

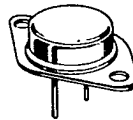
**HIGH VOLTAGE NPN SILICON TRANSISTORS**

... 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**



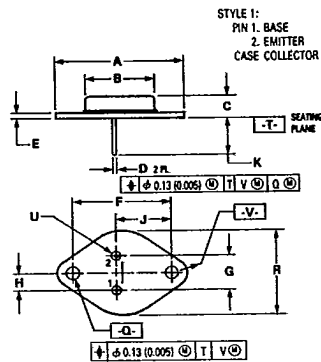
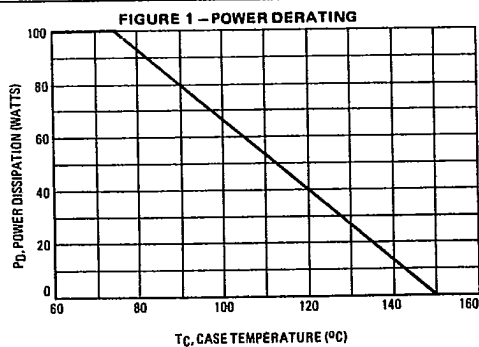
**\*MAXIMUM RATINGS**

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	A dc
Base Current	$I_B$	2.0	A dc
Total Device Dissipation @ $T_C = 75^\circ\text{C}$ Derate above $75^\circ\text{C}$	$P_D$	100 1.33	Watts W/ $^\circ\text{C}$
Operating Junction Temperature Range	$T_J$	-65 to +150	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-65 to +200	$^\circ\text{C}$

**THERMAL CHARACTERISTICS**

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$\theta_{JC}$	0.75	$^\circ\text{C}/\text{W}$

\*Indicates JEDEC Registered Data



- 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		INCHES	
	MIN	MAX	MIN	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	3.94	4.19	0.151	0.165
R	—	28.67	—	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** ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

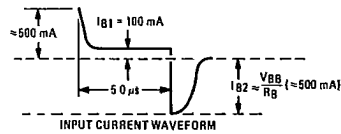
Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Emitter Sustaining Voltage ( $I_C = 100\text{ mAdc}$ , $I_B = 0$ ) (See Figure 12)	$V_{CE(sus)}$	325	—	Vdc
Collector Cutoff Current ( $V_{CE} = 400\text{ Vdc}$ , $I_B = 0$ )	$I_{CEO}$	—	0.25	mAcd
Collector Cutoff Current ( $V_{CE}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

\*Indicates JEDEC Registered Data

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

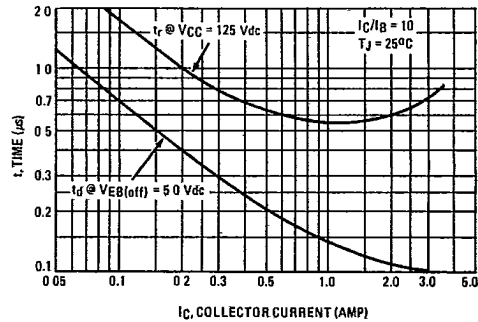
3

**FIGURE 2 – SWITCHING TIMES TEST CIRCUIT**



5.0% Duty Cycle  
 $t_r = 100\text{ ns}$

**FIGURE 3 – TURN-ON TIME**



3-61

FIGURE 4 - THERMAL RESPONSE

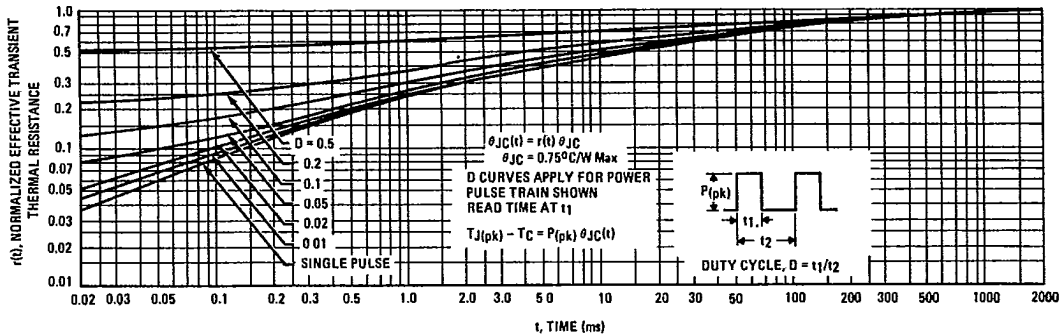
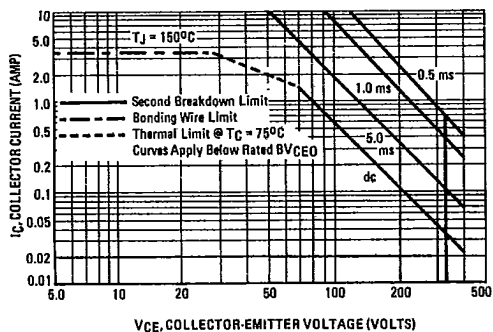


FIGURE 5 - ACTIVE-REGION SAFE-OPERATING AREA



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  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Pulse curves are valid for duty cycles of 10% provided  $T_{J(pk)} \leq 150^\circ\text{C}$ . At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by secondary breakdown.

FIGURE 6 - TURN-OFF TIME

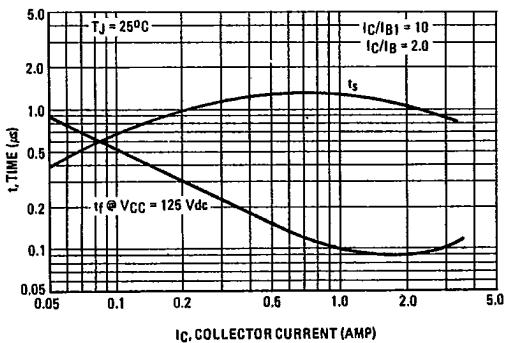


FIGURE 7 - CAPACITANCE

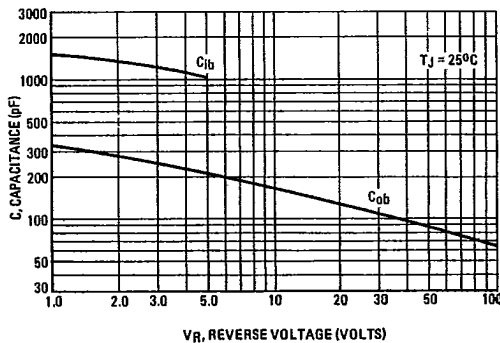


FIGURE 8 – DC CURRENT GAIN

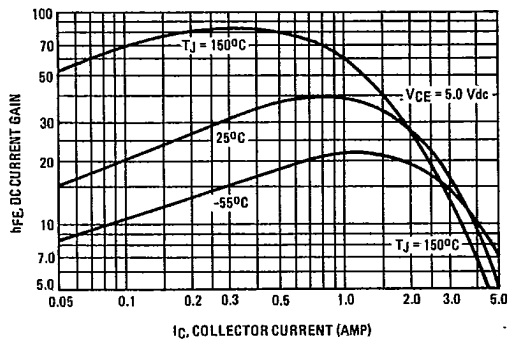


FIGURE 9 – "ON" VOLTAGES

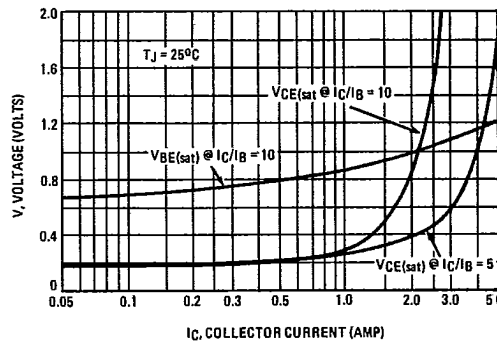


FIGURE 10 – COLLECTOR CUT-OFF REGION

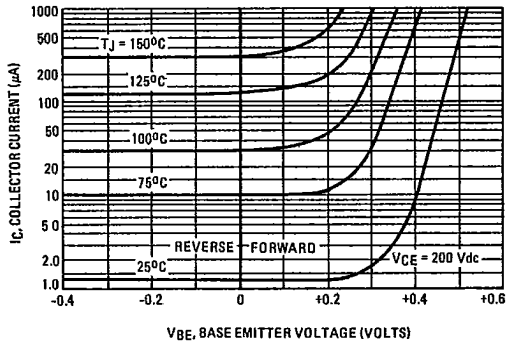


FIGURE 11 – TEMPERATURE COEFFICIENTS

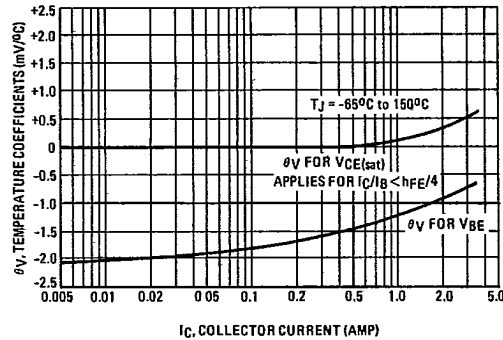
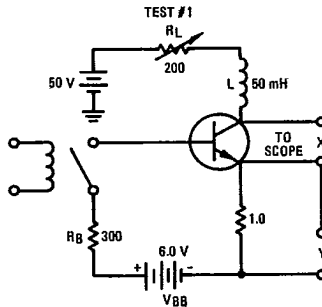
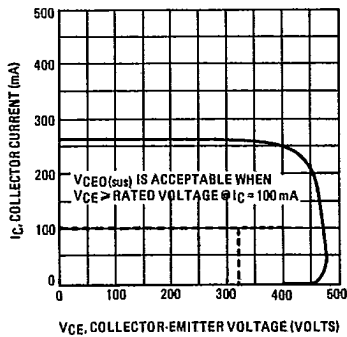


FIGURE 12 – COLLECTOR-EMITTER SUSTAINING VOLTAGE TEST CIRCUITS AND LOAD LINES



3