

# EMS12HHA-7.000M

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## REGULATORY COMPLIANCE (Data Sheet downloaded on May 25, 2020)


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## ITEM DESCRIPTION

Spread Spectrum MEMS Clock Oscillators LVCMOS (CMOS) 2.5Vdc 4 Pad 5.0mm x 7.0mm Plastic Surface Mount (SMD) 7.000MHz  $\pm 50$ ppm Maximum over  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  Tri-State  $\pm 0.25\%$  Center Spread

## ELECTRICAL SPECIFICATIONS

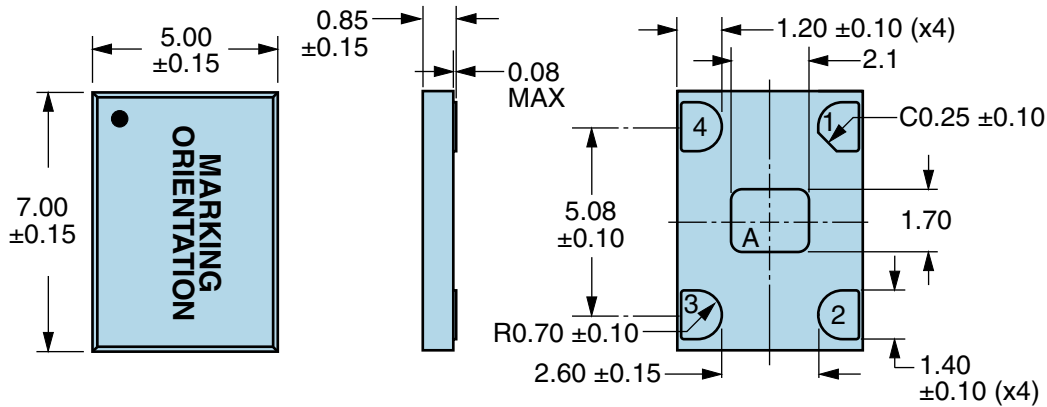
Nominal Frequency	7.000MHz
Frequency Tolerance/Stability	$\pm 50$ ppm Maximum over $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ (Inclusive of all conditions: Calibration Tolerance at $25^{\circ}\text{C}$ , Frequency Stability over the Operating Temperature Range, Supply Voltage Change, Output Load Change, First Year Aging at $25^{\circ}\text{C}$ , $260^{\circ}\text{C}$ Reflow, Shock, and Vibration)
Aging at $25^{\circ}\text{C}$	$\pm 1$ ppm Maximum First Year
Supply Voltage	2.5Vdc $\pm 10\%$
Maximum Supply Voltage	$-0.5\text{Vdc}$ to $+3.65\text{Vdc}$
Input Current	25mA Maximum (Unloaded; Nominal Vdd)
Output Voltage Logic High (Voh)	90% of Vdd Minimum (IOH= $-8\text{mA}$ )
Output Voltage Logic Low (Vol)	10% of Vdd Maximum (IOL= $+8\text{mA}$ )
Rise/Fall Time	2nSec Maximum (Measured from 20% to 80% of waveform)
Duty Cycle	50 $\pm 5$ (%) (Measured at 50% of waveform)
Load Drive Capability	15pF Maximum
Output Logic Type	CMOS
Output Control Function	Tri-State (Disabled Output High Impedance)
Tri-State Input Voltage (Vih and Vil)	70% of Vdd Minimum or No Connection to Enable Output, 30% of Vdd Maximum to Disable Output
Disable Current	20mA Maximum (Disabled Output: High Impedance) (Pad 1=Ground)
Spread Spectrum	$\pm 0.25\%$ Center Spread
Modulation Frequency	30kHz Minimum, 32kHz Typical, 35kHz Maximum
Period Jitter	40pSec Maximum (Cycle to Cycle; Spread Spectrum-On; Fo=133.333M, Vdd=2.5Vdc)
Start Up Time	10mSec Maximum
Storage Temperature Range	$-55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$

## ENVIRONMENTAL & MECHANICAL SPECIFICATIONS

ESD Susceptibility	MIL-STD-883, Method 3015, Class 2, HBM 2000V
Flammability	UL94-V0
Mechanical Shock	MIL-STD-883, Method 2002, Condition G, 30,000G
Moisture Resistance	MIL-STD-883, Method 1004
Moisture Sensitivity Level	J-STD-020, MSL 1
Resistance to Soldering Heat	MIL-STD-202, Method 210, Condition K
Resistance to Solvents	MIL-STD-202, Method 215
Solderability	MIL-STD-883, Method 2003 (Four I/O Pads on bottom of package only)
Temperature Cycling	MIL-STD-883, Method 1010, Condition B
Thermal Shock	MIL-STD-883, Method 1011, Condition B
Vibration	MIL-STD-883, Method 2007, Condition A, 20G

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### MECHANICAL DIMENSIONS (all dimensions in millimeters)



PIN	CONNECTION
1	Tri-State (High Impedance)
2	Ground
3	Output
4	Supply Voltage

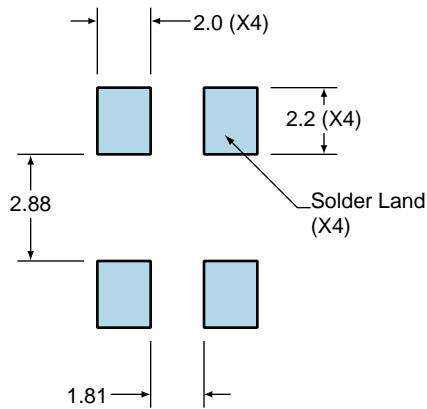
  

LINE	MARKING
1	<b>XXXX or XXXXX</b> XXXX or XXXXX=Ecliptek Manufacturing Identifier

Note A: Center paddle is connected internally to oscillator ground (Pad 2).

### Suggested Solder Pad Layout

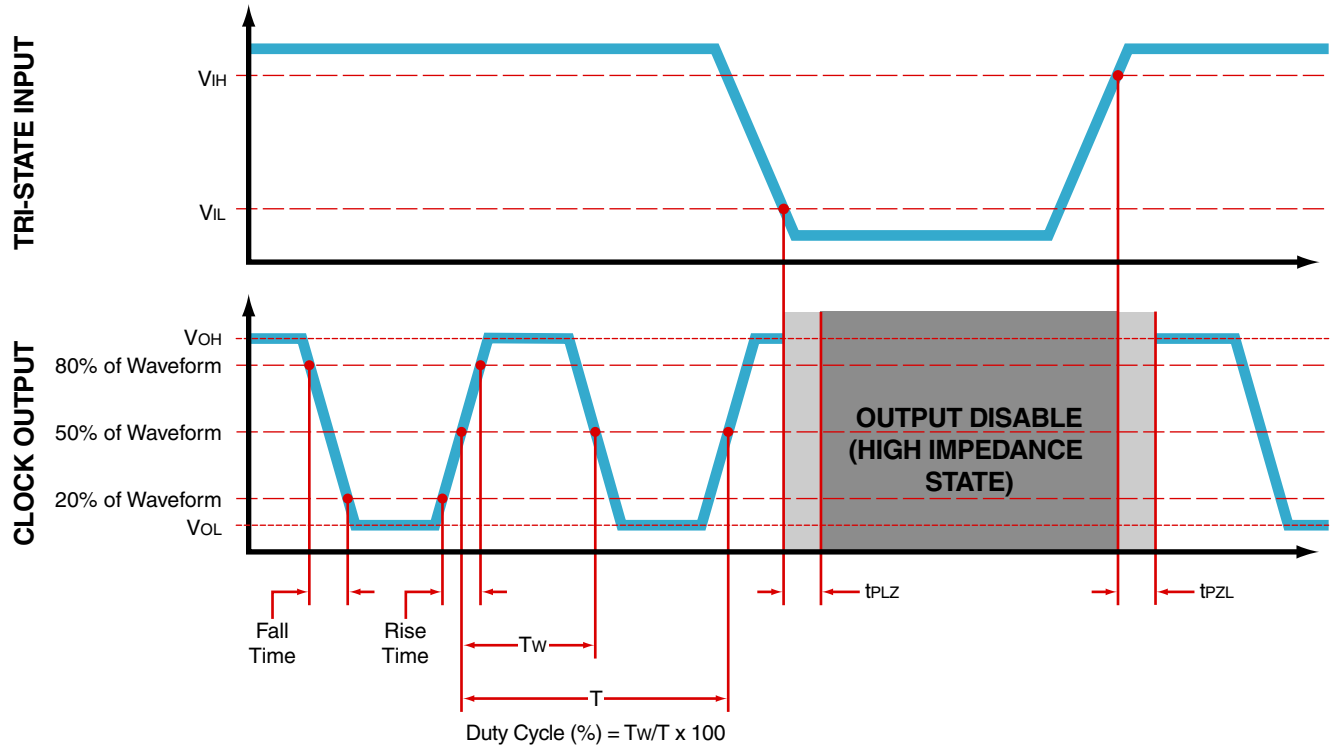
All Dimensions in Millimeters



All Tolerances are ±0.1

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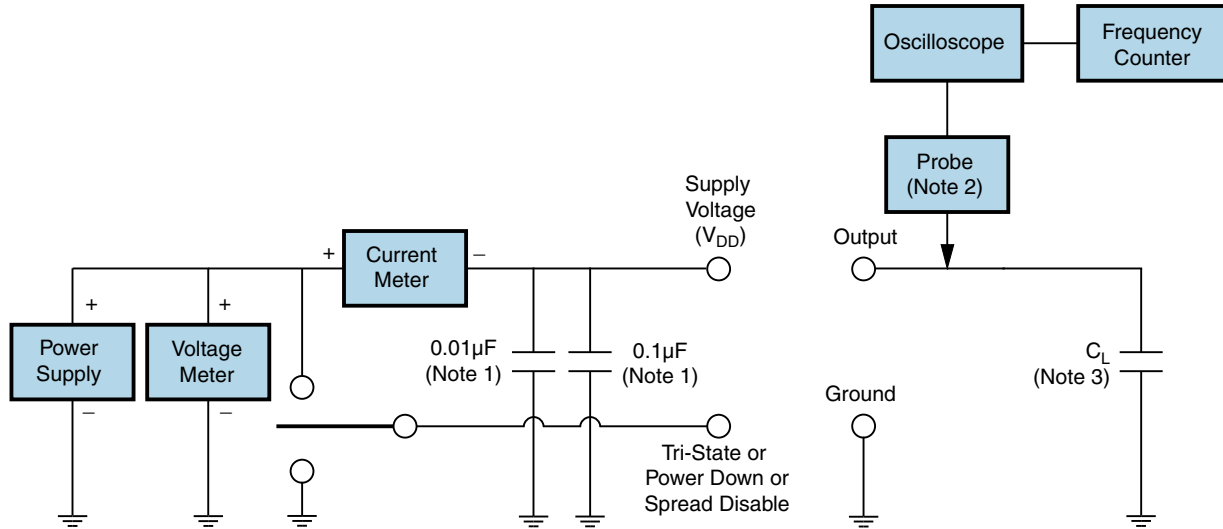
## OUTPUT WAVEFORM & TIMING DIAGRAM



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## Test Circuit for CMOS Output



Note 1: An external 0.01µF ceramic bypass capacitor in parallel with a 0.1µF high frequency ceramic bypass capacitor close (less than 2mm) to the package ground and supply voltage pin is required.

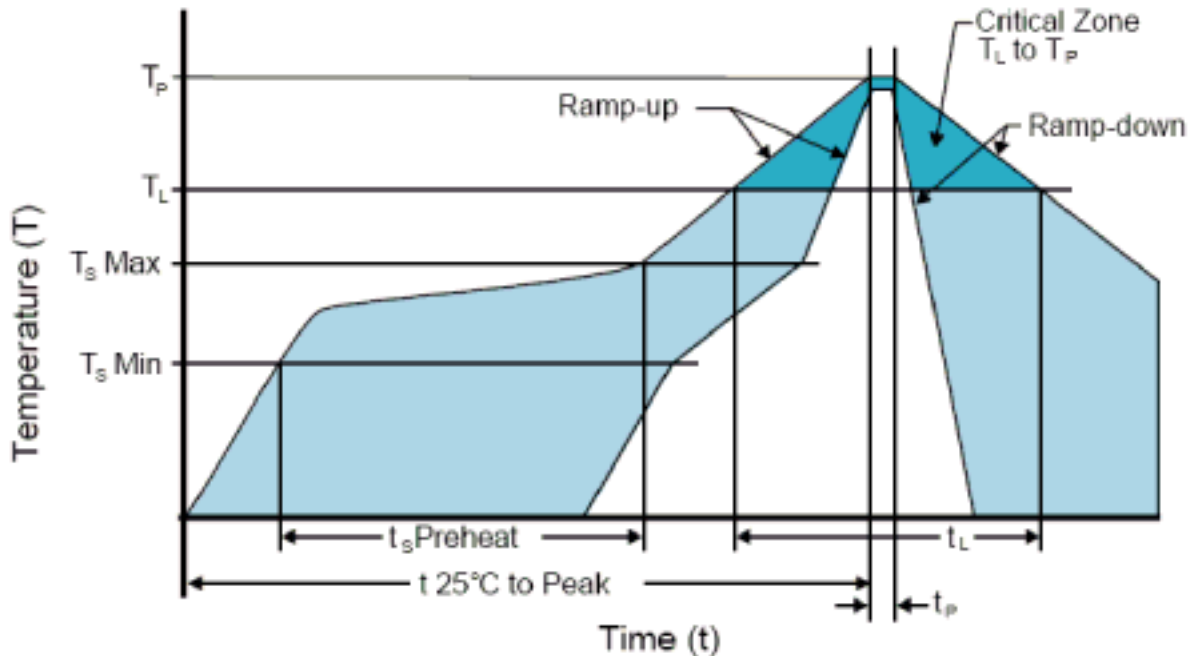
Note 2: A low capacitance (<12pF), 10X attenuation factor, high impedance (>10Mohms), and high bandwidth (>300MHz) passive probe is recommended.

Note 3: Capacitance value C<sub>L</sub> includes sum of all probe and fixture capacitance.

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## Recommended Solder Reflow Methods



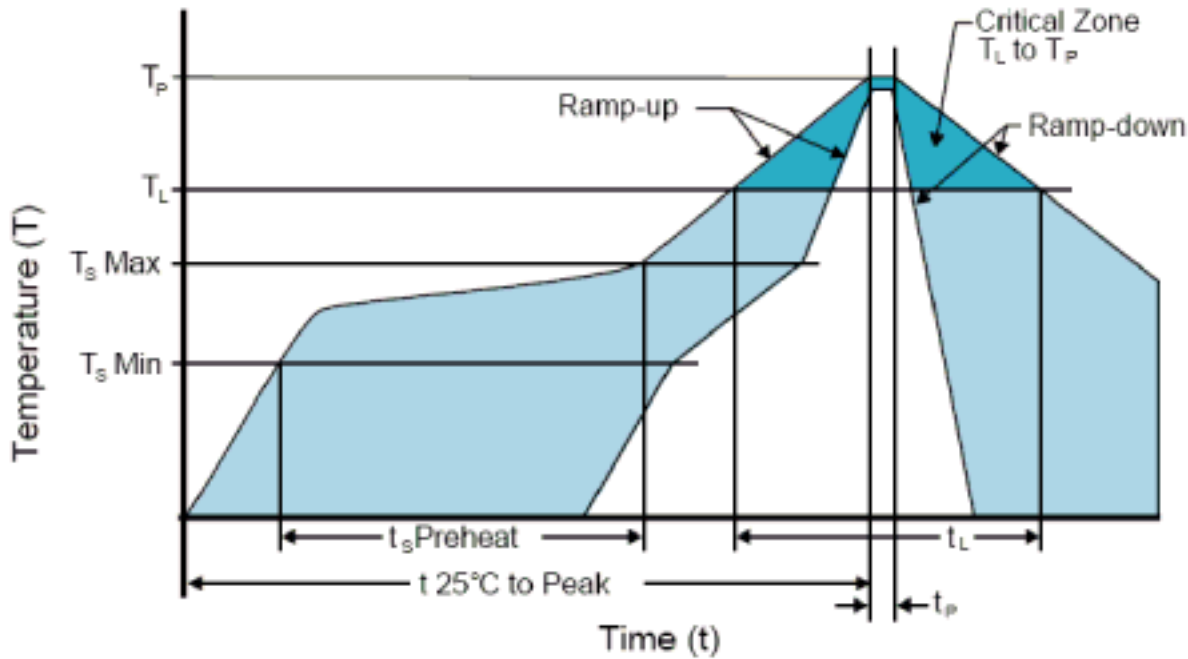
### High Temperature Infrared/Convection

<b><math>T_S \text{ MAX}</math> to <math>T_L</math> (Ramp-up Rate)</b>	3°C/Second Maximum
<b>Preheat</b>	
- Temperature Minimum ( $T_S \text{ MIN}$ )	150°C
- Temperature Typical ( $T_S \text{ TYP}$ )	175°C
- Temperature Maximum ( $T_S \text{ MAX}$ )	200°C
- Time ( $t_s \text{ MIN}$ )	60 - 180 Seconds
<b>Ramp-up Rate (<math>T_L</math> to <math>T_P</math>)</b>	3°C/Second Maximum
<b>Time Maintained Above:</b>	
- Temperature ( $T_L$ )	217°C
- Time ( $t_L$ )	60 - 150 Seconds
<b>Peak Temperature (<math>T_P</math>)</b>	260°C Maximum for 10 Seconds Maximum
<b>Target Peak Temperature (<math>T_P \text{ Target}</math>)</b>	250°C +0/-5°C
<b>Time within 5°C of actual peak (<math>t_p</math>)</b>	20 - 40 Seconds
<b>Ramp-down Rate</b>	6°C/Second Maximum
<b>Time 25°C to Peak Temperature (t)</b>	8 Minutes Maximum
<b>Moisture Sensitivity Level</b>	Level 1

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## Recommended Solder Reflow Methods



### Low Temperature Infrared/Convection 240°C

<b><math>T_s</math> MAX to <math>T_L</math> (Ramp-up Rate)</b>	5°C/Second Maximum
<b>Preheat</b>	
- Temperature Minimum ( $T_s$ MIN)	N/A
- Temperature Typical ( $T_s$ TYP)	150°C
- Temperature Maximum ( $T_s$ MAX)	N/A
- Time ( $t_s$ MIN)	60 - 120 Seconds
<b>Ramp-up Rate (<math>T_L</math> to <math>T_P</math>)</b>	5°C/Second Maximum
<b>Time Maintained Above:</b>	
- Temperature ( $T_L$ )	150°C
- Time ( $t_L$ )	200 Seconds Maximum
<b>Peak Temperature (<math>T_P</math>)</b>	240°C Maximum
<b>Target Peak Temperature (<math>T_P</math> Target)</b>	240°C Maximum 2 Times / 230°C Maximum 1 Time
<b>Time within 5°C of actual peak (<math>t_p</math>)</b>	10 Seconds Maximum 2 Times / 80 Seconds Maximum 1 Time
<b>Ramp-down Rate</b>	5°C/Second Maximum
<b>Time 25°C to Peak Temperature (t)</b>	N/A
<b>Moisture Sensitivity Level</b>	Level 1

### Low Temperature Manual Soldering

185°C Maximum for 10 Seconds Maximum, 2 times Maximum.

### High Temperature Manual Soldering

260°C Maximum for 5 Seconds Maximum, 2 times Maximum.