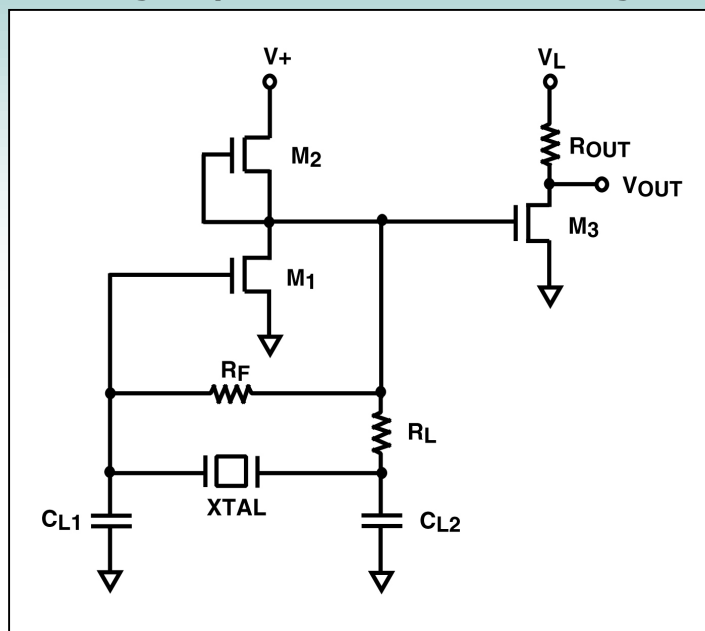


### Ultra Low Voltage Crystal Oscillator Circuit using Active Loads



#### Description

This is an ultra low-voltage crystal oscillator circuit using EPAD MOSFETs with active load and output buffer. This circuit is similar to a standard crystal oscillator circuit used in 5V circuits. However, at low operating voltages, the values of the resistors and the impedance of the inverter MOSFET are selected to optimize oscillation stability and minimize power consumption. An active load device using a depletion mode EPAD MOSFET such as an ALD114804 replaces a passive resistor load at the inverter. Using appropriate component values, a crystal oscillator circuit can be configured to operate in the range of supply voltages from  $V+ = 5V$  to  $V+ = 0.5V$ , with crystal frequencies ranging from 1 MHz to 16 MHz. The active load reduces the contrast in the corresponding power consumption at different supply voltages. At  $V+ = 5V$  the power consumed by the oscillator circuit is 346  $\mu W$  whereas at  $V+ = 0.5V$ , the same circuit consumes a mere 32  $\mu W$  while oscillating at the same selected crystal frequency. At higher crystal frequencies in excess of 4 MHz, a dual EPAD MOSFET can be connected in parallel to provide more low voltage drive current necessary.

#### Recommended Components

EPAD MOSFETs: M1, M3 [ALD110800](#) (either single or dual MOSFET connected in parallel);

Active Load: M2  $\frac{1}{2}$  [ALD114904](#)

$CL1=10pF$ ;  $CL2 = 22pF$ ;  $R_F= 5.6MOhm$ ;  $R_L= 6 Ohm$ ;  $R_{OUT} = 2.4KOhm$

#### Other Related Circuit Ideas

[Schematic no. fet\\_11120.0](#) Ultra Low Voltage Micropower Crystal Oscillator Circuit