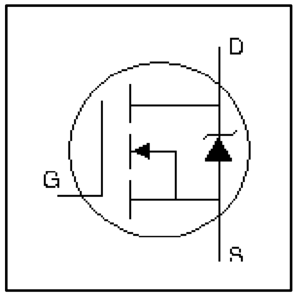
International Rectifier

PD - 9.1232

IRFP460LC

HEXFET® Power MOSFET

- Ultra Low Gate Charge
- Reduced Gate Drive Requirement
- Enhanced 30V V_{gs} Rating
- Reduced C_{iss}, C_{oss}, C_{rss}
- Isolated Central Mounting Hole
- Dynamic dv/dt Rated
- Repetitive Avalanche Rated



V_{DSS} = 500V

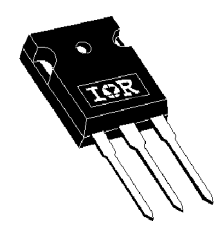
$R_{DS(on)}$ = 0.27Ω

I_D = 20A

Description

This new series of Low Charge HEXFET Power MOSFETs achieve significantly lower gate charge over conventional MOSFETs. Utilizing advanced Hexfet technology the device improvements allow for reduced gate drive requirements, faster switching speeds and increased total system savings. These device improvements combined with the proven ruggedness and reliability of HEXFETs offer the designer a new standard in power transistors for switching applications.

The TO-247 package is preferred for commercial-industrial applications where higher power levels preclude the use of TO-220 devices. The TO-247 is similar but superior to the earlier TO-218 package because of its isolated mounting hole.



TO-247AC

Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	20	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	12	
I_{DM}	Pulsed Drain Current ①	80	
P_D @T_C = 25°C	Power Dissipation	280	W
	Linear Derating Factor	2.2	W/°C
V_{GS}	Gate-to-Source Voltage	±30	V
E_{AS}	Single Pulse Avalanche Energy ②	960	mJ
I_{AR}	Avalanche Current ①	20	A
E_{AR}	Repetitive Avalanche Energy ①	28	mJ
dv/dt	Peak Diode Recovery dv/dt ③	3.5	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting torque, 6-32 or M3 screw.	10 lbf•in (1.1N•m)	

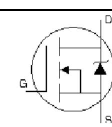
Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	——	——	0.45	
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	——	0.24	——	°C/W
$R_{\theta JA}$	Junction-to-Ambient		——	——	40

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	500	—	—	V	V_{GS} = 0V, ID = 250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.59	—	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	—	—	0.27	Ω	V_{GS} = 10V, I_D = 12A ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	V_{DS} = V_{GS}, I_D = 250µA
g_{fs}	Forward Transconductance	12	—	—	S	V_{DS} = 50V, I_D = 12A
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	µA	V_{DS} = 500V, V_{GS} = 0V
		—	—	250		V_{DS} = 400V, V_{GS} = 0V, T_J = 125°C
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	V_{GS} = 20V
	Gate-to-Source Reverse Leakage	—	—	-100		V_{GS} = -20V
Q_g	Total Gate Charge	—	—	120	nC	I_D = 20A
Q_{gs}	Gate-to-Source Charge	—	—	32		V_{DS} = 400V
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	49		V_{GS} = 10V, See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	18	—	ns	V_{DD} = 250V
t_r	Rise Time	—	77	—		I_D = 20A
$t_{d(off)}$	Turn-Off Delay Time	—	40	—		R_G = 4.3Ω
t_f	Fall Time	—	43	—		R_D = 12Ω, See Fig. 10 ④
L_D	Internal Drain Inductance	—	5.0	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact 
L_S	Internal Source Inductance	—	13	—		
C_{iss}	Input Capacitance	—	3600	—	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	—	440	—		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	—	39	—		f = 1.0MHz, See Fig. 5

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	20	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	80		
V_{SD}	Diode Forward Voltage	—	—	1.8	V	T_J = 25°C, I_S = 20A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	—	570	860	ns	T_J = 25°C, I_F = 20A
Q_{rr}	Reverse Recovery Charge	—	6.6	9.9	µC	di/dt = 100A/µs ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

Notes:

① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)

② V_{DD} = 25V, starting T_J = 25°C, L = 4.3mH R_G = 25Ω, I_{AS} = 20A. (See Figure 12)

③ $I_{SD} \le$ 20A, di/dt ≤ 160A/µs, $V_{DD} \le V_{(BR)DSS}$, $T_J \le$ 150°C

④ Pulse width ≤ 300µs; duty cycle ≤ 2%.

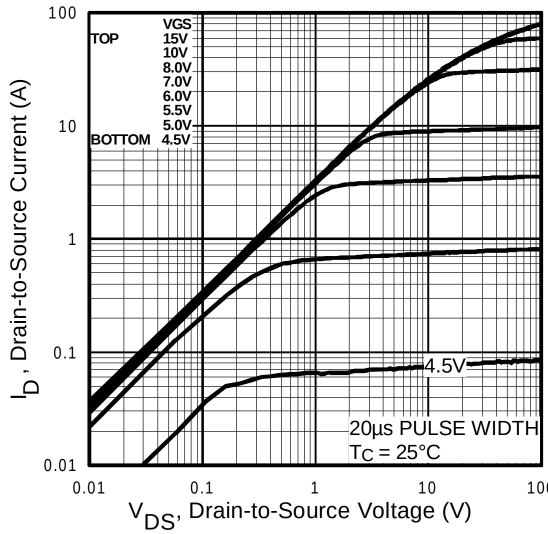


Fig 1. Typical Output Characteristics, $T_C = 25^oC$

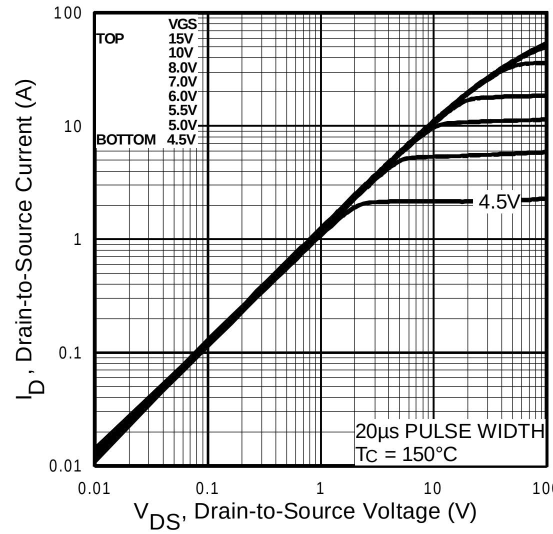


Fig 2. Typical Output Characteristics, $T_C = 150^oC$

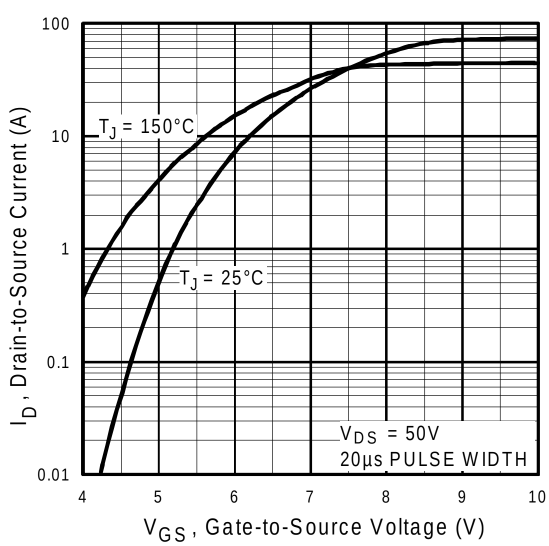


Fig 3. Typical Transfer Characteristics

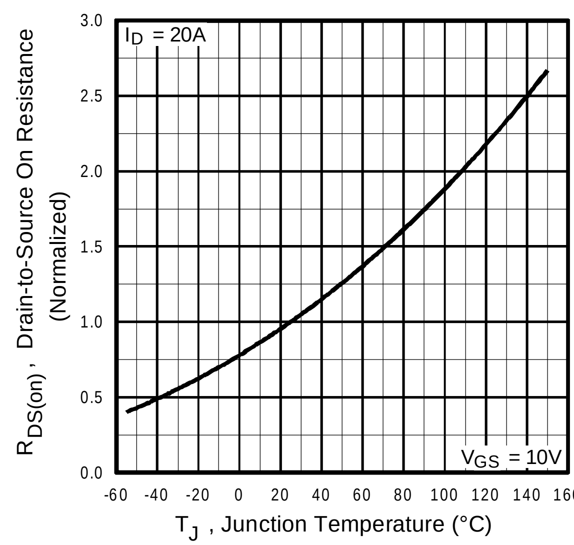


Fig 4. Normalized On-Resistance Vs. Temperature

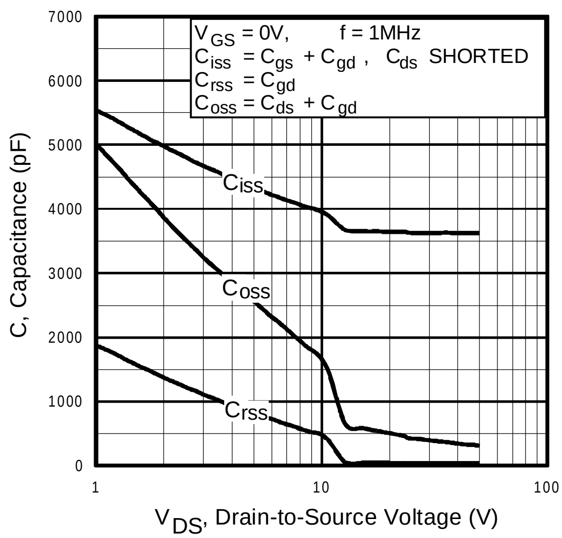


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

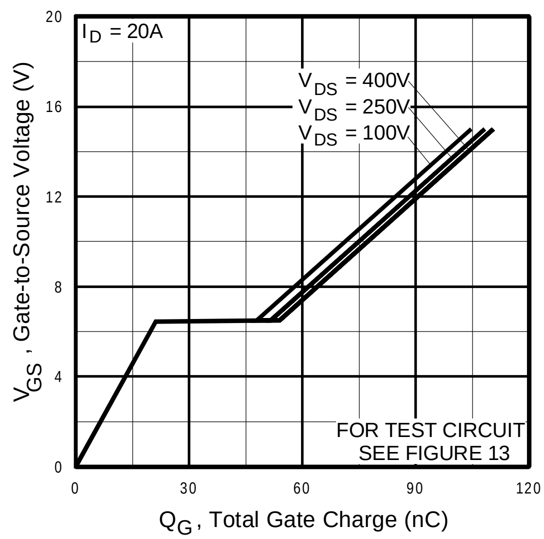


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

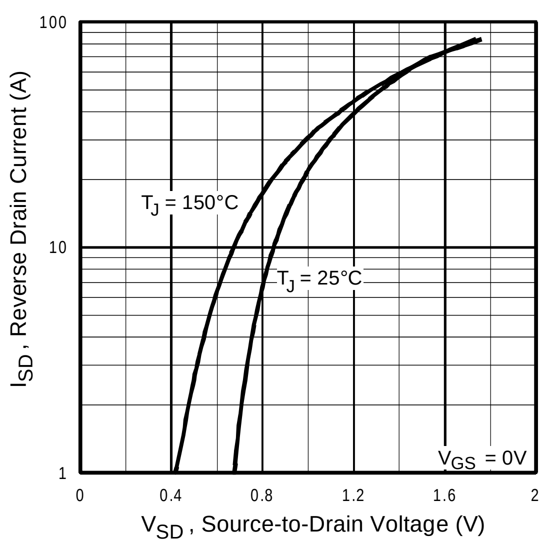


Fig 7. Typical Source-Drain Diode Forward Voltage

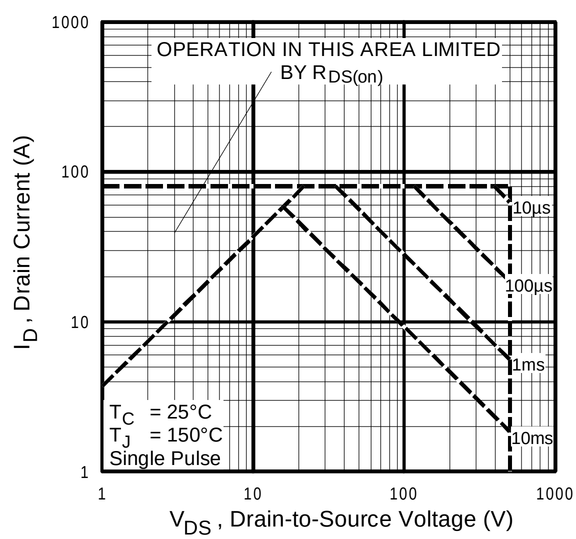


Fig 8. Maximum Safe Operating Area

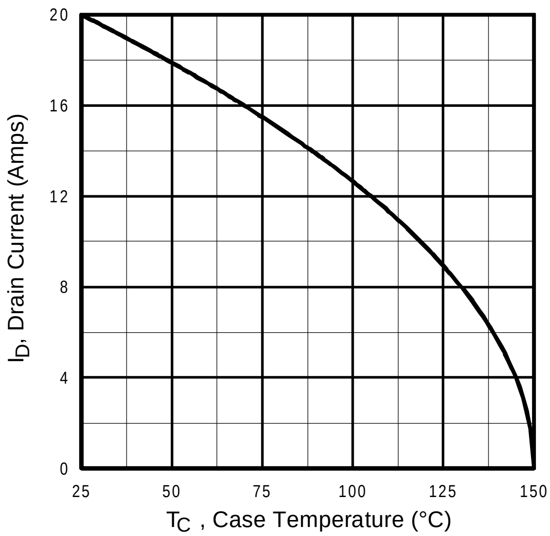


Fig 9. Maximum Drain Current Vs. Case Temperature

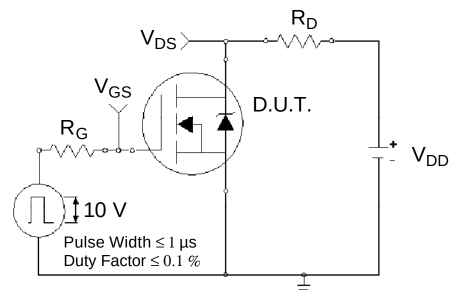


Fig 10a. Switching Time Test Circuit

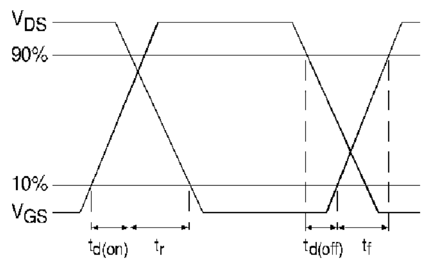


Fig 10b. Switching Time Waveforms

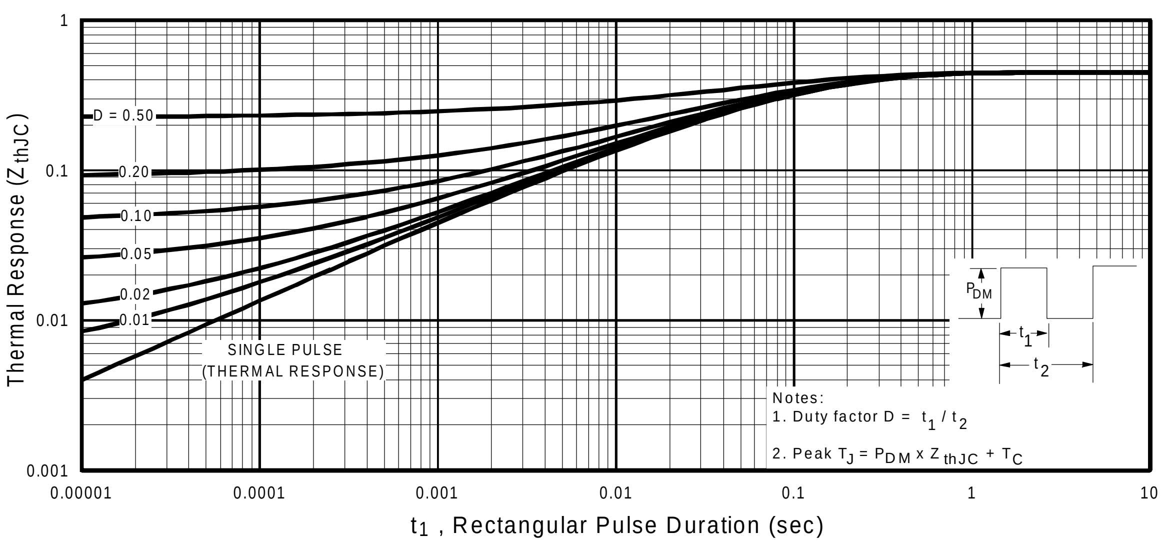


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

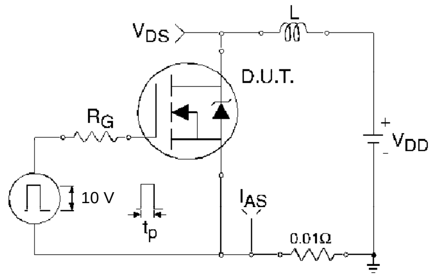


Fig 12a. Unclamped Inductive Test Circuit

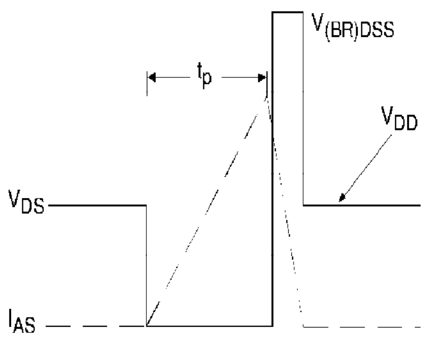


Fig 12b. Unclamped Inductive Waveforms

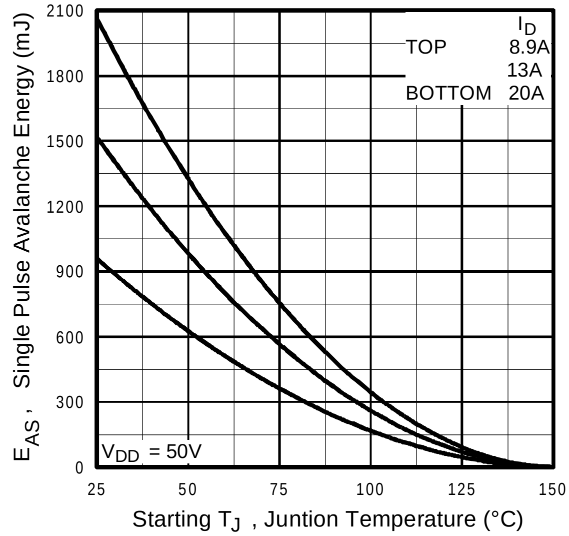


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

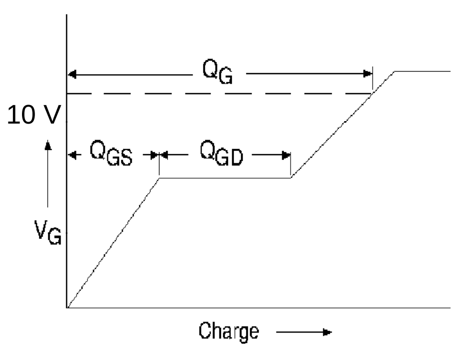


Fig 13a. Basic Gate Charge Waveform

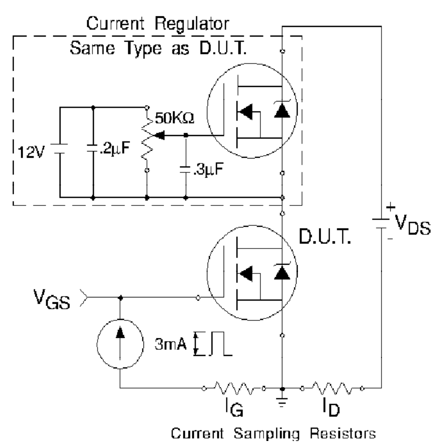
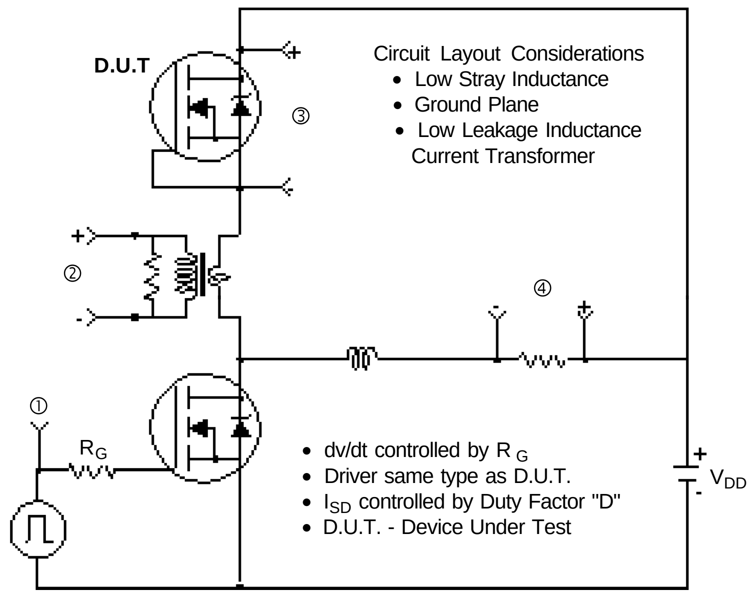
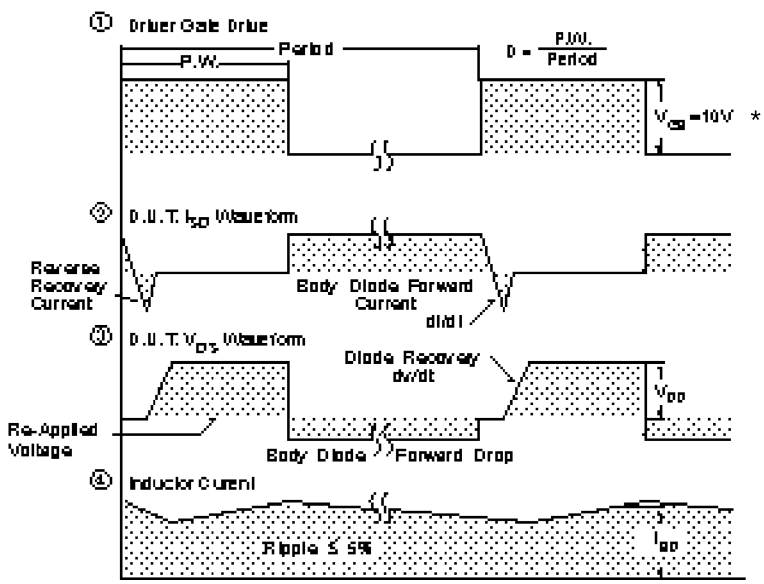


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit

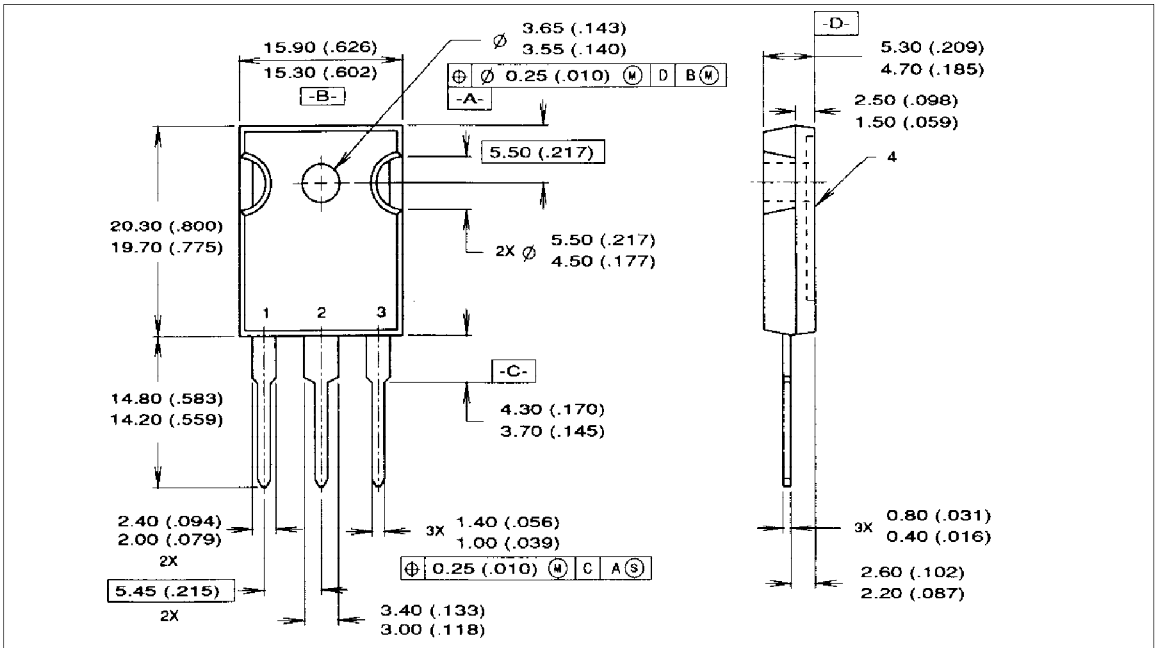




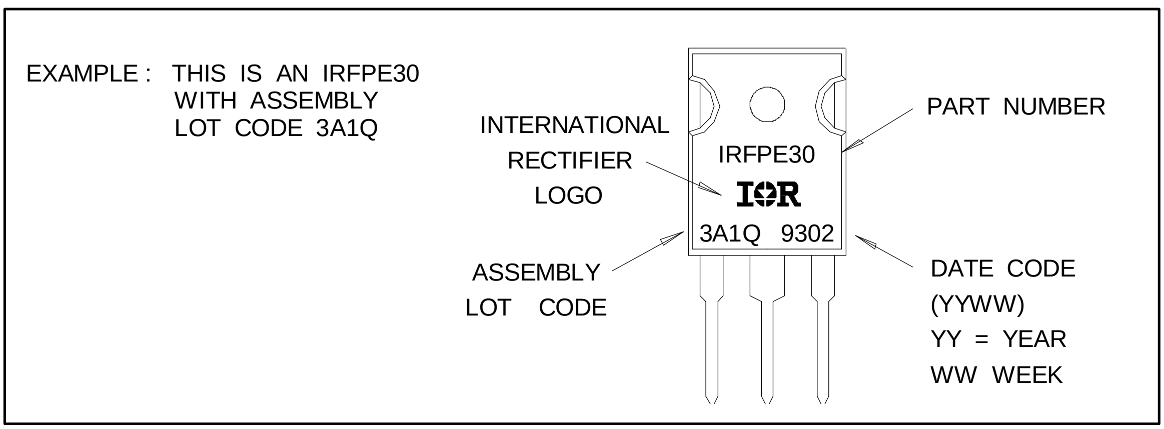
* VGS = 5V for Logic Level Devices

Fig 14. For N-Channel HEXFETS

Package Outline
TO-247AC



Part Marking Information
TO-247AC



International IOR Rectifier

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