HARRIS

IRF460
IRF462

N-Channel Power MOSFETs
Avalanche-Energy Rated

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

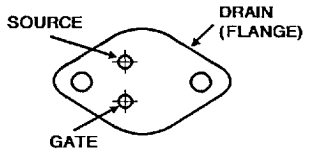
Description

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.

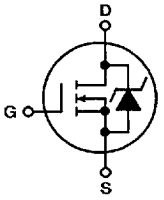
Package

TO-204AE
BOTTOM VIEW



Terminal Diagram

N-CHANNEL ENHANCEMENT MODE



Absolute Maximum Ratings ($T_C = +25^oC$), Unless Otherwise Specified

		IRF460	IRF462	UNITS
Continuous Drain Current				
$T_C = +25^oC$	I_D	21	19	A
$T_C = +100^oC$	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				
$T_C = +25^oC$	P_D	300	300	W
Linear Derating Factor		2.4	2.4	$W/^oC$
Single Pulse Avalanche Energy Rating (2) See Figure 14	E_{AS}*	1200	1200	mJ
Avalanche Current, Repetitive or Non-repetitive (1)	I_{AR}	21	21	A
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-55 to +150	-55 to +150	^oC
Maximum Lead Temperature for Soldering (0.063" (1.6mm) from case for 10s)	T_L	300	300	^oC

NOTES.

1 Repetitive rating: Pulse width limited by maximum junction temperature. See Transient Thermal Impedance Curve (Figure 5).

2. $V_{DD} = 50V$, starting $T_J = +25^oC$, $L = 4.9mH$, $R_{GS} = 25\Omega$, Peak $I_L = 21A$.

3. Pulse Test: Pulse width $\leq 300\mu s$, Duty Cycle $\leq 2\%$

CAUTION: These devices are sensitive to electrostatic discharge. Proper I.C handling procedures should be followed.

File Number **2277.1**

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} > $I_{D(on)}$ X $R_{DS(on)}$ Max
		IRF462	19	—	—		V_{GS} = 10V
$V_{GS(th)}$	Gate Threshold Voltage	ALL	2.0	—	4.0	V	V_{DS} = V_{GS}, I_D = 250μA
g_{fs}	Forward Transconductance ③	ALL	13	20	—	S (℧)	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 x 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 x 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 @ V_{DD} = 50V, Starting T_J = 25°C, L = 4.9 μH, R_G = 25Ω, Peak I_L = 21A

③ Pulse width ≤ 300 μs, Duty Cycle ≤ 2%

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				

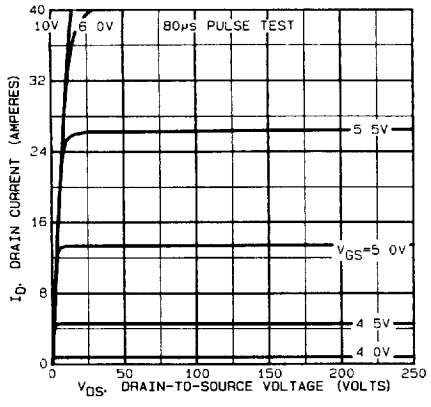


Fig. 1 - Typical output characteristics.

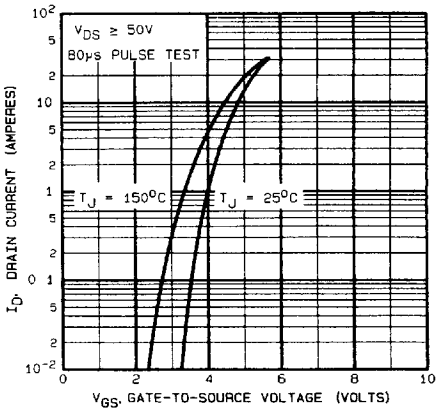


Fig. 2 - Typical transfer characteristics.

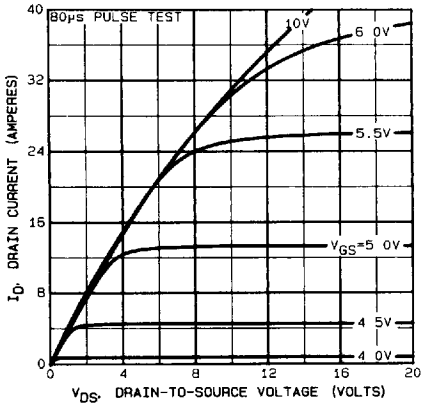


Fig. 3 - Typical saturation characteristics.

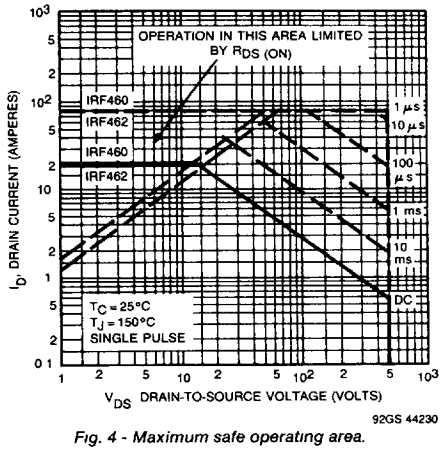


Fig. 4 - Maximum safe operating area.

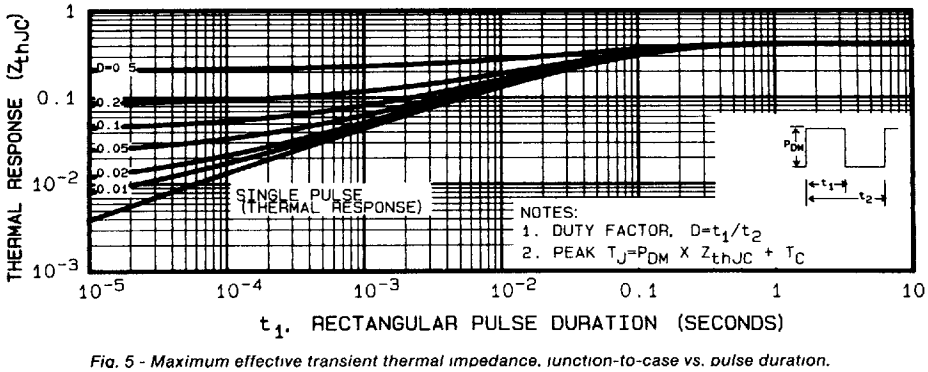


Fig. 5 - Maximum effective transient thermal impedance, junction-to-case vs. pulse duration.

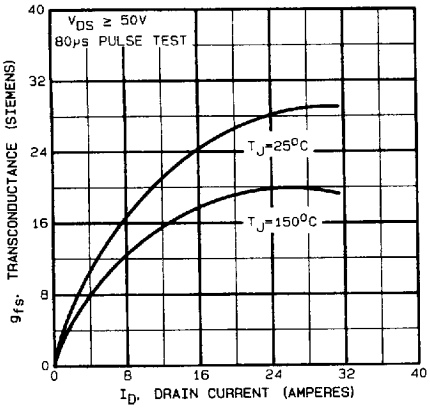


Fig. 6 - Typical transconductance vs. drain current.

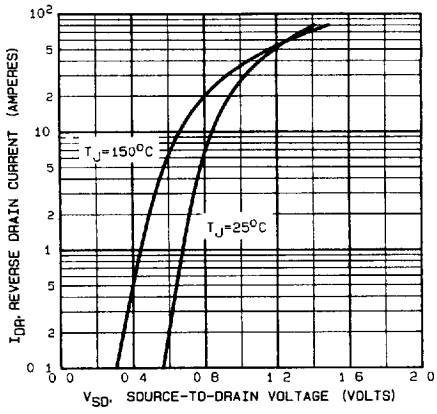


Fig. 7 - Typical source-drain diode forward voltage.

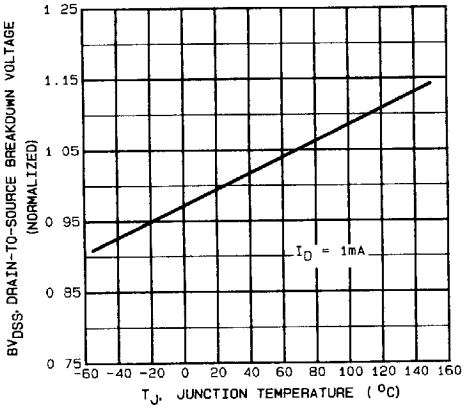


Fig. 8 - Breakdown voltage vs. temperature.

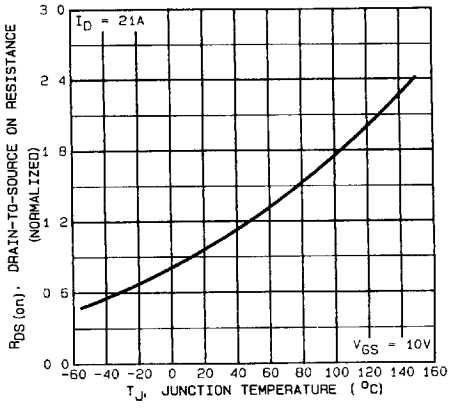


Fig. 9 - Normalized on-resistance vs. temperature.

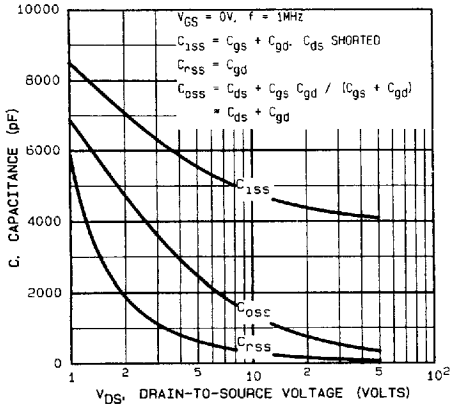


Fig. 10 - Typical capacitance vs. drain-to-source voltage.

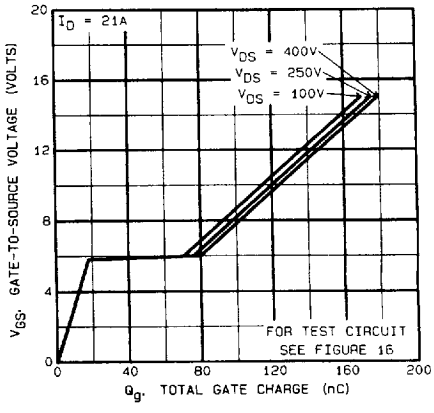


Fig. 11 - Typical gate charge vs. gate-to-source voltage

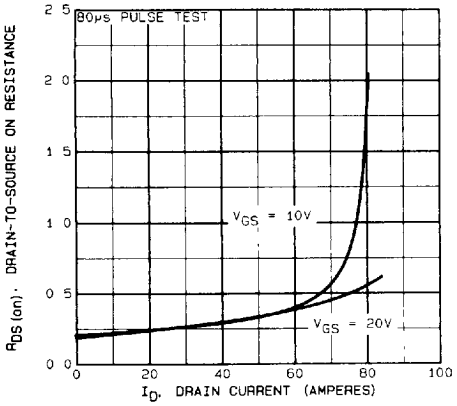


Fig. 12 - Typical on-resistance vs. drain current.

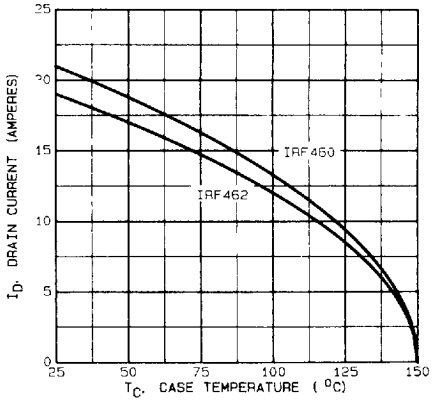


Fig. 13 - Maximum drain current vs case temperature

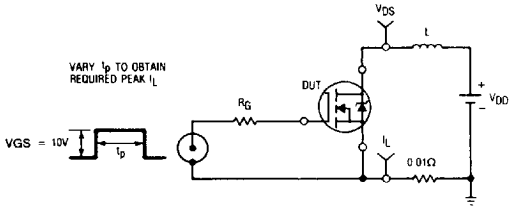


Fig. 14a - Unclamped inductive test circuit.

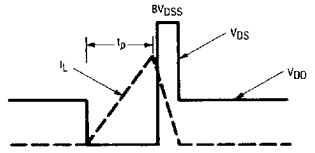


Fig. 14b - Unclamped inductive waveforms

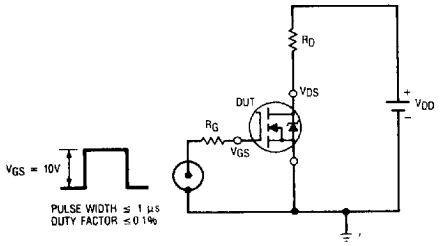


Fig. 15a - Switching time test circuit.

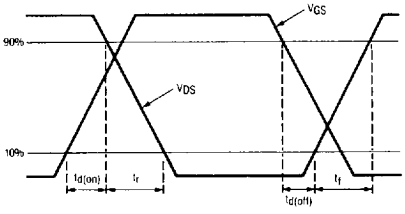


Fig. 15b - Switching time waveforms.

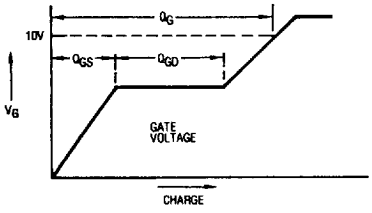


Fig. 16a - Basic gate charge waveform.

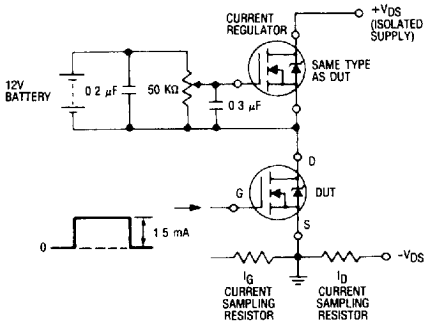


Fig. 16b - Gate charge test circuit.