

Standard Power MOSFETs

IRF430, IRF431, IRF432, IRF433

File Number 1572

Power MOS Field-Effect Transistors

N-Channel Enhancement-Mode Power Field-Effect Transistors

4.0A and 4.5A, 450V-500V

$r_{DS(on)} = 1.5 \Omega$ and 2.0Ω

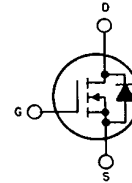
Features:

- SOA is power-dissipation limited
- Nanosecond switching speeds
- Linear transfer characteristics
- High input impedance
- Majority carrier device

The IRF430, IRF431, IRF432 and IRF433 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-204AA steel package.

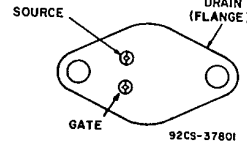
N-CHANNEL ENHANCEMENT MODE



92CS-33741

TERMINAL DIAGRAM

TERMINAL DESIGNATION



JEDEC TO-204AA

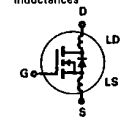
Absolute Maximum Ratings

Parameter	IRF430	IRF431	IRF432	IRF433	Units
V_{DS} Drain-Source Voltage (1)	500	450	500	450	V
V_{DGR} Drain-Gate Voltage ($V_{GS} = 20 \text{ K}\Omega$) (1)	500	450	500	450	V
$I_D @ T_C = 25^\circ\text{C}$ Continuous Drain Current	4.5	4.5	4.0	4.0	A
$I_D @ T_C = 100^\circ\text{C}$ Continuous Drain Current	3.0	3.0	2.5	2.5	A
I_{DM} Pulsed Drain Current (3)	18	18	16	16	A
V_{GS} Gate-Source Voltage	± 20				V
$P_D @ T_C = 25^\circ\text{C}$ Max. Power Dissipation	75 (See Fig. 14)				W
Linear Derating Factor	0.6 (See Fig. 14)				W/°C
I_{LM} Inductive Current, Clamped	18	18	16	16	A
(See Fig. 15 and 16) $L = 100\mu\text{H}$					
T_J Operating Junction and Storage Temperature Range	55 to 150				°C
Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)				°C

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Electrical Characteristics @T_C = 25°C (Unless Otherwise Specified)

Parameter	Type	Min.	Typ	Max.	Units	Test Conditions
BV _{DSS} Drain - Source Breakdown Voltage	IRF430 IRF432	500	—	—	V	V _{GS} = 0V
	IRF431 IRF433	450	—	—	V	I _D = 250μA
	ALL	—	—	—	—	V _{GS} = 0V, I _D = 250μA
V _{GS(th)} Gate Threshold Voltage	ALL	2.0	—	4.0	V	V _{DS} = V _{GS} , I _D = 250μA
I _{GSS} Gate-Source Leakage Forward	ALL	—	—	100	nA	V _{GS} = 20V
I _{GSS} Gate-Source Leakage Reverse	ALL	—	—	-100	nA	V _{GS} = -20V
I _{DSS} Zero Gate Voltage Drain Current	ALL	—	—	250	μA	V _{DS} = Max. Rating, V _{GS} = 0V
	ALL	—	—	1000	μA	V _{DS} = Max. Rating x 0.8, V _{GS} = 0V, T _C = 125°C
I _{D(on)} On-State Drain Current ②	IRF430 IRF431	4.5	—	—	A	V _{DS} > I _{D(on)} × R _{DS(on)} max., V _{GS} = 10V
	IRF432 IRF433	4.0	—	—	A	
	ALL	—	—	—	—	
R _{DS(on)} Static Drain-Source On-State Resistance ②	IRF430 IRF431	—	1.3	1.5	Ω	V _{GS} = 10V, I _D = 2.5A
	IRF432 IRF433	—	1.5	2.0	Ω	
	ALL	—	—	—	—	
g _{fs} Forward Transconductance ②	ALL	2.5	3.2	—	S (Ω)	V _{DS} > I _{D(on)} × R _{DS(on)} max., I _D = 2.5A
C _{iss} Input Capacitance	ALL	—	800	800	pF	V _{GS} = 0V, V _{DS} = 25V, f = 1.0 MHz
C _{oss} Output Capacitance	ALL	—	100	200	pF	See Fig. 10
C _{rss} Reverse Transfer Capacitance	ALL	—	30	60	pF	See Fig. 10
t _{d(on)} Turn-On Delay Time	ALL	—	—	30	ns	V _{DD} = 225V, I _D = 2.5A, Z ₀ = 15Ω See Fig. 17
t _r Rise Time	ALL	—	—	30	ns	
t _{d(off)} Turn-Off Delay Time	ALL	—	—	55	ns	(MOSFET switching times are essentially independent of operating temperature.)
t _f Fall Time	ALL	—	—	30	ns	
Q _g Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	—	22	30	nC	V _{GS} = 10V, I _D = 6.0A, V _{DS} = 0.8 Max. Rating. See Fig. 18 for test circuit. (Gate charge is essentially independent of operating temperature.)
Q _{gs} Gate-Source Charge	ALL	—	11	—	nC	
Q _{gd} Gate-Drain ("Miller") Charge	ALL	—	11	—	nC	
L _D Internal Drain Inductance	ALL	—	5.0	—	nH	Measured between the contact screw on header that is closer to source and gate pins and center of die
L _S Internal Source Inductance	ALL	—	12.5	—	nH	Measured from the source pin, 6 mm (0.25 in.) from header and source bonding pad.



Thermal Resistance

R _{thJC} Junction-to-Case	ALL	—	—	1.67	°C/W	
R _{thCS} Case-to-Sink	ALL	—	0.1	—	°C/W	Mounting surface flat, smooth, and greased.
R _{thJA} Junction-to-Ambient	ALL	—	—	30	°C/W	Free Air Operation

Source-Drain Diode Ratings and Characteristics

I _S Continuous Source Current (Body Diode)	IRF430 IRF431	—	—	4.5	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier
	IRF432 IRF433	—	—	4.0	A	
	ALL	—	—	—	—	
I _{SM} Pulse Source Current (Body Diode) ③	IRF430 IRF431	—	—	18	A	
	IRF432 IRF433	—	—	16	A	
V _{SD} Diode Forward Voltage ②	IRF430 IRF431	—	—	1.4	V	T _C = 25°C, I _S = 4.5A, V _{GS} = 0V
	IRF432 IRF433	—	—	1.3	V	T _C = 25°C, I _S = 4.0A, V _{GS} = 0V
t _{rr} Reverse Recovery Time	ALL	—	800	—	ns	T _J = 150°C, I _C = 4.5A, dI _C /dt = 100A/μs
Q _{RR} Reverse Recovered Charge	ALL	—	4.5	—	μC	T _J = 150°C, I _C = 4.5A, dI _C /dt = 100A/μs
t _{gn} Forward Turn-on Time	ALL	Intrinsic turn-on time is negligible				Turn-on speed is substantially controlled by L _S + L _D .

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. See Transient Thermal Impedance Curve (Fig. 5).

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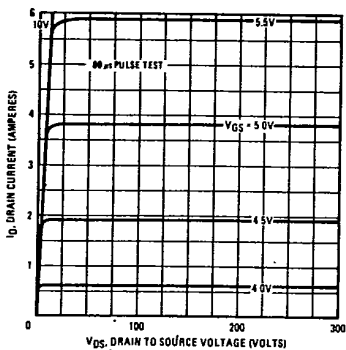


Fig. 1 - Typical Output Characteristics

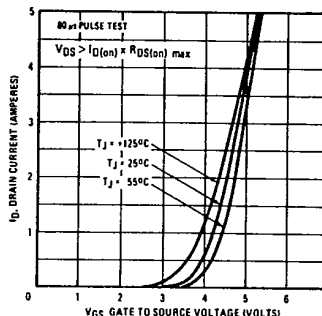


Fig. 2 - Typical Transfer Characteristics

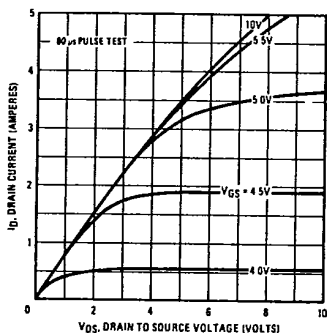


Fig. 3 - Typical Saturation Characteristics

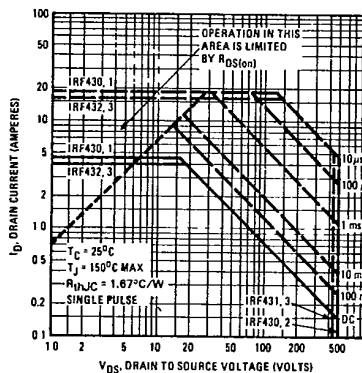


Fig. 4 - Maximum Safe Operating Area

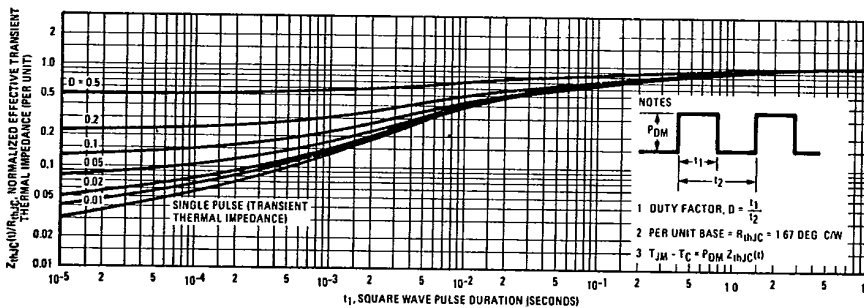


Fig. 5 - Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

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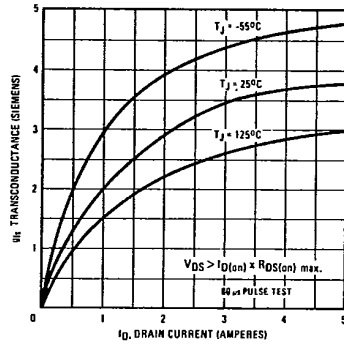


Fig. 6 - Typical Transconductance Vs. Drain Current

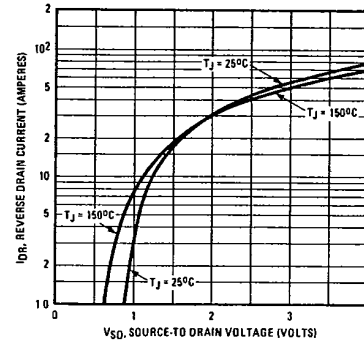


Fig. 7 - Typical Source-Drain Diode Forward Voltage

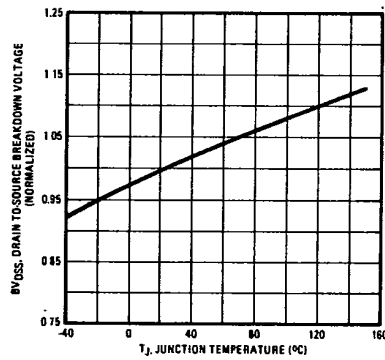


Fig. 8 - Breakdown Voltage Vs. Temperature

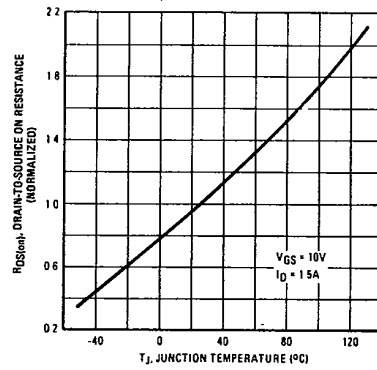


Fig. 9 - Normalized On-Resistance Vs. Temperature

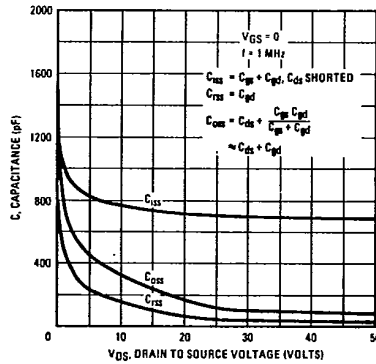


Fig. 10 - Typical Capacitance Vs. Drain-to-Source Voltage

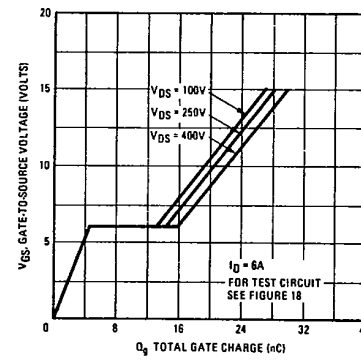


Fig. 11 - Typical Gate Charge Vs. Gate-to-Source Voltage

IRF430, IRF431, IRF432, IRF433

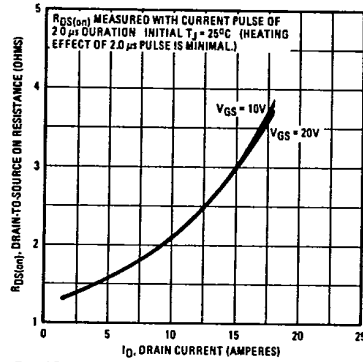


Fig. 12 - Typical On-Resistance Vs. Drain Current

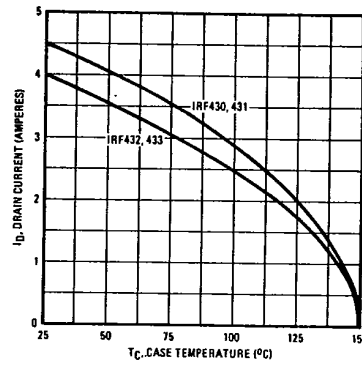


Fig. 13 - Maximum Drain Current Vs. Case Temperature

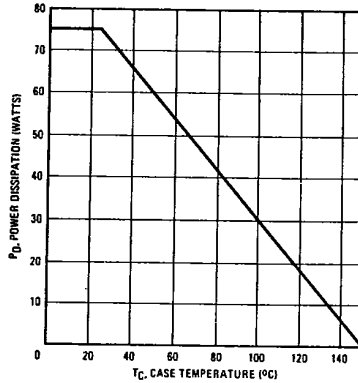


Fig. 14 - Power Vs. Temperature Derating Curve

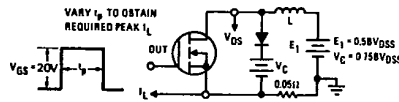


Fig. 15 - Clamped Inductive Test Circuit



Fig. 16 - Clamped Inductive Waveforms

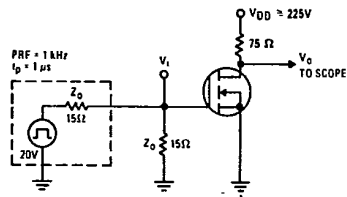


Fig. 17 - Switching Time Test Circuit

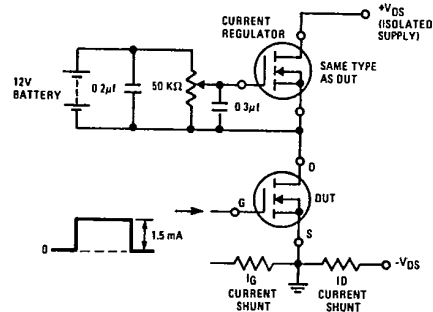


Fig. 18 - Gate Charge Test Circuit