



**THE DATASHEET OF
MJD32CRLG**



MJD31 (NPN), MJD32 (PNP)

Complementary Power Transistors

DPAK For Surface Mount Applications

Designed for general purpose amplifier and low speed switching applications.

Features

- Lead Formed for Surface Mount Applications in Plastic Sleeves
- Straight Lead Version in Plastic Sleeves (“1” Suffix)
- Lead Formed Version in 16 mm Tape and Reel (“T4” Suffix)
- Electrically Similar to Popular TIP31 and TIP32 Series
- Epoxy Meets UL 94, V-0 @ 0.125 in
- NJV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

MAXIMUM RATINGS

| Rating | Symbol | Max | Unit |
|--|----------------|----------------|--------------------------|
| Collector-Emitter Voltage MJD31, MJD32 MJD31C, MJD32C | V_{CEO} | 40 100 | Vdc |
| Collector-Base Voltage MJD31, MJD32 MJD31C, MJD32C | V_{CB} | 40 100 | Vdc |
| Emitter-Base Voltage | V_{EB} | 5.0 | Vdc |
| Collector Current – Continuous | I_C | 3.0 | Adc |
| Collector Current – Peak | I_{CM} | 5.0 | Adc |
| Base Current | I_B | 1.0 | Adc |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C | P_D | 15 0.12 | W W/ $^\circ\text{C}$ |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 1.56 0.012 | W W/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range | T_J, T_{stg} | -65 to +150 | $^\circ\text{C}$ |
| ESD – Human Body Model | HBM | 3B | V |
| ESD – Machine Model | MM | C | V |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|--|-----------------|-----|---------------------------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 8.3 | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Ambient* | $R_{\theta JA}$ | 80 | $^\circ\text{C}/\text{W}$ |
| Lead Temperature for Soldering Purposes | T_L | 260 | $^\circ\text{C}$ |

*These ratings are applicable when surface mounted on the minimum pad sizes recommended.

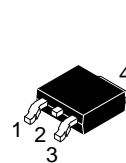
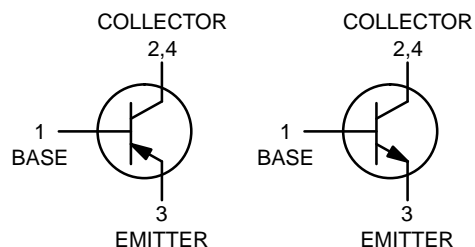


ON Semiconductor®

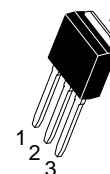
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**SILICON
POWER TRANSISTORS
3 AMPERES
40 AND 100 VOLTS
15 WATTS**

COMPLEMENTARY

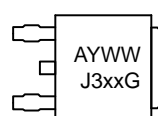


**DPAK
CASE 369C
STYLE 1**

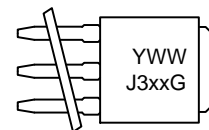


**IPAK
CASE 369D
STYLE 1**

MARKING DIAGRAMS



DPAK



IPAK

A = Site Code
Y = Year
WW = Work Week
xx = 1, 1C, 2, or 2C
G = Pb-Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 8 of this data sheet.

MJD31 (NPN), MJD32 (PNP)

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

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

OFF CHARACTERISTICS

| | | | | |
|--|----------------|-----------|----------|------------------|
| Collector–Emitter Sustaining Voltage (Note 1) ($I_C = 30\text{ mAdc}$, $I_B = 0$) MJD31, MJD32 MJD31C, MJD32C | $V_{CEO(sus)}$ | 40 100 | – – | Vdc |
| Collector Cutoff Current ($V_{CE} = 40\text{ Vdc}$, $I_B = 0$) MJD31, MJD32 ($V_{CE} = 60\text{ Vdc}$, $I_B = 0$) MJD31C, MJD32C | I_{CEO} | – – | 50 50 | $\mu\text{A dc}$ |
| Collector Cutoff Current ($V_{CE} = \text{Rated } V_{CEO}$, $V_{EB} = 0$) | ICES | – | 20 | $\mu\text{A dc}$ |
| Emitter Cutoff Current ($V_{BE} = 5\text{ Vdc}$, $I_C = 0$) | I_{EBO} | – | 1 | mA dc |

ON CHARACTERISTICS (Note 1)

| | | | | |
|---|---------------|----------|---------|-----|
| DC Current Gain ($I_C = 1\text{ A dc}$, $V_{CE} = 4\text{ Vdc}$) ($I_C = 3\text{ A dc}$, $V_{CE} = 4\text{ Vdc}$) | h_{FE} | 25 10 | – 50 | |
| Collector–Emitter Saturation Voltage ($I_C = 3\text{ A dc}$, $I_B = 375\text{ mA dc}$) | $V_{CE(sat)}$ | – | 1.2 | Vdc |
| Base–Emitter On Voltage ($I_C = 3\text{ A dc}$, $V_{CE} = 4\text{ Vdc}$) | $V_{BE(on)}$ | – | 1.8 | Vdc |

DYNAMIC CHARACTERISTICS

| | | | | |
|--|----------|----|---|-----|
| Current Gain – Bandwidth Product (Note 2) ($I_C = 500\text{ mA dc}$, $V_{CE} = 10\text{ Vdc}$, $f_{test} = 1\text{ MHz}$) | f_T | 3 | – | MHz |
| Small–Signal Current Gain ($I_C = 0.5\text{ A dc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1\text{ kHz}$) | h_{fe} | 20 | – | |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.
2. $f_T = |h_{fe}| \cdot f_{test}$.

MJD31 (NPN), MJD32 (PNP)

TYPICAL CHARACTERISTICS

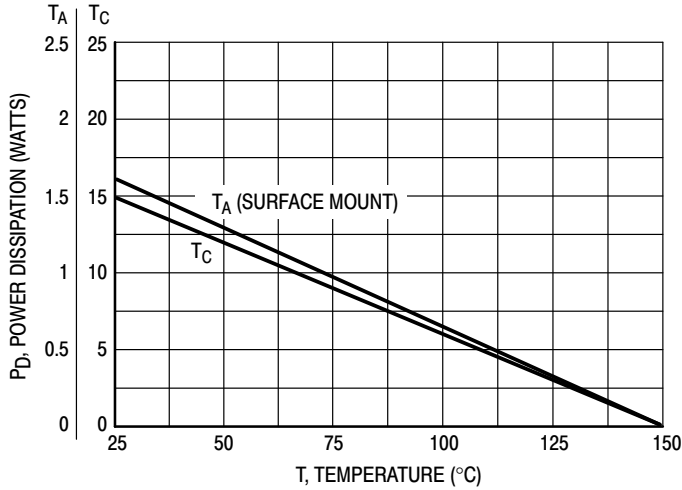
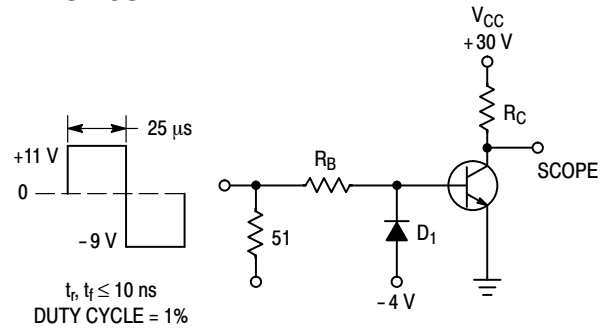


Figure 1. Power Derating



R_B and R_C VARIED TO OBTAIN DESIRED CURRENT LEVELS
 D_1 MUST BE FAST RECOVERY TYPE, e.g.:
 1N5825 USED ABOVE $I_B \approx 100$ mA
 MSD6100 USED BELOW $I_B \approx 100$ mA
 REVERSE ALL POLARITIES FOR PNP.

Figure 2. Switching Time Test Circuit

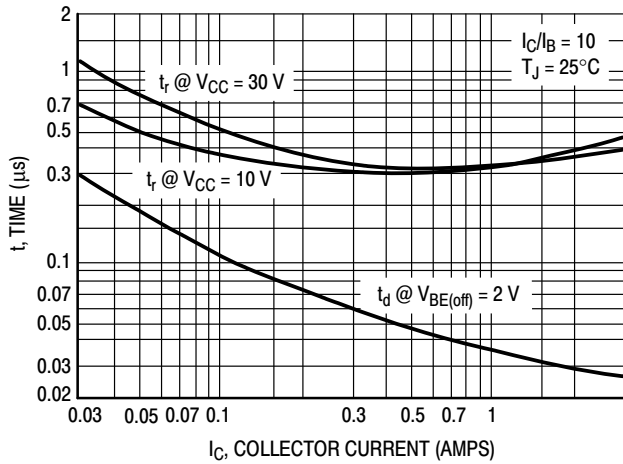


Figure 3. Turn-On Time

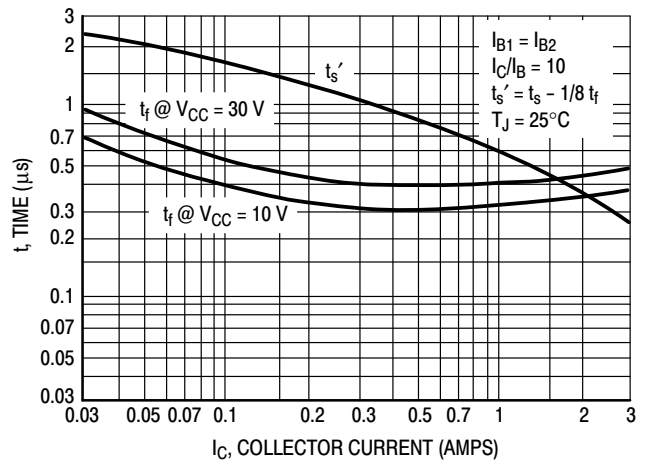


Figure 4. Turn-Off Time

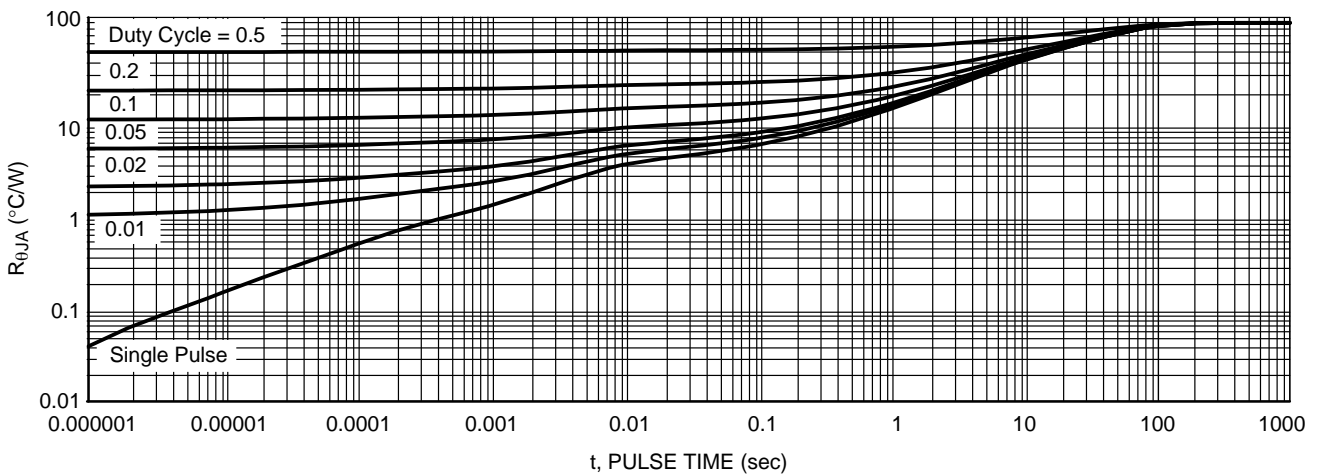


Figure 5. Thermal Response

MJD31 (NPN), MJD32 (PNP)

TYPICAL CHARACTERISTICS – MJD31, MJD31C (NPN)

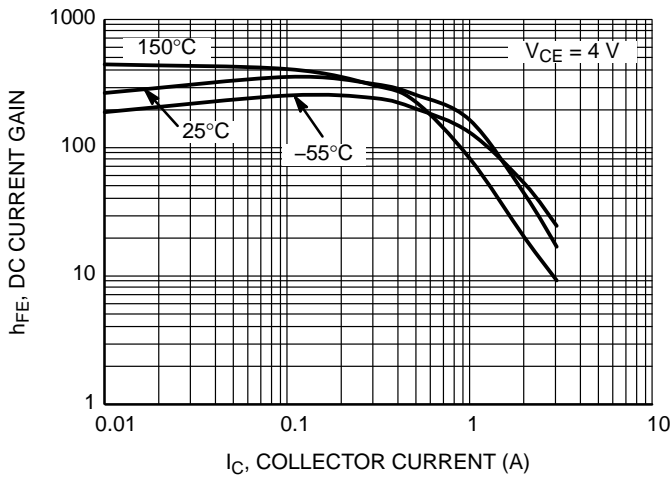


Figure 6. DC Current Gain at $V_{CE} = 4\text{ V}$

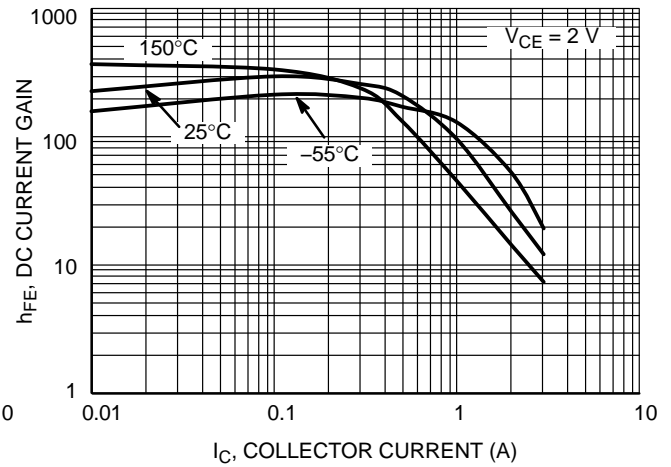


Figure 7. DC Current Gain at $V_{CE} = 2\text{ V}$

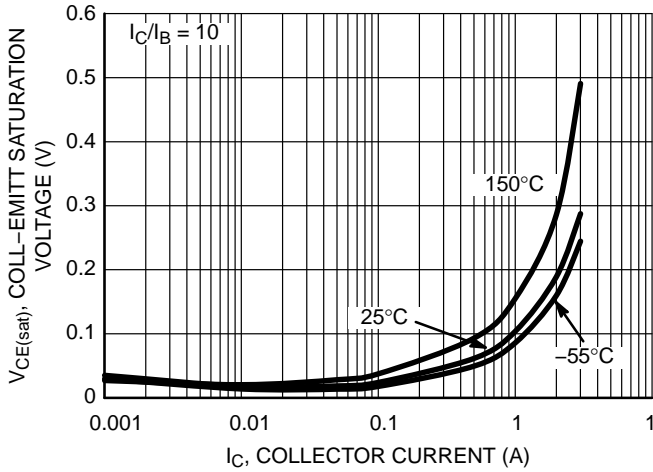


Figure 8. Collector-Emitt Saturation Voltage

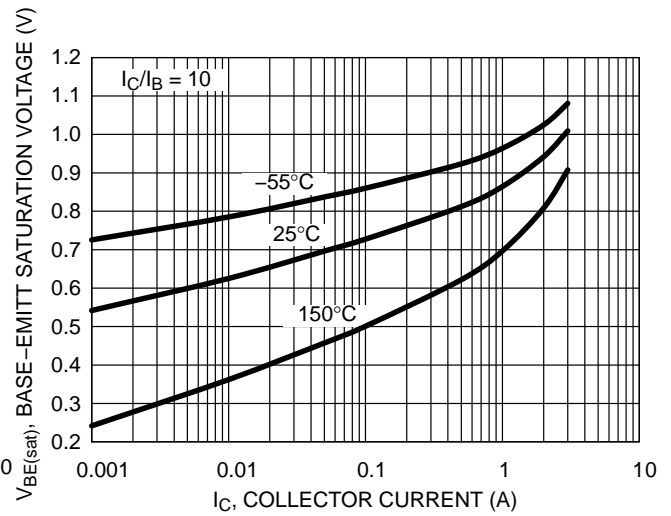


Figure 9. Base-Emitt Saturation Voltage

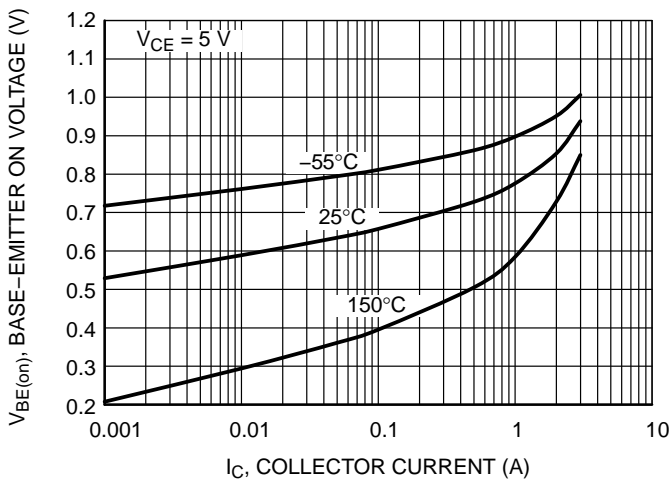


Figure 10. Base-Emitt "On" Voltage

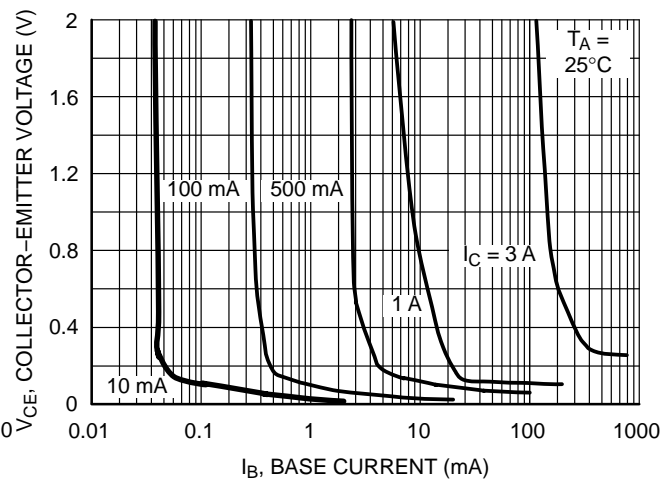


Figure 11. Collector Saturation Region

MJD31 (NPN), MJD32 (PNP)

TYPICAL CHARACTERISTICS – MJD31, MJD31C (NPN)

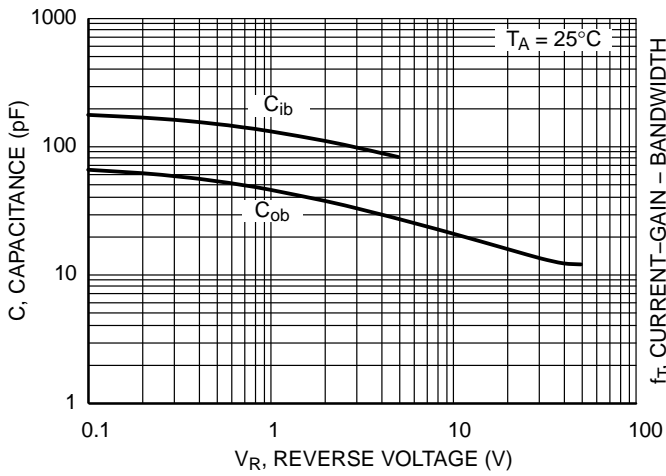


Figure 12. Capacitance

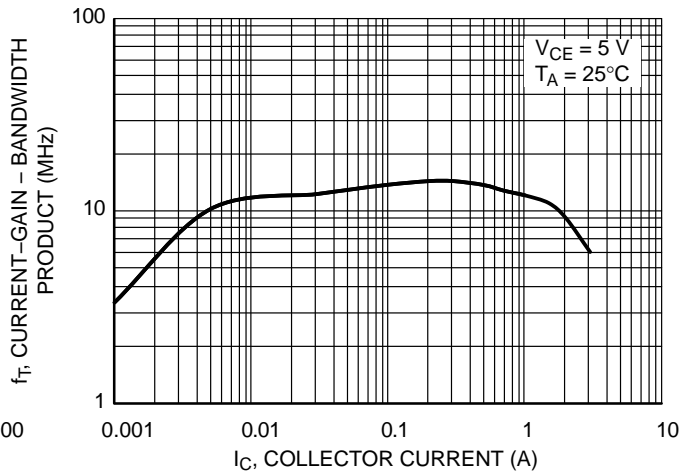


Figure 13. Current-Gain-Bandwidth Product

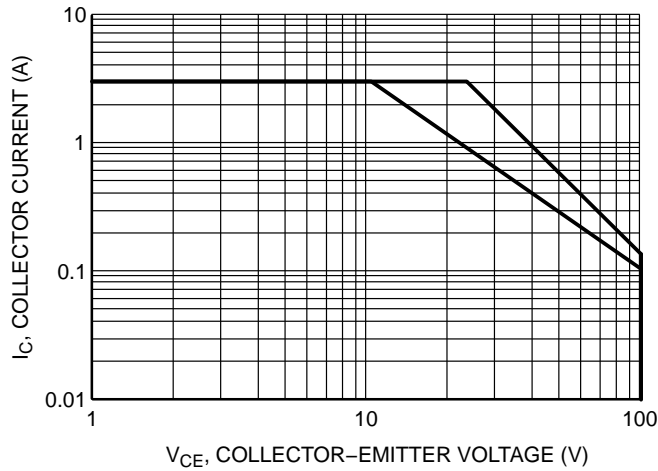


Figure 14. Safe Operating Area

MJD31 (NPN), MJD32 (PNP)

TYPICAL CHARACTERISTICS – MJD32, MJD32C (PNP)

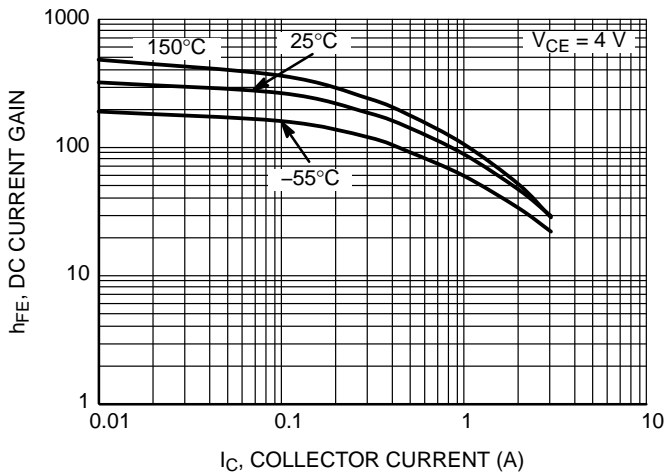


Figure 15. DC Current Gain at $V_{CE} = 4\text{ V}$

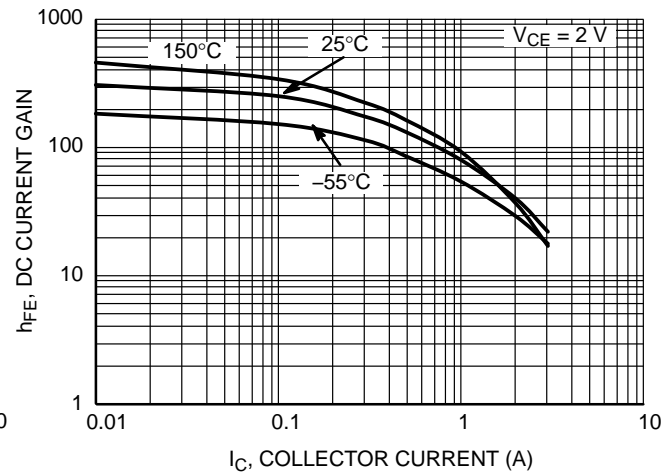


Figure 16. DC Current Gain at $V_{CE} = 2\text{ V}$

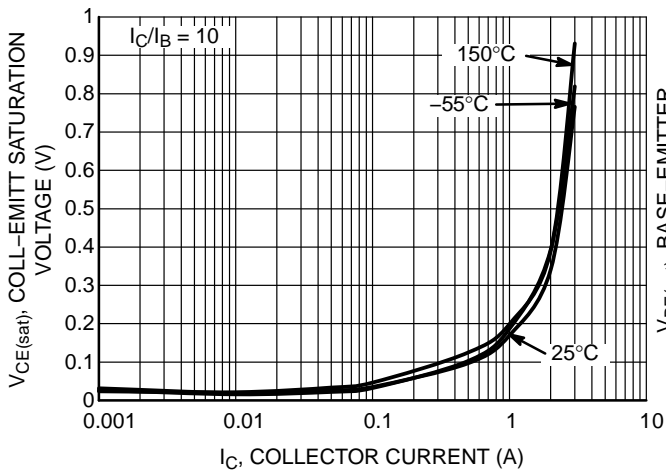


Figure 17. Collector-Emitter Saturation Voltage

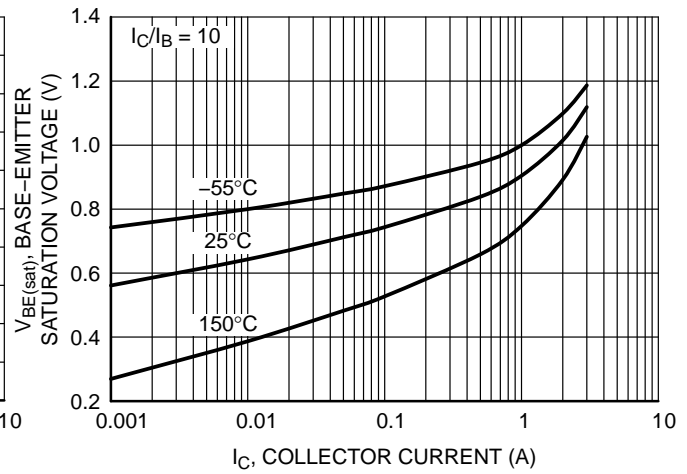


Figure 18. Base-Emitter Saturation Voltage

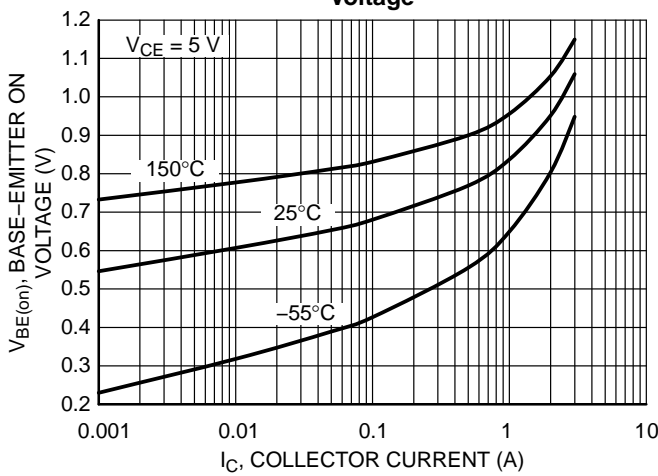


Figure 19. Base-Emitter "On" Voltage

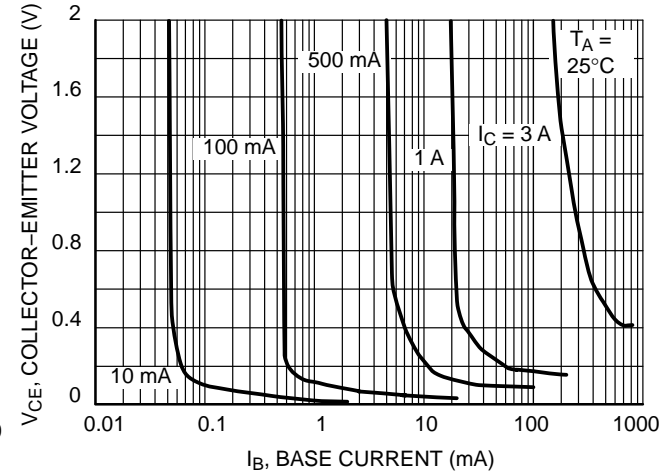


Figure 20. Collector Saturation Region

MJD31 (NPN), MJD32 (PNP)

TYPICAL CHARACTERISTICS

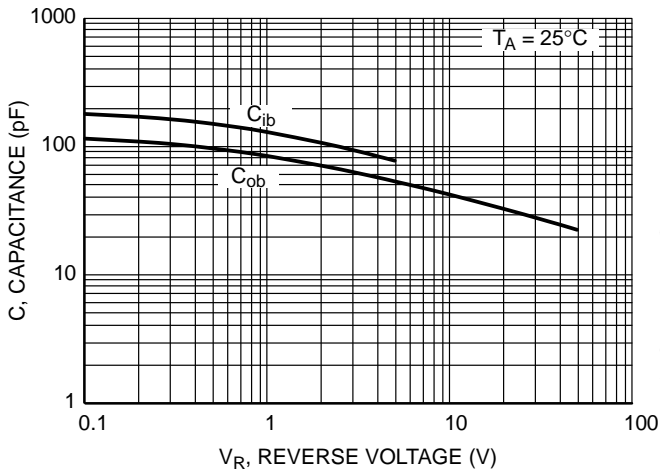


Figure 21. Capacitance

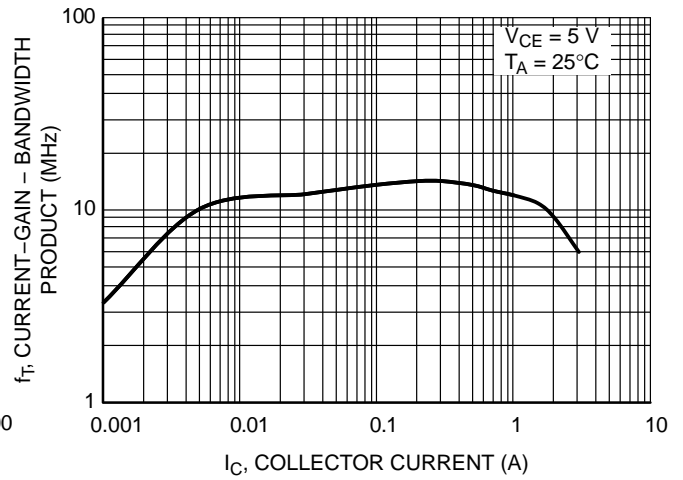


Figure 22. Current-Gain-Bandwidth Product

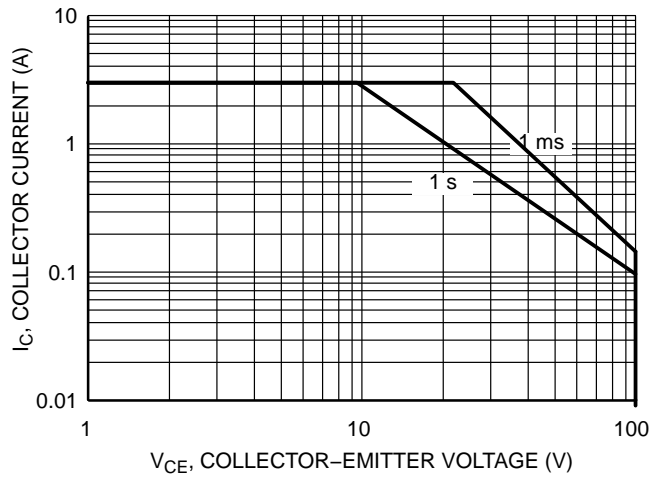


Figure 23. Safe Operating Area

MJD31 (NPN), MJD32 (PNP)

ORDERING INFORMATION

| Device | Package Type | Package | Shipping [†] |
|---------------|-------------------|---------|-----------------------|
| MJD31CG | DPAK (Pb-Free) | 369C | 75 Units / Rail |
| NJVMJD31CG* | DPAK (Pb-Free) | 369C | 75 Units / Rail |
| MJD31C1G | IPAK (Pb-Free) | 369D | 75 Units / Rail |
| MJD31CRLG | DPAK (Pb-Free) | 369C | 1,800 / Tape & Reel |
| NJVMJD31CRLG* | DPAK (Pb-Free) | 369C | 1,800 / Tape & Reel |
| MJD31CT4G | DPAK (Pb-Free) | 369C | 2,500 / Tape & Reel |
| NJVMJD31CT4G* | DPAK (Pb-Free) | 369C | 2,500 / Tape & Reel |
| MJD31T4G | DPAK (Pb-Free) | 369C | 2,500 / Tape & Reel |
| NJVMJD31T4G* | DPAK (Pb-Free) | 369C | 2,500 / Tape & Reel |
| MJD32CG | DPAK (Pb-Free) | 369C | 75 Units / Rail |
| NJVMJD32CG* | DPAK (Pb-Free) | 369C | 75 Units / Rail |
| MJD32CRLG | DPAK (Pb-Free) | 369C | 1,800 / Tape & Reel |
| MJD32CT4G | DPAK (Pb-Free) | 369C | 2,500 / Tape & Reel |
| NJVMJD32CT4G* | DPAK (Pb-Free) | 369C | 2,500 / Tape & Reel |
| MJD32RLG | DPAK (Pb-Free) | 369C | 1,800 / Tape & Reel |
| MJD32T4G | DPAK (Pb-Free) | 369C | 2,500 / Tape & Reel |
| NJVMJD32T4G* | DPAK (Pb-Free) | 369C | 2,500 / Tape & Reel |

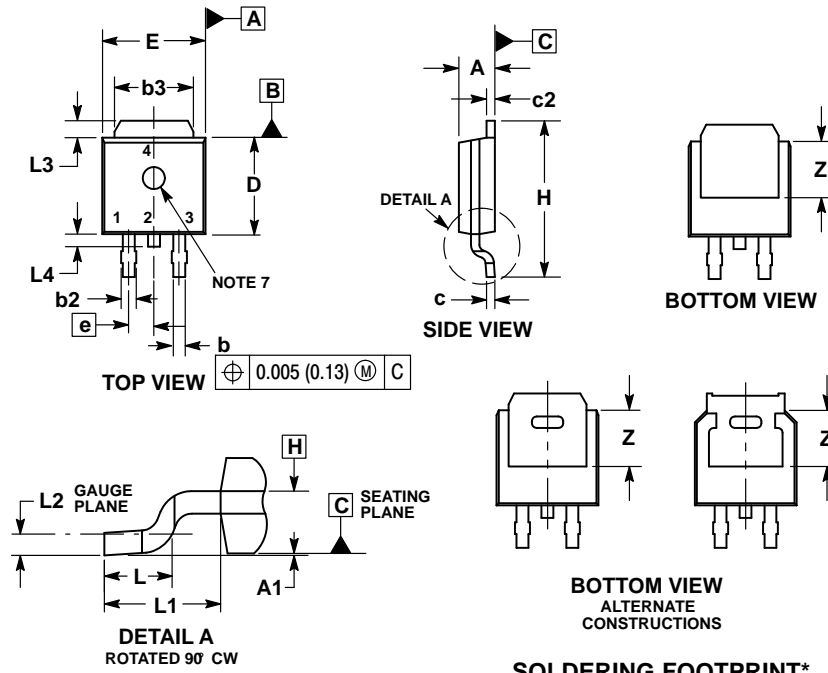
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*NJV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

MJD31 (NPN), MJD32 (PNP)

PACKAGE DIMENSIONS

DPAK (SINGLE GAUGE) CASE 369C ISSUE F



NOTES:

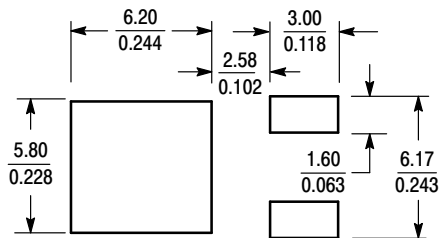
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.
7. OPTIONAL MOLD FEATURE.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.086 | 0.094 | 2.18 | 2.38 |
| A1 | 0.000 | 0.005 | 0.00 | 0.13 |
| b | 0.025 | 0.035 | 0.63 | 0.89 |
| b2 | 0.028 | 0.045 | 0.72 | 1.14 |
| b3 | 0.180 | 0.215 | 4.57 | 5.46 |
| c | 0.018 | 0.024 | 0.46 | 0.61 |
| c2 | 0.018 | 0.024 | 0.46 | 0.61 |
| D | 0.235 | 0.245 | 5.97 | 6.22 |
| E | 0.250 | 0.265 | 6.35 | 6.73 |
| e | 0.090 BSC | | 2.29 BSC | |
| H | 0.370 | 0.410 | 9.40 | 10.41 |
| L | 0.055 | 0.070 | 1.40 | 1.78 |
| L1 | 0.114 REF | | 2.90 REF | |
| L2 | 0.020 BSC | | 0.51 BSC | |
| L3 | 0.035 | 0.050 | 0.89 | 1.27 |
| L4 | --- | 0.040 | --- | 1.01 |
| Z | 0.155 | --- | 3.93 | --- |

STYLE 1:

1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

SOLDERING FOOTPRINT*



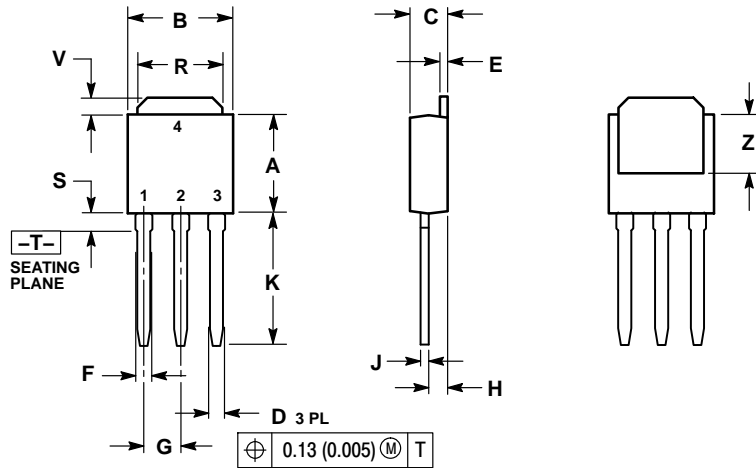
SCALE 3:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

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

MJD31 (NPN), MJD32 (PNP)

PACKAGE DIMENSIONS

IPAK CASE 369D ISSUE C



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES | | MILLIMETERS | |
|-----|--------|-------|-------------|------|
| | MIN | MAX | MIN | MAX |
| A | 0.235 | 0.245 | 5.97 | 6.35 |
| B | 0.250 | 0.265 | 6.35 | 6.73 |
| C | 0.086 | 0.094 | 2.19 | 2.38 |
| D | 0.027 | 0.035 | 0.69 | 0.88 |
| E | 0.018 | 0.023 | 0.46 | 0.58 |
| F | 0.037 | 0.045 | 0.94 | 1.14 |
| G | 0.090 | BSC | 2.29 | BSC |
| H | 0.034 | 0.040 | 0.87 | 1.01 |
| J | 0.018 | 0.023 | 0.46 | 0.58 |
| K | 0.350 | 0.380 | 8.89 | 9.65 |
| R | 0.180 | 0.215 | 4.45 | 5.45 |
| S | 0.025 | 0.040 | 0.63 | 1.01 |
| V | 0.035 | 0.050 | 0.89 | 1.27 |
| Z | 0.155 | --- | 3.93 | --- |

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

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- ✓ Obsolete Management
- ✓ Cost Control Management
- ✓ Shortage Management
- ✓ Alternative Solution
- ✓ Excess Inventory Management