



## AMC431

### PRECISION ADJUSTABLE SHUNT VOLTAGE REFERENCE

#### 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.

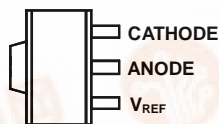
#### APPLICATIONS

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

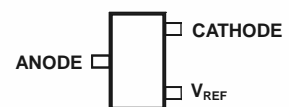
#### PACKAGE PIN OUT



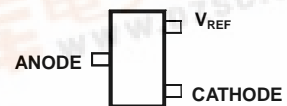
3-Pin Plastic TO-92  
(Top View)



3-Pin Plastic SOT-89  
Surface Mount  
(Top View)



3-Pin Plastic SOT-23  
Surface Mount  
(Top View) (Note 1)



3-Pin Plastic SOT-23  
Surface Mount  
(Top View) (Note 2)

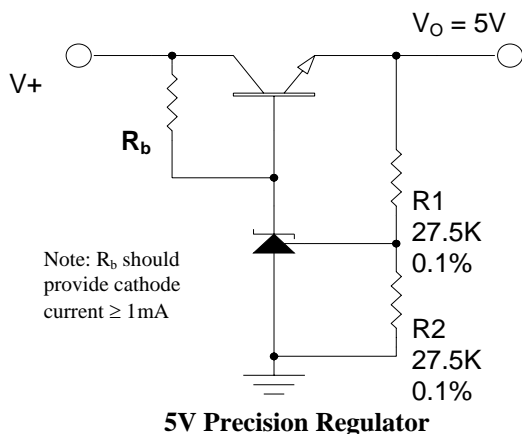
#### ORDER INFORMATION

$T_A$ ( $^{\circ}$ C)	Initial Tolerance	LP	TO-92 3-pin	PK	SOT-89 3-pin	DB	SOT-23 3-pin	DB	SOT-23 3-pin
0 to 70	1.5%	AMC431CLP	--	--	--	--	--	--	--
	1.5%	AMC431CLPF(Lead Free)	--	--	--	--	--	--	--
	1%	AMC431LP	AMC431PK	AMC431IDB	AMC431RDB				
	1%	AMC431LPF(Lead Free)	AMC431PKF(Lead Free)	AMC431IDBF(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)				

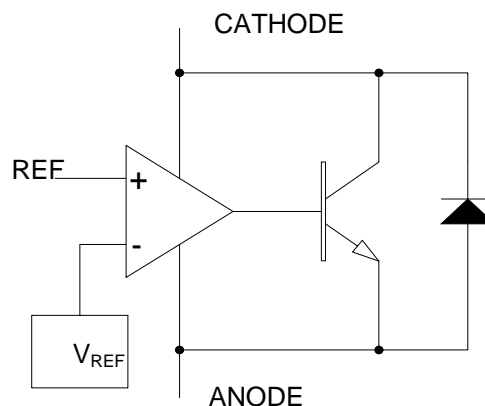
Note: 1. For AMC431RDB and AMC431BRDB.  
 2. For AMC431IDB and AMC431IDBF.  
 3. For surface-mount and TO-92 packages in Tape & Reel, add suffix "T" (e.g., AMC431LPT, AMC431IDBT).  
 4. For TO-92 in Tape & Box (without reel), add suffix "TB" (e.g., AMC431LPTB).  
 5. DB package is only available in Tape & 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	$\theta_{JA}$ (°C/W)	Derating factor $D_F$ (mW/°C) $T_A \geq 25^\circ\text{C}$	$T_A \leq 25^\circ\text{C}$ Power rating(mW)	$T_A = 70^\circ\text{C}$ Power rating(mW)	$T_A = 85^\circ\text{C}$ 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  $T_A = 25^\circ\text{C}$ .

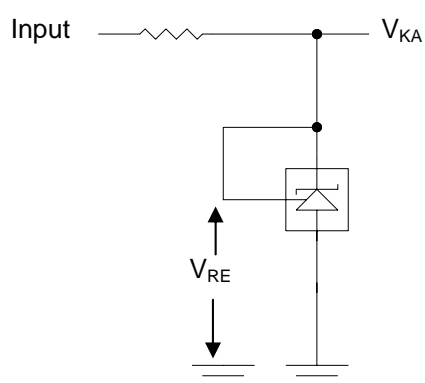
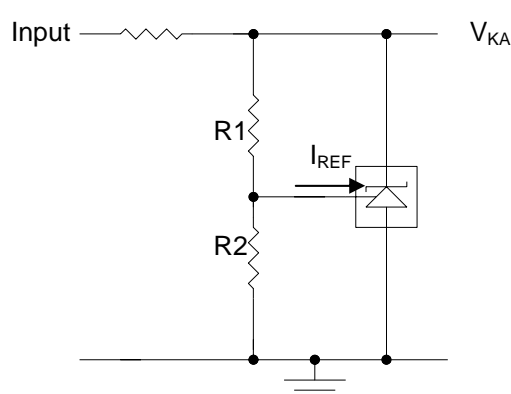
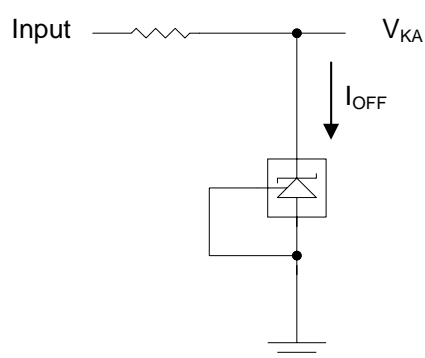
Parameter	Symbol	Test Conditions	AMC431			Units
			Min	Typ	Max	
Reference Input Voltage	$V_{REF}$	$I_K = 10\text{mA}$ , $V_{KA} = V_{REF}$ , note 1	2.475	2.500	2.525	V
Reference Input Voltage	$V_{REF}$	$I_K = 10\text{mA}$ , $V_{KA} = V_{REF}$ , note 2	2.462	2.500	2.538	V
Reference Input Voltage	$V_{REF}$	$I_K = 10\text{mA}$ , $V_{KA} = V_{REF}$ , 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 $100\text{mA}$ , $f \leq 1\text{kHz}$		0.2	0.5	$\Omega$

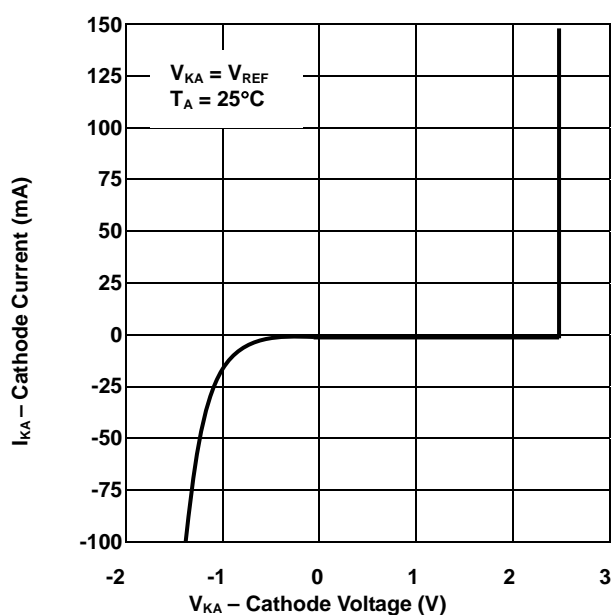
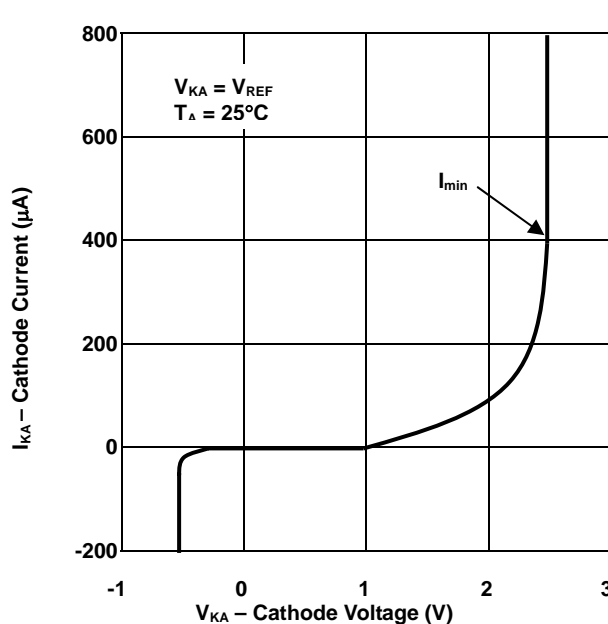
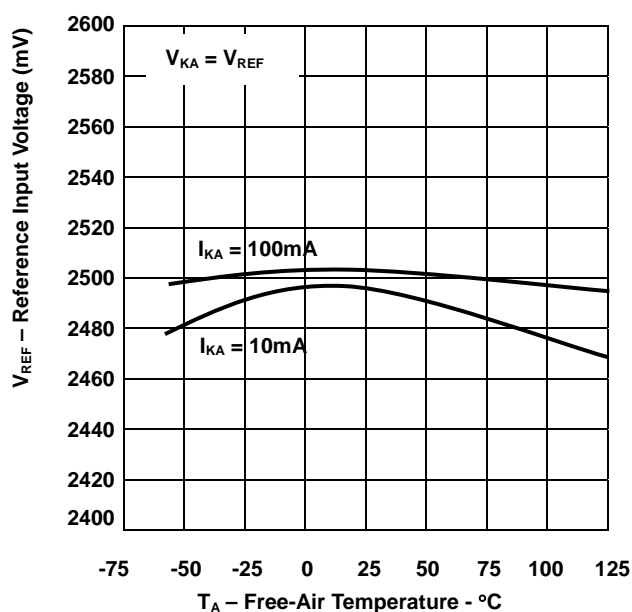
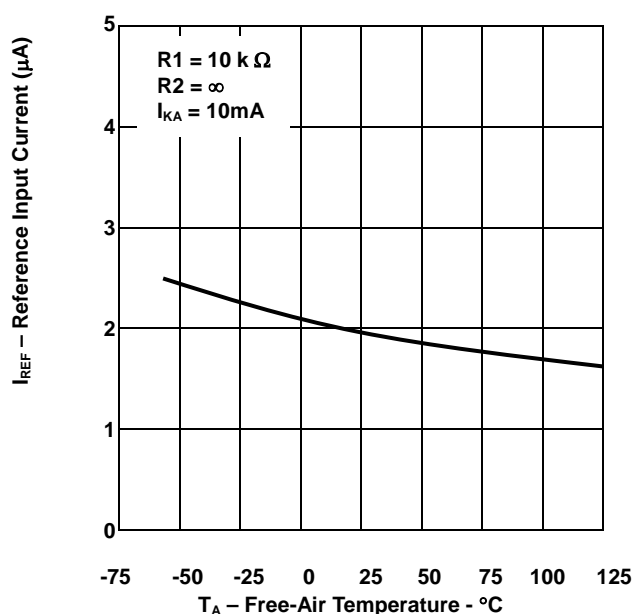
Note 1: For AMC431 only. The output accuracy is 1.0%.

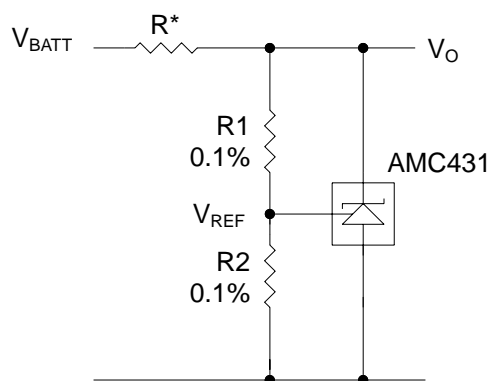
Note 2: For AMC431C only. The output accuracy is 1.5%.

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

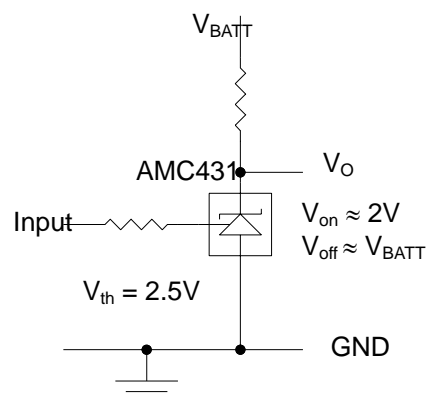
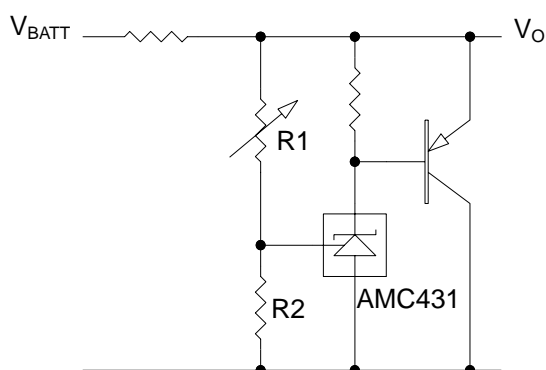
**PARAMETER MEASUREMENT INFORMATION**

**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**


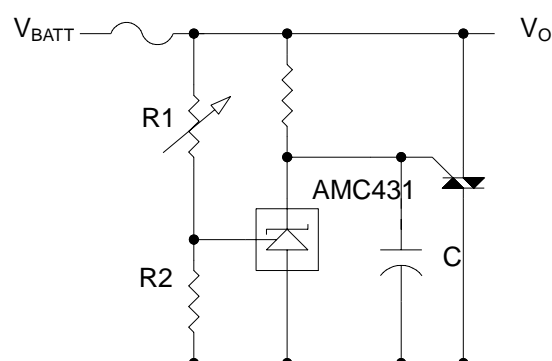
**APPLICATION INFORMATION**


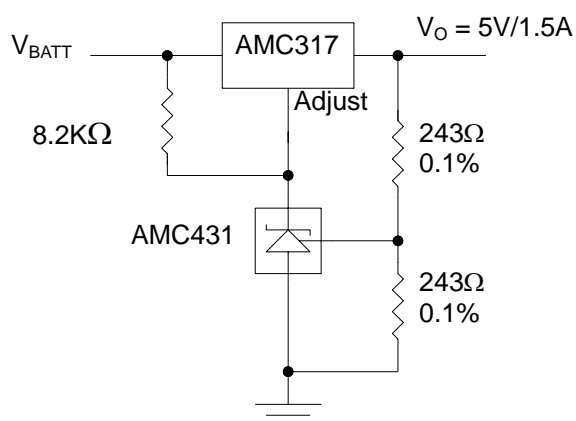
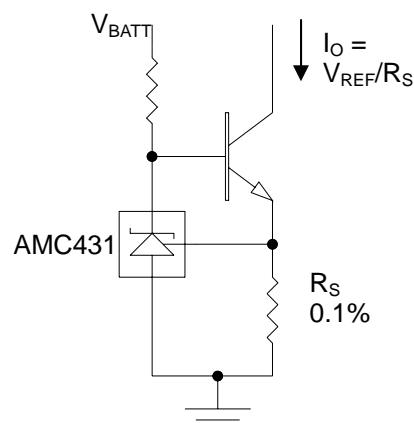
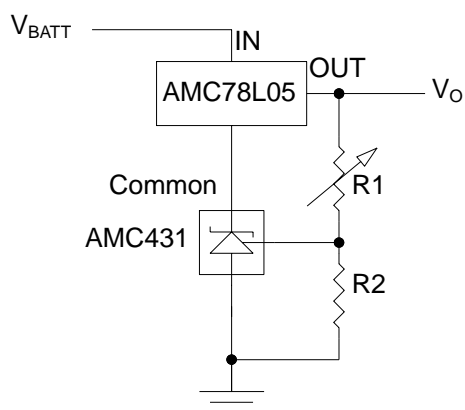
$$V_O = (1 + R1/R2) \times V_{REF}$$

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.**


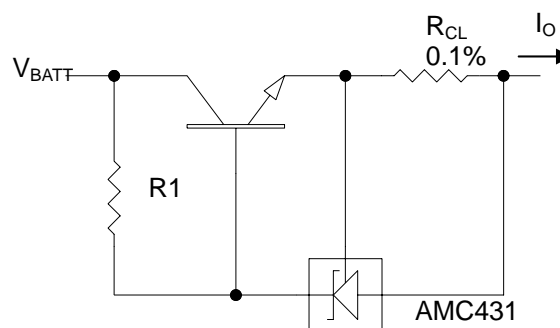
$$V_O = (1 + R1/R2) \times V_{REF}$$

**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**


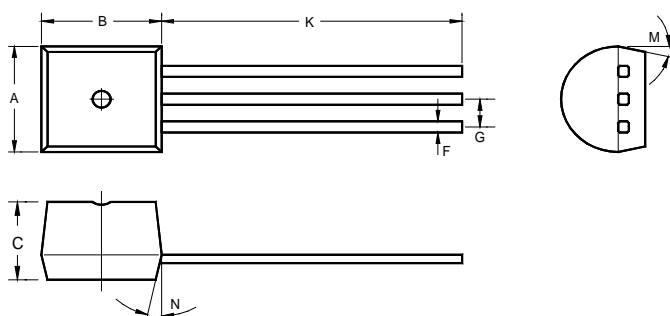
$$I_{OUT} = (V_{REF}/R_{CL}) + I_{KA}$$

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

**Figure 11. Precision Current Limiter**

## PACKAGE

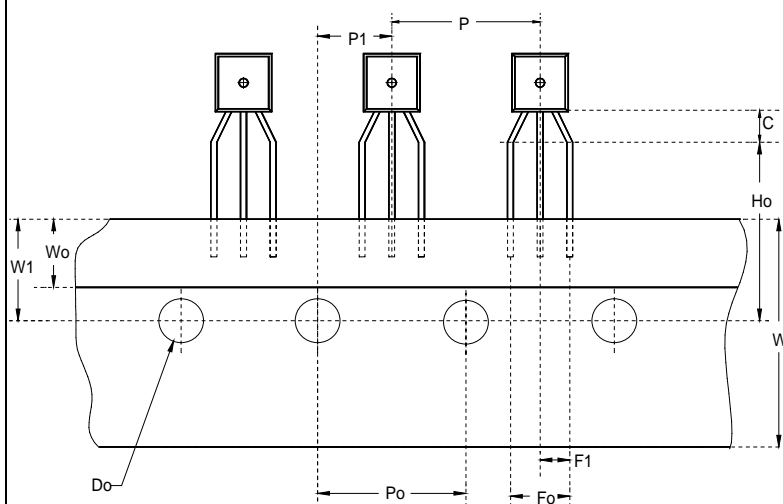
### 3-Pin Plastic TO-92



	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°	-

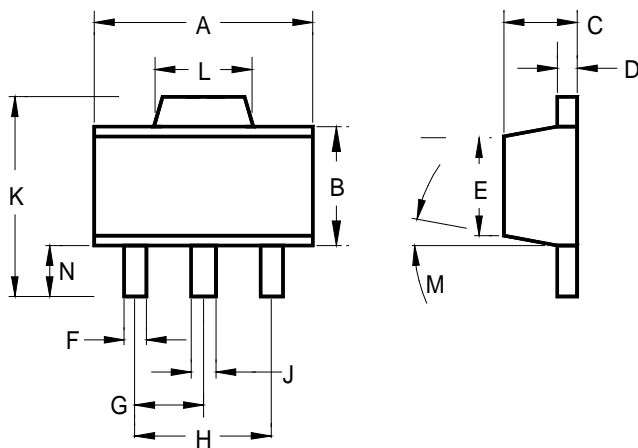
Note: For TO-92 in taping, refer to TO-92 package and taping dimension data for lead dimensions.

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

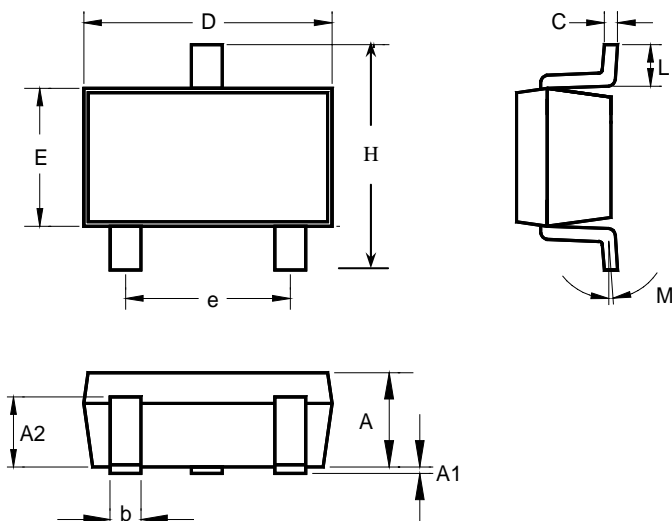


	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
C	0.079	-	-	2.00	-	-
P	0.480	0.500	0.520	12.2	12.7	13.2
Po	0.488	0.500	0.512	12.4	12.7	13.0
Do	0.150	0.157	0.165	3.8	4.0	4.2
P1	0.230	0.250	0.256	5.85	6.35	6.85
Fo	0.165	0.197	0.220	4.2	5.0	5.6
W	0.669	0.709	0.748	17.0	18.0	19.0
Ho	0.610	0.630	0.649	15.5	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°

### **IMPORTANT NOTICE**

ADDtek reserves the right to make changes to its products or to discontinue any integrated circuit product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

A few applications using integrated circuit products may involve potential risks of death, personal injury, or severe property or environmental damage. ADDtek integrated circuit products are not designed, intended, authorized, or warranted to be suitable for use in life-support applications, devices or systems or other critical applications. Use of ADDtek products in such applications is understood to be fully at the risk of the customer. In order to minimize risks associated with the customer's applications, the customer should provide adequate design and operating safeguards.

ADDtek assumes no liability to customer product design or application support. ADDtek warrants the performance of its products to the specifications applicable at the time of sale.

---

**ADDtek Corp.**

9F, No. 20, Sec. 3, Bade Rd., Taipei, Taiwan, 105

TEL: 2-25700299

FAX: 2-25700196

---