

2016 EOS/ESD Symposium

Die Attached and Wire Bonder ESD Risk Assessment

Technical Presentation #1

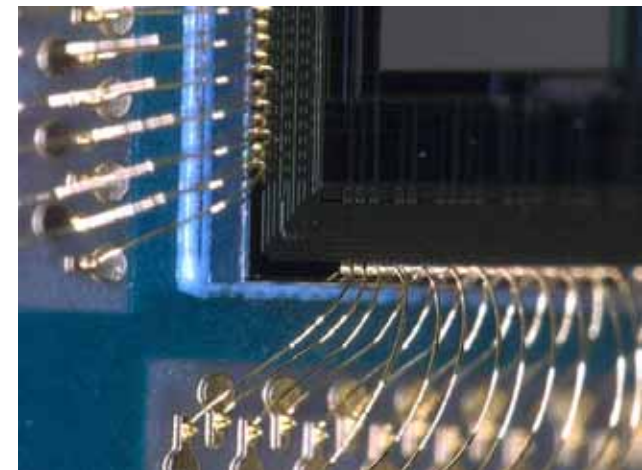
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Outline

1. Introduction
2. Methodology
3. Results
4. Discussion
5. Conclusion
6. References



1. Introduction

- Automated Handling Equipment (AHE)
 - Compliance verification
 - ANSI/ESD S20.20
 - ANSI/ESD S6.1
 - ESD Occurrences↓
- AHE Audits
 - ANSI/ESD SP10.1
- Not enough
 - Need additional assessments



2. Methodology

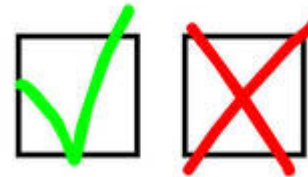
- Resistance Measurement in Die Attach Machine

- Measure Resistance/Volt



- Compare against

- ANSI/ESD S20.20
- ANSI/ESD S6.1
- ANSI/ESD SP10.1

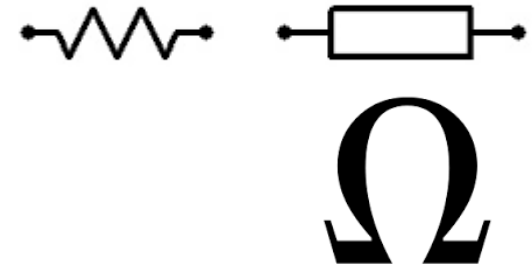


- Investigate further whenever possible

2. Methodology

- Resistance Measurement in Die Attach Machine

- Parts Measured

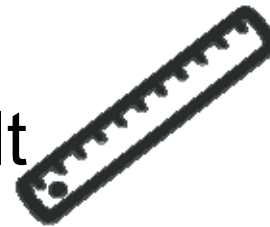


- CPG to AC ground
 - Unloading magazine
 - Pick up head
 - Input pusher
 - Tile pick up arm

2. Methodology

- Resistance Measurement in Wire Bond Machine

- Measure Resistance/Volt



Ω

- Compare against

- ANSI/ESD S20.20
- ANSI/ESD S6.1
- ANSI/ESD SP10.1

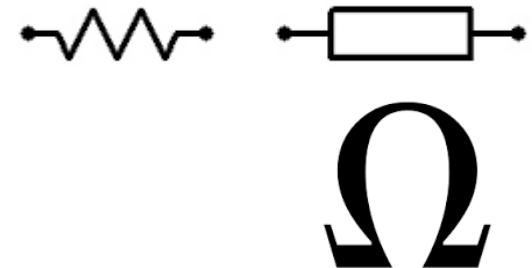


- Investigate further whenever possible

2. Methodology

- Resistance Measurement in Wire Bond Machine

- Parts Measured



- Machine's loading area
 - Gold thread holder
 - ESDS clamp
 - Input loader tile pusher
 - Input loader conveyor belt

2. Methodology

- Voltage Measurement
 - According to ANSI/ESD S20.20
 - insulators within 1 inch of any ESDS
 - Control limit $< \pm 125$ volts
 - Contact and non-contact voltmeters used
 - Stationary and moving parts that exceeded the resistance limits also checked for compliance



3. Results

- Resistance Measurement in DA
 - Red indicates exceeding the required resistance
 - Input pusher low ESD risk

Measurement point	Resistance (Ω)	Requirement	ESD Risk
Machine CPG	$<1\Omega$	$<1\Omega$	Low
Magazine to Ground	$1 \times 10^{11}\Omega$	$<1 \times 10^6\Omega$	High
Pick up Head	$2.5 \times 10^{11}\Omega$	$<1 \times 10^6\Omega$	High
Input Pusher	$2.2 \times 10^{11}\Omega$	$<1 \times 10^6\Omega$	High
Tile Pick Up Arm	1.7Ω	$<1 \times 10^6\Omega$	Low



3. Results

- Resistance Measurement in WB
 - Red indicates exceeding the required resistance
 - Input loader tile pusher low ESD risk

Measurement point	Resistance (Ω)	Requirement	ESD Risk
Loading Area	$<1\Omega$	$<1\Omega$	Low
Gold Thread Holder	$1 \times 10^4\Omega$	$<1 \times 10^6\Omega$	Low
Tile Clamp	$<1\Omega$	$<1 \times 10^6\Omega$	Low
Input Loader Tile Pusher	$9.8 \times 10^{10}\Omega$	$<1 \times 10^6\Omega$	High
Input Loader Conveyor Belt	$2.5 \times 10^5\Omega$	$<1 \times 10^6\Omega$	Low

3. Results

- Voltage Measurement
 - The ESD risk of input pusher and input loader tile pusher were evaluated to be low ESD risk as the tribo-charged voltage were below the control limit

DA →

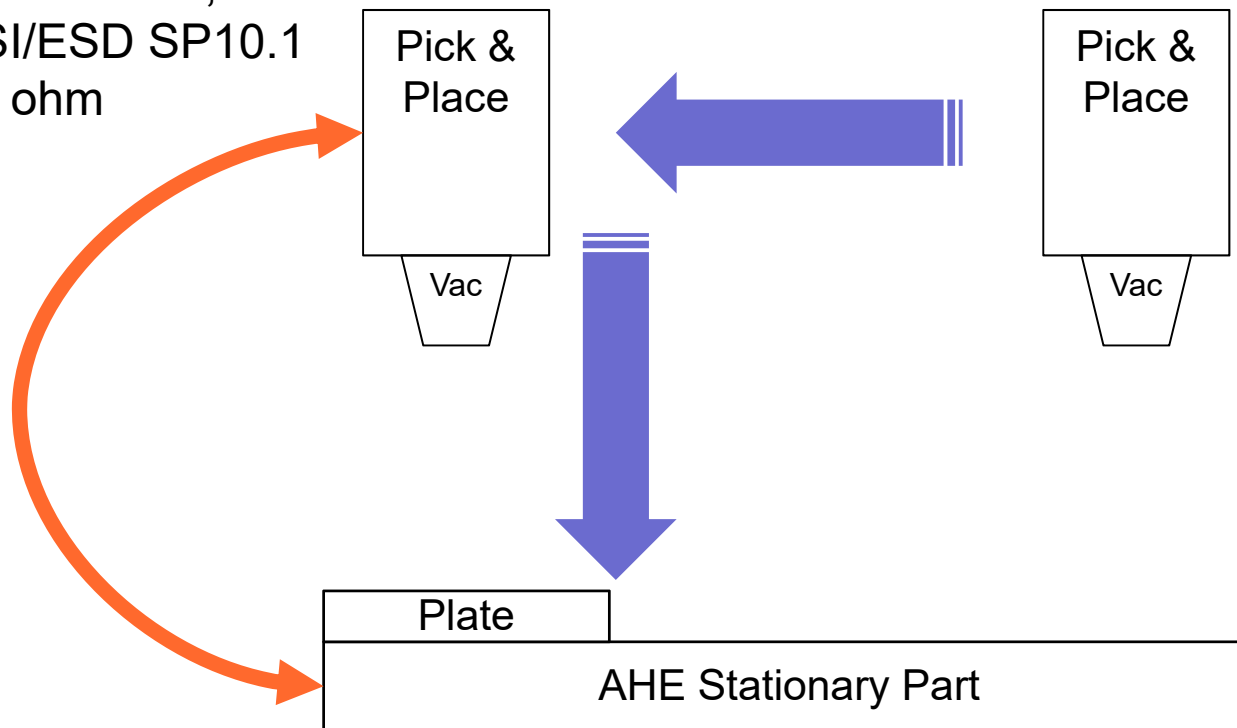
WB →

Part	Tribocharged (V)	Control Limit (V)	ESD Risk
Insulative Strip on Magazine	>200	<125	High
Input Pusher	<-60	<125	Low
Input loader tile pusher	<20	<125	Low

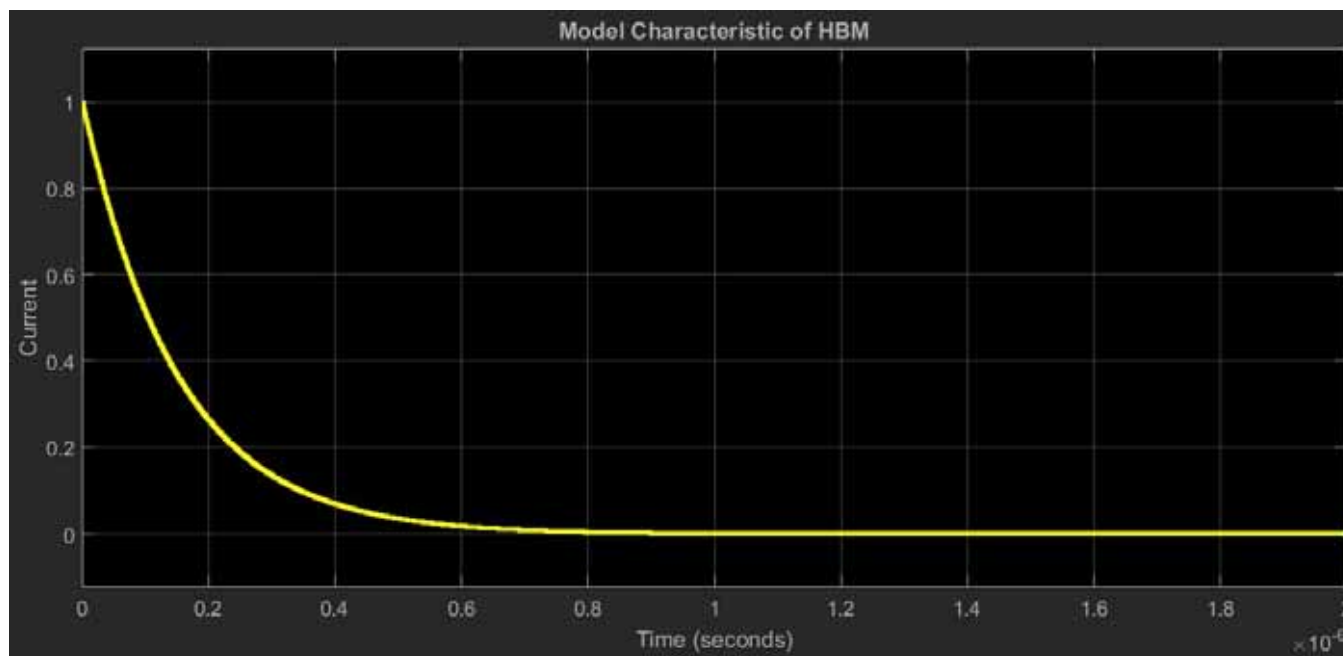
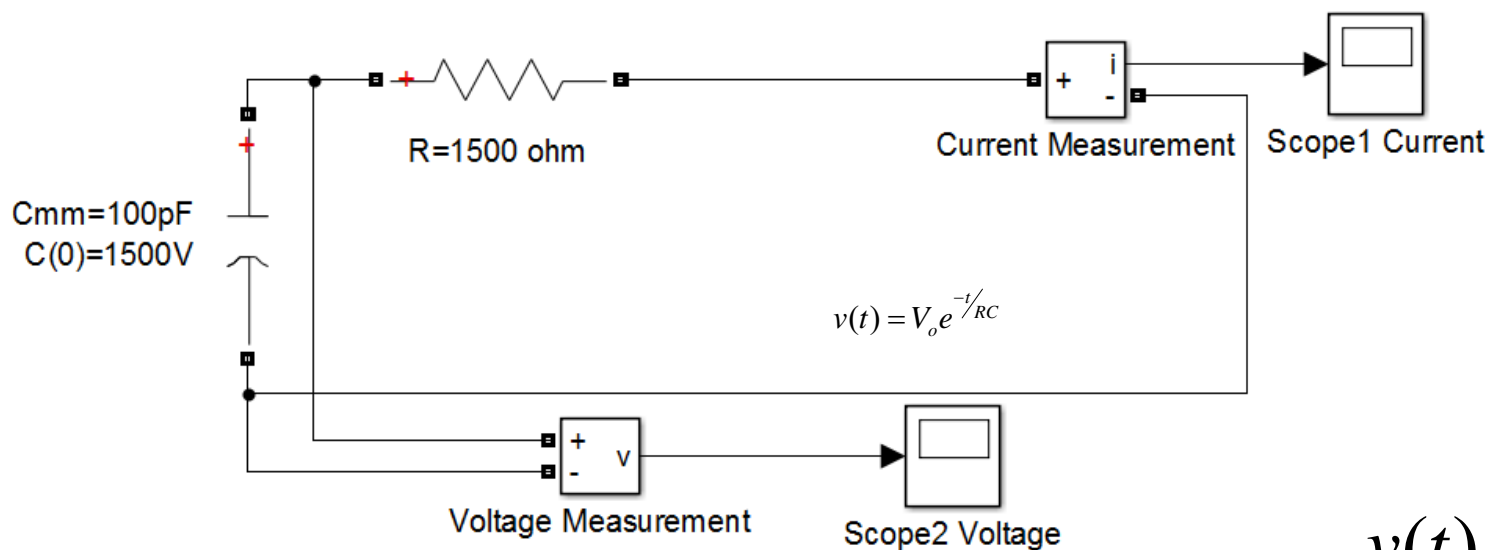


3. Results – Pick & Place RTG

RTG (ohm)
measurement,
ANSI/ESD SP10.1
<E6 ohm



3. Results – HBM Modelling



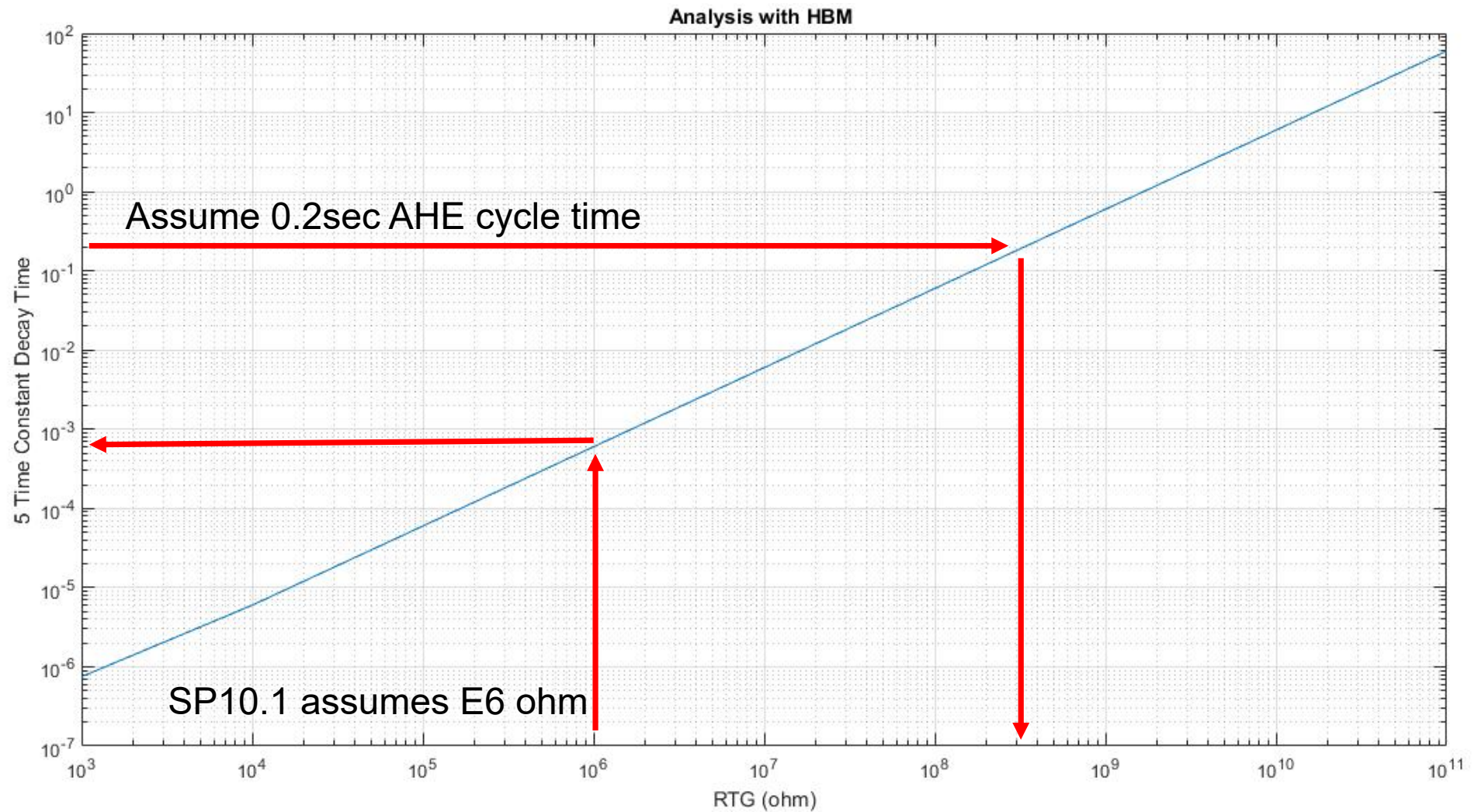
$$v(t) = V_o e^{-t/RC}$$

$$i(t) = I_o e^{-t/RC}$$

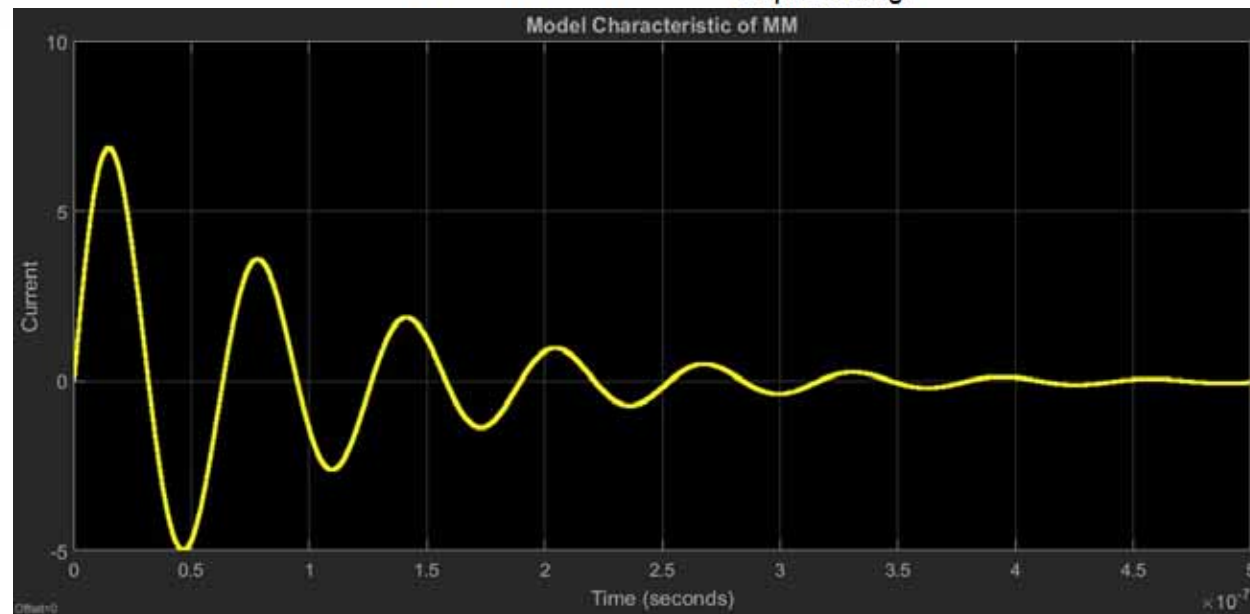
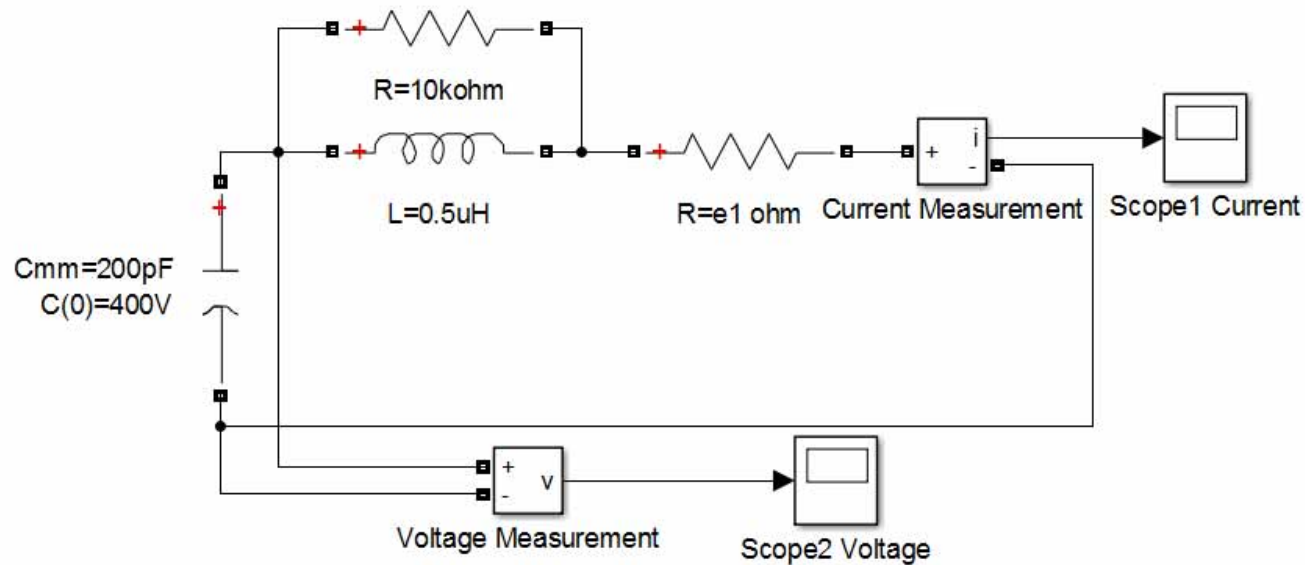
$$\tau = RC$$

$$5\tau @ 0.7\% V_o$$

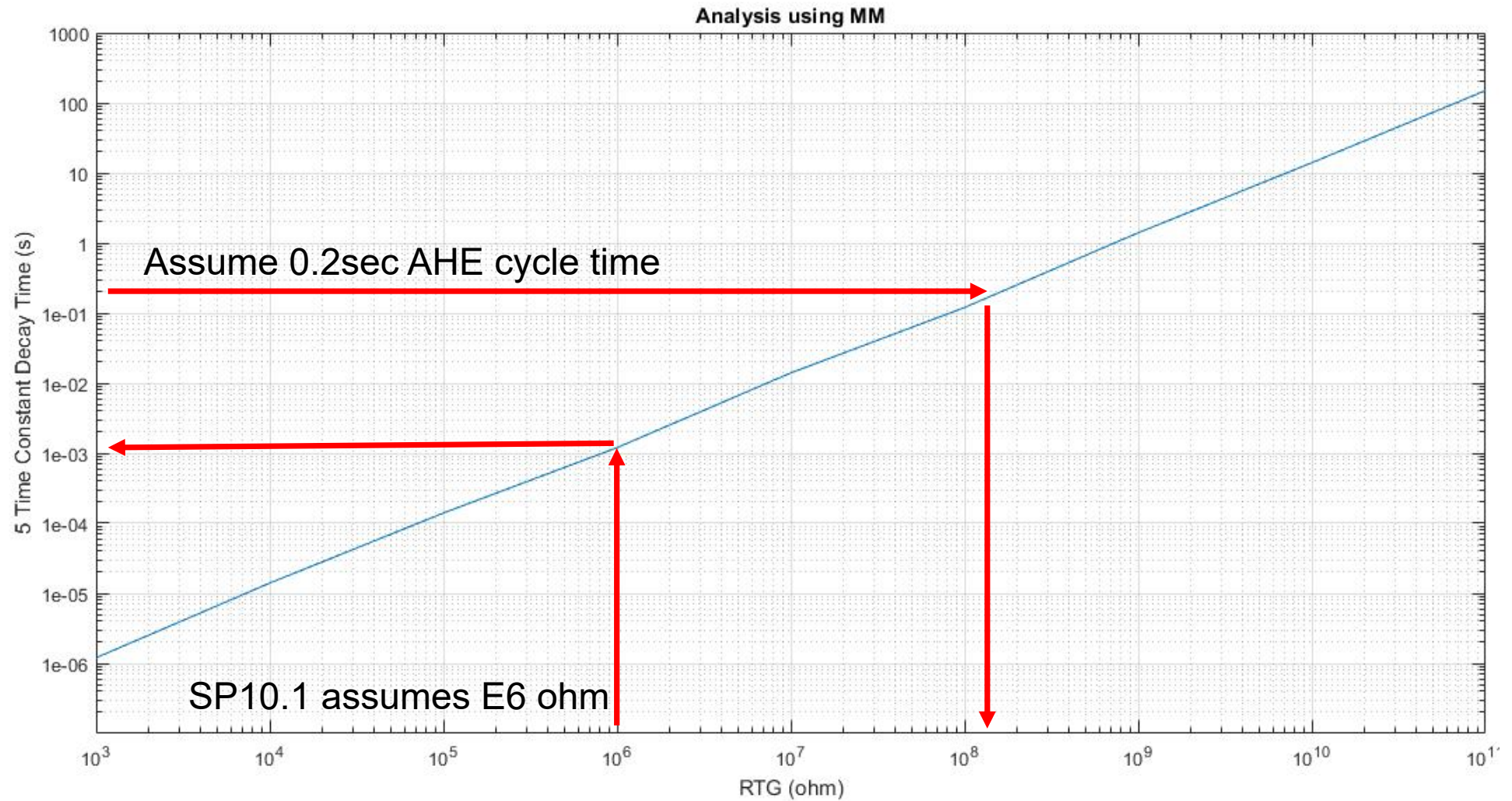
3. Results – HBM Modelling



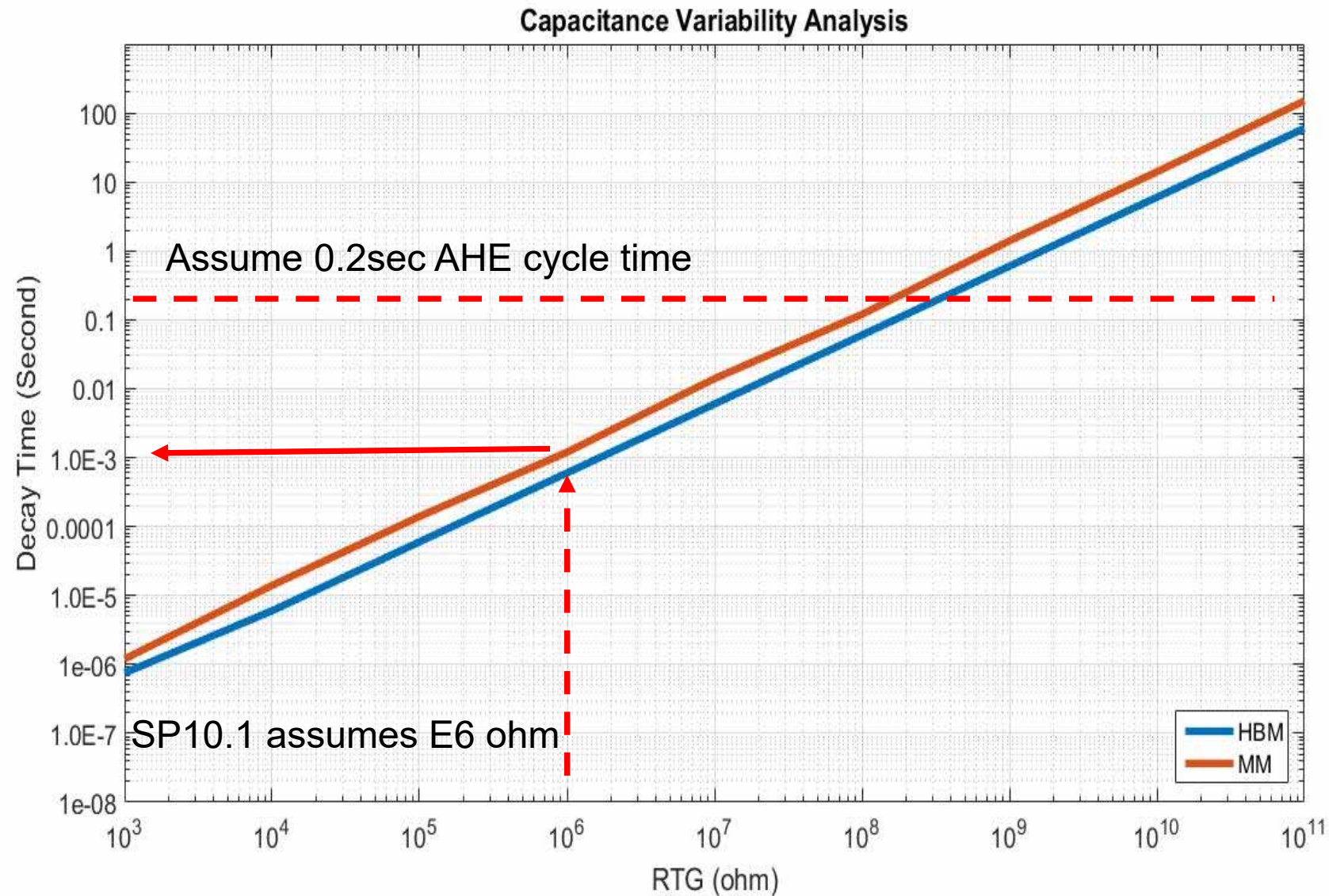
3. Results – MM Modelling



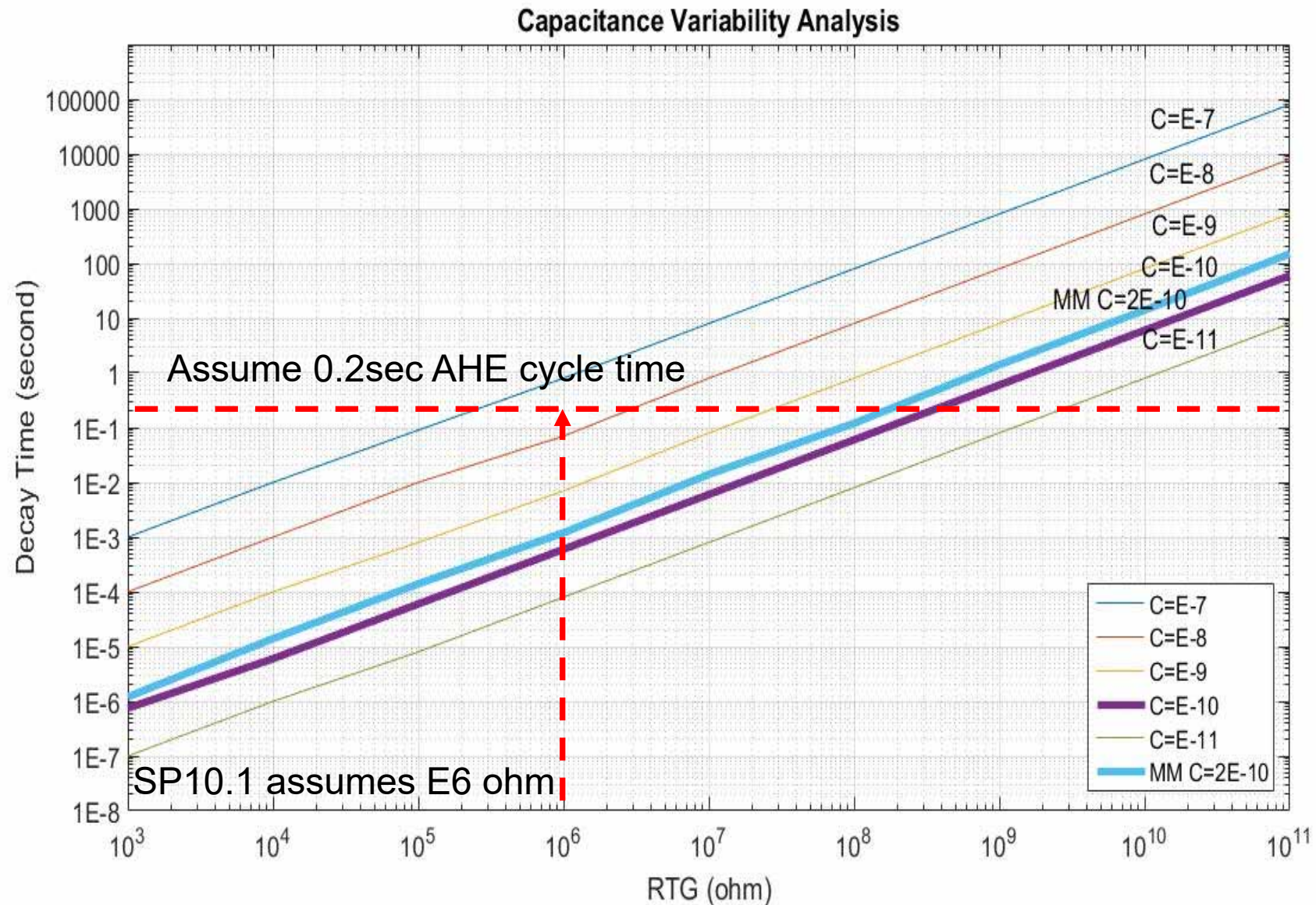
3. Results – MM Modelling



3. Results – HBM vs MM Capacitance



3. Results – HBM vs MM Capacitance



4. Discussion

- Some resistance values of certain parts in DA and WB did not comply with ANSI/ESD S20.20 and ANSI/ESD S6.1
- After further assessment was made, some of the parts do not pose a high ESD risk due to a low tribo-charged value.



4. Discussion

- Using model characteristics of both HBM or MM, static measurement of RTG $\leq 1.0\text{E}6$ ohm (ANSI/ESD SP10.1) is typically 2 orders below the assumed AHE cycle time of 0.2 second.
- For capacitance variability, RTG $\leq 1.0\text{E}6$ ohm is good for capacitance $< 10^{-8}\text{F}$

4. Discussion

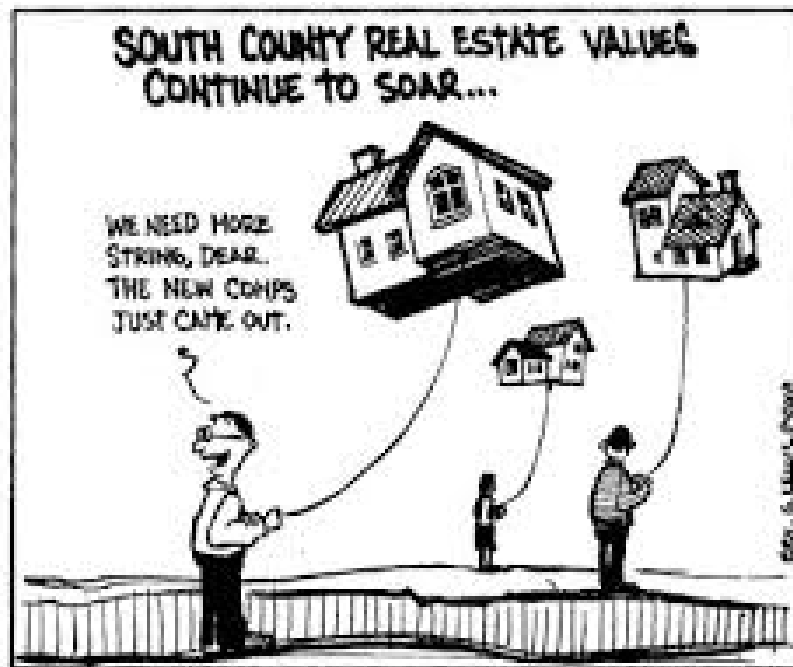
- This additional check was not proposed in ANSI/ESD SP10.1. However, it would be beneficial in assessing the ESD risk the machine part poses
- Certain changes are proposed to help the DA and WB machine comply with the requirements of ANSI/ESD S20.20 and ANSI/ESD S6.1

5. Conclusion

- A measurement of tribo-charged voltage of insulative parts of the machine was proposed as an additional check which will help to assess the ESD risk more thoroughly.
- Recommendations were also proposed to aid in maintaining the AHE so that it complied with the requirements of ANSI/ESD S20.20 and ANSI/ESD S6.1.

5. Conclusion

- Further best practices can be proposed to improve on the current ANSI/ESD SP10.1 so that it can be more comprehensive in assessing ESD risk assessment in AHE.



2004



2005

6. References

- [1] E. S. D. Association, "ANSI/ESD S20.20-2014," in Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices), ed. Rome, NY: ESD Association, 2014, p. 13.
- [2] E. S. D. Association, "ANSI/ESD S6.1-2009 - Grounding," ed: ESD Association, 2009, p. 20.
- [3] E. S. D. Association, "ANSI/ESD SP10.1-2000 - Automated Handling Equipment (AHE)," ed. 7900 Turin Road, Bldg 3 Rome, NY 13440-2069: ESD Association, 2000, p. 15.