

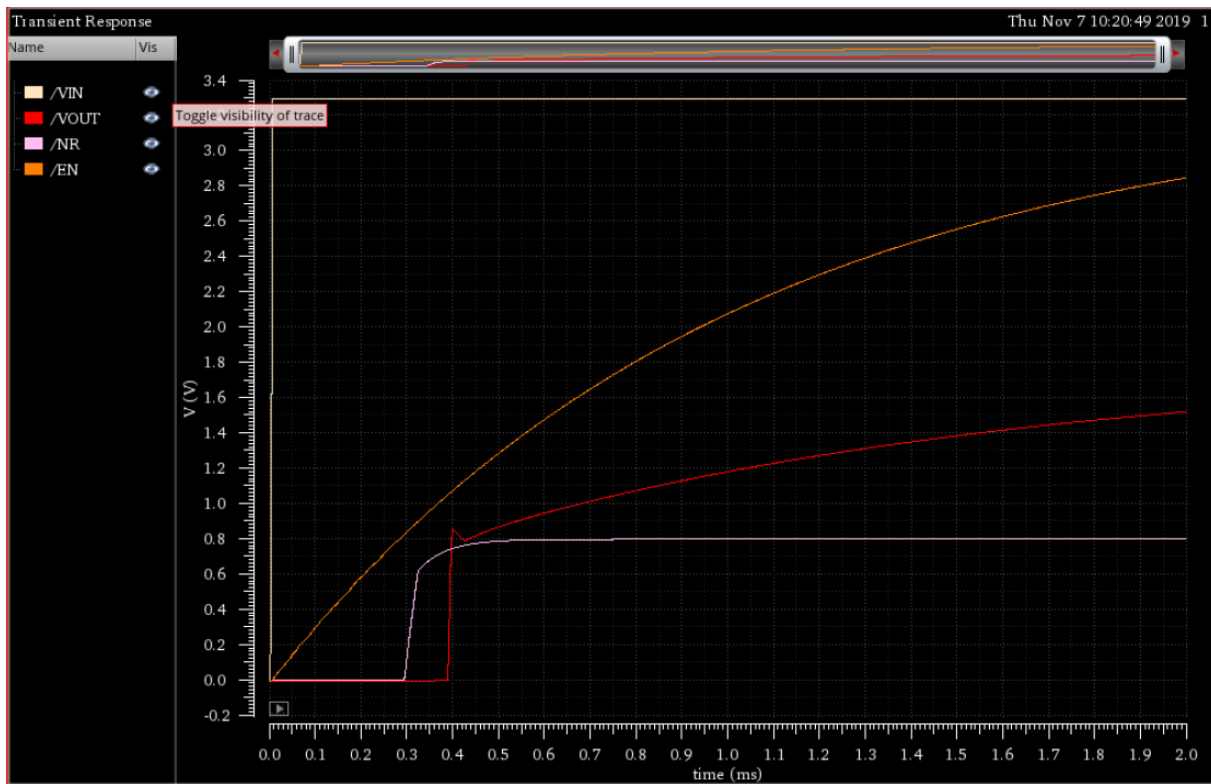
TPS7A80: Common Mode Range of Error Amplifier Causes Non-Monotonic Startup

CMR variation causes some parts to non-monotonic startup

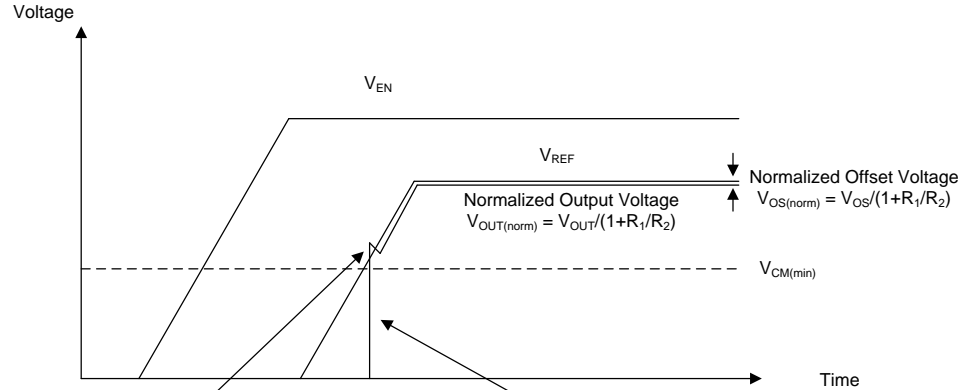
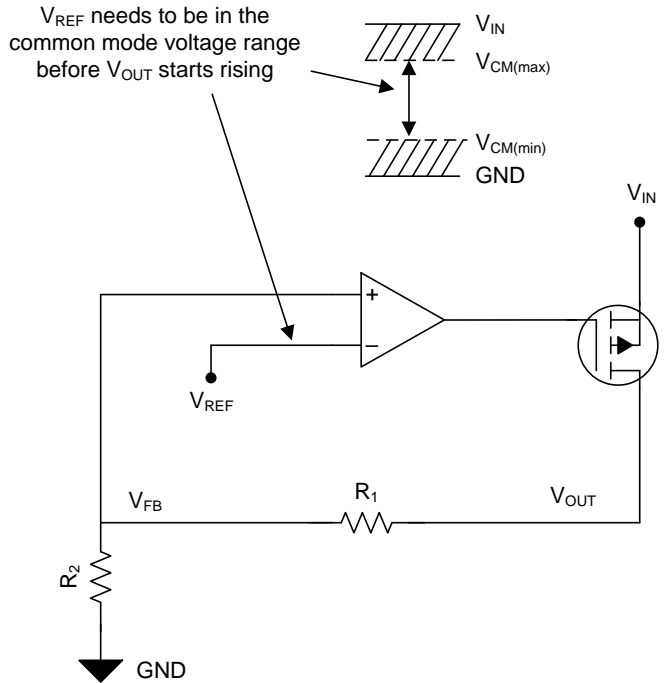


Waveform captured in customer application and can be replicated on the bench

The non-monotonic startup behavior in simulation



Description of Common Mode Range and Effect in LDOs



The large jump in V_{OUT} forces the error amplifier's output to swing to its rail, saturating the output stage and forcing the FET hard-on.

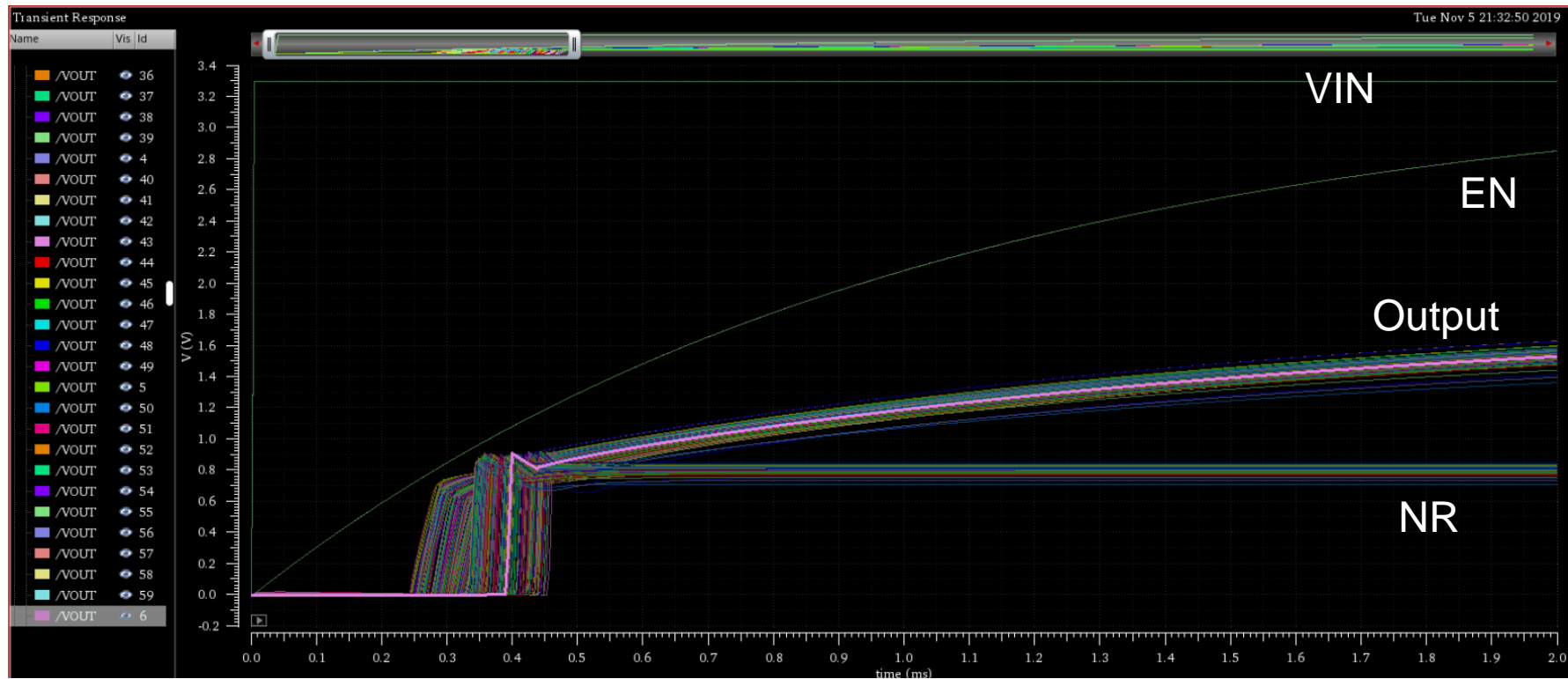
As V_{OUT} is now too high the error amplifier's output swings to its other rail, forcing the FET hard-off. This causes the step in V_{OUT} .

The error amplifier recovers after the step and returns to normal start-up

V_{OUT} jumps up due to error amplifier entering its common mode voltage range

The V_{OUT} step is due to the common mode range requirement of the error amplifier

Simulation shows the variations across corners, process and temp (25,-40,125) -300 test cases



Summary

- The TPS7A80 input pair operates in two modes during startup: the low IGND mode and the high IGND mode and the common-mode voltage range of the LDO is different in the 2 modes.
 - the mode transition can result in the droop visible during startup. The device always starts up in high IGND mode and when it senses the load current is small, it will switch to low IGND mode.
- Simulation results show that across corner, process and temperature (-40,25,125), the highest level that the output reaches before the droop is at 0.9V.