

# **MDF12N50**

## N-Channel MOSFET 500V, 11.5 A, 0.65Ω

### General Description

The MDF12N50 uses advanced Magnachip's MOSFET Technology, which provides low on-state resistance, high switching performance and excellent quality.

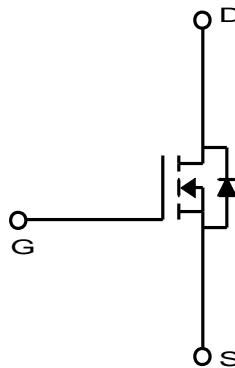
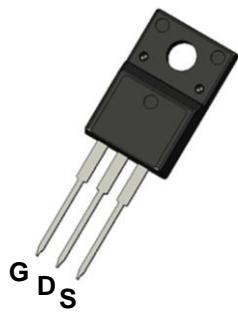
MDF12N50 is suitable device for SMPS, high Speed switching and general purpose applications.

### Features

- $V_{DS} = 500V$
- $I_D = 11.5A$  @  $V_{GS} = 10V$
- $R_{DS(ON)} \leq 0.65\Omega$  @  $V_{GS} = 10V$

### Applications

- Power Supply
- PFC
- High Current, High Speed Switching



### Absolute Maximum Ratings ( $T_a = 25^\circ C$ )

Characteristics	Symbol	Rating	Unit
Drain-Source Voltage	$V_{DSS}$	500	V
Gate-Source Voltage	$V_{GSS}$	$\pm 30$	V
Continuous Drain Current (※)	$I_D$	11.5	A
		7.0	A
Pulsed Drain Current <sup>(1)</sup>	$I_{DM}$	46	A
Power Dissipation	$P_D$	42	W
		0.32	$W/^\circ C$
Peak Diode Recovery $dv/dt$ <sup>(3)</sup>	$Dv/dt$	4.5	V/ns
Single Pulse Avalanche Energy <sup>(4)</sup>	$E_{AS}$	460	mJ
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55~150	$^\circ C$

※  $I_d$  limited by maximum junction temperature

### Thermal Characteristics

Characteristics	Symbol	Rating	Unit
Thermal Resistance, Junction-to-Ambient <sup>(1)</sup>	$R_{\theta JA}$	62.5	$^\circ C/W$
Thermal Resistance, Junction-to-Case <sup>(1)</sup>	$R_{\theta JC}$	3.0	

## Ordering Information

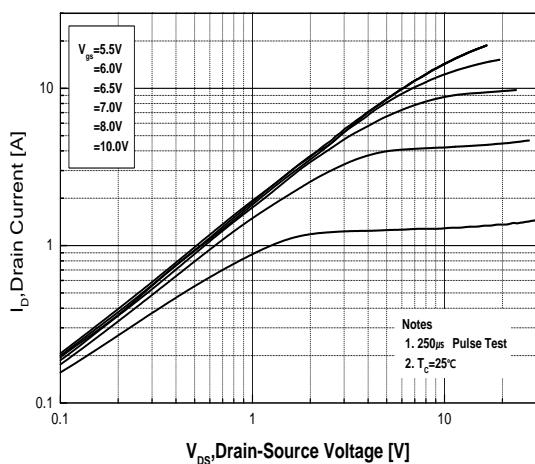
Part Number	Temp. Range	Package	Packing	RoHS Status
MDF12N50TH	-55~150°C	TO-220F	Tube	Halogen Free

## Electrical Characteristics (Ta =25°C)

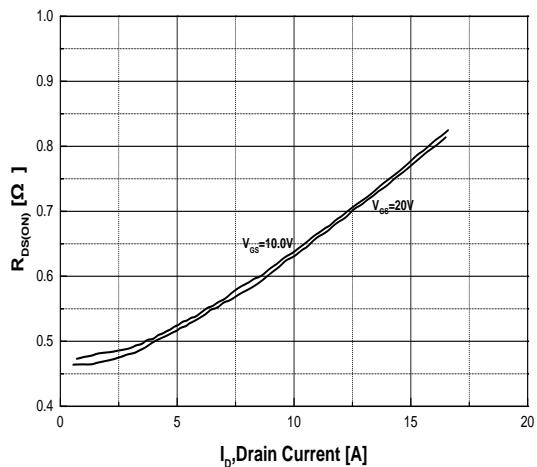
Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
<b>Static Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	I <sub>D</sub> = 250μA, V <sub>GS</sub> = 0V	500	-	-	V
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	3.0	-	5.0	
Drain Cut-Off Current	I <sub>DSS</sub>	V <sub>DS</sub> = 500V, V <sub>GS</sub> = 0V	-	-	1	μA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±30V, V <sub>DS</sub> = 0V	-	-	100	nA
Drain-Source ON Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 5.75A		0.55	0.65	Ω
Forward Transconductance	g <sub>fs</sub>	V <sub>DS</sub> = 30V, I <sub>D</sub> = 5.75A	-	15	-	S
<b>Dynamic Characteristics</b>						
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = 400V, I <sub>D</sub> = 11.5A, V <sub>GS</sub> = 10V <sup>(3)</sup>	-	22.7	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	7.7	-	
Gate-Drain Charge	Q <sub>gd</sub>		-	8.7	-	
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz	-	1030		pF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	5		
Output Capacitance	C <sub>oss</sub>		-	121		
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 250V, I <sub>D</sub> = 11.5A, R <sub>G</sub> = 25Ω <sup>(3)</sup>	-	25		ns
Rise Time	t <sub>r</sub>		-	50		
Turn-Off Delay Time	t <sub>d(off)</sub>		-	40		
Fall Time	t <sub>f</sub>		-	30		
<b>Drain-Source Body Diode Characteristics</b>						
Maximum Continuous Drain to Source Diode Forward Current	I <sub>S</sub>		-	11.5	-	A
Source-Drain Diode Forward Voltage	V <sub>SD</sub>	I <sub>S</sub> = 11.5A, V <sub>GS</sub> = 0V	-		1.4	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 11.5A, dI/dt = 100A/μs <sup>(3)</sup>	-	310		ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>		-	2.6		μC

Note :

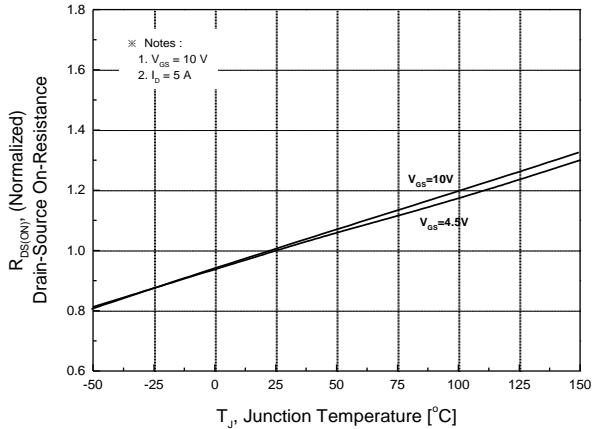
1. Pulse width is based on R<sub>EJC</sub> & R<sub>EJA</sub> and the maximum allowed junction temperature of 150°C.
2. Pulse test: pulse width ≤300us, duty cycle≤2%, pulse width limited by junction temperature T<sub>J(MAX)</sub>=150°C.
3. I<sub>SD</sub> ≤11.5A, di/dt≤200A/us, V<sub>DD</sub>=50V, R<sub>g</sub> =25Ω, Starting T<sub>J</sub>=25°C
4. L=6.3mH, I<sub>AS</sub>=11.5A, V<sub>DD</sub>=50V, R<sub>g</sub> =25Ω, Starting T<sub>J</sub>=25°C



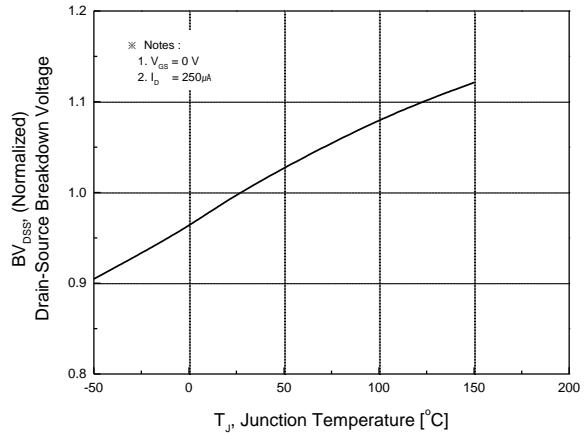
**Fig.1 On-Region Characteristics**



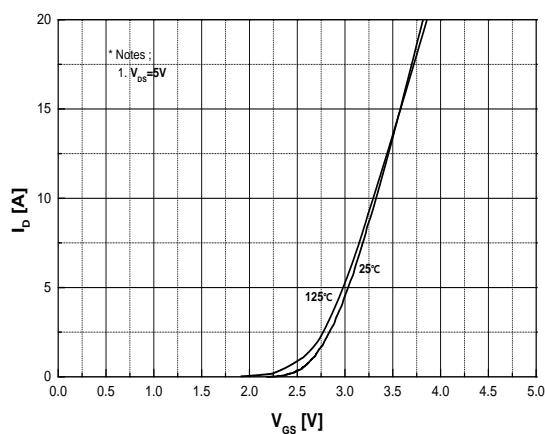
**Fig.2 On-Resistance Variation with Drain Current and Gate Voltage**



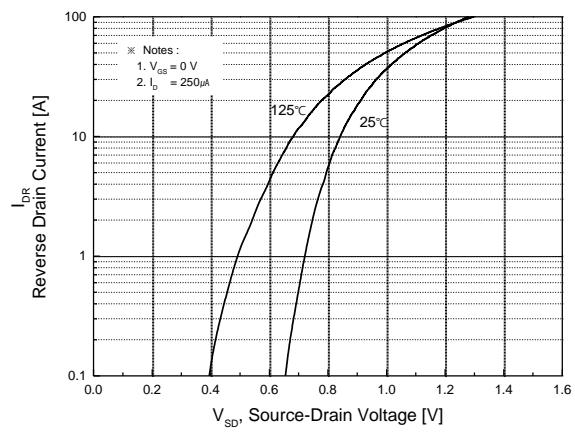
**Fig.3 On-Resistance Variation with Temperature**



**Fig.4 Breakdown Voltage Variation vs. Temperature**



**Fig.5 Transfer Characteristics**



**Fig.6 Body Diode Forward Voltage Variation with Source Current and Temperature**

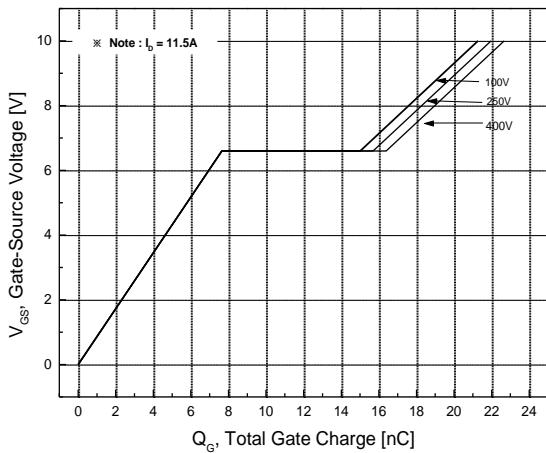


Fig.7 Gate Charge Characteristics

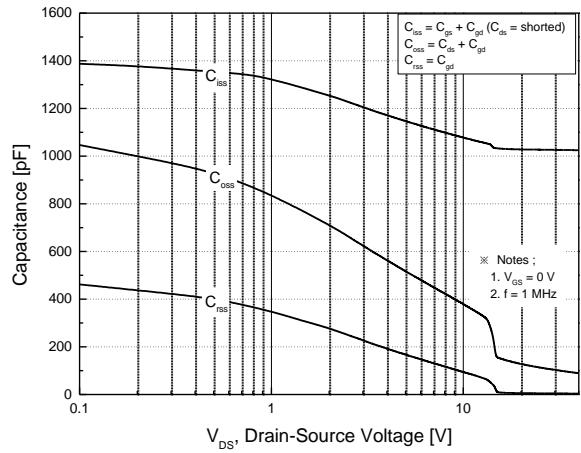


Fig.8 Capacitance Characteristics

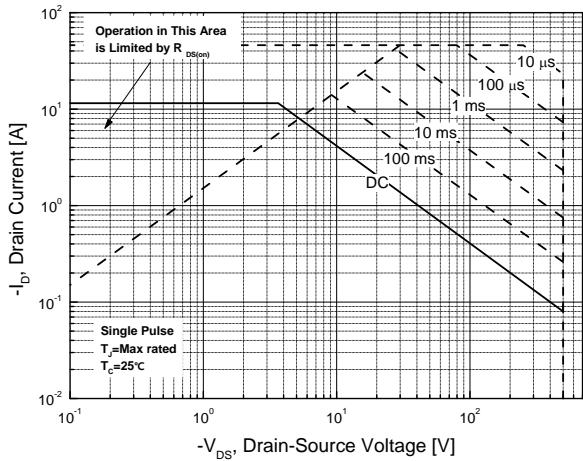


Fig.9 Maximum Safe Operating Area

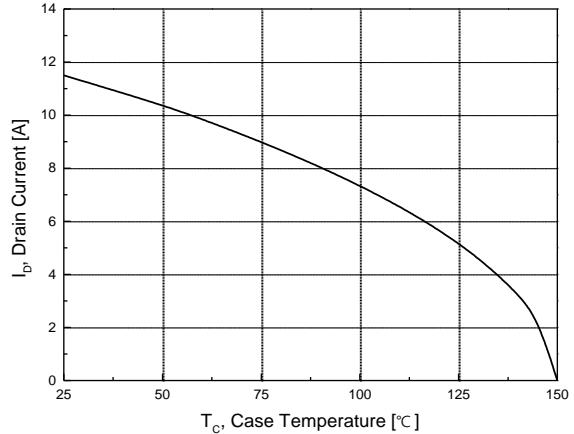


Fig.10 Maximum Drain Current vs. Case Temperature

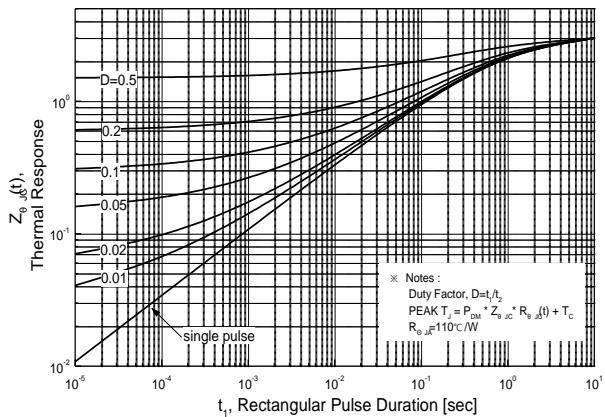


Fig.11 Transient Thermal Response Curve

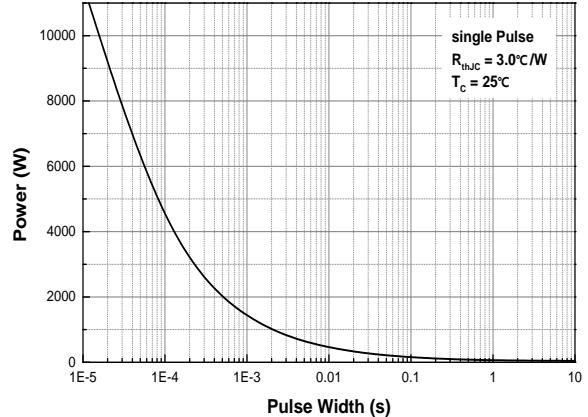
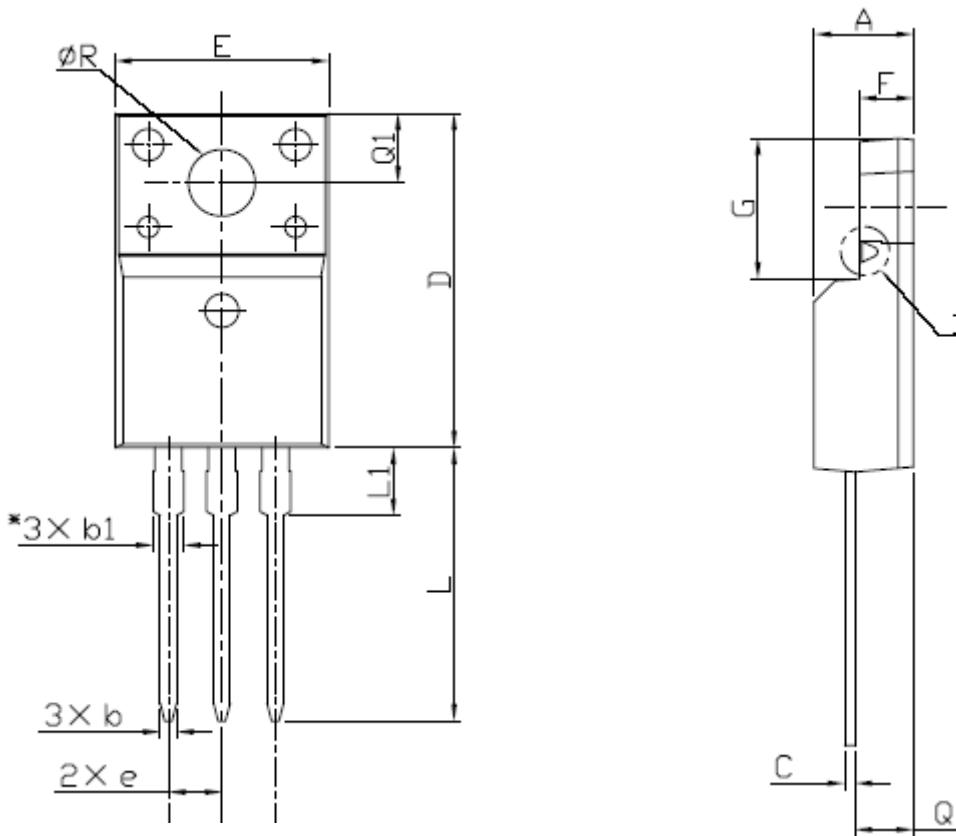


Fig.12 Single Pulse Maximum Power Dissipation

**Physical Dimensions****3 Leads, TO-220F**

Dimensions are in millimeters unless otherwise specified



Symbol	Min	Nom	Max
A	4.50		4.93
b	0.63		0.91
b1	1.15		1.47
C	0.33		0.63
D	15.47		16.13
E	9.60		10.71
e		2.54	
F	2.34		2.84
G	6.48		6.90
L	12.24		13.72
L1	2.79		3.67
Q	2.52		2.96
Q1	3.10		3.50
ØR	3.00		3.55

Note : Package body size, length and width do not include mold flash, protrusions and gate burrs.

**DISCLAIMER:**

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