

The CHARON is a SPI controlled high accuracy TCXO with embedded timer and alarm function.

The Charon is a high stability 7x5 SMD Digitally Controlled Temperature Controlled Crystal Oscillator (DCTCXO) designed and specified to bring together the highest stability TCXO performance with digital frequency control, separate low frequency output, timer and alarm functionality.

### Product description

Serial Peripheral Interface (SPI) controlled high accuracy TCXO with embedded timer and alarm function. Using Rakon's advanced Pluto™ analogue frequency compensation system, the DCTCXO achieves unrivalled frequency stability. A custom ASIC, Charon (Pluto's moon) has been designed to closely interface with the Pluto™ ASIC to provide the extra enhanced functionality in a miniature 7x5 SMD package. In addition to market leading stability the Charon device features integrated timing and control functions. A low frequency timing pulse is derived from a programmable division ratio of the high stability oscillator. This drives the onboard 32 bit timer, which coupled to a 32 bit programmable comparator and alarm circuitry, enables a system to enter a low power standby mode and be woken at a precise time in the future. All digital control is via a standard 4-wire SPI interface.



### Applications

- Military
- Other

### Features

- 32 bit timer
- 32 bit comparator with alarm output
- Low frequency timing pulse
- Digital frequency adjustment
- Low power standby mode

### Specifications

#### 1.0 SPECIFICATION REFERENCES

Line	Parameter	Description
1.1	Model description	RFPT200 'Charon'
1.2	RoHS compliant	Available on request
1.3	Package size available	7.0 mm x 5.0 mm x 2.8 mm

#### 2.0 FREQUENCY CHARACTERISTICS

Line	Parameter	Test Condition	Value	Unit
2.1	Frequency range	Frequency range available depends on output type (Note 1)	3 to 40	MHz
2.2	Frequency calibration	At 25°C at mid-range of DAC, reference nominal frequency	±0.5 to 1	ppm
2.3	Frequency stability over temperature	Reference to (Fmax+Fmin)/2. Max ±0.15 ppm only available over -20°C to 70°C (Note 2)	±0.15 to 2	ppm
2.4	Temperature range	The operating temperature range over which the frequency stability is measured (Note 3)	-55 to 95	°C
2.5	Stability vs. supply voltage changes	±5% variation in supply voltage. Nominal value ±0.1 ppm	±0.05 to 0.2	ppm
2.6	Stability vs. load changes	±10% variation in load. Nominal value ±0.1 ppm	±0.05 to 0.2	ppm
2.7	Long term stability	At 25°C, first year. Nominal value ±1 ppm	±0.5 to 2	ppm
2.8	Long term stability	At 25°C, 10 years predicted, including first year. Nominal value ±3 ppm	±2 to 5	ppm
2.9	Drift due to reflow soldering	At 25°C, at mid-range of DAC, 24 hours after reflow.	±0.5 to 1	ppm

### 3.0 POWER SUPPLY

Line	Parameter	Test Condition	Value	Unit
3.1	Supply voltage	Normally specified as nominal (Vcc) ±5%. Nominal value 3.3V	2.5 to 5.5	V
3.2	Supply current	3.3V, load 15pF (min.@ 10MHz, max.@ 40MHz). Nominal value 4 mA	2 to 6	mA
3.3	Supply current	RF output disabled (min.@ 10MHz, max.@ 40MHz). Nominal value 1.6 mA	1.4 to 1.8	mA

### 4.0 HCMOS OSCILLATOR OUTPUT

Line	Parameter	Test Condition	Value	Unit
4.1	Output waveform	HCMOS		
4.2	Output voltage level low		10 max	%Vcc
4.3	Output voltage level high		90 min	%Vcc
4.4	Rise and fall times	10% to 90% of Voh-Vol. Nominal value 6 ns	4 to 8	ns
4.5	Duty cycle	Measured at 50% Vcc	45 to 55	%
4.6	Load	Normally specified at CL±10%. Nominal value 15 pF	10 to 50	pF

### 5.0 CLIPPED SINEWAVE OSCILLATOR OUTPUT

Line	Parameter	Test Condition	Value	Unit
5.1	Output waveform	Clipped sinewave (DC coupled)		
5.2	Output voltage level	Peak to peak voltage measured at minimum supply voltage	0.8	V
5.3	Output load resistance	Operating range	9 to 11	kΩ
5.4	Output load capacitance	Operating range	9 to 11	pF

### 6.0 RF OUTPUT TRISTATE CONTROL

Line	Parameter	Test Condition	Value	Unit
6.1	Output enabled	Active high or open circuit ≥0.6 Vcc (100 kΩ internal pull up)	60 min	%Vcc
6.2	Output tristate mode		20 max	%Vcc
6.3	Tri-state control	In tri-state mode, the RF output stage is disabled but the oscillator, compensation circuit and digital section are still active. An RF enable signal to stable frequency operation is therefore very rapid		

### 7.0 SSB PHASE NOISE

Line	Parameter	Test Condition	Value	Unit
7.1	SSB phase noise power density at 10Hz offset	Typical at 10MHz	-95	dBc/Hz
7.2	SSB phase noise power density at 100kHz offset	Typical at 10MHz	-145	dBc/Hz

### 8.0 LF TIMING PULSE: PULSE WIDTH

Line	Parameter	Test Condition	Value	Unit
8.1	LF pulse width	Ripple counter setting. User programmable register. Divider ratio at power up: 64	4 to 64	Divider ratio
8.2	LF pulse width	LF timing pulse width = oscillator period * ripple	0.1 to 6.4	μs

## 9.0 LF TIMING PULSE: PULSE PERIOD

Line	Parameter	Test Condition	Value	Unit
9.1	LF pulse period	Sync counter setting. User programmable register. Sync ratio at power up: 4096	2 to 4096	Sync. ratio
9.2	LF pulse period	LF timing pulse period = oscillator period * ripple * sync	0.2 to 26214.4	µs

## 10.0 LF TIMING PULSE: ENABLE SETTING

Line	Parameter	Test Condition	Value	Unit
10.1	LF output off	SPI or bonded in parallel to RF enable	0	
10.2	LF output on	SPI or bonded in parallel to RF enable	1	

## 11.0 COUNTER

Line	Parameter	Test Condition	Value	Unit
11.1	32 bit timer	Continuous count of LF, reset on power up, read via SPI Default: 0. Maximum: $2^{32}-1$ LF counts		
11.2	32 bit min. rollover period	$(2^{32}-1) \times$ LF period	859 min	sec
11.3	32 bit max. rollover period	$(2^{32}-1) \times$ LF period	1303 max	day

## 12.0 ALARM

Line	Parameter	Test Condition	Value	Unit
12.1	32 bit match	Set via SPI which also resets alarm output when set. User programmable register. Default: 0. Maximum: $2^{32}-1$		
12.2	Alarm dedicated output	Alarm latched when match detector matches timer. Power up default: 1 (Note 4)	0 to 1	Alarm high

## 13.0 FREQUENCY CHARACTERISTICS (DAC)

Line	Parameter	Test Condition	Value	Unit
13.1	Frequency min. shift	At 0 - relative to DAC 128	-5 to -10	ppm
13.2	Frequency nominal shift	At 0 - relative to DAC 128	-7 to -15	ppm
13.3	Frequency max. shift	At 0 - relative to DAC 128	-10 to -20	ppm
13.4	Frequency min. shift	At 255 - relative to DAC 128	5 to 10	ppm
13.5	Frequency nominal shift	At 255 - relative to DAC 128	7 to 15	ppm
13.6	Frequency max. shift	At 255 - relative to DAC 128	10 to 20	ppm
13.7	Frequency change per bit	Frequency (DAC 255 - DAC 0) / 256 Nominal value 0.08 ppm	0.04 to 0.2	ppm

## 14.0 STANDARD 4 WIRE SPI INTERFACE (CPOL 0, CPHA 0 MODE)

Line	Parameter	Description
14.1	Diagram	Refer to standard 4 wire SPI interface diagram
14.2	Digital control and LF output	Digital control specification available on request

## 15.0 MARKING

Line	Parameter	Description
15.1	Type	Laser marked
15.2	Line 1	R and manufacturing identifier (X YW) (see model drawing)
15.3	Line 2	Pad 1 / static sensitivity identifier ( $\Delta$ ), abbreviated part number (0000), device date code (YW) (see model drawing)

## 16.0 PIN CONNECTIONS

Line	Parameter	Description
16.1	Pin 1	SPI-CLK (SCLK)
16.2	Pin 2	SPI-IN (SDI)
16.3	Pin 3	SPI-OUT (SDO)
16.4	Pin 4	GND
16.5	Pin 5	+Vs*
16.6	Pin 6	RF out
16.7	Pin 7	ALARM
16.8	Pin 8	LF out
16.9	Pin 9	RF & LF enable
16.10	Pin 10	Supply, +Vs
16.11	Pin 11	DAC_OUT/VCXO*
16.12	Pin 12	SPI-EN (SS enable low)
16.13	Note	* = No connection required, monitor points used during manufacture

## 17.0 ENVIRONMENTAL

Line	Parameter	Description
17.1	Shock	IEC 60068-2-27 test Ea, 1500g,0.5ms, half-sine, 18 shocks total
17.2	Vibration	IEC 60068-2-6 test Fc,20gn,55-2000Hz,4 hours per axis (12 hours total)
17.3	Storage temperature	-55 °C to +125 °C

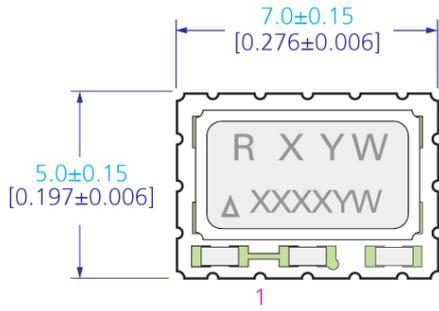
## 18.0 MANUFACTURING INFORMATION

Line	Parameter	Description
18.1	Solderability	MIL-STD-202, method 208, category 3
18.2	Reflow	Solder reflow processes as per attached profile. When soldering, ensure solder does not short top and bottom castellations
18.3	Materials	Part will not contain components with 'pure tin' terminations- part is assembled with lead-bearing solder. Termination finish: Au (0.5 to 1.27µm) over Ni (1.27 to 8.89µm) over tungsten on an alumina substrate

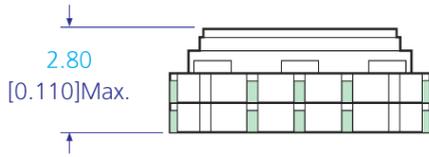
## 19.0 SPECIFICATION NOTES

Line	Parameter	Description
19.1	1	Frequency range available dependant on output type. Available in HCMOS output (3-40MHz) and clipped sinewave output (10-40MHz)
19.2	2	-20°C to 70°C ref. (Fmax +Fmin)/2. ±0.15 ppm min; ±0.3 ppm nominal; ±0.5 ppm max -40°C to 85°C ref. (Fmax +Fmin)/2. ±0.2 ppm min; ±0.5 ppm nominal; ±1.0 ppm max -55°C to 95°C ref. (Fmax +Fmin)/2. ±0.5 ppm min; ±1.0 ppm nominal; ±2.0 ppm max
19.3	3	Stability / temperature range options other than listed man be available upon request. Please consult sales office for a availability
19.4	4	For example the alarm can be set for periods of up to 50 days with 1ms resolution and with sub 1s accuracy

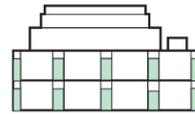
**Drawing Name: RFPT200 Model Drawing**



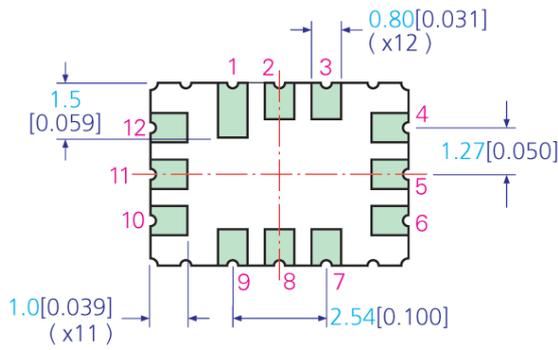
TOP VIEW



SIDE VIEW



END VIEW



BOTTOM VIEW

NOTE: Pin connections are detailed in the specification

TITLE: RFPT200 MODEL OUTLINE DRAWING

FILENAME: RFPT200\_MD

RELATED DRAWINGS:

REVISION: A

DATE: 22-Jul-10

SCALE: 5 : 1

Millimeters [inch]

Tolerance:

XX = ±0.5

X.X = ±0.2

X.XX = ±0.10

X.XXX = ±0.05

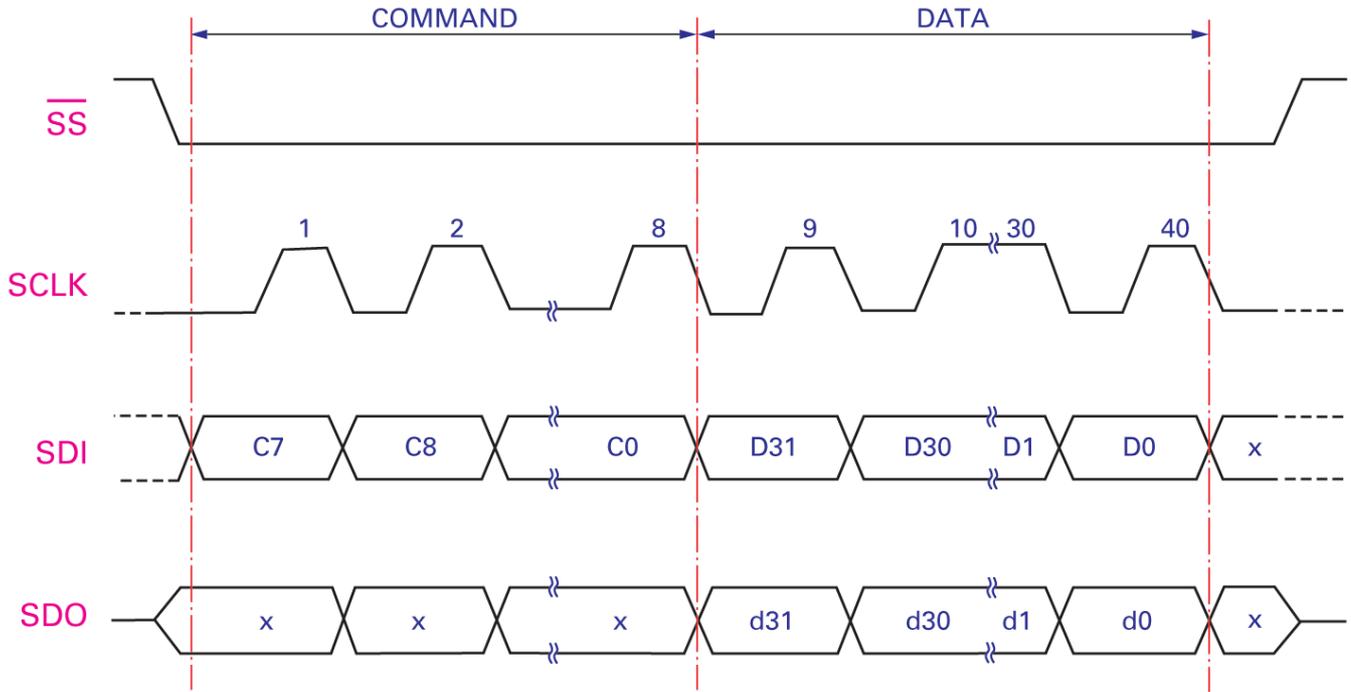
X° = ±1.0°

Hole = ±0.10

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Drawing Name: RFPT200 4 Wire SPI Timing Diagram



TITLE: RFPT200 4 WIRE SPI TIMING DIAGRAM

FILENAME: RFPT200\_4WI

RELATED DRAWINGS:

REVISION: A

DATE: 22-Jul-10

SCALE: NTS

Millimeters [inch]

Tolerance:

XX = ±0.5

X.X = ±0.2

X.XX = ±0.10

X.XXX = ±0.05

X° = ±1.0°

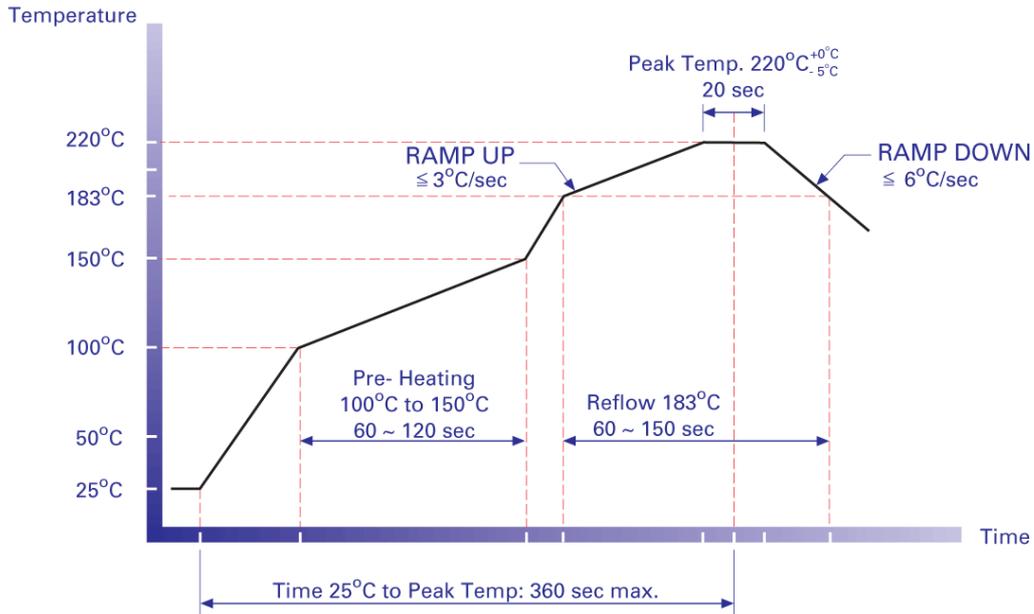
Hole = ±0.10

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# Drawing Name: RFPT200 Series Reflow Profile

## Sn-Pb Eutectic Reflow Soldering Profile \*



**\* NOTE:**

This profile was 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: RFPT200 SERIES REFLOW PROFILE

FILENAME: RFPT200\_RF

RELATED DRAWINGS:

REVISION: A

DATE: 13-Sep-10

SCALE: NTS

Millimeters [inch]

Tolerance:

XX = ±0.5

X.X = ±0.2

X.XX = ±0.10

X.XXX = ±0.05

X<sup>o</sup> = ±1.0<sup>o</sup>

Hole = ±0.10

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