

International

Rectifier

HEXFET® POWER MOSFET

Provisional Data Sheet No. PD 9.1292B

IRFY440CM

N-CHANNEL

500 Volt, 0.85Ω HEXFET

HEXFET technology is the key to International Rectifier's advanced line of power MOSFET transistors. The efficient geometry design achieves very low on-state resistance combined with high transconductance.

HEXFET transistors also feature all of the well-established advantages of MOSFETs, such as voltage control, very fast switching, ease of paralleling and electrical parameter temperature stability. They are well-suited for applications such as switching power supplies, motor controls, inverters, choppers, audio amplifiers, high energy pulse circuits, and virtually any application where high reliability is required.

The HEXFET transistor's totally isolated package eliminates the need for additional isolating material between the device and the heatsink. This improves thermal efficiency and reduces drain capacitance.

Product Summary

Part Number	BV _{DSS}	R _{DS(on)}	I _D
IRFY440CM	500V	0.85Ω	7.0A

Features

- Hermetically sealed
- Electrically isolated
- Simple Drive Requirements
- Ease of Paralleling
- Ceramic eyelets

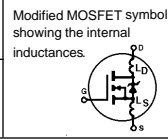
Absolute Maximum Ratings

	Parameter	IRFY440CM	Units
I _D @ V _{GS} =10V, T _C = 25°C	Continuous Drain Current	7.0	A
I _D @ V _{GS} =10V, T _C = 100°C	Continuous Drain Current	4.4	
I _{DM}	Pulsed Drain Current ①	28	
P _D @ T _C = 25°C	Max. Power Dissipation	100	W
	Linear Derating Factor	0.8	W/K⑤
V _{GS}	Gate-to-Source Voltage	±20	V
E _{AS}	Single Pulse Avalanche Energy ②	510	mJ
I _{AR}	Avalanche Current ①	7.0	A
E _{AR}	Repetitive Avalanche Energy ①	10	mJ
dv/dt	Peak Diode Recovery dv/dt ③	3.5	V/ns
T _J	Operating Junction	-55 to 150	°C
T _{stg}	Storage Temperature Range		
	Lead Temperature	300 (0.063 in (1.6mm) from case for 10 sec)	
	Weight	4.3(typical)	g

IRFY440CM Device

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

	Parameter	Min	Typ	Max	Units	Test Conditions
BV _{DSS}	Drain-to-Source Breakdown Voltage	500	—	—	V	V _{GS} = 0V, I _D = 1.0mA
ΔBV _{DSS} /ΔT _J	Temperature Coefficient of Breakdown Voltage	—	0.78	—	V/°C	Reference to 25°C, I _D = 1.0mA
R _{DS(on)}	Static Drain-to-Source On-State Resistance	—	—	0.85	Ω	V _{GS} = 10V, I _D = 4.4A ④
		—	—	0.95		V _{GS} = 10V, I _D = 7.0A
V _{GS(th)}	Gate Threshold Voltage	2.0	—	4.0	V	V _{DS} = V _{GS} , I _D = 250μA
g _{fs}	Forward Transconductance	4.7	—	—	S (r)	V _{DS} ≥ 15V, I _{DS} = 4.4A ④
I _{DSS}	Zero Gate Voltage Drain Current	—	—	25	μA	V _{DS} = 0.8 x max. rating, V _{GS} = 0V
		—	—	250		V _{DS} = 0.8 x max. rating V _{GS} = 0V, T _J = 125°C
I _{GSS}	Gate-to-Source Leakage Forward	—	—	100	nA	V _{GS} = 20V
I _{GSS}	Gate-to-Source Leakage Reverse	—	—	-100		V _{GS} = -20V
Q _g	Total Gate Charge	27.3	—	68.5	nC	V _{GS} = 10V, I _D = 7.0A
Q _{gs}	Gate-to-Source Charge	2.0	—	12.5		V _{DS} = Max. Rating x 0.5
Q _{gd}	Gate-to-Drain ('Miller') Charge	11.1	—	42.4		see figures 6 and 13
t _{d(on)}	Turn-On Delay Time	—	—	21	ns	V _{DD} = 250V, I _D = 7.0A, R _G = 9.1Ω V _{GS} = 10V see figure 10
t _r	Rise Time	—	—	73		
t _{d(off)}	Turn-Off Delay Time	—	—	72		
t _f	Fall Time	—	—	51		
L _D	Internal Drain Inductance	—	8.7	—	nH	Measured from the drain lead, 6mm (0.25 in.) from package to center of die.
L _S	Internal Source Inductance	—	8.7	—		Measured from the source lead, 6mm (0.25 in.) from package to source bonding pad.
C _{iss}	Input Capacitance	—	1300	—	pF	V _{GS} = 0V, V _{DS} = 25V f = 1.0MHz. see figure 5
C _{oss}	Output Capacitance	—	310	—		
C _{rss}	Reverse Transfer Capacitance	—	120	—		



Source-Drain Diode Ratings and Characteristics

	Parameter	Min	Typ	Max	Units	Test Conditions
I _S	Continuous Source Current (Body Diode)	—	—	7.0	A	Modified MOSFET symbol showing the integral reverse p-n junction rectifier.
ISM	Pulse Source Current (Body Diode) ①	—	—	28		
V _{SD}	Diode Forward Voltage	—	—	1.5	V	T _J = 25°C, I _S = 7.0A, V _{GS} = 0V ④
t _{rr}	Reverse Recovery Time	—	—	700	ns	T _J = 25°C, I _F = 7.0A, di/dt ≤ 100 A/μs
Q _{RR}	Reverse Recovery Charge	—	—	8.9	μC	V _{DD} ≤ 50 V ④
t _{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by L _S + L _D .				

Thermal Resistance

Parameter	Min	Typ	Max	Units	Test Conditions
R _{thJC} Junction-to-Case	—	—	1.25	K/W	Typical socket mount Mounting surface flat, smooth
R _{thJA} Junction-to-Ambient	—	—	80		
R _{thCS} Case-to-Sink	—	0.21	—		

IRFY440CM Device

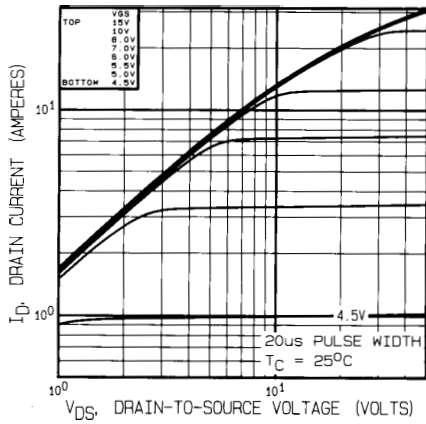


Fig. 1 — Typical Output Characteristics
 $T_C = 25^\circ\text{C}$

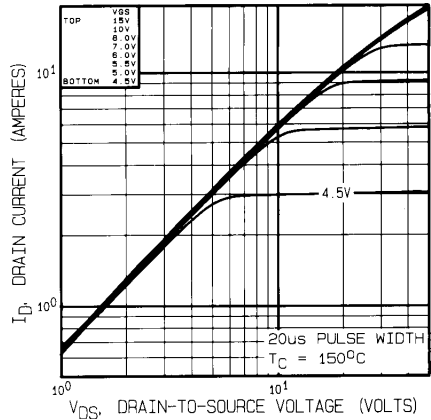


Fig. 2 — Typical Output Characteristics
 $T_C = 150^\circ\text{C}$

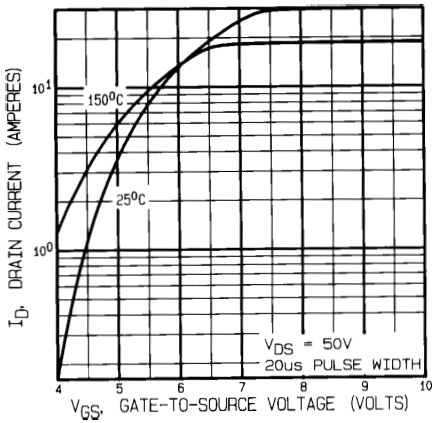


Fig. 3 — Typical Transfer Characteristics

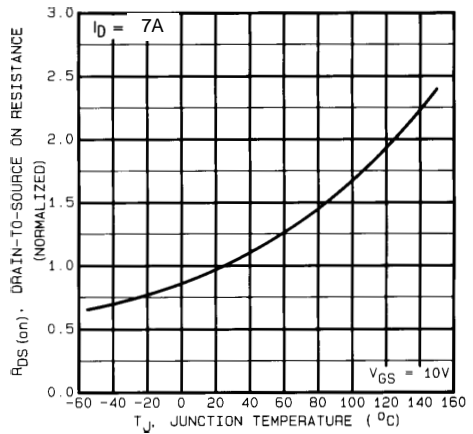


Fig. 4 — Normalized On-Resistance Vs. Temperature

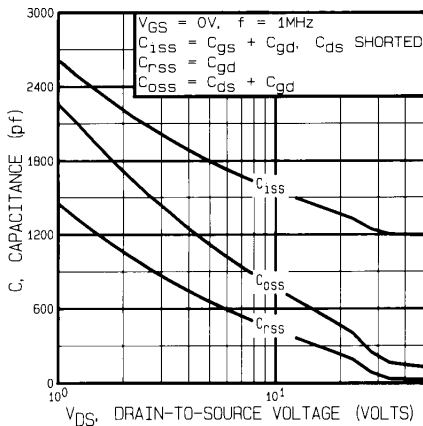


Fig. 5 — Typical Capacitance Vs. Drain-to-Source Voltage

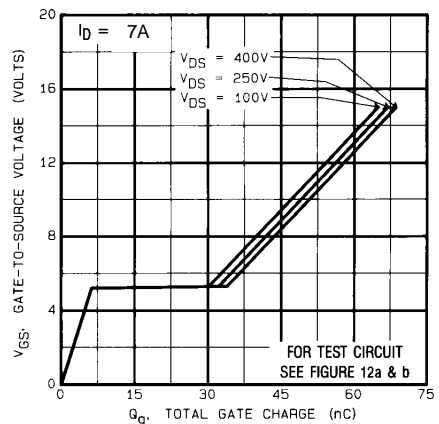


Fig. 6 — Typical Gate Charge Vs. Gate-to-Source Voltage

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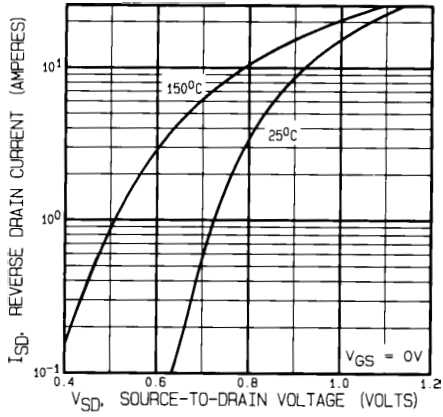


Fig. 7 — Typical Source-to-Drain Diode Forward Voltage

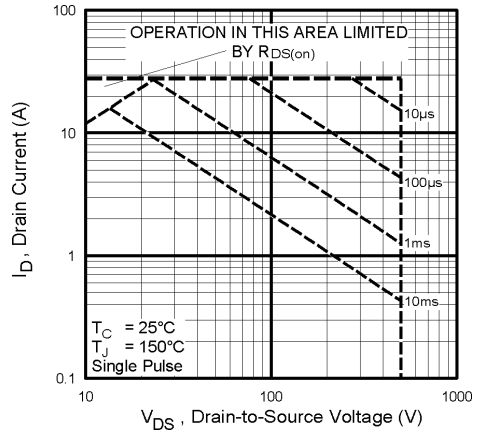


Fig. 8 — Maximum Safe Operating Area

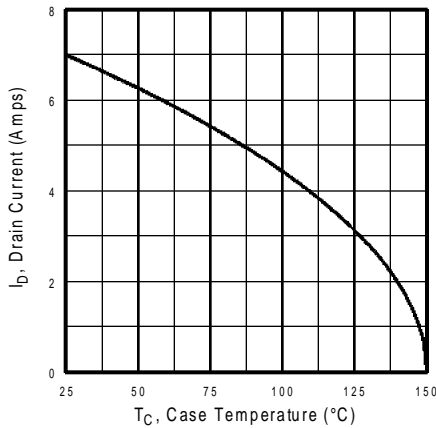


Fig. 9 — Maximum Drain Current Vs. Case Temperature

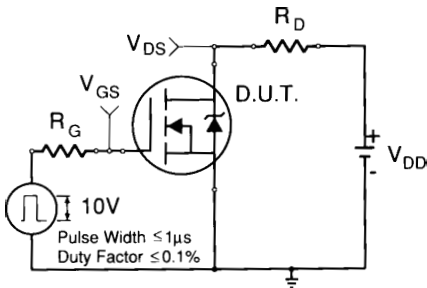


Fig. 10a — Switching Time Test Circuit

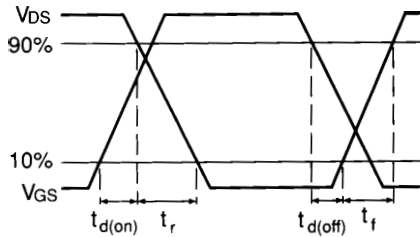


Fig. 10b — Switching Time Waveforms

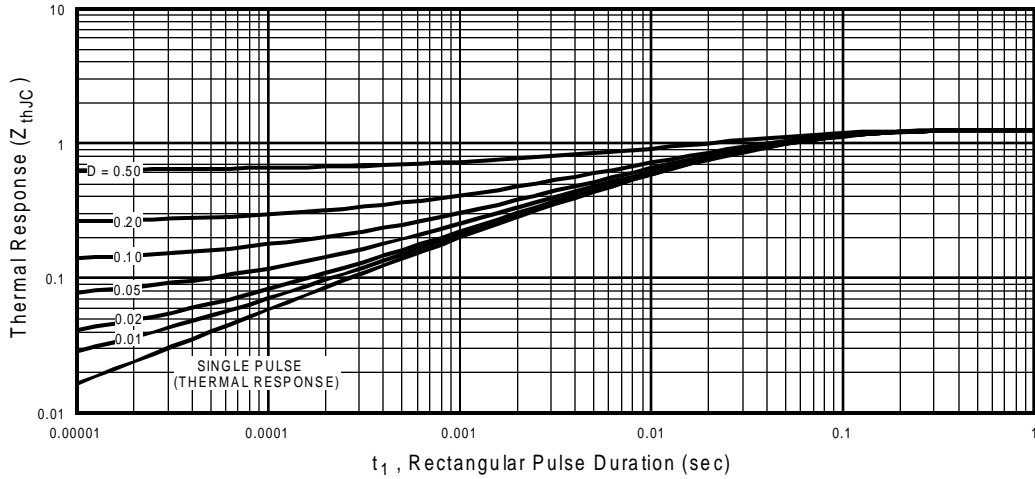


Fig. 11 — Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

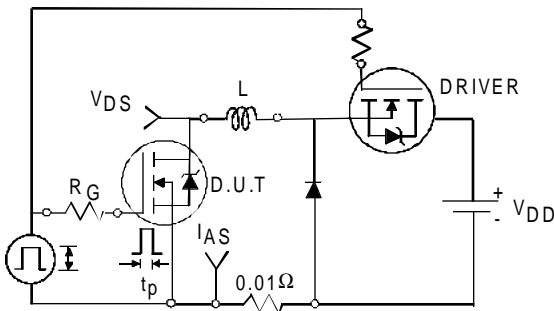


Fig. 12a — Unclamped Inductive Test Circuit

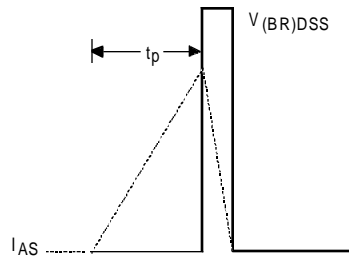


Fig. 12b — Unclamped Inductive Waveforms

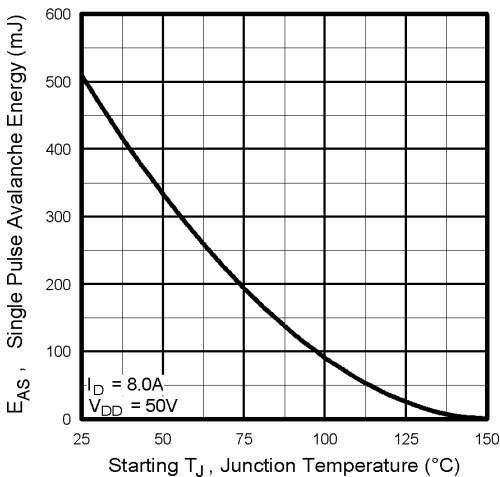


Fig. 12c — Max. Avalanche Energy vs. Current

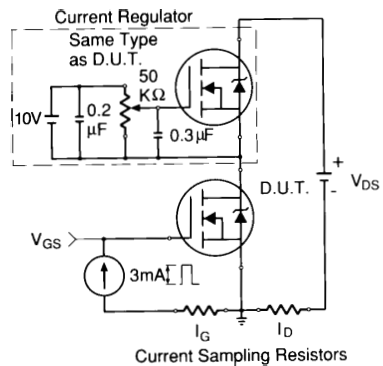


Fig. 13a — Gate Charge Test Circuit

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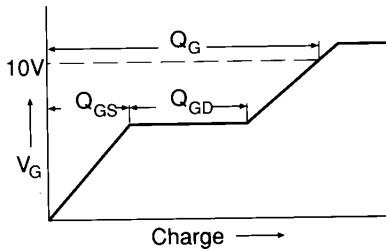


Fig. 13b — Basic Gate Charge Waveform

Notes:

- ① Repetitive Rating; Pulse width limited by maximum junction temperature (see figure 11).
- ② @ $V_{DD} = 50V$, Starting $T_J = 25^\circ C$,
 $E_{AS} = [0.5 * L * (I_D^2) * [BV_{DSS}/(BV_{DSS}-V_{DD})]]$
 Peak $I_L = 7A$, $V_{GS} = 10V$, $25 \leq R_G \leq 200\Omega$
- ③ $I_{SD} \leq 7.0A$, $di/dt \leq 100A/\mu s$, $V_{DD} \leq BV_{DSS}$, $T_J \leq 150^\circ C$
- ④ Pulse width $\leq 300 \mu s$; Duty Cycle $\leq 2\%$
- ⑤ $K/W = ^\circ C/W$ $W/K = W/^\circ C$

Case Outline and Dimensions

Pin 1 - Drain
Pin 2 - Source
Pin 3 - Gate

TO-257AA

NON-STANDARD PIN CONFIGURATION

Pin 1 - Gate
Pin 2 - Drain
Pin 3 - Source

Order Part Type IRFY440C

NOTES:

1. Dimensioning and tolerancing per ANSI Y14.5M-1982
2. Controlling dimension: Inch
3. Dimensions are shown in millimeters (Inches)
4. Outline conforms to JEDEC outline TO-257AA

CAUTION

BERYLLIAWARNING PER MIL-PRF-19500

Packages containing beryllia shall not be ground, sandblasted, machined or have other operations performed on them which will produce beryllia or beryllium dust. Furthermore, beryllium oxide packages shall not be placed in acids that will produce fumes containing beryllium.



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