

*Designer's™ Data Sheet*  
**Complementary NPN-PNP  
Silicon Power Bipolar Transistor**

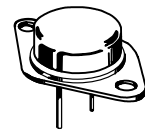
The MJ3281A and MJ1302A are PowerBase power transistors for high power audio, disk head positioners and other linear applications.

- Designed for 100 W Audio Frequency
- Gain Complementary:
  - Gain Linearity from 100 mA to 7 A
  - High Gain — 60 to 175
  - $h_{FE} = 45$  (Min) @  $I_C = 8$  A
- Low Harmonic Distortion
- High Safe Operation Area — 1 A/100 V @ 1 sec
- High  $f_T$  — 30 MHz Typical

**NPN  
MJ3281A\*  
PNP  
MJ1302A\***

\*Motorola Preferred Device

**15 AMPERE  
COMPLEMENTARY  
SILICON POWER  
TRANSISTORS  
200 VOLTS  
250 WATTS**



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

**MAXIMUM RATINGS** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	200	Vdc
Collector-Base Voltage	$V_{CBO}$	200	Vdc
Emitter-Base Voltage	$V_{EBO}$	7	Vdc
Collector-Emitter Voltage — 1.5 V	$V_{CEX}$	200	Vdc
Collector Current — Continuous — Peak (1)	$I_C$	15 25	Adc
Base Current — Continuous	$I_B$	1.5	Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate Above $25^\circ\text{C}$	$P_D$	250 1.43	Watts 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	$R_{\theta JC}$	0.7	$^\circ\text{C/W}$

(1) Pulse Test: Pulse Width = 5 ms, Duty Cycle <10%.

**Designer's Data for "Worst Case" Conditions** — The Designer's Data Sheet permits the design of most circuits entirely from the information presented. SOA Limit curves — representing boundaries on device characteristics — are given to facilitate "worst case" design.

Designer's is a trademark of Motorola, Inc.

**Preferred** devices are Motorola recommended choices for future use and best overall value.

## MJ3281A MJ1302A

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Sustaining Voltage ( $I_C = 100\text{ mA}$ , $I_B = 0$ )	$V_{CEO(sus)}$	200	—	—	Vdc
Emitter–Base Voltage ( $I_E = 100\ \mu\text{A}$ , $I_C = 0$ )	$V_{EBO}$	7	—	—	Vdc
Collector Cutoff Current ( $V_{CB} = 200\text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$	—	—	50	$\mu\text{A}$
Emitter Cutoff Current ( $V_{EB} = 5\text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	—	—	5	$\mu\text{A}$
Emitter Cutoff Current ( $V_{EB} = 7\text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	—	—	25	$\mu\text{A}$
<b>SECOND BREAKDOWN</b>					
Second Breakdown Collector with Base Forward Biased ( $V_{CE} = 50\text{ Vdc}$ , $t = 1\text{ s}$ (non-repetitive)) ( $V_{CE} = 100\text{ Vdc}$ , $t = 1\text{ s}$ (non-repetitive))	$I_{S/b}$	4 1	— —	— —	A
<b>ON CHARACTERISTICS</b>					
DC Current Gain ( $I_C = 100\text{ mA}$ , $V_{CE} = 5\text{ Vdc}$ ) ( $I_C = 1\text{ A}$ , $V_{CE} = 5\text{ Vdc}$ ) ( $I_C = 3\text{ A}$ , $V_{CE} = 5\text{ Vdc}$ ) ( $I_C = 5\text{ A}$ , $V_{CE} = 5\text{ Vdc}$ ) ( $I_C = 7\text{ A}$ , $V_{CE} = 5\text{ Vdc}$ ) ( $I_C = 8\text{ A}$ , $V_{CE} = 5\text{ Vdc}$ ) ( $I_C = 15\text{ A}$ , $V_{CE} = 5\text{ Vdc}$ )	$h_{FE}$	60 60 60 60 60 45 12	125 — — — 115 — 35	175 175 175 175 175 — —	
Collector–Emitter Saturation Voltage ( $I_C = 10\text{ A}$ , $I_B = 1\text{ A}$ )	$V_{CE(sat)}$	—	—	3	Vdc
<b>DYNAMIC CHARACTERISTICS</b>					
Current–Gain — Bandwidth Product ( $I_C = 1\text{ A}$ , $V_{CE} = 5\text{ Vdc}$ , $f_{test} = 1\text{ MHz}$ )	$f_T$	—	30	—	MHz
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f_{test} = 1\text{ MHz}$ )	$C_{ob}$	—	—	600	pF

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

TYPICAL CHARACTERISTICS

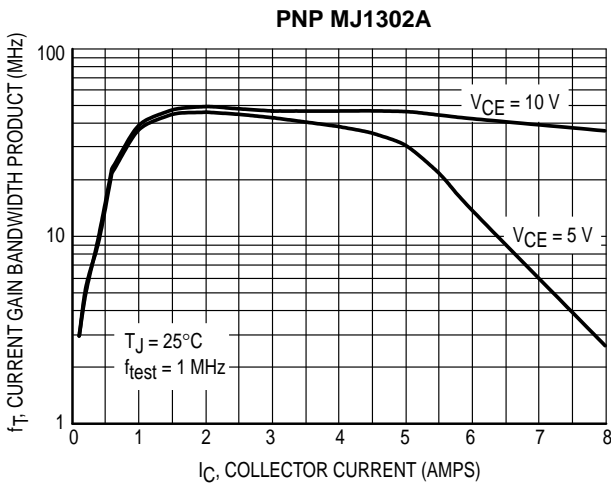


Figure 1. Current-Gain — Bandwidth Product

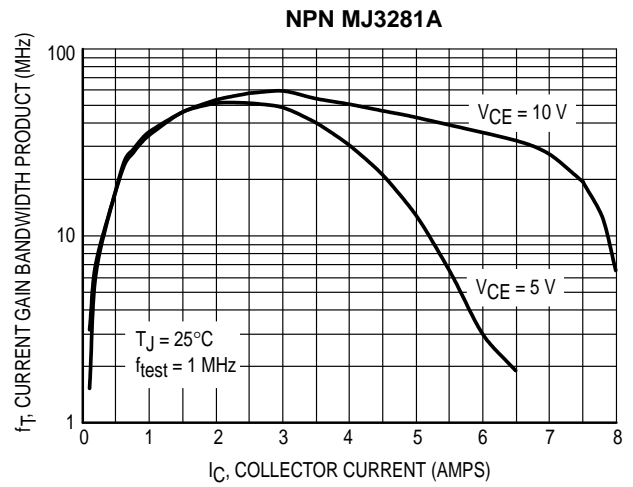


Figure 2. Current-Gain — Bandwidth Product

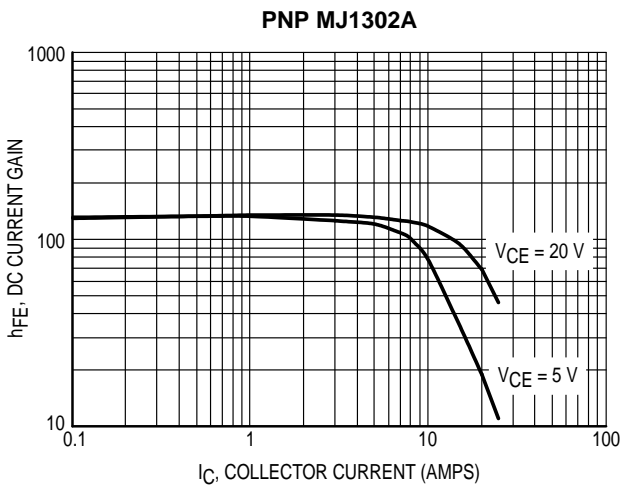


Figure 3. DC Current Gain

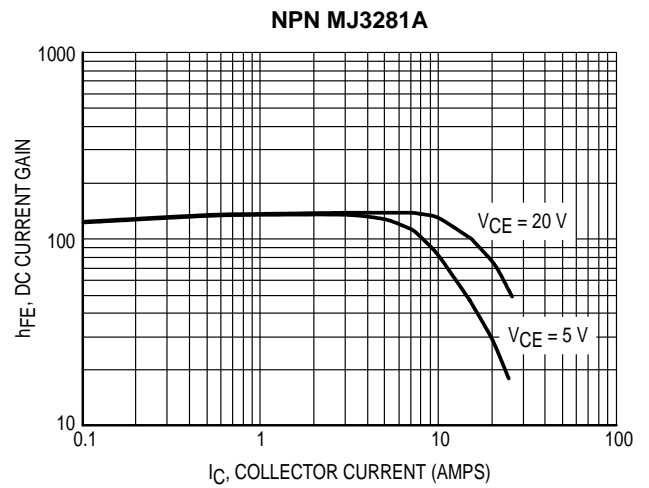


Figure 4. DC Current Gain

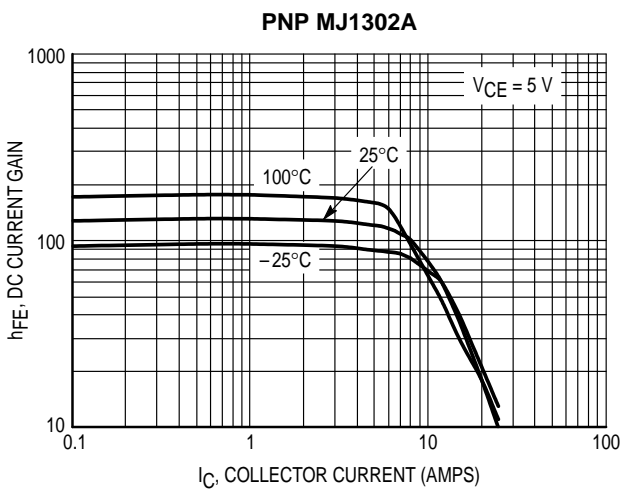


Figure 5. DC Current Gain,  $V_{CE} = 5 V$

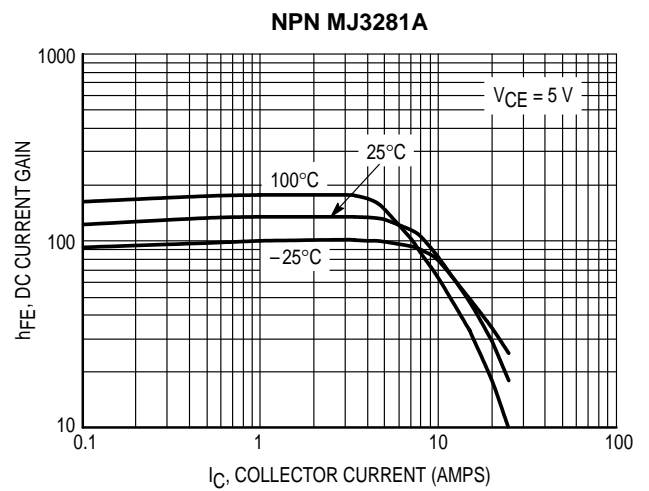


Figure 6. DC Current Gain,  $V_{CE} = 5 V$

TYPICAL CHARACTERISTICS

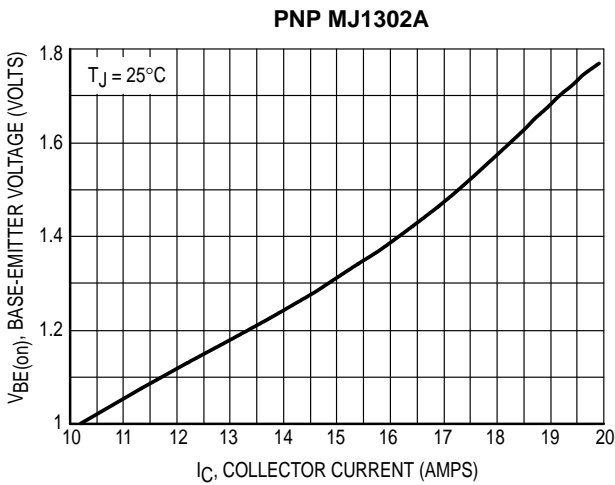


Figure 7. Typical Base-Emitter Voltage

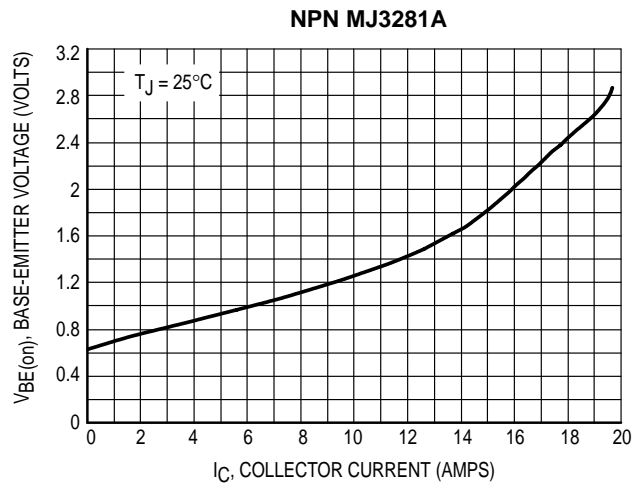


Figure 8. Typical Base-Emitter Voltage

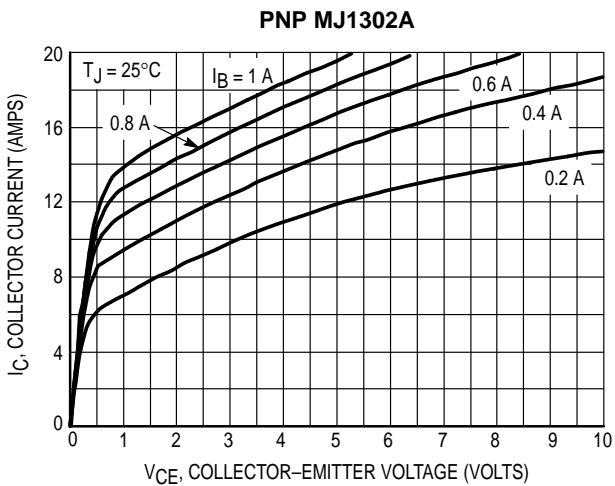


Figure 9. Typical Output Characteristics

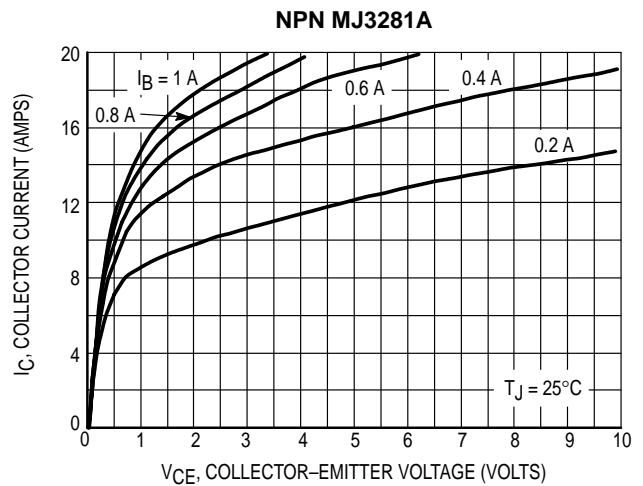


Figure 10. Typical Output Characteristics

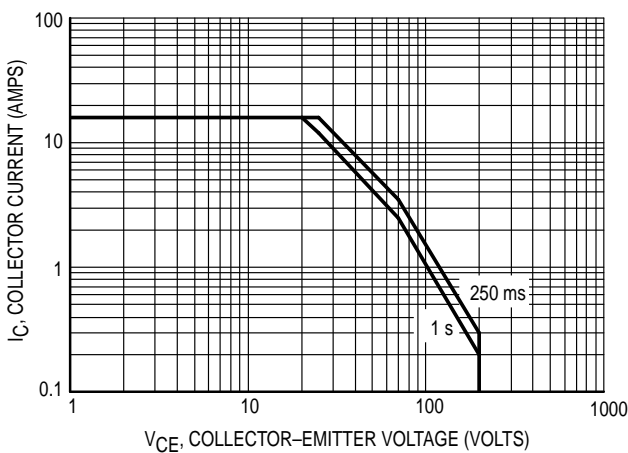
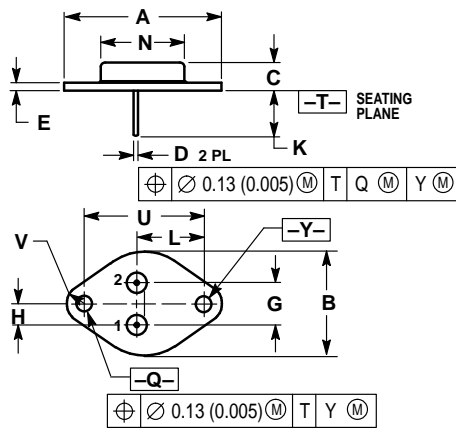


Figure 11. Forward Bias Safe Operating Area (FBSOA)

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 11 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.

PACKAGE DIMENSIONS




- 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

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

## MJ3281A MJ1302A

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MJ3281A/D

