

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

V _{ds} (clamp)	50 V
R _{ds} (on)	200 mΩ
I _{ds} (sd)	1.8 A
T _j (sd)	165°C
EAS	200 mJ

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.

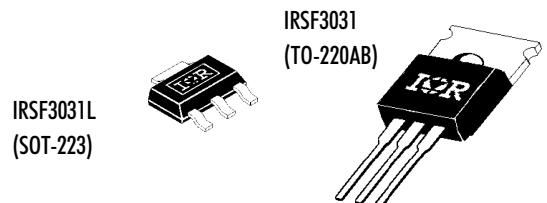
The on-chip protection circuit latches off the power MOSFET in case the drain current exceeds 4A (typical) or the junction temperature exceeds 165°C (typical) and keeps it off until the input is driven below the Reset Threshold voltage. The drain-to-source voltage is actively clamped at 55V (typical) 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.

Applications

- Solenoid Driver
- DC Motor Driver

Available Packages



Absolute Maximum Ratings

Absolute Maximum Ratings indicate sustained limits beyond which damage to the device may occur. (T_c = 25°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 ≤ 25°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		

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	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	$V_{ds} = 5\text{V}, I_{ds} < 10\mu\text{A}$
$I_{i,on}$	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.)

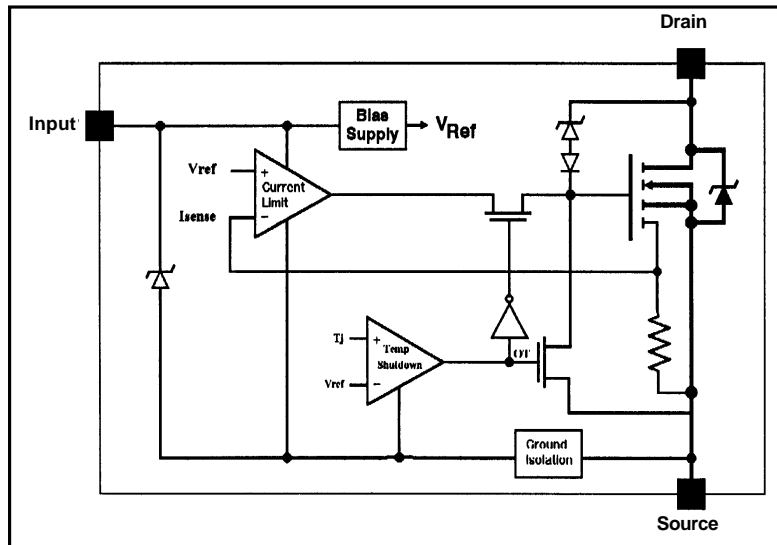
		Minimum	Typical	Maximum	Units	Test Conditions
t_{don}	Turn-On Delay Time	—	—	30	μs	$V_{in} = 2\text{V to } 5\text{V}, 50\% \text{ to } 90\%$
t_r	Rise Time	—	—	30		$V_{in} = 2\text{V to } 5\text{V}, 90\% \text{ to } 10\%$
t_{doff}	Turn-Off Delay Time	—	—	30		$V_{in} = 2\text{V to } 5\text{V}, 50\% \text{ to } 10\%$
t_f	Fall Time	—	—	30		$V_{in} = 2\text{V to } 5\text{V}, 10\% \text{ to } 90\%$
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

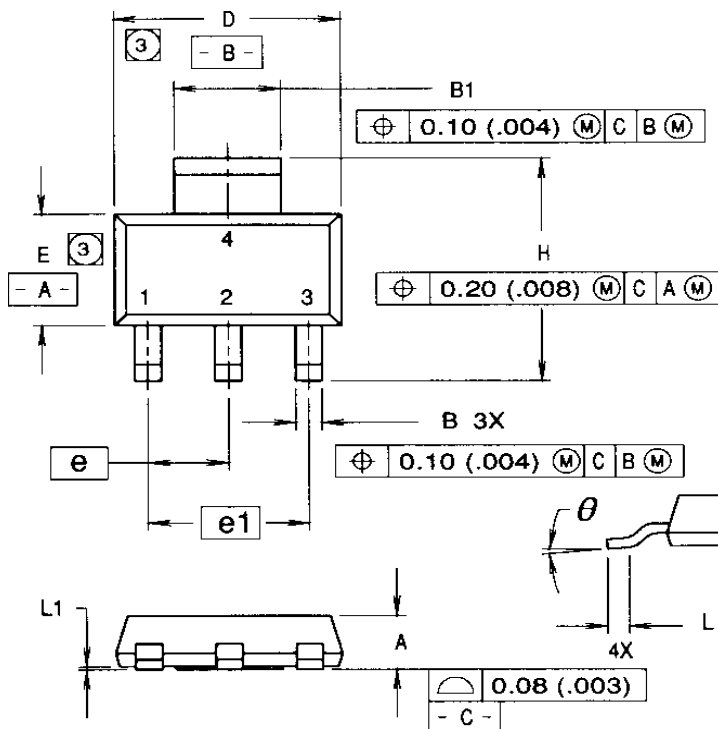
($T_C = 25^\circ\text{C}$ unless otherwise specified. Min/Max specifications are for $T_C = -40^\circ\text{C}$ to $T_C = +125^\circ\text{C}$ unless otherwise specified.)

		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
θ	10° MAX		10° MAX	

NOTES:

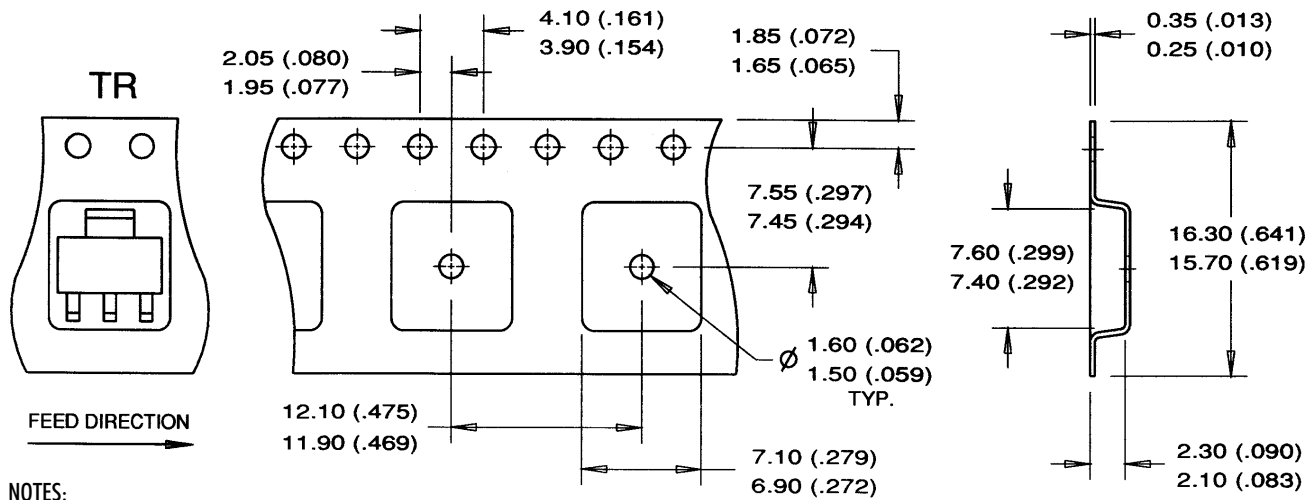
1. Dimensioning and tolerancing per ANSI Y14.5M, 1982
2. Controlling dimension: INCH
3. Dimensions do not include lead flash
- ④ Conforms to JEDEC outline TO-261AA

LEAD ASSIGNMENTS

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

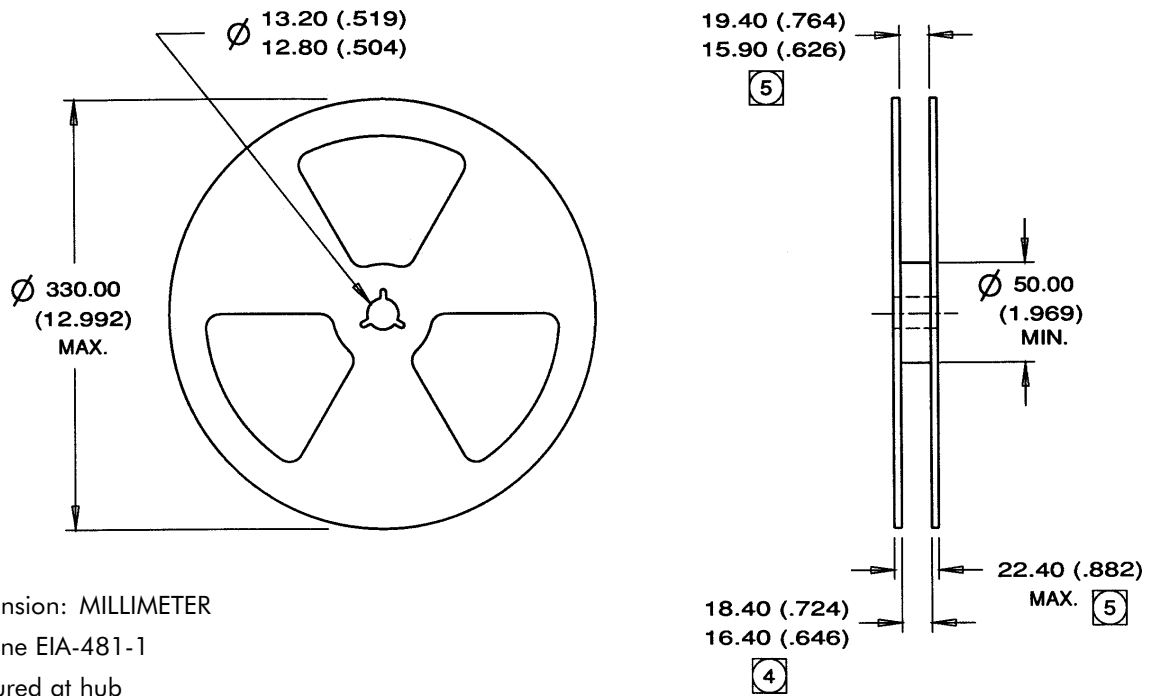
IRSF3031

Tape and Reel — SOT-223 (IRSF3031L)



NOTES:

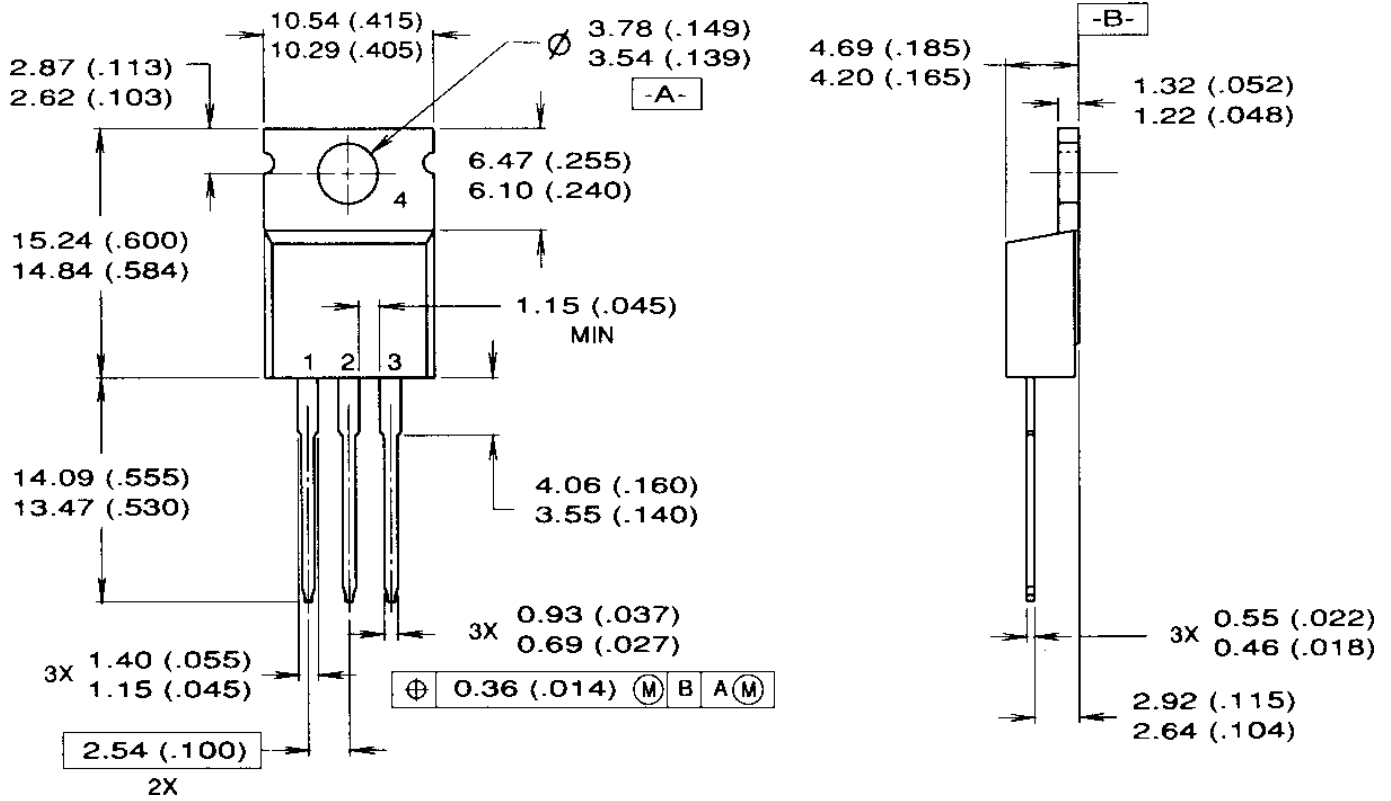
1. Controlling dimension: MILLIMETER
2. Conforms to outline EIA-481 and EIA-541
3. Each \varnothing 330.00 (13.00) reel contains 2,500 devices.



NOTES:

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

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