

## LOW EMI CURRENT SENSE HIGH SIDE SWITCH

### Features

- Load current feedback
- Programmable over current shutdown
- Active clamp
- ESD protection
- Input referenced to Vcc
- Over temperature shutdown
- Switching time optimized for low EMI
- Reverse battery protection
- Lead-Free, Halogen-Free, RoHS compliant

### Description

The AUIR3320(S) is a fully protected 4 terminals high side switch. The input signal is referenced to Vcc. When the input voltage Vcc - Vin is higher than the specified threshold, the output power Mosfet is turned on. When the Vcc - Vin is lower than the specified Vil threshold, the output Mosfet is turned off. A current proportional to the power Mosfet current is sourced to the Ifb pin. Over current shutdown occurs when Vifb-Vin > 4.7V. The current shutdown threshold is adjusted by selecting the proper RIfb. Either over current and over temperature latches off the switch. The device is reset by pulling the input pin high. Other integrated protections (ESD, reverse battery, active clamp) make the switch very rugged in automotive environment.

### Product Summary

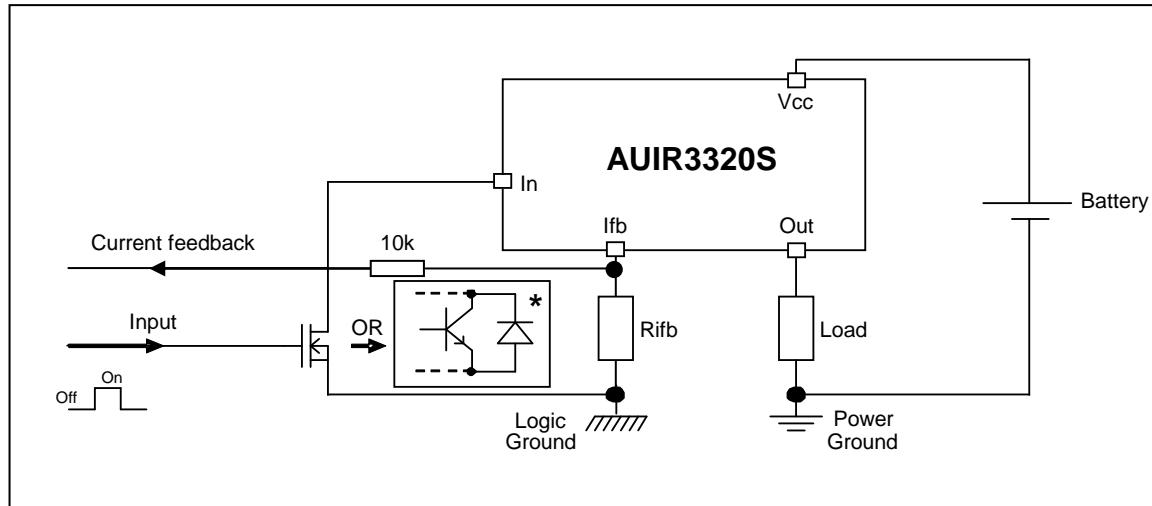
Rds(on)	4 mΩ max.
Vcc op.	6 to 26V
Current Ratio	6000
Prog. Ishutdown	10 to 55A
Vclamp	40V

### Packages



### Ordering Information

Base Part Number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIR3320S	D2-Pak-5-Leads	Tape and reel left	800	AUIR3320STRL

**Typical Connection**

\*The diode between the collector and the emitter is necessary for the reverse battery protection

## 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. (T<sub>j</sub>=-40°..150°C, V<sub>cc</sub>=6.26V Tambient=25°C unless otherwise specified).

Symbol	Parameter	Min.	Max.	Units
V <sub>cc</sub> -Vin	Maximum V <sub>cc</sub> voltage	-16	37	V
V <sub>cc</sub> -Vin cont.	Maximum continuous V <sub>cc</sub> voltage	-16	26	
V <sub>cc</sub> -V <sub>fb</sub>	Maximum I <sub>fb</sub> voltage	-16	33	
V <sub>cc</sub> -V <sub>out</sub>	Maximum output voltage	-0.3	37	
I <sub>ds</sub> cont.	Maximum body diode continuous current R <sub>th</sub> =60°C/W (1) Tambient=25°C	—	2.8	A
I <sub>ds</sub> pulsed	Maximum body diode pulsed current (1)	—	100	
P <sub>d</sub>	Maximum power dissipation R <sub>th</sub> =60°C/W Tambient=25°C	—	2	W
T <sub>j</sub> max.	Maximum operating junction temperature	-40	150	°C
	Maximum storage temperature	-55	150	
Min R <sub>fb</sub>	Minimum on the resistor on I <sub>fb</sub> pin	0.3	—	kΩ
I <sub>fb</sub> max.	Max. I <sub>fb</sub> current	-50	50	mA

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

## Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
R <sub>th1</sub>	Thermal resistance junction to ambient D <sup>2</sup> -Pak Std footprint	60	—	°C/W
R <sub>th2</sub>	Thermal resistance junction to ambient D <sup>2</sup> -Pak 1" sqrt. footprint	40	—	
R <sub>th3</sub>	Thermal resistance junction to case D <sup>2</sup> -Pak	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
I <sub>out</sub>	Continuous output current	—	45	A
	Tambient=85°C, R <sub>th</sub> =5°C/W, T <sub>j</sub> =150°C		16	
	Tambient=85°C, R <sub>th</sub> =40°C/W, T <sub>j</sub> =150°C		—	
R <sub>ifb</sub>	Recommended I <sub>fb</sub> resistor (2)(3)	0.3	3.5	kΩ
Pulse min.	Minimum turn-on pulse width	1	—	ms
F <sub>max.</sub>	Maximum operating frequency	—	200	Hz

(2) If R<sub>ifb</sub> is too low, the device can be damaged.

(3) If R<sub>ifb</sub> is too high, the device may not switch on.

## Protection Characteristics

T<sub>j</sub>=-40°..150°C, V<sub>cc</sub>=6..26V, R<sub>ifb</sub>=500 to 3.5kΩ. Typical value are given for V<sub>cc</sub>=14V and T<sub>j</sub>=25°C

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
V <sub>ifb</sub> -V <sub>in</sub> @Isd	Over-current shutdown threshold	3.8	4.7	5.9	V	
T <sub>sd</sub>	Over temperature threshold	—	165	—	°C	See fig. 5
OV	Over voltage protection (not latched)	26	29	33	V	
Isdf	Fixed over current shutdown	55	75	105	A	V <sub>ifb</sub> <V <sub>ifb</sub> -V <sub>in</sub> @Isd
Isd_560	Programmable over current shutdown	34	50	71		R <sub>ifb</sub> =560Ω
Treset	Time to reset protection	—	50	500	μs	See fig. 5
Min. pulse	Min. pulse width (no WAIT state)	—	900	2000		T <sub>j</sub> =25°C
WAIT	WAIT function timer	0.4	1	2	ms	See fig. 4 and 5
R <sub>ds(on)</sub> rev.	Reverse battery On state resistance, T <sub>j</sub> =25°C	—	4	6	mΩ	V <sub>cc</sub> -V <sub>in</sub> =-14V, I <sub>out</sub> =30A
	T <sub>j</sub> =125°C	—	6	9		

## Static Electrical Characteristics

T<sub>j</sub>=-40°..150°C, V<sub>cc</sub>=6..26V (unless otherwise specified). Typical value are given for V<sub>cc</sub>=14V and T<sub>j</sub>=25°C

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
V <sub>cc</sub> op.	Operating Voltage range	6	—	26	V	
I <sub>cc</sub> off	Supply leakage current	—	1.5	5	μA	V <sub>in</sub> =V <sub>cc</sub> , V <sub>cc</sub> -V <sub>out</sub> =14V, V <sub>cc</sub> -V <sub>ifb</sub> =14V, T <sub>j</sub> =25°C
I <sub>in</sub> , on	On state IN positive current	1.5	3	6	mA	V <sub>cc</sub> -V <sub>in</sub> =14V, T <sub>j</sub> =25°C
V <sub>ih</sub>	High level Input threshold voltage (4)	—	5.4	6.3	V	
V <sub>il</sub>	Low level Input threshold voltage (4)	4	4.9	5.8		
V <sub>hyst</sub>	Input hysteresis V <sub>ih</sub> -V <sub>il</sub>	0.2	0.4	1.5		
I <sub>out</sub>	Drain to source leakage current	—	1.2	5	μA	V <sub>in</sub> =V <sub>cc</sub> , V <sub>cc</sub> -V <sub>ifb</sub> =0V, V <sub>cc</sub> -V <sub>out</sub> =14V, T <sub>j</sub> =25°C
R <sub>ds(on)</sub>	On state resistance (5) T <sub>j</sub> =25°C	—	3.3	4	mΩ	I <sub>out</sub> =30A, V <sub>cc</sub> -V <sub>in</sub> =14V
	On state resistance (5) T <sub>j</sub> =25°C	—	3.5	5.5		I <sub>out</sub> =17A, V <sub>cc</sub> -V <sub>in</sub> =6V
	On state resistance (5)(6) T <sub>j</sub> =150°C	—	5.5	6.5		I <sub>out</sub> =30A, V <sub>cc</sub> -V <sub>in</sub> =14V
V clamp1	V <sub>cc</sub> to V <sub>out</sub> clamp voltage 1	36	39	43	V	I <sub>out</sub> =50mA
V clamp2	V <sub>cc</sub> to V <sub>out</sub> clamp voltage 2	—	40	—		I <sub>out</sub> =30A, T <sub>j</sub> =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

V<sub>cc</sub>=14V, Resistive load=0.5Ω, T<sub>j</sub>=25°C

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
T <sub>don</sub>	Turn on delay time to 10% V <sub>cc</sub>	70	170	300	μs	See figure 2
t <sub>r1</sub>	Rise time to V <sub>cc</sub> -V <sub>out</sub> =5V	30	100	210		
t <sub>r2</sub>	Rise time to V <sub>cc</sub> -V <sub>out</sub> =0.1V <sub>cc</sub>	30	125	250		
E <sub>on</sub>	Turn on energy	—	15	—		
T <sub>doff</sub>	Turn off delay time	30	70	140		
t <sub>f</sub>	Fall time to V <sub>out</sub> =10% of V <sub>cc</sub>	20	100	250		
E <sub>off</sub>	Turn off energy	—	9	—		

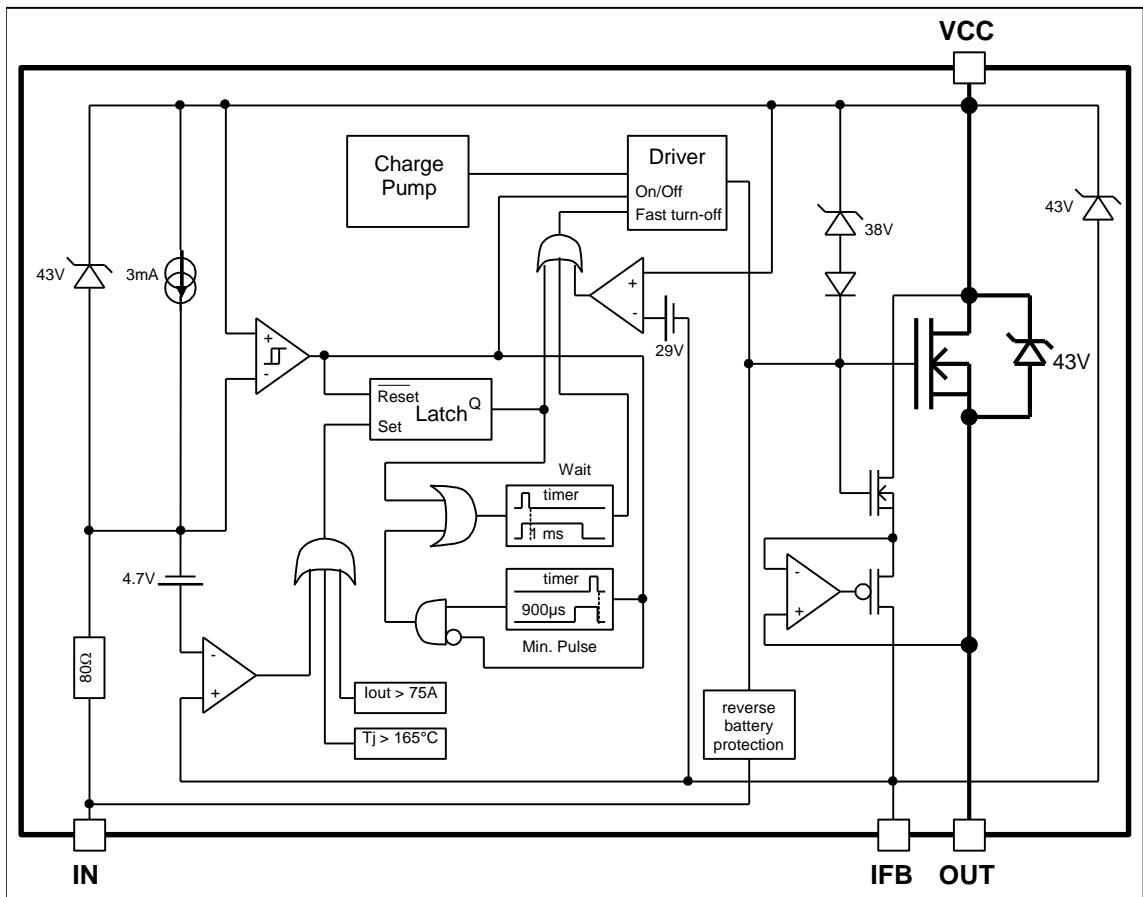
## Current Sense Characteristics

$T_j = -40..150^\circ\text{C}$ ,  $V_{cc} = 6..26\text{V}$  (unless otherwise specified). Typical values are given for  $V_{cc} = 14\text{V}$  and  $T_j = 25^\circ\text{C}$ .

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Ratio	I <sub>Load</sub> /I <sub>fb</sub> current ratio	4900	6000	6600	—	R <sub>fb</sub> =500Ω, I <sub>out</sub> =30A
Ratio_TC	I <sub>Load</sub> /I <sub>fb</sub> variation over temperature (6)	-4	—	+4	%	T <sub>j</sub> =-40°C to 150°C
Offset	Load current diagnostic offset	-0.4	0	+0.4	A	I <sub>out</sub> =2A
Trst	I <sub>fb</sub> response time (low signal)	—	1	—	μs	90% of the I <sub>out</sub> step

## Functional Block Diagram

All values are typical



## Lead Assignments

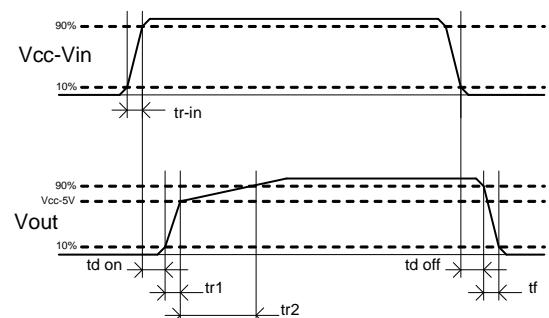
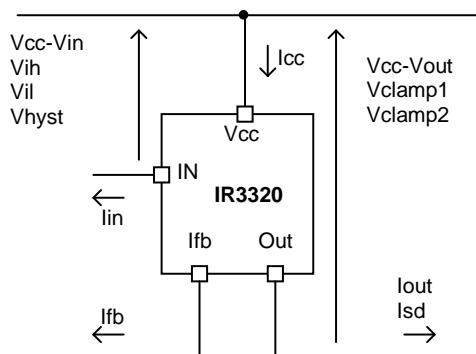
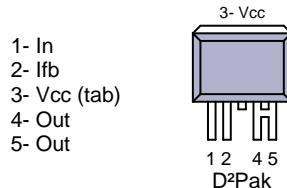
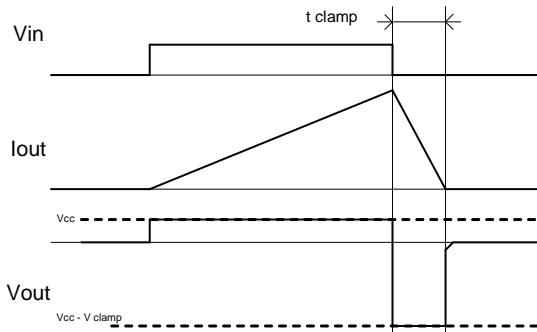
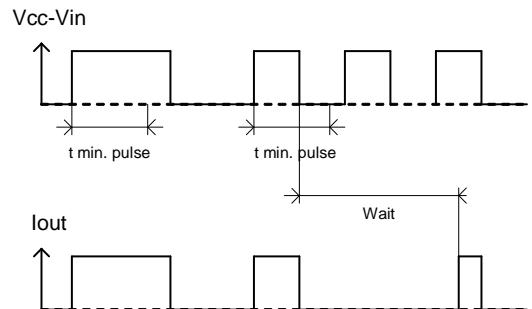


Figure 1 – Voltages and current definitions

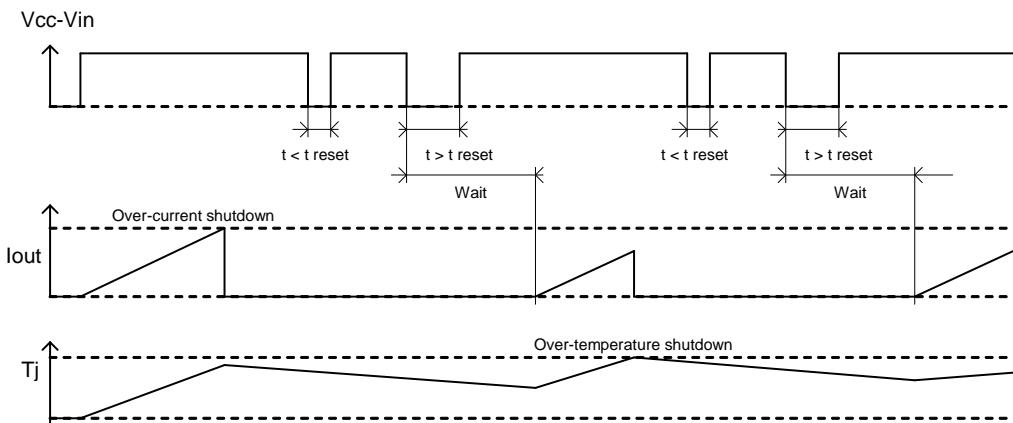
Figure 2 – Switching time definitions



**Figure 3 – Active clamp waveforms**

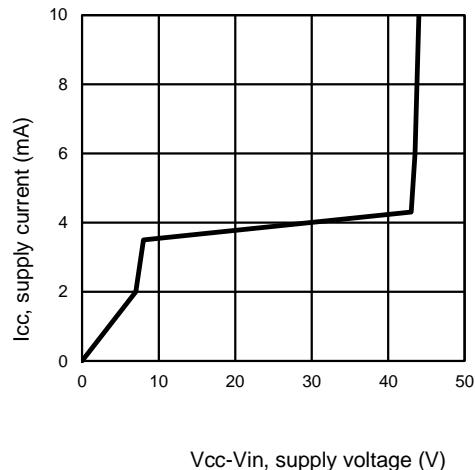


**Figure 4 – Min. pulse and Wait function**

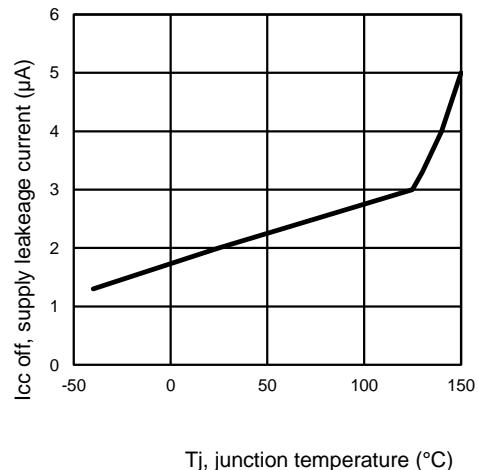


**Figure 5 – Protection Timing Diagrams**

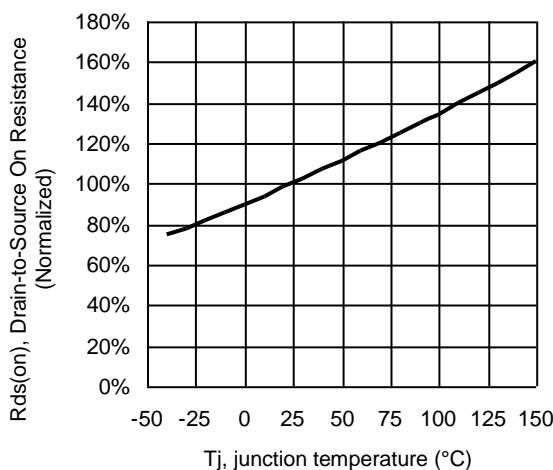
All curves are typical characteristics.  $T_j=25^\circ\text{C}$ ,  $R_{fb}=500\text{ohm}$ ,  $V_{cc}=14\text{V}$  (unless otherwise specified).



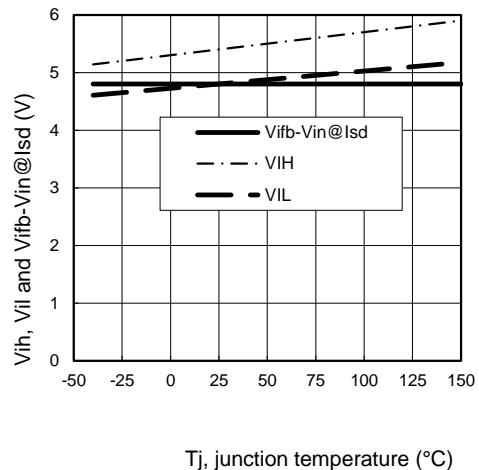
**Figure 6 – Icc (mA) Vs Vcc-Vin (V)**



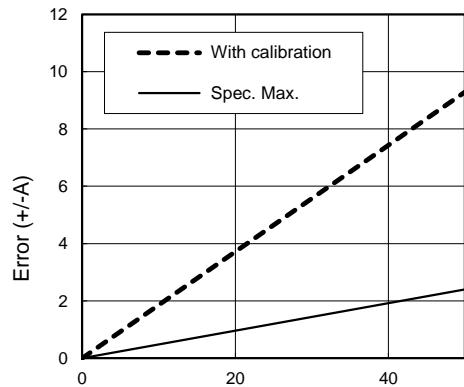
**Figure 7 – Icc off (μA) Vs Tj (°C)**



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

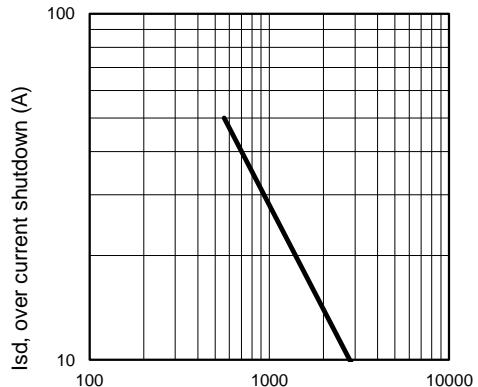


**Figure 9 – Vih, Vil and Vifb-Vin@Isd (V) Vs Tj (°C)**



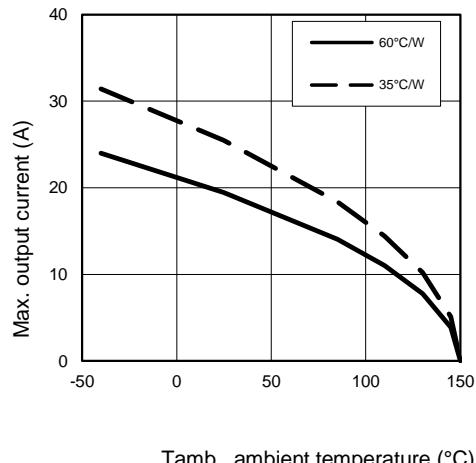
I load, load current (A)

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



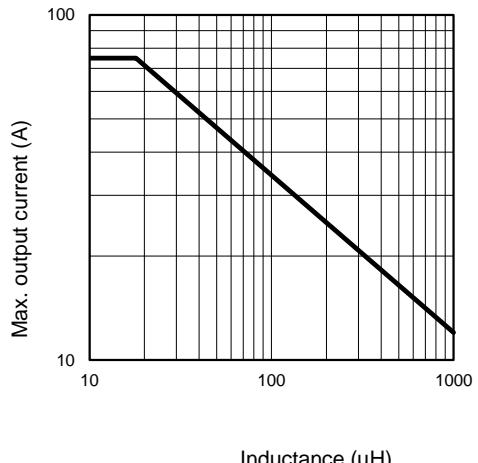
Rifb, feedback resistor (Ω)

**Figure 11 – I<sub>d</sub>s (A) Vs R<sub>ifb</sub> (Ω)**



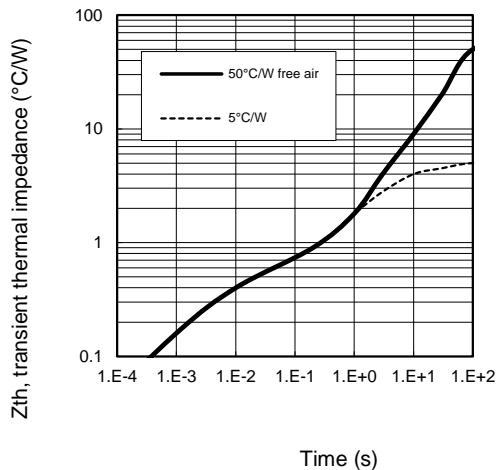
Tamb., ambient temperature (°C)

**Figure 12 – Max. I<sub>out</sub> (A) Vs Tamb. (°C)**



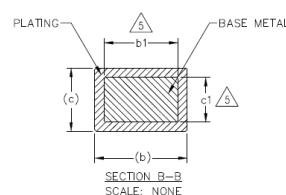
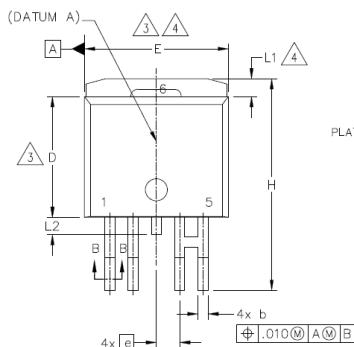
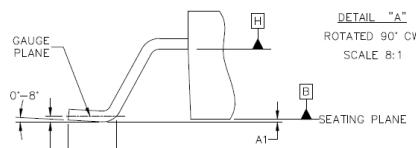
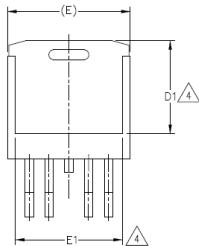
Inductance (μH)

**Figure 13 – Max. I<sub>out</sub> (A) Vs inductance (μH)**

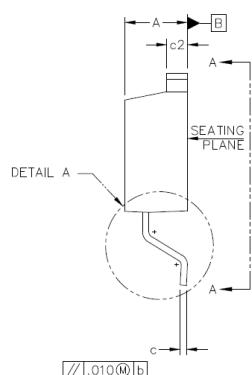
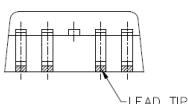


**Figure 14 – Transient thermal impedance ( $^{\circ}\text{C}/\text{W}$ )  
Vs time (s)**

## 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	0.51	0.99	.020	.039
b1	0.51	0.89	.020	.035
c	0.38	0.74	.015	.029
c1	0.38	0.58	.015	.023
c2	1.14	1.65	.045	.065
D	8.38	9.65	.330	.380
D1	6.86	—	.270	—
E	9.65	10.67	.380	.420
E1	6.22	—	.245	—
e	1.70	BSC	.067	BSC
H	14.61	15.88	.575	.625
L	1.78	2.79	.070	.110
L1	—	1.68	—	.066
L2	—	1.78	—	.070
L3	0.25	BSC	.010	BSC



### NOTES:

1. DIMENSIONING AND TOLERANCING AS 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 AT DATUM H.

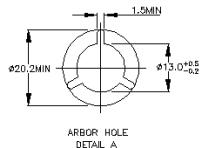
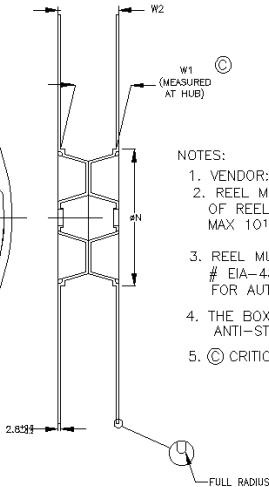
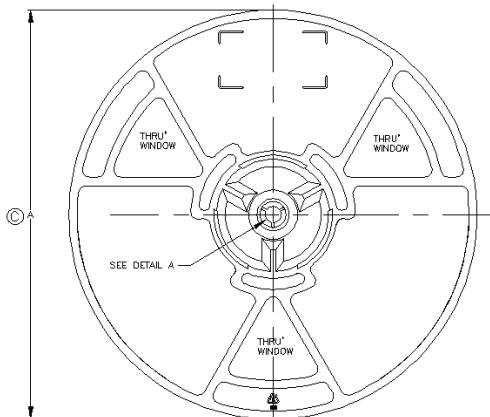
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.

5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.

6. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.

7. CONTROLLING DIMENSION: INCH.

8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-263BA.

**Tape & Reel - D2PAK – 5 leads**


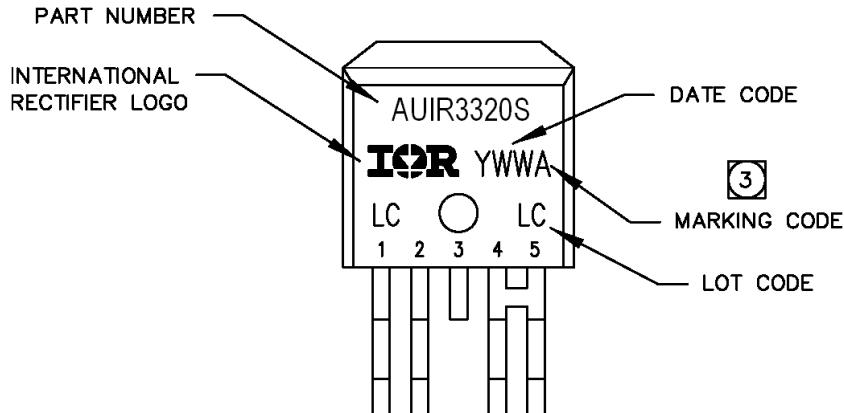
ARBOR HOLE  
DETAIL A

$\phi$  A MAX = 330   
 $\phi$  N MAX = 100  
 W1 = 24.4<sup>+.03</sup><sub>-.03</sub>   
 W2 MAX = 30.4

NOTES:

1. VENDOR: OPTIONAL
2. REEL MUST HAVE ANTI-STATIC COATING SURFACE RESISTIVITY OF REEL (AS PER EIA-541)  $\mu\Omega$ :  $10^9 \Omega\text{hm}/\text{SQUARE}$ ; MAX  $10^{12} \Omega\text{hm}/\text{SQUARE}$
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

## Part Marking Information



## Qualification Information<sup>†</sup>

<b>Qualification Level</b>		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.	
<b>Moisture Sensitivity Level</b>		D2PAK-5L	MSL1, 260°C (per IPC/JEDEC J-STD-020)
<b>ESD</b>	Machine Model	Class M3 (400V) (per AEC-Q100-003)	
	Human Body Model	Class H2 (4,000 V) (per AEC-Q100-002)	
	Charged Device Model	Class C4 (1000 V) (per AEC-Q100-011)	
<b>IC Latch-Up Test</b>		Class II, Level A (per AEC-Q100-004)	
<b>RoHS Compliant</b>		Yes	

**Published by**  
**Infineon Technologies AG**  
**81726 München, Germany**  
**© Infineon Technologies AG 2015**  
**All Rights Reserved.**

### **IMPORTANT NOTICE**

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie"). With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office ([www.infineon.com](http://www.infineon.com)).

### **WARNINGS**

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury

## Revision History

<b>Revision</b>	<b>Date</b>	<b>Notes/Changes</b>
A7	June, 4 <sup>th</sup> 2012	Initial release
A8	August, 13rd 2012	-Update switching limits -Update Iratio max limit
A9	August, 30 <sup>th</sup> 2012	Update Tj max.
Rev1.0	July, 11 <sup>th</sup> 2017	- Page 'Case Outline - D2PAK - 5 Leads' updated - Page 'Ordering information' updated - Page 14 'Notice' updated