

# NTMFS4936N, NTMFS4936NC

## MOSFET – Power, Single, N-Channel, SO-8 FL 30 V, 79 A



ON Semiconductor®

<http://onsemi.com>

### Features

- Low  $R_{DS(on)}$ , Low Capacitance and Optimized Gate Charge to Minimize Conduction, Driver and Switching Losses
- Next Generation Enhanced Body Diode, Engineered for Soft Recovery, Provides Schottky-Like Performance
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

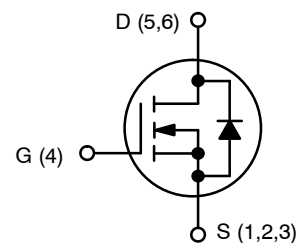
### Applications

- CPU Power Delivery
- DC-DC Converters

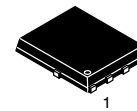
**MAXIMUM RATINGS** ( $T_J = 25^\circ\text{C}$  unless otherwise stated)

Parameter	Symbol	Value	Unit	
Drain-to-Source Voltage	$V_{DSS}$	30	V	
Gate-to-Source Voltage	$V_{GS}$	$\pm 20$	V	
Continuous Drain Current $R_{\theta JA}$ (Note 1)	$I_D$	$T_A = 25^\circ\text{C}$	19.5	A
		$T_A = 100^\circ\text{C}$	12.3	
Power Dissipation $R_{\theta JA}$ (Note 1)	$P_D$	2.62	W	
Continuous Drain Current $R_{\theta JA} \leq 10$ s (Note 1)	$I_D$	$T_A = 25^\circ\text{C}$	35	A
		$T_A = 100^\circ\text{C}$	22	
Power Dissipation $R_{\theta JA} \leq 10$ s (Note 1)	$P_D$	8.4	W	
Continuous Drain Current $R_{\theta JA}$ (Note 2)	$I_D$	$T_A = 25^\circ\text{C}$	11.6	A
		$T_A = 100^\circ\text{C}$	7.3	
Power Dissipation $R_{\theta JA}$ (Note 2)	$P_D$	0.92	W	
Continuous Drain Current $R_{\theta JC}$ (Note 1)	$I_D$	$T_C = 25^\circ\text{C}$	79	A
		$T_C = 100^\circ\text{C}$	50	
Power Dissipation $R_{\theta JC}$ (Note 1)	$P_D$	43	W	
Pulsed Drain Current	$T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$	$I_{DM}$	235	A
Current Limited by Package	$T_A = 25^\circ\text{C}$	$I_{Dmax}$	100	A
Operating Junction and Storage Temperature	$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$	
Source Current (Body Diode)	$I_S$	39.2	A	
Drain to Source DV/DT	$dV/dt$	6.0	V/ns	

$V_{(BR)DSS}$	$R_{DS(ON) MAX}$	$I_D MAX$
30 V	3.8 m $\Omega$ @ 10 V	79 A
	4.8 m $\Omega$ @ 4.5 V	

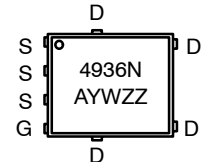


N-CHANNEL MOSFET



SO-8 FLAT LEAD  
CASE 488AA  
STYLE 1

### MARKING DIAGRAM



4936N = Specific Device Code  
A = Assembly Location  
Y = Year  
W = Work Week  
ZZ = Lot Traceability

### ORDERING INFORMATION

Device	Package	Shipping†
NTMFS4936NT1G	SO-8 FL (Pb-Free)	1500 / Tape & Reel
NTMFS4936NT3G	SO-8 FL (Pb-Free)	5000 / Tape & Reel
NTMFS4936NCT1G	SO-8 FL (Pb-Free)	1500 / Tape & Reel
NTMFS4936NCT3G	SO-8 FL (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.

# NTMFS4936N, NTMFS4936NC

## MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise stated)

Parameter	Symbol	Value	Unit
Single Pulse Drain-to-Source Avalanche Energy (T <sub>J</sub> = 25°C, V <sub>DD</sub> = 50 V, V <sub>GS</sub> = 10 V, I <sub>L</sub> = 44 A <sub>pk</sub> , L = 0.1 mH, R <sub>G</sub> = 25 Ω)	E <sub>AS</sub>	96.8	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	T <sub>L</sub>	260	°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.

- Surface-mounted on FR4 board using 1 sq-in pad, 1 oz Cu.
- Surface-mounted on FR4 board using the minimum recommended pad size.

## THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case (Drain)	R <sub>θJC</sub>	2.9	°C/W
Junction-to-Ambient – Steady State (Note 3)	R <sub>θJA</sub>	47.7	
Junction-to-Ambient – Steady State (Note 4)	R <sub>θJA</sub>	135.2	
Junction-to-Ambient – (t ≤ 10 s) (Note 3)	R <sub>θJA</sub>	14.8	

- Surface-mounted on FR4 board using 1 sq-in pad, 1 oz Cu.
- Surface-mounted on FR4 board using the minimum recommended pad size.

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	30			V
Drain-to-Source Breakdown Voltage (transient)	V <sub>(BR)DSSst</sub>	V <sub>GS</sub> = 0 V, I <sub>D(aval)</sub> = 18.5 A, T <sub>case</sub> = 25°C, t <sub>transient</sub> = 100 ns	34			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> /T <sub>J</sub>			15		mV/°C
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 24 V	T <sub>J</sub> = 25°C		1.0	μA
			T <sub>J</sub> = 125°C		10	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V			±100	nA

## ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	1.2	1.6	2.2	V
Negative Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>			4.0		mV/°C
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 30 A	2.9	3.8	mΩ
			I <sub>D</sub> = 15 A	2.9		
		V <sub>GS</sub> = 4.5 V	I <sub>D</sub> = 30 A	3.9	4.8	
			I <sub>D</sub> = 15 A	3.9		
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = 1.5 V, I <sub>D</sub> = 15 A		50		S

## CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1 MHz, V <sub>DS</sub> = 15 V		3044		pF
Output Capacitance	C <sub>OSS</sub>			1014		
Reverse Transfer Capacitance	C <sub>RSS</sub>			39		
Capacitance Ratio	C <sub>RSS</sub> /C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 15 V, f = 1 MHz		0.013	0.026	

- Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
- Switching characteristics are independent of operating junction temperatures.

# NTMFS4936N, NTMFS4936NC

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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### CHARGES, CAPACITANCES & GATE RESISTANCE

Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$		19		nC
Threshold Gate Charge	$Q_{G(TH)}$			4.6		
Gate-to-Source Charge	$Q_{GS}$			9.2		
Gate-to-Drain Charge	$Q_{GD}$			2.4		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$		43		nC

### SWITCHING CHARACTERISTICS (Note 6)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\ \Omega$		15.5		ns
Rise Time	$t_r$			20.6		
Turn-Off Delay Time	$t_{d(OFF)}$			24.6		
Fall Time	$t_f$			7.0		
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\ \Omega$		10.4		ns
Rise Time	$t_r$			19		
Turn-Off Delay Time	$t_{d(OFF)}$			29		
Fall Time	$t_f$			8.0		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 30\text{ A}$	$T_J = 25^\circ\text{C}$		0.8	1.1	V
			$T_J = 125^\circ\text{C}$		0.65		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s}, I_S = 30\text{ A}$			39		ns
Charge Time	$t_a$				21.5		
Discharge Time	$t_b$				17.5		
Reverse Recovery Charge	$Q_{RR}$				36		

### PACKAGE PARASITIC VALUES

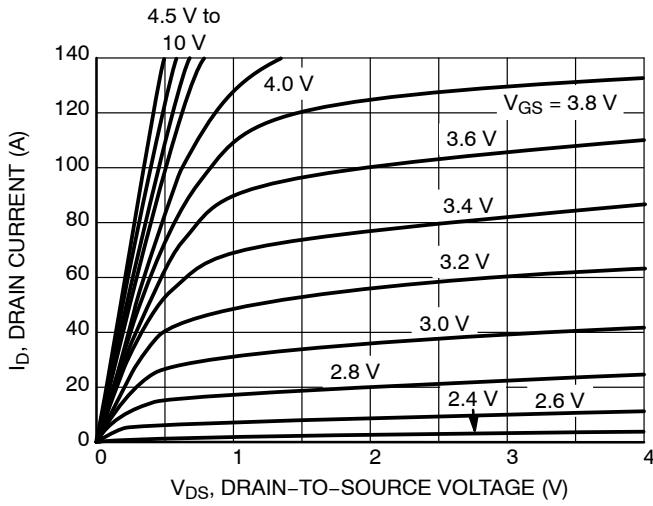
Source Inductance	$L_S$	$T_A = 25^\circ\text{C}$		0.65		nH
Drain Inductance	$L_D$			0.005		nH
Gate Inductance	$L_G$			1.84		nH
Gate Resistance	$R_G$			1.1	2.0	$\Omega$

5. Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

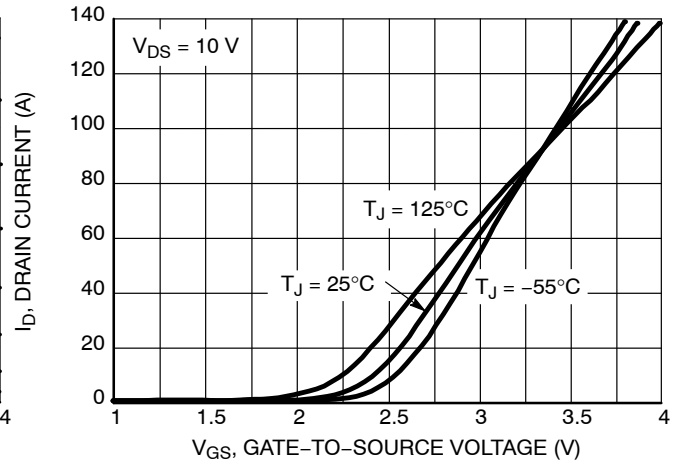
6. Switching characteristics are independent of operating junction temperatures.

# NTMFS4936N, NTMFS4936NC

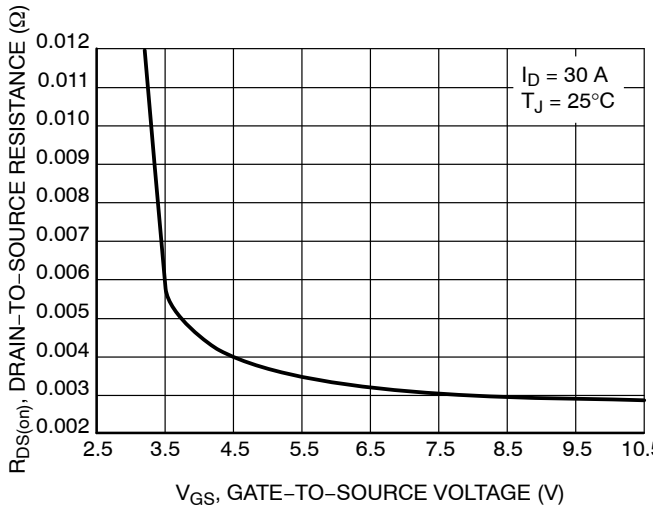
## TYPICAL CHARACTERISTICS



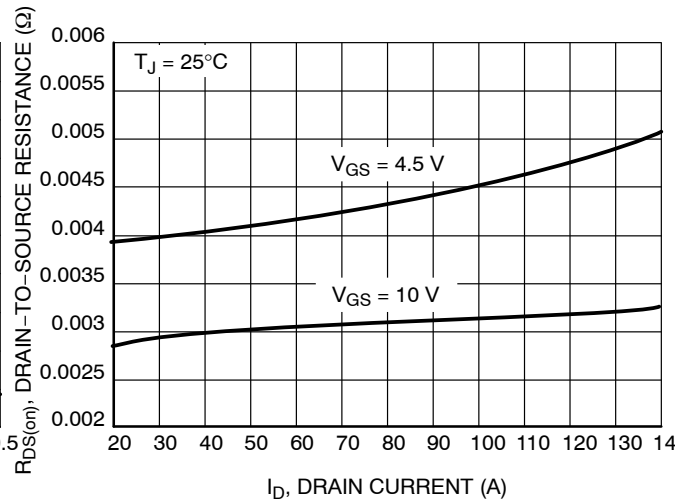
**Figure 1. On-Region Characteristics**



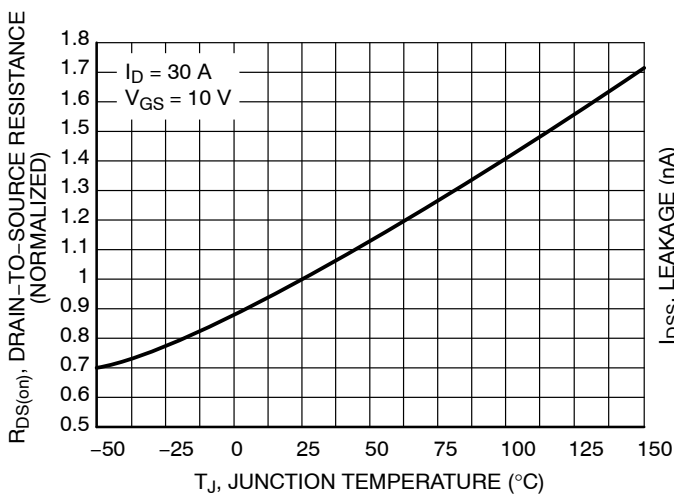
**Figure 2. Transfer Characteristics**



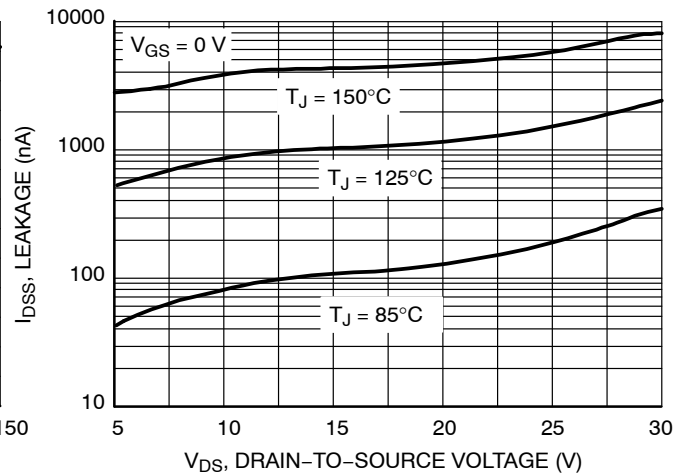
**Figure 3. On-Resistance vs. Gate-to-Source Voltage**



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



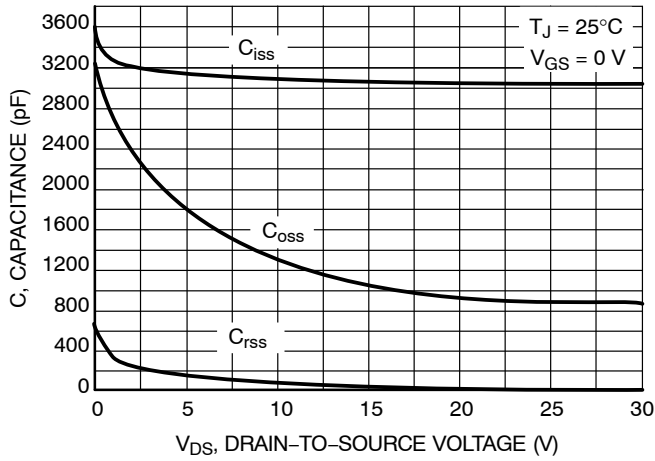
**Figure 5. On-Resistance Variation with Temperature**



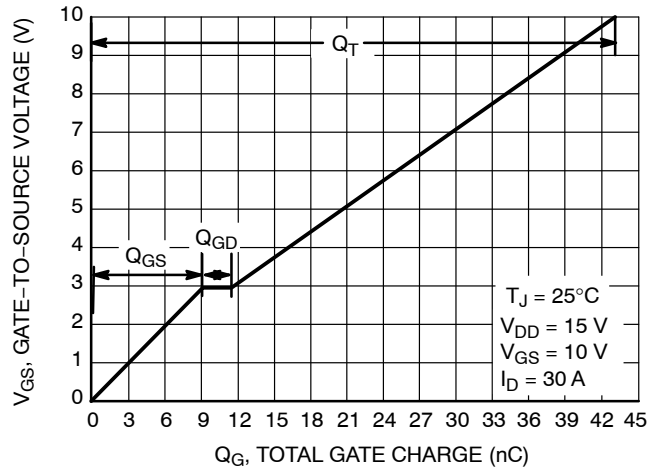
**Figure 6. Drain-to-Source Leakage Current vs. Voltage**

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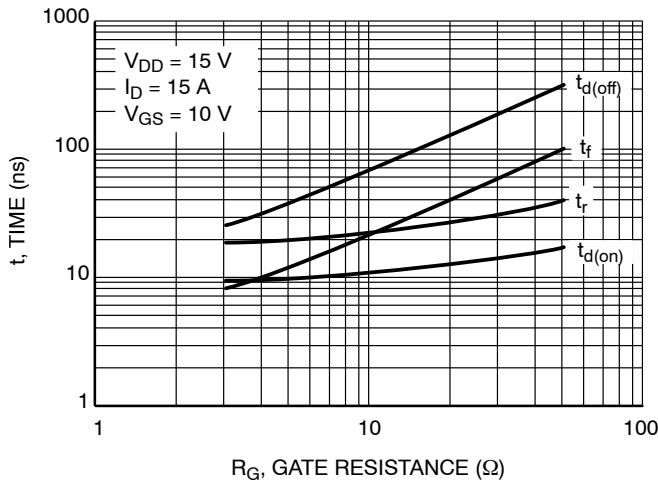
## TYPICAL CHARACTERISTICS



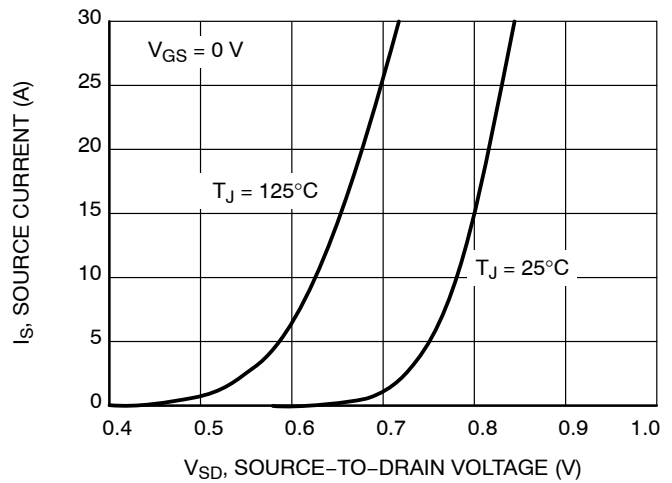
**Figure 7. Capacitance Variation**



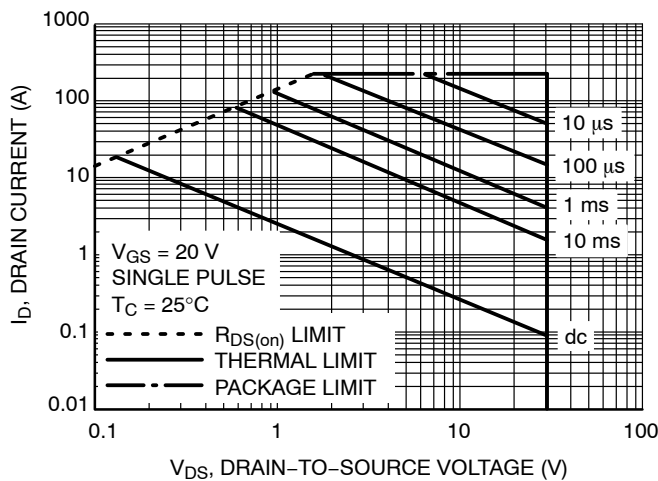
**Figure 8. Gate-To-Source and Drain-To-Source Voltage vs. Total Charge**



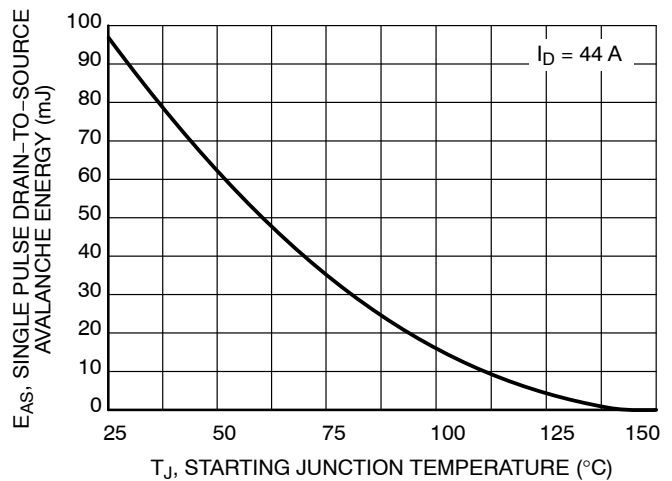
**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**



**Figure 10. Diode Forward Voltage vs. Current**



**Figure 11. Maximum Rated Forward Biased Safe Operating Area**



**Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature**

# NTMFS4936N, NTMFS4936NC

## TYPICAL CHARACTERISTICS

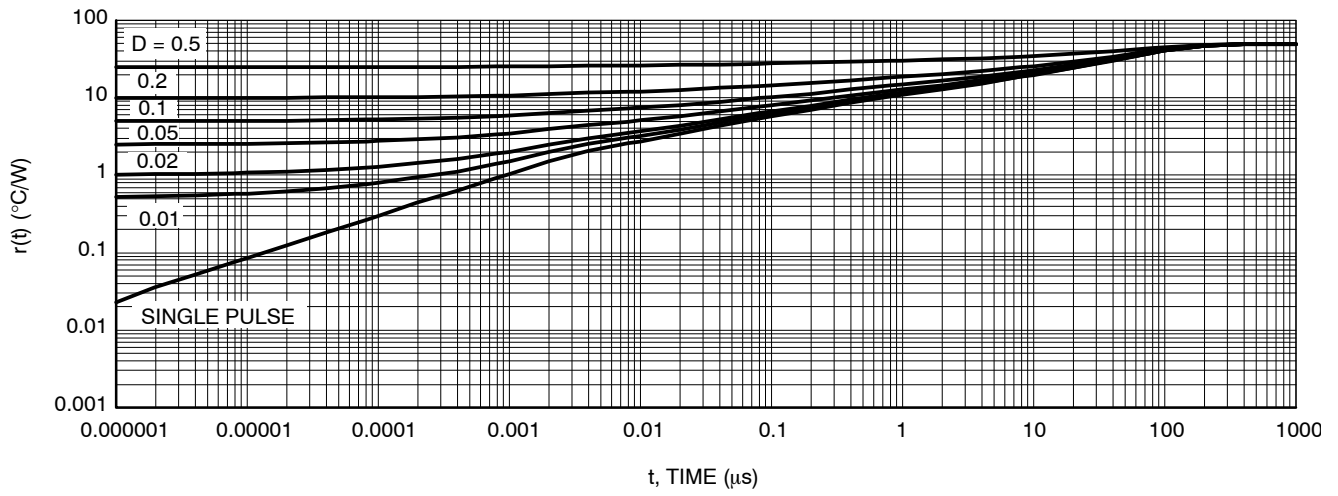


Figure 13. Thermal Response

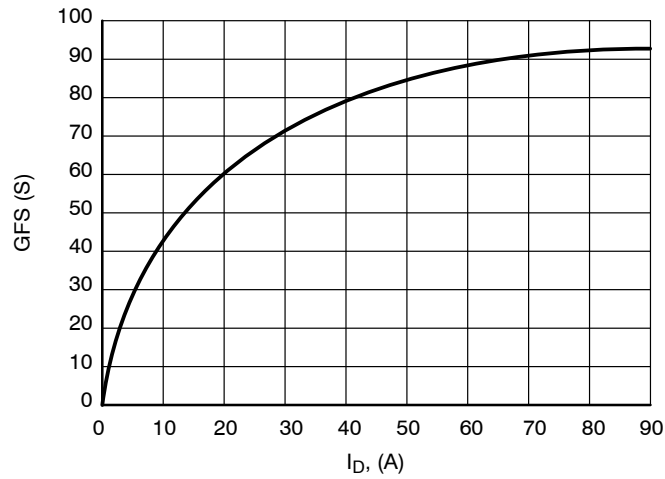
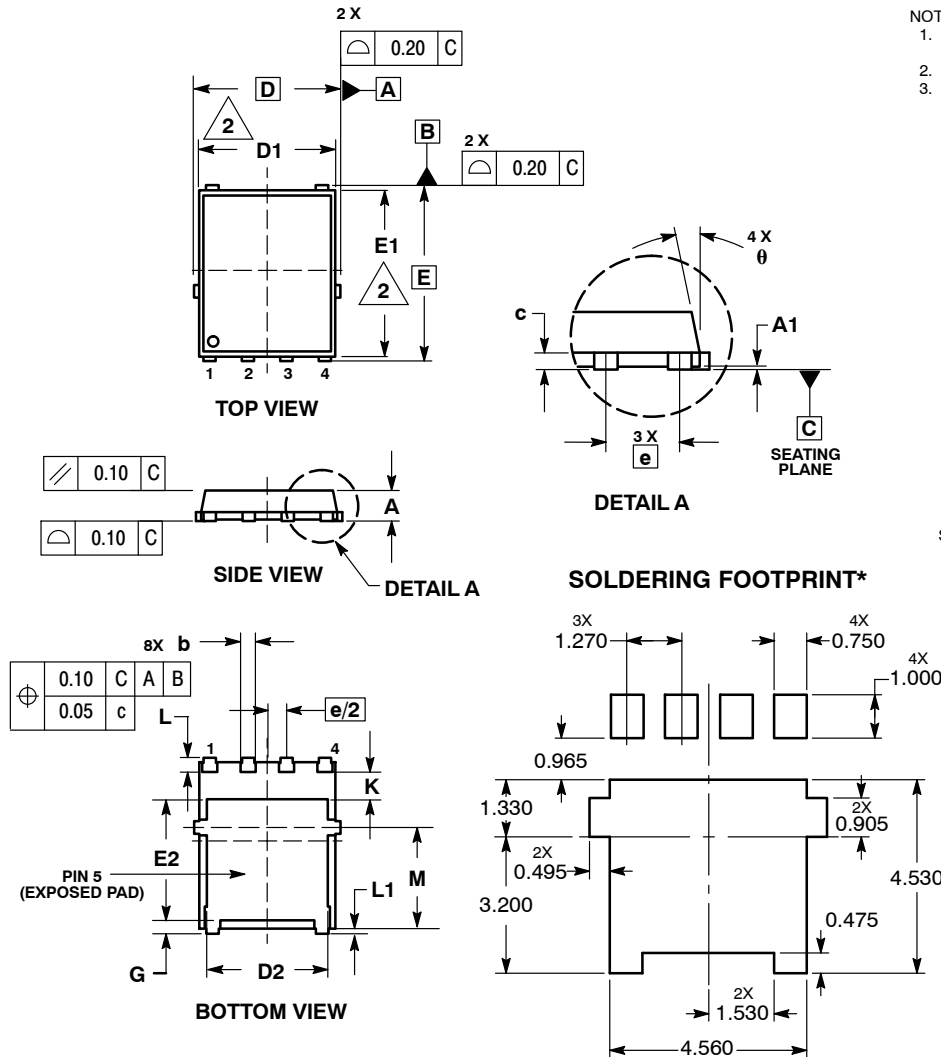


Figure 14. GFS vs.  $I_D$

# NTMFS4936N, NTMFS4936NC

## PACKAGE DIMENSIONS

DFN5 5x6, 1.27P  
(SO-8FL)  
CASE 488AA  
ISSUE G



**NOTES:**

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	5.15 BSC		
D1	4.50	4.90	5.10
D2	3.50	---	4.22
E	6.15 BSC		
E1	5.50	5.80	6.10
E2	3.45	---	4.30
e	1.27 BSC		
G	0.51	0.61	0.71
K	1.20	1.35	1.50
L	0.51	0.61	0.71
L1	0.05	0.17	0.20
M	3.00	3.40	3.80
θ	0°	---	12°

**STYLE 1:**

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

\*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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