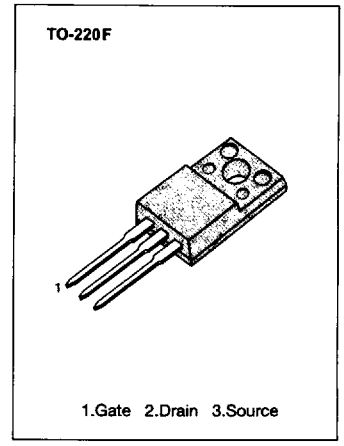
## FEATURES

- Lower $R_{DS(ON)}$
- Improved inductive ruggedness
- Fast switching times
- Rugged polysilicon gate cell structure
- Lower input capacitance
- Extended safe operating area
- Improved high temperature reliability




## PRODUCT SUMMARY

| Part Number | $V_{DS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| IRFS630 | 200V | 0.4Ω | 5.9A |
| IRFS631 | 150V | 0.4Ω | 5.9A |

## ABSOLUTE MAXIMUM RATINGS

| Characteristic | Symbol | IRFS630 | IRFS631 | Unit |
|---|---|---|---|---|
| Drain-Source Voltage (1) | $V_{DSS}$ | 200 | 150 | Vdc |
| Drain-Gate Voltage ($R_{GS}$=1.0MΩ)(1) | $V_{DGR}$ | 200 | 150 | Vdc |
| Gate-Source Voltage | $V_{GS}$ | ±20 | | Vdc |
| Continuous Drain Current $T_C$=25 °C | $I_D$ | 5.9 | | Adc |
| Continuous Drain Current $T_C$=100 °C | $I_D$ | 4.1 | | Adc |
| Drain Current - Pulsed (3) | $I_{DM}$ | 36 | | Adc |
| Gate Current - Pulsed | $I_{GM}$ | ±1.5 | | Adc |
| Single Pulsed Avalanche Energy (4) | $E_{AS}$ | 78 | | mJ |
| Avalanche Current | $I_{AS}$ | 5.9 | | A |
| Total Power Dissipation at $T_C$=25 °C | $P_D$ | 35 | | Watts |
| Derate above 25 °C | | 0.28 | | W/ °C |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{STG}$ | -55 to +150 | | °C |
| Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5 seconds | $T_L$ | 300 | | °C |

Notes : (1) $T_J$=25°C to 150°C
(2) Pulse test : Pulse width≤300μs, Duty Cycle≤2%
(3) Repetitive rating : Pulse width limited by max. junction temperature
(4) L=4mH, $V_{dd}$=50V, $R_G$=25Ω, Starting $T_J$=25°C

## ELECTRICAL CHARACTERISTICS (Tc=25°C unless otherwise specified)

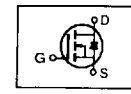
| Symbol | Characteristic | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | | | | | |
| | IRFS630 | 200 | - | - | V | $V_{GS}$=0V, $I_D$=250μA |
| | IRFS631 | 150 | - | - | V | |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | - | 4.0 | V | $V_{DS}$=$V_{GS}$, $I_D$=250μA |
| $I_{GSS}$ | Gate-Source Leakage Forward | - | - | 100 | nA | $V_{GS}$=20V |
| $I_{GSS}$ | Gate-Source Leakage Reverse | - | - | -100 | nA | $V_{GS}$=-20V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | - | - | 250 | μA | $V_{DS}$=Max. Rating, $V_{GS}$=0V |
| | | - | - | 1000 | μA | $V_{DS}$=0.8 Max. Rating, $V_{GS}$=0V, Tc=125°C |
| $R_{DS(on)}$ | Static Drain-Source On Resistance(2) | - | - | 0.4 | Ω | $V_{GS}$=10V, $I_D$=4.5A |
| gfs | Forward Transconductance (2) | 3 | 4.6 | - | ℧ | $V_{DS}$≥50V, $I_D$=4.5A |
| $C_{iss}$ | Input Capacitance | - | 750 | - | pF | $V_{GS}$=0V, $V_{DS}$=25V, f=1.0MHz |
| $C_{oss}$ | Output Capacitance | - | 120 | - | pF | |
| $C_{rss}$ | Reverse Transfer Capacitance | - | 45 | - | pF | |
| $t_{d(on)}$ | Turn-On Delay Time | - | - | 30 | ns | $V_{DD}$=0.5 $BV_{DSS}$, $I_D$=9.0A, $Z_O$=18Ω |
| $t_r$ | Rise Time | - | - | 50 | ns | (MOSFET switching times are essentially |
| $t_{d(off)}$ | Turn-Off Delay Time | - | - | 50 | ns | independent of operating temperature) |
| $t_f$ | Fall Time | - | - | 40 | ns | |
| $Q_g$ | Total Gate Charge (Gate-Source Plus Gate-Drain) | - | - | 34 | nC | $V_{GS}$=10V, $I_D$=9.0A, $V_{DS}$=0.8 Max. Rating (Gate charge is essentially independent of |
| $Q_{gs}$ | Gate-Source Charge | - | 6.1 | - | nC | operating temperature) |
| $Q_{gd}$ | Gate-Drain ("Miller") Charge | - | 12.7 | - | nC | |

## THERMAL RESISTANCE

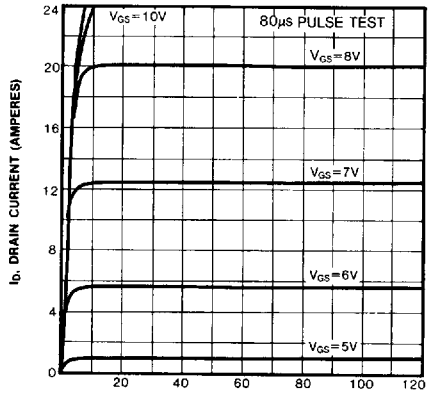
| Symbol | Characteristics | | All | Units | Remark |
|---|---|---|---|---|---|
| $R_{thJC}$ | Junction-to-Case | MAX | 3.57 | K/W | |
| $R_{thCS}$ | Case-to-Sink | TYP | 0.5 | K/W | Mounting surface flat, smooth and greased |
| $R_{thJA}$ | Junction-to-Ambient | MAX | 62.5 | K/W | Free Air Operation |

Notes : (1) $T_J$=25°C to 150°C
(2) Pulse test : Pulse width≤300μs, Duty Cycle≤2%
(3) Repetitive rating : Pulse width limited by max. junction temperature

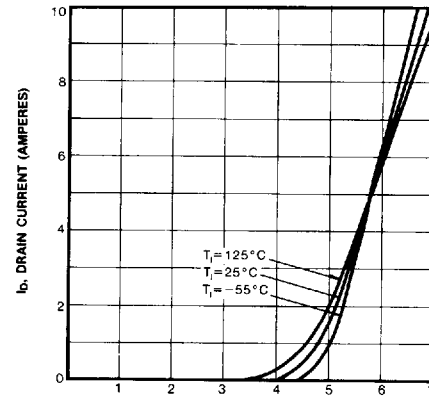
## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

| Symbol | Characteristic | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | - | - | 9.0 | A | Modified MOSFET symbol showing the integral reverse P-N junction rectifier  |
| $I_{SM}$ | Pulse Source Current (Body Diode) (3) | - | - | 36 | A | |
| $V_{SD}$ | Diode Forward Voltage (2) | - | - | 3.0 | V | $T_J$=25°C, $I_S$=9.0A, $V_{GS}$=0V |
| $t_{rr}$ | Reverse Recovery Time | - | 450 | - | ns | $T_J$=25°C, $I_F$=9.0A, $dI_F/dt$=100A/μS |

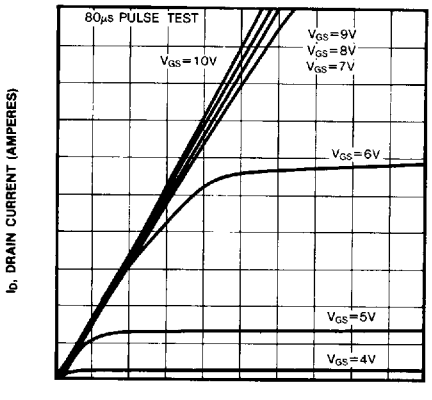
Notes : (1) $T_J$=25°C to 150°C
(2) Pulse test : Pulse width ≤ 300μs, Duty Cycle ≤ 2%
(3) Repetitive rating : Pulse width limited by max. junction temperature



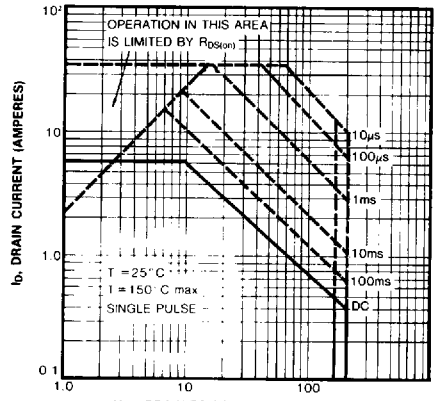
Typical Output Characteristics



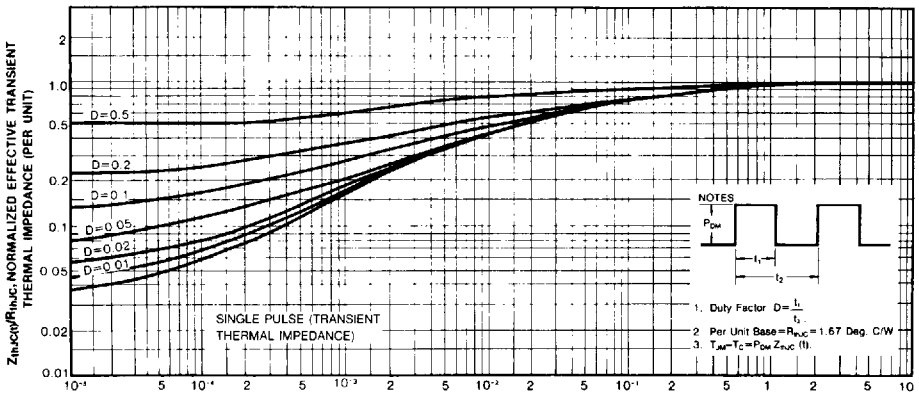
Typical Transfer Characteristics



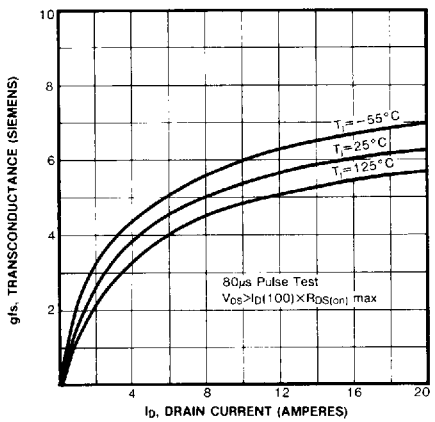
Typical Saturation Characteristics



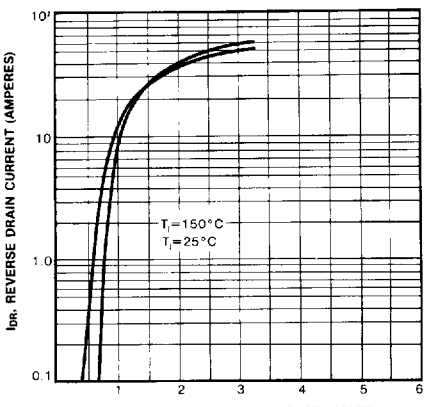
Maximum Safe Operating Area



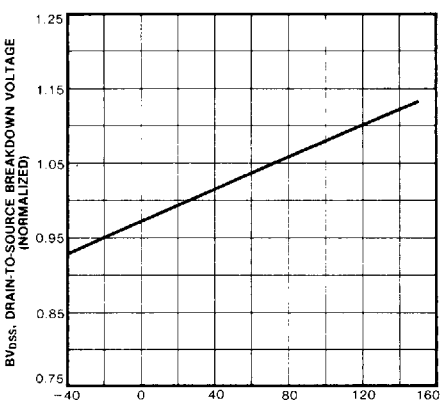

Maximum Effective Transient Thermal Impedance Junction-to-Case Vs. Pulse Duration



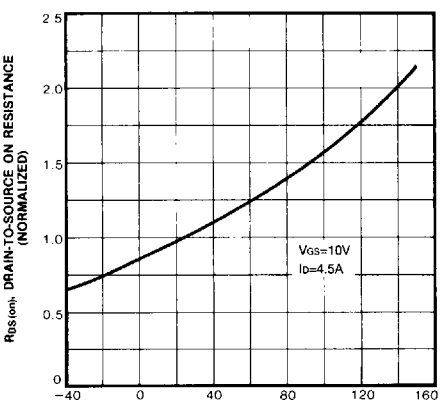

Typical Transcounductance Vs. Drain Current



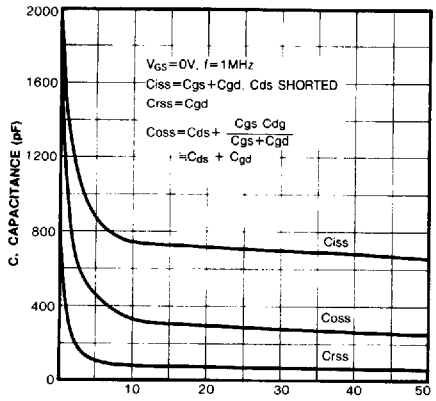

Typical Source—Drain Diode Forward Voltage



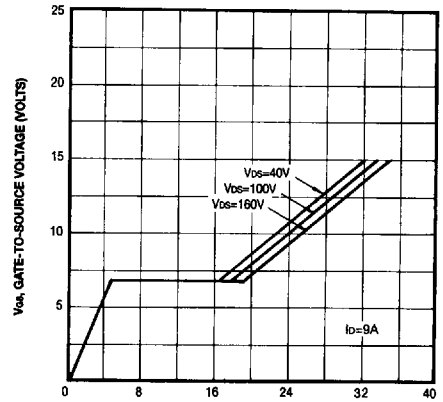

Breakdown Voltage Vs. Temperature



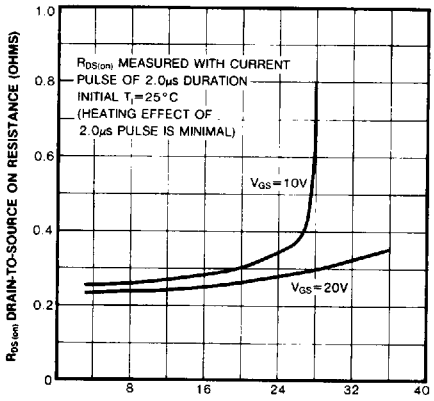

Normalized On-Resistance Vs. Temperature



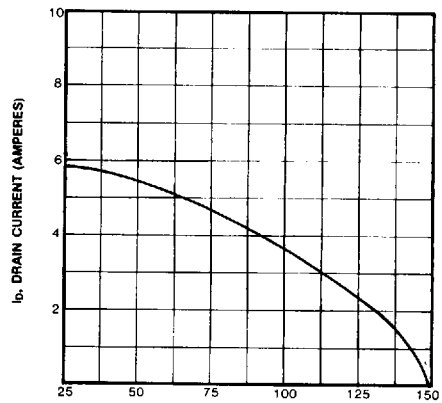

Typical Capacitance Vs. Drain to Source Voltage



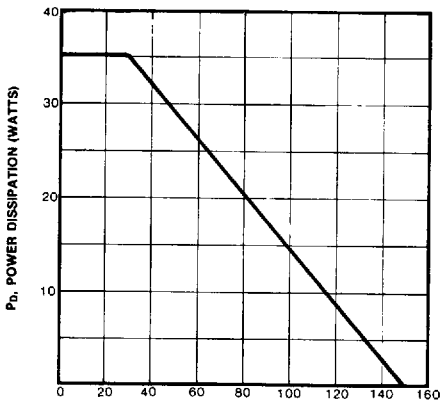

Typical Gate Charge Vs. Gate-to-Source Voltage




Typical On-Resistance Vs. Drain Current




Maximum Drain Current Vs. Case Temperature




Power Vs. Temperature Derating Curve