



## Electrostatic Discharge

By: Mel Scott, Lab Manager



Well, it's my time in the box. I have been able to escape having to write an article for our newsletter now for well over 6 years. They finally caught up with me. I must say I enjoy reading articles a lot more than I do writing them, however, I do enjoy talking to our customers & look forward to hearing from each of you. Hence, my low profile when it comes time for publication of our next newsletter. Apparently, I need to find new hiding places. Now lets move on to the subject at hand.

Problems caused by electrostatic discharge (ESD) have been with us for a long time. The problems caused by ESD can be very expensive in terms of money and ones reputation. Money spent on correcting failures caused by ESD increases exponentially as one progresses from single, bare component failures to product field returns. Reputation can be impacted when a customer gets a product and it fails the instant it is powered up or after operating for just a short while when it is supposed to last for years. You see, ESD is capable of causing instant failure or latent failure, depending on several factors. If you are going to have a problem with ESD, its best to have the instant failure that can be detected during test. Latent defects can pass test and make it all the way through to the field and your customer.

Protection from ESD has become so important that an entire industry has grown up around the phenomena. This leads me to the reason for this article: ESD specifications. ANSI/ESD S20.20, *Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)* was published by the ESD Association in 1999. This document covers the development of a complete ESD control program.

The primary areas of any ESD program must include ESD Training and Instruction along with ESD Protective Products (wrist straps, heel straps, floors, ESD bags, etc). The ESD program must also consist of the monitoring of all of the above items. To be included in the program are:

1. All conductors in the environment, including personnel, shall be electrically connected and attached to a known ground or contrived ground. This attachment creates an equipotential balance between all items and personnel.
2. Necessary non-conductors in the environment cannot lose their electrostatic charge by attachment to ground. Ionization systems provide neutralization of charges on these necessary non-conductive items (plastic housings, packaging materials and some device packages are examples of necessary non-conductors). Assessment of the ESD hazard created by electrostatic charges on the necessary non-conductors in the work place is required to ensure that appropriate actions are implemented when necessary, commensurate with risk to electrostatic discharge sensitive (ESDS) items.
3. Transportation of ESDS items into or outside an ESD Protected Area (hereafter referred to as "EPA") requires enclosure in static protective materials, although the type of material depends on the situation and destination. Inside an EPA, low charging and static dissipative materials may provide adequate protection. Outside an EPA, low charging and static discharge shielding materials are recommended.

Any relative motion and physical separation of materials or flow of solids, liquids or particle-laden gases can generate electrostatic charges. Common sources of ESD include personnel, items made from common polymeric materials, and processing equipment. ESD damage can occur when:



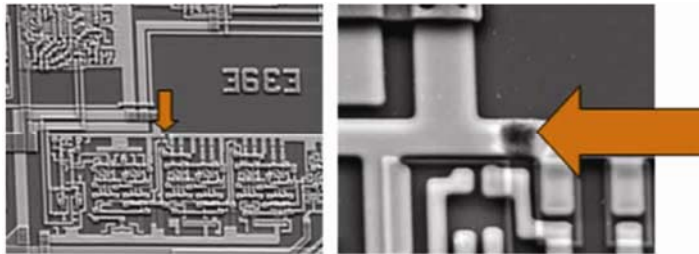
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- a. A charged object comes into contact with an ESD sensitive (ESDS) device, or
- b. An ESDS device is grounded while exposed to an electrostatic field.

ESD S20.20 requires that the Organization shall prepare an ESD Control Program Plan that includes:

- Training
- Compliance Verification (Auditing)
- Grounding/Equipotential Bonding Systems
- Personnel Grounding
- EPA Requirements



Source: Rohm Electronics

Several samples of this IC were rejected as low input resistance (leaky) at a particular input pin. Sectioning the device revealed the partial short circuit through the silicon from the top. The top of the short circuit is shown by the small well on the track.

Many of the ESD control programs that are out there have been developed to the requirements of ANSI/ESD S20.20-1999. However, in March of this year the ESD Association released a revised version of this standard, ANSI/ESD S20.20-2007. This standard also covers the requirements needed to design, establish, implement and maintain an ESD control program to protect electrical or electronic parts, assemblies and equipment susceptible to ESD damage from Human Body Model (HBM) discharges greater than or equal to 100 volts.

As stated in *THRESHOLD™*, Volume 23, No.3, May/June 2007, the ESD Association newsletter, the primary differences between the versions are:

- 1) “The recommended limits in the 1999 version now become required limits.
- 2) The guidance sections have been removed for the ANSI/ESD S20.20 standard. Further information on process design, controls and materials can be found in TR20.20 (ESD Handbook).
- 3) Compliance Verification procedures are now specified and can be found in TR53 (Compliance Verification of ESD Protective Equipment and Materials), which is available from the ESD Association.”

Both the 1999 version and the 2007 revision are available for download from [www.esda.org/s2020.html](http://www.esda.org/s2020.html).



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For the rest of this year companies will be certified to ANSI/ESD S20.20-1999. In 2008, companies will have an option to become certified to either ANSI/ESD S20.20-1999 or ANSI/ESD S20.20-2007. Beginning in 2009, certification will only be granted for the ANSI/ESD S20.20-2007 version.

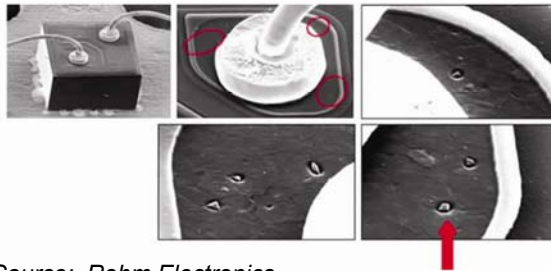
The ESD Association will allow downloading of the 1999 version of the standard until December 2008.

There is a lot of good information on ESD to be had at the ESD Association's web site. There are also regional chapters of this association, for example the Midwest chapter.

If you are interested in ESD and would like to make a difference, check out the ESD Association. They offer memberships and an opportunity to volunteer in standards development groups. They also offer grants to academia for ESD Research.

Having said all that, let me tell you some of the things we can do to help you with your ESD program. We can develop your ESD Control Program Plan; we can develop your training program or provide training of your personnel in ESD protection/prevention according to your ESD Control Program Plan. Also as an independent third party we can perform an audit (verification) of your plant or manufacturing area to determine compliance with your Plan. If there are short comings, we will make recommendations that will help satisfy your requirements.

We have provided the above services for others in the industry and would be pleased to provide them to you. Give us a call and let's talk.



Source: Rohm Electronics

The transistor was also confirmed failed by ESD. The discharge found the weakest point(s) and punched through an oxide passivation layer to underlying silicon. Bipolar devices are becoming very small and susceptible.

Well, that's about it for now. Hopefully we'll communicate again before another 6+ years passes by, if they can find me. Thanks for reading.

If you have any question regarding this article please feel free to contact me at [mescott@stielectronicsinc.com](mailto:mescott@stielectronicsinc.com) or 256-694-5759.