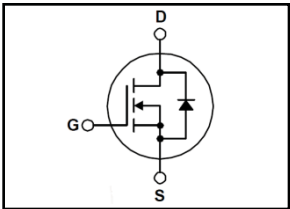


# HF50N06A

## 60V N-Channel MOSFET

$BV_{DSS} = 60\text{ V}$   
 $R_{DS(on) \text{ typ}} = 18\text{ m}\Omega$   
 $I_D = 50\text{ A}$



### FEATURES

- Originative New Design
- Superior Avalanche Rugged Technology
- Robust Gate Oxide Technology
- Very Low Intrinsic Capacitances
- Excellent Switching Characteristics
- Unrivalled Gate Charge : 27 nC (Typ.)
- Extended Safe Operating Area
- Lower  $R_{DS(ON)}$  : 0.018  $\Omega$  (Typ.) @  $V_{GS}=10\text{V}$
- 100% Avalanche Tested

### Absolute Maximum Ratings $T_C=25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Value	Units
$V_{DSS}$	Drain-Source Voltage	60	V
$I_D$	Drain Current – Continuous ( $T_C = 25^\circ\text{C}$ )	50	A
	Drain Current – Continuous ( $T_C = 100^\circ\text{C}$ )	35.4	A
$I_{DM}$	Drain Current – Pulsed	200	A
$V_{GS}$	Gate-Source Voltage	$\pm 25$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	490	mJ
$I_{AR}$	Avalanche Current (Note 1)	50	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	12	mJ
$P_D$	Power Dissipation ( $T_A = 25^\circ\text{C}$ ) *	3.75	W
	Power Dissipation ( $T_C = 25^\circ\text{C}$ ) - Derate above $25^\circ\text{C}$	120	W
		0.8	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +175	$^\circ\text{C}$
$T_L$	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

### Thermal Resistance Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	--	1.24	$^\circ\text{C/W}$
$R_{\theta JA}$	Junction-to-Ambient *	--	40	
$R_{\theta JA}$	Junction-to-Ambient	--	62.5	

\* When mounted on the minimum pad size recommended (PCB Mount)

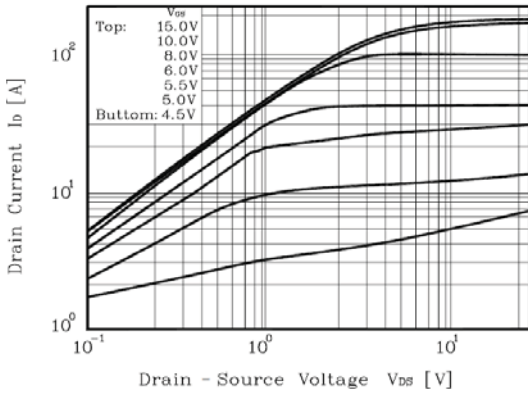
**Electrical Characteristics**  $T_J=25^\circ\text{C}$  unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>On Characteristics</b>						
$V_{GS}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	2.0	--	4.0	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10 \text{ V}, I_D = 25 \text{ A}$	--	18	22	m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 25 \text{ V}, I_D = 25 \text{ A}$	--	22	--	S
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	60	--	--	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 60 \text{ V}, V_{GS} = 0 \text{ V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 48 \text{ V}, T_J = 125^\circ\text{C}$	--	--	10	$\mu\text{A}$
$I_{GSS}$	Gate-Body Leakage Current	$V_{GS} = \pm 25 \text{ V}, V_{DS} = 0 \text{ V}$	--	--	$\pm 100$	nA
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ $f = 1.0 \text{ MHz}$	--	1290	1675	pF
$C_{oss}$	Output Capacitance		--	445	580	pF
$C_{riss}$	Reverse Transfer Capacitance		--	84	110	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Time	$V_{DS} = 30 \text{ V}, I_D = 25 \text{ A},$ $R_G = 25 \Omega$	--	15	40	ns
$t_r$	Turn-On Rise Time		--	105	220	ns
$t_{d(off)}$	Turn-Off Delay Time		--	80	180	ns
$t_f$	Turn-Off Fall Time		--	85	180	ns
$Q_g$	Total Gate Charge	$V_{DS} = 48 \text{ V}, I_D = 50 \text{ A}$ $V_{GS} = 10 \text{ V}$	--	27	34	nC
$Q_{gs}$	Gate-Source Charge		--	5.0	--	nC
$Q_{gd}$	Gate-Drain Charge		--	10.2	--	nC
<b>Source-Drain Diode Maximum Ratings and Characteristics</b>						
$I_S$	Continuous Source-Drain Diode Forward Current		--	--	50	A
$I_{SM}$	Pulsed Source-Drain Diode Forward Current		--	--	200	
$V_{SD}$	Source-Drain Diode Forward Voltage	$I_S = 50 \text{ A}, V_{GS} = 0 \text{ V}$	--	--	1.5	V
$t_{rr}$	Reverse Recovery Time	$I_S = 50 \text{ A}, V_{GS} = 0 \text{ V}$ $di_F/dt = 100 \text{ A}/\mu\text{s}$	--	45	--	ns
$Q_{rr}$	Reverse Recovery Charge		--	70	--	$\mu\text{C}$

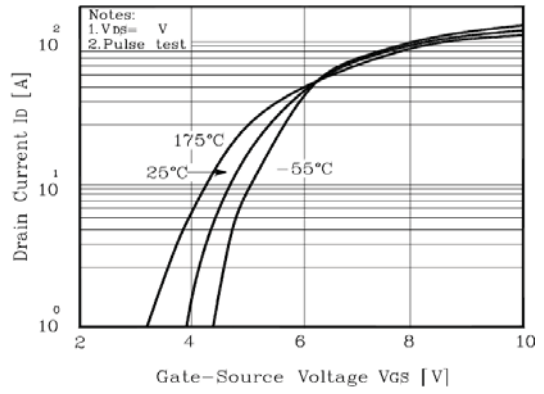
**Notes ;**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L=230\mu\text{H}, I_{AS}=50\text{A}, V_{DD}=25\text{V}, R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$
3. Pulse Test : Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$
4. Essentially Independent of Operating Temperature

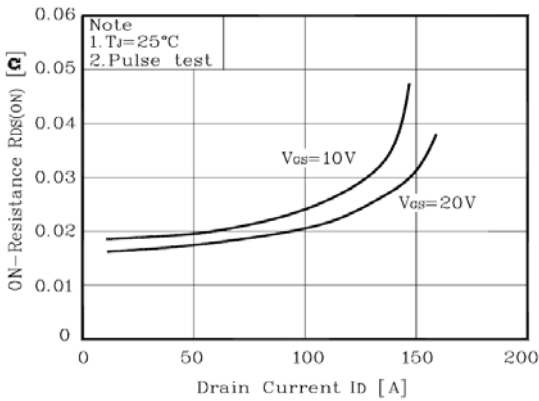
## Typical Characteristics



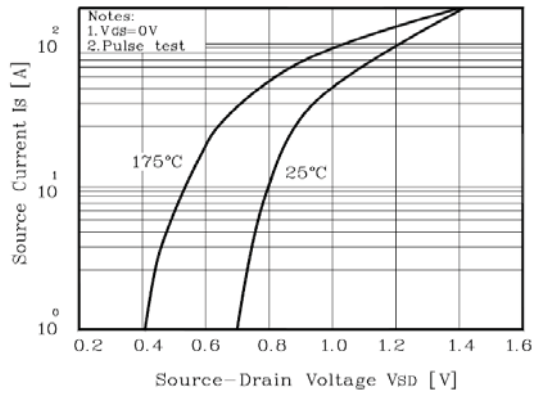
**Figure 1. On Region Characteristics**



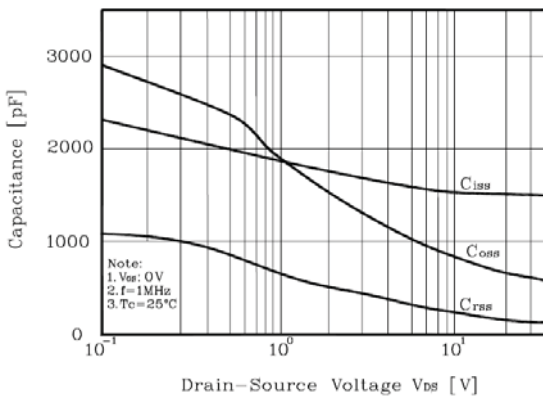
**Figure 2. Transfer Characteristics**



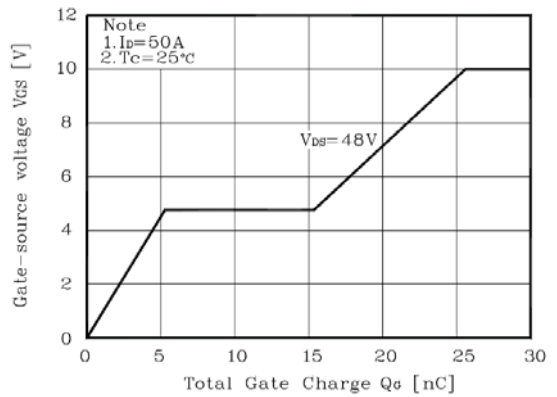
**Figure 3. On Resistance Variation vs Drain Current and Gate Voltage**



**Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature**



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**

Typical Characteristics (continued)

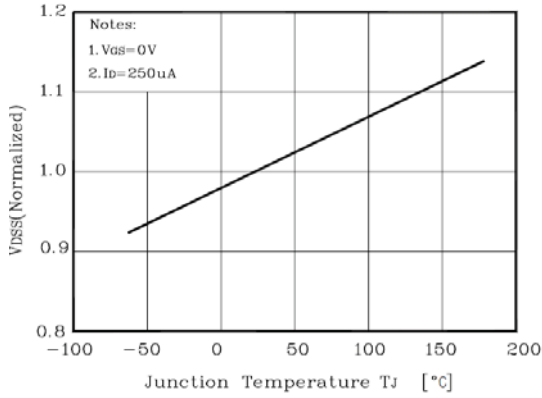


Figure 7. Breakdown Voltage Variation vs Temperature

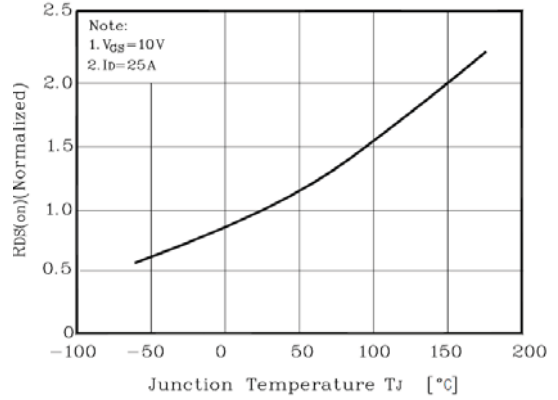


Figure 8. On-Resistance Variation vs Temperature

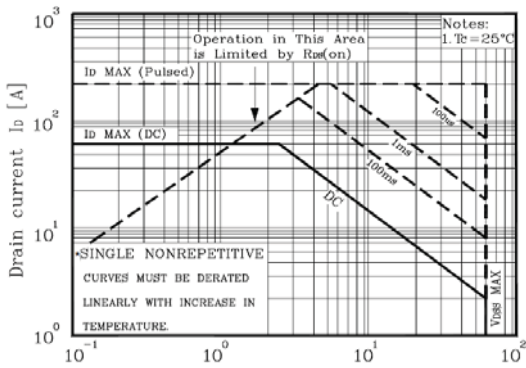


Figure 9. Maximum Safe Operating Area

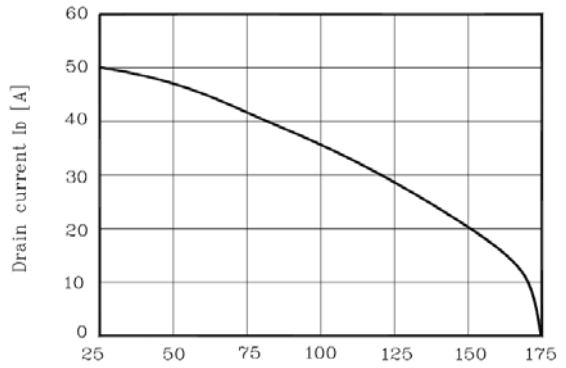


Figure 10. Maximum Drain Current vs Case Temperature

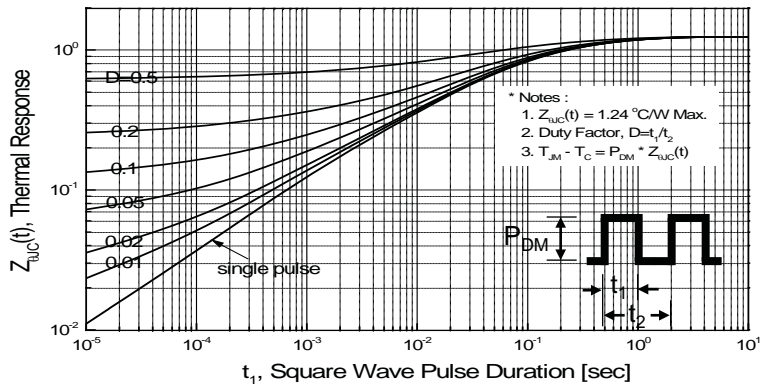


Figure 11. Transient Thermal Response Curve

Fig 12. Gate Charge Test Circuit & Waveform



Fig 13. Resistive Switching Test Circuit & Waveforms



Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

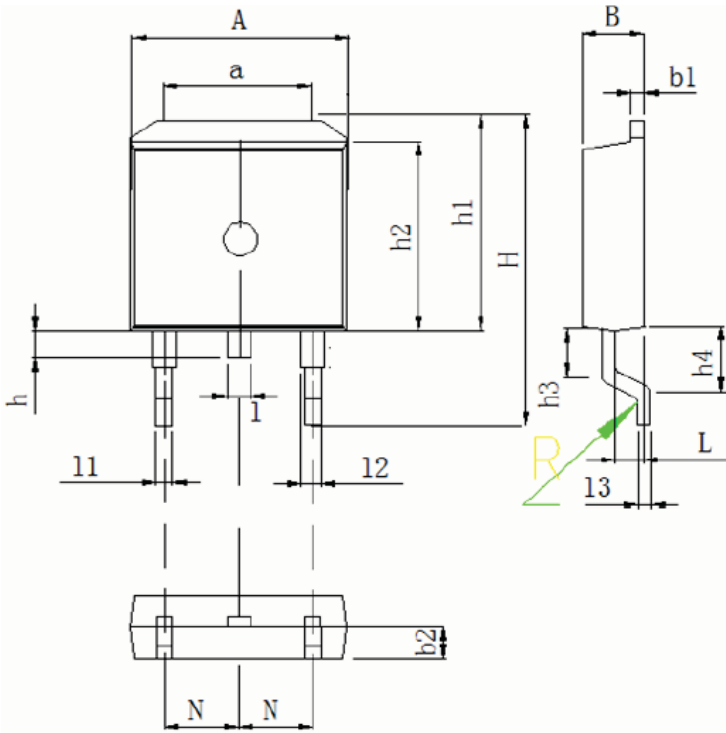


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimension

D<sup>2</sup>-PAK  
(TO-263)



DIM	MILLIMETERS
A	9.8±0.2
a	7.4±0.2
B	4.5±0.2
b1	1.3±0.05
b2	2.4±0.2
H	15.5±0.3
h	1.54±0.2
h1	10.5±0.2
h2	9.2±0.1
h3	1.54±0.2
h4	2.7±0.2
L	2.4±0.2
1	1.3±0.1
11	0.8±0.1
12	1.3±0.1
13	0.5±0.1
N	2.45±0.05
R	0.5R±0.05

Unit :mm