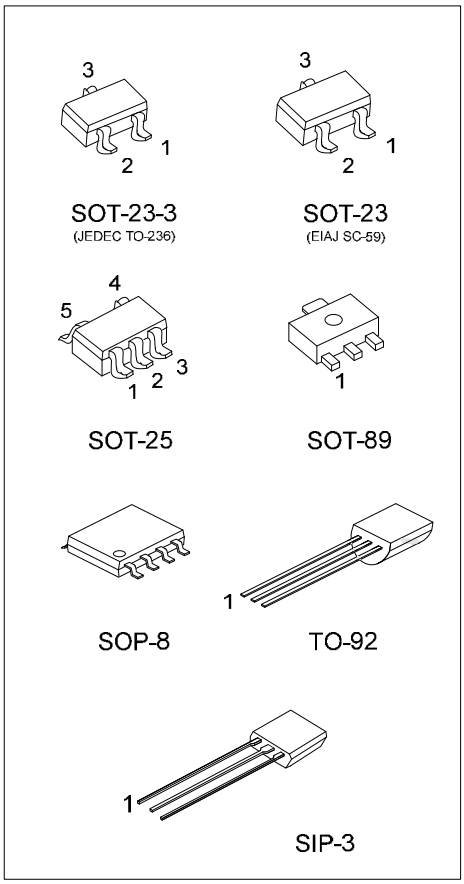
TL431

LINEAR INTEGRATED CIRCUIT

PROGRAMMABLE PRECISION REFERENCE



■ DESCRIPTION

The UTC **TL431** is a three-terminal adjustable regulator with a guaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between V_{REF} (approximately 2.5V) and 36V with two external resistors. It provides very wide applications, including shunt regulator, series regulator, switching regulator, voltage reference and others.

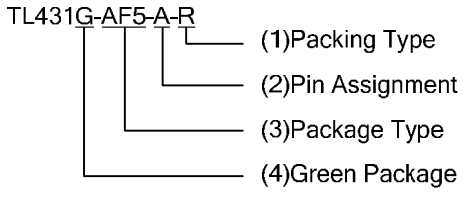
■ FEATURES

* Programmable output Voltage to 36V.
* Low dynamic output impedance 0.2Ω.
* Sink current capability of 1.0 to 100mA.
* Equivalent full-range temperature coefficient of 50ppm/°C typical for operation over full rated operating temperature range.

■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment								Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	
-	TL431G-AB3-R	SOT-89	R	A	K	-	-	-	-	-	Tape Reel
-	TL431G-AE2-R	SOT-23-3	K	R	A	-	-	-	-	-	Tape Reel
-	TL431G-AE3-R	SOT-23	K	R	A	-	-	-	-	-	Tape Reel
-	TL431NSG-AE3-R	SOT-23	R	K	A	-	-	-	-	-	Tape Reel
-	TL431NSG-AE2-R	SOT-23-3	R	K	A	-	-	-	-	-	Tape Reel
-	TL431G-AF5-R	SOT-25	X	X	K	R	A	-	-	-	Tape Reel
-	TL431NG-AF5-A-R	SOT-25	X	A	X	K	R	-	-	-	Tape Reel
-	TL431G-S08-R	SOP-8	K	A	A	X	X	A	A	R	Tape Reel
-	TL431G-G03-K	SIP-3	R	A	K	-	-	-	-	-	Bulk
TL431K-T92-B	TL431G-T92-B	TO-92	R	A	K	-	-	-	-	-	Tape Box
TL431K-T92-K	TL431G-T92-K	TO-92	R	A	K	-	-	-	-	-	Bulk

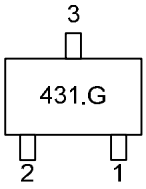
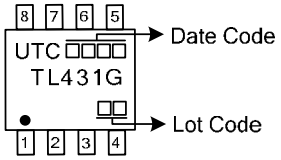
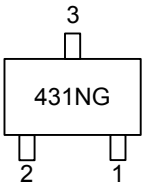
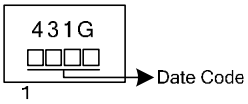
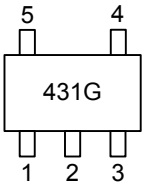
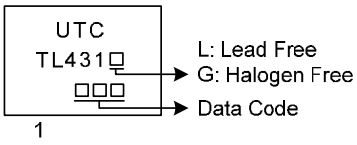
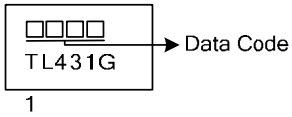
Note: Pin Code: K: Cathode A: Anode R: Reference X: No Connection



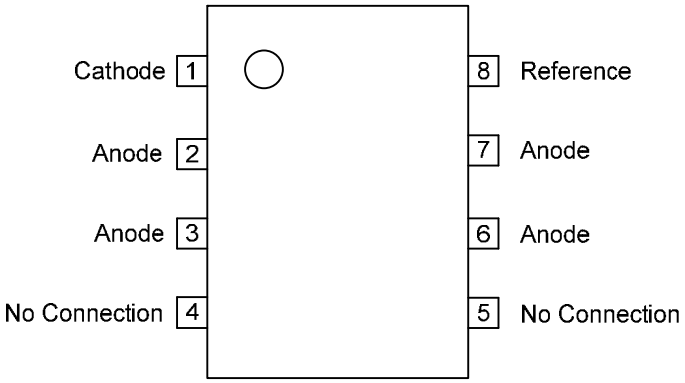
(1) B: Tape Box, K: Bulk, R: Tape Reel, T: Tube
(2) refer to Pin Assignment
(3) AB3: SOT-89, AE2: SOT-23-3, AE3: SOT-23, AF5: SOT-25, S08: SOP-8, G03: SIP-3, T92: TO-92
(4) G: Halogen Free and Lead Free, K: Lead Free

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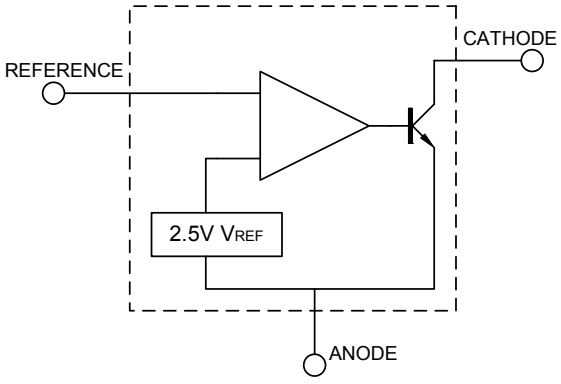
■ MARKING

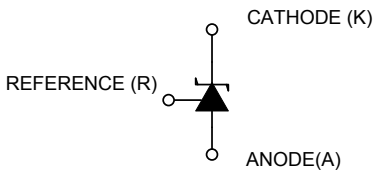
PACKAGE	MARKING	PACKAGE	MARKING
SOT-23-3 SOT-23 (TL431)		SOP-8	
SOT-23-3 SOT-23 (TL431NS)		SIP-3	
SOT-25		TO-92	
SOT-89			

■ PIN CONFIGURATION(For SOP-8)



■ BLOCK DIAGRAM





■ ABSOLUTE MAXIMUM RATINGS (Operating temperature range applies, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	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	TO-92	P_D	770	mW
	SOT-89		800	mW
	SOT-23/SOT-23-3 SOT-25		300	mW
	SIP-3		400	mW
	SOP-8		600	mW
Operating Junction		T_J	+150	°C
Operating Ambient		T_{OPR}	-40 ~ +85	°C
Storage Temperature		T_{STG}	-65 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged Absolute maximum ratings are stress ratings only and functional device operation is not implied.

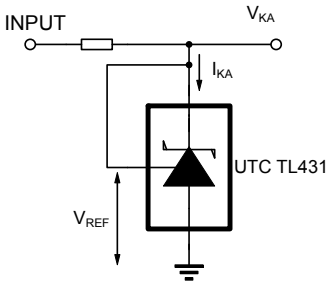
■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Cathode Voltage	V_{KA}	V_{REF}		36	V
Cathode Current	I_{KA}	1		100	mA

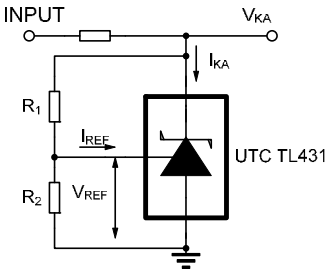
■ ELECTRICAL CHARACTERISTICS (T_C= 25°C, unless otherwise specified.)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Reference Input Voltage	V_{REF}	$V_{KA}=V_{REF}, I_{KA}=10mA$	TL431-A	2.483	2.495	2.507	V
			TL431-1	2.470	2.495	2.520	V
			TL431-2	2.520	-	2.545	V
			TL431-3	2.445	-	2.470	V
Deviation of reference Input Voltage Over temperature	$\frac{\Delta V_{REF}}{\Delta T}$	$V_{KA}=V_{REF}, I_{KA}=10mA$, $0°C \le T_A \le 70°C$			4.5	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	$I_{KA}=10mA$	$\Delta V_{KA}=10V \sim V_{REF}$		-1.0	-2.7	mV/V
			$\Delta V_{KA}=36V \sim 10V$		-0.5	-2.0	mV/V
Reference Input Current	I_{REF}	$I_{KA}=10mA$, R1=10kΩ, R2=∞			1.5	4	μA
Deviation of Reference Input Current Over Full Temperature Range	$\frac{\Delta I_{REF}}{\Delta T}$	$I_{KA}=10mA$, R1=10kΩ, R2=∞, T_A =full Temperature			0.4	1.2	μA
Minimum Cathode Current for Regulation	$I_{KA(MIN)}$	$V_{KA}=V_{REF}$			0.3	0.5	mA
Off-State Cathode Current	$I_{KA(OFF)}$	$V_{KA}=36V$, $V_{REF}=0$			0.05	1.0	μA
Dynamic Impedance	Z_{KA}	$V_{KA}=V_{REF}$, $I_{KA}=1 \sim 100mA, f \le 1.0kHz$			0.15	0.5	Ω

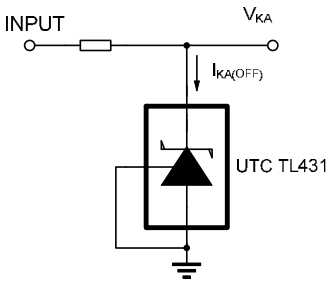
■ TEST CIRCUIT



For $V_{KA}=V_{REF}$

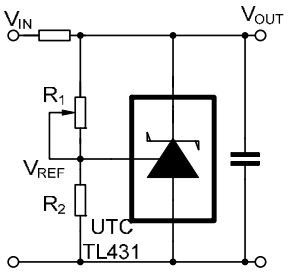


$V_{KA}=V_{REF}\times(1+R_1/R_2)+I_{REF}\times R_1$
For $V_{KA}\geq V_{REF}$



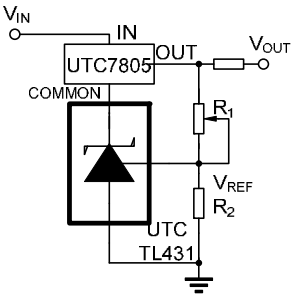
For $I_{KA(OFF)}$

■ APPLICATION CIRCUIT

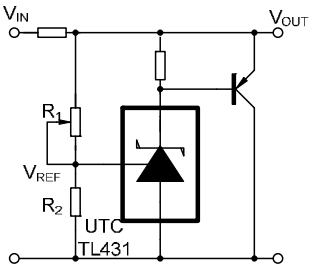


$V_{OUT}=(1+R_1/R_2)\times V_{REF}$

Shutdown Regulator

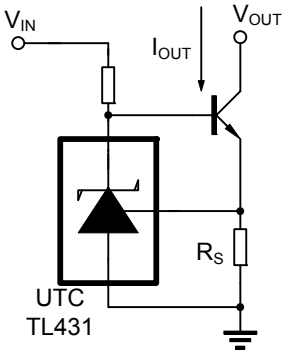


$V_{OUT}=(1+R_1/R_2)\times V_{REF}$
Minimum $V_{OUT}=V_{REF}+5V$
Output Control of a Three -Terminal Fixed Regulator

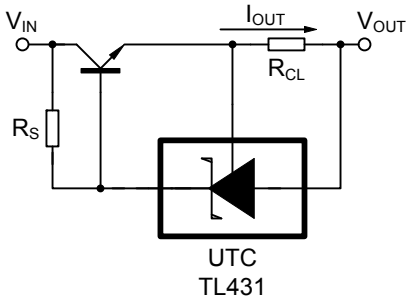


$V_{OUT}=(1+R_1/R_2)\times V_{REF}$

Higher-current Shunt Regulator



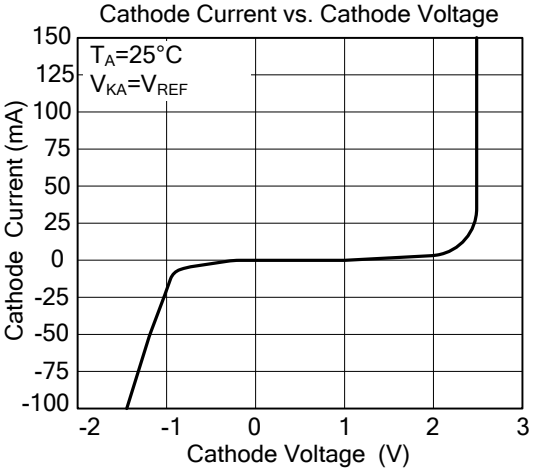
$I_{OUT}=V_{REF}/R_S$
Constant-current Sink



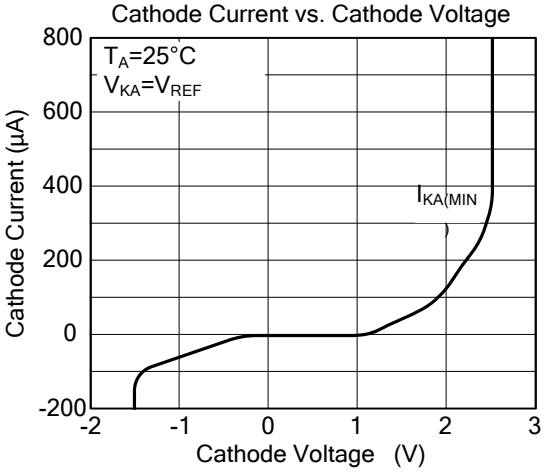
$I_{OUT}=V_{REF}/R_{CL}$
Current Limiting or Current Source

■ TYPICAL CHARACTERISTICS

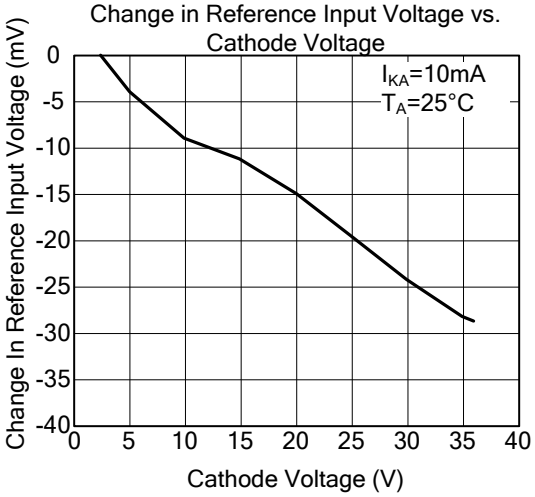
Cathode Current vs. Cathode Voltage



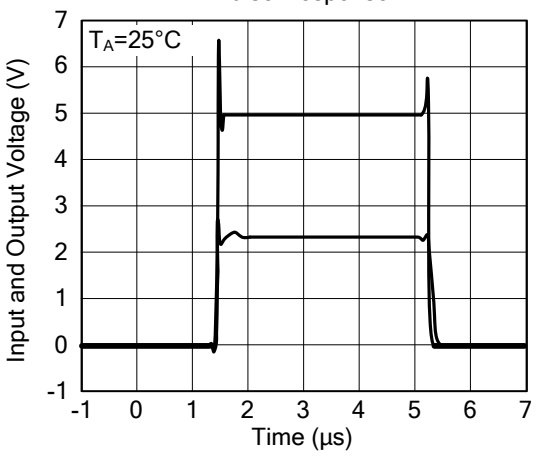
Cathode Current vs. Cathode Voltage



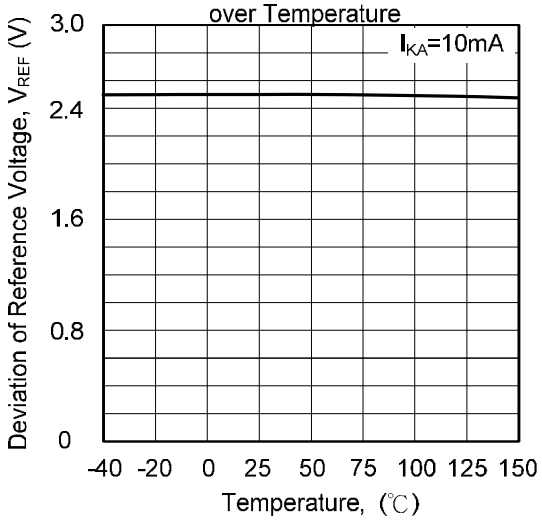
Change in Reference Input Voltage vs. Cathode Voltage



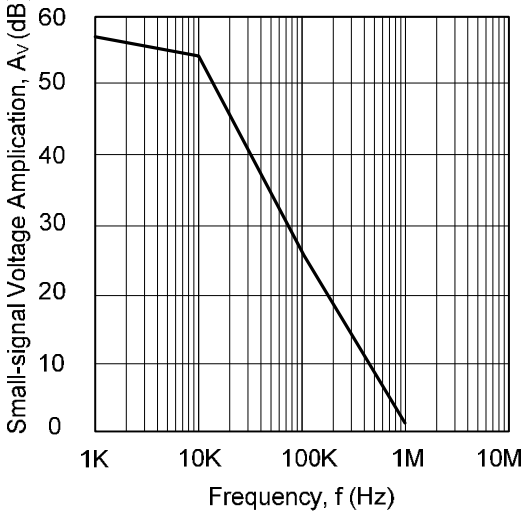
Pulse Response



Deviation of Reference Voltage over Temperature



Frequency Response



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