

PROGRAMMABLE PRECISION REFERENCES

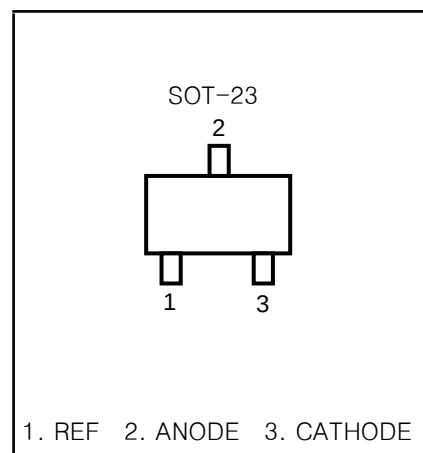
The TL431N is three-terminal adjustable shunt regulator with specified thermal stability.

The output voltage may be set to any value between V_{REF} (Approx. 2.5V) and 36V with two external resistors. This device has a typical output impedance of 0.2Ω .

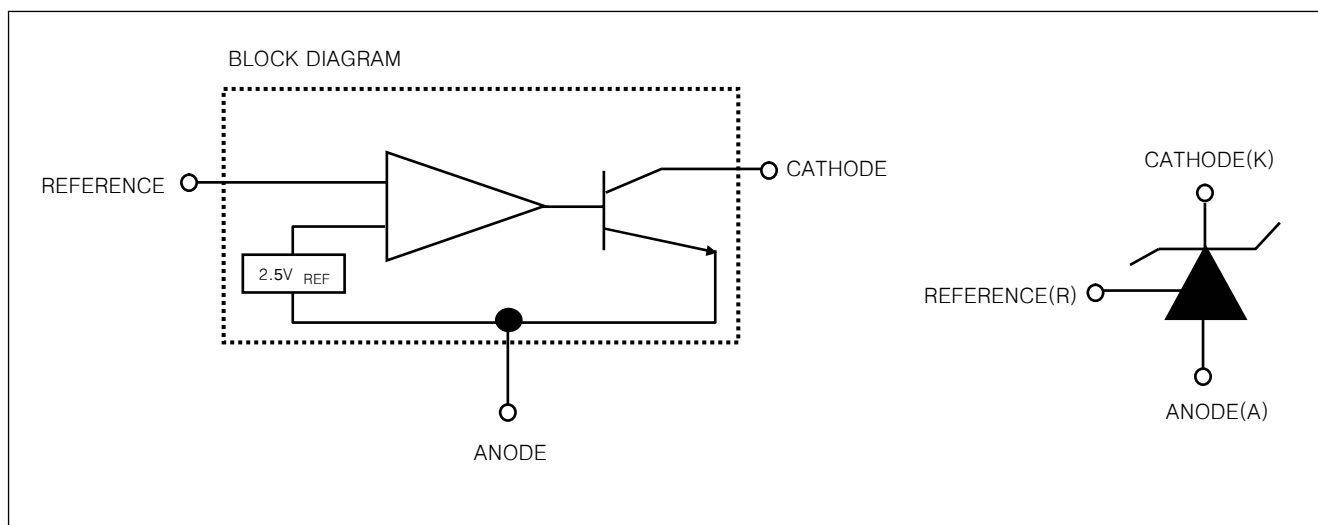
Active output circuitry provides a very sharp turn-on characteristic, making this device excellent replacement for zener diodes in many application.

FEATURES

- Equivalent Full Range Temperature Coefficient 50PPM/°C
- Temperature Compensated For Operation Over Full Rate Operating Temperature Range
- Adjustable Output Voltage
- Fast Turn-on Response
- Sink Current Capability 1mA to 100mA
- Low (0.2Ω Typ.) Dynamic Output Impedance
- Low Output Noise



FUNCTION BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

(Full Operating Ambient Temperature Range Applies Unless Otherwise Noted)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Cathode Voltage	V_{KA}	37	V
Continuous Cathode Current Range	I_{KA}	-100~+150	mA
Reference Input Current Range	I_{REF}	0.05~10	mA
Junction Temperature	T_J	150	°C
Operating Temperature	T_{OPR}	-20 ~ 85	°C
Storage Temperature	T_{STG}	-65 ~ 150	°C
Total Power Dissipation	P_D	700	mW

TL431N -0.3% ELECTRICAL CHARACTERISTIC ($T_A=25^{\circ}\text{C}$, unless otherwise specified)

CHARACTERISTIC	SYMBOL	CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Reference Input Voltage	V_{REF}	1	$V_{KA}=V_{REF}$, $I_K=10\text{mA}$	2.487V	2.495V	2.502V	
Deviation of Reference Input Voltage Over Full Temperature Range	$\Delta V_{REF}/\Delta T$	1	$V_{KA}=V_{REF}$, $I_K=10\text{mA}$ $T_A=\text{Full Range}$		3	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\Delta V_{REF}/\Delta V_{KA}$	2	$I_K=10\text{mA}$		-1.4	-2.7	mV/V
					-1	-2	
Reference Input Current	I_{REF}	2	$I_K=10\text{mA}$, $R1=10\text{k}\Omega$, $R2=\infty$		1.8	4	μA
Deviation of Reference Input Current Over Full Temperature Range	$\Delta I_{REF}/\Delta T$	2	$I_K=10\text{mA}$, $R1=10\text{k}\Omega$, $R2=\infty$ $T_A=\text{Full Range}$		0.4	1.2	μA
Minimum Cathode Current for Regulation	$I_{KA\text{MIN}}$	1	$\Delta V_{KA}=V_{REF}$			0.15	mA
Off-State Cathode Current	$I_{KA\text{OFF}}$	3	$V_{KA}=36\text{V}$, $V_{REF}=0$		0.2	1	μA
Dynamic Impedance	Z_{KA}	1	$V_{KA}=V_{REF}$, $I_K=1\text{mA}\sim 100\text{mA}$, $f\leq 1\text{kHz}$		0.2	0.5	Ω

TL431N-0.5%ELECTRICAL CHARACTERISTIC ($T_A=25^{\circ}\text{C}$, unless otherwise specified)

CHARACTERISTIC	SYMBOL	CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Reference Input Voltage	V_{REF}	1	$V_{KA}=V_{REF}$, $I_K=10\text{mA}$	2.482V	2.495V	2.507V	
Deviation of Reference Input Voltage Over Full Temperature Range	$\Delta V_{REF}/\Delta T$	1	$V_{KA}=V_{REF}$, $I_K=10\text{mA}$ $T_A=\text{Full Range}$		3	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathod Voltage	$\Delta V_{REF}/\Delta V_{KA}$	2	$I_K=10\text{mA}$ $\Delta V_{KA}=10\text{V}-V_{REF}$		-1.4	-2.7	mV/V
			$\Delta V_{KA}=36\text{V}-10\text{V}$		-1	-2	
Reference Input Current	I_{REF}	2	$I_{KA}=10\text{mA}$, $R1=10\text{k}\Omega$, $R2=\infty$		1.8	4	μA
Deviation of Reference Input Current Over Full Temperature Range	$\Delta I_{REF}/\Delta T$	2	$I_K=10\text{mA}$, $R1=10\text{k}\Omega$, $R2=\infty$ $T_A=\text{Full Range}$		0.4	1.2	μA
Minimum Cathode Current for Regulation	$I_{KA\text{MIN}}$	1	$\Delta V_{KA}=V_{REF}$			0.15	mA
Off-State Cathode Current	$I_{KA\text{OFF}}$	3	$V_{KA}=36\text{V}$, $V_{REF}=0$		0.2	1	μA
Dynamic Impedance	Z_{KA}	1	$V_{KA}=V_{REF}$, $I_K=1\text{mA}\sim 100\text{mA}$, $f\leq 1\text{kHz}$		0.2	0.5	Ω

TL431N-1%ELECTRICAL CHARACTERISTIC ($T_A=25^{\circ}\text{C}$, unless otherwise specified)

CHARACTERISTIC	SYMBOL	CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Reference Input Voltage	V_{REF}	1	$V_{KA}=V_{REF}$, $I_K=10\text{mA}$	2.47V	2.495V	2.52V	
Deviation of Reference Input Voltage Over Full Temperature Range	$\Delta V_{REF}/\Delta T$	1	$V_{KA}=V_{REF}$, $I_K=10\text{mA}$ $T_A=\text{Full Range}$		3	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathod Voltage	$\Delta V_{REF}/\Delta V_{KA}$	2	$I_K=10\text{mA}$ $\Delta V_{KA}=10\text{V}-V_{REF}$		-1.4	-2.7	mV/V
			$\Delta V_{KA}=36\text{V}-10\text{V}$		-1	-2	
Reference Input Current	I_{REF}	2	$I_{KA}=10\text{mA}$, $R1=10\text{k}\Omega$, $R2=\infty$		1.8	4	μA
Deviation of Reference Input Current Over Full Temperature Range	$\Delta I_{REF}/\Delta T$	2	$I_K=10\text{mA}$, $R1=10\text{k}\Omega$, $R2=\infty$ $T_A=\text{Full Range}$		0.4	1.2	μA
Minimum Cathode Current for Regulation	$I_{KA\text{MIN}}$	1	$\Delta V_{KA}=V_{REF}$			0.15	mA
Off-State Cathode Current	$I_{KA\text{OFF}}$	3	$V_{KA}=36\text{V}$, $V_{REF}=0$		0.2	1	μA
Dynamic Impedance	Z_{KA}	1	$V_{KA}=V_{REF}$, $I_K=1\text{mA}\sim 100\text{mA}$, $f\leq 1\text{kHz}$		0.2	0.5	Ω

Fig. 1 Test Circuit for $V_{KA}=V_{REF}$

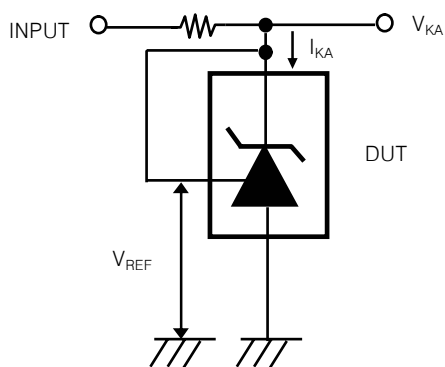


Fig. 2 Test Circuit for $V_{KA} \geq V_{REF}$

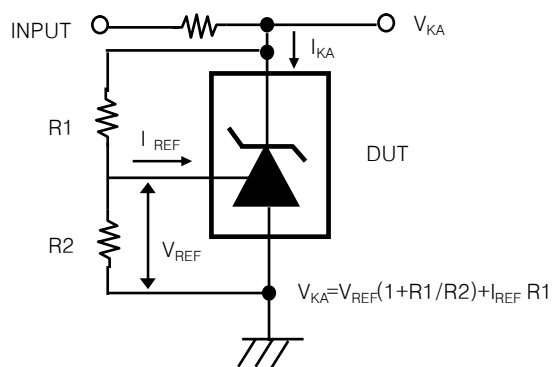
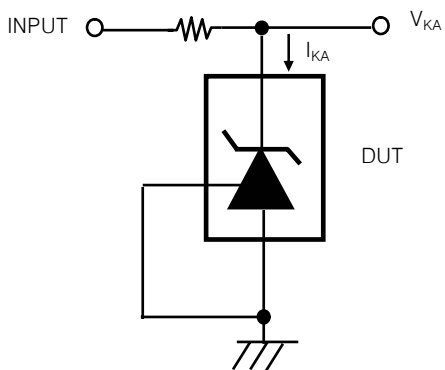
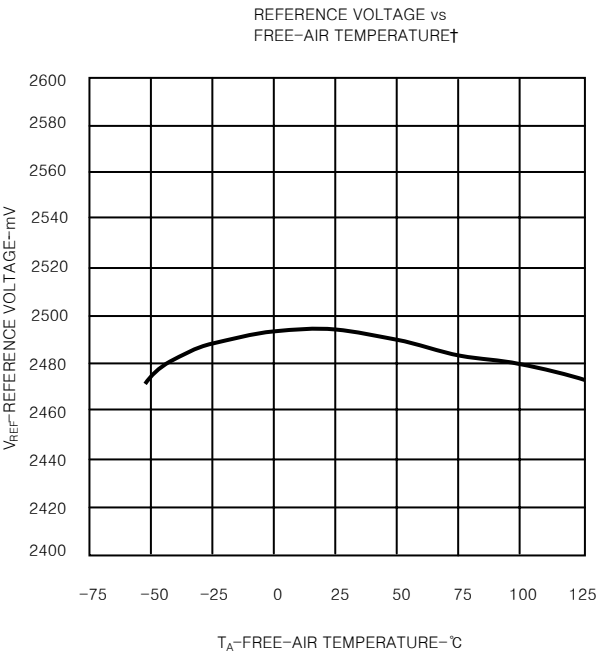


Fig. 3 Test Circuit for I_{KA} (off)



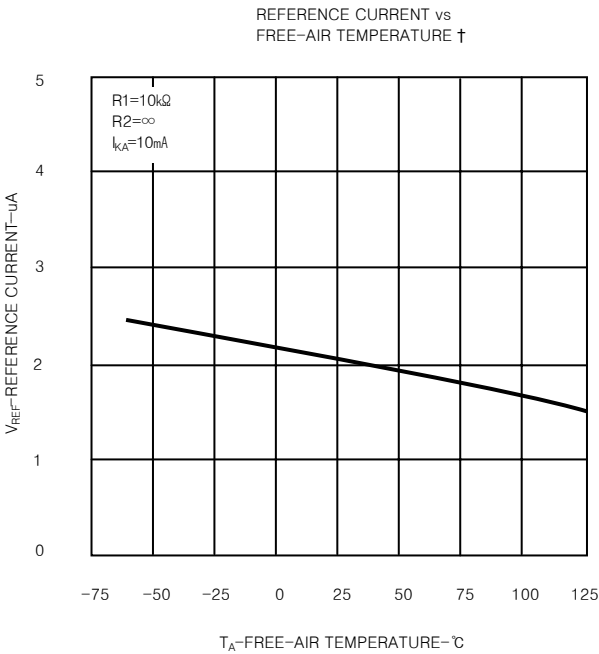
TYPICAL PERFORMANCE CHARACTERISTICS



† Data is applicable only within the recommended operating free-air temperature ranges of the various devices.

‡ Data is for devices having the indicated value of V_{REF} at $I_{KA}=10mA$, $T_A=25^{\circ}C$

Figure 4.



† Data is applicable only within the recommended operating free-air temperature ranges of the various devices.

Figure 5.

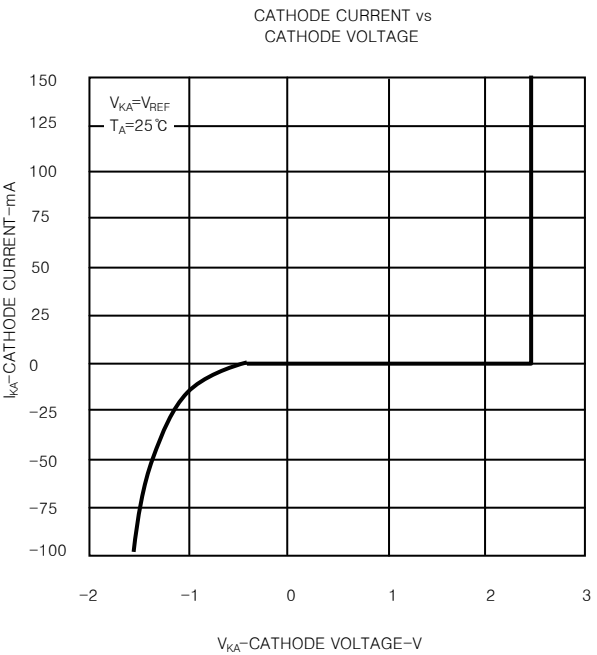


Figure 6.

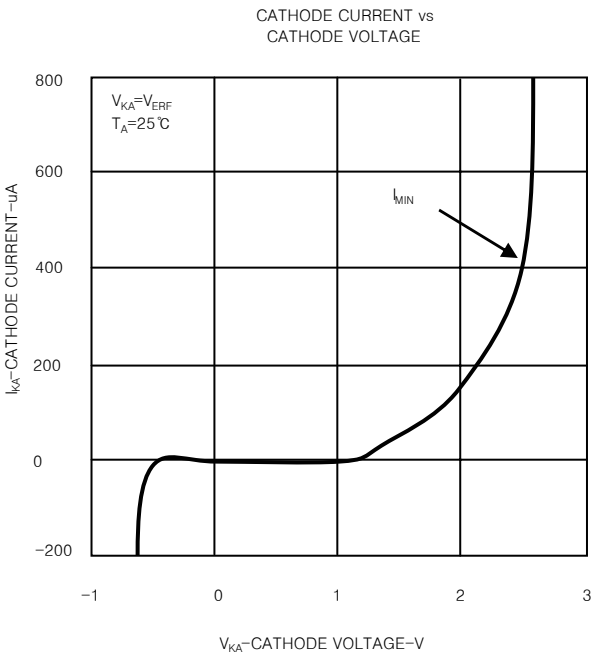
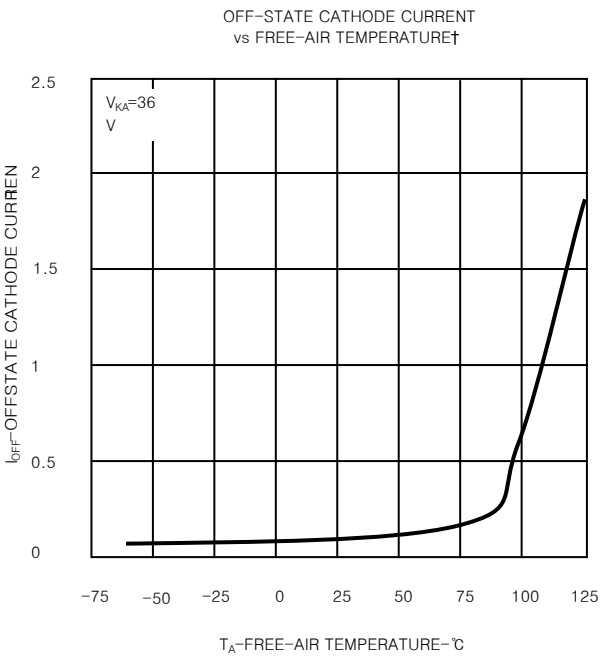


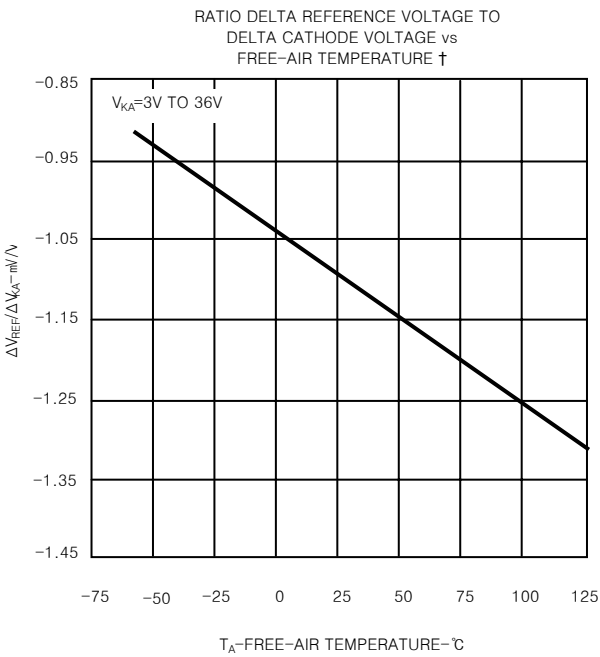
Figure 7.

TYPICAL PERFORMANCE CHARACTERISTICS



† Data is applicable only within the recommended operating free-air temperature ranges of the various devices.

Figure 8.



† Data is applicable only within the recommended operating free-air temperature ranges of the various devices.

Figure 9.

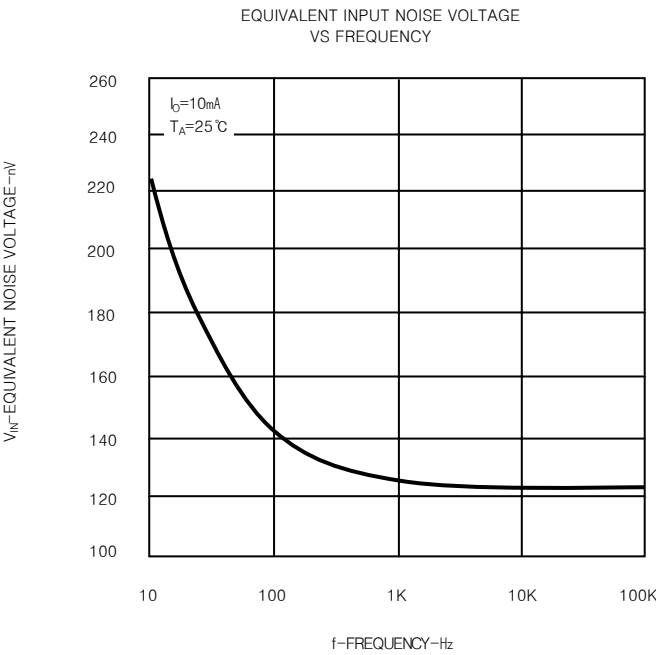


Figure 10.

TYPICAL PERFORMANCE CHARACTERISTICS

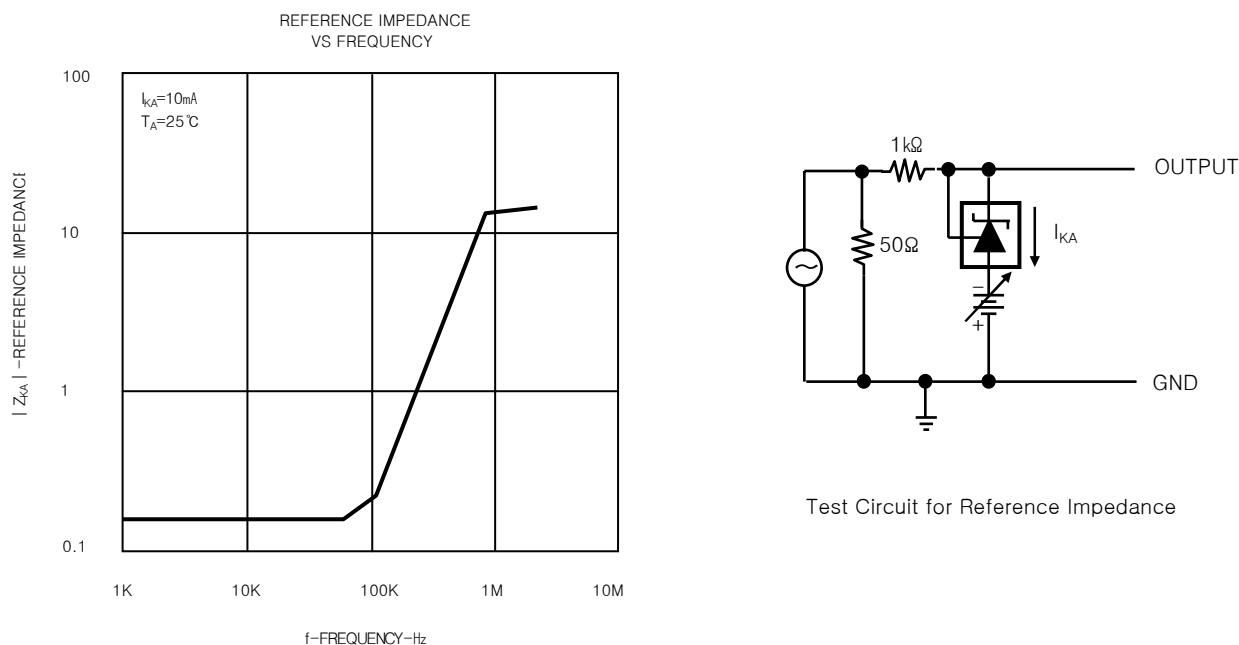


Figure 11.

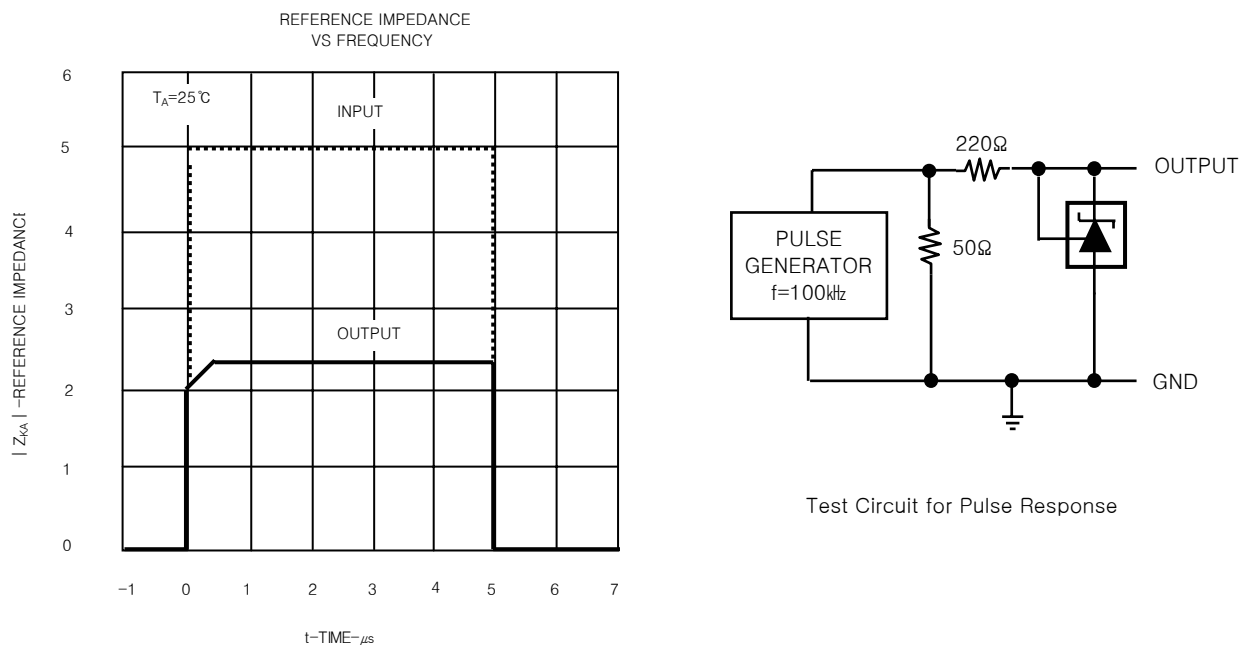
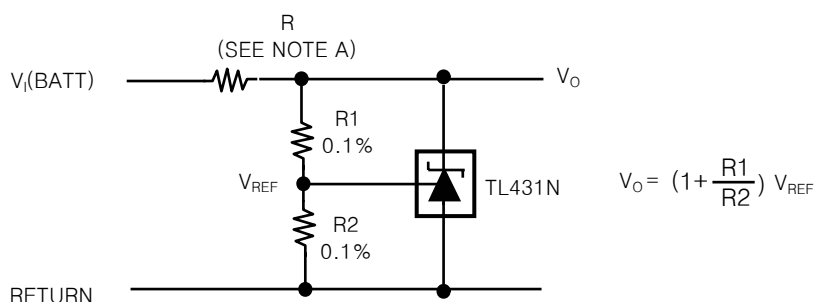


Figure 12.

APPLICATION INFORMATION



NOTE A : R Should provide cathode current $\geq 1\text{mA}$ to the TL431N at minimum $V_I(\text{BATT})$

Figure 13. Shunt Regulator

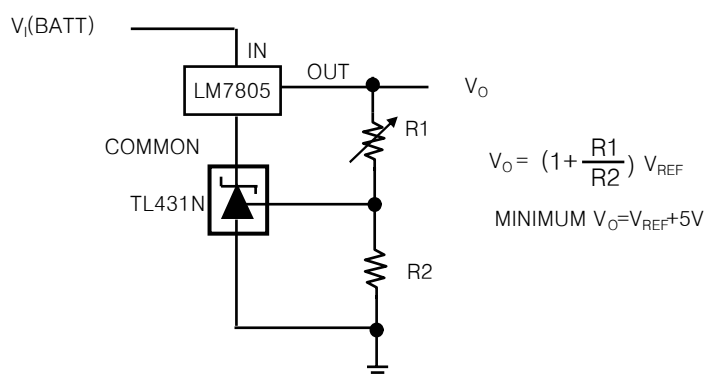


Figure 14. Output Control of a 3-Terminal Fixed Regulator

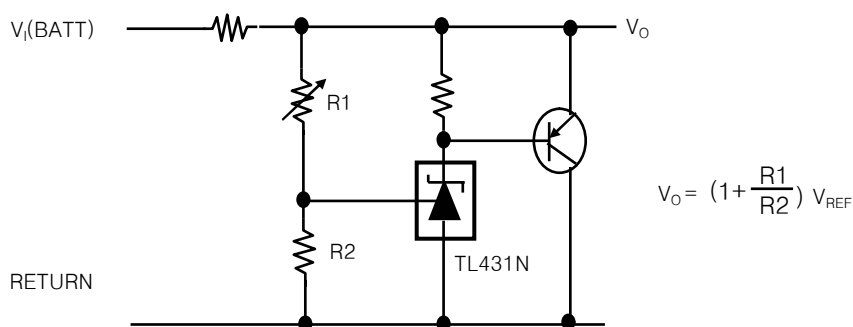
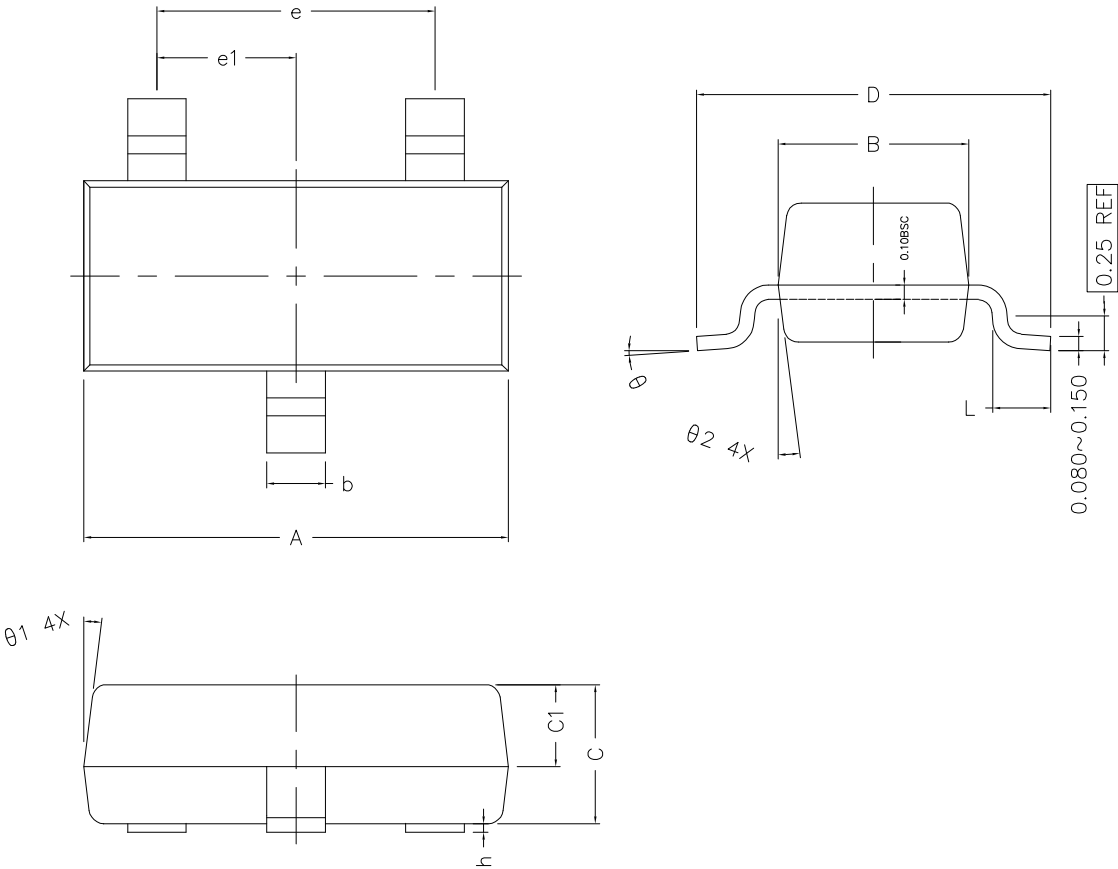


Figure 15. High-Current Shunt Regulator

SOT-23 Package Outline Dimensions (Units: mm)



COMMON DIMENSIONS (UNITS OF MEASURE IS mm)			
	MIN	NORMAL	MAX
A	2.800	2.900	3.000
B	1.200	1.300	1.400
C	0.900	1.000	1.100
C1	0.500	0.550	0.600
D	2.250	2.400	2.550
L	0.300	0.400	0.500
h	0.010	0.050	0.100
b	0.300	0.400	0.500
e	1.90 TYPE		
e1	0.95 TYPE		
θ_1	7° TYPE		
θ_2	7° TYPE		
θ	0° ~ 7°		