

### 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.

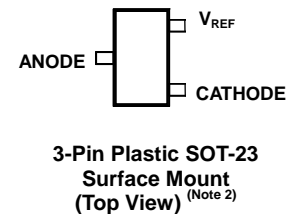
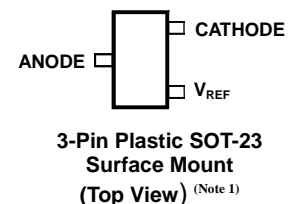
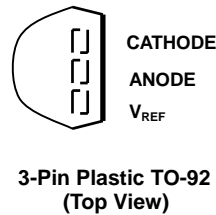
### FEATURES

- Initial voltage reference accuracy of 0.5%, and 1.0%.
- 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-TO-92 and surface mount 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

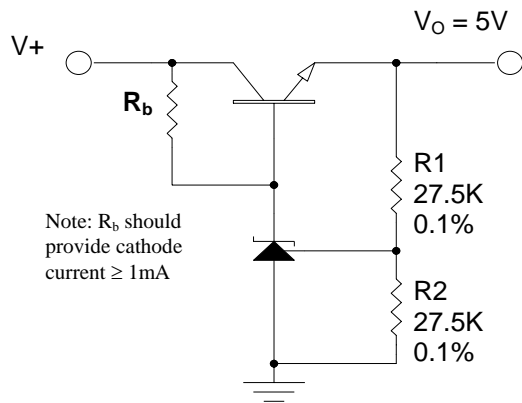
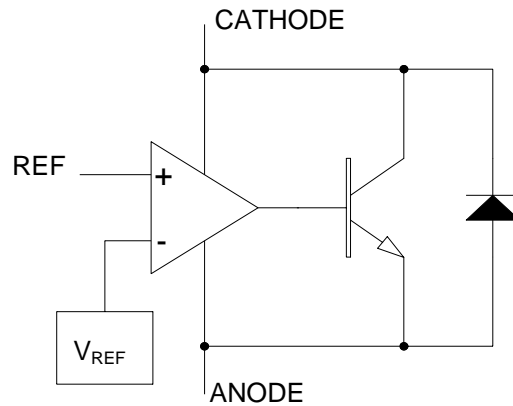
### PACKAGE PIN OUT



### ORDER INFORMATION

$T_A$ ( $^{\circ}$ C)	Tolerance	LP	TO-92	DB	SOT-23	DB	SOT-23
			3-pin		3-pin		3-pin
0 to 70	1%	AMC431LPF (Lead Free)		AMC431DBF (Lead Free)		AMC431RDBF (Lead Free)	
	0.5%	AMC431BLPF (Lead Free)		AMC431BDBF (Lead Free)		AMC431BRDBF (Lead Free)	
		-		-		AMC431BRDBG (Green)	

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., AMC431LPFT, AMC431DBFT).  
 4. For TO-92 in Tape & Box (without reel), add suffix "TB" (e.g., AMC431LPFTB).  
 5. DB package is only available in Tape & Reel.  
 6. The letter "F" is marked for Lead Free process, and "G" is for Green process.

**TYPICAL APPLICATION**

**5V Precision Regulator**
**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
DB	285	3.5	438	280	228

Note :  $\theta_{JA}$  = Thermal Resistance from 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**

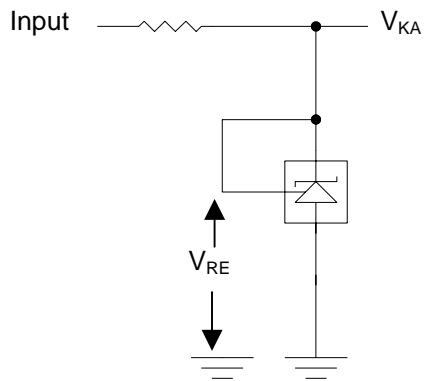
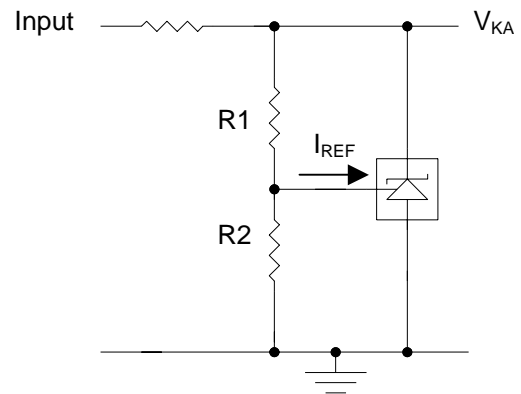
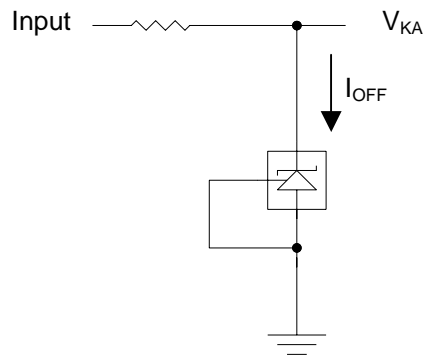
Unless otherwise specified, these specifications apply over the operating ambient temperatures with  $T_A = 25^\circ\text{C}$ .

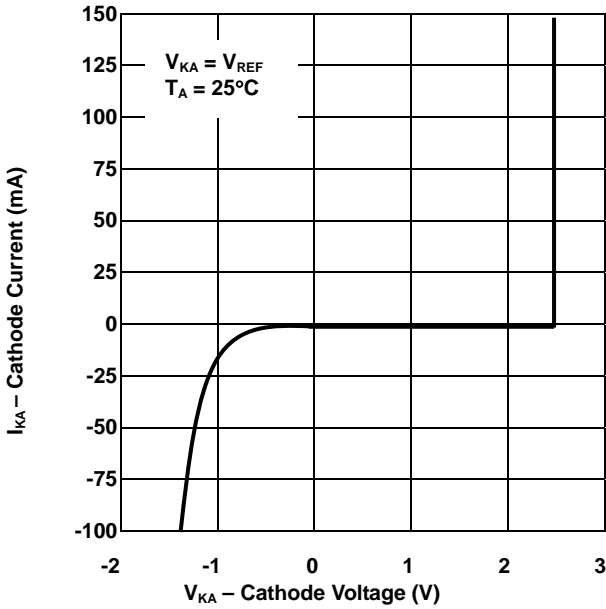
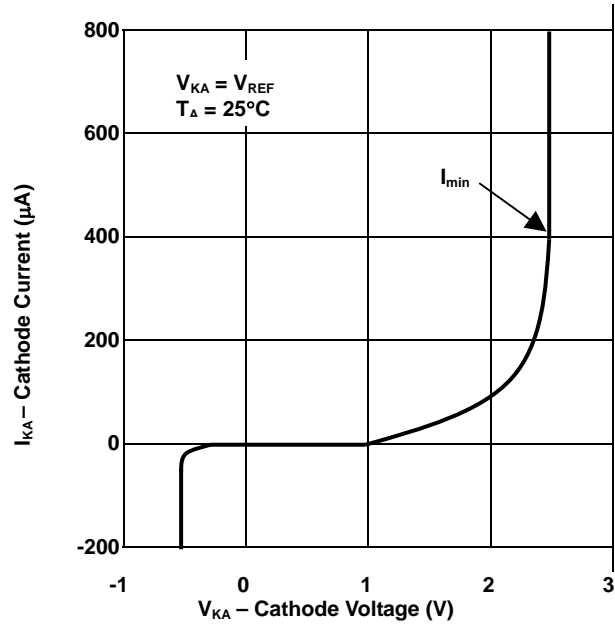
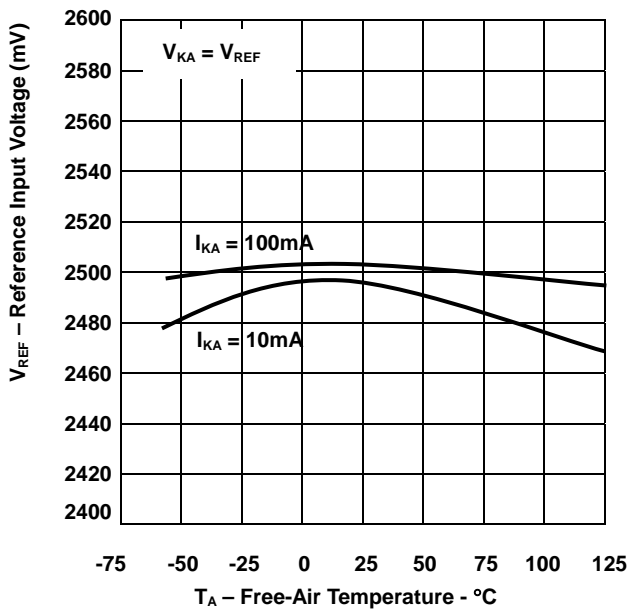
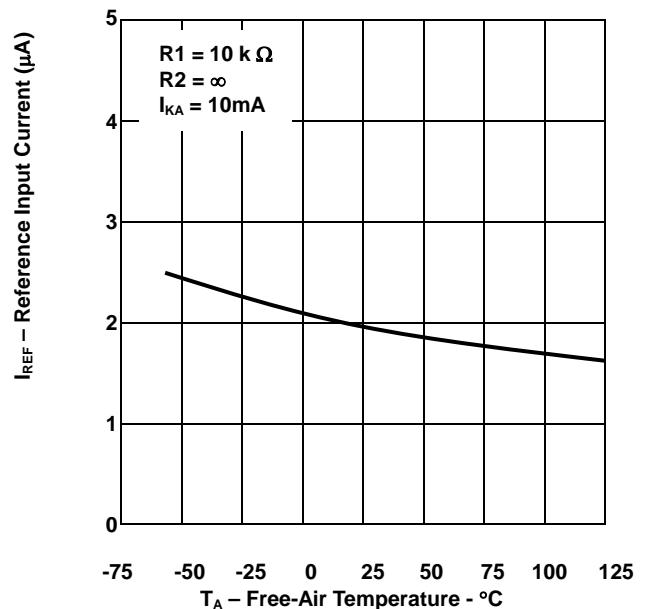
Parameter	Symbol	Test Conditions	AMC431			Units
			Min	Typ	Max	
Reference Input Voltage	$V_{REF}$	$I_K = 10\text{mA}, V_{KA} = V_{REF}$ *Note 1	2.475	2.500	2.525	V
	$V_{REF}$	$I_K = 10\text{mA}, V_{KA} = V_{REF}$ *Note 2	2.487	2.500	2.513	V
Reference Drift		$I_K = 10\text{mA}, V_{KA} = V_{REF}, 0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$		4	17	mV
Voltage Ratio, Ref to Cathode *Note 3		$I_K = 10\text{mA}, V_{KA} = 2.5\text{V to } 36\text{V}$		-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	$\Omega$

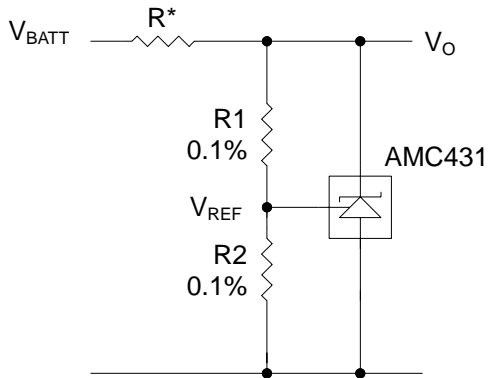
Note 1: For AMC431 only. The output accuracy is 1.0%.

Note 2: For AMC431B only. The output accuracy is 0.5%.

Note 3:  $\frac{\Delta V_{REF}}{\Delta V_{KA}}$  Ratio of change in reference input voltage to the change in cathode voltage

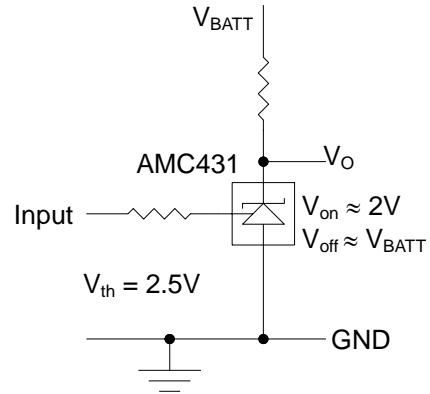
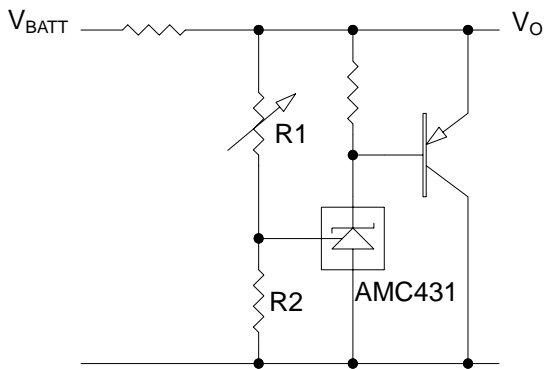
**PARAMETER MEASUREMENT INFORMATION**

**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**


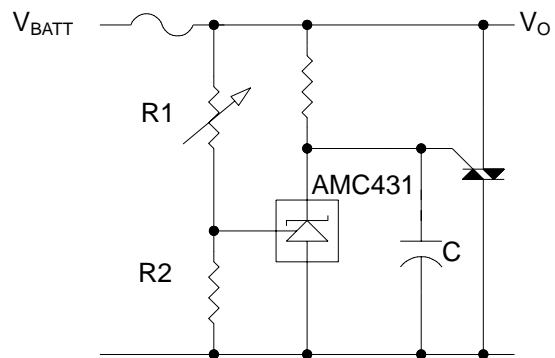
**APPLICATION INFORMATION**


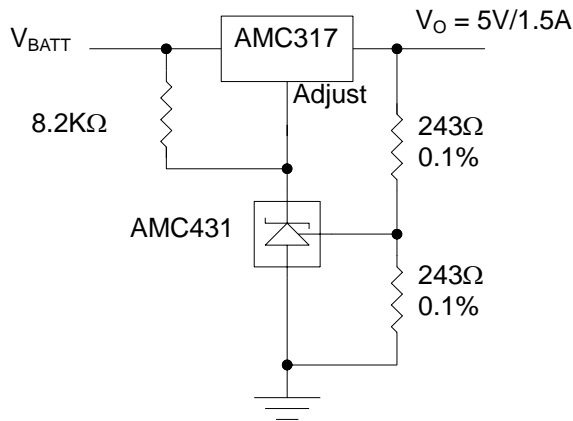
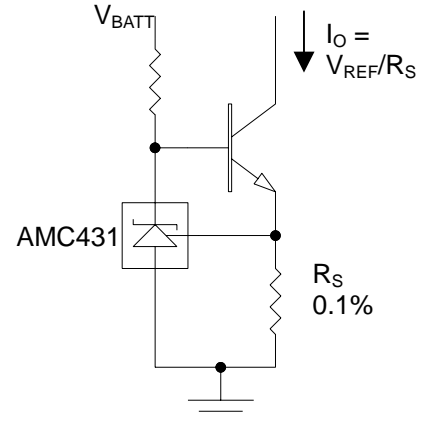
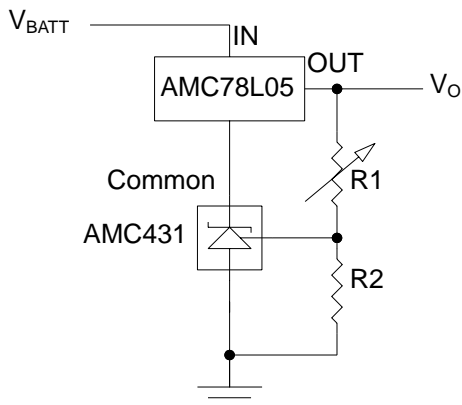
$$V_O = (1 + R1/R2) \times V_{REF}$$

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.**


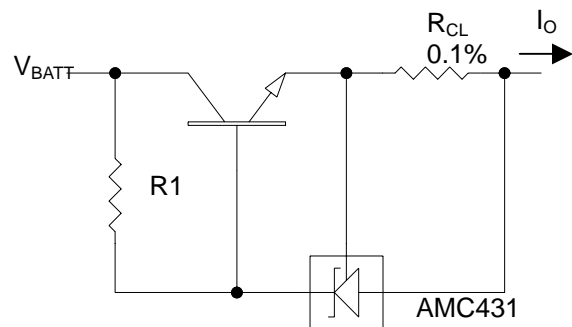
$$V_O = (1 + R1/R2) \times V_{REF}$$

**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**


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

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

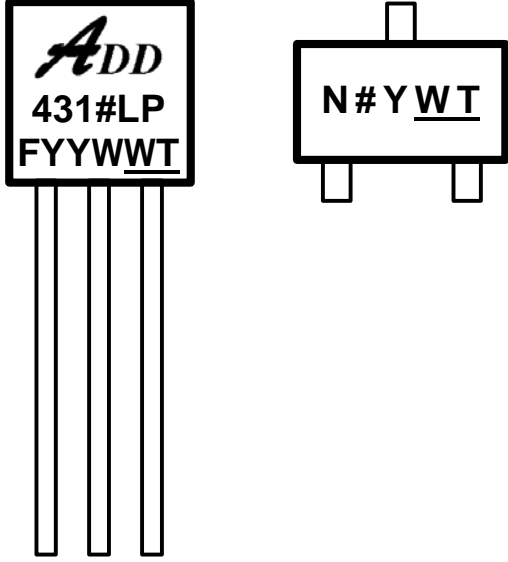
**Figure 10. Output Control of a Three-Terminal Fixed Regulator**


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

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

**Figure 11. Precision Current Limiter**

**PACKAGE**
**Top Marking**



**N : Code for AMC431**

**# : Voltage Accuracy Options**

For TO-92 :

N/A = 1% (AMC431LPF);  
 B = 0.5% (AMC431BLPF);

For SOT-23:

A = 1% (AMC431DBF);  
 B = 0.5% (AMC431BDBF);  
A = 1% (AMC431RDBF);  
B = 0.5% (AMC431BRDBF);

**Y : Year Code**

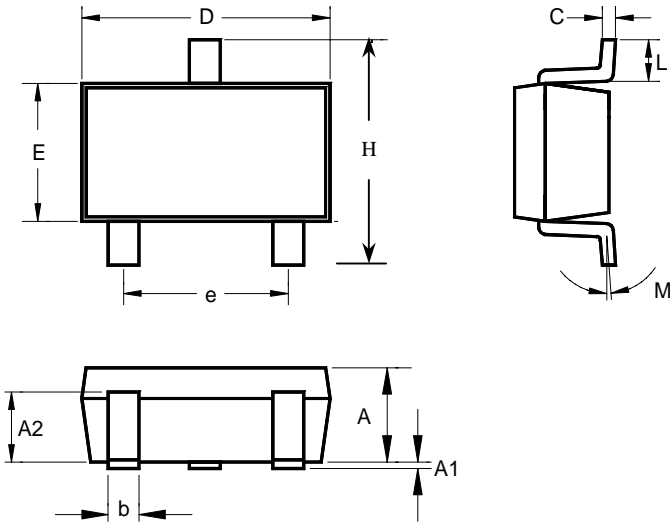
**W : Week Code**

**T : Trace Code**

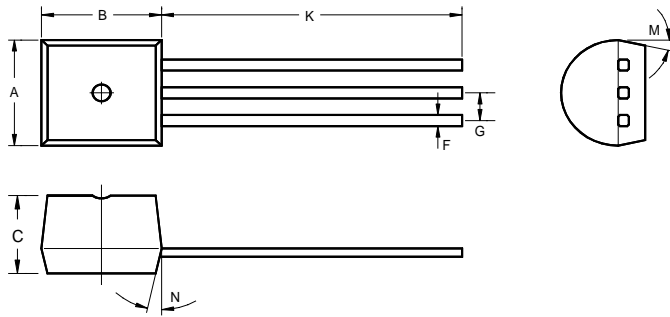
**WT (With Underline) : Green Process**

**WT (Without Underline) : Lead Free Process**

**Surface Mount SOT-23**

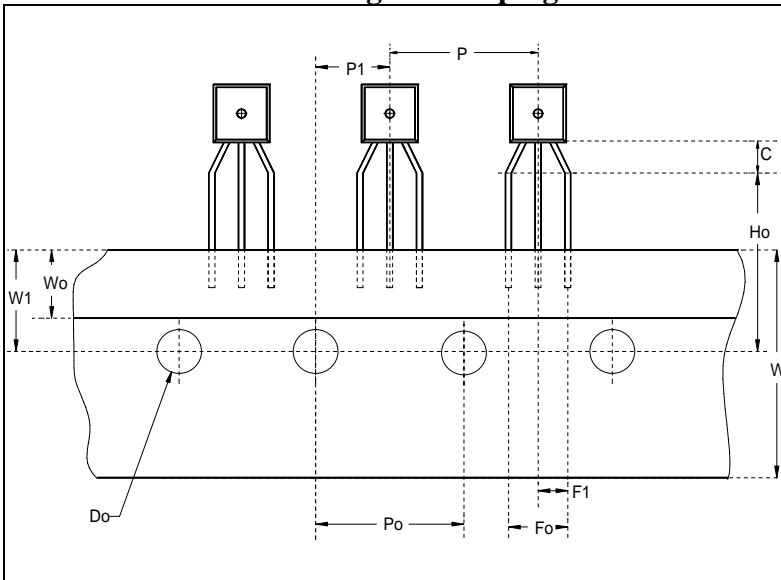


	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	0.039	0.043	0.051	1.00	1.10	1.30
A1	0.000	-	0.004	0.00	-	0.10
A2	0.028	0.032	0.035	0.70	0.80	0.90
b	0.014	0.016	0.020	0.35	0.40	0.50
C	0.004	0.005	0.010	0.10	0.15	0.25
D	0.106	0.114	0.122	2.70	2.90	3.10
E	0.055	0.063	0.071	1.40	1.60	1.80
e	0.075 TYP.			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°

**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

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