

FULLY PROTECTED POWER MOSFET SWITCH

IRSF3021

Features

- Controlled Slew Rate Reduces EMI
- Over Temperature Protection with Auto-Restart
- Linear Current-Limit Protection
- Active Drain-to-Source Clamp
- ESD Protection
- Compatible with Standard Power MOSFET
- Low Operating Input Current
- Monolithic Construction
- Logic Level Input Threshold

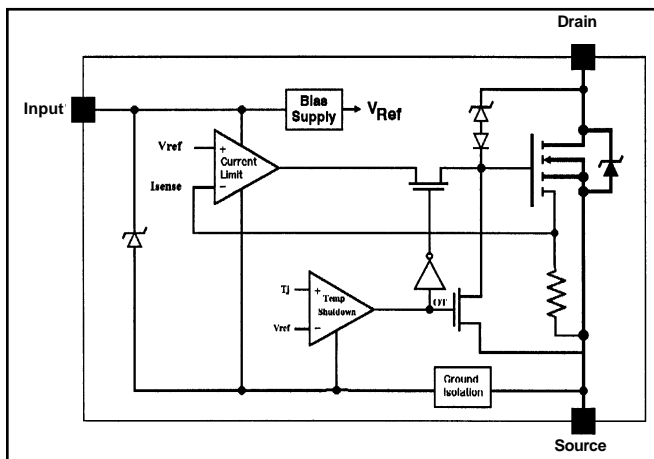
Description

The IRSF3021 Lamp and DC Motor Driver is a fully protected three terminal monolithic SMART POWER MOSFET that features current limiting, over-temperature protection, gate-to-source ESD protection and gate-to-drain clamp for over-voltage protection.

The on-chip protection circuit limits the drain current in the on-state. The over-temperature circuitry turns off the POWER MOSFET when the junction temperature exceeds 165°C. The device restarts automatically once it has cooled down below the reset temperature.

The IRSF3021 is specifically designed for driving loads that require overload protection and in-rush current control while operating in automotive and industrial environments. Targeted applications include resistive loads such as lamps or capacitive loads such as airbag squibs and DC motor drives.

IRSF3021 Block Diagram

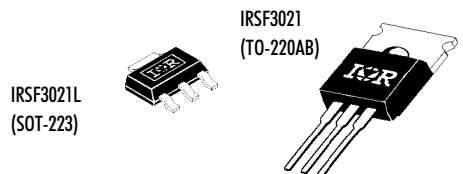


$V_{ds}(clamp)$	50 V
$R_{ds}(on)$	200 m Ω
I_{lim}	3.0 A
$T_{j}(sd)$	165°C
EAS	200 mJ

Applications

- Cabin Lighting
- Airbag System
- Programmable Logic Controller
- DC Motor Drive

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.)

		Minimum	Maximum	Units	Test Conditions
V _{ds, max}	Continuous Drain to Source Voltage	—	50	V	
V _{in, max}	Continuous Input Voltage	-0.3	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, 1.5k Ω
V _{esd2}	Electrostatic Discharge Voltage (Machine Model)	—	1000		200pF, 0 Ω
T _{JOP}	Operating Junction Temperature Range	-40	self-limited	°C	
T _{Stg}	Storage Temperature Range	-40	175		
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} = 6A, t _p = 700 μs
R _{ds(on)}	Drain to Source On Resistance	—	155	200	m Ω	V _{in} = 5V, I _{ds} = 2A
I _{dss}	Drain to Source Leakage Current	—	—	250	μA	V _{ds} = 40V, V _{in} = 0V
V _{th}	Input Threshold Voltage	1.0	2.0	3.0	V	V _{ds} = V _{in} , I _{ds} + I _{in} = 10mA
I _{i, on}	Input Supply Current (Normal Operation)	—	100	300	μA	V _{in} = 5V
I _{i, off}	Input Supply Current (Protection Mode)	—	500	—	μA	V _{in} = 5V
V _{in, clamp}	Input Clamp Voltage	9	10	—	V	I _{in} = 1mA
V _{sd}	Body-Drain Diode Forward Drop ^②	—	1.5	—	V	I _{ds} = -2A, R _{in} = 1k Ω

Thermal Characteristics

		Minimum	Typical	Maximum	Units	Test Conditions
R θ_{jc}	Junction to Case	—	—	4	°C/W	TO-220AB
R θ_{jA}	Junction to Ambient	—	—	60		
R θ_{jc}	Junction to PCB	—	—	40	°C/W	SOT-223
R θ_{jA}	Junction to PCB ^①	—	—	60		

Switching Electrical Characteristics

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

		Minimum	Typical	Maximum	Units	Test Conditions
t _{don}	Turn-On Delay Time	—	10	50	μs	V _{in} = 0V to 5V, 50% to 90%
t _r	Rise Time	—	30	80		V _{in} = 0V to 5V, 90% to 10%
t _{doff}	Turn-Off Delay Time	—	20	60		V _{in} = 0V to 5V, 50% to 10%
t _f	Fall Time	—	15	50		V _{in} = 0V to 5V, 10% to 90%
SR	Output Positive Slew Rate	-4	—	4	V/ μs	V _{in} = 0V to 5V, +dV _{ds} /dt
SR	Output Positive Slew Rate	-4	—	4		V _{in} = 0V to 5V, -dV _{ds} /dt

Protection Characteristics

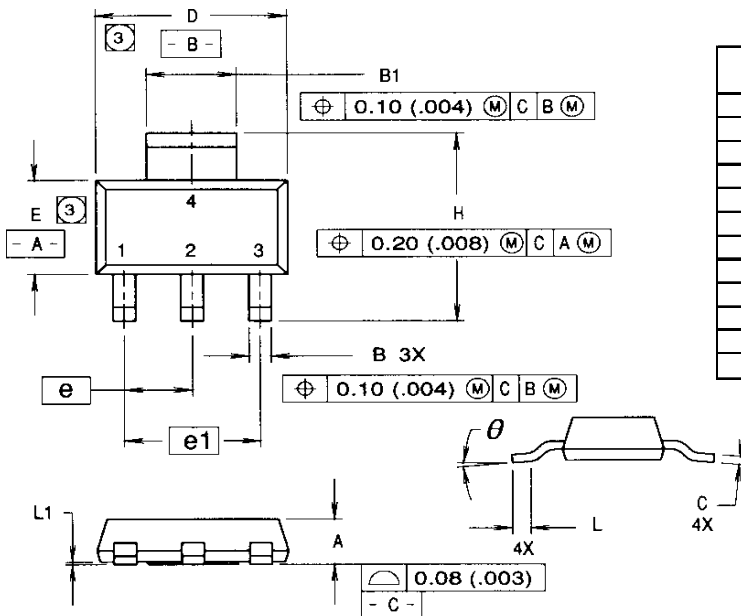
($T_C = 25\text{ }^\circ\text{C}$ unless otherwise specified. Min/Max specifications are for $T_C = -40\text{ }^\circ\text{C}$ to $T_C = +125\text{ }^\circ\text{C}$ unless otherwise specified.)

		Minimum	Typical	Maximum	Units	Test Conditions
$I_{ds(sd)}$	Current Limit	3.0	5.5	8.0	A	$V_{in} = 5V, V_{DS} = 14V$
$T_{j(sd)}$	Over Temperature Shutdown Threshold	155	165	—	$^\circ\text{C}$	$V_{in} = 5V, I_{ds} = 2A$
$V_{protect}$	Min. Input Voltage for Over-temp function	—	3	—	V	
t_{Iresp}	Current Limit Response Time	—	TBD	—	μs	
I_{peak}	Peak Short Circuit Current	—	10	—	A	
t_{Tresp}	Over-Temperature Response Time	—	TBD	—	μs	

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 $V_{in} = 0V$ and starting $T_j = 25\text{ }^\circ\text{C}$.
- 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.

Case Outline — SOT-223 (IRSF3021L)



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	

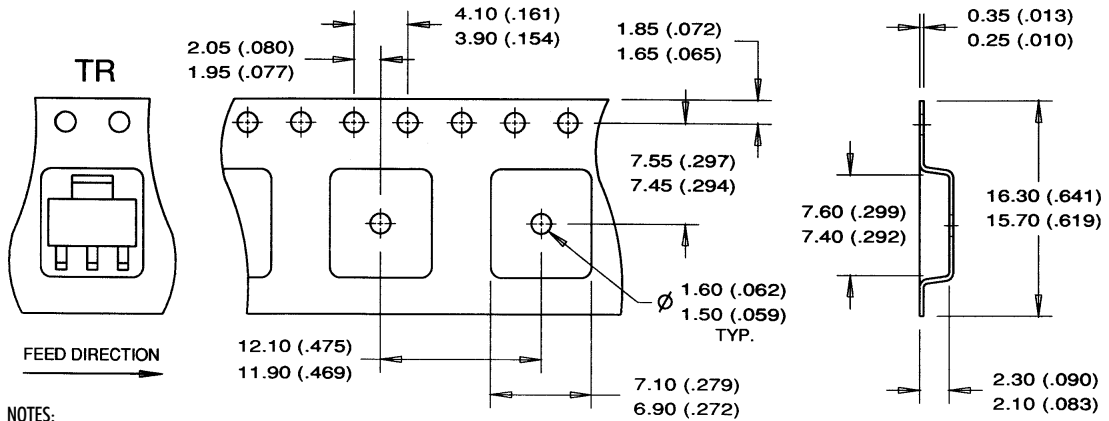
NOTES:

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

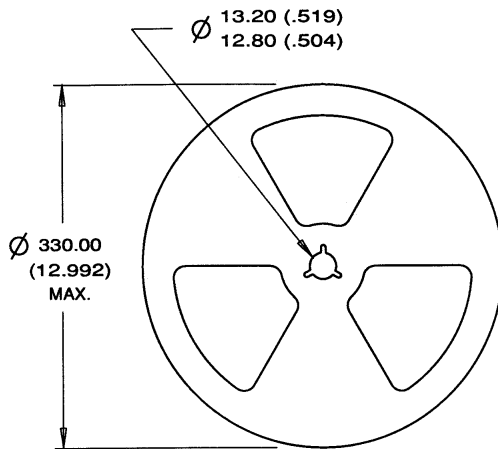
1. Gate
2. Drain
3. Source
4. Drain

Tape and Reel — SOT-223 (IRSF3021L)



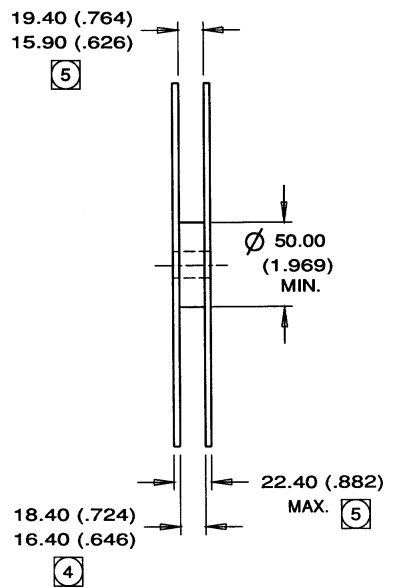
NOTES:

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.

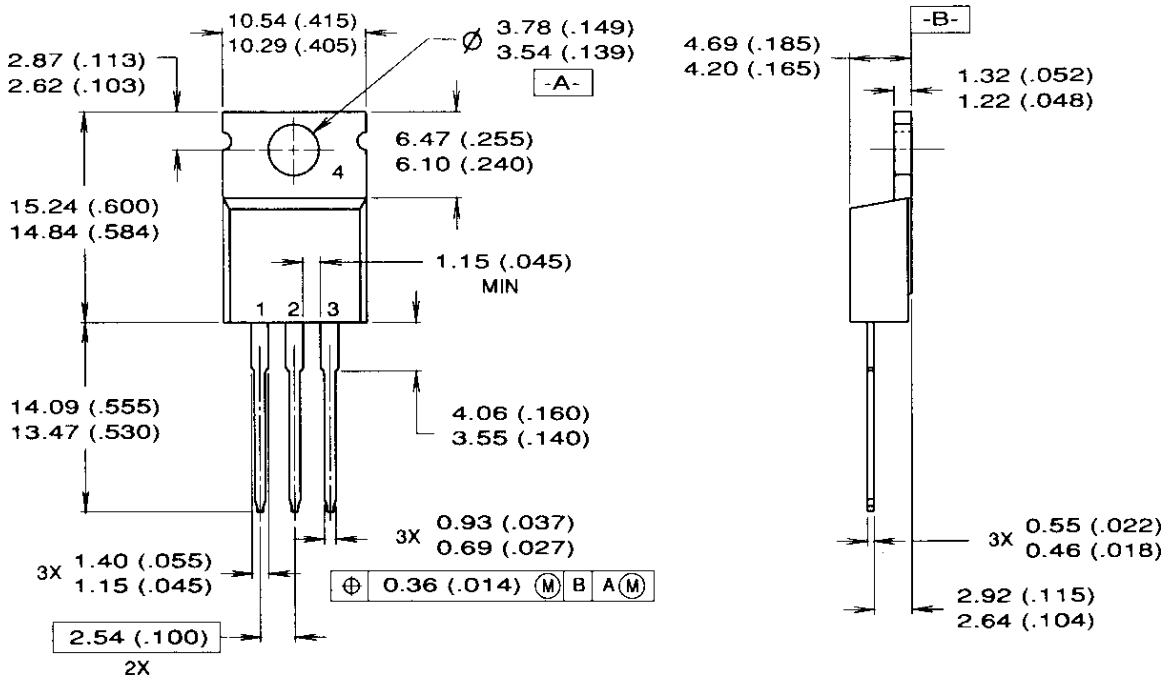


NOTES:

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 (IRSF3021)



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