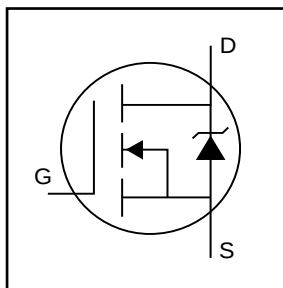


IRFP054N

HEXFET® Power MOSFET

- Advanced Process Technology
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated



$$V_{DS} = 55V$$

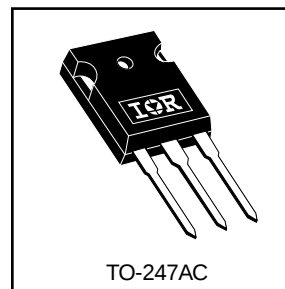
$$R_{DS(on)} = 0.012\Omega$$

$$I_D = 81A\text{⑥}$$

Description

Fifth Generation HEXFETs from International Rectifier utilize advanced processing techniques to achieve extremely low on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET Power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in a wide variety of 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

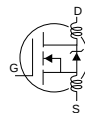
	Parameter	Max.	Units
I_D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	81⑥	A
I_D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	57	
I_{DM}	Pulsed Drain Current ①⑤	290	
P_D @ $T_C = 25^\circ\text{C}$	Power Dissipation	170	W
	Linear Derating Factor	1.1	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy②⑤	360	mJ
I_{AR}	Avalanche Current①	43	A
E_{AR}	Repetitive Avalanche Energy①	17	mJ
dv/dt	Peak Diode Recovery dv/dt ③⑤	5.0	V/ns
T_J	Operating Junction and	-55 to + 175	°C
T_{STG}	Storage Temperature Range		
	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	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.90	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient	—	40	

Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	55	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.06	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 1\text{mA}$ ⑤
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.012	Ω	$V_{GS} = 10V, I_D = 43A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
g_{fs}	Forward Transconductance	30	—	—	S	$V_{DS} = 25V, I_D = 43A$ ⑤
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	$V_{DS} = 55V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 44V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
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	—	—	130	nC	$I_D = 43A$
Q_{gs}	Gate-to-Source Charge	—	—	23		$V_{DS} = 44V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	53		$V_{GS} = 10V$, See Fig. 6 and 13 ④⑤
$t_{d(on)}$	Turn-On Delay Time	—	11	—	ns	$V_{DD} = 28V$
t_r	Rise Time	—	66	—		$I_D = 43A$
$t_{d(off)}$	Turn-Off Delay Time	—	40	—		$R_G = 3.6\Omega$
t_f	Fall Time	—	46	—		$R_D = 0.62\Omega$, See Fig. 10④⑤
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	—	2900	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	880	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	330	—		$f = 1.0\text{MHz}$, See Fig. 5⑤



Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	81⑥	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	290		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 43A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	81	120	ns	$T_J = 25^\circ\text{C}, I_F = 43A$
Q_{rr}	Reverse Recovery Charge	—	240	370	nC	$di/dt = 100A/\mu s$ ④⑤

Notes:

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

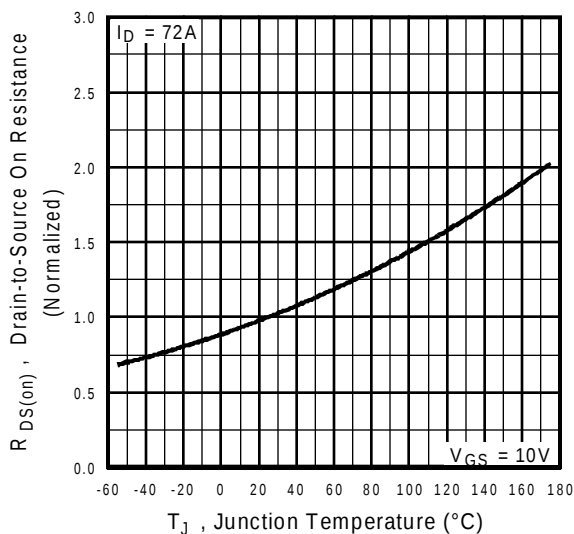
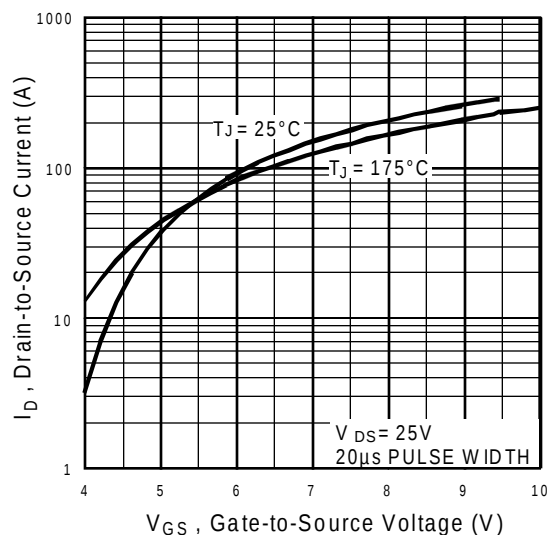
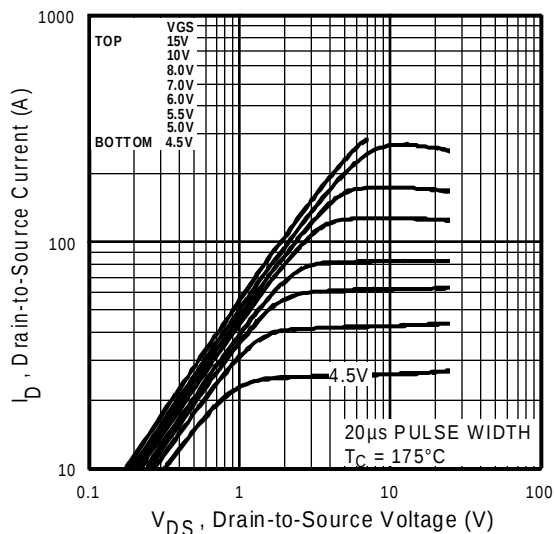
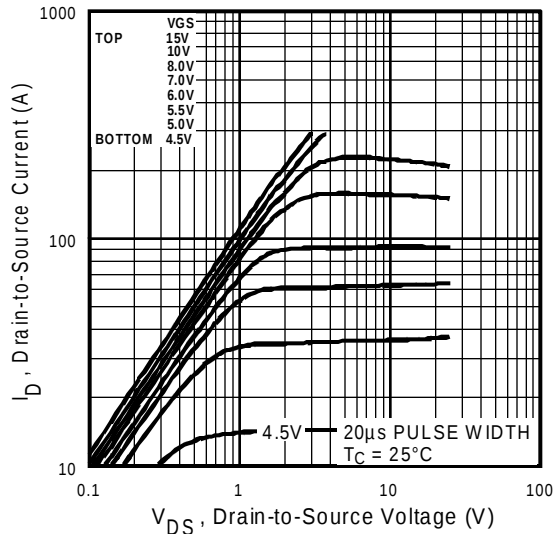
② $V_{DD} = 25V$, starting $T_J = 25^\circ\text{C}$, $L = 390\mu H$
 $R_G = 25\Omega$, $I_{AS} = 43A$. (See Figure 12)

③ $I_{SD} \leq 43A$, $di/dt \leq 260A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$,
 $T_J \leq 175^\circ\text{C}$

④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.

⑤ Uses IRF1010N data and test conditions

⑥ Calculated continuous current based on maximum allowable junction temperature; for recommended current-handling of the package refer to Design Tip # 93-4



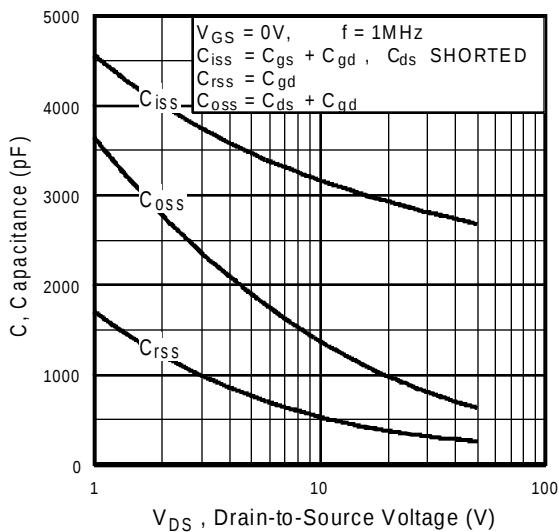


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

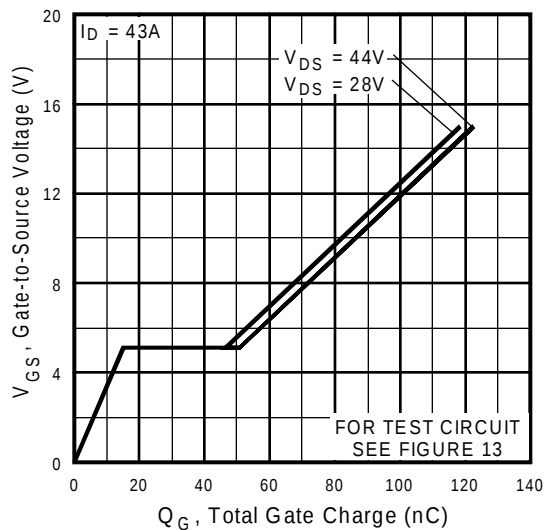


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

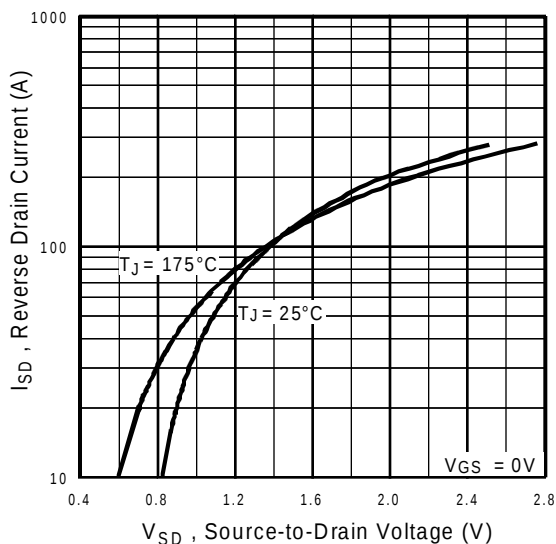


Fig 7. Typical Source-Drain Diode Forward Voltage

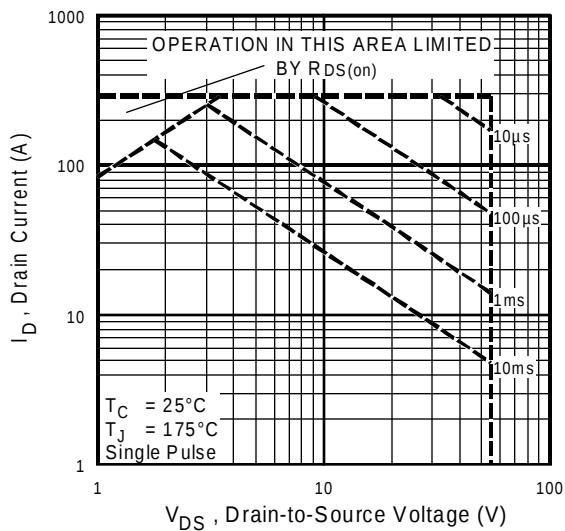


Fig 8. Maximum Safe Operating Area

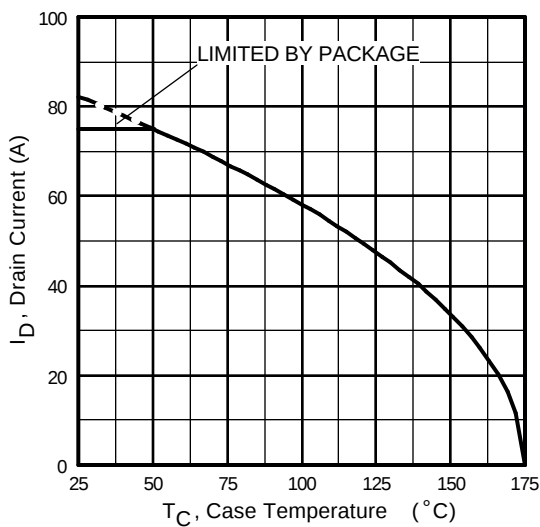


Fig 9. Maximum Drain Current Vs. Case Temperature

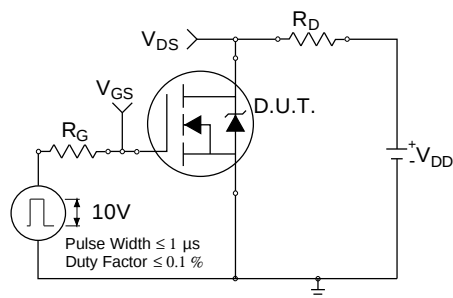


Fig 10a. Switching Time Test Circuit

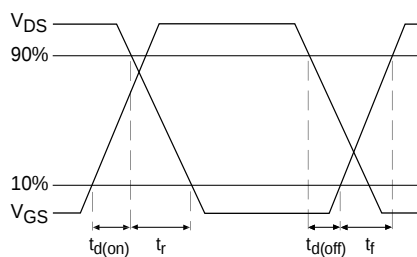


Fig 10b. Switching Time Waveforms

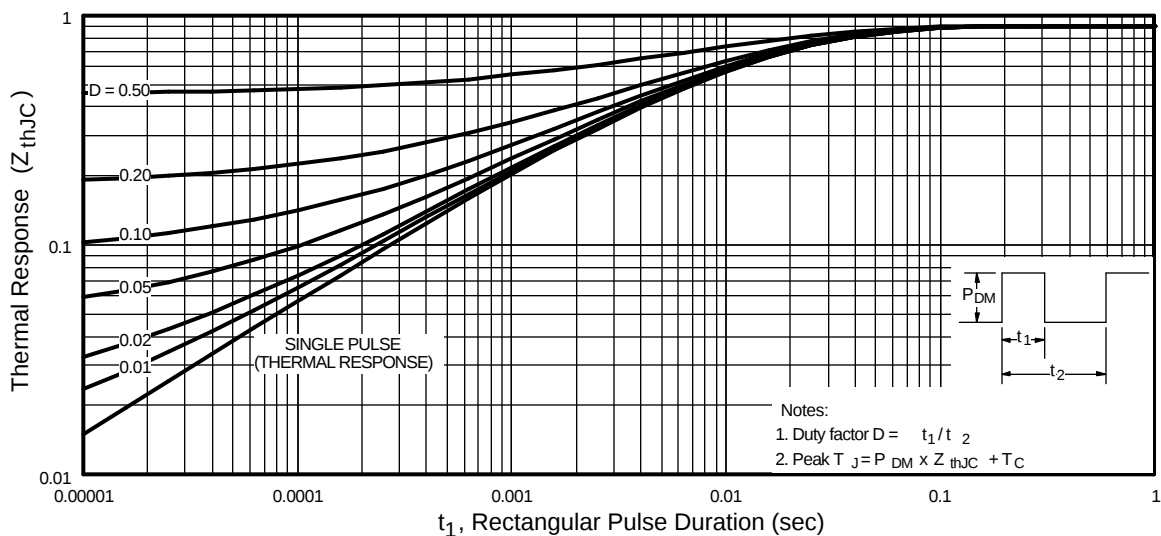


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

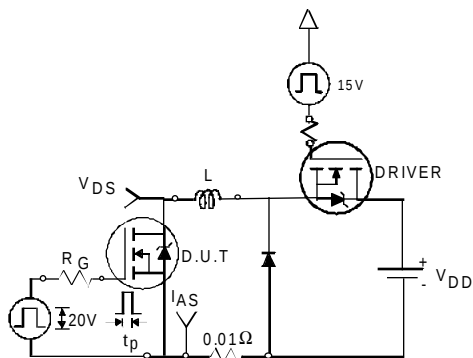


Fig 12a. Unclamped Inductive Test Circuit

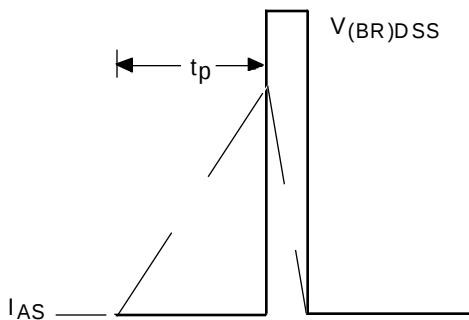


Fig 12b. Unclamped Inductive Waveforms

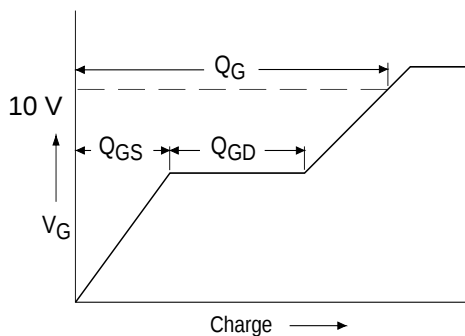


Fig 13a. Basic Gate Charge Waveform

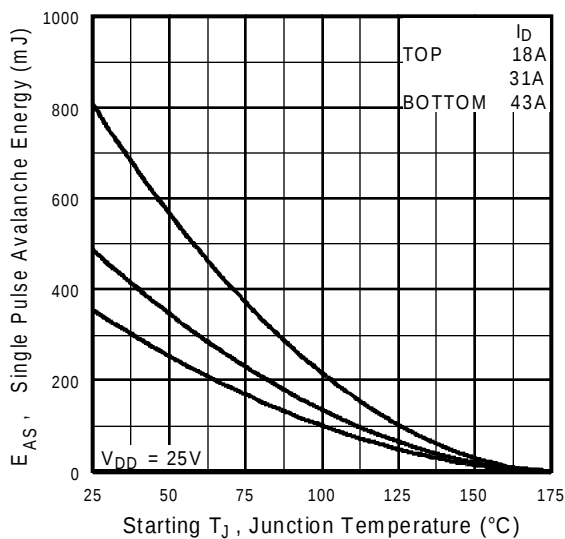


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

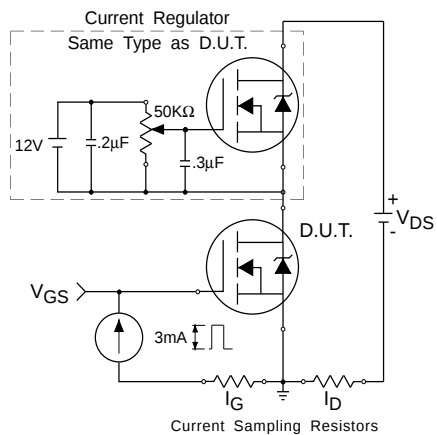


Fig 13b. Gate Charge Test Circuit

D.U.T.

Circuit Layout Considerations

- Low Stray Inductance
- Ground Plane
- Low Leakage Inductance
- Current Transformer

①

R_G

②

③

④

V_{DD}

- dv/dt controlled by R_G
- Driver same type as D.U.T.
- I_{SD} controlled by Duty Factor "D"
- D.U.T. - Device Under Test

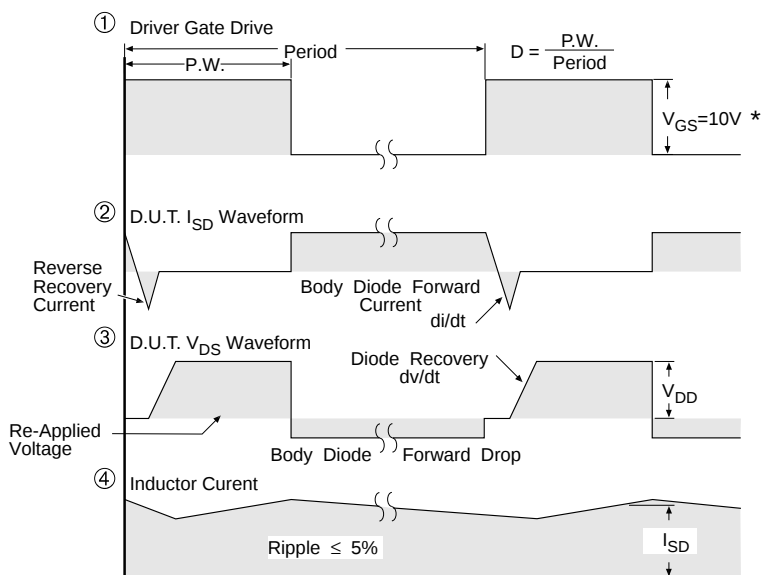


Fig 14. For N-Channel HEXFETS

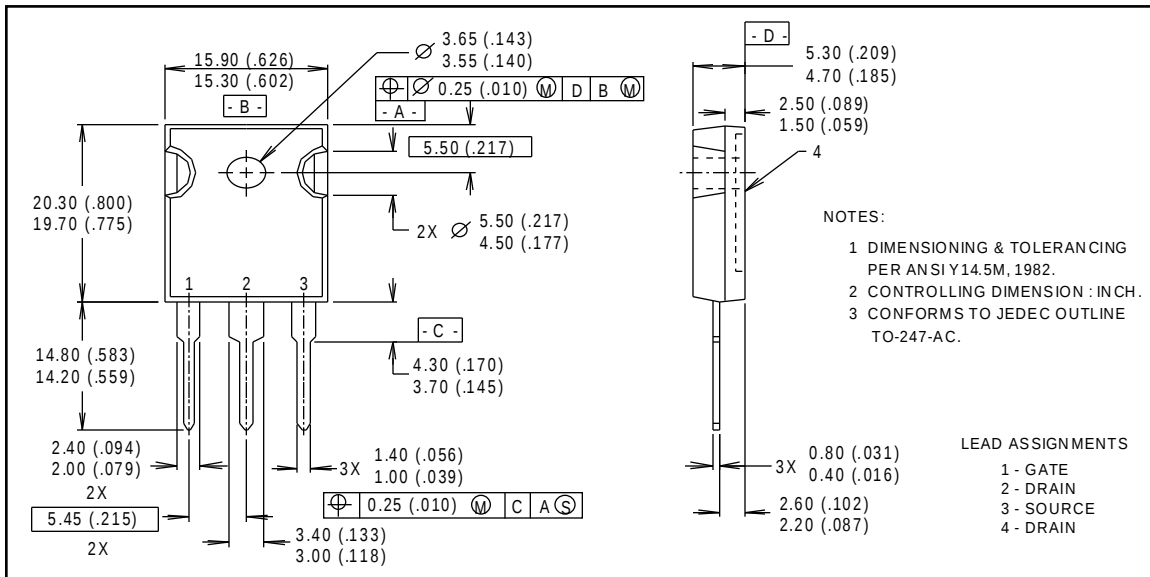
IRFP054N

International
IOR Rectifier

Package Outline

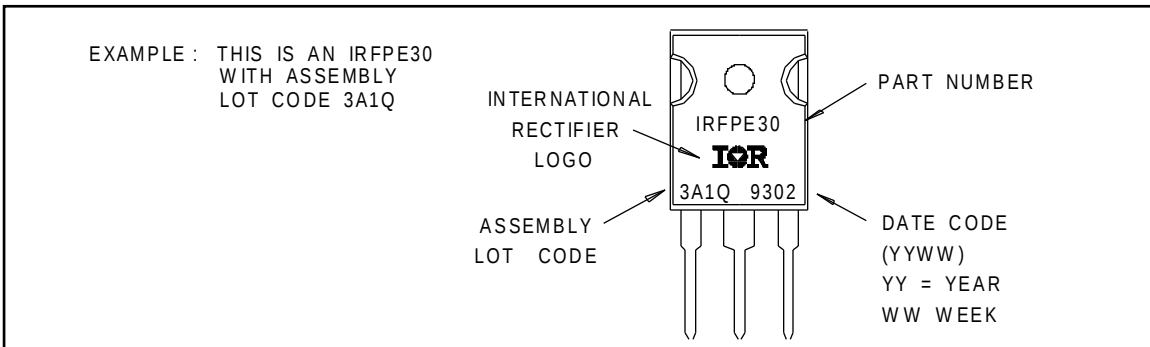
TO-247AC Outline

Dimensions are shown in millimeters (inches)



Part Marking Information

TO-247AC



International IOR Rectifier

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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, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo Japan 171 Tel: 81 3 3983 0086

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<http://www.irf.com/> Data and specifications subject to change without notice.

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