

Simulation of supply voltage bounce at the supply pin of an IC with variation of external bypassing capacitor parameters.

A ferrite component is often added in series with the supply line to provide isolation and to help force the current to be restricted to the local bypass loop. This reduces ground bounce. However supply voltage bounce and Signal Integrity may then be an issue and effective bypassing needs to be considered.

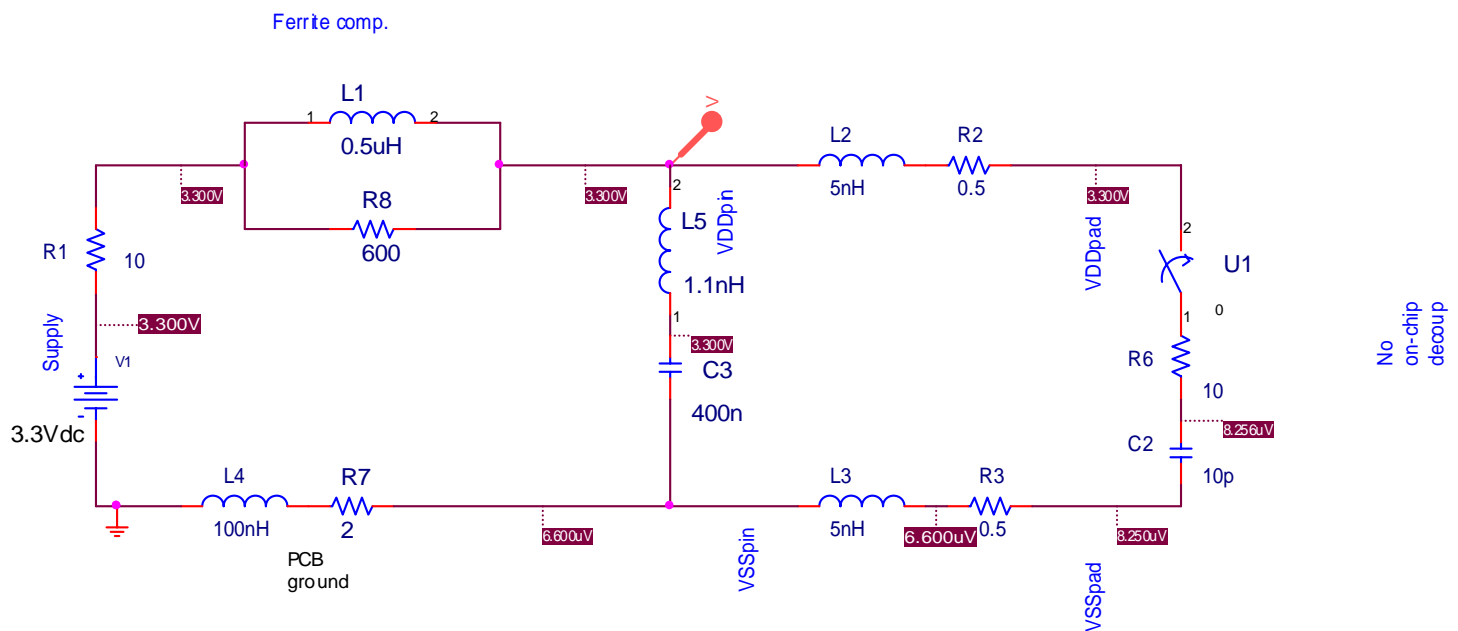
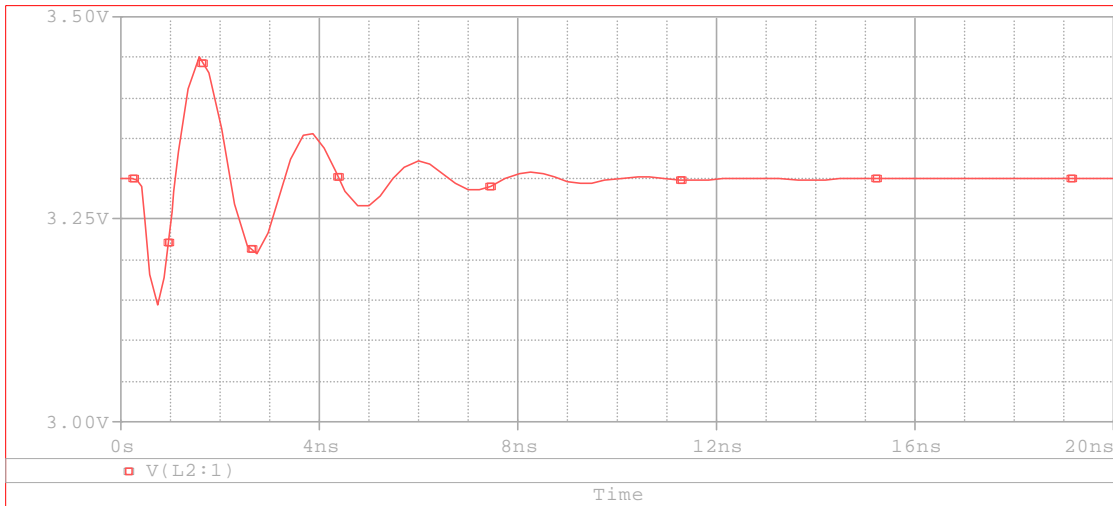


Figure 1. Notional lumped element Spice model of supply bypassing using external local capacitors. With active device (U1, R6, C2) plus package (L2, R2, L3, R3), bypass capacitor (L5, C3) and ferrite (L1, R8).

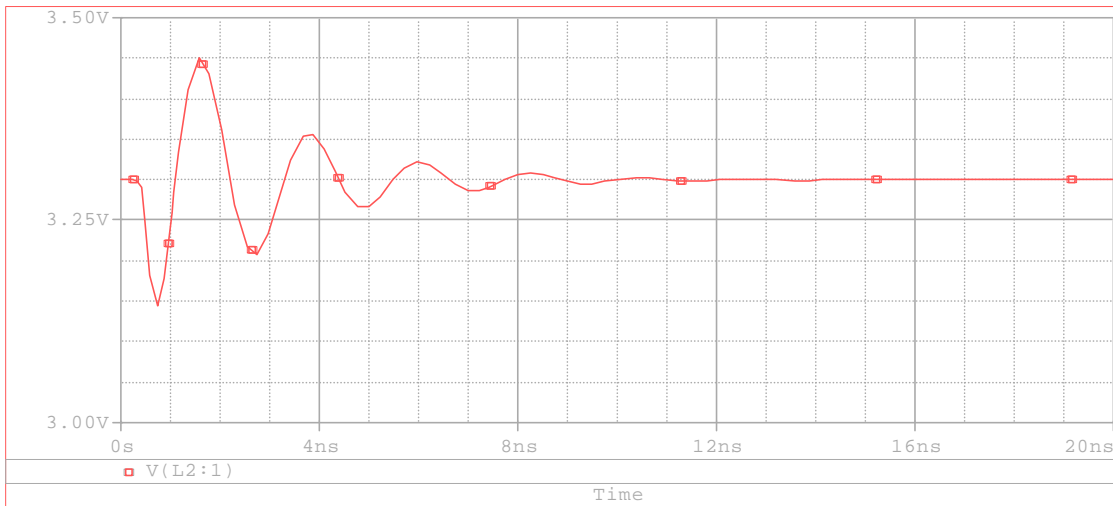
Plot 1 shows the initial voltage bounce when the switch (U1) is closed for the circuit in Figure 1.

Doubling the bypass capacitance value (C3) has no effect as shown in Plot 2.

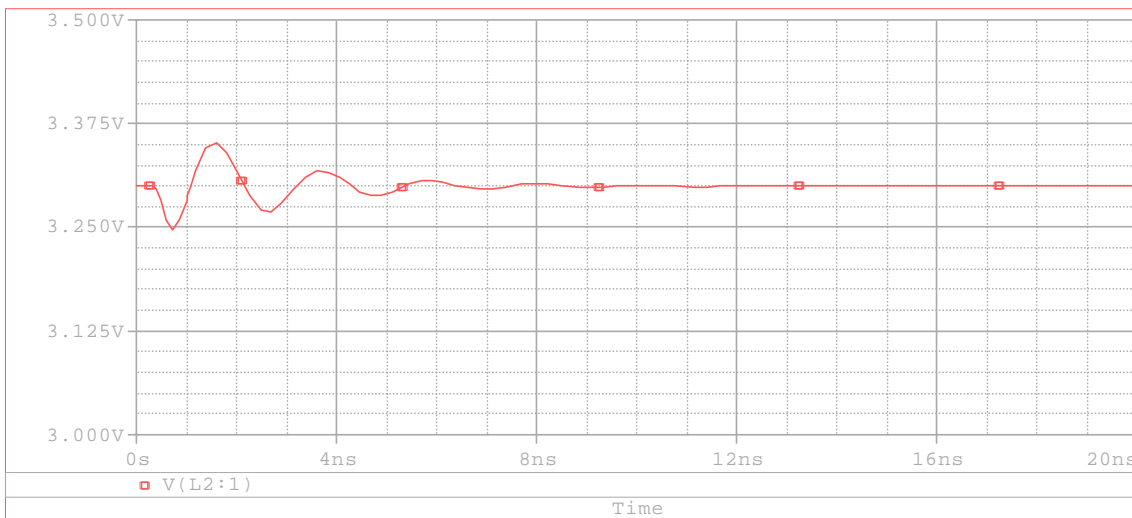
When (L5) the series self-inductance associated with the capacitor, is reduced to a one third value, a substantial change in supply bounce is shown in Plot 3.



Plot 1. Initial simulation of voltage at a 400nF bypass capacitance (C3) (e.g. 4*100nF 0805 capacitors), with 1.1nH total circuit series inductance (L5).



Plot 2. Simulation of voltage at a 800nF bypass capacitance (C3) with 1.1nH total circuit series inductance (L5).



Plot 3. Simulation of voltage at a 400nF bypass capacitance (C3) (e.g. 12*33nF 0805 capacitors), with 0.36nH total circuit series inductance (L5).