International
IOR Rectifier

PD - 95442A

# IRFR3704ZPbF
# IRFU3704ZPbF

HEXFET® Power MOSFET

| $V_{DSS}$ | $R_{DS(on)}$ max | Qg |
|---|---|---|
| 20V | 8.4mΩ | 9.3nC |

### Applications

- High Frequency Synchronous Buck Converters for Computer Processor Power
- High Frequency Isolated DC-DC Converters with Synchronous Rectification for Telecom and Industrial Use
- Lead-Free

### Benefits

- Very Low $R_{DS(on)}$ at 4.5V $V_{GS}$
- Ultra-Low Gate Impedance
- Fully Characterized Avalanche Voltage and Current

D-Pak
IRFR3704Z

I-Pak
IRFU3704Z

### Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-to-Source Voltage | 20 | V |
| $V_{GS}$ | Gate-to-Source Voltage | ± 20 | |
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V | 60④ | A |
| $I_D$ @ $T_C$ = 100°C | Continuous Drain Current, $V_{GS}$ @ 10V | 42④ | |
| $I_{DM}$ | Pulsed Drain Current ① | 240 | |
| $P_D$ @$T_C$ = 25°C | Maximum Power Dissipation | 48 | W |
| $P_D$ @$T_C$ = 100°C | Maximum Power Dissipation | 24 | |
| | Linear Derating Factor | 0.32 | W/°C |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -55 to + 175 | °C |
| | Soldering Temperature, for 10 seconds | 300 (1.6mm from case) | |

### Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | ⎯⎯ | 3.1 | °C/W |
| $R_{\theta JA}$ | Junction-to-Ambient (PCB Mount) ⑤ | ⎯⎯ | 50 | |
| $R_{\theta JA}$ | Junction-to-Ambient | ⎯⎯ | 110 | |

Notes ① through ⑤ are on page 11

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

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-to-Source Breakdown Voltage | 20 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 250µA |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 0.015 | — | V/°C | Reference to 25°C, $I_D$ = 1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | 6.7 | 8.4 | mΩ | $V_{GS}$ = 10V, $I_D$ = 15A ③ |
| | | — | 9.2 | 11.4 | | $V_{GS}$ = 4.5V, $I_D$ = 12A ③ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 1.65 | 2.1 | 2.55 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA |
| $\Delta V_{GS(th)}/\Delta T_J$ | Gate Threshold Voltage Coefficient | — | -5.5 | — | mV/°C | |
| $I_{DSS}$ | Drain-to-Source Leakage Current | — | — | 1.0 | µA | $V_{DS}$ =16V, $V_{GS}$ = 0V |
| | | — | — | 150 | | $V_{DS}$ = 16V, $V_{GS}$ = 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 |
| gfs | Forward Transconductance | 41 | — | — | S | $V_{DS}$ = 10V, $I_D$ = 12A |
| $Q_g$ | Total Gate Charge | — | 9.3 | 14 | | |
| $Q_{gs1}$ | Pre-Vth Gate-to-Source Charge | — | 3.0 | — | | $V_{DS}$ = 10V |
| $Q_{gs2}$ | Post-Vth Gate-to-Source Charge | — | 1.1 | — | nC | $V_{GS}$ = 4.5V |
| $Q_{gd}$ | Gate-to-Drain Charge | — | 2.7 | — | | $I_D$ = 12A |
| $Q_{godr}$ | Gate Charge Overdrive | — | 2.5 | — | | See Fig. 16 |
| $Q_{sw}$ | Switch Charge ($Q_{gs2}$ + $Q_{gd}$) | — | 3.8 | — | | |
| $Q_{oss}$ | Output Charge | — | 5.6 | — | nC | $V_{DS}$ = 10V, $V_{GS}$ = 0V |
| $t_{d(on)}$ | Turn-On Delay Time | — | 41 | — | | $V_{DD}$ = 10V, $V_{GS}$ = 4.5V ③ |
| $t_r$ | Rise Time | — | 8.9 | — | | $I_D$ = 12A |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 4.9 | — | ns | Clamped Inductive Load |
| $t_f$ | Fall Time | — | 12 | — | | |
| $C_{iss}$ | Input Capacitance | — | 1190 | — | | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | — | 380 | — | pF | $V_{DS}$ = 10V |
| $C_{rss}$ | Reverse Transfer Capacitance | — | 170 | — | | $f$ = 1.0MHz |

## Avalanche Characteristics

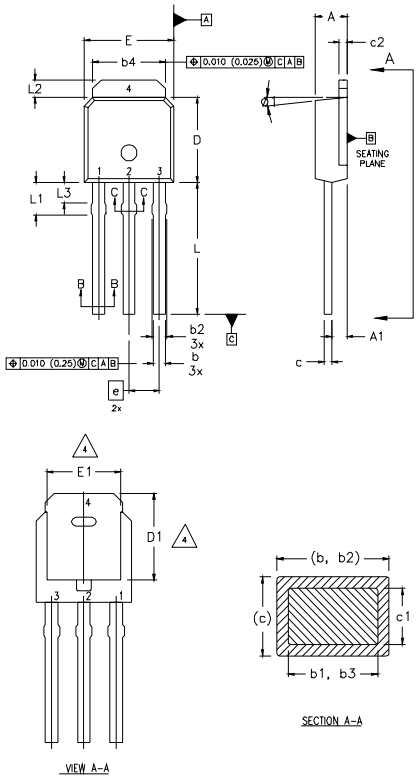
| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $E_{AS}$ | Single Pulse Avalanche Energy② | — | 41 | mJ |
| $I_{AR}$ | Avalanche Current ① | — | 12 | A |
| $E_{AR}$ | Repetitive Avalanche Energy ① | — | 4.8 | mJ |

## Diode Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | — | — | 60④ | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | — | — | 240 | | |
| $V_{SD}$ | Diode Forward Voltage | — | — | 1.0 | V | $T_J$ = 25°C, $I_S$ = 12A, $V_{GS}$ = 0V ③ |
| $t_{rr}$ | Reverse Recovery Time | — | 13 | 19 | ns | $T_J$ = 25°C, $I_F$ = 12A, $V_{DD}$ = 10V |
| $Q_{rr}$ | Reverse Recovery Charge | — | 4.2 | 6.3 | nC | di/dt = 100A/µs ③ |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) | | | | |

## I-Pak (TO-251AA) Package Outline

Dimensions are shown in millimeters (inches)




NOTES:

1 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
2 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
4 THERMAL PAD CONTOUR OPTION WITHIN DIMENSION b4, L2, E1 & D1.
5 LEAD DIMENSION UNCONTROLLED IN L3.
6 DIMENSION b1, b3 APPLY TO BASE METAL ONLY.
7 OUTLINE CONFORMS TO JEDEC OUTLINE TO-251AA.
8 CONTROLLING DIMENSION : INCHES.

| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 2.18 | 2.39 | 0.086 | .094 | |
| A1 | 0.89 | 1.14 | 0.035 | 0.045 | |
| b | 0.64 | 0.89 | 0.025 | 0.035 | |
| b1 | 0.64 | 0.79 | 0.025 | 0.031 | 4 |
| b2 | 0.76 | 1.14 | 0.030 | 0.045 | |
| b3 | 0.76 | 1.04 | 0.030 | 0.041 | |
| b4 | 5.00 | 5.46 | 0.195 | 0.215 | 4 |
| c | 0.46 | 0.61 | 0.018 | 0.024 | |
| c1 | 0.41 | 0.56 | 0.016 | 0.022 | |
| c2 | .046 | 0.86 | 0.018 | 0.035 | |
| D | 5.97 | 6.22 | 0.235 | 0.245 | 3, 4 |
| D1 | 5.21 | - | 0.205 | - | 4 |
| E | 6.35 | 6.73 | 0.250 | 0.265 | 3, 4 |
| E1 | 4.32 | - | 0.170 | - | 4 |
| e | 2.29 | | 0.090 BSC | | |
| L | 8.89 | 9.60 | 0.350 | 0.380 | |
| L1 | 1.91 | 2.29 | 0.075 | 0.090 | |
| L2 | 0.89 | 1.27 | 0.035 | 0.050 | 4 |
| L3 | 1.14 | 1.52 | 0.045 | 0.060 | 5 |
| ø1 | 0° | 15° | 0° | 15° | |

LEAD ASSIGNMENTS

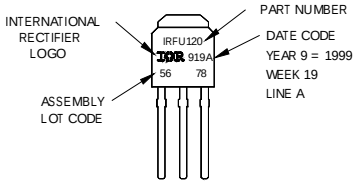
HEXFET

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

## I-Pak (TO-251AA) Part Marking Information

EXAMPLE: THIS IS AN IRFU120
WITH ASSEMBLY
LOT CODE 5678
ASSEMBLED ON WW 19, 1999
IN THE ASSEMBLY LINE "A"

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




OR