

High Voltage Power Transistor

Isolated Package Applications

MJF47G

Designed for line operated audio output amplifiers, switching power supply drivers and other switching applications, where the mounting surface of the device is required to be electrically isolated from the heatsink or chassis.

Features

- Electrically Similar to the Popular TIP47
- 250 $V_{CEO(sus)}$
- 1 A Rated Collector Current
- No Isolating Washers Required
- Reduced System Cost
- UL Recognized, File #E69369, to 3500 V_{RMS} Isolation
- This is a Pb-Free Device*

MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|--|----------------|----------------------|--------------------------|
| Collector-Emmitter Voltage | V_{CEO} | 250 | Vdc |
| Collector-Base Voltage | V_{CB} | 350 | Vdc |
| Emitter-Base Voltage | V_{EB} | 5 | Vdc |
| RMS Isolation Voltage (Note 1) Test No. 1 Per Figure 10 Test No. 2 Per Figure 11 Test No. 3 Per Figure 12 (for 1 sec, R.H. < 30%, $T_A = 25^\circ\text{C}$) | V_{ISOL} | 4500 3500 1500 | V |
| Collector Current – Continuous – Peak | I_C | 1 2 | Adc |
| Base Current – Continuous | I_B | 0.6 | Adc |
| Total Power Dissipation (Note 2) @ $T_C = 25^\circ\text{C}$ Derate above 25°C | P_D | 28.4 0.227 | W W/ $^\circ\text{C}$ |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 2.0 0.016 | W W/ $^\circ\text{C}$ |
| Operating and Storage Temperature Range | T_J, T_{stg} | -65 to +150 | $^\circ\text{C}$ |

THERMAL CHARACTERISTICS

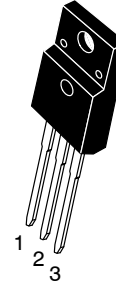
| Characteristic | Symbol | Max | Unit |
|---|-----------------|------|---------------------------|
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 62.5 | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Case (Note 2) | $R_{\theta JC}$ | 4.4 | $^\circ\text{C}/\text{W}$ |
| Lead Temperature for Soldering Purposes | T_L | 260 | $^\circ\text{C}$ |

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.

- Proper strike and creepage distance must be provided.
- Measurement made with thermocouple contacting the bottom insulated surface (in a location beneath the die), the devices mounted on a heatsink with thermal grease and a mounting torque of ≥ 6 in. lbs.

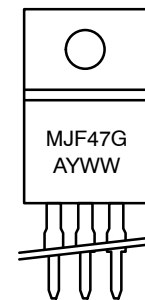
*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NPN SILICON POWER TRANSISTOR 1 AMPERE 250 VOLTS, 28 WATTS



TO-220 FULLPACK
CASE 221D
STYLE 2

MARKING DIAGRAM



G = Pb-Free Package
A = Assembly Location
Y = Year
WW = Work Week

ORDERING INFORMATION

| Device | Package | Shipping |
|--------|------------------------------|---------------|
| MJF47G | TO-220 FULLPACK (Pb-Free) | 50 Units/Rail |

MJF47G

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

| Characteristic | Symbol | Min | Max | Unit |
|---|----------------|----------|----------|------|
| OFF CHARACTERISTICS | | | | |
| Collector-Emitter Sustaining Voltage (Note 3) ($I_C = 30\text{ mAdc}$, $I_B = 0$) | $V_{CEO(sus)}$ | 250 | – | Vdc |
| Collector Cutoff Current ($V_{CE} = 150\text{ Vdc}$, $I_B = 0$) | I_{CEO} | – | 0.2 | mAdc |
| Collector Cutoff Current ($V_{CE} = 350\text{ Vdc}$, $V_{BE} = 0$) | I_{CES} | – | 0.1 | mAdc |
| Emitter Cutoff Current ($V_{BE} = 5\text{ Vdc}$, $I_C = 0$) | I_{EBO} | – | 1 | mAdc |
| ON CHARACTERISTICS (Note 3) | | | | |
| DC Current Gain ($I_C = 0.3\text{ Adc}$, $V_{CE} = 10\text{ Vdc}$) ($I_C = 1\text{ Adc}$, $V_{CE} = 10\text{ Vdc}$) | h_{FE} | 30 10 | 150 – | – |
| Collector-Emitter Saturation Voltage ($I_C = 1\text{ Adc}$, $I_B = 0.2\text{ Adc}$) | $V_{CE(sat)}$ | – | 1 | Vdc |
| Base-Emitter On Voltage ($I_C = 1\text{ Adc}$, $V_{CE} = 10\text{ Vdc}$) | $V_{BE(on)}$ | – | 1.5 | Vdc |
| DYNAMIC CHARACTERISTICS | | | | |
| Current Gain – Bandwidth Product ($I_C = 0.2\text{ Adc}$, $V_{CE} = 10\text{ Vdc}$, $f = 2\text{ MHz}$) | f_T | 10 | – | MHz |

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.

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

TYPICAL CHARACTERISTICS

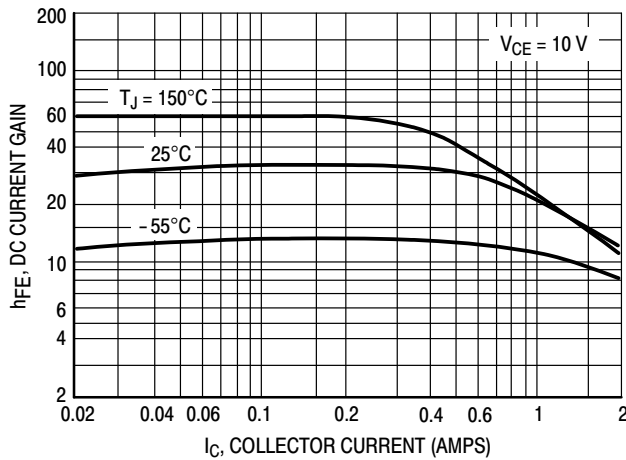


Figure 1. DC Current Gain

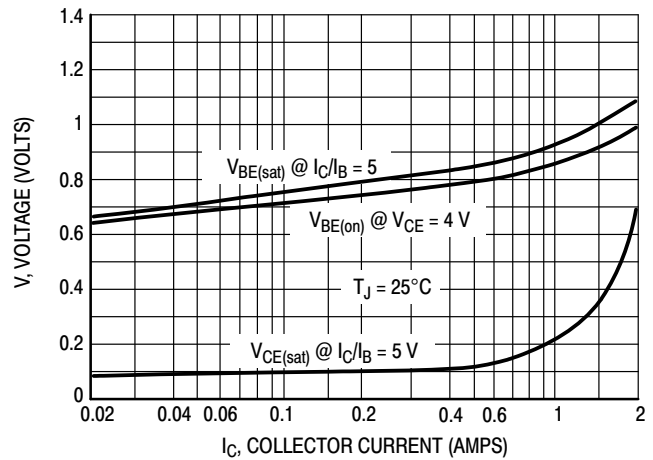


Figure 2. "On" Voltages

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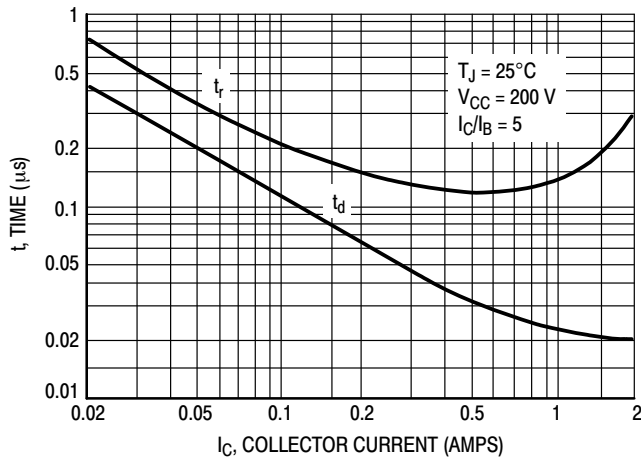


Figure 3. Turn-On Time

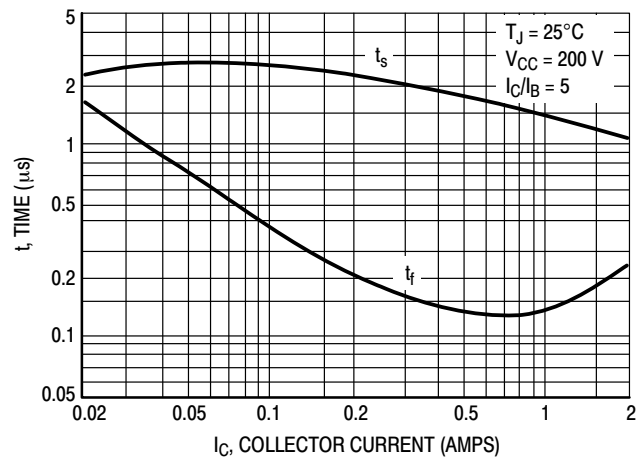


Figure 4. Turn-Off Time

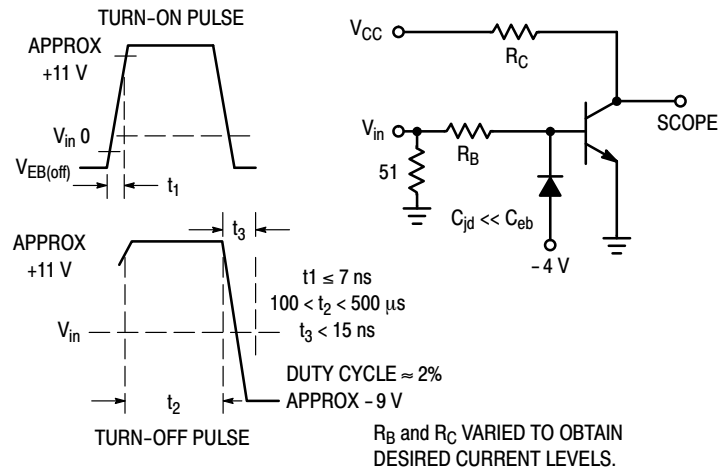


Figure 5. Switching Time Equivalent Circuit

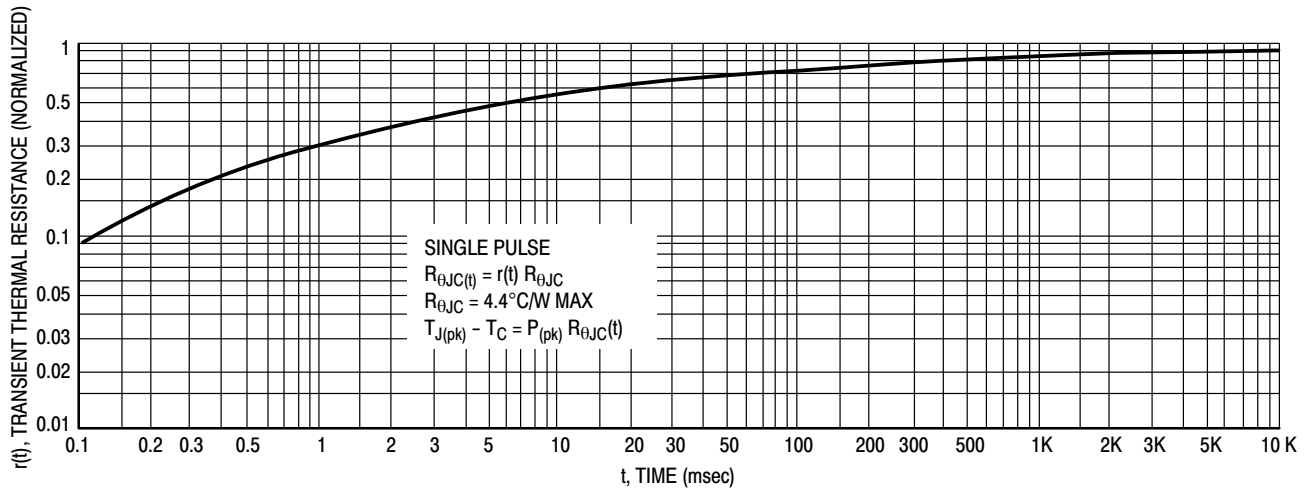


Figure 6. Thermal Response

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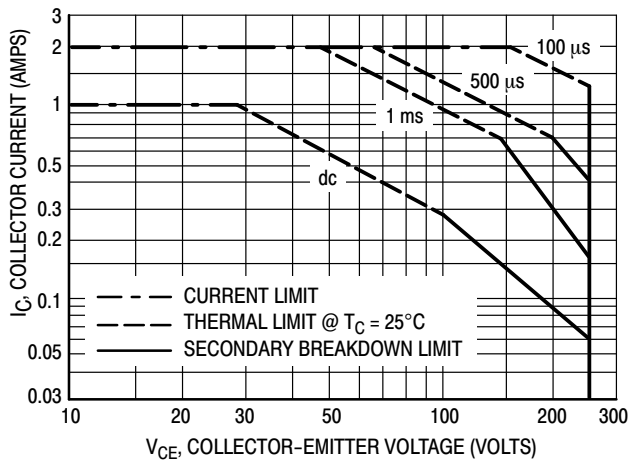


Figure 7. Maximum Forward Bias Safe Operating Area

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

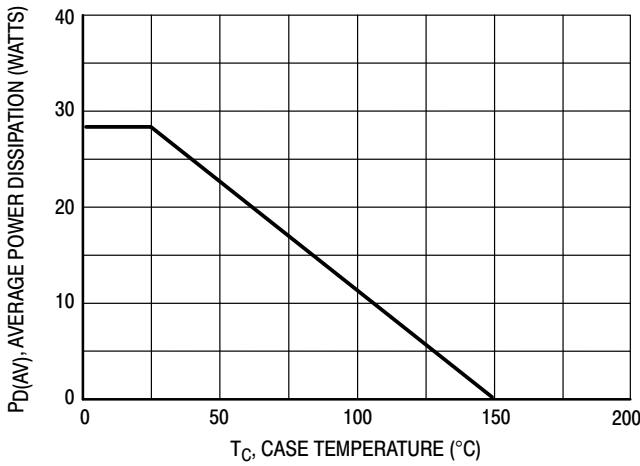


Figure 8. Power Derating

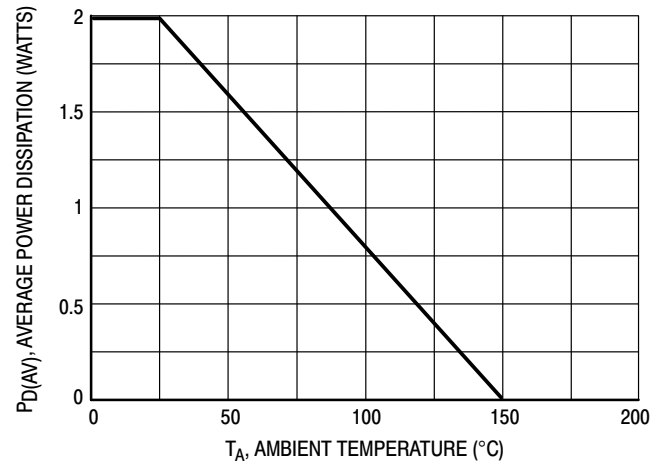


Figure 9. Power Derating

TEST CONDITIONS FOR ISOLATION TESTS*

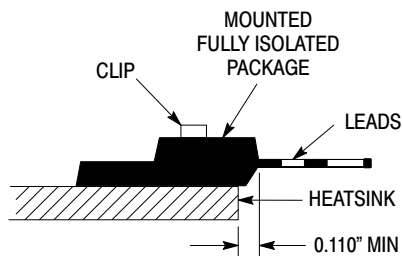


Figure 10. Clip Mounting Position for Isolation Test Number 1

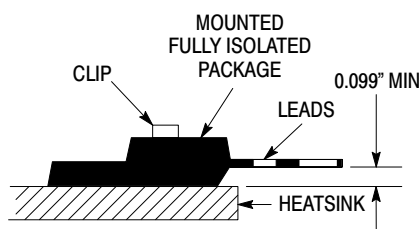


Figure 11. Clip Mounting Position for Isolation Test Number 2

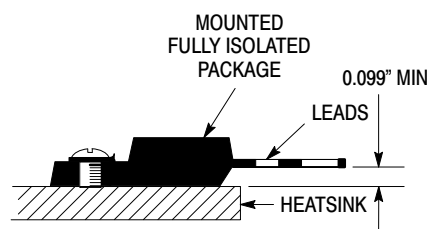


Figure 12. Screw Mounting Position for Isolation Test Number 3

*Measurement made between leads and heatsink with all leads shorted together

MOUNTING INFORMATION

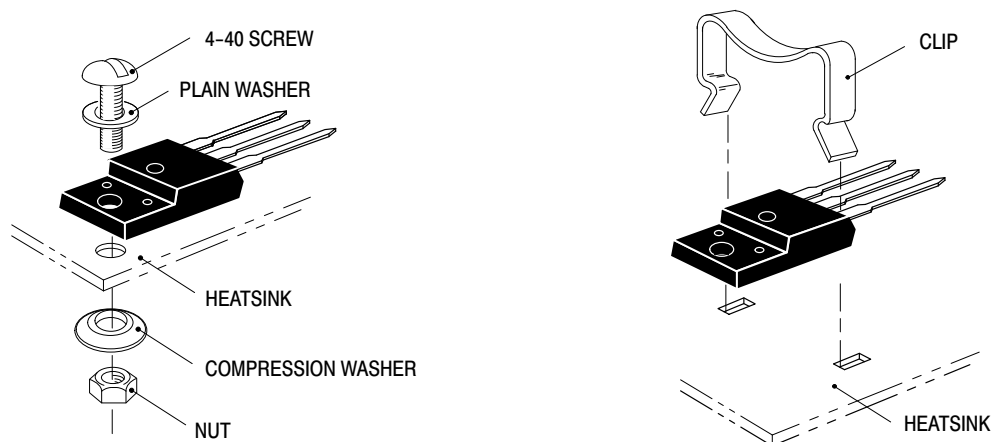


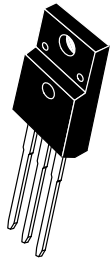
Figure 13. Typical Mounting Techniques*

Laboratory tests on a limited number of samples indicate, when using the screw and compression washer mounting technique, a screw torque of 6 to 8 in · lbs is sufficient to provide maximum power dissipation capability. The compression washer helps to maintain a constant pressure on the package over time and during large temperature excursions.

Destructive laboratory tests show that using a hex head 4-40 screw, without washers, and applying a torque in excess of 20 in · lbs will cause the plastic to crack around the mounting hole, resulting in a loss of isolation capability.

Additional tests on slotted 4-40 screws indicate that the screw slot fails between 15 to 20 in · lbs without adversely affecting the package. However, in order to positively ensure the package integrity of the fully isolated device, **onsemi** does not recommend exceeding 10 in · lbs of mounting torque under any mounting conditions.

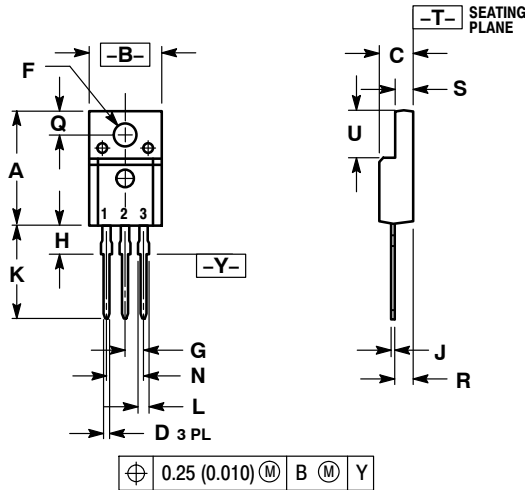
**For more information about mounting power semiconductors see Application Note AN1040.



SCALE 1:1

TO-220 FULLPAK
CASE 221D-03
ISSUE K

DATE 27 FEB 2009



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH
 3. 221D-01 THRU 221D-02 OBSOLETE, NEW STANDARD 221D-03.

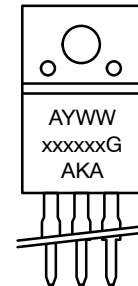
| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.617 | 0.635 | 15.67 | 16.12 |
| B | 0.392 | 0.419 | 9.96 | 10.63 |
| C | 0.177 | 0.193 | 4.50 | 4.90 |
| D | 0.024 | 0.039 | 0.60 | 1.00 |
| F | 0.116 | 0.129 | 2.95 | 3.28 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.118 | 0.135 | 3.00 | 3.43 |
| J | 0.018 | 0.025 | 0.45 | 0.63 |
| K | 0.503 | 0.541 | 12.78 | 13.73 |
| L | 0.048 | 0.058 | 1.23 | 1.47 |
| N | 0.200 BSC | | 5.08 BSC | |
| Q | 0.122 | 0.138 | 3.10 | 3.50 |
| R | 0.099 | 0.117 | 2.51 | 2.96 |
| S | 0.092 | 0.113 | 2.34 | 2.87 |
| U | 0.239 | 0.271 | 6.06 | 6.88 |

MARKING
DIAGRAMS

- STYLE 1:
PIN 1. GATE
2. DRAIN
3. SOURCE
- STYLE 2:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
- STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
- STYLE 4:
PIN 1. CATHODE
2. ANODE
3. CATHODE
- STYLE 5:
PIN 1. CATHODE
2. ANODE
3. GATE
- STYLE 6:
PIN 1. MT 1
2. MT 2
3. GATE



Bipolar



Rectifier

xxxxxx = Specific Device Code
G = Pb-Free Package
A = Assembly Location
Y = Year
WW = Work Week

A = Assembly Location
Y = Year
WW = Work Week
xxxxxx = Device Code
G = Pb-Free Package
AKA = Polarity Designator

| | | |
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