# IRF7N60
POWER MOSFET

## GENERAL DESCRIPTION

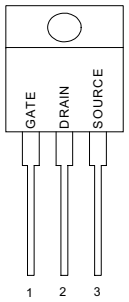
This high voltage MOSFET uses an advanced termination scheme to provide enhanced voltage-blocking capability without degrading performance over time. In addition, this advanced MOSFET is designed to withstand high energy in avalanche and commutation modes. The new energy efficient design also offers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

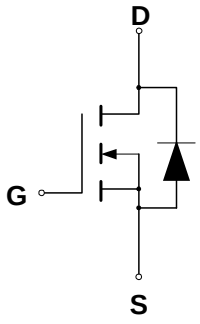
- Robust High Voltage Termination
- Avalanche Energy Specified
- Source-to-Drain Diode Recovery Time Comparable to a Discrete Fast Recovery Diode
- Diode is Characterized for Use in Bridge Circuits
- $I_{DSS}$ Specified at Elevated Temperature

## 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 | $V_{GS}$ | ±20 | V |
| — Non-repetitive | $V_{GSM}$ | ±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 | ℃ |
| Single Pulse Drain-to-Source Avalanche Energy — $T_J$ = 25℃ ($V_{DD}$ = 100V, $V_{GS}$ = 10V, $I_L$ = 7A, L = 10mH, $R_G$ = 25Ω) | $E_{AS}$ | 245 | mJ |
| Thermal Resistance — Junction to Case | $\theta_{JC}$ | 1.0 | ℃/W |
| — Junction to Ambient | $\theta_{JA}$ | 62.5 | |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds | $T_L$ | 260 | ℃ |

(1) Pulse Width and frequency is limited by TJ(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℃.

| | | | CMT07N60 | | | |
|---|---|---|---|---|---|---|
| **Characteristic** | | **Symbol** | **Min** | **Typ** | **Max** | **Units** |
| Drain-Source Breakdown Voltage ($V_{GS}$ = 0 V, $I_D$ = 250 μA) | | $V_{(BR)DSS}$ | 600 | | | V |
| Drain-Source Leakage Current ($V_{DS}$ = 600 V, $V_{GS}$ = 0 V)<br>($V_{DS}$ = 480 V, $V_{GS}$ = 0 V, $T_J$ = 125℃) | | $I_{DSS}$ | | | 100<br>100 | μA |
| Gate-Source Leakage Current-Forward ($V_{gsf}$ = 20 V, $V_{DS}$ = 0 V) | | $I_{GSSF}$ | | | 100 | nA |
| Gate-Source Leakage Current-Reverse ($V_{gsr}$ = 20 V, $V_{DS}$ = 0 V) | | $I_{GSSR}$ | | | 100 | nA |
| Gate Threshold Voltage ($V_{DS}$ = $V_{GS}$, $I_D$ = 250 μA) | | $V_{GS(th)}$ | 2.0 | | 4.0 | V |
| Static Drain-Source On-Resistance ($V_{GS}$ = 10 V, $I_D$ = 3.5A) * | | $R_{DS(on)}$ | | | 1.2 | Ω |
| Forward Transconductance ($V_{DS}$ = 40 V, $I_D$ = 3.5A) * | | $g_{FS}$ | 4.0 | | | mhos |
| Input Capacitance | ($V_{DS}$ = 25 V, $V_{GS}$ = 0 V, f = 1.0 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 V, $I_D$ = 7.0 A, $V_{GS}$ = 10 V, $R_G$ = 9.1Ω) * | $t_{d(on)}$ | | 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 V, $I_D$ = 7.0 A, $V_{GS}$ = 10 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 |
| **SOURCE-DRAIN DIODE CHARACTERISTICS** | | | | | | |
| Forward On-Voltage(1) | ($I_S$ =7.0 A, $d_{IS}/d_t$ = 100A/μs) | $V_{SD}$ | | | 1.4 | V |
| Forward Turn-On Time | | $t_{on}$ | | ** | | ns |
| Reverse Recovery Time | | $t_{rr}$ | | 415 | | ns |

* Pulse Test: Pulse Width ≦300μs, Duty Cycle ≦2%

** Negligible, Dominated by circuit inductance

## TYPICAL ELECTRICAL CHARACTERISTICS

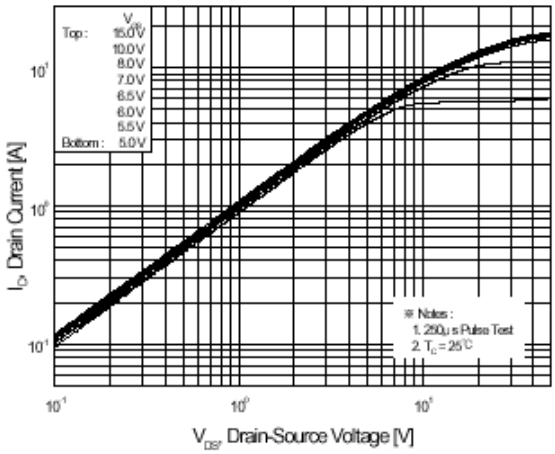



**Figure 1. On-Region Characteristics**

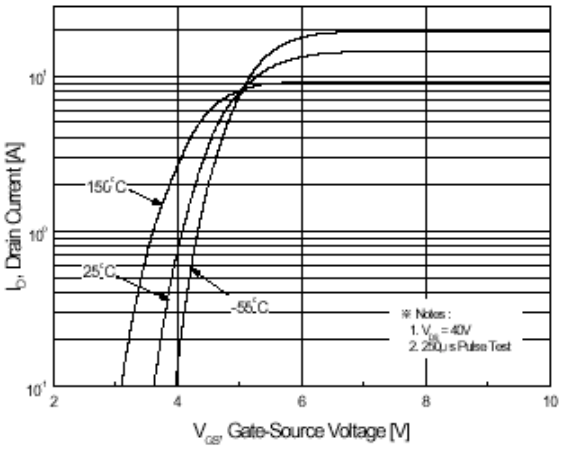



**Figure 2. Transfer Characteristics**

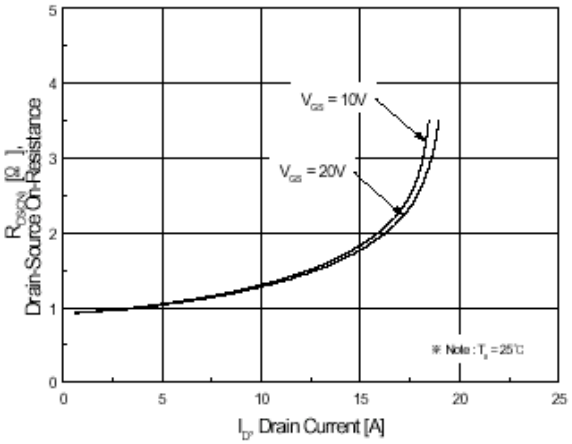



**Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage**

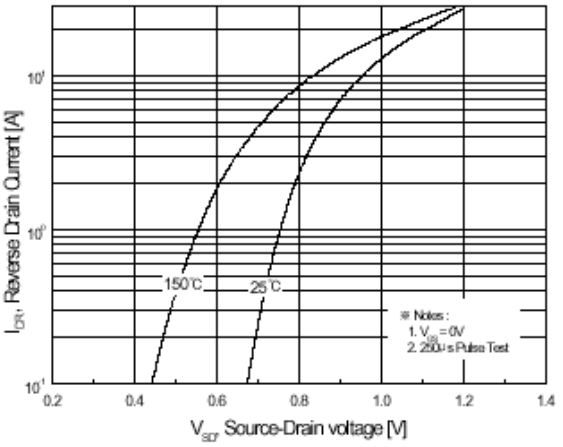



**Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature**

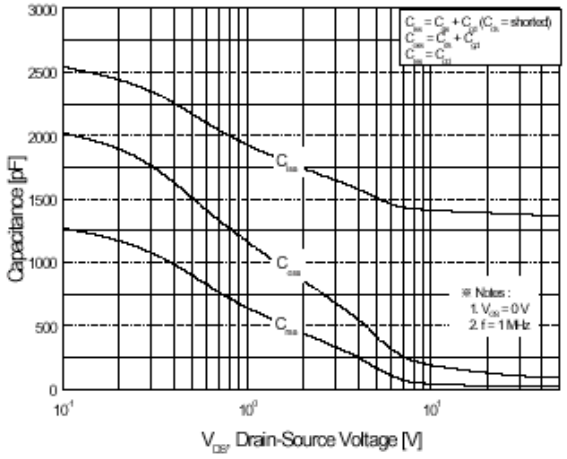



**Figure 5. Capacitance Characteristics**

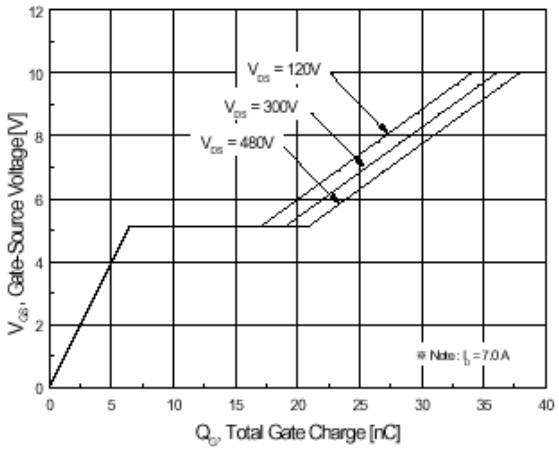



**Figure 6. Gate Charge Characteristics**

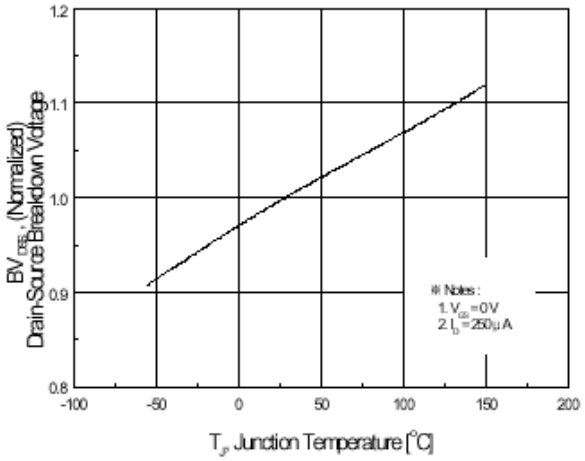



**Figure 7. Breakdown Voltage Variation vs Temperature**

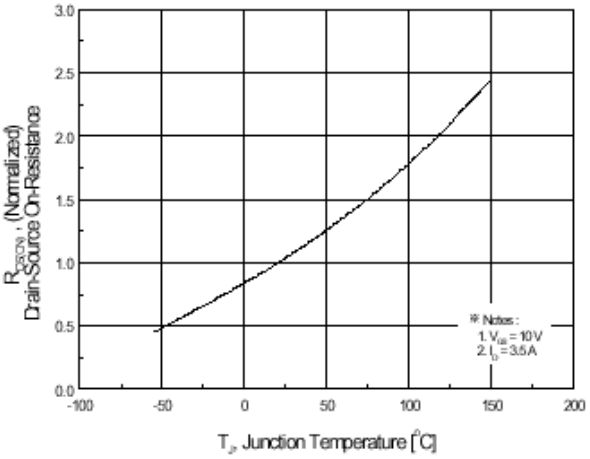



**Figure 8. On-Resistance Variation**

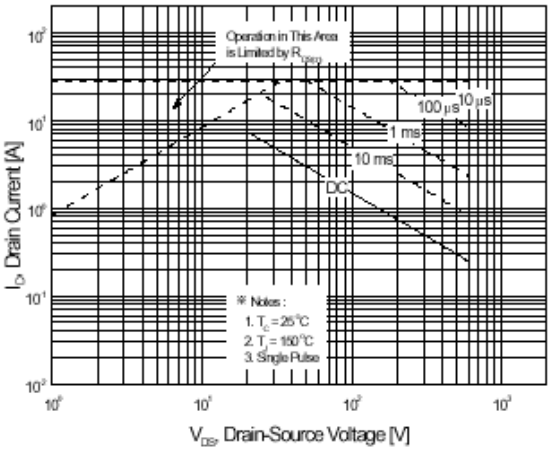



**Figure 9-1. Maximum Safe Operating Area**

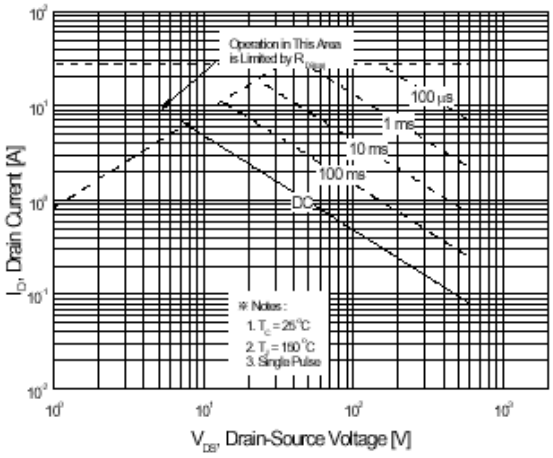



**Figure 9-2. Maximum Safe Operating Area**

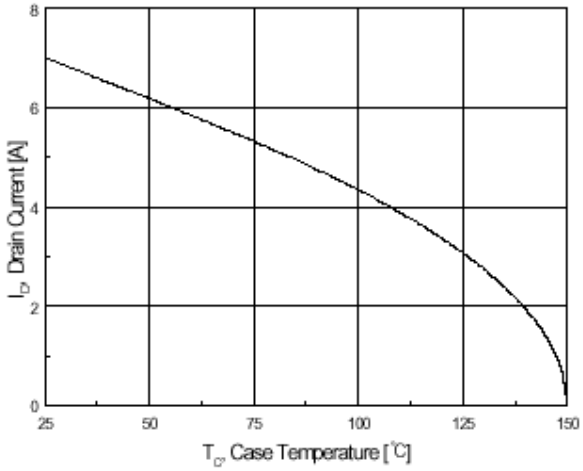
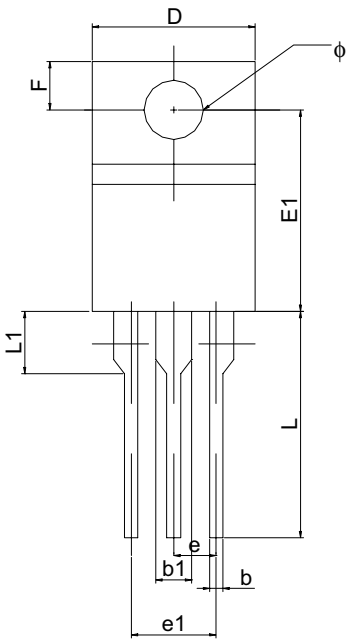


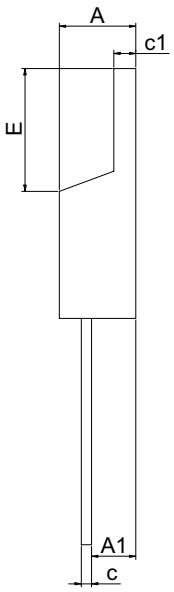

**Figure 10. Maximum Drain Current vs Case Temperature**

## PACKAGE DIMENSION

### TO-220




Front View

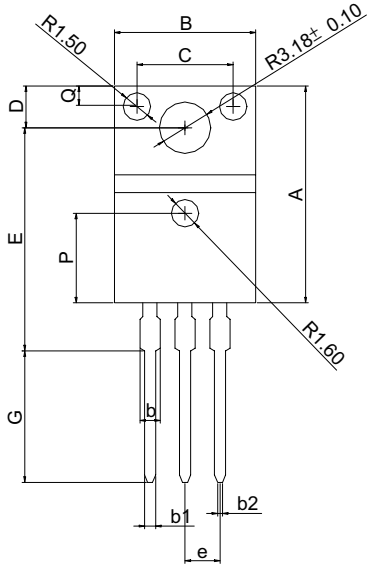



Side View

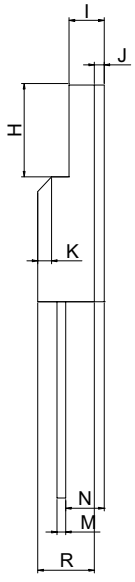
**PIN 1: GATE**
**PIN 2: DRAIN**
**PIN 3: SOURCE**

| SYMBOLS | DIMENSIONS IN MILLIMETERS | | | DIMENSIONS IN INCHS | | |
|---|---|---|---|---|---|---|
| | 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 |

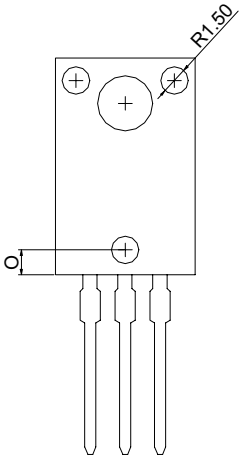
### TO-220FP




Front View




Side View




Back View

| SYMBOLS | DIMENSIONS IN MILLIMETERS | | | DIMENSIONS IN INCHS | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 15.67 | --- | 16.07 | 0.617 | --- | 0.633 |
| B | 9.96 | --- | 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 | --- | 0.396 |
| 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 | --- |