April 14, 1998

TEL:805-498-2111 FAX:805-498-3804 WEB:http://www.semtech.com

DESCRIPTION

The SC431L is a low voltage three terminal adjustable shunt regulator with thermal stability guaranteed over temperature. The output voltage can be adjusted to any value from 1.24V (V_{REF}) to 20V with two external resistors. The SC431L has a typical dynamic output impedance of 0.25Ω. Active output circuitry provides a very sharp turn on characteristic, making the SC431L an excellent replacement for zener diodes.

The SC431L shunt regulator is available in three voltage tolerances (0.5%, 1.0% and 2.0%) and three package options (SOT-23-3, SOT-23-5 and TO-92). The three voltage tolerances allow the designer the opportunity to select the proper cost/tolerance for their application.

FEATURES

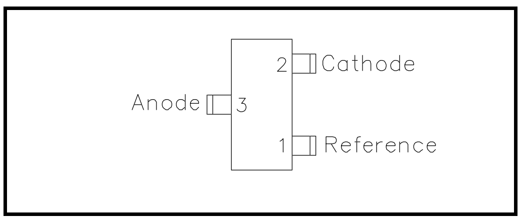
- Low voltage operation (1.24V)
- Adjustable output voltage $V_O = V_{REF}$ to 20V
- Wide operating current range 60µA to 100mA
- Low dynamic output impedance 0.25Ω typ.
- Trimmed bandgap design ± 0.5%
- Upgrade for TLV431A

APPLICATIONS

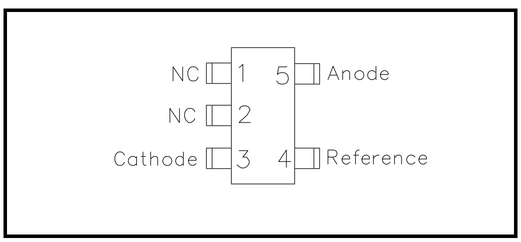
- Linear Regulators
- Adjustable Supplies
- Switching Power Supplies
- Battery Operated Computers
- Instrumentation
- Computer Disk Drives

PIN CONFIGURATIONS

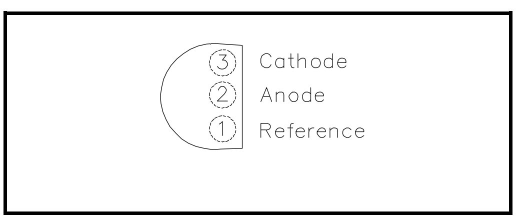
SOT-23-3 Lead (Top View)



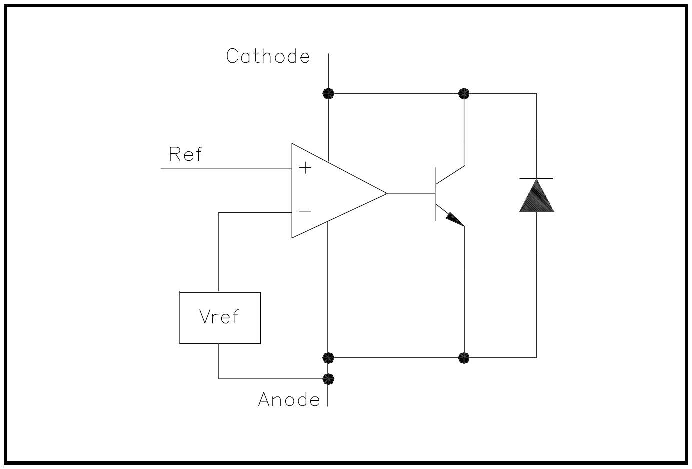
SOT-23-5 Lead (Top View)



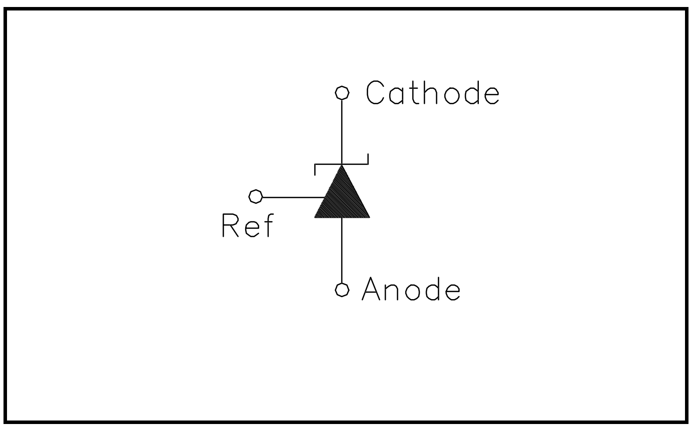
TO-92 (Top View)



BLOCK DIAGRAM



SYMBOL DIAGRAM



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April 14, 1998

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Maximum	Units
Cathode Voltage	V_Z	20	V
Continous Cathode Current	I_Z	100	mA
Reference Current	I_{REF}	3	mA
Operating Junction Temperature Range	T_J	-40 to +150	°C
Storage Temperature Range	T_{STG}	-65 to +150	°C
Thermal Resistance TO-92 SOT-23-3L, SOT-23-5L	θ_{JA}	160 410	°C/W
Power Dissipation at T_A = 25°C TO-92 SOT-23-3L, SOT-23-5L	P_D	0.78 0.30	W
Lead Temperature (Soldering) 10 seconds	T_{LEAD}	260	°C

ORDERING INFORMATION

PACKAGE	TOLERANCE			
	0.5%	**1.0%**	**2.0%**	**T/R Quantity**
SOT-23-3L(1)	SC431LCSK - .5	SC431LCSK - 1	SC431LCSK - 2	3K
SOT-23-5L(2)	SC431LC5SK - .5	SC431LC5SK - 1	SC431LC5SK - 2	3K
TO-92(1)(3)	SC431LCZ - .5	SC431LCZ - 1	SC431LCZ - 2	TR=3K, TA=2K

Notes:
(1) Add suffix 'TR' for Tape & Reel.
(2) Add suffix 'TC' for Tape & Reel.
(3) Add suffix 'TA' for Tape Ammo.

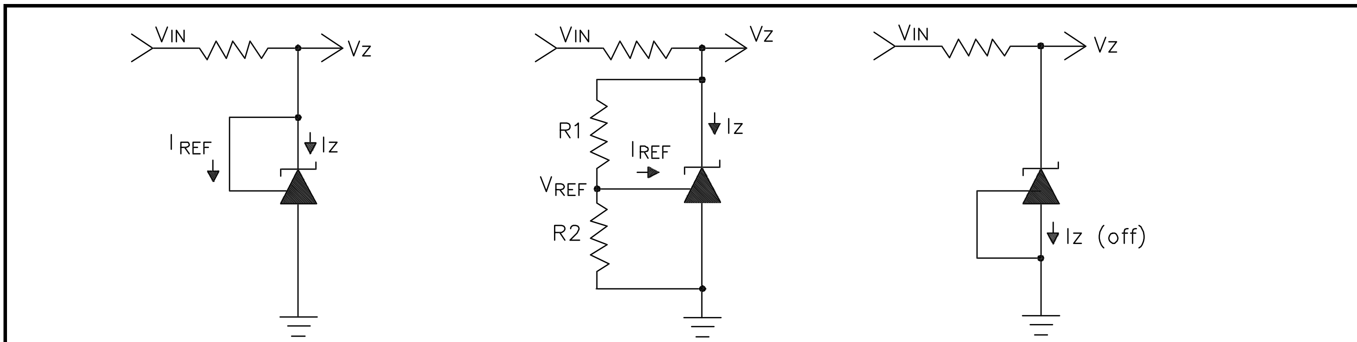
April 14, 1998

ELECTRICAL CHARACTERISTICS

Unless specified, T_A = 25°C

				SC431L 0.5%			SC431L 1%			SC431L 2%			
Parameter	**Symbol**	**Condition**		**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**UNITS**
Reference Voltage	V_{REF}	$V_Z = V_{REF}$, I_Z = 10mA	T_A = 25°C	1.234	1.240	1.246	1.228	1.240	1.252	1.215	1.240	1.265	V
		(test circuit 1)	T_A= -40 to +85°C	1.222		1.258	1.215		1.265	1.200		1.280	
V_{REF} Temp Deviation	V_{DEV}	T_A = -40 to +85°C, $V_Z = V_{REF}$ (test circuit 1) I_Z = 10mA			10	25		10	25		10	35	mV
Ratio of Change in V_{REF} to Change in Cathode Voltage	$\frac{\Delta V_{REF}}{\Delta V_Z}$	I_Z = 10mA, ΔV_Z = 16V to V_{REF} (test circuit 2)			-1.0	-2.7		-1.0	-2.7		-1.0	-2.7	mV/V
Reference Input Current	I_{REF}	R1 = 10kΩ, R2 = ∞, I_Z = 10mA (test circuit 2)			0.15	0.5		0.15	0.5		0.15	0.5	µA
I_{REF} Temp Deviation	$I_{REF(DEV)}$	T_A = -40 to +85°C R1 = 10kΩ, R2 = ∞, I_Z =10mA (test circuit 2)			0.1	0.4		0.1	0.4		0.1	0.4	µA
Off State Cathode Current	$I_{Z\ (off)}$	V_{REF} = 0V	V_Z = 6V		0.04	0.1		0.04	0.1		0.04	0.1	µA
		(test circuit 3)	V_Z = 16V		0.04	0.5		0.04	0.5		0.04	0.5	
Dynamic Output Impedance	r_Z	f < 1kHz, $V_Z = V_{REF}$, I_Z = 100uA to 100mA (test circuit 1)			0.25	0.4		0.25	0.4		0.25	0.4	Ω
Minimum Operating Current	$I_{Z\ (min)}$	$V_Z = V_{REF}$ (test circuit 1)			60	80		60	80		60	80	µA

TEST CIRCUITS



Test Circuit 1: $V_Z = V_{REF}$

Test Circuit 2: $V_Z > V_{REF}$

Test Circuit 3: Off State Current

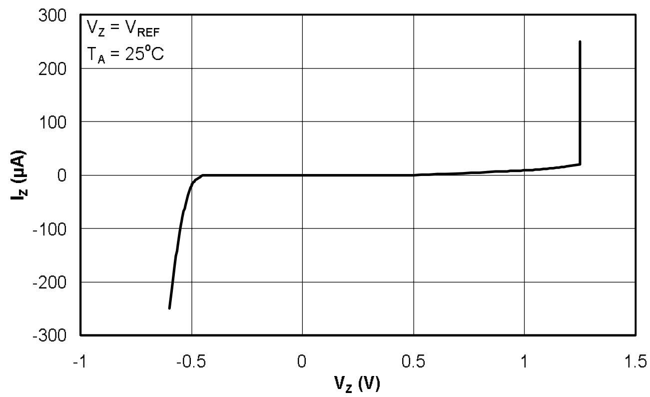
RECOMMENDED OPERATING CONDITIONS

	Min	Max	Symbol
Cathode Voltage, V_Z	V_{REF}	16	V
Cathode Current, I_Z	80µA	100	mA

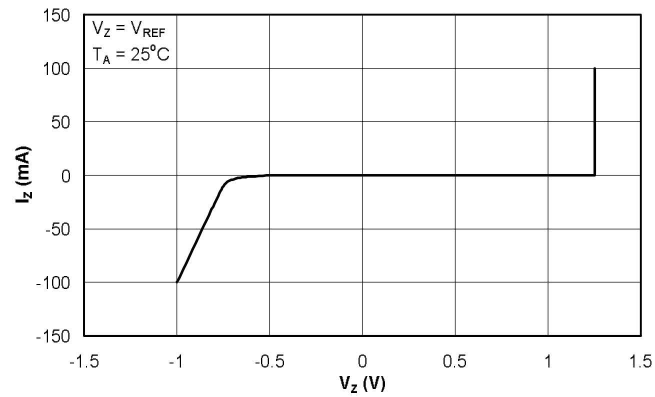
April 14, 1998

CHARACTERISTIC CURVES

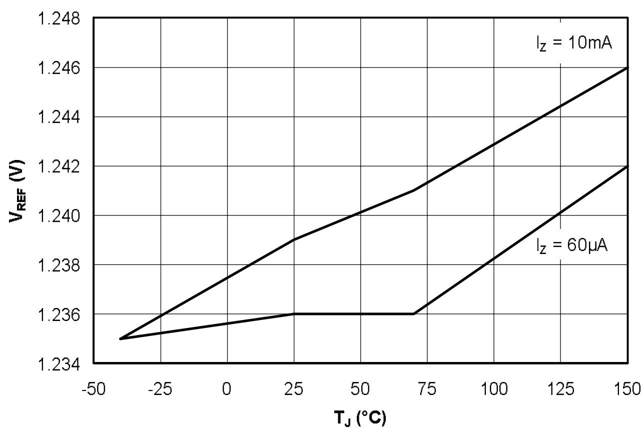
Cathode Current vs. Cathode Voltage



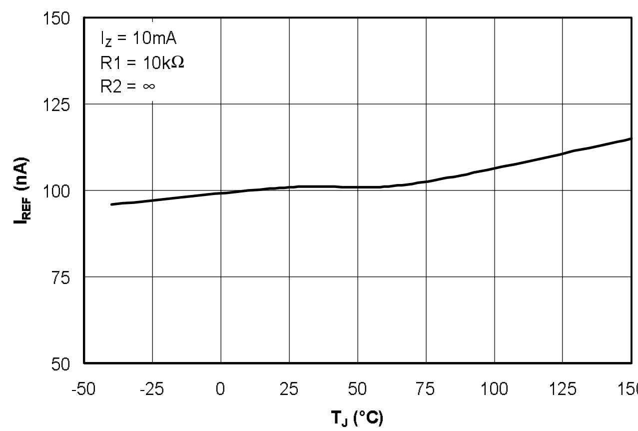
Cathode Current vs. Cathode Voltage



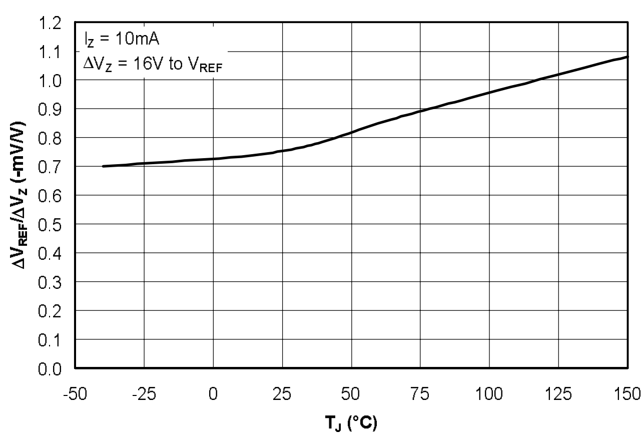
Reference Voltage vs. Junction Temperature



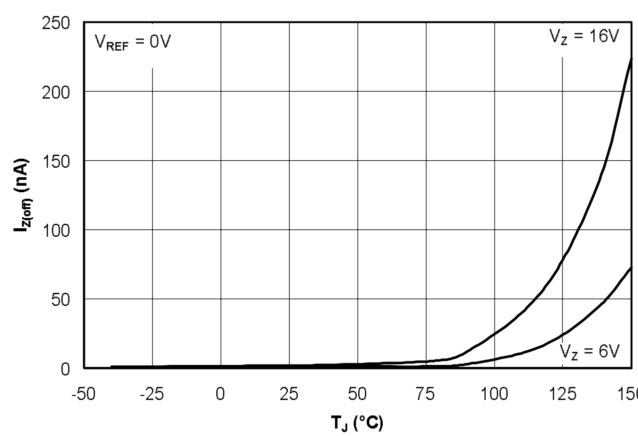
Reference Input Current vs. Junction Temperature



Ratio of Delta Reference Voltage to Delta Cathode Voltage vs. Junction Temperature

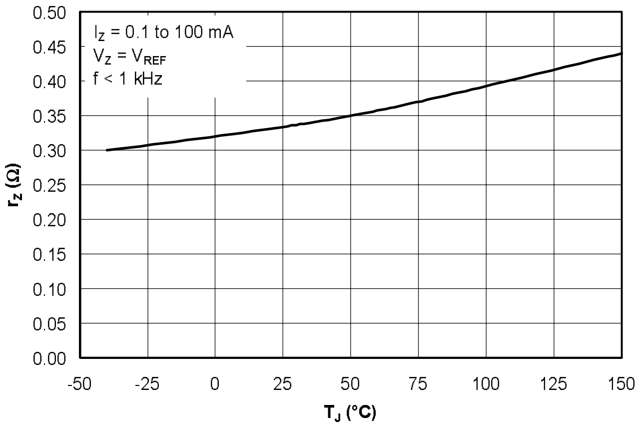


Off State Cathode Current vs. Junction Temperature

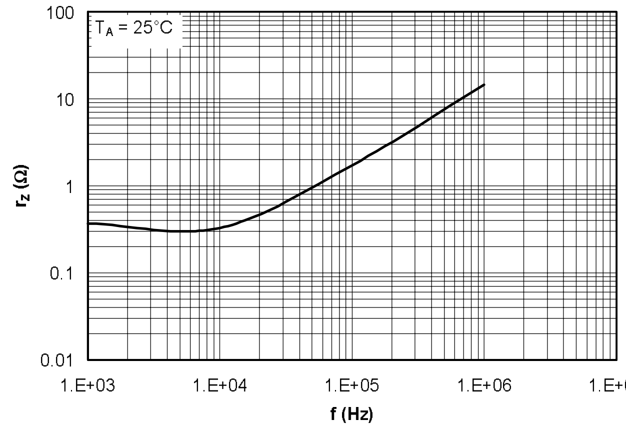


April 14, 1998

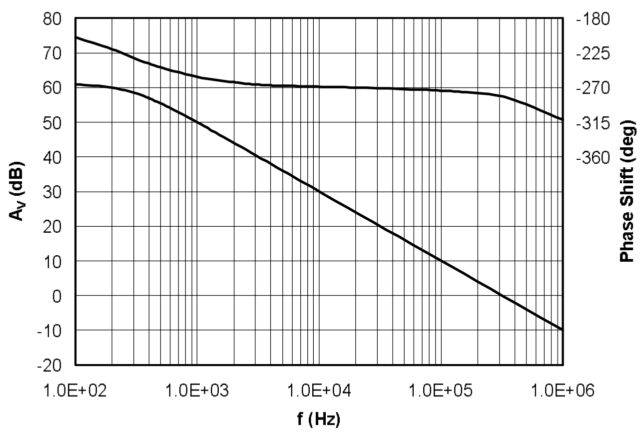
Reference Impedance vs. Junction Temperature



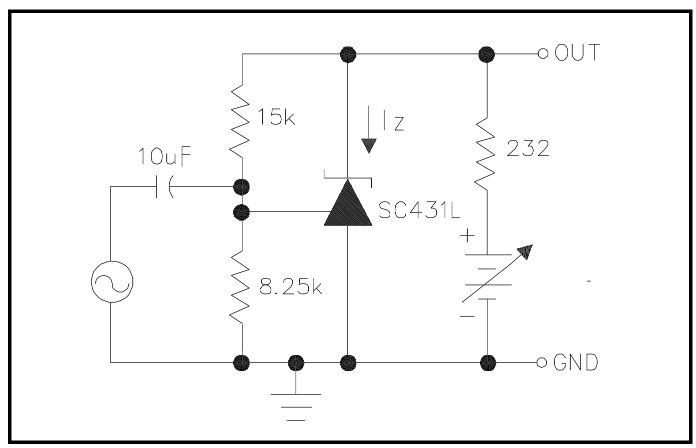
Reference Impedance vs. Frequency



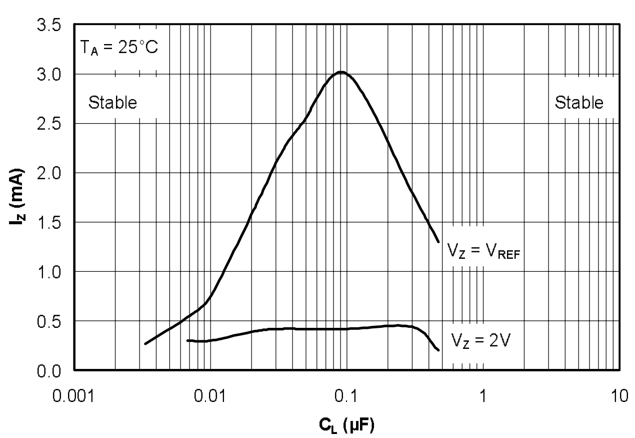
Small Signal Gain and Phase Shift vs. Frequency



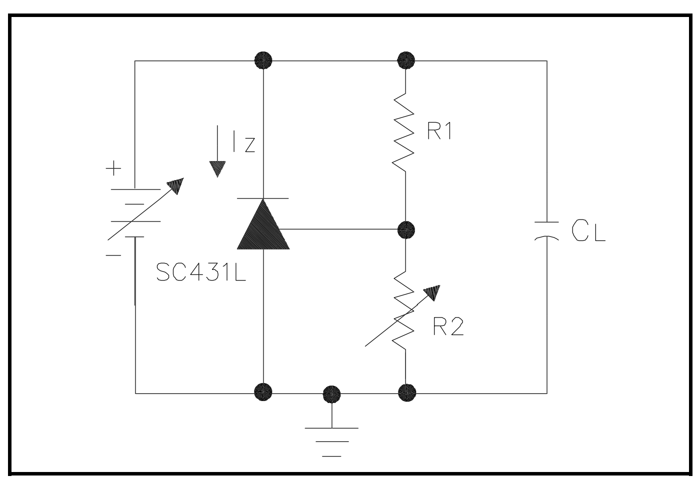
Test Circuit For Small-Signal Gain and Phase Shift



Stability Boundary Condition

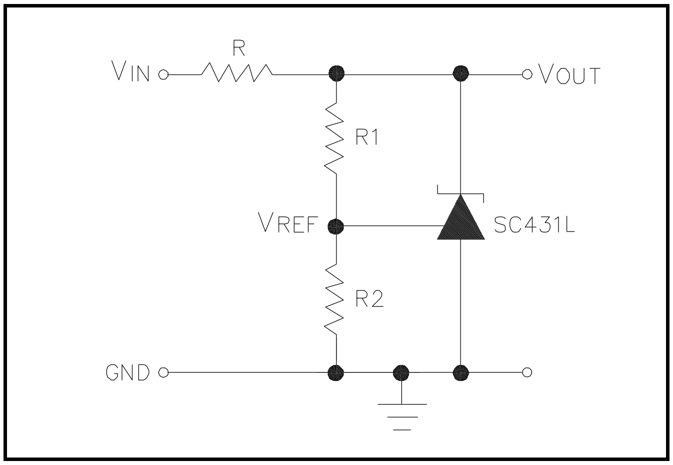


Stability Circuit



April 14, 1998

APPLICATION CIRCUIT



Notes for Application Circuit:

1) Set V_{OUT} according to the following equation:

$$V_{OUT} = V_{REF}\left(1 + \frac{R1}{R2}\right) + I_{REF}\ R1$$

2) Choose the value for R as follows:

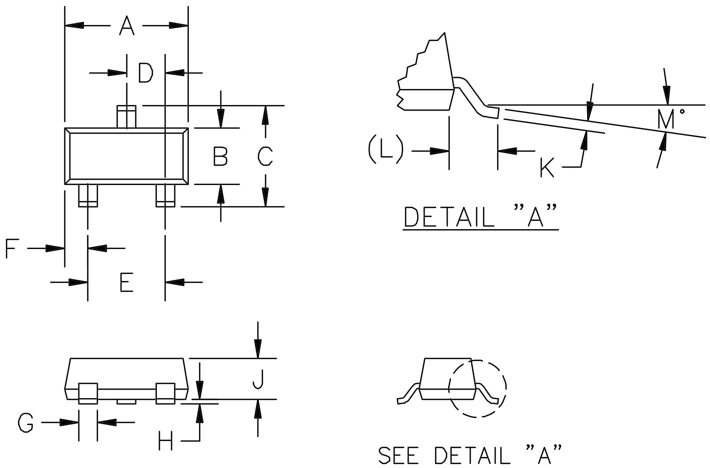
- The maximum limit for R should be such that the cathode current, I_Z, is greater than the minimum operating current (80μA) at $V_{IN(min)}$.
- The minimum limit for R should be such that I_Z does not exceed 100mA under all load conditions, and the instantaneous turn-on value for I_Z does not exceed 150mA. Both of the following conditions must be met:

$$R_{min} \geq \frac{V_{IN(max)}}{150\,mA}$$ (to limit instantaneous turn-on I_Z)

$$R_{min} \geq \frac{V_{IN(max)} - V_{OUT}}{I_{OUT(min)} + 100\,mA}$$ (to limit I_Z under normal operating conditions)

April 14, 1998

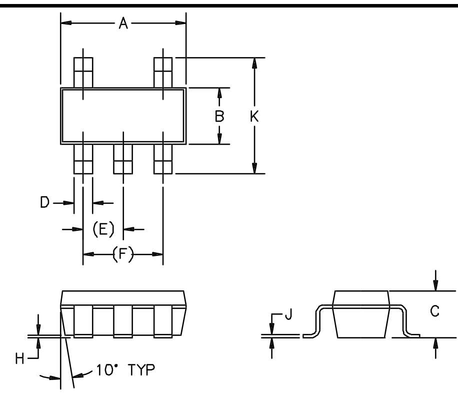
OUTLINE DRAWING SOT-23-3L



DIMᴺ	INCHES MIN	INCHES MAX	MM MIN	MM MAX	NOTE
A	.110	.120	2.80	3.04	–
B	.047	.055	1.20	1.40	–
C	.083	.104	2.10	2.64	–
D	.035	.040	0.89	1.03	–
E	.070	.080	1.78	2.05	–
F	.018	.024	.45	.60	–
G	.015	.020	.37	.51	–
H	.0005	.004	.013	0.10	–
J	.034	.040	.877	1.02	–
K	.003	.007	.085	.180	–
L	–	.027	–	0.69	REF
M	0	8°	0	8°	–

DIMENSIONS 1

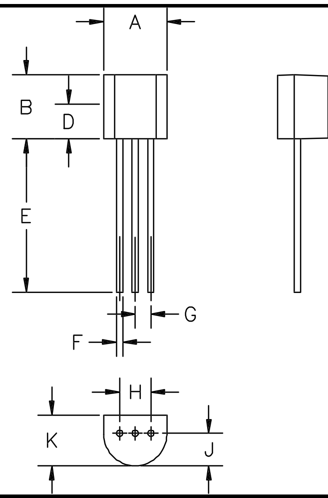
OUTLINE DRAWING SOT-23-5L



DIMᴺ	INCHES MIN	INCHES MAX	MM MIN	MM MAX	NOTE
A	.110	.120	2.80	3.05	–
B	.059	.070	1.50	1.75	–
C	.036	.051	.90	1.30	–
D	.014	.020	.35	.50	–
E	–	.037	–	0.95	REF
F	–	.075	–	1.90	REF
H	–	.006	–	.150	–
J	.0035	.008	.090	.20	–
K	.102	.118	2.6	3.00	–

CONTROLLING DIMENSIONS: MILLIMETERS.

OUTLINE DRAWING TO-92



DIMᴺ	INCHES MIN	INCHES MAX	MM MIN	MM MAX	NOTE
A	.175	.205	4.445	5.207	–
B	.170	.210	4.318	5.334	–
E	.500	.610	12.7	15.5	–
F	.016	.021	.407	.533	–
G	.045	.055	1.143	1.397	–
H	.095	.105	2.413	2.667	–
J	.080	.105	2.032	2.667	–
K	.125	.165	3.175	4.191	–