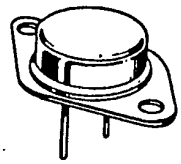
IRF440/441/442/443

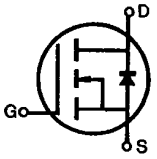
N-CHANNEL POWER MOSFETS

FEATURES

- Low $R_{DS(on)}$ at high voltage
- Improved inductive ruggedness
- Excellent high voltage stability
- Fast switching times
- Rugged polysilicon gate cell structure
- Low input capacitance
- Extended safe operating area
- Improved high temperature reliability
- TO-3 package (High voltage)

TO-3





PRODUCT SUMMARY

Part Number	V_{DS}	$R_{DS(on)}$	I_D
IRF440	500V	0.85Ω	8.0A
IRF441	450V	0.85Ω	8.0A
IRF442	500V	1.10Ω	7.0A
IRF443	450V	1.10Ω	7.0A

MAXIMUM RATINGS

Characteristic	Symbol	IRF440	IRF441	IRF442	IRF443	Unit
Drain-Source Voltage (1)	V_{DSS}	500	450	500	450	Vdc
Drain-Gate Voltage (R_{GS}=1.0MΩ) (1)	V_{DGR}	500	450	500	450	Vdc
Gate-Source Voltage	V_{GS}	±20				Vdc
Continuous Drain Current T_C=25°C	I_D	8.0	8.0	7.0	7.0	Adc
Continuous Drain Current T_C=100°C	I_D	5.0	5.0	4.0	4.0	Adc
Drain Current—Pulsed (3)	I_{DM}	32	32	28	28	Adc
Gate Current—Pulsed	I_{GM}	±1.5				Adc
Total Power Dissipation @ T_C=25°C Derate above 25°C	P_D	125 1.0				Watts W/°C
Operating and Storage Junction Temperature Range	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

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

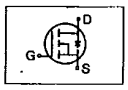
Characteristic	Symbol	Type	Min	Typ	Max	Units	Test Conditions
Drain-Source Breakdown Voltage	BV_{DSS}	IRF440 IRF442	500	—	—	V	V_{GS}=0V, I_D=250μA
		IRF441 IRF443	450	—	—	V	
Gate Threshold Voltage	$V_{GS(th)}$	ALL	2.0	—	4.0	V	V_{DS}=V_{GS}, I_D=250μA
Gate-Source Leakage Forward	I_{GSS}	ALL	—	—	100	nA	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)	$I_{D(on)}$	IRF440 IRF441	8.0	—	—	A	V_{DS}>$I_{D(on)}$×$R_{DS(on)\ max.}$, V_{GS}=10V
		IRF442 IRF443	7.0	—	—	A	
Static Drain-Source On-State Resistance (2)	$R_{DS(on)}$	IRF440 IRF441	—	0.6	0.85	Ω	V_{GS}=10V, I_D=4.0A
		IRF442 IRF443	—	1.0	1.1	Ω	
Forward Transconductance (2)	g_{fs}	ALL	4.0	6.5	—	Ʊ	V_{DS}>$I_{D(on)}$×$R_{DS(on)\ max.}$, I_D=4.0A
Input Capacitance	C_{iss}	ALL	—	1200	1600	pF	V_{GS}=0V, V_{DS}=25V, f=1.0MHz
Output Capacitance	C_{oss}	ALL	—	230	350	pF	
Reverse Transfer Capacitance	C_{rss}	ALL	—	65	150	pF	
Turn-On Delay Time	$t_{d(on)}$	ALL	—	—	35	ns	V_{DD}=0.5BV_{DSS}, I_D=4.0A, Z_O=4.7Ω (MOSFET switching times are essentially independent of operating temperature.)
Rise Time	t_r	ALL	—	—	15	ns	
Turn-Off Delay Time	$t_{d(off)}$	ALL	—	—	90	ns	
Fall Time	t_f	ALL	—	—	30	ns	
Total Gate Charge (Gate-Source Plus Gate-Drain)	Q_g	ALL	—	34	60	nC	V_{GS}=10V, I_D=10A, V_{DS}=0.8 Max. Rating (Gate charge is essentially independent of operating temperature.)
Gate-Source Charge	Q_{gs}	ALL	—	6.0	—	nC	
Gate-Drain ("Miller") Charge	Q_{gd}	ALL	—	28	—	nC	

THERMAL RESISTANCE

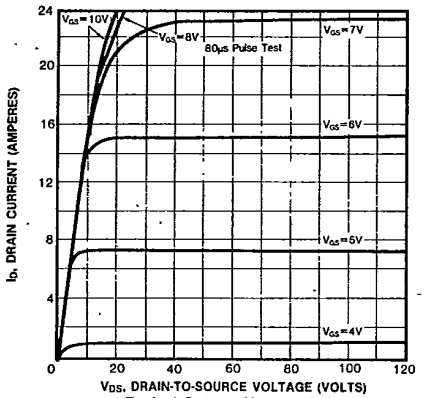
Junction to Case	R_{thJC}	ALL	—	—	1.0	K/W	
Case-to-Sink	R_{thCS}	ALL	—	0.1	—	K/W	Mounting surface flat, smooth, and greased
Junction-to-Ambient	R_{thJA}	ALL	—	—	30	K/W	Free Air Operation

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

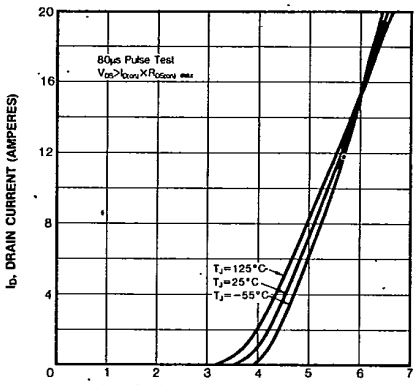
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Characteristic	Symbol	Type	Min	Typ	Max	Units	Test Conditions
Continuous Source Current (Body Diode)	I_S	IRF440 IRF441	—	—	8.0	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier 
		IRF442 IRF443	—	—	7.0	A	
Pulse Source Current (Body Diode) (3)	I_{SM}	IRF440 IRF441	—	—	32	A	
		IRF442 IRF443	—	—	28	A	
Diode Forward Voltage (2)	V_{SD}	IRF440 IRF441	—	—	2.0	V	T_C=25°C, I_S=8.0A, V_{GS}=0V
		IRF442 IRF443	—	—	1.9	V	T_C=25°C, I_S=7.0A, V_{GS}=0V
Reverse Recovery Time	t_{rr}	ALL	—	1100	—	ns	T_J=150°C, I_F=8.0A, dI_F/dt=100A/μs

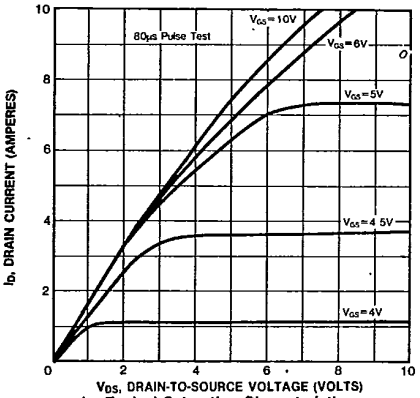
Notes: (1) T_J=25°C to 150°C (2) Pulse test: Pulse width≤300μs, Duty Cycle≤2%
(3) Repetitive rating: Pulse width limited by max. junction temperature



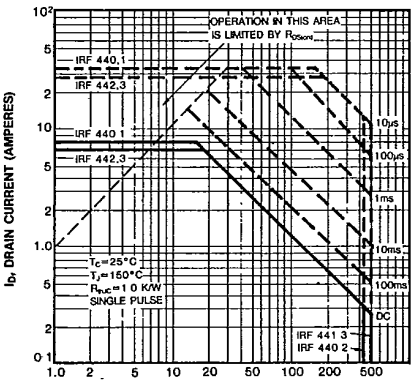
Typical Output Characteristics



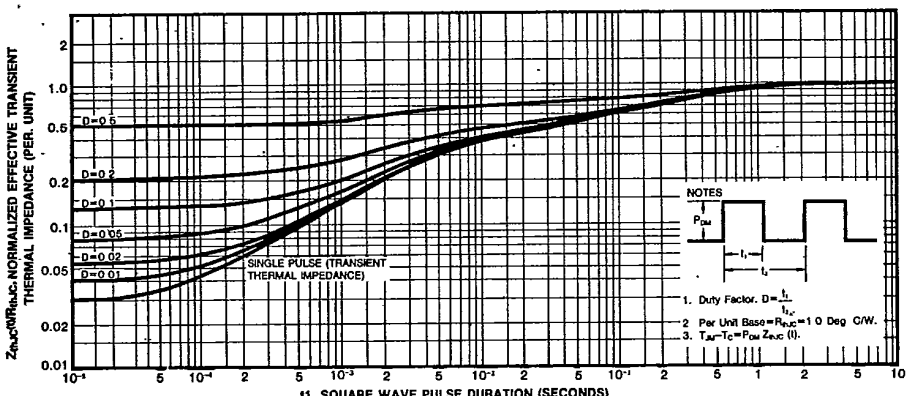
Typical Transfer Characteristics



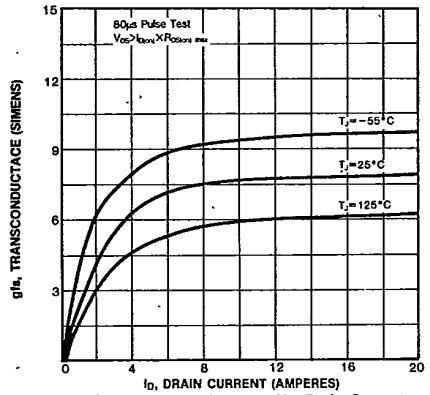
Typical Saturation Characteristics



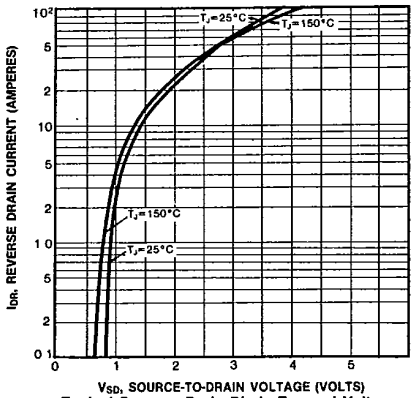
Maximum Safe Operating Area



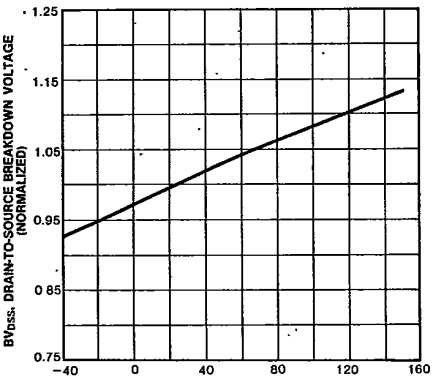
Maximum Effective Transient Thermal Impedance Junction-to-Case Vs. Pulse Duration



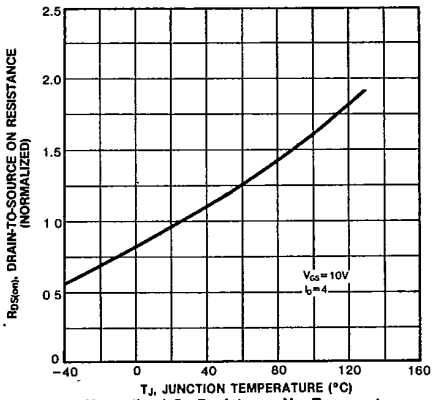
Typical Transcounductance Vs. Drain Current



Typical Source—Drain Diode Forward Voltage



Breakdown Voltage Vs. Temperature



Normalized On-Resistance Vs. Temperature

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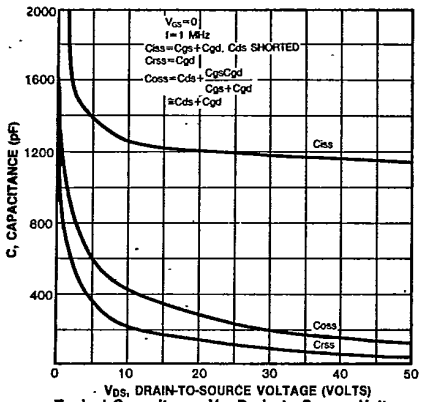
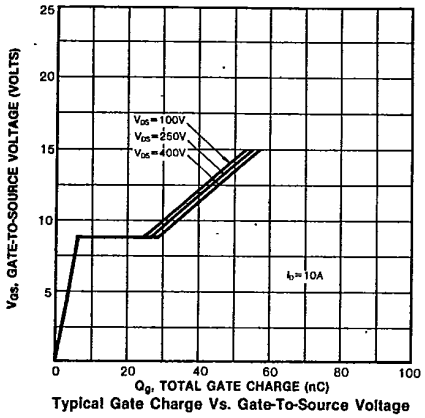
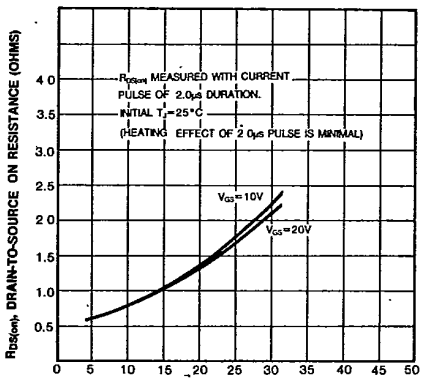


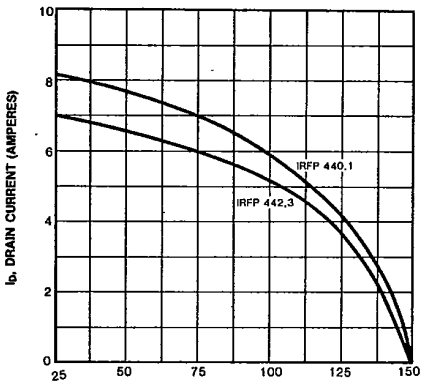
Typical Capacitance Vs. Drain to Source Voltage



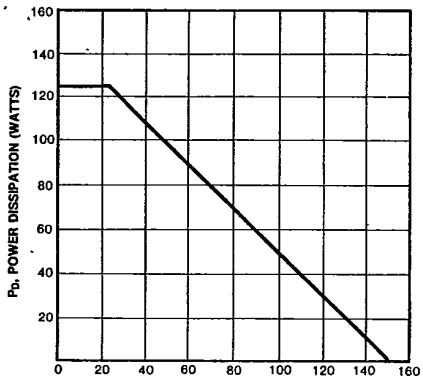
Typical Gate Charge Vs. Gate-To-Source Voltage



Typical On-Resistance Vs. Drain Current



Maximum Drain Current Vs. Case Temperature



Power Vs. Temperature Derating Curve