

Helping Customers Innovate, Improve & Grow



EX-400

## Description

The EX-400 provides exceptionally low aging rates and tight temperature stabilities in an extremely small package over a wide range of environmental conditions. This EMXO series bridges the gap between current large, high precision OCXO's and smaller TCXO's. The EX-400 Series becomes the most economical choice where there is a need for spectral purity, short and long term stability, along with small size and dramatically reduced power consumption.

## Features

- 4-Pin Dip
- Uses Doubly Rotated Crystal
- Low Power Consumption: <0.35 watts @ +25°C
- Previous Model Number: EX-380, EX-381, EX-385 series
- Frequency Range: 10 MHz - 80 MHz

## Applications

- SONET/SDH, DWDM, FDM, ATM, 3G
- Telecom Transmission and Switching Equipment
- Wireless Communication Equipment
- Military Airborne and Mobile systems

## Performance Specifications

		Frequency Stabilities <sup>1</sup>				
Parameter		Min	Typical	Max	Units	Condition
vs. operating temperature range (reference to +25°C)		-75 -100 -250		+75 +100 +250	ppb	-20... +70°C (10 to 20.49 MHz) -20... +70°C (10 to 50 MHz) -20... +70°C (10 to 80 MHz)
		-100 -150 -250		+100 +150 +250	ppb	-40... +85°C (10 to 20.49 MHz) -40... +85°C (10 to 50 MHz) -40... +85°C (10 to 80 MHz)
		-150 -250		+150 +250	ppb	-55... +85°C (10 to 50 MHz) -55... +85°C (10 to 80 MHz)
vs. Stratum3 per GR-1244-CORE	Operating Temp	-140 -140 -140		+140 +140 +140	ppb	-20... +70°C -40... +85°C (10 to 50 MHz) -55... +85°C (10 to 20.49 MHz)
	Holdover Drift MTIE	-370 -4.63		+370 +4.63 +1000	ppb 10-13/sec ns	24 hours Over 7100 seconds 0.16sec < Observe Times < 64 sec
Warm-up Time				1 2	minutes	to ± 1ppm of final frequency (1 hour) to ± 100ppb of final frequency (1 hour)
Initial Tolerance (10 to 19.9 MHz)		-1.0		+1.0	ppm	for fixed frequency
Initial Tolerance (20 to 80 MHz)		-1.5		+1.5	ppm	
vs. supply voltage change (10 to 50 MHz)		-15		+15	ppb	VS ± 5%
vs. supply voltage change (50 to 80 MHz)		-25		+25	ppb	
vs. load change (10 to 80 MHz)		-15		+15	ppb	Load ± 5%

## Performance Specifications

Frequency Stabilities <sup>1</sup> (continued)					
Parameter	Min	Typical	Max	Units	Condition
vs. aging / day (10 to 14.9 MHz)	-1.0		+1.0	ppb	after 30 days of operation
vs. aging / day (15 to 19.9 MHz)	-2.0		+2.0		
vs. aging / day (20 to 49.9 MHz)	-3.0		+3.0		
vs. aging / day (50 to 80.0 MHz)	-4.0		+4.0		
vs. aging / 1st year (10 to 14.9 MHz)	-200		+200	ppb	after 30 days of operation
vs. aging / 1st year (15 to 19.9 MHz)	-300		+300		
vs. aging / 1st year (20 to 80 MHz)	-500		+500		
vs. aging / 10 year (10 to 14.9 MHz)	-1000		+1000	ppb	after 30 days of operation
vs. aging / 10 year (15 to 19.9 MHz)	-2000		+2000		
vs. aging / 10 year (20 to 80 MHz)	-3000		+3000		
Supply Voltage (Vs)					
Supply voltage (Vs)	4.75	5.0	5.25	VDC	
Supply voltage (Vs)	3.135	3.3	3.465	VDC	
Power Consumption			1.5	Watts	during warm-up
			0.35		steady state @ +25°C (10 to 29.99 MHz)
			0.45		steady state @ +25°C (30 to 80 MHz)
			0.7		steady state @ -40°C (10 to 29.99 MHz)
			0.8		steady state @ -40°C (30 to 80 MHz)
RF Output					
Signal [Standard]	HCMOS				
Load		15		pF	
Signal Level (Vol)			0.4	VDC	
Signal Level (Voh)	4.0 2.6			VDC	Vs=5 Vdc Vs=3.3 vdc
Rise/Fall Time			+5	ns	(10-80%) of Vs
Duty cycle	40		60	%	(Voh-Vol)/2
Signal [Option]	Sinewave				
Load		50		ohm	
Output Power [Standard]	0		+4	dBm	50 ohm load
Output Power [Option]	+3		+7	dBm	50 ohm load
Frequency Tuning (EFC)					
Tuning Range	Fixed OCXO; No adjust				
Tuning Range	±1.0 ±2.0 ±3.0 ±4.0		±5.0 ±8.0 ±10.0 ±12.0	ppm	with 10 to 14.99 MHz with 15 to 20.48 MHz with 20.5 to 49.99 MHz with 50 to 80 MHz
Control Voltage Range	0		Vs	VDC	
Tuning Slope	Positive				
Oven Alarm Logic	4.0 2.6		0.4	VDC	During Warmup Vs=5.0 Vdc After Warmup Vs=3.3 Vdc After Warmup
Additional Parameters					
Phase Noise @ 10 MHz (Typical)		-120 -140 -145 -155 -155		dBc/Hz	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz
Phase Noise @ 20 MHz (Typical)		-100 -130 -140 -145 -150		dBc/Hz	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz

### Frequency Stabilities<sup>1</sup> (continued)

Parameter	Min	Typical	Max	Units	Condition
<b>Additional Parameters</b>					
Phase Noise @ 50 MHz (Typical)		-80 -110 -130 -135 -140		dBc/Hz	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz

### Additional Parameters (continued)

Parameter	Min	Typical	Max	Units	Condition
Allan Deviation			0.2	ppb	Tau = 1 sec to 10 sec (10 to 20.49 MHz)
			0.5		Tau = 1 sec to 10 sec (20.5 to 80 MHz)
Acceleration Sensitivity (10 MHz)			1.0	ppb/g	Total Gamma
Weight			5	g	

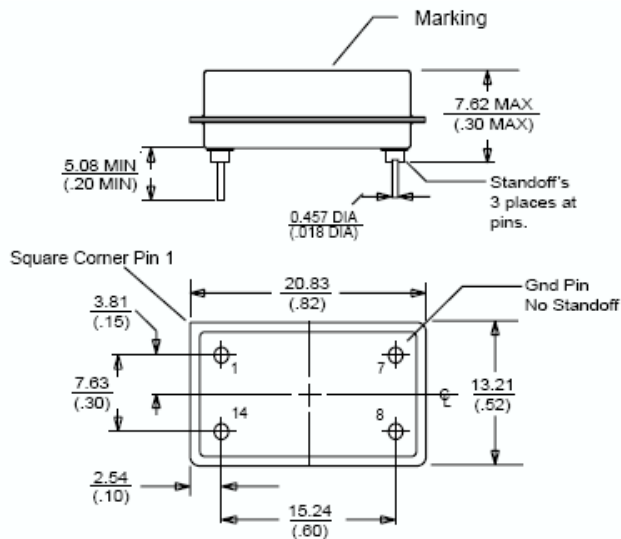
### Absolute Maximum Ratings

Supply Voltage			5.5	VDC	with Vs=5 V
			5.5		with Vs=3.3 V
Output Load			30	pF	
Operable temperature range	-55		+85	°C	
Storage temperature range	-55		+85	°C	

### Standard Environmentals

Vibration - Sine	MIL-STD-202, Method 204, Condition D (20 G, 10Hz-2000Hz)				
Vibration - Random	MIL-STD-202, Method 214, Condition I-F (20 Grms, 10Hz-2000Hz)				
Shock	MIL-STD-202, Method 213, Condition E (1000 G, 0.5ms, halfsine)				
Solderability	MIL-STD-202, Method 208				

## Outline Drawing / Enclosure

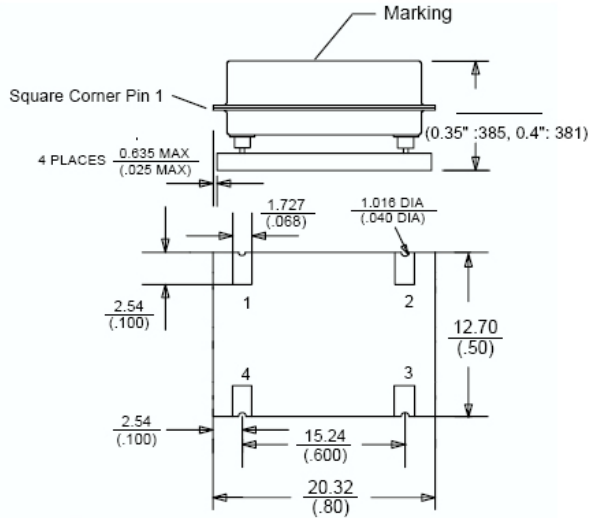


Dimensions in mm (inches)

Type A		
Code	Height "H"	Pin Length "L"
0	7.62	5.08

Pin Connections	
1	EFC \ No Connect \ Oven Monitor
7	Ground (Case)
8	RF Output
14	Supply Voltage Input

# Outline Drawing / Enclosure

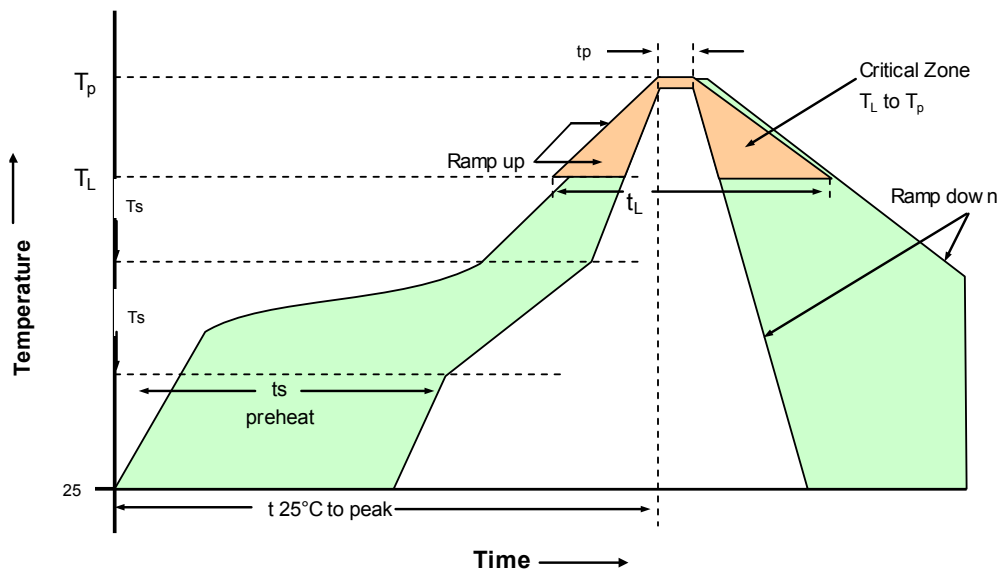


Dimensions in mm (inches)

Type B		
Code	Height "H"	Pin Length "L"
1	8.9 (0.35")	NA
2	10.2 (0.4")	NA

Pin Connections	
1	EFC \ No Connect \ Oven Monitor
7	Ground (Case)
8	RF Output
14	Supply Voltage Input

# Recommended Reflow Profile



Profile Feature	Sn-Pb Assembly	Profile Feature	Sn-Pb Assembly
PRECAUTION: Series shall not expose to temperature higher than 230°C. If exposing to temperature higher than 230°C, stability and power consumption may permanently degrade.			
Average ramp-up rate (TL to Tp)	3°C/second max.	Time 25°C to Peak Temperature	4 minutes max.
Preheat -Temperature Min Tsmin)	135°C	Time maintained above - Temperature (TL)	183°C
-Temperature Min Tsmax)	155°C	- Time (tL)	45-60 seconds
-Time (min to max) (ts)	60-90 seconds		
Tsmax to TL - Ramp-up Rate	3°C/second max.		
Time maintained above - Temperature (TL)	183°C	Time within 5°C of actual Peak Temperature (tp)	10-20 seconds max.
- Time (tL)	45-60 seconds		
Peak Temperature (Tp)	max 220°C	Ramp-down Rate	6°C/second max.

Note: All temperatures refer to topside of the package, measured on the package body surface.

# Ordering Information

## EX - 400 0 - D A J - 107 0 - 10M0000000

**Product Family**  
EX: EMXO

**Package**  
13x20mm

**Height**  
0: A 7.62mm (HCMOS only)  
1: B 8.9mm (HCMOS only)  
2: B 10.2mm (Sinewave only)

**Supply Voltage**  
D: +5V  
E: +3.3V

**RF Output Code**  
A: HCMOS  
E: Sinewave

**Frequency**

**Frequency Control**

- 0: Fixed Frequency (HCMOS)
- 1: Fixed Frequency (0 dBm)
- 2: Fixed Frequency (+3 dBm)
- 3: Electrical Tuning (HCMOS)
- 4: Electrical Tuning (0 dBm)
- 5: Electrical Tuning (+3 dBm)
- 6: Oven Alarm Option (HCMOS)
- 7: Oven Alarm Option (0 dBm)
- 8: Oven Alarm Option (+3 dBm)

**Stability Code**

- 758: ±75ppb
- 107: ±100ppb
- 157: ±150ppb
- 257: ±250ppb
- 507: ±500ppb
- 147: ±140ppb(ST3)

**Temperature Range**

- A: -55°C to +85°C
- E: -40°C to +85°C
- J: -20°C to +70°C

**Temperature Range and Stability Table**

Stability/Temperature	A: -55°C to +85°C	E: -40°C to +85°C	J: -20°C to +70°C
758: (±75ppb)			10 to 20 MHz
107: (±100ppb)	10 to 40 MHz	10 to 40 MHz	10 to 65 MHz
157: (±150ppb)	10 to 65 MHz	10 to 65 MHz	10 to 65 MHz
257: (±250ppb)	10 to 80 MHz	10 to 80 MHz	10 to 80 MHz
507: (±500ppb)	10 to 80 MHz	10 to 80 MHz	10 to 80 MHz
147: (±140ppb(ST3))	10 to 65 MHz	10 to 65 MHz	10 to 65 MHz

**Frequency Range**

10 to 20 MHz
10 to 40 MHz
10 to 65 MHz
10 to 80 MHz

**Notes:**

- Contact factory for improved stabilities or additional product options. Not all options and codes are available at all frequencies.
- Unless other stated all values are valid after warm-up time and refer to typical conditions for supply voltage, frequency control voltage, load, temperature (25°C).
- Phase noise degrades with increasing output frequency.
- Subject to technical modification.
- Contact factory for availability.

## For Additional Information, Please Contact

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