

# NSS60101DMT

## 60 V, 1 A, Low $V_{CE(sat)}$ NPN Transistors

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 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
- NSV60101DMTWTBG – 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	$I_C$	1	A
Collector Current – Peak	$I_{CM}$	2	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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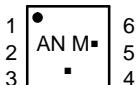
### 60 Volt, 1 Amp NPN Low $V_{CE(sat)}$ Transistors

#### MARKING DIAGRAM



WDFN6  
CASE 506AN

1

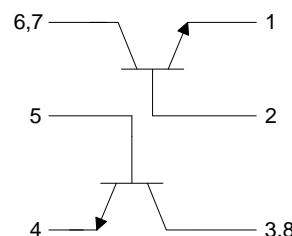
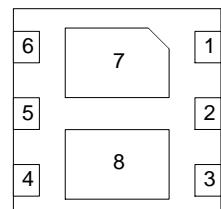


6  
5  
4

AN = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

#### PIN CONNECTIONS



#### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
NSS60101DMTTBG	WDFN6 (Pb-Free)	3000/Tape & Reel
NSV60101DMTWTBG	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.

# NSS60101DMT

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

## ON CHARACTERISTICS

DC Current Gain (Note 4) ( $I_C = 100 \text{ mA}, V_{\text{CE}} = 2.0 \text{ V}$ ) ( $I_C = 500 \text{ mA}, V_{\text{CE}} = 2.0 \text{ V}$ ) ( $I_C = 1 \text{ A}, V_{\text{CE}} = 2.0 \text{ V}$ ) ( $I_C = 2 \text{ A}, V_{\text{CE}} = 2.0 \text{ V}$ )	$h_{\text{FE}}$	150 120 90 35	250 240 180 55		
Collector-Emitter Saturation Voltage (Note 4) ( $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$ ) ( $I_C = 1 \text{ A}, I_B = 50 \text{ mA}$ ) ( $I_C = 1 \text{ A}, I_B = 100 \text{ mA}$ )	$V_{\text{CE}(\text{sat})}$		0.063 0.130 0.115	0.100 0.200 0.180	V
Base-Emitter Saturation Voltage (Note 4) ( $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$ ) ( $I_C = 1 \text{ A}, I_B = 50 \text{ mA}$ ) ( $I_C = 1 \text{ A}, I_B = 100 \text{ mA}$ )	$V_{\text{BE}(\text{sat})}$			1.0 1.0 1.1	V
Base-Emitter Turn-on Voltage (Note 4) ( $I_C = 500 \text{ mA}, V_{\text{CE}} = 2 \text{ V}$ )	$V_{\text{BE}(\text{on})}$			0.9	V

## DYNAMIC CHARACTERISTICS

Output Capacitance ( $V_{\text{CB}} = 10 \text{ V}, f = 1.0 \text{ MHz}$ )	$C_{\text{obo}}$		10		pF
Cutoff Frequency ( $I_C = 50 \text{ mA}, V_{\text{CE}} = 2.0 \text{ V}, f = 100 \text{ MHz}$ )	$f_T$		180		MHz

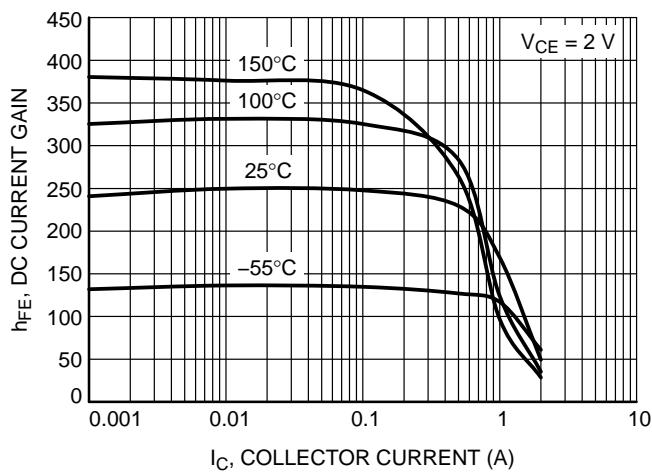
## SWITCHING TIMES

Delay Time ( $V_{\text{CC}} = 10 \text{ V}, I_C = 0.5 \text{ A}, I_{B1} = 25 \text{ mA}, I_{B2} = -25 \text{ mA}$ )	$t_d$		13		ns
Rise Time ( $V_{\text{CC}} = 10 \text{ V}, I_C = 0.5 \text{ A}, I_{B1} = 25 \text{ mA}, I_{B2} = -25 \text{ mA}$ )	$t_r$		18		ns
Storage Time ( $V_{\text{CC}} = 10 \text{ V}, I_C = 0.5 \text{ A}, I_{B1} = 25 \text{ mA}, I_{B2} = -25 \text{ mA}$ )	$t_s$		700		ns
Fall Time ( $V_{\text{CC}} = 10 \text{ V}, I_C = 0.5 \text{ A}, I_{B1} = 25 \text{ mA}, I_{B2} = -25 \text{ mA}$ )	$t_f$		80		ns

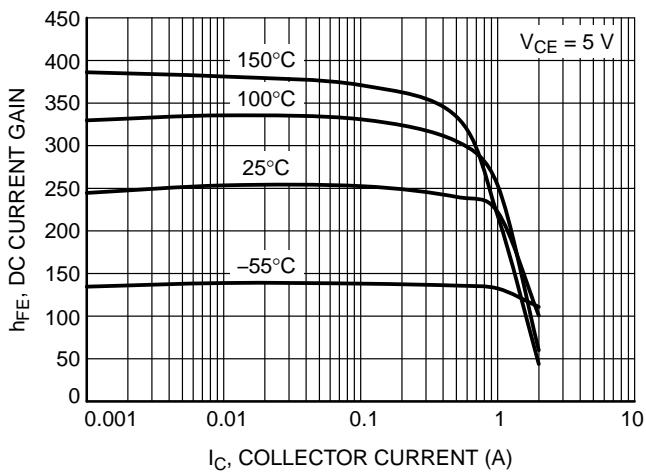
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

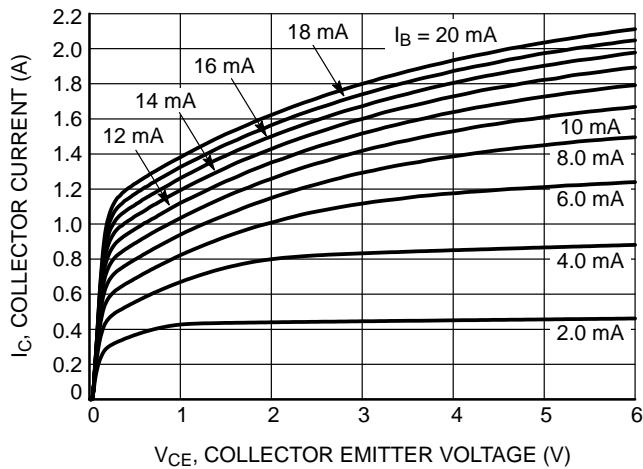
**TYPICAL CHARACTERISTICS**



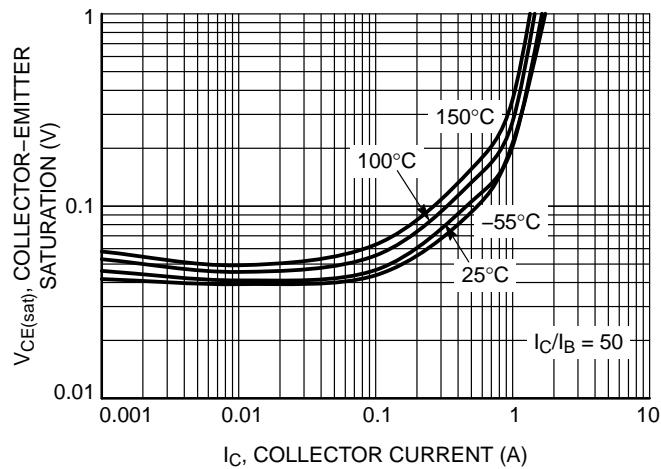
**Figure 1. DC Current Gain**



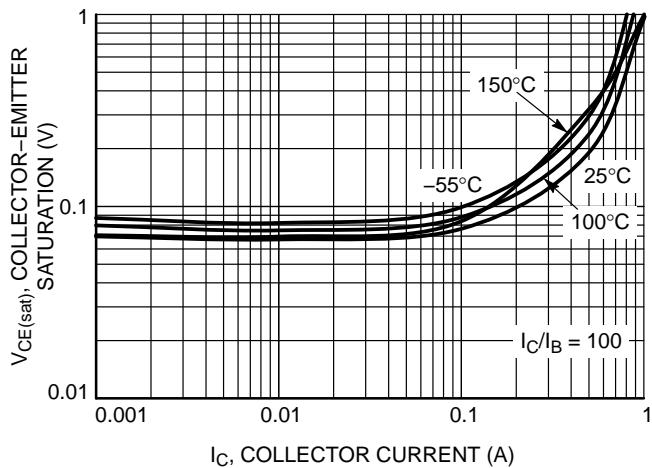
**Figure 2. DC Current Gain**



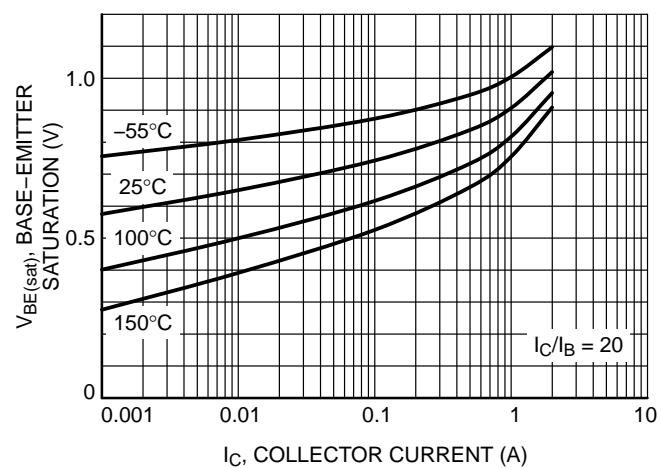
**Figure 3. Collector Current as a Function of Collector Emitter Voltage**



**Figure 4. Collector-Emitter Saturation Voltage**

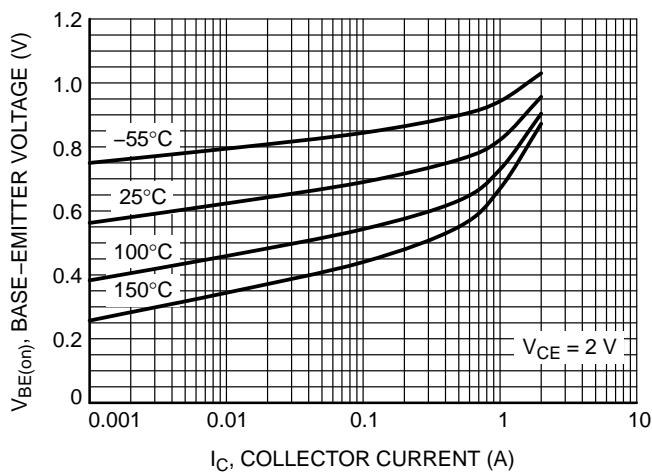


**Figure 5. Collector-Emitter Saturation Voltage**

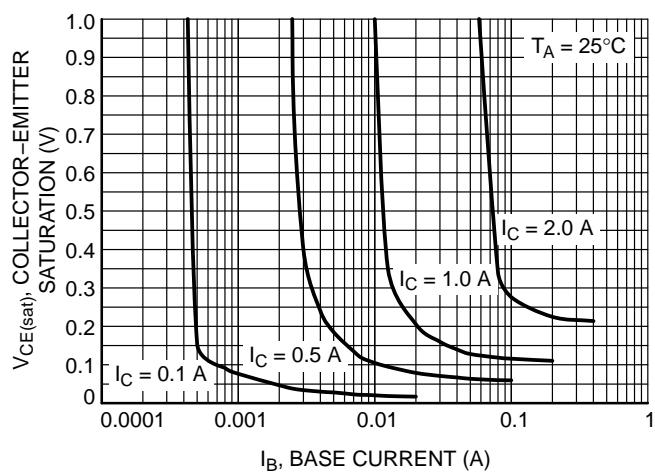


**Figure 6. Base-Emitter Saturation Voltage**

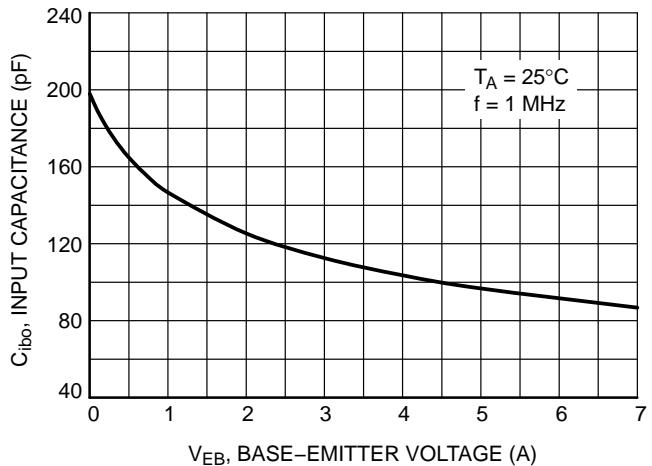
**TYPICAL CHARACTERISTICS**



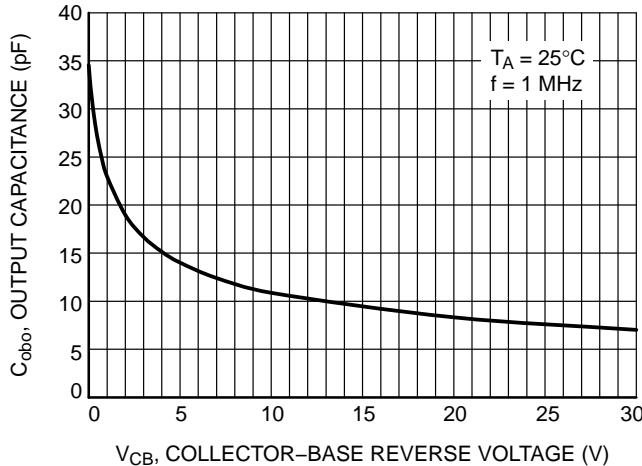
**Figure 7. Base-Emitter "ON" Voltage**



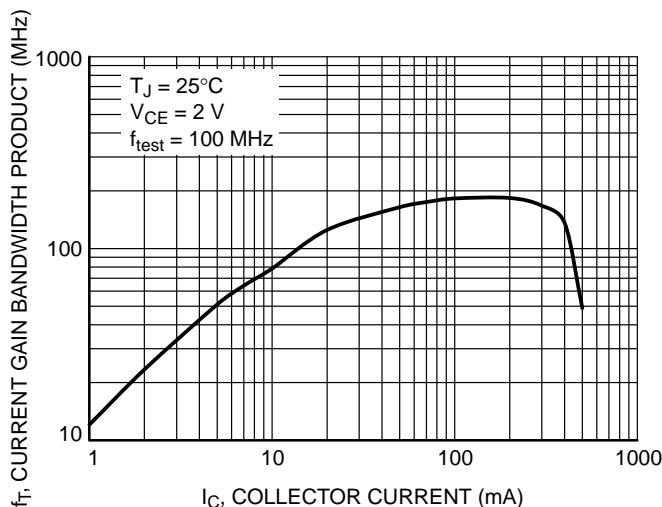
**Figure 8. Collector Saturation Region**



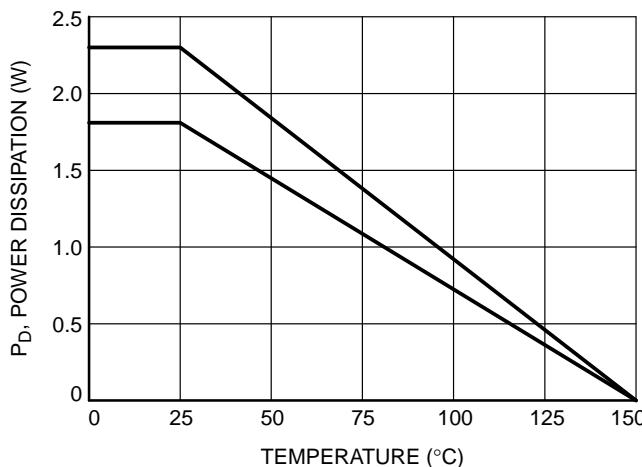
**Figure 9. Input Capacitance**



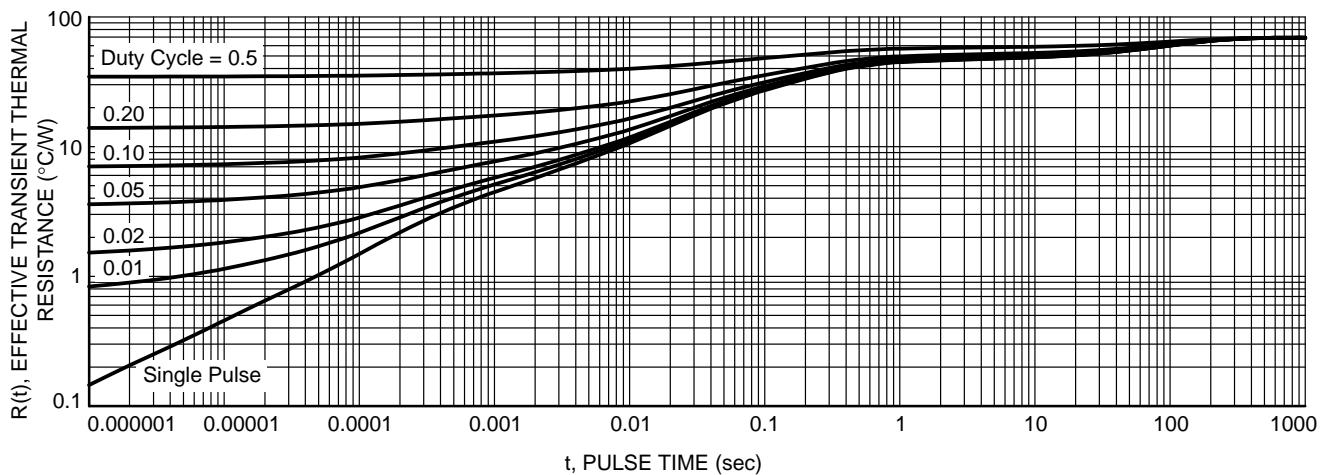
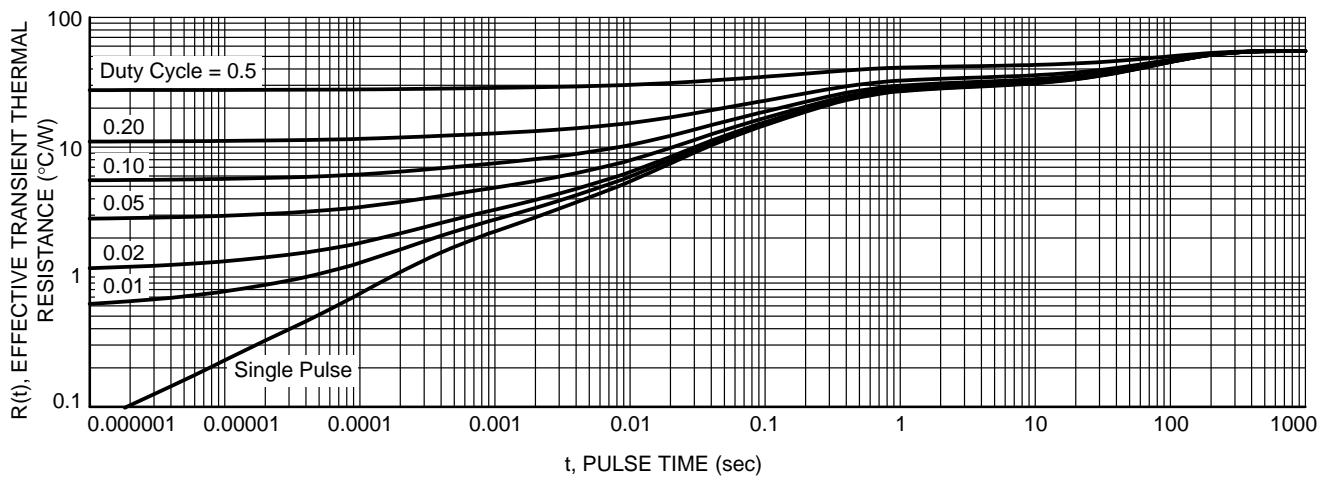
**Figure 10. Output Capacitance**



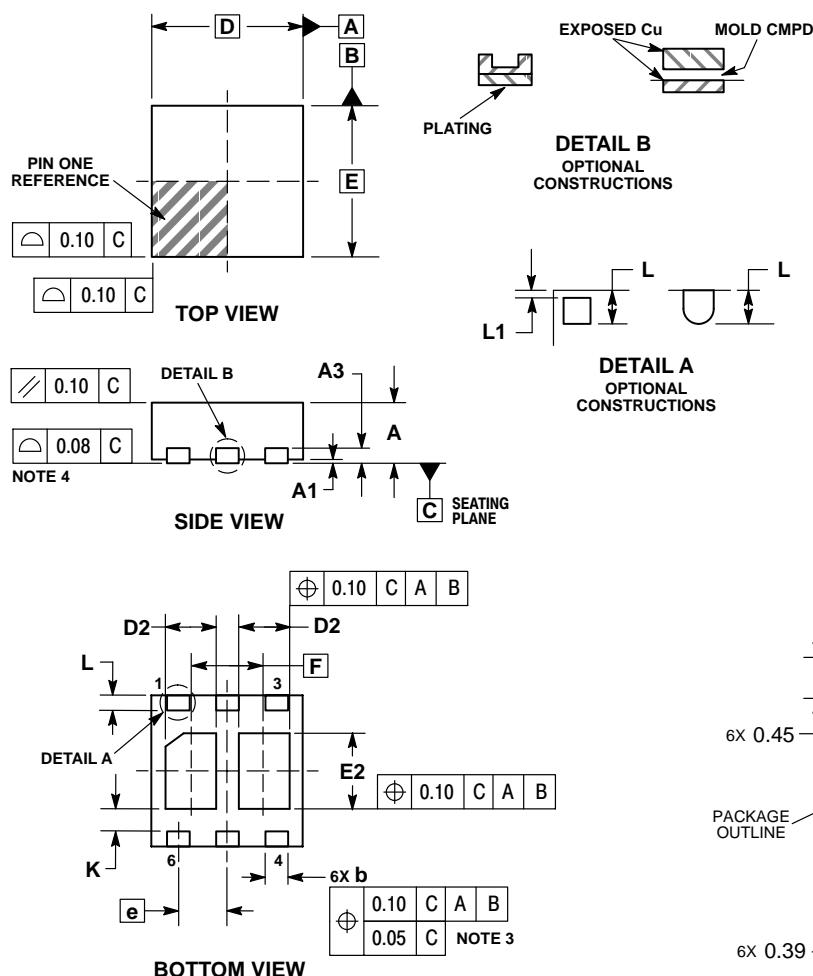
**Figure 11.  $f_T$ , Current Gain Bandwidth Product**



**Figure 12. Power Derating**

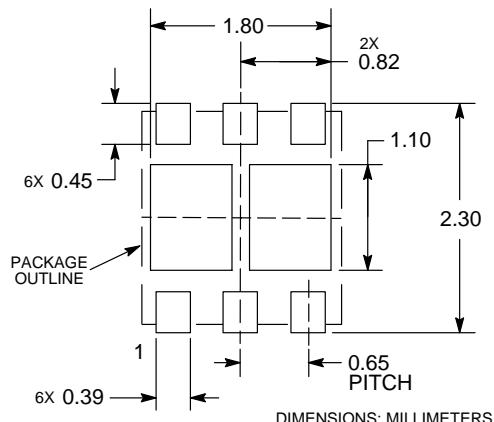
**TYPICAL CHARACTERISTICS****Figure 13. Thermal Resistance by Transistor****Figure 14. Thermal Resistance for Both Transistors**

## PACKAGE DIMENSIONS

WDFN6 2x2, 0.65P  
CASE 506AN  
ISSUE G

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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