

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

## NSS60101DMT

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 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
- 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

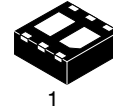
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL CHARACTERISTICS

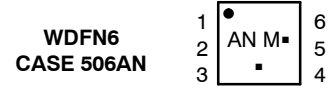
Characteristic	Symbol	Max	Unit
Thermal Resistance Junction-to-Ambient (Notes 1 and 2)	$R_{\theta JA}$	55	$^\circ\text{C}/\text{W}$
Total Power Dissipation per Package @ $T_A = 25^\circ\text{C}$ (Note 2)	$P_D$	2.27	W
Thermal Resistance Junction-to-Ambient (Note 3)	$R_{\theta JA}$	69	$^\circ\text{C}/\text{W}$
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).

## 60 Volt, 1 Amp NPN Low $V_{CE(sat)}$ Transistors



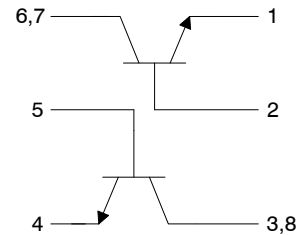
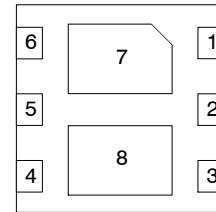
### MARKING DIAGRAM



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

(Note: Microdot may be in either location)

### PIN CONNECTIONS



### ORDERING INFORMATION

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

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

**DYNAMIC CHARACTERISTICS**

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

**SWITCHING TIMES**

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

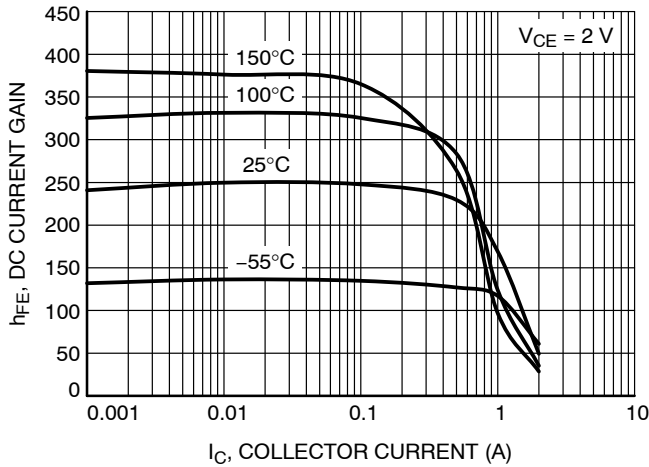


Figure 1. DC Current Gain

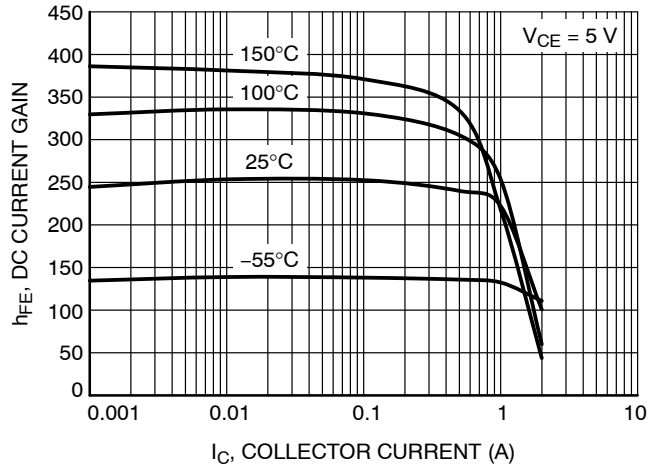


Figure 2. DC Current Gain

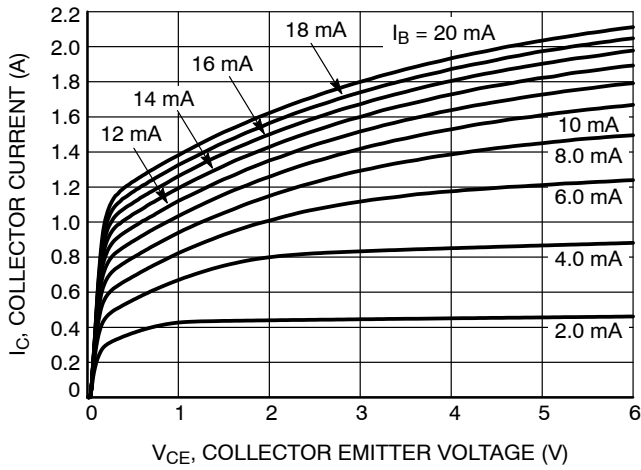


Figure 3. Collector Current as a Function of Collector Emitter Voltage

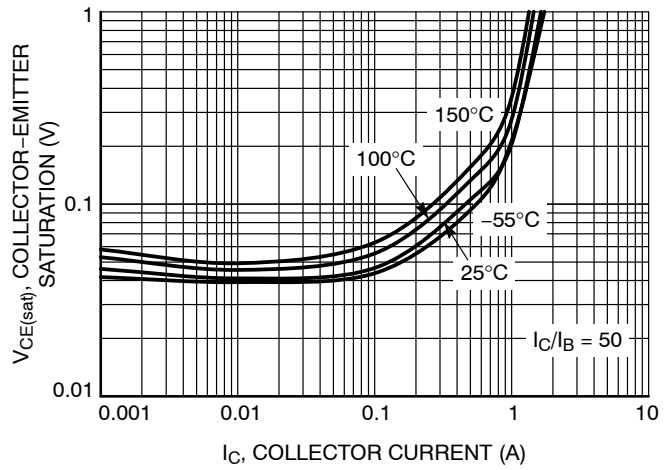


Figure 4. Collector-Emitter Saturation Voltage

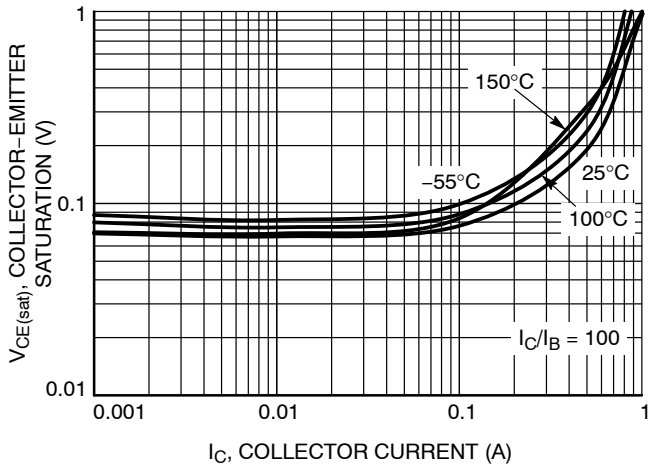


Figure 5. Collector-Emitter Saturation Voltage

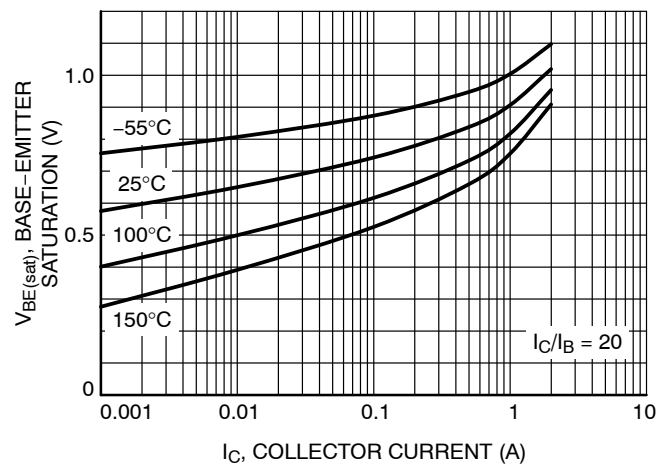


Figure 6. Base-Emitter Saturation Voltage

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## TYPICAL CHARACTERISTICS

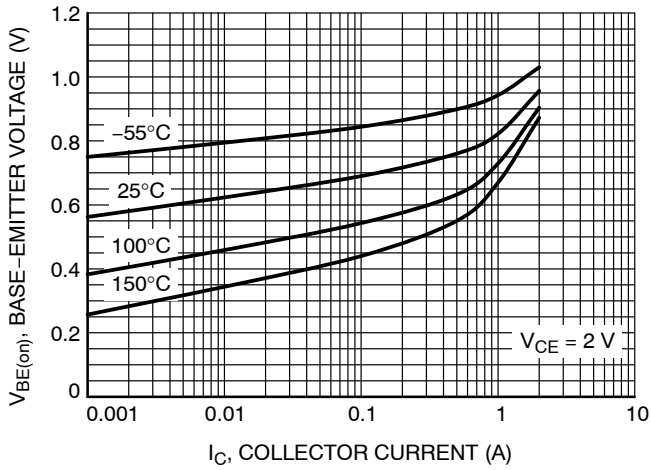


Figure 7. Base-Emitter "ON" Voltage

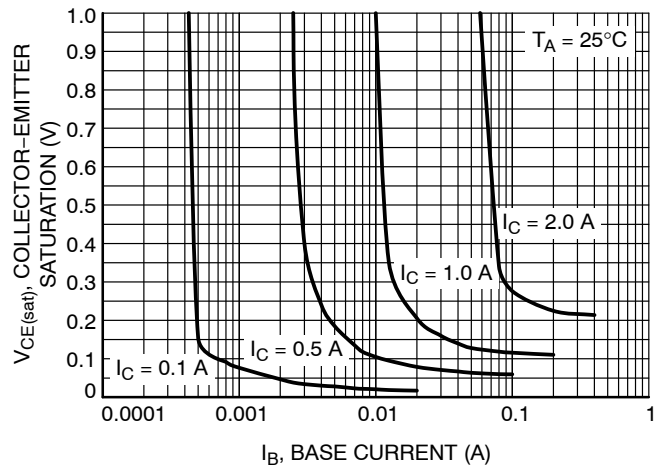


Figure 8. Collector Saturation Region

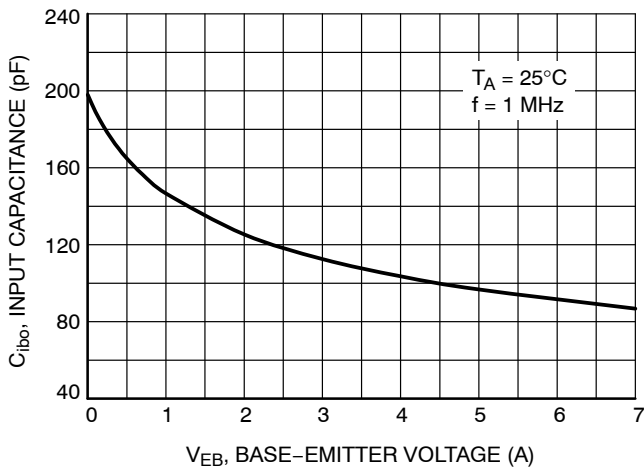


Figure 9. Input Capacitance

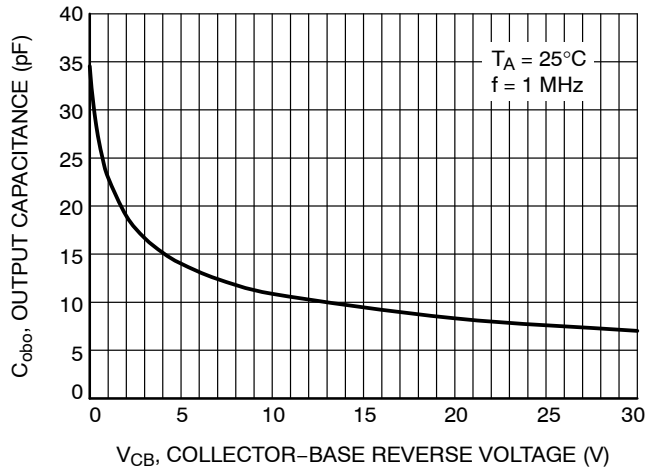


Figure 10. Output Capacitance

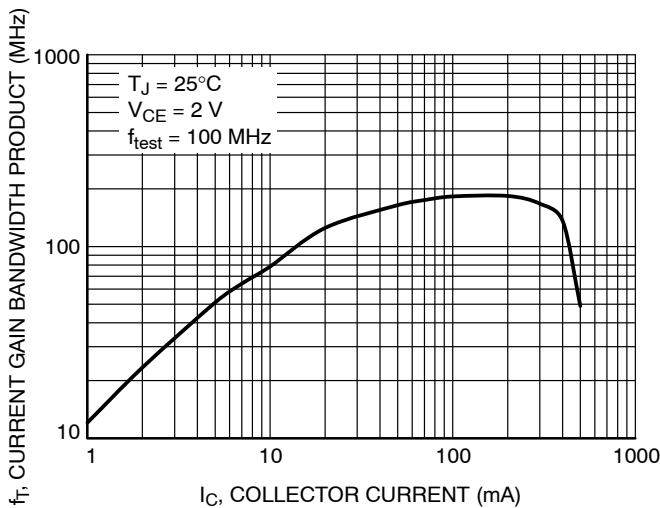


Figure 11.  $f_T$  Current Gain Bandwidth Product

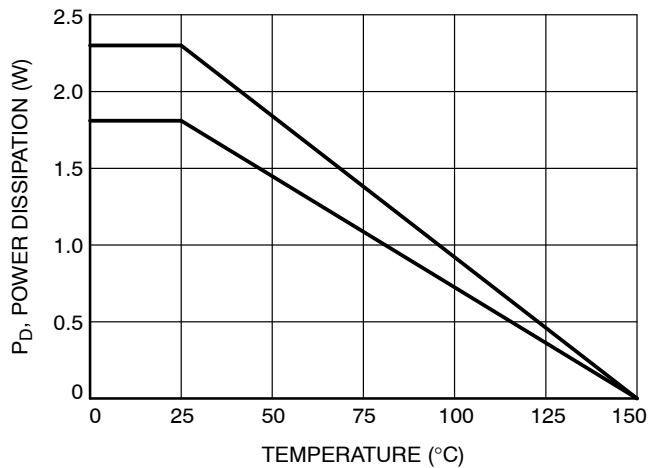


Figure 12. Power Derating

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## TYPICAL CHARACTERISTICS

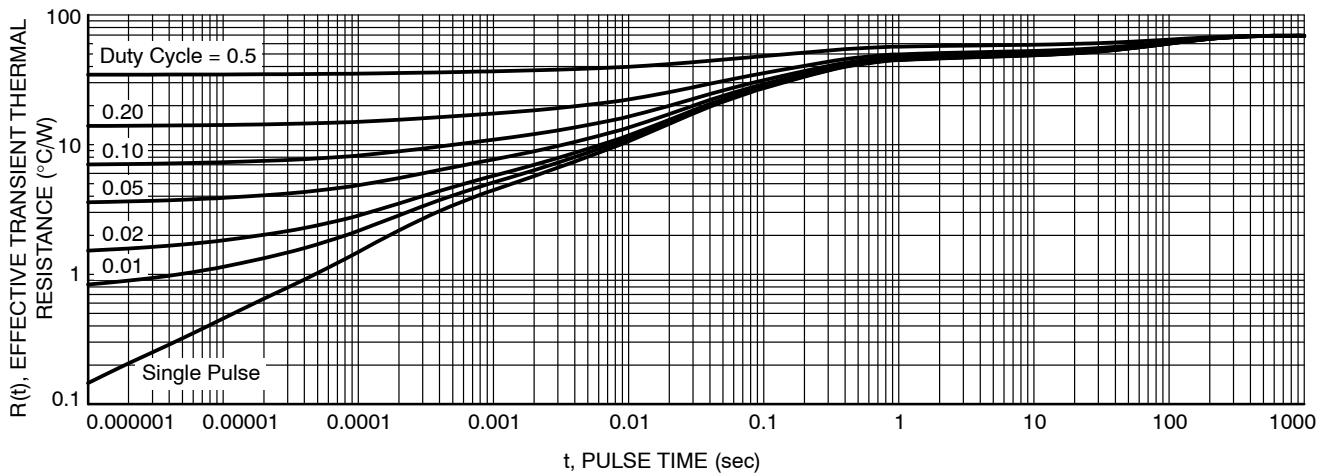


Figure 13. Thermal Resistance by Transistor

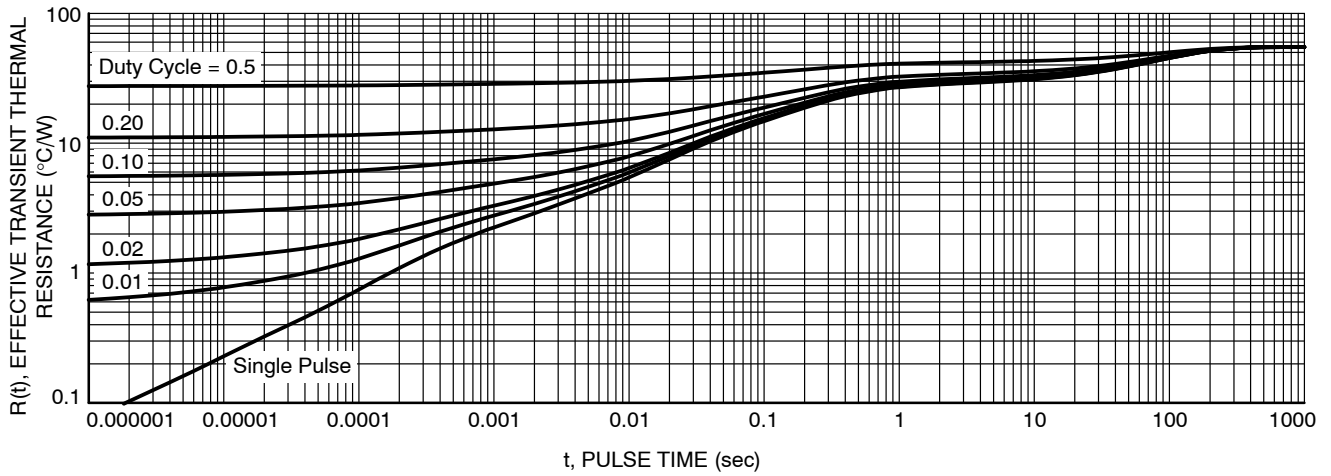
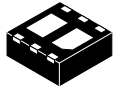


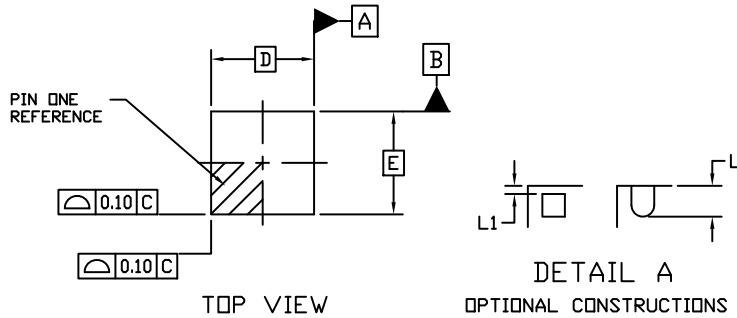
Figure 14. Thermal Resistance for Both Transistors

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



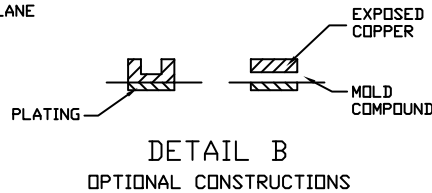
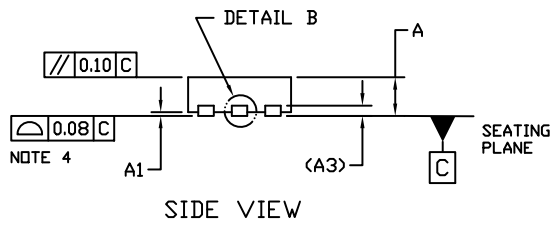
WDFN6 2x2, 0.65P  
CASE 506AN  
ISSUE H

DATE 25 JAN 2022

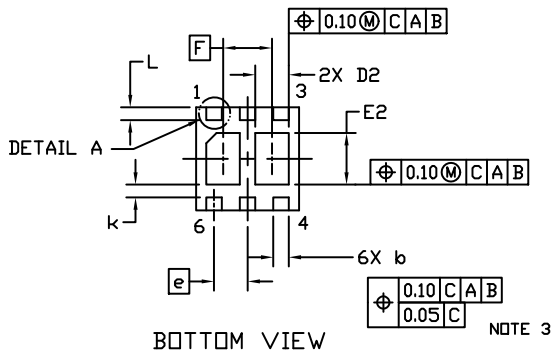


NOTES:

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	
<i>b</i>	0.25	0.35
D	2.00 BSC	
D2	0.57	0.77
E	2.00 BSC	
E2	0.90	1.10
<i>e</i>	0.65 BSC	
F	0.95 BSC	
<i>k</i>	0.25 REF	
L	0.20	0.30
L1	---	0.10

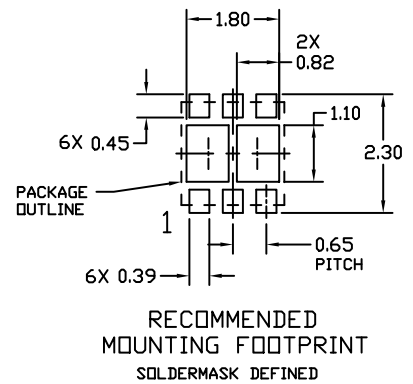


GENERIC MARKING DIAGRAM\*



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.



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