

# MDP5N50F / MDF5N50F

## N-Channel MOSFET 500V, 4.5 A, 1.55Ω

### General Description

The MDP5N50F/MDF5N50F use advanced Magnachip's MOSFET Technology, which provides low on-state resistance, high switching performance and excellent quality.

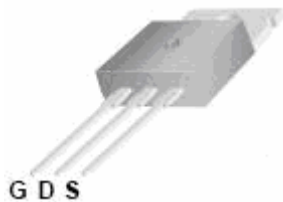
MDP5N50F/MDF5N50F are suitable device for SMPS, HID and general purpose applications.

### Features

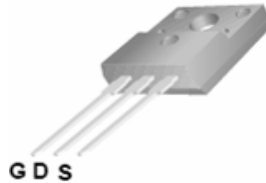
- $V_{DS} = 500V$
- $I_D = 4.5A$  @  $V_{GS} = 10V$
- $R_{DS(ON)} \leq 1.55\Omega$  @  $V_{GS} = 10V$

### Applications

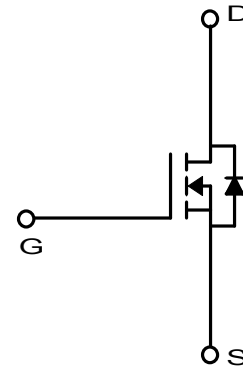
- Power Supply
- PFC
- Ballast



TO-220  
MDP Series



TO-220F  
MDF Series



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

Characteristics		Symbol	MDP5N50F	MDF5N50F	Unit
Drain-Source Voltage		$V_{DSS}$	500		V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$		V
Continuous Drain Current	$T_C = 25^\circ C$	$I_D$	4.5	4.5*	A
	$T_C = 100^\circ C$		2.8	2.8*	A
Pulsed Drain Current <sup>(1)</sup>		$I_{DM}$	18	18*	A
Power Dissipation	$T_C = 25^\circ C$	$P_D$	93	27	W
	Derate above $25^\circ C$		0.74	0.22	W/ $^\circ C$
Repetitive Avalanche Energy <sup>(1)</sup>		$E_{AR}$	93		mJ
Peak Diode Recovery $dv/dt$ <sup>(3)</sup>		$dv/dt$	4.5		V/ns
Single Pulse Avalanche Energy <sup>(4)</sup>		$E_{AS}$	230		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	MDP5N50F	MDF5N50F	Unit
Thermal Resistance, Junction-to-Ambient <sup>(1)</sup>	$R_{\theta JA}$	62.5	62.5	$^\circ C/W$
Thermal Resistance, Junction-to-Case <sup>(1)</sup>	$R_{\theta JC}$	1.35	4.6	

## Ordering Information

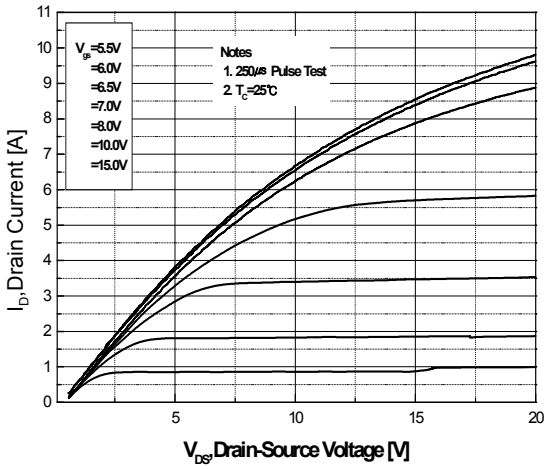
Part Number	Temp. Range	Package	Packing	RoHS Status
MDP5N50FTH	-55~150°C	TO-220	Tube	Halogen Free
MDF5N50FTH	-55~150°C	TO-220F	Tube	Halogen Free

## Electrical Characteristics (Ta =25°C)

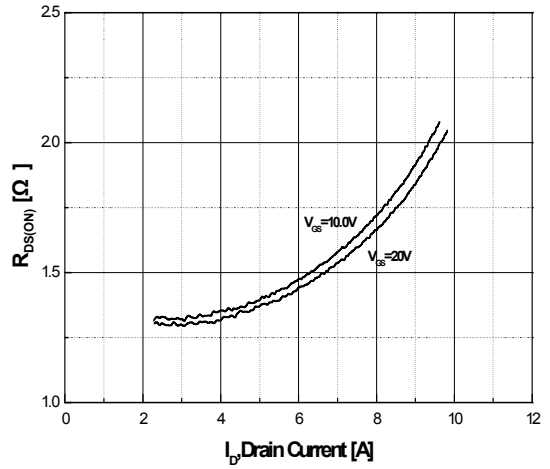
Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
<b>Static Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$I_D = 250\mu A, V_{GS} = 0V$	500	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.5	-	4.5	
Drain Cut-Off Current	$I_{DSS}$	$V_{DS} = 500V, V_{GS} = 0V$	-	-	10	$\mu A$
Gate Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	100	$\mu A$
Drain-Source ON Resistance	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 2.5A$		1.25	1.55	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 30V, I_D = 2.5A$	-	3.3	-	S
<b>Dynamic Characteristics</b>						
Total Gate Charge	$Q_g$	$V_{DS} = 500V, I_D = 5.0A, V_{GS} = 10V^{(3)}$	-	12.1	15.73	nC
Gate-Source Charge	$Q_{gs}$		-	3.6	-	
Gate-Drain Charge	$Q_{gd}$		-	4.3	-	
Input Capacitance	$C_{iss}$	$V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz$	-	500	650	$\mu F$
Reverse Transfer Capacitance	$C_{rss}$		-	1.5	2.25	
Output Capacitance	$C_{oss}$		-	65	84.5	
Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 10V, V_{DS} = 250V, I_D = 5.0A, R_G = 25\Omega^{(3)}$	-	23	48.3	ns
Rise Time	$t_r$		-	30	60	
Turn-Off Delay Time	$t_{d(off)}$		-	37	77.7	
Fall Time	$t_f$		-	29	60.9	
<b>Drain-Source Body Diode Characteristics</b>						
Maximum Continuous Drain to Source Diode Forward Current	$I_S$		-	4.5	-	A
Source-Drain Diode Forward Voltage	$V_{SD}$	$I_S = 5.0A, V_{GS} = 0V$	-		1.4	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = 5.0A, di/dt = 100A/\mu s^{(3)}$	-	80		ns
Body Diode Reverse Recovery Charge	$Q_{rr}$		-	1.6		$\mu C$

Note :

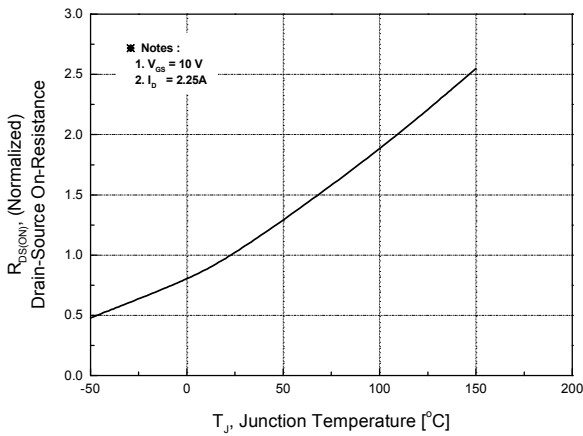
- Pulse width is based on  $R_{\theta JC}$  &  $R_{\theta JA}$  and the maximum allowed junction temperature of 150°C.
- Pulse test: pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ , pulse width limited by junction temperature  $T_J(MAX) = 150^\circ C$ .
- $I_{SD} \leq 4.5A$ ,  $di/dt \leq 200A/\mu s$ ,  $V_{DD} = 50V$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ C$
- $L = 20.5mH$ ,  $I_{AS} = 4.5A$ ,  $V_{DD} = 50V$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ C$



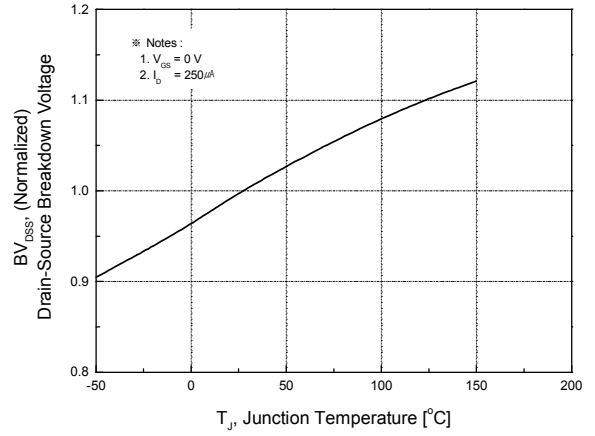
**Fig.1 On-Region Characteristics**



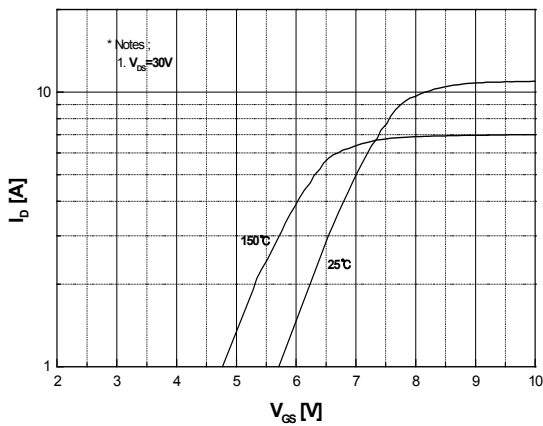
**Fig.2 On-Resistance Variation with Drain Current and Gate Voltage**



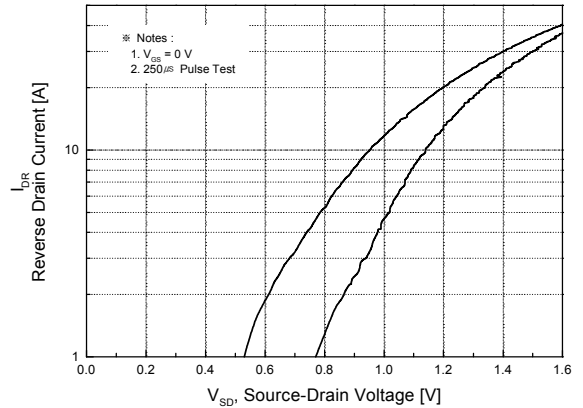
**Fig.3 On-Resistance Variation with Temperature**



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



**Fig.5 Transfer Characteristics**



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

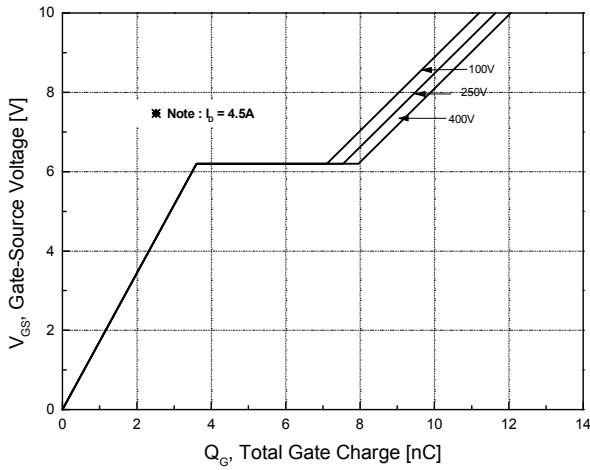


Fig.7 Gate Charge Characteristics

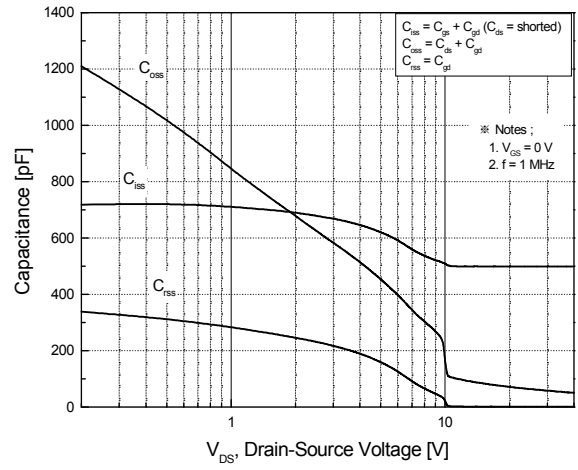


Fig.8 Capacitance Characteristics

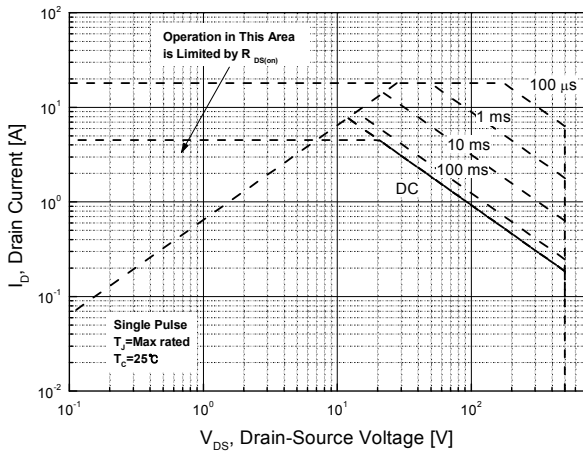


Fig.9 Maximum Safe Operating Area  
MDP5N50F (TO-220)

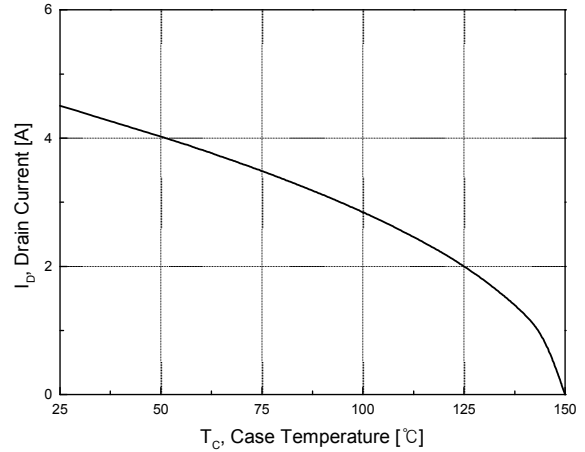


Fig.10 Maximum Drain Current vs. Case Temperature

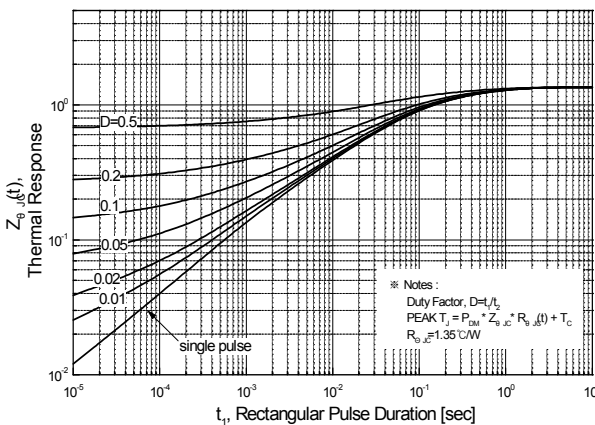


Fig.11 Transient Thermal Response Curve  
MDP5N50F (TO-220)

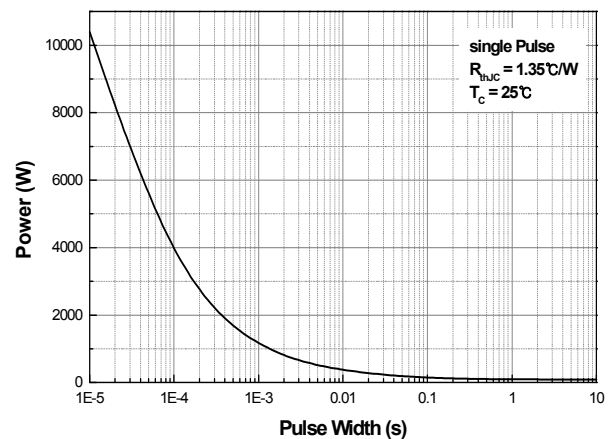
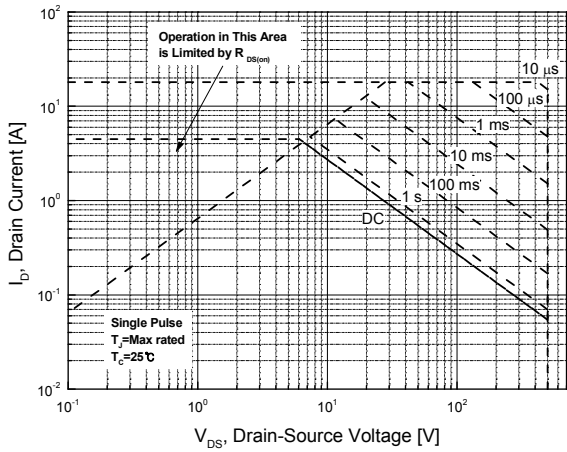
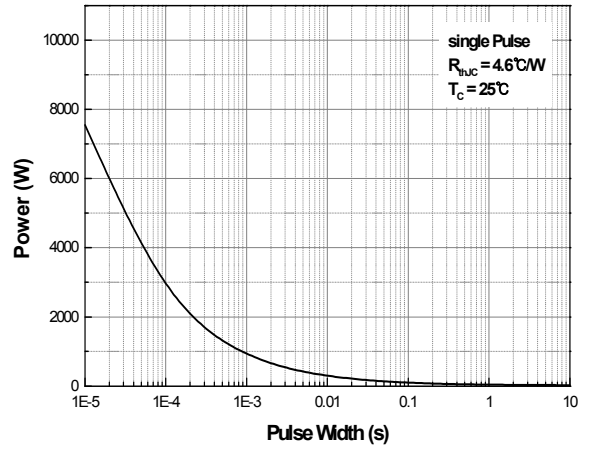


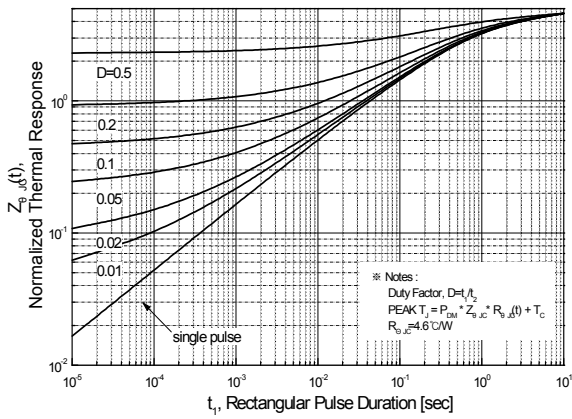
Fig.12 Single Pulse Maximum Power Dissipation – MDP5N50F (TO-220)



**Fig.13 Maximum Safe Operating Area  
MDF5N50F (TO-220F)**



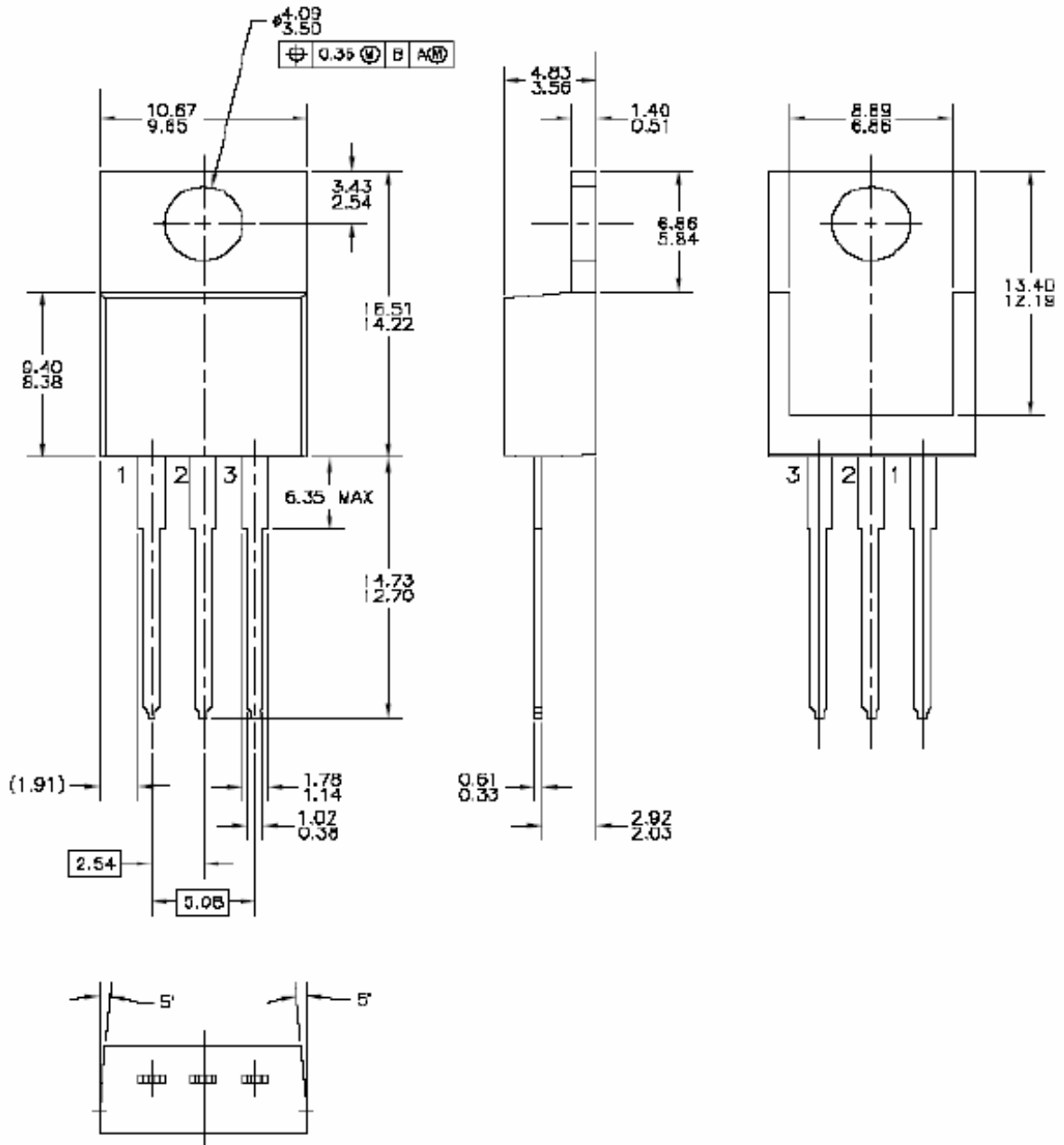
**Fig.12 Single Pulse Maximum Power  
Dissipation- MDF5N50F (TO-220F)**



**Fig.11 Transient Thermal Response Curve  
MDF5N50F (TO-220F)**

Physical Dimensions

TO-220

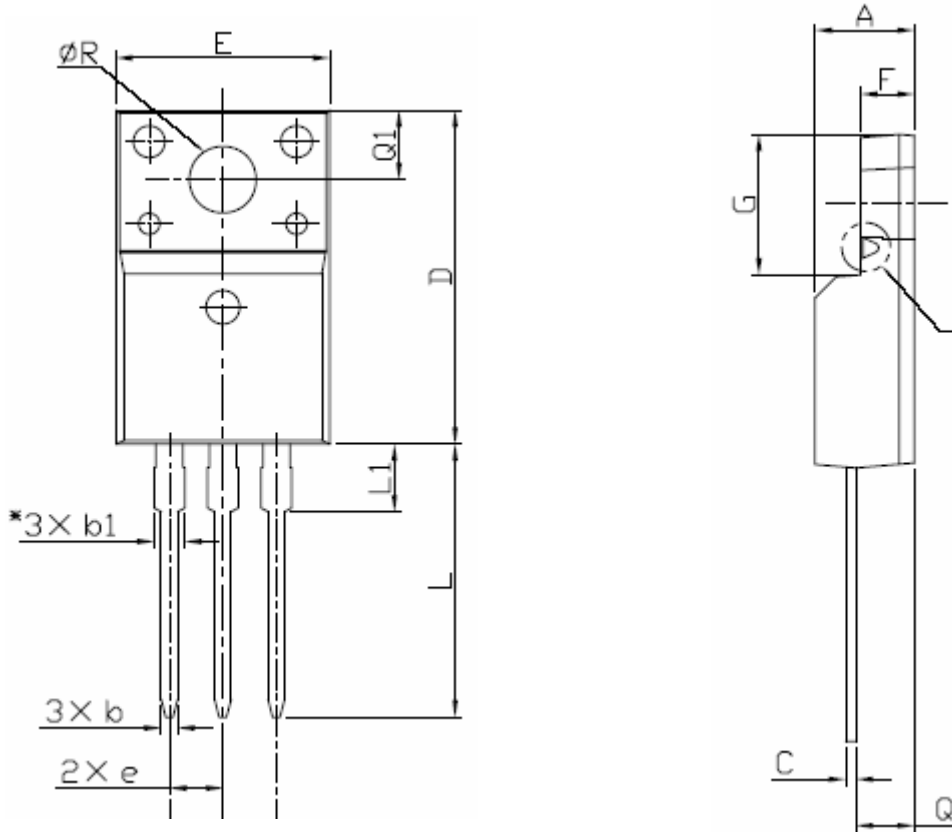


MDP5N50F / MDF5N50F N-channel MOSFET 500V

**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