## Description

The SE432 is a low voltage three terminal adjustable shunt regulator with a guaranteed thermal stability over applicable temperature ranges. The output voltage can be set to any value between $V_{REF}$ (approximately 1.24 V) to 12V with two external resistors. This device has a typical output impedance of 0.25Ω. Active output circuitry provides a very sharp turn on characteristic, making this device excellent replacement for Zener diodes in many applications.

The SE432 is characterized for operation from 0°C to 105°C, and four package options (SOT-23-3, SOT-23-5, TO-92 and SOP-8) allow the designer the opportunity to select the proper package for their applications.

## Features

- Low voltage operation (1.24V)
- Adjustable output voltage $V_0 = V_{REF}$ to 18V
- Wide operating current range 60μA to 100mA
- Low dynamic output impedance 0.05Ω (Typ.)
- Trimmed bandgap design up to ± 0.5%.
- ESD rating is 4KV(Per MIL-STD-883D)
- Available in Halogen-Free Packages.

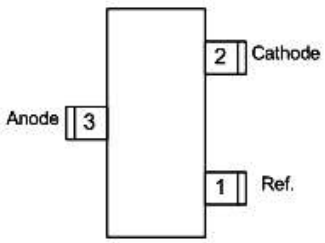
## Application

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

## Pin Configuration

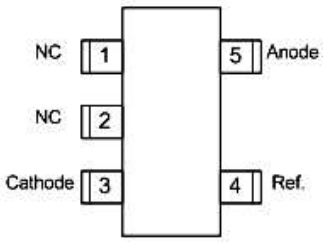
**SOT-23-3, SC59-3L**

**(Top View)**



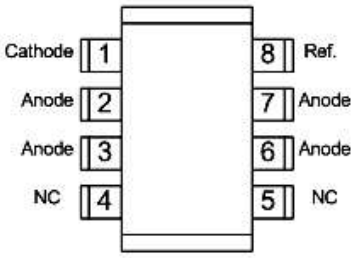

**SOT-23-5L**

**(Top View)**



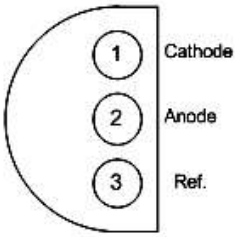

**SOP-8**

**(Top View)**




**TO-92**

**(Top View)**




## Marking Information

| Package | Marking | Production Year Code | Production Week Code | Lead-Free Package |
|---|---|---|---|---|
| SOT-23-3<br>SC59-3L | SE432**W** | Starting with S, a bar on top of S is for production year 2001, and underlined S is for year 2002. The next character is marked on top for 2003, and underlined for 2004. The naming pattern continues with consecutive characters for later years. | A-Z: 1-26<br>a-z: 27-52 | Lead-free package is indicated by a dot on top of the week code. |
| SOT-23-5L | SE432**W** | | | |
| SOP-8 | SE432<br>**YYWW** | YY is for the year of production. 04 means the product is manufactured in year of 2004. | WW is for the week of production. 26 means the product is manufactured in the 26th week | Lead-free package is indicated by LF after YYWW. |
| TO-92 | SE432<br>**YYWW** | | | |

## Absolute Maximum Rating

| Parameter | Symbol | Maximum | Units |
|---|---|---|---|
| Cathode Voltage | $V_{KA}$ | 10 | V |
| Continuous Cathode Current | $I_{KA}$ | 150 | mA |
| Reference Current | $I_{REF}$ | 10 | mA |
| Operating Junction Temperature Range | $T_J$ | 150 | °C |
| Storage Temperature Range | $T_{STG}$ | -40 to 150 | °C |
| Thermal Resistance | $\theta_{JA}$ | 230 (SOT-23-3) | °C/W |
| | | 230 (SOT-23-5) | |
| | | 150 (SOP-8) | |
| | | 220 (TO-92) | |
| Lead Temperature (Soldering) 10 seconds | $T_{LEAD}$ | 260 | °C |

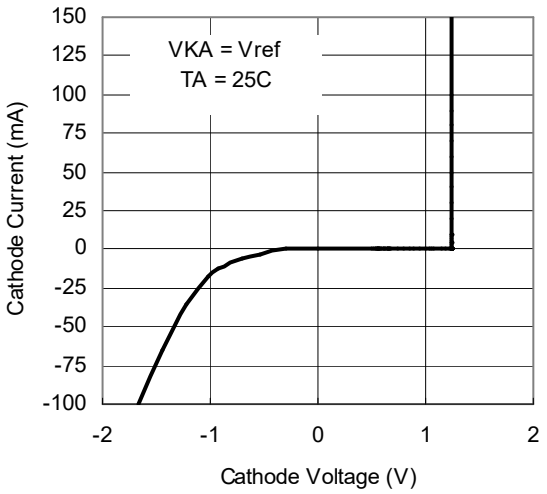
## Electrical Characteristics

| Parameter | | Symbol | Test Conditions & Circuit | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| Reference Voltage | 1.240V ± 0.5% | $V_{REF}$ | Test circuit #1<br>$V_{KA} = V_{REF}$, $I_{KA}$ = 10mA | 1234 | 1240 | 1246 | mV |
| | 1.240V ± 1.0% | | | 1228 | 1240 | 1252 | |
| | 1.240V ± 1.5% | | | 1221 | 1240 | 1259 | |
| | 1.240V ± 2.0% | | | 1215 | 1240 | 1265 | |
| Deviation of Reference Voltage over Full Temperature Range | | $V_{I(DEV)}$ | Test circuit #1<br>$V_{KA} = V_{REF}$, $I_{KA}$ = 10mA,<br>$T_A$ = 0°C - 105°C | -- | 4 | 15 | mV |
| Ratio of Change in Reference Voltage to the Change in Cathode Voltage | | $\Delta V_{REF}/\Delta VKA$ | Test circuit #2<br>$I_{KA}$ = 10mA, $\Delta V_{KA}$ = 12V to $V_{REF}$ | -- | -1.0 | -2.7 | mV/V |
| Reference Current | | $I_{REF}$ | Test circuit #2<br>$I_{KA}$ = 10mA, R1=10kΩ, R2 = ∞ | -- | 0.25 | - | µA |
| Deviation of Reference Current over Full Temperature Range | | $I_{I(DEV)}$ | Test circuit #2<br>$I_{KA}$ = 10mA, R1=10kΩ, R2 = ∞<br>$T_A$ = 0°C - 105°C | -- | 0.10 | 0.50 | µA |
| Minimum Cathode Current for Regulation | | $I_{MIN}$ | Test circuit #1<br>$V_{KA} = V_{REF}$ | -- | 60 | 100 | µA |
| Off-state Cathode Current | | $I_{OFF}$ | Test circuit #3<br>$V_{KA}$ = 12V, $V_{REF}$ = 0 | -- | 0.04 | 0.8 | µA |
| Dynamic Impedance | | $\lvert Z_{KA} \rvert$ | Test circuit #1<br>$I_{KA}$ = 100µA - 80mA,<br>$V_{KA} = V_{REF}$, f ≤ 1kHZ | -- | 0.05 | 0.15 | Ω |

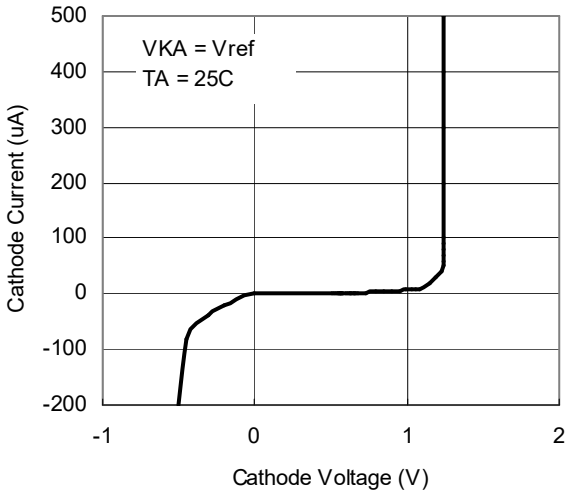
**Note 1:** Upon Customer Request.

## Typical Performance Characteristics

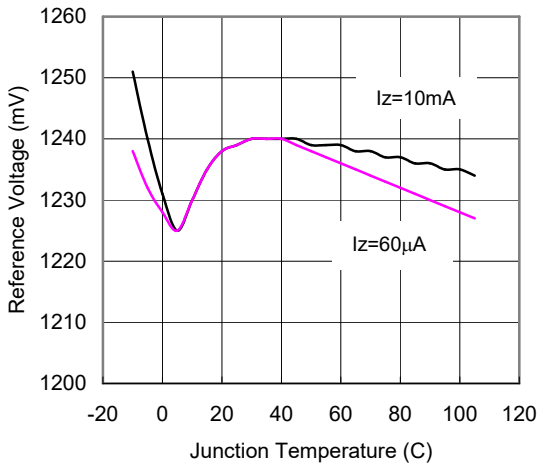
Cathode Current VS Cathode Voltage



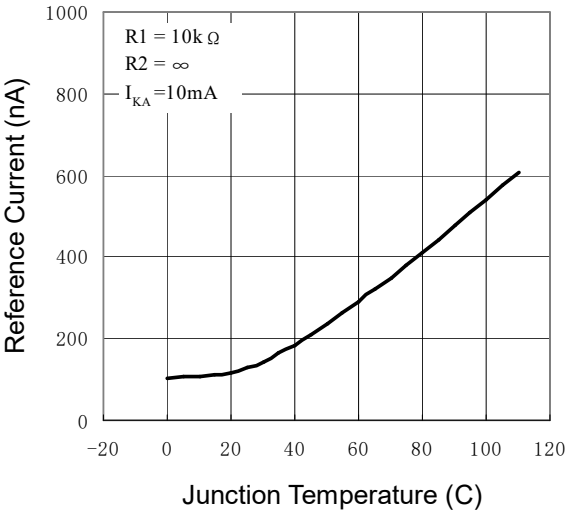

Cathode Current VS Cathode Voltage



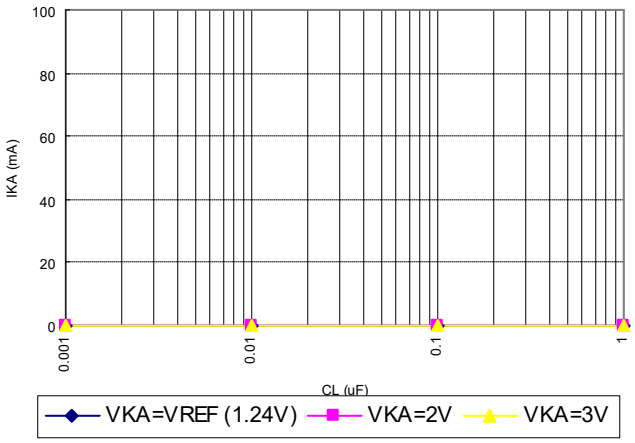

Reference Voltage VS Junction Temperature

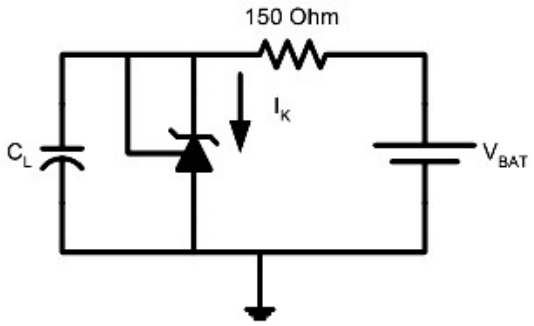



Reference Input Current VS Junction Temperature

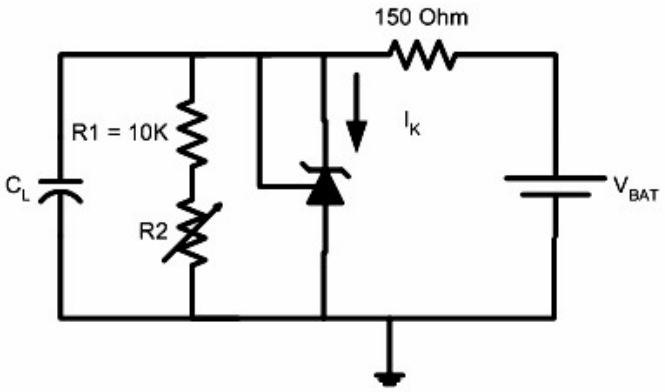


Stability Boundary Condition



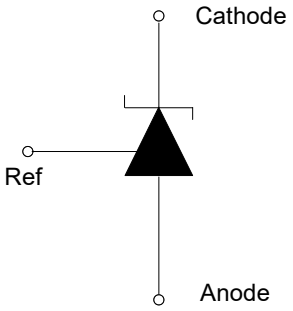

Test Circuit for $V_{KA} = V_{REF}$



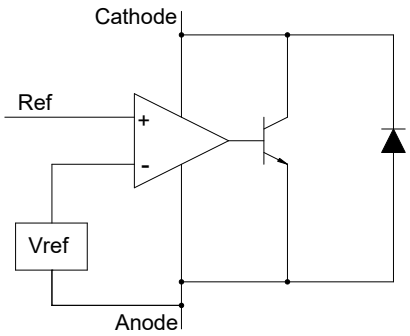

Test Circuit for $V_{KA}$ = 2V, 3V

The areas under the curves represent conditions that may cause the device to oscillate. For $V_{KA}$ = 2V and 3V curves, R2 and $V_{BAT}$ were adjusted to establish the initial $V_{KA}$ and $I_K$ conditions with CL = 0. $V_{BAT}$ and $C_L$ then were adjusted to determine the ranges of stability. As the graph suggested, SE432 is unconditional stable with $I_K$ from 0 to 100mA and with $C_L$ from 0.001uF to 1uF.

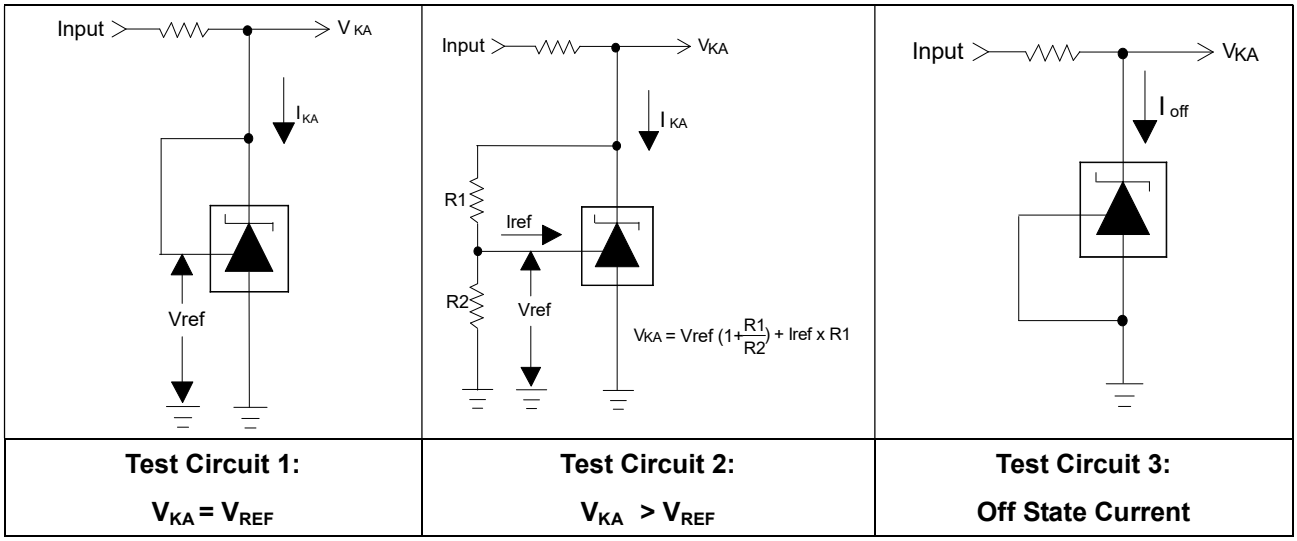
## Symbol Diagram




## Block Diagram

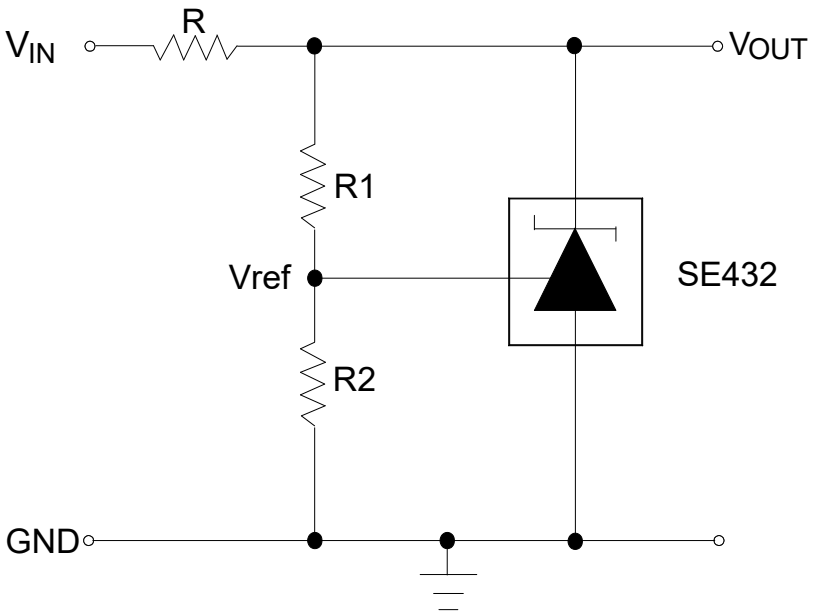



## Test Circuits



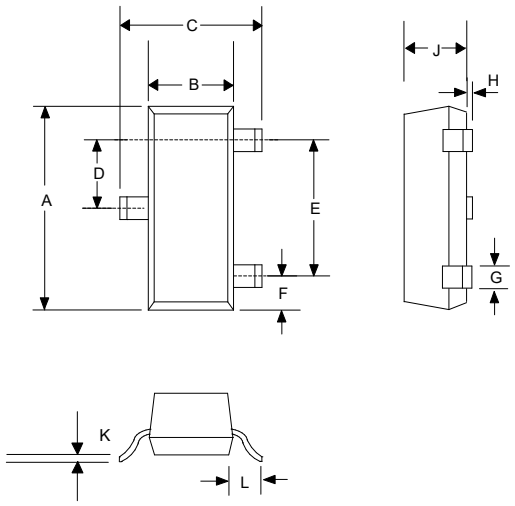

| Test Circuit 1: | Test Circuit 2: | Test Circuit 3: |
|---|---|---|
| $V_{KA} = V_{REF}$ | $V_{KA} > V_{REF}$ | Off State Current |

## Application Circuit



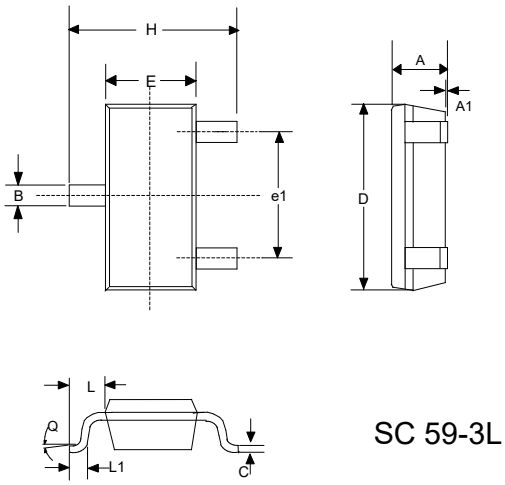

$$V_{OUT} = Vref\left(1+\frac{R1}{R2}\right)$$

## OUTLINE DRAWING SOT-23-3




| DIMENSIONS | | | | |
|---|---|---|---|---|
| DIM^N | INCHES | | MM | |
| | MIN | MAX | MIN | MAX |
| A | 0.110 | 0.120 | 2.80 | 3.04 |
| B | 0.047 | 0.055 | 1.20 | 1.40 |
| C | 0.083 | 0.104 | 2.10 | 2.64 |
| D | 0.035 | 0.040 | 0.89 | 1.03 |
| E | 0.070 | 0.080 | 1.78 | 2.05 |
| F | 0.018 | 0.024 | 0.45 | 0.60 |
| G | 0.015 | 0.020 | 0.37 | 0.51 |
| H | 0.0005 | 0.004 | 0.013 | 0.10 |
| J | 0.034 | 0.040 | 0.887 | 1.02 |
| K | 0.003 | 0.007 | 0.085 | 0.18 |
| L | - | 0.027 | - | 0.69 |

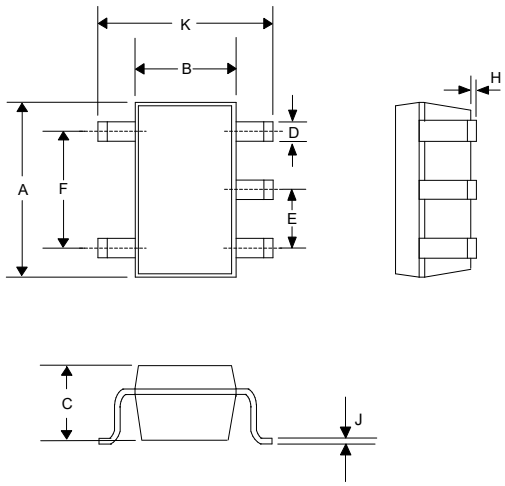
## OUTLINE DRAWING SC59-3L




SC 59-3L

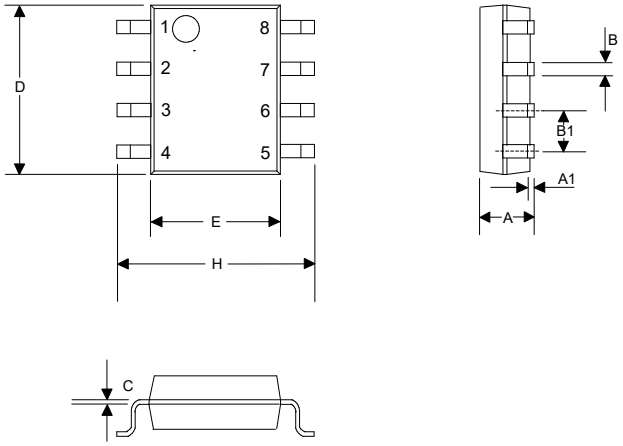
| DIMENSIONS | | | | |
|---|---|---|---|---|
| DIM^N | INCHE | | MM | |
| | MIN | MAX | MIN | MAX |
| A | 0.035 | 0.043 | 0.90 | 1.10 |
| A1 | 0.0004 | 0.005 | 0.01 | 0.13 |
| B | 0.012 | 0.020 | 0.30 | 0.50 |
| C | 0.004 | 0.008 | 0.09 | 0.20 |
| D | 0.110 | 0.122 | 2.80 | 3.10 |
| H | 0.098 | 0.122 | 2.50 | 3.10 |
| E | 0.059 | 0.067 | 1.50 | 1.70 |
| e | 0.037REF | | 0.95REF | |
| e1 | 0.075REF | | 1.90REF | |
| L1 | 0.008 | 0.022 | 0.20 | 0.55 |
| L | 0.014 | 0.031 | 0.35 | 0.80 |
| Q | 0℃ | 10℃ | 0℃ | 10℃ |

## OUTLINE DRAWING SOT-23-5L



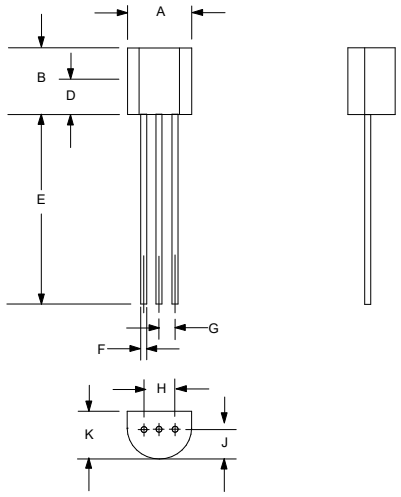

| DIMENSIONS | | | | |
|---|---|---|---|---|
| DIM^N | INCHES | | MM | |
| | MIN | MAX | MIN | MAX |
| A | 0.110 | 0.120 | 2.80 | 3.05 |
| B | 0.059 | 0.070 | 1.50 | 1.75 |
| C | 0.036 | 0.051 | 0.90 | 1.30 |
| D | 0.014 | 0.020 | 0.35 | 0.50 |
| E | - | 0.037 | - | 0.95 |
| F | - | 0.075 | - | 1.90 |
| H | - | 0.006 | - | 0.15 |
| J | 0.0035 | 0.008 | 0.090 | 0.20 |
| K | 0.102 | 0.118 | 2.60 | 3.00 |

## OUTLINE DRAWING SOP-8




| DIMENSIONS | | | | |
|---|---|---|---|---|
| DIM[N] | INCHES | | MM | |
| | MIN | MAX | MIN | MAX |
| A | 0.0532 | 0.0688 | 1.35 | 1.75 |
| A1 | 0.0040 | 0.0098 | 0.10 | 0.25 |
| B | 0.0130 | 0.0200 | 0.33 | 0.51 |
| B1 | 0.050 BSC | | 1.27 BSC | |
| C | 0.0075 | 0.0098 | 0.19 | 0.25 |
| D | 0.1890 | 0.1968 | 4.80 | 5.00 |
| H | 0.2284 | 0.2440 | 5.80 | 6.20 |
| E | 0.1497 | 0.1574 | 3.80 | 4.00 |

## OUTLINE DRAWING TO-92




| DIMENSIONS | | | | |
|---|---|---|---|---|
| DIM[N] | INCHES | | MM | |
| | MIN | MAX | MIN | MAX |
| A | 0.175 | 0.205 | 4.445 | 5.207 |
| B | 0.170 | 0.210 | 4.318 | 5.334 |
| E | 0.500 | 0.610 | 12.70 | 15.50 |
| F | 0.016 | 0.021 | 0.407 | 0.533 |
| G | 0.045 | 0.055 | 1.143 | 1.397 |
| H | 0.095 | 0.105 | 2.413 | 2.667 |
| J | 0.080 | 0.105 | 2.032 | 2.667 |
| K | 0.125 | 0.165 | 3.175 | 4.191 |

**Customer Support**

Seaward Electronics Incorporated – China

Section B, 2nd Floor, ShangDi Scientific Office Complex, #22 XinXi Road

Haidian District, Beijing 100085, China

Tel: 86-10-8289-5700/01/05

Fax: 86-10-8289-5706

Email : sales@seawardinc.com.cn

Seaward Electronics Incorporated – North America

1512 Centre Pointe Dr.

Milpitas, CA95035, USA

Tel: 1-650-444-0713

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