# TIP47G, TIP48G, TIP50G

# 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

- Popular TO−220 Plastic Package
- Complementary to the MJE5730 and MJE5731 Series
- These Devices are Pb−Free and are RoHS Compliant*

### 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 − Continuous | $I_C$ | 1.0 | | | Adc |
| Collector Current − Peak | $I_{CM}$ | 2.0 | | | Adc |
| Base Current | $I_B$ | 0.6 | | | Adc |
| Total Power Dissipation<br>@ $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | 40<br>0.32 | | | W<br>W/°C |
| Total Power Dissipation<br>@ $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | 2.0<br>0.016 | | | W<br>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 |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### 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 |

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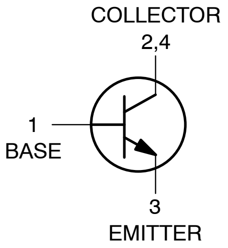
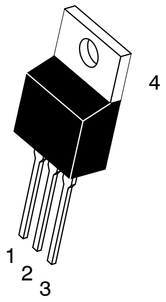
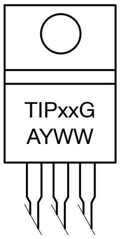
**POWER TRANSISTORS**
**NPN SILICON**
**250−300−400 VOLTS**
**40 WATTS**





**TO−220AB**
**CASE 221A**
**STYLE 1**

### MARKING DIAGRAM



TIPxx = Device Code
xx = 47, 48, or 50
A = Assembly Location
Y = Year
WW = Work Week
G = Pb−Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

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

October, 2014 − Rev. 11

Publication Order Number:
TIP47/D

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

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

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

## ORDERING INFORMATION

| Device | Package | Shipping |
|---|---|---|
| TIP47G | TO−220<br>(Pb−Free) | 50 Units / Rail |
| TIP48G | TO−220<br>(Pb−Free) | 50 Units / Rail |
| TIP49G | TO−220<br>(Pb−Free) | 50 Units / Rail |
| TIP50G | TO−220<br>(Pb−Free) | 50 Units / Rail |

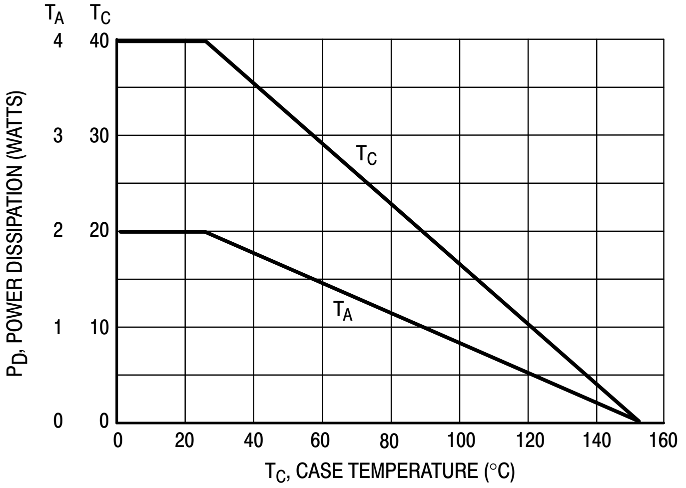
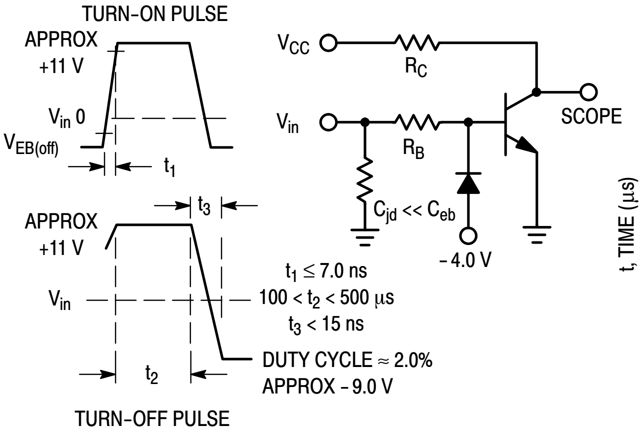


**Figure 1. Power Derating**



$R_B$ and $R_C$ VARIED TO OBTAIN DESIRED CURRENT LEVELS.

**Figure 2. Switching Time Equivalent Circuit**

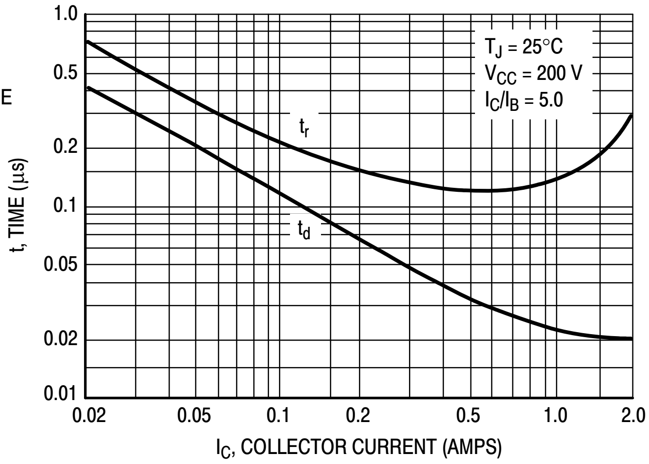


**Figure 3. Turn-On Time**

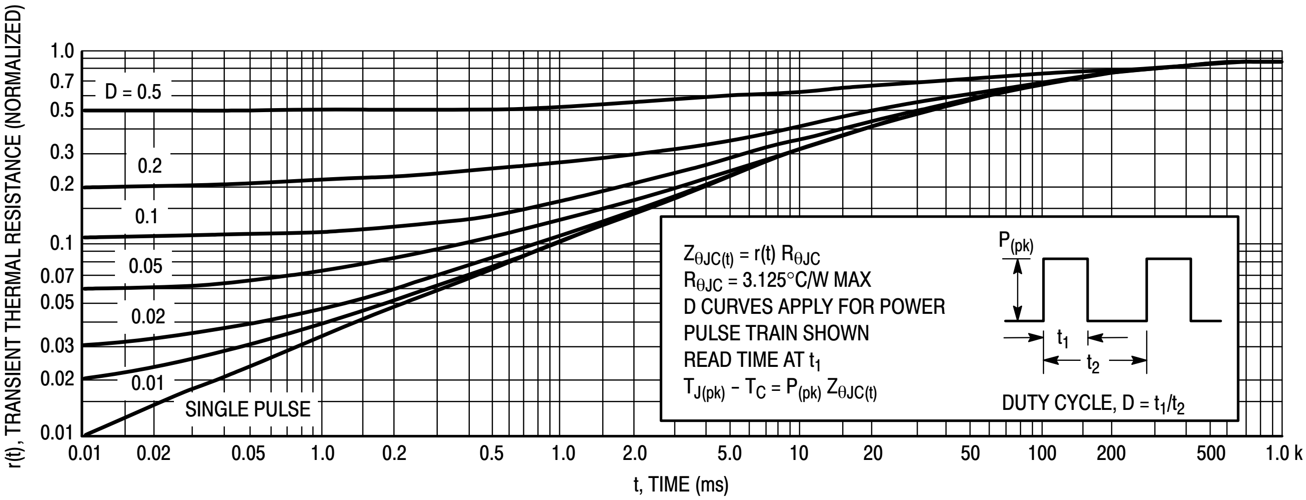


**Figure 4. Thermal Response**

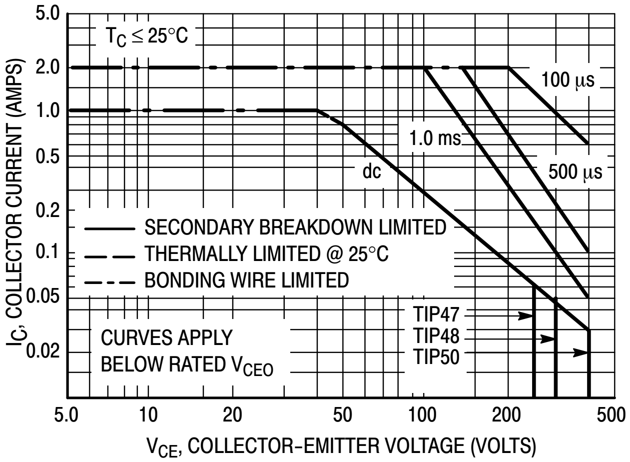


**Figure 5. Active Region Safe Operating Area**

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 $T_{J(pk)} \le 150°C$. $T_{J(pk)}$ 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.

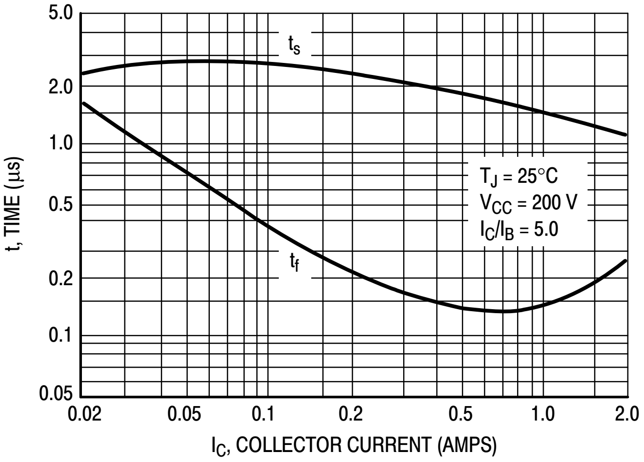


**Figure 6. Turn-Off Time**

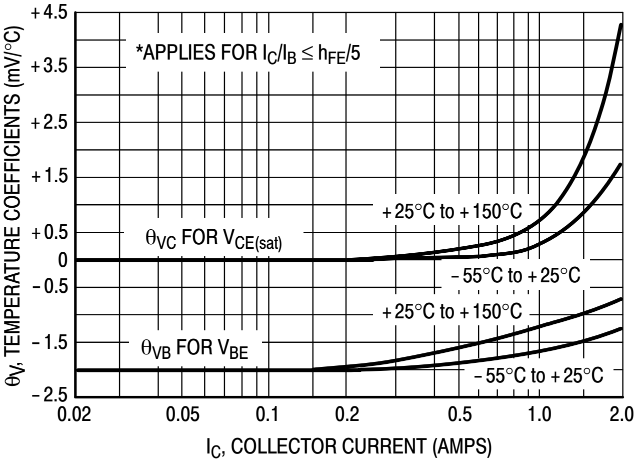
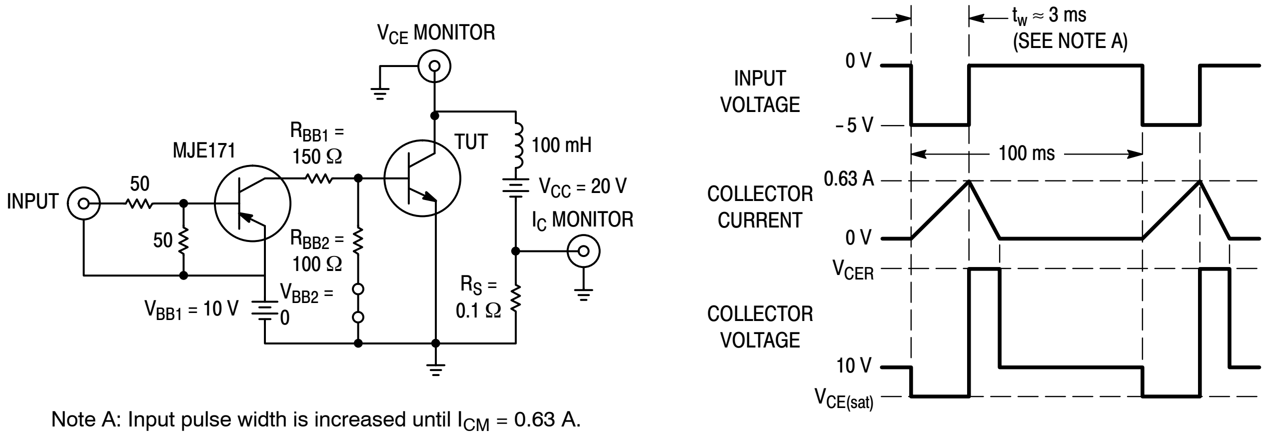


**Figure 7. Temperature Coefficients**



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

**Figure 8. Inductive Load Switching**

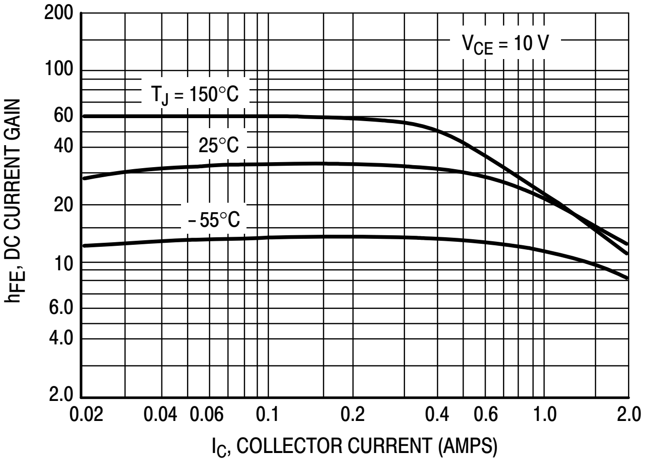


**Figure 9. DC Current Gain**

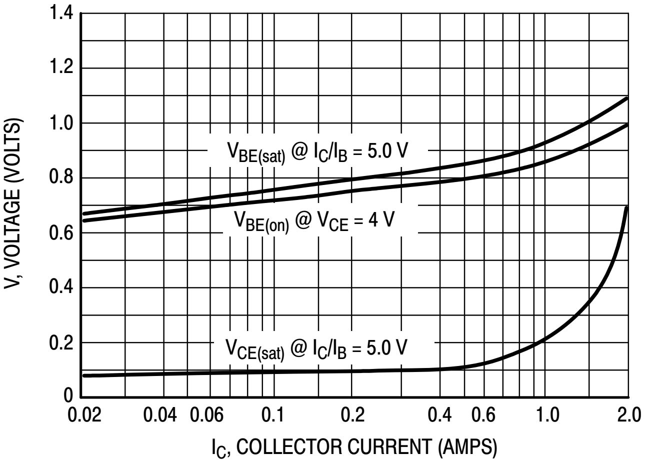
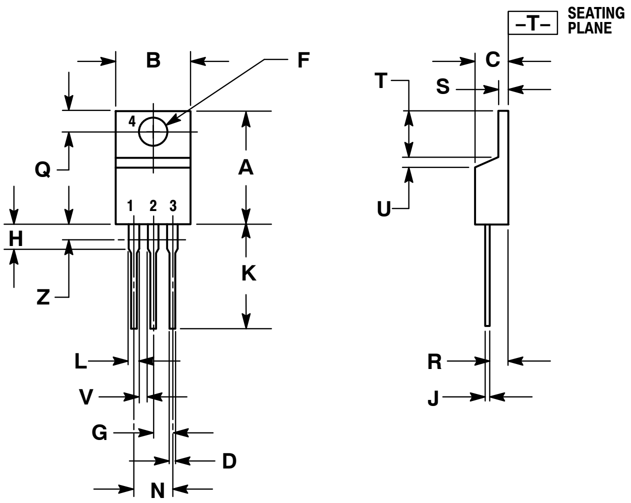


**Figure 10. “On” Voltages**

## PACKAGE DIMENSIONS

### TO−220

CASE 221A−09
ISSUE AH



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 | 0.415 | 9.66 | 10.53 |
| C | 0.160 | 0.190 | 4.07 | 4.83 |
| D | 0.025 | 0.038 | 0.64 | 0.96 |
| F | 0.142 | 0.161 | 3.61 | 4.09 |
| G | 0.095 | 0.105 | 2.42 | 2.66 |
| H | 0.110 | 0.161 | 2.80 | 4.10 |
| J | 0.014 | 0.024 | 0.36 | 0.61 |
| 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

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