

# PNP SILICON HIGH-POWER TRANSISTORS

General Purpose use in amplifier and switching applications.

## FEATURES:

- \*DC Current Gain Specified- 1.0 to 30 A
- \* Low Collector-Emitter Saturation Voltage -  
 $V_{CE(sat)} = 0.75 \text{ V (Max.) @ } I_C = 10 \text{ A - 2N4398, 2N4399}$   
 $V_{CE(sat)} = 1.0 \text{ V (Max.) @ } I_C = 10 \text{ A - 2N5745}$
- \* Complements to NPN 2N5301,2N5302,2N5303

Boca Semiconducotor Corp.  
BSC

PNP  
2N4398  
2N4399  
2N5745

20 , 30 AMPERE  
PNP SILICON  
POWER TRANSISTORS  
40-80 Volts  
200 Watts

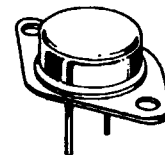
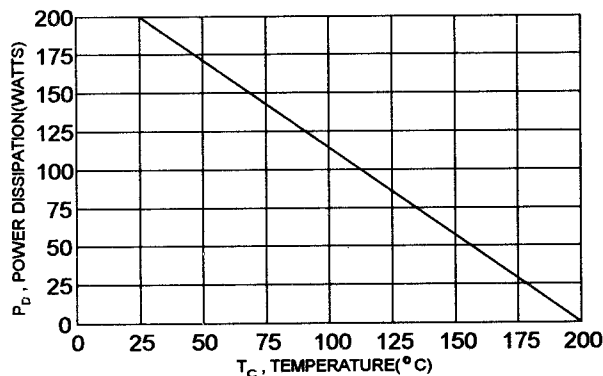
## MAXIMUM RATINGS

| Characteristic                                                                      | Symbol         | 2N4398       | 2N4399   | 2N5745   | Unit                     |
|-------------------------------------------------------------------------------------|----------------|--------------|----------|----------|--------------------------|
| Collector-Emitter Voltage                                                           | $V_{CBO}$      | 40           | 60       | 80       | V                        |
| Collector-Emitter Voltage                                                           | $V_{CEO}$      | 40           | 60       | 80       | V                        |
| Emitter-Base Voltage                                                                | $V_{EB}$       | 5.0          |          |          | V                        |
| Collector Current-Continuous<br>-Peak                                               | $I_C$          | 30<br>50     | 30<br>50 | 20<br>50 | A                        |
| Base current - Continuous<br>- Peak                                                 | $I_B$          | 7.5<br>15    |          |          | A                        |
| Total Power Dissipation @ $T_C=25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 200<br>1.15  |          |          | W<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                 | $T_J, T_{STG}$ | - 65 to +200 |          |          | $^\circ\text{C}$         |

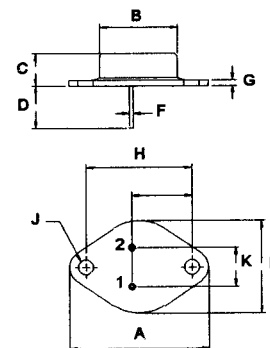
## THERMAL CHARACTERISTICS

| Characteristic                      | Symbol          | Max   | Unit               |
|-------------------------------------|-----------------|-------|--------------------|
| Thermal Resistance Junction to Case | $R_{\theta jc}$ | 0.875 | $^\circ\text{C/W}$ |

FIGURE -1 POWER DERATING



TO-3



PIN 1.BASE  
2.EMITTER  
COLLECTOR(CASE)

| DIM | MILLIMETERS |       |
|-----|-------------|-------|
|     | MIN         | MAX   |
| A   | 38.75       | 39.96 |
| B   | 19.28       | 22.23 |
| C   | 7.96        | 9.28  |
| D   | 11.18       | 12.19 |
| E   | 25.20       | 26.67 |
| F   | 0.92        | 1.09  |
| G   | 1.38        | 1.62  |
| H   | 29.90       | 30.40 |
| I   | 16.64       | 17.30 |
| J   | 3.88        | 4.36  |
| K   | 10.67       | 11.18 |

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

| Characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                              | Symbol        | Min            | Max                           | Unit         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------|-------------------------------|--------------|
| <b>OFF CHARACTERISTICS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |                |                               |              |
| Collector - Emitter Sustaining Voltage (1)<br>( $I_c = 200\text{ mA}$ , $I_B = 0$ )<br>2N4398<br>2N4399<br>2N5745                                                                                                                                                                                                                                                                                                                                           | $V_{CE(sus)}$ | 40<br>60<br>80 |                               | V            |
| Collector Cutoff Current<br>( $V_{CE} = 40\text{ V}$ , $I_B = 0$ )<br>( $V_{CE} = 60\text{ V}$ , $I_B = 0$ )<br>( $V_{CE} = 80\text{ V}$ , $I_B = 0$ )<br>2N4398<br>2N4399<br>2N5745                                                                                                                                                                                                                                                                        | $I_{CEO}$     |                | 5.0<br>5.0<br>5.0             | mA           |
| Collector Cutoff Current<br>( $V_{CE} = 40\text{ V}$ , $V_{BE(off)} = 1.5\text{ V}$ )<br>( $V_{CE} = 60\text{ V}$ , $V_{BE(off)} = 1.5\text{ V}$ )<br>( $V_{CE} = 80\text{ V}$ , $V_{BE(off)} = 1.5\text{ V}$ )<br>( $V_{CE} = 30\text{ V}$ , $V_{BE(off)} = 1.5\text{ V}$ , $T_c = 150^\circ\text{C}$ )<br>( $V_{CE} = 80\text{ V}$ , $V_{BE(off)} = 1.5\text{ V}$ , $T_c = 150^\circ\text{C}$ )<br>2N4398<br>2N4399<br>2N5745<br>2N4398, 2N4399<br>2N5745 | $I_{CEX}$     |                | 5.0<br>5.0<br>5.0<br>10<br>10 | mA<br><br>mA |
| Emitter Cutoff Current<br>( $V_{EB} = 5.0\text{ V}$ , $I_c = 0$ )<br>All Types                                                                                                                                                                                                                                                                                                                                                                              | $I_{EBO}$     |                | 5.0                           | mA           |

**ON CHARACTERISTICS (1)**

|                                                                                                                                                                                                                                                                                                                                                                                                      |               |                              |                                                |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------------------|------------------------------------------------|---|
| DC Current Gain<br>( $I_c = 1.0\text{ A}$ , $V_{CE} = 2.0\text{ V}$ )<br>( $I_c = 10\text{ A}$ , $V_{CE} = 2.0\text{ V}$ )<br>( $I_c = 15\text{ A}$ , $V_{CE} = 2.0\text{ V}$ )<br>( $I_c = 20\text{ A}$ , $V_{CE} = 2.0\text{ V}$ )<br>( $I_c = 30\text{ A}$ , $V_{CE} = 4.0\text{ V}$ )<br>All Types<br>2N5745<br>2N4398, 2N4399<br>2N5745<br>2N4398, 2N4399                                       | $h_{FE}$      | 40<br>15<br>15<br>5.0<br>5.0 | 60<br>60                                       |   |
| Collector-Emitter Saturation Voltage<br>( $I_c = 10\text{ A}$ , $I_B = 1.0\text{ A}$ )<br>( $I_c = 15\text{ A}$ , $I_B = 1.5\text{ A}$ )<br>( $I_c = 20\text{ A}$ , $I_B = 2.0\text{ A}$ )<br>( $I_c = 20\text{ A}$ , $I_B = 4.0\text{ A}$ )<br>( $I_c = 30\text{ A}$ , $I_B = 6.0\text{ A}$ )<br>2N4398, 2N4399<br>2N5745<br>2N4398, 2N4399<br>2N5745<br>2N4398, 2N4399<br>2N5745<br>2N4398, 2N4399 | $V_{CE(sat)}$ |                              | 0.75<br>1.0<br>1.0<br>1.5<br>2.0<br>2.0<br>4.0 | V |
| Base-Emitter Saturation Voltage<br>( $I_c = 10\text{ A}$ , $I_B = 1.0\text{ A}$ )<br>( $I_c = 15\text{ A}$ , $I_B = 1.5\text{ A}$ )<br>( $I_c = 20\text{ A}$ , $I_B = 2.0\text{ A}$ )<br>( $I_c = 20\text{ A}$ , $I_B = 4.0\text{ A}$ )<br>2N4398, 2N4399<br>2N5745<br>2N4398, 2N4399<br>2N5745<br>2N4398, 2N4399<br>2N5745                                                                          | $V_{BE(sat)}$ |                              | 1.6<br>1.7<br>1.85<br>2.0<br>2.5<br>2.5        | V |
| Base-Emitter On Voltage<br>( $I_c = 10\text{ A}$ , $V_{CE} = 2.0\text{ V}$ )<br>( $I_c = 15\text{ A}$ , $V_{CE} = 2.0\text{ V}$ )<br>( $I_c = 20\text{ A}$ , $V_{CE} = 4.0\text{ V}$ )<br>( $I_c = 30\text{ A}$ , $V_{CE} = 4.0\text{ V}$ )<br>2N5745<br>2N4398, 2N4399<br>2N5745<br>2N4398, 2N4399                                                                                                  | $V_{BE(on)}$  |                              | 1.5<br>1.7<br>2.5<br>3.0                       | V |

(1) Pulse Test: Pulse width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$

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

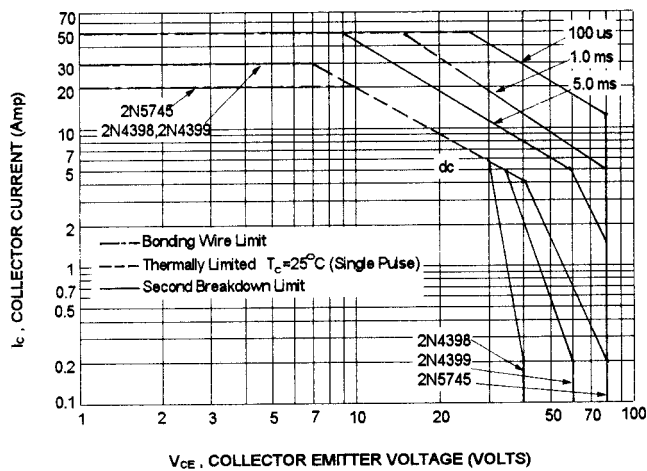
| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

**DYNAMIC CHARACTERISTICS**

|                                                                                                                |                          |          |            |     |
|----------------------------------------------------------------------------------------------------------------|--------------------------|----------|------------|-----|
| Current-Gain-Bandwidth Product (2)<br>( $I_C = 1.0\text{ A}$ , $V_{CE} = 10\text{ V}$ , $f = 1.0\text{ MHz}$ ) | 2N4398, 2N4399<br>2N5745 | $f_T$    | 4.0<br>2.0 | MHz |
| Small-Signal Current Gain<br>( $I_C = 1.0\text{ A}$ , $V_{CE} = 10\text{ V}$ , $f = 1.0\text{ KHz}$ )          |                          | $h_{fe}$ | 40         |     |

**SWITCHING CHARACTERISTICS**

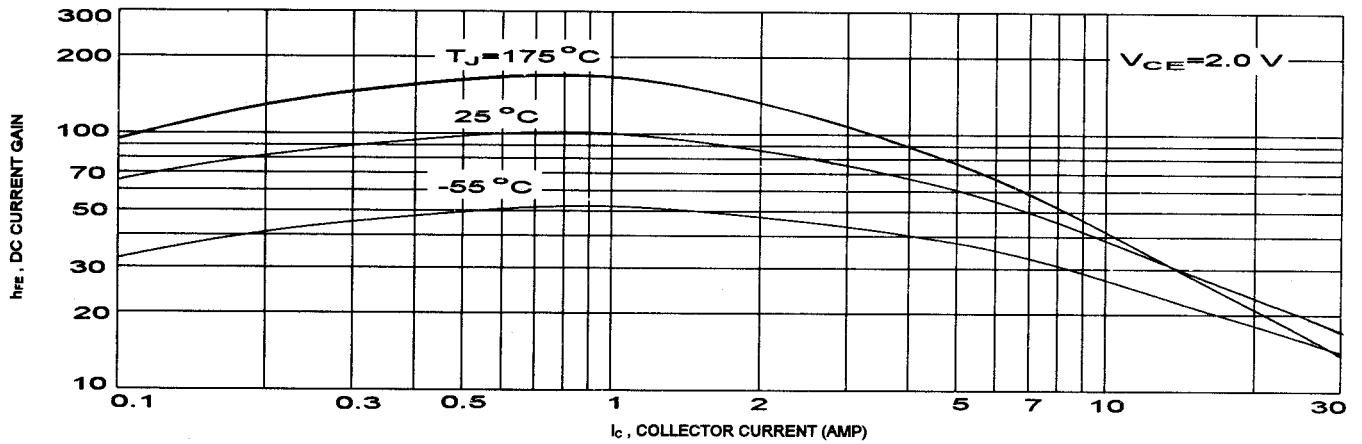
|              |                                                                                      |                          |       |            |    |
|--------------|--------------------------------------------------------------------------------------|--------------------------|-------|------------|----|
| Rise Time    | $V_{CC} = 30\text{ V}$<br>$I_C = 10.0\text{ A}$                                      | 2N4398, 2N4399<br>2N5745 | $t_r$ | 0.4<br>1.0 | us |
| Storage Time | $I_{B1} = I_{B2} = 1.0\text{ A}$<br>$t_p = 0.1\text{ ms}$<br>Duty Cycle $\leq 2.0\%$ | 2N4398, 2N4399<br>2N5745 | $t_s$ | 1.5<br>2.0 | us |
| Fall Time    |                                                                                      | 2N4398, 2N4399<br>2N5745 | $t_f$ | 0.6<br>1.0 | us |

(1) Pulse Test: Pulse width = 300 us , Duty Cycle  $\leq 2.0\%$ (2)  $f_T = |h_{fe}| \cdot f_{\text{test}}$ **ACTIVE REGION SAFE OPERATING AREA (SOA)**

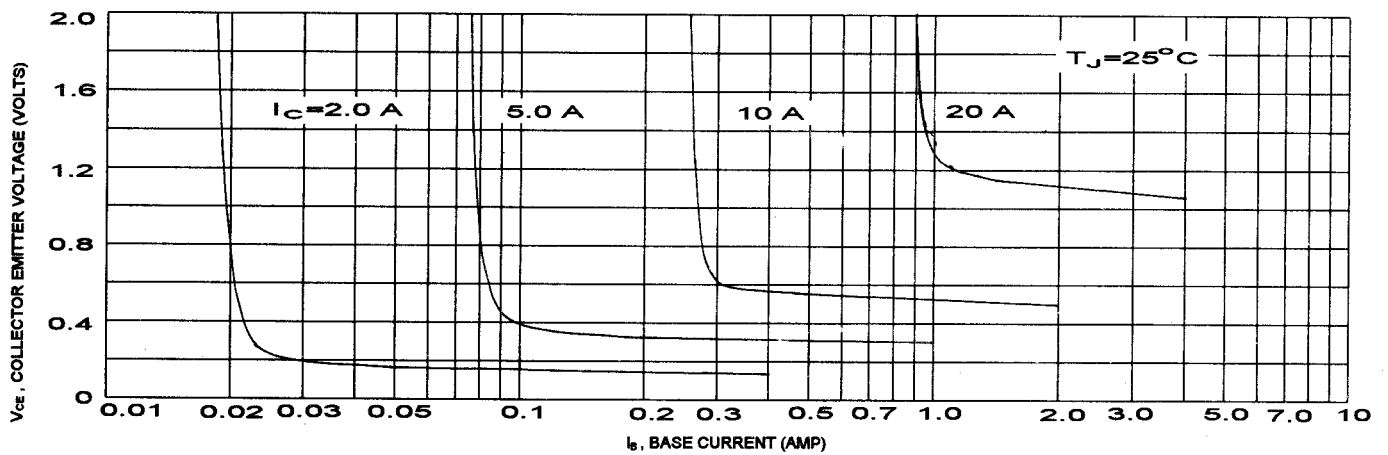
There are two limitation on the power handling ability of a transistor: average junction temperature and second breakdown safe operating area curves indicate  $I_C$ - $V_{CE}$  limits of the transistor that must be observed for reliable operation i.e., the transistor must not be subjected to greater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

The data of SOA curve is base on  $T_{J(PK)} = 200^\circ\text{C}$ ;  $T_c$  is variable depending on conditions. second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(PK)} < 200^\circ\text{C}$ . At high case temperatures, thermal limitation will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

DC CURRENT GAIN



COLLECTOR SATURATION REGION



"ON" VOLTAGES

