International
IOR Rectifier

May, 9th 2012
Automotive grade

AUIPS1041(L)(R)/AUIPS1042G

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

Product Summary

Rds(on)	100mΩ (max.)
Vclamp	39V
Ishutdown	4.5A (typ.)

Packages

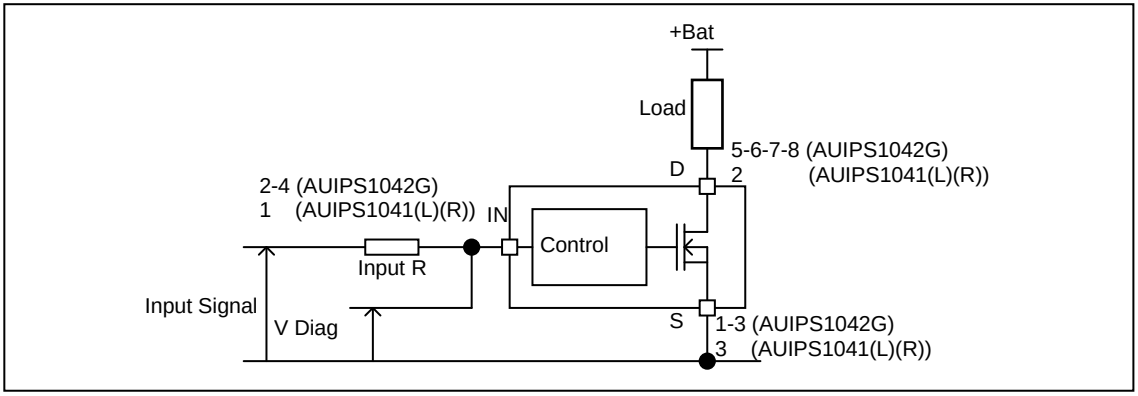


SOT-223	SO-8	D-Pak
AUIPS1041L	AUIPS1042G	AUIPS1041R

Description

The AUIPS1041(L)(R) and AUIPS1042G are three terminal Intelligent Power Switches (IPS) featuring low side MOSFETs with over-current, over-temperature, ESD protection and drain to source active clamp. The AUIPS1042G is a dual channel device while the AUIPS1041 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 4.5A. 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



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)
		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-Q100-003)	
	Human Body Model	Class H2 (+/-2500V) (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. (Tj= -40°C..150°C, Vcc=6..36V 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
Isd cont.	Max diode continuous current (limited by thermal dissipation)	—	1.5	A
Pd	Maximum power dissipation (internally limited by thermal protection) Rth=60°C/W AUIPS1041L 1" sqr. Footprint		2	W
	Rth=100°C/W AUIPS1042G std. footprint		1.25	
Tj max.	Max. storage & operating temperature junction temperature	-40	150	°C

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
Rth1	Thermal resistance junction to ambient AUIPS1041L SOT-223 std. footprint	100	—	°C/W
Rth2	Thermal resistance junction to ambient AUIPS1041L SOT-223 1" sqr. Footprint	60	—	
Rth1	Thermal resistance junction to ambient AUIPS1041R D-Pak std. footprint	70	—	
Rth2	Thermal resistance junction to case AUIPS1041R D-Pak	6	—	
Rth1	Thermal resistance junction to ambient AUIPS1042G SO-8 std. Footprint 1 die active	100	—	
Rth1	Thermal resistance junction to ambient AUIPS1042G 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
VIH	High level input voltage	4.5	5.5	V
VIL	Low level input voltage	0	0.5	
Ids	Continuous drain current, Tambient=85°C, Tj=125°C, Vin=5V Rth=60°C/W AUIPS1041L 1" sqr. Footprint	—	1.95	A
	Continuous drain current, Tambient=85°C, Tj=125°C, Vin=5V Rth=50°C/W AUIPS1041R 1" sqr. Footprint	—	2.2	
	Continuous drain current, Tambient=85°C, Tj=125°C, Vin=5V Rth=100°C/W AUIPS1042G 1" sqr. Footprint - 1 die active	—	1.5	
	Continuous drain current, Tambient=85°C, Tj=125°C, Vin=5V Rth=130°C/W AUIPS1042G 1" sqr. Footprint - 2 die active		0.7	
Rin	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)	—	20	µH
Max. F	Max. frequency	—	2000	Hz
Max. t rise	Max. input rising time	—	1	µs

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

Static Electrical Characteristics

Tj= -40..150°C, Vcc=6..28V (unless otherwise specified), typical value are given for Tj=25°C

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Rds(on)	ON state resistance Tj=25°C	—	80	100	mΩ	Vin=5V, Ids=3A
	ON state resistance Tj=150°C	—	135	175		
Idss1	Drain to source leakage current	—	0.1	2	µA	Vcc=14V, Tj=25°C
Idss2	Drain to source leakage current	—	0.2	4		Vcc=28V, Tj=25°C
V clamp1	Drain to source clamp voltage 1	36	38	—	V	Id=10mA
V clamp2	Drain to source clamp voltage 2	—	39	42		Id=1A
Vin clamp	IN to source pin clamp voltage	5.5	6.5	7.5		Iin=1mA
Vth	Input threshold voltage	—	1.7	—		Id=10mA

Switching Electrical Characteristics

Vcc=14V, Resistive load=5Ω, Rinput=0Ω, Vin=5V, Tj=25°C

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Tdon	Turn-on delay time to 20%	2	7	15	µs	See figure 2
Tr	Rise time 20% to 80%	2	7	20		
Tdoff	Turn-off delay time to 80%	15	40	150		
Tf	Fall time 80% to 20%	4	10	20		
Eon + Eoff	Turn on and off energy	—	0.2	—	mJ	

Protection Characteristics

Tj= -40..150°C, Vcc=6..28V (unless otherwise specified), typical value are given for Tj=25°C

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Tsd	Over temperature threshold	150(2)	165	—	°C	See figure 1
Isd	Over current threshold	2.7	4.5	6	A	See figure 1
OV	Over voltage protection (not active when the device is ON)	34	37	—	V	
Vreset	IN protection reset threshold	—	1.7	—	V	
Treset	Time to reset protection	15(2)	50	200	µs	Vin=0V, Tj=25°C

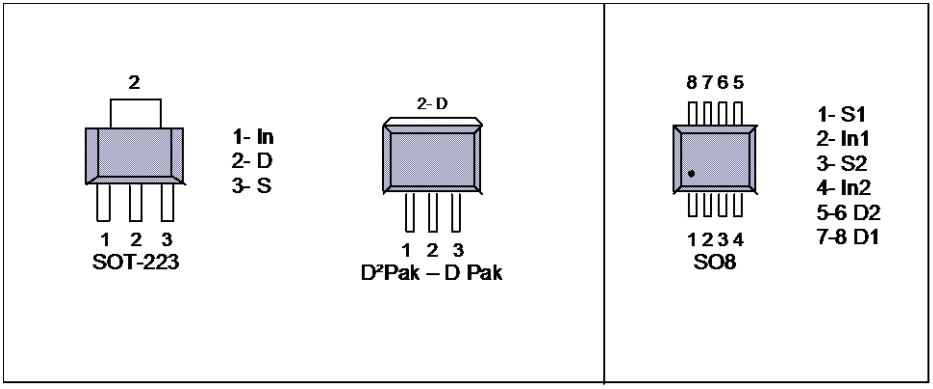
(2) Guaranteed by design

Diagnostic

Tj= -40..150°C, Vcc=6..28V (unless otherwise specified), typical value are given for Tj=25°C

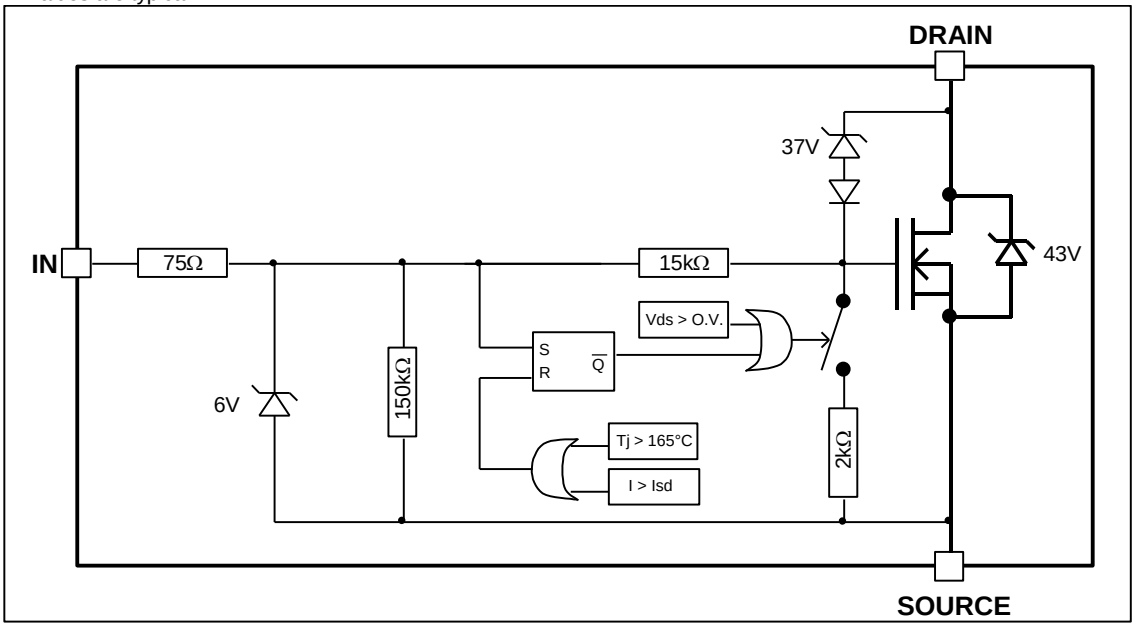
Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Iin, on	ON state IN positive current	10	32	80	µA	Vin=5V
Iin, off	OFF state IN positive current (after protection latched)	120	230	350		Vin=5V

Lead Assignments



Functional Block Diagram

All values are typical



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

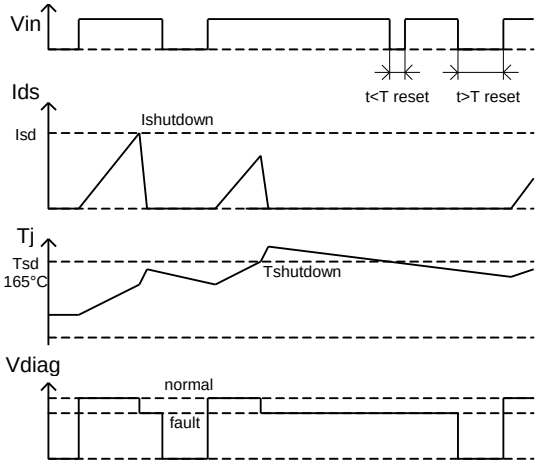


Figure 1 – Timing diagram

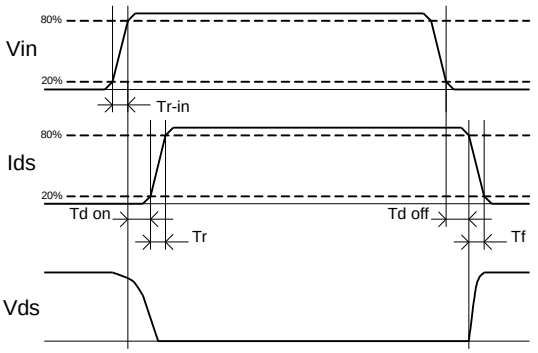


Figure 2 – IN rise time & switching definitions

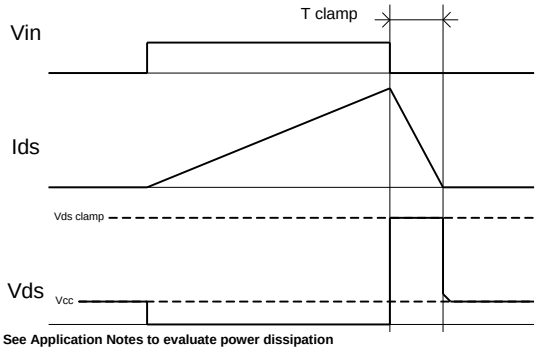


Figure 3 – Active clamp waveforms

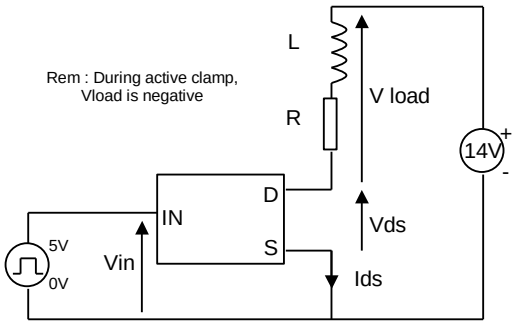


Figure 4 – Active clamp test circuit

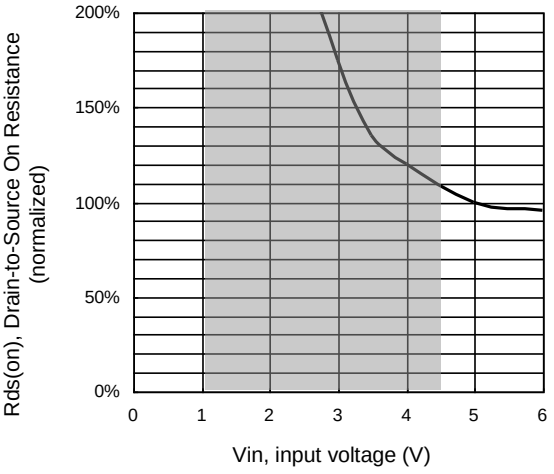


Figure 5 – Normalized Rds(on) (%) Vs Input voltage (V)

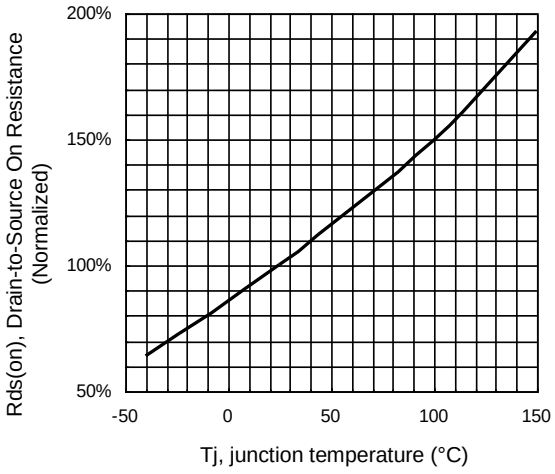


Figure 6 - Normalized Rds(on) (%) Vs Tj (°C)

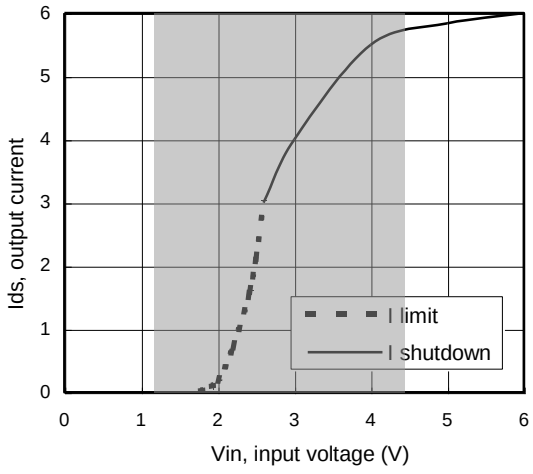


Figure 7 – Current limitation and current shutdown Vs Input voltage (V)

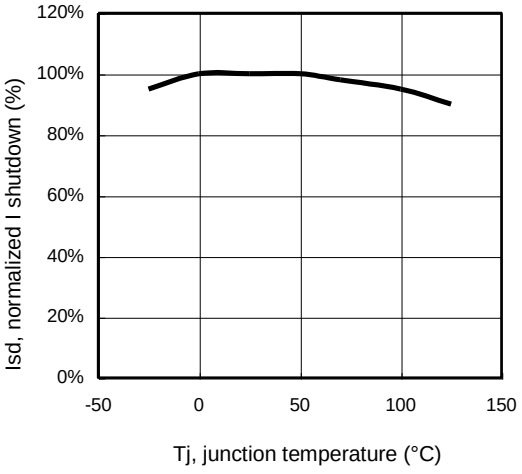


Figure 8 – Normalized I shutdown (%) Vs junction temperature (°C)

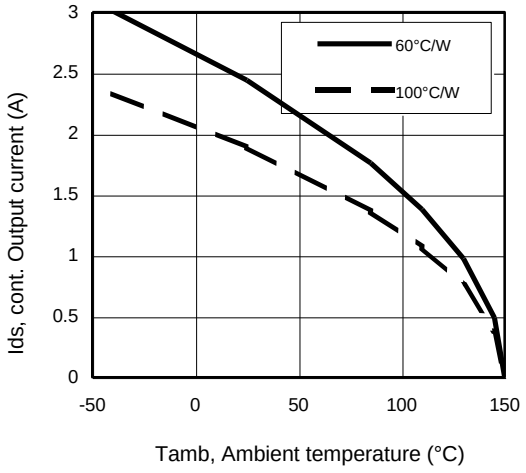


Figure 9 – Max. continuous output current (A) Vs Ambient temperature (°C)

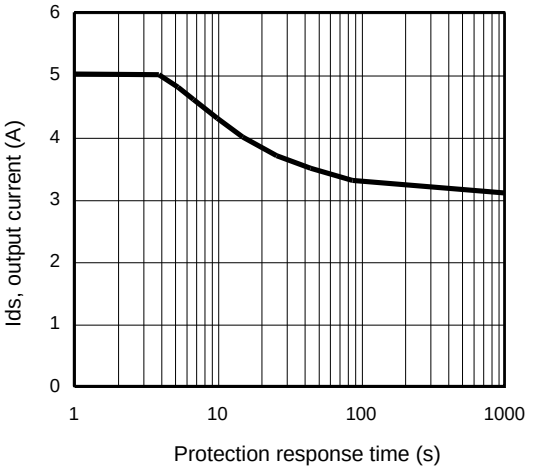


Figure 10 – Ids (A) Vs over temperature protection response time (s) / IPS1041L

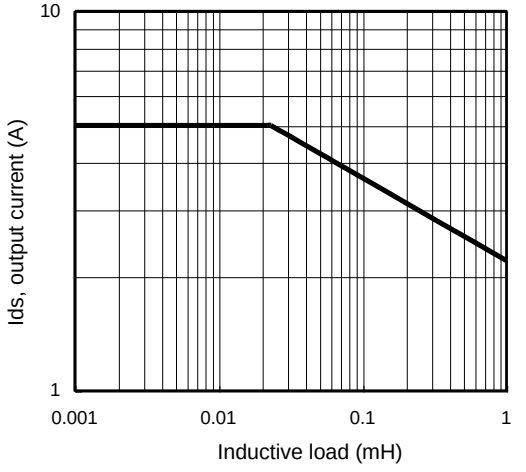


Figure 11 – Max. ouput current (A) Vs Inductive load (mH)

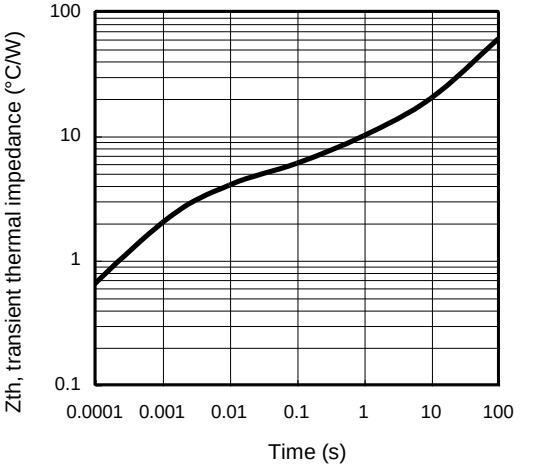


Figure 12 – Transient thermal impedance (°C/W) Vs time (s)

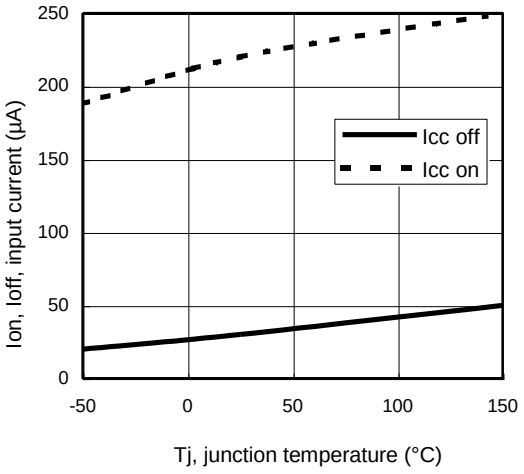


Figure 13 – Input current (µA) On and Off Vs junction temperature (°C)

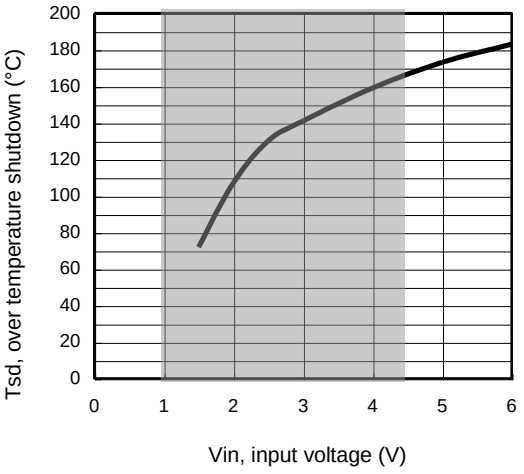
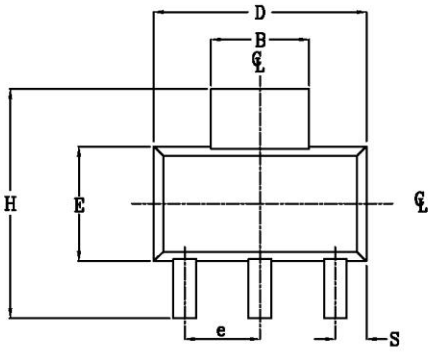


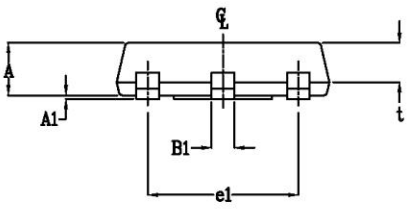
Figure 14 – Over temperature shutdown (°C) Vs input voltage (V)

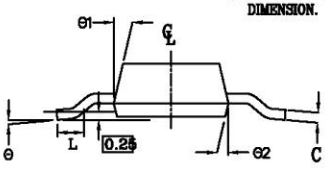
Case Outline - SOT-223 - Automotive Q100 PbF MSL2 qualified



POS	MILLIMETERS		INCHES	
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.

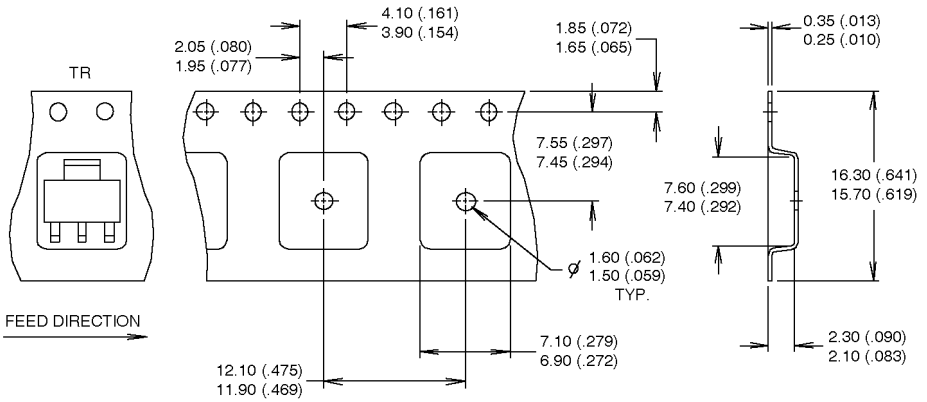




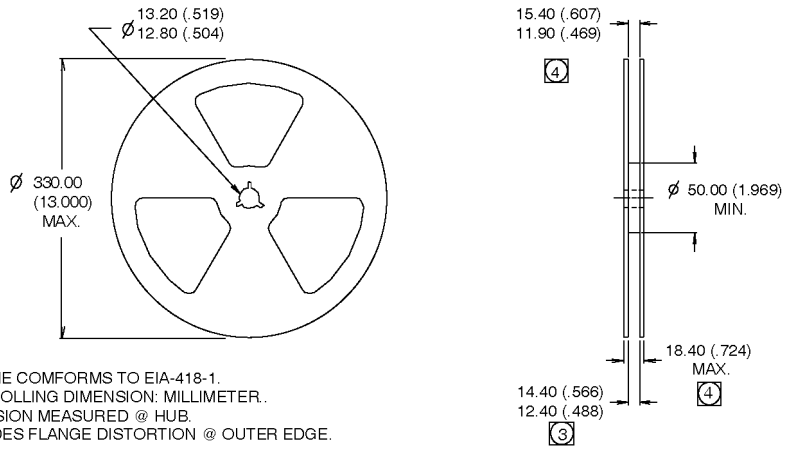
Leads and drain are plated with 100% Sn

Tape & Reel - SOT-223

Dimensions are shown in milimeters (inches)



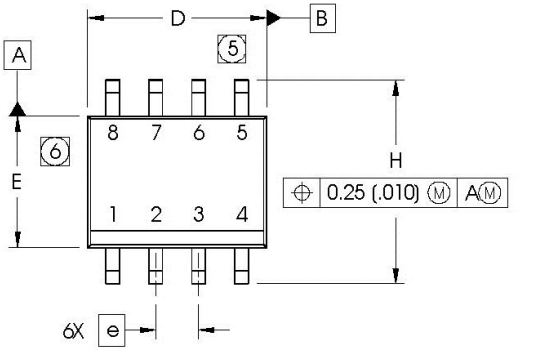
NOTES :
1. CONTROLLING DIMENSION: MILLIMETER.
2. OUTLINE CONFORMS TO EIA-481 & EIA-541.
3. EACH Ø330.00 (13.00) REEL CONTAINS 2,500 DEVICES.



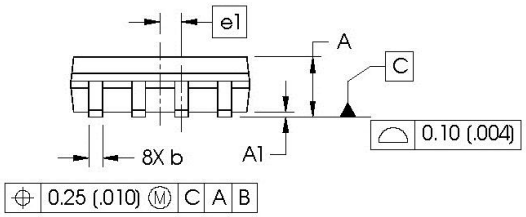
NOTES :
1. OUTLINE COMFORMS TO EIA-418-1.
2. CONTROLLING DIMENSION: MILLIMETER..
3. DIMENSION MEASURED @ HUB.
4. INCLUDES FLANGE DISTORTION @ OUTER EDGE.

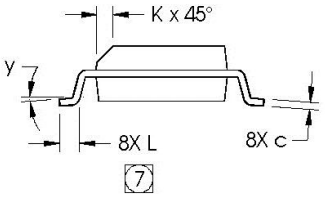
Case Outline - SO-8 - Automotive Q100 PbF MSL2 qualified

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:

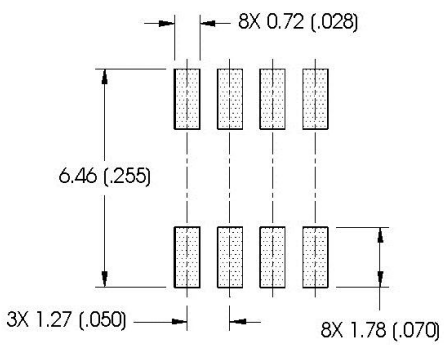
1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.

(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).

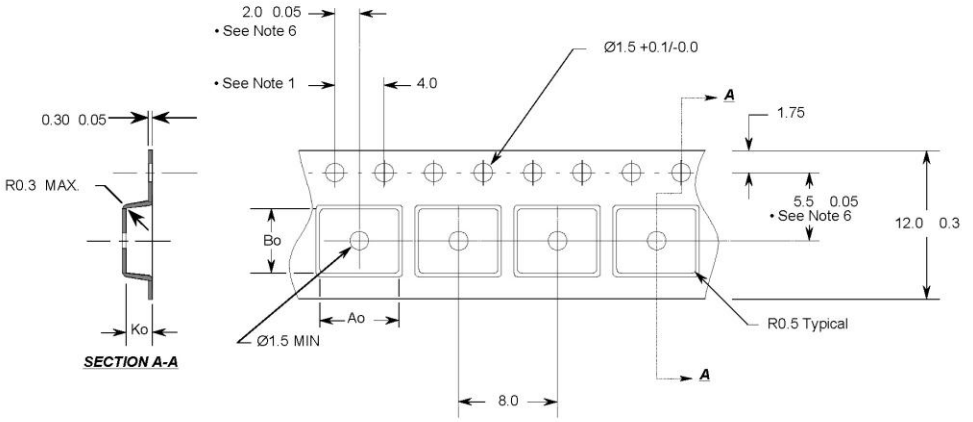
(7) DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

FOOTPRINT



Leads and drain are plated with 100% Sn

Tape & Reel - SO-8

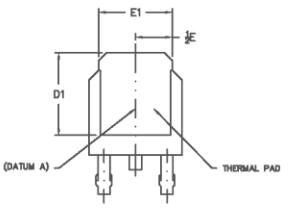


Notes:
1. 10 sprocket hole pitch cumulative tolerance 0.2
2. Camber not to exceed 1mm in 100mm
3. Material: Black Conductive Advantek Polystyrene
4. Ao and Bo measured on a plane 0.3mm above the bottom of the pocket
5. Ko measured from a plane on the inside bottom of the pocket to the top surface of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

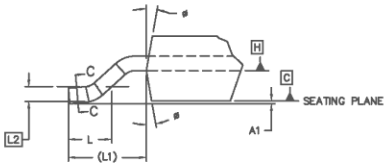
Ao = 6.4 mm
Bo = 5.2 mm
Ko = 2.1 mm

- All Dimensions in Millimeters -

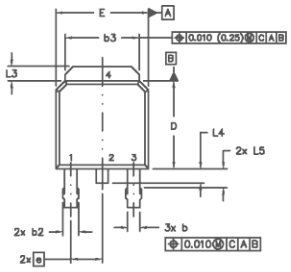
Case Outline – D-Pak - Automotive Q100 PbF MSL1 qualified



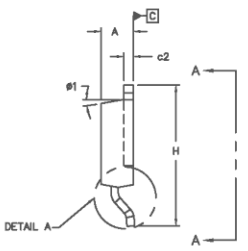
VIEW A–A

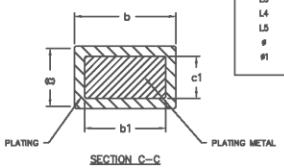


DETAIL "A"
ROTATED 90°



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	–	.305	–	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
ø	0°	10°	0°	10°	
ø1	0°	15°	0°	15°	



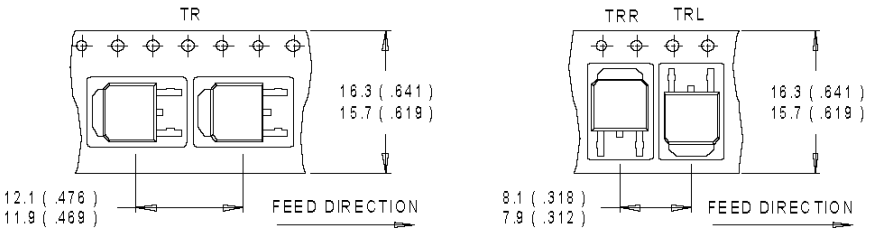


SECTION C–C

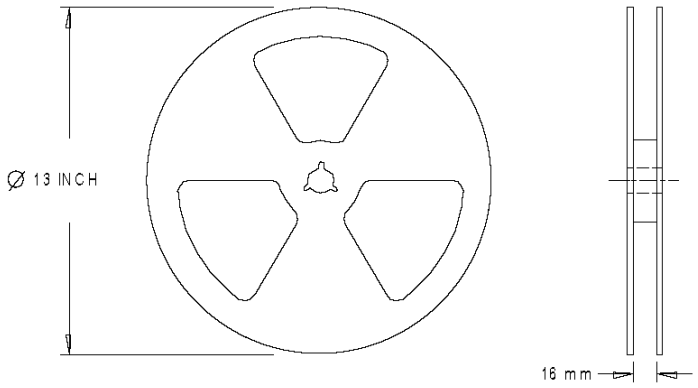
NOTES:

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 - D-Pak



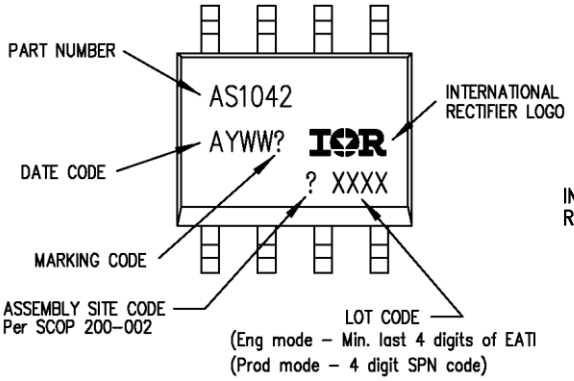
NOTES :
1. CONTROLLING DIMENSION : MILLIMETER.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
3. OUTLINE CONFORMS TO EIA-481 & EIA-541.

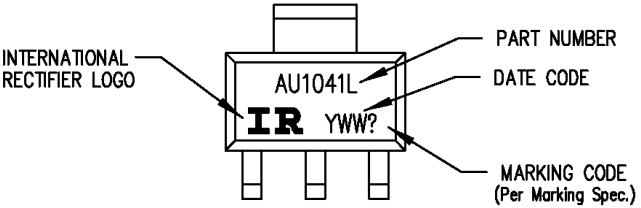


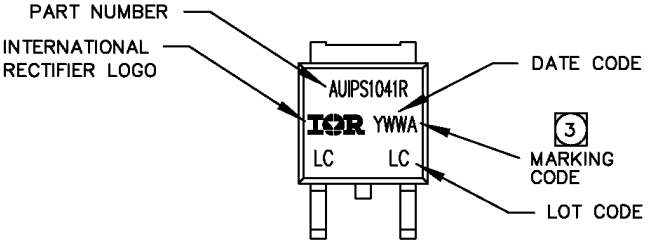
NOTES :
1. OUTLINE CONFORMS TO EIA-481.

Dimensions are shown in millimeters (inches)

Part Marking Information







Ordering Information

Base Part Number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIPS1042	SOIC-8	Tube	95	AUIPS1042G
		Tape and reel	2500	AUIPS1042GTR
AUIPS1041	SOT-223	Tube	80	AUIPS1041L
		Tape and reel	2500	AUIPS1041LTR
AUIPS1041	D-Pak-5-Lead	Tube	75	AUIPS1041R
		Tape and reel	2000	AUIPS1041RTR
		Tape and reel left	3000	AUIPS1041RTRL
		Tape and reel right	3000	AUIPS1041RTRR

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Revision History

Revision	Date	Notes/Changes
C1	November, 24th, 2010	AU release
C2	December, 7th 2010	Remove ESD section page 3
C3	December, 9th 2010	Update qual page
C4	December, 14th 2010	Update Tdon
D	February, 28th 2011	Update Max rating
E	March, 14th 2011	Update part marking
F	November, 14th 2011	Update T&R SOT223
G	May 9th, 2012	Update component number for the SOT223 tube.

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