Z893X3 PLL Loop Filter

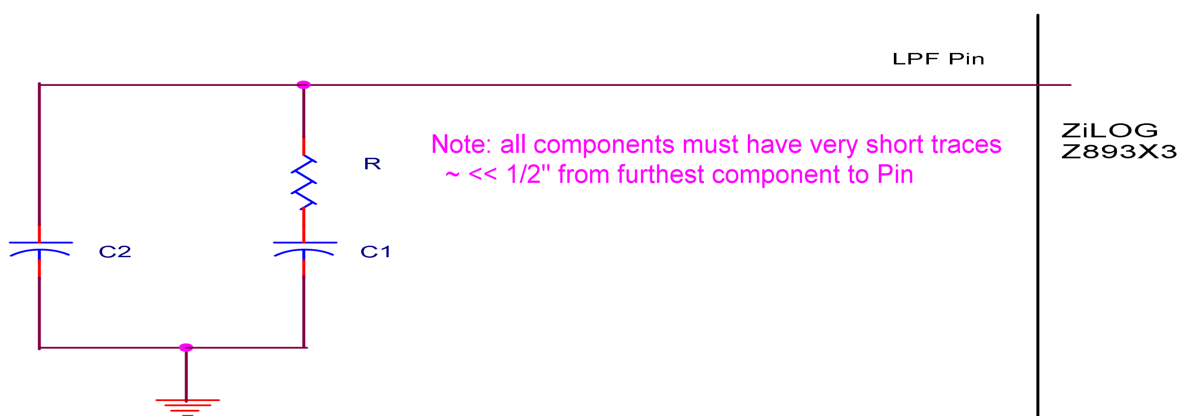
The ZiLOG Clock Frequency Synthesizer Phase Lock Loop Filter for the Z893X3.

The ZiLOG PLL synthesizer is very forgiving. In most circumstances, the following table should suffice using standard component values.

Desired Frequency	R	C1	C2
20 MHz	8870	0.1 uf	8.2 nf
10 Mhz	4120	0.22 uf	18 nf
5 MHz	2000	0.47 uf	39 nf

The following equations describe the behavior of the PLL. In the example, a desired output frequency of 20 MHz is derived from a 32 kHz crystal. A desired damping characteristic of "1" is used. A resistor is used to measure Ip at the LPF pin to VDD. From a gain radians plot, Kv is determined as 56.6 megaradians. It is assumed that the nominal voltage is 5 volts. Settling time is 3 ms in the example on page 2.

Primary, secondary time constants and natural frequency are calculated, yielding C1,C2 and R.



Legend

Yellow	User Inputs
Drk Blue	Intermediate Values
Pink	Measured Data
Green	Output Circuit Values
LT Blue	Derivation Information
Lt Brown	Topic Indexs

OT001100-DSP1298

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Constants $ms := 1 \cdot 10^{-3}$ $Meg := 1 \cdot 10^{6}$ $K := 1000$

	Desired Clock Frequency	Crystal frequency	Damping
Input Assumptions	$Fosc := 20 \cdot Meg$	$Fxtal := 32.768 \cdot K$	$\zeta := 1$

Settling_time

User Input $t := 3\ ms$

	Supply Voltage	Resistor used	Measured Voltage at LPF Pin
Values used to calculate Ip (Reference Current)	$VDD := 5$	$Req := 68493$	$LPF := 2.5$

Calculate Ip current output $Ip := \frac{VDD - LPF}{Req}$ Ip Value $Ip = 3.65 \cdot 10^{-5}$

Multiples of Reference Xtal $N := \frac{Fosc}{Fxtal}$ $N = 610.352$ $Kn := \frac{1}{N}$ $Kn = 1.638 \cdot 10^{-3}$

From Gain Plot $Kv := 56.55 \cdot 10^{6}$

Assumes output is 0 to 5 volt with - 2π to 2π input

Kp $Kp := \frac{VDD}{4 \cdot \pi}$ $Kp = 0.398$

Natural Frequency $\omega n := \frac{(2 \cdot \pi)}{t}$ $\omega n = 2.094 \cdot 10^{3}$

Primary Time Constant $T1 := \frac{(Kp \cdot Kv \cdot Kn)}{\omega n^{2}}$ $T1 = 8.404 \cdot 10^{-3}$

Secondary Time Constant $T2 := \frac{(2 \cdot \zeta)}{\omega n}$ $T2 = 9.549 \cdot 10^{-4}$

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Since T1 = (Req + R1)*C1 -> = (Req * C1) + (R1*C1) = (Req * C1) +T2

$C1 := \frac{-(T2 - T1)}{Req}$ $C1 = 1.088 \cdot 10^{-7}$

Since T2 = R1 * C1 -> R1 = T2 / C1

$R1 := \frac{T2}{C1}$ $R1 = 8.78 \cdot 10^{3}$

Check T1 $(Req + R1) \cdot C1 = 8.404 \cdot 10^{-3}$ $T1 = 8.404 \cdot 10^{-3}$

Check T2 $R1 \cdot C1 = 9.549 \cdot 10^{-4}$ $T2 = 9.549 \cdot 10^{-4}$

For Stability: T3 < 0.1 * T2; so C2 < 0.1 C1

$C2 := .08 \cdot C1$ $C2 = 8.701 \cdot 10^{-9}$