

# NTMFS4841NH

## Power MOSFET

### 30 V, 59 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
- Low  $R_G$
- These are Pb-Free Device\*

#### 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	
Steady State	Continuous Drain Current $R_{\theta JA}$ (Note 1)	$T_A = 25^\circ\text{C}$	$I_D$ 13.5	A
		$T_A = 85^\circ\text{C}$	9.7	
	Power Dissipation $R_{\theta JA}$ (Note 1)	$T_A = 25^\circ\text{C}$	$P_D$ 2.16	W
		$T_A = 85^\circ\text{C}$	1.1	
	Continuous Drain Current $R_{\theta JA} \leq 10$ s	$T_A = 25^\circ\text{C}$	$I_D$ 21.8	A
		$T_A = 85^\circ\text{C}$	15.7	
	Power Dissipation $R_{\theta JA} \leq 10$ s	$T_A = 25^\circ\text{C}$	$P_D$ 5.7	W
		$T_A = 85^\circ\text{C}$	2.9	
	Continuous Drain Current $R_{\theta JA}$ (Note 2)	$T_A = 25^\circ\text{C}$	$I_D$ 8.6	A
		$T_A = 85^\circ\text{C}$	6.2	
Power Dissipation $R_{\theta JA}$ (Note 2)	$T_A = 25^\circ\text{C}$	$P_D$ 0.87	W	
	$T_A = 85^\circ\text{C}$	0.45		
Continuous Drain Current $R_{\theta JC}$ (Note 1)	$T_C = 25^\circ\text{C}$	$I_D$ 59	A	
	$T_C = 85^\circ\text{C}$	42.5		
Power Dissipation $R_{\theta JC}$ (Note 1)	$T_C = 25^\circ\text{C}$	$P_D$ 41.7	W	
	$T_C = 85^\circ\text{C}$	21.7		
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	$T_A = 25^\circ\text{C}$	$I_{DM}$ 177	A
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$
Source Current (Body Diode)		$I_S$	35	A
Drain to Source $dV/dt$		$dV/dt$	6	V/ns
Single Pulse Drain-to-Source Avalanche Energy ( $V_{DD} = 24$ V, $V_{GS} = 10$ V, $I_L = 25.6$ A, $L = 0.3$ mH, $R_G = 25 \Omega$ )		EAS	98	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.

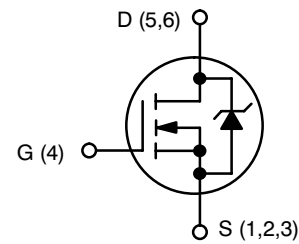
1. Surface-mounted on FR4 board using 1 sq-in pad, 1 oz Cu.
2. Surface-mounted on FR4 board using the minimum recommended pad size.



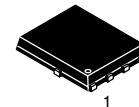
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$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	$I_D$ MAX
30 V	7.0 m $\Omega$ @ 10 V	59 A
	11.6 m $\Omega$ @ 4.5 V	

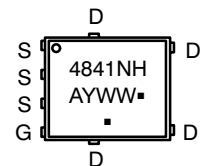


N-CHANNEL MOSFET



SO-8 FLAT LEAD  
CASE 488AA  
STYLE 1

#### MARKING DIAGRAM



A = Assembly Location  
Y = Year  
WW = Work Week  
▪ = Pb-Free Package  
(Note: Microdot may be in either location)

#### ORDERING INFORMATION

Device	Package	Shipping†
NTMFS4841NHT1G	SO-8FL (Pb-Free)	1500 / Tape & Reel
NTMFS4841NHT3G	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.

# NTMFS4841NH

## THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	3	°C/W
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	57.8	
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	143.5	
Junction-to-Ambient ( $t \leq 10$ s)	$R_{\theta JA}$	22.1	

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0$ V, $I_D = 250$ $\mu\text{A}$	30			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			28		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0$ V, $V_{DS} = 24$ V	$T_J = 25$ °C		1	$\mu\text{A}$
			$T_J = 125$ °C		10	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0$ V, $V_{GS} = \pm 20$ V			$\pm 100$	nA

## ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}$ , $I_D = 250$ $\mu\text{A}$	1.5	2.1	2.5	V	
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			5.6		mV/°C	
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10$ V to 11.5 V	$I_D = 30$ A		4.8	7.0	m $\Omega$
			$I_D = 15$ A		4.8		
		$V_{GS} = 4.5$ V	$I_D = 30$ A		8.8	11.6	
			$I_D = 15$ A		8.5		
Forward Transconductance	$g_{FS}$	$V_{DS} = 1.5$ V, $I_D = 50$ A		57		S	

## CHARGES AND CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{GS} = 0$ V, $f = 1$ MHz, $V_{DS} = 12$ V		1565	2113	pF
Output Capacitance	$C_{OSS}$			325	439	
Reverse Transfer Capacitance	$C_{RSS}$			173	268	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5$ V, $V_{DS} = 15$ V; $I_D = 30$ A		11.3	16.7	nC
Threshold Gate Charge	$Q_{G(TH)}$			1.4	2.1	
Gate-to-Source Charge	$Q_{GS}$			5.3	7.9	
Gate-to-Drain Charge	$Q_{GD}$			4.5	6.8	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 11.5$ V, $V_{DS} = 15$ V, $I_D = 30$ A		24.4	33	nC

## SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5$ V, $V_{DS} = 15$ V, $I_D = 15$ A, $R_G = 3.0$ $\Omega$		12.1	18.1	ns
Rise Time	$t_r$			23.3	34.9	
Turn-Off Delay Time	$t_{d(OFF)}$			14.1	21.1	
Fall Time	$t_f$			4.9	7.3	
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 11.5$ V, $V_{DS} = 15$ V, $I_D = 15$ A, $R_G = 3.0$ $\Omega$		7.2	10.7	ns
Rise Time	$t_r$			20.6	30.9	
Turn-Off Delay Time	$t_{d(OFF)}$			21.9	32.9	
Fall Time	$t_f$			2.9	4.4	

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
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### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V},$ $I_S = 30\text{ A}$	$T_J = 25^\circ\text{C}$		0.86	1.2	V
			$T_J = 125^\circ\text{C}$		0.71		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s},$ $I_S = 30\text{ A}$			18.8		ns
Charge Time	$t_a$				11.4		
Discharge Time	$t_b$				7.4		
Reverse Recovery Charge	$Q_{RR}$				6.7		

### PACKAGE PARASITIC VALUES

Source Inductance	$L_S$	$T_A = 25^\circ\text{C}$		0.93		nH
Drain Inductance	$L_D$			0.005		
Gate Inductance	$L_G$			1.84		
Gate Resistance	$R_G$			0.90		$\Omega$

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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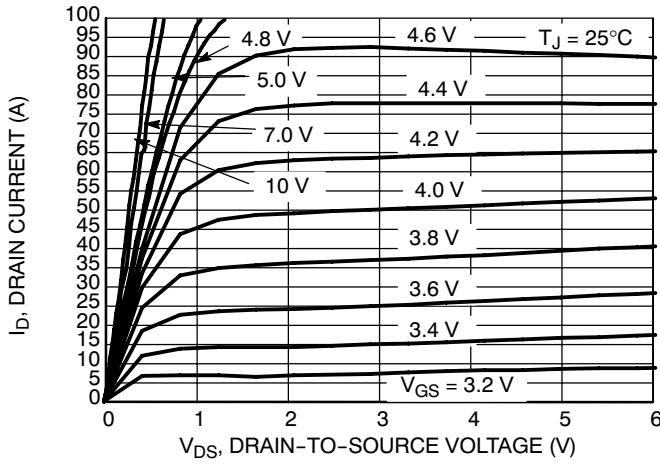


Figure 1. On-Region Characteristics

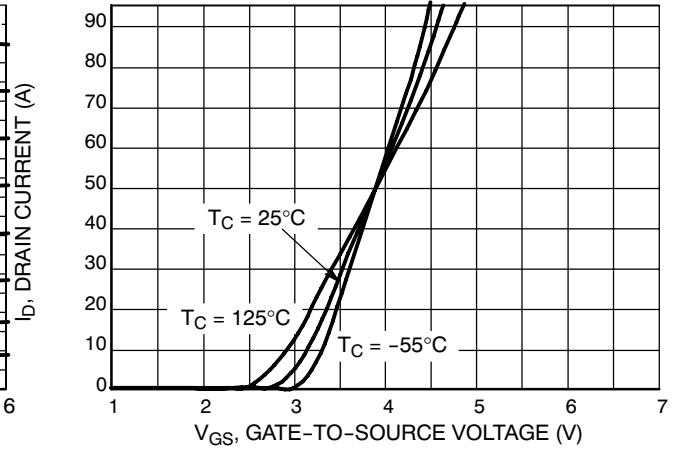


Figure 2. Transfer Characteristics

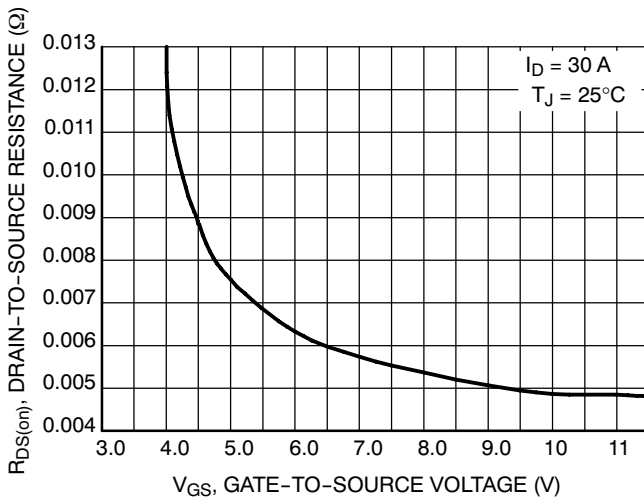


Figure 3. On-Resistance versus Gate-to-Source Voltage

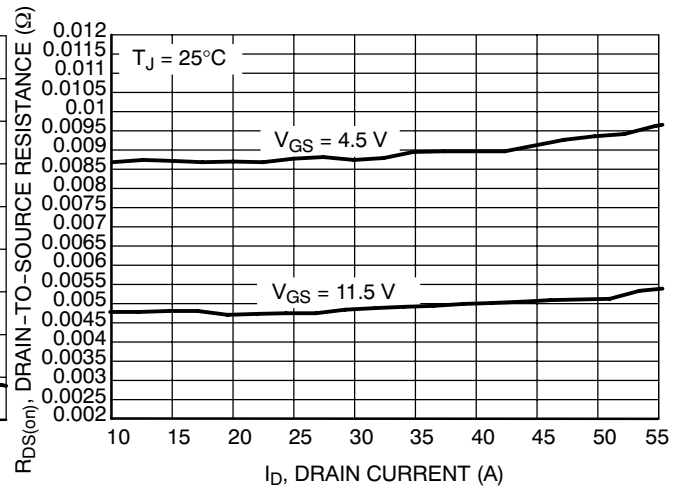


Figure 4. On-Resistance versus Drain Current and Gate Voltage

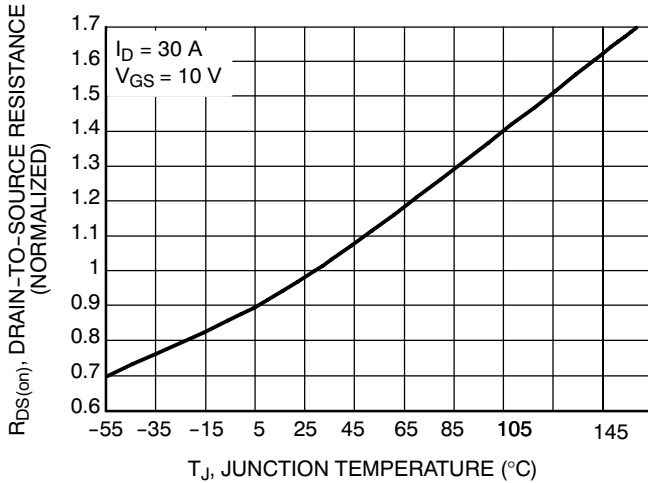


Figure 5. On-Resistance Variation with Temperature

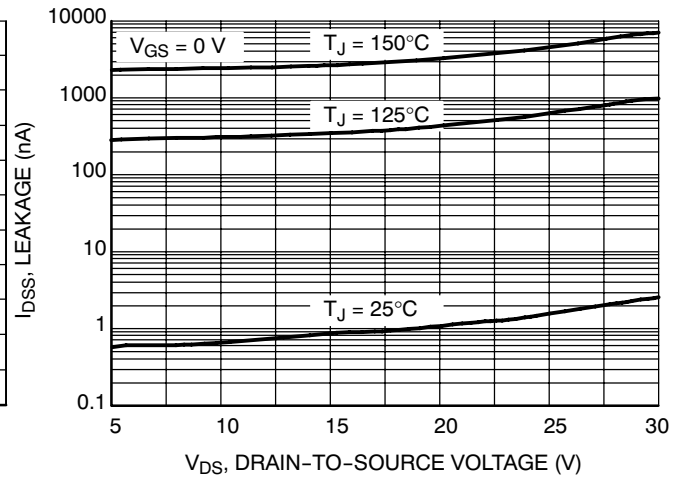
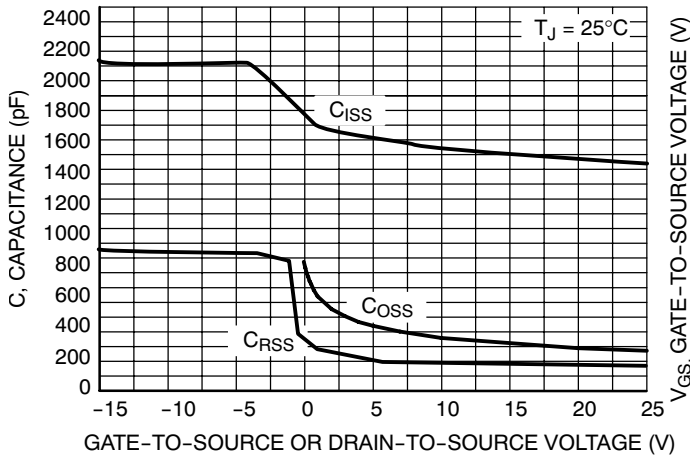
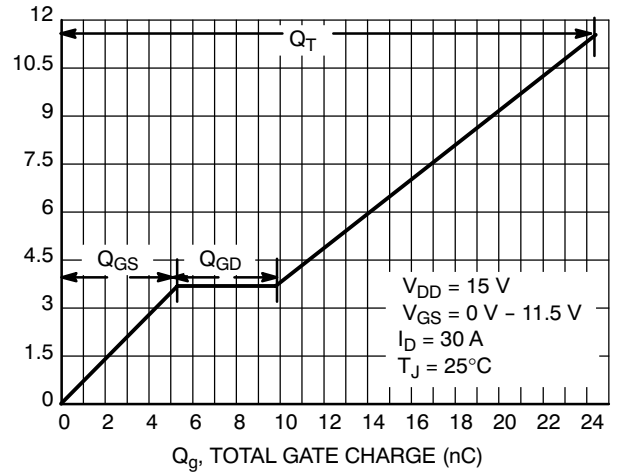


Figure 6. Drain-to-Source Leakage Current versus Voltage

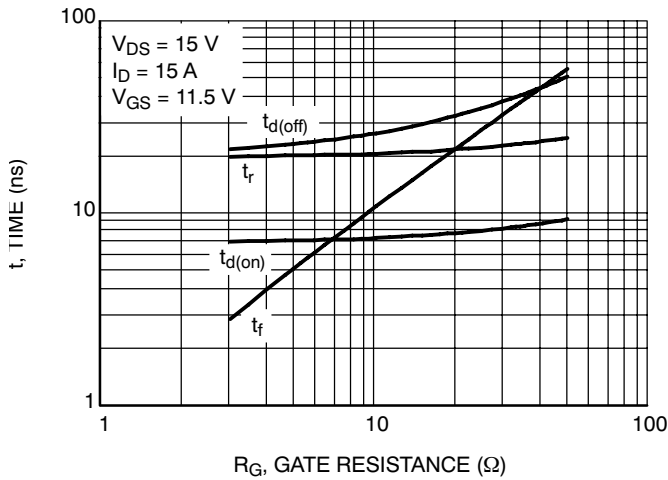
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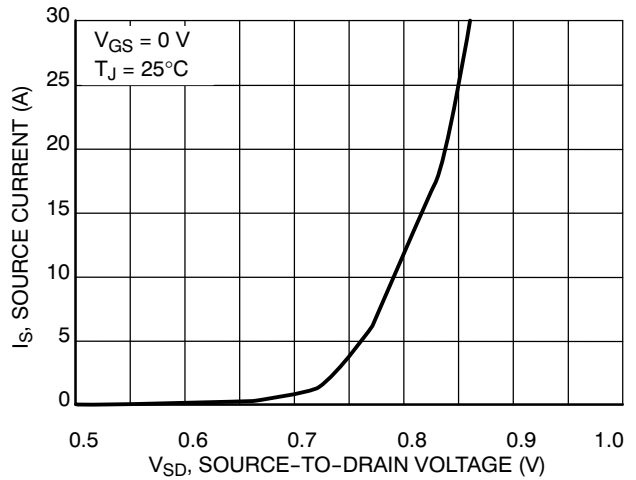
**Figure 7. Capacitance Variation**



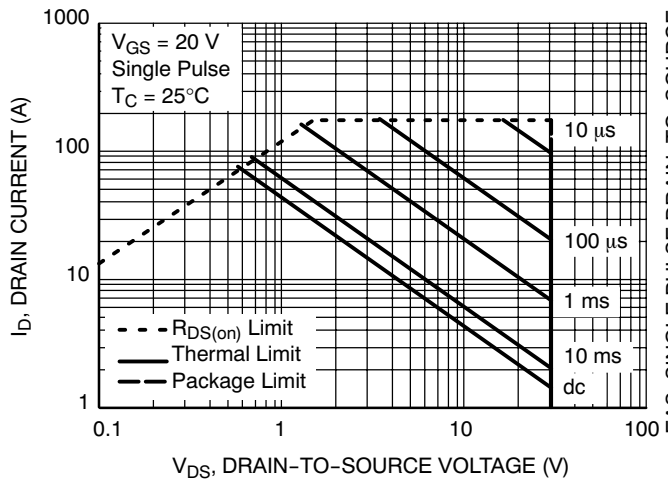
**Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Gate Charge**



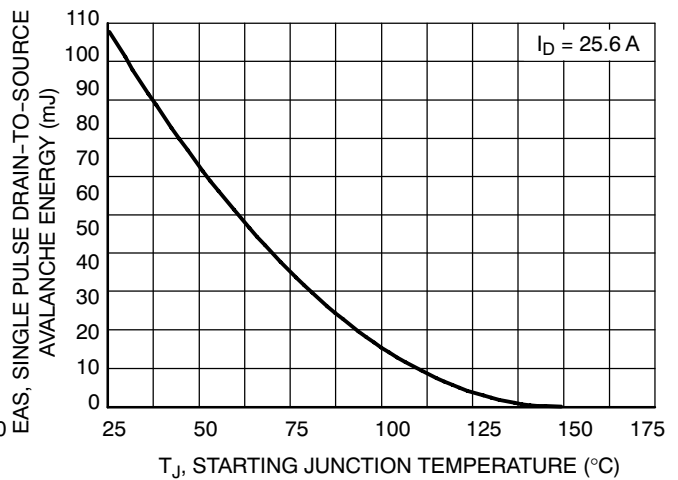
**Figure 9. Resistive Switching Time Variation versus Gate Resistance**



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



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



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

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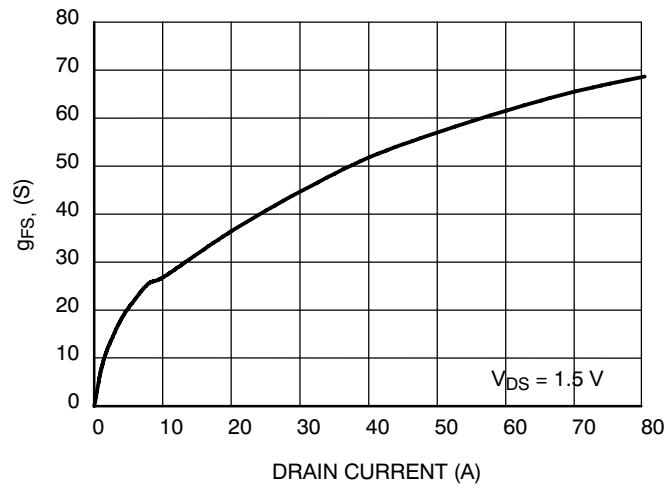
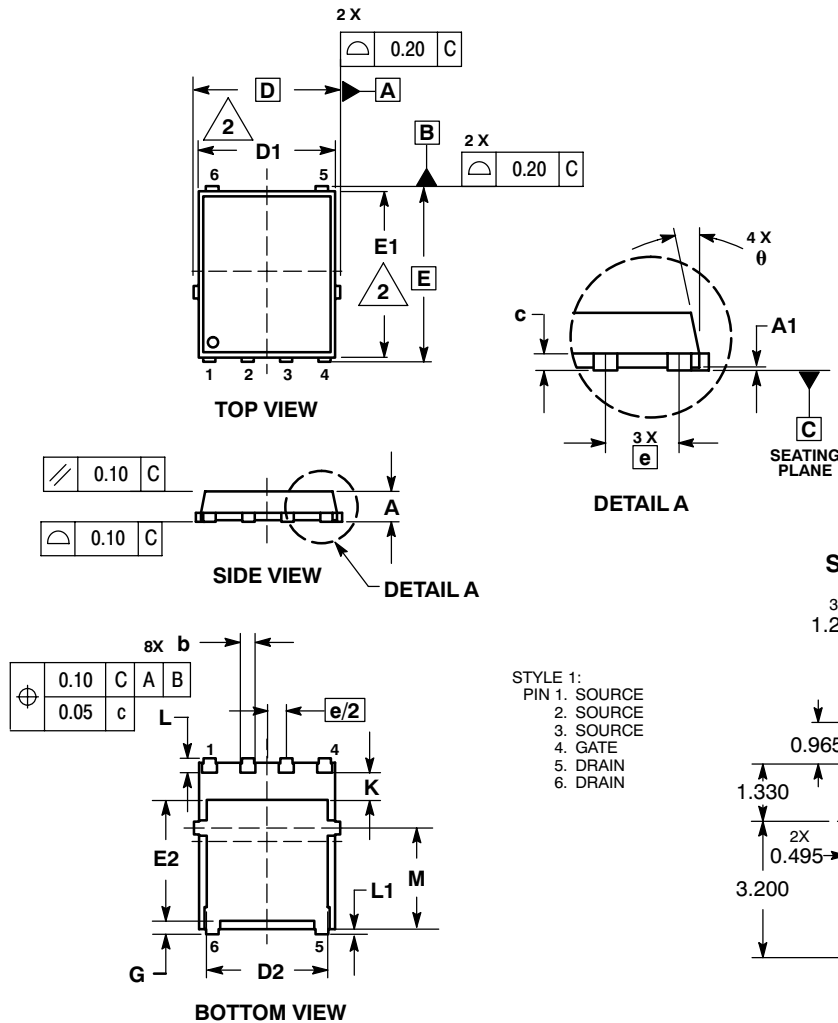


Figure 13.  $G_{FS}$  versus Drain Current

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## PACKAGE DIMENSIONS

DFN6 5x6, 1.27P (SO8 FL)  
CASE 488AA-01  
ISSUE C

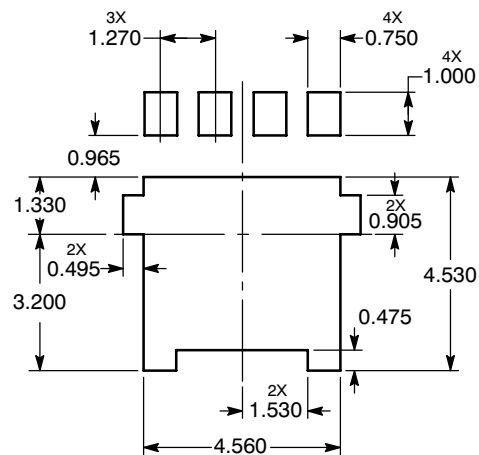


**NOTES:**

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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