SP433
Constant Voltage and Constant Current Controller

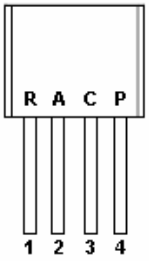
DESCRIPTION
The SP433 is high-voltage four-terminal adjustable voltage references, with over current protection feature. The SP433 is a one chip solution to a 2.5V precision voltage reference and constant current output in the application of secondary feedback control of power supply, DC/DC converter, adaptor and charger. SP433 is idea for low cost switching power supply application.

APPLICATIONS
- Battery Charger
- Battery Power Equipment
- Linear Regulators
- Switch Power Supply
- Cellular Phone
- Digital Cameras
- Computer Disk Drivers
- Instrumentation

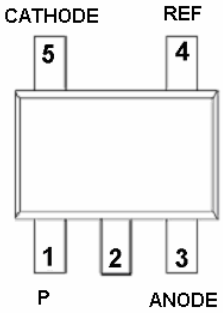
FEATURES
- Voltage Reference Accuracy of 0.5% & 1.0%
- Sink Current Capability from 1mA to 100mA
- Adjustable Output Voltage from VREF to 18V
- Low Output Noise
- Typical Output Dynamic Impedance Less Than 200mΩ
- Available in SOT-23-5L and TO-94 package
- Over Current Protection

PIN CONFIGURATION

TO-94

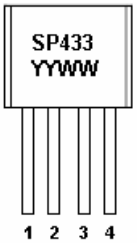


SOT-23-5L



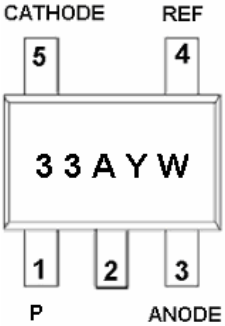
PART MARKING

TO-94



Y : Year Code
W: Weak Code

SOT-23-5L



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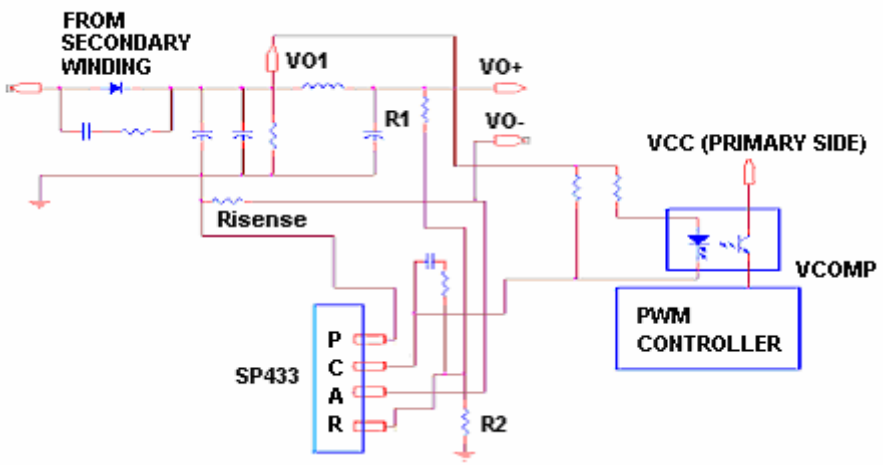
TYPICAL APPLCATION CIRCUIT



PIN DESCRIPTION (TO-94)

Pin	Symbol	Description
1	R	REF
2	A	ANODE
3	C	CATHODE
4	P	CURRENT ENABLE

PIN DESCRIPTION (SOT-23-5L)

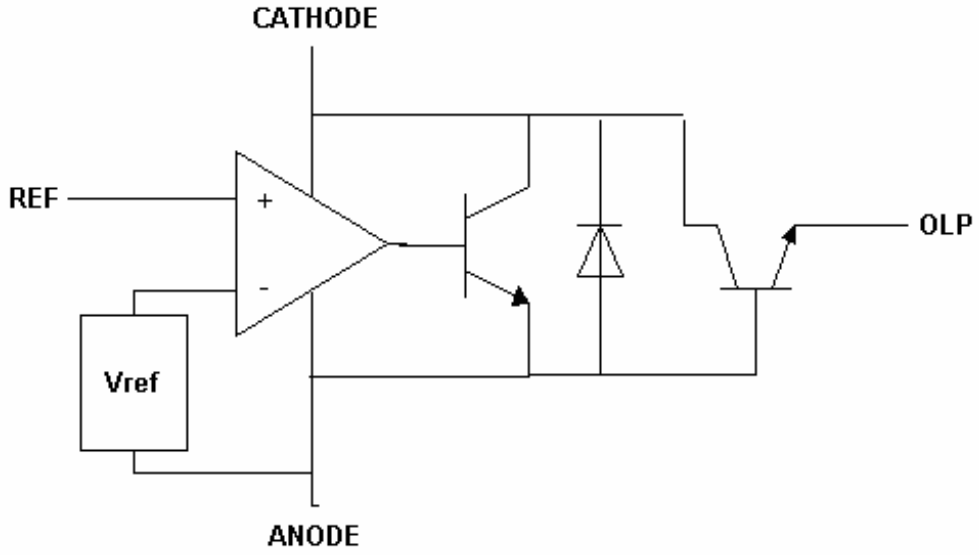
Pin	Symbol	Description
1	P	CURRENT ENABLE
2	NC	NC
3	ANODE	ANODE
4	REF	REF
5	CATHODE	CATHODE

ORDERING INFORMATION

Part Number	Voltage Tolerance	Package	Part Marking
SP433AS25RGB	0.5%	SOT-23-5L	33AYW
SP433BS25RGB	1.0%	SOT-23-5L	33BYW
SP433AT94AGB	0.5%	TO-94	SP433
SP433BT94AGB	1.0%	TO-94	SP433

※ Week Code : A ~ Z (1 ~ 26) ; a ~ z (27 ~ 52)
※ SP433AS25RGB : Tape Reel ; Pb – Free ; Halogen -Free
※ SP433BS25RGB : Tape Reel ; Pb – Free ; Halogen -Free
※ SP433AT94AGB : Tape Ammo ; Pb-Free ; Halogen -Free
※ SP433BT94AGB : Tape Ammo ; Pb-Free ; Halogen -Free

BLOCK DIAGRAM



ABSOULTE MAXIMUM RATINGS

(T_A=25℃ Unless otherwise specified)

Parameter	Symbol	Value	Unit
Cathode Voltage	V_Z	18	V
Continuous Cathode Current Range	I_Z	150	mA
Reference Current Range	I_{REF}	10	mA
Operating Junction Temperature Range	T_J	-40 ~ +150	℃
Storage Temperature Range	T_{STG}	-65 ~ +150	℃
Lead Temperature Range (Soldering 10Sec)	T_{SOL}	260	℃
Thermal Resistance	Θ_{JA}	140	℃/W

The IC has a protection circuit against static electricity. Do not apply high static electricity or high voltage that exceeds the performance of the protection circuit to the IC.

ELECTRICAL CHARACTERISTICS

(T_A=25℃ , Unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Reference Input Voltage (I_K=10mA,V_Z=V_{REF})	V_{REF}	SP433A SP433B	2.487 2.475	2.5 2.5	2.513 2.525	V
V_{REF} Temp Deviation	V_{DEV}	T_A=-40℃~+80℃ V_Z=V_{REF} I_Z=10mA		10	25	mV
Ratio Of Change In REF To Change In Cathode Voltage	△V_{REF}/ △V_Z	I_Z=10mA, △V_Z = 18V~V_{REF}		-1.4	-2.7	mV/V
Reference Input Current	I_{REF}	I_Z=10mA R1=10KΩ R2=∞			1	uA
IREF Temp Deviation	$I_{REF(DEV)}$	T_A=-40℃~+80℃ R1=10KΩ , R2=∞ I_Z=10mA			2.5	uA
Off-State Cathode Current	$I_{Z(OFF)}$	V_{REF}=0V , V_Z=18V			0.1	uA
Dynamic Output Impedance	R_Z	f<1kHz , V_Z=V_{REF} I_Z=1mA~100mA		1.0	1.5	Ω
Minimum Operating Current	$I_{Z(MIN)}$	V_Z=V_{REF}			1.0	mA
Current Amplification	Iamp	V_C=1V, I_A=50uA	10			mA
Saturation Voltage	Vsat	Ic=150mA, I_A=10mA			0.8	V
Maximum Protection Current	I_P				100	mA

APPLICATION NOTE

In the above application, SP433 is used to provide an accurate control of voltage and current. The voltage loop is controlled through an internal error amplifier, the resistor bridge R_1, R_2 and the photo-coupler. The relation between V_{out}, R_1, R_2 and V_{ref} is shown in:

$$V_{out} = V_{ref} \times (1+R_1/R_2)$$

The current loop is controlled through an internal transistor, the sense resistor and the photo-coupler. The control equation is:

$$R_{isense} \quad X \quad I_{-limit} = 0.7V \text{ (typical)}$$

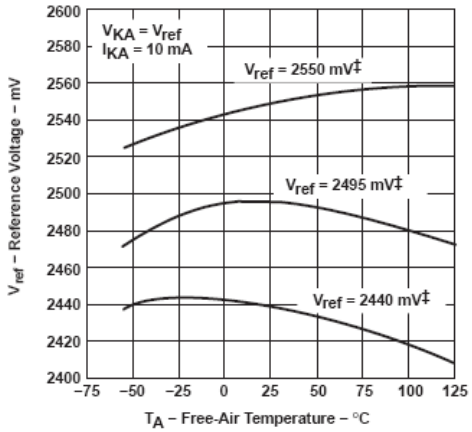
Where I_{-limit} is the desired current limit. The selection of R_{isense} should consider the power loss through R_{isense}. It is calculated as:

$$P_{-limit} = 0.7 \quad X \quad I_{-limit}$$

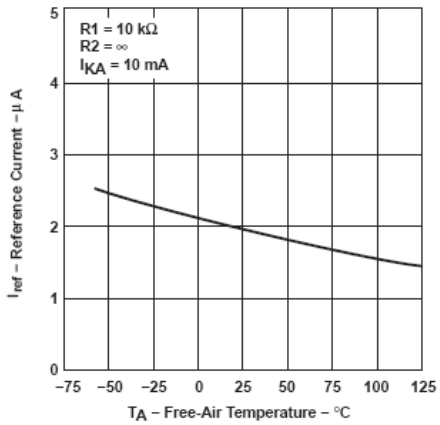
Whether AC input is at High Line or Low Line, SP433 can provide the same current protection. It has the fuse function at the output.

PERFORMANCE CHARACTERISTICS

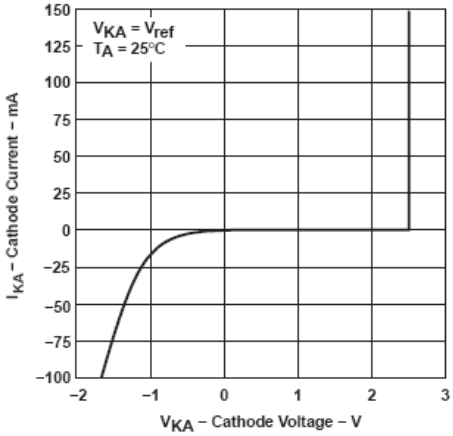
REFERENCE VOLTAGE
vs
FREE-AIR TEMPERATURE



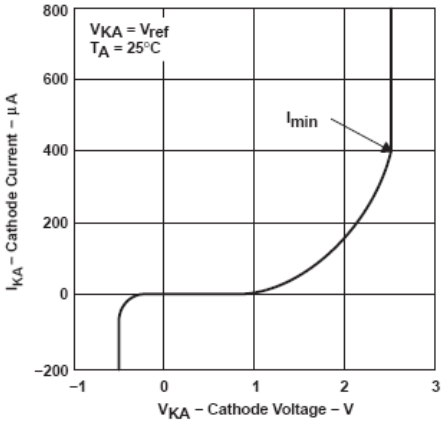
REFERENCE CURRENT
vs
FREE-AIR TEMPERATURE



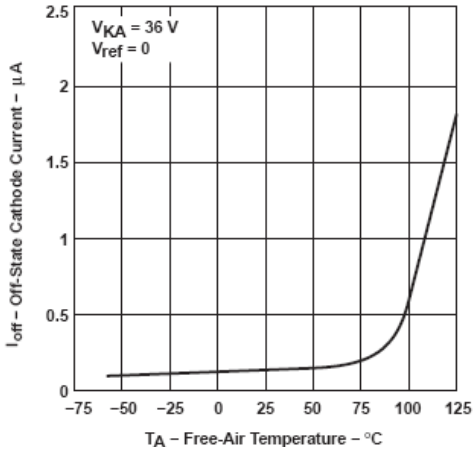
CATHODE CURRENT
vs
CATHODE VOLTAGE



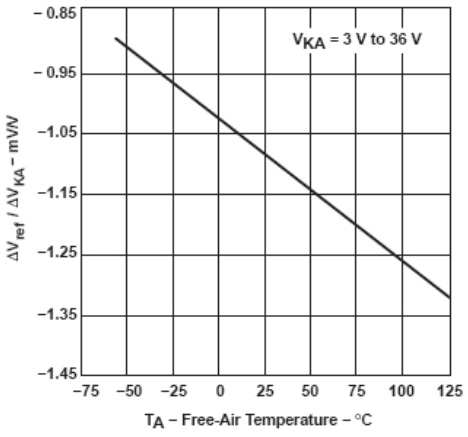
CATHODE CURRENT
vs
CATHODE VOLTAGE



OFF-STATE CATHODE CURRENT
vs
FREE-AIR TEMPERATURE

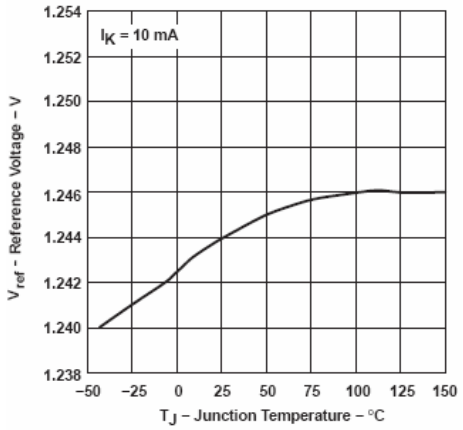


RATIO OF DELTA REFERENCE VOLTAGE TO
DELTA CATHODE VOLTAGE
vs
FREE-AIR TEMPERATURE

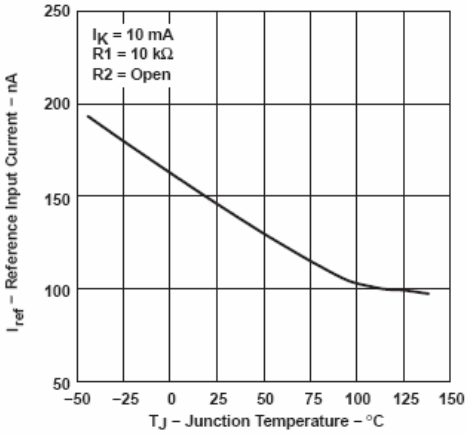


PERFORMANCE CHARACTERISTICS

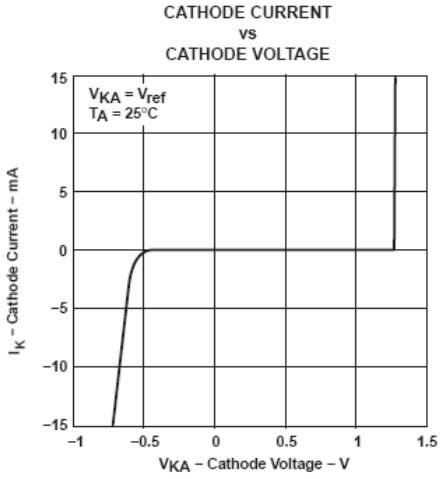
REFERENCE VOLTAGE
vs
JUNCTION TEMPERATURE



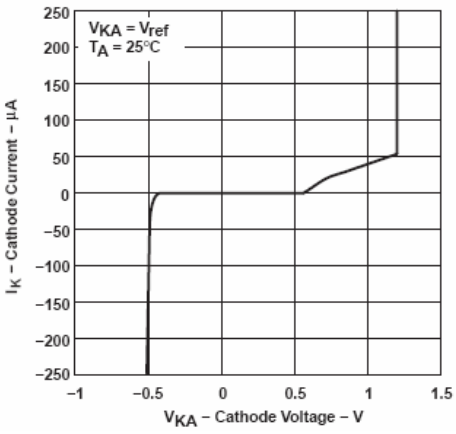
REFERENCE INPUT CURRENT
vs
JUNCTION TEMPERATURE



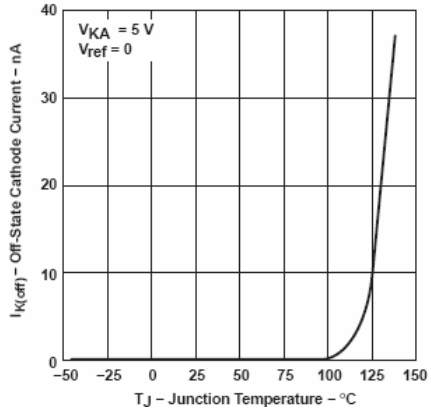
CATHODE CURRENT
vs
CATHODE VOLTAGE



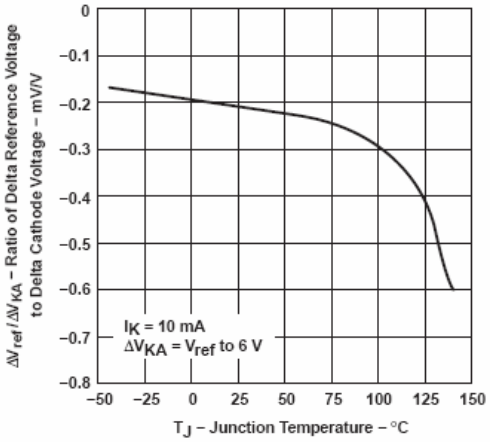
CATHODE CURRENT
vs
CATHODE VOLTAGE



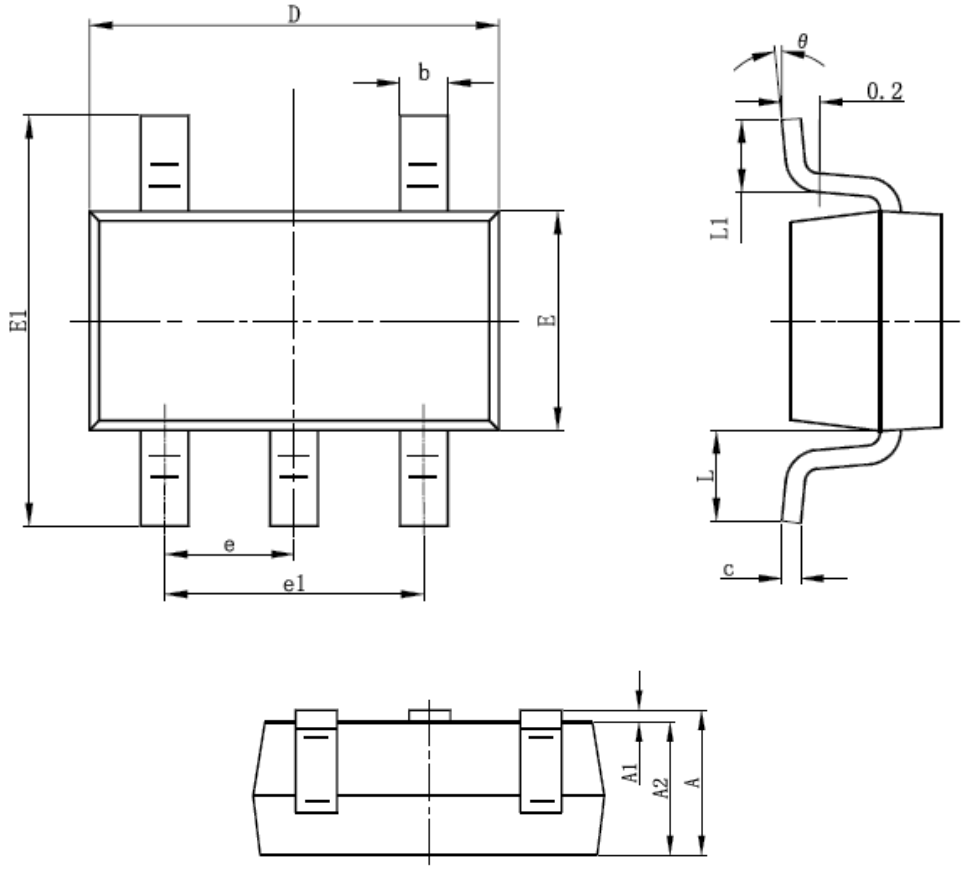
OFF-STATE CATHODE CURRENT
vs
JUNCTION TEMPERATURE



RATIO OF DELTA REFERENCE VOLTAGE
TO DELTA CATHODE VOLTAGE
vs
JUNCTION TEMPERATURE

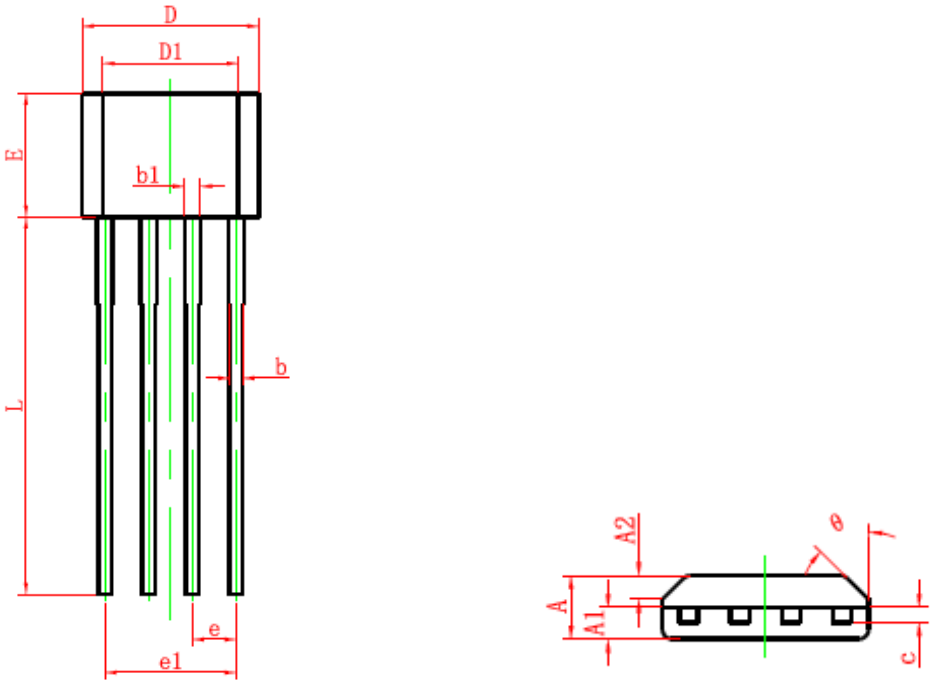


SOT-23-5L PACKAGE OUTLINE



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.400	0.012	0.016
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950TYP		0.037TYP	
e1	1.800	2.000	0.071	0.079
L	0.700REF		0.028REF	
L1	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

TO-94 PACKAGE OUTLINE



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.800	0.055	0.071
A1	0.700	0.900	0.028	0.035
A2	0.500	0.700	0.020	0.028
b	0.360	0.500	0.014	0.020
b1	0.380	0.550	0.015	0.022
c	0.360	0.510	0.014	0.020
D	4.980	5.280	0.196	0.208
D1	3.780	4.080	0.149	0.161
E	3.450	3.750	0.136	0.148
e	1.270 TYP		0.050 TYP	
e1	3.710	3.910	0.146	0.154
L	14.900	15.300	0.587	0.602
θ	45° TYP		45° TYP	

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