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NTMFS5C609NL

Power MOSFET

60 V, 1.36 mΩ, 250 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, Halogen Free/BFR 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_{DSS}	60	V
Gate-to-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)	$T_C = 25^\circ\text{C}$	I_D	250
			175
Power Dissipation $R_{\theta JC}$ (Note 1)	$T_C = 25^\circ\text{C}$	P_D	167
			83
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	$T_A = 25^\circ\text{C}$	I_D	38
			27
Power Dissipation $R_{\theta JA}$ (Notes 1 & 2)	$T_A = 25^\circ\text{C}$	P_D	3.8
			1.9
Pulsed Drain Current	I_{DM}	900	A
Operating Junction and Storage Temperature	T_J, T_{stg}	-55 to +175	°C
Source Current (Body Diode)	I_S	164	A
Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 17$ A)	E_{AS}	451	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	T_L	260	°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	°C/W
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	39	

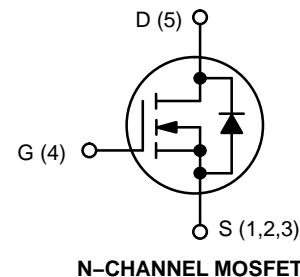
1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface-mounted on FR4 board using a 650 mm², 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent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



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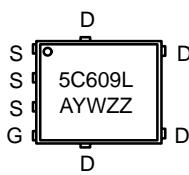
$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX
60 V	1.36 mΩ @ 10 V	
	2.3 mΩ @ 4.5 V	250 A



N-CHANNEL MOSFET



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



MARKING
DIAGRAM

5C609L = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceability

ORDERING INFORMATION

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

NTMFS5C609NL

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		60			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V _{(BR)DSS} /T _J				12.7		mV/°C
Zero Gate Voltage Drain Current	I _{DSS}	V _{GS} = 0 V, V _{DS} = 60 V	T _J = 25 °C		10		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}				-5.76		mV/°C
Drain-to-Source On Resistance	R _{DSS(on)}	V _{GS} = 10 V	I _D = 50 A		1.13	1.36	mΩ
		V _{GS} = 4.5 V	I _D = 50 A		1.65	2.3	
Forward Transconductance	g _{FS}	V _{DS} = 15 V, I _D = 50 A			151		S

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C _{ISS}	V _{GS} = 0 V, f = 1 MHz, V _{DS} = 25 V		6660		pF
Output Capacitance	C _{OSS}			2953		
Reverse Transfer Capacitance	C _{rss}			45		
Total Gate Charge	Q _{G(TOT)}	V _{GS} = 4.5 V, V _{DS} = 30 V; I _D = 50 A	V _{GS} = 4.5 V, V _{DS} = 30 V; I _D = 50 A	41		nC
Total Gate Charge	Q _{G(TOT)}		V _{GS} = 10 V, V _{DS} = 30 V; I _D = 50 A	91		
Threshold Gate Charge	Q _{G(TH)}			5		
Gate-to-Source Charge	Q _{GS}			17.1		
Gate-to-Drain Charge	Q _{GD}			10.9		
Plateau Voltage	V _{GP}			2.9		V

SWITCHING CHARACTERISTICS (Note 5)

Turn-On Delay Time	t _{d(ON)}	V _{GS} = 4.5 V, V _{DS} = 30 V, I _D = 50 A, R _G = 1.0 Ω		19		ns
Rise Time	t _r			51		
Turn-Off Delay Time	t _{d(OFF)}			47		
Fall Time	t _f			18		

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V _{SD}	V _{GS} = 0 V, I _S = 50 A	T _J = 25°C		0.78	1.2	V
			T _J = 125°C		0.66		
Reverse Recovery Time	t _{RR}	V _{GS} = 0 V, dI _S /dt = 100 A/μs, I _S = 50 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.

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

5. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

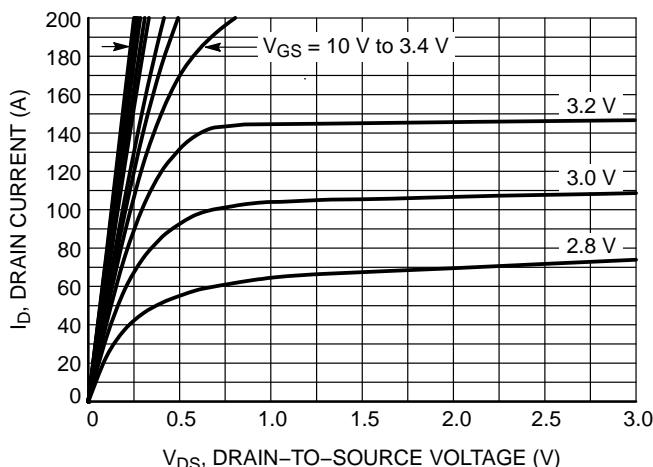


Figure 1. On-Region Characteristics

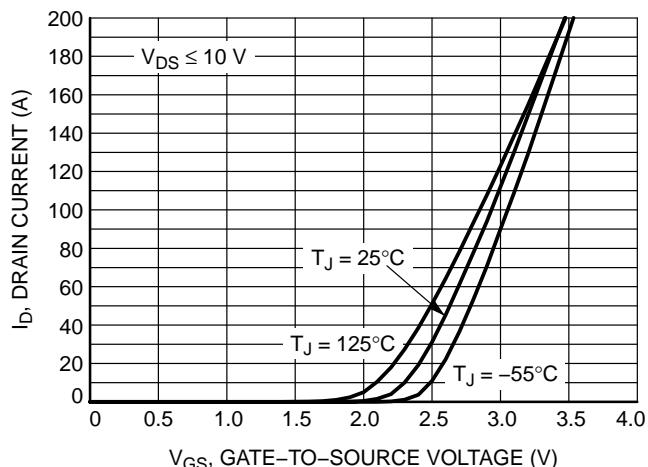


Figure 2. Transfer Characteristics

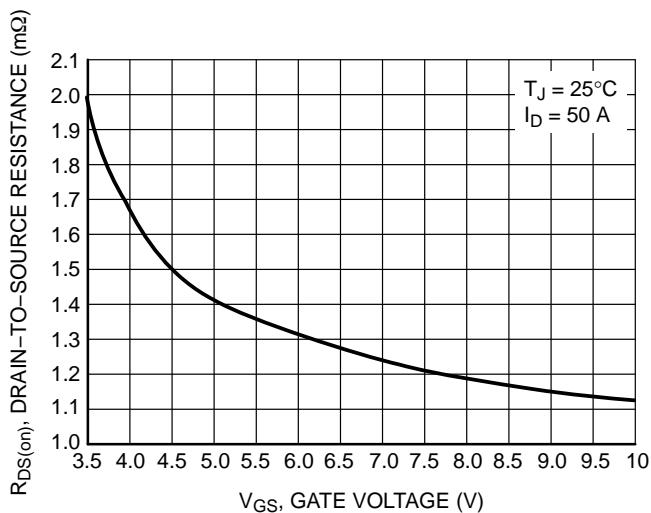


Figure 3. On-Resistance vs. Gate-to-Source Voltage

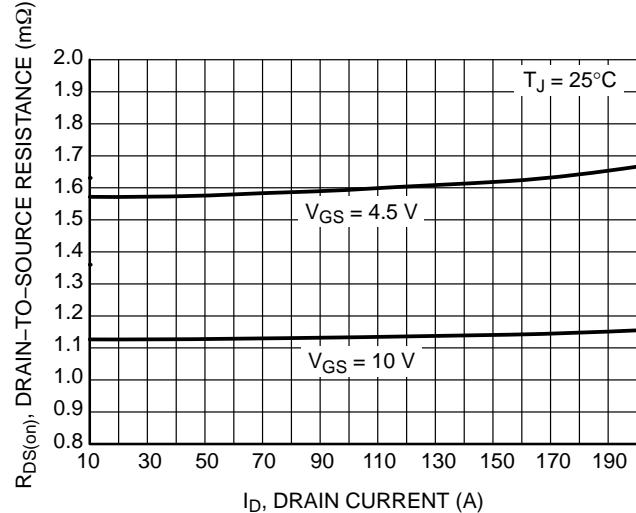


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

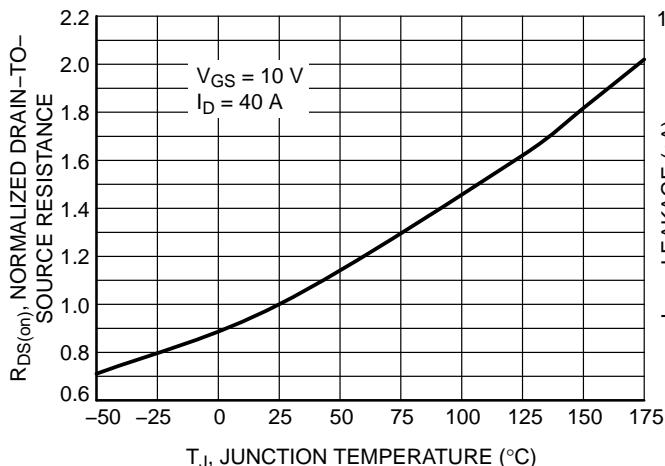


Figure 5. On-Resistance Variation with Temperature

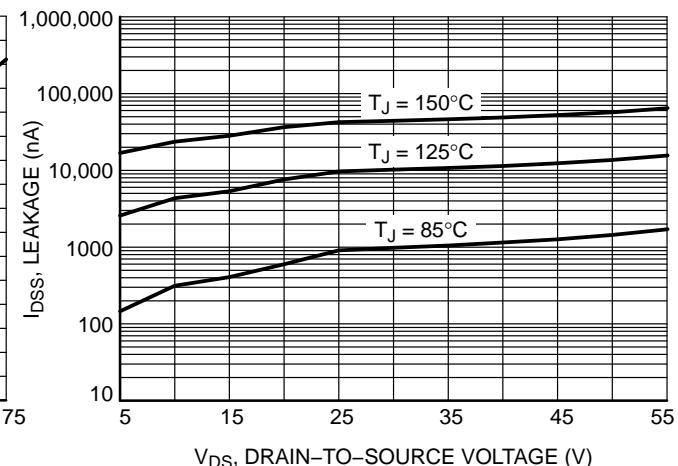


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

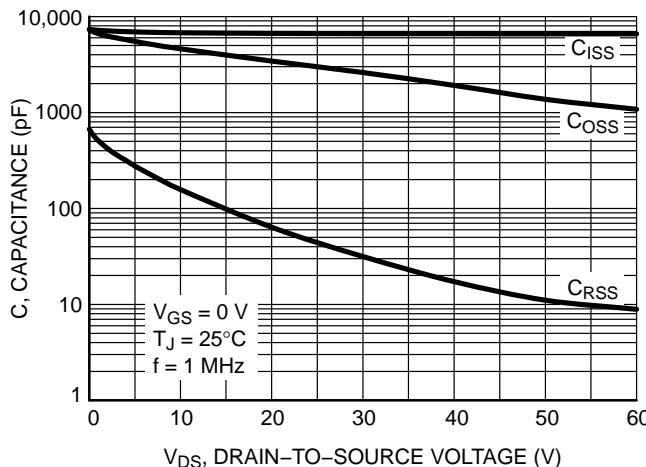


Figure 7. Capacitance Variation

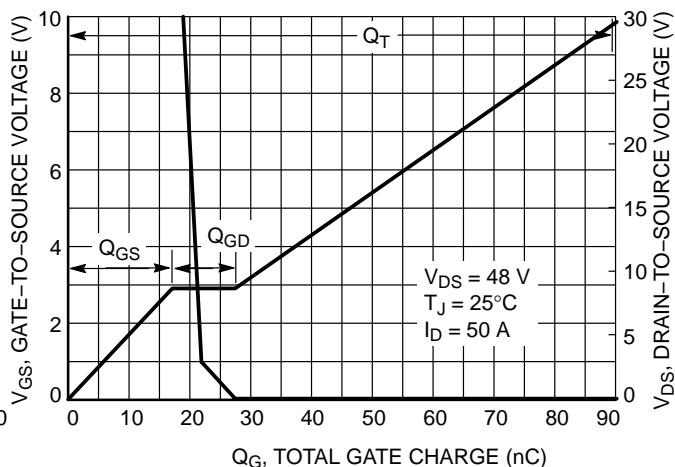


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

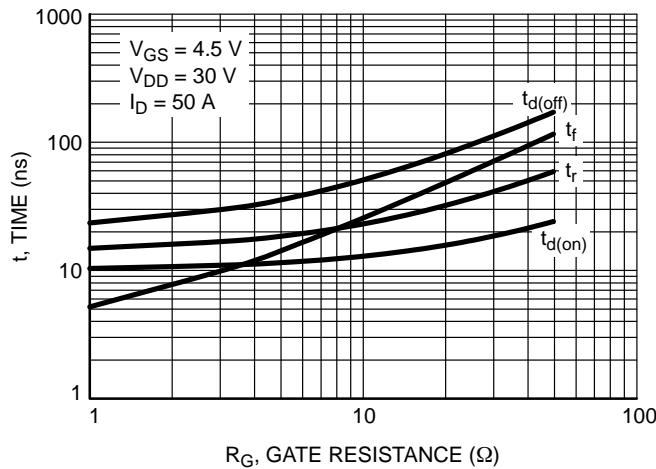


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

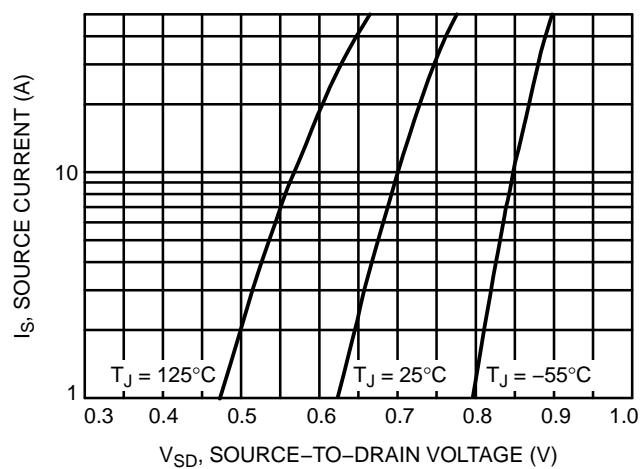


Figure 10. Diode Forward Voltage vs. Current

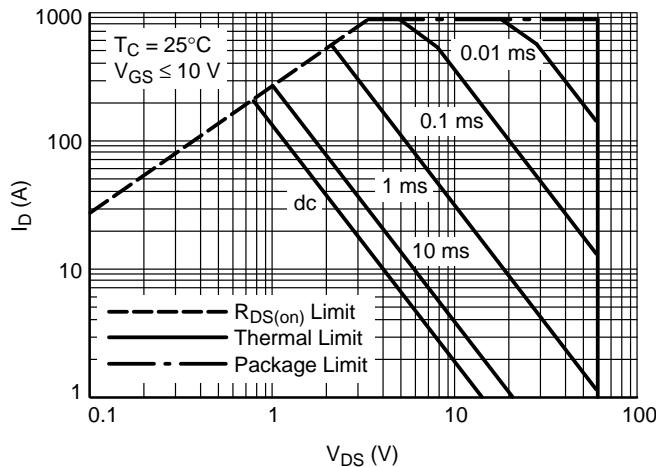


Figure 11. Safe Operating Area

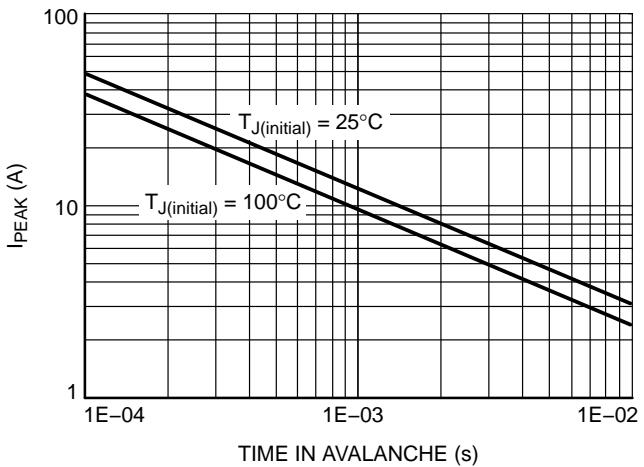


Figure 12. I_{PEAK} vs. Time in Avalanche

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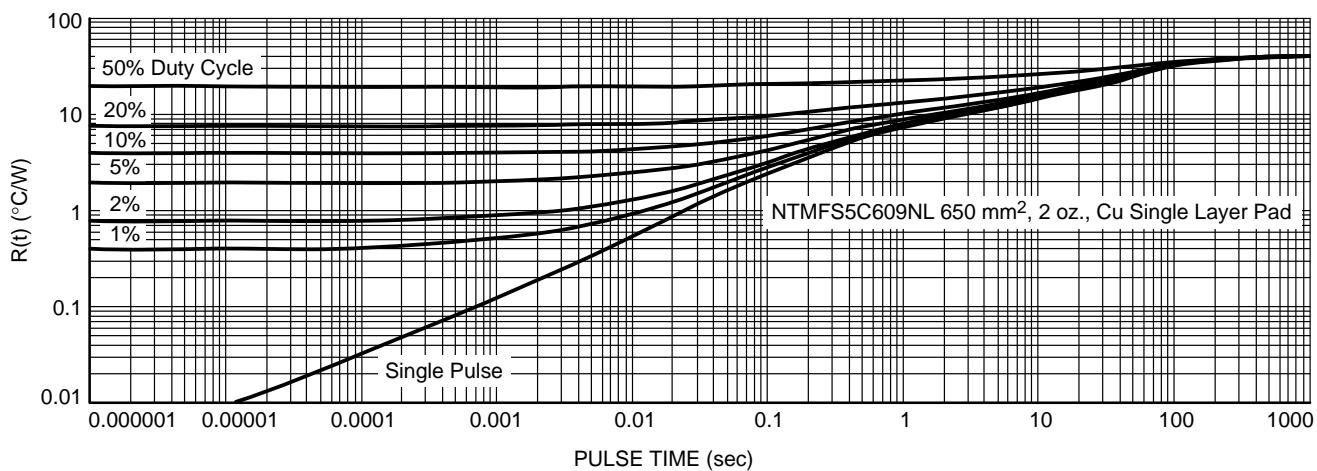


Figure 13. Thermal Characteristics

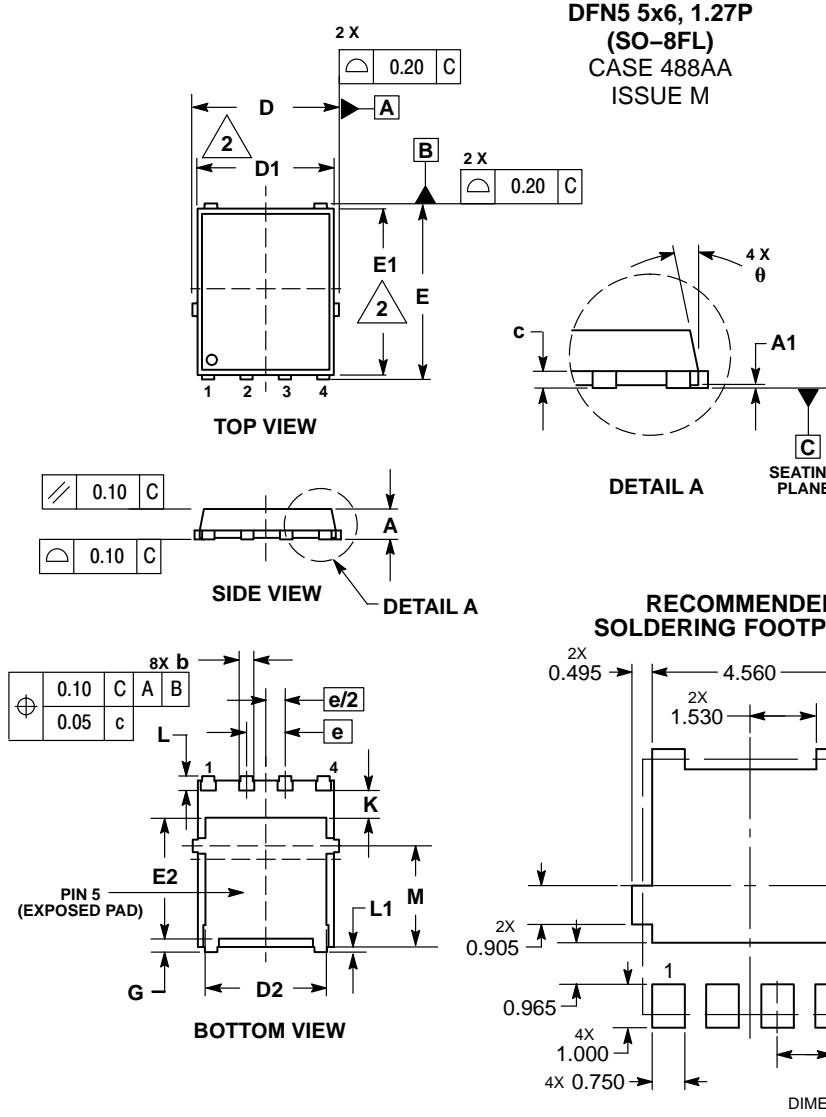
DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping [†]
NTMFS5C609NLT1G	5C609L	DFN5 (Pb-Free)	1500 / 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.

NTMFS5C609NL

PACKAGE DIMENSIONS



*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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