TIP47*
TIP49*
TIP48*
TIP50*

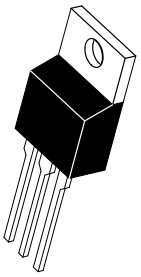
*Motorola Preferred Device

High Voltage NPN Silicon Power Transistors

. . . designed for line operated audio output amplifier, Switchmode power supply drivers and other switching applications.

- 250 V to 400 V (Min) — $V_{CEO(sus)}$
- 1 A Rated Collector Current
- Popular TO–220 Plastic Package

1.0 AMPERE
POWER TRANSISTORS
NPN SILICON
250 – 300 – 350 – 400 VOLTS
40 WATTS



CASE 221A–06
TO–220AB

MAXIMUM RATINGS

Rating	Symbol	TIP47	TIP48	TIP49	TIP50	Unit
Collector–Emitter Voltage	V_{CEO}	250	300	350	400	Vdc
Collector–Base Voltage	V_{CB}	350	400	450	500	Vdc
Emitter–Base Voltage	V_{EB}	5.0				Vdc
Collector Current — Continuous Peak	I_C	1.0 2.0				Adc
Base Current	I_B	0.6				Adc
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	40 0.32				Watts W/°C
Total Power Dissipation @ T_A = 25°C Derate above 25°C	P_D	2.0 0.016				Watts W/°C
Unclamped Inducting Load Energy (See Figure 8)	E	20				mJ
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +150				°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.125	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	62.5	°C/W

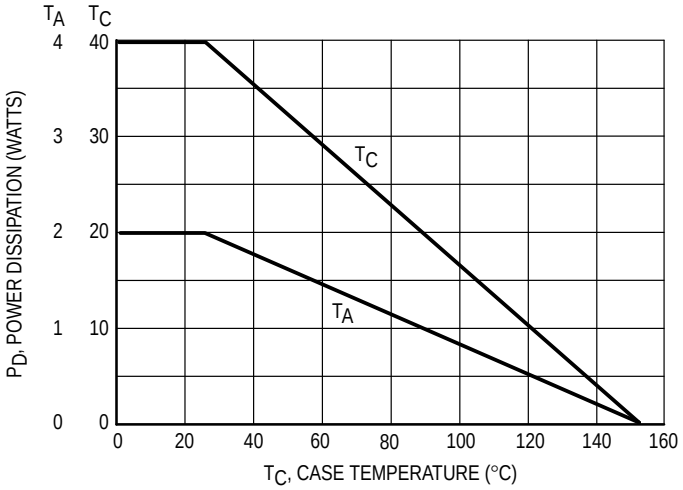


Figure 1. Power Derating

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

REV 1

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

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector–Emitter Sustaining Voltage (1)	TIP47	$V_{CEO(sus)}$	250	—	Vdc
(I_C = 30 mAdc, I_B = 0)	TIP48		300	—	
	TIP49		350	—	
	TIP50		400	—	
Collector Cutoff Current		I_{CEO}			mAdc
(V_{CE} = 150 Vdc, I_B = 0)	TIP47		—	1.0	
(V_{CE} = 200 Vdc, I_B = 0)	TIP48		—	1.0	
(V_{CE} = 250 Vdc, I_B = 0)	TIP49		—	1.0	
(V_{CE} = 300 Vdc, I_B = 0)	TIP50		—	1.0	
Collector Cutoff Current		I_{CES}			mAdc
(V_{CE} = 350 Vdc, V_{BE} = 0)	TIP47		—	1.0	
(V_{CE} = 400 Vdc, V_{BE} = 0)	TIP48		—	1.0	
(V_{CE} = 450 Vdc, V_{BE} = 0)	TIP49		—	1.0	
(V_{CE} = 500 Vdc, V_{BE} = 0)	TIP50		—	1.0	
Emitter Cutoff Current		I_{EBO}	—	1.0	mAdc
(V_{BE} = 5.0 Vdc, I_C = 0)					
ON CHARACTERISTICS (1)					
DC Current Gain		h_{FE}			—
(I_C = 0.3 Adc, V_{CE} = 10 Vdc)			30	150	
(I_C = 1.0 Adc, V_{CE} = 10 Vdc)			10	—	
Collector–Emitter Saturation Voltage		$V_{CE(sat)}$	—	1.0	Vdc
(I_C = 1.0 Adc, I_B = 0.2 Adc)					
Base–Emitter On Voltage		$V_{BE(on)}$	—	1.5	Vdc
(I_C = 1.0 Adc, V_{CE} = 10 Vdc)					
DYNAMIC CHARACTERISTICS					
Current–Gain — Bandwidth Product		f_T	10	—	MHz
(I_C = 0.1 Adc, V_{CE} = 10 Vdc, f = 2.0 MHz)					
Small–Signal Current Gain		h_{fe}	25	—	—
(I_C = 0.2 Adc, V_{CE} = 10 Vdc, f = 1.0 kHz)					

(1) Pulse Test: Pulse width ≤ 300 μs, Duty Cycle ≤ 2.0%.

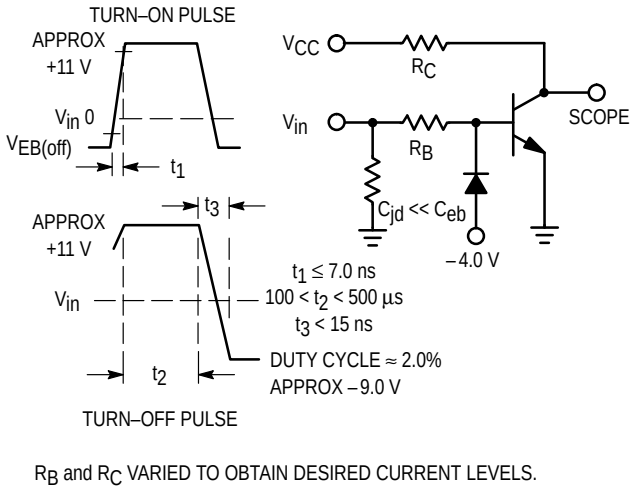


Figure 2. Switching Time Equivalent Circuit

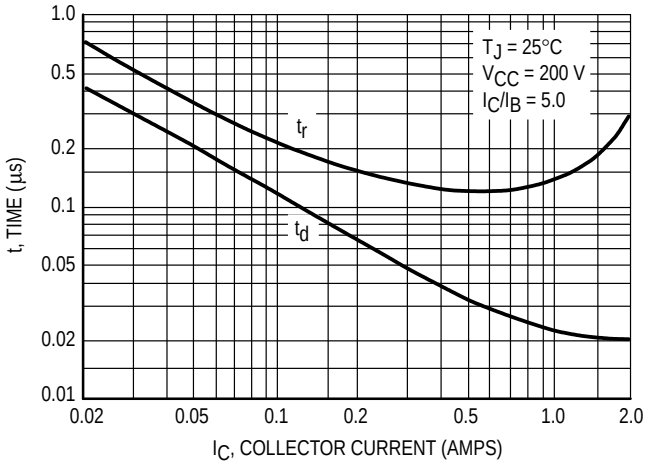


Figure 3. Turn–On Time

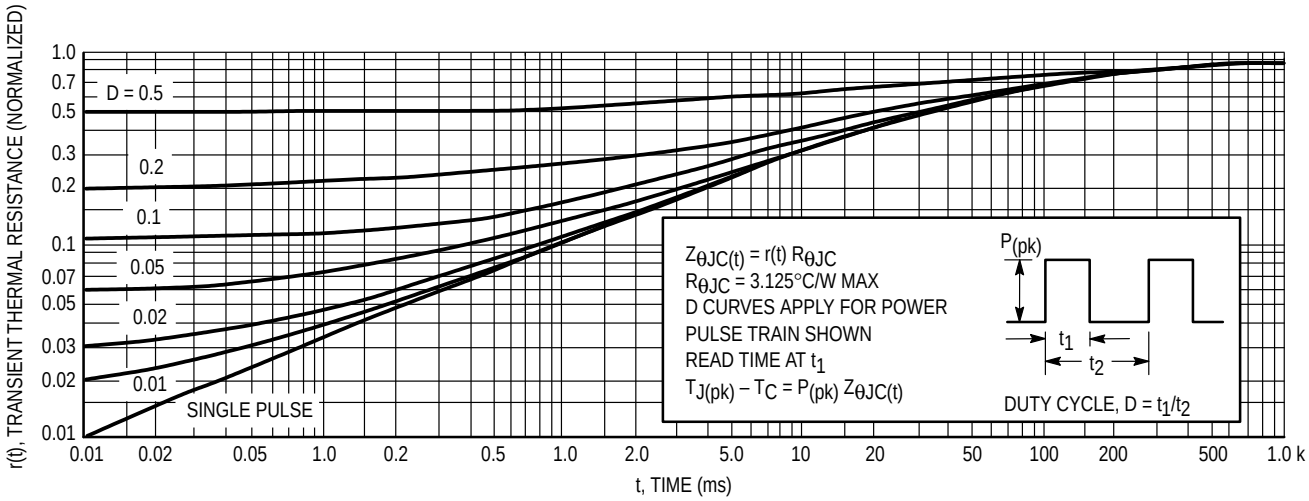


Figure 4. Thermal Response

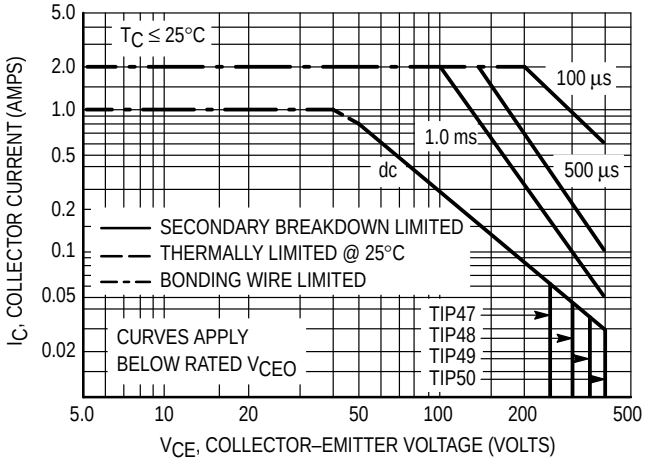


Figure 5. Active Region Safe Operating Area

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 5 is based on $T_{J(pk)}$ = 150°C; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 150°C$. $T_{J(pk)}$ may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

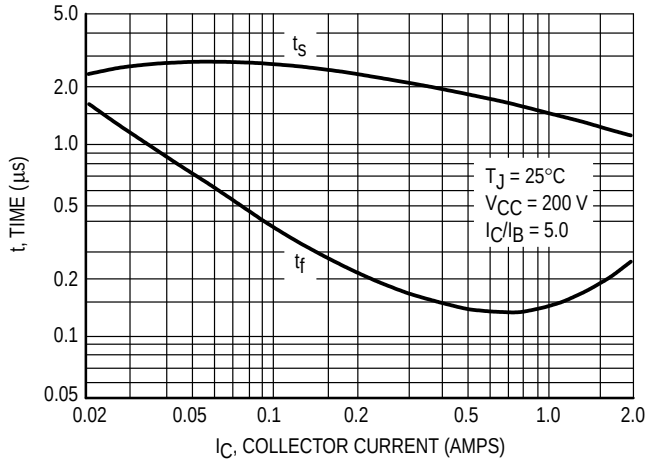


Figure 6. Turn–Off Time

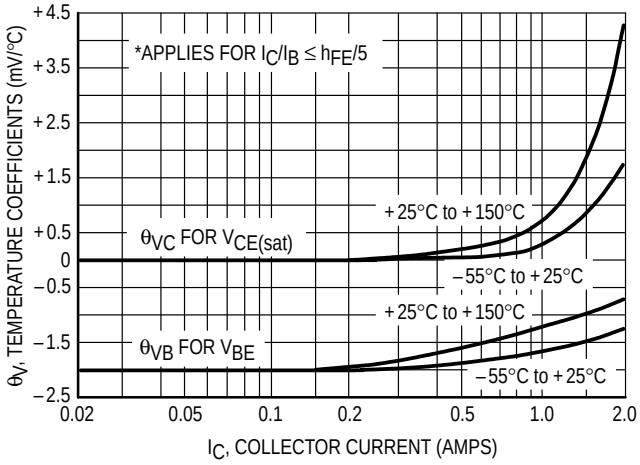
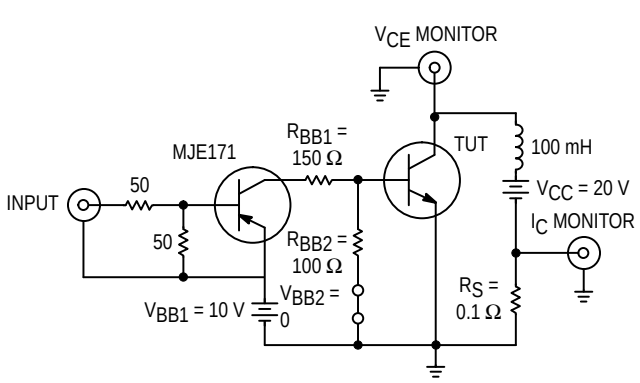
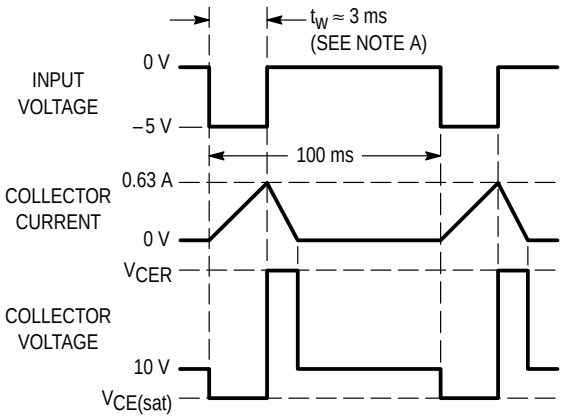


Figure 7. Temperature Coefficients





Note A: Input pulse width is increased until I_{CM} = 0.63 A.

Figure 8. Inductive Load Switching

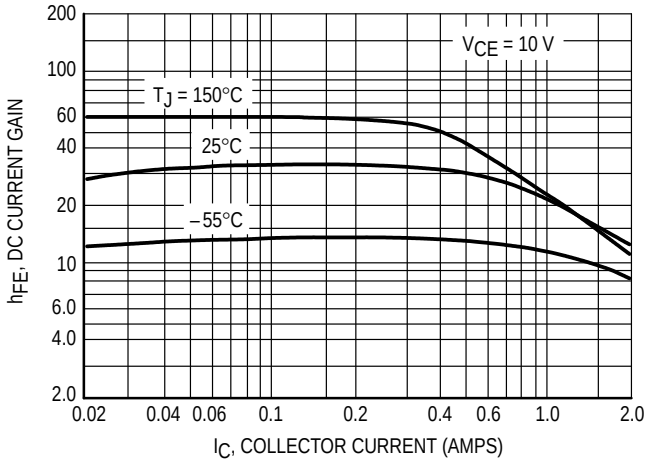


Figure 9. DC Current Gain

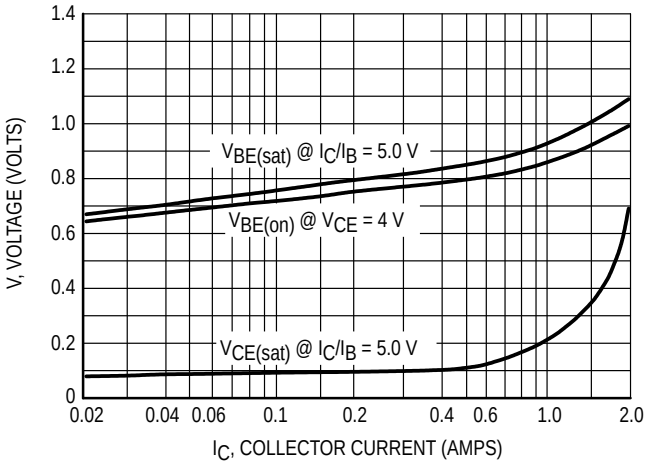
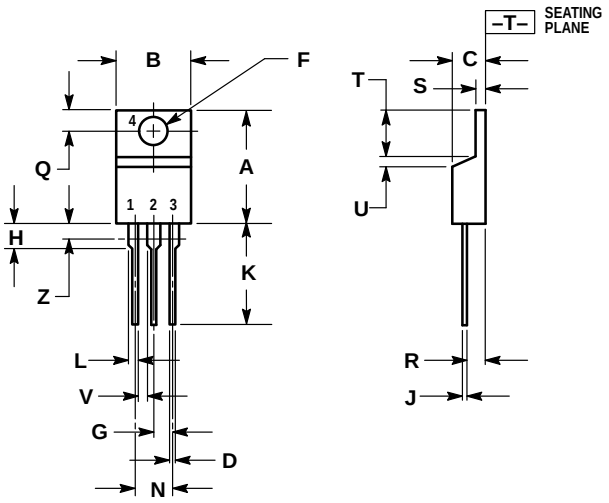


Figure 10. “On” Voltages

PACKAGE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	—	1.15	—
Z	—	0.080	—	2.04

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

CASE 221A–06
TO–220AB
ISSUE Y

How to reach us:
USA / EUROPE: Motorola Literature Distribution;
P.O. Box 20912; Phoenix, Arizona 85036. 1–800–441–2447

MFAX: RMFAX0@email.sps.mot.com – TOUCHTONE (602) 244–6609
INTERNET: http://Design–NET.com

JAPAN: Nippon Motorola Ltd.; Tatsumi–SPD–JLDC, Toshikatsu Otsuki,
6F Seibu–Butsuryu–Center, 3–14–2 Tatsumi Koto–Ku, Tokyo 135, Japan. 03–3521–8315

HONG KONG: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852–26629298