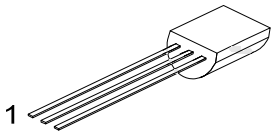
TL431H

LINEAR INTEGRATED CIRCUIT

PROGRAMMABLE PRECISION REFERENCE



TO-92

■ DESCRIPTION

The UTC **TL431H** 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.

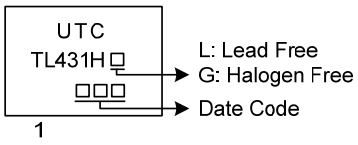
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
TL431HL-T92-B	TL431HG-T92-B	TO-92	R	A	K	Tape Box
TL431HL-T92-K	TL431HG-T92-K	TO-92	R	A	K	Bulk

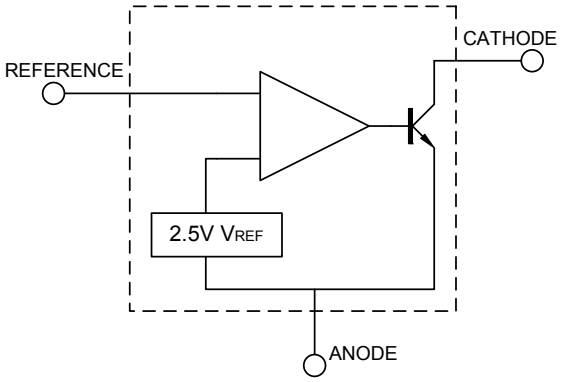
Note: Pin Code: K: Cathode A: Anode R: Reference

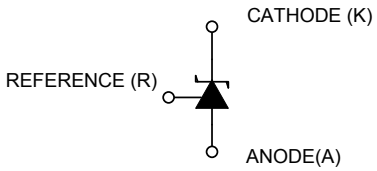
TL431HG-T92-B (1)Packing Type (2)Package Type (3)Green Package	(1) B: Tape Box, K: Bulk (2) T92: TO-92 (3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



■ 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	P_D	770	mW
Operating Junction	T_J	+150	°C
Operating Ambient (Note 2)	T_{OPR}	-40 ~ +125	°C
Storage Temperature	T_{STG}	-65 ~ +150	°C

Notes: 1. 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.
2. It is guarantee by design, not 100% be tested.

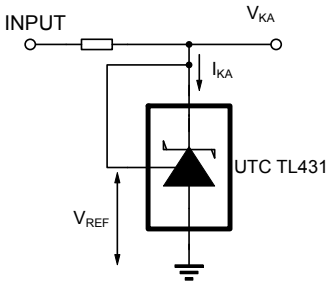
■ RECOMMENDED OPERATING CONDITIONS

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

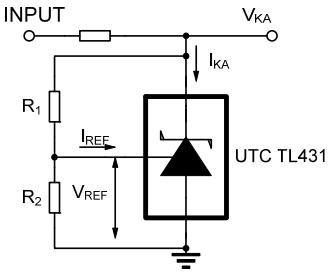
■ ELECTRICAL CHARACTERISTICS (T_C= 25°C, unless otherwise specified.)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Reference Input Voltage	V_{REF}	$V_{KA}=V_{REF}$, I_{KA}=10mA	TL431H-A (±0.5%)	2.483	2.495	2.507	V
			TL431H-1 (±1%)	2.470	2.495	2.520	V
			TL431H-2 (+2%)	2.520	-	2.545	V
			TL431H-3 (-2%)	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 ≤T_A≤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	ΔV_{KA}=10V~V_{REF}		-1.0	-2.7	mV/V
			ΔV_{KA}=36V~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~ 100mA,f≤1.0kHz			0.15	0.5	Ω

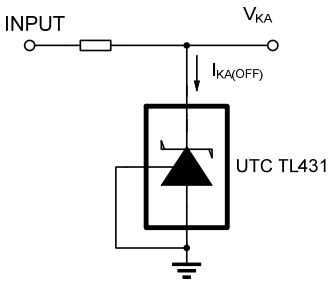
■ TEST CIRCUIT



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

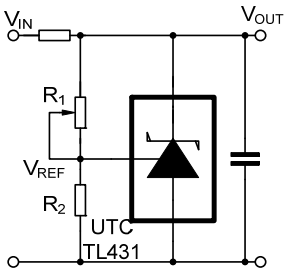


$V_{KA}=V_{REF}\times(1+R_1/R_2)+I_{REF}\times R_1$
For $V_{KA}\geq V_{REF}$



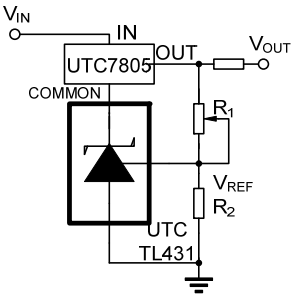
For $I_{KA(OFF)}$

■ APPLICATION CIRCUIT

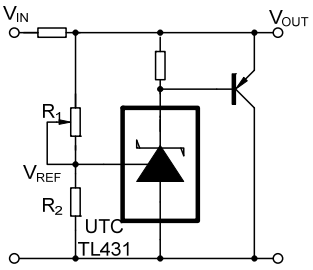


$V_{OUT}=(1+R_1/R_2)\times V_{REF}$

Shutdown Regulator

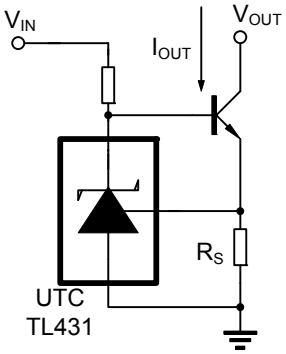


$V_{OUT}=(1+R_1/R_2)\times V_{REF}$
Minimum $V_{OUT}=V_{REF}+5V$
Output Control of a Three -Terminal Fixed Regulator

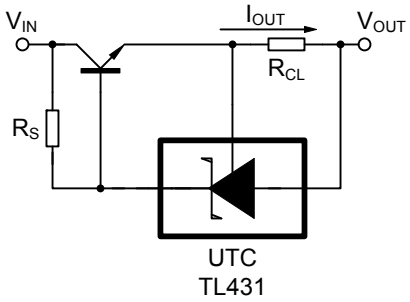


$V_{OUT}=(1+R_1/R_2)\times V_{REF}$

Higher-current Shunt Regulator



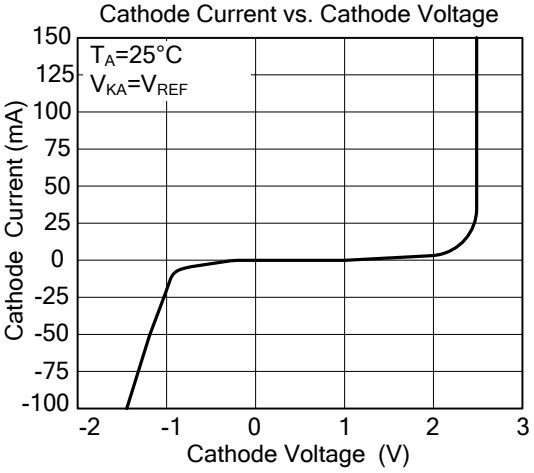
$I_{OUT}=V_{REF}/R_S$
Constant-current Sink



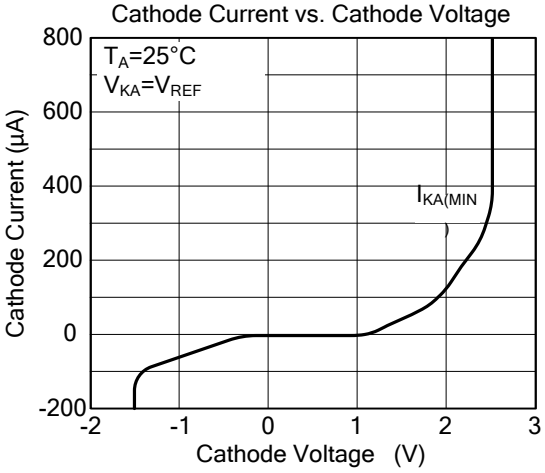
$I_{OUT}=V_{REF}/R_{CL}$
Current Limiting or Current Source

■ TYPICAL CHARACTERISTICS

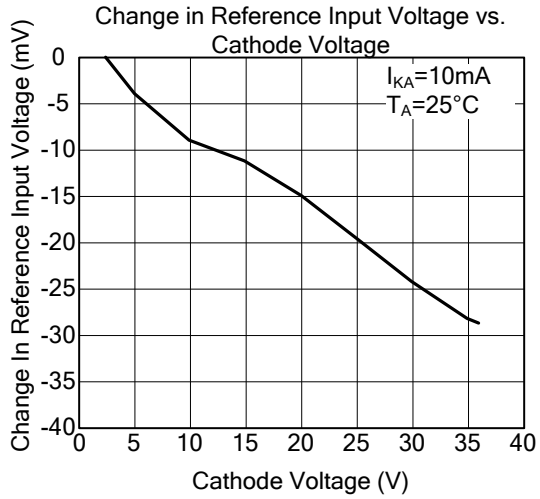
Cathode Current vs. Cathode Voltage



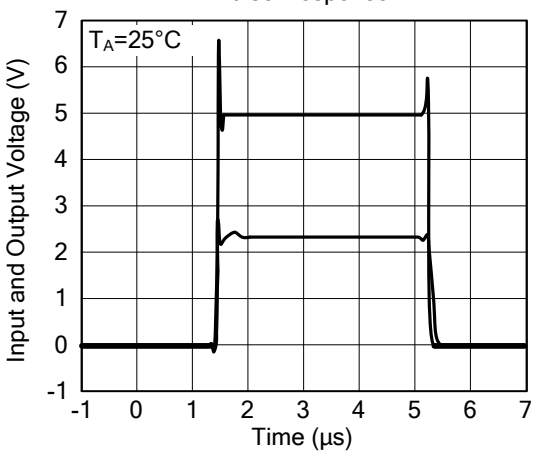
Cathode Current vs. Cathode Voltage



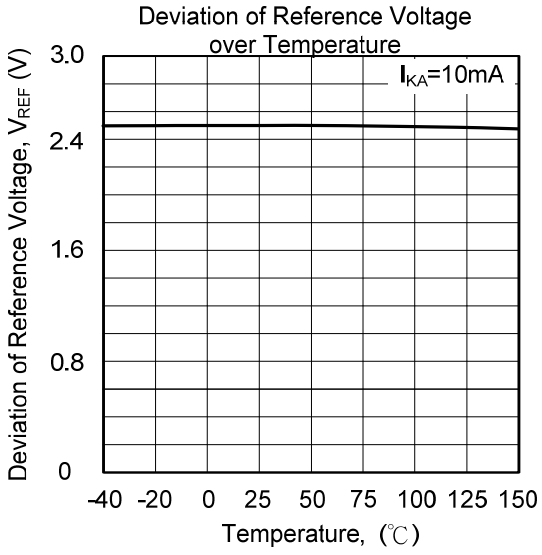
Change in Reference Input Voltage vs. Cathode Voltage



Pulse Response



Deviation of Reference Voltage over Temperature



Frequency Response