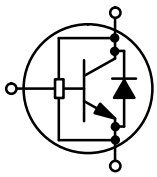
# MJE18002D2

*Advance Information*

# High Speed, High Gain Bipolar NPN Power Transistor with Integrated Collector-Emitter Diode and Built-in Efficient Antisaturation Network

**POWER TRANSISTORS**
**2 AMPERES**
**1000 VOLTS**
**50 WATTS**



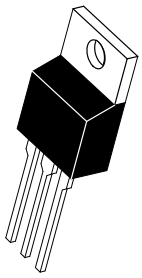
The MJE18002D2 use a newly developed technology, so called H2BIP*, to design the state of art transistor dedicated to the Electronic Light Ballast and PFC** circuit.

The main advantages brought by these new transistors are:

- Improved Global Efficiency Due to the Low Base Drive Requirements
- DC Current Gain Typically Centered at 45
- Extremely Low Storage Time Variation, Thanks to the Antisaturation Network
- Easy to Use Thanks to the Integrated Collector/Emitter Diode

The MOTOROLA “Sig Sixma” philosophy provides tight and reproductible parameter distribution.

* High speed High gain BIPolar transistor
** Power Factor Control



**CASE 221A–06**
**TO–220AB**

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector–Emitter Sustaining Voltage | $V_{CEO}$ | 450 | Vdc |
| Collector–Base Breakdown Voltage | $V_{CBO}$ | 1000 | Vdc |
| Collector–Emitter Breakdown Voltage | $V_{CES}$ | 1000 | Vdc |
| Emitter–Base Voltage | $V_{EBO}$ | 12 | Vdc |
| Collector Current — Continuous<br>— Peak (1) | $I_C$<br>$I_{CM}$ | 2<br>5 | Adc |
| Base Current — Continuous<br>— Peak (1) | $I_B$<br>$I_{BM}$ | 1<br>2 | Adc |
| *Total Device Dissipation @ $T_C$ = 25°C<br>*Derate above 25°C | $P_D$ | 50<br>0.4 | Watt<br>W/°C |
| Operating and Storage Temperature | $T_J$, $T_{stg}$ | –65 to 150 | °C |

**THERMAL CHARACTERISTICS**

| | | | |
|---|---|---|---|
| Thermal Resistance — Junction to Case<br>— Junction to Ambient | $R_{\theta JC}$<br>$R_{\theta JA}$ | 2.5<br>62.5 | °C/W |
| Maximum Lead Temperature for Soldering Purposes:<br>1/8″ from case for 5 seconds | $T_L$ | 260 | °C |

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

This document contains information on a new product. Specifications and information herein are subject to change without notice.

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**ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted)

| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Collector–Emitter Sustaining Voltage ($I_C$ = 100 mA, L = 25 mH) | | $V_{CEO(sus)}$ | 450 | 570 | | Vdc |
| Collector Cutoff Current ($V_{CE}$ = Rated $V_{CEO}$, $I_B$ = 0) | | $I_{CEO}$ | | | 100 | μAdc |
| Collector Cutoff Current ($V_{CE}$ = Rated $V_{CES}$, $V_{EB}$ = 0) | @ $T_C$ = 25°C | $I_{CES}$ | | | 100 | μAdc |
| | @ $T_C$ = 125°C | | | | 500 | |
| ($V_{CE}$ = 500 V, $V_{EB}$ = 0) | @ $T_C$ = 125°C | | | | 100 | |
| Emitter–Cutoff Current ($V_{EB}$ = 10 Vdc, $I_C$ = 0) | | $I_{EBO}$ | | | 100 | μAdc |
| **ON CHARACTERISTICS** | | | | | | |
| Base–Emitter Saturation Voltage | | $V_{BE(sat)}$ | | | | Vdc |
| ($I_C$ = 0.4 Adc, $I_B$ = 40 mAdc) | @ $T_C$ = 25°C | | | 0.78 | 1 | |
| ($I_C$ = 1 Adc, $I_B$ = 0.2 Adc) | @ $T_C$ = 25°C | | | 0.87 | 1.1 | |
| Collector–Emitter Saturation Voltage | | $V_{CE(sat)}$ | | | | Vdc |
| ($I_C$ = 0.4 Adc, $I_B$ = 40 mAdc) | @ $T_C$ = 25°C | | | 0.36 | 0.6 | |
| | @ $T_C$ = 125°C | | | 0.5 | 1 | |
| ($I_C$ = 1 Adc, $I_B$ = 0.2 Adc) | @ $T_C$ = 25°C | | | 0.4 | 0.75 | |
| | @ $T_C$ = 125°C | | | 0.65 | 1.2 | |
| DC Current Gain | | $h_{FE}$ | | | | — |
| ($I_C$ = 0.4 Adc, $V_{CE}$ = 1 Vdc) | @ $T_C$ = 25°C | | 14 | 25 | | |
| | @ $T_C$ = 125°C | | 8 | 15 | | |
| ($I_C$ = 1 Adc, $V_{CE}$ = 1 Vdc) | @ $T_C$ = 25°C | | 6 | 10 | | |
| | @ $T_C$ = 125°C | | 4 | 6 | | |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Current Gain Bandwidth ($I_C$ = 0.5 Adc, $V_{CE}$ = 10 Vdc, f = 1 MHz) | | $f_T$ | | 13 | | MHz |
| Output Capacitance ($V_{CB}$ = 10 Vdc, $I_E$ = 0, f = 1 MHz) | | $C_{ob}$ | | 50 | 100 | pF |
| Input Capacitance ($V_{EB}$ = 8 Vdc) | | $C_{ib}$ | | 340 | 500 | pF |
| **DIODE CHARACTERISTICS** | | | | | | |
| Forward Diode Voltage | | $V_{EC}$ | | | | V |
| ($I_{EC}$ = 1 Adc) | @ $T_C$ = 25°C | | | 1.2 | 1.5 | |
| ($I_{EC}$ = 0.2 Adc) | @ $T_C$ = 25°C | | | 0.9 | 1.2 | |
| | @ $T_C$ = 125°C | | | 0.6 | | |
| ($I_{EC}$ = 0.4 Adc) | @ $T_C$ = 25°C | | | 1 | 1.3 | |
| | @ $T_C$ = 125°C | | | 0.6 | | |
| Forward Recovery Time | | $t_{fr}$ | | | | ns |
| ($I_F$ = 0.2 Adc, di/dt = 10 A/μs) | @ $T_C$ = 25°C | | | 540 | | |
| ($I_F$ = 0.4 Adc, di/dt = 10 A/μs) | @ $T_C$ = 25°C | | | 517 | | |
| ($I_F$ = 1 Adc, di/dt = 10 A/μs) | @ $T_C$ = 25°C | | | 480 | | |

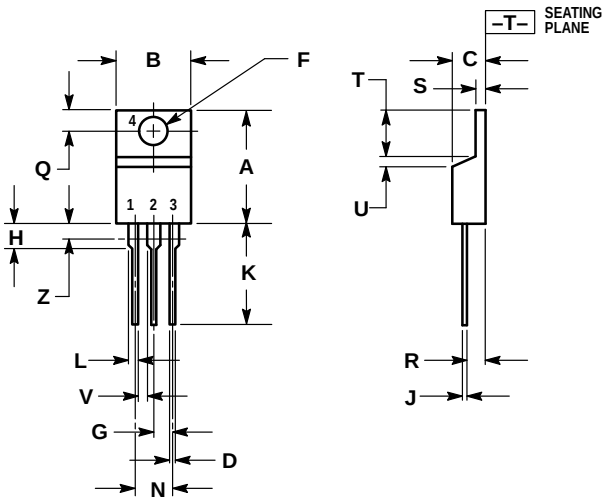
**ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted)

| Characteristic | | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **SWITCHING CHARACTERISTICS: Resistive Load** (D.C. ≤ 10%, Pulse Width = 20 μs) | | | | | | | |
| Turn–on Time | $I_C$ = 1 Adc, $I_{B1}$ = 0.2 Adc<br>$I_{B2}$ = 0.5 Adc<br>$V_{CC}$ = 300 Vdc | @ $T_C$ = 25°C<br>@ $T_C$ = 125°C | $t_{on}$ | | 100<br>94 | 150 | ns |
| Turn–off Time | | @ $T_C$ = 25°C<br>@ $T_C$ = 125°C | $t_{off}$ | 0.95 | <br>1.5 | 1.25 | μs |
| **SWITCHING CHARACTERISTICS: Inductive Load** ($V_{clamp}$ = 300 V, $V_{CC}$ = 15 V, L = 200 μH) | | | | | | | |
| Fall Time | $I_C$ = 0.4 Adc<br>$I_{B1}$ = 40 mAdc<br>$I_{B2}$ = 0.2 Adc | @ $T_C$ = 25°C<br>@ $T_C$ = 125°C | $t_f$ | | 130<br>120 | 175 | ns |
| Storage Time | | @ $T_C$ = 25°C<br>@ $T_C$ = 125°C | $t_s$ | | 0.55<br>0.7 | 0.65 | μs |
| Crossover Time | | @ $T_C$ = 25°C<br>@ $T_C$ = 125°C | $t_c$ | | 110<br>100 | 175 | ns |
| Fall Time | $I_C$ = 0.8 Adc<br>$I_{B1}$ = 160 mAdc<br>$I_{B2}$ = 160 mAdc | @ $T_C$ = 25°C<br>@ $T_C$ = 125°C | $t_f$ | | 130<br>140 | 175 | ns |
| Storage Time | | @ $T_C$ = 25°C<br>@ $T_C$ = 125°C | $t_s$ | 2.1 | <br>3 | 2.4 | μs |
| Crossover Time | | @ $T_C$ = 25°C<br>@ $T_C$ = 125°C | $t_c$ | | 275<br>350 | 350 | ns |
| Fall Time | $I_C$ = 1 Adc<br>$I_{B1}$ = 0.2 Adc<br>$I_{B2}$ = 0.5 Adc | @ $T_C$ = 25°C<br>@ $T_C$ = 125°C | $t_f$ | | 100<br>100 | 150 | ns |
| Storage Time | | @ $T_C$ = 25°C<br>@ $T_C$ = 125°C | $t_s$ | | 1.05<br>1.45 | 1.2 | μs |
| Crossover Time | | @ $T_C$ = 25°C<br>@ $T_C$ = 125°C | $t_c$ | | 100<br>115 | 150 | ns |

**DYNAMIC SATURATION VOLTAGE**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Dynamic Saturation Voltage:<br>Determined 1 μs and 3 μs respectively after rising $I_{B1}$ reaches 90% of final $I_{B1}$ | $I_C$ = 0.4 Adc<br>$I_{B1}$ = 40 mA<br>$V_{CC}$ = 300 V | @ 1 μs | @ $T_C$ = 25°C | $V_{CE(dsat)}$ | | 7.4 | | V |
| | | @ 3 μs | @ $T_C$ = 25°C | | | 2.5 | | |
| | $I_C$ = 1 Adc<br>$I_{B1}$ = 0.2 A<br>$V_{CC}$ = 300 V | @ 1 μs | @ $T_C$ = 25°C | | | 11.7 | | |
| | | @ 3 μs | @ $T_C$ = 25°C | | | 1.3 | | |

## PACKAGE DIMENSIONS




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.570 | 0.620 | 14.48 | 15.75 |
| B | 0.380 | 0.405 | 9.66 | 10.28 |
| C | 0.160 | 0.190 | 4.07 | 4.82 |
| D | 0.025 | 0.035 | 0.64 | 0.88 |
| F | 0.142 | 0.147 | 3.61 | 3.73 |
| G | 0.095 | 0.105 | 2.42 | 2.66 |
| H | 0.110 | 0.155 | 2.80 | 3.93 |
| J | 0.018 | 0.025 | 0.46 | 0.64 |
| K | 0.500 | 0.562 | 12.70 | 14.27 |
| L | 0.045 | 0.060 | 1.15 | 1.52 |
| N | 0.190 | 0.210 | 4.83 | 5.33 |
| Q | 0.100 | 0.120 | 2.54 | 3.04 |
| R | 0.080 | 0.110 | 2.04 | 2.79 |
| S | 0.045 | 0.055 | 1.15 | 1.39 |
| T | 0.235 | 0.255 | 5.97 | 6.47 |
| U | 0.000 | 0.050 | 0.00 | 1.27 |
| V | 0.045 | — | 1.15 | — |
| Z | — | 0.080 | — | 2.04 |

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

**CASE 221A–06**
**TO–220AB**
**ISSUE Y**



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