

ON Semiconductor

Is Now



To learn more about onsemi™, please visit our website at
www.onsemi.com

onsemi and onsemi. and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries. onsemi owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of onsemi product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. onsemi reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and onsemi makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using onsemi products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by onsemi. "Typical" parameters which may be provided in onsemi data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. onsemi does not convey any license under any of its intellectual property rights nor the rights of others. onsemi products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use onsemi products for any such unintended or unauthorized application, Buyer shall indemnify and hold onsemi and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that onsemi was negligent regarding the design or manufacture of the part. onsemi is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.

MOSFET - Power, Single N-Channel, Shielded Gate, PowerTrench®

120 V, 53 mΩ, 4.5 A

NTLJS053N12MCL

Features

- Shielded Gate MOSFET Technology
- 50% Lower Q_{rr} than Other MOSFET Suppliers
- Lowers Switching Noise/EMI
- Low Profile – 0.5 mm Maximum in MicroFET 2x2 mm
- 100% UIL Tested
- These Devices are Pb-Free and are RoHS Compliant

Typical Applications

- Primary DC-DC MOSFET
- Synchronous Rectifier in DC-DC and AC-DC
- Motor Drive

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

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DS}	120	V
Gate-to-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current (Note 1)	I_D	4.5	A
Power Dissipation (Note 1)	P_D	2.1	W
Power Dissipation (Note 2)	P_D	0.62	W
Pulsed Drain Current (Note 3)	I_{DM}	51	A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 4\text{ A}$) (Note 4)	E_{AS}	8	mJ
Maximum 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 CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance Junction-to-Ambient (Note 1)	$R_{\theta JA}$	60	$^\circ\text{C/W}$
Thermal Resistance Junction-to-Ambient (Note 2)	$R_{\theta JA}$	200	$^\circ\text{C/W}$

1. Surface mounted on a FR-4 board using 1 in² pad of 2 oz copper.
2. Surface mounted on a FR-4 board using the minimum recommended pad of 2 oz copper.
3. Pulsed ID please refer to Figure 11 SOA graph for more details
4. E_{AS} of 8 mJ is based on starting $T_J = 25^\circ\text{C}$; $L = 1\text{ mH}$, $I_{AS} = 4\text{ A}$, $V_{DD} = 120\text{ V}$, $V_{GS} = 10\text{ V}$.

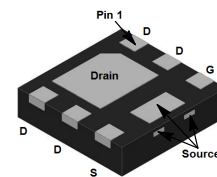
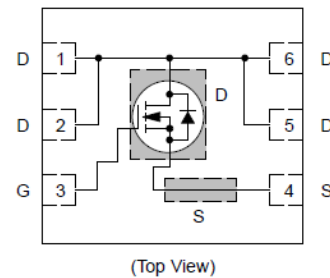


ON Semiconductor®

www.onsemi.com

$V_{(BR)DSS}$	$R_{DS(on)} \text{ MAX}$	$I_D \text{ MAX}$
120 V	53 mΩ @ 10 V	4.5 A
	70 mΩ @ 4.5 V	

N-CHANNEL MOSFET



UDFN6
(2 X 2)
CASE 517DZ

MARKING DIAGRAM



AA = Specific Device Code
M = One Digit Date Code
■ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 5 of this data sheet.

NTLJS053N12MCL

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain-to-Source Breakdown Voltage	V _{(BR)DSS}	V _{GS} = 0 V, I _D = 250 μA	120			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V _{(BR)DSS} /T _J	I _D = 250 μA, referenced to 25°C		55		mV/°C
Zero Gate Voltage Drain Current	I _{DSS}	V _{GS} = 0 V, V _{DS} = 96 V, T _J = 25°C			1	μA
Gate-to-Source Leakage Current	I _{GSS}	V _{GS} = ±20 V, V _{DS} = 0 V			±100	nA

ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	V _{GS(TH)}	V _{GS} = V _{DS} , I _D = 30 μA	1.0	1.5	3.0	V
Gate Threshold Temperature Coefficient	V _{GS(TH)} /T _J	V _{GS} = V _{DS} , I _D = 30 μA		-4.4		mV/°C
Drain-to-Source On Resistance	R _{DS(on)}	V _{GS} = 10 V, I _D = 5.2 A, T _J = 25°C		42	53	mΩ
		V _{GS} = 4.5 V, I _D = 4.5 A, T _J = 25°C		55	70	mΩ
		V _{DS} = 10 V, I _D = 5.2 A, T _J = 125°C		71	90	mΩ

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C _{ISS}	V _{GS} = 0 V, f = 1 MHz V _{DS} = 60 V		520		pF
Output Capacitance	C _{OSS}			190		
Reverse Transfer Capacitance	C _{RSS}			1.8		
Gate-Resistance	R _G			2.0	3.0	Ω
Total Gate Charge	Q _{G(TOT)}	V _{GS} = 10 V, V _{DS} = 60 V, I _D = 5.2 A		7.8		nC
4.5 V Gate Charge	Q _{G(4.5V)}			3.8		
Gate-to-Source Charge	Q _{GS}			1.5		
Gate-to-Drain Charge	Q _{GD}			1.0		
Output Charge	Q _{OSS}	V _{GS} = 0 V, V _{DD} = 60 V		17		nC
Total Gate Charge Sync	Q _{SYNC}	V _{DS} = 0 V, V _{GS} = 0 ~ 10 V		6.7		nC

RESISTIVE SWITCHING CHARACTERISTICS (Note 6)

Turn-On Delay Time	t _{d(on)}	V _{GS} = 10 V, V _{DS} = 60 V, I _D = 5.2 A, R _G = 6 Ω		5.9		ns
Rise Time	t _r			1.6		
Turn-Off Delay Time	t _{d(off)}			14		
Fall Time	t _f			2.6		

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V _{SD}	V _{GS} = 0 V, I _S = 5.2 A, T _J = 25°C		0.87	1.2	V
Reverse Recovery Time	t _{RR}	I _F = 5.2 A, dI _S /dt = 300 A/μs		25		ns
Reverse Recovery Charge	Q _{RR}			31		nC
Reverse Recovery Time	t _{RR}	I _F = 5.2 A, dI _S /dt = 1000 A/μs		15		ns
Reverse Recovery Charge	Q _{RR}			64		nC

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.

5. Pulse test: pulse width ≤ 300 μs, duty ratio ≤ 2%.

6. Switching characteristics are independent of operating junction temperature

TYPICAL CHARACTERISTICS

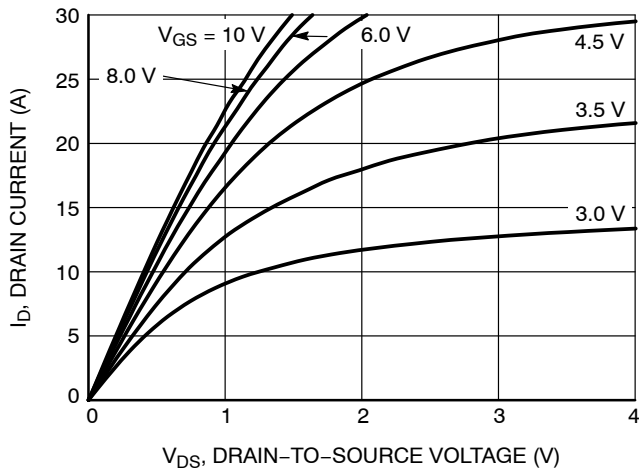


Figure 1. On-Region Characteristics

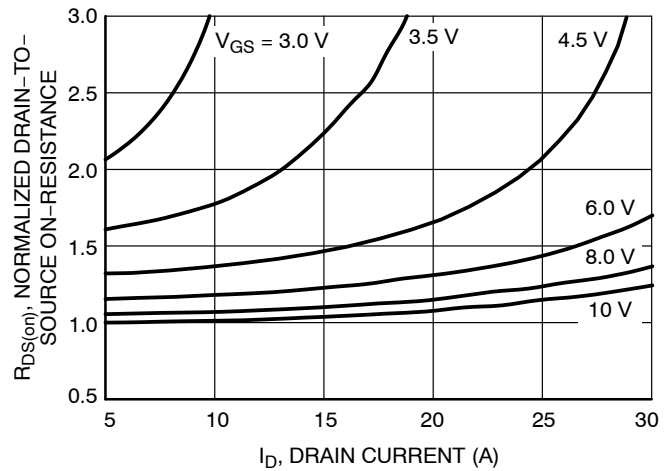


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

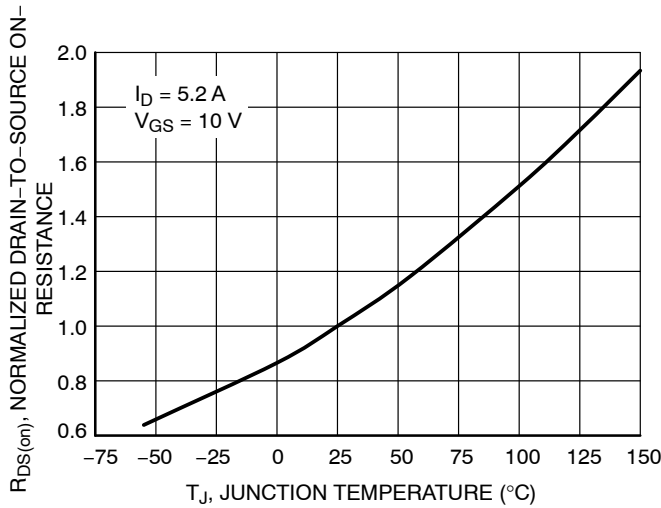


Figure 3. On-Resistance Variation with Temperature

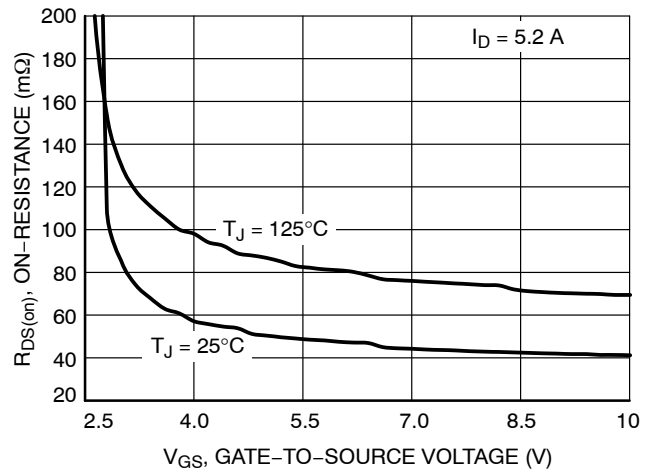


Figure 4. On-Resistance vs. Gate-to-Source Voltage

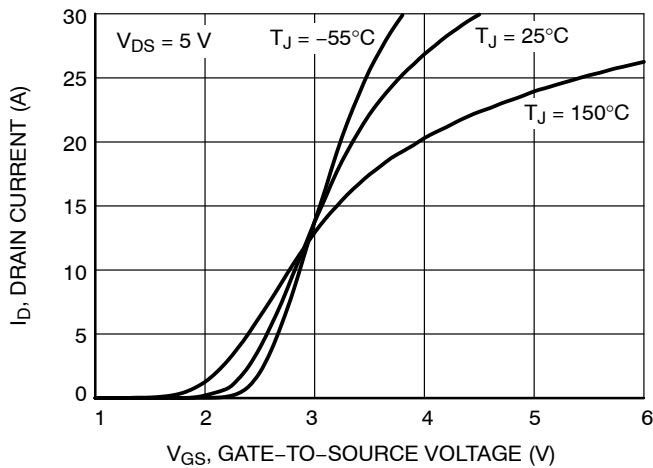


Figure 5. Transfer Characteristics

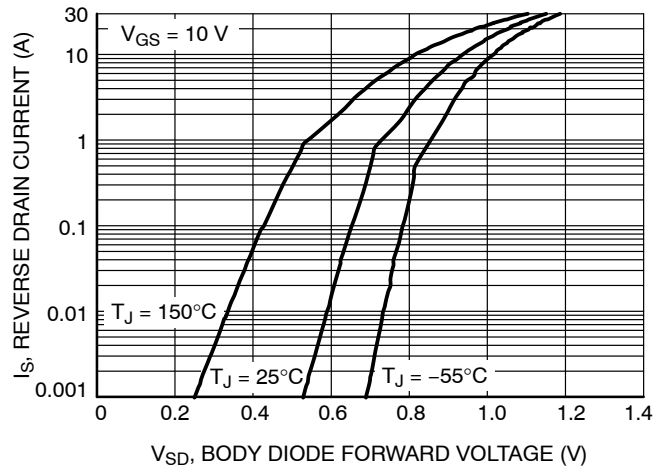


Figure 6. Diode Forward Voltage vs. Current

TYPICAL CHARACTERISTICS

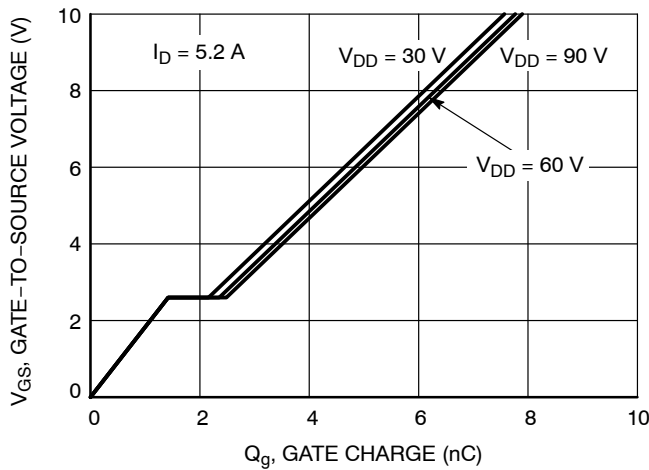


Figure 7. Gate-to-Source Voltage vs. Total Charge

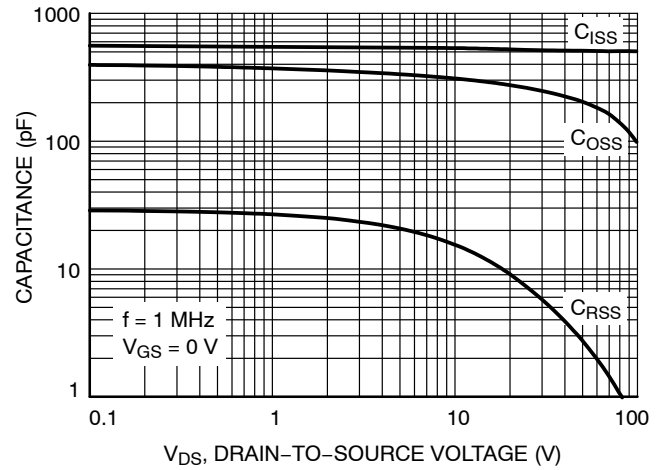


Figure 8. Capacitance vs. Drain-to-Source Voltage

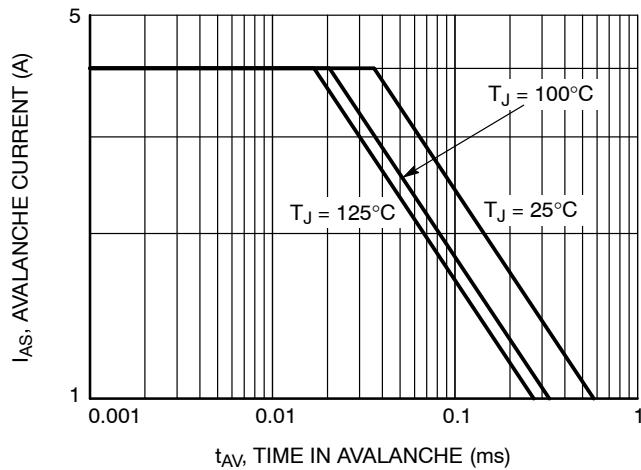


Figure 9. Unclamped Inductive Switching Capability

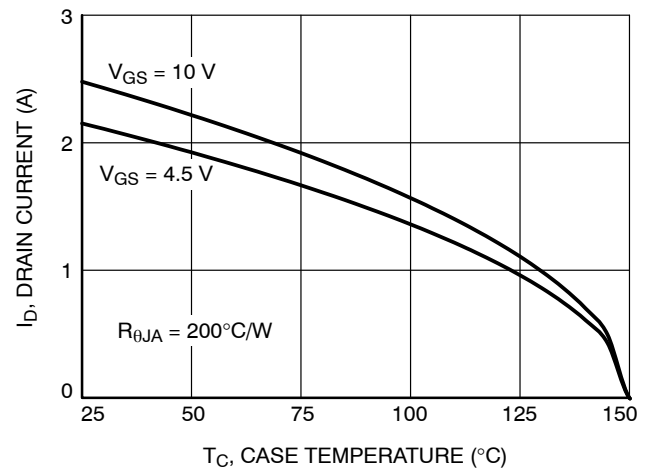


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

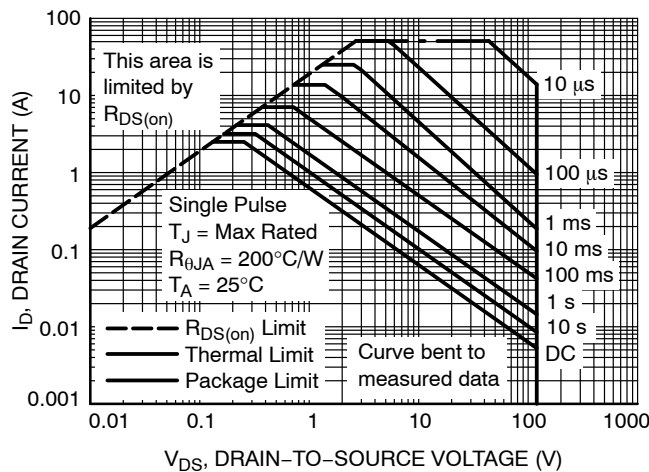


Figure 11. Safe Operating Area

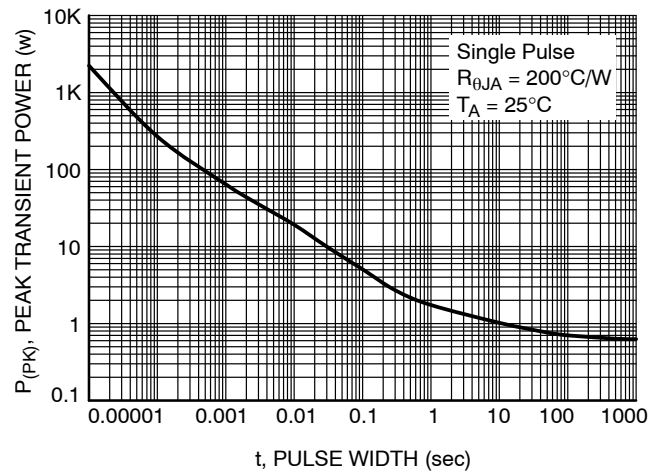


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS

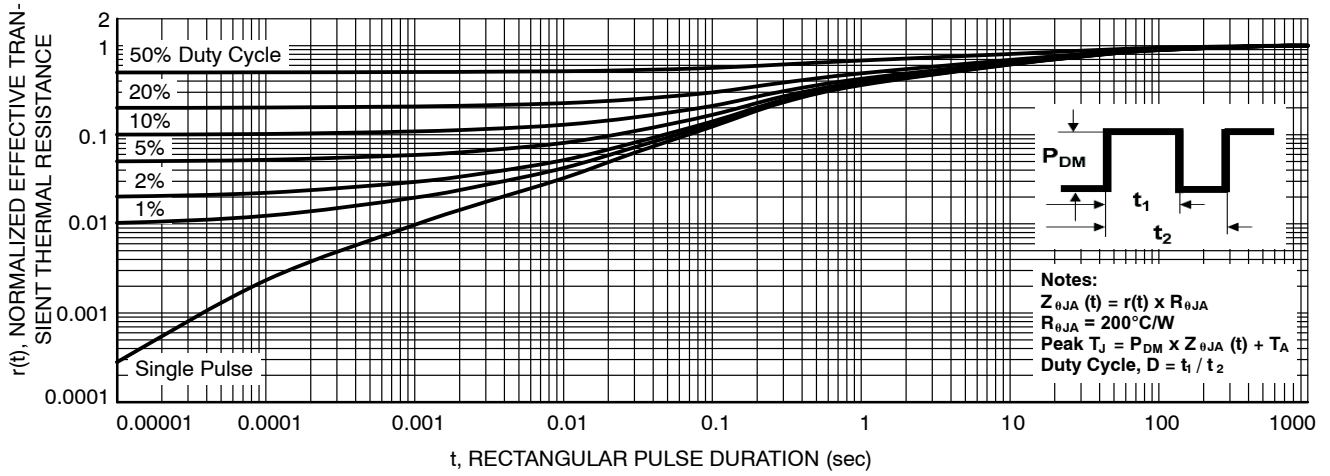


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

DEVICE ORDERING INFORMATION

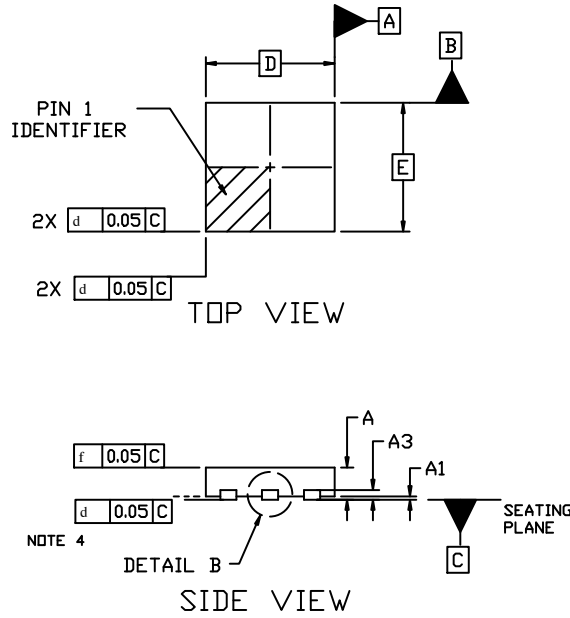
Device	Marking	Package	Shipping†
NTLJS053N12MCLTAG	AA	UDFN6 (Pb-Free)	3000 / Tape & Reel

†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.

NTLJS053N12MCL

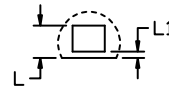
PACKAGE DIMENSIONS

UDFN6 2x2, 0.65P
CASE 517DZ
ISSUE A

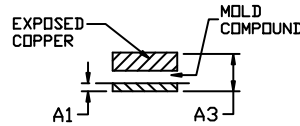


NOTES:

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.

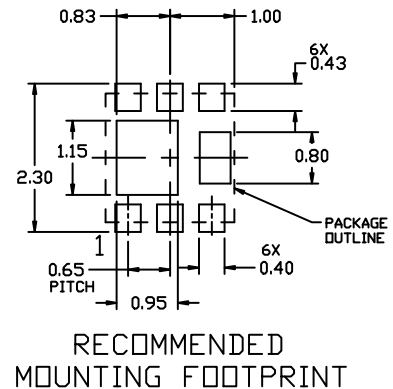
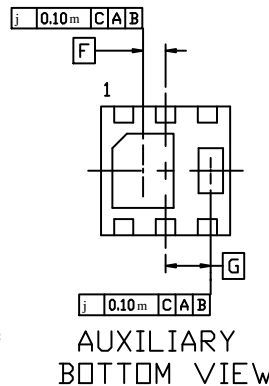
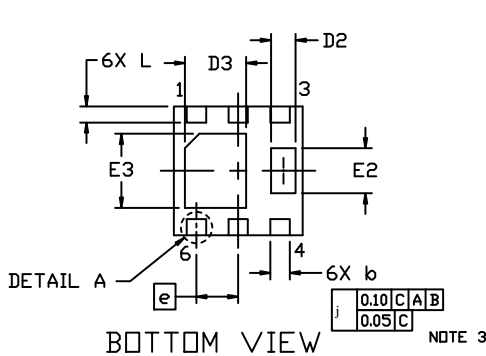


DETAIL A
OPTIONAL
CONSTRUCTION



DETAIL B
OPTIONAL
CONSTRUCTION

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.45	0.50	0.55
A1	0.00	0.025	0.05
A3	0.13 REF		
b	0.25	0.30	0.35
D	1.95	2.00	2.05
E	1.95	2.00	2.05
e	0.65 BSC		
D2	0.33	0.38	0.43
D3	0.85	0.95	1.05
E2	0.65	0.70	0.75
E3	1.05	1.15	1.25
F	0.325 BSC		
G	0.700 BSC		
L	0.20	0.25	0.30
L1	---		0.10



POWERTRENCH is a registered trademark on Semiconductor Components Industries, LLC.

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Email Requests to: orderlit@onsemi.com

ON Semiconductor Website: www.onsemi.com

TECHNICAL SUPPORT
North American Technical Support:
Voice Mail: 1 800-282-9855 Toll Free USA/Canada
Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative