

# 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	$V_{CBO}$	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 @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	200 1.14	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.

### THERMAL CHARACTERISTICS

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

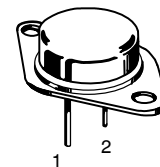
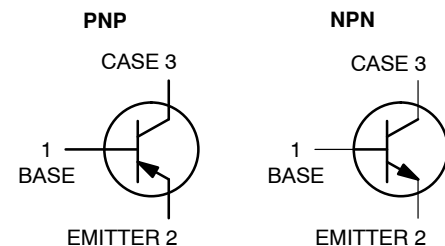


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## 20 AMPERE POWER TRANSISTORS COMPLEMENTARY SILICON 140 VOLTS, 250 WATTS

### 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 (Pb-Free)	100 Units/Tray
MJ15002G	TO-204AA (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) ( $I_C = 200 \text{ mAdc}$ , $I_B = 0$ )	$V_{CEO(sus)}$	140	–	Vdc
Collector Cutoff Current ( $V_{CE} = 140 \text{ Vdc}$ , $V_{BE(off)} = 1.5 \text{ Vdc}$ ) ( $V_{CE} = 140 \text{ Vdc}$ , $V_{BE(off)} = 1.5 \text{ Vdc}$ , $T_C = 150^\circ\text{C}$ )	$I_{CEX}$	–	100 2.0	$\mu\text{Adc}$ mAdc
Collector Cutoff Current ( $V_{CE} = 140 \text{ Vdc}$ , $I_B = 0$ )	$I_{CEO}$	–	250	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB} = 5 \text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	–	100	$\mu\text{Adc}$
<b>SECOND BREAKDOWN</b>				
Second Breakdown Collector Current with Base Forward Biased ( $V_{CE} = 40 \text{ Vdc}$ , $t = 1 \text{ s}$ (non-repetitive)) ( $V_{CE} = 100 \text{ Vdc}$ , $t = 1 \text{ s}$ (non-repetitive))	$I_{S/b}$	5.0 0.5	– –	Adc
<b>ON CHARACTERISTICS</b>				
DC Current Gain ( $I_C = 4 \text{ Adc}$ , $V_{CE} = 2 \text{ Vdc}$ )	$h_{FE}$	25	150	–
Collector-Emitter Saturation Voltage ( $I_C = 4 \text{ Adc}$ , $I_B = 0.4 \text{ Adc}$ )	$V_{CE(sat)}$	–	1.0	Vdc
Base-Emitter On Voltage ( $I_C = 4 \text{ Adc}$ , $V_{CE} = 2 \text{ Vdc}$ )	$V_{BE(on)}$	–	2.0	Vdc
<b>DYNAMIC CHARACTERISTICS</b>				
Current-Gain — Bandwidth Product ( $I_C = 0.5 \text{ Adc}$ , $V_{CE} = 10 \text{ Vdc}$ , $f_{test} = 0.5 \text{ MHz}$ )	$f_T$	2.0	–	MHz
Output Capacitance ( $V_{CB} = 10 \text{ Vdc}$ , $I_E = 0$ , $f_{test} = 1 \text{ MHz}$ )	$C_{ob}$	–	1000	pF

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

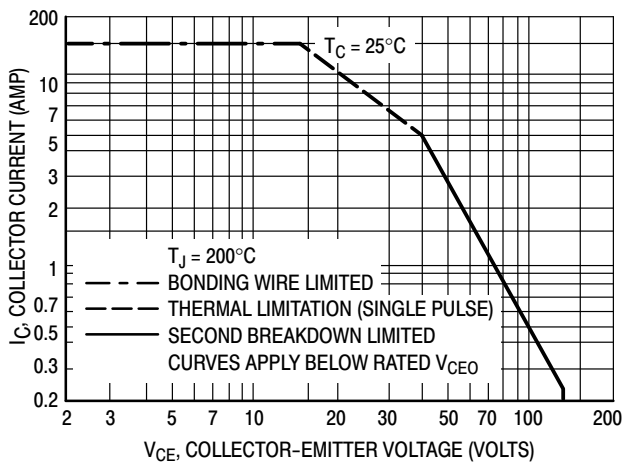


Figure 1. Active-Region Safe Operating Area

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

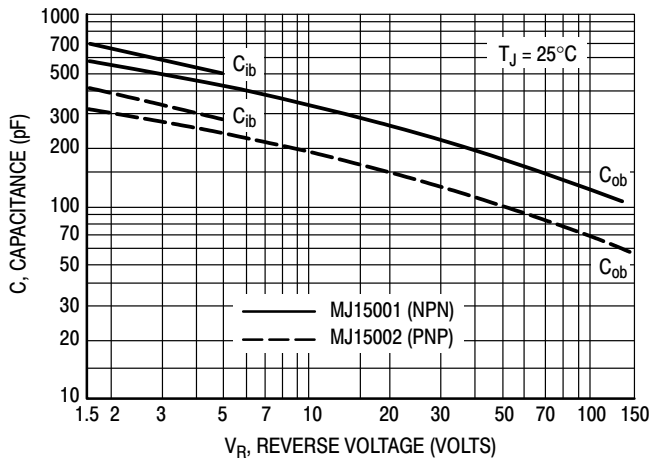


Figure 2. Capacitances

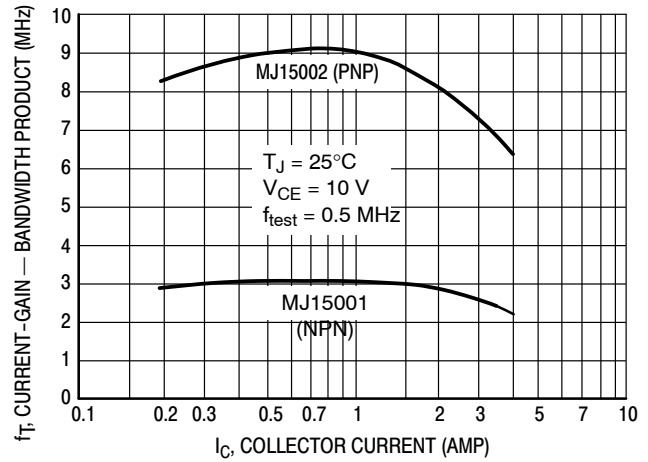


Figure 3. Current-Gain — Bandwidth Product

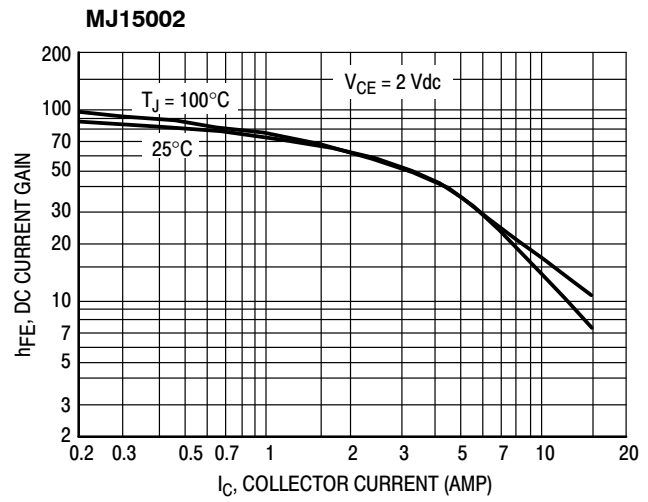
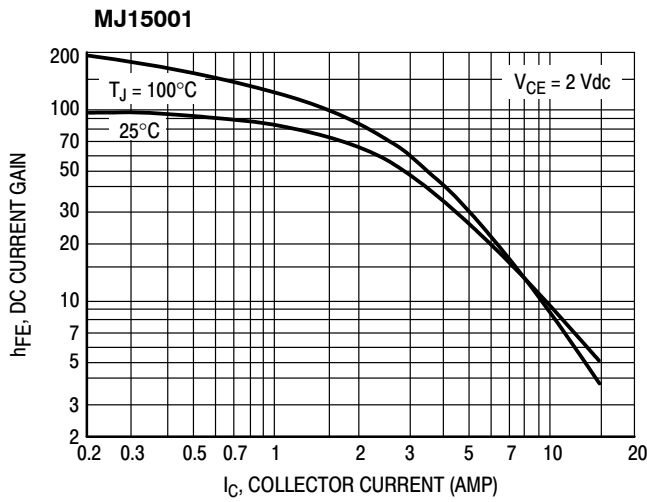


Figure 4. DC Current Gain

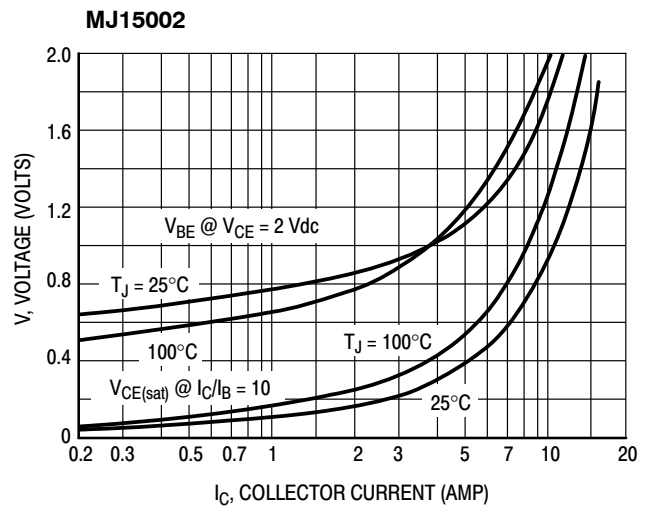
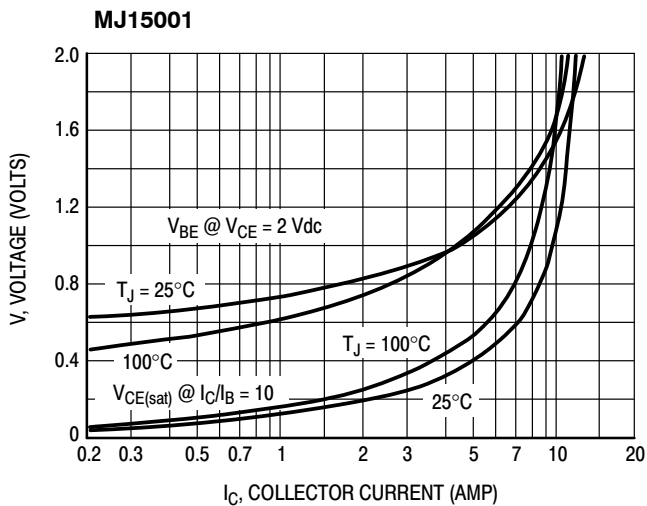
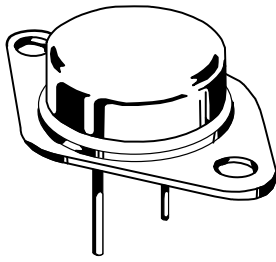


Figure 5. "On" Voltages

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

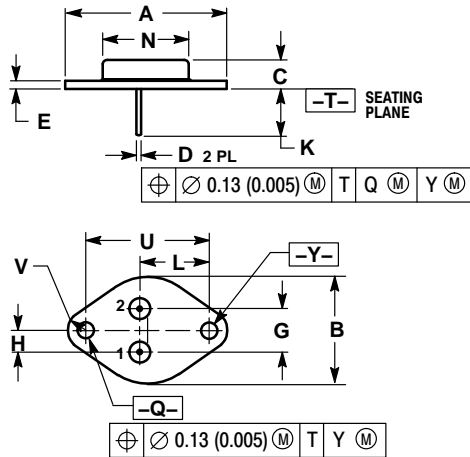
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TO-204 (TO-3)  
CASE 1-07  
ISSUE Z

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> |   |

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