



TL431L

LINEAR INTEGRATED CIRCUIT

PROGRAMMABLE PRECISION REFERENCE

DESCRIPTION

The UTC **TL431L** 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 20V with two external resistors. It provides very wide applications, including shunt regulator, series regulator, switching regulator, voltage reference and others.

FEATURES

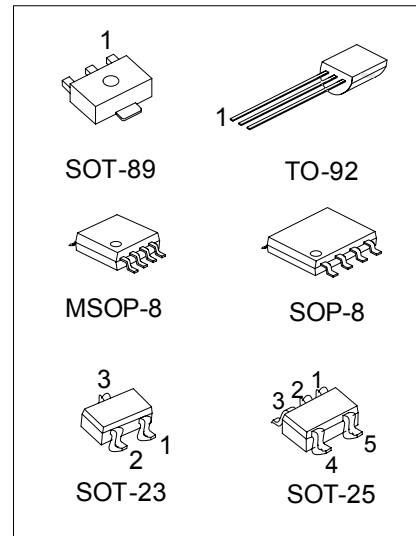
- *Programmable output Voltage to 20V.
- *Low dynamic output impedance 0.2Ω.
- *Sink current capability of 1.0 ~ 100mA.
- *Equivalent full-range temperature coefficient of 50ppm/ °C typical for operation over full rated operating temperature range.

ORDERING INFORMATION

Order Number		Pin Assignment								Package	Packing
Normal	Lead Free Plating	1	2	3	4	5	6	7	8		
TL431L-AB3-R	TL431LK-AB3-R	R	A	K	-	-	-	-	-	SOT-89	Tape Reel
TL431L-AE3-R	TL431LK-AE3-R	K	R	A	-	-	-	-	-	SOT-23	Tape Reel
TL431L-AF5-R	TL431LK-AF5-R	X	X	K	R	A	-	-	-	SOT-25	Tape Reel
TL431L-S08-R	TL431LK-S08-R	K	A	A	X	X	A	A	R	SOP-8	Tape Reel
TL431L-S08-T	TL431LK-S08-T	K	A	A	X	X	A	A	R	SOP-8	Tube
TL431L-SM1-R	TL431LK-SM1-R	K	X	X	X	X	A	X	R	MSOP-8	Tape Reel
TL431L-SM1-T	TL431LK-SM1-T	K	X	X	X	X	A	X	R	MSOP-8	Tube
TL431L-T92-B	TL431LK-T92-B	R	A	K	-	-	-	-	-	TO-92	Tape Box
TL431L-T92-K	TL431LK-T92-K	R	A	K	-	-	-	-	-	TO-92	Bulk
TL431L-T92-R	TL431LK-T92-R	R	A	K	-	-	-	-	-	TO-92	Tape Reel

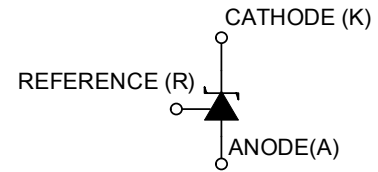
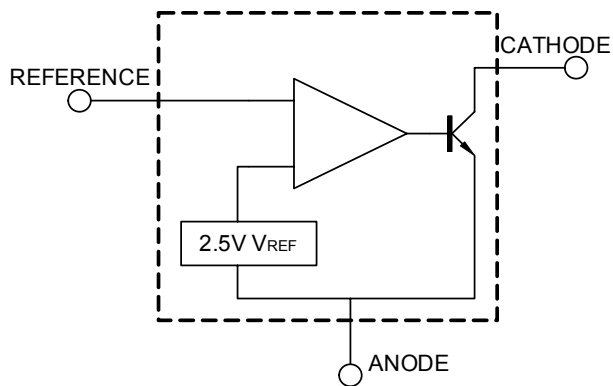
Note: Pin Code: K: Cathode A: Anode R: Reference X: No Connection

<p>TL431LK-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, AF3: SOT-25, S08: SOP-8, SM1: MSOP-8, T92: TO-92 (3) K: Lead Free Plating Blank: Pb/Sn</p>
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*Pb-free plating product number: TL431LK

■ BLOCK DIAGRAM



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

PARAMETER	SYMBOL	RATINGS	UNIT
Cathode Voltage	V_{KA}	20	V
Cathode Current Range (Continuous)	I_{KA}	-100 ~ +150	mA
Reference Input Current Range	I_{REF}	-0.05 ~ +10	mA
Operating Junction Temperature	T_J	150	°C
Operating Ambient Temperature	T_{OPR}	0 ~ +70	°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

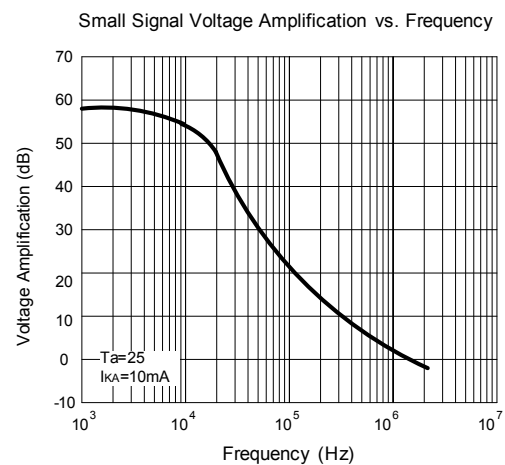
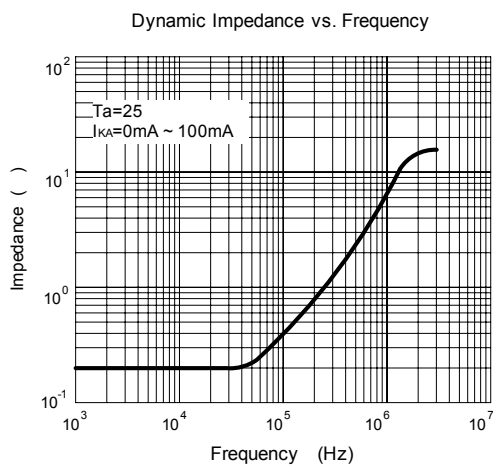
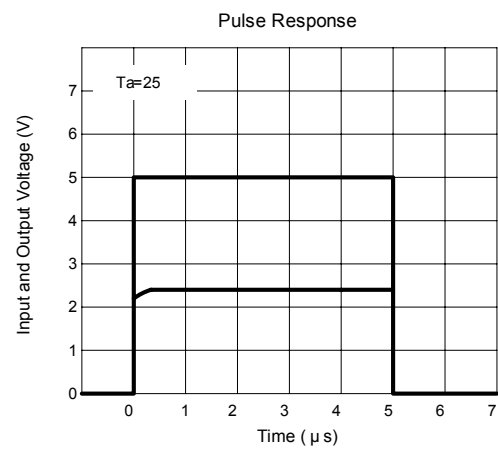
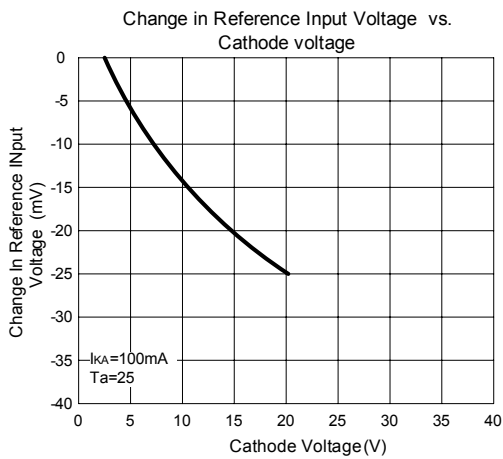
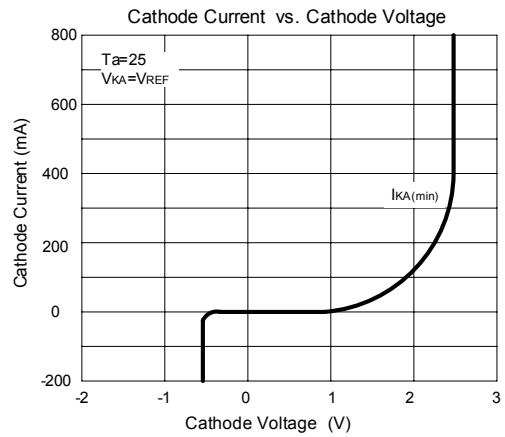
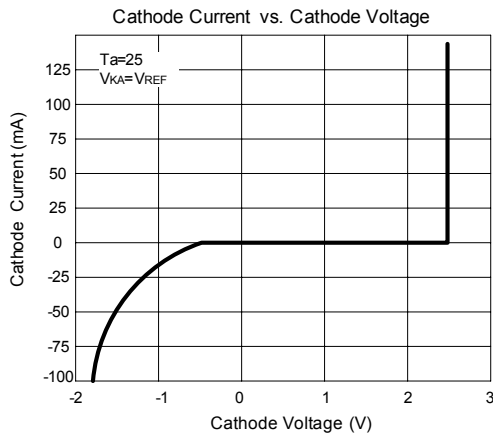
PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Cathode Voltage	V_{KA}	V_{REF}		20	V
Cathode Current	I_{KA}	1		100	mA

■ ELECTRICAL CHARACTERISTICS ($T_a=25^\circ\text{C}$, unless otherwise specified)

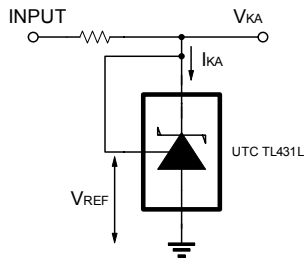
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Reference Input Voltage	V_{REF}	$V_{KA}=V_{REF}$, $I_{KA}=10\text{mA}$	2.450	2.50	2.550	V
Deviation of Reference Input Voltage Over temperature (note 1)	$\Delta V_{REF}/\Delta T$	$V_{KA}=V_{REF}$, $I_{KA}=10\text{mA}$ $0 \leq T_A \leq 70$		4.5	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\Delta V_{REF}/\Delta V_{KA}$	$I_{KA}=10\text{mA}$ $\Delta V_{KA}=10\text{V} \sim V_{REF}$ $\Delta V_{KA}=20\text{V} \sim 10\text{V}$		-1.0 -0.5	-2.7 -2.0	mV/V
Reference Input Current	I_{REF}	$I_{KA}=10\text{mA}$, $R1=10\text{k}\Omega$, $R2=\infty$		1.5	4	μA
Deviation of Reference Input Current Over Full Temperature Range	$\Delta I_{REF}/\Delta T$	$I_{KA}=10\text{mA}$, $R1=10\text{k}\Omega$, $R2=\infty$ $T_A=\text{full Temperature}$		0.4	1.2	μA
Minimum Cathode Current for Regulation	$I_{KA(\text{MIN})}$	$V_{KA}=V_{REF}$		0.45	1.0	mA
Off-State Cathode Current	$I_{KA(\text{OFF})}$	$V_{KA}=20\text{V}$, $V_{REF}=0$		0.05	1.0	μA
Dynamic Impedance	Z_{KA}	$V_{KA}=V_{REF}$, $I_{KA}=1 \sim 100\text{mA}$ $f \leq 1.0\text{kHz}$		0.15	0.5	Ω

Remark: Reference voltage of $\pm 1\%$ tolerance is also available per customer's request.

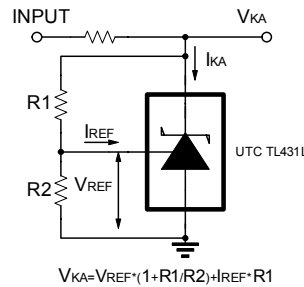
TYPICAL CHARACTERISTICS



TEST CIRCUIT

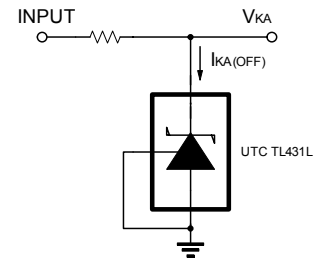


Test Circuit For $V_{KA} = V_{REF}$



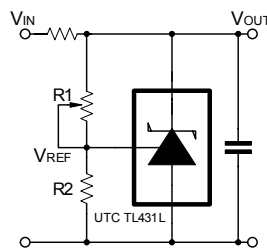
Test Circuit for $V_{KA} \geq V_{REF}$

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



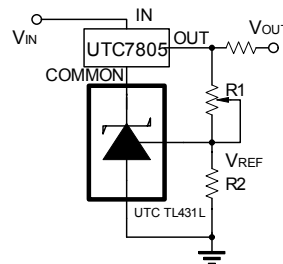
Test Circuit For $I_{KA(OFF)}$

APPLICATION CIRCUIT



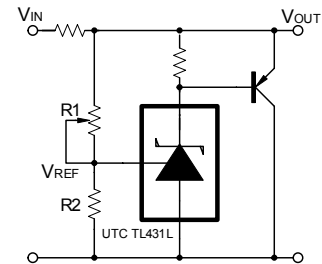
$$V_{OUT} = (1 + R1/R2) \cdot V_{REF}$$

Shutdown Regulator



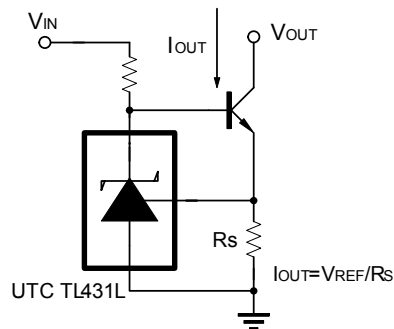
$$V_{OUT} = (1 + R1/R2) \cdot V_{REF}$$

Output Control of a Three-Terminal Fixed Regulator

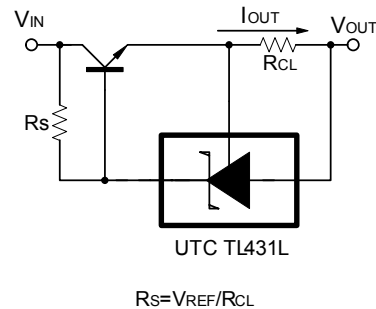


$$V_{OUT} = (1 + R1/R2) \cdot V_{REF}$$

Higher-Current Shunt Regulator



Constant-Current Sink



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

Current Limiting or Current Source

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