

Input Over/Under Voltage Clamping for UT16MX1** Analog Multiplexers

Table 1. Cross Reference of Applicable Products

Product Name	Manufacturer Part Number	SMD #	SMD Device Type	Internal PIC** Number:
16:1 Analog Mux	UT16MX110	5962-10233	03, 04*	YA25B
16:1 Analog Mux	UT16MX111	5962-10233	05, 06*	YA26B
16:1 Analog Mux	UT16MX112	5962-10233	01, 02*	YA27B
16:1 Analog Mux	UT16MX113	5962-10236	03, 04*	YA28B
16:1 Analog Mux	UT16MX114	5962-10236	05, 06*	YA29B
16:1 Analog Mux	UT16MX115	5962-10236	01, 02*	YA30B
16:1 Analog Mux	UT16MX116	5962-10237	03, 04*	YA31B
16:1 Analog Mux	UT16MX117	5962-10237	01, 02*	YA32B

* Even Device Types are processed to Q+ flow.

**PIC = Production Identification Code

1 Introduction

This application note describe input over/under voltage protection circuits for use with the UT16MX1** devices. As an analog multiplexer, the analog input signals may inadvertently surge to levels not supported by the multiplexer. To protect the device from any damage, input protection circuits can be used.

2 Clamping Input Voltage

There are several ways to clamp/clip the input voltage for sensitive circuits. Although there are more elaborate methods, this application note discusses diode based implementations. The following diode based clamps will be discussed:

- General diode with voltage reference
- Zener diode

2.1 General Diode with voltage reference

In the configuration shown in Figure 1, the left diode will not forward bias until the voltage reaches junction potential plus V1 volts. The right diode will not forward bias until the input reaches a junction potential plus V2 in the negative direction.

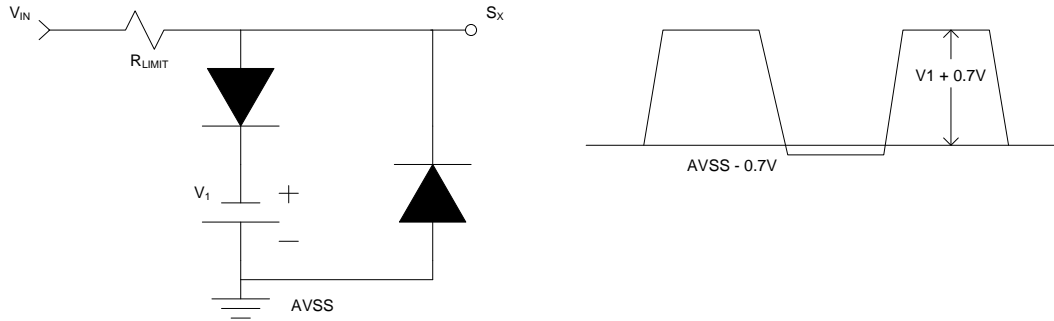


Figure 1. Basic junction diode overvoltage protection scheme.

The overvoltage current is limited by R_{LIMIT} as per the following equation:

$$I_{LIMIT} = \frac{|V_{IN}| - |V_1| - V_{FBD}}{R_{LIMIT}}$$

where V_{FBD} is the forward biased voltage drop of the diode.

An industry rule-of-thumb is to select R_{LIMIT} so that no more than 5mA will flow through the IC input.

As an option, the V_1 and V_2 voltage references could be implemented with Zener diodes.

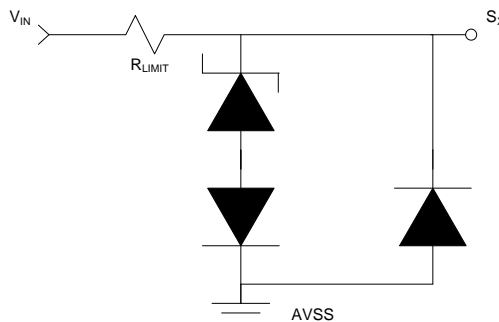


Figure 2. Diode based protection using Zener diode references.

2.2 Zener Diode Based Clamp

In the zener diode based configuration shown in Figure 3, the zener can limit one side to the zener voltage (V_z) while clamping the other side to near zero.

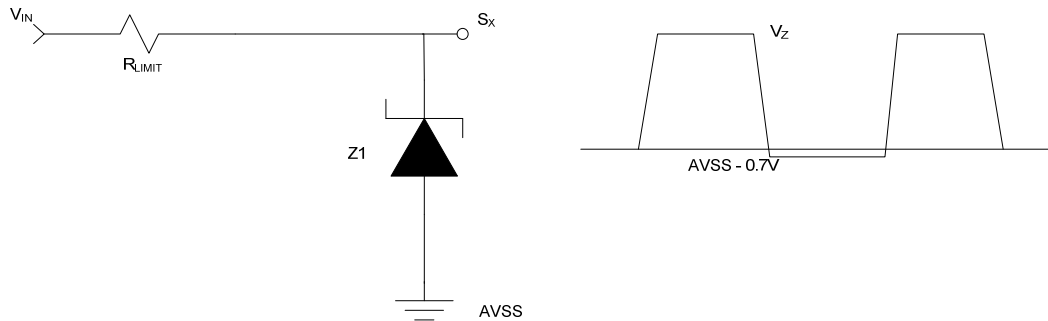


Figure 3. Zener diode based unidirectional overvoltage protection.

3 Summary

The above circuits show possible configurations for clamping the input voltage to a positive voltage not greater than the rail, and negative voltage no greater than a diode drop below $AVSS$.

Note: R_{on} for the channel will be effected for all the above schemes recommended. The $R_{on}(\text{Total})$ equals $R_{on}(\text{ASIC})$ plus the R_{LIMIT} . If a large R_{on} value cannot be tolerated, than an active clamp could possibly be used for the positive voltage direction.