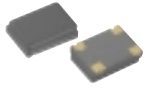




# VOLTAGE CONTROLLED CRYSTAL OSCILLATORS HCMOS/TTL 3.3V

**SURFACE MOUNT**  
**T package**  
T2306,  
T2320, T2330



## 5 x 7 mm Surface Mount

Commercial: 0° to 70°C

3 MHz to 32.768 MHz

### GUARANTEED CAPTURE RANGE/ABSOLUTE PULL RANGE

Guaranteed Capture Range (GCR) and Absolute Pull Range (APR) are terms often used interchangeably. MF's Guaranteed Capture Range (GCR) is defined as the minimum guaranteed frequency deviation or "pull" (in ppm) around the nominal frequency, with all effects of temperature, variations in  $V_{DD}$  and load taken into account. This amount of absolute frequency deviation is available under all operating conditions for modulation or capturing other signals. No additional frequency capture allowances are necessary.

### FEATURES

- Guaranteed Capture Range of  $\pm 50$  ppm
- Excellent incremental and best-straight-line linearity
- Start-up time is less than 5ms
- Each unit is ATE-tested to guarantee full compliance with all electrical specifications

### TYPICAL APPLICATIONS

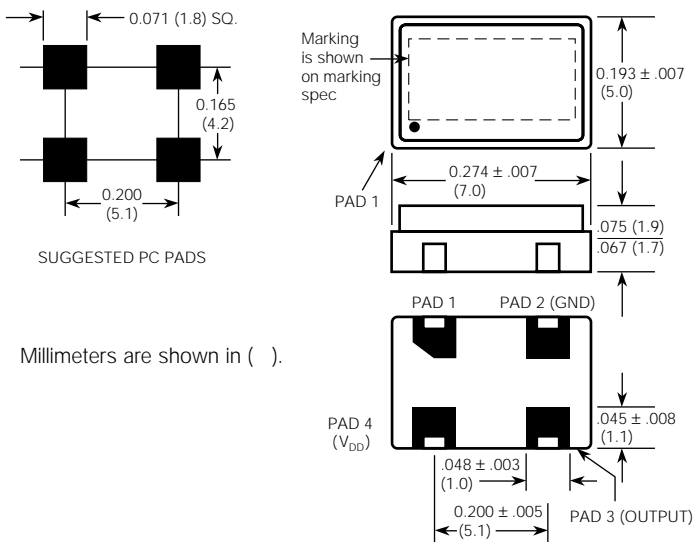
- Phase locked loops and data acquisition projects, including:
  - xDSL customer premise equipment
  - Cable modems
  - ATM/SONET/SDH

### Description

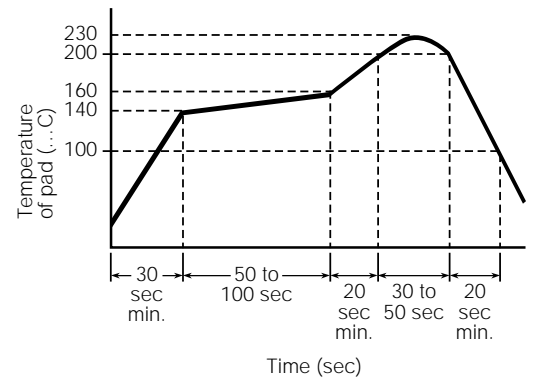
These SMD VCXOs generate a 3.3 volt HCMOS/TTL frequency output which is controlled ("pulled") by an input voltage. MF Electronics' VCXO specification defines not only the end-point frequency/voltage parameters, but also the center voltage at which the nominal frequency is achieved.

### CONNECTIONS

T Package	
Pad 1.	Control Voltage
Pad 2.	Ground
Pad 3.	Output
Pad 4.	+3.3V, $V_{DD}$



"T" Package



Recommended Reflow Soldering Profile



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**Center Frequency is Between Two Voltages with ±50 ppm stability**

MODEL	Marking Letter ID	Control Voltage (Volts)	Guaranteed Frequency Deviation (ppm)	Control Capture Range (ppm)	Center Voltage at Center Frequency	Frequency Stability (ppm)
T2306	VQ	0 to 3.0	± 50 min	± 50	-	50, max

**Center Frequency is at 1.5V with ±50 ppm stability**

MODEL	Marking Letter ID	Control Voltage (Volts)	Frequency Deviation (ppm)	Guaranteed Capture Range (ppm)	Control Voltage at Center Frequency	Center Frequency Stability (ppm)
T2320	VR	0.5 to 2.5	± 50 to 150	± 50	1.5	± 30, typ

**Center Frequency is at 1.5V with ±25 ppm stability**

MODEL	Marking Letter ID	Control Voltage (Volts)	Frequency Deviation (ppm)	Guaranteed Capture Range (ppm)	Control Voltage at Center Frequency	Center Frequency Stability (ppm)
T2330	VS	0.5 to 2.5	± 50 to 150	± 50	1.5	± 15, typ

**DESCRIPTIONS**

T2306	±50 ppm, min. deviation when using 0 to 3.0V rail-to-rail control-voltage
T2320	±50 ppm capture when using using 0.5 to 2.5V control-voltage and 1.5V center with ±50 ppm stability
T2330	±50 ppm capture when using using 0.5 to 2.5V control-voltage and 1.5V center with ±25 ppm stability

**FREQUENCY STABILITY**

Frequency stability vs. Temperature (0 to 70°C) is typically better than ±20 ppm. Since the deviation of each oscillator is tested and guaranteed over the whole operating temperature range, it is not necessary to make additional capture allowances. All oscillators will capture frequencies with the full minimum values of the deviation under all conditions.

**QUALITY**

Each VCXO is computer-tested at three temperatures to guarantee full compliance to the specification.

**ELECTRICAL SPECIFICATIONS**

**Frequency Range** 3 MHz to 32.768 MHz

**Frequency Stability** Includes calibration at 25°C, operating temperature, change of input voltage, change of load, shock and vibration.

	MIN	TYP	MAX	UNITS
<b>Input Voltage, V<sub>DD</sub></b>	3.0	3.3	3.6	volts
<b>Input Current</b>				
3 M to 10 MHz		2.0	3.5	mA
10.1 to 20 MHz		3.0	4.0	mA
20.1 to 30 MHz		5.0	6.0	mA
30.1 MHz and above		7.0	8.0	mA
<b>Output Levels</b>				
"0" Level, sinking 16 mA			0.4	volts
"1" Level CMOS, sourcing 8 mA	V <sub>DD</sub> -4			volts
<b>Rise and Fall Times</b>				
CMOS, 15 pf, 20 to 80%		3.0	4	ns
CMOS, 30 pf, 20 to 80%)		4.0	5	ns
CMOS, 50 pf, 20 to 80%)		6.0	8	ns
<b>Symmetry</b>				
CMOS, @ 50% V <sub>DD</sub>	48/52	45/55		percent
<b>Aging</b>				
First year		3		ppm
After first year		1		ppm/yr
<b>Input Impedance,</b> Pad 1, Control Voltage	100	1000		Kohms
<b>Control Voltage Bandwidth</b>	15	75		KHz



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**SURFACE MOUNT "T"**

T packages are glass-ceramic packages, hermetically sealed at 420°C. For hand-soldering, the temperature of the iron should not exceed 400°C for three seconds.

**ENVIRONMENTAL SPECIFICATIONS**

**Temperature**

Operating 0° to 70°C  
Storage -55° to +125°C

**Temperature Cycle** – Not to exceed ±5 ppm change when exposed to 2 hours maximum at each temperature from 0 to 120°C, with 25°C reference

**Shock** – 1000 Gs, 0.35 ms, 1/2 sine wave, 3 shocks in each plane

**Vibration** – 10-2000 Hz of .06" d.a. or 20 Gs, whichever is less

**Humidity** – Resistant to 85° R.H. at 85°C

**MECHANICAL, SPECIFICATIONS**

**Gross Leak** – Each unit checked in 125°C fluorocarbon

**Fine Leak** – Mass spectrometer leak rate less than 5 X 10<sup>-8</sup> atoms, cc/sec of helium

**Case** – Hermetically sealed package

**Pads** – 60 microinch of gold over nickel

**Marking** – Print is permanent white ink.

**Resistance to Solvents** – MIL STD 202, Method 215

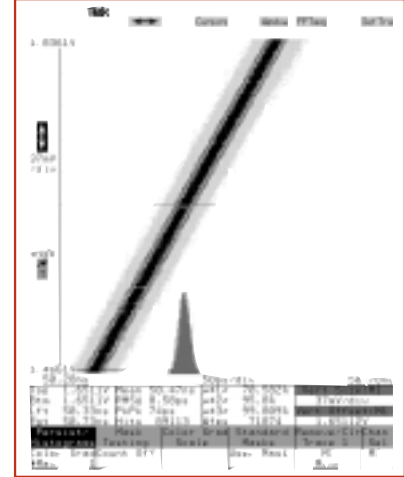


Fig. 1 T2320-20M

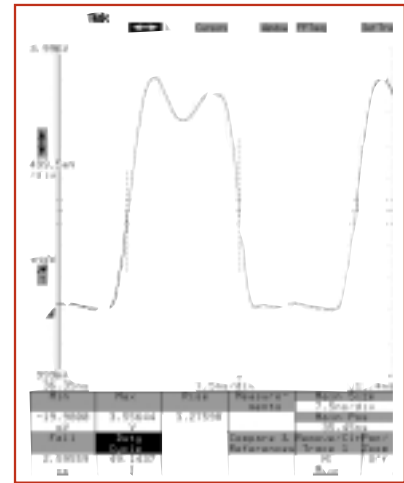
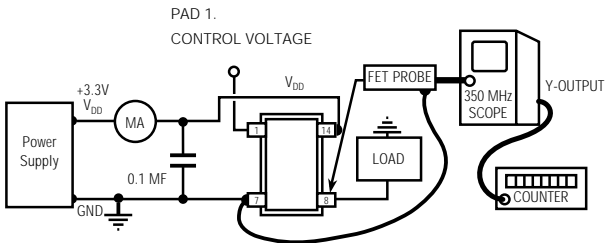


Fig. 2 T2320-19.44M  
with 25 pf load



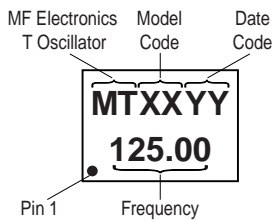
To adapt Fet probe to receptacle use Tektronix Part #103-0164-00

To connect output to scope use Tektronix Part #131-0258-00 (receptacle)

**TEST CIRCUIT**

**MARKING SPECIFICATION**

The format for the marking is:





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DEVIATION vs CONTROL VOLTAGE  
FOR T2330-27M, TYPICAL

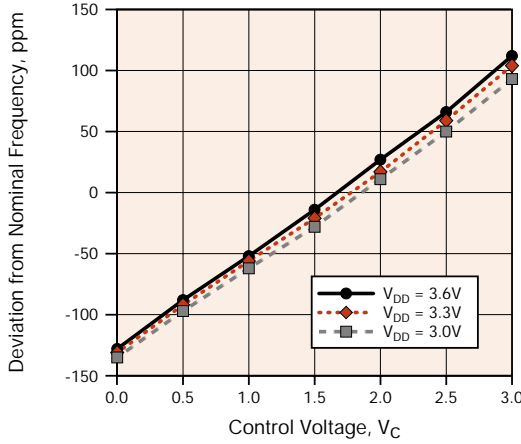


Fig. 3 Deviation vs. Control Voltage at 0°C

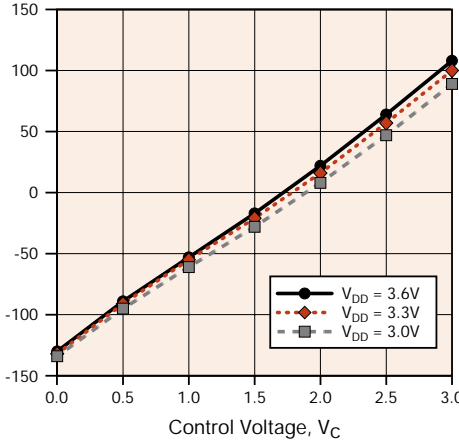


Fig. 4 Deviation vs. Control Voltage at 25°C

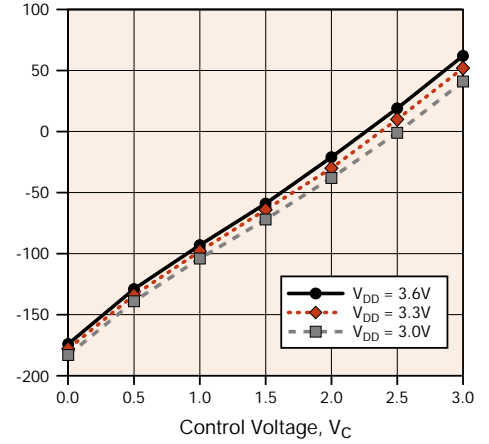
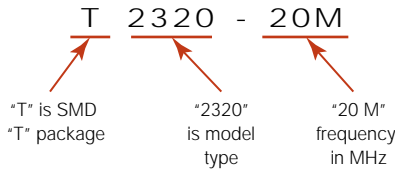


Fig. 5 Deviation vs. Control Voltage at 70°C

**HOW TO ORDER**

For Part Number, put package type before model number, and add frequency in MHz, for example:



SS#	Rev.
T2306	A



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