

# MJD47, NJVMJD47T4G, MJD50

## High Voltage Power Transistors

### DPAK For Surface Mount Applications

Designed for line operated audio output amplifier, switchmode supply drivers and other switching applications.

#### Features

- Lead Formed for Surface Mount Applications in Plastic Sleeves (No Suffix)
- Electrically Similar to Popular TIP47, and TIP50
- 250 and 400 V (Min) –  $V_{CEO(sus)}$
- 1 A Rated Collector Current
- Epoxy Meets UL 94 V-0 @ 0.125 in
- ESD Ratings:
  - ♦ Human Body Model, 3B > 8000 V
  - ♦ Machine Model, C > 400 V
- NJV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These are Pb-Free Packages\*

#### MAXIMUM RATINGS

| Rating                                                                                            | Symbol         | Max            | Unit                     |
|---------------------------------------------------------------------------------------------------|----------------|----------------|--------------------------|
| Collector-Emitter Voltage<br>MJD47, NJVMJD47T4G<br>MJD50                                          | $V_{CEO}$      | 250<br>400     | Vdc                      |
| Collector-Base Voltage<br>MJD47, NJVMJD47T4G<br>MJD50                                             | $V_{CB}$       | 350<br>500     | Vdc                      |
| Emitter-Base Voltage                                                                              | $V_{EB}$       | 5              | Vdc                      |
| Collector Current<br>Continuous<br>Peak                                                           | $I_C$          | 1<br>2         | Adc                      |
| Base Current                                                                                      | $I_B$          | 0.6            | Adc                      |
| Total Power Dissipation<br>@ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$          | $P_D$          | 15<br>0.12     | W<br>W/ $^\circ\text{C}$ |
| Total Power Dissipation (Note 1)<br>@ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 1.56<br>0.0125 | W<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                               | $T_J, T_{stg}$ | -65 to +150    | $^\circ\text{C}$         |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. These ratings are applicable when surface mounted on the minimum pad sizes recommended.

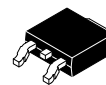
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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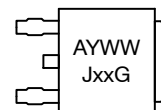
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**NPN SILICON POWER  
TRANSISTORS  
1 AMPERE  
250, 400 VOLTS, 15 WATTS**



**DPAK  
CASE 369C  
STYLE 1**

#### MARKING DIAGRAM



A = Assembly Location  
Y = Year  
WW = Work Week  
Jxx = Device Code  
xx = 47 or 50  
G = Pb-Free Package

#### ORDERING INFORMATION

| Device      | Package           | Shipping†         |
|-------------|-------------------|-------------------|
| MJD47G      | 369C<br>(Pb-Free) | 75 Units/Rail     |
| MJD47T4G    | 369C<br>(Pb-Free) | 2,500/Tape & Reel |
| NJVMJD47T4G | 369C<br>(Pb-Free) | 2,500/Tape & Reel |
| MJD50G      | 369C<br>(Pb-Free) | 75 Units/Rail     |
| MJD50T4G    | 369C<br>(Pb-Free) | 2,500/Tape & Reel |

†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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## THERMAL CHARACTERISTICS

| Characteristic                                  | Symbol          | Max  | Unit                 |
|-------------------------------------------------|-----------------|------|----------------------|
| Thermal Resistance Junction-to-Case             | $R_{\theta JC}$ | 8.33 | $^{\circ}\text{C/W}$ |
| Thermal Resistance Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 80   | $^{\circ}\text{C/W}$ |
| Lead Temperature for Soldering Purpose          | $T_L$           | 260  | $^{\circ}\text{C}$   |

2. These ratings are applicable when surface mounted on the minimum pad sizes recommended.

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

| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

### OFF CHARACTERISTICS

|                                                                                                                            |                             |               |            |            |      |
|----------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------|------------|------------|------|
| Collector-Emitter Sustaining Voltage (Note 3)<br>( $I_C = 30 \text{ mAdc}$ , $I_B = 0$ )                                   | MJD47, NJVMJD47T4G<br>MJD50 | $V_{CE(sus)}$ | 250<br>400 | –<br>–     | Vdc  |
| Collector Cutoff Current<br>( $V_{CE} = 150 \text{ Vdc}$ , $I_B = 0$ )<br>( $V_{CE} = 300 \text{ Vdc}$ , $I_B = 0$ )       | MJD47, NJVMJD47T4G<br>MJD50 | $I_{CEO}$     | –<br>–     | 0.2<br>0.2 | mAdc |
| Collector Cutoff Current<br>( $V_{CE} = 350 \text{ Vdc}$ , $V_{BE} = 0$ )<br>( $V_{CE} = 500 \text{ Vdc}$ , $V_{BE} = 0$ ) | MJD47, NJVMJD47T4G<br>MJD50 | $I_{CES}$     | –<br>–     | 0.1<br>0.1 | mAdc |
| Emitter Cutoff Current<br>( $V_{BE} = 5 \text{ Vdc}$ , $I_C = 0$ )                                                         |                             | $I_{EBO}$     | –          | 1          | mAdc |

### ON CHARACTERISTICS (Note 3)

|                                                                                                                                     |               |          |          |     |
|-------------------------------------------------------------------------------------------------------------------------------------|---------------|----------|----------|-----|
| DC Current Gain<br>( $I_C = 0.3 \text{ Adc}$ , $V_{CE} = 10 \text{ Vdc}$ )<br>( $I_C = 1 \text{ Adc}$ , $V_{CE} = 10 \text{ Vdc}$ ) | $h_{FE}$      | 30<br>10 | 150<br>– | –   |
| Collector-Emitter Saturation Voltage<br>( $I_C = 1 \text{ Adc}$ , $I_B = 0.2 \text{ Adc}$ )                                         | $V_{CE(sat)}$ | –        | 1        | Vdc |
| Base-Emitter On Voltage<br>( $I_C = 1 \text{ Adc}$ , $V_{CE} = 10 \text{ Vdc}$ )                                                    | $V_{BE(on)}$  | –        | 1.5      | Vdc |

### DYNAMIC CHARACTERISTICS

|                                                                                                                   |          |    |   |     |
|-------------------------------------------------------------------------------------------------------------------|----------|----|---|-----|
| Current Gain — Bandwidth Product<br>( $I_C = 0.2 \text{ Adc}$ , $V_{CE} = 10 \text{ Vdc}$ , $f = 2 \text{ MHz}$ ) | $f_T$    | 10 | – | MHz |
| Small-Signal Current Gain<br>( $I_C = 0.2 \text{ Adc}$ , $V_{CE} = 10 \text{ Vdc}$ , $f = 1 \text{ kHz}$ )        | $h_{fe}$ | 25 | – | –   |

3. Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

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## TYPICAL CHARACTERISTICS

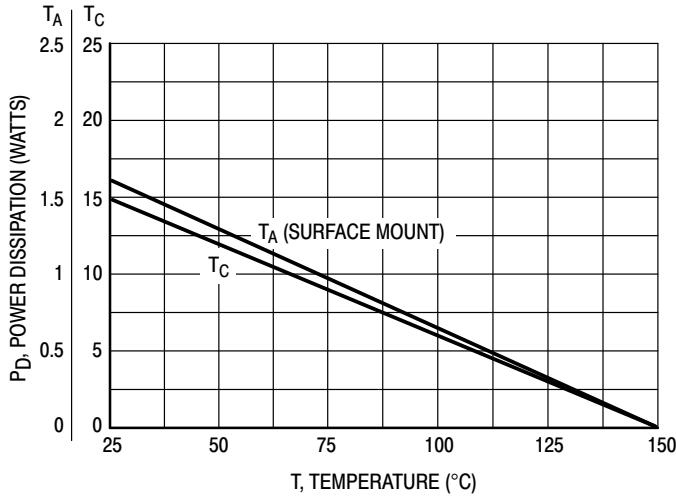


Figure 1. Power Derating

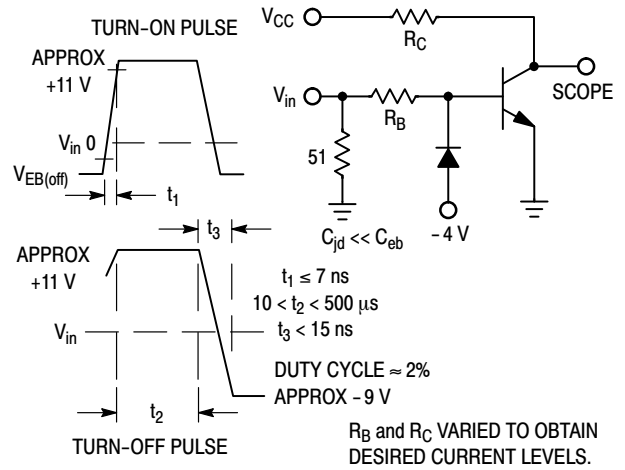


Figure 2. Switching Time Equivalent Circuit

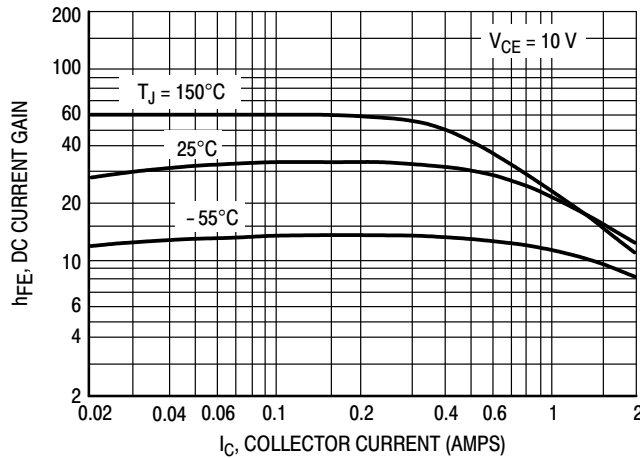


Figure 3. DC Current Gain

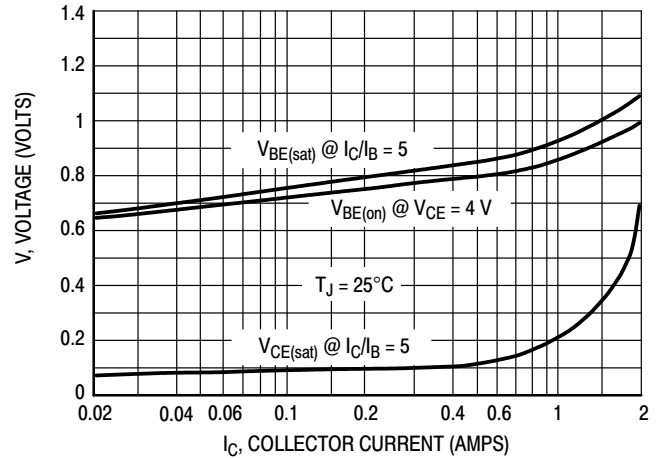


Figure 4. "On" Voltages

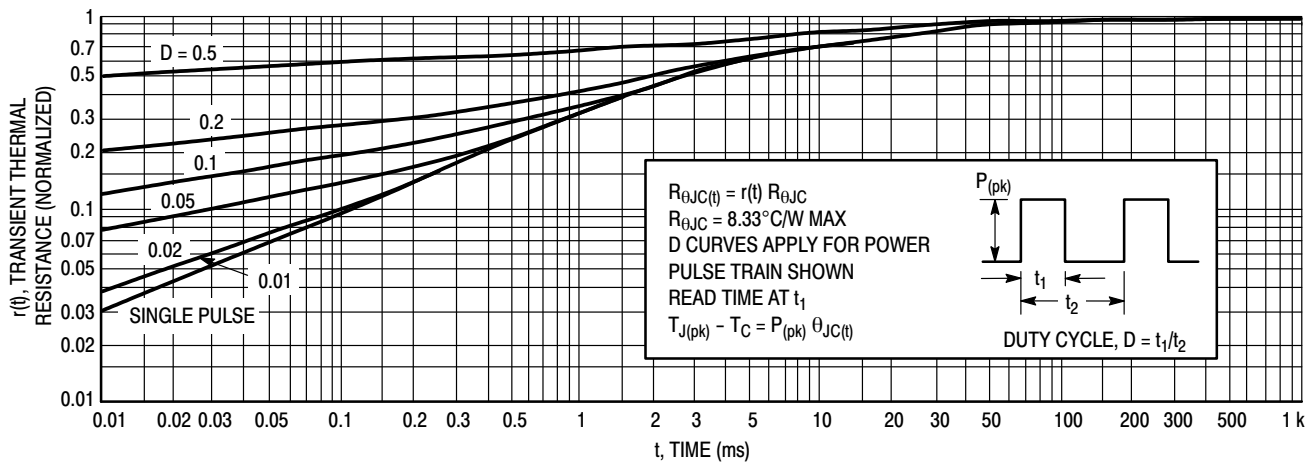


Figure 5. Thermal Response

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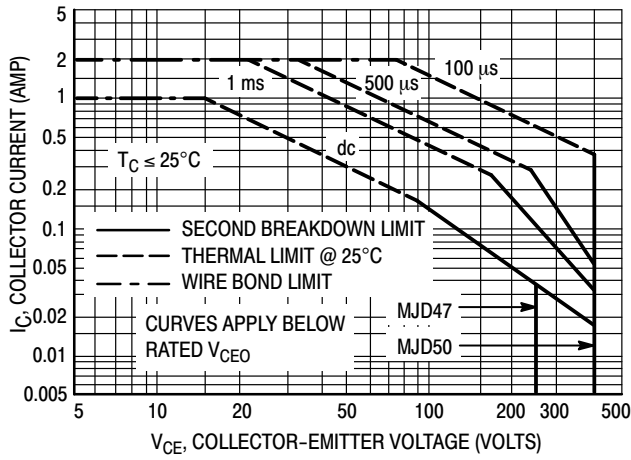


Figure 6. Active Region Safe Operating Area

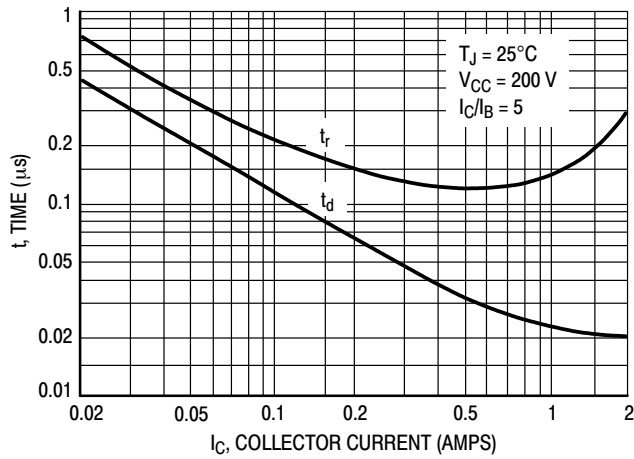


Figure 7. Turn-On Time

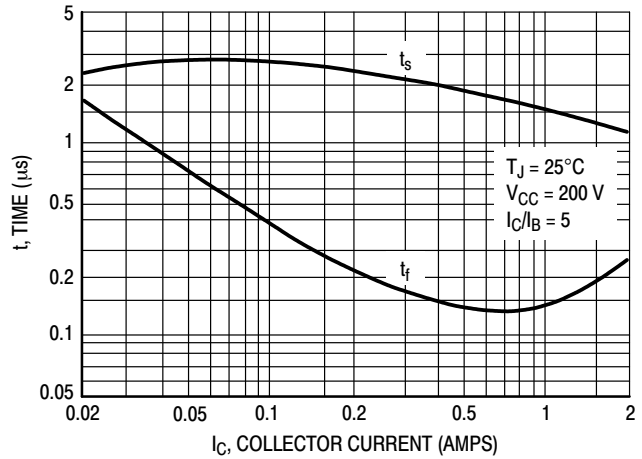


Figure 8. Turn-Off Time

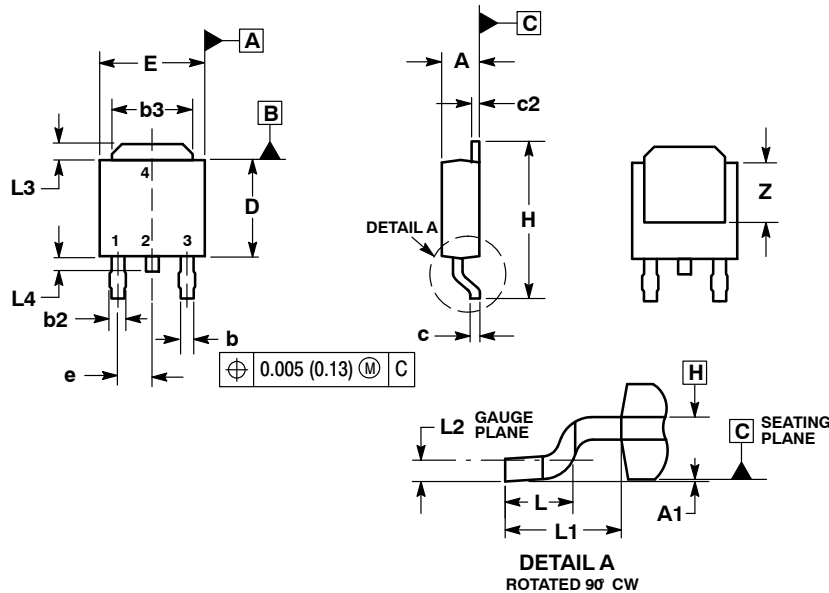
There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 6 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 5. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

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## PACKAGE DIMENSIONS

### DPAK CASE 369C ISSUE D

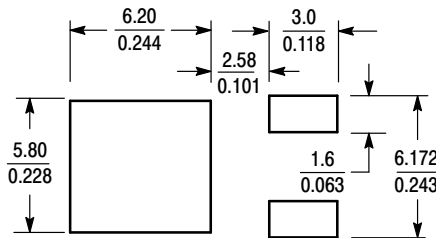


#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.086     | 0.094 | 2.18        | 2.38  |
| A1  | 0.000     | 0.005 | 0.00        | 0.13  |
| b   | 0.025     | 0.035 | 0.63        | 0.89  |
| b2  | 0.030     | 0.045 | 0.76        | 1.14  |
| b3  | 0.180     | 0.215 | 4.57        | 5.46  |
| c   | 0.018     | 0.024 | 0.46        | 0.61  |
| c2  | 0.018     | 0.024 | 0.46        | 0.61  |
| D   | 0.235     | 0.245 | 5.97        | 6.22  |
| E   | 0.250     | 0.265 | 6.35        | 6.73  |
| e   | 0.090 BSC |       | 2.29 BSC    |       |
| H   | 0.370     | 0.410 | 9.40        | 10.41 |
| L   | 0.055     | 0.070 | 1.40        | 1.78  |
| L1  | 0.108 REF |       | 2.74 REF    |       |
| L2  | 0.020 BSC |       | 0.51 BSC    |       |
| L3  | 0.035     | 0.050 | 0.89        | 1.27  |
| L4  | ---       | 0.040 | ---         | 1.01  |
| Z   | 0.155     | ---   | 3.93        | ---   |

### SOLDERING FOOTPRINT\*



SCALE 3:1 (mm/inches)

#### STYLE 1:

- PIN 1. BASE
- COLLECTOR
- EMITTER
- COLLECTOR

\*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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