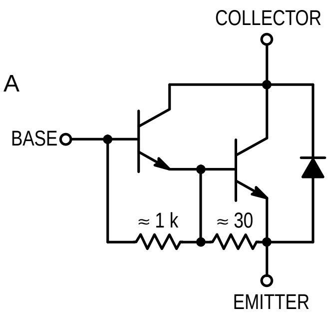
BU323AP

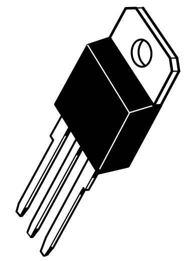
DARLINGTON NPN SILICON POWER TRANSISTOR 400 VOLTS 125 WATTS

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 — $V_{CER(sus)}$ = 475 Vdc
- 125 Watts Capability at 50 Volts
- V_{CE} Sat Specified at –40°C = 2.0 V Max. at I_C = 6.0 A
- Photoglass Passivation for Reliability and Stability





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°C — T_C = 100°C Derate above 25°C	P_D	125 100 1.0	Watts Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +200	°C

THERMAL CHARACTERISTICS

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

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

REV 7

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS[1]					
Collector–Emitter Sustaining Voltage (Figure 1) L = 10 mH (I_C = 200 mAdc, I_B = 0, V_{clamp} = Rated V_{CEO})	$V_{CEO(sus)}$	400			Vdc
Collector–Emitter Sustaining Voltage (Figure 1) (I_C = 3 A, R_{BE} = 100 Ohms, L = 500 μH) Unclamped	$V_{CER(sus)}$	475			Vdc
Collector Cutoff Current (Rated V_{CER}, R_{BE} = 100 Ohms)	I_{CER}			1	mAdc
Collector Cutoff Current (Rated V_{CBO}, I_E = 0)	I_{CBO}			1	mAdc
Emitter Cutoff Current (V_{EB} = 6 Vdc, I_C = 0)	I_{EBO}			40	mAdc
ON CHARACTERISTICS[1]					
DC Current Gain (I_C = 3 Adc, V_{CE} = 6 Vdc) (I_C = 6 Adc, V_{CE} = 6 Vdc) (I_C = 10 Adc, V_{CE} = 6 Vdc)	h_{FE}	 300 150 50	 550 350 150	 2000 	
Collector–Emitter Saturation Voltage (I_C = 3 Adc, I_B = 60 mAdc) (I_C = 6 Adc, I_B = 120 mAdc) (I_C = 10 Adc, I_B = 300 mAdc (I_C = 6 Adc, I_B = 120 mAdc, T_C = –40°C)	$V_{CE(sat)}$			 1.5 1.7 2.7 2.0	Vdc
Base–Emitter Saturation Voltage (I_C = 6 Adc, I_B = 120 mAdc) (I_C = 10 Adc, I_B = 300 mAdc) (I_C = 6 Adc, I_B = 120 mAdc, T_C = –40°C)	$V_{BE(sat)}$			 2.2 3 2.4	Vdc
Base–Emitter On Voltage (I_C = 10 Adc, V_{CE} = 6 Vdc)	$V_{BE(on)}$			2.5	Vdc
Diode Forward Voltage (I_F = 10 Adc)	V_f		2	3.5	Vdc
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f_{test} = 100 kHz)	C_{ob}		165	350	pF
SWITCHING CHARACTERISTICS					
Storage Time (V_{CC} = 12 Vdc, I_C = 6 Adc, I_{B1} = I_{B2} = 0.3 Adc) Fig. 2	t_s		7.5	15	μs
Fall Time (V_{CC} = 12 Vdc, I_C = 6 Adc, I_{B1} = I_{B2} = 0.3 Adc) Fig. 2	t_f		5.2	15	μs
FUNCTIONAL TESTS					
Second Breakdown Collector Current with Base–Forward Biased	$I_{S/B}$		See Figure 10		
Pulsed Energy Test (See Figure 12)	$I_C{}^2L/2$	550			mJ

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

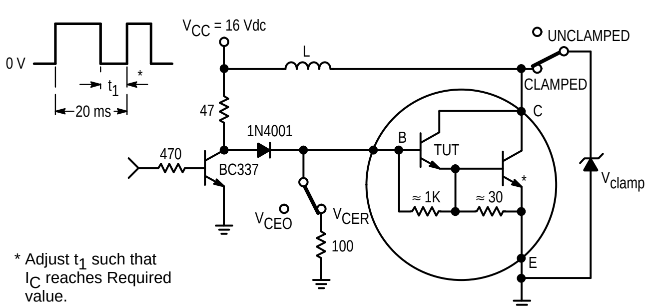


Figure 1. Sustaining Voltage Test Circuit

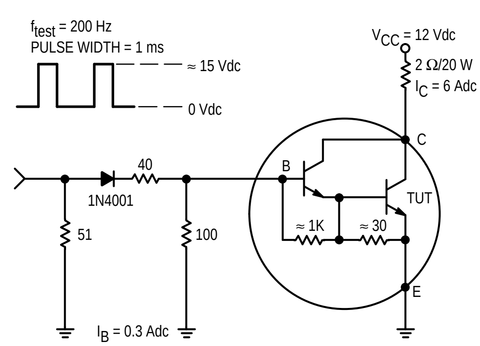


Figure 2. Switching Times Test Circuit

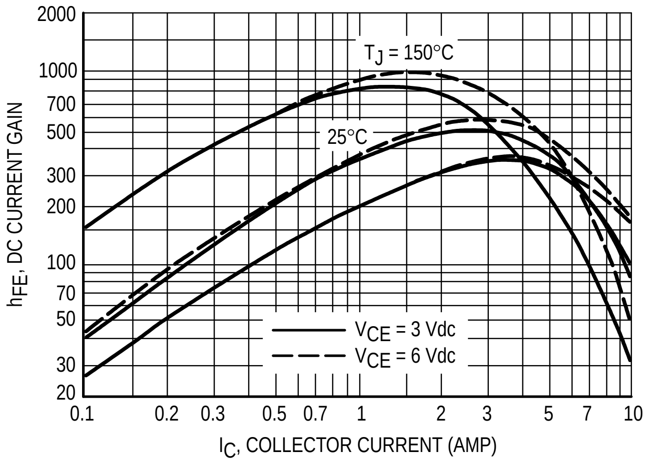


Figure 3. DC Current Gain

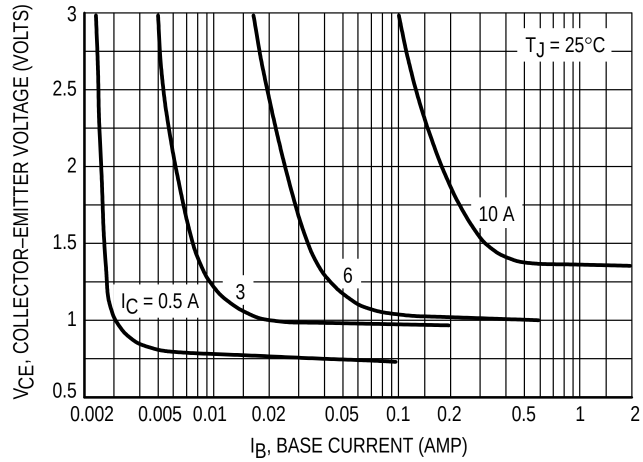


Figure 4. Collector Saturation Region

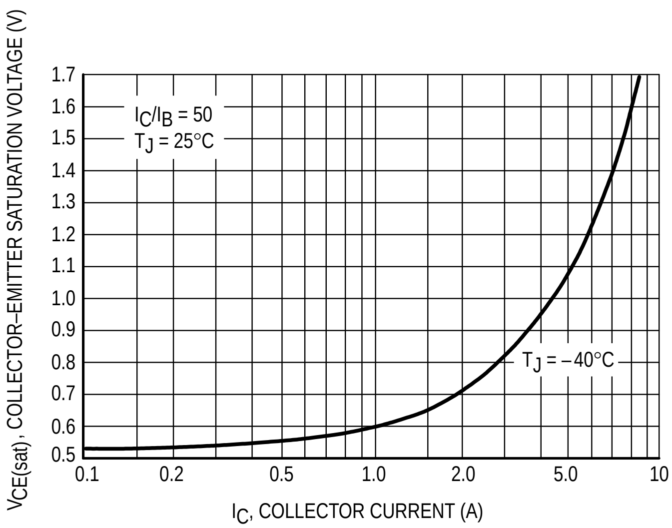


Figure 5. Collector–Emitter Saturation Voltage

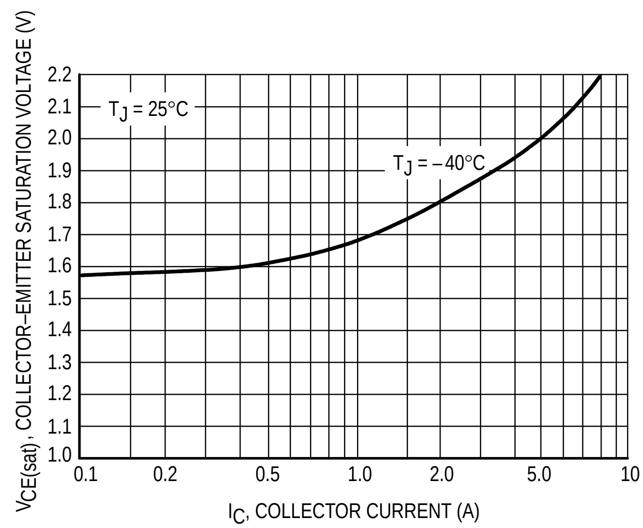


Figure 6. Base–Emitter Voltage

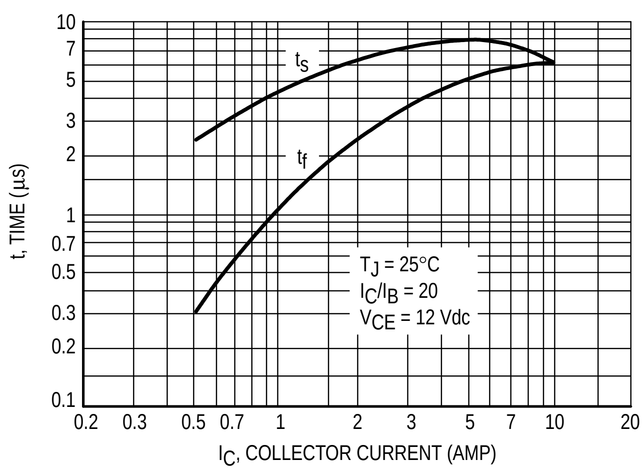


Figure 7. Turn–Off Switching Time

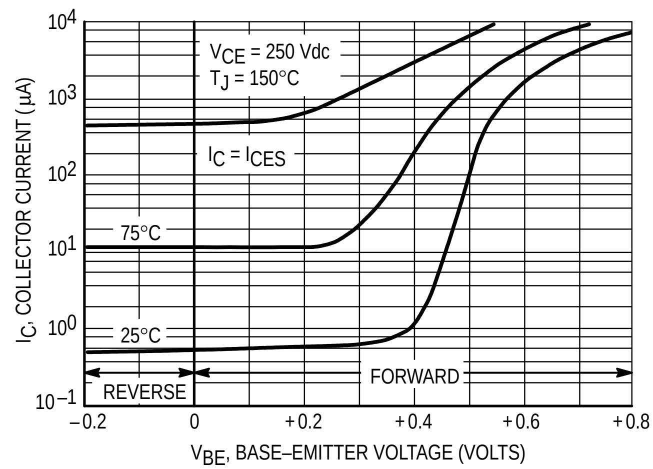


Figure 8. Collector Cutoff Region

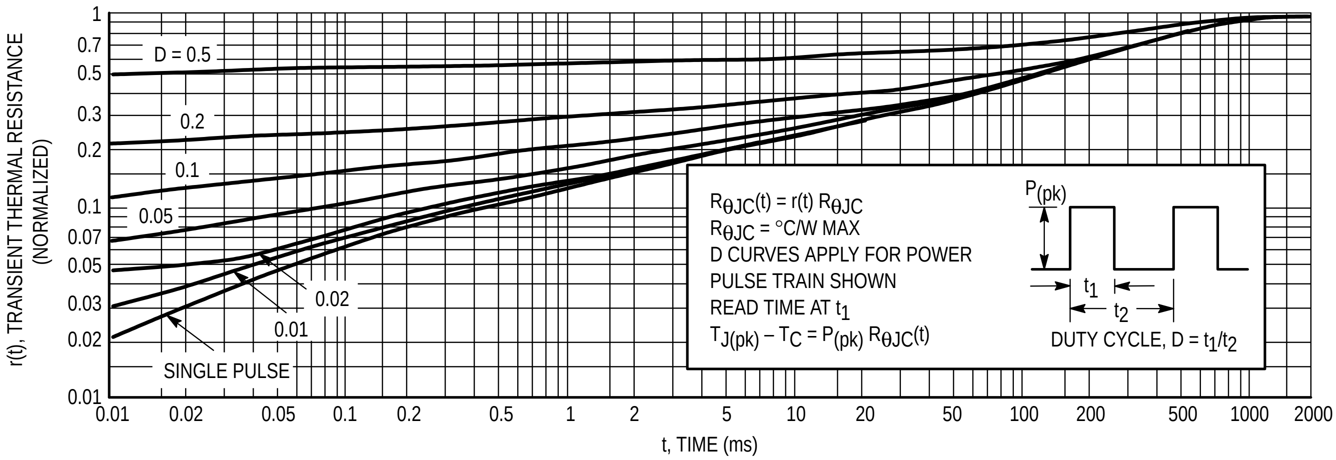


Figure 9. Thermal Response

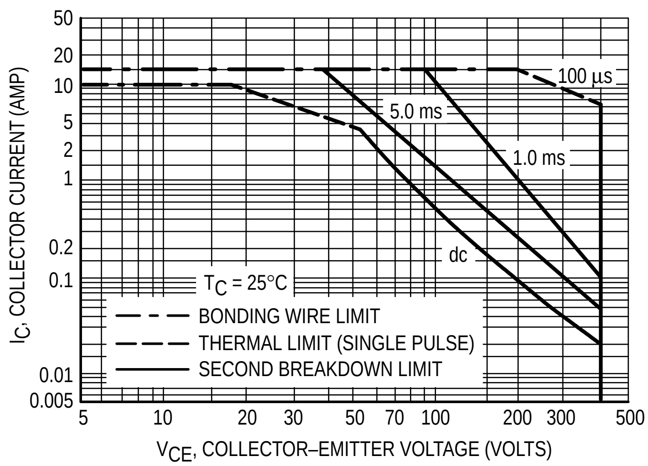


Figure 10. Forward Bias Safe Operating Area

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 $T_C = 25°C$, $T_{J(pk)}$ is variable depending on power level. Second breakdown pulse limits are valid for duty cycles to 10% but must be derated when $T_C \geq 25°C$. 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.

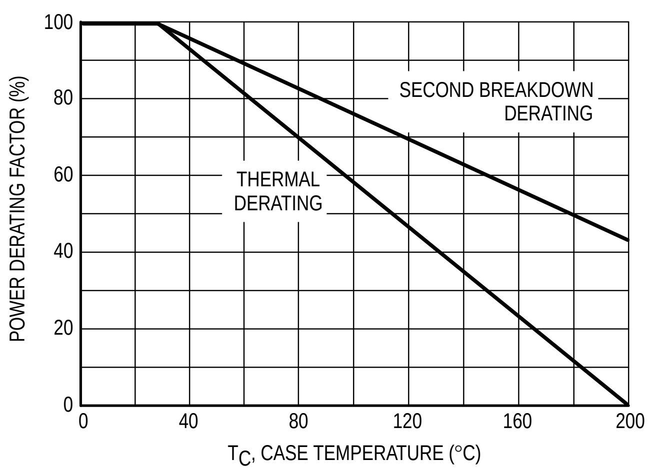
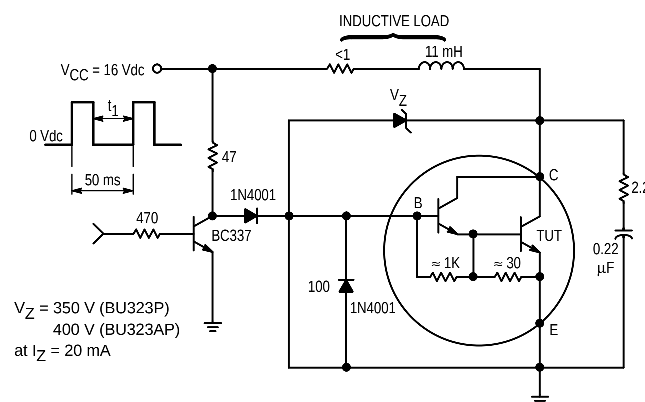


Figure 11. Power Derating

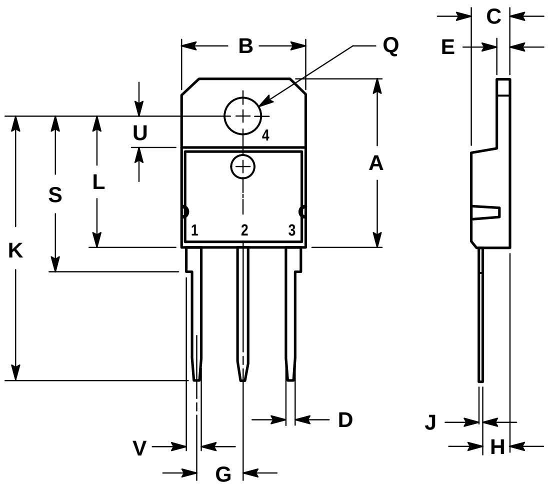


t_1 to be selected such that I_C reaches 10 Adc before switch–off.

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.

	MILLIMETERS		INCHES	
DIM	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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