

# High Power NPN Silicon Power Transistors

... designed for linear amplifiers, series pass regulators, and inductive switching applications.

- Forward Biased Second Breakdown Current Capability  
 $I_{S/b} = 3.75 \text{ Adc @ } V_{CE} = 40 \text{ Vdc} \text{ — } 2N3771$   
 $= 2.5 \text{ Adc @ } V_{CE} = 60 \text{ Vdc} \text{ — } 2N3772$

## \*MAXIMUM RATINGS

Rating	Symbol	2N3771	2N3772	Unit
Collector-Emitter Voltage	$V_{CEO}$	40	60	Vdc
Collector-Emitter Voltage	$V_{CEX}$	50	80	Vdc
Collector-Base Voltage	$V_{CB}$	50	100	Vdc
Emitter-Base Voltage	$V_{EB}$	5.0	7.0	Vdc
Collector Current — Continuous Peak	$I_C$	30 30	20 30	Adc
Base Current — Continuous Peak	$I_B$	7.5 15	5.0 15	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	150 0.855		Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +200		$^\circ\text{C}$

## THERMAL CHARACTERISTICS

Characteristics	Symbol	2N3771, 2N3772	Unit
Thermal Resistance, Junction to Case	$\theta_{JC}$	1.17	$^\circ\text{C/W}$

\* Indicates JEDEC Registered Data.

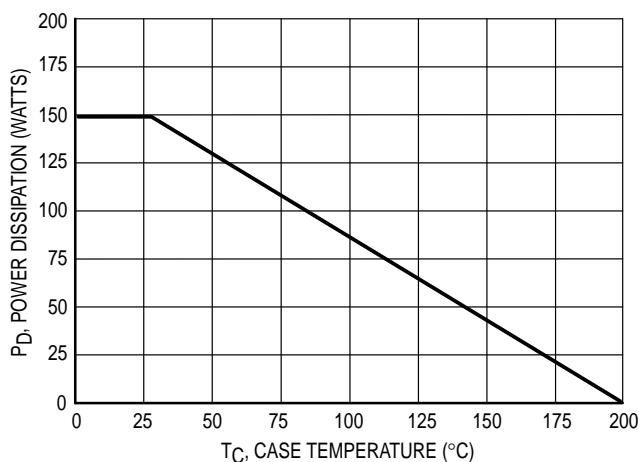


Figure 1. Power Derating

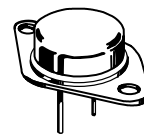
Preferred devices are Motorola recommended choices for future use and best overall value.

REV 7

**2N3771\***  
**2N3772**

\*Motorola Preferred Device

**20 and 30 AMPERE  
POWER TRANSISTORS  
NPN SILICON  
40 and 60 VOLTS  
150 WATTS**



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

## 2N3771 2N3772

### 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) ( $I_C = 0.2 \text{ Adc}$ , $I_B = 0$ )	2N3771 2N3772	$V_{CEO(sus)}$	40 60	— —	Vdc
Collector–Emitter Sustaining Voltage ( $I_C = 0.2 \text{ Adc}$ , $V_{EB(off)} = 1.5 \text{ Vdc}$ , $R_{BE} = 100 \text{ Ohms}$ )	2N3771 2N3772	$V_{CEX(sus)}$	50 80	— —	Vdc
Collector–Emitter Sustaining Voltage ( $I_C = 0.2 \text{ Adc}$ , $R_{BE} = 100 \text{ Ohms}$ )	2N3771 2N3772	$V_{CER(sus)}$	45 70	— —	Vdc
*Collector Cutoff Current ( $V_{CE} = 30 \text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 50 \text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 25 \text{ Vdc}$ , $I_B = 0$ )	2N3771 2N3772	$I_{CEO}$	— —	10 10	mAdc
*Collector Cutoff Current ( $V_{CE} = 50 \text{ Vdc}$ , $V_{EB(off)} = 1.5 \text{ Vdc}$ ) ( $V_{CE} = 100 \text{ Vdc}$ , $V_{EB(off)} = 1.5 \text{ Vdc}$ ) ( $V_{CE} = 45 \text{ Vdc}$ , $V_{EB(off)} = 1.5 \text{ Vdc}$ ) ( $V_{CE} = 30 \text{ Vdc}$ , $V_{EB(off)} = 1.5 \text{ Vdc}$ , $T_C = 150^\circ\text{C}$ )  ( $V_{CE} = 45 \text{ Vdc}$ , $V_{EB(off)} = 1.5 \text{ Vdc}$ , $T_C = 150^\circ\text{C}$ )	2N3771 2N3772 2N6257 2N3771 2N3772	$I_{CEV}$	— — — — —	2.0 5.0 4.0 10 10	mAdc
*Collector Cutoff Current ( $V_{CB} = 50 \text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 100 \text{ Vdc}$ , $I_E = 0$ )	2N3771 2N3772	$I_{CBO}$	— —	2.0 5.0	mAdc
*Emitter Cutoff Current ( $V_{BE} = 5.0 \text{ Vdc}$ , $I_C = 0$ ) ( $V_{BE} = 7.0 \text{ Vdc}$ , $I_C = 0$ )	2N3771 2N3772	$I_{EBO}$	— —	5.0 5.0	mAdc
<b>*ON CHARACTERISTICS</b>					
DC Current Gain (1) ( $I_C = 15 \text{ Adc}$ , $V_{CE} = 4.0 \text{ Vdc}$ ) ( $I_C = 10 \text{ Adc}$ , $V_{CE} = 4.0 \text{ Vdc}$ ) ( $I_C = 8.0 \text{ Adc}$ , $V_{CE} = 4.0 \text{ Vdc}$ ) ( $I_C = 30 \text{ Adc}$ , $V_{CE} = 4.0 \text{ Vdc}$ ) ( $I_C = 20 \text{ Adc}$ , $V_{CE} = 4.0 \text{ Vdc}$ )	2N3771 2N3772 2N3771 2N3772	$h_{FE}$	15 15 5.0 5.0	60 60 — —	—
Collector–Emitter Saturation Voltage ( $I_C = 15 \text{ Adc}$ , $I_B = 1.5 \text{ Adc}$ ) ( $I_C = 10 \text{ Adc}$ , $I_B = 1.0 \text{ Adc}$ ) ( $I_C = 30 \text{ Adc}$ , $I_B = 6.0 \text{ Adc}$ ) ( $I_C = 20 \text{ Adc}$ , $I_B = 4.0 \text{ Adc}$ )	2N3771 2N3772 2N3771 2N3772	$V_{CE(sat)}$	— — — —	2.0 1.4 4.0 4.0	Vdc
Base–Emitter On Voltage ( $I_C = 15 \text{ Adc}$ , $V_{CE} = 4.0 \text{ Vdc}$ ) ( $I_C = 10 \text{ Adc}$ , $V_{CE} = 4.0 \text{ Vdc}$ ) ( $I_C = 8.0 \text{ Adc}$ , $V_{CE} = 4.0 \text{ Vdc}$ )	2N3771 2N3772	$V_{BE(on)}$	— —	2.7 2.2	Vdc
<b>*DYNAMIC CHARACTERISTICS</b>					
Current–Gain — Bandwidth Product ( $I_C = 1.0 \text{ Adc}$ , $V_{CE} = 4.0 \text{ Vdc}$ , $f_{test} = 50 \text{ kHz}$ )		$f_T$	0.2	—	MHz
Small–Signal Current Gain ( $I_C = 1.0 \text{ Adc}$ , $V_{CE} = 4.0 \text{ Vdc}$ , $f = 1.0 \text{ kHz}$ )		$h_{fe}$	40	—	—
<b>SECOND BREAKDOWN</b>					
Second Breakdown Energy with Base Forward Biased, $t = 1.0 \text{ s}$ (non–repetitive) ( $V_{CE} = 40 \text{ Vdc}$ ) ( $V_{CE} = 60 \text{ Vdc}$ )	2N3771 2N3772	$I_{S/b}$	3.75 2.5	— —	Adc

\* Indicates JEDEC Registered Data.

(1) Pulse Test: 300  $\mu\text{s}$ , Rep. Rate 60 cps.

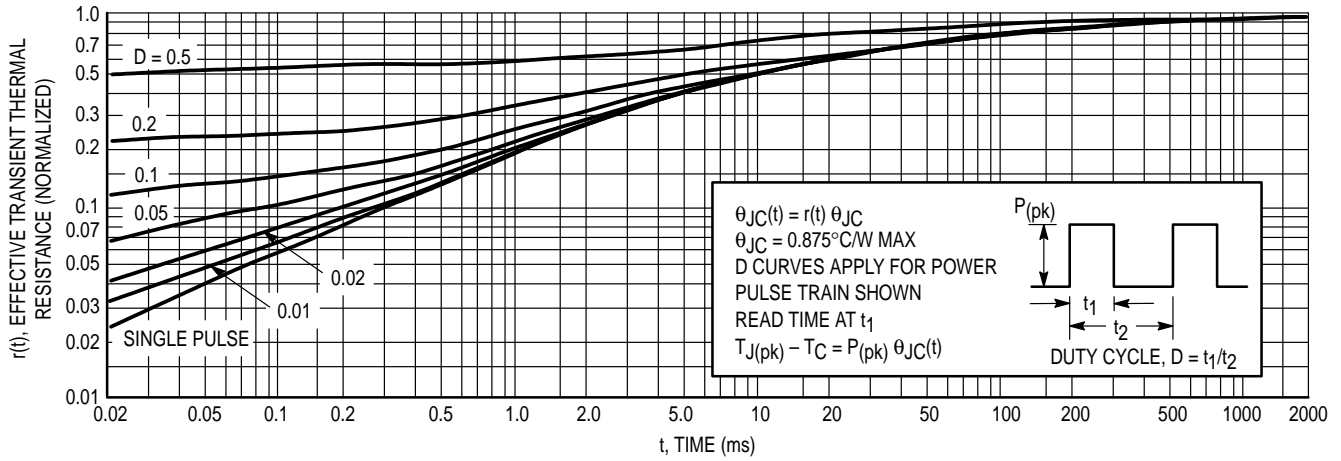


Figure 2. Thermal Response — 2N3771, 2N3772

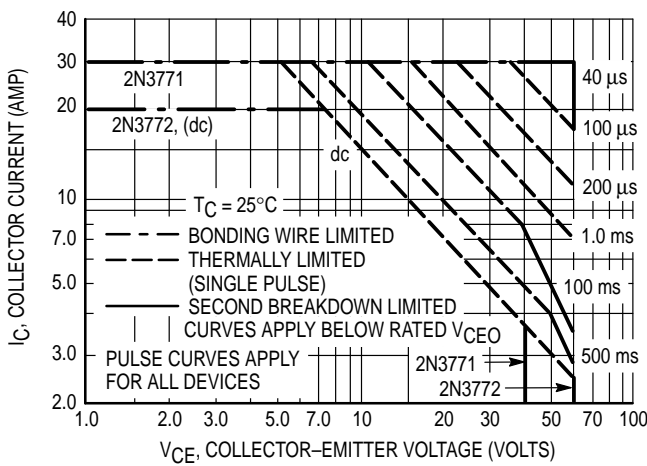


Figure 3. Active-Region Safe Operating Area — 2N3771, 2N3772

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.

Figure 3 is based on JEDEC registered Data. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} < 200^{\circ}\text{C}$ .  $T_{J(pk)}$  may be calculated from the data of Figure 2. Using data of Figure 2 and the pulse power limits of Figure 3,  $T_{J(pk)}$  will be found to be less than  $T_{J(max)}$  for pulse widths of 1 ms and less. When using Motorola transistors, it is permissible to increase the pulse power limits until limited by  $T_{J(max)}$ .

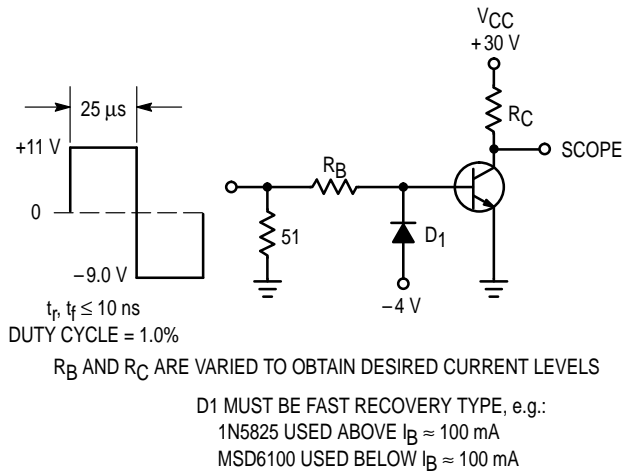


Figure 4. Switching Time Test Circuit

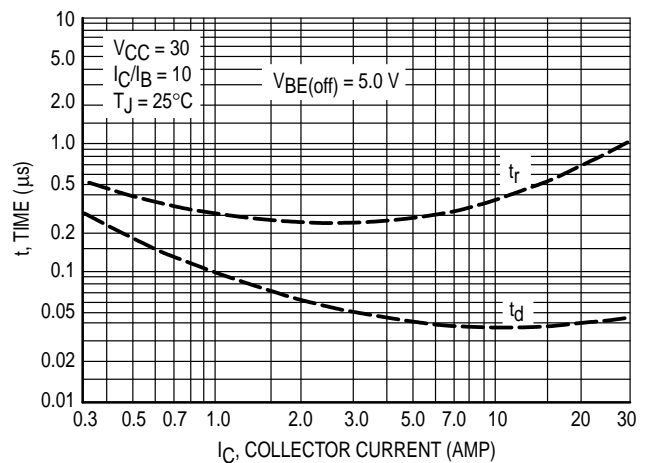
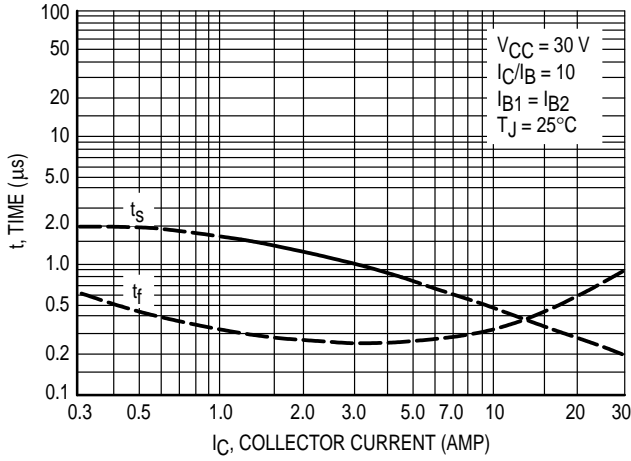
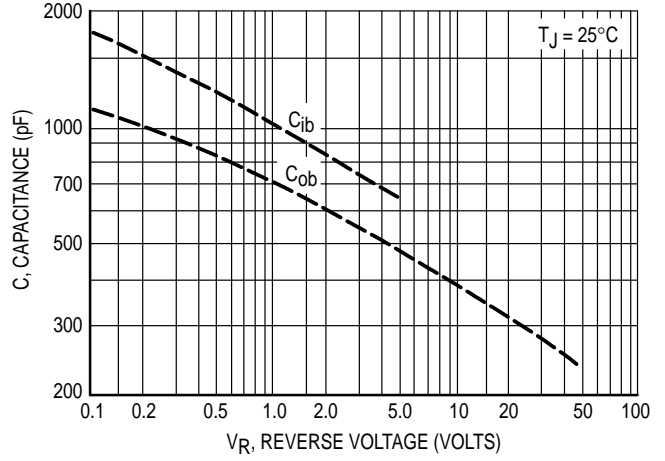


Figure 5. Turn-On Time

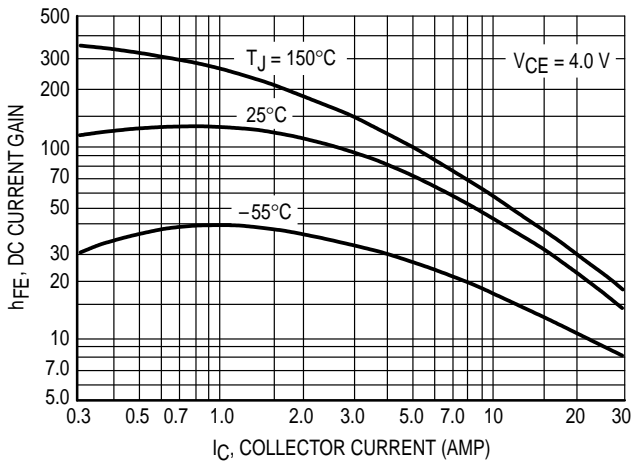
**2N3771 2N3772**



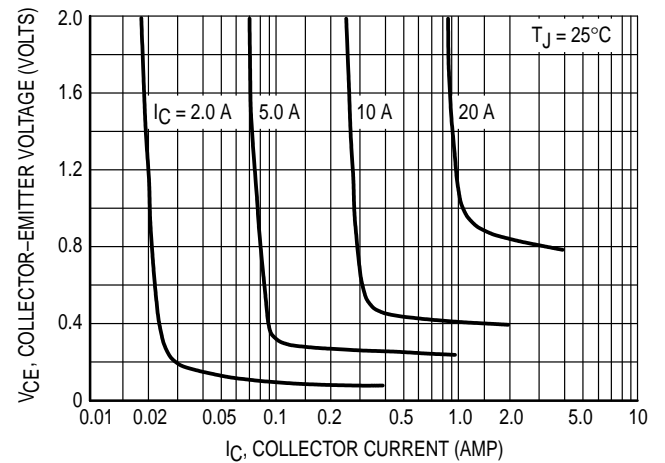
**Figure 6. Turn-Off Time**



**Figure 7. Capacitance**

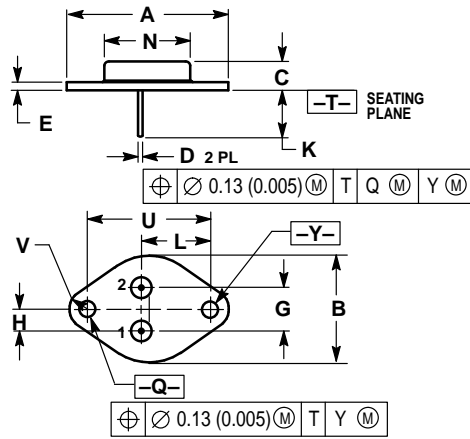


**Figure 8. DC Current Gain**



**Figure 9. Collector Saturation Region**

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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