

# NTLUS020N03C

## MOSFET – Power, Single, N-Channel, $\mu$ Cool, UDFN6, 1.6x1.6x0.55 mm 30 V, 13 m $\Omega$ , 8.2 A

### Features

- UDFN Package with Exposed Drain Pads for Excellent Thermal Conduction
- Low Profile UDFN 1.6 x 1.6 x 0.55 mm for Board Space Saving
- Ultra Low  $R_{DS(on)}$
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

- Power Load Switch
- Wireless Charging
- DC-DC Converters
- Motor Drive

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

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			$V_{DSS}$	30	V
Gate-to-Source Voltage			$V_{GS}$	$\pm 20$	V
Continuous Drain Current $R_{\theta JA}$ (Note 1, 3)	Steady State	$T_A = 25^{\circ}\text{C}$	$I_D$	8.2	A
		$T_A = 85^{\circ}\text{C}$		5.9	
Power Dissipation $R_{\theta JA}$ (Note 1, 3)		$T_A = 25^{\circ}\text{C}$	$P_D$	1.52	W
Continuous Drain Current $R_{\theta JA}$ (Note 2, 3)	Steady State	$T_A = 25^{\circ}\text{C}$	$I_D$	5.3	A
		$T_A = 85^{\circ}\text{C}$		3.8	
Power Dissipation $R_{\theta JA}$ (Note 2, 3)		$T_A = 25^{\circ}\text{C}$	$P_D$	0.65	W
Pulsed Drain Current		$t_p = 10\ \mu\text{s}$	$I_{DM}$	24	A
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.

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Ambient – Steady State (Note 1, 3)	$R_{\theta JA}$	82.5	$^\circ\text{C/W}$
Junction-to-Ambient – Steady State min Pad (Note 2, 3)	$R_{\theta JA}$	194.8	

1. Surface-mounted on FR4 board using 1 in<sup>2</sup> pad size, 2 oz Cu pad.

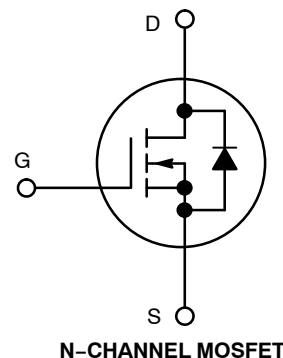


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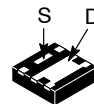
### MOSFET

$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX
30 V	13 m $\Omega$ @ 10 V	8.2 A
	18 m $\Omega$ @ 4.5 V	

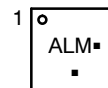


N-CHANNEL MOSFET

### MARKING DIAGRAM



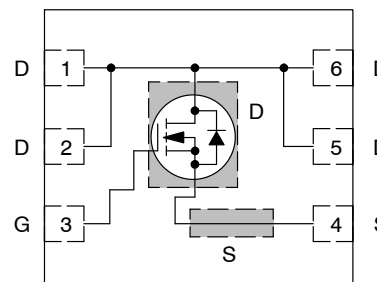
UDFN6  
( $\mu$ COOL)  
CASE 517AU



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

(Note: Microdot may be in either location)

### PIN CONNECTIONS



(Top View)

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

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2. Surface-mounted on FR4 board using the min pad size, 2 oz Cu pad.
3. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
4. This device does not have ESD protection diode.

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	30			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = 250\text{ }\mu\text{A}$ , ref to $25^\circ\text{C}$		13.4		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$	$T_J = 25^\circ\text{C}$		1.0	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		10	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$			100	nA

### ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	1.2		2.2	V
Negative Threshold Temp. Coefficient	$V_{GS(TH)}/T_J$	$I_D = 250\text{ }\mu\text{A}$ , ref to $25^\circ\text{C}$		-4.2		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 8.0\text{ A}$		10	13	m $\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 8\text{ A}$		14	18	
Forward Transconductance	$g_{FS}$	$V_{DS} = 1.5\text{ V}, I_D = 8\text{ A}$		24		S

### CHARGES & CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 15\text{ V}$		620		pF
Output Capacitance	$C_{OSS}$			280		
Reverse Transfer Capacitance	$C_{RSS}$			15		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 8\text{ A}$		5		nC
Threshold Gate Charge	$Q_{G(TH)}$			0.8		
Gate-to-Source Charge	$Q_{GS}$			1.8		
Gate-to-Drain Charge	$Q_{GD}$			1.6		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}; I_D = 8\text{ A}$		11		nC

### SWITCHING CHARACTERISTICS, $V_{GS} = 4.5\text{ V}$ (Note 6)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DD} = 15\text{ V}, I_D = 8\text{ A}, R_G = 6\text{ }\Omega$		9		ns
Rise Time	$t_r$			26		
Turn-Off Delay Time	$t_{d(OFF)}$			13		
Fall Time	$t_f$			3		

### SWITCHING CHARACTERISTICS, $V_{GS} = 10\text{ V}$ (Note 6)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DD} = 15\text{ V}, I_D = 8\text{ A}, R_G = 6\text{ }\Omega$		6		ns
Rise Time	$t_r$			24		
Turn-Off Delay Time	$t_{d(OFF)}$			16		
Fall Time	$t_f$			2.3		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 8\text{ A}$	$T_J = 25^\circ\text{C}$		0.8	1	V
			$T_J = 125^\circ\text{C}$		0.7		

5. Pulse Test: pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
6. Switching characteristics are independent of operating junction temperatures.

# NTLUS020N03C

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
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### DRAIN-SOURCE DIODE CHARACTERISTICS

Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s},$ $I_S = 8\text{ A}$		23		ns
Charge Time	$t_a$			12		
Discharge Time	$t_b$			11		
Reverse Recovery Charge	$Q_{RR}$			10		nC

5. Pulse Test: pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
6. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

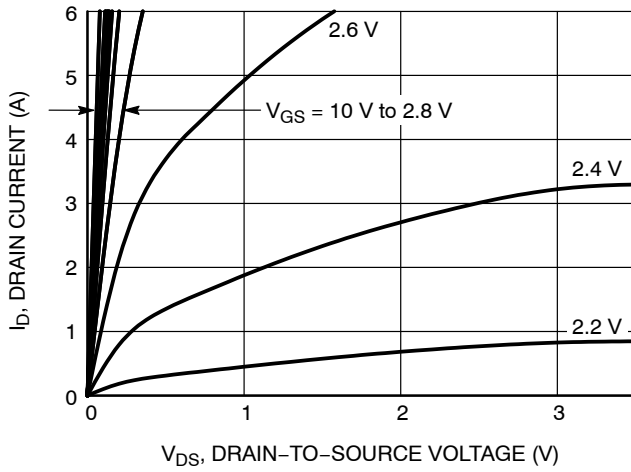


Figure 1. On-Region Characteristics

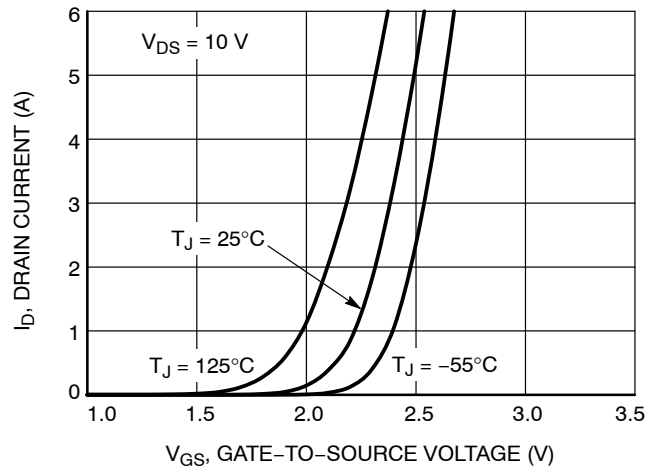


Figure 2. Transfer Characteristics

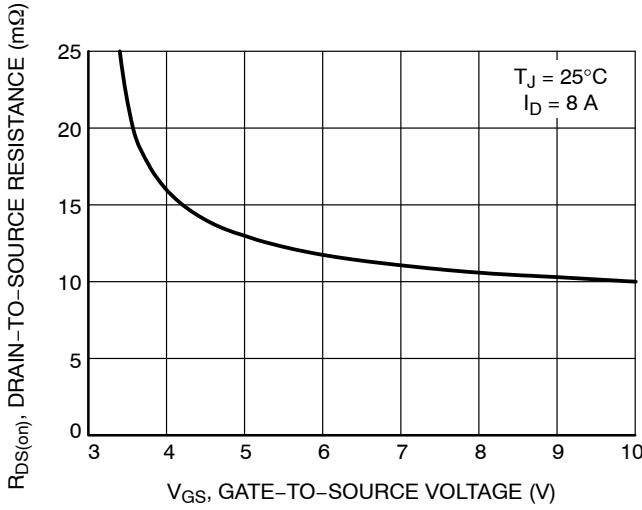


Figure 3. On-Resistance vs. Gate-to-Source Voltage

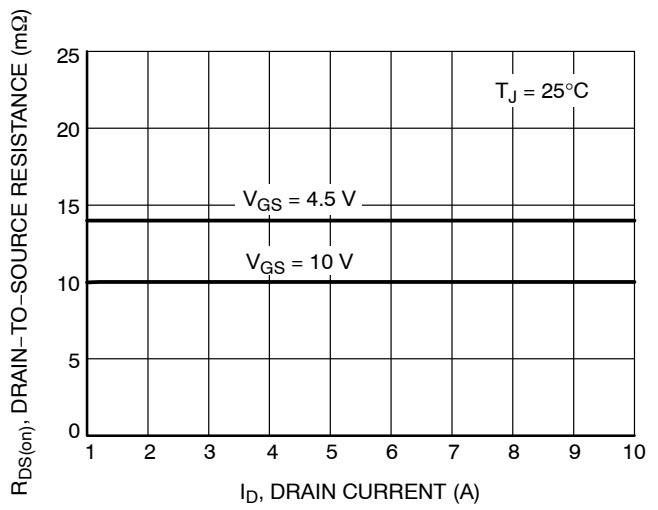


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

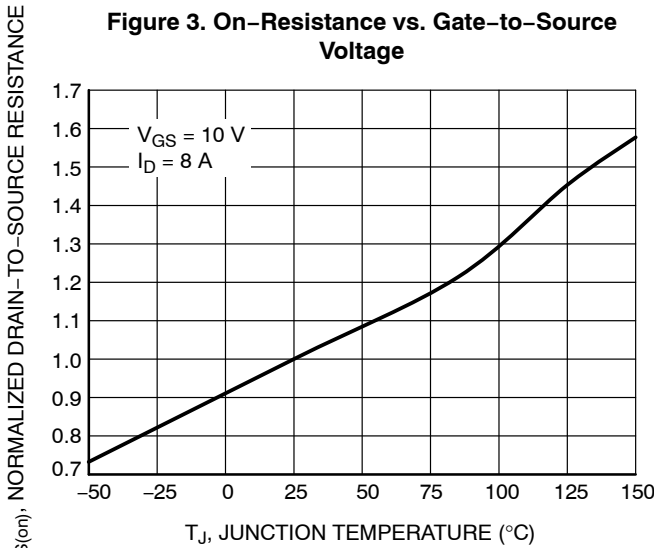


Figure 5. On-Resistance Variation with Temperature

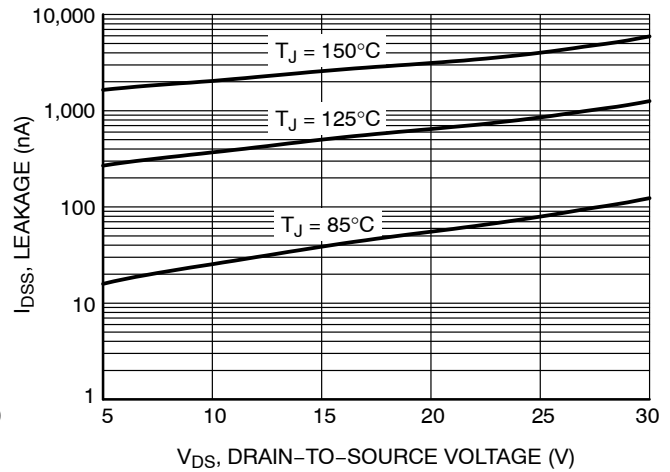


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

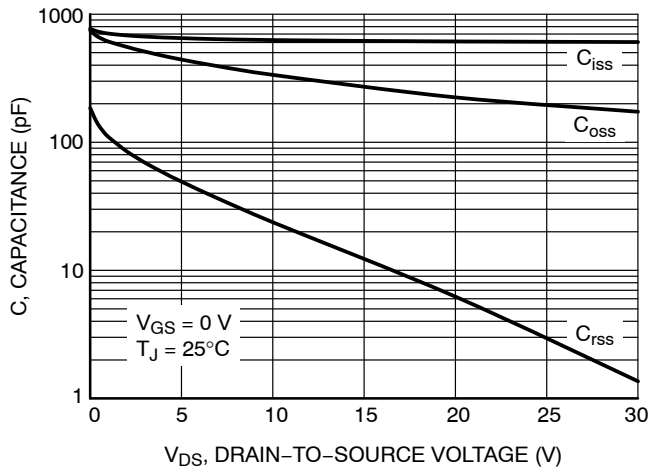


Figure 7. Capacitance Variation

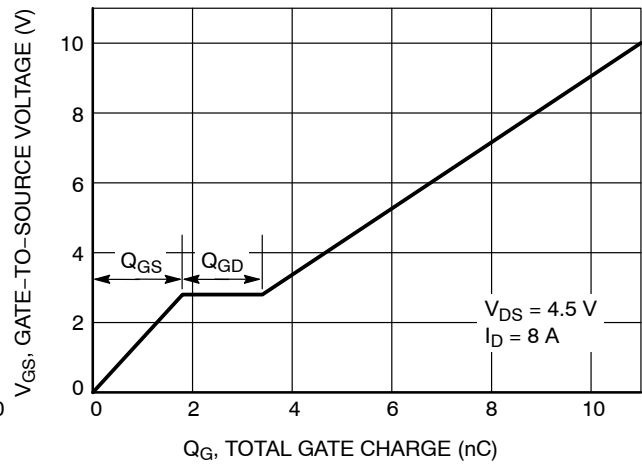


Figure 8. Gate-to-Source vs. Total Charge

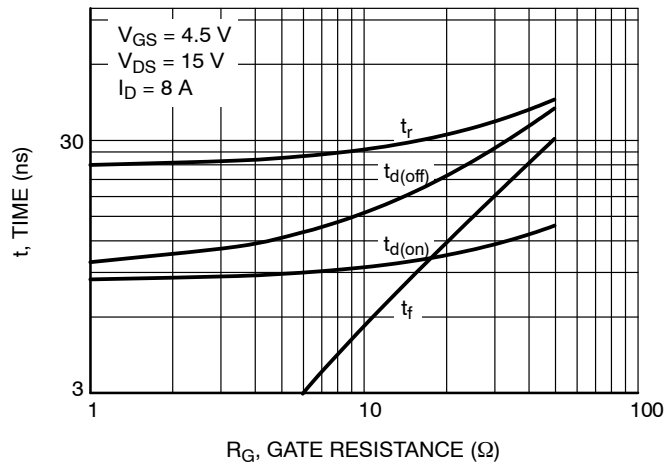


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

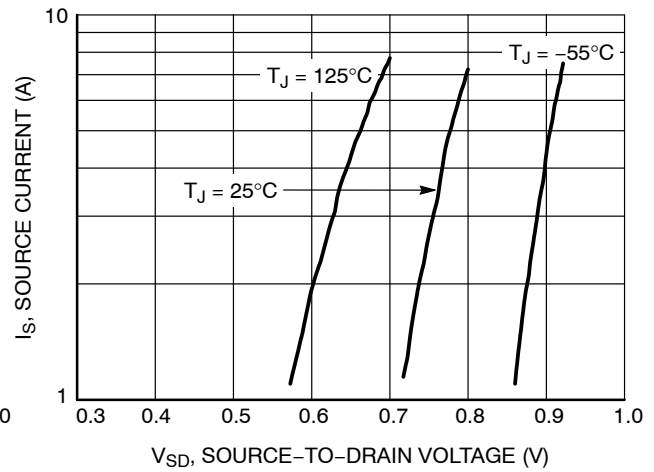


Figure 10. Diode Forward Voltage vs. Current

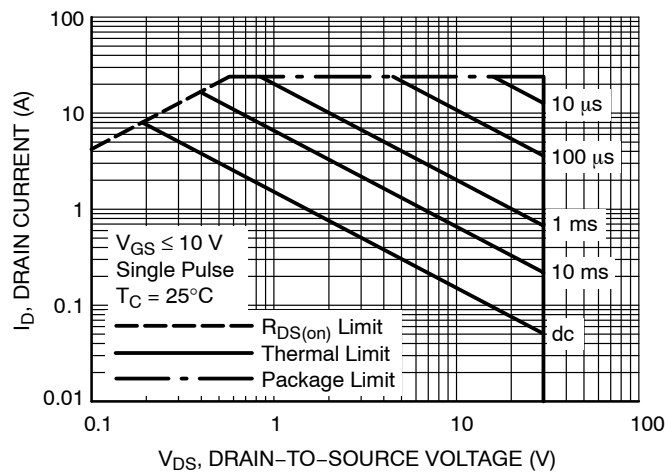
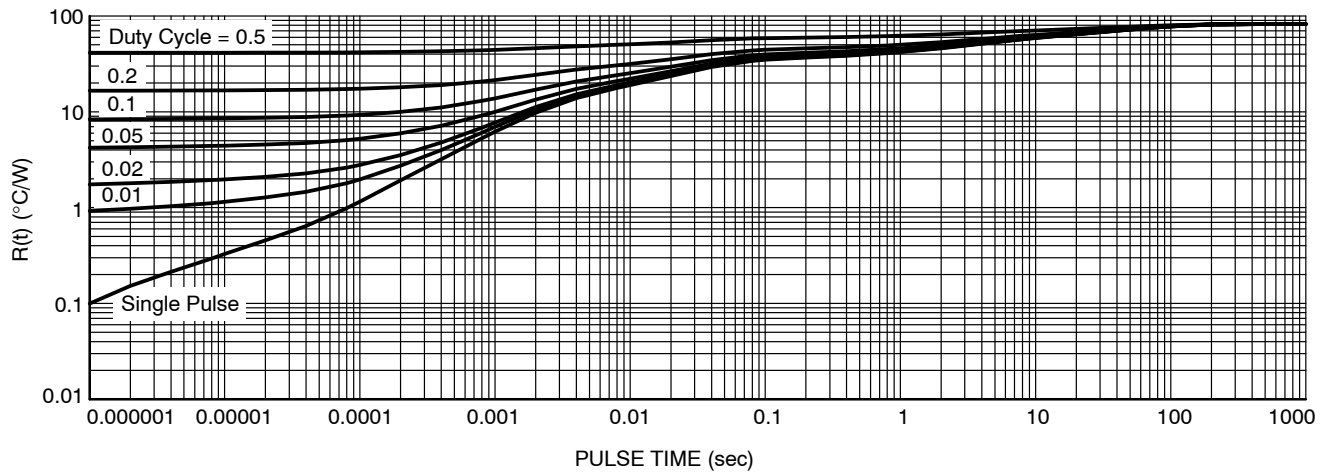


Figure 11. Maximum Rated Forward Biased Safe Operating Area

# NTLUS020N03C

## TYPICAL CHARACTERISTICS

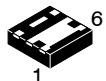


**Figure 12. Thermal Response**

### DEVICE ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
NTLUS020N03CTAG	UDFN6 (Pb-Free)	3000 / Tape & Reel

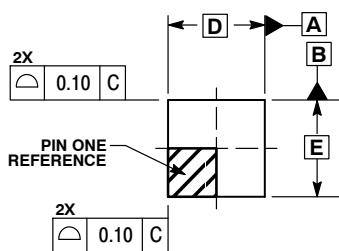
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



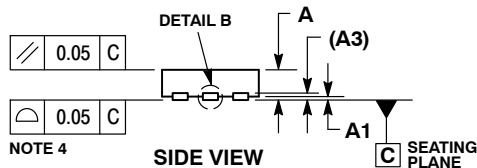
SCALE 4:1

**UDFN6 1.6x1.6, 0.5P**  
CASE 517AU  
ISSUE O

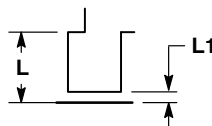
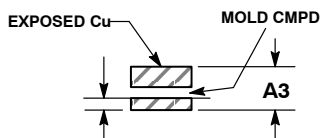
DATE 16 OCT 2008



TOP VIEW



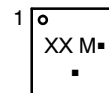
SIDE VIEW


DETAIL A  
OPTIONAL  
CONSTRUCTION

DETAIL B  
OPTIONAL  
CONSTRUCTION

## 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	0.62	0.72
D2	0.15	0.25
E2	0.57	0.67
F	0.55	BSC
G	0.25	BSC
L	0.20	0.30
L1	---	0.15

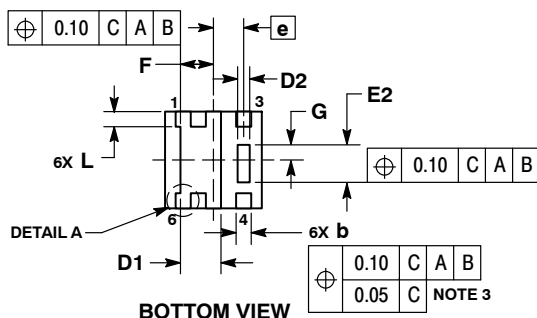
**GENERIC  
MARKING DIAGRAM\***


XX = Specific Device Code

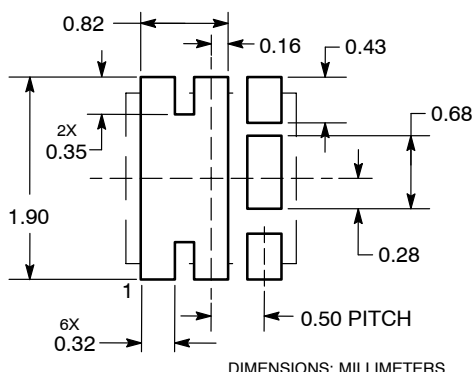
M = Date Code

▪ = Pb-Free Package

(Note: Microdot may be in either loca-

tion)  
\*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.


BOTTOM VIEW

**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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<b>DESCRIPTION:</b>	<b>UDFN6 1.6x1.6, 0.5P</b>	<b>PAGE 1 OF 1</b>

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