

# Frequency Synthesizer

KSN-2060A-119+

50Ω 2010 to 2060 MHz

## The Big Deal

- Low phase noise and spurious
- Robust design and construction
- Small size 0.80" x 0.58" x 0.24"



CASE STYLE: DK1171

## Product Overview

The KSN-2060A-119+ is a Frequency Synthesizer, designed to operate from 2010 to 2060 MHz for cellular infrastructure application. The KSN-2060A-119+ is packaged in a metal case (size of 0.80" x 0.58" x 0.24") 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: -110 dBc/Hz typ. @ 10 kHz offset</li><li>• Comparison Spurious: -84 dBc typ.</li><li>• Reference Spurious: -104 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-2060A-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 0.24"	The small size enables the KSN-2060A-119+ to be used in compact designs.



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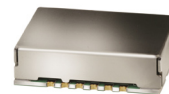


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- Integrated VCO + PLL
- Low phase noise and spurious
- Robust design and construction
- Low operating voltage (VCC VCO=+5V, VCC PLL=+5V)
- Small size 0.80" x 0.58" x 0.24"



CASE STYLE: DK1171  
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.*

- Cellular infrastructure

The KSN-2060A-119+ is a Frequency Synthesizer, designed to operate from 2010 to 2060 MHz for cellular infrastructure application. The KSN-2060A-119+ is packaged in a metal case (size of 0.80" x 0.58" x 0.24") to shield against unwanted signals and noise. To enhance the robustness of KSN-2060A-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.

The diagram illustrates a Phase-Locked Loop (PLL) system. An external crystal oscillator ( $F_{REF}$  XTAL) provides a reference signal (REF In) to the PLL. The PLL block contains a  $1/R$  R Counter, a  $K\Phi$  Phase Detector / Charge Pump, and a  $1/N$  N Counter. The PLL is powered by VCC PLL and has control pins LE, DATA, CLOCK, and LOCK DET. The output of the PLL (CP) goes to a Loop Filter, which outputs  $V_t$  to the VCO. The VCO is powered by VCC VCO and has a control pin VP. The VCO output goes to a Splitter, which outputs RF Out. The Splitter also receives a feedback signal (RFInA) from the PLL output.



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REV. OR  
M126018  
EDR-8343F1  
KSN-2060A-119+  
Category-A1  
RAV  
100321  
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**Electrical Specifications** (over operating temperature -40°C to +85°C)

Parameters		Test Conditions	Min.	Typ.	Max.	Units
Frequency Range		-	2010	-	2060	MHz
Step Size		-	-	100	-	kHz
Settling Time		Within $\pm 1$ kHz	-	10	-	mSec
Output Power		-	0	+3	+6	dBm
SSB Phase Noise	@ 100 Hz offset	-	-	-72	-	dBc/Hz
	@ 1 kHz offset	-	-	-79	-74	
	@ 10 kHz offset	-	-	-110	-104	
	@ 100 kHz offset	-	-	-133	-127	
	@ 1 MHz offset	-	-	-151	-145	
Reference Spurious Suppression		Ref. Freq. 60 MHz	-	-104	-80	dBc
Comparison Spurious Suppression		Step Size 100 kHz	-	-84	-65	
Non - Harmonic Spurious Suppression		-	-	-90	-	
Harmonic Suppression		-	-	-24	-18	
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		-	-	32	38	mA
PLL Supply Current		-	-	15	22	
Reference Input (External)	Frequency	60 (square wave)	-	60	-	MHz
	Amplitude	1	-	1	-	V <sub>P-P</sub>
	Input impedance	-	-	100	-	K $\Omega$
	Phase Noise @ 1 kHz offset	-	-	-130	-	dBc/Hz
RF Output port Impedance		-	-	50	-	$\Omega$
Input Logic Level	Input high voltage	-	2.60	-	-	V
	Input low voltage	-	-	-	0.55	V
Digital Lock Detect	Locked	-	2.45	-	3.25	V
	Unlocked	-	-	-	0.40	V
Frequency Synthesizer PLL		-	ADF4113			
PLL Programming		-	3-wire serial 3V CMOS			
Register Map @ 2060 MHz	F_Register	-	(MSB) 100111111000000010010011 (LSB)			
	N_Register	-	(MSB) 001000101000001101100001 (LSB)			
	R_Register	-	(MSB) 000100000000100101100000 (LSB)			

**Absolute Maximum Ratings**

Parameters	Ratings
VCO Supply Voltage	5.7V
PLL Supply Voltage	6.3V
VCO Supply Voltage to PLL Supply Voltage	-0.3V to +5.5V
Reference Frequency Voltage	-0.3Vmin, +3.2Vmax
Data, Clock, LE Levels	-0.3Vmin, +3.2Vmax
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



Patent Pending

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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
2010	2.42	2.40	2.33	31.15	32.06	32.44	13.59	15.28	16.67
2016	2.54	2.51	2.43	31.22	32.13	32.50	13.60	15.29	16.68
2024	2.74	2.71	2.64	31.28	32.20	32.56	13.61	15.30	16.70
2032	2.92	2.90	2.83	31.31	32.22	32.59	13.61	15.30	16.70
2040	3.08	3.07	2.99	31.32	32.23	32.59	13.62	15.31	16.71
2048	3.20	3.19	3.11	31.33	32.23	32.59	13.62	15.31	16.71
2056	3.32	3.32	3.21	31.34	32.23	32.59	13.62	15.32	16.72
2060	3.37	3.37	3.26	31.34	32.23	32.59	13.63	15.32	16.73

FREQUENCY (MHz)	HARMONICS (dBc)					
	F2			F3		
	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
2010	-23.71	-24.46	-25.43	-35.02	-34.73	-34.74
2016	-23.36	-23.87	-24.63	-34.03	-33.92	-34.88
2024	-24.40	-24.40	-24.55	-35.68	-34.74	-34.13
2032	-25.50	-25.64	-25.65	-35.11	-33.09	-32.01
2040	-25.35	-25.83	-26.33	-36.77	-35.27	-34.28
2048	-24.33	-25.03	-25.95	-37.72	-37.16	-36.09
2056	-23.46	-24.08	-24.92	-32.61	-32.53	-33.43
2060	-23.56	-23.91	-24.60	-32.89	-31.33	-31.89



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FREQUENCY (MHz)	PHASE NOISE (dBc/Hz) @ OFFSETS				
	+25°C				
	100Hz	1kHz	10kHz	100kHz	1MHz
2010	-71.31	-78.86	-110.54	-132.96	-151.73
2016	-70.43	-79.88	-110.10	-132.97	-150.48
2024	-72.46	-78.34	-109.91	-132.85	-151.77
2032	-71.89	-78.23	-109.68	-132.77	-150.98
2040	-71.22	-77.02	-109.61	-132.57	-150.70
2048	-75.69	-78.10	-109.33	-132.53	-150.17
2056	-71.89	-77.32	-109.54	-132.18	-150.60
2060	-74.23	-80.10	-109.17	-132.23	-150.40

FREQUENCY (MHz)	PHASE NOISE (dBc/Hz) @ OFFSETS				
	-45°C				
	100Hz	1kHz	10kHz	100kHz	1MHz
2010	-72.53	-77.53	-110.16	-133.62	-151.06
2016	-71.60	-78.99	-109.93	-133.36	-148.69
2024	-70.66	-78.35	-109.68	-133.31	-151.04
2032	-70.97	-78.51	-109.54	-133.08	-150.67
2040	-70.16	-78.38	-109.27	-133.02	-149.77
2048	-73.20	-79.36	-109.61	-132.89	-149.54
2056	-70.97	-78.80	-109.22	-132.88	-148.89
2060	-70.23	-78.79	-109.36	-133.00	-149.48

FREQUENCY (MHz)	PHASE NOISE (dBc/Hz) @ OFFSETS				
	+85°C				
	100Hz	1kHz	10kHz	100kHz	1MHz
2010	-71.37	-77.10	-108.82	-131.59	-151.05
2016	-72.85	-77.63	-108.93	-131.49	-149.19
2024	-73.86	-78.44	-108.77	-131.60	-149.57
2032	-70.37	-77.34	-108.48	-131.15	-151.04
2040	-71.58	-79.17	-108.69	-131.25	-149.65
2048	-72.64	-77.77	-108.05	-130.84	-149.96
2056	-69.71	-78.70	-108.28	-130.85	-150.94
2060	-68.83	-77.12	-107.93	-130.69	-150.92



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COMPARISON SPURIOUS ORDER	COMPARISON SPURIOUS @ Fcarrier 2010MHz+(n*Fcomparison) (dBc) note 1			COMPARISON SPURIOUS @ Fcarrier 2035MHz+(n*Fcomparison) (dBc) note 1			COMPARISON SPURIOUS @ Fcarrier 2060MHz+(n*Fcomparison) (dBc) note 1		
	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
-5	-99.13	-101.49	-103.90	-96.27	-99.00	-101.73	-96.62	-98.79	-103.63
-4	-95.09	-98.01	-100.29	-92.20	-94.72	-98.26	-92.50	-95.45	-99.49
-3	-88.01	-90.40	-93.90	-85.48	-88.20	-91.62	-85.32	-89.05	-92.81
-2	-77.32	-78.78	-81.53	-74.19	-76.25	-79.72	-74.30	-76.67	-81.00
-1	-89.99	-89.63	-90.57	-86.51	-86.79	-89.07	-86.39	-87.39	-91.93
0 note 2	-	-	-	-	-	-	-	-	-
+1	-90.16	-88.55	-91.22	-86.20	-86.42	-88.65	-85.94	-86.94	-91.15
+2	-76.55	-78.03	-80.77	-73.70	-75.65	-78.82	-73.79	-76.29	-80.07
+3	-87.49	-90.30	-92.48	-84.05	-86.64	-90.53	-84.53	-88.58	-91.81
+4	-93.48	-95.74	-99.22	-91.30	-93.33	-95.68	-91.64	-94.24	-97.32
+5	-98.38	-100.31	-104.08	-95.86	-97.93	-100.85	-96.08	-98.42	-101.76

Note 1: Comparison frequency 100 kHz

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

REFERENCE SPURIOUS ORDER	REFERENCE SPURIOUS @ Fcarrier 2010MHz+(n*Freference) (dBc) note 3			REFERENCE SPURIOUS @ Fcarrier 2035MHz+(n*Freference) (dBc) note 3			REFERENCE SPURIOUS @ Fcarrier 2060MHz+(n*Freference) (dBc) note 3		
	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
-5	-123.21	-122.65	-126.87	-124.04	-126.00	-126.05	-123.87	-126.93	-125.88
-4	-110.65	-113.40	-113.66	-107.06	-109.43	-109.72	-103.20	-105.19	-106.67
-3	-93.63	-94.51	-95.26	-93.71	-96.12	-98.66	-100.76	-102.89	-104.69
-2	-101.61	-102.43	-104.11	-103.04	-103.79	-106.39	-104.04	-105.79	-107.51
-1	-113.12	-111.54	-113.30	-113.58	-113.47	-113.29	-115.87	-115.65	-114.68
0 note 4	-	-	-	-	-	-	-	-	-
+1	-119.73	-116.61	-114.05	-117.49	-114.47	-112.90	-117.81	-116.64	-114.45
+2	-97.91	-99.53	-100.37	-98.80	-100.54	-102.21	-100.19	-102.06	-103.23
+3	-88.71	-89.57	-90.94	-88.92	-91.18	-93.95	-94.97	-97.05	-99.22
+4	-104.53	-106.52	-109.09	-101.12	-102.94	-105.08	-96.80	-99.01	-101.22
+5	-129.34	-131.05	-130.89	-126.75	-129.60	-131.02	-122.22	-124.16	-126.87

Note 3: Reference frequency 60 MHz

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



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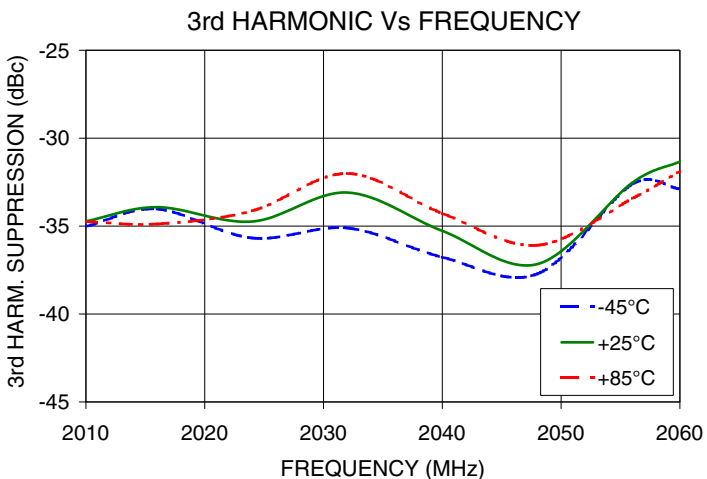
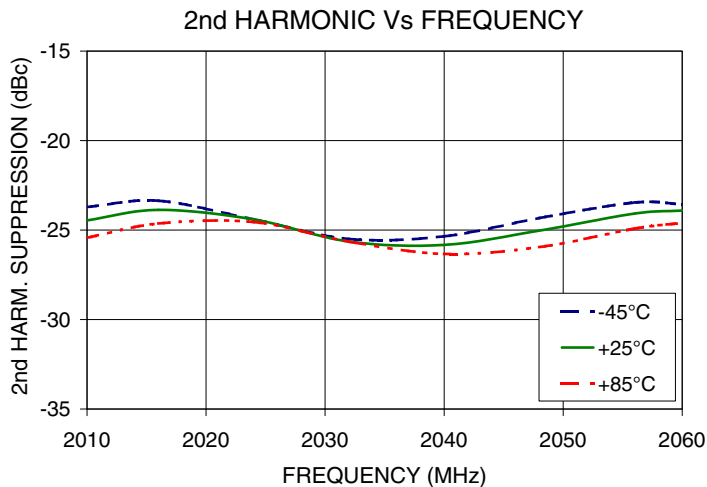
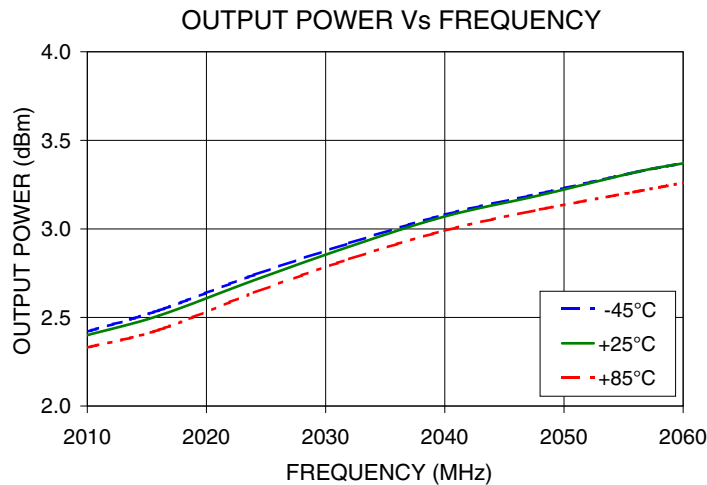


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Typical Performance Curves



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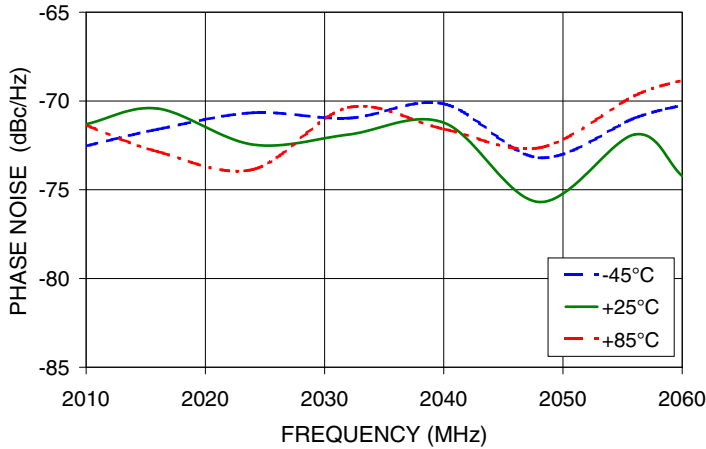


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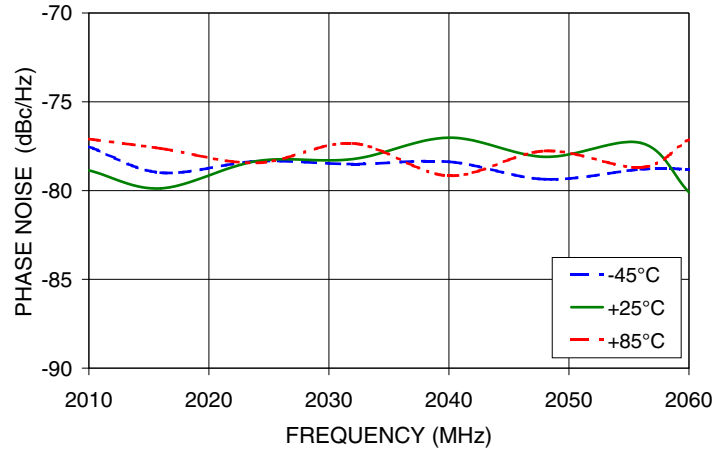


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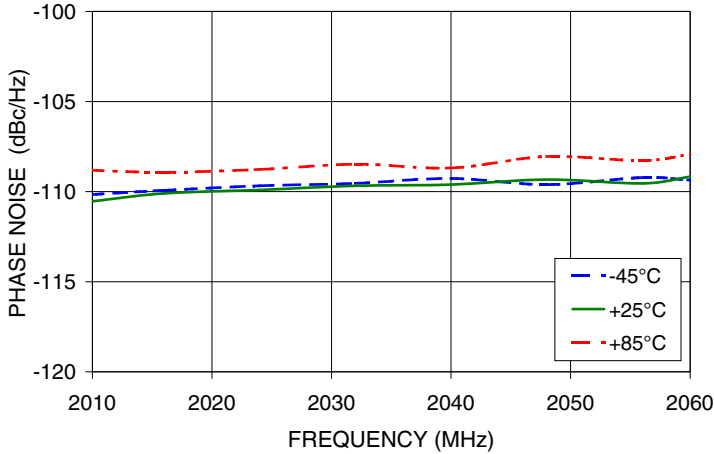
PHASE NOISE @100Hz offset



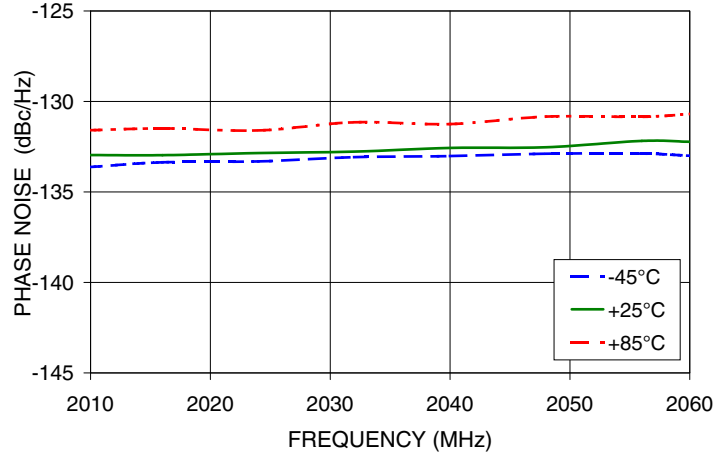
PHASE NOISE @1kHz offset



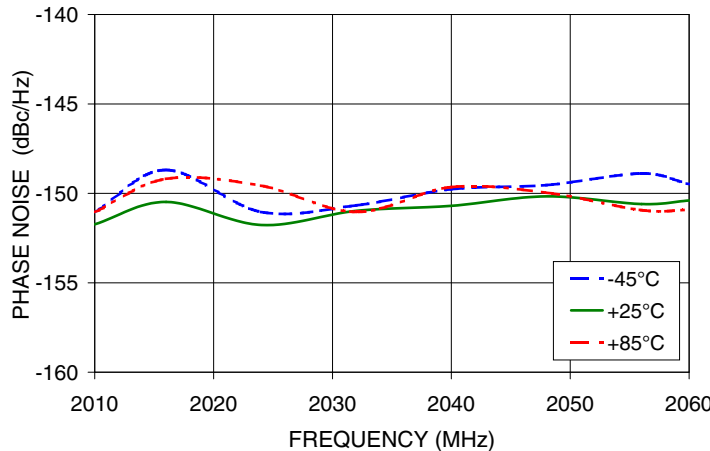
PHASE NOISE @10kHz offset



PHASE NOISE @100kHz offset



PHASE NOISE @1MHz offset



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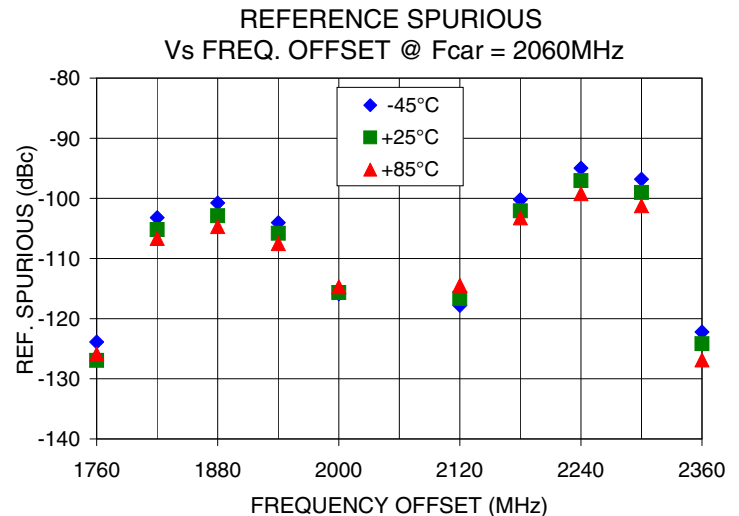
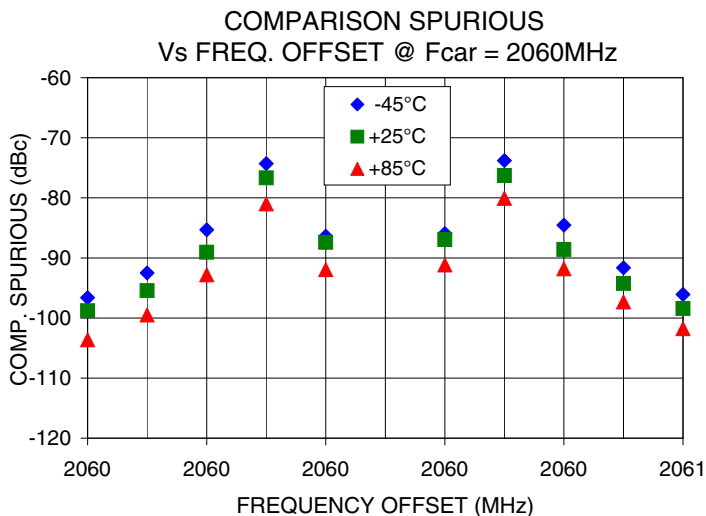
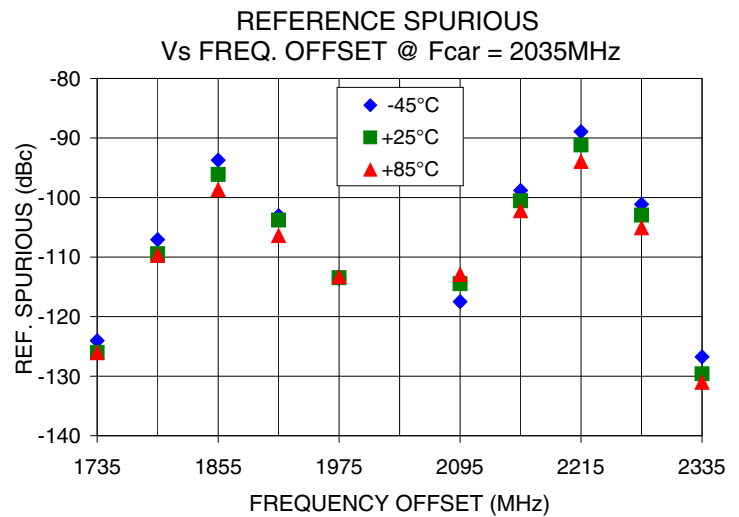
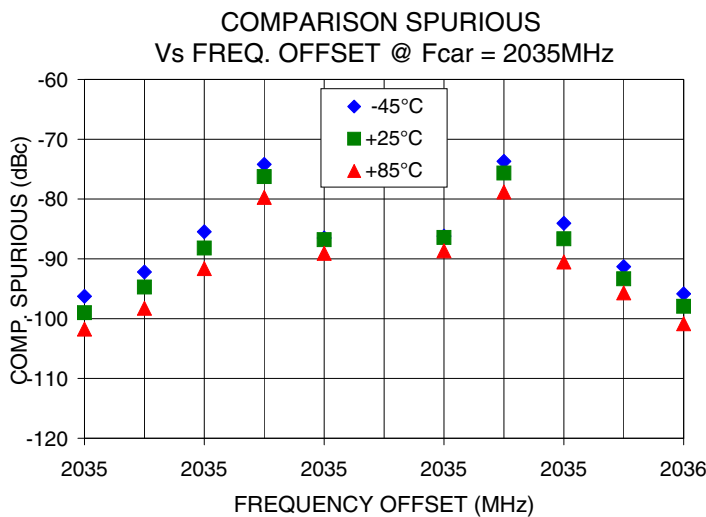
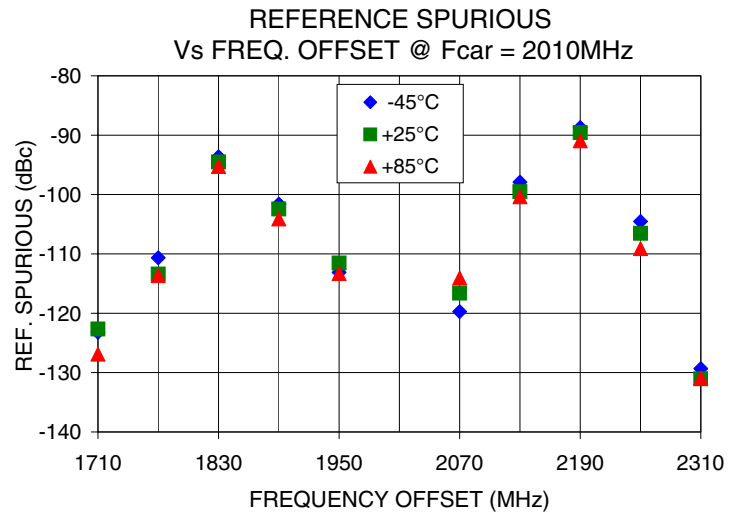
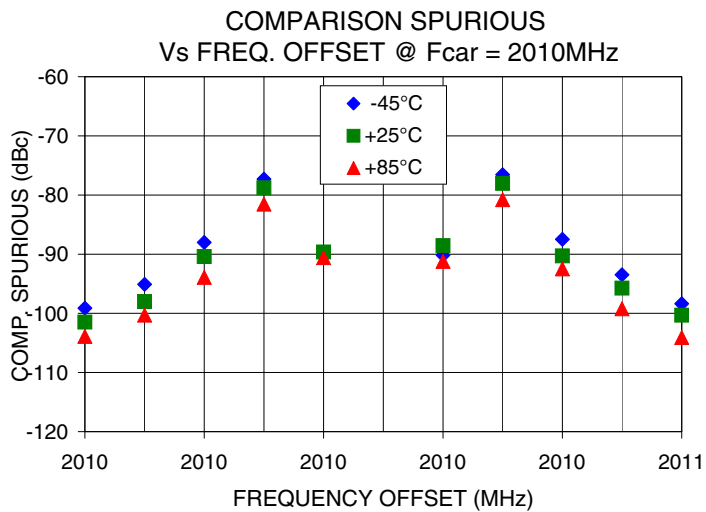


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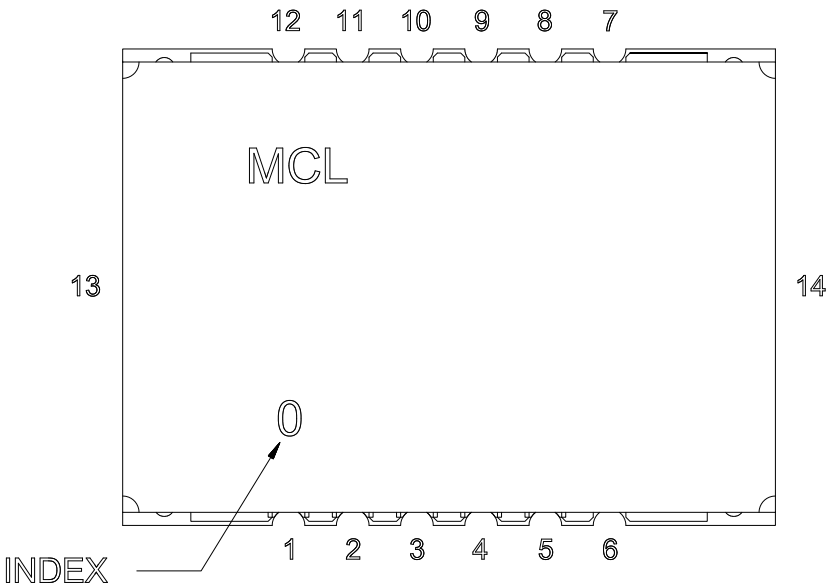


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Pin Configuration

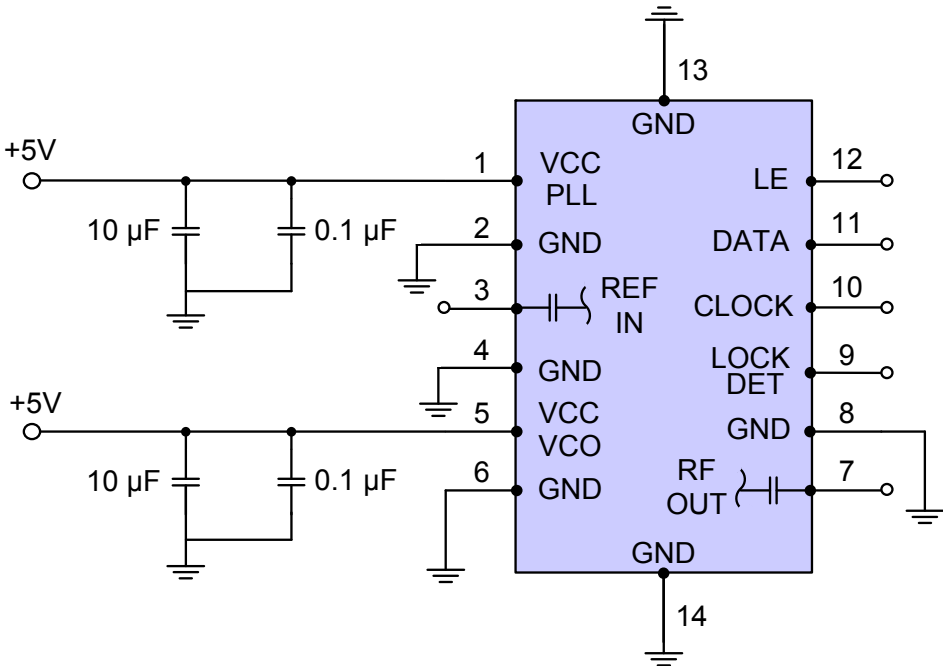


Pin Connection

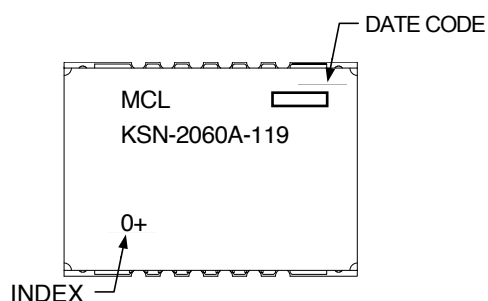
Pin Number	Function
1	VCC PLL
2	GND
3	REF IN
4	GND
5	VCC VCO
6	GND
7	RF OUT
8	GND
9	LOCK DET
10	CLOCK
11	DATA
12	LE
13	GND
14	GND

Recommended Application Circuit

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



## 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:** DK1171

**Tape & Reel:** TR-F28

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

**Evaluation Board:** TB-567+

**Environment Ratings:** ENV03T2



IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS9100 CERTIFIED RoHS compliant

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