Description

The TLV431Q is a three-terminal adjustable shunt regulator offering excellent temperature stability and output current handling capability up to 20mA. The output voltage may be set to any chosen voltage between 1.24 and 18 volts by selection of two external divider resistors.

The TLV431Q can be used as a replacement for Zener diodes in many applications requiring an improvement in Zener performance.

The TLV431Q is available in 3 tolerance bands with initial tolerances of 1%, 0.5%, and 0.2% for the A, B and T bands respectively.

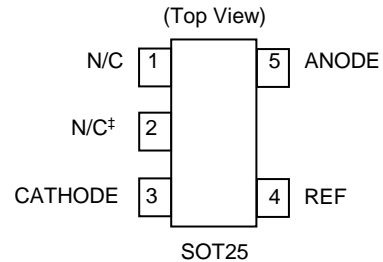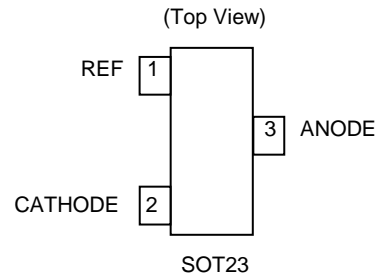The TLV431Q is qualified to AEC-Q100 Grade 1 and is automotive-compliant supporting PPAP documentation.

Features

- Low Voltage Operation, V_{REF} = 1.24V
- Temperature Range -40°C to +125°C
- Reference Voltage Tolerance at +25°C
    - 0.2%   TLV431TQ (End of Life, EOL)
    - 0.5%   TLV431BQ
    - 1%   TLV431AQ
- Typical V_{REF} Deviation Across Full Temperature Range (Note 1)
    - 4mV (0°C to +70°C)
    - 6mV (-40°C to +85°C)
    - 11mV (-40°C to +125°C)
- 80µA Minimum Cathode Current
- 0.25Ω Typical Output Impedance
- Adjustable Output Voltage V_{REF} to 18V
- **Totally Lead-Free & Fully RoHS Compliant (Notes 2 & 3)**
- **Halogen and Antimony Free. "Green" Device (Note 4)**
- **The TLV431Q is suitable for automotive applications requiring specific change control; this part is AEC-Q100 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**
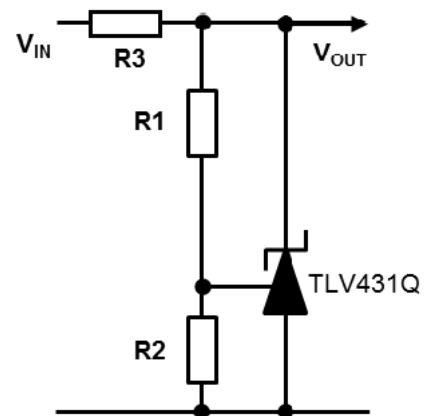 **https://www.diodes.com/quality/product-definitions/**

Pin Assignments

(Top View)

SOT23

(Top View)

SOT25

‡ Pin should be left floating or connected to anode

Typical Application Circuit

Adjustable High Accuracy Shunt Reference

Notes: 1. The V_{REF} deviation is defined as the differences between the maximum and minimum values obtained over the specified temperature range.
2. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
3. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
4. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

TLV431Q
Document number: DS36915 Rev. 4 - 2

1 of 14
www.diodes.com

August 2023
© 2023 Copyright Diodes Incorporated. All Rights Reserved.

Absolute Maximum Ratings (Note 5)

Symbol	Parameter	Rating	Unit
V_{KA}	Cathode Voltage	20	V
I_{KA}	Continuous Cathode Current	-20 to 20	mA
I_{REF}	Reference Input Current Range	-0.05 to 3	mA
V_{IN}	Input Supply Voltage (Relative to Ground)	-0.03 to 18	V
T_J	Operating Junction Temperature	-40 to +150	°C
T_S	Storage Temperature	-65 to +150	°C
ESD Susceptibility			
HBM	Human Body Model	4	kV
MM	Machine Model	400	V
CDM	Charged Device Model	1	kV

Notes: 5. a) Stresses beyond those listed under *Absolute Maximum Ratings* can cause permanent damage to the device. These are stress ratings only and functional operation of the device at these conditions is not implied. Exposure to absolute-maximum-rated conditions for extended period can affect device reliability.
Semiconductor devices are ESD sensitive and can be damaged by exposure to ESD events. Suitable ESD precautions should be taken when handling and transporting these devices.
b) Ratings apply to ambient temperature at +25°C.

Recommended Operating Conditions (@ T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Min	Max	Unit
V_{KA}	Cathode Voltage	V_{REF}	18	V
I_{KA}	Cathode Current	0.1	15	mA
T_A	Operating Ambient Temperature Range	-40	+125	°C

Package Thermal Data

Package	θ_{JA}	P_{DIS} T_A = +25°C, T_J = +150°C
SOT23	380°C/W	330mW
SOT25	250°C/W	500mW

TLV431Q
Document number: DS36915 Rev. 4 - 2

2 of 14
www.diodes.com

August 2023
© 2023 Copyright Diodes Incorporated. All Rights Reserved.

Electrical Characteristics (@T$_A$ = +25°C, I$_K$ = 10mA, unless otherwise specified.)

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V$_{REF}$	Reference Voltage	V$_{KA}$ = V$_{REF}$, T$_A$ = +25°C	TLV431AQ	1.228	1.24	1.252	V
			TLV431BQ	1.234	1.24	1.246	
			TLV431TQ	1.2375	1.24	1.2425	
		V$_{KA}$ = V$_{REF}$, T$_A$ = 0°C to +70°C	TLV431AQ	1.221	—	1.259	
			TLV431BQ	1.227	—	1.253	
			TLV431TQ	1.230	—	1.250	
		V$_{KA}$ = V$_{REF}$, T$_A$ = -40°C to +85°C	TLV431AQ	1.215	—	1.265	
			TLV431BQ	1.224	—	1.259	
			TLV431TQ	1.228	—	1.252	
		V$_{KA}$ = V$_{REF}$, T$_A$ = -40°C to +125°C	TLV431AQ	1.209	—	1.271	
			TLV431BQ	1.221	—	1.265	
			TLV431TQ	1.224	—	1.255	
V$_{REF(DEV)}$ (Note 6)	Deviation of Reference Voltage Over Full Temperature Range	V$_{KA}$ = V$_{REF}$	T$_A$ = 0°C to +70°C	—	4	12	mV
			T$_A$ = -40°C to +85°C	—	6	20	
			T$_A$ = -40°C to +125°C	—	11	31	
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	Ratio of Change in Reference Voltage to the Change in Cathode Voltage	V$_{KA}$ for V$_{REF}$ to	6V	—	-1.5	-2.7	mV/V
			18V	—	-1.5	-2.7	
I$_{REF}$	Reference Input Current	R$_1$ = 10kΩ, R$_2$ = OC		—	0.15	0.5	µA
I$_{REF(DEV)}$ (Note 6)	I$_{REF}$ Deviation Over Full Temperature Range	R$_1$ = 10kΩ, R$_2$ = OC	T$_A$ = 0°C to +70°C	—	0.05	0.3	µA
			T$_A$ = -40°C to +85°C	—	0.1	0.4	
			T$_A$ = -40°C to +125°C	—	0.15	0.5	
I$_{KMIN}$	Minimum Cathode Current for Regulation	V$_{KA}$ = V$_{REF}$	T$_A$ = 0°C to +70°C	—	55	80	µA
			T$_A$ = -40°C to +85°C	—	55	80	
			T$_A$ = -40°C to +125°C	—	55	100	
I$_{K(OFF)}$	Off-State Current	V$_{KA}$ = 18V, V$_{REF}$ = 0V		—	0.001	0.1	µA
Z$_{KA}$ (Note 7)	Dynamic Output Impedance	V$_{KA}$ = V$_{REF}$, f = <1kHz I$_K$ = 0.1 to 15mA		—	0.25	0.4	Ω

Notes: 6. The deviation parameters V$_{REF(DEV)}$ and I$_{REF(DEV)}$ are defined as the differences between the maximum and minimum values across the specified temperature range. The average full-range temperature coefficient of the reference input voltage, dV$_{REF}$/dT, is defined as:

$$\left|\frac{dV_{REF}}{dT}\right|\left(\frac{ppm}{°C}\right) = \frac{\left(\frac{V_{REF(DEV)}}{V_{REF}(T_A=25°C)}\right) \times 10^6}{\Delta T_A}$$

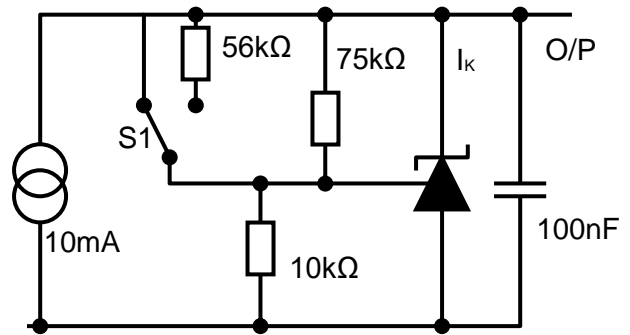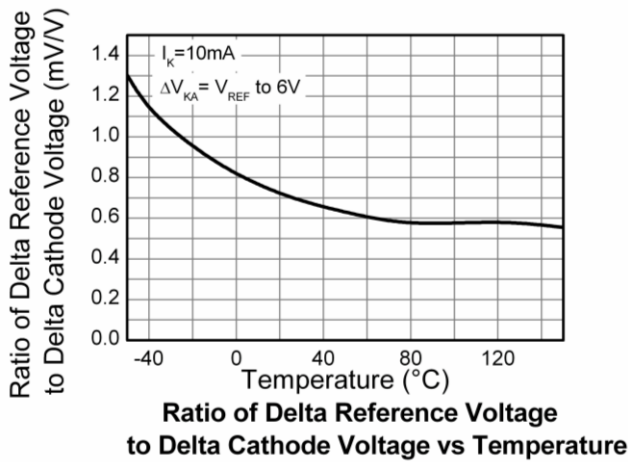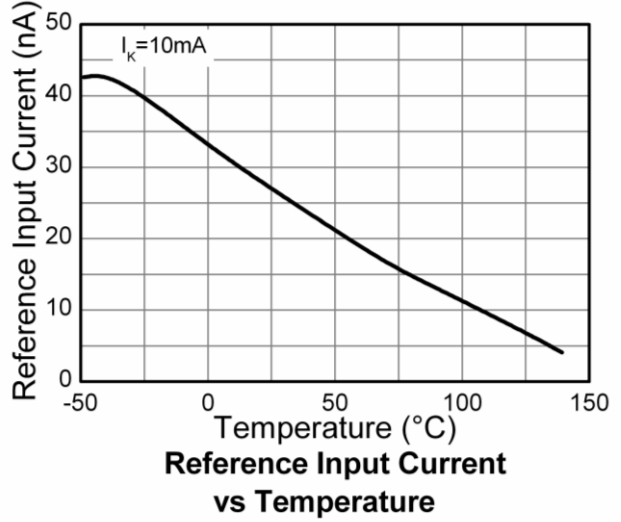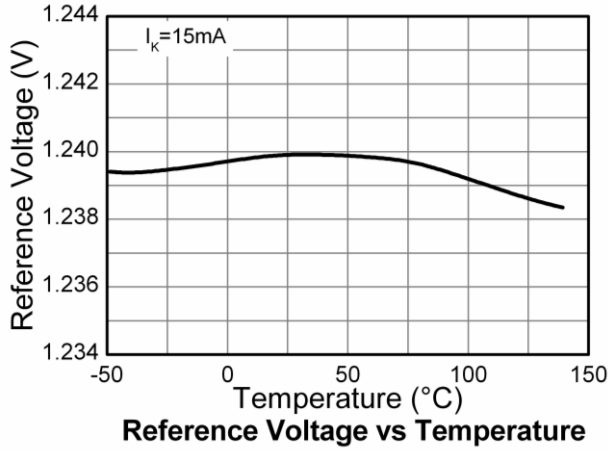where ΔT$_A$ is the rated operating free-air temperature range of the device.

dV$_{REF}$/dT can be positive or negative, depending on whether minimum V$_{REF}$ or maximum V$_{REF}$, respectively, occurs at the lower temperature.

7. The dynamic impedance is defined as:
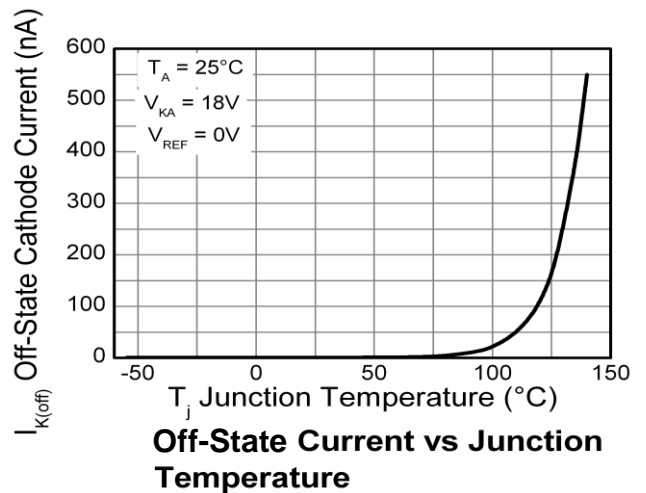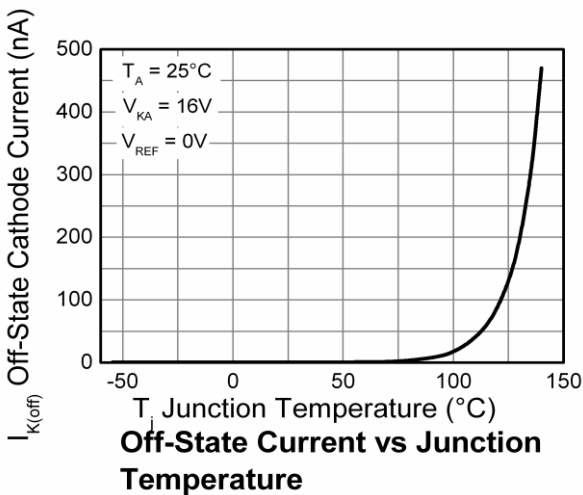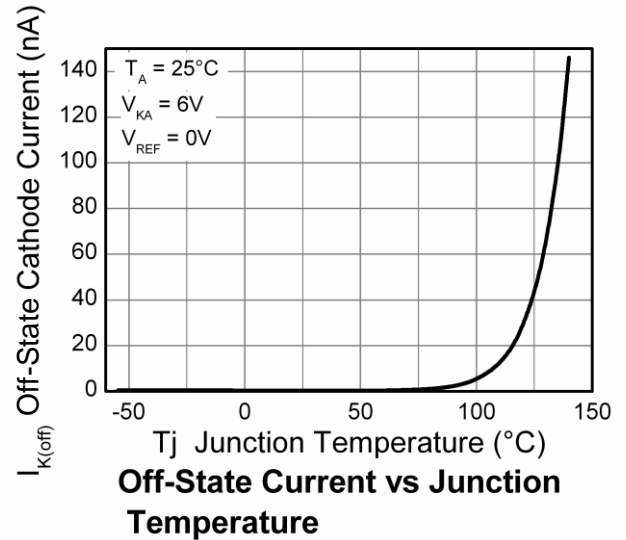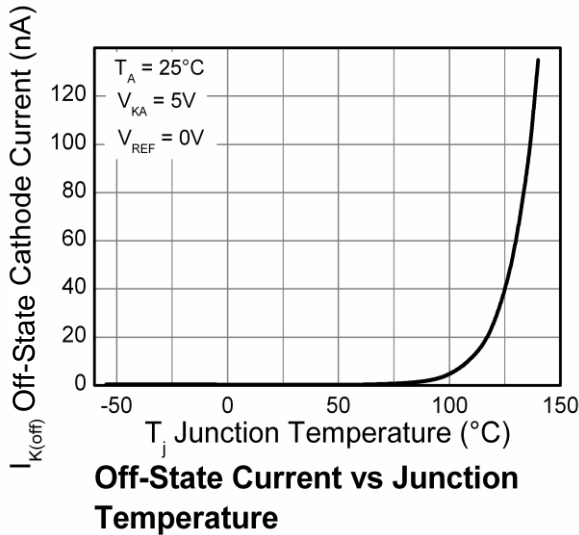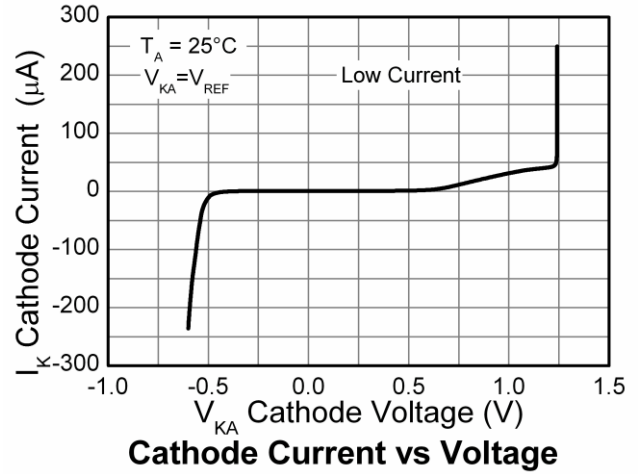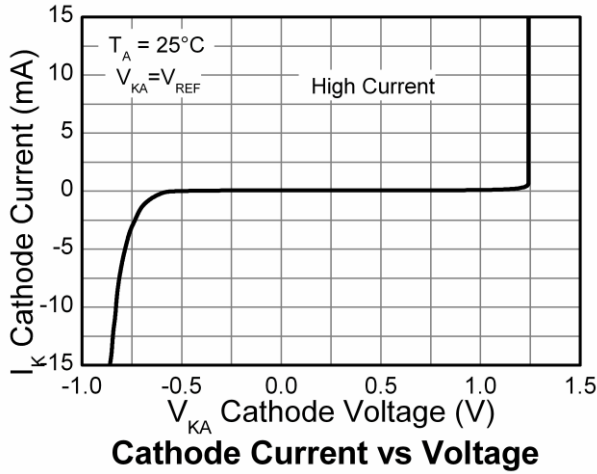
$$|Z_{KA}| = \frac{\Delta V_{KA}}{\Delta I_{KA}}$$

When the device is operating with two external resistors (see *Typical Application Circuit* Figure 1), the total dynamic impedance of the circuit is increased by a factor of $\left(1+\frac{R1}{R2}\right)$.

TLV431Q
Document number: DS36915 Rev. 4 - 2

3 of 14
www.diodes.com

August 2023
© 2023 Copyright Diodes Incorporated. All Rights Reserved.

Typical Characteristics

Reference Voltage vs Temperature

**Reference Input Current
vs Temperature**

**Ratio of Delta Reference Voltage
to Delta Cathode Voltage vs Temperature**

Test Circuit for V_{REF} Measurement

Typical Characteristics (continued)

Cathode Current vs Voltage

Cathode Current vs Voltage

**Off-State Current vs Junction
Temperature**

**Off-State Current vs Junction
Temperature**

**Off-State Current vs Junction
Temperature**

**Off-State Current vs Junction
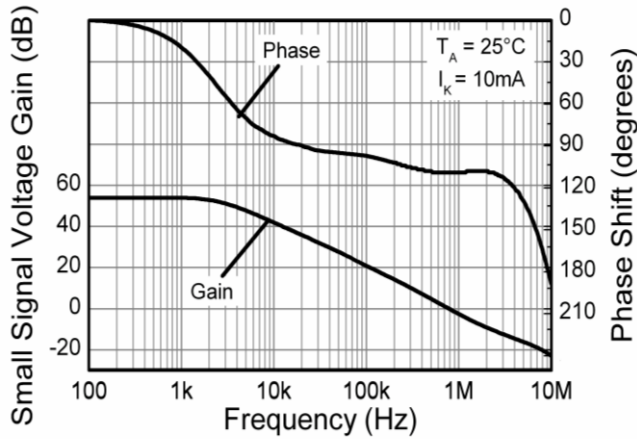Temperature**

Typical Characteristics (continued)
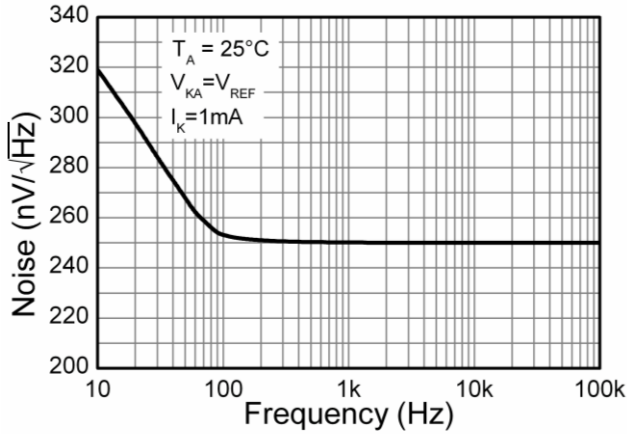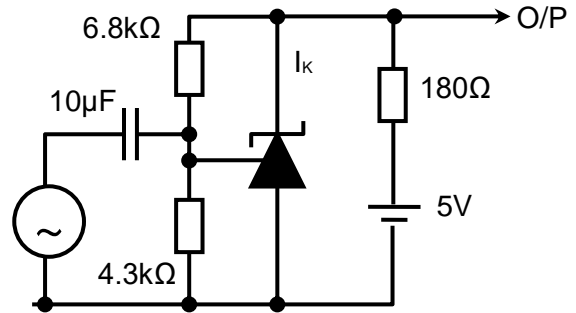

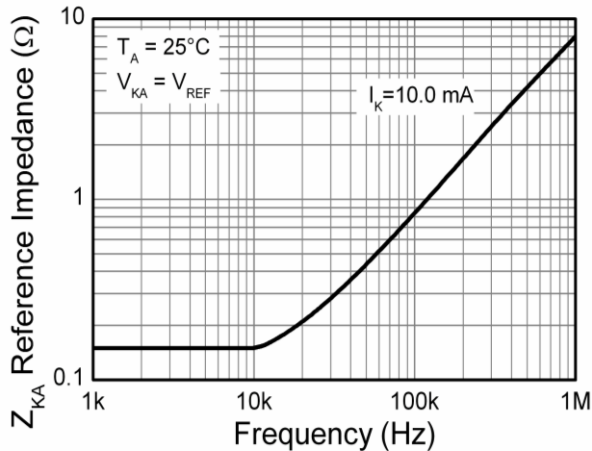**Equivalent Input Noise Voltage vs Frequency**
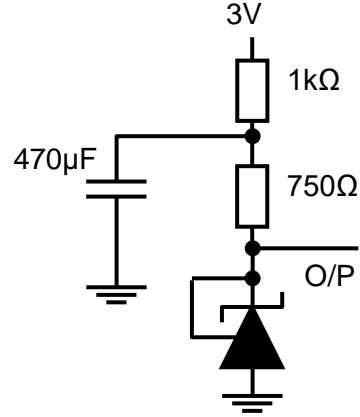
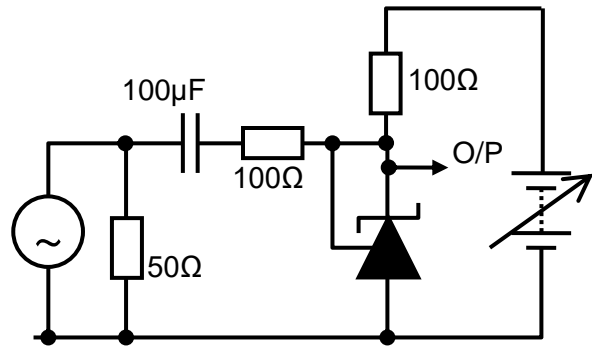**Test Circuit for Input Noise Voltage**

Phase Shift and Gain vs Frequency

Test Circuit for Phase Shift and Gain

Reference Impedance vs Frequency

Test Circuit for Reference Impedance

TLV431Q
Document number: DS36915 Rev. 4 - 2

6 of 14
www.diodes.com

August 2023
© 2023 Copyright Diodes Incorporated. All Rights Reserved.

Typical Characteristics (continued)
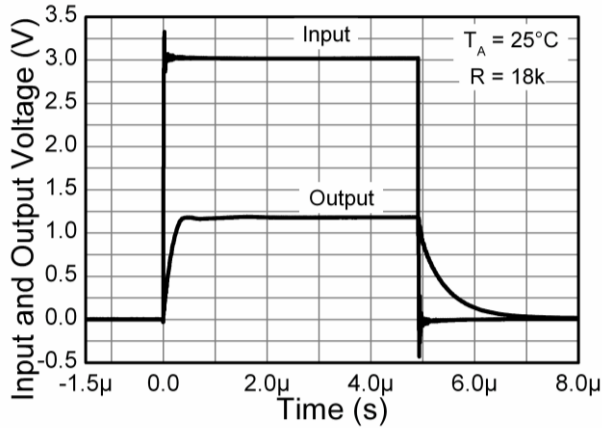
Pulse Response
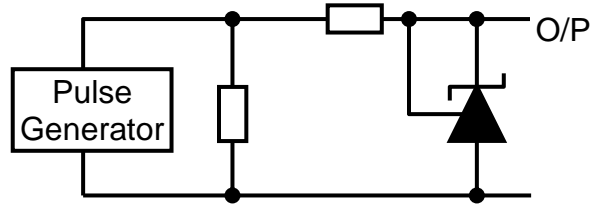
Test Circuit for Pulse Response

Pulse Response

Stability Boundary Condition
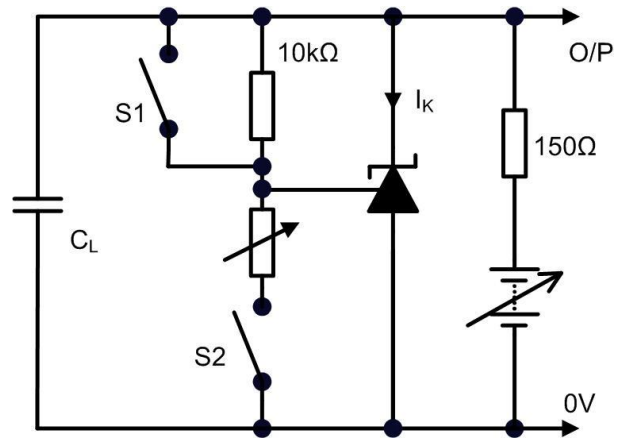
Test Circuit for Stability Boundary

TLV431Q
Document number: DS36915 Rev. 4 - 2

7 of 14
www.diodes.com

August 2023
© 2023 Copyright Diodes Incorporated. All Rights Reserved.

Application Notes

In a conventional shunt regulator application (Figure 1), an external series resistor (R3) is connected between the supply voltage, V_{IN}, and the TLV431Q. The 0.5% and 0.2% tolerance versions allow the creation of a high-accuracy adjustable shunt reference.
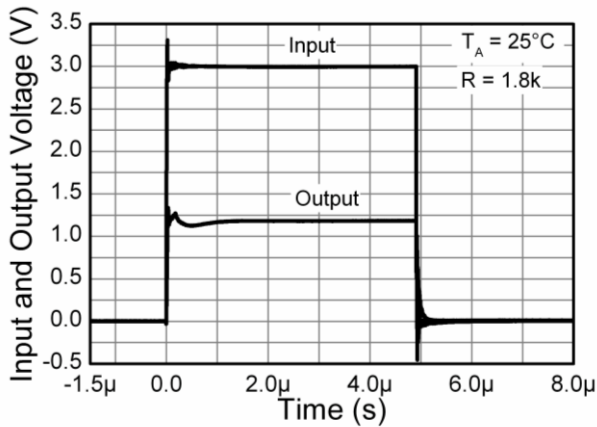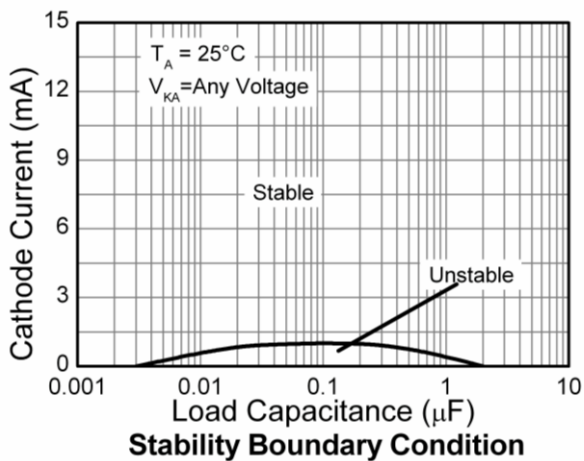
R3 determines the current that flows through the load (I_L) and the TLV431Q (I_K). The TLV431Q will adjust how much current it sinks or "shunts" to maintain a voltage equal to V_{REF} across its feedback pin. Since load current and supply voltage may vary, R3 should be small enough to supply at least the minimum acceptable I_{KMIN} to the TLV431Q even when the supply voltage is at its minimum and the load current is at its maximum value. When the supply voltage is at its maximum and I_L is at its minimum, R3 should be large enough so that the current flowing through the TLV431Q is less than 15mA.

R3 is determined by the supply voltage, (V_{IN}), the load and operating current, (I_L and I_K), and the TLV431Q's reverse breakdown voltage, V_{KA}.
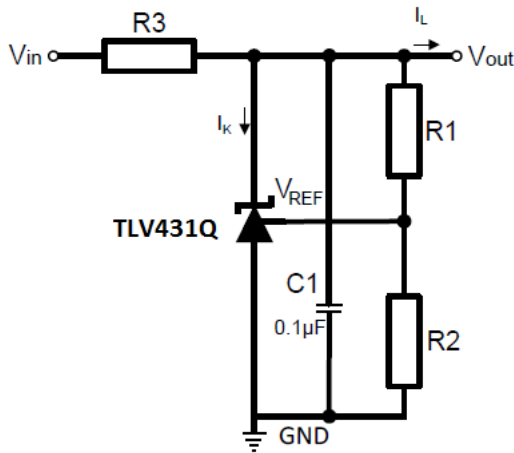
$$R_3 = \frac{V_{IN} - V_{KA}}{I_L + I_K}$$

where

$$V_{KA} = V_{REF} \times \left(1 + \frac{R_1}{R_2}\right)$$

and $V_{KA} = V_{OUT}$

Figure 1. Adjustable Low Voltage Reference

The values of R1 and R2 should be large enough so that the current flowing through them is much smaller than the current through R3 yet not too large so that the voltage drop across them caused by I_{REF} affects the reference accuracy.

Printed Circuit Board Layout Considerations
The TLV431Q in the SOT25 package has the die attached to pin 2, which results in an electrical contact between pin 2 and pin 5. Therefore, pin 2 of the SOT25 package must be left floating or connected to pin 5.

Other Applications of the TLV431Q
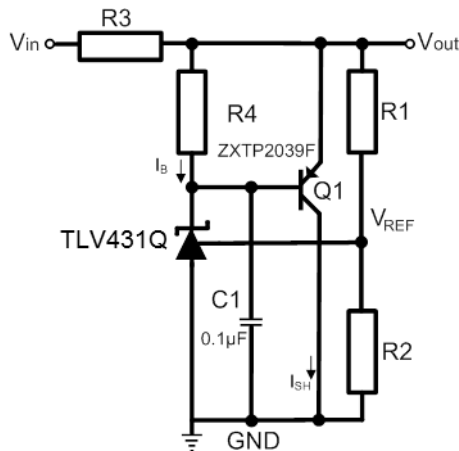
$$V_{OUT} = V_{REF}\left(1 + \frac{R1}{R2}\right)$$

$$R3 = \frac{V_{IN} - V_{OUT}}{I_{SH} + I_B}$$

$$R4 = \frac{V_{BE}}{I_B}$$

$$\left(\frac{I_{SH}}{h_{FE(min)}}\right) < I_B \leq 15\text{mA}$$

Figure 2. High Current Shunt Regulator

It may at times be required to shunt-regulate more current than the 15mA that the TLV431Q is capable of.

Figure 2 shows how this can be done using transistor Q1 to amplify the TLV431Q's current. Care needs to be taken that the power dissipation and/or SOA requirements of the transistor is not exceeded.

TLV431Q
Document number: DS36915 Rev. 4 - 2

8 of 14
www.diodes.com

August 2023
© 2023 Copyright Diodes Incorporated. All Rights Reserved.

Application Notes (continued)
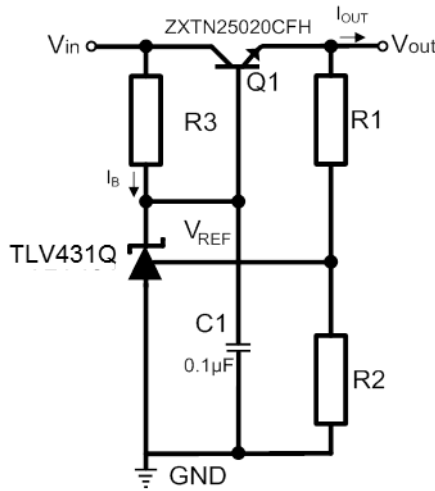
Figure 3. Basic Series Regulator

$$V_{OUT} = V_{REF}\left(1 + \frac{R1}{R2}\right)$$

$$R3 = \frac{V_{IN} - (V_{OUT} + V_{BE})}{I_B}$$

$$\left(\frac{I_{OUT(max)}}{h_{FE(min)}}\right) < I_B \leq 15mA$$

A very effective and simple series regulator can be implemented as shown in Figure 3 above. This may be preferable if the load requires more current than can be provided by the TLV431Q alone and there is a need to conserve power when the load is not being powered. This circuit also uses one component less than the shunt circuit shown in Figure 3 above.

Figure 4. Series Regulator with Current Limit

$$V_{OUT} = V_{REF}\left(1 + \frac{R1}{R2}\right)$$

$$R3 = \frac{V_{IN} - (V_{OUT} + V_{BE})}{I_B}$$

$$\left(\frac{I_{OUT(max)}}{h_{FE(min)}}\right) < I_B \leq 18mA$$
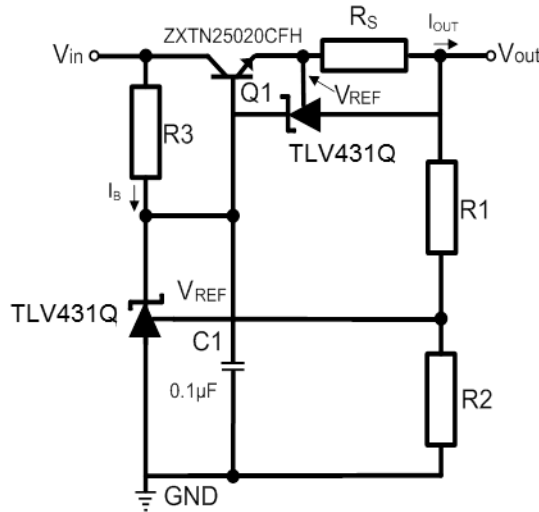
$$R_S = \frac{V_{REF}}{I_{OUT(max)}}$$

Figure 4 adds current limit to the series regulator in Figure 3 using a second TLV431Q. For currents below the limit, the circuit works normally supplying the required load current at the design voltage. However, should attempts be made to exceed the design current set by the second TLV431Q, the device begins to shunt current away from the base of Q1. This begins to reduce the output voltage and thus ensuring that the output current is clamped at the design value. Subject only to Q1's ability to withstand the resulting power dissipation, the circuit can withstand either a brief or indefinite short circuit.

Application Notes (continued)

Figure 5. Increasing Output Voltage of a Fixed Linear Regulator
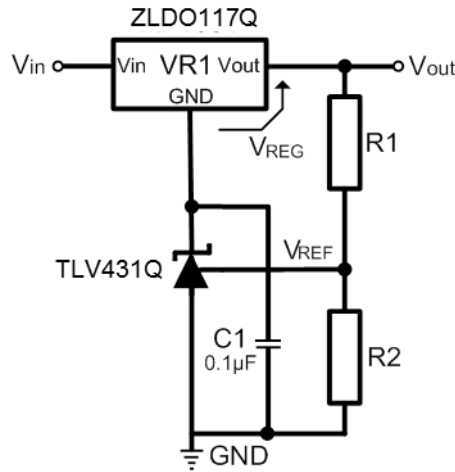
$$V_{OUT} = V_{REF}\left(1 + \frac{R1}{R2}\right)$$

$$V_{OUT} \geq (V_{REG} + V_{REF})$$

(All features of the regulator such as short circuit protection, thermal shutdown, etc, are maintained.)

One of the useful applications of the TLV431Q is in using it to improve the accuracy and/or extend the range and flexibility of fixed voltage regulators. In the circuit in Figure 5 above both the output voltage and its accuracy are entirely determined by the TLV431Q, R1 and R2. However, the rest of the features of the regulator (up to 1A output current, output current limiting and thermal shutdown) are all still available.

Figure 6. Adjustable Linear Voltage Regulator
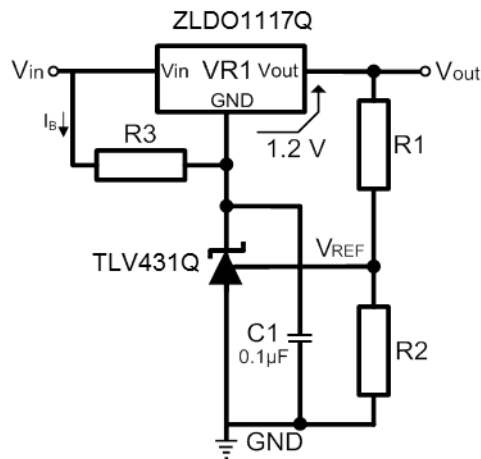
$$V_{OUT} = V_{REF}\left(1 + \frac{R1}{R2}\right)$$

$$V_{OUT} \geq (V_{REG} + V_{REF})$$

$$R3 = \frac{V_{IN} - (V_{OUT} - V_{REG})}{I_B}$$

$$0.1mA \leq I_B \leq 18mA$$

(All features of the regulator such as short circuit protection, thermal shutdown, etc, are maintained.)

Figure 6 is similar to Figure 5 with adjustability added. Note the addition of R3, This is added to provide sufficient bias current for the TLV431Q.

TLV431Q
Document number: DS36915 Rev. 4 - 2

10 of 14
www.diodes.com

August 2023
© 2023 Copyright Diodes Incorporated. All Rights Reserved.

Ordering Information

TLV431 <u>X</u> <u>Q(X)X</u> <u>TA</u>

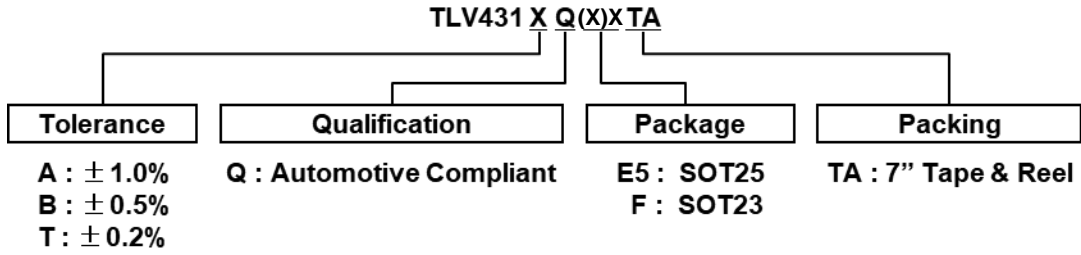| Tolerance	Qualification	Package	Packing
A : ± 1.0% B : ± 0.5% T : ± 0.2%	Q : Automotive Compliant	E5 : SOT25 F : SOT23	TA : 7" Tape & Reel

Tolerance	Part Number	Package (Note 8)	Identification Code	Reel Size	Tape Width	Packing		Status
						Qty.	Carrier	
1%	TLV431AQE5TA	SOT25	V1A	7", 180mm	8mm	3000	7" Tape & Reel	RTM
	TLV431AQFTA	SOT23	V1A	7", 180mm	8mm	3000	7" Tape & Reel	RTM
0.5%	TLV431BQE5TA	SOT25	V1B	7", 180mm	8mm	3000	7" Tape & Reel	RTM
	TLV431BQFTA	SOT23	V1B	7", 180mm	8mm	3000	7" Tape & Reel	RTM
0.2%	TLV431TQFTA	SOT23	V1T	7", 180mm	8mm	3000	7" Tape & Reel	EOL

Note: 8. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.

Marking Information

(1)   SOT23

(Top View)

XXX : Identification code

(2)   SOT25

(Top View)

XXX : Identification code

TLV431Q
Document number: DS36915 Rev. 4 - 2

11 of 14
www.diodes.com

August 2023
© 2023 Copyright Diodes Incorporated. All Rights Reserved.
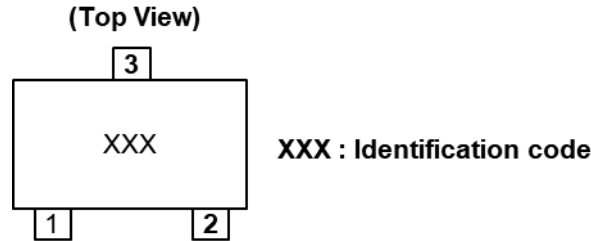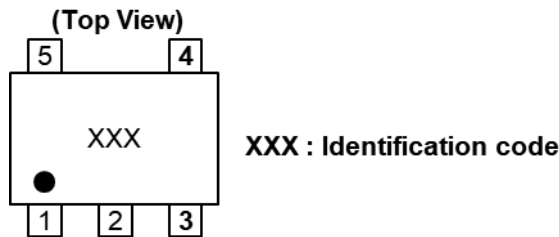
Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

(1)   Package Type: SOT23
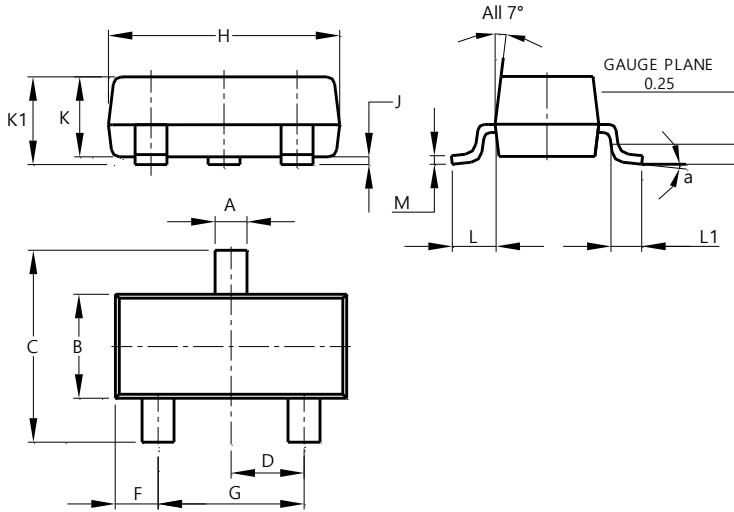
SOT23			
Dim	**Min**	**Max**	**Typ**
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	0°	8°	--
All Dimensions in mm			

(2)   Package Type: SOT25
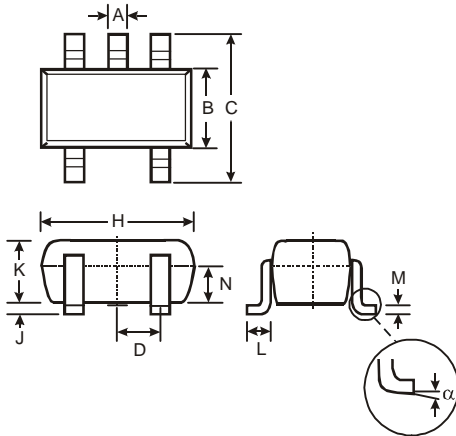
SOT25			
Dim	**Min**	**Max**	**Typ**
A	0.35	0.50	0.38
B	1.50	1.70	1.60
C	2.70	3.00	2.80
D	-	-	0.95
H	2.90	3.10	3.00
J	0.013	0.10	0.05
K	1.00	1.30	1.10
L	0.35	0.55	0.40
M	0.10	0.20	0.15
N	0.70	0.80	0.75
α	0°	8°	-
All Dimensions in mm			

TLV431Q
Document number: DS36915 Rev. 4 - 2

12 of 14
www.diodes.com

August 2023
© 2023 Copyright Diodes Incorporated. All Rights Reserved.

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

(1)   Package Type: SOT23
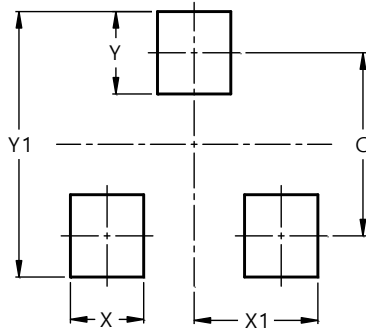
Dimensions	Value (in mm)
C	2.0
X	0.8
X1	1.35
Y	0.9
Y1	2.9

(2)   Package Type: SOT25
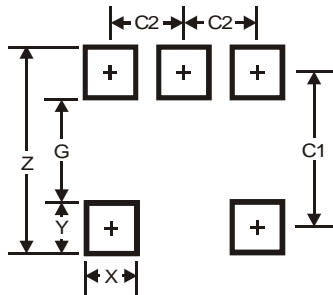
Dimensions	Value
Z	3.20
G	1.60
X	0.55
Y	0.80
C1	2.40
C2	0.95

Note: The suggested land pattern dimensions have been provided for reference only, as actual pad layouts may vary depending on application. These dimensions may be modified based on user equipment capability or fabrication criteria. A more robust pattern may be desired for wave soldering and is calculated by adding 0.2 mm to the 'Z' dimension. For further information, please reference document IPC-7351A, Naming Convention for Standard SMT Land Patterns, and for International grid details, please see document IEC, Publication 97.

Note: For high voltage applications, the appropriate industry sector guidelines should be considered with regards to creepage and clearance distances between device Terminals and PCB tracking.

Mechanical Data

(1)   SOT23

- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 ⓔ3
- Weight: 0.009 grams (Approximate)

(2)   SOT25

- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 ⓔ3
- Weight: 0.016 grams (Approximate)

TLV431Q
Document number: DS36915 Rev. 4 - 2

13 of 14
www.diodes.com

August 2023
© 2023 Copyright Diodes Incorporated. All Rights Reserved.

IMPORTANT NOTICE

1.   DIODES INCORPORATED (Diodes) AND ITS SUBSIDIARIES MAKE NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO ANY INFORMATION CONTAINED IN THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

2.   The Information contained herein is for informational purpose only and is provided only to illustrate the operation of Diodes' products described herein and application examples. Diodes does not assume any liability arising out of the application or use of this document or any product described herein. This document is intended for skilled and technically trained engineering customers and users who design with Diodes' products. Diodes' products may be used to facilitate safety-related applications; however, in all instances customers and users are responsible for (a) selecting the appropriate Diodes products for their applications, (b) evaluating the suitability of Diodes' products for their intended applications, (c) ensuring their applications, which incorporate Diodes' products, comply the applicable legal and regulatory requirements as well as safety and functional-safety related standards, and (d) ensuring they design with appropriate safeguards (including testing, validation, quality control techniques, redundancy, malfunction prevention, and appropriate treatment for aging degradation) to minimize the risks associated with their applications.

3.   Diodes assumes no liability for any application-related information, support, assistance or feedback that may be provided by Diodes from time to time. Any customer or user of this document or products described herein will assume all risks and liabilities associated with such use, and will hold Diodes and all companies whose products are represented herein or on Diodes' websites, harmless against all damages and liabilities.

4.   Products described herein may be covered by one or more United States, international or foreign patents and pending patent applications. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks and trademark applications. Diodes does not convey any license under any of its intellectual property rights or the rights of any third parties (including third parties whose products and services may be described in this document or on Diodes' website) under this document.

5.   Diodes' products are provided subject to Diodes' Standard Terms and Conditions of Sale (https://www.diodes.com/about/company/terms-and-conditions/terms-and-conditions-of-sales/) or other applicable terms. This document does not alter or expand the applicable warranties provided by Diodes. Diodes does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.

6.   Diodes' products and technology may not be used for or incorporated into any products or systems whose manufacture, use or sale is prohibited under any applicable laws and regulations. Should customers or users use Diodes' products in contravention of any applicable laws or regulations, or for any unintended or unauthorized application, customers and users will (a) be solely responsible for any damages, losses or penalties arising in connection therewith or as a result thereof, and (b) indemnify and hold Diodes and its representatives and agents harmless against any and all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim relating to any noncompliance with the applicable laws and regulations, as well as any unintended or unauthorized application.

7.   While efforts have been made to ensure the information contained in this document is accurate, complete and current, it may contain technical inaccuracies, omissions and typographical errors. Diodes does not warrant that information contained in this document is error-free and Diodes is under no obligation to update or otherwise correct this information. Notwithstanding the foregoing, Diodes reserves the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes.

8.   Any unauthorized copying, modification, distribution, transmission, display or other use of this document (or any portion hereof) is prohibited. Diodes assumes no responsibility for any losses incurred by the customers or users or any third parties arising from any such unauthorized use.

9. This Notice may be periodically updated with the most recent version available at https://www.diodes.com/about/company/terms-and-conditions/important-notice

The Diodes logo is a registered trademark of Diodes Incorporated in the United States and other countries.
All other trademarks are the property of their respective owners.
© 2023 Diodes Incorporated. All Rights Reserved.

www.diodes.com

TLV431Q
Document number: DS36915 Rev. 4 - 2

14 of 14
www.diodes.com

August 2023
© 2023 Copyright Diodes Incorporated. All Rights Reserved.

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for Voltage References *category:*

Click to view products by Diodes Incorporated *manufacturer:*

Other Similar products are found below :

5962-8686103XC LT1236AIS8-10PBF MSB-T MSDB-T REF01J/883 LM4040B25QFTA NJM2823F-TE1 EL5226IR EL5326IR EL5326IRZ ISL21007DFB825Z ISL21009BFB812Z ISL21009CFB812Z ISL60002BIH312 TS3320AMR TS3325AMR TS3330AMR TS3333AMR X60003CIG3-41 X60003DIG3Z-41T1 X60250V8I REF3025TB-GT3 TL431CPG LT1027CCS8-5#TRPBF AD587KRZ-REEL CA-HP6025S CA-HP6041S LT1236BCS8-5#TRPBF ADR435BRMZ-REEL7 CA-HP6050S MC1403BN LM285Z-2.5 LM385B-ADJ LM385B-2.5 HT385R-1.2 HT336R-2.5 TL431L REF6050IDGKR TL431APA LM385D-1.2RG MC1403BDRG LT6657AHMS8-2.5#TRPBF LM236D-2.5RG LM336LP-5.0G LM336D-5.0RG LM385LP-2.5G LM336D-2.5RG LM385D-2.5RG MAX6225BESA+T MAX875BESA+T