

MOSFET - Power, Single N-Channel, Source-Down TDFN9

60 V, 1.5 mΩ, 235 A



ON Semiconductor®

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Product Preview

NTMFSS1D5N06CL

Features

- Small Footprint (5x6 mm) for Compact Design
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Q_G and Capacitance to Minimize Driver Losses
- These Devices are Pb-Free, Halogen-Free / BFR Free and are RoHS Compliant

Typical Applications

- DC-DC Converters
- Power Load Switch
- Notebook Battery Management

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

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DSS}	60	V
Gate-to-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current $R_{\theta JC}$ (Note 2)	Steady State	$T_C = 25^\circ\text{C}$	I_D 235 A
		$T_C = 25^\circ\text{C}$	P_D 167 W
Power Dissipation $R_{\theta JC}$ (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	I_D 36 A
		$T_A = 25^\circ\text{C}$	P_D 3.8 W
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2)	Steady State	$T_A = 25^\circ\text{C}$	I_D 36 A
Power Dissipation $R_{\theta JA}$ (Notes 1, 2)	Steady State	$T_A = 25^\circ\text{C}$	P_D 3.8 W
Pulsed Drain Current	$T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$	I_{DM}	900 A
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = \text{TBD A}, L = \text{TBD mH}$)	E_{AS}	451	mJ
Lead Temperature Soldering Reflow for Soldering Purposes (1/8" from case for 10 s)	T_L	260	$^\circ\text{C}$

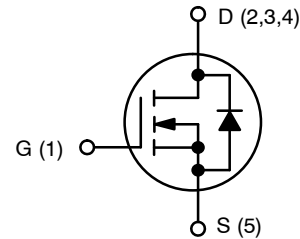
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL RESISTANCE MAXIMUM RATINGS

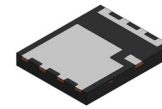
Parameter	Symbol	Value	Unit
Junction-to-Case - Steady State (Note 2)	$R_{\theta JC}$	0.9	$^\circ\text{C}/\text{W}$
Junction-to-Ambient - Steady State (Note 2)	$R_{\theta JA}$	39	$^\circ\text{C}/\text{W}$

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
 2. Surface-mounted on FR4 board using a 1 in² pad size, 2 oz. Cu pad.
- This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	I_D MAX
60 V	1.5 mΩ @ 10 V	235 A
	2.3 mΩ @ 4.5 V	



N-CHANNEL MOSFET



TDFN9 5x6
CASE 520AE

MARKING DIAGRAM



XXXX = Specific Device Code
 A = Assembly Location
 Y = Year
 W = Work Week
 ZZ = Wafer Lot

ORDERING INFORMATION

Device	Package	Shipping†
NTMFSS1D5N06CLT1G	TDFN9 (Pb-Free)	1500 / Tape & Reel
NTMFSS1D5N06CLT3G	TDFN9 (Pb-Free)	5000 / 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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ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	60			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = 250\ \mu\text{A}$, ref to 25°C		12.7		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$ $T_J = 25^\circ\text{C}$			10	μA
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$			100	nA

ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	1.2		2.0	V
Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$	$I_D = 250\ \mu\text{A}$, ref to 25°C		-5.76		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 50\text{ A}$		1.2	1.5	m Ω
		$V_{GS} = 4.5\text{ V}, I_D = 50\text{ A}$		1.65	2.3	
Forward Transconductance	g_{FS}	$V_{DS} = 15\text{ V}, I_D = 50\text{ A}$		151		S
Gate Resistance	R_G	$T_A = 25^\circ\text{C}$		TBD		Ω

CHARGES & CAPACITANCES

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 25\text{ V}$		6660		pF	
Output Capacitance	C_{OSS}			2953			
Reverse Capacitance	C_{RSS}			45			
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 30\text{ V}, I_D = 50\text{ A}$		91		nC	
Total Gate Charge	$Q_{G(TOT)}$		$V_{GS} = 4.5\text{ V}, V_{DS} = 30\text{ V}, I_D = 50\text{ A}$		41		
Gate-to-Drain Charge	Q_{GD}				10.9		
Gate-to-Source Charge	Q_{GS}				17.1		
Plateau Voltage	V_{GP}				2.9		

SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DD} = 30\text{ V}, I_D = 50\text{ A}, R_G = 1.0\ \Omega$		19		ns
Rise Time	t_r			51		
Turn-Off Delay Time	$t_{d(OFF)}$			47		
Fall Time	t_f			18		

SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	V_{SD}	$V_{GS} = 0\text{ V}, I_S = 50\text{ A}$	$T_J = 25^\circ\text{C}$		0.78	1.2	V
			$T_J = 125^\circ\text{C}$		0.66		
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, di/dt = 100\text{ A}/\mu\text{s}, I_S = 50\text{ A}$		78		ns	
Charge Time	t_a			36			
Discharge Time	t_b			42			
Reverse Recovery Charge	Q_{RR}			105			nC

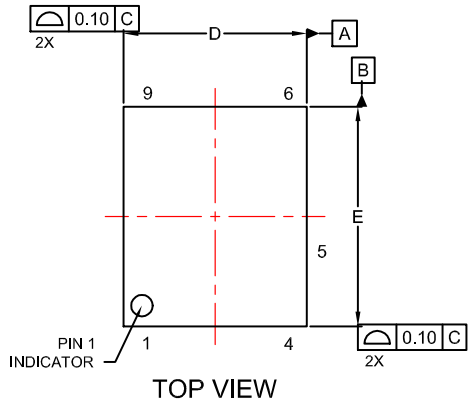
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

3. Switching characteristics are independent of operating junction temperatures.

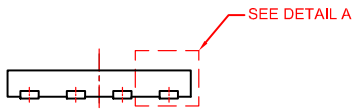
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PACKAGE DIMENSIONS

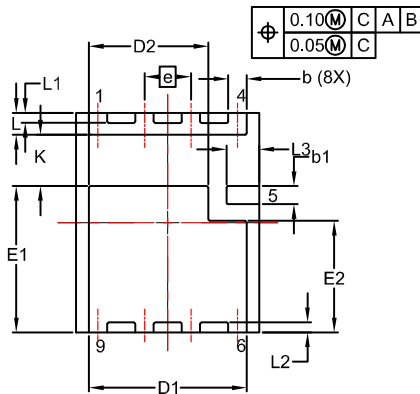
TDFN9 5x6, 1.27P
CASE 520AE
ISSUE A



TOP VIEW



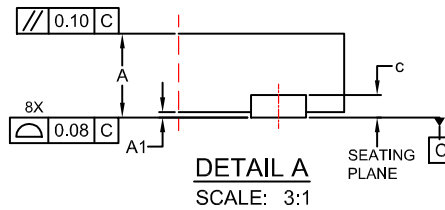
FRONT VIEW



BOTTOM VIEW

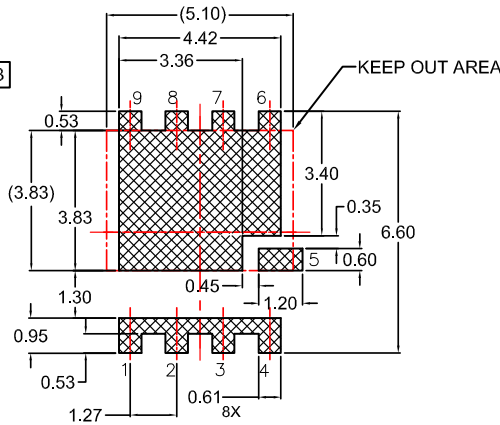
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1, D2, E1 AND E2 DO NOT INCLUDE MOLD FLASH.
5. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.



DETAIL A
 SCALE: 3:1

UNIT IN MILLIMETER			
DIM	MIN	NOM	MAX
A	0.95	1.00	1.05
A1	0.00	0.02	0.05
b	0.45	0.50	0.55
b1	0.45	0.50	0.55
c	0.17	0.22	0.27
D	4.90	5.00	5.10
D1	4.10	4.30	4.50
D2	3.16	3.26	3.36
E	5.90	6.00	6.10
E1	3.90	4.00	4.10
E2	2.95	3.05	3.15
e	1.27 BSC		
K	1.30	1.40	1.50
L	0.50	0.60	0.70
L1	0.18	0.28	0.38
L2	0.18	0.28	0.38
L3	0.75	0.85	0.95



LAND PATTERN
 RECOMMENDATION

*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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