

# Small Signal BJT and MOSFET

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

## NSM3005NZ

### 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	$T_p = 10 \mu\text{s}$	$T_A = 25^\circ\text{C}$	$I_{DM}$ 673 mA
		$T_A = 85^\circ\text{C}$	
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	$^\circ\text{C}$

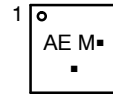
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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

### MARKING DIAGRAM



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



AE = Specific Device Code

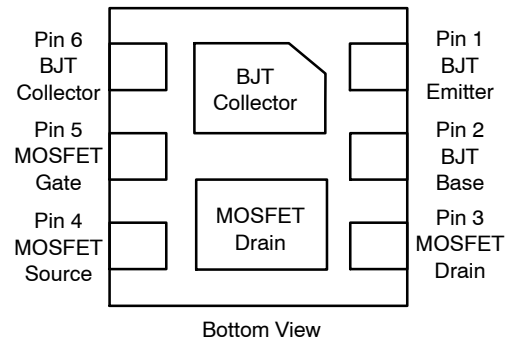
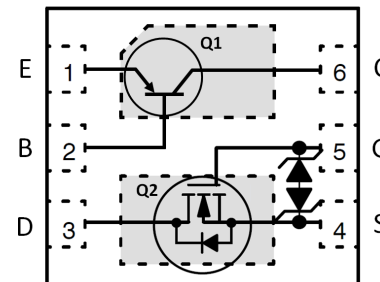
M = Date Code

■ = 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 <sup>†</sup>
NSM3005NZTAG	UDFN6 (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 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

## ON CHARACTERISTICS (Note 2)

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

## ON CHARACTERISTICS (Note 2)

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(ON)</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.

TYPICAL CHARACTERISTICS – Q1

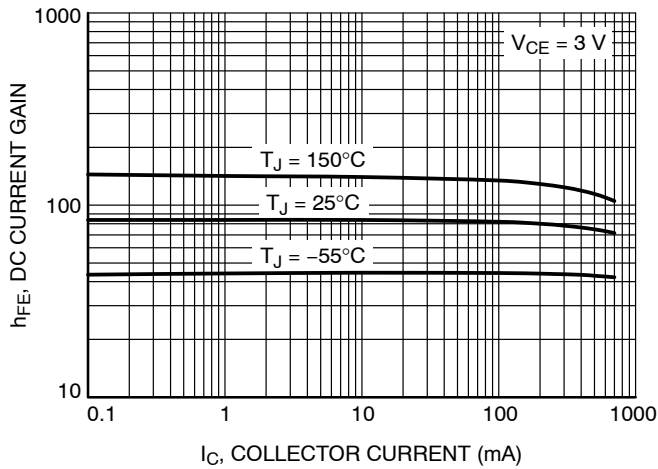


Figure 1. PNP DC Current Gain vs. Collector Current

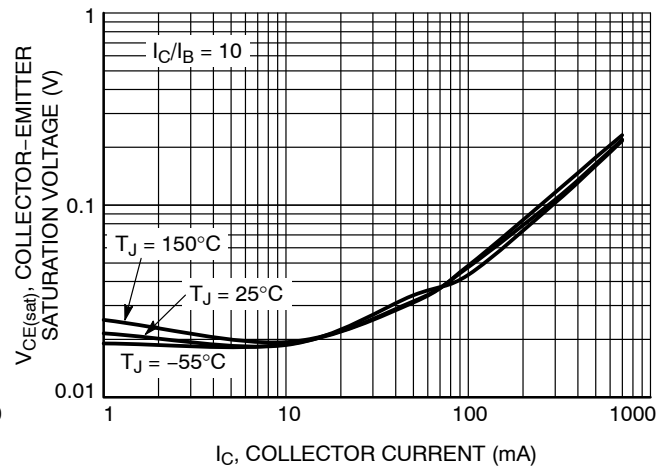


Figure 2. PNP VCE vs. IC

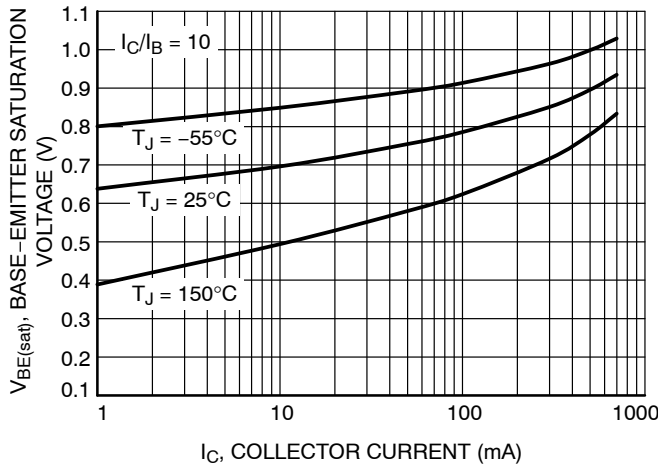


Figure 3. PNP VBE(sat) vs. IC

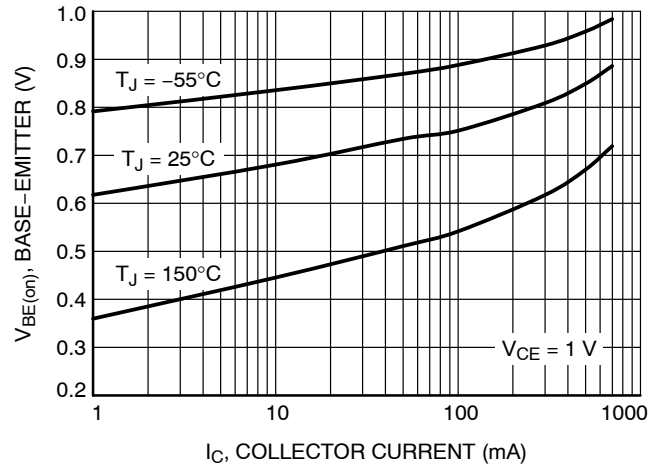


Figure 4. PNP VBE(on) vs. IC

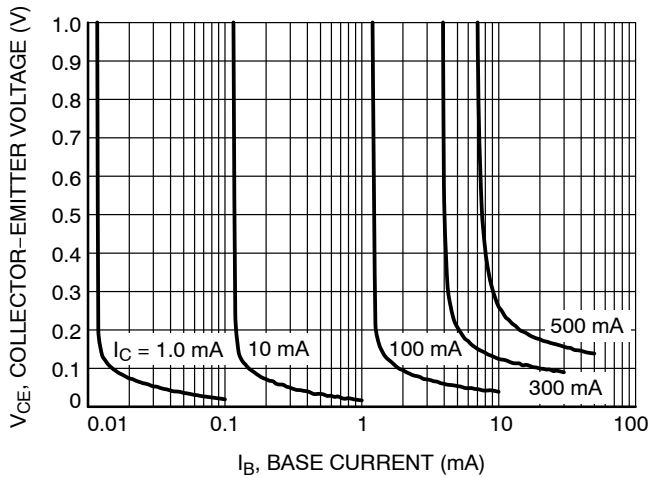


Figure 5. PNP VCE vs. IB

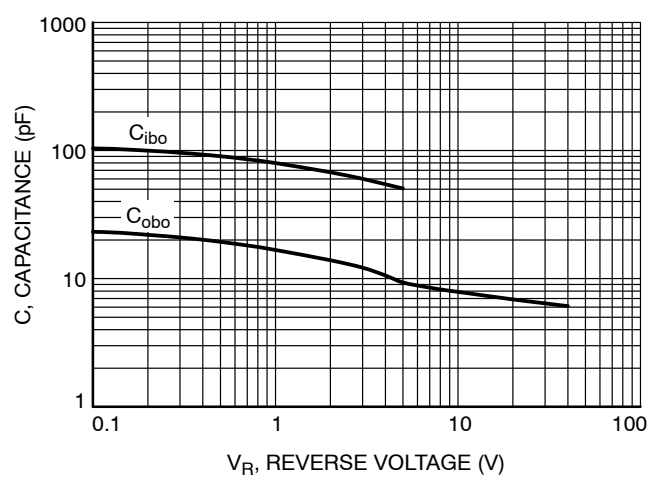


Figure 6. PNP Capacitance

TYPICAL CHARACTERISTICS – Q2

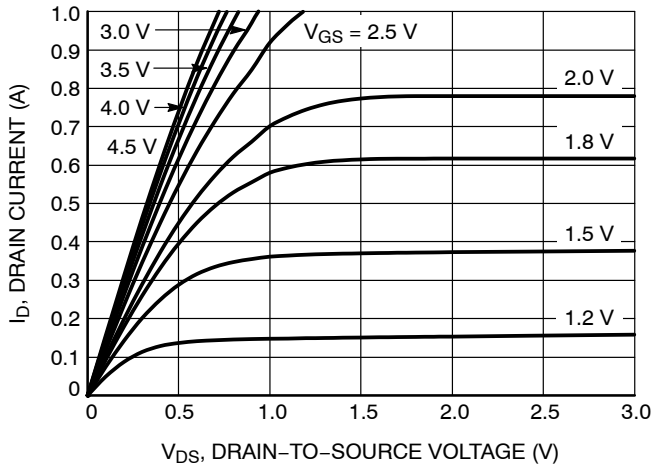


Figure 7. On-Region Characteristics

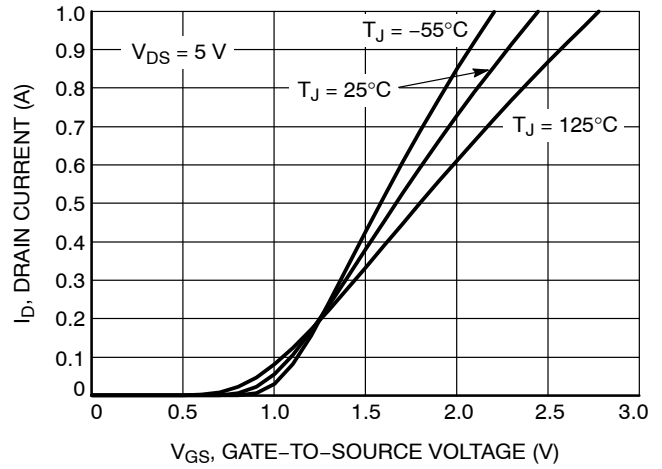


Figure 8. Transfer Characteristics

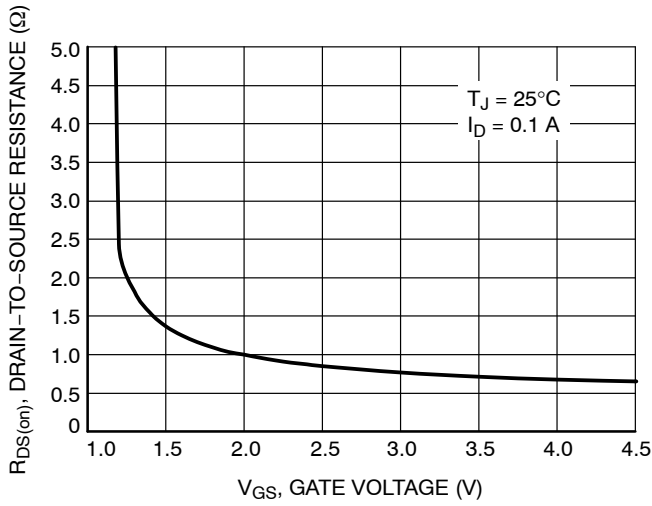


Figure 9. On-Resistance vs. Gate-to-Source Voltage

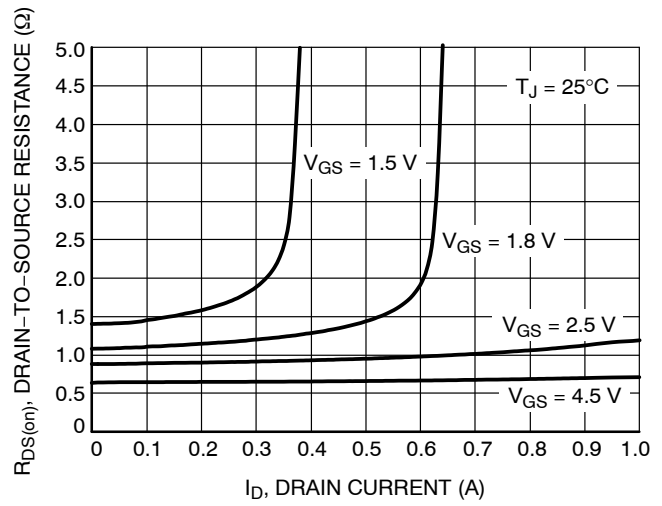


Figure 10. On-Resistance vs. Drain Current and Gate Voltage

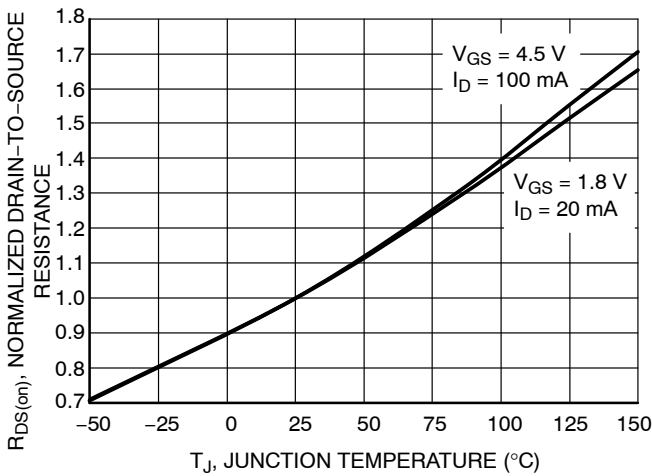


Figure 11. On-Resistance Variation with Temperature

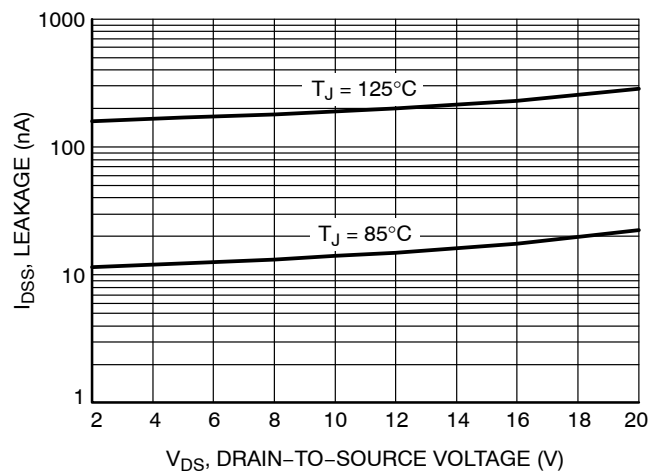


Figure 12. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS – Q2

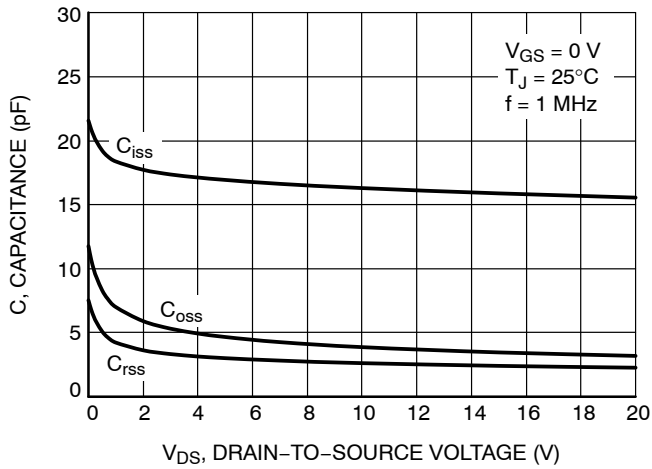


Figure 13. Capacitance Variation

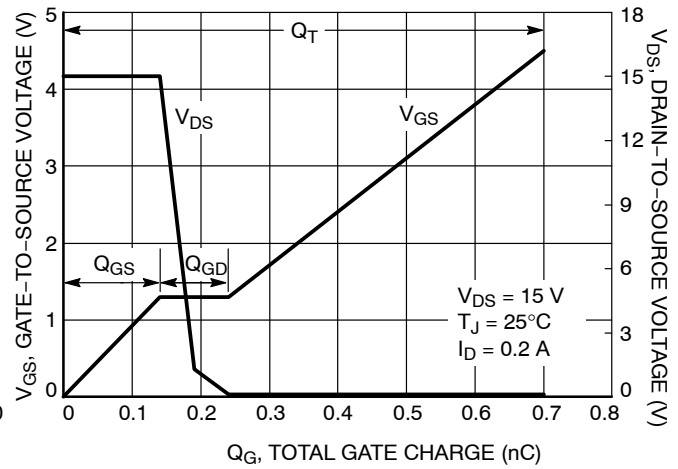


Figure 14. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

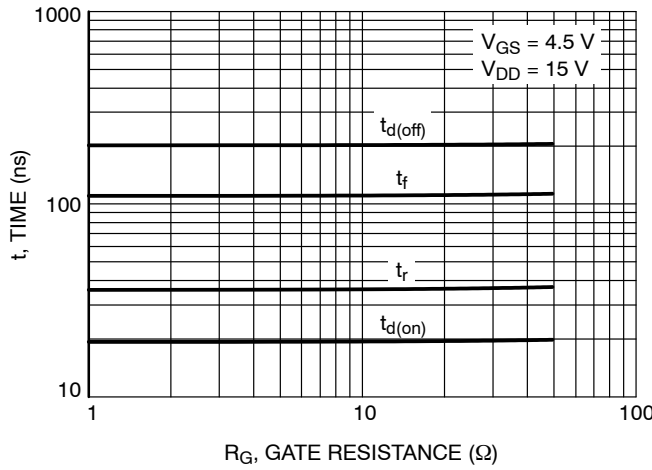


Figure 15. Resistive Switching Time Variation vs. Gate Resistance

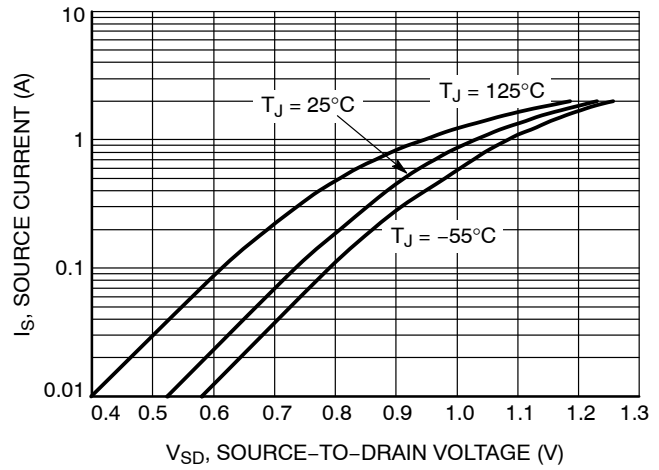


Figure 16. Diode Forward Voltage vs. Current

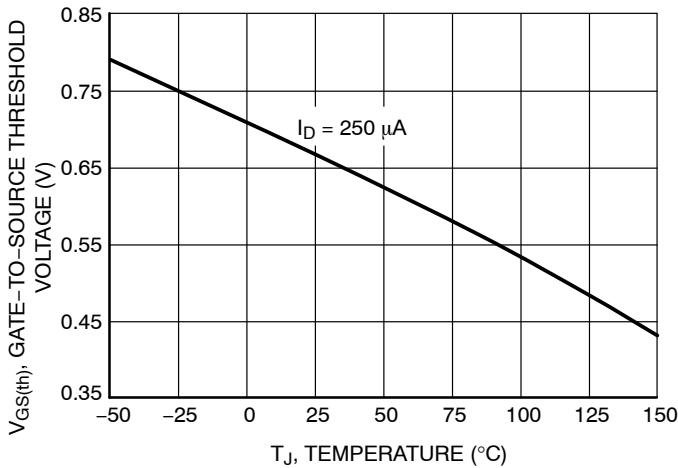
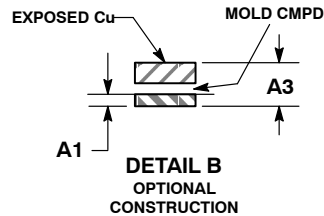
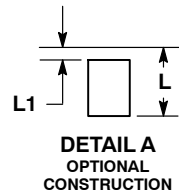


Figure 17. Threshold Voltage

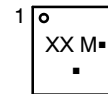


DATE 02 SEP 2008



DIM	MILLIMETERS	
	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

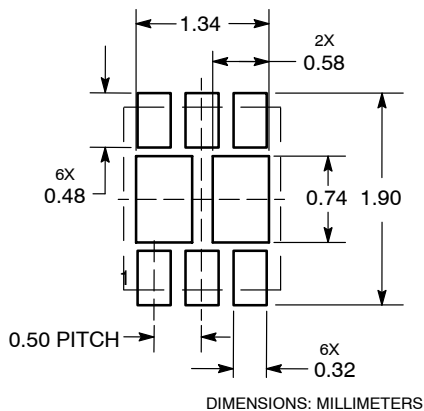
### GENERIC MARKING DIAGRAM\*



- = 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. Some products may not follow the Generic Marking.

**SOLDERMASK DEFINED  
MOUNTING FOOTPRINT\***

DIMENSIONS: MILLIMETERS

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

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