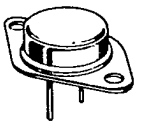
Boca Semiconductor Corp. (BSC)

HIGH VOLTAGE NPN SILICON TRANSISTORS

. . . designed for use in high-voltage inverters, converters, switching regulators and line operated amplifiers.

- High Collector-Emitter Voltage – V_{CEX} = 700 Vdc
- Excellent DC Current Gain – h_{FE} = 10 (Min) @ I_C = 2.5 Adc
- Low Collector-Emitter Saturation Voltage – $V_{CE(sat)}$ = 0.8 Vdc (Max) @ I_C = 1.0 Adc

3.5 AMPERE
POWER TRANSISTORS NPN SILICON
400 VOLTS
100 WATTS



***MAXIMUM RATINGS**

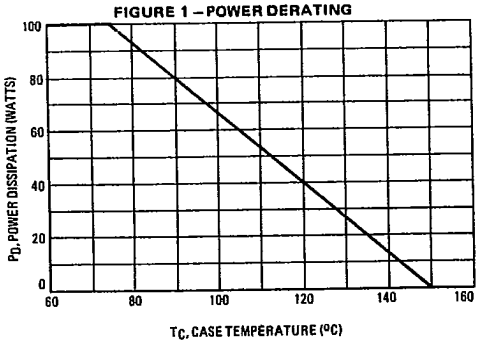
Rating	Symbol	2N3902	Unit
Collector-Emitter Voltage	V_{CEO}	400	Vdc
Collector-Emitter Voltage	V_{CEX}	700	Vdc
Emitter-Base Voltage	V_{EB}	5.0	Vdc
Collector Current – Continuous	I_C	3.5	Adc
Base Current	I_B	2.0	Adc
Total Device Dissipation @ T_C = 75°C Derate above 75°C	P_D	100 1.33	Watts W/°C
Operating Junction Temperature Range	T_J	-65 to +150	°C
Storage Temperature Range	T_{stg}	-65 to +200	°C

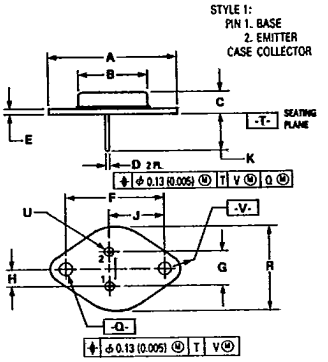
THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	0.75	°C/W

*Indicates JEDEC Registered Data

FIGURE 1 – POWER DERATING





NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO-204AA OUTLINE SHALL APPLY.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	—	39.37	—	1.550
B	—	21.08	—	0.830
C	6.35	8.25	0.250	0.325
D	0.97	1.09	0.038	0.043
E	1.40	1.77	0.055	0.070
F	30.15 BSC		1.187 BSC	
G	10.92 BSC		0.430 BSC	
H	5.46 BSC		0.215 BSC	
J	16.89 BSC		0.665 BSC	
K	11.18	12.19	0.440	0.480
Q	3.84	4.19	0.151	0.165
R	—	26.67	—	1.050
U	4.83	5.33	0.190	0.210
V	3.84	4.19	0.151	0.165

CASE 1-06
TO-204AA
(TO-3)

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Sustaining Voltage (I_C = 100 mAdc, I_B = 0) (See Figure 12)	$V_{CEO(sus)}$	325	–	Vdc
Collector Cutoff Current (V_{CE} = 400 Vdc, I_B = 0)	I_{CEO}	–	0.25	mAdc
Collector Cutoff Current (V_{CE} = 700 Vdc, $V_{EB(off)}$ = 1.5 Vdc)	I_{CEX}	–	2.5	mAdc
(V_{CE} = 400 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 125°C)		–	0.5	
Emitter Cutoff Current (V_{BE} = 5.0 Vdc, I_C = 0)	I_{EBO}	–	5.0	mAdc
ON CHARACTERISTICS (1)				
DC Current Gain (I_C = 1.0 Adc, V_{CE} = 5.0 Vdc)	h_{FE}	30	90	–
(I_C = 2.5 Adc, V_{CE} = 5.0 Vdc)		10	–	
Collector-Emitter Saturation Voltage (I_C = 1.0 Adc, I_B = 0.1 Adc)	$V_{CE(sat)}$	–	0.8	Vdc
(I_C = 2.5 Adc, I_B - 0.5 Adc)		–	2.5	
Base-Emitter Saturation Voltage (I_C = 1.0 Adc, I_B - 0.1 Adc)	$V_{BE(sat)}$	–	1.5	Vdc
(I_C 2.5 Adc, I_B 0.5 Adc)		–	2.0	
DYNAMIC CHARACTERISTICS				
Current-Gain—Bandwidth Product (I_C = 0.2 Adc, V_{CE} = 10 Vdc)	f_T	2.8	–	MHz

*Indicates JEDEC Registered Data
(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

3

FIGURE 2 – SWITCHING TIMES TEST CIRCUIT

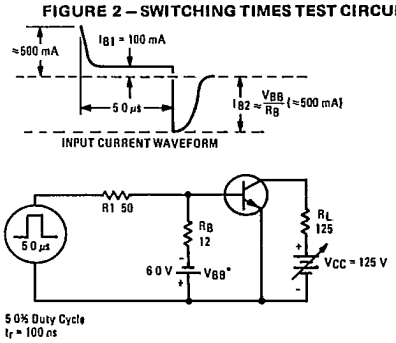
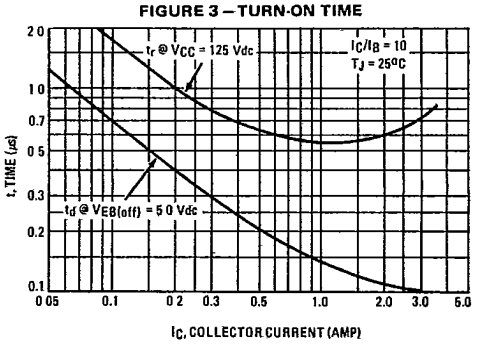


FIGURE 3 – TURN-ON TIME



T-33-13

FIGURE 4 – THERMAL RESPONSE

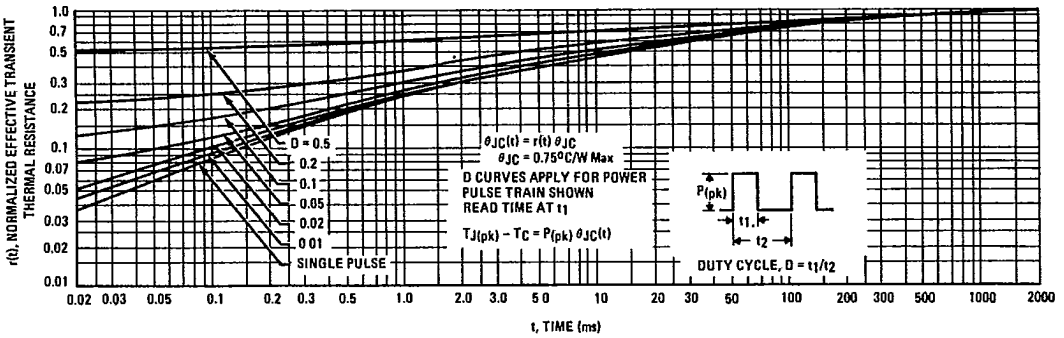
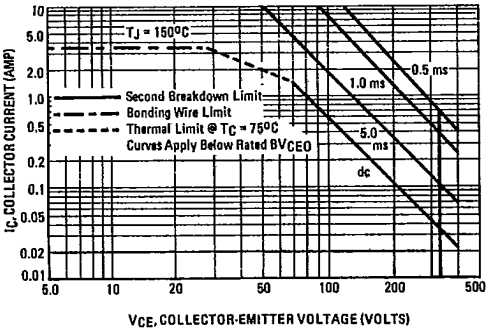


FIGURE 5 – ACTIVE-REGION SAFE-OPERATING AREA



There are two limitations on the power handling ability of a transistor: junction temperature and secondary 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 5 is based on $T_{J(pk)}$ = 150°C; T_C is variable depending on conditions. Pulse curves are valid for duty cycles of 10% provided $T_{J(pk)} \leq 150°C$. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by secondary breakdown.

3

FIGURE 6 – TURN-OFF TIME

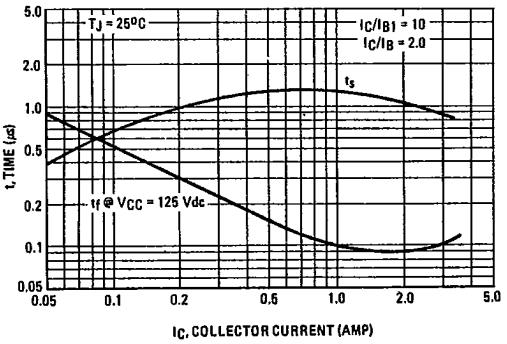


FIGURE 7 – CAPACITANCE

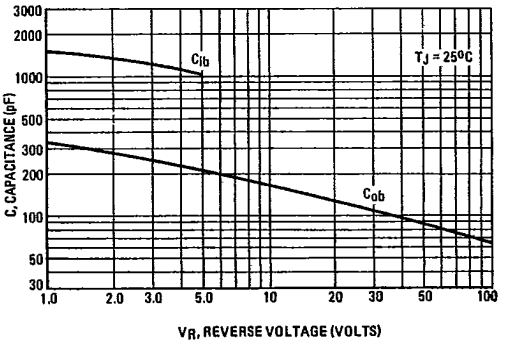


FIGURE 8 – DC CURRENT GAIN

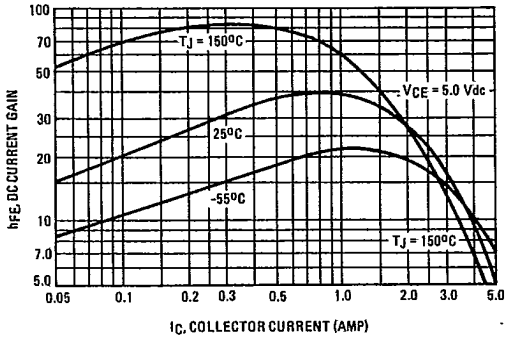


FIGURE 9 – "ON" VOLTAGES

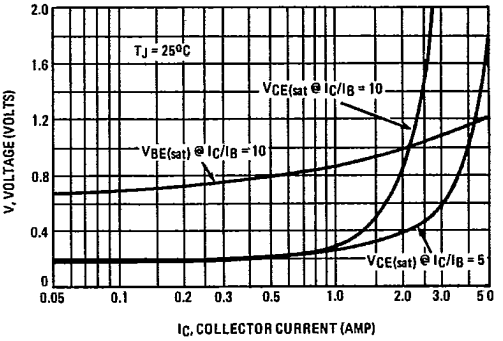


FIGURE 10 – COLLECTOR CUT-OFF REGION

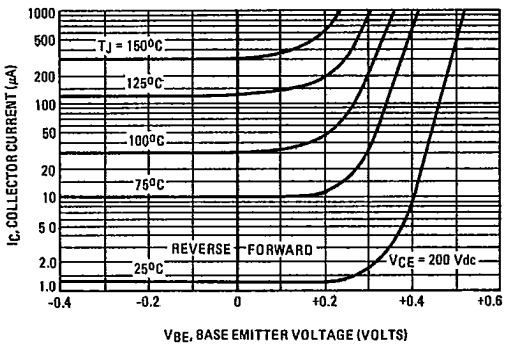


FIGURE 11 – TEMPERATURE COEFFICIENTS

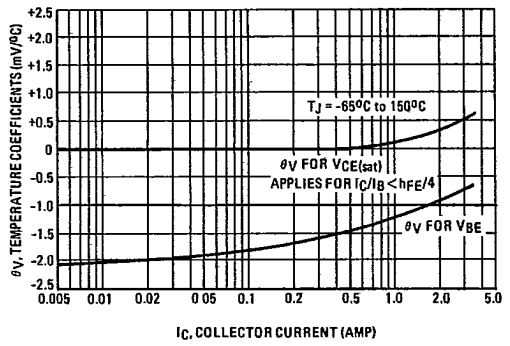
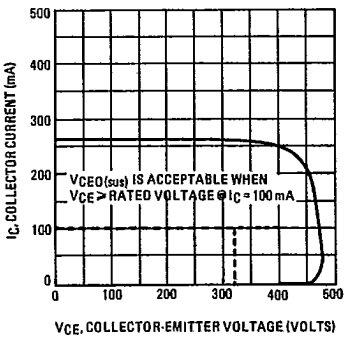
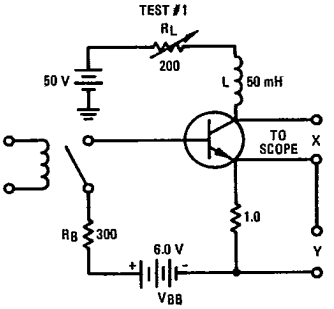


FIGURE 12 – COLLECTOR-EMITTER SUSTAINING VOLTAGE TEST CIRCUITS AND LOAD LINES





3