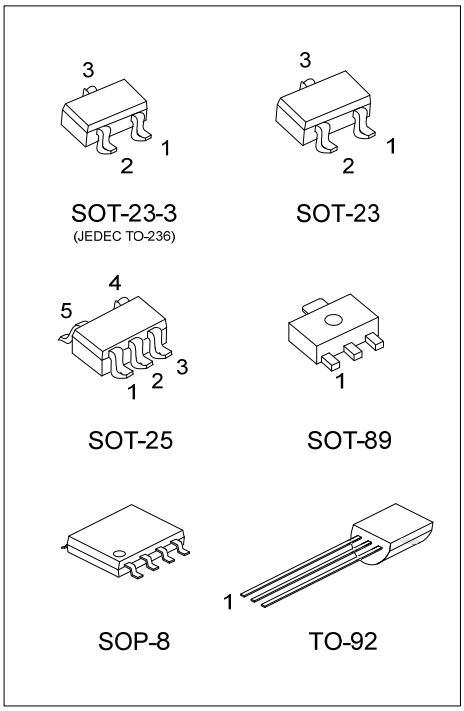
TL431

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.

Lead-free: TL431K
Halogen-free: TL431G
TL431NS for SOT-23
Lead-free: TL431NSL
Halogen-free: TL431NSG

■ ORDERING INFORMATION

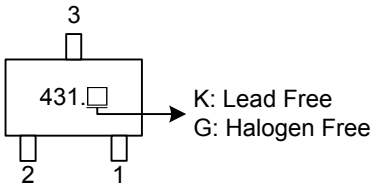
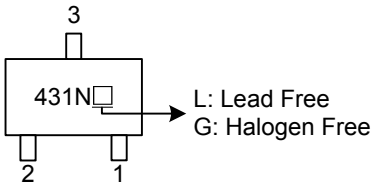
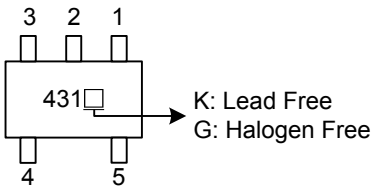
Ordering Number			Pin Assignment								Package	Packing
Normal	Lead Free	Halogen Free	1	2	3	4	5	6	7	8		
TL431-AB3-R	TL431K-AB3-R	TL431G-AB3-R	R	A	K	-	-	-	-	-	SOT-89	Tape Reel
TL431-AE2-R	TL431K-AE2-R	TL431G-AE2-R	K	R	A	-	-	-	-	-	SOT-23-3	Tape Reel
TL431-AE3-R	TL431K-AE3-R	TL431G-AE3-R	K	R	A	-	-	-	-	-	SOT-23	Tape Reel
TL431NS-AE3-R	TL431NSL-AE3-R	TL431NSG-AE3-R	R	K	A	-	-	-	-	-	SOT-23	Tape Reel
TL431-AF5-R	TL431K-AF5-R	TL431G-AF5-R	X	X	K	R	A	-	-	-	SOT-25	Tape Reel
TL431-S08-R	TL431K-S08-R	TL431G-S08-R	K	A	A	X	X	A	A	R	SOP-8	Tape Reel
TL431-T92-B	TL431K-T92-B	TL431G-T92-B	R	A	K	-	-	-	-	-	TO-92	Tape Box
TL431-T92-K	TL431K-T92-K	TL431G-T92-K	R	A	K	-	-	-	-	-	TO-92	Bulk

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

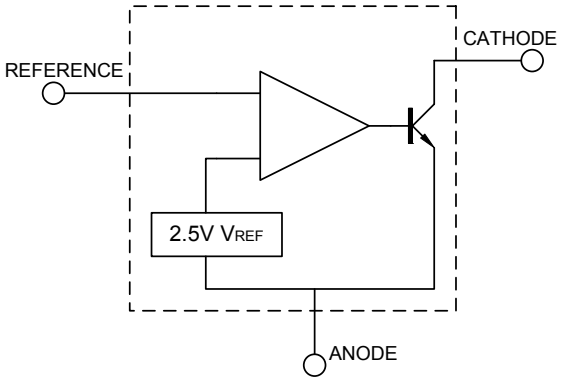
TL431K-AB3-R
(1)Packing Type
(2)Package Type
(3)Lead Plating

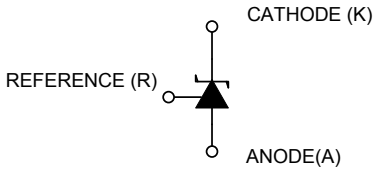
(1) B: Tape Box, K: Bulk, R: Tape Reel
(2) AB3: SOT-89, AE2: SOT-23-3, AE3: SOT-23, AF5: SOT-25, S08:SOP-8, T92: TO-92
(3) G: Halogen Free, K: Lead Free Plating, Blank: Pb/Sn
G: Halogen Free, L: Lead Free Only for TL431NS Type

■ MARKING

PACKAGE	MARKING
SOT-23-3 SOT-23	
SOT-23 (TL431NS)	
SOT-25	

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
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

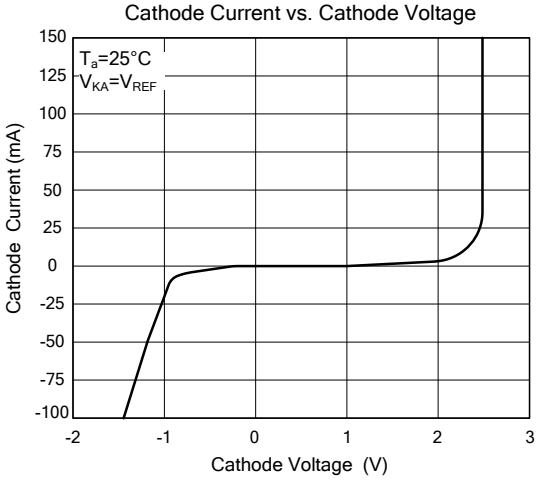
PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Cathode Voltage	V_{KA}	V_{REF}		36	V
Cathode Current	I_{KA}	1		100	mA

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

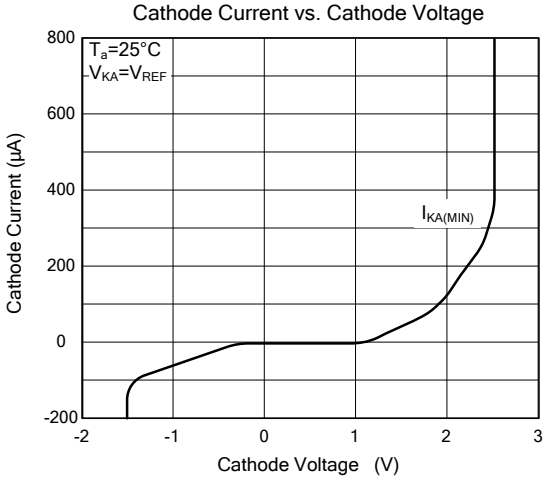
PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Reference Input Voltage	V_{REF}	$V_{KA}=V_{REF}, I_{KA}$=10mA		2.470	2.495	2.520	V
Deviation of reference Input Voltage Over temperature	$\frac{\Delta V_{REF}}{\Delta T}$	$V_{KA}=V_{REF}, I_{KA}$=10mA 0°C ≤Ta≤70°C			4.5	17	mV
Ratio of Change in Reference 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=∞ Ta =full Temperature			0.4	1.2	μA
Minimum Cathode Current for Regulation	$I_{KA(MIN)}$	$V_{KA}=V_{REF}$			0.19	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 to 100mA f≤1.0kHz			0.15	0.5	Ω

■ TYPICAL CHARACTERISTICS

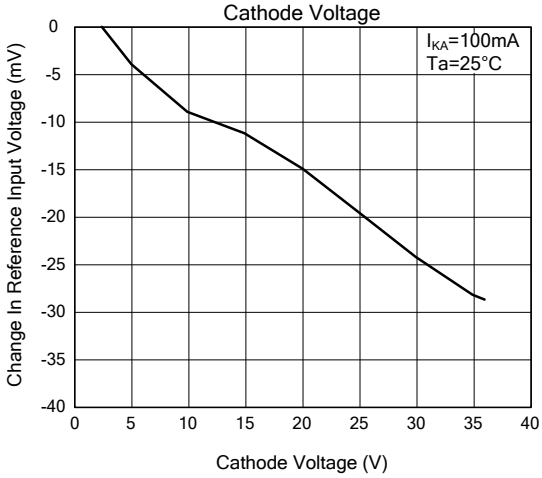
Cathode Current vs. Cathode Voltage



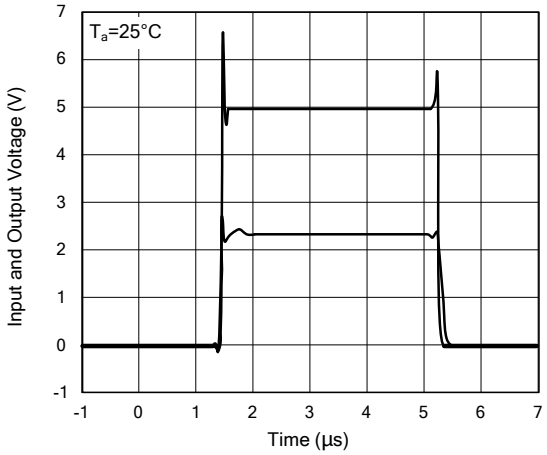
Cathode Current vs. Cathode Voltage



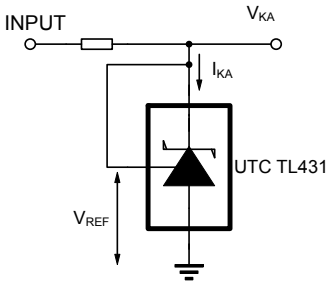
Change in Reference Input Voltage vs. Cathode Voltage



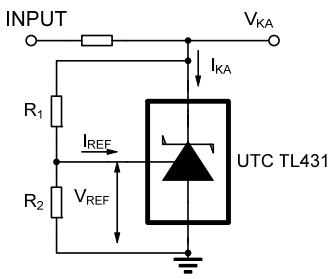
Pulse Response



■ TEST CIRCUIT

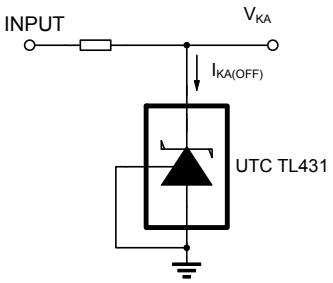


For $V_{KA}=V_{REF}$



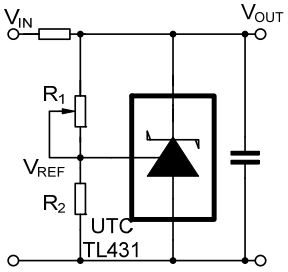
$V_{KA}=V_{REF}\times(1+R_1/R_2)+I_{REF}\times R_1$

For $V_{KA}\geq V_{REF}$



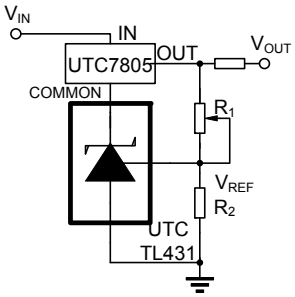
For $I_{KA(OFF)}$

■ APPLICATION CIRCUIT



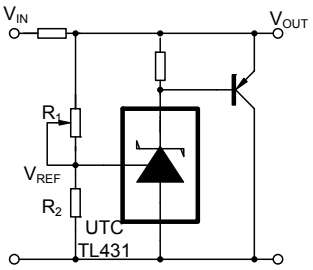
$V_{OUT}=(1+R_1/R_2)\times V_{REF}$

Shutdown Regulator



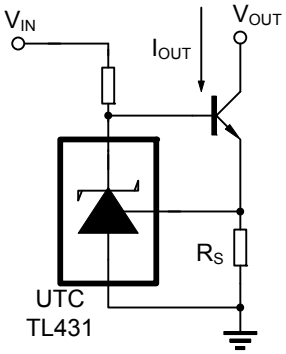
$V_{OUT}=(1+R_1/R_2)\times V_{REF}$
Minimum $V_{OUT}=V_{REF}+5V$

Output Control of a Three -Terminal Fixed Regulator



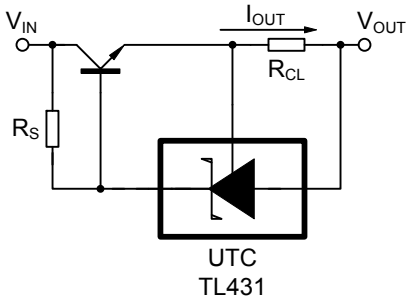
$V_{OUT}=(1+R_1/R_2)\times V_{REF}$

Higher-current Shunt Regulator



$I_{OUT}=V_{REF}/R_S$

Constant-current Sink



$R_S=V_{REF}/R_{CL}$

Current Limiting or Current Source