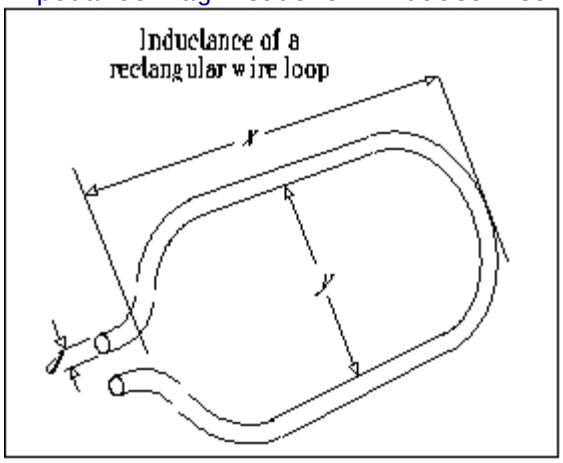
INDUCTANCE OF RECTANGULAR LOOPS file: rectangl.mcd

Formulas included in this spreadsheet:

Inductance of rectangular wire loop.	LRECT()
Impedance magnitude of inductor at one frequency.	XLF()
Impedance magnitude of inductor to rising edge.	XLR()



Variables used:

d Diameter of wire (in.) $D := 20.1 \cdot 10^{-3}$

x Length of wire loop (in.) $X := 1$

y Breadth of wire loop (in.) $Y := 1$

Inductance of wire loop (H):

$$LRECT(d, x, y) := 10.16 \cdot 10^{-9} \cdot \left(x \cdot \ln\left(\frac{2 \cdot y}{d}\right) + y \cdot \ln\left(\frac{2 \cdot x}{d}\right) \right)$$

$$LRECT(D, X, Y) = 9.348 \cdot 10^{-8}$$

A loop of 24-gauge wire 1 in.\253 has about 100 nH of inductance.

Changing the wire diameter from AWG 30 to AWG 10 makes little difference. The log function is very insensitive to wire size.

If your loop consists of different-sized conductors, use the diameter of the smallest one.

Impedance magnitude of inductor at frequency f (W):

l Inductance (H) $L := LRECT(D, X, Y)$

f Frequency (Hz) $F := 100 \cdot 10^{6}$

$$XLF(l, f) := 2 \cdot \pi \cdot f \cdot l$$

$$XLF(L, F) = 58.733$$

The impedance, at 100 MHz, of a 100-nH inductor is 62 W.

Impedance magnitude of inductor as seen by rising edge (W):

l Inductance (H) (as defined above)

tr 10-90% rise time (s) $TR := 5 \cdot 10^{-9}$

$$XLT(l, tr) := \frac{\pi \cdot l}{tr}$$

$$XLT(L, TR) = 58.733$$

The impedance as seen by a 5ns rising edge of a 100nH inductor is 62 W.