

**GENERAL DESCRIPTION**

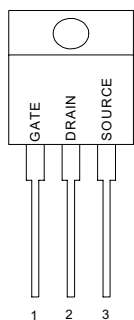
This high voltage MOSFET uses an advanced termination scheme to provide enhanced voltage-blocking capability without degrading performance over time. In addition, this advanced MOSFET is designed to withstand high energy in avalanche and commutation modes. The new energy efficient design also offers a drain-to-source diode with a fast recovery time. Designed for high voltage, high speed switching applications in power supplies, converters and PWM motor controls, these devices are particularly well suited for bridge circuits where diode speed and commutating safe operating areas are critical and offer additional and safety margin against unexpected voltage transients.

**FEATURES**

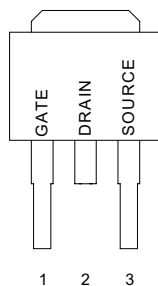
- ◆ Robust High Voltage Termination
- ◆ Avalanche Energy Specified
- ◆ Source-to-Drain Diode Recovery Time Comparable to a Discrete Fast Recovery Diode
- ◆ Diode is Characterized for Use in Bridge Circuits
- ◆  $I_{BSS}$  and  $V_{DS(on)}$  Specified at Elevated Temperature

**PIN CONFIGURATION**

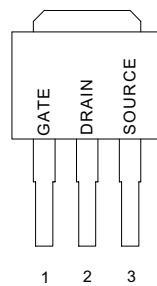
TO-220/TO-220FP  
Front View



TO-252  
Front View

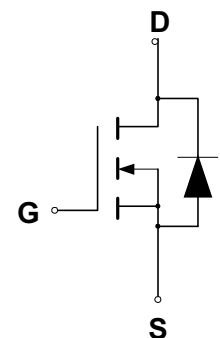


TO-251  
Front View



**SYMBOL**

N-Channel MOSFET



**ABSOLUTE MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Drain to Current — Continuous	$I_D$	2.0	A
— Pulsed	$I_{DM}$	9.0	
Gate-to-Source Voltage — Continue	$V_{GS}$	$\pm 20$	V
— Non-repetitive	$V_{GSM}$	$\pm 40$	V
Total Power Dissipation	$P_D$		W
TO-251/TO-252		60	
TO-220		60	
TO-220FP		32	
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	$^{\circ}C$
Single Pulse Drain-to-Source Avalanche Energy — $T_J = 25^{\circ}C$ ( $V_{DD} = 100V, V_{GS} = 10V, I_L = 2A, L = 10mH, R_G = 25\Omega$ )	$E_{AS}$	20	mJ
Thermal Resistance — Junction to Case	$\theta_{JC}$	1.0	$^{\circ}C/W$
— Junction to Ambient	$\theta_{JA}$	62.5	
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	$T_L$	260	$^{\circ}C$

### ORDERING INFORMATION

Part Number	Package
IRF820-251	TO-251
IRF820-252	TO-252
IRF820-220	TO-220
IRF820-220FP	TO-220 Full Package

### ELECTRICAL CHARACTERISTICS

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

Characteristic		Symbol	IRF820			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 ( $V_{DS} = 600\text{ V}$ , $V_{GS} = 0\text{ V}$ ) ( $V_{DS} = 480\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125^\circ\text{C}$ )		$I_{DSS}$			0.1 1.0	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 ( $V_{GS} = 10\text{ V}$ , $I_D = 1.2\text{A}$ ) *		$R_{DS(on)}$			4.4	$\Omega$
Forward Transconductance ( $V_{DS} \geq 50\text{ V}$ , $I_D = 1.0\text{A}$ ) *		$g_{FS}$	1.4			mhos
Input Capacitance	$(V_{DS} = 25\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1.0\text{ MHz}$ )	$C_{iss}$		435		pF
Output Capacitance		$C_{oss}$		56		pF
Reverse Transfer Capacitance		$C_{rss}$		9.2		pF
Turn-On Delay Time	$(V_{DD} = 300\text{ V}$ , $I_D = 2.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 18\Omega$ ) *	$t_{d(on)}$		12		ns
Rise Time		$t_r$		21		ns
Turn-Off Delay Time		$t_{d(off)}$		30		ns
Fall Time		$t_f$		24		ns
Total Gate Charge	$(V_{DS} = 400\text{ V}$ , $I_D = 2.0\text{ A}$ , $V_{GS} = 10\text{ V}$ ) *	$Q_g$		13	22	nC
Gate-Source Charge		$Q_{gs}$		2.0		nC
Gate-Drain Charge		$Q_{gd}$		6.0		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
<b>SOURCE-DRAIN DIODE CHARACTERISTICS</b>						
Forward On-Voltage(1)	$(I_S = 2.0\text{ A}$ , $V_{GS} = 0\text{ V}$ , $dI_S/dt = 100\text{A}/\mu\text{s}$ )	$V_{SD}$			1.5	V
Forward Turn-On Time		$t_{on}$		**		ns
Reverse Recovery Time		$t_{rr}$		340		ns

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

\*\* Negligible, Dominated by circuit inductance

TYPICAL ELECTRICAL CHARACTERISTICS

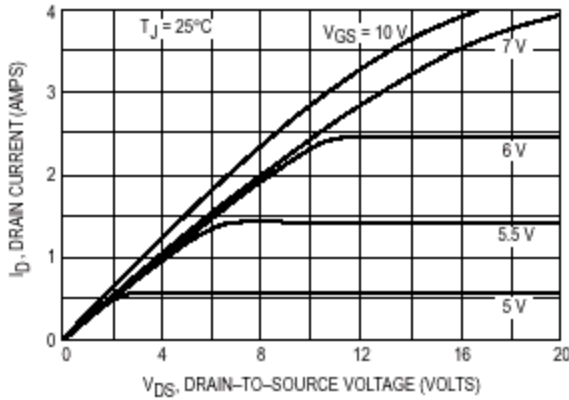


Figure 1. On-Region Characteristics

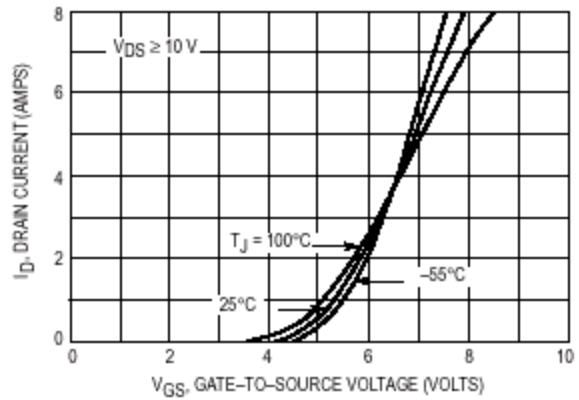


Figure 2. Transfer Characteristics

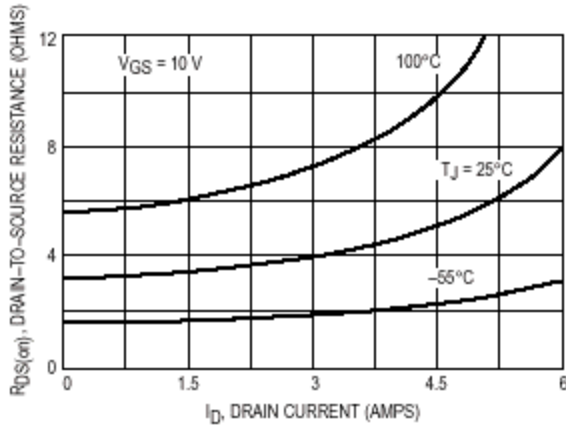


Figure 3. On-Resistance versus Drain Current and Temperature

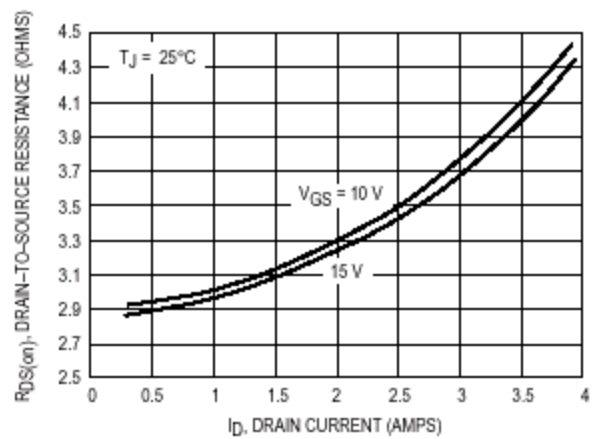


Figure 4. On-Resistance versus Drain Current and Gate Voltage

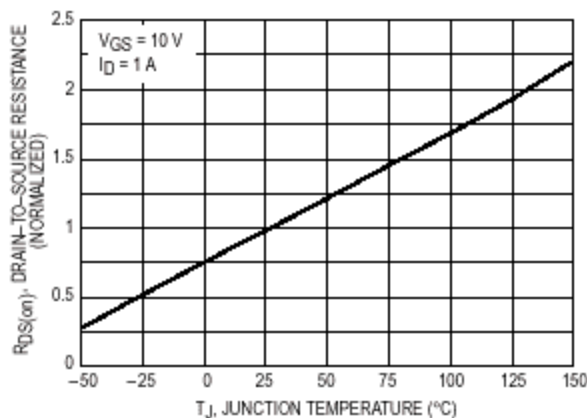


Figure 5. On-Resistance Variation with Temperature

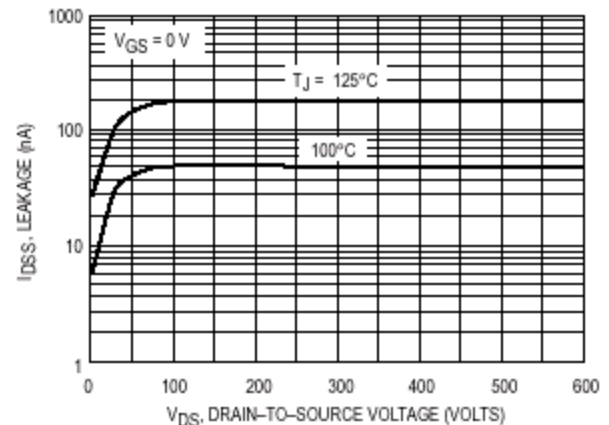
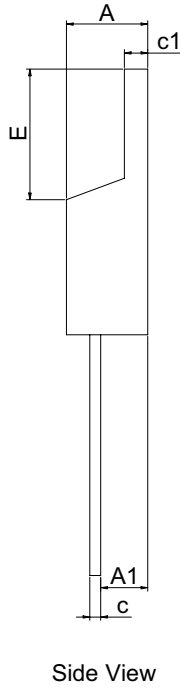
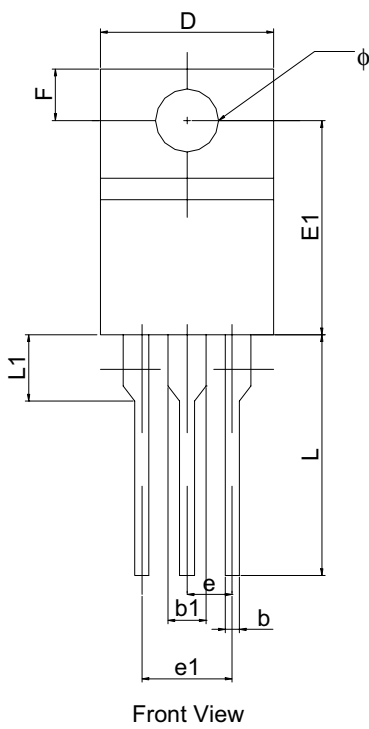


Figure 6. Drain-To-Source Leakage Current versus Voltage

PACKAGE DIMENSION

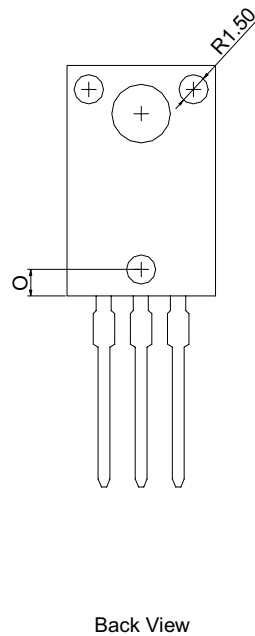
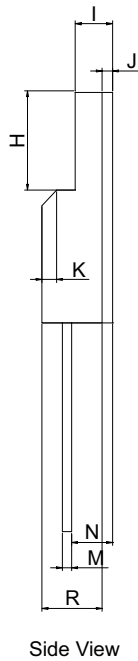
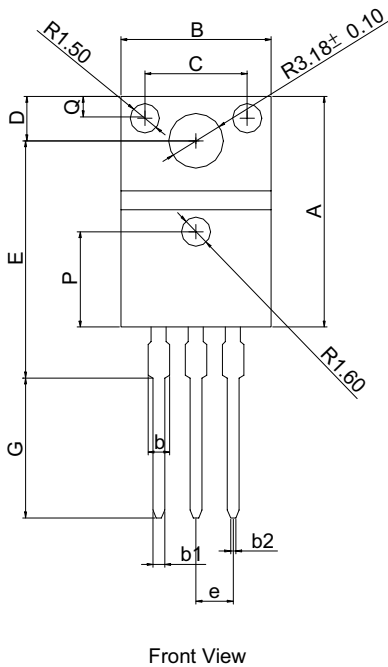
TO-220



**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

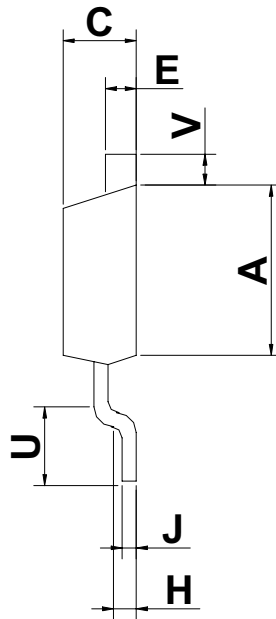
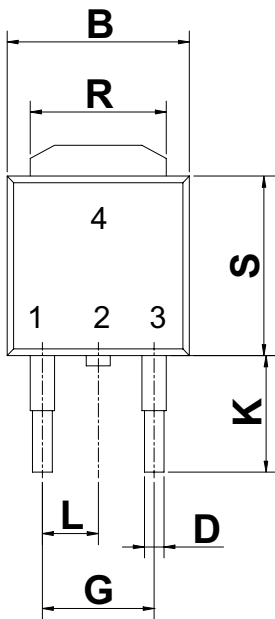
TO-220FP



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	----

**PACKAGE DIMENSION**

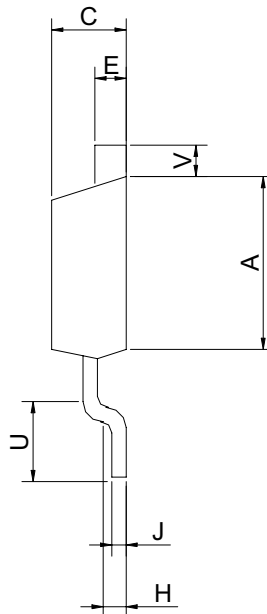
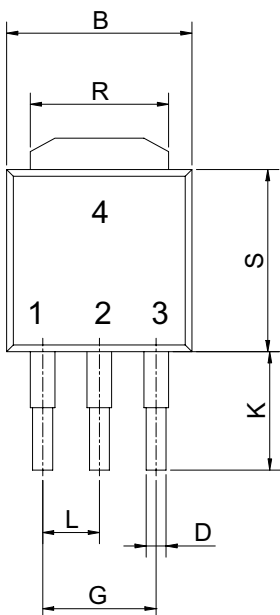
**TO-252**



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

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	5.97	----	6.35	0.235	----	0.250
B	6.35	----	6.73	0.250	----	0.265
C	2.19	----	2.38	0.086	----	0.094
D	0.69	----	0.88	0.027	----	0.035
E	0.84	----	1.01	0.033	----	0.047
G	4.58BSC			0.180BSC		
H	0.87	----	1.01	0.034	----	0.040
J	0.46	----	0.58	0.018	----	0.023
K	2.60	----	2.89	0.102	----	0.114
L	2.29BSC			0.090BSC		
R	4.45	----	5.46	0.175	----	0.215
S	0.51	----	1.27	0.020	----	0.050
U	0.51	----	----	0.020	----	----
V	0.77	----	1.27	0.030	----	0.050

**TO-251**



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

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	5.97	----	6.35	0.235	----	0.250
B	6.35	----	6.73	0.250	----	0.265
C	2.19	----	2.38	0.086	----	0.094
D	0.69	----	0.88	0.027	----	0.035
E	0.84	----	1.01	0.033	----	0.047
G	4.58BSC			0.180BSC		
H	0.87	----	1.01	0.034	----	0.040
J	0.46	----	0.58	0.018	----	0.023
K	2.60	----	2.89	0.102	----	0.114
L	2.29BSC			0.090BSC		
R	4.45	----	5.46	0.175	----	0.215
S	0.51	----	1.27	0.020	----	0.050
U	0.51	----	----	0.020	----	----
V	0.77	----	1.27	0.030	----	0.050