Basics of Analog Multiplexers – 4

Exercises

TI Precision Labs – Op Amps

1. A multiplexer MUX36S08 has the following test conditions.

VDD = 18V, VSS connected to GND = 0V, Vin (max) = 25V

Calculate the value of the series protection resistor.

(Internal ESD diode current should be limited to 4mA. Internal ESD diode forward voltage drop is 0.7V.)

2. The multiplexer used in particular application has a use-case where an over-voltage event occurs on ab OFF channel as shown below. Choose an input series protection resistor and Zener diode with the proper clamping voltage so that the break down current of the Zener diode is not more than 5mA.

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Solution

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$R_{PROTECTION}$ Calculation

$V_{DD} = +18V \quad V_{SS} = 0V$

$V_{OVER\ VOLTAGE}$ at Input Channel $= 25V$

Internal ESD diode current should not exceed 4mA.

$I_{LIMIT} = 4mA$

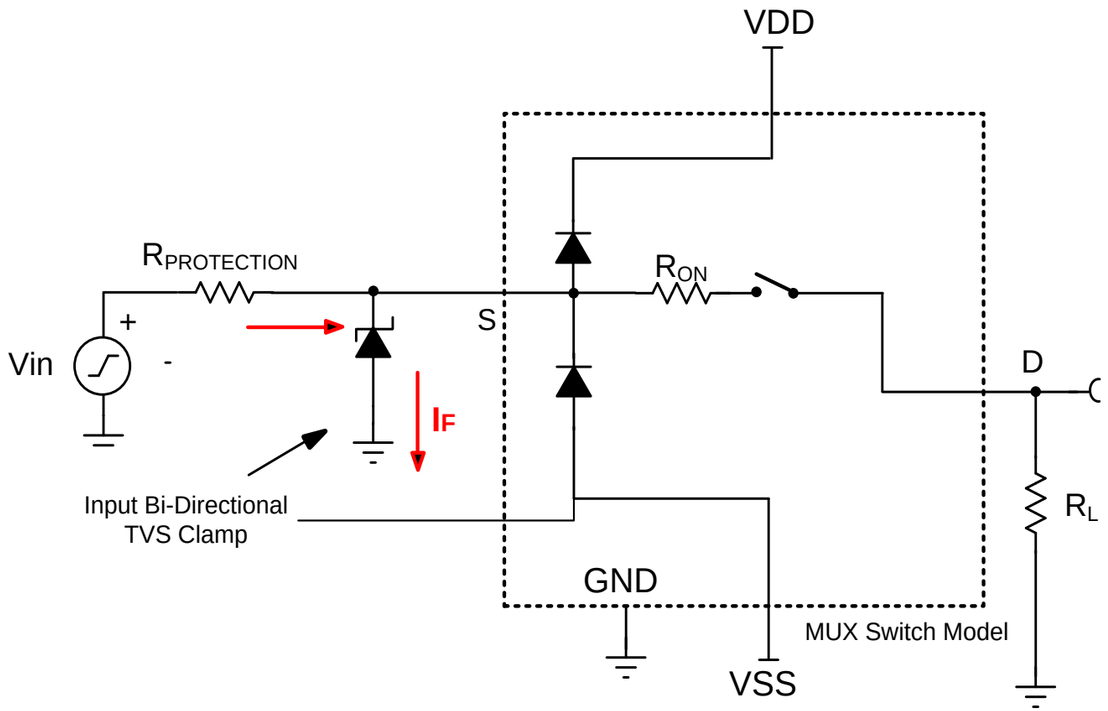
$$R_{PROTECTION} = \frac{V_{IN} - V_{DD} - V_{BE}}{I_{LIMIT}}$$

$$R_{PROTECTION} = \frac{25V - 18V - 0.7V}{4mA}$$

= 1.57 k ohm. Choose 1.6 k ohms - Standard Value

2. The multiplexer used in particular application has a use-case where an over-voltage event occurs on an OFF channel as shown below. Choose an input series protection resistor and Zener diode with the proper clamping voltage so that the break down current of the Zener diode is not more than 5mA.

The input protection on the OFF channel with a series resistor and Zener Diode clamping is shown in the below figure. We will now see how to calculate the value of RPROTECTION and the Zener Breakdown Voltage.



$R_{PROTECTION}$ Example Calculation

$V_{DD} = +13V \quad V_{SS} = 0V$

$V_{OVER\ VOLTAGE}$ at Input Channel $= 15V$

Breakdown current of Zener diode should not exceed 5mA.

$I_{LIMIT} = 5mA$

$$R_{PROTECTION} = \frac{V_{IN} - V_{DD} - V_{BE}}{I_{LIMIT}}$$

$$R_{PROTECTION} = \frac{15V - 13V - 0.2V}{5mA}$$

= 360 Ohm.

Choose 365 Ohms - Standard Value