

# Bipolar Power Transistors

## 40 V, 3.0 A, Low $V_{CE(sat)}$

### NPN Transistor

#### NSS40301MZ4

onsemi'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

- 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<br>Total $P_D$ @ $T_A = 25^\circ\text{C}$ (Note 1)<br>Total $P_D$ @ $T_A = 25^\circ\text{C}$ (Note 2) | $P_D$          | 2.0<br>0.80 | W                |
| Operating and Storage Junction Temperature Range                                                                              | $T_J, T_{stg}$ | -55 to +150 | $^\circ\text{C}$ |

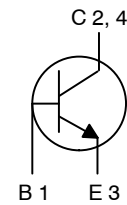
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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.

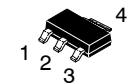
## NPN TRANSISTOR

### 3.0 AMPERES

### 40 VOLTS, 2.0 WATTS

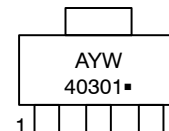


Schematic



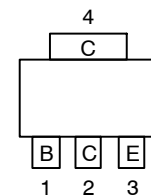
SOT-223  
CASE 318E  
STYLE 1

#### 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<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 | $R_{\theta JA}$<br>$R_{\theta JA}$ | 64<br>155 | $^{\circ}\text{C/W}$ |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds                                                                                                                            | $T_L$                              | 260       | $^{\circ}\text{C}$   |

## 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<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>( $I_C = 3.0 \text{ Adc}$ , $I_B = 0.3 \text{ Adc}$ ) | $V_{CE(sat)}$ | –<br>–<br>–       | –<br>–<br>– | 0.050<br>0.100<br>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<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 | –<br>–<br>– | 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)<br>( $I_C = 500 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ , $f_{test} = 1.0 \text{ MHz}$ ) | $f_T$    | – | 215 | – | MHz |

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

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

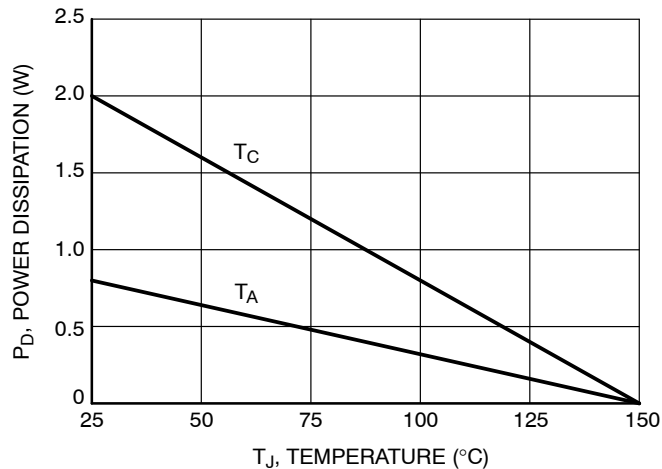


Figure 1. Power Derating

TYPICAL CHARACTERISTICS

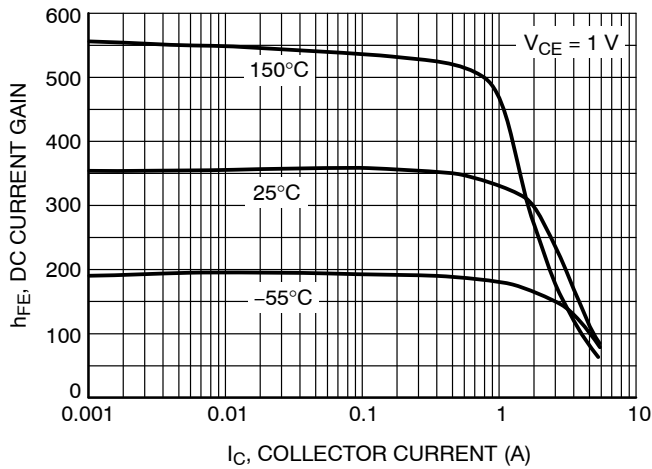


Figure 2. DC Current Gain

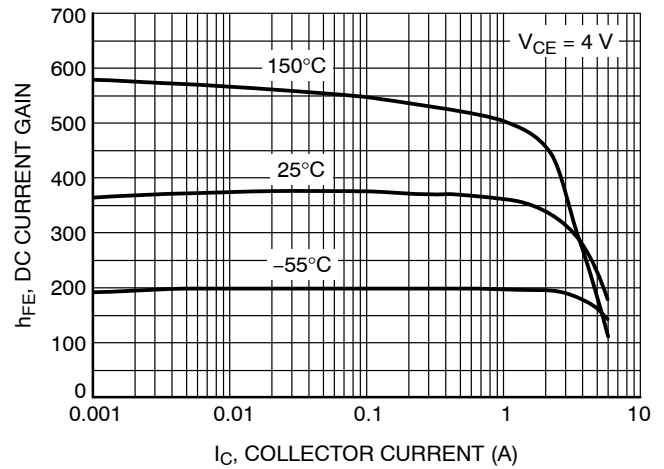


Figure 3. DC Current Gain

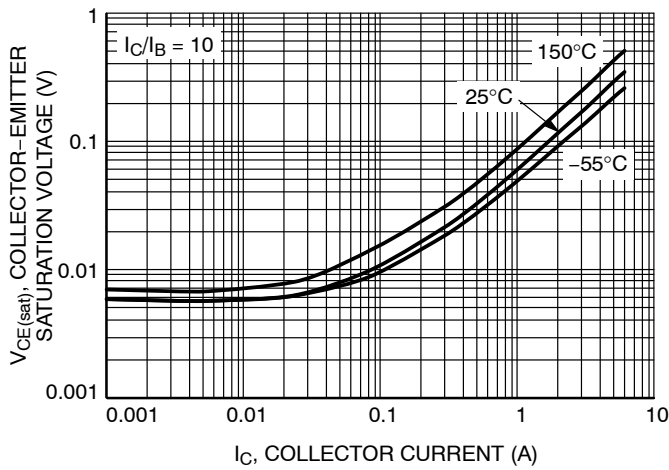


Figure 4. Collector-Emitter Saturation Voltage

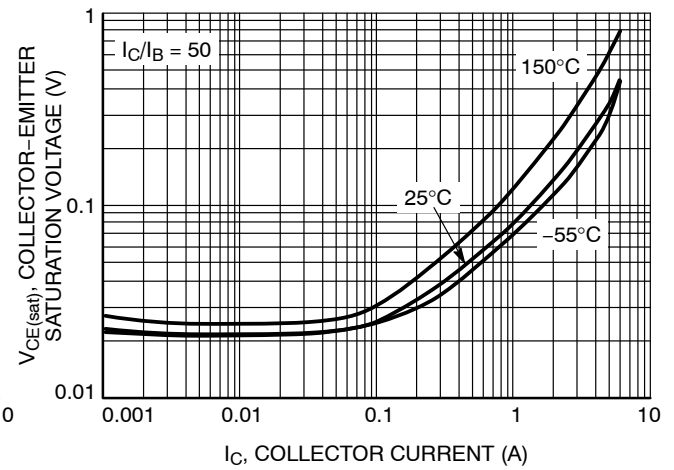


Figure 5. Collector-Emitter Saturation Voltage

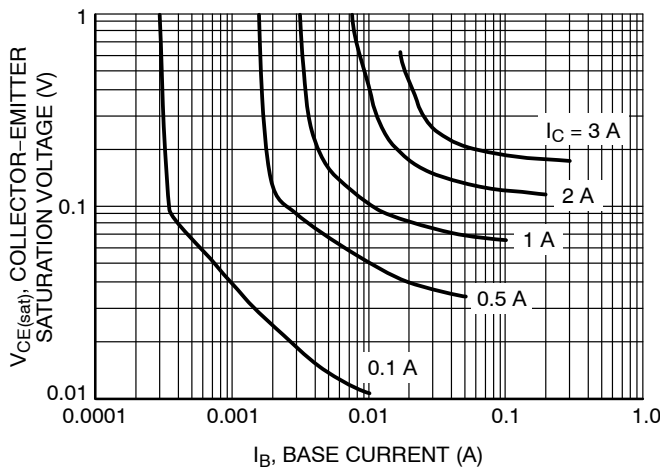


Figure 6. Collector Saturation Region

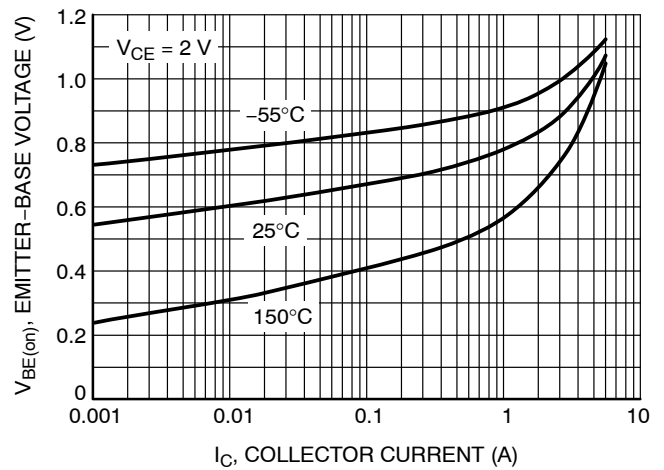


Figure 7.  $V_{BE(on)}$  Voltage

TYPICAL CHARACTERISTICS

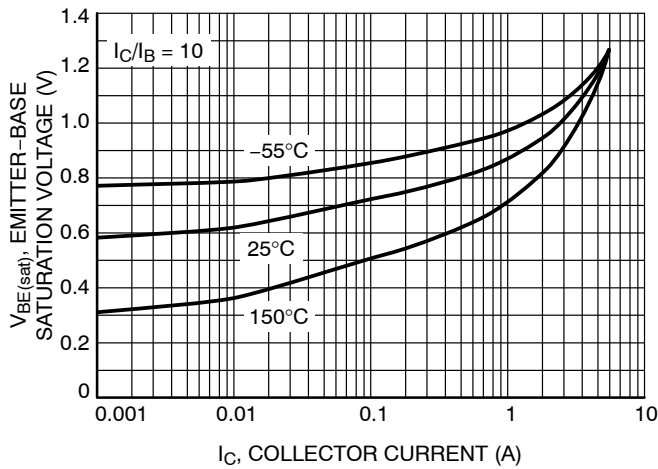


Figure 8. Base-Emitter Saturation Voltage

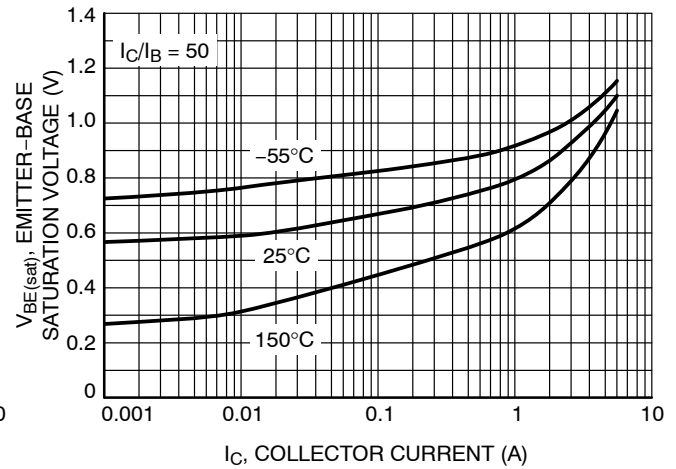


Figure 9. Base-Emitter Saturation Voltage

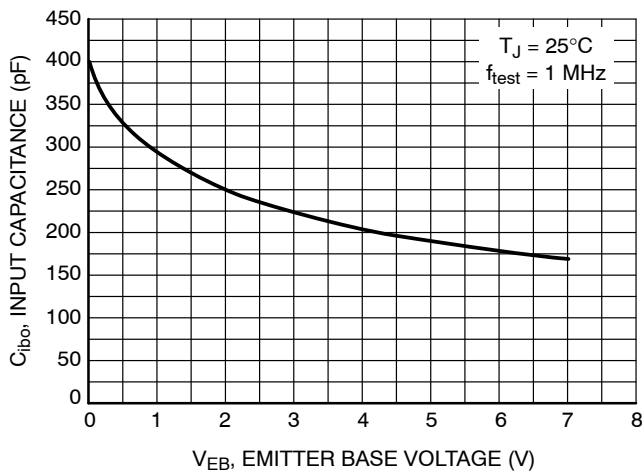


Figure 10. Input Capacitance

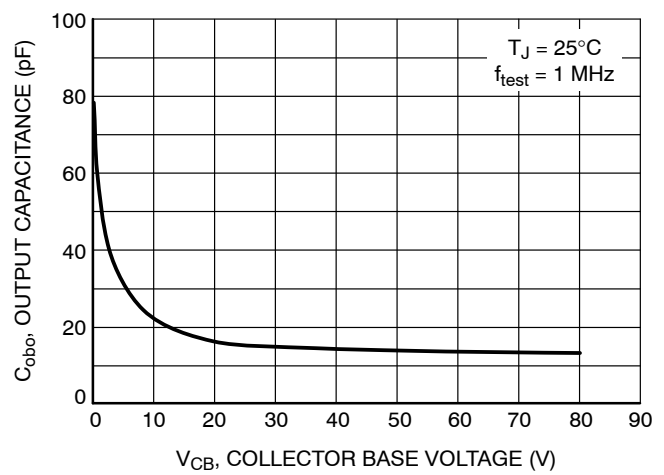


Figure 11. Output Capacitance

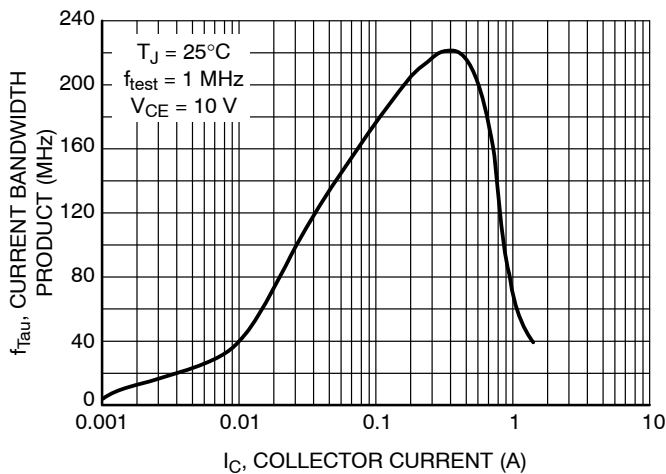


Figure 12. Current-Gain Bandwidth Product

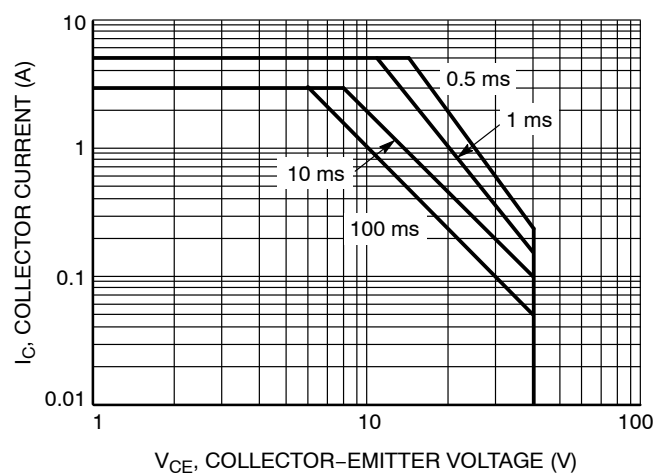


Figure 13. Safe Operating Area

## NSS40301MZ4

### ORDERING INFORMATION

| Device          | Package              | Shipping <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   |
| NSV40301MZ4T3G* | 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.

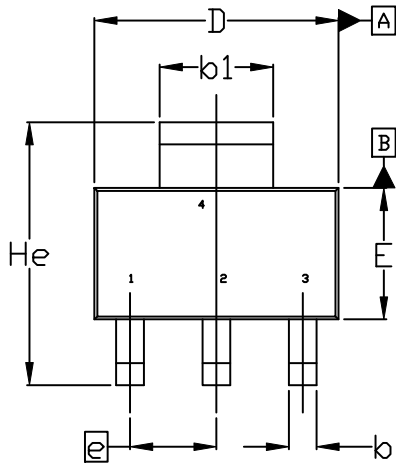
\*NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable



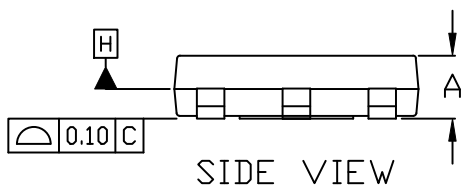
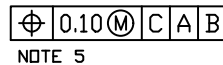
SCALE 1:1

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

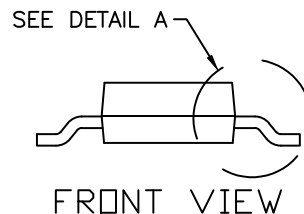
DATE 02 OCT 2018



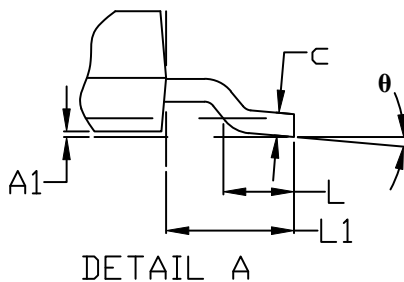
TOP VIEW



SIDE VIEW



FRONT VIEW

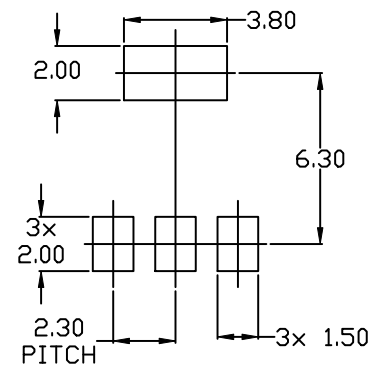


DETAIL A

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°  |



RECOMMENDED MOUNTING  
FOOTPRINT

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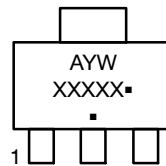
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**SOT-223 (TO-261)**  
CASE 318E-04  
ISSUE R

DATE 02 OCT 2018

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