

# NSM3005NZ

## Small Signal BJT and MOSFET

30 V, 500 mA, PNP BJT with 20 V, 224 mA, N-Channel MOSFET

### Features

- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Typical Applications

- Portable Devices

#### Q1 MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	30	V
Collector-Base Voltage	$V_{CBO}$	40	V
Emitter-Base Voltage	$V_{EBO}$	5.0	V
Collector Current	$I_C$	500	mA
Base Current	$I_B$	50	mA

#### Q2 MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Value	Unit		
Drain-to-Source Voltage	$V_{DSS}$	20	V		
Gate-to-Source Voltage	$V_{GS}$	$\pm 8$	V		
Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	224	mA
		$T_A = 85^\circ\text{C}$			
		$t \leq 5 \text{ s}$			
Pulsed Drain Current	$T_p = 10 \mu\text{s}$	$I_{DM}$	673	mA	
Source Current (Body Diode)		$I_S$	120	mA	

### THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance Junction-to-Ambient (Note 1) Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$R_{\theta JA}$ $P_D$	245 0.8	$^\circ\text{C/W}$ W
Operating Junction and Storage Temperature	$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	$T_L$	260	$^\circ\text{C}$

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.

1. Surface mounted on FR4 board using 1 in sq pad size (Cu. area = 1.127 in sq [1 oz] including traces).



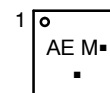
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### MARKING DIAGRAM



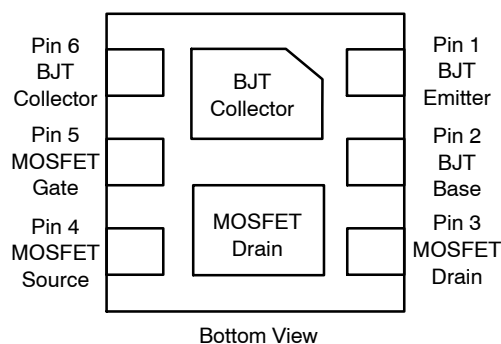
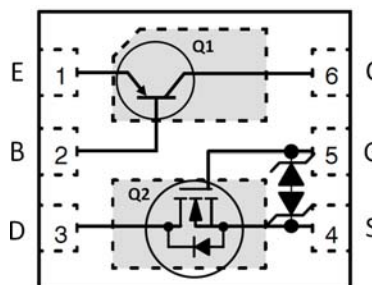
UDFN6  
CASE 517AT  
 $\mu\text{COOL}^{\text{TM}}$



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

(Note: Microdot may be in either location)  
\*Date Code orientation may vary depending upon manufacturing location.

### PIN CONNECTIONS



### ORDERING INFORMATION

Device	Package	Shipping†
NSM3005NZTAG	UDFN6 (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 Specifications Brochure, BRD8011/D.

# NSM3005NZ

## Q1 ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
Collector–Base Breakdown Voltage	V <sub>(BR)CBO</sub>	I <sub>C</sub> = 100 μA	40	–	–	V
Collector–Emitter Breakdown Voltage	V <sub>(BR)CEO</sub>	I <sub>C</sub> = 10 mA	30	–	–	V
Emitter–Base Breakdown Voltage	V <sub>(BR)EBO</sub>	I <sub>E</sub> = 100 μA	5.0	–	–	V
Collector Cutoff Current	I <sub>CBO</sub>	V <sub>CB</sub> = 25 V, I <sub>E</sub> = 0 A	–	–	1.0	μA
Emitter Cutoff Current	I <sub>EBO</sub>	V <sub>EB</sub> = 5.0 V, I <sub>C</sub> = 0 A	–	–	10	μA
<b>ON CHARACTERISTICS (Note 2)</b>						
DC Current Gain	h <sub>FE</sub>	V <sub>CE</sub> = 3.0 V, I <sub>C</sub> = 30 mA	20	–	100	
		V <sub>CE</sub> = 3.0 V, I <sub>C</sub> = 100 mA	20	–	100	
		V <sub>CE</sub> = 3.0 V, I <sub>C</sub> = 500 mA	20	–	100	
Collector–Emitter Saturation Voltage	V <sub>CE(sat)</sub>	I <sub>C</sub> = 500 mA, I <sub>B</sub> = 50 mA	–	–	0.4	V
Base–Emitter Saturation Voltage	V <sub>BE(sat)</sub>	I <sub>C</sub> = 500 mA, I <sub>B</sub> = 50 mA	–	–	1.1	V
Base–Emitter Turn–On Voltage	V <sub>BE(on)</sub>	V <sub>CE</sub> = 1.0 V, I <sub>C</sub> = 500 mA	–	–	1.0	V

## Q2 ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
Drain–to–Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	20	–	–	V
Drain–to–Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> /T <sub>J</sub>	I <sub>D</sub> = –250 μA, ref to 25°C	–	19	–	mV/°C
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 16 V, T <sub>J</sub> = 25°C	–	–	1.0	μA
Gate–to–Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±8.0 V	–	–	±2.0	μA
<b>ON CHARACTERISTICS (Note 2)</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	0.4	–	1.0	V
Negative Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>	–	–	1.9	–	mV/°C
Drain–to–Source On Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 100 mA	–	0.65	1.4	Ω
		V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 50 mA	–	0.9	1.9	
		V <sub>GS</sub> = 1.8 V, I <sub>D</sub> = 20 mA	–	1.1	2.2	
		V <sub>GS</sub> = 1.5 V, I <sub>D</sub> = 10 mA	–	1.4	4.3	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = 5.0 V, I <sub>D</sub> = 100 mA	–	0.56	–	S

## CHARGES AND CAPACITANCES

Input Capacitance	C <sub>ISS</sub>	f = 1.0 MHz, V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 15 V	–	15.8	–	pF
Output Capacitance	C <sub>OSS</sub>		–	3.5	–	
Reverse Transfer Capacitance	C <sub>RSS</sub>		–	2.4	–	
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 15 V; I <sub>D</sub> = 200 mA	–	0.70	–	nC
Threshold Gate Charge	Q <sub>G(TH)</sub>		–	0.05	–	
Gate–to–Source Charge	Q <sub>GS</sub>		–	0.14	–	
Gate–to–Drain Charge	Q <sub>GD</sub>		–	0.10	–	

## SWITCHING CHARACTERISTICS, V<sub>GS</sub> = 4.5 V (Note 3)

Turn–On Delay Time	t <sub>d(ON)</sub>	V <sub>GS</sub> = 4.5 V, V <sub>DD</sub> = 15 V, I <sub>D</sub> = 200 mA, R <sub>G</sub> = 2 Ω	–	18	–	ns
Rise Time	t <sub>r</sub>		–	35	–	
Turn–Off Delay Time	T <sub>d(OFF)</sub>		–	201	–	
Fall Time	t <sub>f</sub>		–	110	–	

## DRAIN–SOURCE DIODE CHARACTERISTICS

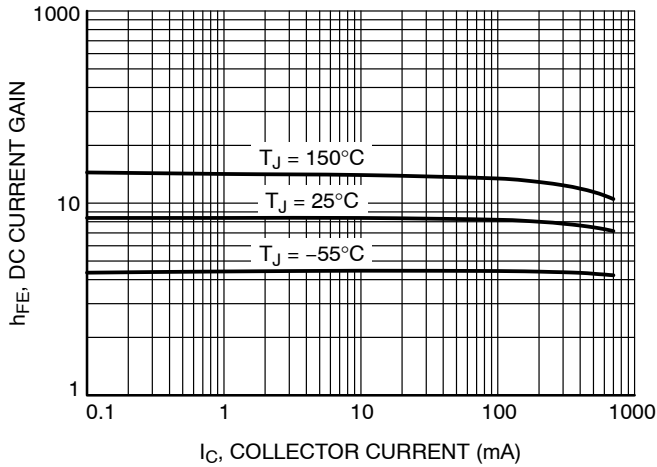
Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 10 mA	–	0.55	1.0	V
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2. Pulsed Condition: Pulse Width = 300 msec, Duty Cycle ≤ 2%.

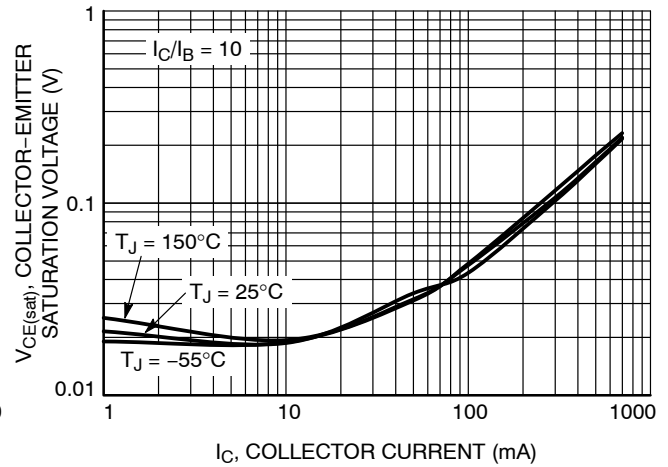
3. Switching characteristics are independent of operating junction temperatures.

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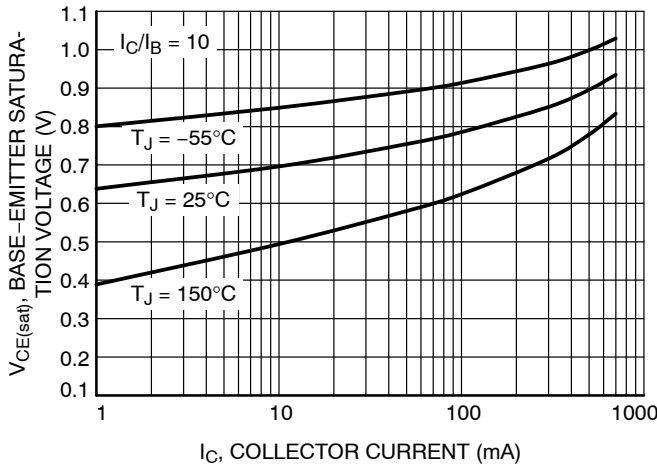
## TYPICAL CHARACTERISTICS – Q1



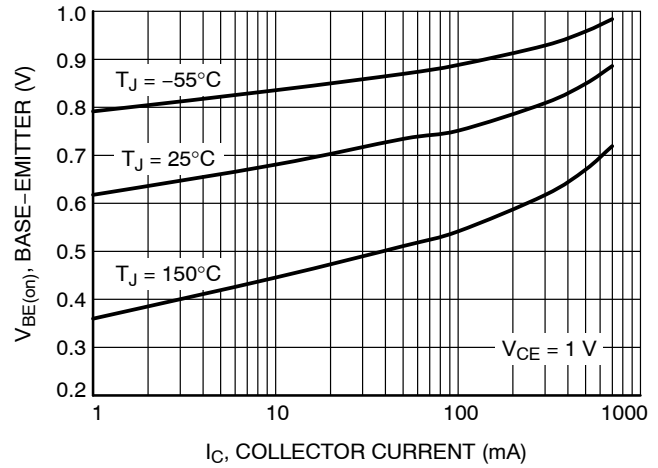
**Figure 1. PNP DC Current Gain vs. Collector Current**



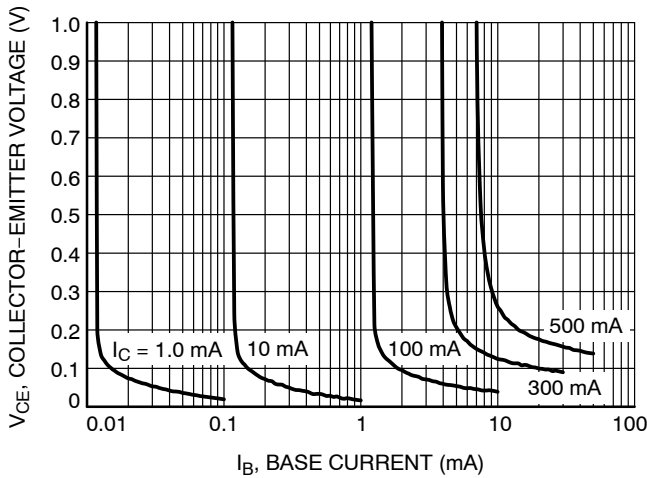
**Figure 2. PNP VCE vs. IC**



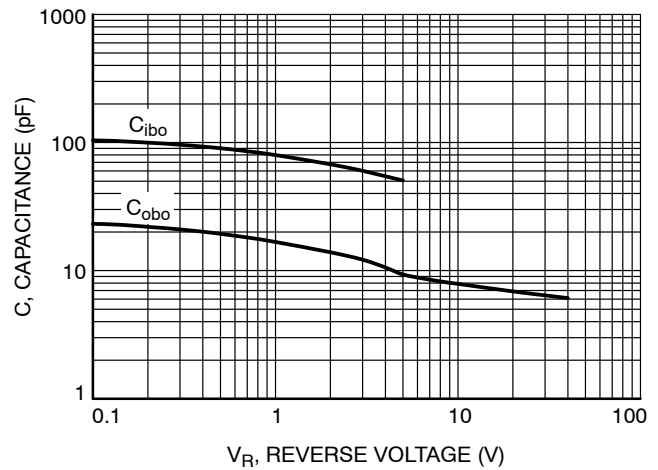
**Figure 3. PNP VBE(sat) vs. IC**



**Figure 4. PNP VBE(on) vs. IC**



**Figure 5. PNP VCE vs. IB**



**Figure 6. PNP Capacitance**

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## TYPICAL CHARACTERISTICS – Q2

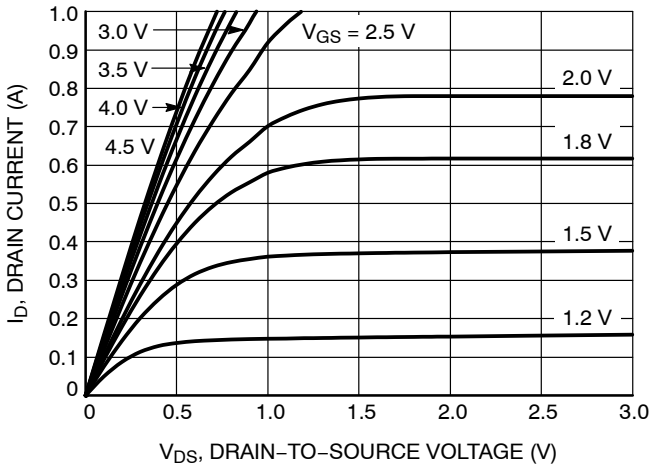


Figure 7. On-Region Characteristics

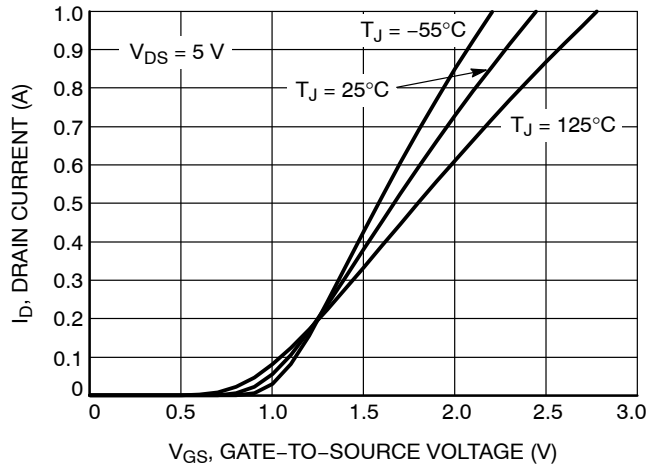


Figure 8. Transfer Characteristics

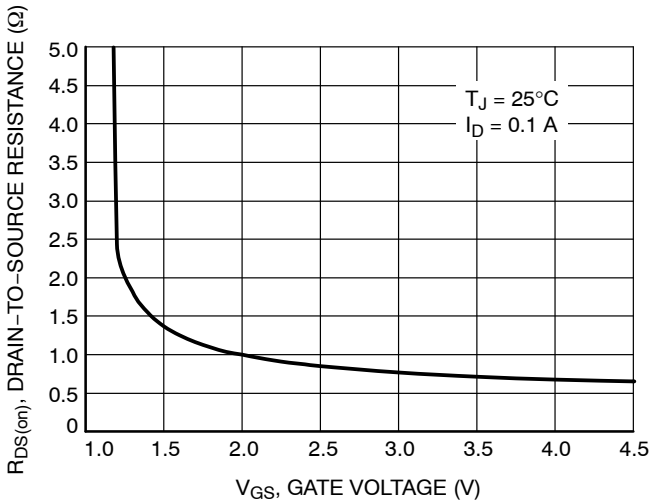


Figure 9. On-Resistance vs. Gate-to-Source Voltage

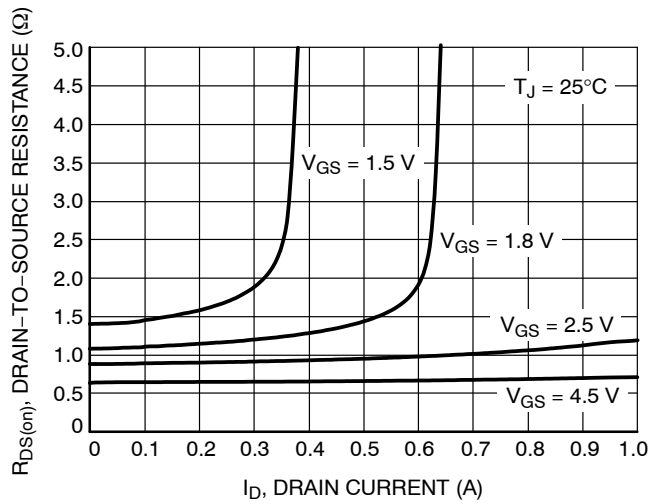


Figure 10. On-Resistance vs. Drain Current and Gate Voltage

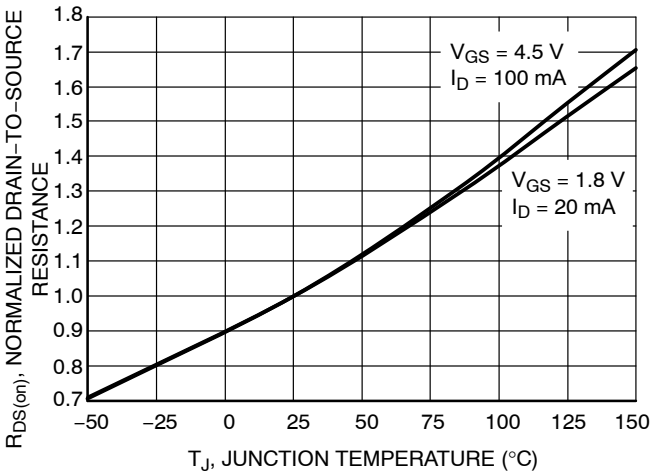


Figure 11. On-Resistance Variation with Temperature

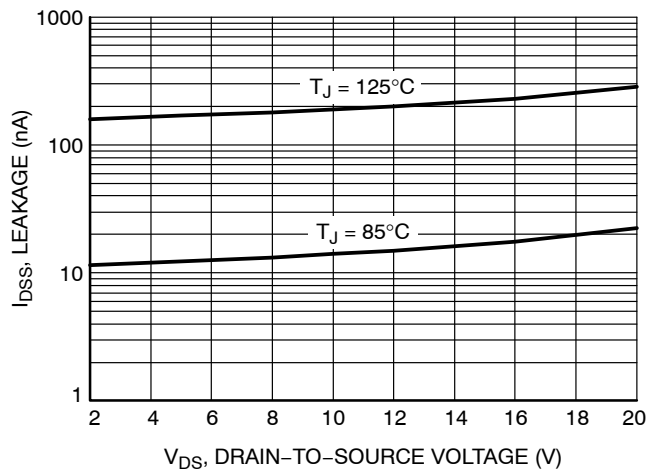
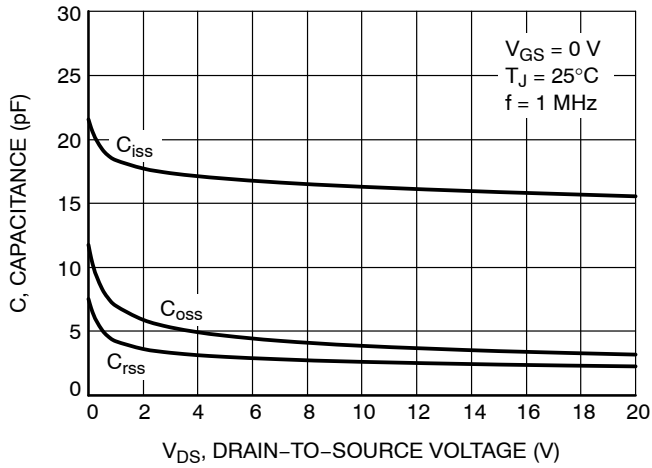


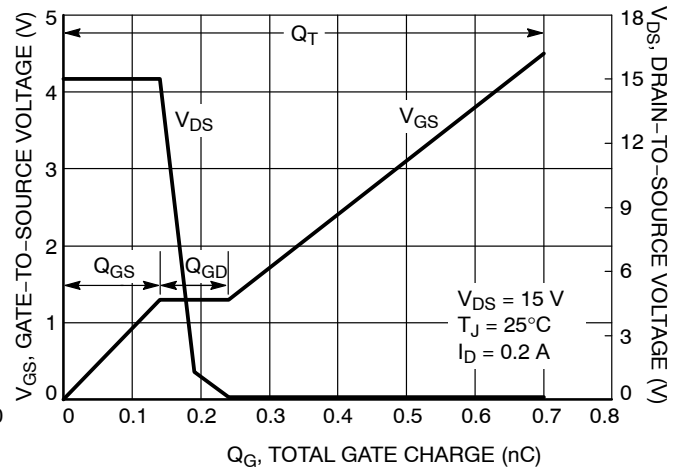
Figure 12. Drain-to-Source Leakage Current vs. Voltage

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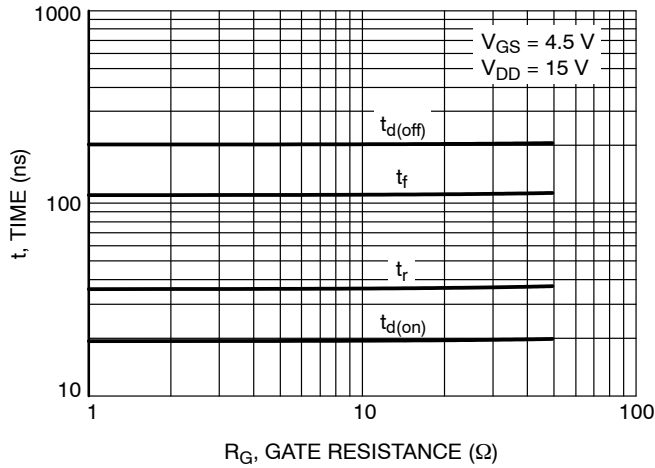
## TYPICAL CHARACTERISTICS – Q2



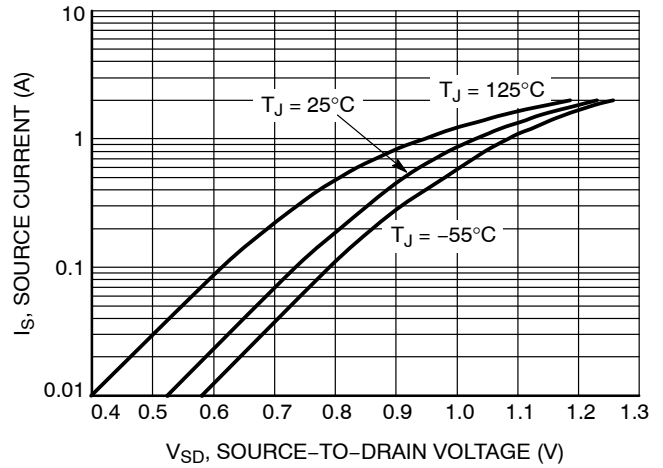
**Figure 13. Capacitance Variation**



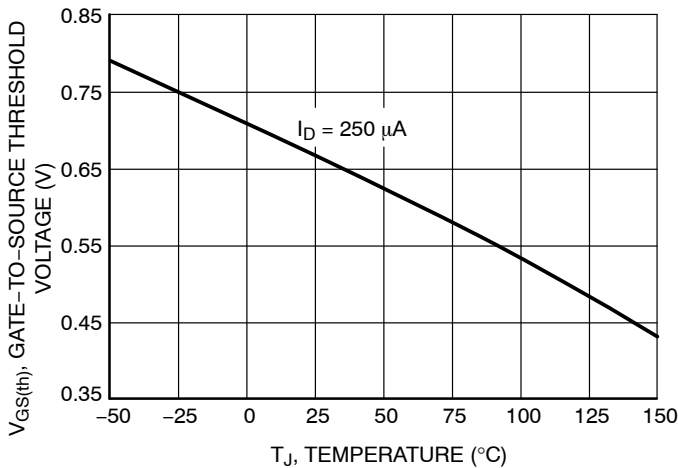
**Figure 14. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**



**Figure 15. Resistive Switching Time Variation vs. Gate Resistance**



**Figure 16. Diode Forward Voltage vs. Current**



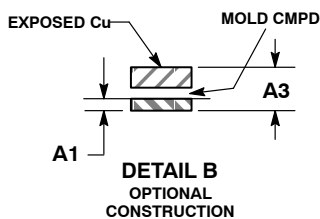
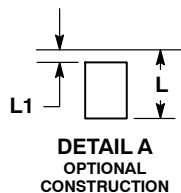
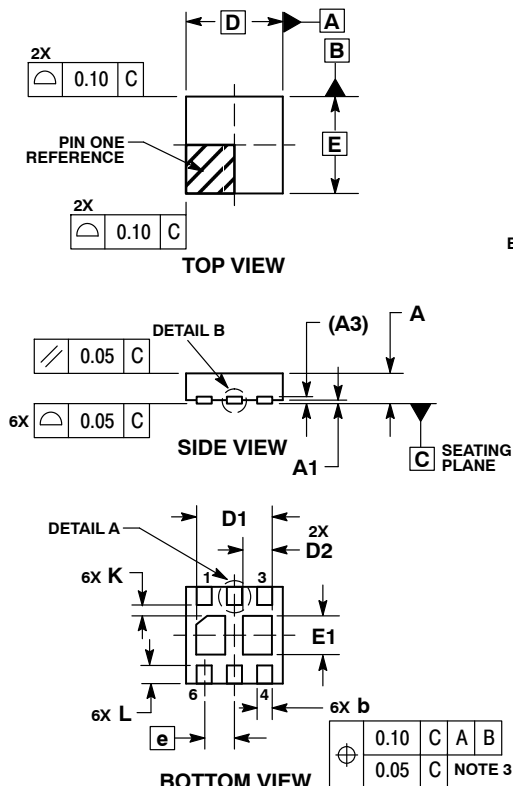
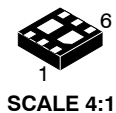
**Figure 17. Threshold Voltage**



### UDFN6 1.6x1.6, 0.5P

CASE 517AT-01  
ISSUE O

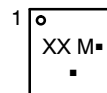
DATE 02 SEP 2008



- 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 TERMINAL.
  4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

MILLIMETERS		
DIM	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.13	REF
b	0.20	0.30
D	1.60	BSC
E	1.60	BSC
e	0.50	BSC
D1	1.14	1.34
D2	0.38	0.58
E1	0.54	0.74
K	0.20	---
L	0.15	0.35
L1	---	0.10

### GENERIC MARKING DIAGRAM\*



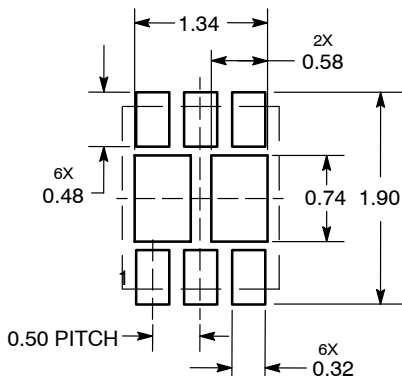
- XX = Specific Device Code
- M = Date Code
- = Pb-Free Package

(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.

### SOLDERMASK DEFINED MOUNTING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

\*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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<b>DESCRIPTION:</b>	<b>6 PIN UDFN, 1.6X1.6, 0.5P</b>	<b>PAGE 1 OF 1</b>

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