

Standard Power MOSFETs

IRF641, IRF643

File Number 1585

Power MOS Field-Effect Transistors

N-Channel Enhancement-Mode Power Field-Effect Transistors

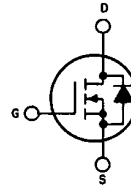
16A and 18A, 150V

$r_{DS(on)} = 0.18 \Omega$ and 0.22Ω

Features:

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

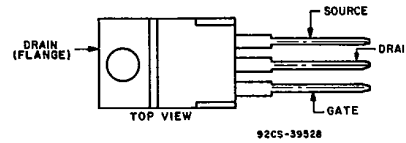
N-CHANNEL ENHANCEMENT MODE



92CS-33741

TERMINAL DIAGRAM

TERMINAL DESIGNATION



92CS-39328

JEDEC TO-220AB

The IRF641 and IRF643 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.

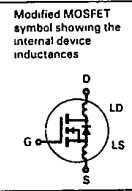
The IRF-types are supplied in the JEDEC TO-220AB plastic package.

Absolute Maximum Ratings

Parameter	IRF641	IRF643	Units
V_{DS} Drain - Source Voltage (1)	150	150	V
V_{DGR} Drain - Gate Voltage ($R_{GS} = 20 \text{ k}\Omega$) (1)	150	150	V
$I_D @ T_C = 25^\circ\text{C}$ Continuous Drain Current	18	18	A
$I_D @ T_C = 100^\circ\text{C}$ Continuous Drain Current	11	10	A
I_{DM} Pulsed Drain Current (2)	72	64	A
V_{GS} Gate - Source Voltage	± 20		V
$P_D @ T_C = 25^\circ\text{C}$ Max. Power Dissipation	125	(See Fig 14)	W
Linear Derating Factor	1.0	(See Fig 14)	W/°C
I_{LM} Inductive Current, Clamped	72	(See Fig. 15 and 16) L = 100 μ H 72 64 64	A
T_J Operating Junction and Storage Temperature Range	-55 to 100		°C
T_{stg} Lead Temperature	300 (0.064 in. (1.6mm) from case for 10s)		°C

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

Parameter	Type	Min	Typ	Max	Units	Test Conditions
BV _{DSS} Drain - Source Breakdown Voltage	IRF641 IRF643	150	-	-	V	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	-	-	500	nA	V _{GS} = 20V
I _{GSS} Gate-Source Leakage Reverse	ALL	-	-	-500	nA	V _{GS} = -20V
I _{DSS} Zero Gate Voltage Drain Current	ALL	-	-	250	μA	V _{DS} = Max. Rating, V _{GS} = 0V
I _{DSS} Zero Gate Voltage Drain Current	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	IRF641 IRF643	18	-	-	A	V _{DS} > I _{D(on)} × R _{DS(on)} max., V _{GS} = 10V
R _{DS(on)} Static Drain-Source On-State Resistance ②	IRF641 IRF643	-	0.14	0.18	Ω	V _{GS} = 10V, I _D = 10A
R _{DS(on)} Static Drain-Source On-State Resistance ②	IRF643	-	0.20	0.22	Ω	V _{GS} = 10V, I _D = 10A
β _{fs} Forward Transconductance ②	ALL	6.0	10	-	S(Ω)	V _{DS} > I _{D(on)} × R _{DS(on)} max., I _D = 10A
C _{iss} Input Capacitance	ALL	-	1275	1600	pF	V _{GS} = 0V, V _{DS} = 25V, f = 1.0 MHz
C _{oss} Output Capacitance	ALL	-	500	750	pF	See Fig. 10
C _{rss} Reverse Transfer Capacitance	ALL	-	180	300	pF	See Fig. 10
t _{d(on)} Turn On Delay Time	ALL	-	16	30	ns	V _{DD} = 75V, I _D = 10A, Z ₀ = 4.7Ω
t _r Rise Time	ALL	-	27	60	ns	See Fig. 17
t _{d(off)} Turn-Off Delay Time	ALL	-	40	80	ns	(MOSFET switching times are essentially independent of operating temperature.)
t _f Fall Time	ALL	-	31	60	ns	(MOSFET switching times are essentially independent of operating temperature.)
Q _g Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	-	43	60	nC	V _{GS} = 10V, I _D = 22A, 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	-	16	-	nC	
Q _{gd} Gate-Drain ("Miller") Charge	ALL	-	27	-	nC	
L _D Internal Drain Inductance	ALL	-	3.5	-	nH	Measured from the contact screw on tab to center of die.
L _D Internal Drain Inductance	ALL	-	4.5	-	nH	Measured from the drain lead, 6mm (0.25 in.) from package to center of die.
L _S Internal Source Inductance	ALL	-	7.5	-	nH	Measured from the source lead, 6mm (0.25 in.) from package to source bonding pad.



Thermal Resistance

R _{thJC} Junction-to-Case	ALL	-	-	1.0	°C/W	
R _{thCS} Case-to-Sink	ALL	-	1.0	-	°C/W	Mounting surface flat, smooth, and greased.
R _{thJA} Junction-to-Ambient	ALL	-	-	80	°C/W	Free Air Operation

Source-Drain Diode Ratings and Characteristics

I _S Continuous Source Current (Body Diode)	IRF641 IRF643	-	-	18 16	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier
I _{SM} Pulse Source Current (Body Diode) ③	IRF641 IRF643	-	-	72 64	A	
V _{SD} Diode Forward Voltage ②	IRF641 IRF643	-	-	2.0 1.9	V	T _C = 25°C, I _S = 18A, V _{GS} = 0V
t _{rr} Reverse Recovery Time	ALL	-	650	-	ns	T _J = 150°C, I _F = 18A, dI _F /dt = 100 A/μs
Q _{RR} Reverse Recovered Charge	ALL	-	4.1	-	μC	T _J = 150°C, I _F = 18A, dI _F /dt = 100 A/μs
t _{on} 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).

IRF641, IRF643

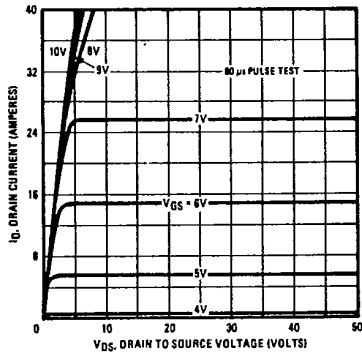


Fig. 1 - Typical Output Characteristics

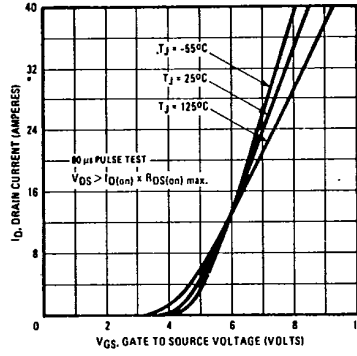


Fig. 2 - Typical Transfer Characteristics

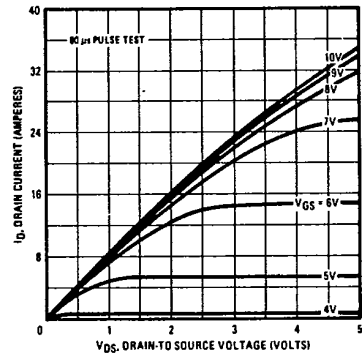


Fig. 3 - Typical Saturation Characteristics

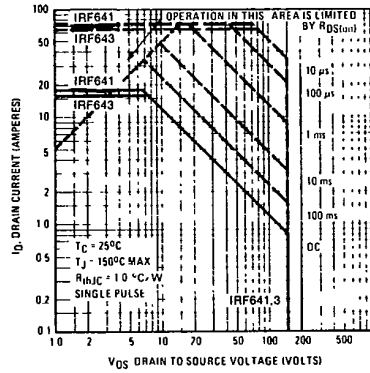


Fig. 4 - Maximum Safe Operating Area

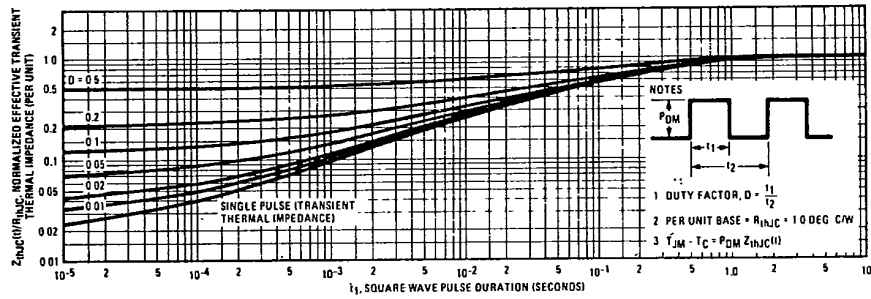


Fig. 5 - Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

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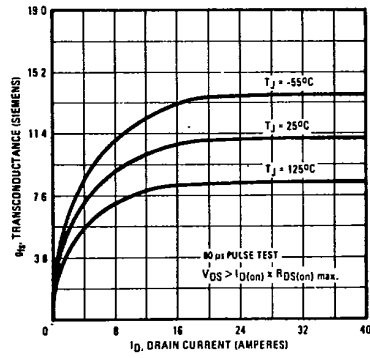


Fig. 6 - Typical Transconductance Vs. Drain Current

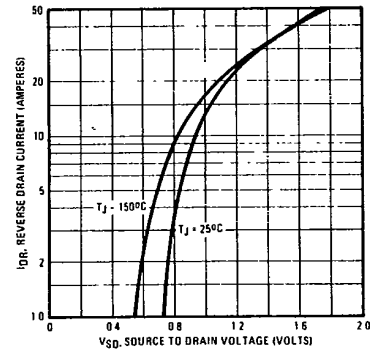


Fig. 7 - Typical Source-Drain Diode Forward Voltage

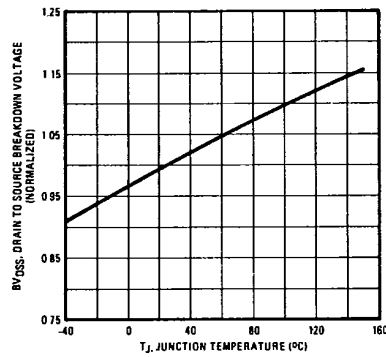


Fig. 8 - Breakdown Voltage Vs. Temperature

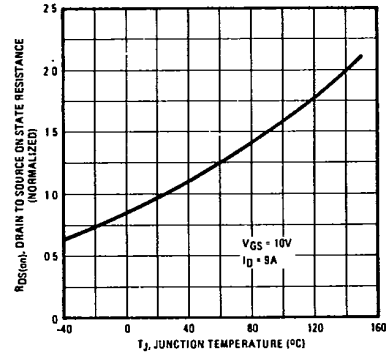


Fig. 9 - Normalized On-Resistance Vs. Temperature

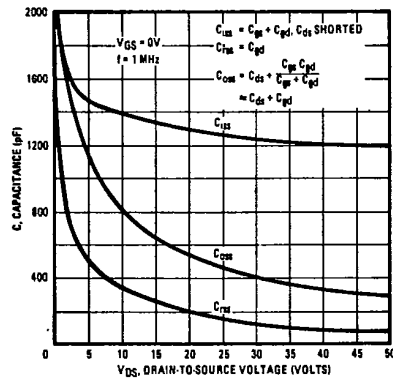


Fig. 10 - Typical Capacitance Vs. Drain-to-Source Voltage

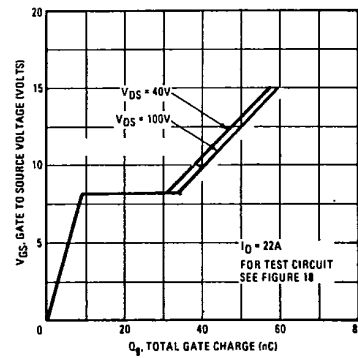


Fig. 11 - Typical Gate Charge Vs. Gate-to-Source Voltage

IRF641, IRF643

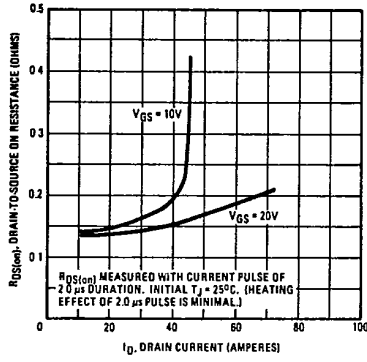


Fig. 12 - Typical On-Resistance Vs. Drain Current

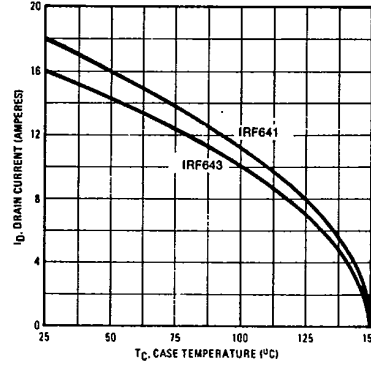


Fig. 13 - Maximum Drain Current Vs. Case Temperature

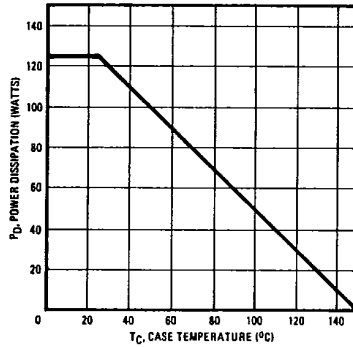


Fig. 14 - Power Vs. Temperature Derating Curve

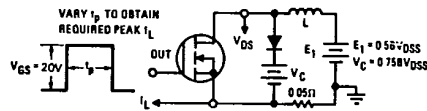


Fig. 15 - Clamped Inductive Test Circuit



Fig. 16 - Clamped Inductive Waveforms

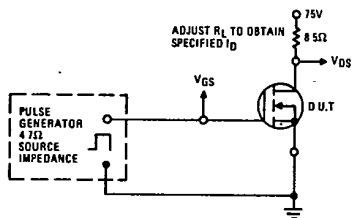


Fig. 17 - Switching Time Test Circuit

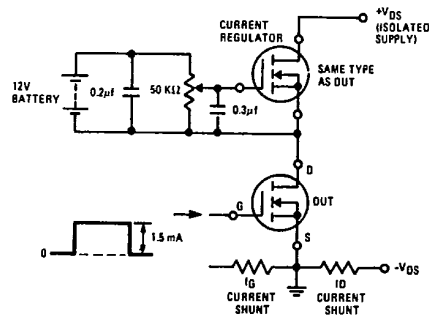


Fig. 18 - Gate Charge Test Circuit