

TIP47, TIP48, TIP50

Preferred Device

High Voltage NPN Silicon Power Transistors

This series is designed for line operated audio output amplifier, SWITCHMODE™ power supply drivers and other switching applications.

Features

- 250 V to 400 V (Min) – $V_{CEO(sus)}$
- 1 A Rated Collector Current
- Popular TO–220 Plastic Package
- Pb–Free Packages are Available*

MAXIMUM RATINGS

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

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|--|-----------------|-------|--------------------|
| Thermal Resistance, Junction–to–Case | $R_{\theta JC}$ | 3.125 | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction–to–Ambient | $R_{\theta JA}$ | 62.5 | $^\circ\text{C/W}$ |

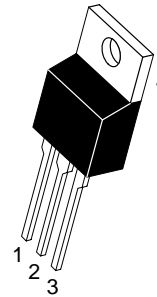
*For additional information on our Pb–Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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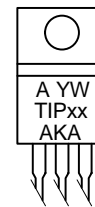
<http://onsemi.com>

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



TO–220AB
CASE 221A
STYLE 1

MARKING DIAGRAM



A = Assembly Location
Y = Year
W = Work Week
TIP = Device Code
xx = 47, 48, or 50
AKA = Location Code

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

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

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

| Characteristic | Symbol | Min | Max | Unit | |
|--|-------------------------|-----------------------|-------------------|-------------------|-----|
| OFF CHARACTERISTICS | | | | | |
| Collector–Emitter Sustaining Voltage (Note 1) (I _C = 30 mA, I _B = 0) | TIP47 TIP48 TIP50 | V _{CEO(sus)} | 250 300 400 | – – – | Vdc |
| Collector Cutoff Current (V _{CE} = 150 Vdc, I _B = 0) (V _{CE} = 200 Vdc, I _B = 0) (V _{CE} = 300 Vdc, I _B = 0) | TIP47 TIP48 TIP50 | I _{CEO} | – – – | 1.0 1.0 1.0 | mA |
| Collector Cutoff Current (V _{CE} = 350 Vdc, V _{BE} = 0) (V _{CE} = 400 Vdc, V _{BE} = 0) (V _{CE} = 500 Vdc, V _{BE} = 0) | TIP47 TIP48 TIP50 | I _{CES} | – – – | 1.0 1.0 1.0 | mA |
| Emitter Cutoff Current (V _{BE} = 5.0 Vdc, I _C = 0) | | I _{EBO} | – | 1.0 | mA |
| ON CHARACTERISTICS (Note 1) | | | | | |
| DC Current Gain (I _C = 0.3 A, V _{CE} = 10 Vdc) (I _C = 1.0 A, V _{CE} = 10 Vdc) | | h _{FE} | 30 10 | 150 – | – |
| Collector–Emitter Saturation Voltage (I _C = 1.0 A, I _B = 0.2 A) | | V _{CE(sat)} | – | 1.0 | Vdc |
| Base–Emitter On Voltage (I _C = 1.0 A, V _{CE} = 10 Vdc) | | V _{BE(on)} | – | 1.5 | Vdc |
| DYNAMIC CHARACTERISTICS | | | | | |
| Current–Gain — Bandwidth Product (I _C = 0.1 A, V _{CE} = 10 Vdc, f = 2.0 MHz) | | f _T | 10 | – | MHz |
| Small–Signal Current Gain (I _C = 0.2 A, V _{CE} = 10 Vdc, f = 1.0 kHz) | | h _{fe} | 25 | – | – |

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

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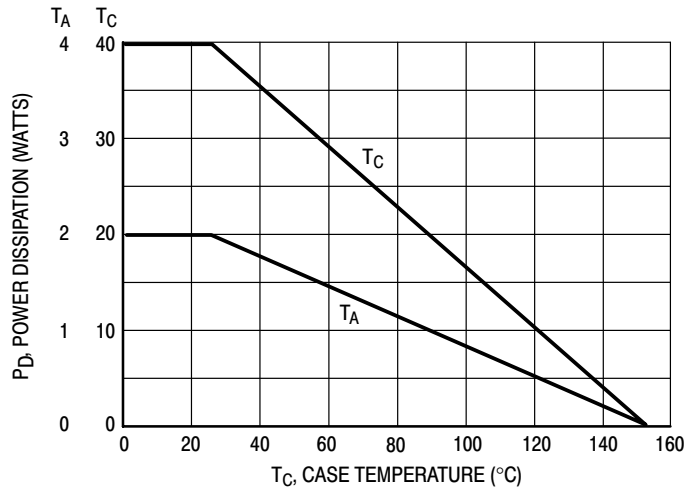
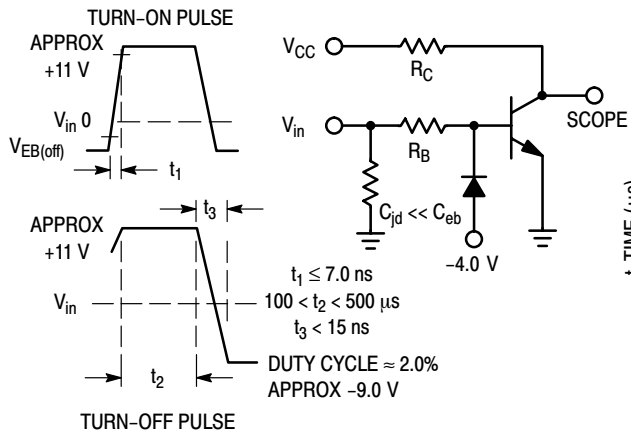


Figure 1. Power Derating



R_B and R_C VARIED TO OBTAIN DESIRED CURRENT LEVELS.

Figure 2. Switching Time Equivalent Circuit

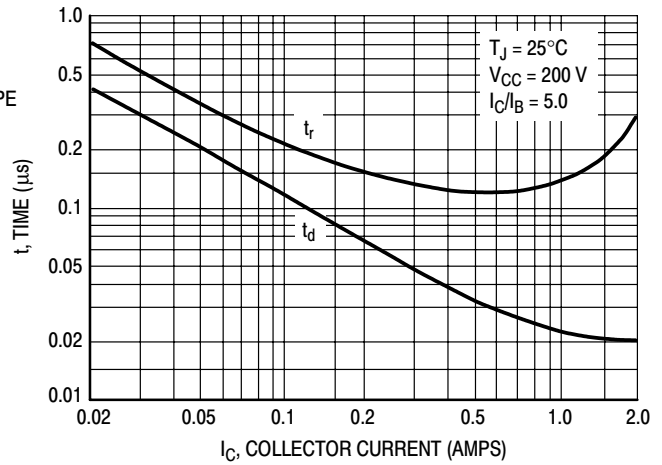


Figure 3. Turn-On Time

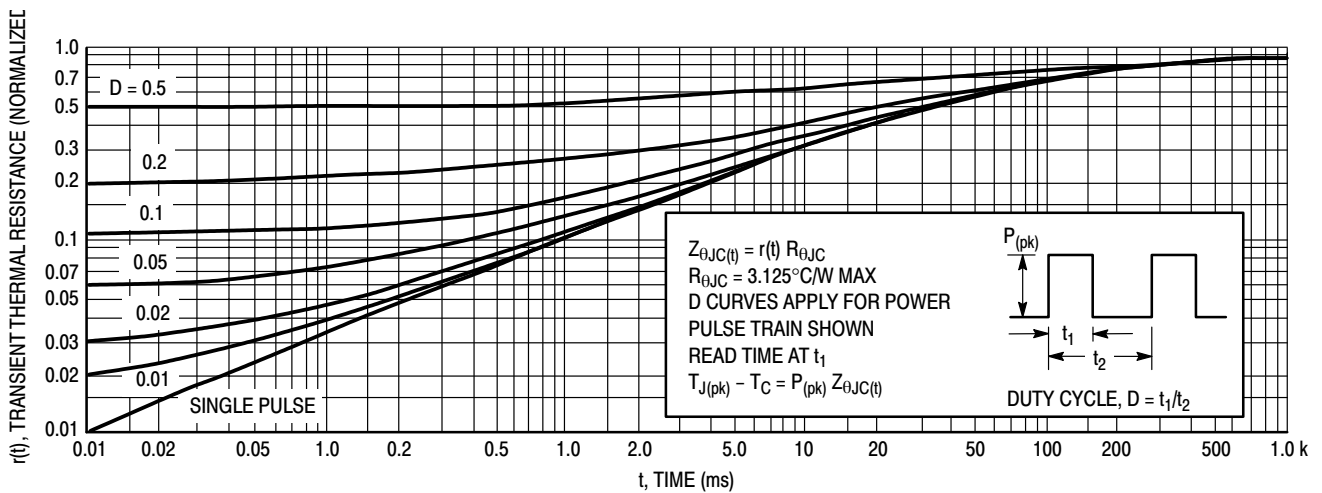


Figure 4. Thermal Response

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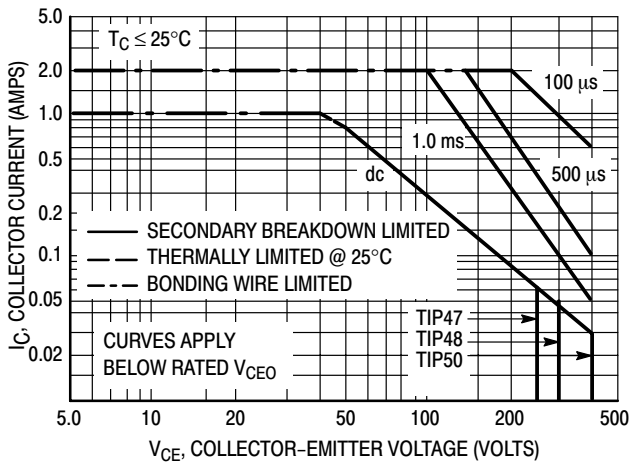


Figure 5. Active Region Safe Operating Area

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 $T_{J(pk)} = 150^\circ\text{C}$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 150^\circ\text{C}$. $T_{J(pk)}$ 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.

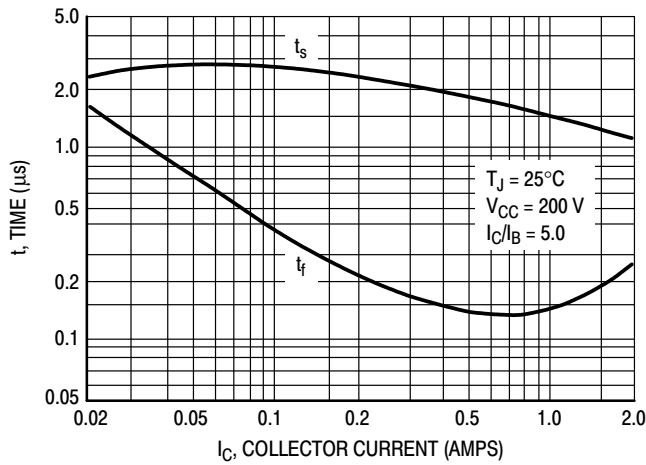


Figure 6. Turn-Off Time

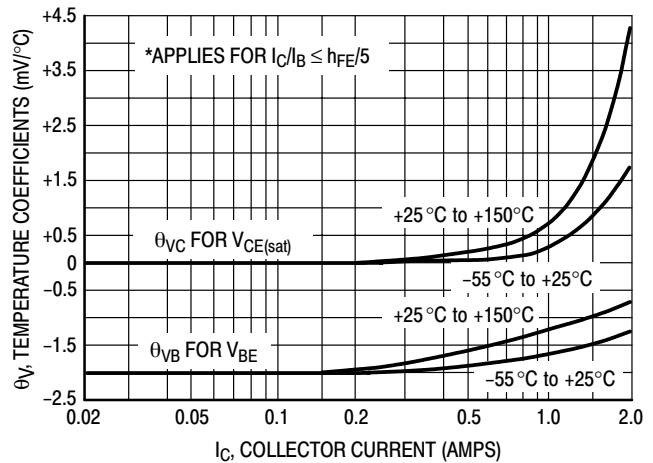
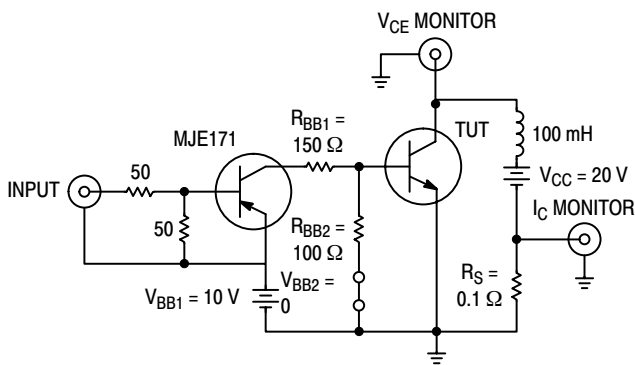


Figure 7. Temperature Coefficients



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

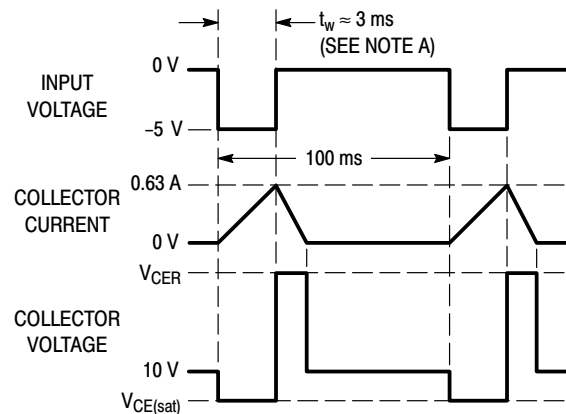


Figure 8. Inductive Load Switching

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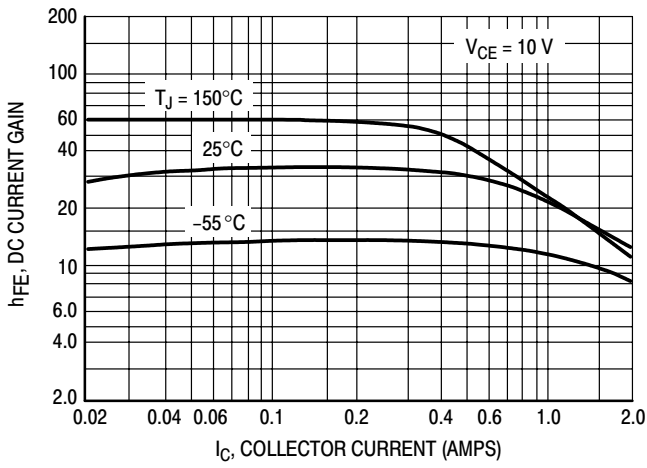


Figure 9. DC Current Gain

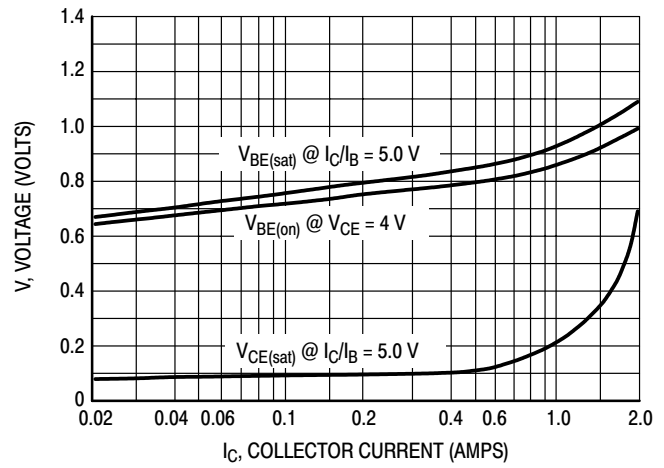


Figure 10. "On" Voltages

ORDERING INFORMATION

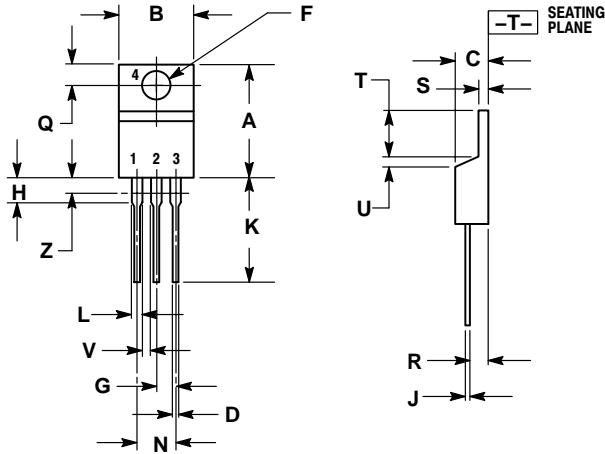
| Device | Package | Shipping [†] |
|--------|---------------------|-----------------------|
| TIP47 | TO-220 | 50 Units / Rail |
| TIP47G | TO-220 (Pb-Free) | 50 Units / Rail |
| TIP48 | TO-220 | 50 Units / Rail |
| TIP48G | TO-220 (Pb-Free) | 50 Units / Rail |
| TIP50 | TO-220 | 50 Units / Rail |
| TIP50G | TO-220 (Pb-Free) | 50 Units / Rail |

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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PACKAGE DIMENSIONS

TO-220AB CASE 221A-09 ISSUE AA




- 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.

| DIM | INCHES | | MILLIMETERS | |
|-----|--------|-------|-------------|-------|
| | 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:
1. BASE
 2. COLLECTOR
 3. EMITTER
 4. COLLECTOR

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