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INTELLIGENT POWER LOW SIDE SWITCH

Features

- Over temperature shutdown
- Over current shutdown
- Active clamp
- Low current & logic level input
- ESD protection
- Optimized Turn On/Off for EMI
- Diagnostic on the input current

Description

The AUIPS2031R is a three terminal Intelligent Power Switch (IPS) that features a low side MOSFET with over-current, over-temperature, ESD protection and drain to source active clamp. This device offers protections and the high reliability required in harsh environments. The switch provides efficient protection by turning OFF the power MOSFET when the temperature exceeds 165°C or when the drain current reaches 15A. The device restarts once the input is cycled. A serial resistance connected to the input provides the diagnostic. The avalanche capability is significantly enhanced by the active clamp and covers most inductive load demagnetizations.

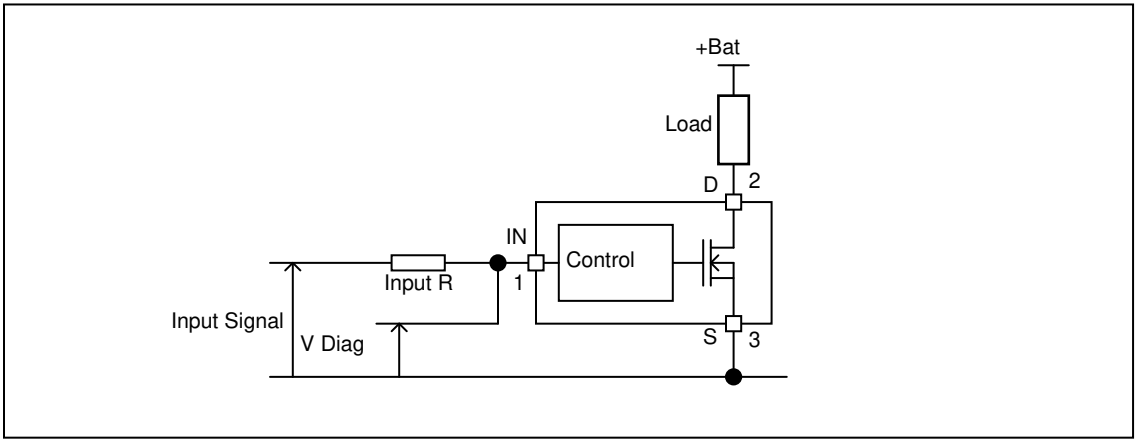
Product Summary

Rds(on)	60mΩ (max.)
Vclamp	68V
Ishutdown	10A (min.)

Packages

DPak
AUIPS2031R

Typical Connection



Qualification Information†

Qualification Level		Automotive (per AEC-Q100††)	
		Comments: This family of ICs has passed an Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.	
Moisture Sensitivity Level		DPAK-3L	MSL1, 260°C (per IPC/JEDEC J-STD-020)
ESD	Machine Model	Class M3 (+/-400V) (per AEC-Q100-003)	
	Human Body Model	Class H1C (+/-2000V) (per AEC-Q100-002)	
	Charged Device Model	Class C4 (+/-1000V) (per AEC-Q100-011)	
IC Latch-Up Test		Class II, Level A (per AEC-Q100-004)	
RoHS Compliant		Yes	

† Qualification standards can be found at International Rectifier's web site http://www.irf.com/
†† Exceptions to AEC-Q100 requirements are noted in the qualification report.
††† Higher MSL ratings may be available for the specific package types listed here. Please contact your International Rectifier sales representative for further information.

Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. (Tj= -40°C..150°C, Vcc=6..50V unless otherwise specified).

Symbol	Parameter	Min.	Max.	Units
Vds	Maximum drain to source voltage	-0.3	60	V
Vin	Maximum input voltage	-0.3	6	V
Isd cont.	Max diode continuous current (limited by thermal dissipation) Rth=50°C/W	—	2.5	A
Pd	Maximum power dissipation (internally limited by thermal protection) Rth=50C°/W	—	2.5	W
Tj max.	Maximum operating junction temperature	-40	150	°C
	Maximum storage temperature	-55	150	

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
Rth1	Thermal resistance junction to ambient IPS2031R D-Pak std. footprint	70	—	°C/W
Rth2	Thermal resistance junction to ambient IPS2031R D-Pak 1" sqr. footprint	50	—	
Rth3	Thermal resistance junction to case IPS2031R D-Pak	2.5	—	

Recommended Operating Conditions

These values are given for a quick design. For operation outside these conditions, please consult the application notes.

Symbol	Parameter		Min.	Max.	Units
VIH	High level input voltage		4	5.5	
VIL	Low level input voltage		0	0.5	
Ids	Continuous drain current, Tambient=85°C, Tj=125°C, Vin=5V,Rth=70°C/W		—	2.3	A
Rin	Recommended resistor in series with IN pin	Input signal voltage=5V (1)	0.5	1.5	kΩ
		Input signal voltage=4V (1)	0.5	1	
Max. t rise	Max. input signal rising time (from 10% to 90%)(2)		—	0.5	µs

(1) Input signal of the pulse generator not the voltage on the IN pin of the device. Do not connect any other component on the input.

(2) Max. t rise is for the input signal of the pulse generator not on the IN pin voltage of the device

Static Electrical Characteristics

Tj=-40..150°C, Vcc=6..50V (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Rds(on)	ON state resistance Tj=25°C	—	45	60	mΩ	Vin=5V, Ids=5A
	ON state resistance Tj=150°C	—	80	110		
Idss1	Drain to source leakage current	—	0.1	1	µA	Vcc=14V, Vin=0V, Tj=25°C
Idss2	Drain to source leakage current	—	0.15	2		Vcc=50V, Vin=0V, Tj=25°C
V clamp1	Drain to source clamp voltage 1	63	68	—	V	Id=20mA See fig. 3 & 4
V clamp2	Drain to source clamp voltage 2	—	68	75		Id=1A
Vin clamp	IN to source pin clamp voltage	5.5	6.2	7.5		Iin=1mA
Vth	Input threshold voltage	1.1	2	2.8		Id=200mA
Iin, on	ON state IN positive current	10	40	80	µA	Vin=5V
Iin, off	OFF state IN positive current (after protection latched)	120	250	350		

Switching Electrical Characteristics

Vcc=28V, Resistive load=10Ω, Rinput=50Ω, Vin=5V, Tj=25°C

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Tdon	Turn-on delay time to 20%	0.5	2	5	µs	See figure 2
Tr	Rise time 20% to 80%	0.2	1.4	3		
Tdoff	Turn-off delay time to 80%	3	8	12		
Tf	Fall time 80% to 20%	0.2	1.4	3		
Eon + Eoff	Turn on and off energy	—	110	—	µJ	

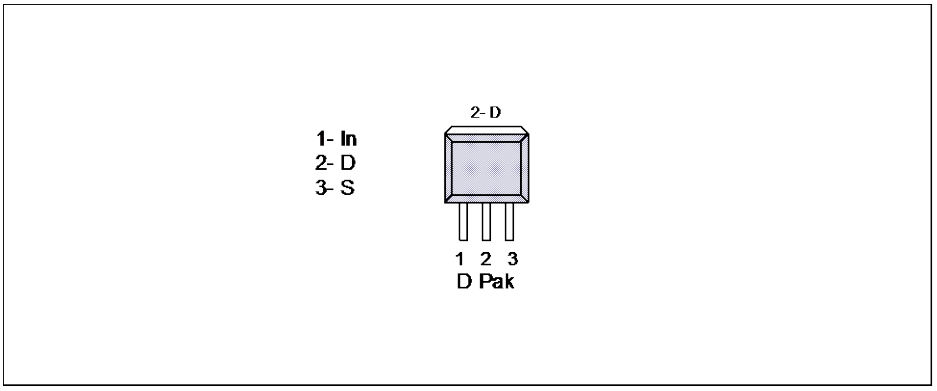
Protection Characteristics

Tj=-40..150°C, Vcc=6..50V (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Tsd	Over temperature threshold	150(2)	165	—	°C	See figure 1
Isd	Over current threshold	10	15	20	A	See figure 1
Vreset	IN protection reset threshold	0.9	1.6	2	V	
Treset	Time to reset protection	15	50	500	µs	Vin=0V, Tj=25°C

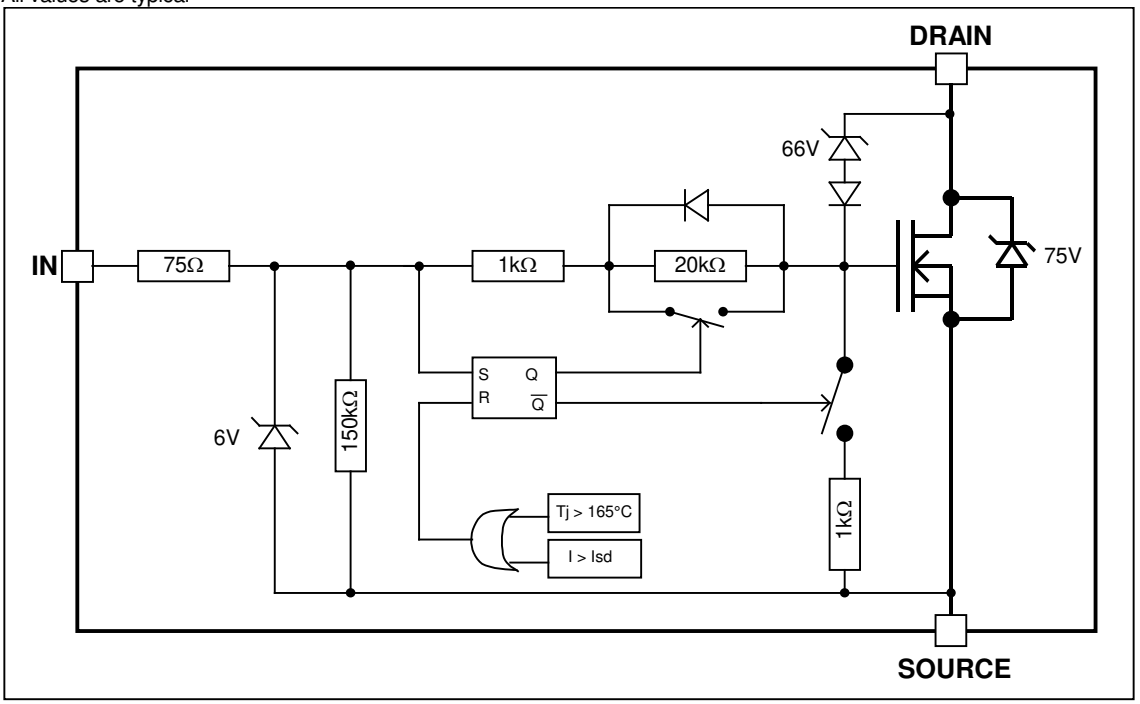
(2) Guaranteed by design

Lead Assignments



Functional Block Diagram

All values are typical



All curves are typical values. Operating in the shaded area is not recommended.

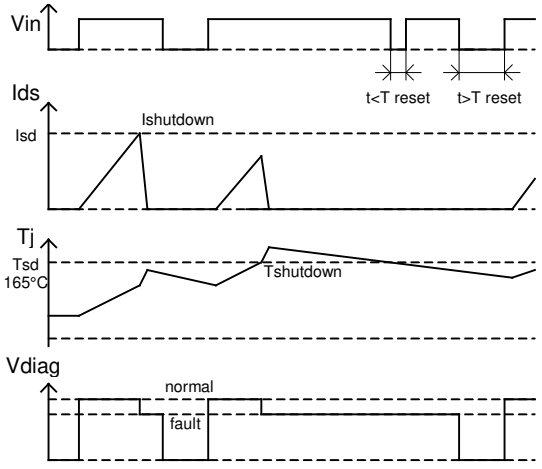


Figure 1 – Timing diagram

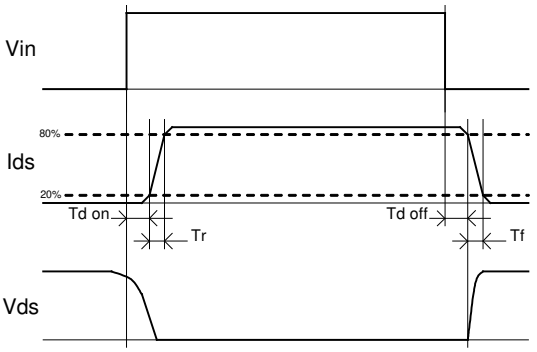


Figure 2 – IN rise time & switching definitions

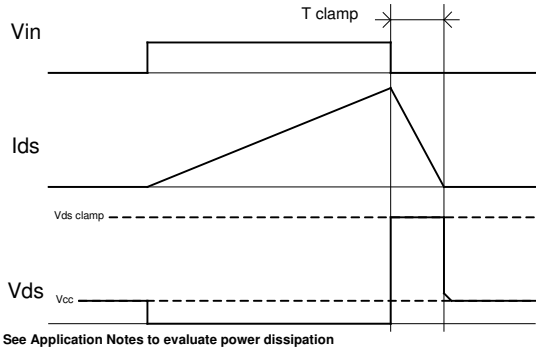


Figure 3 – Active clamp waveforms

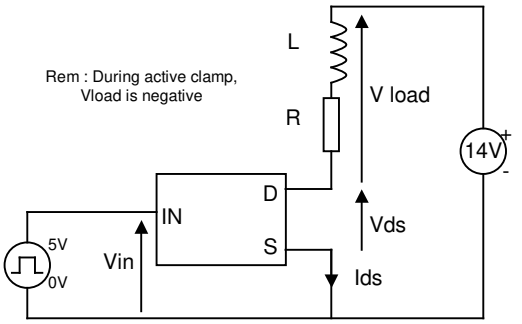


Figure 4 – Active clamp test circuit

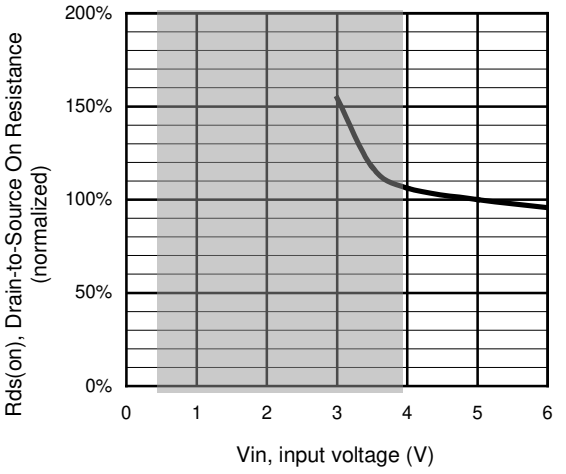


Figure 5 – Normalized Rdson (%) Vs Input voltage (V)

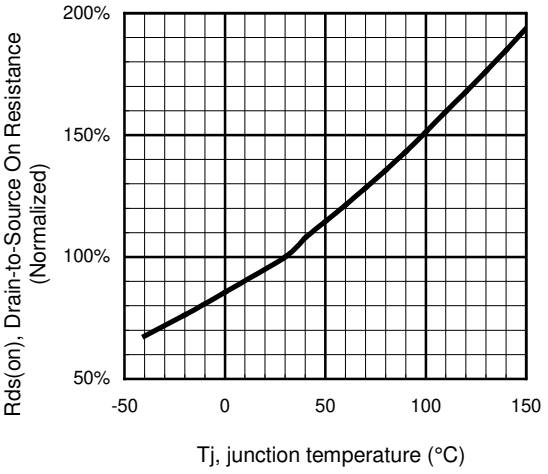


Figure 6 - Normalized Rds(on) (%) Vs Tj (°C)

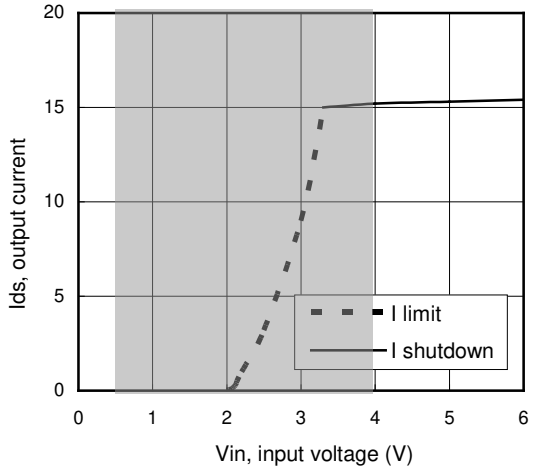


Figure 7 – Current limitation and current shutdown Vs Input voltage (V)

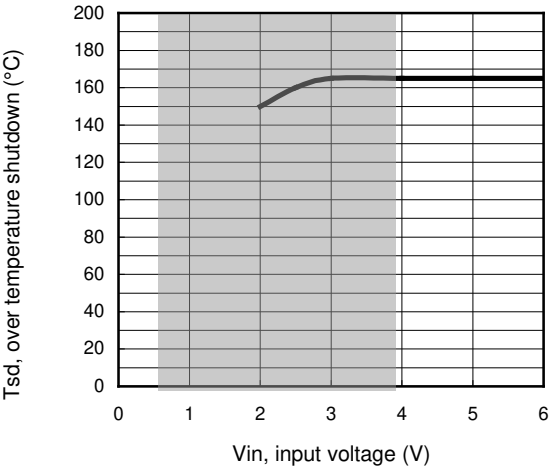


Figure 8 – Over temperature shutdown (°C) Vs input voltage (V)

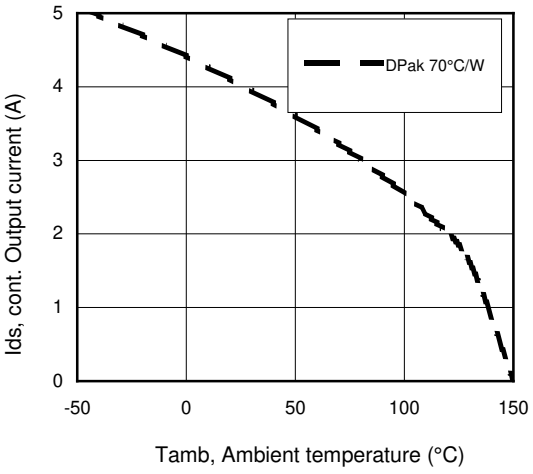


Figure 9 – Max. continuous output current (A) Vs Ambient temperature (°C)

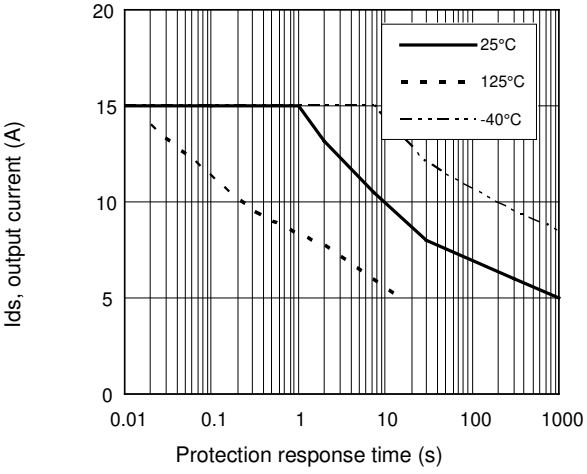


Figure 10 – Ids (A) Vs over temperature protection response time (s)

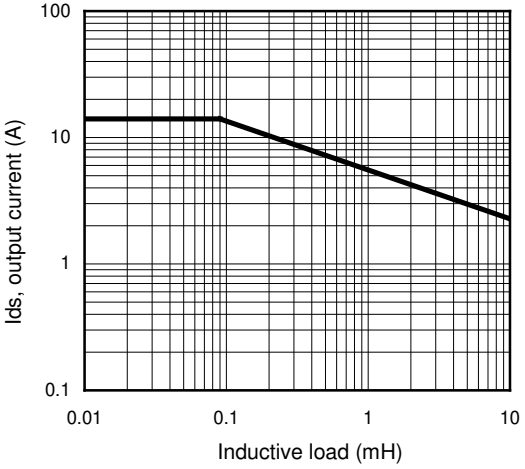


Figure 11 – Max. ouput current (A) Vs Inductive load (mH)

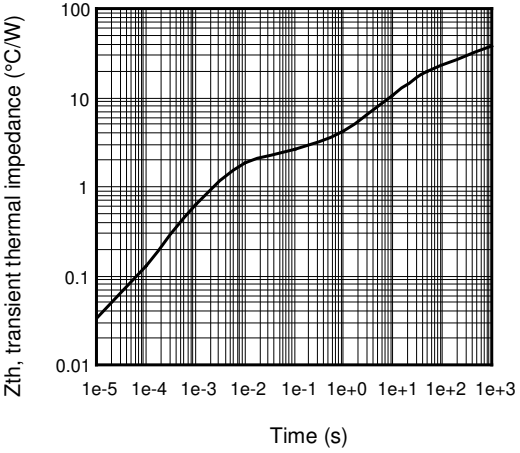


Figure 12 – Transient thermal impedance (°C/W) Vs time (s)

This is for single pulse when Tj=165°C and for repetitive pulses when Tj<115°C before turning off.

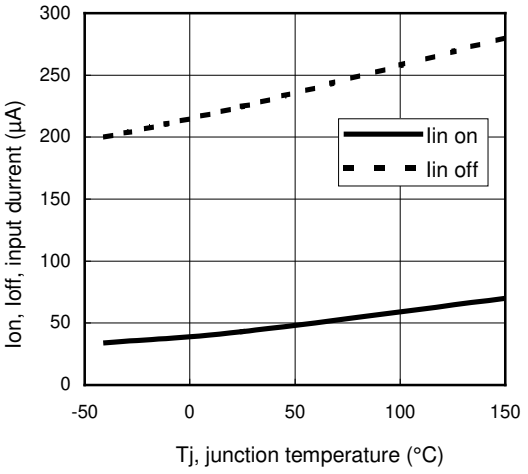
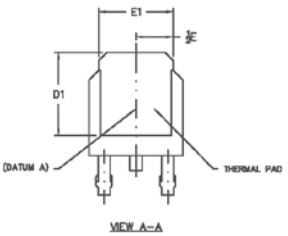
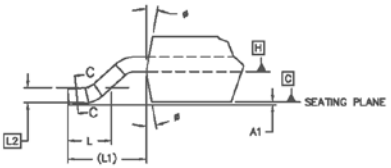


Figure 13 – Input current (µA) On and Off Vs junction temperature (°C)

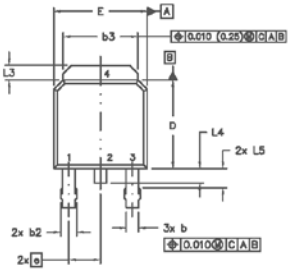
Case outline – Dpak



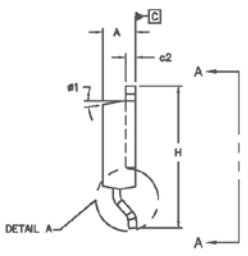
VIEW A–A

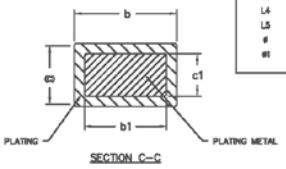


DETAIL "A"
ROTATED 90°



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	2.18	2.39	.086	.094	
A1		0.13		.005	
b	0.64	0.89	.025	.035	5
b1	0.64	0.79	.025	0.031	5
b2	0.76	1.14	.030	.045	
b3	4.95	5.46	.195	.215	
c	0.46	0.61	.018	.024	5
c1	0.41	0.56	.016	.022	5
c2	.046	0.89	.018	.035	5
D	5.97	6.22	.235	.245	6
D1	5.21	–	.205	–	4
E	6.35	6.73	.250	.265	6
E1	4.32	–	.170		4
e	2.29		.090 BSC		
H	9.40	10.41	.370	.410	
L	1.40	1.78	.055	.070	
L1	2.74 REF.		.108 REF.		
L2	0.51 BSC		.020 BSC		
L3	0.89	1.27	.035	.050	
L4		1.02		.040	
L5	1.14	1.52	.045	.060	3
ϕ	0°	10°	0°	10°	
ϕ1	0°	15°	0°	15°	





SECTION C–C

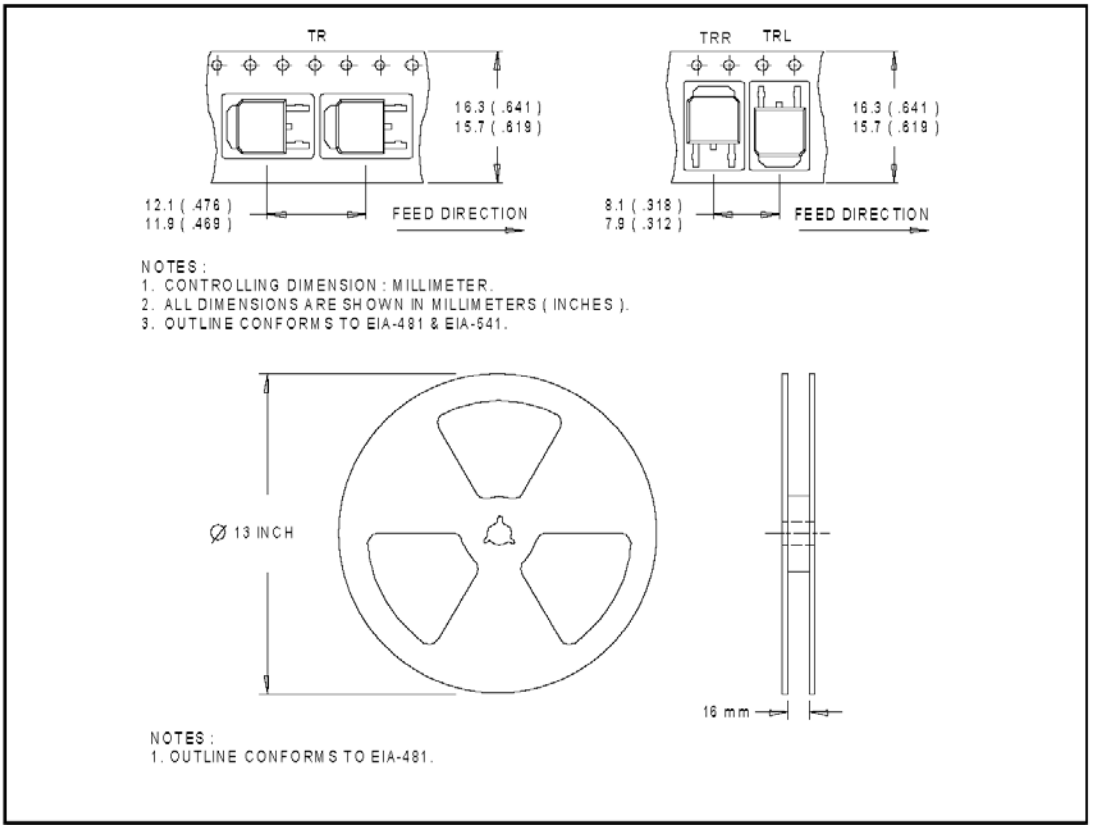
NOTES:

1.0 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M– 1994.
2.0 DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
3.0 LEAD DIMENSION UNCONTROLLED IN L5
4.0 DIMENSION D1 AND E1 ESTABLISH A MINIMUM MOUNTING SURFACE FOR THERMAL PAD.
5.0 SECTION C–C DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN .005 [0.127] AND .010 [0.2540 FROM THE LEAD TIP.
6.0 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
7.0 OUTLINE CONFORMS TO JEDEC OUTLINE TO–252AA.

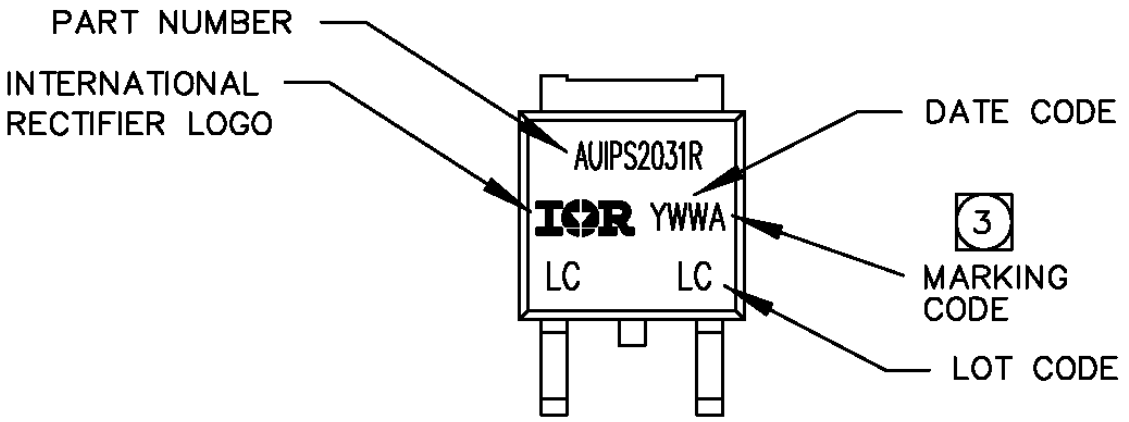
8.0 LEADS AND DRAIN ARE PLTED WITH 100% Sn

Tape & Reel – Dpak

Dimensions are shown in millimeters (inches)



Part Marking Information



Ordering Information

Base Part Number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIPS2031R	D-Pak-5-Lead	Tube	75	AUIPS2031R
		Tape and reel	2000	AUIPS2031RTR
		Tape and reel left	3000	AUIPS2031RTRL
		Tape and reel right	3000	AUIPS2031RTRR

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For technical support, please contact IR's Technical Assistance Center
http://www.irf.com/technical-info/

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101 N. Sepulveda Blvd., El Segundo, California 90245
Tel: (310) 252-7105

Revision History

Revision	Date	Notes/Changes
A4	March, 25th, 2010	Add tri-temp ds
A5	May, 10th 2010	Update before qual
A6	November, 17th 2010	Final release
A7	December, 7th 2010	Remove ESD section page3
A8	December, 9th 2010	Update qual page
B	June, 21st 2012	Update storage temperature
C	December, 3rd 2012	Update switching losses Add a note figure 11
D	April, 18th 2013	Update Recommended Input resistor

