

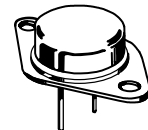
**BU11**

**SWITCHMODE Series**  
**NPN Silicon Power Transistor**

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

- High DC current gain;  $h_{FE}$  min. = 20 at  $I_C = 6$  A
- Low  $V_{CE(sat)}$ ,  $V_{CE(sat)}$  max. = 0.6 V at  $I_C = 6$  A
- Very fast switching times:  
     $T_F$  max. = 0.8  $\mu$ s at  $I_C = 12$  A

**20 AMPERES**  
**NPN SILICON**  
**POWER**  
**METAL TRANSISTOR**  
**200 VOLTS**  
**150 WATTS**



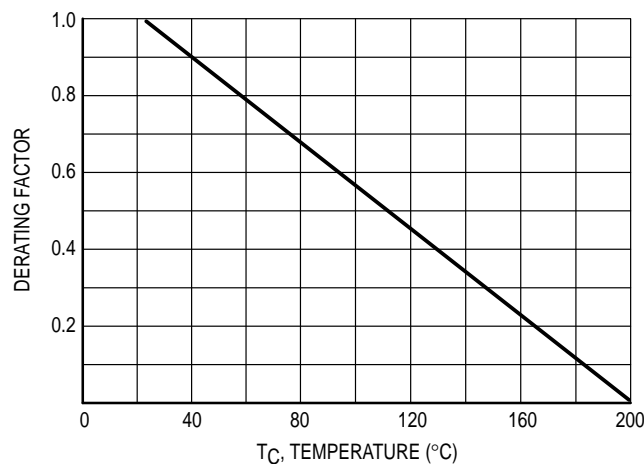
**CASE 1-07**  
**TO-204AA**  
**(TO-3)**

**MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO(sus)}$	200	Vdc
Collector-Base Voltage	$V_{CBO}$	250	Vdc
Emitter-Base Voltage	$V_{EBO}$	7	Vdc
Collector-Emitter Voltage ( $V_{BE} = -1.5$ V)	$V_{CEX}$	250	Vdc
Collector-Emitter Voltage ( $R_{BE} = 100 \Omega$ )	$V_{CER}$	240	Vdc
Collector-Current— Continuous	$I_C$	20	Adc
— Peak ( $p_w \leq 10$ ms)	$I_{CM}$	25	Apk
Base-Current continuous	$I_B$	4	Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$	$P_D$	150	Watts
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to 200	$^\circ\text{C}$

**THERMAL CHARACTERISTICS**

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



**Figure 1. Power Derating**

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**REV 7**

**BUV11****ELECTRICAL CHARACTERISTICS** ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Sustaining Voltage ( $I_C = 200\text{ mA}$ , $I_B = 0$ , $L = 25\text{ mH}$ )	$V_{CEO(sus)}$	200		Vdc
Collector Cutoff Current at Reverse Bias ( $V_{CE} = 250\text{ V}$ , $V_{BE} = -1.5\text{ V}$ ) ( $V_{CE} = 250\text{ V}$ , $V_{BE} = -1.5\text{ V}$ , $T_C = 125^\circ\text{C}$ )	$I_{CEX}$		1.5 6	mAdc
Collector–Emitter Cutoff Current ( $V_{CE} = 160\text{ V}$ )	$I_{CEO}$		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 0.15		Adc
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**ON CHARACTERISTICS<sup>1</sup>**

DC Current Gain ( $I_C = 6\text{ A}$ , $V_{CE} = 2\text{ V}$ ) ( $I_C = 12\text{ A}$ , $V_{CE} = 4\text{ V}$ )	$h_{FE}$	20 10	60	
Collector–Emitter Saturation Voltage ( $I_C = 6\text{ A}$ , $I_B = 0.6\text{ A}$ ) ( $I_C = 12\text{ A}$ , $I_B = 1.5\text{ A}$ )	$V_{CE(sat)}$		0.6 1.5	Vdc
Base–Emitter Saturation Voltage ( $I_C = 12\text{ A}$ , $I_B = 1.5\text{ A}$ )	$V_{BE(sat)}$		1.5	Vdc

**DYNAMIC CHARACTERISTICS**

Current Gain — Bandwidth Product ( $V_{CE} = 15\text{ V}$ , $I_C = 1\text{ A}$ , $f = 4\text{ MHz}$ )	$f_T$	8.0		MHz
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**SWITCHING CHARACTERISTICS (Resistive Load)**

Turn–on Time	$(I_C = 12\text{ A}$ , $I_{B1} = I_{B2} = 1.5\text{ A}$ , $V_{CC} = 150\text{ V}$ , $T_C = 12.5^\circ\text{C}$ )	$t_{on}$	0.8	$\mu\text{s}$
Storage Time		$t_s$	1.8	
Fall Time		$t_f$	0.4	

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

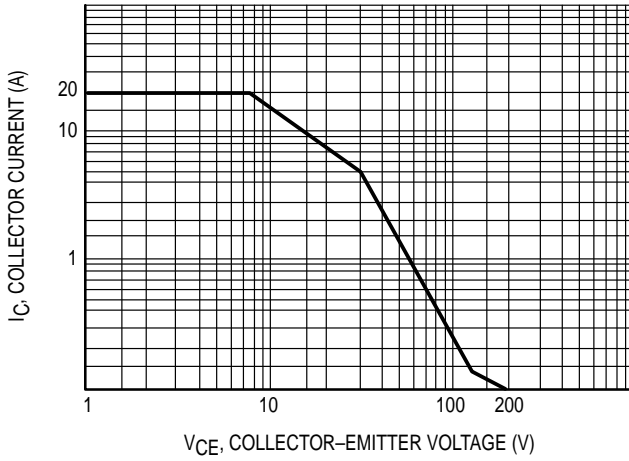


Figure 2. Active Region Safe Operating Area

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  $T_C = 25^\circ C$ ;  $T_{J(pk)}$  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 handled to values less than the limitations imposed by second breakdown.

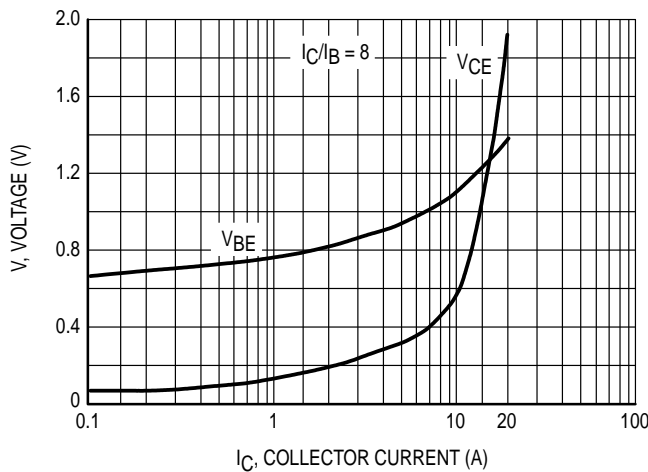


Figure 3. "On" Voltages

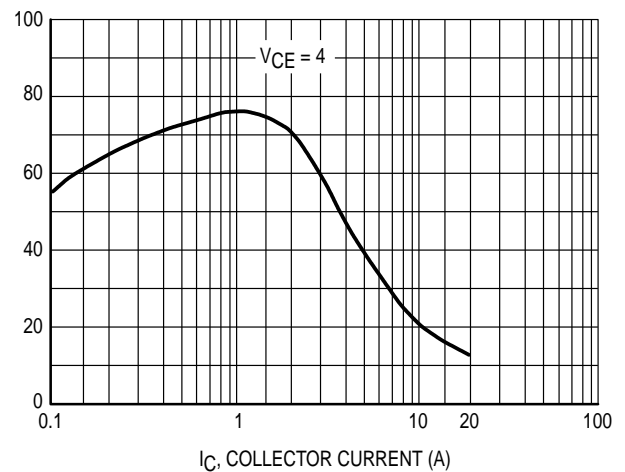


Figure 4. DC Current Gain

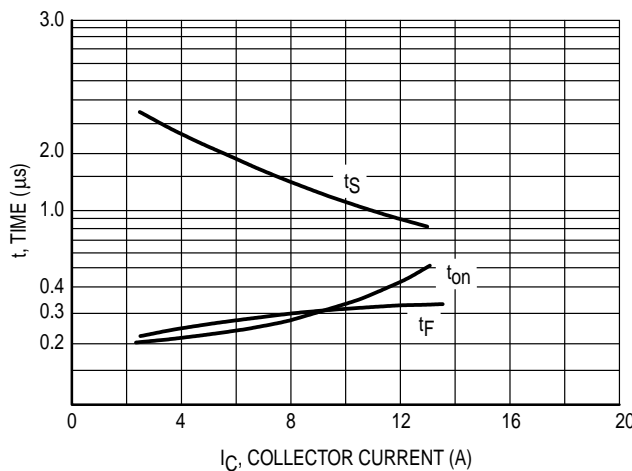


Figure 5. Switching Times versus Collector Current

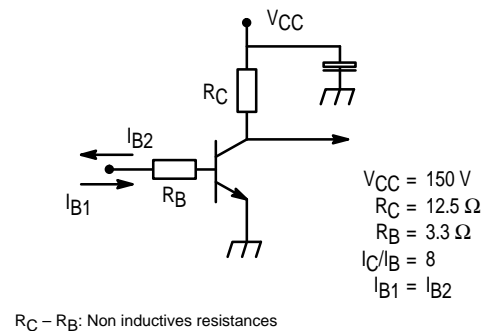
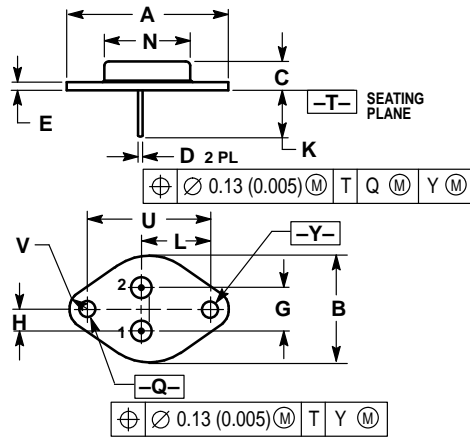


Figure 6. Switching Times Test Circuit

PACKAGE DIMENSIONS



- 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	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.550 REF		39.37 REF	
B	—	1.050	—	26.67
C	0.250	0.335	6.35	8.51
D	0.038	0.043	0.97	1.09
E	0.055	0.070	1.40	1.77
G	0.430 BSC		10.92 BSC	
H	0.215 BSC		5.46 BSC	
K	0.440	0.480	11.18	12.19
L	0.665 BSC		16.89 BSC	
N	—	0.830	—	21.08
Q	0.151	0.165	3.84	4.19
U	1.187 BSC		30.15 BSC	
V	0.131	0.188	3.33	4.77

STYLE 1:  
 PIN 1: BASE  
 2: EMITTER  
 CASE: COLLECTOR

CASE 1-07  
 TO-204AA (TO-3)  
 ISSUE Z

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