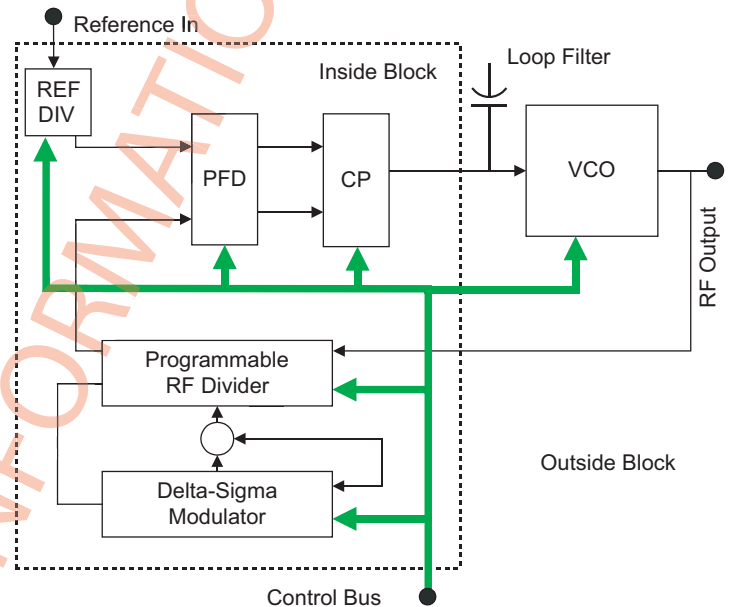


Typical Applications

The TRFS-451 is a low power fractional-n frequency synthesizer, designed for use in such applications as:

- Cable modems
- Pagers
- Satellite TV receivers
- Bluetooth
- Multi-mode radios
- Test equipment
- WCDMA, UMTS, CDMA, GSM, PCS, WLAN, GPS, AMPS systems

Block Diagram



Product Overview

The TRFS-451 Fractional-N Synthesizer contains all the circuitry required to implement a low phase noise, low spurious content, low current, high frequency signal source for multiple applications. The TRFS-451 contains an input Reference Frequency Divider, a programmable RF divider, Charge Pump, Phase Frequency Detector, and a 22 bit Delta-Sigma Modulator for high resolution. The IP block can be combined with either integrated or external VCO circuits and can be used with either external or integrated loop filter circuitry. The phase detector has a constant slope, even at zero degree phase error (no dead band).

The Synthesizer is provided as symbols and layouts in Cadence® OPUS library format. Additionally, Verilog-A and Matlab high level system models are available.

Key Features

- Reference divider for frequency synthesizers with divide range from 1 to 8
- Synchronous divider architecture to avoid harmonic suppression
- Low phase noise
- RF divide range between from 56 to 1023 for frequency synthesizers
- Frequency resolution of $F_{ref}/2^{22}$
- MASH 1-2-1 DSM with dithering
- Phase-frequency detector with linear detection range of $\pm 2\pi \cdot 5ns$ and zero phase error
- Charge pump with low leakage current

Reference Divider Overview

The reference divider circuit divides the nominal input frequency of 30MHz over a divide range of 1 to 8 using synchronous dividers. The circuit requires separate analog and digital supplies. The mode control inputs select the divide range as well as shutting down the divider.

Performance Summary

Item	Unit	Min	Typical	Max
Input Frequency	MHz	1	30	40
Phase Noise @10kHz offset	dBc/Hz	-153		-161.1
Noise Floor @100kHz	dBc/Hz	-155		-162.8
Divider Range (R)		1	4	8
Input Signal Level	mVp-p	200		1000
Total Supply Current	mA		1.11	1.43
Total Standby Current	nA		4	42
Mode Control	Digital	VIL		VIH

RF Divider Overview

The input RF frequency can be divided over a divide range of 56 to 1023. The divider circuit is an 8/9 dual modulus prescaler. The divide value is controlled by the delta sigma modulator and provides the divided output to the phase-frequency detector. The mode control inputs select the divide range as well as shuts down the synthesizer.

Performance Summary

Item	Unit	Min	Typical	Max	Notes
Input Frequency	MHz			3000	process dependent
RF Divider Range (N)		56		1023	
Input Signal Level	mVp-p		200		
Total Supply Current	mA		3	4	Includes the internal bias generator
Total Standby Current	μA			1	
Mode Control	Digital	VIL		VIH	VIL turns the divider off

DSM-PFD-CP Overview

The DSM PFD CP block consists of a Delta-Sigma modulator, a phase-frequency detector, and a charge pump integrated together for use in frequency synthesizers for wireless communications applications. The 4th-order Delta-Sigma modulator, implemented in MASH 1-2-1 architecture, uses dithering to reduce the spurious signal levels. The phase-frequency detector can detect a maximum frequency of 25MHz with a linear detection range of $\pm 2\pi$ -5ns. The charge pump provides a current of 200uA over the output voltage range of 0.5V to Vcc-0.5V with low off-state leakage current.

DSM Performance Summary

Item	Unit
Order	4th
Structure	MASH 1-2-1
Low pass filter at output	Yes
Dithering	Yes
Dithering Noise Level	~-120dB FS (22bit) in dynamic mode 0 in static mode
Number of outputs	5 bits
Quantizer	DC balanced

Phase-frequency Detector Performance Summary

Item	Unit	Min	Typical	Max
Maximum Frequency	MHz			25
Dead Band	ns			0
Phase Error	Degree		0	
Linear Detection Range	ns	-2 π +5ns		-2 π -5ns
Phase Compare Mode			Tr	

Charge Pump Performance Summary

Item	Unit	Min	Typical	Max
Output Voltage Range	V	0.5		Vcc-0.5
Output Current	uA		200	
Leakage Current	nA	0.2	<1	57
Current Match	%		~1	
Mode Control	Digital	VIL		VIH
Reference Current	uA		50	

Contact: sales@tahoerf.com
Tahoe RF Semiconductor, Inc.
12834 Earhart Ave
Auburn, CA 95602
http://www.tahoerf.com
(530) 823-9786