

### Features

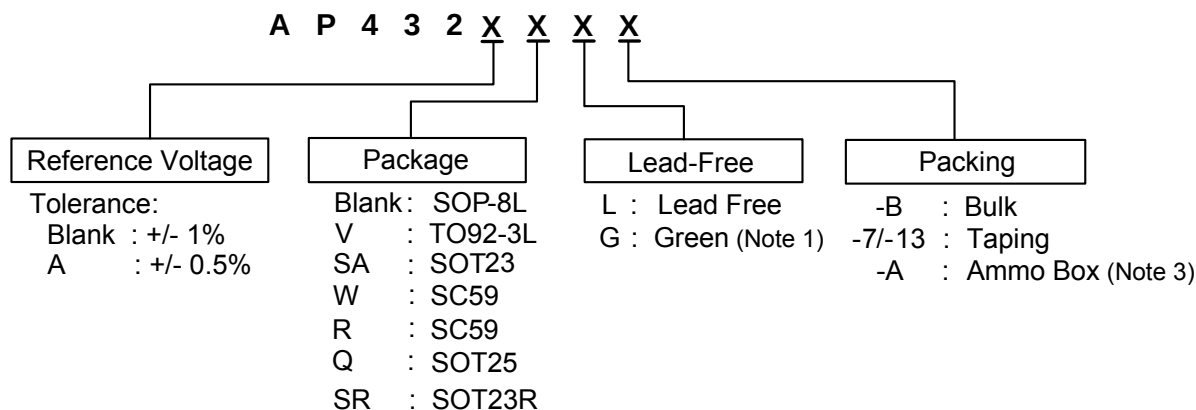
- Precision reference voltage  
AP432 :  $1.24V \pm 1\%$   
AP432A :  $1.24V \pm 0.5\%$
- Sink current capability: 200mA
- Minimum cathode current for regulation: 150 $\mu$ A
- Equivalent full-range temp coefficient: 30 ppm/ $^{\circ}$ C
- Fast turn-on response
- Low dynamic output impedance: 0.2 $\Omega$
- Programmable output voltage to 20V
- Low output noise
- Packages: SOT23, SOT23R, SOT25, SC59 (W package code), SC59 (R package code), SOP-8L and TO92-3L
- SOT23, SOT23R, SOP-8L and SC59: Available in "Green" Molding Compound (No Br, Sb) (Note 1)
- Lead Free Finish/ RoHS Compliant for Lead Free and "Green" Products (Note 2)

### General Description

The AP432/432A are 3-terminal adjustable precision shunt regulators with guaranteed stable temperature over the applicable extended commercial temperature range. The output voltage may be set at any level greater than 1.24V ( $V_{REF}$ ) up to 20V merely by selecting two external resistors that act as a voltage divider network. These devices have a typical output impedance of 0.2 $\Omega$ . Active output circuitry provides very sharp turn-on characteristics, making these devices excellent improved replacements for Zener diodes in many applications.

The precise  $\pm 1\%$  reference voltage tolerance of the AP432/432A make it possible in many applications to avoid the use of a variable resistor, consequently saving cost and eliminating drift and reliability problems associated with it.

### Ordering Information



Note: 1. SOT23, SOT23R are "Green" products only.  
2. RoHS revision 13.2.2003. Glass and High Temperature Solder Exemptions Applied, see EU Directive Annex Notes 5 and 7.

| Device<br>(Note 4) | Package<br>Code | Packaging<br>(Note 5) | 7" Tape and Reel    |                       | 13" Tape and Reel   |                       | Ammo Box |                       |
|--------------------|-----------------|-----------------------|---------------------|-----------------------|---------------------|-----------------------|----------|-----------------------|
|                    |                 |                       | Quantity            | Part Number<br>Suffix | Quantity            | Part Number<br>Suffix | Quantity | Part Number<br>Suffix |
| AP432(A)SA         | SA              | SOT23                 | 3000/Tape<br>& Reel | -7                    | NA                  | NA                    | NA       | NA                    |
| AP432(A)SR         | SR              | SOT23R                | 3000/Tape<br>& Reel | -7                    | NA                  | NA                    | NA       | NA                    |
| AP432(A)Q          | Q               | SOT25                 | 3000/Tape<br>& Reel | -7                    | NA                  | NA                    | NA       | NA                    |
| AP432(A)W          | W               | SC59                  | 3000/Tape<br>& Reel | -7                    | NA                  | NA                    | NA       | NA                    |
| AP432(A)R          | R               | SC59                  | 3000/Tape<br>& Reel | -7                    | NA                  | NA                    | NA       | NA                    |
| AP432(A)           |                 | SOP-8L                | NA                  | NA                    | 2500/Tape<br>& Reel | -13                   | NA       | NA                    |
| AP432(A)V          | V               | TO92-3L               | NA                  | NA                    | NA                  | NA                    | 2000/Box | -A                    |

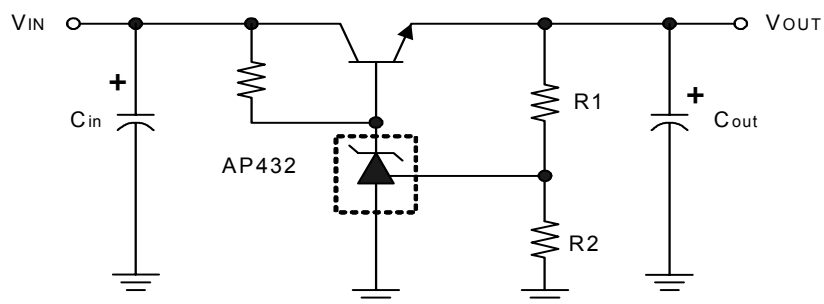
Notes: 3. Ammo Box is for TO92-3 Spread Lead.  
4. Suffix "A" denotes AP432A device.  
5. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at <http://www.diodes.com/datasheets/ap02001.pdf>.

## Pin Assignment

| Package                   | Pin Configuration (Top View)                     |
|---------------------------|--------------------------------------------------|
| SOT25                     | <p>NC 1 5 ANODE<br/>NC 2 4 REF<br/>CATHODE 3</p> |
| SC-59<br>(Package Code-W) | <p>ANODE 1 3 REF<br/>2 CATHODE</p>               |
| SC-59<br>(Package Code-R) | <p>ANODE 1 3 CATHODE<br/>2 REF</p>               |
| TO92-3L                   | <p>3 Cathode<br/>2 Anode<br/>1 REF</p>           |

| Package | Pin Configuration (Top View)                                                 |
|---------|------------------------------------------------------------------------------|
| SOP-8L  | <p>CATHODE 1 8 REF<br/>ANODE 2 7 ANODE<br/>ANODE 3 6 ANODE<br/>NC 4 5 NC</p> |
| SOT23   | <p>ANODE 1 3 REF<br/>2 CATHODE</p>                                           |
| SOT23R  | <p>ANODE 1 3 CATHODE<br/>2 REF</p>                                           |

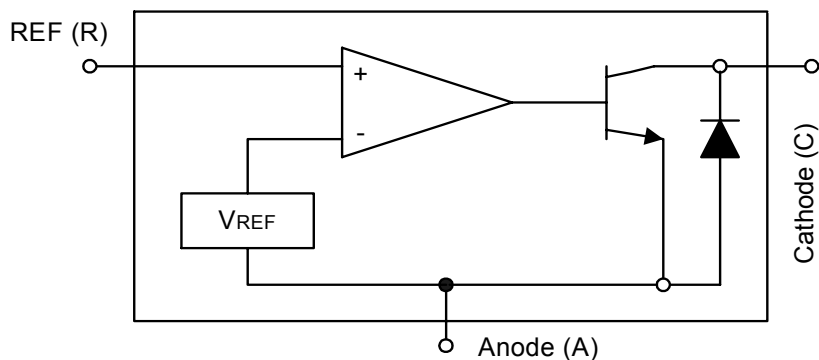
## Typical Application Circuit



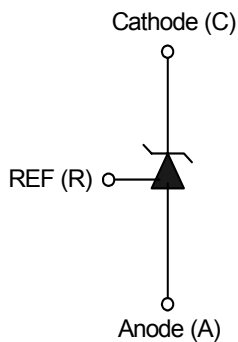
$$V_{OUT} = (1 + R1/R2)V_{REF}$$

Precision Regulator

## Block Diagram



## Symbol



---

**Absolute Maximum Ratings**

---

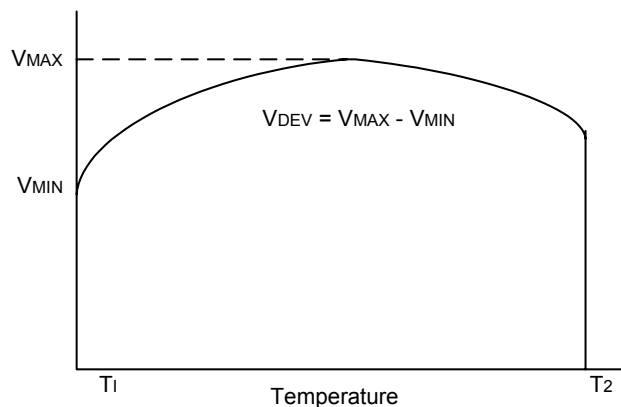
| Symbol           | Parameter                         |          | Rating      | Unit |
|------------------|-----------------------------------|----------|-------------|------|
| V <sub>CV</sub>  | Cathode Voltage                   |          | +20         | V    |
| I <sub>CC</sub>  | Continuous Cathode Current        |          | -10 to +250 | mA   |
| I <sub>REF</sub> | Reference Input Current           |          | 10          | mA   |
| T <sub>OP</sub>  | Operating Temperature             |          | -20 to +85  | °C   |
| T <sub>ST</sub>  | Storage Temperature               |          | -65 to +150 | °C   |
| P <sub>D</sub>   | Power Dissipation<br>(Notes 6, 7) | SOT23(R) | 250         | mW   |
|                  |                                   | SOT25    | 250         | mW   |
|                  |                                   | SC59     | 400         | mW   |
|                  |                                   | SOP-8L   | 600         | mW   |
|                  |                                   | TO92-3L  | 780         | mW   |

Note: 6. T<sub>J</sub>, max =150°C

7. Ratings apply to ambient temperature at 25°C

### Electrical Characteristics ( $T_A = 25^\circ\text{C}$ , $V^+ = +5.0\text{V}$ , unless otherwise stated )

| Parameter                                                                 | Test conditions                                                                                        | Symbol                                 | Min.           | Typ. | Max.           | Unit          |
|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------------------------|----------------|------|----------------|---------------|
| Reference Voltage                                                         | $V_{KA} = V_{REF}$ ,<br>$I_{KA} = 10\text{mA}$ (Fig.1)                                                 | $V_{REF}$                              | 1.227<br>1.233 | 1.24 | 1.252<br>1.246 | V             |
| Deviation of Reference Input Voltage over Temperature (Note 8)            | $V_{KA} = V_{REF}$ , $I_{KA} = 10\text{mA}$ ,<br>$T_A = \text{full range}$ (Fig.1)                     | $V_{REF}$                              |                | 3.0  | 20             | mV            |
| Ratio of the Change in Reference Voltage to the Change in Cathode Voltage | $I_{KA} = 10\text{mA}$ (Fig.2)<br>$V_{KA} = 20 \sim V_{REF}$                                           | $\frac{\Delta V_{REF}}{\Delta V_{KA}}$ |                | -1.4 | -2.0           | mV/V          |
| Reference Input Current                                                   | $R1 = 10\text{K}\Omega$ , $R2 = \infty$<br>$I_{KA} = 10\text{mA}$ (Fig.2)                              | $I_{REF}$                              |                | 1.4  | 3.5            | $\mu\text{A}$ |
| Deviation of Reference Input Current over Temperature                     | $R1 = 10\text{K}\Omega$ , $R2 = \infty$<br>$I_{KA} = 10\text{mA}$<br>$T_A = \text{Full range}$ (Fig.2) | $\alpha I_{REF}$                       |                | 0.4  | 1.2            | $\mu\text{A}$ |
| Minimum Cathode Current for Regulation                                    | $V_{KA} = V_{REF}$ (Fig.1)                                                                             | $I_{KA(\text{min})}$                   |                | 0.15 | 0.3            | mA            |
| Off-state Current                                                         | $V_{KA} = 20\text{V}$ , $V_{REF} = 0\text{V}$ (Fig.3)                                                  | $I_{KA(\text{off})}$                   |                | 0.1  | 1.0            | $\mu\text{A}$ |
| Dynamic Output Impedance (Note 9)                                         | $V_{KA} = V_{REF}$<br>Frequency $\leq 1\text{KHz}$ (Fig.1)                                             | $ Z_{KA} $                             |                | 0.2  | 0.5            | $\Omega$      |



Note: 8. Deviation of reference input voltage,  $V_{DEV}$ , is defined as the maximum variation of the reference over the full temperature range. The average temperature coefficient of the reference input voltage  $\alpha V_{REF}$  is defined as:

$$\alpha V_{REF} = \frac{\left( \frac{V_{DEV}}{V_{REF}(25^\circ\text{C})} \right) \cdot 10^6}{T_2 - T_1} \dots\dots\dots (\text{ppm}/^\circ\text{C})$$

Where:

$T_2 - T_1$  = full temperature change.

$\alpha V_{REF}$  can be positive or negative depending on whether the slope is positive or negative.

Note: 9. The dynamic output impedance,  $R_z$ , is defined as:

$$|Z_{KA}| = \frac{\Delta V_{KA}}{\Delta I_{KA}}$$

When the device is programmed with two external resistors  $R1$  and  $R2$  (see Figure 2.), the dynamic output impedance of the overall circuit, is defined as:

$$|Z_{KA}'| = \frac{\Delta V}{\Delta I} \approx |Z_{KA}| \left( 1 + \frac{R1}{R2} \right)$$

## Test Circuits

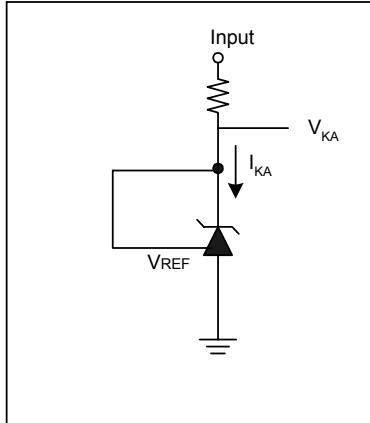


Fig 1. Test Circuit for  $V_{KA} = V_{REF}$

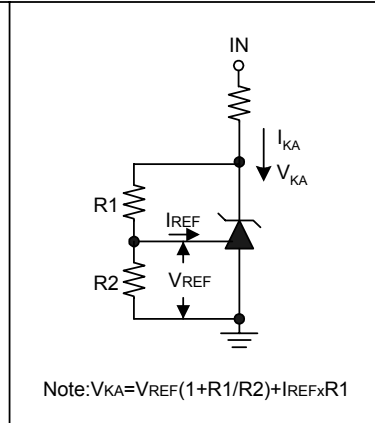


Fig 2. Test Circuit for  $V_{KA} > V_{REF}$

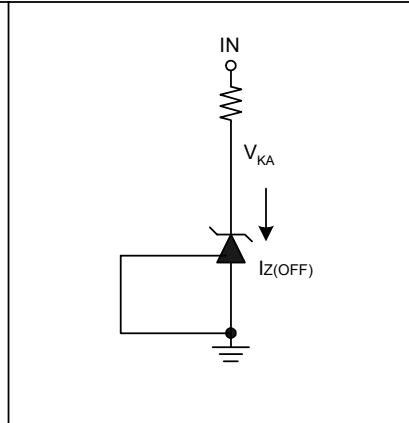
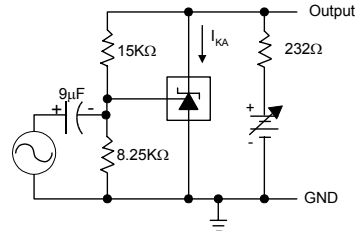
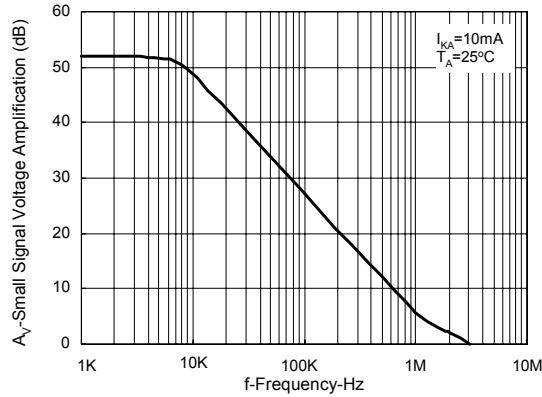


Fig 3. Test Circuit for Off-State Current

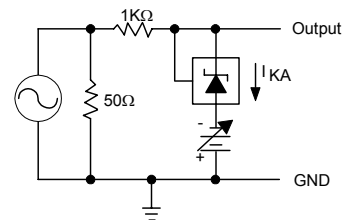
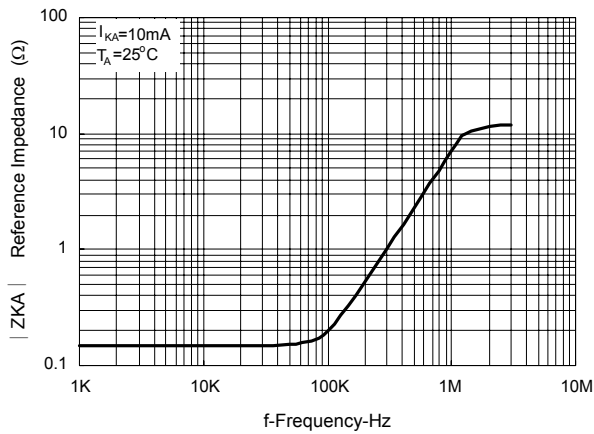
## Typical Performance Characteristics

Small-Signal Voltage Amplification vs Frequency



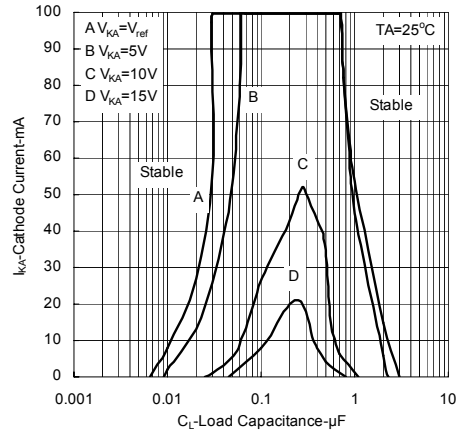
Test Circuit for Voltage Amplification

Reference Impedance vs Frequency

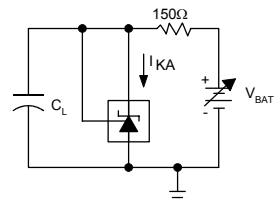


Test Circuit for Reference Impedance

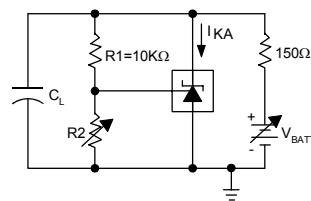
STABILITY BOUNDARY CONDITIONS†



†The areas under the curves represent conditions that may cause the device to oscillate. For curves B, C, and D, R2 and V+ were adjusted to establish the initial  $V_{KA}$  and  $I_{KA}$  conditions with  $C_L = 0.01 \mu F$  and  $V_{BATT}$  and  $C_L$  were then adjusted to determine the ranges of stability.

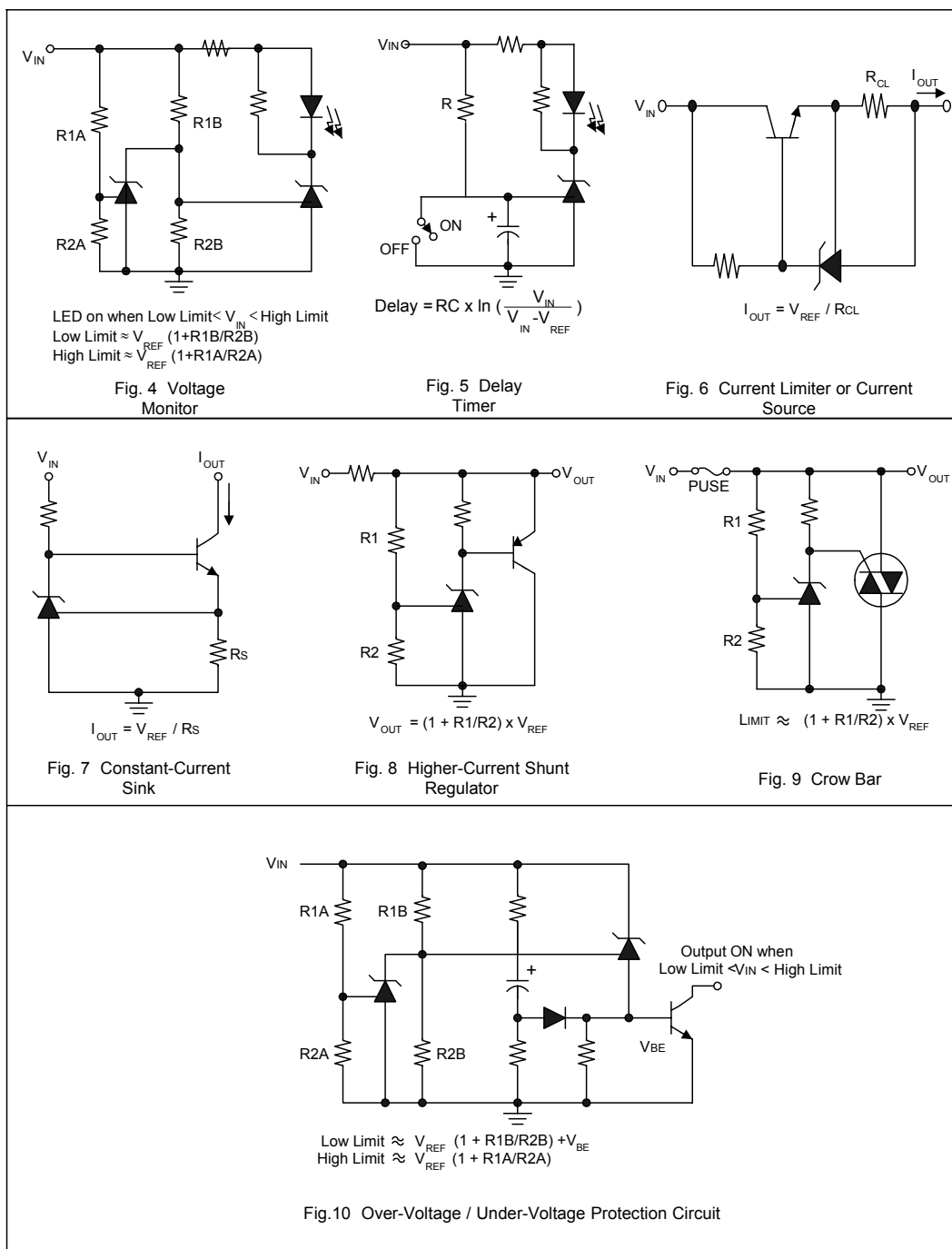


Test Circuit for Curve A



Test Circuit for Curve B, C, and D

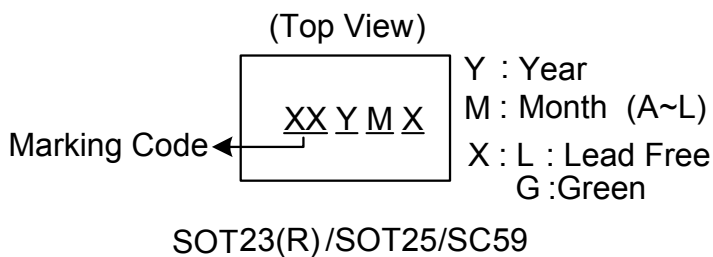
### Application Examples



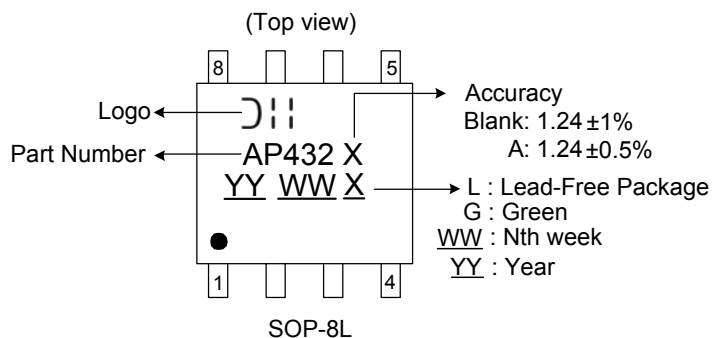


## Marking Information

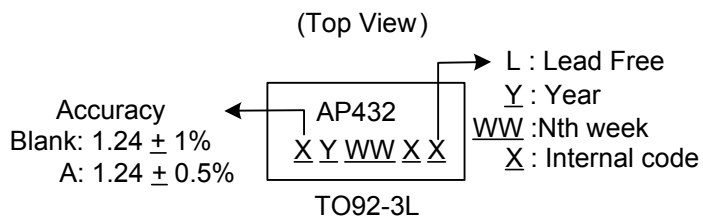
### (1) SOT23(R) /SOT25/SC59



### (2) SOP-8L



### (3) TO92-3



---

**Marking Information** (Continued)

---

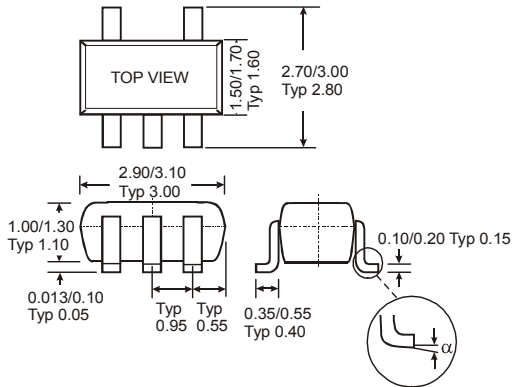
**Marking Code Table**

| Device   | Package (Note 10) | Marking Code | Date Code |
|----------|-------------------|--------------|-----------|
| AP432SA  | SOT23             | D3           | YM        |
| AP432ASA | SOT23             | D4           | YM        |
| AP432SR  | SOT23R            | D7           | YM        |
| AP432ASR | SOT23R            | D8           | YM        |
| AP432Q   | SOT25             | B7           | YM        |
| AP432AQ  | SOT25             | B8           | YM        |
| AP432W   | SC59              | B3           | YM        |
| AP432AW  | SC59              | B4           | YM        |
| AP432R   | SC59              | B5           | YM        |
| AP432AR  | SC59              | B6           | YM        |

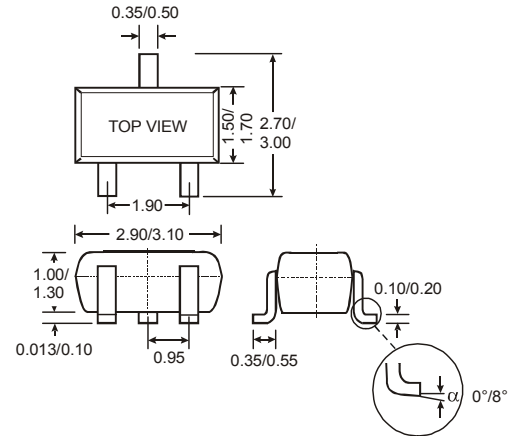
Note: 10. For Packaging Details, go to our website at <http://www.diodes.com/datasheets/ap02007.pdf>.

**Package Information** ( All Dimensions in mm )

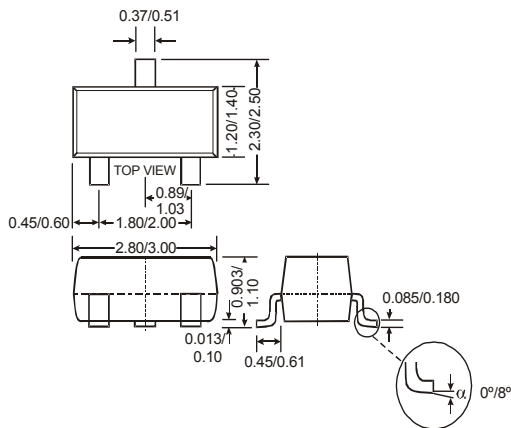
**(1) SOT25**



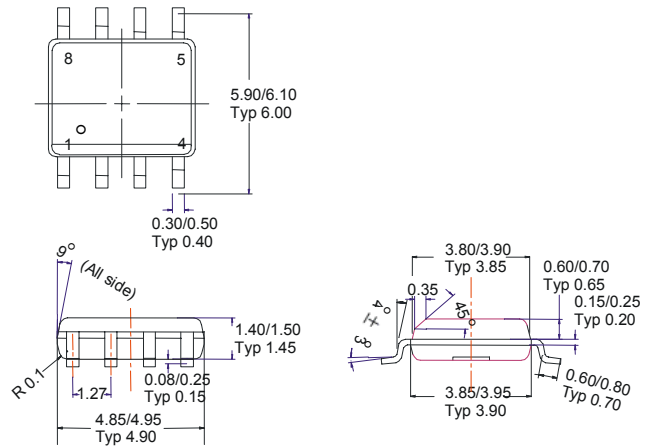
**(2) SC59**



**(3) SOT23(R)**

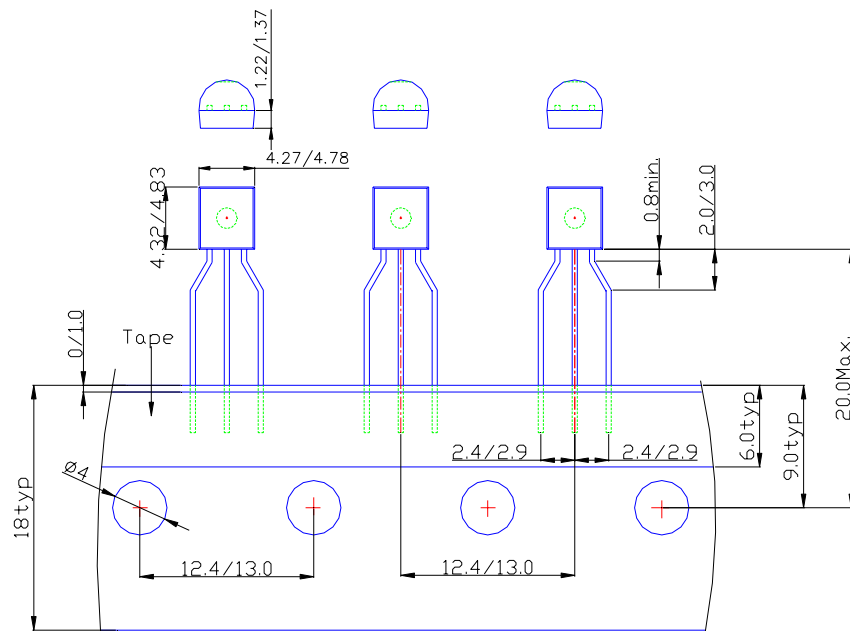


**(4) SOP-8L**



**Package Information** (Continued) ( All Dimensions in mm )

**(5) TO92-3L for Ammo pack**



**IMPORTANT NOTICE**

Diodes Incorporated and its subsidiaries reserve the right to make modifications, enhancements, improvements, corrections or other changes without further notice to any product herein. Diodes Incorporated does not assume any liability arising out of the application or use of any product described herein; neither does it convey any license under its patent rights, nor the rights of others. The user of products in such applications shall assume all risks of such use and will agree to hold Diodes Incorporated and all the companies whose products are represented on our website, harmless against all damages.

**LIFE SUPPORT**

Diodes Incorporated products are not authorized for use as critical components in life support devices or systems without the expressed written approval of the President of Diodes Incorporated.

## Данный компонент на территории Российской Федерации

**Вы можете приобрести в компании MosChip.**

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

moschip.ru\_6

moschip.ru\_9