# Adjustable Voltage Reference – TLV431W

**Precision low-voltage programmable Shunt Reference in bare die form**

**Rev 1.0**
**18/03/21**



## Description

The TLV431W three-terminal shunt reference combines low temperature co-efficient zener band-gap regulation with programmability. The device operates over a wide 80µA to 100mA current range with voltage adjustable from $V_{REF}$ (1.24V) to 18V, set via x2 external resistors. With high temperature stability and typical dynamic impedance of 0.2Ω, these references make excellent replacements for zener diodes in many high reliability applications. With sharp accurate response, the device is simply implemented as either positive or negative reference.

## Features:

- Programmable output voltage to 18V
- ±0.5% reference voltage tolerance at 25°C
- Low dynamic output impedance 0.2Ω Typ
- Sink current capability 80µA to 100mA
- Band-gap reference corrects temperature drift
- Direct replacement for TLV431 and TLVH431
- Full military temperature range.

## Ordering Information

The following part suffixes apply:

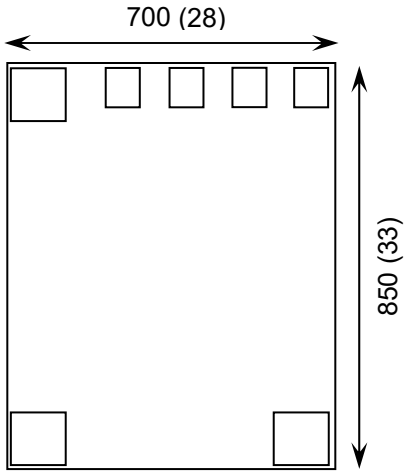
- No suffix - MIL-STD-883 /2010B Visual Inspection
- "**H**" - MIL-STD-883 /2010B Visual Inspection
  + MIL-PRF-38534 Class H LAT
- "**K**" - MIL-STD-883 /2010A Visual Inspection (Space)
  + MIL-PRF-38534 Class K LAT

LAT = Lot Acceptance Test.

For further information on LAT process flows see below.

www.siliconsupplies.com\quality\bare-die-lot-qualification

## Die Dimensions in µm (mils)




## Supply Formats:

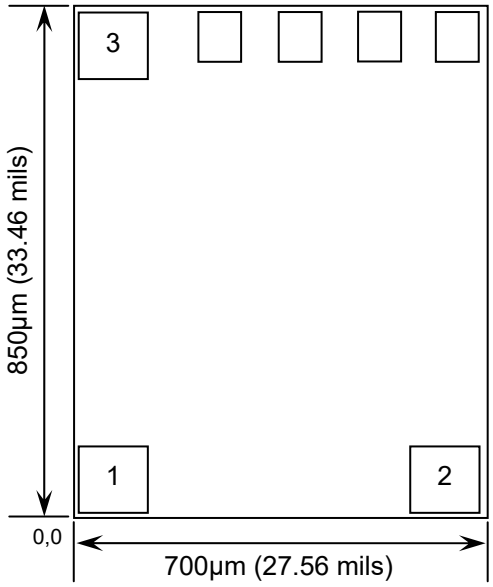
- Default – Die in Waffle Pack (400 per tray capacity)
- Sawn Wafer on Tape – On request
- Unsawn Wafer – On request
- Die Thickness <> 280µm(11 Mils) – On request
- In Metal or Ceramic package – On request

## Mechanical Specification

| | | |
|---|---|---|
| Die Size (Unsawn) | 700 x 850<br>28 x 33 | µm<br>mils |
| Minimum Bond Pad Size | 100 x 100<br>3.94 x 3.94 | µm<br>mils |
| Die Thickness | 260 (±20)<br>11 (±0.8) | µm<br>mils |
| Top Metal Composition | Al 1%Si 1.4µm | |
| Back Metal Composition | N/A – Bare Si | |

Rev 1.0
18/03/21

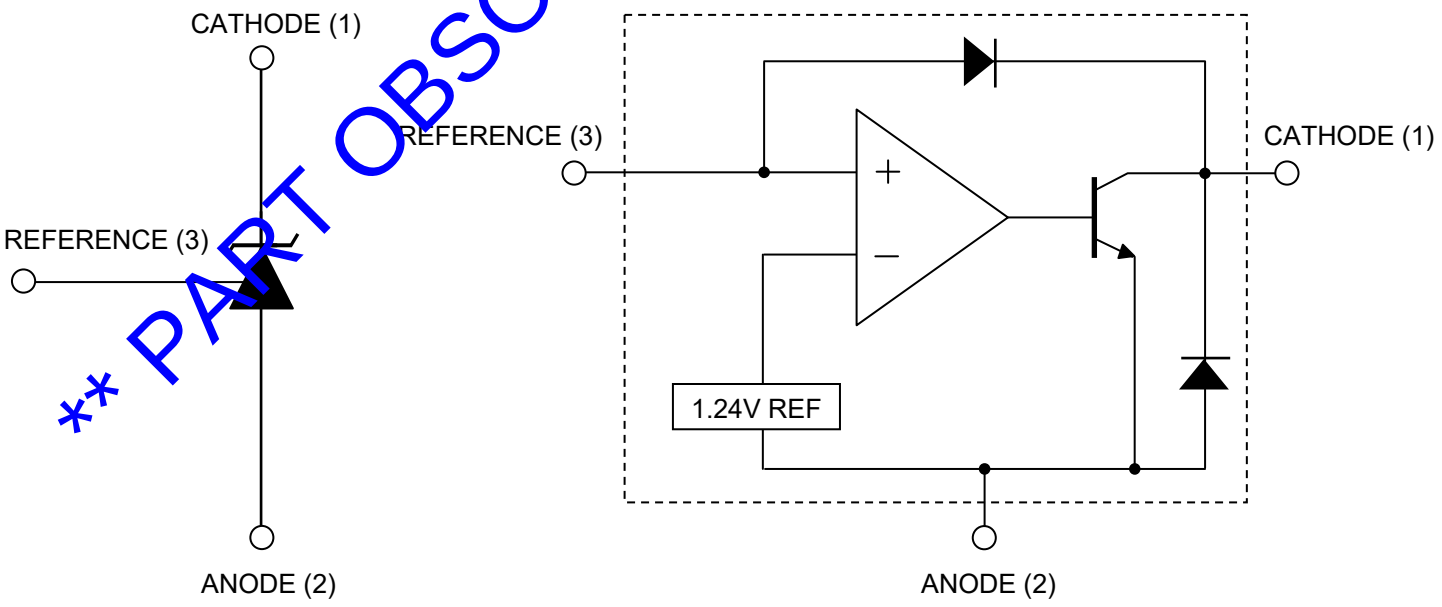
## Pad Layout and Functions




| PAD | FUNCTION | COORDINATES (µm) | |
|---|---|---|---|
| | | X | Y |
| 1 | CATHODE (K) | 60 | 60 |
| 2 | ANODE (A) | 540 | 60 |
| 3 | REFERENCE | 60 | 690 |
| CONNECT CHIP BACK TO ANODE | | | |



## Symbol & functional block diagram



**Rev 1.0**
**18/03/21**

## Absolute Maximum Ratings[1] $T_A$ = 25°C unless otherwise stated

| PARAMETER | SYMBOL | VALUE | UNIT |
|---|---|---|---|
| Cathode to Anode Voltage | $V_{KA}$ | 20 | V |
| Cathode Current Range, Continuous | $I_K$ | 120 | mA |
| Reference Input Current Range, Continuous | $I_{REF}$ | -0.05 to 3 | mA |
| ESD Rating (Human Body Model) | $V_{ESD}$ | >2 | kV |
| Operating Junction Temperature Range | $T_J$ | 150 | °C |
| Storage Temperature | $T_{STG}$ | -65 to 150 | °C |

**1.** Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability.

## Recommended Operating Conditions

| PARAMETER | SYMBOL | MIN | MAX | UNIT |
|---|---|---|---|---|
| Cathode Voltage | $V_{KA}$ | $V_{REF}$ | 18 | V |
| Cathode Current | $I_K$ | 0.08 | 100 | mA |
| Ambient Operating Temperature Range | $T_A$ | -55 to 125 | | °C |

## Electrical Characteristics, $T_A$ = 25°C, $V_{KA} = V_{REF}$, $I_K$ = 10mA unless otherwise stated

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Reference input voltage | $V_{REF}$ | $V_{KA} = V_{REF}$, $I_K$ = 10mA | 1.235 | 1.240 | 1.245 | V |
| Reference input voltage, Deviation over temperature range | $\Delta V_{REF}$ | $V_{KA} = V_{REF}$, $I_K$ = 10mA, -55˚C ≤ $T_A$ ≤ +125˚C | - | 10 | 20 | mV |
| Ratio of change in reference input voltage to change in cathode to anode voltage | $\Delta V_{REF} / \Delta V_{KA}$ | $I_K$ = 10mA , $\Delta V_{KA}$ = 18V to $V_{REF}$ | -1.0 | -0.4 | - | mV/V |
| Reference input current | $I_{REF}$ | $I_K$ = 10mA, R1 = 10kΩ, R2 = ∞ | - | 0.1 | 0.5 | µA |
| Reference input current, Deviation over temperature range | $\Delta I_{REF}$ | $I_K$ = 10mA, R1 = 10kΩ, R2 = ∞ | - | 0.04 | 0.2 | µA |
| Minimum cathode current for regulation | $I_{K(MIN)}$ | 1.215V ≤ $V_{REF}$ ≤ 1.265V | - | 60 | 80 | µA |
| Off-State cathode current | $I_{K(OFF)}$ | $V_{KA}$ = 18V, $V_{REF}$ = 0V | - | 0.01 | 0.5 | µA |
| Dynamic impedance | $\lvert Z_{KA} \rvert$ | $I_K$ = 100mA to 1mA , f ≤ 1.0KHz | - | 0.2 | 0.4 | Ω |

## Test Circuits

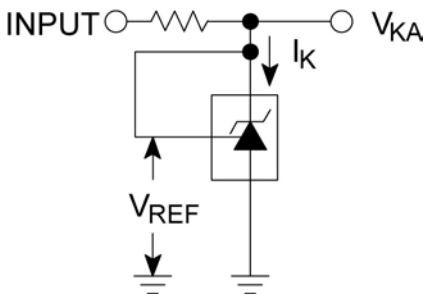



**FIGURE 1.** $V_{KA} = V_{REF}$

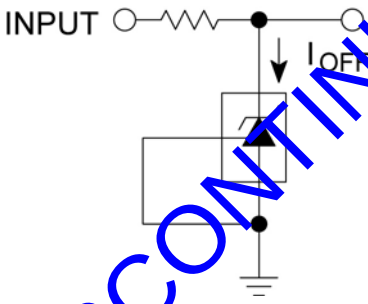
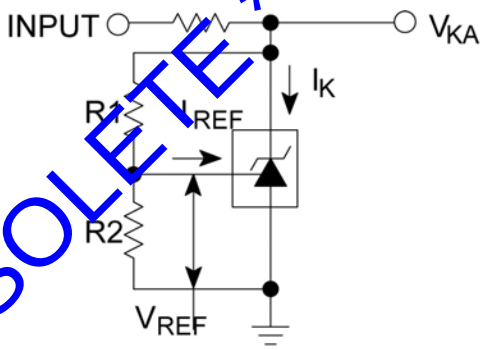



**FIGURE 2.** $I_{OFF}$




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

**FIGURE 3.** $V_{KA} > V_{REF}$