

# MJ15001 (NPN), MJ15002 (PNP)

## Complementary Silicon Power Transistors

The MJ15001 and MJ15002 are power transistors designed for high power audio, disk head positioners and other linear applications.

### Features

- High Safe Operating Area
- For Low Distortion Complementary Designs
- High DC Current Gain
- These Devices are Pb-Free and are RoHS Compliant\*

### MAXIMUM RATINGS

| Rating  | Symbol         | Value       | Unit                     |
|---|----------------|-------------|--------------------------|
| Collector-Emitter Voltage   | $V_{CEO}$      | 140         | Vdc                      |
| Collector-Base Voltage  | $V_{CB0}$      | 140         | Vdc                      |
| Emitter-Base Voltage  | $V_{EBO}$      | 5           | Vdc                      |
| Collector Current - Continuous  | $I_C$          | 15          | Adc                      |
| Base Current - Continuous   | $I_B$          | 5           | Adc                      |
| Emitter Current - Continuous  | $I_E$          | 20          | Adc                      |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 200<br>1.14 | W<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                   | $T_J, T_{stg}$ | -65 to +200 | $^\circ\text{C}$         |

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.

### THERMAL CHARACTERISTICS

| Characteristic  | Symbol          | Max   | Unit                      |
|---|-----------------|-------|---------------------------|
| Thermal Resistance, Junction-to-Case  | $R_{\theta JC}$ | 0.875 | $^\circ\text{C}/\text{W}$ |
| Maximum Lead Temperature for Soldering<br>Purposes 1/16" from Case for $\leq 10$ secs | $T_L$           | 265   | $^\circ\text{C}$          |

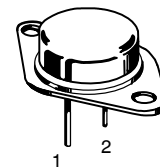
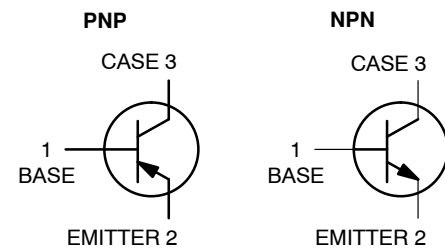


**ON Semiconductor®**

<http://onsemi.com>

## 20 AMPERE POWER TRANSISTORS COMPLEMENTARY SILICON 140 VOLTS, 250 WATTS

### SCHEMATIC



**TO-204AA (TO-3)  
CASE 1-07  
STYLE 1**

### MARKING DIAGRAM



MJ1500x = Device Code  
x = 1 or 2  
G = Pb-Free Package  
A = Location Code  
YY = Year  
WW = Work Week  
MEX = Country of Origin

### ORDERING INFORMATION

| Device   | Package               | Shipping       |
|----------|-----------------------|----------------|
| MJ15001G | TO-204AA<br>(Pb-Free) | 100 Units/Tray |
| MJ15002G | TO-204AA<br>(Pb-Free) | 100 Units/Tray |

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

# MJ15001 (NPN), MJ15002 (PNP)

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

| Characteristic   | Symbol         | Min        | Max        | Unit                    |
|--|----------------|------------|------------|-------------------------|
| <b>OFF CHARACTERISTICS</b>   |                |            |            |                         |
| Collector-Emitter Sustaining Voltage (Note 1)<br>( $I_C = 200 \text{ mAdc}$ , $I_B = 0$ )  | $V_{CEO(sus)}$ | 140        | –          | Vdc                     |
| Collector Cutoff Current<br>( $V_{CE} = 140 \text{ Vdc}$ , $V_{BE(off)} = 1.5 \text{ Vdc}$ )<br>( $V_{CE} = 140 \text{ Vdc}$ , $V_{BE(off)} = 1.5 \text{ Vdc}$ , $T_C = 150^\circ\text{C}$ )           | $I_{CEX}$      | –          | 100<br>2.0 | $\mu\text{Adc}$<br>mAdc |
| Collector Cutoff Current<br>( $V_{CE} = 140 \text{ Vdc}$ , $I_B = 0$ )   | $I_{CEO}$      | –          | 250        | $\mu\text{Adc}$         |
| Emitter Cutoff Current<br>( $V_{EB} = 5 \text{ Vdc}$ , $I_C = 0$ )   | $I_{EBO}$      | –          | 100        | $\mu\text{Adc}$         |
| <b>SECOND BREAKDOWN</b>  |                |            |            |                         |
| Second Breakdown Collector Current with Base Forward Biased<br>( $V_{CE} = 40 \text{ Vdc}$ , $t = 1 \text{ s}$ (non-repetitive))<br>( $V_{CE} = 100 \text{ Vdc}$ , $t = 1 \text{ s}$ (non-repetitive)) | $I_{S/b}$      | 5.0<br>0.5 | –<br>–     | Adc                     |
| <b>ON CHARACTERISTICS</b>  |                |            |            |                         |
| DC Current Gain<br>( $I_C = 4 \text{ Adc}$ , $V_{CE} = 2 \text{ Vdc}$ )  | $h_{FE}$       | 25         | 150        | –                       |
| Collector-Emitter Saturation Voltage<br>( $I_C = 4 \text{ Adc}$ , $I_B = 0.4 \text{ Adc}$ )  | $V_{CE(sat)}$  | –          | 1.0        | Vdc                     |
| Base-Emitter On Voltage<br>( $I_C = 4 \text{ Adc}$ , $V_{CE} = 2 \text{ Vdc}$ )  | $V_{BE(on)}$   | –          | 2.0        | Vdc                     |
| <b>DYNAMIC CHARACTERISTICS</b>   |                |            |            |                         |
| Current-Gain — Bandwidth Product<br>( $I_C = 0.5 \text{ Adc}$ , $V_{CE} = 10 \text{ Vdc}$ , $f_{test} = 0.5 \text{ MHz}$ )   | $f_T$          | 2.0        | –          | MHz                     |
| Output Capacitance<br>( $V_{CB} = 10 \text{ Vdc}$ , $I_E = 0$ , $f_{test} = 1 \text{ MHz}$ )   | $C_{ob}$       | –          | 1000       | pF                      |

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

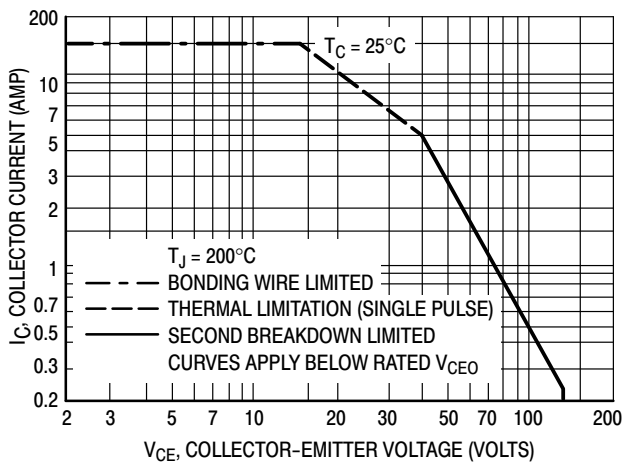


Figure 1. Active-Region Safe Operating Area

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 1 is based on  $T_J(pk) = 200^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

# MJ15001 (NPN), MJ15002 (PNP)

## TYPICAL CHARACTERISTICS

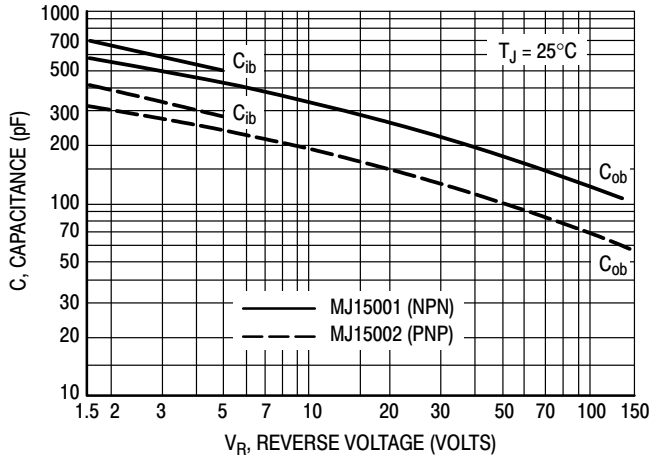


Figure 2. Capacitances

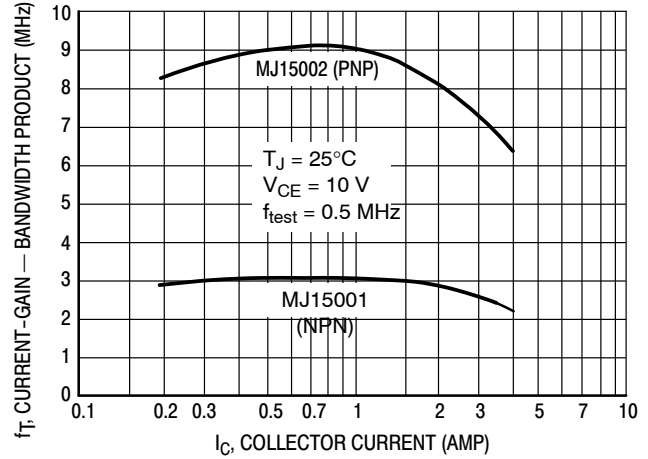


Figure 3. Current-Gain — Bandwidth Product

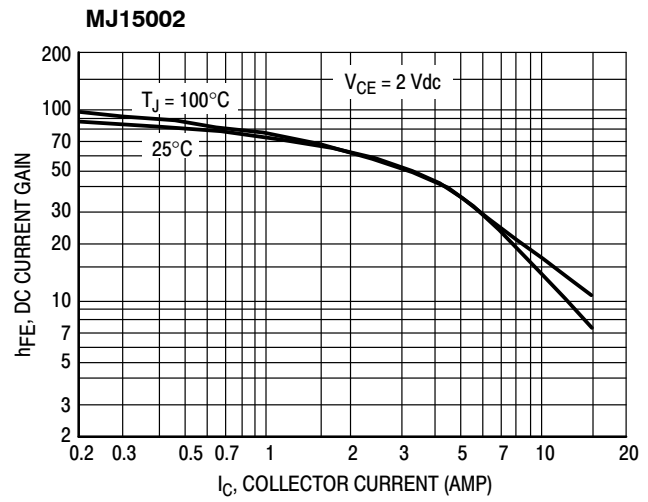
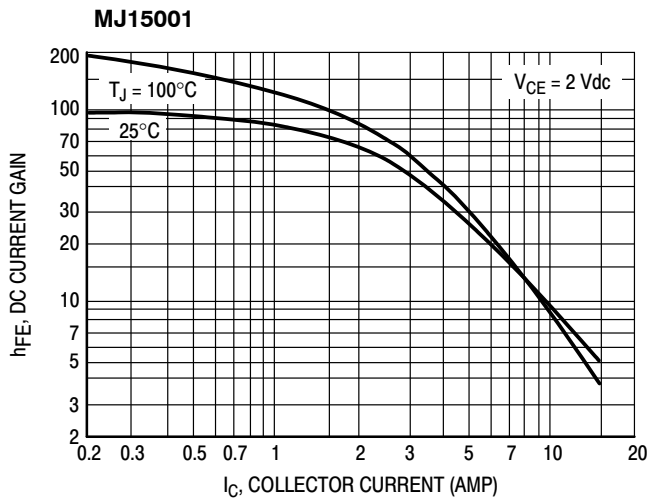


Figure 4. DC Current Gain

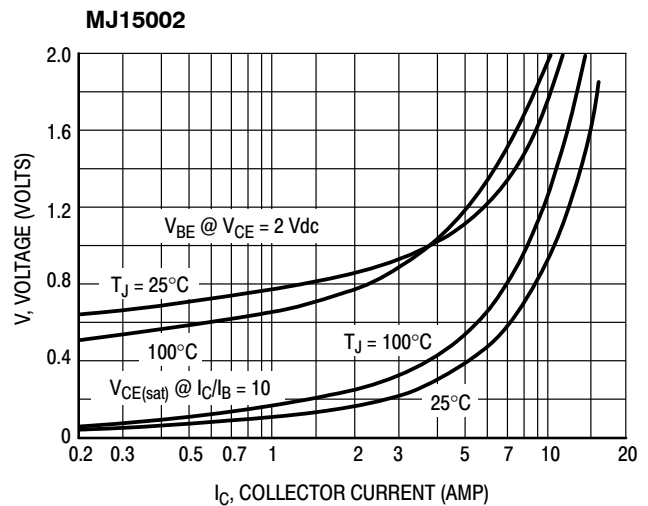
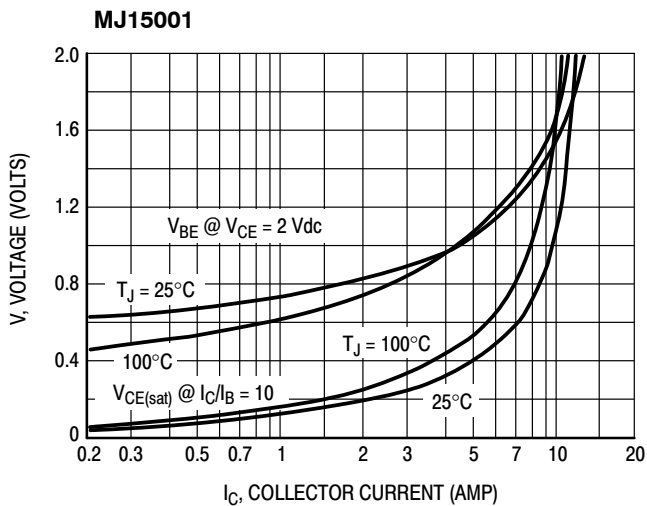


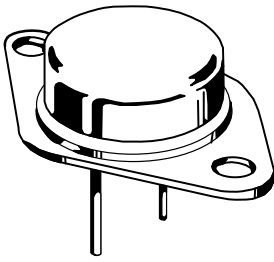
Figure 5. "On" Voltages

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

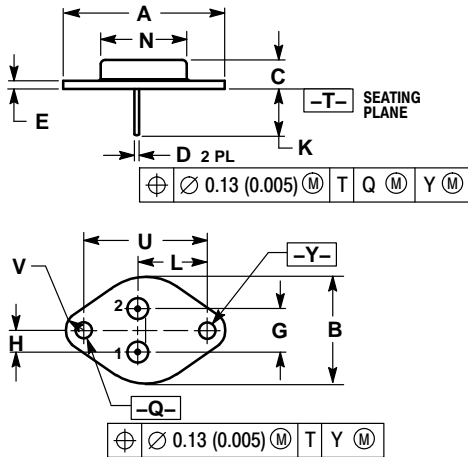


## TO-204 (TO-3) CASE 1-07 ISSUE Z

DATE 05/18/1988



SCALE 1:1



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO-204AA OUTLINE SHALL APPLY.

| DIM | INCHES    |           | MILLIMETERS |           |
|-----|-----------|-----------|-------------|-----------|
|     | MIN       | MAX       | MIN         | MAX       |
| A   | 1.550 REF | ---       | 39.37 REF   | ---       |
| B   | ---       | 1.050     | ---         | 26.67     |
| C   | 0.250     | 0.335     | 6.35        | 8.51      |
| D   | 0.038     | 0.043     | 0.97        | 1.09      |
| E   | 0.055     | 0.070     | 1.40        | 1.77      |
| G   | 0.430 BSC | ---       | 10.92 BSC   | ---       |
| H   | 0.215 BSC | ---       | 5.46 BSC    | ---       |
| K   | 0.440     | 0.480     | 11.18       | 12.19     |
| L   | ---       | 0.665 BSC | ---         | 16.89 BSC |
| N   | ---       | 0.830     | ---         | 21.08     |
| Q   | 0.151     | 0.165     | 3.84        | 4.19      |
| U   | 1.187 BSC | ---       | 30.15 BSC   | ---       |
| V   | 0.131     | 0.188     | 3.33        | 4.77      |

- |  |  |   |   |   |
|--|--|---|---|---|
| <p>STYLE 1:<br/>PIN 1. BASE<br/>2. EMITTER<br/>CASE: COLLECTOR</p> | <p>STYLE 2:<br/>PIN 1. BASE<br/>2. COLLECTOR<br/>CASE: EMITTER</p> | <p>STYLE 3:<br/>PIN 1. GATE<br/>2. SOURCE<br/>CASE: DRAIN</p>           | <p>STYLE 4:<br/>PIN 1. GROUND<br/>2. INPUT<br/>CASE: OUTPUT</p>       | <p>STYLE 5:<br/>PIN 1. CATHODE<br/>2. EXTERNAL TRIP/DELAY<br/>CASE: ANODE</p> |
| <p>STYLE 6:<br/>PIN 1. GATE<br/>2. EMITTER<br/>CASE: COLLECTOR</p> | <p>STYLE 7:<br/>PIN 1. ANODE<br/>2. OPEN<br/>CASE: CATHODE</p>     | <p>STYLE 8:<br/>PIN 1. CATHODE #1<br/>2. CATHODE #2<br/>CASE: ANODE</p> | <p>STYLE 9:<br/>PIN 1. ANODE #1<br/>2. ANODE #2<br/>CASE: CATHODE</p> |   |

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer.

**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at [www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)