Sipex®

AS2815

1.5A Low Dropout Voltage Regulator Adjustable & Fixed Output, Fast Response

FEATURES

- Adjustable Output Down To 1.2V
- Fixed Output Voltages 1.5V, 2.5V, 3.3V, 5.0V
- Output Current of 1.5A
- Low Dropout Voltage 1.1V Typ.
- Extremely Tight Load And Line Regulation
- Current & Thermal Limiting
- Standard 3-Terminal Low Cost TO-220, TO-263 & TO-252
- Similar To Industry Standard LT1086/LT1586

APPLICATIONS

- Powering VGA & Sound Card
- Power PC™Supplies
- SMPS Post-Regulator
- High Efficiency "Green" Computer Systems
- High Efficiency Linear Power Supplies
- Portable Instrumentation
- Constant Current Regulators
- Adjustable Power Supplies
- Battery charger

PRODUCT DESCRIPTION

The AS2815 is a low power 1.5A adjustable and fixed voltage regulators that are very easy to use. It requires only 2 external resistors to set the output voltage for adjustable version. The AS2815 are designed for low voltage applications that offers lower dropout voltage and faster transient response. This device is an excellent choice for use in powering low voltage microprocessor that require a lower dropout, faster transient response to regulate from +2.5V to 3.8V supplies and as a post regulator for switching supplies applications. The AS2815 features low dropout of a maximum 1.2V.

The AS2815 offers over current limit and protection against over-current faults, reversed input polarity, reversed load insertion, and positive and negative transient voltage. The I_Q of this device flows into the load, which increases efficiency.

The AS2815 are offered in a 3-pin TO-220, TO-263 & TO-252 packages compatible with other 3 terminal regulators. For a 3A low dropout regulator refer to the AS2830 data sheet.

ORDERING INFORMATION

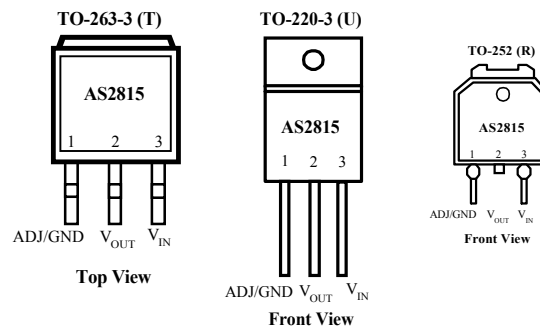| TO-220 3-PIN	DD PLASTIC 3-PIN	TO-252 DPAK	OPERERATING JUNCTION TEMP RANGE
AS2815YU-X	AS2815YT-X	AS2815YR-X	-45 to +125°C

X = Output Voltage (i.e. 1.5 for 1.5V, 2.5 for 2.5V etc.).
Y = Output Tolerance, Y= A for 1% or
　　　　　　　　　 Blank for 2%
Consult with factory for other fixed output voltages

PIN CONNECTIONS

TO-263-3 (T)

AS2815

1 2 3

ADJ/GND V_OUT V_IN

Top View

TO-220-3 (U)

AS2815

1 2 3

ADJ/GND V_OUT V_IN

Front View

TO-252 (R)

AS2815

1 2 3

ADJ/GND V_OUT V_IN

Front View

Rev. 10/11/00

ABSOLUTE MAXIMUM RATINGS

Lead Temp. (Soldering, 10 Seconds) .... 300°C
Storage Temperature Range .... -65° to +150°C
Operating Junction Temperature Range ....
    AS2815 Control Section .... -45°C +125°C
    AS2815 Power Transistor ....-45°C +150°C

Maximum Input Supply Voltage 10V
Input to Output Voltage Differential 10V

ELECTRICAL CHARACTERISTICS (NOTE 1) at I_{OUT} = 10mA, T_a=25°C, unless otherwise specified.

PARAMETER	CONDITIONS	Typ	AS2815A Min	AS2815A Max	AS2815 Min	AS2815 Max	Units
1.5V Version							
Output Voltage (Note 2)	AS2815-1.5V, 0 ≤I_{OUT}≤1.5A, 2.75V≤V_{IN}≤7V	1.5 **1.5**	1.485 **1.470**	1.515 **1.530**	1.470 **1.455**	1.530 **1.545**	V
2.5V Version							
Output Voltage (Note 2)	AS2815-2.5V,0 ≤I_{OUT}≤1.5A, 3.5V≤V_{IN}≤7V	2.5 **2.5**	2.475 **2.450**	2.525 **2.550**	2.450 **2.425**	2.550 **2.575**	V
3.3V Version							
Output Voltage (Note 2)	AS2815-3.3V, 0 ≤I_{OUT}≤1.5A, 4.75V≤V_{IN}≤7V	3.3 **3.3**	3.270 **3.240**	3.330 **3.360**	3.230 **3.201**	3.370 **3.399**	V
5.0V Version							
Output Voltage (Note 2)	AS2815-5.0V, 0 ≤I_{OUT}≤1.5A, 5.5V≤V_{IN}≤7V	5.0 **5.0**	4.95 **4.90**	5.05 **5.10**	4.900 **4.850**	5.100 **5.150**	V
All Voltage Options							
Reference Voltage (V_{REF})	V_{IN}≤ 7V, P≤ P_{MAX} 1.5V≤ (V_{IN} -V_{OUT})≤5.75V, 10mA≤I_{OUT}≤1.5A	**1.250**	**1.225**	**1.270**	**1.225**	**1.270**	V
Min. Load Current (Note 3)	1.5V≤ (V_{IN} -V_{OUT})≤5.75V	**5**		**10**		**10**	mA
Line Regulation ($\Delta V_{REF}(V_{IN})$)	2.75V≤V_{IN}≤7V, I_{OUT}=10mA, T_J=25°C (Note 3)	0.005		0.2		0.2	%
	V_{IN} ≤7V, I_{OUT}=0mA, T_J=25°C (Note 2)	0.005		0.2		0.2	%
Load Regulation($\Delta V_{REF}(I_{OUT})$)	10mA≤I_{OUT} ≤1.5A, (V_{IN}-V_{OUT})=3V, T_J=25°C (Note 3)	0.05		0.3		0.3	%
	0≤I_{OUT} ≤1.5A, V_{IN}=7V, T_J=25°C (Note 2)	0.05		0.3		0.3	%
Dropout Voltage	ΔV_{REF}=1% I_{OUT} =1.5A (Note 3) I_{OUT}≤ 1.5A (Note 2)	**1.1**		**1.2**		**1.2**	V
Current Limit $I_{OUT(MAX)}$	V_{IN}=7V 1.4V≤ (V_{IN}- V_{OUT}) (Note3)	**2.5**	**1.7**		**1.7**		A
Long Term Stability	T_A=125°C, 1000 Hrs.	0.3 (Note 2)		1		1	%
Thermal Regulation (ΔV_{OUT}(Pwr))	T_A=25°C, 20 ms pulse	0.01		0.020		0.020	%/W
Temperature Stability (ΔV_{OUT}(T))		0.25					%
Output Noise, RMS	10Hz to 10khz T_A=25°C	0.003					% V_O
Thermal Resistance	TO-220 Junction to Tab			3.0		3.0	°C/W
	Junction to Ambient			60		60	
	DD Package Junction to Tab			3.0		3.0	°C/W
	Junction to Ambient			60		60	

The Bold specifications apply to the full operating temperature range.
Note 1: Changes in output voltage due to heating effects are covered under the specification for thermal regulation.
Note 2: Fixed Version Only
Note 3: Adjustable Version Only

APPLICATION HINTS

The AS2815 incorporates protection against over-current faults, reversed load insertion, over temperature operation, and positive and negative transient voltage. However, the use of an output capacitor is required in order to insure the stability and the performances.

Stability

The output capacitor is part of the regulator's frequency compensation system. Either a 22µF aluminum electrolytic capacitor or a 10µF solid tantalum capacitor between the output terminal and ground guarantees stable operation for all operating conditions.

However, in order to minimize overshoot and undershoot, and therefore optimize the design, please refer to the section 'Ripple Rejection'.

Ripple Rejection

Ripple rejection can be improved by adding a capacitor between the ADJ pin and ground. When ADJ pin bypassing is used, the value of the output capacitor required increases to its maximum (22µF for an aluminum electrolytic capacitor, or 10µF for a solid tantalum capacitor). If the ADJ pin is not bypass, the value of the output capacitor can be lowered to 100µF for an electrolytic aluminum capacitor or 4.7µF for a solid tantalum capacitor.

However the value of the ADJ-bypass capacitor should be chosen with respect to the following equation:

$C = 1 / (6.28 * F_R * R_1)$

Where C = value of the capacitor in Farads (select an equal or larger standard value),

F_R = ripple frequency in Hz,

R_1 = value of resistor R_1 in Ohms.

If an ADJ-bypass capacitor is use, the amplitude of the output ripple will be independent of the output voltage. If an ADJ-bypass capacitor is not used, the output ripple will be proportional to the ratio of the output voltage to the reference voltage:

$M = V_{OUT} / V_{REF}$

Where M = multiplier for the ripple seen when the ADJ pin is optimally bypassed.

V_{REF} = Reference Voltage

Reducing parasitic resistance and inductance

One solution to minimize parasitic resistance and inductance is to connect in parallel capacitors. This arrangement will improve the transient response of the power supply if your system requires rapidly changing current load condition.

Thermal Consideration

Although the AS2815 offers some limiting circuitry for overload conditions, it is necessary not to exceed the maximum junction temperature, and therefore to be careful about thermal resistance. The heat flow will follow the lowest resistance path, which is the Junction-to-case thermal resistance. In order to insure the best thermal flow of the component, a proper mounting is required. Note that the case of the device is electrically connected to the output. In case the case has to be electrically isolated, a thermally conductive spacer can be used. However do not forget to consider its contribution to thermal resistance.

Assuming:
$V_{IN} = 10V$, $V_{OUT} = 5V$, $I_{OUT} = 1.5A$, $T_A = 50°C/W$,
$\theta_{Heatsink\ Case} = 6°C/W$, $\theta_{Heatsink\ Case} = 0.5°C/W$, $\theta_{JC} = 3°C/W$

Power dissipation under this condition
$P_D = (V_{IN} - V_{OUT}) * I_{OUT} = 7.5W$

Junction Temperature
$T_J = T_A + P_D * (\theta_{Case - HS} + \theta_{HS} + \theta_{JC})$

For Control & Power Sections
$T_J = 50 + 7.5*(0.5+6=3) = 121.25°C$
$121.25°C < T_{J\ (max)}$ for Control & Power Sections.

In both case reliable operation is insured by adequate junction temperature.
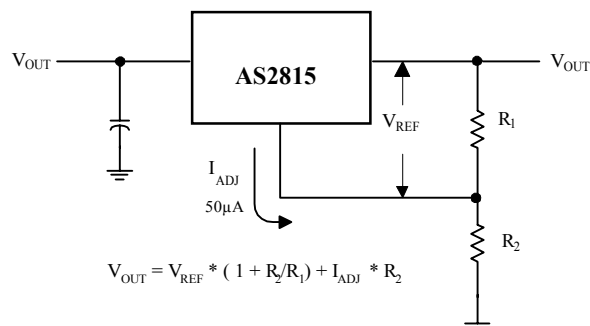
Basic Adjustable Regulator

$$V_{OUT} = V_{REF} * (1 + R_2/R_1) + I_{ADJ} * R_2$$

Fig.2 Basic Adjustable Regulator

Basic Fixed Regulator

Output Voltage

Consider Figure 2. The resistance R_1 generates a constant current flow, normally the specified load current of 10mA. This current will go through the resistance R_2 to set the overall output voltage. The current I_{ADJ} is very small and constant. Therefore its contribution to the overall output voltage is very small and can generally be ignored.

Load Regulation

Parasitic line resistance can degrade load regulation. In order not to affect the behavior of the regulator, it is best to connect directly the R_1 resistance from the resistor divider to the case,

and not to the load. For the same reason, it is best to connect the resistor R_2 to the Negative side of the load.

Output Voltage

The fixed voltage LDO voltage regulators are simple to use regulators since the V_{OUT} is preset to the specifications. It is important however, to provide the proper output capacitance for stability and improvement. For most operating conditions a capacitance of 22uF tantalum or 100uF electrolytic will ensure stability and prevent oscillation.
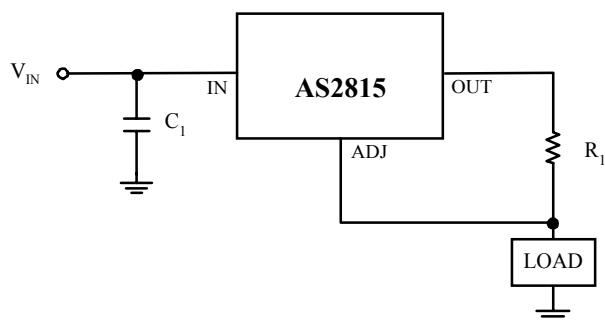

Fig.3 Basic Adjustable Regulator

TYPICAL APPLICATIONS

Fig. 4 1.5A Current output Regulator

$$V_{OUT} = V_{REF} \left(1 + \frac{R_2}{R_1}\right) + I_{ADJ} R_2$$
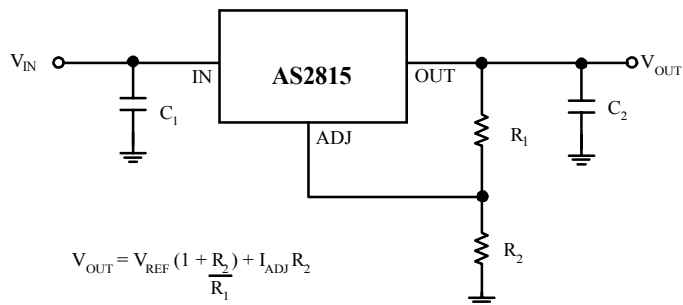
Fig. 5 Typical Adjustable Regulator

*C$_1$ improves ripple rejection. Xc should be ~ R$_1$ at ripple frequency.

Note A: $V_{IN(MIN)} = $ (Intended V_{OUT}) + ($V_{DROPOUT\,(MAX)}$)
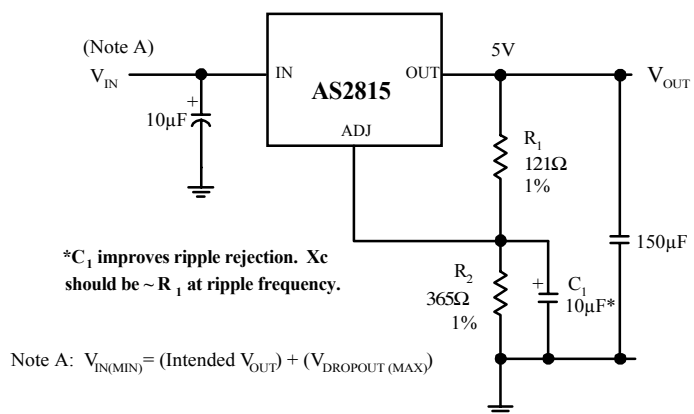
Fig. 6   Improving Ripple Rejection

Note A: $V_{IN(MIN)} = $ (Intended V_{OUT}) + ($V_{DROPOUT\,(MAX)}$)
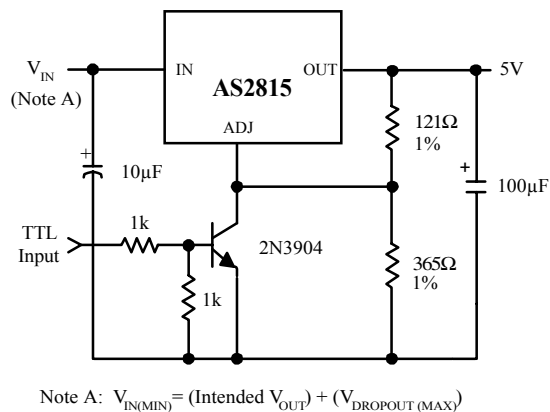
Fig.7 5V Regulator with Shutdown

TYPICAL CHARACTERISTICS

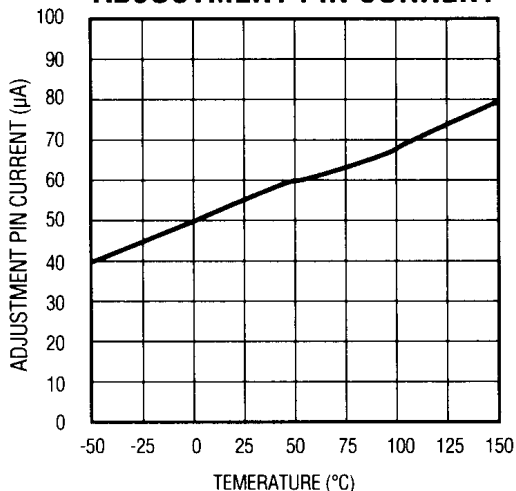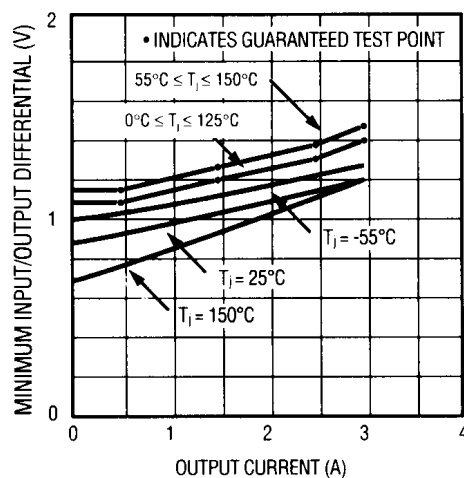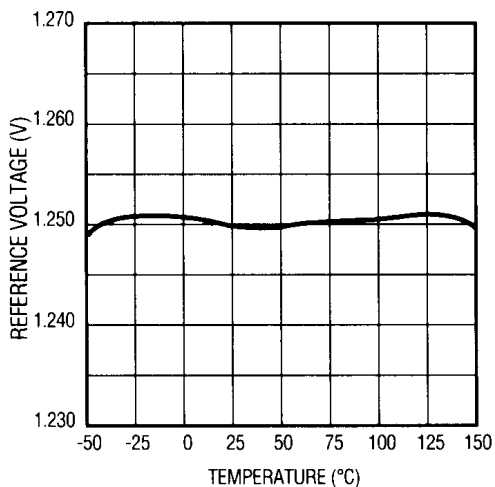### LOAD REGULATION
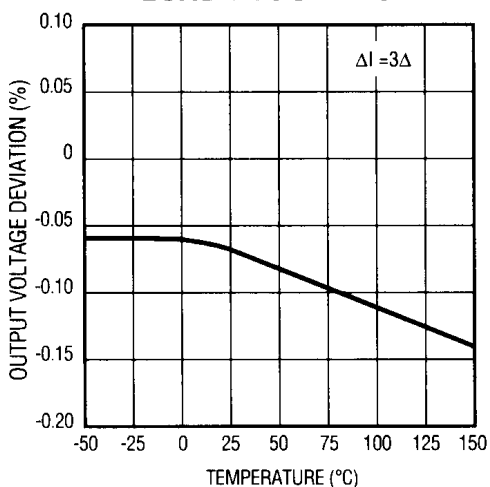
SHORT CIRCUIT CURRENT
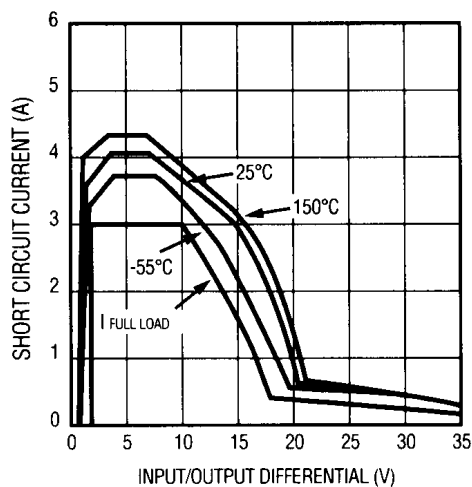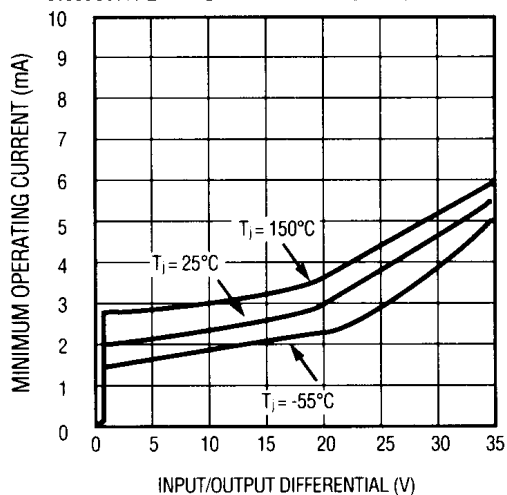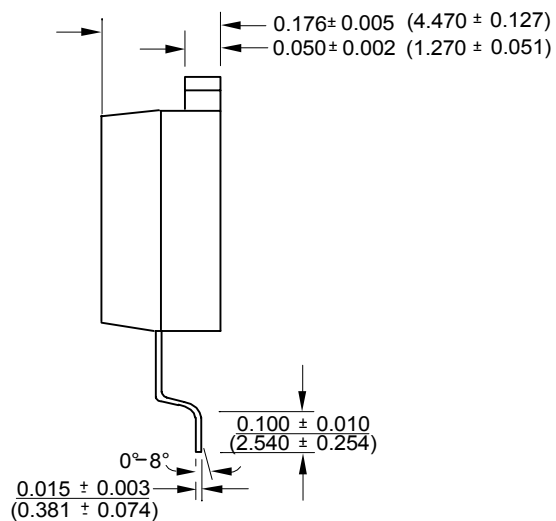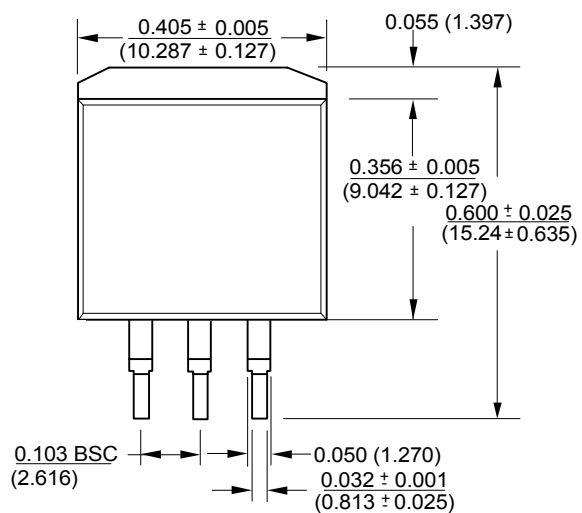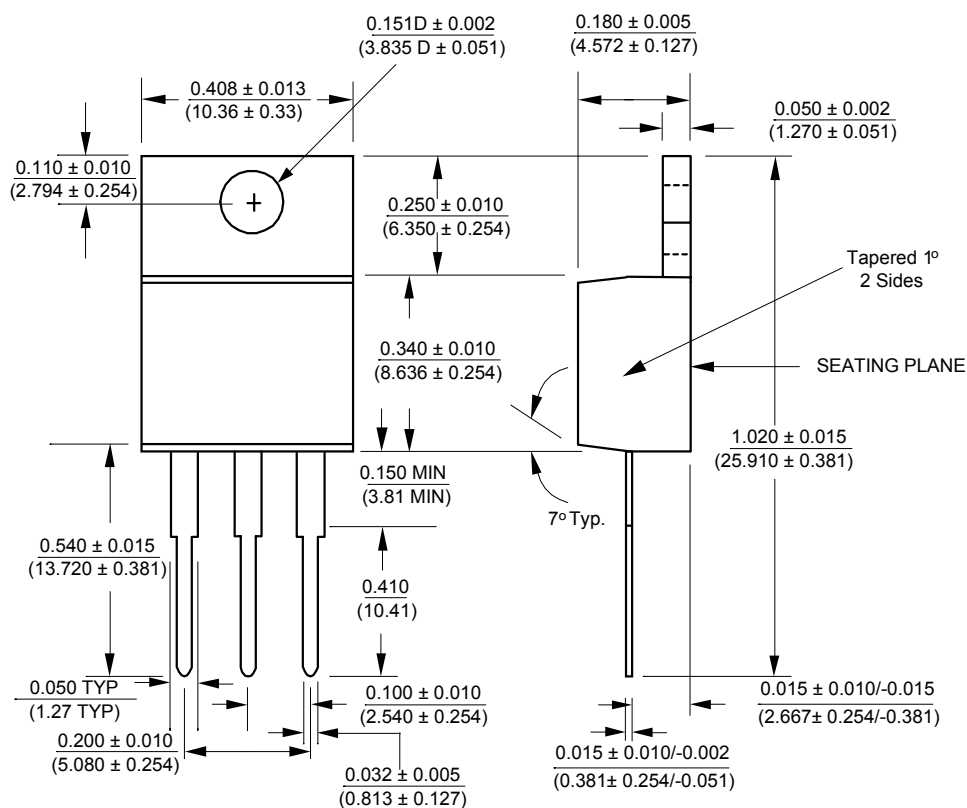

ADJUSTMENT PIN CURRENT

DROPOUT VOLTAGE

TEMPERATURE STABILITY

MINIMUM OPERATING CURRENT

PACKAGE DRAWING
TO-263-3L (T)

AS2815

PACKAGE DRAWING
TO-220-3L (U)

0.151D ± 0.002
(3.835 D ± 0.051)

0.180 ± 0.005
(4.572 ± 0.127)

0.408 ± 0.013
(10.36 ± 0.33)

0.050 ± 0.002
(1.270 ± 0.051)

0.110 ± 0.010
(2.794 ± 0.254)

0.250 ± 0.010
(6.350 ± 0.254)

Tapered 1º
2 Sides

0.340 ± 0.010
(8.636 ± 0.254)

SEATING PLANE

1.020 ± 0.015
(25.910 ± 0.381)

0.150 MIN
(3.81 MIN)

7º Typ.

0.540 ± 0.015
(13.720 ± 0.381)

0.410
(10.41)

0.050 TYP
(1.27 TYP)

0.100 ± 0.010
(2.540 ± 0.254)

0.015 ± 0.010/-0.015
(2.667± 0.254/-0.381)

0.200 ± 0.010
(5.080 ± 0.254)

0.032 ± 0.005
(0.813 ± 0.127)

0.015 ± 0.010/-0.002
(0.381± 0.254/-0.051)

PACKAGE DRAWING
TO252-3L (R)

-A-

E

b_2

L_2

4

D

L_3

L_1

1   2   3

-C-

b

b_1

3 PLCS

.010 (M) A (M) C

e

e1

D_1

TERM 4

E_1

BACK VIEW A-A

-B-

A

A_1

C_1

A

SEATING
PLANE

H

L

c

A

8

NOTES
1. Refer To Applicable Symbol List.
2. Dimensions And Tolerancing Per Ansi Y14.5m - 1982.
3. Lead Dimension Uncontrolled in L_3.
4. Tab Contour Optional Within Dim. b_2 & L_2 And E_1 & D_1
   5. D1 & E1 Establishes A Minimum Mounting Surface for Terminal 4.
6. L is the Termal Length for Soldering.
7. Controlling Dimension: Inch
8. 2 Mils Suggested For Postive Contact At Mounting.

SYMBOL	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	0.086	0.094	2.184	2.3876	
A1	0.035	0.045	0.889	1.143	
b	0.025	0.035	0.635	0.889	
b1	0.300	0.045	7.620	1.143	
b2	0.205	0.215	5.207	5.461	4
c	0.018	0.023	0.457	0.5842	
c1	0.018	0.023	0.457	0.5842	
D	0.235	0.245	5.969	6.223	
D1	0.170	-	4.318	-	4,5
E	0.250	0.265	6.350	6.731	
E1	0.170	-	4.318	-	4,5
e	0.098		2.489		
e1	0.180		4.572		
H	0.370	0.410	9.398	10.414	
L	0.020	-	0.508	-	6
L1	0.025	0.040	0.635	1.016	
L2	0.035	0.050	0.889	1.270	4
L3	0.045	0.060	1.143	1.524	3

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