

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 10 μ F 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 10 μ F 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

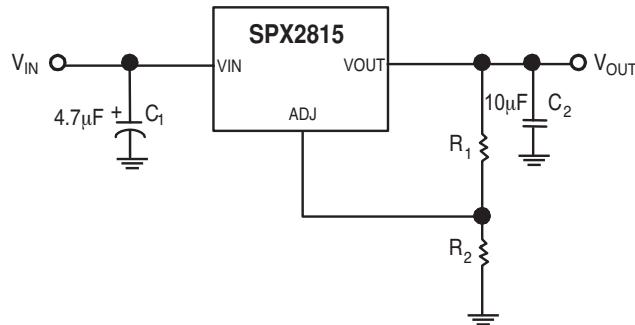


Figure 1: SPX2815 Typical Application

Revision History

Document No.	Release Date	Change Description
247DSR00	May 23, 2023	Updated: <ul style="list-style-type: none">■ 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.

Table of Contents

General Description	i
Features.....	i
Applications	i
Specifications	1
Absolute Maximum Ratings	1
Thermal Specifications	1
Pin Information	3
Pin Configuration	3
Typical Performance Characteristics	4
Application Information	4
Output Capacitor	4
Thermal Characteristics	4
Ripple Rejection	5
Output Voltage	5
Layout Considerations.....	5
Block Diagram	7
Mechanical Dimensions.....	8
3-Pin TO-263.....	8
3-Pin TO-220.....	9
3-pin TO-252	10
Ordering Information.....	11

List of Figures

Figure 1: SPX2815 Typical Application	i
Figure 2: SPX2815 Pin Configuration.....	3
Figure 3: Line Regulation for SPX2815U-3.3 $I_{OUT} = 10mA$	4
Figure 4: V_{OUT} vs Temperature, $V_{IN} = 2.5V$, $I_{OUT} = 10mA$	4
Figure 5: $V_{IN} = 4.0V$, $I_{OUT} = 10mA$	4
Figure 6: $V_{IN} = 5.0V$, $I_{OUT} = 10mA$	4
Figure 7: Ripple Rejection $V_{IN} = 3.3V$, $V_{OUT} = 1.8V$ (adj), $I_{LOAD} = 200mA$	5
Figure 8: Current Source	5
Figure 9: Typical Adjustable Regulator.....	6
Figure 10: Improving Ripple Rejection	6
Figure 11: 9.5V Regulator with Shutdown	6
Figure 12: Recommended Connections for Best Results.....	6
Figure 13: SPX2815 Block Diagram.....	7
Figure 14: SPX2815 Mechanical Dimensions—3-Pin TO-263.....	8
Figure 15: SPX2815 Mechanical Dimensions—3-Pin TO-220.....	9
Figure 16: SPX2815 Mechanical Dimensions—3-Pin TO-220.....	10

List of Tables

Table 1: Absolute Maximum Ratings.....	1
Table 2: Thermal Performance.....	1
Table 3: Electrical Characteristics	2
Table 4: Pin Description	3
Table 5: Ordering Information.....	11

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 $V_{IN} = V_{OUT} + 1.5V$, $T_A = 25^\circ C$, $C_{IN} = C_{OUT} = 10\mu F$, $I_{OUT} = 10mA$, unless otherwise specified. The • denotes the specifications that apply over the full operating temperature range of $-40^\circ C \leq T_J \leq 125^\circ C$, 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
	$10mA \leq I_{OUT} \leq 1.5A$, $4.25V \leq V_{IN} \leq 10V$	•	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
	$10mA \leq I_{OUT} \leq 1.5A$, $4.75V \leq V_{IN} \leq 10V$	•	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
	$10mA \leq I_{OUT} \leq 1.5A$, $6.50V \leq V_{IN} \leq 10V$	•	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
	$10mA \leq I_{OUT} \leq 1.5A$, $1.5V \leq (V_{IN} - V_{OUT}) \leq 10V$	•	1.225	-	1.275	1.212	-	1.287	
Output Voltage Temperature Stability	-		-	0.3	-	-	0.5	-	%
Line Regulation	$4.25V \leq V_{IN} \leq 10V$, $V_{OUT} = 2.5V$, $I_{OUT} = 10mA$		-	0.1	0.2	-	0.1	0.2	%
	$4.75V \leq V_{IN} \leq 10V$, $V_{OUT} = 3.3V$, $I_{OUT} = 10mA$		-	0.1	0.2	-	0.1	0.2	
	$6.50V \leq V_{IN} \leq 10V$, $V_{OUT} = 5.0V$, $I_{OUT} = 10mA$		-	0.1	0.2	-	0.1	0.2	
Load Regulation	$10mA \leq I_{OUT} \leq 1.5A$, $V_{OUT} = 2.5V$		-	0.1	0.3	-	0.1	0.3	%
	$10mA \leq I_{OUT} \leq 1.5A$, $V_{OUT} = 3.3V$		-	0.1	0.3	-	0.1	0.3	
	$10mA \leq I_{OUT} \leq 1.5A$, $V_{OUT} = 5.0V$		-	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	$25^\circ C$, 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	$125^\circ C$, 1000Hrs		-	0.03	-	-	0.03	-	%
RMS Output Noise	% of V_{OUT} , $10Hz \leq f \leq 10kHz$		-	0.003	-	-	0.003	-	%

Pin Information

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

Pin Configuration

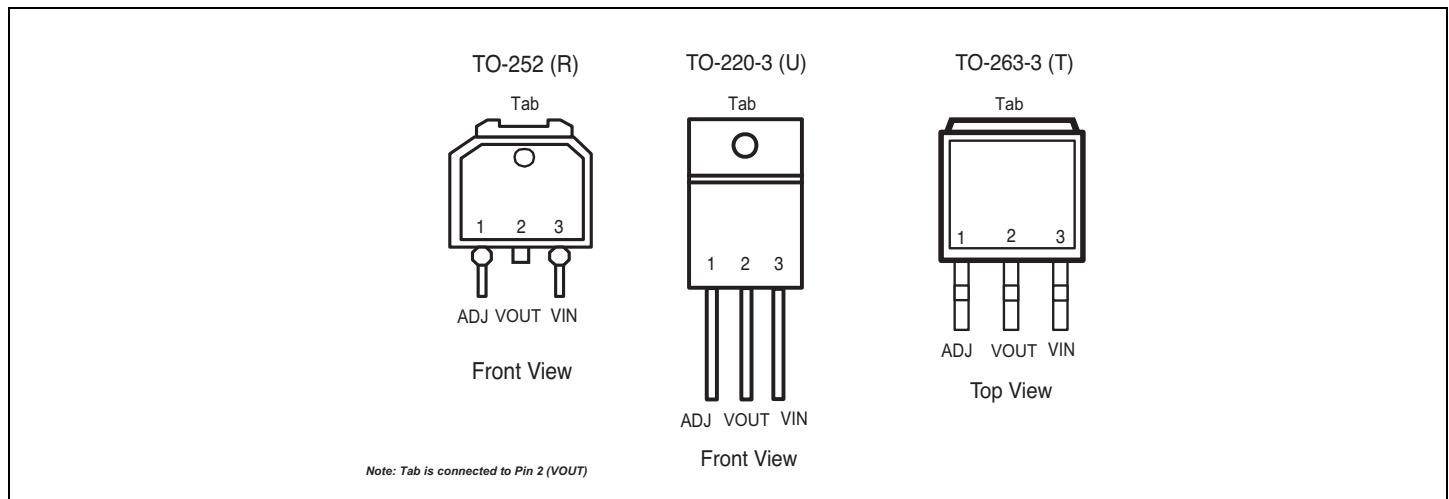


Figure 2: SPX2815 Pin Configuration

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 10 μ F or larger capacitor.
3	VIN	Input voltage pin. Bypass to GND with 4.7 μ F 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

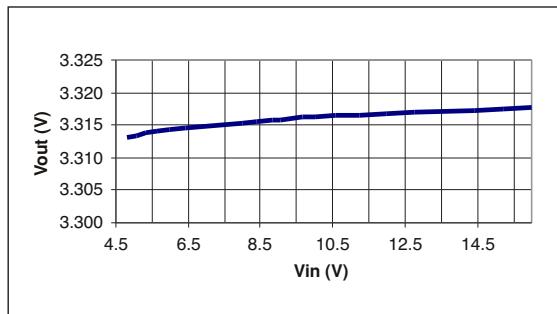


Figure 3: Line Regulation for SPX2815U-3.3
 $I_{OUT} = 10\text{mA}$

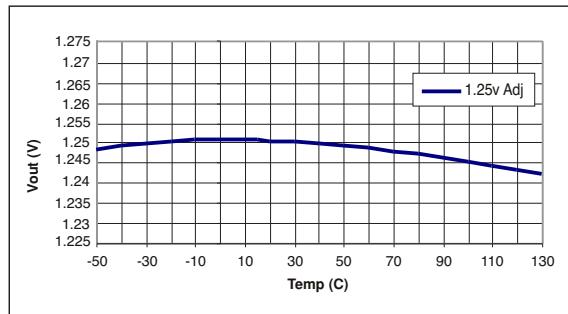


Figure 4: V_{OUT} vs Temperature, $V_{IN} = 2.5\text{V}$, $I_{OUT} = 10\text{mA}$

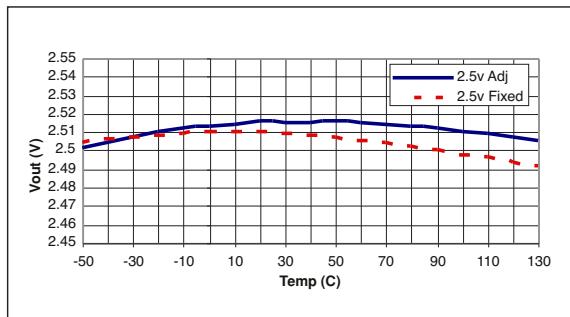


Figure 5: $V_{IN} = 4.0\text{V}$, $I_{OUT} = 10\text{mA}$

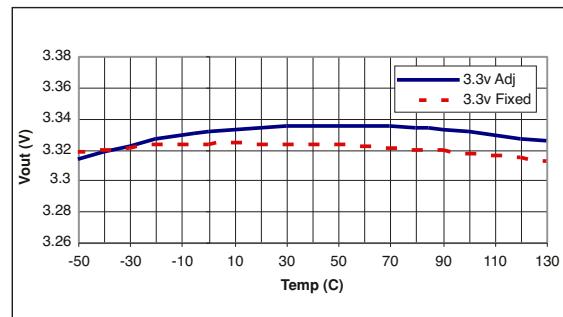


Figure 6: $V_{IN} = 5.0\text{V}$, $I_{OUT} = 10\text{mA}$

Application Information

Output Capacitor

To ensure the stability of the SPX2815, an output capacitor of at least $10\mu\text{F}$ (ceramic or tantalum) or $22\mu\text{F}$ (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 $100\mu\text{F}$) 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 $> 179^\circ\text{C}$ and deactivated at $\leq 165^\circ\text{C}$.

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:

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

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 $22\mu\text{F}$ for an electrolytic aluminum capacitor or $10\mu\text{F}$ 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:

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

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

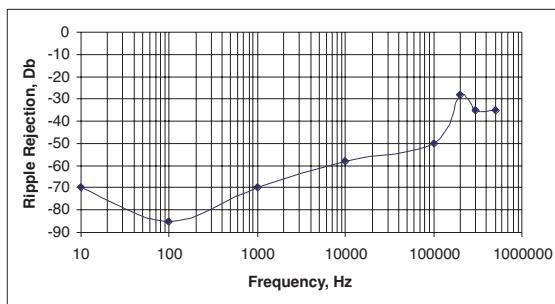


Figure 7: Ripple Rejection $V_{\text{IN}} = 3.3\text{V}$, $V_{\text{OUT}} = 1.8\text{V}$ (adj), $I_{\text{LOAD}} = 200\text{mA}$

$$V_{\text{REF}} = 1.25\text{V}$$

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:

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

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 $50\mu\text{A}$) flows through R_2 . When I_{ADJ} is taken into account, the formula becomes as follows:

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

where,

$$V_{\text{REF}} = 1.25\text{V}$$

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.

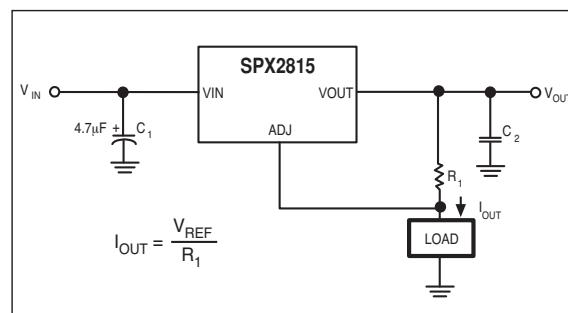
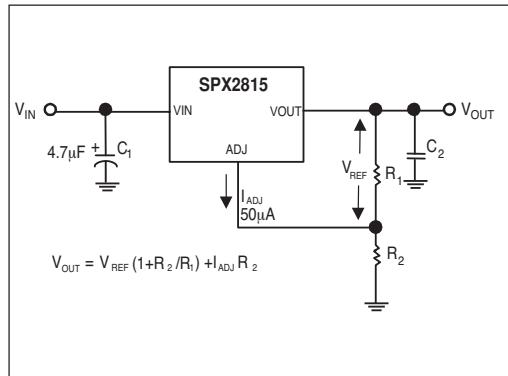
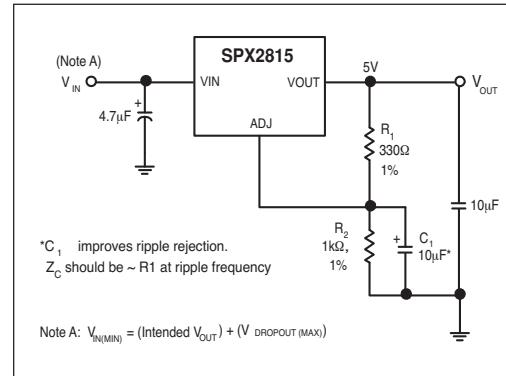
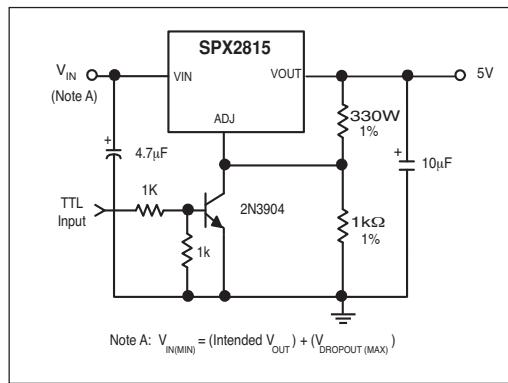
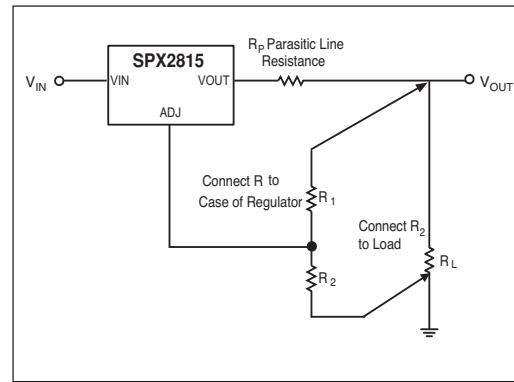


Figure 8: Current Source

**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

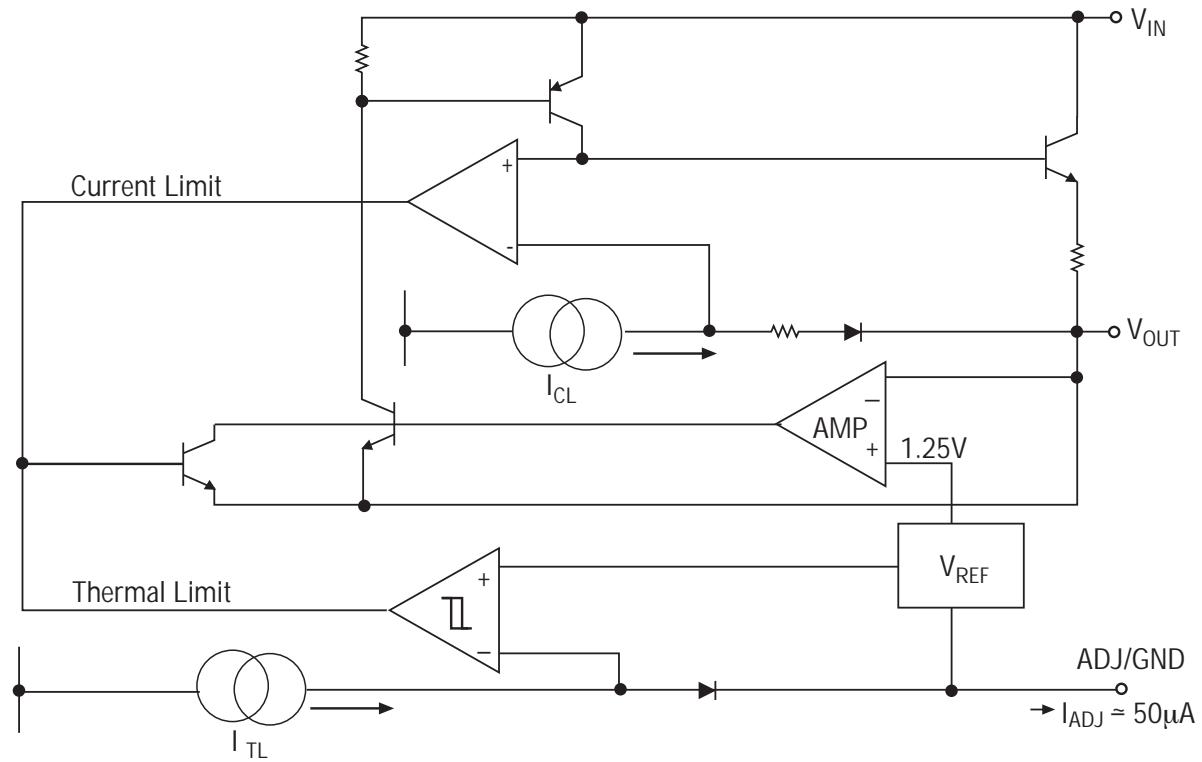


Figure 13: SPX2815 Block Diagram

Mechanical Dimensions

3-Pin TO-263

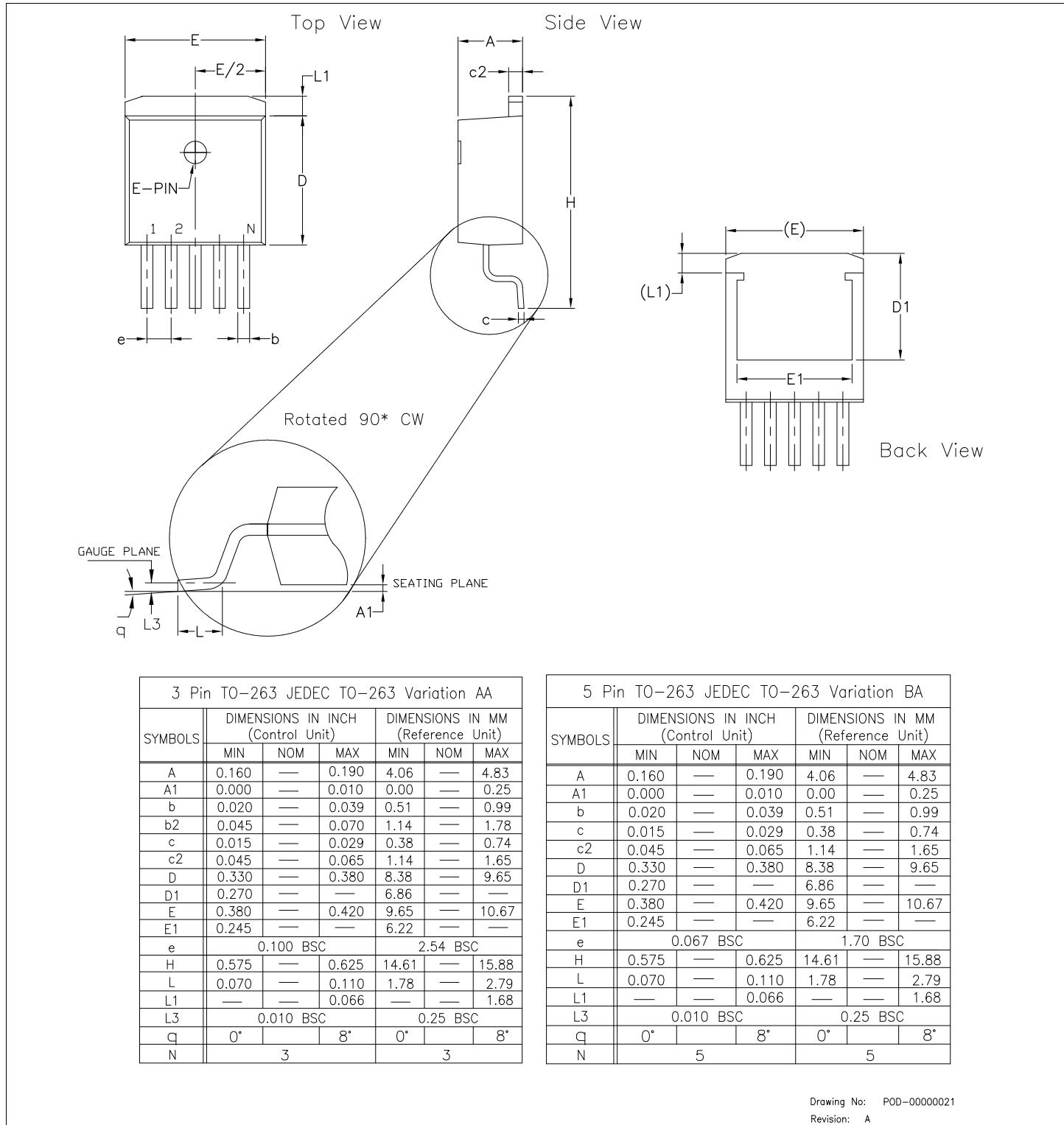
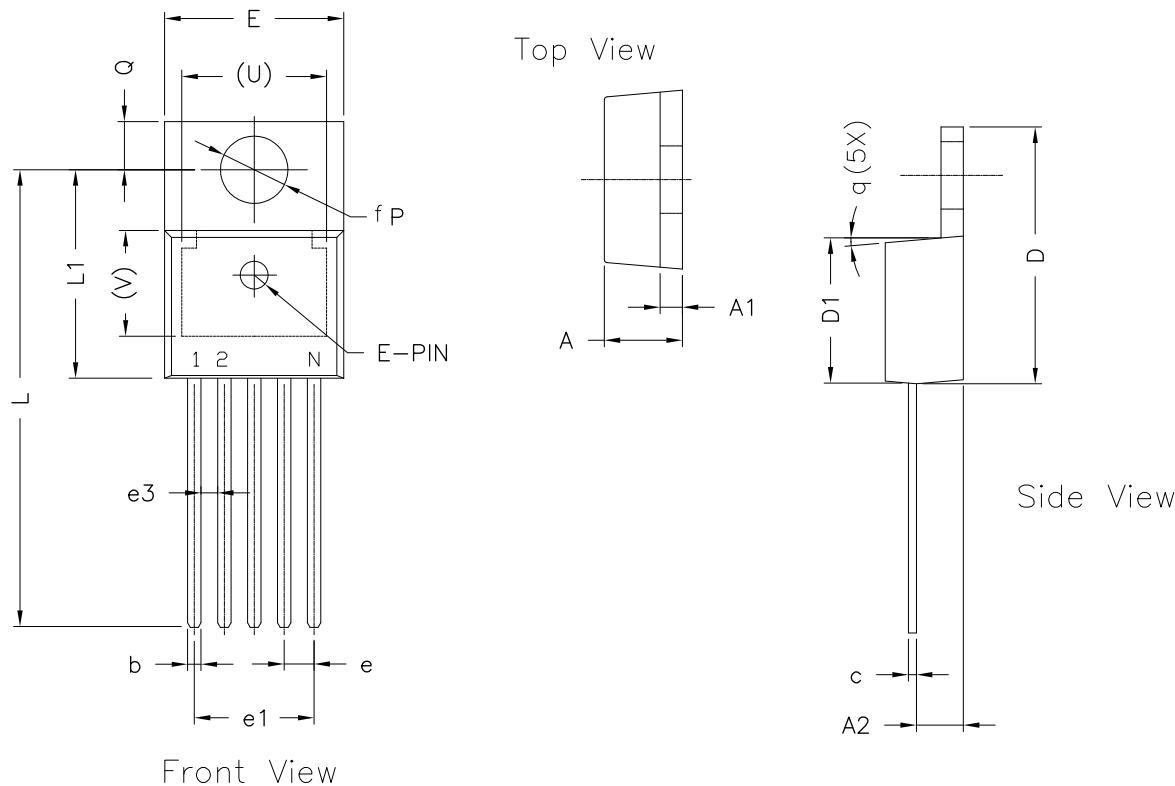


Figure 14: SPX2815 Mechanical Dimensions–3-Pin TO-263

3-Pin TO-220

TO-220 version obsolete



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

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

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

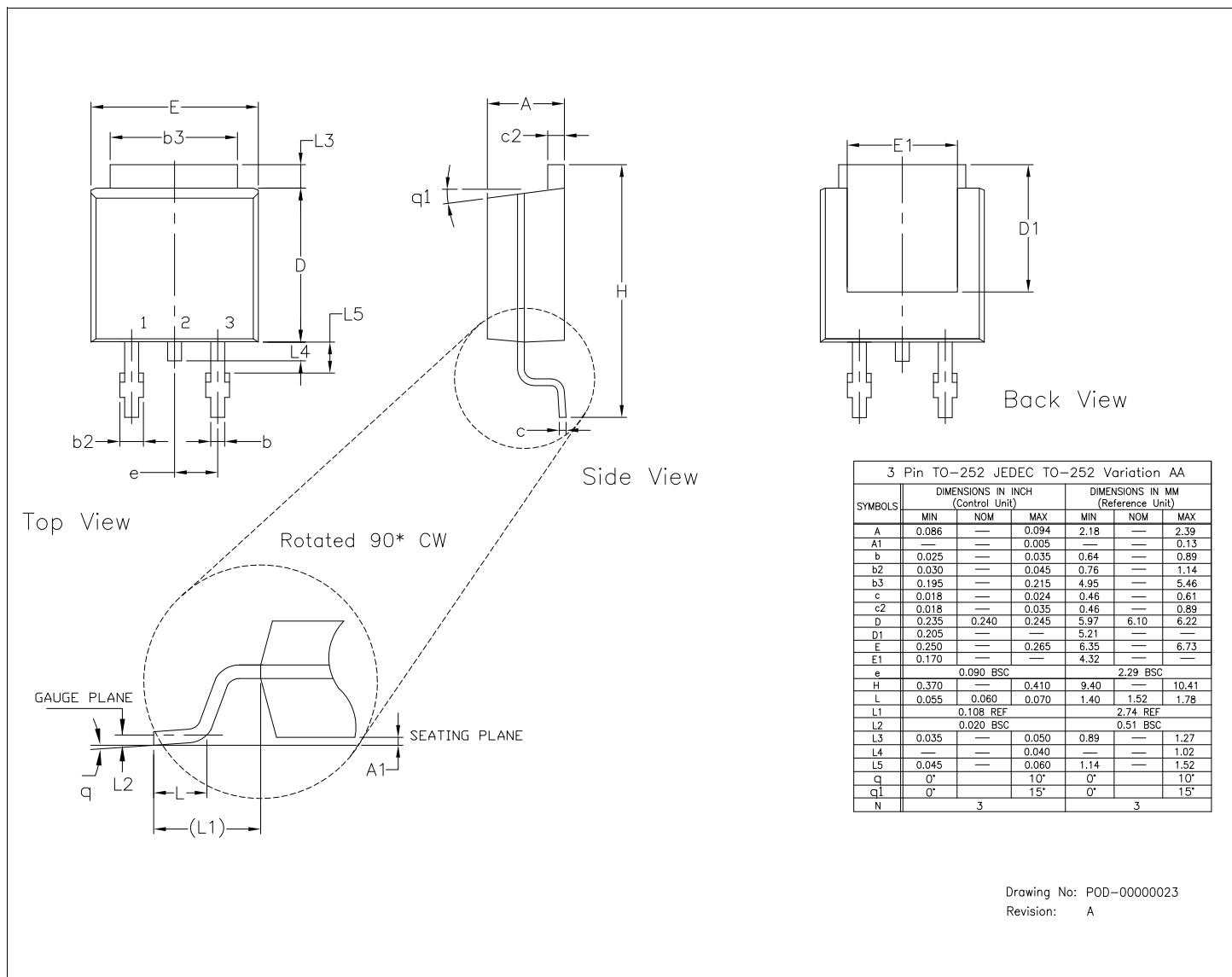


Figure 16: SPX2815 Mechanical Dimensions–3-Pin TO-220

Ordering Information

Table 5: Ordering Information

Ordering Part Number	Operating Temperature Range	Accuracy	Top Mark	Output Voltage	Package
SPX2815AT-L/TR	$-40^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$	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

The content of this document is furnished for informational use only, is subject to change without notice, and should not be construed as a commitment by MaxLinear, Inc. MaxLinear, Inc. assumes no responsibility or liability for any errors or inaccuracies that may appear in the informational content contained in this document. Complying with all applicable copyright laws is the responsibility of the user. Without limiting the rights under copyright, no part of this document may be reproduced into, stored in, or introduced into a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise), or for any purpose, without the express written permission of MaxLinear, Inc.

EXCEPT AS OTHERWISE PROVIDED EXPRESSLY IN WRITING BY MAXLINEAR, AND TO THE MAXIMUM EXTENT PERMITTED BY LAW: (A) THE MAXLINEAR PRODUCTS ARE PROVIDED ON AN "AS IS" BASIS WITHOUT REPRESENTATIONS OR WARRANTIES OF ANY KIND, INCLUDING WITHOUT LIMITATION ANY IMPLIED OR STATUTORY WARRANTIES AND ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NON-INFRINGEMENT, OR TITLE; AND (B) MAXLINEAR DOES NOT GUARANTEE THAT THE PRODUCTS WILL BE FREE OF ERRORS OR DEFECTS. MAXLINEAR PRODUCTS SHOULD NOT BE USED IN ANY EMERGENCY, SECURITY, MILITARY, LIFE-SAVING, OR OTHER CRITICAL USE CASE WHERE A FAILURE OR MALFUNCTION COULD CAUSE PERSONAL INJURY OR DEATH, OR DAMAGE TO OR LOSS OF PROPERTY. USERS ASSUME ALL RISK FOR USING THE MAXLINEAR PRODUCTS IN SUCH USE CASE. CUSTOMERS AND USERS ARE SOLELY RESPONSIBLE FOR USING THEIR OWN SKILL AND JUDGMENT TO DETERMINE WHETHER MAXLINEAR PRODUCTS ARE SUITABLE FOR THE INTENDED USE CASE.

MaxLinear, Inc. may have patents, patent applications, trademarks, copyrights, or other intellectual property rights covering subject matter in this document. Except as expressly provided in any written license agreement from MaxLinear, Inc., the furnishing of this document does not give you any license to these patents, trademarks, copyrights, or other intellectual property.

MaxLinear, the MaxLinear logo, any other MaxLinear trademarks (including but not limited to MxL, Full-Spectrum Capture, FSC, AirPHY, Puma, AnyWAN, VectorBoost, MXL WARE, and Panther), and the MaxLinear logo on the products sold are all property of MaxLinear, Inc. or one of MaxLinear's subsidiaries in the U.S.A. and other countries. All rights reserved.

All third-party products, company names and logos are trademarks™ or registered® trademarks and remain the property of their respective holders/owners. Use of such marks does not imply any affiliation with, sponsorship or endorsement by the owners/holders of such trademarks. All references by MaxLinear to third party trademarks are intended to constitute nominative fair use under applicable trademark laws.

The URLs provided are for informational purposes only; they do not constitute an endorsement or an approval by MaxLinear of any of the products or services of the corporation or organization or individual. MaxLinear bears no responsibility for the accuracy, legality or content of the external site or for that of subsequent links. Contact the external site for answers to questions regarding its content.