

# MJ21294

## NPN Silicon Power Transistor

With superior safe operating area performance, this power transistor is ideal for high temperature linear control circuits.

### Features

- Exceptional Safe Operating Area
- Dual Die Device with Standard 40 mil pins
- Pb-Free Package is Available\*

### Benefits

- More Reliable Performance at Higher Powers
- Designed for Higher Temperature SOA
- Interchangeable with Standard Single Die TO-3 Devices

### Applications

- Linear Power Supplies
- Battery Conditioning
- DC Motor Control
- Positioners
- DC Heating Controls
- High Power Audio Amplifiers

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	250	Vdc
Collector-Base Voltage	$V_{CBO}$	400	Vdc
Emitter-Base Voltage	$V_{EBO}$	5.0	Vdc
Collector-Emitter Voltage - 1.5 V	$V_{CEX}$	400	Vdc
Collector Current - Continuous Peak (Note 1)	$I_C$	20 40	Adc
Base Current - Continuous	$I_B$	5.0	Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate Above $25^\circ\text{C}$	$P_D$	350 2.0	W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +200	$^\circ\text{C}$

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.50	$^\circ\text{C}/\text{W}$

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. Pulse Test: Pulse Width = 5  $\mu\text{s}$ , Duty Cycle  $\leq 10\%$ . (continued)

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



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**20 AMPS  
250 VOLTS  
350 WATTS**

### MARKING DIAGRAM



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



MJ21294 = Specific Device Code  
G = Pb-Free Package  
A = Assembly Site  
YY = Year  
WW = Work Week  
MEX = Assembly Location

### ORDERING INFORMATION

Device	Package	Shipping
MJ21294	TO-3	100 Units / Tray
MJ21294G	TO-3 (Pb-Free)	100 Units / Tray



## MJ21294

### ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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#### OFF CHARACTERISTICS

Collector–Emitter Sustaining Voltage (I <sub>C</sub> = 100 mA <sub>dc</sub> , I <sub>B</sub> = 0)	V <sub>CE(sus)</sub>	250	–	–	V <sub>dc</sub>
Collector Cutoff Current (V <sub>CE</sub> = 200 V <sub>dc</sub> , I <sub>B</sub> = 0)	I <sub>CEO</sub>	–	–	100	μA <sub>dc</sub>
Emitter Cutoff Current (V <sub>CE</sub> = 5 V <sub>dc</sub> , I <sub>C</sub> = 0)	I <sub>EBO</sub>	–	–	10	μA <sub>dc</sub>
Collector Cutoff Current (V <sub>CE</sub> = 250 V <sub>dc</sub> , V <sub>BE(off)</sub> = 1.5 V <sub>dc</sub> )	I <sub>CEx</sub>	–	–	100	μA <sub>dc</sub>

#### SECOND BREAKDOWN

Second Breakdown Collector Current with Base Forward Biased (V <sub>CE</sub> = 40 V <sub>dc</sub> , t = 1 s (non-repetitive))	I <sub>S/b</sub>	6.0	–	–	A <sub>dc</sub>
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#### ON CHARACTERISTICS

DC Current Gain (I <sub>C</sub> = 8 A <sub>dc</sub> , V <sub>CE</sub> = 5 V <sub>dc</sub> ) (I <sub>C</sub> = 16 A <sub>dc</sub> , V <sub>CE</sub> = 5 V <sub>dc</sub> )	h <sub>FE</sub>	40 15	– –	100 –	
Base–Emitter On Voltage (I <sub>C</sub> = 8 A <sub>dc</sub> , V <sub>CE</sub> = 5 V <sub>dc</sub> )	V <sub>BE(on)</sub>	–	–	1.4	V <sub>dc</sub>
Collector–Emitter Saturation Voltage (I <sub>C</sub> = 8 A <sub>dc</sub> , I <sub>B</sub> = 0.8 A <sub>dc</sub> ) (I <sub>C</sub> = 16 A <sub>dc</sub> , I <sub>B</sub> = 3.2 A <sub>dc</sub> )	V <sub>CE(sat)</sub>	– –	– –	0.5 1.0	V <sub>dc</sub>

#### DYNAMIC CHARACTERISTICS

Current Gain Bandwidth Product (I <sub>C</sub> = 1 A <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f <sub>test</sub> = 1 MHz)	f <sub>T</sub>	4	–	–	MHz
Output Capacitance (V <sub>CB</sub> = 10 V <sub>dc</sub> , I <sub>E</sub> = 0, f <sub>test</sub> = 1 MHz)	C <sub>ob</sub>	–	–	500	pF

NOTE: Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤2%

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## TYPICAL CHARACTERISTICS

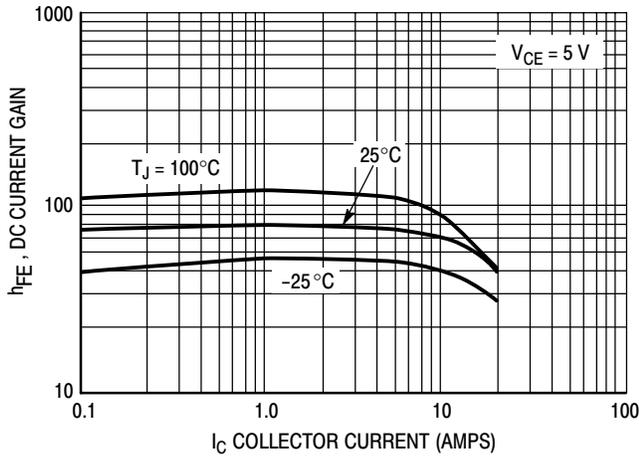


Figure 1. DC Current Gain

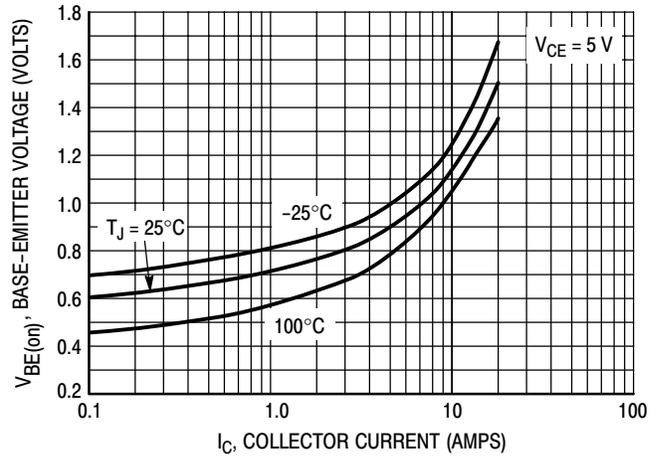


Figure 2. Base-Emitter Voltage

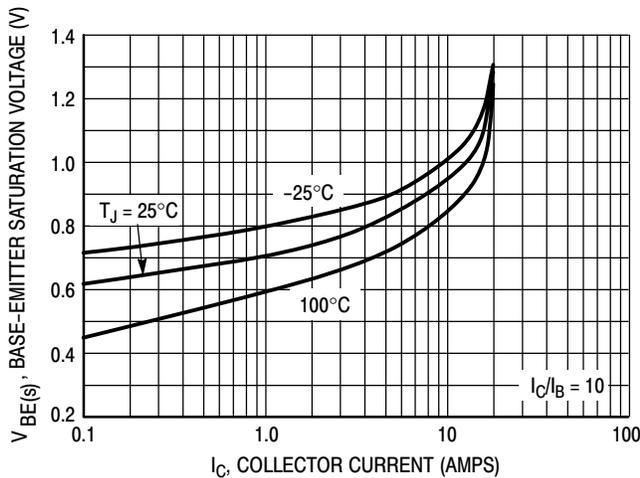


Figure 3. Base-Emitter Saturation Voltage

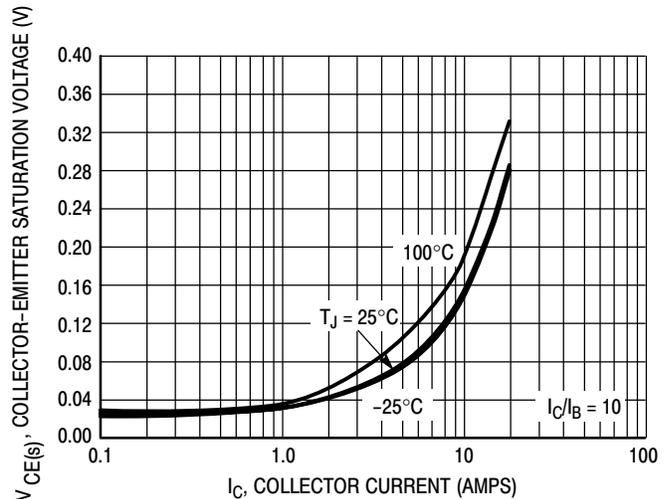


Figure 4. Collector-Emitter Saturation Voltage

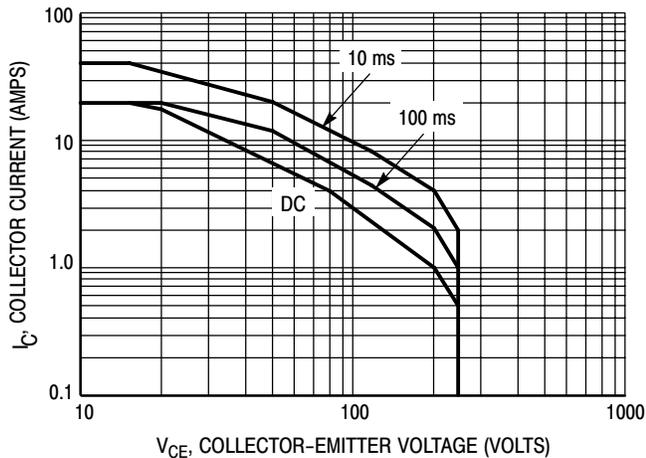


Figure 5. Active Region Safe Operating Area

There are two limitations on the power handling ability of a transistor; average junction temperature and secondary 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 5 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 than can be handled to values less than the limitations imposed by second breakdown.

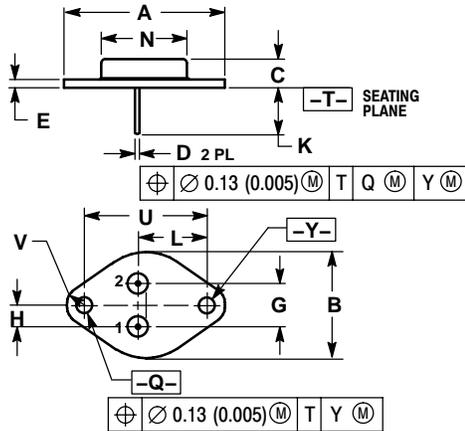
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## PACKAGE DIMENSIONS

### TO-204AA (TO-3)

CASE 1-07

ISSUE Z



#### 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:

1. BASE
  2. EMITTER
- CASE: COLLECTOR

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