

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">• Phase Noise: -98 dBc/Hz typ. @ 10 kHz offset• Step Size Spurious: -80 dBc typ.• Comparison Spurious: -100 dBc typ.• Reference Spurious: -100 dBc typ. | 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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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 _{P-P} |
| | 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 | | |
|---------------------------------------|--|---------|---------|--|---------|---------|--|---------|---------|
| | -45°C | +25°C | +85°C | -45°C | +25°C | +85°C | -45°C | +25°C | +85°C |
| | n | | | | | | | | |
| -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 | | |
|--------------------------|--|---------|---------|--|---------|--------|--|--------|---------|
| | -45°C | +25°C | +85°C | -45°C | +25°C | +85°C | -45°C | +25°C | +85°C |
| | n | | | | | | | | |
| -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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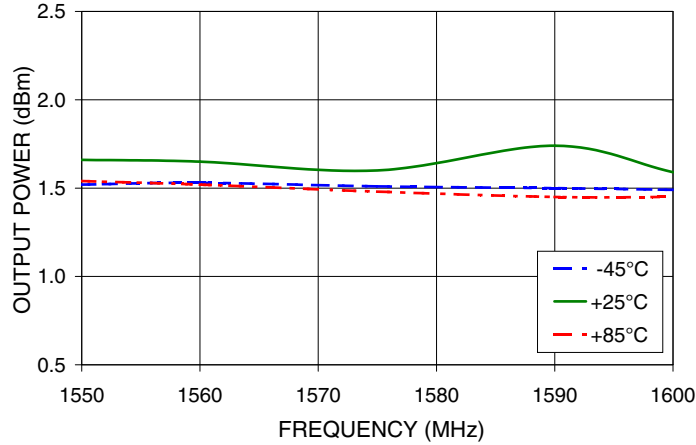
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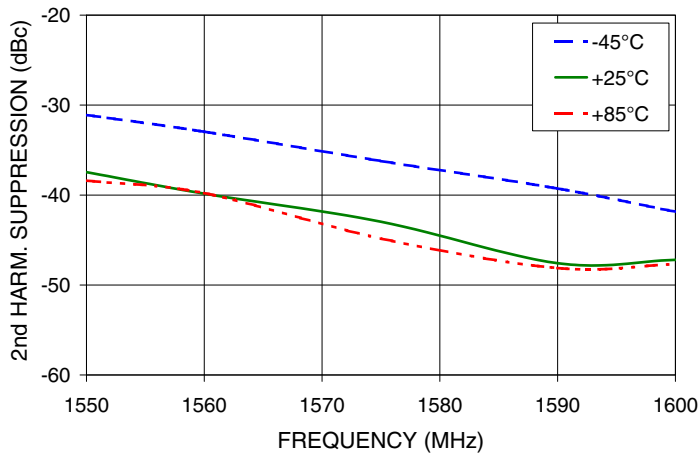
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Typical Performance Curves

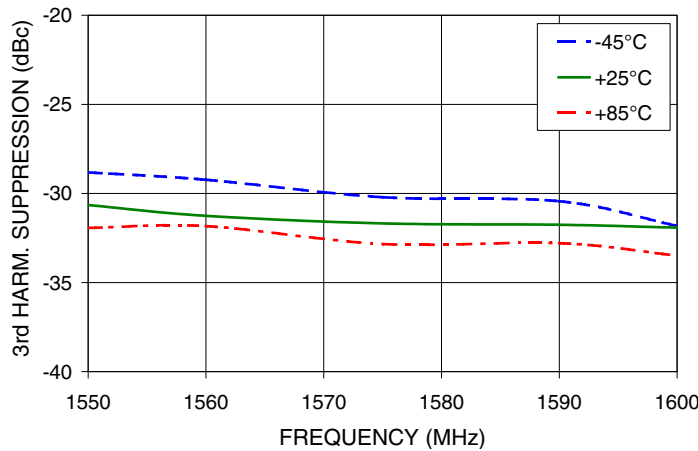
OUTPUT POWER Vs FREQUENCY



2nd HARMONIC Vs FREQUENCY



3rd HARMONIC Vs FREQUENCY



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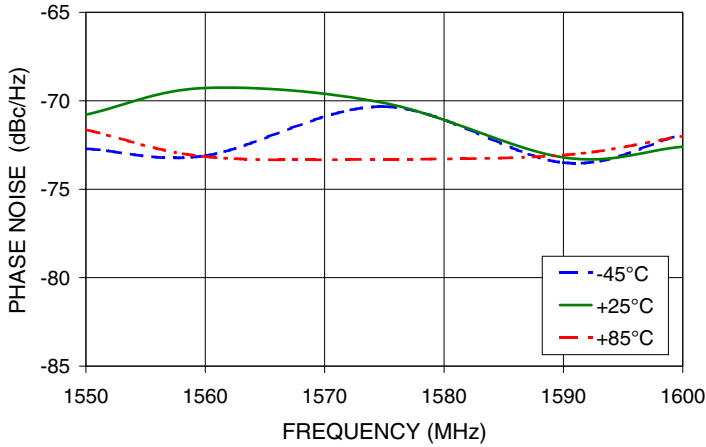


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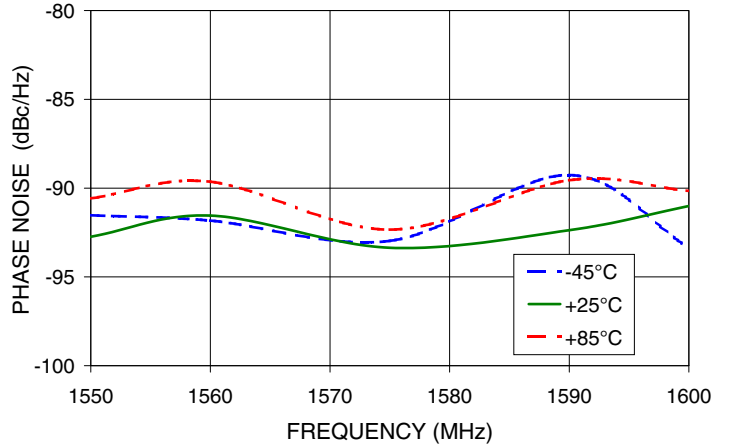


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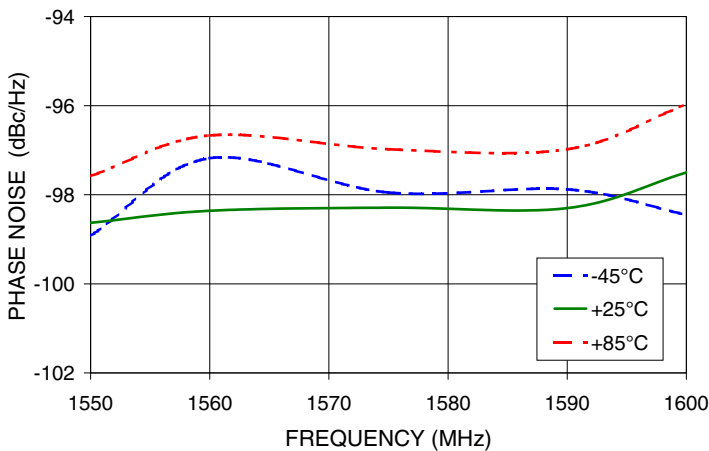
PHASE NOISE @ 100Hz offset



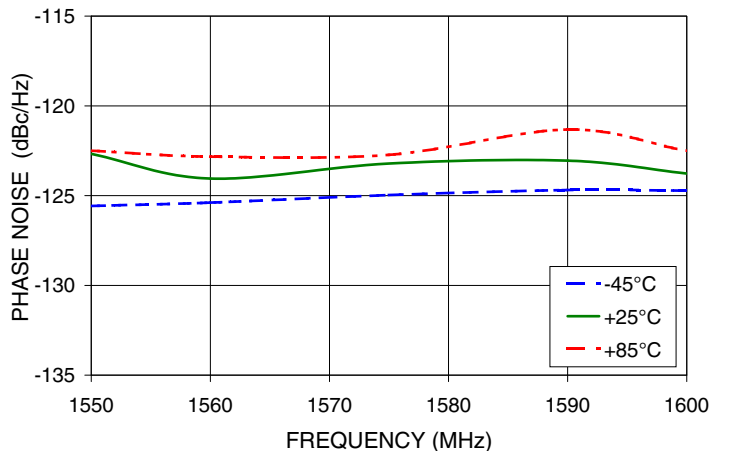
PHASE NOISE @ 1kHz offset



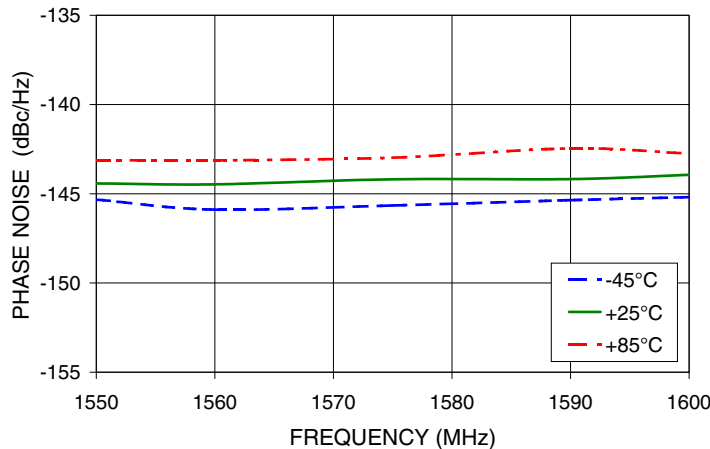
PHASE NOISE @ 10kHz offset



PHASE NOISE @ 100kHz offset



PHASE NOISE @ 1MHz offset



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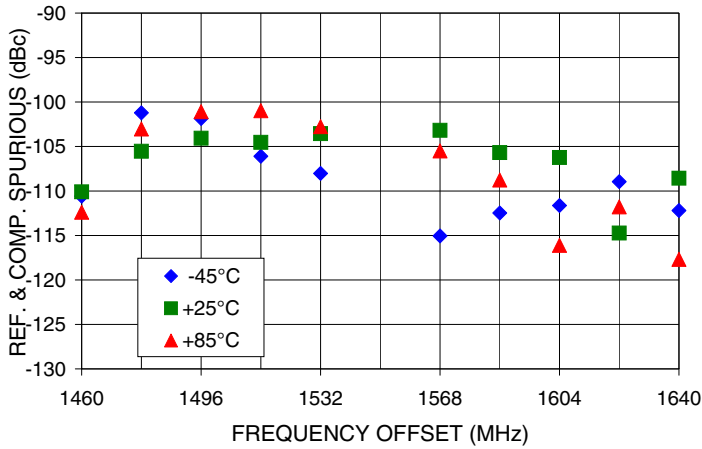


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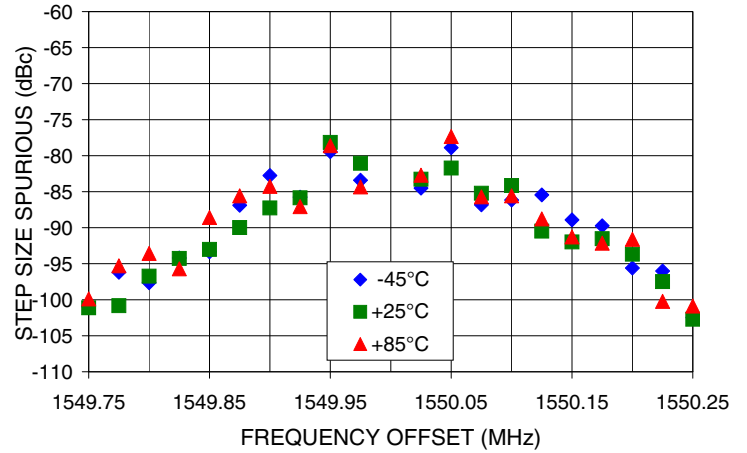


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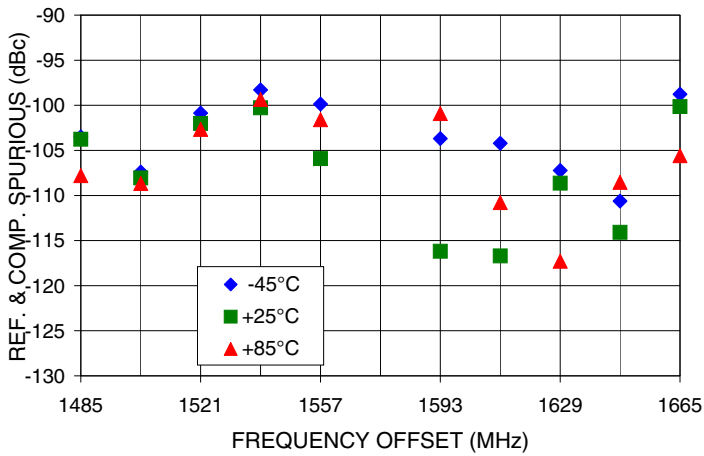
REFERENCE & COMPARISON SPURIOUS
Vs FREQ. OFFSET @ Fcar = 1550MHz



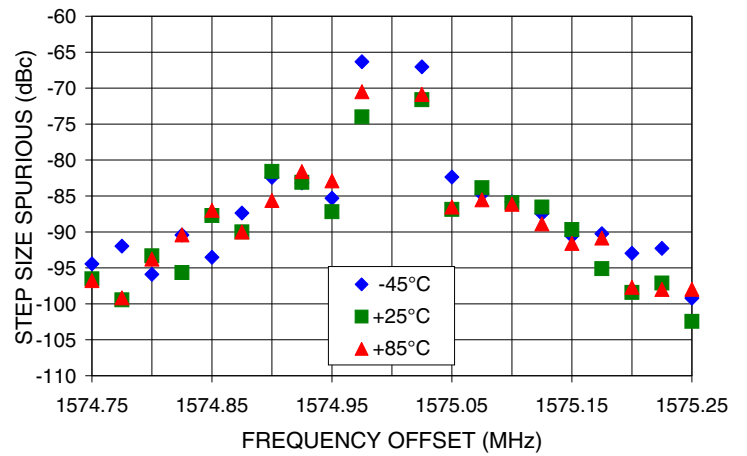
0.5 STEP SIZE & STEP SIZE SPURIOUS
Vs FREQ. OFFSET @ Fcar = 1550MHz



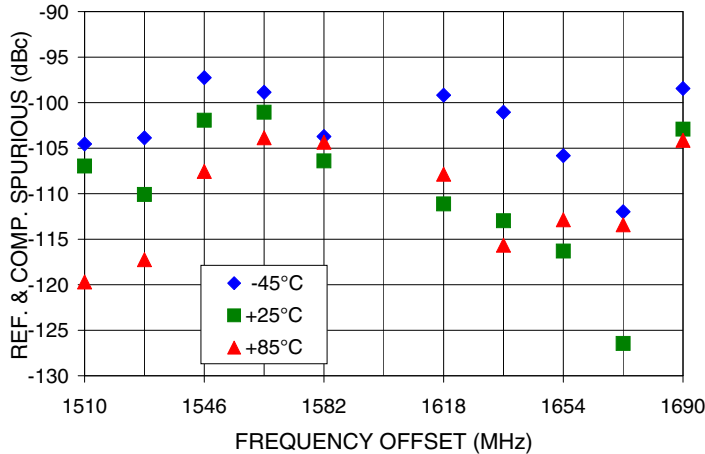
REFERENCE & COMPARISON SPURIOUS
Vs FREQ. OFFSET @ Fcar = 1575MHz



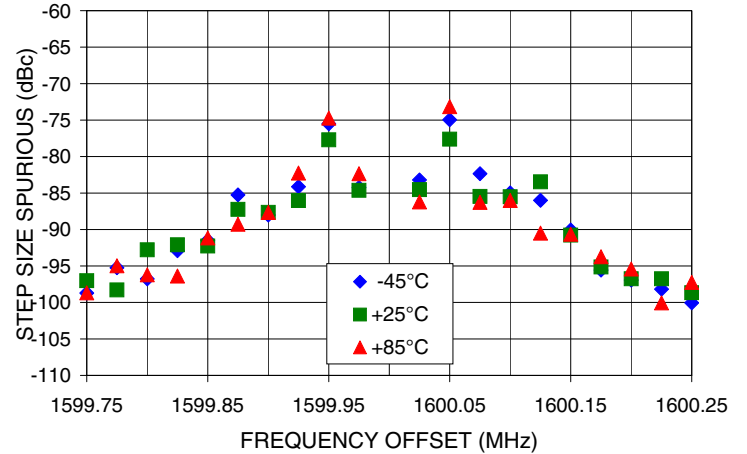
0.5 STEP SIZE & STEP SIZE SPURIOUS
Vs FREQ. OFFSET @ Fcar = 1575MHz



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



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



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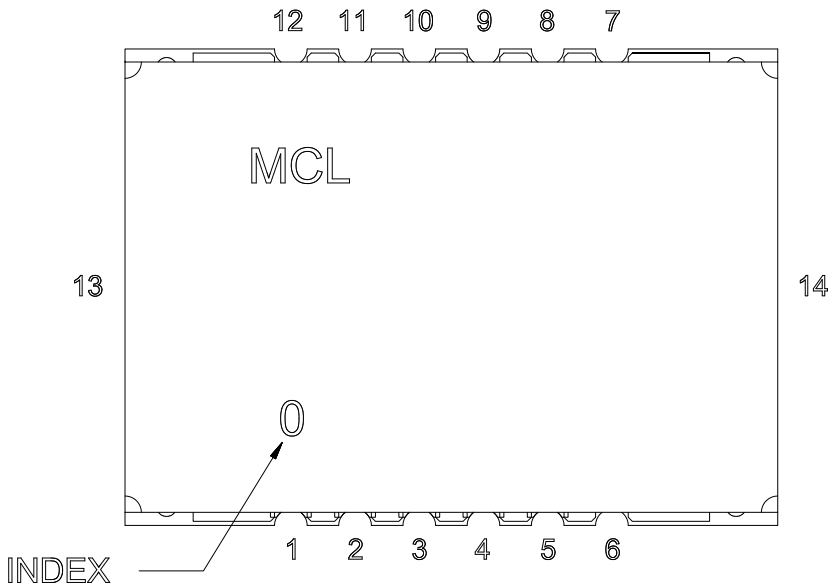


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Notes: 1. Performance and quality attributes and conditions not expressly stated in this specification sheet are intended to be excluded and do not form a part of this specification sheet. 2. Electrical specifications and performance data contained 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.

Pin Configuration

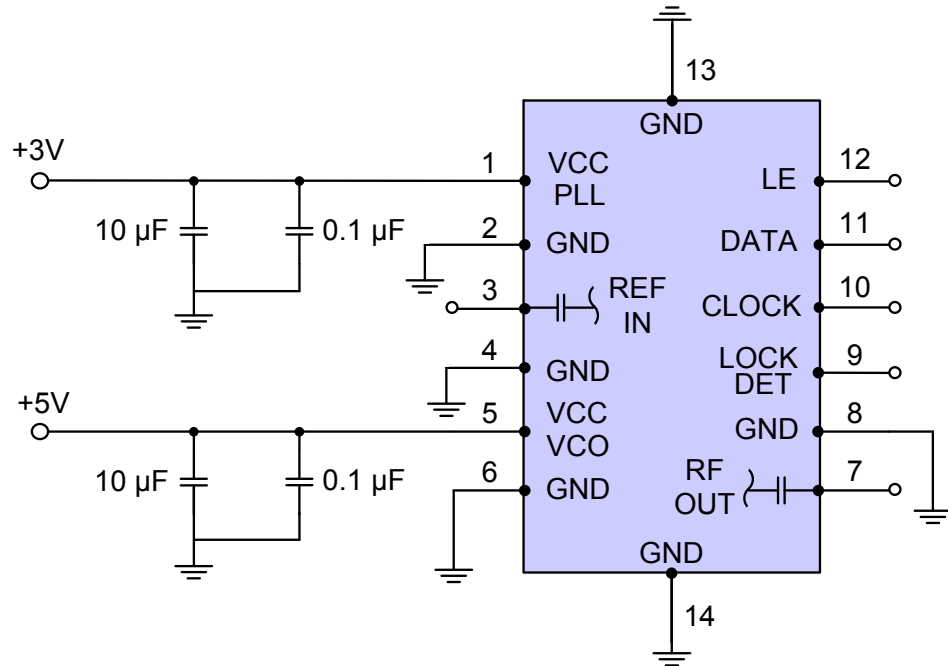


Pin Connection

| 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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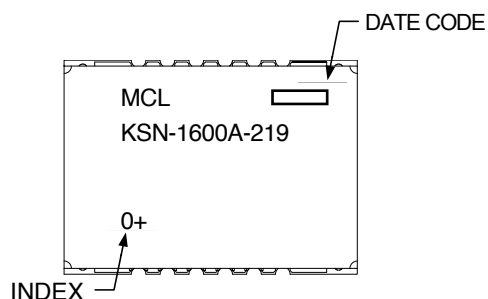


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Device Marking



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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