

Precision Ultra Low Phase Noise OCXO in 41x30mm SMD Package with OSC Disable and Oven Alarm features for Instrumentation



ESD Sensitive

41 x 30 x 16 mm
Datasheet #2213A

Features

- SC-cut crystal
- High Stability
- Low Aging
- Ultra Low Phase Noise
 - Ultimate (U) -146 dBc/Hz at 10Hz
 - 172 dBc/Hz on the floor
 - Extraordinary (E) -88 dBc/Hz at 0.1 Hz
 - 119 dBc/Hz at 1 Hz
 - 148 dBc/Hz at 10 Hz
 - 168 dBc/Hz on the floor

Applications

- Instrumentation
- Radar
- Satellite Communications
- Reference
- COTS/Dual use

Absolute Maximum Ratings

Parameters	Symbol	Condition	Min	Typ	Max	Unit	Notes
Input Break Down Voltage	V _{cc}		-0.5		13.6	V	
Storage Temperature	T _s		-40		85	°C	
Control Voltage	V _c		-1		5.5	V	

Electrical

Parameters	Symbol	Condition	Min	Typ	Max	Unit	Notes
Frequency	F			10.000		MHz	
Frequency Stability	$\Delta F/F$	vs. temp. grades L, P, and U			± 5 ± 200	ppb	-10°C to 75°C 75°C to 80°C
		vs. temp, grade E			± 1		0°C to 75°C
		vs. Supply		0.2	0.5	ppb/5%V _{cc}	
		Vs. Load			0.5	ppb/5% Rload	
Aging		per day		5E-10			After 30 days
		per 30 days		5E-9			
		per year, first year		3E-8			
		second year		2E-8			
Allan Deviation		15 years		3E-7			
		0.1s		3E-13			
		1.0 s		2E-12			
		10 s		5E-12			

All parameters for 10 MHz

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Electrical (cont.)

Parameters	Symbol	Condition	Min	Typ	Max	Unit	Notes	
SSB Phase Noise (Achieved after 10 minutes warm-up) 2*	$\mathcal{L}(\phi)$	1Hz		-110	-105	dBc/Hz	Grade L	All parameters for 10 MHz
		10 Hz			-140			
		100 Hz			-155			
		1 KHz			-160			
		10 KHz			-168			
		100 KHz			-170			
		1Hz			-112	dBc/Hz	Grade P	
		10 Hz			-145			
		100 Hz			-156			
		1 KHz			-162			
		10 KHz			-170			
		100 KHz			-172			
		1Hz			-115	dBc/Hz	Grade U	
		10 Hz			-146			
		100 Hz			-156			
		1 KHz			-163			
		10 KHz			-170			
		100 KHz			-172			
		0.1Hz			-88	dBc/Hz	Grade E 6*	
		1Hz			-119			
		10 Hz			-148			
		100 Hz			-160			
		1 KHz			-168			
		10 KHz			-168			
		100 KHz			-168			
Retrace		After 30 minutes			±10	ppb	24 Hours off 3*	
G-sensitivity		worst direction			±1.0	ppb/G		
Input Voltage	V _{cc}		10.5	12.0	12.6	V		
Power consumption	P	steady state, 25°C steady state, -10°C start-up @ -10°C		1.2 1.8 2.5	1.5 3.2	W	Still air	
Spectral Purity		Spurious Harmonics/Sine Harmonics		-35	-80 -30 -45	dBc	Non-harmonic E grade	
Load		Internally AC-coupled 50 Ohm						
Warm-up time	τ_w	to 0.1ppm accuracy to 10ppb accuracy		3	5 10	minutes	Off time <24 hrs Aging rate was reached	
Start-up time	τ_s	From cold start at room temperature		5		seconds	RF output to appear	
		From OSC EN activation			0.1			
Output Waveform		Sinewave						
Output Power			+10	+13	+17	dBm	L, P, and U grades	
			+7		+12		E grade	
Control voltage	V _c		0		5.0	V		
Reference Voltage	V _{ref}	No load	4.8 4.0	5.0 4.096	5.2 4.2	V	100 Ohm series to V _{ref} E grade, straight to V _{ref}	
Output Impedance		At V _{ref} pin			100	Ohm	L, P, and U grades	

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Electrical (cont.)

Parameters	Symbol	Condition	Min	Typ	Max	Unit	Notes
Output Short Circuit Current Vref	Io			20		mA	E grade
Pull range		from nominal F	±0.3	±0.5	±0.8	ppm	
Absolute Pull Range	APR	Over all conditions	±0.05			ppm	Sufficient for lifetime, 15 years
Deviation slope		Monotonic, positive	0.15		0.25	ppm/V	
Tuning Linearity					10%		
Initial Calibration	ΔF/F	As shipped at 25°C, Vc = 2.50 V			±0.1	ppm	L, P, and U grades
					±0.03		E grade
Stability	Vc0	@25°C, Fnom.	2.5 ± 0.3			V	3*
Oven Ready (N/A for E grade)		V pad #2	3.3		0.5	V	Ready Not Ready
Oscillator Enable		CMOS Logic “1” (5.0V>V>2.4) or floating Logic “0” (V<0.5V)	Enabled			V	Oscillation stops 5*
			Disabled				
Modulation Bandwidth	Fm	-3 dB at 1 KHz	DC		1	KHz	

Environmental and Mechanical

Parameter	Description
Operating Temperature Range	-10°C to 75°C. Operable range -10°C to 80°C, meaning that stability from 75°C to 80°C of ± 5 ppb may not be met, otherwise OCXO will function. 0°C to 75°C for E grade
Mechanical Shock	Per MIL-STD-202, 30G, 11ms
Vibration	Per MIL-STD-202, 5G to 2000Hz
Soldering Conditions	See profile below. The device may be reflowed once. Reflowing upside down is not allowed. Hand soldering is highly encouraged. NO CLEAN assembly is recommended

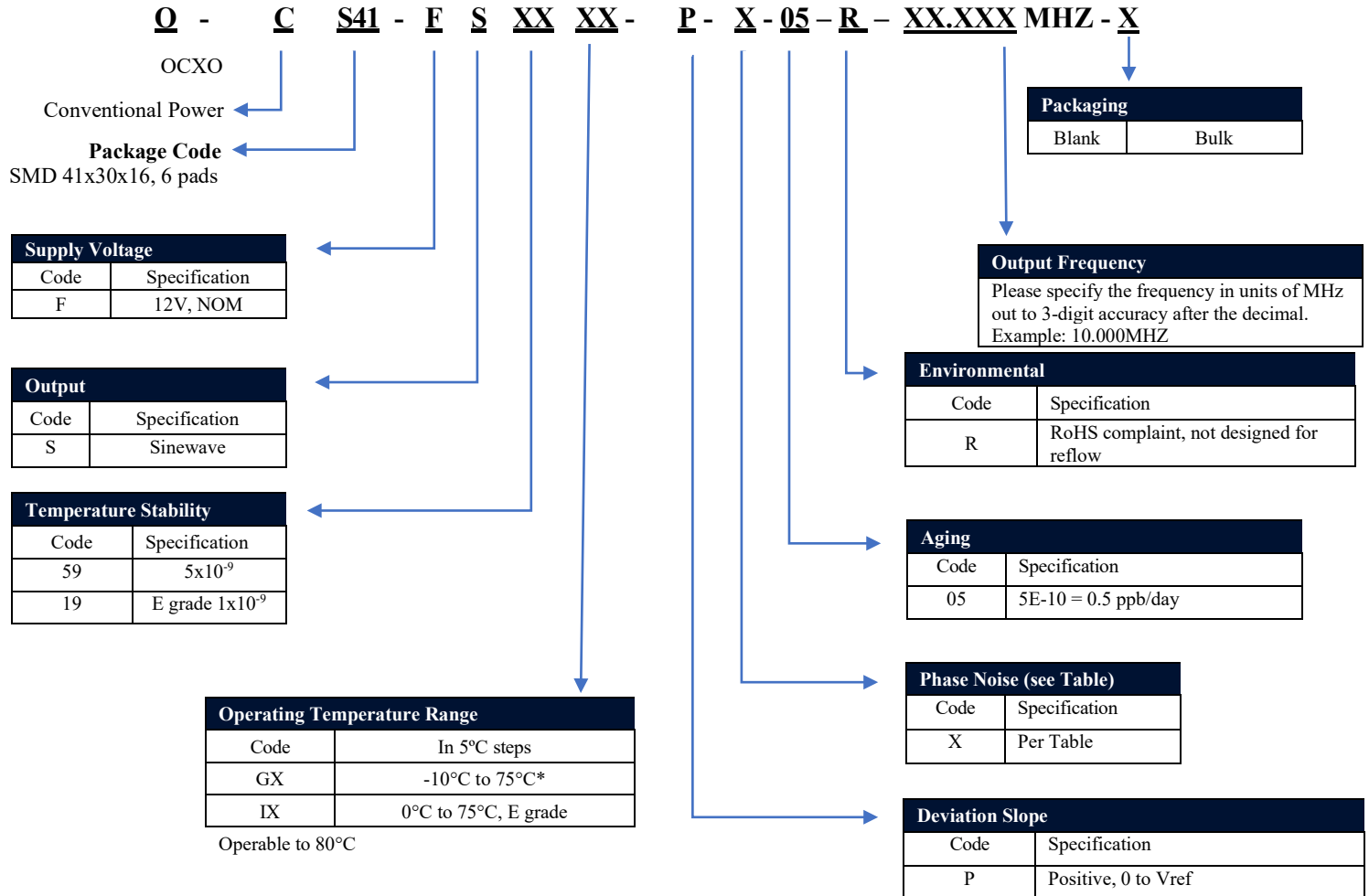
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Creating a Part Number



Not all combinations are available. Consult Factory.

Temperature Code Table

Letter	Temp °C	Letter	Temp °C	Letter	Temp °C	Letter	Temp °C	Letter	Temp °C	Letter	Temp °C
A	-40	F	-15	K	10	P	35	U	60	Z	85
B	-35	G	-10	L	15	Q	40	V	65		
C	-30	H	-5	M	20	R	45	W	70		
D	-25	I	0	N	25	S	50	X	75		
E	-20	J	5	O	30	T	55	Y	80		

Notes:

2* It's assumed that phase noise test is performed under static conditions (no vibration), in still air, and care is taken for minimizing EMI. Cross correlation method is recommended with equipment having adequate performance

3* Longer storage time, especially at low temperatures, may affect both retrace and setability parameters. It may require few days on power for re-stabilization

4) All parameters, unless otherwise specified, are at nominal conditions, i.e.: T=25°C, Nominal Vcc & Nominal Load.

5) Additional retrace from OSC DIS to OSC EN is within normal aging and temperature stability range of frequency deviation. Cannot be specified separately.

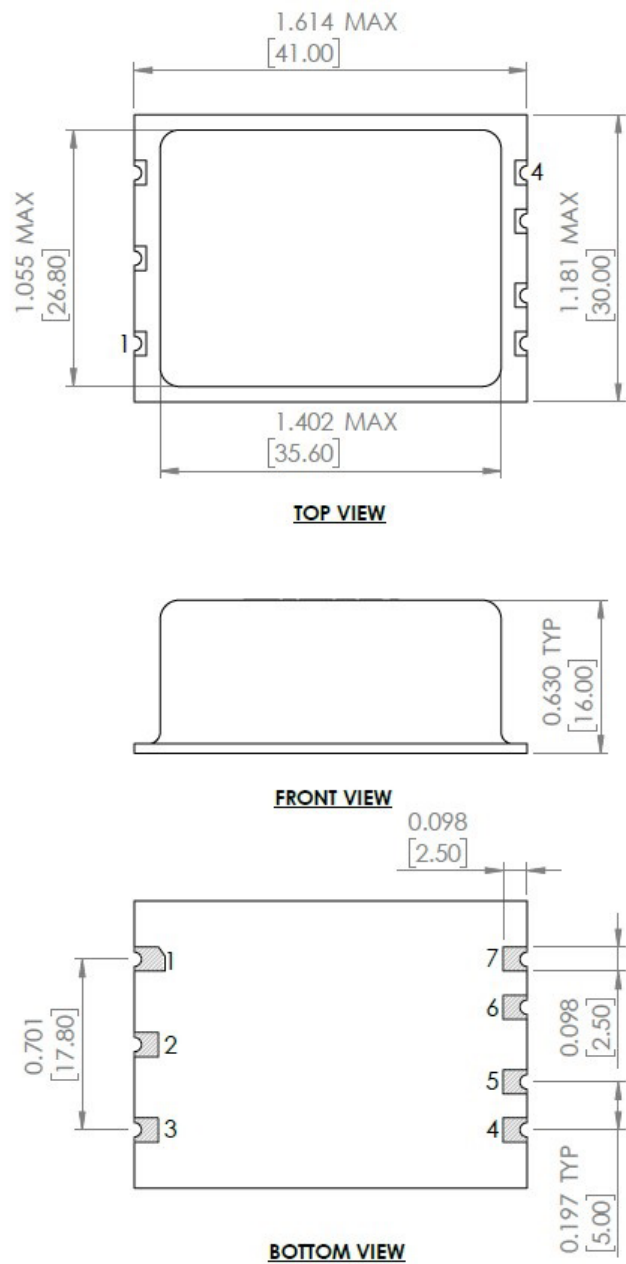
6* E grade phase noise test is performed with internal bias to Vc = 2.5 V, provided by resistive divider from Vref. Resistors are low noise metal film. After the test the bias is removed.

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Mechanical Dimensions



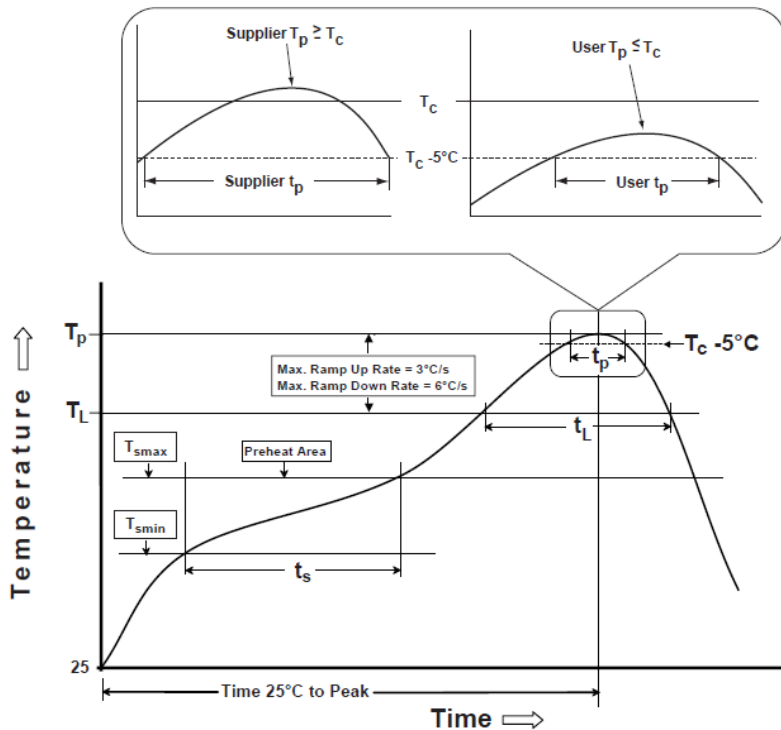
Pin #	Function
1	GND
2	Oven Ready indicator (N/A for E grade)
3	RF Output
4	Vcc
5	Output Enable
6	Vc
7	Vref

Dimensions: inches [mm]

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Reflow Profile [JEDEC J-STD-020]

Table 1

SnPb Eutectic Process Classification Temperatures (T_c)		
Package Thickness	Volume mm ³ <350	Volume mm ³ ≥350
<2.5 mm	235°C	220°C
≥2.5 mm	220°C	220°C

Table 2

Pb-Free Process Classification Temperatures (T_c)			
Package Thickness	Volume mm ³ <350	Volume mm ³ 350-2000	Volume mm ³ >2000
<1.6 mm	260°C	260°C	260°C
1.6 mm - 2.5 mm	260°C	250°C	245°C
>2.5 mm	250°C	245°C	245°C

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat / soak		
Temperature minimum (T_{smin})	100°C	150°C
Temperature maximum (T_{smax})	150°C	200°C
Time (T_{smin} to T_{smax}) (t_s)	60 - 120 sec.	60 - 120 sec.
Average ramp-up rate (T_{smax} to T_p)	3°C/sec. max	3°C/sec. max
Liquidous temperature (T_L)	183°C	217°C
Time at liquidous (t_L)	60 - 150 sec.	60 - 150 sec.
Peak package body temperature (T_p)*	see Table 1	see Table 2
Time (t_p)** within 5°C of the specified classification temperature (T_c)	20 sec.	30 sec.
Ramp-down rate (T_p to T_{smax})	6°C/sec. max	6°C/sec. max
Time 25°C to peak temperature	6 min. max	8 min. max
Reflow cycles	1 max	1 max

 *Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum.

 **Tolerance for time at peak profile temperature (t_p) is defined as supplier minimum and a user maximum.

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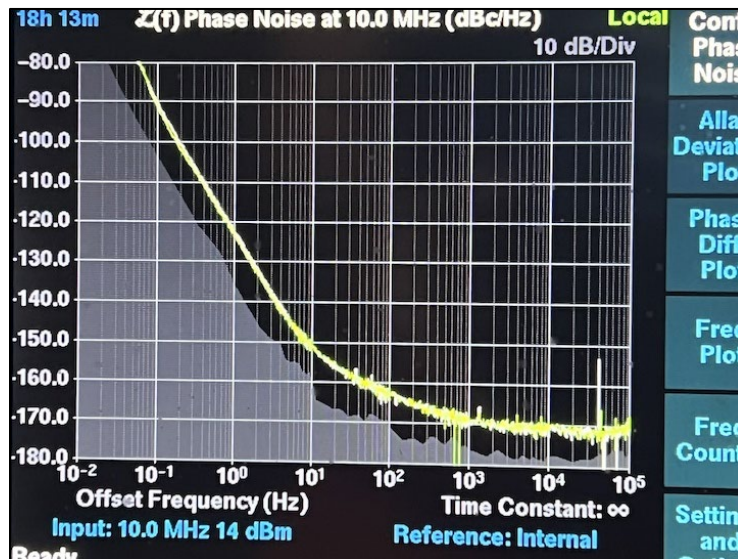


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Phase Noise Plot

E Grade performance example



Allan Deviation Plot

