

MOTOROLA

SEMICONDUCTOR

TECHNICAL DATA

2N3867, 2N3868

See Page 3-32

NPN
2N3902

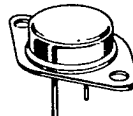
HIGH VOLTAGE NPN SILICON TRANSISTORS

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

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

3.5 AMPERE
POWER TRANSISTORS
NPN SILICON

400 VOLTS
100 WATTS



*MAXIMUM RATINGS

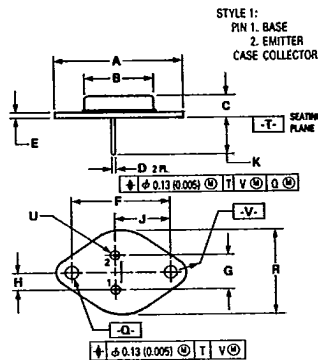
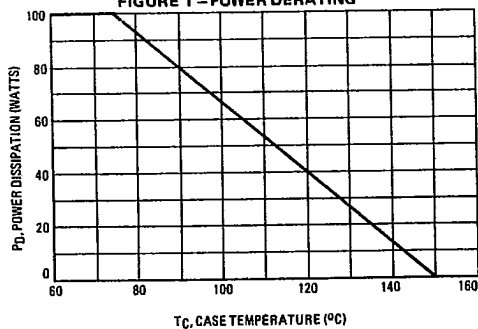
Rating	Symbol	2N3902	Unit
Collector-Emitter Voltage	V_{CEO}	400	Vdc
Collector-Emitter Voltage	V_{CEX}	700	Vdc
Emitter-Base Voltage	V_{EB}	5.0	Vdc
Collector Current — Continuous	I_C	3.5	Adc
Base Current	I_B	2.0	Adc
Total Device Dissipation @ $T_C = 75^\circ\text{C}$ Derate above 75°C	P_D	100 1.33	Watts 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	θ_{JC}	0.75	$^\circ\text{C/W}$

*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		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	12.18	0.440	0.480
Q	3.84	4.19	0.151	0.165
R	—	28.97	—	1.060
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)

T-33-13

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Sustaining Voltage (I _C = 100 mA, I _B = 0) (See Figure 12)	V _{CE(sus)}	325	—	V _{dc}
Collector Cutoff Current (V _{CE} = 400 V _{dc} , I _B = 0)	I _{CEO}	—	0.25	mA _{dc}
Collector Cutoff Current (V _{CE} = 700 V _{dc} , V _{EB(off)} = 1.5 V _{dc}) (V _{CE} = 400 V _{dc} , V _{EB(off)} = 1.5 V _{dc} , T _C = 125°C)	I _{CEX}	—	2.5 0.5	mA _{dc}
Emitter Cutoff Current (V _{BE} = 5.0 V _{dc} , I _C = 0)	I _{EBO}	—	5.0	mA _{dc}
ON CHARACTERISTICS (1)				
DC Current Gain (I _C = 1.0 A _{dc} , V _{CE} = 5.0 V _{dc}) (I _C = 2.5 A _{dc} , V _{CE} = 5.0 V _{dc})	h _{FE}	30 10	90 —	—
Collector-Emitter Saturation Voltage (I _C = 1.0 A _{dc} , I _B = 0.1 A _{dc}) (I _C = 2.5 A _{dc} , I _B = 0.5 A _{dc})	V _{CE(sat)}	—	0.8 2.5	V _{dc}
Base-Emitter Saturation Voltage (I _C = 1.0 A _{dc} , I _B = 0.1 A _{dc}) (I _C = 2.5 A _{dc} , I _B = 0.5 A _{dc})	V _{BE(sat)}	—	1.5 2.0	V _{dc}
DYNAMIC CHARACTERISTICS				
Current-Gain-Bandwidth Product (I _C = 0.2 A _{dc} , V _{CE} = 10 V _{dc})	f _T	2.8	—	MHz

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

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FIGURE 2 — SWITCHING TIMES TEST CIRCUIT

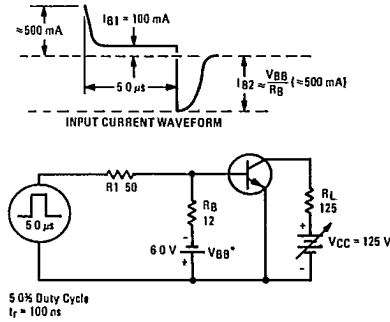
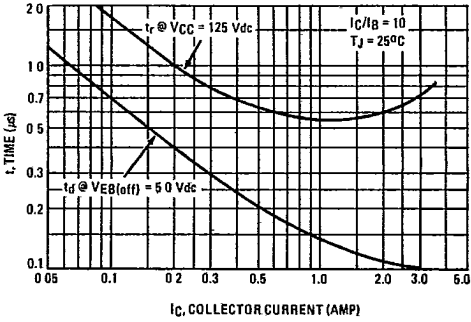


FIGURE 3 — TURN-ON TIME



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FIGURE 4 - THERMAL RESPONSE

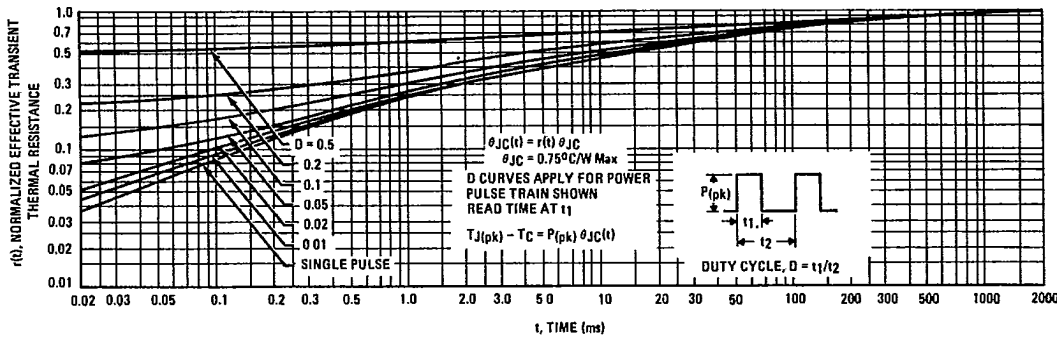
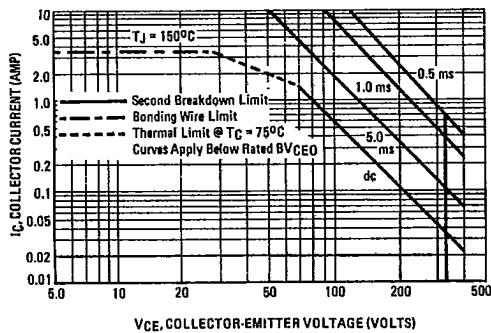


FIGURE 5 - ACTIVE-REGION SAFE-OPERATING AREA



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 $T_J(p_k) = 150^\circ\text{C}$; T_C is variable depending on conditions. Pulse curves are valid for duty cycles of 10% provided $T_J(p_k) \leq 150^\circ\text{C}$. 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

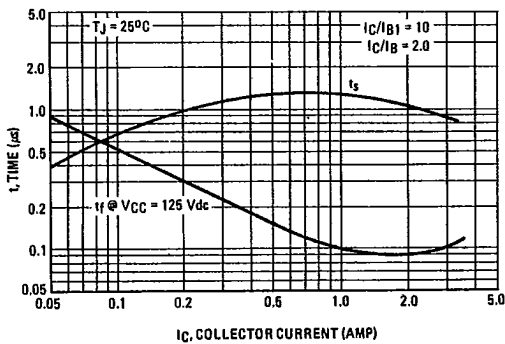
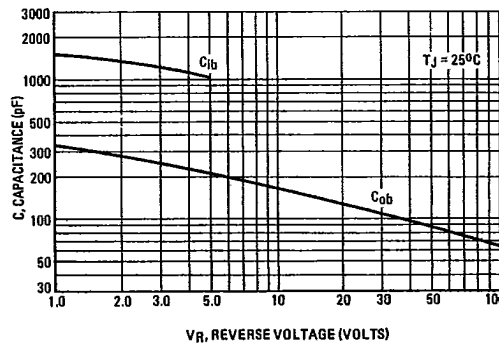


FIGURE 7 - CAPACITANCE



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FIGURE 8 — DC CURRENT GAIN

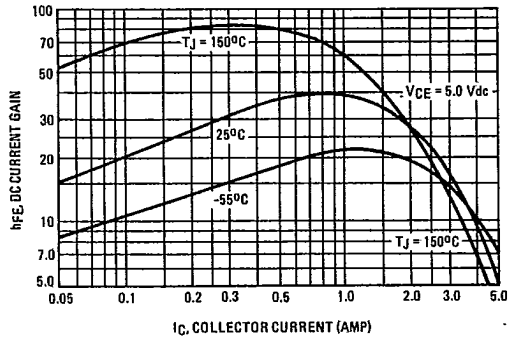


FIGURE 9 — "ON" VOLTAGES

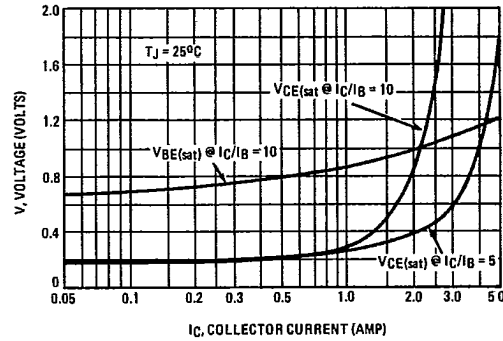


FIGURE 10 — COLLECTOR CUT-OFF REGION

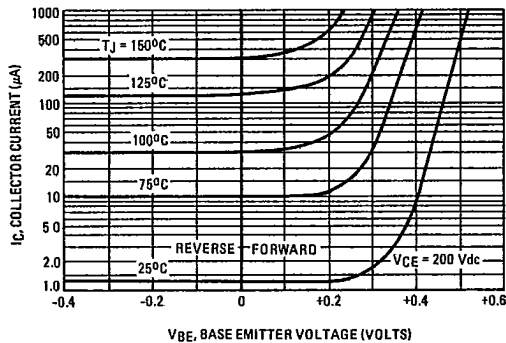


FIGURE 11 — TEMPERATURE COEFFICIENTS

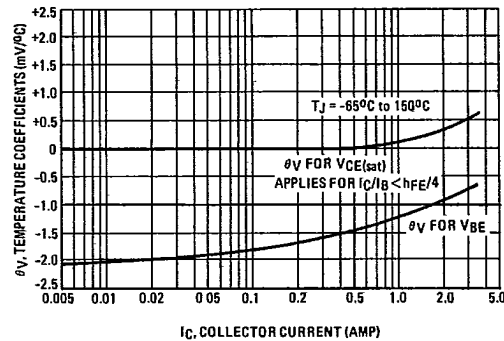
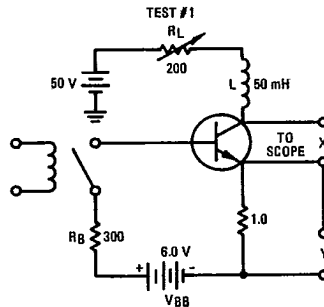
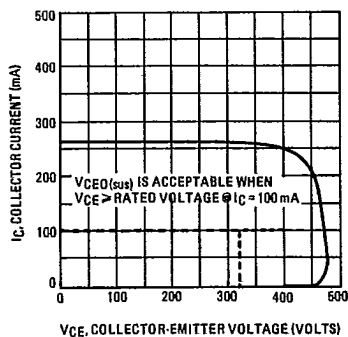


FIGURE 12 — COLLECTOR-EMITTER SUSTAINING VOLTAGE TEST CIRCUITS AND LOAD LINES



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