

**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

R _{ds(on)}	250mΩ (max.)
V _{clamp}	39V
I _{shutdown}	2.8A (typ.)

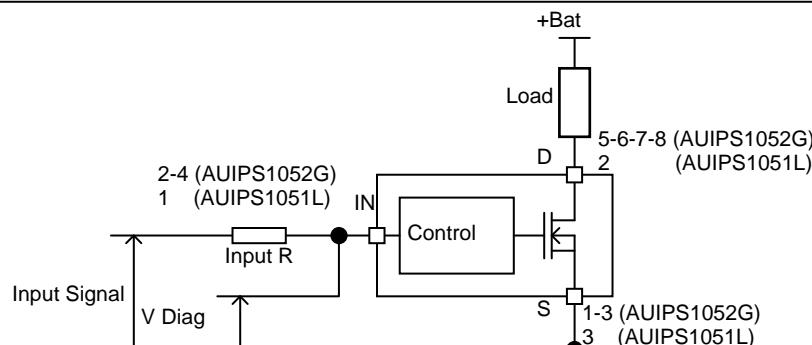
Packages



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	
V_{ds}	Maximum drain to source voltage	-0.3	36	V	
V_{ds} cont.	Maximum continuous drain to source voltage	-	28	V	
V_{in}	Maximum input voltage	-0.3	6	V	
I_{sd} cont.	Max diode continuous current (limited by thermal dissipation)	—	1.3	A	
P_d	Maximum power dissipation (internally limited by thermal protection)		2	W	
	$R_{th}=60^\circ\text{C}/\text{W}$ AUIPS1051L 1" sqrt. Footprint		1.25		
$T_{j max}$		Max. storage & operating temperature junction temperature	-40	150	°C

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	100	—	
R_{th1}	1 die active	—	—	
R_{th1}	Thermal resistance junction to ambient AUIPS1052G SO-8 std. footprint	130	—	
	2 die active	—	—	

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, $T_{ambient}=85^\circ\text{C}$, $T_j=125^\circ\text{C}$, $V_{in}=5\text{V}$ $R_{th}=60^\circ\text{C}/\text{W}$ AUIPS1051L 1" sqrt. Footprint	—	1.4	A
	Continuous drain current, $T_{ambient}=85^\circ\text{C}$, $T_j=125^\circ\text{C}$, $V_{in}=5\text{V}$ $R_{th}=100^\circ\text{C}/\text{W}$ AUIPS1052G 1" sqrt. Footprint - 1 die active	—	1.1	A
	Continuous drain current, $T_{ambient}=85^\circ\text{C}$, $T_j=125^\circ\text{C}$, $V_{in}=5\text{V}$ $R_{th}=130^\circ\text{C}/\text{W}$ AUIPS1052G 1" sqrt. Footprint - 2 die active		0.5	A
R_{in}	Recommended resistor in series with IN pin to generate a diagnostic	0.5	10	$\text{k}\Omega$
$Max\ L$	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

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
R _{ds(on)}	ON state resistance $T_j = 25^\circ\text{C}$	—	160	250	MΩ	$V_{cc} = 5\text{V}$, $I_{ds} = 1\text{A}$
	ON state resistance $T_j = 150^\circ\text{C}$	—	340	450		
I _{dss1}	Drain to source leakage current	—	0.1	2	μA	$V_{cc} = 14\text{V}$, $T_j = 25^\circ\text{C}$
I _{dss2}	Drain to source leakage current	—	0.2	4	μA	$V_{cc} = 28\text{V}$, $T_j = 25^\circ\text{C}$
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

$V_{cc} = 14\text{V}$, Resistive load = 10Ω , $R_{input} = 50\Omega$, $V_{in} = 5\text{V}$, $T_j = 25^\circ\text{C}$

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

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

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
O _V	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	$V_{in} = 0\text{V}$, $T_j = 25^\circ\text{C}$

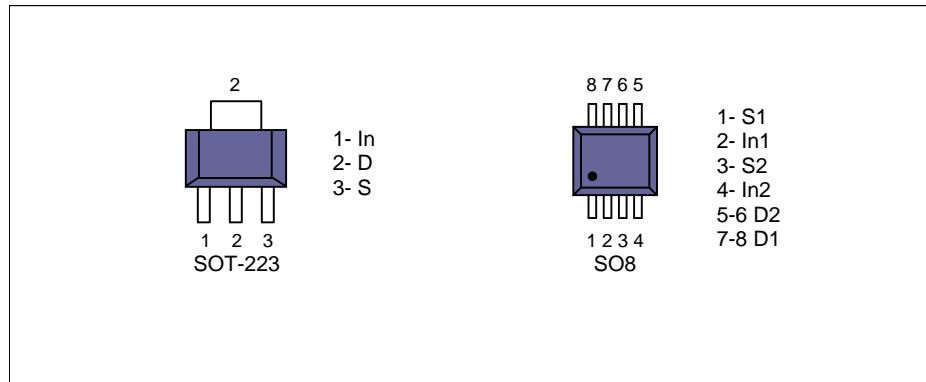
(2)Guaranteed by design

Diagnostic

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

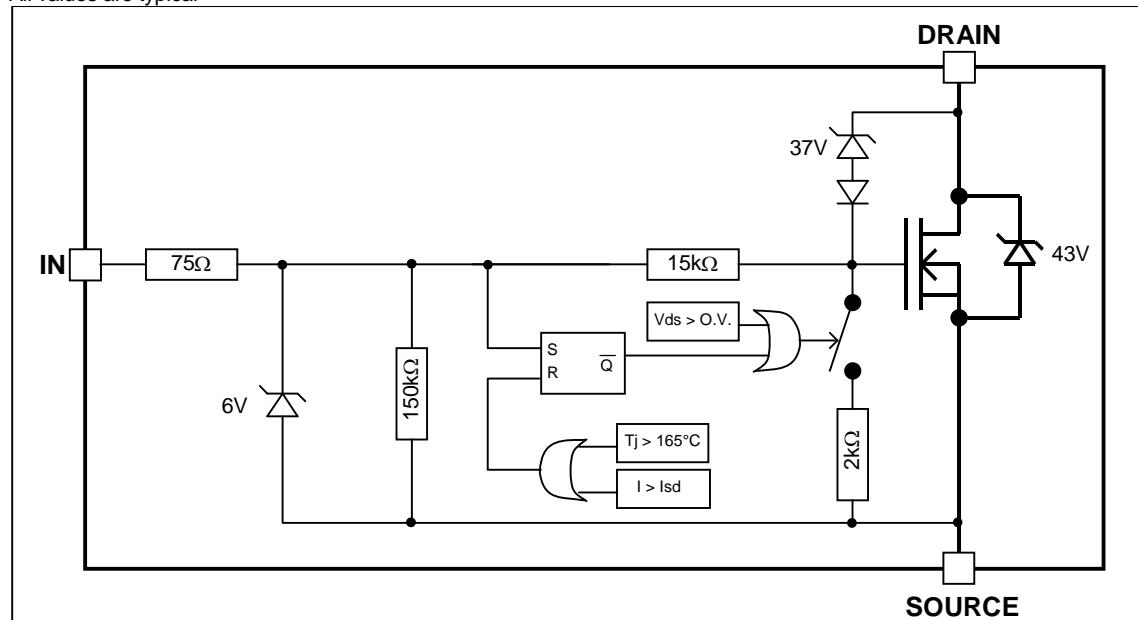
Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
I _{in, on}	ON state IN positive current	10	32	80	μA	$V_{in} = 5\text{V}$
I _{in, off}	OFF state IN positive current (after protection latched – fault condition)	120	230	350		

Lead Assignments

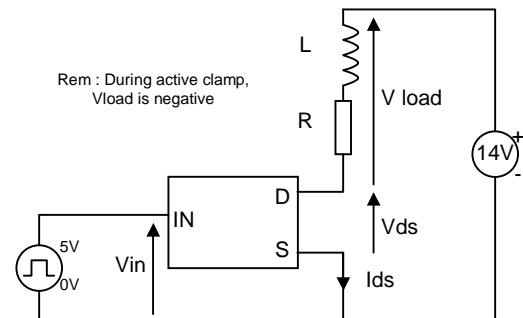
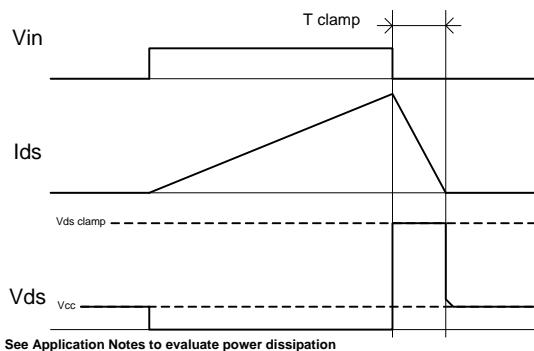
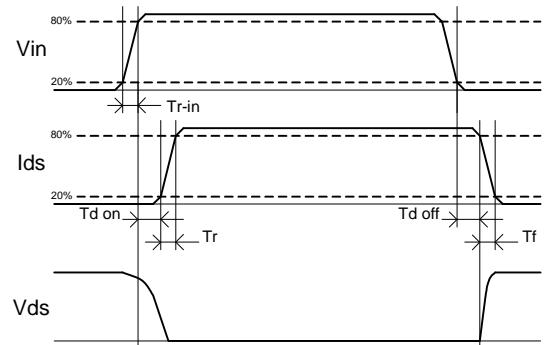
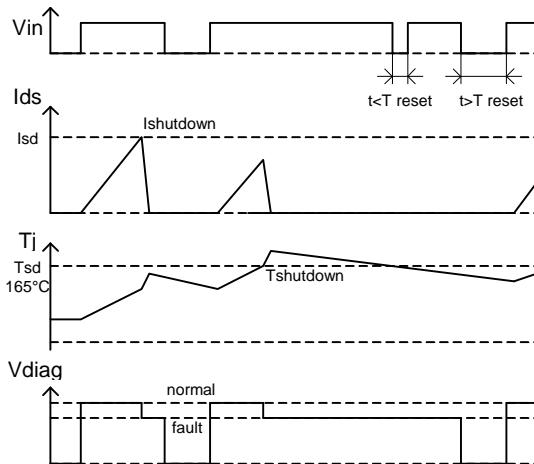


Functional Block Diagram

All values are typical



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



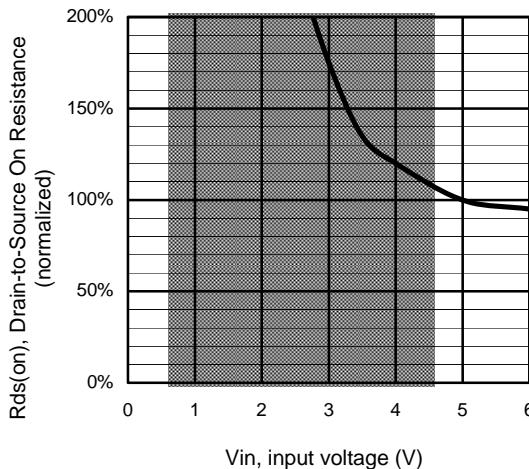


Figure 5 – Normalized $R_{ds(on)}$ (%) Vs Input voltage (V)

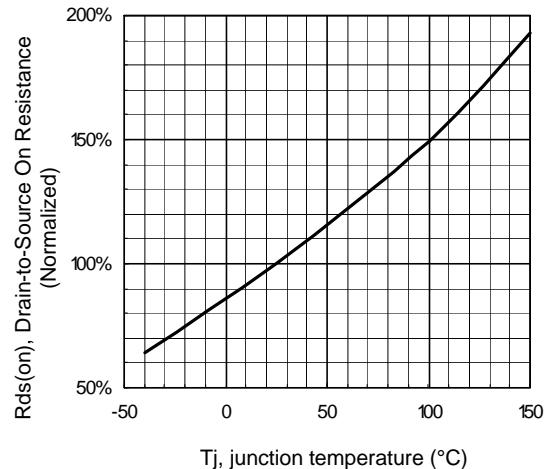


Figure 6 - Normalized $R_{ds(on)}$ (%) Vs T_j (°C)

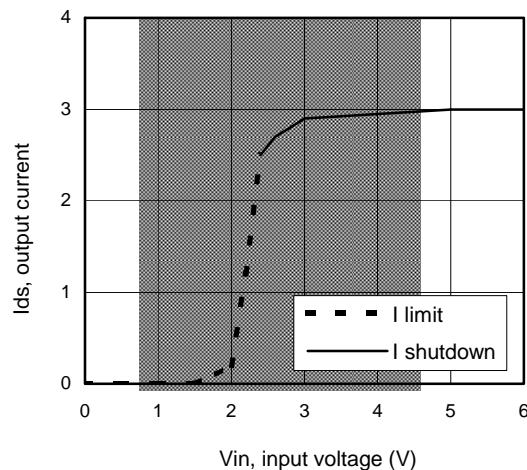


Figure 7 – Current limitation and current shutdown Vs Input voltage (V)

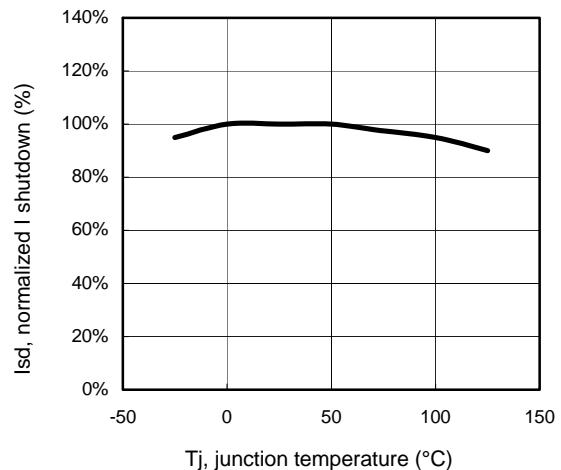


Figure 8 – Normalized $I_{shutdown}$ (%) Vs junction temperature (°C)

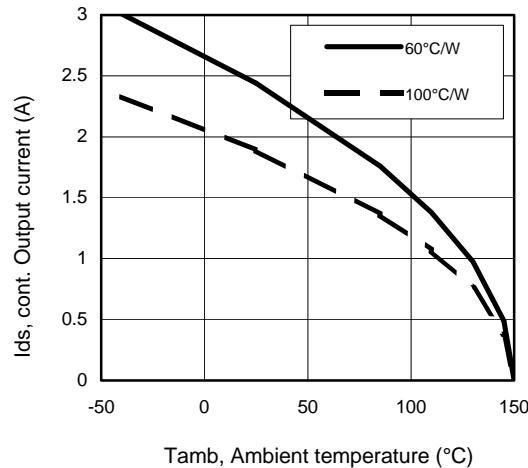


Figure 9 – Max. continuous output current (A) Vs Ambient temperature (°C)

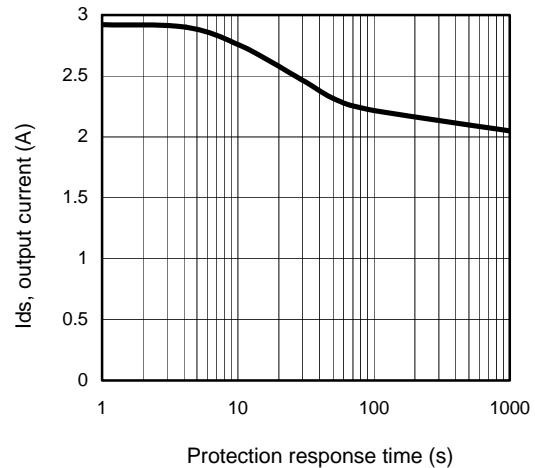


Figure 10 – Ids (A) Vs over temperature protection response time (s) / IPS1051L

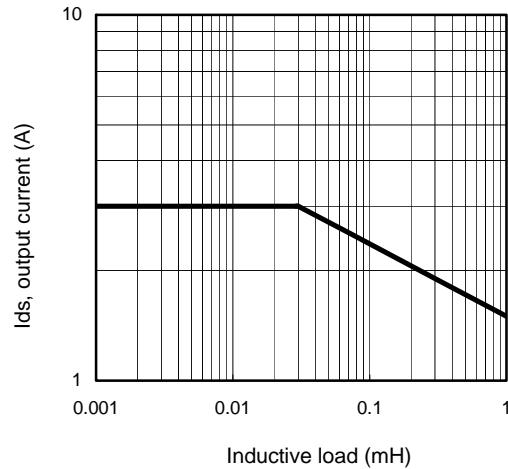


Figure 11 – Max. ouput current (A) Vs Inductive load (mH)

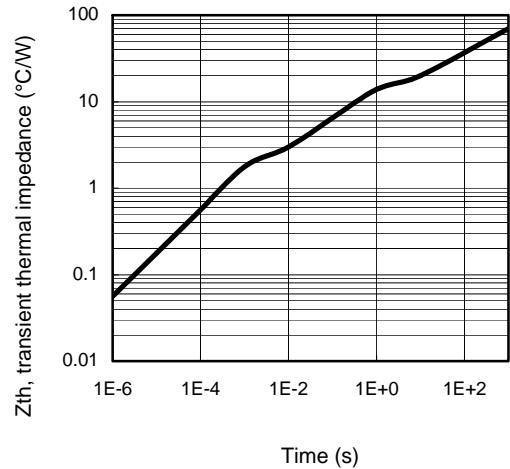
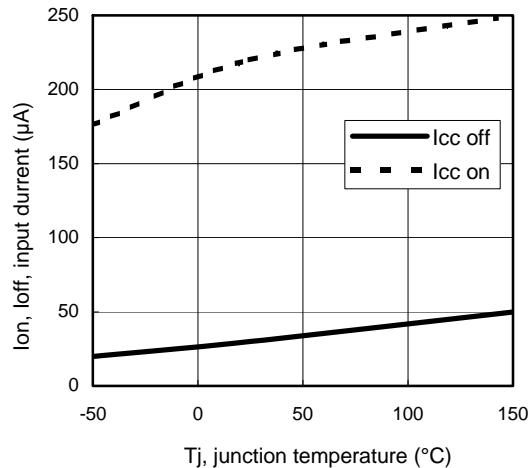
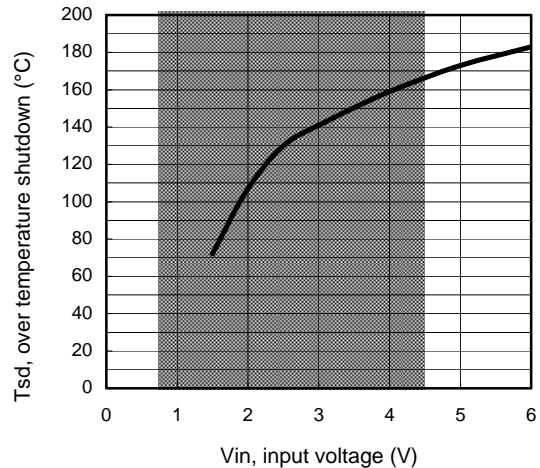


Figure 12 – Transient thermal impedance (°C/W) Vs time (s)

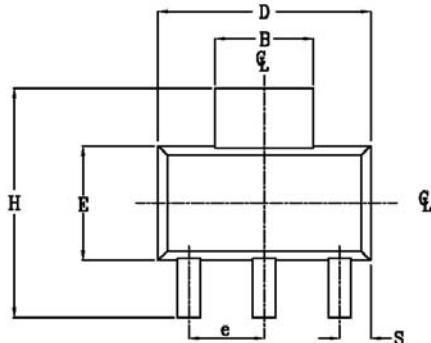


**Figure 13 – Input current (μA) On and Off
Vs junction temperature (°C)**



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

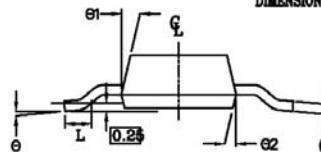
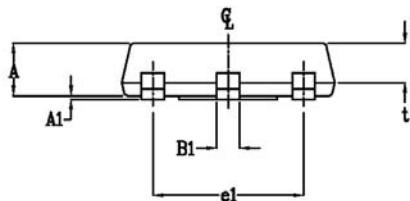
Case Outline - SOT-223 - Automotive Q100 PbF MSL2 qualified



POS	MILLIMETERS		INCHES	
	MAX	MIN	MAX	MIN
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	.028
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
G	10° MAX		10° MAX	
G1	16°	10°	16°	10°
G2	16°	10°	16°	10°
L	0.75 MIN		0.0295 MIN	

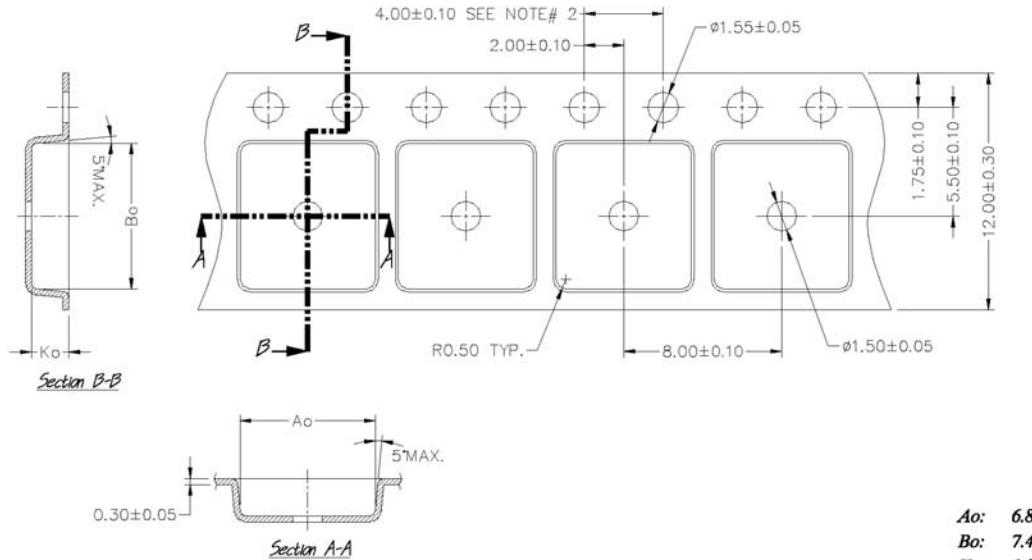
NOTE:

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

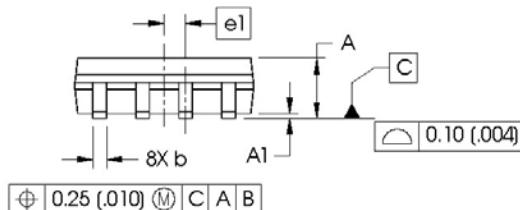
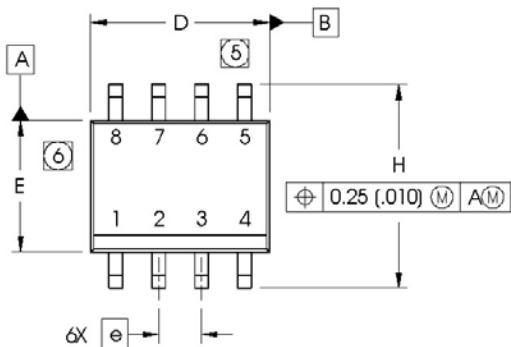


NOTES:

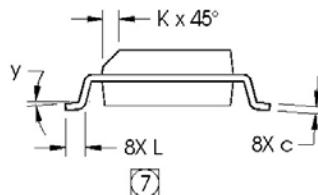
1. Ao & Bo are measured at 0.3mm above base of pocket.
2. 10 pitches cumulative tol. $\pm 0.2\text{mm}$.

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

Dimensions are shown in millimeters (inches)



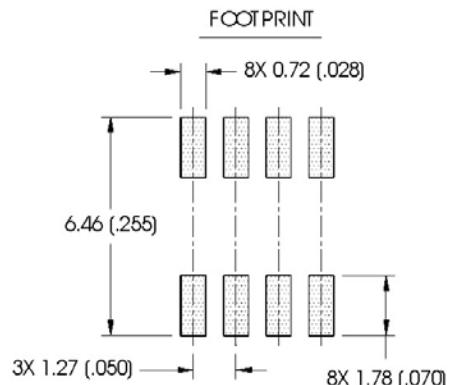
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0532	.0688	1.35	1.75
A1	.0040	.0098	0.10	0.25
b	.013	.020	0.33	0.51
c	.0075	.0098	0.19	0.25
D	.189	.1968	4.80	5.00
E	.1497	.1574	3.80	4.00
e	.050	BASIC	1.27	BASIC
e1	.025	BASIC	0.635	BASIC
H	.2284	.2440	5.80	6.20
K	.0099	.0196	0.25	0.50
L	.016	.050	0.40	1.27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



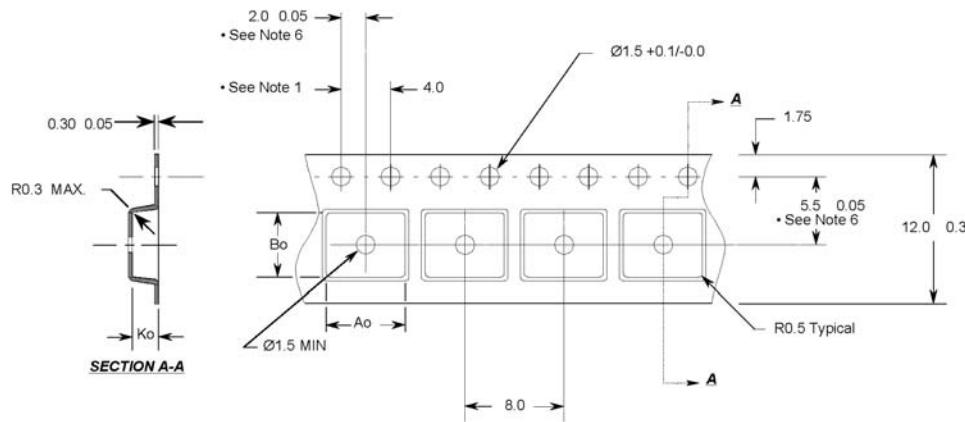
NOTES:

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.

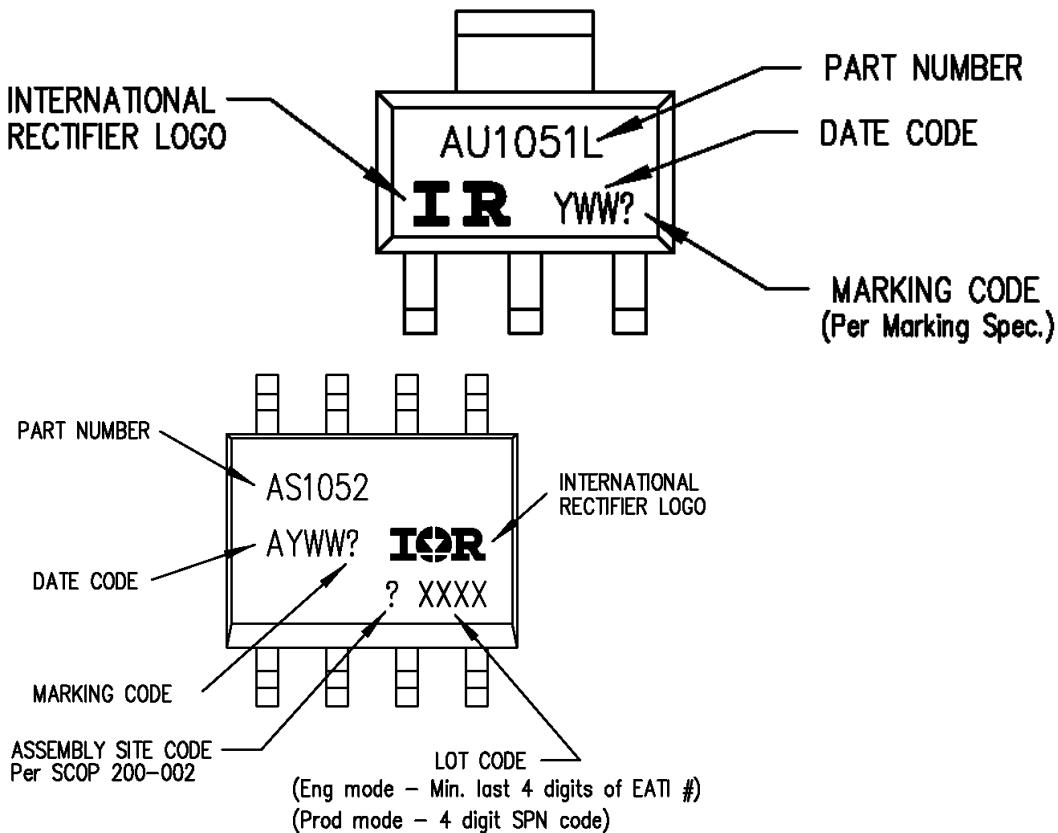
$$A_o = 6.4 \text{ mm}$$

$$B_o = 5.2 \text{ mm}$$

$$K_o = 2.1 \text{ mm}$$

- 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	95	AUIPS1051L
		Tape and reel	2500	AUIPS1051LTR

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

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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