

IRSF3031 **(NOTE: For new designs, we recommend IR's new products IPS021 and IPS021L)**

FULLY PROTECTED POWER MOSFET SWITCH

Features

- Controlled slew rate reduces EMI
- Over temperature protection
- Over current protection
- Active drain-to-source clamp
- ESD protection
- Lead compatible with standard Power MOSFET
- Low operating input current
- Monolithic construction
- Dual set/reset threshold input

Description

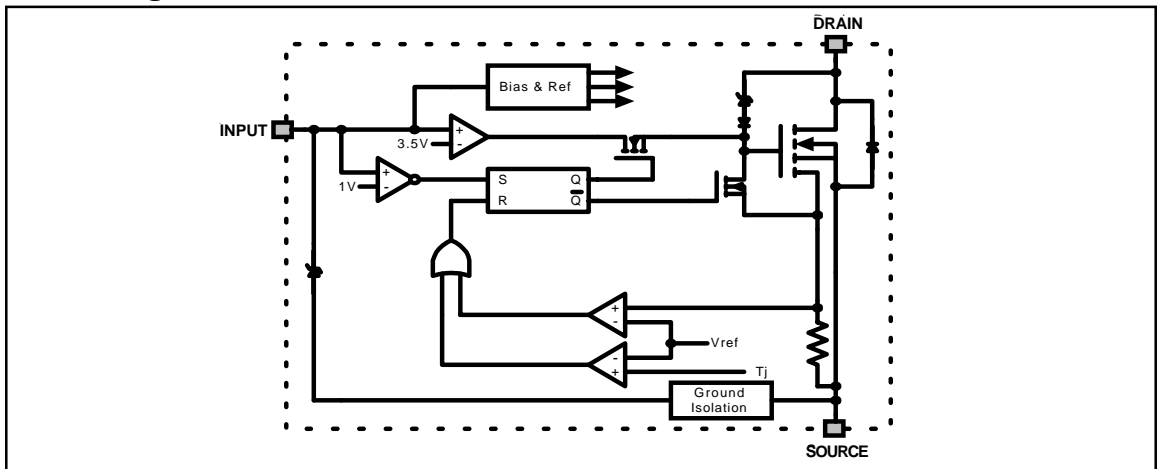
The IRSF3031 is a three-terminal monolithic Smart Power MOSFET with built-in short circuit, over-temperature, ESD and over-voltage protections and dual set/reset input threshold .

The on-chip protection circuit latches off the Power MOSFET in case the drain current exceeds 4A (typical) or the junction temperature exceeds 165°C (typical) and keeps it off until the input is driven below the Reset Threshold voltage.

The drain to source voltage is actively clamped at 55V prior to the avalanche of the Power MOSFET, thus improving its performance during turn-off with inductive loads.

The input requirements are very low (100µA typical) which makes the IRSF3031 compatible with most existing designs based on standard power MOSFETs.

Block Diagram



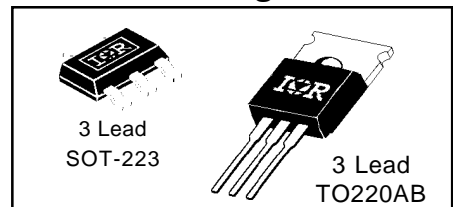
Product Summary

| | |
|-------------------------|--------|
| V _{ds} (clamp) | 50 V |
| R _{ds} (on) | 200 mW |
| I _{ds} (sd) | 4 A |
| T _j (sd) | 165°C |
| EAS | 200 mJ |

Applications

- Solenoid Driver
- DC Motor Driver
- Programmable Logic Controller

Available Packages



Absolute Maximum Ratings

Absolute Maximum Ratings indicate sustained limits beyond which damage to the device may occur. ($T_c = 25^\circ\text{C}$ unless otherwise specified.)

| Symbol | Parameter | Min. | Max. | Units | Test Conditions |
|---------------|--|------|--------------|-------|--------------------------------------|
| $V_{ds, max}$ | Continuous drain to source voltage | — | 50 | V | |
| $V_{in, max}$ | Continuous input voltage | -0.3 | 10 | | |
| I_{ds} | Continuous drain current | — | self limited | A | |
| P_d | Power dissipation | — | 30 | W | $T_c \leq 25^\circ\text{C}$, TO220 |
| | | — | 3.0 | W | $T_c \leq 25^\circ\text{C}$, SOT223 |
| EAS | Unclamped single pulse inductive energy ^② | — | 200 | mJ | |
| V_{esd1} | Electrostatic discharge voltage (Human Body Model) | — | 4000 | V | 100pF, 1.5kW |
| V_{esd2} | Electrostatic discharge voltage (Machine Model) | — | 1000 | | 200pF, 0w |
| T_{Jop} | Operating junction temperature range | -55 | 150 | °C | |
| T_{Stg} | Storage temperature range | -55 | 150 | | |
| T_L | Lead temperature (soldering, 10 seconds) | — | 300 | | |

Static Electrical Characteristics

($T_c = 25^\circ\text{C}$ unless otherwise specified.)

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|-----------------|--|------|------|------|------------|--|
| $V_{ds, clamp}$ | Drain to source clamp voltage | 50 | 56 | 65 | V | $I_{ds} = 2\text{A}$ |
| $R_{ds(on)}$ | Drain to source on resistance | — | 155 | 200 | m Ω | $V_{in} = 5\text{V}$, $I_{ds} = 2\text{A}$ |
| I_{dss} | Drain to source leakage current | — | — | 250 | mA | $V_{ds} = 40\text{V}$, $V_{in} = 0\text{V}$ |
| V_{set} | Input threshold voltage | 2.5 | 3.2 | 4.0 | V | $V_{ds} = 5\text{V}$, $I_{ds} > 10\text{mA}$ |
| V_{reset} | Input protection reset threshold voltage | 0.5 | 1.0 | 1.5 | V | $V_{ds} = 5\text{V}$, $I_{ds} < 10\text{mA}$ |
| $I_{i, on}$ | Input supply current (normal operation) | — | 100 | 300 | mA | $V_{in} = 5\text{V}$ |
| $I_{i, off}$ | Input supply current (protection mode) | — | 120 | 400 | mA | $V_{in} = 5\text{V}$ |
| $V_{in, clamp}$ | Input clamp voltage | 9 | 10 | — | V | $I_{in} = 1\text{mA}$ |
| V_{sd} | Body-drain diode forward drop ^③ | — | 1.5 | — | V | $I_{ds} = -2\text{A}$, $R_{in} = 1\text{k}\Omega$ |

Thermal Characteristics

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|------------|--|------|------|------|-------|-----------------|
| R_{thjc} | Thermal resistance, junction-to-case | — | — | 4 | °C/W | TO-220AB |
| R_{thja} | Thermal resistance, junction-to-ambient | — | — | 60 | | |
| R_{thjc} | Thermal resistance, junction-to-case | — | — | 40 | °C/W | SOT-223 |
| R_{thja} | Thermal resistance, junction-to-PCB ^① | — | — | 60 | | |

NOTES:

- ① When mounted on a 1" square PCB (FR-4 or G10 material). For recommended footprint and soldering techniques, refer to International Rectifier Application Note AN-994.
- ② E_{AS} is tested with a constant current source of 6A applied for 700 μs with $V_{in} = 0\text{V}$ and starting $T_j = 25^\circ\text{C}$.
- ③ Input current must be limited to less than 5mA with a 1k Ω resistor in series with the input when the Body-Drain Diode is forward biased.

Switching Electrical Characteristics

($V_{CC} = 14V$, resistive load (R_L) = 10Ω , $R_{in} = 100\Omega$. Specifications measured at $T_C = 25^\circ C$ unless otherwise specified.)

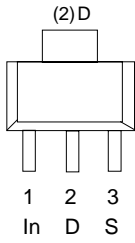
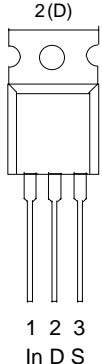
| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|------------|---------------------------|------|------|------|-------|---------------------------------------|
| t_{don} | Turn-on delay time | — | — | 30 | ms | $V_{in} = 2V$ to $5V$, 50% to 90% |
| t_r | Rise time | — | — | 30 | | $V_{in} = 2V$ to $5V$, 90% to 10% |
| t_{doff} | Turn-off delay time | — | — | 30 | | $V_{in} = 5V$ to $2V$, 50% to 10% |
| t_f | Fall time | — | — | 30 | | $V_{in} = 5V$ to $2V$, 10% to 90% |
| SR | Output positive slew rate | -6 | — | 6 | V/ms | $V_{in} = 2V$ to $5V$, $+dV_{ds}/dt$ |
| SR | Output negative slew rate | -6 | — | 6 | | $V_{in} = 5V$ to $2V$, $-dV_{ds}/dt$ |

Protection Characteristics

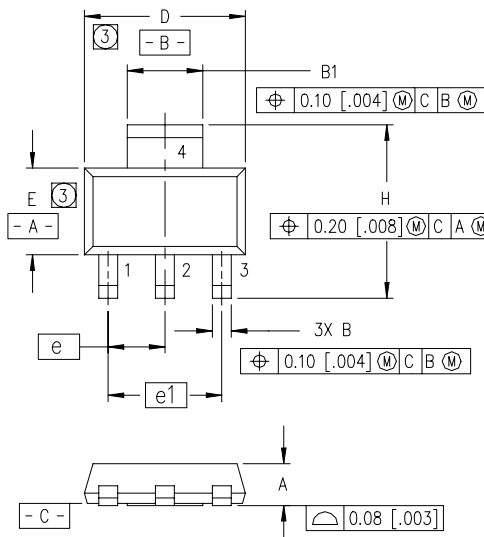
($T_C = 25^\circ C$ unless otherwise specified.)

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---------------|---|------|------|------|------------|-------------------------------|
| $I_{ds(sd)}$ | Current limit | 1.8 | 4 | 6 | A | $V_{in} = 5V$ |
| $T_{j(sd)}$ | Over temperature shutdown threshold | 155 | 165 | — | $^\circ C$ | $V_{in} = 5V$, $I_{ds} = 2A$ |
| $V_{protect}$ | Min. input voltage for over-temp function | — | 3 | — | V | |
| t_{iresp} | Over current response time | — | TBD | — | ms | |
| I_{peak} | Peak short circuit current | — | TBD | — | A | |
| t_{reset} | Protection reset time | — | TBD | — | ms | |
| t_{Tresp} | Over-temperature response time | — | TBD | — | | |

Lead Assignments

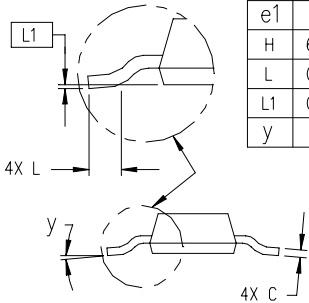
| | |
|--|--|
|  <p>3 Lead - SOT223</p> |  <p>3 Lead - TO220</p> |
| IRSF3031L | IRSF3031 |
| Part Number | |

Case Outline 3 Lead - SOT-223

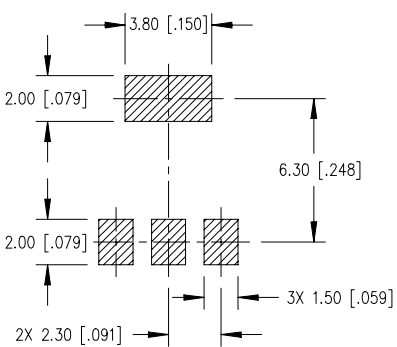


- LEAD ASSIGNMENTS
- 1 = GATE
 - 2 = DRAIN
 - 3 = SOURCE
 - 4 = DRAIN

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|--------|------|
| | MIN | MAX | MIN | MAX |
| A | 1.55 | 1.80 | .061 | .071 |
| B | 0.65 | 0.85 | .026 | .033 |
| B1 | 2.95 | 3.15 | .116 | .124 |
| C | 0.25 | 0.35 | .010 | .014 |
| D | 6.30 | 6.70 | .248 | .264 |
| E | 3.30 | 3.70 | .130 | .146 |
| e | 2.30 | BSC | .0905 | BSC |
| e1 | 4.60 | BSC | .181 | BSC |
| H | 6.71 | 7.29 | .287 | .264 |
| L | 0.91 | — | .036 | — |
| L1 | 0.061 | BSC | .0024 | BSC |
| y | — | 10° | — | 10° |



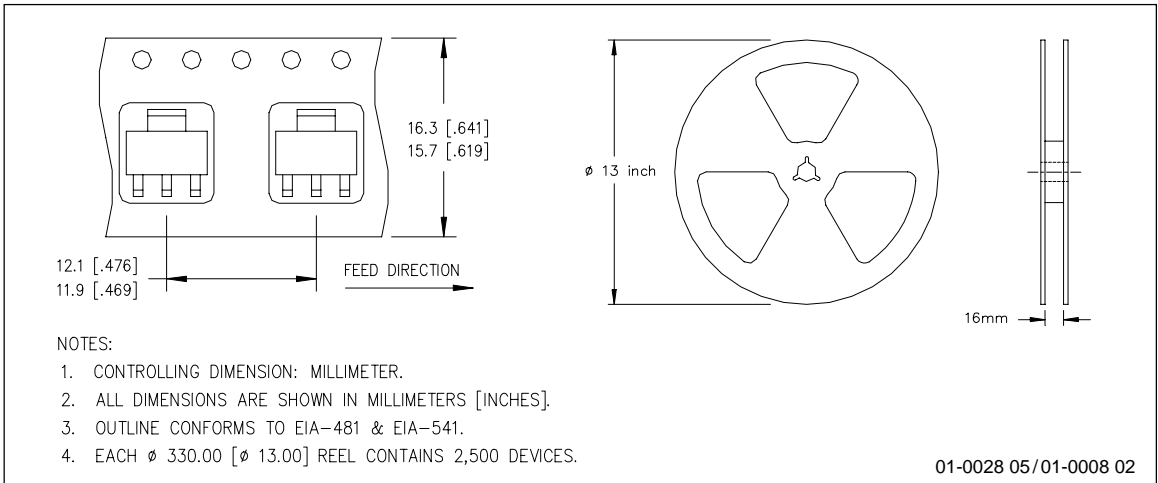
MINIMUM RECOMMENDED FOOTPRINT



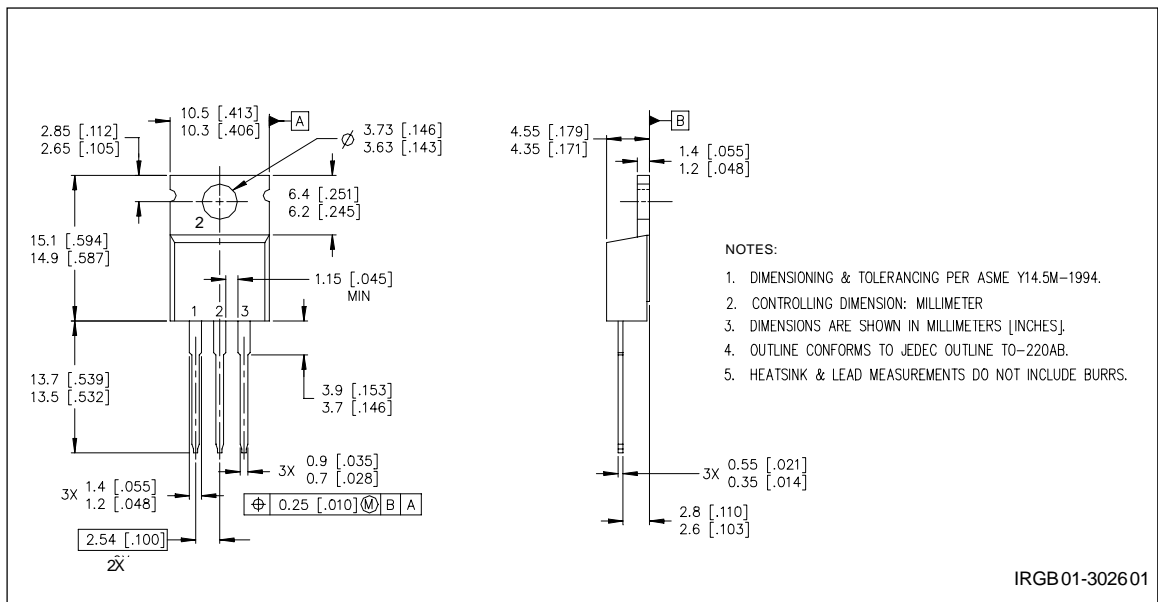
- NOTES:
1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982.
 2. CONTROLLING DIMENSION: INCH.
 3. DIMENSIONS DO NOT INCLUDE MOLD FLASH.
 4. OUTLINE CONFORMS TO JEDEC OUTLINE TO-261AA.
 5. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].

IRGB X01-3032 00

Tape & Reel - SOT223



Case Outline 3 Lead - TO220



International
IOR Rectifier

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<http://www.irf.com/>

Data and specifications subject to change without notice. 9/98