

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, Dual N- & P-Channel, SO8FL

**100 V, 13.4 mΩ, 60 A,
-100 V, 36 mΩ, -36 A**

NTMFC013NP10M5L

Features

- Small Footprint (5 x 6 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

- Power Tools, Battery Operated Vacuums
- UAV/Drones, Material Handling
- Motor Drive, Home Automation

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$, Unless otherwise specified)

Parameter			Symbol	Q1	Q2	Unit
Drain-to-Source Breakdown Voltage			$V_{(BR)DSS}$	100	-100	V
Gate-to-Source Voltage			V_{GS}	± 20	± 20	V
Continuous Drain Current $R_{\theta JC}$ (Note 2)	Steady State	$T_C = 25^{\circ}\text{C}$	I_D	60	-36	A
Power Dissipation $R_{\theta JC}$ (Note 2)			P_D	102	102	W
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2)	Steady State	$T_A = 25^{\circ}\text{C}$	I_D	9	-5	A
Power Dissipation $R_{\theta JA}$ (Notes 1, 2)			P_D	2.7	2.7	W
Pulsed Drain Current	$T_A = 25^{\circ}\text{C}$, $t_p = 10\text{ }\mu\text{s}$		I_{DM}	208	-184	A
Operating Junction and Storage Temperature Range			T_J , T_{stg}	-55 to +150		$^{\circ}\text{C}$
Source Current (Body Diode)			I_S	85	85	A
Single Pulse Drain-to-Source Avalanche Energy ($I_L = 17.9/18.4\text{ A}$, $L = 1\text{ mH}$)			E_{AS}	161	169	mJ
Lead Temperature Soldering Reflow for Soldering Purposes (1/8" from case for 10 s)			T_L	260	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.

1. Surface-mounted on FR4 board using 1 in² pad size, 1 oz Cu pad.
2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

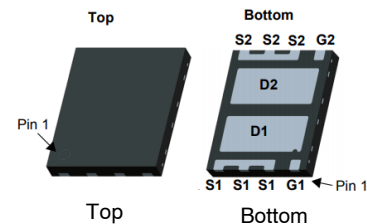
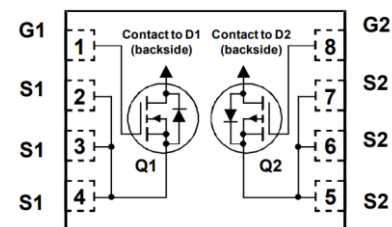


ON Semiconductor®

www.onsemi.com

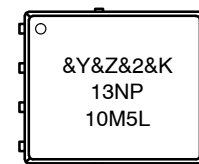
$V_{(BR)DSS}$	$R_{DS(on)} \text{ MAX}$	$I_D \text{ MAX}$
100 V	13.4 mΩ @ 10 V	60 A
-100 V	36 mΩ @ 10 V	-36 A

Dual-Channel MOSFET



**WDFN8
CASE 511DC**

MARKING DIAGRAM



&Y = ON Semiconductor Logo
&Z = Assembly Plant Code
&2 = Numeric Date Code
&K = Lot Code
13NP10M5L = Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 10 of this data sheet.

NTMFC013NP10M5L

THERMAL CHARACTERISTICS

Symbol	Parameter	Q1	Q2	Unit
$R_{\theta JC}$	Junction-to-Case – Steady State (Note 3)	1.46	1.46	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient – Steady State (Note 3)	55	55	

3. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

ELECTRICAL CHARACTERISTICS (Q1, N-CHANNEL) ($T_J = 25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
-----------	--------	-----------------	-----	-----	-----	------

OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	100			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS} / T_J$	$I_D = 250\text{ }\mu\text{A}$, ref to 25°C		60		$\text{mV}/^{\circ}\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 80\text{ V}$	$T_J = 25^{\circ}\text{C}$		1	μA
			$T_J = 125^{\circ}\text{C}$		100	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	nA

ON CHARACTERISTICS

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 158\text{ }\mu\text{A}$	1.0	1.7	3.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)} / T_J$	$I_D = 158\text{ }\mu\text{A}$, ref to 25°C		8.85		$\text{mV}/^{\circ}\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 8.5\text{ A}$		9.16	13.4	$\text{m}\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 6.8\text{ A}$		15.2	35.0	
Forward Transconductance	g_{FS}	$V_{DS} = 5\text{ V}, I_D = 8.5\text{ A}$		15.5		S
Gate-Resistance	R_G	$T_A = 25^{\circ}\text{C}$		1.57		Ω

CHARGES & CAPACITANCES

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 50\text{ V}$		1345		pF
Output Capacitance	C_{OSS}			307		
Reverse Transfer Capacitance	C_{RSS}			17.5		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 50\text{ V}, I_D = 8.5\text{ A}$		12		nC
Threshold Gate Charge	$Q_{G(TH)}$			2.4		
Gate-to-Source Charge	Q_{GS}			4.7		
Gate-to-Drain Charge	Q_{GD}			5		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DD} = 50\text{ V}, I_D = 8.5\text{ A}$		23		nC
Plateau Voltage	V_{GP}			3.3		

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DS} = 50\text{ V}, I_D = 8.5\text{ A}, R_G = 6\text{ }\Omega$		12		ns
Rise Time	t_r			8		
Turn-Off Delay Time	$t_{d(OFF)}$			30		
Fall Time	t_f			10		
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 50\text{ V}, I_D = 8.5\text{ A}, R_G = 6\text{ }\Omega$		20.1		ns
Rise Time	t_r			40.9		
Turn-Off Delay Time	$t_{d(OFF)}$			22.7		
Fall Time	t_f			16		

NTMFC013NP10M5L

ELECTRICAL CHARACTERISTICS (Q1, N-CHANNEL) ($T_J = 25^\circ\text{C}$ unless otherwise noted) (continued)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Forward Diode Voltage	V_{SD}	$V_{GS} = 0\text{ V}$, $I_S = 8.5\text{ A}$	$T_J = 25^\circ\text{C}$	0.77	1.2	V
			$T_J = 125^\circ\text{C}$	0.63		
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}$, $dI_S/dt = 100\text{ A}/\mu\text{s}$, $I_S = 4.2\text{ A}$		39		ns
Charge Time	t_a			22		
Discharge Time	t_b			17		
Reverse Recovery Charge	Q_{RR}			38		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.

ELECTRICAL CHARACTERISTICS (Q2, P-CHANNEL) ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}$, $I_D = -250\text{ }\mu\text{A}$	-100			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS} / T_J$	$I_D = -250\text{ }\mu\text{A}$, ref to 25°C		60		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}$, $V_{DS} = -80\text{ V}$	$T_J = 25^\circ\text{C}$		-1	μA
			$T_J = 125^\circ\text{C}$		-100	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$			± 100	nA

ON CHARACTERISTICS

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}$, $I_D = -158\text{ }\mu\text{A}$	-2.0	-3.31	-4.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)} / T_J$	$I_D = -158\text{ }\mu\text{A}$, ref to 25°C		6.9		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$, $I_D = -8.5\text{ A}$		28.5	36	m Ω
		$V_{GS} = -6\text{ V}$, $I_D = -5.7\text{ A}$		38.3	50.1	
Forward Transconductance	g_{FS}	$V_{DS} = -5\text{ V}$, $I_D = -8.5\text{ A}$		17.7		S
Gate-Resistance	R_G	$T_A = 25^\circ\text{C}$		2.41		Ω

CHARGES & CAPACITANCES

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$, $V_{DS} = -50\text{ V}$		2443		pF
Output Capacitance	C_{OSS}			330		
Reverse Transfer Capacitance	C_{RSS}			15		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -10\text{ V}$, $V_{DS} = -50\text{ V}$, $I_D = -8.5\text{ A}$		30		nC
Threshold Gate Charge	$Q_{G(TH)}$			6.9		
Gate-to-Source Charge	Q_{GS}			10.4		
Gate-to-Drain Charge	Q_{GD}			5.1		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -6\text{ V}$, $V_{DS} = -50\text{ V}$, $I_D = -8.5\text{ A}$		18.4		
Plateau Voltage	V_{GP}			5		V

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}$, $V_{DS} = -50\text{ V}$, $I_D = -8.5\text{ A}$, $R_G = 6\text{ }\Omega$		12.4		ns
Rise Time	t_r			16.1		
Turn-Off Delay Time	$t_{d(OFF)}$			20		
Fall Time	t_f			24		

NTMFC013NP10M5L

ELECTRICAL CHARACTERISTICS (Q2, P-CHANNEL) ($T_J = 25^\circ\text{C}$ unless otherwise noted) (continued)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -6\text{ V}, V_{DS} = -50\text{ V}, I_D = -8.5\text{ A},$ $R_G = 6\ \Omega$		27		ns
Rise Time	t_r			25		
Turn-Off Delay Time	$t_{d(OFF)}$			22		
Fall Time	t_f			8.5		

OFF CHARACTERISTICS

Forward Diode Voltage	V _{SD}	V _{GS} = 0 V, I _S = -8.5 A	T _J = 25°C		-0.84	-1.2	V
			T _J = 125°C		0.7		
Reverse Recovery Time	t _{RR}	V _{GS} = 0 V, dI _S /dt = 100 A/μs, I _S = -4.2 A			39		ns
Charge Time	t _a				23		
Discharge Time	t _b				16.6		
Reverse Recovery Charge	Q _{RR}				38		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.

TYPICAL CHARACTERISTICS – N-CANNEL

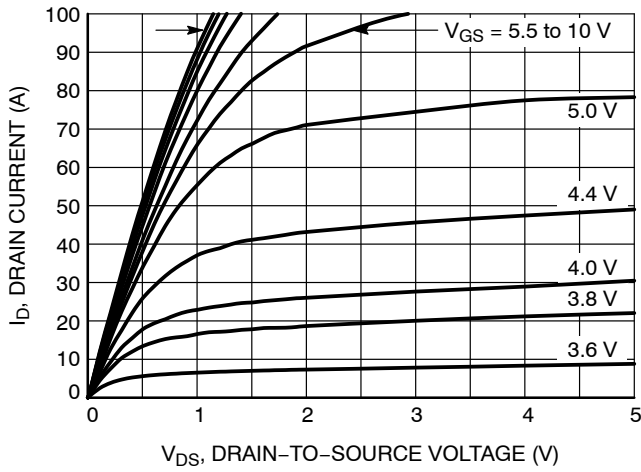


Figure 1. On-Region Characteristics

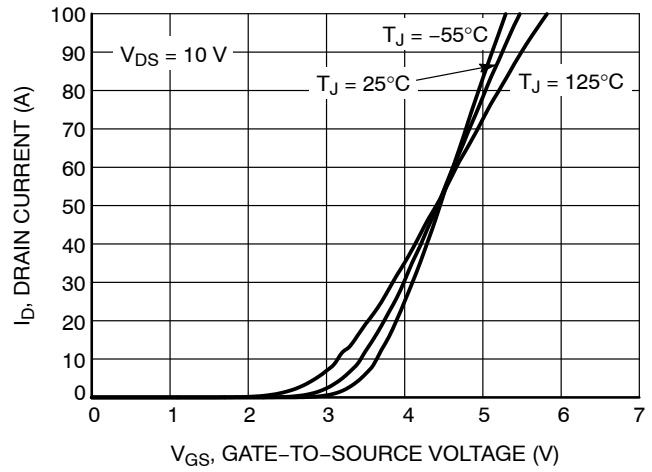


Figure 2. Transfer Characteristics

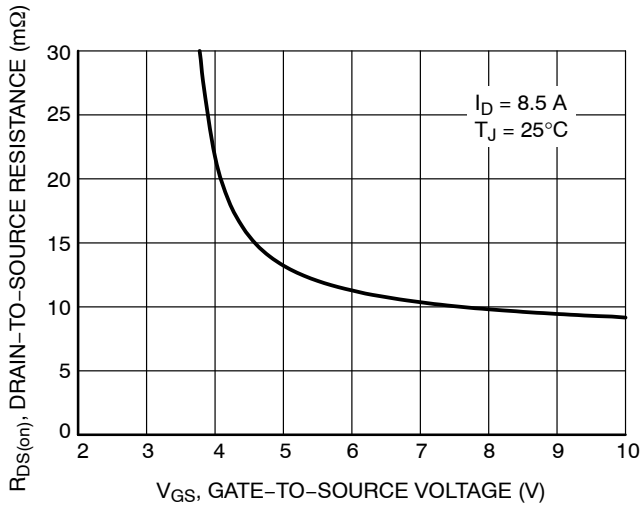


Figure 3. On-Resistance vs. Gate-to-Source Voltage

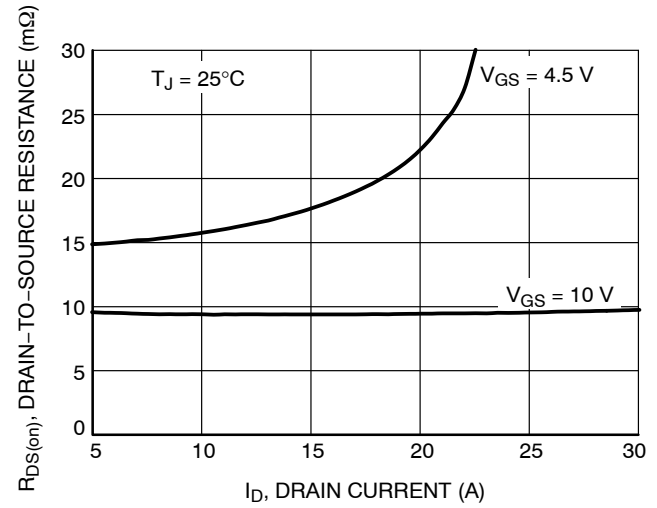


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

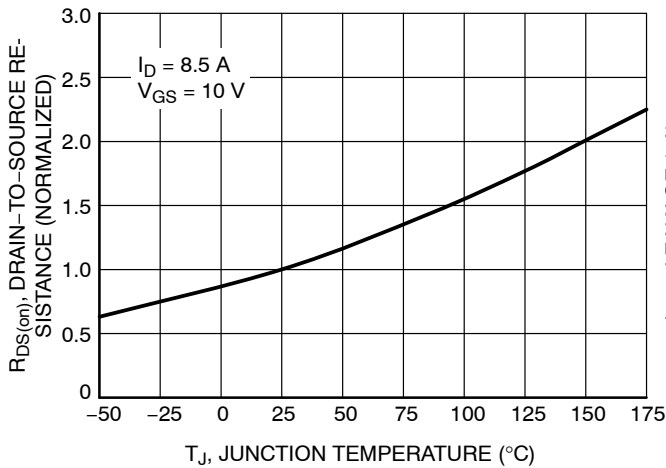


Figure 5. On-Resistance Variation with Temperature

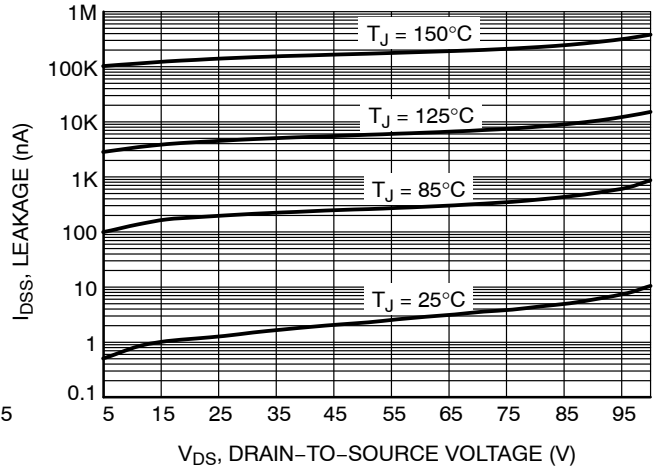


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS – N-CHANNEL

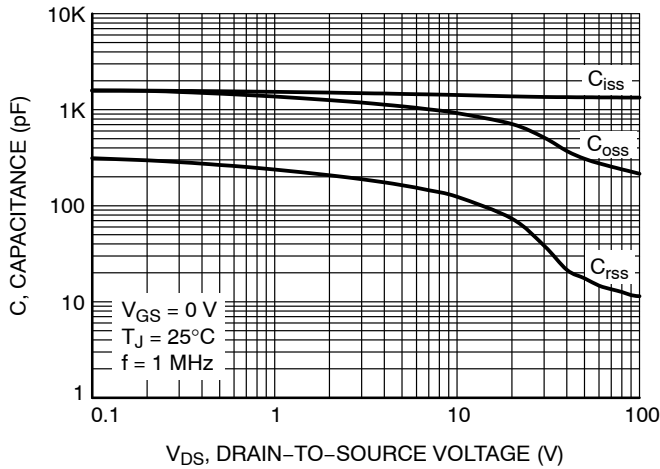


Figure 7. Capacitance Variation

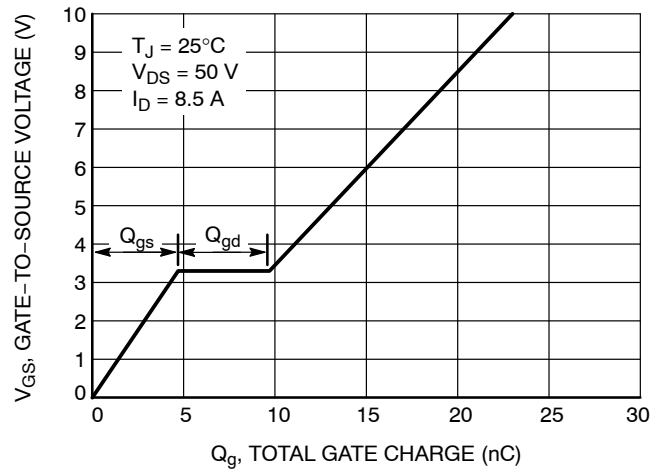


Figure 8. Gate-to-Source vs. Total Charge

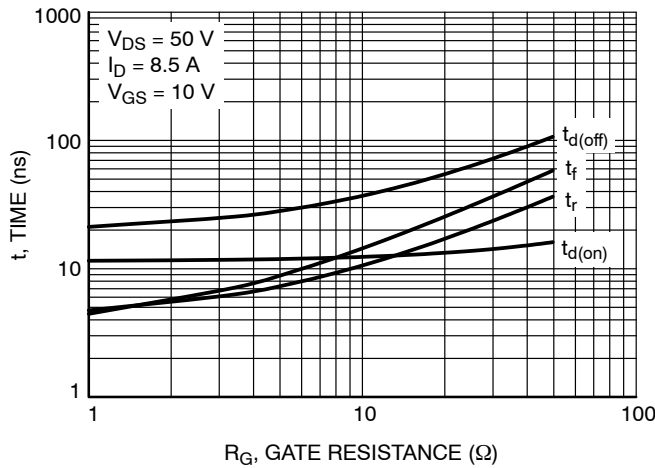


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

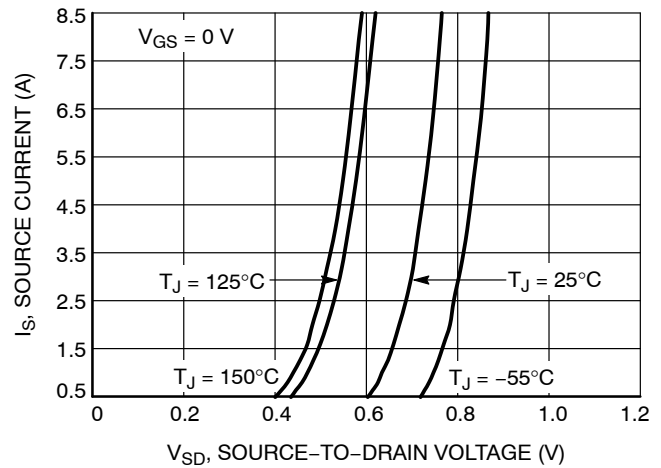


Figure 10. Diode Forward Voltage vs. Current

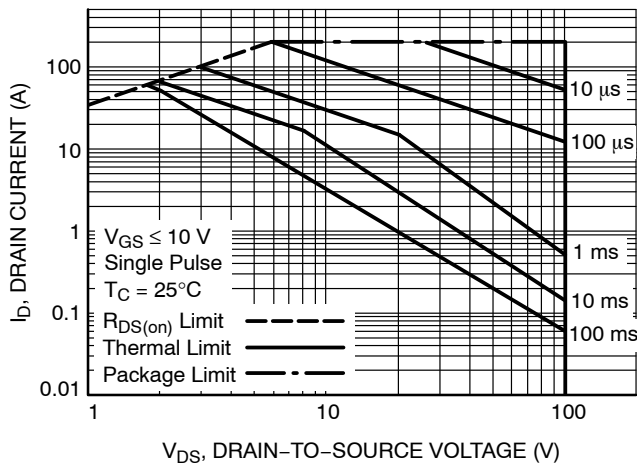


Figure 11. Maximum Rated Forward Biased Safe Operating Area

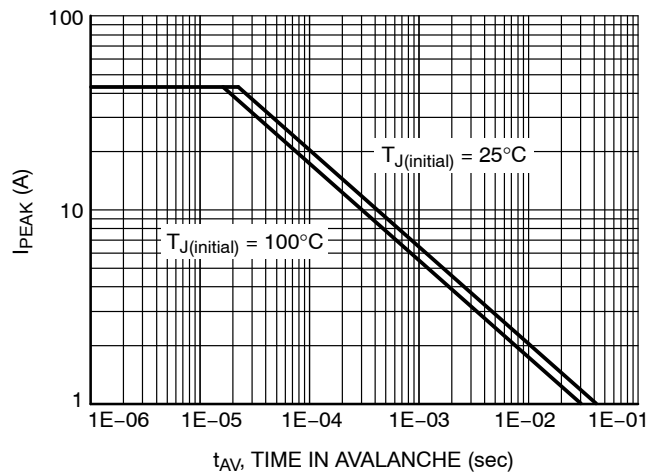


Figure 12. Maximum Drain Current vs. Time in Avalanche

NTMFC013NP10M5L

TYPICAL CHARACTERISTICS – N-CHANNEL

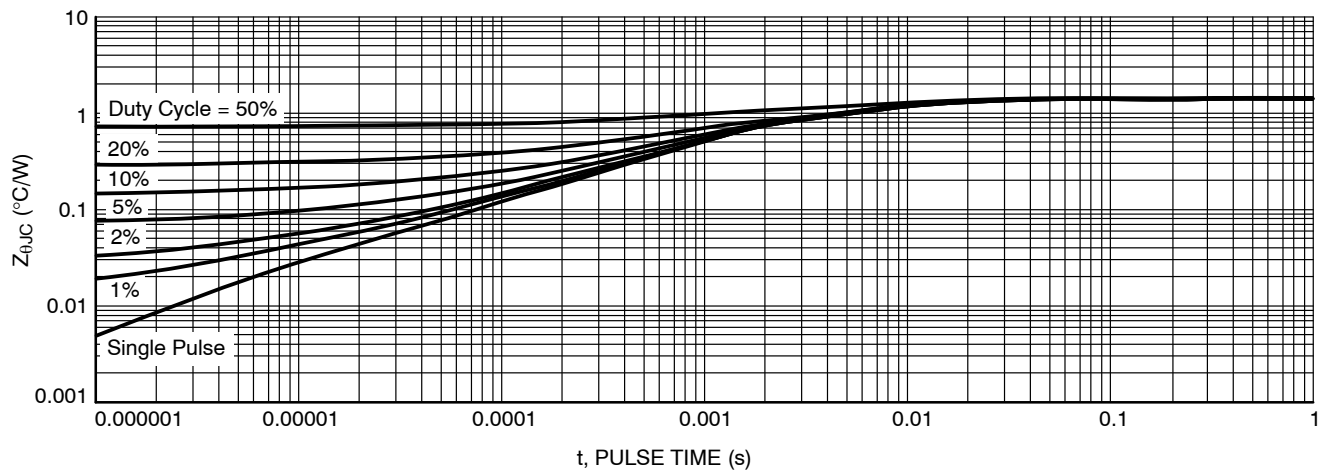


Figure 13. Thermal Response

TYPICAL CHARACTERISTICS – P-CHANNEL

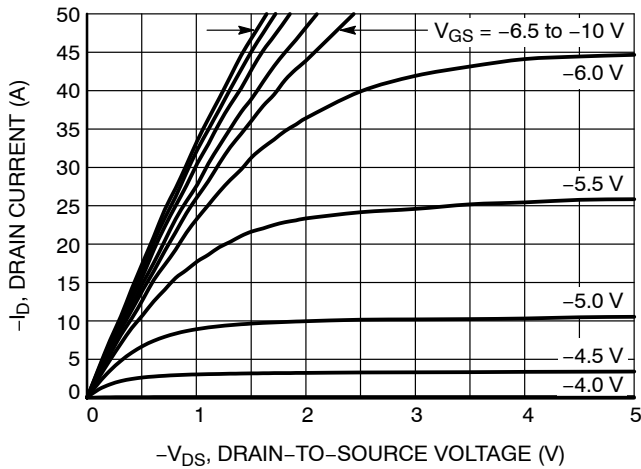


Figure 14. On-Region Characteristics

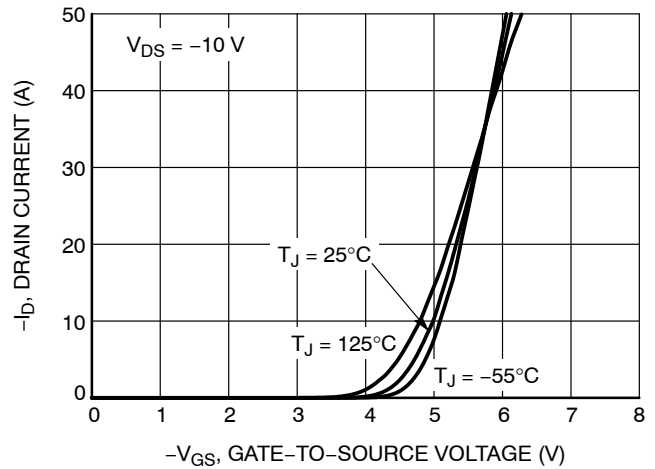


Figure 15. Transfer Characteristics

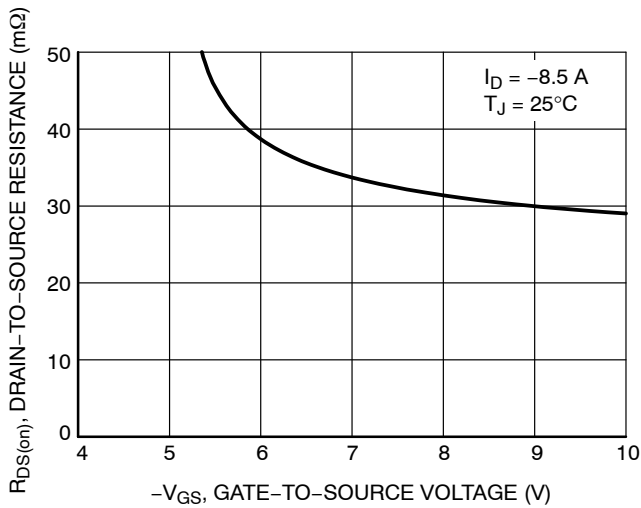


Figure 16. On-Resistance vs. Gate-to-Source Voltage

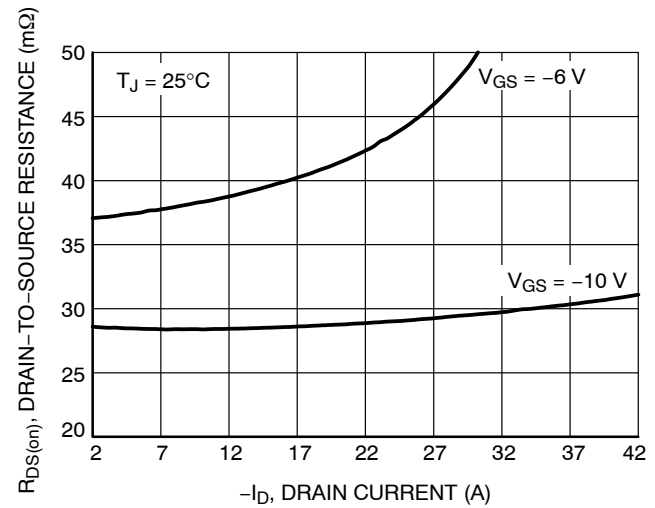


Figure 17. On-Resistance vs. Drain Current and Gate Voltage

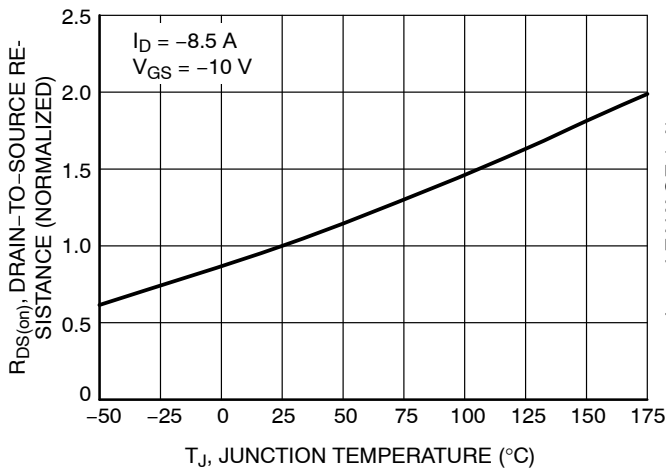


Figure 18. On-Resistance Variation with Temperature

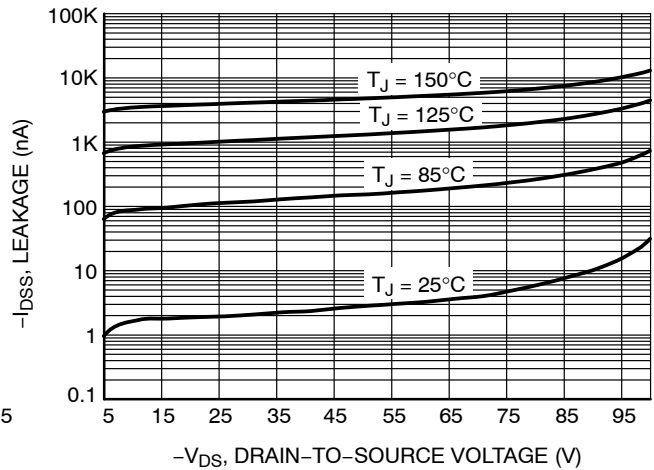


Figure 19. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS – P-CHANNEL

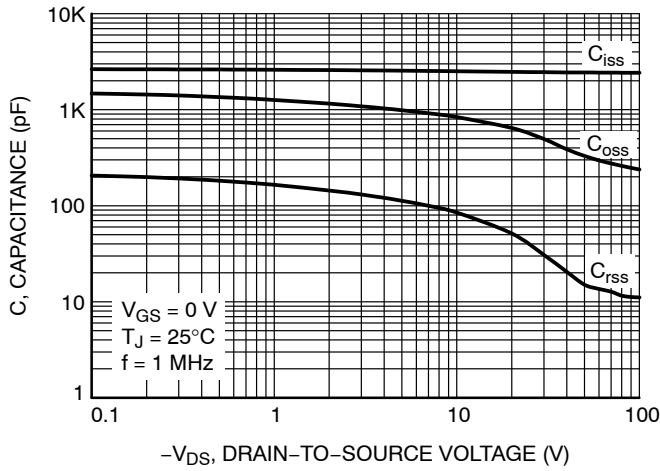


Figure 20. Capacitance Variation

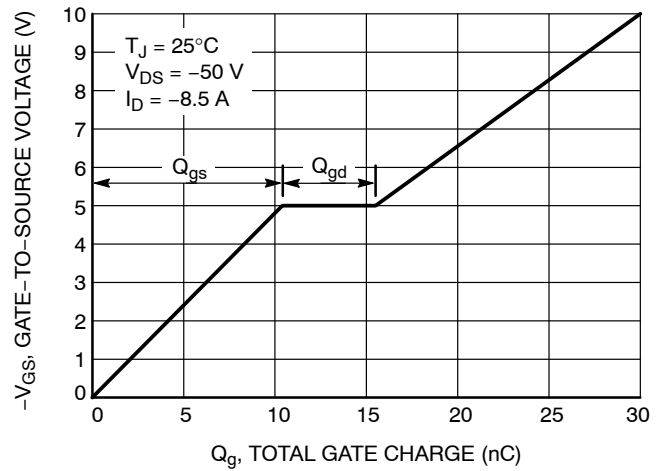


Figure 21. Gate-to-Source vs. Total Charge

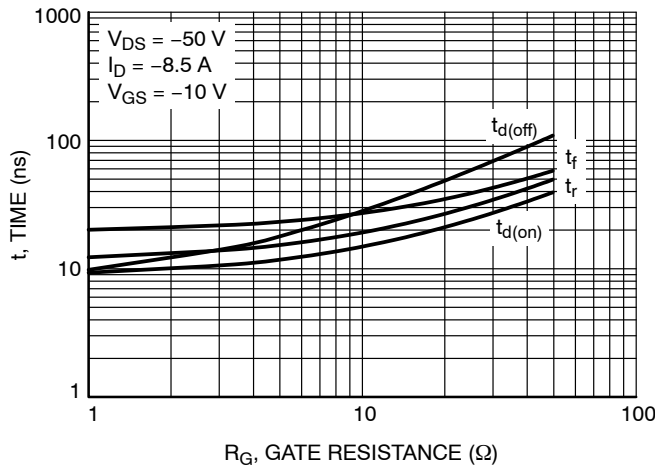


Figure 22. Resistive Switching Time Variation vs. Gate Resistance

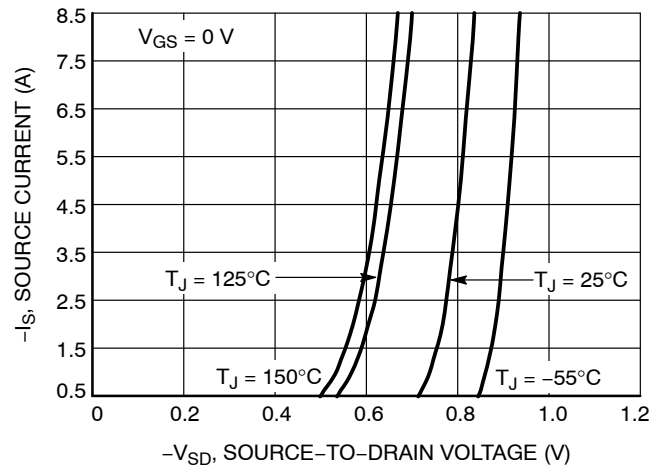


Figure 23. Diode Forward Voltage vs. Current

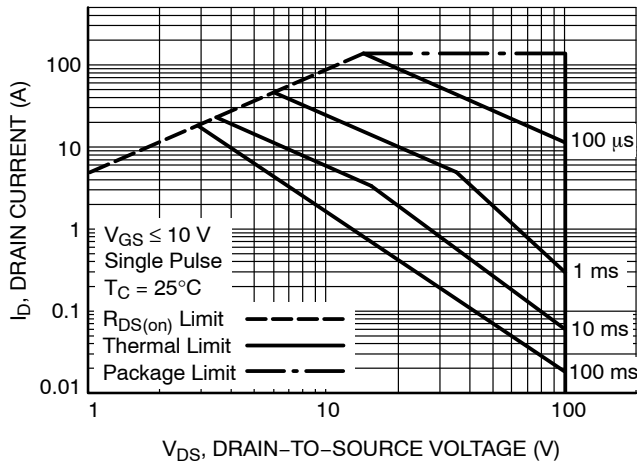


Figure 24. Maximum Rated Forward Biased Safe Operating Area

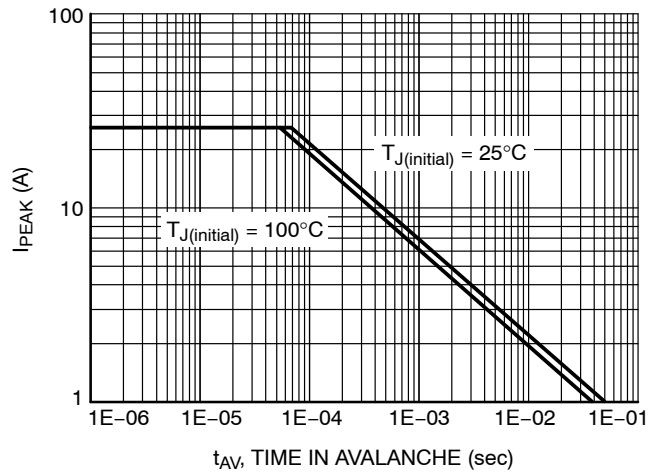


Figure 25. Maximum Drain Current vs. Time in Avalanche

NTMFC013NP10M5L

TYPICAL CHARACTERISTICS – P-CHANNEL

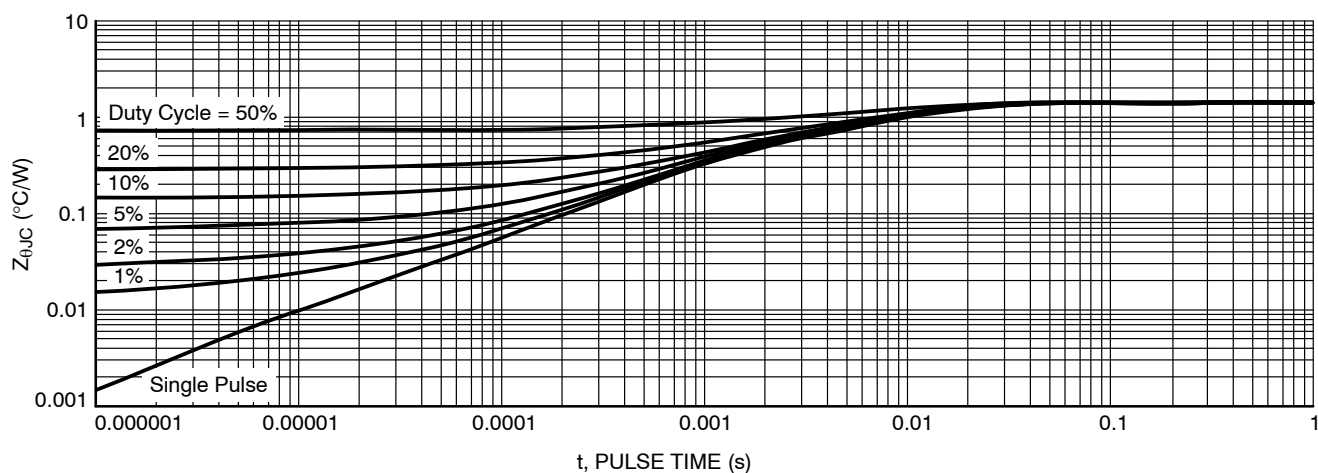


Figure 26. Thermal Response

ORDERING INFORMATION

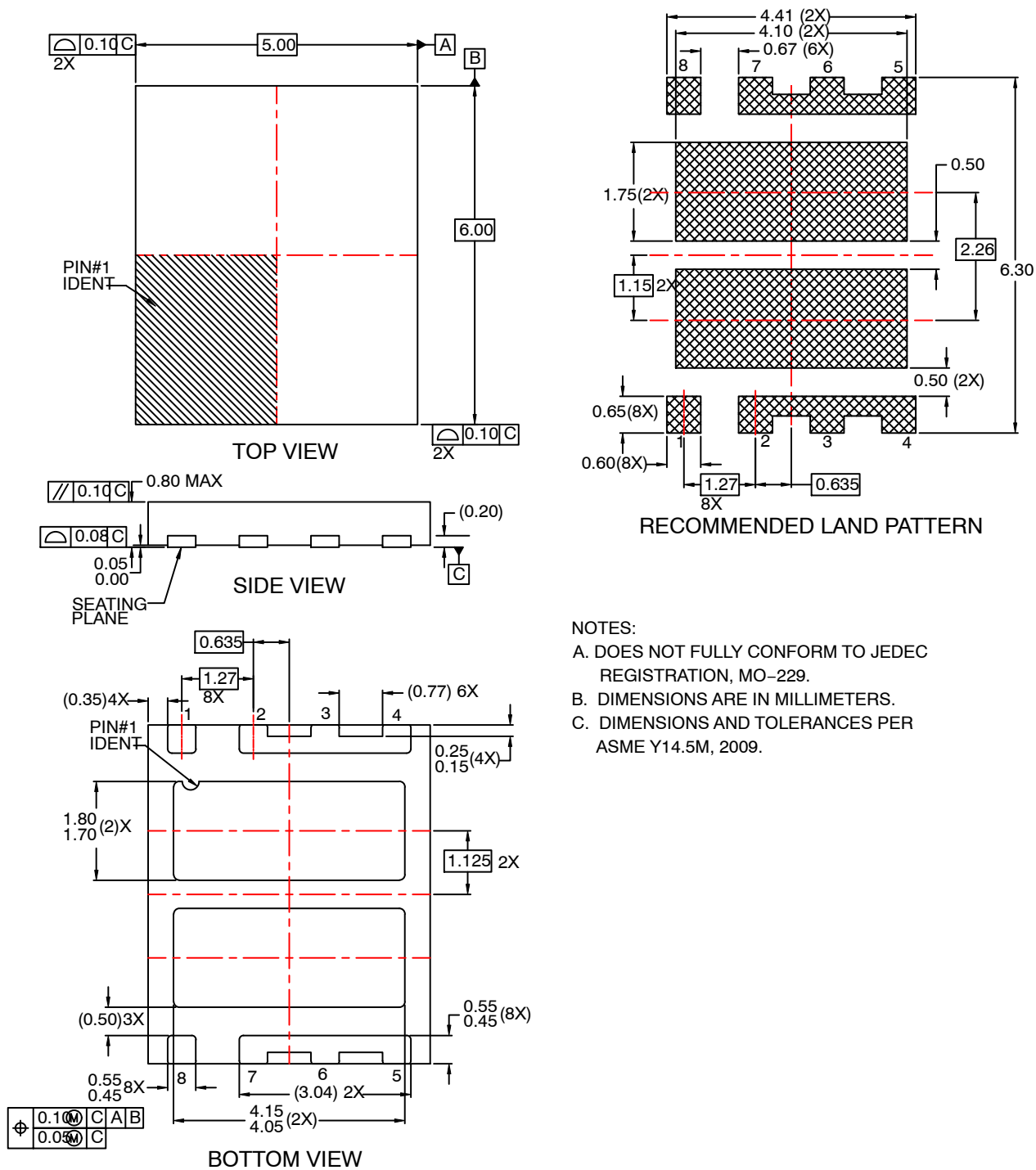
Device	Device Marking	Package	Shipping (Qty / Packing) [†]
NTMFC013NP10M5L	13NP10M5L	SO8FL (Pb-Free/Halogen Free)	3000 / Tape & Reel

[†]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.


NTMFC013NP10M5L

PACKAGE DIMENSIONS

WDFN8 5x6, 1.27P
CASE 511DC
ISSUE O



- NOTES:
- A. DOES NOT FULLY CONFORM TO JEDEC REGISTRATION, MO-229.
 - B. DIMENSIONS ARE IN MILLIMETERS.
 - C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.

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