# Frequency Synthesizer KSN-1770A-119+

## 50Ω 1710 to 1770 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: DK1042

## Product Overview

The KSN-1770A-119+ is a Frequency Synthesizer, designed to operate from 1710 to 1770 MHz for UMTS application. The KSN-1770A-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:<br>• Phase Noise: -99 dBc/Hz typ. @ 10 kHz offset<br>• Comparison Spurious: -97 dBc typ.<br>• Reference Spurious: -99 dBc typ. | Low phase noise and spurious improve system EVM (Error Vector Magnitude). |
| Robust design and construction | To enhance the robustness of KSN-1770A-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-1770A-119+ to be used in compact designs. |

**Notes**
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*Surface Mount*

# Frequency Synthesizer

## KSN-1770A-119+

50Ω 1710 to 1770 MHz

CASE STYLE: DK1042

### Features

- Integrated VCO + PLL
- Low phase noise and spurious
- Robust design and construction
- Low operating voltage (VCC VCO=+5V, VCC PLL=+3.3V)
- Small size 0.80" x 0.58" x 0.15"

***+RoHS Compliant***

*The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications*

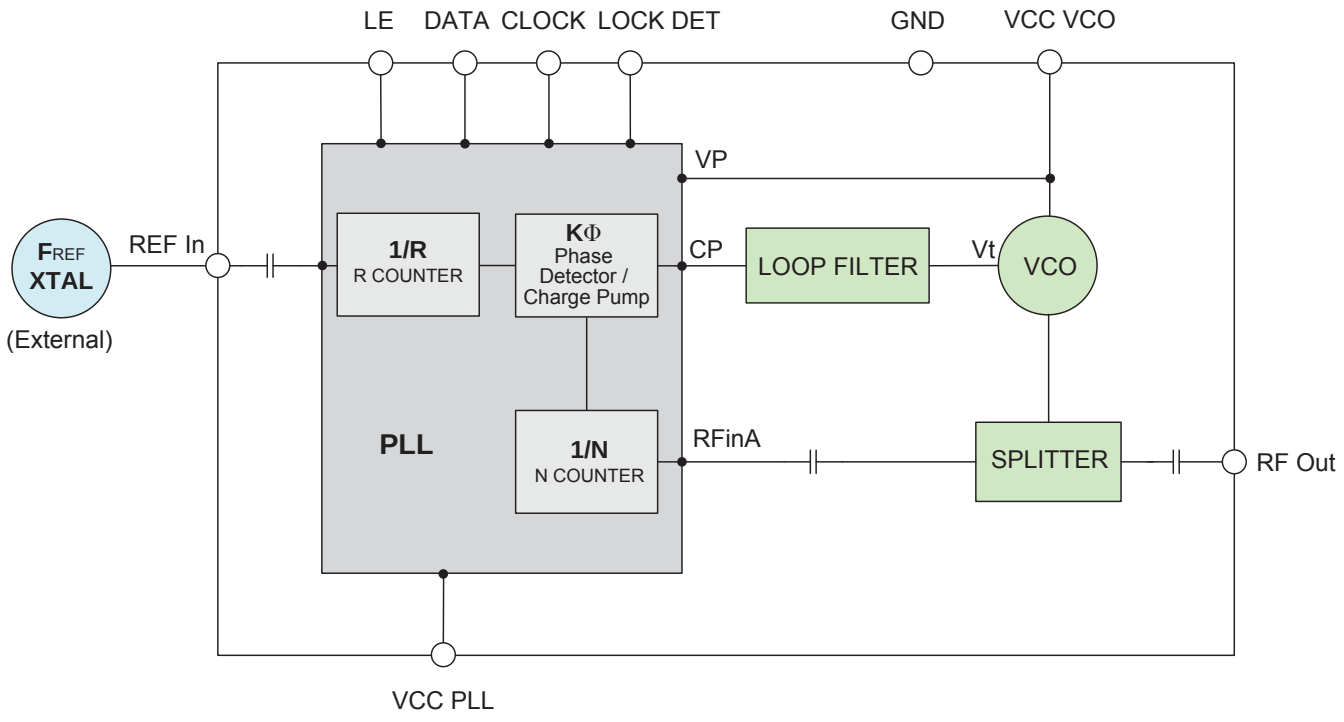
### Applications

- UMTS

### General Description

The KSN-1770A-119+ is a Frequency Synthesizer, designed to operate from 1710 to 1770 MHz for UMTS application. The KSN-1770A-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-1770A-119+, each internal component is secured to the substrate with chip bonder, thereby eliminating the risk of tomb-stoning during subsequent solder reflow operations by the customer.

### Simplified Schematic

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

| Parameters | | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Frequency Range | | - | 1710 | - | 1770 | MHz |
| Step Size | | - | - | 200 | - | kHz |
| Settling Time | | Within ± 1 kHz | - | 5 | - | mSec |
| Output Power | | - | +1 | +3 | +5 | dBm |
| SSB Phase Noise | | @ 100 Hz offset | - | -79 | - | dBc/Hz |
| | | @ 1 kHz offset | - | -79 | -74 | |
| | | @ 10 kHz offset | - | -99 | -93 | |
| | | @ 100 kHz offset | - | -125 | -120 | |
| | | @ 1 MHz offset | - | -145 | -140 | |
| Reference Spurious Suppression | | Ref. Freq. 26 MHz | - | -99 | -78 | dBc |
| Comparison Spurious Suppression | | Step Size 200 kHz | - | -97 | -77 | |
| Non - Harmonic Spurious Suppression | | - | - | -90 | - | |
| Harmonic Suppression | | - | - | -34 | -25 | |
| VCO Supply Voltage | | +5.00 | +4.75 | +5.00 | +5.25 | V |
| PLL Supply Voltage | | +3.30 | +3.15 | +3.30 | +3.45 | |
| VCO Supply Current | | - | - | 46 | 52 | mA |
| PLL Supply Current | | - | - | 7 | 14 | |
| Reference Input (External) | Frequency | 26 (sine wave) | - | 26 | - | 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 | - | 2.80 | - | - | V |
| | Input low voltage | - | - | - | 0.60 | V |
| Digital Lock Detect | Locked | - | 2.75 | - | 3.45 | V |
| | Unlocked | - | - | - | 0.40 | V |
| Frequency Synthesizer PLL | | - | ADF4118 | | | |
| PLL Programming | | - | 3-wire serial 3.3V CMOS | | | |
| Register Map @ 1770 MHz | F_Register | - | (MSB) X0XXX00000X0010010010 (LSB) | | | |
| | N_Register | - | (MSB) 10000100010100100 1001 (LSB) | | | |
| | R_Register | - | (MSB) 1XXXX0000001000001000 (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*

| 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 |
| 1710 | 3.05 | 3.18 | 2.98 | 43.68 | 45.54 | 46.86 | 5.80 | 7.23 | 8.49 |
| 1715 | 3.02 | 3.16 | 2.97 | 43.74 | 45.59 | 46.89 | 5.83 | 7.26 | 8.52 |
| 1725 | 2.89 | 3.05 | 2.88 | 43.85 | 45.67 | 46.97 | 5.82 | 7.24 | 8.51 |
| 1735 | 2.81 | 2.96 | 2.80 | 43.92 | 45.73 | 47.03 | 5.81 | 7.23 | 8.50 |
| 1745 | 2.79 | 2.91 | 2.75 | 43.99 | 45.80 | 47.09 | 5.83 | 7.25 | 8.53 |
| 1755 | 2.92 | 3.01 | 2.84 | 44.05 | 45.87 | 47.14 | 5.82 | 7.24 | 8.52 |
| 1765 | 3.10 | 3.20 | 3.03 | 44.11 | 45.92 | 47.19 | 5.84 | 7.26 | 8.55 |
| 1770 | 3.17 | 3.28 | 3.12 | 44.14 | 45.95 | 47.21 | 5.83 | 7.25 | 8.54 |

| FREQUENCY (MHz) | HARMONICS (dBc) | | | | | |
|---|---|---|---|---|---|---|
| | F2 | | | F3 | | |
| | -45°C | +25°C | +85°C | -45°C | +25°C | +85°C |
| 1710 | -35.64 | -38.05 | -43.82 | -31.05 | -34.18 | -36.15 |
| 1715 | -36.40 | -38.71 | -44.43 | -30.86 | -33.81 | -35.92 |
| 1725 | -37.48 | -39.83 | -45.02 | -30.44 | -33.75 | -36.01 |
| 1735 | -38.43 | -41.35 | -46.13 | -30.34 | -33.43 | -35.62 |
| 1745 | -39.49 | -42.96 | -46.90 | -31.40 | -34.44 | -36.39 |
| 1755 | -39.46 | -43.32 | -45.61 | -31.43 | -34.76 | -36.59 |
| 1765 | -39.13 | -42.18 | -42.79 | -29.94 | -33.33 | -35.63 |
| 1770 | -39.84 | -42.23 | -42.11 | -29.21 | -32.17 | -34.51 |

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| FREQUENCY (MHz) | PHASE NOISE (dBc/Hz) @OFFSETS +25°C | | | | |
|---|---|---|---|---|---|
| | 100Hz | 1kHz | 10kHz | 100kHz | 1MHz |
| 1710 | -78.02 | -78.46 | -99.19 | -124.76 | -144.82 |
| 1715 | -82.98 | -78.09 | -99.34 | -124.92 | -145.13 |
| 1725 | -78.38 | -78.14 | -99.31 | -125.19 | -145.09 |
| 1735 | -77.82 | -78.93 | -99.36 | -125.28 | -145.33 |
| 1745 | -77.59 | -79.39 | -98.86 | -125.47 | -145.23 |
| 1755 | -82.13 | -80.27 | -98.34 | -125.53 | -145.62 |
| 1765 | -82.84 | -79.98 | -98.33 | -125.33 | -145.57 |
| 1770 | -77.39 | -79.67 | -98.54 | -125.43 | -145.64 |

| FREQUENCY (MHz) | PHASE NOISE (dBc/Hz) @OFFSETS -45°C | | | | |
|---|---|---|---|---|---|
| | 100Hz | 1kHz | 10kHz | 100kHz | 1MHz |
| 1710 | -76.17 | -81.00 | -99.05 | -126.12 | -146.28 |
| 1715 | -82.45 | -79.20 | -99.26 | -126.22 | -146.43 |
| 1725 | -79.08 | -80.15 | -99.09 | -126.50 | -146.41 |
| 1735 | -77.26 | -79.38 | -99.07 | -126.46 | -146.76 |
| 1745 | -76.55 | -78.15 | -99.35 | -126.64 | -146.81 |
| 1755 | -77.38 | -79.19 | -99.04 | -126.79 | -146.94 |
| 1765 | -76.53 | -79.92 | -98.23 | -126.63 | -146.78 |
| 1770 | -75.11 | -80.48 | -98.39 | -126.66 | -147.06 |

| FREQUENCY (MHz) | PHASE NOISE (dBc/Hz) @OFFSETS +85°C | | | | |
|---|---|---|---|---|---|
| | 100Hz | 1kHz | 10kHz | 100kHz | 1MHz |
| 1710 | -76.99 | -79.48 | -98.14 | -123.35 | -143.43 |
| 1715 | -76.35 | -78.41 | -98.13 | -123.43 | -143.39 |
| 1725 | -76.77 | -78.30 | -98.59 | -123.58 | -143.72 |
| 1735 | -77.12 | -78.40 | -98.04 | -123.80 | -143.83 |
| 1745 | -76.75 | -79.75 | -97.72 | -123.85 | -143.64 |
| 1755 | -82.49 | -79.01 | -97.88 | -123.83 | -143.94 |
| 1765 | -76.39 | -80.13 | -97.86 | -123.93 | -143.88 |
| 1770 | -75.97 | -78.33 | -98.14 | -123.91 | -143.94 |

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| COMPARISON SPURIOUS ORDER | COMPARISON SPURIOUS @Fcarrier 1710MHz+(n*Fcomparison) (dBc) note 1 | | | COMPARISON SPURIOUS @Fcarrier 1740MHz+(n*Fcomparison) (dBc) note 1 | | | COMPARISON SPURIOUS @Fcarrier 1770MHz+(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 | -118.45 | -116.37 | -120.17 | -117.83 | -112.77 | -114.86 | -122.39 | -116.54 | -111.87 |
| -4 | -118.01 | -112.35 | -119.61 | -112.84 | -114.19 | -109.75 | -118.08 | -115.92 | -112.27 |
| -3 | -111.52 | -107.53 | -114.13 | -107.48 | -112.53 | -106.34 | -114.79 | -115.95 | -106.83 |
| -2 | -106.68 | -107.65 | -105.43 | -103.39 | -108.04 | -100.53 | -107.12 | -110.09 | -104.43 |
| -1 | -94.64 | -98.16 | -97.02 | -95.43 | -98.03 | -94.14 | -94.35 | -96.34 | -99.63 |
| 0 note 2 | - | - | - | - | - | - | - | - | - |
| +1 | -94.53 | -95.41 | -99.82 | -100.18 | -93.55 | -93.42 | -96.25 | -95.18 | -99.13 |
| +2 | -108.31 | -106.82 | -105.22 | -102.07 | -105.20 | -100.43 | -107.25 | -106.39 | -106.28 |
| +3 | -116.48 | -109.71 | -111.14 | -109.05 | -106.68 | -106.52 | -111.20 | -111.48 | -107.68 |
| +4 | -120.93 | -113.91 | -115.08 | -110.79 | -109.39 | -111.17 | -113.68 | -120.80 | -113.22 |
| +5 | -116.96 | -116.71 | -121.17 | -114.86 | -109.41 | -113.08 | -119.18 | -116.10 | -112.71 |

Note 1: Comparison frequency 200 kHz
Note 2: All spurs are referenced to carrier signal (n=0).

| REFERENCE SPURIOUS ORDER | REFERENCE SPURIOUS @Fcarrier 1710MHz+(n*Freference) (dBc) note 3 | | | REFERENCE SPURIOUS @Fcarrier 1740MHz+(n*Freference) (dBc) note 3 | | | REFERENCE SPURIOUS @Fcarrier 1770MHz+(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 | -101.54 | -133.10 | -134.58 | -102.81 | -128.40 | -129.77 | -106.38 | -129.93 | -130.38 |
| -4 | -113.92 | -124.72 | -128.21 | -114.95 | -127.93 | -128.74 | -115.49 | -125.57 | -128.56 |
| -3 | -109.49 | -129.86 | -129.53 | -93.39 | -128.07 | -128.87 | -96.09 | -131.50 | -129.73 |
| -2 | -105.91 | -113.45 | -116.33 | -106.52 | -113.64 | -117.41 | -106.30 | -114.76 | -116.60 |
| -1 | -99.97 | -100.62 | -99.27 | -97.69 | -98.38 | -97.82 | -96.97 | -98.89 | -98.65 |
| 0 note 4 | - | - | - | - | - | - | - | - | - |
| +1 | -98.05 | -98.93 | -99.25 | -96.89 | -96.97 | -96.67 | -100.62 | -96.35 | -95.74 |
| +2 | -106.85 | -116.37 | -118.48 | -107.61 | -115.68 | -117.02 | -105.31 | -117.76 | -118.93 |
| +3 | -99.79 | -135.37 | -131.82 | -96.94 | -128.49 | -132.35 | -97.68 | -131.41 | -132.90 |
| +4 | -115.76 | -125.67 | -127.30 | -116.19 | -127.08 | -124.42 | -112.99 | -126.12 | -128.41 |
| +5 | -104.57 | -126.43 | -123.80 | -104.13 | -128.75 | -128.36 | -106.19 | -129.85 | -133.88 |

Note 3: Reference frequency 26 MHz
Note 4: All spurs are referenced to carrier signal (n=0).

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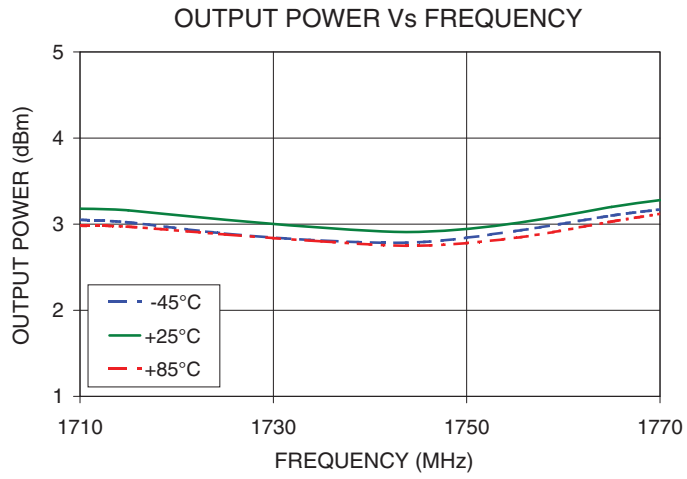
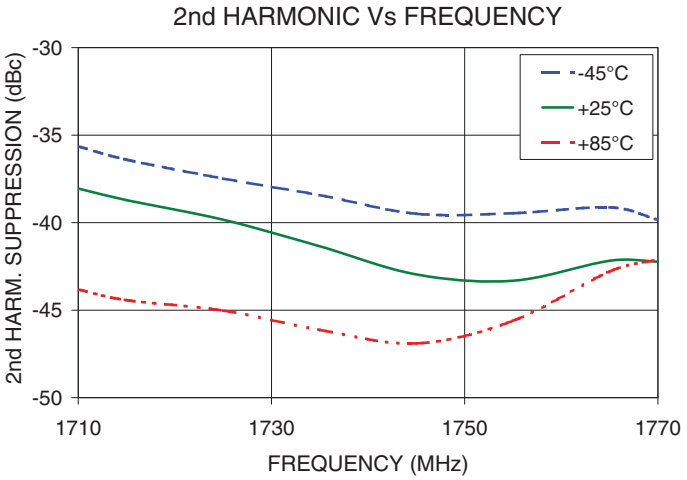
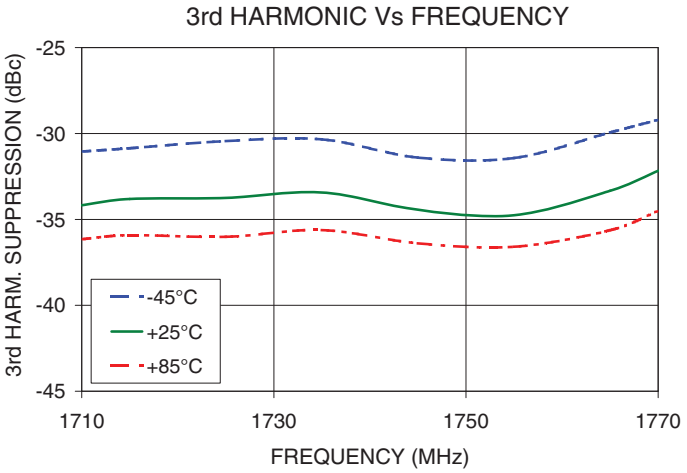
## Typical Performance Curves

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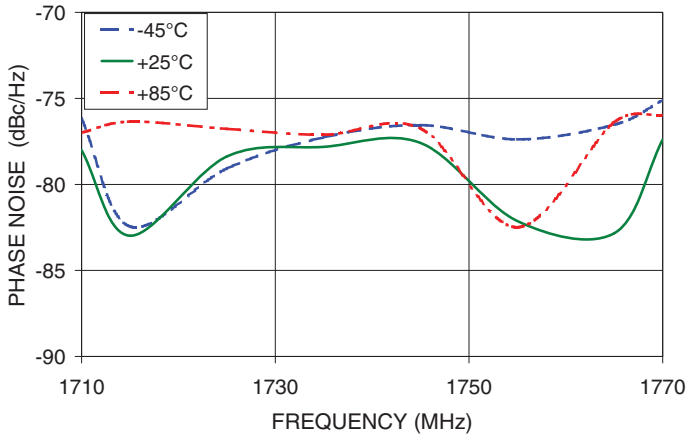
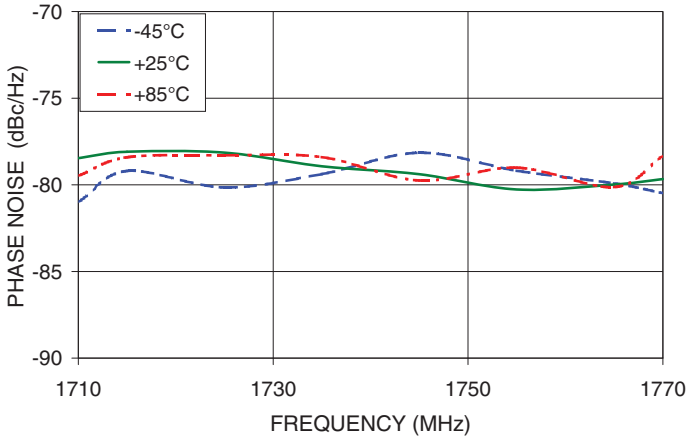
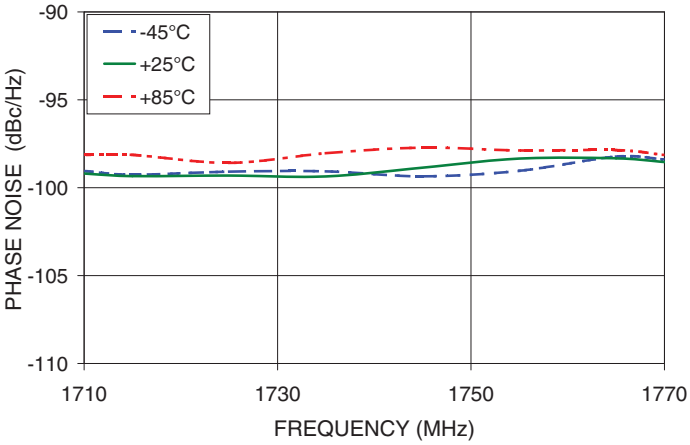
PHASE NOISE @100Hz offset



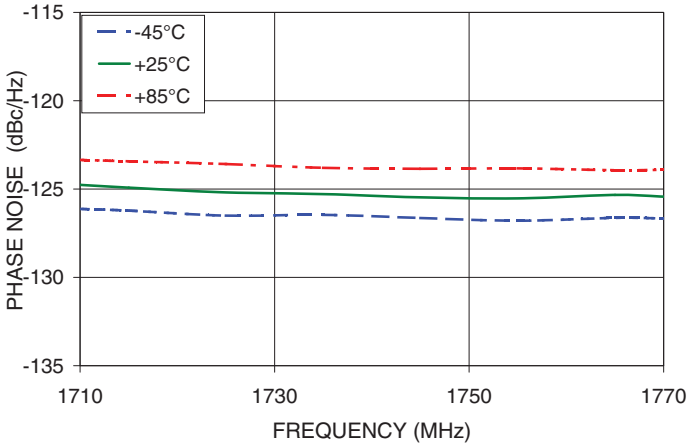

PHASE NOISE @1kHz offset



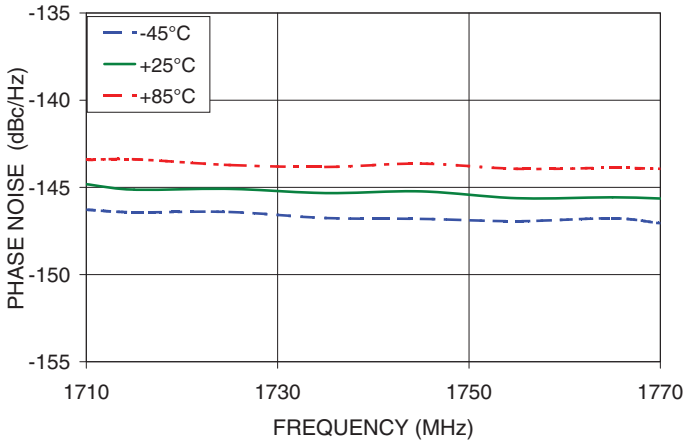

PHASE NOISE @10 kHz offset




PHASE NOISE @100 kHz offset




PHASE NOISE @1MHz offset

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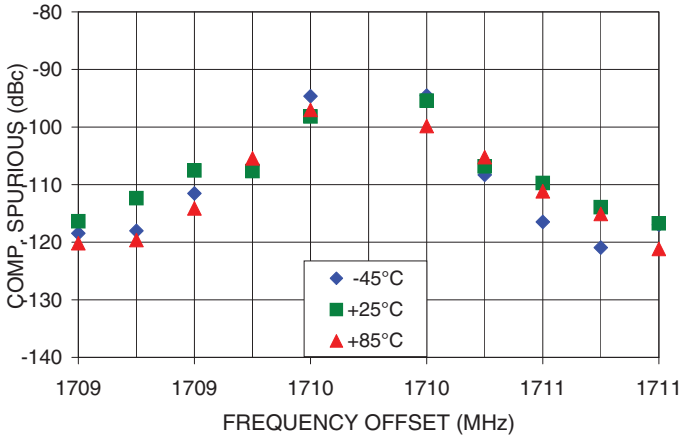
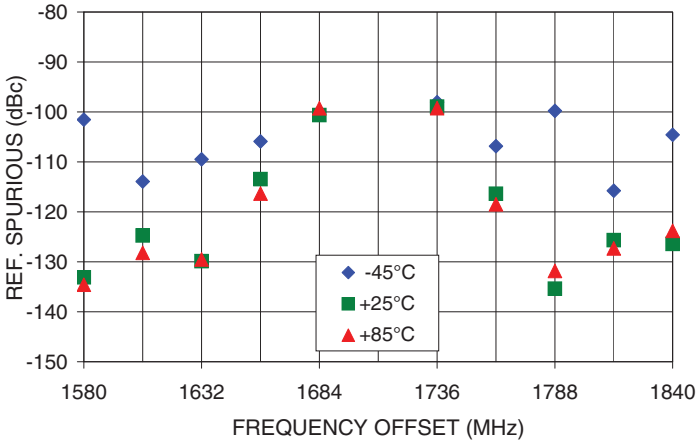
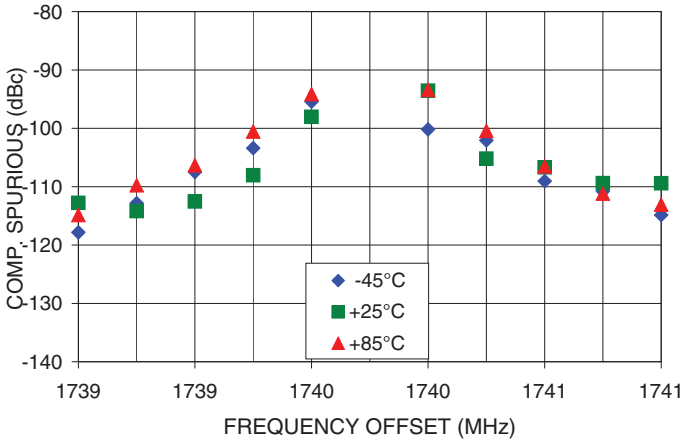
COMPARISON SPURIOUS
Vs FREQ. OFFSET @ Fcar = 1710MHz



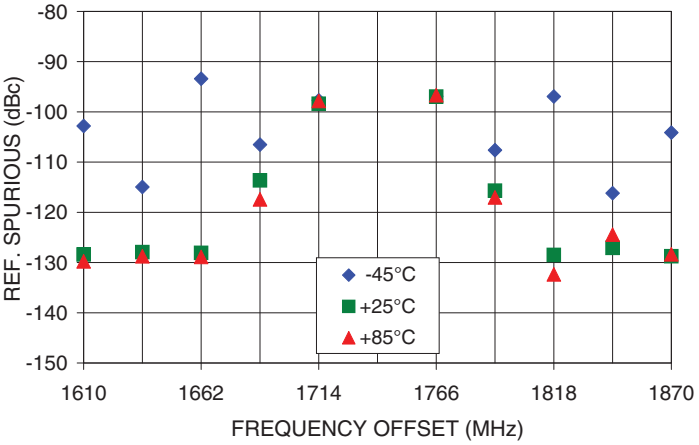

REFERENCE SPURIOUS
Vs FREQ. OFFSET @ Fcar = 1710MHz



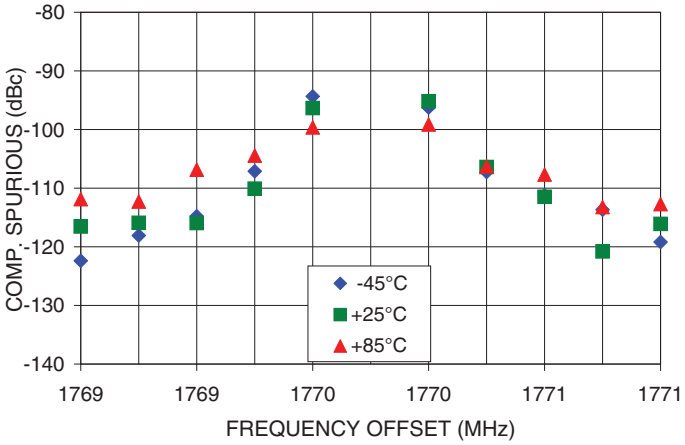

COMPARISON SPURIOUS
Vs FREQ. OFFSET @ Fcar = 1740MHz



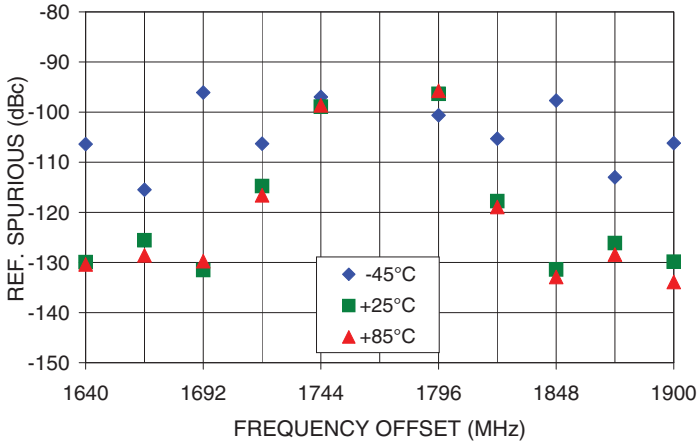

REFERENCE SPURIOUS
Vs FREQ. OFFSET @ Fcar = 1740MHz




COMPARISON SPURIOUS
Vs FREQ. OFFSET @ Fcar = 1770MHz




REFERENCE SPURIOUS
Vs FREQ. OFFSET @ Fcar = 1770MHz




**Notes**
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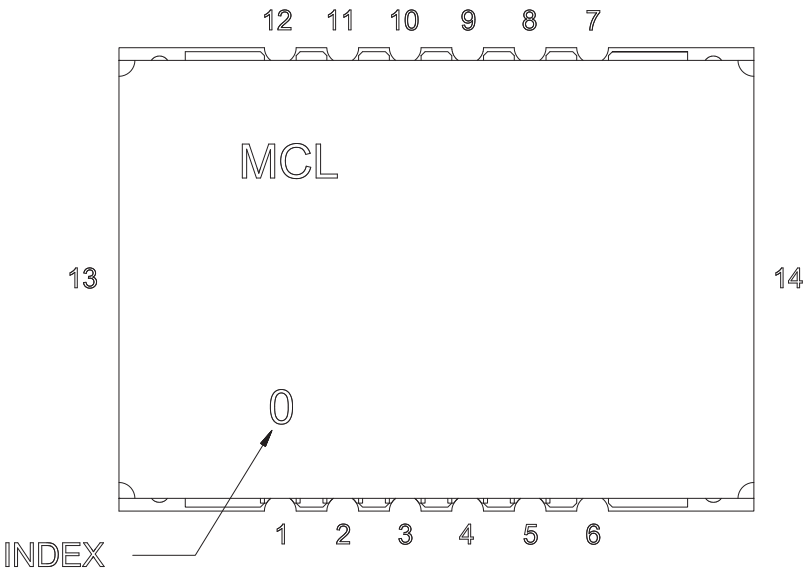
**B.** Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
**C.** The parts covered by this specification document are subject to Mini-Circuits standard limited 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

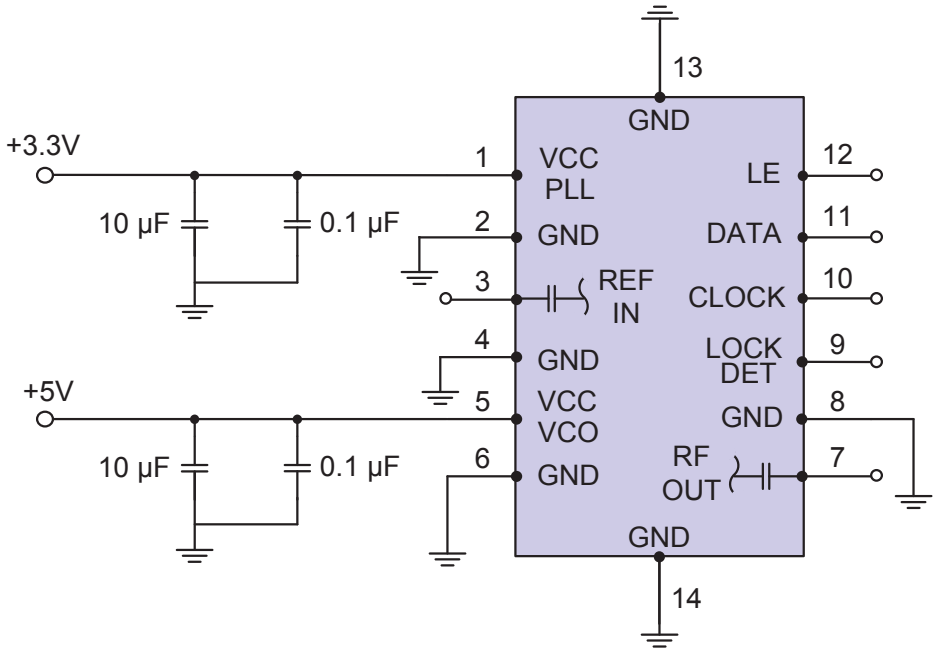



## Pin Connection

| 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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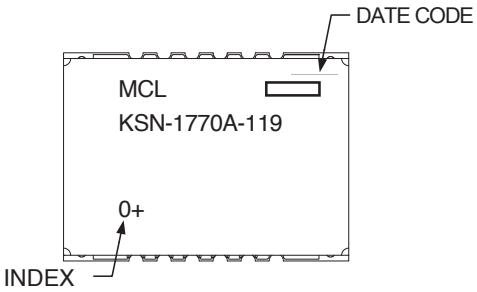
## Device Marking




### 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:** DK1042

**Tape & Reel:** TR-F28

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

**Evaluation Board:** TB-567-1+

**Environment Ratings:** ENV03T2

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