

IRL3402PbF

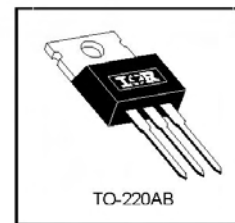
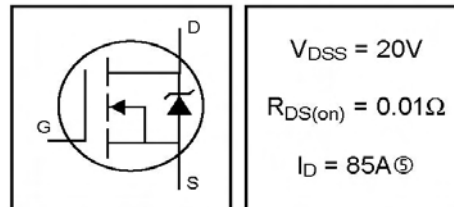
HEXFET® Power MOSFET

- Advanced Process Technology
- Optimized for 4.5V-7.0V Gate Drive
- Ideal for CPU Core DC-DC Converters
- Fast Switching
- Lead-Free

Description

These HEXFET Power MOSFETs were designed specifically to meet the demands of CPU core DC-DC converters. Advanced processing techniques combined with an optimized gate oxide design results in a die sized specifically to offer maximum efficiency at minimum cost.

The TO-220 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 watts. The low thermal resistance and low package cost of the TO-220 contribute to its wide acceptance throughout the industry.



Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---------------------------------|---|--------------------|-------|
| $I_D @ T_C = 25^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 5.0\text{V}$ | 85 ^① | A |
| $I_D @ T_C = 100^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 5.0\text{V}$ | 54 | |
| I_{DM} | Pulsed Drain Current ^① | 340 | |
| $P_D @ T_C = 25^\circ\text{C}$ | Power Dissipation | 110 | W |
| | Linear Derating Factor | 0.91 | W/°C |
| V_{GS} | Gate-to-Source Voltage | ± 10 | V |
| V_{GSM} | Gate-to-Source Voltage (Start Up Transient, $t_p = 100\mu\text{s}$) | 14 | V |
| E_{AS} | Single Pulse Avalanche Energy ^② | 290 | mJ |
| I_{AR} | Avalanche Current ^① | 51 | A |
| E_{AR} | Repetitive Avalanche Energy ^① | 11 | mJ |
| dv/dt | Peak Diode Recovery dv/dt ^③ | 5.0 | V/ns |
| T_J | Operating Junction and Storage Temperature Range | -55 to + 150 | °C |
| T_{STG} | | | |
| | | | |
| | Mounting torque, 6-32 or M3 screw | 10 lbf•in (1.1N•m) | |

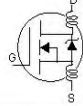
Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|-----------------|-------------------------------------|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case | — | 1.1 | °C/W |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.50 | — | |
| $R_{\theta JA}$ | Junction-to-Ambient | — | 62 | |

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International
IR Rectifier

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 | 20 | — | — | V | $V_{GS} = 0V, I_D = 250\mu A$ |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 0.02 | — | V/°C | Reference to 25°C , $I_D = 1mA$ |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | — | 0.010 | Ω | $V_{GS} = 4.5V, I_D = 51A$ ④ |
| | | — | — | 0.008 | | $V_{GS} = 7.0V, I_D = 51A$ ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 0.70 | — | — | V | $V_{DS} = V_{GS}, I_D = 250\mu A$ |
| g_{fs} | Forward Transconductance | 65 | — | — | S | $V_{DS} = 10V, I_D = 51A$ |
| I_{DSS} | Drain-to-Source Leakage Current | — | — | 25 | μA | $V_{DS} = 20V, V_{GS} = 0V$ |
| | | — | — | 250 | | $V_{DS} = 16V, V_{GS} = 0V, T_J = 150^\circ\text{C}$ |
| I_{GSS} | Gate-to-Source Forward Leakage | — | — | 100 | nA | $V_{GS} = 10V$ |
| | Gate-to-Source Reverse Leakage | — | — | -100 | | $V_{GS} = -10V$ |
| Q_g | Total Gate Charge | — | — | 78 | nC | $I_D = 51A$ |
| Q_{gs} | Gate-to-Source Charge | — | — | 18 | | $V_{DS} = 10V$ |
| Q_{gd} | Gate-to-Drain ("Miller") Charge | — | — | 30 | | $V_{GS} = 4.5V$, See Fig. 6 ④ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 10 | — | ns | $V_{DD} = 10V$ |
| t_r | Rise Time | — | 140 | — | | $I_D = 51A$ |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 80 | — | | $R_G = 5.0\Omega, V_{GS} = 4.5V$ |
| t_f | Fall Time | — | 120 | — | | $R_D = 0.19\Omega$, ④ |
| L_D | Internal Drain Inductance | — | 4.5 | — | nH | Between lead, 6mm (0.25in.) from package and center of die contact |
| L_S | Internal Source Inductance | — | 7.5 | — | |  |
| C_{iss} | Input Capacitance | — | 3300 | — | pF | $V_{GS} = 0V$ |
| C_{oss} | Output Capacitance | — | 1400 | — | | $V_{DS} = 15V$ |
| C_{rss} | Reverse Transfer Capacitance | — | 510 | — | | $f = 1.0MHz$, See Fig. 5 |

Source-Drain Ratings and Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|----------|---|---|------|------|-------|---|
| I_S | Continuous Source Current (Body Diode) | — | — | 85 | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| I_{SM} | Pulsed Source Current (Body Diode) ① | — | — | 340 | | |
| V_{SD} | Diode Forward Voltage | — | — | 1.3 | V | $T_J = 25^\circ\text{C}, I_S = 51A, V_{GS} = 0V$ ④ |
| t_{rr} | Reverse Recovery Time | — | 72 | 110 | ns | $T_J = 25^\circ\text{C}, I_F = 51A$ |
| Q_{rr} | Reverse Recovery Charge | — | 160 | 240 | nC | $di/dt = 100A/\mu s$ 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.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 220\mu H$
 $R_G = 25\Omega$, $I_{AS} = 51A$.
- ③ $I_{SD} \leq 51A$, $di/dt \leq 82A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$,
 $T_J \leq 150^\circ\text{C}$
- ④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.
- ⑤ Calculated continuous current based on maximum allowable junction temperature; for recommended current-handling of the package refer to Design Tip # 93-4

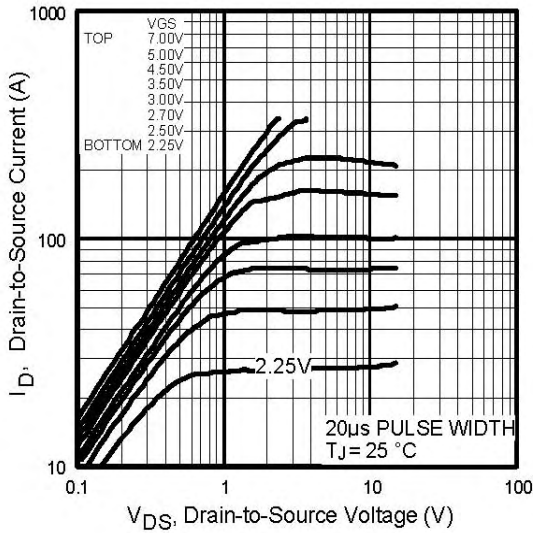


Fig 1. Typical Output Characteristics

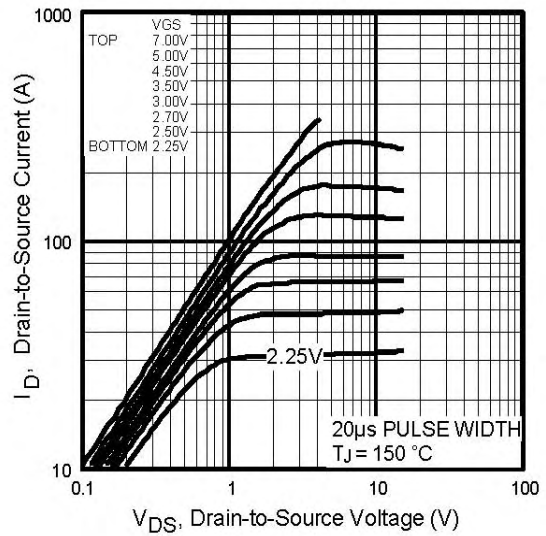


Fig 2. Typical Output Characteristics

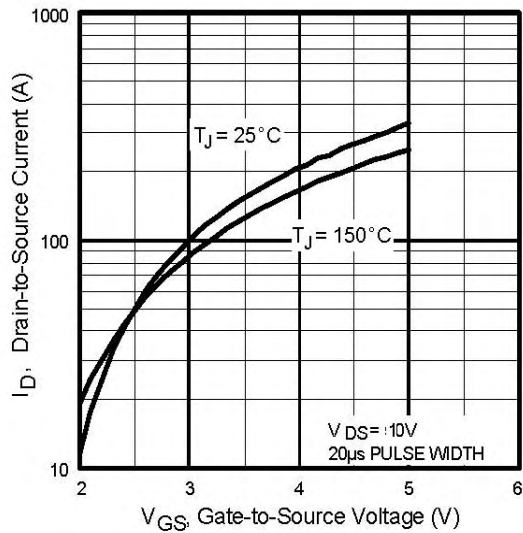


Fig 3. Typical Transfer Characteristics

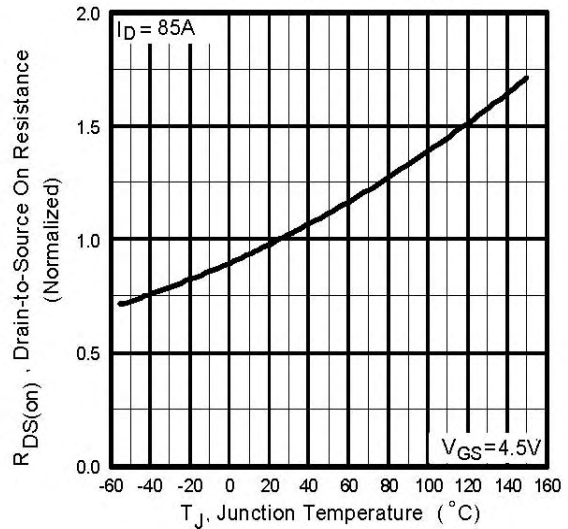


Fig 4. Normalized On-Resistance Vs. Temperature

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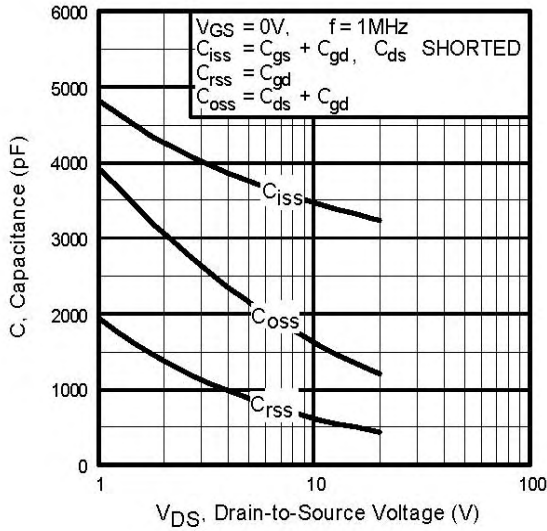


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

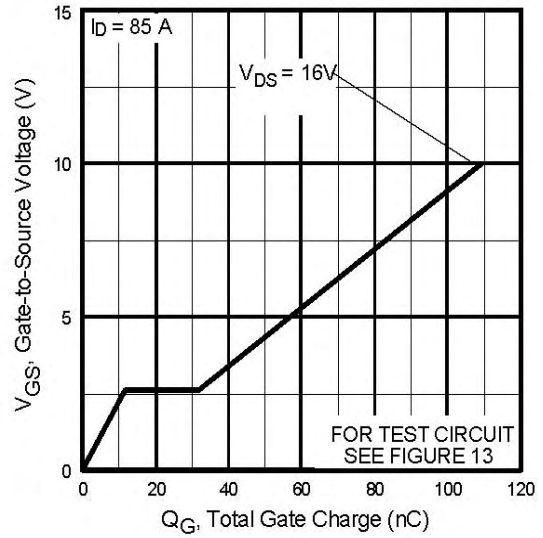


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

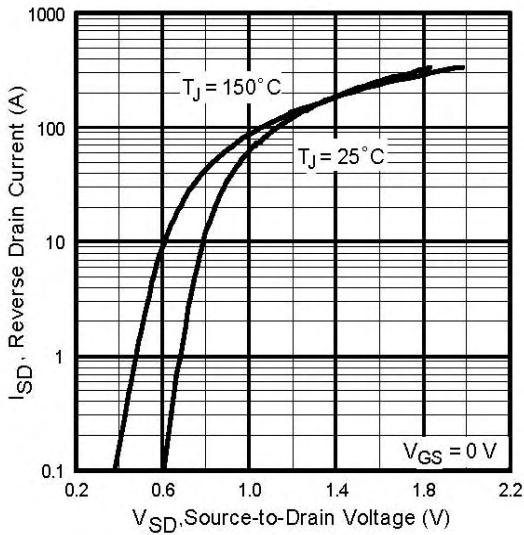


Fig 7. Typical Source-Drain Diode Forward Voltage

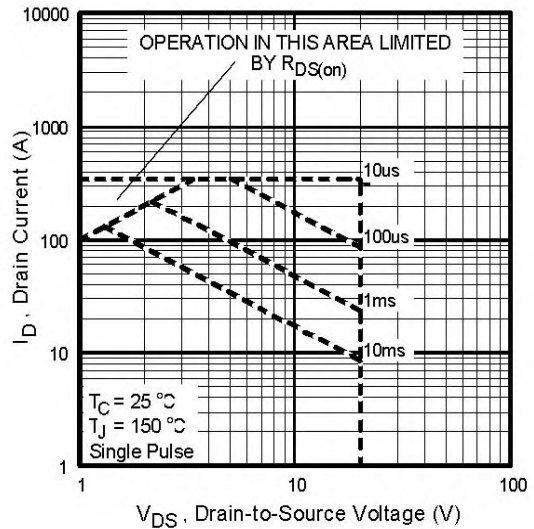


Fig 8. Maximum Safe Operating Area

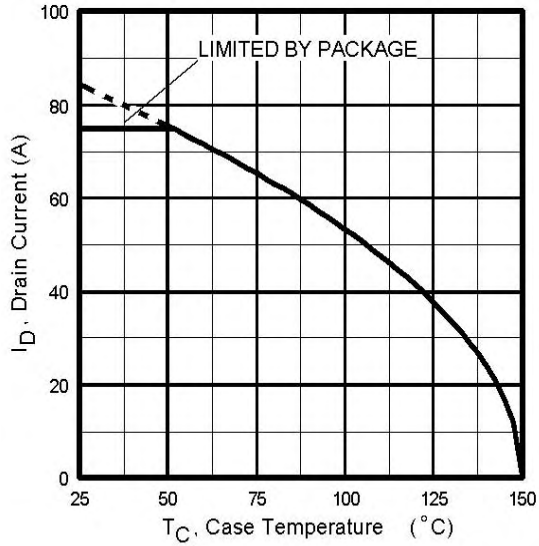


Fig 9. Maximum Drain Current Vs. Case Temperature

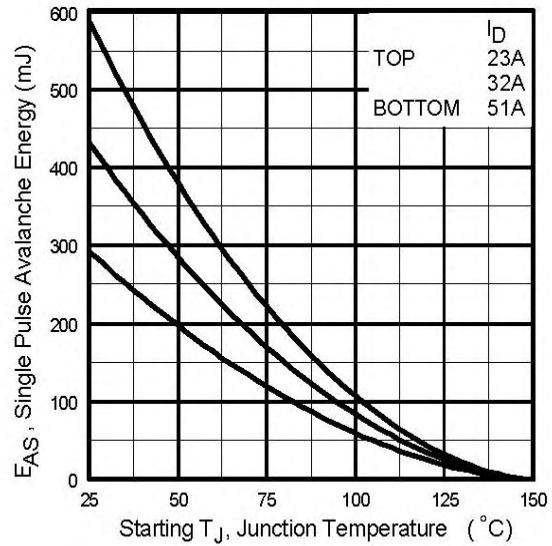


Fig 10. Maximum Avalanche Energy Vs. Drain Current

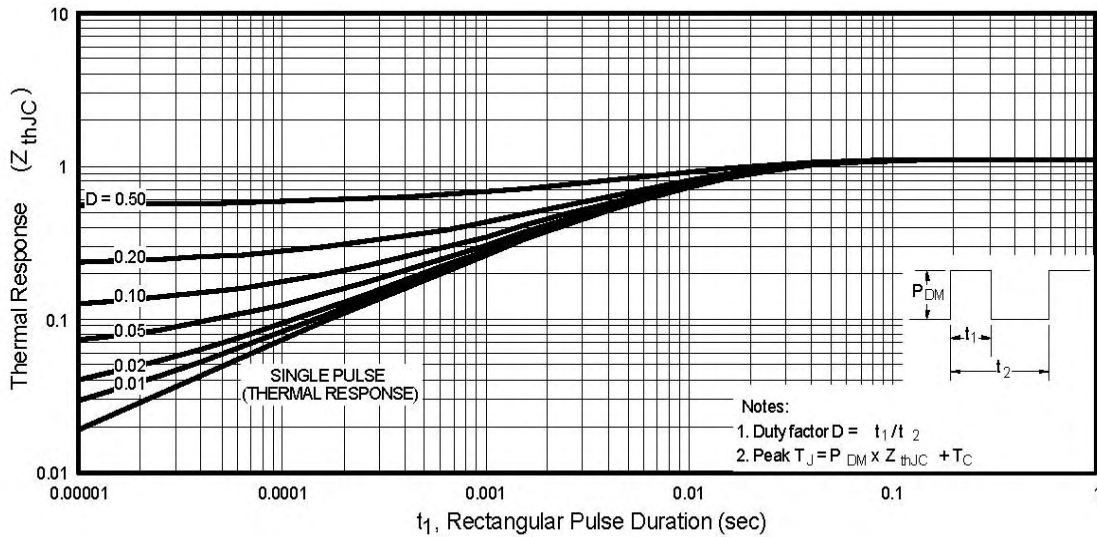


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

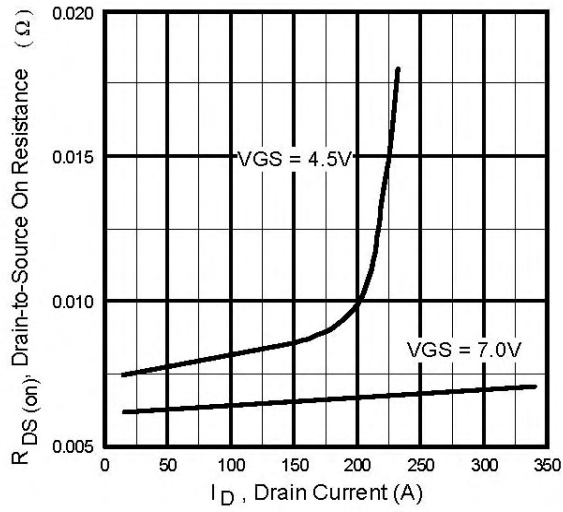


Fig 12. On-Resistance Vs. Drain Current

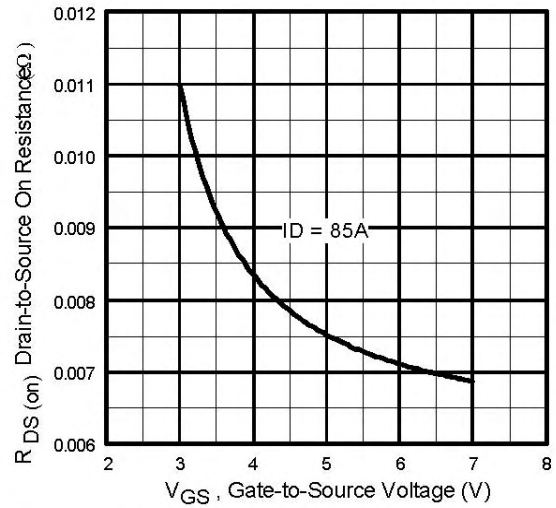
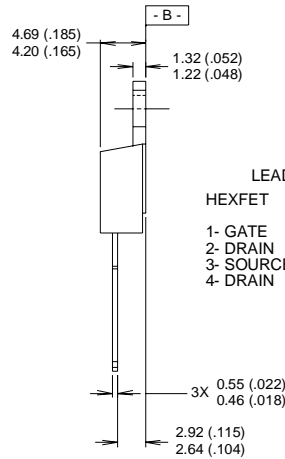
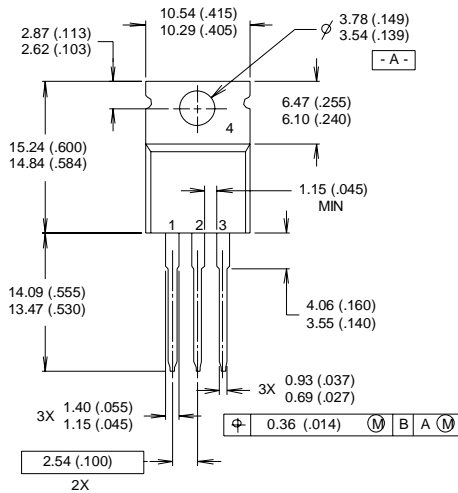


Fig 13. On-Resistance Vs. Gate Voltage

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



LEAD ASSIGNMENTS

| HEXFET | IGBTs, CoPACK |
|-----------|---------------|
| 1- GATE | 1- GATE |
| 2- DRAIN | 2- COLLECTOR |
| 3- SOURCE | 3- EMITTER |
| 4- DRAIN | 4- COLLECTOR |

NOTES:

- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
- 2 CONTROLLING DIMENSION : INCH

- 3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.
- 4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

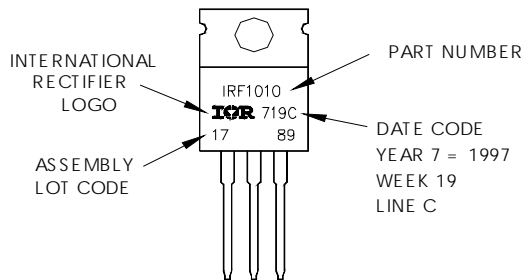
TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010

LOT CODE 1789

ASSEMBLED ON WW 19, 1997
 IN THE ASSEMBLY LINE "C"

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



Data and specifications subject to change without notice.

Note: For the most current drawings please refer to the IR website at:
<http://www.irf.com/package/>