

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.

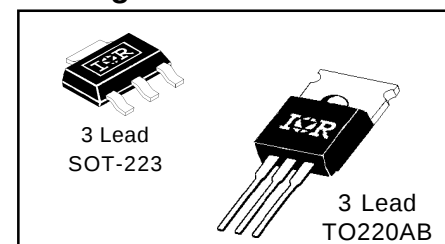
Product Summary

$V_{ds}(clamp)$	50 V
$R_{ds}(on)$	200 mΩ
$I_{ds}(sd)$	4 A
$T_j(sd)$	165°C
EAS	200 mJ

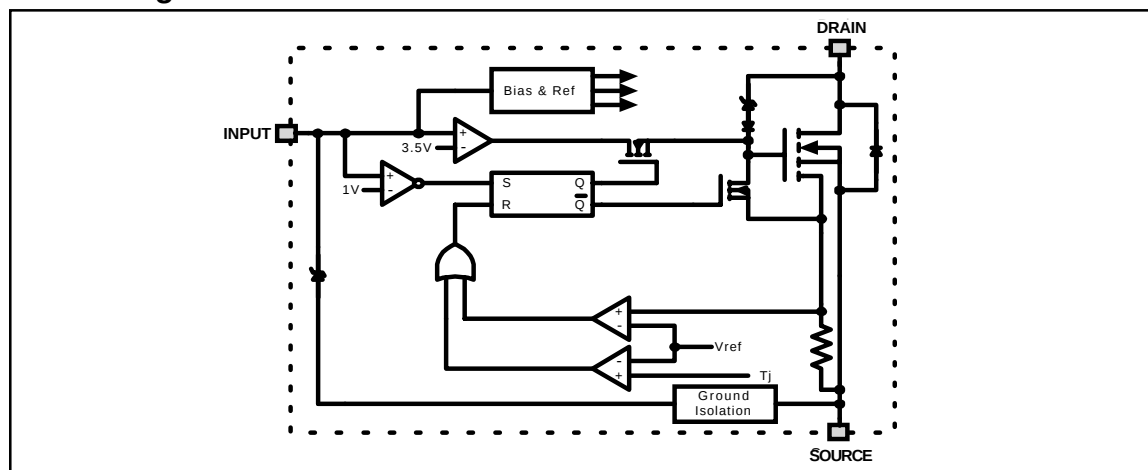
Applications

- Solenoid Driver
- DC Motor Driver
- Programmable Logic Controller

Packages



Block Diagram



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, 1.5k Ω
V_{esd2}	Electrostatic discharge voltage (Machine Model)	—	1000		200pF, 0 Ω
T_{Jop}	Operating junction temperature range	-55	150	$^\circ\text{C}$	
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
$V_{ds, \text{clamp}}$	Drain to source clamp voltage	50	56	65	V	$I_{ds} = 2\text{A}$
$R_{ds(\text{on})}$	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	μA	$V_{ds} = 40\text{V}$, $V_{in} = 0\text{V}$
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	$V_{ds} = 5\text{V}$, $I_{ds} < 10\mu\text{A}$
$I_{i, \text{on}}$	Input supply current (normal operation)	—	100	300	μA	$V_{in} = 5\text{V}$
$I_{i, \text{off}}$	Input supply current (protection mode)	—	120	400	μA	$V_{in} = 5\text{V}$
$V_{in, \text{clamp}}$	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	$^\circ\text{C/W}$	TO-220AB
R_{thja}	Thermal resistance, junction-to-ambient	—	—	60		
R_{thjc}	Thermal resistance, junction-to-case	—	—	40	$^\circ\text{C/W}$	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.)

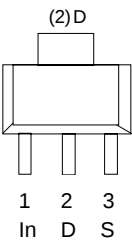
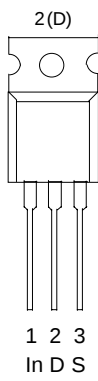
Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
t_{don}	Turn-on delay time	—	—	30	μs	$V_{in} = 2V$ to $5V$, 50% to 90%
t_r	Rise time	—	—	30		$V_{in} = 2V$ to $5V$, 90% to 10%
t_{doff}	Turn-off delay time	—	—	30		$V_{in} = 5V$ to $2V$, 50% to 10%
t_f	Fall time	—	—	30		$V_{in} = 5V$ to $2V$, 10%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

Protection Characteristics

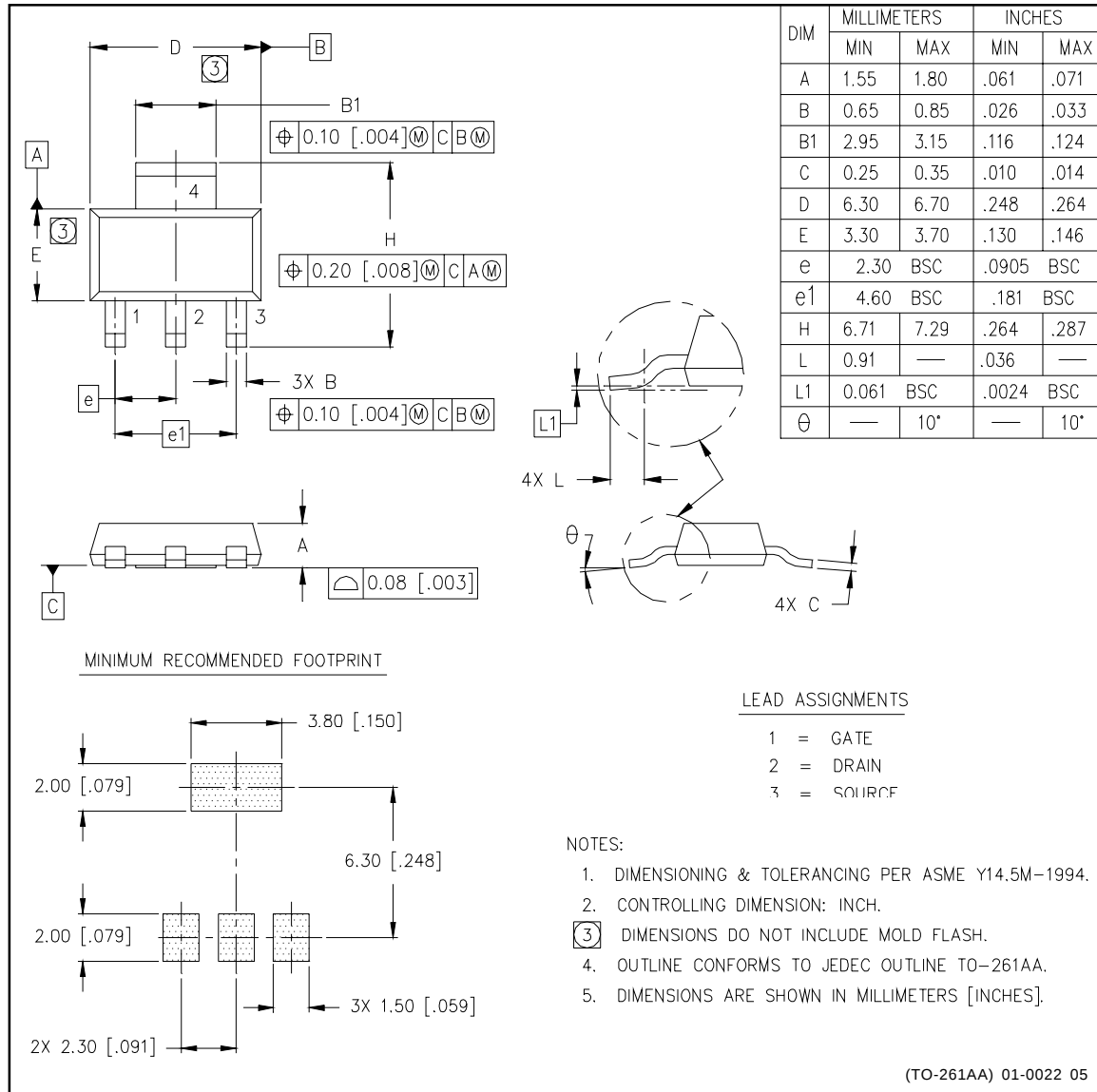
($T_C = 25^\circ C$ unless otherwise specified.)

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	—	μs	
I_{peak}	Peak short circuit current	—	TBD	—	A	
t_{reset}	Protection reset time	—	TBD	—	μs	
t_{Tresp}	Over-temperature response time	—	TBD	—		

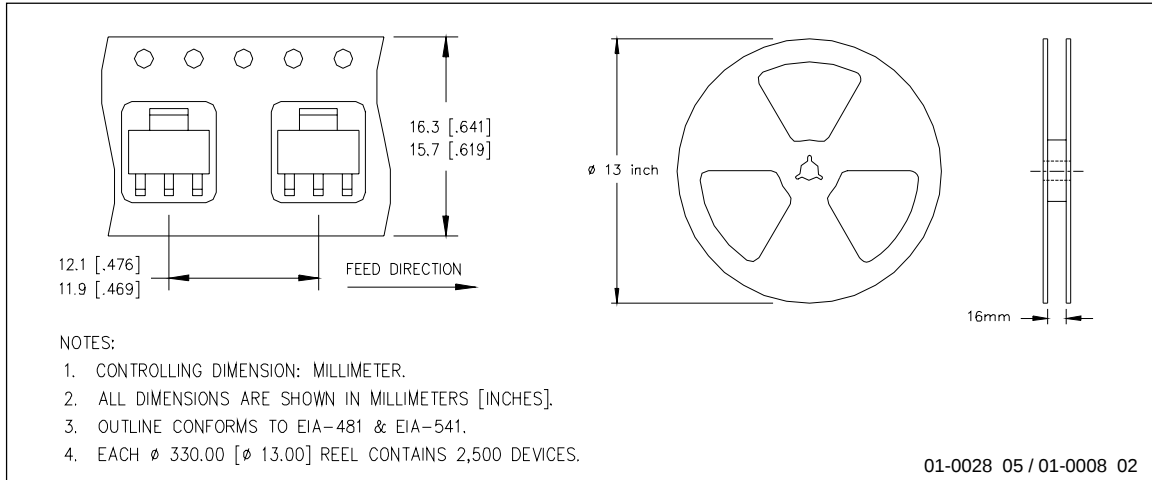
Lead Assignments

 3 Lead - SOT223	 3 Lead - TO220
IRSF3031L	IRSF3031
Part Number	

Case Outline - SOT-223



Tape & Reel - SOT223



Case Outline 3 Lead - TO220

