International
IOR Rectifier

May 9th, 2012
Automotive grade

AUIPS2051L/AUIPS2052G

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

Applications

- Solenoids and relays
- 24V truck loads

Description

The AUIPS2051L/AUIPS2052G 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. The AUIPS2052 is a dual channel device while the AUIPS2051 is a single channel.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 1.8A. 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

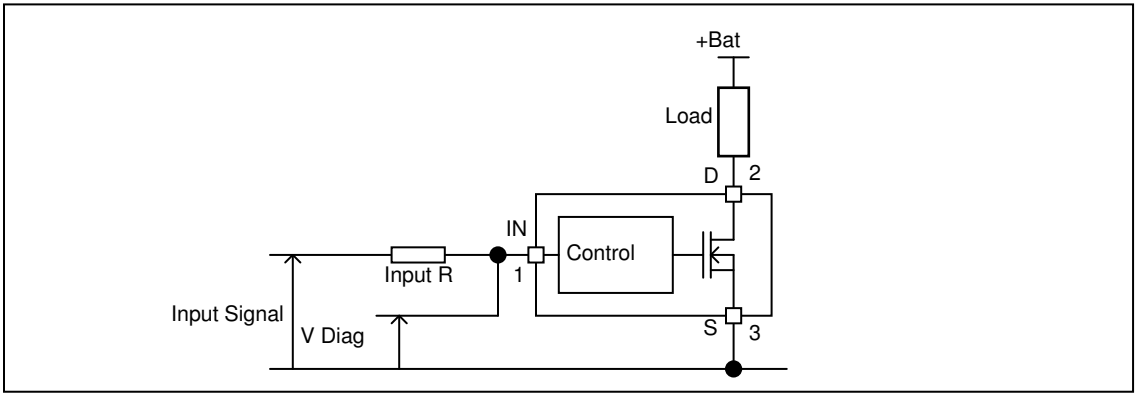
Rds(on)	300mΩ (max.)
Vclamp	70V
Ishutdown	1.8A (typ.)

Packages

SOT223
AUIPS2051L

SO-8
AUIPS2052G

Typical Connection



Qualification Information†

Qualification Level		Automotive (per AEC-Q100††)	
		Comments: This IC has passed an Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.	
Moisture Sensitivity Level		SOT-223	MSL2††, 260℃ (per IPC/JEDEC J-STD-020)
		8L-SOICN	MSL2††, 260℃ (per IPC/JEDEC J-STD-020)
ESD	Machine Model	Class M3 (per AEC-Q-100-003)	
	Human Body Model	Class H2 (per AEC-Q-100-002)	
	Charged Device Model	Class C5 (per AEC-Q-100-011)	
IC Latch-Up Test		ClassII, 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.

Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are referenced to Ground lead. (Tambient=25℃ unless otherwise specified).

Symbol	Parameter	Min.	Max.	Units
Vds	Maximum drain to source voltage	-0.3	60	V
Vds cont.	Maximum continuous drain to source voltage	-	35	V
Vin	Maximum input voltage	-0.3	6	V
Isd cont.	Max diode continuous current (limited by thermal dissipation) Rth=125℃/W	—	1	A
Pd	Maximum power dissipation (internally limited by thermal protection)			W
	Rth=60C°/W AUIPS2051L 1" sqr. footprint	—	2	
	Rth=100℃/W AUIPS2052G std. footprint	—	1.25	
ESD	Electrostatic discharge voltage (Human body) C=100pF, R=1500Ω			kV
	Between drain and source	—	4	
	Other combinations	—	3	
	Electrostatic discharge voltage (Machine Model) C=200pF,R=0Ω			
	Between drain and source	—	0.5	
	Other combinations	—	0.3	
Tj max.	Max. storage & operating temperature junction temperature	-40	150	℃

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
Rth1	Thermal resistance junction to ambient SOT-223 std. footprint	100	—	℃/W
Rth2	Thermal resistance junction to ambient SOT-223 1" sqr. footprint	60	—	
Rth1	Thermal resistance junction to ambient SO-8 std. Footprint 1 die active	100	—	
Rth1	Thermal resistance junction to ambient SO-8 std. footprint 2 die active	130	—	

note : Tj=Power dissipated in one channel x Rth

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℃, Tj=125℃, Vin=5V,Rth=100℃/W	—	0.9	A
Rin	Recommended resistor in series with IN pin to generate a diagnostic	0.5	5	kΩ
Max. t rise	Max. input rising time	—	1	µs

Static Electrical Characteristics

Tj=-40..150℃, Vcc=28V (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Rds(on)	ON state resistance Tj=25℃	—	250	300	mΩ	Vin=5V, Ids=1A
	ON state resistance Tj=150℃(2)	—	440	520		
Idss1	Drain to source leakage current	—	0.2	1	µA	Vcc=28V, Tj=25℃
Idss2	Drain to source leakage current	—	0.5	2		Vcc=50V, Tj=25℃
V clamp1	Drain to source clamp voltage 1	63	69	—	V	Id=20mA See fig. 3 & 4
V clamp2	Drain to source clamp voltage 2	—	70	75		Id=150mA
Vin clamp	IN to source pin clamp voltage	5.5	6.2	7.5		Iin=1mA
Vth	Input threshold voltage	1.1	2	2.7		Id=50mA
Iin, on	ON state IN positive current	15	40	80	µA	Vin=5V
Iin, off	OFF state IN positive current (after protection latched)	150	250	350		

Switching Electrical Characteristics

Vcc=28V, Resistive load=50Ω, Rinput=50Ω, Vin=5V, Tj=25℃

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Tdon	Turn-on delay time to 20%	0.1	1	3	µs	See figure 2
Tr	Rise time 20% to 80%	0.1	0.3	2.5		
Tdoff	Turn-off delay time to 80%	1	1.8	3.5		
Tf	Fall time 80% to 20%	0.1	0.5	2.5		
Eon + Eoff	Turn on and off energy	—	5	—	µJ	

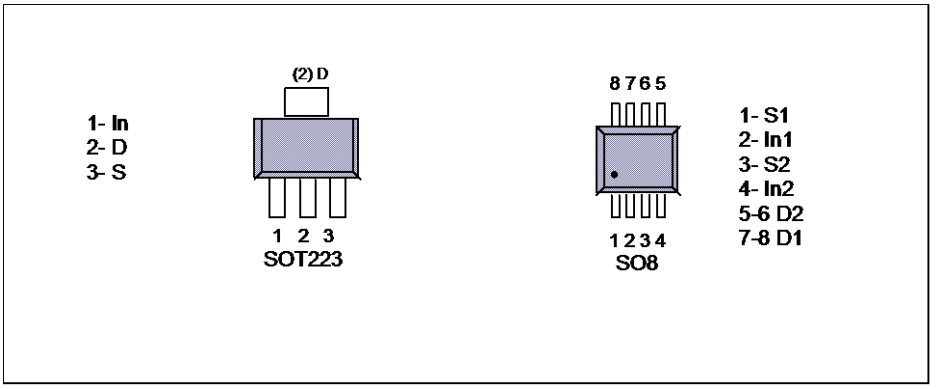
Protection Characteristics

Tj=-40..150℃, Vcc=28V (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Tsd	Over temperature threshold	150(2)	165	—	℃	See figure 1
Isd	Over current threshold	1.2	1.8	3	A	See figure 1
Vreset	IN protection reset threshold	1.1	1.6	2	V	
Treset	Time to reset protection	15(2)	50	500	µs	Vin=0V, Tj=25℃

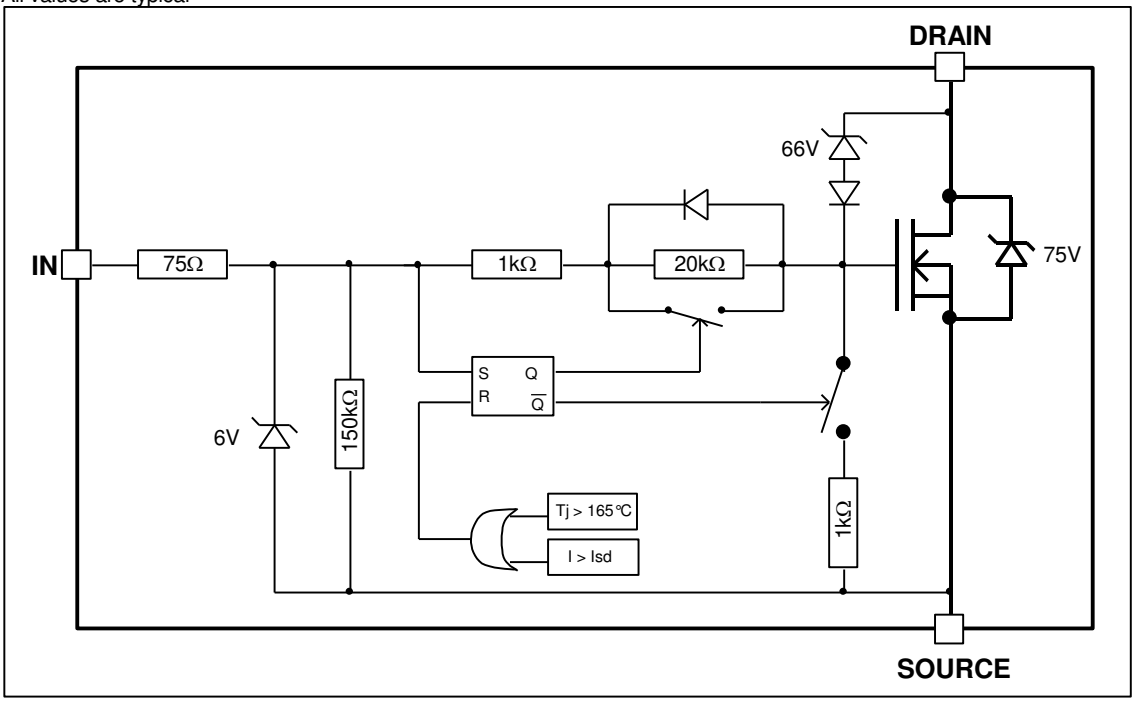
(2) Guaranteed by design

Lead Assignments



Functional Block Diagram

All values are typical



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

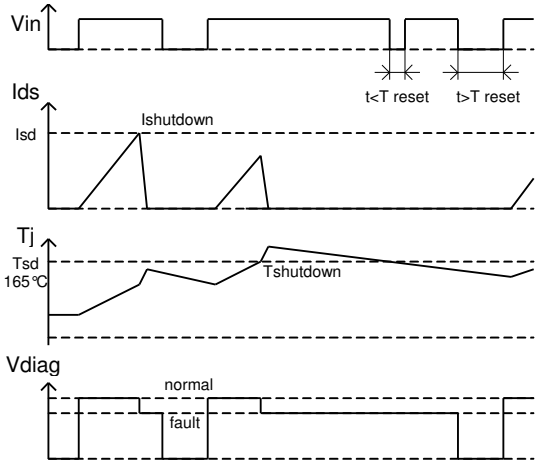


Figure 1 – Timing diagram

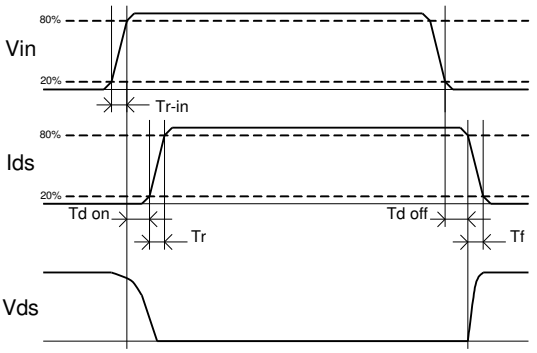
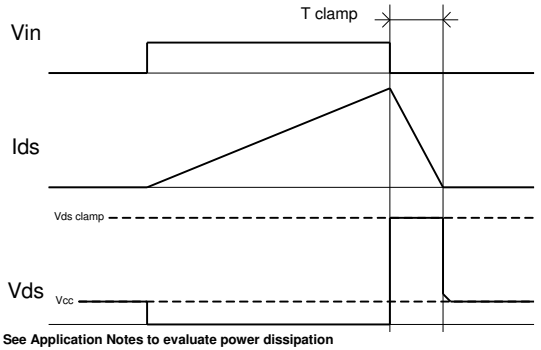


Figure 2 – IN rise time & switching definitions



See Application Notes to evaluate power dissipation

Figure 3 – Active clamp waveforms

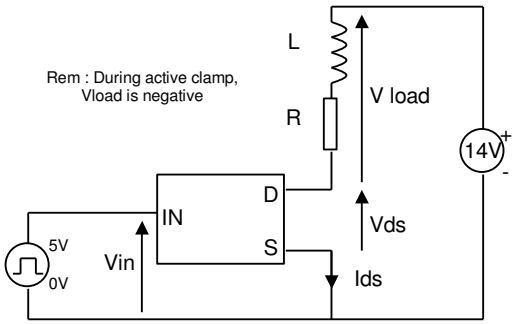


Figure 4 – Active clamp test circuit

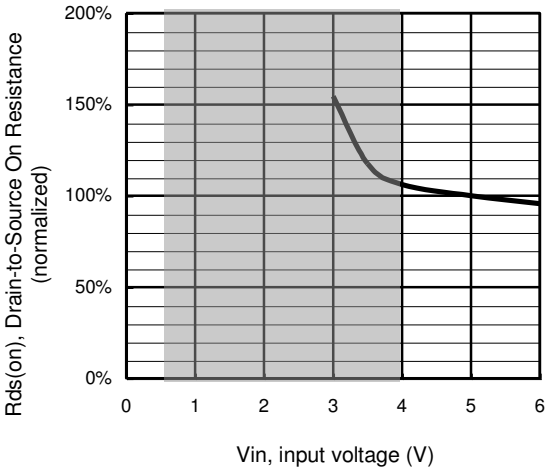


Figure 5 – Normalized Rdson (%) Vs Input voltage (V)

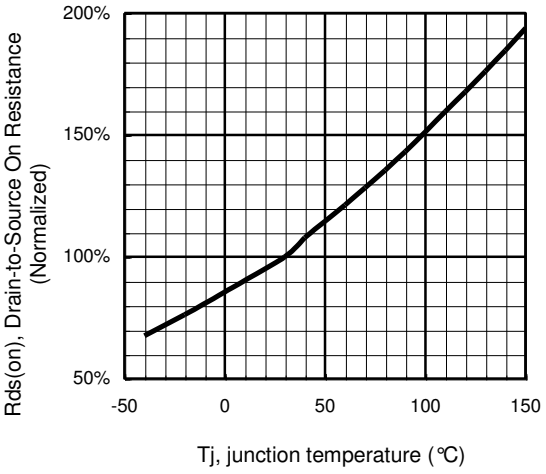


Figure 6 - Normalized Rds(on) (%) Vs Tj (°C)

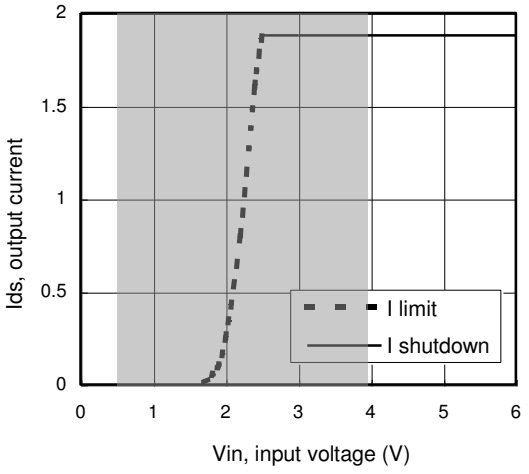


Figure 7 – Current limitation and current shutdown Vs Input voltage (V)

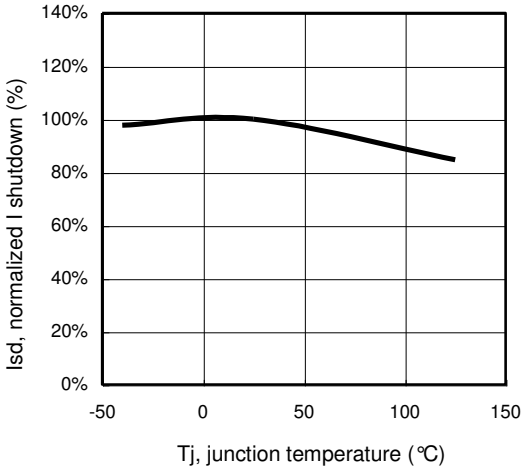


Figure 8 – Normalized I shutdown (%) Vs junction temperature (°C)

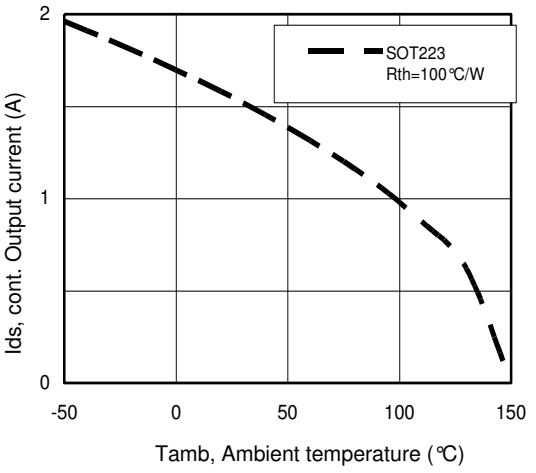


Figure 9 – Max. continuous output current (A) Vs Ambient temperature (°C)

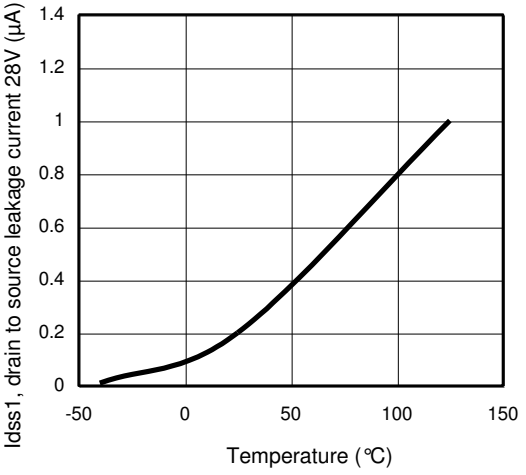


Figure 10 – Idss1 (µA) Vs temperature (°C)

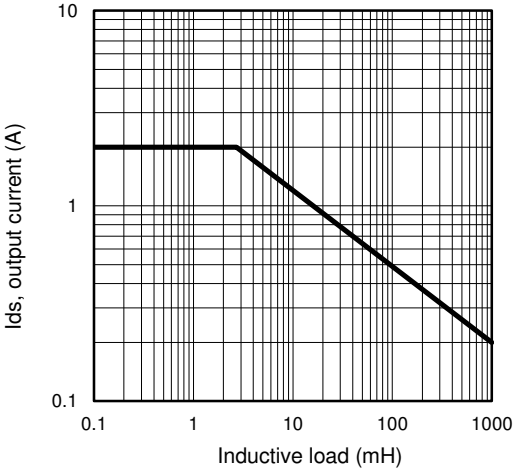


Figure 11 – Max. ouput current (A) Vs Inductive load (mH)

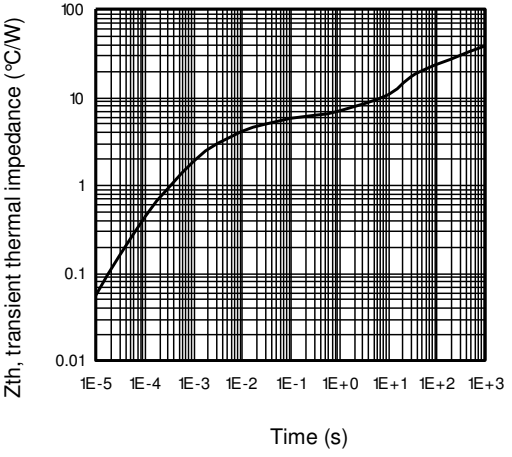


Figure 12 – Transient thermal impedance (°C/W) Vs time (s)

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

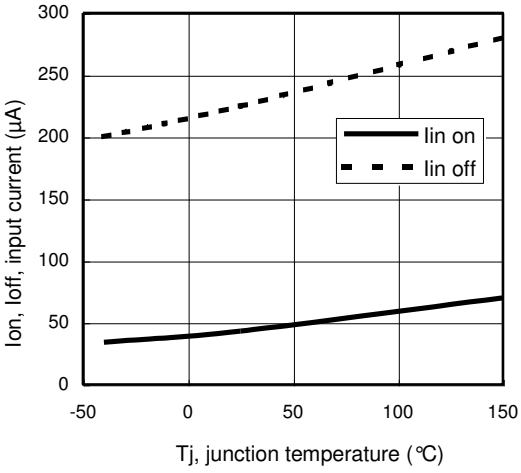


Figure 13 – Input current (µA) On and Off Vs junction temperature (°C)

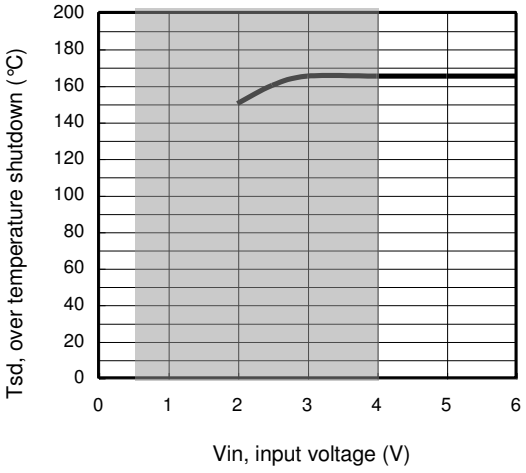
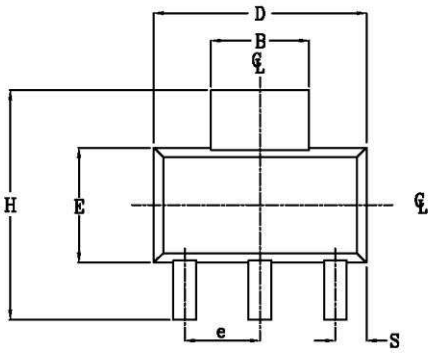


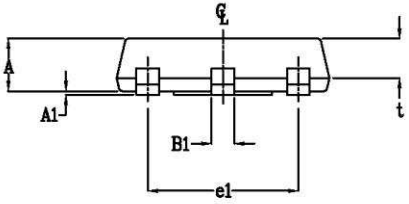
Figure 14 – Over temperature shutdown (°C) Vs input voltage (V)

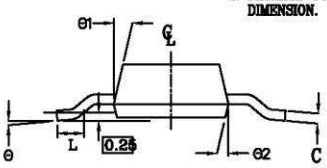
Case Outline - SOT-223



POS	MILLIMETERS		INCHES	
1	MAX	MIN	MAX	MIN
A	1.70	1.50	.067	.060
A1	0.10	0.02	.004	.0008
B	3.15	2.95	.124	.116
B1	0.85	0.65	.033	.026
C	0.35	0.25	.014	.010
D	6.70	6.30	.264	.248
e	2.30 NOM		.0905 NOM	
e1	4.60 NOM		.181 NOM	
E	3.70	3.30	.146	.130
H	7.30	6.70	.287	.264
S	1.05	0.85	.041	.033
t	1.30	1.10	.051	.043
Θ	10° MAX		10° MAX	
Θ1	16°	10°	16°	10°
Θ2	16°	10°	16°	10°
L	0.75 MIN		0.0295 MIN	

NOTE:
1. PACKAGE OUTLINE EXCLUSIVE OF ANY MOLD FLASHES DIMENSION.
2. PACKAGE OUTLINE EXCLUSIVE OF BURR DIMENSION.

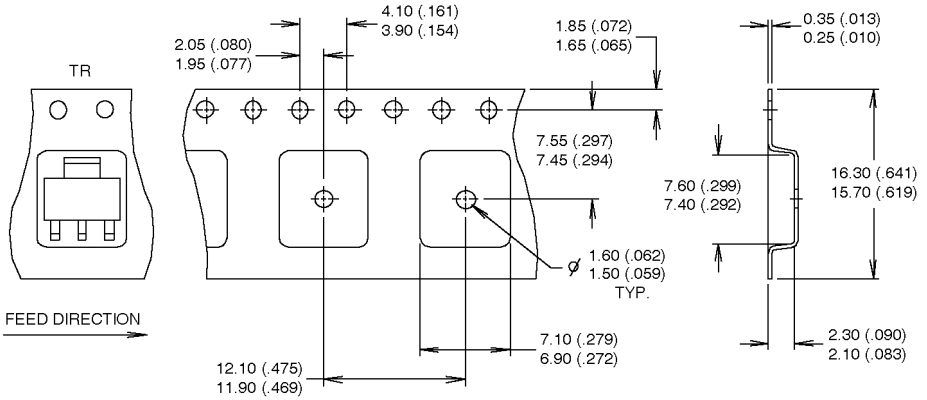




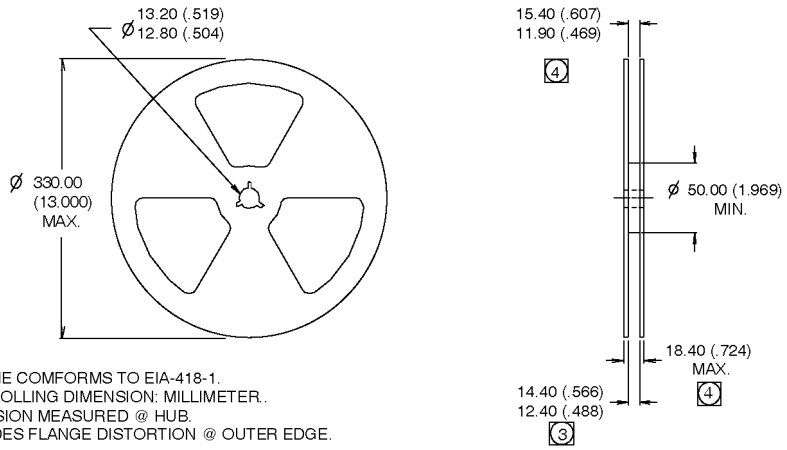
Leads and drain are plated with 100% Sn

Tape & Reel - SOT-223

Dimensions are shown in milimeters (inches)



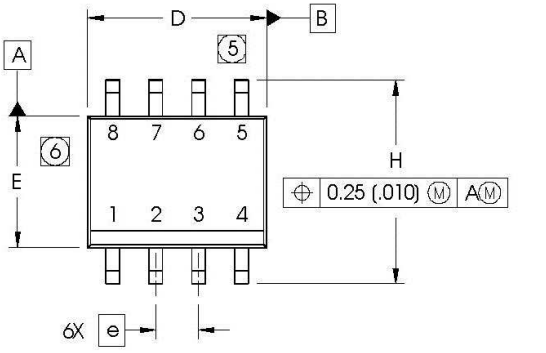
NOTES :
1. CONTROLLING DIMENSION: MILLIMETER.
2. OUTLINE CONFORMS TO EIA-481 & EIA-541.
3. EACH Ø330.00 (13.00) REEL CONTAINS 2,500 DEVICES.



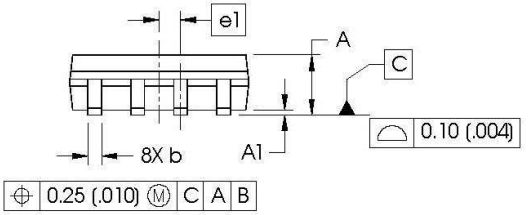
NOTES :
1. OUTLINE COMFORMS TO EIA-418-1.
2. CONTROLLING DIMENSION: MILLIMETER..
3. DIMENSION MEASURED @ HUB.
4. INCLUDES FLANGE DISTORTION @ OUTER EDGE.

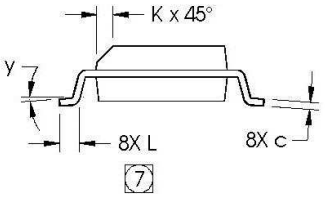
Case Outline - SO-8

Dimensions are shown in millimeters (inches)



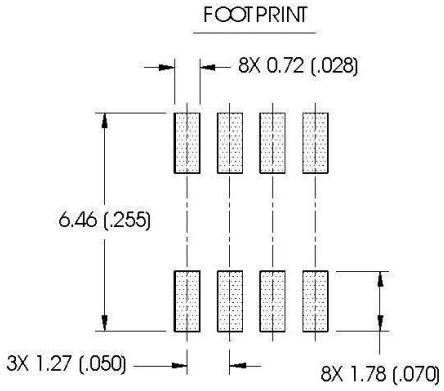
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0532	.0688	1.35	1.75
A1	.0040	.0098	0.10	0.25
b	.013	.020	0.33	0.51
c	.0075	.0098	0.19	0.25
D	.189	.1968	4.80	5.00
E	.1497	.1574	3.80	4.00
e	.050 BASIC		1.27 BASIC	
e1	.025 BASIC		0.635 BASIC	
H	.2284	.2440	5.80	6.20
K	.0099	.0196	0.25	0.50
L	.016	.050	0.40	1.27
y	0°	8°	0°	8°





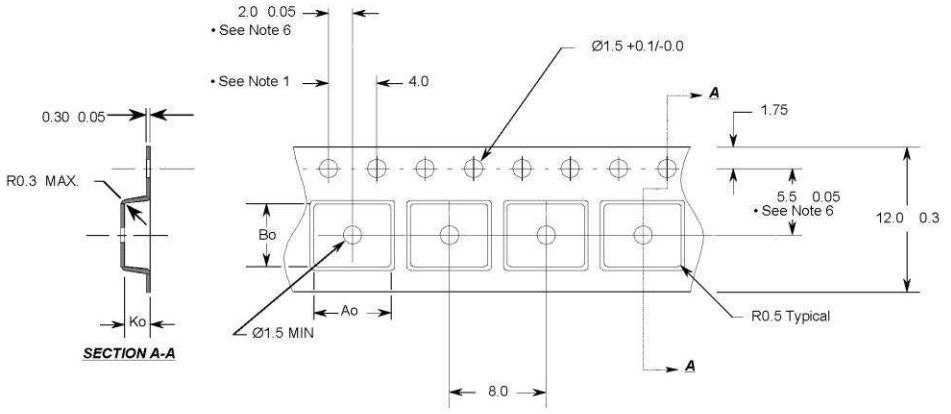
NOTES:

1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.
5. DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.15 (.006).
6. DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 (.010).
7. DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.



Leads and drain are plated with 100% Sn

Tape & Reel - SO-8

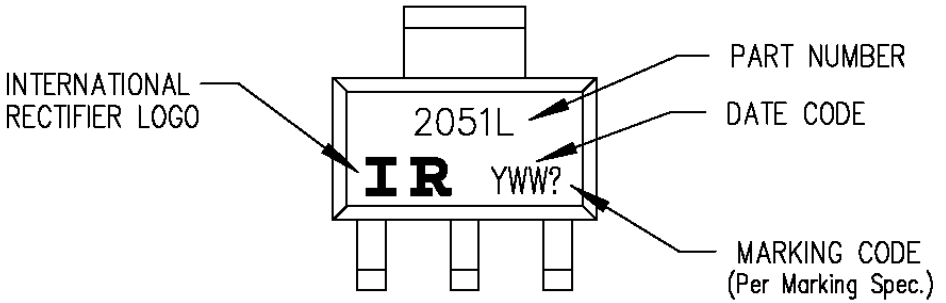


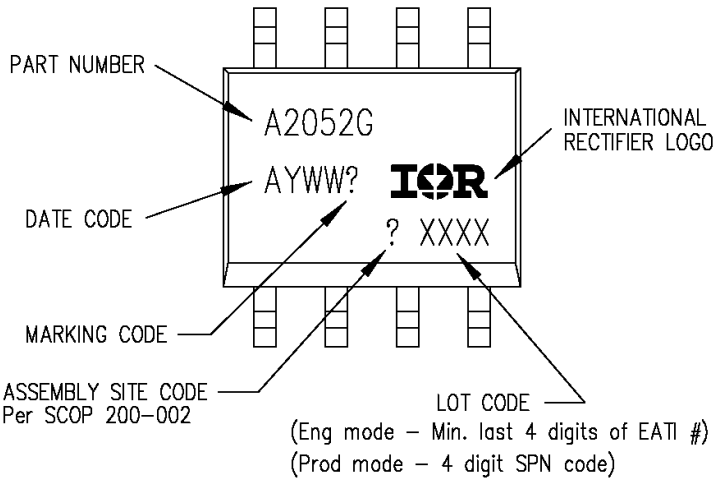
Notes:
1. 10 sprocket hole pitch cumulative tolerance 0.2
2. Camber not to exceed 1mm in 100mm
3. Material: Black Conductive Advantek Polystyrene
4. Ao and Bo measured on a plane 0.3mm above the bottom of the pocket
5. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
6. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.

Ao = 6.4 mm
Bo = 5.2 mm
Ko = 2.1 mm

- All Dimensions in Millimeters -

Part Marking Information





Ordering Information

Base Part Number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIPS2051L	SOT223	Tube	80	AUIPS2051L
		Tape and reel	2500	AUIPS2051LTR
AUIPS2052G	SO8	Tube	95	AUIPS2052G
		Tape and reel	2500	AUIPS2052GTR

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

WORLD HEADQUARTERS:
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Tel: (310) 252-7105

Revision History

Revision	Date	Notes/Changes
A	30/10/08	First release
B	23/03/2009	Add latch up information
C	15/09/2009	Add application section
D	21/02/2011	Update Fig 11
E	November, 14th 2011	Update T&R SOT223
F	May 9th, 2012	Update the component number of the SOT223 tube