

GENERAL DESCRIPTION

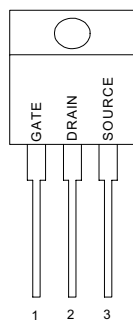
This advanced high voltage MOSFET is designed to withstand high energy in the avalanche mode and switch efficiently. This new high energy device also offers a drain-to-source diode with fast recovery time. Designed for high voltage, high speed switching applications such as power supplies, converters, power motor controls and bridge circuits.

FEATURES

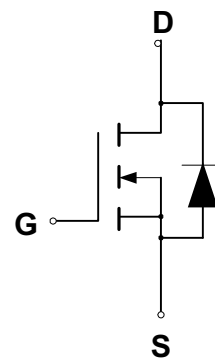
- ◆ Higher Current Rating
- ◆ Lower $R_{ds(on)}$
- ◆ Lower Capacitances
- ◆ Lower Total Gate Charge
- ◆ Tighter VSD Specifications
- ◆ Avalanche Energy Specified

PIN CONFIGURATION

TO-220/TO-220FP
Top View



SYMBOL



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain to Current – Continuous	I_D	4.0	A
– Pulsed	I_{DM}	18	
Gate-to-Source Voltage – Continue	V_{GS}	± 20	V
– Non-repetitive	V_{GSM}	± 40	V
Total Power Dissipation	P_D		W
TO-220		96	
TO-220FP		38	
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^{\circ}C$
Single Pulse Drain-to-Source Avalanche Energy – $T_J = 25^{\circ}C$ ($V_{DD} = 100V, V_{GS} = 10V, I_L = 4A, L = 10mH, R_G = 25\Omega$)	E_{AS}	80	mJ
Thermal Resistance – Junction to Case	θ_{JC}	1.70	$^{\circ}C/W$
– Junction to Ambient	θ_{JA}	62	
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	T_L	300	$^{\circ}C$

ORDERING INFORMATION

Part Number	Package
IRF4N60	TO-220
IRF4N60FP	TO-220 Full Package

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, $T_J = 25^\circ\text{C}$.

Characteristic	Symbol	IRF4N60			Units
		Min	Typ	Max	
Drain-Source Breakdown Voltage ($V_{GS} = 0\text{ V}$, $I_D = 250\ \mu\text{A}$)	$V_{(BR)DSS}$	600			V
Drain-Source Leakage Current ($V_{DS} = 600\text{ V}$, $V_{GS} = 0\text{ V}$)	I_{DSS}			0.1	mA
Gate-Source Leakage Current-Forward ($V_{gsf} = 20\text{ V}$, $V_{DS} = 0\text{ V}$)	I_{GSSF}			100	nA
Gate-Source Leakage Current-Reverse ($V_{gsr} = 20\text{ V}$, $V_{DS} = 0\text{ V}$)	I_{GSSR}			-100	nA
Gate Threshold Voltage ($V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$)	$V_{GS(th)}$	2.0		4.0	V
Static Drain-Source On-Resistance ($V_{GS} = 10\text{ V}$, $I_D = 2.0\text{ A}$) *	$R_{DS(on)}$		1.5	2.4	Ω
Forward Transconductance ($V_{DS} = 50\text{ V}$, $I_D = 2.0\text{ A}$) *	g_{FS}	2.5			mhos
Input Capacitance	$(V_{DS} = 25\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1.0\text{ MHz}$)	C_{iss}	520	730	pF
Output Capacitance		C_{oss}	125	180	pF
Reverse Transfer Capacitance		C_{rss}	8.0	20	pF
Turn-On Delay Time	$(V_{DD} = 300\text{ V}$, $I_D = 4.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 9.1\Omega$) *	$t_{d(on)}$	12	20	ns
Rise Time		t_r	7.0	10	ns
Turn-Off Delay Time		$t_{d(off)}$	19	40	ns
Fall Time		t_f	10	20	ns
Total Gate Charge	$(V_{DS} = 480\text{ V}$, $I_D = 4.0\text{ A}$, $V_{GS} = 10\text{ V}$) *	Q_g	5.0	10	nC
Gate-Source Charge		Q_{gs}	2.7		nC
Gate-Drain Charge		Q_{gd}	2.0		nC
Internal Drain Inductance (Measured from the drain lead 0.25" from package to center of die)	L_D		4.5		nH
Internal Drain Inductance (Measured from the source lead 0.25" from package to source bond pad)	L_S		7.5		nH
SOURCE-DRAIN DIODE CHARACTERISTICS					
Forward On-Voltage(1)	$(I_S = 4.0\text{ A}$, $d_I/d_t = 100\text{ A}/\mu\text{s}$)	V_{SD}		1.5	V
Forward Turn-On Time		t_{on}	**		ns
Reverse Recovery Time		t_{rr}		655	

* Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$

** Negligible, Dominated by circuit inductance

TYPICAL ELECTRICAL CHARACTERISTICS

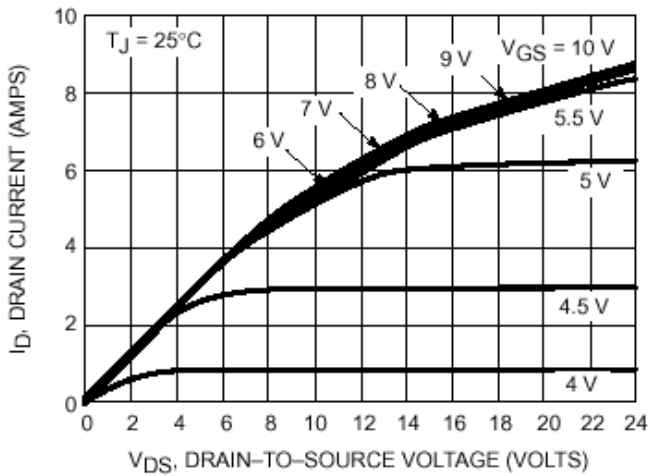


Figure 1. On-Region Characteristics

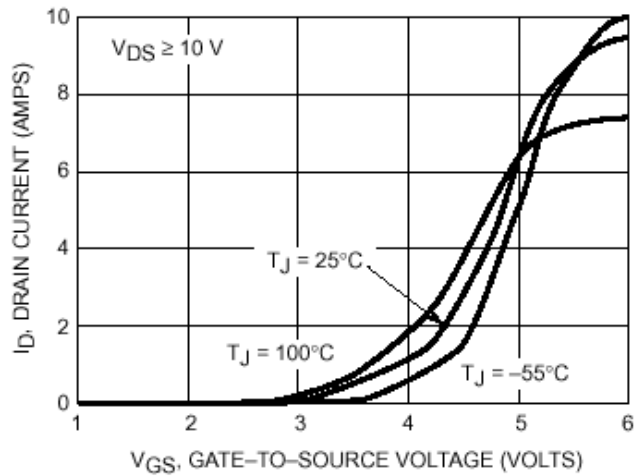


Figure 2. Transfer Characteristics

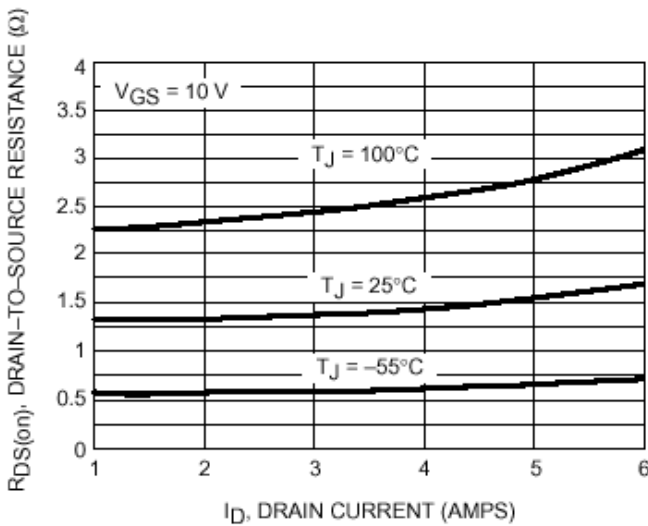


Figure 3. On-Resistance versus Drain Current and Temperature

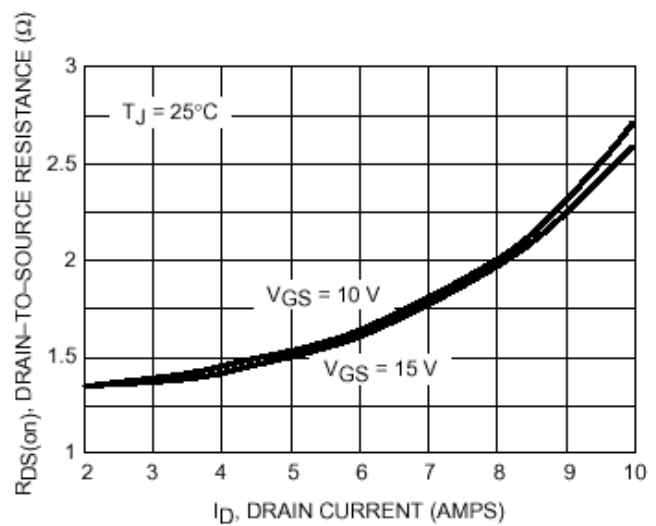


Figure 4. On-Resistance versus Drain Current and Gate Voltage

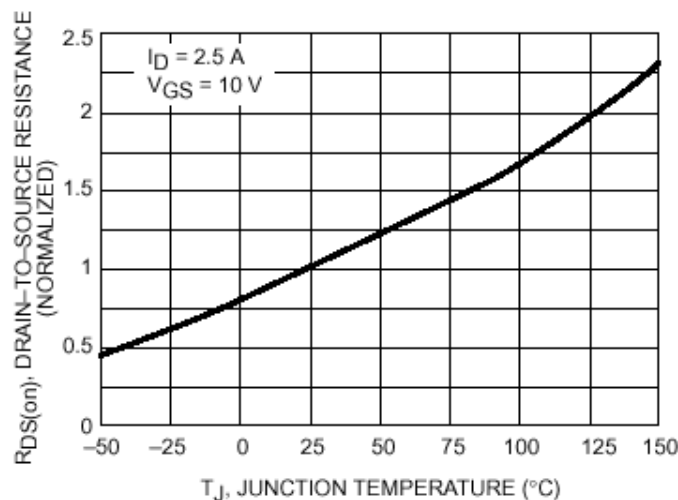


Figure 5. On-Resistance Variation with Temperature

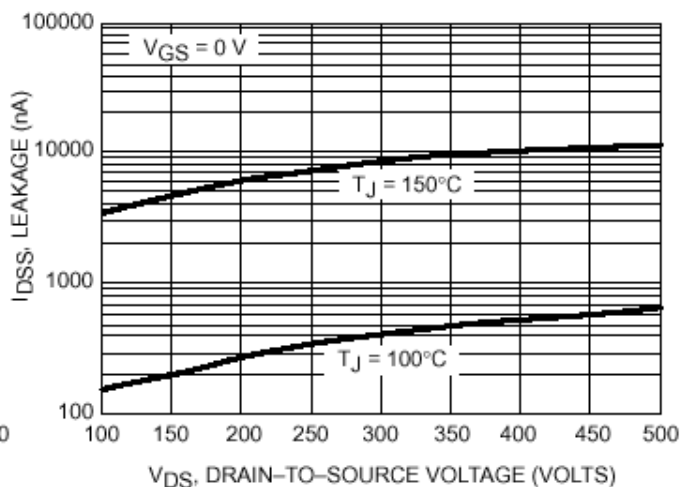
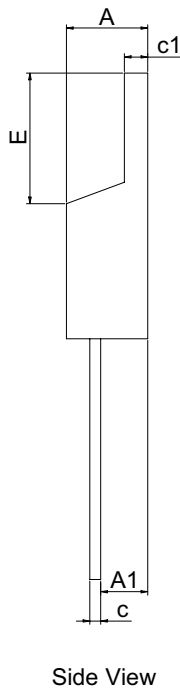
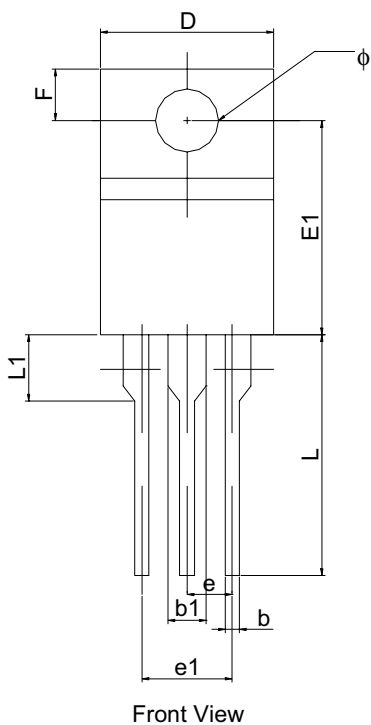


Figure 6. Drain-to-Source Leakage Current versus Voltage

PACKAGE DIMENSION

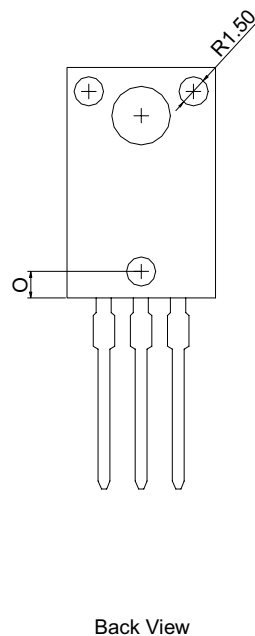
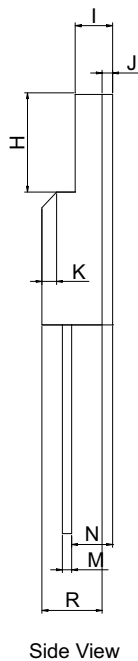
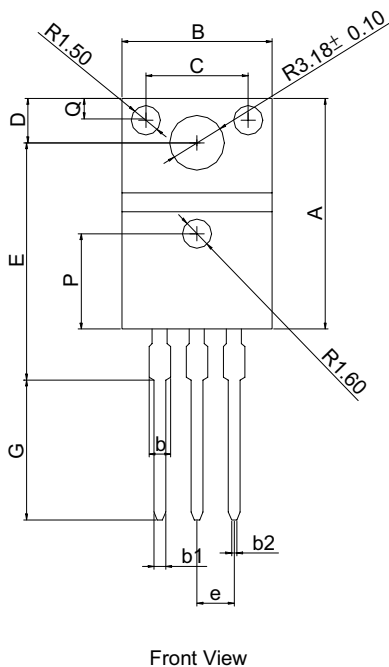
TO-220



PIN 1: GATE
PIN 2: DRAIN
PIN 3: SOURCE

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	4.47	----	4.67	0.176	----	0.184
A1	2.52	----	2.82	0.099	----	0.111
b	0.71	----	0.91	0.028	----	0.036
b1	1.17	----	1.37	0.046	----	0.054
c	0.31	----	0.53	0.012	----	0.021
c1	1.17	----	1.37	0.046	----	0.054
D	10.01	----	10.31	0.394	----	0.406
E	8.50	----	8.90	0.335	----	0.350
E1	12.06	----	12.46	0.475	----	0.491
e	----	2.54	----	----	0.100	----
e1	4.98	----	5.18	0.196	----	0.204
F	2.59	----	2.89	0.102	----	0.114
L	13.40	----	13.80	0.528	----	0.543
L1	3.56	----	3.96	0.140	----	0.156
φ	3.79	----	3.89	0.149	----	0.153

TO-220FP



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	15.87	----	16.07	0.617	----	0.633
B	9.98	----	10.36	0.392	----	0.408
C	----	7.00	----	----	0.275	----
D	3.20	----	3.40	0.126	----	0.134
E	15.60	----	16.00	0.614	----	0.630
G	9.45	----	10.05	0.372	----	0.398
H	6.48	----	6.88	0.255	----	0.279
I	2.34	----	2.74	0.092	----	0.108
J	----	0.70	----	----	0.028	----
K	----	1.00	----	----	0.039	----
M	0.45	----	0.60	0.018	----	0.024
N	2.56	----	2.96	0.101	----	0.117
O	----	1.80	----	----	0.071	----
P	----	6.50	----	----	0.256	----
Q	----	1.50	----	----	0.059	----
R	4.50	----	4.90	0.177	----	0.193
b	----	1.47	----	----	0.058	----
b1	0.70	----	0.90	0.028	----	0.035
b2	0.25	----	0.45	0.010	----	0.018
e	----	2.54	----	----	0.100	----