

### General Description

The MDF9N60 uses advanced MagnaChip's MOSFET Technology, which provides low on-state resistance, high switching performance and excellent quality.

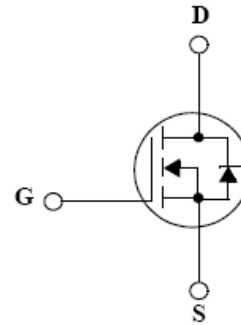
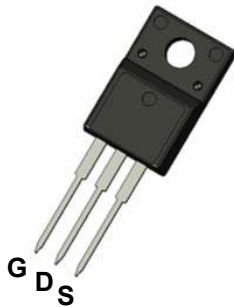
MDF9N60 is suitable device for SMPS, high Speed switching and general purpose applications.

### Features

- $V_{DS} = 600V$
- $V_{DS} = 660V$  @  $T_{jmax}$
- $I_D = 9.0A$  @  $V_{GS} = 10V$
- $R_{DS(ON)} \leq 0.75\Omega$  @  $V_{GS} = 10V$

### Applications

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



### Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-Source Voltage		$V_{DSS}$	600	V
Drain-Source Voltage @ $T_{jmax}$		$V_{DSS} @ T_{jmax}$	660	V
Gate-Source Voltage		$V_{GSS}$	±30	V
Continuous Drain Current (※)	$T_C=25^\circ C$	$I_D$	9.0	A
	$T_C=100^\circ C$		5.7	A
Pulsed Drain Current <sup>(1)</sup>		$I_{DM}$	32	A
Power Dissipation	$T_C=25^\circ C$	$P_D$	48	W
	Derate above 25 °C		0.38	W/°C
Repetitive Avalanche Energy $E_{AR}$ <sup>(1)</sup>		$E_{AR}$	4.8	mJ
Peak Diode Recovery $dv/dt$ <sup>(3)</sup>		$Dv/dt$	4.5	V/ns
Single Pulse Avalanche Energy <sup>(4)</sup>		$E_{AS}$	480	mJ
Junction and Storage Temperature Range		$T_J, T_{stg}$	-55~150	°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	°C/W
Thermal Resistance, Junction-to-Case <sup>(1)</sup>	$R_{\theta JC}$	2.62	

## Ordering Information

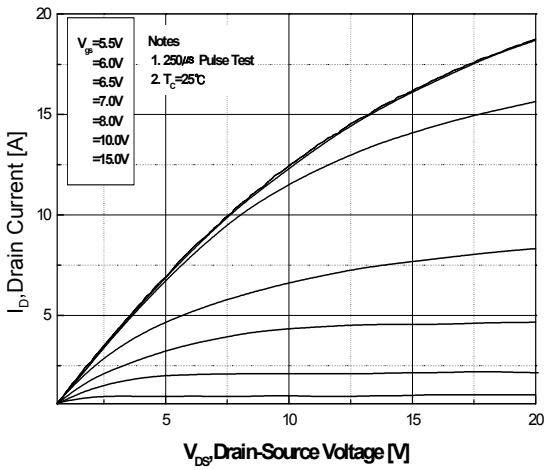
Part Number	Temp. Range	Package	Packing	RoHS Status
MDF9N60TH	-55~150°C	TO-220F	Tube	Halogen Free

## Electrical Characteristics (Ta =25°C)

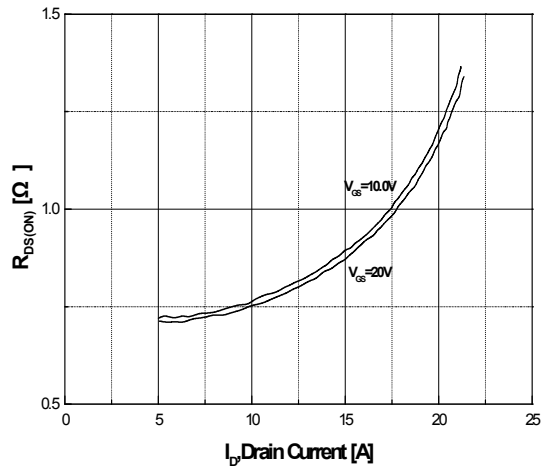
Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
<b>Static Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$I_D = 250\mu A, V_{GS} = 0V$	600	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	3.0	-	5.0	
Drain Cut-Off Current	$I_{DSS}$	$V_{DS} = 600V, V_{GS} = 0V$	-	-	1	$\mu A$
Gate Leakage Current	$I_{GSS}$	$V_{GS} = \pm 30V, V_{DS} = 0V$	-	-	100	nA
Drain-Source ON Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 4.5A$		0.65	0.75	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 30V, I_D = 4.5A$	-	7.0	-	S
<b>Dynamic Characteristics</b>						
Total Gate Charge	$Q_g$	$V_{DS} = 480V, I_D = 9.0A, V_{GS} = 10V^{(3)}$	-	27	-	nC
Gate-Source Charge	$Q_{gs}$		-	8.2	-	
Gate-Drain Charge	$Q_{gd}$		-	10.7	-	
Input Capacitance	$C_{iss}$	$V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz$	-	1160		pF
Reverse Transfer Capacitance	$C_{rss}$		-	6.2		
Output Capacitance	$C_{oss}$		-	134		
Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 10V, V_{DS} = 300V, I_D = 9.0A, R_G = 25\Omega^{(3)}$	-	31		ns
Rise Time	$t_r$		-	59		
Turn-Off Delay Time	$t_{d(off)}$		-	48		
Fall Time	$t_f$		-	30		
<b>Drain-Source Body Diode Characteristics</b>						
Maximum Continuous Drain to Source Diode Forward Current	$I_S$		-	11	-	A
Source-Drain Diode Forward Voltage	$V_{SD}$	$I_S = 9.0A, V_{GS} = 0V$	-		1.4	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = 9.0A, di/dt = 100A/\mu s^{(3)}$	-	360		ns
Body Diode Reverse Recovery Charge	$Q_{rr}$		-	3.9		$\mu C$

Note :

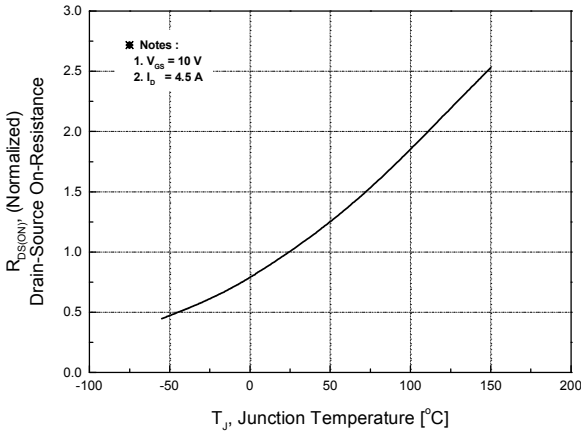
- Pulse width is based on  $R_{\theta JC}$  &  $R_{\theta JA}$  and the maximum allowed junction temperature of 150°C.
- Pulse test: pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ , pulse width limited by junction temperature  $T_{J(MAX)}=150^\circ C$ .
- $I_{SD} \leq 9.0A, di/dt \leq 200A/\mu s, V_{DD}=50V, R_g = 25\Omega$ , Starting  $T_J=25^\circ C$
- $L=10.8mH, I_{AS}=9.0A, V_{DD}=50V, R_g = 25\Omega$ , Starting  $T_J=25^\circ C$



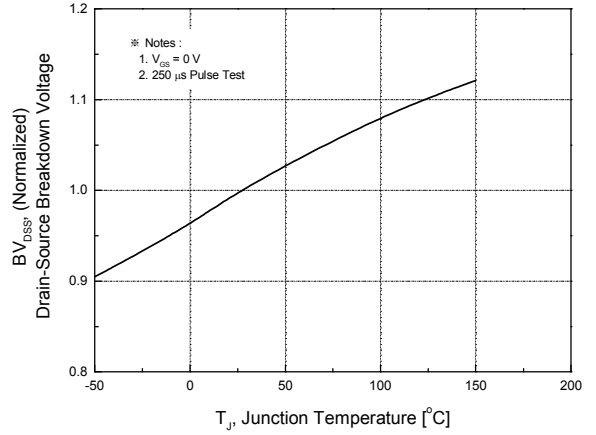
**Fig.1 On-Region Characteristics**



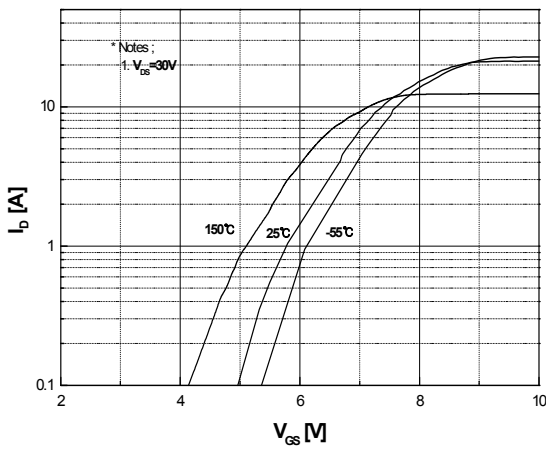
**Fig.2 On-Resistance Variation with Drain Current and Gate Voltage**



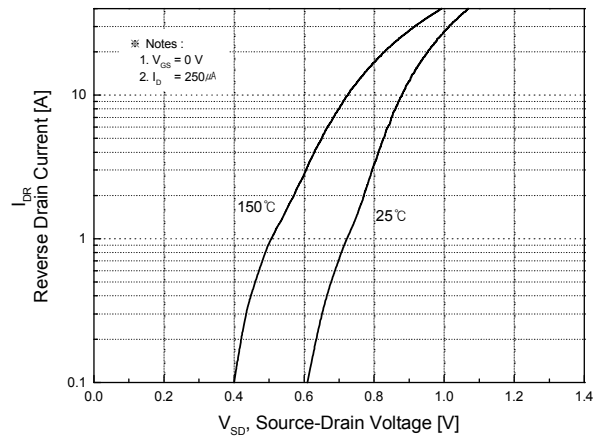
**Fig.3 On-Resistance Variation with Temperature**



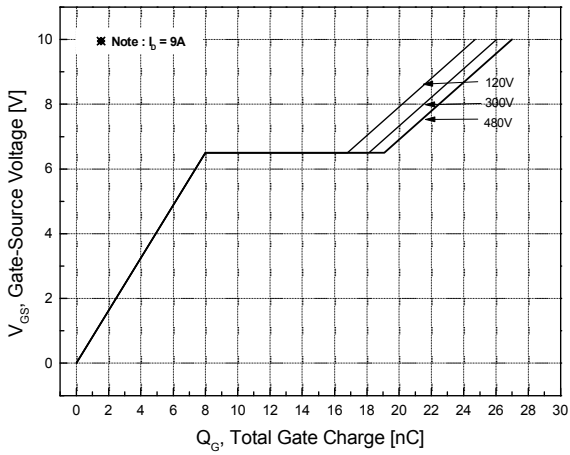
**Fig.4 Breakdown Voltage Variation vs. Temperature**



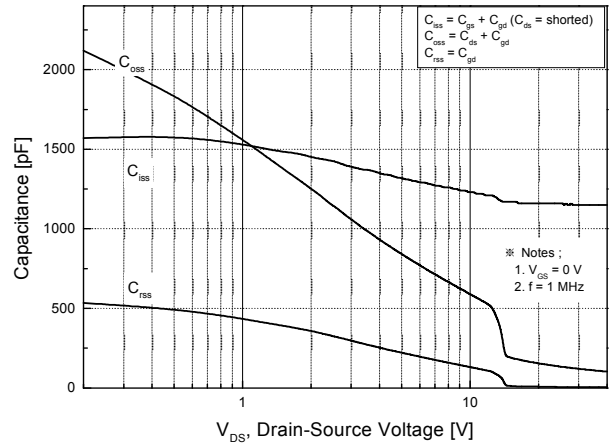
**Fig.5 Transfer Characteristics**



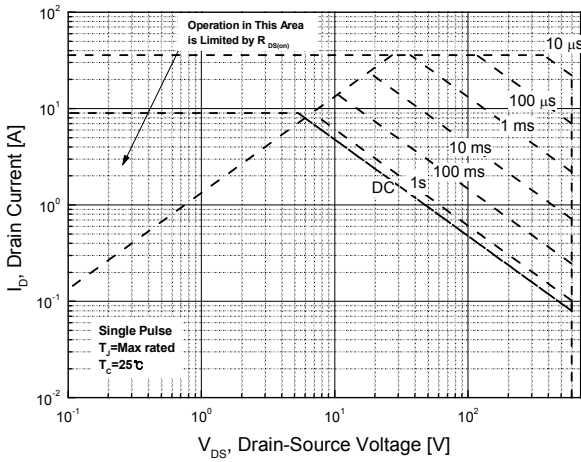
**Fig.6 Body Diode Forward Voltage Variation with Source Current and Temperature**



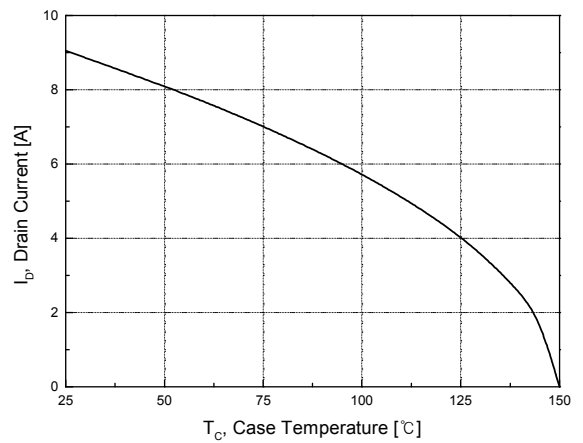
**Fig.7 Gate Charge Characteristics**



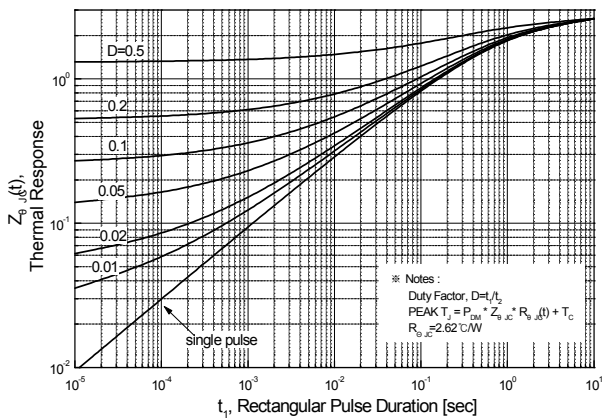
**Fig.8 Capacitance Characteristics**



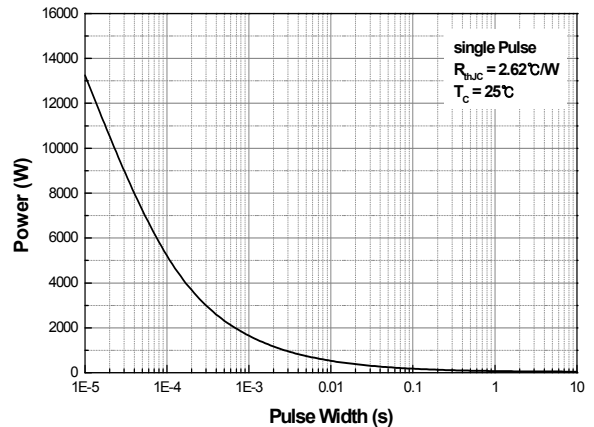
**Fig.9 Maximum Safe Operating Area**



**Fig.10 Maximum Drain Current vs. Case Temperature**



**Fig.11 Transient Thermal Response Curve**

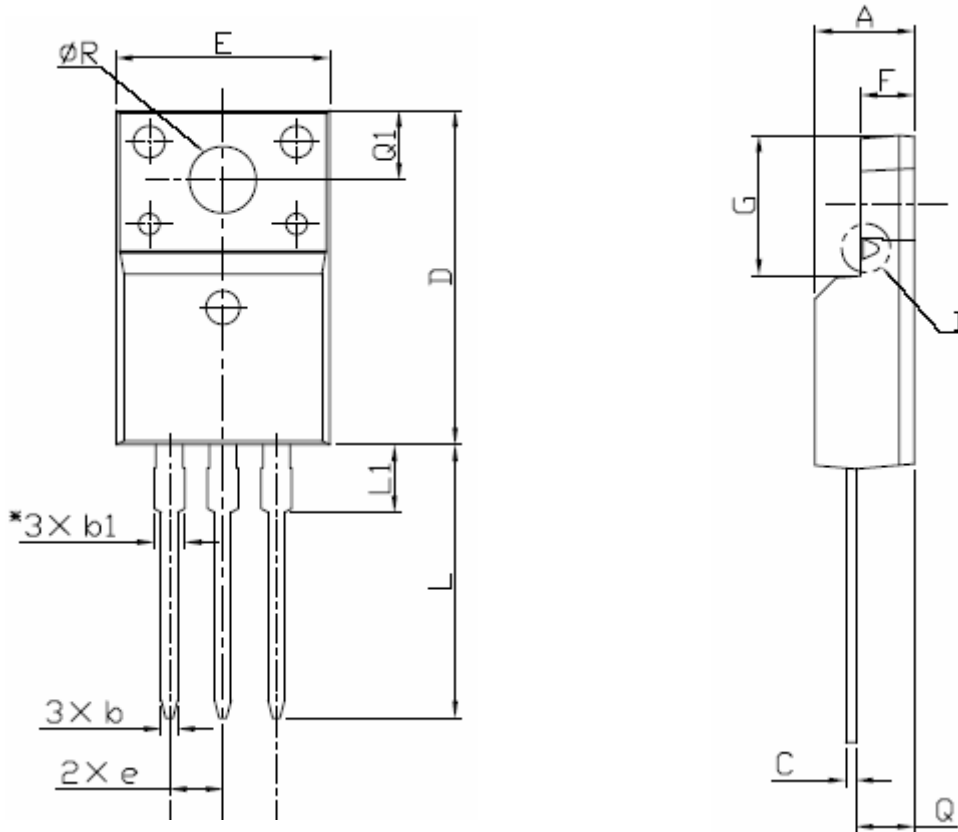


**Fig.12 Single Pulse Maximum Power Dissipation**

**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
$\varnothing R$	3.00		3.55

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