

# Frequency Synthesizer

SSN-1602FA+

50Ω 1402 to 1602 MHz

## The Big Deal

- Fractional N synthesizer
- Low phase noise and spurious
- Very small size 0.60" x 0.60" x 0.138"



CASE STYLE: KJ1367

## Product Overview

The SSN-1602FA+ is a Frequency Synthesizer, designed to operate from 1402 to 1602 MHz for Military & Avionics application. The SSN-1602FA+ is packaged in a metal case (size of 0.60" x 0.60" x 0.138") to shield against unwanted signals and noise.

## Key Features

Feature	Advantages
Low phase noise and spurious: <ul style="list-style-type: none"><li>• Phase Noise: -97 dBc/Hz typ. @ 10 kHz offset</li><li>• Step Size Spurious: -80 dBc typ.</li><li>• Comparison Spurious: -75 dBc typ.</li><li>• Reference Spurious: -80 dBc typ.</li></ul>	Low phase noise and spurious improve system EVM (Error Vector Magnitude).
Robust design and construction	To enhance the robustness of SSN-1602FA+, each internal component is secured to the substrate with chip bonder, thereby eliminating the risk of tombstoning during subsequent solder reflow operations by the customer.
Small size, 0.60" x 0.60" x 0.138"	The small size enables the SSN-1602FA+ to be used in compact designs.



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50Ω 1402 to 1602 MHz

### Features

- Fractional N synthesizer
- Integrated VCO + PLL
- Low phase noise and spurious
- Robust design and construction
- Low operating voltage (VCC VCO=+5.0V, VCC PLL=+3.3V)
- Small size 0.60" x 0.60" x 0.138"



CASE STYLE: KJ1367  
PRICE: \$ 29.95 ea. QTY (1-9)

+ RoHS compliant in accordance with EU Directive (2002/95/EC)

The +Suffix has been added in order to identify RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications.

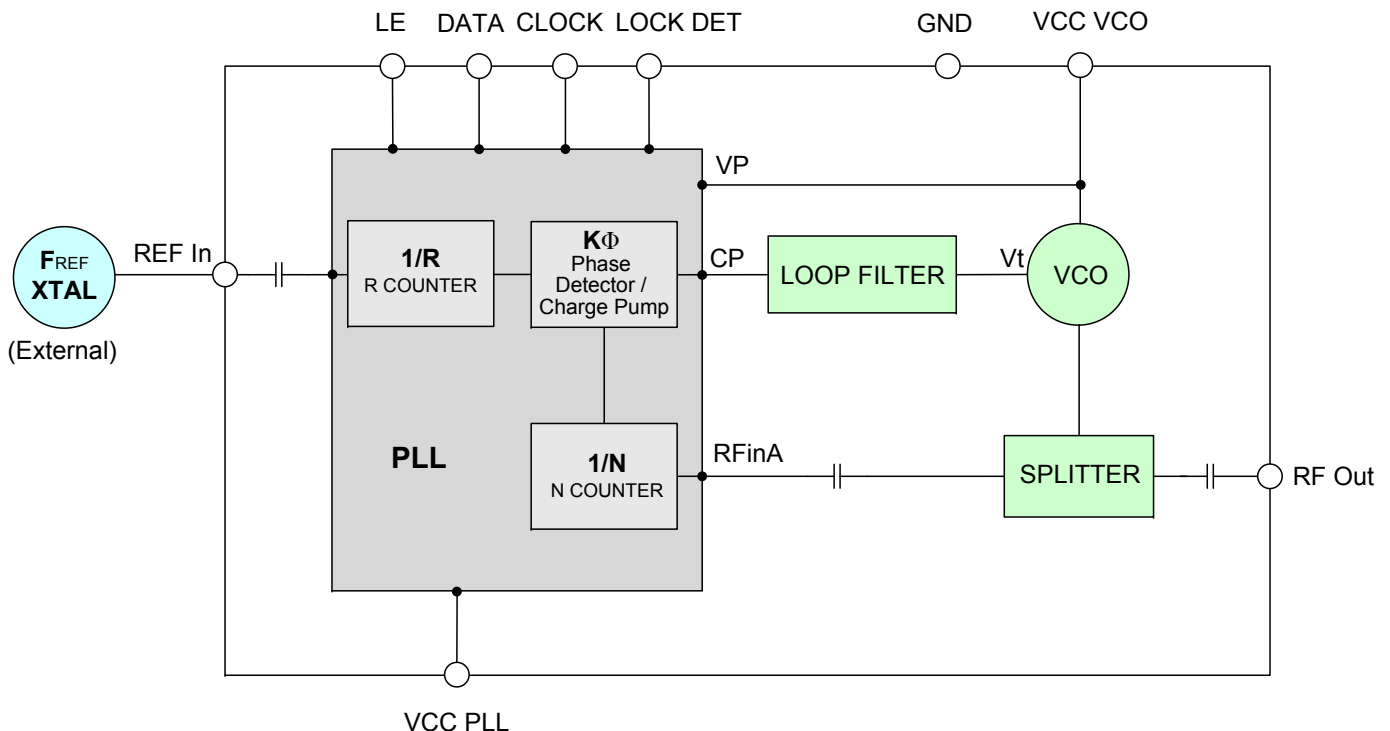
### Applications

- Military & Avionics

### General Description

The SSN-1602FA+ is a Frequency Synthesizer, designed to operate from 1402 to 1602 MHz for Military & Avionics application. The SSN-1602FA+ is packaged in a metal case (size of 0.60" x 0.60" x 0.138") to shield against unwanted signals and noise. To enhance the robustness of SSN-1602FA+, each internal component is secured to the substrate with chip bonder, thereby eliminating the risk of tombstoning during subsequent solder reflow operations by the customer.

### Simplified Schematic



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**Electrical Specifications** (over operating temperature -20°C to +85°C)

Parameters	Test Conditions	Min.	Typ.	Max.	Units
Frequency Range	-	1402	-	1602	MHz
Step Size	-	-	200	-	kHz
Comparison Frequency	-	-	13	-	MHz
Settling Time	Within ± 1 kHz	-	25	-	mSec
Output Power	-	-2.5	+0.5	+3.5	dBm
SSB Phase Noise	@ 100 Hz offset	-	-85	-	dBc/Hz
	@ 1 kHz offset	-	-87	-81	
	@ 10 kHz offset	-	-97	-90	
	@ 100 kHz offset	-	-120	-113	
	@ 1 MHz offset	-	-140	-133	
Integrated SSB Phase Noise	@ 100Hz to 1MHz offset	-	-49	-	dBc
Step Size Spurious Suppression	Step Size 200 kHz	-	-80	-60	dBc
0.5 Step Size Spurious Suppression	0.5 Step Size 100 kHz	-	-85	-65	
Reference Spurious Suppression	Ref. Freq. 26 MHz	-	-80	-60	
Comparison Spurious Suppression	Comp. Freq. 13 MHz	-	-75	-60	
Non - Harmonic Spurious Suppression	-	-	-90	-	
Harmonic Suppression	-	-	-25	-10	
VCO Supply Voltage	+5.00	+4.75	+5.00	+5.25	
PLL Supply Voltage	+3.30	+3.15	+3.30	+3.45	mA
VCO Supply Current	-	-	44	51	
PLL Supply Current	-	-	14	22	
Reference Input (External)	Frequency	26 (square wave)	-	26	
	Amplitude	1	-	1	V <sub>P-P</sub>
	Input impedance	-	-	100	KΩ
	Phase Noise @ 1 kHz offset	-	-	-135	dBc/Hz
RF Output port Impedance	-	-	50	-	Ω
Input Logic Level	Input high voltage	-	2.80	-	V
	Input low voltage	-	-	0.60	V
Digital Lock Detect	Locked	-	2.75	-	V
	Unlocked	-	-	0.40	V
Frequency Synthesizer PLL	-	ADF4153			
PLL Programming	-	3-wire serial 3.3V CMOS			
Register Map @ 1602 MHz	R0_Register	-	(MSB) 111101100000000111100 (LSB)		
	R1_Register	-	(MSB) 100001000000100000101 (LSB)		
	R2_Register	-	(MSB) 111100010 (LSB)		
	R3_Register	-	(MSB) 1111000111 (LSB)		

**Absolute Maximum Ratings**

Parameters	Ratings
VCO Supply Voltage	5.8V
PLL Supply Voltage	4.0V
VCO Supply Voltage to PLL Supply Voltage	-0.3V to +5.8V
Reference Frequency Voltage	-0.3Vmin, VCC PLL +0.3Vmax
Data, Clock, LE Levels	-0.3Vmin, VCC PLL +0.3Vmax
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +100°C

Permanent damage may occur if any of these limits are exceeded



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Typical Performance Data

FREQUENCY (MHz)	POWER OUTPUT (dBm)			VCO CURRENT (mA)			PLL CURENT (mA)		
	-25°C	+25°C	+85°C	-25°C	+25°C	+85°C	-25°C	+25°C	+85°C
	1402	0.58	0.88	1.32	42.99	43.85	45.13	12.72	14.19
1405	0.57	0.85	1.30	43.00	43.86	45.15	12.61	14.09	16.05
1430	0.45	0.71	1.16	43.04	43.92	45.21	11.54	13.00	14.92
1455	0.44	0.65	1.15	42.93	43.98	45.28	12.62	14.11	16.08
1480	0.41	0.63	1.10	43.16	44.04	45.35	12.72	14.22	16.19
1505	0.30	0.56	1.00	43.06	44.27	45.43	12.77	14.28	16.25
1530	0.19	0.39	0.85	43.34	44.19	45.53	12.82	14.34	16.32
1555	0.20	0.38	0.83	43.42	44.29	45.63	12.88	14.39	16.36
1580	0.09	0.26	0.73	43.53	44.38	45.73	12.87	14.39	16.36
1602	0.02	0.14	0.68	43.61	44.47	45.80	12.74	14.26	16.23

FREQUENCY (MHz)	HARMONICS (dBc)					
	F2			F3		
	-25°C	+25°C	+85°C	-25°C	+25°C	+85°C
1402	-17.85	-19.09	-20.30	-27.42	-27.23	-30.36
1405	-18.28	-19.29	-20.67	-27.66	-27.53	-30.85
1430	-19.83	-21.24	-22.62	-26.96	-27.17	-30.22
1455	-21.17	-22.73	-23.82	-26.90	-27.33	-30.41
1480	-23.28	-24.40	-25.74	-28.11	-27.83	-31.62
1505	-25.18	-26.67	-27.61	-27.43	-28.23	-31.15
1530	-26.38	-28.11	-28.45	-26.67	-28.74	-30.22
1555	-28.30	-30.23	-30.59	-27.62	-29.29	-30.68
1580	-31.55	-32.45	-32.80	-27.87	-27.11	-30.25
1602	-31.61	-34.24	-33.66	-26.37	-26.49	-27.43



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FREQUENCY (MHz)	PHASE NOISE (dBc/Hz) @ OFFSETS				
	+25°C				
	100Hz	1kHz	10kHz	100kHz	1MHz
1402	-89.51	-87.67	-96.21	-120.71	-140.39
1405	-89.03	-87.52	-96.64	-120.76	-140.96
1430	-88.67	-87.45	-96.92	-121.20	-141.49
1455	-87.80	-88.01	-96.96	-121.29	-141.48
1480	-88.09	-87.92	-97.50	-121.59	-140.92
1505	-86.79	-88.90	-97.50	-121.89	-142.11
1530	-87.64	-85.94	-97.17	-121.79	-142.00
1555	-87.54	-84.75	-97.28	-121.93	-140.33
1580	-87.36	-85.52	-97.26	-121.76	-140.91
1602	-86.39	-85.35	-97.39	-121.68	-141.16

FREQUENCY (MHz)	PHASE NOISE (dBc/Hz) @ OFFSETS				
	-25°C				
	100Hz	1kHz	10kHz	100kHz	1MHz
1402	-86.29	-91.22	-97.40	-122.17	-142.38
1405	-86.39	-90.39	-97.60	-122.16	-142.50
1430	-86.10	-90.34	-97.92	-122.42	-142.81
1455	-87.47	-91.14	-97.73	-122.41	-142.67
1480	-85.63	-90.23	-97.97	-122.52	-142.85
1505	-87.35	-90.81	-97.86	-122.55	-142.48
1530	-86.24	-89.40	-98.06	-122.66	-140.52
1555	-85.90	-89.12	-98.14	-122.64	-142.98
1580	-85.90	-89.60	-98.21	-122.58	-143.08
1602	-85.85	-89.53	-98.23	-122.54	-142.84

FREQUENCY (MHz)	PHASE NOISE (dBc/Hz) @ OFFSETS				
	+85°C				
	100Hz	1kHz	10kHz	100kHz	1MHz
1402	-87.91	-86.26	-93.40	-117.44	-136.84
1405	-87.42	-87.26	-93.46	-117.58	-137.74
1430	-87.51	-86.06	-94.43	-118.46	-138.78
1455	-86.55	-85.46	-94.87	-118.99	-139.36
1480	-87.33	-86.27	-95.31	-119.54	-139.85
1505	-87.14	-86.04	-95.16	-119.91	-140.06
1530	-86.35	-85.99	-95.44	-120.08	-138.52
1555	-86.94	-84.80	-95.44	-120.23	-140.04
1580	-85.79	-85.19	-95.25	-120.17	-140.63
1602	-85.77	-84.76	-95.21	-119.98	-139.96



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COMPARISON SPURIOUS ORDER	COMPARISON SPURIOUS @Fcarrier 1402MHz+(n*Fcomparison) (dBc) note 1			COMPARISON SPURIOUS @Fcarrier 1502MHz+(n*Fcomparison) (dBc) note 1			COMPARISON SPURIOUS @Fcarrier 1602MHz+(n*Fcomparison) (dBc) note 1			
	n	-25°C	+25°C	+85°C	-25°C	+25°C	+85°C	-25°C	+25°C	+85°C
	-5	-78.01	-79.41	-79.24	-78.14	-77.03	-78.09	-77.95	-76.60	-78.14
-4	-80.67	-83.00	-83.06	-81.19	-80.27	-81.16	-80.06	-78.89	-81.38	
-3	-81.19	-83.16	-83.05	-81.00	-80.68	-80.67	-79.63	-78.83	-81.32	
-2	-82.04	-84.43	-84.86	-82.61	-81.87	-81.31	-81.11	-79.62	-83.30	
-1	-86.28	-87.99	-93.63	-84.73	-88.46	-84.82	-88.29	-84.67	-88.21	
0 note 2	-	-	-	-	-	-	-	-	-	
+1	-85.11	-83.03	-83.26	-82.23	-84.96	-86.76	-85.88	-91.03	-82.89	
+2	-79.24	-78.19	-77.57	-78.33	-79.18	-80.13	-79.37	-81.20	-78.70	
+3	-78.29	-77.47	-77.22	-77.89	-78.28	-78.96	-77.93	-79.04	-78.23	
+4	-77.58	-77.54	-77.45	-77.22	-77.92	-78.54	-77.20	-78.36	-78.09	
+5	-74.99	-74.76	-75.10	-74.78	-74.99	-75.12	-74.53	-75.48	-75.57	

Note 1: Comparison frequency 13 MHz

Note 2: All spurs are referenced to carrier signal (n=0).

REFERENCE SPURIOUS ORDER	REFERENCE SPURIOUS @Fcarrier 1402MHz+(n*Frefernce) (dBc) note 3			REFERENCE SPURIOUS @Fcarrier 1502MHz+(n*Frefernce) (dBc) note 3			REFERENCE SPURIOUS @Fcarrier 1602MHz+(n*Frefernce) (dBc) note 3			
	n	-25°C	+25°C	+85°C	-25°C	+25°C	+85°C	-25°C	+25°C	+85°C
	-5	-86.53	-89.14	-98.80	-83.58	-85.31	-89.94	-86.86	-85.93	-88.77
-4	-81.22	-81.67	-82.14	-81.78	-79.88	-82.17	-81.82	-81.12	-83.10	
-3	-88.78	-94.11	-93.08	-82.20	-85.31	-89.89	-83.20	-83.32	-84.25	
-2	-80.67	-83.00	-83.06	-81.19	-80.27	-81.16	-80.06	-78.89	-81.38	
-1	-82.04	-84.43	-84.86	-82.61	-81.87	-81.31	-81.11	-79.62	-83.30	
0 note 4	-	-	-	-	-	-	-	-	-	
+1	-79.24	-78.19	-77.57	-78.33	-79.18	-80.13	-79.37	-81.20	-78.70	
+2	-77.58	-77.54	-77.45	-77.22	-77.92	-78.54	-77.20	-78.36	-78.09	
+3	-83.84	-84.87	-88.77	-85.75	-86.06	-86.71	-80.70	-81.86	-87.13	
+4	-80.06	-80.05	-81.15	-80.44	-80.78	-82.29	-80.63	-82.43	-82.86	
+5	-92.70	-92.89	-94.46	-89.51	-94.30	-92.56	-87.09	-89.02	-99.10	

Note 3: Reference frequency 26 MHz

Note 4: All spurs are referenced to carrier signal (n=0).



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STEP SIZE SPURIOUS ORDER  n	0.5 STEP SIZE & STEP SIZE SPURIOUS @Fcarrier 1402MHz+(n*Fstep size) (dBc) note 5			0.5 STEP SIZE & STEP SIZE SPURIOUS @Fcarrier 1502MHz+(n*Fstep size) (dBc) note 5			0.5 STEP SIZE & STEP SIZE SPURIOUS @Fcarrier 1602MHz+(n*Fstep size) (dBc) note 5		
	-25°C	+25°C	+85°C	-25°C	+25°C	+85°C	-25°C	+25°C	+85°C
-5.0	-109.45	-95.15	-97.44	-92.86	-99.34	-98.38	-98.53	-95.58	-101.16
-4.5	-111.33	-107.62	-111.70	-112.04	-110.90	-109.98	-112.77	-110.35	-109.66
-4.0	-88.33	-85.72	-84.13	-85.27	-94.65	-95.54	-94.47	-111.26	-92.61
-3.5	-111.11	-109.06	-104.66	-110.93	-113.71	-108.20	-110.22	-113.12	-111.73
-3.0	-92.70	-89.57	-89.10	-90.71	-94.38	-95.91	-104.58	-107.56	-91.63
-2.5	-106.70	-104.50	-106.93	-109.53	-108.01	-109.67	-108.00	-108.41	-109.31
-2.0	-86.57	-88.95	-89.31	-74.50	-92.96	-89.27	-85.61	-100.70	-85.54
-1.5	-101.60	-104.43	-99.96	-104.68	-102.99	-102.28	-101.51	-101.23	-103.90
-1.0	-88.76	-74.43	-74.71	-71.70	-83.29	-80.76	-83.45	-93.43	-79.63
-0.5	-87.88	-88.97	-87.50	-84.67	-89.45	-87.25	-87.98	-84.48	-87.14
0 note 6	-	-	-	-	-	-	-	-	-
+0.5	-88.09	-88.30	-86.00	-84.05	-88.00	-85.90	-80.90	-86.82	-87.84
+1.0	-86.87	-74.68	-74.93	-71.40	-85.18	-81.54	-82.48	-95.48	-80.44
+1.5	-104.58	-104.10	-100.73	-103.45	-96.73	-104.39	-103.42	-105.60	-104.66
+2.0	-85.93	-88.24	-88.75	-74.74	-93.62	-88.44	-86.10	-101.27	-85.18
+2.5	-110.57	-107.45	-105.47	-107.63	-111.34	-110.82	-103.99	-110.77	-102.64
+3.0	-93.90	-90.72	-88.68	-90.89	-94.67	-93.94	-105.83	-106.47	-93.26
+3.5	-113.30	-107.57	-110.04	-108.55	-108.79	-111.85	-109.14	-108.35	-108.32
+4.0	-88.46	-86.53	-84.11	-84.95	-95.63	-95.31	-95.12	-109.83	-92.01
+4.5	-110.54	-111.50	-105.87	-111.43	-112.32	-111.90	-110.19	-110.96	-109.85
+5.0	-107.54	-95.39	-96.97	-92.35	-99.64	-98.60	-98.25	-95.66	-102.53

Note 5: Step size 200 kHz

Note 6: All spurs are referenced to carrier signal (n=0).



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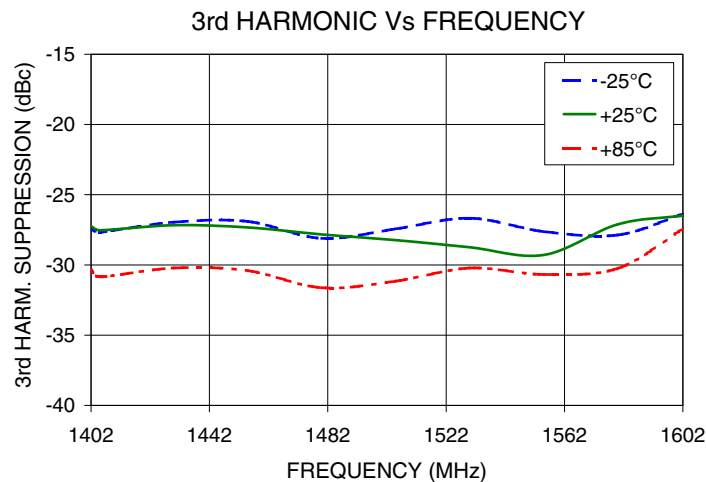
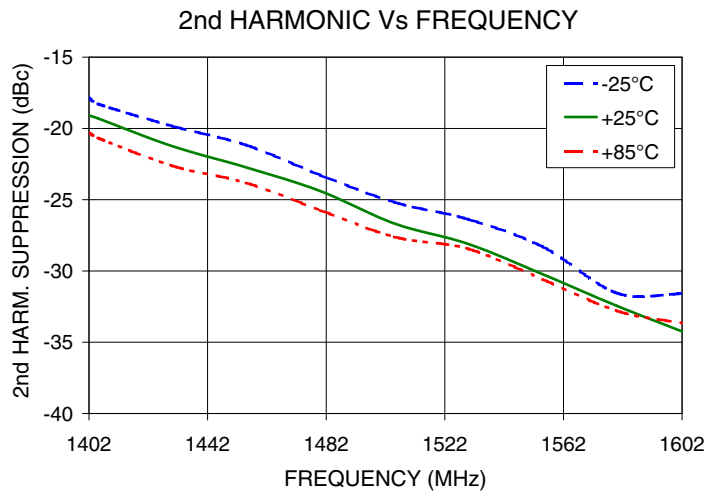
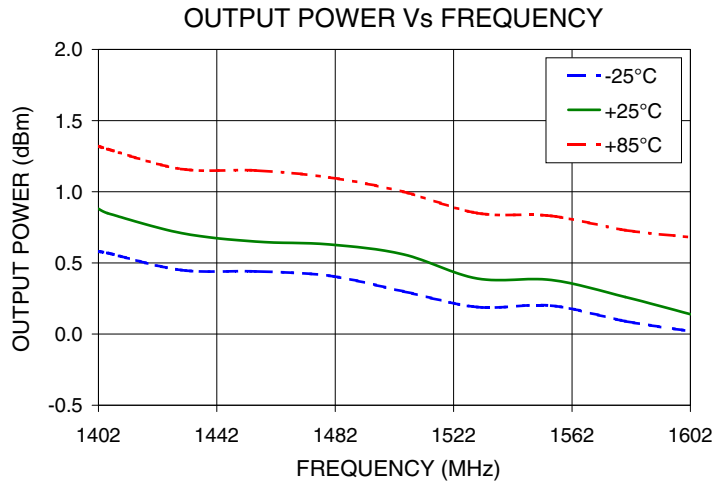


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Typical Performance Curves



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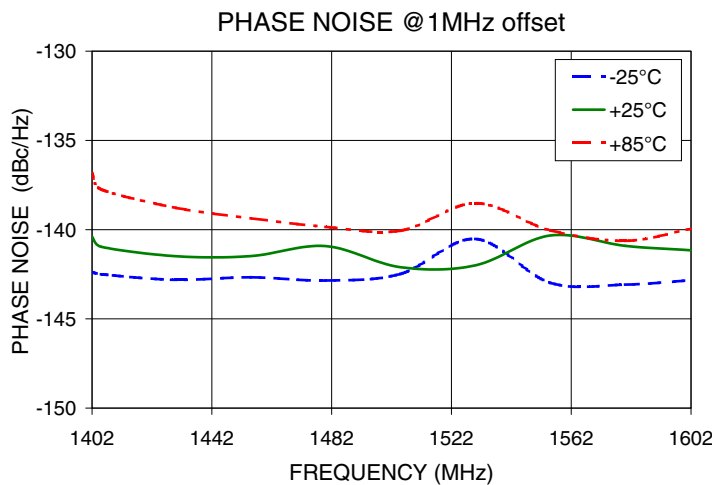
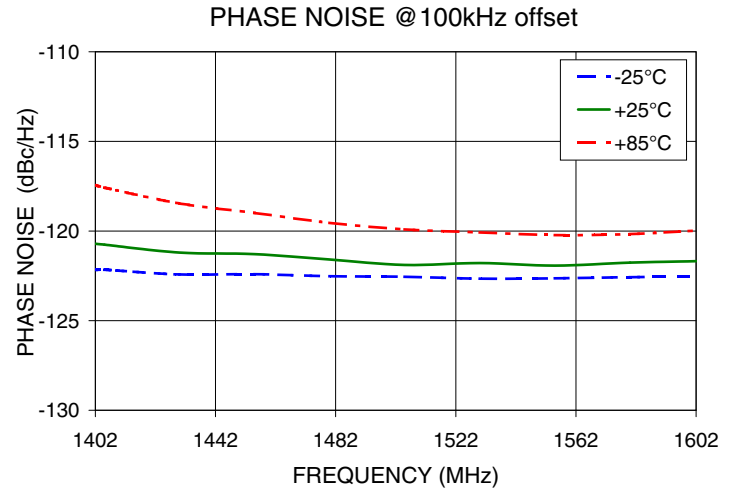
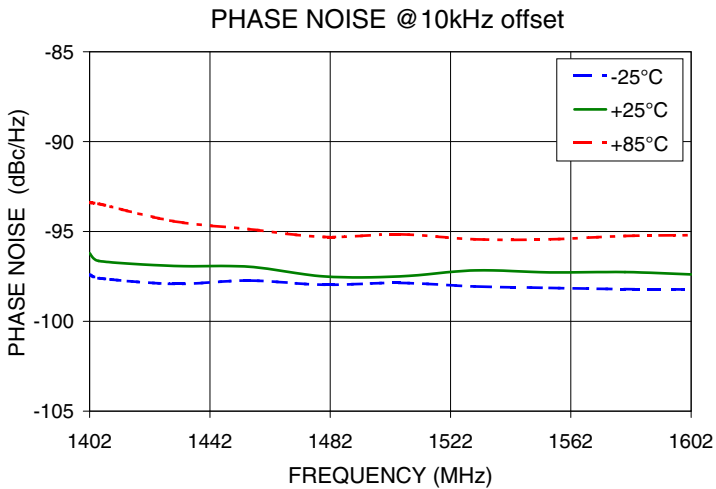
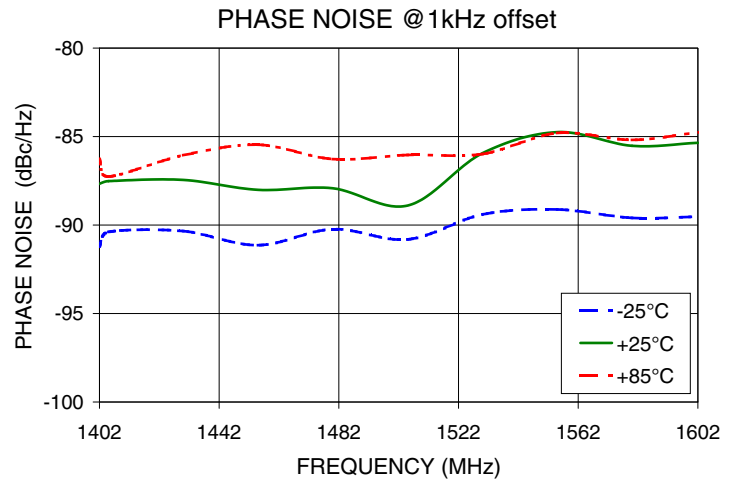
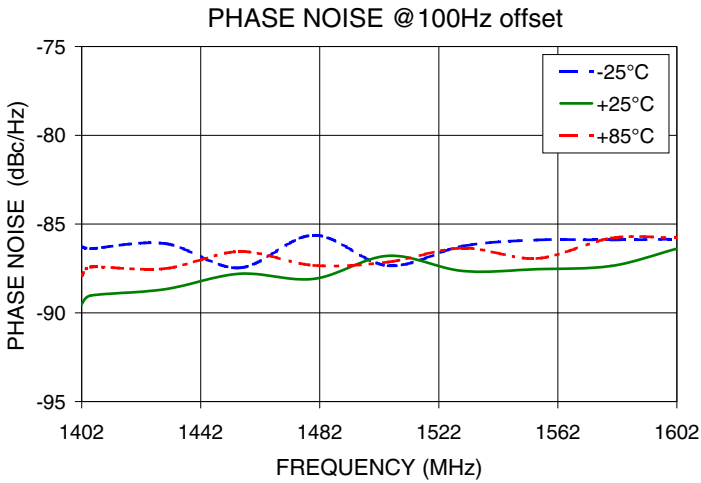


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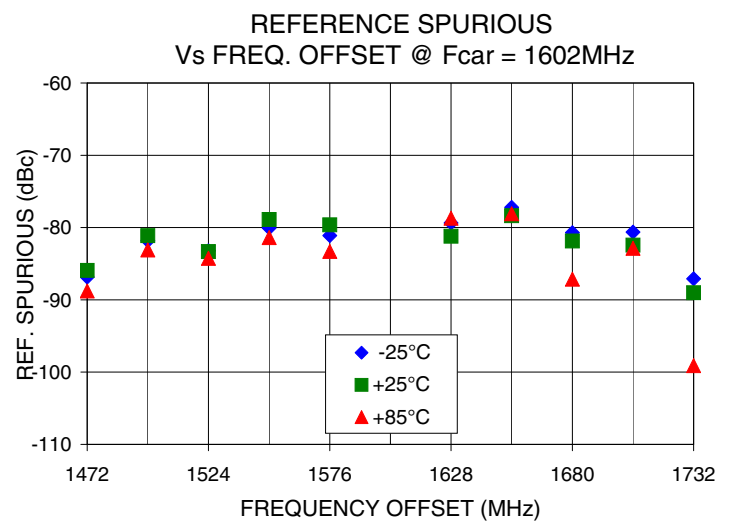
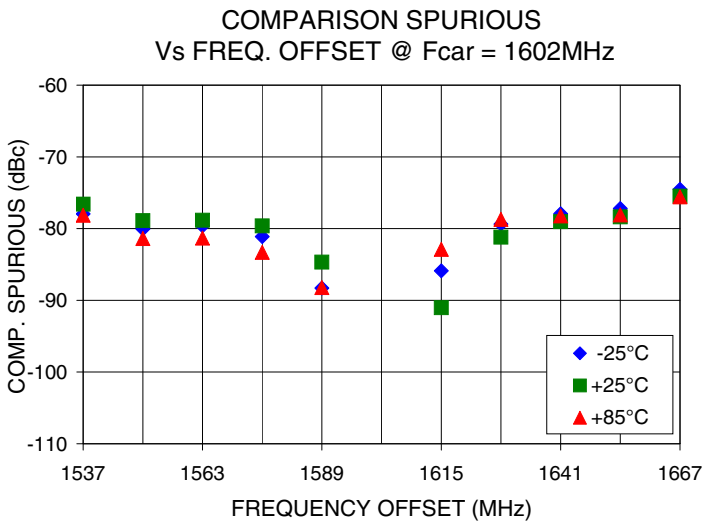
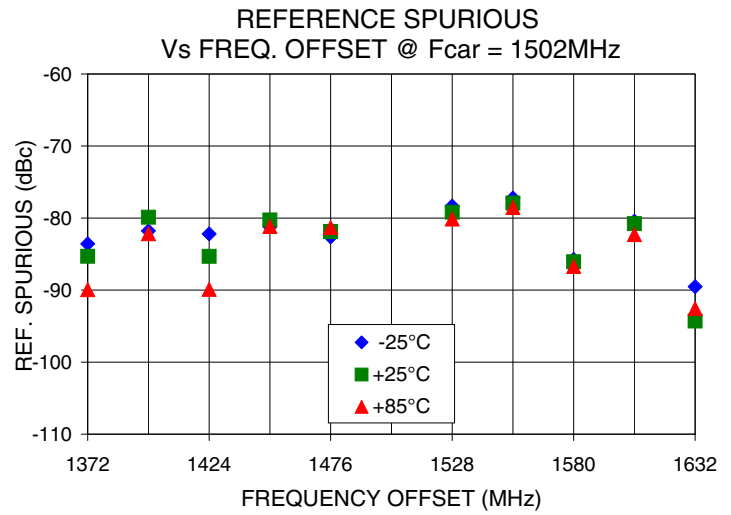
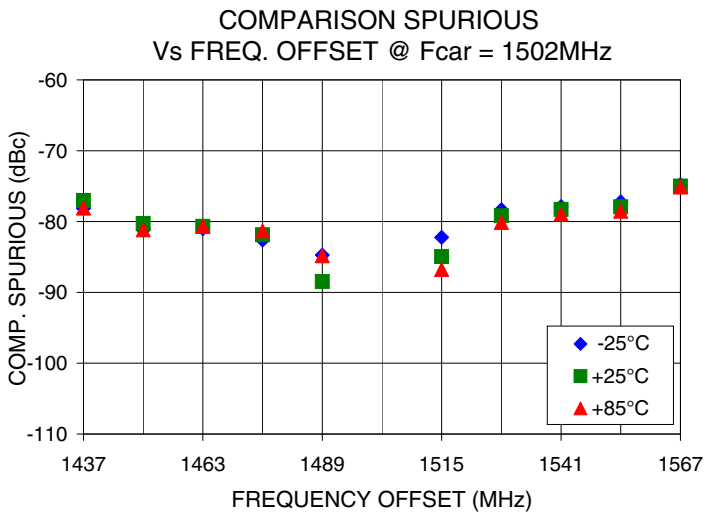
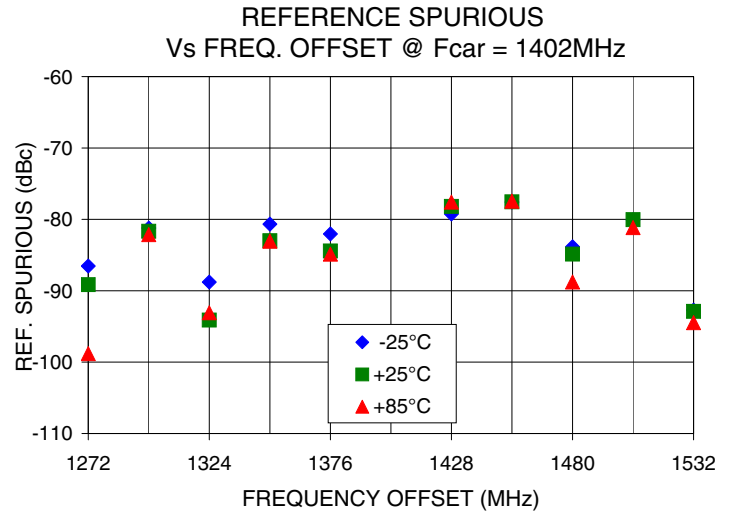
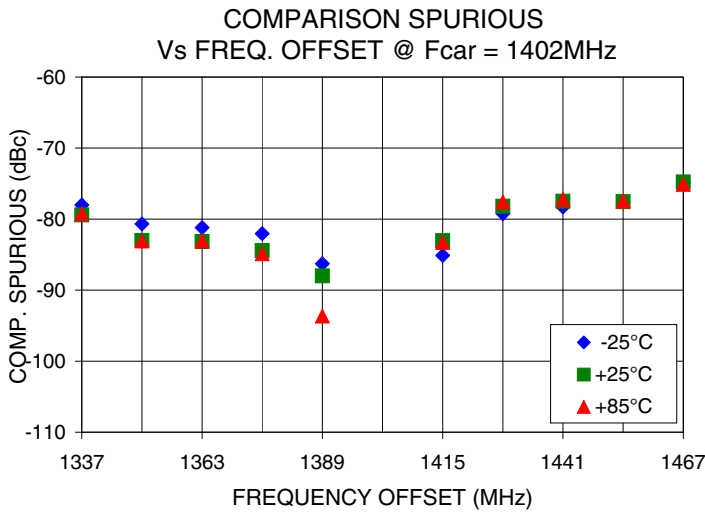
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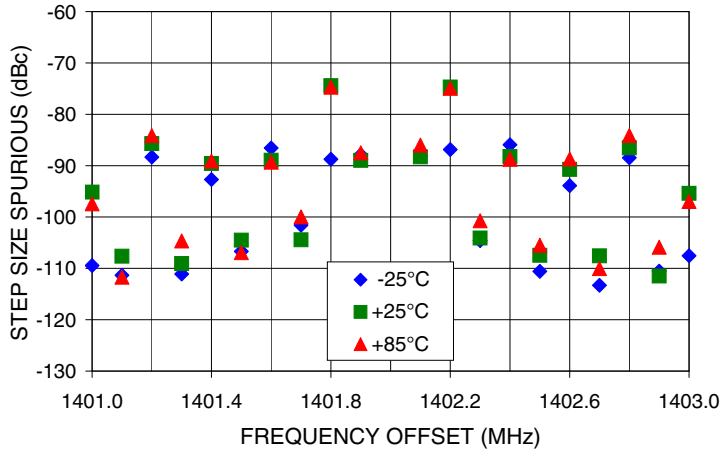


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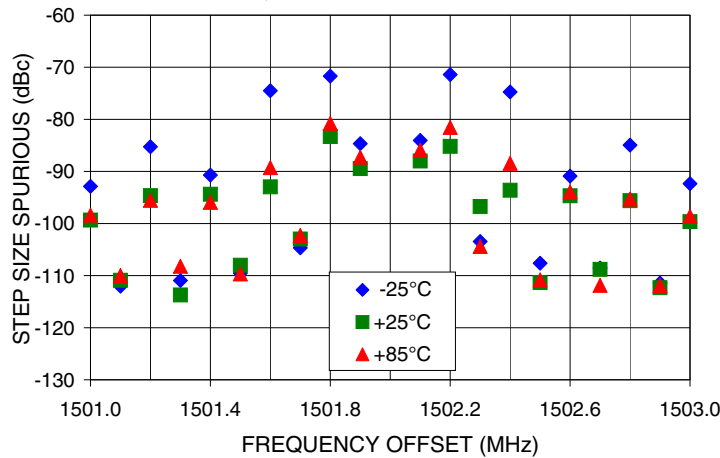


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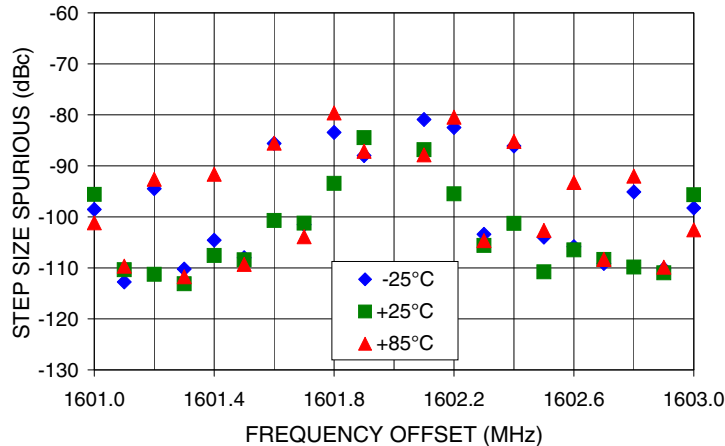
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Vs FREQ. OFFSET @ Fcar = 1402MHz



0.5 STEP SIZE & STEP SIZE SPURIOUS  
Vs FREQ. OFFSET @ Fcar = 1502MHz



0.5 STEP SIZE & STEP SIZE SPURIOUS  
Vs FREQ. OFFSET @ Fcar = 1602MHz



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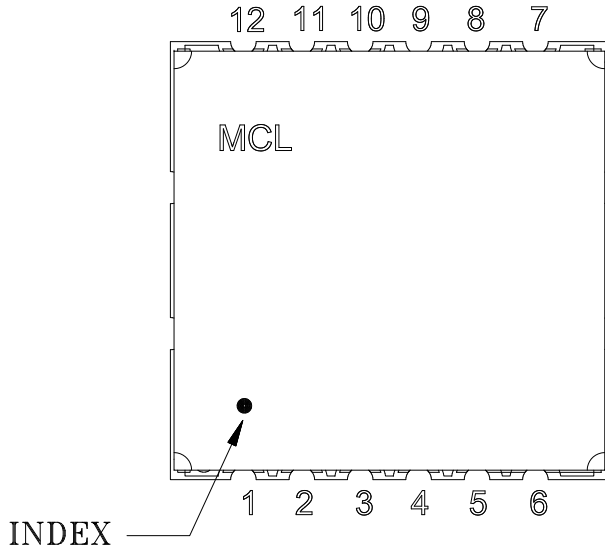


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Pin Configuration

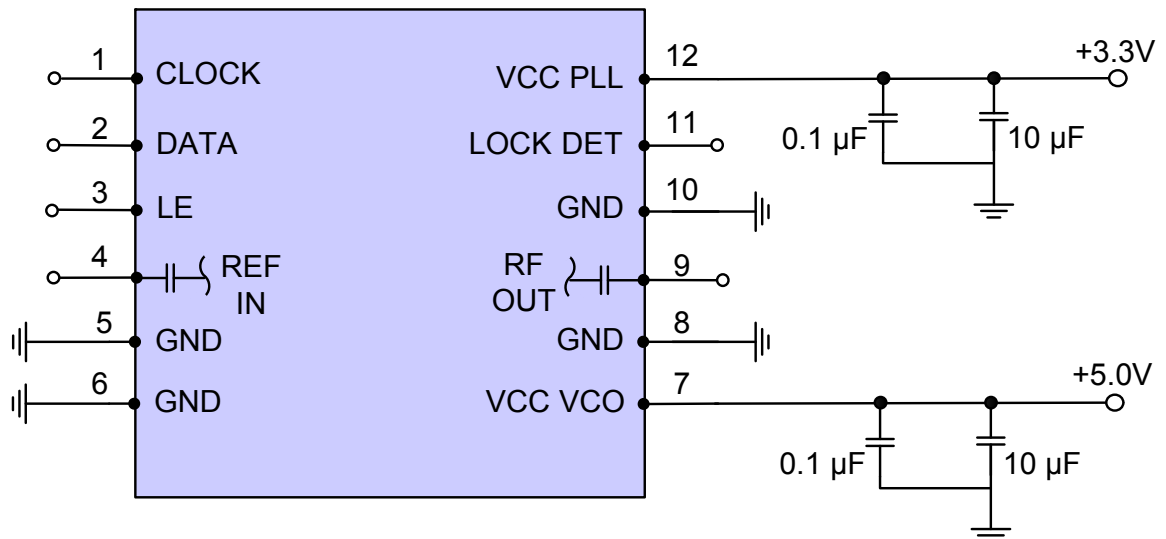


Pin Connection

Pin Number	Function
1	CLOCK
2	DATA
3	ENABLED
4	REF IN
5	GND
6	GND
7	VCC VCO
8	GND
9	RF OUT
10	GND
11	LOCK DET
12	VCC PLL

Recommended Application Circuit

Note: REF IN and RF OUT ports are internally AC coupled.



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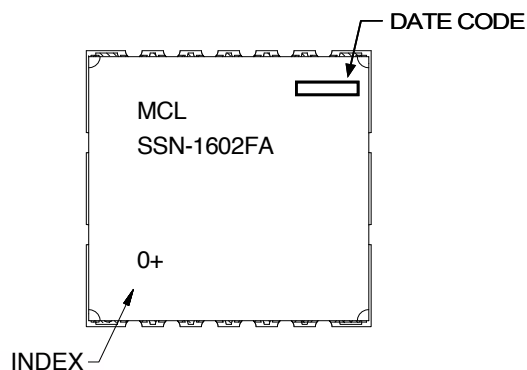


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## Device Marking

**Additional Detailed Technical Information**

Additional information is available on our web site. To access this information enter the model number on our web site home page.

**Case Style:** KJ1367

**Tape & Reel:** TR-F95

**Suggested Layout for PCB Design:** PL-317

**Evaluation Board:** TB-552+

**Environment Ratings:** ENV03T2



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