Provisional Data Sheet No. PD 9.1292B

International
IOR Rectifier

HEXFET® POWER MOSFET

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

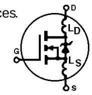
- Hermetically sealed
- Electrically isolated
- Simple Drive Requirements
- Ease of Paralleling
- Ceramic eyelets

Absolute Maximum Ratings

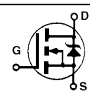
	Parameter	IRFY440CM	Units
I_D @ V_{GS}=10V, T_C = 25°C	Continuous Drain Current	7.0	A
I_D @ V_{GS}=10V, T_C = 100°C	Continuous Drain Current	4.4	
I_{DM}	Pulsed Drain Current ①	28	
P_D @ T_C = 25°C	Max. Power Dissipation	100	W
	Linear Derating Factor	0.8	W/K⑤
V_{GS}	Gate-to-Source Voltage	±20	V
E_{AS}	Single Pulse Avalance Energy ②	510	mJ
I_{AR}	Avalance 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 T_{STG}	Operating Junction Storage Temperature Range	-55 to 150	°C
	Lead Temperature	300 (0.063 in (1.6mm) from case for 10 sec)	
	Weight	4.3(typical)	g

IRFY440CM Device

Electrical Characteristics @ Tj = 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
$\Delta BV_{DSS}/\Delta T_J$	Temperature Coefficient of Breakdown Voltage	—	0.78	—	V/°C	Reference to 25°C, I_D = 1.0mA
$R_{DS(on)}$	Static Drain-to-Source	—	—	0.85	Ω	V_{GS} = 10V, I_D = 4.4A ④
	On-State Resistance	—	—	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 (℧)	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
t_r	Rise Time	—	—	73		V_{GS} = 10V
$t_{d(off)}$	Turn-Off Delay Time	—	—	72		
t_f	Fall Time	—	—	51		see figure 10
L_D	Internal Drain Inductance	—	8.7	—	nH	Measured from the drain lead, 6mm (0.25 in.) from package to center of die. Modified MOSFET symbol showing the internal inductances. 
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
C_{oss}	Output Capacitance	—	310	—		f = 1.0MHz.
C_{rss}	Reverse Transfer Capacitance	—	120	—		see figure 5

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. 
I_{SM}	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	
R_{thJA}	Junction-to-Ambient	—	—	80		Typical socket mount
R_{thCS}	Case-to-Sink	—	0.21	—		Mounting surface flat, smooth

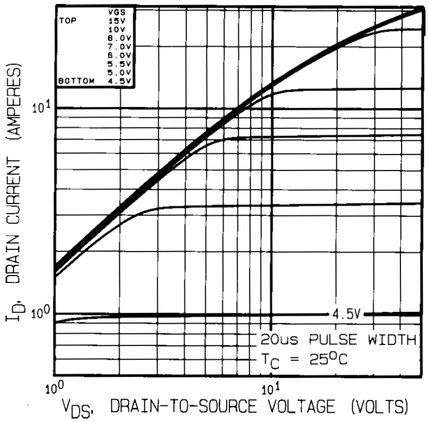


Fig. 1 — Typical Output Characteristics $T_C = 25°C$

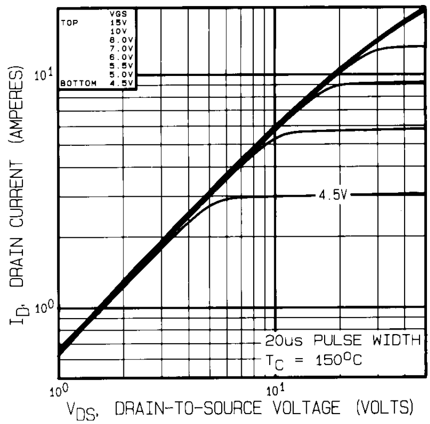


Fig. 2 — Typical Output Characteristics $T_C = 150°C$

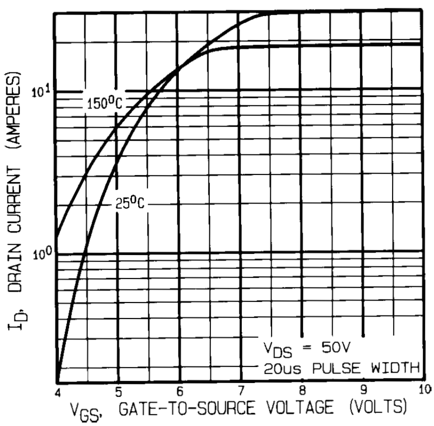


Fig. 3 — Typical Transfer Characteristics

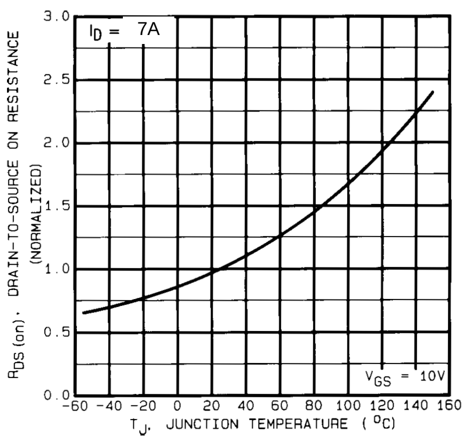


Fig. 4 — Normalized On-Resistance Vs. Temperature

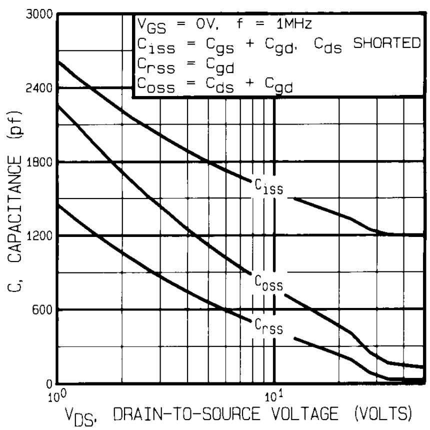


Fig. 5 — Typical Capacitance Vs. Drain-to-Source Voltage

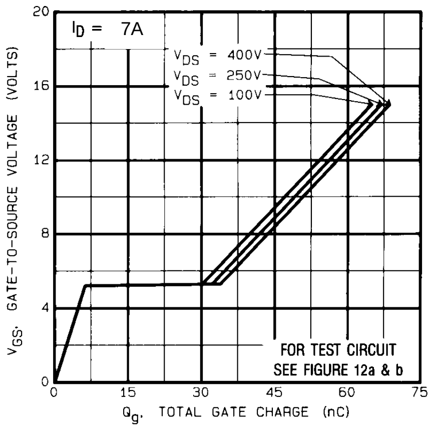


Fig. 6 — Typical Gate Charge Vs. Gate-to-Source Voltage

IRFY440CM Device

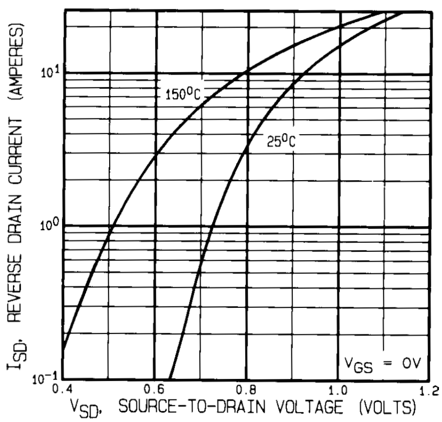


Fig. 7 — Typical Source-to-Drain Diode Forward Voltage

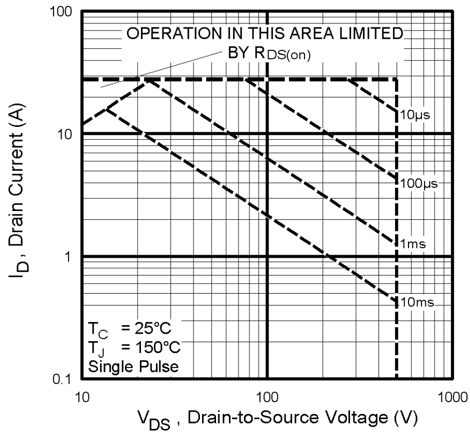


Fig. 8 — Maximum Safe Operating Area

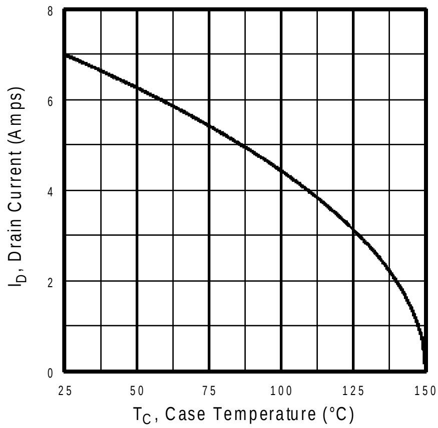


Fig. 9 — Maximum Drain Current Vs. Case Temperature

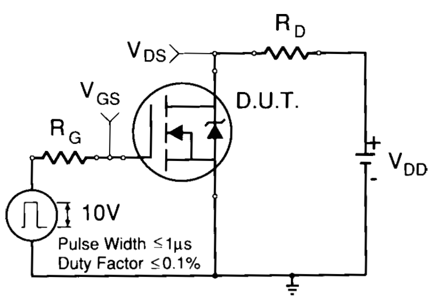


Fig. 10a — Switching Time Test Circuit

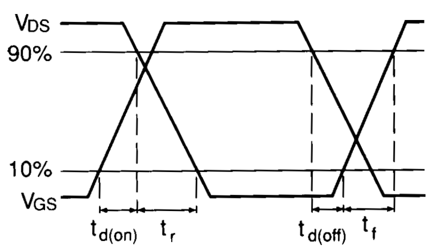


Fig. 10b — Switching Time Waveforms

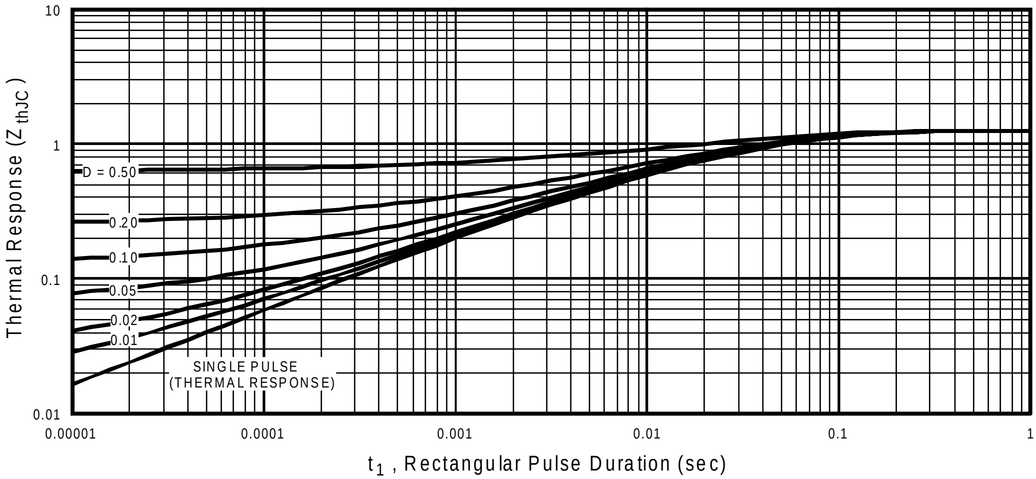


Fig. 11 — Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

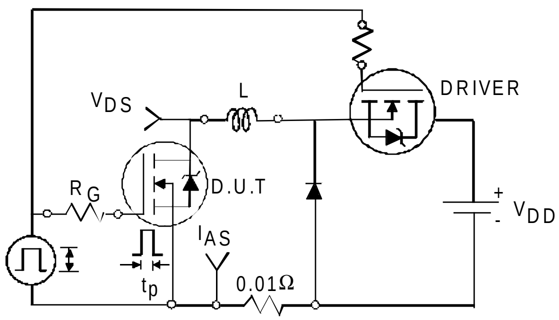


Fig. 12a — Unclamped Inductive Test Circuit

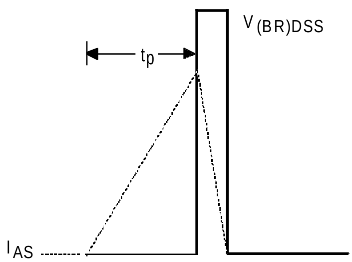


Fig. 12b — Unclamped Inductive Waveforms

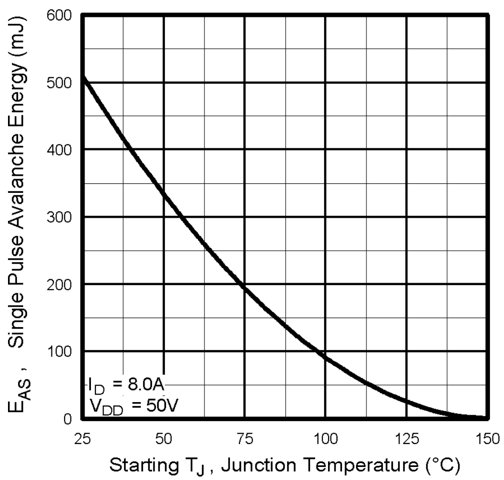


Fig. 12c — Max. Avalanche Energy vs. Current

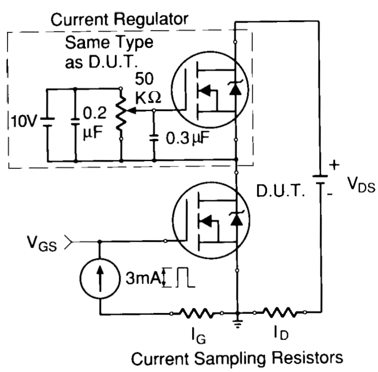


Fig. 13a — Gate Charge Test Circuit

IRFY440CM Device

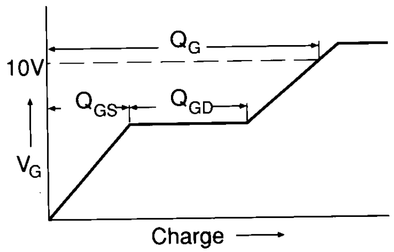


Fig. 13b — Basic Gate Charge Waveform

Notes:

① Repetitive Rating; Pulse width limited by maximum junction temperature (see figure 11).

② @ V_{DD} = 50V, Starting T_J = 25°C,
$E_{AS} = [0.5 * L * (I_L^2) * [BV_{DSS}/(BV_{DSS}-V_{DD})]$
Peak I_L = 7A, V_{GS} = 10V, $25 \le R_G \le 200\Omega$

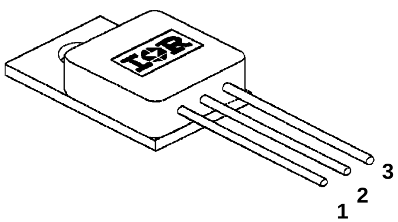
③ $I_{SD} \le 7.0A$, di/dt $\le$ 100A/µs, $V_{DD} \le BV_{DSS}$, $T_J \le 150°C$

④ Pulse width ≤ 300 µs; Duty Cycle ≤ 2%

⑤ K/W = °C/W   W/K = W/°C

Case Outline and Dimensions

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

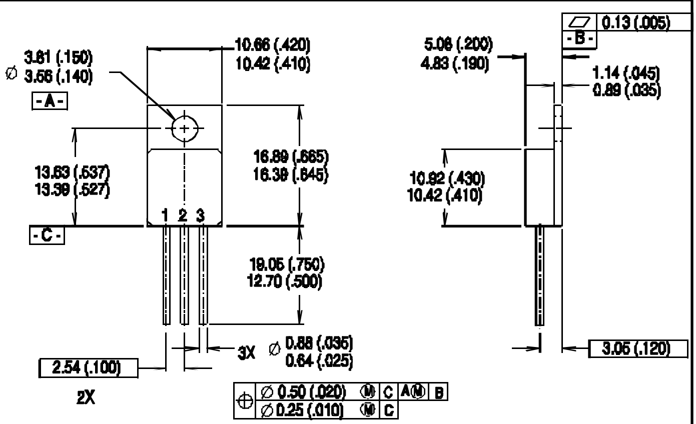


TO-257AA

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.

International
IOR Rectifier

WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, Tel: (310) 322 3331
EUROPEAN HEADQUARTERS: Hurst Green, Oxted, Surrey RH8 9BB, UK Tel: ++ 44(0) 1883 732020
IR CANADA: 7321 Victoria Park Ave., Suite 201, Markham, Ontario L3R 2Z8, Tel: (905) 475 1897
IR GERMANY: Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 6172 96590
IR ITALY: Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 11 451 0111
IR FAR EAST: K&H Bldg., 2F, 3-30-4 Nishi-Ikeburo 3-Chome, Toshima-Ki, Tokyo Japan 171 Tel: 81 3 3983 0086
IR SOUTHEAST ASIA: 315 Outram Road, #10-02 Tan Boon Liat Building, Singapore 0316 Tel: 65 221 8371