

# NSS60600MZ4

## Low $V_{CE(sat)}$ Transistor, PNP, 60 V, 6.0 A, SOT-223 Package

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

- Complementary to NSS60601MZ4
- 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 ( $T_A = 25^\circ\text{C}$ )

Rating	Symbol	Max	Unit
Collector-Emitter Voltage	$V_{CEO}$	-60	Vdc
Collector-Base Voltage	$V_{CBO}$	-100	Vdc
Emitter-Base Voltage	$V_{EBO}$	-6.0	Vdc
Collector Current - Continuous	$I_C$	-6.0	A
Collector Current - Peak	$I_{CM}$	-12.0	A

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.

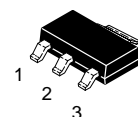
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



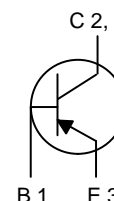
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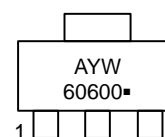
**-60 VOLTS, 6.0 AMPS  
2.0 WATTS  
PNP LOW  $V_{CE(sat)}$  TRANSISTOR  
EQUIVALENT  $R_{DS(on)}$  50 mΩ**



SOT-223  
CASE 318E  
STYLE 1

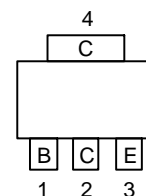


### MARKING DIAGRAM



- A = Assembly Location
- Y = Year
- W = Work Week
- 60600 = 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.

# NSS60600MZ4

## THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$ (Note 1)	800 6.5	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$ (Note 1)	155	$^\circ\text{C/W}$
Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$ (Note 2)	2 15.6	W mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$ (Note 2)	64	$^\circ\text{C/W}$
Total Device Dissipation (Single Pulse < 10 sec.)	$P_{D\text{single}}$ (Note 3)	710	mW
Junction and Storage Temperature Range	$T_J, T_{\text{stg}}$	-55 to +150	$^\circ\text{C}$

1. FR-4 @  $7.6 \text{ mm}^2$ , 1 oz. copper traces.
2. FR-4 @  $645 \text{ mm}^2$ , 1 oz. copper traces.
3. Thermal response.

## ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
NSS60600MZ4T1G	SOT-223 (Pb-Free)	1,000 / Tape & Reel
NSV60600MZ4T1G	SOT-223 (Pb-Free)	1,000 / Tape & Reel
NSS60600MZ4T3G	SOT-223 (Pb-Free)	4,000 / Tape & Reel
NSV60600MZ4T3G	SOT-223 (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.

# NSS60600MZ4

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector-Emitter Breakdown Voltage ( $I_C = -10\text{ mAdc}$ , $I_B = 0$ )	$V_{(BR)CEO}$	-60	-	-	Vdc
Collector-Base Breakdown Voltage ( $I_C = -0.1\text{ mAdc}$ , $I_E = 0$ )	$V_{(BR)CBO}$	-100	-	-	Vdc
Emitter-Base Breakdown Voltage ( $I_E = -0.1\text{ mAdc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	-6.0	-	-	Vdc
Collector Cutoff Current ( $V_{CB} = -100\text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$	-	-	-0.1	$\mu\text{A}$ dc
Emitter Cutoff Current ( $V_{EB} = -6.0\text{ Vdc}$ )	$I_{EBO}$	-	-	-0.1	$\mu\text{A}$ dc

## ON CHARACTERISTICS

DC Current Gain (Note 4) ( $I_C = -500\text{ mA}$ , $V_{CE} = -2.0\text{ V}$ ) ( $I_C = -1.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ ) ( $I_C = -2.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ ) ( $I_C = -6.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ )	$h_{FE}$	150 120 100 70	- - - -	- 360 - -	-
Collector-Emitter Saturation Voltage (Note 4) ( $I_C = -0.1\text{ A}$ , $I_B = -2.0\text{ mA}$ ) ( $I_C = -1.0\text{ A}$ , $I_B = -0.100\text{ A}$ ) ( $I_C = -2.0\text{ A}$ , $I_B = -0.200\text{ A}$ ) ( $I_C = -3.0\text{ A}$ , $I_B = -60\text{ mA}$ ) ( $I_C = -6.0\text{ A}$ , $I_B = -0.6\text{ A}$ )	$V_{CE(sat)}$	- - - - -	- -0.050 -0.100 - -	-0.050 -0.070 -0.120 -0.250 -0.350	V
Base-Emitter Saturation Voltage (Note 4) ( $I_C = -1.0\text{ A}$ , $I_B = -0.1\text{ A}$ )	$V_{BE(sat)}$	-	-	-1.0	V
Base-Emitter Turn-on Voltage (Note 4) ( $I_C = -1.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ )	$V_{BE(on)}$	-	-	-0.900	V
Cutoff Frequency ( $I_C = -500\text{ mA}$ , $V_{CE} = -10\text{ V}$ , $f = 1.0\text{ MHz}$ )	$f_T$	100	-	-	MHz
Input Capacitance ( $V_{EB} = 5.0\text{ V}$ , $f = 1.0\text{ MHz}$ )	$C_{ibo}$	-	360	-	pF
Output Capacitance ( $V_{CB} = 10\text{ V}$ , $f = 1.0\text{ MHz}$ )	$C_{obo}$	-	60	-	pF

## SWITCHING CHARACTERISTICS

Delay ( $V_{CC} = -30\text{ V}$ , $I_C = 750\text{ mA}$ , $I_{B1} = 15\text{ mA}$ )	$t_d$	-	100	-	ns
Rise ( $V_{CC} = -30\text{ V}$ , $I_C = 750\text{ mA}$ , $I_{B1} = 15\text{ mA}$ )	$t_r$	-	180	-	ns
Storage ( $V_{CC} = -30\text{ V}$ , $I_C = 750\text{ mA}$ , $I_{B1} = 15\text{ mA}$ )	$t_s$	-	540	-	ns
Fall ( $V_{CC} = -30\text{ V}$ , $I_C = 750\text{ mA}$ , $I_{B1} = 15\text{ mA}$ )	$t_f$	-	145	-	ns

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.

4. Pulsed Condition: Pulse Width = 300 msec, Duty Cycle  $\leq 2\%$ .

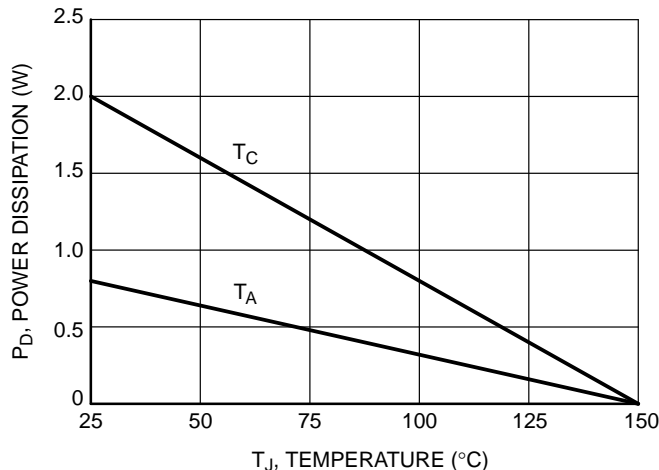


Figure 1. Power Derating

# NSS60600MZ4

## TYPICAL CHARACTERISTICS

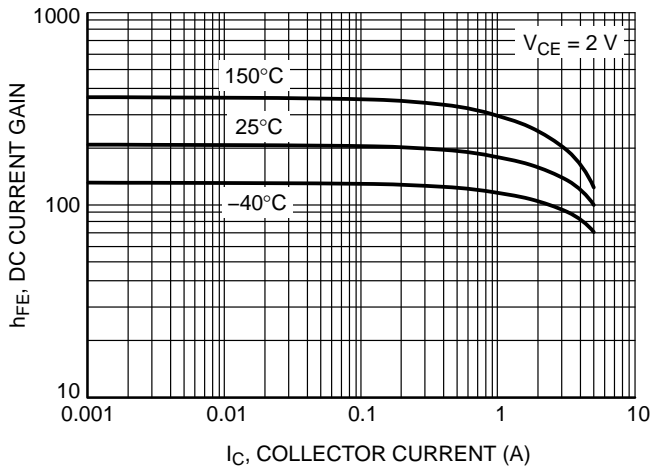


Figure 2. DC Current Gain

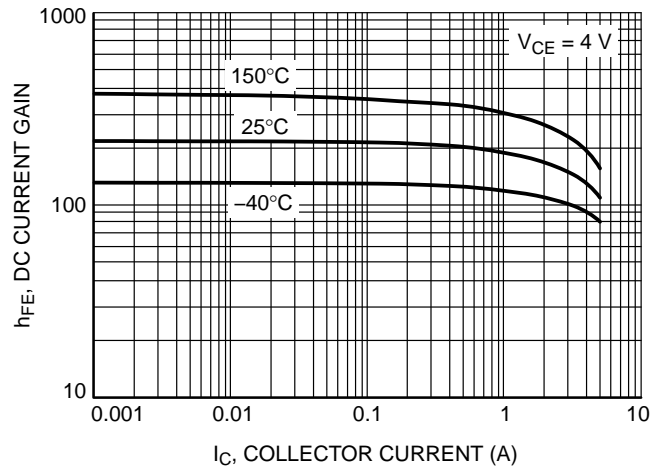


Figure 3. DC Current Gain

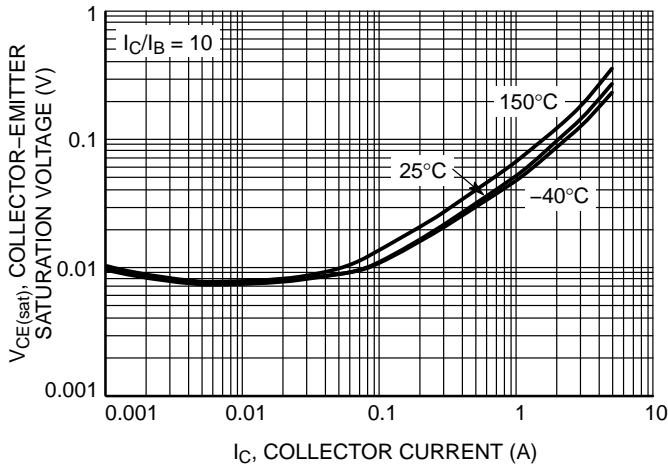


Figure 4. Collector-Emitter Saturation Voltage

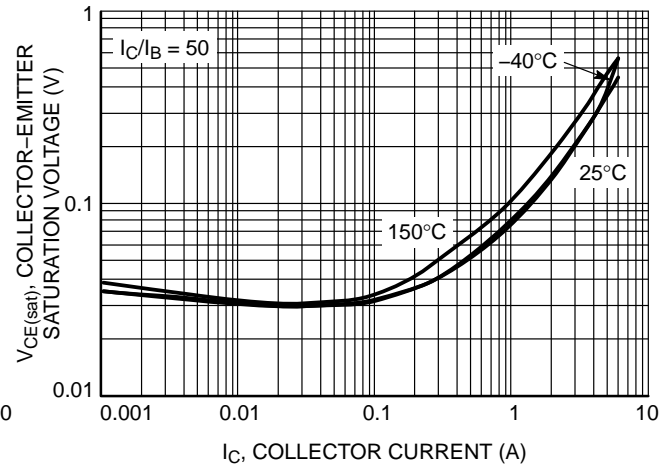


Figure 5. Collector-Emitter Saturation Voltage

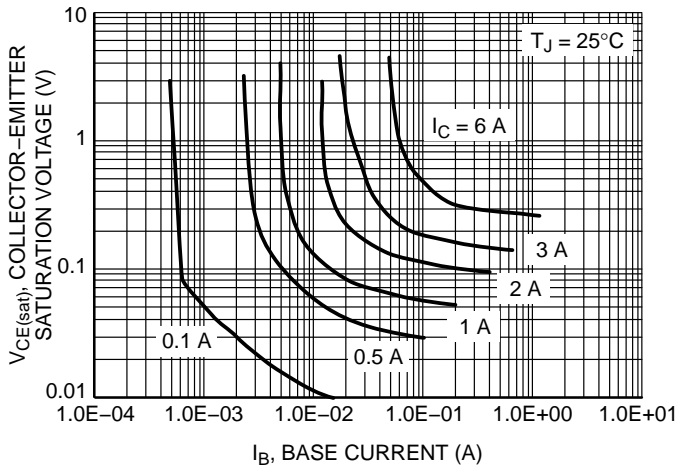


Figure 6. Collector Saturation Region

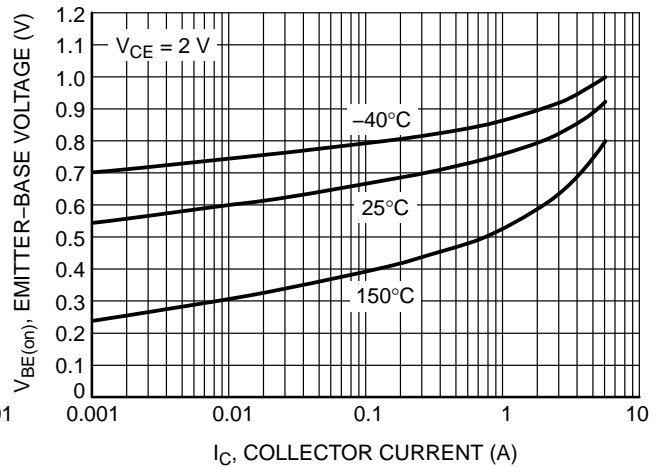


Figure 7.  $V_{BE(on)}$  Voltage

# NSS60600MZ4

## TYPICAL CHARACTERISTICS

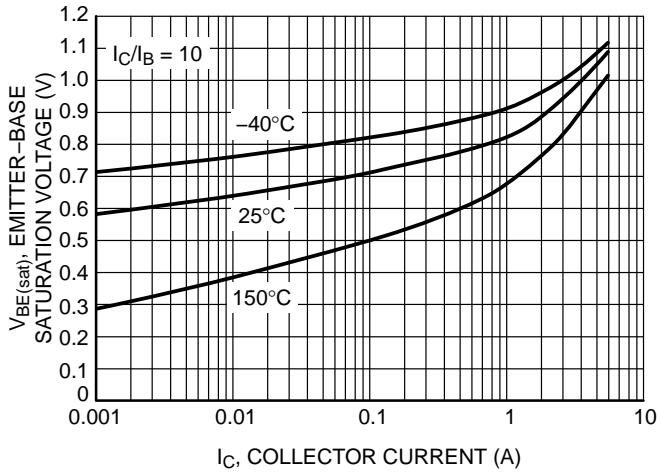


Figure 8. Base-Emitter Saturation Voltage

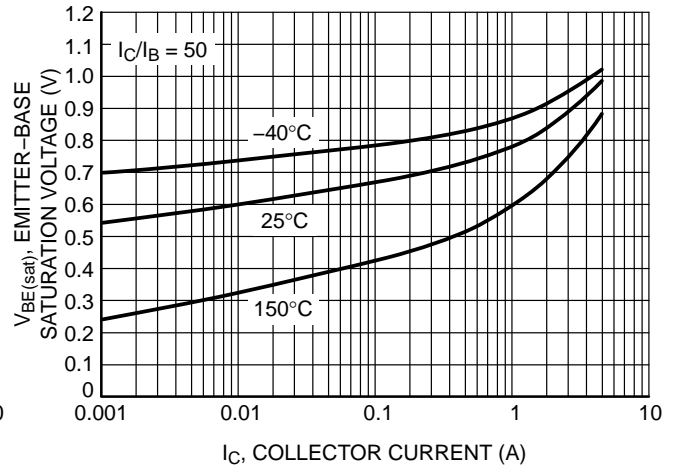


Figure 9. Base-Emitter Saturation Voltage

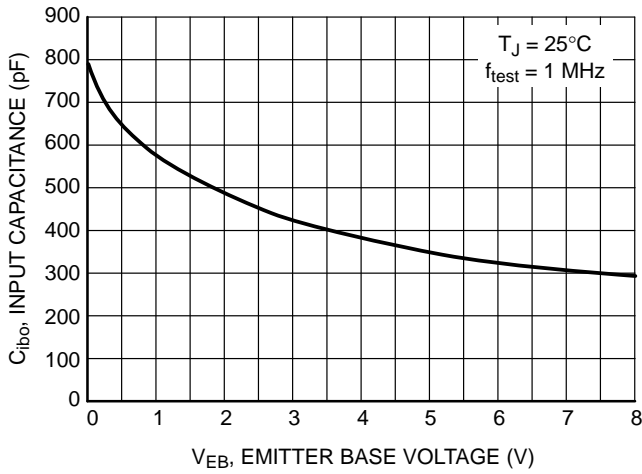


Figure 10. Input Capacitance

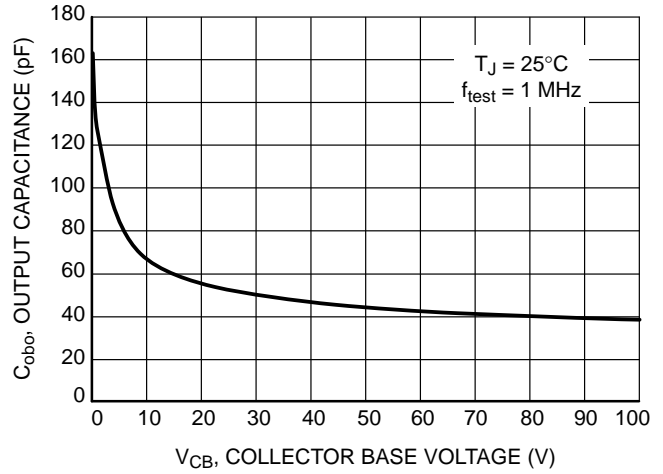


Figure 11. Output Capacitance

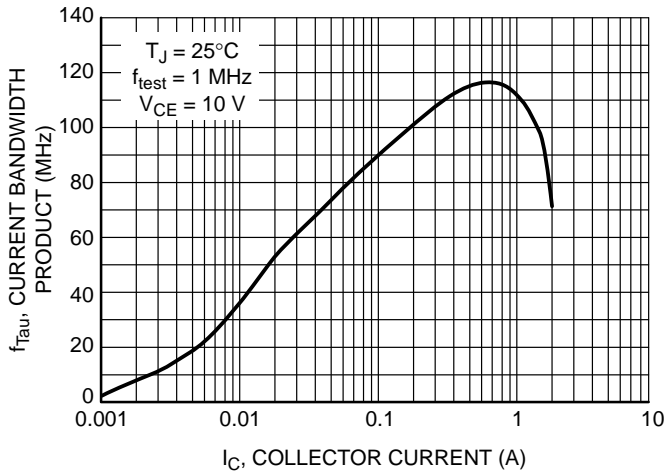


Figure 12. Current-Gain Bandwidth Product

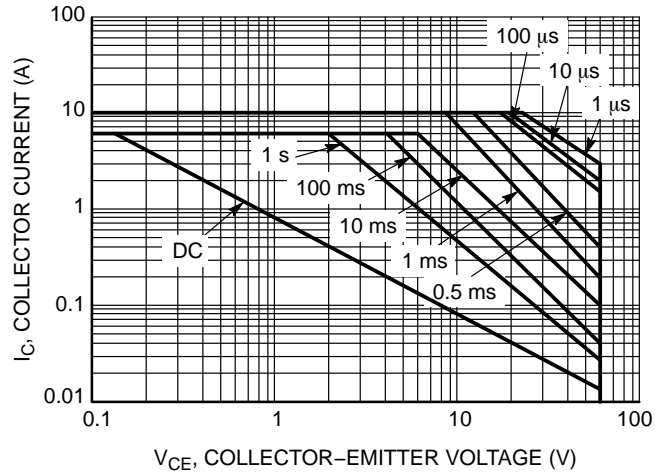


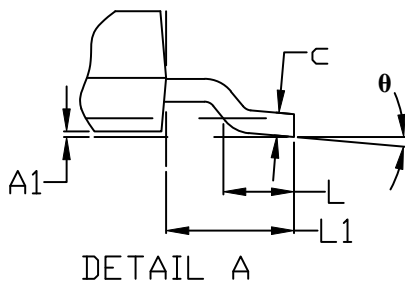
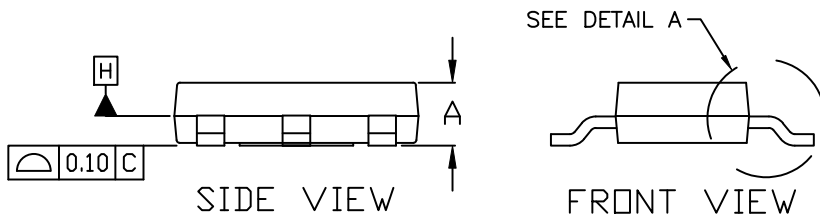
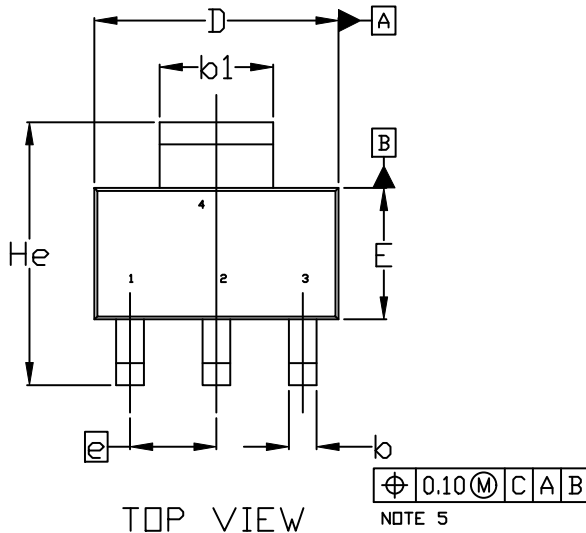
Figure 13. Safe Operating Area



SCALE 1:1

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

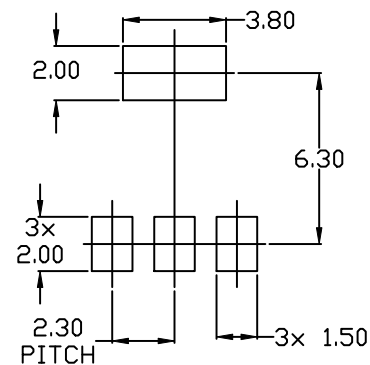
DATE 02 OCT 2018



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
$\theta$	0°	---	10°



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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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