

# Frequency Synthesizer

KSN-1600A-219+

50Ω 1550 to 1600 MHz

## The Big Deal

- Fractional N synthesizer
- Low phase noise and spurious
- Robust design and construction
- Small size 0.80" x 0.58" x 0.15"



CASE STYLE: DK801

## Product Overview

The KSN-1600A-219+ is a Frequency Synthesizer, designed to operate from 1550 to 1600 MHz for base station application. The KSN-1600A-219+ is packaged in a metal case (size of 0.80" x 0.58" x 0.15") 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: -98 dBc/Hz typ. @ 10 kHz offset</li><li>• Step Size Spurious: -80 dBc typ.</li><li>• Comparison Spurious: -100 dBc typ.</li><li>• Reference Spurious: -100 dBc typ.</li></ul>	Low phase noise and spurious improve system EVM (Error Vector Magnitude).
Robust design and construction	To enhance the robustness of KSN-1600A-219+, 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, 0.80" x 0.58" x 0.15"	The small size enables the KSN-1600A-219+ to be used in compact designs.



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# Frequency Synthesizer

KSN-1600A-219+

50Ω 1550 to 1600 MHz

## Features

- Fractional N synthesizer
- Integrated VCO + PLL
- Low phase noise and spurious
- Robust design and construction
- Low operating voltage (VCC VCO=+5V, VCC PLL=+3V)
- Small size 0.80" x 0.58" x 0.15"

## Applications

- Base station

## General Description

The KSN-1600A-219+ is a Frequency Synthesizer, designed to operate from 1550 to 1600 MHz for base station application. The KSN-1600A-219+ is packaged in a metal case (size of 0.80" x 0.58" x 0.15") to shield against unwanted signals and noise. To enhance the robustness of KSN-1600A-219+, 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.



CASE STYLE: DK801  
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.

## Simplified Schematic



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REV. OR  
M127888  
EDR-9481F1  
KSN-1600A-219+  
Category-A1  
RAV  
100704  
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**Electrical Specifications** (over operating temperature -40°C to +85°C)

Parameters	Test Conditions	Min.	Typ.	Max.	Units	
Frequency Range	-	1550	-	1600	MHz	
Step Size	-	-	50	-	kHz	
Comparison Frequency	-	-	18	-	MHz	
Settling Time	Within ± 1 kHz	-	10	-	mSec	
Output Power	-	-1.5	+1.7	+4.5	dBm	
SSB Phase Noise	@ 100 Hz offset	-	-72	-	dBc/Hz	
	@ 1 kHz offset	-	-90	-86		
	@ 10 kHz offset	-	-98	-92		
	@ 100 kHz offset	-	-123	-118		
	@ 1 MHz offset	-	-144	-139		
Step Size Spurious Suppression	Step Size 50 kHz	-	-80	-66	dBc	
0.5 Step Size Spurious Suppression	0.5 Step Size 25 kHz	-	-79	-60		
Reference & Comparison Spurious Suppression	Ref. & Comp. Freq. 18 MHz	-	-100	-80		
Non - Harmonic Spurious Suppression	-	-	-90	-		
Harmonic Suppression	-	-	-30	-20		
VCO Supply Voltage	5.00	4.75	5.00	5.25	V	
PLL Supply Voltage	3.00	2.85	3.00	3.15		
VCO Supply Current	-	-	46	52	mA	
PLL Supply Current	-	-	13	22		
Reference Input (External)	Frequency	18 (square wave)	-	18	-	MHz
	Amplitude	1	-	1	-	V <sub>P-P</sub>
	Input impedance	-	-	100	-	KΩ
	Phase Noise @ 1 kHz offset	-	-	-140	-	dBc/Hz
RF Output port Impedance	-	-	50	-	Ω	
Input Logic Level	Input high voltage	-	2.55	-	-	V
	Input low voltage	-	-	-	0.55	V
Digital Lock Detect	Locked	-	2.45	-	3.15	V
	Unlocked	-	-	-	0.40	V
Frequency Synthesizer PLL	-	ADF4153				
PLL Programming	-	3-wire serial 3V CMOS				
Register Map @ 1600 MHz	R0_Register	-	(MSB) 10110000001010000000 (LSB)			
	R1_Register	-	(MSB) 100000100010110100001 (LSB)			
	R2_Register	-	(MSB) 11000010 (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)		
	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
	1550	1.52	1.66	1.54	44.19	45.63	46.38	13.74	14.22
1560	1.53	1.65	1.52	44.11	45.57	46.34	12.10	12.50	14.66
1575	1.51	1.60	1.48	44.00	45.50	46.31	13.67	14.18	16.38
1590	1.50	1.74	1.45	43.91	45.83	46.27	13.73	14.21	16.41
1600	1.49	1.59	1.45	43.84	45.41	46.25	12.10	12.50	14.66

FREQUENCY (MHz)	HARMONICS (dBc)					
	F2			F3		
	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
1550	-31.10	-37.46	-38.39	-28.82	-30.65	-31.93
1560	-32.96	-39.84	-39.78	-29.23	-31.26	-31.83
1575	-36.22	-42.97	-44.84	-30.21	-31.68	-32.84
1590	-39.28	-47.58	-48.12	-30.44	-31.76	-32.79
1600	-41.85	-47.20	-47.68	-31.82	-31.92	-33.49

FREQUENCY (MHz)	PHASE NOISE (dBc/Hz) @ OFFSETS				
	+25°C				
	100Hz	1kHz	10kHz	100kHz	1MHz
1550	-70.79	-92.74	-98.63	-122.67	-144.42
1560	-69.28	-91.55	-98.36	-124.05	-144.47
1575	-70.13	-93.36	-98.29	-123.21	-144.19
1590	-73.20	-92.37	-98.30	-123.05	-144.18
1600	-72.60	-91.01	-97.50	-123.77	-143.94

FREQUENCY (MHz)	PHASE NOISE (dBc/Hz) @ OFFSETS				
	-45°C				
	100Hz	1kHz	10kHz	100kHz	1MHz
1550	-72.71	-91.53	-98.92	-125.58	-145.33
1560	-73.11	-91.83	-97.18	-125.39	-145.89
1575	-70.33	-92.97	-97.95	-124.97	-145.66
1590	-73.50	-89.26	-97.88	-124.69	-145.36
1600	-71.91	-93.36	-98.45	-124.72	-145.19

FREQUENCY (MHz)	PHASE NOISE (dBc/Hz) @ OFFSETS				
	+85°C				
		1kHz	10kHz	100kHz	1MHz
1550	-71.64	-90.58	-97.58	-122.50	-143.12
1560	-73.16	-89.64	-96.67	-122.83	-143.13
1575	-73.31	-92.34	-96.98	-122.73	-142.98
1590	-73.07	-89.56	-96.98	-121.32	-142.46
1600	-72.00	-90.16	-95.97	-122.51	-142.75



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REFERENCE & COMPARISON SPURIOUS ORDER	REFERENCE & COMPARISON SPURIOUS @ Fcarrier 1550MHz+(n*Freference) (dBc) note 1			REFERENCE & COMPARISON SPURIOUS @ Fcarrier 1575MHz+(n*Freference) (dBc) note 1			REFERENCE & COMPARISON SPURIOUS @ Fcarrier 1600MHz+(n*Freference) (dBc) note 1			
	n	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
	-5	-110.58	-110.10	-112.39	-103.50	-103.76	-107.80	-104.54	-106.97	-119.69
-4	-101.21	-105.53	-103.03	-107.40	-108.05	-108.67	-103.87	-110.09	-117.25	
-3	-101.85	-104.07	-101.09	-100.86	-102.01	-102.66	-97.26	-101.93	-107.55	
-2	-106.10	-104.53	-100.97	-98.29	-100.28	-99.35	-98.86	-101.05	-103.85	
-1	-108.03	-103.56	-102.77	-99.86	-105.92	-101.59	-103.72	-106.40	-104.35	
0 note 2	-	-	-	-	-	-	-	-	-	
+1	-115.06	-103.18	-105.50	-103.69	-116.18	-100.91	-99.18	-111.12	-107.86	
+2	-112.47	-105.69	-108.77	-104.21	-116.70	-110.78	-101.05	-112.98	-115.65	
+3	-111.64	-106.23	-116.11	-107.22	-108.64	-117.29	-105.83	-116.30	-112.86	
+4	-108.95	-114.73	-111.79	-110.63	-114.09	-108.53	-111.98	-126.45	-113.41	
+5	-112.20	-108.56	-117.69	-98.77	-100.14	-105.58	-98.45	-102.91	-104.14	

Note 1: Reference frequency = Comparison frequency = 18 MHz

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

STEP SIZE SPURIOUS ORDER	0.5 STEP SIZE & STEP SIZE SPURIOUS @Fcarrier 1550MHz+(n*Fstep size) (dBc) note 3			0.5 STEP SIZE & STEP SIZE SPURIOUS @Fcarrier 1575MHz+(n*Fstep size) (dBc) note 3			0.5 STEP SIZE & STEP SIZE SPURIOUS @Fcarrier 1600MHz+(n*Fstep size) (dBc) note 3			
	n	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
	-5.0	-100.96	-101.12	-99.89	-94.44	-96.52	-96.76	-98.71	-97.01	-98.68
-4.5	-96.19	-100.82	-95.29	-91.98	-99.45	-99.16	-95.25	-98.28	-94.97	
-4.0	-97.64	-96.73	-93.57	-95.89	-93.32	-93.77	-96.77	-92.78	-96.20	
-3.5	-94.21	-94.27	-95.71	-90.43	-95.65	-90.41	-92.91	-92.09	-96.38	
-3.0	-93.36	-93.02	-88.58	-93.52	-87.72	-86.99	-91.49	-92.27	-91.15	
-2.5	-86.89	-89.98	-85.57	-87.37	-27.69	-90.00	-85.25	-87.24	-89.27	
-2.0	-82.75	-87.26	-84.25	-82.41	-81.57	-85.62	-88.02	-87.65	-87.67	
-1.5	-85.76	-85.85	-87.08	-83.18	-83.10	-81.60	-84.14	-86.03	-82.26	
-1.0	-79.45	-78.16	-78.61	-85.31	-87.19	-82.89	-75.51	-77.70	-74.72	
-0.5	-83.41	-81.05	-84.33	-66.32	-74.00	-70.50	-84.25	-84.62	-82.35	
0 note 4	-	-	-	-	-	-	-	-	-	
+0.5	-84.51	-83.27	-82.71	-67.04	-71.61	-70.86	-83.21	-84.53	-86.21	
+1.0	-78.89	-81.72	-77.34	-82.37	-86.86	-86.54	-74.96	-77.62	-73.15	
+1.5	-86.83	-85.21	-85.71	-84.75	-83.85	-85.53	-82.35	-85.47	-86.27	
+2.0	-86.16	-84.15	-85.58	-85.80	-85.93	-86.15	-84.98	-85.51	-86.02	
+2.5	-85.45	-90.47	-88.78	-87.45	-86.53	-88.88	-86.00	-83.46	-90.49	
+3.0	-88.92	-91.98	-91.28	-90.57	-89.67	-91.59	-90.07	-90.76	-90.64	
+3.5	-89.74	-91.53	-92.14	-90.24	-95.11	-90.84	-95.56	-95.13	-93.73	
+4.0	-95.60	-93.68	-91.61	-92.96	-98.40	-97.69	-96.94	-96.75	-95.41	
+4.5	-96.01	-97.48	-100.22	-92.29	-97.10	-97.99	-98.18	-96.76	-100.06	
+5.0	-102.46	-102.72	-100.88	-99.22	-102.43	-97.97	-100.05	-98.66	-97.24	

Note 3: Step size 50 kHz

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



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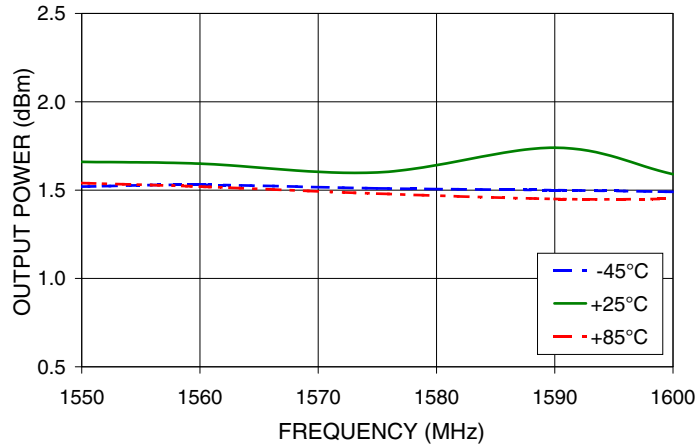
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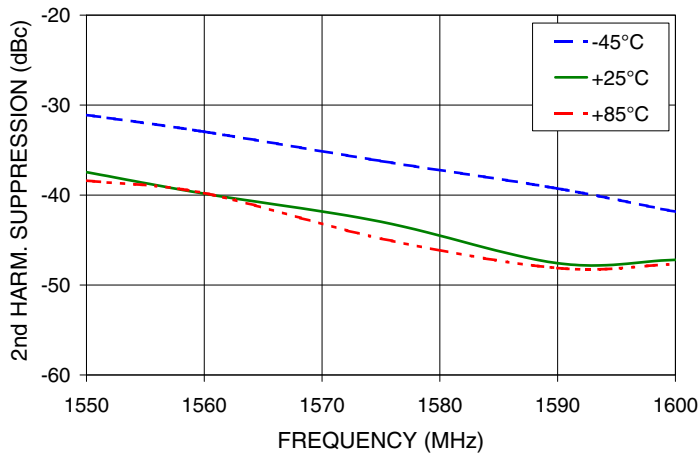
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Typical Performance Curves

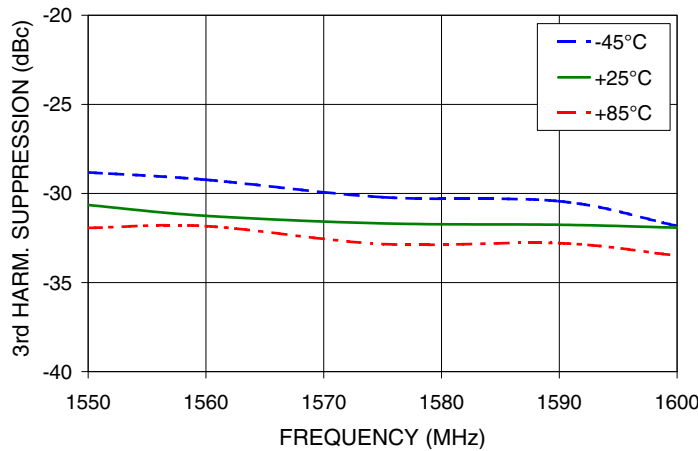
OUTPUT POWER Vs FREQUENCY



2nd HARMONIC Vs FREQUENCY



3rd HARMONIC Vs FREQUENCY



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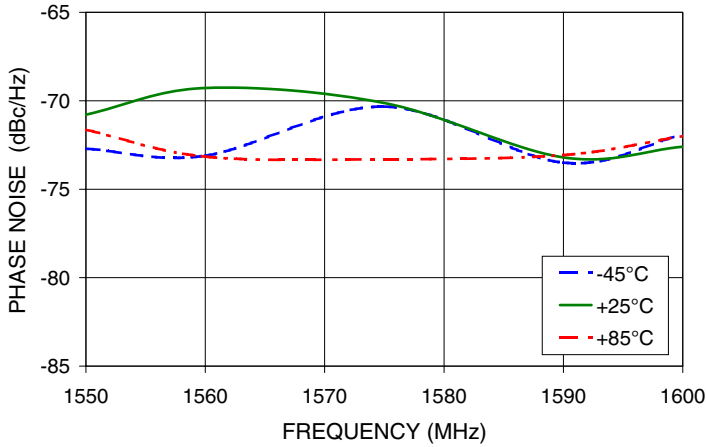


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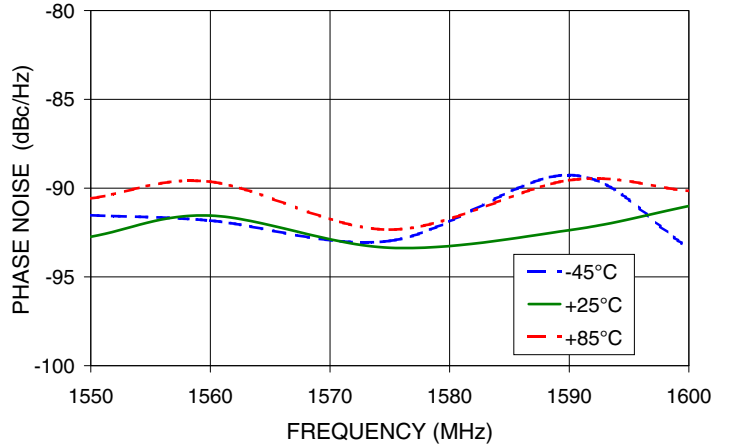


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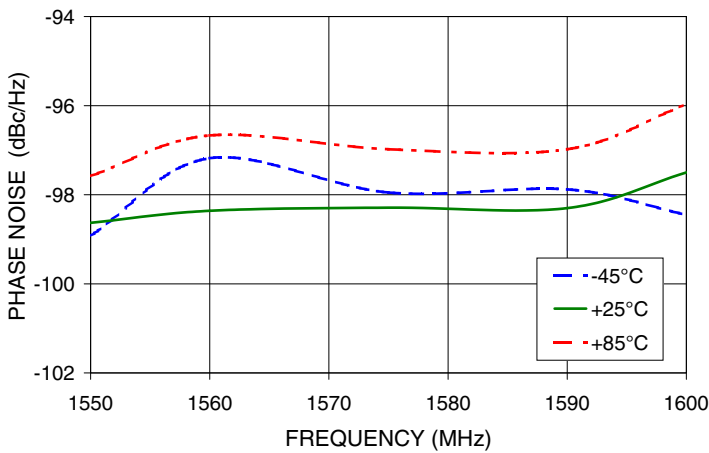
PHASE NOISE @ 100Hz offset



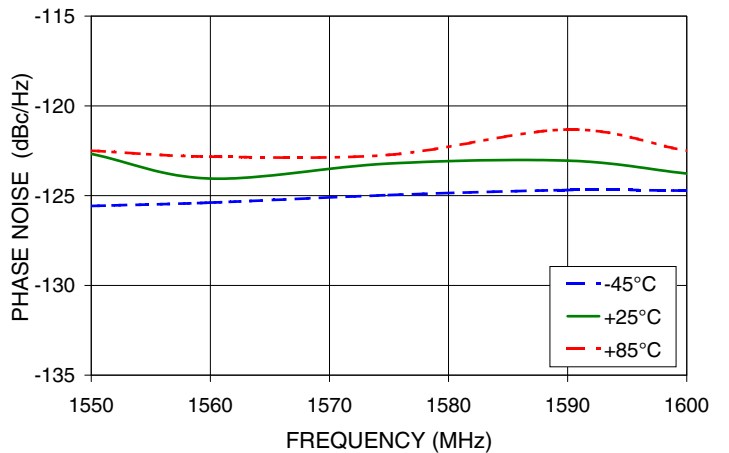
PHASE NOISE @ 1kHz offset



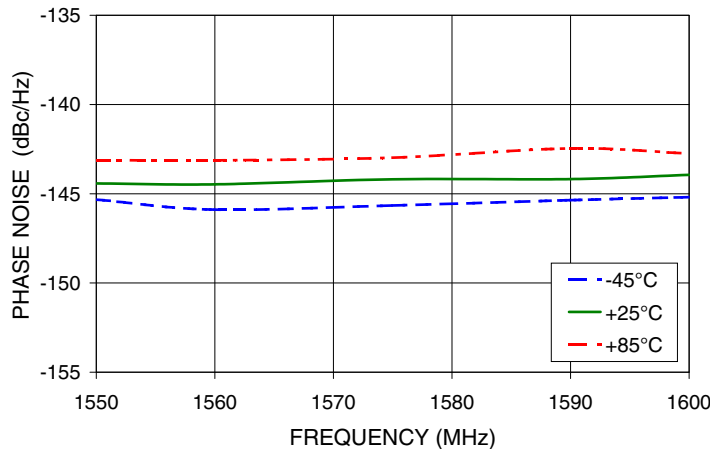
PHASE NOISE @ 10kHz offset



PHASE NOISE @ 100kHz offset



PHASE NOISE @ 1MHz offset



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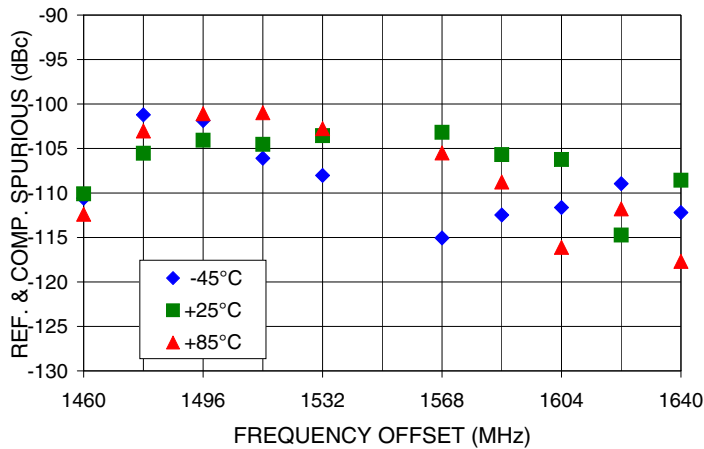


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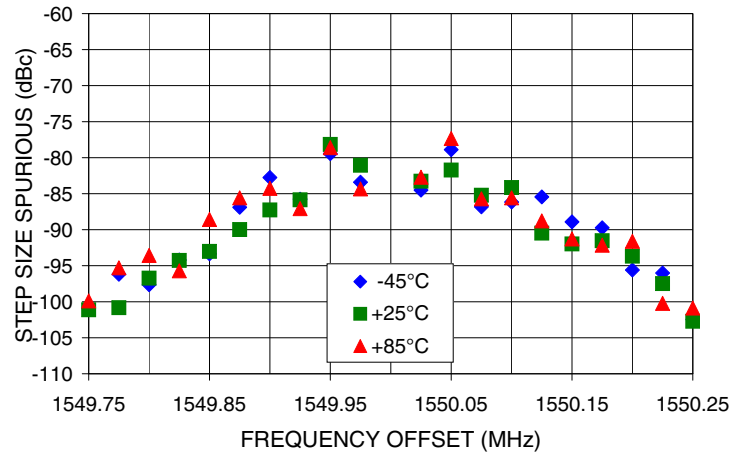


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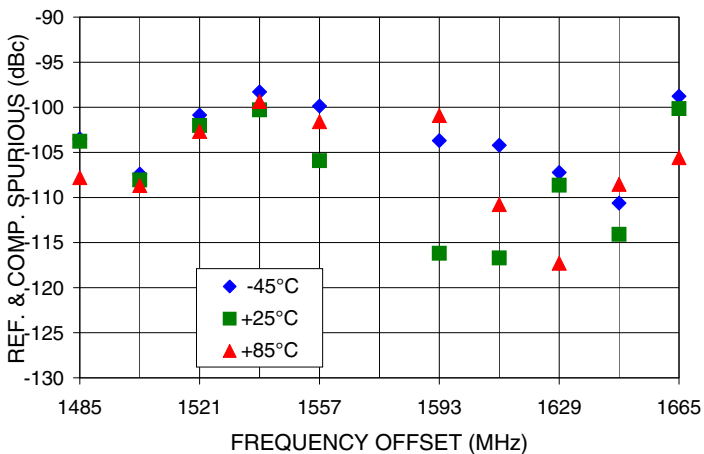
REFERENCE & COMPARISON SPURIOUS  
Vs FREQ. OFFSET @ Fcar = 1550MHz



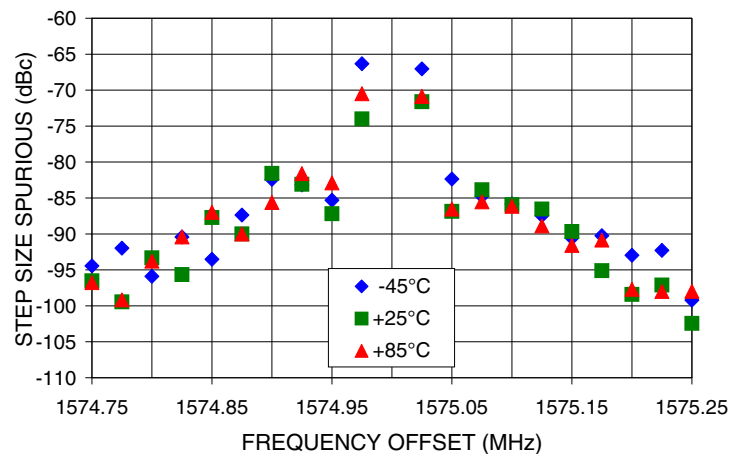
0.5 STEP SIZE & STEP SIZE SPURIOUS  
Vs FREQ. OFFSET @ Fcar = 1550MHz



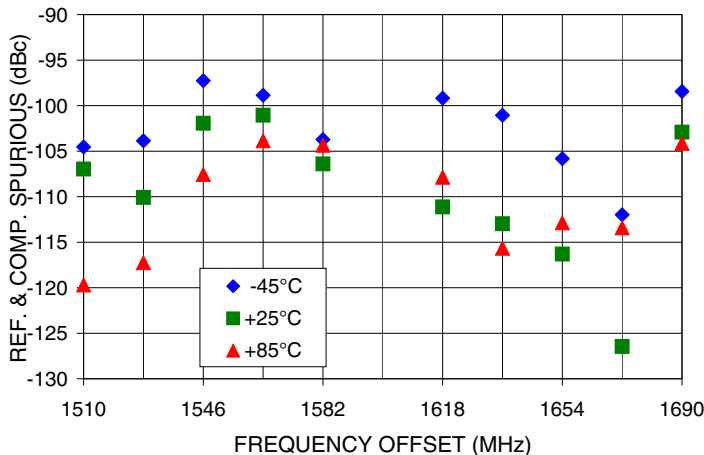
REFERENCE & COMPARISON SPURIOUS  
Vs FREQ. OFFSET @ Fcar = 1575MHz



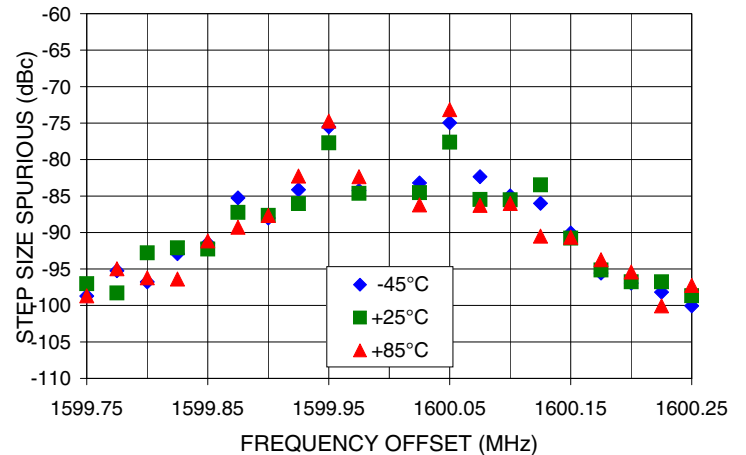
0.5 STEP SIZE & STEP SIZE SPURIOUS  
Vs FREQ. OFFSET @ Fcar = 1575MHz



REFERENCE & COMPARISON SPURIOUS  
Vs FREQ. OFFSET @ Fcar = 1600MHz



0.5 STEP SIZE & STEP SIZE SPURIOUS  
Vs FREQ. OFFSET @ Fcar = 1600MHz



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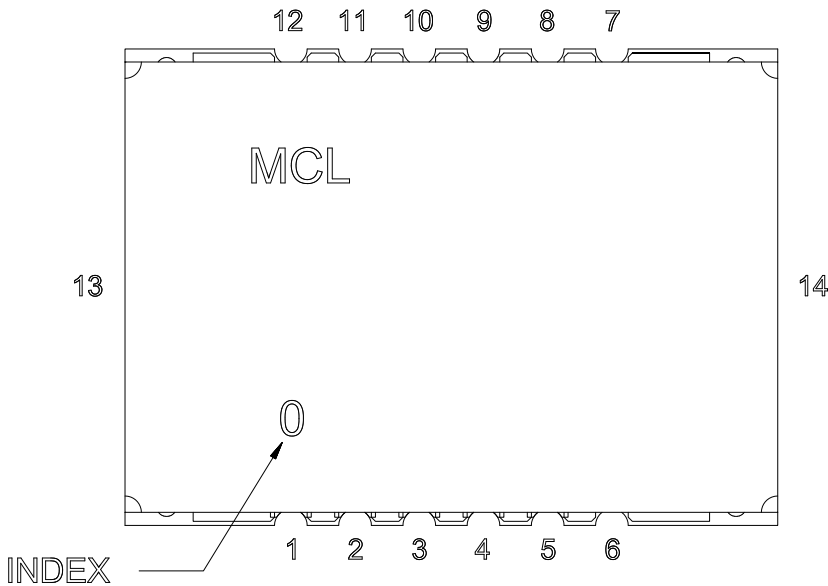


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Notes: 1. Performance and quality attributes and conditions not expressly stated in this specification sheet are intended to be excluded and do not form a part of this specification sheet. 2. Electrical specifications and performance data contained herein are based on Mini-Circuit's applicable established test performance criteria and measurement instructions. 3. The parts covered by this specification sheet are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at [www.minicircuits.com/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp).

Pin Configuration

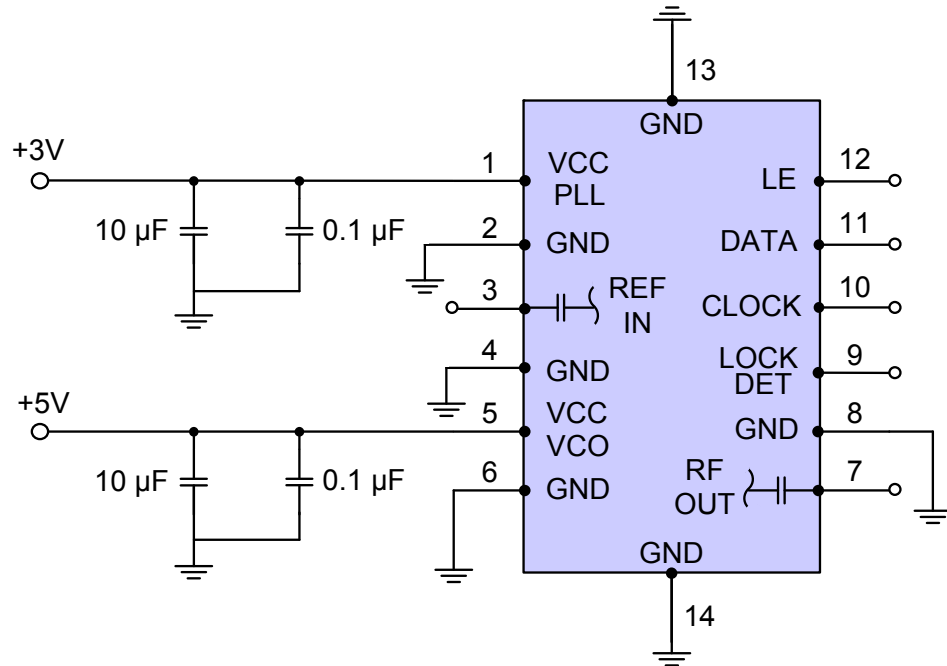


Pin Connection

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

Recommended Application Circuit

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



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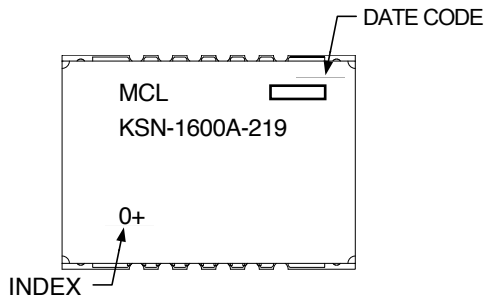


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## Device Marking

**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:** DK801

**Tape & Reel:** TR-F28

**Suggested Layout for PCB Design:** PL-249

**Evaluation Board:** TB-567-2+

**Environment Ratings:** ENV03T2



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