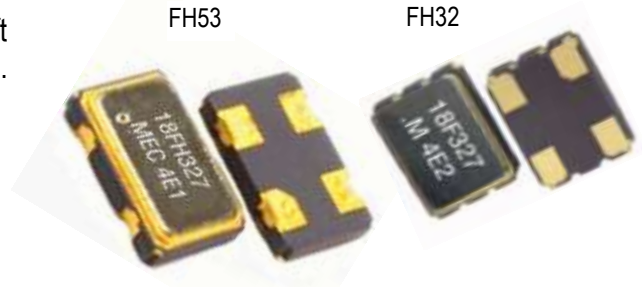


## Frequency Shift Keyed Silicon Oscillators “FH32” and “FH53” Series



**MERCURY**  
Since 1973

The FH series is an extremely low power precision frequency shift keyed silicon oscillator with a total frequency error less than 1.0%. This Si-gate CMOS oscillator produces a square wave output and requires no external components other than power supply bypass capacitors. The operating voltage range is 1.5V to 3.3V which allows operation from a single Li-Ion cell or 2 AA alkaline cells.



This frequency shift keyed oscillator has two selectable output frequencies. The output frequency is selected by an external logic level signal applied to its frequency control pin (pin 1). A low level input increases the output frequency by approximately 5% compared to a high level or no input to pin 1. This allows binary data signals to be transmitted as two distinct frequencies. As an example, the output frequency of a 32.768 KHz silicon oscillator will shift to 34.406 KHz when its pin 1 is taken to logic low. The output frequency returns back to 32.768 KHz if the logic low is removed or logic high is applied.

If a frequency shift is not required, please select the “**SH32**” or “**SH53**” series. Their pin 1 is no connection.

### Features:

- Hermetically sealed & metal-lid grounded ceramic leadless package
- Superior moisture resistant, compared to plastic molded packaging
- Internally frequency tuned to the specified voltage (no external components needed)
- Ultra-low supply current [10  $\mu$ A typical at +2.5V]
- Fast start up time
- Fast frequency shift rate
- Low supply current
- +1.55V to +3.3V single supply
- Withstands high vibration and harsh environments
- Suitable for light weight, compact consumer electronic devices
- Ideal for high density boards
- RoHS compliant and (Pb) lead-free product
- No mechanical parts. No PLL
- US Patent: 6,281,732. A collaboration with **Micro Oscillator Inc.** [www.micro-oscillator.com](http://www.micro-oscillator.com)



### Applications:

- ▲ Microprocessor Clocks
- ▲ Remote Controls
- ▲ Data transmission



**MERCURY** [www.mercury-crystal.com](http://www.mercury-crystal.com)

TEL (886)-2-2406-2779, FAX (886)-2-2496-0769, e-mail: [sales-tw@mercury-crystal.com](mailto:sales-tw@mercury-crystal.com)  
U.S.A.: TEL (1)-909-466-0427, FAX (1)-909-466-0762, e-mail: [sales-us@mercury-crystal.com](mailto:sales-us@mercury-crystal.com)



**Absolute Maximum Ratings**

<b>Power Supply Voltage V<sub>DD</sub></b>	+3.6 V max.
<b>Input Voltage</b>	-0V min.; V <sub>DD</sub> V max.
<b>Output Voltage</b>	-0V min.; V <sub>DD</sub> V max.
<b>Operation Junction Temperature</b>	-55°C min.; +125°C max.

**General Specifications:** Ta=+25°C

<b>Product Series</b>	“FH32” series. Package size: 3.2x2.5x1.0 mm CLCC 4 pads				
	“FH53” series. Package size: 5x3.2x1.2 mm CLCC 4 pads				
<b>Frequency Range</b>	20 KHz to 80 KHz				
<b>Popular Frequency</b>	32.768 KHz				
<b>Frequency Shift</b>	5% typical				
<b>Input Voltage (V<sub>DD</sub>) D.C.</b>	+1.55 V±5%	+1.8 V±5%	+2.5 V±5%	+3.0 V±5%	+3.3 V±5%
<b>Voltage Code for Part No.</b>	15	18	25	3	33
<b>FH32 Availability</b>	FH32			Not available	Not available
<b>FH53 Availability</b>	FH53				
<b>Current Consumption</b>	3 µA typical	5 µA typical	10 µA typical	16 µA typical	18 µA typical
<b>Initial Frequency Accuracy</b>	± 0.5% max. at +25°C				
<b>Frequency Error vs Supply Voltage</b>	±0.2% typical	±0.2% typical	±0.3% typical	±0.2% typical	±0.2% typical
<b>Frequency Error vs Temperature (0°C to +70°C)</b>	±0.1% typical	±0.1% typical	±0.3% typical	±0.2% typical	±0.2% typical
<b>Frequency Standard Deviation</b>	0.5 Hz. typ.	0.5 Hz. typ.	1 Hz. typ.	2 Hz. typ.	2 Hz. typ.
<b>Output Logic and Waveform</b>	CMOS. Square wave.				
<b>Output “High” Voltage; V<sub>OH</sub></b>	0.9*V <sub>DD</sub> min.				
<b>Output “Low” Voltage; V<sub>OL</sub></b>	0.1*V <sub>DD</sub> max.				
<b>Duty Cycle</b>	50% ±5% at 50% V <sub>DD</sub>				
<b>Rise Time (Tr)/ Fall Time (Tf)</b> Condition: 12 pF Load	38n sec. typ.	33n sec. typ.	25n sec. typ.	24n sec. typ.	24n sec. typ.
<b>Start-up Time (Ts) (note 1)</b>	30 µ sec. max.				
<b>Oscillator Turn On Time (note 2)</b>	0.3 sec. min				
<b>Supply Voltage Rise Time</b>	1 µ sec. min.				

Notes:

1/ Output signal frequency is stable by the second pulse cycle, after the supply voltage is stable. This time is dependent on the oscillator frequency. 32.768 KHz is given.

2/ Oscillator start up requires a relatively clean supply voltage that does not drop down towards zero volts during turn on. After the supply voltage drops below about 1v, the voltage should go to 0v for 0.3 sec. min. before the oscillator is turned on again.



**Environmental Performance Specifications**

<b>Green Requirement</b>	RoHS compliant, Pb (lead) free in accordance with EU Directive 2002/95/EC 6/6 (2002/95/EC) and WEEE (2002/96/EC). Free of halide, cadmium, hexavalent chromium, lead, mercury, PBB's and PBDE's.
<b>Moisture Sensitivity Level</b>	Level 1 (infinite) according to IPC/JEDEC J-STD-020D.1
<b>Second Level Interconnect</b>	e4
<b>Operating Temp. Range</b>	0 to +70°C
<b>Storage Temp. Range</b>	-55 to +125°C
<b>Humidity</b>	85% RH, 85°C, 48 hours
<b>Fine Leak / Gross Leak</b>	MIL-Std-883, method 1014, condition A / MIL-Std-883, method 1014, condition C
<b>Solderability</b>	MIL-STD-202F method 208E
<b>Reflow</b>	260°C max. for 10 sec.max. 2 reflows.
<b>Vibration</b>	MIL-STD-202F method 204, 35G, 50 to 2000 Hz
<b>Shock</b>	MIL-STD-202F method 213B, test condi. E, 1000GG ½ sine wave
<b>Resistance to Solvent</b>	MIL-STD-202, method 215
<b>Temperature Cycling</b>	MIL-STD-883, method 1010
<b>Pad Surface Finish</b>	Gold (0.3 to 1.0 µm) over nickel (1.27 to 8.89 µm)
<b>Weight of the Device</b>	FH32: 0.042grams typical; FH53: 0.078grams typical

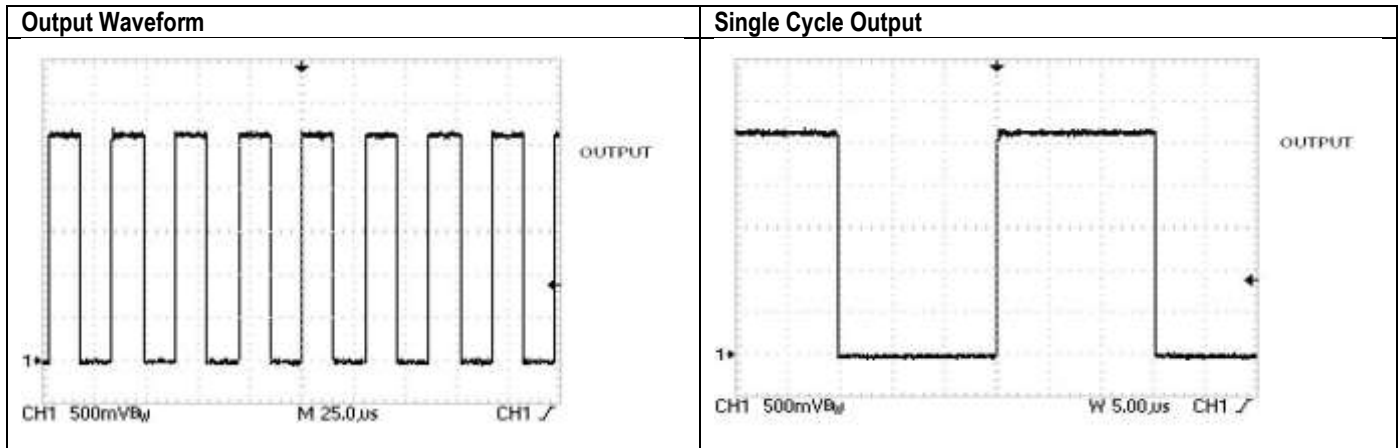
**Part Number Format and Example:**

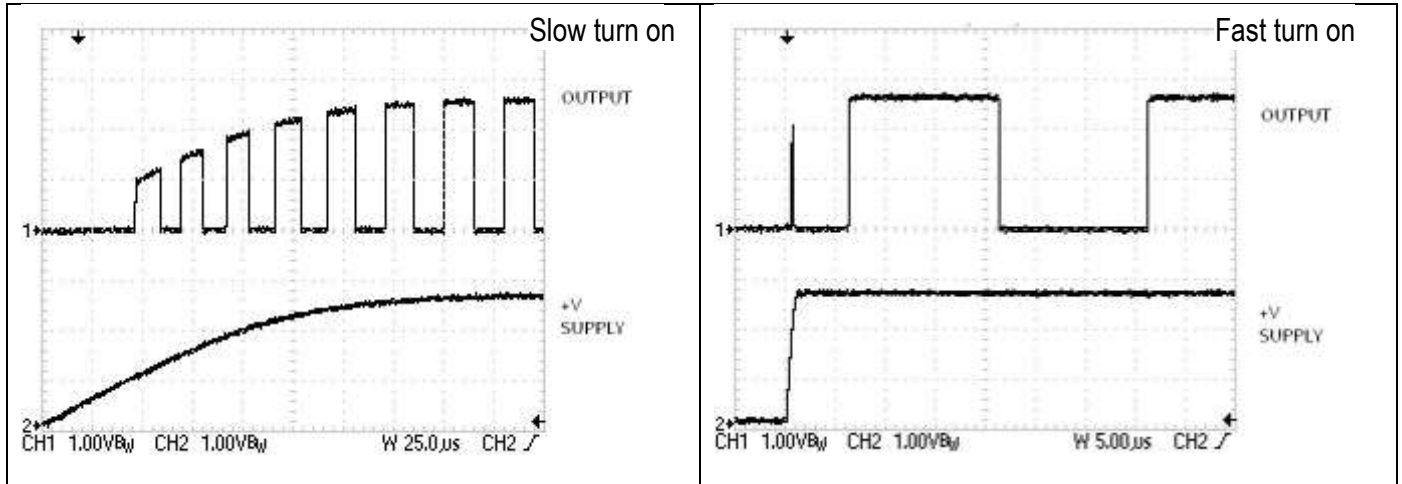
Example: 18FH32-327

⌀: User input

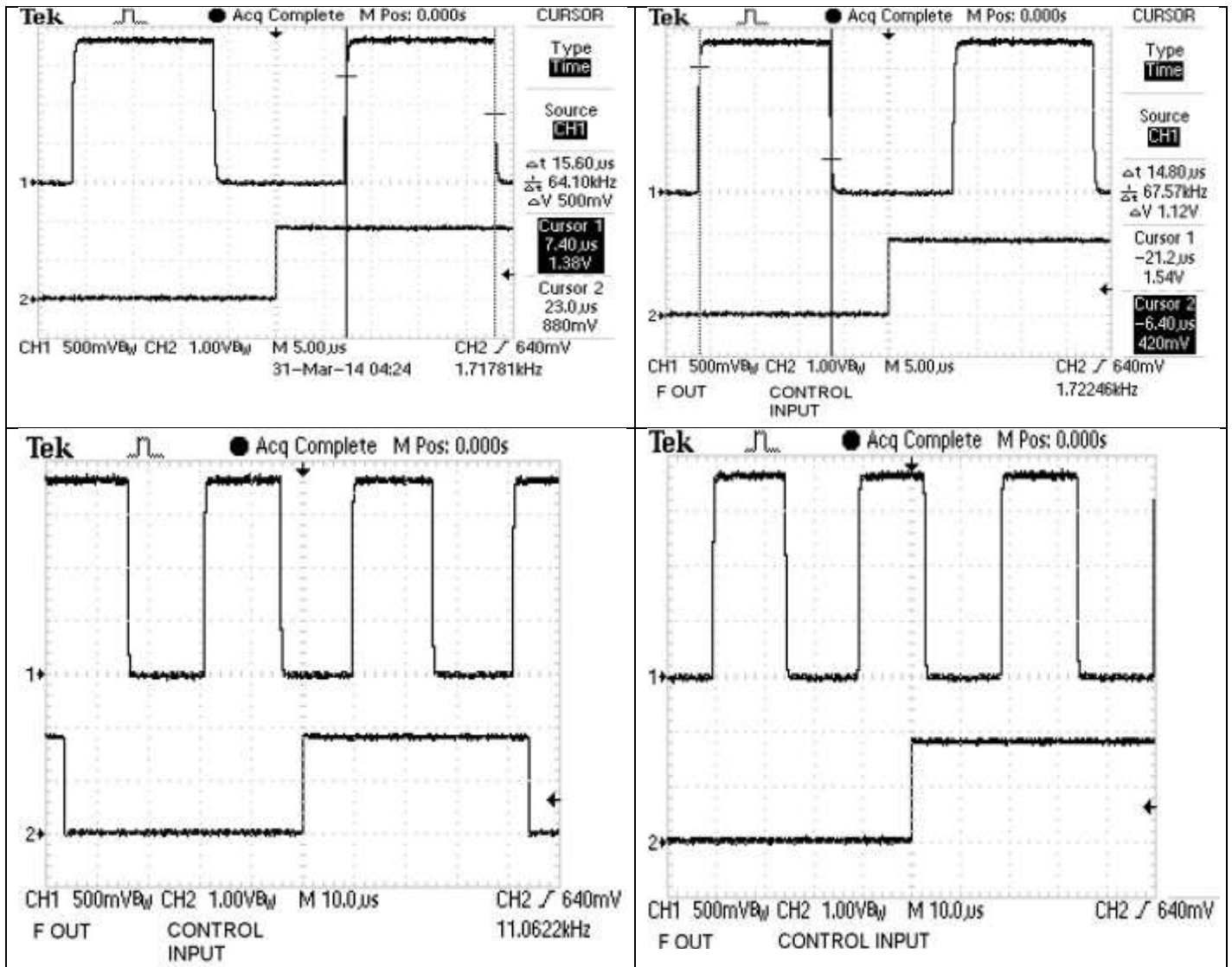
⌀		⌀		⌀
18	FH	32	-	327
Supply voltage code “33” for 3.3V <sub>V<sub>DD</sub></sub> “3” for 3.0 V <sub>V<sub>DD</sub></sub> “25” for 2.5V <sub>V<sub>DD</sub></sub> “18” for 1.8V <sub>V<sub>DD</sub></sub> “15” for 1.55V <sub>V<sub>DD</sub></sub>	Product series	Package size. “32” for 3.2x2.5x1.0 mm “53” for 5x3.2x1.2 mm		Frequency in KHz. 327 = 32.768 KHz

**Typical Output Waveform**

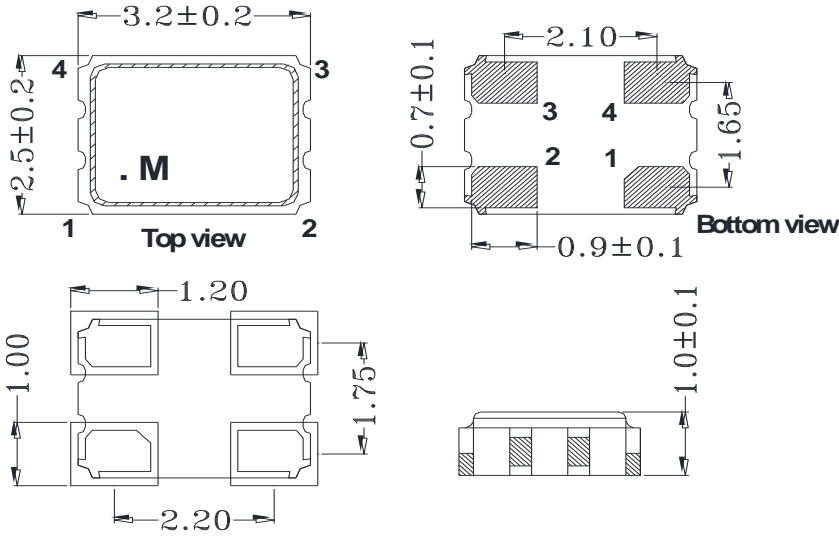




**Frequency Shift Control Typical Waveform**

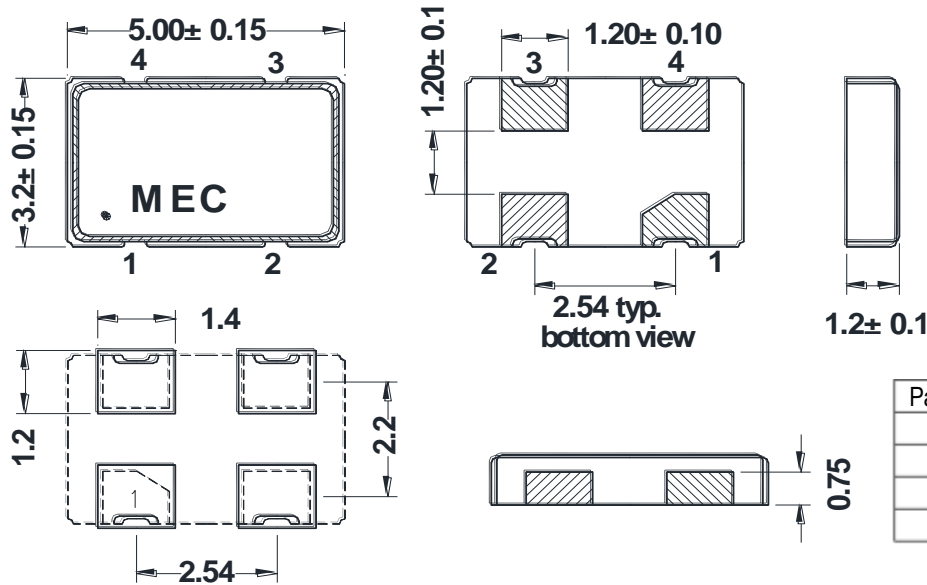


**FH32 Package Dimensions and Recommended Solder Pad Layout** unit: (mm)



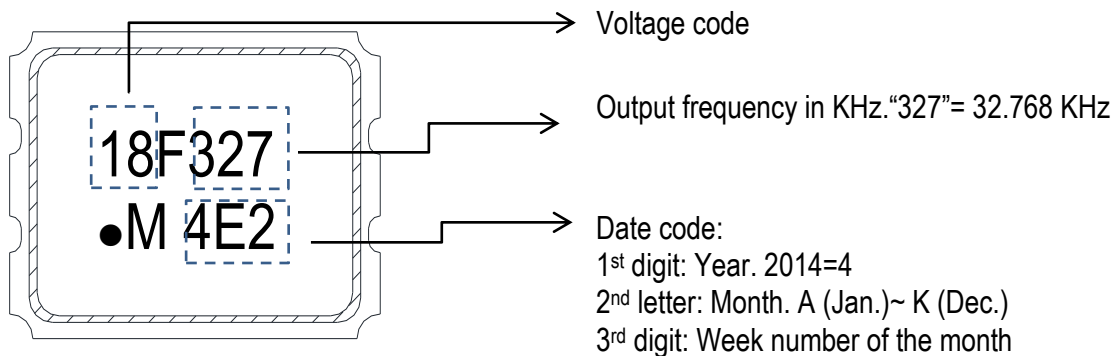
Pad No.	Function
1	Frequency Shift Input
2	Ground
3	Output
4	Supply voltage

**FH53 Package Dimensions and Recommended Solder Pad Layout** unit: (mm)

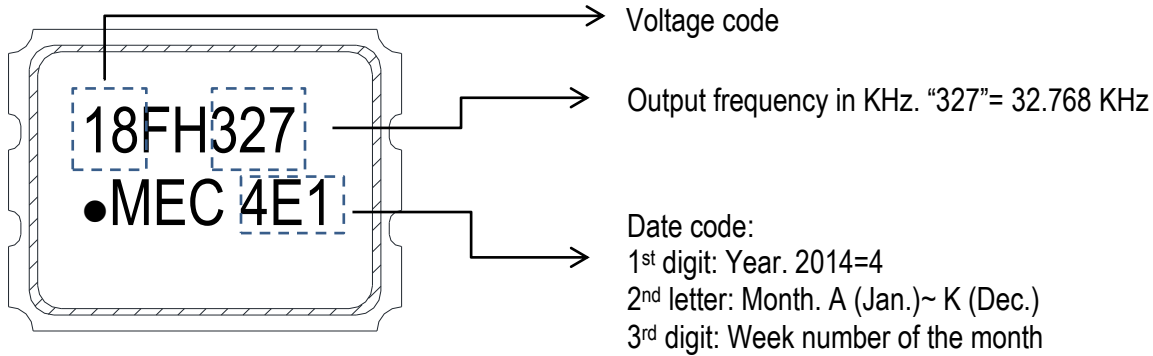


Pad No.	Function
1	Frequency Shift Input
2	Ground
3	Output
4	Supply voltage

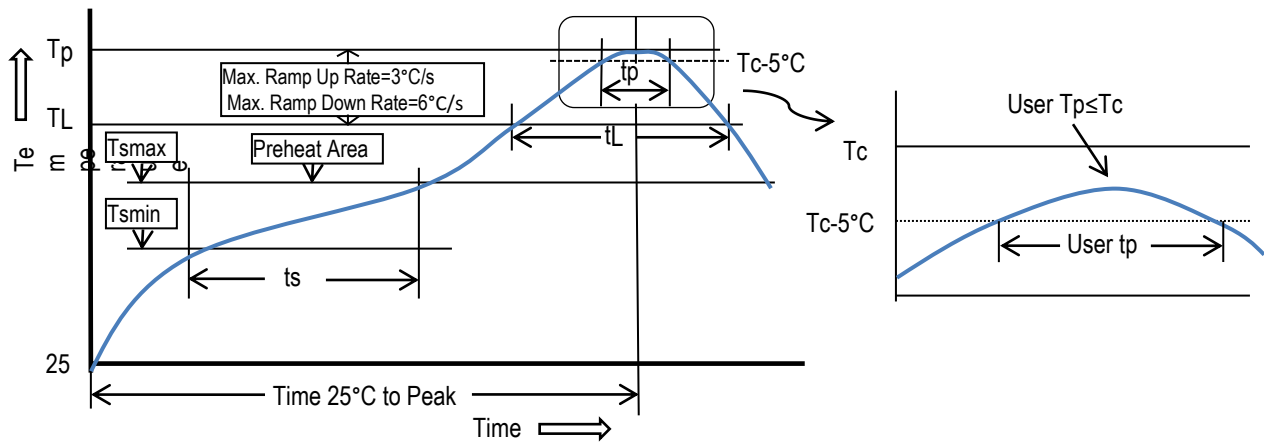
**FH32 Product Marking** “F”: Frequency shift keyed silicon oscillator. “●”: Pad 1 index (top view); “M”: Mercury



**FH53 Product Marking** “FH”: Frequency shift keyed silicon oscillator; “●”: Pad 1 index (top view); “MEC”: Mercury



**Recommended Solder Reflow Profile**(perIPC/JEDEC J-STD-020D.1)



Profile Feature	Sn-Pb Eutectic Assembly	Pb-free Assembly
Preheat/Soak		
- Temperature min. ( $T_s$ min.)	100°C	150°C
- Temperature max. ( $T_s$ max.)	150°C	200°C
- Time ( $t_s$ ) ( $T_s$ min. to $T_s$ max.)	60 to 120 seconds	60 to 180 seconds
Ramp-up rate ( $T_L$ to $T_p$ )	3°C / sec. max.	3°C / sec. max.
Liquidous temperature ( $T_L$ )	183°C	217°C
Time ( $t_L$ ) maintained above $T_L$	60 to 150 seconds	60 to 150 seconds
Peak package body temperature ( $T_p$ )	235°C	260°C
Time ( $T_p$ ) within 5°C of the classification temperature $T_c$	10 to 30 seconds	20 to 40 seconds
Ramp-down rate ( $T_p$ to $T_L$ )	6°C / second max.	6°C / second max.
Time 25°C to peak temperature	6 minutes max.	8 minutes max.

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