

PROGRAMMABLE CURRENT SENSE HIGH SIDE SWITCH

Features

- Load current feedback
- Programmable over current shutdown
- Active clamp
- ESD protection
- Input referenced to Vcc
- Over temperature shutdown
- Reverse battery protection
- Lead-Free

Description

The AUIR3314(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.

Typical Connection

Product Summary

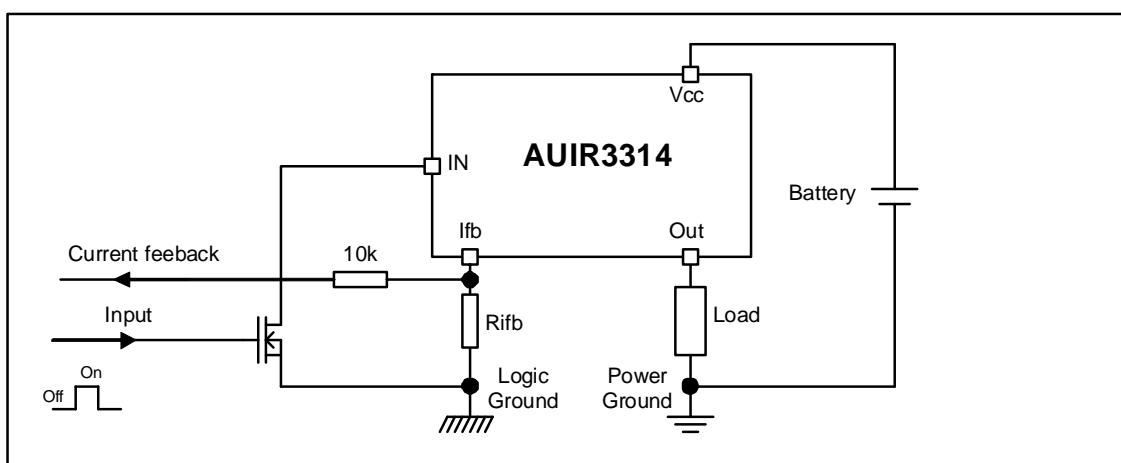
| | |
|-----------------|------------|
| Rds(on) | 12 mΩ max. |
| Vcc op. | 6 to 32V |
| Current Ratio | 5300 |
| Prog. Ishutdown | 6 to 58A |
| Vclamp | 40V |

Packages



TO-220
AUIR3314

D2Pak
Pin 4 and 5 fused
AUIR3314S



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. (T_j =-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 $R_{th}=60^{\circ}\text{C}/\text{W}$ (1) | — | 2.8 | A |
| Ids pulsed | Maximum body diode pulsed current (1) | — | 100 | |
| Pd | Maximum power dissipation $R_{th}=60^{\circ}\text{C}/\text{W}$ | — | 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 D ² -Pak Std footprint | 60 | — | °C/W |
| Rth2 | Thermal resistance junction to case D ² -Pak | 1.2 | — | |
| Rth3 | Thermal resistance junction to case TO-220 | 1.2 | — | |

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 | — | 18 | A |
| | $T_{ambient}=85^{\circ}\text{C}$, $R_{th}=5^{\circ}\text{C}/\text{W}$, $T_j=125^{\circ}\text{C}$ | | 5 | |
| | $T_{ambient}=85^{\circ}\text{C}$, $R_{th}=60^{\circ}\text{C}/\text{W}$, $T_j=125^{\circ}\text{C}$ | — | — | |
| Rifb | Recommended Ifb resistor (2)(3) | 0.5 | 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

T_j=-40°..150°C, V_{cc}=6..26V, R_{ifb}=500 to 5kΩ

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|--|---------------------------------------|------|------|------|-------|--|
| V _{ifb} -V _{in} @I _{sd} | Over-current shutdown threshold | 3.8 | 4.7 | 5.9 | V | |
| T _{sd} | Over temperature threshold | — | 165 | — | °C | See fig. 5 |
| OV | Over voltage protection (not latched) | 33 | 35 | 39 | V | |
| I _{sd} f | Fixed over current shutdown | 57 | 72 | 90 | A | V _{ifb} <V _{ifb} -V _{in} @I _{sd} |
| I _{sd} _1k | Programmable over current shutdown 1k | 19 | 24 | 32 | | R _{ifb} =1kΩ |
| t _{reset} | Time to reset protection | — | 50 | 500 | μs | See fig. 5 |
| Min. pulse | Min. pulse width (no WAIT state) | 150 | 400 | 1200 | | T _j =25°C |
| WAIT | WAIT function timer | 0.4 | 1 | 2 | ms | See fig. 4 and 5 |
| R _{ds(on)} rev. | Reverse battery On state resistance | — | 10 | 18 | mΩ | V _{cc} -V _{in} =-14V, I _{out} =20A |
| | T _j =25°C | — | 15 | 27 | | |
| | T _j =125°C | — | 15 | 27 | | |

Static Electrical Characteristics

T_j=-40°..150°C, V_{cc}=6..26V (unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|----------------------|---|------|------|------|-------|---|
| V _{cc} op. | Operating Voltage range | 6 | — | 32 | V | |
| I _{cc} off | Supply leakage current | — | 1.5 | 5 | μA | V _{in} =V _{cc} , V _{cc} -V _{out} =14V, V _{cc} -V _{ifb} =14V, T _j =25°C |
| I _{in} , on | On state IN positive current | 1.5 | 3 | 6 | mA | V _{cc} -V _{in} =14V, T _j =25°C |
| V _{ih} | High level Input threshold voltage (4) | — | 5.4 | 6.3 | V | |
| V _{il} | Low level Input threshold voltage (4) | 4 | 4.9 | 5.8 | | |
| V _{hyst} | Input hysteresis V _{ih} -V _{il} | 0.2 | 0.4 | 1.5 | | |
| I _{out} | Drain to source leakage current | — | 1.2 | 5 | μA | V _{in} =V _{cc} , V _{cc} -V _{ifb} =0V, V _{cc} -V _{out} =14V, T _j =25°C |
| R _{ds(on)} | On state resistance (5) T _j =25°C | — | 9 | 12 | mΩ | I _{out} =20A, V _{cc} -V _{in} =14V |
| | On state resistance (5) T _j =25°C | — | 9.5 | 17 | | I _{out} =15A, V _{cc} -V _{in} =6V |
| | On state resistance (5) T _j =150°C | — | 17 | 23 | | I _{out} =20A, V _{cc} -V _{in} =14V |
| V clamp1 | V _{cc} to V _{out} clamp voltage 1 | 36 | 39 | — | V | I _{out} =50mA |
| V clamp2 | V _{cc} to V _{out} clamp voltage 2 | — | 40 | 43 | | I _{out} =20A, T _j =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) R_{dson} is measured between the tab and the Out pin, 5mm away from the package.

Switching Electrical Characteristics

V_{cc}=14V, Resistive load=0.5Ω, T_j=25°C

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|-------------------|--|------|------|------|-------|-----------------|
| t _{don} | Turn on delay time to 10% V _{cc} | 5 | 21 | 55 | μs | See figure 2 |
| t _{r1} | Rise time to V _{cc} -V _{out} =5V | 2 | 8 | 20 | | |
| t _{r2} | Rise time to V _{cc} -V _{out} =0.1V _{cc} | 7 | 27 | 70 | | |
| E _{on} | Turn on energy | — | 4.5 | — | | |
| t _{doff} | Turn off delay time | 13 | 55 | 140 | | |
| t _f | Fall time to V _{out} =10% of V _{cc} | 5 | 20 | 55 | | |
| E _{off} | Turn off energy | — | 2 | — | | |

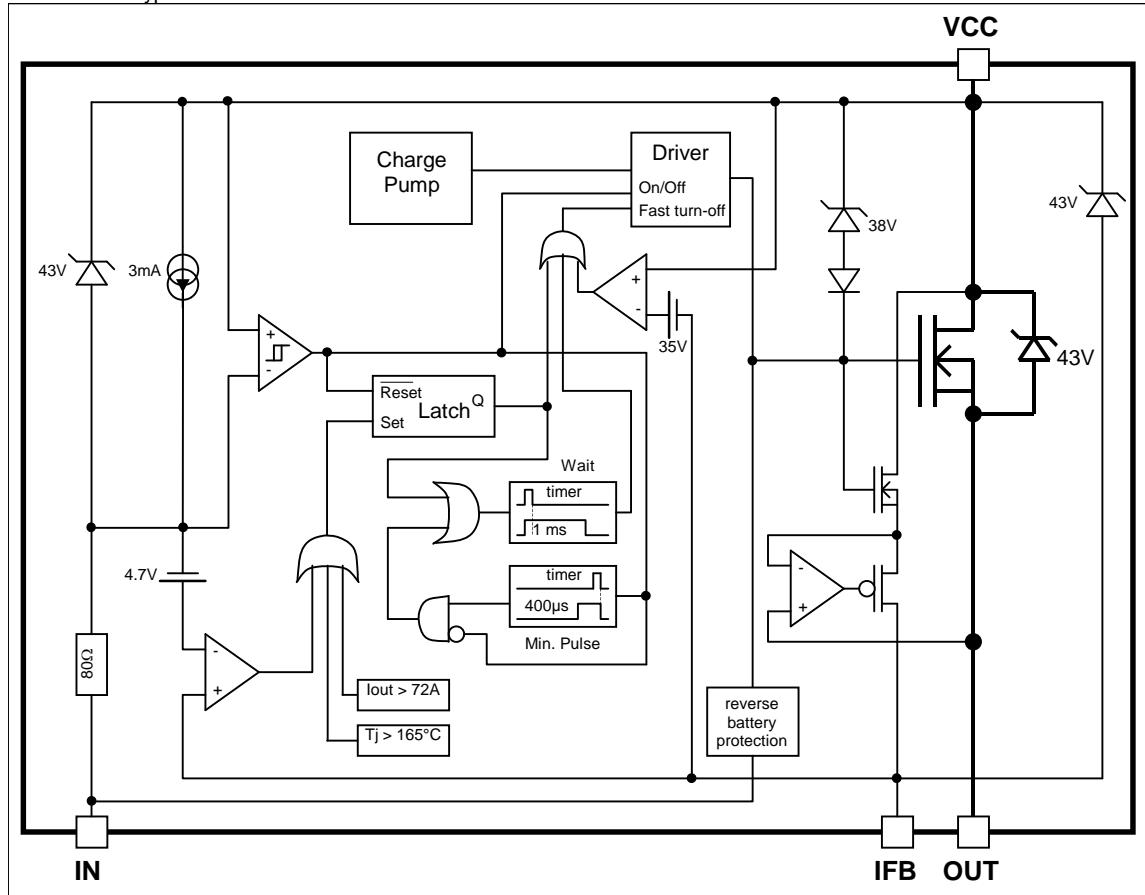
Current Sense Characteristics

$T_j = -40^\circ\text{C} \text{ to } 150^\circ\text{C}$, $V_{CC} = 6\text{..}26\text{V}$ (unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|----------|--|-------|------|-------|-------|--|
| Ratio | I Load/lifb current ratio | 4800 | 5300 | 6000 | — | $R_{fb} = 500\Omega$, $I_{out} = 40\text{A}$ |
| Ratio_TC | I Load/lifb variation aver temperature | -5 | — | +5 | % | $T_j = -40^\circ\text{C}$ to 150°C |
| Offset | Load current diagnostic offset | -0.15 | 0 | +0.18 | A | $I_{out} = 2\text{A}$ |
| trst | lifb response time (low signal) | — | 1 | — | μs | 90% of the I_{out} step |

Functional Block Diagram

All values are typical



Lead Assignments

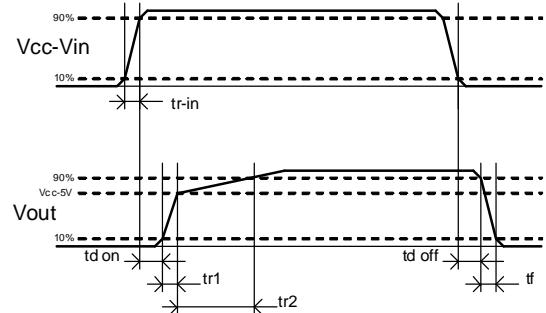
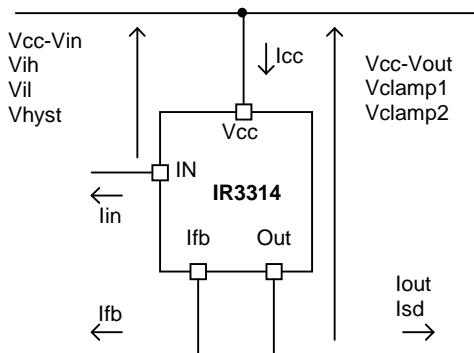
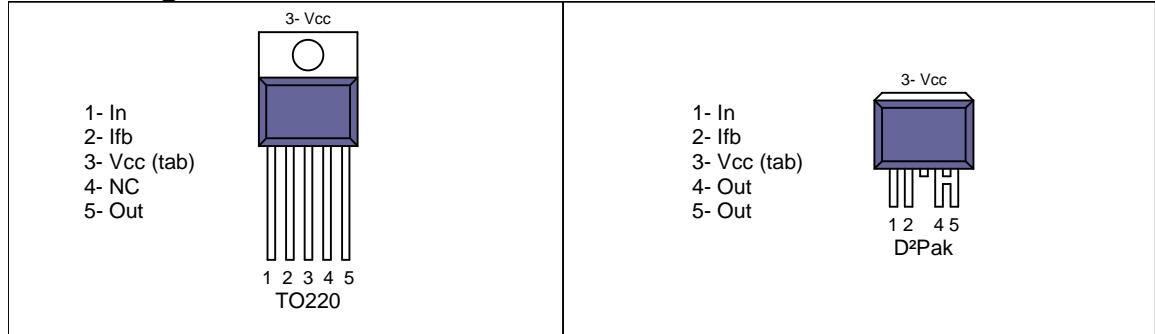


Figure 1 – Voltages and current definitions

Figure 2 – Switching time definitions

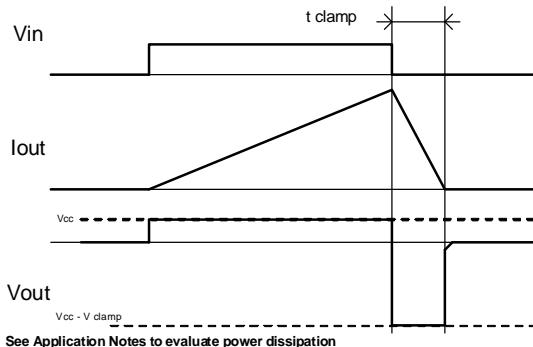


Figure 3 – Active clamp waveforms

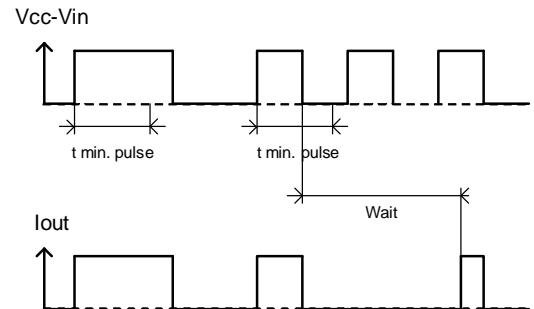


Figure 4 – Min. pulse and Wait function

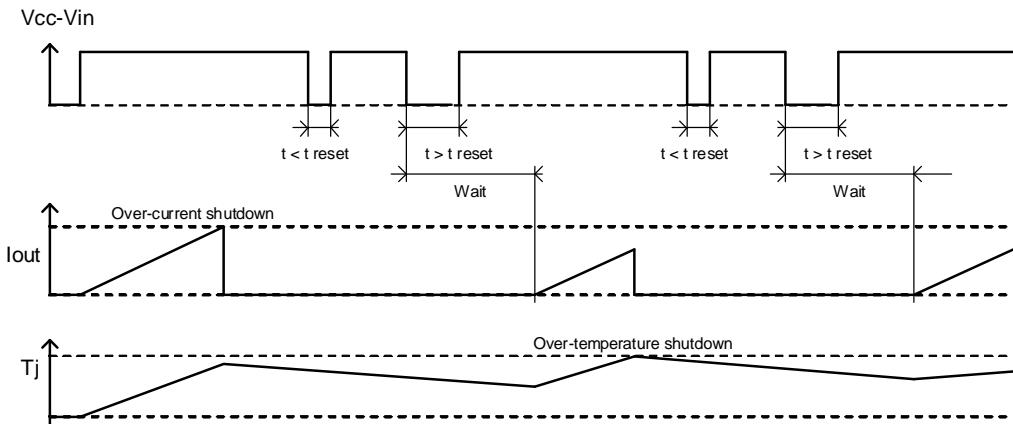


Figure 5 – Protection Timing Diagrams

All curves are typical characteristics. Operation in hatched areas is not recommended. $T_j=25^\circ\text{C}$, $R_{ifb}=500\text{ohm}$, $V_{cc}=14\text{V}$ (unless otherwise specified).

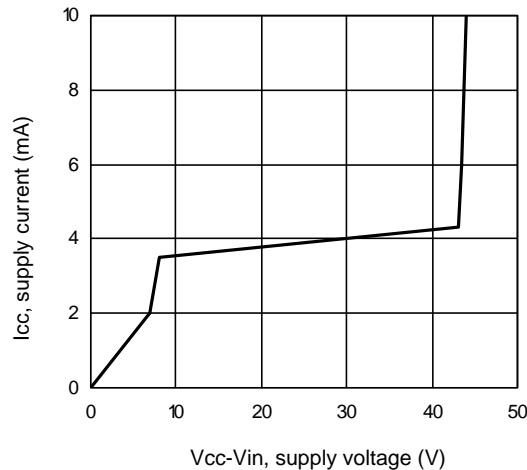


Figure 6 – Icc (mA) Vs Vcc-Vin (V)

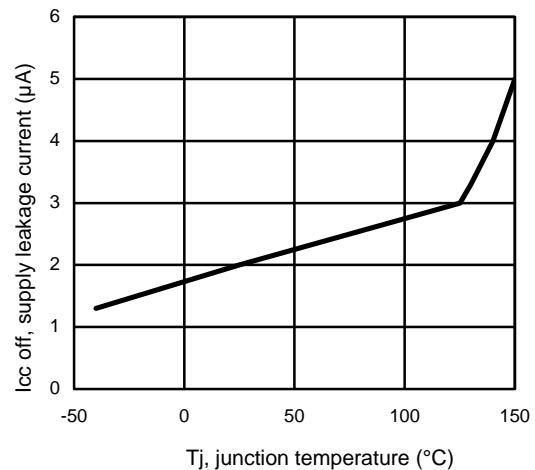


Figure 7 – Icc off (μA) Vs Tj (°C)

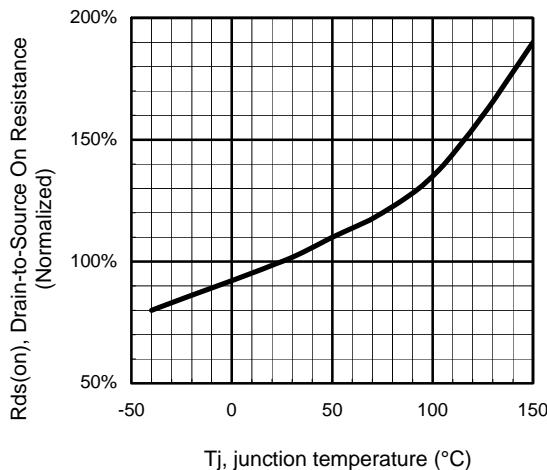


Figure 8 - Normalized Rds(on) (%) Vs Tj (°C)

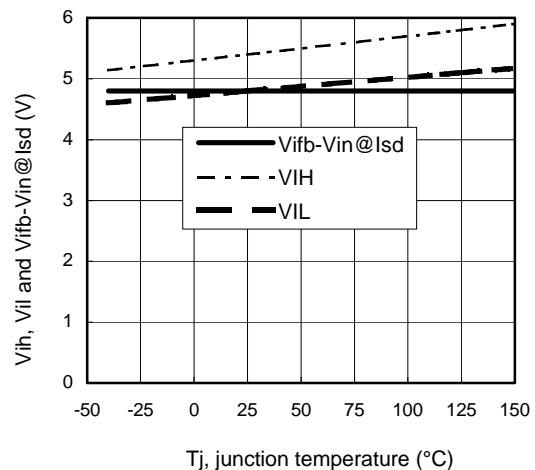


Figure 9 – Vih, Vil and Vifb-Vin@Isd (V) Vs Tj (°C)

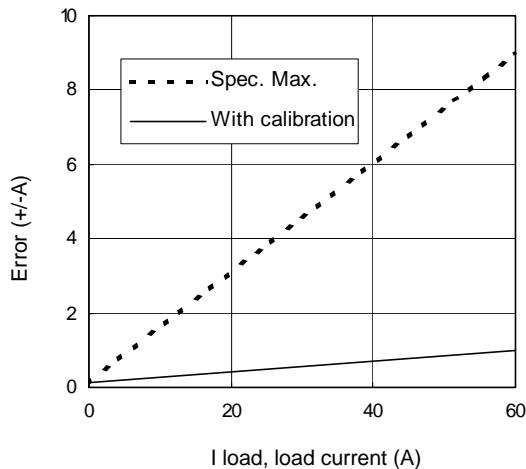


Figure 10 – Error (+/- A) Vs I load (A)

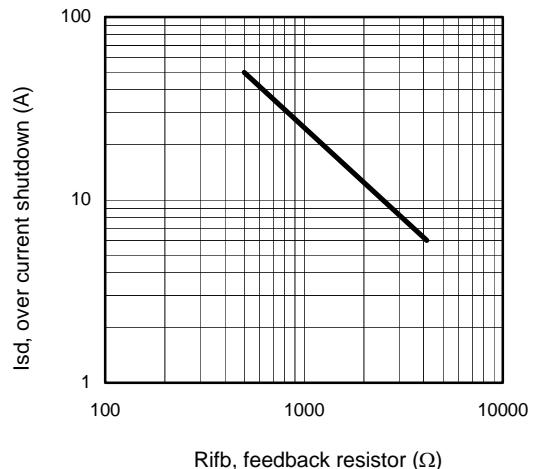


Figure 11 – Ids (A) Vs Rifb (Ω)

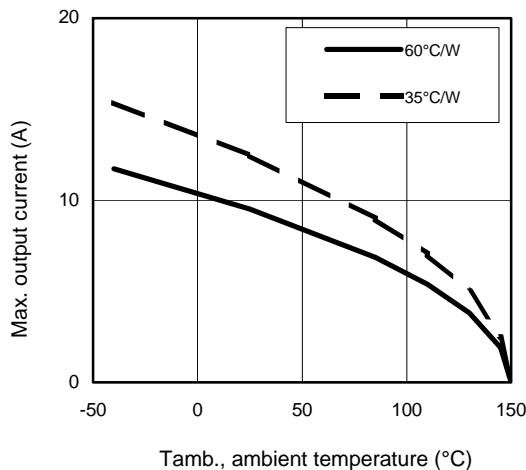


Figure 12 – Max. Iout (A) Vs Tamb. (°C)

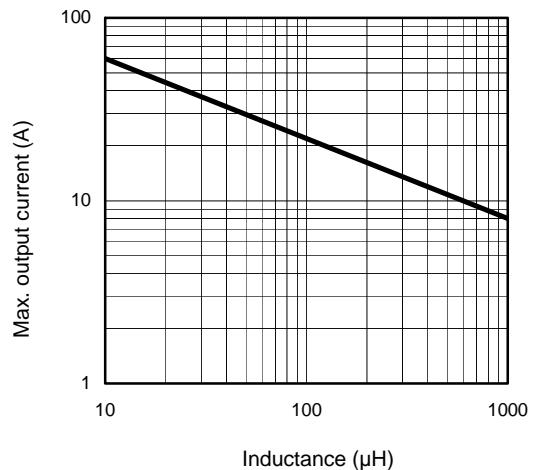


Figure 13 – Max. Iout (A) Vs inductance (μH)

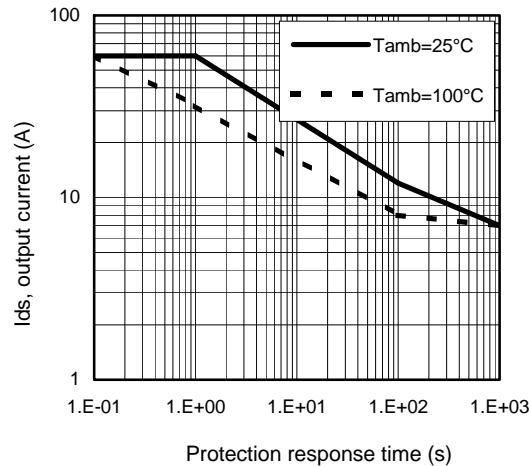


Figure 14 – I_{ds} (A) Vs over temperature protection response time (s)

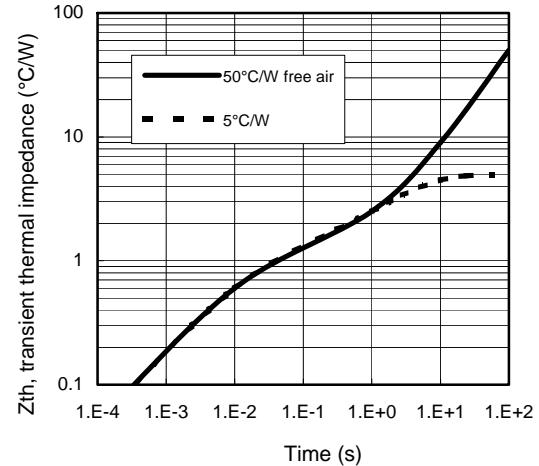
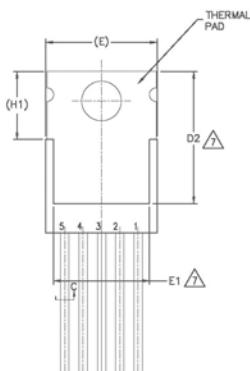
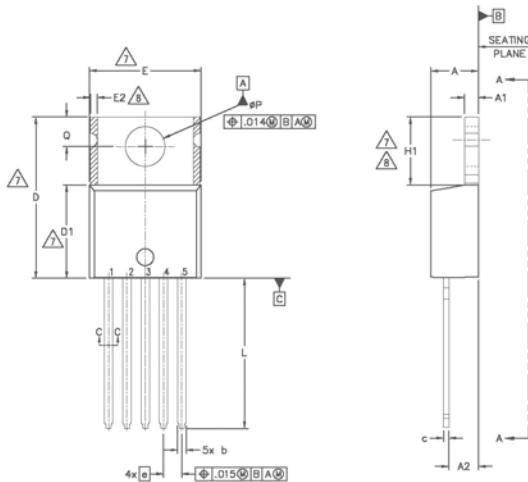


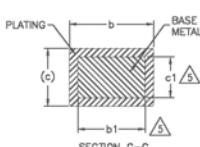
Figure 15 – Transient thermal impedance (°C/W) Vs time (s)

Case Outline - TO220 - 5 Leads



SECTION A-A

| S- Y- M- B- O- L- | 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 | | |
| 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 | | |
| 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 | | |
| MP | 3.53 | 3.73 | .139 | .147 | | |
| P | 2.64 | 3.05 | .100 | .120 | | |

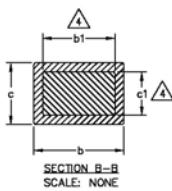
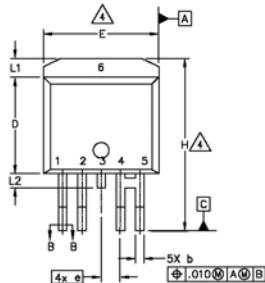
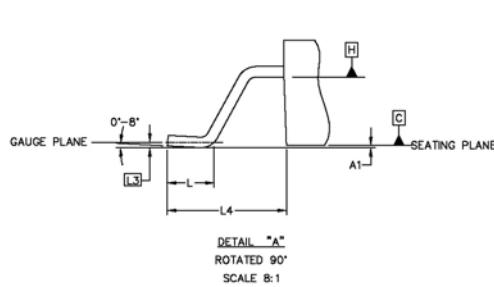
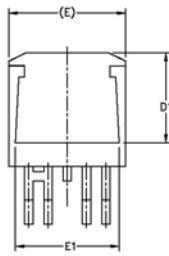


NOTES

1- DIMENSIONS AND TOLERANCING AS PER ASME Y14.5M - 1994.
2- DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
3- LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
4- DIMENSION D₁ D₂ & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH
SHALL NOT EXCEED .005" (0.127 MM) 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- THE HOLE P.D. CANNOT EXCEED .500" WITH DIMENSIONS E1,H1,D2 & E1
8- DIMENSION H1 DICTINE A ZONE WHERE STANDING
AND SINGULATION IRREGULARITIES ARE ALLOWED.
9- OUTLINE CONFORMS TO JEGS-10-220, EXCEPT A2 (max.) AND D2 (min.)
WHERE DIMENSIONS ARE DERIVED FROM THE ACTUAL PACKAGE, OUTLINE
DIMENSIONS ARE INCHES [MILLIMETERS].

10 - LEADS AND DRUM ARE PLATED WITH 100% Sn

Case Outline - D2PAK - 5 Leads

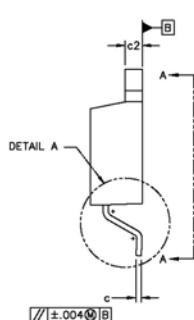


| SYMBOL | DIMENSIONS | | | | NOTES |
|--------|-------------|-------|--------|----------|-------|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | .160 | .190 | |
| A1 | | 0.254 | | .010 | |
| b | 0.66 | 0.91 | .026 | .036 | 4 |
| b1 | 0.66 | 0.81 | .028 | .032 | |
| c | 0.38 | 0.74 | .015 | .029 | |
| c1 | 0.38 | 0.58 | .015 | .023 | 4 |
| c2 | 1.14 | 1.85 | .045 | .065 | |
| D | 8.51 | 9.65 | .335 | .380 | 3 |
| D1 | 6.86 | | .270 | | |
| E | 9.65 | 10.67 | .380 | .420 | |
| E1 | 6.22 | | .245 | | 3 |
| 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 | |

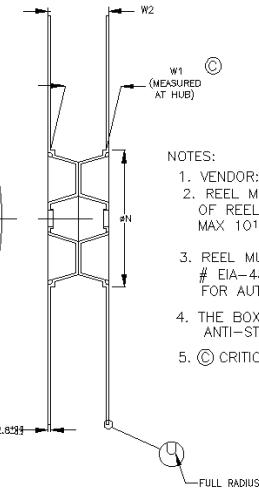
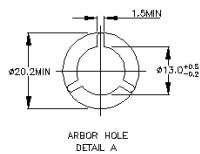
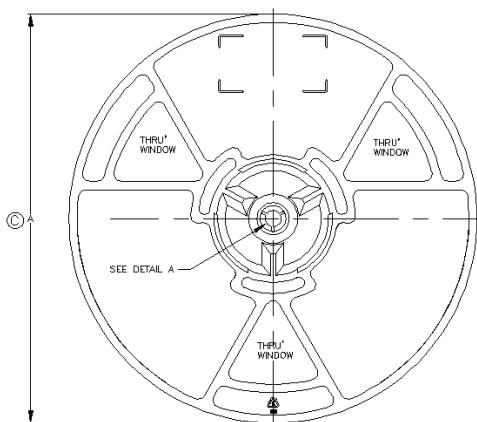
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NOTES:

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 PLATED WITH 100% Sn



Tape & Reel - D2PAK – 5 leads

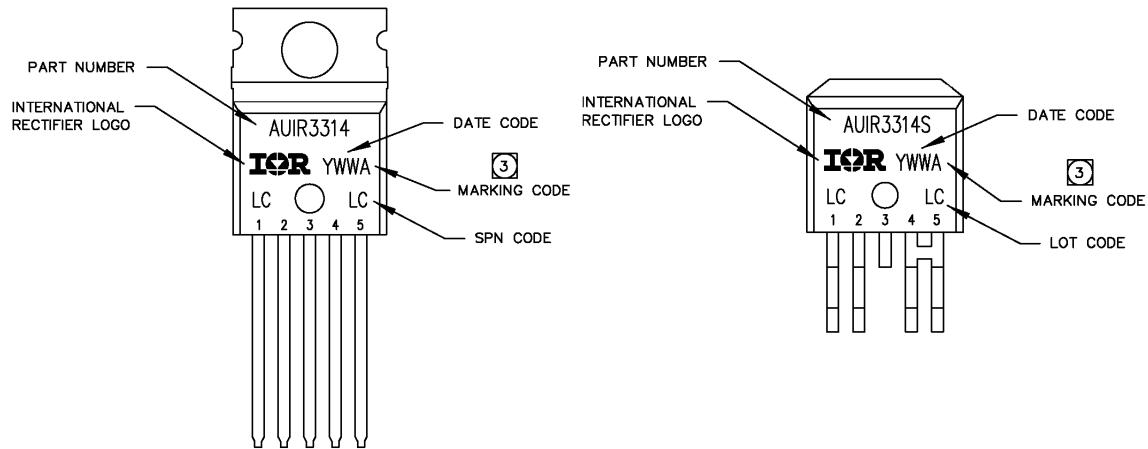


NOTES:

1. VENDOR: OPTIONAL
2. REEL MUST HAVE ANTI-STATIC COATING SURFACE RESISTIVITY OF REEL (AS PER EIA-541) $\mu\Omega$: $10^8 \Omega/\text{cm}^2$; MAX $10^{12} \Omega/\text{cm}^2$
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. (C) CRITICAL

ϕA MAX = 330 (C)
 ϕN MAX = 100
 W1 = 24.4^{+.3}_{-.2} (C)
 W2 MAX = 30.4

Part Marking Information



Ordering Information

| Base Part Number | Package Type | Standard Pack | | Complete Part Number |
|------------------|----------------|---------------------|----------|----------------------|
| | | Form | Quantity | |
| AUIR3314 | TO220 – 5Leads | Tube | 50 | AUIR3314 |
| | D2-Pak-5-Leads | Tube | 50 | AUIR3314S |
| | | Tape and reel left | 800 | AUIR3314STRL |
| | | Tape and reel right | 800 | AUIR3314STRR |

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For technical support, please contact IR's Technical Assistance Center

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Revision History

| Revision | Date | Notes/Changes |
|-----------------|-------------|--|
| A | 01/09/2006 | First release |
| B | 22/01/2007 | Pin assignment |
| C | 16/04/2008 | Isd_1K max : 31A -> 30A Isd_1k typ : 18A -> 18.8A |
| D | 14/01/2010 | AU release |
| E | 14/11/2010 | Change description |
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