

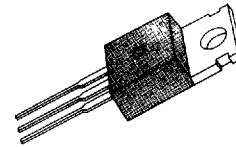
**IRF9530/9531/9532/9533**  
**IRFP9130/9131/9132/9133**
**P-CHANNEL**  
**POWER MOSFETS**
**FEATURES**

- 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**

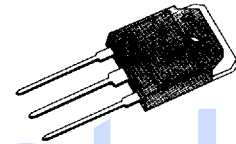
| Part Number      | $V_{DS}$ | $R_{DS(on)}$  | $I_D$ |
|------------------|----------|---------------|-------|
| IRF9530/IRFP9130 | -100V    | 0.30 $\Omega$ | -12A  |
| IRF9531/IRFP9131 | -60V     | 0.30 $\Omega$ | -12A  |
| IRF9532/IRFP9132 | -100V    | 0.40 $\Omega$ | -10A  |
| IRF9533/IRFP9133 | -60V     | 0.40 $\Omega$ | -10A  |

TO-220



IRF9530/9531/9532/9533

TO-3P



IRFP9130/9131/9132/9133

2

**MAXIMUM RATINGS**

| Characteristic   | Symbol         | IRF9530<br>IRFP9130 | IRF9531<br>IRFP9131 | IRF9532<br>IRFP9132 | IRF9533<br>IRFP9133 | Unit                   |
|--|----------------|---------------------|---------------------|---------------------|---------------------|------------------------|
| Drain-Source Voltage (1)   | $V_{DSS}$      | -100                | -60                 | -100                | -60                 | Vdc                    |
| Drain-Gate Voltage ( $R_{GS}=1.0M\Omega$ )(1)                              | $V_{DGR}$      | -100                | -60                 | -100                | -60                 | Vdc                    |
| Gate-Source Voltage  | $V_{GS}$       | $\pm 20$            |                     |                     |                     | Vdc                    |
| Continuous Drain Current $T_C=25^\circ C$                                  | $I_D$          | -12                 | -12                 | -10                 | -10                 | Adc                    |
| Continuous Drain Current $T_C=100^\circ C$                                 | $I_D$          | -7.5                | -7.5                | -6.5                | -6.5                | Adc                    |
| Drain Current—Pulsed (3)   | $I_{DM}$       | -48                 | -48                 | -40                 | -40                 | Adc                    |
| Gate Current—Pulsed  | $I_{GM}$       | $\pm 1.5$           |                     |                     |                     | Adc                    |
| Single Pulsed Avalanche Energy (4)   | $E_{AS}$       | 550                 |                     |                     |                     | mJ                     |
| Avalanche Current  | $I_{AS}$       | -12                 |                     |                     |                     | A                      |
| Total Power Dissipation @ $T_C=25^\circ C$<br>Derate above $25^\circ C$    | $P_D$          | 75<br>0.6           |                     |                     |                     | Watts<br>W/ $^\circ C$ |
| Operating and Storage<br>Junction Temperature Range                        | $T_J, T_{stg}$ | -55 to 150          |                     |                     |                     | $^\circ C$             |
| Maximum Lead Temp. for Soldering<br>Purposes, 1/8" from case for 5 seconds | $T_L$          | 300                 |                     |                     |                     | $^\circ C$             |

- Notes:** (1)  $T_J=25^\circ C$  to  $150^\circ C$   
 (2) Pulse test: Pulse width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$   
 (3) Repetitive rating: Pulse with limited by max. junction temperature  
 (4)  $L=8.5mH$ ,  $V_{dd}=-25V$ ,  $R_G=25\Omega$ , Starting  $T_J=25^\circ C$

**ELECTRICAL CHARACTERISTICS** ( $T_C=25^\circ\text{C}$  unless otherwise specified)


| Symbol       | Characteristic   | Min  | Typ | Max  | Units    | Test Conditions   |
|--------------|--|------|-----|------|----------|---|
| $BV_{DSS}$   | Drain-Source Breakdown Voltage<br>IRF9530/IRFP9130<br>IRF9532/IRFP9132                 | -100 | —   | —    | V        | $V_{GS}=0V$<br>$I_D=-250\mu A$  |
|              | IRF9531/IRFP9131<br>IRF9533/IRFP9133   | -60  | —   | —    | V        |   |
| $V_{GS(th)}$ | Gate Threshold Voltage   | 2.0  | —   | 4.0  | V        | $V_{DS}=V_{GS}$ , $I_D=-250\mu A$   |
| $I_{GSS}$    | 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<br>Drain Current   | —    | —   | 250  | $\mu A$  | $V_{DS}=\text{Max. Rating}$ , $V_{GS}=0V$   |
|              |  | —    | —   | 1000 | $\mu A$  | $V_{DS}=\text{Max. Rating} \times 0.8$ , $V_{GS}=0V$ , $T_C=125^\circ\text{C}$  |
| $I_{D(on)}$  | On-State Drain-Source Current (2)<br>IRF9530/IRFP9130<br>IRF9531/IRFP9131              | -12  | —   | —    | A        | $V_{DS} \leq -4.8V$ , $V_{GS}=-10V$   |
|              | IRF9532/IRFP9132<br>IRF9533/IRFP9133   | -10  | —   | —    | A        |   |
| $R_{DS(on)}$ | Static Drain-Source On-State<br>Resistance (2)<br>IRF9530/IRFP9130<br>IRF9531/IRFP9131 | —    | —   | 0.3  | $\Omega$ | $V_{GS}=-10V$ , $I_D=-6.5A$   |
|              | IRF9532/IRFP9132<br>IRF9533/IRFP9133   | —    | —   | 0.4  | $\Omega$ |   |
| $g_{fs}$     | Forward Transconductance (2)   | 2.0  | —   | —    | $\Omega$ | $V_{DS} \leq -50V$ , $I_D=-6.5A$  |
| $C_{iss}$    | Input Capacitance  | —    | 835 | —    | pF       | $V_{GS}=0V$ , $V_{DS}=-25V$ , $f=1.0\text{MHz}$   |
| $C_{oss}$    | Output Capacitance   | —    | 357 | —    | pF       |   |
| $C_{rss}$    | Reverse Transfer Capacitance   | —    | 94  | —    | pF       |   |
| $t_{d(on)}$  | Turn-On Delay Time   | —    | —   | 60   | ns       | $V_{DD}=0.5BV_{DSS}$ , $I_D=-6.5A$ , $Z_\theta=50\Omega$<br>(MOSFET switching times are essentially independent of operating temperature) |
| $t_r$        | Rise Time  | —    | —   | 140  | ns       |   |
| $t_{d(off)}$ | Turn-Off Delay Time  | —    | —   | 140  | ns       |   |
| $t_f$        | Fall Time  | —    | —   | 140  | ns       |   |
| $Q_g$        | Total Gate Charge<br>(Gate-Source Plus Gate-Drain)                                     | —    | —   | 45   | nC       | $V_{GS}=-15V$ , $I_D=-15A$ , $V_{DS}=0.8 \text{ Max. Rating}$<br>(Gate charge is essentially independent of operating temperature.)       |
| $Q_{gs}$     | Gate-Source Charge   | —    | —   | 20   | nC       |   |
| $Q_{gd}$     | Gate-Drain ("Miller") Charge   | —    | —   | 25   | nC       |   |

**THERMAL RESISTANCE**

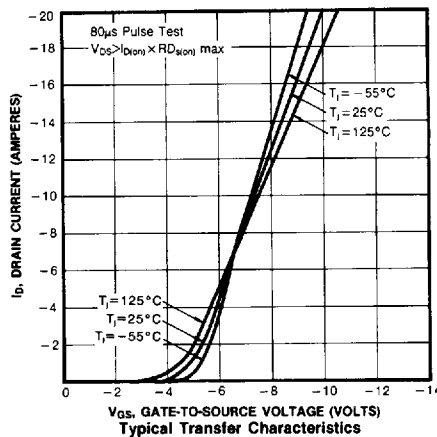
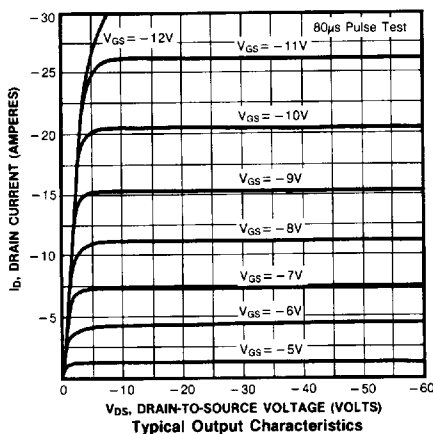
| Symbol     | Characteristic      |     | IRF9530-3 | IRFP9130-3 | Unit |  |
|------------|---------------------|-----|-----------|------------|------|--|
| $R_{thJC}$ | Junction-to-Case    | MAX | 1.67      | 1.67       | K/W  |  |
| $R_{thCS}$ | Case-to-Sink        | TYP | 1.0       | 0.24       | K/W  | Mounting surface flat, smooth, and greased |
| $R_{thJA}$ | Junction-to-Ambient | MAX | 80        | 40         | K/W  | Free Air Operation                         |

- Notes: (1)  $T_J=25^\circ\text{C}$  to  $150^\circ\text{C}$   
(2) Pulse test: Pulse width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$   
(3) Repetitive rating: Pulse width limited by max. junction temperature

**SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS**

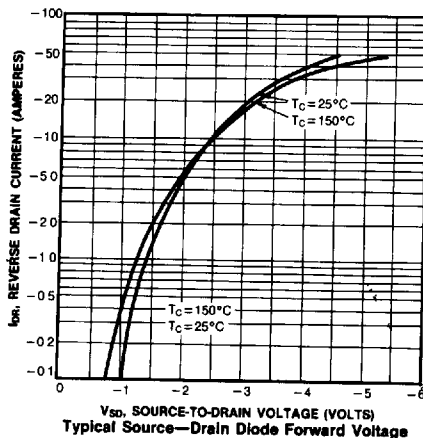
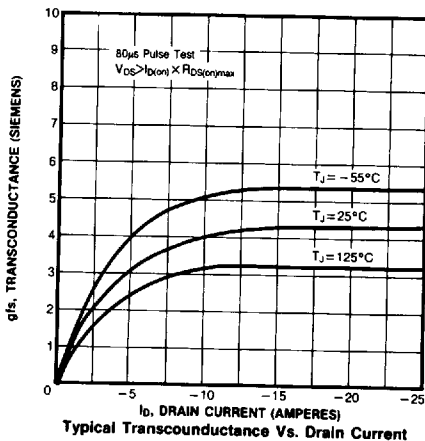
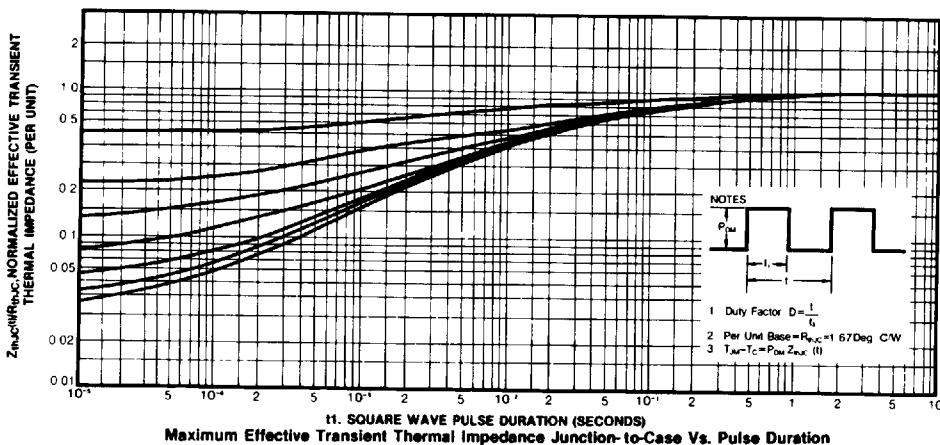
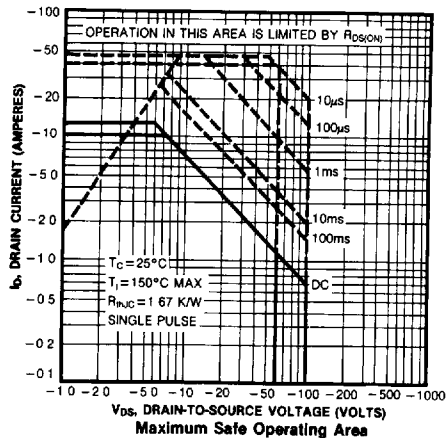
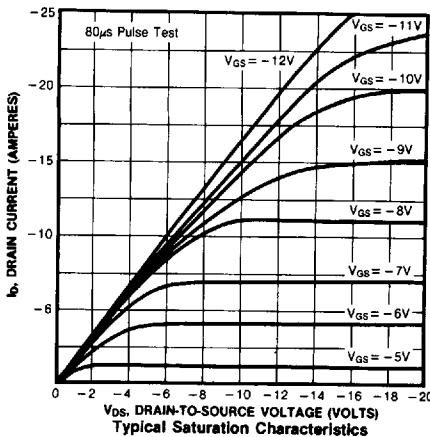
| Symbol          | Characteristic   | Min | Typ | Max  | Units | Test Conditions  |
|-----------------|--|-----|-----|------|-------|--|
| I <sub>S</sub>  | Continuous Source Current (Body Diode)<br>IRF9530/IRFP9130<br>IRF9531/IRFP9131 | —   | —   | -12  | A     | Modified MOSFET symbol showing the integral reverse P-N junction rectifier  |
|                 | IRF9532/IRFP9132<br>IRF9533/IRFP9133   | —   | —   | -10  | A     |  |
| I <sub>SM</sub> | Pulse Source Current (Body Diode) (3)<br>IRF9530/IRFP9130<br>IRF9531/IRFP9131  | —   | —   | -48  | A     |  |
|                 | IRF9532/IRFP9132<br>IRF9533/IRFP9133   | —   | —   | -40  | A     |  |
| V <sub>SD</sub> | Diode Forward Voltage (2)<br>IRF9530/IRFP9130<br>IRF9531/IRFP9131              | —   | —   | -6.3 | A     | T <sub>C</sub> =25°C, I <sub>S</sub> =-12A, V <sub>GS</sub> =0V  |
|                 | IRF9532/IRFP9132<br>IRF9533/IRFP9133   | —   | —   | -6.0 | A     | T <sub>C</sub> =25°C, I <sub>S</sub> =-10A, V <sub>GS</sub> =0V  |
| t <sub>rr</sub> | Reverse Recovery Time  | —   | 300 | —    | ns    | T <sub>J</sub> =150°C, I <sub>F</sub> =-6.0A, di <sub>F</sub> /dt=100A/μS  |

**Notes:** (1) T<sub>J</sub>=25°C to 150°C (2) Pulse test. Pulse width≤300μs, Duty Cycle≤2%  
 (3) Repetitive rating: Pulse with limited by max. junction temperature



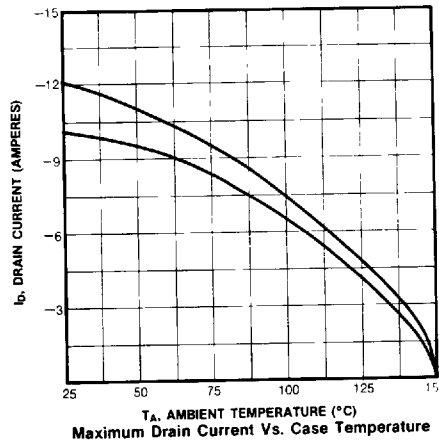
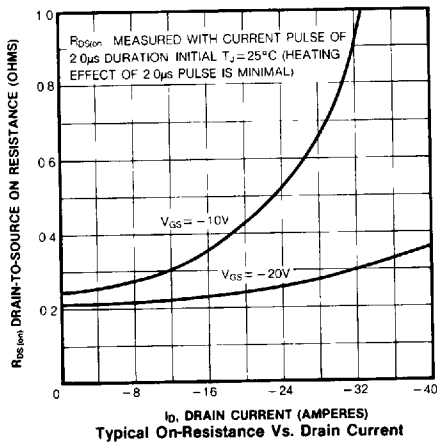
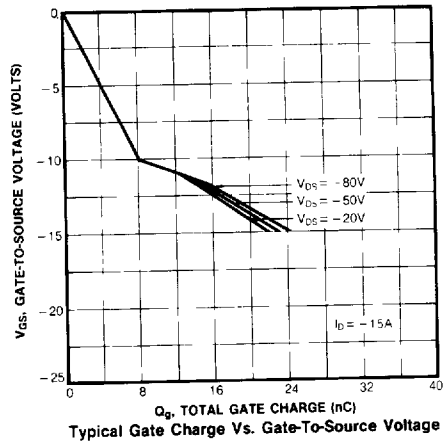
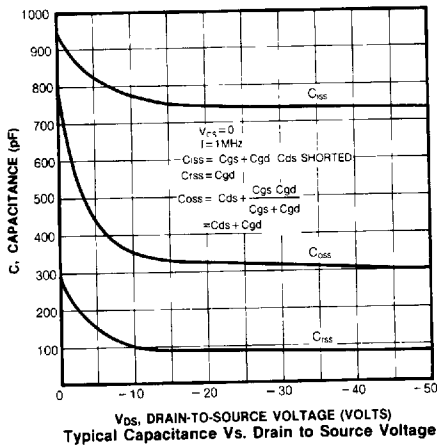
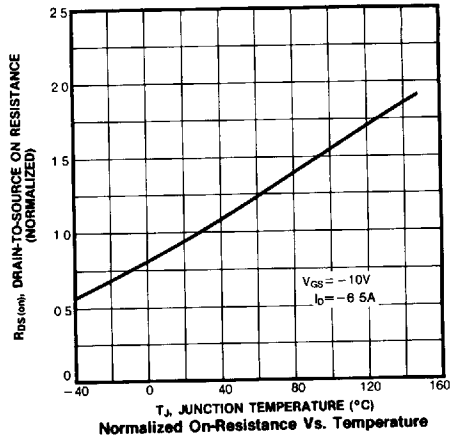
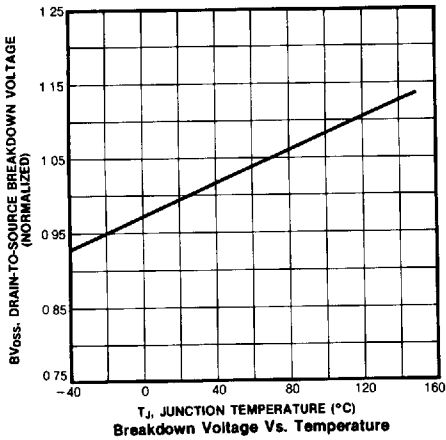
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