

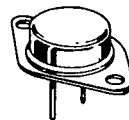
MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA
BUV11N
NPN SILICON POWER METAL TRANSISTOR

... designed for high speed, high current, high power applications.

- High DC Current gain — H_{FE} min 20 @ $I_C = 8$ A
- Very fast switching times
 t_F max. = $0.25 \mu s$ @ $I_C = 15$ A
- Low $V_{CE(sat)}$: $V_{CE(sat)}$ max. = 0.6 V, @ $I_C = 8$ A
- High V_{CEO} : 160 V.

**NPN SILICON
POWER
METAL TRANSISTOR**

20 AMPERES

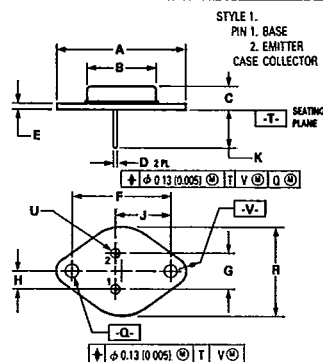
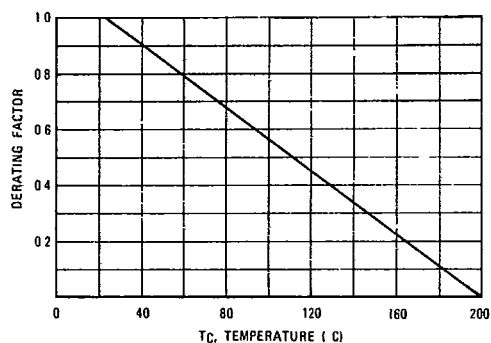

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO(sus)}$	160	Vdc
Collector-Base Voltage	V_{CBO}	220	Vdc
Emitter-Base Voltage	V_{EBO}	7	Vdc
Collector-Emitter Voltage ($V_{BE} = -1.5$ V)	V_{CEX}	220	Vdc
Collector-Emitter Voltage ($R_{BE} = 100\Omega$)	V_{CER}	200	Vdc
Collector-Current — continuous	I_C	20	Adc
— peak (pw ≤ 10 ms)	I_{CM}	25	Apk
Base-Current continuous	I_B	5	Adc
Total Power Dissipation @ $T_C = 25^\circ C$	P_D	150	Watts
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to 200	$^\circ C$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max.	Unit
Thermal Resistance, Junction to Case	θ_{JC}	1.17	$^\circ C/W$

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	20.15 BSC		1.187 BSC	
G	10.92 BSC		0.430 BSC	
H	5.48 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	—	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
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OFF CHARACTERISTICS¹

Collector-Emitter Sustaining Voltage ($I_C = 200\text{ mA}$, $I_B = 0$, $L = 25\text{ mH}$)	$V_{CEO(sus)}$	160		Vdc
Collector Cutoff Current at Reverse Bias: ($V_{CE} = 220\text{ V}$, $V_{BE} = -1.5\text{ V}$) ($V_{CE} = 220\text{ V}$, $V_{BE} = -1.5\text{ V}$, $T_C = 125^\circ\text{C}$)	I_{CEX}		1.5 6.0	mAdc
Collector-Emitter Cutoff Current ($V_{CE} = 130\text{ V}$)	I_{CEO}		1.5	mAdc
Emitter-Base Reverse Voltage ($I_E = 50\text{ mA}$)	V_{EBO}	7		V
Emitter-Cutoff Current ($V_{EB} = 5\text{ V}$)	I_{EBO}		1.0	mAdc

SECOND BREAKDOWN

Second Breakdown Collector Current with base forward biased ($V_{CE} = 30\text{ V}$, $t = 1\text{ s}$) ($V_{CE} = 140\text{ V}$, $t = 1\text{ s}$)	$I_{S/b}$	5 0.15		Adc
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ON CHARACTERISTICS¹

DC Current Gain ($I_C = 8\text{ A}$, $V_{CE} = 2\text{ V}$) ($I_C = 15\text{ A}$, $V_{CE} = 4\text{ V}$)	h_{FE}	20 10	60	
Collector-Emitter Saturation Voltage ($I_C = 8\text{ A}$, $I_B = 0.8\text{ A}$) ($I_C = 15\text{ A}$, $I_B = 1.88\text{ A}$)	$V_{CE(sat)}$		0.6 1.5	Vdc
Base-Emitter Saturation Voltage ($I_C = 15\text{ A}$, $I_B = 1.88\text{ A}$)	$V_{BE(sat)}$		1.8	Vdc

DYNAMIC CHARACTERISTICS

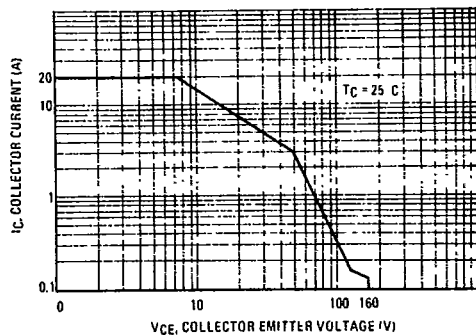
Current Gain — Bandwidth Product ($V_{CE} = 15\text{ V}$, $I_C = 1\text{ A}$, $f = 4\text{ MHz}$)	f_T	8		MHz
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SWITCHING CHARACTERISTICS (Resistive Load)

Turn on Time	$(I_C = 15\text{ A}$, $I_{B1} = I_{B2} = 1.88\text{ A}$, $V_{CC} = 30\text{ V}$, $R_L = 2\Omega$)	t_{on}	1.2	μs
Storage Time		t_s	1.2	
Fall Time		t_f	0.25	

¹ Pulse Test: Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2\%$.

FIGURE 2 — ACTIVE REGION 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 2 is based on $T_C = 25^\circ\text{C}$; $T_J(\text{pk})$ is variable depending on power level. Second breakdown limitations do not derate the same as thermal limitations.

At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown. (See AN415A)

FIGURE 3 — "ON" VOLTAGES

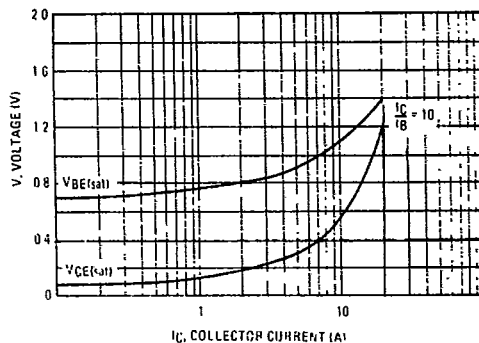


FIGURE 4 — DC CURRENT GAIN

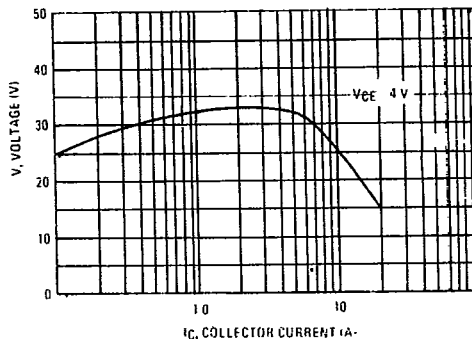


FIGURE 5 — RESISTIVE SWITCHING PERFORMANCE

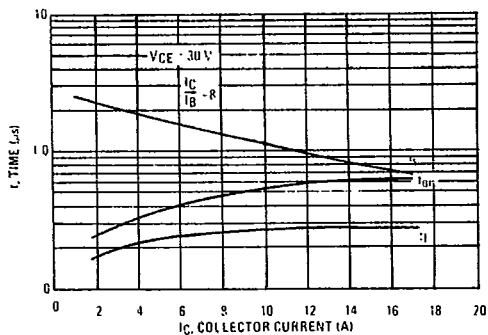


FIGURE 6 — SWITCHING TIMES TEST CIRCUIT

