

# ON Semiconductor

## Is Now

The logo for onsemi, featuring the word "onsemi" in a dark teal, lowercase, sans-serif font. The letter "i" is stylized with a white dot and a teal vertical bar. A small orange triangle is positioned above the top right of the "i". A trademark symbol (TM) is located to the right of the logo.

To learn more about onsemi™, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

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# PNP Transistors, Low $V_{CE(sat)}$ , 60 V, 2 A

## NSS60200DMT

ON Semiconductor'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 lighting, 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
- Wetable Flank Package for optimal Automated Optical Inspection (AOI); NSV60200DMTWTBG – Wetable 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 (Notes 1 and 2)	$R_{\theta JA}$	55	$^\circ\text{C}/\text{W}$
Total Power Dissipation per Package @ $T_A = 25^\circ\text{C}$ (Note 2)	$P_D$	2.27	W
Thermal Resistance Junction-to-Ambient (Note 3)	$R_{\theta JA}$	69	$^\circ\text{C}/\text{W}$
Power Dissipation per Transistor @ $T_A = 25^\circ\text{C}$ (Note 3)	$P_D$	1.8	W
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

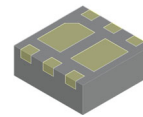
1. Per JESD51-7 with 100 mm<sup>2</sup> pad area and 2 oz. Cu (Dual Operation).
2.  $P_D$  per Transistor when both are turned on is one half of Total  $P_D$  or 1.13 Watts.
3. Per JESD51-7 with 100 mm<sup>2</sup> pad area and 2 oz. Cu (Single-Operation).



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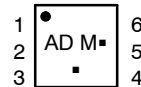
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60 Volt, 2 Amp  
PNP Low  $V_{CE(sat)}$  Transistors



WDFN6  
CASE 515AM

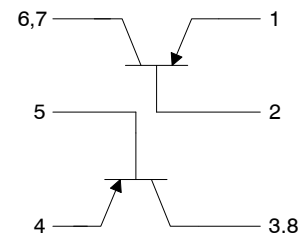
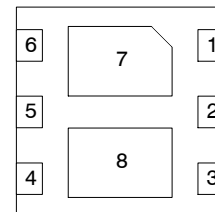
### MARKING DIAGRAM



AD = Specific Device Code  
M = Date Code  
■ = Pb-Free Package

(Note: Microdot may be in either location)

### PIN CONNECTIONS



### ORDERING INFORMATION

Device	Package	Shipping†
NSS60200DMTTBG	WDFN6 (Pb-Free)	3000/Tape & Reel
NSV60200DMTWTBG	WDFN6 (Pb-Free)	3000/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.

# NSS60200DMT

**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 4) ( $I_C = -100\text{ mA}$ , $V_{CE} = -2.0\text{ V}$ ) ( $I_C = -500\text{ mA}$ , $V_{CE} = -2.0\text{ V}$ ) ( $I_C = -1\text{ A}$ , $V_{CE} = -2.0\text{ V}$ ) ( $I_C = -2\text{ A}$ , $V_{CE} = -2.0\text{ V}$ )	$h_{FE}$	150 120 90 40	230 180 140 80		
Collector-Emitter Saturation Voltage (Note 4) ( $I_C = -500\text{ mA}$ , $I_B = -50\text{ mA}$ ) ( $I_C = -700\text{ mA}$ , $I_B = -7.0\text{ mA}$ ) ( $I_C = -1\text{ A}$ , $I_B = -50\text{ mA}$ ) ( $I_C = -1\text{ A}$ , $I_B = -100\text{ mA}$ ) ( $I_C = -2\text{ A}$ , $I_B = -200\text{ mA}$ )	$V_{CE(sat)}$		-0.115 -0.295 -0.250 -0.200 -0.365	-0.160 -0.420 -0.350 -0.300 -0.450	V
Base-Emitter Saturation Voltage (Note 4) ( $I_C = -500\text{ mA}$ , $I_B = -50\text{ mA}$ ) ( $I_C = -1\text{ A}$ , $I_B = -50\text{ mA}$ ) ( $I_C = -1\text{ A}$ , $I_B = -100\text{ mA}$ )	$V_{BE(sat)}$			-1.0 -1.0 -1.1	V
Base-Emitter Turn-on Voltage (Note 4) ( $I_C = -500\text{ mA}$ , $V_{CE} = -2.0\text{ V}$ )	$V_{BE(on)}$			-0.9	V

**DYNAMIC CHARACTERISTICS**

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

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

TYPICAL CHARACTERISTICS

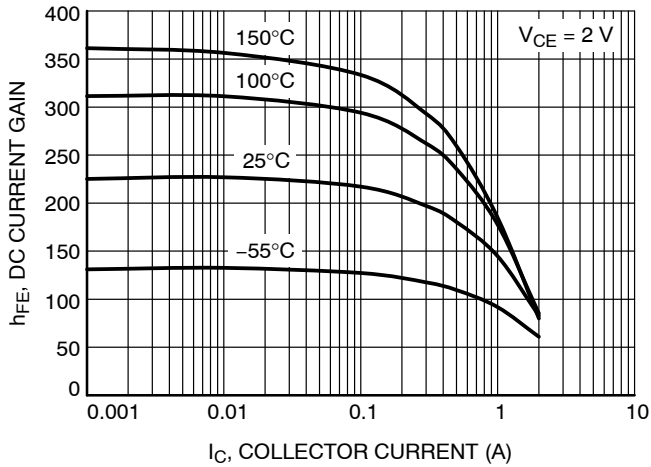


Figure 1. DC Current Gain

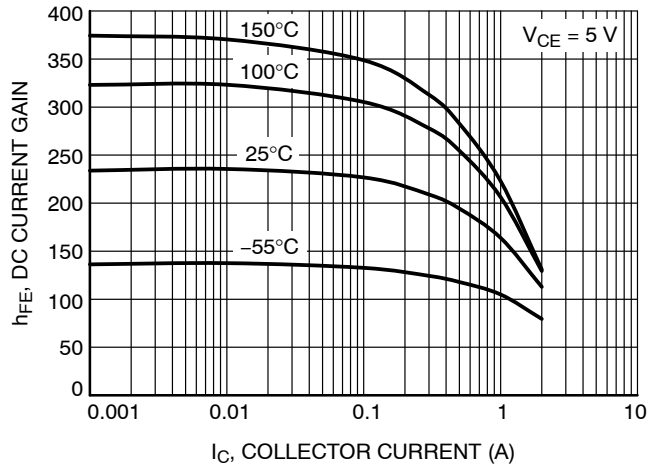


Figure 2. DC Current Gain

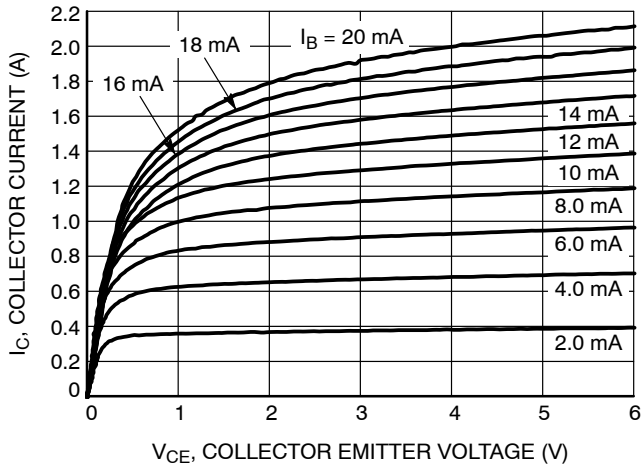


Figure 3. Collector Current as a Function of Collector Emitter Voltage

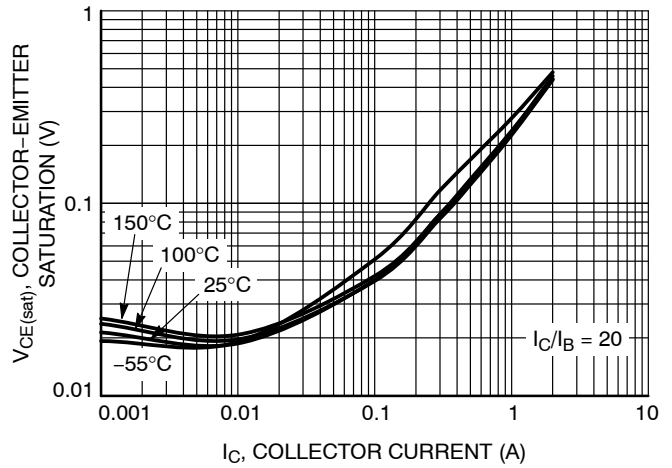


Figure 4. Collector-Emitter Saturation Voltage

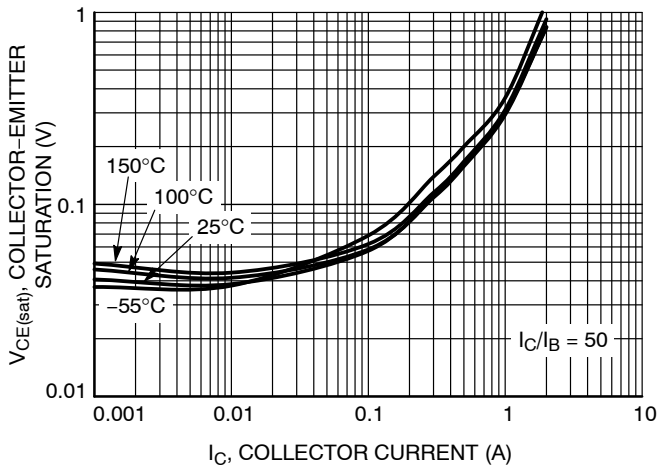


Figure 5. Collector-Emitter Saturation Voltage

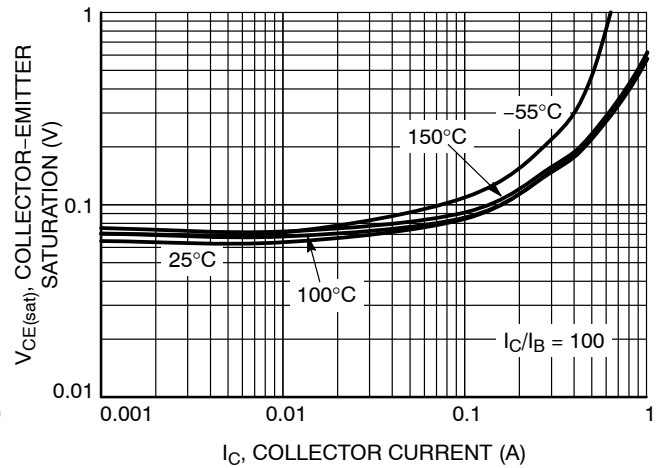


Figure 6. Collector-Emitter Saturation Voltage

# NSS60200DMT

## TYPICAL CHARACTERISTICS

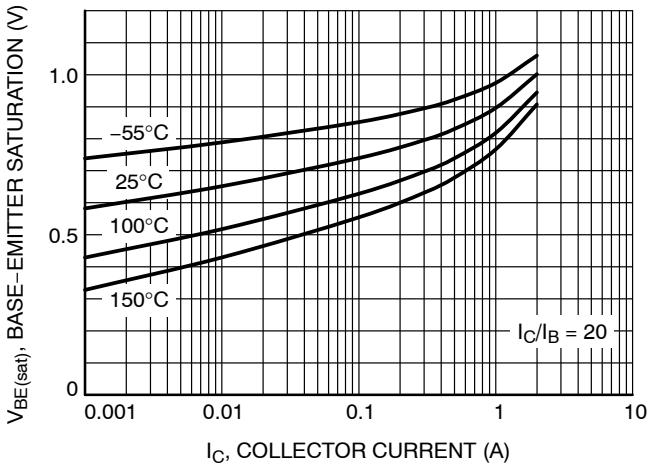


Figure 7. Base-Emitter Saturation Voltage

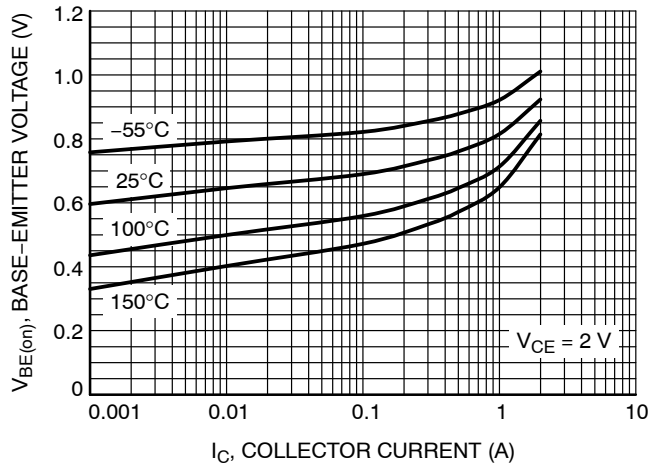


Figure 8. Base-Emitter "ON" Voltage

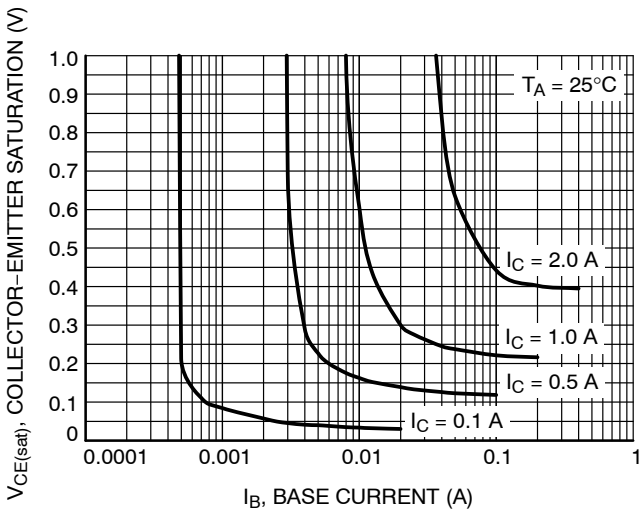


Figure 9. Collector Saturation Region

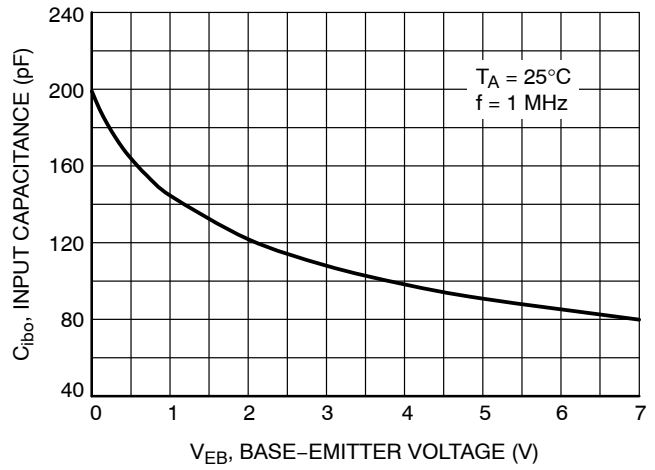


Figure 10. Input Capacitance

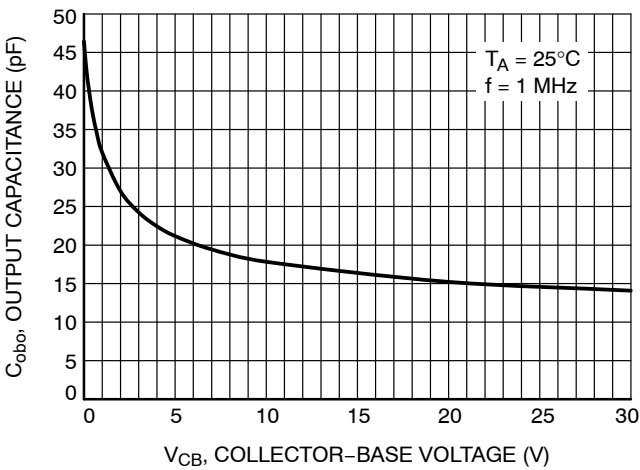


Figure 11. Output Capacitance

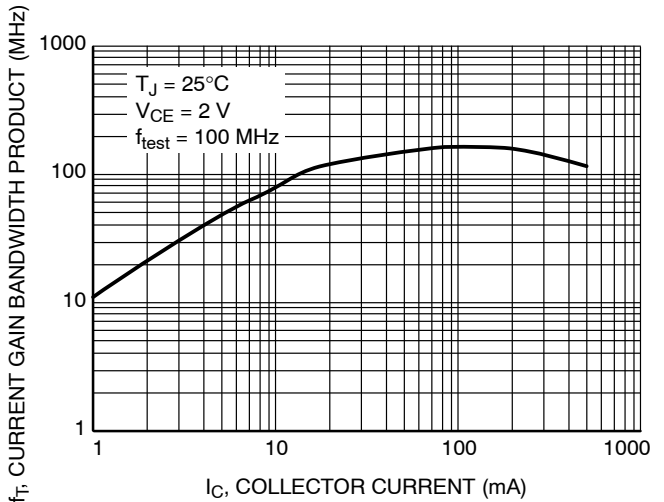


Figure 12.  $f_T$ , Current Gain Bandwidth Product

# NSS60200DMT

## TYPICAL CHARACTERISTICS

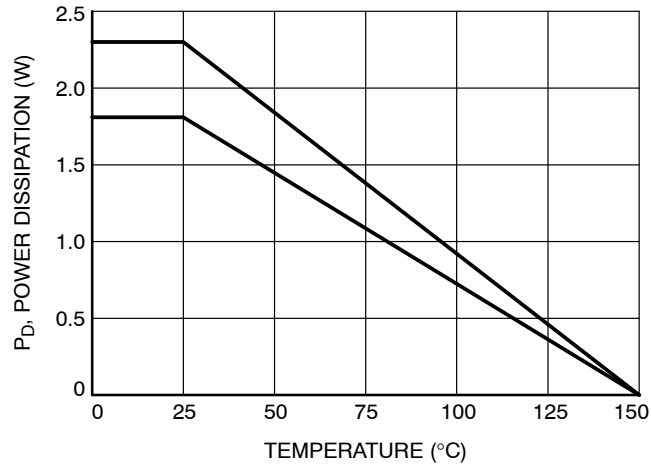


Figure 13. Power Derating

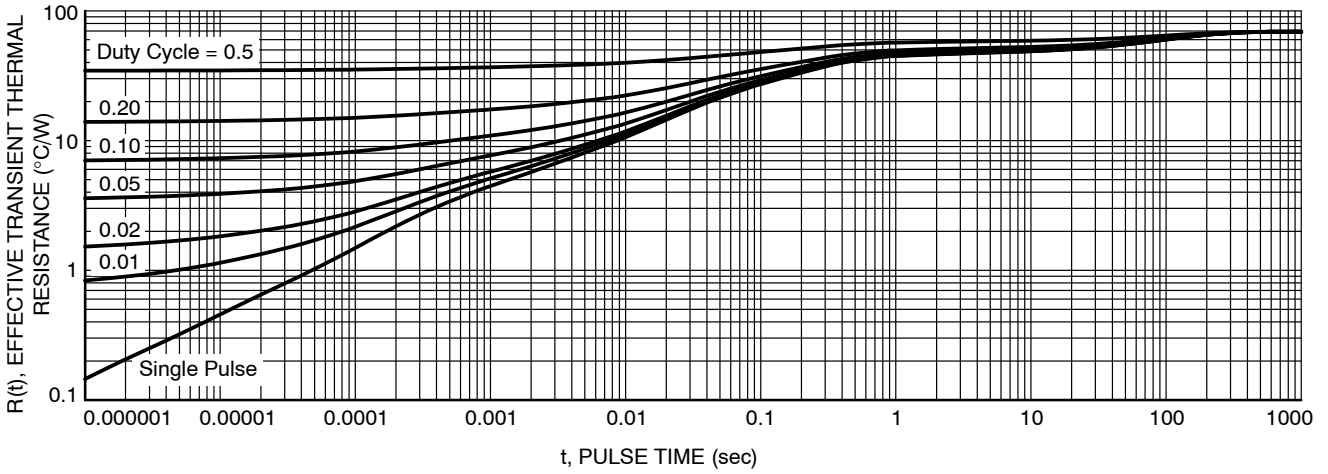


Figure 14. Thermal Resistance by Transistor

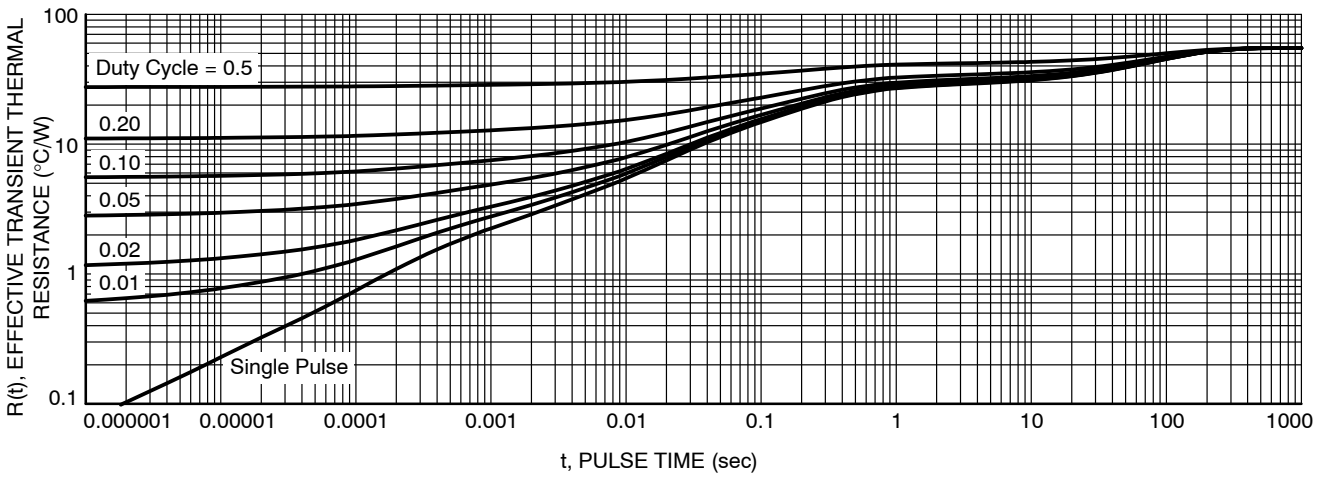
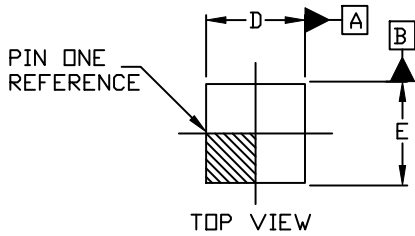


Figure 15. Thermal Resistance for Both Transistors

# NSS60200DMT

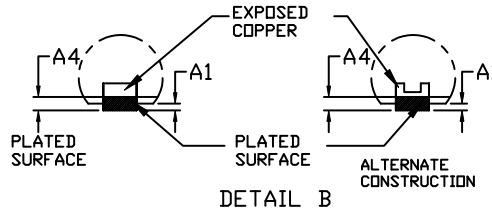
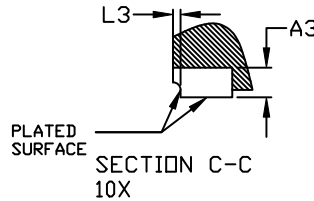
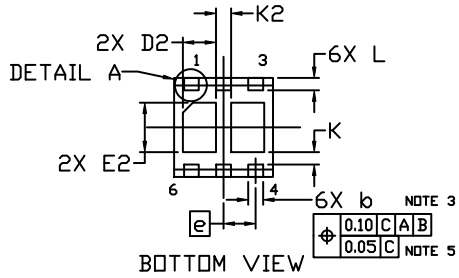
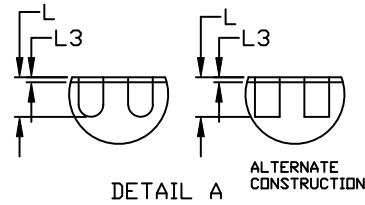
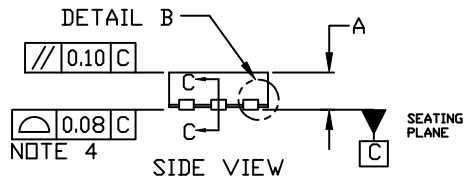
## PACKAGE DIMENSIONS

**WDFNW6 2x2, 0.65P**  
**CASE 515AM**  
**ISSUE O**

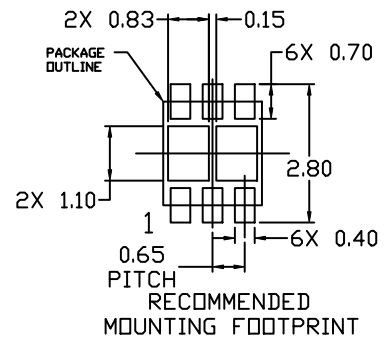


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION *b* APPLIES TO PLATED TERMINALS AND IS MEASURED BETWEEN 0.15 AND 0.30MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
5. POSITIONAL TOLERANCE APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.



DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.70	0.75	0.80
A1	0.00	---	0.05
A3	0.20 REF		
A4	0.10	---	---
<i>b</i>	0.25	0.30	0.35
D	1.90	2.00	2.10
D2	0.62	0.67	0.72
E	1.90	2.00	2.10
E2	0.90	1.00	1.10
<i>e</i>	0.65 BSC		
K	0.20 REF		
K2	0.305 REF		
L	0.20	0.25	0.30
L3	0.05 REF		



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

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