

# MJ15022 (NPN), MJ15024 (NPN)

## Silicon Power Transistors

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	A dc
Collector Current – Peak (Note 1)	$I_{CM}$	30	A dc
Base Current – Continuous	$I_B$	5	A dc
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	$^\circ\text{C/W}$

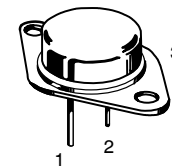
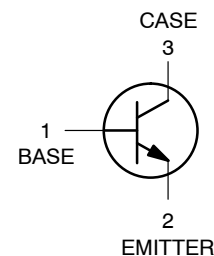


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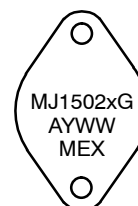
**16 AMPERES  
SILICON POWER TRANSISTORS  
200 – 250 VOLTS, 250 WATTS**

### 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 additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor 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) ( $I_C = 100\text{ mAdc}$ , $I_B = 0$ )	MJ15022 MJ15024	$V_{CEO(sus)}$	200 250	-
Collector Cutoff Current ( $V_{CE} = 200\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ ) ( $V_{CE} = 250\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ )	MJ15022 MJ15024	$I_{CEX}$	- -	250 250
Collector Cutoff Current ( $V_{CE} = 150\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 200\text{ vdc}$ , $I_B = 0$ )	MJ15022 MJ15024	$I_{CEO}$	- -	500 500
Emitter Cutoff Current ( $V_{CE} = 5\text{ Vdc}$ , $I_B = 0$ )		$I_{EBO}$	-	500
<b>SECOND BREAKDOWN</b>				
Second Breakdown Collector Current with Base Forward Biased ( $V_{CE} = 50\text{ Vdc}$ , $t = 0.5\text{ s}$ (non-repetitive)) ( $V_{CE} = 80\text{ Vdc}$ , $t = 0.5\text{ s}$ (non-repetitive))		$I_{S/b}$	5 2	- -
<b>ON CHARACTERISTICS</b>				
DC Current Gain ( $I_C = 8\text{ Adc}$ , $V_{CE} = 4\text{ Vdc}$ ) ( $I_C = 16\text{ Adc}$ , $V_{CE} = 4\text{ Vdc}$ )		$h_{FE}$	15 5	60 -
Collector-Emitter Saturation Voltage ( $I_C = 8\text{ Adc}$ , $I_B = 0.8\text{ Adc}$ ) ( $I_C = 16\text{ Adc}$ , $I_B = 3.2\text{ Adc}$ )		$V_{CE(sat)}$	- -	1.4 4.0
Base-Emitter On Voltage ( $I_C = 8\text{ Adc}$ , $V_{CE} = 4\text{ Vdc}$ )		$V_{BE(on)}$	-	2.2
<b>DYNAMIC CHARACTERISTICS</b>				
Current-Gain - Bandwidth Product ( $I_C = 1\text{ Adc}$ , $V_{CE} = 10\text{ Vdc}$ , $f_{test} = 1\text{ MHz}$ )		$f_T$	4	-
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f_{test} = 1\text{ MHz}$ )		$C_{ob}$	-	500

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

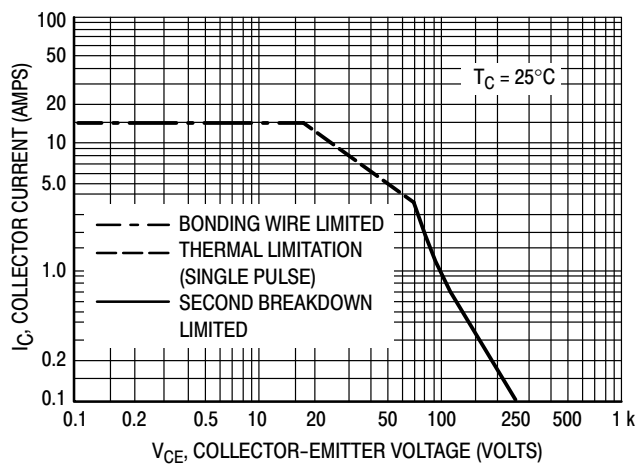


Figure 1. Active-Region Safe Operating Area

There are two limitations on the powerhandling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  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  $I_{on}$  than the limitations imposed by second breakdown.

# MJ15022 (NPN), MJ15024 (NPN)

## TYPICAL CHARACTERISTICS

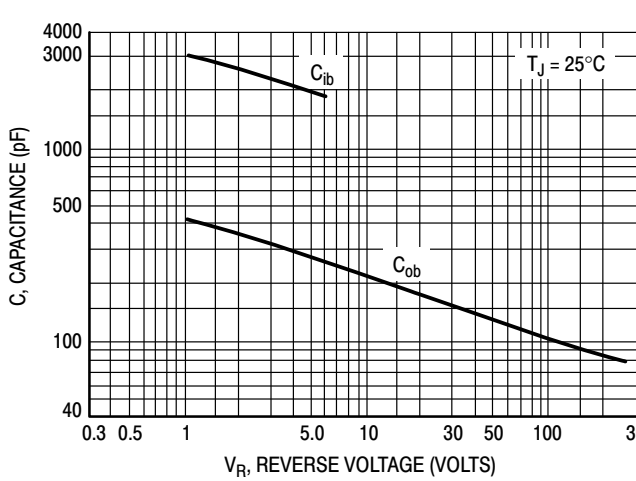


Figure 2. Capacitances

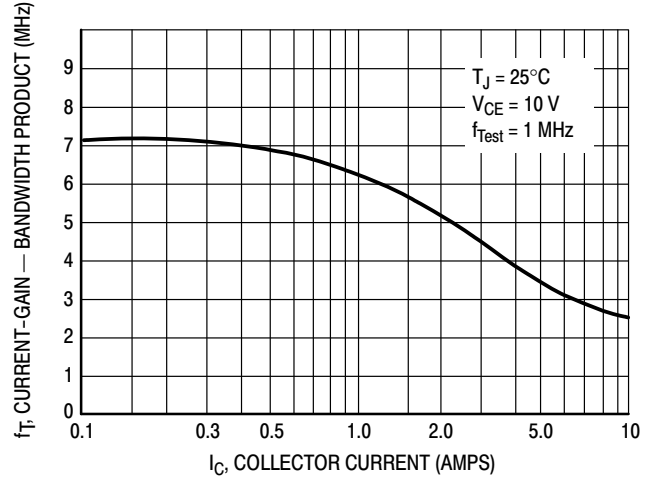


Figure 3. Current-Gain — Bandwidth Product

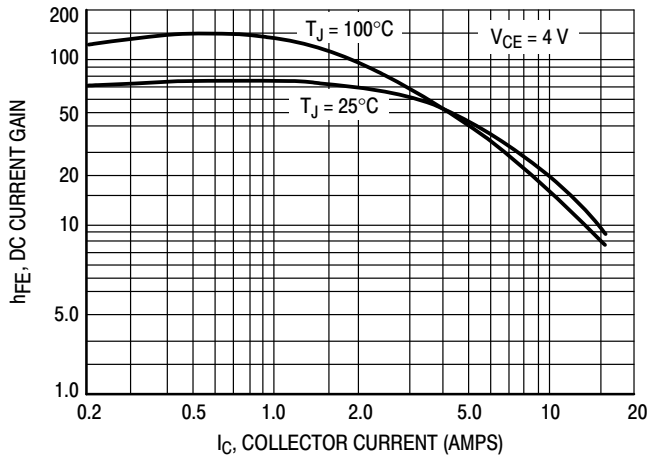


Figure 4. DC Current Gain

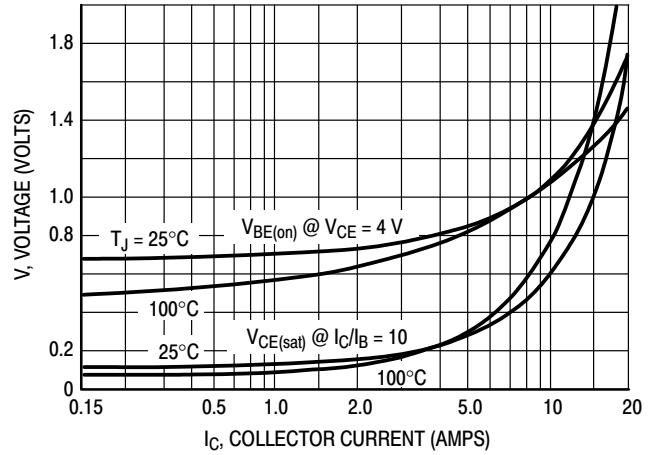


Figure 5. "On" Voltage

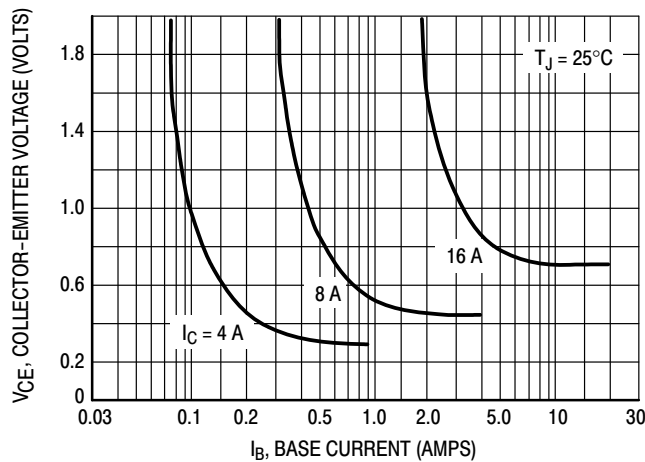
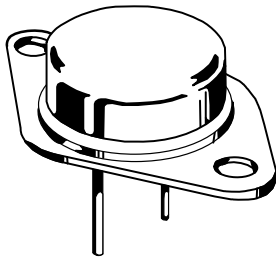


Figure 6. Collector Saturation Region

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

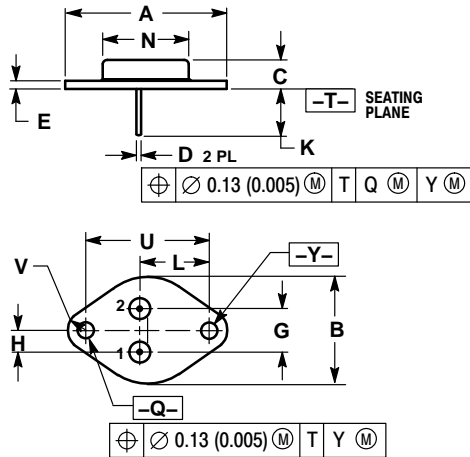
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TO-204 (TO-3)  
CASE 1-07  
ISSUE Z

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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