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Diagnosis of Power Electronic Systems

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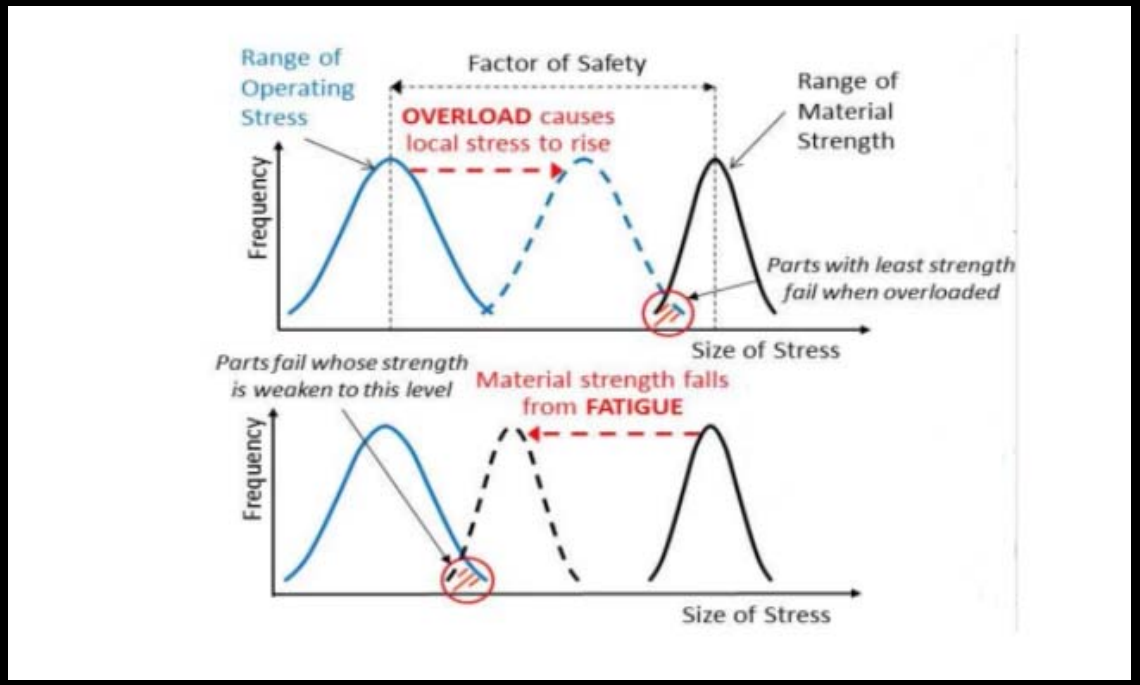
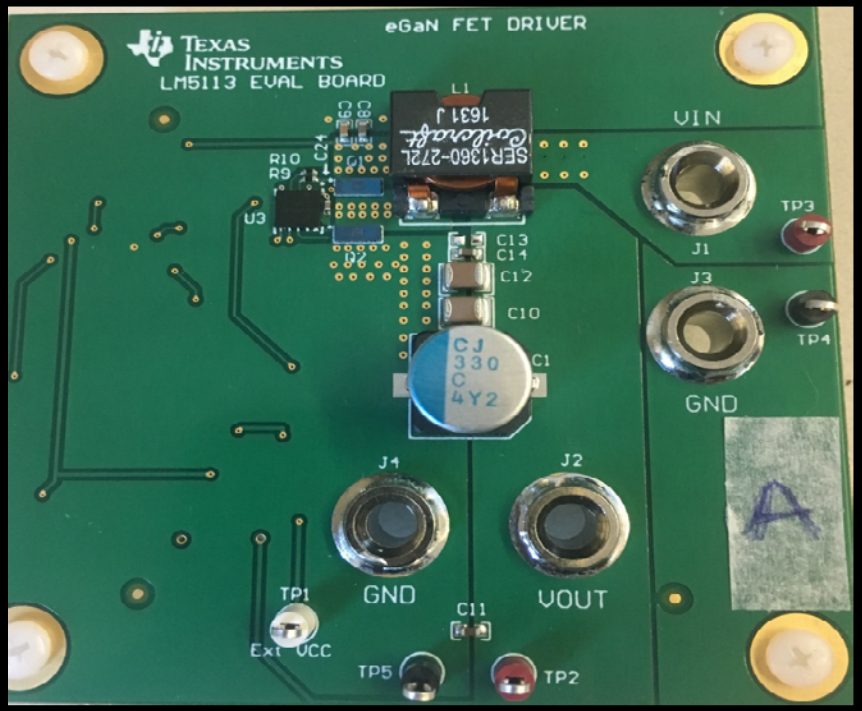
Background

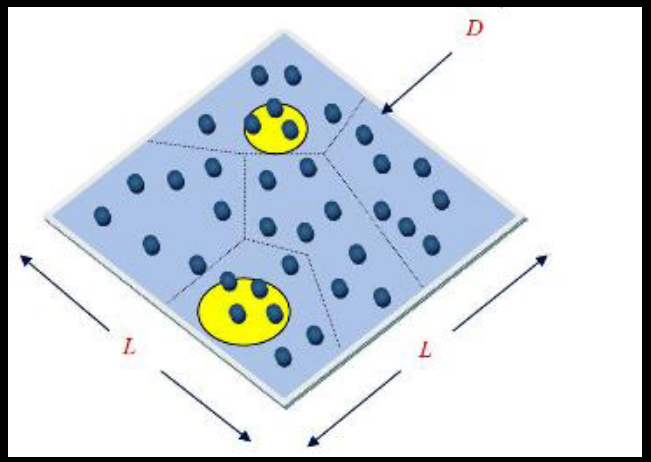

Range of Operating Stress
Factor of Safety
OVERLOAD causes local stress to rise
Range of Material Strength
Frequency
Parts with least strength fail when overloaded
Size of Stress
Parts fail whose strength is weaken to this level
Material strength falls from FATIGUE
Frequency
Size of Stress

Problem Definition and Objectives

- Developing a real-time embedded sensory network coupled with a recovery system, in order to diagnose and "heal" power electronics in their operation as they cope with electronic stress.
- Intended Users: Power Electronic manufacturers
- Focus: Development of sensory network and failure model

Approach Overview



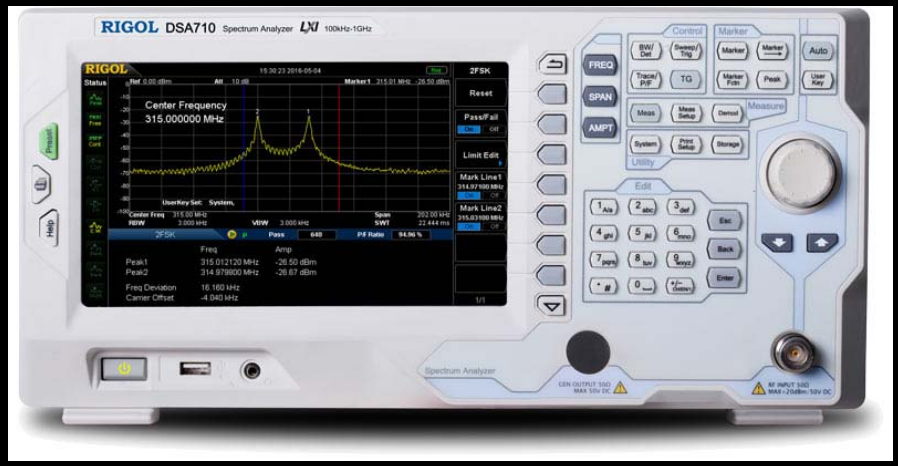


Constraints

- Economics
- Accuracy – 1% accuracy
- Operating conditions
- Sampling Rate

Current State of Art

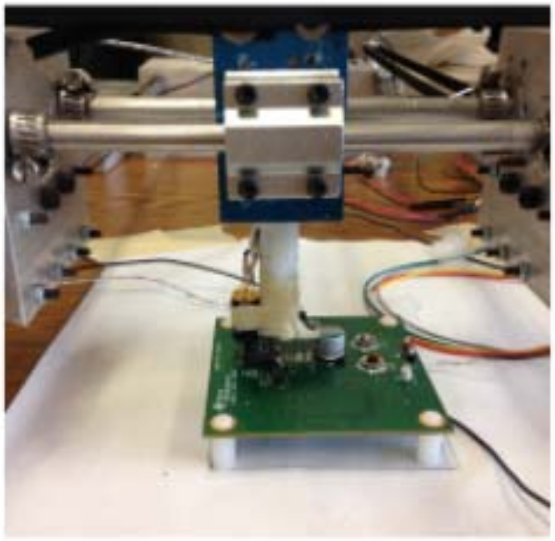
- Spectrum Analyzer



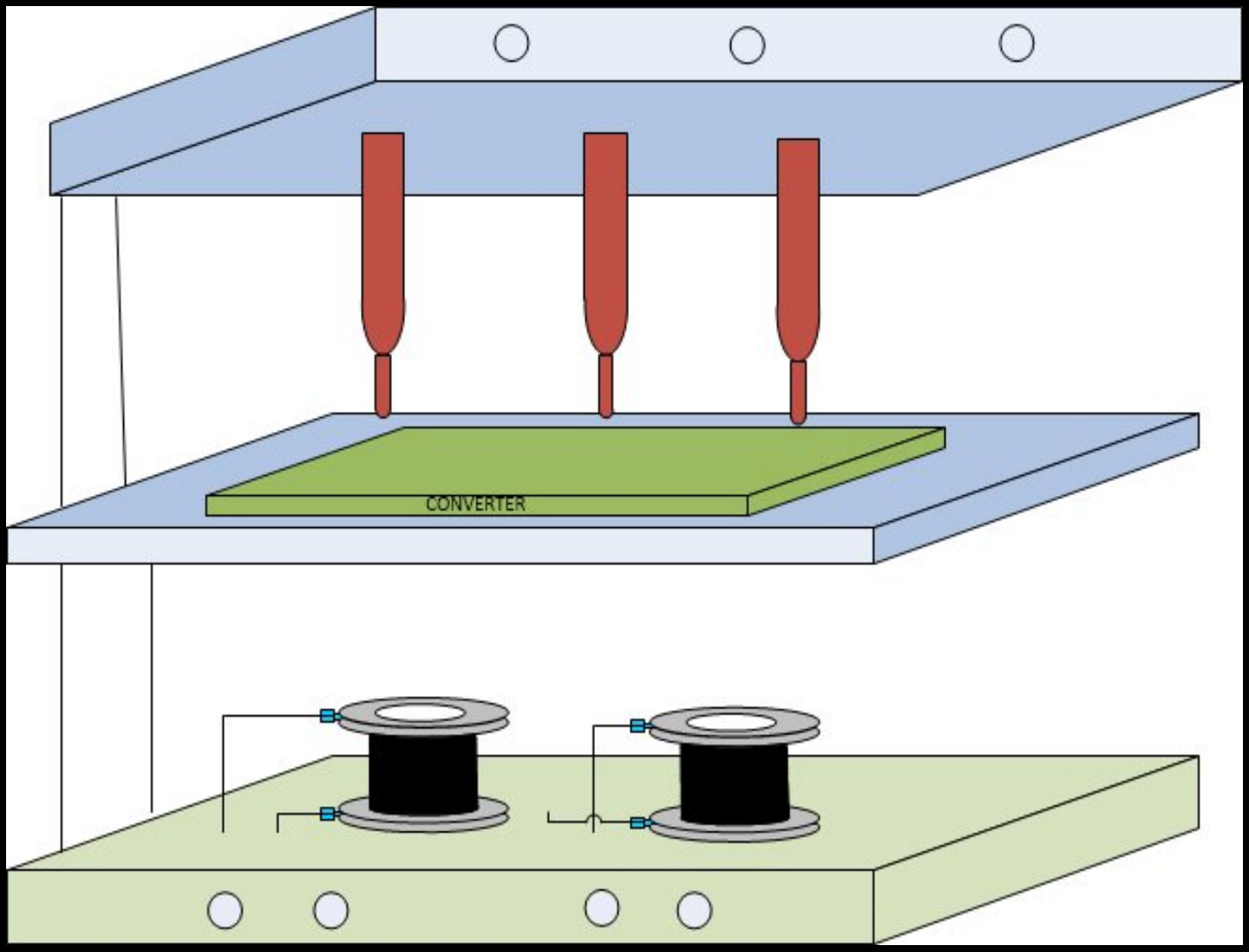
- Differences:
  - Intrusive
  - Large
  - Expensive

Solution Designs

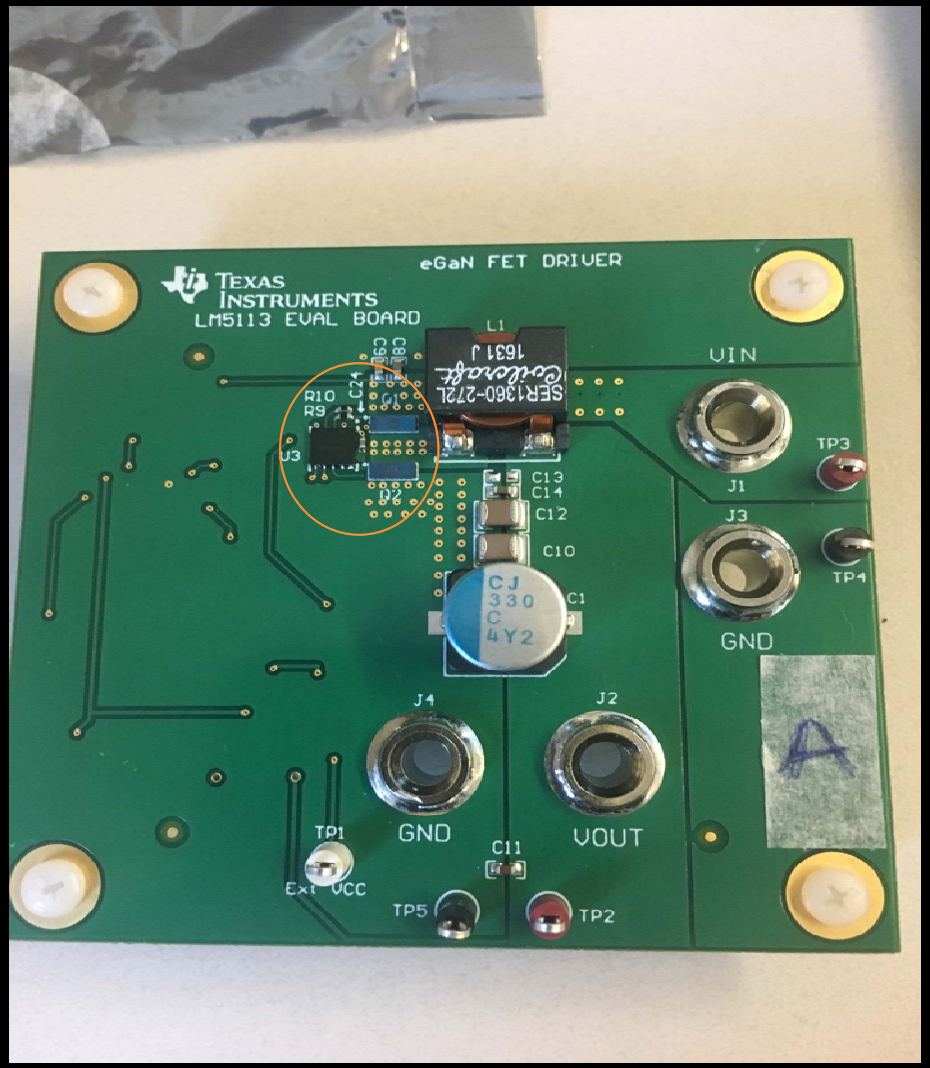
Design – 1.0

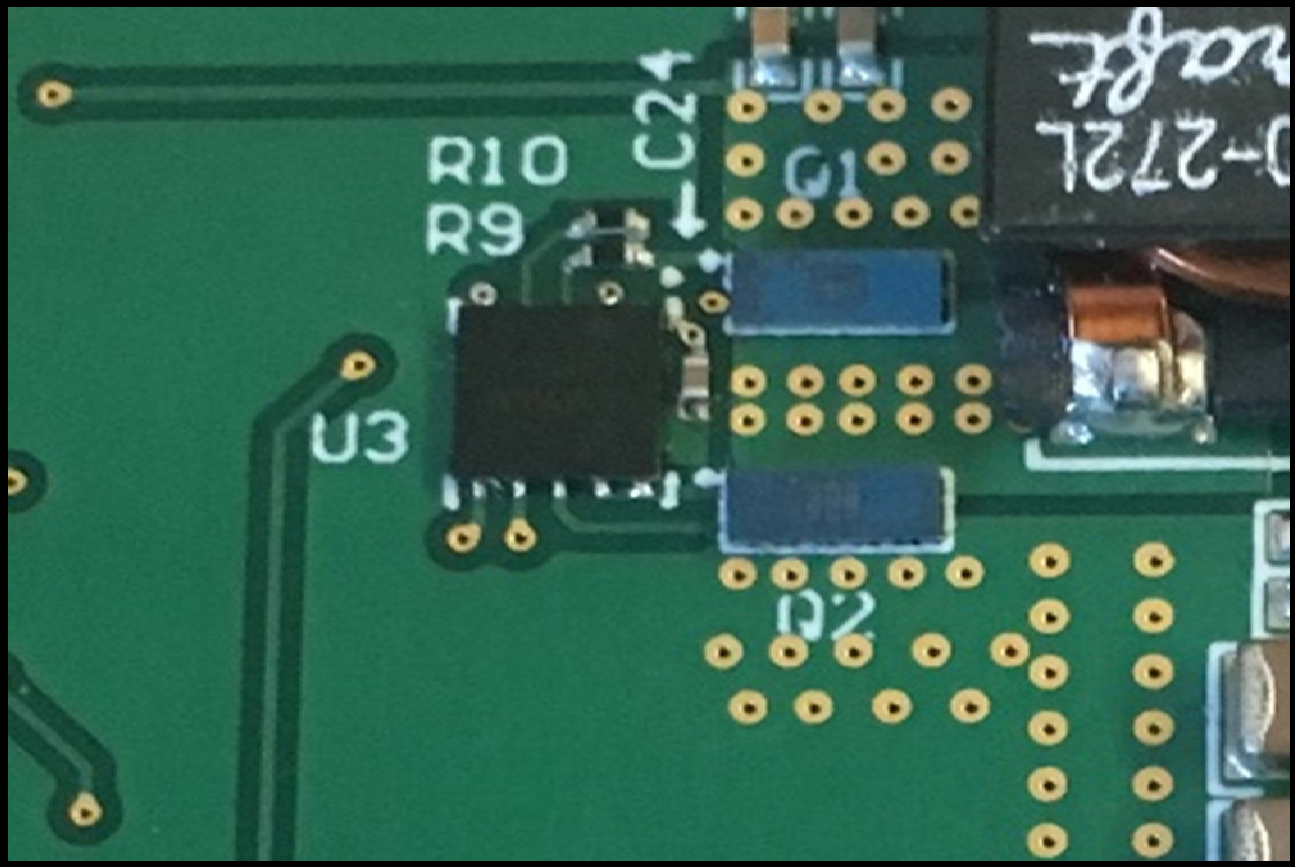


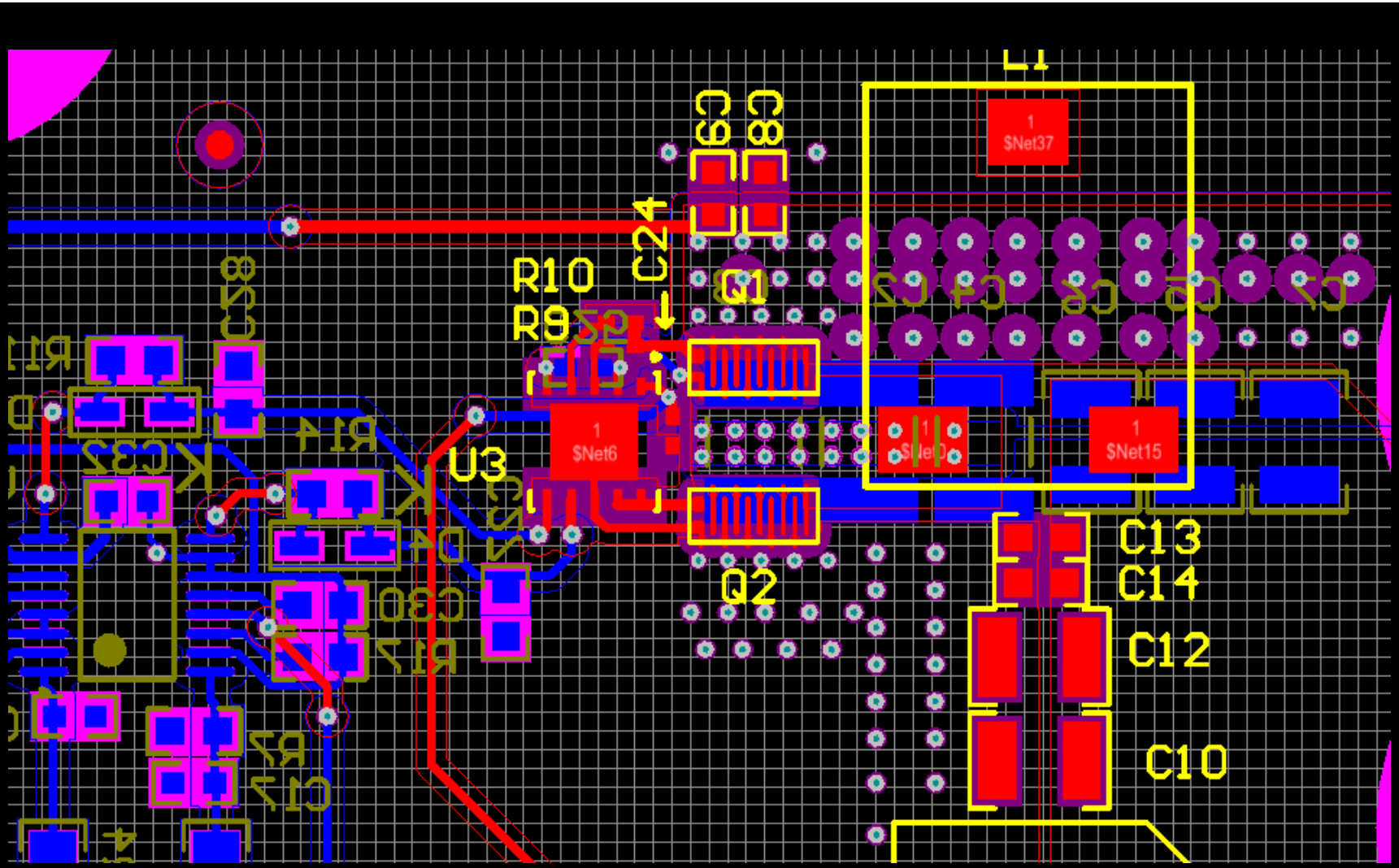
Design 1.1a Analysis


CONVERTER

Design 1.1b Analysis

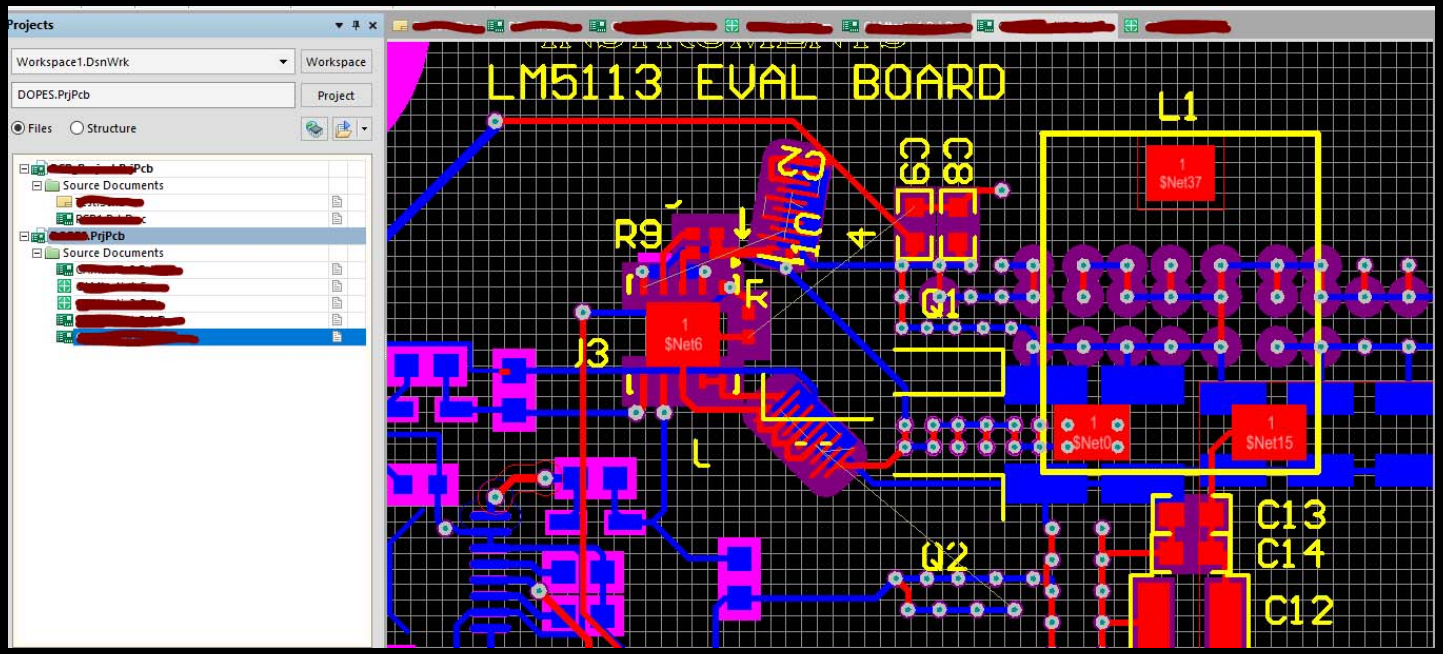

eGaN FET DRIVER
TEXAS INSTRUMENTS
LM5113 EVAL BOARD
L1
SER1360-272L
VIN
J1
TP3
J3
TP4
GND
C13
C14
C12
C10
C1
J4
J2
GND
VOUT
TP1
C11
TP5
TP2
U3
R10
R9
D2
A

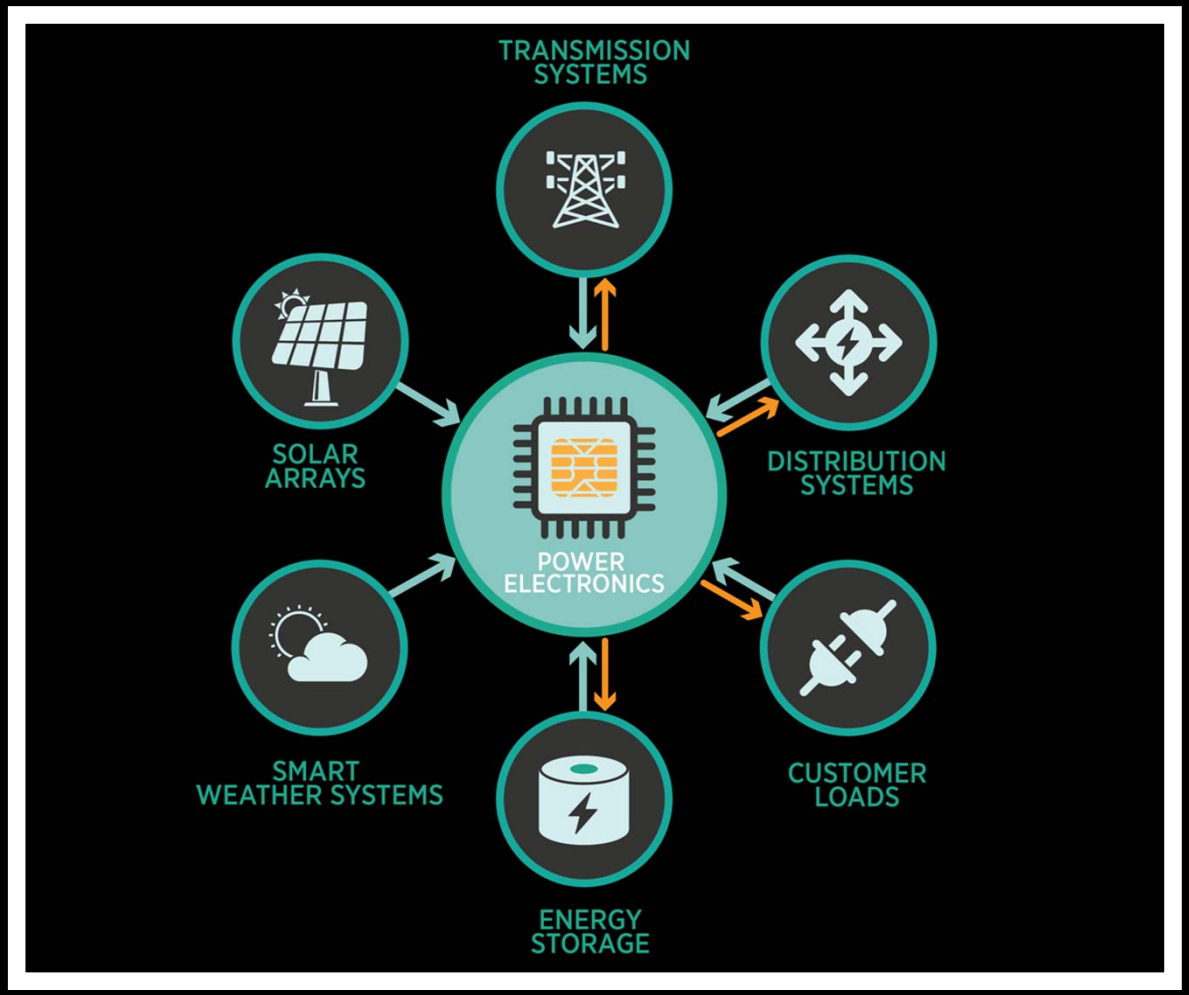

R10
R9
C24
Q1
U3
D2


L1
C9
C8
C24
R10
R9
Q1
Q2
U3
C13
C14
C12
C10
$Net37
$Net6
$Net15

Top Selection

- Design 1.1b




TRANSMISSION SYSTEMS
SOLAR ARRAYS
DISTRIBUTION SYSTEMS
POWER ELECTRONICS
SMART WEATHER SYSTEMS
CUSTOMER LOADS
ENERGY STORAGE

Conclusion