## **Frequency Synthesizer**

**50**Ω **945 to 976 MHz** 

## The Big Deal

- · 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-976A-119+ is a Frequency Synthesizer, designed to operate from 945 to 976 MHz for base station application. The KSN-976A-119+ 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: • Phase Noise: -116 dBc/Hz typ. @ 10 kHz offset • Comparison Spurious: -86 dBc typ. • Reference Spurious: -114 dBc typ.	Low phase noise and spurious improve system EVM (Error Vector Magnitude).
Robust design and construction	To enhance the robustness of KSN-976A-119+, 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-976A-119+ to be used in compact designs.

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# Surface Mount Frequency Synthesizer

50Ω 945 to 976 MHz

#### Features

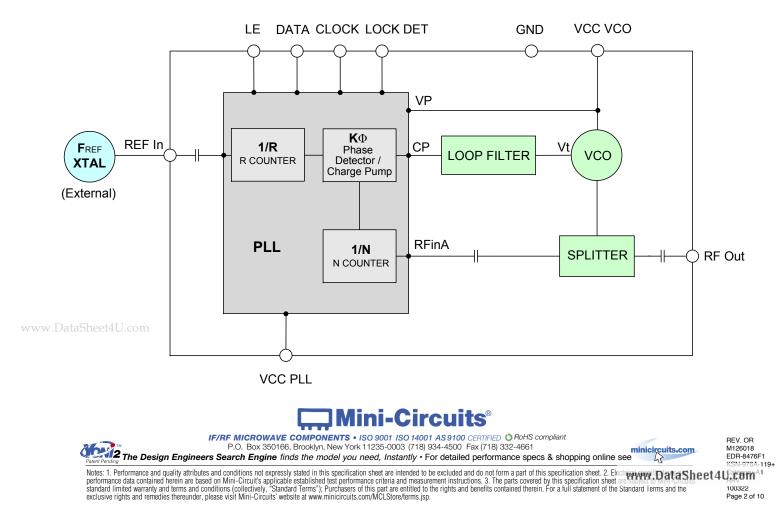
- Integrated VCO + PLL
- Low phase noise and spurious
- Robust design and construction
- Low operating voltage (VCC VCO=+5V, VCC PLL=+5V)
- Small size 0.80" x 0.58" x 0.15"

#### Applications

Base station

#### **General Description**

The KSN-976A-119+ is a Frequency Synthesizer, designed to operate from 945 to 976 MHz for base station application. The KSN-976A-119+ 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-976A-119+, 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**



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.



#### Electrical Specifications (over operating temperature -40°C to +85°C)

Parameters	Test Conditions	Min.	Тур.	Max.	Units				
Frequency Range	-	945	-	976	MHz				
Step Size		-	-	20	-	kHz			
Settling Time		Within ± 1 kHz	-	20	-	mSec			
Output Power		-	-2.5	+0.7	+2.5	dBm			
· ·		@ 100 Hz offset	-	-73	-				
		@ 1 kHz offset	-	-84	-79	-			
SSB Phase Noise		@ 10 kHz offset	-	-116	-111	dBc/Hz			
		@ 100 kHz offset	-	-139	-133	1			
		@ 1 MHz offset	-	-158	-152	1			
Integrated SSB Phase Noise		@ 100 Hz to 1MHz	-	-44	-38	dBc			
Reference Spurious Suppres	sion	Ref. Freq. 15 MHz	-	-114	-75				
Comparison Spurious Suppre	ession	Step Size 20 kHz	-	-86	-60				
Non - Harmonic Spurious Su	ppression	-	-	-90	-	dBc			
Harmonic Suppression		-	-	-30	-23	]			
VCO Supply Voltage		5.00	4.75	5.00	5.25	v			
PLL Supply Voltage		5.00	4.75	5.00	5.25				
VCO Supply Current		-	-	34	40				
PLL Supply Current		-	-	11	18	– mA			
	Frequency	15 (sine wave)	-	15	-	MHz			
Reference Input	Amplitude	1	-	1	-	V <sub>P-P</sub>			
(External)	Input impedance	-	-	100	-	ΚΩ			
	Phase Noise @ 1 kHz offset	-	-	-135	-	dBc/Hz			
RF Output port Impedance		-	-	50	-	Ω			
	Input high voltage	-	4.20	-	-	V			
Input Logic Level	Input low voltage	-	-	-	0.95	V			
Digital Look Datast	Locked	-	4.35	-	5.25	V			
Digital Lock Detect	Unlocked	-	-	-	0.40	V			
Frequency Synthesizer PLL		-	ADF4113						
PLL Programming		-	3-wire serial 5V CMOS						
	F_Register	-	(MSB) 0101	(MSB) 010111111000000010010011 (LSB)					
Register Map @ 976 MHz	N_Register	-	(MSB) 0000	01011111010	100000000	1 (LSB)			
	R_Register	-	(MSB) 0001	10000000010	0111011100	D (LSB)			

#### **Absolute Maximum Ratings**

Parameters	Ratings
VCO Supply Voltage	6V
PLL Supply Voltage	6V
VCO Supply Voltage to PLL Supply Voltage	-0.3V to +5.5V
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**

	PO	POWER OUTPUT VCO CURRENT			PLL CURENT				
FREQUENCY (MHz)		(dBm)			(mA)			(mA)	
	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
945	0.61	0.79	0.82	32.42	33.90	34.85	8.81	10.96	12.74
948	0.59	0.77	0.80	32.41	33.90	34.86	8.81	10.96	12.74
954	0.55	0.73	0.76	32.40	33.90	34.86	8.82	10.97	12.75
960	0.52	0.69	0.72	32.38	33.89	34.85	8.82	10.97	12.75
966	0.50	0.67	0.69	32.36	33.88	34.84	8.83	10.98	12.76
972	0.50	0.65	0.68	32.34	33.86	34.84	8.84	11.00	12.77
976	0.50	0.65	0.67	32.34	33.85	34.83	8.84	10.99	12.77

FREQUENCY	HARMONICS (dBc)										
(MHz)		F2		F3							
. ,	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C					
945	-28.88	-29.72	-30.73	-53.53	-54.08	-54.09					
948	-28.92	-29.80	-30.77	-53.98	-54.19	-54.00					
954	-28.78	-29.65	-30.63	-54.43	-54.20	-53.53					
960	-29.11	-29.86	-30.81	-55.17	-53.95	-53.18					
966	-30.06	-30.80	-31.72	-54.77	-53.82	-52.83					
972	-31.05	-31.76	-32.70	-53.37	-52.47	-51.64					
976	-31.59	-32.35	-33.26	-52.76	-51.69	-50.86					

FREQUENCY	PHASE NOISE (dBc/Hz) @OFFSETS						
(MHz)	+25°C						
,	100Hz	1kHz	10kHz	100kHz	1MHz		
945	-76.52	-83.86	-116.81	-139.02	-156.66		
948	-75.67	-84.11	-116.62	-139.04	-158.00		
954	-73.55	-83.86	-116.55	-138.83	-158.42		
960	-72.19	-84.71	-116.86	-138.89	-158.92		
966	-69.33	-84.37	-116.38	-138.78	-158.40		
972	-68.73	-84.19	-116.47	-138.85	-158.42		
976	-68.00	-86.23	-116.57	-138.71	-158.09		

FREQUENCY	PH	IASE NOIS	E (dBc/Hz	) @OFFSE	TS	FREQUENCY	PH	ASE NOIS	E (dBc/Hz	) @OFFSE	тѕ
(MHz)		-45°C							+85°C		
	100Hz	1kHz	10kHz	100kHz	1MHz		100Hz	1kHz	10kHz	100kHz	1MHz
945	-77.85	-82.18	-116.84	-139.88	-156.11	945	-74.34	-83.48	-115.32	-137.04	-155.21
948	-74.35	-84.36	-116.74	-140.17	-157.05	948	-76.03	-84.55	-115.15	-137.17	-155.30
954	-76.27	-84.35	-116.53	-140.07	-155.75	954	-75.97	-83.98	-115.13	-137.26	-155.29
960 960	-74.82	-83.77	-116.26	-140.27	-157.17	960	-74.38	-85.37	-115.23	-137.23	-156.35
966	-75.77	-84.38	-116.00	-139.98	-155.01	966	-73.36	-85.14	-115.23	-137.42	-156.63
972	-73.87	-82.48	-116.09	-139.46	-155.76	972	-74.67	-85.65	-115.10	-137.17	-155.93
976	-70.97	-86.12	-115.89	-139.23	-157.96	976	-72.17	-83.85	-115.00	-137.19	-155.85

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COMPARISON SPURIOUS ORDER	COMPARISON SPURIOUS @Fcarrier 945MHz+(n*Fcomparison) (dBc) note 1			COMPARISON SPURIOUS @Fcarrier 960MHz+(n*Fcomparison) (dBc) note 1			COMPARISON SPURIOUS @Fcarrier 976MHz+(n*Fcomparison) (dBc) note 1		
n	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
-5	-104.10	-108.96	-99.49	-100.18	-105.12	-101.68	-96.29	-100.31	-101.58
-4	-107.52	-107.93	-97.45	-100.28	-102.41	-98.72	-94.68	-97.64	-99.25
-3	-104.23	-103.25	-95.50	-112.24	-111.92	-98.82	-105.17	-101.28	-99.35
-2	-96.12	-97.38	-92.00	-95.95	-98.50	-91.06	-94.00	-95.36	-90.31
-1	-86.77	-88.42	-84.74	-85.31	-86.72	-80.33	-80.57	-82.66	-77.56
0 <sup>note 2</sup>	-	-	-	-	-	-	-	-	-
+1	-86.47	-88.65	-85.96	-84.98	-85.68	-81.42	-80.94	-82.39	-77.61
+2	-95.32	-97.86	-92.22	-96.71	-98.58	-91.02	-95.41	-95.07	-90.39
+3	-102.72	-103.59	-97.54	-108.26	-111.88	-100.24	-105.82	-100.77	-100.67
+4	-112.07	-108.89	-97.89	-104.57	-103.08	-99.32	-97.25	-98.14	-99.75
+5	-106.44	-107.50	-99.83	-102.44	-106.70	-103.90	-97.43	-101.38	-104.50

Note 1: Comparison frequency 20 kHz

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

REFERENCE SPURIOUS ORDER	REFERENCE SPURIOUS @Fcarrier 945MHz+(n*Freference) (dBc) note 3			REFERENCE SPURIOUS @Fcarrier 960MHz+(n*Freference) (dBc) note 3			REFERENCE SPURIOUS @Fcarrier 976MHz+(n*Freference) (dBc) note 3		
n	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
-5	-114.40	-121.08	-123.27	-107.02	-110.08	-117.50	-118.04	-121.19	-120.18
-4	-107.69	-106.84	-107.70	-103.51	-100.58	-96.73	-107.31	-108.57	-108.15
-3	-116.22	-127.59	-123.70	-111.83	-111.12	-110.94	-123.05	-125.71	-126.49
-2	-108.76	-109.32	-109.07	-109.52	-117.19	-113.64	-112.69	-114.04	-114.14
-1	-121.24	-126.09	-128.24	-118.57	-114.51	-112.60	-123.88	-122.72	-126.21
0 <sup>note 4</sup>	-	-	-		-	-		-	-
+1	-116.05	-115.27	-115.56	-114.17	-107.54	-106.35	-116.77	-120.75	-121.46
+2	-106.29	-110.17	-108.90	-116.24	-117.42	-110.18	-106.89	-108.92	-109.64
+3	-109.52	-113.27	-113.40	-104.35	-107.92	-108.96	-118.03	-120.60	-117.61
+4	-100.57	-103.68	-104.39	-91.51	-92.44	-92.85	-103.66	-104.79	-104.88
+5	-110.40	-110.71	-111.37	-119.46	-109.56	-108.65	-116.87	-117.92	-117.06

Note 3: Reference frequency 15 MHz

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

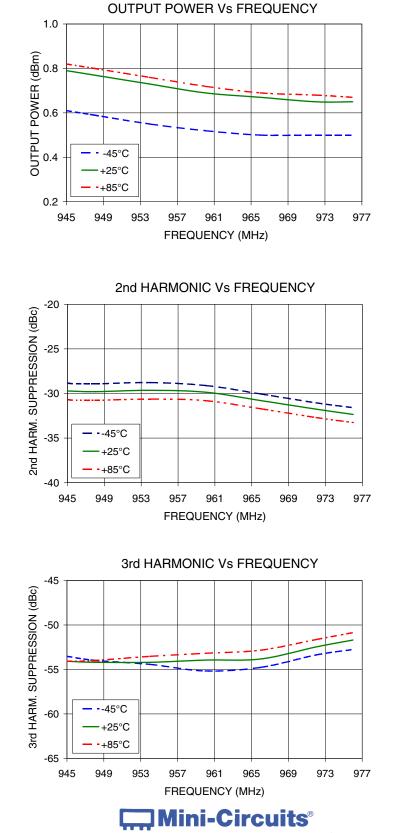


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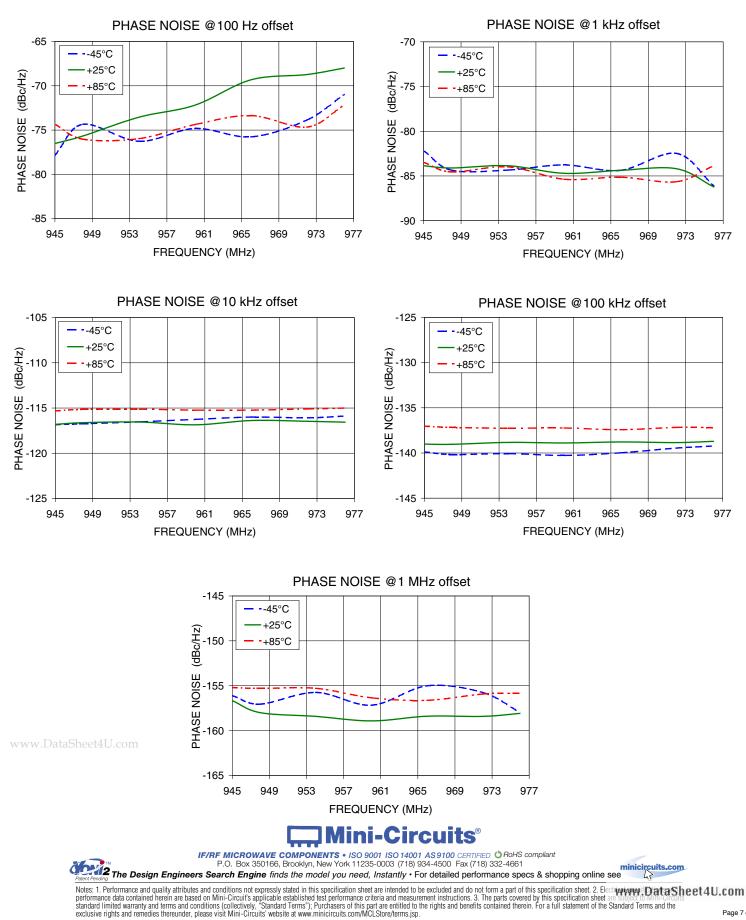
#### **Typical Performance Curves**





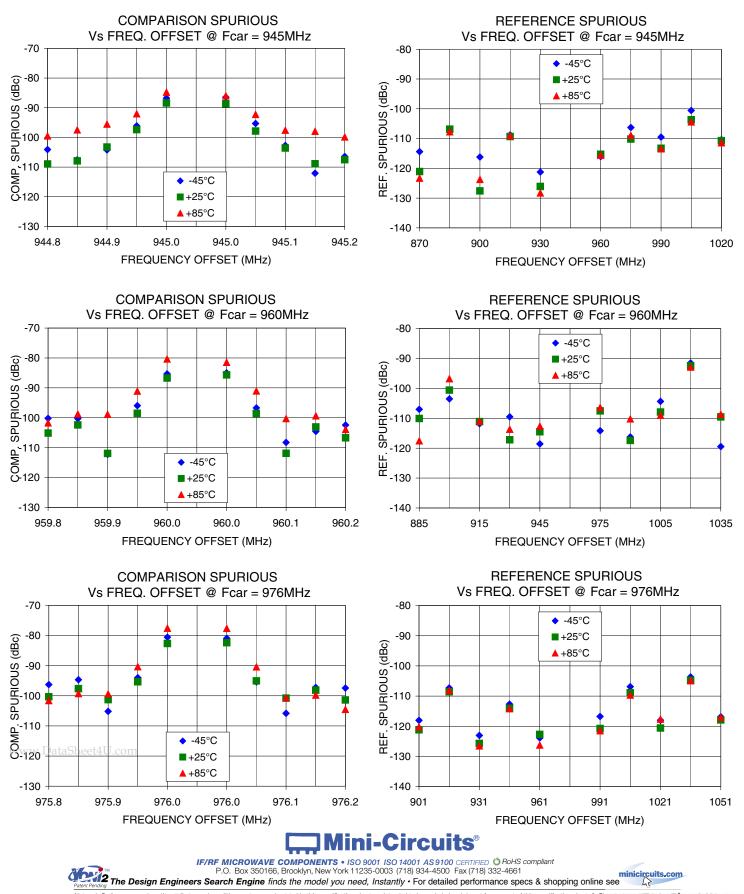
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### KSN-976A-119+



#### **Frequency Synthesizer**

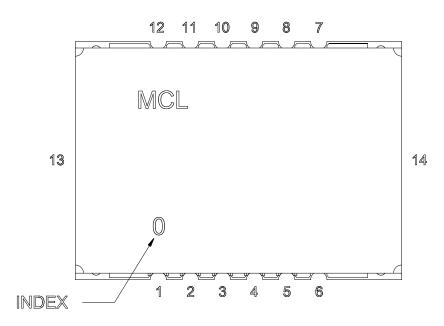
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#### **Frequency Synthesizer**

#### **Pin Configuration**



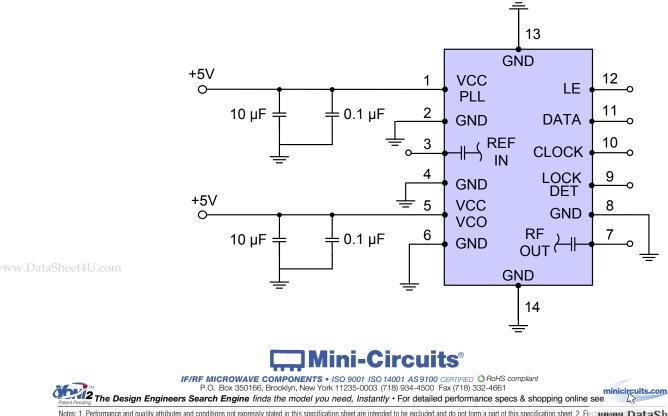
#### KSN-976A-119+

#### **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

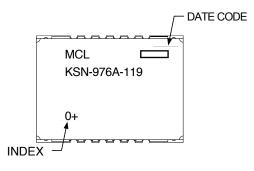
#### **Recommended Application Circuit**

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



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#### **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+

Environment Ratings: ENV03T2



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