

# Low $V_{CE(sat)}$ PNP Transistor

## 60 V, 2 A

### NSS60200SMT

onsemi's e<sup>2</sup>PowerEdge family of low  $V_{CE(sat)}$  transistors are miniature 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 LED lightning, power management...etc. 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

- NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- NSV60200SMTWTBG – Wettable Flanks Device
- 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         | $V_{CBO}$ | 60  | Vdc  |
| Emitter-Base Voltage           | $V_{EBO}$ | 6   | Vdc  |
| Collector Current – Continuous | $I_C$     | 2   | A    |
| Collector Current – Peak       | $I_{CM}$  | 3   | A    |

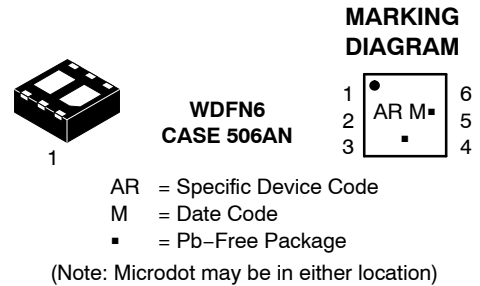
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

#### THERMAL CHARACTERISTICS

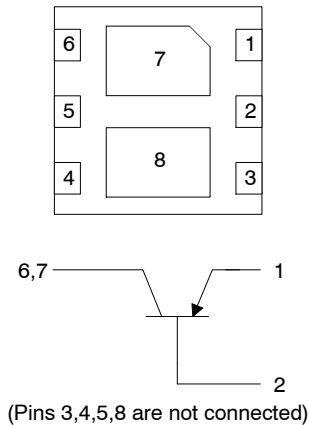
| Characteristic                                              | Symbol          | Max         | Unit               |
|-------------------------------------------------------------|-----------------|-------------|--------------------|
| Thermal Resistance Junction-to-Ambient (Note 1)             | $R_{\theta JA}$ | 69          | $^\circ\text{C/W}$ |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$ (Note 1) | $P_D$           | 1.8         | W                  |
| Junction and Storage Temperature Range                      | $T_J, T_{stg}$  | -55 to +150 | $^\circ\text{C}$   |

1. Per JE51-7 with 100 mm<sup>2</sup> pad area and 2 oz. Cu.

60 Volt, 2 Amp  
PNP Low  $V_{CE(sat)}$  Transistor



#### PIN CONNECTIONS



#### ORDERING INFORMATION

| Device          | Package         | Shipping <sup>†</sup> |
|-----------------|-----------------|-----------------------|
| NSS60200SMTTBG  | WDFN6 (Pb-Free) | 3000/Tape & Reel      |
| NSV60200SMTWTBG | WDFN6 (Pb-Free) | 3000/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 Specification Brochure, BRD8011/D.

# NSS60200SMT

**Table 1. 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 ( $I_C = -10\text{ mA}$ , $I_B = 0$ ) | $V_{(BR)CEO}$ | -60 |     |      | V    |
| Collector–Base Breakdown Voltage ( $I_C = -0.1\text{ mA}$ , $I_E = 0$ )   | $V_{(BR)CBO}$ | -80 |     |      | V    |
| Emitter–Base Breakdown Voltage ( $I_E = -0.1\text{ mA}$ , $I_C = 0$ )     | $V_{(BR)EBO}$ | -6  |     |      | V    |
| Collector Cutoff Current ( $V_{CB} = -60\text{ V}$ , $I_E = 0$ )          | $I_{CBO}$     |     |     | -100 | nA   |
| Emitter Cutoff Current ( $V_{BE} = -5.0\text{ V}$ )                       | $I_{EBO}$     |     |     | -100 | nA   |

## ON CHARACTERISTICS

|                                                                                                                                                                                                                                                                                                                       |               |                        |                                                |                                                |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------------|------------------------------------------------|------------------------------------------------|---|
| DC Current Gain (Note 2)<br>( $I_C = -100\text{ mA}$ , $V_{CE} = -2.0\text{ V}$ )<br>( $I_C = -500\text{ mA}$ , $V_{CE} = -2.0\text{ V}$ )<br>( $I_C = -1\text{ A}$ , $V_{CE} = -2.0\text{ V}$ )<br>( $I_C = -2\text{ A}$ , $V_{CE} = -2.0\text{ V}$ )                                                                | $h_{FE}$      | 150<br>120<br>90<br>40 | 230<br>180<br>140<br>80                        |                                                |   |
| Collector–Emitter Saturation Voltage (Note 2)<br>( $I_C = -500\text{ mA}$ , $I_B = -50\text{ mA}$ )<br>( $I_C = -700\text{ mA}$ , $I_B = -7.0\text{ mA}$ )<br>( $I_C = -1\text{ A}$ , $I_B = -50\text{ mA}$ )<br>( $I_C = -1\text{ A}$ , $I_B = -100\text{ mA}$ )<br>( $I_C = -2\text{ A}$ , $I_B = -200\text{ mA}$ ) | $V_{CE(sat)}$ |                        | -0.115<br>-0.295<br>-0.250<br>-0.200<br>-0.365 | -0.160<br>-0.420<br>-0.350<br>-0.300<br>-0.450 | V |
| Base–Emitter Saturation Voltage (Note 2)<br>( $I_C = -500\text{ mA}$ , $I_B = -50\text{ mA}$ )<br>( $I_C = -1\text{ A}$ , $I_B = -50\text{ mA}$ )<br>( $I_C = -1\text{ A}$ , $I_B = -100\text{ mA}$ )                                                                                                                 | $V_{BE(sat)}$ |                        |                                                | -1.0<br>-1.0<br>-1.1                           | V |
| Base–Emitter Turn-on Voltage (Note 2)<br>( $I_C = 500\text{ mA}$ , $I_B = 50\text{ mA}$ )                                                                                                                                                                                                                             | $V_{BE(on)}$  |                        |                                                | -0.9                                           | V |

## DYNAMIC CHARACTERISTICS

|                                                                                               |           |  |     |  |     |
|-----------------------------------------------------------------------------------------------|-----------|--|-----|--|-----|
| Output Capacitance<br>( $V_{CB} = 10\text{ V}$ , $f = 1.0\text{ MHz}$ )                       | $C_{obo}$ |  | 18  |  | pF  |
| Cutoff Frequency<br>( $I_C = 50\text{ mA}$ , $V_{CE} = 2.0\text{ V}$ , $f = 100\text{ MHz}$ ) | $f_T$     |  | 155 |  | MHz |

## SWITCHING TIMES

|                                                                                                                       |       |  |     |  |    |
|-----------------------------------------------------------------------------------------------------------------------|-------|--|-----|--|----|
| Delay Time ( $V_{CC} = -10\text{ V}$ , $I_C = -0.5\text{ A}$ , $I_{B1} = -25\text{ mA}$ , $I_{B2} = 25\text{ mA}$ )   | $t_d$ |  | 15  |  | ns |
| Rise Time ( $V_{CC} = -10\text{ V}$ , $I_C = -0.5\text{ A}$ , $I_{B1} = -25\text{ mA}$ , $I_{B2} = 25\text{ mA}$ )    | $t_r$ |  | 13  |  | ns |
| Storage Time ( $V_{CC} = -10\text{ V}$ , $I_C = -0.5\text{ A}$ , $I_{B1} = -25\text{ mA}$ , $I_{B2} = 25\text{ mA}$ ) | $t_s$ |  | 360 |  | ns |
| Fall Time ( $V_{CC} = -10\text{ V}$ , $I_C = -0.5\text{ A}$ , $I_{B1} = -25\text{ mA}$ , $I_{B2} = 25\text{ mA}$ )    | $t_f$ |  | 22  |  | 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.

2. Pulse Condition: Pulse Width = 300  $\mu\text{sec}$ , Duty Cycle  $\leq 2\%$

TYPICAL CHARACTERISTICS

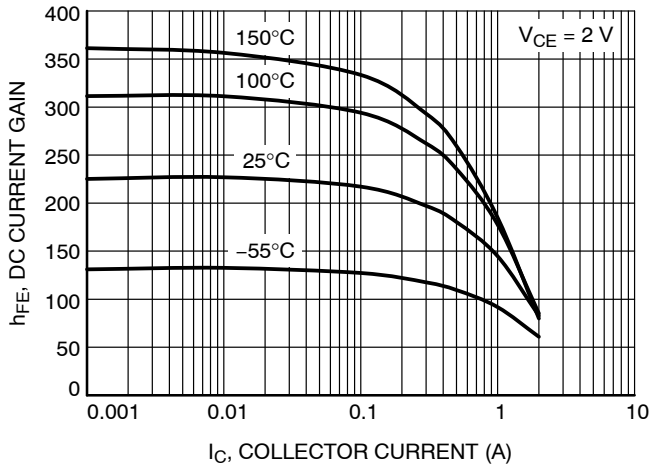


Figure 1. DC Current Gain

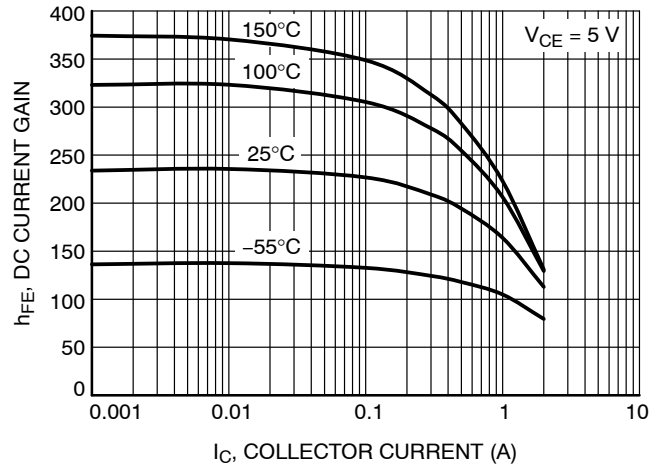


Figure 2. DC Current Gain

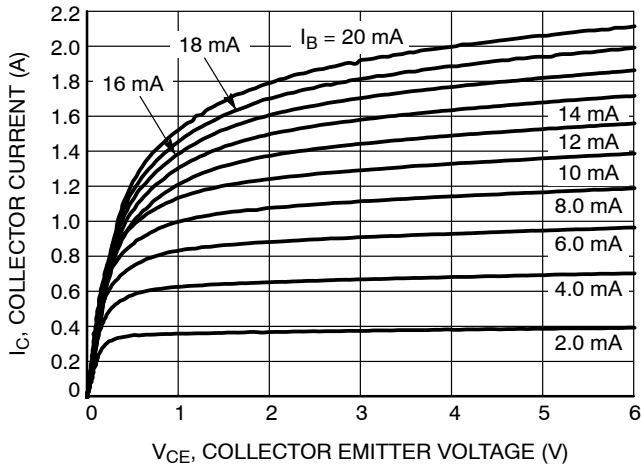


Figure 3. Collector Current as a Function of Collector Emitter Voltage

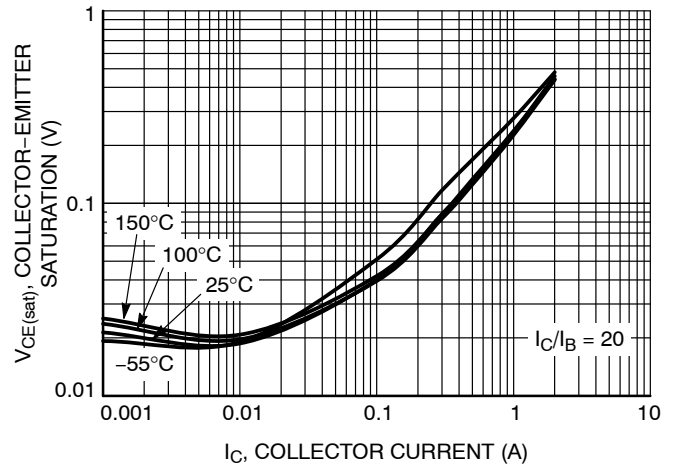


Figure 4. Collector-Emitter Saturation Voltage

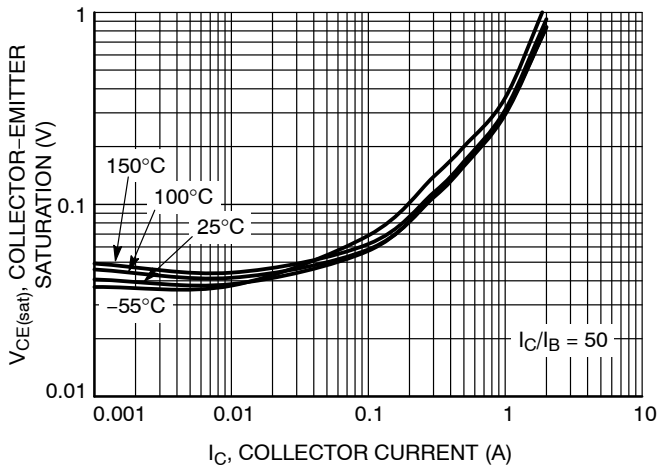


Figure 5. Collector-Emitter Saturation Voltage

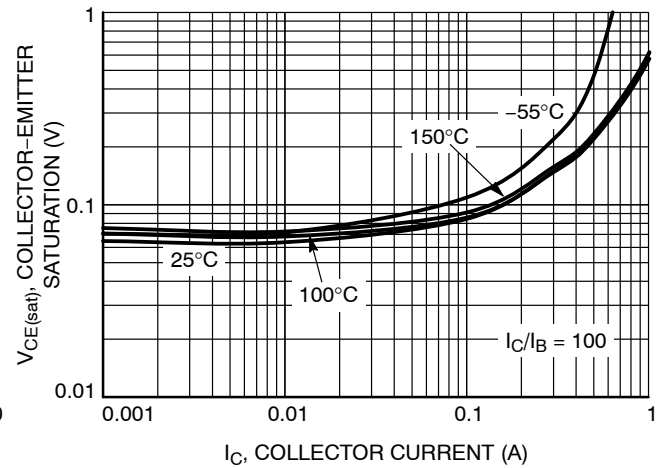


Figure 6. Collector-Emitter Saturation Voltage

TYPICAL CHARACTERISTICS

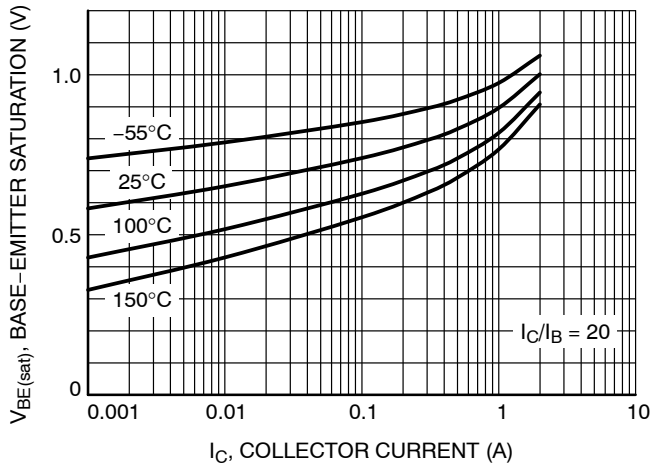


Figure 7. Base-Emitter Saturation Voltage

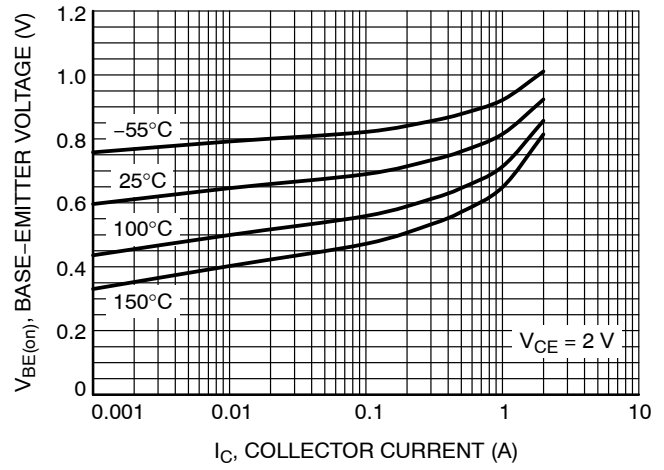


Figure 8. Base-Emitter "ON" Voltage

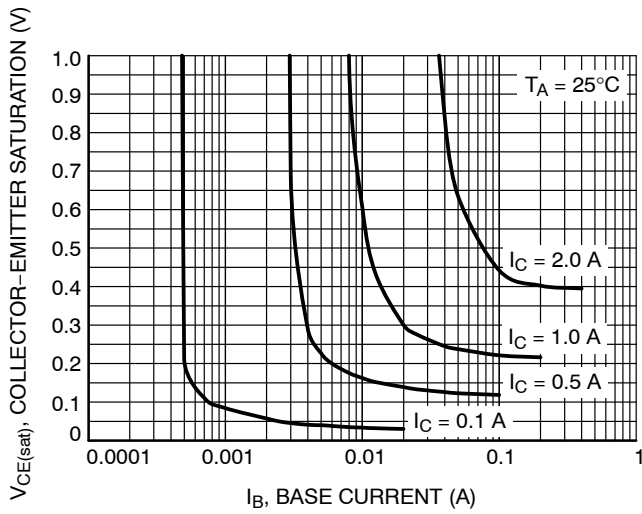


Figure 9. Collector Saturation Region

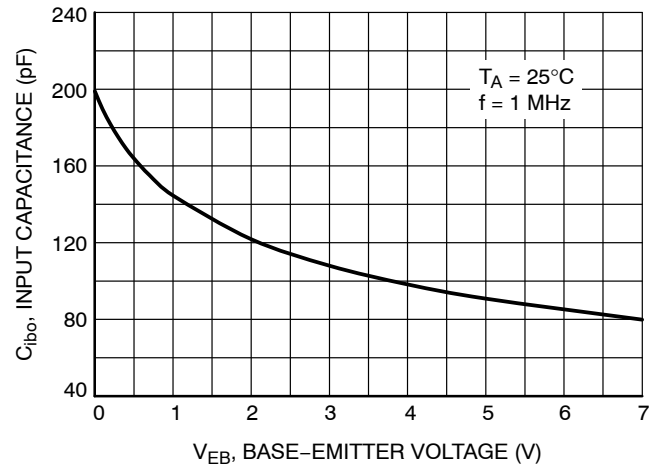


Figure 10. Input Capacitance

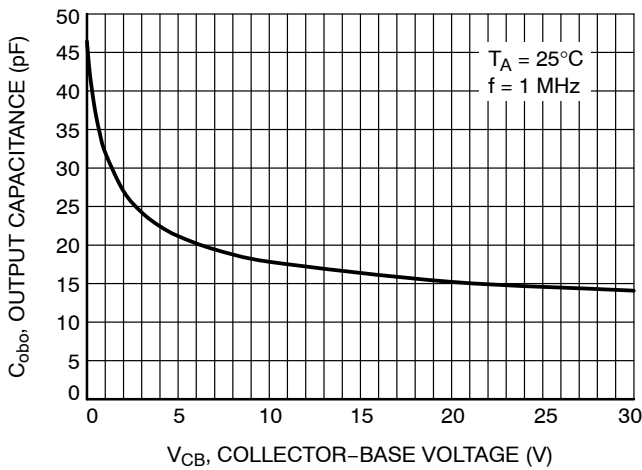


Figure 11. Output Capacitance

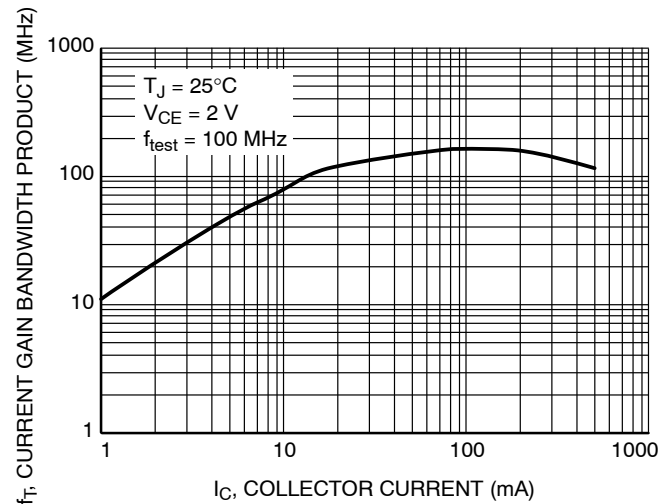


Figure 12.  $f_T$ , Current Gain Bandwidth Product

# NSS60200SMT

## TYPICAL CHARACTERISTICS

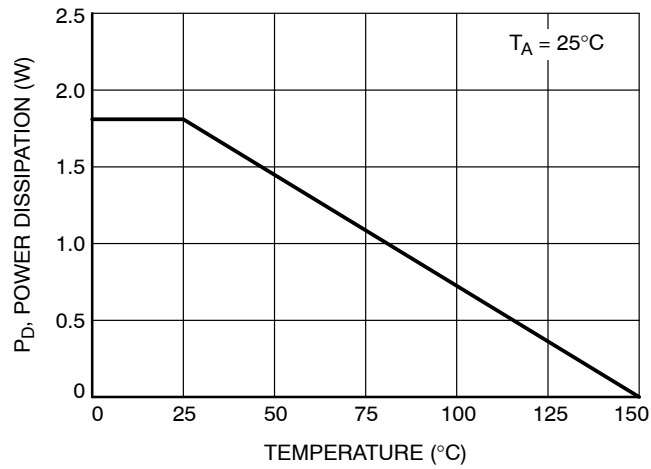


Figure 13. Power Derating

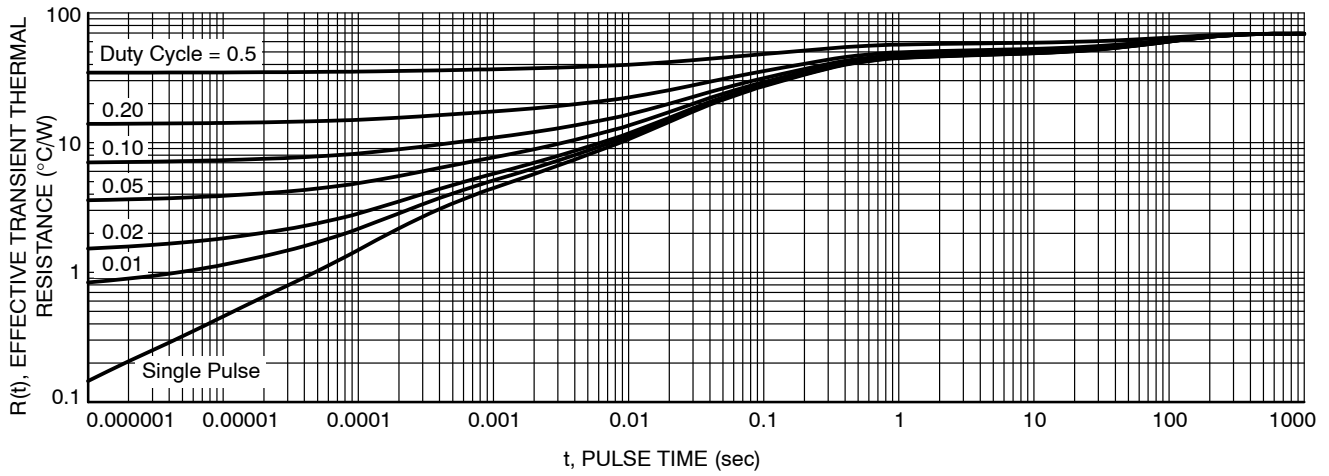
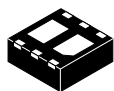


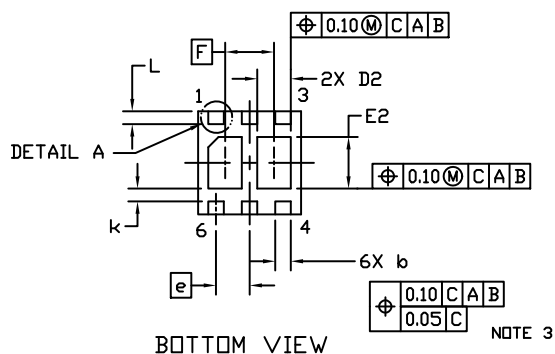
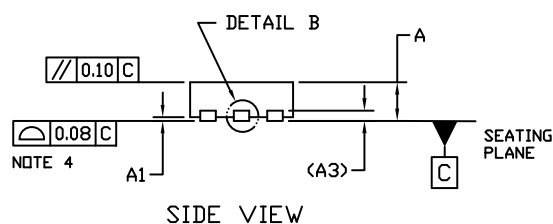
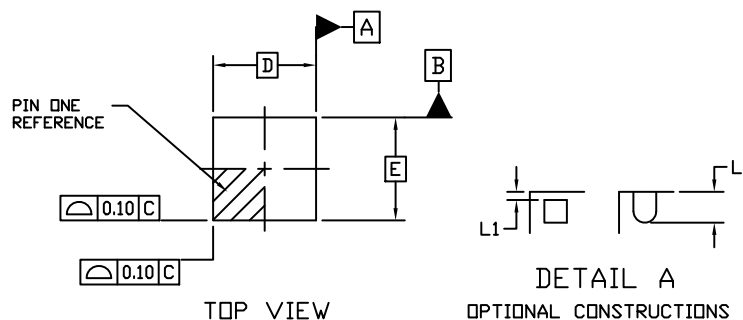
Figure 14. Thermal Resistance by Transistor

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



WDFN6 2x2, 0.65P  
CASE 506AN  
ISSUE H

DATE 25 JAN 2022



## GENERIC MARKING DIAGRAM\*



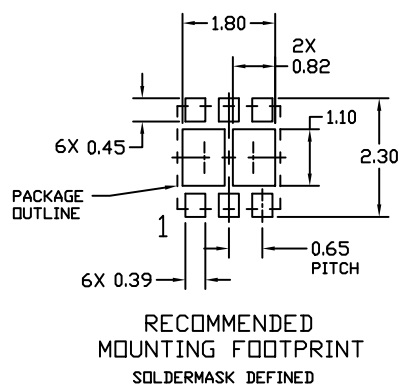
XX = Specific Device Code  
M = Date Code

\*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.

## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION *b* APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN.        | MAX. |
| A   | 0.70        | 0.80 |
| A1  | 0.00        | 0.05 |
| A3  | 0.20 REF    |      |
| b   | 0.25        | 0.35 |
| D   | 2.00 BSC    |      |
| D2  | 0.57        | 0.77 |
| E   | 2.00 BSC    |      |
| E2  | 0.90        | 1.10 |
| e   | 0.65 BSC    |      |
| F   | 0.95 BSC    |      |
| k   | 0.25 REF    |      |
| L   | 0.20        | 0.30 |
| L1  | ---         | 0.10 |



|                  |                  |                                                                                                                                                                                  |
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