

Improving Precision and Reducing Errors in Automated Semi Manufacturing by Managing EMI

Vladimir Kraz
OnFILTER

Introduction

Unwanted electrical signals (EMI) cause problems in semi process:

- Loss of productivity
- Errors in test
- Process variations
- Equipment malfunction
- Device damage

We will discuss EMI origins, EMI mitigation, and EMI management in a semi manufacturing environment

Background

Smaller geometry and higher density require better accuracy and precision in every step of the process.

Lower supply and signal levels make devices, equipment, and processes more vulnerable to interference

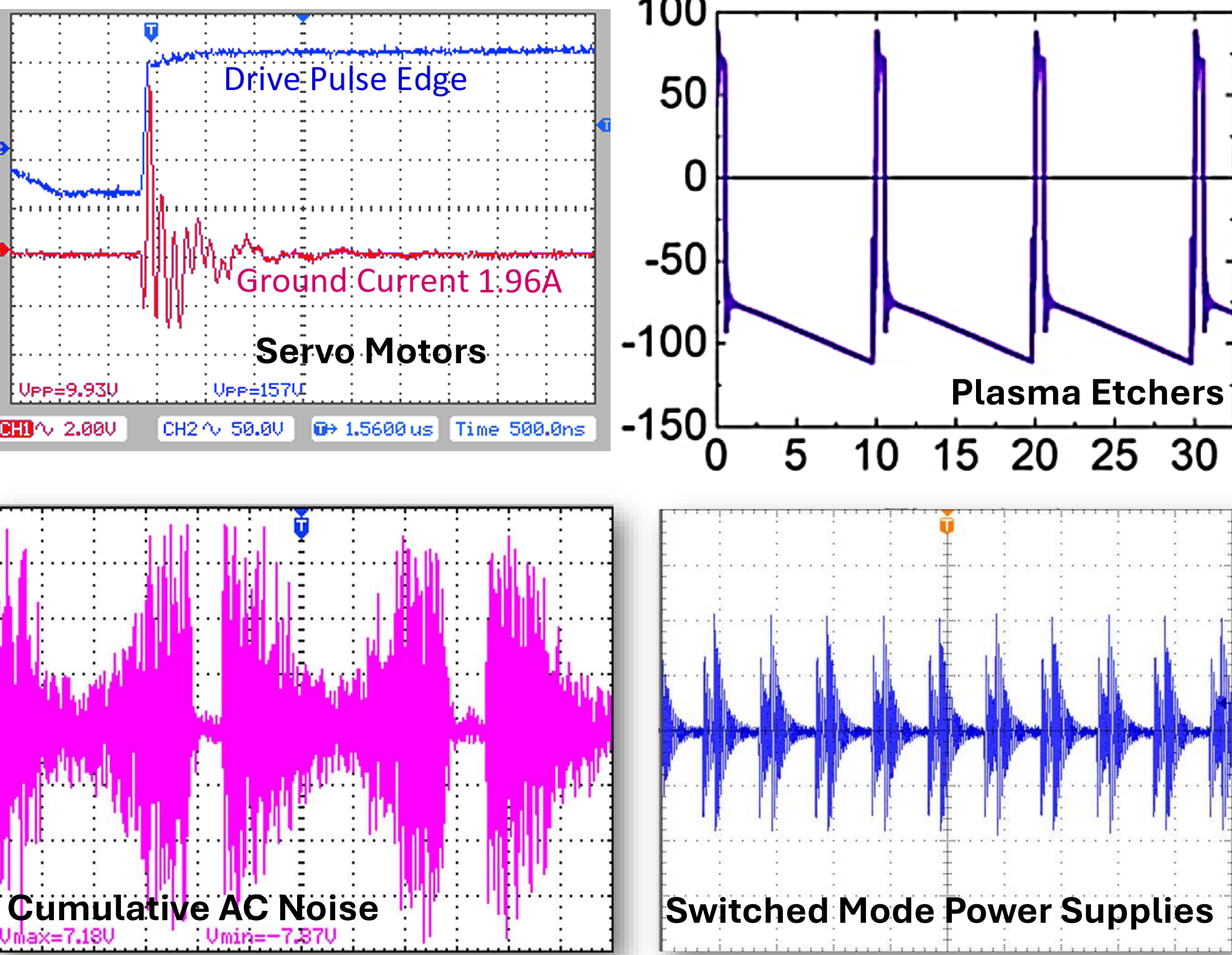
“Smart” Manufacturing may be impeded by the effects of EMI due to its dependency on automation and AI

Sources of EMI in Semi Environment

Automated semi process employs a number of EMI-generating equipment, among them:

- Motors (servo, stepper, VFD)
- Switched mode power supplies
- RF generators
- Plasma etchers
- Heaters
- Commutations
- Wireless communication

Examples of EMI in Semi Mfg.

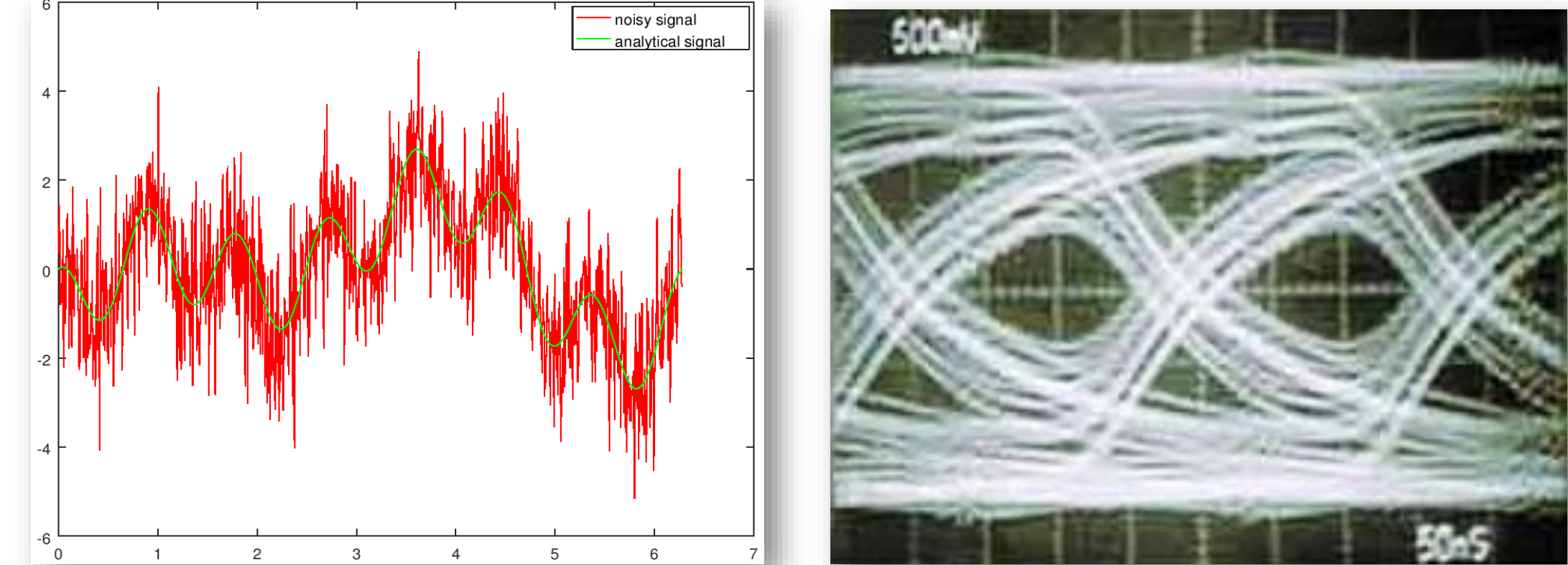


Effect of EMI on Semi Process

Unwanted noise is never a good thing. Especially when so much depends on accurate data, stable process, and precision movements

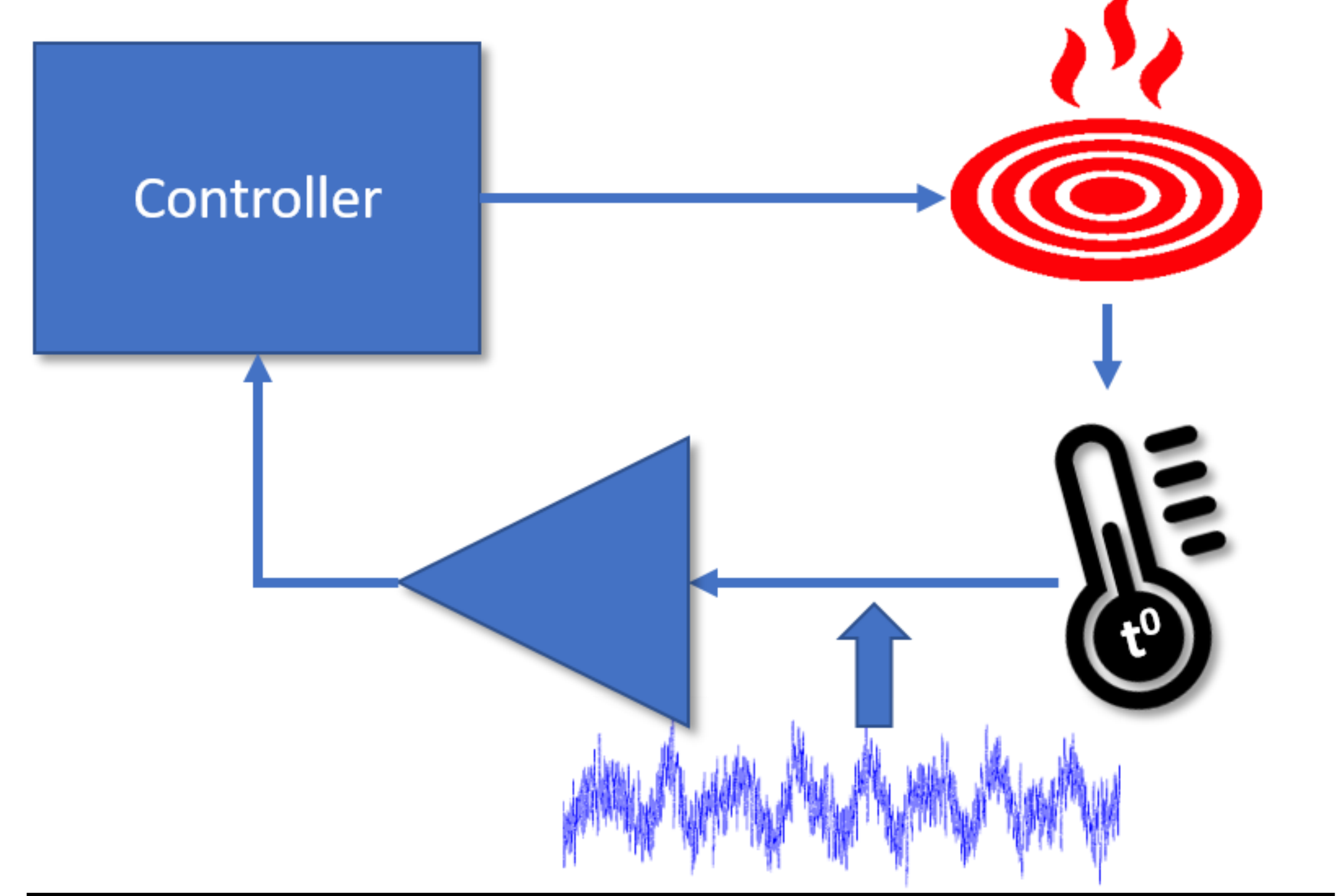
Test

- Garbled results
- Uncertainty in results
- Low accuracy
- Duplication of tests



Process

- Errors in recipes
- Non-repeatable errors
- Uncertainty in outcomes



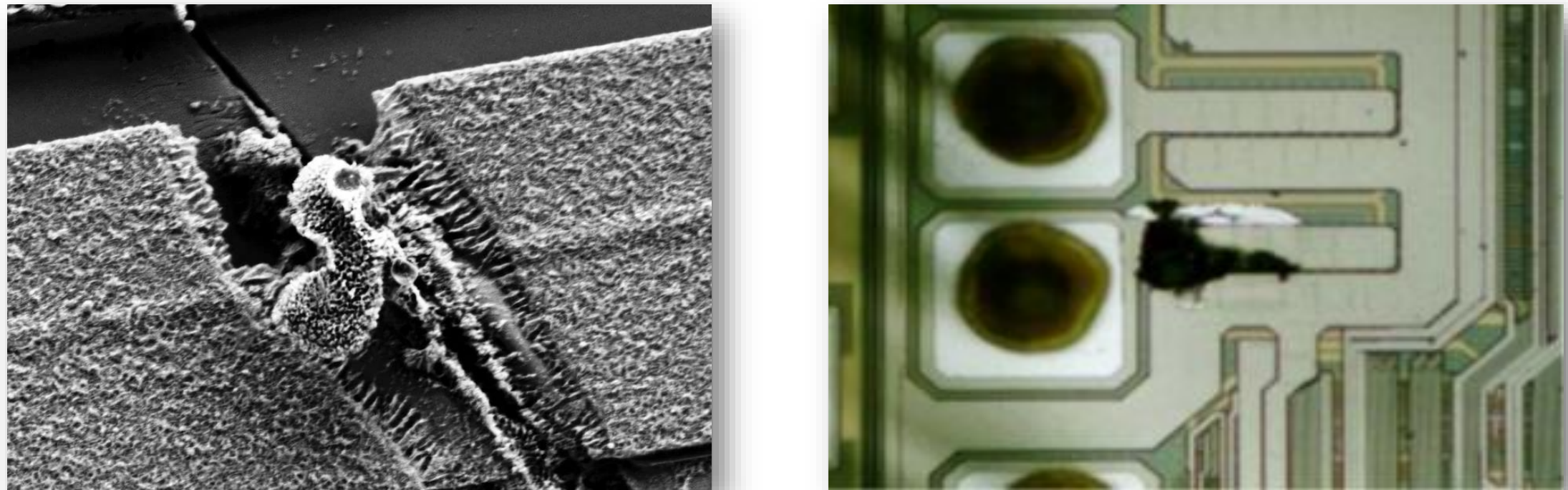
Equipment Errors

- Injected erroneous control signals
- Uncertain logic levels
- Positioning errors
- Alignment issues
- Tool lock-up
- Often masked as “software errors”



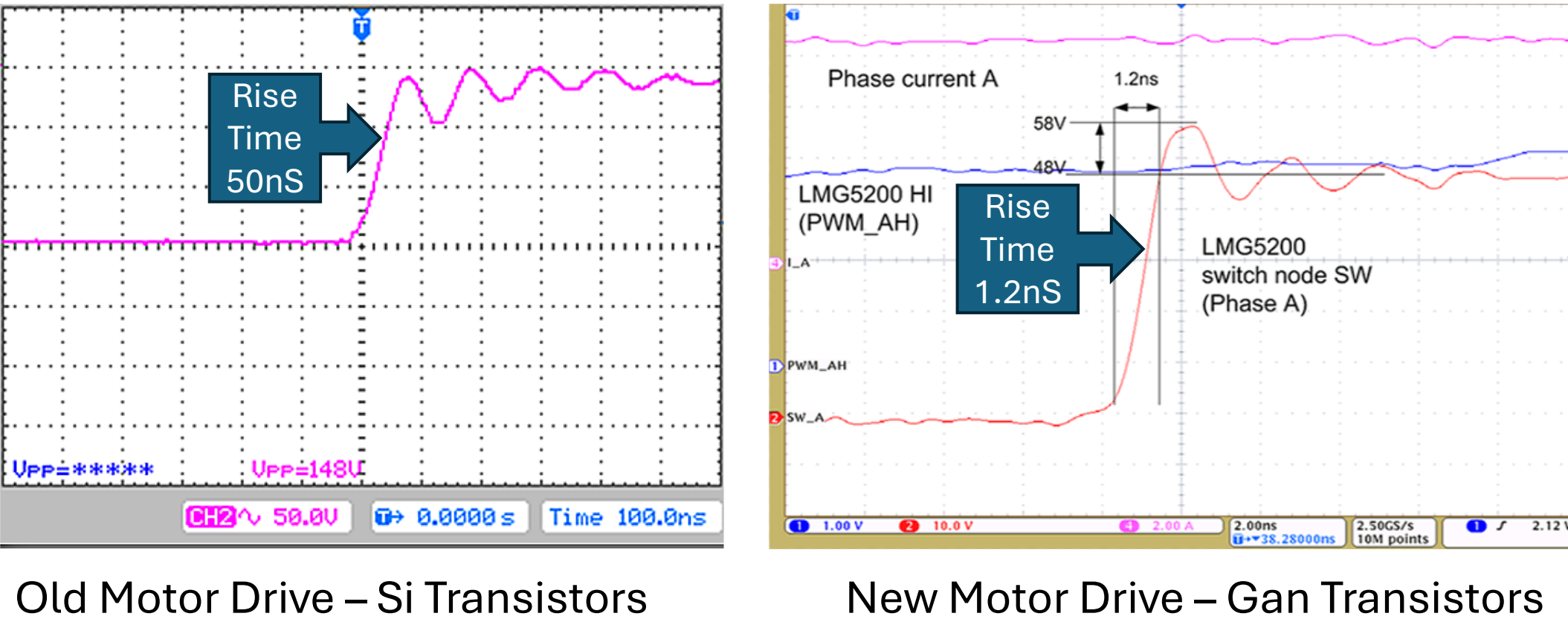
Electrical Overstress (EOS)

- EOS is number one cause of damage to devices
- Unwanted voltages and currents can cause physical damage to devices, such as high leakage current, etc.
- The main culprit is EMI
- Sometimes damage is “latent” – device tests OK, but fails in field



What the Future Holds

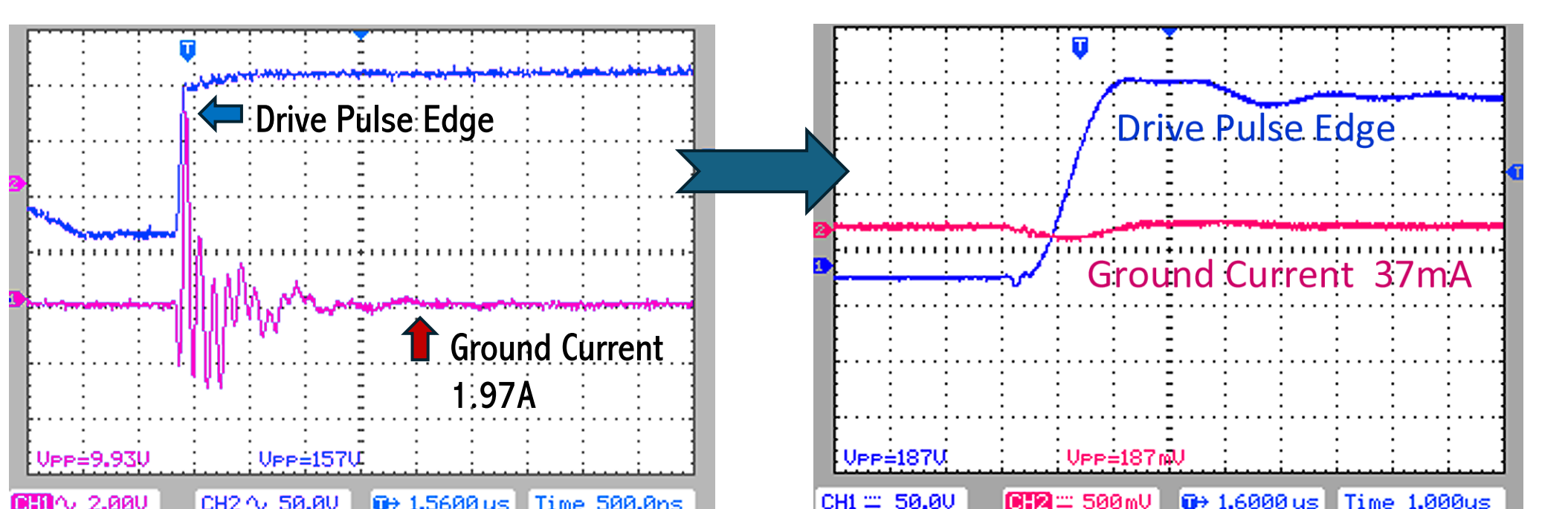
- Smaller geometry – more demanding requirements for interference
- More automation – more EMI
- There is no path to increase of productivity the future without addressing EMI



How to Control EMI?

Source → Path → Target

- Physically separate EMI-prone process and tools from the “quiet” ones
- Establish power/ground schemes
- Route power, ground, and data cables
- Filter noise on power lines and ground
- Filter power and ground on motors
- Filter noisy power supplies
- Use correct shielding (properly!)



Example of Mitigation: Ground Current Before and After Filtering Servo Motor

EMI Management

Treat EMI as an integral part of process variables – just like contamination or ESD

SEMI Standards and IRDS recommendations provide specific guidance on assessment and management of EMI at every step of semi and PCBA manufacturing

Facility

- Process flow
- Equipment co-location
- Power and ground
- Data flow
- Planning for the future

Process

- Make your process EMI-cognizant
- Configure your process flow for the lowest EMI exposure

Equipment

- Specify that all new tools comply with SEMI E.176
- Bring existing tools in E.176 compliance
- Conduct EMI audits

References

SEMI E.176

Guide to Assess and Minimize Electromagnetic Interference (EMI) in a Semiconductor Manufacturing Environment

IRDS

Facility Integration Recommendations

Contact Information

Vladimir Kraz
OnFILTER
vkraz@onfilter.com
www.onfilter.com

