Adjustable Precision Shunt Regulator

General Description

- LM431A and LM431B are three terminal adjustable precision shunt regulators With guaranteed thermal stability over a full operation temperature range.
- The output Voltage of these ICs can be set to any value between V_{REF} (Typical 2.50V) and the corresponding maximum cathode voltage (36V) with two external resistors.
- These devices feature the sharp turn-on characteristics, low temperature coefficient and low output impedance, making them ideal substitute for Zener Diode in many applications such as switching power supply, charger and other adjustable regulators.

TO-92 (Bulk)

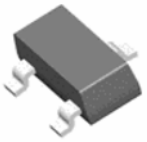
TO-92 (Ammo)

- LM431 precision reference Voltage tolerance is offered in 2 grades:1.0% for LM431A and 0.5% for LM431B
- Both LM431A and LM431B are available in TO-92 (Bulk), TO-92 (Ammo),SOT-89, SOT-23,SOT-23-5 and SOP-8 packages.

SOT-89

.Features

- Programmable Precise Output Voltage:2.50V to 36V
- High Stability under Capacitive Load
- Wide Operation Temperature Range:-40°C to 125°C
- Low Temperature Deviation:4.5mV (Typical)
- Low Equivalent Full-range Temperature Coefficient :20ppm/°C (Typical)
- Sink Current Capacity:1mA to100mA
- Low Output Noise
- RoHS Compliance and Halogen Free



SOT-23

SOT-23-5

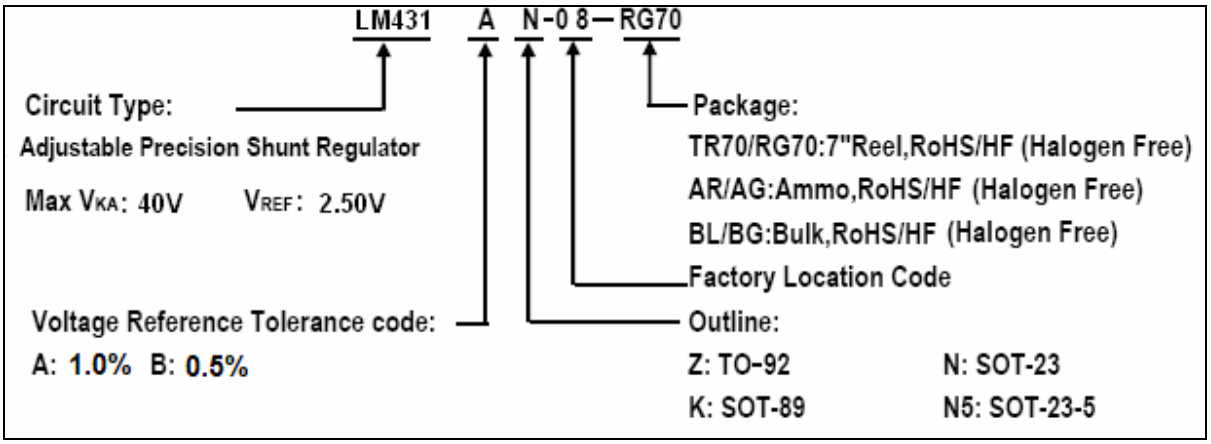
RoHS Compliant

HALOGEN FREE

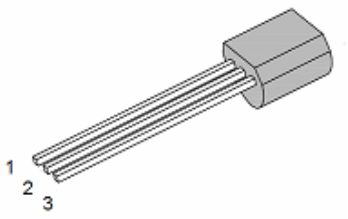
Applications

- Switching Power Supply
- Charger
- Voltage Adapter
- Graphic Card
- Precision Voltage Reference

Ordering Information

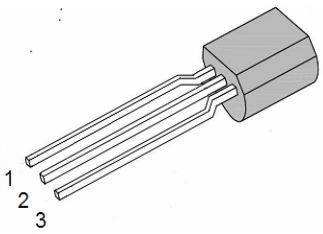


Pin Configuration



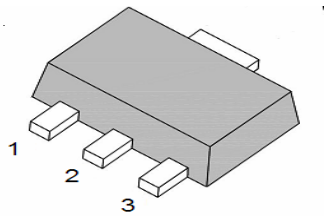
1: REF 2: ANODE 3: CATHODE

TO-92(Bulk)



1: REF 2: ANODE 3: CATHODE

TO-92(Ammo)



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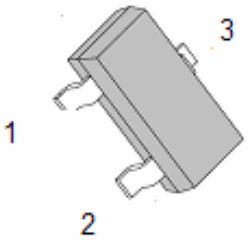
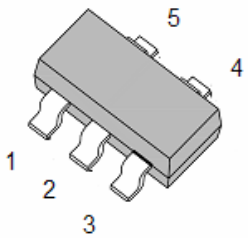
SOT-89



1: REF 2: CATHODE 3: ANODE

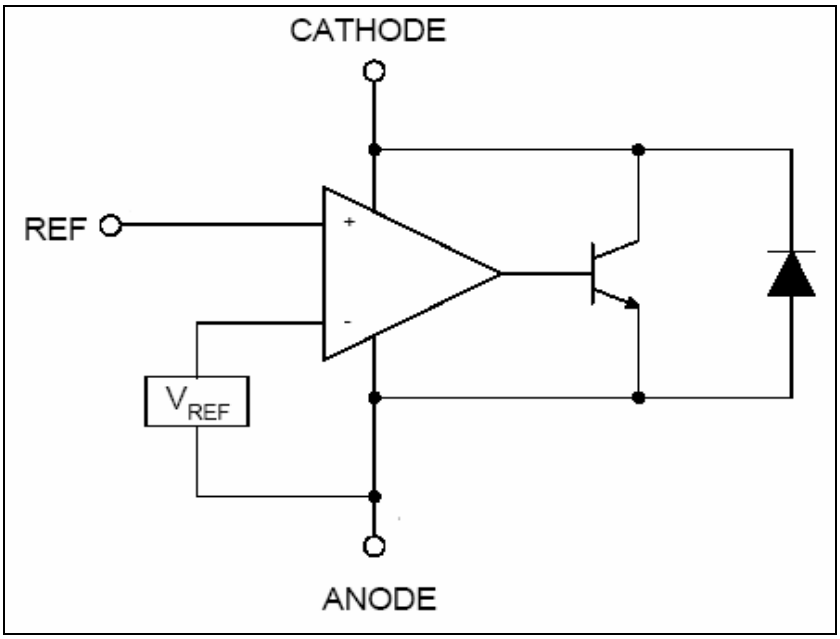
SOT-23



1:NC 2:NC 3: CATHODE 4: REF 5: ANODE

SOT-23-5

Functional Block Diagram



Marking information

Outline	Temperature Range	V_{REF} Tolerance	Part Number		Marking Code		Packing Type
			RoHS	Halogen Free	RoHS	Halogen Free	
TO-92	-40 to 125°C	1.0%	LM431AZ-08-AR	LM431AZ-08-AG	AS431BZ-E1	AS431BZ-G1	Ammo
			LM431AZ-08-BL	LM431AZ-08-BG			Bulk
		0.5%	LM431BZ-08-AR	LM431BZ-08-AG	AS431AZ-E1	AS431AZ-G1	Ammo
			LM431BZ-08-BL	LM431BZ-08-BG			Bulk
SOT-89	-40 to 125°C	1.0%	LM431AK-08-TR70	LM431AK-08-RG70	E43H	G43H	Tape & Reel
		0.5%	LM431BK-08-TR70	LM431BK-08-RG70	E43G	G43G	
SOT-23	-40 to 125°C	1.0%	LM431AN-08-TR70	LM431AN-08-RG70	EB6	GB6	Tape & Reel
		0.5%	LM431BN-08-TR70	LM431BN-08-RG70	EB5	GB5	
SOT-23 -5	-40 to 125°C	1.0%	LM431AN5-08-TR70	LM431AN5-08-RG70	E6I	G6I	Tape & Reel
		0.5%	LM431BN5-08-TR70	LM431BN5-08-RG70	E6H	G6H	

Absolute Maximum Ratings (Note1)

Symbol	Description		Ratings	Unit
V_{KA}	Cathode Voltage		40	V
I_{KA}	Continuous Cathode Current		-100 to 150	mA
I_{REF}	Reference Input Current		10	mA
P_D	Power Dissipation	Z:TO-92	770	mW
		K:SOT-89		
		N:SOT-23	370	
		N5:SOT-23-5		
T_J	Junction Temperature		150	°C
T_{STG}	Storage Temperature Range		-65 to 150	°C
ESD(Human body model)	ESD		2000	V

Recommend Operating Ratings (Note1)

Symbol	Description	Ratings		Unit
		Min	Max	
V_{KA}	Cathode Voltage	V_{REF}	36	V
I_{KA}	Continuous Cathode Current	1.0	100	mA
T_A	Operating Ambient Temperature	-40	125	°C

Note1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Recommend operating ratings indicate conditions for which the devices is functional, but do not guarantee specific specification limits. For guarantee specification and test conditions, see the electrical characteristics, the guarantee specification apply only for the test conditions listed.

Electrical Characteristics (T_A=25°C, unless otherwise specified)

Symbol	Description		Min.	Typ.	Max.	Unit	Test Circuit	Test Conditions	
V_{REF}	Reference Voltage	0.5%	2.487	2.500	2.512	V	Fig.1	$V_{KA}=V_{REF}, I_{KA}=10mA$	
		1.0%	2.475	2.500	2.525	V			
ΔV_{REF}	Deviation of Reference Voltage Over Full Temperature Range		-	4.5	8	mV	Fig.1	0°C to 70°C	$V_{KA}=V_{REF}$ $I_{KA}=10mA$
			-	4.5	10			-40°C to 85°C	
			-	4.5	16			-40°C to125°C	
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	Ratio of change in Reference Voltage to the change in Cathode Voltage		-	-1.0	-2.7	mV/ V	Fig.2	ΔV_{KA}=10V to V_{REF}	I_{KA}=10mA
			-	-0.5	-2.0			ΔV_{KA}=36V to10V	

Symbol	Description	Min.	Typ.	Max.	Unit	Test Circuit	Test Conditions
I_{REF}	Reference Current	-	0.7	4.0	uA	Fig.2	I_{KA}=10mA,R1=10KΩ,R2=∞
Δ I_{REF}	Deviation of Reference Current Over Full Temperature Range	-	0.4	1.2	uA	Fig.2	I_{KA}=10mA, R1=10KΩ,R2=∞ T_A =-40°C to 125°C
$I_{KA(Min)}$	Minimum Cathode Current for Regulation	-	0.4	1.0	mA	Fig.1	V_{KA}=V_{REF}
$I_{KA(Off)}$	Off-state Cathode Current	-	0.05	1.0	uA	Fig.3	V_{KA}=36V, V_{REF}=0V
Z_{KA}	Dynamic Impedance	-	0.15	0.5	Ω	Fig.1	V_{KA}=V_{REF}, I_{KA}=1mA to 100mA,f≤1.0KHz
$R_{\theta JC}$	Thermal Resistance	-	-	81.9	-	°C/W	TO-92
		-	-	84.9	-		SOT-89
		-	-	135.9	-		SOT-23
		-	-	135.9	-		SOT-23-5

Parameter Test Circuit

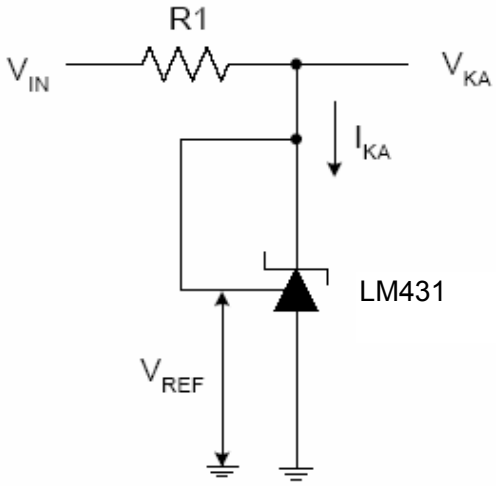


Fig.1 Test Circuit for V_{KA}=V_{REF}

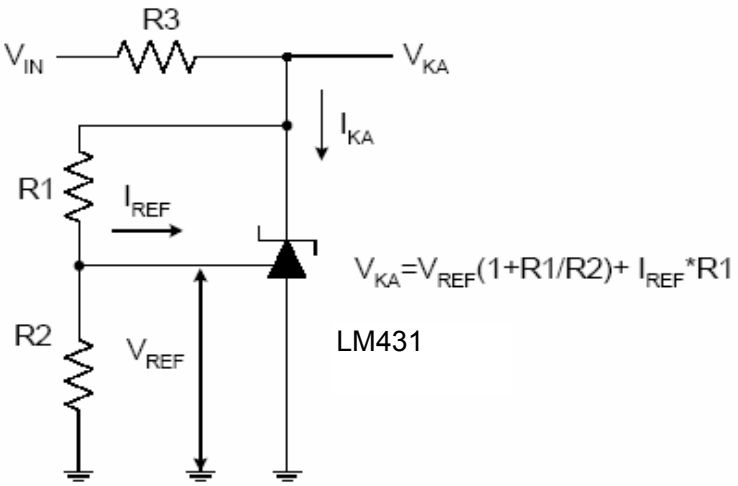


Fig.2 Test Circuit for V_{KA}>V_{REF}

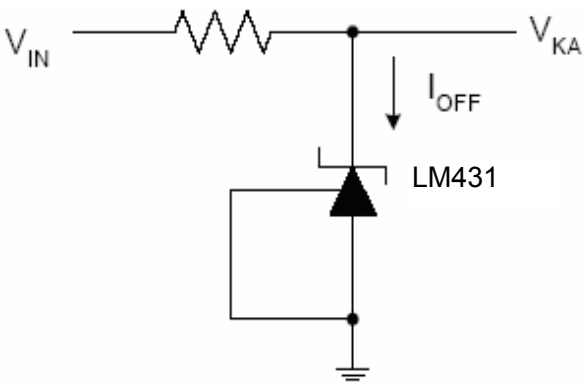


Fig.3 Test Circuit for $I_{KA(Off)}$

Typical Characteristics Curves

Fig.4 V_{REF}-T_A

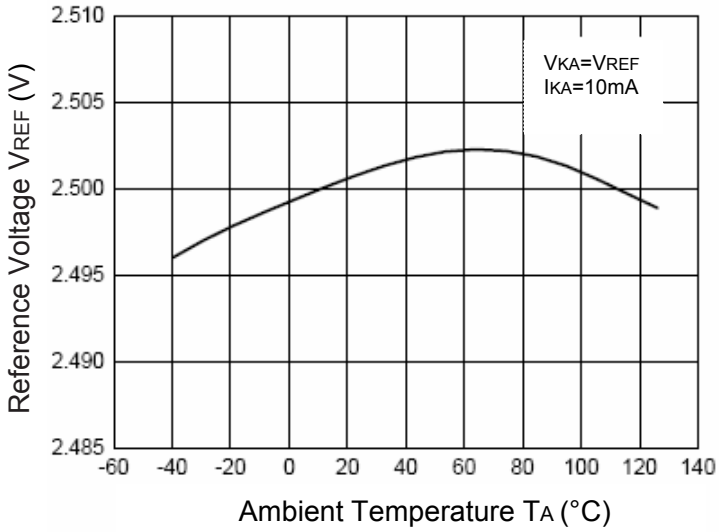


Fig.5 I_{REF}-T_A

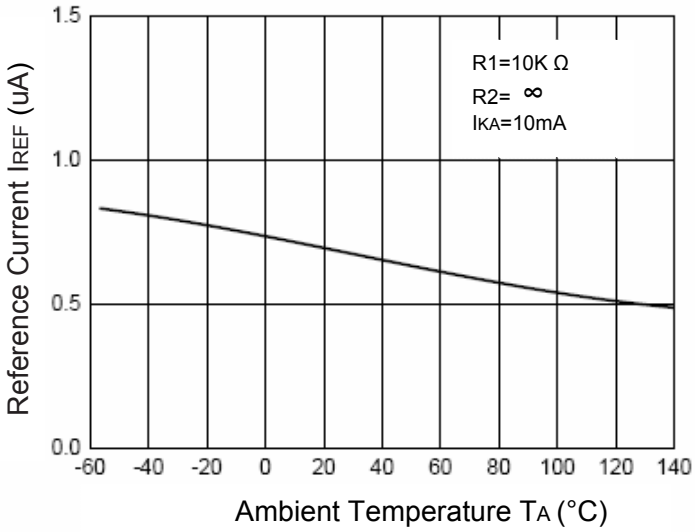


Fig.6 I_{KA}-V_{KA}

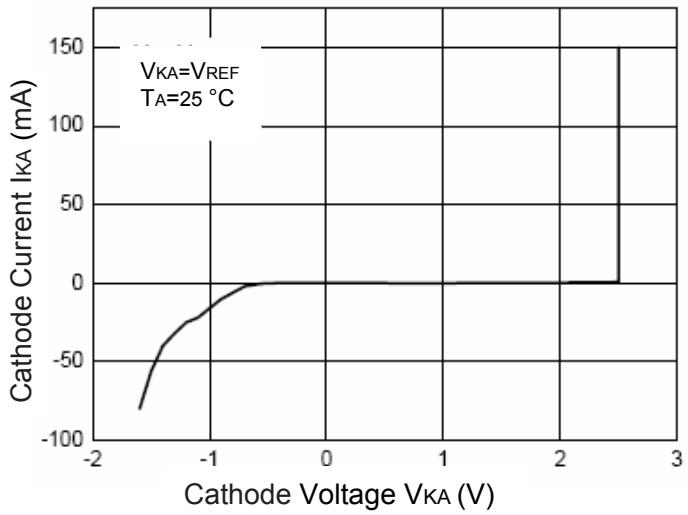


Fig.7 I_{KA}-V_{KA}

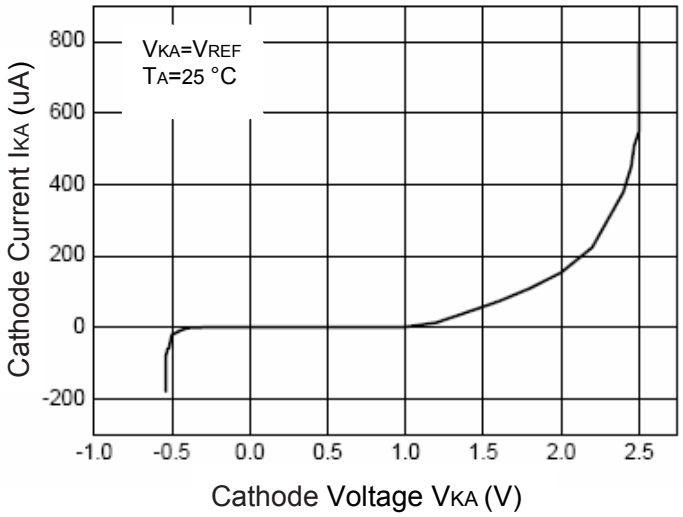


Fig.8 $I_{KA(Off)}$-T_A

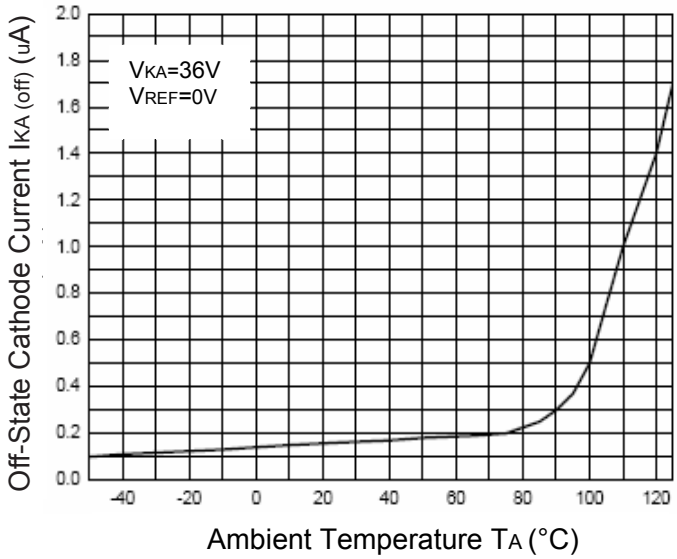


Fig.9 $\frac{\Delta V_{REF}}{\Delta V_{KA}}$ -T_A

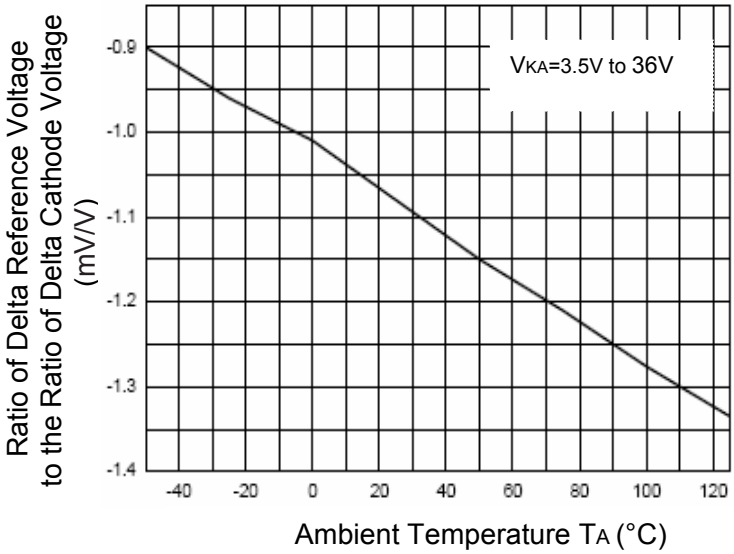
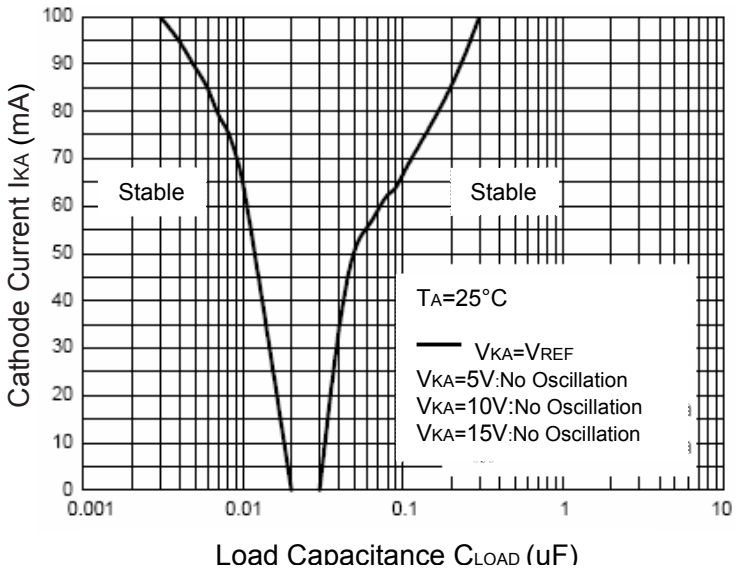


Fig.10 Stability Boundary Conditions Vs. Load Capacitance



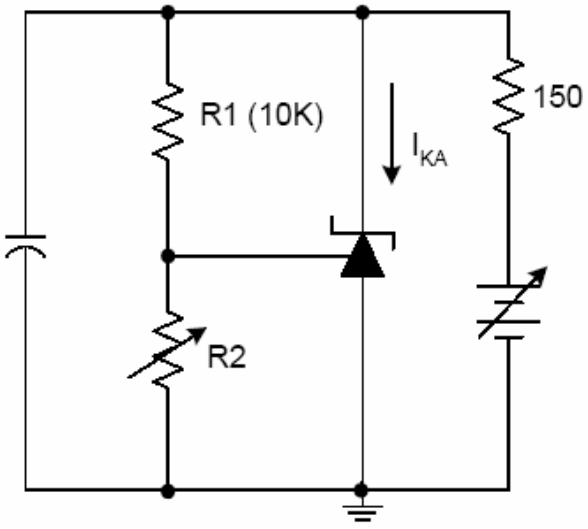
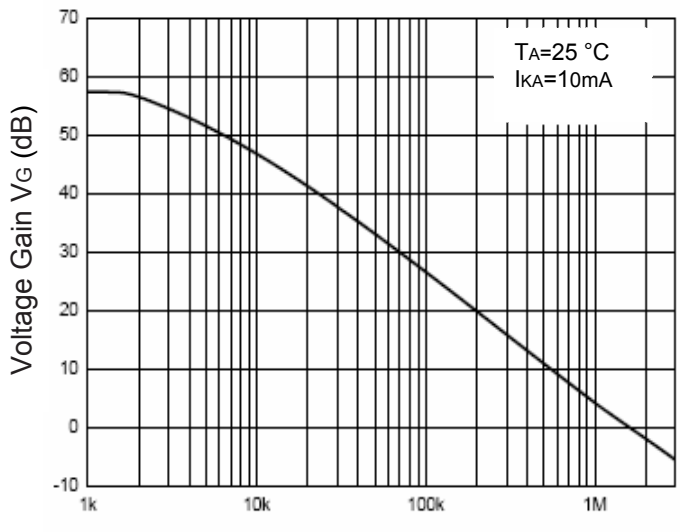


Fig.11 Small Signal Voltage Gain vs. Frequency



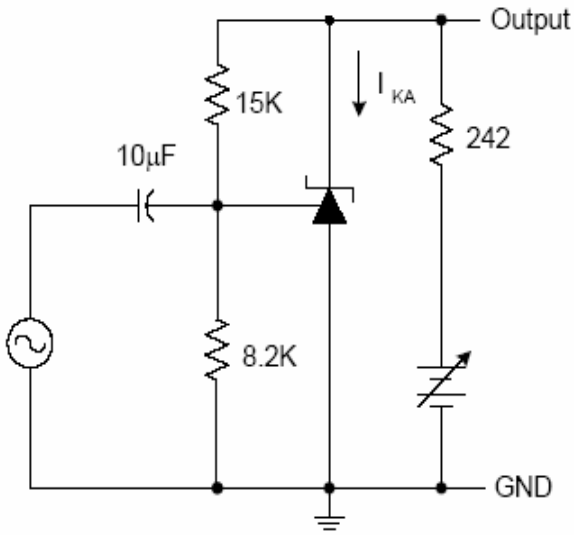
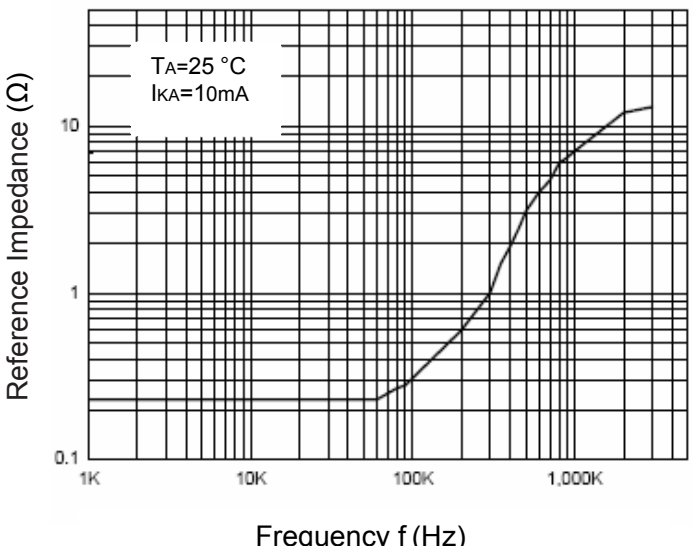


Fig.12 Reference Impedance Vs Frequency



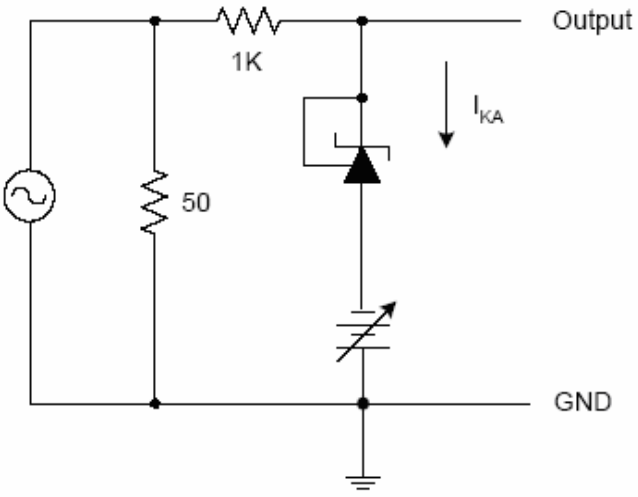
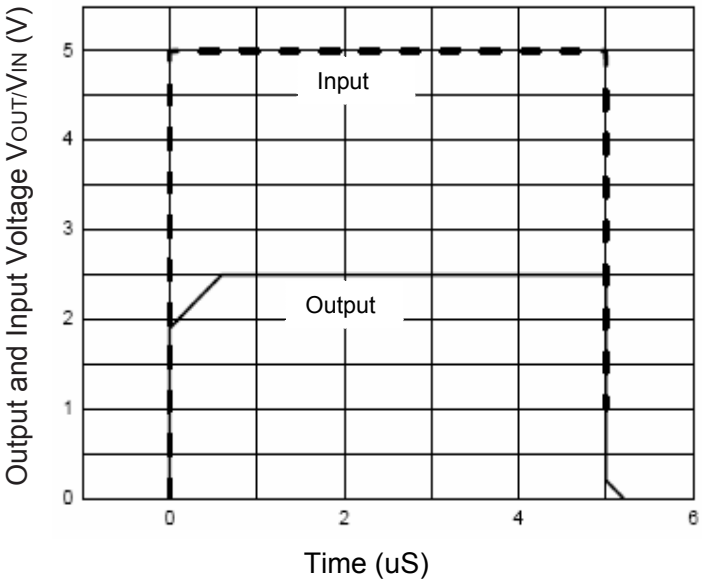
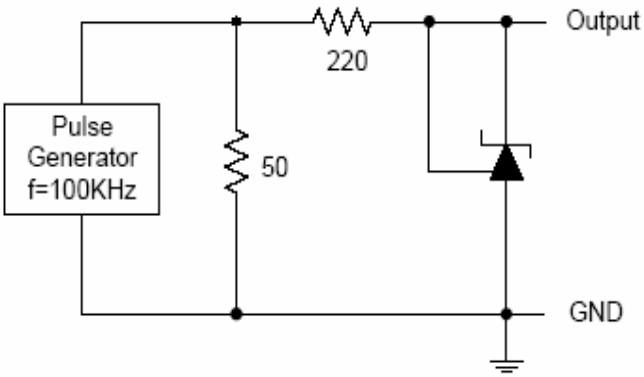


Fig.13 Pulse Respond of Input and Output Voltage





Typical Application Circuit

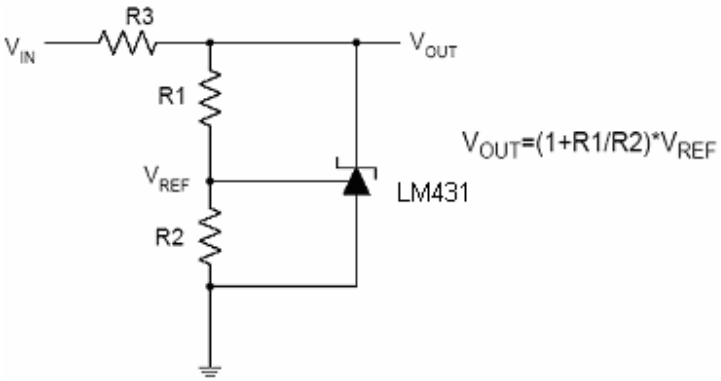


Fig.14 Shunt Regulator

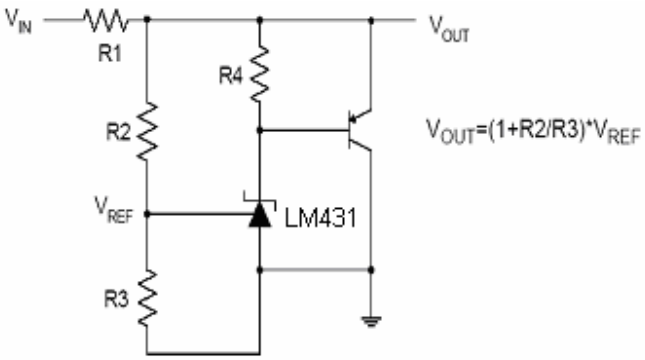


Fig.15 High Current Shunt Regulator

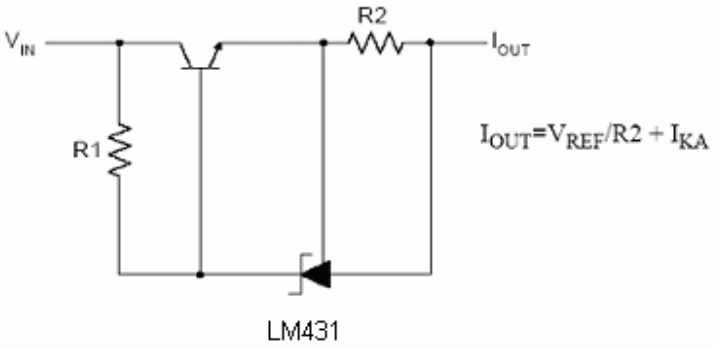


Fig.16 Current Source or Current Limit

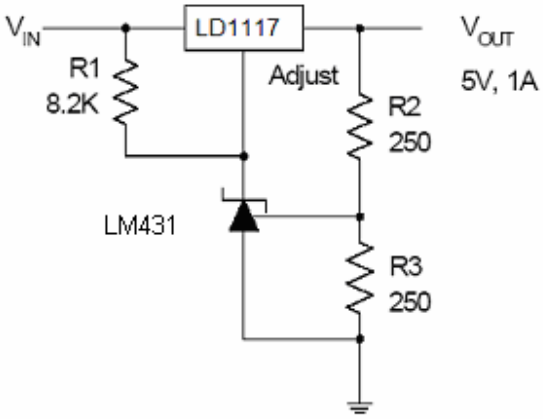


Fig.17 Precision 5V 1A Regulator

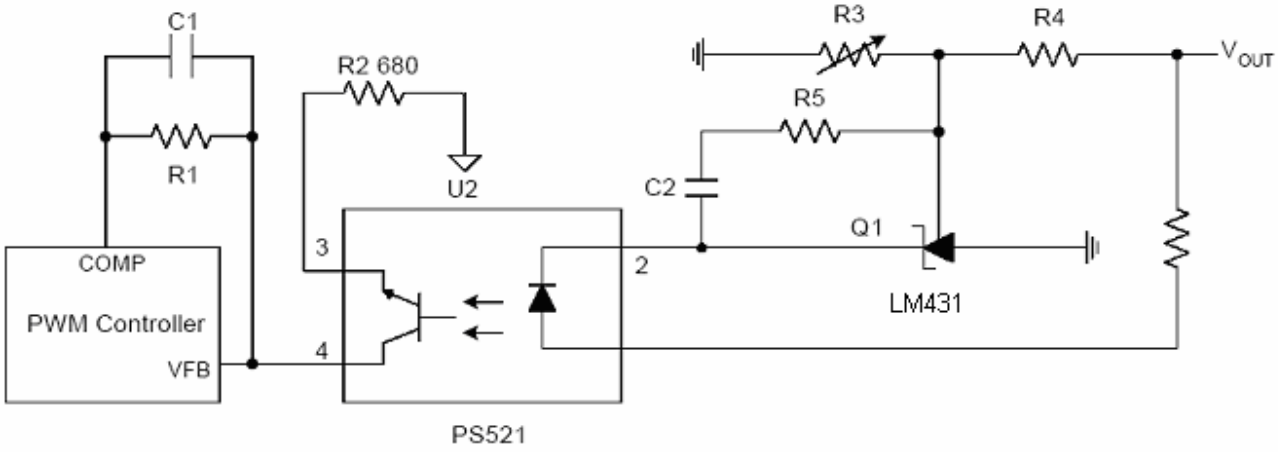
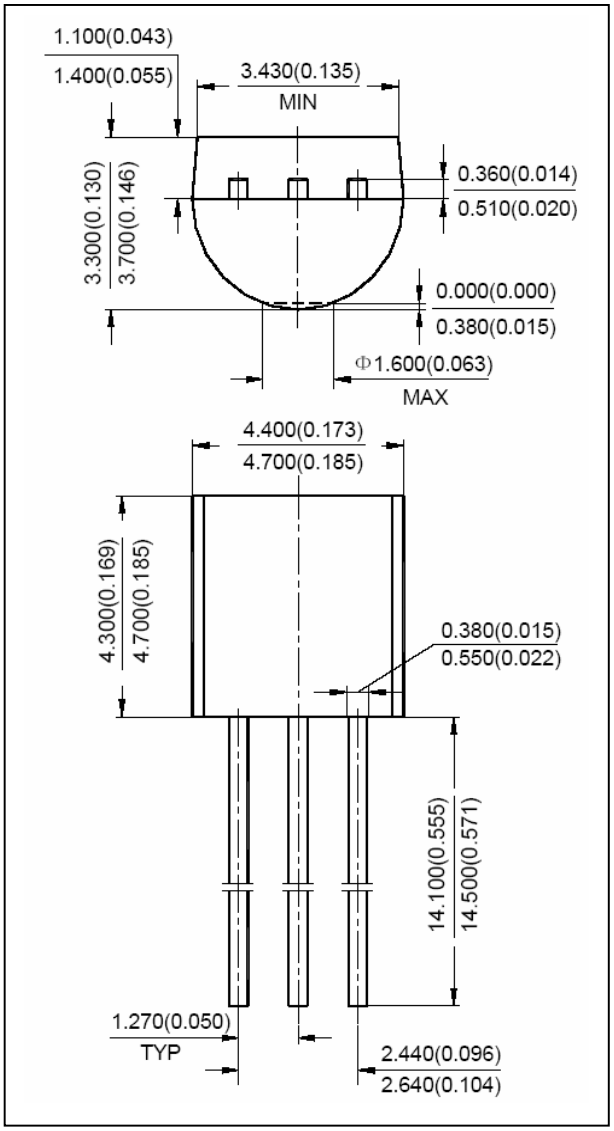
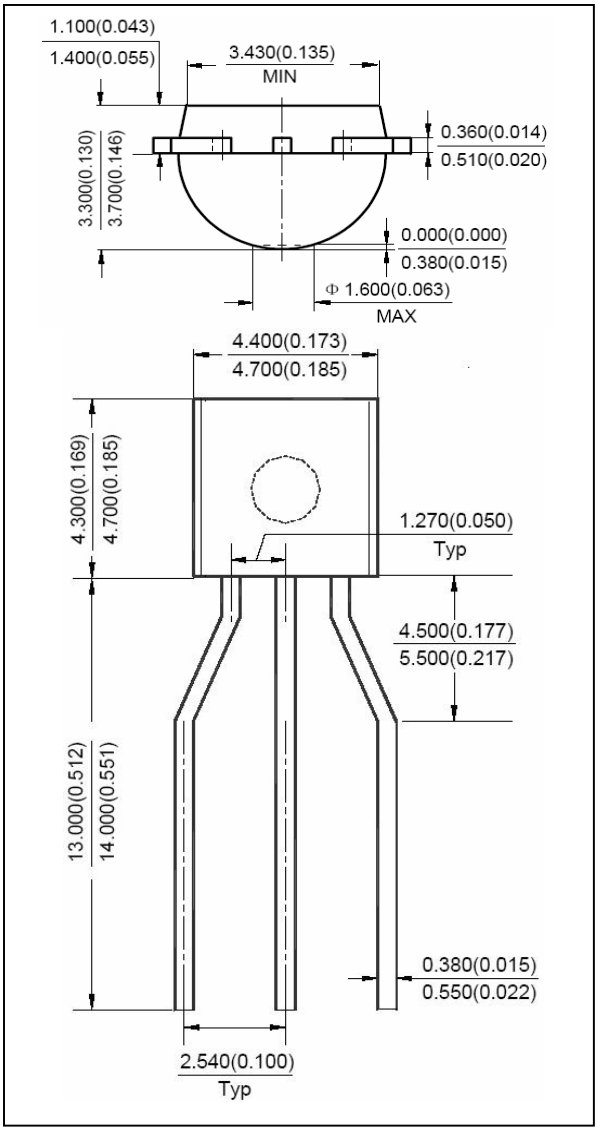


Fig.18 PWM Converter With Reference

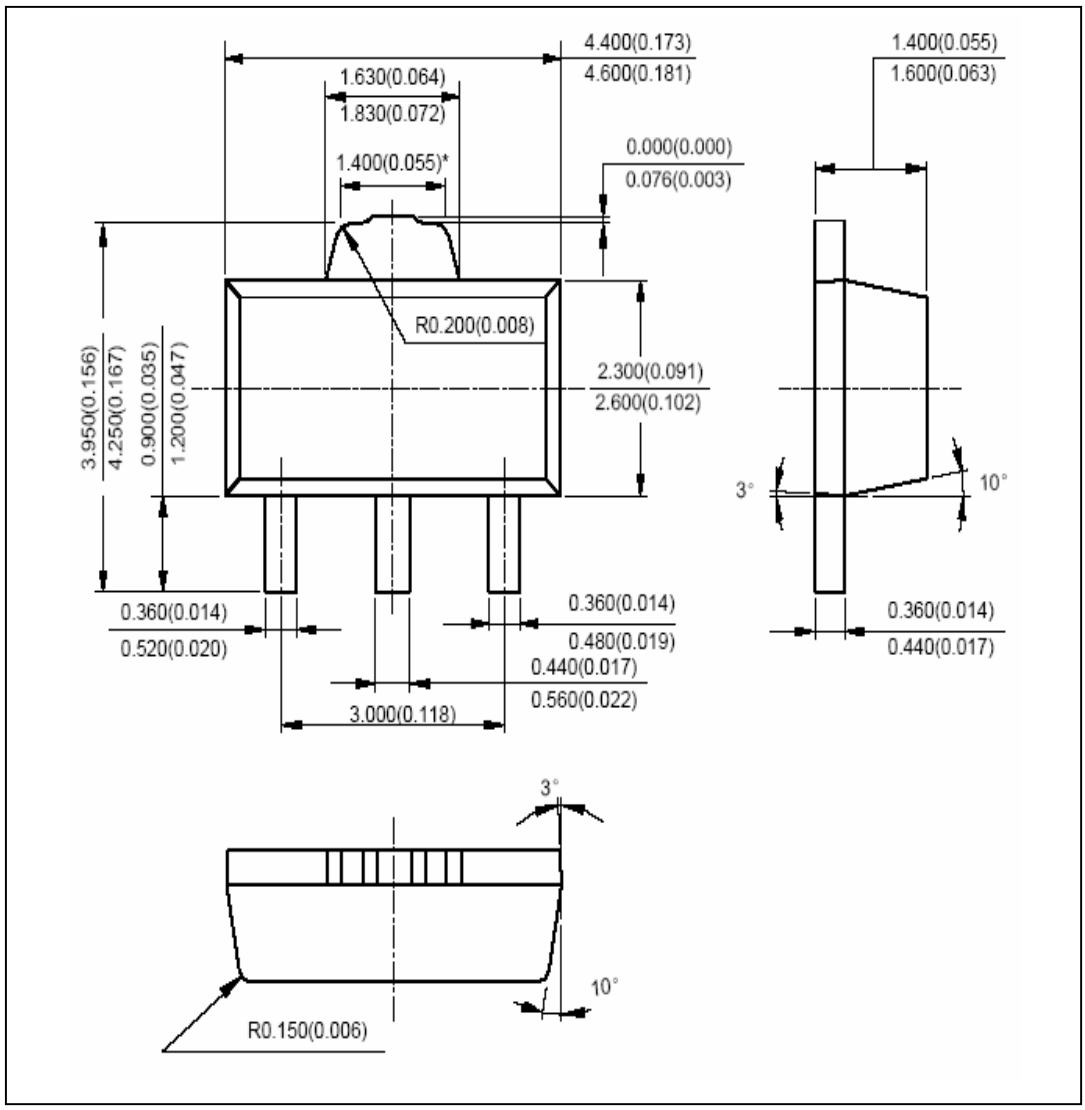
Dimensions in mm (inch)



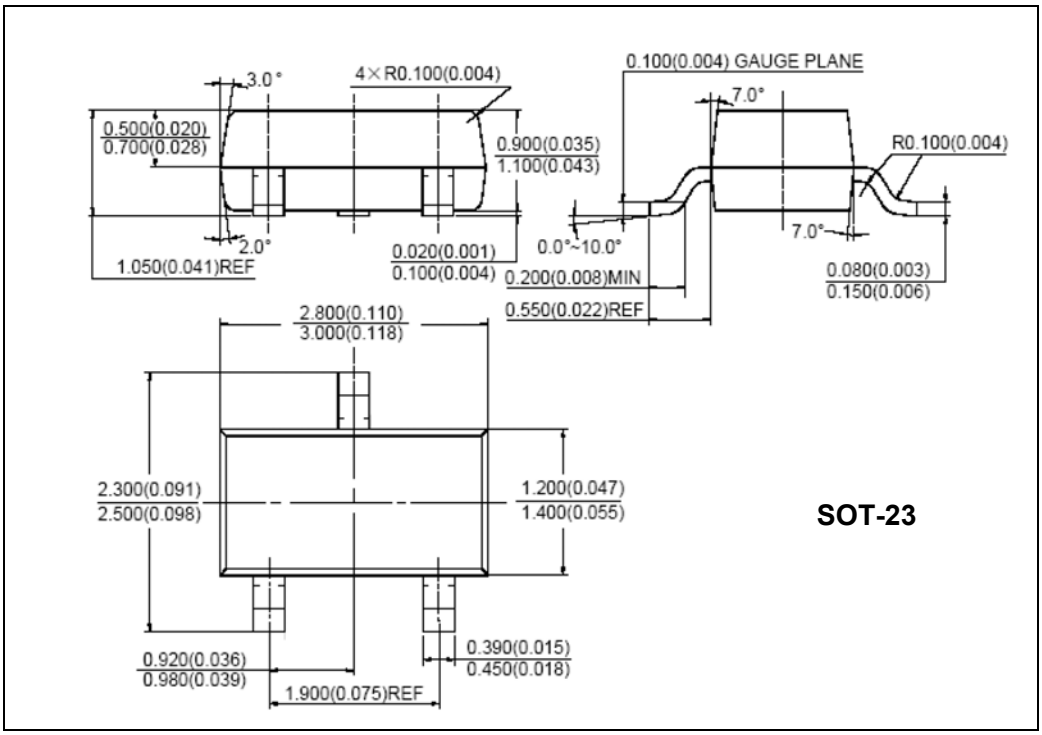
TO-92 Buck

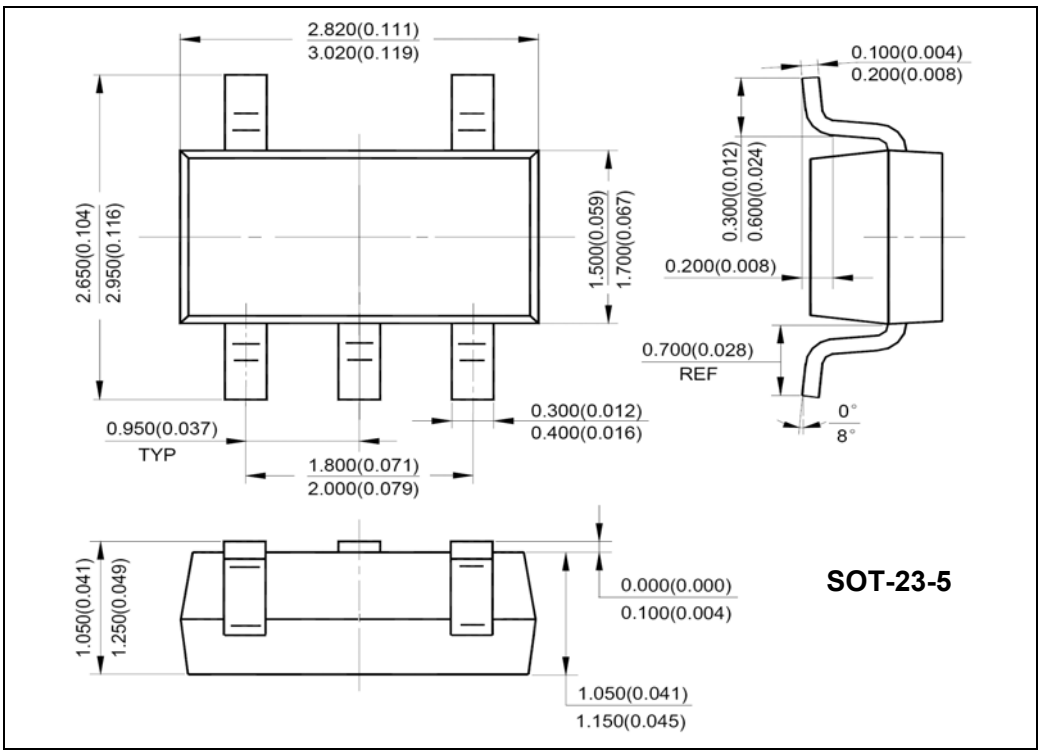


TO-92 Ammo


4.400(0.173)
4.600(0.181)
1.630(0.064)
1.830(0.072)
1.400(0.055)*
0.000(0.000)
0.076(0.003)
R0.200(0.008)
3.950(0.156)
4.250(0.167)
0.900(0.035)
1.200(0.047)
2.300(0.091)
2.600(0.102)
0.360(0.014)
0.520(0.020)
0.360(0.014)
0.480(0.019)
0.440(0.017)
0.560(0.022)
3.000(0.118)
1.400(0.055)
1.600(0.063)
3°
10°
0.360(0.014)
0.440(0.017)
3°
10°
R0.150(0.006)

SOT-89


3.0°
4×R0.100(0.004)
0.100(0.004) GAUGE PLANE
7.0°
0.500(0.020)
0.700(0.028)
0.900(0.035)
1.100(0.043)
R0.100(0.004)
2.0°
7.0°
1.050(0.041)REF
0.020(0.001)
0.100(0.004)
0.0°~10.0°
0.200(0.008)MIN
0.080(0.003)
0.150(0.006)
0.550(0.022)REF
2.800(0.110)
3.000(0.118)
2.300(0.091)
2.500(0.098)
1.200(0.047)
1.400(0.055)
SOT-23
0.920(0.036)
0.980(0.039)
0.390(0.015)
0.450(0.018)
1.900(0.075)REF


2.820(0.111)
3.020(0.119)
0.100(0.004)
0.200(0.008)
0.300(0.012)
0.600(0.024)
2.650(0.104)
2.950(0.116)
1.500(0.059)
1.700(0.067)
0.200(0.008)
0.700(0.028)
REF
0.950(0.037)
TYP
0.300(0.012)
0.400(0.016)
0°
8°
1.800(0.071)
2.000(0.079)
SOT-23-5
1.050(0.041)
1.250(0.049)
0.000(0.000)
0.100(0.004)
1.050(0.041)
1.150(0.045)

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