Soldering guidelines for Statek's surface-mount crystals and oscillators

1. Introduction

Statek's crystals and oscillators are hermetically sealed low thermal-mass devices requiring special attention before subjecting them to a soldering process. To avoid compromising the integrity of the seal or damaging the device, the temperature must not exceed a maximum allowable peak temperature for a maximum allowable time.

Herein, we provide recommendations for surface-mount devices that have a maximum operational temperature of 200°C or lower. For through-hole and high-temperature devices, please contact the factory. In Section 2, we present general guidelines. In Section 3, we summarise the guidelines by device family. In Section 4, we provide a few tips for hand soldering. Lastly, in Section 5, we note some of the consequences of failing to follow the guidelines given here.

2. General guidelines

For surface-mount devices that have a maximum operational temperature of 200°C or lower, we recommend that the solder-reflow temperature, time, and ramp rate not exceed the limits given in Table 2. An example of an acceptable solder-reflow profile for these devices is given in Figure 1.

Statek offers the five termination options given in Table 1 for its surface-mount devices.

TABLE 1. SM Termination options

Option	Description	Pb free
SM1	Gold plated	Yes
SM2	Solder plated	No
SM3	Solder sipped	No
SM4	Solder plated	Yes
SM5	Solder dipped	Yes

The SM1 termination is a gold plated pad and the solder-reflow profile must not exceed the maximum allowable temperatures, times, and rates given in Table 2 to avoid damaging the device.

The SM2 and SM3 terminations contain Sn63Pb37 solder while the SM4 and SM5 terminations contain a Pb-free Sn-based solder. In these four cases, the solder-reflow profile must be both hot enough to melt the termination's solder and yet not so hot that it damages the device.

3. Guidelines by device family

3.1. CX surface-mount crystals

All CX-series surface-mount (SM) crystals have a high-temperature-solder seal rim. Keep the peak temperature under 260°C to avoid reflowing this solder.

3.2. Surface-mount oscillators

While many of Statek's surface-mount oscillators have a solderless seal, for those with a maximum operational temperature of 200°C or lower, we recommend keeping the peak temperature under 260°C in all cases to avoid damaging the oscillator IC, as well as to avoid reflowing the solder of those that do have a solder seal.

4. Hand soldering considerations

When hand-soldering crystals (e.g., during prototyping), avoid touching the soldering iron to the seal rim or the lid itself. Also, use either a fine-tipped soldering iron, or better yet a dual-tipped SMD iron (preferably with temperature control).

info@IQDfrequencyproducts.com www.IQDfrequencyproducts.com
UK Office: +44 (0) 1460 270200 US Office: +1 760668 8935
IQD Frequency Products Ltd, Station Road, Crewkerne, Somerset TA18 8AR UK

5. Consequences of failing to follow the guidelines given in Table 2

If the maximum temperature/times given in Table 2 are exceeded, possible consequences are:

1. *Reflow of the solder seal.* This should be considered a catastrophic failure. For example, crystals, having a vacuum interior, will have molten solder forced into the interior of the package. Not only is this solder a contaminant (e.g., a potential cause of shorts in tuning-fork crystals), it will normally cause the frequency to be abnormally low (by hundreds or thousands of ppm) and the resistance to be high. Further, with the seal now broken, the frequency and resistance can continue to change quickly over time.
2. *Abnormal frequency shifts*. Subjecting the crystal or oscillator to excessive temperatures (or acceptable temperatures for excessive times) can result in unacceptable frequency shifts.

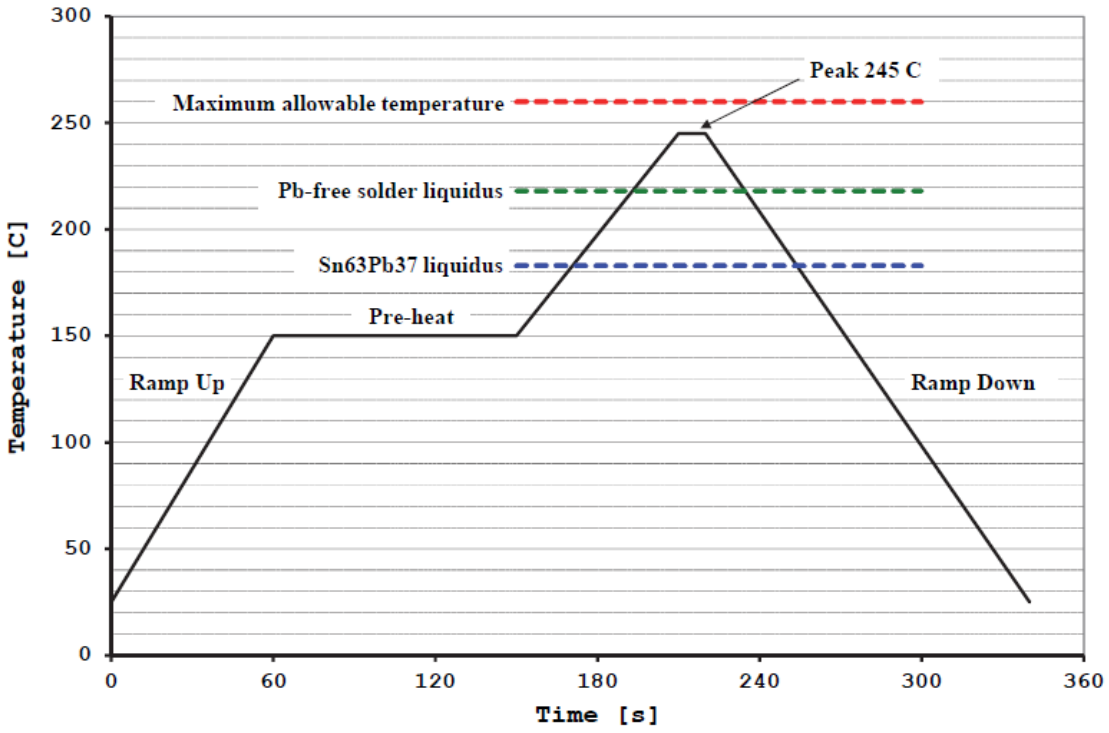

FIGURE 1. An acceptable solder-reflow profile for Statek surface-mount crystals and oscillators that have a maximum operational temperature of 200°C or lower

TABLE 2. Maximum solder-reflow temperatures/times/rates for Statek surface-mount crystals and oscillators that have a maximum operational temperature of 200°C or lower

Device Family	Example members	Max Temp/Time	Max Ramp Rate
CX Crystals	CX1, CX4, CX9, CX11, CX16, CX18, and CX20 with SM1, SM2, SM3, SM3, SM4, or SM5 termination	260°C for 20s	±5°C/s
Oscillators	CXOM, CXO3M, HGXO, CXOX, CXOMK, CXOL, CXOQ, , DFXO, STXO	260°C for 20s	±5°C/s

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