

# NSS40301MZ4, NSV40301MZ4T1G

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

ON Semiconductor's e<sup>2</sup>PowerEdge 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 e<sup>2</sup>PowerEdge devices to be driven directly from PMU's control outputs, and the Linear Gain (Beta) makes them ideal components in analog amplifiers.

### Features

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



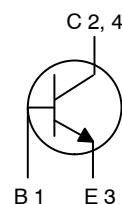
ON Semiconductor®

<http://onsemi.com>

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

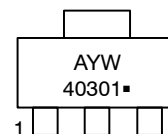


**SOT-223  
CASE 318E  
STYLE 1**



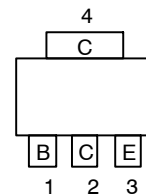
**Schematic**

### 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 2 of this data sheet.

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

# NSS40301MZ4, NSV40301MZ4T1G

## MAXIMUM RATINGS (T<sub>C</sub> = 25°C unless otherwise noted)

| Rating                                                                                                                                                                                                                                                        | Symbol                            | Value       | Unit |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------|------|
| Collector–Emitter Voltage                                                                                                                                                                                                                                     | V <sub>CEO</sub>                  | 40          | Vdc  |
| Collector–Base Voltage                                                                                                                                                                                                                                        | V <sub>CB</sub>                   | 40          | Vdc  |
| Emitter–Base Voltage                                                                                                                                                                                                                                          | V <sub>EB</sub>                   | 6.0         | Vdc  |
| Base Current – Continuous                                                                                                                                                                                                                                     | I <sub>B</sub>                    | 1.0         | Adc  |
| Collector Current<br>Continuous<br>Peak                                                                                                                                                                                                                       | I <sub>C</sub>                    | 3.0<br>5.0  | Adc  |
| Total Power Dissipation<br>Total P <sub>D</sub> @ T <sub>A</sub> = 25°C mounted on 1" sq. (645 sq. mm) Collector pad on FR–4 bd material<br>Total P <sub>D</sub> @ T <sub>A</sub> = 25°C mounted on 0.012" sq. (7.6 sq. mm) Collector pad on FR–4 bd material | P <sub>D</sub>                    | 2.0<br>0.80 | W    |
| Operating and Storage Junction Temperature Range                                                                                                                                                                                                              | T <sub>J</sub> , T <sub>stg</sub> | –55 to +150 | °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.

## THERMAL CHARACTERISTICS

| Characteristic                                                                                                                                                                                           | Symbol                               | Max       | Unit |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------|------|
| Thermal Resistance, Junction–to–Case<br>Junction–to–Ambient on 1" sq. (645 sq. mm) Collector pad on FR–4 bd material<br>Junction–to–Ambient on 0.012" sq. (7.6 sq. mm) Collector pad on FR–4 bd material | R <sub>θJA</sub><br>R <sub>θJA</sub> | 64<br>155 | °C/W |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds                                                                                                                            | T <sub>L</sub>                       | 260       | °C   |

## ORDERING INFORMATION

| Device         | Package              | Shipping <sup>†</sup> |
|----------------|----------------------|-----------------------|
| NSS40301MZ4T1G | SOT–223<br>(Pb–Free) | 1,000 / Tape & Reel   |
| NSV40301MZ4T1G | SOT–223<br>(Pb–Free) | 1,000 / Tape & Reel   |
| NSS40301MZ4T3G | SOT–223<br>(Pb–Free) | 4,000 / Tape & Reel   |

<sup>†</sup>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.

# NSS40301MZ4, NSV40301MZ4T1G

## 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 ( $I_E = 50\text{ }\mu\text{Adc}$ , $I_C = 0\text{ Adc}$ )        | $V_{EBO}$      | 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 1)

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

### DYNAMIC CHARACTERISTICS

|                                                                                                                               |          |  |     |  |     |
|-------------------------------------------------------------------------------------------------------------------------------|----------|--|-----|--|-----|
| Output Capacitance<br>( $V_{CB} = 10\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )                                                     | $C_{ob}$ |  | 25  |  | pF  |
| Input Capacitance<br>( $V_{EB} = 5.0\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )                                                     | $C_{ib}$ |  | 170 |  | pF  |
| Current-Gain – Bandwidth Product (Note 2)<br>( $I_C = 500\text{ mA}$ , $V_{CE} = 10\text{ V}$ , $f_{test} = 1.0\text{ MHz}$ ) | $f_T$    |  | 215 |  | MHz |

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

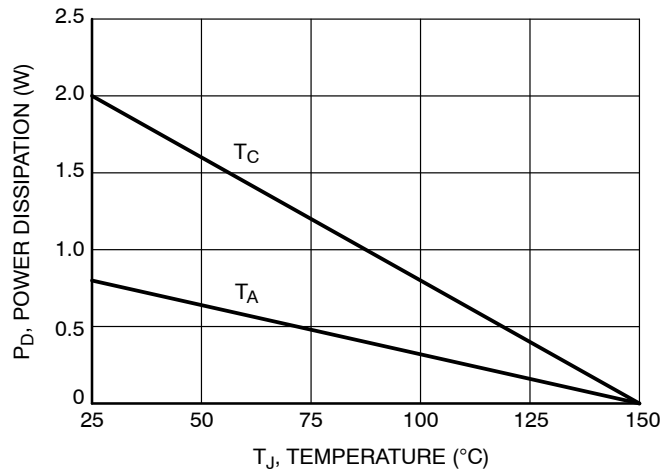


Figure 1. Power Derating

TYPICAL CHARACTERISTICS

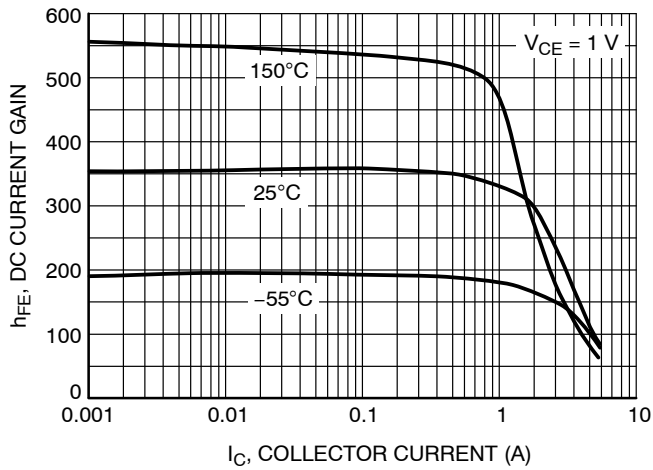


Figure 2. DC Current Gain

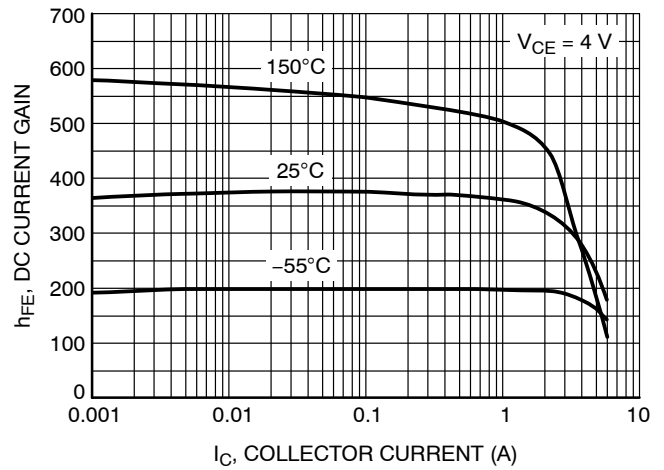


Figure 3. DC Current Gain

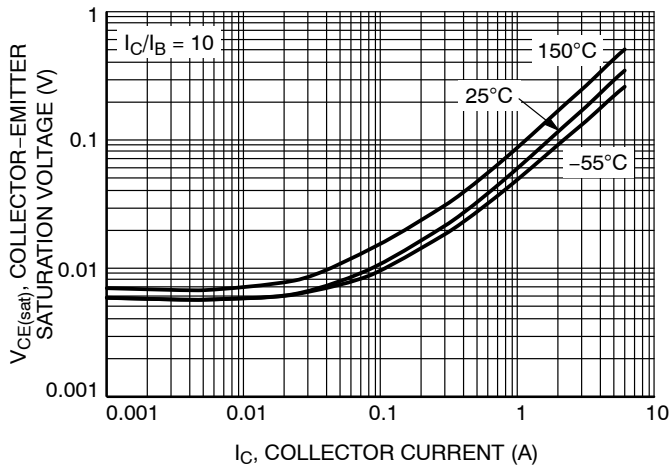


Figure 4. Collector-Emitter Saturation Voltage

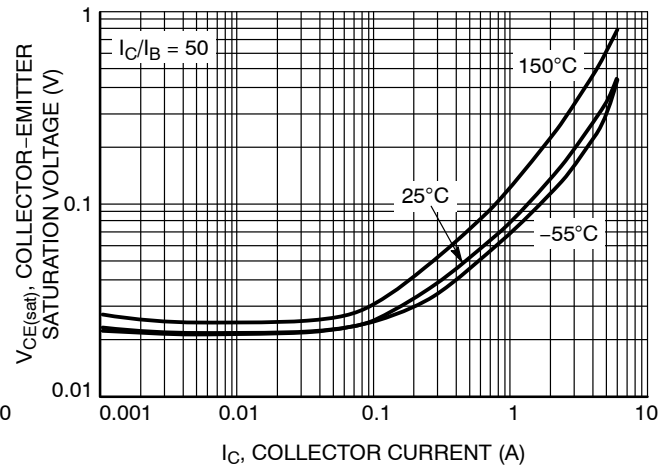


Figure 5. Collector-Emitter Saturation Voltage

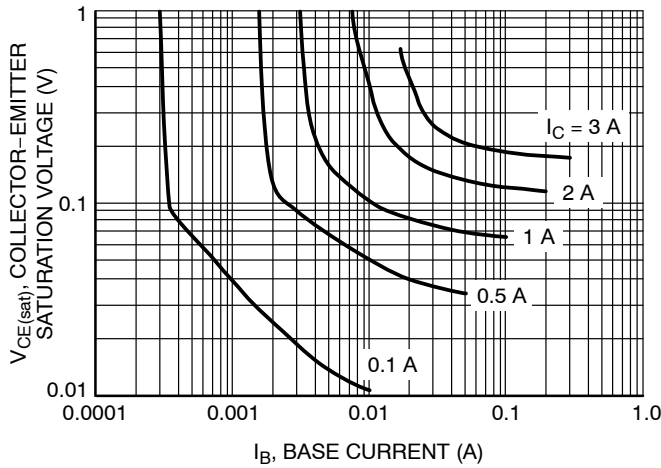


Figure 6. Collector Saturation Region

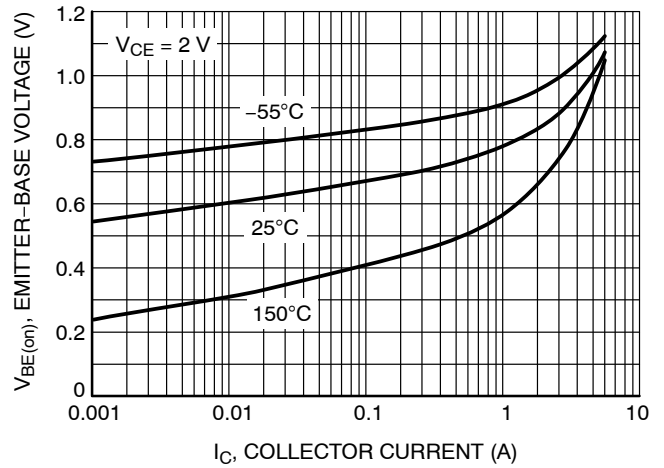


Figure 7.  $V_{BE(on)}$  Voltage

TYPICAL CHARACTERISTICS

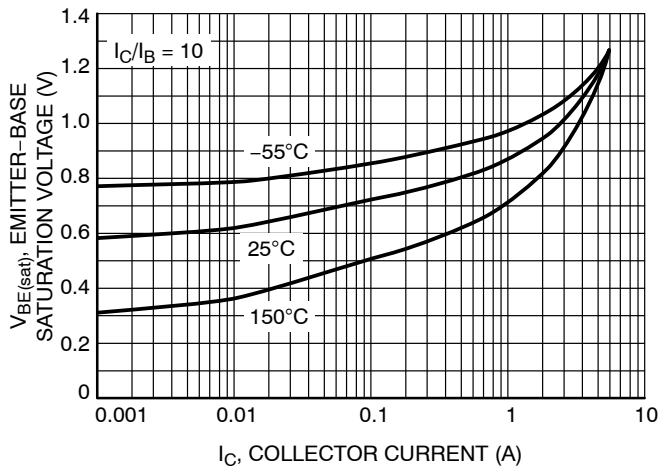


Figure 8. Base-Emitter Saturation Voltage

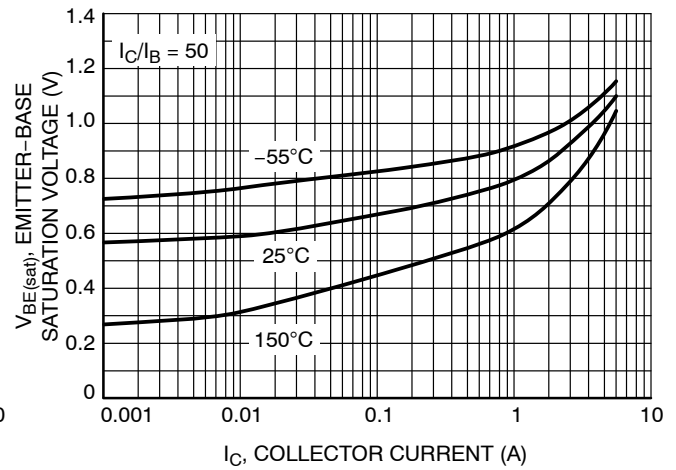


Figure 9. Base-Emitter Saturation Voltage

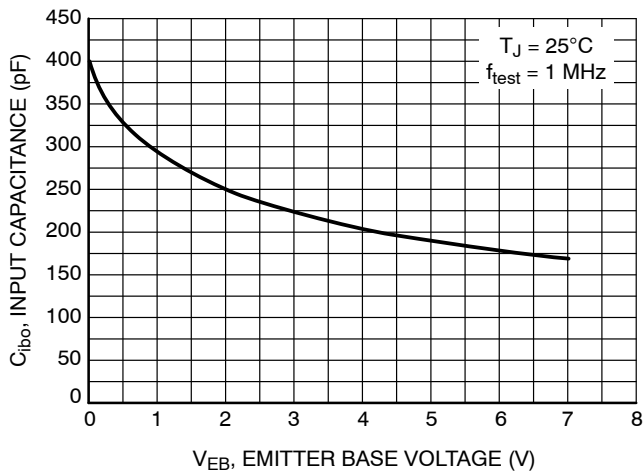


Figure 10. Input Capacitance

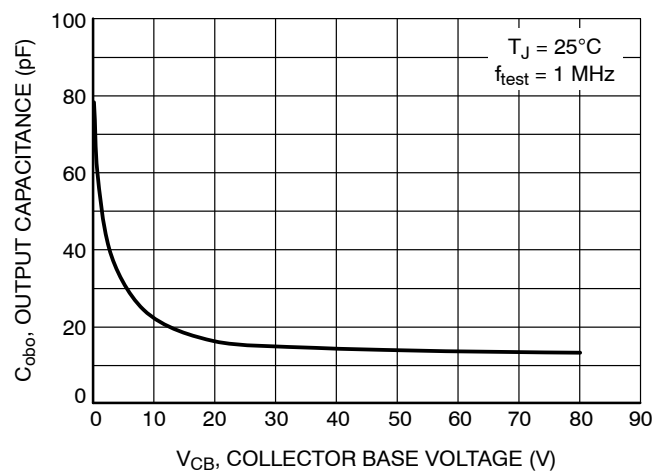


Figure 11. Output Capacitance

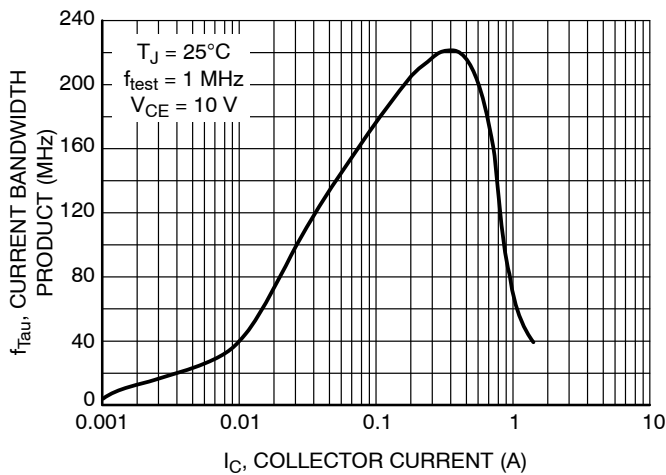


Figure 12. Current-Gain Bandwidth Product

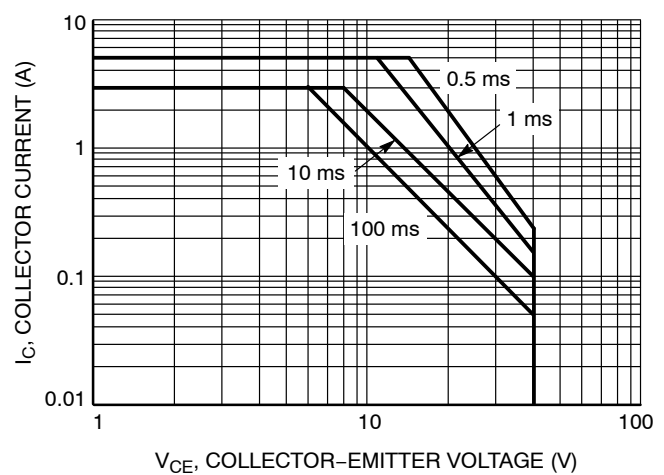
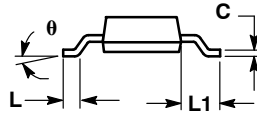
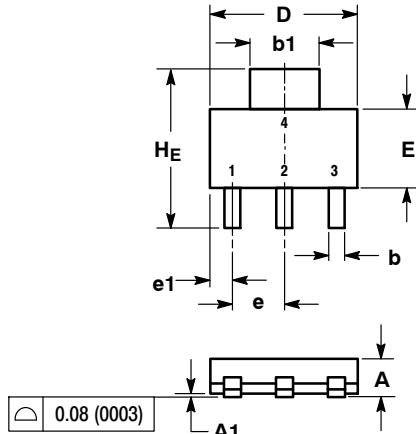


Figure 13. Safe Operating Area

# NSS40301MZ4, NSV40301MZ4T1G

## PACKAGE DIMENSIONS

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

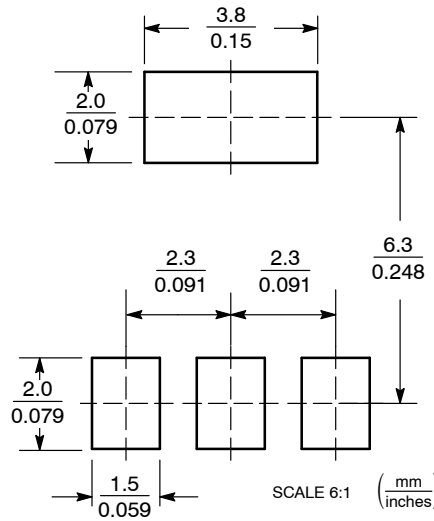


NOTES:  
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.  
2. CONTROLLING DIMENSION: INCH.

| DIM   | MILLIMETERS |      |      | INCHES |       |       |
|-------|-------------|------|------|--------|-------|-------|
|       | MIN         | NOM  | MAX  | MIN    | NOM   | MAX   |
| A     | 1.50        | 1.63 | 1.75 | 0.060  | 0.064 | 0.068 |
| A1    | 0.02        | 0.06 | 0.10 | 0.001  | 0.002 | 0.004 |
| b     | 0.60        | 0.75 | 0.89 | 0.024  | 0.030 | 0.035 |
| b1    | 2.90        | 3.06 | 3.20 | 0.115  | 0.121 | 0.126 |
| c     | 0.24        | 0.29 | 0.35 | 0.009  | 0.012 | 0.014 |
| D     | 6.30        | 6.50 | 6.70 | 0.249  | 0.256 | 0.263 |
| E     | 3.30        | 3.50 | 3.70 | 0.130  | 0.138 | 0.145 |
| e     | 2.20        | 2.30 | 2.40 | 0.087  | 0.091 | 0.094 |
| e1    | 0.85        | 0.94 | 1.05 | 0.033  | 0.037 | 0.041 |
| L     | 0.20        | ---  | ---  | 0.008  | ---   | ---   |
| L1    | 1.50        | 1.75 | 2.00 | 0.060  | 0.069 | 0.078 |
| H_E   | 6.70        | 7.00 | 7.30 | 0.264  | 0.276 | 0.287 |
| theta | 0°          | ---  | 10°  | 0°     | ---   | 10°   |

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

### SOLDERING FOOTPRINT\*



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

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NSS40301MZ4/D



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- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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