OSCILLATOR SECTION
HIGH-VALUE PHASE-LOCKED COAXIAL RESONATOR OSCILLATOR

BCO SERIES:
0.20–4 GHz (Fundamental)
4–16 GHz (Multiplied)

FEATURES

- Low cost
- Phase locked to external standard or internal crystal reference
- High Q ceramic resonator
- Low phase noise
- Small package
- 100% burn-in and temperature testing
- Three-year warranty

The BCO Series phase-locked source offers excellent phase noise and spurious performance in a 2.25" W x 2.25" L x .55" H housing and is available in fixed frequencies from 200 MHz to 16 GHz in fundamental or multiplied configurations. Units can operate from either external reference, or internal TCXO with stability as low as 1 ppm. Flexible internal DC regulators allow operating DC from 8 to 15 VDC.

ELECTRICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th></th>
<th>20 – 16 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output frequency range</td>
<td>20 – 16 GHz</td>
</tr>
<tr>
<td>Output power</td>
<td>+13 dBm minimum</td>
</tr>
<tr>
<td>Output harmonic</td>
<td>-20 dBc maximum</td>
</tr>
<tr>
<td>Output spurious</td>
<td>-70 dBc maximum</td>
</tr>
<tr>
<td>Phase noise</td>
<td>See graph</td>
</tr>
<tr>
<td>Input reference frequency</td>
<td>1 – 200 MHz</td>
</tr>
<tr>
<td>Input impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Load VSWR</td>
<td>1.5:1 nominal</td>
</tr>
<tr>
<td>DC power requirements</td>
<td>+8 to +15 volts @ 200 mA</td>
</tr>
<tr>
<td>Fundamental</td>
<td>+8 to +15 volts @ 300 mA</td>
</tr>
<tr>
<td>Multiplied</td>
<td></td>
</tr>
</tbody>
</table>

TYPICAL PHASE NOISE

![Typical Phase Noise Graph](image-url)
**HIGH-VALUE PHASE-LOCKED COAXIAL RESONATOR OSCILLATOR**

### ORDERING INFORMATION

- **Series**
- **Reference Frequency**
  - External MHz (1–200)
  - Internal (Insert I)
- **Output Frequency (MHz)**
- **Alarm**
  3. TTL: low in-lock, high out-of-lock.
  4. TTL: high in-lock, low out-of-lock.
- **Positive D.C. Supply Voltage (8 – 15)**
- **Standard Options (See Table)**

### MECHANICAL SPECIFICATIONS

- **Outline drawings**
  - Multiplied: 143886, 154937
  - Fundamental: 166055
- **Size**
  2.25” x 2.25” x 0.6”
- **Weight**
  100 grams
- **RF connectors**
  - SMA female
- **DC connectors**
  - Multiplied or
  - Fundamental
  - Feedthru filter
  - Available on
  - Multiplied only
  - 4-pin JST™

### ENVIRONMENTAL SPECIFICATIONS

- **Temperature**
  - Operating: -10 to +60°C
  - Storage: -50 to +100°C
- **Humidity**
  95% at 40°C noncondensing
- **Shock (survival)**
  30 g’s, 10 ms pulse
- **Vibration (survival)**
  20 to 2000 Hz random to 4 g’s rms

Note: Extended temperature available, please contact MITEQ.

### EXAMPLE: Part Number BCO-10-13050-3-15P BCO Series phase-locked oscillator with 13.05 GHz output locked to 10 MHz reference with TTL alarm and +15 volts D.C. supply voltage.
143886
BCO SERIES (MULTIPLIED WITH DC FEEDTHRU)

NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.

154937
BCO SERIES (MULTIPLIED WITH INTEGRATED 4 PIN CONNECTOR)
166055
BCO SERIES (FUNDAMENTAL)
PHASE-LOCKED COAXIAL RESONATOR OSCILLATOR

DLP SERIES: 500–3200 MHz

FEATURES
• Low susceptibility to vibration
• 100% environmental screening
• Three-year warranty

OPTIONS
• Higher output power
• Dual RF outputs (50 dB isolation)
• DC and status filtercons

ELECTRICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output frequency range</td>
<td>500 – 3200 MHz</td>
</tr>
<tr>
<td>Output power</td>
<td>+13 dBm minimum</td>
</tr>
<tr>
<td>Output power variation (0 to 60°C)</td>
<td>±1.5 dB maximum</td>
</tr>
<tr>
<td>Output harmonic</td>
<td>-20 dBc maximum</td>
</tr>
<tr>
<td>Output spurious</td>
<td>-80 dBc maximum</td>
</tr>
<tr>
<td>Phase noise</td>
<td>See graph</td>
</tr>
<tr>
<td>Input reference frequency</td>
<td>1 – 100 MHz</td>
</tr>
<tr>
<td>Input power level</td>
<td>0 ±3 dBm</td>
</tr>
<tr>
<td>Input impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Load VSWR</td>
<td>1.5:1 nominal</td>
</tr>
<tr>
<td>DC power (Note 1)</td>
<td>+12 to +20 volts @ 250 mA typical</td>
</tr>
</tbody>
</table>

Note 1: Add 100 mA @ +V for dual output.

TYPICAL PHASE NOISE

![Typical Phase Noise Graph](image)
**PHASE-LOCKED COAXIAL RESONATOR OSCILLATOR**

**BLOCK DIAGRAM**

![Block Diagram](image)

**ENVIRONMENTAL SPECIFICATIONS**
- **Temperature**
  - Operating: -25 to +75°C
  - Storage: -45 to +85°C
- **Humidity**: 95% at 40°C, noncondensing
- **Shock**: 30 g’s, 10 ms pulse
- **Vibration**: 20 to 2000 Hz random to 4 g’s rms

**MECHANICAL SPECIFICATIONS**
- **Outline drawing**: 138411
- **Size**: 2.15" x 3.15" x 1.33"
- **Weight**: 200 grams
- **RF connectors**: SMA female
- **DC connectors**: 9-pin filtered D type

**ORDERING INFORMATION**

**DLP**

Series

- Input Reference MHz (1 – 100)
- Output Frequency MHz
- Alarm:
  - 0. 0 volts in-lock, +V out-of-lock.
  - 3. TTL: low in-lock, high out-of-lock.
  - 4. TTL: high in-lock, low out-of-lock.
- Positive D.C. Supply Voltage (12 – 20)
- Dual Output Unit (DO)

**EXAMPLE:** Part Number DLP-10-02000-3-15P DLP Series phase-locked oscillator with 2 GHz output locked to 10 MHz reference with TTL alarm and +15 volts D.C. supply voltage.

**OUTLINE DRAWING**

![Outline Drawing](image)

**D CONNECTOR PINOUTS**

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+15 V</td>
</tr>
<tr>
<td>2</td>
<td>VCO 0 VOLTAGE</td>
</tr>
<tr>
<td>3</td>
<td>ALARM</td>
</tr>
<tr>
<td>4</td>
<td>+5 V</td>
</tr>
<tr>
<td>5</td>
<td>GROUND</td>
</tr>
<tr>
<td>6</td>
<td>+15 V</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
</tr>
<tr>
<td>8</td>
<td>+5 V</td>
</tr>
<tr>
<td>9</td>
<td>GROUND</td>
</tr>
</tbody>
</table>

**NOTE:** DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.
MITEQ’s CP/CPM Series oscillator is a high performance, compact, low cost, phase-locked oscillator with output frequencies of .9 to 3.2 GHz (CP Series) and from 4 to 18 GHz (CPM Series). The low profile package allows for easy system integration. Low vibration sensitivity makes the oscillator ideal for both mobile and airborne applications.

### FEATURES
- High Q ceramic resonator
- Low phase noise
- Low vibration susceptibility
- Internally regulated
- Small package
- CPM > 15 GHz with external doubler
- CP-I with internal crystal reference
- 100% temperature/phase popping tested
- Three-year warranty

### ELECTRICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>CP Series</th>
<th>CPM Series (&gt; 15 GHz with external doubler)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output frequency range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CP Series</td>
<td>.9 – 3.2 GHz</td>
<td></td>
</tr>
<tr>
<td>CPM Series</td>
<td>4 – 15 GHz</td>
<td></td>
</tr>
<tr>
<td>Output power</td>
<td>+13 dBm to 15 GHz, +10 dBm above 15 GHz</td>
<td></td>
</tr>
<tr>
<td>Output harmonic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CP Series</td>
<td>-20 dBc maximum</td>
<td></td>
</tr>
<tr>
<td>CPM Series</td>
<td>-50 dBc maximum</td>
<td></td>
</tr>
<tr>
<td>Output spurious</td>
<td>-70 dBc maximum</td>
<td></td>
</tr>
<tr>
<td>Phase noise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$F_{\text{ref}}$ (integer multiple $F_0$)</td>
<td>10 – 200 MHz at 0 ±3 dBm</td>
<td></td>
</tr>
<tr>
<td>Input impedance</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50 ohms</td>
<td></td>
</tr>
<tr>
<td>Load VSWR</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.5:1 nominal</td>
<td></td>
</tr>
<tr>
<td>DC power (+11 V minimum)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CP Series</td>
<td>+11 to +15 volts</td>
<td></td>
</tr>
<tr>
<td>CPM Series</td>
<td>275 mA maximum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500 mA maximum</td>
<td></td>
</tr>
</tbody>
</table>
ENVIRONMENTAL SPECIFICATIONS

Temperature
- Operating: -20 to +70°C
- Storage: -40 to +85°C

Humidity
- 95% at 40°C noncondensing

Shock (survival)
- 30 g’s, 10 ms pulse

Vibration (survival)
- 20 to 2000 Hz random to 4 g’s rms

FUNDAMENTAL/MULTIPLIED PHASE-LOCKED COAXIAL RESONATOR OSCILLATOR

TYPICAL PHASE NOISE

- **CP-1260-15P**
  - 1.26 GHz WITH 10 MHz INPUT REFERENCE
  - PHASE NOISE (dBc/Hz)
  - FREQUENCY OFFSET (Hz)

- **CP-10-2200-15P**
  - 2.2 GHz WITH 10 MHz INPUT REFERENCE
  - PHASE NOISE (dBc/Hz)
  - FREQUENCY OFFSET (Hz)

- **CPM-10-8000-15P**
  - 8 GHz WITH 10 MHz INPUT REFERENCE
  - PHASE NOISE (dBc/Hz)
  - FREQUENCY OFFSET (Hz)

- **CPM-15990-15P**
  - 15.99 GHz WITH 102.5 MHz INPUT REFERENCE
  - PHASE NOISE (dBc/Hz)
  - FREQUENCY OFFSET (Hz)

ORDERING INFORMATION

Series
- CP
- CPM

Reference Frequency
- External MHz (10 – 200)
- Internal: CP Series Only (Insert I)

Output Frequency MHz

Positive D.C. Supply Voltage (11 – 15)

EXAMPLE: Part Number CP-10-01000-11P CP Series phase-locked oscillator at 1 GHz locked to 10 MHz reference and 11 volts D.C. supply voltage.

MECHANICAL SPECIFICATIONS

Outline drawings
- CP: 146962
- CPM: 146941

Size
- CP: 1.35” x 2.25” x 0.6”
- CPM: 2.25” x 2.25” x 0.6”

Weight
- ≤ 150 grams

RF connectors
- SMA female

DC connectors
- Feedthru filter

ENVIRONMENTAL SPECIFICATIONS

Temperature
- Operating: -20 to +70°C
- Storage: -40 to +85°C

Humidity
- 95% at 40°C noncondensing

Shock (survival)
- 30 g’s, 10 ms pulse

Vibration (survival)
- 20 to 2000 Hz random to 4 g’s rms
NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.
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**DLCRO SERIES:**

0.8–4 GHz (Fundamental)  
4–15 GHz (Multiplied)

**FEATURES**

- High performance in a small package
- Excellent close in phase noise
- Excellent spurious performance
- Excellent performance/cost ratio
- 100% burn-in and temperature/phase popping tested
- Three-year warranty

The DLCRO Series phase-locked source offers excellent phase noise and spurious performance in a 2.25” W x 2.25” L x .60” H housing. The dual loop configuration improves phase noise and spurious performance compared to a single loop design, and has the flexibility to allow output frequencies that are not direct multiples of the input. Available in fixed frequencies from 800 MHz to 15 GHz in fundamental or multiplied configurations. The DLC can operate with external reference of 1 to 200 MHz, and with 11 to 15 VDC supply input.

**ELECTRICAL SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output frequency range</td>
<td>0.8 – 15 GHz (&gt;15 GHz, contact MITEQ)</td>
</tr>
<tr>
<td>Output power</td>
<td>+13 dBm minimum</td>
</tr>
<tr>
<td>Output harmonic</td>
<td>-50 dBc maximum (-20 dBc to 4 GHz)</td>
</tr>
<tr>
<td>Output spurious</td>
<td>-70 dBc maximum</td>
</tr>
<tr>
<td>Phase noise</td>
<td>See graph</td>
</tr>
<tr>
<td>Input frequency range</td>
<td>1 – 200 MHz</td>
</tr>
<tr>
<td>Input impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Load VSWR</td>
<td>1.5:1</td>
</tr>
<tr>
<td>DC power</td>
<td></td>
</tr>
<tr>
<td>Fundamental</td>
<td>+11 to +15 volts at 250 mA</td>
</tr>
<tr>
<td>Multiplied</td>
<td>+11 to +15 volts at 300 mA</td>
</tr>
</tbody>
</table>
LOWEST NOISE PHASE-LOCKED DIELECTRIC RESONATOR OSCILLATOR

ORDERING INFORMATION

DLCRO - - - - - - - P

Series
Reference Frequency
External MHz (1 – 200)
Internal (Insert I)
Output Frequency MHz
Alarm
3. TTL: low in-lock, high out-of-lock.
4. TTL: high in-lock, low out-of-lock.
Positive D.C. Supply Voltage (11 – 15)

EXAMPLE: Part Number DLCRO-10-10000-3-12P Double Loop phase-locked oscillator with 10 GHz output locked to 10 MHz reference with TTL alarm and +12 volts D.C. supply voltage.

MECHANICAL SPECIFICATIONS

Outline drawing .................. 153748
Size .................................. 2.25" x 2.25" x 0.60"
Weight .............................. ≤ 100 grams
RF connectors .................. SMA female
DC connectors .................. Feedthru filter

ENVIRONMENTAL SPECIFICATIONS

Temperature
Operating ............... -10 to +60°C
Storage ................. -50 to +100°C
Humidity ..................... 95% at 40°C noncondensing
Shock (survival) ......... 30 g’s, 10 ms pulse
Vibration (survival) ..... 20 to 2000 Hz random to 4 g’s rms

Note: Extended temperature available, please contact MITEQ.
153748
DLCRO SERIES

NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.
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PLDRO SERIES: 1.75–40 GHz

FEATURES
- Lowest phase noise
- Very fine frequency resolution
- Reference from 5 to 100 MHz
- Internal reference available
- Small package
- Low power consumption
- 100% temperature/phase popping tested
- 100% burn-in
- Three-year warranty

ELECTRICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Subharmonic unit</th>
<th>Fundamental unit</th>
<th>Multiplied X2 unit</th>
<th>Multiplied X4 unit</th>
<th>Multiplied X4 unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output frequency range</td>
<td>1.75 – 6.7 GHz</td>
<td>6.7 – 13.4 GHz</td>
<td>13.4 – 26.8 GHz</td>
<td>26.8 – 40 GHz</td>
<td></td>
</tr>
<tr>
<td>Output power</td>
<td>+13 dBm minimum</td>
<td>+10 dBm minimum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output harmonic</td>
<td>-50 dBc maximum</td>
<td>-20 dBc maximum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output spurious</td>
<td>-85 dBc maximum</td>
<td>-80 dBc maximum</td>
<td>-75 dBc maximum</td>
<td>-70 dBc maximum</td>
<td></td>
</tr>
<tr>
<td>Phase noise</td>
<td>See graph</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference frequency</td>
<td>5 – 100 MHz (Note 1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference input power</td>
<td>0 ±3 dBm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC power</td>
<td>+5 VDC or +8 VDC</td>
<td>+5 VDC, or +8 VDC, or +12 VDC, or +15 VDC</td>
<td>+8 VDC, or +12 VDC, or +15 VDC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage tolerance</td>
<td>-0 or +0.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>530 mA maximum</td>
<td>350 mA maximum</td>
<td>550 mA maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load VSWR</td>
<td>2:1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lock alarm</td>
<td>TTL “high” in-lock (Note 2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connectors</td>
<td>SMA or K female</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage/Alarm/Phase</td>
<td>Solder pin feedthru</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Reference frequency above 100 MHz is available, please contact MITEQ.
2. Reverse logic available.
ULTRA-LOW NOISE PHASE-LOCKED
DIELECTRIC RESONATOR OSCILLATOR

ENVIRONMENTAL SPECIFICATIONS

Temperature
Operating .............. -20 to +70°C
Storage ............... -50 to +100°C
Humidity .............. 95% at 40°C noncondensing
Shock (survival) ...... 30 g’s, 10 ms pulse
Vibration (survival) .. 20 to 2000 Hz random to 4 g’s rms

Note: Extended temperature ranges available, please contact MITEQ.

ORDERING INFORMATION


EXAMPLE: Part Number PLDRO-10-11500-3-8P Phase-Locked Dielectric Resonator Oscillator with 11.5 GHz output locked to 10 MHz reference with TTL alarm and +8 volts D.C. supply voltage.

MECHANICAL SPECIFICATIONS

Outline drawings
Fundamental .................. 148748
Multiplied .................... 156650

Size
Fundamental .................. 2.25" x 2.25" x 0.95"
Multiplied .................... 2.70" x 3.00" x 1.05"

Weight ...................... ≤ 200 grams
RF connectors ................. SMA female, SMA/K-female
DC connectors ................ Feedthrufilter

ENVIRONMENTAL SPECIFICATIONS
148748
PLDRO SERIES (FUNDAMENTAL)

NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.
NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.
The VFS unit is a state-of-the-art high performance multi-source oscillator, which is capable of providing up to three discrete frequencies one at a time, and it is enclosed in a package size of 4.0" L x 3.5" W x 1.1" H. The frequency of operation is 1 to 16 GHz with a bandwidth of approximately 20% and an output power of +13 dBm minimum.

**ELECTRICAL SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output frequency range</td>
<td>1 – 16 GHz (Note 1)</td>
</tr>
<tr>
<td>Output power</td>
<td>+13 dBm minimum</td>
</tr>
<tr>
<td>Output spurious</td>
<td>&lt; -70 dBc</td>
</tr>
<tr>
<td>Output harmonic</td>
<td>≤ -20 dBc</td>
</tr>
<tr>
<td>Reference frequency</td>
<td>5 – 100 MHz (customer specified)</td>
</tr>
<tr>
<td>Reference input power</td>
<td>0 ±3 dBm</td>
</tr>
<tr>
<td>Load VSWR</td>
<td>2:1</td>
</tr>
<tr>
<td>Connectors</td>
<td></td>
</tr>
<tr>
<td>RF/IN/OUT</td>
<td>SMA female</td>
</tr>
<tr>
<td>DC power/alarm</td>
<td>9-pin D (FCC17E09PC-2E0)</td>
</tr>
<tr>
<td>Frequency control</td>
<td>5-pin Molex (S5B-PH-SM)</td>
</tr>
<tr>
<td>Frequency selection control</td>
<td>Two bit TTL (customer specified)</td>
</tr>
<tr>
<td>Phase alarm</td>
<td>TTL or open collector</td>
</tr>
<tr>
<td>Phase noise</td>
<td>See graph</td>
</tr>
<tr>
<td>DC power</td>
<td>+5.2 VDC @ 380 mA, and +15 or +12 VDC @ 160 mA</td>
</tr>
</tbody>
</table>

Note 1: This unit is capable of outputting up to three different frequencies one at a time.
VARIABLE FREQUENCY MULTI-SOURCE OSCILLATOR

ORDERING INFORMATION

VFS-Series
Reference Frequency MHz (1 – 200)
Output Frequency 1 (MHz)
  \( A_1 \) \( A_0 \)
  0 0
Output Frequency 2 (MHz)
  \( A_1 \) \( A_0 \)
  0 1
Output Frequency 3 (MHz)
  \( A_1 \) \( A_0 \)
  1 0
Positive D.C. Supply Voltage (12 or 15)

EXAMPLE: Part Number VFS-10-09750-10500-11250-15P Variable Frequency phase-locked oscillator with output frequencies of 9.75 GHz, 10.5 GHz and 11.25 GHz locked to 10 MHz reference operating from +5 and +15 volts D.C. supply voltage.

MECHANICAL SPECIFICATIONS
Outline drawing 156516
Size 3.50° x 4.00° x 1.13°
Weight \( \leq 350 \) grams
RF connectors SMA female
DC connectors Filtered 9-pin D
Frequency control 5-pin Molex

ENVIRONMENTAL SPECIFICATIONS
Temperature Operating -10 to +60°C
Storage -50 to +100°C
Humidity 95% at 40°C noncondensing
Shock (survival) 30 g’s, 10 ms pulse
Vibration (survival) 20 to 2000 Hz random to 4 g’s rms

Note: Extended temperature available, please contact MITEQ.
NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.
MECHANICALLY-TUNED DIELECTRIC RESONATOR PHASE-LOCKED COAXIAL RESONATOR OSCILLATOR

LP SERIES: 500–3200 MHz

FEATURES
• High Q ceramic resonator
• Low phase noise
• Low susceptibility to vibration
• Three-year warranty
• 100% temperature/phase popping tested

OPTIONS
• Higher output power
• 1 – 20 MHz input reference (dual-loop design)
• Internal crystal reference
• Integrated relay alarm

ELECTRICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>LP-2000-C</th>
<th>LP-3095-C</th>
<th>LP-10-730-C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output frequency range</td>
<td>500–3200 MHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output power</td>
<td>+13 dBm minimum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output power variation</td>
<td>±1.5 dB maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output harmonic</td>
<td>-20 dBc maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output spurious</td>
<td>-70 dBc maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase noise</td>
<td>See graph</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input reference frequency</td>
<td>Factory selectable</td>
<td>1 – 550 MHz (optional)</td>
<td></td>
</tr>
<tr>
<td>Input impedance</td>
<td>50 ohms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load VSWR</td>
<td>1.5:1 nominal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC power (Notes 1 and 2)</td>
<td>+15 or +20 volts @ 250 mA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Add 50 mA @ +V for internal crystal reference.
2. Add 120 mA @ +V and 220 mA @ +5 volts for external 1 – 20 MHz reference.

Typical Phase Noise

[Graph showing typical phase noise with frequency offsets from 10 Hz to 10 MHz for LP-2000-C, LP-3095-C, and LP-10-730-C]
PHASE-LOCKED COAXIAL RESONATOR OSCILLATOR

BLOCK DIAGRAM

ORDERING INFORMATION

MECHANICAL SPECIFICATIONS
Outline drawing: 165654
Size: 2.15" x 3.15" x 1.32"
Weight: 250 grams nominal
RF connectors: SMA female
DC connectors: Feedthru filter

ENVIRONMENTAL SPECIFICATIONS
Temperature
Operating: -10 to +60°C
Storage: -45 to +85°C
Humidity: 95% at 40°C noncondensing
Shock (survival): 30 g's, 10 ms pulse
Vibration (survival): 20 to 2000 Hz random to 4 g's rms
NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.
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LPLM SERIES: 3.4–15 GHz

FEATURES
- Superior phase noise
- Ideal for digital radio links
- 100% burn-in
- Three-year warranty

OPTIONS
- Internal crystal reference (mechanically adjustable)
- 1 – 20 MHz input reference (dual-loop design)

ELECTRICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output frequency range</td>
<td>3.4 – 15 GHz</td>
</tr>
<tr>
<td>Output power</td>
<td>+13 dBm minimum</td>
</tr>
<tr>
<td>Output power variation</td>
<td>±1.5 dB maximum</td>
</tr>
<tr>
<td>Output impedance</td>
<td>50 ohms nominal</td>
</tr>
<tr>
<td>Output tuning range</td>
<td>2% of bandwidth nominal (Note 1)</td>
</tr>
<tr>
<td>Output harmonic</td>
<td>-50 dBc minimum (Out to Third harmonic)</td>
</tr>
<tr>
<td>Output spurious</td>
<td>-70 dBc minimum (standard)</td>
</tr>
<tr>
<td>Phase noise</td>
<td>See graph</td>
</tr>
<tr>
<td>Input reference frequency</td>
<td></td>
</tr>
<tr>
<td>Internal</td>
<td>Factory selectable</td>
</tr>
<tr>
<td>External</td>
<td>1 – 550 MHz (optional)</td>
</tr>
<tr>
<td>Input power level</td>
<td>0 ±3 dBm</td>
</tr>
<tr>
<td>Load VSWR</td>
<td>1.5:1 nominal</td>
</tr>
<tr>
<td>DC power</td>
<td>+15 or +20 volts</td>
</tr>
<tr>
<td></td>
<td>@ 400 mA typical (standard)</td>
</tr>
<tr>
<td></td>
<td>@ 600 mA (optional)</td>
</tr>
</tbody>
</table>

Note 1: Up to 5% available on custom models.

GUARANTEED PHASE NOISE

<table>
<thead>
<tr>
<th>Offset from Carrier (kHz)</th>
<th>Phase Noise at 4 GHz Carrier (dBc/Hz)</th>
<th>Phase Noise at 8 GHz Carrier (dBc/Hz)</th>
<th>Phase Noise at 15 GHz Carrier (dBc/Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>-85</td>
<td>-80</td>
<td>-75</td>
</tr>
<tr>
<td>1</td>
<td>-105</td>
<td>-100</td>
<td>-95</td>
</tr>
<tr>
<td>10</td>
<td>-113</td>
<td>-107</td>
<td>-100</td>
</tr>
<tr>
<td>100</td>
<td>-113</td>
<td>-107</td>
<td>-100</td>
</tr>
<tr>
<td>1</td>
<td>-133</td>
<td>-127</td>
<td>-120</td>
</tr>
<tr>
<td>10</td>
<td>-145</td>
<td>-145</td>
<td>-140</td>
</tr>
</tbody>
</table>

Notes: Internal models: 100 MHz (typical), External models: Phase noise must be at least -121 @ 100 Hz, -141 @ 1 kHz, -153 @ 10 kHz for guaranteed performance.
MULTIPLIED PHASE-LOCKED COAXIAL RESONATOR OSCILLATOR

ORDERING INFORMATION

```
LPLM - [S] - [F] - [O] - P
```

Series
Reference Frequency
MHz (1 – 550)
Internal (Insert I, specify °C)
Output Frequency MHz
Alarm
0. 0 volts in-lock, +V (typ.) out-of-lock.
   (contact closure to ground)
2. Relay: closed in-lock, open out-of-lock.
   (contact closure to ground)
3. TTL: low in-lock, high out-of-lock.
4. TTL: high in-lock, low out-of-lock.
Positive D.C. Supply Voltage (12, 15 or 20)

EXAMPLE: Part Number LPLM-10-10000-3-15P LPLM Series phase-locked oscillator with 10 GHz output locked to 10 MHz reference with TTL alarm and +15 volts D.C. supply voltage.

MECHANICAL SPECIFICATIONS

Outline drawings................. 165652, 165653
Size
LPLM (4-8)...................... 2.20" x 3.65" x 1.42"
LPLM (8-15).................... 2.15" x 3.15" x 1.32"
Weight .......................... 350 grams nominal
RF connectors............... SMA female
DC connectors ................. Feedthru filter

ENVIRONMENTAL SPECIFICATIONS

Temperature
Operating ...................... -10 to +60°C
Storage ....................... -45 to +85°C (standard)
Humidity ...................... 95% at 40°C, noncondensing
Shock (survival) ............. 30 g’s, 10 ms pulse
Vibration (survival) ......... 20 to 2000 Hz random to 4 g’s rms
OUTLINE DRAWINGS

165652
LPLM SERIES (1 TO 20 MHZ INPUT, 8 TO 15 GHz OUTPUT)

OPTIONS A (EXTERNAL REFERENCE)

OPTIONS B.C (INTERNAL REFERENCE)

OPTION -5, -10 (DUAL LOOP)

OPTIONAL MOUNTING PLATE CONFIGURATION

NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.
165652
LPLM SERIES (50 TO 550 MHz INPUT, 8 TO 15 GHz OUTPUT)

OPTIONS B, C AND D (INTERNAL REFERENCE)

OPTION A (EXTERNAL REFERENCE)

OPTIONAL MOUNTING PLATE CONFIGURATION

NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.
NOTES: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.
165653
LPLM SERIES (50 TO 550 MHz INPUT, 4 TO 8 GHz OUTPUT)

OPTIONS B,C AND D (INTERNAL REFERENCE)

OPTION A. (EXTERNAL REFERENCE)

OPTIONAL MOUNTING PLATE CONFIGURATION

NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.
MECHANICALLY-TUNED DIELECTRIC RESONATOR

PHASE-LOCKED CRYSTAL OSCILLATOR

PLD SERIES:
30–130 MHz (PLD)
130–1000 MHz (PLD-1C)

FEATURES
• Low phase noise design
• Fractional frequency division available
• Low subharmonics for multiplied models (-70 dBc)
• +13 dBm standard output power

OPTIONS
• Higher output power
• TTL output
• Coupled RF output

ELECTRICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Output frequency range</th>
<th>30 – 130 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundamental (PLD)</td>
<td>130 – 1000 MHz</td>
</tr>
<tr>
<td>Multiplied (PLD-1C)</td>
<td></td>
</tr>
<tr>
<td>Output power</td>
<td>+13 dBm minimum</td>
</tr>
<tr>
<td>Output power variation</td>
<td>±1 dB maximum</td>
</tr>
<tr>
<td>Output harmonic</td>
<td>-20 dBc maximum</td>
</tr>
<tr>
<td>Output spurious</td>
<td>-70 dBc maximum</td>
</tr>
<tr>
<td>Phase noise</td>
<td>See graphs</td>
</tr>
<tr>
<td>Input reference frequency</td>
<td>1 – 20 MHz</td>
</tr>
<tr>
<td>Input power level</td>
<td>0 ±3 dBm</td>
</tr>
<tr>
<td>Input impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Load VSWR</td>
<td>1.5:1 nominal</td>
</tr>
<tr>
<td>DC power (Note 1)</td>
<td>+15 or +20 volts @ 250 mA and +5 volts @ 200 mA</td>
</tr>
</tbody>
</table>

Note 1: Add 120 mA @ +V for PLD-1C.

TYPICAL PHASE NOISE

PLD SERIES

PLD-1C SERIES

---
PHASE-LOCKED CRYSTAL OSCILLATOR

BLOCK DIAGRAM

ORDERING INFORMATION

MECHANICAL SPECIFICATIONS
Outline drawings
PLD .......................... 138410
PLD-1C ......................... 138413
Size
PLD .......................... 2.6" x 3.20" x 0.87"
PLD-1C ......................... 2.15" x 3.15" x 1.33"
Weight
Fundamental ................. 250 grams nominal
Multiplied .................... 300 grams nominal
RF connectors .............. SMA female
DC connectors ............. Feedthru filter

ENVIRONMENTAL SPECIFICATIONS
Temperature
Operating ..................... 0 to 60°C
Storage ....................... -45 to +85°C
Humidity ...................... 95% at 40°C, noncondensing
Shock (survival) ............... 30 g's, 10 ms pulse
Vibration (survival) .......... 20 to 2000 Hz random to 4 g's rms

REFERENCE AMPLIFIER
INPUT REFERENCE
1 – 20 MHz
REFERENCE DIVIDER
1, 2, 3...128
DIVIDER CIRCUITS
FRACTIONAL DIVISION UP TO 10 MHz RESOLUTION
REFERENCE DIVIDER
REFERENCE
DIGITAL PHASE DETECTOR
ACTIVE LOWPASS FILTER
Oscillator
OSCILLATOR
RF OUTPUT (Fo)
VCXO: 30 – 165 MHz
MULTIPLIER CIRCUITS
÷ BY N
(Coupled output)
N*Fo
130 – 1000 MHz
FUNDAMENTAL RF OUTPUT (Fo)
AFC INPUT
DIGITAL PHASE DETECTOR
ORDERING INFORMATION
Series
PLD (output freq. is 30-130 MHz)
PLD-1C (output freq. is 130-1000 MHz)
Input Frequency MHz (1 – 20 )
Output Frequency MHz
Alarm
0. 0 volts in-lock, +V out-of-lock.
   (contact closure to ground)
2. Relay: closed in-lock, open out-of-lock.
   (contact closure to ground)
3. TTL: low in-lock, high out-of-lock.
4. TTL: high in-lock, low out-of-lock.
Positive D.C. Supply Voltage (15 or 20)
EXAMPLE: Part Number PLD-10-0100-3-15P PLD Series 100 MHz phase-locked crystal oscillator with 10 MHz reference, TTL alarm and +15 volts D.C. supply voltage.
NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLimeters.
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ULTRA LOW-NOISE CRYSTAL OSCILLATOR

XTO-05 SERIES: 5–130 MHz

FEATURES
• Ultra low phase noise
• Low current consumption
• Low cost
• Oven controlled

ELECTRICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output frequency range</td>
<td>5 – 130 MHz</td>
</tr>
<tr>
<td>Output power</td>
<td>+11 dBm minimum (standard)</td>
</tr>
<tr>
<td></td>
<td>+15 dBm maximum (optional)</td>
</tr>
<tr>
<td>Output power variation (0 to 60°C)</td>
<td>±1 dB maximum</td>
</tr>
<tr>
<td>Output impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Output harmonic</td>
<td>-30 dBc minimum</td>
</tr>
<tr>
<td>Frequency stability</td>
<td>F. ±1 ppm, (0 to 60°C)</td>
</tr>
<tr>
<td></td>
<td>G. ±0.1 ppm (0 to 60°C)</td>
</tr>
<tr>
<td></td>
<td>J. ±0.01 ppm (0 to 50°C)</td>
</tr>
<tr>
<td>Phase noise</td>
<td>See graph</td>
</tr>
<tr>
<td>Aging rate</td>
<td>2 x 10⁻⁶ per 24 hours</td>
</tr>
<tr>
<td>Load VSWR</td>
<td>1.5:1 nominal</td>
</tr>
<tr>
<td>DC power requirements</td>
<td>+15, +20 or +24 volts</td>
</tr>
<tr>
<td></td>
<td>@ 300 mA (warm-up)</td>
</tr>
<tr>
<td></td>
<td>@ 175 mA (continuous)</td>
</tr>
</tbody>
</table>

TYPICAL PHASE NOISE

![Graph showing typical phase noise over frequency offset (Hz) and phase noise (dBc/Hz).]
**ORDERING INFORMATION**

**XTO-05**

Series
Output Frequency MHz
Stability (select one)

- F. ±1 ppm (0 to 60°C)
- G. ±0.1 ppm (0 to 60°C)
- J. ±0.01 ppm (0 to 50°C)

Positive D.C. Supply Voltage (15, 20, or 24)

EXAMPLE: Part Number XTO-020-F-15P XTO Series crystal oscillator with 20 MHz output, ±1 ppm stability and +15 volts D.C. supply voltage.

**MECHANICAL SPECIFICATIONS**

Outline drawings................. 138427
Size........................................ 2.0” x 2.0” x 1.0”
Weight.......................... 100 grams nominal
RF connectors ............... SMA female
DC connectors .............. Feedthru filter

**ENVIRONMENTAL SPECIFICATIONS**

Temperature
- Operating ..................... 0 to 60°C
- Storage ...................... -45 to +85°C
Humidity............................. 95% at 45°C, noncondensing
Shock (survival) ................. 30 g’s, 10 ms pulse
Vibration (survival) ............ 20 to 2000 Hz random to 4 g’s rms

**OUTLINE DRAWING**

**138427**

**XTO-05 SERIES**

NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.
# Multiplied Crystal Oscillator to 1 GHz

## XTM Series: 130–1000 MHz

### Features
- Low phase noise
- Mechanical tunability

### Electrical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Specification Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output frequency range</td>
<td>130 – 1000 MHz</td>
</tr>
<tr>
<td>Output power</td>
<td>+10 dBm minimum</td>
</tr>
<tr>
<td>Output power variation (0 to 60°C)</td>
<td>±1 dB maximum</td>
</tr>
<tr>
<td>Output impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Output harmonic</td>
<td>-30 dBc minimum</td>
</tr>
<tr>
<td>Output spurious</td>
<td>-60 dBc minimum</td>
</tr>
<tr>
<td>Phase noise</td>
<td>See graph</td>
</tr>
<tr>
<td>Load VSWR</td>
<td>1.5:1 nominal</td>
</tr>
<tr>
<td>Frequency stability</td>
<td>±5 ppm (-10 to 60°C)</td>
</tr>
<tr>
<td>DC power</td>
<td>+15, +20 or +24 volts @ 240 mA nominal</td>
</tr>
</tbody>
</table>

### Typical Phase Noise

![Typical Phase Noise Graph](image-url)
ORDERING INFORMATION

XTM - C - P

Series
Output Frequency MHz (130 – 1000)
Stability: ±5 ppm (-10 to 60°C)
Positive D.C. Supply Voltage (15, 20 or 24)

EXAMPLE: Part Number XTM-150-C-15P XTM Series multiplied crystal oscillator with 150 MHz output, ±5 ppm stability and +15 volts D.C. supply voltage.

MECHANICAL SPECIFICATIONS
Outline drawing.............. 123528
Size............................ 2.15” x 3.15” x 1.33”
Weight.......................... 300 grams nominal
RF connectors ............... SMA female
DC connectors.............. Feedthru filter

ENVIRONMENTAL SPECIFICATIONS
Temperature
Operating ..................... -10 to +60°C
Storage ......................... -45 to +85°C
Humidity ....................... 95% at 40°C, noncondensing
Shock (survival) ............ 30 g’s, 10 ms pulse
Vibration (survival) ........ 20 to 2000 Hz random to 4 g’s rms

MECHANICAL SPECIFICATIONS

OUTLINE DRAWING

EXAMPLE: Part Number XTM-150-C-15P XTM Series multiplied crystal oscillator with 150 MHz output, ±5 ppm stability and +15 volts D.C. supply voltage.

NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.