# **Power MOSFET**

# 30 V, 46 A, Single N-Channel, SO-8 FL

### **Features**

- Low R<sub>DS(on)</sub> to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant

## **Applications**

- CPU Power Delivery
- DC-DC Converters

### **MAXIMUM RATINGS** (T<sub>.1</sub> = 25°C unless otherwise stated)

Para	meter		Symbol	Value	Unit
Drain-to-Source Volt	age		$V_{DSS}$	30	V
Gate-to-Source Volta	age		$V_{GS}$	±20	V
Continuous Drain Current R <sub>0JA</sub>		T <sub>A</sub> = 25°C	I <sub>D</sub>	15.0	Α
(Note 1)		T <sub>A</sub> = 80°C		11.2	
Power Dissipation $R_{\theta JA}$ (Note 1)		T <sub>A</sub> = 25°C	P <sub>D</sub>	2.49	W
Continuous Drain		T <sub>A</sub> = 25°C	I <sub>D</sub>	22.5	Α
Current $R_{\theta JA} \le 10 \text{ s}$ (Note 1)		T <sub>A</sub> = 80°C		16.8	
Power Dissipation $R_{\theta JA} \le 10 \text{ s (Note 1)}$	Steady	T <sub>A</sub> = 25°C	P <sub>D</sub>	5.6	W
Continuous Drain	State	T <sub>A</sub> = 25°C	I <sub>D</sub>	8.2	Α
Current R <sub>θJA</sub> (Note 2)		T <sub>A</sub> = 80°C		6.2	
Power Dissipation $R_{\theta JA}$ (Note 2)		T <sub>A</sub> = 25°C	P <sub>D</sub>	0.75	W
Continuous Drain		T <sub>C</sub> = 25°C	I <sub>D</sub>	46	Α
Current R <sub>θJC</sub> (Note 1)		T <sub>C</sub> =80°C		34	
Power Dissipation $R_{\theta JC}$ (Note 1)		T <sub>C</sub> = 25°C	P <sub>D</sub>	23.6	W
Pulsed Drain Current	$T_A = 25^{\circ}$	°C, t <sub>p</sub> = 10 μs	I <sub>DM</sub>	132	Α
Current Limited by Pa	ickage	$T_A = 25^{\circ}C$	I <sub>Dmax</sub>	80	Α
Operating Junction ar Temperature	nd Storage		T <sub>J</sub> , T <sub>STG</sub>	–55 to +150	°C
Source Current (Body Diode)		I <sub>S</sub>	21	Α	
Drain to Source dV/dt			dV/d <sub>t</sub>	7.0	V/ns
Single Pulse Drain–to–Source Avalanche Energy ( $T_J = 25^{\circ}C$ , $V_{GS} = 10$ V, $I_L = 25$ A <sub>pk</sub> , $L = 0.1$ mH, $R_{GS} = 25$ $\Omega$ ) (Note 3)		E <sub>AS</sub>	31	mJ	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			TL	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.

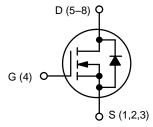
- 1. Surface-mounted on FR4 board using 1 sq-in pad, 1 oz Cu.
- 2. Surface-mounted on FR4 board using the minimum recommended pad size.
- 3. This is the absolute maximum rating. Parts are 100% tested at  $T_J=25^{\circ}C$ ,  $V_{GS}=10$  V,  $I_L=17$  Apk,  $E_{AS}=14$  mJ.



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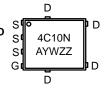
V <sub>(BR)DSS</sub>	R <sub>DS(ON)</sub> MAX	I <sub>D</sub> MAX
30 V	6.95 mΩ @ 10 V	
30 V	10.8 mΩ @ 4.5 V	40 (



**N-CHANNEL MOSFET** 







A = Assembly Location

= Year

V = Work Week

Z = Lot Traceability

#### **ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>
NTMFS4C10NT1G	SO-8 FL (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.

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## THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case (Drain)	$R_{ heta JC}$	5.3	
Junction-to-Ambient - Steady State (Note 4)	$R_{\theta JA}$	50.3	°C/W
Junction-to-Ambient - Steady State (Note 5)	$R_{\theta JA}$	165.9	C/VV
Junction–to–Ambient – (t ≤ 10 s) (Note 4)	$R_{\theta JA}$	22.2	

- 4. Surface–mounted on FR4 board using 1 sq-in pad, 1 oz Cu.5. Surface–mounted on FR4 board using the minimum recommended pad size.

# FI FCTRICAL CHARACTERISTICS (T<sub>1</sub> = 25°C unless otherwise specified)

Parameter	Symbol	Test Condition		Min	Тур	Max	Unit
OFF CHARACTERISTICS				-	•		-
Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$		30			V
Drain-to-Source Breakdown Voltage (transient)	V <sub>(BR)DSSt</sub>	$V_{GS} = 0 \text{ V}, I_{D(aval)} = 7.1 \text{ A},$ $T_{case} = 25^{\circ}\text{C}, t_{transient} = 100 \text{ ns}$		34			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> / T <sub>J</sub>				14.5		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	
			T <sub>J</sub> = 125°C			10	μΑ
Gate-to-Source Leakage Current	I <sub>GSS</sub>	$V_{DS} = 0 \text{ V}, V_{GS}$	<sub>S</sub> = ±20 V			±100	nA
ON CHARACTERISTICS (Note 6)							
Gate Threshold Voltage	V <sub>GS(TH)</sub>	$V_{GS} = V_{DS}, I_{D}$	= 250 μΑ	1.3		2.2	V
Negative Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>				4.7		mV/°C
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 30 A		5.8	6.95	0
	V <sub>GS</sub> = 4.5 V I <sub>D</sub> = 15 A	8.9	10.8	mΩ			
Forward Transconductance	9 <sub>FS</sub>	V <sub>DS</sub> = 1.5 V, I <sub>D</sub> = 15 A			43		S
Gate Resistance	$R_{G}$	T <sub>A</sub> = 25°C		0.3	1.0	2.0	Ω
CHARGES AND CAPACITANCES							
Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1 MHz, V <sub>DS</sub> = 15 V			987		pF
Output Capacitance	C <sub>OSS</sub>				574		
Reverse Transfer Capacitance	C <sub>RSS</sub>				162		
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			0.165		
Total Gate Charge	$Q_{G(TOT)}$				9.7		20
Threshold Gate Charge	Q <sub>G(TH)</sub>				1.5		
Gate-to-Source Charge	$Q_GS$	$V_{GS} = 4.5 \text{ V}, V_{DS} = 15 \text{ V}; I_D = 30 \text{ A}$			2.8		nC
Gate-to-Drain Charge	$Q_{GD}$				4.8		1
Gate Plateau Voltage	$V_{GP}$				3.2		V
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 15 V; I <sub>D</sub> = 30 A			18.6		nC
SWITCHING CHARACTERISTICS (Note 7)					_		
Turn-On Delay Time	t <sub>d(ON)</sub>	$V_{GS} = 4.5 \text{ V}, V_{DS} = 15 \text{ V},$ $I_{D} = 15 \text{ A}, R_{G} = 3.0 \Omega$			9.0		ns
Rise Time	t <sub>r</sub>				34		
Turn-Off Delay Time	t <sub>d(OFF)</sub>				14		
Fall Time	t <sub>f</sub>				7.0		

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

Parameter	Symbol	Test Condition		Min	Тур	Max	Unit
SWITCHING CHARACTERISTICS (N	ote 7)			•	•	•	•
Turn-On Delay Time	t <sub>d(ON)</sub>	$V_{GS} = 10 \text{ V}, V_{DS} = 15 \text{ V},$ $I_{D} = 15 \text{ A}, R_{G} = 3.0 \Omega$			7.0		ns
Rise Time	t <sub>r</sub>				26		
Turn-Off Delay Time	t <sub>d(OFF)</sub>				18		
Fall Time	t <sub>f</sub>				4.0		
DRAIN-SOURCE DIODE CHARACT	ERISTICS						
Forward Diode Voltage	$V_{SD}$	V <sub>SD</sub> V <sub>GS</sub> = 0 V, I <sub>S</sub> = 10 A	T <sub>J</sub> = 25°C		0.80	1.1	.,
			T <sub>J</sub> = 125°C		0.67		V
Reverse Recovery Time	t <sub>RR</sub>	$V_{GS} = 0 \text{ V, } dI_{S}/dt = 100 \text{ A/}\mu\text{s,}$ $I_{S} = 30 \text{ A}$			26.7		
Charge Time	t <sub>a</sub>				14.1		ns
Discharge Time	t <sub>b</sub>				12.6		
Reverse Recovery Charge	$Q_{RR}$				13.7		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.

6. Pulse Test: pulse width  $\leq 300~\mu s$ , duty cycle  $\leq 2\%$ .

7. Switching characteristics are independent of operating junction temperatures.

### **TYPICAL CHARACTERISTICS**

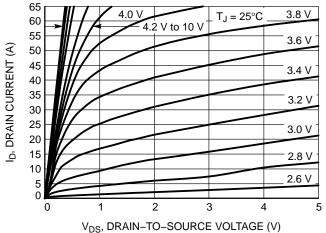


Figure 1. On-Region Characteristics

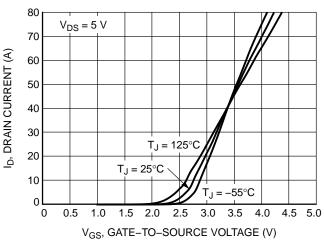


Figure 2. Transfer Characteristics

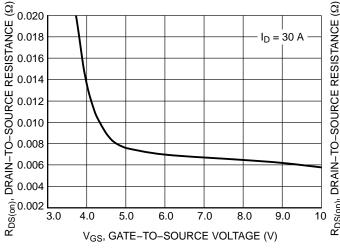


Figure 3. On-Resistance vs. V<sub>GS</sub>

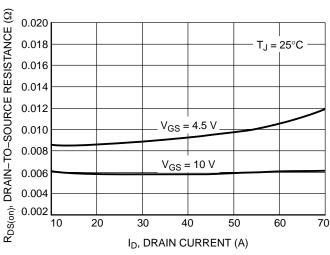


Figure 4. On–Resistance vs. Drain Current and Gate Voltage

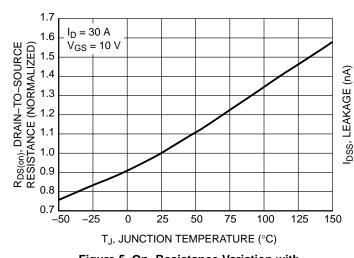


Figure 5. On–Resistance Variation with Temperature

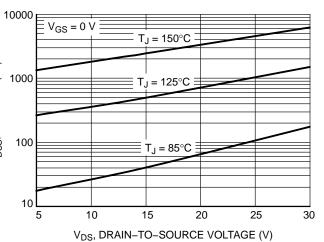


Figure 6. Drain-to-Source Leakage Current vs. Voltage

### **TYPICAL CHARACTERISTICS**

V<sub>GS</sub>, GATE-TO-SOURCE VOLTAGE (V)

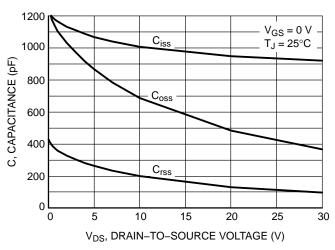


Figure 7. Capacitance Variation

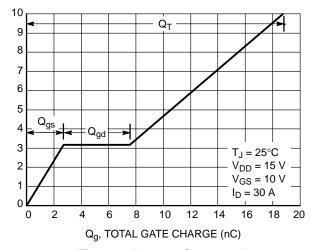


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

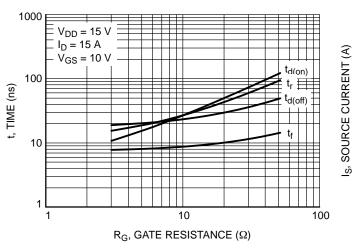


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

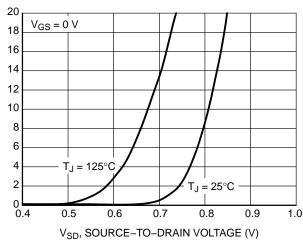


Figure 10. Diode Forward Voltage vs. Current

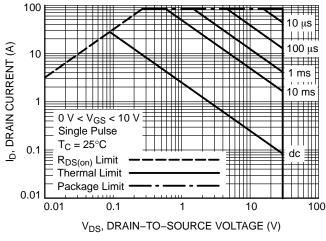


Figure 11. Maximum Rated Forward Biased Safe Operating Area

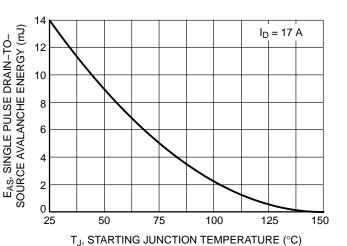


Figure 12. Maximum Avalanche Energy vs.
Starting Junction Temperature

## **TYPICAL CHARACTERISTICS**

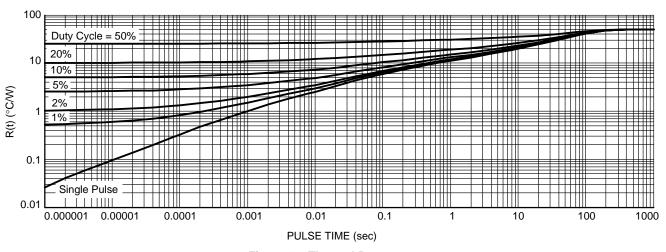


Figure 13. Thermal Response

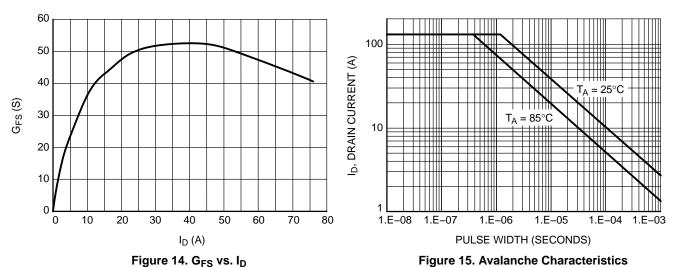
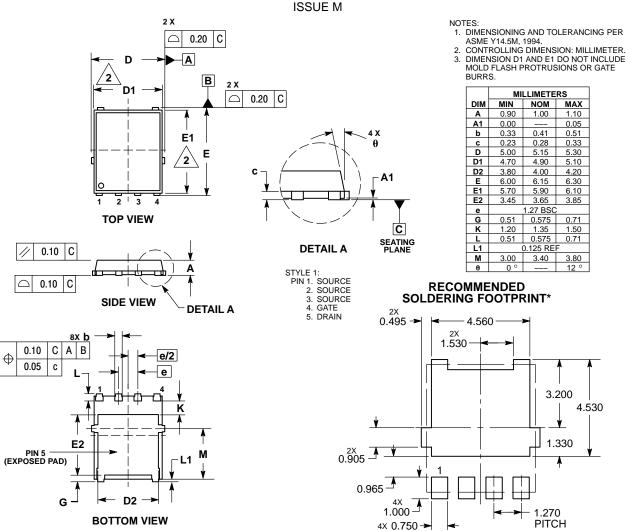


Figure 15. Avalanche Characteristics

#### PACKAGE DIMENSIONS

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



\*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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