

## 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.

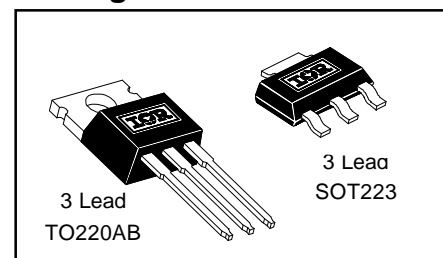
### Product Summary

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

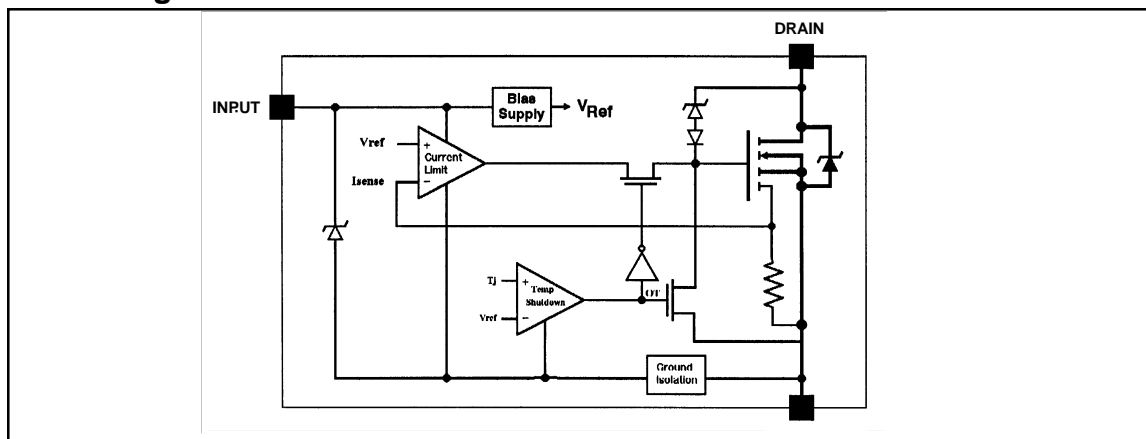
### Applications

- 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<sub>C</sub> = 25°C unless otherwise specified.)

Symbol	Parameter	Min.	Max.	Units	Test Conditions
V <sub>ds, max</sub>	Continuous drain to source voltage	—	50	V	
V <sub>in, max</sub>	Continuous input voltage	-0.3	10		
I <sub>ds</sub>	Continuous drain current	—	self limited	A	
P <sub>d</sub>	Power dissipation	—	30	W	T <sub>C</sub> ≤ 25°C, TO220
		—	3	W	T <sub>C</sub> ≤ 25°C, SOT223
EAS	Unclamped single pulse inductive energy <sup>②</sup>	—	200	mJ	
V <sub>esd1</sub>	Electrostatic discharge voltage (Human Body Model)	—	4000	V	100pF, 1.5kΩ
V <sub>esd2</sub>	Electrostatic discharge voltage (Machine Model)	—	1000		200pF, 0Ω
T <sub>Jop</sub>	Operating junction temperature range	-55	150	°C	
T <sub>Stg</sub>	Storage temperature range	-55	150		
T <sub>L</sub>	Lead temperature (soldering, 10 seconds)	—	300		

## Static Electrical Characteristics

(T<sub>C</sub> = 25°C unless otherwise specified.)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
V <sub>ds, clamp</sub>	Drain to source clamp voltage	50	56	65	V	I <sub>ds</sub> = 6A, t <sub>p</sub> = 700 μS
R <sub>ds(on)</sub>	Drain to source on resistance	—	155	200	mΩ	V <sub>in</sub> = 5V, I <sub>ds</sub> = 2A
I <sub>dss</sub>	Drain to source leakage current	—	—	250	μA	V <sub>ds</sub> = 40V, V <sub>in</sub> = 0V
V <sub>th</sub>	Input threshold voltage	1.0	2.0	3.0	V	V <sub>ds</sub> = V <sub>in</sub> , I <sub>ds</sub> + I <sub>in</sub> = 10mA
I <sub>i, on</sub>	Input supply current (Normal Operation)	—	100	300	μA	V <sub>in</sub> = 5V
I <sub>i, off</sub>	Input supply current (Protection Mode)	—	250	500	μA	V <sub>in</sub> = 5V
V <sub>in, clamp</sub>	Input clamp voltage	9	10	—	V	I <sub>in</sub> = 1mA
V <sub>sd</sub>	Body-drain diode forward drop <sup>③</sup>	—	1.5	—		I <sub>ds</sub> = -2A, R <sub>in</sub> = 1kΩ

## Thermal Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
R <sub>thjc</sub>	Junction to case	—	—	4	°C/W	TO-220AB
R <sub>thja</sub>	Junction to ambient	—	—	60		
R <sub>thjc</sub>	Junction to case	—	—	40	°C/W	SOT-223
R <sub>thja</sub>	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<sub>AS</sub> is tested with a constant current source of 6A applied for 700μS with V<sub>in</sub> = 0V and starting T<sub>j</sub> = 25°C.
- ③ Input current must be limited to less than 5mA with a 1kΩ 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.)

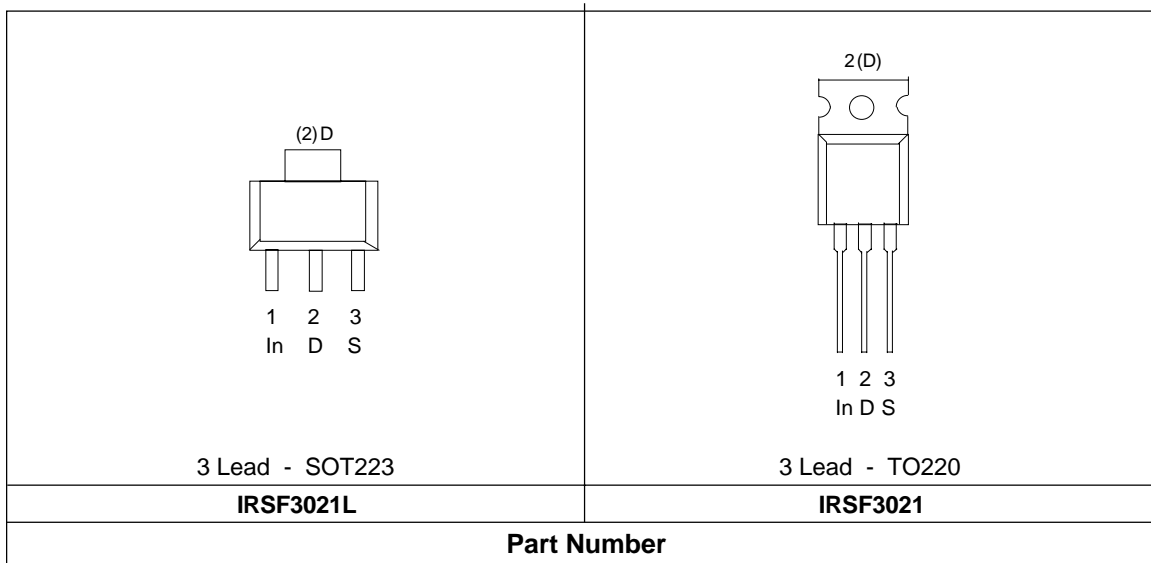
Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$t_{don}$	Turn-on delay time	—	10	50	$\mu s$	$V_{in} = 0V$ to 5V, 50% to 90%
$t_r$	Rise Time	—	30	80		$V_{in} = 0V$ to 5V, 90% to 10%
$t_{doff}$	Turn-off delay time	—	20	60		$V_{in} = 5V$ to 0V, 50% to 10%
$t_f$	Fall time	—	15	50	V/ $\mu s$	$V_{in}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

**Protection Characteristics**

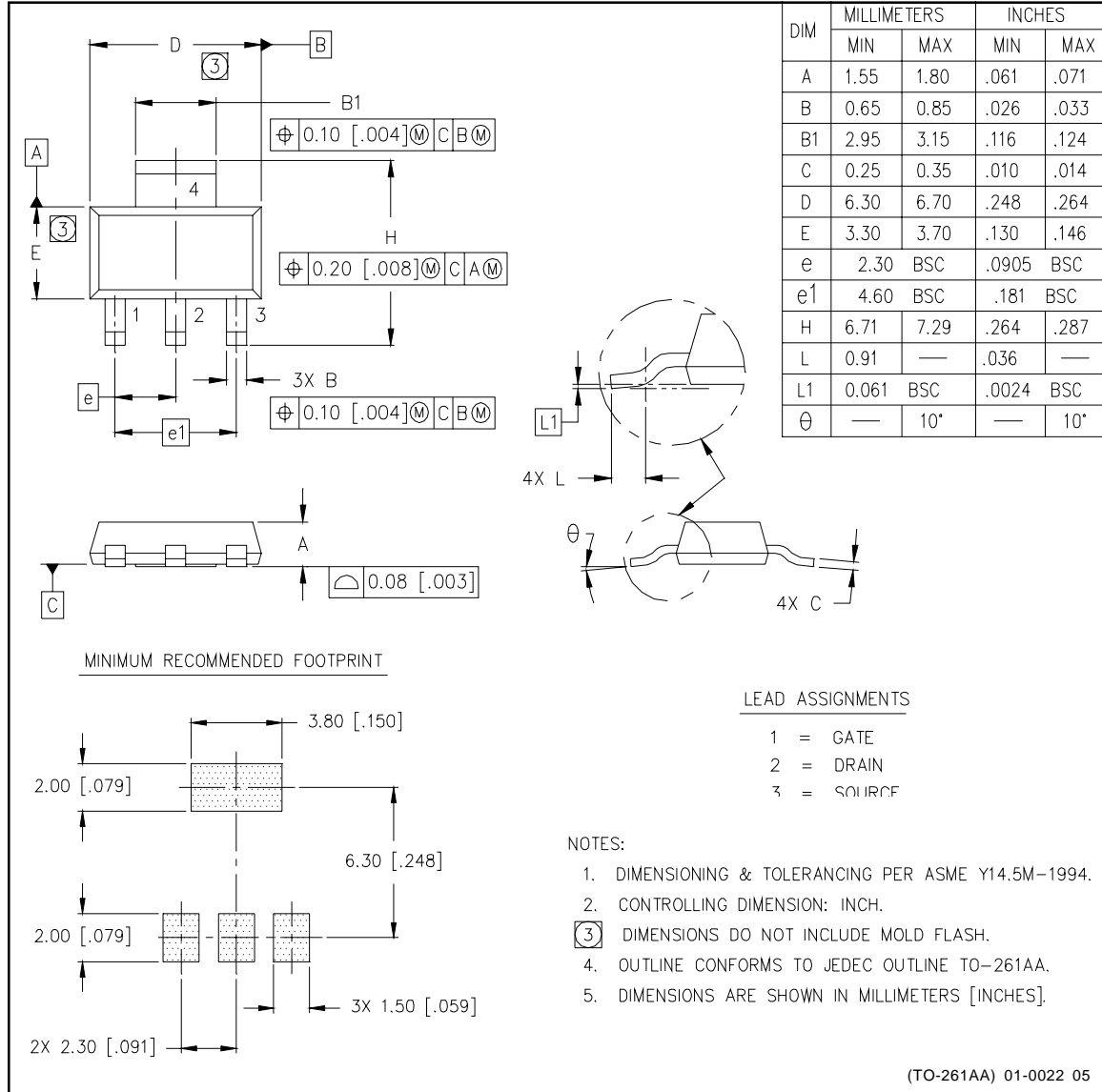
( $T_C = 25^\circ C$  unless otherwise specified.)

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	
$t_{lres}$	Current limit response time	—	TBD	—	$\mu s$	
$I_{peak}$	Peak short circuit current	—	10	—	A	
$t_{Tresp}$	Over-temperature response time	—	TBD	—	$\mu s$	

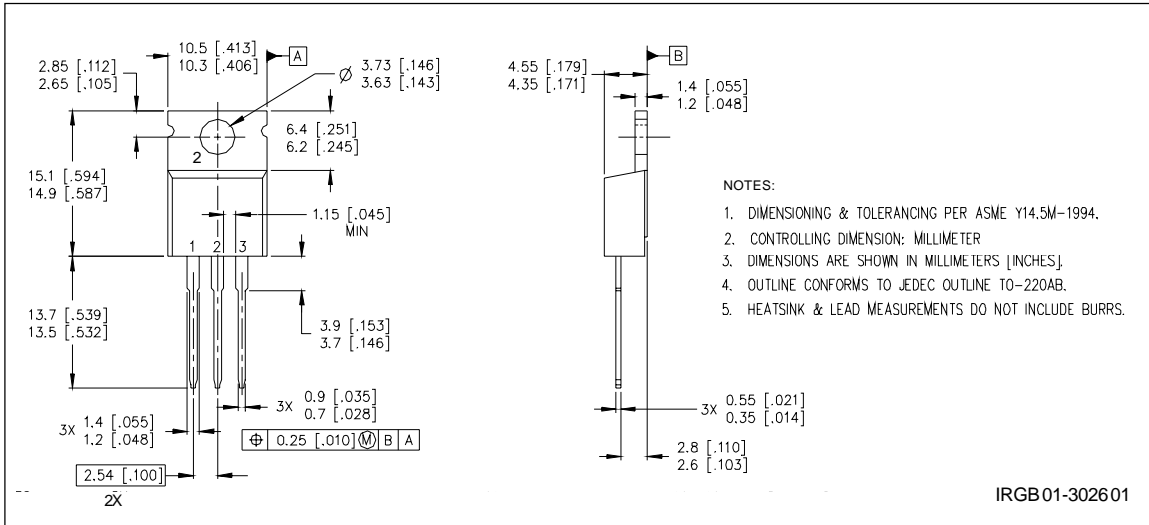
**Lead Assignments**



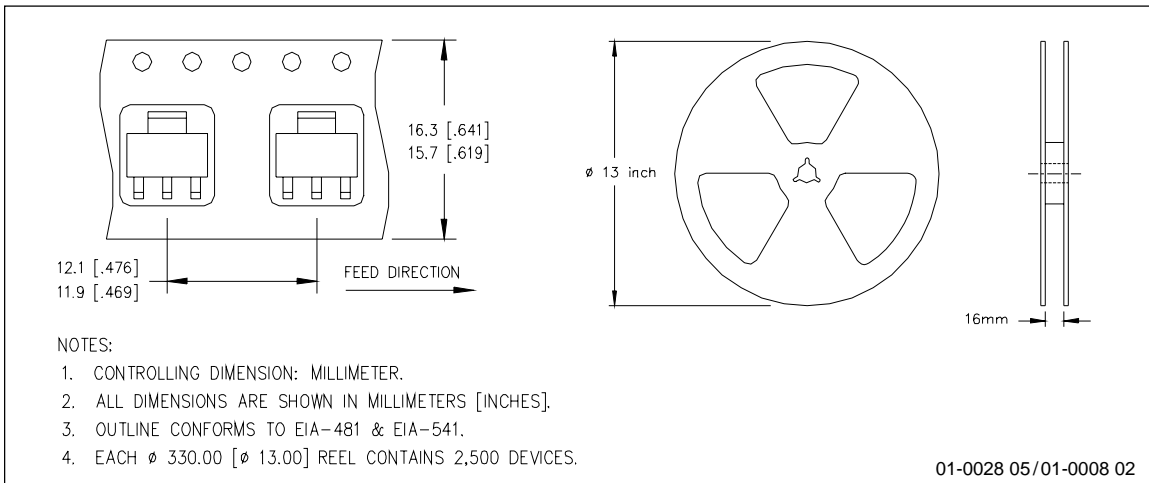
## Case Outline - SOT-223



**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/>