$Cres1 := 1000 \cdot 10^{-12}$

$Cres2 := 1000 \cdot 10^{-12}$

$Cres3 := 22000 \cdot 10^{-12}$

$CDV1 := 100 \cdot 10^{-12}$

$CDV2 := 470 \cdot 10^{-12}$

$Vdd := 5$ Supply Voltage

$Vss := 0$ Ground

$RSER := 18$

$RAD := 3$

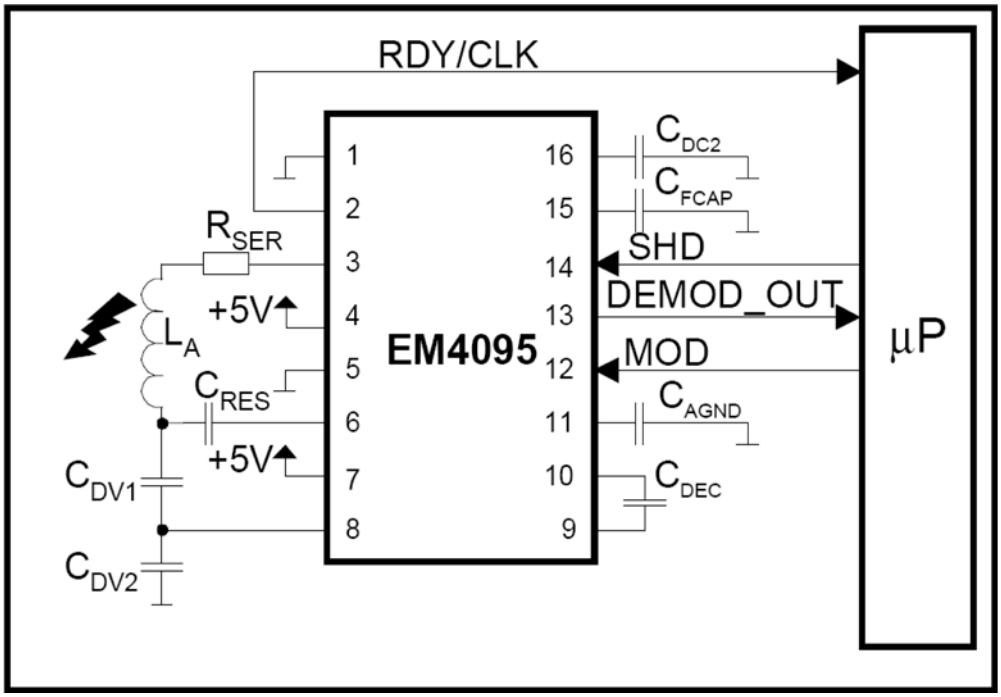
$IDDon := 0.25$

$WDmil := 0.010$ in

$ODmil := 0.011$ in

$RW := \frac{106}{1000}\frac{\Omega}{ft}$

30 AWG Magnet Wire, coated



$C_{Vdd} := 100nf$ $C_{DVdd} := 100nf$ $C_{DC2} := 6.8nf$ $C_{FCAP} := 10nf$ $C_{DEC} := 100nf$ $C_{AGND} := 100..220nf$

$WD := WDmil \cdot 2.54$ $OD := ODmil \cdot 2.54$

$WD = 0.025$ cm

$OD = 0.028$ cm

$a := 3.6$ cm $Nt := 20$ turns

$b := OD \cdot Nt$

$b = 0.559$ cm

$ri := a - \frac{b}{2}$ $ro := a + \frac{b}{2}$

$ri = 3.3$ cm

$ro = 3.9$ cm

$Length := \frac{\pi \cdot \left(ro^2 - ri^2\right)}{OD} \cdot \frac{1}{100}$

$Length = 4.524$ meter

$Resistance := Length \cdot \frac{1000}{25.4 \cdot 12} \cdot RW$

$Resistance = 1.573$ Ω

$Lspirol := \frac{0.3937 \cdot (a \cdot Nt)^2}{(8 \cdot a) + (11 \cdot b)} \cdot 10^{-6}$

$Lspirol = 58 \times 10^{-6}$ H

$Cres := Cres1 + Cres2 + Cres3$

$Cres = 24 \times 10^{-9}$ F

$Co := Cres + \frac{CDV1 \cdot CDV2}{CDV1 + CDV2}$

$Co = 24 \times 10^{-9}$

$f_0 := \frac{1}{2 \cdot \pi \cdot \sqrt{Lspirol \cdot Co}}$ Operating Frequency $f_0 = 134202$

$Q := \frac{2 \cdot \pi \cdot f_0 \cdot Lspirol}{Resistance}$ Theoretical Q $Q = 31$

$IANT := \frac{4}{\pi} \cdot \frac{Vdd - Vss}{Resistance + RSER + 2 \cdot RAD}$ Antenna coil current (<250mA) $IANT = 0.249$

$IRMS := \frac{IANT}{\sqrt{2}}$ RMS current (A) $IRMS = 0.176$

$VANTpp := \frac{IANT}{\pi \cdot f_0 \cdot Co}$ Peak to peak Antenna Voltage $VANTpp = 24.518$

$VDMOD\_INpp := VANTpp \cdot \frac{CDV1}{CDV1 + CDV2}$ $VDMOD\_INpp = 4.301$

$P := 2 \cdot IRMS^2 \cdot RAD + IDDon \cdot (Vdd - Vss)$ $P = 1.436$

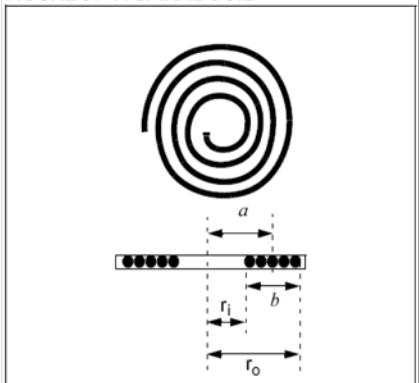
INDUCTANCE OF SPIRAL WOUND COIL WITH SINGLE LAYER

The inductance of a spiral inductor is calculated by:

EQUATION 25:

$$L = \frac{(0.3937)(aN)^2}{8a + 11b} \quad (\mu H)$$

FIGURE 9: A SPIRAL COIL



where:

$a = (r_i + r_o)/2$

$b = r_o - r_i$

r_i = Inner radius of the spiral

r_o = Outer radius of the spiral

Note: All dimensions are in cm