Keywords: Faster Lock Time, Tuner

APPLICATION NOTE 6448

TUNER CONFIGURATION FOR FASTER LOCK TIME

Abstract: This application note describes the configuration for faster lock time for the MAX2112/MAX2120/MAX2121 direct-conversion satellite tuners.

Overview

The MAX2112/MAX2120/MAX2121 VCO autoselect (VAS) circuits are hardwired for a clock period of $57340/f_{XTAL}$. Given MAX2120 and f_{XTAL} = 4MHz, this translates to a VAS clock period of 14.34ms. If the VAS must transition from the lowest to highest frequency VCO, the lock time would be approximately 14.34ms x 23 bands, or 330ms. This can be unacceptably slow for many applications. This number can be cut down to 172ms by simply programming the VCO[4:0] bits of Register 07 to 10011, which seeds the VAS operation from nearly the center of the VCO range.

Configuration for Faster Lock Time

For the fastest possible lock time, the VCO[4:0] bits can be seeded according to the following algorithm, given a desired LO frequency (f_{LO}):

1. Enable VAS mode by programming the VAS bit to 1 (Reg 07).
2. Choose VCO divider mode (bit D24 of Reg 06) and calculate f_{VCO}:

    If $f_{LO} \leq 1125MHz$:

        Program bit D24 (Reg 06) to 1 (divide-by-4 mode)

        $f_{VCO} = f_{LO} \times 4$

    Else:

        D24 = 0 (divide-by-2 mode)

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$f_{VCO} = f_{LO} \times 2$

3. Choose VCO seed value (VCO[4:0]) based on lookup table (see Table 1):

   If $f_{VCO} < f_{2\_3}$, then VCO[4:0] = 01010 (VCO2).
   Else, if $f_{VCO} < f_{3\_4}$, then VCO[4:0] = 01011 (VCO3).
   Else, if $f_{VCO} < f_{4\_5}$, then VCO[4:0] = 01100 (VCO4).
   . . .
   Else, if $f_{VCO} < f_{21\_22}$, then VCO[4:0] = 11101 (VCO21).
   Else, if $f_{VCO} < f_{22\_23}$, then VCO[4:0] = 11110 (VCO22).
   Else VCO[4:0] = 11111 (VCO23).

4. Calculate and load N counter value (and F counter value for MAX2112/MAX2120/MAX2121).
   - For the MAX2112, the F counter LSB word must be loaded last to initiate a new VAS sequence.
   - For the MAX2120/MAX2121, the N counter LSB word must be loaded last to initiate a new VAS sequence.

This algorithm seeds the VCO to within ±2 VCOs and thus guarantees a lock time of < 14.34ms × 2 < 30ms for the MAX2112/MAX2120/MAX2121 using a 4MHz XTAL. The MAX2112/MAX2120/MAX2121's lock time is faster by the ratio of f_{XTAL}/4MHz.

Table 1. Lookup Table for VCO Seed Values

VCO Transition Frequency (MHz)		
	MAX2112	**MAX2120/2121**
f_{0_1} =	2135	2101
f_{1_2} =	2200	2165
f_{2_3} =	2275	2249
f_{3_4} =	2355	2313
f_{4_5} =	2445	2396
f_{5_6} =	2545	2491
f_{6_7} =	2660	2598
f_{7_8} =	2760	2707
f_{8_9} =	2770	2730
f_{9_10} =	2865	2816
f_{10_11} =	2965	2911
f_{11_12} =	3070	3013
f_{12_13} =	3190	3126
f_{13_14} =	3330	3256
f_{14_15} =	3480	3402
f_{15_16} =	3640	3572
f_{16_17} =	3685	3633
f_{17_18} =	3795	3737
f_{18_19} =	3915	3848
f_{19_20} =	4035	3965
f_{20_21}=	4170	4092
f_{21_22} =	4325	4239
f_{22_23}=	4500	4401

Note: Since the minimum required VCO frequency is 2250MHz (1125MHz x 2), the algorithm starts with "if $f_{VCO} < f_{2\_3}$," which is close to 2250MHz.

Related Parts		
MAX2112	Complete, Direct-Conversion Tuner for DVB-S2 Applications	Free Samples
MAX2120	Complete, Direct-Conversion Tuner for DVB-S and Free-to-Air Applications	Free Samples
MAX2121	Complete Direct-Conversion L-Band Tuner	Free Samples

More Information
For Technical Support: https://www.maximintegrated.com/en/support
For Samples: https://www.maximintegrated.com/en/samples
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