Precision Programmable Reference

Features

- Reference voltage tolerance at 25°C
  - 0.5％ (B Grade)
  - 0.8％ (A Grade)
- Sink current capability: 1mA to 100mA
- 0.2Ω Typical output impedance
- Adjustable output voltage: V_{REF} to 36V
- High stability under capacitive load
- Typical temperature drift:5mV
- Low output noise
- Operation from -40℃ up to 125°C
- Package type: SOT23-3L

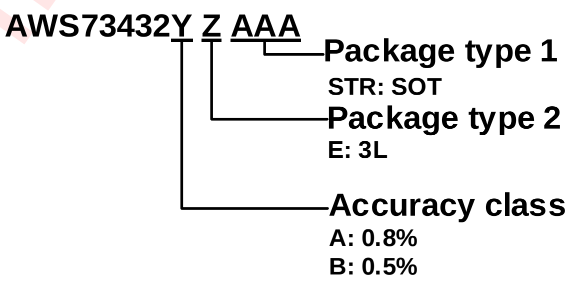
Applications

- Power
- Current sensing
- Led lighting
- Industry
- Instrumentation
- Voltage monitoring
- Comparator with integrated reference

General Description

The AWS73432XX are adjustable shunt voltage references with guaranteed temperature stability over the operating temperature range. The device temperature range is extended from -40°C up to +125°C. The output voltage can be set to any value between V_{REF} and 36V with two external resistors. The AWS73432XX operates with a wide current range from 1mA to 100mA with a typical dynamic impedance of 0.2Ω.

Device Comparison



Typical Application Circuit

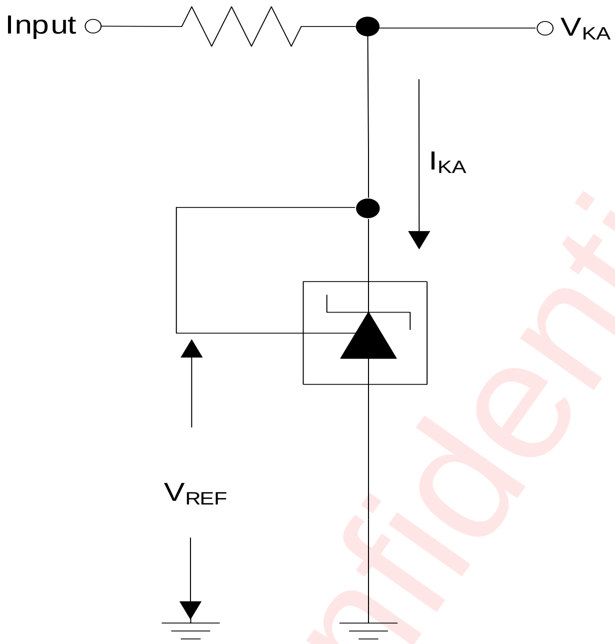


Figure 1 Typical Application Circuit of AWS73432XX

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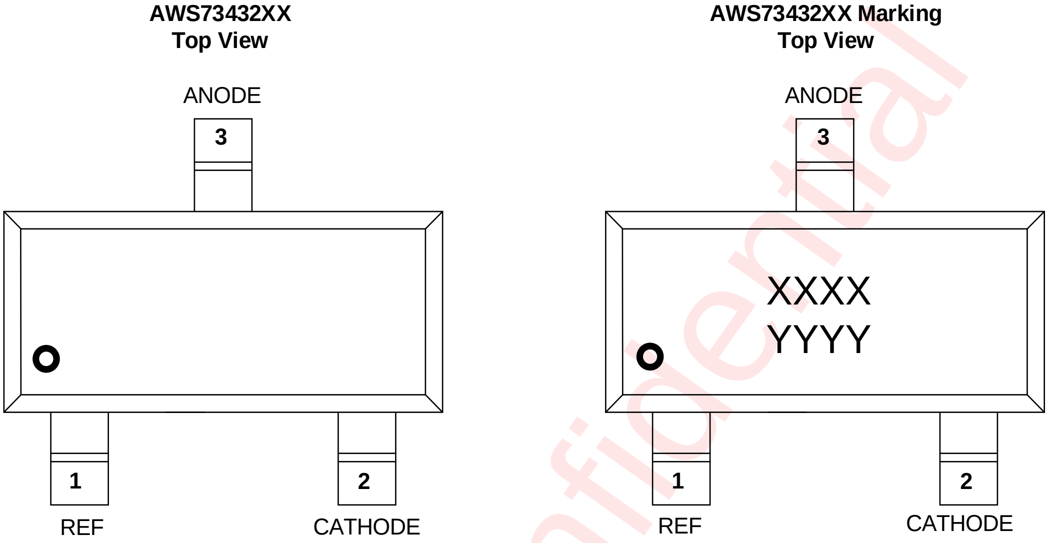
Pin Configuration And Top Mark



XXXX - Refer to Ordering Information of Marking
YYYY - Production Tracing Code

Figure 2 Pin Configuration and Top Mark

Pin Definition

No.	NAME	DESCRIPTION
AWS73432AESTR AWS73432BESTR		
1	REF	Threshold relative to the universal anode.
2	CATHODE	Supply voltage/Shunt current.
3	ANODE	Ground.

Functional Block Diagram

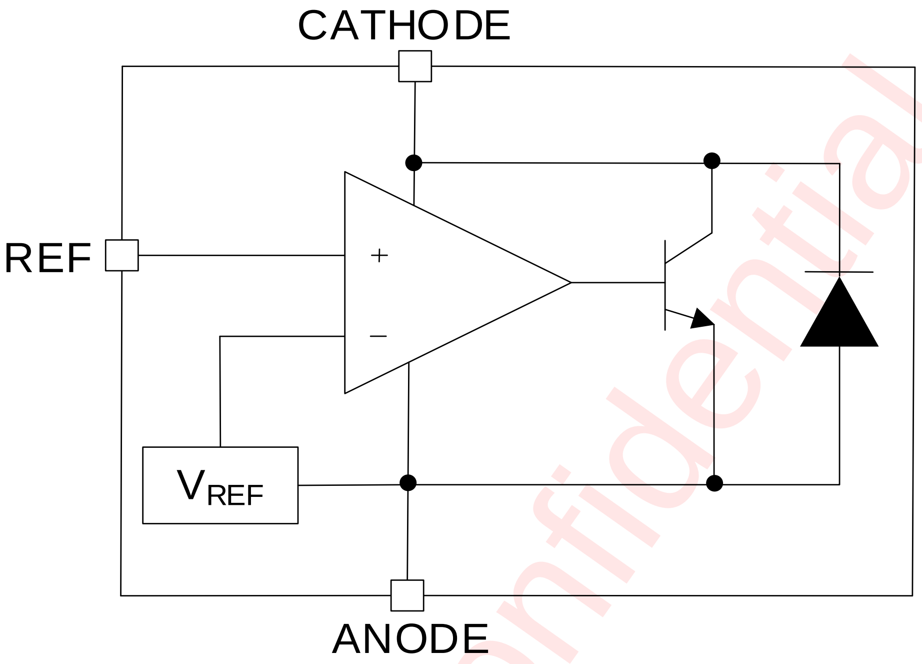


Figure 3 Functional Block Diagram

Typical Application Circuits

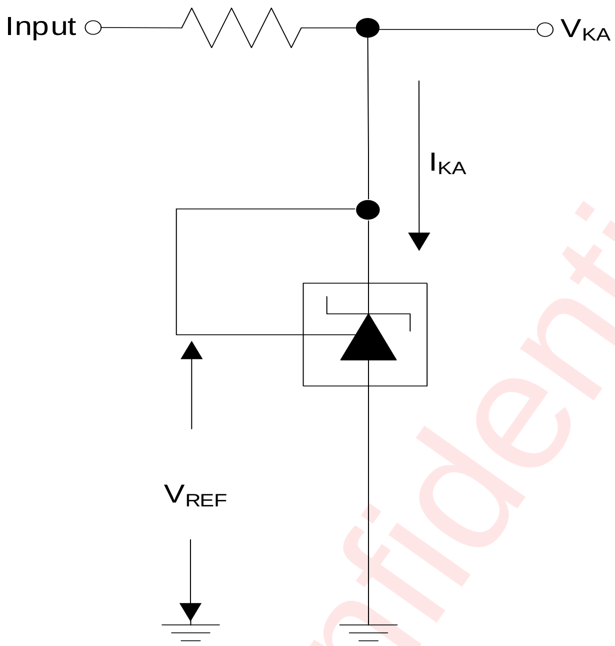


Figure 4 Typical Application Circuit of AWS73432XX

Notice for Typical Application Circuits:

1. The AWS73432XX operates with a wide current range from 1mA to 100mA(MAX).

Ordering Information

Part Number	Temperature	Package	Marking	Moisture Sensitivity Level	Environmental Information	Delivery Form
AWS73432AESTR	-40°C~125°C	SOT23-3L	TPQP	MSL1	ROHS+HF	3000 units/ Tape and Reel
AWS73432BESTR	-40°C~125°C	SOT23-3L	QF8B	MSL1	ROHS+HF	3000 units/ Tape and Reel

Absolute Maximum Ratings(NOTE1)

PARAMETERS	RANGE
Cathode voltage V_{KA} (NOTE1)	40V
Continuous cathode current I_{KA}	-100mA to 100mA
Maximum operating junction temperature T_{JMAX}	150°C
Junction-to-ambient thermal resistance θ_{JA}	248°C/W
Operating free-air temperature range	-40°C to 125°C
Storage temperature T_{STG}	-65°C to 150°C
Lead temperature (soldering 10 seconds)	260°C
ESD	
Human Body Model (All pins, per JEDEC JS-001)(NOTE2)	±4kV
Charged Device Model (All pins, per JEDEC JS-002)(NOTE3)	±2kV

NOTE1：All voltage values are with respect to ANODE, unless otherwise noted.

NOTE2: The human body model is a 100pF capacitor discharged through a 1.5kΩ resistor into each pin. Test method: ESDA/JEDEC JS-001-2024.

NOTE3: Test method: ESDA/JEDEC JS-002-2025.

Recommended Operating Conditions

PARAMETERS		MIN	MAX	UNIT
V_{KA}	Cathode voltage	V_{REF}	36	V
I_{KA}	Cathode current	1	100	mA
T_A	Operating junction temperature T_A	-40	125	°C

Electrical Characteristics

All test conditions: T_A = 25°C for typical values (unless otherwise noted).

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
V_{REF}	Reference voltage	V_{KA} = V_{REF} ,I_{KA} = 10mA, B grade,0.5% initial accuracy	2.483	2.495	2.507	V
		V_{KA} = V_{REF} ,I_{KA} = 10mA, A grade,0.8% initial accuracy	2.475	2.495	2.515	V
V_{DEV}(NOTE1)	Deviation of reference input voltage over full temperature range	V_{KA} = V_{REF} ,I_{KA} = 10mA,		5	25	mV
$\left\lvert\frac{\Delta V_{REF}}{\Delta V_{KA}}\right\rvert$	Ratio of the change in reference voltage to the change in cathode voltage	V_{KA} = 10V to V_{REF} ,I_{KA} = 10mA		0.1	0.8	mV/V
		V_{KA} = 36V to 10V ,I_{KA} = 10mA		0.03	0.4	mV/V
I_{REF}	Reference input current	I_{KA} = 10mA,R_U = 10KΩ,R_D open		0.2	0.8	μA
I_{DEV}	Deviation of reference input current over full temperature range	I_{KA} = 10mA,R_U = 10KΩ,R_D open T_A = -40 to 125°C		0.06	0.8	μA
I_{KA}(MIN)	Minimum cathode current for regulation	V_{KA} = V_{REF}		0.2	0.6	mA
I_{KA} (OFF)	Off-state current	V_{KA} = 36V,V_{REF} = 0V		0.1	0.5	μA
$\lvert Z_{KA}\rvert$(NOTE1)	Dynamic output impedance	V_{KA} = V_{REF}, f <= 1KHz, I_{KA} = 1mA to 100mA		0.2		Ω

NOTE1： The relevant data are product design simulation guarantee data, not FT data.

Typical Characteristics

Ambient temperature is 25°C, unless otherwise noted.

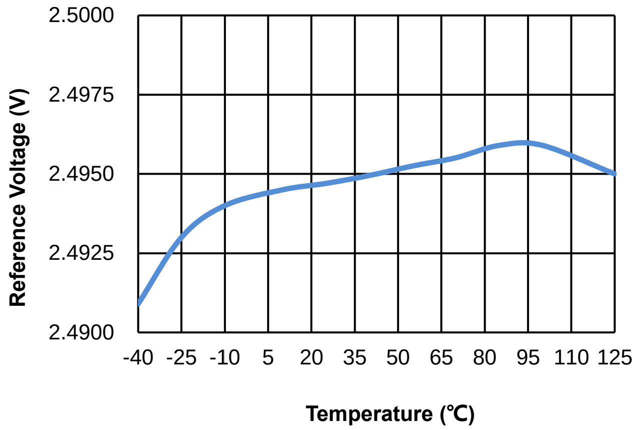


Figure 5 Reference voltage vs. Temperature

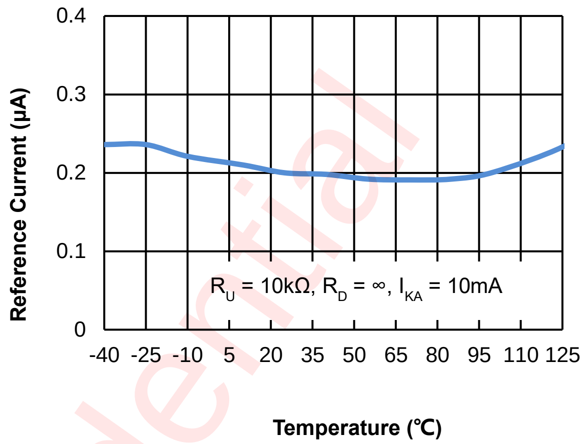


Figure 6 Reference current vs. Temperature

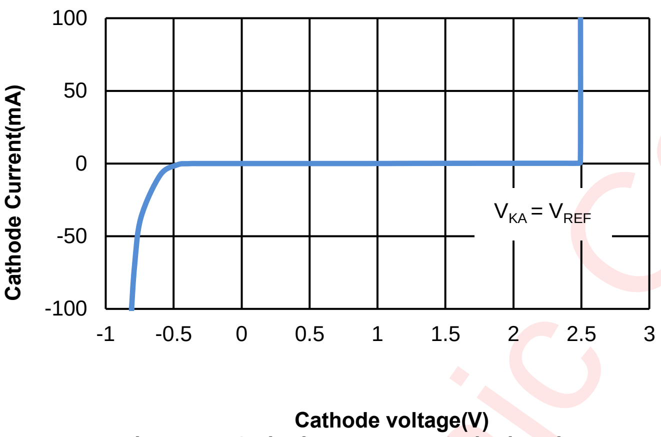


Figure 7 Cathode current vs. Cathode voltage

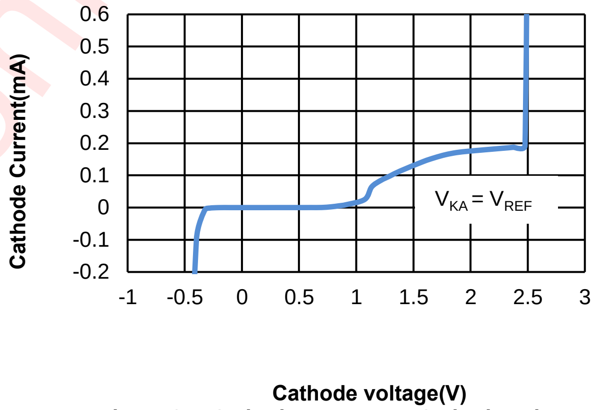


Figure 8 Cathode current vs. Cathode voltage

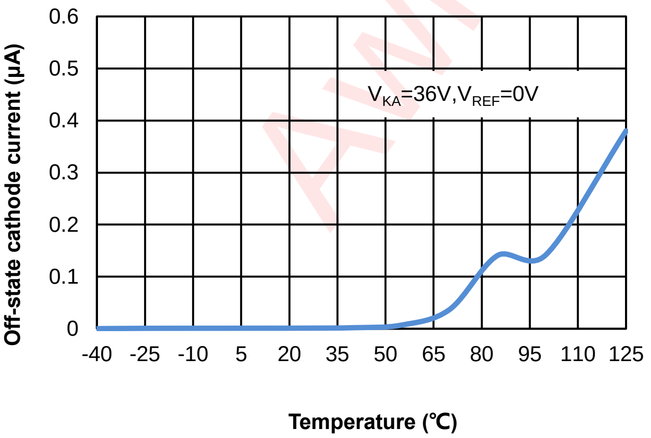


Figure 9 Off-state cathode current vs. Temperature

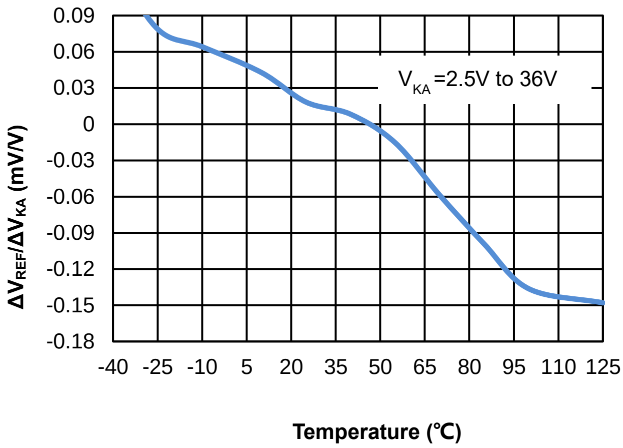


Figure 10 Ratio of delta reference voltage to delta cathode voltage vs. Temperature

Typical Characteristics(Continued)

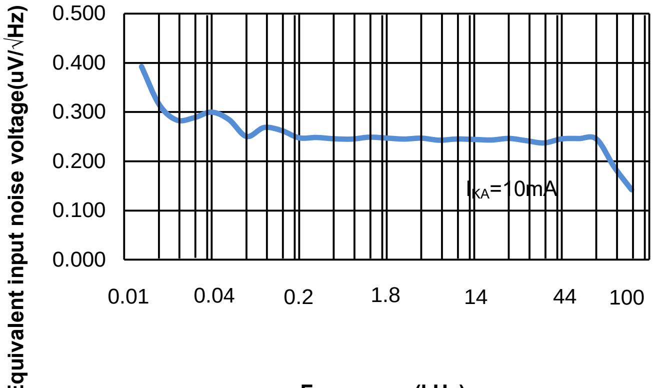


Figure 11 Equivalent input noise voltage vs. Frequency

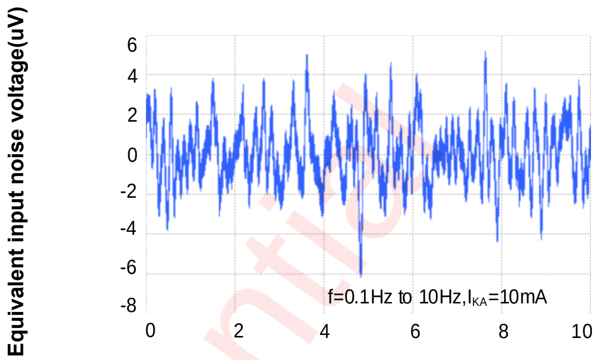


Figure 12 Equivalent input noise voltage over a 10s period

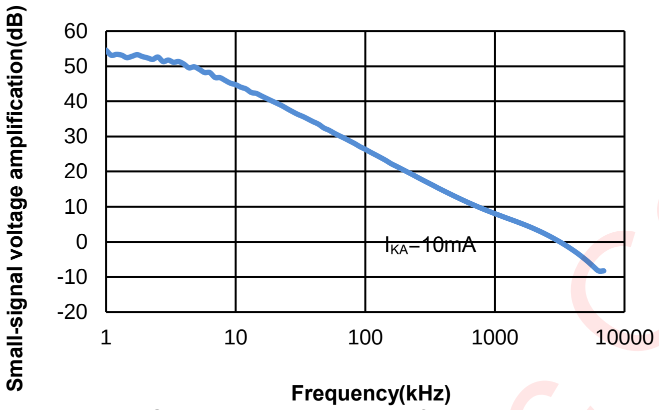


Figure 13 Small-signal voltage amplification vs. Frequency

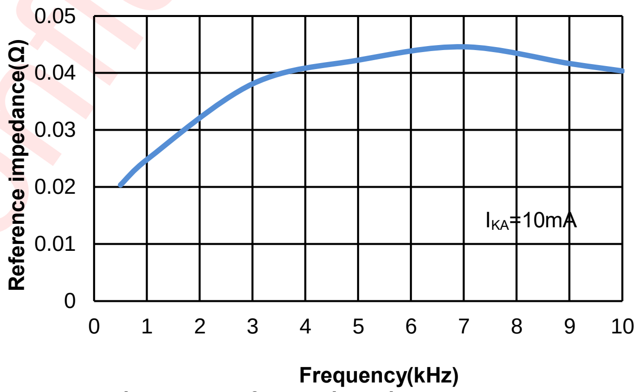


Figure 14 Reference impedance vs. Frequency

Detailed Functional Description

Test circuit

Typical Characteristics Measurement Information

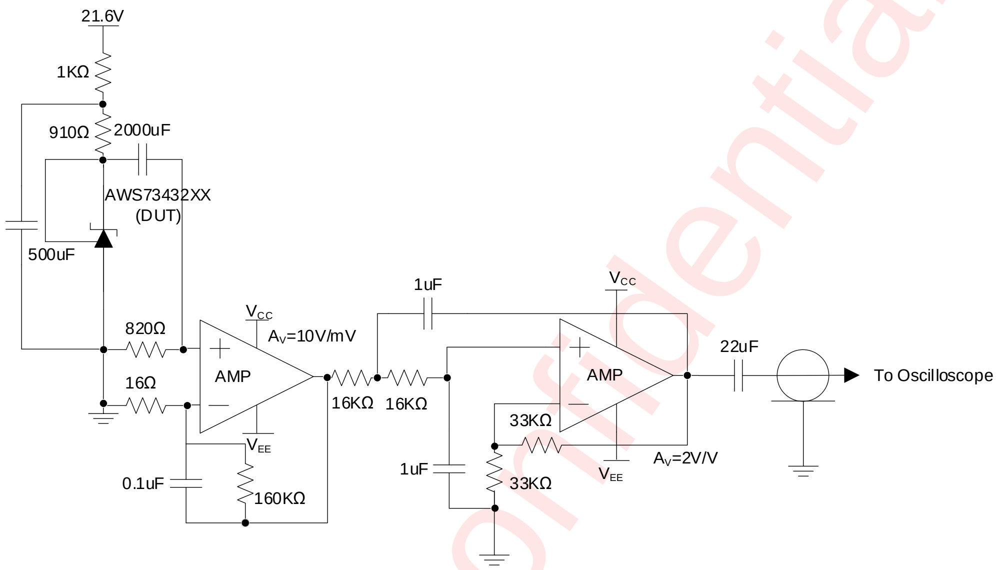


Figure 15 Test circuit for equivalent input noise voltage over a 10s period

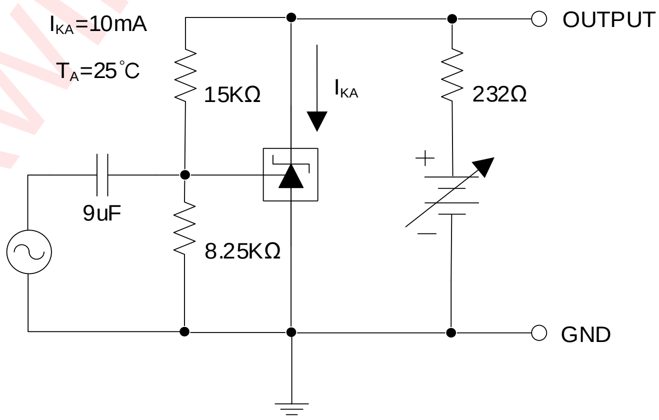


Figure 16 Test circuit for voltage amplification

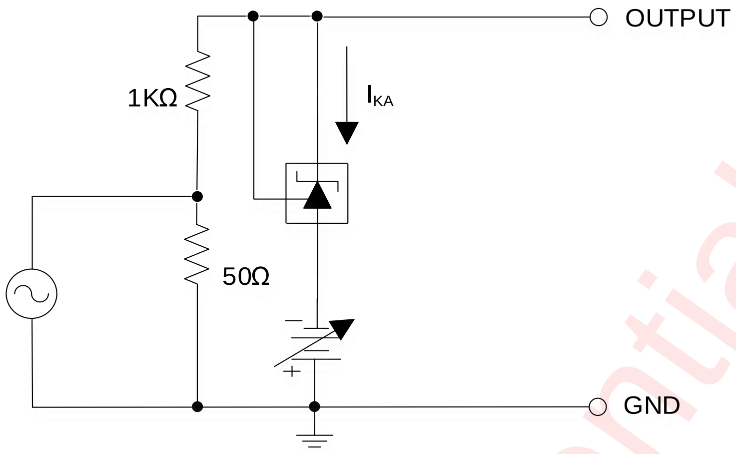


Figure 17 Test circuit for reference impedance

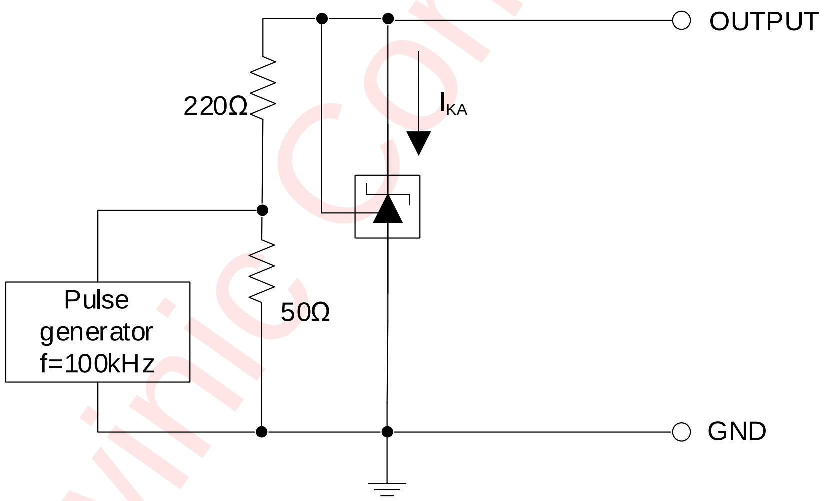


Figure 18 Test circuit for pulse response

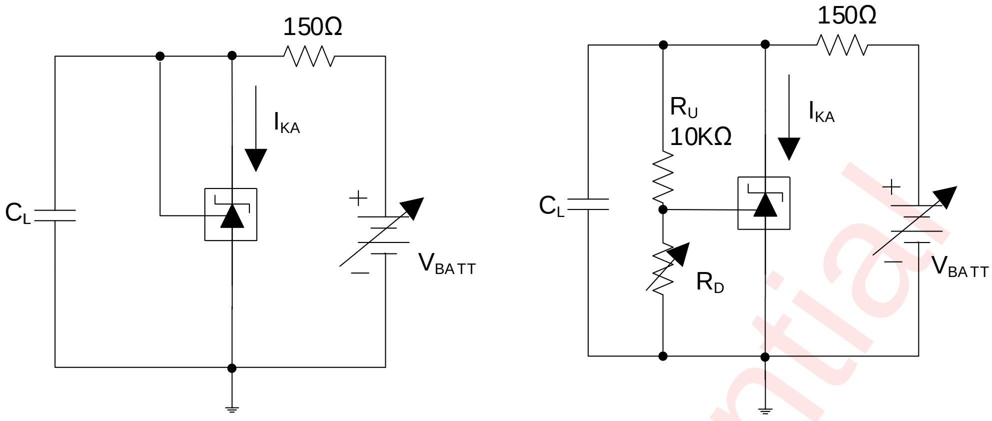
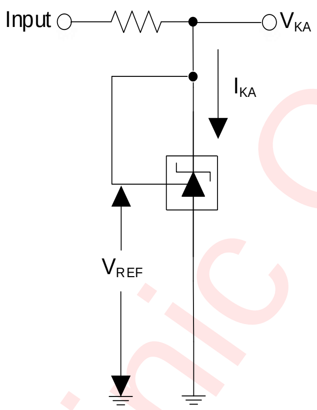


Figure 19 Test circuit for stability boundary conditions



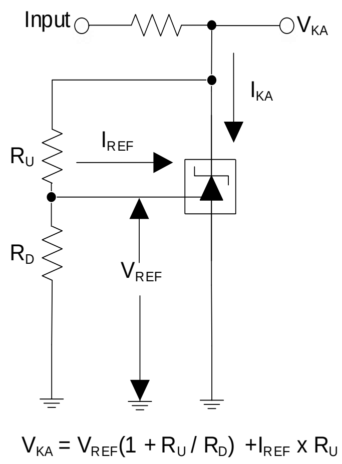


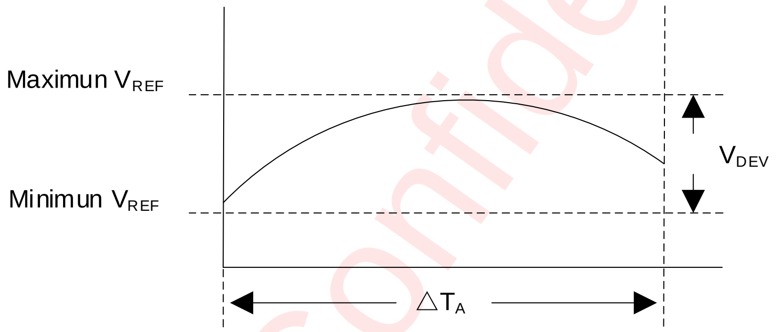
Figure 20 Test circuit for V_{KA}=V_{REF}

Figure 21 Test circuit for V_{KA}>V_{REF}

Temperature coefficient

The deviation parameters V_{DEV} and I_{DEV} are defined as the differences between the maximum and minimum values obtained over the rated temperature range. The average full-range temperature coefficient of the reference input voltage αV_{REF} is defined as:

$$|\alpha V_{REF}|\left(\frac{ppm}{℃}\right)=\frac{\left(\frac{V_{DEV}}{V_{REF\ at\ 25℃}}\right)\times 10^6}{\Delta T_A}$$



where,

ΔT_A is the rated operating temperature range of the device.

αV_{REF} is positive or negative, depending on whether minimum V_{REF} or maximum V_{REF}, respectively, occurs at the lower temperature.

Dynamic impedance

The dynamic impedance is defined as:

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

When the device is operating with two external resistors, the total dynamic impedance of the circuit is given by:

$$|z'|=\frac{\Delta V}{\Delta I}$$

which is approximately equal to

$$|Z_{KA}|\left(1+\frac{R_U}{R_D}\right)$$

Application Information

Shunt Regulator/Reference

The Figure 21 is shunt regulator schematic, design requirements for this design example, use the parameters listed in Table 1 as the input parameters.

Table 1. Design parameters

Design parameter	Example value
Supply voltage(NOTE1)	40V
Cathode current (I_{KA})	5mA
Output voltage(V_{OUT})	V_{REF} to 36V
Load capacitance	100nF
Feedback resistor values and accuracy R_U and R_D	10kΩ (0.1%)

Note1：All voltage values are with respect to ANODE, unless otherwise noted.

Detailed design procedure

When using the AWS73432XX as a shunt regulator, determine the following:

- Input voltage range
- Temperature range
- Total accuracy
- Cathode current
- Reference initial accuracy
- Output capacitance

Programming Output/Cathode Voltage

In order to program the cathode voltage to a regulated voltage a resistive divider must be shunted between the CATHODE and ANODE pins with the mid-point tied to the REF pin. This can be seen in Figure 21, with R_U and R_D being the resistive divider. The cathode/output voltage in the shunt regulator configuration can be approximated by the equation shown in Figure 21. The cathode voltage can be more accurately determined by taking into account the reference input current:

$$V_{OUT}=V_{REF}\left(1+\frac{R_U}{R_D}\right)+I_{REF}\times R_U$$

In order for this equation to be valid, the AWS73432XX must be fully biased so that it has enough open-loop gain to mitigate any gain error. This can be done by meeting the I_{MIN} specification denoted in electrical characteristics.

Total Accuracy

When programming the output above unity gain (V_{KA} = V_{REF}), the AWS73432XX is susceptible to other errors that may affect the overall accuracy beyond V_{REF}. These errors include:

- R_U and R_D accuracies
- $V_{I(DEV)}$: change in reference voltage over temperature
- $\Delta V_{REF}/\Delta V_{KA}$: change in reference voltage to the change in cathode voltage
- $|Z_{KA}|$: dynamic impedance, causing a change in cathode voltage with cathode current

Worst case cathode voltage can be determined by taking all of the variables into account.

Power Supply Recommendations

When using the AWS73432XX as a linear regulator to supply a load, designers will typically use a bypass capacitor on the CATHODE pin. When doing this, the AWS73432XX remains stable.

In order to not exceed the maximum cathode current, be sure that the supply voltage is current limited. Also, be sure to limit the current being driven into the REF pin, as not to exceed its absolute maximum rating.

For applications shunting high currents, pay attention to the cathode and anode trace lengths, adjusting the width of the traces to have the proper current density.

PCB Layout Consideration

Bypass capacitors should be placed as close to the part as possible. Current-carrying traces need to have widths appropriate for the amount of current they are carrying; in the case of the AWS73432XX, these currents will be low. AWS73432XX PCB layout should be considered. Here is an example of PCB Layout:

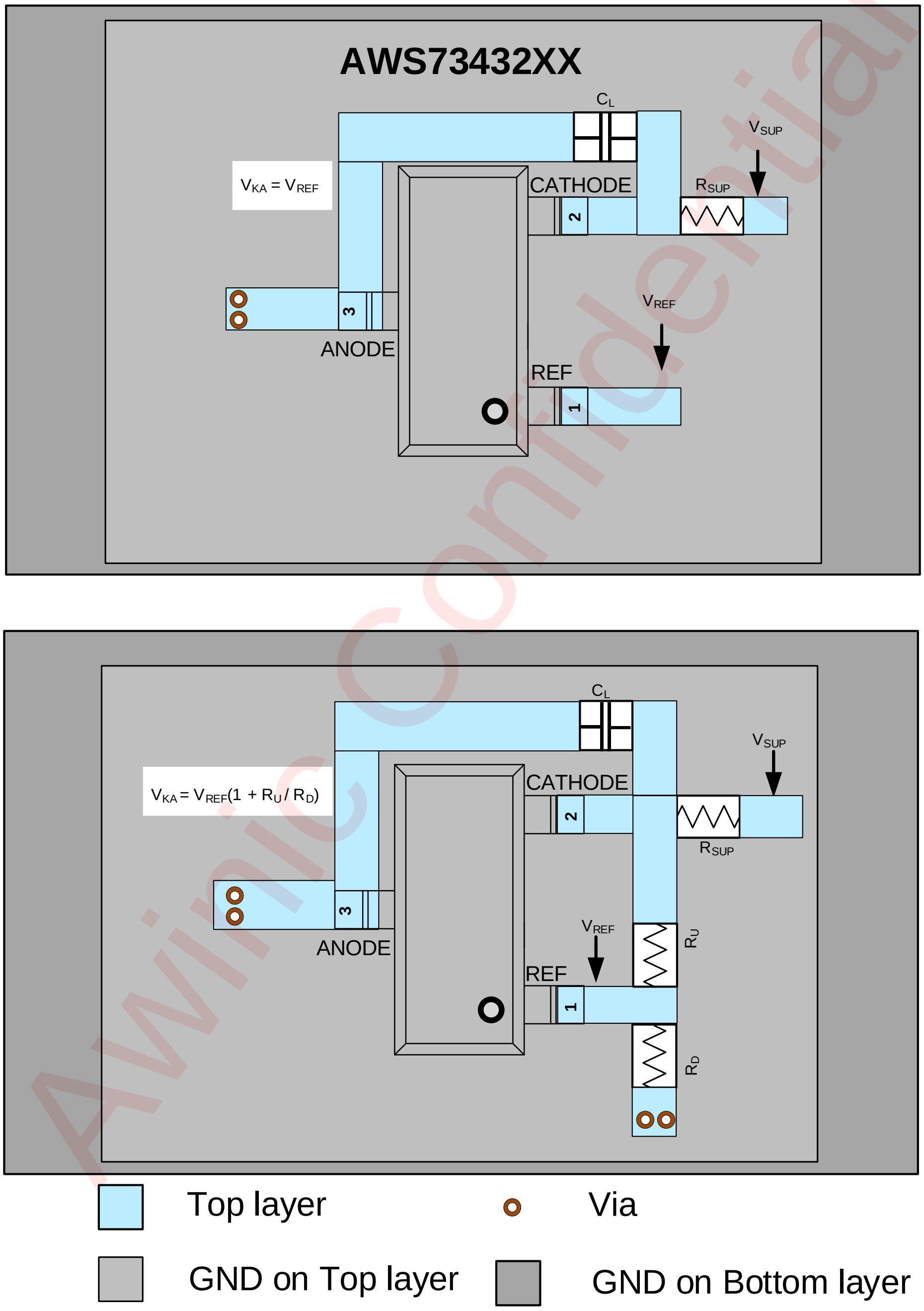
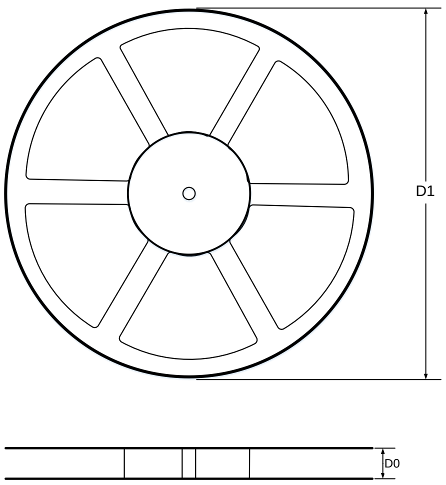


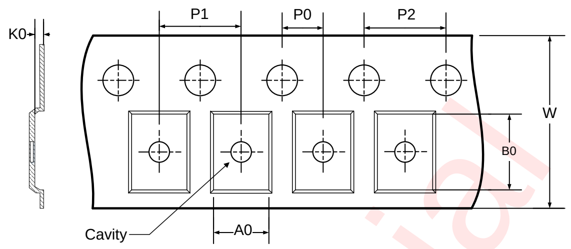
Figure 22 External Components Placements and PCB Layout Example

Tape And Reel Information

REEL DIMENSIONS

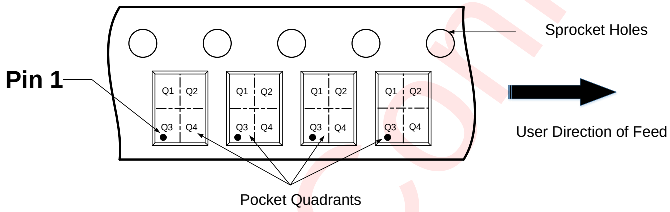


TAPE DIMENSIONS



A0：Dimension designed to accommodate the component width
B0：Dimension designed to accommodate the component length
K0：Dimension designed to accommodate the component thickness
W：Overall width of the carrier tape
P0：Pitch between successive cavity centers and sprocket hole
P1：Pitch between successive cavity centers
P2：Pitch between sprocket hole
D1：Reel Diameter
D0：Reel Width

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



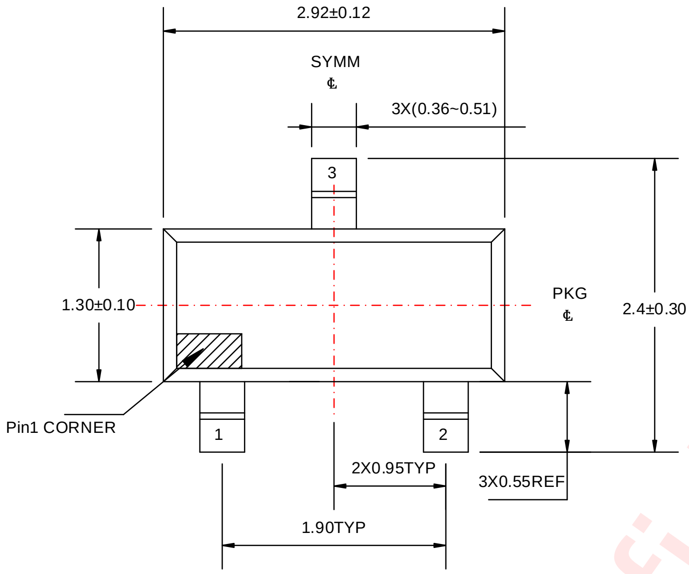
Note：The above picture is for reference only. Please refer to the value in the table below for the actual size

DIMENSIONS AND PIN1 ORIENTATION

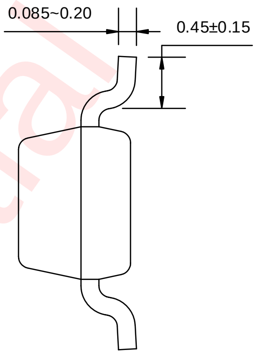
D1 (mm)	D0 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
178	8.4	3.15	2.77	1.22	2	4	4	8	Q3

All dimensions are nominal

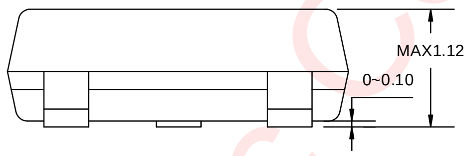
Package Description



TOP VIEW



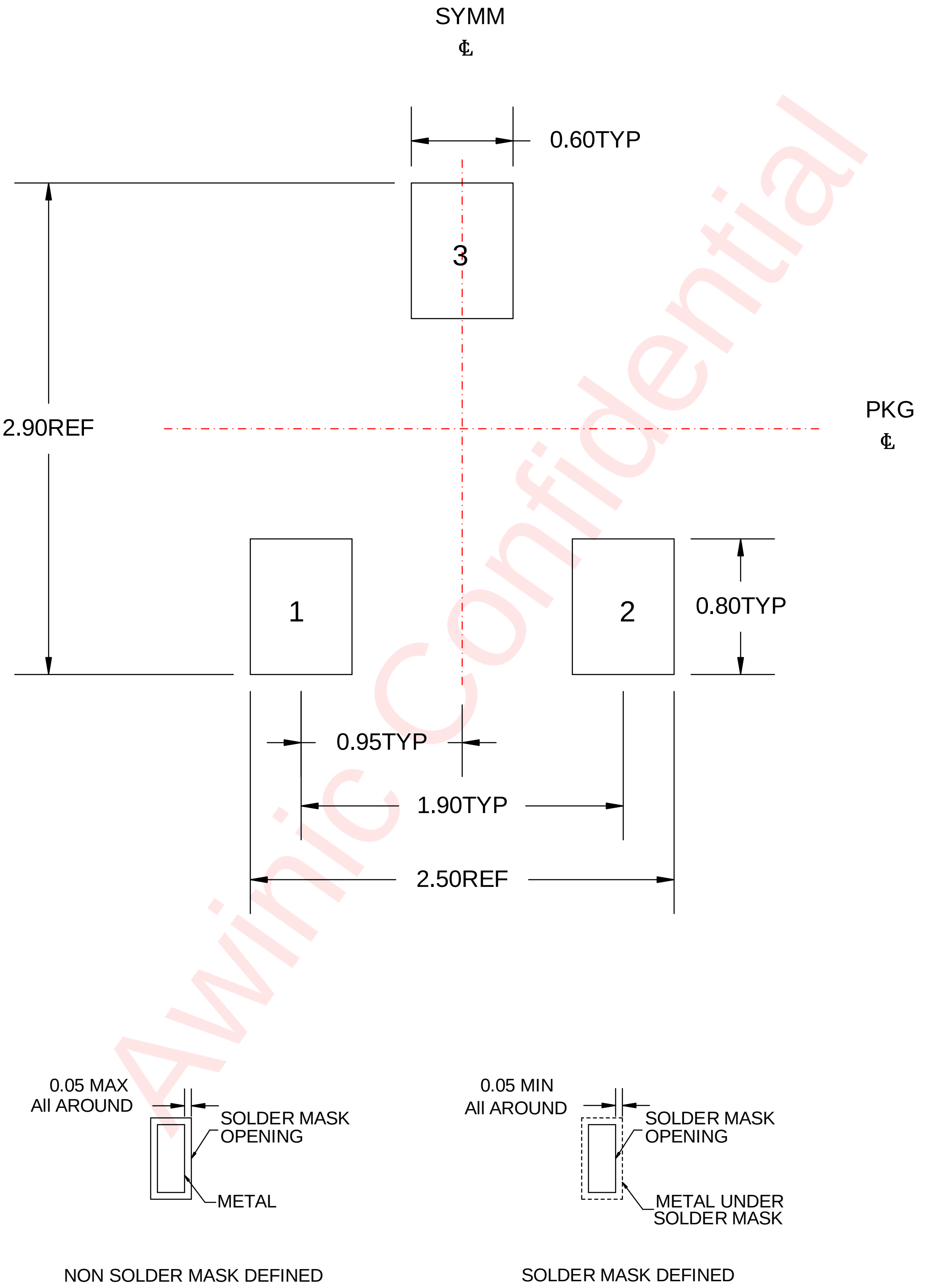
SIDE VIEW



BOTTOM VIEW

Unit: mm

Land Pattern Data



Unit： mm

Revision History

Version	Date	Change Record
V1.0	Nov. 2025	Datasheet V1.0 released

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