IRF840R, IRF841R
IRF842R, IRF843R

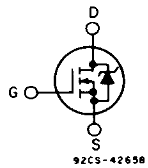
File Number **2034**

Avalanche Energy Rated N-Channel Power MOSFETs

8A and 7A, 500V-400V
$r_{DS}(on) = 0.85\Omega$ and 1.1Ω

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

TERMINAL DIAGRAM

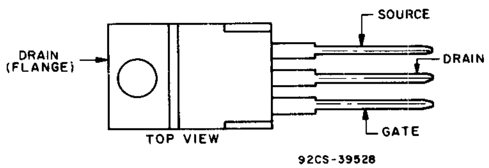


N-CHANNEL ENHANCEMENT MODE

The IRF840R, IRF841R, IRF842R and IRF843R 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

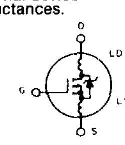
Absolute Maximum Ratings

	Parameter	IRF840R	IRF841R	IRF842R	IRF843R	Units
V_{DS}	Drain - Source Voltage ①	500	450	500	450	V
V_{DGR}	Drain - Gate Voltage (R_{GS} = 20 KΩ) ①	500	450	500	450	V
I_D @ T_C = 25°C	Continuous Drain Current	8.0	8.0	7.0	7.0	A
I_D @ T_C = 100°C	Continuous Drain Current	5.0	5.0	4.0	4.0	A
I_{DM}	Pulsed Drain Current ③	32	32	28	28	A
V_{GS}	Gate - Source Voltage	±20				V
P_D @ T_C = 25°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	510				mj
T_J T_{stg}	Operating Junction and Storage Temperature Range	-55 to 150				°C
	Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)				°C

IRF840R, IRF841R
IRF842R, IRF843R

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

Parameter		Type	Min.	Typ.	Max.	Units	Test Conditions
BV_{DSS}	Drain - Source Breakdown Voltage	IRF840R IRF842R	500	—	—	V	$V_{GS} = 0V$
		IRF841R IRF843R	450	—	—	V	$I_D = 250\mu A$
$V_{GS(th)}$	Gate Threshold Voltage	ALL	2.0	—	4.0	V	$V_{DS} = V_{GS}$, $I_D = 250\mu A$
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	IRF840R IRF841R	8.0	—	—	A	$V_{DS} > I_{D(on)} \times R_{DS(on)\,max.}$, $V_{GS} = 10V$
		IRF842R IRF843R	7.0	—	—	A	
$R_{DS(on)}$	Static Drain-Source On-State Resistance ②	IRF840R IRF841R	—	0.8	0.85	Ω	$V_{GS} = 10V$, $I_D = 4.0A$
		IRF842R IRF843R	—	1.0	1.1	Ω	
g_{fs}	Forward Transconductance ②	ALL	4.0	6.5	—	S(℧)	$V_{DS} > I_{D(on)} \times R_{DS(on)max.}$, $I_D = 4.0A$
C_{iss}	Input Capacitance	ALL	—	1225	—	pF	$V_{GS} = 0V$, $V_{DS} = 25V$, f = 1.0 MHz See Fig. 10
C_{oss}	Output Capacitance	ALL	—	200	—	pF	
C_{rss}	Reverse Transfer Capacitance	ALL	—	85	—	pF	
$t_{d(on)}$	Turn-On Delay Time	ALL	—	17	35	ns	$V_{DD} \approx 200V$, $I_D = 4.0A$, $Z_o = 4.7\Omega$ See Fig. 17 (MOSFET switching times are essentially independent of operating temperature.)
t_r	Rise Time	ALL	—	5	15	ns	
$t_{d(off)}$	Turn-Off Delay Time	ALL	—	42	90	ns	
t_f	Fall Time	ALL	—	14	30	ns	
Q_g	Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	—	42	60	nC	$V_{GS} = 10V$, $I_D = 10A$, 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	—	20	—	nC	
Q_{gd}	Gate-Drain ("Miller") Charge	ALL	—	22	—	nC	
L_D	Internal Drain Inductance	ALL	—	3.5	—	nH	Measured from the contact screw on tab to center of die. — Modified MOSFET symbol showing the internal device inductances.
			—	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.

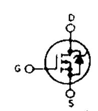


Thermal Resistance

RthJC	Junction-to-Case	ALL	—	—	1.0	°C/W	
RthCS	Case-to-Sink	ALL	—	1.0	—	°C/W	Mounting surface flat, smooth, and greased.
RthJA	Junction-to-Ambient	ALL	—	—	80	°C/W	Free Air Operation

Source-Drain Diode Ratings and Characteristics

I_S	Continuous Source Current (Body Diode)	IRF840R IRF841R	—	—	8.0	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier.
		IRF842R IRF843R	—	—	7.0	A	
I_{SM}	Pulse Source Current (Body Diode) ③	IRF840R IRF841R	—	—	32	A	
		IRF842R IRF843R	—	—	28	A	
V_{SD}	Diode Forward Voltage ②	IRF840R IRF841R	—	—	2.0	V	$T_C = 25°C$, $I_S = 8.0A$, $V_{GS} = 100A/\mu s$
		IRF842R IRF843R	—	—	1.9	V	$T_C = 25°C$, $I_S = 7.0A$, $V_{GS} = 100A/\mu s$
t_{rr}	Reverse Recovery Time	ALL	—	1100	—	ns	$T_J = 150°C$, $I_F = 8.0A$, $dI_F/dt = 100A/\mu s$
Q_{RR}	Reverse Recovered Charge	ALL	—	6.4	—	μC	$T_J = 150°C$, $I_F = 8.0A$, $dI_F/dt = 100A/\mu s$
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 = 9.1 mH, $R_{gs} = 50\Omega$, $I_{peak} = 10A$. See figures 15, 16.

6

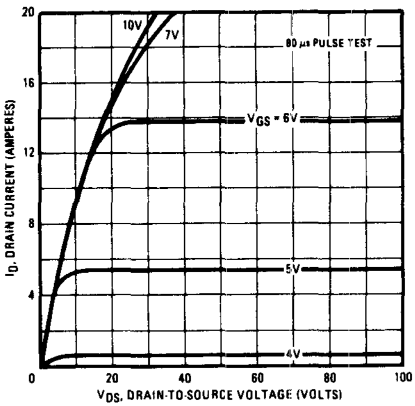


Fig. 1 – Typical Output Characteristics

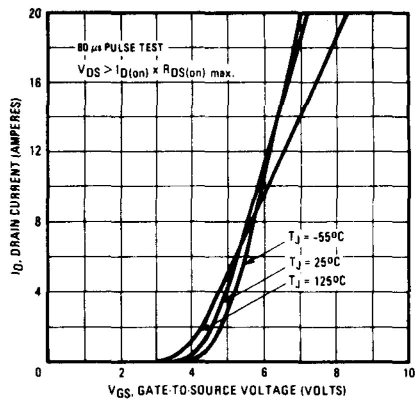


Fig. 2 – Typical Transfer Characteristics

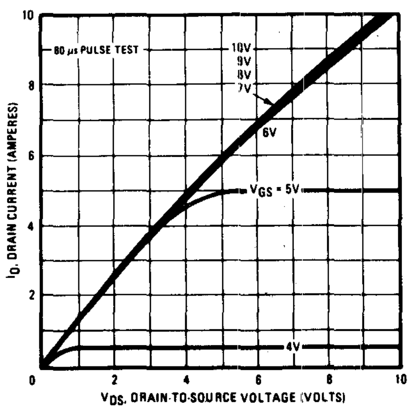


Fig. 3 – Typical Saturation Characteristics

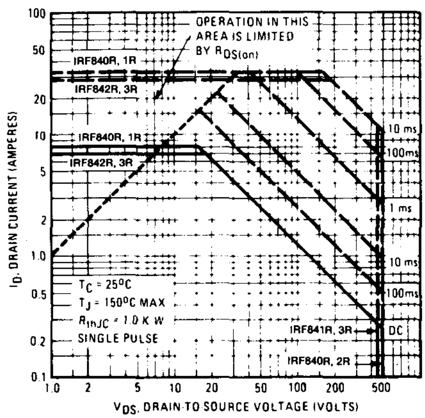


Fig. 4 – Maximum Safe Operating Area

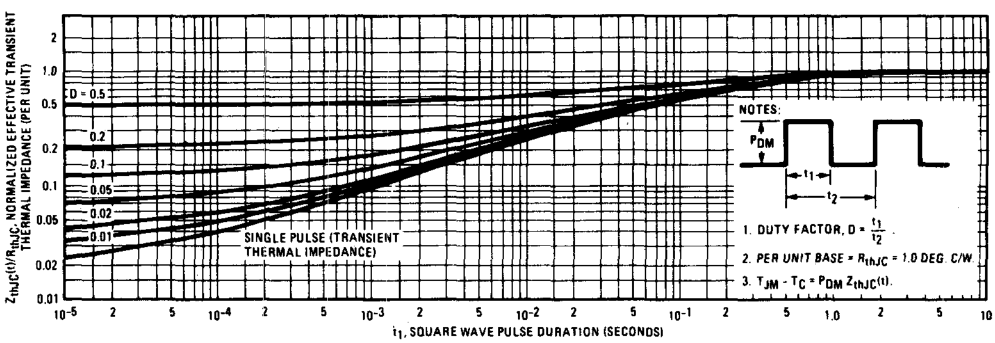


Fig. 5 – Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

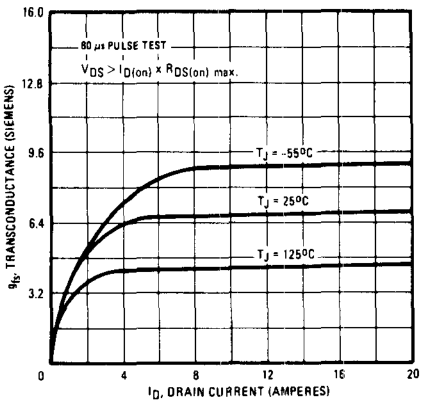


Fig. 6 – Typical Transconductance Vs. Drain Current

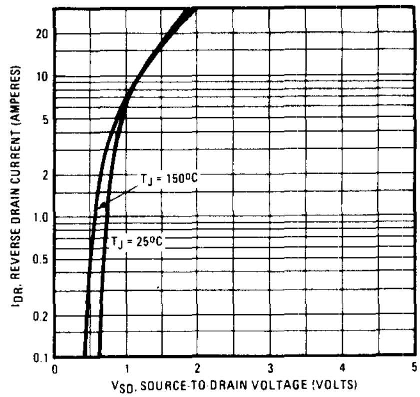


Fig. 7 – Typical Source-Drain Diode Forward Voltage

6

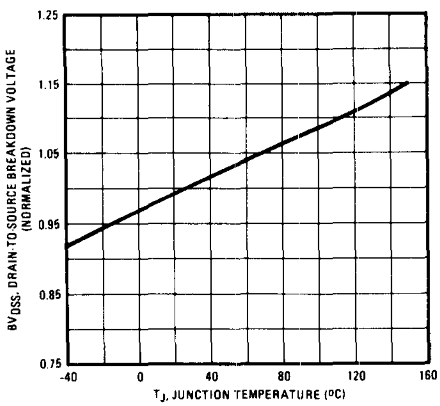


Fig. 8 – Breakdown Voltage Vs. Temperature

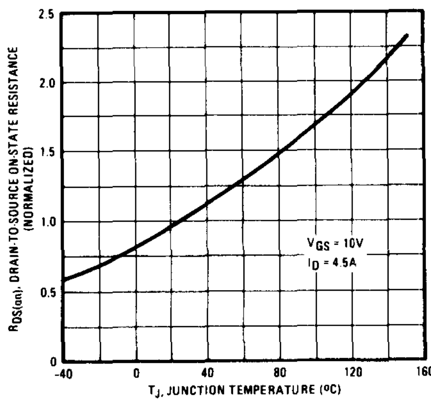


Fig. 9 – Normalized On-Resistance Vs. Temperature

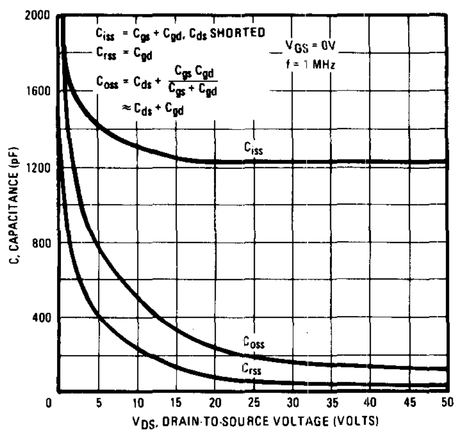


Fig. 10 – Typical Capacitance Vs. Drain-to-Source Voltage

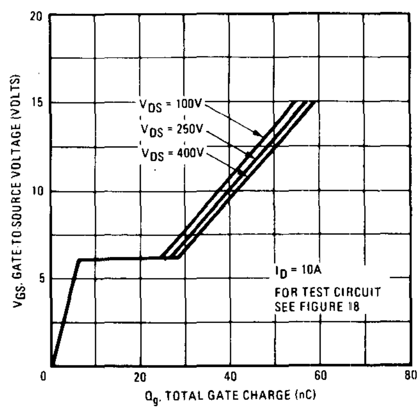


Fig. 11 – Typical Gate Charge Vs. Gate-to-Source Voltage

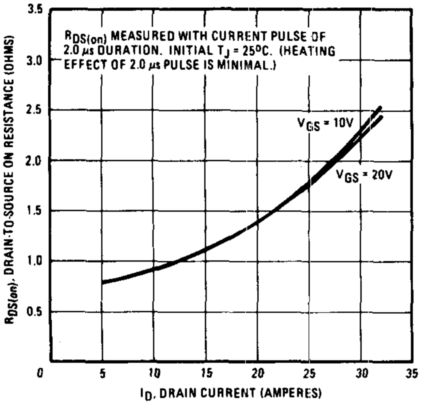


Fig. 12 – Typical On-Resistance Vs. Drain Current

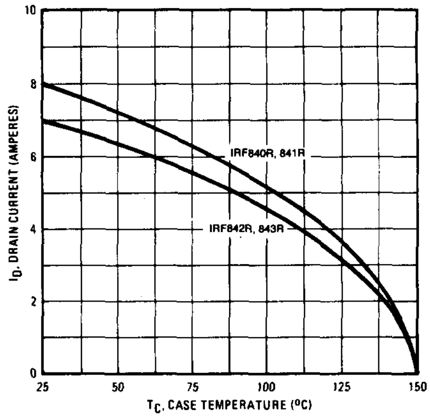


Fig. 13 – Maximum Drain Current Vs. Case Temperature

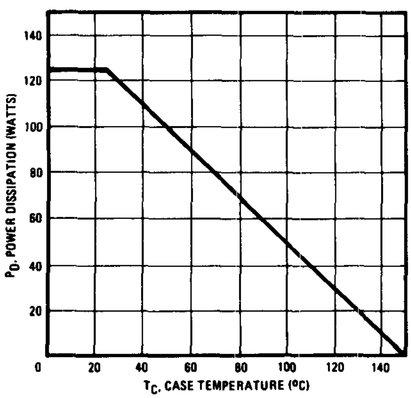


Fig. 14 – Power Vs. Temperature Derating Curve

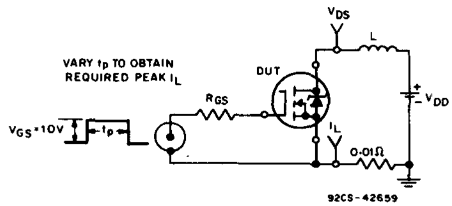


Fig. 15 — Unclamped Energy Test Circuit

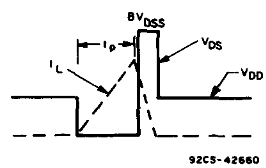


Fig. 16 — Unclamped Energy Waveforms

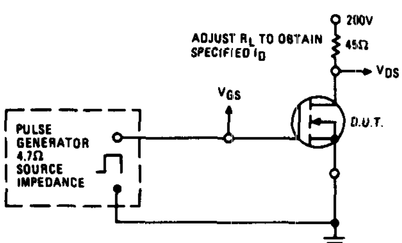


Fig. 17 – Switching Time Test Circuit

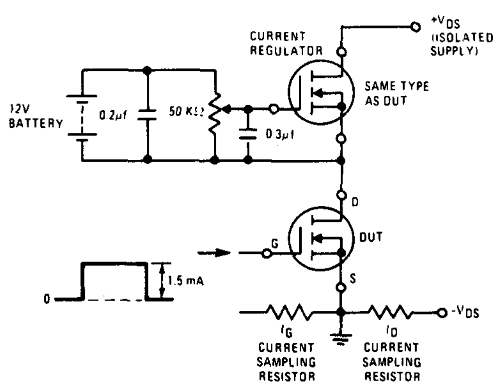


Fig. 18 – Gate Charge Test Circuit