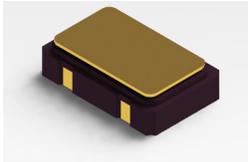


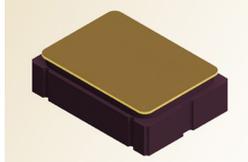


# FMI Commercial “New” Space Products

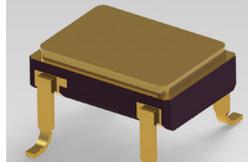
Crystals & Oscillators for SmallSat & CubeSat Applications



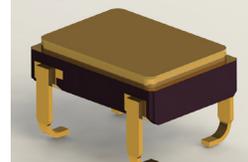
5x3.2 mm SMD



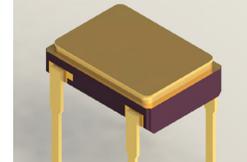
5x7 mm SMD



5x7 mm Gull Wing



5x7 mm J-Lead



5x7 mm Straight Lead

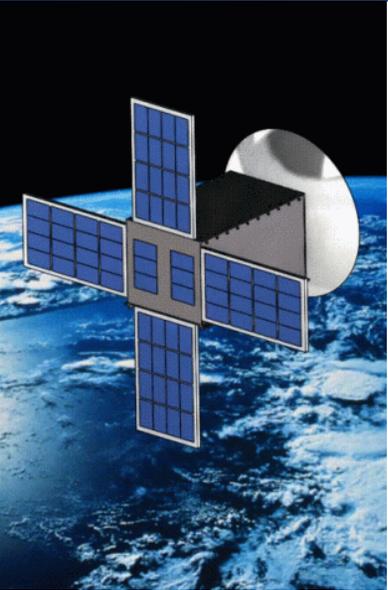
Performance Excellence | Smallest & Lightest Product Offerings | Hi-Rel & Low Cost

product feature  
**C33**



3.2x2.5 mm SMD

Compelling Frequency & Timing Solutions for Mission Success



**Mission Success  
Optimized Cost**

## Frequency Control Solutions for Commercial Space Missions

**SmallSat**

**CubeSat**

**NanoSat**

**MicroSat**

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 demand for optimized size, weight, power and costs associated with 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 and sets an example 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

5x3.2 mm SMD



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



**Features**

- Hi-Rel | Low-Cost
- Customer Support & Service
- Mission Life Duration Options
- Proven High Shock Crystal Support
- Operating Life > 20,000 Hours at +125°C
- See C55 Series for SEL >75 MeV cm<sup>2</sup>/mg LET (48 MHz to 130 MHz) see datasheet on our website
- ECCN - EAR99

**Electrical SPECIFICATIONS**

Mission Life / Screening Code			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			
A	B	C						-55°C to +125°C (ppm)	-55°C to +125°C (ppm)	-40°C to +105°C (ppm)	-40°C to +85°C (ppm)
6 Months to 1 year	1 Year to 2 years	3 Years to 5 years						CODE A	CODE B	CODE C	CODE D
<b>01</b>	<b>02</b>	<b>03</b>	0.5 to 0.9	1.1	3	45/55	±10	±100	±75	±60	±50
<b>04</b>	<b>05</b>	<b>06</b>	1 to 7.9	1.3	3	40/60	±10	±100	±75	±60	±50
<b>07</b>	<b>08</b>	<b>09</b>	8 to 15.9	3	3	40/60	±10	±100	±75	±60	±50
<b>11</b>	<b>12</b>	<b>13</b>	16 to 49.9	6	2	40/60	±10	±100	±75	±60	±50
<b>14</b>	<b>15</b>	<b>16</b>	50 to 74.9	8	2	40/60	±10	±100	±75	±60	±50
<b>17</b>	<b>18</b>	<b>19</b>	75 to 94.9	16	2	40/60	±10	±100	±75	±60	±50
<b>21</b>	<b>22</b>	<b>23</b>	95 to 130	25	2	40/60	±10	±100	±75	±60	±50

See page 6 for screening details

CMOS Output, 15 pF Load		1/ Frequency Aging Limit
Output Voltage - Logic "0" is Vcc x 0.1 Vdc		Max change over 30 days
Output Voltage - Logic "1" is Vcc is 0.9 Vdc		Projected max change for 1 year after 30 days
Start-up Time: 10 msec max		
		±1.5 ppm
		±10 ppm

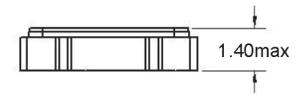
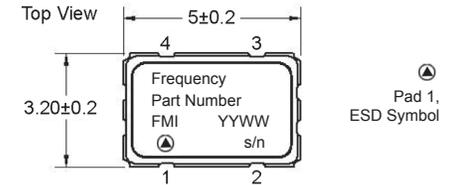
Please Contact Us for Specification Options that are Outside of or beyond those Shown in the Table Above

**Standard PAD CONFIGURATION**

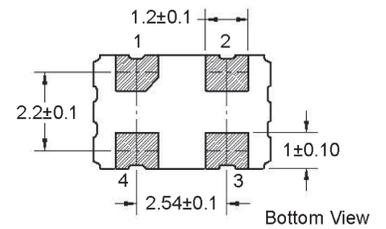
Pin Number	Function
1	Output Enable (Tri-state)*
2	Ground (case)
3	Output
4	Supply V (Vcc)

\* Enable, Logic 1 | Disable, Logic 0

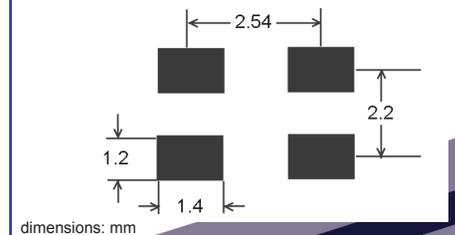
**C53 | C55**  
Mechanical SPECIFICATIONS



frequency stability vs. temperature code



**Recommended Land Pattern**

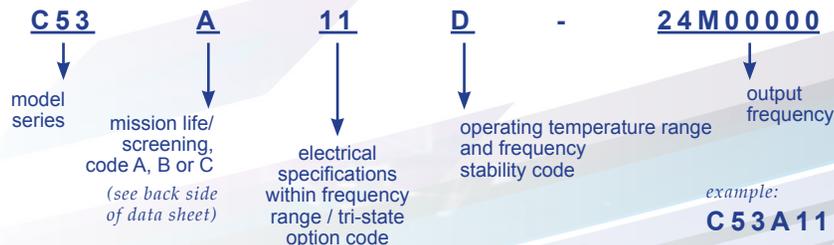


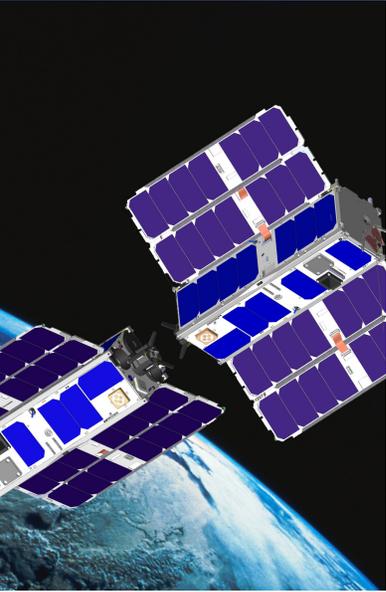
dimensions: mm

Pin / Pad Configuration

P1	Output Enable (Tri-state)
P2	Ground (case)
P3	Output
P4	Supply V (Vcc)

**How To ORDER**





# C88 SERIES, including package variations C73, C75, C83 & C78

## < 50 KRad/Si - TID, Commercial Space

Crystal Oscillator | 3.3V | CMOS | 5x7mm Ceramic SMD Gull Wing Leads | 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 +125°C
- See C85 Series for SEL >75 MeV cm<sup>2</sup>/mg LET (48 MHz to 130 MHz) see datasheet on our website
- ECCN - EAR99

C88 Heritage MIL QPL B Level Similarity is M55310/41, 5x7 Gull Wing

### Electrical SPECIFICATIONS

Mission Life / Screening Code			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			
A 6 Months to 1 year	B 1 Year to 2 years	C 3 Years to 5 years						-55°C to +125°C (ppm)	-55°C to +125°C (ppm)	-40°C to +105°C (ppm)	-40°C to +85°C (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	±75	±60	±50
04	05	06	1 to 7.9	1.2	3	48/52	±10	±100	±75	±60	±50
07	08	09	8 to 15.9	3	3	45/55	±10	±100	±75	±60	±50
11	12	13	16 to 49.9	6	3	45/55	±10	±100	±75	±60	±50
14	15	16	50 to 79.9	8	2	40/60	±10	±100	±75	±60	±50
17	18	19	80 to 94.9	10	2	40/60	±10	±100	±75	±60	±50
21	22	23	95 to 130	25	2	40/60	±10	±100	±75	±60	±50

frequency stability vs. temperature code

Customer Selected Mission Life

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

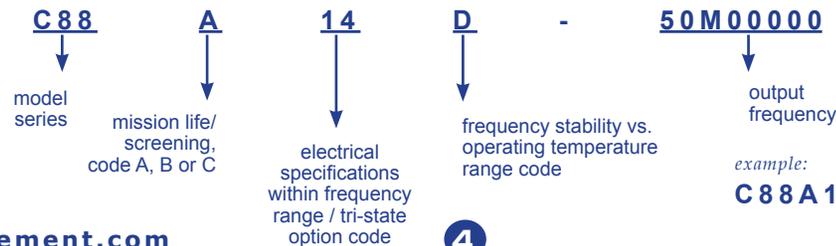
Please Contact Us for Specification Options that are Outside of or beyond those Shown in the Table Above

#### Standard PAD CONFIGURATION

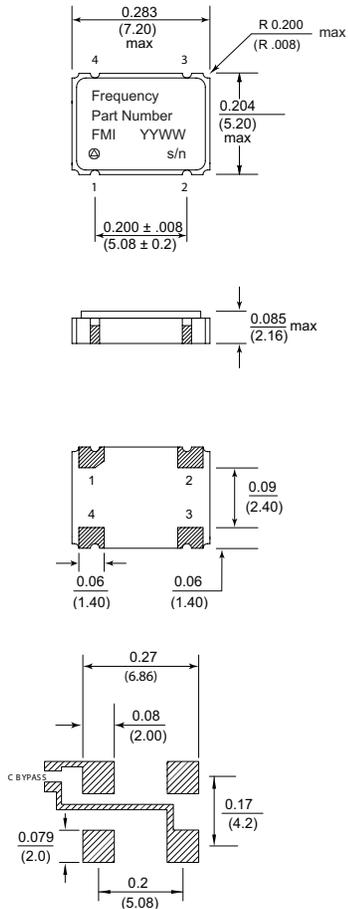
Pin Number	Function
1	Output Enable (Tri-state)*
2	Ground (case)
3	Output
4	Supply V (Vcc)

\* Enable, Logic 1 | Disable, Logic 0

### How To ORDER

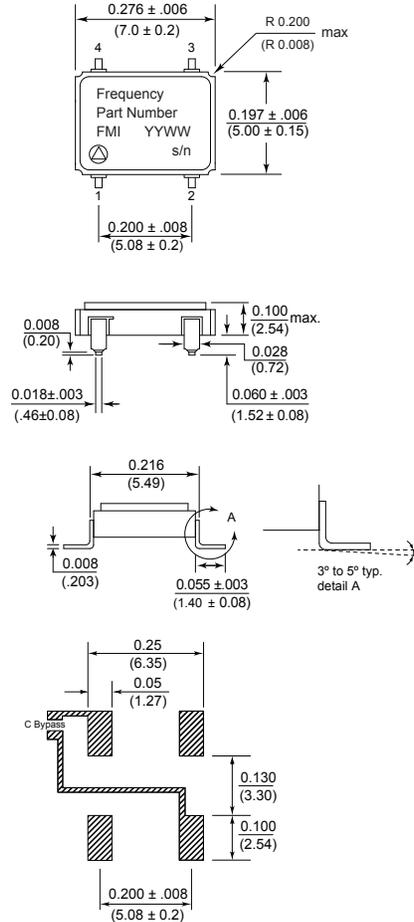
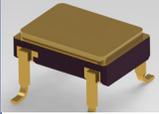


**C73 | C75**  
5x7



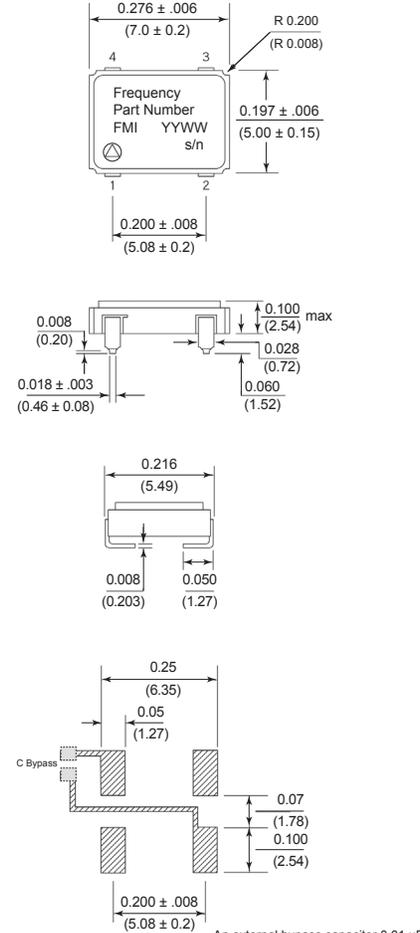
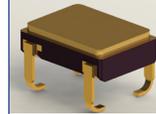
An external bypass capacitor 0.01µF is required between Vcc and GND

**C88 | C85**  
5x7 Gull Wing Leads



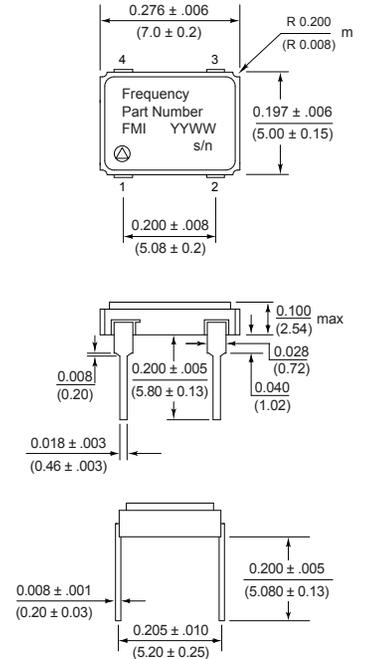
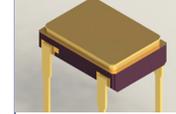
An external bypass capacitor 0.01µF is required between Vcc and GND

**C83**  
5x7 J-Lead



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

**C78**  
5x7 Straight-Lead

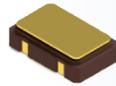


Pin / Pad Configuration	
P1	Output Enable (Tri-state)
P2	Ground (case)
P3	Output
P4	Supply V (Vcc)

dimensions: inches/(mm)



**Solutions for High-Performance Low-Cost Missions**



**3.2 x 2.5 mm Ceramic SMD**  
**Smallest Package Footprint Available**  
 3.3V CMOS, 500 KHz to 100 MHz  
 Please Contact Us or Visit our Website for Details

**Product Highlight**

Mission Life   Screening- A, B & C OPTIONS		CODE			
Screening	Method	Options:	A	B	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, 150°C, 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 +23°C		•	•	•
Marking & Serialization	MIL-STD-1285		•	•	•
Electrical Test	Nominal Vcc & Extremes and Nominal Temp and Extremes			•	•
Burn-in (load)	+125°C, Nominal Supply Voltage and Burn-in load, 160 hours min			•	•
Burn-in (no-load)	+125°C, Nominal Supply Voltage and Burn-in load, 48 hours min		•		
Interim Electrical	Functional Test Only				•
Burn-in (load)	+125°C, Nominal Supply Voltage and Burn-in load, 160 hours min				•
Final Electrical Test	a) Input current, output frequency, output waveform, are tested at +23°C ±2°C b) Frequency stability is tested over the specified temperature range; at both extremes and at +25°C 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, +70°C Condition				•
Frequency/Temperature Stability	MIL-PRF-55310, Over temperature extremes, 20 points equally spaced				•
External Visual & Mechanical	MIL-STD-883, Method 2009		•	•	•

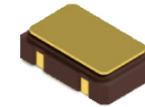
*note: other options, screening levels and custom test plans available.*

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 & 20 MHz to 150 MHz Crystals in 5x3.2 smd packages. These crystals are also available in a variety of both thru-hole and smd packages. Please inquire.



Contact Us

Frequency Management International

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

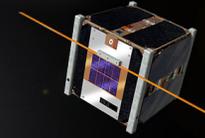
Contact us for assistance with your specification. We will provide you with the technical support and the required documentation.



**FREQUENCY MANAGEMENT | International**  
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Huntington Beach, CA 92649

Sales@FrequencyManagement.com  
Tel. 714 373 8100 Fax. 714 373 8700  
**800 800 9825 (USA Only)**

**SmallSat | CubeSat**



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