

**GENERAL DESCRIPTION**

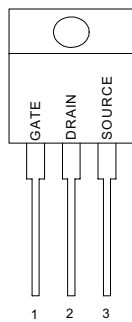
This high voltage MOSFET uses an advanced termination scheme to provide enhanced voltage-blocking capability without degrading performance over time. In addition, this advanced MOSFET is designed to withstand high energy in avalanche and commutation modes. The new energy efficient design also offers 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**

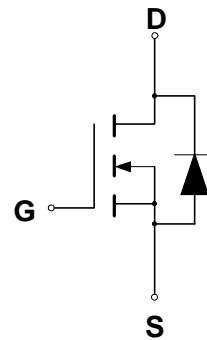
- ◆ Robust High Voltage Termination
- ◆ Avalanche Energy Specified
- ◆ Source-to-Drain Diode Recovery Time Comparable to a Discrete Fast Recovery Diode
- ◆ Diode is Characterized for Use in Bridge Circuits
- ◆  $I_{BSS}$  Specified at Elevated Temperature

**PIN CONFIGURATION**

TO-220/TO-220FP  
Front View



**SYMBOL**



N-Channel MOSFET

**ABSOLUTE MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Drain to Current – Continuous	$I_D$	7.0	A
– Pulsed	$I_{DM}$	20	
Gate-to-Source Voltage – Continue	$V_{GS}$	$\pm 20$	V
– Non-repetitive	$V_{GSM}$	$\pm 40$	V
Total Power Dissipation	$P_D$		W
TO-220		147	
TO-220FP		50	
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	$^{\circ}C$
Single Pulse Drain-to-Source Avalanche Energy – $T_J = 25^{\circ}C$ ( $V_{DD} = 100V, V_{GS} = 10V, I_L = 7A, L = 10mH, R_G = 25\Omega$ )	$E_{AS}$	245	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	$^{\circ}C$

(1) Pulse Width and frequency is limited by  $T_J(max)$  and thermal response

### ORDERING INFORMATION

Part Number	Package
IRF7N60	TO-220
IRF7N60FP	TO-220 Full Pak

### ELECTRICAL CHARACTERISTICS

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

Characteristic	Symbol	CMT07N60			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 ( $V_{DS} = 600\text{ V}$ , $V_{GS} = 0\text{ V}$ ) ( $V_{DS} = 480\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125^\circ\text{C}$ )	$I_{DSS}$			100 100	$\mu\text{A}$
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 ( $V_{GS} = 10\text{ V}$ , $I_D = 3.5\text{A}$ ) *	$R_{DS(on)}$			1.2	$\Omega$
Forward Transconductance ( $V_{DS} = 40\text{ V}$ , $I_D = 3.5\text{A}$ ) *	$g_{FS}$	4.0			mhos
Input Capacitance	$(V_{DS} = 25\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1.0\text{ MHz}$ )	$C_{iss}$	1380	1800	pF
Output Capacitance		$C_{oss}$	115	150	pF
Reverse Transfer Capacitance		$C_{rss}$	23	30	pF
Turn-On Delay Time	$(V_{DD} = 300\text{ V}$ , $I_D = 7.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 9.1\Omega$ ) *	$t_{d(on)}$	30	70	ns
Rise Time		$t_r$	80	170	ns
Turn-Off Delay Time		$t_{d(off)}$	125	260	ns
Fall Time		$t_f$	85	180	ns
Total Gate Charge	$(V_{DS} = 480\text{ V}$ , $I_D = 7.0\text{ A}$ , $V_{GS} = 10\text{ V}$ ) *	$Q_g$	38	50	nC
Gate-Source Charge		$Q_{gs}$	6.4		nC
Gate-Drain Charge		$Q_{gd}$	15		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)	$(I_S = 7.0\text{ A}$ , $dI_S/dt = 100\text{A}/\mu\text{s}$ )	$V_{SD}$		1.4	V
Forward Turn-On Time		$t_{on}$	**		ns
Reverse Recovery Time		$t_{rr}$	415		ns

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

\*\* Negligible, Dominated by circuit inductance

TYPICAL ELECTRICAL CHARACTERISTICS

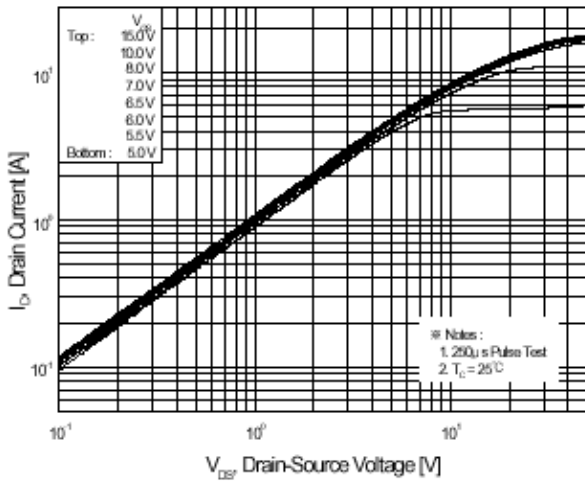


Figure 1. On-Region Characteristics

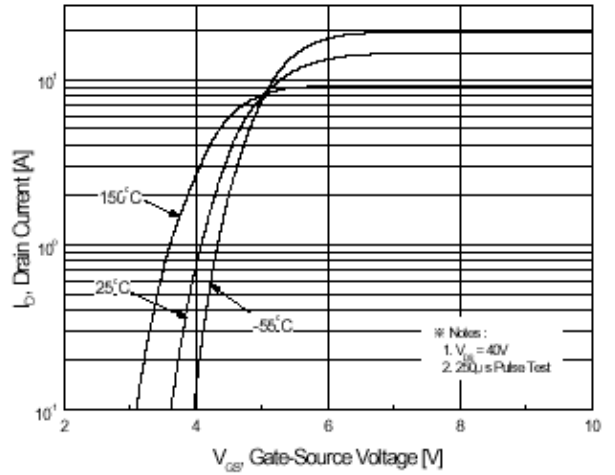


Figure 2. Transfer Characteristics

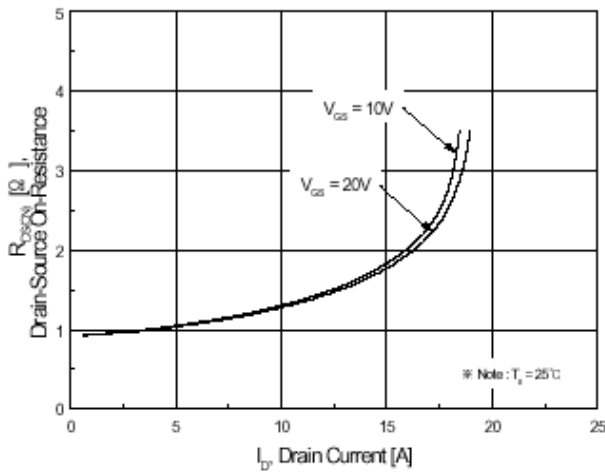


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

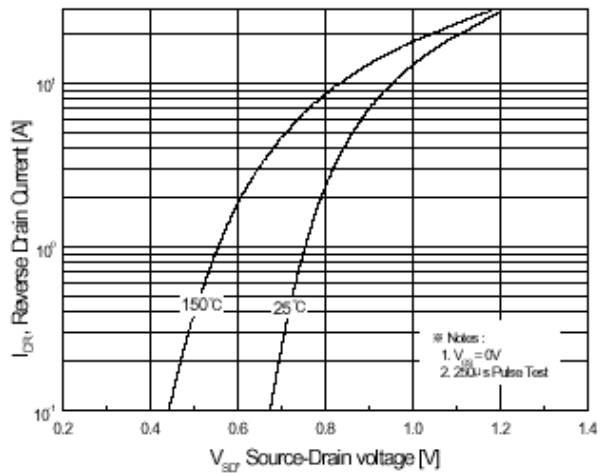
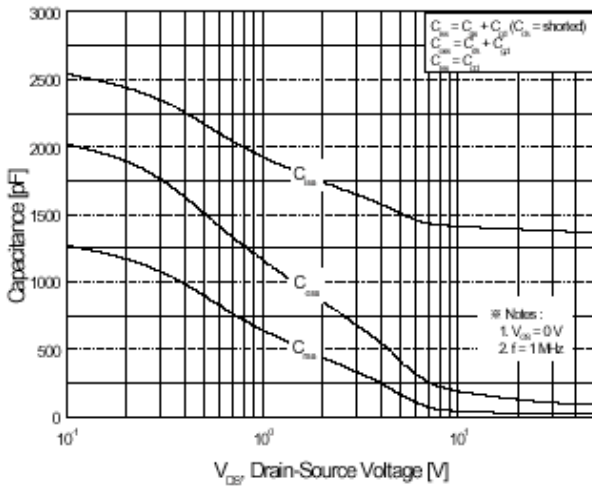
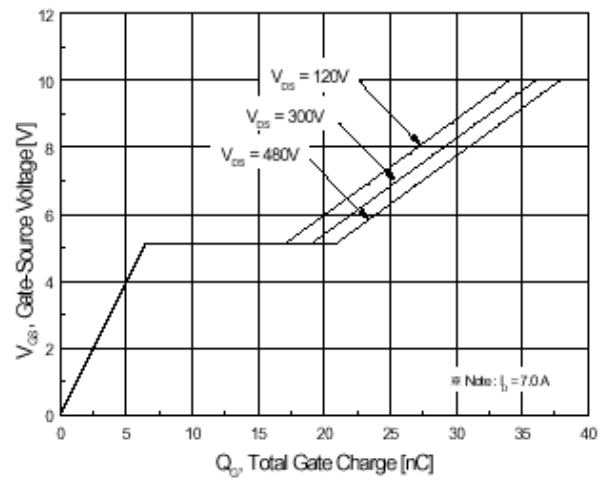


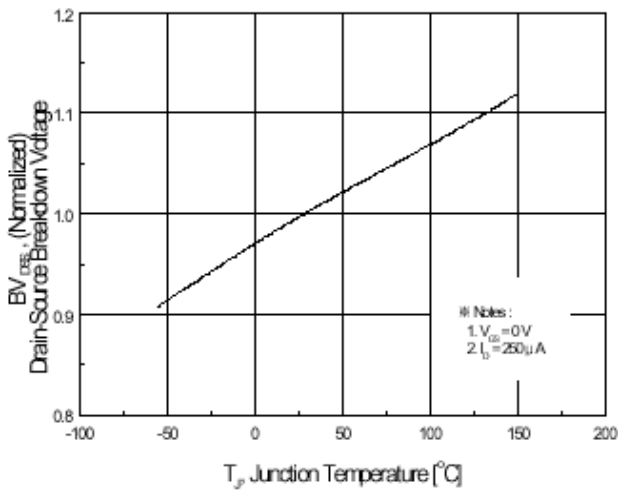
Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature



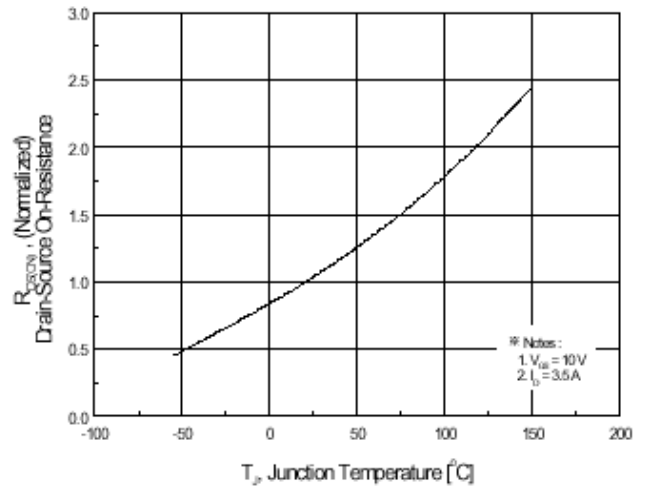
**Figure 5. Capacitance Characteristics**



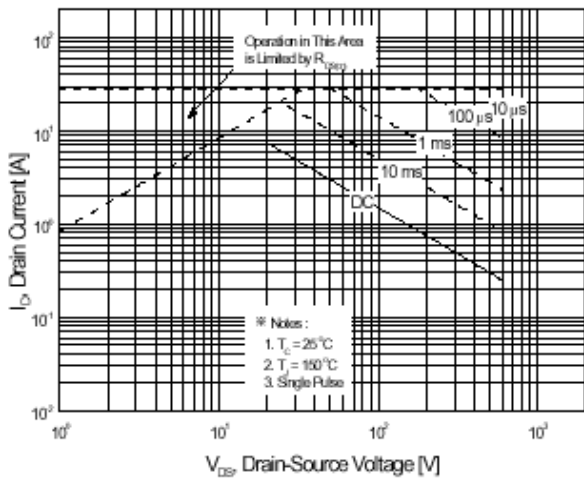
**Figure 6. Gate Charge Characteristics**



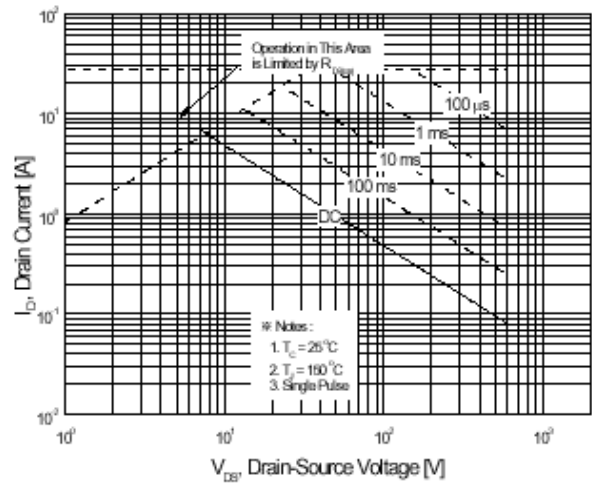
**Figure 7. Breakdown Voltage Variation vs Temperature**



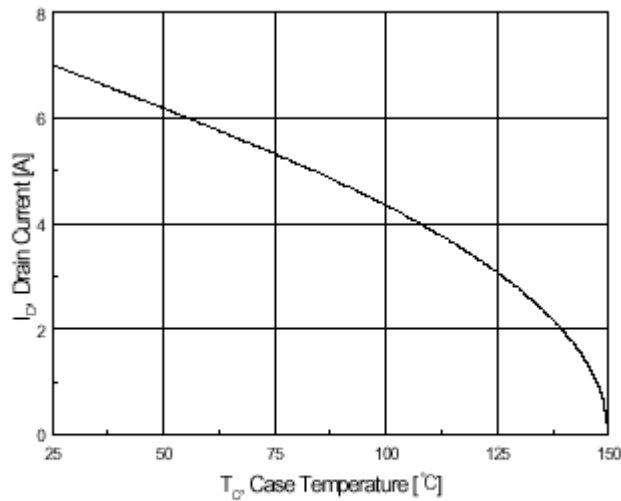
**Figure 8. On-Resistance Variation**



**Figure 9-1. Maximum Safe Operating Area**



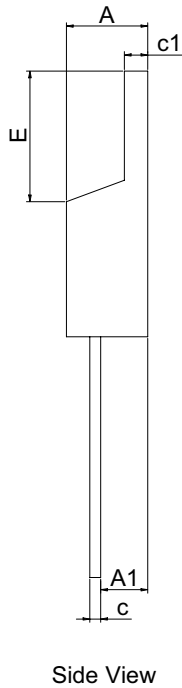
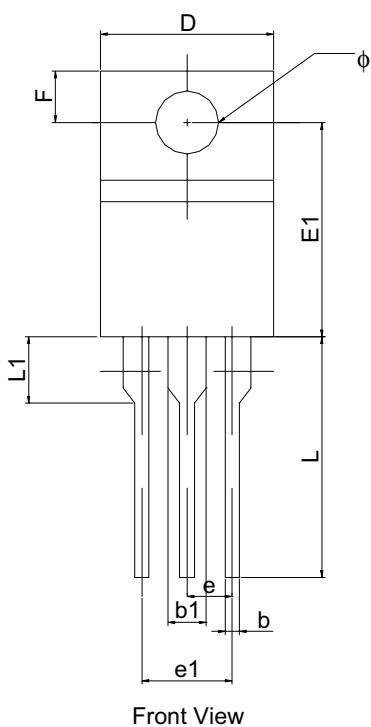
**Figure 9-2. Maximum Safe Operating Area**



**Figure 10. Maximum Drain Current vs Case Temperature**

PACKAGE DIMENSION

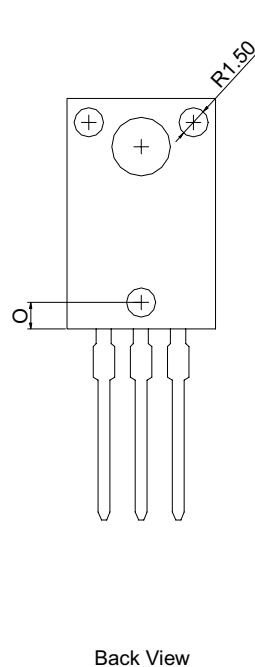
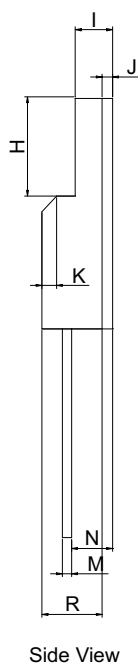
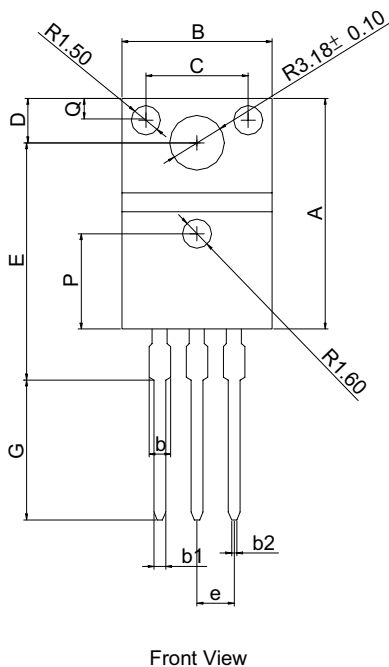
TO-220



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	----