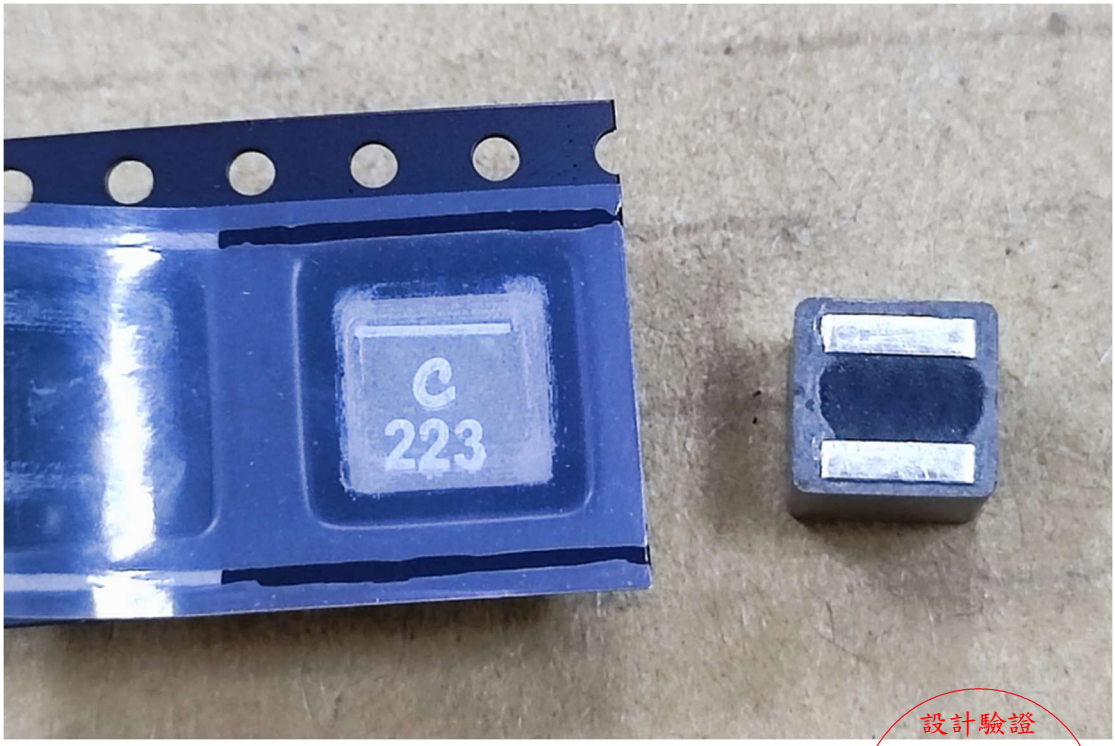


設計驗證
工程課
2024-05-03
發行
鈺緯科技開發股份有限公司

XiYang Town, MeiJiang District
GuangDong Province
514768 P.R. China
广东省梅州市梅江区西阳镇

Ph: 0753-2882922/2882638
Fax: 0753-2884467
www.coilcraft.com

COILCRAFT SPECIFICATION FOR APPROVAL

CUSTOMER: DIVA Laboratories. Ltd.

DESCRIPTION: Shielded Power Inductors

CUSTOMER PART NO: 3LCH220441Y (L0194)

COILCRAFT SAMPLE NO: XAL6060-223MEC

PREPARED BY: YX Mao DATE: 2024-5-3

CHECKED BY: Jenny Li DATE: 2024-5-3

APPROVED BY: DH Chen DATE: 2024-5-3

CUSTOMER APPROVAL SIGNATURE

DISPOSITION:

□ APPROVED □ REJECTED □ OTHERS

AUTHORIZED SIGNATURE:

設計驗證
工程課
2024-05-03
發行
鈺鐸科技開發股份有限公司

DATE:

Form Rev. A

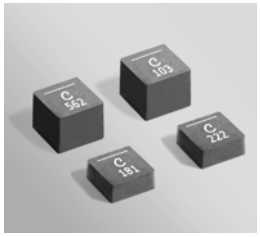
Revision History

Rev. No.	Date of change	Reason/ Detail of revision
1.0	2024-05-03	First Edition.

This product may not be used in medical or high risk applications without prior Coilcraft approval.

Specification subject to change without notice. Please check web site for latest information.

1. ELECTRICAL SPECIFICATION



- High current; very low DCR
- Soft saturation
- AEC-200 Grade 1 (–40°C to +125°C)

Part number[1]	Inductance[2] ±20% (µH)	DCR (mOhms)[3] typ	DCR (mOhms)[3] max	SRF typ[4] (MHz)	Isat[5] (A)	Irms (A)[6] 20°C rise	Irms (A)[6] 40°C rise
XAL6060-223MEC	22	55.12	60.63	9.0	5.6	3.6	5.0

1 When ordering, please specify **termination** and **packaging** codes: e.g. XAL6060-223M**EC**

Termination: **E =** RoHS compliant tin-silver over copper.

Special order: T = RoHS tin-silver-copper (95.5/4/0.5) or **S** = non-RoHS tin-lead (63/37).

Packaging: **C = 7" machine-ready reel**

EIA-481 embossed plastic tape. Quantities less than full reel available: in tape (not machine ready) or with leader and trailer ($25 charge).

B = Less than full reel

In an effort to simplify our part numbering system, Coilcraft is eliminating the need for multiple packaging codes. When ordering, simply change the last letter of your part number from B to C.

D = 13" machine-ready reel

EIA-481 embossed plastic tape. Factory order only, not stocked.

2 Inductance tested at 1MHz, 0.1 Vrms, 0 Adc.

3 DCR measured on a micro-ohmmeter.

4 SRF measured using Agilent/HP 4395A or equivalent.

5 Isat: DC current at 25°C that causes an inductance drop of 30% (typ) from its value without current.

6 Irms: Current that causes the specified temperature rise from 25°C ambient. This information is for reference only and does not represent absolute maximum ratings. **Irms testing was performed on 0.75 inch wide × 0.25 inch thick copper traces in still air. Temperature rise is highly dependent on many factors including pcb land pattern, trace size, and proximity to other components. Therefore temperature rise should be verified in application conditions.**

7 Electrical specifications at 25°C.

8 **Operating voltage:** 0 – 60 V

9 **Ambient temperature:** –40°C to +125°C with (40°C rise) Irms current.

10 **Maximum part temperature:** +165°C (ambient + temp rise).

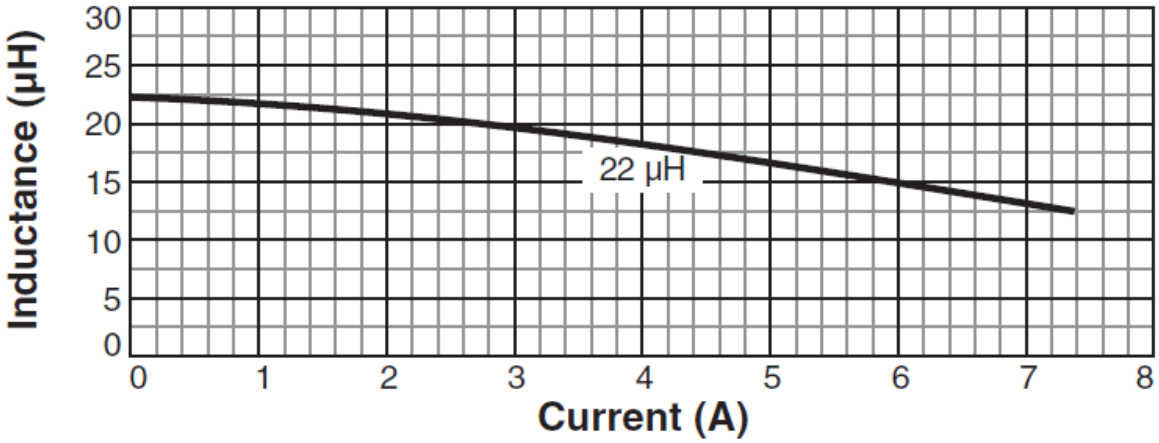
11 **Storage temperature:** Component: –55°C to +165°C

Tape and reel packaging: –55°C to +80°C

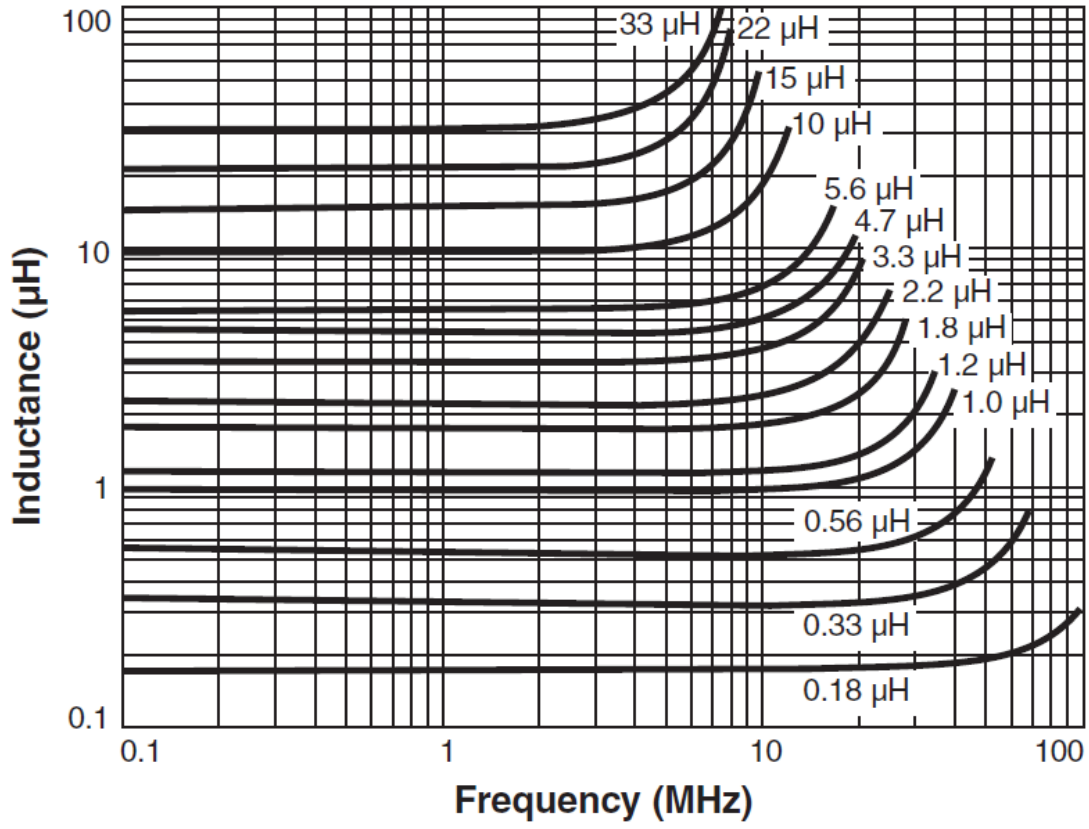
12 **Resistance to soldering heat** Max three 40 second reflows at +260°C, parts cooled to room temperature between cycles.

13 **Moisture Sensitivity Level (MSL) 1** (unlimited floor life at <30°C / 85% relative humidity)

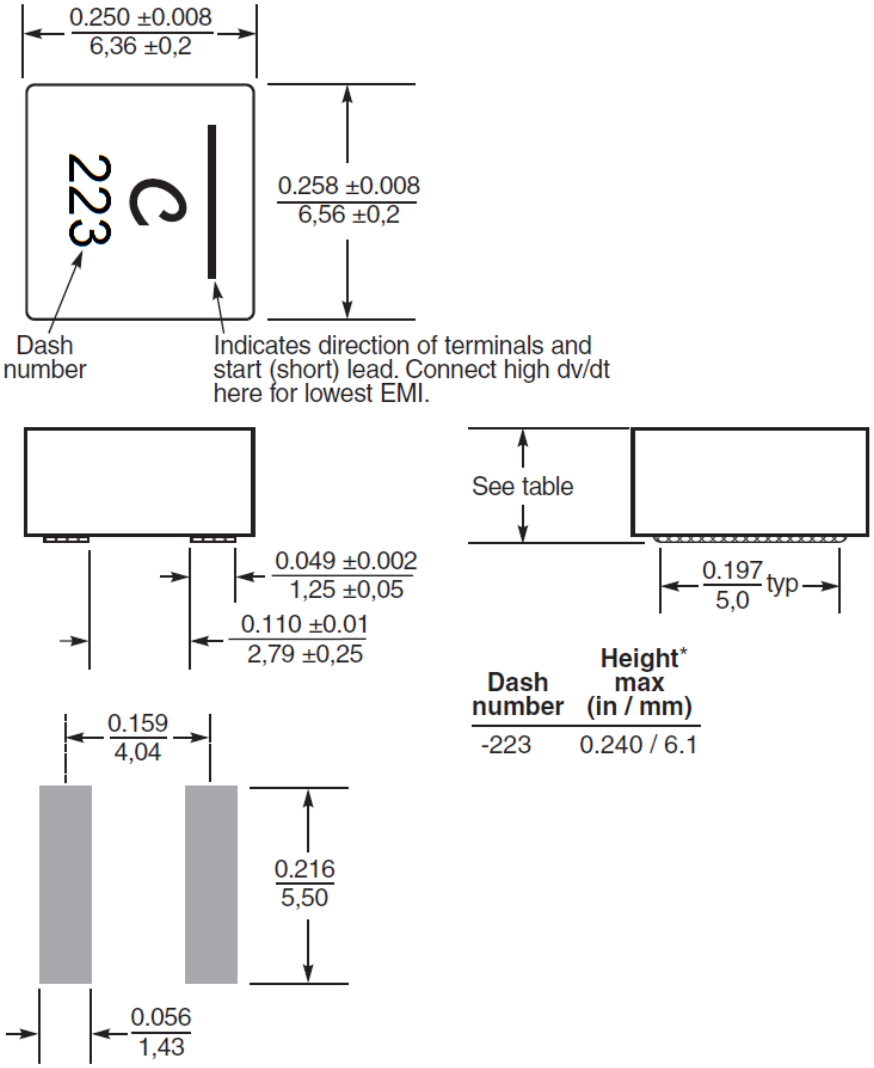
2. L vs Current



3. Typical L vs Frequency (reference 22 µH)



4. DIMENSION



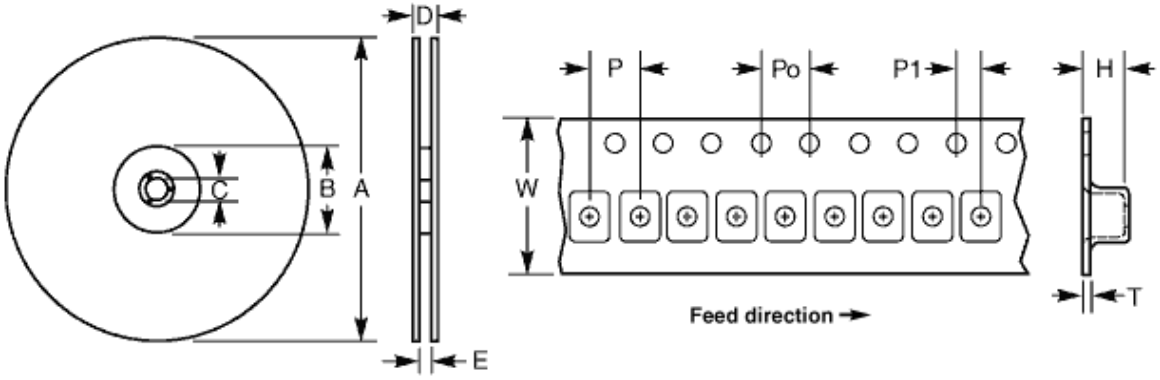
Dash number	Height* max (in / mm)
-223	0.240 / 6.1

Recommended Land Pattern

Dimensions are in inches / mm

* For optional tin-lead and tin-silver-copper terminations, dimensions are for the mounted part. Dimensions before mounting can be an additional 0.005 inch / 0.13 mm.

5. PACKING SPECIFICATION



Parts per reel		Reel dimensions (mm)					Tape dimensions (mm)						Orientation
7" (178 mm)	**13"** (330 mm)	**A**	**B**	**C**	**D**	**E**	**W**	**P**	**Po**	**P1**	**H**	**T**	
250	750*	178/330	60/100	13	22,4	16,4	16	12	4	2	6,23	0,4	

* Special order

When ordering, please specify **termination** and **packaging** codes: e.g. XAL6060-223ME**C**

Packaging: **C = 7" machine-ready reel**

EIA-481 embossed plastic tape. Quantities less than full reel available: in tape (not machine ready) or with leader and trailer ($25 charge).

B = Less than full reel

In an effort to simplify our part numbering system, Coilcraft is eliminating the need for multiple packaging codes. When ordering, simply change the last letter of your part number from B to C.

D = 13" machine-ready reel

EIA-481 embossed plastic tape. Factory order only, not stocked.

ENVIROMENTAL

General

Operating temperature range

Specification

As specified on component data sheet.

Environmental/Life

Static humidity

Specification

There must be no change in appearance.

Inductance must not change more than stated tolerance.

Test method/condition

Inductors shall be subjected to 85℃, 85% relative humidity for 1000 hours.

Inductors are to be tested after being air dried for one day.

Thermal shock

Specification

There shall be no case deformation or change in dimensions.

Inductance must not change more than the stated tolerance.

Test method/condition

Inductors shall be subjected 300 times to the following temperature cycle: -40℃ for 15 minutes to maximum operating temperature for 15 minutes; transition time less than 20 seconds.

Inductors are to be tested after one day at room temperature.

Thermal cycling

Specification

There shall be no case deformation or change in dimensions.

Inductance must not change more than the stated tolerance.

Test method/condition

Inductors shall be subjected 1000 times to the following temperature cycle: -40℃ for 15 minutes to maximum operating temperature for 15 minutes; transition time 10 minutes.

Inductors are to be tested after one day at room temperature.

Low temperature storage

Specification

There must be no change in appearance.

Inductance must not change more than stated tolerance.

Test method/condition

Inductors shall be subjected to -55℃ ±2℃ for 1000 hours.

Inductors are to be tested after one day at room temperature.

High temperature load life

Specification

Inductors must not have a shorted or open winding.

Test method/condition

Inductors shall be stored at maximum operating temperature for 1000 hours with rated current applied. Inductors shall be inspected at start of test and at 1000 hours.
Inductors are to be tested after one day at room temperature.

Board flex

Specification

There must be no case deformation or open circuit during test.

Test method/condition

Inductors shall be mounted to PC board. Apply force to center of PC board to flex 2 mm min.

Moisture resistance

Specification

Inductors must not have a shorted or open winding.

Test method/condition

Inductors shall be subjected to ten 24-hour cycles at 25℃ to 65℃ at 80 to 95% relative humidity, per MIL-STD202 Method 106. Inductors are to be tested after one day at room temperature.

Vibration

Specification

There must be no case deformation or change in dimensions.
Inductance shall not change more than stated tolerance.

Test method/condition

Inductors shall be vibrated for 20 minutes at 5 G from 10 Hz to 2000 Hz per MIL-STD 202 Method 204.

Mechanical shock

Specification

There must be no case deformation or change in dimensions.
Inductance shall not change more than stated tolerance.

Test method/condition

Test per MIL-STD 202 method 213 test condition C. Test mounted samples in three axes, six times, totaling 18 shocks (100 G, 6 ms, half-sine).

Other

Solderability

Specification

The metalized area must have 90% minimum solder coverage.

Test method/condition

Dip pads in flux (Alpha 100 or equivalent) and dip in solder pot (96.5 Sn/3.0 Ag/0.5 Cu or 63 Sn/37 Pb solder) at 232℃ ±5℃. For parts less than or equal to 0.195" (4.95 mm) in length or width, dip for 5 seconds. For parts greater than 0.195" (4.95 mm) in length or width, dip for 20 seconds.

Resistance to soldering heat

Specification

There must be no case deformation or change in dimensions.

Inductance shall not change more than the stated tolerance.

Test method/condition

Test per MIL-STD-202 Method 210 Condition B. Inductors shall be reflowed three times onto a PC board using 96.5 Sn/3.0 Ag/0.5 Cu or 63 Sn/37 Pb solder paste. Allow 24 hours between reflows.

For 96.5 Sn/3.0 Ag/0.5 Cu solder paste: >217℃ for 90 seconds.

Solder process shall be at a maximum temperature of 260℃.

For 63 Sn/37 Pb solder paste: >183℃ for 120 seconds.

Solder process shall be at a maximum temperature of 235℃.

Component adhesion (push test)

Specification

2.7 kg

Test method/condition

Inductors shall be reflow soldered (260℃ ±5℃ for 10 seconds) to a tinned copper substrate. A force gauge shall be applied to the side of the component. Inductors must withstand the stated force without a failure of the termination to component attachment.

Resistance to solvent

Specification

There must be no change in appearance or obliteration of marking.

Test method/condition

Inductors must withstand 6 minutes of alcohol.

Flammability

Specification

IEC 60695-2-2

Test method/condition

Inductors must withstand needle-flame test.

Soldering Surface Mount Components

Proper soldering maximizes the strength and conductivity of the connection

Introduction

Soldering is the process of using a metal alloy with a low melting temperature (solder) to fuse the electrical contacts of a component to the pads of a circuit board. Proper soldering maximizes the strength and conductivity of the connection. Poor soldering can result in weak connections, higher resistance that causes heat buildup at the connection, and possible failure of the component.

The type of components and the pads to which they will be attached dictate the appropriate soldering method. The correct amount and duration of heat to be applied is a function of the heat transfer characteristics of the component, the circuit board, the solder pads, the solder (and flux), and the environment in which the soldering takes place. For this reason, effective soldering requires reasonably controlled conditions. Some experimentation is usually required to determine the optimal conditions for each application.

Types of Solder

Solder comes in the form of paste, wire (also called string solder), bar, and in preformed shapes. There are many alloy combinations of solder, but the most common combination for electronics has been 63Sn/37Pb (63% Tin, 37% Lead) solder, which has a melting point of 183°C (361°F).

Environmental regulation agencies are urging the use of low-lead or no-lead solders. A common no-lead solder composition is 96.5% Tin / 3.5% Silver. Tin / Silver solder has a higher melting temperature (221°C / 430°F), which could cause process difficulties when used as a replacement for lead-based solder. The entire circuit must be designed to withstand the higher temperatures used for the low-lead or no-lead solders. Another environment-friendly option, "no-clean" solders are used in applications where post-reflow cleaning using CFC-based cleaners is to be avoided.

Flux

Soldering flux is applied to the connection area to remove oxidation from the metal surfaces to be soldered, and to aid in solder flow. If metal oxidation is not removed, solder does not adhere well to the solder pad. Flux can be applied separately, just before applying the solder, or simultaneously when using solder paste or rosincore solder.

Solder paste typically contains flux, and rosin-core solder has a center core of flux. As these types of solder melt, flux is released, eliminating the need for a separate flux application.

General Soldering Guidelines

All soldering applications require the following considerations:

- **Preparation** – Clean connections are essential to soldering. Clean connections maximize the ability of the solder to adhere uniformly to the joint surfaces (wetting).
- **Soldering Method** – The component type and size, and your specific application determine the soldering method.
- **Materials Selection** – The component contacts, circuit board pads, solder, and flux materials must all be compatible with the soldering method.
- **Maximum Temperature** – The soldering materials and method determine the temperature profile. All components must be able to withstand the maximum exposure temperature of the soldering operation for the specified time duration.

Soldering Methods

The appropriate soldering method depends on the specific application, production volume and time requirements, and the types of components to be soldered. Automatic methods include wave, infrared (IR) reflow, air convection reflow, radiant heating reflow, and vapor phase soldering. Manual methods include using a soldering iron with wire-type solder, or reflow using wire solder or paste and a hot air pencil or gun.

When using only surface mount technology (SMT) components, a reflow process is best. For thru-hole components, and where thru-hole and SMT components are combined on the same board, a wave soldering process is typically used. In some cases, combinations of wave soldering and reflow soldering are used. When manually soldering SMT components, a nickel barrier is strongly recommended.

Thermal Profiles

With any soldering method, the optimal preheating, heating, and cooling cycle chosen for a particular method results in complete wetting of all solder joints and minimized thermal stresses. Too little heat does not allow the solder to melt and flow properly. Too much heat can cause oxidation to take place before the solder solidifies, resulting in a "cold" solder connection. Too much heat can also cause damage to the component or circuit board. Cold solder connections are weaker and have higher resistance than a normal connection. Heating or cooling too quickly can cause thermal shock leading to cracked materials. The recommended cooling method is always gradual cooling to room temperature in order to avoid thermal shock.

Reflow Profile

As with all soldering methods, the optimal reflow profile for a circuit board assembly is dependent on the solder material, solder amount, flux, temperature limit of each soldered component, heat transfer characteristics of the circuit board and component materials, and the layout of all components. For example, a component with a heat-sink element attached may require a longer heating cycle than other components on the same circuit board. The temperature versus time limitation of the least robust component of the circuit board assembly ultimately may determine the actual temperature profile that must be used. For these reasons, Coilcraft does not specify soldering profiles for our components.

Contact the solder, circuit board and component manufacturers to determine the temperature limits for your particular application. See **Temperature Limits** for our chip and power inductor maximum temperature specifications.

Solder Amount

An optimal solder fillet is determined by part size, termination style, and pad geometry. Experimentation is recommended to establish the amount of solder to be applied to the connection. The solder fillet radius should be approximately the height of the inductor terminal. Optimal solder fillets for a chip inductor, power inductor, and "Spring" inductor are shown in Figure 1.

Part Positioning

Tombstoning (also called drawbridging) is when one end of a component tips up during soldering. It results from uneven forces on the ends of the part. To avoid tombstoning or other movement of SMT components during soldering, ensure that the solder quantity, positioning, and heating is even at all solder joints.

The magnetic fields of unshielded inductors couple when placed in close proximity to each other. The closer the spacing, the stronger the magnetic coupling. To minimize inductor coupling, avoid narrow spacing between solder lands of adjacent inductors.

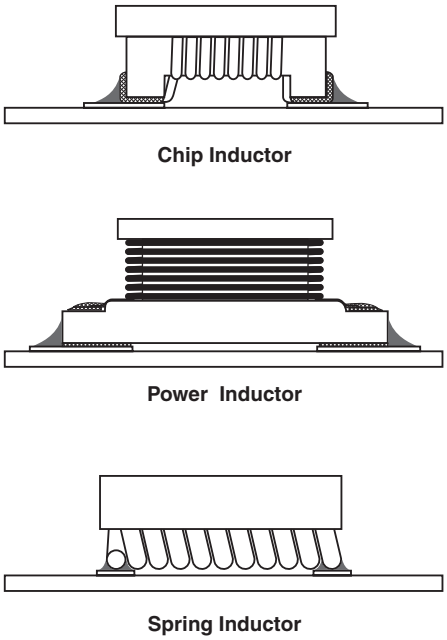


Figure 1. Optimal Solder Fillets

Adhesives

If an adhesive is used to pre-attach the component, make sure that it is kept as far as possible from the solder joint area. If too much adhesive is used, it can creep into the solder joint, causing soldering problems.

Reworking Soldered Joints

When manually reworking soldered joints, hot air reflow is recommended as a more controlled method than using a soldering iron. If a soldering iron must be used, follow the manual soldering technique described later.

Chip Inductor Soldering

Use the following table as a guideline for selecting a soldering method based on the size of a surface-mount component. The preference of a soldering method is based on temperature control and even heat distribution. Reflow is always the preferred automatic method for even and controlled soldering. Wave soldering is discouraged as it requires the part to be secured to the board in a separate operation before soldering. When soldering manually, a hot air pencil provides a reasonably controlled and evenly distributed amount of heat to a solder connection without making direct contact. Soldering smaller size chip inductors with a soldering iron is discouraged due to lack of temperature control, although it may be possible under carefully controlled conditions. Only chip inductors with a nickel barrier as part of the termination should be soldered manually.

Size	Soldering Method			
	Automatic		Manual	
	Reflow	Wave	Hot Air Pencil	Soldering Iron
0201	P	A	P	A
0302	P	A	P	A
0402	P	A	P	A
0603	P	A	P	O
0805	P	A	P	O
1008	P	A	P	O
1206	P	A	P	O
1812	P	A	P	O

Key: P = Preferred; O = Optional; A = Avoid

Temperature Limits

Our chip inductors meet the following resistance to soldering heat condition: Three reflows at >217°C for 90 seconds (+260°C ±5°C for 20–40 seconds), allowing parts to cool to room temperature between.

Power Inductor Soldering

The same logic for choosing a chip inductor soldering method can be applied to power inductor soldering. Reflow is the preferred method for SMT components. Other methods are possible, but typically do not offer process controls comparable to reflow methods.

Temperature Limits

Our power inductors meet the following resistance to soldering heat condition: Three reflows at >217°C for 90 seconds (+260°C ±5°C for 20–40 seconds), allowing parts to cool to room temperature between.

Manual (Hand) Soldering Technique

While the amount of solder, and the amount and duration of heat to be applied are application-specific, the following general hand-soldering guidelines will lead to consistent and reliable solder connections. A hot air pencil is preferred for even heat application and control, however, the following technique applies to hand-soldering of surface-mount or thru-hole electronic components using rosin-core solder and a soldering iron.

Preparation

Before beginning the soldering process, identify the solder composition and flux type (if you're not using rosin core solder). The solder type dictates the appropriate temperature of the soldering iron tip. Use small diameter wire solder for soldering small SMT components.

Before heating the soldering iron, select an appropriate size tip. Use a smaller tip for fine work and a larger tip for larger connections. Clean the tip of any contamination or oxidation. Try not to scratch the tip surface, as scratches cause the tip to lose heat too quickly. Place a sponge, soaked in cold water, nearby for frequent tip cleaning between soldering operations.

Clean the electronic component's contacts/leads and the circuit board pads of any contamination or residue.

Soldering Iron Temperature

The optimum temperature setting is the lowest one that allows the solder to melt completely and flow into the solder connection.

A temperature-controlled soldering iron is recommended, especially for fine wire applications. Check the solder manufacturer's temperature recommendations for the specific solder type. The solder manufacturer may only provide the melting temperature range, so you may have to experiment to determine the appropriate soldering iron tip temperature.

Place the Component

Center the electronic component on the circuit board mounting pads. For thru-hole components, feed the leads through the holes and bend the end of the lead over to hold it in place.

Tin Soldering Iron Tip

Apply a small amount of solder to the heated soldering iron tip. This aids in conducting heat to the solder connection and prevents the tip from overheating. A clean, tinned soldering iron tip appears shiny. An overheated or burnt tip appears brown or black. Water soluble flux tends to wick up and away from the soldering iron tip, causing it to overheat. No-clean solders contain less flux, and may require more frequent tinning of the tip.

Pre-tinning the component leads/contacts and the circuit board pads can also improve the solderability of the connection.

Heat the Connection

If you are using a separate flux, apply a small amount to the connection area.

Apply the soldering iron tip to the opposite side of the connection to where the solder is applied. Hold the tip of the soldering iron for a few seconds against the connection so that it touches the component lead/contact and the circuit board pad. For larger connections, more heating time may be required.

Apply the Solder

Touch the end of the solder wire to the heated connection on the side opposite of the soldering iron tip. Allow the solder to flow into the connection. If the heating is sufficient, the solder spreads out into the connection and wicks up

onto the component lead/contact. Once this happens, stop adding solder, and then remove the soldering iron.

Do not move the component or board until the solder connection cools for a few seconds. Moving the component or board before it cools can result in a “cold” solder connection.

When soldering is complete, clip off excess lead lengths close to the connection. Use an ohmmeter to check for a short or open connection.

Further reference

Selecting Flux for Soldering Coilcraft Components

PCB Washing and Coilcraft Parts

Kester, Inc. (www.kester.com)

Indium Corporation of America (www.indium.com)

Alpha Metals (www.alphametals.com)

Soldering Surface Mount Components

RoHS compliant components

For all soldering methods, the optimal reflow profile for a circuit board assembly is dependent on several factors other than just the Coilcraft component and the chosen solder paste, such as the size and layout of all components. Large parts may require higher temperatures or a longer preheat time, whereas smaller parts (0201, 0402) may require extra considerations to avoid damage to the components.

Following are general guidelines (See Table 1.) that should only be considered a starting point for development of a proper reflow profile that considers, at a minimum, part size, the specific customer-chosen solder alloy, and the PCB component population. No single reflow profile covers all possible circuit board designs.

Table 1. General Guidelines

	RoHS	Units
Preheat / Soak Temperature	150 – 200	°C
Preheat / Soak Duration	60 – 120	seconds
Ramp-up Rate	3	°C/second
Typ. Reflow Temperature	217	°C
Peak Temperature	255 – 260	°C
Time Within 5 °C of Peak	30	seconds
Time Above Reflow Temperature	60 – 150	seconds
Ramp-down Rate	6	°C/second

