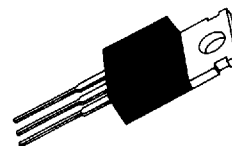


FEATURES

- 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

TO-220



IRF9Z24/Z25
 IRF9Z20/Z22

PRODUCT SUMMARY

| Part Number | V_{DS} | $R_{DS(on)}$ | I_D |
|-------------|----------|---------------|-------|
| IRF9Z20 | -50V | 0.28 Ω | -9.7A |
| IRF9Z24 | -60V | 0.28 Ω | -9.7A |
| IRF9Z22 | -50V | 0.33 Ω | -8.9A |
| IRF9Z25 | -60V | 0.33 Ω | -8.9A |

ABSOLUTE MAXIMUM RATINGS

| Characteristic | Symbol | IRF9Z20 | IRF9Z22 | IRF9Z24 | IRF9Z25 | Unit |
|--|----------------|------------|---------|---------|---------|------------------------|
| Drain-Source Voltage (1) | V_{DSS} | -50 | | -60V | | Vdc |
| Drain-Gate Voltage ($R_{GS}=1.0M\Omega$)(1) | V_{DGR} | -50 | | -60V | | Vdc |
| Gate-Source Voltage | V_{GS} | ± 20 | | | | Vdc |
| Continuous Drain Current $T_C=25^\circ C$ | I_D | -9.7 | -8.9 | -9.7 | -8.9 | A |
| Continuous Drain Current $T_C=100^\circ C$ | I_D | -6.1 | -5.6 | -6.1 | -5.6 | A |
| Drain Current—Pulsed (3) | I_{DM} | -39 | -36 | -39 | -36 | A |
| Gate Current—Pulsed | I_{GM} | ± 1.5 | | | | A |
| Single Pulsed Avalanche Energy (4) | E_{AS} | 4.2 | | | | mJ |
| Avalanche Current | I_{AS} | -9.7 | | | | A |
| Total Power Dissipation at $T_C=25^\circ C$ Derate above $25^\circ C$ | P_D | 40 | | 0.32 | | Watts W/ $^\circ C$ |
| Operating and Storage Junction Temperature Range | T_J, T_{stg} | -55 to 150 | | | | $^\circ C$ |
| Maximum Lead Temp. for Soldering 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) $L=100\mu H$, $V_{dd}=-25V$, $R_G=25\Omega$, Starting $T_J=25^\circ C$

IRF9Z24/Z25

IRF9Z20/Z22

P-CHANNEL

POWER MOSFETS

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

| Symbol | Characteristic | Min | Typ | Max | Units | Test Conditions |
|---------------------|---|------|------|------|-------|--|
| BV _{DSS} | Drain-Source Breakdown Voltage IRF9Z24/Z25 | -60 | — | — | V | V _{GS} =0V, I _D =-250μA |
| | IRF9Z20/Z22 | -50 | — | — | 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 V _{DS} =0.8Max. Rating, T _C =125°C, V _{GS} =0V |
| | | — | — | 1000 | | |
| I _{D(on)} | On-State Drain-Source Current (2) IRF9Z20/Z24 | -9.7 | — | — | A | V _{DS} ≤-3.2V V _{GS} =-10V |
| | IRF9Z22/Z25 | -8.9 | — | — | | |
| R _{DS(on)} | Static Drain-Source On-State Resistance IRF9Z20/Z24 | — | 0.18 | 0.28 | Ω | V _{GS} =-10V, I _D =-5.6A |
| | IRF9Z22/Z25 | — | — | 0.33 | | |
| g _{fs} | Forward Transconductance (2) | 2.3 | 4.1 | — | ∪ | V _{DS} =2×V _{GS} , I _D =-5.6A |
| C _{ISS} | Input Capacitance | — | 635 | — | pF | V _{GS} =0V |
| C _{OSS} | Output Capacitance | — | 218 | — | pF | V _{DS} =-25V |
| C _{rSS} | Reverse Transfer Capacitance | — | 105 | — | pF | f=1.0MHz |
| t _{d(on)} | Turn-On Delay Time | — | 8.2 | 12 | ns | V _{DD} =-25V, I _D =-9.7A, R _G =18Ω R _D =2.4Ω (MOSFET switching times are essentially independent of operating temperature) |
| t _r | Rise Time | — | 57 | 86 | | |
| t _{d(off)} | Turn-Off Delay Time | — | 12 | 18 | | |
| t _f | Fall Time | — | 25 | 38 | | |
| Q _g | Total Gate Charge (Gate-Source Plus Gate-Drain) | — | 17 | 26 | | |
| Q _{gs} | Gate-Source Charge | — | 4.1 | 6.2 | nC | V _{GS} =-10V, I _D =-9.7A, V _{DS} =0.8Max. Rating (Gate charge is essentially independent of operating temperature) |
| Q _{gd} | Gate-Drain ("Miller") Charge | — | 5.7 | 8.6 | | |

THERMAL RESISTANCE

| | | | | | |
|-------------------|---------------------|-----|-----|-----|---|
| R _{thJC} | Junction-to-Case | MAX | 3.1 | K/W | |
| R _{thCS} | Case-to-Sink | TYP | 1.0 | K/W | Mounting surface flat smooth, and greased |
| R _{thJA} | Junction-to-Ambient | MAX | 80 | 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

IRF9Z24/Z25
IRF9Z20/Z22

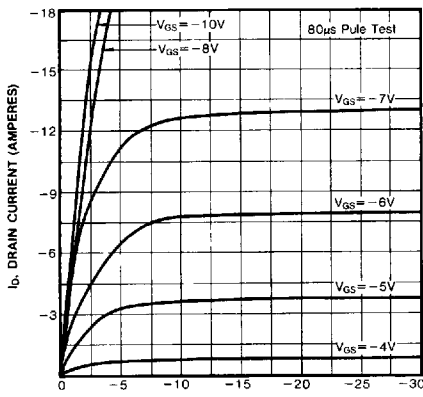
P-CHANNEL
POWER MOSFETS

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

| Symbol | Characteristic | Min | Typ | Max | Units | Test Conditions |
|----------|--|-----|-----|------|-------|---|
| I_S | Continuous Source Current (Body Diode) | — | — | -9.7 | A | Modified MOSFET integral reverse P-N junction rectifier  |
| I_{SM} | Pulse Source Current | — | — | -39 | A | |
| V_{SD} | Diode Forward Voltage | — | — | -6.3 | V | $T_C=25^\circ\text{C}$, $I_S=-9.7\text{A}$, $V_{GS}=0\text{V}$ |
| t_{rr} | Reverse Recovery Time | — | — | 280 | ns | $T_J=25^\circ\text{C}$, $I_F=-9.7\text{A}$, $dI_F/dt=10\text{S}$ |

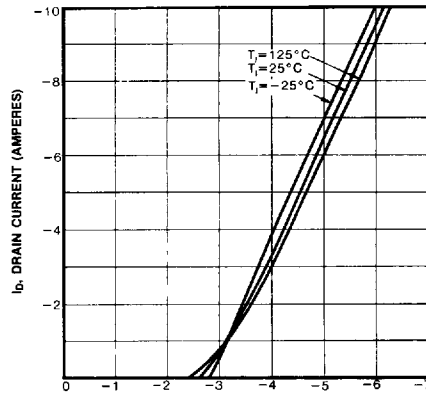
- Notes:** (1) $T_J=25^\circ\text{C}$ to 150°C
 (2) Pulse test. Pulse width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$
 (3) Repetitive rating. Pulse with limited by max. junction temperature

2

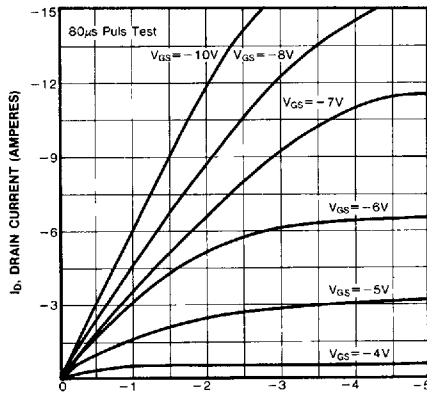


Typical Output Characteristics

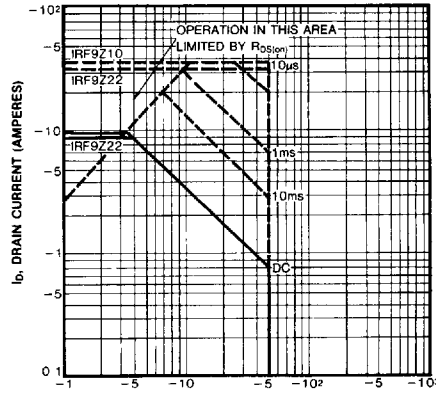
IRF9Z20



Typical Transfer Characteristics



Typical Saturation Characteristics

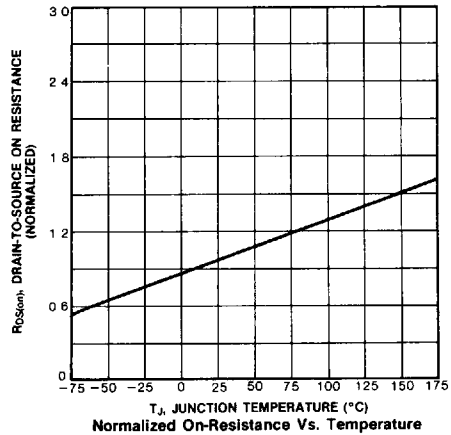
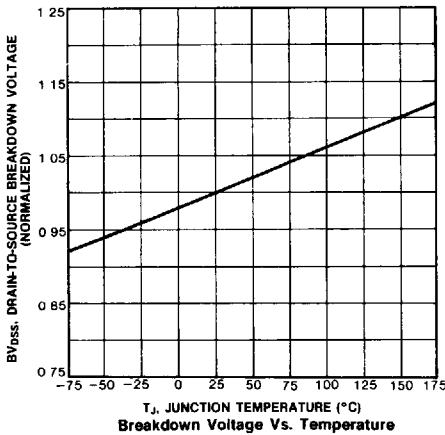
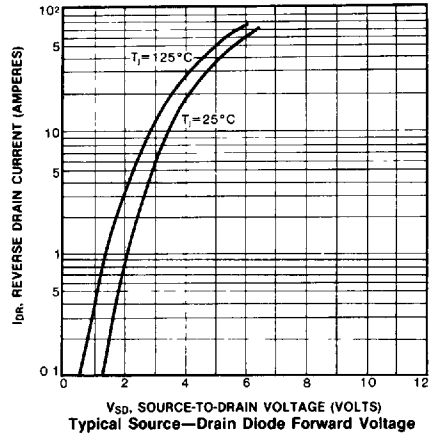
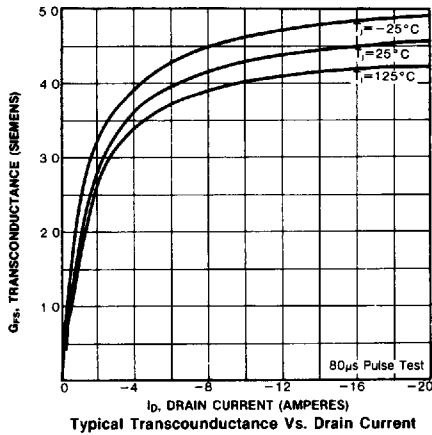
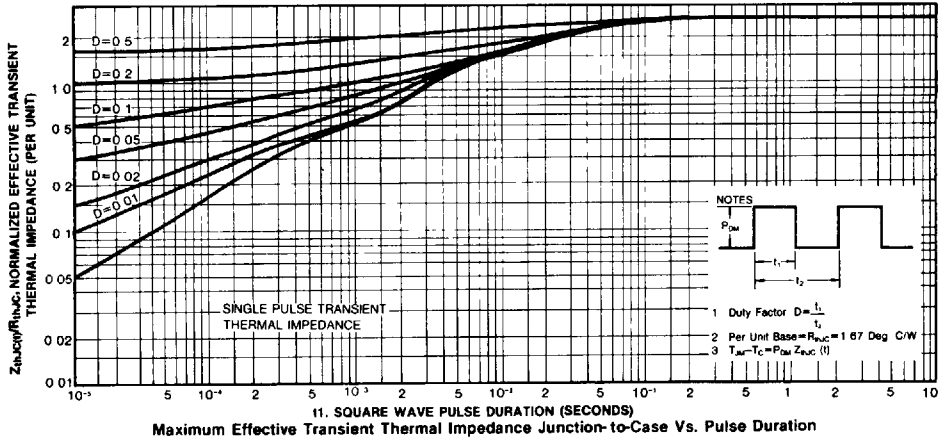


Maximum Safe Operating Area



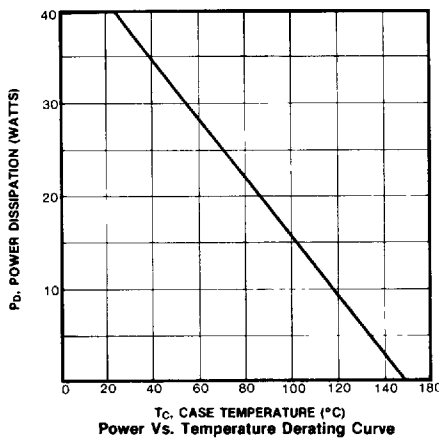
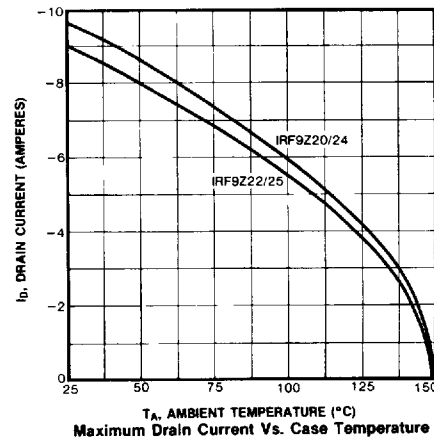
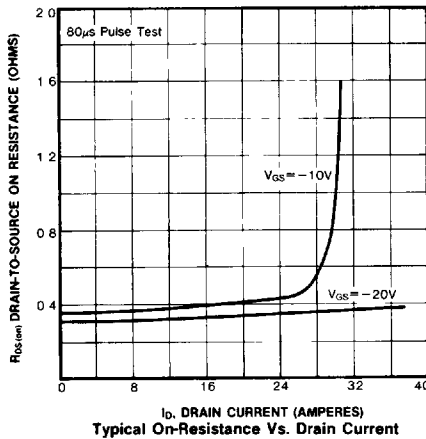
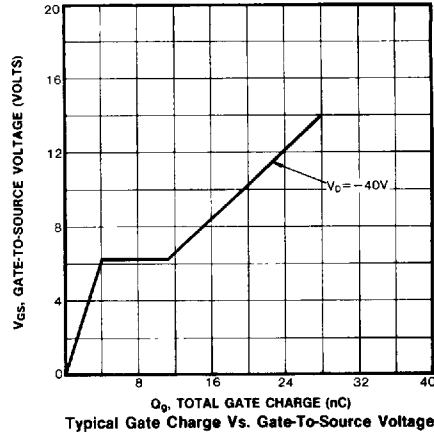
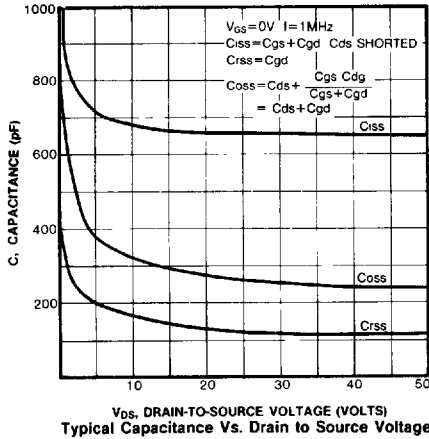
IRF9Z24/Z25
IRF9Z20/Z22

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IRF9Z20/Z22

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2