

NTMFS5H409NL

Power MOSFET

40 V, 1.1 mΩ, 270 A, Single N-Channel

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 and are RoHS Compliant

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

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DS}	40	V
Gate-to-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)	I_D	$T_C = 25^\circ\text{C}$	A
		$T_C = 100^\circ\text{C}$	
Power Dissipation $R_{\theta JC}$ (Note 1)	P_D	$T_C = 25^\circ\text{C}$	W
		$T_C = 100^\circ\text{C}$	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	I_D	$T_A = 25^\circ\text{C}$	A
		$T_A = 100^\circ\text{C}$	
Power Dissipation $R_{\theta JA}$ (Notes 1 & 2)	P_D	$T_A = 25^\circ\text{C}$	W
		$T_A = 100^\circ\text{C}$	
Pulsed Drain Current	I_{DM}	$T_A = 25^\circ\text{C}$, $t_p = 10 \mu\text{s}$	A
Operating Junction and Storage Temperature	T_J, T_{stg}	-55 to $+150$	$^\circ\text{C}$
Source Current (Body Diode)	I_S	160	A
Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 45 \text{ A}$)	E_{AS}	304	mJ
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 MAXIMUM RATINGS

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

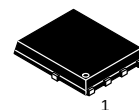
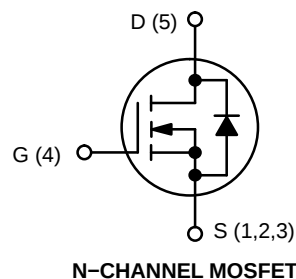
1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface-mounted on FR4 board using a 650 mm², 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.



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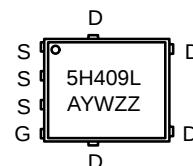
www.onsemi.com

$V_{(BR)DSS}$	$R_{DS(on)} \text{ MAX}$	$I_D \text{ MAX}$
40 V	1.1 mΩ @ 10 V	270 A
	1.6 mΩ @ 4.5 V	



DFN5
(SO-8FL)
CASE 488AA
STYLE 1

MARKING DIAGRAM



5H409L = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceability

ORDERING INFORMATION

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

NTMFS5H409NL

ELECTRICAL CHARACTERISTICS (T_J = 25°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 V, I _D = 250 μA	40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V _{(BR)DSS} /T _J			19.1		mV/°C
Zero Gate Voltage Drain Current	I _{DSS}	V _{GS} = 0 V, V _{DS} = 40 V	T _J = 25 °C		1.0	μA
			T _J = 125°C		250	
Gate-to-Source Leakage Current	I _{GSS}	V _{DS} = 0 V, V _{GS} = 20 V			100	nA

ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	V _{GS(TH)}	V _{GS} = V _{DS} , I _D = 250 μA	1.2		2.0	V
Threshold Temperature Coefficient	V _{GS(TH)} /T _J			-4.8		mV/°C
Drain-to-Source On Resistance	R _{DS(on)}	V _{GS} = 10 V, I _D = 50 A		0.85	1.1	mΩ
		V _{GS} = 4.5 V, I _D = 50 A		1.2	1.6	
Forward Transconductance	g _{FS}	V _{DS} = 15 V, I _D = 50 A		300		S

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C _{ISS}	V _{GS} = 0 V, f = 1 MHz, V _{DS} = 20 V		5700		pF
Output Capacitance	C _{OSS}			1400		
Reverse Transfer Capacitance	C _{RSS}			73		
Total Gate Charge	Q _{G(TOT)}	V _{GS} = 4.5 V, V _{DS} = 20 V; I _D = 50 A		41		nC
Total Gate Charge	Q _{G(TOT)}	V _{GS} = 10 V, V _{DS} = 20 V; I _D = 50 A		89		
Threshold Gate Charge	Q _{G(TH)}	V _{GS} = 4.5 V, V _{DS} = 20 V; I _D = 50 A		8.6		
Gate-to-Source Charge	Q _{GS}			15		
Gate-to-Drain Charge	Q _{GD}			10		
Plateau Voltage	V _{GP}			2.8		V
Output Charge	Q _{OSS}	V _{GS} = 0 V, V _{DS} = 20 V		62		nC

SWITCHING CHARACTERISTICS (Note 5)

Turn-On Delay Time	t _{d(ON)}	V _{GS} = 4.5 V, V _{DS} = 20 V, I _D = 50 A, R _G = 2.5 Ω		17		ns
Rise Time	t _r			130		
Turn-Off Delay Time	t _{d(OFF)}			40		
Fall Time	t _f			14		

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V _{SD}	V _{GS} = 0 V, I _S = 50 A	T _J = 25°C		0.79	1.2	V
			T _J = 125°C		0.64		
Reverse Recovery Time	t _{RR}	V _{GS} = 0 V, dI _S /dt = 100 A/μs, I _S = 50 A		59		ns	
Charge Time	t _a			31			
Discharge Time	t _b			28			
Reverse Recovery Charge	Q _{RR}			80		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.

4. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

5. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

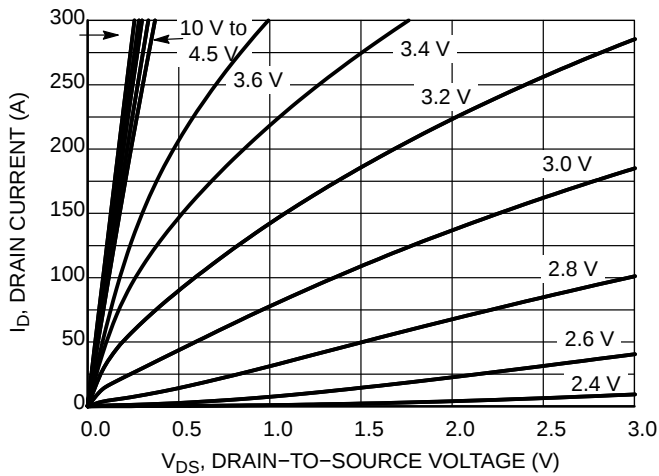


Figure 1. On-Region Characteristics

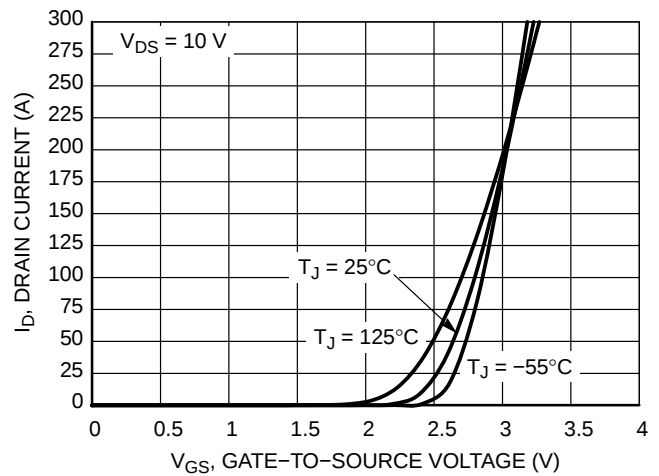


Figure 2. Transfer Characteristics

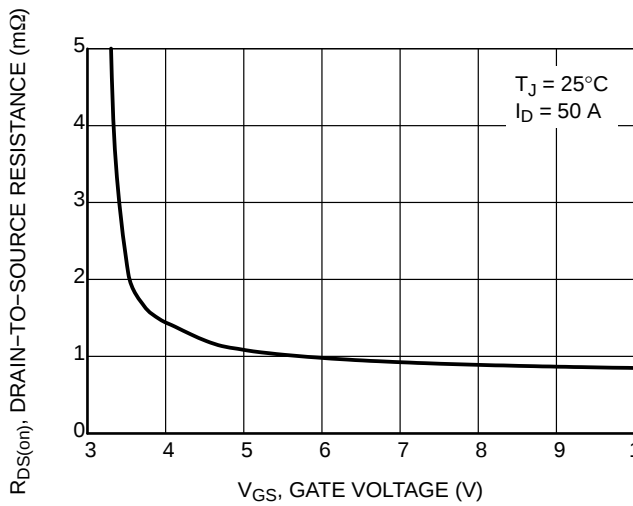


Figure 3. On-Resistance vs. Gate-to-Source Voltage

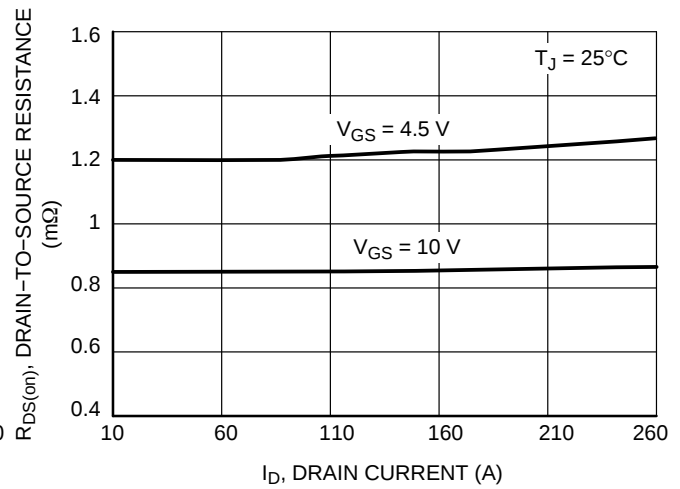


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

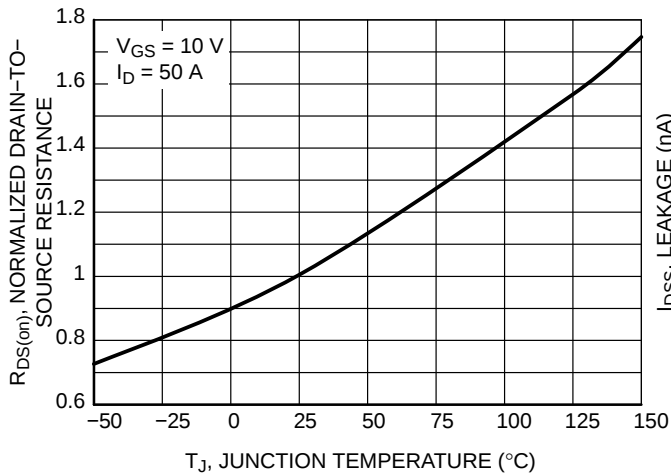


Figure 5. On-Resistance Variation with Temperature

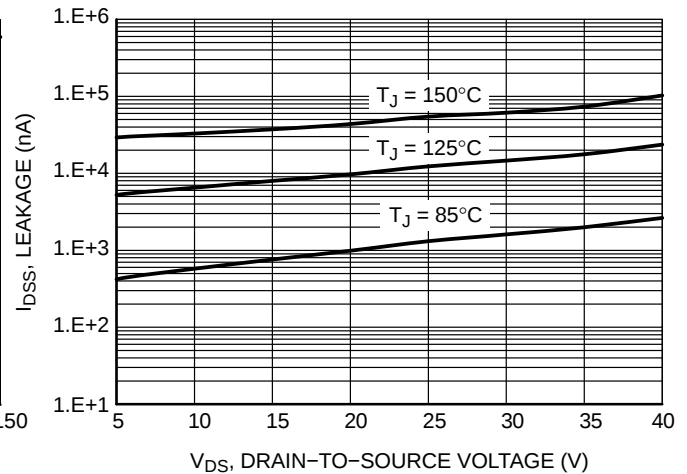


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

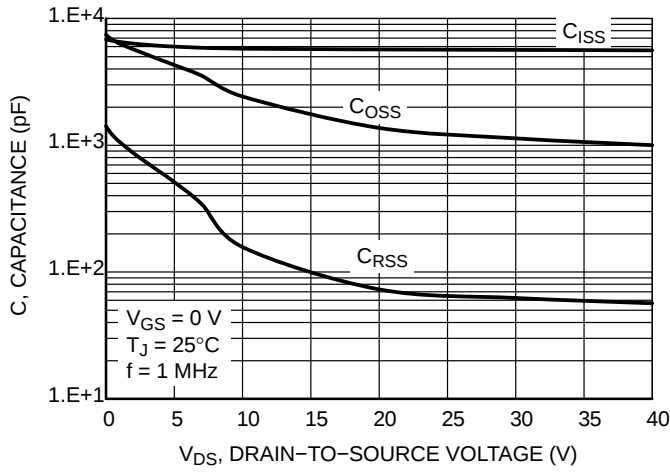


Figure 7. Capacitance Variation

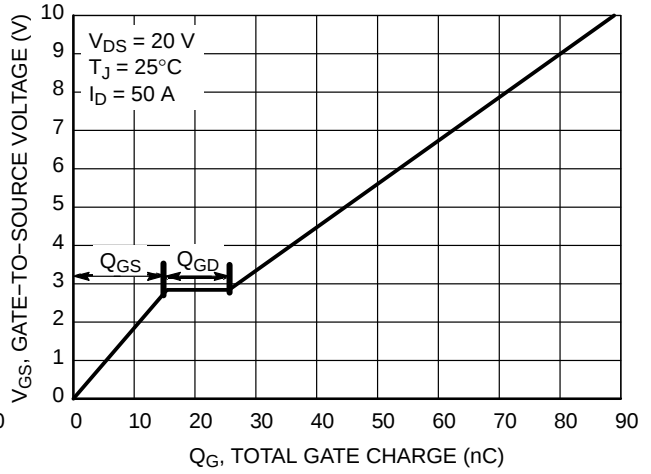


Figure 8. Gate-to-Source vs. Total Charge

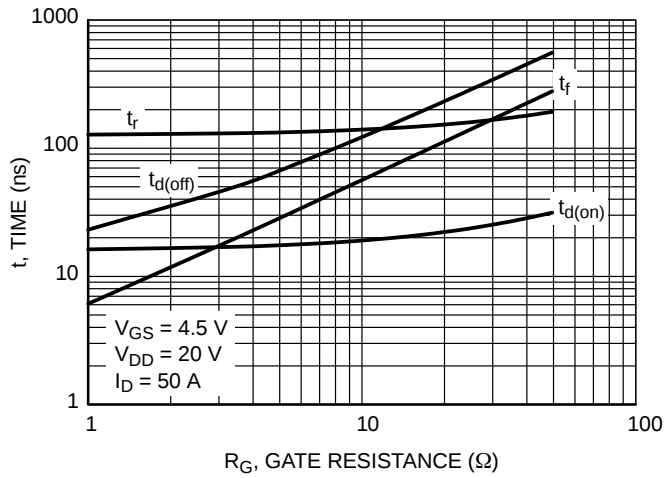


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

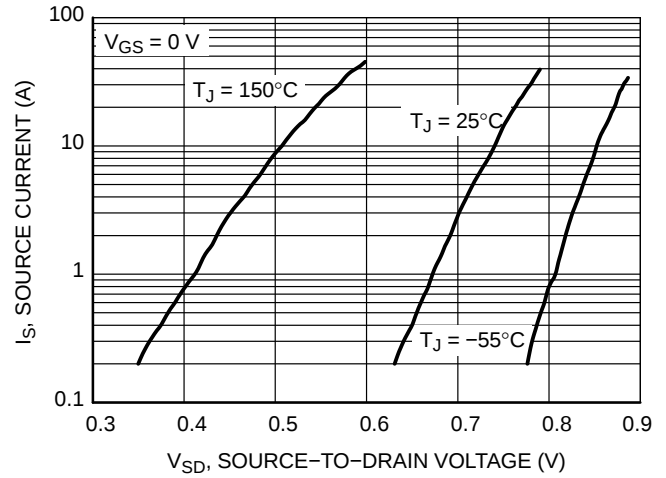


Figure 10. Diode Forward Voltage vs. Current

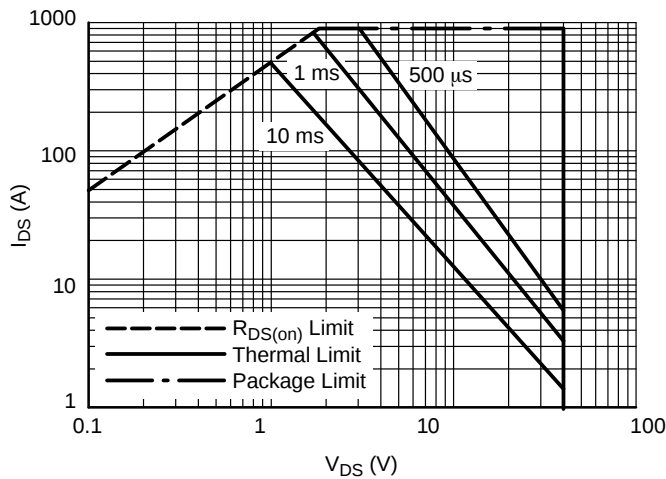


Figure 11. Safe Operating Area

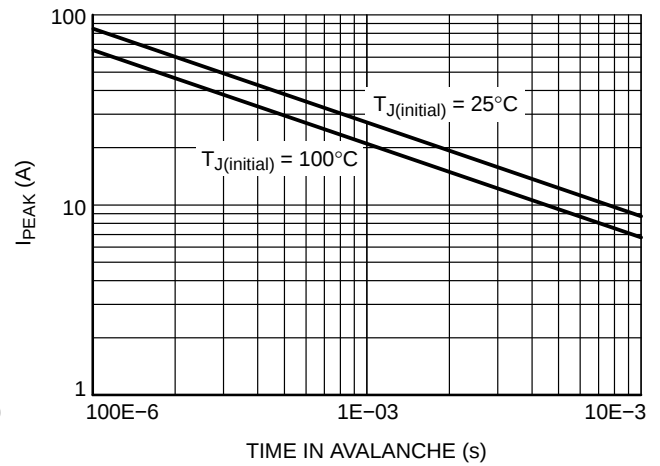


Figure 12. I_{PEAK} vs. Time in Avalanche

NTMFS5H409NL

DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping [†]
NTMFS5H409NLT1G	5H409L	DFN5 (Pb-Free)	1500 / Tape & Reel
NTMFS5H409NLT3G	5H409L	DFN5 (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 Specifications Brochure, BRD8011/D.

PACKAGE DIMENSIONS

[illegible]

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.00	---	0.05
b	0.33	0.41	0.51
c	0.23	0.28	0.33
D	5.00	5.15	5.30
D1	4.70	4.90	5.10
D2	3.80	4.00	4.20
E	6.00	6.15	6.30
E1	5.70	5.90	6.10
E2	3.45	3.65	3.85
e	1.27 BSC		
G	0.51	0.575	0.71
K	1.20	1.35	1.50
L	0.51	0.575	0.71
L1	0.125 REF		
M	3.00	3.40	3.80
a	0°	---	12°

PIN 1. SOURCE
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN

RECOMMENDED SOLDERING FOOTPRINT*

DIMENSIONS: MILLIMETERS

*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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