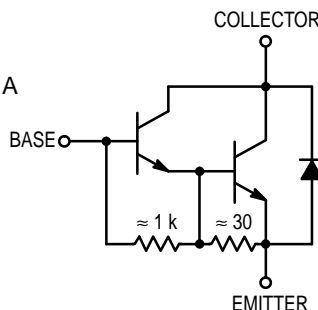


BU323AP

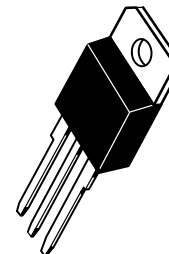
NPN Silicon Darlington Power Transistor

The BU323AP is a monolithic darlington transistor designed for automotive ignition, switching regulator and motor control applications.

- Collector–Emitter Sustaining Voltage —
 $V_{CE(sus)} = 475 \text{ Vdc}$
- 125 Watts Capability at 50 Volts
- $V_{CE \text{ Sat}}$ Specified at $-40^\circ\text{C} = 2.0 \text{ V Max.}$ at $I_C = 6.0 \text{ A}$
- Photoglass Passivation for Reliability and Stability



**DARLINGTON
NPN SILICON
POWER TRANSISTOR
400 VOLTS
125 WATTS**



**CASE 340D-01
TO-218 TYPE**

MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|--|----------------|-------------|---------------------|
| Collector–Emitter Voltage | $V_{CEO(sus)}$ | 400 | Vdc |
| Collector–Emitter Voltage | V_{CEV} | 475 | Vdc |
| Emitter–Base Voltage | V_{EB} | 6.0 | Vdc |
| Collector Current — Continuous | I_C | 10 | Adc |
| — Peak (1) | I_{CM} | 16 | |
| Base Current — Continuous | I_B | 3.0 | Adc |
| — Peak (1) | I_{BM} | | |
| Total Power Dissipation — $T_C = 25^\circ\text{C}$ | P_D | 125 | Watts |
| — $T_C = 100^\circ\text{C}$ | | 100 | Watts |
| Derate above 25°C | | 1.0 | W/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range | T_J, T_{stg} | -65 to +200 | $^\circ\text{C}$ |

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|--|-----------------|-----|--------------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.0 | $^\circ\text{C/W}$ |
| Maximum Lead Temperature for Soldering Purposes: 1/8" from Case for 5 Seconds | T_L | 275 | $^\circ\text{C}$ |

(1) Pulse Test: Pulse Width = 5.0 ms, Duty Cycle $\leq 10\%$.

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|-----------------------|-----|-----|-----|------|
| OFF CHARACTERISTICS¹ | | | | | |
| Collector–Emitter Sustaining Voltage (Figure 1) L = 10 mH ($I_C = 200\text{ mA}$, $I_B = 0$, $V_{\text{clamp}} = \text{Rated } V_{\text{CEO}}$) | $V_{\text{CEO(sus)}}$ | 400 | | | Vdc |
| Collector–Emitter Sustaining Voltage (Figure 1) ($I_C = 3\text{ A}$, $R_{\text{BE}} = 100\text{ Ohms}$, L = 500 μH) Unclamped | $V_{\text{CER(sus)}}$ | 475 | | | Vdc |
| Collector Cutoff Current (Rated V_{CER} , $R_{\text{BE}} = 100\text{ Ohms}$) | I_{CER} | | | 1 | mAdc |
| Collector Cutoff Current (Rated V_{CBO} , $I_E = 0$) | I_{CBO} | | | 1 | mAdc |
| Emitter Cutoff Current ($V_{\text{EB}} = 6\text{ Vdc}$, $I_C = 0$) | I_{EBO} | | | 40 | mAdc |

| | | | | | |
|--|----------------------|------------------|-------------------|--------------------------|-----|
| ON CHARACTERISTICS¹ | | | | | |
| DC Current Gain ($I_C = 3\text{ Adc}$, $V_{\text{CE}} = 6\text{ Vdc}$) ($I_C = 6\text{ Adc}$, $V_{\text{CE}} = 6\text{ Vdc}$) ($I_C = 10\text{ Adc}$, $V_{\text{CE}} = 6\text{ Vdc}$) | hFE | 300 150 50 | 550 350 150 | 2000 | |
| Collector–Emitter Saturation Voltage ($I_C = 3\text{ Adc}$, $I_B = 60\text{ mAdc}$) ($I_C = 6\text{ Adc}$, $I_B = 120\text{ mAdc}$) ($I_C = 10\text{ Adc}$, $I_B = 300\text{ mAdc}$) ($I_C = 6\text{ Adc}$, $I_B = 120\text{ mAdc}$, $T_C = -40^\circ\text{C}$) | $V_{\text{CE(sat)}}$ | | | 1.5 1.7 2.7 2.0 | Vdc |
| Base–Emitter Saturation Voltage ($I_C = 6\text{ Adc}$, $I_B = 120\text{ mAdc}$) ($I_C = 10\text{ Adc}$, $I_B = 300\text{ mAdc}$) ($I_C = 6\text{ Adc}$, $I_B = 120\text{ mAdc}$, $T_C = -40^\circ\text{C}$) | $V_{\text{BE(sat)}}$ | | | 2.2 3 2.4 | Vdc |
| Base–Emitter On Voltage ($I_C = 10\text{ Adc}$, $V_{\text{CE}} = 6\text{ Vdc}$) | $V_{\text{BE(on)}}$ | | | 2.5 | Vdc |
| Diode Forward Voltage ($I_F = 10\text{ Adc}$) | V_f | | 2 | 3.5 | Vdc |

| | | | | | |
|---|-----------------|--|-----|-----|----|
| DYNAMIC CHARACTERISTICS | | | | | |
| Output Capacitance ($V_{\text{CB}} = 10\text{ Vdc}$, $I_E = 0$, $f_{\text{test}} = 100\text{ kHz}$) | C_{ob} | | 165 | 350 | pF |

| | | | | | |
|----------------------------------|--|-------|-----|----|---------------|
| SWITCHING CHARACTERISTICS | | | | | |
| Storage Time | $(V_{\text{CC}} = 12\text{ Vdc}$, $I_C = 6\text{ Adc}$, $I_{\text{B1}} = I_{\text{B2}} = 0.3\text{ Adc}$) Fig. 2 | t_s | 7.5 | 15 | μs |
| Fall Time | | t_f | 5.2 | 15 | μs |

| | | | | | |
|--|--------------------|-----|------------------|--|----|
| FUNCTIONAL TESTS | | | | | |
| Second Breakdown Collector Current with Base–Forward Biased | $I_{\text{S/B}}$ | | See Figure 10 | | |
| Pulsed Energy Test (See Figure 12) | $I_{\text{C2L/2}}$ | 550 | | | mJ |

¹Pulse Test: Pulse Width = 300 μs , Duty Cycle = 2%.

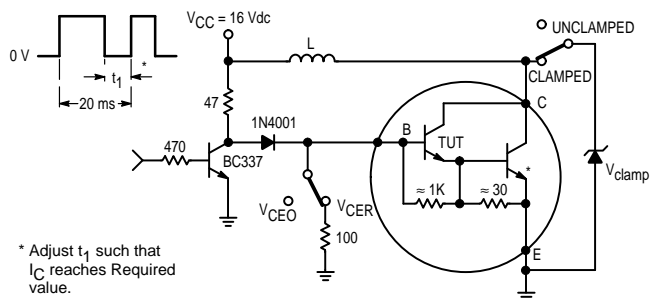


Figure 1. Sustaining Voltage Test Circuit

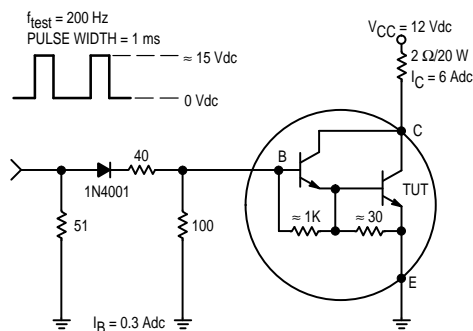


Figure 2. Switching Times Test Circuit

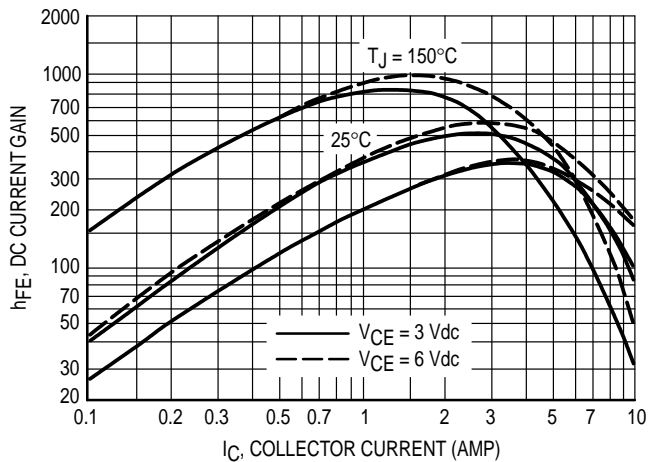


Figure 3. DC Current Gain

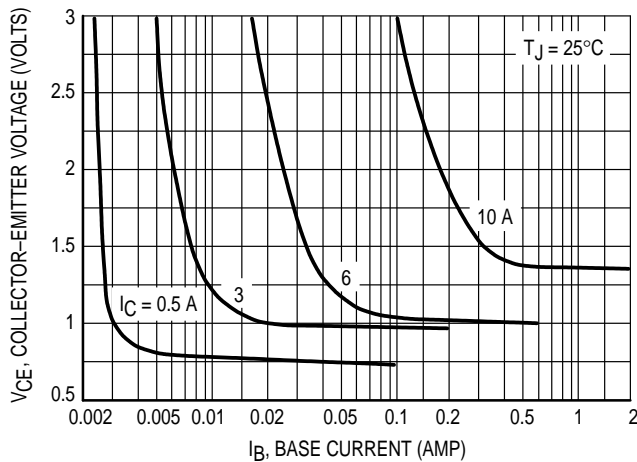


Figure 4. Collector Saturation Region

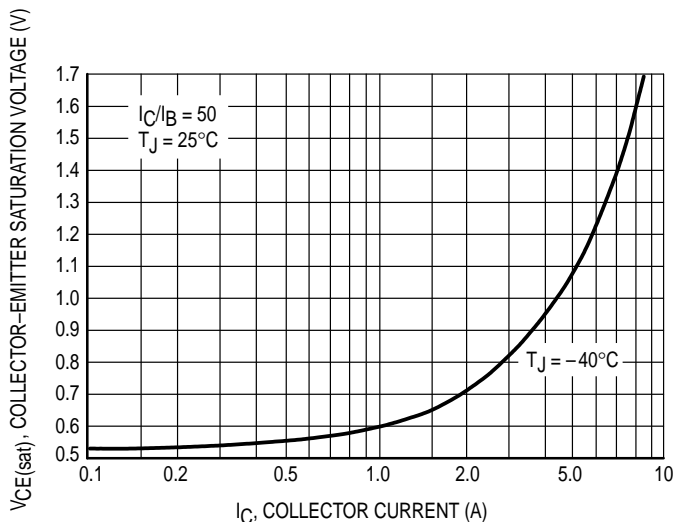


Figure 5. Collector-Emitter Saturation Voltage

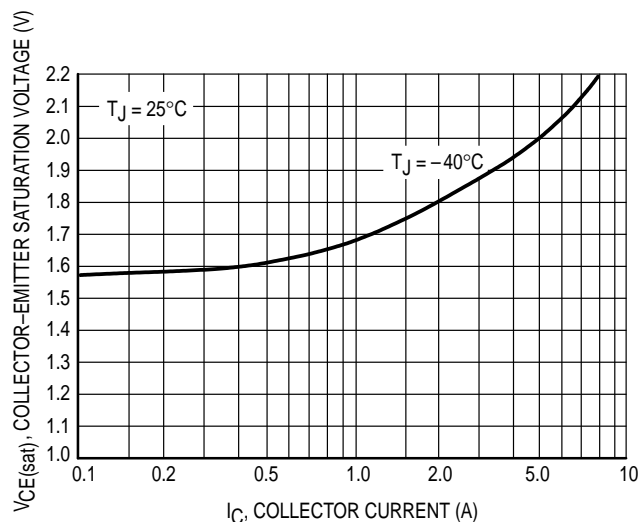


Figure 6. Base-Emitter Voltage

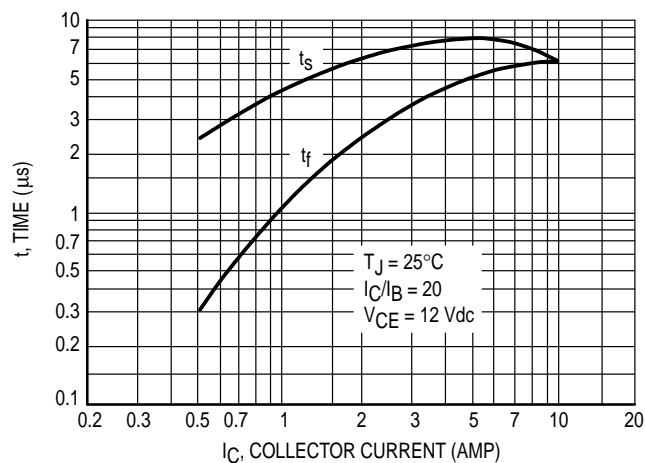


Figure 7. Turn-Off Switching Time

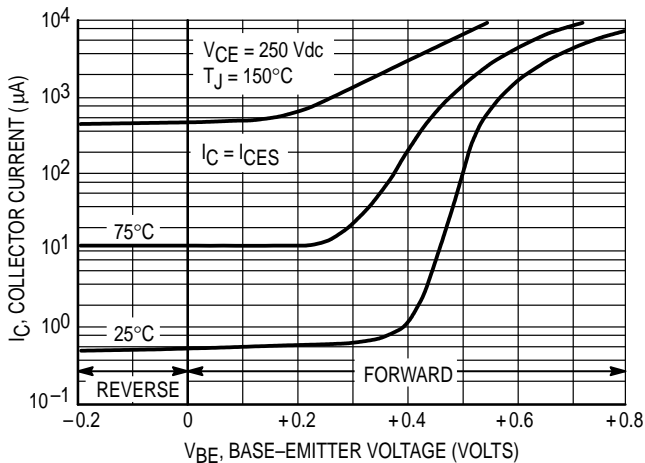


Figure 8. Collector Cutoff Region

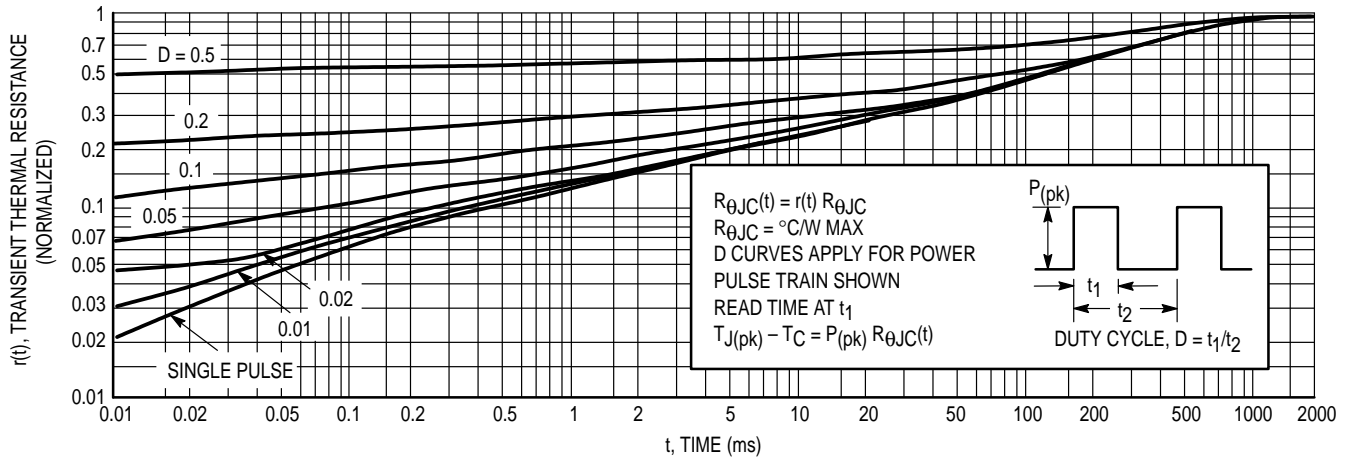


Figure 9. Thermal Response

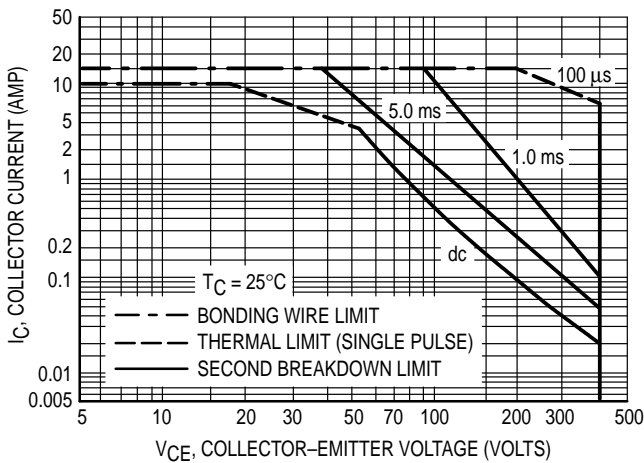


Figure 10. Forward Bias Safe Operating Area

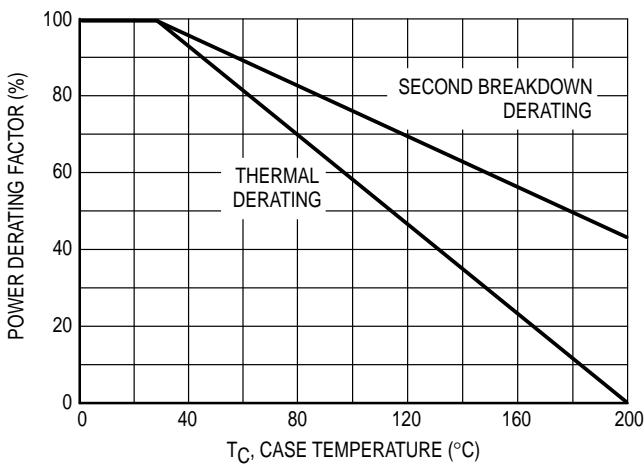
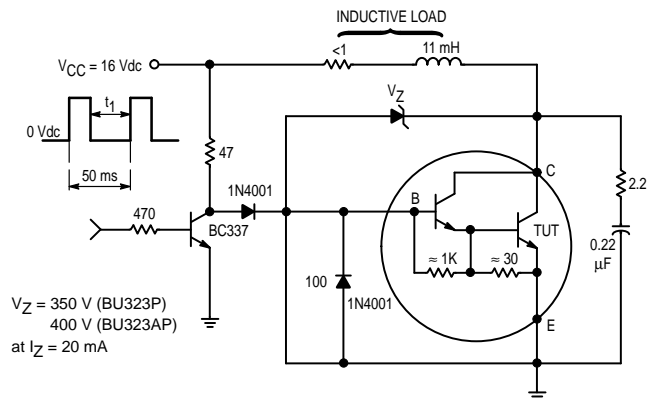


Figure 11. Power Derating

There are two limitations on the power handling ability of a transistor average junction temperature and second breakdown. Safe operating area curves indicate $I_C - V_{CE}$ limits of the transistor that must be observed for reliable operation, i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 10 is based on $T_C = 25^{\circ}\text{C}$, $T_{J(pk)}$ is variable depending on power level. Second breakdown pulse limits are valid for duty cycles to 10% but must be derated when $T_C \geq 25^{\circ}\text{C}$. Second breakdown limitations do not derate the same as thermal limitations. Allowable current at the voltages shown on Figure 10 may be found at any case temperature by using the appropriate curve on Figure 11.

$T_{J(pk)}$ may be calculated from the data in Figure 11. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

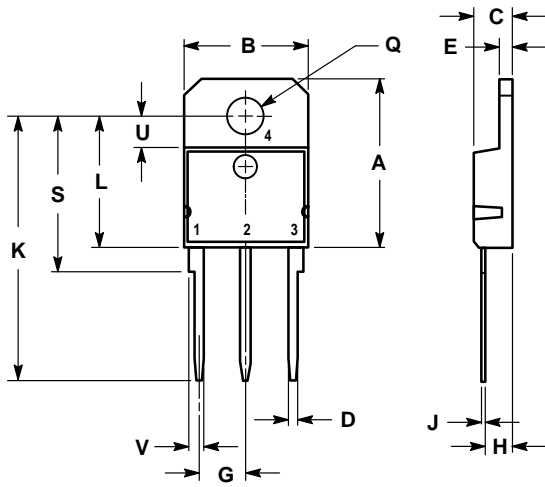


t_1 to be selected such that I_C reaches 10 Adc before switch-off.

NOTE: Figure 12 specifies energy handling capabilities in an automotive ignition circuit.

Figure 12. Ignition Test Circuit

PACKAGE DIMENSIONS




- NOTES:
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 19.00 | 19.60 | 0.749 | 0.771 |
| B | 14.00 | 14.50 | 0.551 | 0.570 |
| C | 4.20 | 4.70 | 0.165 | 0.185 |
| D | 1.00 | 1.30 | 0.040 | 0.051 |
| E | 1.45 | 1.65 | 0.058 | 0.064 |
| G | 5.21 | 5.72 | 0.206 | 0.225 |
| H | 2.60 | 3.00 | 0.103 | 0.118 |
| J | 0.40 | 0.60 | 0.016 | 0.023 |
| K | 28.50 | 32.00 | 1.123 | 1.259 |
| L | 14.70 | 15.30 | 0.579 | 0.602 |
| Q | 4.00 | 4.25 | 0.158 | 0.167 |
| S | 17.50 | 18.10 | 0.689 | 0.712 |
| U | 3.40 | 3.80 | 0.134 | 0.149 |
| V | 1.50 | 2.00 | 0.060 | 0.078 |

- STYLE 1:
 PIN 1. BASE
 2. COLLECTOR
 3. EMITTER
 4. COLLECTOR

CASE 340D-01
 TO-218 TYPE
 ISSUE A

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