

Adjustable Precision shunt Regulator

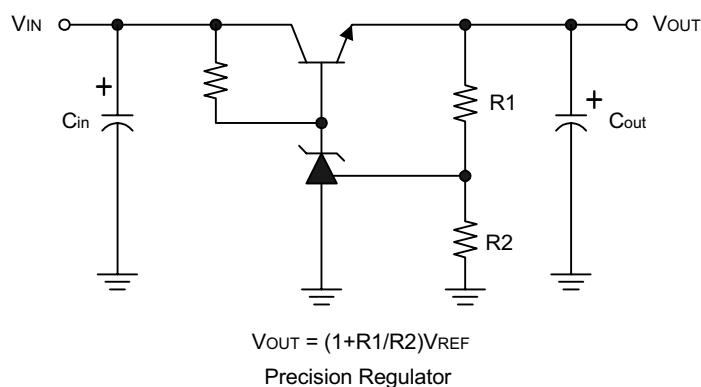
■ Features

- Precision reference voltage
CP431 : $2.495V \pm 1\%$
CP431A : $2.495V \pm 0.5\%$
- Sink current capability: 200mA
- Minimum cathode current for regulation: $300 \mu A$
- Equivalent full-range temp. coefficient: $30 \text{ ppm}/^{\circ}C$
- Fast turn-on response
- Low dynamic output impedance: 0.2Ω
- Programmable output voltage to 36v
- Low output noise.
- Packages: TO92,SOT23

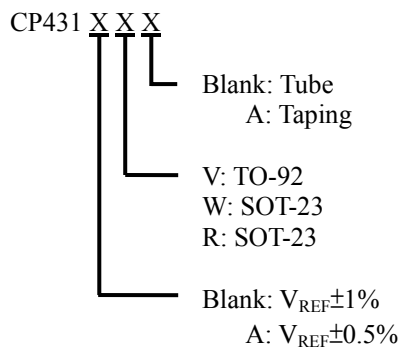
■ Description

The CP431/CP431A are 3-terminal adjustable precision shunt regulators with guaranteed temperature stability over the applicable extended commercial temperature range. The output voltage may be set at any level greater than $2.495V(V_{REF})$ up to 36V merely by selecting two external resistors that act as a voltage divider network. These devices have a typical output impedance of 0.2Ω . Active output circuitry provides a very sharp turn-on characteristics, making these devices excellent improved replacements for Zener diodes in many applications. The precise (+/-) 1% Reference voltage tolerance of the CP431/431A make it possible in many applications to avoid the use of a variable resistor, consequently saving cost and eliminating drift and reliability problems associated with it.

■ Typical Application Circuit



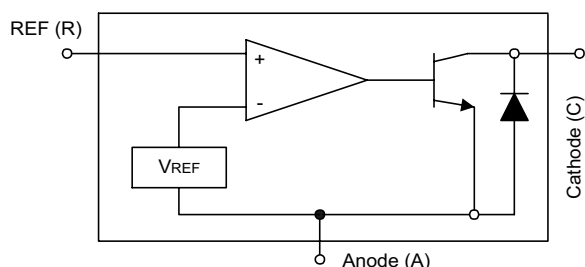
■ Ordering Information



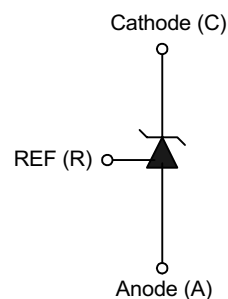
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Adjustable Precision shunt Regulator

■ Block Diagram



■ Symbol



■ Pin Configuration

Order Number	Pin Configuration (Top View)
CP431V CP431AV (TO-92)	
CP431W CP431AW (SOT-23)	
CP431R CP431AR (SOT-23)	

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■ Absolute Maximum Ratings

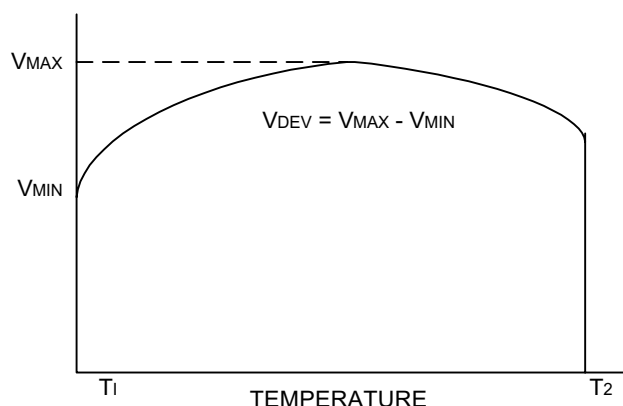
Cathode Voltage	36V
Continuous Cathode Current	-10mA ~ 150mA
Reference Input Current Range	10mA
Operating Temperature Range	0°C ~ 70°C
Lead Temperature.....	260°C
Storage Temperature	-65°C ~ 150°C
Power Dissipation	
TO-92 Package	0.78W
SOT-23 package	0.23W

■ Electrical Characteristics (Ta=25°C , unless otherwise specified.)

PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Reference voltage	$V_{KA} = V_{REF}$, $I_{KA} = 10mA$ (Fig.1)	V_{REF}	2.470 2.482	2.495	2.520 2.507	V
Deviation of Reference input voltage over temperature (Note 3)	$V_{KA} = V_{REF}$, $I_{KA} = 10mA$, $T_a = 0^\circ C \sim +70^\circ C$	V_{REF}		8.0	20	mV
Ratio of the change in Reference voltage to the change in Cathode voltage	$I_{KA} = 10mA$ (Fig.2)	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$		-1.4 -1	-2.0 -2	mV/V mV/V
Reference input current	$R1 = 10K\Omega$, $R2 = \infty$, $I_{KA} = 10mA$	I_{REF}		1.4	3.5	μA
Deviation of Reference input current over temperature	$R1 = 10K\Omega$, $R2 = \infty$, $I_{KA} = 10mA$, $T_a = \text{Full range}$	αI_{REF}		0.4	1.2	μA
Minimum Cathode current for regulation	$V_{KA} = V_{REF}$ (Fig.1)	$I_{KA(MIN)}$		0.19	0.5	mA
Off-state current	$V_{KA} = 36V$, $V_{REF} = 0V$	$I_{KA(OFF)}$		0.1	1.0	μA
Dynamic output impedance	$V_{KA} = V_{REF}$, $V_{KA} = V_{REF}$, $\Delta I_{KA} = 1mA \sim 100mA$, Frequency $\leq 1KHz$ (Fig.1)	$ Z_{KA} $		0.2	0.5	Ω

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Note . Deviation of reference input voltage, V_{DEV} , is defined as the maximum variation of the reference over the full temperature range.

The average temperature coefficient of the reference input voltage αV_{REF} is defined as:

$$|\alpha V_{REF}| = \frac{\left(\frac{V_{DEV}}{V_{REF}(25^{\circ}\text{C})} \right) \cdot 10^6}{T_2 - T_1} \dots\dots\dots (\text{ppm}/^{\circ}\text{C})$$

Where:

$T_2 - T_1$ = full temperature change.

αV_{REF} can be positive or negative depending on whether the slope is positive or negative.

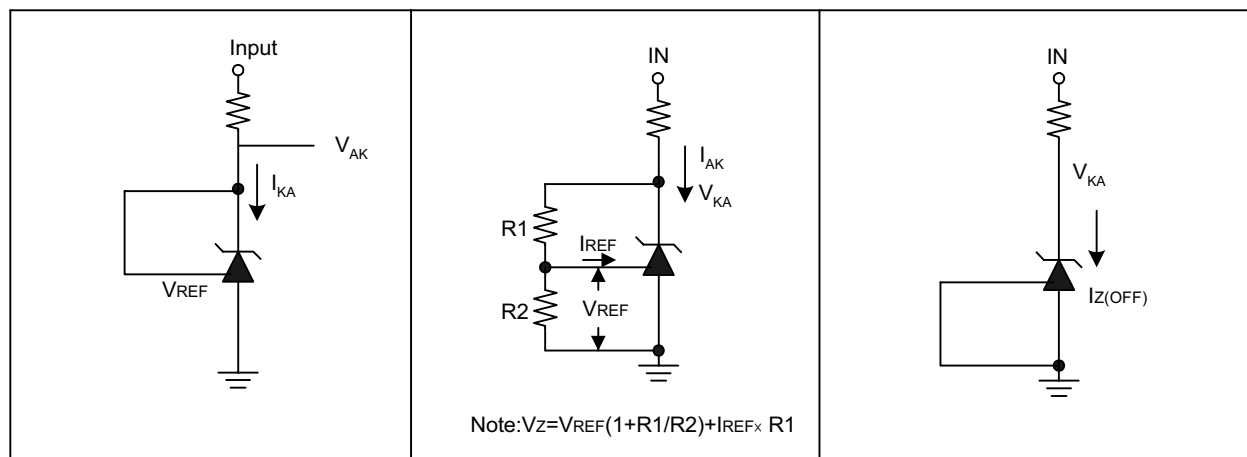
Note 4. The dynamic output impedance, R_Z , is defined as:

$$|Z_{KA}| = \frac{\Delta V_{KA}}{\Delta I_{KA}}$$

When the device is programmed with two external resistors $R1$ and $R2$ (see Figure 2.), the dynamic output impedance of the overall circuit, is defined as:

$$|Z_{KA}'| = \frac{\Delta v}{\Delta i} \approx |Z_{KA}| \cdot \left(1 + \frac{R1}{R2} \right)$$

■ Test Circuits



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

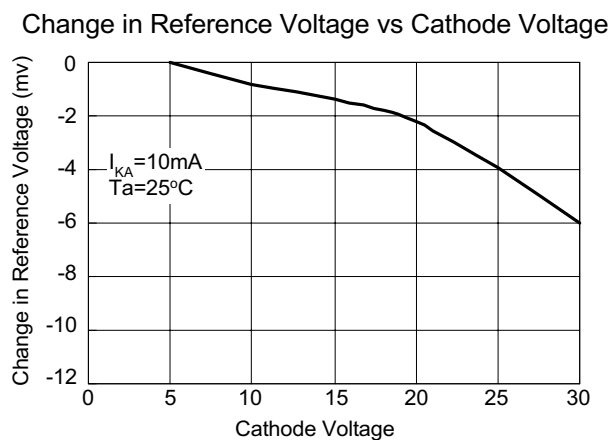
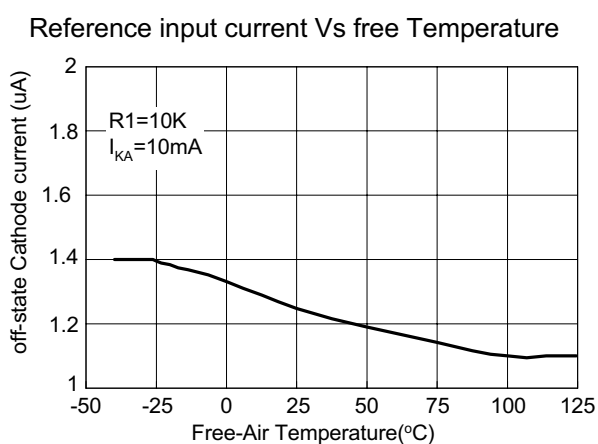
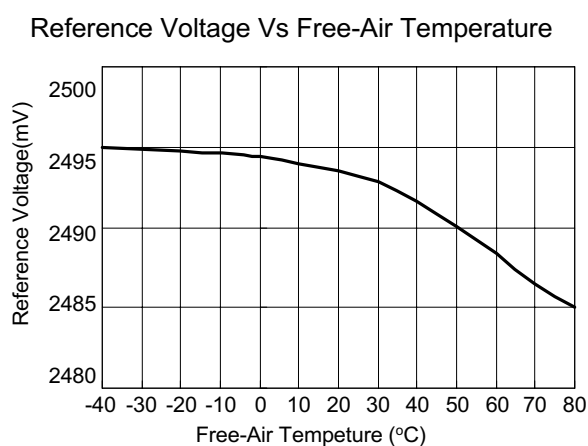
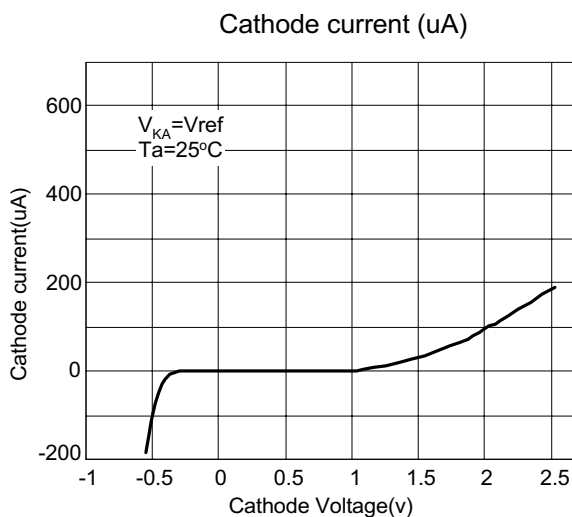
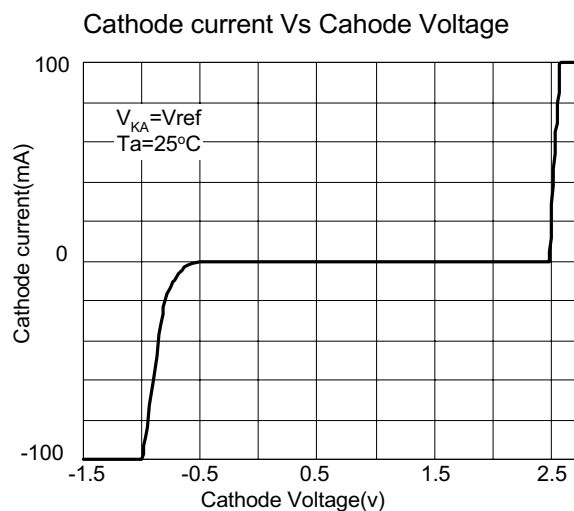
Test circuit for $V_{KA} > V_{REF}$

Test Circuit for off-state Current

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■ Typical Performance Characteristics



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Application Examples

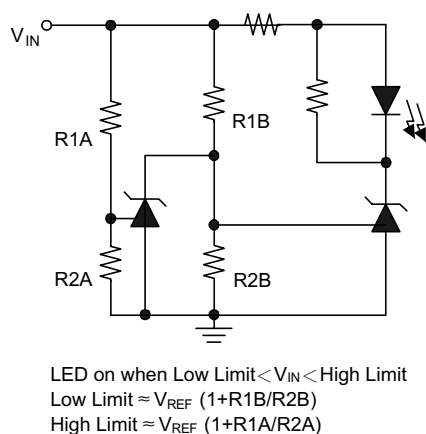


Fig.1 Voltage Monitor

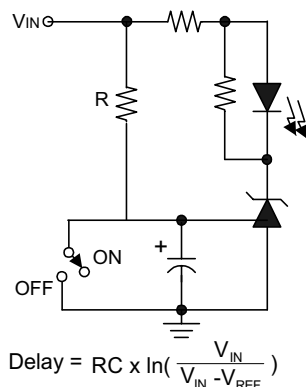


Fig.2 Delay Timer

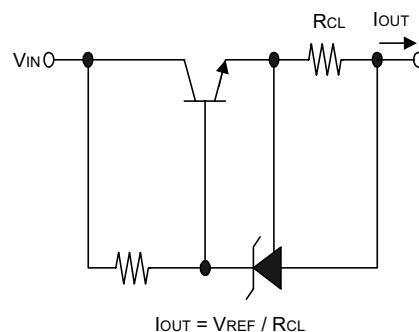


Fig.3 Current Limiter or Current Source

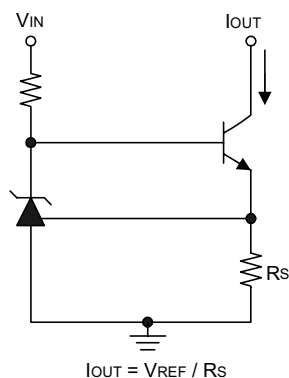


Fig.4 Constant-Current Sink

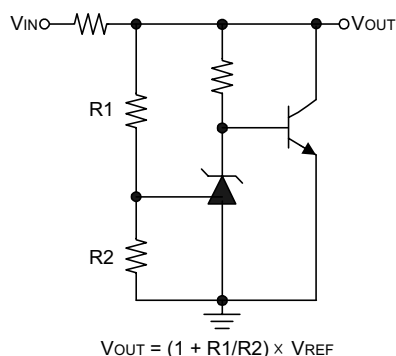


Fig.5 Higher-Current Shunt Regulator

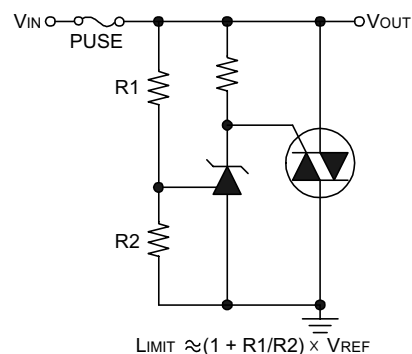


Fig.6 Crow Bar

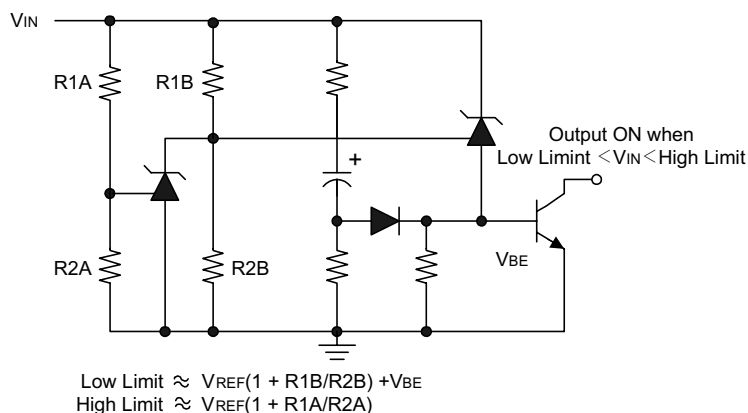
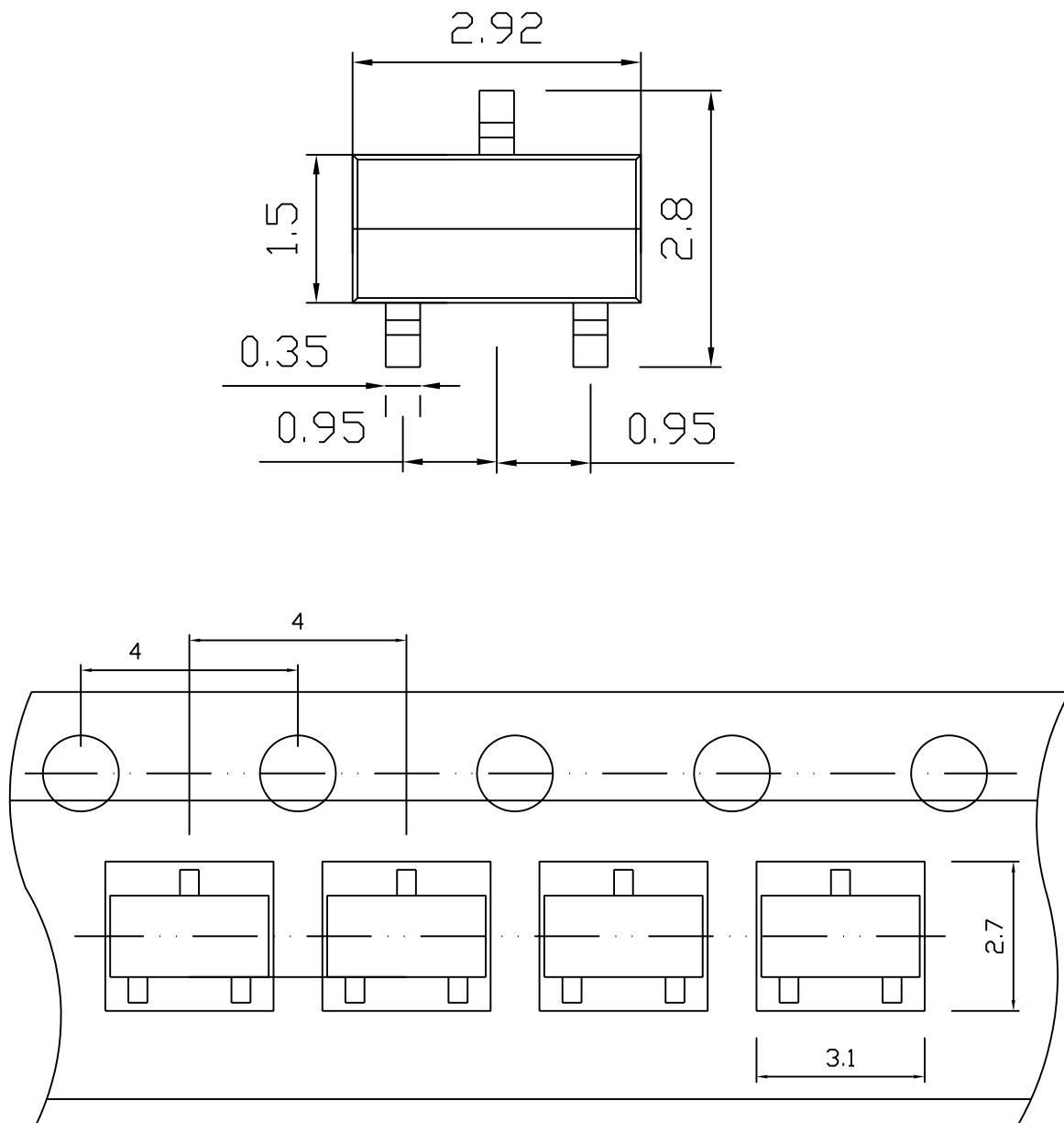


Fig.7 Over-Voltage / Under-Voltage Protection Circuit

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■ Taping Specifications For SOT-23 package

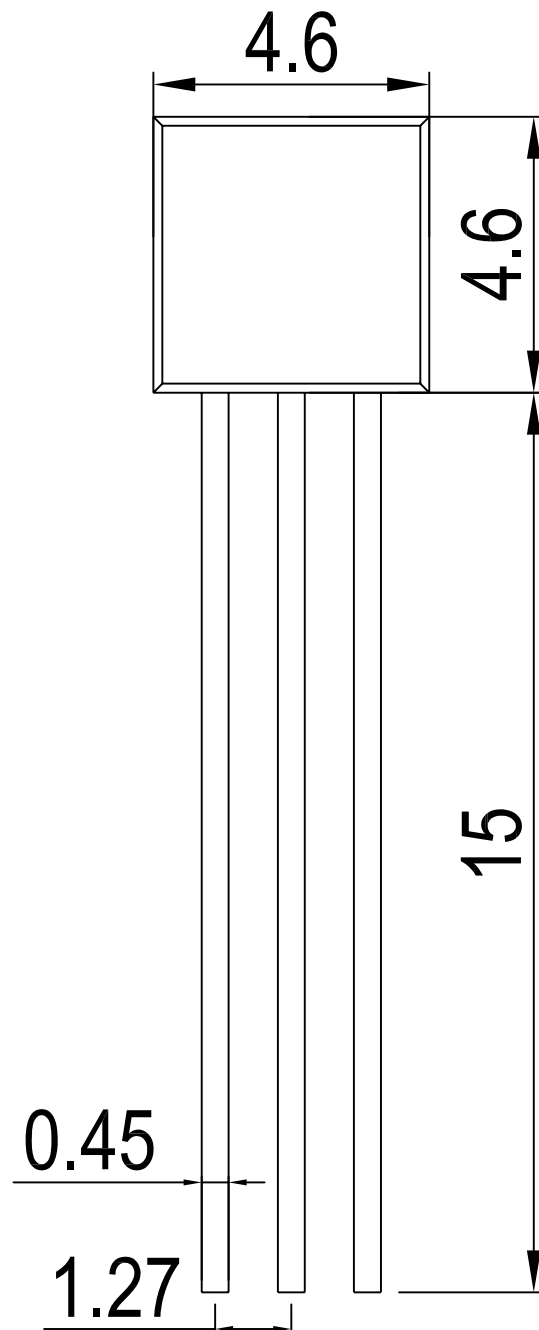


Units: mm

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Adjustable Precision shunt Regulator

■ Bulk Specifications For TO-92

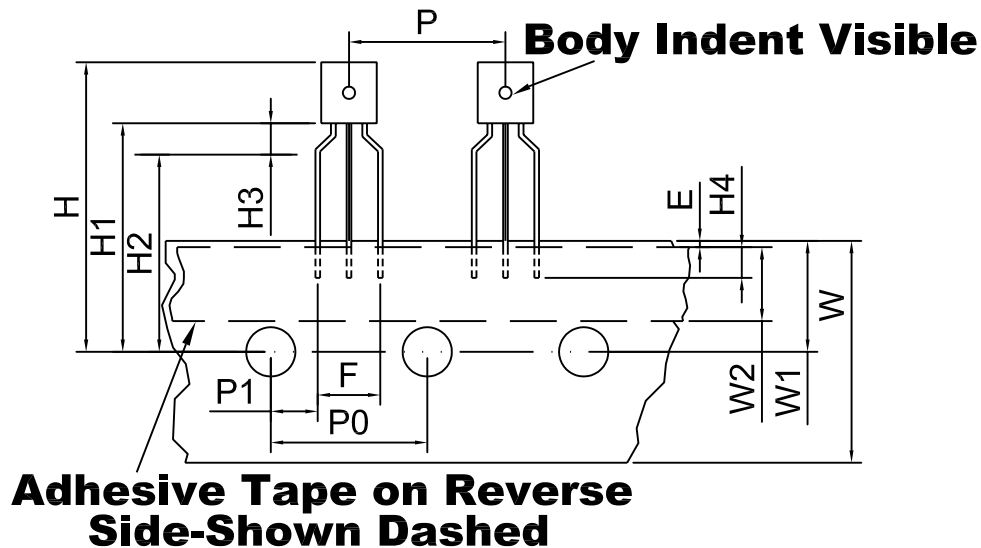


Units: mm

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- Taping Specifications For TO-92 package



SYMBOL	SPECIFICATIONS (mm)	SPECIFICATIONS (inch)
P	12.7 ± 1.0	0.50 ± 0.07
P0	12.7 ± 1.0	0.50 ± 0.07
P1	3.81 ± 0.4	0.15 ± 0.016
H	21.0~26.0	0.828~1.024
H1	17.0~21.0	0.669~0.828
H2	14.0~18.0	0.551~0.709
H3	3.4 max.	0.125 max.
H4	2.5 min.	0.098 min.
F	5.08 ± 0.2	0.2 ± 0.008
W	18.0 ± 0.5	0.708 ± 0.020
W1	9.0 ± 0.5	0.354 ± 0.020
W2	6.0 ± 0.5	0.236 ± 0.020
ΦD0	4.0 ± 0.2	0.157 ± 0.008
E	0.5 max.	0.020 max.

Units: mm

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