# MAOC-110820

## Broadband Voltage Controlled Oscillator
## 10.55 - 11.05 GHz

Rev. V1

### Features

- Phase Noise: -88/-113dBc/Hz @ 10/100kHz
- Wide Tuning Range
- Low Current Consumption: 120 mA
- Excellent Temperature Stability
- Proven Microphonic Performance
- +5 V Bias
- Lead-Free 5 mm 32-Lead Package
- Halogen-Free "Green" Mold Compound
- RoHS* Compliant and 260°C Reflow Compatible

### Description

The MAOC-110820 is a voltage controlled oscillator for frequency generation. No external matching components are required. This VCO is easily integrated into a phase lock loop using the divide-by-two output. The extremely low phase noise makes this part ideal for many radio applications including high capacity digital radios.

The MAOC-110820 primary applications are Point-to-Point Radio, Point-to-Multipoint Radio, Communications Systems, and Low Phase Noise applications.

The 5 mm package has a lead-free finish that is RoHS compliant and compatible with a 260ºC reflow temperature. The package features low lead inductance and an excellent thermal path.

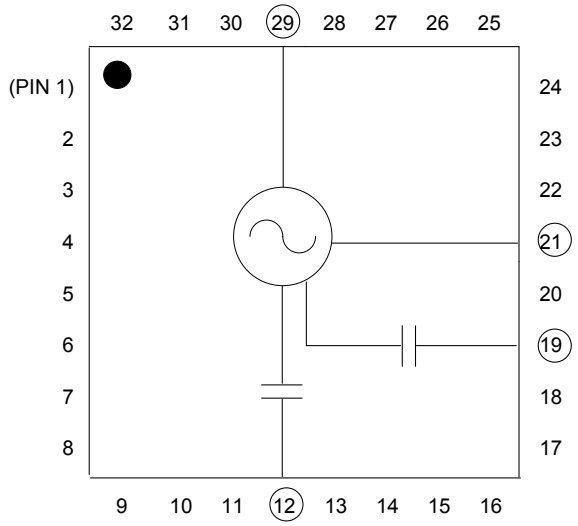
### Ordering Information[1]

| Part Number | Package |
|---|---|
| MAOC-110820-TR0500 | 500 part Reel |
| MAOC-110820-TR1000 | 1000 part Reel |
| MAOC-110820-001SMB | Sample Board |

1. Reference Application Note M513 for reel size information.

* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

### Block Diagram




### Pin Configuration[2]

| Pin | Function |
|---|---|
| 1 - 11 | N/C |
| 12 | RF/2 |
| 13 - 18 | N/C |
| 19 | RF |
| 20 | N/C |
| 21 | $V_{CC}$ |
| 22 - 28 | N/C |
| 29 | $V_{TUNE}$ |
| 30 - 32 | N/C |
| 33[3] | GND |

2. MACOM recommends connecting unused package pins to ground.
3. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

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### Electrical Specifications: $T_A$ = +25°C, $V_{CC}$ = 5.0 V[4], $Z_0$ = 50 Ω

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|---|---|---|---|---|---|
| Output Power | RF Port, 10.55 - 11.05 GHz<br>RF/2 Port, 5.275 - 5.525 GHz | dBm | 5<br>-2 | 11<br>3 | — |
| SSB Phase Noise | RF Port, 10 kHz Offset, 10.55 - 11.05 GHz<br>RF Port, 100 kHz Offset, 10.55 - 11.05 GHz | dBc/Hz | — | -88<br>-113 | —<br>-108 |
| Harmonics/Subharmonics<br>$V_{CC}$ = $V_{TUNE}$ = 5 V | RF Port, $^1/_2$ $F_o$<br>RF Port, 2 $F_o$ | dBc | — | -31<br>-39 | — |
| Pulling<br>(Sensitivity to Match)<br>$V_{CC}$ = $V_{TUNE}$ = 5 V | RF Port, VSWR = 1.95:1 to 2.25:1 | MHz pk-pk | — | 7.5 | — |
| Pushing<br>(Sensitivity to Supply Voltage) | RF Port, $V_{TUNE}$ = 5 V<br>RF/2 Port, $V_{TUNE}$ = 5 V | MHz/V | — | 20<br>10 | — |
| Frequency Drift Rate<br>(Sensitivity to Temperature) | RF Port, 10.55 - 11.05 GHz<br>RF/2 Port, 5.275 - 5.525 GHz | MHz/°C | — | 1.1<br>0.55 | — |
| Output Return Loss | RF Port, 10.55 - 11.05 GHz<br>RF/2 Port, 5.275 - 5.525 GHz | dB | — | 5<br>15 | — |
| Tuning Sensitivity @ RF Port | $V_{TUNE}$ = 5 V | GHz/V | — | 0.13 | — |
| Supply Current | $I_{CC}$ | mA | — | 120 | 150 |
| Tune Voltage | $V_{TUNE}$ | V | 1.5 | — | 12.5 |
| Tuning Current Leakage | $V_{TUNE}$ = 13 V | µA | — | 5 | — |

4. VCO can operate over the 4.75 V to 5.25 V supply voltage range.

### Absolute Maximum Ratings [5,6,7]

| Parameter | Absolute Maximum |
|---|---|
| Voltage | 5.5 Vdc |
| $V_{TUNE}$ | 0 to 15 Vdc |
| Storage Temperature | -55ºC to +150ºC |
| Operating Temperature | -40ºC to +85ºC |
| Junction Temperature[8] | +150ºC |

5. Exceeding any one or combination of these limits may cause permanent damage to this device.
6. MACOM does not recommend sustained operation near these survivability limits.
7. Operating at nominal conditions with $T_J$ ≤ +150°C will ensure MTBF > 1 x $10^6$ hours.
8. Junction Temperature ($T_J$) = $T_C$ + Θjc * (V * I)
   Typical thermal resistance (Θjc) = 58° C/W.
   a) For $T_C$ = 25°C, $T_J$ = 59°C @ 5 V, 118 mA
   b) For $T_C$ = 85°C, $T_J$ = 120°C @ 5 V, 120 mA

### Handling Procedures

Please observe the following precautions to avoid damage:

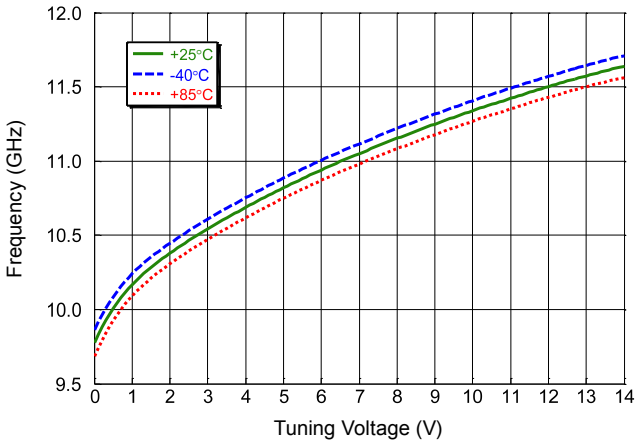
### Static Sensitivity

These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM Class 1B devices.

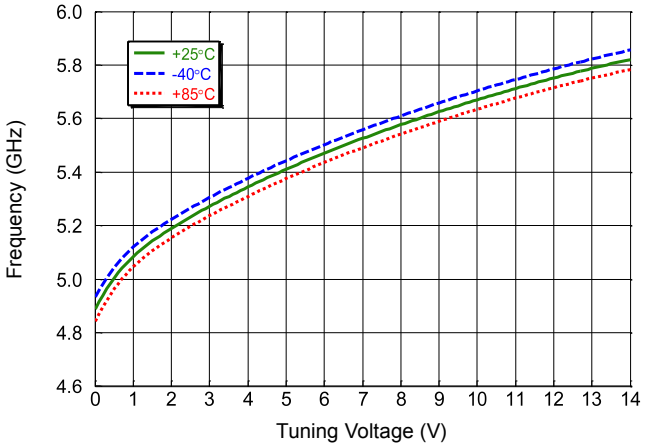

**ESD Rating: Class 1B**

## Typical Performance Curves: $V_{CC}$ = 5 V, $T_A$ = +25°C (unless otherwise indicated)

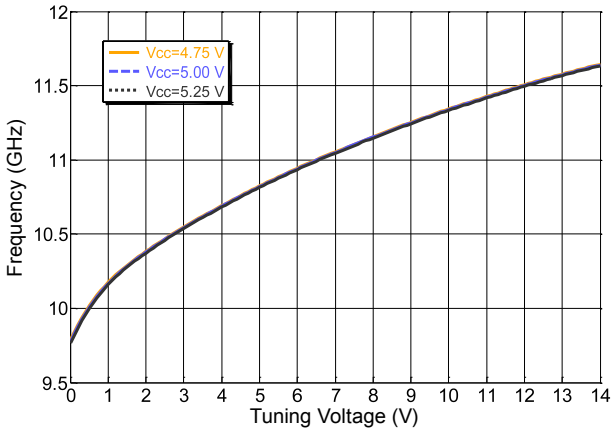
***Output Frequency vs. Tune Voltage - RF Port***



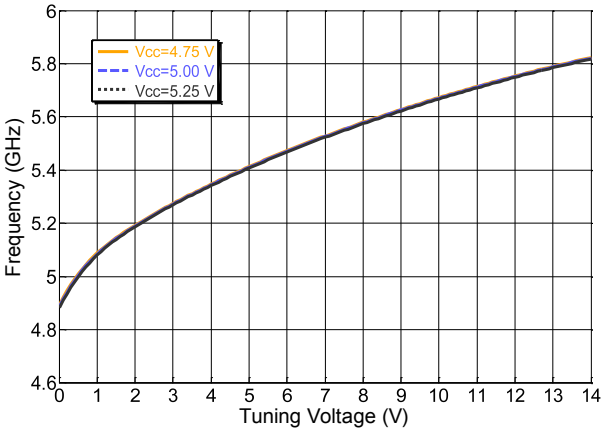

***Output Frequency vs. Tune Voltage - RF/2 Port***



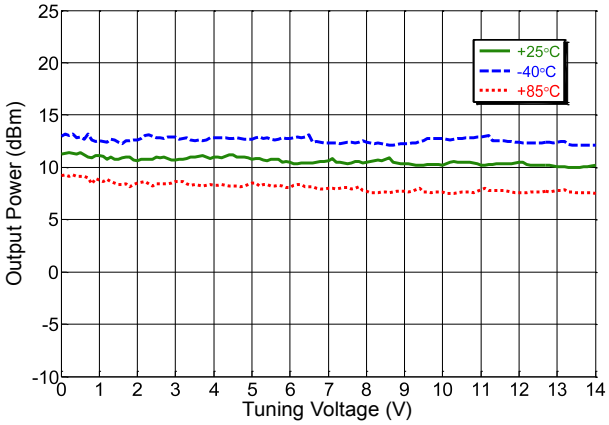

***Output Frequency vs. Tuning / Supply Voltage - RF Port***



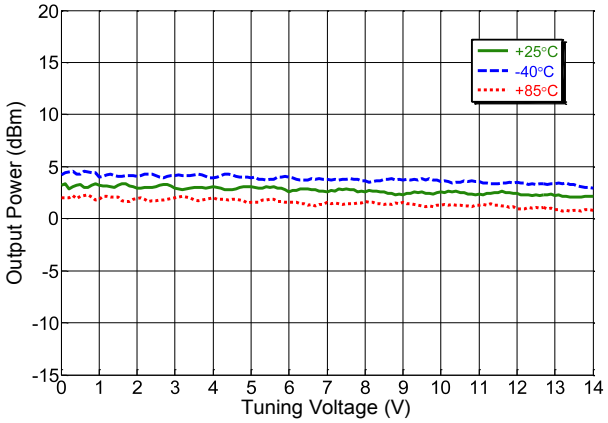

***Output Frequency vs. Tuning / Supply Voltage - RF/2 Port***




***Output Power vs. Tuning Voltage - RF Port***

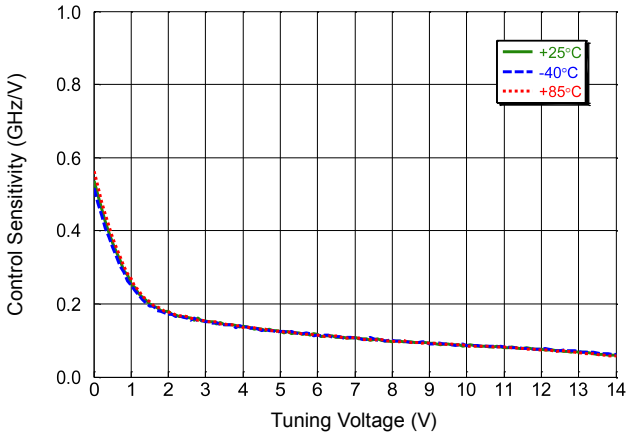



***Output Power vs. Tuning Voltage - RF/2 Port***

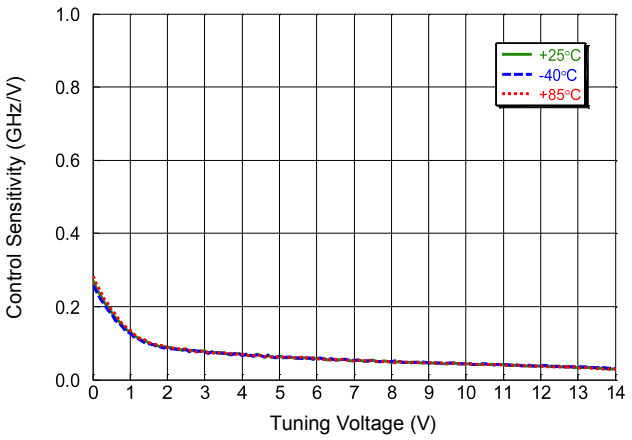


## Typical Performance Curves: $V_{CC}$ = 5 V, $T_A$ = +25°C (unless otherwise indicated)

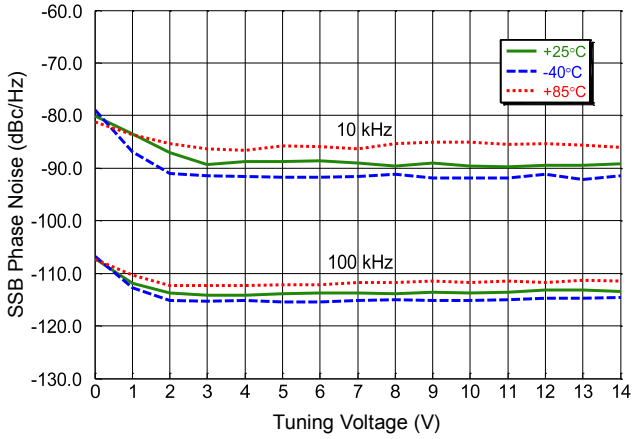
***Frequency Sensitivity vs. Tuning Voltage - RF Port***



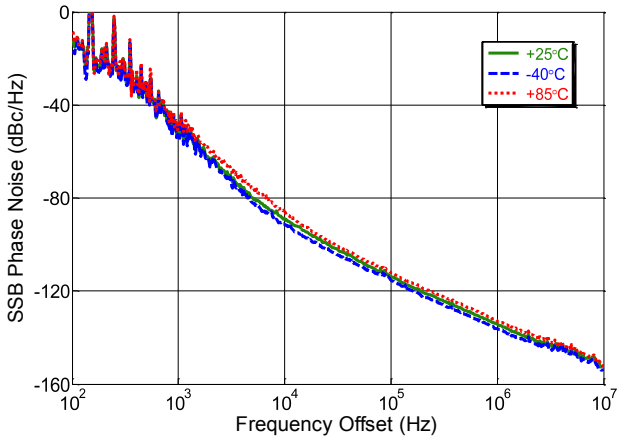

***Frequency Sensitivity vs. Tuning Voltage - RF/2 Port***



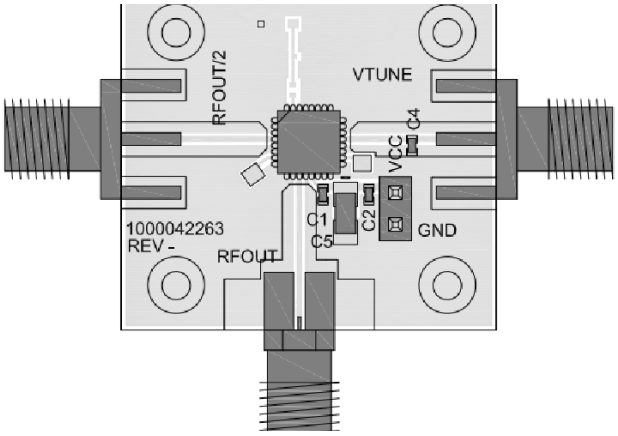

***Single Side Band Phase Noise vs. Tuning Voltage - RF port***




***Single Side Band Phase Noise vs. Frequency Offset - RF Port ($V_{TUNE}$ = 5V)***



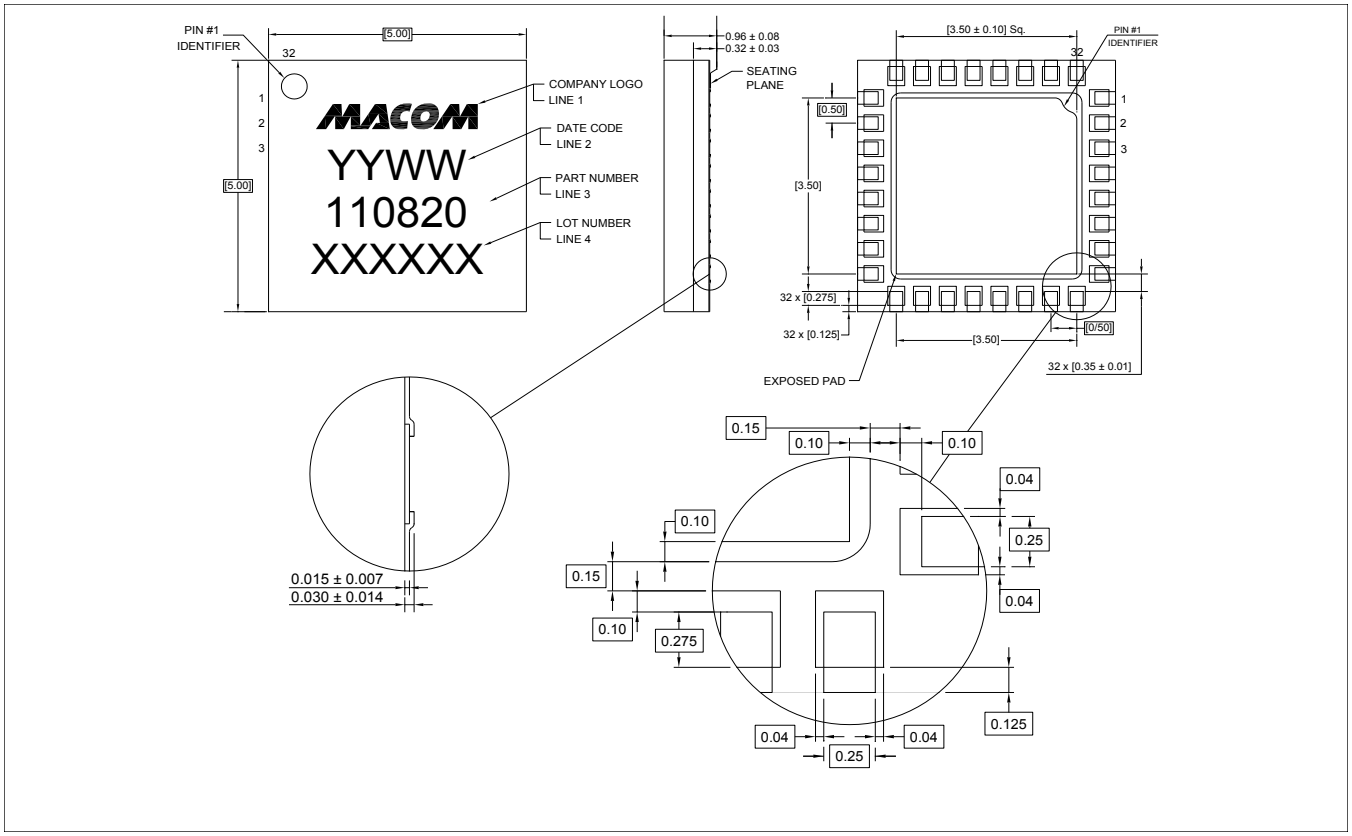
## Sample Board




## Parts List

| Component | Value | Case Size |
|---|---|---|
| C1 | 100 pF | 0402 |
| C2, C4 | 0.1 µF | 0402 |
| C5 | 10 µF Tantalum | 1206 |

## *Lead-Free* 5 mm 32-Lead PQFN†




† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 3 requirements.
Plating is ENEPIG over copper.