

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/°C |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 1.56 0.012 | W W/°C |
| Operating and Storage Junction Temperature Range | T_J, T_{stg} | -65 to +150 | °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 | °C/W |
| Thermal Resistance, Junction-to-Ambient* | $R_{\theta JA}$ | 80 | °C/W |
| Lead Temperature for Soldering Purposes | T_L | 260 | °C |

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

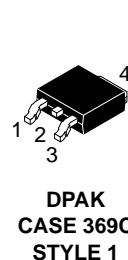
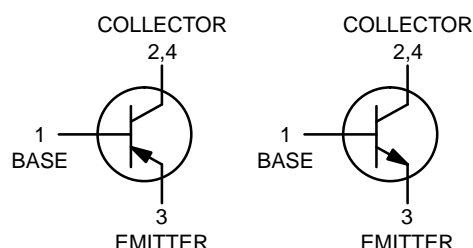


ON Semiconductor®

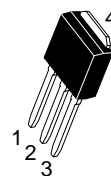
www.onsemi.com

SILICON POWER TRANSISTORS 3 AMPERES 40 AND 100 VOLTS 15 WATTS

COMPLEMENTARY

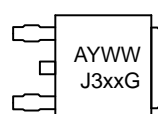


DPAK
CASE 369C
STYLE 1

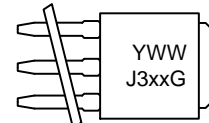


IPAK
CASE 369D
STYLE 1

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 | $V_{CE(sus)}$ | 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 | μAdc |
| Collector Cutoff Current ($V_{CE} = \text{Rated } V_{CEO}$, $V_{EB} = 0$) | I_{CES} | – | 20 | μAdc |
| Emitter Cutoff Current ($V_{BE} = 5\text{ Vdc}$, $I_C = 0$) | I_{EBO} | – | 1 | mAdc |

ON CHARACTERISTICS (Note 1)

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

DYNAMIC CHARACTERISTICS

| | | | | |
|---|----------|----|---|-----|
| Current Gain – Bandwidth Product (Note 2) ($I_C = 500\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f_{test} = 1\text{ MHz}$) | f_T | 3 | – | MHz |
| Small–Signal Current Gain ($I_C = 0.5\text{ Adc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1\text{ kHz}$) | 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 $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2\%$.
2. $f_T = |h_{fe}| \cdot f_{test}$.

MJD31 (NPN), MJD32 (PNP)

TYPICAL CHARACTERISTICS

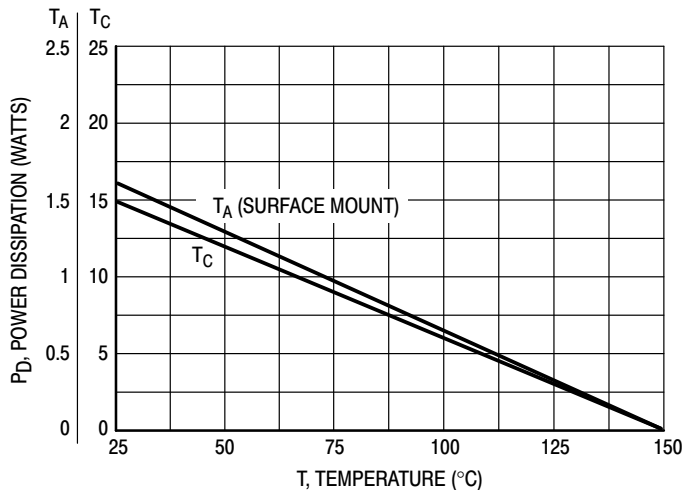
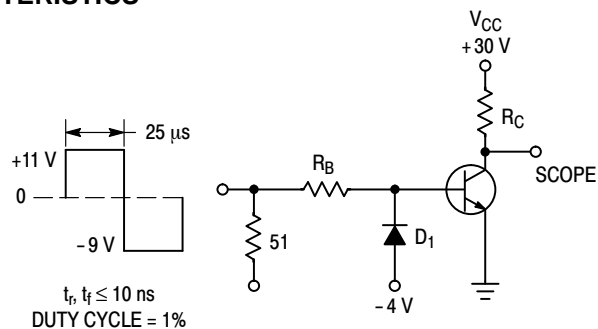


Figure 1. Power Derating



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

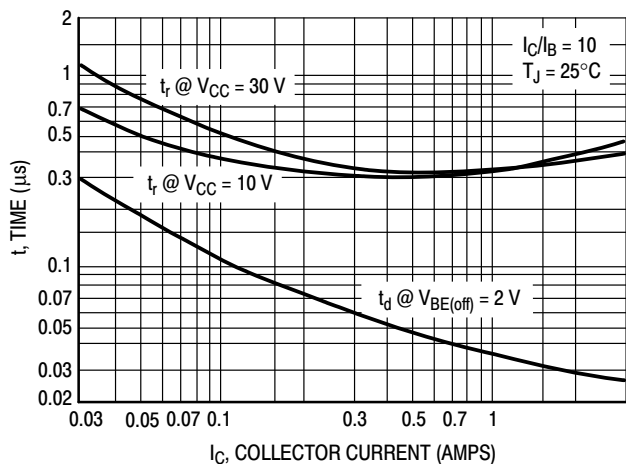


Figure 3. Turn-On Time

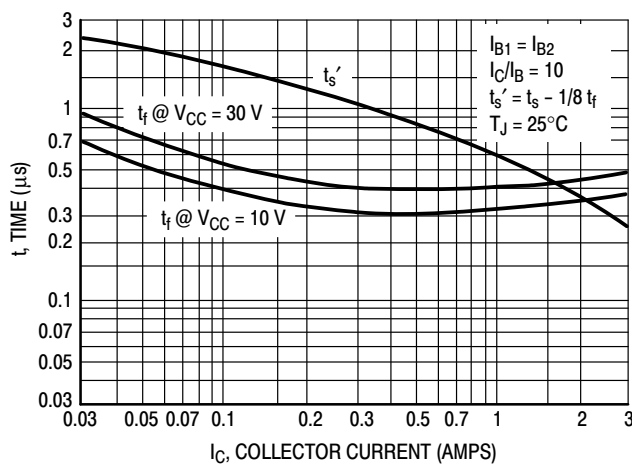


Figure 4. Turn-Off Time

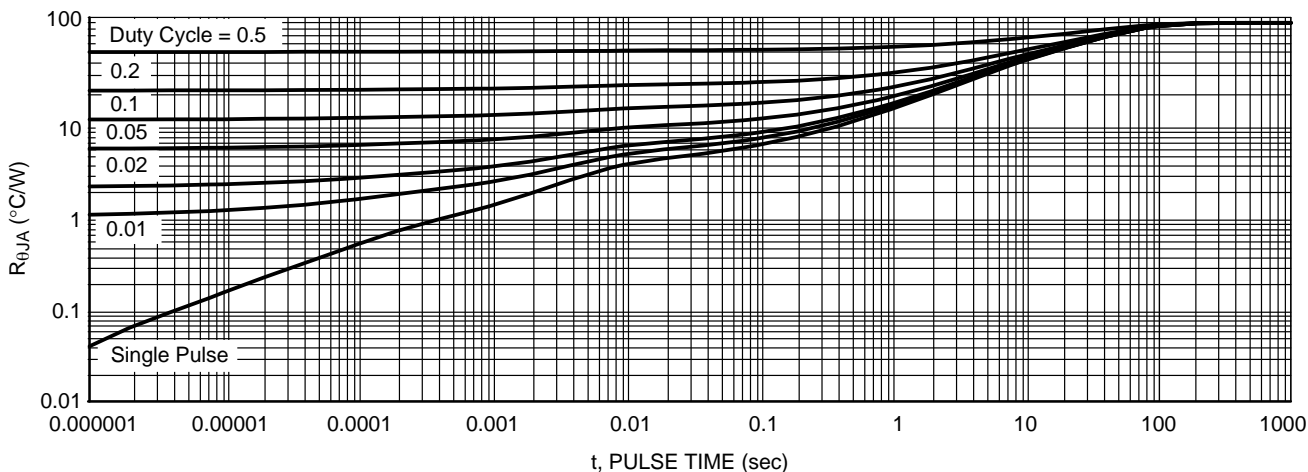


Figure 5. Thermal Response

MJD31 (NPN), MJD32 (PNP)

TYPICAL CHARACTERISTICS – MJD31, MJD31C (NPN)

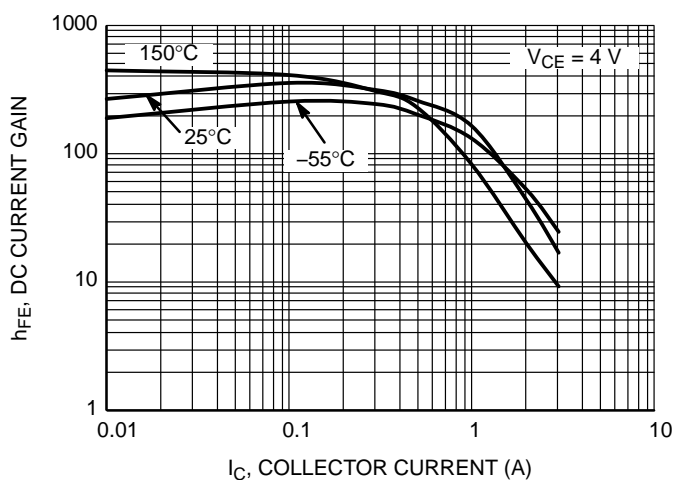


Figure 6. DC Current Gain at $V_{CE} = 4\text{ V}$

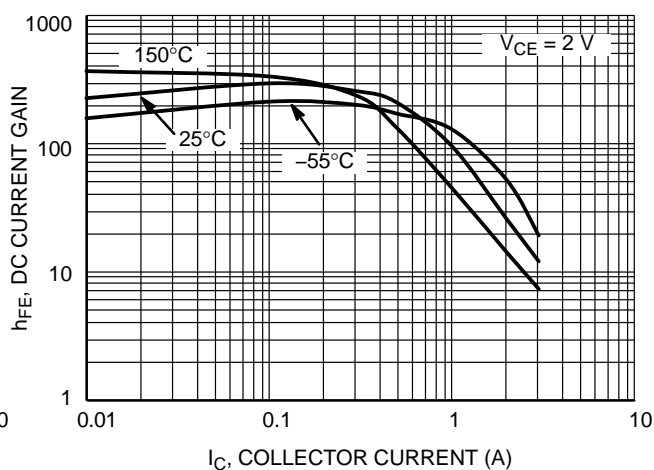


Figure 7. DC Current Gain at $V_{CE} = 2\text{ V}$

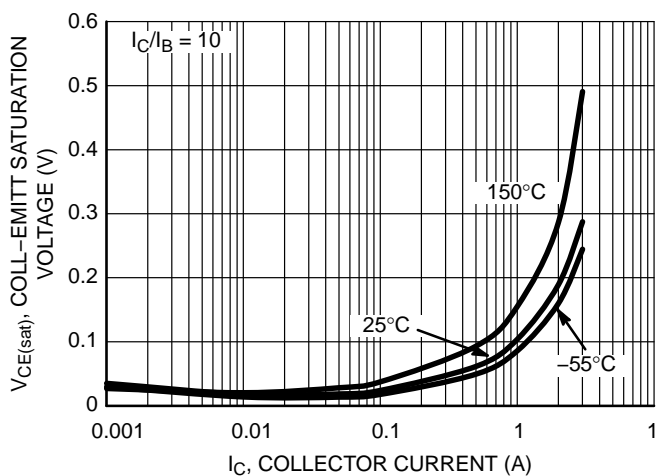


Figure 8. Collector-Emitter Saturation Voltage

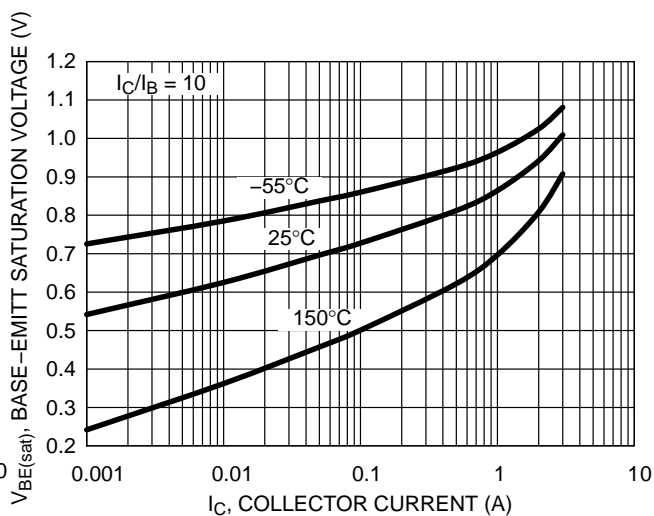


Figure 9. Base-Emitter Saturation Voltage

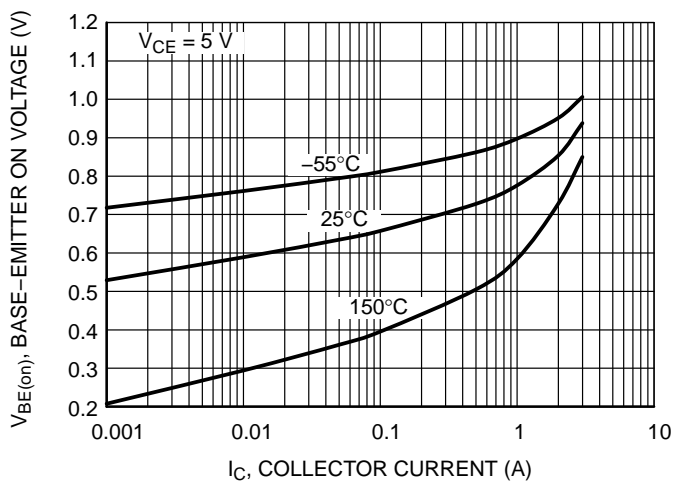


Figure 10. Base-Emitter "On" Voltage

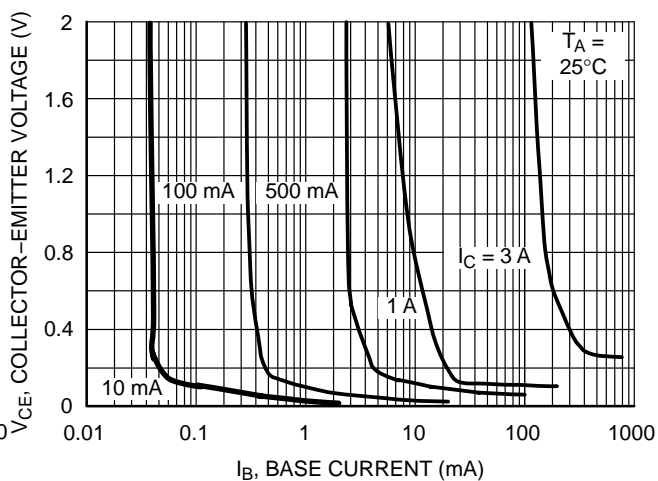


Figure 11. Collector Saturation Region

MJD31 (NPN), MJD32 (PNP)

TYPICAL CHARACTERISTICS – MJD31, MJD31C (NPN)

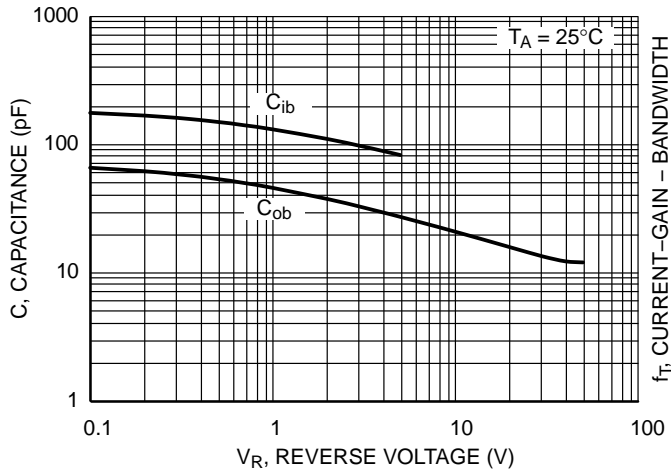


Figure 12. Capacitance

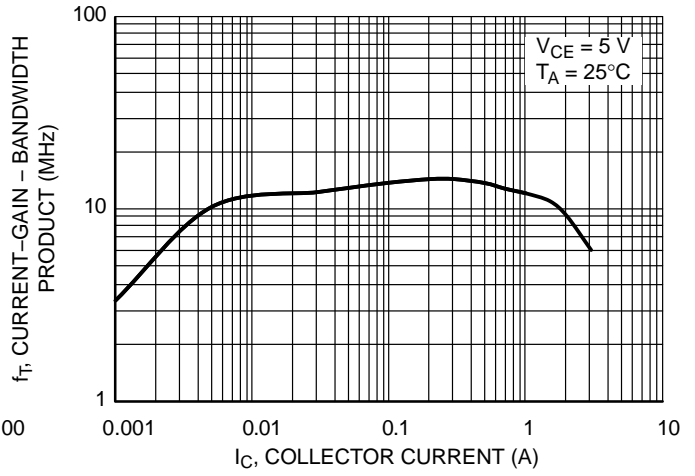


Figure 13. Current-Gain-Bandwidth Product

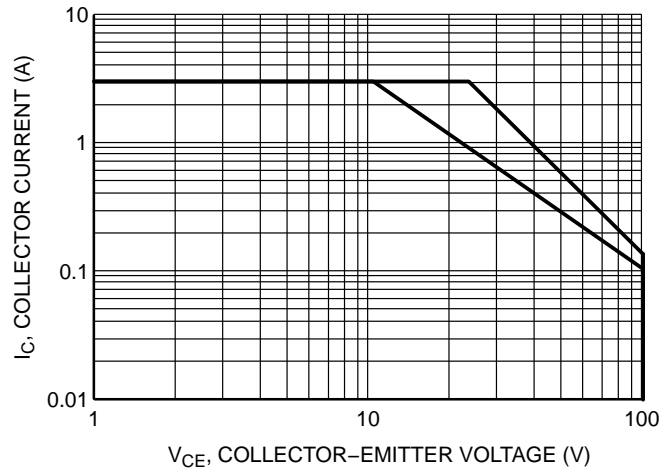


Figure 14. Safe Operating Area

MJD31 (NPN), MJD32 (PNP)

TYPICAL CHARACTERISTICS – MJD32, MJD32C (PNP)

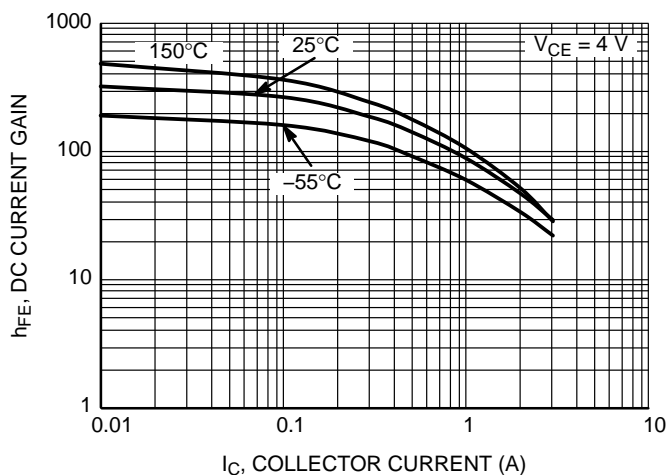


Figure 15. DC Current Gain at $V_{CE} = 4\text{ V}$

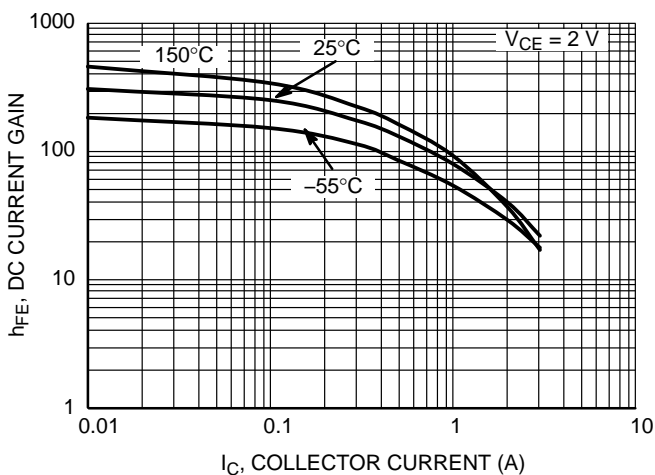


Figure 16. DC Current Gain at $V_{CE} = 2\text{ V}$

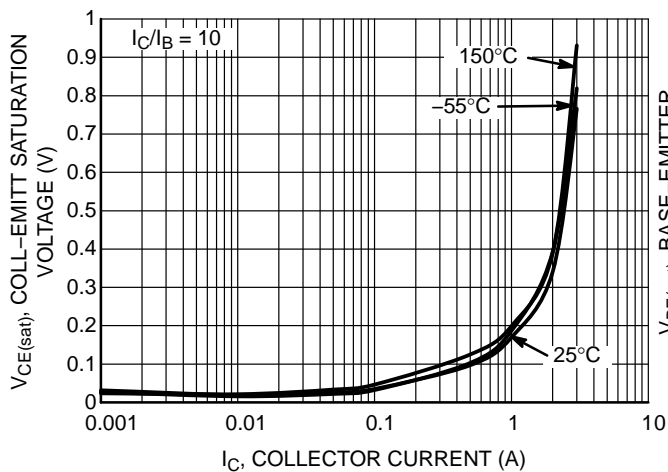


Figure 17. Collector-Emitter Saturation Voltage

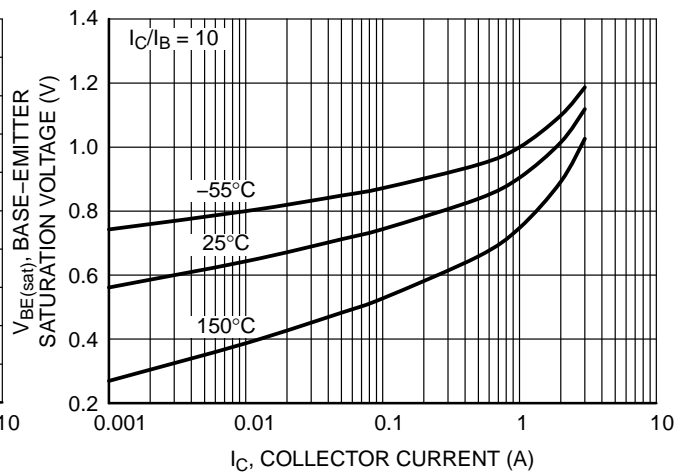


Figure 18. Base-Emitter Saturation Voltage

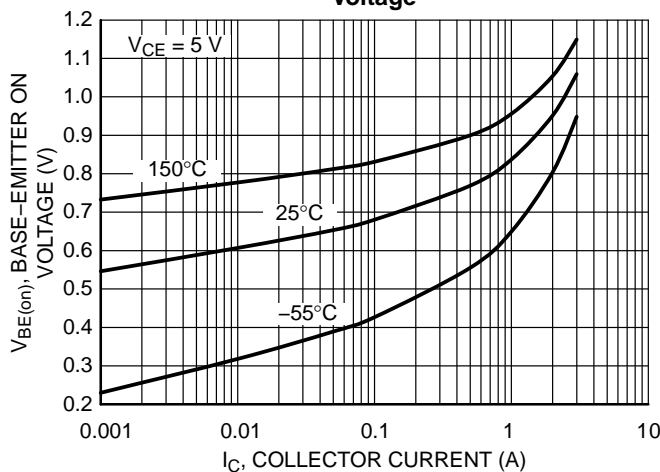


Figure 19. Base-Emitter "On" Voltage

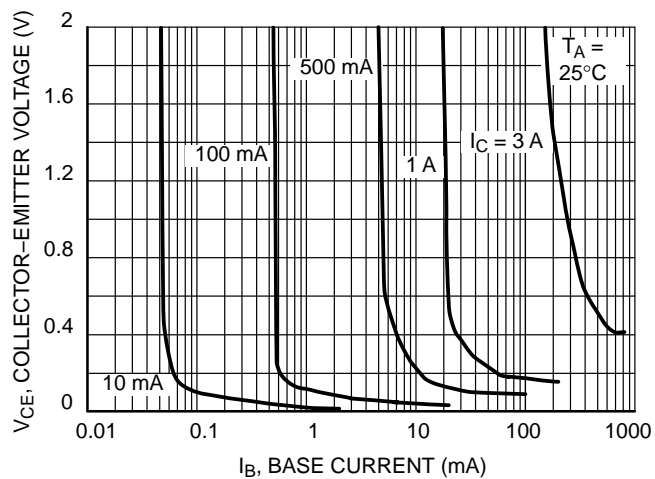


Figure 20. Collector Saturation Region

MJD31 (NPN), MJD32 (PNP)

TYPICAL CHARACTERISTICS

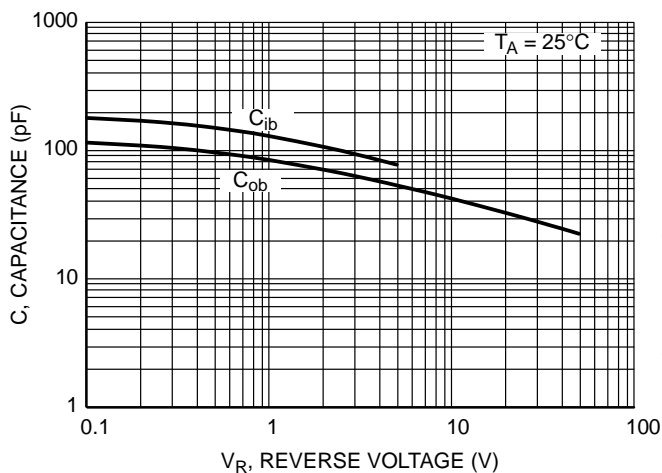


Figure 21. Capacitance

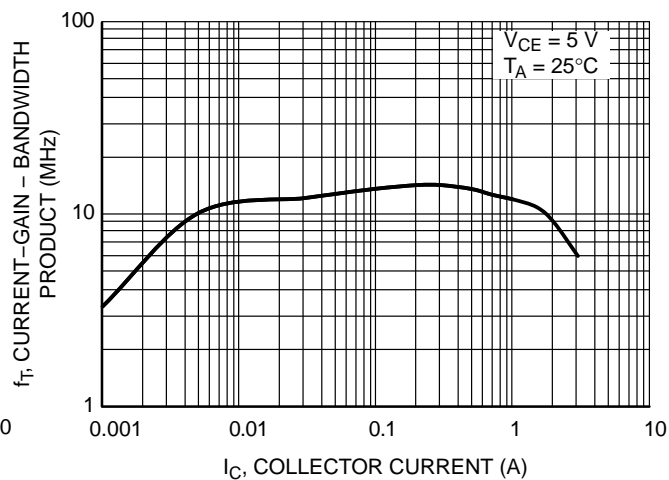


Figure 22. Current-Gain-Bandwidth Product

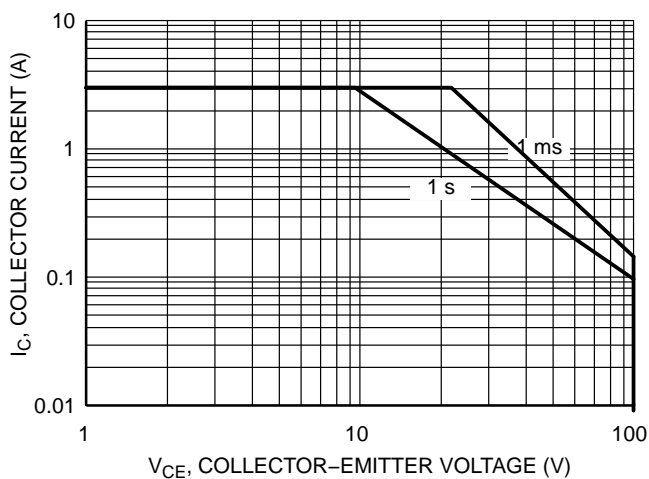


Figure 23. Safe Operating Area

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 |

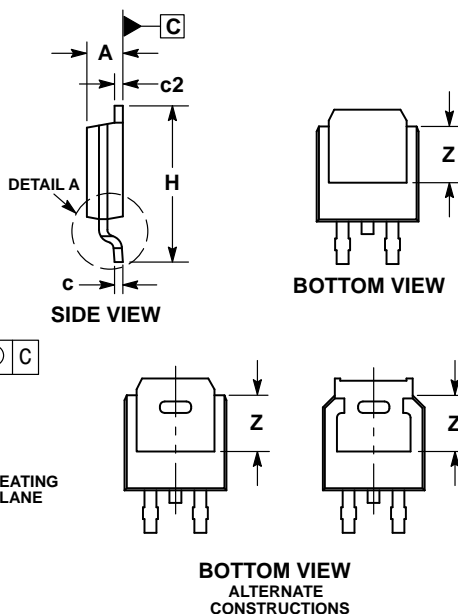
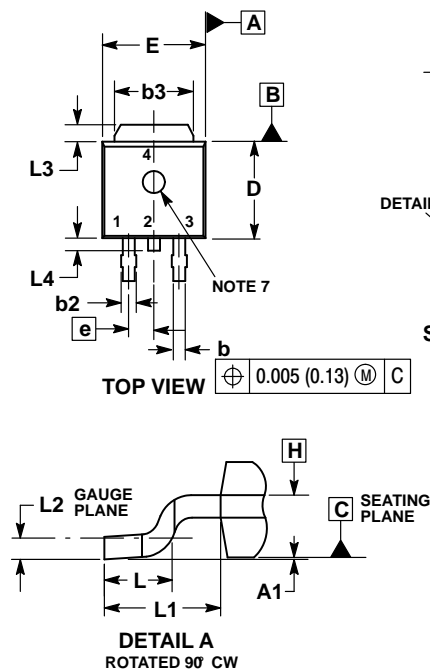
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

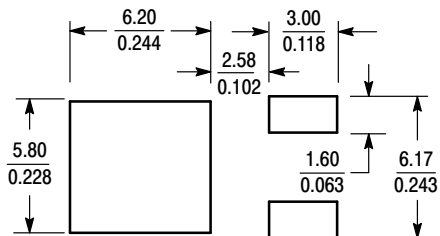
MJD31 (NPN), MJD32 (PNP)

PACKAGE DIMENSIONS

DPAK (SINGLE GAUGE) CASE 369C ISSUE F



SOLDERING FOOTPRINT*



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

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:

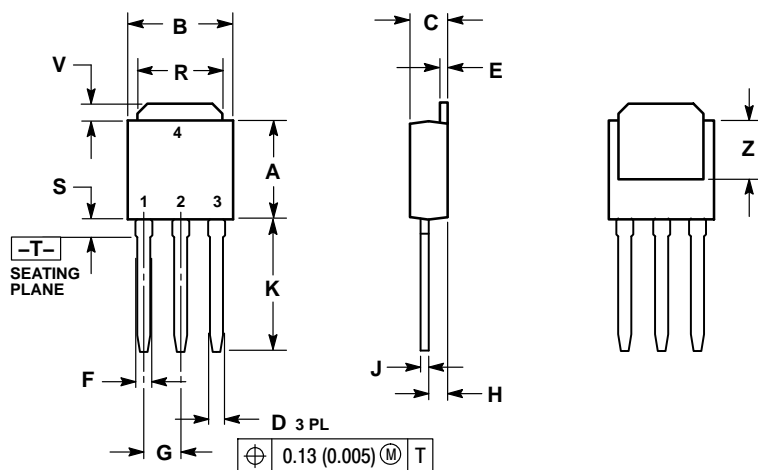
1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

*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

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marketing.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative