

# NSS40301MDR2G

## Dual Matched 40 V, 6.0 A, Low $V_{CE(sat)}$ NPN Transistor

These transistors are part of the ON Semiconductor e<sup>2</sup>PowerEdge family of Low  $V_{CE(sat)}$  transistors. They are assembled to create a pair of devices highly matched in all parameters, including ultra low saturation voltage  $V_{CE(sat)}$ , high current gain and Base/Emitter turn on voltage.

Typical applications are current mirrors, differential amplifiers, 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

- Current Gain Matching to 10%
- Base Emitter Voltage Matched to 2 mV
- This is a Pb-Free Device

### MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

| Rating                         | Symbol    | Max                        | Unit |
|--------------------------------|-----------|----------------------------|------|
| Collector-Emitter Voltage      | $V_{CEO}$ | 40                         | Vdc  |
| Collector-Base Voltage         | $V_{CBO}$ | 40                         | Vdc  |
| Emitter-Base Voltage           | $V_{EBO}$ | 6.0                        | Vdc  |
| Collector Current – Continuous | $I_C$     | 3.0                        | A    |
| Collector Current – Peak       | $I_{CM}$  | 6.0                        | A    |
| Electrostatic Discharge        | ESD       | HBM Class 3B<br>MM Class C |      |

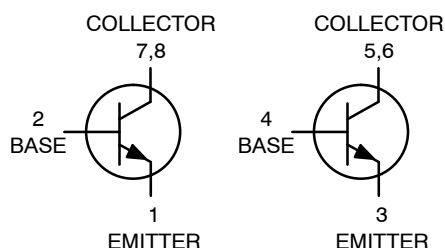
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.



ON Semiconductor®

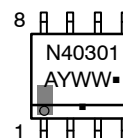
<http://onsemi.com>

**40 VOLTS**  
**6.0 AMPS**  
**NPN LOW  $V_{CE(sat)}$  TRANSISTOR**  
**EQUIVALENT  $R_{DS(on)}$  44 mΩ**



**SOIC-8**  
**CASE 751**  
**STYLE 16**

### DEVICE MARKING



N40301 = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
■ = Pb-Free Package  
(Note: Microdot may be in either location)

### ORDERING INFORMATION

| Device        | Package             | Shipping†             |
|---------------|---------------------|-----------------------|
| NSS40301MDR2G | SOIC-8<br>(Pb-Free) | 2500 /<br>Tape & Reel |

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

# NSS40301MDR2G

## THERMAL CHARACTERISTICS

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

### SINGLE HEATED

|                                                                                                  |                 |            |                            |
|--------------------------------------------------------------------------------------------------|-----------------|------------|----------------------------|
| Total Device Dissipation (Note 1)<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$           | 576<br>4.6 | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient (Note 1)                                                 | $R_{\theta JA}$ | 217        | $^\circ\text{C/W}$         |
| Total Device Dissipation (Note 2)<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$           | 676<br>5.4 | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient (Note 2)                                                 | $R_{\theta JA}$ | 185        | $^\circ\text{C/W}$         |

### DUAL HEATED (Note 3)

|                                                                                                  |                 |             |                            |
|--------------------------------------------------------------------------------------------------|-----------------|-------------|----------------------------|
| Total Device Dissipation (Note 1)<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$           | 653<br>5.2  | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient (Note 1)                                                 | $R_{\theta JA}$ | 191         | $^\circ\text{C/W}$         |
| Total Device Dissipation (Note 2)<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$           | 783<br>6.3  | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient (Note 2)                                                 | $R_{\theta JA}$ | 160         | $^\circ\text{C/W}$         |
| Junction and Storage Temperature Range                                                           | $T_J, T_{stg}$  | -55 to +150 | $^\circ\text{C}$           |

1. FR-4 @ 10 mm<sup>2</sup>, 1 oz. copper traces, still air.
2. FR-4 @ 100 mm<sup>2</sup>, 1 oz. copper traces, still air.
3. Dual heated values assume total power is the sum of two equally powered devices.

# NSS40301MDR2G

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

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

### OFF CHARACTERISTICS

|                                                                                       |                      |     |   |     |      |
|---------------------------------------------------------------------------------------|----------------------|-----|---|-----|------|
| Collector–Emitter Breakdown Voltage<br>(I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 0) | V <sub>(BR)CEO</sub> | 40  | – | –   | Vdc  |
| Collector–Base Breakdown Voltage<br>(I <sub>C</sub> = 0.1 mAdc, I <sub>E</sub> = 0)   | V <sub>(BR)CBO</sub> | 40  | – | –   | Vdc  |
| Emitter–Base Breakdown Voltage<br>(I <sub>E</sub> = 0.1 mAdc, I <sub>C</sub> = 0)     | V <sub>(BR)EBO</sub> | 6.0 | – | –   | Vdc  |
| Collector Cutoff Current<br>(V <sub>CB</sub> = 40 Vdc, I <sub>E</sub> = 0)            | I <sub>CBO</sub>     | –   | – | 0.1 | μAdc |
| Emitter Cutoff Current<br>(V <sub>EB</sub> = 6.0 Vdc)                                 | I <sub>EBO</sub>     | –   | – | 0.1 | μAdc |

### ON CHARACTERISTICS

|                                                                                                                                                                                                                                                                                                             |                                                                           |                                 |                                  |                                  |         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------|----------------------------------|----------------------------------|---------|
| DC Current Gain (Note 4)<br>(I <sub>C</sub> = 10 mA, V <sub>CE</sub> = 2.0 V)<br>(I <sub>C</sub> = 500 mA, V <sub>CE</sub> = 2.0 V)<br>(I <sub>C</sub> = 1.0 A, V <sub>CE</sub> = 2.0 V)<br>(I <sub>C</sub> = 2.0 A, V <sub>CE</sub> = 2.0 V)<br>(I <sub>C</sub> = 2.0 A, V <sub>CE</sub> = 2.0 V) (Note 5) | h <sub>FE</sub><br><br><br><br><br>h <sub>FE(1)</sub> /h <sub>FE(2)</sub> | 200<br>200<br>180<br>180<br>0.9 | 400<br>350<br>340<br>320<br>0.99 | –<br>–<br>–<br>–<br>–            |         |
| Collector–Emitter Saturation Voltage (Note 4)<br>(I <sub>C</sub> = 0.1 A, I <sub>B</sub> = 0.010 A)<br>(I <sub>C</sub> = 1.0 A, I <sub>B</sub> = 0.100 A)<br>(I <sub>C</sub> = 1.0 A, I <sub>B</sub> = 0.010 A)<br>(I <sub>C</sub> = 2.0 A, I <sub>B</sub> = 0.200 A)                                       | V <sub>CE(sat)</sub>                                                      | –<br>–<br>–<br>–                | 0.008<br>0.044<br>0.080<br>0.082 | 0.011<br>0.060<br>0.115<br>0.115 | V       |
| Base–Emitter Saturation Voltage (Note 4)<br>(I <sub>C</sub> = 1.0 A, I <sub>B</sub> = 0.01 A)                                                                                                                                                                                                               | V <sub>BE(sat)</sub>                                                      | –                               | 0.780                            | 0.900                            | V       |
| Base–Emitter Turn–on Voltage (Note 4)<br>(I <sub>C</sub> = 0.1 A, V <sub>CE</sub> = 2.0 V)<br>(I <sub>C</sub> = 0.1 A, V <sub>CE</sub> = 2.0 V) (Note 6)                                                                                                                                                    | V <sub>BE(on)</sub><br>V <sub>BE(1)</sub> – V <sub>BE(2)</sub>            | –<br>–                          | 0.650<br>0.3                     | 0.750<br>2.0                     | V<br>mV |
| Cutoff Frequency<br>(I <sub>C</sub> = 100 mA, V <sub>CE</sub> = 5.0 V, f = 100 MHz)                                                                                                                                                                                                                         | f <sub>T</sub>                                                            | 100                             | –                                | –                                | MHz     |
| Input Capacitance (V <sub>EB</sub> = 0.5 V, f = 1.0 MHz)                                                                                                                                                                                                                                                    | C <sub>ibo</sub>                                                          | –                               | 320                              | 450                              | pF      |
| Output Capacitance (V <sub>CB</sub> = 3.0 V, f = 1.0 MHz)                                                                                                                                                                                                                                                   | C <sub>obo</sub>                                                          | –                               | 40                               | 50                               | pF      |

### SWITCHING CHARACTERISTICS

|                                                                                    |                |   |   |     |    |
|------------------------------------------------------------------------------------|----------------|---|---|-----|----|
| Delay (V <sub>CC</sub> = 30 V, I <sub>C</sub> = 750 mA, I <sub>B1</sub> = 15 mA)   | t <sub>d</sub> | – | – | 100 | ns |
| Rise (V <sub>CC</sub> = 30 V, I <sub>C</sub> = 750 mA, I <sub>B1</sub> = 15 mA)    | t <sub>r</sub> | – | – | 100 | ns |
| Storage (V <sub>CC</sub> = 30 V, I <sub>C</sub> = 750 mA, I <sub>B1</sub> = 15 mA) | t <sub>s</sub> | – | – | 780 | ns |
| Fall (V <sub>CC</sub> = 30 V, I <sub>C</sub> = 750 mA, I <sub>B1</sub> = 15 mA)    | t <sub>f</sub> | – | – | 110 | ns |

4. Pulsed Condition: Pulse Width = 300 μsec, Duty Cycle ≤ 2%.

5. h<sub>FE(1)</sub>/h<sub>FE(2)</sub> is the ratio of one transistor compared to the other transistor within the same package. The smaller h<sub>FE</sub> is used as numerator.

6. V<sub>BE(1)</sub> – V<sub>BE(2)</sub> is the absolute difference of one transistor compared to the other transistor within the same package.

TYPICAL CHARACTERISTICS

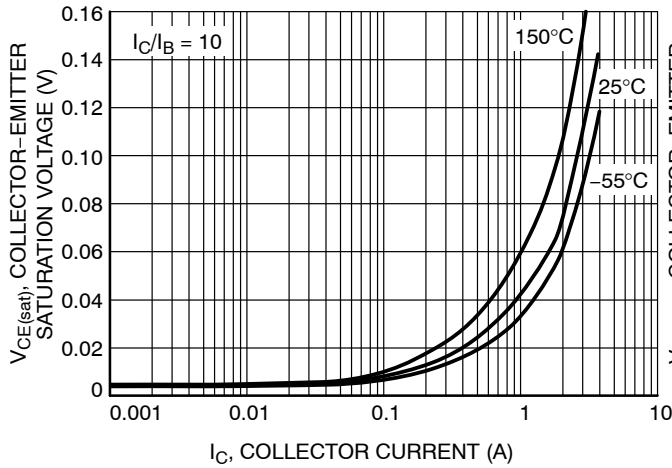


Figure 1. Collector Emitter Saturation Voltage vs. Collector Current

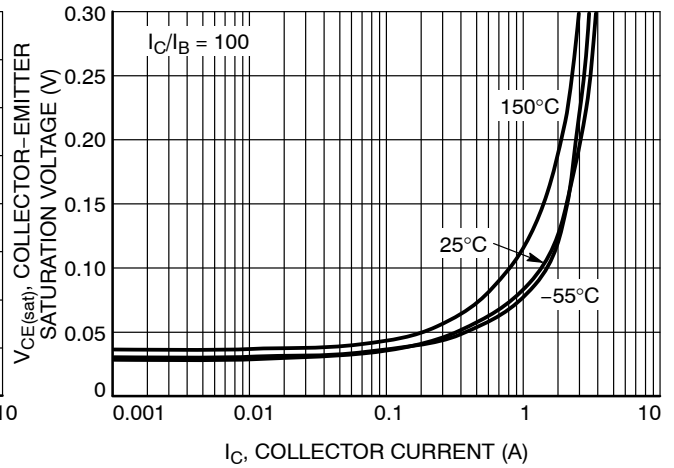


Figure 2. Collector Emitter Saturation Voltage vs. Collector Current

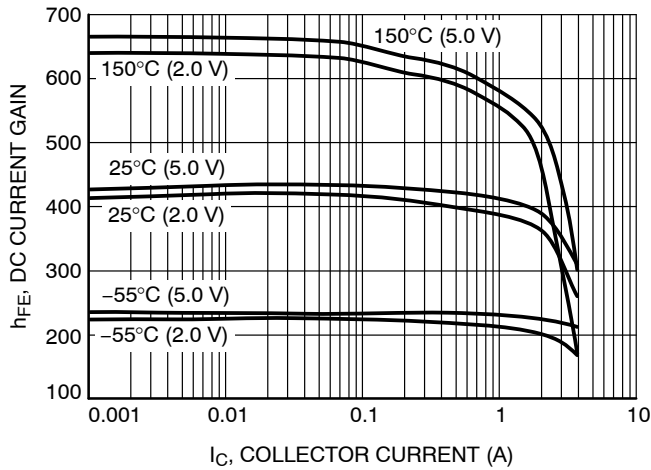


Figure 3. DC Current Gain vs. Collector Current

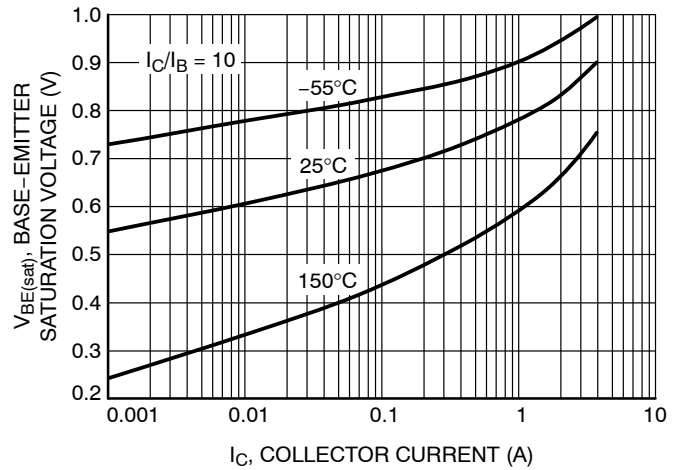


Figure 4. Base Emitter Saturation Voltage vs. Collector Current

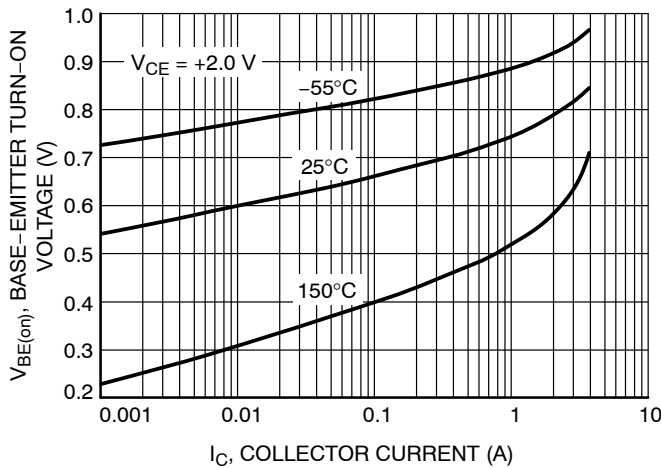


Figure 5. Base Emitter Turn-On Voltage vs. Collector Current

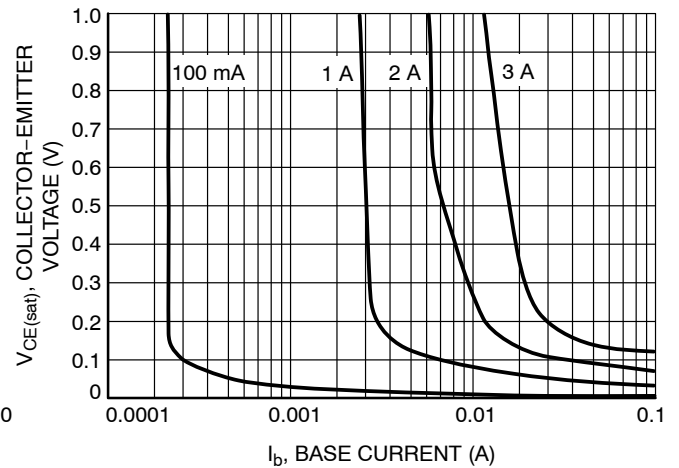


Figure 6. Saturation Region

TYPICAL CHARACTERISTICS

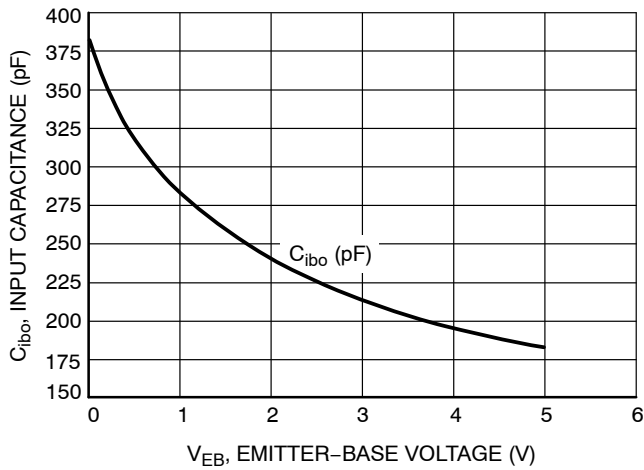


Figure 7. Input Capacitance

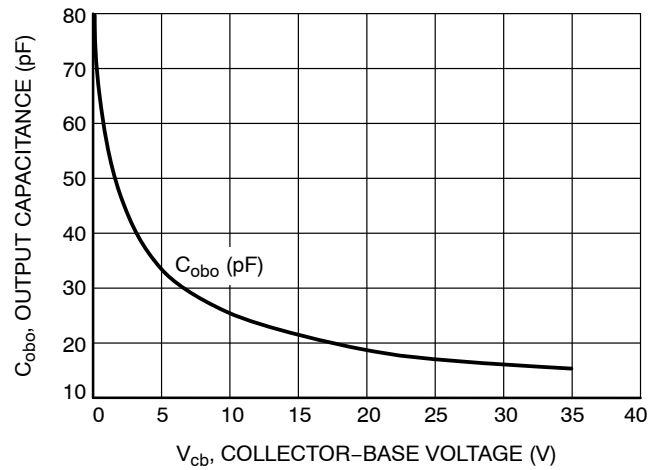


Figure 8. Output Capacitance

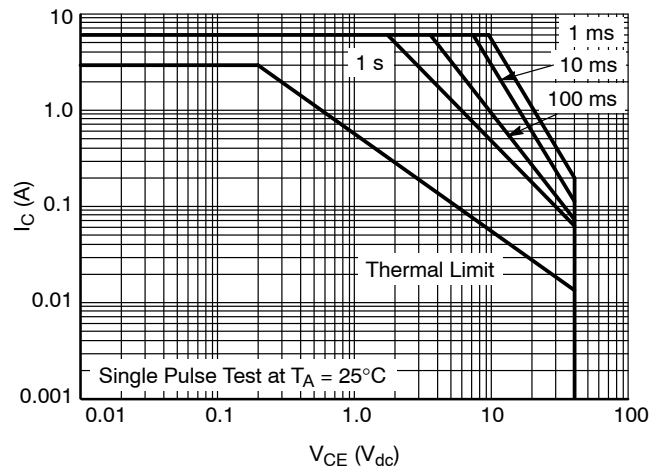
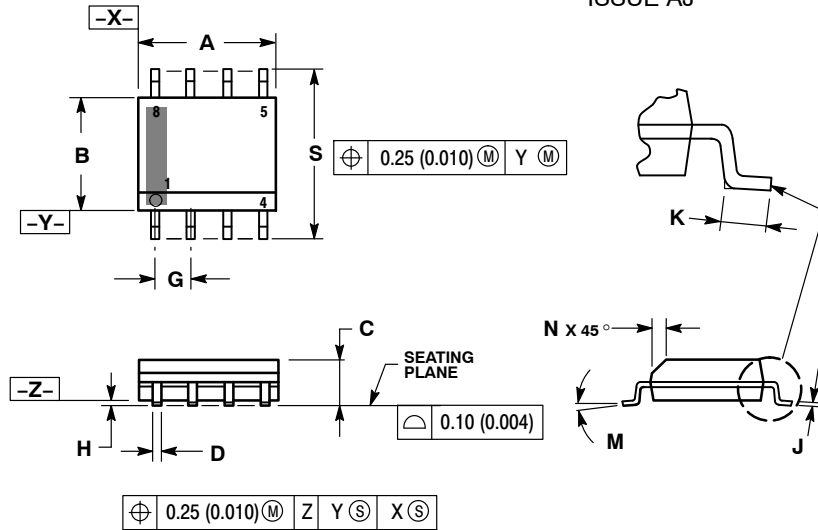


Figure 9. Safe Operating Area

# NSS40301MDR2G

## PACKAGE DIMENSIONS

### SOIC-8 NB CASE 751-07 ISSUE AJ

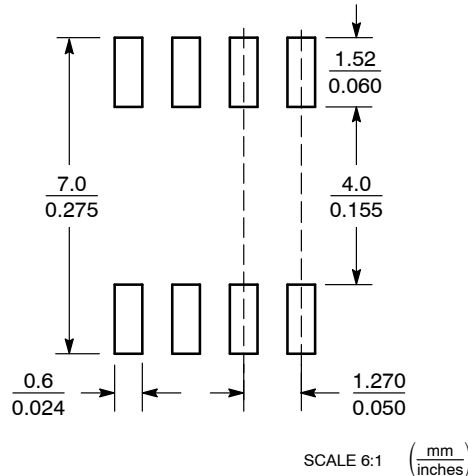


#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 4.80        | 5.00 | 0.189     | 0.197 |
| B   | 3.80        | 4.00 | 0.150     | 0.157 |
| C   | 1.35        | 1.75 | 0.053     | 0.069 |
| D   | 0.33        | 0.51 | 0.013     | 0.020 |
| G   | 1.27 BSC    |      | 0.050 BSC |       |
| H   | 0.10        | 0.25 | 0.004     | 0.010 |
| J   | 0.19        | 0.25 | 0.007     | 0.010 |
| K   | 0.40        | 1.27 | 0.016     | 0.050 |
| M   | 0°          | 8°   | 0°        | 8°    |
| N   | 0.25        | 0.50 | 0.010     | 0.020 |
| S   | 5.80        | 6.20 | 0.228     | 0.244 |

### SOLDERING FOOTPRINT\*



#### STYLE 16:

- PIN 1: EMITTER, DIE #1  
 2. BASE, DIE #1  
 3. EMITTER, DIE #2  
 4. BASE, DIE #2  
 5. COLLECTOR, DIE #2  
 6. COLLECTOR, DIE #2  
 7. COLLECTOR, DIE #1  
 8. COLLECTOR, DIE #1

\*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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- 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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#### Как с нами связаться

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