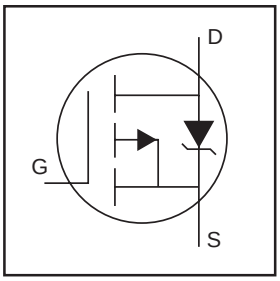
PD - 95665

International
IOR Rectifier

# IRFP9140NPbF

HEXFET® Power MOSFET

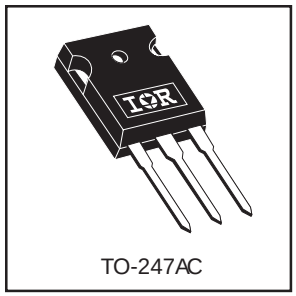
- Advanced Process Technology
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- P-Channel
- Fast Switching
- Fully Avalanche Rated
- Lead-Free




$V_{DSS}$ = -100V

$R_{DS(on)}$ = 0.117Ω

$I_D$ = -23A




TO-247AC

## 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.

## Absolute Maximum Ratings

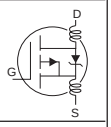
| | Parameter | Max. | Units |
|---|---|---|---|
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ -10V | -23 | A |
| $I_D$ @ $T_C$ = 100°C | Continuous Drain Current, $V_{GS}$ @ -10V | -16 | |
| $I_{DM}$ | Pulsed Drain Current ①⑤ | -76 | |
| $P_D$ @$T_C$ = 25°C | Power Dissipation | 140 | W |
| | Linear Derating Factor | 0.91 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ± 20 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy②⑤ | 430 | mJ |
| $I_{AR}$ | Avalanche Current① | -11 | A |
| $E_{AR}$ | Repetitive Avalanche Energy① | 14 | 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 | ––– | 1.1 | °C/W |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.24 | ––– | |
| $R_{\theta JA}$ | Junction-to-Ambient | ––– | 40 | |

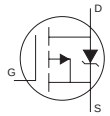
## Electrical Characteristics @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | -100 | ––– | ––– | V | $V_{GS}$ = 0V, $I_D$ = -250µA |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | ––– | -0.11 | ––– | V/°C | Reference to 25°C, $I_D$ = -1mA⑤ |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | ––– | ––– | 0.117 | Ω | $V_{GS}$ = -10V, $I_D$ = -13A ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | -2.0 | ––– | -4.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = -250µA |
| $g_{fs}$ | Forward Transconductance | 5.3 | ––– | ––– | S | $V_{DS}$ = -50V, $I_D$ = 11A⑤ |
| $I_{DSS}$ | Drain-to-Source Leakage Current | ––– | ––– | -25 | µA | $V_{DS}$ = -100V, $V_{GS}$ = 0V |
| | | ––– | ––– | -250 | | $V_{DS}$ = -80V, $V_{GS}$ = 0V, $T_J$ = 150°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 | ––– | ––– | 97 | nC | $I_D$ = -11A |
| $Q_{gs}$ | Gate-to-Source Charge | ––– | ––– | 15 | | $V_{DS}$ = -80V |
| $Q_{gd}$ | Gate-to-Drain ("Miller") Charge | ––– | ––– | 51 | | $V_{GS}$ = -10V, See Fig. 6 and 13 ④⑤ |
| $t_{d(on)}$ | Turn-On Delay Time | ––– | 15 | ––– | ns | $V_{DD}$ = -50V |
| $t_r$ | Rise Time | ––– | 67 | ––– | | $I_D$ = -11A |
| $t_{d(off)}$ | Turn-Off Delay Time | ––– | 51 | ––– | | $R_G$ = 5.1Ω |
| $t_f$ | Fall Time | ––– | 51 | ––– | | $R_D$ = 4.2Ω, See Fig. 10 ④⑤ |
| $L_D$ | 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 | ––– | 1300 | ––– | pF | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | ––– | 400 | ––– | | $V_{DS}$ = -25V |
| $C_{rss}$ | Reverse Transfer Capacitance | ––– | 240 | ––– | | $f$ = 1.0MHz, See Fig. 5⑤ |




## Source-Drain Ratings and Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | ––– | ––– | -23 | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ①⑤ | ––– | ––– | -76 | | |
| $V_{SD}$ | Diode Forward Voltage | ––– | ––– | -1.3 | V | $T_J$ = 25°C, $I_S$ = -13A, $V_{GS}$ = 0V ④ |
| $t_{rr}$ | Reverse Recovery Time | ––– | 150 | 220 | ns | $T_J$ = 25°C, $I_F$ = -11A |
| $Q_{rr}$ | Reverse RecoveryCharge | ––– | 830 | 1200 | 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 Starting $T_J$ = 25°C, L = 7.1mH $R_G$ = 25Ω, $I_{AS}$ = -11A. (See Figure 12)

③ $I_{SD}$ ≤ -11A, di/dt ≤ -470A/µs, $V_{DD}$ ≤ $V_{(BR)DSS}$, $T_J$ ≤ 175°C

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

⑤ Uses IRF9540N data and test conditions

# IRFP9140NPbF

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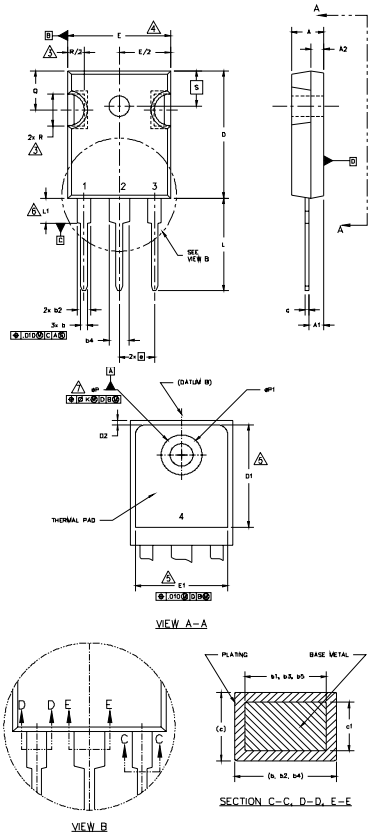
## TO-247AC Package Outline Dimensions are shown in millimeters (inches)




NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M 1994.
2. DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS]
3. CONTOUR OF SLOT OPTIONAL.
4. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENISONS D1 & E1.
6. LEAD FINISH UNCONTROLLED IN L1.
7. øP TO HAVE A MAXIMUM DRAFT ANGLE OF 1.5 ° TO THE TOP OF THE PART WITH A MAXIMUM HOLE DIAMETER OF .154" [3.91].
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-247 WITH THE EXCEPTION OF DIMENSION c.

| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | INCHES | | MILLIMETERS | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | .183 | .209 | 4.65 | 5.31 | |
| A1 | .087 | .102 | 2.21 | 2.59 | |
| A2 | .059 | .098 | 1.50 | 2.49 | |
| b | .039 | .055 | 0.99 | 1.40 | |
| b1 | .039 | .053 | 0.99 | 1.35 | |
| b2 | .065 | .094 | 1.65 | 2.39 | |
| b3 | .065 | .092 | 1.65 | 2.37 | |
| b4 | .102 | .135 | 2.59 | 3.43 | |
| b5 | .102 | .133 | 2.59 | 3.38 | |
| c | .015 | .034 | 0.38 | 0.86 | |
| c1 | .015 | .030 | 0.38 | 0.76 | |
| D | .776 | .815 | 19.71 | 20.70 | 4 |
| D1 | .515 | – | 13.08 | – | 5 |
| D2 | .020 | .030 | 0.51 | 0.76 | |
| E | .602 | .625 | 15.29 | 15.87 | 4 |
| E1 | .540 | – | 15.72 | – | |
| e | .215 BSC | | 5.46 BSC | | |
| øk | .010 | | 2.54 | | |
| L | .559 | .634 | 14.20 | 16.10 | |
| L1 | .146 | .169 | 3.71 | 4.29 | |
| N | 3 | | 7.62 BSC | | |
| øP | .140 | .144 | 3.56 | 3.66 | |
| øP1 | – | .275 | – | 6.98 | |
| Q | .209 | .224 | 5.31 | 5.69 | |
| R | .178 | .216 | 4.52 | 5.49 | |
| S | .217 BSC | | 5.51 BSC | | |

LEAD ASSIGNMENTS

HEXFET

1.– GATE
2.– DRAIN
3.– SOURCE
4.– DRAIN

IGBTs, CoPACK

1.– GATE
2.– COLLECTOR
3.– EMITTER
4.– COLLECTOR

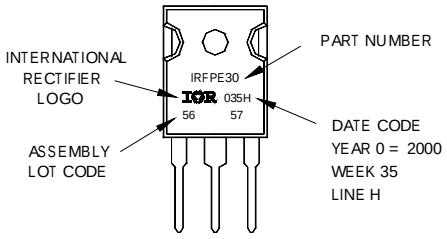
DIODES

1.– ANODE/OPEN
2.– CATHODE
3.– ANODE

## TO-247AC Part Marking Information

EXAMPLE: THIS IS AN IRFPE30
WITH ASSEMBLY
LOT CODE 5657
ASSEMBLED ON WW 35, 2000
IN THE ASSEMBLY LINE "H"

**Note:** "P" in assembly line position indicates "Lead-Free"




Data and specifications subject to change without notice.

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