

Designer's™ Data Sheet

Complementary NPN-PNP Silicon Power Bipolar Transistor

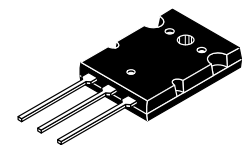
The MJL3281A and MJL1302A are PowerBase power transistors for high power audio, disk head positioners and other linear applications.

- 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 Second
- High f_T — 30 MHz Typical

NPN
MJL3281A*
PNP
MJL1302A*

*Motorola Preferred Device

15 AMPERE
COMPLEMENTARY
SILICON POWER
TRANSISTORS
200 VOLTS
200 WATTS



CASE 340G-02, STYLE 2
TO-264

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°C | P_D | 200 1.43 | Watts W/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range | T_J, T_{stg} | - 65 to +150 | $^\circ\text{C}$ |

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|--------------------------------------|-----------------|-----|---------------------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 0.7 | $^\circ\text{C}/\text{W}$ |

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | |
|---|----------------|-----|---|---|-----|
| Collector-Emitter Sustaining Voltage ($I_C = 100$ mAdc, $I_B = 0$) | $V_{CEO(sus)}$ | 200 | — | — | Vdc |
| Emitter-Base Voltage ($I_E = 100$ μ Adc, $I_C = 0$) | V_{EBO} | 7 | — | — | Vdc |

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

(continued)

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.

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

REV 1

MJL3281A MJL1302A

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---------------|--|--------------------------------------|---|-----------------|
| OFF CHARACTERISTICS | | | | | |
| Collector Cutoff Current ($V_{CB} = 200\text{ Vdc}$, $I_E = 0$) | I_{CBO} | — | — | 50 | μAdc |
| Emitter Cutoff Current ($V_{EB} = 5\text{ Vdc}$, $I_C = 0$) | I_{EBO} | — | — | 5 | μAdc |
| Emitter Cutoff Current ($V_{EB} = 7\text{ Vdc}$, $I_C = 0$) | I_{EBO} | — | — | 25 | μAdc |
| SECOND BREAKDOWN | | | | | |
| 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 _{dc} |
| ON CHARACTERISTICS | | | | | |
| DC Current Gain ($I_C = 100\text{ mAdc}$, $V_{CE} = 5\text{ Vdc}$) ($I_C = 1\text{ Adc}$, $V_{CE} = 5\text{ Vdc}$) ($I_C = 3\text{ Adc}$, $V_{CE} = 5\text{ Vdc}$) ($I_C = 5\text{ Adc}$, $V_{CE} = 5\text{ Vdc}$) ($I_C = 7\text{ Adc}$, $V_{CE} = 5\text{ Vdc}$) ($I_C = 8\text{ Adc}$, $V_{CE} = 5\text{ Vdc}$) ($I_C = 15\text{ Adc}$, $V_{CE} = 5\text{ Vdc}$) | h_{FE} | 60 60 60 60 60 45 12 | 125 — — — 115 — 35 | 175 175 175 175 175 — — | |
| Collector–Emitter Saturation Voltage ($I_C = 10\text{ Adc}$, $I_B = 1\text{ Adc}$) | $V_{CE(sat)}$ | — | — | 3 | V _{dc} |
| DYNAMIC CHARACTERISTICS | | | | | |
| Current–Gain — Bandwidth Product ($I_C = 1\text{ Adc}$, $V_{CE} = 5\text{ Vdc}$, $f_{test} = 1\text{ MHz}$) | f_T | — | 30 | — | MHz |
| Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f_{test} = 1\text{ MHz}$) | C_{ob} | — | — | 600 | pF |

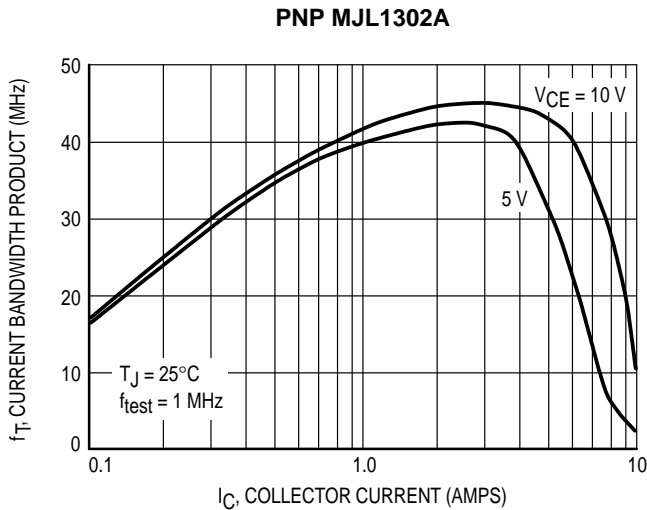


Figure 1. Typical Current Gain Bandwidth Product

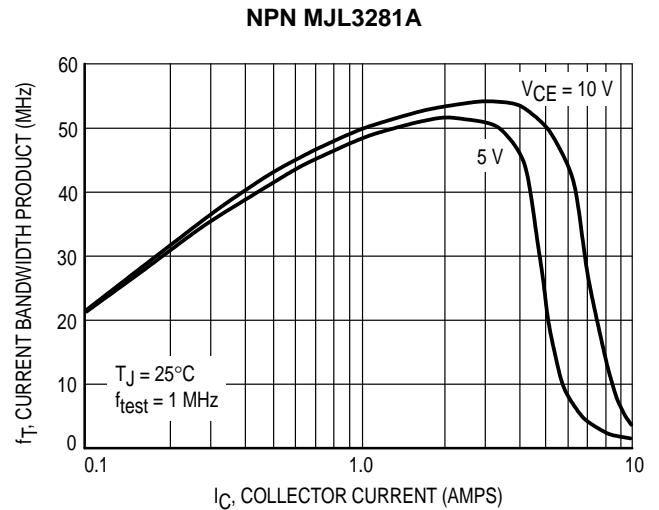


Figure 2. Typical Current Gain Bandwidth Product

TYPICAL CHARACTERISTICS

PNP MJL1302A

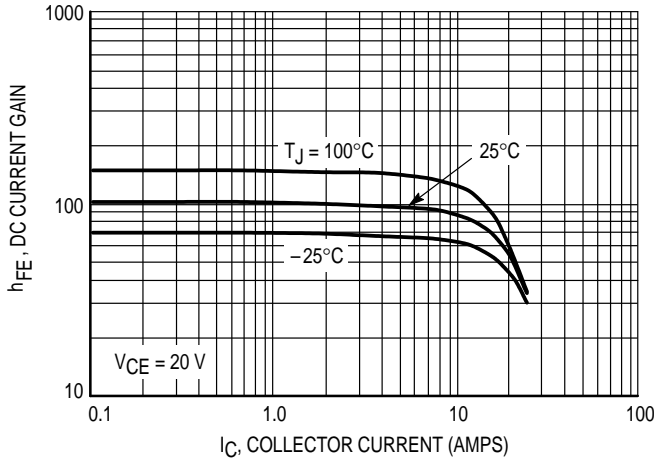


Figure 3. DC Current Gain, $V_{CE} = 20\text{ V}$

NPN MJL3281A

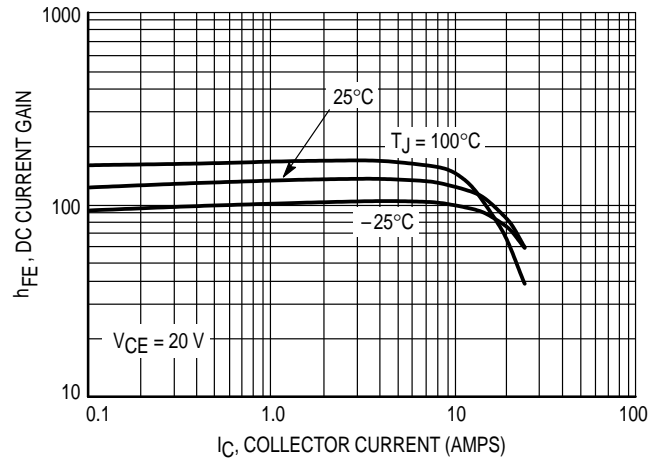


Figure 4. DC Current Gain, $V_{CE} = 20\text{ V}$

PNP MJL1302A

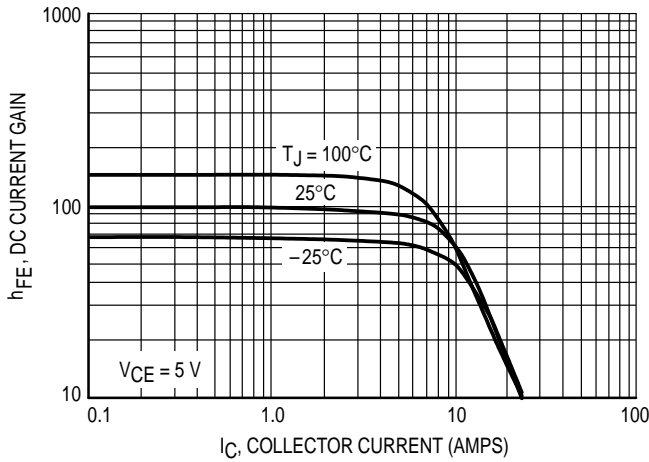


Figure 5. DC Current Gain, $V_{CE} = 5\text{ V}$

NPN MJL3281A

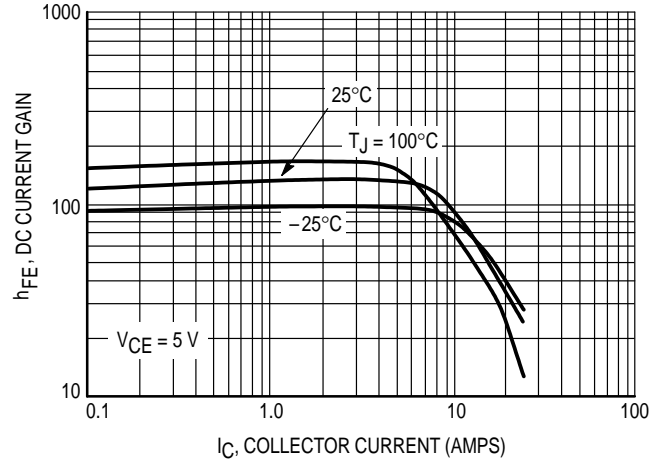


Figure 6. DC Current Gain, $V_{CE} = 5\text{ V}$

PNP MJL1302A

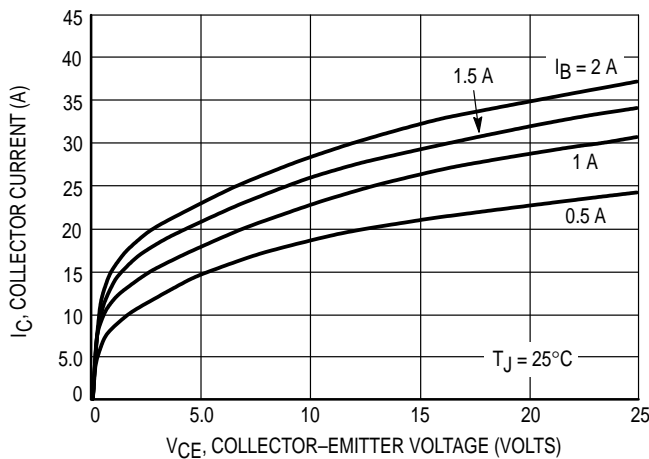


Figure 7. Typical Output Characteristics

NPN MJL3281A

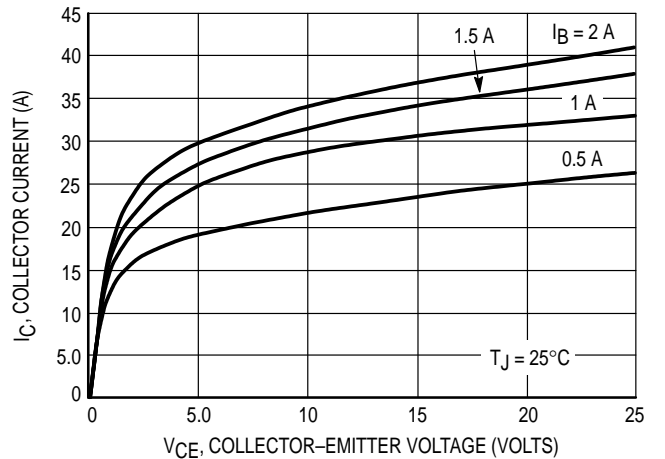


Figure 8. Typical Output Characteristics

TYPICAL CHARACTERISTICS

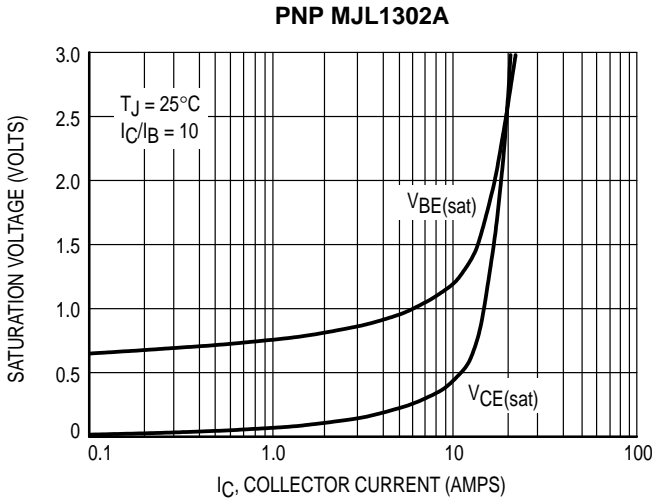


Figure 9. Typical Saturation Voltages

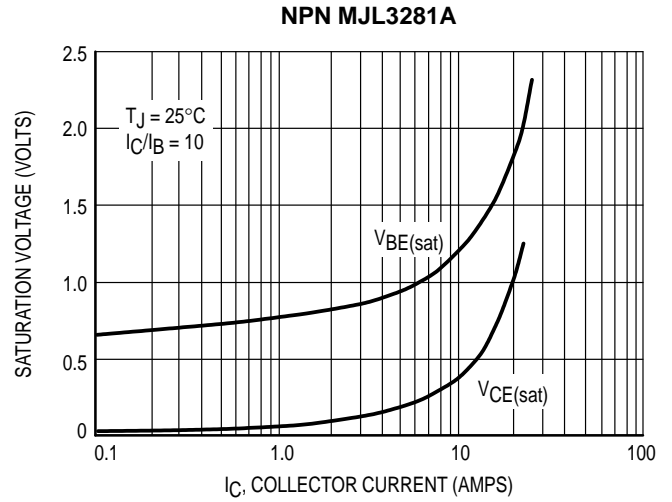


Figure 10. Typical Saturation Voltages

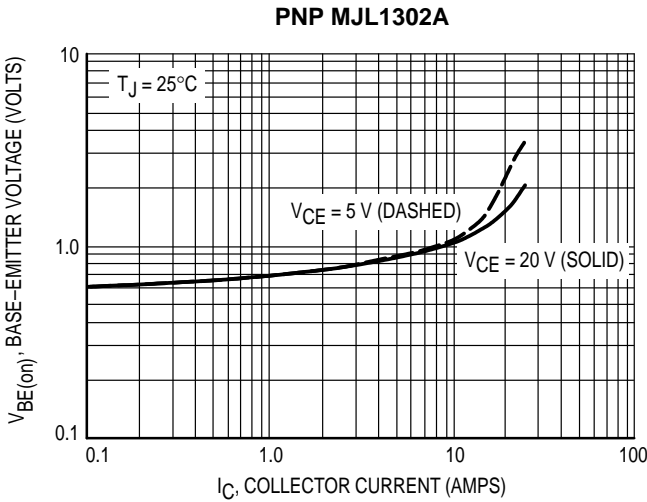


Figure 11. Typical Base-Emitter Voltage

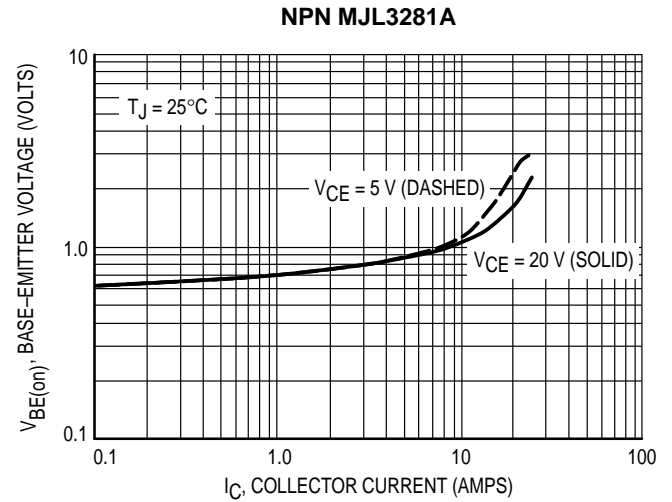


Figure 12. Typical Base-Emitter Voltage

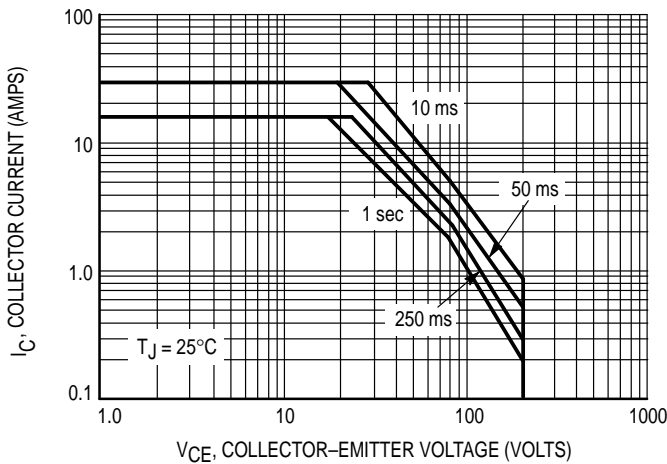


Figure 13. Active Region Safe Operating Area

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 13 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.

TYPICAL CHARACTERISTICS

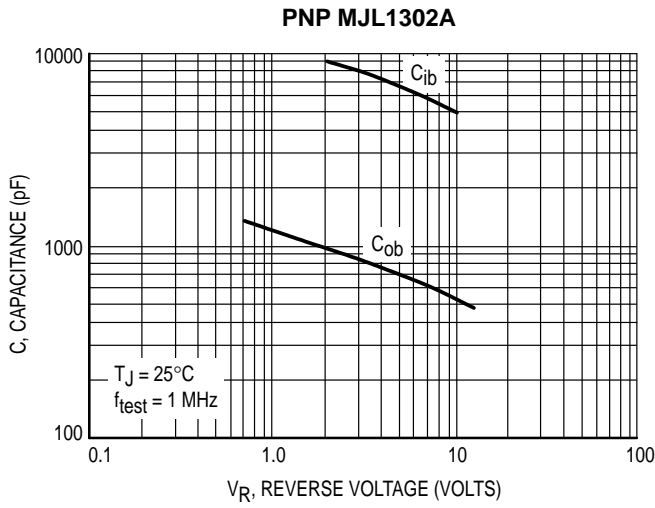


Figure 14. MJL1302A Typical Capacitance

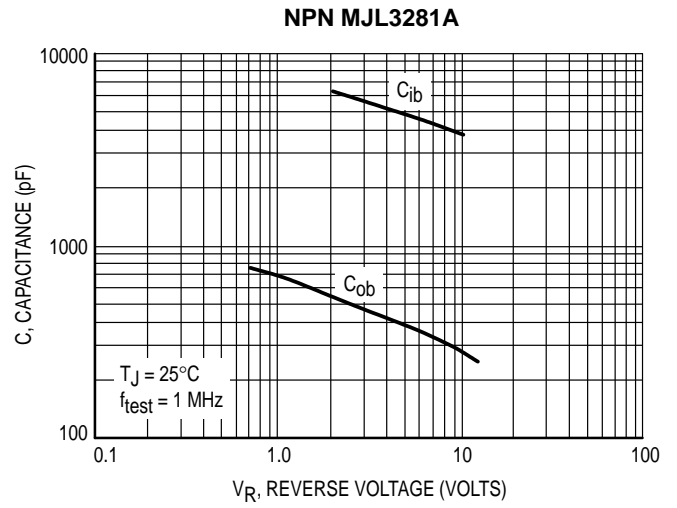
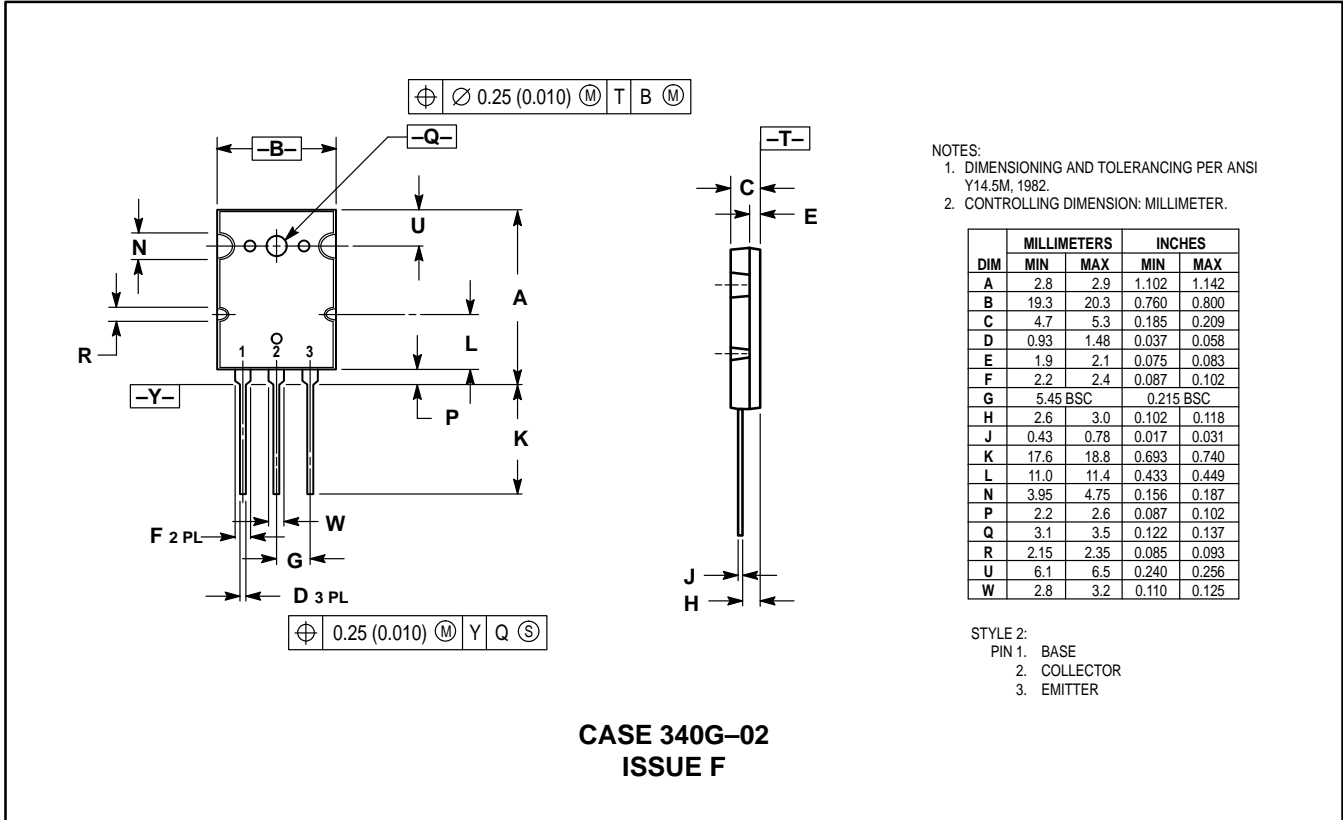


Figure 15. MJL3281A Typical Capacitance

PACKAGE DIMENSIONS



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