SPX2815

Data Sheet

1.5A Low Dropout Voltage Regulator

General Description

The SPX2815 is a low power positive-voltage regulator designed to satisfy moderate power requirements with a cost effective, small footprint solution. This device is an excellent choice for use in battery-powered applications and portable computers. The SPX2815 features very low quiescent current and a low dropout voltage of 1.1V at a full load. As output current decreases, quiescent current flows into the load, increasing efficiency.

The SPX2815 is offered in a surface mount TO-263-3 package. An output capacitor of 10µF ceramic or tantalum provides unconditional stability.

TO-263 version available, TO-220 and TO-252 versions obsolete

For more details about the ordering information, see "Ordering Information" on page 11

Features

- Guaranteed 1.5A output current
- Three terminal adjustable or fixed 2.5V, 3.3V, and 5.0V
- Low quiescent current
- Low dropout voltage of 1.1V @ 1.5A 0.1% line and 0.1% load regulation
- Stable with 10uF ceramic capacitor
- Overcurrent and thermal protection
- Compatible with industry standard *LT1086/LT1586s*

Applications

- Industrial Equipment
- Telecommunications Equipment
- Desktop PCs, servers
- Battery chargers
- SMPS Post-regulator
- Constant current regulators

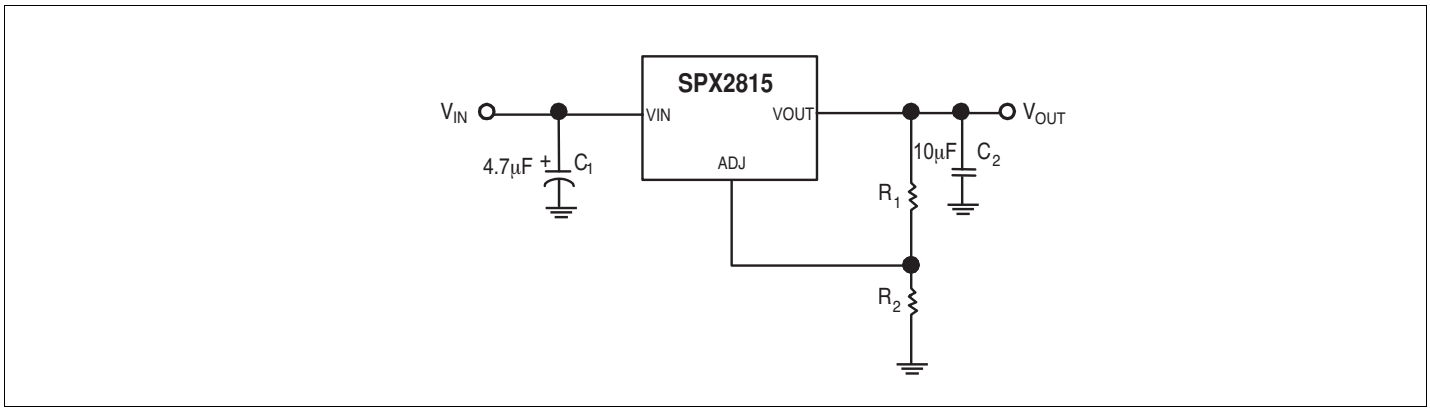


Figure 1: SPX2815 Typical Application

Revision History

Document No.	Release Date	Change Description
247DSR00	May 23, 2023	**Updated:** ■ New template applied, contents rewriting, and obsolete packages highlighted. ■ "General Description" section. ■ "Applications" section. ■ "SPX2815 Typical Application" figure. ■ "Specifications" section. ■ "Pin Information" section. ■ "Application Information" section. ■ "Ordering Information" section.
Rev C	6/21/06	Legacy Sipex data sheet.

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Specifications

Absolute Maximum Ratings

Important: The stresses above what is listed under the following table may cause permanent damage to the device. This is a stress rating only—functional operation of the device above what is listed under the following table or any other conditions beyond what MaxLinear recommends is not implied. Exposure to conditions above the recommended extended periods of time may affect device reliability. Solder reflow profile is specified in the IPC/JEDEC J-STD-020C standard.

Table 1: Absolute Maximum Ratings

	Min	Max	Units
Power Dissipation	Internally limited		-
Lead Temperature (soldering, 5 seconds)	-	260	°C
Storage Temperature Range	–65	150	°C
Operating Junction Temperature Range	–40	125	°C
Input Supply Voltage		10	V
Input to Output Voltage	-	8.8	V
ESD Rating	-	2	kV

Thermal Specifications

TO-263 version available, TO-220 and TO-252 versions obsolete

Table 2: Thermal Performance

Symbol	Parameter	Package	Typ	Units
Ψ_{JB}	Junction to Case, at Tab	TO-220	3	°C/W
θ_{JA}	Junction to Ambient	TO-220	29.3	°C/W
Ψ_{JB}	Junction to Case, at Tab	TO-263	3	°C/W
θ_{JA}	Junction to Ambient	TO-263	31.4	°C/W
Ψ_{JB}	Junction to Case, at Tab	TO-252	6	°C/W
θ_{JA}	Junction to Ambient	TO-252	50	°C/W

Electrical Characteristics

Electrical characteristics at $V_{IN} = V_{OUT} + 1.5V$, $T_A = 25°C$, $C_{IN} = C_{OUT} = 10\mu F$, I_{OUT} =10mA, unless otherwise specified. The • denotes the specifications that apply over the full operating temperature range of $–40°C \le T_J \le 125°C$, unless otherwise specified.

Table 3: Electrical Characteristics

Parameter	Conditions		Min	Typ	Max	Min	Typ	Max	Units
2.5V Version				**SPX2815A**			**SPX2815**		
Output Voltage	I_{OUT} = 10mA, V_{IN} = 4.5V		2.475	2.500	2.525	2.450	2.500	2.550	V
	10mA ≤ I_{OUT} ≤ 1.5A, 4.25V ≤ V_{IN} ≤ 10V	•	2.450	-	2.550	2.425	-	2.575	
3.30V Version									
Output Voltage	I_{OUT} = 10mA, V_{IN} = 5V		3.267	3.300	3.333	3.234	3.300	3.366	V
	10mA ≤ I_{OUT} ≤ 1.5A, 4.75V ≤ V_{IN} ≤ 10V	•	3.234	-	3.366	3.201	-	3.399	
5.0V Version									
Output Voltage	I_{OUT} = 10mA, V_{IN} = 7V		4.950	5.000	5.050	4.900	5.000	5.100	V
	10mA ≤ I_{OUT} ≤ 1.5A, 6.50V ≤ V_{IN} ≤ 10V	•	4.900	-	5.100	4.850	-	5.150	
All Voltage Options									
Reference Voltage	I_{OUT} = 10mA, (V_{IN} - V_{OUT}) = 2V		1.238	1.250	1.262	1.225	1.250	1.275	V
	10mA ≤ I_{OUT} ≤ 1.5A, 1.5V ≤ (V_{IN} - V_{OUT}) ≤10V	•	1.225	-	1.275	1.212	-	1.287	
Output Voltage Temperature Stability	-		-	0.3	-	-	0.5	-	%
Line Regulation	4.25V ≤ V_{IN} ≤ 10V, V_{OUT} = 2.5V, I_{OUT} = 10mA		-	0.1	0.2	-	0.1	0.2	%
	4.75V ≤ V_{IN} ≤ 10V, V_{OUT} = 3.3V, I_{OUT} = 10mA		-	0.1	0.2	-	0.1	0.2	
	6.50V ≤ V_{IN} ≤ 10V, V_{OUT} = 5.0V, I_{OUT} = 10mA		-	0.1	0.2	-	0.1	0.2	
Load Regulation	10mA ≤ I_{OUT} ≤ 1.5A, V_{OUT} = 2.5V		-	0.1	0.3	-	0.1	0.3	%
	10mA ≤ I_{OUT} ≤ 1.5A, V_{OUT} = 3.3V		-	0.1	0.3	-	0.1	0.3	
	10mA ≤ I_{OUT} ≤ 1.5A, V_{OUT} = 5.0V		-	0.1	0.3	-	0.1	0.3	
Dropout Voltage[2]	I_{OUT} = 0.5A		-	1.00	-	-	1.00	-	V
	I_{OUT} = 1.5A		-	1.10	1.2	-	1.10	1.2	
Quiescent Current	Fixed voltage versions		-	4	10	-	4	10	mA
Adjust Pin Current		•	-	50	120	-	50	120	µA
Current Limit	(V_{IN} - V_{OUT}) = 5V		2.5	-	-	2.5	-	-	A
Thermal Regulation	25°C, 30mS pulse		-	0.01	0.1	-	0.01	0.1	%W
Ripple Rejection	f_{RIPPLE} = 120Hz, (V_{IN} - V_{OUT}) = 2V, V_{RIPPLE} =1V_{PP}		60	75	-	60	75	-	dB
Long Term Stability	125°C, 1000Hrs		-	0.03	-	-	0.03	-	%
RMS Output Noise	% of V_{OUT}, 10Hz ≤ f ≤ 10kHz		-	0.003	-	-	0.003	-	%

Pin Information

TO-263 version available, TO-220 and TO-252 versions obsolete

Pin Configuration

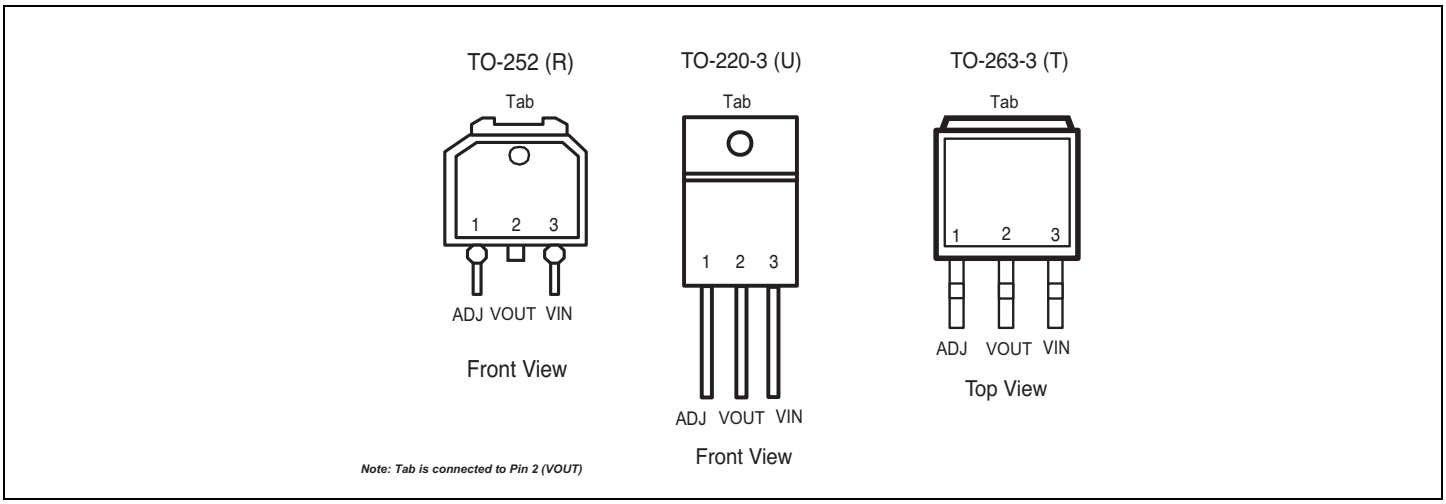


Figure 2: SPX2815 Pin Configuration

Pin Description

Table 4: Pin Description

Pin Number	Pin Name	Description
1	ADJ	Output voltage adjustment pin. For setting the output voltage, see “Application Information” on page 4.
2	VOUT	Output voltage pin. Bypass to GND with 10μF or larger capacitor.
3	VIN	Input voltage pin. Bypass to GND with 4.7μF or larger capacitor.
Tab	VOUT	Tab pin and VOUT pin are internally connected. Thermal performance of the package relies on this pin have a good thermal connection sunk to the VOUT power plane.

Typical Performance Characteristics

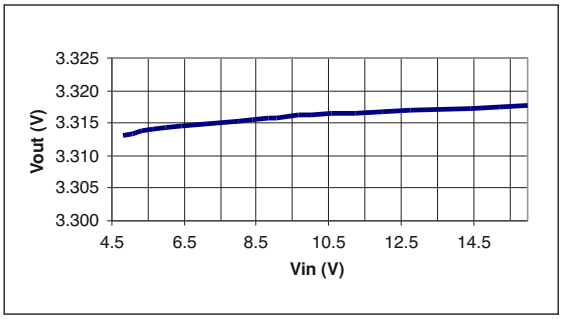


Figure 3: Line Regulation for SPX2815U-3.3 I_{OUT} = 10mA

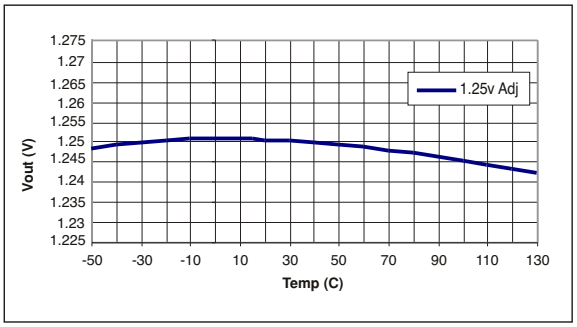


Figure 4: V_{OUT} vs Temperature, V_{IN}= 2.5V, I_{OUT} =10mA

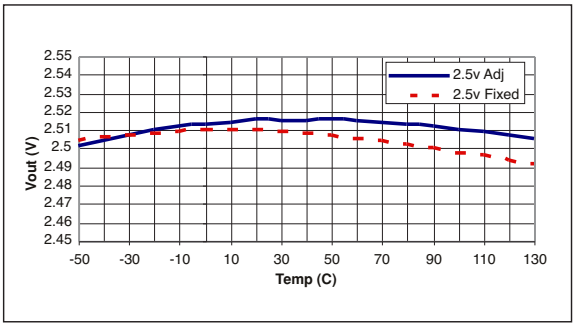


Figure 5: V_{IN} = 4.0V, I_{OUT} = 10mA

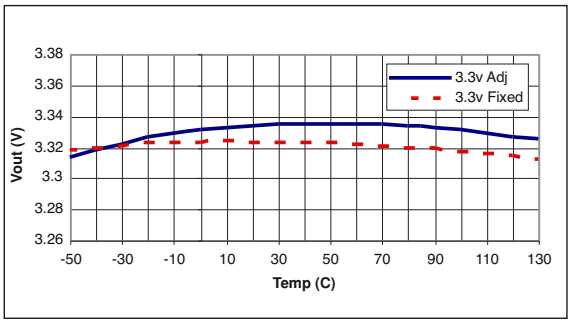


Figure 6: V_{IN} = 5.0V, I_{OUT} =10mA

Application Information

Output Capacitor

To ensure the stability of the SPX2815, an output capacitor of at least 10μF (ceramic or tantalum) or 22μF (aluminum) is required. The value can change based on the application requirements of the output load or temperature

range. The value of equivalent series resistance (ESR) can vary based on the type of capacitor used in the applications to guarantee stability. The recommended value for ESR is 0.5Ω or less. A larger value of output capacitance (up to 100μF) can improve the load transient response.

Thermal Characteristics

The SPX2815 features internal thermal limiting to protect the device during overload conditions.

Special care needs to be taken during continuous load conditions such that the maximum junction temperature does not exceed 125°C. Thermal protection is activated at > 179°C and deactiviated at ≤165°C.

The thermal interaction from other components in the application can affect the thermal resistance of the SPX2815. The actual thermal resistance can be determined with experimentation.

The SPX2815 power dissipation is calculated as follows:

$P_D = (V_{IN} - V_{OUT})(I_{OUT})$

The maximum Junction Temperature range:

$T_J = T_A(max) + P_D \times \theta_{JA}$ (thermal resistance, junction-to-ambient)

Maximum junction temperature must not exceed 125°C.

Ripple Rejection

Ripple rejection can be improved by adding a capacitor between the ADJ pin and ground as shown in Figure 10 on page 6. When the ADJ pin bypassing is used, the value of the output capacitor required increases to its maximum. If the ADJ pin is not bypassed, the value of the output capacitor can be lowered to 22µF for an electrolytic aluminum capacitor or 10µF for a solid tantalum capacitor (Figure 9 on page 6). However, the value of the ADJ-bypass capacitor should be chosen as follows:

$$C = 1/(6.28 \times F_R \times R_1)$$

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 Ω.

If an ADJ-bypass capacitor is used, the amplitude of the output ripple is independent of the output voltage. If an ADJ-bypass capacitor is not used, the output ripple is 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} = 1.25V

Ripple rejection for the adjustable version is shown in Figure 7.

Output Voltage

The output of the adjustable regulator can be set to any voltage from 1.25V to 15V. The value of V_{OUT} can be approximated using the formula:

$$V_{OUT} = 1.25 \times (R_1 + R_2)/R_1$$

A small correction to this formula is required depending on the values of resistors R_1 and R_2, since the adjustable pin current (approx 50µA) flows through R_2. When I_{ADJ} is taken into account, the formula becomes as follows:

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

where,

V_{REF} = 1.25V

Layout Considerations

Parasitic line resistance can degrade load regulation. To avoid this, connect R_1 directly to V_{OUT} as shown in Figure 12 on page 6. For the same reason, R_2 should be connected to the negative side of the load.

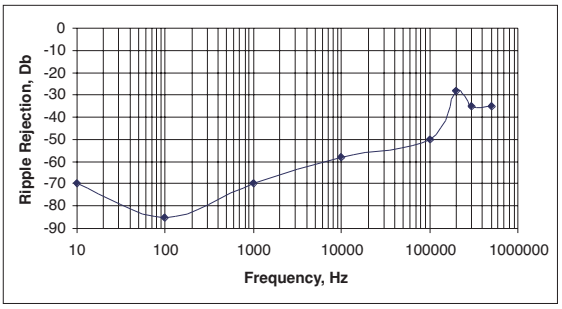


Figure 7: Ripple Rejection V_{IN} = 3.3V, V_{OUT} = 1.8V (adj), I_{LOAD} = 200mA

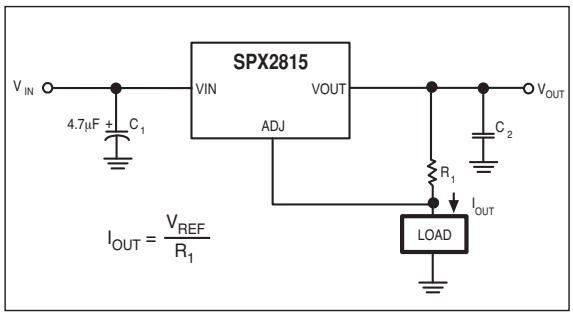


Figure 8: Current Source

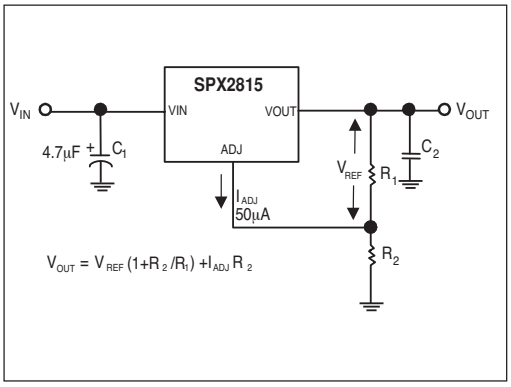


Figure 9: Typical Adjustable Regulator

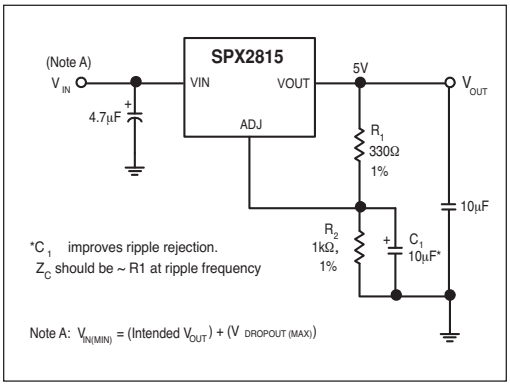


Figure 10: Improving Ripple Rejection

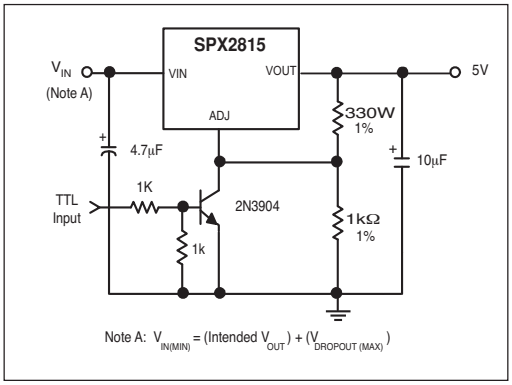


Figure 11: 9.5V Regulator with Shutdown

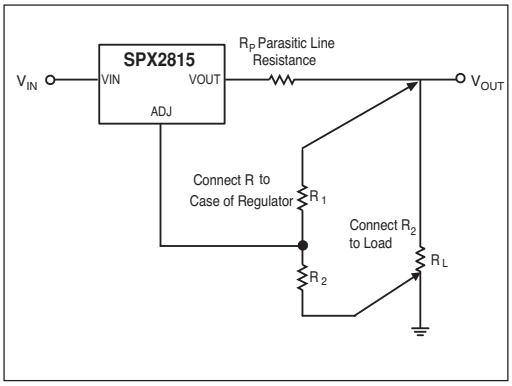


Figure 12: Recommended Connections for Best Results

Block Diagram

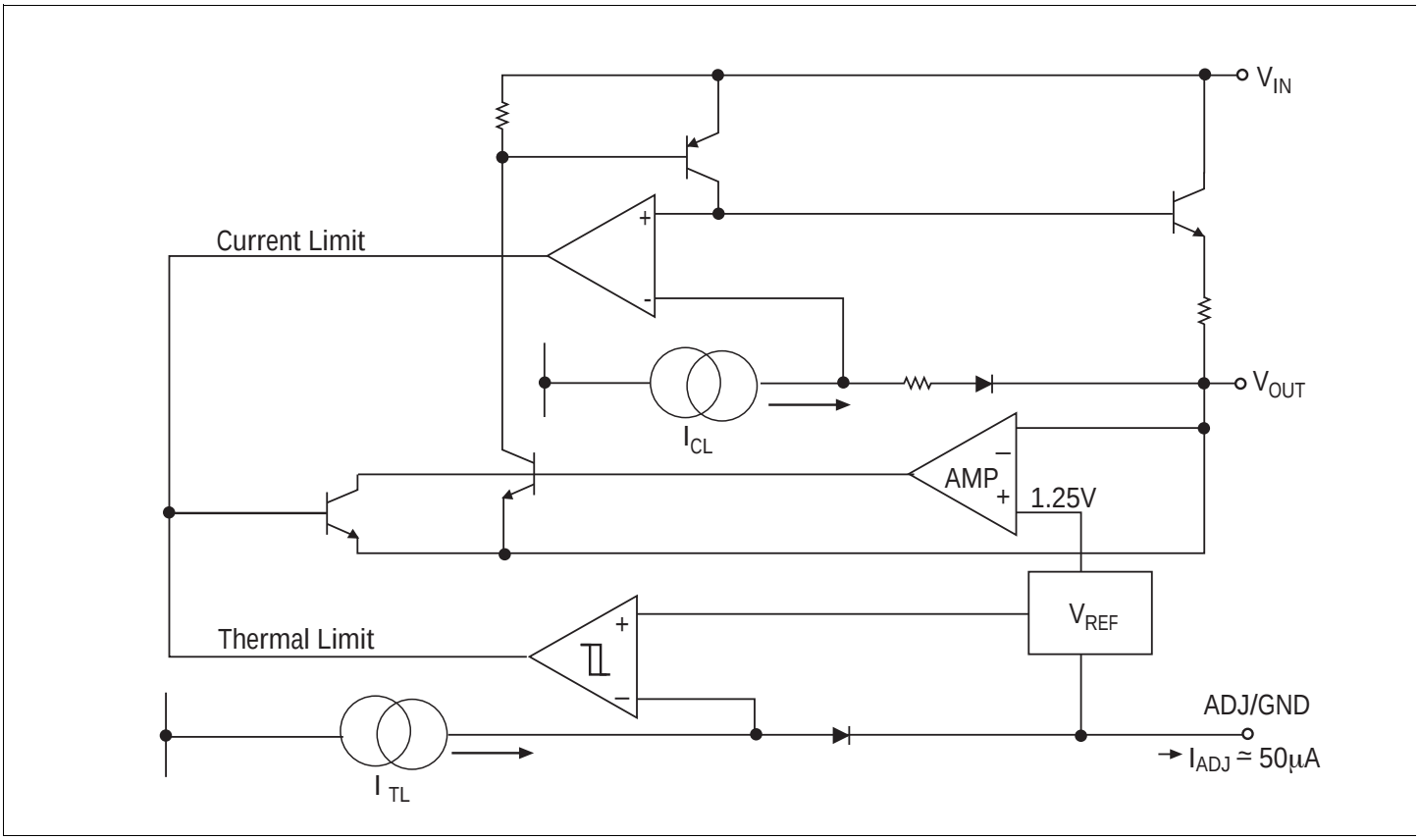
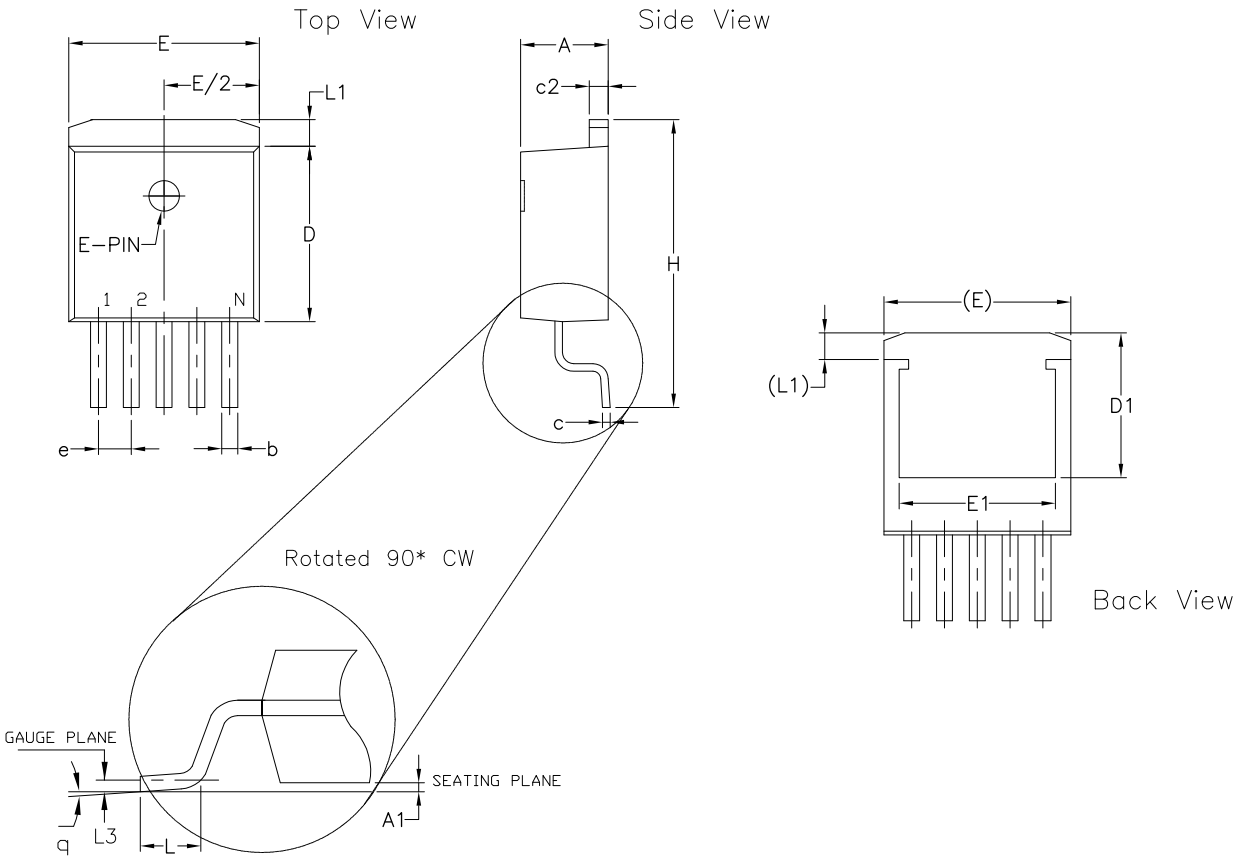


Figure 13: SPX2815 Block Diagram

Mechanical Dimensions

3-Pin TO-263



3 Pin TO-263 JEDEC TO-263 Variation AA						
SYMBOLS	DIMENSIONS IN INCH (Control Unit)			DIMENSIONS IN MM (Reference Unit)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.160	—	0.190	4.06	—	4.83
A1	0.000	—	0.010	0.00	—	0.25
b	0.020	—	0.039	0.51	—	0.99
b2	0.045	—	0.070	1.14	—	1.78
c	0.015	—	0.029	0.38	—	0.74
c2	0.045	—	0.065	1.14	—	1.65
D	0.330	—	0.380	8.38	—	9.65
D1	0.270	—	—	6.86	—	—
E	0.380	—	0.420	9.65	—	10.67
E1	0.245	—	—	6.22	—	—
e	0.100 BSC			2.54 BSC		
H	0.575	—	0.625	14.61	—	15.88
L	0.070	—	0.110	1.78	—	2.79
L1	—	—	0.066	—	—	1.68
L3	0.010 BSC			0.25 BSC		
q	0°		8°	0°		8°
N	3			3		

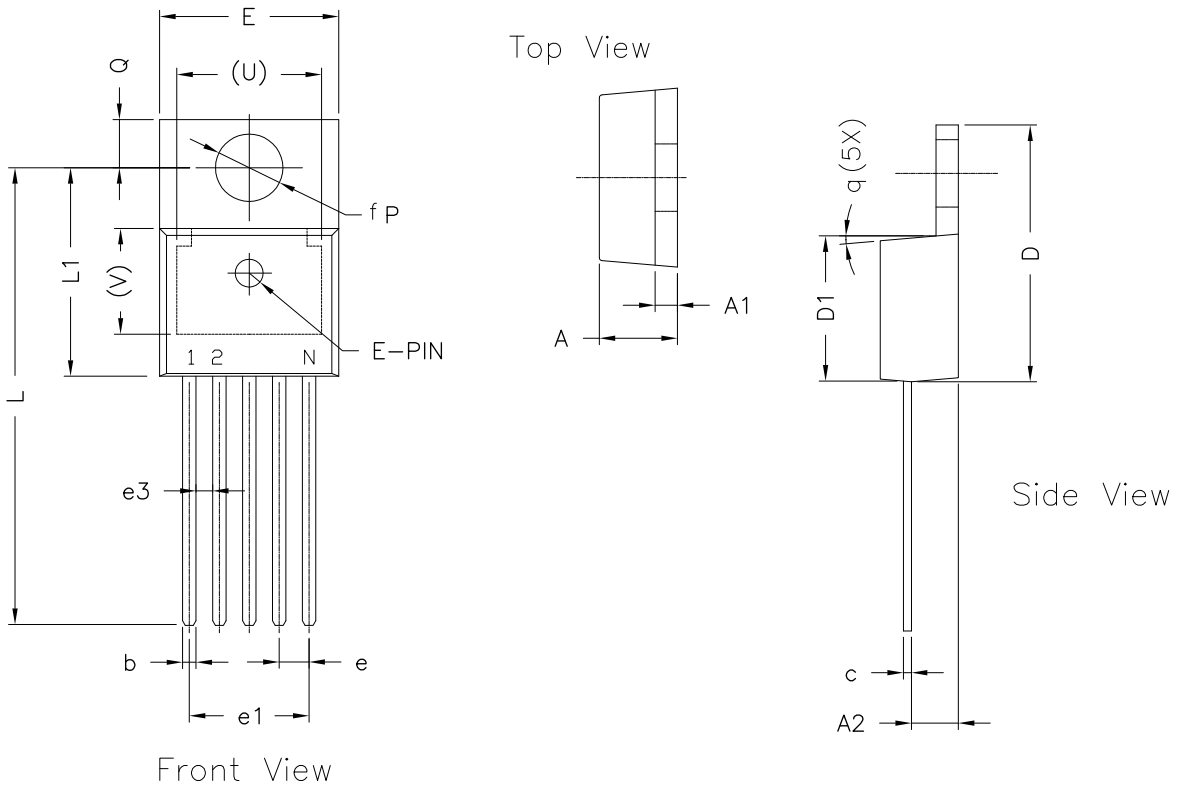
5 Pin TO-263 JEDEC TO-263 Variation BA						
SYMBOLS	DIMENSIONS IN INCH (Control Unit)			DIMENSIONS IN MM (Reference Unit)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.160	—	0.190	4.06	—	4.83
A1	0.000	—	0.010	0.00	—	0.25
b	0.020	—	0.039	0.51	—	0.99
c	0.015	—	0.029	0.38	—	0.74
c2	0.045	—	0.065	1.14	—	1.65
D	0.330	—	0.380	8.38	—	9.65
D1	0.270	—	—	6.86	—	—
E	0.380	—	0.420	9.65	—	10.67
E1	0.245	—	—	6.22	—	—
e	0.067 BSC			1.70 BSC		
H	0.575	—	0.625	14.61	—	15.88
L	0.070	—	0.110	1.78	—	2.79
L1	—	—	0.066	—	—	1.68
L3	0.010 BSC			0.25 BSC		
q	0°		8°	0°		8°
N	5			5		

Drawing No: POD-00000021
Revision: A

Figure 14: SPX2815 Mechanical Dimensions–3-Pin TO-263

3-Pin TO-220

TO-220 version obsolete



3 Pin TO-220 (Option 1)* JEDEC TO-220-AB				
SYMBOLS	DIMENSIONS IN INCH (Control Unit)		DIMENSIONS IN MM (Reference Unit)	
	MIN	MAX	MIN	MAX
A	0.140	0.190	3.56	4.82
A1	0.020	0.055	0.51	1.40
A2	0.080	0.115	2.03	2.92
b	0.015	0.040	0.38	1.02
c	0.014	0.024	0.36	0.61
D	0.560	0.650	14.22	16.51
D1	0.330	0.355	8.38	9.02
D2	0.480	0.507	12.19	12.88
E	0.380	0.420	9.65	10.67
E1	0.270	0.350	6.86	8.89
e	0.100 BSC		2.54 BSC	
e1	0.200 BSC		5.08 BSC	
H1	0.230	0.270	5.84	6.86
L	0.500	0.580	12.70	14.73
L1	—	0.250	—	6.35
P	0.139	0.156	3.53	3.96
Q	0.103	0.113	2.62	2.87
V	0.240 REF		6.10 REF	
q	3°	7°	3°	7°
N	3		3	

* Refer to product datasheet for POD option being used

3 Pin TO-220 (Option 2)*				
SYMBOLS	DIMENSIONS IN INCH (Control Unit)		DIMENSIONS IN MM (Reference Unit)	
	MIN	MAX	MIN	MAX
A	0.140	0.190	3.56	4.82
A1	0.020	0.055	0.51	1.40
A2	0.080	0.115	2.03	2.92
b	0.015	0.040	0.38	1.02
c	0.014	0.024	0.36	0.61
D	0.560	0.650	14.22	16.51
D1	0.330	0.355	8.38	9.02
D2	0.480	0.507	12.19	12.88
E	0.380	0.420	9.65	10.67
E1	0.270	0.350	6.86	8.89
e	0.100 BSC		2.54 BSC	
e1	0.200 BSC		5.08 BSC	
H1	0.230	0.270	5.84	6.86
L	0.500	0.580	12.70	14.73
L1	0.345 BSC		8.76 BSC	
P	0.139	0.156	3.53	3.96
Q	0.103	0.113	2.62	2.87
V	0.240 REF		6.10 REF	
q	3°	7°	3°	7°
N	3		3	

* Refer to product datasheet for POD option being used

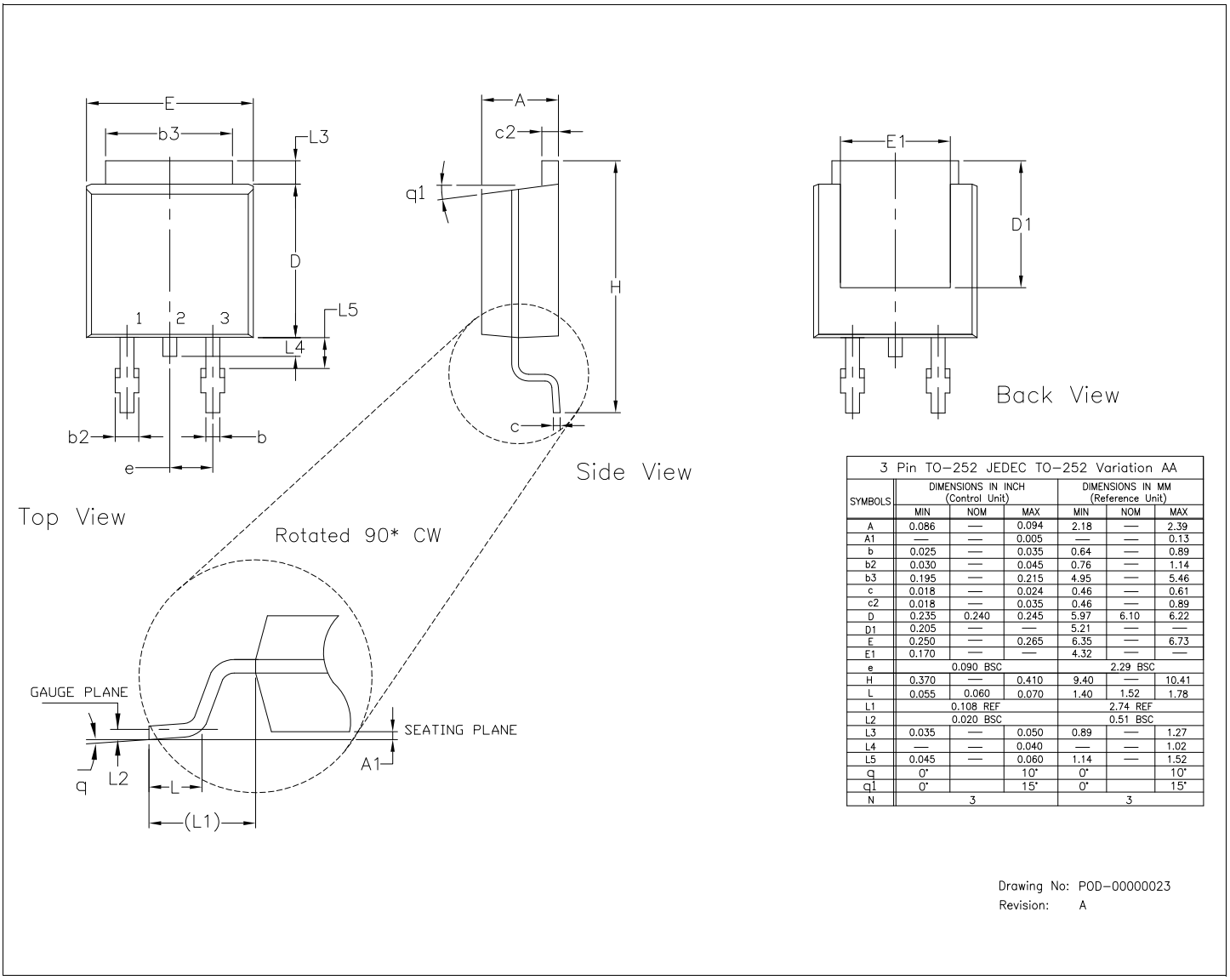
5 Pin TO-220 JEDEC TS-001 Variation AA				
SYMBOLS	DIMENSIONS IN INCH (Control Unit)		DIMENSIONS IN MM (Reference Unit)	
	MIN	MAX	MIN	MAX
A	0.165	0.190	4.19	4.82
A1	0.035	0.055	0.89	1.39
A2	0.085	0.115	2.16	2.92
b	0.020	0.040	0.51	1.01
c	0.012	0.025	0.31	0.63
D	0.570	0.625	14.48	15.87
D1	0.330	0.370	8.39	9.39
E	0.390	0.415	9.91	10.54
e	0.067 BSC		1.70 BSC	
e1	0.263	0.273	6.68	6.93
e3	0.030	0.040	0.76	1.02
L	0.945	1.045	24.00	26.54
L1	0.465	0.539	11.81	13.69
P	0.139	0.156	3.53	3.96
Q	0.103	0.113	2.62	2.87
U	0.300 REF		7.62 REF	
V	0.240 REF		6.10 REF	
q	3°	7°	3°	7°
N	5		5	

Drawing No: POD-00000020
Revision: A

Figure 15: SPX2815 Mechanical Dimensions–3-Pin TO-220

3-pin TO-252

TO-252 version obsolete



3 Pin TO-252 JEDEC TO-252 Variation AA						
SYMBOLS	DIMENSIONS IN INCH (Control Unit)			DIMENSIONS IN MM (Reference Unit)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.086	—	0.094	2.18	—	2.39
A1	—	—	0.005	—	—	0.13
b	0.025	—	0.035	0.64	—	0.89
b2	0.030	—	0.045	0.76	—	1.14
b3	0.195	—	0.215	4.95	—	5.46
c	0.018	—	0.024	0.46	—	0.61
c2	0.018	—	0.035	0.46	—	0.89
D	0.235	0.240	0.245	5.97	6.10	6.22
D1	0.205	—	—	5.21	—	—
E	0.250	—	0.265	6.35	—	6.73
E1	0.170	—	—	4.32	—	—
e	0.090 BSC			2.29 BSC		
H	0.370	—	0.410	9.40	—	10.41
L	0.055	0.060	0.070	1.40	1.52	1.78
L1	0.108 REF			2.74 REF		
L2	0.020 BSC			0.51 BSC		
L3	0.035	—	0.050	0.89	—	1.27
L4	—	—	0.040	—	—	1.02
L5	0.045	—	0.060	1.14	—	1.52
q	0°		10°	0°		10°
q1	0°		15°	0°		15°
N	3			3		

Drawing No: POD-00000023
Revision: A

Figure 16: SPX2815 Mechanical Dimensions–3-Pin TO-220

Ordering Information

Table 5: Ordering Information

Ordering Part Number	Operating Temperature Range	Accuracy	Top Mark	Output Voltage	Package
SPX2815AT-L/TR	–40°C ≤ T_J ≤ 125°C	1%	SPX2815ATYYWWLX	ADJ	3 lead TO-263

Note: For more information about part numbers, as well as the most up-to-date ordering information and additional information on environmental rating, go to www.maxlinear.com/SPX2815.

MaxLinear, Inc.
5966 La Place Court, Suite 100
Carlsbad, CA 92008
Tel.: +1 (760) 692-0711
Fax: +1 (760) 444-8598

www.maxlinear.com

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