

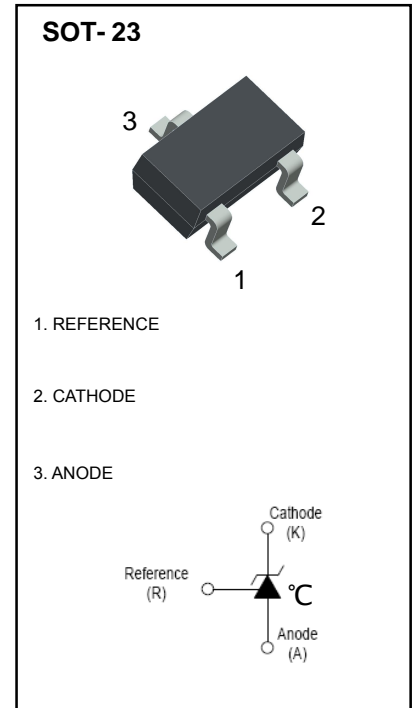
## SOT-23 Encapsulate Adjustable Reference Source

### Device Description

The TL431 is a three-terminal adjustable shunt regulator offering excellent temperature stability. This device has a typical dynamic output impedance of  $0.2\Omega$ . The device can be used as a replacement for zener diodes in many applications.

### FEATURES

- The output voltage can be adjusted to 36V
- Low dynamic output impedance, its typical value is  $0.2\Omega$
- Trapping current capability is 1 to 100mA
- Low output noise voltage
- Fast on -state response
- The effective temperature compensation in the working range of full temperature
- The typical value of the equivalent temperature factor in the whole temperature scope is  $50 \text{ ppm}/^\circ\text{C}$



### Applications

- Shunt Regulator
- High-Current Shunt Regulator
- Precision Current Limiter

### Marking

- 431

### Limiting Values (Absolute Maximum Rating)

Parameter	Symbol	Value	Unit
Cathode Voltage	$V_{KA}$	37	V
Cathode Current Range (Continuous)	$I_{KA}$	-100~+150	mA
Reference Input Current Range	$I_{ref}$	0.05~+10	mA
Power Dissipation	$P_D$	300	mW
Thermal Resistance from Junction to Ambient	$R_{\theta JA}$	417	$^\circ\text{C}/\text{W}$
Operating Junction Temperature	$T_j$	150	$^\circ\text{C}$
Operating Ambient Temperature Range	$T_{opr}$	-25~+85	$^\circ\text{C}$
Storage temperature Range	$T_{stg}$	-65~+150	$^\circ\text{C}$

## Electrical Characteristics ( $T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test conditions	Min	Typ	Max	Unit	
Reference input voltage (Fig.1)	$V_{\text{ref}}$	$V_{\text{KA}}=V_{\text{REF}}, I_{\text{KA}}=10\text{mA}$	2.475	2.5	2.525	V	
Deviation of reference input voltage over temperature (note) (Fig.1)	$\Delta V_{\text{ref}}/\Delta T$	$V_{\text{KA}}=V_{\text{REF}}, I_{\text{KA}}=10\text{mA}$ $T_{\text{MIN}}\leq T_a\leq T_{\text{MAX}}$		4.5	17	mV	
Ratio of change in reference input voltage to the change in cathode voltage (Fig.2)	$\Delta V_{\text{ref}}/\Delta V_{\text{KA}}$	$I_{\text{KA}}=10\text{mA}$	$\Delta V_{\text{KA}}=10\text{V}\sim V_{\text{REF}}$		-1.0	-2.7	mV/V
			$\Delta V_{\text{KA}}=36\text{V}\sim 10\text{V}$		-0.5	-2.0	mV/V
Reference input current (Fig.2)	$I_{\text{ref}}$	$I_{\text{KA}}=10\text{mA}, R_1=10\text{k}\Omega$ $R_2=\infty$		1.5	4	$\mu\text{A}$	
Deviation Of reference input current over full temperature range (Fig.2)	$\Delta I_{\text{ref}}/\Delta T$	$I_{\text{KA}}=10\text{mA}, R_1=10\text{k}\Omega$ $R_2=\infty$ $T_A=-25$ to $85^\circ\text{C}$		0.4	1.2	$\mu\text{A}$	
Minimum cathode current for regulation (Fig.1)	$I_{\text{KA}(\text{min})}$	$V_{\text{KA}}=V_{\text{REF}}$		0.45	1.0	mA	
Off-state cathode Current (Fig.3)	$I_{\text{KA}(\text{OFF})}$	$V_{\text{KA}}=36\text{V}, V_{\text{REF}}=0$		0.05	1.0	$\mu\text{A}$	
Dynamic impedance	$Z_{\text{KA}}$	$V_{\text{KA}}=V_{\text{REF}}, I_{\text{KA}}=1$ to $100\text{mA}$ $f\leq 1.0\text{kHz}$		0.15	0.5	$\Omega$	

Note:  $T_{\text{MIN}}=-25^\circ\text{C}$ ,  $T_{\text{MAX}}=+85^\circ\text{C}$

### CLASSIFICATION cZV<sub>ref</sub>

Rank	*** 0.5%	*****1%
Range	2.487-2.513	2.475-2.525

Figure 1. Test Circuit for  $V_{\text{KA}} = V_{\text{ref}}$

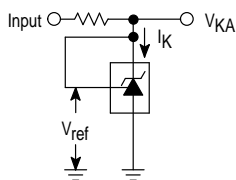


Figure 2. Test Circuit for  $V_{\text{KA}} > V_{\text{ref}}$

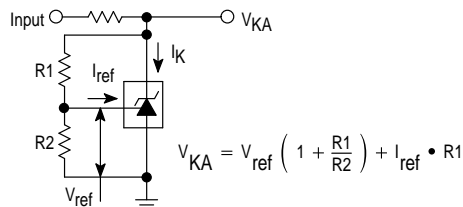
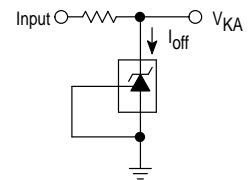
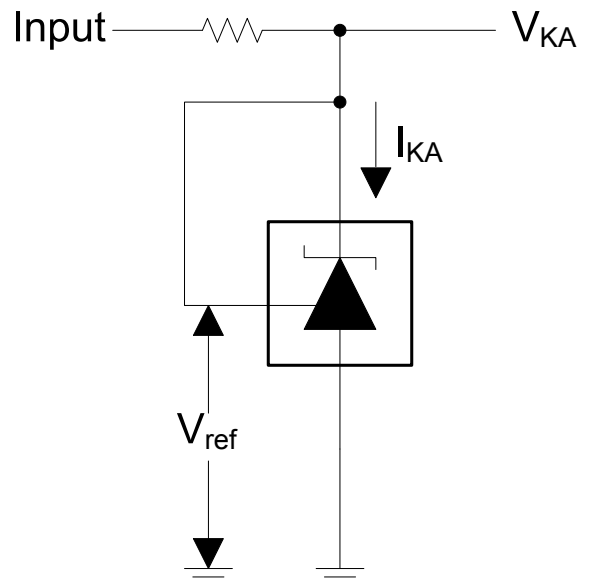
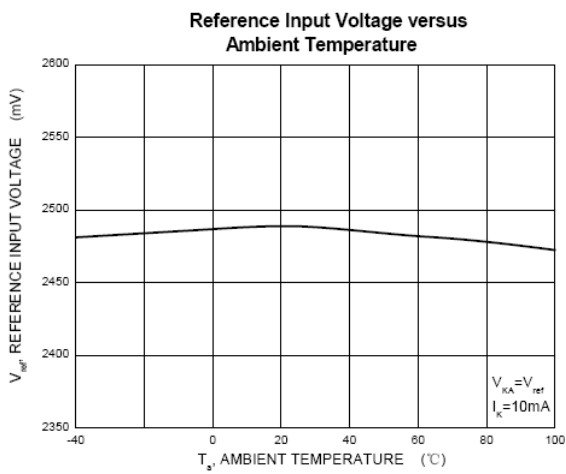
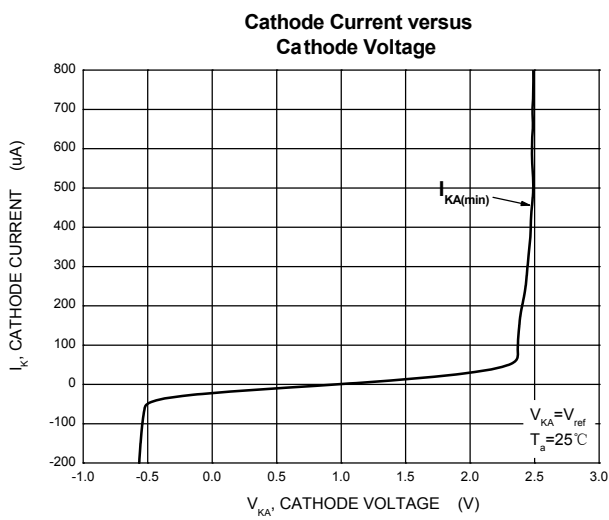
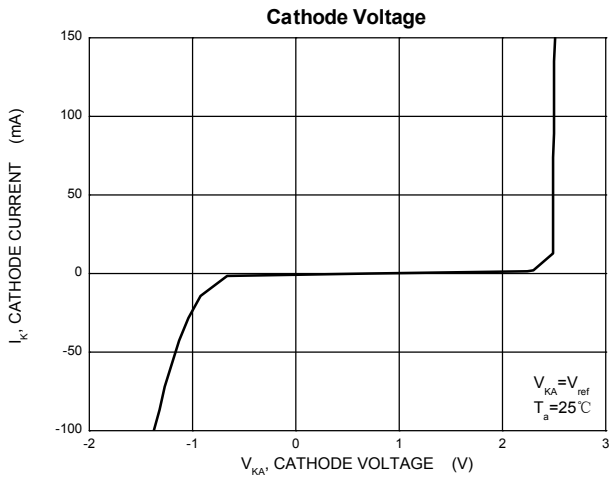


Figure 3. Test Circuit for  $I_{\text{off}}$



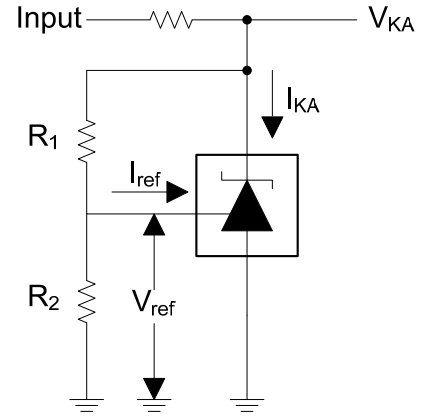
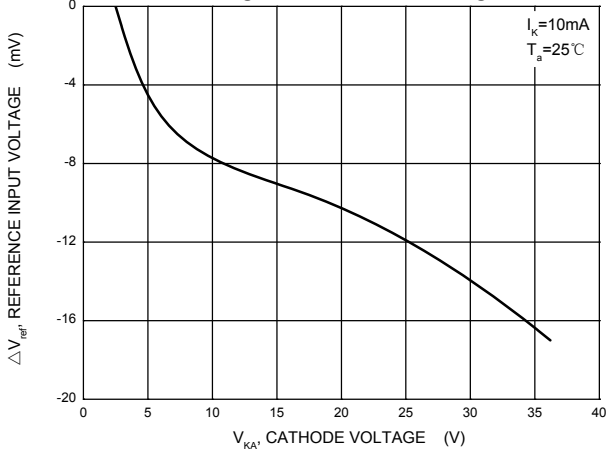
# Typical Characteristics



Test Circuit for  $V_{KA} = V_{ref}$

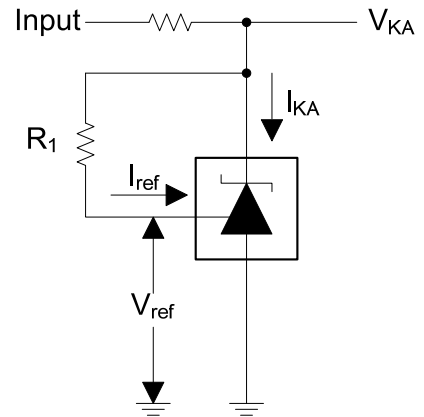
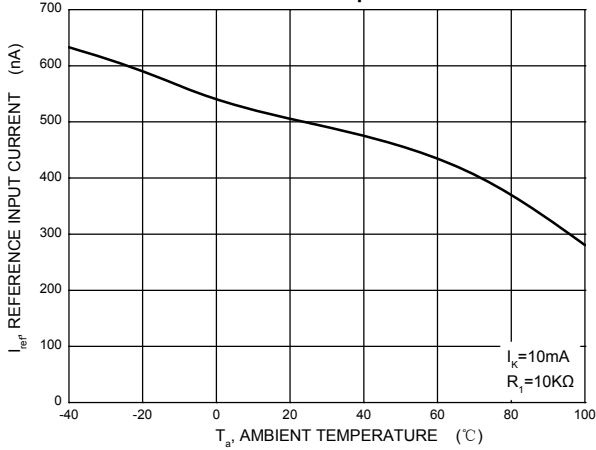
# Typical Characteristics

**Change in Reference Input Voltage versus Cathode Voltage**



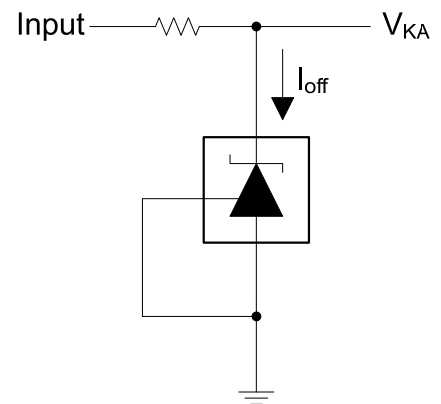
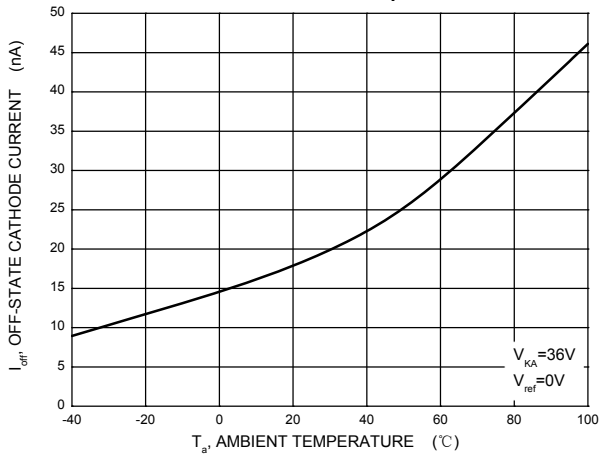
Test Circuit for  $V_{KA} = V_{ref}(1 + R1/R2) + R1 * I_{ref}$

**Reference Input Current versus Ambient Temperature**



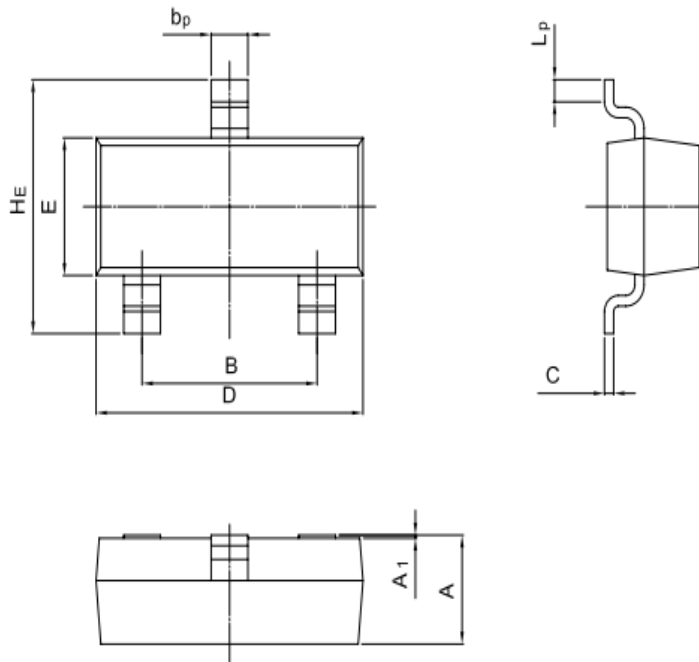
Test Circuit for I<sub>ref</sub>

**Off-State Cathode Current versus Ambient Temperature**



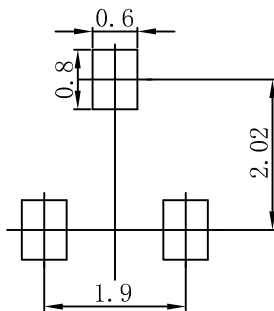
Test Circuit for I<sub>off</sub>

## SOT-23 Package Outline Dimensions



UNIT	A	B	$b_p$	C	D	E	$H_E$	$A_1$	$L_p$
mm	1.40 0.95	2.04 1.78	0.50 0.35	0.19 0.08	3.10 2.70	1.65 1.20	3.00 2.20	0.100 0.013	0.50 0.20

## SOT-23 Suggested Pad Layout



**Note:**

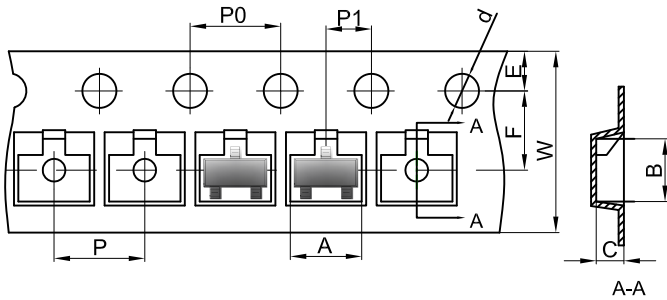
1. Controlling dimension: in millimeters.
2. General tolerance:  $\pm 0.05\text{mm}$ .
3. The pad layout is for reference purposes only.

**NOTICE**

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# Reel Taping Specifications For Surface Mount Devices-SOT-23

## SOT-23 Embossed Carrier Tape



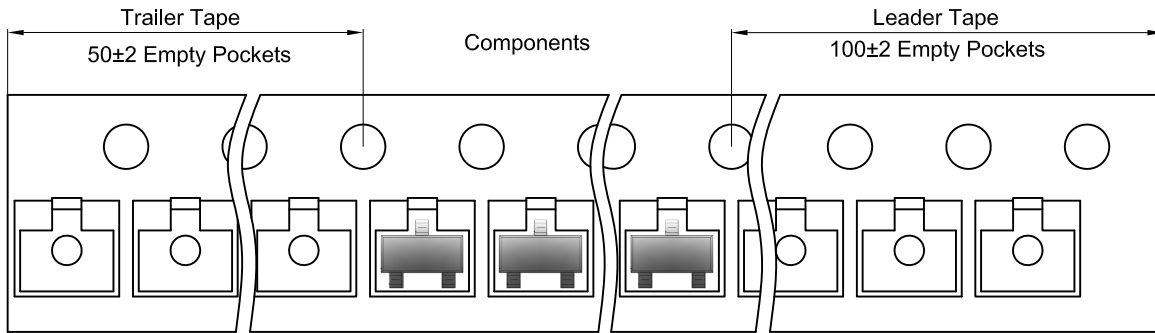
### Packaging Description:

SOT-23 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 3,000 units per 7" or 17.8cm diameter reel. The reels are clear in color and is made of polystyrene plastic (anti-static coated).

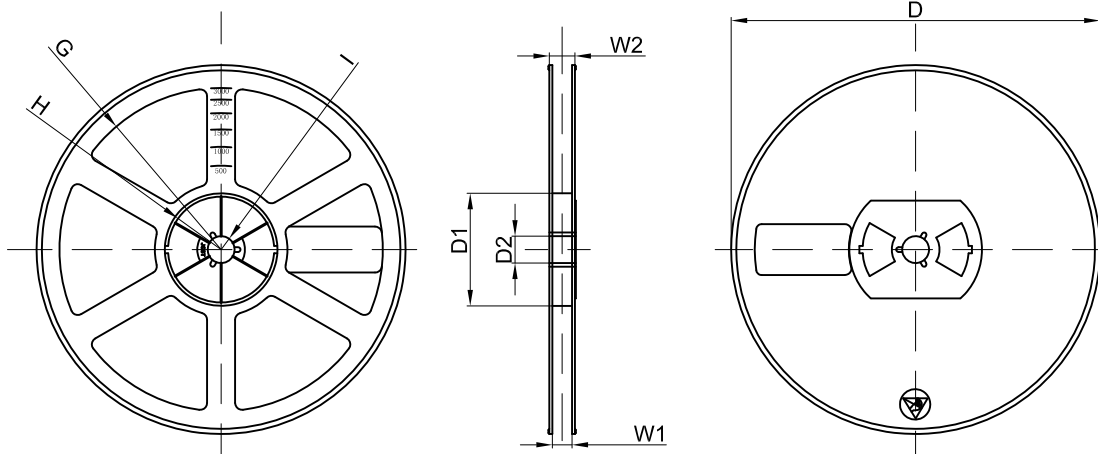
Dimensions are in millimeter

Pkg type	A	B	C	d	E	F	P0	P	P1	W
SOT-23	3.15	2.77	1.22	Ø1.50	1.75	3.50	4.00	4.00	2.00	8.00

## SOT-23 Tape Leader and Trailer



## SOT-23 Reel



Dimensions are in millimeter

Reel Option	D	D1	D2	G	H	I	W1	W2
7"Dia	Ø178.00	54.40	13.00	R78.00	R25.60	R6.50	9.50	12.30

REEL	Reel Size	Box	Box Size(mm)	Carton	Carton Size(mm)	G.W.(kg)
3000 pcs	7 inch	45,000 pcs	203×203×195	180,000 pcs	438×438×230	

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