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		D2PAK-5L	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 H3A (4,500 V) (per AEC-Q100-002)	
	Charged Device Model	Class C4 (1000 V) (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. All voltage parameters are referenced to Vcc lead. (Tj=-40°..150°C, Vcc=6..26V Tambient=25°C unless otherwise specified).

Symbol	Parameter	Min.	Max.	Units
Vcc-Vin	Maximum Vcc voltage	-16	37	V
Vcc-Vin cont.	Maximum continuous Vcc voltage	-16	32	
Vcc-Vfb	Maximum Ifb voltage	-16	33	
Vcc-Vout	Maximum output voltage	-0.3	37	
Ids cont.	Maximum body diode continuous current Rth=60°C/W (1)	—	2.8	A
Ids pulsed	Maximum body diode pulsed current (1)	—	100	
Pd	Maximum power dissipation Rth=60°C/W	—	2	W
Tj max.	Max. storage & operating temperature junction temperature	-40	150	°C
Min Rfb	Minimum on the resistor on Ifb pin	0.3	—	kΩ
Ifb max.	Max. Ifb current	-50	50	mA

(1) Limited by junction temperature. Pulsed is also limited by wiring

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
Rth1	Thermal resistance junction to ambient D²-Pak Std footprint	60	—	°C/W
Rth2	Thermal resistance junction to case D²-Pak	0.7	—	
Rth2	Thermal resistance junction to case TO220	0.7	—	

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
Iout	Continuous output current			A
	Tambient=85°C, Rth=5°C/W, Tj=125°C		23	
	Tambient=85°C, Rth=60°C/W, Tj=125°C	—	7	
Rifb	Recommended Ifb resistor (2)(3)	0.3	3.5	kΩ
Pulse min.	Minimum turn-on pulse width	1	—	ms
Fmax.	Maximum operating frequency	—	200	Hz

(2) If Rifb is too low, the device can be damaged.
(3) If Rifb is too high, the device may not switch on.

Protection Characteristics

Tj=-40°..150°C, Vcc=6..26V, Rifb=300 to 5kΩ

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Vifb-Vin@Isd	Over-current shutdown threshold	3.8	4.7	5.9	V	
Tsd	Over temperature threshold	—	165	—	°C	See fig. 5
OV	Over voltage protection (not latched)	33	35	39	V	
Isdf	Fixed over current shutdown	90	120	150	A	Vifb<Vifb-Vin@Isd
Isd_1k	Programmable over current shutdown 1k	30	40	53		Rifb=1kΩ
treset	Time to reset protection	—	50	500	µs	See fig. 5
Min. pulse	Min. pulse width (no WAIT state)	150	400	1200		Tj=25°C
WAIT	WAIT function timer	0.4	1	2	ms	See fig. 4 and 5
Rds(on) rev.	Reverse battery On state resistance Tj=25°C	4	6.7	10	mΩ	Vcc-Vin=-14V, Iout=30A
	Tj=125°C	—	10	15		

Static Electrical Characteristics

Tj=-40°..150°C, Vcc=6..26V (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Vcc op.	Operating Voltage range	6	—	32	V	
Icc off	Supply leakage current	—	1.5	5	µA	Vin=Vcc, Vcc-Vout=14V, Vcc-Vifb=14V, Tj=25°C
Iin, on	On state IN positive current	1.5	3	6	mA	Vcc-Vin=14V, Tj=25°C
Vih	High level Input threshold voltage (4)	—	5.4	6.3	V	
Vil	Low level Input threshold voltage (4)	4	4.9	5.8		
Vhyst	Input hysteresis Vih-Vil	0.2	0.4	1.5		
Iout	Drain to source leakage current	—	1.2	5	µA	Vin=Vcc, Vcc-Vifb=0V, Vcc-Vout=14V, Tj=25°C
Rds(on)	On state resistance (5) Tj=25°C	—	5.5	7	mΩ	Iout=30A, Vcc-Vin=14V
	On state resistance (5) Tj=25°C	—	6	10		Iout=17A, Vcc-Vin=6V
	On state resistance (5)(6) Tj=150°C	—	10.5	13.5		Iout=30A, Vcc-Vin=14V
V clamp1	Vcc to Vout clamp voltage 1	36	39	—	V	Iout=50mA
V clamp2	Vcc to Vout clamp voltage 2	—	40	43		Iout=30A, Tj=25°C

(4) Input thresholds are measured directly between the input pin and the tab. Any parasitic resistance in common between the load current path and the input signal path can significantly affect the thresholds.
(5) Rdson is measured between the tab and the Out pin, 5mm away from the package.
(6) Guaranteed by design

Switching Electrical Characteristics

Vcc=14V, Resistive load=0.5Ω, Tj=25°C

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
tdon	Turn on delay time to 10% Vcc	8	32	80	µs	See figure 2
tr1	Rise time to Vcc-Vout=5V	3	16	40		
tr2	Rise time to Vcc-Vout=0.1Vcc	6	40	90		
Eon	Turn on energy	—	4.5	—	mJ	
tdoff	Turn off delay time	20	80	200	µs	
tf	Fall time to Vout=10% of Vcc	8	32	80		
Eoff	Turn off energy	—	2	—	mJ	

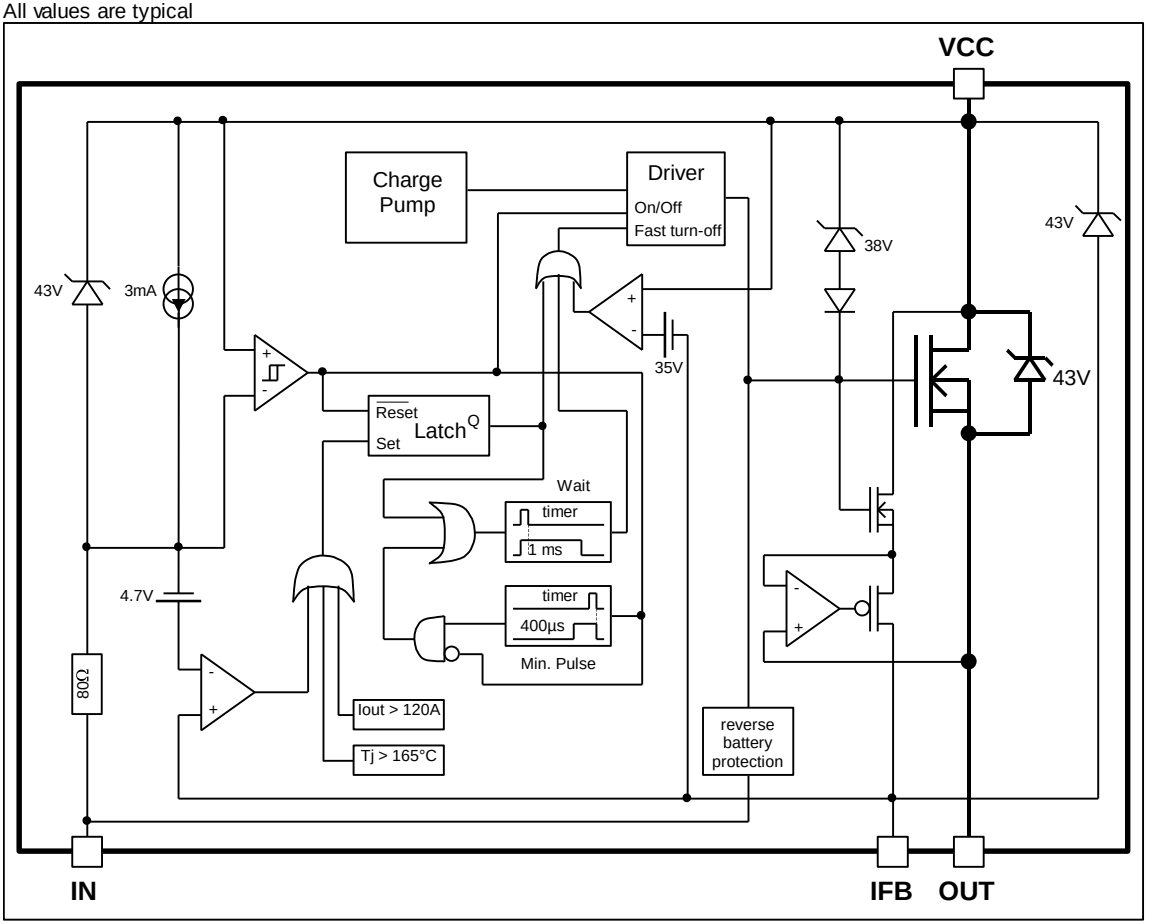
Current Sense Characteristics

Tj=-40°..150°C, Vcc=6..26V (unless otherwise specified)

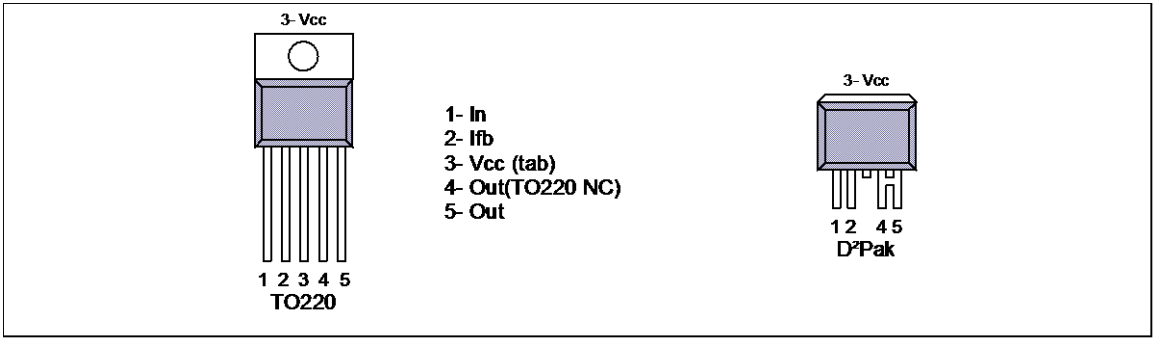
Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Ratio	I Load/Ifb current ratio	8200	8,800	9,950	—	Rfb=500Ω, Iout=60A
Ratio_TC	I Load/Ifb variation aver temperature(6)	-5	—	+5	%	Tj=-40°C to 150°C
Offset	Load current diagnostic offset	-0.2	0	+0.3	A	Iout=2A
trst	Ifb response time (low signal)	—	1	—	µs	90% of the Iout step

Functional Block Diagram

All values are typical



Lead Assignments



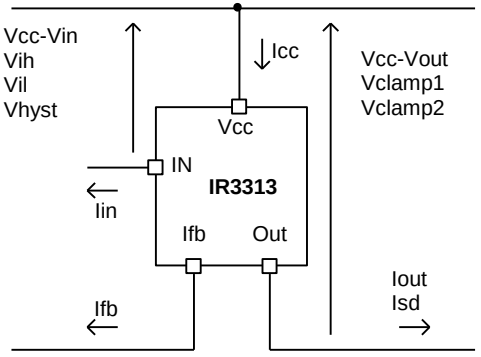


Figure 1 – Voltages and current definitions

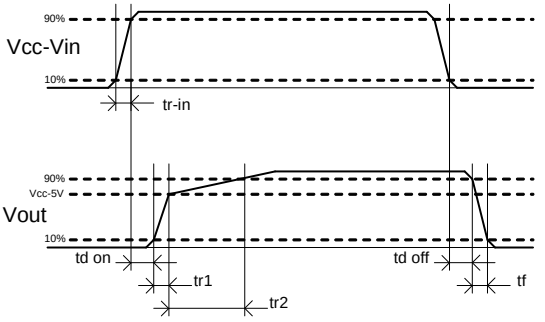


Figure 2 – Switching time definitions

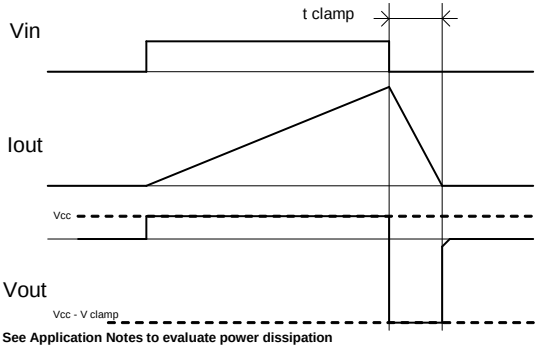


Figure 3 – Active clamp waveforms

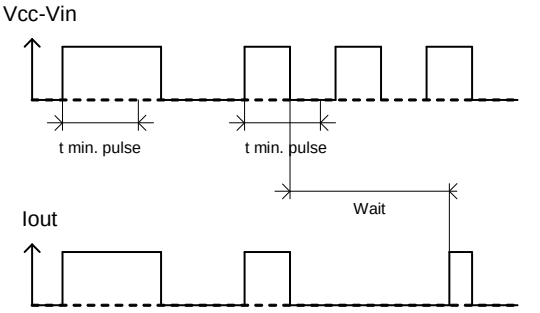


Figure 4 – Min. pulse and Wait function

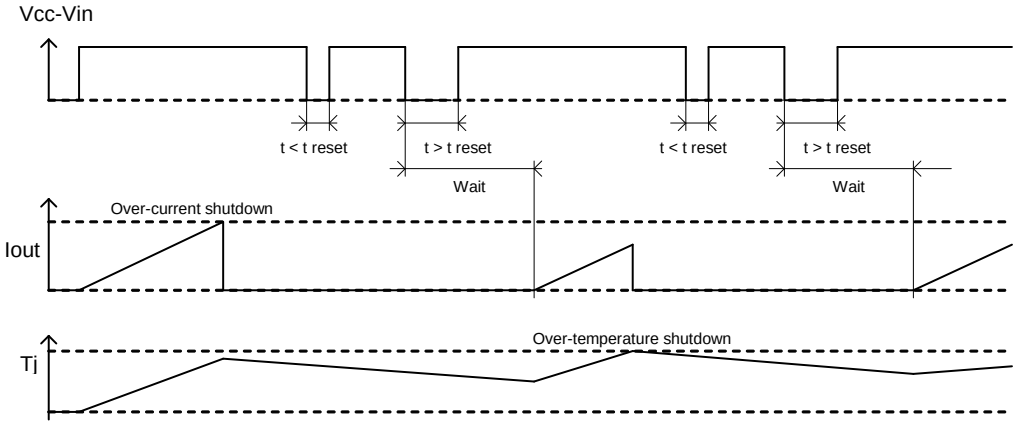


Figure 5 – Protection Timing Diagrams

All curves are typical characteristics. Operation in hatched areas is not recommended. Tj=25°C, Rifb=500ohm, Vcc=14V (unless otherwise specified).

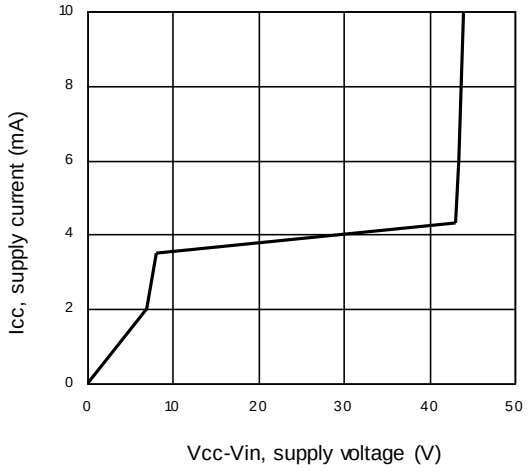


Figure 6 – Icc (mA) Vs Vcc-Vin (V)

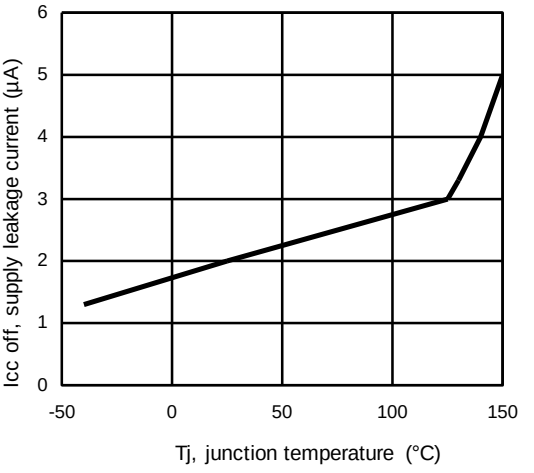


Figure 7 – Icc off (µA) Vs Tj (°C)

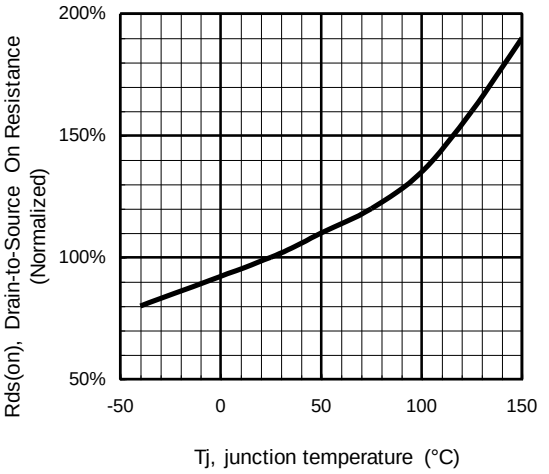


Figure 8 - Normalized Rds(on) (%) Vs Tj (°C)

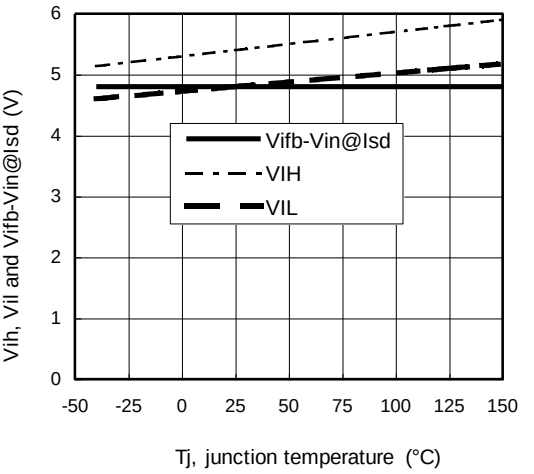


Figure 9 – Vih, Vil and Vifb-Vin@Isd (V) Vs Tj (°C)

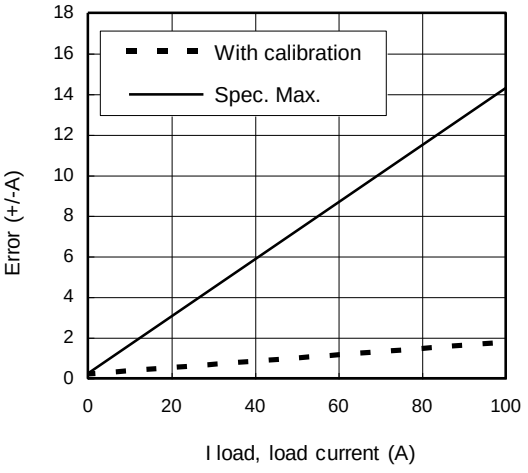


Figure 10 – Error (+/- A) Vs I load (A)

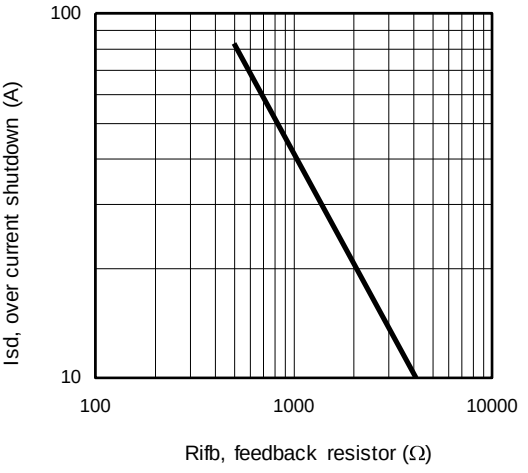


Figure 11 – Ids (A) Vs Rifb (Ω)

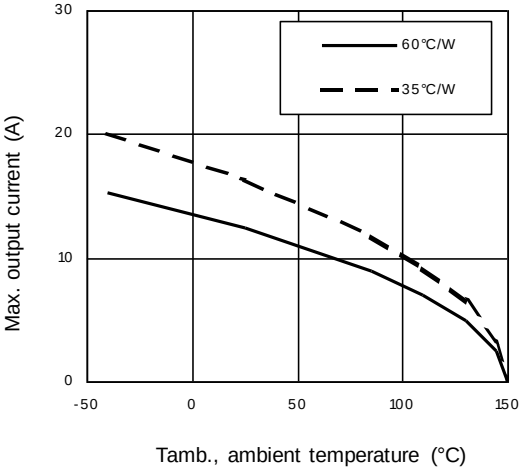


Figure 12 – Max. Iout (A) Vs Tamb. (°C)

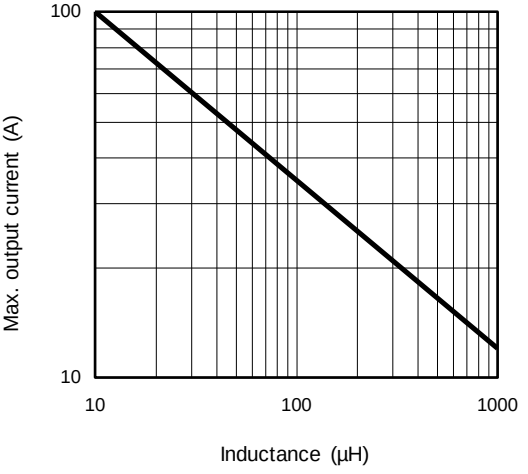


Figure 13 – Max. Iout (A) Vs inductance (µH)

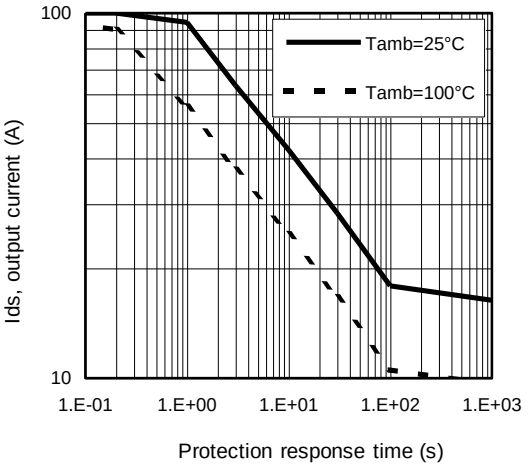


Figure 14 – Ids (A) Vs over temperature protection response time (s)/ Rth=60°C/W

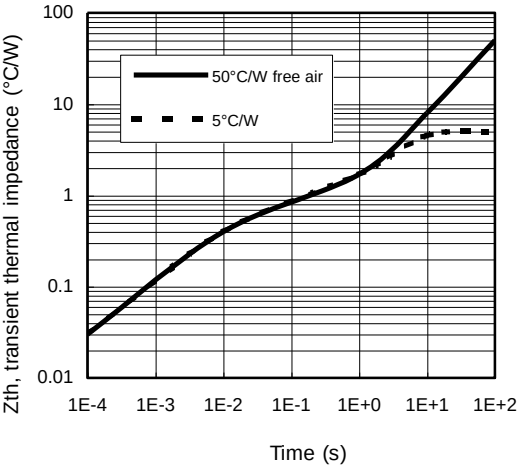
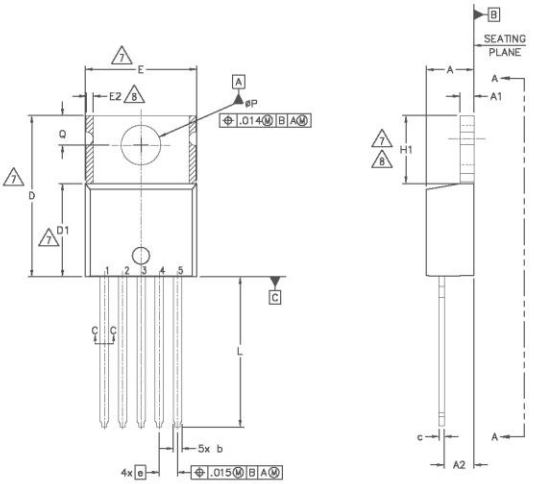
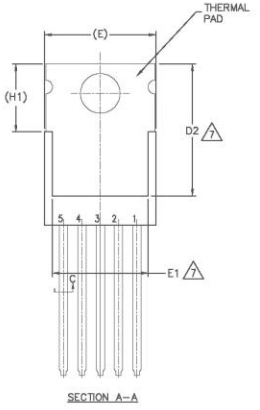


Figure 15 – Transient thermal impedance (°C/W) Vs time (s)

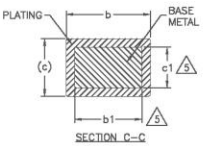
Case Outline - TO220 - 5 Leads





SECTION A–A

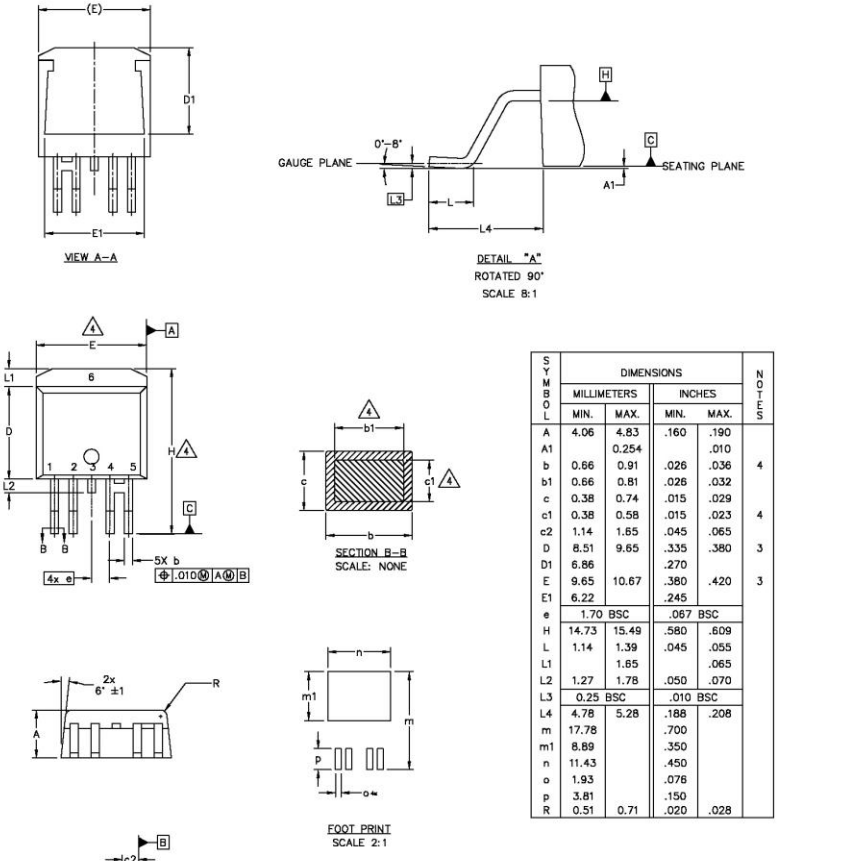
SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.83	.140	.190	
A1	0.51	1.40	.020	.055	
A2	2.03	2.92	.080	.115	
b	0.64	0.89	.025	.035	
b1	0.64	0.84	.025	.033	5
c	0.36	0.61	.014	.024	
c1	0.36	0.56	.014	.022	5
D	14.22	16.51	.560	.650	4
D1	8.38	9.02	.330	.355	
D2	11.68	12.88	.460	.507	7
E	9.65	10.67	.380	.420	4,7
E1	6.86	8.89	.270	.350	7
E2	–	0.76	–	.030	8
e	1.70 BSC		.067 BSC		
H1	5.84	6.86	.230	.270	7,8
L	12.70	14.73	.500	.580	
øP	3.53	3.73	.139	.147	
Q	2.54	3.05	.100	.120	



SECTION C–C

NOTES:
1.– DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M– 1994.
2.– DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
3.– LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
4.– DIMENSION D, D1 & 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.– OUTLINE CONFORMS TO JEDEC TO–220, EXCEPT A2 (max.) AND D2 (min.) WHERE DIMENSIONS ARE DERIVED FROM THE ACTUAL PACKAGE OUTLINE.
10.– LEADS AND DRAIN ARE PLATED WITH 100% Sn

Case Outline - D2PAK - 5 Leads

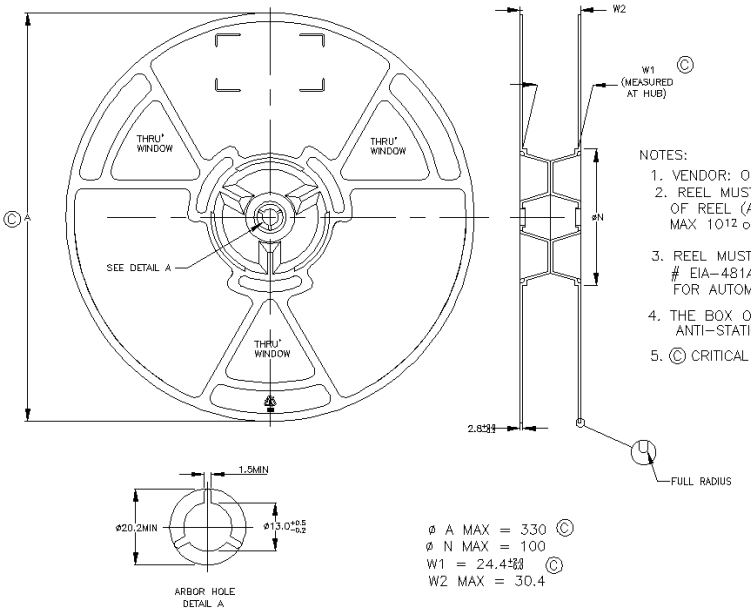


SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1		0.254		.010	
b	0.66	0.91	.026	.036	4
b1	0.66	0.81	.026	.032	
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	4
c2	1.14	1.65	.045	.065	
D	8.51	9.65	.335	.380	3
D1	6.86		.270		
E	9.65	10.67	.380	.420	3
E1	6.22		.245		
e	1.70 BSC		.067 BSC		
H	14.73	15.49	.580	.609	
L	1.14	1.39	.045	.055	
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	1.93		.076		
p	3.81		.150		
R	0.51	0.71	.020	.028	

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 [.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: MILLIMETERS
6. LEADS AND DRAIN ARE PLTED WITH 100% Sn

Tape & Reel - D2PAK – 5 leads

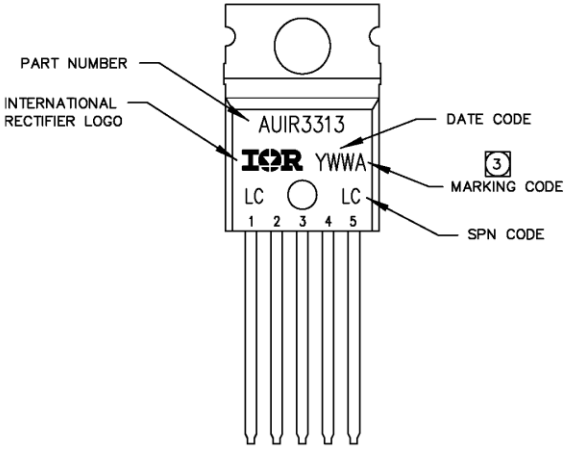


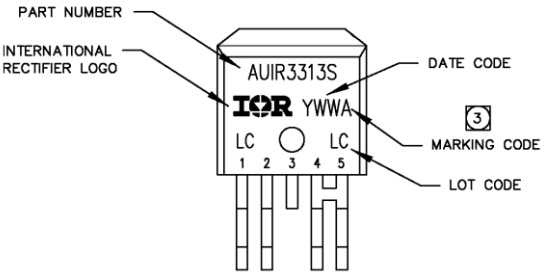
NOTES:

1. VENDOR: OPTIONAL
2. REEL MUST HAVE ANTI–STATIC COATING SURFACE RESISTIVITY OF REEL (AS PER EIA–541) uin: 10^{5} ohm/SQUARE; MAX 10^{12} ohm/SQUARE
3. REEL MUST ALSO MEET REQUIREMENTS OF EIA STANDARD # EIA–481A, TAPING OF SURFACE–MOUNT COMPONENTS FOR AUTOMATIC PLACEMENT.
4. THE BOX OF PACKING MUST CONTAIN THE REELS INSIDE AN ANTI–STATIC BAG.
5. Ⓒ CRITICAL

Ø A MAX = 330 Ⓒ
Ø N MAX = 100
W1 = 24.4 Ⓒ
W2 MAX = 30.4

Part Marking Information





Ordering Information

Base Part Number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIR3313	TO220 – 5Leads	Tube	50	AUIR3313
	D2-Pak-5-Leads	Tube	50	AUIR3313S
		Tape and reel left	800	AUIR3313STRL
		Tape and reel right	800	AUIR3313STRR

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For technical support, please contact IR's Technical Assistance Center
http://www.irf.com/technical-info/
WORLD HEADQUARTERS:
233 Kansas St., El Segundo, California 90245
Tel: (310) 252-7105

Revision History

Revision	Date	Notes/Changes
A	01/09/2006	First release
B	22/01/2007	Pbf version release
C	16/04/2008	TO220 release
D	14/04/2010	AU release
E	14/11/2010	Change description section
F	10/12/2011	Vcalmp specified at 25°C