

### DESCRIPTION

The AMC431 is a three-terminal adjustable shunt voltage regulator with specified thermal stability and pin-to-pin compatible with the earlier 431 series. The output voltage can be adjusted to any value between  $V_{REF}$  and 36V by using two external resistors. The AMC431 offers low output impedance for improved load regulation with a typical output impedance of 200m $\Omega$ . Because of the active output circuitry, the AMC431 can replace the zener diodes in applications such as switching power supplies, OVP crowbar circuits, references for A/D, D/A converters with improved turn-on characteristics.

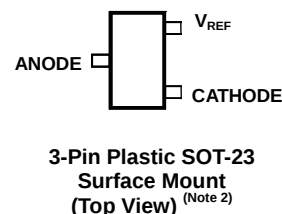
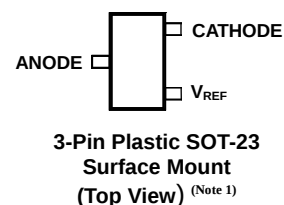
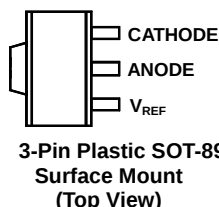
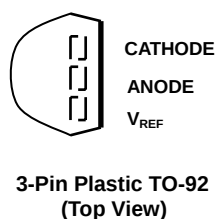
### FEATURES

- Initial voltage reference accuracy of 0.5%, 1.0%, and 1.5%
- Sink current capability from 1mA to 100mA
- Typical output dynamic impedance less than 200m $\Omega$ ;
- Adjustable output voltage from  $V_{REF}$  to 36V
- Available in 3L-TO92 and surface mount SOT89, SOT23.
- Low output noise
- Typical equivalent full range temperature coefficient of 30ppm/ $^{\circ}$ C
- Pin assignment identical to earlier TL431 series.

### APPLICATIONS

- Voltage Reference
- Precision shunt regulator
- High current shunt regulator
- PWM down converter with reference
- Voltage monitor

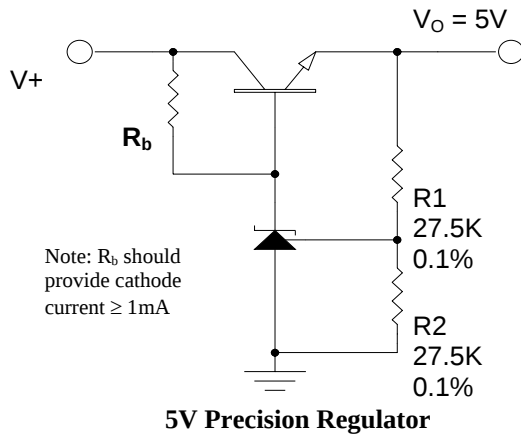
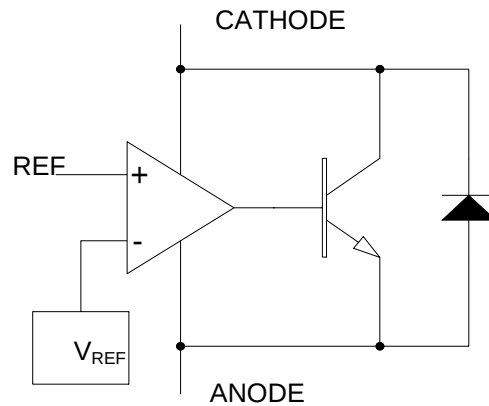
### PACKAGE PIN OUT



### ORDER INFORMATION

| $T_A$ ( $^{\circ}$ C) | Initial Tolerance | LP                    | TO-92<br>3-pin        | PK                    | SOT-89<br>3-pin        | DB | SOT-23<br>3-pin | DB | SOT-23<br>3-pin |
|-----------------------|-------------------|-----------------------|-----------------------|-----------------------|------------------------|----|-----------------|----|-----------------|
| 0 to 70               | 1.5%              | AMC431CLP             | --                    | --                    | --                     | -- | --              | -- | --              |
|                       | 1.5%              | AMC431CLPF(Lead Free) | --                    | --                    | --                     | -- | --              | -- | --              |
|                       | 1%                | AMC431LP              | AMC431PK              | AMC431DB              | AMC431RDB              |    |                 |    |                 |
|                       | 1%                | AMC431LPF(Lead Free)  | AMC431PKF(Lead Free)  | AMC431DBF(Lead Free)  | AMC431RDBF(Lead Free)  |    |                 |    |                 |
|                       | 0.5%              | AMC431BLP             | AMC431BPK             | AMC431BDB             | AMC431BRDB             |    |                 |    |                 |
|                       | 0.5%              | AMC431BLPF(Lead Free) | AMC431BPKF(Lead Free) | AMC431BDBF(Lead Free) | AMC431BRDBF(Lead Free) |    |                 |    |                 |

Note: 1. For AMC431RDB and AMC431BRDB.  
 2. For AMC431DB and AMC431BDB.  
 3. For surface-mount and TO-92 packages in Tape & Reel, add suffix "T" (e.g., AMC431LPT, AMC431DBT).  
 4. For TO-92 in Tape & Box (without reel), add suffix "TB" (e.g., AMC431LPTB).  
 5. DB package is only available in Tape & Reel.  
 6. The letter "F" is marked for Lead Free process.

**TYPICAL APPLICATION**

**BLOCK DIAGRAM**

**ABSOLUTE MAXIMUM RATINGS (Note 1)**

|                                                                                                                                                                                |                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Cathode to Anode Voltage ( $V_{KA}$ ) (Note 2)                                                                                                                                 | -0.3V to 37V    |
| Continuous Cathode Current ( $I_K$ )                                                                                                                                           | -100mA to 150mA |
| Reference Input Current ( $I_{REF}$ )                                                                                                                                          | -50uA to 10mA   |
| Maximum junction temperature range, $T_J$                                                                                                                                      | 150°C           |
| Storage temperature range                                                                                                                                                      | -65°C to 150°C  |
| Lead temperature (soldering, 10 seconds)                                                                                                                                       | 260°C           |
| Note 1: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of the specified terminal. |                 |
| Note 2: Voltage values are with respect to the anode terminal unless otherwise noted.                                                                                          |                 |

**POWER DISSIPATION TABLE**

| Package | $\theta_{JA}$<br>(°C/W) | Derating factor<br>$D_F(\text{mW}/^\circ\text{C})$<br>$T_A \geq 25^\circ\text{C}$ | $T_A \leq 25^\circ\text{C}$<br>Power rating(mW) | $T_A = 70^\circ\text{C}$<br>Power rating(mW) | $T_A = 85^\circ\text{C}$<br>Power rating (mW) |
|---------|-------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------|----------------------------------------------|-----------------------------------------------|
| LP      | 156                     | 6.41                                                                              | 801                                             | 513                                          | 417                                           |
| LPF     | 156                     | 6.41                                                                              | 801                                             | 513                                          | 417                                           |
| PK      | 71(note)                | 14.1                                                                              | 1763                                            | 1128                                         | 916                                           |
| PKF     | 71(note)                | 14.1                                                                              | 1763                                            | 1128                                         | 916                                           |
| DB      | 285                     | 3.5                                                                               | 438                                             | 280                                          | 228                                           |
| DBF     | 285                     | 3.5                                                                               | 438                                             | 280                                          | 228                                           |

Note 1: For PK package, Thermal Resistance-Junction to Tab ( $\theta_{JT}$ ) = 35°C/W.  $T_J = T_{TAB} + (P_D \times \theta_{JT})$ .

$P_D$ : Power Dissipation.

2.  $\theta_{JA}$ : Thermal Resistance-Junction to Ambient,  $D_F = 1/\theta_{JA}$

Junction Temperature Calculation:  $T_J = T_A + (P_D \times \theta_{JA})$ .

The  $\theta_{JA}$  numbers are guidelines for the thermal performance of the device/PC-board system.

All of the above assume no ambient airflow.

**RECOMMENDED OPERATING CONDITIONS**

| Parameter                                   | Min | Max | Units |
|---------------------------------------------|-----|-----|-------|
| Operating free air temperature range, $T_A$ | 0   | 70  | °C    |
| Cathode current, $I_K$                      | 1   | 100 | mA    |
| Cathode voltage, $V_{KA}$                   | 0   | 36  | V     |

**ELECTRICAL CHARACTERISTICS**

Unless otherwise specified, these specifications apply over the operating ambient temperatures with  $T_A = 25^\circ\text{C}$ .

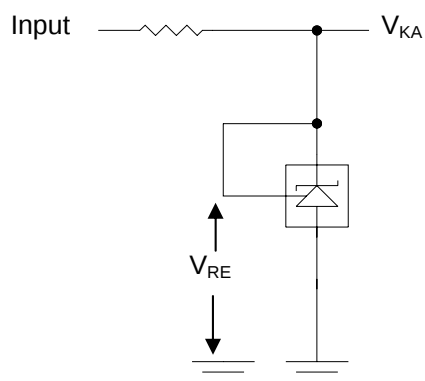
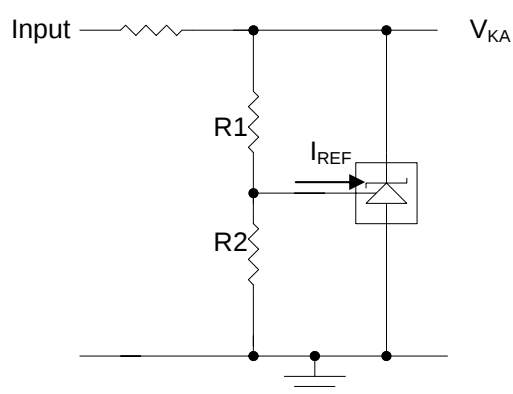
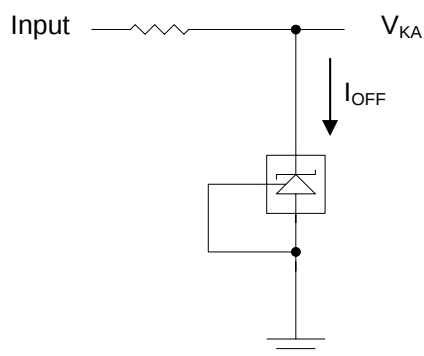
| Parameter                              | Symbol     | Test Conditions                                                                             | AMC431 |       |       | Units         |
|----------------------------------------|------------|---------------------------------------------------------------------------------------------|--------|-------|-------|---------------|
|                                        |            |                                                                                             | Min    | Typ   | Max   |               |
| Reference Input Voltage                | $V_{REF}$  | $I_K = 10\text{mA}$ , $V_{KA} = V_{REF}$ , note 1                                           | 2.475  | 2.500 | 2.525 | V             |
| Reference Input Voltage                | $V_{REF}$  | $I_K = 10\text{mA}$ , $V_{KA} = V_{REF}$ , note 2                                           | 2.462  | 2.500 | 2.538 | V             |
| Reference Input Voltage                | $V_{REF}$  | $I_K = 10\text{mA}$ , $V_{KA} = V_{REF}$ , note 3                                           | 2.487  | 2.500 | 2.513 | V             |
| Reference Drift                        |            | $I_K = 10\text{mA}$ , $V_{KA} = V_{REF}$ , $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ |        | 4     | 17    | mV            |
| Voltage Ratio, Ref to Cathode (note 4) |            | $I_K = 10\text{mA}$ , $V_{KA} = 2.5\text{V to } 36\text{V}$                                 |        | -1.4  | -2.7  | mV/V          |
| Reference Input Current                | $I_{REF}$  | $I_K = 10\text{mA}$ , $V_{KA} = V_{REF}$                                                    |        |       | 2.3   | $\mu\text{A}$ |
|                                        |            | $I_K = 10\text{mA}$ , $V_{KA} = V_{REF}$ , $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ |        | 2     | 4     |               |
| Minimum Operating Current              | $I_{MIN}$  | $V_{KA} = V_{REF}$                                                                          |        | 0.4   | 1     | mA            |
| Off-State Cathode Current              | $I_{OFF}$  | $V_{KA} = 36\text{V}$ , $V_{REF} = 0\text{V}$                                               |        | 0.1   | 1     | $\mu\text{A}$ |
| Dynamic Impedance                      | $ Z_{KA} $ | $V_{KA} = V_{REF}$ , $I_K = 1\text{mA to } 100\text{mA}$ ,<br>$f \leq 1\text{kHz}$          |        | 0.2   | 0.5   | $\Omega$      |

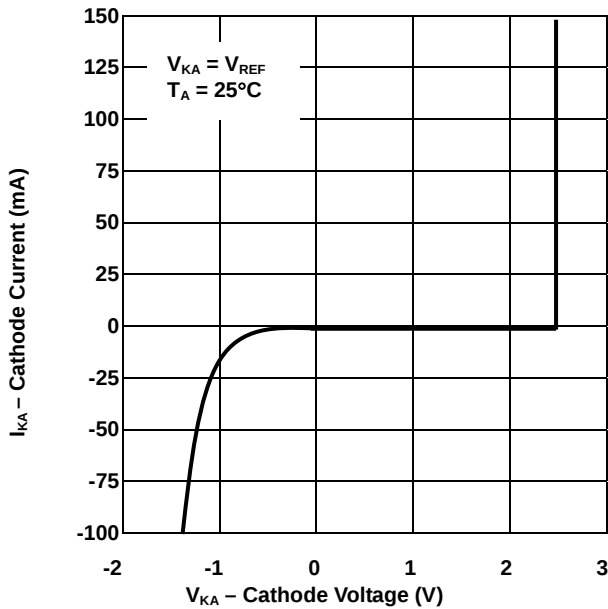
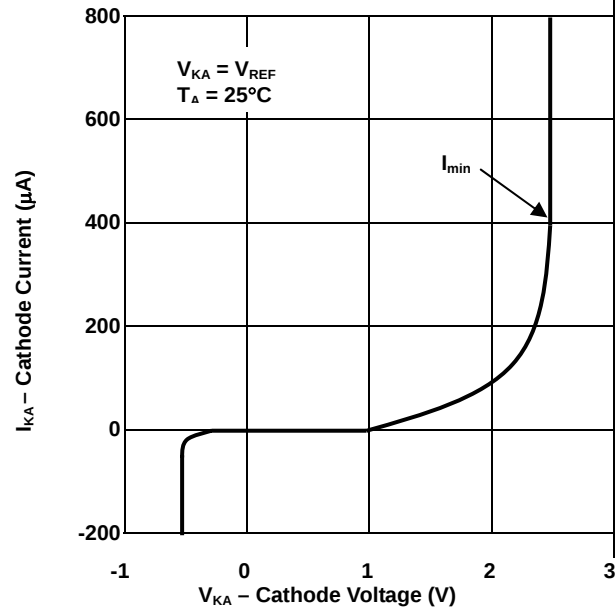
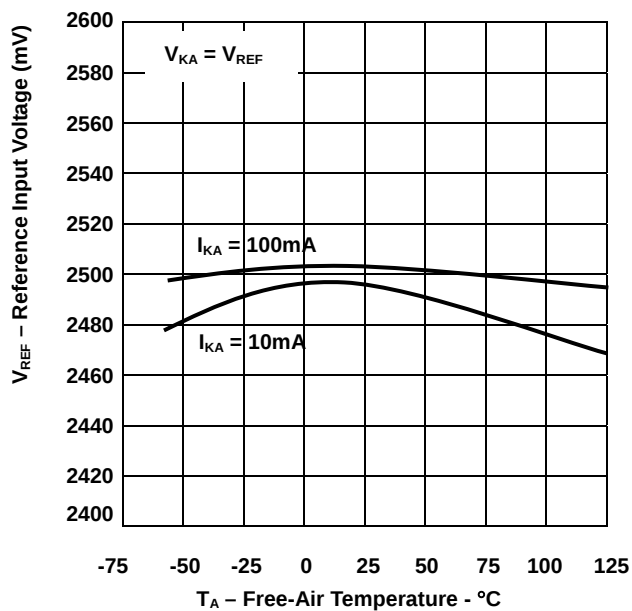
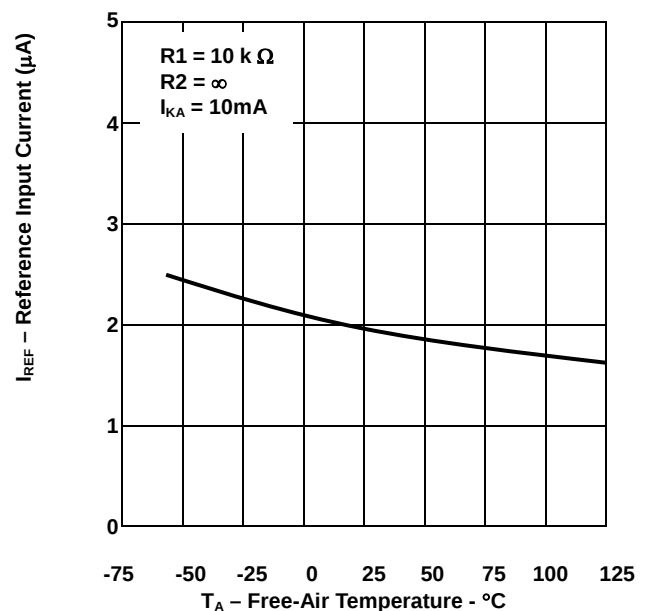
Note 1: For AMC431 only. The output accuracy is 1.0%.

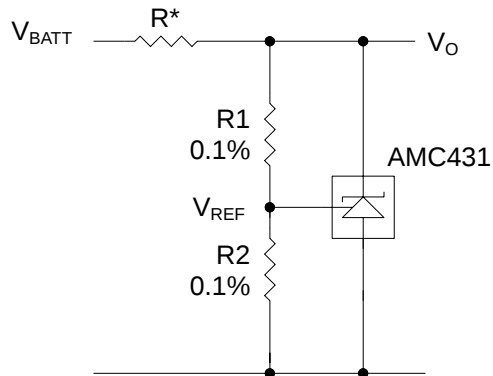
Note 2: For AMC431C only. The output accuracy is 1.5%.

Note 3: For AMC431B only. The output accuracy is 0.5%.

Note 4:  $\frac{\Delta V_{REF}}{\Delta V_{KA}}$  Ratio of change in reference input voltage to the change in cathode voltage

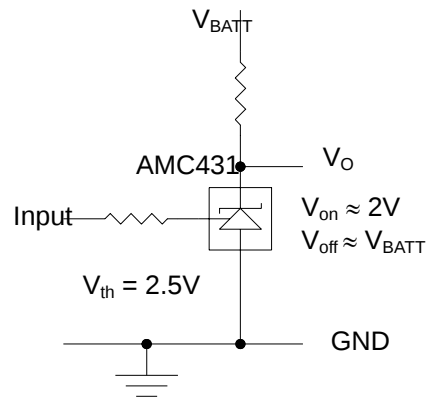
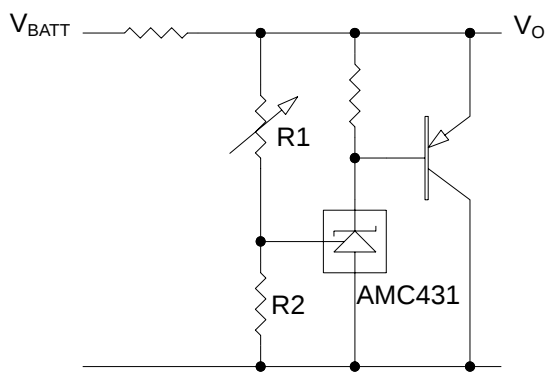
**PARAMETER MEASUREMENT INFORMATION**

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

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

**Figure 3.** Test Circuit for  $I_{OFF}$

**CHARACTERIZATION CURVES**
**CATHODE CURRENT vs CATHODE VOLTAGE**

**CATHODE CURRENT vs CATHODE VOLTAGE**

**REFERENCE INPUT VOLTAGE vs FREE-AIR TEMPERATURE**

**REFERENCE INPUT CURRENT vs FREE-AIR TEMPERATURE**


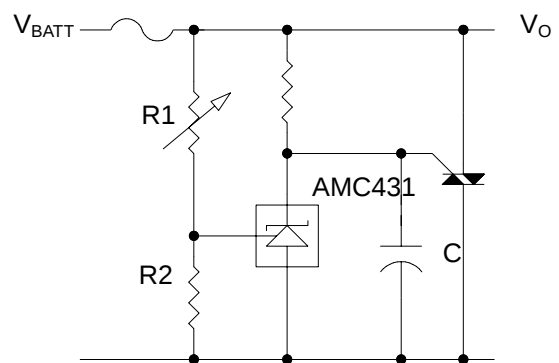
**APPLICATION INFORMATION**


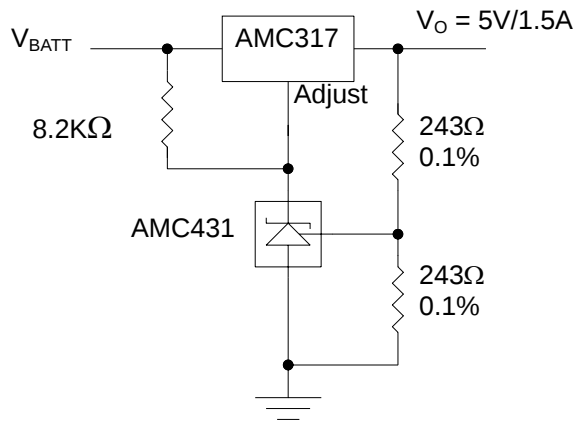
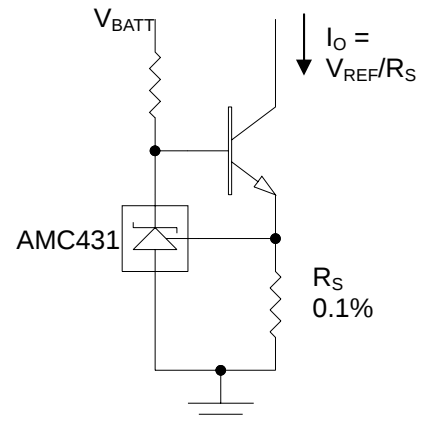
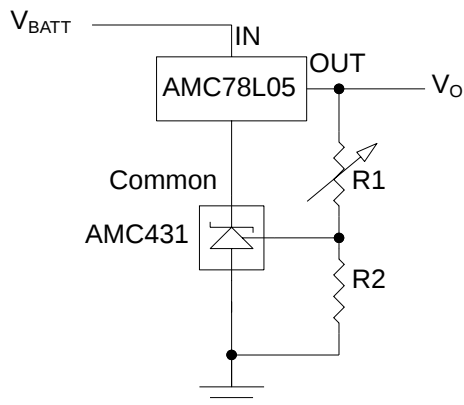
$$V_O = (1 + R1/R2) \times V_{REF}$$

Note: R should provide 1mA cathode current to the AMC431 of minimum  $V_{BATT}$

**Figure 4. Shunt Regulator**

**Figure 5. Single –Supply Comparator With Temperature compensated threshold.**


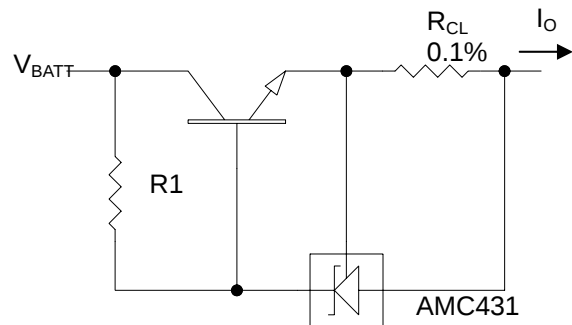
$$V_O = (1 + R1/R2) \times V_{REF}$$

**Figure 6. High-Current Shunt Regulator**

**Figure 7. Crowbar Circuit**

**APPLICATION INFORMATION (continued)**

**Figure 8. Precision 5V, 1.5A Regulator**

**Figure 9. Precision Constant Current Sink**


$$V_O = (1 + R1/R2) \times V_{REF}$$

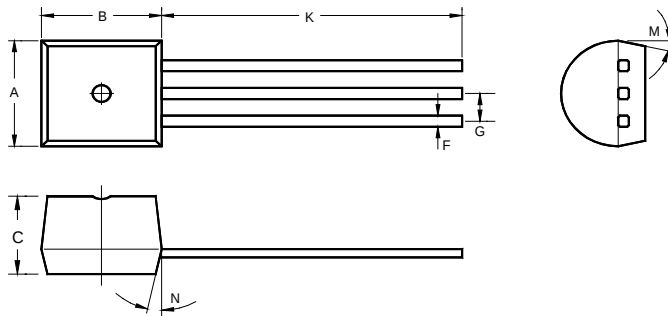
$$\text{Min } V_O = V_{REF} + 5V$$

**Figure 10. Output Control of a Three-Terminal Fixed Regulator**


$$I_{OUT} = (V_{REF}/R_{CL}) + I_{KA}$$

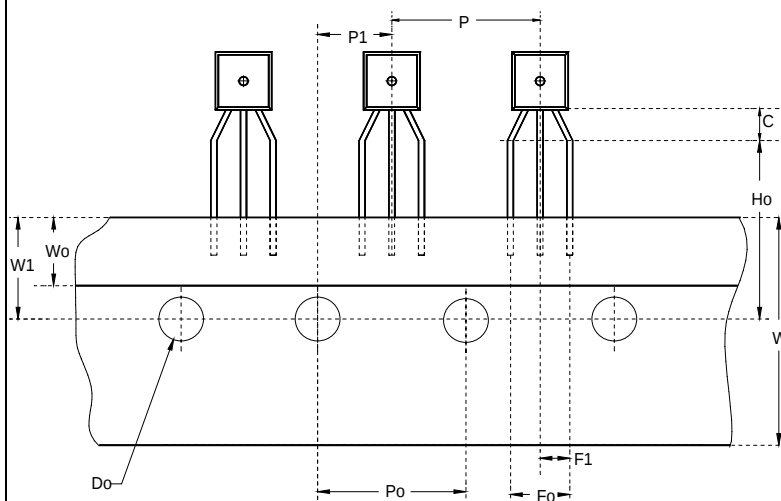
$$R1 = V_{BATT}/((I_O/h_{FE}) + I_{KA})$$

**Figure 11. Precision Current Limiter**

**PACKAGE**
**3-Pin Plastic TO-92**


|   | INCHES |       |       | MILLIMETERS |       |      |
|---|--------|-------|-------|-------------|-------|------|
|   | MIN    | TYP   | MAX   | MIN         | TYP   | MAX  |
| A | 0.175  | 0.180 | 0.205 | 4.45        | 4.57  | 5.21 |
| B | 0.170  | 0.180 | 0.210 | 4.32        | 4.57  | 5.33 |
| C | 0.125  | 0.142 | 0.165 | 3.18        | 3.62  | 4.19 |
| F | -      | 0.015 | -     | -           | 0.38  | -    |
| G | -      | 0.050 | -     | -           | 1.27  | -    |
| J | -      | 0.150 | -     | -           | 3.81  | -    |
| K | 0.500  | 0.580 | -     | 12.70       | 14.73 | -    |
| M | -      | 5°    | -     | -           | 5°    | -    |
| N | -      | 5°    | -     | -           | 5°    | -    |

Note: For TO-92 in taping, refer to TO-92 package and taping dimension data for lead dimensions.

**3-Pin Plastic TO-92 Package and Taping Dimensions**


|    | INCHES |       |       | MILLIMETERS |      |      |
|----|--------|-------|-------|-------------|------|------|
|    | MIN    | TYP   | MAX   | MIN         | TYP  | MAX  |
| C  | 0.079  | -     | -     | 2.00        | -    | -    |
| P  | 0.480  | 0.500 | 0.520 | 12.2        | 12.7 | 13.2 |
| Po | 0.488  | 0.500 | 0.512 | 12.4        | 12.7 | 13.0 |
| Do | 0.150  | 0.157 | 0.165 | 3.8         | 4.0  | 4.2  |
| P1 | 0.230  | 0.250 | 0.256 | 5.85        | 6.35 | 6.85 |
| Fo | 0.165  | 0.197 | 0.220 | 4.2         | 5.0  | 5.6  |
| W  | 0.669  | 0.709 | 0.748 | 17.0        | 18.0 | 19.0 |
| Ho | 0.610  | 0.630 | 0.649 | 15.5        | 16.0 | 16.5 |
| W0 | 0.224  | 0.236 | 0.248 | 5.7         | 6.0  | 6.3  |
| W1 | 0.335  | 0.354 | 0.374 | 8.5         | 9.0  | 9.5  |

**3-Pin Surface Mount SOT-89**

|   | INCHES    |     |       | MILLIMETERS |     |      |
|---|-----------|-----|-------|-------------|-----|------|
|   | MIN       | TYP | MAX   | MIN         | TYP | MAX  |
| A | 0.173     | -   | 0.181 | 4.39        | -   | 4.59 |
| B | 0.090     | -   | 0.102 | 2.28        | -   | 2.59 |
| C | 0.055     | -   | 0.063 | 1.39        | -   | 1.60 |
| D | 0.015     | -   | 0.017 | 0.38        | -   | 0.43 |
| E | 0.084     | -   | 0.090 | 2.13        | -   | 2.28 |
| F | 0.016     | -   | 0.019 | 0.33        | -   | 0.48 |
| G | 0.059 BSC |     |       | 1.49 BSC    |     |      |
| H | 0.118 BSC |     |       | 2.99 BSC    |     |      |
| J | 0.018     | -   | 0.022 | 0.45        | -   | 0.55 |
| K | 0.155     | -   | 0.167 | 3.94        | -   | 4.24 |
| L | 0.067     | -   | 0.072 | 1.70        | -   | 1.82 |
| M | 0°        | -   | 8°    | 0°          | -   | 8°   |
| N | 0.035     | -   | 0.047 | 0.89        | -   | 1.19 |

**Surface Mount SOT-23**

|    | INCHES     |       |       | MILLIMETERS |      |      |
|----|------------|-------|-------|-------------|------|------|
|    | MIN        | TYP   | MAX   | MIN         | TYP  | MAX  |
| A  | 0.039      | 0.043 | 0.051 | 1.00        | 1.10 | 1.30 |
| A1 | 0.000      | -     | 0.004 | 0.00        | -    | 0.10 |
| A2 | 0.028      | 0.032 | 0.035 | 0.70        | 0.80 | 0.90 |
| b  | 0.014      | 0.016 | 0.020 | 0.35        | 0.40 | 0.50 |
| C  | 0.004      | 0.005 | 0.010 | 0.10        | 0.15 | 0.25 |
| D  | 0.106      | 0.114 | 0.122 | 2.70        | 2.90 | 3.10 |
| E  | 0.055      | 0.063 | 0.071 | 1.40        | 1.60 | 1.80 |
| e  | 0.075 TYP. |       |       | 1.90 TYP.   |      |      |
| H  | 0.102      | 0.110 | 0.118 | 2.60        | 2.80 | 3.00 |
| L  | 0.015      | -     | -     | 0.37        | -    | -    |
| M  | 1°         | 5°    | 9°    | 1°          | 5°   | 9°   |
|    |            |       |       |             |      |      |

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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



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