Stacking Power MOSFETs

NMOS Configuration

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Test 3

- NMOS Configuration
- MOSFET:
  - STP8NM60
- Calculated Capacitance Values:
  - 50pF, 100pF, 150pF, 200pF
- Max Voltage:
  - 2500 V
- Changes:
  - Fabricated a new board

Test 3 – Calculations

Cgs = 440 pF
Cgd = 10 pF

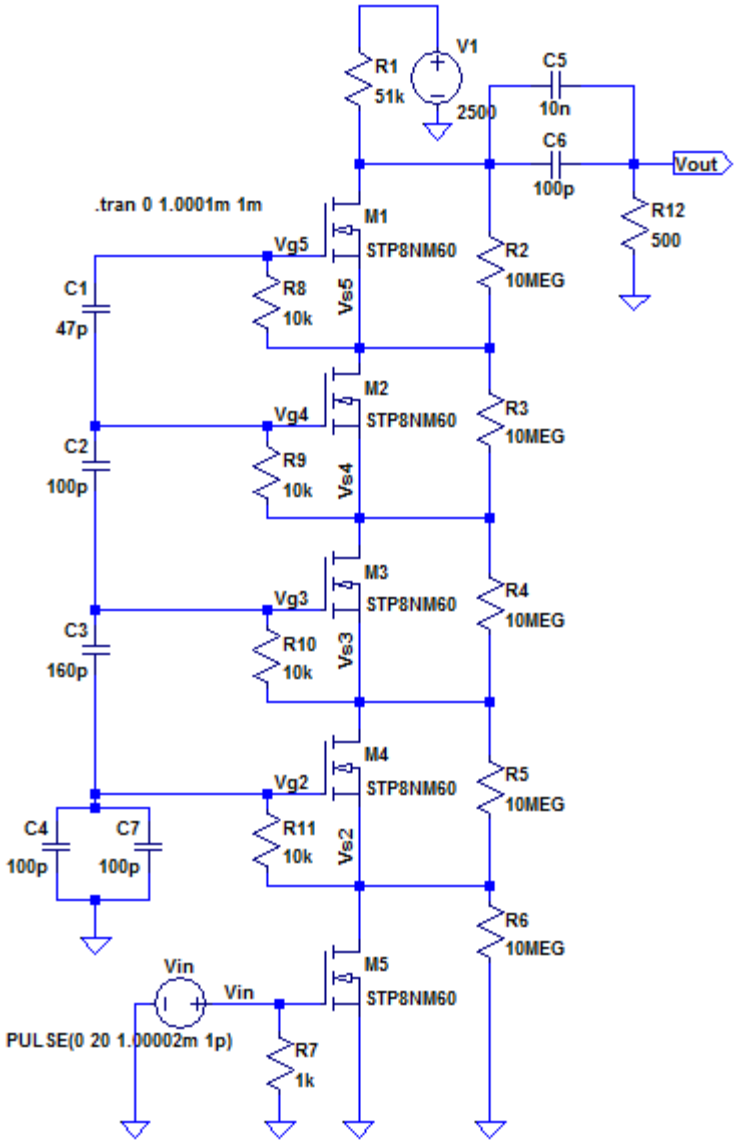
Vd = 500 V
Vgs = 20 V
Av = 25

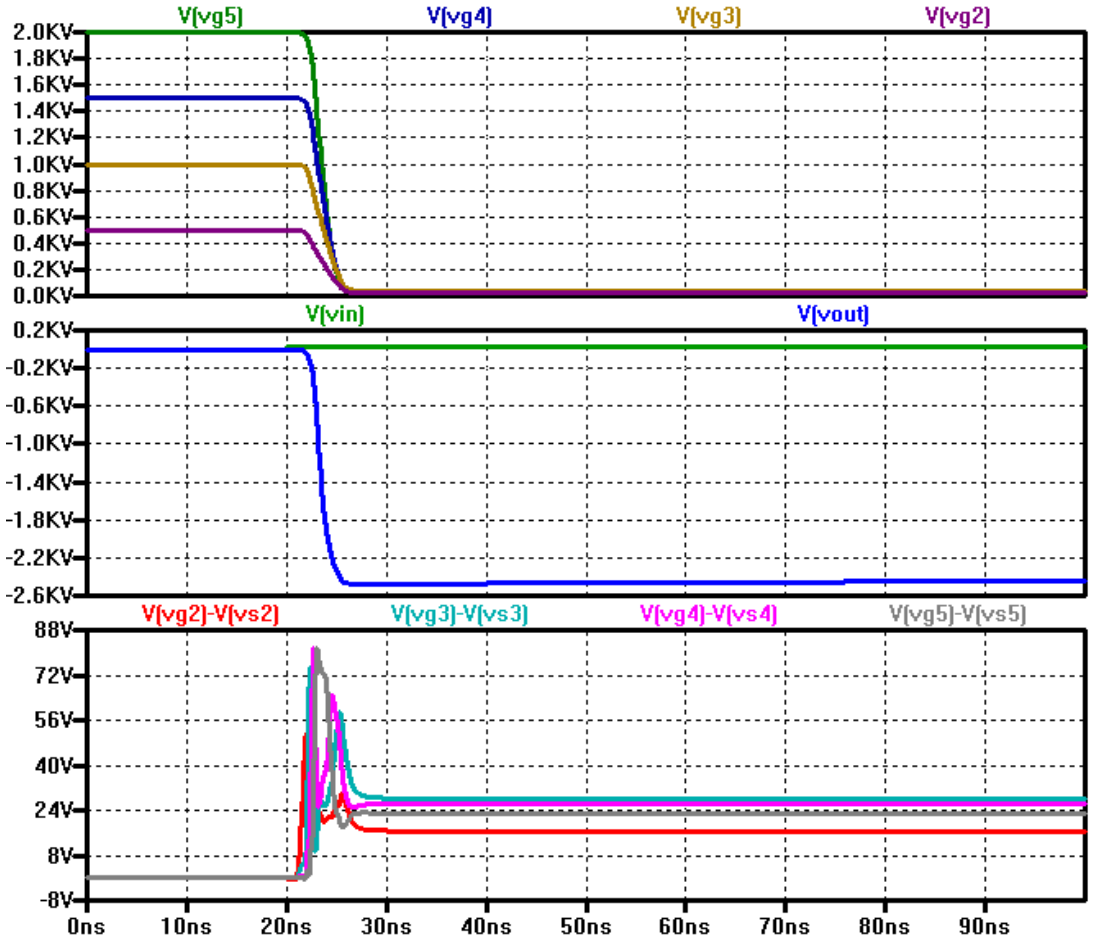
C'gs = Cgs + Av * Cgd
= 440 pF + 25 * 10 pF
= 690 pF

Vgs = Vd * C2 / (C2 + C'gs) *Solve for C2*
C2 = [(Vgs / Vd) * C'gs] / [1 – (Vgs / Vd)]
= [(20 / 500) * 690p] / [1 – (20 / 500)]
= 28.75 pF

*To ensure the MOSFETs turn on, increase C2 to **50 pF***

Test 3 – Simulation & Values

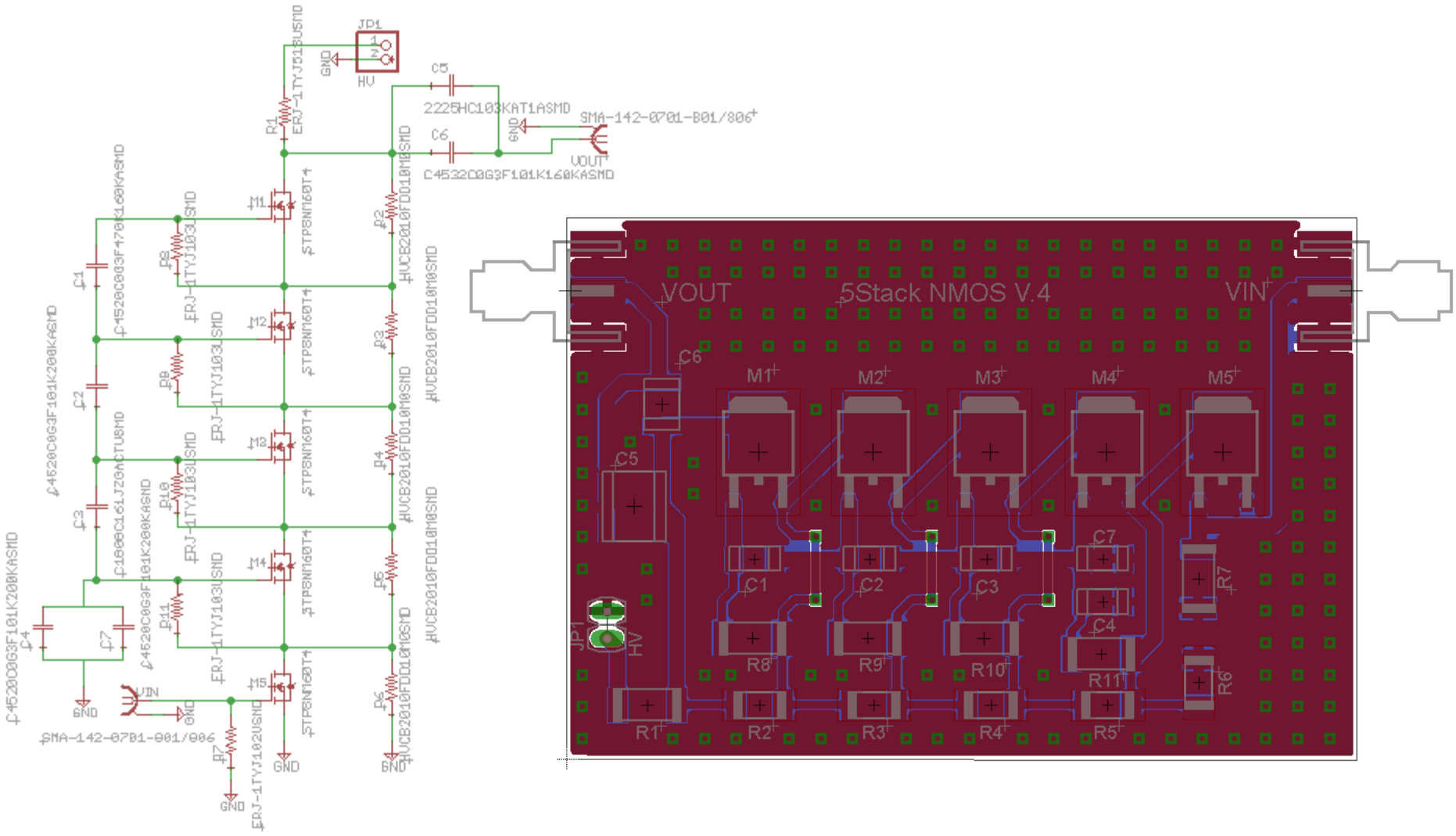




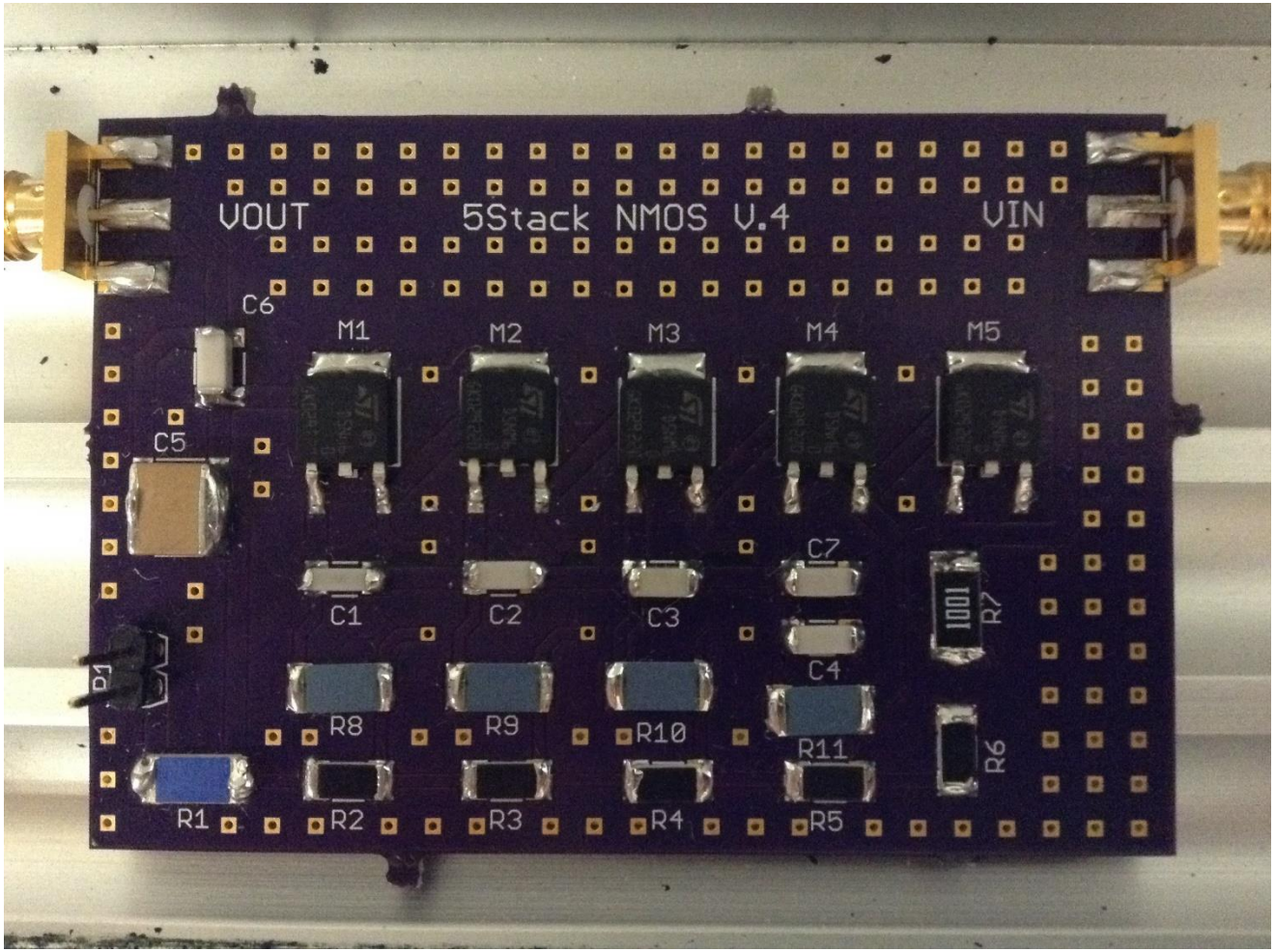
*Values reflect components available

*Simulation are the same as the previous test

Test 3 – PCB Layout

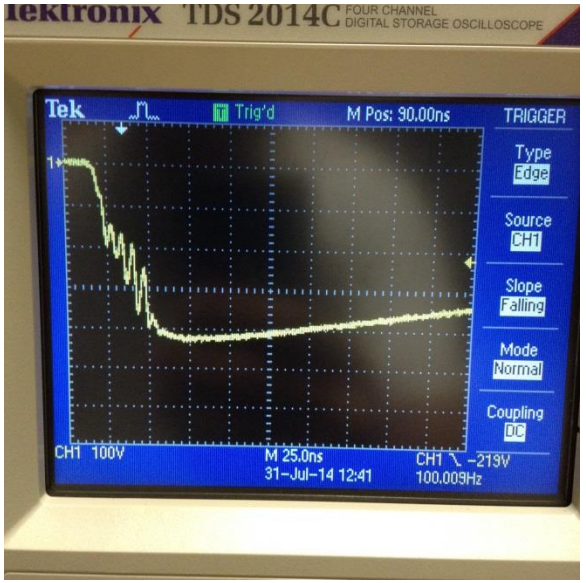


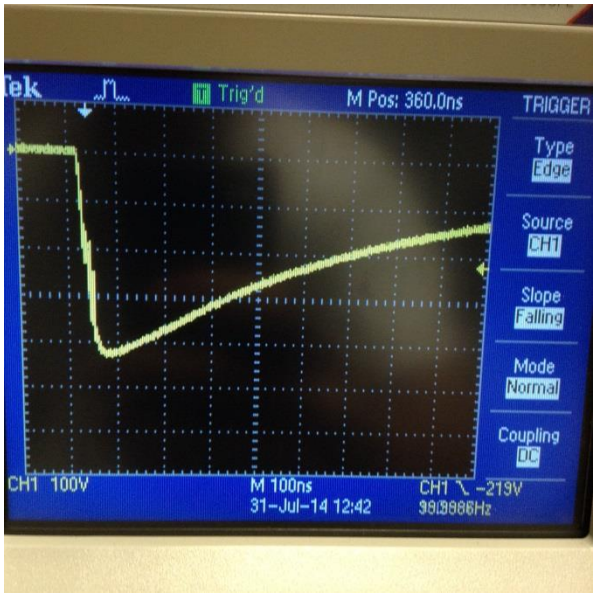
Test 3 – Chip


VOUT
5Stack NMOS V.4
VIN
C6
M1
M2
M3
M4
M5
C5
C7
C1
C2
C3
1001
R7
C4
R8
R9
R10
R11
R6
R1
R2
R3
R4
R5

Test 3 – Sample 1 Results

- Vin = 504 V
- Switching = 420 V, or 83.3%
- Voltage Across (Difference):
  - M1: 468 V (-36)
  - M2: 342V (-126)
  - M3: 235 V (-107)
  - M4: 135 V (-100)
  - M5: 64 V (-71)
- Ringing still occurs, but much less than previous test
- More voltage is switching as well
- PC board needs to be reworked to eliminate the oscillation





Test 3 – Sample 2 Results

- Vin = 754 V
- Switching = 580 V, or 76.9%
- Voltage Across (Difference):
  - M1: 700 V (-50)
  - M2: 522 V (-178)
  - M3: 370 V (-152)
  - M4: 235 V (-135)
  - M5: 132 V (-103)