



# TL431

## LINEAR INTEGRATED CIRCUIT

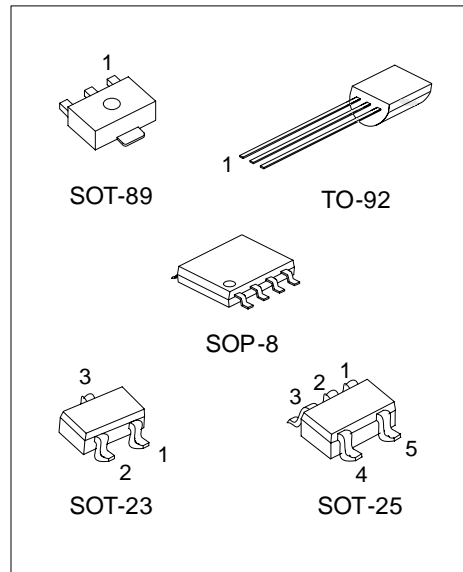
### PROGRAMMABLE PRECISION REFERENCE

#### 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 36 V 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.



\*Pb-free plating product number: TL431K  
 \*Pb-free plating product for SOT-23NS type number: TL431NSL

#### ORDERING INFORMATION

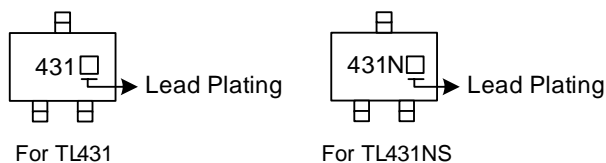
[www.DataSheet4U.com](http://www.DataSheet4U.com)

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

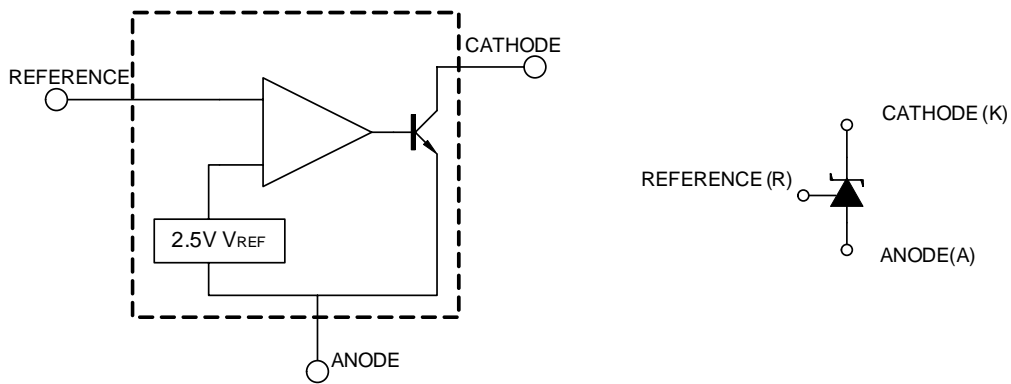
Note: Pin Code: K: Cathode A: Anode R: Reference X: No Connection

<p>TL431K-AB3-R</p> <p>(1)Packing Type (2)Package Type (3)Lead Plating</p>	<p>(1) B: Tape Box, K: Bulk, R: Tape Reel, T: Tube          (2) AB3: SOT-89, AE3: SOT-23, AF5: SOT-25, S08:SOP-8, T92: TO-92          (3) K: Lead Free Plating Blank Pb/Sn          L : Lead Free Plating Only for SOT-23NS Type</p>
--	--

#### MARKING (SOT-23/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-25		300	mW
Operating Junction Temperature		$T_J$	+150	°C
Operating Ambient Temperature		$T_{OPR}$	-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.

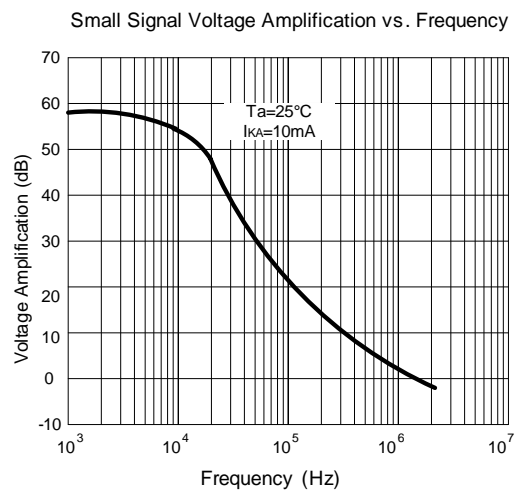
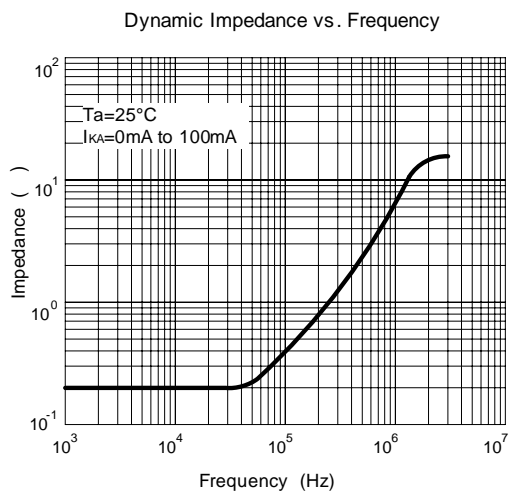
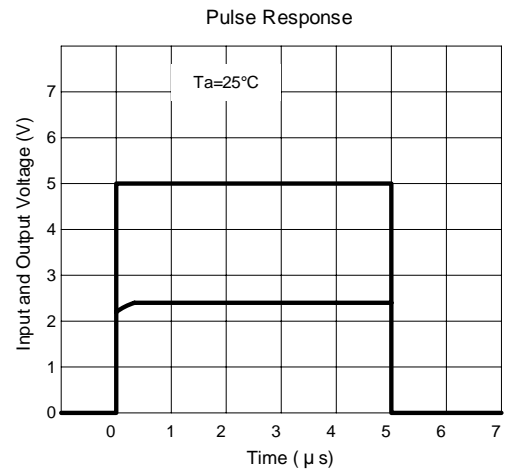
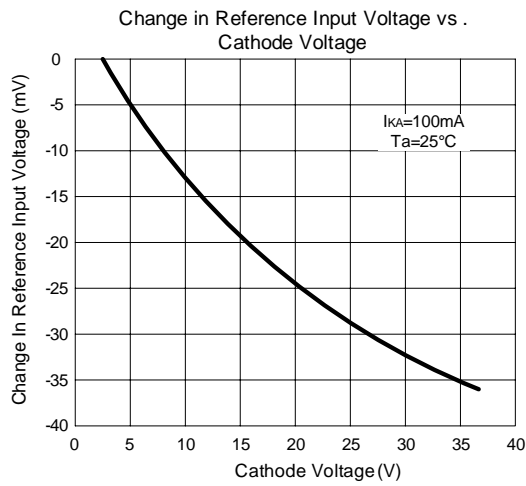
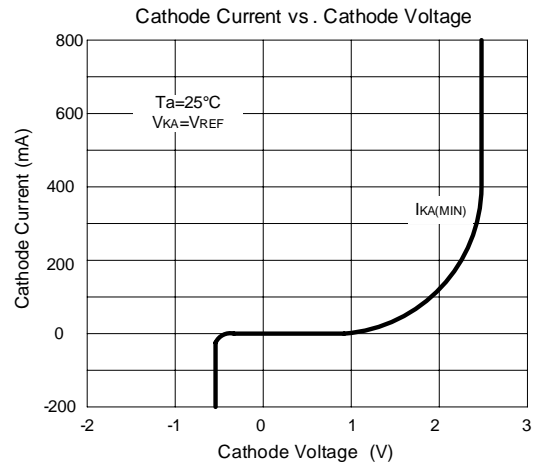
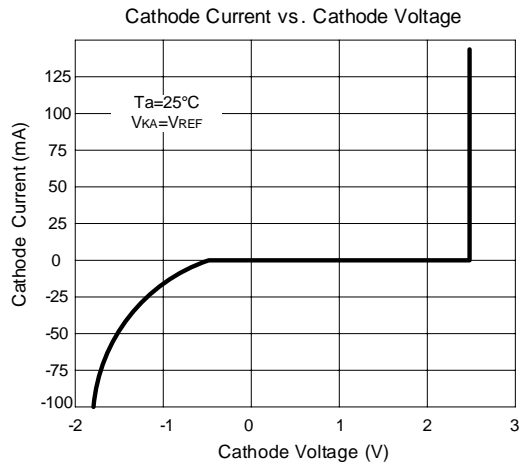
■ RECOMMENDED OPERATING CONDITIONS

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

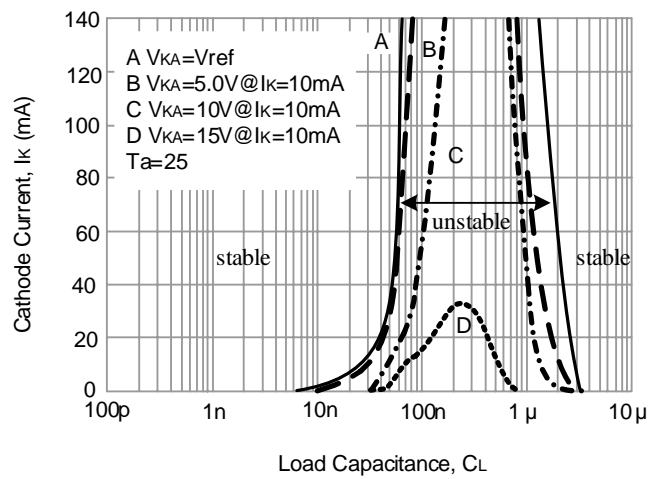
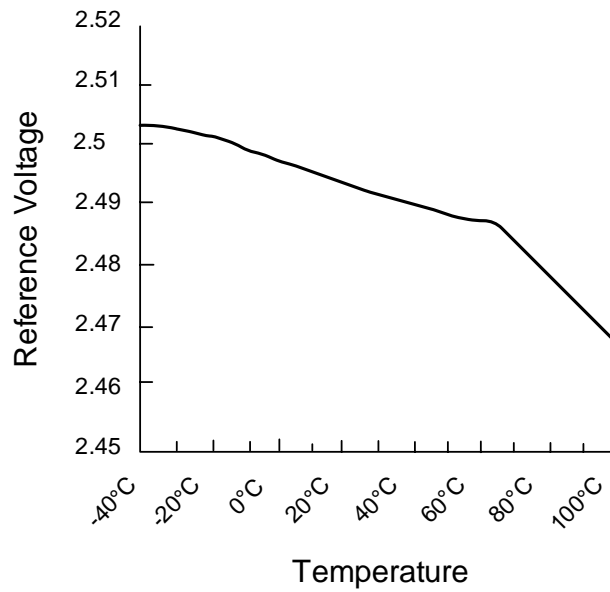
■ ELECTRICAL CHARACTERISTICS ( $T_C=25$  , unless otherwise specified.)

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	$\Delta V_{REF}/\Delta T$	$V_{KA}=V_{REF}, I_{KA}=10mA$ $0^\circ C \quad T_a \quad 70^\circ C$		4.5	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\Delta V_{REF}/\Delta V_{KA}$	$I_{KA}=10mA$ $\Delta V_{KA}=10V \sim V_{REF}$ $\Delta V_{KA}=36V \sim 10V$		-1.0 -0.5	-2.7 -2.0	mV/V
Reference Input Current	$I_{REF}$	$I_{KA}=10mA, R1=10k\Omega, R2=\infty$		1.5	4	$\mu A$
Deviation of Reference Input Current Over Full Temperature Range	$\Delta I_{REF}/\Delta T$	$I_{KA}=10mA, R1=10k\Omega, R2=\infty$ $T_a = \text{full Temperature}$		0.4	1.2	$\mu A$
Minimum Cathode Current for Regulation	$I_{KA(MIN)}$	$V_{KA}=V_{REF}$		0.45	1.0	mA
Off-State Cathode Current	$I_{KA(OFF)}$	$V_{KA}=36V, V_{REF}=0$		0.05	1.0	$\mu A$
Dynamic Impedance	$Z_{KA}$	$V_{KA}=V_{REF}, I_{KA}=1 \text{ to } 100mA$ $f \leq 1.0kHz$		0.15	0.5	$\Omega$

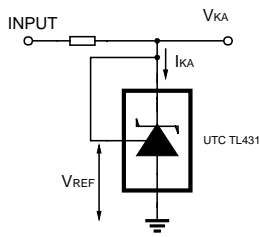
## TYPICAL CHARACTERISTICS



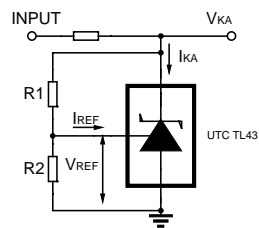
■ TYPICAL CHARACTERISTICS (Cont.)



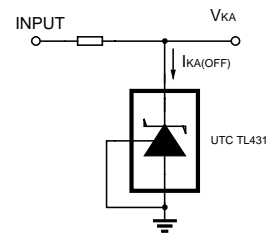
### TEST CIRCUIT



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

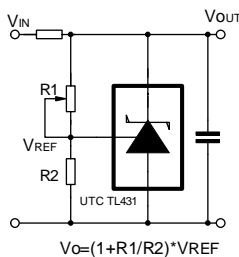


For  $V_{KA} = V_{REF} \cdot (1 + R1/R2) + I_{REF} \cdot R1$

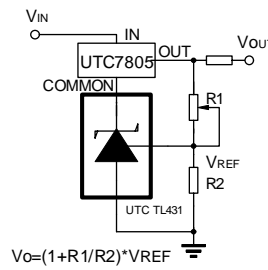


For  $I_{KA(OFF)}$

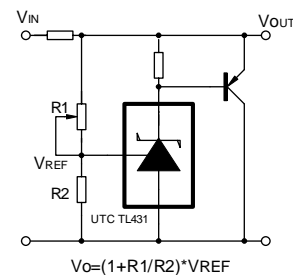
### APPLICATION CIRCUIT



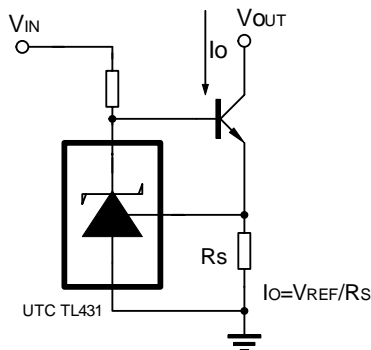
Shutdown Regulator



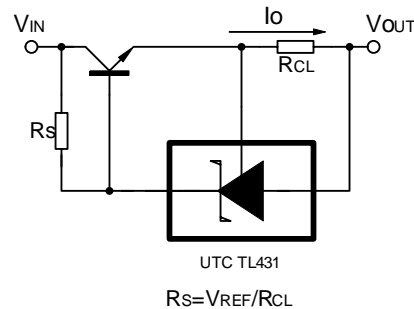
Output Control of a Three-Terminal Fixed Regulator



Higher-current Shunt Regulator



Constant-current Sink



Current Limiting or Current Source

UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice.