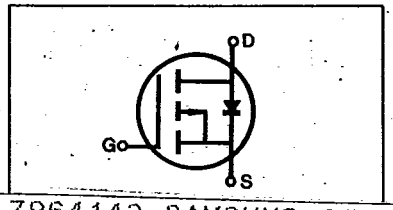
IRF9220/9221/9222/9223
IRFP9220/9221/9222/9223
IRF9620/9621/9622/9623

P-CHANNEL POWER MOSFETS

Preliminary Specification

T-39-19

–200 Volt, 1.5 Ohm SFET



PRODUCT SUMMARY

Part Number	V_{DS}	$R_{DS(on)}$	I_D
IRF/IRFP9220, IRF9620	–200V	1.5Ω	–3.5A
IRF/IRFP9221, IRF9621	–150V	1.5Ω	–3.5A
IRF/IRFP9222, IRF9622	–200V	2.4Ω	–3.0A
IRF/IRFP9223, IRF9623	–150V	2.4Ω	–3.0A

FEATURES

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

PACKAGE STYLE

Package Type	Part Number
TO-3	IRF9220/9221/9222/9223
TO-3P	IRFP9220/9221/9222/9223
TO-220	IRF9620/9621/9622/9623

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MAXIMUM RATINGS

Characteristic	Symbol	IRF/IRFP 9220 9620	9221 9621	9222 9622	9223 9623	Unit
Drain-Source Voltage (1)	V_{DSS}	–200	–150	–200	–150	Vdc
Drain-Gate Voltage (R_{GS}=1.0MΩ) (1)	V_{DGR}	–200	–150	–200	–150	Vdc
Gate-Source Voltage	V_{GS}	±20				Vdc
Continuous Drain Current T_C=25°C	I_D	–3.5	–3.5	–3.0	–3.0	Adc
Continuous Drain Current T_C=100°C	I_D	–2.0	–2.0	–1.5	–1.5	Adc
Drain Current—Pulsed (3)	I_{DM}	–14	–14	–12	–12	Adc
Gate Current—Pulsed	I_{GM}	±1.5				Adc
Total Power Dissipation @ T_C=25°C Derate above 25°C	P_D	40 0.32				Watts W/°C
Operating and Storage Junction Temperature Rangy	T_J, Tstg	–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

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

Characteristic	Symbol	Type	Min	Typ	Max	Units	Test Conditions
Drain-Source Breakdown Voltage	BV_{DSS}	IRF9220/2 IRFP9220/2 IRF9620/2	−200	—	—	V	V_{GS}=0V
		IRF9221/3 IRFP9221/3 IRF9621/3	−150	—	—	V	I_D=−250μA
Gate Threshold Voltage	$V_{GS(th)}$	ALL	−2.0	—	−4.0	V	V_{DS}=V_{GS}, I_D=−250μA
Gate-Source Leakage Forward	I_{GSS}	ALL	—	—	−100	nA	V_{GS}=−20V
Gate-Source Leakage Reverse	I_{GSS}	ALL	—	—	100	nA	V_{GS}=20V
Zero Gate Voltage Drain Current	I_{DSS}	ALL	—	—	−250	μA	V_{DS}=Max. Rating, V_{GS}=0V
			—	—	−1000	μA	V_{DS}=Max. Rating×0.8, V_{GS}=0V, T_C=125°C
On-State Drain-Source Current (2)	$I_{D(on)}$	IRF9220/1 IRFP9220/1 IRF9620/1	−3.5	—	—	A	V_{DS}>$I_{D(on)}$×$R_{DS(on)\ max.}$, V_{GS}=−10V
		IRF9222/3 IRFP9222/3 IRF9622/3	−3.0	—	—	A	
Static Drain-Source On-State Resistance (2)	$R_{DS(on)}$	IRF9220/1 IRFP9220/1 IRF9620/1	—	—	1.5	Ω	V_{GS}=−10V, I_D=−1.5A
		IRF9222/3 IRFP9222/3 IRF9622/3	—	—	2.4	Ω	
Forward Transconductance (2)	g_{fs}	ALL	1.0	—	—	Ʊ	V_{DS}>$I_{D(on)}$×$R_{DS(on)\ max.}$, I_D=−1.5A
Input Capacitance	C_{iss}	ALL	—	—	400	pF	V_{GS}=0V, V_{DS}=−25V, f=1.0MHz
Output Capacitance	C_{oss}	ALL	—	—	125	pF	
Reverse Transfer Capacitance	C_{rss}	ALL	—	—	45	pF	
Turn-On Delay Time	$t_{d(on)}$	ALL	—	—	40	ns	V_{DD}=0.5BV_{DSS}, I_D=−1.5A, Z_O=50Ω, (MOSFET switching times are essentially independent of operating temperature.)
Rise Time	t_r	ALL	—	—	50	ns	
Turn-Off Delay Time	$t_{d(off)}$	ALL	—	—	50	ns	
Fall Time	t_f	ALL	—	—	40	ns	
Total Gate Charge (Gate-Source Plus Gate-Drain)	Q_g	ALL	—	—	22	nC	V_{GS}=−15V, I_D=−4.0A, V_{DS}=0.8 Max. Rating (Gate charge is essentially independent of operating temperature.)
Gate-Source Charge	Q_{gs}	ALL	—	—	9	nC	
Gate-Drain ("Miller") Charge	Q_{gd}	ALL	—	—	13	nC	

THERMAL RESISTANCE

Junction-to-Case	R_{thJC}	ALL	—	—	3.12	K/W	
Case-to-Sink	R_{thCS}	ALL	—	1.0	—	K/W	Mounting surface flat, smooth, and greased
Junction-to-Ambient	R_{thJA}	IRFPXXX IRF96XX	—	—	80	K/W	Free Air Operation
		IRF92XX	—	—	30	K/W	

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

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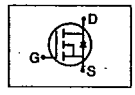
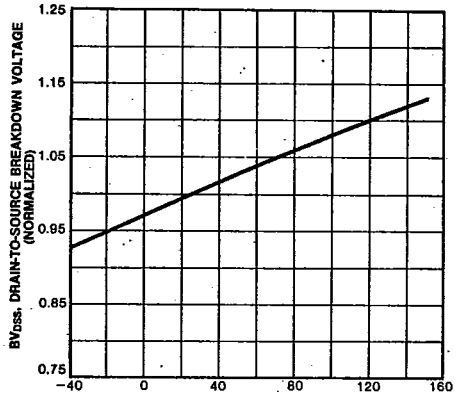
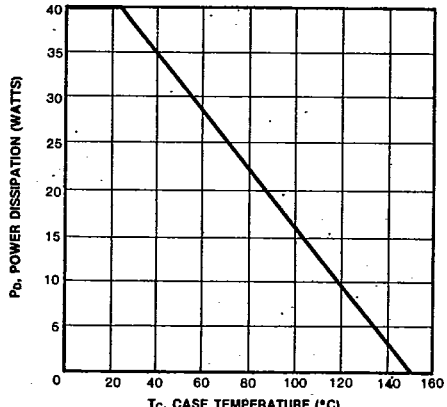
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Characteristic	Symbol	Type	Min	Typ	Max	Units	Test Conditions
Continuous Source Current (Body Diode)	I_S	IRF9220/1 IRFP9220/1 IRF9620/1	—	—	−3.5	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier 
		IRF9232/3 IRFP9232/3 IRF9622/3	—	—	−3.0	A	
Pulse Source Current (Body Diode) (3)	I_{SM}	IRF9220/1 IRFP9220/1 IRF9620/1	—	—	−14	A	
		IRF9232/3 IRFP9232/3 IRF9622/3	—	—	−12	A	
Diode Forward Voltage (2)	V_{SD}	IRF9220/1 IRFP9220/1 IRF9620/1	—	—	−7.0	V	T_C=25°C, I_S=−3.5A, V_{GS}=0V
		IRF9232/3 IRFP9232/3 IRF9622/3	—	—	−6.8	V	T_C=25°C, I_S=−3.0A, V_{GS}=0V
Reverse Recovery Time	t_{rr}	ALL	—	—	—	ns	T_J=150°C, I_F=−3.5A, dI_F/dt=100A/μs,

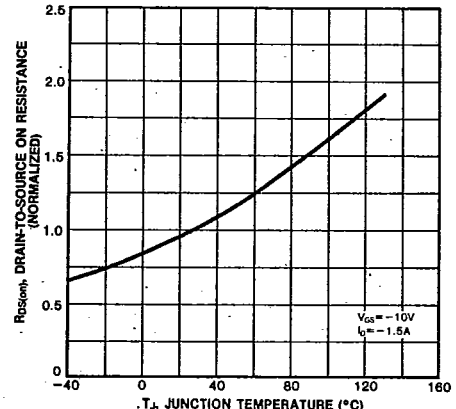
Notes: (1) T_J=25°C to 150°C (2) Pulse test: Pulse width≤300μs, Duty Cycle≤2%
(3) Repetitive rating: Pulse width limited by max. junction temperature



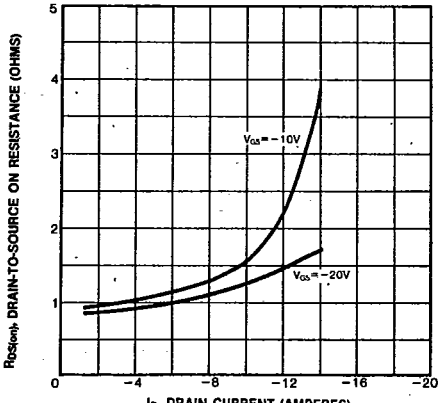
Breakdown Voltage Vs. Temperature



Power Vs. Temperature Derating Curve



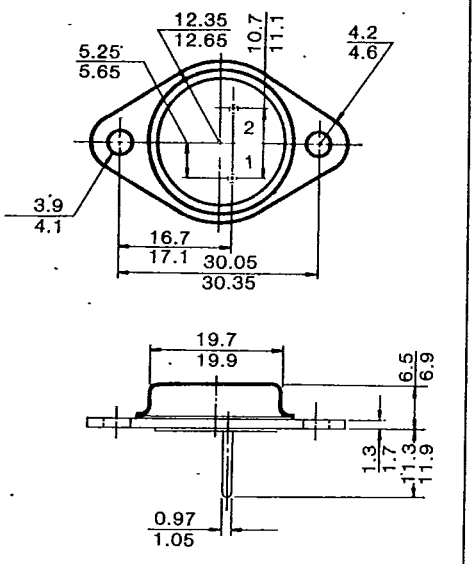
Normalized On-Resistance Vs. Temperature



Typical On-Resistance Vs. Drain Current

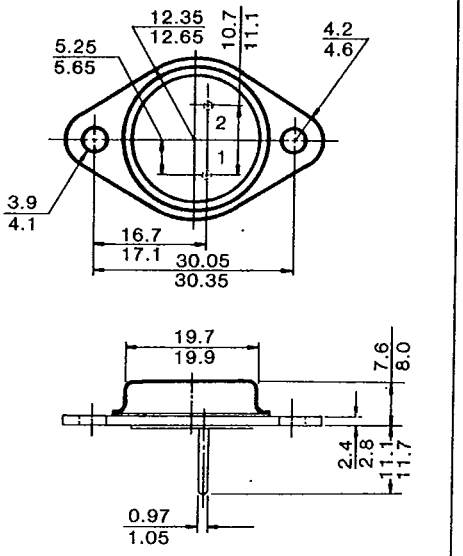
PACKAGE DIMENSIONS

TO-3(Standard Type) **Unit: mm**



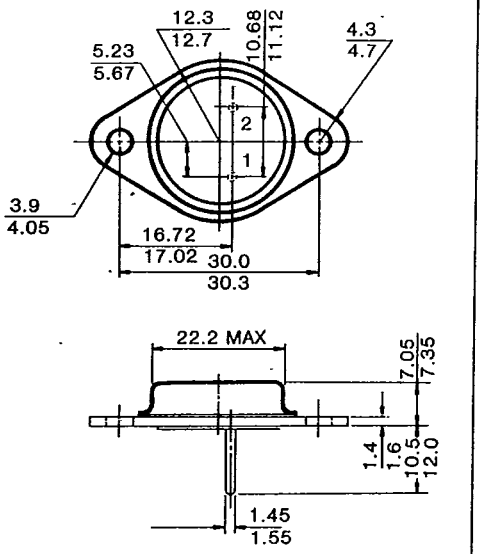
1. Gate 2. Source Case: Drain

TO-3(High-Voltage Type) **Unit: mm**



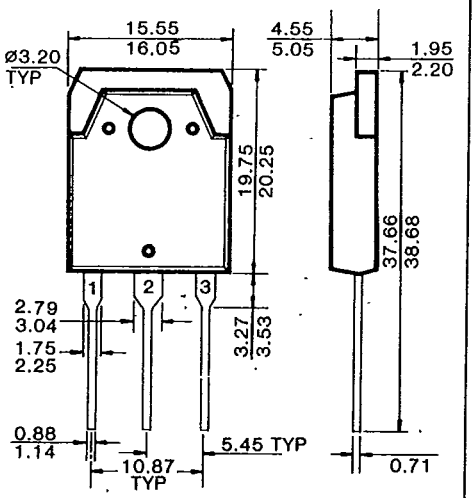
1. Gate 2. Source Case: Drain

TO-3(High Current Type) **Unit: mm**



1. Gate 2. Source Case: Drain

TO-3P **Unit: mm**

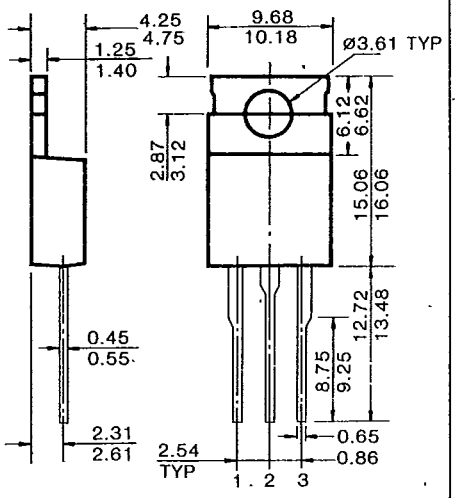


1. Gate 2. Drain 3. Source

6°

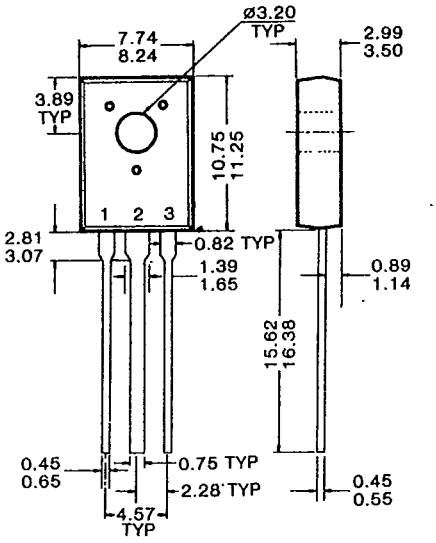
PACKAGE DIMENSIONS

TO-220 **Unit: mm**



1. Gate 2. Drain 3. Source

TO-126 **Unit: mm**



1. Gate 2. Drain 3. Source