

### General Description

These N-channel MOSFET are produced using advanced Magnachip's MOSFET Technology, which provides low on-state resistance, high switching performance and excellent quality.

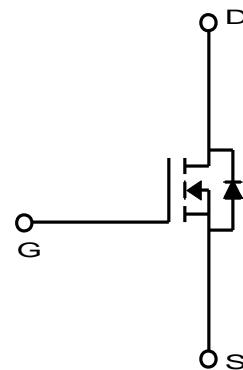
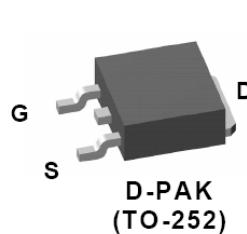
These devices are suitable device for SMPS, high Speed switching and general purpose applications.

### Features

- $V_{DS} = 600V$
- $I_D = 3.5A$
- $R_{DS(ON)} \leq 2.0\Omega$  @  $V_{GS} = 10V$

### Applications

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



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

Characteristics	Symbol	Rating	Unit
Drain-Source Voltage	$V_{DSS}$	600	V
Gate-Source Voltage	$V_{GSS}$	$\pm 30$	V
Continuous Drain Current	$I_D$	3.5	A
		2.2	A
Pulsed Drain Current <sup>(1)</sup>	$I_{DM}$	14	A
Power Dissipation	$P_D$	67.5	W
		0.54	W/°C
Repetitive Avalanche Energy <sup>(1)</sup>	$E_{AR}$	6.75	mJ
Peak Diode Recovery dv/dt <sup>(3)</sup>	dv/dt	4.5	V/ns
Single Pulse Avalanche Energy <sup>(4)</sup>	$E_{AS}$	170	mJ
Junction and Storage Temperature Range	$T_j, T_{stg}$	-55~150	°C

\*  $I_d$  limited by maximum junction temperature

### Thermal Characteristics

Characteristics	Symbol	MDD4N60	Unit
Thermal Resistance, Junction-to-Ambient <sup>(1)</sup>	$R_{thja}$	110	°C/W
Thermal Resistance, Junction-to-Case <sup>(1)</sup>	$R_{thjc}$	1.85	

## Ordering Information

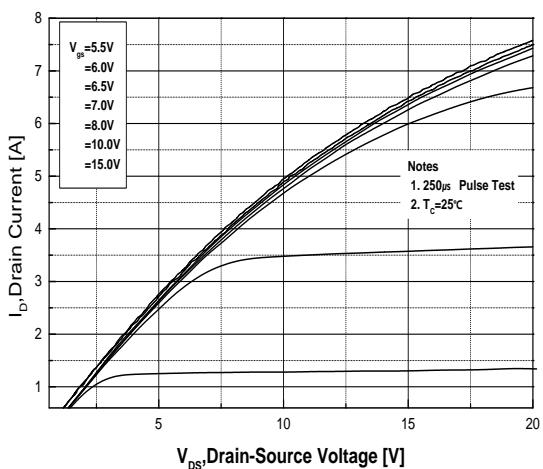
Part Number	Temp. Range	Package	Packing	RoHS Status
MDD4N60RH	-55~150°C	D-pak	Reel	Compliant

## Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )

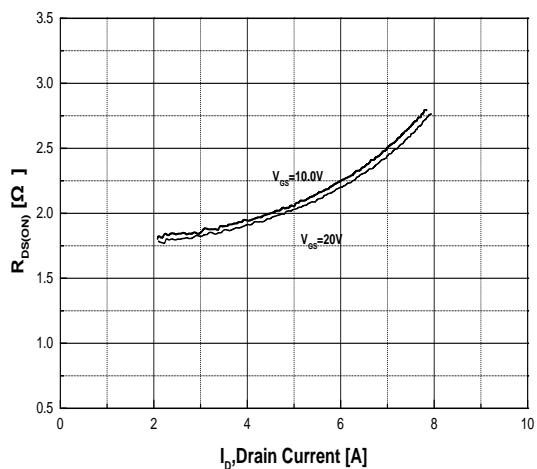
Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
<b>Static Characteristics</b>						
Drain-Source Breakdown Voltage	$\text{BV}_{\text{DSS}}$	$I_D = 250\mu\text{A}, V_{\text{GS}} = 0\text{V}$	600	-	-	V
Gate Threshold Voltage	$V_{\text{GS(th)}}$	$V_{\text{DS}} = V_{\text{GS}}, I_D = 250\mu\text{A}$	3.0	-	5.0	
Drain Cut-Off Current	$I_{\text{DSS}}$	$V_{\text{DS}} = 600\text{V}, V_{\text{GS}} = 0\text{V}$	-	-	1	$\mu\text{A}$
Gate Leakage Current	$I_{\text{GSS}}$	$V_{\text{GS}} = \pm 30\text{V}, V_{\text{DS}} = 0\text{V}$	-	-	100	nA
Drain-Source ON Resistance	$R_{\text{DS(ON)}}$	$V_{\text{GS}} = 10\text{V}, I_D = 1.75\text{A}$		1.7	2.0	$\Omega$
Forward Transconductance	$g_{\text{fs}}$	$V_{\text{DS}} = 30\text{V}, I_D = 1.75\text{A}$	-	4	-	S
<b>Dynamic Characteristics</b>						
Total Gate Charge	$Q_g$	$V_{\text{DS}} = 480\text{V}, I_D = 4.0\text{A}, V_{\text{GS}} = 10\text{V}^{(3)}$	-	12.1		
Gate-Source Charge	$Q_{\text{gs}}$		-	3.5		nC
Gate-Drain Charge	$Q_{\text{gd}}$		-	4.4		
Input Capacitance	$C_{\text{iss}}$	$V_{\text{DS}} = 25\text{V}, V_{\text{GS}} = 0\text{V}, f = 1.0\text{MHz}$	-	506	660	
Reverse Transfer Capacitance	$C_{\text{rss}}$		-	2.3	3	pF
Output Capacitance	$C_{\text{oss}}$		-	58	75	
Turn-On Delay Time	$t_{\text{d(on)}}$	$V_{\text{GS}} = 10\text{V}, V_{\text{DS}} = 300\text{V}, I_D = 4.0\text{A}, R_G = 25\Omega^{(3)}$	-	12		
Rise Time	$t_r$		-	20		
Turn-Off Delay Time	$t_{\text{d(off)}}$		-	27		ns
Fall Time	$t_f$		-	20		
<b>Drain-Source Body Diode Characteristics</b>						
Maximum Continuous Drain to Source Diode Forward Current	$I_S$		-	4.6	-	A
Source-Drain Diode Forward Voltage	$V_{\text{SD}}$	$I_S = 4.0\text{A}, V_{\text{GS}} = 0\text{V}$	-		1.4	V
Body Diode Reverse Recovery Time	$t_{\text{rr}}$	$I_F = 4.0\text{A}, dI/dt = 100\text{A}/\mu\text{s}^{(3)}$	-	243		ns
Body Diode Reverse Recovery Charge	$Q_{\text{rr}}$		-	1.5		$\mu\text{C}$

Note :

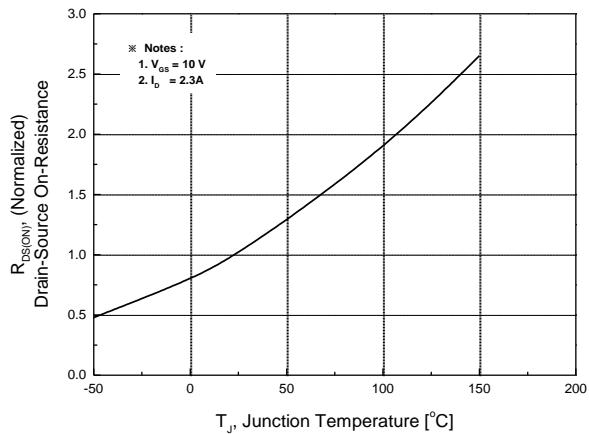
1. Pulse width is based on  $R_{\text{thjc}}$  &  $R_{\text{thja}}$  and the maximum allowed junction temperature of  $150^\circ\text{C}$ .
2. Pulse test: pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ , pulse width limited by junction temperature  $T_{j(\text{max})}=150^\circ\text{C}$ .
3.  $I_{\text{SD}} \leq 4.0\text{A}$ ,  $dI/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{\text{DD}}=50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_j=25^\circ\text{C}$
4.  $L=17.9\text{mH}$ ,  $I_{\text{AS}}=4.0\text{A}$ ,  $V_{\text{DD}}=50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_j=25^\circ\text{C}$ ,



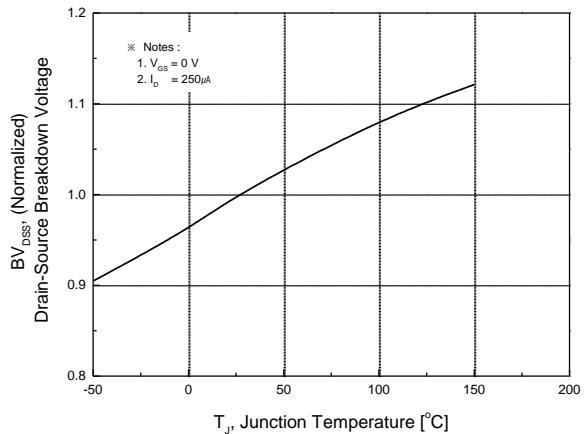
**Fig.1 On-Region Characteristics**



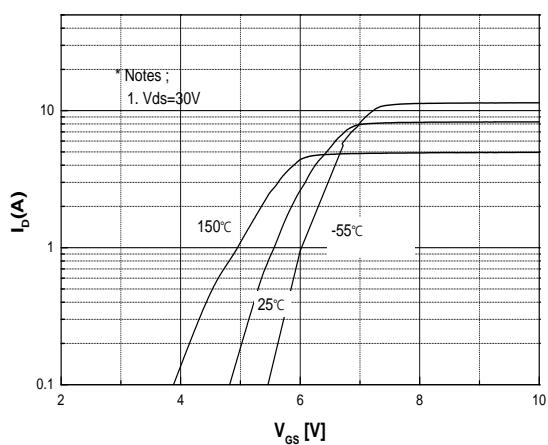
**Fig.2 On-Resistance Variation with Drain Current and Gate Voltage**



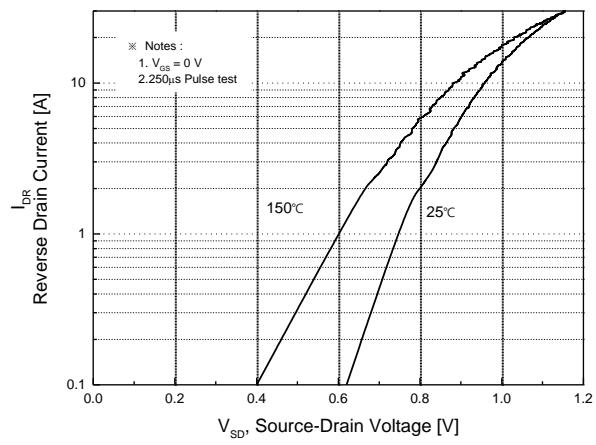
**Fig.3 On-Resistance Variation with Temperature**



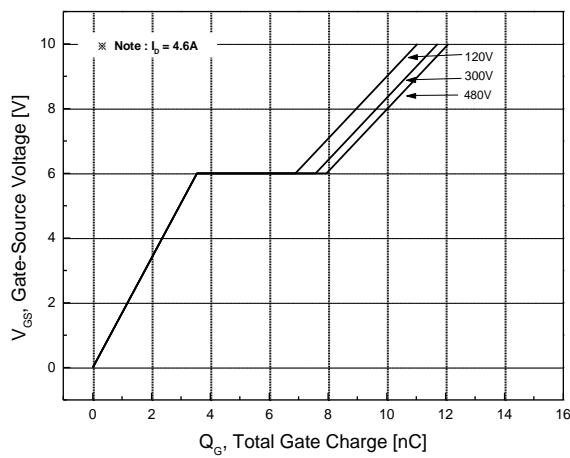
**Fig.4 Breakdown Voltage Variation vs. Temperature**



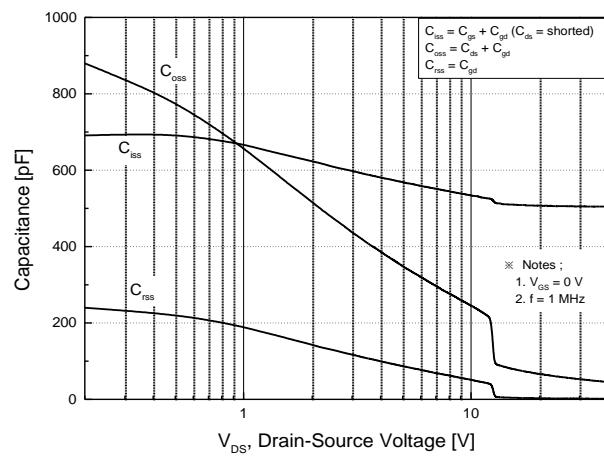
**Fig.5 Transfer Characteristics**



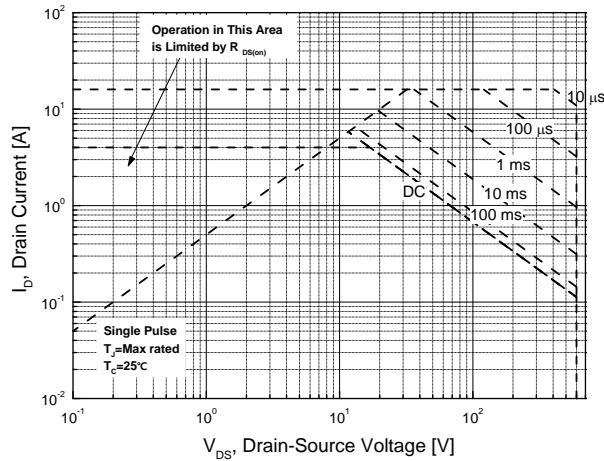
**Fig.6 Body Diode Forward Voltage Variation with Source Current and Temperature**



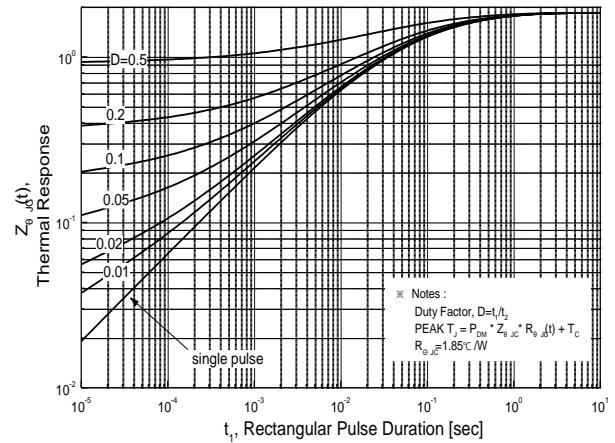
**Fig.7 Gate Charge Characteristics**



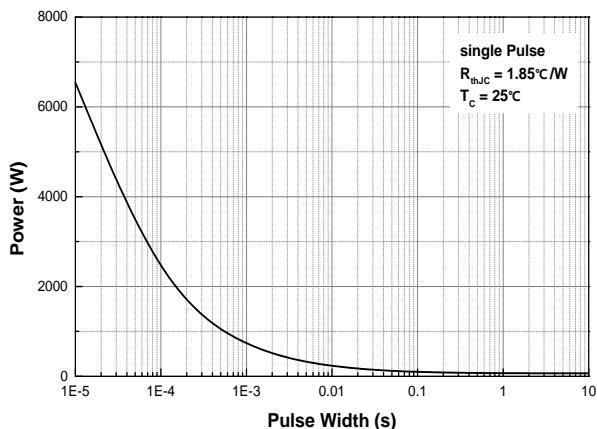
**Fig.8 Capacitance Characteristics**



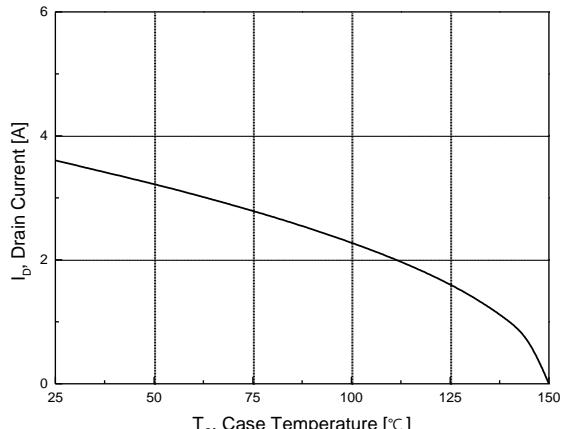
**Fig.9 Maximum Safe Operating Area**



**Fig.10 Transient Thermal Response Curve**



**Fig.11 Single Pulse Maximum Power Dissipation**

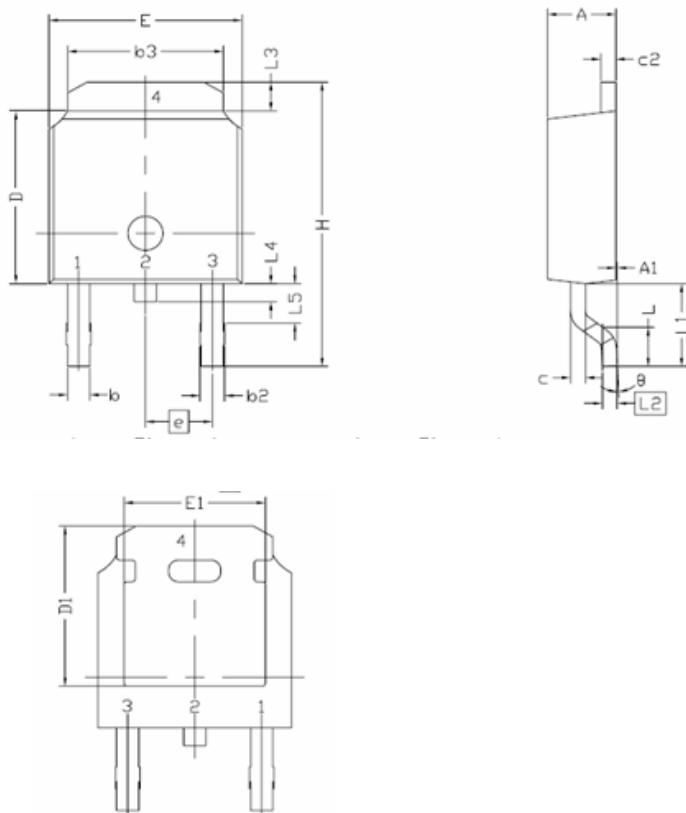


**Fig.12 Maximum Drain Current vs. Case Temperature**

## Physical Dimension

### TO-252 (DPAK)

Dimensions are in millimeters, unless otherwise specified



Symbol	Min.	Nom.	Max.
E	6.35	-	6.73
L	1.40	1.52	1.78
L1		2.74 REF	
L2		0.508 BCS	
L3	0.89	-	1.27
L4	-	-	1.02
L5	1.14	-	1.52
D	5.97	6.10	6.22
H	9.40	-	10.41
b	0.64	-	0.89
b2	0.76	-	1.14
b3	4.95	-	5.46
e		2.286 BSC	
A	2.18	-	2.39
A1	-	-	0.13
c	0.46	-	0.61
c2	0.46	-	0.89
D1	5.21	-	-
E1	4.32	-	-
Θ	0.00	-	10.00

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

**DISCLAIMER:**

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