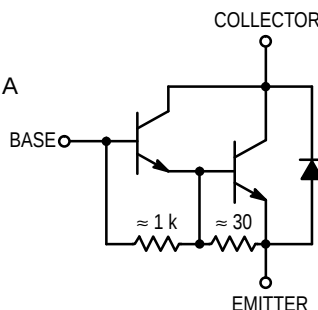


BU323AP

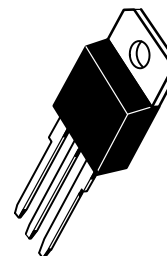
NPN Silicon Darlington Power Transistor

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 — Peak (1)	I_C I_{CM}	10 16	Adc
Base Current — Continuous — Peak (1)	I_B I_{BM}	3.0	Adc
Total Power Dissipation — $T_C = 25^\circ\text{C}$ — $T_C = 100^\circ\text{C}$ Derate above 25°C	P_D	125 100 1.0	Watts Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	$-65 \text{ to } +200$	$^\circ\text{C}$

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) $L = 10\text{ mH}$ ($I_C = 200\text{ mAdc}$, $I_B = 0$, $V_{\text{clamp}} = \text{Rated } V_{\text{CEO}}$)	$V_{\text{CEO(sus)}}$	400			Vdc
Collector–Emitter Sustaining Voltage (Figure 1) ($I_C = 3\text{ A}$, $R_{\text{BE}} = 100\text{ Ohms}$, $L = 500\text{ }\mu\text{H}$) 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 ($I_C = 3\text{ Adc}$, $V_{\text{CE}} = 6\text{ Vdc}$) ($I_C = 6\text{ Adc}$, $V_{\text{CE}} = 6\text{ Vdc}$) ($I_C = 10\text{ Adc}$, $V_{\text{CE}} = 6\text{ Vdc}$)	h_{FE}	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

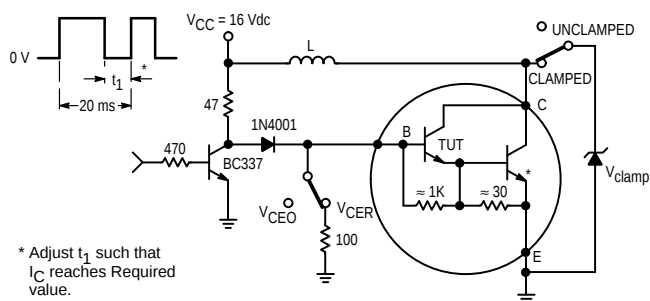
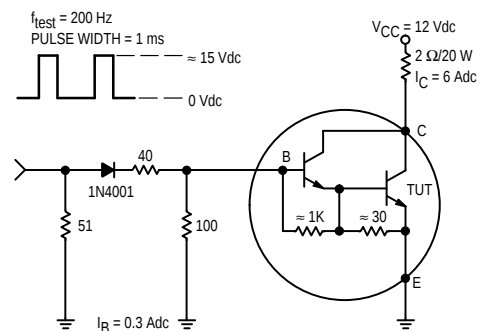
Output Capacitance ($V_{\text{CB}} = 10\text{ Vdc}$, $I_E = 0$, $f_{\text{test}} = 100\text{ kHz}$)	C_{ob}		165	350	pF
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SWITCHING CHARACTERISTICS

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

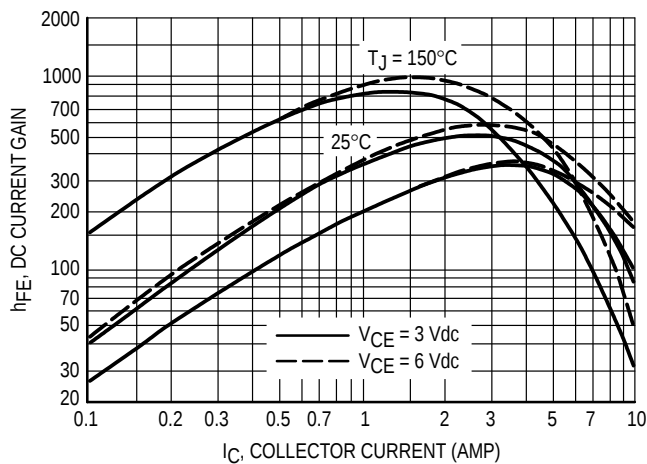


Figure 3. DC Current Gain

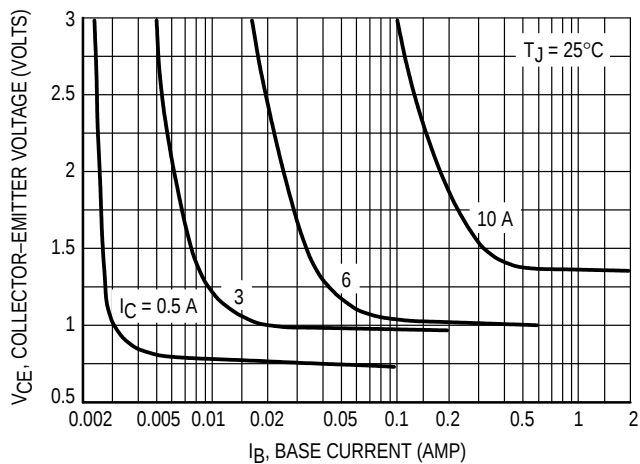


Figure 4. Collector Saturation Region

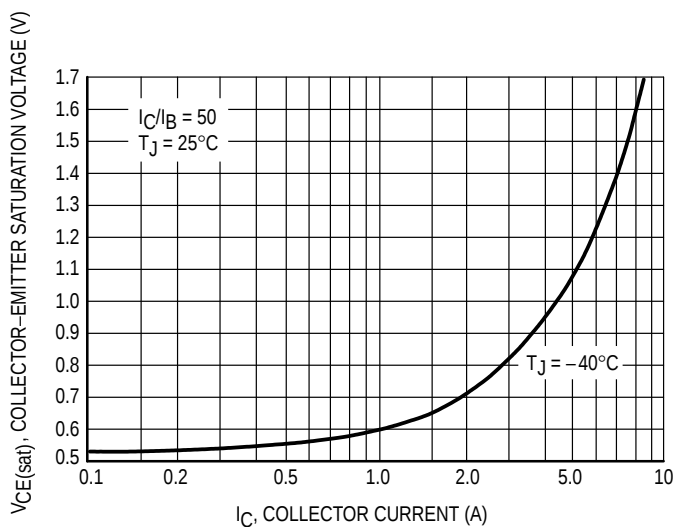


Figure 5. Collector-Emitter Saturation Voltage

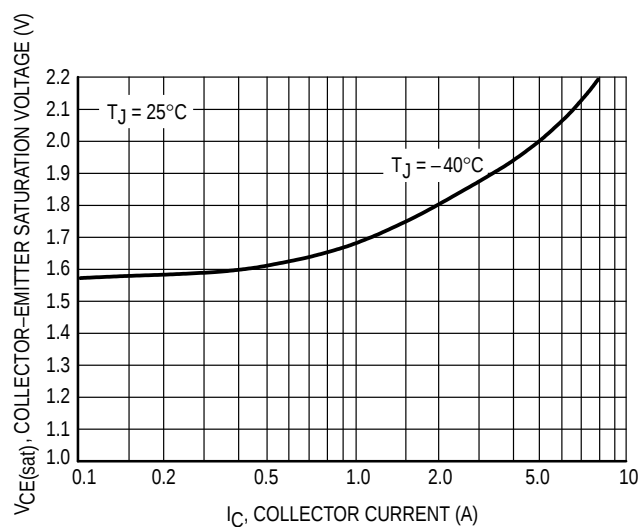


Figure 6. Base-Emitter Voltage

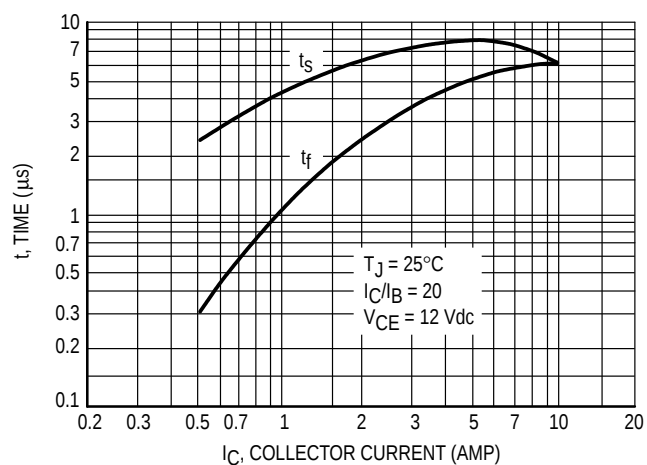


Figure 7. Turn-Off Switching Time

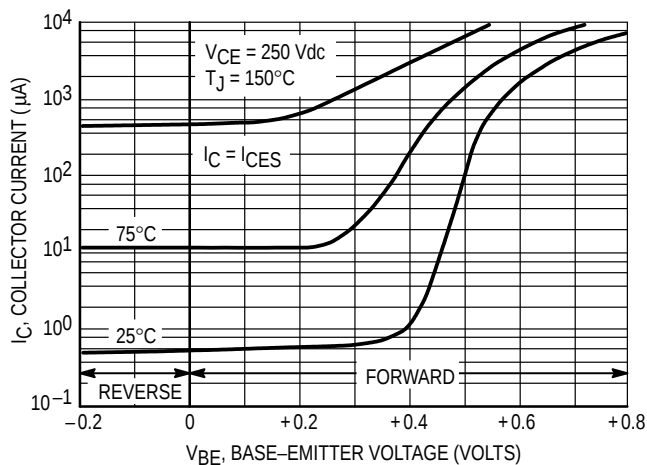
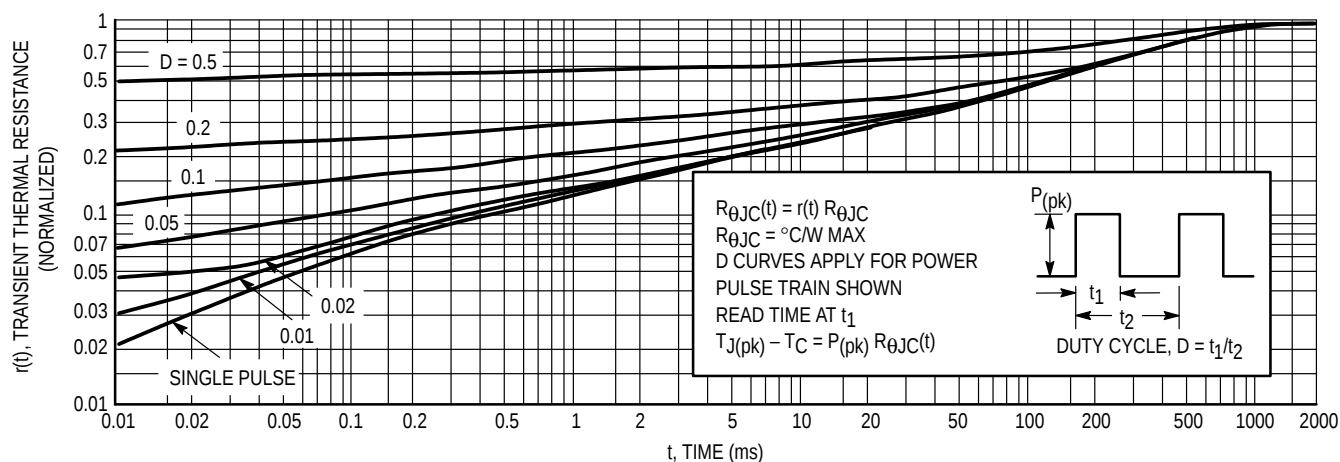
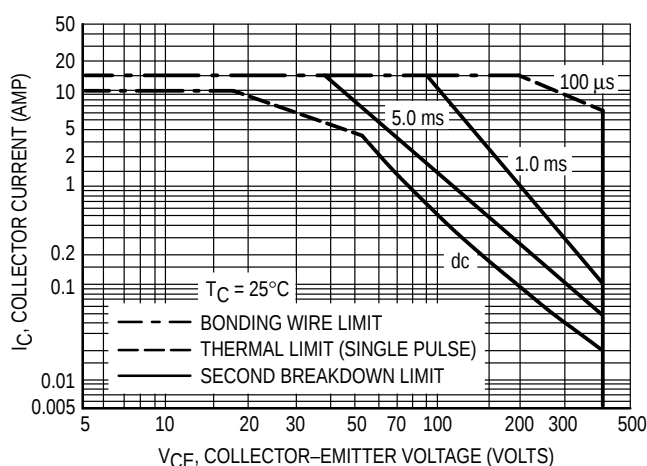
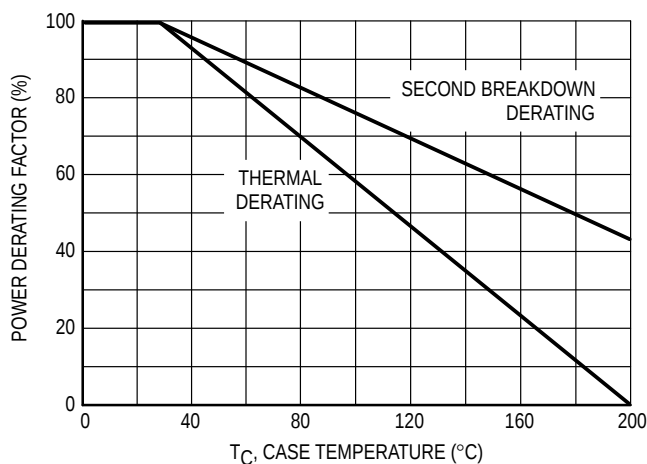


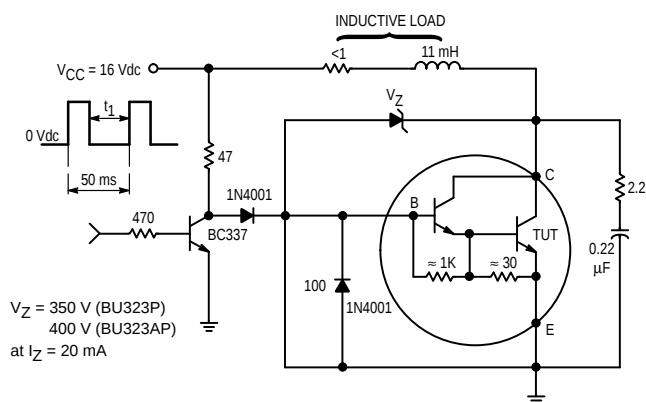
Figure 8. Collector Cutoff Region


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.

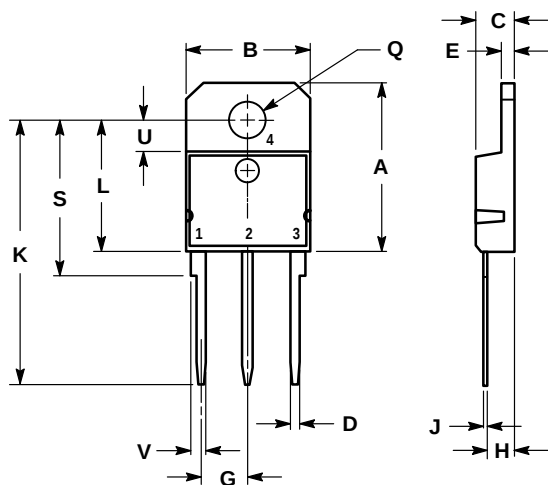


t_1 to be selected such that I_C reaches 10 Adc before switch-off.

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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