



Soldering guidelines for Statek's 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, and even then the time at this peak temperature must not exceed a maximum allowable time.

In Section 2 and 3, we present the guidelines for Statek's surface-mount and through-hole devices. In Section 4, we summarize the guidelines by device family. In Section 5, we provide a few tips for hand soldering. Lastly, in Section 6, we note some of the consequences of failing to follow the guidelines given here.

2. Surface-mount devices

For surface-mount devices, 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 dipped	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. Through-hole devices

For through-hole (leaded) devices, we recommend that the package temperature not exceed the temperature given in Table 3.

4. Guidelines by device family

4.1 CX SM crystals

All CX-series SM-version crystals have a high-temperature-solder seal rim and keeping the peak temperature under 260 °C avoids reflowing this solder.

4.2 CX leaded crystals

While care should be taken not to reflow the solder in the package seal-rim, it is also important not to melt the lead-attach solder (Sn63Pb37) by keeping the temperature under 175 °C.

4.3 CX -01 crystals

The CX -01 termination crystal is no longer a standard Statek product. It is a "surface-mount" part intended for mounting using conductive epoxy and is not appropriate for a SMT solder-reflow process.

4.4 Surface-mount oscillators

The Statek surface-mount oscillators all have a high-temperature-solder seal rim and keeping the peak temperature under 260 °C avoids reflowing this solder.

4.5 Leaded oscillators

4.5.1 LXO and LXOM

The Statek LXO and LXOM oscillators contain Sn63Pb37 solder, so keep the temperature under 175 °C to avoid melting this solder.

4.5.2 TO-39 oscillators

The Statek leaded oscillators in metal TO-39 packages contain high-temperature solder and keeping the peak temperature under 260 °C avoids reflowing this solder.

5. 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).

6. Consequences of failing to follow the guidelines in Tables 2 and 3

If the maximum temperature/times given in Table 2 or Table 3 are exceeded, possible consequences are

1. *Reflow of the solder-seal rim.* 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. *Reflow of the lead-attach solder.* While not as catastrophic as reflow of the solder-seal rim, this will disrupt or even prevent the assembly of the crystal.
3. *Abnormal frequency shifts.* Subjecting the crystal or oscillator to excessive temperatures (or acceptable temperatures for excessive times) can result in unacceptable frequency shifts

Table 2—Maximum solder-reflow temperatures/times/rates for surface-mount devices

Device family	Example members	Max Temp/Time	Max Ramp Rate
CX SM crystals	CX1, CX2, CX3, CX4, CX6, CX7, CX8, and CX9 with SM1, SM2, SM3, SM3, SM4, or SM5	260 °C for 20 s	±5 °C/s
Surface-mount oscillators	CXO, CXOM, CXO3M, HGXO, LSC, LSM, SQXO-2-SM, DQXO-3-SM	260 °C for 10 s	±5 °C/s

Table 3—Maximum package temperatures for through-hole devices

Device family	Example members	Max Temp/Time
CX leaded crystals	CX1-03, CX2-02, CX2-03, CX2-04	175 °C for 10 s
LXO & LXOM oscillators	LXO, LXO-1, LXOM	175 °C for 10 s
TO-39 oscillators	DQXO-3, LQXO-4, SQXO-2	260 °C for 10 s

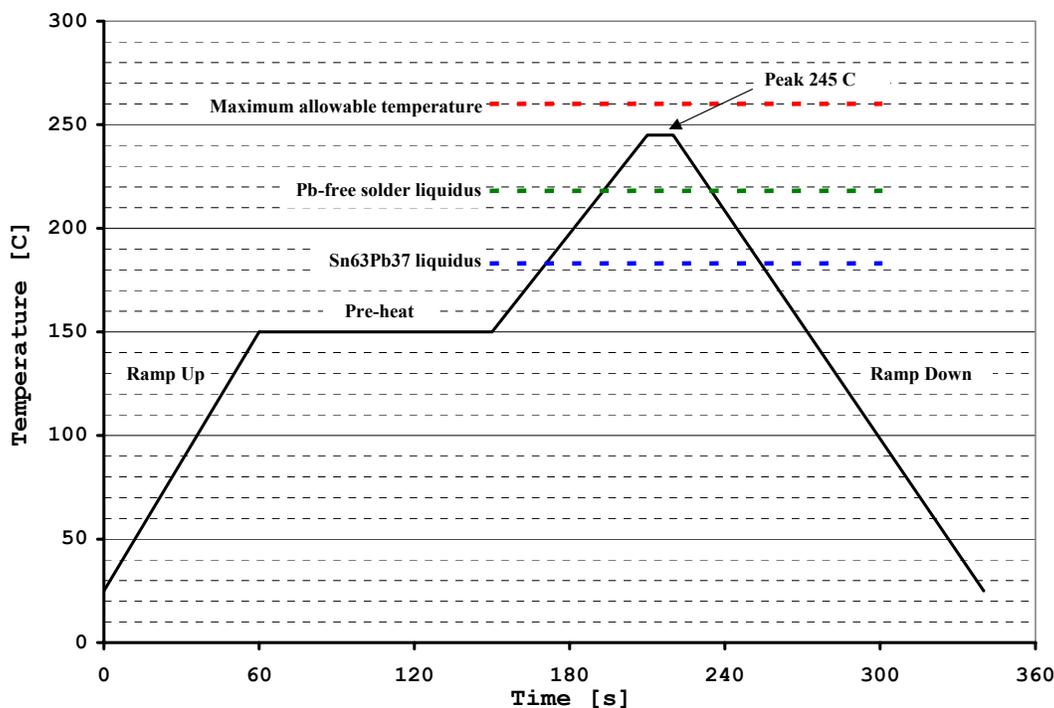


Figure 1—An acceptable solder-reflow profile for Statek CX SM crystals and surface-mount oscillators.