

## Broadband Voltage Controlled Oscillator

### 11.42 - 12.32 GHz

Rev. V1

#### 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-011701 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-011701 primary applications are Point-to-Point Radio, Point-to-Multipoint Radio, Communications Systems, and Low Phase Noise applications.

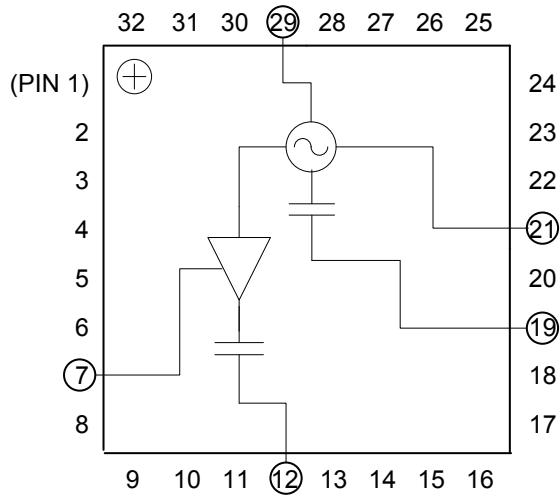
The 5 mm PQFN package has a lead-free finish that is RoHS compliant and compatible with a 260°C reflow temperature. The package also features low lead inductance and an excellent thermal path.

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

Part Number	Package
MAOC-011701-TR0500	500 piece reel
MAOC-011701-TR1000	1000 piece reel
MAOC-011701-001SMB	Sample Board

1. Reference Application Note M513 for reel size information.

#### Block Diagram



#### Pin Configuration<sup>2</sup>

Pin	Function
1 - 6	N/C
7	$V_{BUFFER}$
8 - 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 <sup>3</sup>	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.

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

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### Electrical Specifications: $T_A = +25^\circ\text{C}$ , $V_{CC} = V_{BUFFER} = 5 \text{ V}^4$ , $Z_0 = 50 \Omega$

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Output Power	RF Port, 11.42- 12.32 GHz RF/2 Port, 5.71 - 6.16 GHz	dBm	0	5	—
SSB Phase Noise $V_{CC}=V_{TUNE}=5\text{V}$	RF Port, 10kHz Offset RF Port, 100kHz Offset	dBc/Hz	—	-82 -112	-108
Harmonics/Subharmonics $V_{CC}=V_{TUNE}=5\text{V}$	RF Port, $\frac{1}{2} F_o$ RF Port, $2 F_o$	dBc	—	-18 -26	—
Pulling (Sensitivity to Match) $V_{CC}=V_{TUNE}=5\text{V}$	RF Port, VSWR = 1.95:1 to 2.25:1	MHz pk-pk	—	7	—
Pushing (Sensitivity to Supply Voltage)	RF Port, $V_{TUNE} = 5 \text{ V}$ RF/2 Port, $V_{TUNE} = 5 \text{ V}$	MHz/V	—	12 6	—
Frequency Drift Rate (Sensitivity to Temperature)	RF Port, 11.42 - 12.32 GHz RF/2 Port, 5.71- 6.16 GHz	MHz/ $^\circ\text{C}$	—	1.0 0.5	—
Output Return Loss	RF Port, 11.42 - 12.32 GHz RF/2 Port, 5.71 - 6.16 GHz	dB	—	3 6	—
Tuning Sensitivity @ RF Port	$V_{TUNE} = 5 \text{ V}$	GHz/V	—	0.21	—
Supply Current	$I_{TOTAL} (I_{CC} + I_{BUFFER})$ $I_{CC}$ $I_{BUFFER}$	mA	—	175 155 20	205 175 30
Tune Voltage	$V_{TUNE}$	V	1	—	13
Tuning Current Leakage	$V_{TUNE} = 13 \text{ V}$	$\mu\text{A}$	—	5	10

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

### Absolute Maximum Ratings<sup>5,6,7</sup>

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

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- MACOM does not recommend sustained operation near these survivability limits.
- Operating at nominal conditions with  $T_J \leq +135^\circ\text{C}$  will ensure  $MTBF > 2.5 \times 10^6$  hours.
- Junction Temperature ( $T_J$ ) =  $T_C + \Theta_{JC} * (V * I)$   
Typical thermal resistance ( $\Theta_{JC}$ ) = 35 $^\circ\text{C/W}$ .
  - For  $T_C = 25^\circ\text{C}$ ,  $T_J = 56^\circ\text{C}$  @ 5 V, 175 mA
  - For  $T_C = 85^\circ\text{C}$ ,  $T_J = 117^\circ\text{C}$  @ 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

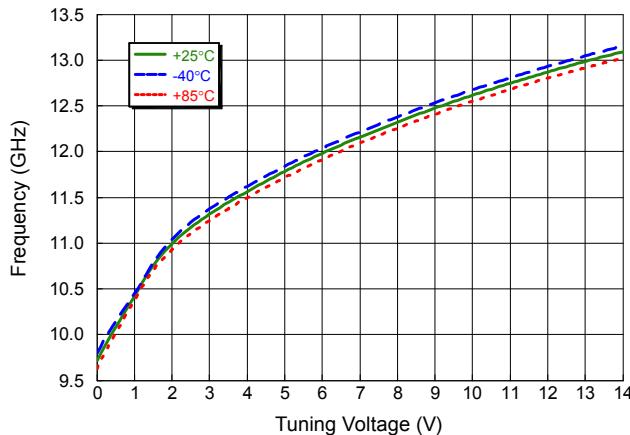
## Broadband Voltage Controlled Oscillator

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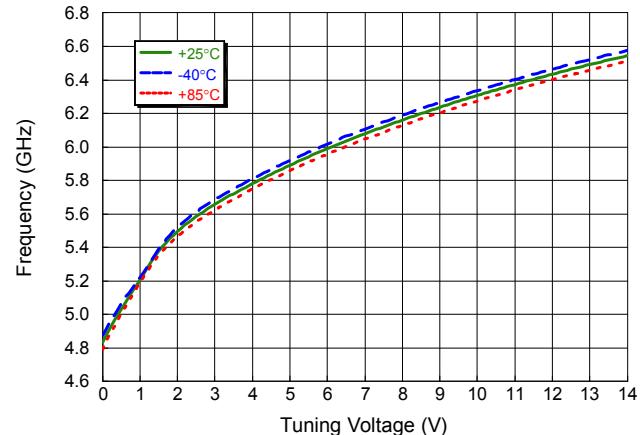
Rev. V1

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

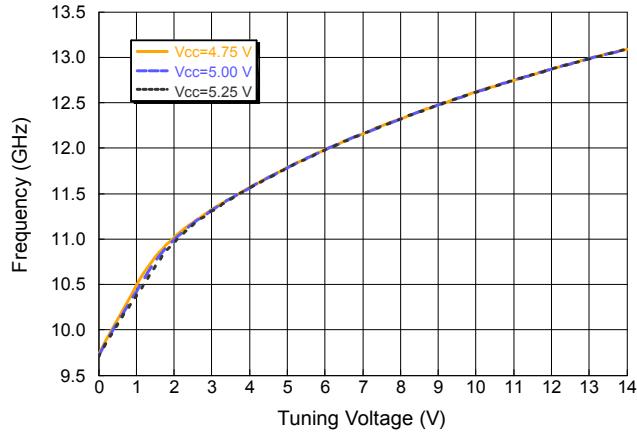
**Output Frequency vs. Tune Voltage - RF Port**



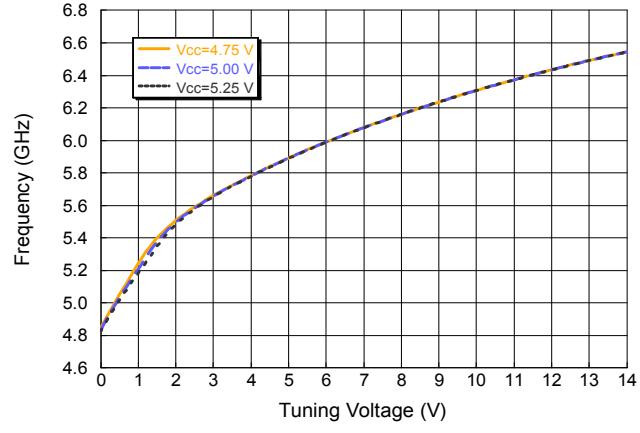
**Output Frequency vs. Tune Voltage - RF/2 Port**



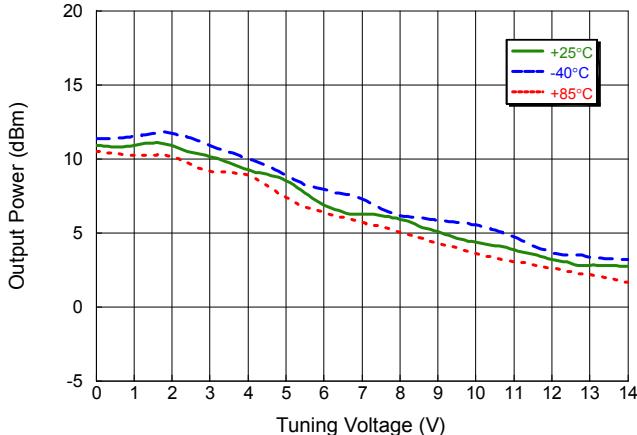
**Output Frequency vs. Tuning / Supply Voltage - RF Port**



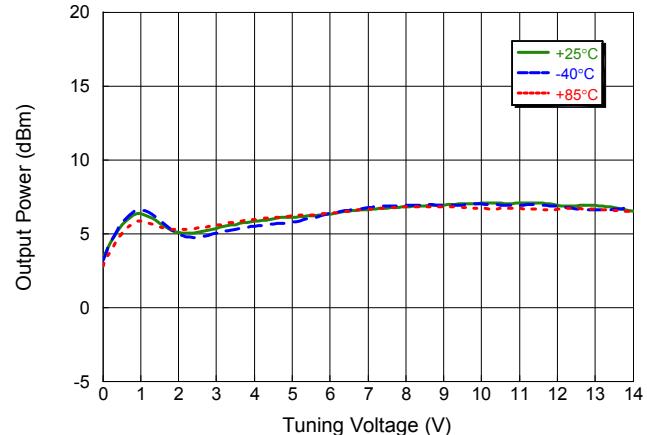
**Output Frequency vs. Tuning / Supply Voltage - RF/2 Port**



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



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



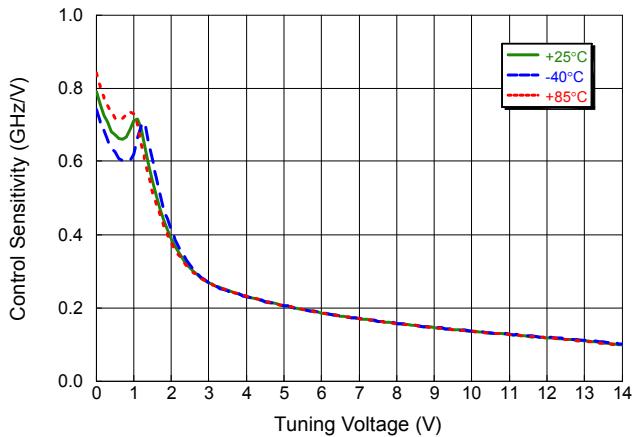
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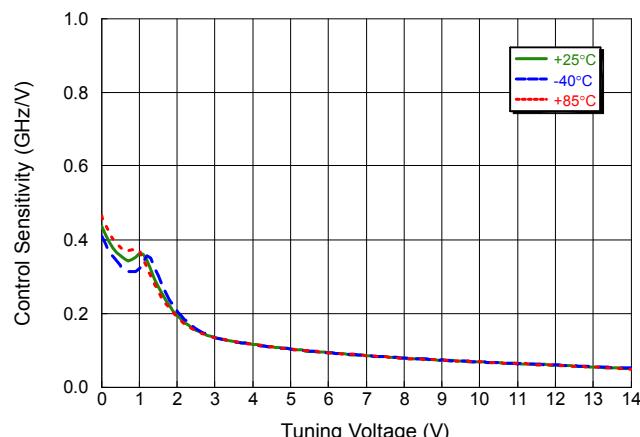
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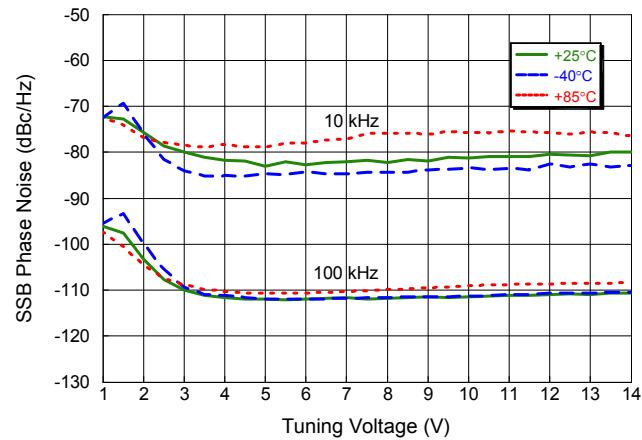
Frequency Sensitivity vs. Tuning Voltage - RF Port



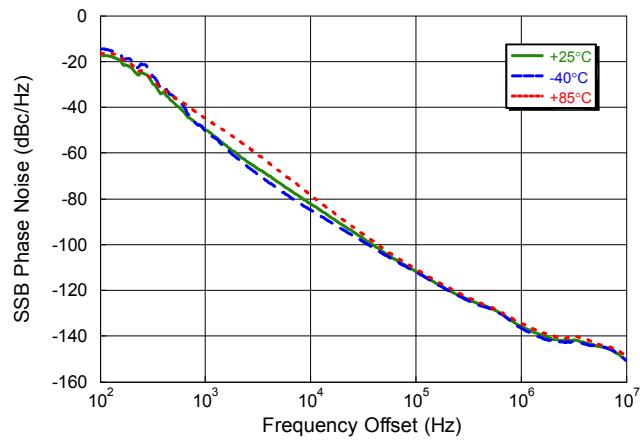
Frequency Sensitivity vs. Tuning Voltage - RF/2 Port



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



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

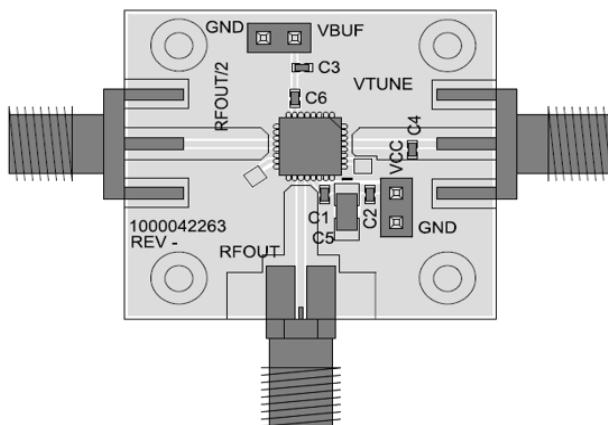


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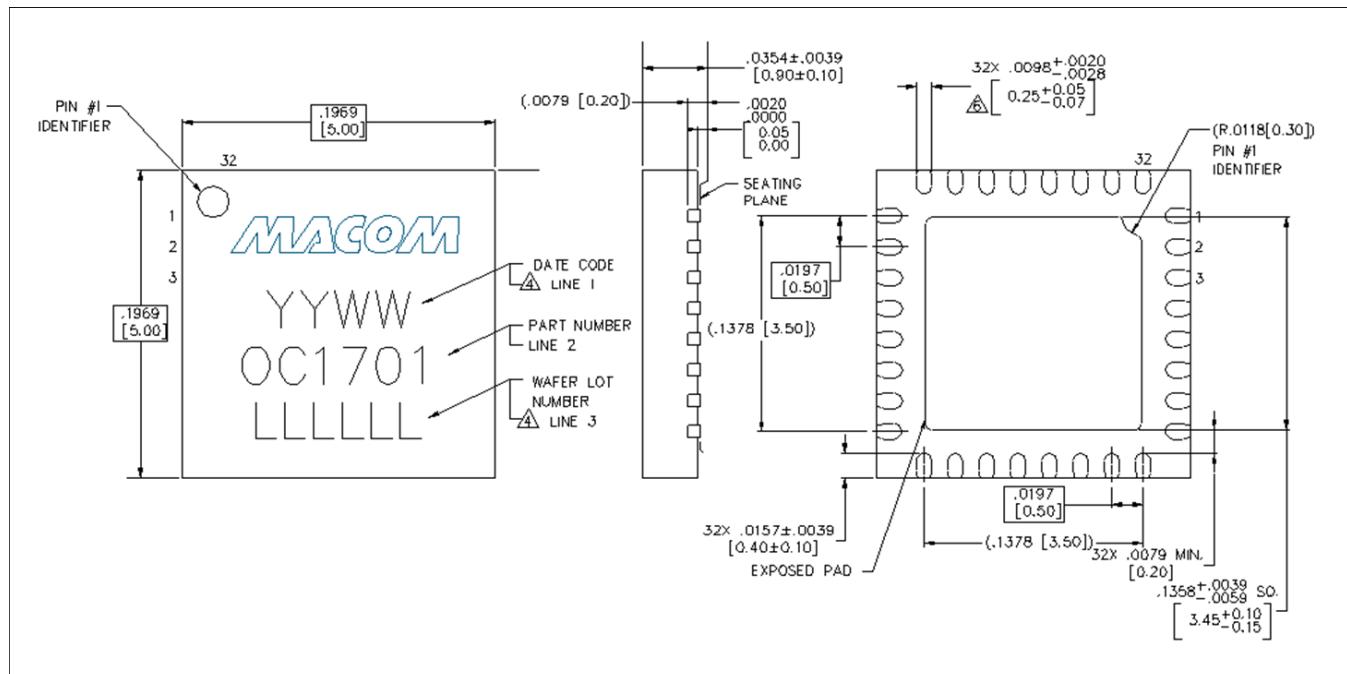
### Sample Board



### Parts List

Component	Value	Case Size
C1	100 pF	0402
C2, C3, C4	0.1 $\mu$ F	0402
C5	10 $\mu$ F Tantalum	1206
C6	0 $\Omega$	0402

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



<sup>†</sup>Reference Application Note S2083 for lead-free solder reflow recommendations.

Meets JEDEC moisture sensitivity level 1 requirements.

Plating is 100% matte tin over copper.

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