Selecting an ESD Diode

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Definition

• From Infineon training materials



I/O Operating Range

- What is the peak operating voltage of your I/O or power?
 - What is the current at that voltage?
- Uni vs bi directional required? Protect both directions.





	able 3	DC Characteristics	at T_A ?	= 25 °C, unless	otherwise specified
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Parameter	Symbol	Values			Unit	Note /	
		Min.	Тур.	Max.		Test Condition	
Reverse working voltage ¹⁾	V _{RWM}	-	-	3.3	v	VO to GND	
Reverse current ¹⁾	I _R	-	1	50	nA	I/O to GND, V _R = 3.3 V	
Breakdown voltage ¹⁾	V _{BR}	-	6.2	-	v	I/O to GND,	
Reverse trigger voltage ²⁾	V _H	-	6.2	-	v	I/O to GND,	
Reverse holding voltage ²⁾	V _h	3.35	4	4.4	v	I/O to <i>GND</i> , I _R = 10 mA	

Voltage forced
Current forced

From OnSemi App Notes

Signal Integrity

- How fast is your signal?
 - What junction (line-gnd) capacitance can your application tolerate?
 - Measure C(V,f)
 - Watch for line-line capacitance in arrays
 - Insertion Loss
 - Impedance Matching
 - Package selection. Be cognizant of route out
 - Individual
 - Multi-layer
 - Route through

Clamping Voltage

- No such thing as a single clamping voltage.
 - The line along the breakdown region which has a current corresponding to every voltage
- Using different surge currents you can plot the dynamic performance of a diode. This is called the dynamic resistance, or Rdyn.
 - An Rdyn plot can also reveals soft failures.

Clamping Voltage, Part 2

- Goal is to select a diode with an Rdyn that is sufficiently low
 - All ESD structures have an Rdyn.
 - During an ESD event all devices will be conducting and will act like resistors in parallel.
 - The goal is to pick a diode with low enough Rdyn that it conducts most of the current.
 - You will probably not block ALL of an ESD event flowing through the ESD structure in your ASIC.

Diode Destruction

- This is not the way to select a diode
- Destruction ratings from an Infineon ESD diode

Parameter	Symbol		Unit		
		Min.	Тур.	Max.	
ESD contact discharge ¹⁾	V _{ESD}	-20	-	20	kV
Peak pulse current $(t_p = 8/20 \ \mu s)^{2}$	I _{PP}	-3	-	3	Α
Operating temperature	T _{OP}	-40	-	125	°C
Storage temperature	T _{stg}	-65	-	150	°C

Table 2Maximum Rating at $T_A = 25$ °C, unless otherwise specified

1) V_{ESD} according to IEC61000-4-2

2) I_{PP} according to IEC61000-4-5

Selecting Your Diode

• Diode(IO,Rdyn,SI,limit)