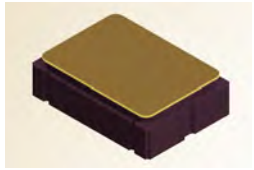
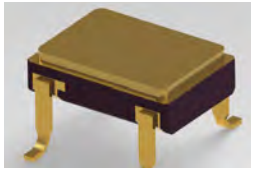
FMI Commercial "New" Space Products

Crystals & Oscillators for SmallSat & CubeSat Applications

5x3.2 mm SMD

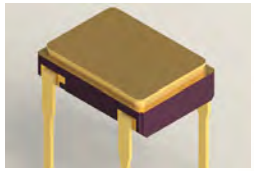


5x7 mm SMD



5x7 mm Gull Wing

5x7 mm J-Lead

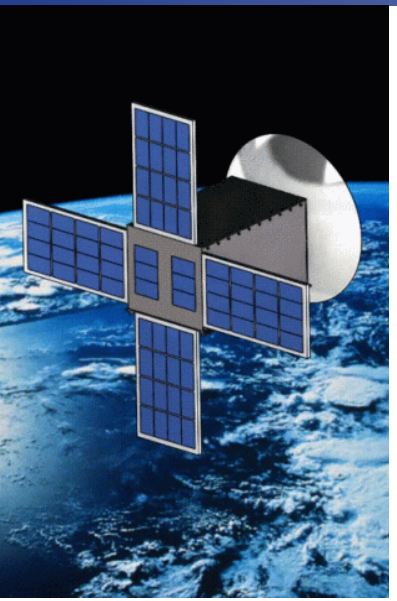


5x7 mm Straight Lead

Performance Excellence | Smallest & Lightest Product Offerings | Hi-Rel & Low Cost

Compelling Frequency & Timing Solutions for Mission Success

www.FrequencyManagement.com



Mission Success
Optimized Cost

Frequency Control Solutions for Commercial Space Missions

SmallSat **CubeSat** **Nanosat**

FMI has been at the forefront of providing the most reliable timing devices and clock solutions to the ever-expanding market for space missions utilizing miniature scale electronics, often referred to as CubeSat, SmallSat and Nanosat, etc. Our customers have been selecting from our standard product offering for miniaturized commercial space (C-Series) which benefits from years of FMI's extensive development in miniature scale, highly reliable and cost-efficient solutions used in commercial high reliability applications. We are uniquely blending the best attributes of cost effective assemblies used in industrial/telecomm applications with the benefits of our vast experience in the design and manufacturing of crystals and clock oscillators for a wide variety of space applications.

The FMI C-Series product offering is a direct response to the need for satellite miniaturization that often correlates with diverse mission life objectives. The C-Series offers optimum solutions for the ever-expanding scope of CubeSat and SmallSat missions as well as constellations of small spacecraft.

In pioneering the efficient and miniaturized commercial space grade clock solutions, FMI takes a strong position to encourage the industry to contribute and reduce any potential space debris regardless of the applications mentioned above which may include IoT and M2M small satellite networks or the satellites that may be utilized for remote sensing.

FMI is uniquely prepared to efficiently respond to the timing and frequency control requirements of miniaturized satellite designers and manufacturers.

C53 SERIES, < 50 KRad/Si - TID, Commercial Space

Crystal Oscillator | 3.3V | CMOS | 5x3.2 mm Ceramic SMD | SmallSat-CubeSat

5x3.2 mm SMD

Features

- Hi-Rel | Low-Cost
- Customer Support & Service
- Mission Life Duration Options
- Proven High Shock Crystal Support
- Operating Life > 20,000 Hours at +125ºC
- ECCN - EAR99

Electrical SPECIFICATIONS

Mission Life / Screening Code A (6 Months to 1 year)	B (1 Year to 2 years)	C (3 Years to 5 years)	Frequency Range (MHz)	Supply Current @ 3.3V ±10% (mA)	Rise/Fall Time (tr/tf) max (nsec)	Symmetry min / max (%)	Aging per year max 1/ (ppm)	Frequency Stability Vs. Temperature -55ºC to +125ºC (ppm)	-55ºC to +125ºC (ppm)	-40ºC to +105ºC (ppm)	-40ºC to +85ºC (ppm)
CODE	CODE	CODE						CODE A	CODE B	CODE C	CODE D
01	02	03	0.5 to 0.9	1.1	3	45/55	±10	±100	±65	±50	±40
04	05	06	1 to 7.9	1.3	3	40/60	±10	±100	±65	±50	±40
07	08	09	8 to 15.9	3	3	40/60	±10	±100	±65	±50	±40
11	12	13	16 to 49.9	6	2	40/60	±10	±100	±65	±50	±40
14	15	16	50 to 74.9	8	2	40/60	±10	±100	±65	±50	±40
17	18	19	75 to 94.9	16	2	40/60	±10	±100	±65	±50	±40
21	22	23	95 to 130	25	2	40/60	±10	±100	±65	±50	±40

frequency stability vs. temperature code

See page 6 for screening details

CMOS Output, 15 pF Load

Output Voltage - Logic "0" is Vcc x 0.1 Vdc
Output Voltage - Logic "1" is Vcc is 0.9 Vdc
Start-up Time: 10 msec max

1/ Frequency Aging Limit

Max change over 30 days	±1.5 ppm
Projected max change for 1 year after 30 days	±10 ppm

Please Contact Us for Specification Options that are Outside of or beyond those Shown in the Table Above

Standard PAD CONFIGURATION

Pin Number	Function
1	Output Enable (Tri-state)*
2	Ground (case)
3	Output
4	Supply V (Vcc)

* Enable, Logic 1 | Disable, Logic 0

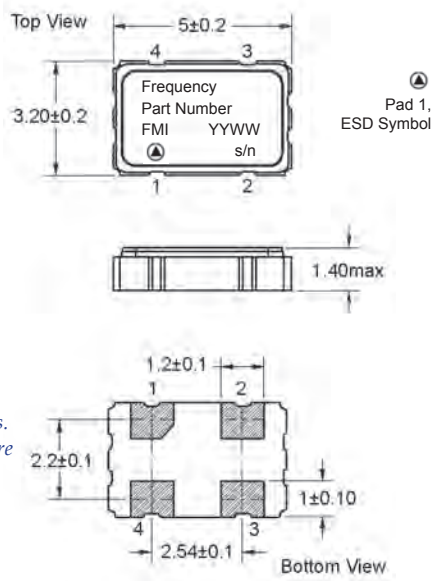
How To ORDER

C53 A 11 D - 24M00000

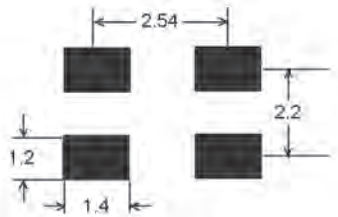
- C53 — model series
- A — mission life/ screening, code A, B or C *(see back side of data sheet)*
- 11 — electrical specifications within frequency range / tri-state option code
- D — operating temperature range and frequency stability code
- 24M00000 — output frequency

example: **C53A11D-24M00000**

Mechanical SPECIFICATIONS

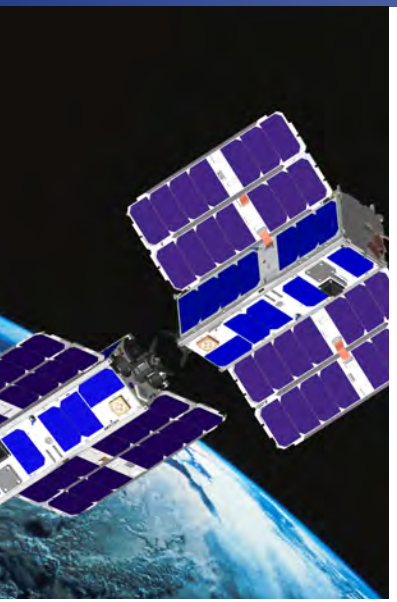


Recomended Land Pattern



dimensions: mm

Pin / Pad Configuration	
P1	No Connect / Tri-state Enable
P2	Ground (case)
P3	Output
P4	Supply V (Vcc)



C73 SERIES, including package variations C88, C83 & C78

< 50 KRad/Si - TID, Commercial Space

Crystal Oscillator | 3.3V | CMOS | 5x7mm Ceramic SMD and Leaded Versions | SmallSat-CubeSat

Features

- Hi-Rel | Low-Cost
- Customer Support & Services
- Mission Life Duration Options
- Proven High Shock Crystal Support
- Operating Life > 20,000 Hours at +125ºC
- ECCN - EAR99

Customer Selected Mission Life

Electrical SPECIFICATIONS

Mission Life / Screening Code A (6 Months to 1 year)	B (1 Year to 2 years)	C (3 Years to 5 years)	Frequency Range (MHz)	Supply Current @ 3.3V ±10% (mA)	Rise/Fall Time (tr/tf) max (nsec)	Symmetry min / max (%)	Aging per year max 1/ (ppm)	Frequency Stability Vs. Temperature: -55ºC to +125ºC (ppm)	-55ºC to +125ºC (ppm)	-40ºC to +105ºC (ppm)	-40ºC to +85ºC (ppm)
CODE	CODE	CODE						CODE A	CODE B	CODE C	CODE D
01	02	03	0.5 to 0.9	1	3	48/52	±10	±100	±60	±50	±40
04	05	06	1 to 7.9	1.2	3	48/52	±10	±100	±60	±50	±40
07	08	09	8 to 15.9	3	3	45/55	±10	±100	±60	±50	±40
11	12	13	16 to 49.9	6	3	45/55	±10	±100	±60	±50	±40
14	15	16	50 to 79.9	8	2	40/60	±10	±100	±60	±50	±40
17	18	19	80 to 94.9	10	2	40/60	±10	±100	±60	±50	±40
21	22	23	95 to 130	25	2	40/60	±10	±100	±60	±50	±40

frequency stability vs. temperature code

See page 6 for screening details

CMOS Output, 15 pF Load

Output Voltage - Logic "0" is Vcc x 0.1 Vdc
Output Voltage - Logic "1" is Vcc is 0.9 Vdc
Start-up Time: 10 msec max

1/ Frequency Aging Limit

Max change over 30 days	±1.5 ppm
Projected max change for 1 year after 30 days	±10 ppm

Please Contact Us for Specification Options that are Outside of or beyond those Shown in the Table Above

Standard PAD CONFIGURATION

Pin Number	Function
1	Output Enable (Tri-state)*
2	Ground (case)
3	Output
4	Supply V (Vcc)

* Enable, Logic 1 | Disable, Logic 0

How To ORDER

C73 A 14 D - 50M00000

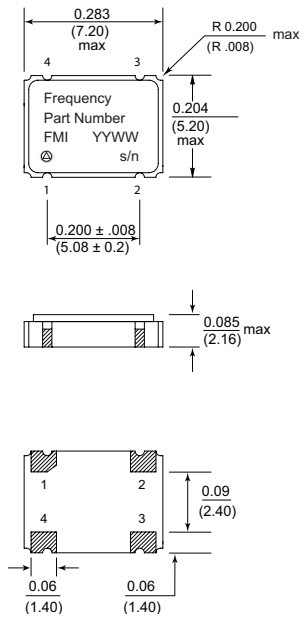
- C73 — model series
- A — mission life/ screening, code A, B or C
- 14 — electrical specifications within frequency range / tri-state option code
- D — frequency stability vs. operating temperature range code
- 50M00000 — output frequency

example:

C73A14D-50M00000

C73

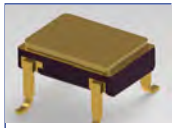
5x7

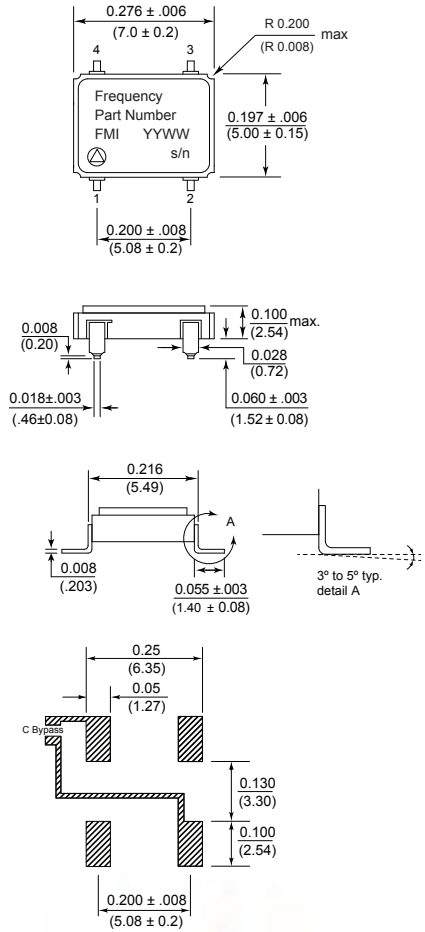


An external bypass capacitor 0.01µF is required between Vcc and GND

C88

5x7 Gull Wing Leads

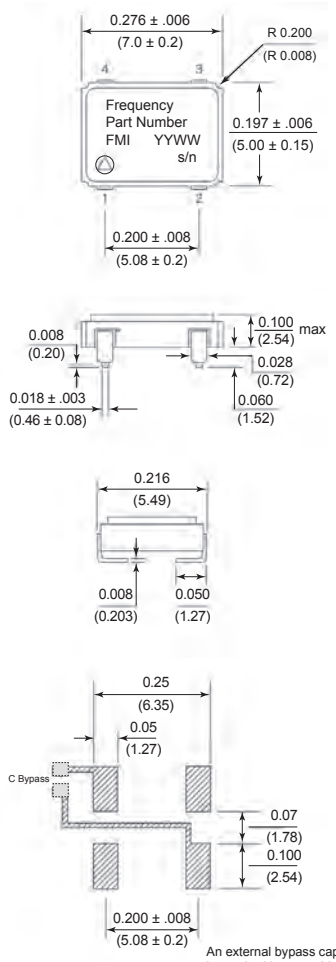




An external bypass capacitor 0.01µF is required between Vcc and GND

C83

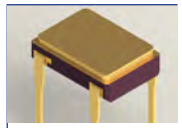
5x7 J-Lead

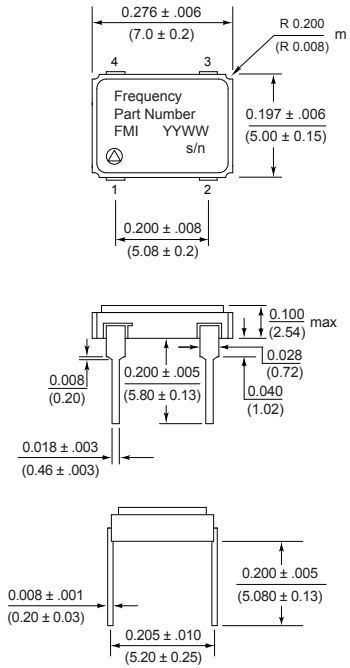


An external bypass capacitor 0.01 µF is required between Vcc and GND

C78

5x7 Straight-Lead

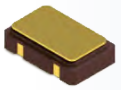




Pin / Pad Configuration	
P1	No Connect / Tri-state Enable
P2	Ground (case)
P3	Output
P4	Supply V (Vcc)

dimensions: inches/(mm)

Solutions for High-Performance Low-Cost Missions



3.2 x 2.5 mm Ceramic SMD
Smallest Package Footprint Available
Please Contact Us For Details

Product Highlight

Mission Life | Screening- A, B & C OPTIONS

Screening	Method	Options:	CODE A	CODE B	CODE C
Non-Destruct Bond Pull	MIL-STD-883, Method 2023		●	●	●
Internal Visual	MIL-STD-883, Method 2017		●	●	●
Stabilization (Vacuum) Bake	MIL-STD-883, Method 1008, Condition C, 150ºC, 24 hours min		●	●	●
Temperature Cycling	MIL-STD-883, Method 1010, Condition B, 10 Cycles		●	●	●
Constant Acceleration	MIL-STD-883, Method 2001, Condition A (Y1 only, 5000 g's)			●	●
PIND Test	MIL-STD-883, Method 2020, Condition B, 5 passes max				●
Seal: Fine Leak	MIL-STD-883, Method 1014, Condition A1				●
	MIL-STD-202, Method 112, Condition C, 111A			●	
Seal: Gross Leak	MIL-STD-202, Method 112, Condition D		●	●	●
Electrical Test	Functional Test Only at +23ºC		●	●	●
Marking & Serialization	MIL-STD-1285		●	●	●
Electrical Test	Nominal Vcc & Extremes and Nominal Temp and Extremes			●	●
Burn-in (load)	+125ºC, Nominal Supply Voltage and Burn-in load, 160 hours min			●	●
Burn-in (no-load)	+125ºC, Nominal Supply Voltage and Burn-in load, 48 hours min		●		
Interim Electrical	Functional Test Only				●
Burn-in (load)	+125ºC, Nominal Supply Voltage and Burn-in load, 160 hours min				●
Final Electrical Test a) Input current, output frequency, output waveform, are tested at +23ºC ±2ºC b) Frequency stability is tested over the specified temperature range; at both extremes and at +25ºC at a minimum of 5 temperature increments note: Recording of test data is by lot # and then serial #			●	●	●
Radiography	MIL-STD-883, Method 2012				●
Frequency Aging	MIL-PRF-55310, +70ºC Condition				●
Frequency/Temperature Stability	MIL-PRF-55310, Over temperature extremes, 20 points equally spaced				●
External Visual & Mechanical	MIL-STD-883, Method 2009		●	●	●

note: other options, screening levels and custom test plans available.

Eliminating the Need for System Component Redundancy

Environmental COMPLIANCE

Environmental	Specification	Method	Condition
Vibration – Sine	MIL-STD-202	Method 204	Condition D 20g, 10 to 2 KHz
Vibration – Random	MIL-STD-202	Method 214	Condition 1 30g rms, 10 to 2 KHz Random
Shock	MIL-STD-202	Method 213	Condition I 100g, 6 ms, F:1500, 0.5 ms
Seal Test	MIL-STD-883	Method 1014	Condition A1 Fine Leak
Seal Test	MIL-STD-883	Method 1014	Condition C1 Gross Leak
Temperature Cycling	MIL-STD-883	Method 1010	Condition B 10 Cycles Minimum
Constant Acceleration	MIL-STD-883	Method 2001	Condition A 5000g, Y1 Axis
Thermal Shock	MIL-STD-202	Method 107	Condition B
Ambient Pressure	MIL-STD-202	Method 105	Condition C
Resistance to Soldering Heat	MIL-STD-202	Method 210	Condition C
Moisture Resistance	MIL-STD-202	Method 106	with 7B Sub-cycle
Salt Atmosphere (corrosion)	MIL-STD-883	Method 1009	Condition A (24 hrs)
Terminal Strength	MIL-STD-202	Method 211	Test Condition D
Solderability	MIL-STD-883	Method 2003	
Resistance to Solvents	MIL-STD-202	Method 215	

Packaged Crystals for Space Applications

8 MHz to 150 MHz Crystals in ruggedized 5x7 mm smd packages. These crystals are also available in a variety of both thru-hole and smd packages. Please inquire.

Contact Us

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15302 Bolsa Chica Street
Huntington Beach, CA
92649

tel: 714 373 8100
fax: 714 373 8700
toll free (USA): 800 800 9825

Sales@FrequencyManagement.com

Qualification & Specification References

MIL-STD-790 Certified
FMI is QPL per MIL-PRF-55310
ISO 9001:2015
Pb-free RoHS Certified

Military Reference Specifications

MIL-PRF-55310	Oscillators, Crystal Controlled, General Specification For
MIL-PRF-38534	Hybrid Microcircuits, General Specification For
MIL-STD-202	Test Method Standard, Electronic and Electrical Components
MIL-STD-883	Test Methods and Procedures for Microelectronics
MIL-STD-1686	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment

Materials

1. Package Materials:
   Ceramic, Alumina 90% min
2. External Lead Plating Material:
   Gold plated Kovar, 0.15 µm (60 µ inch) min, over 2.0 µm (80 µ inch) min Nickel

Products for Space Applications

Contact us for assistance with your specification. We will provide you with the technical support and the required documentation.

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