

## FULLY PROTECTED POWER MOSFET SWITCH

### Features

- Controlled slew rate reduces EMI
- Over temperature protection with auto-restart
- Linear current-limit protection
- Active drain-to-source clamp
- ESD protection
- Lead compatible with standard Power MOSFET
- Low operating input current
- Monolithic construction

### 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, ESD protection and over-voltage protection.

The on-chip protection circuit limits the drain current at 5.5A (typical) in the on-state, when the load is short circuited. The over-temperature circuitry turns off the Power MOSFET when the junction temperature exceeds 165°C (typical). 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.

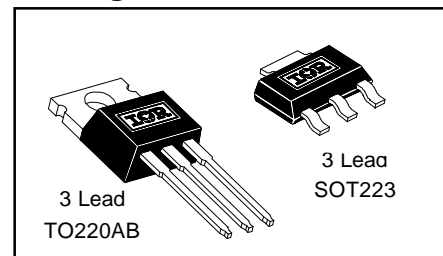
### Product Summary

$V_{ds(clamp)}$	50V
$R_{ds(on)}$	200m $\Omega$
$I_{lim}$	5.5A
$T_{j(sd)}$	165°C
EAS	200mJ

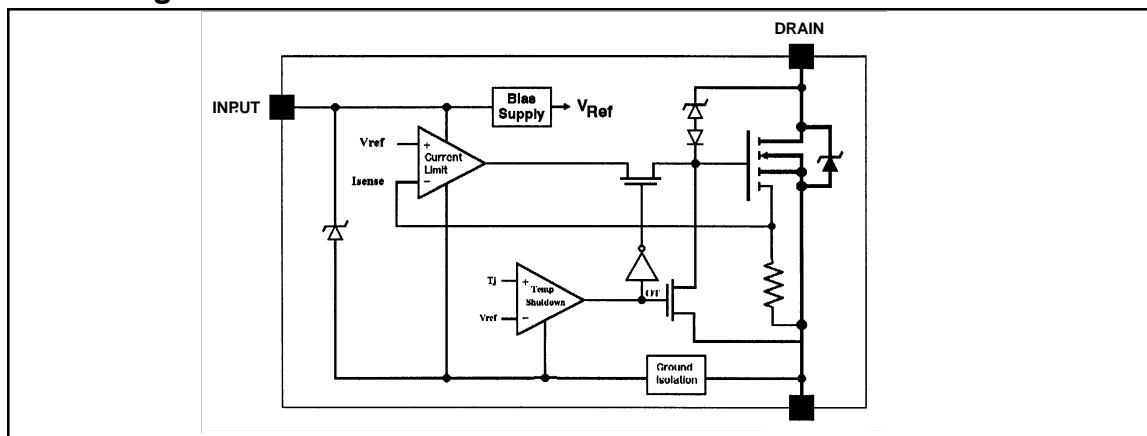
### Applications

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

### 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	W	$T_C \leq 25^\circ\text{C}$ , SOT223
EAS	Unclamped single pulse inductive energy <sup>②</sup>	—	200	mJ	
$V_{esd1}$	Electrostatic discharge voltage (Human Body Model)	—	4000	V	100pF, 1.5k $\Omega$
$V_{esd2}$	Electrostatic discharge voltage (Machine Model)	—	1000		200pF, 0 $\Omega$
$T_{Jop}$	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
$V_{ds, \text{clamp}}$	Drain to source clamp voltage	50	56	65	V	$I_{ds} = 6\text{A}$ , $t_p = 700 \mu\text{S}$
$R_{ds(\text{on})}$	Drain to source on resistance	—	155	200	m $\Omega$	$V_{in} = 5\text{V}$ , $I_{ds} = 2\text{A}$
$I_{dss}$	Drain to source leakage current	—	—	250	$\mu\text{A}$	$V_{ds} = 40\text{V}$ , $V_{in} = 0\text{V}$
$V_{th}$	Input threshold voltage	1.0	2.0	3.0	V	$V_{ds} = V_{in}$ , $I_{ds} + I_{in} = 10\text{mA}$
$I_{i, \text{on}}$	Input supply current (Normal Operation)	—	100	300	$\mu\text{A}$	$V_{in} = 5\text{V}$
$I_{i, \text{off}}$	Input supply current (Protection Mode)	—	250	500	$\mu\text{A}$	$V_{in} = 5\text{V}$
$V_{in, \text{clamp}}$	Input clamp voltage	9	10	—	V	$I_{in} = 1\text{mA}$
$V_{sd}$	Body-drain diode forward drop <sup>③</sup>	—	1.5	—		$I_{ds} = -2\text{A}$ , $R_{in} = 1\text{k}\Omega$

## Thermal Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$R_{thjc}$	Junction to case	—	—	4	°C/W	TO-220AB
$R_{thja}$	Junction to ambient	—	—	60		
$R_{thjc}$	Junction to case	—	—	40	°C/W	SOT-223
$R_{thja}$	Junction to PCB <sup>①</sup>	—	—	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 $\mu\text{S}$  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 $\Omega$  resistor in series with the input when the Body-Drain Diode is forward biased.

**Switching Electrical Characteristics**

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

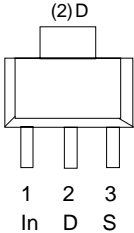
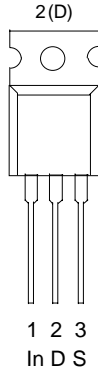
Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$t_{don}$	Turn-on delay time	—	10	50	$\mu s$	$V_{in} = 0V$ to $5V$ , 50% to 90%
$t_r$	Rise Time	—	30	80		$V_{in} = 0V$ to $5V$ , 90% to 10%
$t_{doff}$	Turn-off delay time	—	20	60		$V_{in} = 5V$ to $0V$ , 50% to 10%
$t_f$	Fall time	—	15	50	$V/\mu s$	$V_{in} = 5V$ to $0V$ , 10% to 90%
SR	Output positive slew rate	-4	—	4		$V_{in} = 0V$ to $5V$ , $+dV_{ds}/dt$
SR	Output negative slew rate	-4	—	4		$V_{in} = 5V$ to $0V$ , $-dV_{ds}/dt$

**Protection Characteristics**

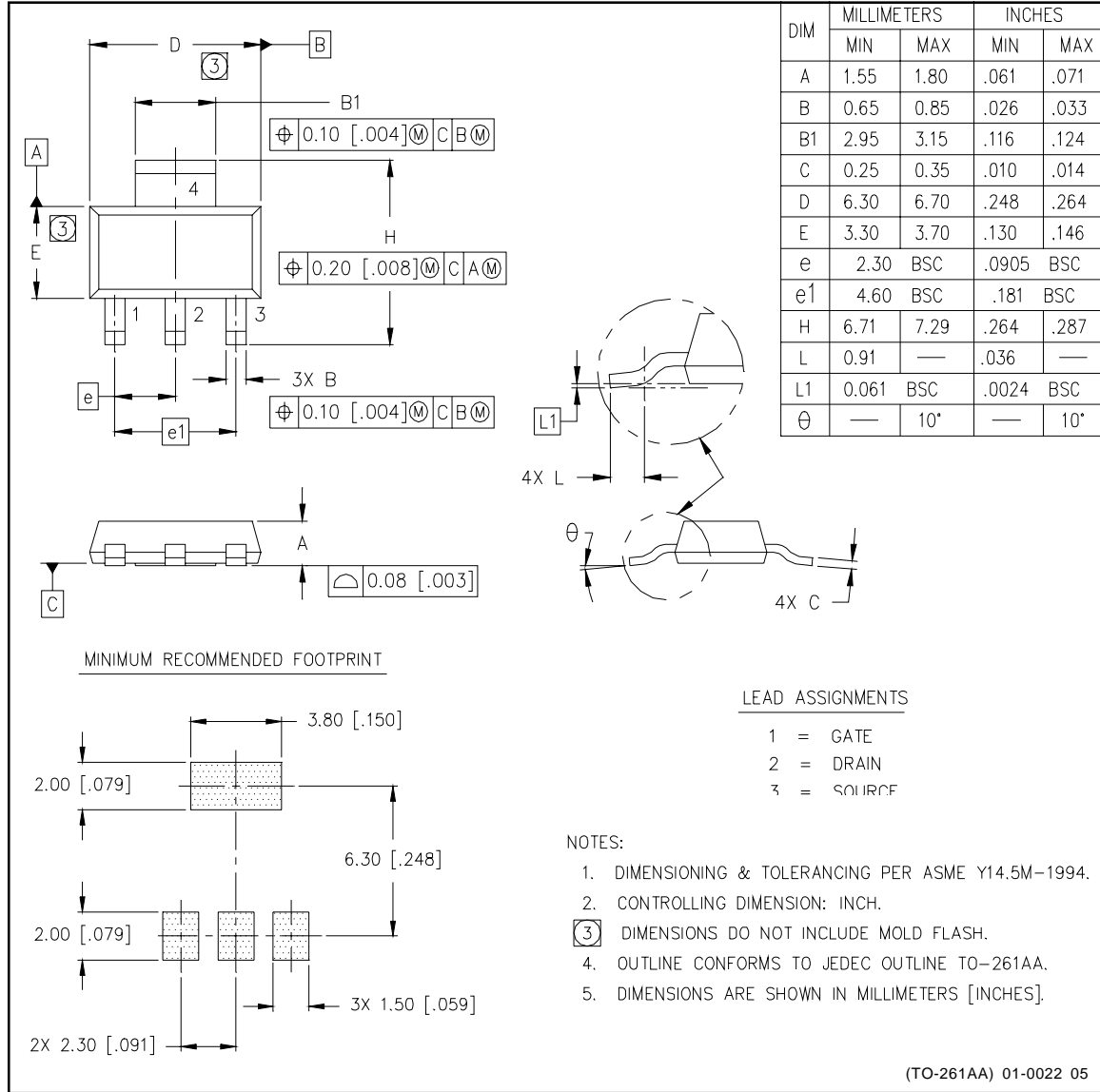
( $T_C = 25^\circ C$  unless otherwise specified.)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$I_{ds(lim)}$	Current limit	3.0	5.5	8.0	A	$V_{in} = 5V$ , $V_{ds} = 14V$
$T_{j(sd)}$	Over temperature shutdown threshold	155	165	—	$^\circ C$	$V_{in} = 5V$ , $I_{ds} = 2A$
$V_{protect}$	Min. input voltage for over-temp function	—	3	—	V	
$t_{lresp}$	Current limit response time	—	TBD	—	$\mu s$	
$I_{peak}$	Peak short circuit current	—	10	—	A	
$t_{Tresp}$	Over-temperature response time	—	TBD	—	$\mu s$	

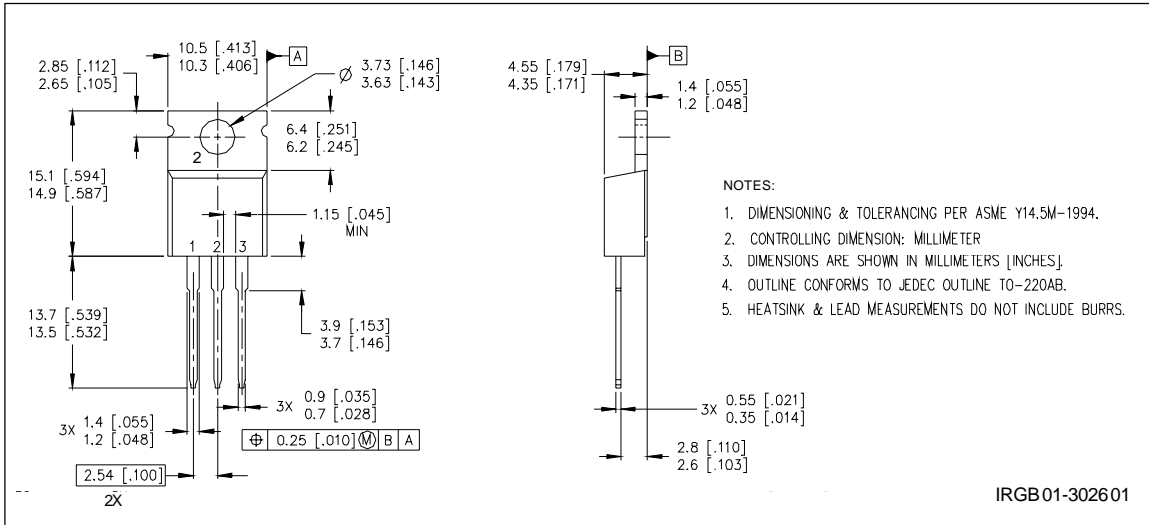
**Lead Assignments**

 <p>3 Lead - SOT223</p>	 <p>3 Lead - TO220</p>
<b>IRSF3021L</b>	<b>IRSF3021</b>
<b>Part Number</b>	

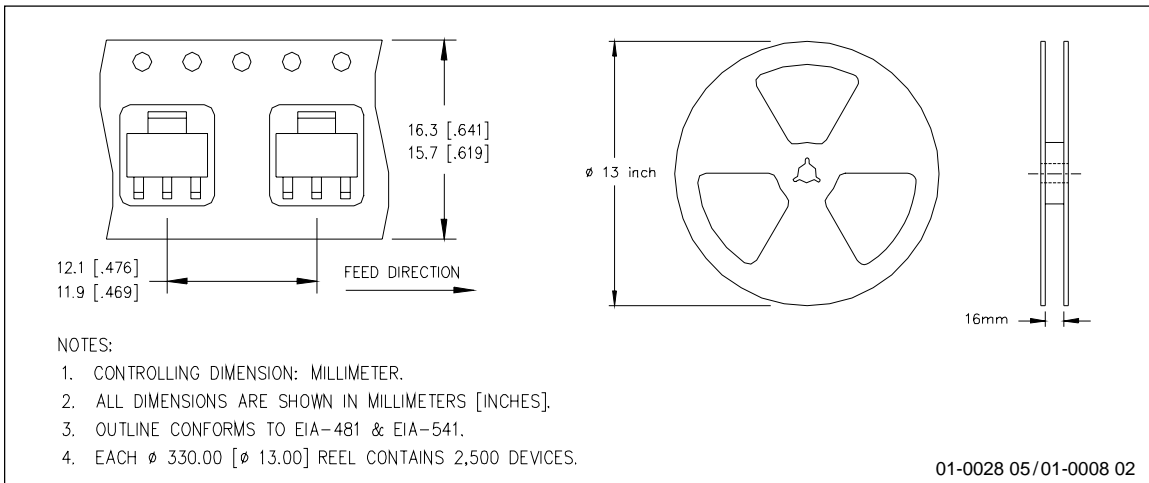
## Case Outline - SOT-223



**Case Outline 3 Lead - TO220**



**Tape & Reel - SOT223**



Note: For the most current drawings please refer to the IR website at:  
<http://www.irf.com/package/>