

SINGLE/DUAL CHANNEL INTELLIGENT POWER LOW SIDE SWITCH

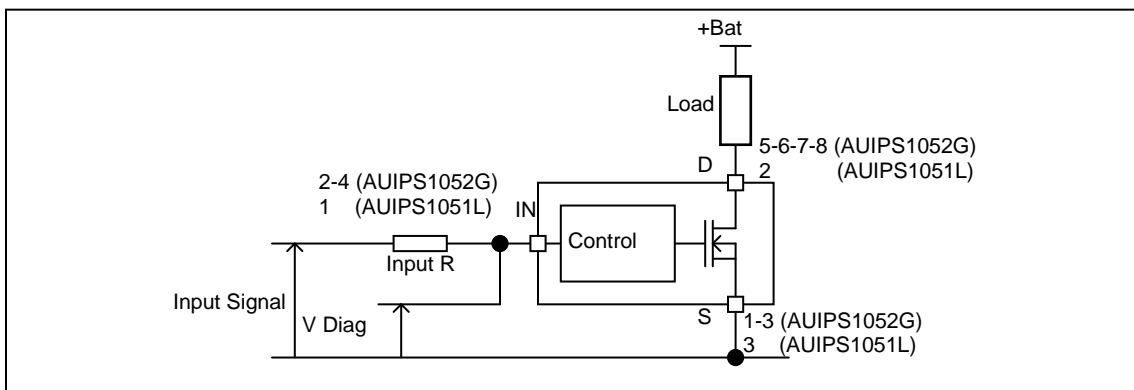
Features

- 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
- Lead free and RoHS compliant

Description

The AUS1051L and AUIPS1052G are Intelligent Power Switches (IPS) featuring low side MOSFETs with over-current, over-temperature, ESD protection and drain to source active clamp. The AUIPS1052G is a dual channel device while the AUIPS1051 is a single channel. These devices offer protections and the high reliability required in harsh environments. Each switch provides efficient protection by turning OFF the power MOSFET when the temperature exceeds 165°C or when the drain current reaches 3A. 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.

Typical Connection



Product Summary

Rds(on)	250mΩ (max.)
Vclamp	39V
Ishutdown	2.8A (typ.)

Packages



SOT-223
 AUIPS1051L



SO-8
 AUIPS1052G

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		SOT223-3L	MSL2, 260°C (per IPC/JEDEC J-STD-020)
		8L-SOICN	MSL2, 260°C (per IPC/JEDEC J-STD-020)
ESD	Machine Model	Class M4 (+/-450V) (per AEC-Q-100-003)	
	Human Body Model	Class H3A (+/-4500V) (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.

Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. ($T_j = -40^{\circ}\text{C}..150^{\circ}\text{C}$, $V_{CC} = 6..36\text{V}$ unless otherwise specified).

Symbol	Parameter	Min.	Max.	Units
Vds	Maximum drain to source voltage	-0.3	36	V
Vds cont.	Maximum continuous drain to source voltage	-	28	V
Vin	Maximum input voltage	-0.3	6	V
I _{sd} cont.	Max diode continuous current (limited by thermal dissipation)	—	1.3	A
Pd	Maximum power dissipation (internally limited by thermal protection)			W
	R _{th} =60°C/W AUIPS1051L 1" sqrt. Footprint R _{th} =100°C/W AUIPS1052G std. footprint		2 1.25	
T _j max.	Maximum operating junction temperature	-40	150	°C
	Maximum storage temperature	-55	150	

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
R _{th1}	Thermal resistance junction to ambient AUIPS1051L SOT-223 std. footprint	100	—	°C/W
R _{th2}	Thermal resistance junction to ambient AUIPS1051L SOT-223 1" sqrt. Footprint	60	—	
R _{th1}	Thermal resistance junction to ambient AUIPS1052G SO-8 std. Footprint 1 die active	100	—	
R _{th1}	Thermal resistance junction to ambient AUIPS1052G SO-8 std. footprint 2 die active	130	—	

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
V _{IH}	High level input voltage	4.5	5.5	V
V _{IL}	Low level input voltage	0	0.5	
I _{ds}	Continuous drain current, T _{ambient} =85°C, T _j =125°C, V _{in} =5V R _{th} =60°C/W AUIPS1051L 1" sqrt. Footprint	—	1.4	A
	Continuous drain current, T _{ambient} =85°C, T _j =125°C, V _{in} =5V R _{th} =100°C/W AUIPS1052G 1" sqrt. Footprint - 1 die active	—	1.1	A
	Continuous drain current, T _{ambient} =85°C, T _j =125°C, V _{in} =5V R _{th} =130°C/W AUIPS1052G 1" sqrt. Footprint - 2 die active			0.5
R _{in}	Recommended resistor in series with IN pin to generate a diagnostic	0.5	10	kΩ
Max L	Max. recommended load inductance (including line inductance)(1)	—	30	μH
Max. F	Max. frequency	—	10	kHz
Max. t rise	Max. input rise time	—	1	μs

(1) Higher inductance is possible if maximum load current is limited - see figure 11

Static Electrical Characteristics

T_j= -40..150°C, V_{cc}=6..28V (unless otherwise specified), typical value are given for T_j=25°C

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
R _{ds(on)}	ON state resistance T _j =25°C	—	160	250	mΩ	V _{in} =5V, I _{ds} =1A
	ON state resistance T _j =150°C	—	340	450		
I _{dss1}	Drain to source leakage current	—	0.1	2	μA	V _{cc} =14V, T _j =25°C
I _{dss2}	Drain to source leakage current	—	0.2	4		V _{cc} =28V, T _j =25°C
V _{clamp1}	Drain to source clamp voltage 1	36	38	—	V	I _d =20mA
V _{clamp2}	Drain to source clamp voltage 2	—	39	42		I _d =0.5A
V _{in clamp}	IN to source pin clamp voltage	5.5	6.5	7.5		I _{in} =1mA
V _{th}	Input threshold voltage	—	1.7	—		I _d =10mA

Switching Electrical Characteristics

V_{cc}=14V, Resistive load=10Ω, R_{input}=50Ω, V_{in}=5V, T_j=25°C

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
T _{don}	Turn-on delay time to 20%	1	3	10	μs	See figure 2
T _r	Rise time 20% to 80%	1	3	10		
T _{doff}	Turn-off delay time to 80%	3	15	40		
T _f	Fall time 80% to 20%	2	4	10		
E _{on} + E _{off}	Turn on and off energy	—	0.1	—	mJ	

Protection Characteristics

T_j= -40..150°C, V_{cc}=6..28V (unless otherwise specified), typical value are given for T_j=25°C

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
T _{sd}	Over temperature threshold	150(2)	165	—	°C	See figure 1
I _{sd}	Over current threshold	1.9	2.8	3.8	A	See figure 1
OV	Over voltage protection (not active when the device is ON)	34	37	—	V	
V _{reset}	IN protection reset threshold	—	1.7	—	V	
T _{reset}	Time to reset protection	15(2)	50	200	μs	V _{in} =0V, T _j =25°C

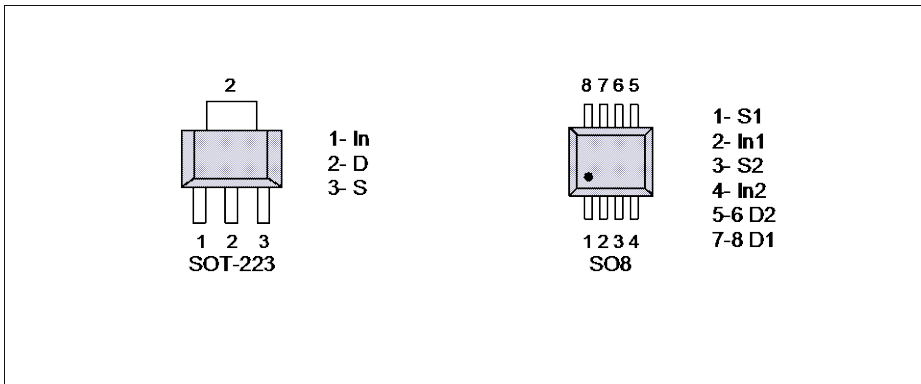
(2)Guaranteed by design

Diagnostic

T_j= -40..150°C, V_{cc}=6..28V (unless otherwise specified), typical value are given for T_j=25°C

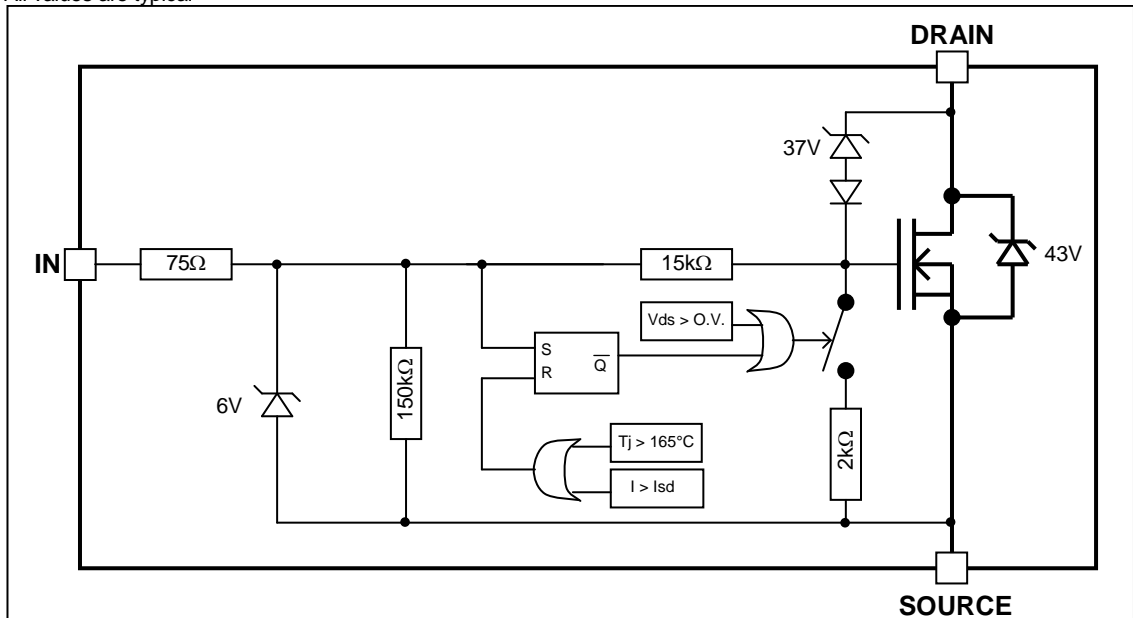
Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
I _{in, on}	ON state IN positive current	10	32	80	μA	V _{in} =5V
I _{in, off}	OFF state IN positive current (after protection latched – fault condition)	120	230	350		

Lead Assignments



Functional Block Diagram

All values are typical



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

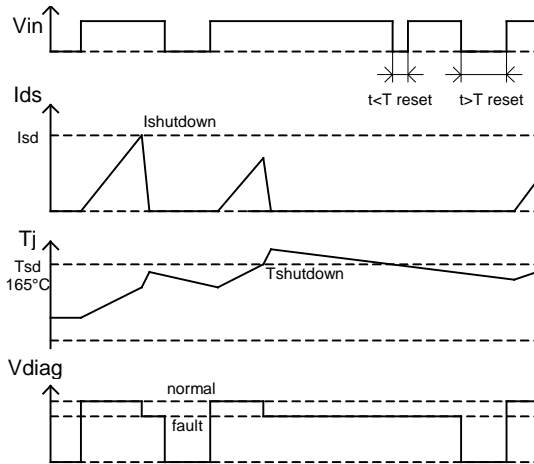


Figure 1 – Timing diagram

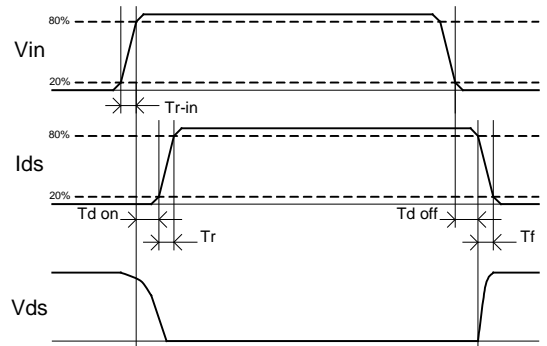
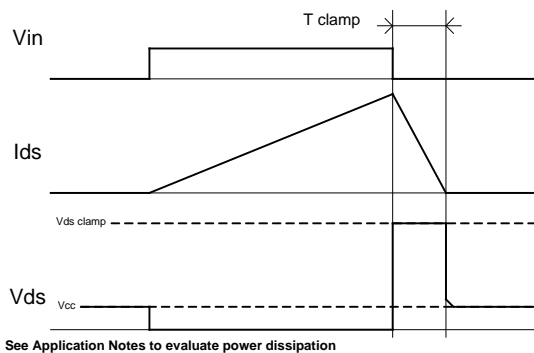


Figure 2 – IN rise time & switching definitions



See Application Notes to evaluate power dissipation

Figure 3 – Active clamp waveforms

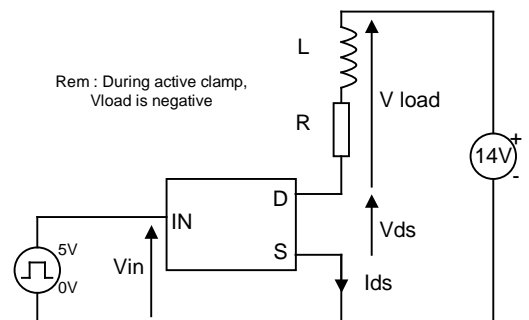
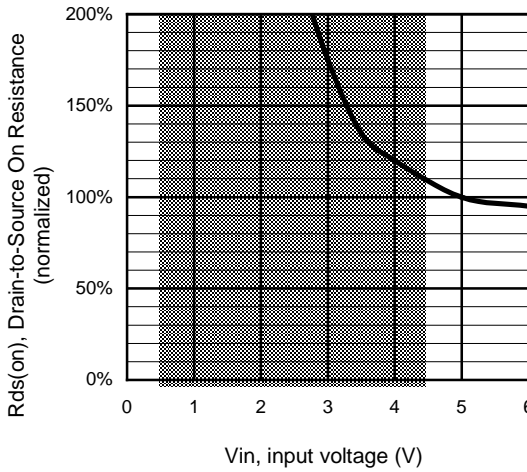
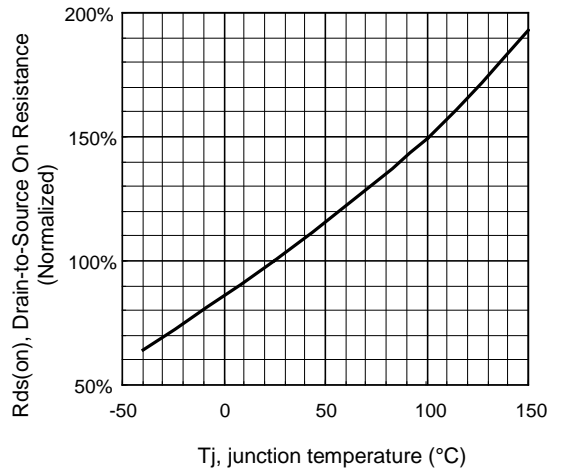
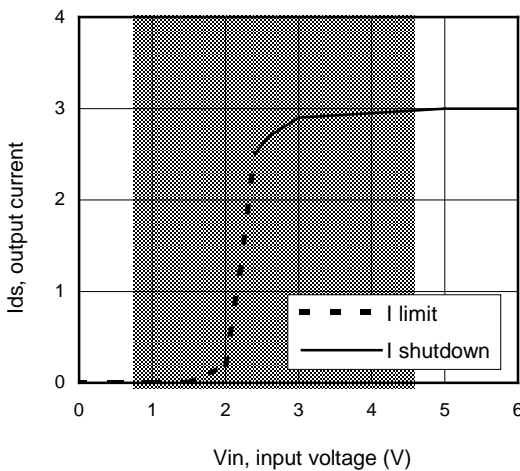
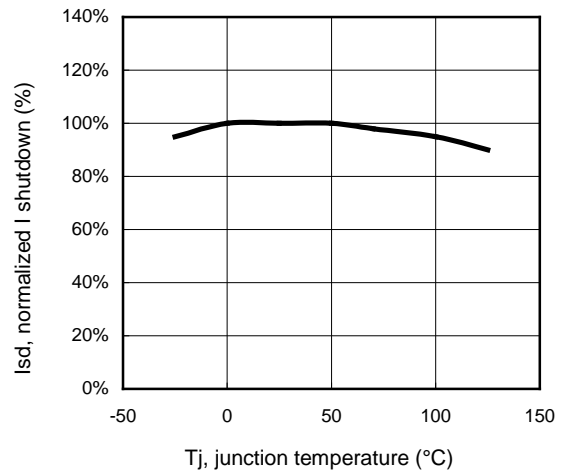


Figure 4 – Active clamp test circuit


Figure 5 – Normalized Rds(on) (%) 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)

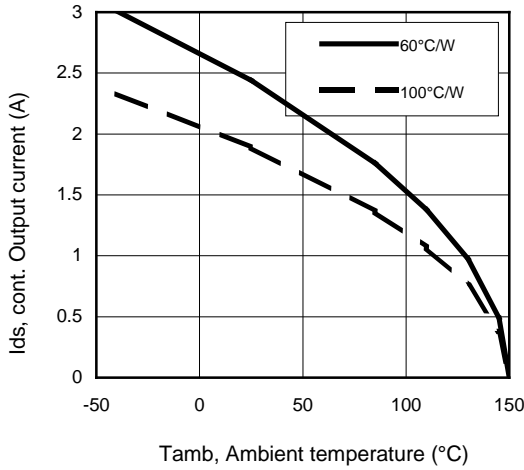


Figure 9 – Max. continuous output current (A) Vs Ambient temperature (°C)

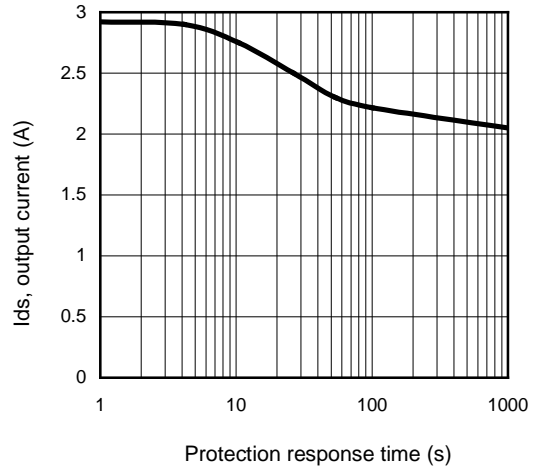


Figure 10 – Ids (A) Vs over temperature protection response time (s) / IPS1051L

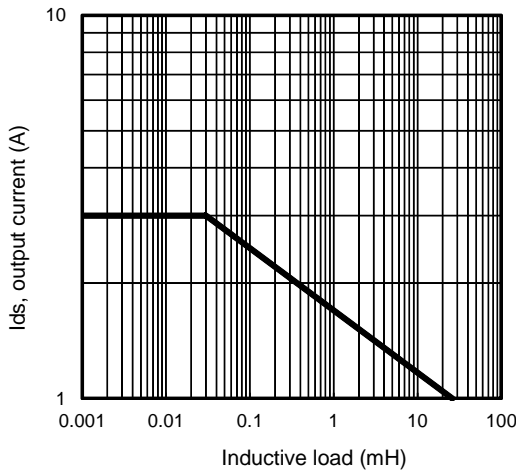


Figure 11 – Max. output current (A) Vs Inductive load (mH)

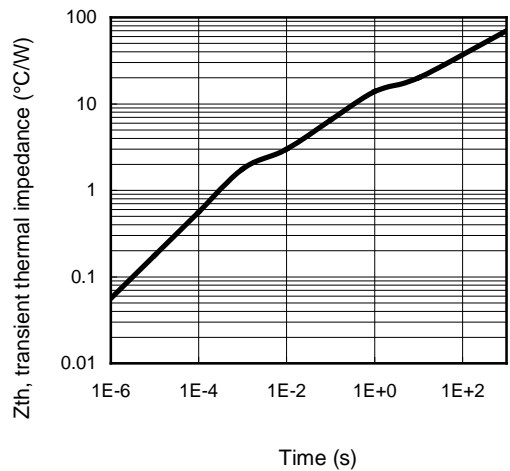


Figure 12 – Transient thermal impedance (°C/W) Vs time (s)

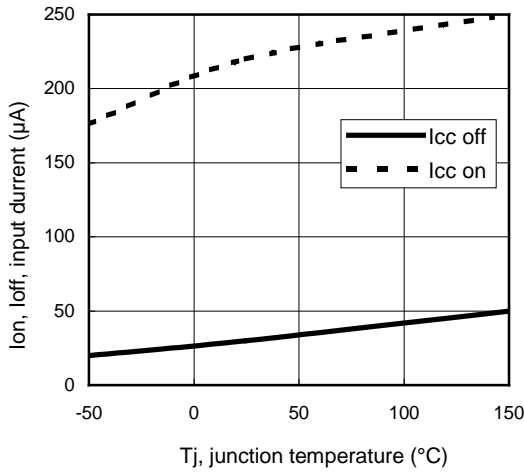


Figure 13 – Input current (µA) On and Off Vs junction temperature (°C)

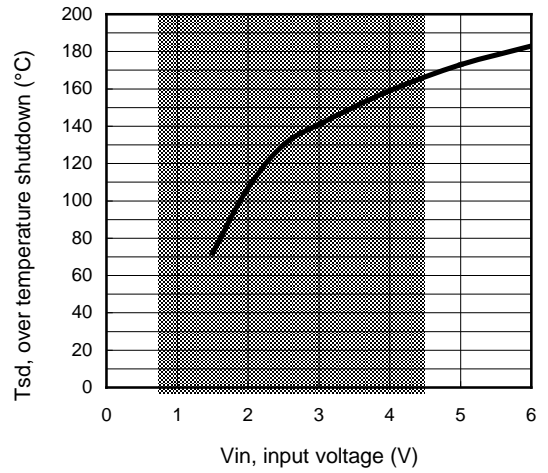
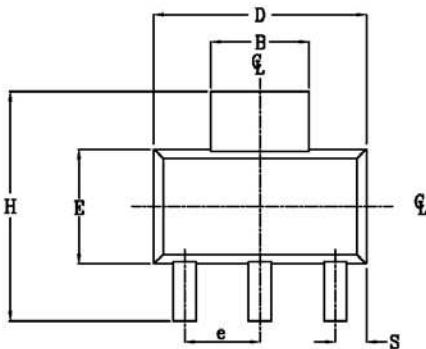
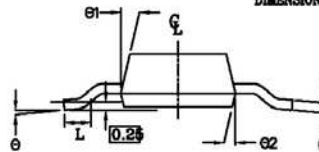
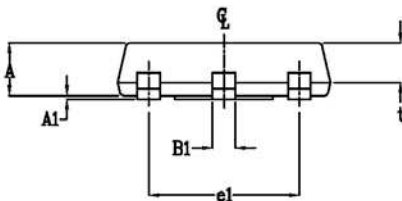


Figure 14 – Over temperature shutdown (°C) Vs input voltage (V)

Case Outline - SOT-223 - Automotive Q100 PbF MSL2 qualified


POS	MILLIMETERS		INCHES	
	MAX	MIN	MAX	MIN
i	1.70	1.50	.067	.060
A	0.10	0.02	.004	.0008
A1	3.15	2.95	.124	.116
B	0.85	0.65	.033	.026
B1	0.35	0.25	.014	.010
C	6.70	6.30	.264	.248
D	2.30 NOM		.0905 NOM	
e	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	
$\Theta 1$	16°	10°	16°	10°
$\Theta 2$	16°	10°	16°	10°
L	0.75 MIN		0.0295 MIN	

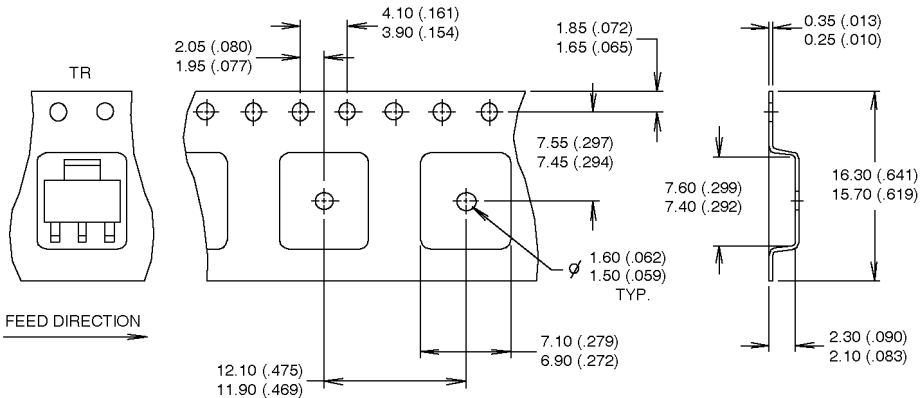
NOTE:
 1. PACKAGE OUTLINE EXCLUSIVE OF ANY MOLD FLASHES DIMENSION.
 2. PACKAGE OUTLINE EXCLUSIVE OF BURR DIMENSION.



Leads and drain are plated with 100% Sn

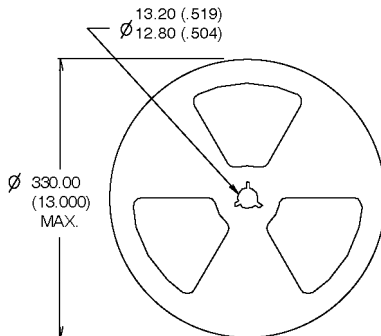
Tape & Reel - SOT-223

Dimensions are shown in millimeters (inches)



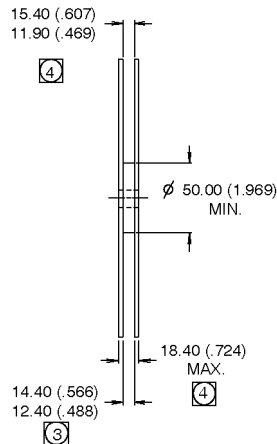
NOTES :

1. CONTROLLING DIMENSION: MILLIMETER.
2. OUTLINE CONFORMS TO EIA-481 & EIA-541.
3. EACH $\varnothing 330.00$ (13.00) REEL CONTAINS 2,500 DEVICES.



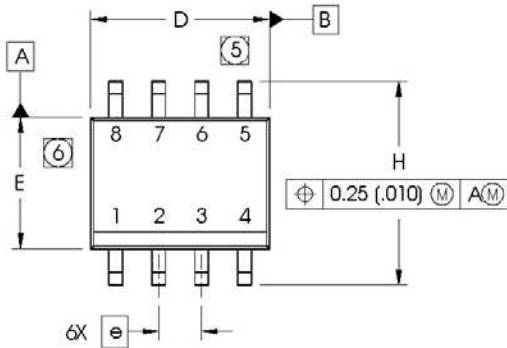
NOTES :

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

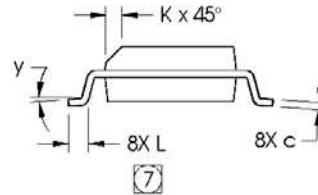
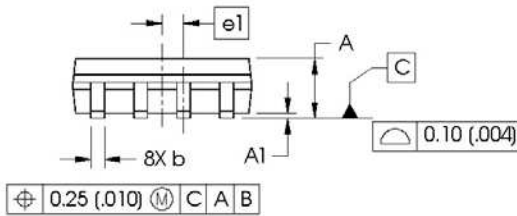


Case Outline - SO-8 - Automotive Q100 PbF MSL2 qualified

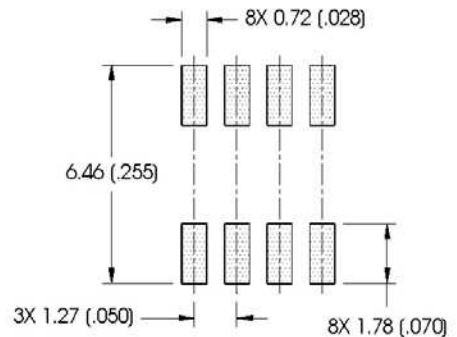
Dimensions are shown in millimeters (inches)



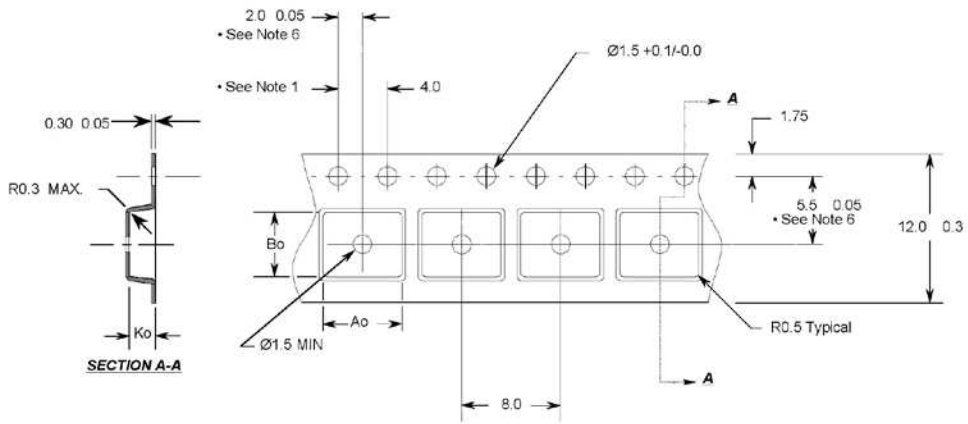
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0532	.0688	1.35	1.75
A1	.0040	.0098	0.10	0.25
b	.013	.020	0.33	0.51
c	.0075	.0098	0.19	0.25
D	.189	.1968	4.80	5.00
E	.1497	.1574	3.80	4.00
e	.050 BASIC		1.27 BASIC	
e1	.025 BASIC		0.635 BASIC	
H	.2284	.2440	5.80	6.20
K	.0099	.0196	0.25	0.50
L	.016	.050	0.40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


NOTES:

- DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
- CONTROLLING DIMENSION: MILLIMETER
- DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
- 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.

FOOTPRINT


Leads and drain are plated with 100% Sn

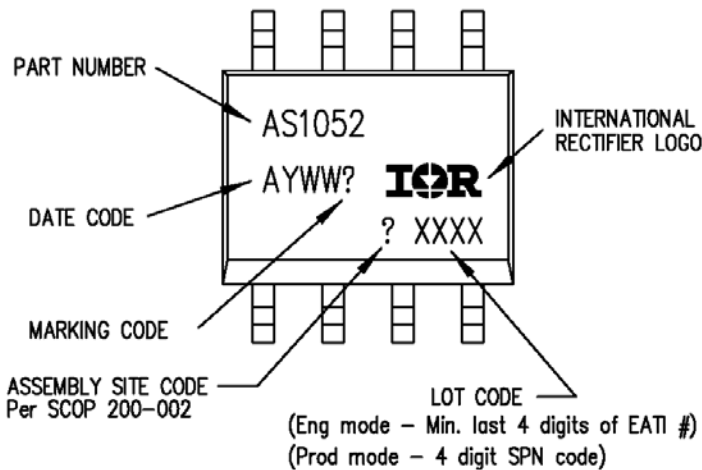
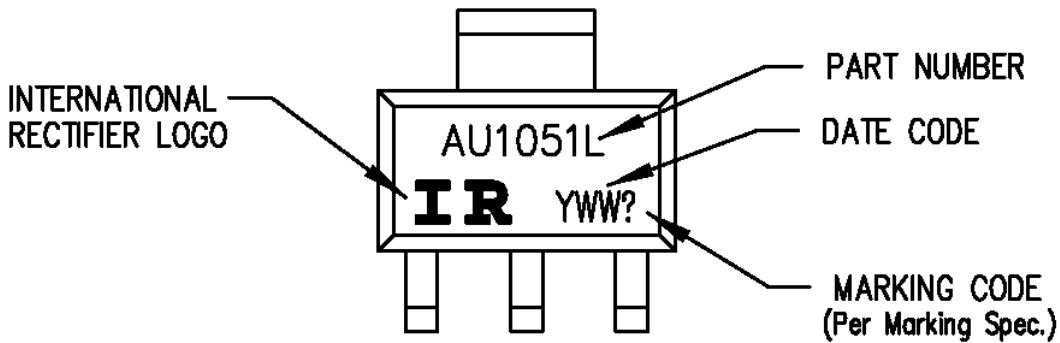
Tape & Reel - SO-8

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	
AUIPS1051	SOIC-8	Tube	95	AUIPS1052G
		Tape and reel	2500	AUIPS1052GTR
AUIPS1051	SOT-223	Tube	80	AUIPS1051L
		Tape and reel	2500	AUIPS1051LTR

IMPORTANT NOTICE

Unless specifically designated for the automotive market, International Rectifier Corporation and its subsidiaries (IR) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or services without notice. Part numbers designated with the "AU" prefix follow automotive industry and / or customer specific requirements with regards to product discontinuance and process change notification. All products are sold subject to IR's terms and conditions of sale supplied at the time of order acknowledgment.

IR warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with IR's standard warranty. Testing and other quality control techniques are used to the extent IR deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

IR assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using IR components. To minimize the risks with customer products and applications, customers should provide adequate design and operating safeguards.

Reproduction of IR information in IR data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alterations is an unfair and deceptive business practice. IR is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of IR products or serviced with statements different from or beyond the parameters stated by IR for that product or service voids all express and any implied warranties for the associated IR product or service and is an unfair and deceptive business practice. IR is not responsible or liable for any such statements.

IR products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or in other applications intended to support or sustain life, or in any other application in which the failure of the IR product could create a situation where personal injury or death may occur. Should Buyer purchase or use IR products for any such unintended or unauthorized application, Buyer shall indemnify and hold International Rectifier and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that IR was negligent regarding the design or manufacture of the product.

Only products certified as military grade by the Defense Logistics Agency (DLA) of the US Department of Defense, are designed and manufactured to meet DLA military specifications required by certain military, aerospace or other applications. Buyers acknowledge and agree that any use of IR products not certified by DLA as military-grade, in applications requiring military grade products, is solely at the Buyer's own risk and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

IR products are neither designed nor intended for use in automotive applications or environments unless the specific IR products are designated by IR as compliant with ISO/TS 16949 requirements and bear a part number including the designation "AU". Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, IR will not be responsible for any failure to meet such requirements

For technical support, please contact IR's Technical Assistance Center

<http://www.irf.com/technical-info/>

WORLD HEADQUARTERS:

101 N. Sepulveda Blvd., El Segundo, California 90245

Tel: (310) 252-7105

Revision History

Revision	Date	Notes/Changes
C1	November, 24 th , 2010	AU release
C2	December, 7 th 2010	ESD section removed page 3
C3	February, 28 th 2011	Update Max rating voltage
C4	March, 14 th 2011	Update Part Marking
C5	March, 17 th 2011	Update ESD level and Lead free/RoHS compliant
D	November, 14 th , 2011	Update T&R SOT223
E	January, 11 th 2012	Update fig. 11
F	May 9 th , 2012	Update the component number of the SOT223 tube
G	June, 21 st 2012	Update storage temperature, Figure 9
H	April, 30 th 2013	Correct the functional block diagram page 5