

NSS40301MZ4

Bipolar Power Transistors 40 V, 3.0 A, Low $V_{CE(sat)}$ NPN Transistor

ON Semiconductor's e²PowerEdge family of low $V_{CE(sat)}$ transistors are surface mount devices featuring ultra low saturation voltage ($V_{CE(sat)}$) and high current gain capability. These are designed for use in low voltage, high speed switching applications where affordable efficient energy control is important.

Typical applications are DC-DC converters and power management in portable and battery powered products such as cellular and cordless phones, PDAs, computers, printers, digital cameras and MP3 players. Other applications are low voltage motor controls in mass storage products such as disc drives and tape drives. In the automotive industry they can be used in air bag deployment and in the instrument cluster. The high current gain allows e²PowerEdge devices to be driven directly from PMU's control outputs, and the Linear Gain (Beta) makes them ideal components in analog amplifiers.

Features

- Complement to NSS40300MZ4 Series
- NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

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

| Rating | Symbol | Value | Unit |
|---|----------------|-------------|------------------|
| Collector-Emitter Voltage | V_{CEO} | 40 | Vdc |
| Collector-Base Voltage | V_{CB} | 40 | Vdc |
| Emitter-Base Voltage | V_{EB} | 6.0 | Vdc |
| Base Current - Continuous | I_B | 1.0 | Adc |
| Collector Current - Continuous | I_C | 3.0 | Adc |
| Collector Current - Peak | I_{CM} | 5.0 | Adc |
| Total Power Dissipation Total P_D @ $T_A = 25^\circ\text{C}$ (Note 1) Total P_D @ $T_A = 25^\circ\text{C}$ (Note 2) | P_D | 2.0 0.80 | W |
| Operating and Storage Junction Temperature Range | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

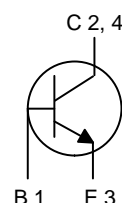
1. Mounted on 1" sq. (645 sq. mm) Collector pad on FR-4 bd material.
2. Mounted on 0.012" sq. (7.6 sq. mm) Collector pad on FR-4 bd material.



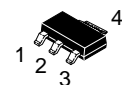
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**NPN TRANSISTOR
3.0 AMPERES
40 VOLTS, 2.0 WATTS**

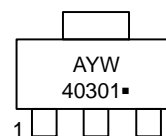


Schematic



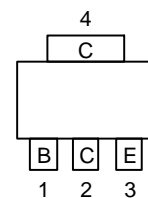
**SOT-223
CASE 318E
STYLE 1**

MARKING DIAGRAM



- A = Assembly Location
- Y = Year
- W = Work Week
- 40301 = Specific Device Code
- = Pb-Free Package

PIN ASSIGNMENT



Top View Pinout

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

NSS40301MZ4

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|--|------------------------------------|-----------|------|
| Thermal Resistance, Junction-to-Case Junction-to-Ambient on 1" sq. (645 sq. mm) Collector pad on FR-4 bd material Junction-to-Ambient on 0.012" sq. (7.6 sq. mm) Collector pad on FR-4 bd material | $R_{\theta JA}$ $R_{\theta JA}$ | 64 155 | °C/W |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds | T_L | 260 | °C |

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

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

OFF CHARACTERISTICS

| | | | | | |
|--|----------------|-----|---|-----|------|
| Collector-Emitter Sustaining Voltage ($I_C = 10\text{ mAdc}$, $I_B = 0\text{ Adc}$) | $V_{CEO(sus)}$ | 40 | - | - | Vdc |
| Emitter-Base Voltage ($I_E = 50\ \mu\text{Adc}$, $I_C = 0\text{ Adc}$) | V_{EBO} | 6.0 | - | - | Vdc |
| Collector Cutoff Current ($V_{CB} = 40\text{ Vdc}$) | I_{CBO} | - | - | 100 | nAdc |
| Emitter Cutoff Current ($V_{BE} = 6.0\text{ Vdc}$) | I_{EBO} | - | - | 100 | nAdc |

ON CHARACTERISTICS (Note 3)

| | | | | | |
|---|---------------|-------------------|-------------|-------------------------|-----|
| Collector-Emitter Saturation Voltage ($I_C = 0.5\text{ Adc}$, $I_B = 50\text{ mAdc}$) ($I_C = 1.0\text{ Adc}$, $I_B = 20\text{ mAdc}$) ($I_C = 3.0\text{ Adc}$, $I_B = 0.3\text{ Adc}$) | $V_{CE(sat)}$ | - | - | 0.050 0.100 0.200 | Vdc |
| Base-Emitter Saturation Voltage ($I_C = 1.0\text{ Adc}$, $I_B = 0.1\text{ Adc}$) | $V_{BE(sat)}$ | - | - | 1.0 | Vdc |
| Base-Emitter On Voltage ($I_C = 1.0\text{ Adc}$, $V_{CE} = 2.0\text{ Vdc}$) | $V_{BE(on)}$ | - | - | 0.9 | Vdc |
| DC Current Gain ($I_C = 0.5\text{ Adc}$, $V_{CE} = 1.0\text{ Vdc}$) ($I_C = 1.0\text{ Adc}$, $V_{CE} = 1.0\text{ Vdc}$) ($I_C = 3.0\text{ Adc}$, $V_{CE} = 1.0\text{ Vdc}$) | h_{FE} | 220 200 100 | - - - | 500 | - |

DYNAMIC CHARACTERISTICS

| | | | | | |
|---|----------|---|-----|---|-----|
| Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $f = 1.0\text{ MHz}$) | C_{ob} | - | 25 | - | pF |
| Input Capacitance ($V_{EB} = 5.0\text{ Vdc}$, $f = 1.0\text{ MHz}$) | C_{ib} | - | 170 | - | pF |
| Current-Gain - Bandwidth Product (Note 4) ($I_C = 500\text{ mA}$, $V_{CE} = 10\text{ V}$, $F_{test} = 1.0\text{ MHz}$) | f_T | - | 215 | - | MHz |

3. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.

4. $f_T = |h_{FE}| \cdot f_{test}$

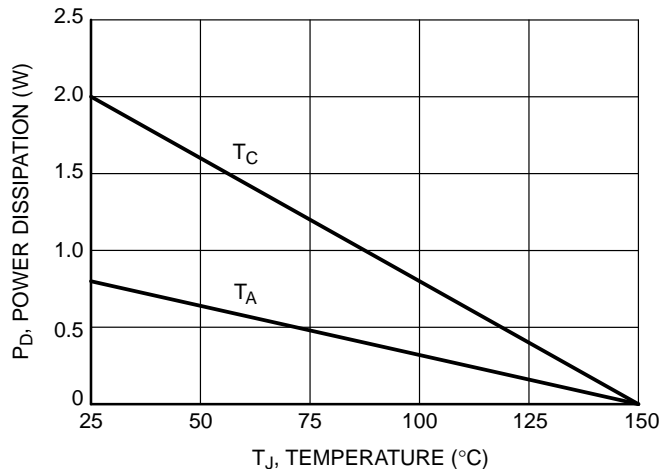


Figure 1. Power Derating

NSS40301MZ4

TYPICAL CHARACTERISTICS

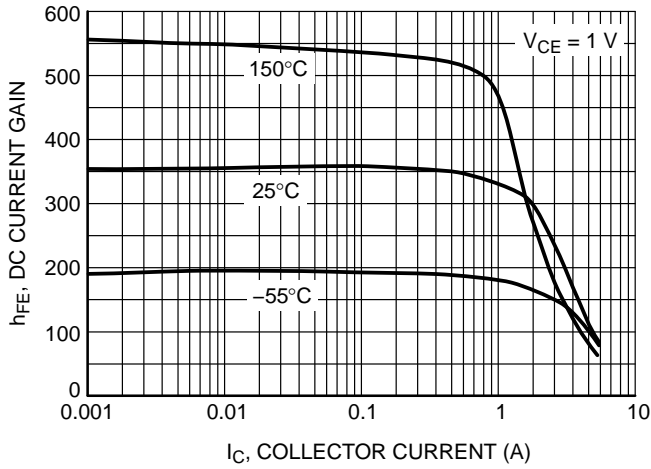


Figure 2. DC Current Gain

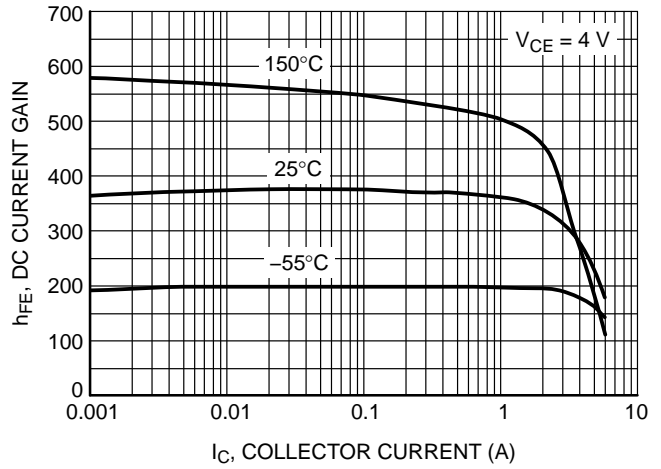


Figure 3. DC Current Gain

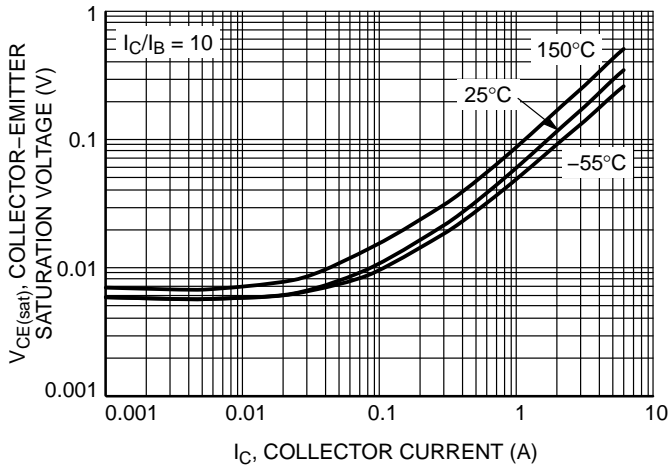


Figure 4. Collector-Emitter Saturation Voltage

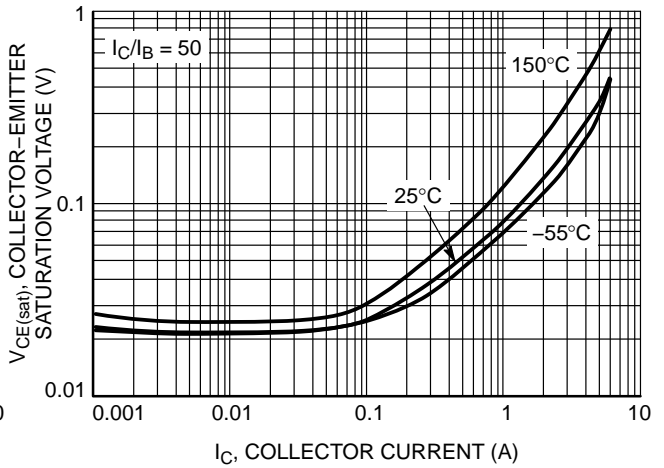


Figure 5. Collector-Emitter Saturation Voltage

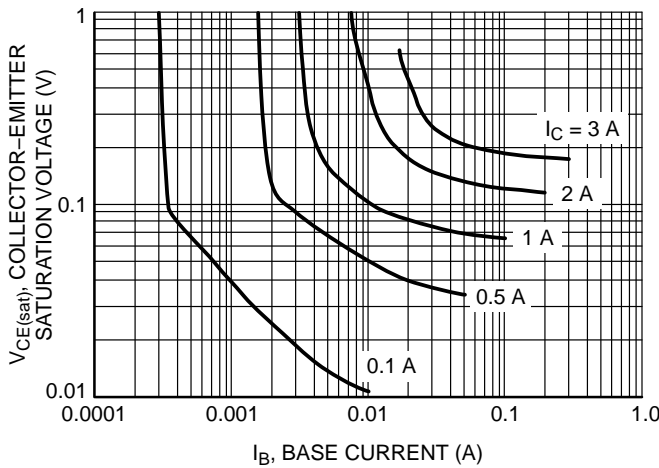


Figure 6. Collector Saturation Region

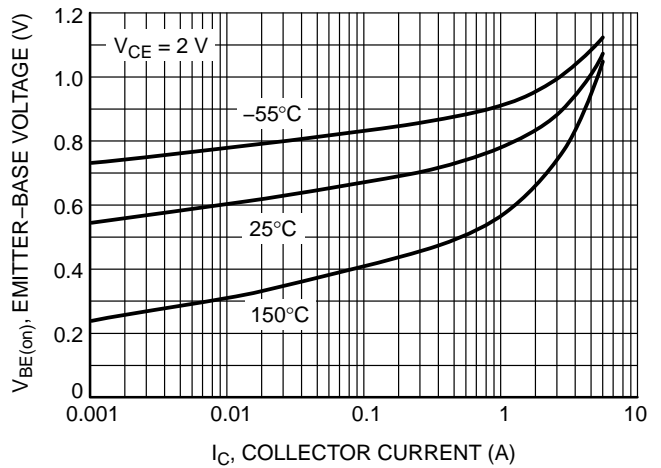


Figure 7. $V_{BE(on)}$ Voltage

TYPICAL CHARACTERISTICS

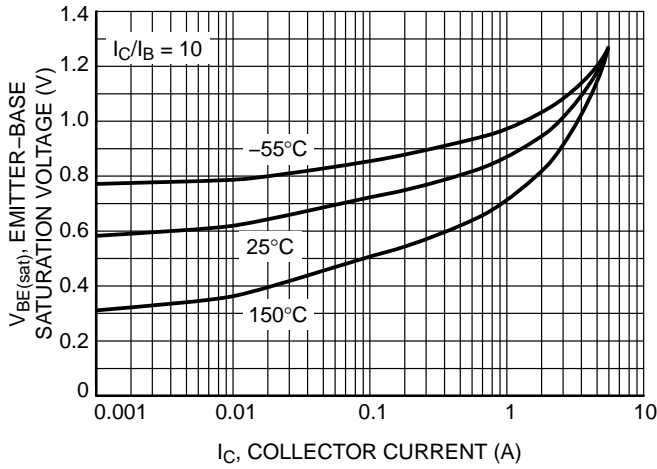


Figure 8. Base-Emitter Saturation Voltage

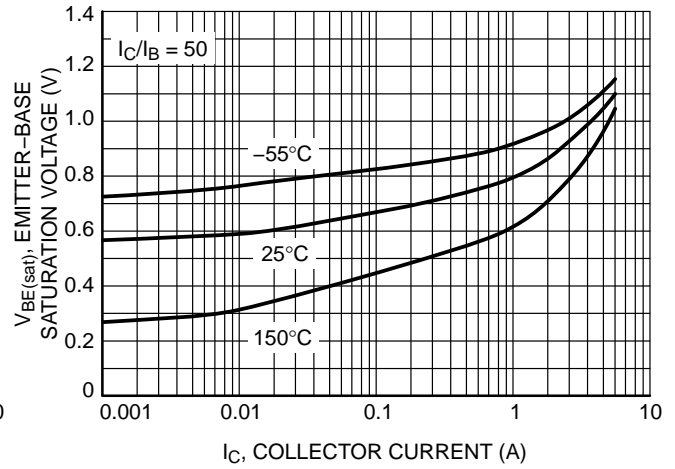


Figure 9. Base-Emitter Saturation Voltage

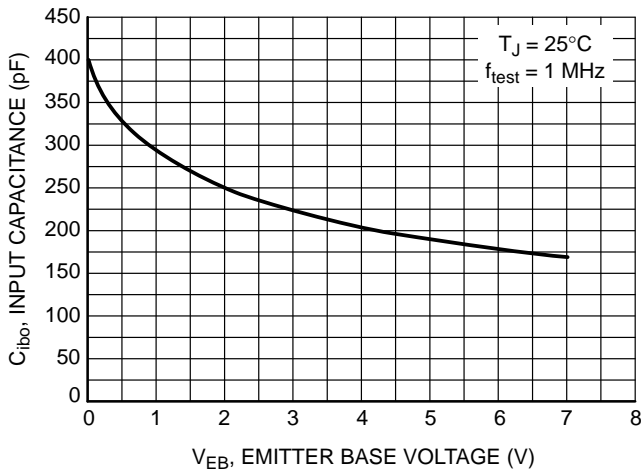


Figure 10. Input Capacitance

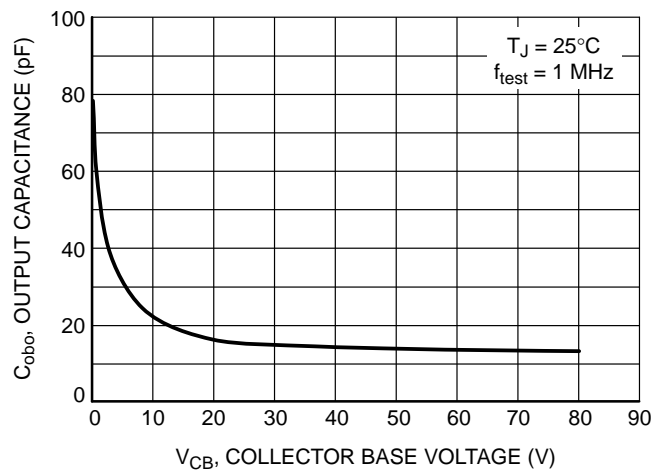


Figure 11. Output Capacitance

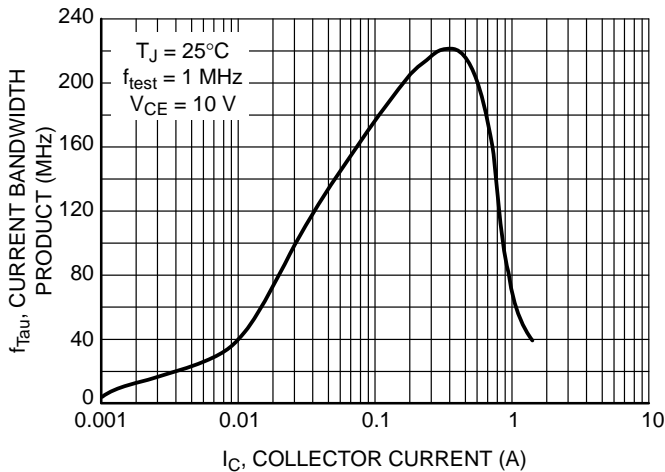


Figure 12. Current-Gain Bandwidth Product

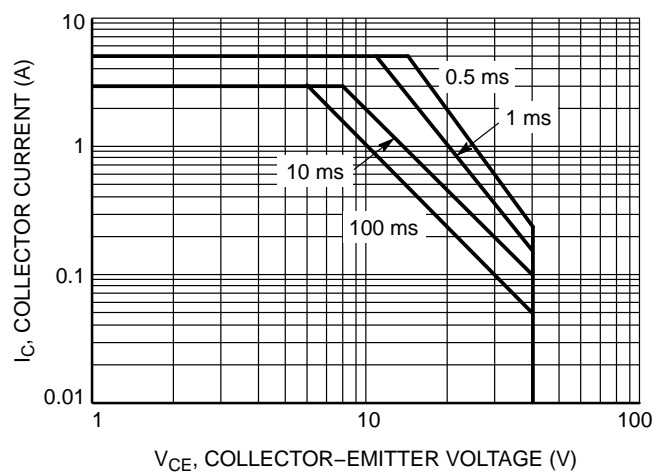


Figure 13. Safe Operating Area

NSS40301MZ4

ORDERING INFORMATION

| Device | Package | Shipping† |
|-----------------|----------------------|---------------------|
| NSS40301MZ4T1G | SOT-223 (Pb-Free) | 1,000 / Tape & Reel |
| NSV40301MZ4T1G* | SOT-223 (Pb-Free) | 1,000 / Tape & Reel |
| NSS40301MZ4T3G | SOT-223 (Pb-Free) | 4,000 / 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.

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

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

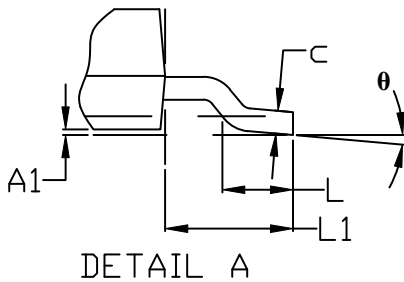
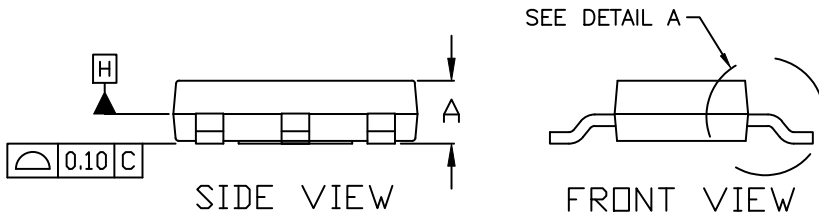
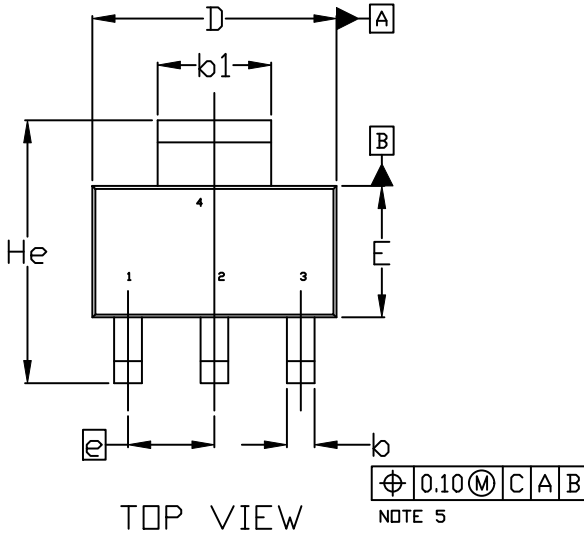
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SCALE 1:1

SOT-223 (TO-261)
CASE 318E-04
ISSUE R

DATE 02 OCT 2018



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS D & E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.200MM PER SIDE.
4. DATUMS A AND B ARE DETERMINED AT DATUM H.
5. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT OF THE PACKAGE BODY.
6. POSITIONAL TOLERANCE APPLIES TO DIMENSIONS b AND b1.

| MILLIMETERS | | | |
|-------------|----------|------|------|
| DIM | MIN. | NOM. | MAX. |
| A | 1.50 | 1.63 | 1.75 |
| A1 | 0.02 | 0.06 | 0.10 |
| b | 0.60 | 0.75 | 0.89 |
| b1 | 2.90 | 3.06 | 3.20 |
| c | 0.24 | 0.29 | 0.35 |
| D | 6.30 | 6.50 | 6.70 |
| E | 3.30 | 3.50 | 3.70 |
| e | 2.30 BSC | | |
| L | 0.20 | --- | --- |
| L1 | 1.50 | 1.75 | 2.00 |
| He | 6.70 | 7.00 | 7.30 |
| θ | 0° | --- | 10° |



| | | |
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CASE 318E-04
ISSUE R

DATE 02 OCT 2018

- | | | | | |
|--|---|---|---|---|
| STYLE 1: PIN 1. BASE 2. COLLECTOR 3. EMITTER 4. COLLECTOR | STYLE 2: PIN 1. ANODE 2. CATHODE 3. NC 4. CATHODE | STYLE 3: PIN 1. GATE 2. DRAIN 3. SOURCE 4. DRAIN | STYLE 4: PIN 1. SOURCE 2. DRAIN 3. GATE 4. DRAIN | STYLE 5: PIN 1. DRAIN 2. GATE 3. SOURCE 4. GATE |
| STYLE 6: PIN 1. RETURN 2. INPUT 3. OUTPUT 4. INPUT | STYLE 7: PIN 1. ANODE 1 2. CATHODE 3. ANODE 2 4. CATHODE | STYLE 8: CANCELLED | STYLE 9: PIN 1. INPUT 2. GROUND 3. LOGIC 4. GROUND | STYLE 10: PIN 1. CATHODE 2. ANODE 3. GATE 4. ANODE |
| STYLE 11: PIN 1. MT 1 2. MT 2 3. GATE 4. MT 2 | STYLE 12: PIN 1. INPUT 2. OUTPUT 3. NC 4. OUTPUT | STYLE 13: PIN 1. GATE 2. COLLECTOR 3. EMITTER 4. COLLECTOR | | |

**GENERIC
 MARKING DIAGRAM***




- A = Assembly Location
- Y = Year
- W = Work Week
- XXXXX = Specific Device Code
- = Pb-Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

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