

How to Bypass VCO Calibration for the ADF4355-2

By Robert Brennan

VCO CALIBRATION

Bypass VCO Calibration for Faster Lock Times

For any given output frequency, the ADF4355-2 uses a certain voltage controlled oscillator (VCO) core, band, and bias code. These three settings are selected automatically during the VCO automatic calibration (AUTOCAL). The settings are read from the ADF4355-2 and stored in a lookup table. Using this lookup table to bypass the AUTOCAL routine dramatically decreases the total lock time when changing the frequency. For example, lock times of less than 30 μ s are possible with a 59.7 kHz loop bandwidth. Figure 1 shows an example of a suitable loop filter.

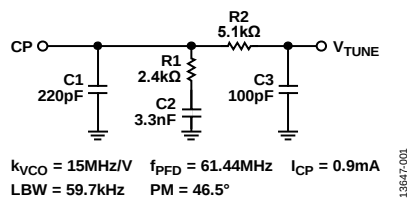


Figure 1. Example Loop Filter with a 59.7 kHz Loop Bandwidth

Because each ADF4355-2 chip is unique, a new lookup table must be generated for every chip.

VCO Readback Procedure

The VCO readback procedure is as follows:

- Load all registers to lock to the desired frequency.
 - Ensure VCO read is set to VCO core and band (R10, DB[28:26] = 0b001) (see Figure 5).
 - Ensure VCO readback is set to VCO calibration complete (R7, DB[14:12] = 0b110) (see Figure 4).
 - Ensure MUXOUT is set to VCO readback (R4, DB[29:27] = 0b111) (see Figure 3).
 - Ensure AUTOCAL is enabled (R0, DB21 = 0b1); see the ADF4355-2 data sheet for the R0 register map.
- Wait until MUXOUT outputs a logic high (VCO calibration complete).
- Load R7 with VCO readback set to VCO readback (R7, DB[14:12] = 0b111).
- Pulse SPI CLK while LE is kept high. The data outputs on MUXOUT. Extract the data as shown in Figure 2.
- Load R10 with VCO read set to VCO bias code (R10, DB[28:26] = 0b011).
- Repeat Step 4 for bias data.

- Repeat Step 1 through Step 6 to build a lookup table for all desired frequencies. For Step 1, writing R10, R7, R2, R1, and R0 is only required after the first iteration. R2 and R1 are optional if they have not changed.

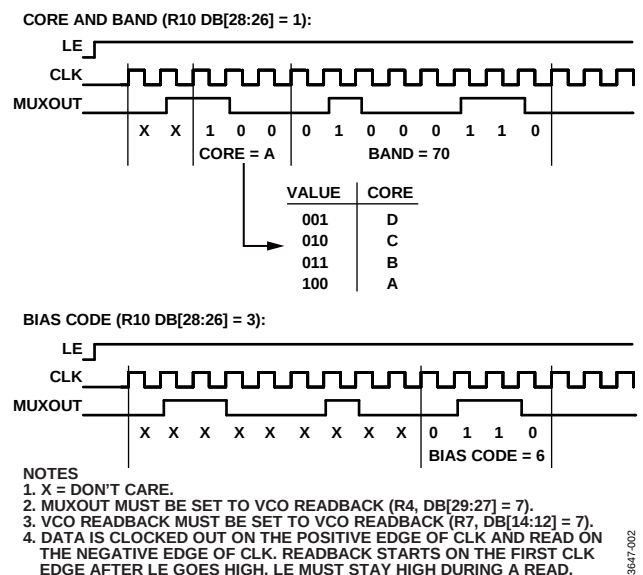


Figure 2. VCO Readback

Bypass Automatic Calibration (AUTOCAL) to Manually Select VCO and Lock

If the required VCO core, band, and bias code for a desired frequency is known (for example, in a lookup table), bypass the VCO calibration routine and set the VCO data manually with the following steps:

- Load R0 with AUTOCAL disabled (R0, DB21 = 0b0). This step is optional if AUTOCAL is already disabled.
- Load R10 with VCO write set to VCO core and band (R10, DB[31:29] = 0b001).
- Load R11 with the desired VCO core, VCO band, and VCO bias setting as defined in Figure 6. Note that the VCO core bits are different for read and write.
- Load R10 with VCO write set to VCO bias code (R10, DB[31:29] = 0b011).
- Reload R11 with the same value as in Step 3.
- Lock to the desired frequency by programming R2, R1, and R0, respectively.

Expanded ADF4355-2 Register Maps

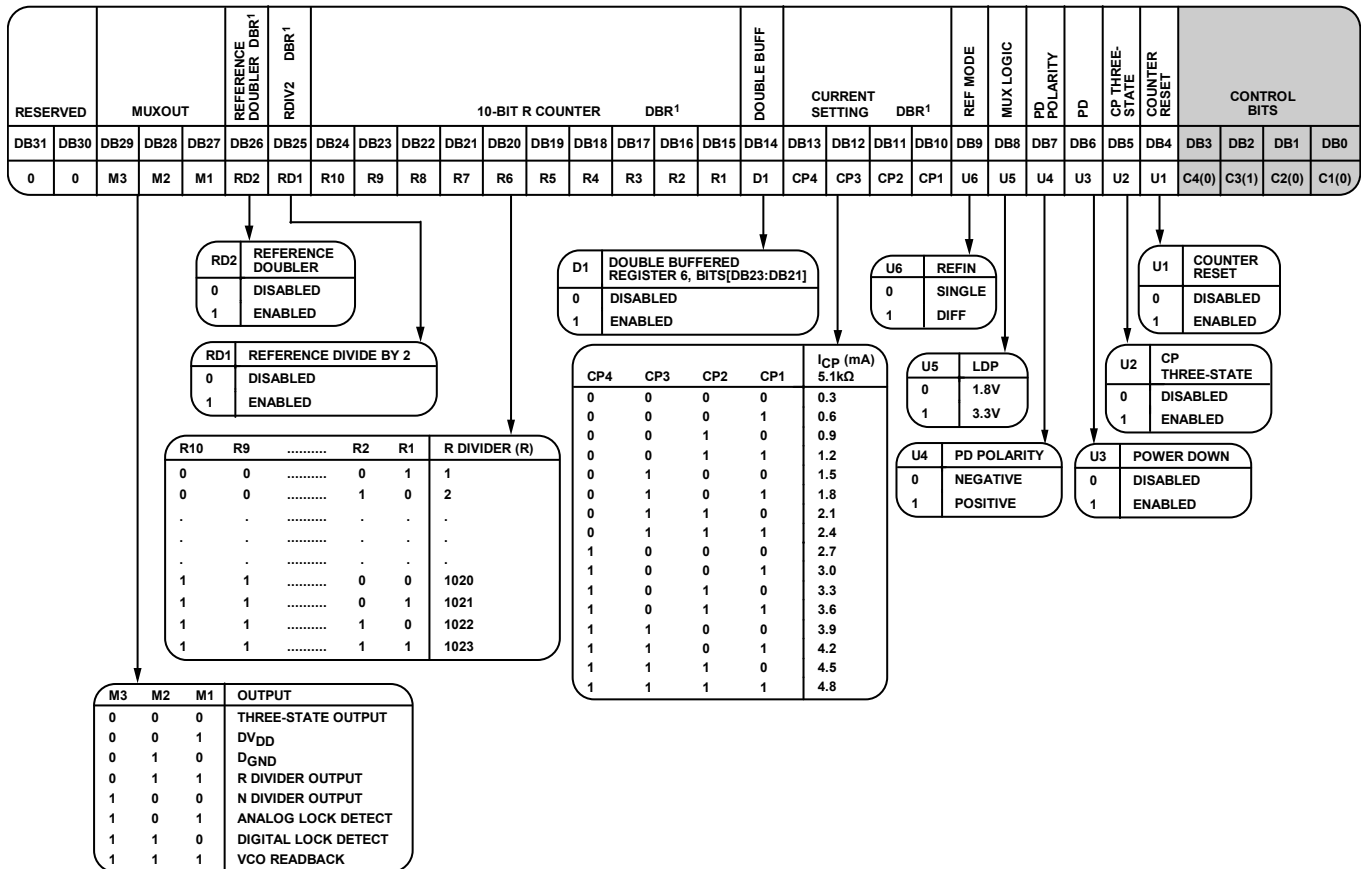
¹DBR = DOUBLE BUFFERED REGISTER—BUFFERED BY THE WRITE TO REGISTER 0.

Figure 3. Register 4

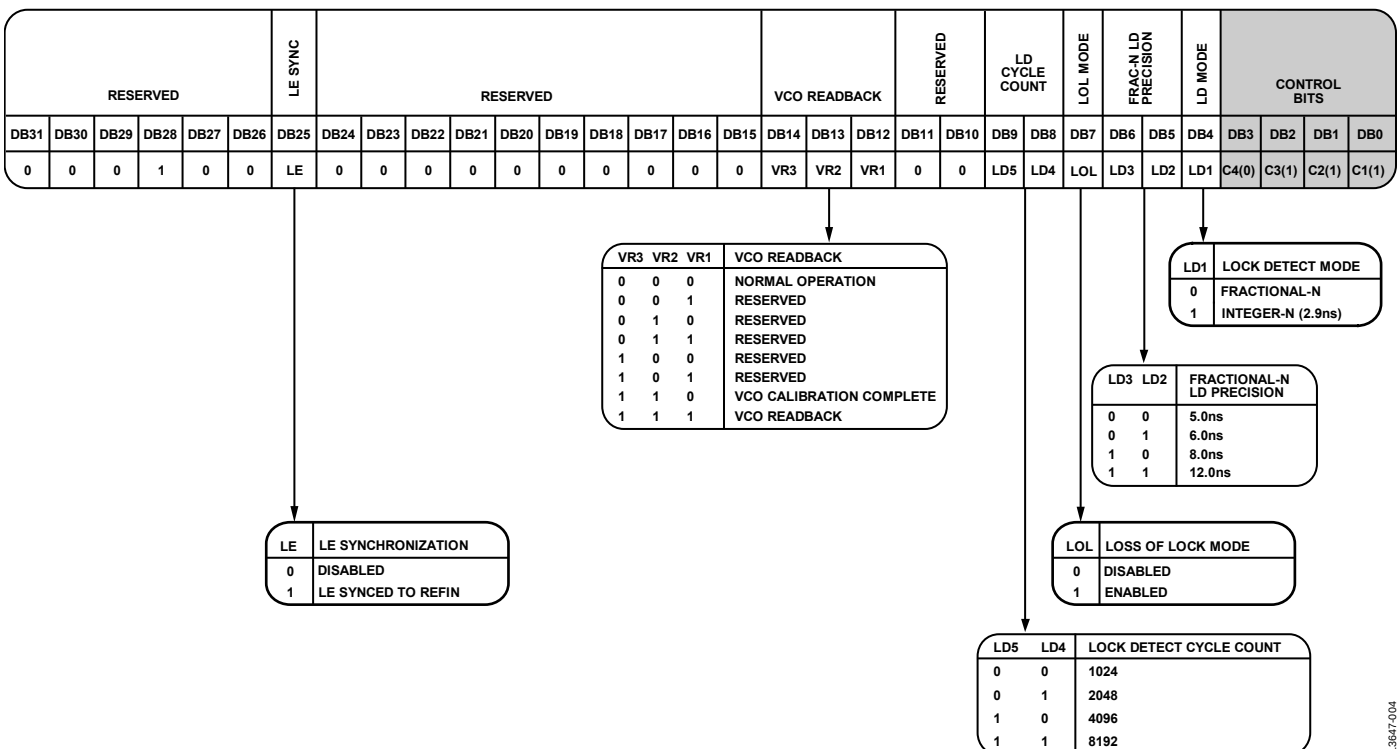


Figure 4. Register 7

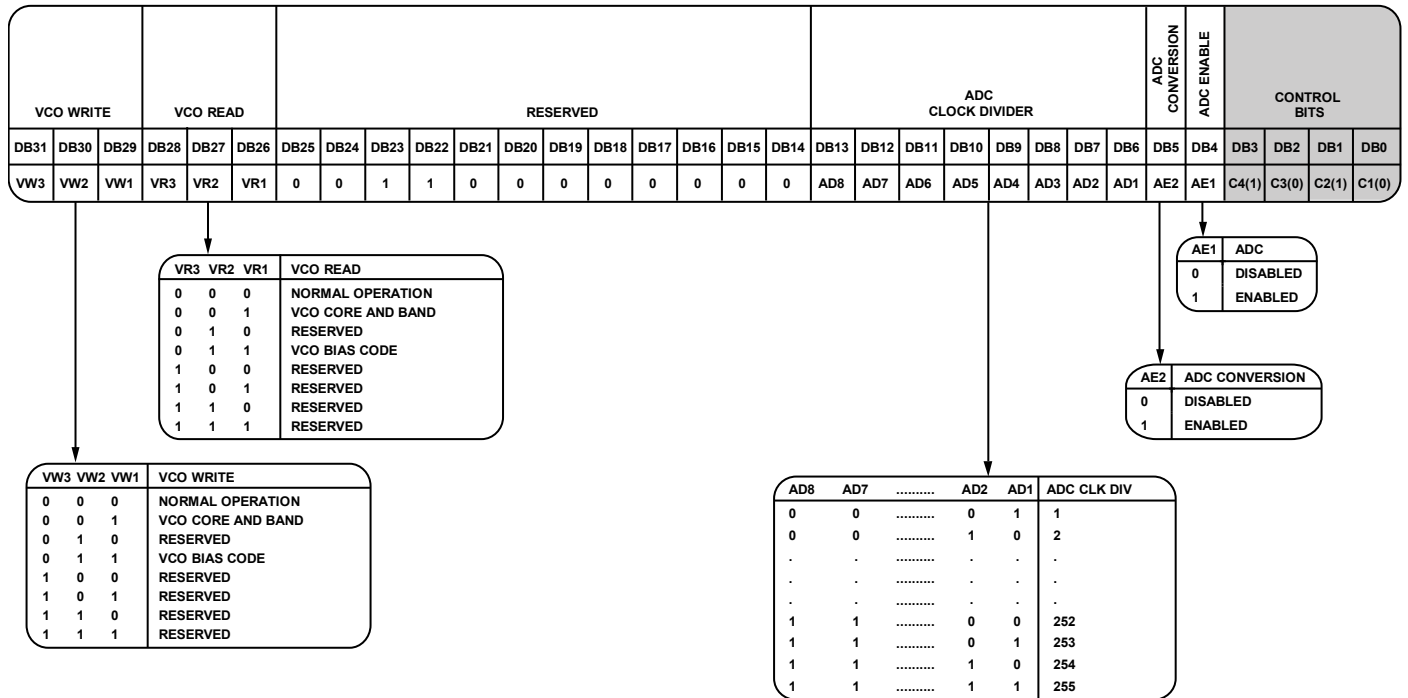


Figure 5. Register 10

13847-005

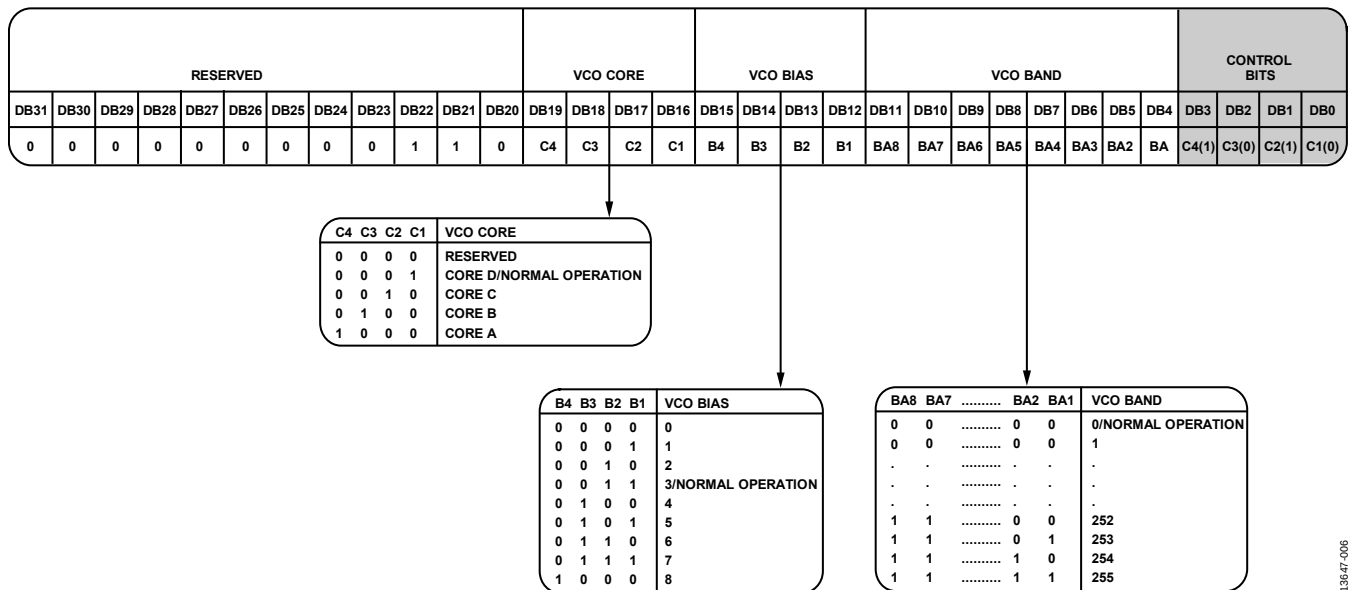


Figure 6. Register 11

13847-005

Read Timing Characteristics

Table 1. Read Timing

Parameter	Limit at T_{MIN} to T_{MAX}	Unit	Description
t_1	15	ns min	LE high to CLK high
t_2	15	ns min	CLK high to DATA ready
t_3	25	ns min	CLK high duration
t_4	25	ns min	CLK low duration
t_5	10	ns min	CLK high to LE low (next write)

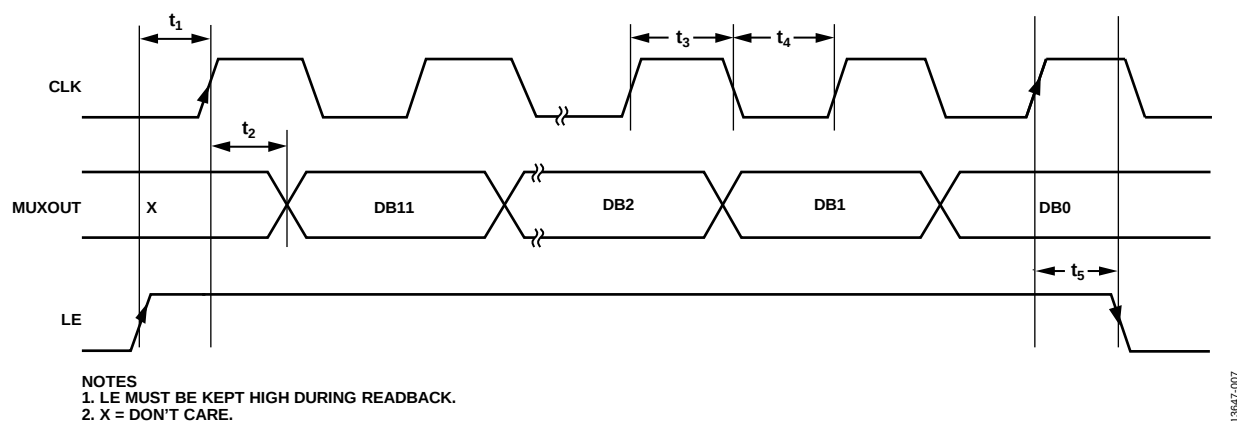
Read Timing Diagram

Figure 7. Read Timing Diagram