

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)
		D2PAK-3L
		MSL1, 260°C (per IPC/JEDEC J-STD-020)
		TO220-5L
		Not applicable
ESD	Machine Model	Class M4 (+/-450V) (per AEC-Q100-003)
	Human Body Model	Class H2 (+/-2500V) (per AEC-Q100-002)
	Charged Device Model	Class C3B (+/-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°C..150°C, V_{cc}=6..36V 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)	—	4	A
P _d	Maximum power dissipation (internally limited by thermal protection)			
	R _{th} =5°C/W AUIPS1031	—	25	W
	R _{th} =40°C/W AUIPS1031S 1" sqr. Footprint	—	3.1	
	R _{th} =50C/W AUIPS1031R 1" sqr. footprint	—	2.5	
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 AUIPS1031 TO-220 free air	50	—	°C/W
R _{th2}	Thermal resistance junction to case AUIPS1031 TO-220	3.9	—	
R _{th1}	Thermal resistance junction to ambient AUIPS1031S D ² Pak std. footprint	60	—	
R _{th2}	Thermal resistance junction to ambient AUIPS1031S D ² Pak 1" sqr. footprint	40	—	
R _{th3}	Thermal resistance junction to case AUIPS1031S D ² Pak	3.9	—	
R _{th1}	Thermal resistance junction to ambient AUIPS1031R D-Pak std. footprint	70	—	
R _{th2}	Thermal resistance junction to ambient AUIPS1031R D-Pak 1" sqr. Footprint	50	—	
R _{th3}	Thermal resistance junction to case AUIPS1031R D-Pak	3.9	—	

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 _{IL}	Low level input voltage	0	0.5	
I _{ds}	Continuous drain current, T _{ambient} =85°C, T _j =125°C, V _{in} =5V			A
	R _{th} =5°C/W AUIPS1031	—	9.5	
	R _{th} =40°C/W AUIPS1031S 1" sqr. footprint	—	3.3	
	R _{th} =50C/W AUIPS1031R 1" sqr. footprint	—	3	
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)	—	50	μH
Max F	Max. frequency (switching losses = conduction losses)	—	1.5	kHz
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

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	—	40	50	mΩ	V _{in} = 5V, I _{ds} = 8A
	ON state resistance T _j = 150°C (2)	—	76	95		
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	39	—	V	I _d = 20mA
V _{clamp2}	Drain to source clamp voltage 2	—	40	42		I _d = 1A
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 = 1.5Ω, R_{input} = 0Ω, V_{in} = 5V, T_j = 25°C

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
T _{don}	Turn-on delay time to 20%	3	10	30	μs	See figure 2
T _r	Rise time 20% to 80%	6	20	40		
T _{doff}	Turn-off delay time to 80%	20	70	200		
T _f	Fall time 80% to 20%	6	15	30		
E _{on} + E _{off}	Turn on and off energy	—	0.7	—	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	9.5	18	27	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

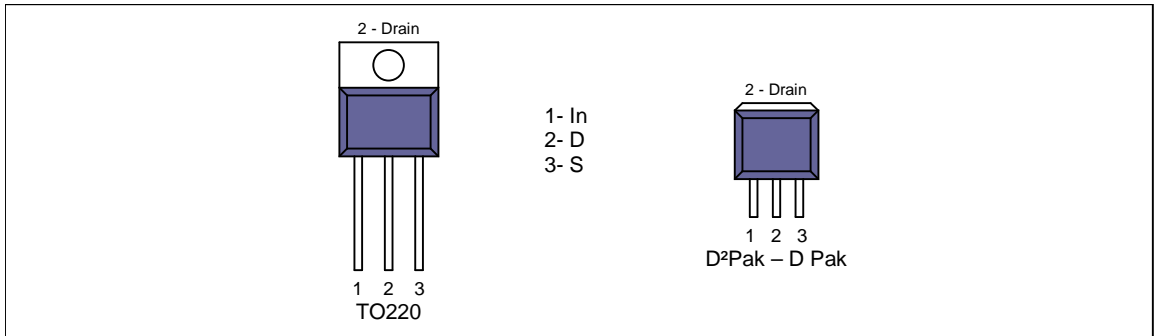
Diagnostic

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)	120	230	350		V _{in} = 5V

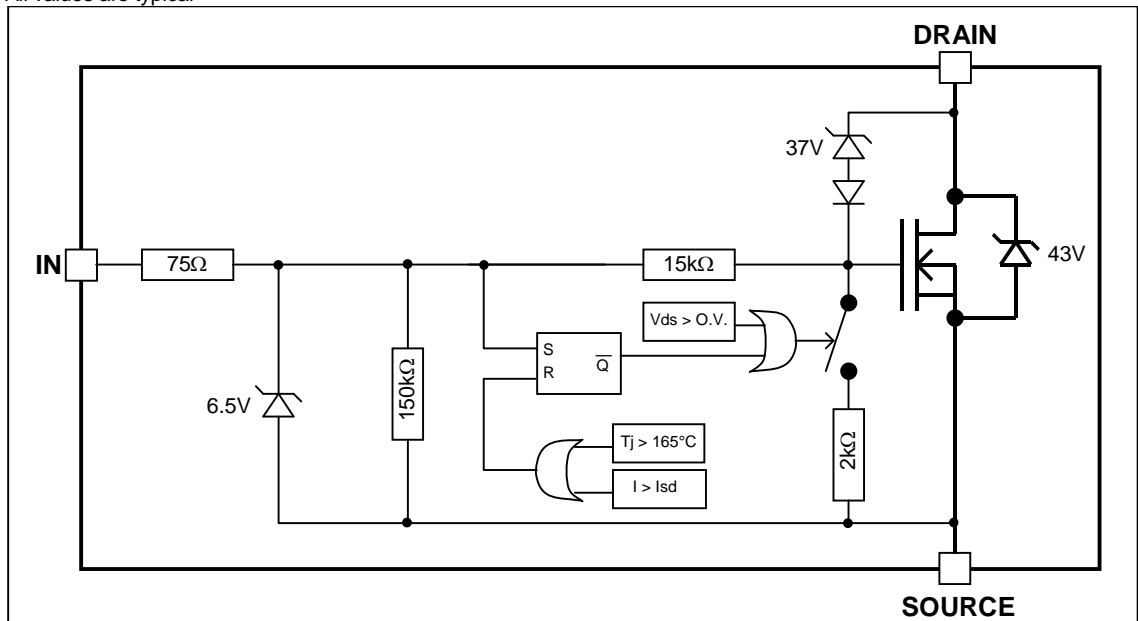
(2) Guaranteed by design

Lead Assignments



Functional Block Diagram

All values are typical



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

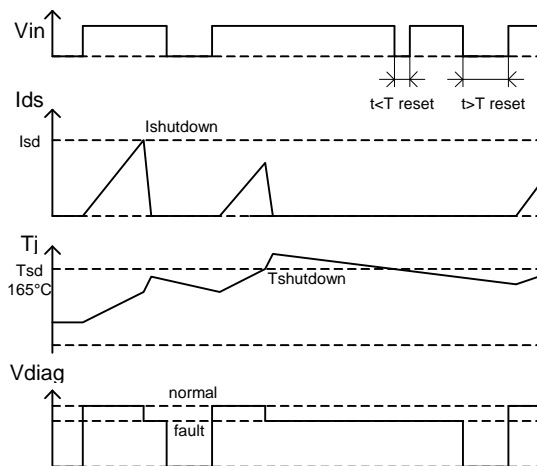


Figure 1 – Timing diagram

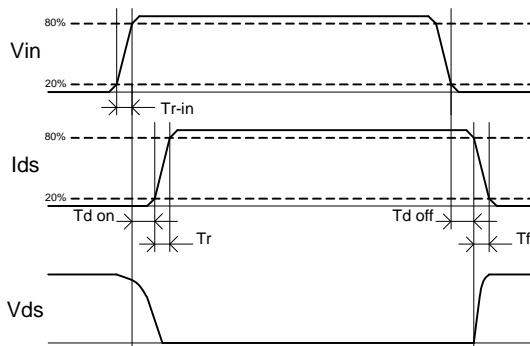


Figure 2 – IN rise time & switching definitions

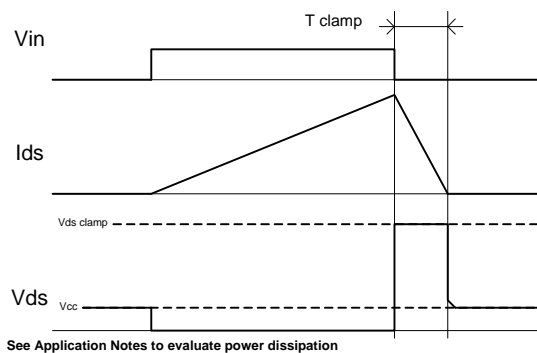


Figure 3 – Active clamp waveforms

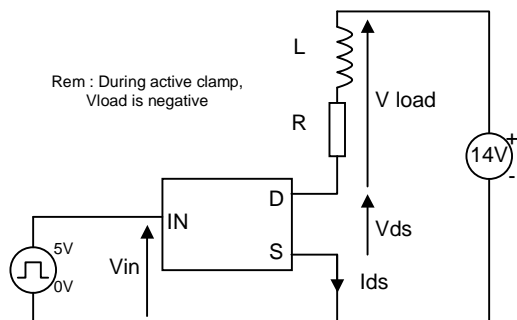


Figure 4 – Active clamp test circuit

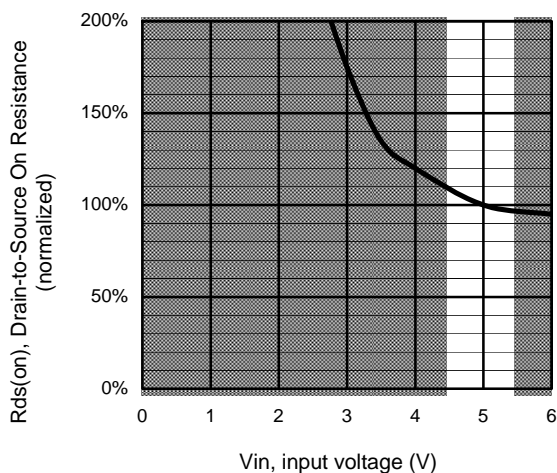


Figure 5 – Normalized R_{ds(on)} (%) Vs Input voltage (V)

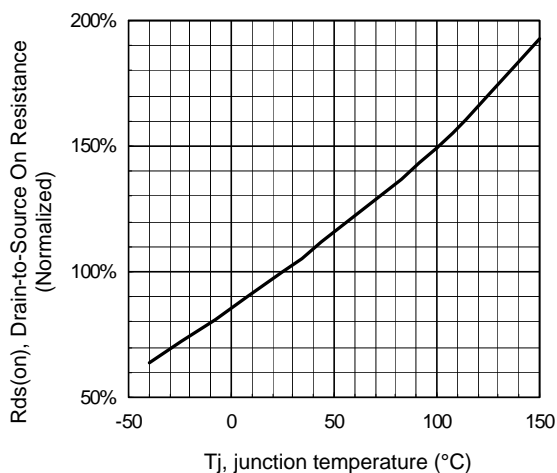


Figure 6 - Normalized R_{ds(on)} (%) Vs T_j (°C)

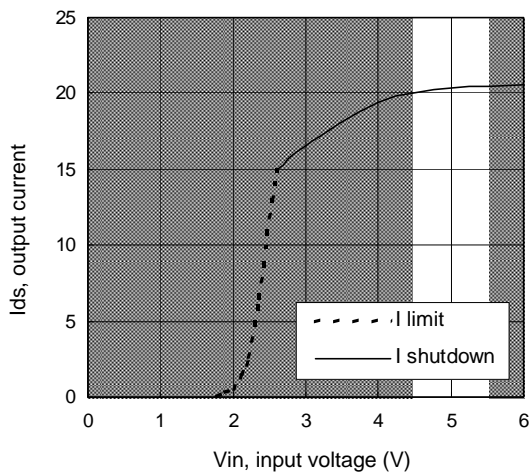


Figure 7 – Current limitation and current shutdown Vs Input voltage (V)

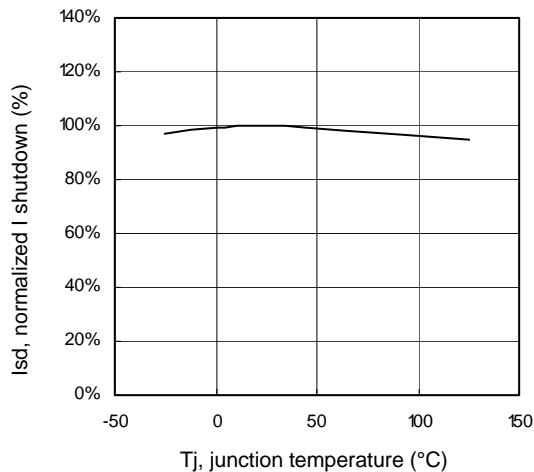


Figure 8 – Normalized I shutdown (%) Vs junction temperature (°C)

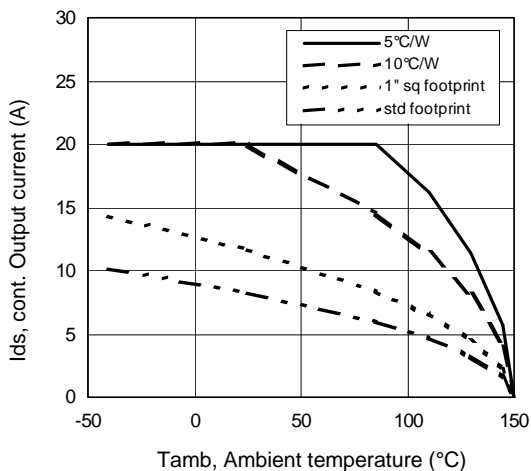


Figure 9 – Max. continuous output current (A) Vs Ambient temperature (°C)

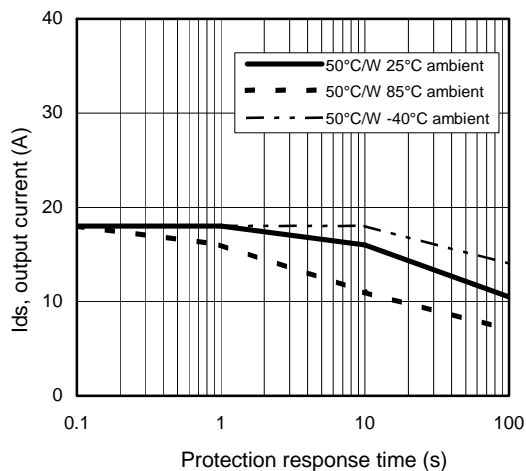


Figure 10 – Ids (A) Vs over temperature protection response time (s)

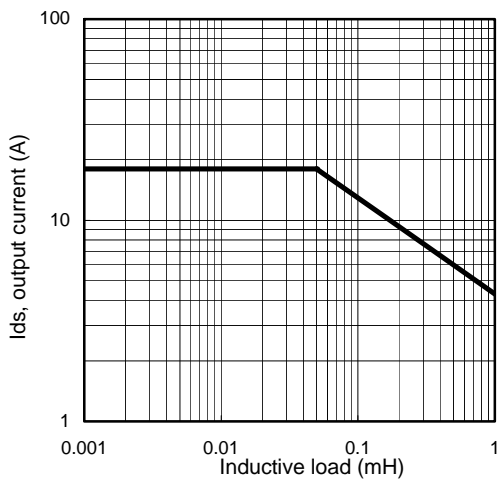


Figure 11 – Max. output current (A) Vs Inductive load (mH)

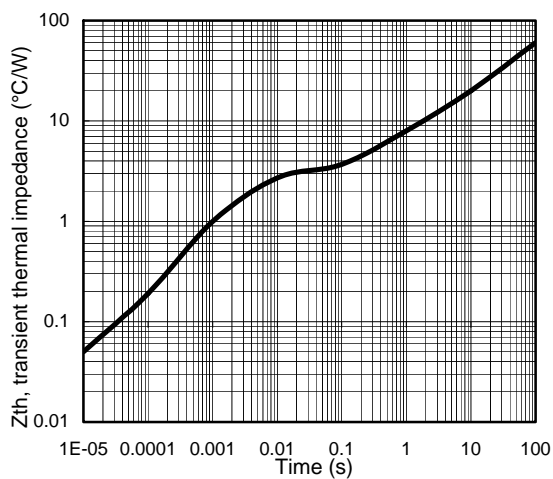
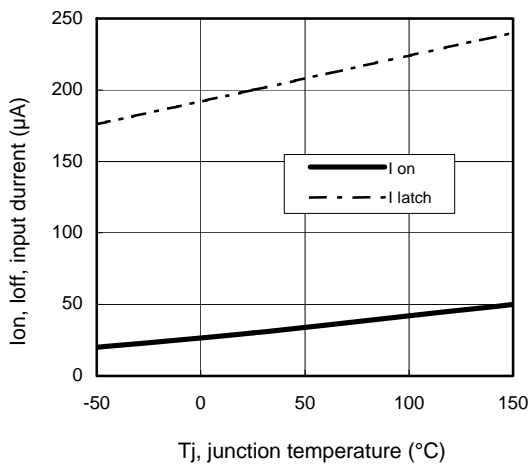
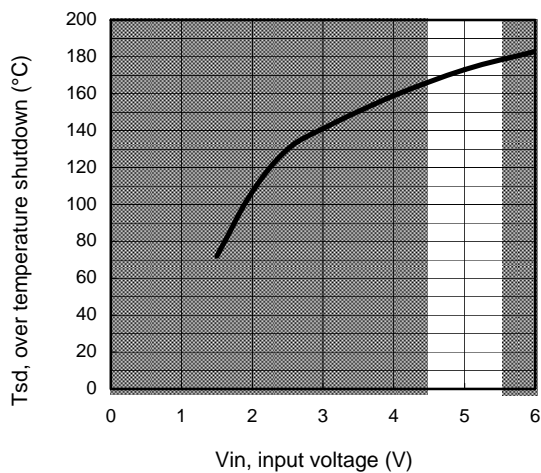


Figure 12 – Transient thermal impedance (°C/W) Vs time (s)

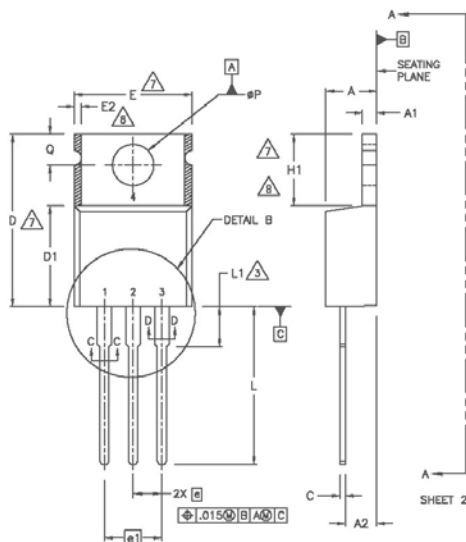
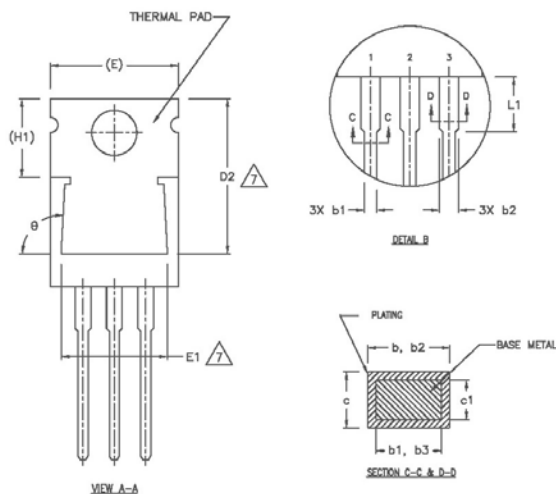


**Figure 13 – Input current (µA) On and Off
Vs junction temperature (°C)**



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

Case Outline – TO-220 AB – Automotive Q100 PbF qualified

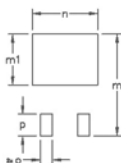
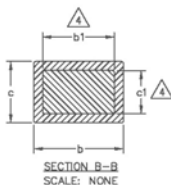
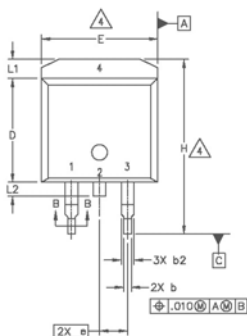
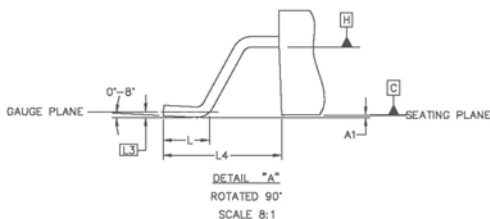
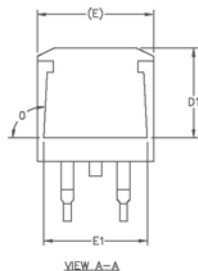


SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.82	.140	.190	5
A1	0.51	1.40	.020	.055	
A2	2.04	2.92	.080	.115	
b	0.38	1.01	.015	.040	
b1	0.38	0.96	.015	.038	
b2	1.15	1.77	.045	.070	5
b3	1.15	1.73	.045	.068	
c	0.36	0.61	.014	.024	
c1	0.36	0.56	.014	.022	
D	14.22	16.51	.560	.650	
D1	8.38	9.02	.330	.355	7
D2	12.19	12.88	.480	.507	
E	9.66	10.66	.380	.420	4,7
E1	8.38	8.89	.330	.350	7
e	2.54 BSC		.100 BSC		7,8
e1	5.08		.200 BSC		
H1	5.85	6.55	.230	.270	
L	12.70	14.73	.500	.580	
L1	—	6.35	—	.250	
øP	3.54	4.08	.139	.161	3
Q	2.54	3.42	.100	.135	
ø	90°-93°		90°-93°		

NOTES:

- 1 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
- 2 DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
- 3 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
- 4 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.
- 5 DIMENSION b1 & c1 APPLY TO BASE METAL ONLY.
- 6 CONTROLLING DIMENSION : INCHES.
- 7 THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
- 8 DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.
- 9 LEADS AND DRAIN ARE PLATED WITH 100% Sn

Case Outline - D²Pak (SMD-220) - Automotive Q100 PbF MSL1 qualified

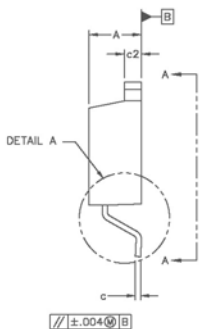


FOOT PRINT
SCALE 2:1

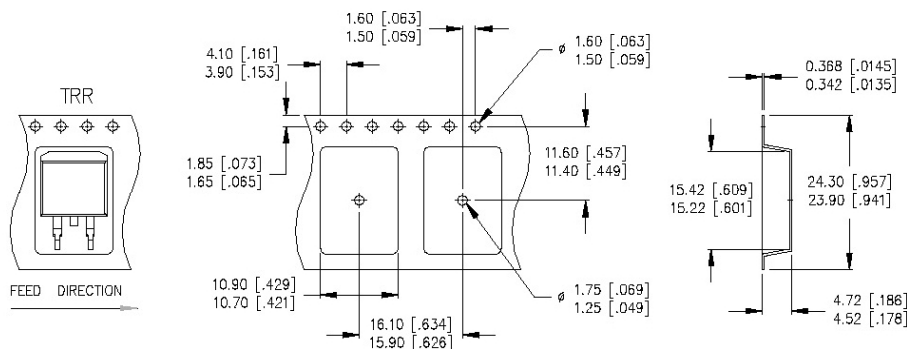
SYM BO L	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	4
A1	0.00	0.254	.000	.010	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.78	.045	.070	4
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	3
c2	1.14	1.65	.045	.065	
D	8.51	9.65	.335	.380	3
D1	8.86		.270		
E	9.65	10.67	.380	.420	
E1	6.22		.245		
e	2.54 BSC		.100 BSC		
H	14.61	15.88	.575	.625	
L	1.78	2.79	.070	.110	
L1		1.65		.065	
L2	1.27	1.78	.050	.070	
L3	0.25 BSC		.010 BSC		
L4	4.78	5.28	.188	.208	
m	17.78		.700		
m1	8.89		.350		
n	11.43		.450		
o	2.08		.082		
p	3.81		.150		
R	0.51	0.71	.020	.028	
θ	90°	93°	90°	93°	

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES]
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
5. CONTROLLING DIMENSION: INCH.
6. LEADS & DRAIN CONTACT ARE PLATED : 100% Sn

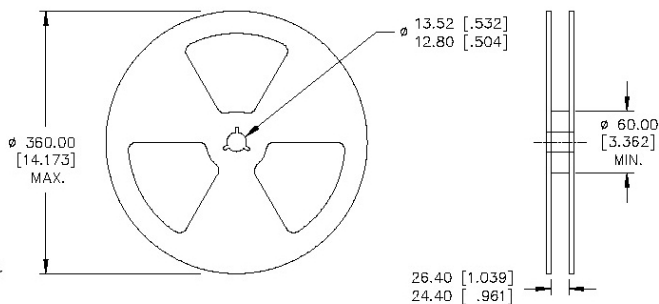


Tape & Reel - D²Pak (SMD220)



NOTES:

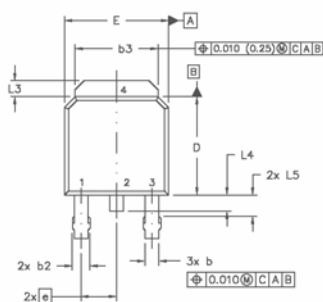
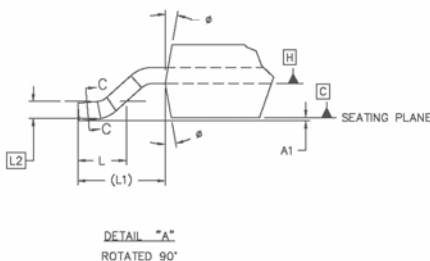
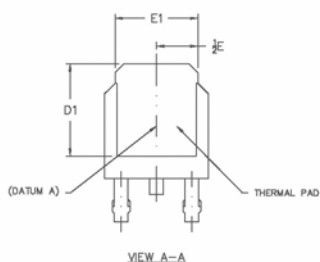
1. OUTLINE CONFORMS TO EIA-481 & EIA-541.
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCH].



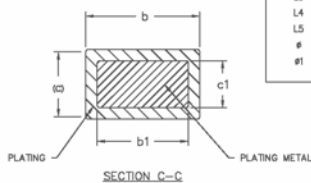
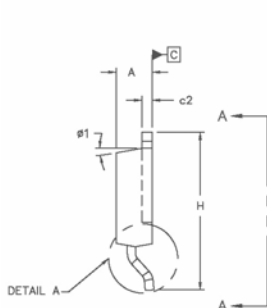
NOTES:

1. OUTLINE CONFORMS TO EIA-481 & EIA-541.
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].

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



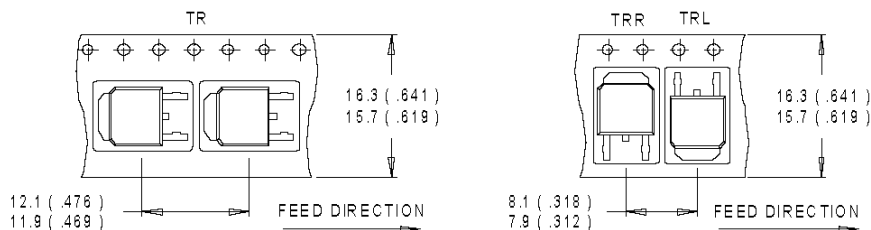
SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	2.18	2.39	.086	.094	
A1		0.13		.005	
b	0.64	0.89	.025	.035	5
b1	0.64	0.79	.025	.031	5
b2	0.76	1.14	.030	.045	
b3	4.95	5.46	.195	.215	
c	0.46	0.61	.018	.024	5
c1	0.41	0.56	.016	.022	5
c2	.046	0.89	.018	.035	5
D	5.97	6.22	.235	.245	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	8.40	10.41	.370	.410	
L	1.40	1.78	.055	.070	
L1	2.74 REF.		.108 REF.		
L2	.051 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"	



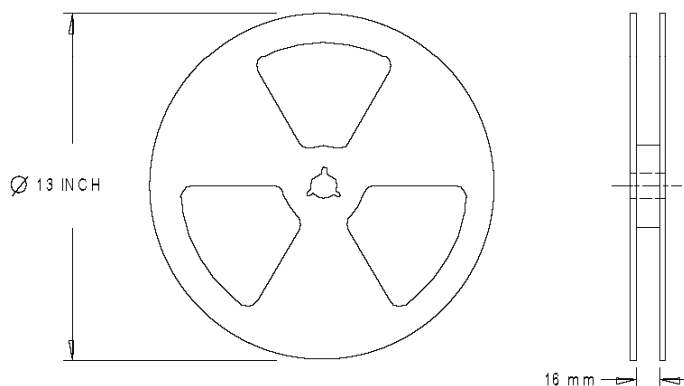
NOTES:

- 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 PLATED WITH 100% Sn

Tape & Reel - D-Pak



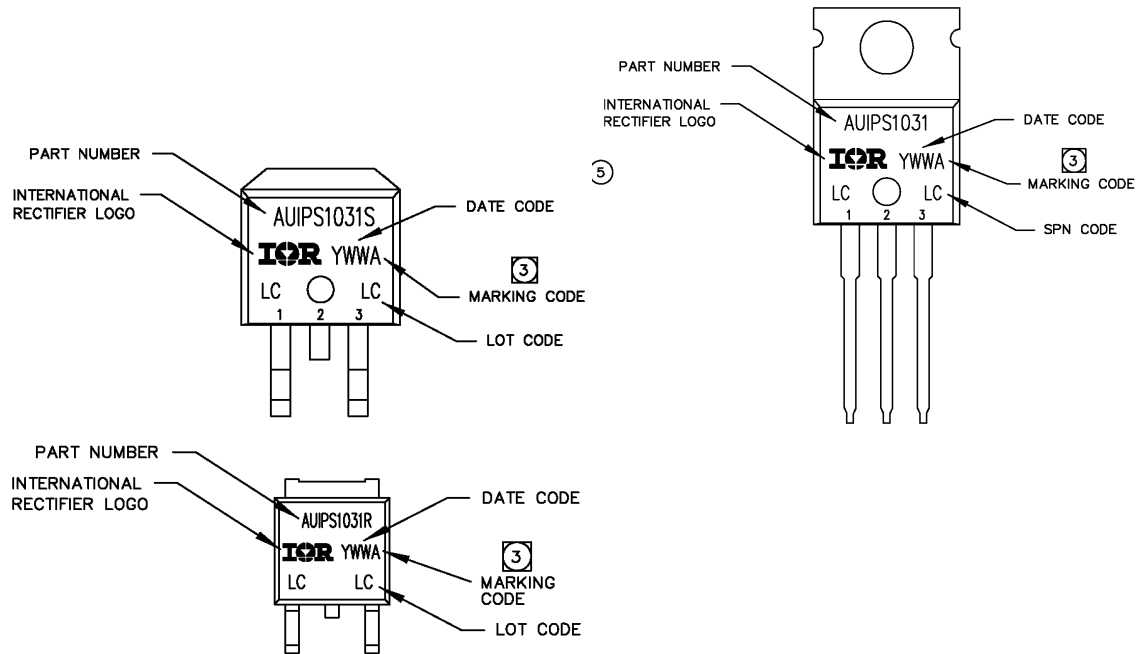
- NOTES :
1. CONTROLLING DIMENSION : MILLIMETER.
 2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
 3. OUTLINE CONFORMS TO EIA-481 & EIA-541.



- 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	
AUIPS1031	TO220 – 5Leads	Tube	50	AUIPS1031
	D2-Pak-5-Leads	Tube	50	AUIPS1031S
		Tape and reel left	800	AUIPS1031STRL
		Tape and reel right	800	AUIPS1031STRR
	D-Pak-5-Lead	Tube	75	AUIPS1031R
		Tape and reel	2000	AUIPS1031RTR
		Tape and reel left	3000	AUIPS1031RTRL
		Tape and reel right	3000	AUIPS1031RTRR

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Revision History

Revision	Date	Notes/Changes
D	November, 24 th , 2010	AU release
D1	December, 7 th , 2010	Remove ESD section page 3
D2	December, 9 th 2010	Update qual page 2
E	February, 8th 2011	Update Vclamp page 1
F	February, 28 th 2011	Update Max rating