

International

IOR Rectifier

FULLY PROTECTED DMOS POWER SWITCH

IRSF3031

Features

- Extremely Rugged for Harsh Operating Environments
- Over Temperature Protection
- Over Current Protection
- Active Drain-to-Source Clamp
- ESD Protection
- 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 threshold input.

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 (typical) 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.

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.)

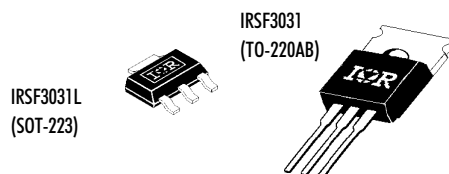
		Minimum	Maximum	Units	Test Conditions
$V_{ds, \max}$	Continuous Drain to Source Voltage	—	50	V	
$V_{in, \max}$	Continuous Input Voltage	0	8		
I_{ds}	Continuous Drain Current	—	self limited		
P_d	Power Dissipation	—	30	W	$T_c \leq 25^\circ\text{C}$
EAS	Unclamped Single Pulse Inductive Energy	—	200	mJ	
V_{esd1}	Electrostatic Discharge Voltage (Human Body Model)	—	4000	V	1000pF, 1.5kΩ
V_{esd2}	Electrostatic Discharge Voltage (Machine Model)	—	1000		200pF, 0Ω
T_{Jop}	Operating Junction Temperature Range	-40	150	°C	
T_{Stg}	Storage Temperature Range	-40	150		
T_L	Lead Temperature (Soldering, 10 seconds)	—	300		

$V_{ds}(\text{clamp})$	50 V
$R_{ds(on)}$	200 mΩ
$I_{ds(sd)}$	1.8 A
$T_j(sd)$	165°C
EAS	200 mJ

Applications

- Solenoid Driver
- DC Motor Driver

Available Packages





Static Electrical Characteristics

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

		Minimum	Typical	Maximum	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	$\text{m}\Omega$	$V_{in} = 5\text{V}$, $I_{ds} = 2\text{A}$
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	$V_{ds} = 5\text{V}$, $I_{ds} < 10\mu\text{A}$
$I_{i,on}$	Input Supply Current (Normal Operation)	—	100	300	μA	$V_{in} = 5\text{V}$
$I_{i,off}$	Input Supply Current (Protection Mode)	—	120	400	μA	$V_{in} = 5\text{V}$
$V_{in, clamp}$	Input Clamp Voltage	9	10	—	V	$I_{in} = 10\text{mA}$
V_{sd}	Body-Drain Diode Forward Drop	—	1.5	—	V	$I_{ds} = -2\text{A}$, $R_{in} = 1\text{k}\Omega$

Thermal Characteristics

		Minimum	Typical	Maximum	Units	Test Conditions
$R\theta_{jc}$	Thermal Resistance, Junction-to-Case	—	—	4	$^\circ\text{C}/\text{W}$	
$R\theta_{jA}$	Thermal Resistance, Junction-to-Ambient	—	—	62		

Switching Electrical Characteristics

($V_{CC} = 14\text{V}$, Resistive Load (R_L) = 10Ω , $R_{in} = 100\Omega$. Typical specifications measured at $T_C = 25^\circ\text{C}$. Min/max specifications are for $T_C = -40^\circ\text{C}$ to $T_C = 125^\circ\text{C}$ unless otherwise specified.)

		Minimum	Typical	Maximum	Units	Test Conditions
t_{don}	Turn-On Delay Time	—	—	30	μs	$V_{in} = 2\text{V to } 5\text{V}$, 50% to 90%
t_r	Rise Time	—	—	30		$V_{in} = 2\text{V to } 5\text{V}$, 90% to 10%
t_{doff}	Turn-Off Delay Time	—	—	30		$V_{in} = 2\text{V to } 5\text{V}$, 50% to 10%
t_f	Fall Time	—	—	30		$V_{in} = 2\text{V to } 5\text{V}$, 10% to 90%
SR	Output Positive Slew Rate	-5	—	5	$\text{V}/\mu\text{s}$	$V_{in} = 2\text{V to } 5\text{V}$, $+dV_{ds}/dt$
SR	Output Positive Slew Rate	-5	—	5		$V_{in} = 2\text{V to } 5\text{V}$, $-dV_{ds}/dt$

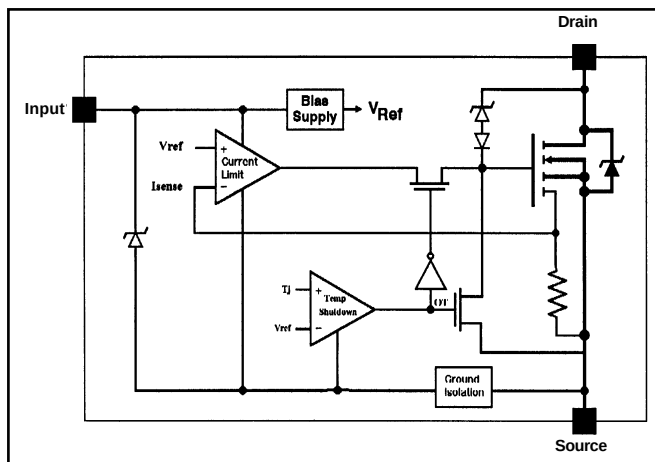
Protection Characteristics

($T_C = 25^\circ\text{C}$ unless otherwise specified. Min/Max specifications are for $T_C = -40^\circ\text{C}$ to $T_C = +125^\circ\text{C}$ unless otherwise specified.)

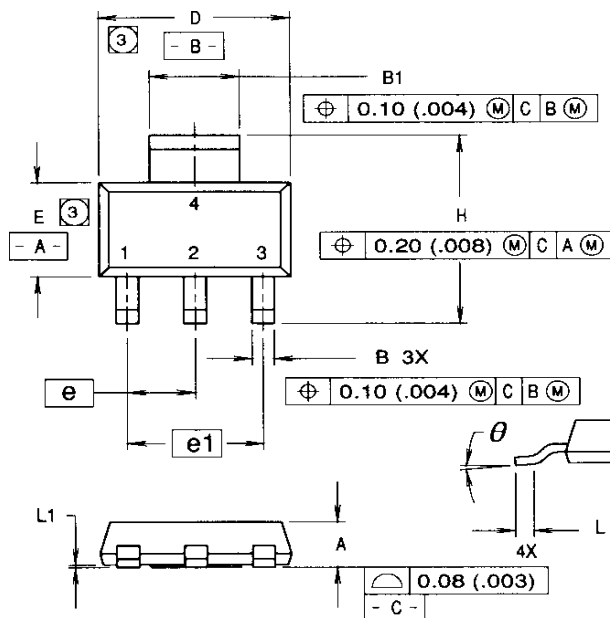
		Minimum	Typical	Maximum	Units	Test Conditions
$I_{ds(sd)}$	Current Limit	1.8	4	6	A	$V_{in} = 5\text{V}$
$T_{j(sd)}$	Over Temperature Shutdown Threshold	155	165	—	$^\circ\text{C}$	$V_{in} = 5\text{V}$, $I_{ds} = 2\text{A}$
$V_{protect}$	Min. Input Voltage for Over-temp function	—	3	—	V	
t_{iresp}	Over 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	—		



Block Diagram



Case Outline — SOT-223 (IRSF3031L)



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.55	1.80	0.061	0.071
B	0.65	0.85	0.026	0.033
B1	2.95	3.15	0.116	0.124
C	0.25	0.35	0.010	0.014
D	6.30	6.70	0.248	0.264
E	3.30	3.70	0.130	0.146
e	2.30 BSC		.0905 BSC	
e1	4.60 BSC		0.181 BSC	
H	6.71	7.29	0.287	0.264
L	—	0.91	—	0.036
L1	0.02	0.10	0.0006	0.004
theta	10° MAX		10° MAX	

NOTES:

1. Dimensioning and tolerancing per ANSI Y14.5M, 1982
2. Controlling dimension: INCH
3. Dimensions do not include lead flash
4. Conforms to JEDEC outline TO-261AA

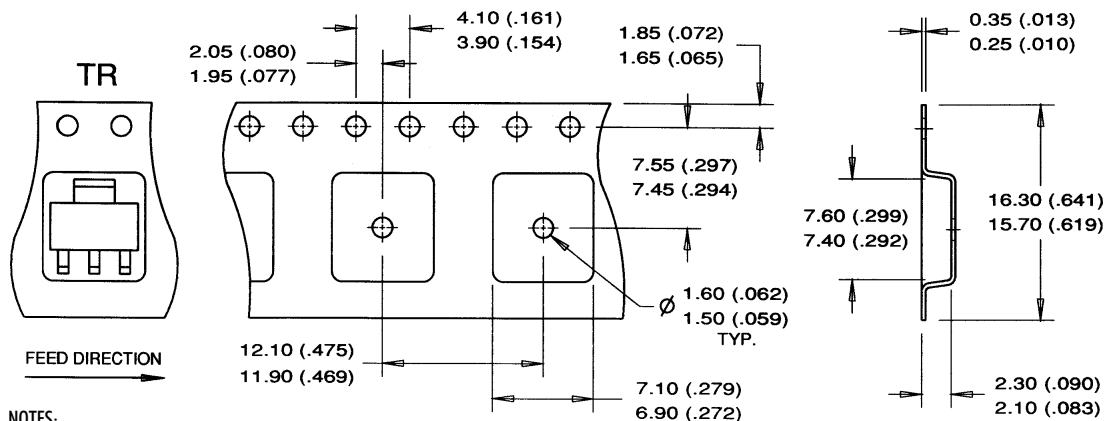
LEAD ASSIGNMENTS

1. Gate
2. Drain
3. Source
4. Drain

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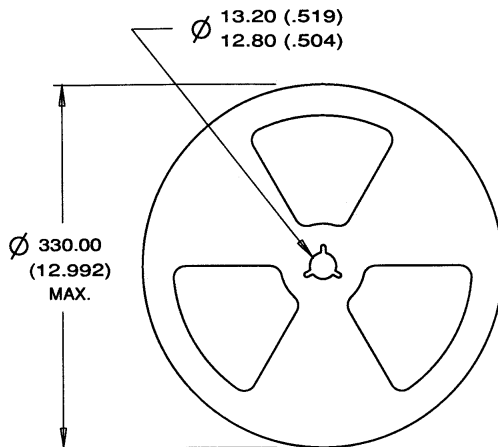
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Tape and Reel — SOT-223 (IRSF3031L)



NOTES:

1. Controlling dimension: MILLIMETER
2. Conforms to outline EIA-481 and EIA-541
3. Each $\varnothing$ 330.00 (13.00) reel contains 2,500 devices.



NOTES:

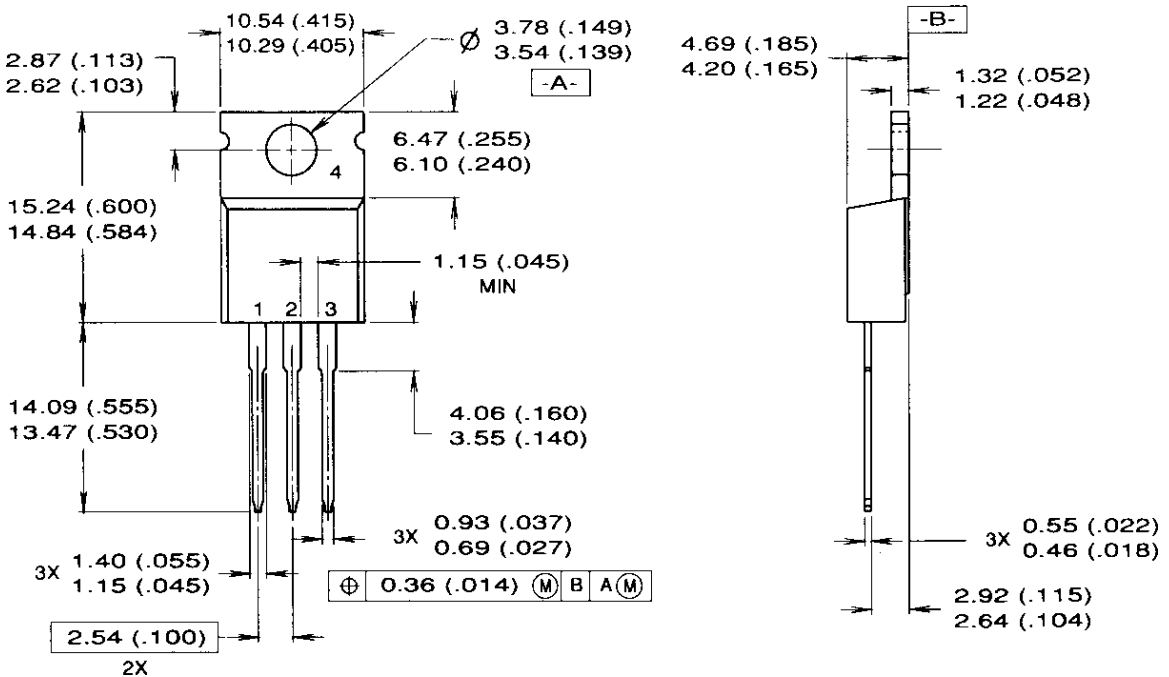
1. Controlling dimension: MILLIMETER
2. Conforms to outline EIA-481-1
- ③ Dimension measured at hub
- ④ Includes flange distortion at outer edge

To Order

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Case Outline — TO-220AB (IRSF3031)



NOTES:

1. Dimensioning and tolerancing per ANSI Y14.5M, 1982
2. Controlling dimension: INCH
3. Dimensions shown are in millimeters (inches)
4. Conforms to JEDEC outline TO-251AA
5. Dimension does not include solder dip. Solder dip max. +0.16 (.006)

LEAD ASSIGNMENTS

1. Gate
2. Drain
3. Source
4. Drain

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Data and specifications subject to change without notice.

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