

AMC Doc. #: AMC431_C
November 2002



AMC431

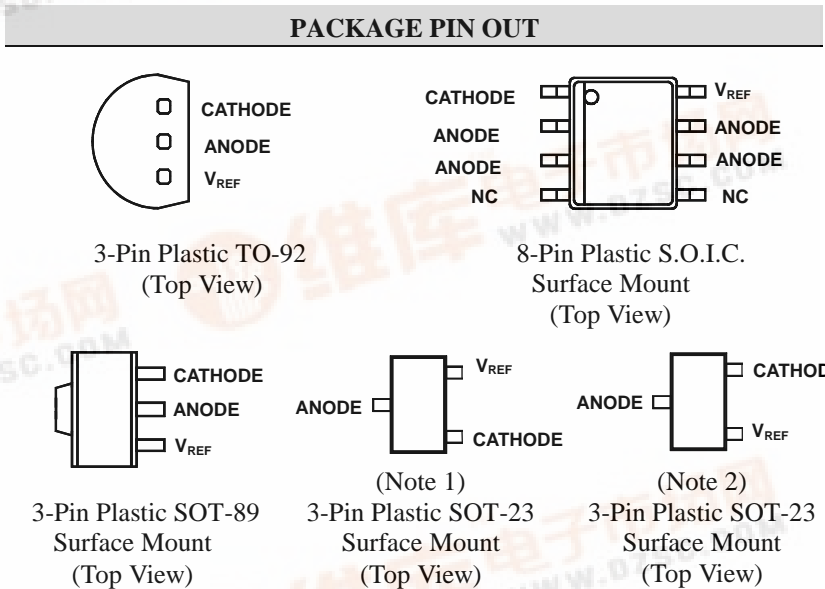
PRECISION ADJUSTABLE SHUNT VOLTAGE REFERENCE

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 200mΩ. 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 200mΩ**;
 - Adjustable output voltage from V_{REF} to 36V
 - Available in 3L-TO92 and surface mount SOT89, SOT23 and 8 pin S.O.I.C. packages
 - Low output noise
 - Typical equivalent full range temperature coefficient of 30ppm/°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



ORDER INFORMATION

T_A (°C)	Initial Tolerance	DM	SOIC	LP	TO-92	PK	SOT-89	DB	SOT-23	DB	SOT-23
		8-pin	8-pin	3-pin	3-pin	3-pin	3-pin	3-pin	3-pin	3-pin	
0 to 70	1.5%	--	--	AMC431CLP	--	--	--	--	--	--	--
	1%	AMC431DM	AMC431DM	AMC431LP	AMC431PK	AMC431PK	AMC431DB	AMC431DB	AMC431RDB	AMC431RDB	AMC431RDB
	0.5%	--	--	AMC431BLP	AMC431BPB	AMC431BPB	AMC431BDB	AMC431BDB	AMC431BRDB	AMC431BRDB	AMC431BRDB

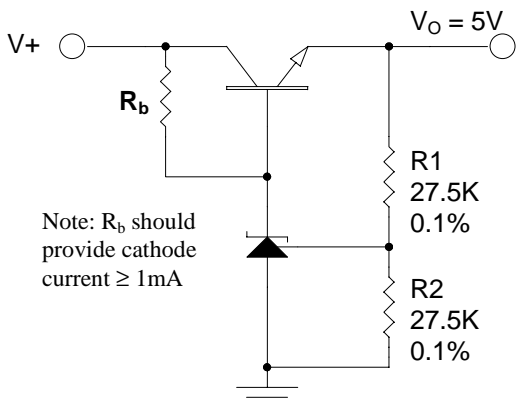
- Note: 1. For AMC431DB and AMC431BDB.
 2. For AMC431RDB and AMC431BRDB.
 3. For surface-mount and TO-92 packages in Tape & Reel, add suffix "T" (e.g., AMC431LPT, AMC431DBT).
 4. For TO-92 in Tape & Box (without reel), add suffix "TB" (e.g., AMC431LPTB).
 5. DB package is only available in Tape & Reel.



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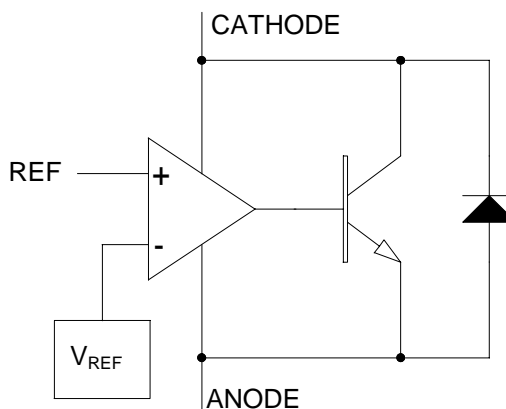
PRECISION ADJUSTABLE SHUNT VOLTAGE REGULATORS

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	θ_{JA} (°C/W)	Derating factor D_F (mW/°C) $T_A \geq 25^\circ\text{C}$	$T_A \leq 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$	$T_A = 85^\circ\text{C}$
			Power rating(mW)	Power rating(mW)	Power rating (mW)
DM	165	6.06	757	485	394
LP	156	6.41	801	513	417
PK	71(note)	14.1	1763	1128	916
DB	285	3.5	438	280	228

Note :

- For PK package, Thermal Resistance-Junction to Tab (θ_{JT}) = 35°C/W. $T_J = T_{TAB} + (P_D \times \theta_{JT})$.
 P_D : Power Dissipation.
- θ_{JA} : Thermal Resistance-Junction to Ambient, $D_F = 1/\theta_{JA}$
Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$.
The θ_{JA} numbers are guidelines for the thermal performance of the device/PC-board system.
All of the above assume no ambient airflow.

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PRECISION ADJUSTABLE SHUNT VOLTAGE REGULATORS

RECOMMENDED OPERATING CONDITIONS	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	μA
		$I_K = 10\text{mA}, V_{KA} = V_{REF}, 0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$		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	μA
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	Ω
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

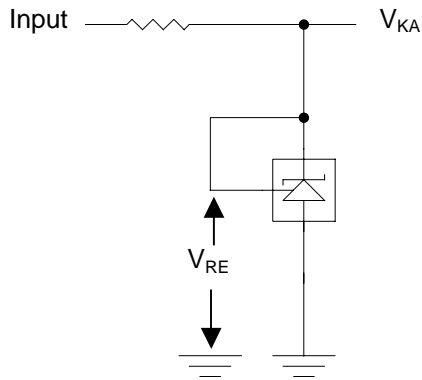


Figure 1. Test Circuit for $V_{KA} = V_{REF}$

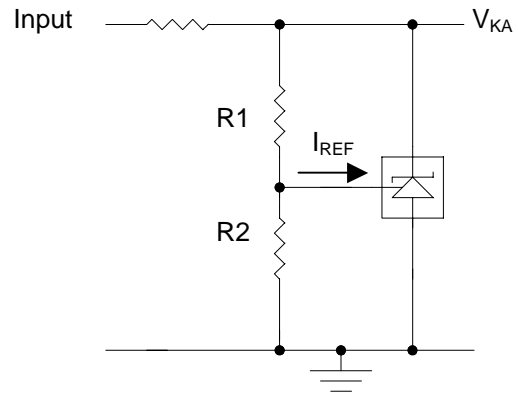


Figure 2. Test Circuit for $V_{KA} > V_{REF}$

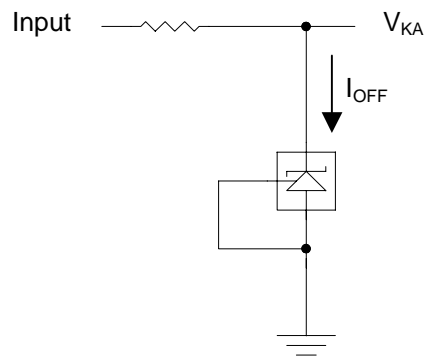
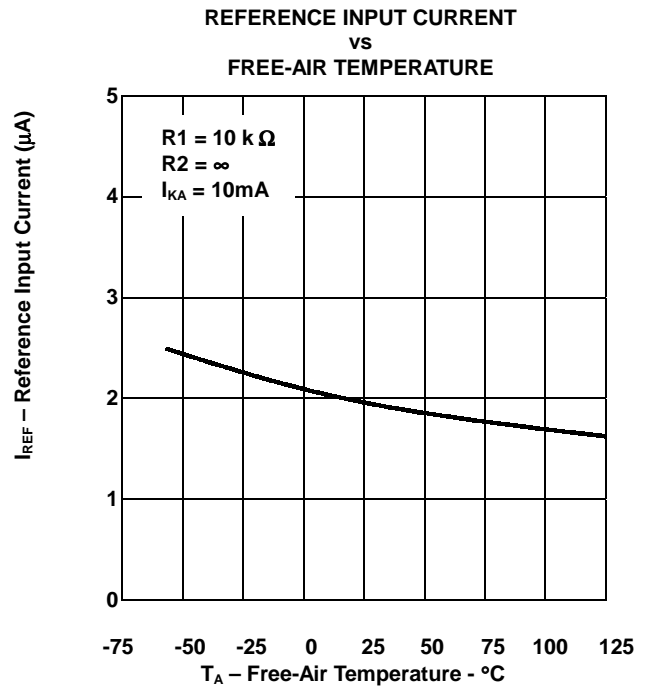
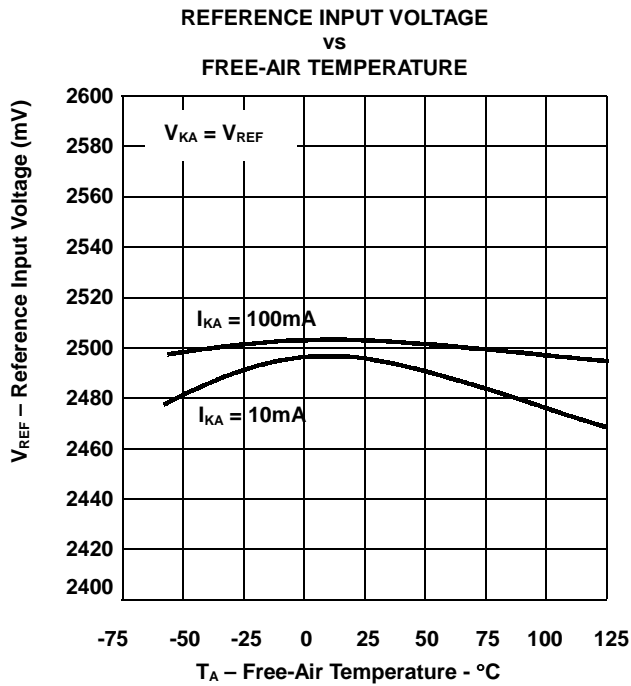
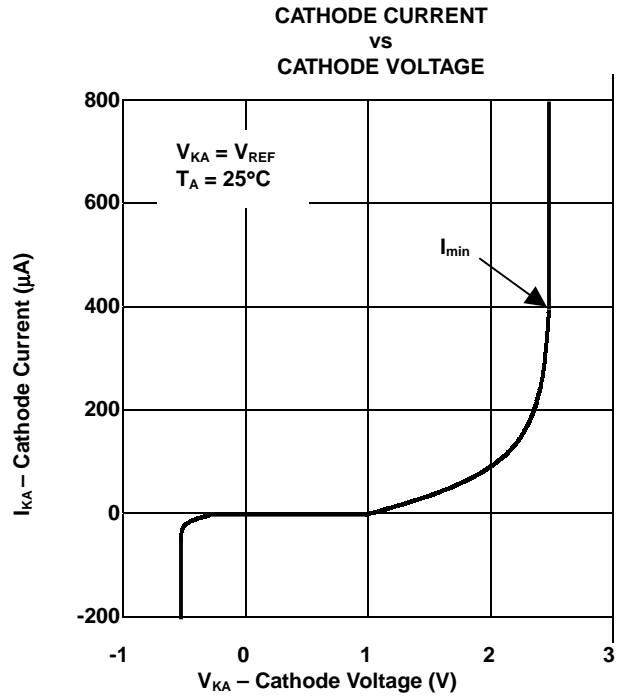
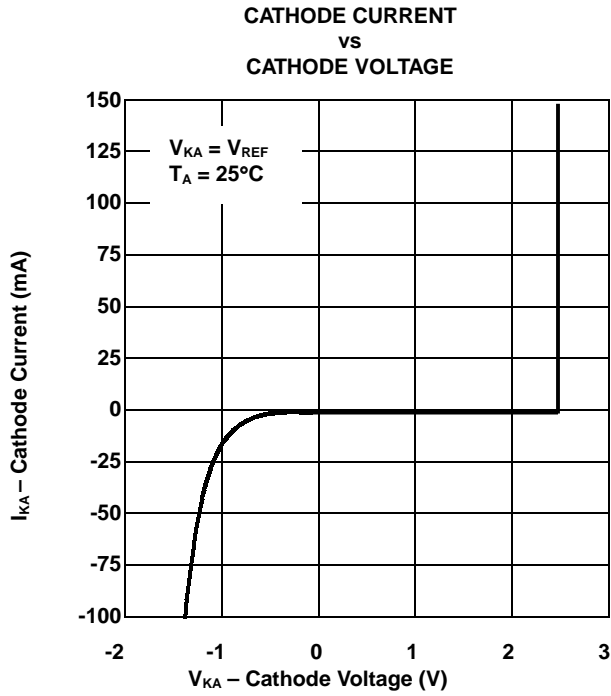
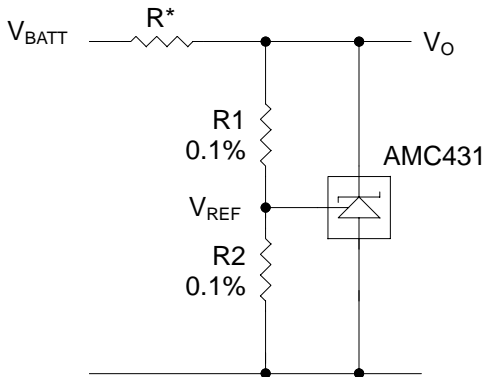


Figure 3. Test Circuit for I_{OFF}

CHARACTERIZATION CURVES



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

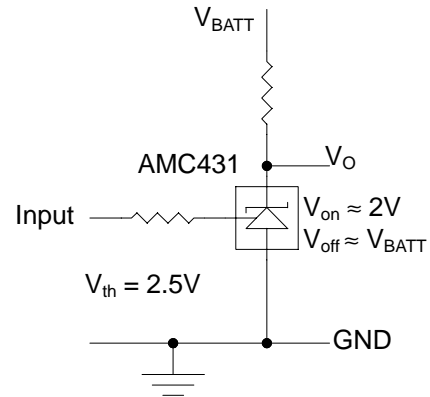
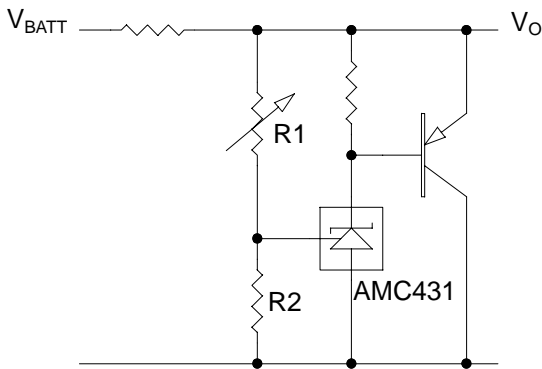


Figure 5. Single-Supply Comparator With Temperature compensated threshold.



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

Figure 6. High-Current Shunt Regulator

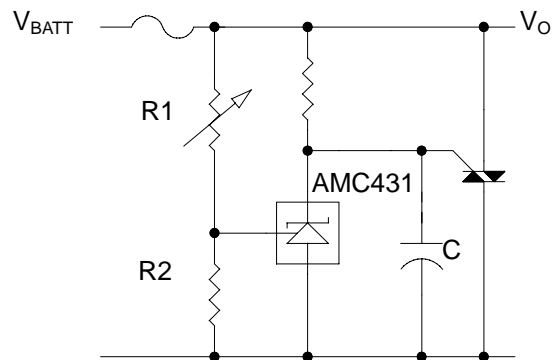


Figure 7. Crowbar Circuit

APPLICATION INFORMATION (continued)

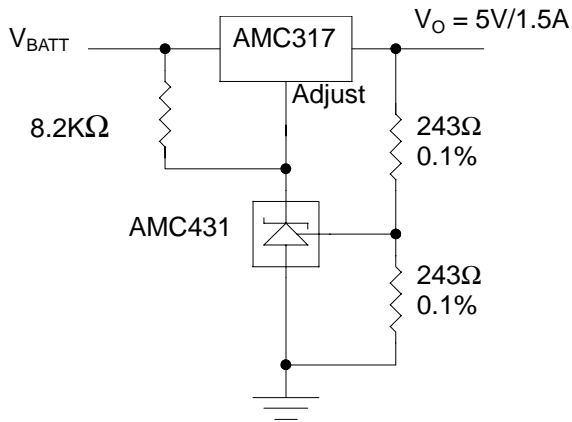


Figure 8. Precision 5V, 1.5A Regulator

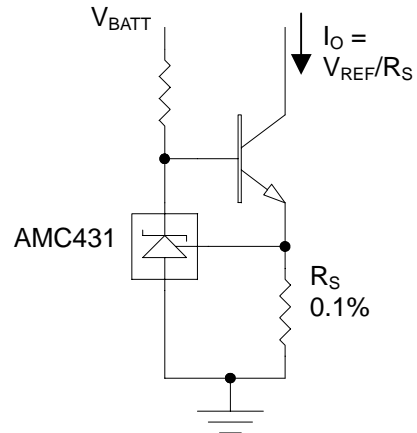
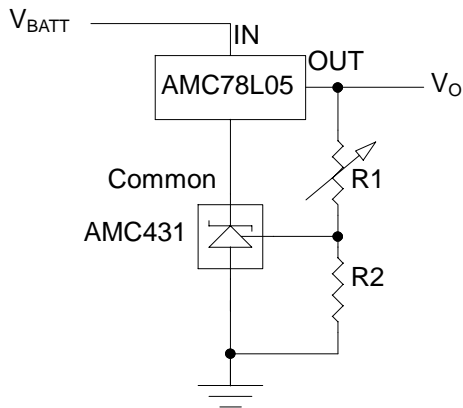


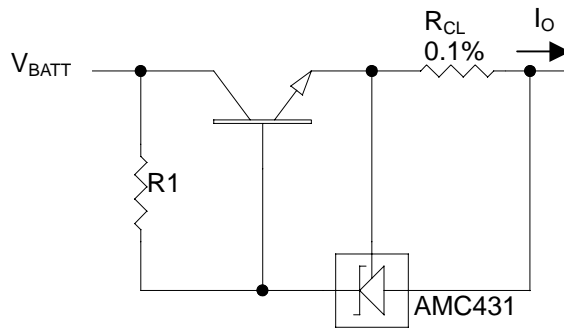
Figure 9. Precision Constant Current Sink



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

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

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

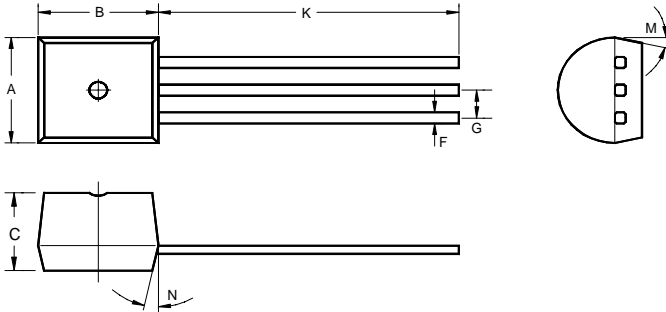


$$I_{OUT} = (V_{REF}/R_{CL}) + I_{KA}$$

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

Figure 11. Precision Current Limiter

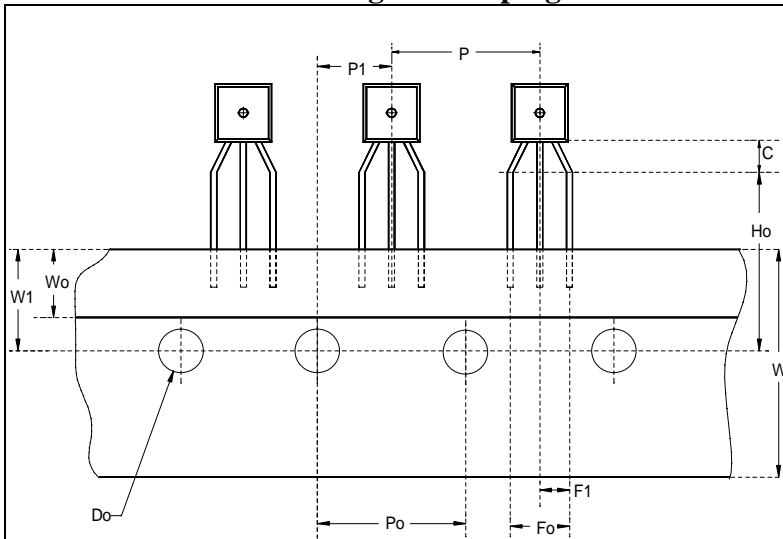
3-Pin Plastic TO-92



	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°	-

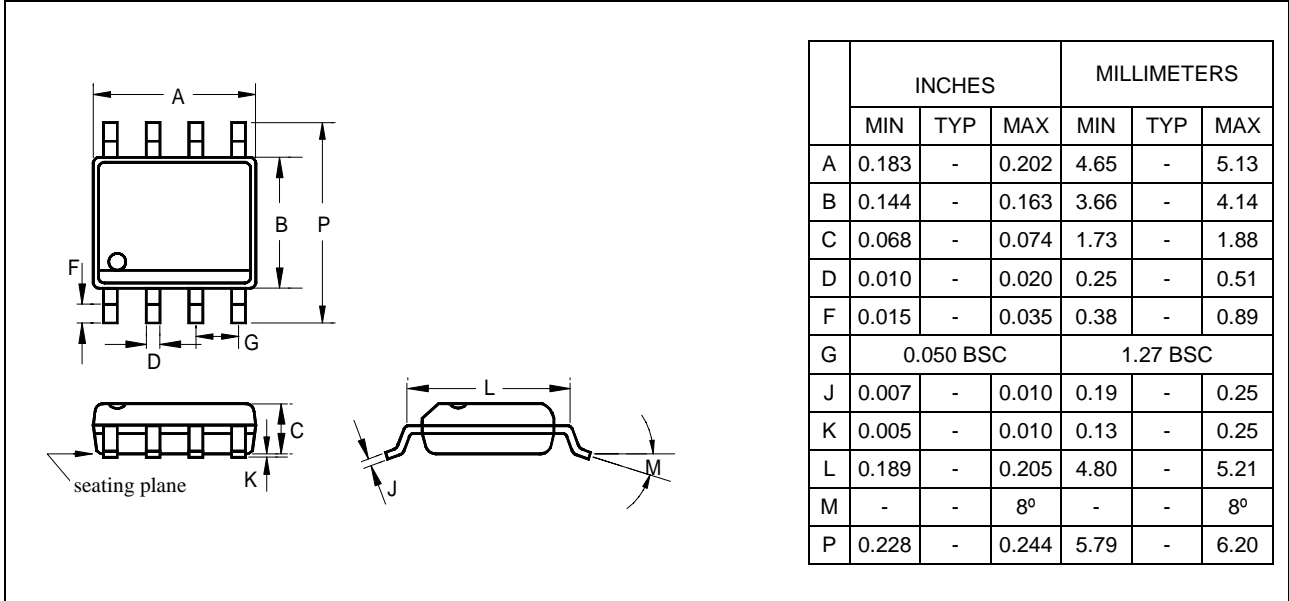
Note: For TO-92 in taping, refer to TO-92 package and taping dimension data for lead dimensions.

3-Pin Plastic TO-92 Package and Taping Dimensions

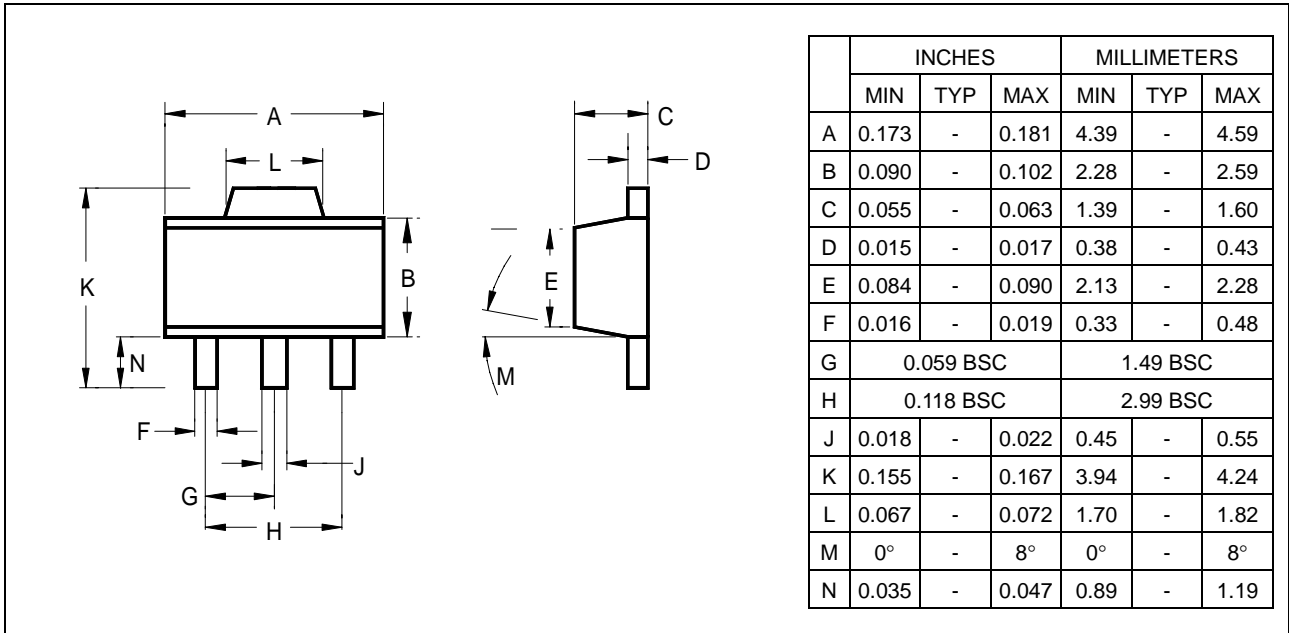


	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
C	0.079	-	-	2.00	-	-
P	0.480	0.500	0.520	12.2	12.7	13.2
Po	0.488	0.500	0.512	12.4	12.7	13.0
Do	0.150	0.157	0.165	3.8	4.0	4.2
P1	0.230	0.250	0.256	5.85	6.35	6.85
Fo	0.165	0.197	0.220	4.2	5.0	5.6
W	0.669	0.709	0.748	17.0	18.0	19.0
Ho	0.610	0.630	0.649	15.5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

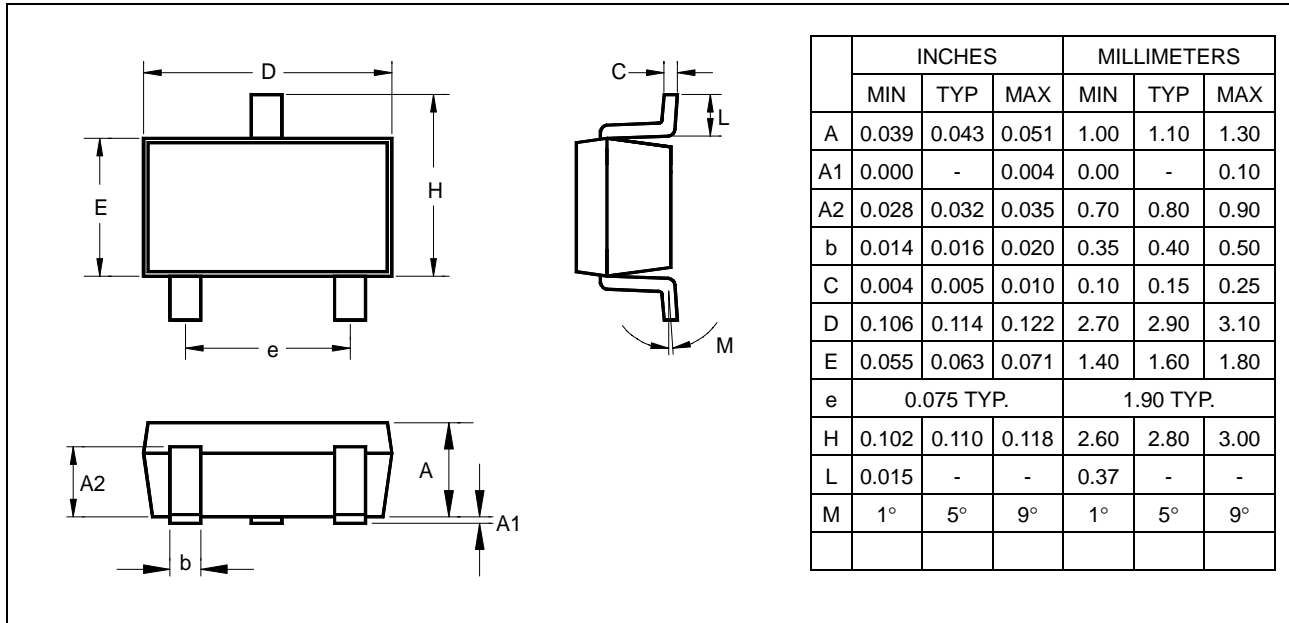
8-Pin Plastic S.O.I.C.



3-Pin Surface Mount SOT-89



Surface Mount SOT-23



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PRECISION ADJUSTABLE SHUNT
VOLTAGE REGULATORS

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