

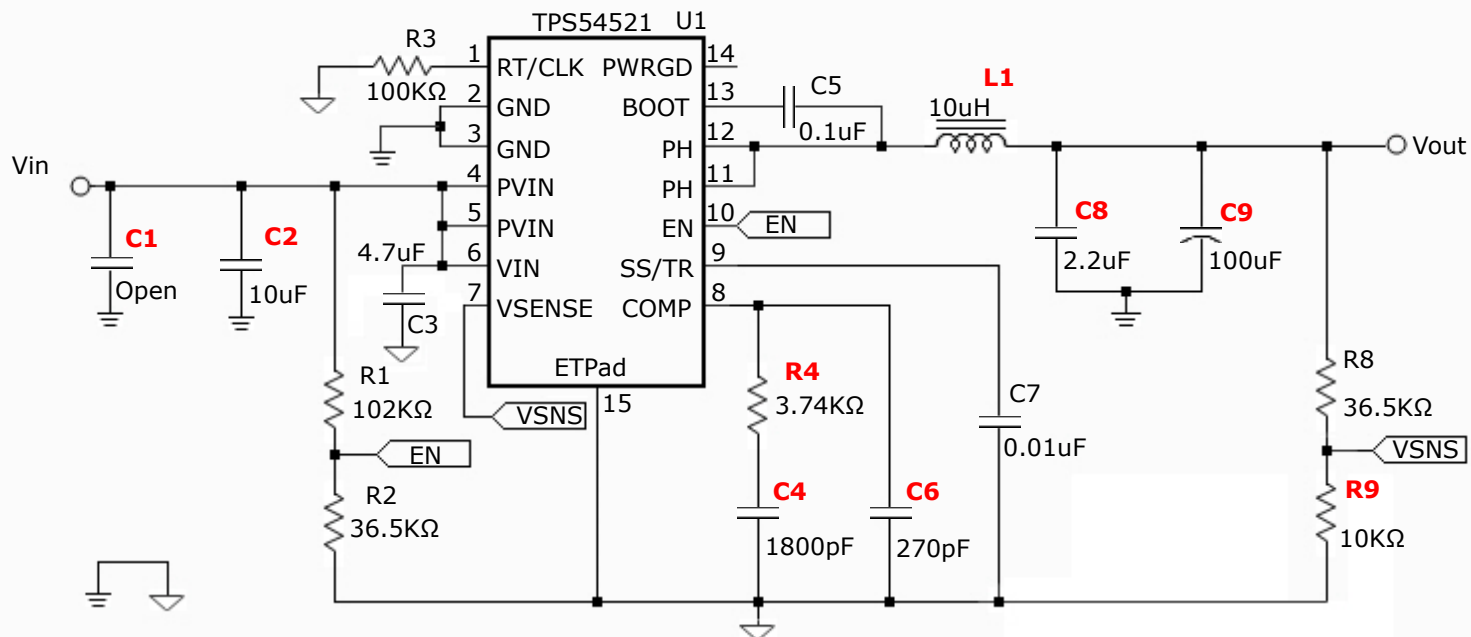
SwitcherPro Design Report

Schematic

Design Name: TPS54521

Part: TPS54521

VinMin: 11V **VinMax:** 12V **Vout:** 3.7V **Iout:** 0.64A



i Please refer to the datasheet section 'Enable and Adjusting Under-Voltage Lockout' for details on UVLO resistor calculations.

SwitcherPro Design Report

Analysis - Main

Design Name: TPS54521

Part: TPS54521

VinMin: 11V **VinMax:** 12V **Vout:** 3.7V **Iout:** 0.64A

| Parameter Units-Symbol | User Input Minimum | User Input Nominal | User Input Maximum | Default Input Minimum | Default Input Nominal | Default Input Maximum | Calculated Minimum | Calculated Nominal | Calculated Maximum |
|--|-----------------------|-----------------------|-----------------------|--------------------------|--------------------------|--------------------------|-----------------------|-----------------------|-----------------------|
| Input Voltage Volts - V | 11.00 | - | 12.00 | - | - | - | - | - | - |
| Input Ripple mVp-p - mVp-p | - | - | - | - | - | 240 | - | - | 36.6 |
| UVLO(Start) Volts - V | - | - | - | - | - | - | - | 4.47 | - |
| UVLO(Stop) Volts - V | - | - | - | - | - | - | - | 3.98 | - |
| Switching Frequency KHz - KHz | - | - | - | - | 495 | - | - | - | - |
| Slow Start ms - ms | - | - | - | - | 3.48 | - | - | - | - |
| Estimated PCB Area mm ² - mm ² | - | - | - | - | - | - | - | 467 | - |
| Max Component Height mm - mm | - | - | - | - | - | 25 | - | - | 12 |

SwitcherPro Design Report

Analysis - Output1

Design Name: TPS54521

Part: TPS54521

VinMin: 11V **VinMax:** 12V **Vout:** 3.7V **Iout:** 0.64A

| Parameter Units-Symbol | User Input Minimum | User Input Nominal | User Input Maximum | Default Input Minimum | Default Input Nominal | Default Input Maximum | Calculated Minimum | Calculated Nominal | Calculated Maximum |
|--|-----------------------|-----------------------|-----------------------|--------------------------|--------------------------|--------------------------|-----------------------|-----------------------|-----------------------|
| Output Voltage Volts - V | - | 3.700 | - | - | - | - | 3.552 | - | 3.892 |
| Output Ripple mVp-p - mVp-p | - | - | - | - | - | 74 | - | - | 97.8 |
| Output Current Amps - A | - | - | 0.641 | 0.001 | - | - | - | - | - |
| Inductor Peak to Peak Current Amps - A | - | - | - | - | - | - | 0.625 | - | 0.652 |
| Current Limit Threshold Amps - A | - | - | - | - | 0.962 | - | - | - | - |
| Gain Margin dB - dB | - | - | - | -10 | - | - | - | -76 | - |
| Phase Margin Deg. - Deg. | - | - | - | 60 | - | - | - | 69 | - |
| Upper FET RDSon mOhms - mΩ | - | - | - | - | - | - | 81 | - | 81 |
| Lower FET RDSon mOhms - mΩ | - | - | - | - | - | - | 66 | - | 66 |
| Duty Cycle % - % | - | - | - | - | - | - | 31.3 | - | 34.2 |
| On Time Min (switch) ns - ns | - | - | - | - | - | - | 527.5 | - | 863.3 |
| Cross Over Frequency KHz - KHz | - | - | - | - | - | - | - | 44 | - |

SwitcherPro Design Report

Stress Results

Design Name: TPS54521

Part: TPS54521

VinMin: 11V **VinMax:** 12V **Vout:** 3.7V **Iout:** 0.64A

| Device | Rated Voltage | Calculated Voltage | Rated Current (RMS) | Calculated Current (RMS) | Error Message | Power | Calculated Max Temp |
|----------------------------|---------------|--------------------|---------------------|--------------------------|---------------|-------|---------------------|
| C2 (High Freq. Input Cap) | 25V | 12.1V | 3.5A | 0.32A | - | 102uW | - |
| C9 (Bulk Output Cap) | 35V | 3.72V | 0.67A | 88mA | - | 1mW | - |
| C8 (High Freq. Output Cap) | 100V | 3.72V | 2.55A | 0.1A | - | 20uW | - |
| L1 (Output Inductor) | - | - | 3.3A | 0.67A | - | 10mW | - |
| U1 (Converter) | 20V | 12.1V | 6.2A | 0.67A | - | 136mW | 27°C |

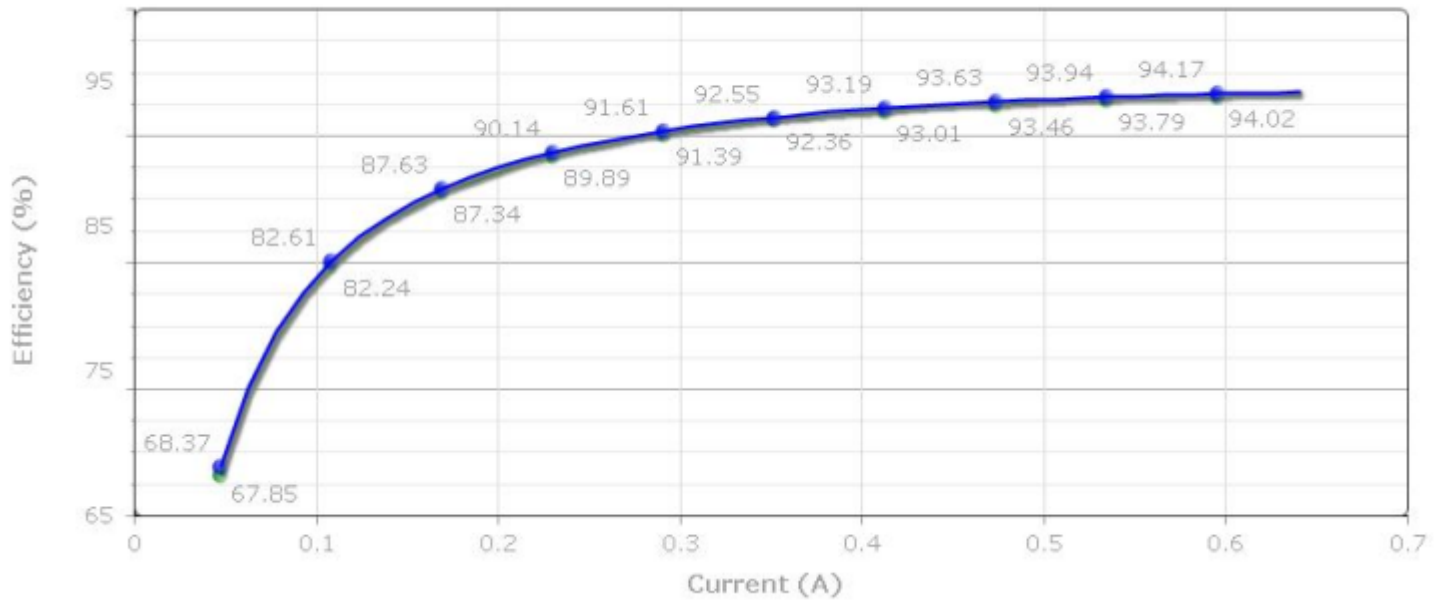
SwitcherPro Design Report

Efficiency

Design Name: TPS54521

Part: TPS54521

VinMin: 11V **VinMax:** 12V **Vout:** 3.7V **Iout:** 0.64A



— Efficiency For Vin Max
— Efficiency For Vin Min

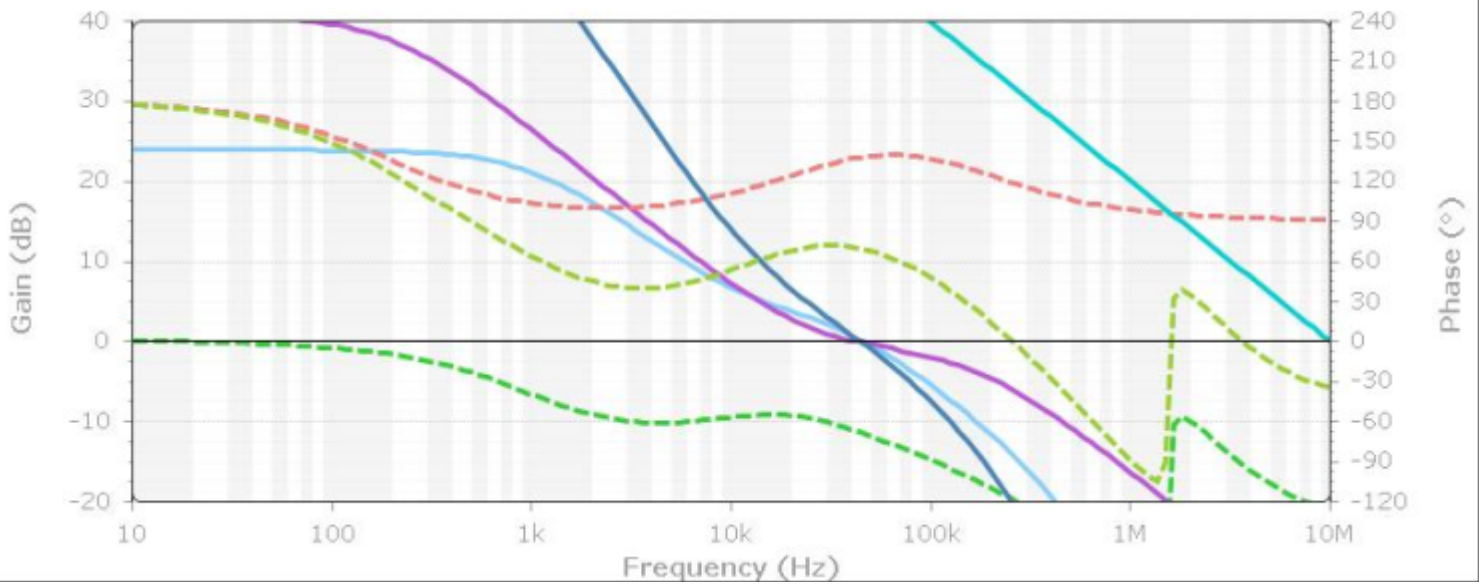
SwitcherPro Design Report

Loop Response

Design Name: TPS54521

Part: TPS54521

VinMin: 11V **VinMax:** 12V **Vout:** 3.7V **Iout:** 0.64A



- Power Stage Gain
- Power Stage Phase
- Compensation Gain
- Compensation Phase
- Error Amp Gain
- Total Gain
- Total Phase

SwitcherPro Design Report

Bill of Materials

Design Name: TPS54521

Part: TPS54521

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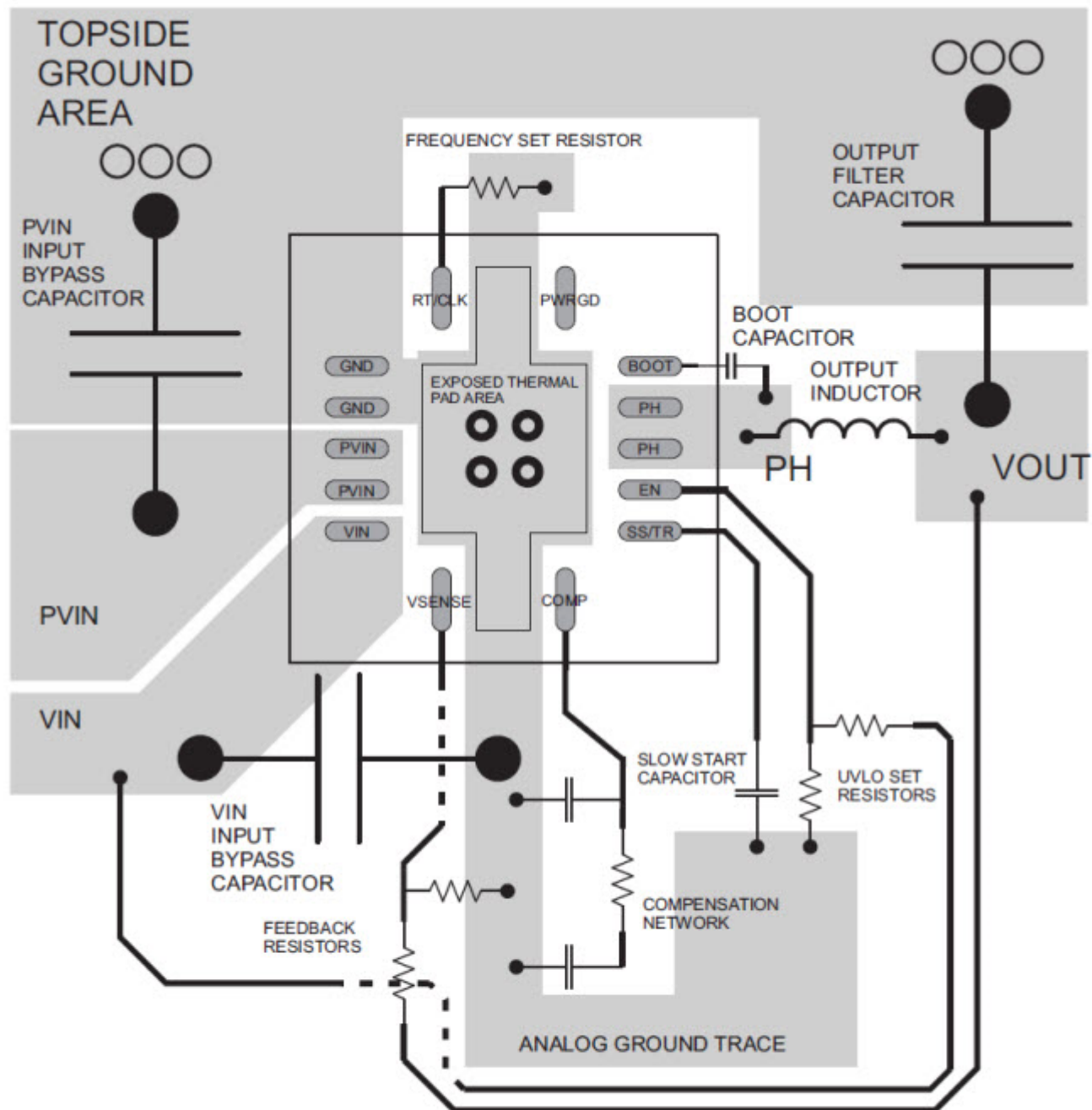
| Name | Quantity | Part Number | Description | Manufacturer | Package | Area(mm ²) | Height(mm) |
|------|----------|--------------------|---|-------------------------|---------------|------------------------|------------|
| C2 | 1 | C3225X7R1E106M | Capacitor, Ceramic, 10uF, 25V, 20% | TDK | C3225 1210 | 8 | 1 |
| C3 | 1 | Standard | Capacitor, Ceramic, 4.7uF, 25V, 10% | Standard | 0805 | 3 | 1 |
| C4 | 1 | Standard | Capacitor, Ceramic, 1800pF, 16V, 10% | Standard | 0603 | 2 | 1 |
| C5 | 1 | Standard | Capacitor, Ceramic, 0.1uF, 16V, 20% | Standard | 0603 | 2 | 1 |
| C6 | 1 | Standard | Capacitor, Ceramic, 270pF, 16V, 10% | Standard | 0603 | 2 | 1 |
| C7 | 1 | Standard | Capacitor, Ceramic, 0.01uF, 16V, 20% | Standard | 0603 | 2 | 1 |
| C8 | 1 | GRM32ER72A225KA35L | Capacitor, Ceramic, 2.2uF, 100V, 10% | Murata Manufacturing | 1210 | 8 | 8 |
| C9 | 1 | EEEF1V101P | Capacitor, Electrolytic, 100uF, 35V, 20% | Panasonic | Radial Can | 86 | 12 |
| L1 | 1 | ELLATV100M | Inductor, 10uH, 3.3A, 23mΩ | Panasonic | ELLATV | 111 | 4 |
| R1 | 1 | Standard | Resistor, SurfaceMount, 102KΩ, 100mW, 1% | Standard | 0603 | 2 | 1 |
| R2 | 1 | Standard | Resistor, SurfaceMount, 36.5KΩ, 100mW, 1% | Standard | 0603 | 2 | 1 |
| R3 | 1 | Standard | Resistor, SurfaceMount, 100KΩ, 100mW, 1% | Standard | 0603 | 2 | 1 |
| R4 | 1 | Standard | Resistor, SurfaceMount, 3.74KΩ, 100mW, 1% | Standard | 0603 | 2 | 1 |
| R8 | 1 | Standard | Resistor, SurfaceMount, 36.5KΩ, 100mW, 1% | Standard | 0603 | 2 | 1 |
| R9 | 1 | Standard | Resistor, SurfaceMount, 10KΩ, 100mW, 1% | Standard | 0603 | 2 | 1 |
| U1 | 1 | TPS54521 | IC, Converter, 14 pins | Texas Instruments, Inc. | QFN-Power PAD | 13 | 1 |

SwitcherPro Design Report Layout

Design Name: TPS54521

Part: TPS54521

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- 0.010 in. Diameter Thermal VIA to Ground Plane
- VIA to Ground Plane
- - - Etch Under Component

SwitcherPro Design Report

Layout Notes

Design Name: TPS54521

Part: TPS54521

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TPS54521

Layout is a critical portion of good power supply design. The top layer should contain the main power traces for VIN, VOUT, and the PH node. The top layer should also have connections for the remaining pins of the TPS54521 and a large top side area filled with ground. The top layer ground area should be connected to the internal ground layer(s) using vias at the input bypass capacitor, the output filter capacitor and directly under the TPS54521 device to provide a thermal path from the exposed thermal pad land to ground. The GND pin should be tied directly to the exposed thermal pad under the IC. For operation at full rated load, the top side ground area together with the internal ground plane, must provide adequate heat dissipating area.

There are several signals paths that conduct fast changing currents or voltages that can interact with stray inductance or parasitic capacitance to generate noise or degrade the power supplies performance. To help eliminate these problems, the PVIN pin should be bypassed to ground with a low ESR ceramic bypass capacitor with X5R or X7R dielectric. Care should be taken to minimize the loop area formed by the bypass capacitor connections, the PVIN pins, and the ground connections. The VIN pin must also be bypassed to ground using a low ESR ceramic capacitor with X5R or X7R dielectric. Make sure to connect this capacitor to the quiet analog ground trace rather than the power ground trace of the PVIN bypass capacitor.

Since the PH connection is the switching node, the output inductor should be located close to the PH pins, and the area of the PCB conductor minimized to prevent excessive capacitive coupling. The output filter capacitor ground should use the same power ground trace as the PVIN input bypass capacitor. Try to minimize this conductor length while maintaining adequate width. The small signal components should be grounded to the analog ground path as shown.

The RT/CLK pin is sensitive to noise so the RT resistor should be located as close as possible to the IC and routed with minimal lengths of trace.