Investigation of Pole-Zero Tracking Frequency Compensation of LDR

MP6-05

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Abstract

Low Dropout Regulator (LDR) is commonly used in most performance application, such as mobiles and blue tooth, due to the low noise, fast transient response. This research mainly focuses on frequency compensation technique such that it increases the stability and improves the response time of the LDR.

The following figure shows that when the output current decreases, the Unit-Gain Frequency ALSO decreases. This causes the LDR cannot operate at a fixed optimum bandwidth.
MOS-ESR Compensation

MOS-ESR Compensation Scheme is a new compensation scheme. The following is the concept if it.
- an NMOSFET in series with the output capacitor replaces the conventional ESR.
- the large drain-source resistance of the NMOSFET forces the ESR zero and the output pole to be the same value.
- the dynamic pole becomes fixed and cancelled for different current level.
- a controlling network is used to control the drain-source resistance to minimize the output ripple voltage when there is a sudden change in output current.

Controlling network to make the drain-source resistance of the MOS-ESR as small as possible when a sudden change in output current occurs.

MOS-ESR to generate a large drain-source resistance
The simulated frequency response of the MOS-ESR compensated LDR shows that when the output current varies, the output pole disappears and acts as a two pole system.

These four figures show the output voltage transient response when the output current drops a decade from 100mA, 10mA, 1mA and 0.1mA. The worst case occurs when the output current drops from 100mA to 10mA in 1us. The ripple voltage is about 70mV which is within the acceptable range 100mV.