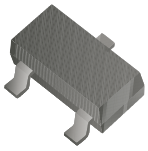
TL431

Programmable Precision Reference

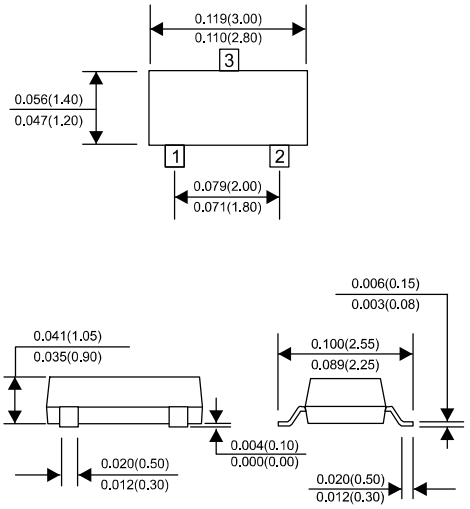


RoHS Device
Halogen Free

FEATURES

- The output voltage can be adjusted to 36V
- Low dynamic output impedance, its typical value is 0.2 Ω
- 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 ppm/℃

SOT-23

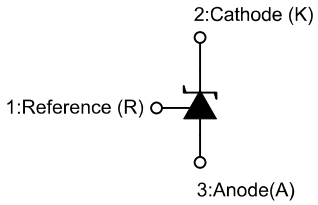


Dimensions in inches and (millimeter)

Applications

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

Circuit Diagram



Absolute Maximum Ratings (T_C=25℃ unless otherwise specified)

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

Electrical Characteristics (at TA=25°C unless otherwise noted)

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

Note: T_{MIN}=-25℃ ,T_{MAX}=+85℃

CLASSIFICATION of V_{ref}

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

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

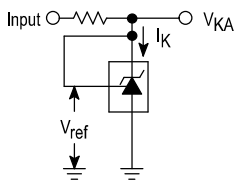


Figure 2. Test Circuit for V_{KA} > V_{ref}

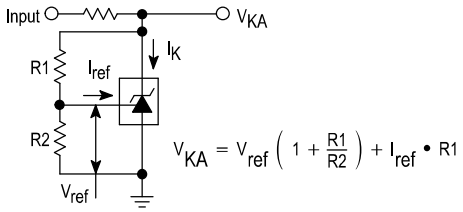
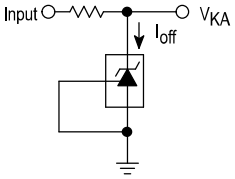
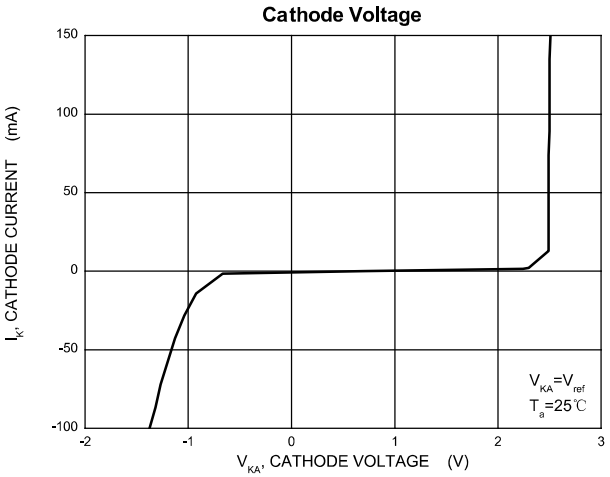
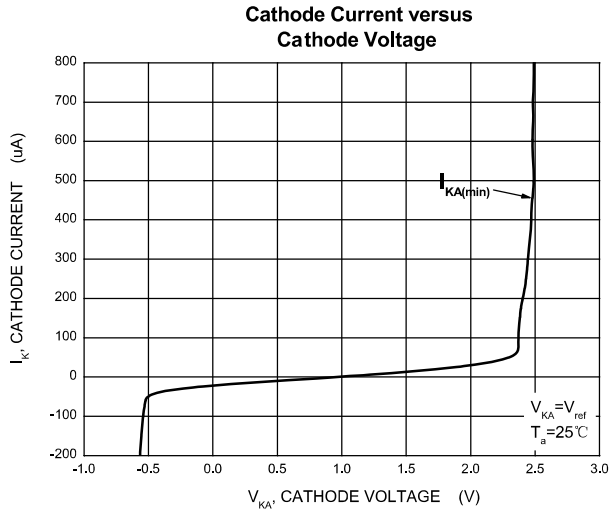


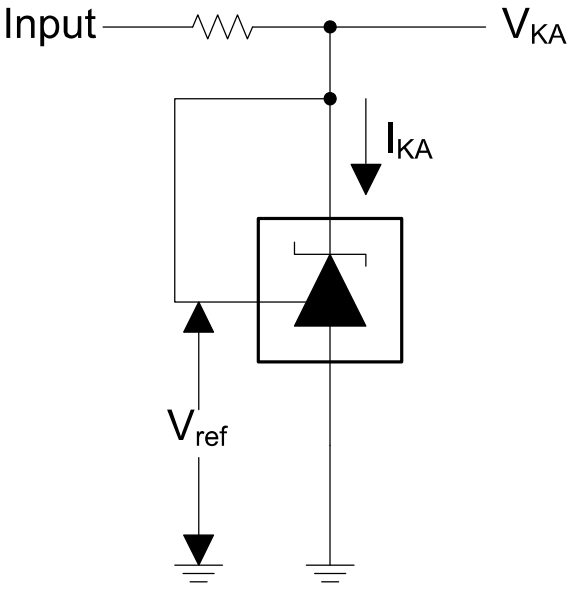
Figure 3. Test Circuit for I_{off}



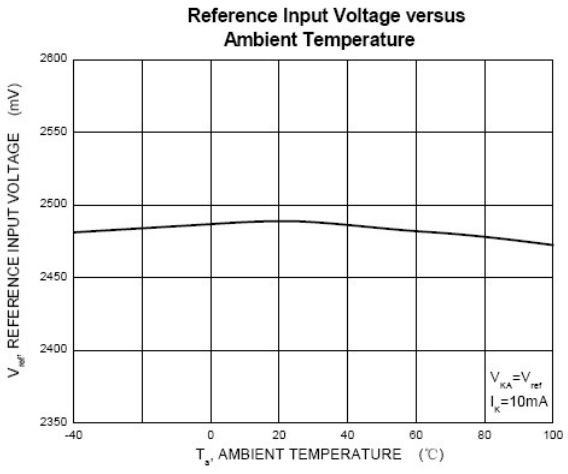
Typical Characteristics





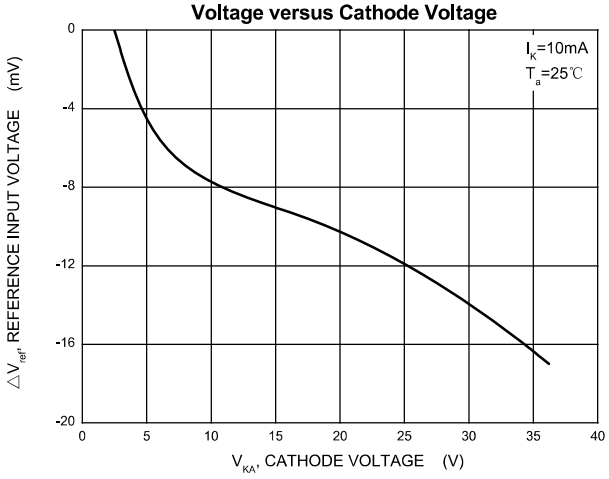


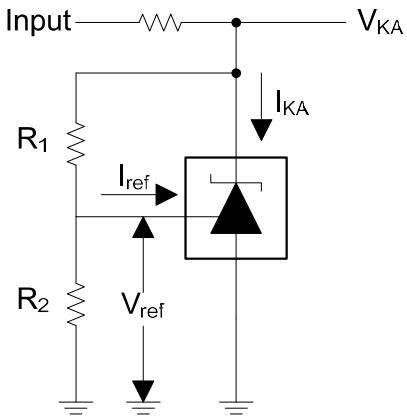
Test Circuit for $V_{KA}=V_{ref}$



Typical Characteristics

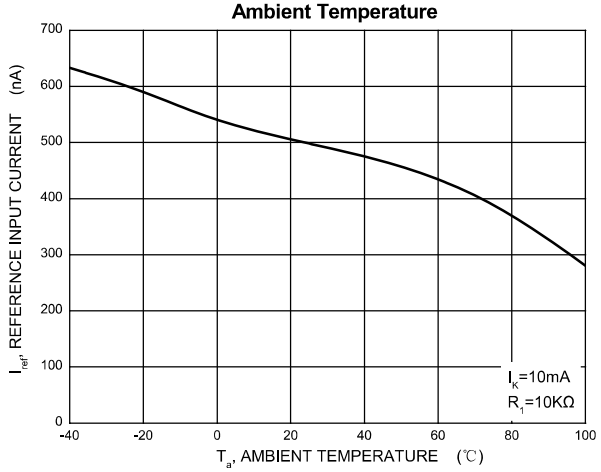
Change in Reference Input Voltage versus Cathode Voltage

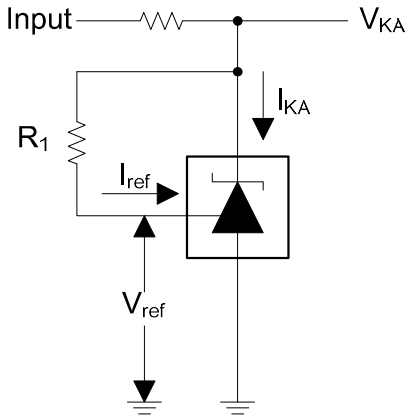




Test Circuit for $V_{KA}=V_{ref}(1+R1/R2)+R1*I_{ref}$

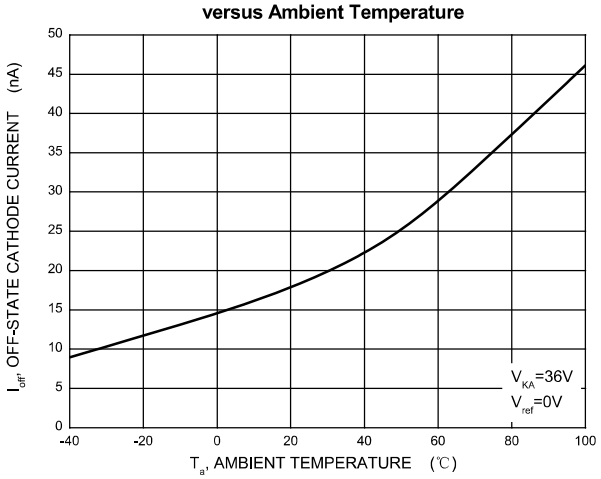
Reference Input Current versus Ambient Temperature

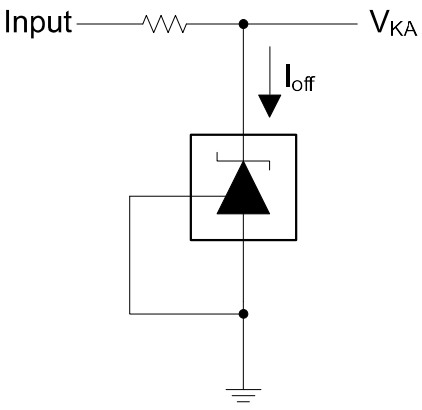




Test Circuit for I_{ref}

Off-State Cathode Current versus Ambient Temperature

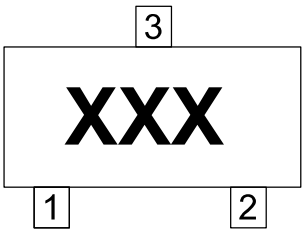




Test Circuit for I_{off}

Marking Code

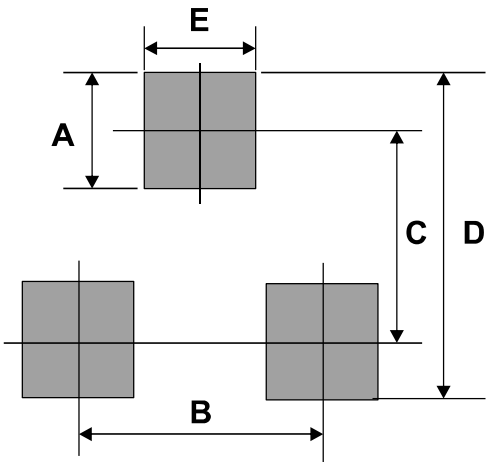
Part Number	Marking Code
TL431	431



xxx = Product type marking code

Suggested PAD Layout

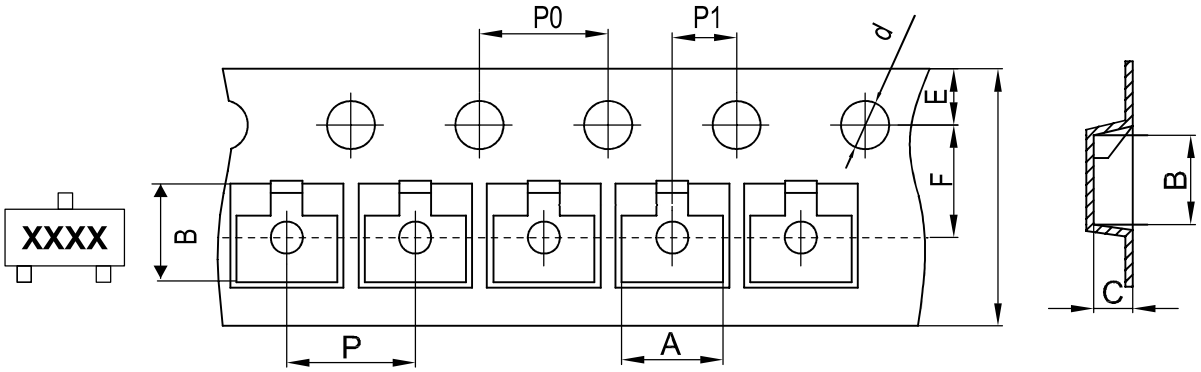
SIZE	SOT-23	
	(mm)	(inch)
A	0.80	0.031
B	1.90	0.075
C	2.02	0.080
D	2.82	0.111
E	0.60	0.024

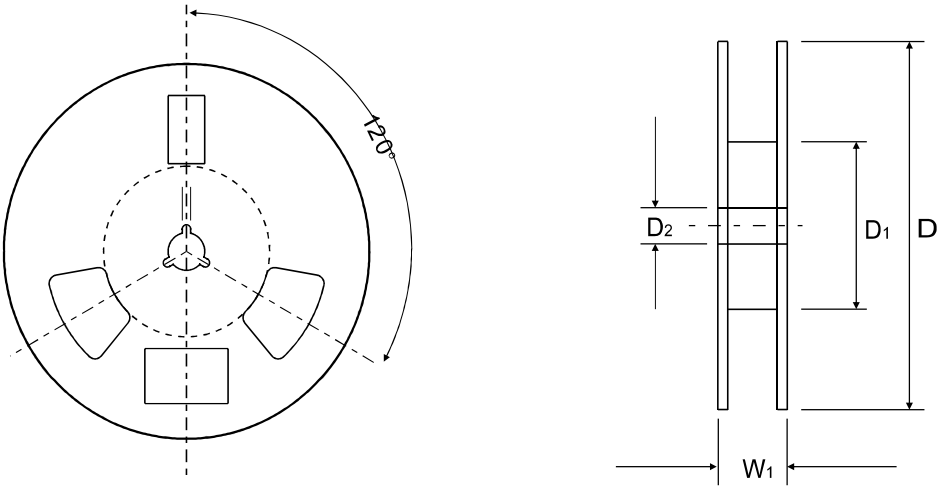


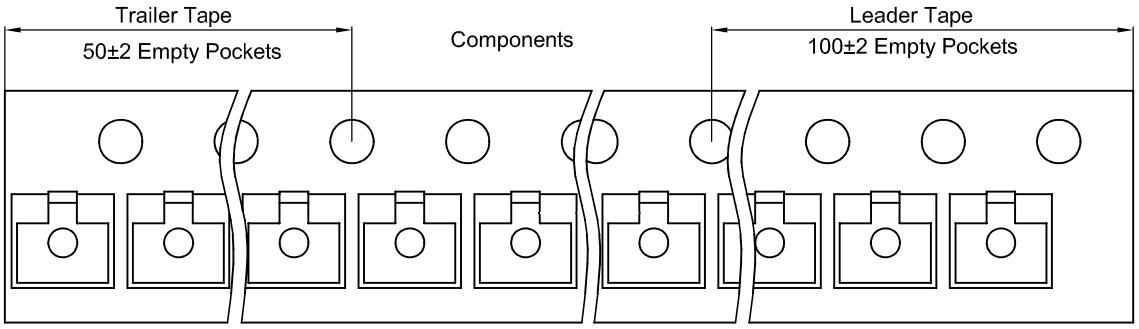
Standard Packaging

Case Type	Qty Per Reel	Reel Size
	(Pcs)	(inch)
SOT-23	3,000	7

Reel Taping Specification







	SYMBOL	A	B	C	d	D	D1	D2
SOT-23	(mm)	3.15 ± 0.10	2.77 ± 0.10	1.22 ± 0.10	1.50 ± 0.10	178.00 ± 2.00	54.40 ± 1.00	13.00 ± 1.00
	(inch)	0.124 ± 0.004	0.109 ± 0.004	0.048 ± 0.004	0.059 ± 0.004	7.008 ± 0.079	2.142 ± 0.039	0.512 ± 0.039

	SYMBOL	E	F	P	P0	P1	W	W1
SOT-23	(mm)	1.75 ± 0.10	3.50 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	2.00 ± 0.10	8.00 + 0.30 / - 0.10	12.30 ± 1.00
	(inch)	0.069 ± 0.004	0.138 ± 0.004	0.157 ± 0.004	0.157 ± 0.004	0.079 ± 0.004	0.315 + 0.012 / - 0.004	0.484 ± 0.039