


# 1500-3000 MHz Frequency Synthesizer

Low Phase Noise in a Lower Cost Package



## Features

- Low Phase Noise: -104 dBc/Hz (100 kHz offset)
- Internal Reference Oscillator (External Reference Option No Extra Charge)
- No User Programming Required
- Integrated Microcontroller Look-up Table
- EAR99, RoHS Compliant 
- DEMO Board available upon request

API Technologies' Model LCFS1049 frequency synthesizer combines a monolithic integer-n microwave synthesizer, a reference oscillator and a microcontroller to provide an economical frequency source solution. Complex serial register programming is not required. A built-in lookup table in the microcontroller allows for simplified frequency programming with a dual 8-bit binary frequency selection word. Either parallel or serial programming can be accommodated. A Demo or Evaluation board can be ordered as an LCFS1049-DEMO. The LCFS1049 synthesizer is RoHS compliant, however there is a lead based solder used in the construction of the Demo Board (if the DEMO Board is requested).

## Technical Specifications

Parameter	Typical	Min/Max
Frequency Range	1500 to 3000 MHz	1500 to 3000 MHz
Output Power	+13 dBm	-
Internal Input Reference Frequency	40 MHz	-
Step Size	5 MHz	-
SSB Phase Noise	-86 dBc/Hz @ 1 kHz -86 dBc/Hz @ 10 kHz -104 dBc/Hz @ 100 kHz -133 dBc/Hz @ 1 MHz -156 dBc/Hz @ 10 MHz	-
Digital Lock Indicator	3.3 volt logic	-
Locking Speed	200 $\mu$ sec	-
Spurious	-40 dBc	-
Harmonics	-20 dBc	-
Output VSWR	1.75:1	2.0:1
DC Supply Voltage	+3.3 volts	(+/- 2%) volts
DC Supply Current *	175 mA*	---
Frequency Accuracy	$\pm$ 2 PPM	---
Frequency Aging	$\pm$ 1 PPM	---
Frequency vs. Temperature	$\pm$ 2 PPM	---

## Maximum (No Damage) Ratings

Storage Temperature	-55°C to +125°C
Operating Temperature	-40°C to +85°C
DC Voltage	+5 volts

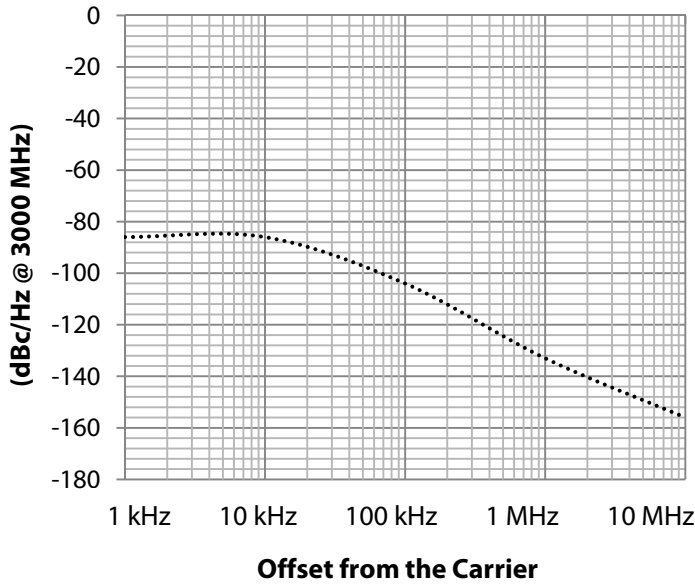
**Notes:** Typical values are measured at 25°C, but not guaranteed.

## Mechanical & Electrical

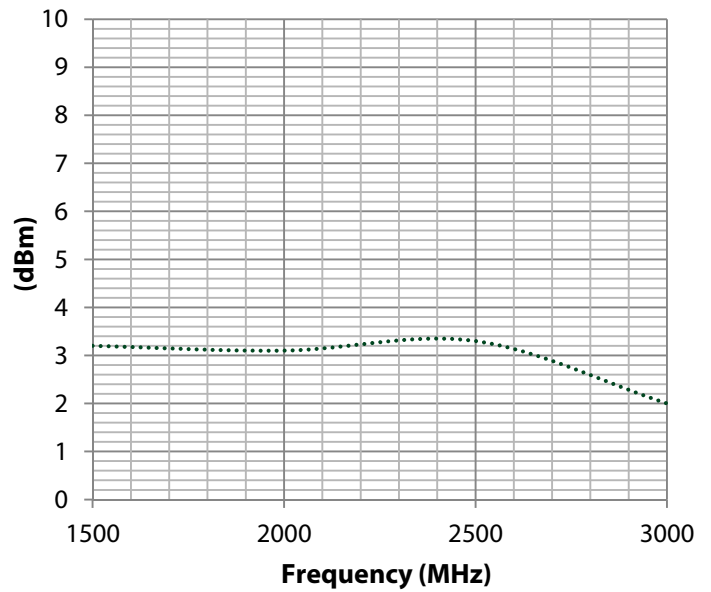
Parameter	Specification
Specification Temperatures (Min/Max)	-40°C to +85°C
Housing Size	0.800" L x 0.800" W x 0.130" H
Housing Drawing	LC800
Package Type	Surface Mount

Typical Performance

Phase Noise (dBc/Hz)



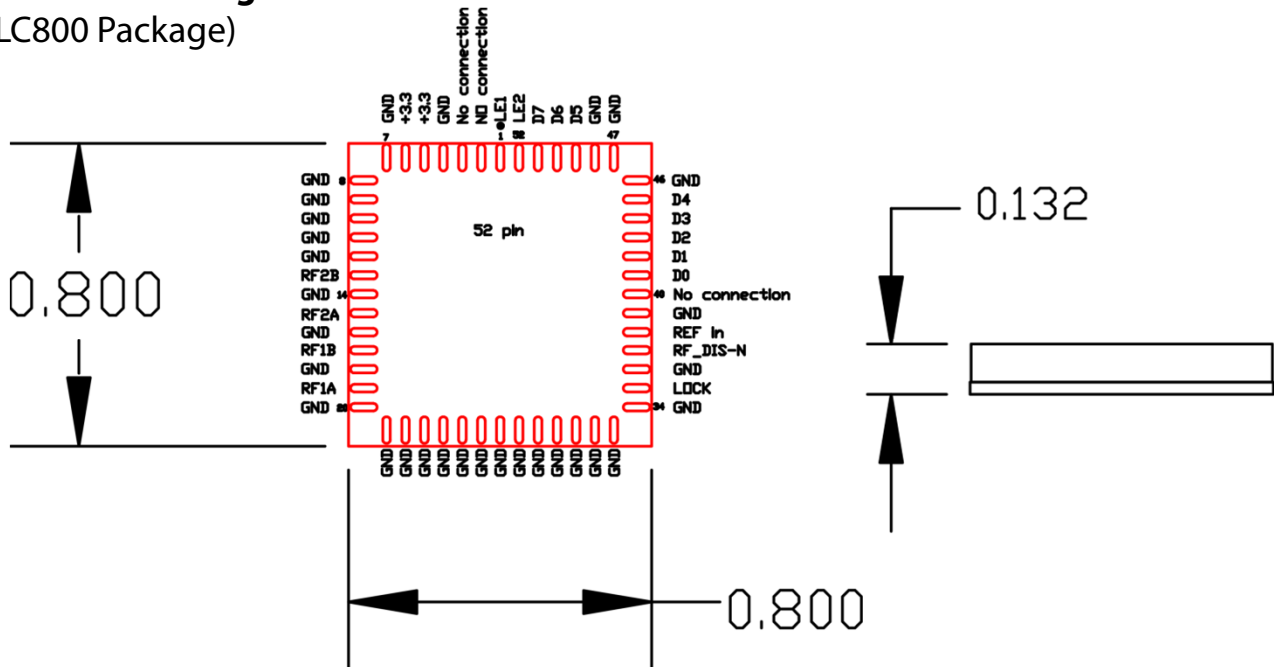
Output Power (dBm)



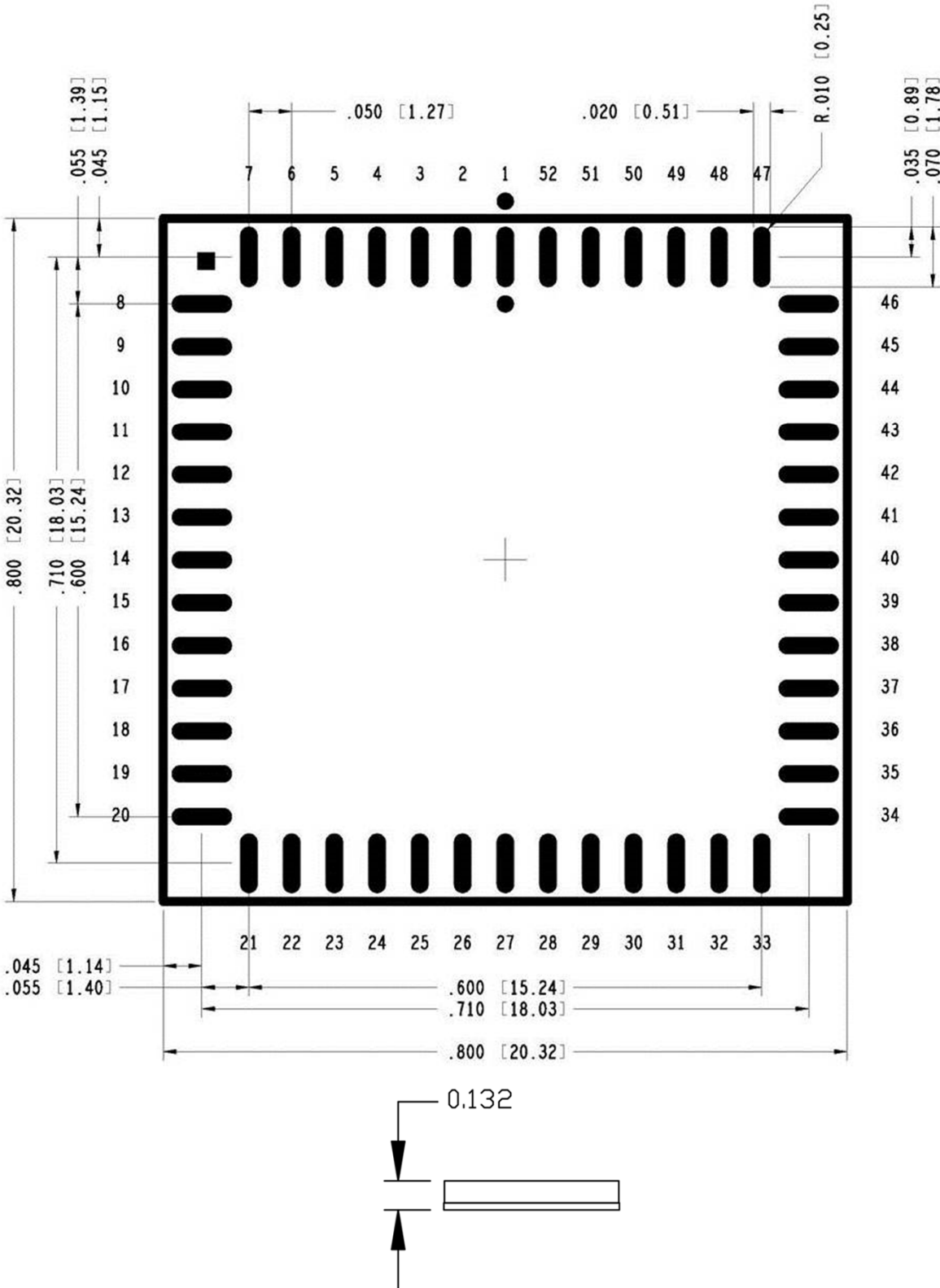
Notes

1. Specifications labeled "min." or "max." are guaranteed in a 50 Ohm system over the specified temperature range.
2. Output frequency and step size must be specified.
3. Other input voltages are available.

Outline Drawing (LC800 Package)



**Outline Drawing**  
(LC800 Package)



The LCFS synthesizer is controlled by a 16 bit binary ( $2^{16}=65536$ ) frequency control word. Interface logic is LV (3.3 V cmos). The control word addresses a custom lookup table in the built-in microcontroller for the desired output frequency. As an example a control word of all zeroes would address the first (lowest) frequency. The next location would address the next higher frequency (lowest frequency + 1 frequency step). The frequency control word is split into (2) 8 bit words along with a latch signal that differentiates between the low 8 bits and the high 8 bits. This control structure allows the synthesizer to be controlled by an 8 bit parallel port plus an additional latch control line (9 bits).

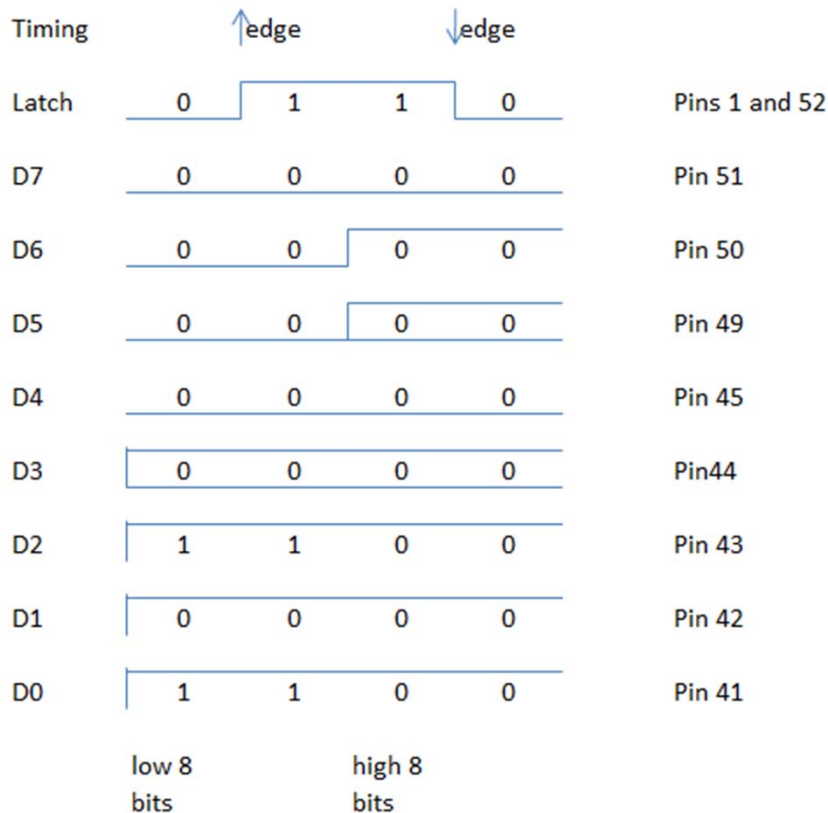
**Programming example:**

This spreadsheet calculates the control word and Low and High 8 bits from the desired output frequency. 275 to 550 MHz with a 5 MHz step size.

$F_{out}$	Control word= $(F_{out}-275)/5$	Leading zeroes suppressed
Desired frequency: 300 MHz .....	Control word= 5 (Base10) .....	Binary .....
Low 8 bits = the remainder of control word /256 .....	Low 8 Bits= 5 (Base 10) .....	101 .....
High 8 bits =int(control word/256) .....	High 8 Bits = 0 (Base 10) .....	0 .....

**If the synthesizer is programmed with a control word that is beyond the highest step, the highest frequency will be the output. The additional bit is the latching signal. The rising edge latches the Low 8 Bits and the falling edge latches the High 8 Bits.**

Programming sequence:	(Base 10)
1 Program 5	Low 8 bits Output the Low 8 bits
2 Program 5	Latch signal goes High
3 Program 0	Latch signal still is High
4 Program 0	Latch signal goes Low Causes the latch signal to fall, storing the High 8 bits. The output of the synthesizer will now change to the new frequency.



## Application Notes



**The Demo Board will be supplied with a similar spreadsheet along with some “Visual Basic Code” that transfers the frequency entered in the yellow cell to the USB and parallel converter located on the Demo Board.**

### Pinout Description

<b>Pin 1 and 52</b>	Latch 1 and Latch 2 Normally tied together. A rising edge on these pins latches the low control byte. A falling edge latches the High control byte.
<b>Pins 2,3 and 40</b>	No connection. Leave these pins open. (used for factory programming)
<b>Pin 4</b>	DC Ground
<b>Pins 5 and 6</b>	+3.3 V dc power input
<b>Pin 8-11</b>	DC Ground
<b>Pin 12</b>	RF Ground
<b>Pin 13</b>	Ground
<b>Pin 14</b>	RF Ground
<b>Pin 15</b>	RF Output
<b>Pin 16</b>	RF Ground
<b>Pin 17</b>	Ground
<b>Pin 18</b>	RF ground
<b>Pin 19</b>	Ground
<b>Pin 20</b>	RF Ground
<b>Pins 21-34</b>	DC Ground
<b>Pin 35</b>	Lock detect output ( <b>High</b> when locked/ <b>Low</b> unlocked), internal 240 ohm series resistor can directly drive a lock LED to ground (5 mA source current).
<b>Pin 36</b>	DC Ground
<b>Pin 37</b>	RF disable normally open. Ground this pin to blank the RF output.
<b>Pin 38</b>	Reference oscillator in/out (one or the other depending on model option) output 1k impedance. Input 50 ohms (1 dBm nominal)
<b>Pin 39</b>	Signal Ground for Reference
<b>Pin 40</b>	No connection. Leave this pins open. (used for factory programming)
<b>Pin 41</b>	Data 0 LSB of the upper or lower 8 bit control word
<b>Pin 42</b>	Data 1
<b>Pin 43</b>	Data 2
<b>Pin 44</b>	Data 3
<b>Pin 45</b>	Data 4
<b>Pin 46-48</b>	Data Ground
<b>Pin 49</b>	Data 5
<b>Pin 50</b>	Data 6
<b>Pin 51</b>	Data 7 MSB of the upper or lower 8 bit control word

**Note: Ground unused RF outputs.**

# LCFS Demo Board Driver Installation

- 1) Plug the USB cable to the Windows based (7 or newer) computer. The demo board and synthesizer will be powered by the USB port. Allow Windows time to find the driver through an automatic search. A good driver installation is indicated by a flashing yellow light.
- 2) Go to the Windows Control Panel, find the icon “hardware and sound, devices and printers”. There should be an icon for a USB serial port. Double click on the icon, and select the “Hardware” tab of the properties window.
- 3) Click on the properties button. On the “General” tab click on the change settings button. Click on the “Port Settings A” tab, and then click on the advanced button.
- 4) In the “Advanced Settings” window, click on the “com port” button and select a high numbered “com port” that is not in use such as 11 or 12.
- 5) Click on the OK button 3X to close all the windows.
- 6) You should now have a USB com port in your hardware window with the new com number. You will use this com number in the control spreadsheet to address a particular demo board. If you install multiple demo boards be sure to give them different com numbers.

