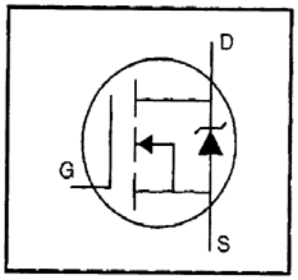
PD- 95933A

International
IOR Rectifier

# IRFD024PbF

**HEXFET® Power MOSFET**

- Dynamic dv/dt Rating
- For Automatic Insertion
- End Stackable
- 175°C Operating Temperature
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Lead-Free



$V_{DSS} = 60V$

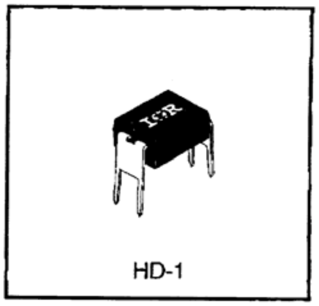
$R_{DS(on)} = 0.10\Omega$

$I_D = 2.5A$

## Description

Third Generation HEXFETs from International Rectifier provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The 4-pin DIP package is a low cost machine-insertable case style which can be stacked in multiple combinations on standard 0.1 inch pin centers. The dual drain serves as a thermal link to the mounting surface for power dissipation levels up to 1 watt.



HD-1

## Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $I_D$ @ $T_A$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V | 2.5 | A |
| $I_D$ @ $T_A$ = 100°C | Continuous Drain Current, $V_{GS}$ @ 10V | 1.8 | |
| $I_{DM}$ | Pulsed Drain Current ① | 20 | |
| $P_D$ @$T_A$ = 25°C | Power Dissipation | 1.3 | W |
| | Linear Derating Factor | 0.0083 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ± 20 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy ② | 91 | mJ |
| dv/dt | Peak Diode Recovery dv/dt ③ | 4.5 | V/ns |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -55 to + 175 | °C |
| | Soldering Temperature, for 10sec | | |

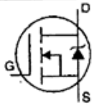
## Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JA}$ | Junction-to-Ambient | — | 120 | °C/W |

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

| | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 60 | — | — | V | $V_{GS}=0V$, $I_D= 250\mu A$ |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 0.061 | — | V/°C | Reference to 25°C, $I_D= 1mA$ |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | — | 0.10 | Ω | $V_{GS}=10V$, $I_D=1.5A$ 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 | 0.90 | — | — | S | $V_{DS}=25V$, $I_D=1.5A$ ④ |
| $I_{DSS}$ | Drain-to-Source Leakage Current | — | — | 25 | µA | $V_{DS}=60V$, $V_{GS}=0V$ |
| | | — | — | 250 | | $V_{DS}=48V$, $V_{GS}=0V$, $T_J=150°C$ |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | — | — | 100 | nA | $V_{GS}=20V$ |
| | Gate-to-Source Reverse Leakage | — | — | -100 | | $V_{GS}=-20V$ |
| $Q_g$ | Total Gate Charge | — | — | 25 | nC | $I_D=17A$ |
| $Q_{gs}$ | Gate-to-Source Charge | — | — | 5.8 | | $V_{DS}=48V$ |
| $Q_{gd}$ | Gate-to-Drain ("Miller") Charge | — | — | 11 | | $V_{GS}=10V$ See Fig. 6 and 13 ④ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 13 | — | ns | $V_{DD}=30V$ |
| $t_r$ | Rise Time | — | 58 | — | | $I_D=17A$ |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 25 | — | | $R_G=18\Omega$ |
| $t_f$ | Fall Time | — | 42 | — | | $R_D=1.7\Omega$ See Figure 10 ④ |
| $L_D$ | Internal Drain Inductance | — | 4.0 | — | nH | Between lead, 6 mm (0.25in.) from package and center of die contact  |
| $L_S$ | Internal Source Inductance | — | 6.0 | — | | |
| $C_{iss}$ | Input Capacitance | — | 640 | — | pF | $V_{GS}=0V$ |
| $C_{oss}$ | Output Capacitance | — | 360 | — | | $V_{DS}= 25V$ |
| $C_{rss}$ | Reverse Transfer Capacitance | — | 79 | — | | $f$=1.0MHz See Figure 5 |

## Source-Drain Ratings and Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | — | — | 2.5 | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | — | — | 20 | | |
| $V_{SD}$ | Diode Forward Voltage | — | — | 1.5 | V | $T_J=25°C$, $I_S=2.5A$, $V_{GS}=0V$ ④ |
| $t_{rr}$ | Reverse Recovery Time | — | 88 | 180 | ns | $T_J=25°C$, $I_F=17A$ |
| $Q_{rr}$ | Reverse Recovery Charge | — | 0.29 | 0.64 | µC | di/dt=100A/µs ④ |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is neglegible (turn-on is dominated by $L_S+L_D$) | | | | |

Notes:

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

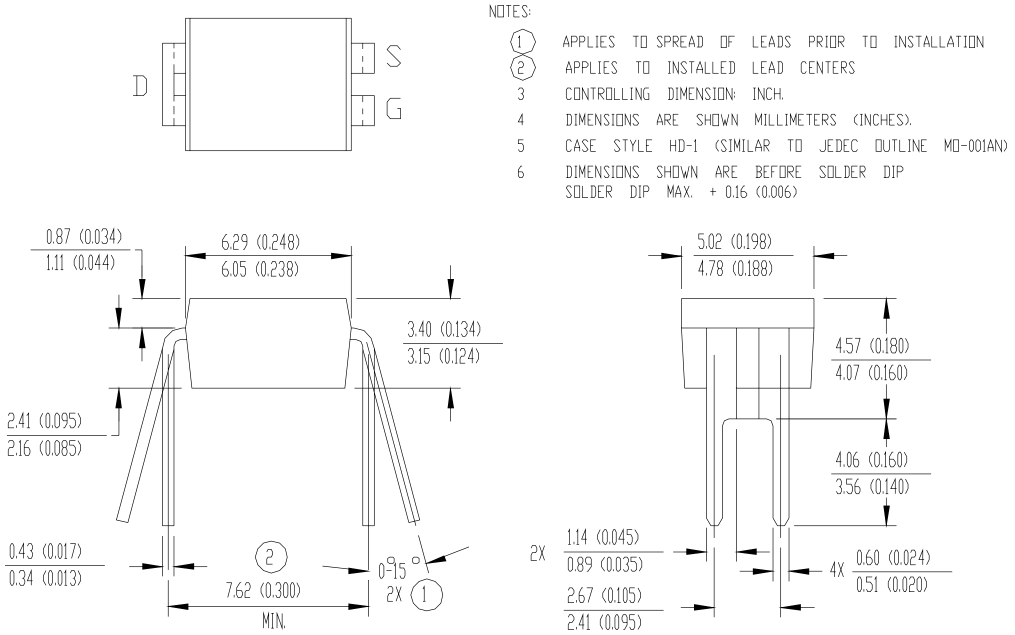
② $V_{DD}=25V$, starting $T_J=25°C$, $L=16mH$ $R_G=25\Omega$, $I_{AS}=2.5A$ (See Figure 12)

③ $I_{SD}\le 17A$, $di/dt \le 140A/\mu s$, $V_{DD} \le V_{(BR)DSS}$, $T_J \le 175°C$

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

## Hexdip Package Outline

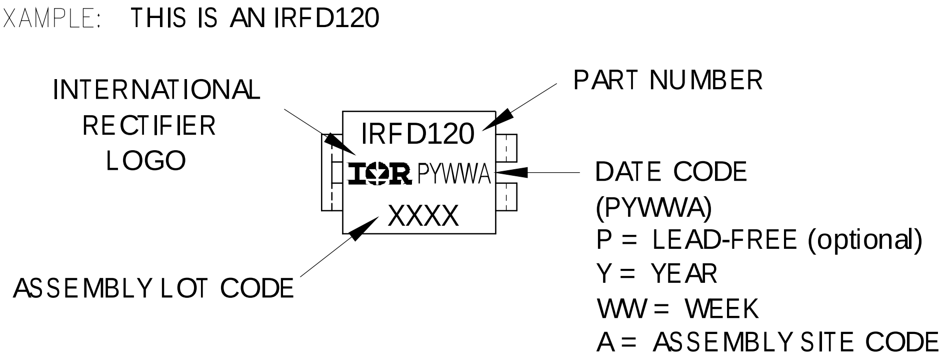
Dimensions are shown in millimeters (inches)



NOTES:

① APPLIES TO SPREAD OF LEADS PRIOR TO INSTALLATION
② APPLIES TO INSTALLED LEAD CENTERS
3 CONTROLLING DIMENSION: INCH.
4 DIMENSIONS ARE SHOWN MILLIMETERS (INCHES).
5 CASE STYLE HD-1 (SIMILAR TO JEDEC OUTLINE MO-001AN)
6 DIMENSIONS SHOWN ARE BEFORE SOLDER DIP
SOLDER DIP MAX. + 0.16 (0.006)

## Hexdip Part Marking Information



P = LEAD-FREE (optional)
Y = YEAR
WW = WEEK
A = ASSEMBLY SITE CODE