GENERAL DESCRIPTION

The CM431 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 CM431 offers low output impedance for improved load regulation with a typical output impedance of 200mΩ. Because of the active output circuitry, the CM431 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

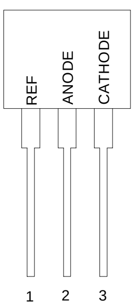
- Initial voltage reference accuracy of 1.0%.
- Sink current capability from 1mA to 100mA
- Typical output dynamic impedance less than 200mΩ;
- Adjustable output voltage from V_{REF} to 36V
- Available in SOT-23, SOT-89, TO-92, & SOP-8
- Low output noise
- Typical equivalent full range temperature coefficient of 30ppm/^{o}C

APPLICATIONS

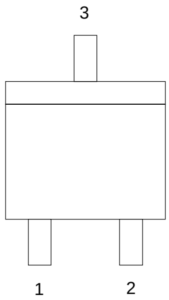
- Voltage Reference
- Precision shunt regulator
- High current shunt regulator
- PWM down converter with reference
- Voltage monitor

PIN CONFIGURATION

TO-92
Front View



SOT-23-3
Top View

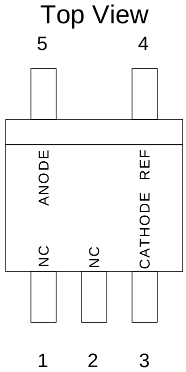


	CM431XCM233	CM431XCM2R3
Pin 1	REF	CATHODE
Pin 2	CATHODE	REF
Pin 3	ANODE	ANODE

Suffix "X": Grade "A", "B", "C", or "D"

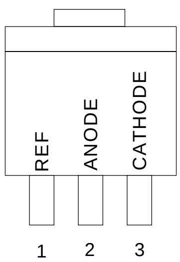
SOT-23-5

Top View

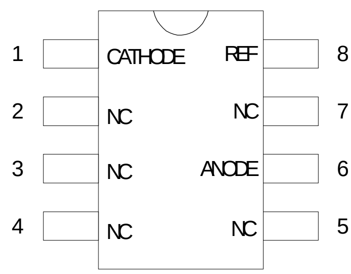


SOT-89

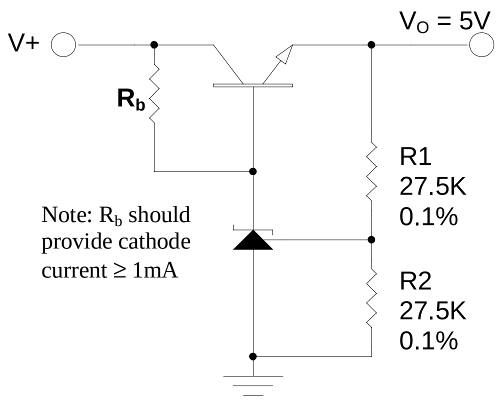
Top View



SOP-8
Top View

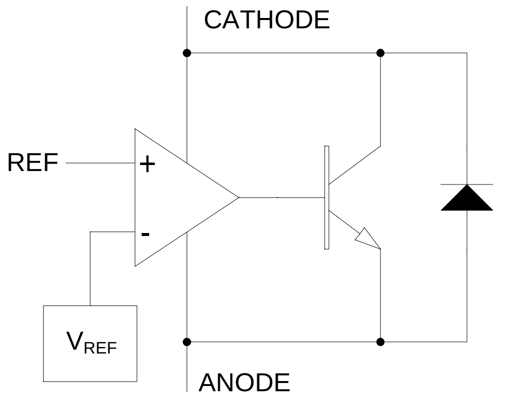


TYPICAL APPLICATION



5V Precision Regulator

BLOCK DIAGRAM



ORDERING INFORMATION

PACKAGE	TOLERANCE			
	0.5%	0.7%	1.0%	T/R Quantity
SOT-23 (1)	CM431ACM233	CM431DCM233	CM431BCM233	TR=3K
SOT-23 (1)	CM431ACM2R3	CM431DCM2R3	CM431BCM2R3	TR=3K
SOT-89 (1)	CM431ACM89	CM431DCM89	CM431BCM89	TR=1K
TO-92 (2)	CM431ACN	CM431DCN	CM431BCN	TA=2K
SOP-8	CM431ACS	CM431DCS	CM431BCS	

Notes：

（1） Add suffix ″TR″for Tape & Reel.

（2） Add suffix ″TA″for Tape Ammo.

ABSOLUTE MAXIMUM RATINGS

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 (soldiering, 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 (mW/°C) $T_A \geqq 25$ °C	$T_A \leqq 25$ °C Power rating(mW)	T_A=70 °C Power rating(mW)	T_A= 85 °C Power rating (mW)
SOP-8	165	6.06	757	485	394
TO-92	156	6.41	801	513	417
SOT-89	71(note)	14.1	1763	1128	916
SOT-23	285	3.5	438	280	228

Note :
1. For SOT-89 package, Thermal Resistance-Junction to Tab (θ_{JT}) = 35 °C/W. $T_J = T_{TAB} + (P_D \times \theta_{JT})$
2. θ_{JA}: Thermal Resistance-Junction to Ambient
   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.

RECOMMENDED OPERATING CONDITIONS

	Min	Max	Units
Operating free air temperature range, T_A	0	105	°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°C.

Parameter	Symbol	Test Conditions	CM431			Units
			Min	Typ	Max	
Reference Input Voltage	V_{REF}	I_K = 10mA, V_{KA} = V_{REF} ,0.5%	2.482	2.495	2.507	V
		I_K = 10mA, V_{KA} = V_{REF} ,0.7%	2.478	2.495	2.512	V
		I_K = 10mA, V_{KA} = V_{REF} ,1.0%	2.470	2.495	2.520	V
Reference Drift		I_K = 10mA, V_{KA} = V_{REF}, $0^oC \le T_A \le 70^oC$		4	17	mV
Voltage Ratio, Ref to Cathode (note 4)		I_K = 10mA, V_{KA} = 2.5V to 36V		-1.4	-2.7	mV/V
Reference Input Current	I_{REF}	I_K = 10mA,V_{KA} = V_{REF}		2	4	µA
		I_K = 10mA,V_{KA} = V_{REF}, $0^oC \le T_A \le 70^oC$			2.3	
Minimum Operating Current	I_{MIN}	V_{KA} = V_{REF}		0.4	1	mA
Off-State Cathode Current	I_{OFF}	V_{KA} = 36V, V_{REF} = 0V		0.1	1	µA
Dynamic Impedance	$\|Z_{KA}\|$	V_{KA} = V_{REF}, I_K = 1mA to 100mA, $f \le 1kHz$		0.2	0.5	Ω

Note 3: These parameters are guaranteed by design

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

PARAMETER MEASUREMENT INFORMATION

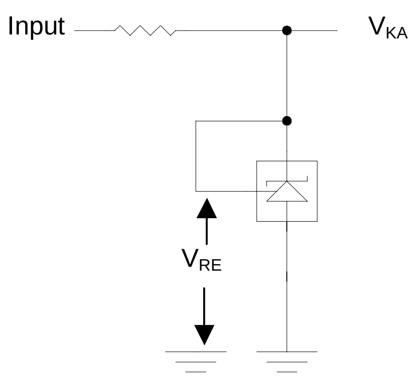
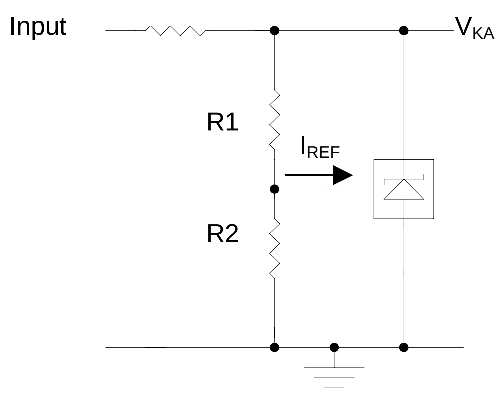


Figure 1. Test Circuit for $V_{KA} = V_{REF}$



$(1 + R1/R2) + I_{REF} \times R1$

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

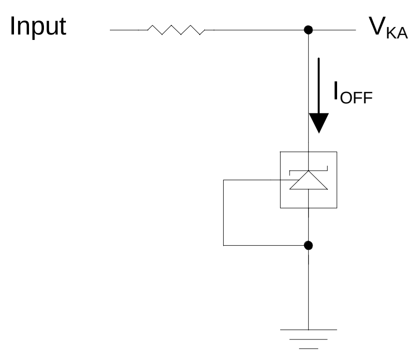
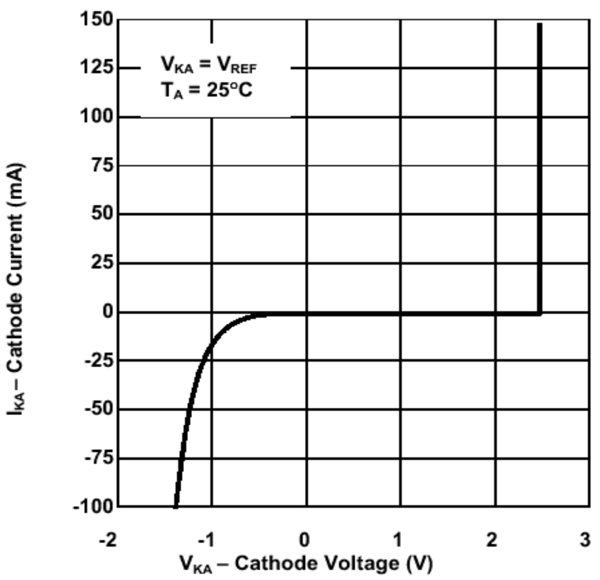


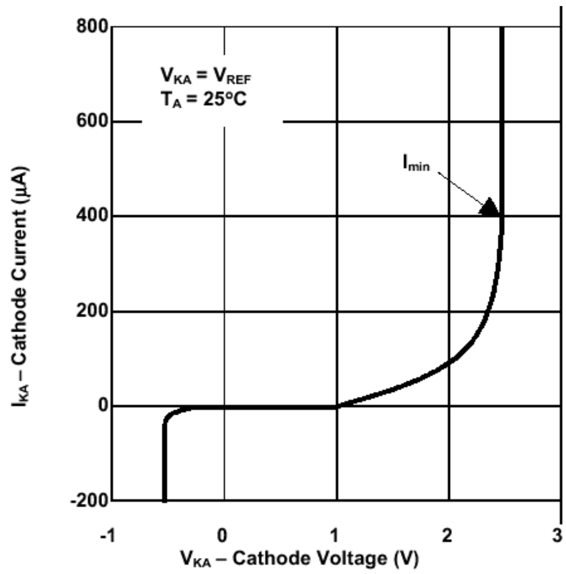
Figure 3. Test Circuit for I_{OFF}

TYPICAL CHARACTERISTICS

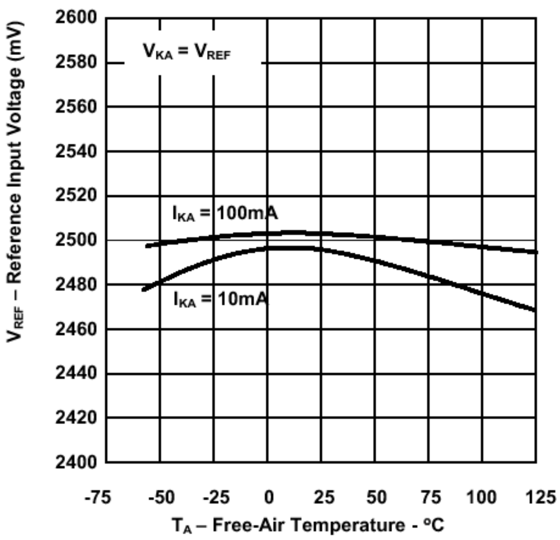
Cathode Current vs. Cathode Voltage



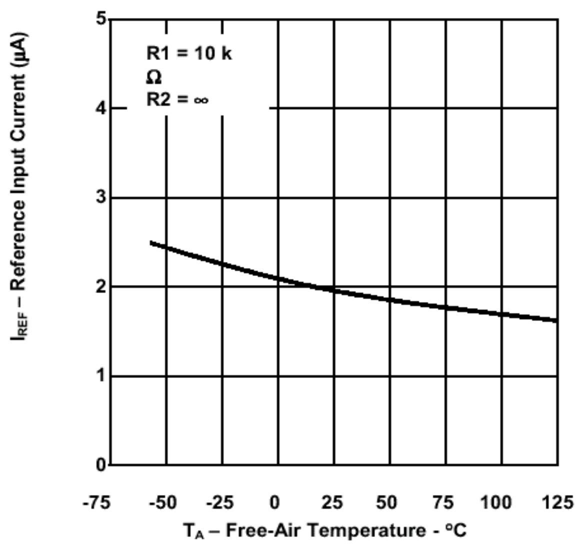
Cathode Current vs. Cathode Voltage



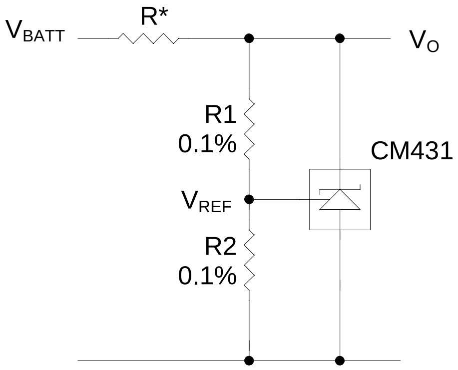
Ref. Input Voltage vs. Free-Air Temperature



Ref. 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 CM431 of minimum V_{BATT}

Figure 4. **Shunt Regulator**

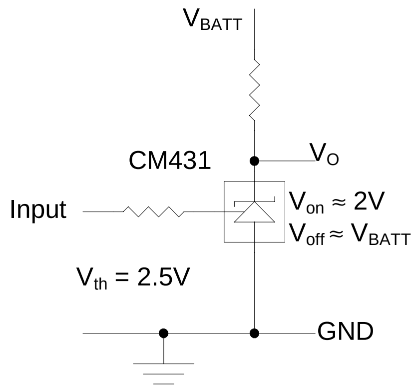
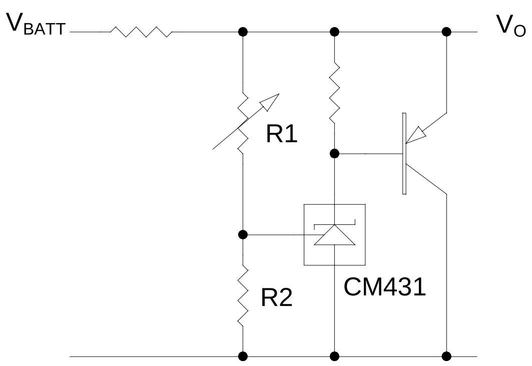


Figure 5. **Single –Supply Comparator With Temperature compensated threshold.**



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

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

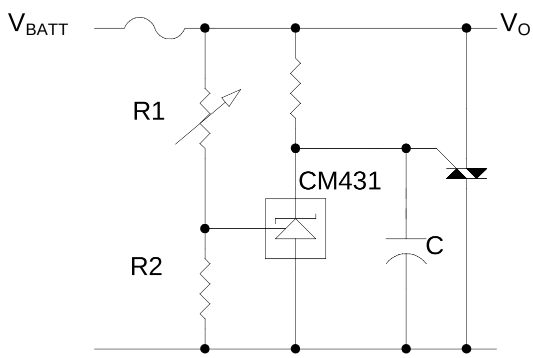


Figure 7. Crowbar Circuit

APPLICATION INFORMATION (continued)

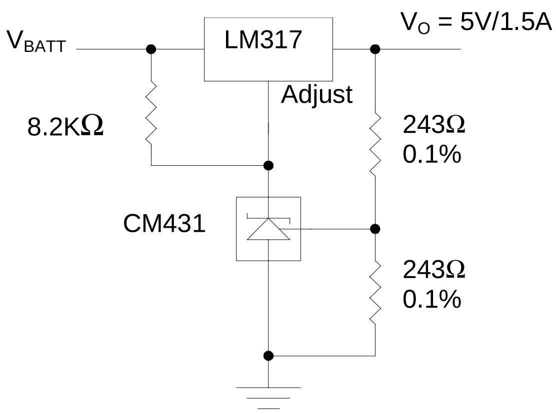


Figure 8.Precision 5V, 1.5A Regulator

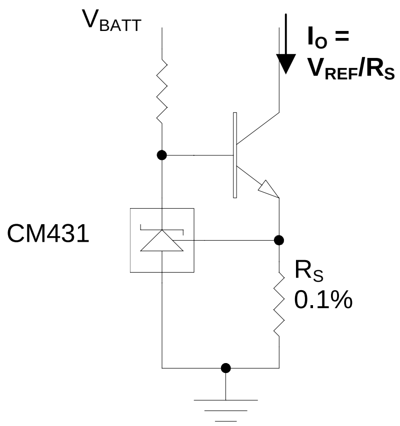
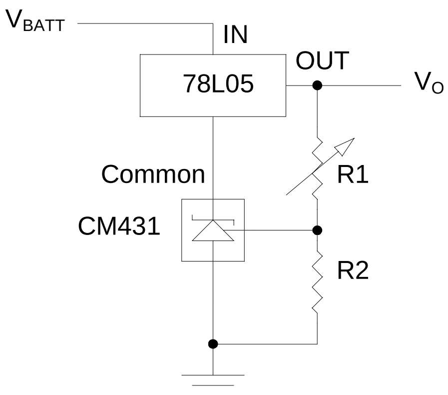


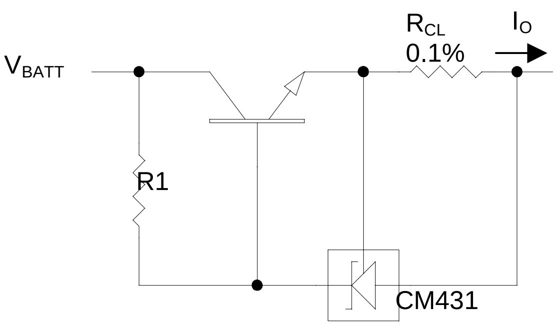
Figure 9. Precision Constant Current Sink



V_O = (1 + R1/R2) × V_{REF}

Min V_O = V_{REF} + 5V

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

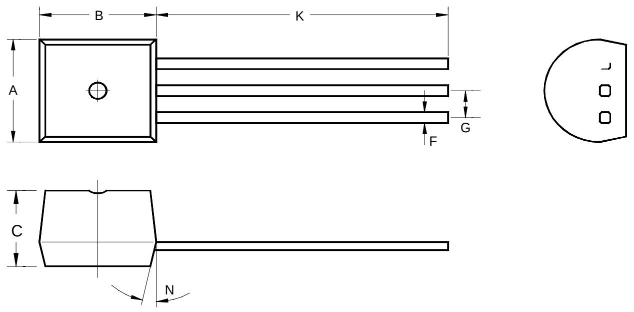


I_{OUT} = (V_{REF}/R_{CL}) + I_{KA}

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

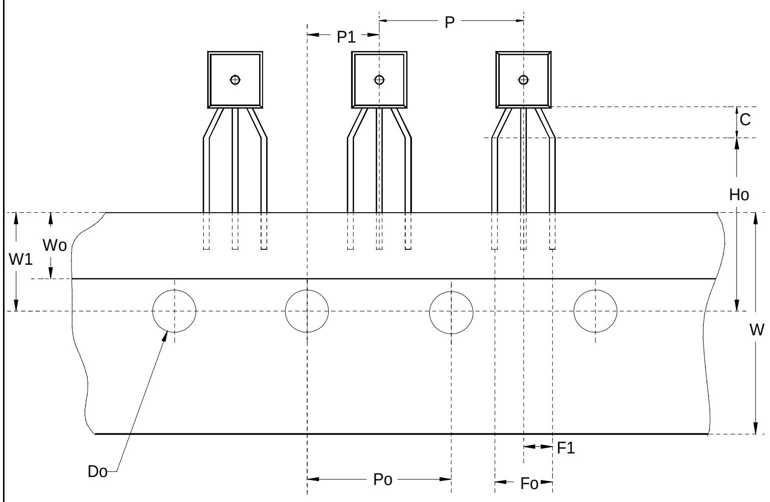
Figure 11. Precision Current Limiter

3-Pin Plastic TO-92 Package Dimension



	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	-	5º	-	-	5º	-
N	-	5º	-	-	5º	-

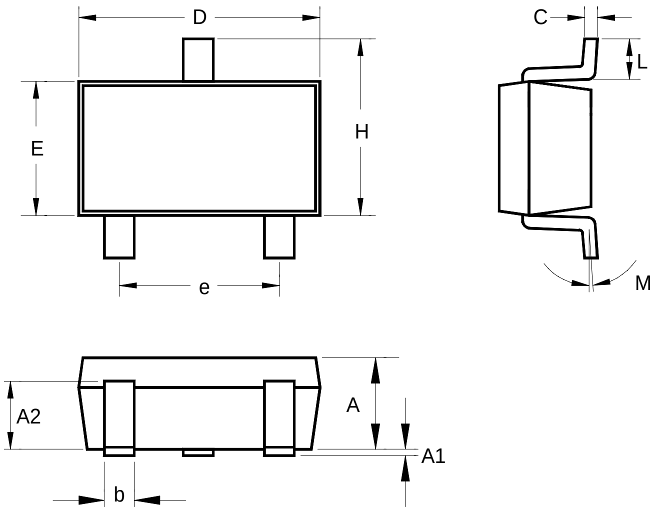
3-Pin Plastic TO-92 Carrier Dimensions



	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
Wo	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

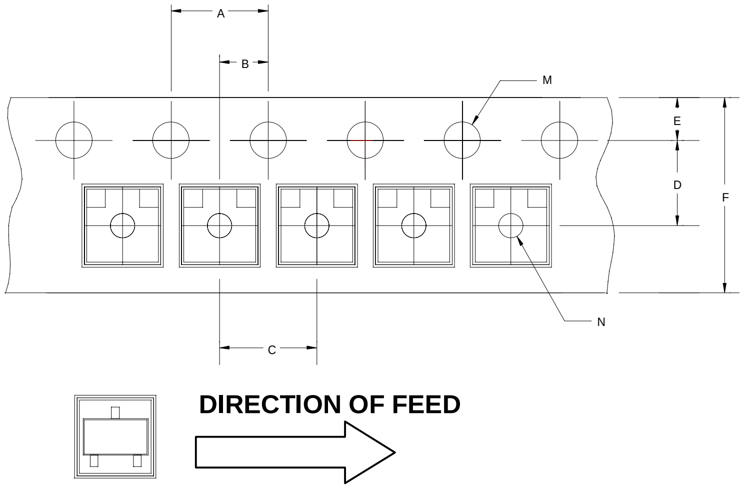
Note: For TO-92, 2,500 units per ammo

Surface Mount SOT-23



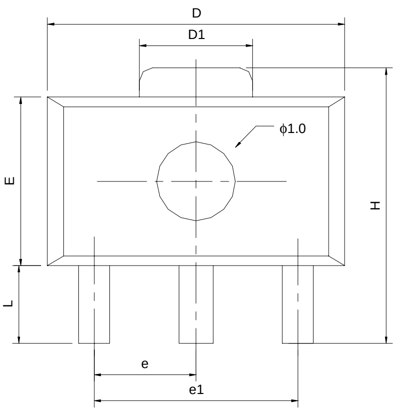
	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	0.039	0.043	0.051	1.00	1.10	1.30
A1	0.000	-	0.004	0.00	-	0.10
A2	0.028	0.032	0.035	0.70	0.80	0.90
b	0.014	0.016	0.020	0.35	0.40	0.50
C	0.004	0.005	0.010	0.10	0.15	0.25
D	0.106	0.114	0.122	2.70	2.90	3.10
E	0.055	0.063	0.071	1.40	1.60	1.80
e	0.075 TYP.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

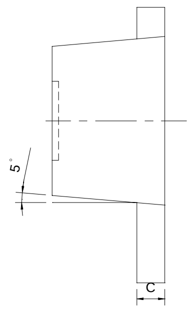
Surface Mount SOT-23 Carrier Dimensions

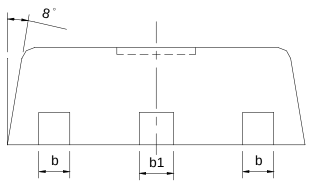


MILLIMETERS			
A	4.0 ± 0.1	M	1.5 ± 0.1
B	2.0 ± 0.05	N	1.1 ± 0.1
C	4.0± 0.1		
D	2.5 ± 0.05		
E	1.75 ± 0.1		
F	6.0 ± 0.2		

SOT-89 Package Dimension

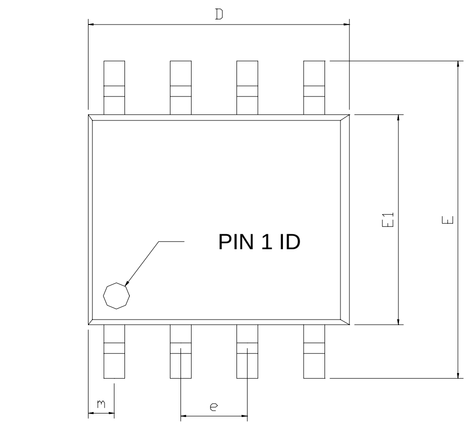




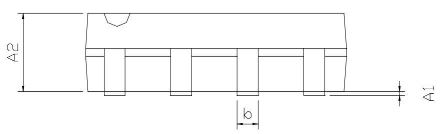


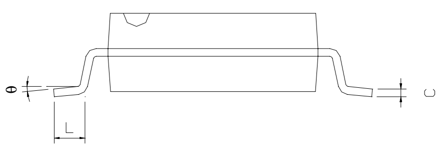
SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.40	1.50	1.60	0.055	0.059	0.063
L	0.80	---	1.20	0.031	---	0.047
b	0.36	0.42	0.48	0.014	0.016	0.018
b1	0.41	0.47	0.53	0.016	0.018	0.020
C	0.38	0.40	0.43	0.014	0.015	0.017
D	4.40	4.50	4.60	0.173	0.177	0.181
D1	1.40	1.60	1.75	0.055	0.062	0.069
H	3.94	---	4.25	0.155	---	0.167
E	2.40	2.50	2.60	0.094	0.098	0.102
e1	2.90	3.00	3.10	0.114	0.118	0.122
e	1.45	1.50	1.55	0.057	0.059	0.061

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



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHS		
	MIN	NOM	MAX	MIN	NOM	MAX
A1	0.10	---	0.25	0.004	---	0.010
A2	1.40	---	1.55	0.055	---	0.061
b	0.30	---	0.51	0.012	---	0.020
C	0.15	---	0.26	0.006	---	0.010
D	4.60	---	5.06	0.169	---	0.199
E	5.79	---	6.20	0.228	---	0.244
E1	3.76	---	4.01	0.148	---	0.158
e	---	1.27	---	---	0.050	---
L	0.38	---	0.69	0.015	---	0.035
m	0.43	---	0.69	0.017	---	0.027
θ	0°	---	8°	0°	---	8°





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