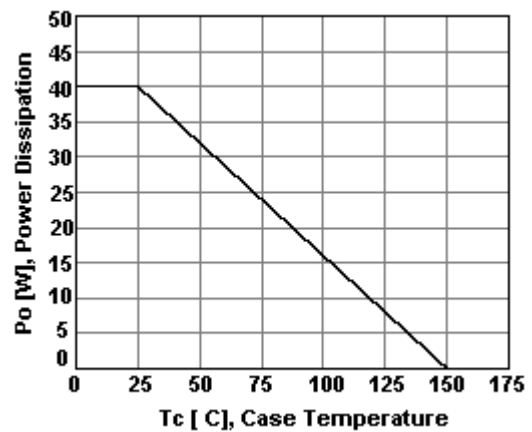
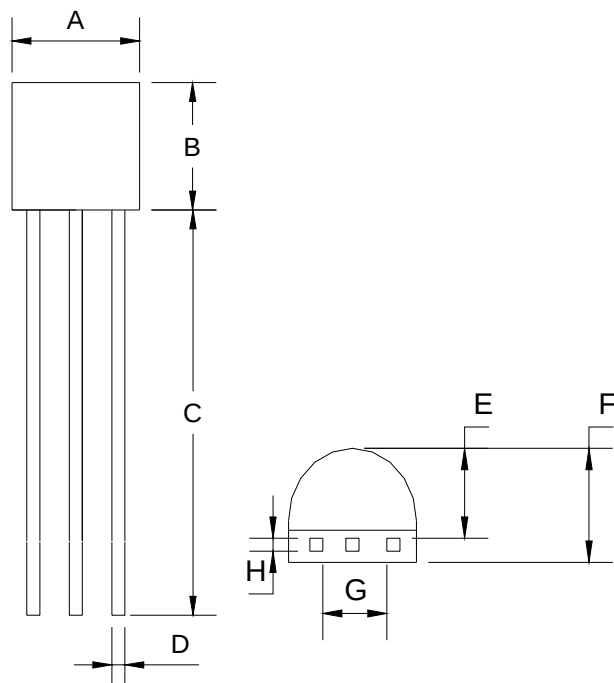


Figure 6. Power Derating



## TO-92 Mechanical Drawing



| DIM | TO-92 DIMENSION |      |            |       |
|-----|-----------------|------|------------|-------|
|     | 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 |
|     |                 |      |            |       |

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