Things which damage IC:

- Thermal expansion,
- Mechanical stress to the device,
- Short circuits,
- excess current or voltage,
- EMI (electromagnetic interfere),
- ESD (Electrostatic Discharge),
- Electrical Overstress.

- Damage by ESD:

- Damage by EOS:

Source of ESD:

- Electrostatic electricity is an imbalance of positive and negative charges on the surface of objects.
- Walking along a carpeted flour generate…
- Interaction between two different body. *No friction was required for electrons to move, It is simply increase contact between two object*
- Higher in the list is most positive object.

TRIBOELECTRIC SERIES

your hand
glass
your hair
nylon
wool
fur
silk
paper
cotton
hard rubber
polyester
polyvinylchloride plastic

How it happened?

- AS we know Human body model is huge source of static energy.
- **HBM** store more than 1000-4000V,
- Then if HBM contact with component/device…
- Electrostatic discharge event accrues,
- That IC may be fail… OR give unexpected output.

➢ Failure further divide into two parts:

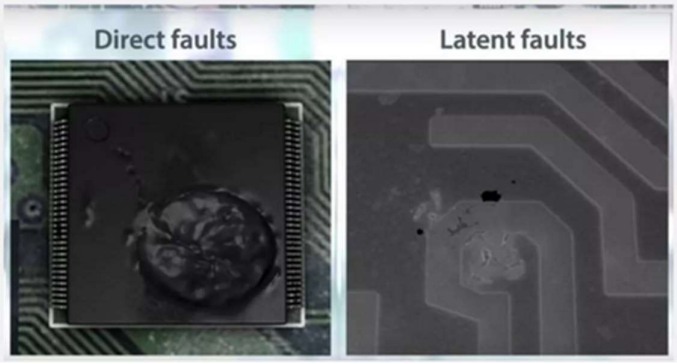
(i) Direct failure,

(ii) Latent failure.

Types of Failure:

➢ **Direct failure**: In this through over stress the whole IC is damaged. and damage will be visible to eye. Cost of it is low compare to latent failure.

➢ **Latent failure**: In this the IC would appears normal but after some time the IC do not work properly. This damage is not often visible to eye.

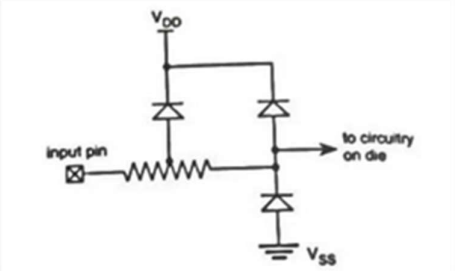


ESD Protection steps:

ESD protection problem is to use clamping diodes implemented using MOS transistors with gates tied up to either GND for nMOS transistors, or to VDD for pMOS transistors

For normal range of input voltages these transistors are in the OFF state.

If the input voltage builds up above (or below) a certain level, one of the transistors starts to conduct clamping the input voltage at the same level.

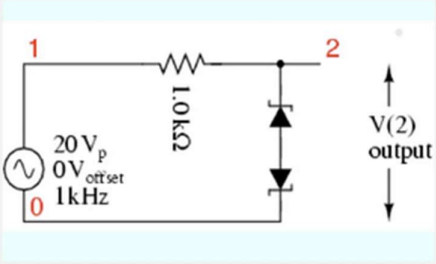


- ESD protection network example

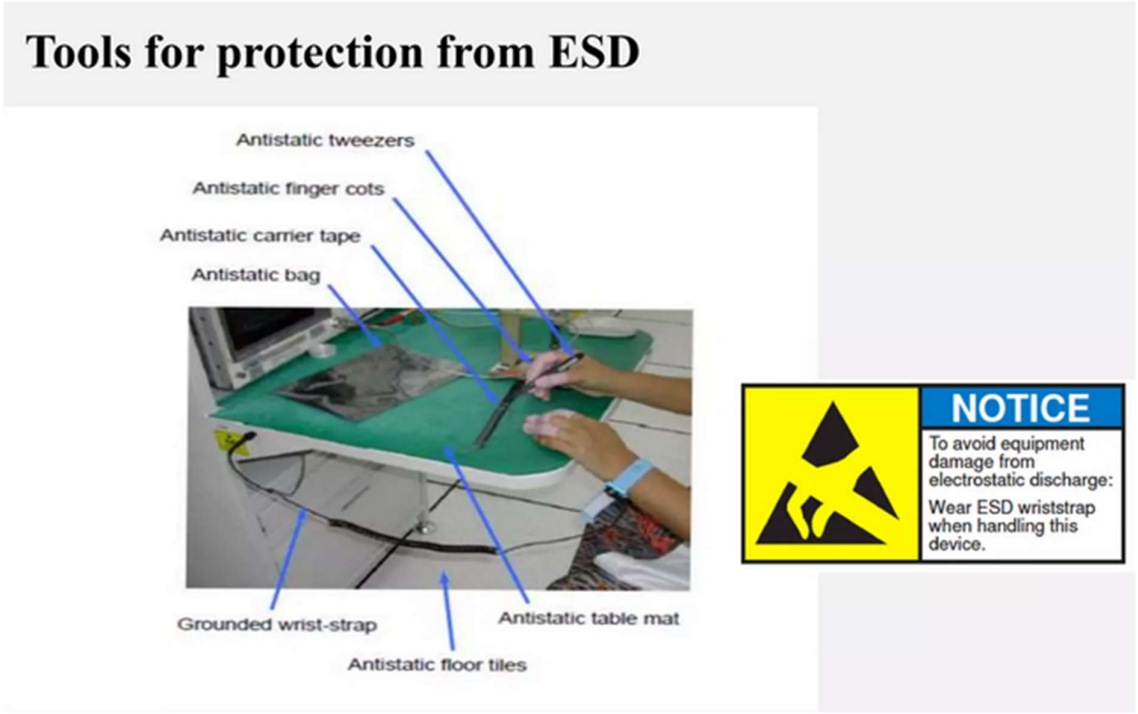
CONTINUE…

- There are many devices which protect main circuit that is called **Electrostatic Discharge Sensitive (ESDS) devices.** *Like:*

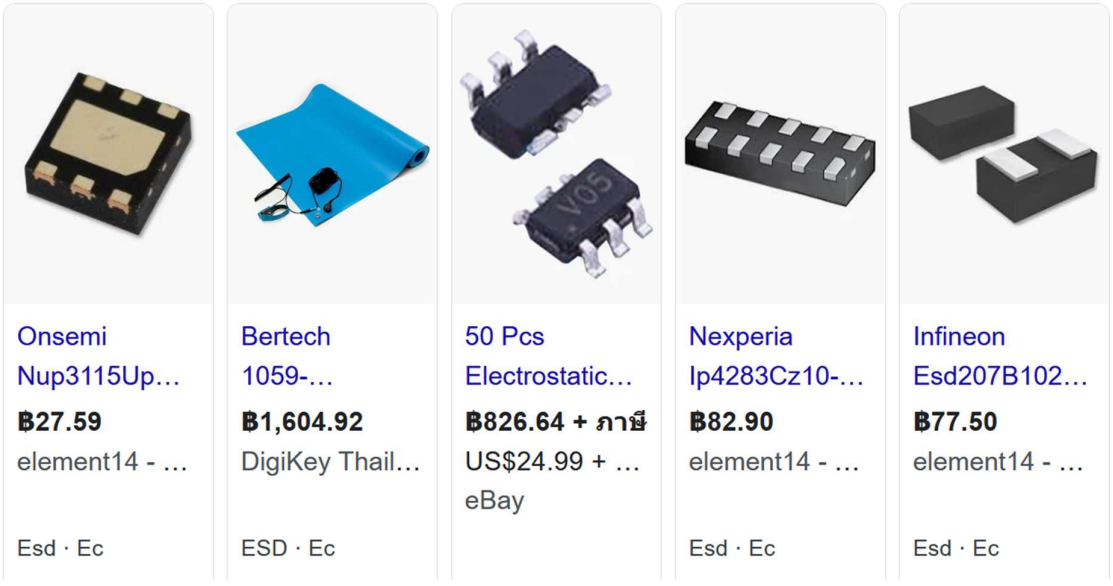
- High Electron Mobility Transistors (HEMTs)
- Laser diodes.
- Back-to-back zeners.



- Ionizers
- Bench top ionizer



IC



Onsemi Nup3115Up…
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Esd · Ec

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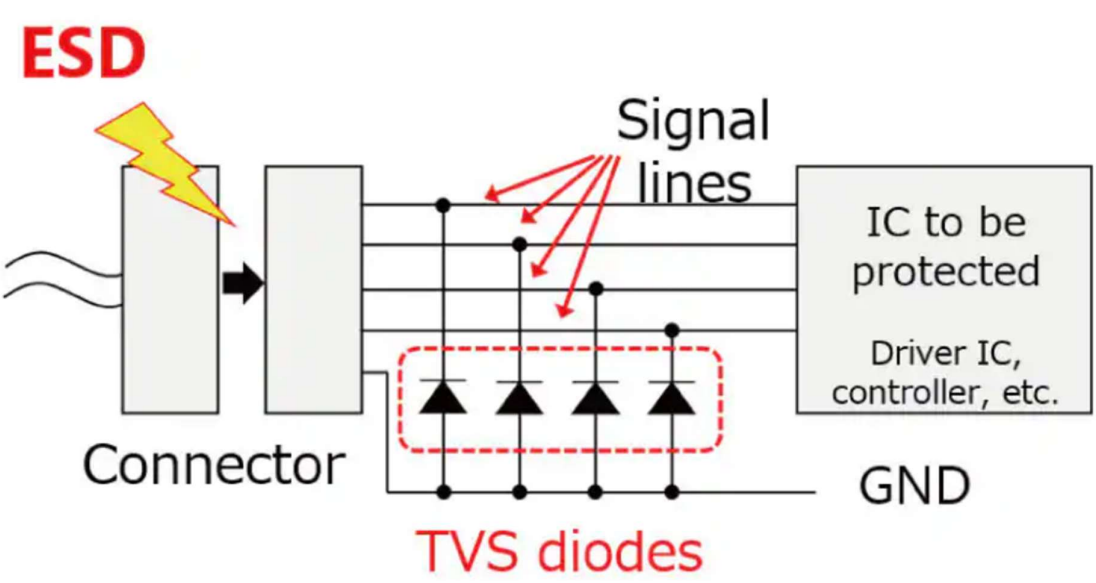
ESD
Signal lines
IC to be protected
Driver IC, controller, etc.
Connector
GND
TVS diodes