

August 1991

Features

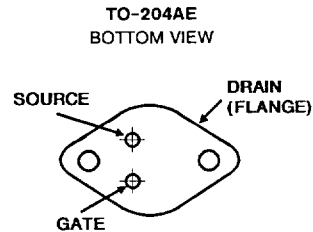
- 21A and 19A, 500V
- $r_{DS(on)} = 0.27\Omega$ and 0.35Ω
- Single Pulse Avalanche Energy Rated
- SOA is Power-Dissipation Limited
- Nanosecond Switching Speeds
- Linear Transfer Characteristics
- High Input Impedance

Description

The IRF460 and IRF462 are advanced power MOSFETs designed, tested, and guaranteed to withstand a specified level of energy in the breakdown avalanche mode of operation. These are n-channel enhancement-mode silicon gate power field-effect transistors designed for applications such as switching regulators, switching converters, motor drivers, relay drivers, and drivers for high-power bipolar switching transistors requiring high speed and low gate-drive power. These types can be operated directly from integrated circuits.

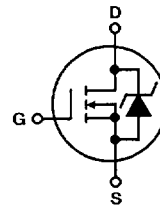
The IRF-types are supplied in the JEDEC TO-204AE metal package.

Package



Terminal Diagram

N-CHANNEL ENHANCEMENT MODE



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N-CHANNEL
POWER MOSFETS

Absolute Maximum Ratings ($T_C = +25^\circ\text{C}$), Unless Otherwise Specified


	IRF460	IRF462	UNITS
Continuous Drain Current			
$T_C = +25^\circ\text{C}$ I_D	21	19	A
$T_C = +100^\circ\text{C}$ I_D	14	12	A
Pulsed Drain Current (1) I_{DM}	84	76	A
Gate-Source Voltage V_{GS}	± 20	± 20	V
Maximum Power Dissipation			
$T_C = +25^\circ\text{C}$ P_D	300	300	W
Linear Derating Factor	2.4	2.4	W/ $^\circ\text{C}$
Single Pulse Avalanche Energy Rating (2) E_{AS}^*	1200	1200	mJ
See Figure 14			
Avalanche Current, Repetitive or Non-repetitive (1) I_{AR}	21	21	A
Operating and Storage Junction T_J, T_{STG}	-55 to +150	-55 to +150	$^\circ\text{C}$
Temperature Range			
Maximum Lead Temperature for Soldering T_L	300	300	$^\circ\text{C}$
(0.063" (1.6mm) from case for 10s)			

NOTES:

1. Repetitive rating; Pulse width limited by maximum junction temperature. See Transient Thermal Impedance Curve (Figure 5).
2. $V_{DD} = 50\text{V}$, starting $T_J = +25^\circ\text{C}$, $L = 4.9\text{mH}$, $R_{GS} = 25\Omega$, Peak $I_L = 21\text{A}$.
3. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$.

IRF460, IRF462

ELECTRICAL CHARACTERISTICS At Case Temperature (T_J) = 25°C Unless Otherwise Specified


Parameter		Type	Min.	Typ.	Max.	Units	Test Conditions	
BV _{DSS}	Drain-to-Source Breakdown Voltage	ALL	500	—	—	V	V _{GS} = 0V, I _D = 250 μA	
R _{DS(on)}	Static Drain-to-Source On-State Resistance ③	IRF460	—	0.24	0.27	Ω	V _{GS} = 10V, I _D = 12A	
		IRF462	—	0.27	0.35			
I _{D(on)}	On-State Drain Current ③	IRF460	21	—	—	A	V _{DS} > I _{D(on)} × R _{DS(on)} Max. V _{GS} = 10V	
		IRF462	19	—	—			
V _{GS(th)}	Gate Threshold Voltage	ALL	2.0	—	4.0	V	V _{DS} = V _{GS} , I _D = 250 μA	
g _{fs}	Forward Transconductance ③	ALL	13	20	—	S (ft)	V _{DS} ≥ 50V, I _{DS} = 12A	
I _{DSS}	Zero Gate Voltage Drain Current	ALL	—	—	250	μA	V _{DS} = Max. Rating, V _{GS} = 0V	
			—	—	1000		V _{DS} = 0.8 × Max. Rating V _{GS} = 0V, T _J = 125°C	
I _{GSS}	Gate-to-Source Leakage Forward	ALL	—	—	100	nA	V _{GS} = 20V	
I _{GSS}	Gate-to-Source Leakage Reverse	ALL	—	—	-100	nA	V _{GS} = -20V	
Q _g	Total Gate Charge	ALL	—	120	190	nC	V _{GS} = 10V, I _D = 21A	
Q _{gs}	Gate-to-Source Charge	ALL	—	18	—	nC	V _{DS} = 0.8 × Max. Rating See Fig. 16	
Q _{gd}	Gate-to-Drain ("Miller") Charge	ALL	—	62	—	nC	(Independent of operating temperature)	
t _{d(on)}	Turn-On Delay Time	ALL	—	23	35	ns	V _{DD} = 250V, I _D ≈ 21A, R _G = 4.3Ω	
t _r	Rise Time	ALL	—	81	120	ns	R _D = 12Ω	
t _{d(off)}	Turn-Off Delay Time	ALL	—	85	130	ns	See Fig. 15	
t _f	Fall Time	ALL	—	65	98	ns	(Independent of operating temperature)	
L _D	Internal Drain Inductance	ALL	—	5.0	—	nH	Measured from the drain lead, 6mm (0.25 in.) from package to center of die.	Modified MOSFET symbol showing the internal inductances. 
L _S	Internal Source Inductance	ALL	—	13	—	nH	Measured from the source lead, 6mm (0.25 in.) from package to source bonding pad.	
C _{iss}	Input Capacitance	ALL	—	4100	—	pF	V _{GS} = 0V, V _{DS} = 25V	
C _{oss}	Output Capacitance	ALL	—	480	—	pF	f = 1.0 MHz	
C _{rss}	Reverse Transfer Capacitance	ALL	—	84	—	pF	See Fig. 10	
R _{thJC}	Junction-to-Case	ALL	—	—	0.42	°C/W		
R _{thJS}	Case-to-Sink	ALL	—	0.10	—	°C/W	Mounting surface flat, smooth, and greased	
R _{thJA}	Junction-to-Ambient	ALL	—	—	30	°C/W	Typical socket mount	

① Repetitive Rating; Pulse width limited by maximum junction temperature (see figure 5) Refer to current HEXFET reliability report

② Pulse width ≤ 300 μs; Duty Cycle ≤ 2%

③ @ V_{DD} = 50V, Starting T_J = 25°C,
L = 4.9 μH, R_G = 25Ω,
Peak I_L = 21A.

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Parameter		Type	Min.	Typ.	Max.	Units	Test Conditions		
I _S	Continuous Source Current (Body Diode)	ALL	—	—	21	A	Modified MOSFET symbol showing the integral Reverse p-n junction rectifier. 		
I _{SM}	Pulsed Source Current (Body Diode) ①	ALL	—	—	84	A			
V _{SD}	Diode Forward Voltage ③	ALL	—	—	1.8	V	T _J = 25°C, I _S = 21A, V _{GS} = 0V		
t _{rr}	Reverse Recovery Time	ALL	280	580	1200	ns	T _J = 25°C, I _F = 21A, di/dt = 100 A/μs		
Q _{RR}	Reverse Recovery Charge	ALL	3.8	8.1	18	μC			
t _{on}	Forward Turn-On Time	ALL	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by L _S + L _D .						

IRF460, IRF462

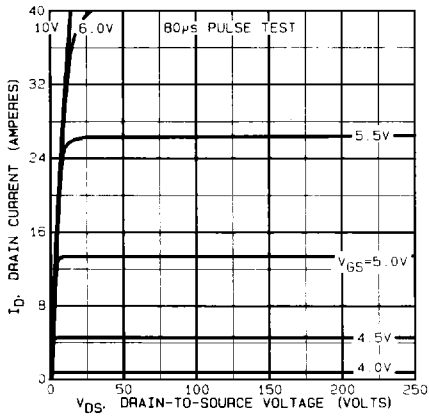


Fig. 1 - Typical output characteristics.

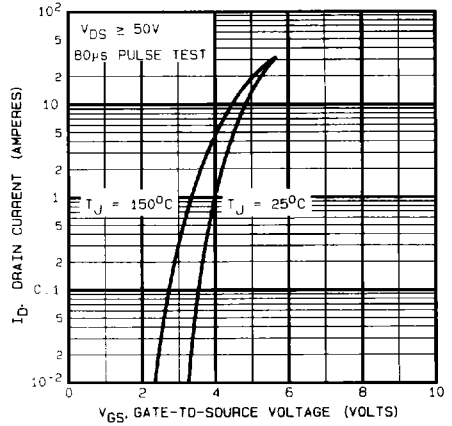


Fig. 2 - Typical transfer characteristics.

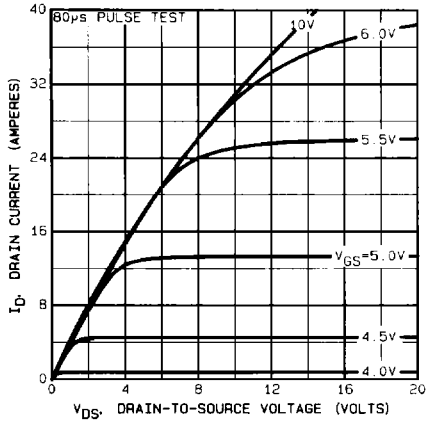


Fig. 3 - Typical saturation characteristics.

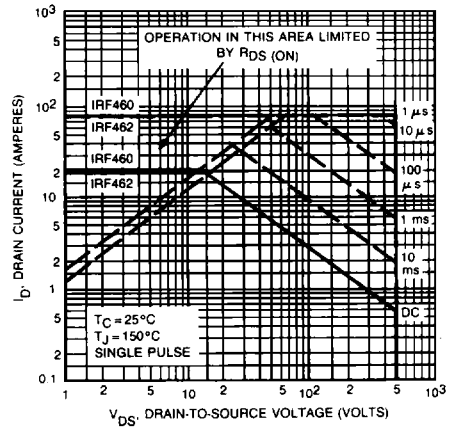


Fig. 4 - Maximum safe operating area.

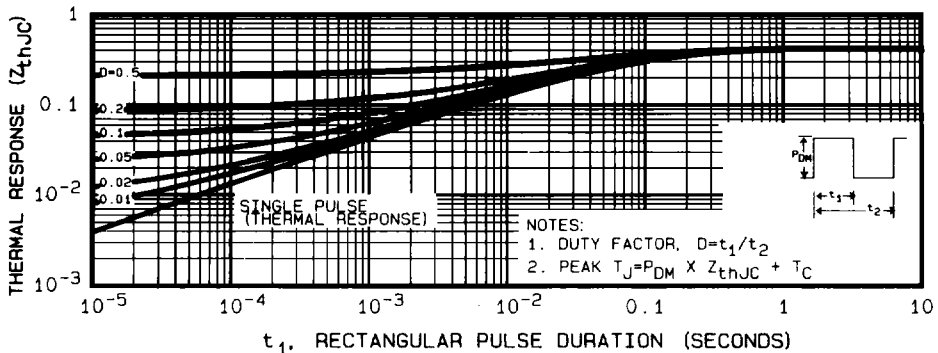


Fig. 5 - Maximum effective transient thermal impedance, junction-to-case vs. pulse duration.

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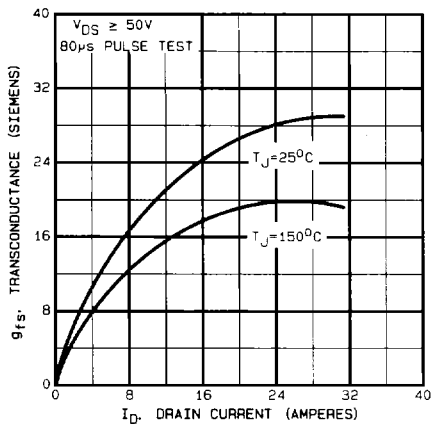


Fig. 6 - Typical transconductance vs. drain current.

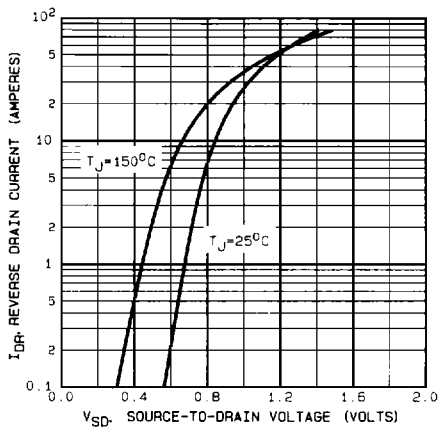


Fig. 7 - Typical source-drain diode forward voltage.

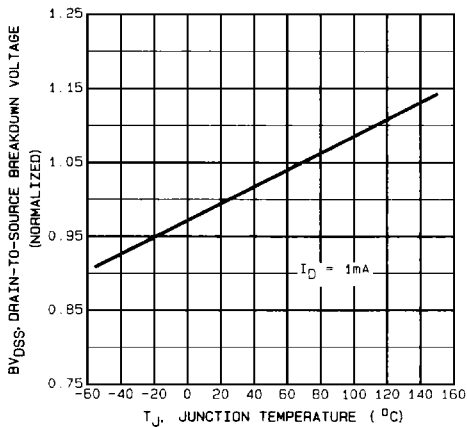


Fig. 8 - Breakdown voltage vs. temperature.

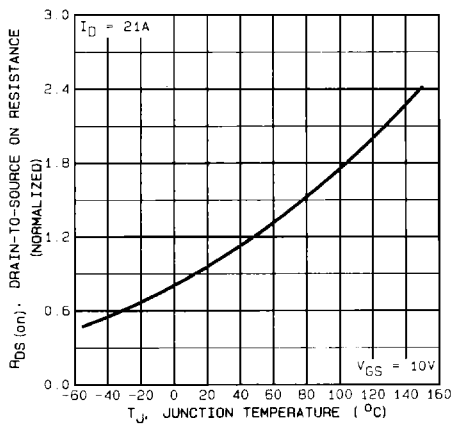


Fig. 9 - Normalized on-resistance vs. temperature.

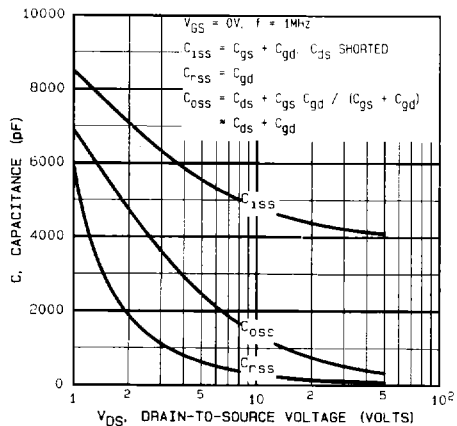


Fig. 10 - Typical capacitance vs. drain-to-source voltage.

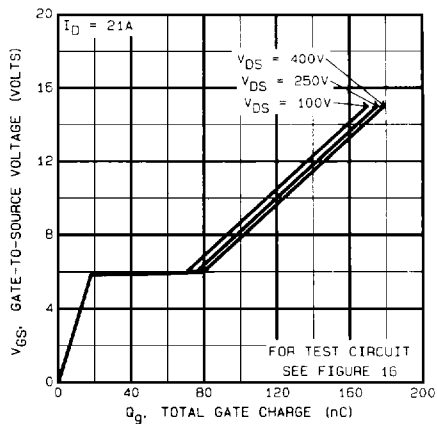


Fig. 11 - Typical gate charge vs. gate-to-source voltage.

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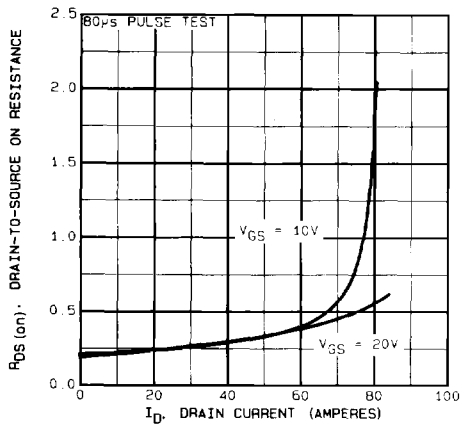


Fig. 12 - Typical on-resistance vs. drain current.

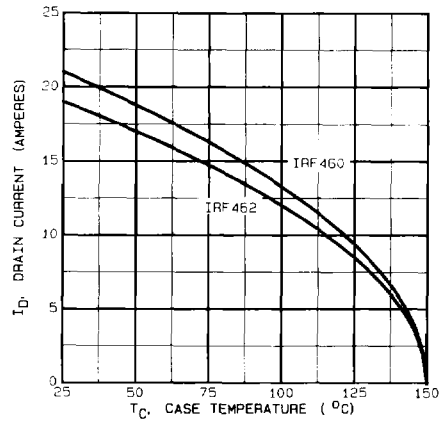


Fig. 13 - Maximum drain current vs. case temperature.

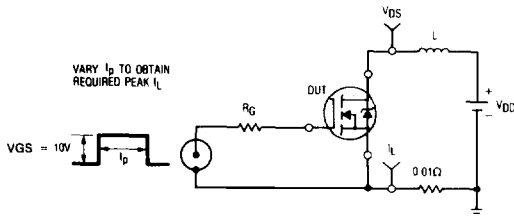


Fig. 14a - Unclamped inductive test circuit.

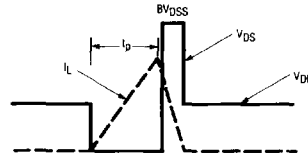


Fig. 14b - Unclamped inductive waveforms.

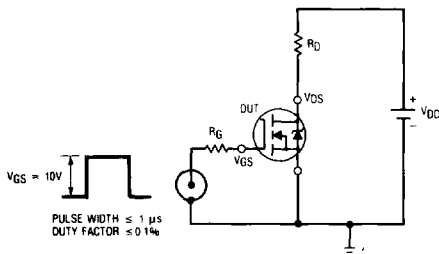


Fig. 15a - Switching time test circuit.

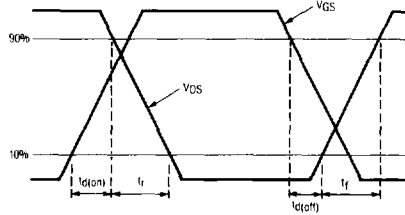


Fig. 15b - Switching time waveforms.

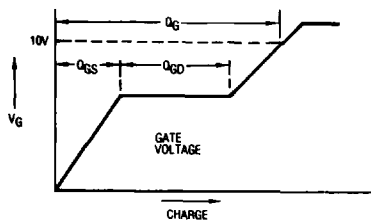


Fig. 16a - Basic gate charge waveform.

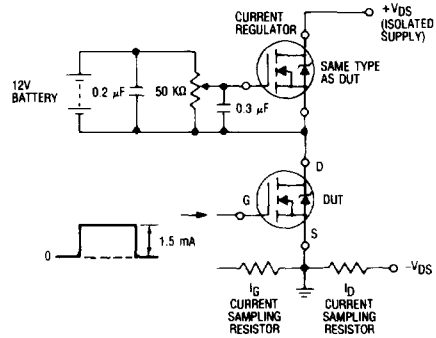


Fig. 16b - Gate charge test circuit.

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