

# Silicon Power Transistors

## MJ15022 (NPN), MJ15024 (NPN)

The MJ15022 and MJ15024 are power transistors designed for high power audio, disk head positioners and other linear applications.

### Features

- High Safe Operating Area
- High DC Current Gain
- These Devices are Pb-Free and are RoHS Compliant\*
- Complementary to MJ15023 (PNP), MJ15025 (PNP)

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage MJ15022 MJ15024	$V_{CEO}$	200 250	Vdc
Collector-Base Voltage MJ15022 MJ15024	$V_{CBO}$	350 400	Vdc
Emitter-Base Voltage	$V_{EBO}$	5	Vdc
Collector-Emitter Voltage	$V_{CEX}$	400	Vdc
Collector Current – Continuous	$I_C$	16	Adc
Collector Current – Peak (Note 1)	$I_{CM}$	30	Adc
Base Current – Continuous	$I_B$	5	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	250 1.43	W W/ $^\circ\text{C}$
Operating and Storage Junction 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.

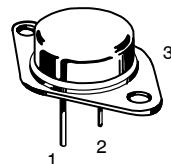
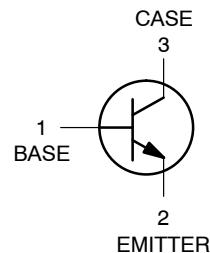
1. Pulse Test: Pulse Width = 5 ms, Duty Cycle  $\leq 10\%$ .

### THERMAL CHARACTERISTICS

Characteristics	Symbol	Max	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.70	$^\circ\text{C/W}$

## 16 AMPERES SILICON POWER TRANSISTORS 200 – 250 VOLTS, 250 WATTS

### SCHEMATIC



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

### MARKING DIAGRAM



MJ1502x	= Device Code
x	= 2 or 4
G	= Pb-Free Package
A	= Assembly Location
Y	= Year
WW	= Work Week
MEX	= Country of Origin

### ORDERING INFORMATION

Device	Package	Shipping
MJ15022G	TO-204 (Pb-Free)	100 Units / Tray
MJ15024G	TO-204 (Pb-Free)	100 Units / Tray

†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](#).

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

# MJ15022 (NPN), MJ15024 (NPN)

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 2) ( $I_C = 100 \text{ mA}_\text{dc}$ , $I_B = 0$ )	$V_{\text{CEO}(\text{sus})}$	200 250	—	—
Collector Cutoff Current ( $V_{\text{CE}} = 200 \text{ Vdc}$ , $V_{\text{BE}(\text{off})} = 1.5 \text{ Vdc}$ ) ( $V_{\text{CE}} = 250 \text{ Vdc}$ , $V_{\text{BE}(\text{off})} = 1.5 \text{ Vdc}$ )	$I_{\text{CEX}}$	— —	250 250	$\mu\text{A}_\text{dc}$
Collector Cutoff Current ( $V_{\text{CE}} = 150 \text{ Vdc}$ , $I_B = 0$ ) ( $V_{\text{CE}} = 200 \text{ vdc}$ , $I_B = 0$ )	$I_{\text{CEO}}$	— —	500 500	$\mu\text{A}_\text{dc}$
Emitter Cutoff Current ( $V_{\text{CE}} = 5 \text{ Vdc}$ , $I_B = 0$ )	$I_{\text{EBO}}$	—	500	$\mu\text{A}_\text{dc}$
<b>SECOND BREAKDOWN</b>				
Second Breakdown Collector Current with Base Forward Biased ( $V_{\text{CE}} = 50 \text{ Vdc}$ , $t = 0.5 \text{ s}$ (non-repetitive)) ( $V_{\text{CE}} = 80 \text{ Vdc}$ , $t = 0.5 \text{ s}$ (non-repetitive))	$I_{\text{S/b}}$	5 2	— —	$\text{A}_\text{dc}$

**ON CHARACTERISTICS**

DC Current Gain ( $I_C = 8 \text{ Adc}$ , $V_{\text{CE}} = 4 \text{ Vdc}$ ) ( $I_C = 16 \text{ Adc}$ , $V_{\text{CE}} = 4 \text{ Vdc}$ )	$h_{\text{FE}}$	15 5	60 —	—
Collector-Emitter Saturation Voltage ( $I_C = 8 \text{ Adc}$ , $I_B = 0.8 \text{ Adc}$ ) ( $I_C = 16 \text{ Adc}$ , $I_B = 3.2 \text{ Adc}$ )	$V_{\text{CE}(\text{sat})}$	— —	1.4 4.0	$\text{Vdc}$
Base-Emitter On Voltage ( $I_C = 8 \text{ Adc}$ , $V_{\text{CE}} = 4 \text{ Vdc}$ )	$V_{\text{BE}(\text{on})}$	—	2.2	$\text{Vdc}$

**DYNAMIC CHARACTERISTICS**

Current-Gain – Bandwidth Product ( $I_C = 1 \text{ Adc}$ , $V_{\text{CE}} = 10 \text{ Vdc}$ , $f_{\text{test}} = 1 \text{ MHz}$ )	$f_T$	4	—	$\text{MHz}$
Output Capacitance ( $V_{\text{CB}} = 10 \text{ Vdc}$ , $I_E = 0$ , $f_{\text{test}} = 1 \text{ MHz}$ )	$C_{\text{ob}}$	—	500	$\text{pF}$

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

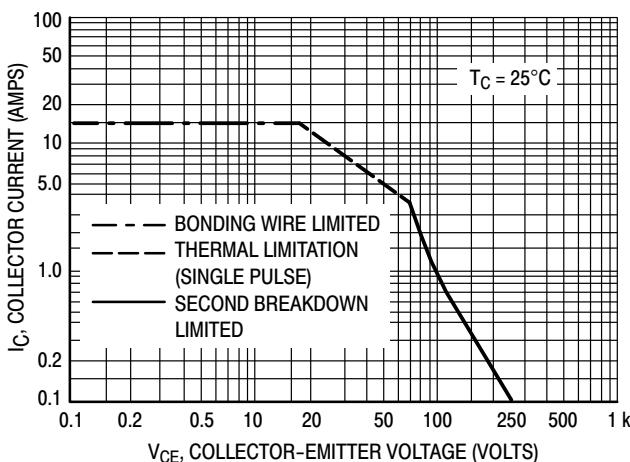


Figure 1. Active-Region Safe Operating Area

There are two limitations on the powerhandling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{\text{CE}}$  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  $T_{\text{J}(\text{pk})} = 200^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. At high case temperatures, thermal limitations will reduce the power that can be handled to values  $I_{\text{on}}$  than the limitations imposed by second breakdown.

# MJ15022 (NPN), MJ15024 (NPN)

## TYPICAL CHARACTERISTICS

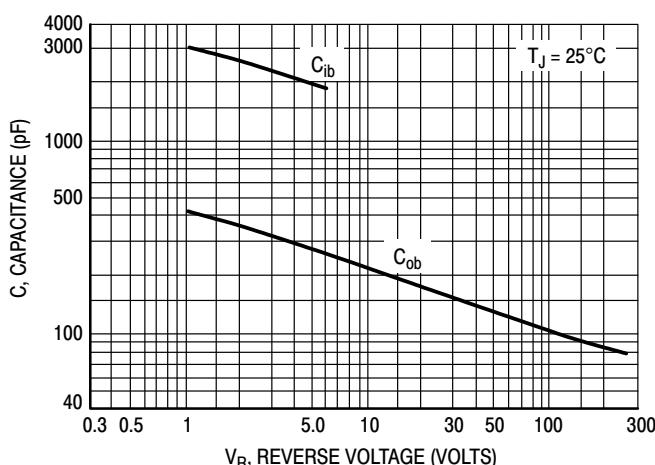


Figure 2. Capacitances

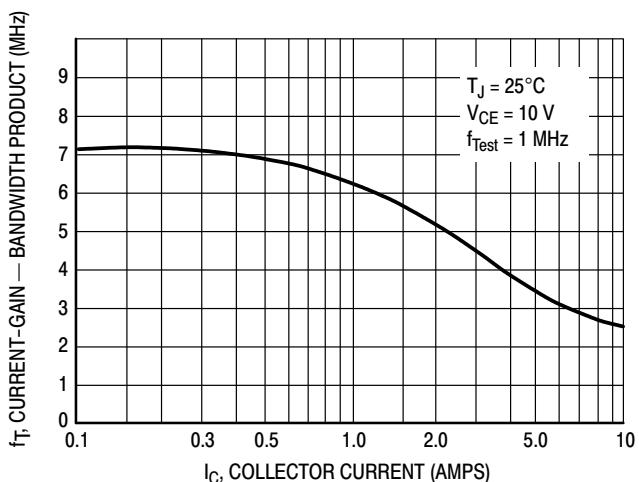


Figure 3. Current-Gain — Bandwidth Product

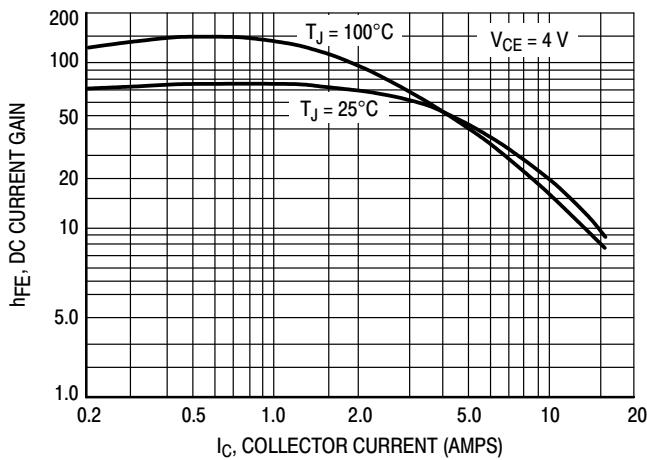


Figure 4. DC Current Gain

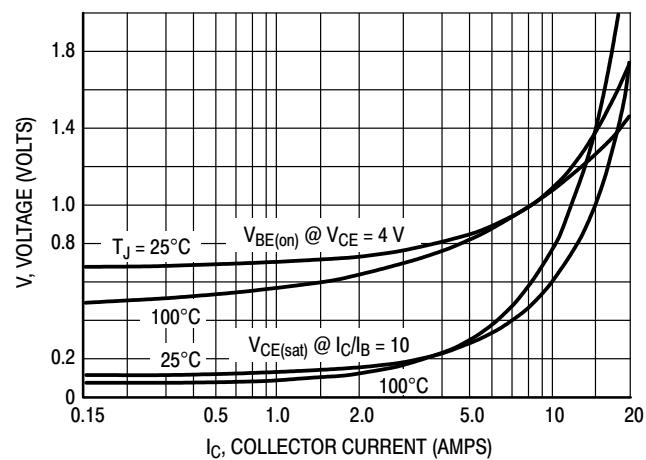


Figure 5. "On" Voltage

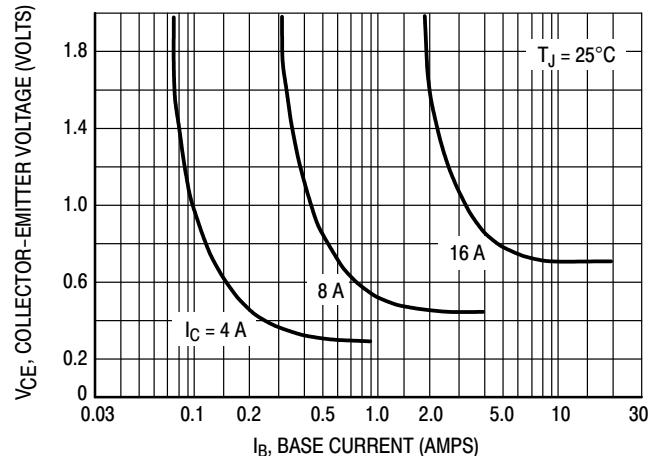
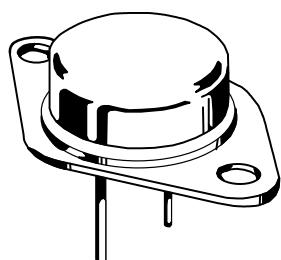


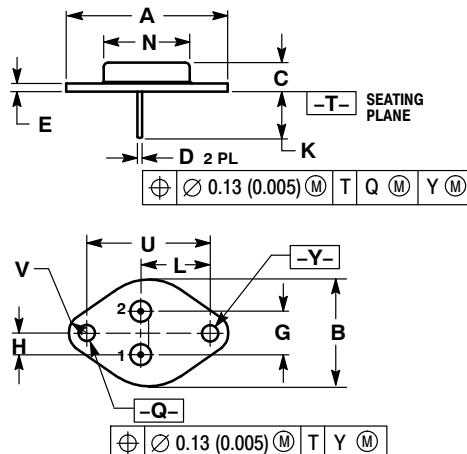
Figure 6. Collector Saturation Region



SCALE 1:1

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

DATE 10 MAR 2000



## 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

STYLE 1:  
PIN 1. BASE  
2. Emitter  
CASE: COLLECTOR

STYLE 2:  
PIN 1. BASE  
2. COLLECTOR  
CASE: Emitter

STYLE 3:  
PIN 1. GATE  
2. SOURCE  
CASE: DRAIN

STYLE 4:  
PIN 1. GROUND  
2. INPUT  
CASE: OUTPUT

STYLE 5:  
PIN 1. CATHODE  
2. EXTERNAL TRIP/DELAY  
CASE: ANODE

STYLE 6:  
PIN 1. GATE  
2. Emitter  
CASE: COLLECTOR

STYLE 7:  
PIN 1. ANODE  
2. OPEN  
CASE: CATHODE

STYLE 8:  
PIN 1. CATHODE #1  
2. CATHODE #2  
CASE: ANODE

STYLE 9:  
PIN 1. ANODE #1  
2. ANODE #2  
CASE: CATHODE

DOCUMENT NUMBER:	98ASB42001B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	TO-204 (TO-3)	PAGE 1 OF 1

onsemi and ONSEMI are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the 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. onsemi does not convey any license under its patent rights nor the rights of others.

**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)

