# Frequency Synthesizer KSN-860A-119+

## 50Ω 856.6 to 858.6 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-860A-119+ is a Frequency Synthesizer, designed to operate from 856.6 to 858.6 MHz for receiver application. The KSN-860A-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: -101 dBc/Hz typ. @ 10 kHz offset<br>• Comparison Spurious: -72 dBc typ.<br>• Reference Spurious: -113 dBc typ. | Low phase noise and spurious improve system EVM (Error Vector Magnitude). |
| Robust design and construction | To enhance the robustness of KSN-860A-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-860A-119+ to be used in compact designs. |

*Surface Mount*

# Frequency Synthesizer

## KSN-860A-119+

50Ω 856.6 to 858.6 MHz

CASE STYLE: DK1042
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.*

### 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"

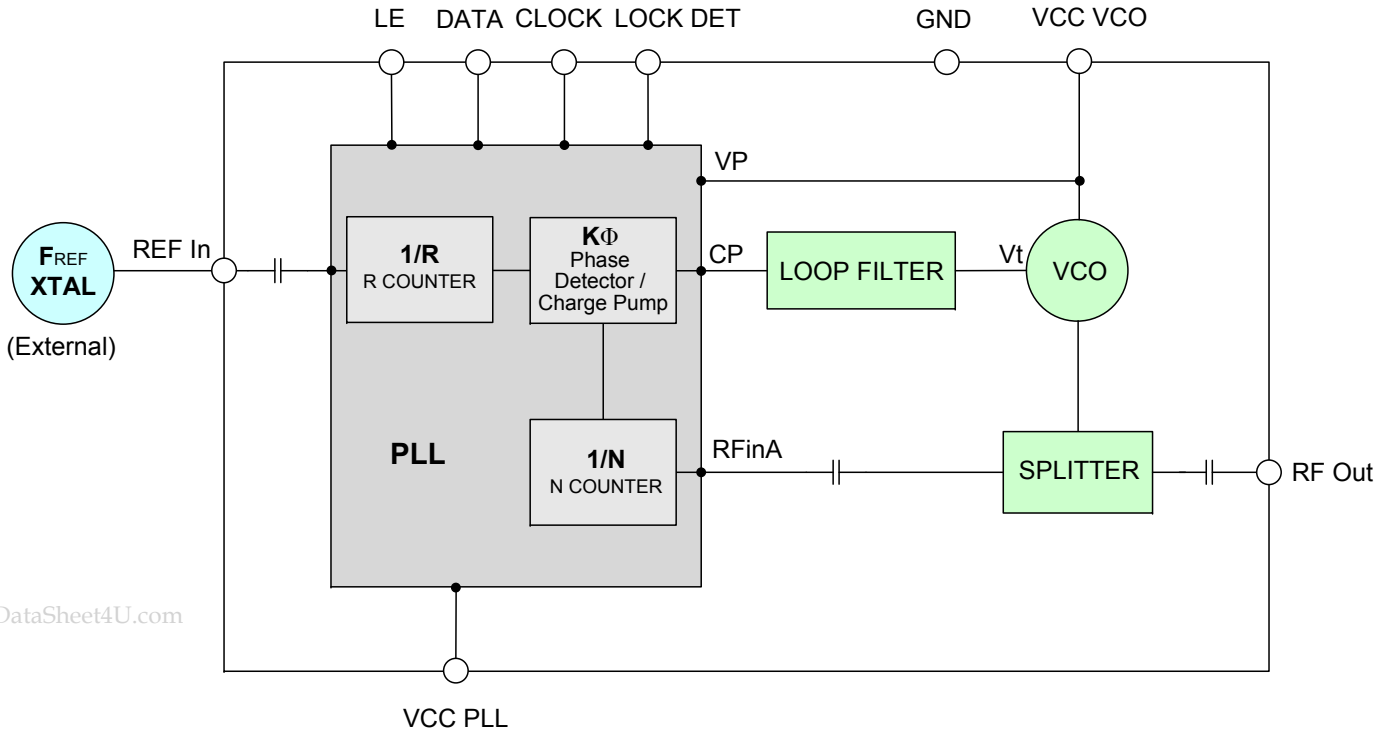
### Applications

- Receiver

### General Description

The KSN-860A-119+ is a Frequency Synthesizer, designed to operate from 856.6 to 858.6 MHz for receiver application. The KSN-860A-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-860A-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



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

| Parameters | | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Frequency Range | | - | 856.6 | - | 858.6 | MHz |
| Step Size | | - | - | 5 | - | kHz |
| Settling Time | | Within ± 1 kHz | - | 20 | - | mSec |
| Output Power | | - | 0 | +3 | +6 | dBm |
| SSB Phase Noise | | @ 100 Hz offset | - | -52 | - | dBc/Hz |
| | | @ 1 kHz offset | - | -78 | -73 | |
| | | @ 10 kHz offset | - | -101 | -92 | |
| | | @ 100 kHz offset | - | -125 | -120 | |
| | | @ 1 MHz offset | - | -145 | -140 | |
| Reference Spurious Suppression | | Ref. Freq. 10 MHz | - | -113 | -90 | dBc |
| Comparison Spurious Suppression | | Step Size 5 kHz | - | -72 | -45 | |
| Non - Harmonic Spurious Suppression | | - | - | -90 | - | |
| Harmonic Suppression | | - | - | -26 | -20 | |
| 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 | | - | - | 31 | 38 | mA |
| PLL Supply Current | | - | - | 10 | 17 | |
| Reference Input (External) | Frequency | 10 (square wave) | - | 10 | - | MHz |
| | Amplitude | 1 | - | 1 | - | $V_{P-P}$ |
| | Input impedance | - | - | 100 | - | KΩ |
| | Phase Noise @ 1 kHz offset | - | - | -145 | - | 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 | | - | ADF4113 | | | |
| PLL Programming | | - | 3-wire serial 3.3V CMOS | | | |
| Register Map @ 858.6 MHz | F_Register | - | (MSB) 10011111100000010010011 (LSB) | | | |
| | N_Register | - | (MSB) 00110100111011000100001 (LSB) | | | |
| | R_Register | - | (MSB) 00010000001111101000000 (LSB) | | | |

## Absolute Maximum Ratings

| Parameters | Ratings |
|---|---|
| VCO Supply Voltage | 5.6V |
| PLL Supply Voltage | 5.6V |
| 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

## 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 |
| 856.6 | 3.62 | 3.84 | 3.77 | 29.25 | 31.34 | 32.90 | 7.85 | 9.98 | 11.97 |
| 857.0 | 3.61 | 3.84 | 3.77 | 29.25 | 31.34 | 32.90 | 7.85 | 9.98 | 11.96 |
| 857.6 | 3.61 | 3.83 | 3.77 | 29.24 | 31.34 | 32.90 | 7.85 | 9.99 | 11.97 |
| 858.0 | 3.60 | 3.83 | 3.77 | 29.24 | 31.34 | 32.90 | 7.85 | 9.99 | 11.97 |
| 858.6 | 3.60 | 3.83 | 3.77 | 29.24 | 31.34 | 32.90 | 7.85 | 9.99 | 11.97 |

| FREQUENCY (MHz) | HARMONICS (dBc) | | | | | |
|---|---|---|---|---|---|---|
| | F2 | | | F3 | | |
| | -45°C | +25°C | +85°C | -45°C | +25°C | +85°C |
| 856.6 | -23.99 | -25.79 | -28.09 | -35.36 | -37.37 | -39.97 |
| 857.0 | -24.02 | -25.83 | -28.14 | -35.33 | -37.38 | -40.01 |
| 857.6 | -24.08 | -25.88 | -28.18 | -35.31 | -37.37 | -40.02 |
| 858.0 | -24.12 | -25.92 | -28.21 | -35.29 | -37.36 | -40.02 |
| 858.6 | -24.21 | -25.99 | -28.29 | -35.25 | -37.31 | -39.99 |

| FREQUENCY (MHz) | PHASE NOISE (dBc/Hz) @OFFSETS +25°C | | | | |
|---|---|---|---|---|---|
| | 100Hz | 1kHz | 10kHz | 100kHz | 1MHz |
| 856.6 | -49.89 | -79.20 | -102.34 | -124.71 | -145.07 |
| 857.0 | -51.94 | -79.33 | -102.03 | -124.56 | -144.77 |
| 857.6 | -47.92 | -78.89 | -101.58 | -124.60 | -144.91 |
| 858.0 | -51.85 | -78.76 | -101.28 | -124.51 | -144.84 |
| 858.6 | -50.78 | -78.09 | -101.16 | -124.56 | -144.85 |

| FREQUENCY (MHz) | PHASE NOISE (dBc/Hz) @OFFSETS -45°C | | | | |
|---|---|---|---|---|---|
| | 100Hz | 1kHz | 10kHz | 100kHz | 1MHz |
| 856.6 | -53.98 | -78.26 | -98.27 | -125.40 | -145.56 |
| 857.0 | -53.65 | -78.21 | -98.53 | -125.22 | -145.38 |
| 857.6 | -54.68 | -78.77 | -98.23 | -125.58 | -145.48 |
| 858.0 | -56.10 | -77.89 | -98.80 | -125.37 | -145.69 |
| 858.6 | -57.33 | -79.49 | -98.98 | -125.33 | -145.68 |

| FREQUENCY (MHz) | PHASE NOISE (dBc/Hz) @OFFSETS +85°C | | | | |
|---|---|---|---|---|---|
| | 100Hz | 1kHz | 10kHz | 100kHz | 1MHz |
| 856.6 | -50.33 | -77.22 | -95.16 | -123.47 | -143.73 |
| 857.0 | -49.64 | -77.33 | -96.52 | -123.55 | -143.59 |
| 857.6 | -49.43 | -77.14 | -97.07 | -123.49 | -143.70 |
| 858.0 | -51.87 | -78.09 | -96.88 | -123.47 | -143.74 |
| 858.6 | -51.04 | -76.60 | -96.99 | -123.66 | -143.77 |

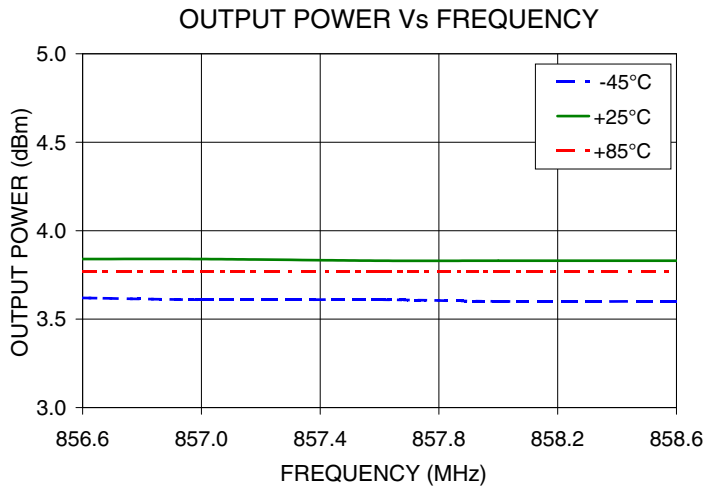
| COMPARISON SPURIOUS ORDER | COMPARISON SPURIOUS @Fcarrier 856.6MHz+(n*Fcomparison) (dBc) note 1 | | | COMPARISON SPURIOUS @Fcarrier 857.6MHz+(n*Fcomparison) (dBc) note 1 | | | COMPARISON SPURIOUS @Fcarrier 858.6MHz+(n*Fcomparison) (dBc) note 1 | | |
|---|---|---|---|---|---|---|---|---|---|
| n | -45°C | +25°C | +85°C | -45°C | +25°C | +85°C | -45°C | +25°C | +85°C |
| -5 | -84.36 | -85.04 | -82.66 | -83.49 | -84.46 | -86.85 | -83.00 | -83.76 | -87.23 |
| -4 | -81.74 | -82.73 | -80.99 | -80.54 | -82.50 | -83.56 | -82.54 | -82.22 | -82.15 |
| -3 | -79.78 | -79.59 | -75.35 | -78.18 | -80.83 | -78.31 | -79.29 | -79.51 | -78.33 |
| -2 | -74.62 | -76.12 | -68.18 | -73.05 | -76.84 | -71.71 | -76.16 | -75.39 | -72.23 |
| -1 | -63.72 | -75.02 | -50.25 | -68.36 | -71.97 | -53.32 | -63.72 | -69.56 | -54.08 |
| 0 note 2 | - | - | - | - | - | - | - | - | - |
| +1 | -64.41 | -69.46 | -50.52 | -70.22 | -69.42 | -52.40 | -70.50 | -69.85 | -53.81 |
| +2 | -73.84 | -76.81 | -68.83 | -73.02 | -75.88 | -70.30 | -73.79 | -73.70 | -72.24 |
| +3 | -79.88 | -79.82 | -75.17 | -79.40 | -80.63 | -78.36 | -79.46 | -79.63 | -78.77 |
| +4 | -82.40 | -81.42 | -80.57 | -81.12 | -82.96 | -85.99 | -80.91 | -83.07 | -84.25 |
| +5 | -84.77 | -84.24 | -85.64 | -82.43 | -83.09 | -87.50 | -83.83 | -84.43 | -88.86 |

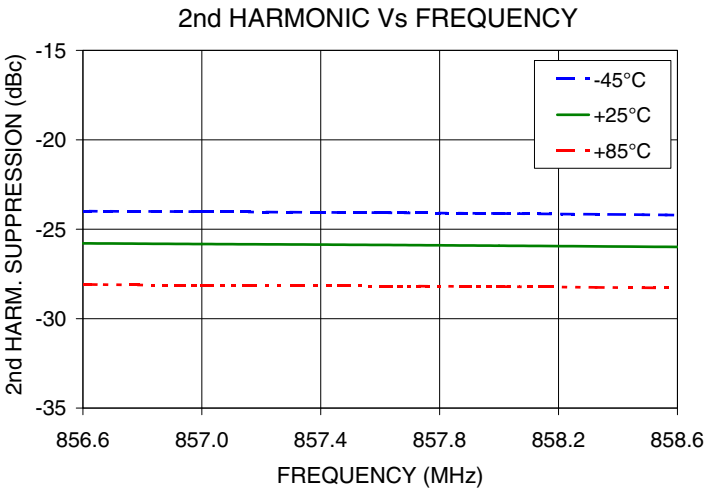
Note 1: Comparison frequency 5 kHz
Note 2: All spurs are referenced to carrier signal (n=0).

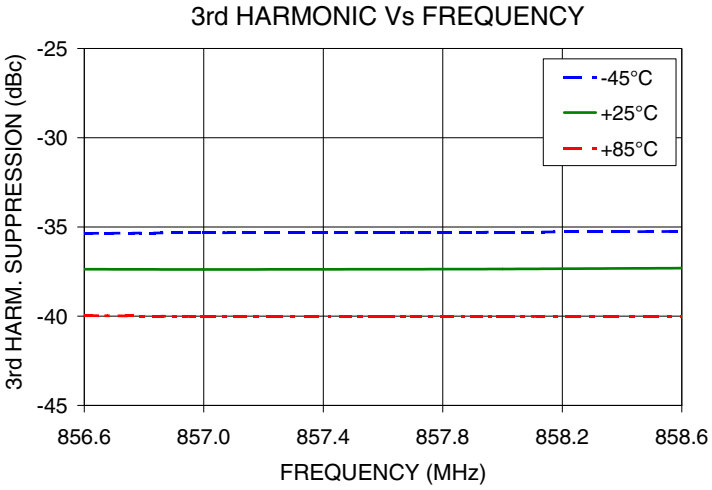
| REFERENCE SPURIOUS ORDER | REFERENCE SPURIOUS @Fcarrier 856.6MHz+(n*Freference) (dBc) note 3 | | | REFERENCE SPURIOUS @Fcarrier 857.6MHz+(n*Freference) (dBc) note 3 | | | REFERENCE SPURIOUS @Fcarrier 858.6MHz+(n*Freference) (dBc) note 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| n | -45°C | +25°C | +85°C | -45°C | +25°C | +85°C | -45°C | +25°C | +85°C |
| -5 | -126.65 | -126.95 | -127.08 | -126.75 | -126.67 | -128.92 | -127.06 | -125.91 | -129.61 |
| -4 | -128.02 | -126.24 | -130.72 | -127.10 | -131.13 | -131.57 | -129.52 | -129.77 | -131.56 |
| -3 | -121.61 | -119.33 | -122.73 | -120.68 | -120.04 | -121.75 | -120.65 | -120.00 | -121.09 |
| -2 | -131.28 | -129.88 | -131.12 | -131.86 | -128.79 | -131.95 | -130.98 | -129.80 | -130.93 |
| -1 | -114.40 | -112.51 | -112.80 | -114.95 | -113.25 | -115.51 | -114.69 | -113.36 | -112.14 |
| 0 note 4 | - | - | - | - | - | - | - | - | - |
| +1 | -113.89 | -113.86 | -112.24 | -114.75 | -115.06 | -113.91 | -115.62 | -113.73 | -111.84 |
| +2 | -130.13 | -130.74 | -130.95 | -131.65 | -132.03 | -130.68 | -130.46 | -131.54 | -131.74 |
| +3 | -124.85 | -123.94 | -124.55 | -126.66 | -124.33 | -126.50 | -125.80 | -123.55 | -123.83 |
| +4 | -131.37 | -127.09 | -132.12 | -130.60 | -131.12 | -131.28 | -130.41 | -129.18 | -129.66 |
| +5 | -127.55 | -125.25 | -125.37 | -124.64 | -126.02 | -130.15 | -128.67 | -125.73 | -126.39 |

Note 3: Reference frequency 10 MHz
Note 4: All spurs are referenced to carrier signal (n=0).

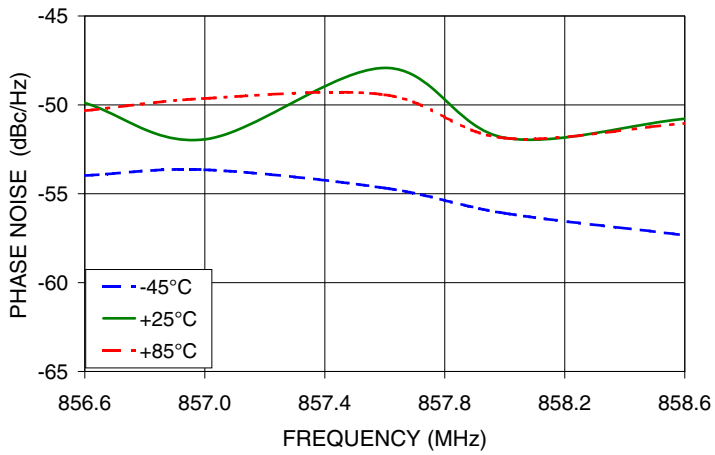
## Typical Performance Curves



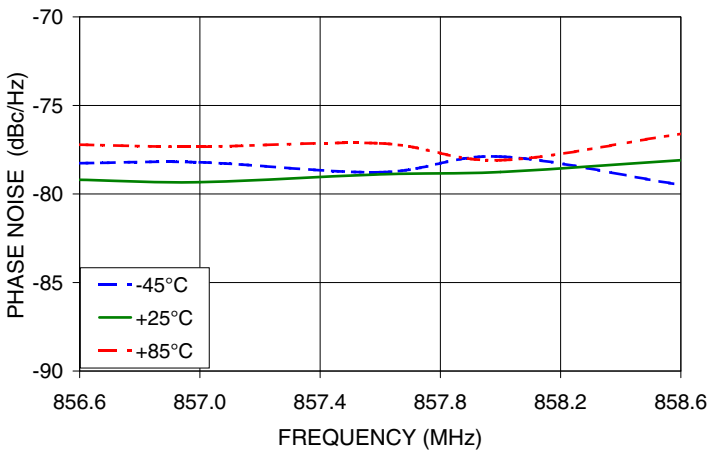



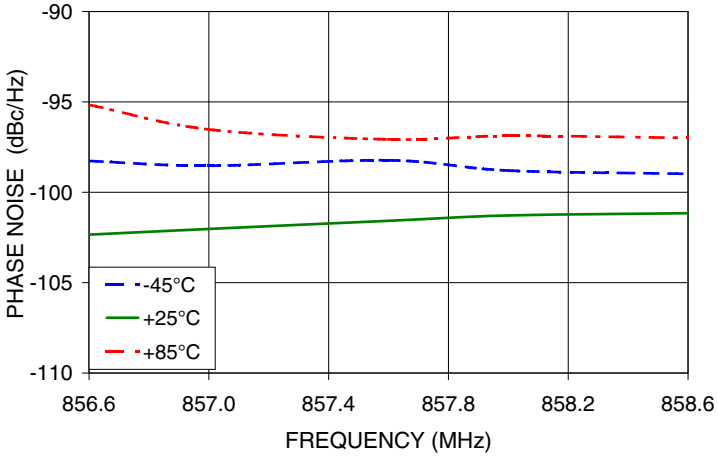
PHASE NOISE @100Hz offset



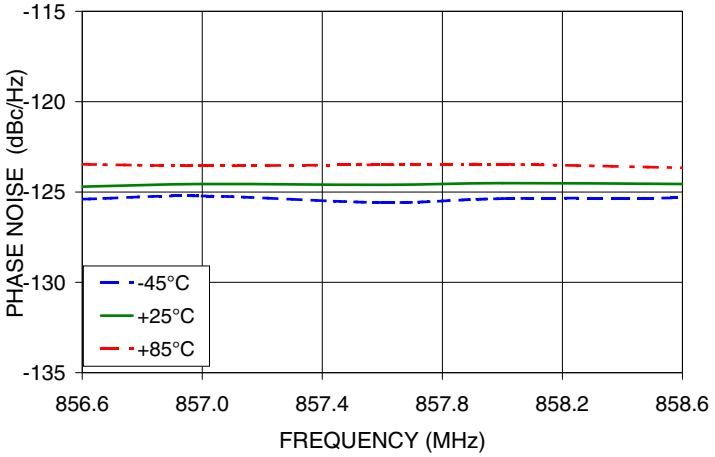

PHASE NOISE @1kHz offset



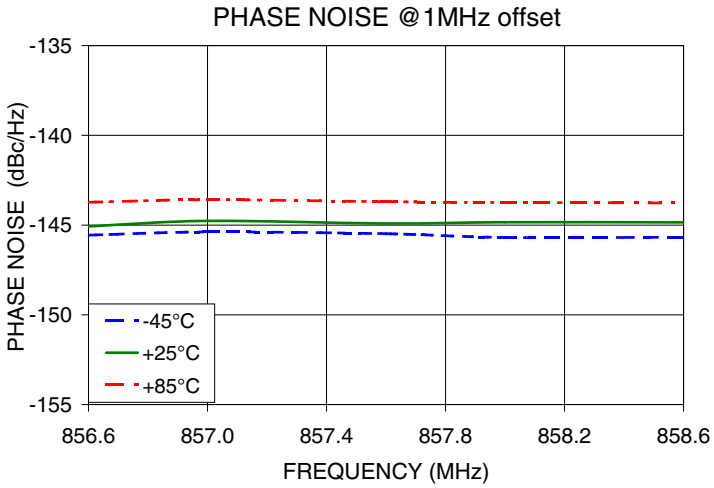

PHASE NOISE @10 kHz offset



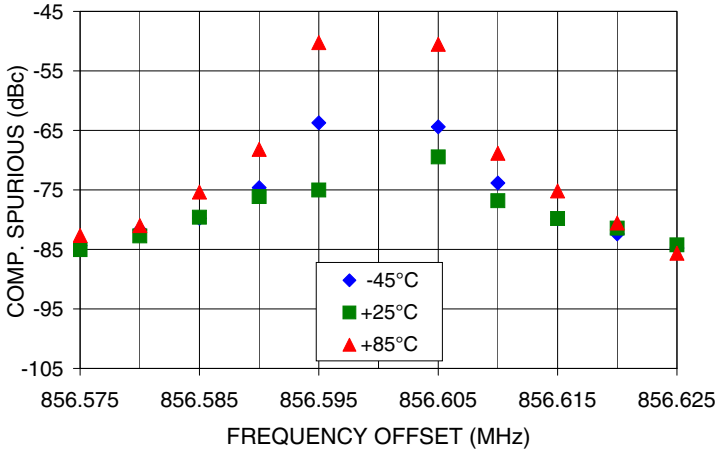

PHASE NOISE @100 kHz offset




PHASE NOISE @1MHz offset



COMPARISON SPURIOUS
Vs FREQ. OFFSET @ Fcar = 856.6MHz

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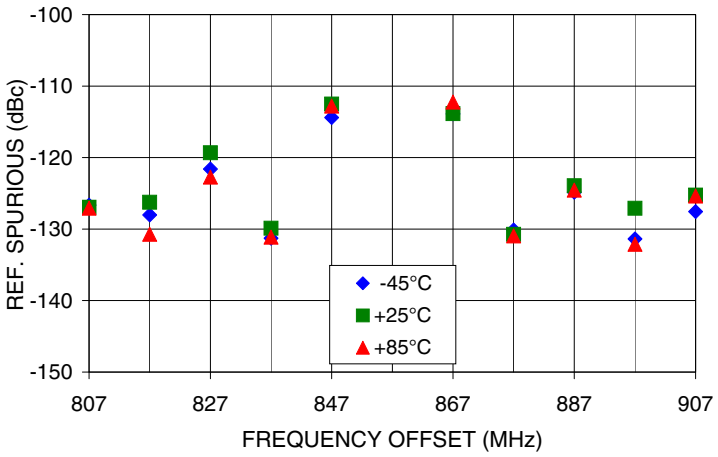
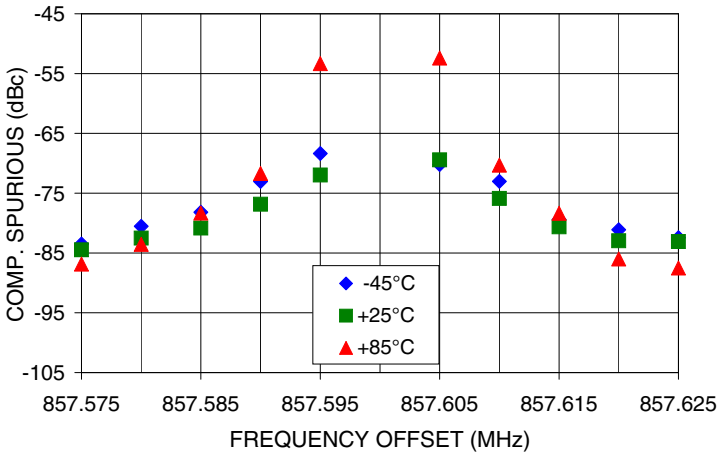
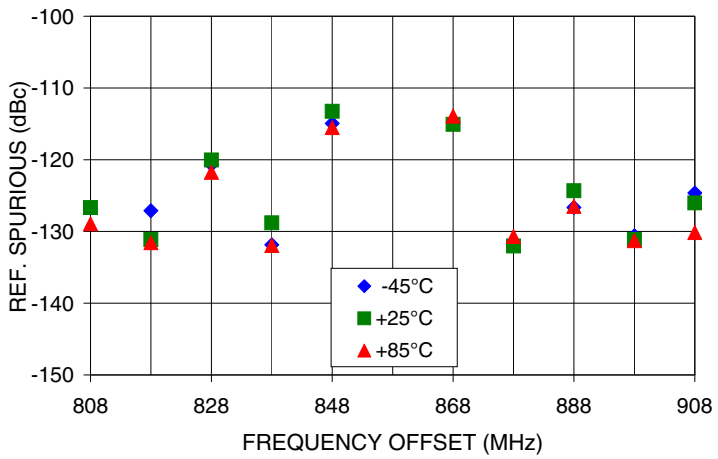


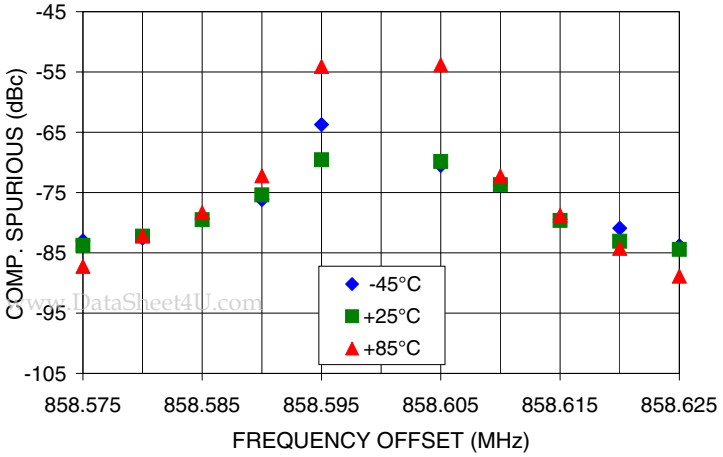

COMPARISON SPURIOUS
Vs FREQ. OFFSET @ Fcar = 857.6MHz




REFERENCE SPURIOUS
Vs FREQ. OFFSET @ Fcar = 857.6MHz

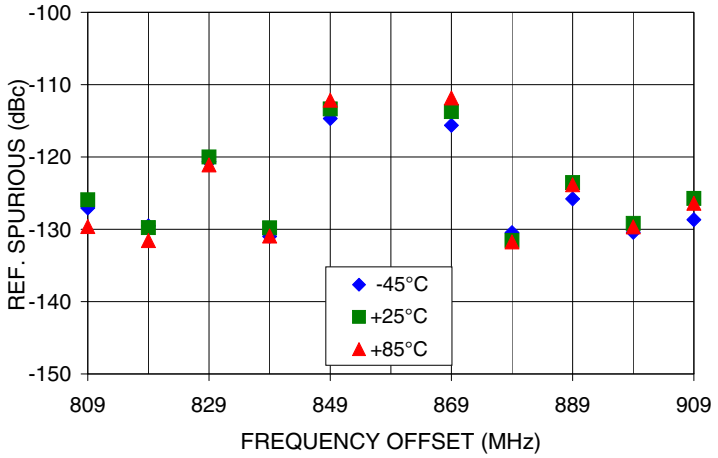



COMPARISON SPURIOUS
Vs FREQ. OFFSET @ Fcar = 858.6MHz

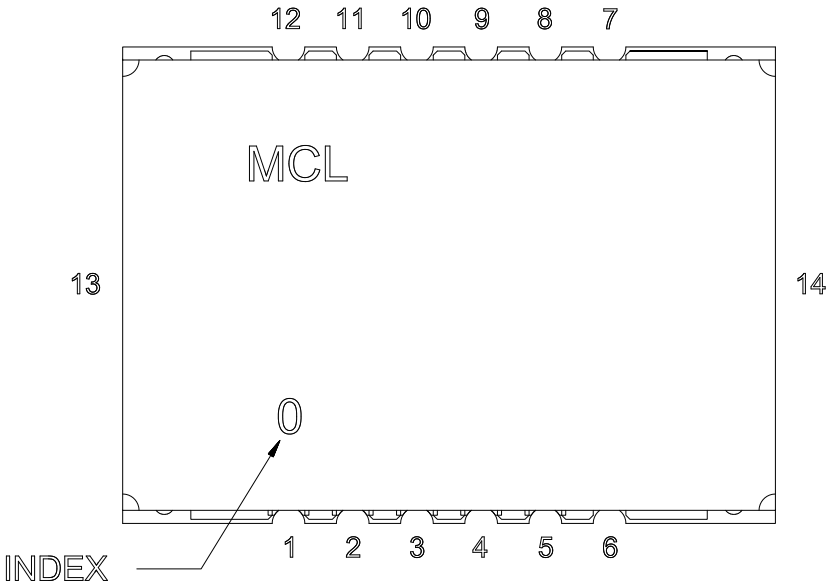





REFERENCE SPURIOUS
Vs FREQ. OFFSET @ Fcar = 858.6MHz



## Pin Configuration

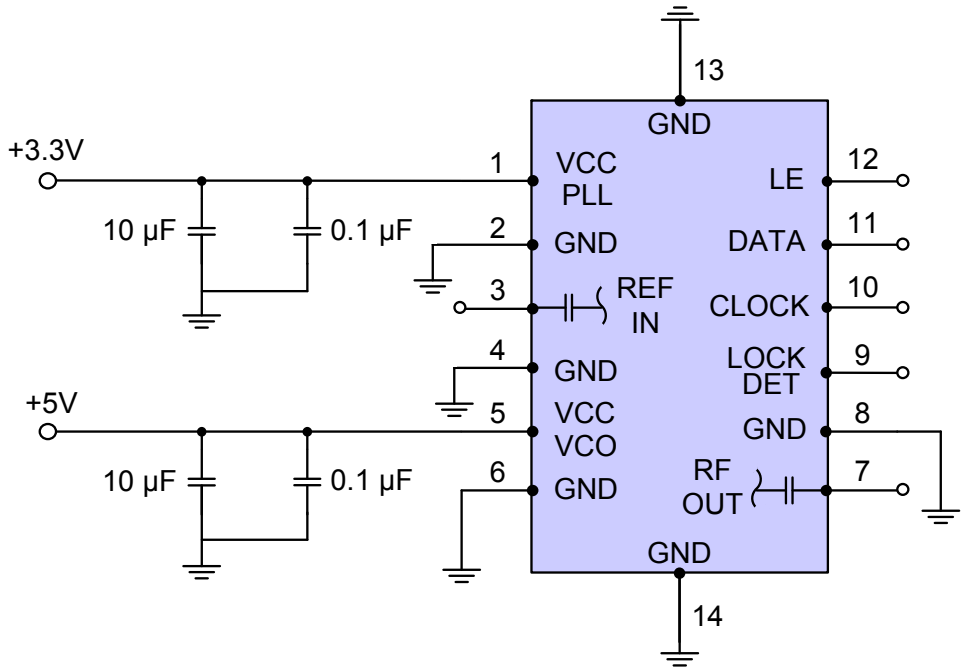



## Pin Connection

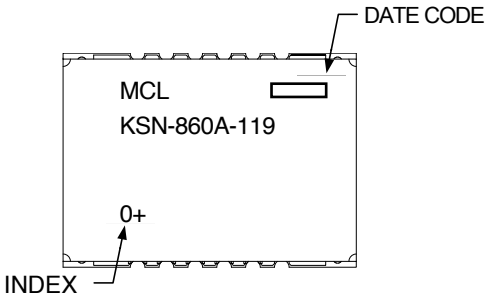
| Pin Number | Function |
|---|---|
| 1 | VCC PLL |
| 2 | GND |
| 3 | REF IN |
| 4 | GND |
| 5 | VCC VCO |
| 6 | GND |
| 7 | RF OUT |
| 8 | GND |
| 9 | LOCK DET |
| 10 | CLOCK |
| 11 | DATA |
| 12 | LE |
| 13 | GND |
| 14 | GND |

## 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:** DK801

**Tape & Reel:** TR-F28

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

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

**Environment Ratings:** ENV03T2