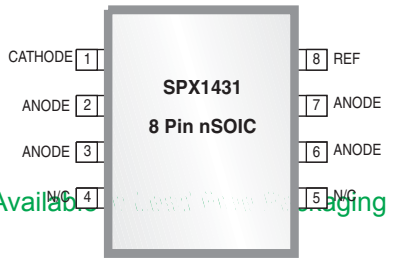
SPX1431

Precision Adjustable Shunt Regulator

FEATURES

- Trimmed Bandgap Reference to 0.4%
- Wide Operating Current 1mA to 150mA
- Extended Temperature Range: -55°C to 125°C
- Low Temperature Coefficient 30 ppm/°C
- Offered in TO-92, SOIC, SOT-89, SOT-23-5
- Improved Replacement in Performance for LT1431
- Low Cost Solution



Now Available in Lead Free Packaging

APPLICATIONS

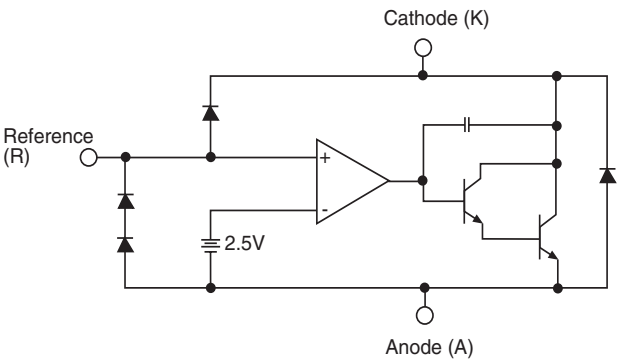
- Battery Operating Equipment
- Adjustable Supplies
- Switching Power Supplies
- Error Amplifiers
- Single Supply Amplifier
- Monitors / VCRs / TVs
- Personal Computers

DESCRIPTION

The SPX1431 is a 3-terminal adjustable shunt voltage regulator providing a highly accurate bandgap reference. The SPX1431 acts as an open-loop error amplifier with a 2.5V temperature compensation reference. The SPX1431's thermal stability, wide operating current (150mA) and temperature range (-55°C to 125°C) makes it suitable for a variety of applications that require a low cost, high performance solution. SPX1431 tolerance of 0.4% is proven to be sufficient to overcome all of the other errors in the system to virtually eliminate the need for trimming in the power supply manufacturer's assembly lines and contributes a significant cost savings.

The output voltage may be adjusted to any value between V_{REF} and 36 volts with two external resistors. The SPX1431 is available in TO-92, SOIC-8, SOT-89, and SOT-23-5 packages.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Cathode-Anode Reverse Breakdown V_{KA} 37V
Anode-Cathode Forward Current, (<10ms) I_{AK} 1A
Operating Cathode Current I_{KA} 150mA
Reference Input Current I_{REF} 10mA
Continuous Power Dissipation at 25°C P_D
TO-92 ..... 775mW
SOT-23 ..... 200 mW
SOIC-8 ..... 750mW
SOT-89 ..... 1000mW

Junction Temperature T_J ..... 150 °C
Storage Temperature T_{STG} ..... -65 to 150 °C

NOTE: Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

RECOMMENDED CONDITIONS

PARAMETER	SYMBOL	RATING	UNIT
Cathode Voltage	V_{KA}	V_{REF} to 36	V
Cathode Current	I_K	10	mA

TYPICAL THERMAL RESISTANCES

PACKAGE	0_{JA}	0_{JC}	TYPICAL DERATING
TO-92	160°C/W	80°C/W	6.3 mW/°C
SOT-23	575°C/W	150°C/W	1.7 mW/°C
SOIC-8	175°C/W	45°C/W	5.7 mW/°C
SOT-89	110°C/W	8°C/W	9.1mW/C°

Typical deratings of the thermal resistances are given for ambient temperature >25°C.

ELECTRICAL CHARACTERISTICS

Electrical characteristics at 25°C I_K= 10mA $V_K = V_{REF}$, unless otherwise specified.

PARAMETER	SYMBOL	FIGURE	CONDITIONS	MIN	TYP	MAX	UNITS
SPX1431							
Reference Voltage	V_{REF}	2 2	 T_J= 0 °C to 105°C	2.490 2.465	2.500	2.510 2.535	V V
ΔV_{REF} with Temp.*	TC	2			0.07	0.20	mV/ °C
Ratio of Change in V_{REF} to Cathode Voltage	$\frac{\Delta V_{REF}}{\Delta V_K}$	3	V_k= 3V to 36V	-2.0	-1.1		mV/V
Reference Input Current	I_{REF}	3			0.7	1.9	µA
I_{REF} Temp Deviation	ΔI_{REF}	3	T_J= 0 °C to 105°C		0.4	1.2	µA
Min I_K for Regulation	$I_{K(MIN)}$	2			0.4	1	mA
Off State Leakage	$I_{K(OFF)}$	4	V_{REF}= 0V, V_{KA}= 36V		0.04	250	nA
Dynamic Output Impedance	Z_{KA}	2	$f_z \leq$1kHz I_K= 1 to 150mA		0.15	0.5	Ω

Operating Range (T_J) = - 55°C to 125°C.
**** See appropiate test circuit (Figure 2)***

CALCULATING AVERAGE TEMPERATURE COEFFICIENT (TC)

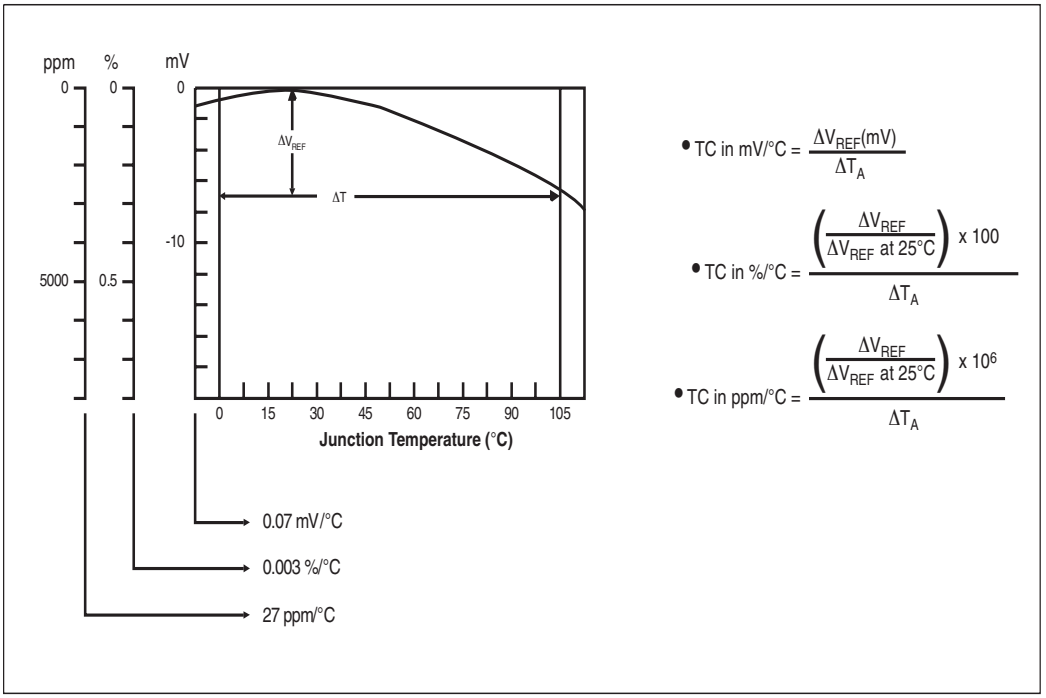


Figure 1. V_{REF} VS Temperature.

TEST CIRCUITS

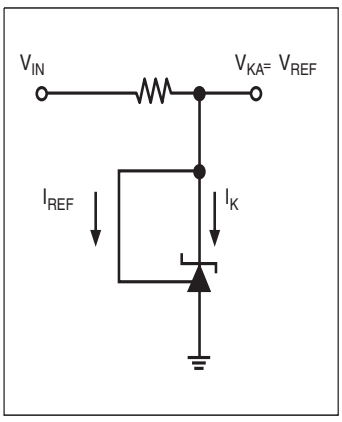


Figure 2. Test Circuit for $V_{KA} = V_{REF}$

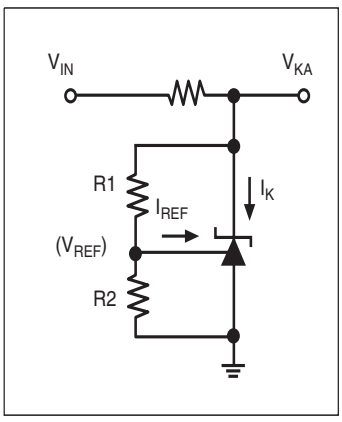


Figure 3. Test Circuit for $V_{KA} > V_{REF}$

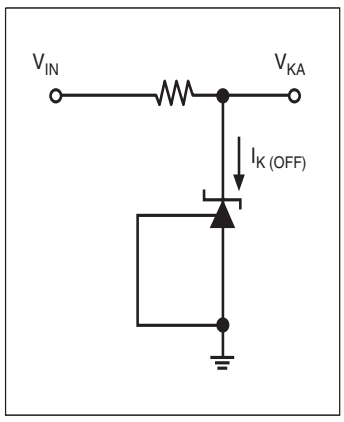


Figure 4. Test Circuit for I_{KOFF}

TYPICAL PERFORMANCE CHARACTERISTICS

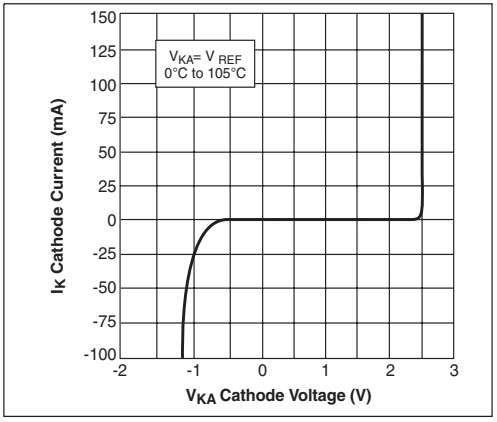


Figure 5. High Current Operating Characteristics

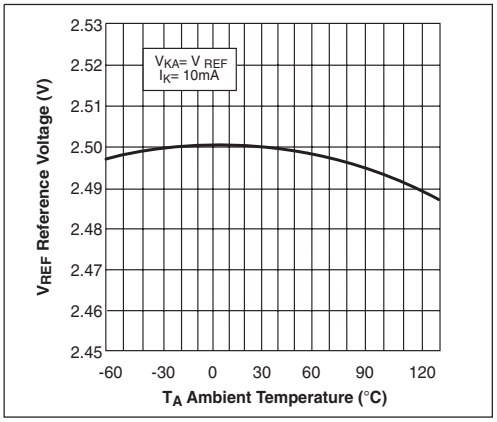


Figure 6. Reference Voltage VS Ambient Tempetature

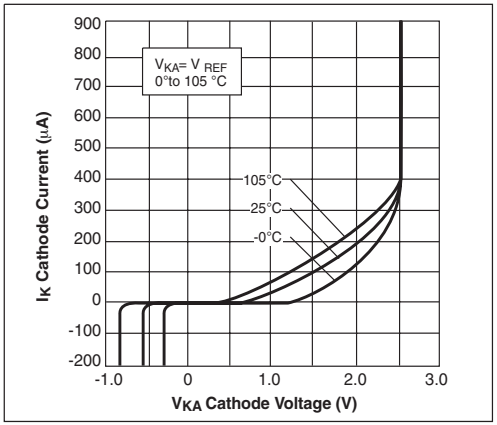


Figure 7. Low Current Operating Characteristics

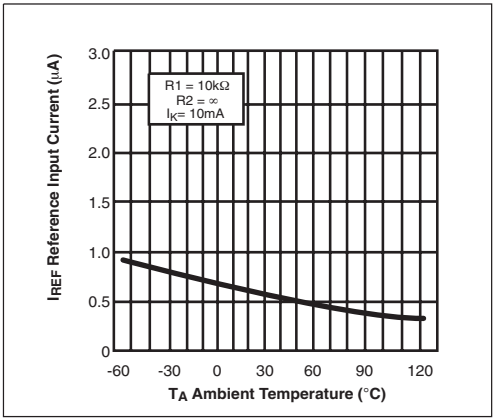


Figure 8. Reference Input Current VS Ambient Temperature

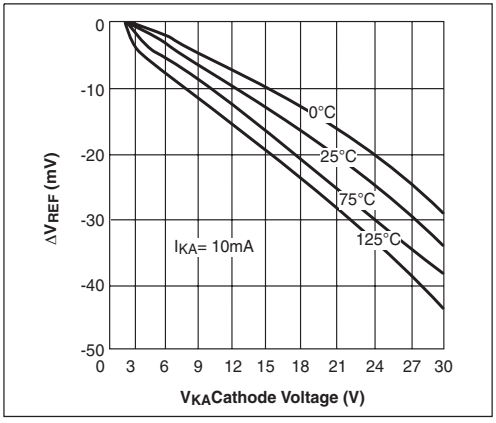


Figure 9. Reference Voltage Line Regulation VS Cathode Voltage and $T_{AMBIENT}$

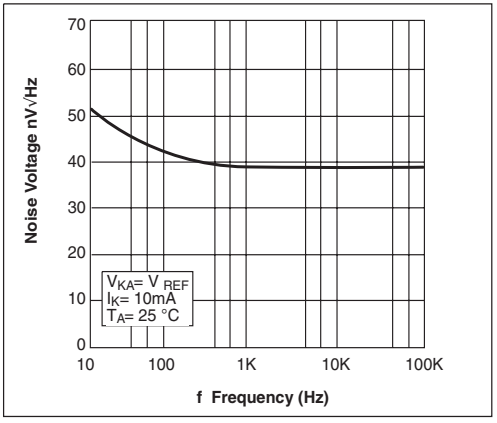


Figure 10. Noise Voltage VS Frequency

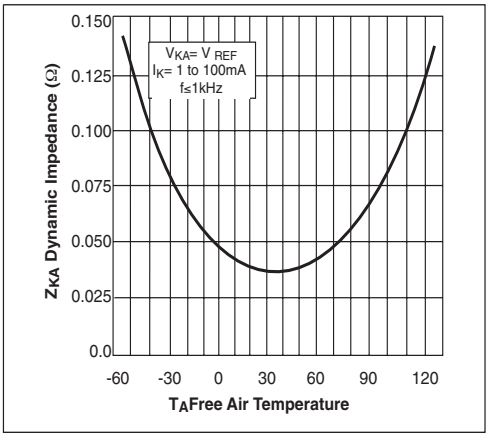


Figure 11. Low Frequency Dynamic Output Impedance VS $T_{AMBIENT}$

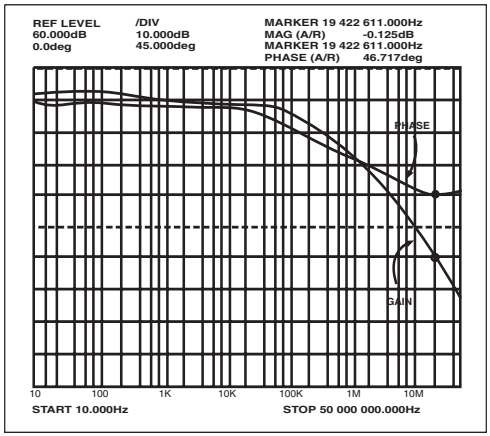


Figure 12. Small Signal Gain and Phase VS Frequency; I_K= 10mA, T_A= 25 °C

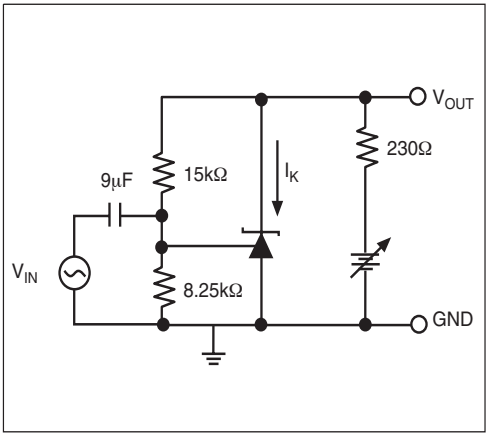


Figure 13. Test Circuit for Gain and Phase Frequency Response

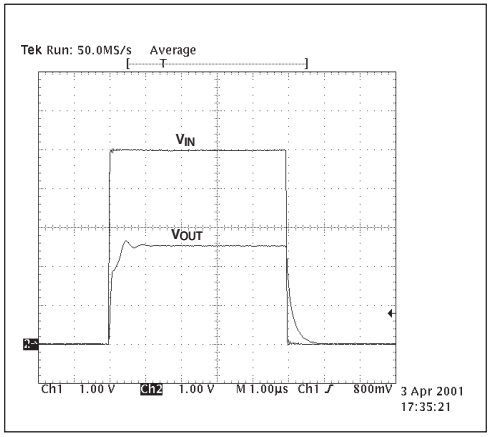


Figure 14. Frequency = 100kHz, I_K= 10mA, T_A= 25 °C

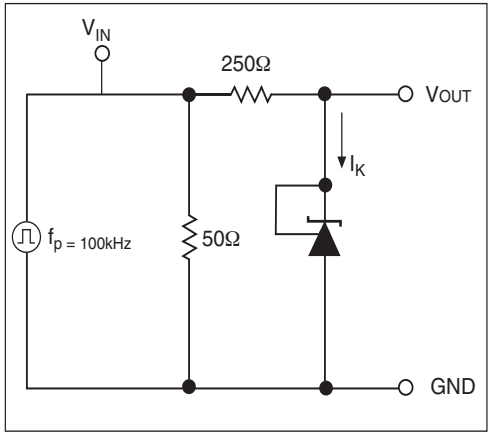


Figure 15. Test Circuit for Pulse Response

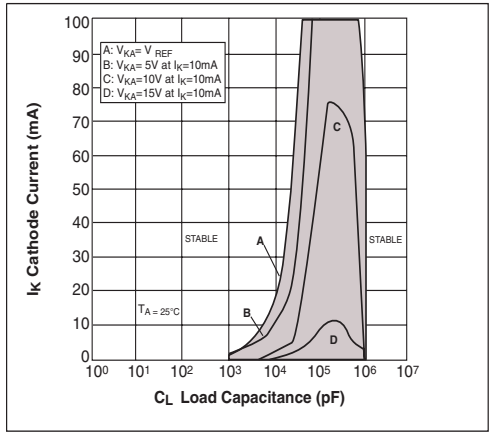


Figure 16. Stability Boundary Conditions

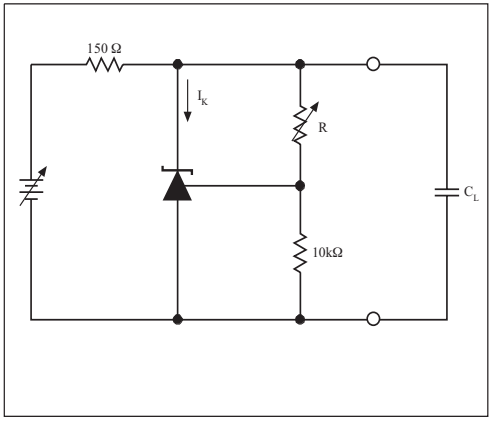


Figure 17. Test Circuit for Stability

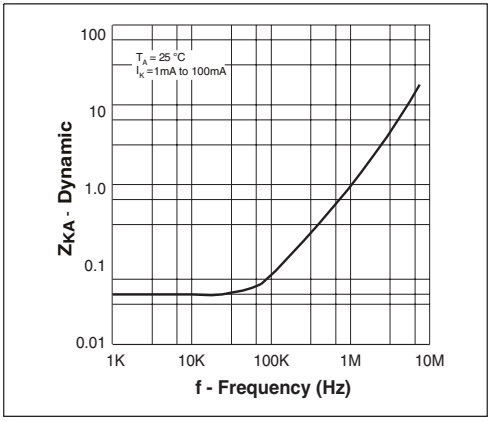


Figure 18. Dynamic Output Impedance T_A = 25 °C, I_K = 1 to 100mA

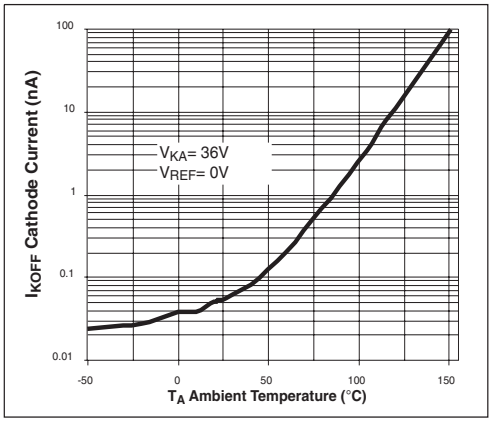


Figure 19. Off State Leakage

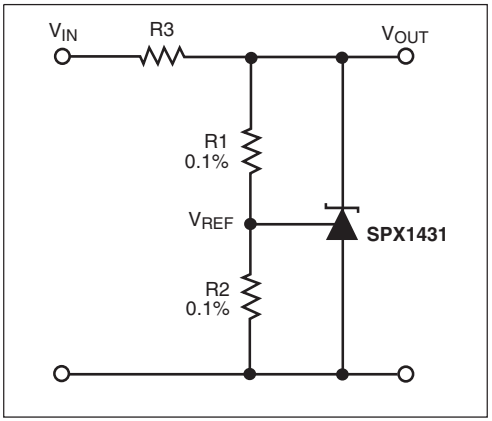


Figure 20. Shunt Regulator V_{OUT} = (1+R1/R2)V_{REF}

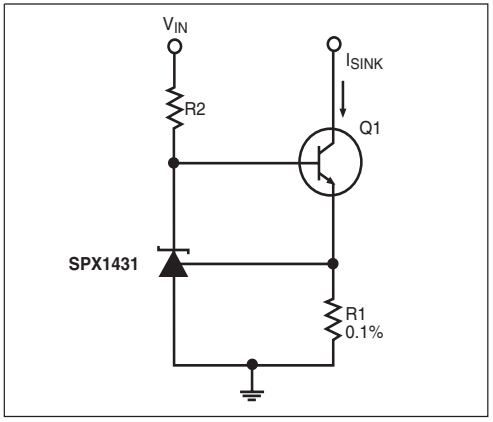


Figure 21. Constant Current, Sink, I_{SINK}= V_{REF}/R1

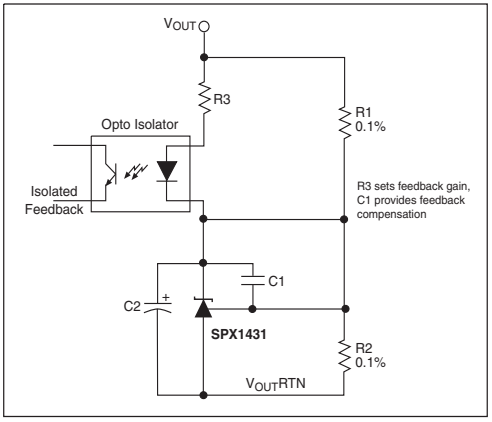


Figure 22. Reference Amplifier for Isolated Feedback in Off-Line DC-DC Converters

TYPICAL PERFORMANCE CHARACTERISTICS

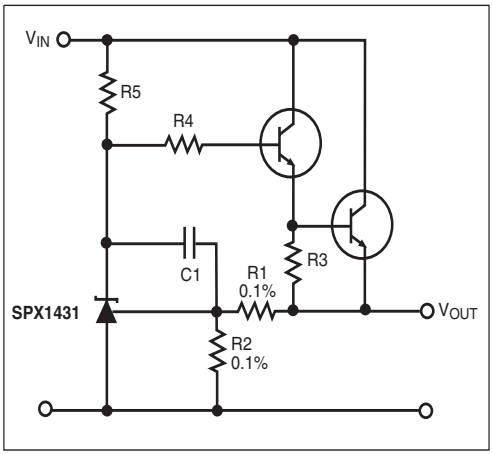


Figure 23. Precision High Current Series Regulator
V_{OUT}= (1+R1/R2)V_{REF}

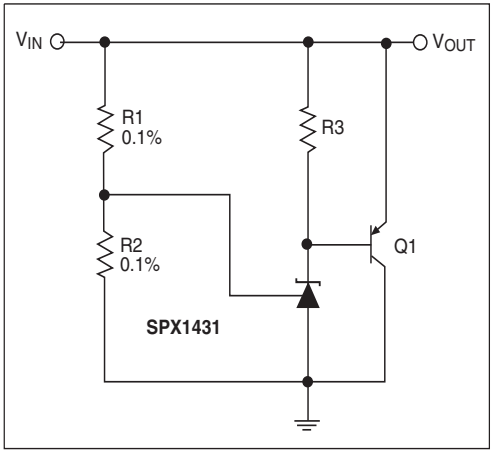


Figure 24. High Current Shunt Regulator
V_{OUT}= (1+R1/R2)V_{REF}

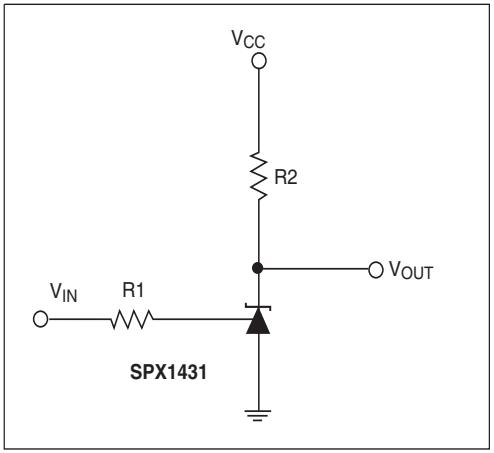
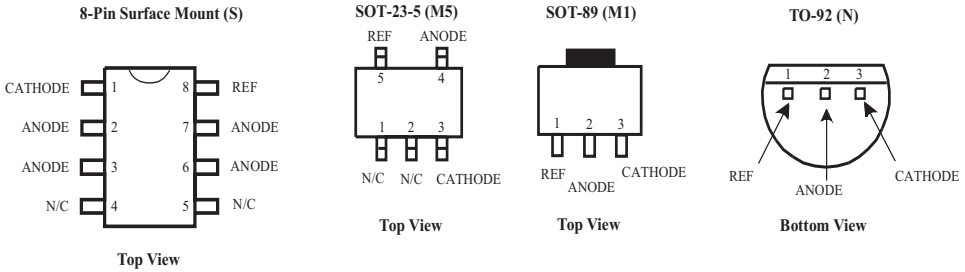


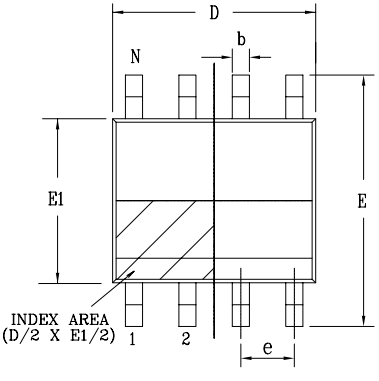
Figure 25. Single Supply Comparator with Temperature Compensated Threshold. V_{IN}threshold = 2.5V

**** Resistor values are chosen such that the effect to $I_{REF}$is negligible .***

PACKAGE PINOUTS

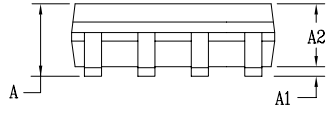


REVISION HISTORY			
REV.	DISCRIPTION	DATE	APP'D
A	DRAWING ORIGINATION	08/16/05	JL
B	DRAWING FORMAT MODIFICATION	07/19/06	JL

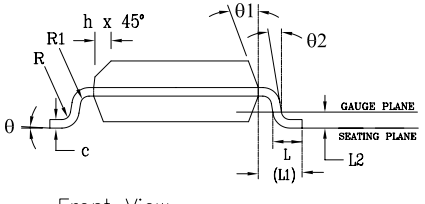


Top View

8 Pin SOICN JEDEC MS-012 Variation AA						
SYMBOLS	DIMENSIONS IN MM (Control Unit)			DIMENSIONS IN INCH (Reference Unit)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.35	—	1.75	0.053	—	0.069
A1	0.10	—	0.25	0.004	—	0.010
A2	1.25	—	1.65	0.049	—	0.065
b	0.31	—	0.51	0.012	—	0.020
c	0.17	—	0.25	0.007	—	0.010
E	6.00 BSC			0.236 BSC		
E1	3.90 BSC			0.154 BSC		
e	1.27 BSC			0.050 BSC		
h	0.25	—	0.50	0.010	—	0.020
L	0.40	—	1.27	0.016	—	0.050
L1	1.04 REF			0.041 REF		
L2	0.25 BSC			0.010 BSC		
R	0.07	—	—	0.003	—	—
R1	0.07	—	—	0.003	—	—
θ	0°	—	8°	0°	—	8°
θ1	5°	—	15°	5°	—	15°
θ2	0°	—	—	0°	—	—
D	4.90 BSC			0.193 BSC		
N	8			8		



Side View

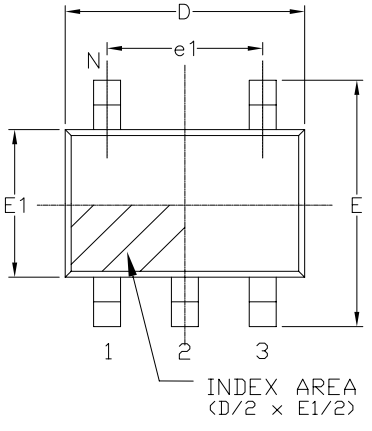


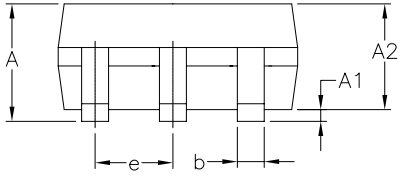
Front View

Solved by Sipex	SIPEX CORPORATION	
	8 PIN SOICN PACKAGE OUTLINE	
Packaging Approval:	Drawing No: 8-PIN SOICN	
By: JL Date: 07/19/06	Revision: B	Sheet: 1 OF 1

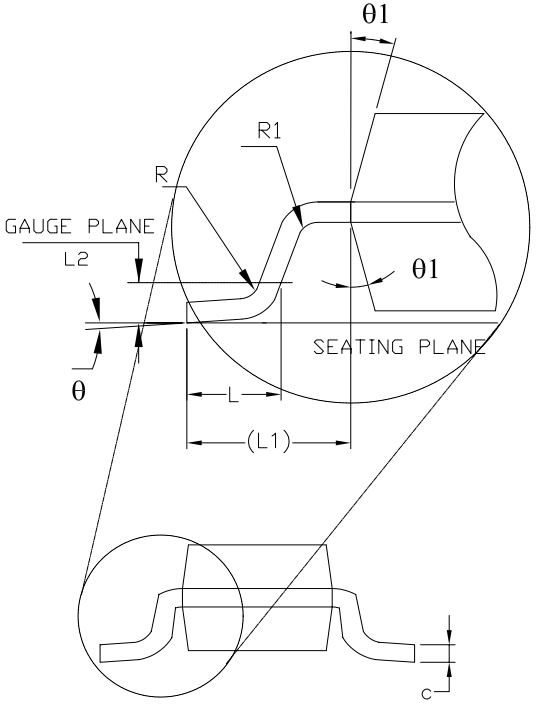
REVISION HISTORY			
REV.	DISCRIPTION	DATE	APP'D
A	DRAWING ORIGINATION	10/3/05	JL
B	DRAWING FORMAT MODIFICATION	07/25/06	JL

Top View





Side View



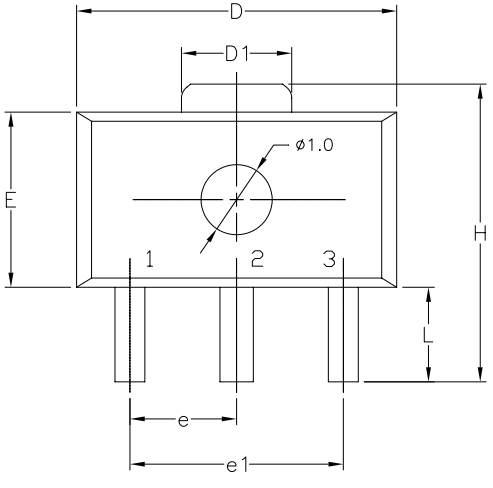
Front View

5 Pin SOT-23 JEDEC MO-178 Variation AA						
SYMBOLS	DIMENSIONS IN MM (Control Unit)			DIMENSIONS IN INCH (Reference Unit)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	—	—	1.45	—	—	0.057
A1	0.00	—	0.15	0.000	—	0.006
A2	0.90	1.15	1.30	0.036	0.045	0.051
b	0.30	—	0.50	0.012	—	0.020
c	0.08	—	0.22	0.003	—	0.009
D	2.90 BSC			0.115 BSC		
E	2.80 BSC			0.111 BSC		
E1	1.60 BSC			0.063 BSC		
e	0.95 BSC			0.038 BSC		
e1	1.90 BSC			0.075 BSC		
L	0.30	0.45	0.60	0.012	0.018	0.024
L1	0.60 REF			0.024 REF		
L2	0.25 BSC			0.010 BSC		
R	0.10	—	—	0.004	—	—
R1	0.10	—	0.25	0.004	—	0.010
θ	0°	4°	8°	0°	4°	8°
θ1	5°	10°	15°	5°	10°	15°
N	5			5		

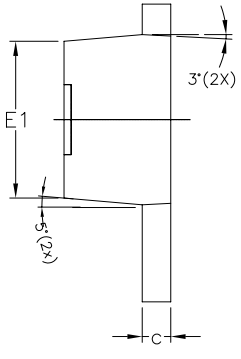
Solved by Sipex		SIPEX CORPORATION	
		5 PIN SOT-23 PACKAGE OUTLINE	
Packaging Approval:		Drawing No:	5-PIN SOT-23
By: JL	Date: 07/25/06	Revision: B	Sheet: 1 OF 1

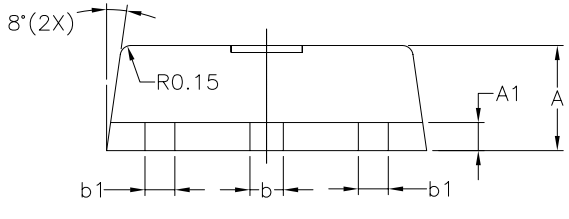
REVISION HISTORY			
REV.	DISCRIPTION	DATE	APP'D
A	DRAWING ORIGINATION	02/02/06	JL
B	DRAWING FORMAT MODIFICATION	09/11/06	JL

Top View



Front View



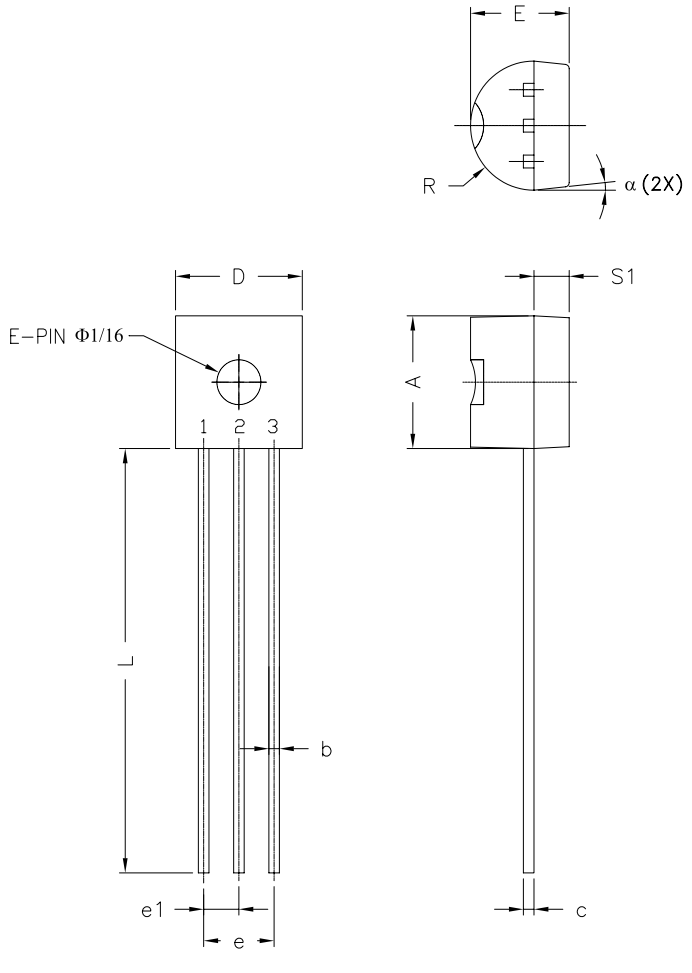


Side View

3 Pin SOT-89 JEDEC TO-243 Variation AA						
SYMBOLS	DIMENSIONS IN MM (Control Unit)			DIMENSIONS IN INCH (Reference Unit)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.40	1.50	1.60	0.055	0.059	0.063
A1	0.30	0.40	0.50	0.011	0.015	0.019
b	0.44	0.47	0.56	0.017	0.018	0.022
b1	0.36	0.42	0.48	0.014	0.016	0.019
c	0.35	0.40	0.44	0.014	0.015	0.017
D	4.40	4.50	4.60	0.173	0.177	0.181
D1	1.62	1.60	1.83	0.064	0.062	0.072
E	2.29	2.50	2.60	0.090	0.098	0.102
E1	2.13	—	2.29	0.084	—	0.090
e	1.50 BSC			0.059 BSC		
e1	3.00 BSC			0.118 BSC		
H	3.94	—	4.25	0.155	—	0.167
L	0.89	—	1.20	0.035	—	0.047
N	3			3		

Solved by Sipex		SIPEX CORPORATION	
		3 PIN SOT-89 PACKAGE OUTLINE	
Packaging Approval:		Drawing No:	3-PIN SOT-89
By: JL	Date: 09/11/06	Revision: B	Sheet: 1 OF 1

REVISION HISTORY			
REV.	DISCRIPTION	DATE	APP'D
A	DRAWING ORIGINATION	09/23/05	JL
B	DRAWING FORMAT MODIFICATION	08/15/06	JL



3 Pin TO-92 JEDEC TO-226-AA				
SYMBOLS	DIMENSIONS IN INCH (Control Unit)		DIMENSIONS IN MM (Reference Unit)	
	MIN	MAX	MIN	MAX
A	0.170	0.210	4.32	5.33
b	0.014	0.020	0.36	0.51
c	0.016	0.022	0.41	0.55
D	0.175	0.205	4.45	5.20
E	0.125	0.165	3.18	4.19
e	0.095	0.105	2.42	2.66
e1	0.045	0.055	1.15	1.39
L	0.500	0.610	12.70	15.49
R	0.045	0.095	2.16	2.41
S1	0.045	0.060	1.14	1.52
α	4°	6°	4°	6°
N	3		3	

Solved by Sipex

SIPEX CORPORATION

3 PIN TO-92 PACKAGE OUTLINE

Packaging Approval:		Drawing No: 3-PIN TO-92	
By: JL	Date: 08/15/06	Revision: B	Sheet: 1 OF 1

Part Number	Package Code	RoHS	Status	Pack Quantity
SPX1431M1	SOT-89-3		Active	Bulk
SPX1431M1/TR	SOT-89-3		Active	2500 Tape & Reel
SPX1431M1-L	SOT-89-3	▪	Active	Bulk
SPX1431M1-L/TR	SOT-89-3	▪	Active	2500 Tape & Reel
SPX1431M5	SOT-23-5		EOL	Bulk
SPX1431M5/TR	SOT-23-5		EOL	2500 Tape & Reel
SPX1431M5-L	SOT-23-5	▪	EOL	Bulk
SPX1431M5-L/TR	SOT-23-5	▪	EOL	2500 Tape & Reel
SPX1431N	TO-92		EOL	Bulk
SPX1431N/TR	TO-92		OBS	2000 Tape & Reel
SPX1431N-L	TO-92	▪	EOL	Bulk
SPX1431N-L/TR	TO-92	▪	EOL	2000 Tape & Reel
SPX1431S	NSOIC8		EOL	Bulk
SPX1431S/TR	NSOIC8		EOL	2500 Tape & Reel
SPX1431S-L	NSOIC8	▪	EOL	Bulk
SPX1431S-L/TR	NSOIC8	▪	EOL	2500 Tape & Reel

Solved by Sipex

Sipex Corporation

Headquarters and Sales Office
233 South Hillview Drive
Milpitas, CA 95035
TEL: (408) 934-7500
FAX: (408) 935-7600

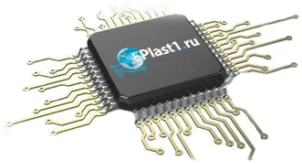
Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)
Факс: 8 (812) 320-02-42
Электронная почта: org@eplast1.ru
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.