NIF5003N

Preferred Device

Self-Protected FET with Temperature and Current Limit

42 V, 14 A, Single N−Channel, SOT−223

HDPlus™ devices are an advanced series of power MOSFETs which utilize ON Semiconductors latest MOSFET technology process to achieve the lowest possible on−resistance per silicon area while incorporating smart features. Integrated thermal and current limits work together to provide short circuit protection. The devices feature an integrated Drain−to−Gate Clamp that enables them to withstand high energy in the avalanche mode. The Clamp also provides additional safety margin against unexpected voltage transients. Electrostatic Discharge (ESD) protection is provided by an integrated Gate−to−Source Clamp.

Features

- Short Circuit Protection/Current Limit
- Thermal Shutdown with Automatic Restart
- I_{DSS} Specified at Elevated Temperature
- Avalanche Energy Specified
- Slew Rate Control for Low Noise Switching
- Overvoltage Clamped Protection
- Pb−Free Packages are Available

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Drain−to−Source Voltage Internally Clamped	V_{DSS}	42	Vdc
Gate−to−Source Voltage	V_{GS}	±14	Vdc
Drain Current Continuous	I_D	Internally Limited	
Total Power Dissipation @ T_A = 25°C (Note 1) @ T_A = 25°C (Note 2)	P_D	 1.25 1.9	W
Thermal Resistance Junction−to−Case Junction−to−Ambient (Note 1) Junction−to−Ambient (Note 2)	 $R_{\theta JC}$ $R_{\theta JA}$ $R_{\theta JA}$	 12 100 65	°C/W
Single Pulse Drain−to−Source Avalanche Energy (V_{DD} = 25 Vdc, V_{GS} = 5.0 Vdc, V_{DS} = 40 Vdc, I_L = 3.2 Apk, L = 120 mH, R_G = 25 Ω)	E_{AS}	400	mJ
Operating and Storage Temperature Range (Note 3)	T_J, T_{stg}	−55 to 150	°C

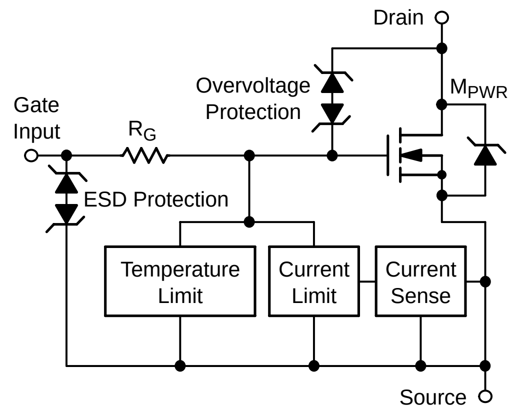
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

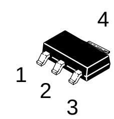
1. Surface mounted onto minimum pad size (0.412″ square) FR4 PCB, 1 oz cu.
2. Mounted onto 1″ square pad size (1.127″ square) FR4 PCB, 1 oz cu.
3. Normal pre−fault operating range. See thermal limit range conditions.

ON Semiconductor®

http://onsemi.com

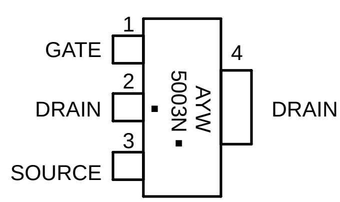
V_{DSS} (Clamped)	$R_{DS(on)}$ TYP	I_D MAX (Limited)
42 V	53 mΩ @ 10 V	14 A





SOT−223
CASE 318E
STYLE 3

MARKING DIAGRAM



A	= Assembly Location
Y	= Year
W	= Work Week
5003N	= Specific Device Code
▪	= Pb−Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

Preferred devices are recommended choices for future use and best overall value.

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain−to−Source Clamped Breakdown Voltage (V_{GS} = 0 Vdc, I_D = 250 μAdc) (V_{GS} = 0 Vdc, I_D = 250 μAdc, T_J = −40°C to 150°C)	$V_{(BR)DSS}$	 42 40	 46 45	 51 51	 Vdc mV/°C
Zero Gate Voltage Drain Current (V_{DS} = 32 Vdc, V_{GS} = 0 Vdc) (V_{DS} = 32 Vdc, V_{GS} = 0 Vdc, T_J = 150°C)	I_{DSS}	 − −	 0.6 2.5	 5.0 −	μAdc
Gate Input Current (V_{GS} = 5.0 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	−	50	125	μAdc
ON CHARACTERISTICS					
Gate Threshold Voltage (V_{DS} = V_{GS}, I_D = 1.2 mAdc) Threshold Temperature Coefficient (Negative)	$V_{GS(th)}$	 1.0 −	 1.7 5.0	 2.2 −	 Vdc mV/°C
Static Drain−to−Source On−Resistance (Note 4) (V_{GS} = 10 Vdc, I_D = 3.0 Adc, T_J @ 25°C) (V_{GS} = 10 Vdc, I_D = 3.0 Adc, T_J @ 150°C)	$R_{DS(on)}$	 − −	 53 95	 68 123	mΩ
Static Drain−to−Source On−Resistance (Note 4) (V_{GS} = 5.0 Vdc, I_D = 3.0 Adc, T_J @ 25°C) (V_{GS} = 5.0 Vdc, I_D = 3.0 Adc, T_J @ 150°C)	$R_{DS(on)}$	 − −	 63 105	 76 135	mΩ
Source−Drain Forward On Voltage (I_S = 7.0 A, V_{GS} = 0 V)	V_{SD}	−	0.95	1.1	V

SWITCHING CHARACTERISTICS

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Turn−on Time (V_{in} to 90% I_D)	R_L = 4.7 Ω, V_{in} = 0 to 10 V, V_{DD} = 12 V	$T_{(on)}$	−	16	20	μs
Turn−off Time (V_{in} to 10% I_D)	R_L = 4.7 Ω, V_{in} = 10 to 0 V, V_{DD} = 12 V	$T_{(off)}$	−	80	100	μs
Slew Rate On	R_L = 4.7 Ω, V_{in} = 0 to 10 V, V_{DD} = 12 V	$-dV_{DS}/dt_{on}$	−	1.4	−	V/μs
Slew Rate Off	R_L = 4.7 Ω, V_{in} = 10 to 0 V, V_{DD} = 12 V	dV_{DS}/dt_{off}	−	0.5	−	V/μs

SELF PROTECTION CHARACTERISTICS (T_J = 25°C unless otherwise noted) (Note 5)

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Current Limit	(V_{GS} = 5.0 Vdc) V_{DS} = 10 V (V_{GS} = 5.0 Vdc, T_J = 150°C)	I_{LIM}	12 7.0	18 13	24 18	Adc
Current Limit	(V_{GS} = 10 Vdc) V_{DS} = 10 V (V_{GS} = 10 Vdc, T_J = 150°C)	I_{LIM}	18 13	22 18	30 25	Adc
Temperature Limit (Turn−off)	V_{GS} = 5.0 Vdc	$T_{LIM(off)}$	150	175	200	°C
Thermal Hysteresis	V_{GS} = 5.0 Vdc	$\Delta T_{LIM(on)}$	−	15	−	°C
Temperature Limit (Turn−off)	V_{GS} = 10 Vdc	$T_{LIM(off)}$	150	165	185	°C
Thermal Hysteresis	V_{GS} = 10 Vdc	$\Delta T_{LIM(on)}$	−	15	−	°C
Input Current during Thermal Fault	V_{DS} = 35 V, (V_{GS} = 5.0 V, T_j = 150°C)	$I_{g(fault)}$	0.6	−	−	mA
Input Current during Thermal Fault	V_{DS} = 35 V, (V_{GS} = 10 V, T_j = 150°C)	$I_{g(fault)}$	2.0	−	−	mA

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

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Electro−Static Discharge Capability	Human Body Model (HBM)	ESD	4000	−	−	V
Electro−Static Discharge Capability	Machine Model (MM)	ESD	400	−	−	V

4. Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2%.
5. Fault conditions are viewed as beyond the normal operating range of the part.

TYPICAL PERFORMANCE CURVES

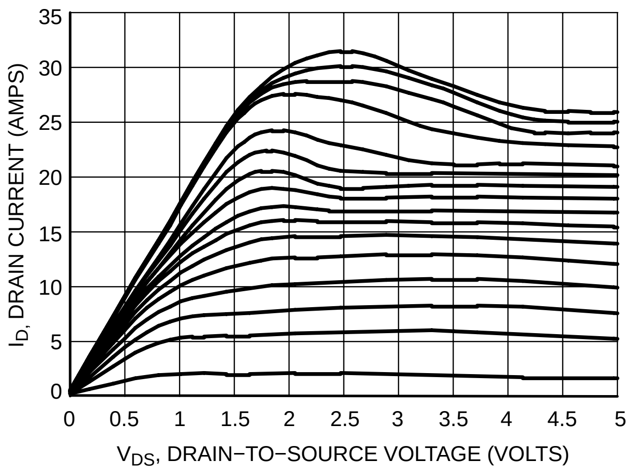


Figure 1. On−Region Characteristics

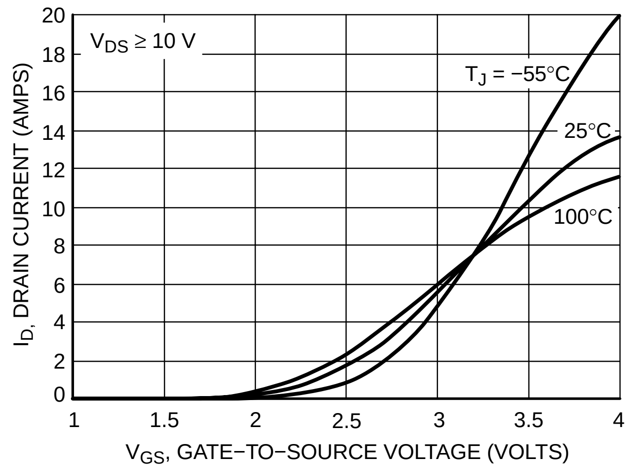


Figure 2. Transfer Characteristics

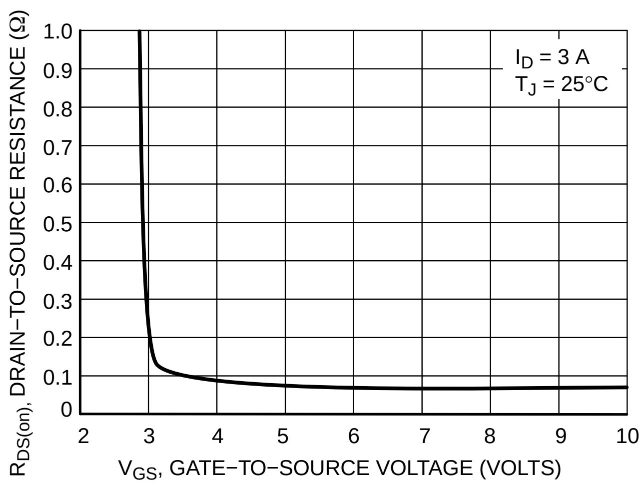


Figure 3. On−Resistance vs. Gate−to−Source Voltage

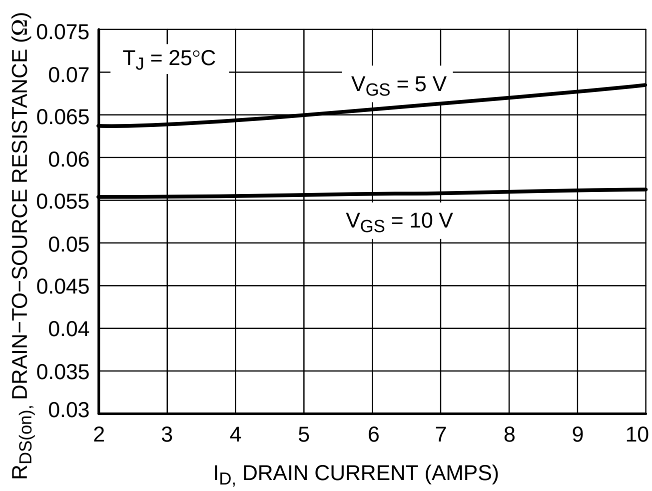


Figure 4. On−Resistance vs. Drain Current and Gate Voltage

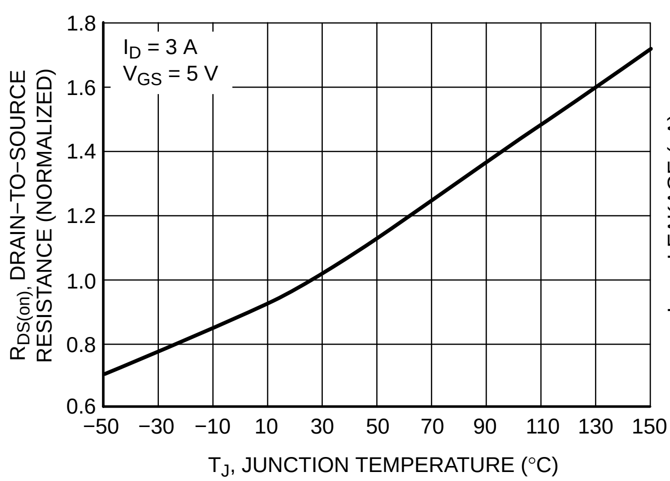


Figure 5. On−Resistance Variation with Temperature

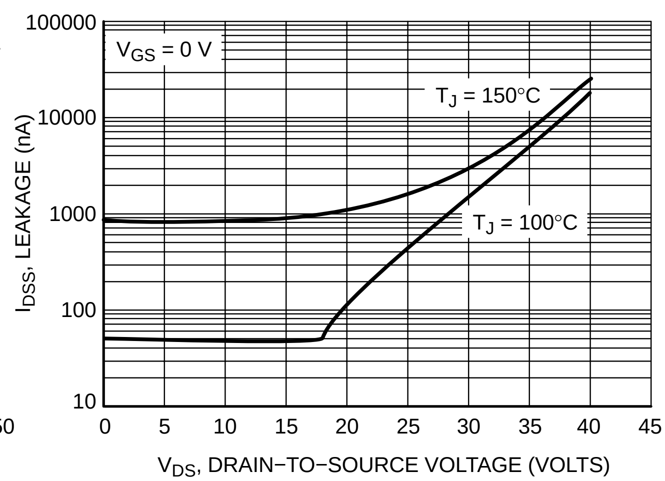


Figure 6. Drain−to−Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES

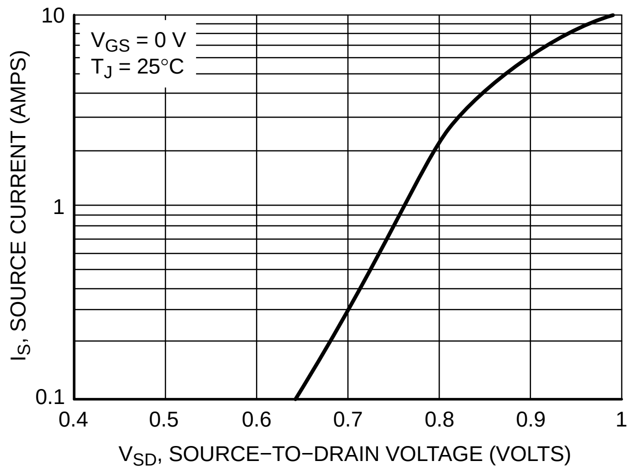


Figure 7. Diode Forward Voltage vs. Current

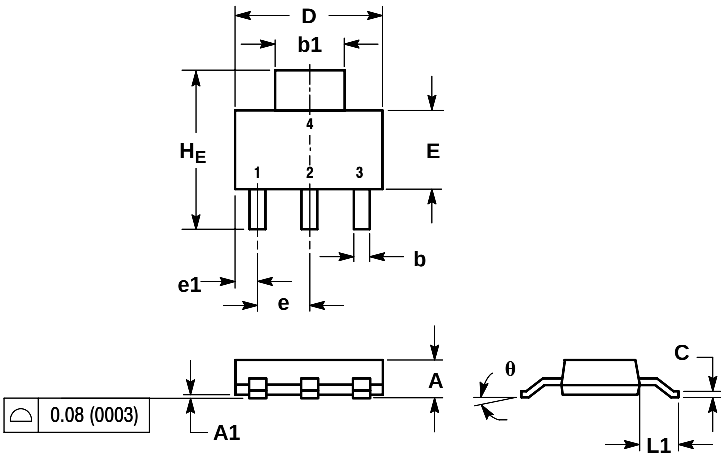
ORDERING INFORMATION

Device	Package	Shipping†
NIF5003NT1	SOT−223	1000 / Tape & Reel
NIF5003NT1G	SOT−223 (Pb−Free)	1000 / Tape & Reel
NIF5003NT3	SOT−223	4000 / Tape & Reel
NIF5003NT3G	SOT−223 (Pb−Free)	4000 / 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.

PACKAGE DIMENSIONS

SOT−223 (TO−261)
CASE 318E−04
ISSUE L

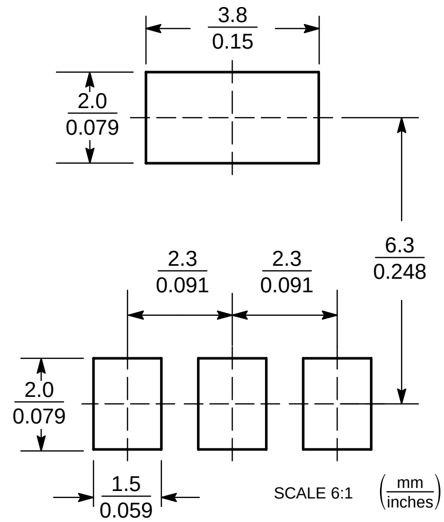


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	MILLIMETERS			INCHES		
DIM	**MIN**	**NOM**	**MAX**	**MIN**	**NOM**	**MAX**
A	1.50	1.63	1.75	0.060	0.064	0.068
A1	0.02	0.06	0.10	0.001	0.002	0.004
b	0.60	0.75	0.89	0.024	0.030	0.035
b1	2.90	3.06	3.20	0.115	0.121	0.126
c	0.24	0.29	0.35	0.009	0.012	0.014
D	6.30	6.50	6.70	0.249	0.256	0.263
E	3.30	3.50	3.70	0.130	0.138	0.145
e	2.20	2.30	2.40	0.087	0.091	0.094
e1	0.85	0.94	1.05	0.033	0.037	0.041
L1	1.50	1.75	2.00	0.060	0.069	0.078
H_E	6.70	7.00	7.30	0.264	0.276	0.287
θ	0°	−	10°	0°	−	10°

STYLE 3:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

SOLDERING FOOTPRINT*



*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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PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 61312, Phoenix, Arizona 85082−1312 USA
Phone: 480−829−7710 or 800−344−3860 Toll Free USA/Canada
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