

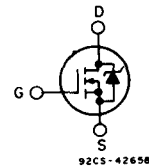
Avalanche Energy Rated N-Channel Power MOSFETs

16A and 18A, 200V, 150V
 $r_{DS(on)} = 0.18\Omega$ and 0.22Ω

Features:

- Single pulse avalanche energy rated
- SOA is power-dissipation limited
- Nanosecond switching speeds
- Linear transfer characteristics
- High input impedance

N-CHANNEL ENHANCEMENT MODE

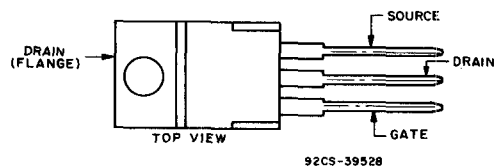


TERMINAL DIAGRAM

The IRF640R, IRF641R, IRF642R and IRF643R 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-220AB plastic package.

TERMINAL DESIGNATION



JEDEC TO-220AB

Absolute Maximum Ratings

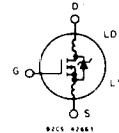
Parameter	IRF640R	IRF641R	IRF642R	IRF643R	Units
V_{DS} Drain - Source Voltage ①	200	150	200	150	V
V_{DGR} Drain - Gate Voltage ($R_{GS} = 20\text{ K}\Omega$) ①	200	150	200	150	V
$I_D @ T_C = 25^\circ\text{C}$ Continuous Drain Current	18	18	16	16	A
$I_D @ T_C = 100^\circ\text{C}$ Continuous Drain Current	11	11	10	10	A
I_{DM} Pulsed Drain Current ③	72	72	64	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
E_{AS} Single Pulse Avalanche Energy Rating ④	580				mJ
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

IRF640R, IRF641R, IRF642R, IRF643R

Electrical Characteristics @ $T_C = 25^\circ\text{C}$ (Unless Otherwise Specified)

Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions
BV _{DSS} Drain - Source Breakdown Voltage	IRF640R	200	—	—	V	V _{GS} = 0V I _D = 250μA
	IRF642R	—	—	—	—	
	IRF641R IRF643R	150	—	—	V	
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
		—	—	1000	μA	V _{DS} = Max. Rating x 0.8, V _{GS} = 0V, T _C = 125°C
I _{D(on)} On-State Drain Current ②	IRF640R	18	—	—	A	V _{DS} > I _{D(on)} x R _{DSON(max)} , V _{GS} = 10V
	IRF641R	—	—	—	—	
	IRF642R IRF643R	16	—	—	A	
R _{DSON} Static Drain-Source On-State Resistance ②	IRF640R	—	0.14	0.18	Ω	V _{GS} = 10V, I _D = 10A
	IRF641R	—	—	—	—	
	IRF642R IRF643R	—	0.20	0.22	Ω	
g _{fs} Forward Transconductance ②	ALL	6.0	10	—	S(Ω)	V _{DS} > I _{D(on)} x R _{DSON(max)} , I _D = 10A
C _{iss} Input Capacitance	ALL	—	1275	—	pF	V _{GS} = 0V, V _{DS} = 25V, f = 1.0 MHz See Fig. 10
C _{oss} Output Capacitance	ALL	—	500	—	pF	
C _{rss} Reverse Transfer Capacitance	ALL	—	160	—	pF	
t _{d(on)} Turn-On Delay Time	ALL	—	16	30	ns	V _{DD} ≈ 75V, I _D = 10A, Z ₀ = 4.7Ω See Fig. 17 (MOSFET switching times are essentially independent of operating temperature.)
t _r Rise Time	ALL	—	27	60	ns	
t _{d(off)} Turn-Off Delay Time	ALL	—	40	80	ns	
t _f Fall Time	ALL	—	31	60	ns	
Q _g Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	—	43	60	nC	V _{GS} = 10V, I _D = 22A, V _{DS} = 0.8V 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.
		—	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.

6

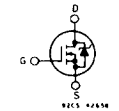


Thermal Resistance

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

Source-Drain Diode Ratings and Characteristics

I _S Continuous Source Current (Body Diode)	IRF640R	—	—	18	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier.
	IRF641R	—	—	16	A	
	IRF642R IRF643R	—	—	—	—	
I _{SM} Pulse Source Current (Body Diode) ③	IRF640R	—	—	72	A	
	IRF641R	—	—	—	—	
	IRF642R IRF643R	—	—	64	A	
V _{SD} Diode Forward Voltage ②	IRF640R	—	—	2.0	V	T _C = 25°C, I _S = 18A, V _{GS} = 0V
	IRF641R	—	—	—	—	T _C = 25°C, I _S = 16A, V _{GS} = 0V
	IRF642R IRF643R	—	—	1.9	V	T _C = 25°C, I _S = 16A, V _{GS} = 0V
t _{rr} Reverse Recovery Time	ALL	—	650	—	ns	T _J = 150°C, I _F = 18A, dI _F /dt = 100A/μs
Q _{RR} Reverse Recovered Charge	ALL	—	4.1	—	μC	T _J = 150°C, I _F = 18A, dI _F /dt = 100A/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).

④ V_{DD} = 50V, starting T_J = 25°C, L = 2.7 mH, R_{DS} = 50Ω, I_{peak} = 18A. See figures 15, 16.

IRF640R, IRF641R, IRF642R, IRF643R

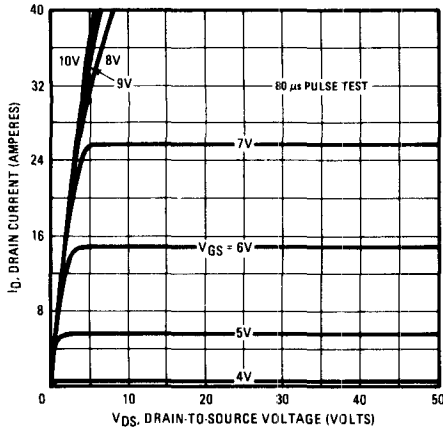


Fig. 1 - Typical Output Characteristics

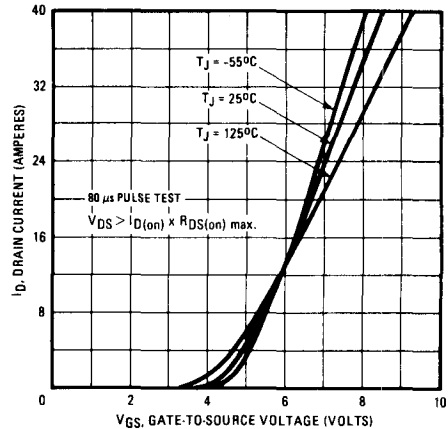


Fig. 2 - Typical Transfer Characteristics

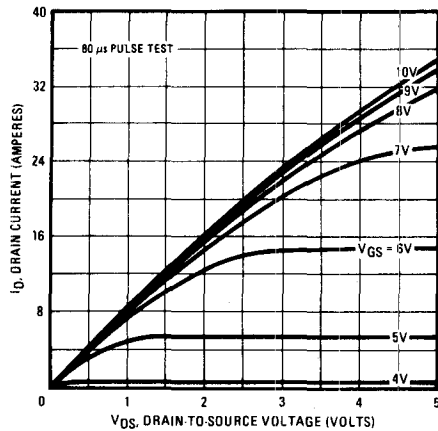


Fig. 3 - Typical Saturation Characteristics

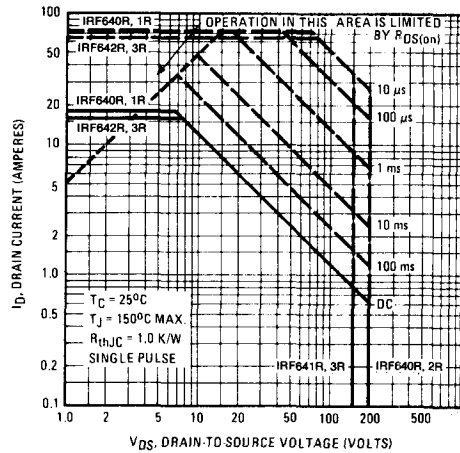


Fig. 4 - Maximum Safe Operating Area

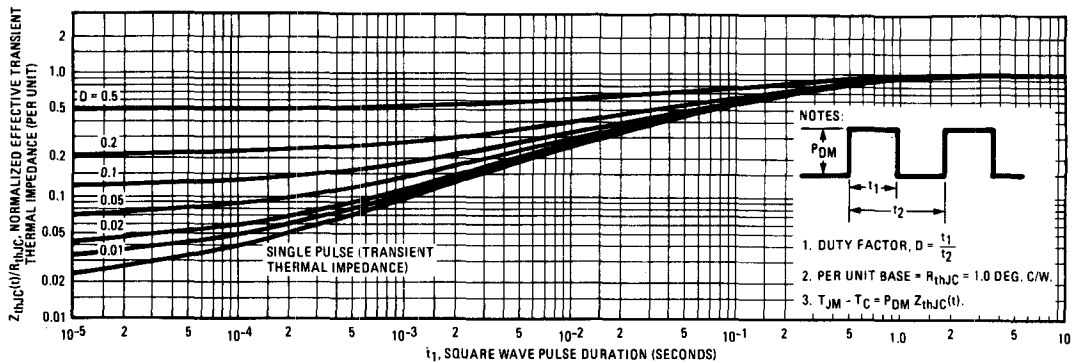


Fig. 5 - Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

IRF640R, IRF641R, IRF642R, IRF643R

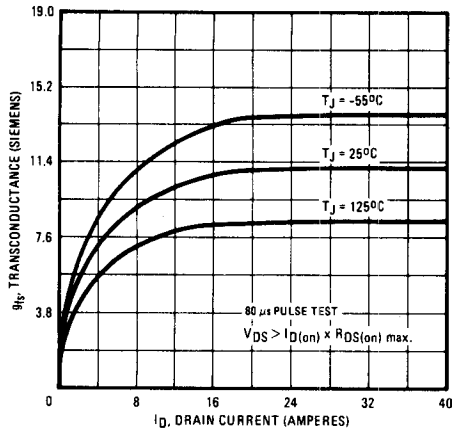


Fig. 6 – Typical Transconductance Vs. Drain Current

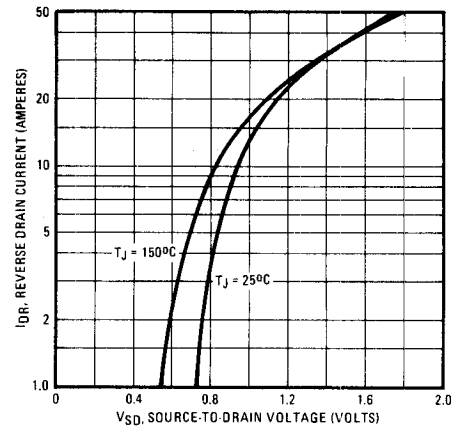


Fig. 7 – Typical Source-Drain Diode Forward Voltage

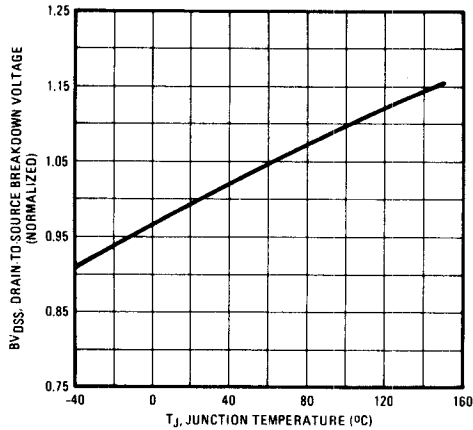


Fig. 8 – Breakdown Voltage Vs. Temperature

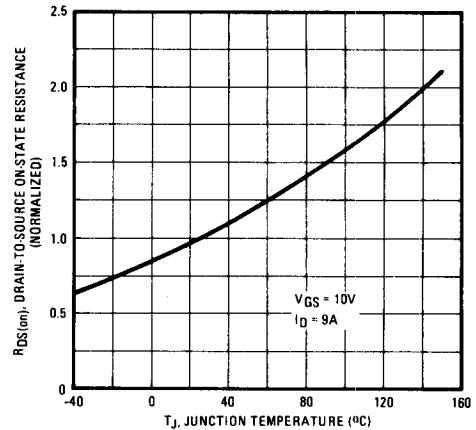


Fig. 9 – Normalized On-Resistance Vs. Temperature

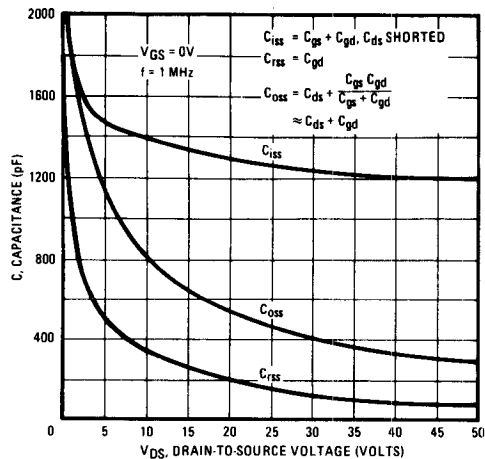


Fig. 10 – Typical Capacitance Vs. Drain-to-Source Voltage

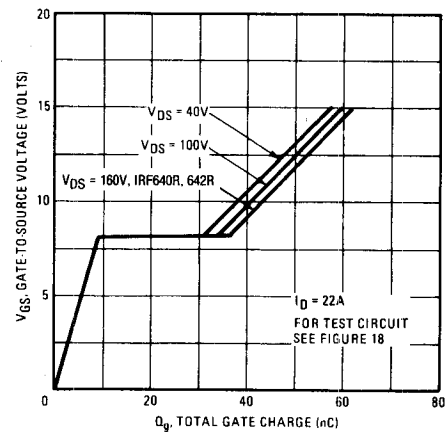


Fig. 11 – Typical Gate Charge Vs. Gate-to-Source Voltage

IRF640R, IRF641R, IRF642R, IRF643R

