

RFPO45



SMD Oven Controlled Crystal Oscillator

Rakon's Mercury oven controlled crystal oscillator (OCXO) provides comparable stability to 'traditional' OCXOs in a small SMD package.



Product description

Using Rakon's proprietary Mercury ASIC, the OCXO is capable of short term ageing of less than ± 2 ppb per day, with temperature stability down to ± 10 ppb. The miniature, highly integrated oven used ensures short warm up times with power consumption of only 350 mW at room temperature.

Applications

- Network timing and synchronisation
- IP timing
- LTE

Features

- ± 20 ppb stability over -40 to 85°C
- World's smallest OCXO

Specifications

1.0 SPECIFICATION REFERENCES

| Line | Parameter | Description |
|------|-------------------|--------------------------|
| 1.1 | Model description | RFPO45 |
| 1.2 | RoHS compliant | Yes |
| 1.3 | Package size | 9.7 mm x 7.5 mm x 4.3 mm |

2.0 FREQUENCY CHARACTERISTICS

| Line | Parameter | Test Condition | Value | Unit |
|------|---|---|-----------------|---------|
| 2.1 | Frequency range | Frequency range available (note 1) | 10 to 26 | MHz |
| 2.2 | Frequency calibration | At 25°C \pm 2°C, at time of shipment, reference to nominal frequency (note 2) | ± 0.5 max | ppm |
| 2.3 | Reflow shift | After 1 hour recovery at 25°C | ± 1 max | ppm |
| 2.4 | Frequency stability over temperature in still air | Reference to $(F_{max} + F_{min})/2$, see model code builder (note 3) | ± 10 to 100 | ppb |
| 2.5 | Temperature range | The operating temperature range over which the frequency stability is measured (note 3) | -40 to 85 | °C |
| 2.6 | Frequency slope in still air | Temperature ramp 1°C/minute max. | ± 0.5 to 2 | ppb/°C |
| 2.7 | Supply voltage stability | $\pm 5\%$ variation, reference to frequency at 3.3V, typical... | ± 10 | ppb |
| 2.8 | Load sensitivity | ± 5 pF variation, reference to frequency at 15pF, typical... | ± 10 | ppb |
| 2.9 | Warm-up time | Note 4, typically less than... | 3 | minutes |
| 2.10 | g-sensitivity | Gamma vector of all three axes from 30 Hz to 1500 Hz, typically less than... | 2 | ppb/g |
| 2.11 | Holdover drift | 24 hours, temperature variation $\leq \pm 1^\circ\text{C}$ (note 5), typically less than... | ± 2.5 to 4 | ppb |
| 2.12 | Free-run accuracy | All causes, 20 years life, reference to nominal frequency | ± 4.6 max | ppm |
| 2.13 | Loop bandwidth for wander generation compliance | MTIE compliant with GR-1244 Fig 5-5 & G.812 Type III Fig1 (≤ 100 ns), TDEV compliant with GR-1244 Fig 5-4 & G.812 Type III Fig2 (≤ 10 ns), oscillator stabilised 24 hours at Constant temperature ($\pm 1^\circ\text{C}$, still air), data collected over 100,000 seconds at 1 second intervals (-3dB cut-off, 2nd order high pass loop filter) | 3 min | mHz |

3.0 FREQUENCY AGING

| Line | Parameter | Test Condition | Value | Unit |
|------|---------------------|--|--------|------|
| 3.1 | Long term stability | Per day (note 5), typically less than... | ±2 | ppb |
| 3.2 | Long term stability | First year | ±1 max | ppm |
| 3.3 | Long term stability | 20 years | ±3 max | ppm |

4.0 ROOT ALLAN VARIANCE

| Line | Parameter | Test Condition | Value | Unit |
|------|---------------------|--|-------|------|
| 4.1 | Root Allan Variance | Typical value for a 20 MHz unit at 25°C, tau = 0.1s | 7 | E-11 |
| 4.2 | Root Allan Variance | Typical value for a 20 MHz unit at 25°C, tau = 1.0s | 7 | E-11 |
| 4.3 | Root Allan Variance | Typical value for a 20 MHz unit at 25°C, tau = 10s | 7 | E-11 |
| 4.4 | Root Allan Variance | Typical value for a 20 MHz unit at 25°C, tau = 100s | 8 | E-11 |
| 4.5 | Root Allan Variance | Typical value for a 20 MHz unit at 25°C, tau = 1000s | 8 | E-11 |

5.0 POWER SUPPLY

| Line | Parameter | Test Condition | Value | Unit |
|------|----------------|--|---------|------|
| 5.1 | Supply voltage | ±5% | 3.3 | V |
| 5.2 | Input power | warm up, -40°C to 85°C devices, typical... | 1000 | mW |
| 5.3 | Input power | warm up, -20°C to 70°C devices, typical... | 800 | mW |
| 5.4 | Input power | Steady state in still air at 25°C, -40°C to 85°C devices | 400 max | mW |
| 5.5 | Input power | Steady state in still air at 25°C, -20°C to 70°C devices | 350 max | mW |

6.0 HCMOS OSCILLATOR OUTPUT

| Line | Parameter | Test Condition | Value | Unit |
|------|---------------------------|---|----------|------|
| 6.1 | Output waveform | HCMOS | | |
| 6.2 | Output voltage level low | Measured with a capacitive load of 15pF | 10 max | %Vcc |
| 6.3 | Output voltage level high | Measured with a capacitive load of 15pF | 90 min | %Vcc |
| 6.4 | Rise and fall times | Measured with a capacitive load of 15pF | 4 max | ns |
| 6.5 | Duty cycle | Measured at 50% level | 45 to 55 | % |
| 6.6 | Output load | Nominal | 15 | pF |

7.0 SSB PHASE NOISE

| Line | Parameter | Test Condition | Value | Unit |
|------|--|---|-------|--------|
| 7.1 | SSB phase noise power density at 1 Hz offset | Typical value for a 12.8MHz carrier at 25°C | -70 | dBc/Hz |
| 7.2 | SSB phase noise power density at 10 Hz offset | Typical value for a 12.8MHz carrier at 25°C | -96 | dBc/Hz |
| 7.3 | SSB phase noise power density at 100 Hz offset | Typical value for a 12.8MHz carrier at 25°C | -123 | dBc/Hz |
| 7.4 | SSB phase noise power density at 1kHz offset | Typical value for a 12.8MHz carrier at 25°C | -143 | dBc/Hz |
| 7.5 | SSB phase noise power density at 10kHz offset | Typical value for a 12.8MHz carrier at 25°C | -152 | dBc/Hz |
| 7.6 | SSB phase noise power density at 100kHz offset | Typical value for a 12.8MHz carrier at 25°C | -153 | dBc/Hz |
| 7.7 | SSB phase noise power density at 1MHz offset | Typical value for a 12.8MHz carrier at 25°C | -154 | dBc/Hz |

8.0 ENVIRONMENTAL

| Line | Parameter | Test Condition | Value | Unit |
|------|---------------------------|---|------------|------|
| 8.1 | Storage temperature | | -55 to 125 | °C |
| 8.2 | Acceleration steady state | IEC 60068-2-7 test Ga, 5000g, 10s (at peak acceleration), Y-axis only | | |
| 8.3 | Moisture sensitivity | IPC/JEDEC J-STD-020, Class 1 | | |
| 8.4 | Temperature cycling | IEC 60068-2-14 test Na, 400 cycles, -40°C to +125°C | | |
| 8.5 | Solderability | JESD 22-B102D, Method 2 Preconditioning 150°C, 16 hours | | |
| 8.6 | Humidity | EIA/JEDEC22-A101, 85°C/85%R.H., 1000 hours | | |
| 8.7 | Shock | IEC 60068-2-27, test Ea; 1500g, 0.5ms, 18 shocks total | | |
| 8.8 | Vibration | IEC 60068-2-6, test Fc: 20g, 60 to 2000Hz 12 hours total | | |
| 8.9 | RoHS | Parts are fully compliant with the European Union directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment. Note parts are suitable for assembly using both Lead-free solders and Tin/Lead solders | | |

9.0 PIN CONNECTIONS

| Line | Parameter | Description |
|------|-----------------------|--|
| 9.1 | Pin 1: Do Not Connect | |
| 9.2 | Pin 2: GND | |
| 9.3 | Pin 3: OUTPUT | |
| 9.4 | Pin 4: VCC | For correct operation decouple the supply voltage with a 10 µF capacitor close to the oscillator |

10.0 MARKING

| Line | Parameter | Description |
|------|-----------|---|
| 10.1 | Type | Laser marked |
| 10.2 | Line 1 | RAKON |
| 10.3 | Line 2 | Part number (Mxxxx) |
| 10.4 | Line 3 | Frequency in MHz (xx.x MHz) |
| 10.5 | Line 4 | Pin 1 identifier (indent), and date / location code (YYWWX) |

11.0 MANUFACTURING INFORMATION

| Line | Parameter | Description |
|------|-----------------------|--|
| 11.1 | Reflow | IPC/JEDEC J-STD-020, Package reflow temperature for the Pb-Free process is 250°C, or for the Sn-Pb eutectic process is 220°C. The solder reflow processes are as per the attached profiles |
| 11.2 | Packaging description | Tape and reel. 24mm wide tape and Ø330mm (Ø13") reel. Standard packing quantity is 100 to 1000 units per reel |

12.0 SPECIFICATION NOTES

| Line | Parameter | Description |
|------|-----------|--|
| 12.1 | Note 1 | Standard frequencies are 10, 12.8, 13, 19.44, 20, 25 and 26 MHz. Other frequencies available on request. |
| 12.2 | Note 2 | The characteristics of the component may be temporarily affected by the processes of assembly and soldering. The frequency specifications apply 48 hours after assembly. Nominal conditions apply unless otherwise stated. |
| 12.3 | Note 3 | Stability / temperature range options other than listed may be available upon request. Please consult sales office for availability. |
| 12.4 | Note 4 | Time needed for frequency to be within ±20 ppb reference to frequency after 1 hour, at 25°C. Parameter is frequency, assembly and operating history dependent. |
| 12.5 | Note 5 | After 30 days of continuous operation. |

13.0 DISCLAIMER

Line Parameter

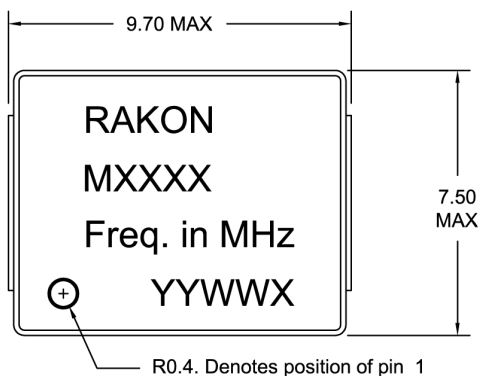
Description

13.1 Disclaimer

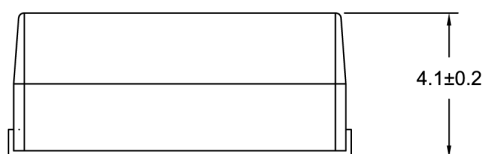
“Samples supplied according to this specification are supplied from our development or pre-production programme and as such are not qualification approved products. No condition, warranty or representation regarding quality, suitability, performance, life or continuation of supply is given or implied and Guarantee in clause 6.1 of our standard Conditions of Sale is not applicable. The right is reserved to change the design or specification or cease supply without notice.” RAKON UK Limited

Drawing Name: RFPO40/45 Model Drawing

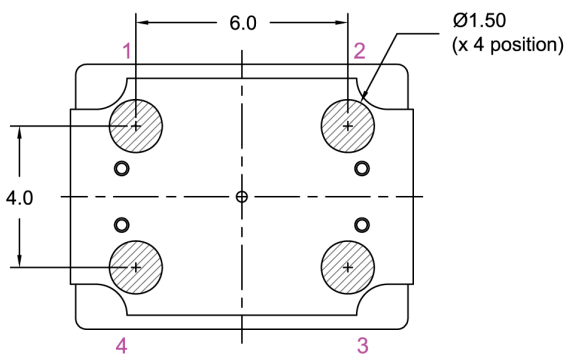
MODEL DRAWING



TOP VIEW



FRONT VIEW

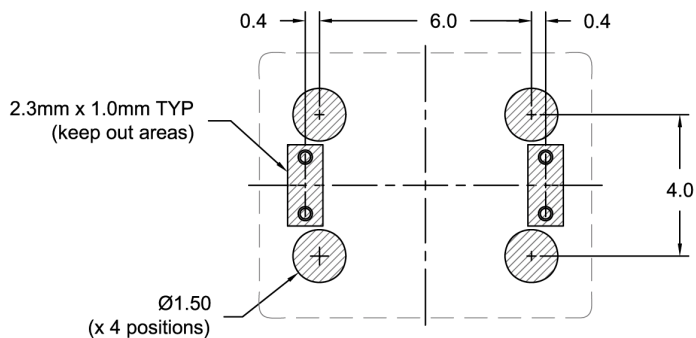


BOTTOM VIEW

NOTE:

1. Pin connections are detailed in the specification.
2. Cover: Plastic
3. Base: FR4
4. Finish: < 0.05 ~ 0.13 µm Gold over 3 ~ 6 µm Nickel

RECOMMENDED PAD LAYOUT - TOP VIEW



TITLE: RFPO40/45 MODEL DRAWING

RELATED DRAWINGS:

FILENAME: CAT646

REVISION: B

DATE: 21-Nov-11

SCALE: 5 : 1

Millimetres

TOLERANCES:

XX =

X.X = ±0.2

X.XX = ±0.10

X.XXX =

X° =

Hole =

rakon

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Drawing Name: Mercury-RFPO Model Code Builder

MODEL CODE BUILDER:

RFPOX X XX X XX

PRODUCT CODE

RFPO 4 = Mercury OCXO 9x7 SMD
 RFPO 5 = Mercury OCXO 14x9 SMD
 RFPO 6 = Mercury OCXO 20x13 DIL

MODEL CODE

1 = 3.3V HCMOS
 2 = 5.0V HCMOS
 3 = 3.3V Clipped Sine Wave
 4 = 5.0V Clipped Sine Wave
 5 = 3.3V HCMOS Stratum 3+

RoHS CODE

LF = RoHS compliant

FREQUENCY ADJUSTMENT CODE

A = Pin 1 VCO for voltage control option
 B = Pin 1 NC for fixed frequency option

TEMPERATURE STABILITY CODE

| Temperature range | Stability (±ppb) | | | | |
|-------------------|------------------|----|----|----|-----|
| | 10 | 20 | 25 | 50 | 100 |
| -20°C to 70°C | US | VS | PS | RS | - |
| -40°C to 85°C | - | VX | PX | RX | SX |

EXAMPLE:

RFPO5 1 RX A LF

LF = RoHS compliant

A = Pin 1 VCO for voltage control option

RX = ±50ppb max, temperature range -40°C to 85°C

1 = 3.3V HCMOS

RFPO5 = Mercury OCXO 14 x 9 SMD

TITLE: MERCURY-RFPO MODEL CODE BUILDER

FILENAME: CAT645

RELATED DRAWINGS:

REVISION: A

DATE: 12-Oct-11

SCALE: NTS

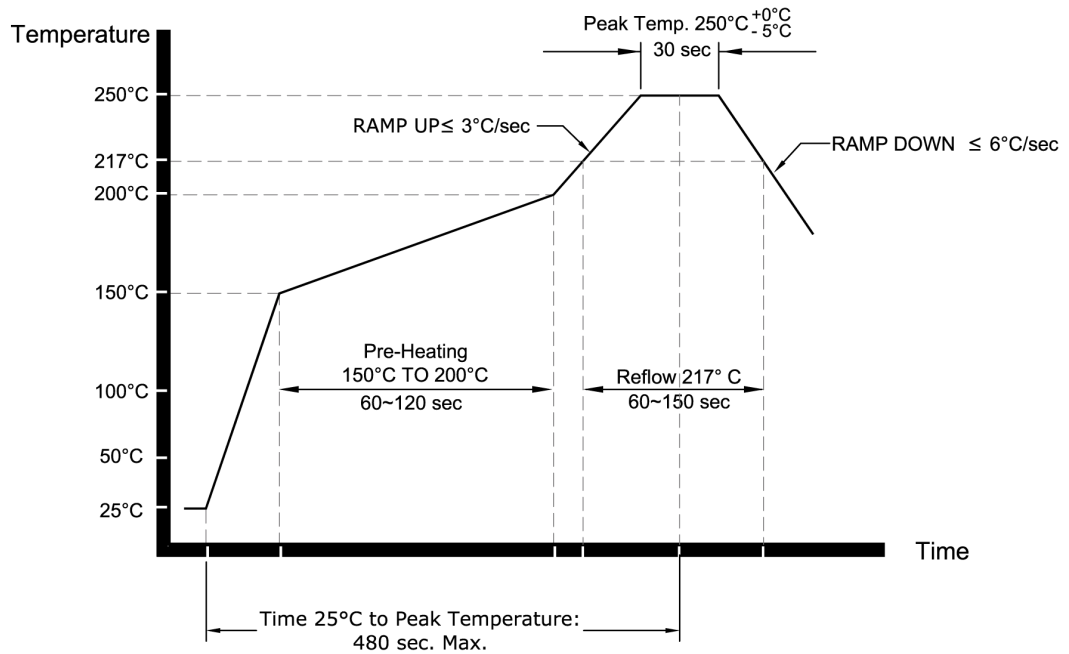
Millimetres



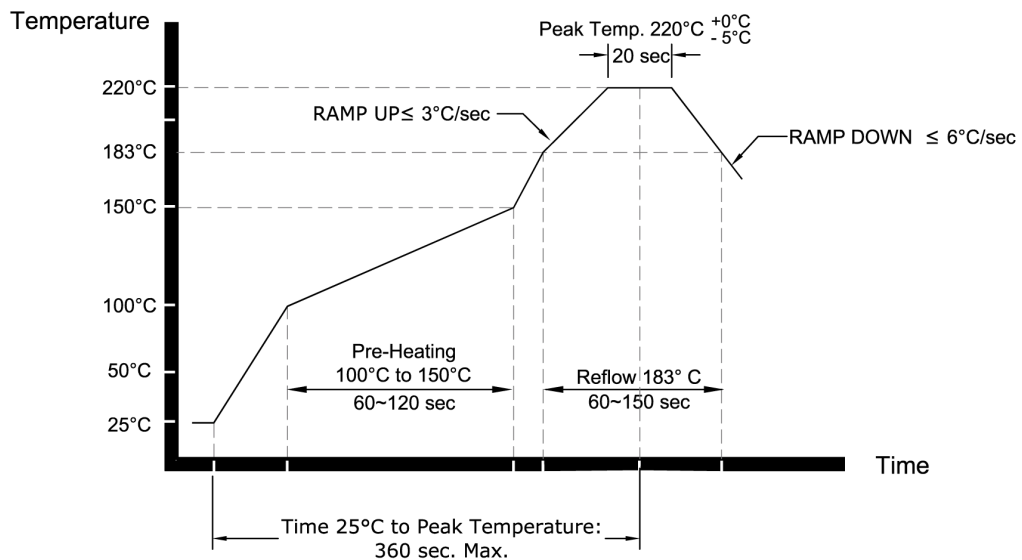
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Drawing Name: RFPO40 Series Reflow

Pb-Free Reflow Soldering Profile *



Sn-Pb Eutectic Reflow Soldering Profile *



* NOTE:

These profile were used during the qualification testing of the product and therefore represents worst case conditions. It is not recommended for use by the customer in the actual assembly of these parts.

TITLE: RFPO40 SERIES REFLOW

FILENAME: CAT649

RELATED DRAWINGS:

REVISION: A

DATE: 25-Oct-11

SCALE: NTS

Millimetres



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