

APPLICATION NOTE

MOUNTING AND SOLDERING OF PC AND BC SERIES PRODUCTS

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MAXWELL TECHNOLOGIES APPLICATION NOTE: Mounting and Soldering of PC and BC Series Products

Maxwell PC and BC family of products are designed to be mounted to PC boards and to accept solder as a means of attaching those products to the PCB. Maxwell has converted these products to be compliant with the requirements of the RoHS directive and, as such, has moved to lead-free preparations that require adjustments in the processes which are used to interconnect these compliant products to the PCB.

NOTE: Please note that the process and parameters described in this document were developed on specific equipment. The parameters will apply to that equipment and it is very likely that alternative pieces of equipment will require adjustment and fine tuning of those parameters to achieve an optimized result.

PC Series Products (PC5, PC10)

PC products covered by the application note include all PC5 and PC 10 products. The changes to these parts as necessitated by RoHS and the lead-free specifications required that Maxwell change the tinning on the leads of the part to a lead-free composition. That in turn requires adjustment to the soldering processes needed for these components.

Hand Soldering PC Products

In order to hand solder PC products good soldering practices must apply. It is assumed in this document that the user has experience with hand soldering of electronic components and that fundamental soldering processes are understood.

Maxwell has transitioned to a lead-free tin on the leads of the PC parts. In addition, there has been a move toward lead-free board designs which means that lead-free soldering techniques must be employed. The tinning process applies a thin film of lead-free alloy to the leads. The composition of the alloy is:

96.5 Sn ,3.0 Ag ,0.5 Cu	or	99.3 Sn / 0.7 Cu
Melting Point: 217°C		Melting Point: 227°C

In general, lead-free soldering by hand requires higher heat and more active fluxes than solder containing lead as a constituent. Therefore new thermal profiles must be adopted and new cleaning agents should be utilized. The following are the parameters and materials that should be used for lead-free hand soldering of PC products:

Recommended Solder tip temperature: 343°C / 650°F

Solder Composition and size: Sn96.5Ag3.0Cu0.5 alloy, .062 dia

Recommended solder – Kester SN96227558 or K100LD – includes flux core, other solders are available on the market which are equivalent to this type. Flux – If not using flux core wire, use a halide free, activated rosin based flux. There are many such fluxes available on the market.

Maximum contact time with component leads – 10 seconds

NOTE: Excessive time in contact with the component leads will potentially damage the device.

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Limit lead contact time to 10 seconds

Wave Soldering PC Components

In order to wave solder PC components special attention must be paid to the dwell time and total time at temperature since the ultracapacitors are a temperature sensitive component. Below are the recommendations for wave soldering PC components from Maxwell.

NOTE: Maxwell wave soldering parameters represent recommended parameters for specific equipment. Other equipment may require adjustment of the parameters

Equipment used for parameter development: Electrovert Econopack 03

Recommended Solder Pot Temperature:	248°C / 478°F
Solder Composition:	Sn96.5Ag3.0Cu0.5 alloy
Recommended Flux:	Kester 2331ZX
Recommended Preheat:	Preheat board from bottom side only, bring top of board to 100C maximum immediately before soldering, preheat time will depend upon heating efficiency.
Conveyor speed:	2.8cm / sec
Dwell time:	2.5 seconds

NOTE: Do not exceed 100°C on the top of the board. Exceeding this temperature may result in damage to the parts

BC Axial Products (BCAP0120/0140/0310/0350 x250 T03)

BC products covered by this section include the Maxwell BCAP350, BCAP 310, BCAP140 and BCAP120 with axial connection points . All products comprising the BC series product line are RoHS compliant.

General Precautions

Excessive heat applied to the ultracapacitor during soldering processes may damage the component causing deterioration in performance and life. The following precautions should be followed when soldering the Maxwell ultracapacitor.

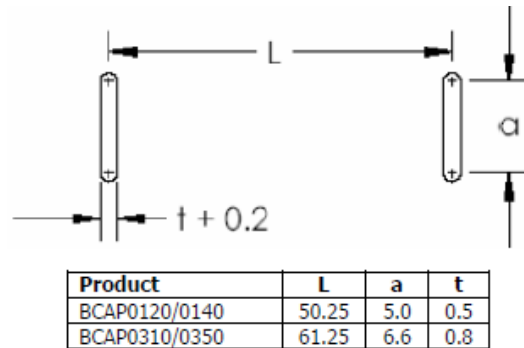
1. The ultracapacitor is polarized. Reference the label for positive and negative potentials.
2. The ultracapacitor case is at the negative potential. Insure that the case is adequately insulated from other components.

Mounting Recommendations

The tab style is similar to a fast on connector. Fast on connections may not be suitable for the RMS current for the application; therefore, the recommended mounting method is to solder.

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When soldering the recommended circuit board cut out is depicted in the following diagram in mm.



If lead tabs projecting through the PCB are not permitted, it is recommended to precut the tabs prior to installation. The cut length should be the thickness of the PCB plus 1.5 mm minimum. If permissible the preferred cut length is PCB plus 2.0 mm.

The end to end spacing for mounting capacitors in series may be dependent on certification requirements and system voltage level.

The tab connections are not intended to support the capacitor weight during shock and vibration in an application. The products are designed to provide a 1 mm body standoff of the capacitor body to the PCB. Provisions should be made to alleviate the tabs from supporting the capacitor weight during mounting. It is recommended that the ultracapacitor body be seated against the PCB with RTV sealant. Make sure the ultracapacitors are seated and aligned. To ensure even flow during soldering, the PCB slots should be aligned in the flow direction during soldering.

Solder Tab Composition

The lead tabs are comprised aluminum alloy. The earlier A01, A03 versions of the BCAP350/310 and the BCAP140/120 are nickel-plated, 200-400 microns thick followed by gold plating 3 microns thick. The new B01 version of the BCAP0350/0310 are nickel plated - 1um thick, followed by tin over nickel 2.5um thick.

Wave Soldering BC Components

Components are wave solderable. Wave soldering is used in the fabrication of BPAK and BMOD products based on the BC series capacitors. The recommended schedule for wave soldering is provided below. The recommendations are based on specific wave soldering equipment. Adjustments may be necessary due to equipment. The equipment used for establishing the following recommendation is Electrovert Econopack 03.

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The following recommendations are also specific to the type of solder chosen. With RoHS compliant materials:

Solder:	Sn96.5 Ag3.0 Cu0.5 alloy
Flux:	Kester 2331ZX
Solder pot temperature:	260°C
Recommended Preheat:	Bottom side only. Board temperature at top of board should be 100°C just before soldering.
Conveyor speed:	2.8 cm/sec
Dwell time:	2.5 seconds

Note: Selection of different soldering alloys and equipment may necessitate modifications to recommendations.

BC Radial Products (BCAP0310/0350 x270 T08/09)

BC products covered by this section include the Maxwell BCAP0350, BCAP0310, with radial connection points. All products comprising the BC series product line are RoHS compliant.

General Precautions

Excessive heat applied to the ultracapacitor during soldering processes may damage the component causing deterioration in performance and life. The following precautions should be followed when soldering the Maxwell ultracapacitor.

1. The ultracapacitor is polarized. Reference the label for positive and negative potentials.
2. The ultracapacitor case is at the positive potential. Ensure that the case is adequately insulated from other components.

Mounting Recommendations

PCB Thickness Compatibility

PCB Thickness*	Compatibility
<u>350F cell</u>	
Below 1.5 mm	Possible, but not recommended. Board may not support the mass.
Between 1.5 to 2.4 mm	Recommended
Between 2.4 to 3.2 mm	Possible, but not recommended
Over 3.2 mm	Not recommended/ not supported
<u>310F cell</u>	
Below 1.5 mm	Possible, but not recommended
Between 1.5 to 2.4 mm	Recommended
Over 2.4 mm	Not recommended/ not supported

*not including trace thickness

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PCB Hole Layout Dimensions

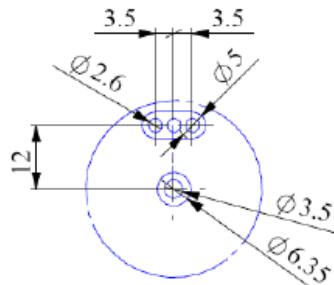


Figure 1. Board drillings for BCAP0310 P270 T10.

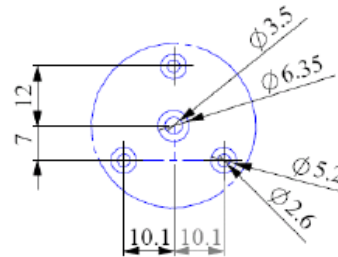


Figure 2. Board drillings for BCAP0350 E270 T11.

Solder Tab Composition

The lead tabs are comprised of Aluminum alloy. The tabs are Nickel plated followed by Tin over the Nickel. The Nickel thickness is 1um and the Tin thickness is 2.5um.

Hand Soldering Radial D-cell Components

In order to hand solder, good soldering practices must apply. It is assumed in this document that the user has experience with hand soldering of electronic components and that fundamental soldering processes are understood.

In general, lead-free soldering by hand requires higher heat and more active fluxes than solder containing lead as a constituent. The following are the parameters and materials that should be used for lead-free hand soldering:

Recommended Solder tip temperature:	343°C / 650°F
Solder Composition and size:	Sn96.5Ag3.0Cu0.5 alloy, .062 dia
Recommended solder –	Kester SN96227558 – includes flux core, other solders are available on the market which are equivalent to this type. Flux – If not using flux core wire, use a halide free, activated rosin based flux. There are many such fluxes available on the market.

Maximum contact time with component leads – 10 seconds

NOTE: Excessive time in contact with the component leads will potentially damage the device. Limit lead contact time to 10 seconds

Wave Soldering Radial D-cell Components

Components are wave solderable. Wave soldering is used in the fabrication of BMOD products based on the Radial D-cell capacitors. The recommended schedule for wave soldering is provided below. These recommendations are based on specific wave soldering equipment.

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Adjustments may be necessary due to equipment. The equipment used for establishing the following recommendation is Kirsten 5360.

Recommended wave soldering profile for printed circuit assembly using leaded eutectic alloy.

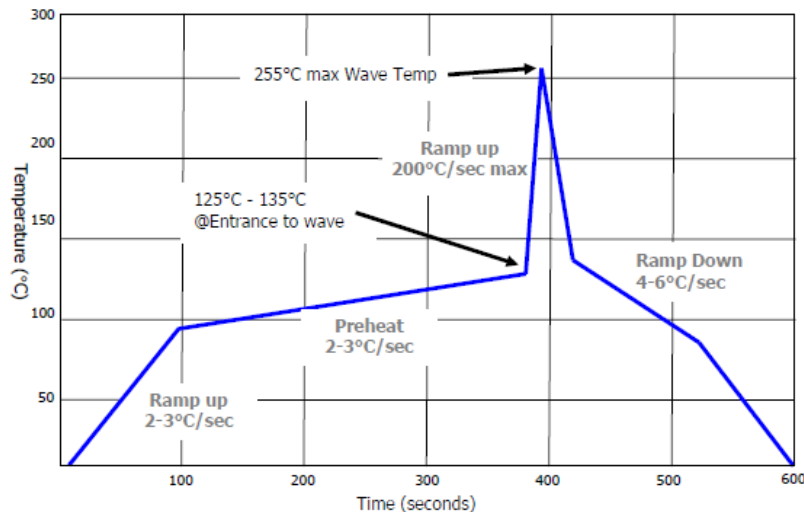


Figure 3. Recommended wave solder profile for Eutectic solder.

Total soldering process time from room temperature to peak temperature 255°C and cool down is 10 minutes Max. The time to reach the required temperatures depends on the design of the application and on the power of pre-heating section of the soldering machine.

All temperatures are measured on the leads of the component on top of the PCB.

Solder:	Eutectic Solder (Sn63/Pb37) 183°C
Recommended Flux:	Kester 2331ZX
Ramp Up Rate:	1°-3° C/sec. Max
Preheat:	140° to 170°C for 150 sec. Max
Temperature Entrance into Wave	~170°C
Ramp to Peak Temp:	200°C/sec.
Peak Temp:	240°C for 1.5 to 5 sec. Max
Cool Down Rate	6°C /sec. Max

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Recommended wave soldering profile for printed circuit assembly using lead-free alloy

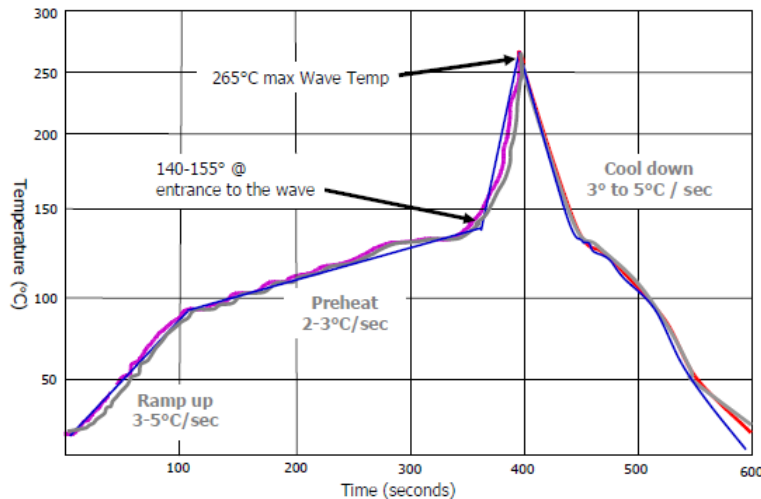


Figure 4. Recommended wave solder profile for "lead-free" process.

Total soldering process time from room temperature to peak temperature 265°C and cool down is 10 minutes max. The time to reach the required temperatures depends on the design of the application and on the power of pre-heating section of the soldering machine. All temperatures are measured on the leads of the component on top of the PCB.

Solder:	Lead-free (Sn96.5/Ag 3.0/Cu0.5) liquidus point 217°C
Recommended Flux	Kester 979T
Ramp Up Rate:	3°-5° C/sec. Max
Preheat:	140° to 155° C 2°-3° C/sec on top of board
Temperature entrance into wave:	140° to 155° C on top of board
Ramp to peak temp:	200°C/sec
Peak Temp:	265°C for 1.5 to 5 sec. Max
Cool Down Rate:	3°C-5°C /sec. Max
Conveyor Speed:	40-50 cm/min

Note : Due to the relatively high thermal mass of the component and especially if the total number or the density of components on the PCB is high, the use of a standard thermo-profiling device is strongly recommended to achieve good soldering results and to avoid excessive temperature in the capacitor.