

Industry Council on ESD Target Levels



Understanding ESD Control Programs for ICs with various HBM and CDM Sensitivities

A Consolidated Message from the Industry Council

Purpose

- A Basic ESD Control Program is mandatory across the semiconductor industry for handling IC components; Advanced ESD Control is gradually becoming important for the industry
- There has been some confusion about the extent of these programs as the new ESD levels are established for IC qualification
- The purpose is to clarify the issues of “Basic” versus “Advanced” ESD control
- Describe the HBM and CDM levels at which these specific programs apply

Basic ESD Control Program

- Avoid personnel charging and discharging into the device by **grounding personnel**
- Avoid discharges between different items by having them at the same potential, e.g. by using **ESD safe work surfaces**
- Use **ESD safe packaging** when removing devices from the ESD safe workplace
- *Electronics manufacturers use at least this level across the globe while most do more than this basic level.*

Basic ESD Control Program

If the bullets below are fulfilled, personnel will not charge to more than 100V.

This means it is clearly safe to handle devices with an HBM robustness $\geq 500V$

- ✓ Personnel Grounding through wrist straps or properly selected footwear/flooring system
- ✓ Grounded work surfaces
- ✓ ESD-safe Packaging

If these are not fulfilled the control program has no meaning and even 2kV HBM devices may be in jeopardy.

CDM Control

- CDM control requires additional steps of control of charging of devices by
 - ✓ Controlling insulators
 - ✓ Controlling charging of boards during processing
 - ✓ Avoiding hard (metal-to-metal) discharges
- Many basic ESD control elements like dissipative work surfaces reduce the CDM risk
- Programs following above requirements have CDM control intrinsically implemented (process analysis may be required)

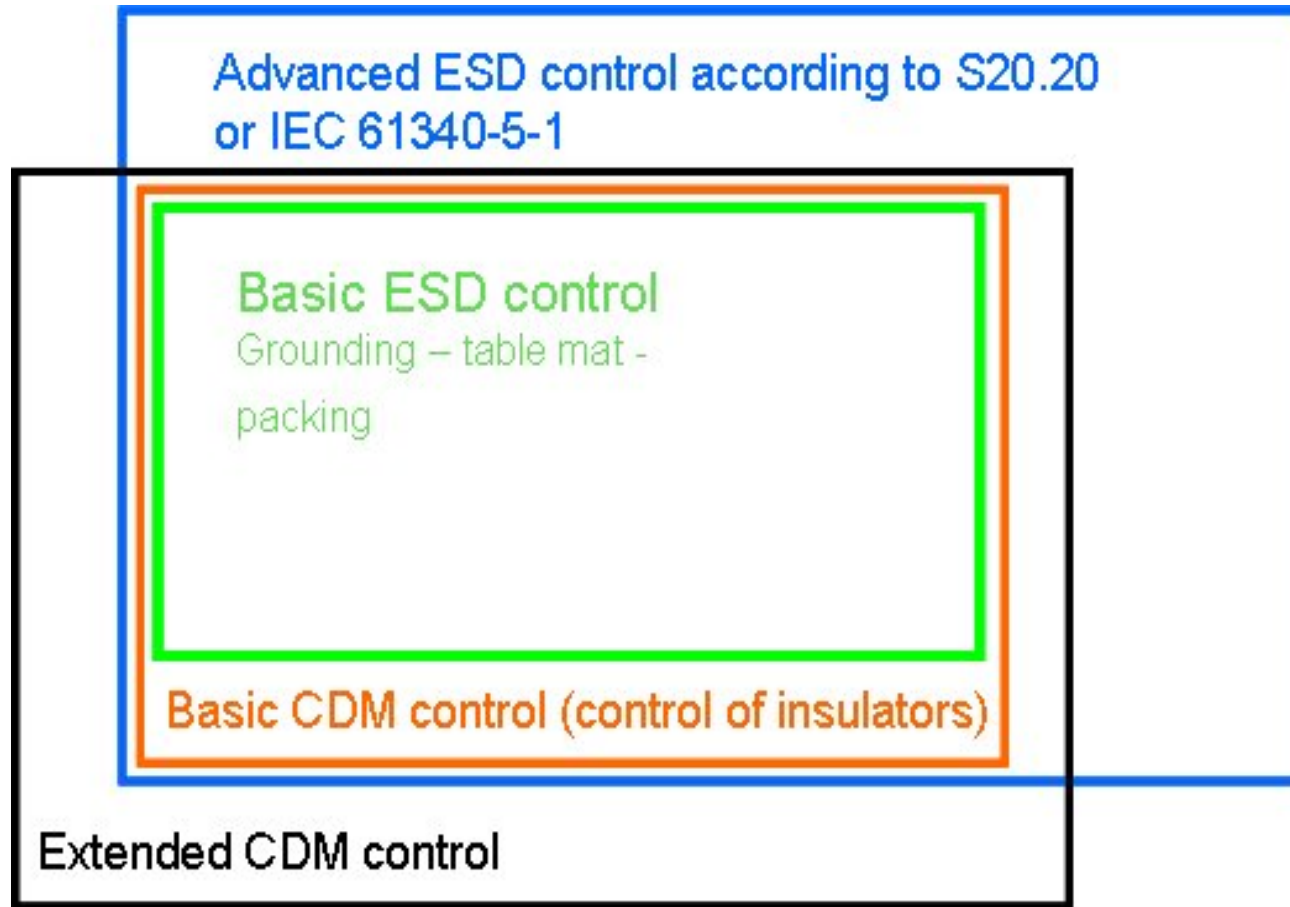
ESD Controls Summary

- 1. General ESD Control includes:
 - Basic ESD Control
 - ✓ Wrist straps
 - ✓ Grounding
 - ✓ Packing
 - CDM Control
 - ✓ Controlling insulators
 - ✓ Controlling charged boards
 - ✓ Avoiding hard discharges
- 2. Advanced ESD Control includes:
 - More detailed processes of the above

Advanced ESD Control Program

- For IC devices with $\ll 500\text{V}$ HBM or $\ll 250\text{V}$ CDM, more advanced control programs are necessary
- Advanced ESD control programs have
 - ✓ more elements to give higher safety in case one element fails
 - ✓ more elements to make ESD control more convenient
 - ✓ more frequent compliance verification
 - ✓ data to prove program works
 - ✓ more elements to cover CDM threat

Relationship between General ESD Control and CDM Specific Control



Extended CDM Control involves more detailed measurements in addition to the control of insulators

Summary (1)

- **Basic ESD Control**

- Any electronic manufacturer has to follow this
- The basic program can be
 - Following one of the known standards
 - Customized in-house program following the basic control requirements
- With any of the above basic programs, 1kV HBM devices are safe and no need to do anything different
- Variations across different production areas in the basic programs is not of concern for changing from 2kV HBM to 1kV HBM
- Vast amount of industry data for the last 10 years supports that even 500V HBM devices are safe independent of the basic program followed

Summary (2)

- **General ESD Control**
 - Includes both Basic ESD and CDM controls
 - General CDM steps are basic in nature and are always important regardless of the devices' HBM performance
 - With the General ESD Control in place, $\geq 500V$ HBM and $\geq 250V$ CDM are safe

Summary (3)

- **Advanced ESD Control**
 - **Comply with S20.20 or IEC 61340-5-1**
 - Requires regular auditing process
 - With the advent of advanced technology IC devices, majority of the industry is progressing towards these advanced steps
 - **Extended CDM controls and measurements**
 - These programs are aimed for devices with $\geq 100V$ HBM and $\geq 100V$ CDM