

# Voltage Controlled Oscillator 7.06 - 7.9 GHz

Rev. V6

#### **Features**

- · Low Phase Noise
- Wide Tuning Range
- Divide-by-Two Output
- Integrated Buffer Amplifier
- Excellent Temperature Stability
- +5 V Bias
- Lead-Free 5 mm 32-Lead PQFN Package
- Halogen-Free "Green" Mold Compound
- RoHS\* Compliant and 260°C Reflow Compatible

#### **Description**

The MAOC-009261 is an InGaP HBT-based 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-009261 primary applications are Point-to-Point Radio, Point-to-Multipoint Radio, Communications Systems, and Low Phase Noise applications.

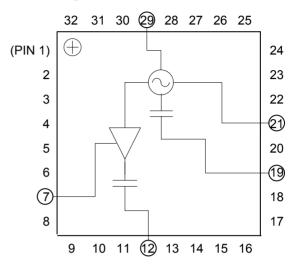
The 5 mm PQFN package has a lead-free finish that is RoHS compliant and compatible with a 260°C reflow temperature. The package also features low lead inductance and an excellent thermal path.

## Ordering Information<sup>1</sup>

Part Number	Package
MAOC-009261-TR0500	500 piece reel
MAOC-009261-TR1000	1000 piece reel
MAOC-009261-SMB003	Sample Board

<sup>1.</sup> Reference Application Note M513 for reel size information.

#### **Block Diagram**



## Pin Designations<sup>2</sup>

Pin	Function	Pin	Function	
1	N/C	17	N/C	
2	N/C	18	N/C	
3	N/C	19	RF	
4	N/C	20	N/C	
5	N/C	21	V <sub>CC</sub>	
6	N/C	22	N/C	
7	V <sub>BUFFER</sub>	23	N/C	
8	N/C	24	N/C	
9	N/C	25	N/C	
10	N/C	26	N/C	
11	N/C	27	N/C	
12	RF/2	28	N/C	
13	N/C	29	$V_{TUNE}$	
14	N/C	30	N/C	
15	N/C	31	N/C	
16	N/C	32	N/C	

The exposed pad centered on the package bottom must be connected to RF and DC ground. Connecting all N/C pins to RF/DC Ground in the layout is also recommended.

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<sup>\*</sup> Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.



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## Electrical Specifications: $T_A = +25^{\circ}C$ , $V_{CC} = V_{BUFFER} = 5 V^3$ , $Z_0 = 50 \Omega$

Parameter	Test Conditions	Units	Min.	Тур.	Max.
Output Power	RF Port, 7.06 - 7.9 GHz RF/2 Port, 3.53 - 3.95 GHz	dBm	8 -2	12 2	
SSB Phase Noise $V_{CC}=V_{BUFFER}=V_{TUNE}=5V$	RF Port, 10 KHZ Offset RF Port, 100 KHZ Offset	dBc/Hz	_	-93 -116	_
Harmonics/Subharmonics V <sub>CC</sub> =V <sub>BUFFER</sub> =V <sub>TUNE</sub> =5V	RF Port, ${}^{1}I_{2}$ F <sub>0</sub> RF Port, 2 F <sub>0</sub>	dBc	_	-24 -17	_
Pulling (Sensitivity to Match) V <sub>CC</sub> =V <sub>BUFFER</sub> =V <sub>TUNE</sub> =5V	RF Port, VSWR = 1.95:1 to 2.25:1	MHz pk-pk		8.7	
Pushing (Sensitivity to Supply Voltage)	RF Port, $V_{TUNE} = 5 V$ RF/2 Port, $V_{TUNE} = 5 V$	MHz/V	_	2 1	_
Frequency Drift Rate (Sensitivity to Temperature)	RF Port, 7.06 - 7.9 GHz RF/2 Port, 3.53 - 3.95 GHz	MHz/°C		0.6 0.3	
Output Return Loss	RF Port, 7.06 - 7.9 GHz RF/2 Port, 3.53 - 3.95 GHz	dB	_	5 13	_
Tuning Sensitivity @ RF Port	V <sub>TUNE</sub> = 5 V	GHz/V		0.12	
Supply Current	I <sub>TOTAL</sub> (I <sub>CC</sub> + I <sub>BUFFER</sub> ) I <sub>CC</sub> I <sub>BUFFER</sub>	mA	_	175 155 20	205 175 30
Tune Voltage⁴	$V_{TUNE}$	V	1	_	13
Tuning Current Leakage	V <sub>TUNE</sub> = 13 V	μA	_	5	10

<sup>3.</sup> VCO can operate over the 4.75 V to 5.25 V supply voltage range.

# **Absolute Maximum Ratings** 5,6,7

Parameter	Absolute Maximum
Supply Voltage (V <sub>CC</sub> & V <sub>BUFFER</sub> )	+5.5 Vdc
$V_{TUNE}$	0 to +15 Vdc
Storage Temperature	-55°C to +150°C
Operating Temperature	-40°C to +85°C
Case Temperature (T <sub>C</sub> ) (measured @ exposed pad)	+100°C
Junction Temperature <sup>8</sup>	+135°C

- 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<sub>J</sub> ≤ +135°C will ensure MTBF >  $2.5 \times 10^{6}$  hours.
- 8. Junction Temperature  $(T_J) = T_C + \Theta_{C} * (V * I)$ Typical thermal resistance (Θjc) = 35° C/W.

## a) For $T_C = 25^{\circ}C$ , $T_J = 56^{\circ}C$ @ 5 V, 175 mA b) For $T_C = 85^{\circ}C$ , $T_J = 117^{\circ}C$ @ 5 V, 180 mA

### **Handling Procedures**

Please observe the following precautions to avoid damage:

#### **Static Sensitivity**

Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.



**ESD Rating: Class 1A** 

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<sup>4.</sup> RF and RF/2 frequency ranges are 7.0 - 7.9 GHz and 3.5 - 3.95 GHz respectively with tune voltage range of 0.5 - 13.0 volts.

# **MAOC-009261**

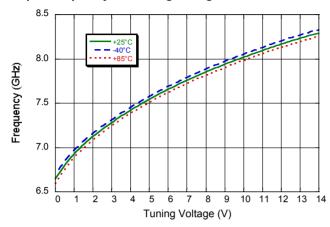


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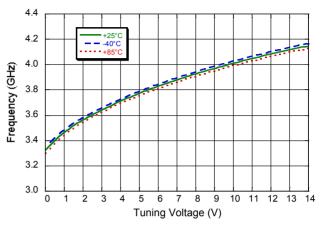
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## Typical Performance Curves: $V_{CC} = V_{BUFFER} = 5 \text{ V}$ , $T_A = +25^{\circ}\text{C}$ (unless otherwise indicated)

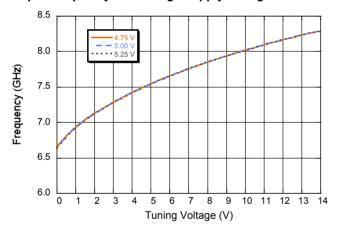
#### Output Frequency vs. Tuning Voltage - RF Port



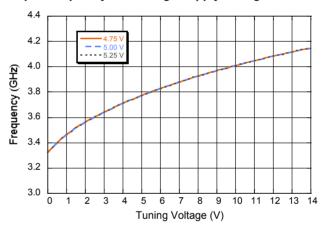
#### Output Frequency vs. Tuning Voltage - RF/2 Port



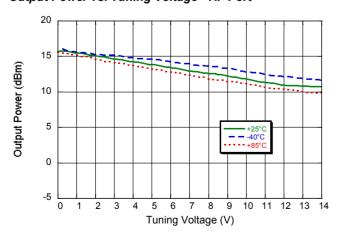
#### Output Frequency vs. Tuning / Supply Voltage - RF Port



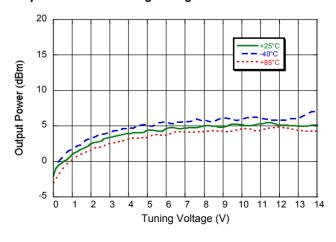
#### Output Frequency vs. Tuning / Supply Voltage - RF/2 Port



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



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



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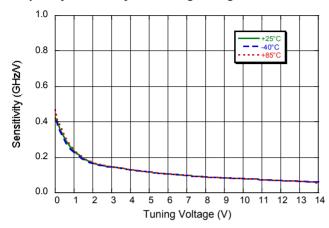


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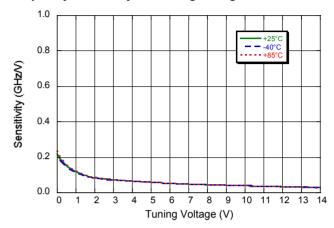
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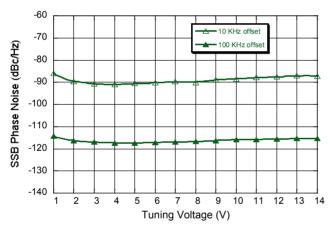
#### Frequency Sensitivity vs. Tuning Voltage - RF Port



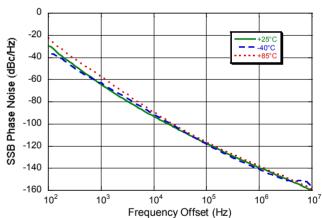
#### Frequency Sensitivity vs. Tuning Voltage - RF/2 Port



# Single Side Band Phase Noise vs. Tuning Voltage RF Port



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

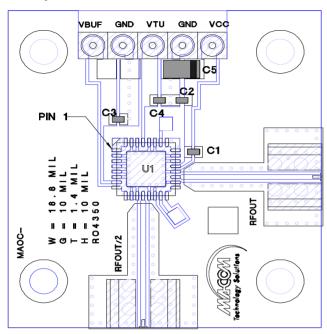




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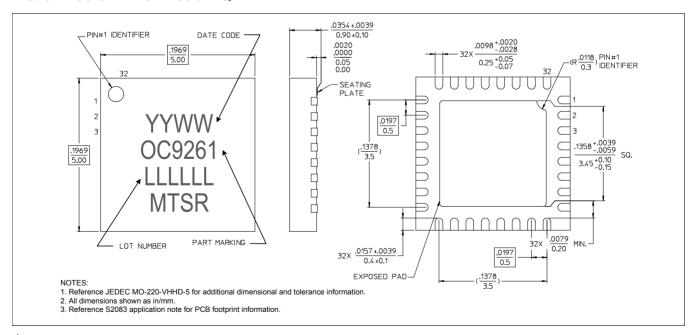
#### **Sample Board**



#### **Parts List**

Component	Value	Case Size
C1	100 pF	0402
C2, C3, C4	0.1 μF	0402
C5	10 μF Tantalum	1206

### Lead-Free 5 mm 32-Lead PQFN<sup>†</sup>



<sup>&</sup>lt;sup>†</sup> Reference Application Note S2083 for lead-free solder reflow recommendations. Meets JEDEC moisture sensitivity level 3 requirements. Plating is 100% matte tin over copper.

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