

NTMFS4946N

Power MOSFET

30 V, 100 A, Single N-Channel, SO-8 FL

Features

- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- Thermally Enhanced SO8 Package
- These are Pb-Free Device

Applications

- CPU Power Delivery
- DC-DC Converters
- Low Side Switching

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}	± 20	V
Continuous Drain Current $R_{\theta JA}$ (Note 1)	$T_A = 25^\circ\text{C}$	I_D	20.3	A
	$T_A = 85^\circ\text{C}$		14.6	
Power Dissipation $R_{\theta JA}$ (Note 1)	$T_A = 25^\circ\text{C}$	P_D	2.25	W
	$T_A = 85^\circ\text{C}$		32.8	A
Continuous Drain Current $R_{\theta JA} \leq 10$ sec	$T_A = 25^\circ\text{C}$	I_D	23.7	
	$T_A = 85^\circ\text{C}$		5.90	W
Power Dissipation $R_{\theta JA}, t \leq 10$ sec	$T_A = 25^\circ\text{C}$	I_D	12.7	A
	$T_A = 85^\circ\text{C}$		9.2	
Continuous Drain Current $R_{\theta JA}$ (Note 2)	$T_A = 25^\circ\text{C}$	P_D	0.89	W
	$T_A = 85^\circ\text{C}$		100	A
Power Dissipation $R_{\theta JA}$ (Note 2)	$T_A = 25^\circ\text{C}$	I_D	72	
	$T_A = 85^\circ\text{C}$		55.5	W
Pulsed Drain Current	$t_p = 10\mu\text{s}$	$T_A = 25^\circ\text{C}$	I_{DM}	200 A
Current limited by package		$T_A = 25^\circ\text{C}$	$I_{Dmaxpkg}$	100 A
Operating Junction and Storage Temperature		T_J, T_{STG}	-55 to +150	$^\circ\text{C}$
Source Current (Body Diode)		I_S	55	A
Drain to Source dV/dt		dV/dt	6	V/ns
Single Pulse Drain-to-Source Avalanche Energy ($V_{DD} = 50$ V, $V_{GS} = 10$ V, $I_L = 37 A_{pk}$, $L = 0.3$ mH, $R_G = 25 \Omega$)		EAS	205	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		T_L	260	$^\circ\text{C}$

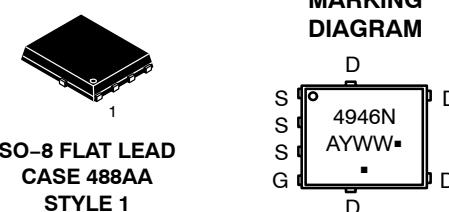
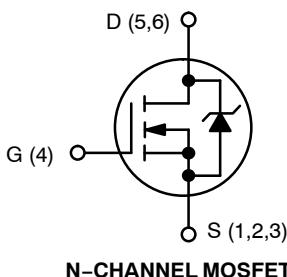
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.



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$V_{(BR)DSS}$	$R_{DS(ON) \text{ MAX}}$	$I_D \text{ MAX}$
30 V	3.4 m Ω @ 10 V	100 A
	5.1 m Ω @ 4.5 V	



A = Assembly Location
 Y = Year
 WW = Work Week
 ■ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping [†]
NTMFS4946NT1G	SO-8FL (Pb-Free)	1500 / Tape & Reel
NTMFS4946NT3G	SO-8FL (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.

*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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THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	2.25	$^{\circ}\text{C}/\text{W}$
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	55.6	
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	140.8	
Junction-to-Ambient – $t \leq 10$ sec	$R_{\theta JA}$	21.2	

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

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(\text{BR})\text{DSS}}$	$V_{\text{GS}} = 0 \text{ V}, I_D = 250 \mu\text{A}$	30			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(\text{BR})\text{DSS}}/T_J$			25		$\text{mV}/^{\circ}\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{\text{GS}} = 0 \text{ V}, V_{\text{DS}} = 24 \text{ V}$	$T_J = 25^{\circ}\text{C}$		1	μA
			$T_J = 125^{\circ}\text{C}$		10	
Gate-to-Source Leakage Current	I_{GSS}	$V_{\text{DS}} = 0 \text{ V}, V_{\text{GS}} = \pm 20 \text{ V}$			± 100	nA

ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{\text{GS(TH)}}$	$V_{\text{GS}} = V_{\text{DS}}, I_D = 250 \mu\text{A}$	1.45	1.8	2.5	V
Negative Threshold Temperature Coefficient	$V_{\text{GS(TH)}}/T_J$			5.2		$\text{mV}/^{\circ}\text{C}$
Drain-to-Source On Resistance	$R_{\text{DS(on)}}$	$V_{\text{GS}} = 10 \text{ V to } 11.5 \text{ V}$	$I_D = 30 \text{ A}$		2.5	3.4
			$I_D = 15 \text{ A}$		2.4	
		$V_{\text{GS}} = 4.5 \text{ V}$	$I_D = 30 \text{ A}$		3.8	5.1
			$I_D = 15 \text{ A}$		3.8	
Forward Transconductance	g_{FS}	$V_{\text{DS}} = 1.5 \text{ V}, I_D = 30 \text{ A}$		85		S

CHARGES AND CAPACITANCES

Input Capacitance	C_{iss}	$V_{\text{GS}} = 0 \text{ V}, f = 1 \text{ MHz}, V_{\text{DS}} = 12 \text{ V}$		3250		pF
Output Capacitance	C_{oss}			562		
Reverse Transfer Capacitance	C_{rss}			289		
Total Gate Charge	$Q_{\text{G(TOT)}}$	$V_{\text{GS}} = 4.5 \text{ V}, V_{\text{DS}} = 15 \text{ V}; I_D = 30 \text{ A}$		21.8	32	nC
	$Q_{\text{G(TH)}}$			3.2		
	Q_{GS}			8.1		
	Q_{GD}			7.4		
Total Gate Charge	$Q_{\text{G(TOT)}}$	$V_{\text{GS}} = 11.5 \text{ V}, V_{\text{DS}} = 15 \text{ V}, I_D = 30 \text{ A}$		53		nC

SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	$t_{\text{d(ON)}}$	$V_{\text{GS}} = 4.5 \text{ V}, V_{\text{DS}} = 15 \text{ V}, I_D = 15 \text{ A}, R_G = 3.0 \Omega$		18.9		ns
Rise Time	t_r			34		
Turn-Off Delay Time	$t_{\text{d(OFF)}}$			24.6		
Fall Time	t_f			9.4		

3. Pulse Test: pulse width $\leq 300 \mu\text{s}$, duty cycle $\leq 2\%$.
4. Switching characteristics are independent of operating junction temperatures.

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS (Note 4)						
Turn-On Delay Time	$t_{d(\text{ON})}$	$V_{GS} = 11.5 \text{ V}$, $V_{DS} = 15 \text{ V}$, $I_D = 15 \text{ A}$, $R_G = 3.0 \Omega$		10.7		ns
Rise Time	t_r			18.9		
Turn-Off Delay Time	$t_{d(\text{OFF})}$			34.2		
Fall Time	t_f			7.1		
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	1.0	V
			$T_J = 125^\circ\text{C}$	0.66		
Reverse Recovery Time	t_{RR}	$V_{GS} = 0 \text{ V}$, $dI_S/dt = 100 \text{ A}/\mu\text{s}$, $I_S = 30 \text{ A}$		21.6		ns
Charge Time	t_a			11.4		
Discharge Time	t_b			10.2		
Reverse Recovery Charge	Q_{RR}			8.5		nC
PACKAGE PARASITIC VALUES						
Source Inductance	L_S	$T_A = 25^\circ\text{C}$		0.65		nH
Drain Inductance	L_D			0.005		
Gate Inductance	L_G			1.84		
Gate Resistance	R_G		0.5	1.4	2.2	Ω

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

4. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

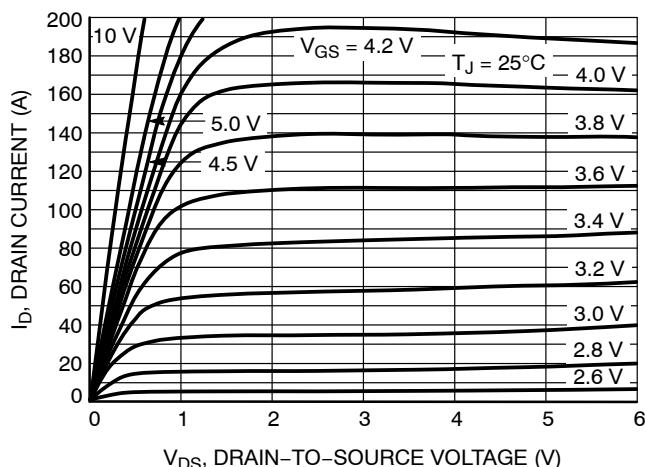


Figure 1. On-Region Characteristics

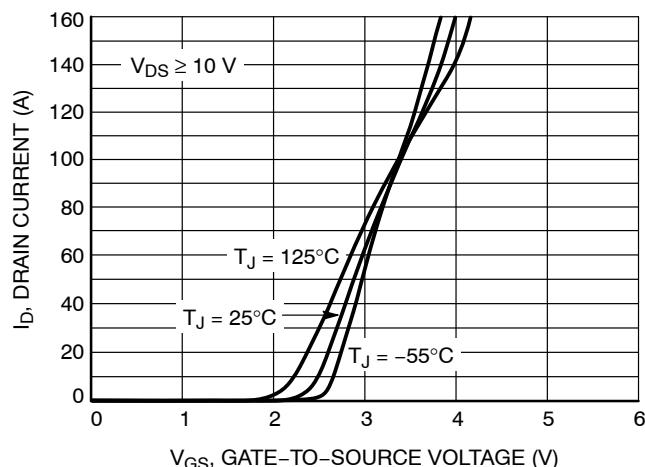


Figure 2. Transfer Characteristics

TYPICAL CHARACTERISTICS

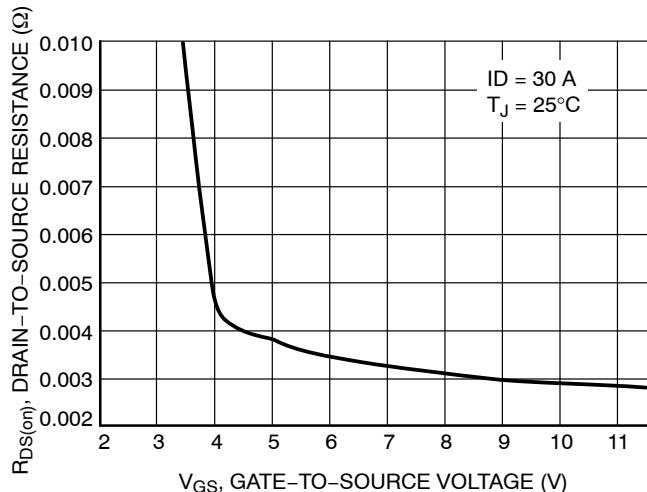


Figure 3. On-Resistance vs. Gate-to-Source Voltage

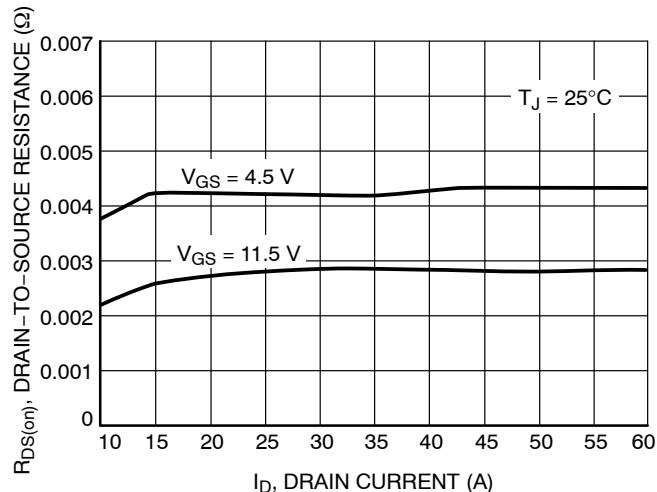


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

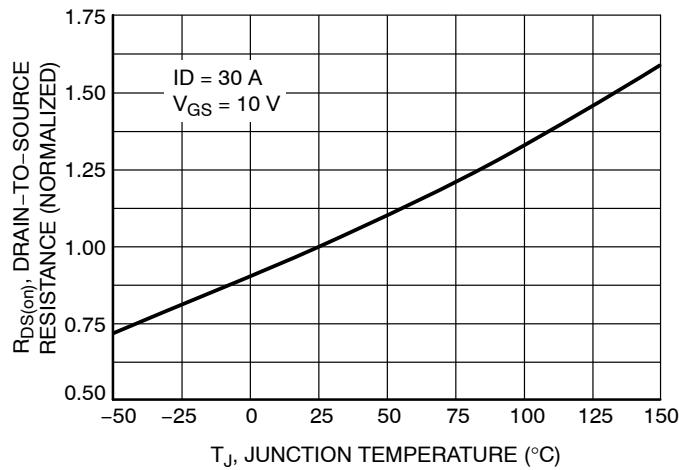


Figure 5. On-Resistance Variation with Temperature

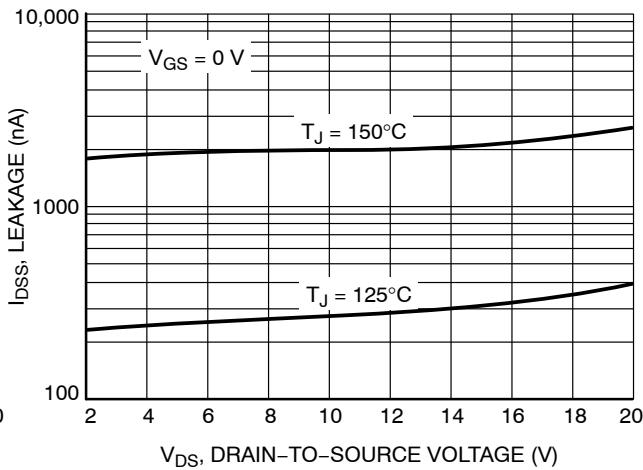


Figure 6. Drain-to-Source Leakage Current vs. Voltage

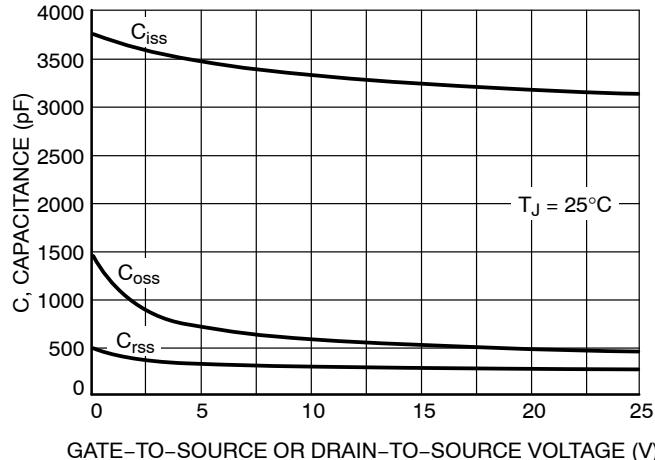


Figure 7. Capacitance Variation

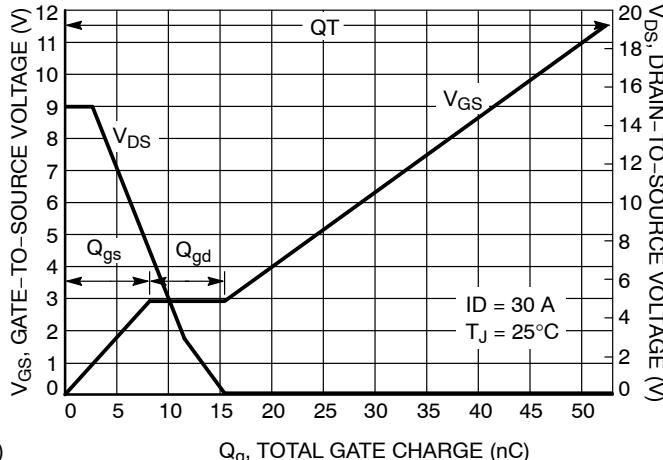


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

TYPICAL CHARACTERISTICS

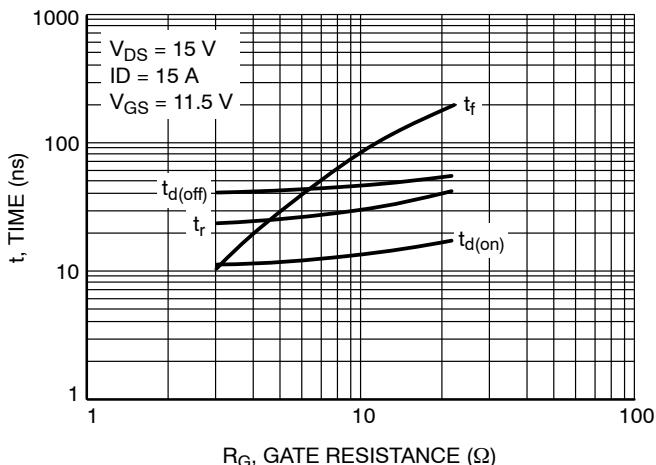


Figure 9. Resistive Switching Time Variation
vs. Gate Resistance

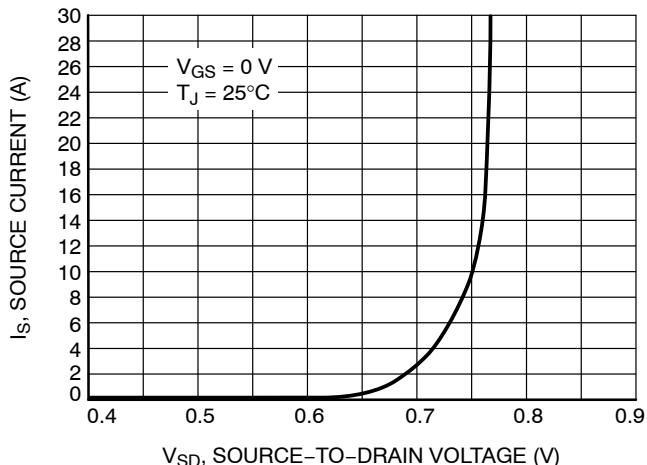


Figure 10. Diode Forward Voltage vs. Current

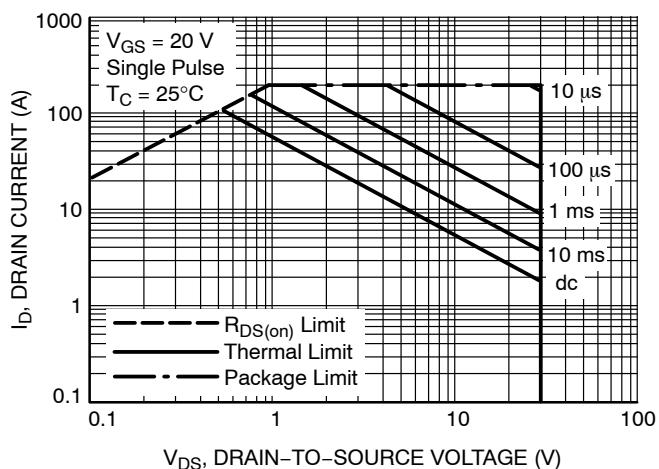


Figure 11. Maximum Rated Forward Biased
Safe Operating Area

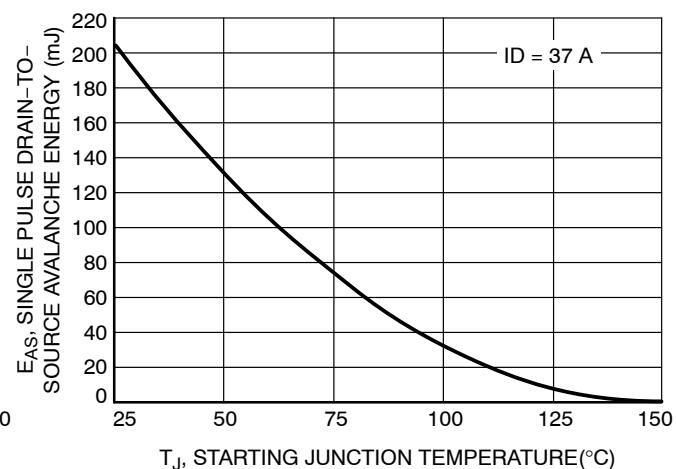


Figure 12. Maximum Avalanche Energy vs.
Starting Junction Temperature

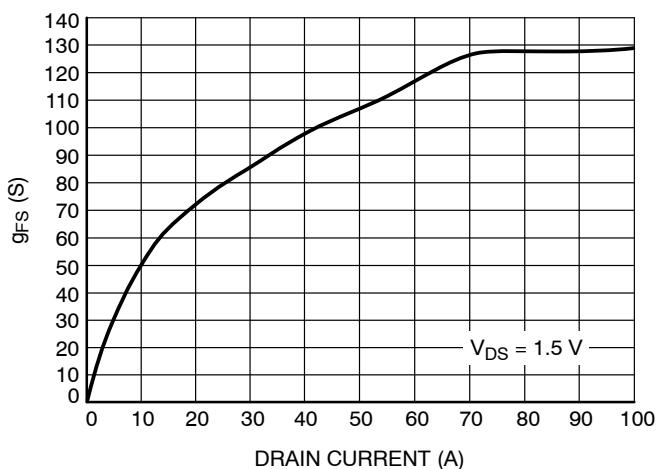


Figure 13. g_{FS} vs. Drain Current

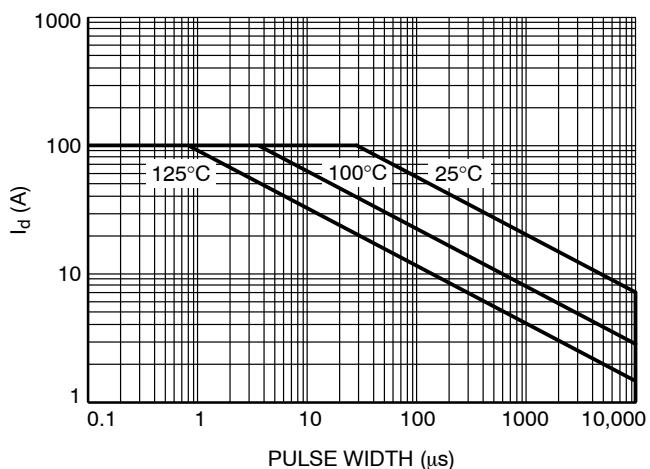


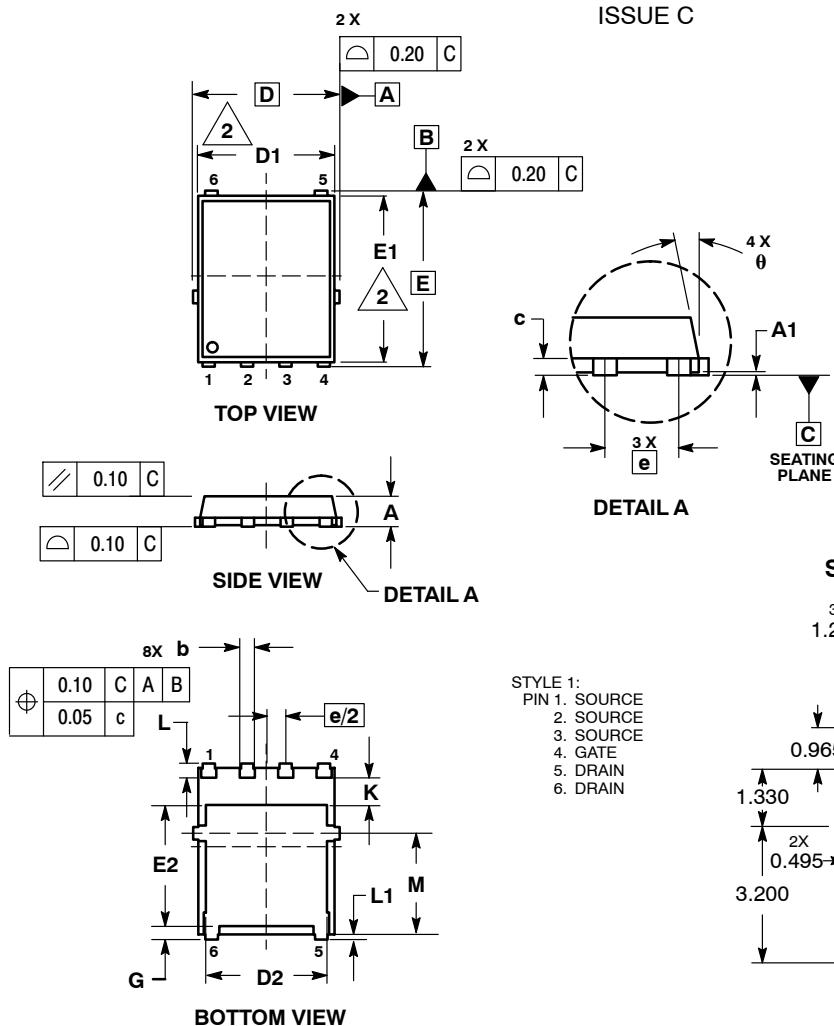
Figure 14. I_d vs. Pulse Width

PACKAGE DIMENSIONS

DFN6 5x6, 1.27P (SO8 FL)

CASE 488AA-01

ISSUE C

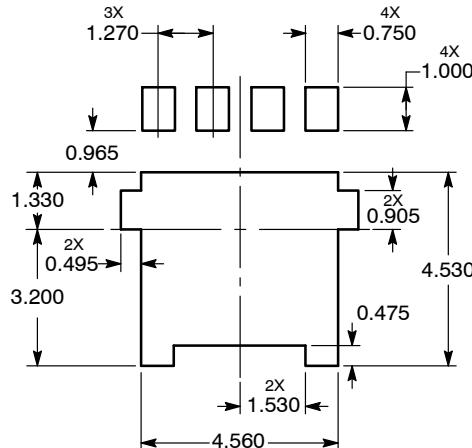


NOTES:

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	0.51	---	---
L	0.51	0.61	0.71
L1	0.05	0.17	0.20
M	3.00	3.40	3.80
θ	0 °	---	12 °

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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