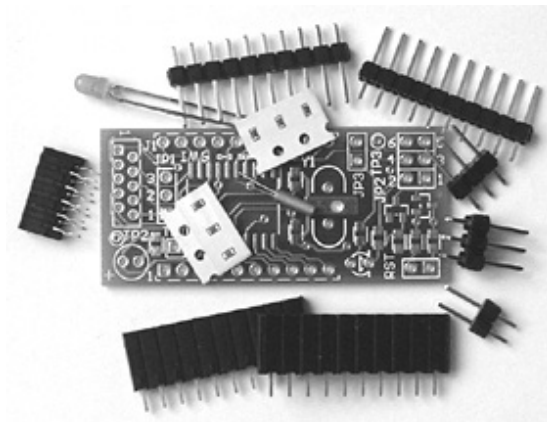


M-SERIES, MSP430 MODULES: Model M-28 and M-20

KIT ASSEMBLY GUIDE



Version 1.0

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WARRANTY INFORMATION

EMBEDDEDkits warrants that the Kit you receive shall contain all the components specified in the parts list, and that all components shall be free from defects for a period of 60 days from the date you receive the Kit. If, during such warranty period, (i) EMBEDDEDkits is notified promptly upon the discovery of any defective component(s), including a detailed description of such defect; (ii) the component(s) in question may be returned to EMBEDDEDkits, accompanied with a Return Material Authorization (RMA) number; and (iii) if EMBEDDEDkits examination of such component(s) reveals defects, not caused by accident, improper installation, misuse, alteration, repair, use, or construction contrary to any instructions issued by EMBEDDEDkits, EMBEDDEDkits shall repair or directly replace the defective component or replace it with a functionally equivalent component, at its sole option. EMBEDDEDkits shall return the repaired or replaced component(s) to the buyer free of charge, shipping prepaid.

Adding any components not listed in the assembly instructions, or making any modifications to the Kit will void this Warranty!

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Section 1

Overview

EMBEDDEDkits Kits Return Policy

Customer satisfaction is a top priority for us. However, because of the nature of our products, we cannot accept returns of partially (or completely) assembled kits. We will accept returns of in new-condition, unassembled kits within 15 days from the date you receive the Kit. The buyer is responsible for payment of shipping charges and a, 15% restocking fee. The returned Kit must be in a resalable new-condition, and must include all parts, manuals, and original packaging. If you decide to make a return, please contact our Customer Service Department customerservice@embeddedkits.com via email to obtain an RMA number. Returns without an RMA number, or not meeting the above requirements will not be accepted!

Missing parts

We thoroughly check the content of each kit before shipment, so only on very rare occasions you will find missing parts. If you have determined that a component is missing, contact EMBEDDEDkits customer service department and we will send you the missing item free of charge. However before you do so, make sure that you have not misread the marking on any of the other components included in the Kit. We continually improve the design of our products, so make certain that an alternate component has not been substituted for the item you have determined missing. EMBEDDEDkits reserves the right to make components substitutions at any time, or as components availability dictates. In most cases, these changes will be noted in an addendum to the manual.

Damaged parts during/after assembly

Components or materials lost or damaged during/after assembly can be ordered from EMBEDDEDkits for a reasonable charge. Contact our Sales Department salesdept@embeddedkits.com with your request.

Factory repair of Kits

Fully completed Kits may be returned to EMBEDDEDkits for troubleshooting or repair only. Factory trained technicians are available to evaluate or repair nonfunctioning kits for a service fee of \$25.00 per hour (min. ½ hour evaluation charge) plus return shipping and handling charges. If the repair will require more than an hour, our technicians will contact you by telephone, for your approval before starting. To qualify for repair service, your Kit must be fully completed and unmodified. Contact our Customer Service Department customerservice@embeddedkits.com for further details.

Section 2

Introduction

MSP430 M–28 and M–20 Module, Kit Assembly Guide

The purpose of this Assembly Guide is to provide the Kit builder step–by–step instructions for the construction and I/O testing of EMBEDDEDkits, M–28 and M–20 MSP430 Modules.

Congratulations on your purchase of an EMBEDDEDkits, M–Series Module Kit. The M–28 can support all of the MSP430F12xxIDW, 28–pin SOIC devices (user supplied) and the M–20 can support all of the MSP430F11xxxIDW, 20–pin SOIC devices (user supplied). Both Modules and are ideal for quick prototyping work, or can be directly used in your end–product.

For additional information consult EMBEDDEDkits, M–28 and M–20 M–Series Modules User’s Guide.

Required Skill Level

Some general experience with soldering passive components using wire solder, and soldering Surface Mount Technology (SMT) components using solder paste. For a step–by–step guide on how to solder SMT components, refer to EMBEDDEDkits “Solder Paste Applicator User’s Guide”.

Work Area

Kit construction requires a well–ventilated, well–lighted, uncluttered work area where you can identify and organize all the components, and where you can assemble the Kit.

Minimum required tools and supplies

- ___ Soldering Station w/temperature control, or low–wattage (15 – 25W) Soldering Iron
- ___ Soldering tip, conical 1/32” DIA. max (1/64” DIA. recommended)
- ___ Sponge for cleaning tip
- ___ Solder Paste, 63/37 composition (no–clean type recommended)
- ___ Spatula w/0.020” tip (max) or 1/4W resistor lead, for applying solder paste
- ___ Metal tweezers, for handling SMT components
- ___ Diagonal Cutters

Additional recommended tools and supplies

- ___ Solder Paste Applicator (EMBEDDEDkits Part # SPA–3)
- ___ Solder Sucker or Desoldering Braid

- ___ Desk lamp
- ___ Magnifier, 3x to 5x magnification
- ___ Grounding Wrist Strap
- ___ Pen Vacuum pick-up Tool, for handling SMT components
- ___ Long Nose Pliers

Recommended Test Equipment

- ___ Voltmeter with clip-on leads, or Oscilloscope with probe

Section 3

Getting Started

Read Before You Start

Experience shows that there are four common mistakes that kit builders make. Avoid the following mistakes and your Kit will, in most cases, work on the first try:

Installing the wrong component

Always double-check each step. A 470 ohms and a 47K SMT resistor look the same, but they may act very differently in an electronic circuit! The same applies for capacitors. There is usually no difference in size from a 0.001uF capacitor and a 0.1uF SMT capacitor, but their effect in a circuit can be very different.

Installing a component backward

Always double-check before soldering a polarized capacitor. The negative lead is usually marked on the capacitor's case, and must be connected to the ground point or negative point of the circuit. EMBEDDEDkits PC-Boards have a (+) marking near the capacitor outline, to indicate the correct insertion for a polarized capacitor, positive (unmarked) lead. Check the orientation of diodes. The white band on the designated footprint denotes the Cathode, and should coincide with the band on the diode.

Faulty solder connections

Inspect your solder joints, and look out for solder bridges. A bad solder joint will look dull, and is usually caused by not applying enough heat to properly melt the solder, or to reflow the solder paste.

Omitted or missing components

Check to make sure that you have completed each step in the Kit assembly sequence.

Tips for soldering through-hole components

Good heat distribution and frequent soldering iron tip cleaning, are a must for producing professional looking solder joints. Before you insert the component, inspect its leads and corresponding pad(s) for surface residue. If you notice any residue, wipe it off with a cotton swab. Clean any oxidation or access solder from the soldering iron tip before soldering any leads. Allow the tip to contact both the component lead and pad for approximately one second before applying the solder. For best results, the solder should also contact both the lead and pad to allow it to melt evenly. Apply solder sparingly, just enough to melt around the component lead and to cover most of the pad. And remember, more solder does not make a better electrical connection. It just wastes solder and may result in solder shorts between pads.

Quick–guide for hand soldering Surface Mount Technology Components

EMBEDDEDkits does not recommend soldering SMT components with wire solder. Nor do we recommend soldering SMT components by first applying Flux to both the component leads and PC–board pads, and then by applying heat to the component leads to reflow any existing solder. In most cases, there is not enough solder deposited on the pads by the PC–Board manufacturer to yield good connections, even if the soldering iron is properly tinned. This situation is made worst by the fact that not all the IC's leads make physical contact with their corresponding pads. In addition, this method will usually require a higher tip temperature to start the reflow process, which can increase the possibility of component damage due to the application of excess heat. Therefore, EMBEDDEDkits only recommends the use of Solder Paste or Solder Creams to solder SMT components, when assembling any of our Kits.

A fixed temperature low–wattage 25W (max) soldering iron with a 1/32” DIA. tip (max) can be used to solder SMT components with solder paste. But, make sure not to apply heat any longer than necessary or you may damage the component.

Getting the Solder Paste ready

If the Solder Paste was stored in a refrigerated environment, allow it to warm up to ambient temperature before use. Do not attempt to accelerate the warming process!

If the solder paste comes in a jar, stir its content vigorously for a minimum of (2) minutes before use. A plastic knife or similar disposable object can be used to stir the solder paste. If the solder paste comes in a 35gm (or other size) syringe or EMBEDDEDkits Solder Paste Applicator (SPA–3) stirring is not required, since the solder paste will shear automatically when dispensed.

If the solder paste comes in a jar, scoop a small amount (approx the size of a small pea) and deposit on a flat surface. A disposable plastic bag, piece of tin foil, or other clean (unpainted) metal object can be used. When done, close the jar and store accordingly. If the solder paste comes in a syringe, first uncap the container and then with a round object (a pen will work) slowly push the internal plug to eject a small amount of solder paste onto a flat surface. If the SPA–3 tool is used, the solder paste can be directly dispensed onto the PC–board pads.

You should never place unused solder paste back into its container. Instead, dispose of it accordingly!

Applying the Solder Paste with a Spatula

A small spatula with a 0.020” (max) tip can be used to apply the solder paste, but we highly recommend that you use EMBEDDEDkits, Solder Paste Applicator (Part # SPA–3) for better results. Using this tool will save you time and effort, and will result in a more precise and consistent application of solder paste. Too little solder paste can yield a poor solder connection. Too much, can result in an incomplete solder paste reflow and possible solder shorts between pads.

Applying the correct amount of solder paste will require a steady hand, a bit of trial and error and some practice. The use of a Solder Paste Dispensing Tool will of course make this task easier.

Scoop a small amount of solder paste with the tip of the spatula. Although not as easy, the lead from a 1/4w resistor can be used instead. The collected amount should be enough to approx cover 1/2 to 2/3 the length of the component pad, and at a thickness of approx the lead diameter of a 1/4w resistor.

Applying the Solder Paste with the Solder Paste Applicator (SPA-3)

Applying the solder paste with EMBEDDEDkits, SPA-3 is a snap. But before you do so, try a couple of practice dispensing shots. This is to get you accustomed to the amount of thumb pressure required to properly dispense a bead of solder paste onto the component pad. If at first, you find that you have dispensed too much solder paste, just wipe it off with a paper towel and start over. In no time, you will become a pro at dispensing the proper amount of solder paste.

Position the SP-DT3 Tool tip slightly above (if you prefer, the tip can rest on the pad) at approx 1/2 of the length of the component pad. With your thumb, apply sufficient pressure to the Tool plug to eject and deposit (dispense) a bead of solder paste. The bead should be approx equal to 1/2 of the length of the component pad. This can easily be done by slowly pulling the PC-board away from the Tool tip with one hand, while the solder paste is ejected.

Reflow (soldering) of SMT components leads

Start the reflow (soldering) process by touching the outer edge of the component pad with the tip of the soldering iron. Hold this position until the solder paste starts to reflow. If the tip is making good physical contact with the pad, this will happen almost immediately. During reflow, the melting point of the solder paste alloy is reached, and the solder paste in contact with the tip turns into molten solder. When this happens, slowly push the soldering iron tip toward the outer edge of the component lead. This action will cause the molten solder to wick under (if the lead is not in direct contact with the pad) and around the component lead. If necessary, this process should be repeated to completely reflow the dispensed solder paste. In most cases, with the soldering iron set to the appropriate temperature, a second pass is all you need to properly solder the component lead. Any solder paste displaced between pads can be removed by sliding the soldering iron tip back-and-forth between the pads.

Desoldering tips for through-hole components

If you need to remove a through-hole component follow these simple instructions: 1) If possible, grasp one of the component leads with a pair of needle-nose pliers. If this is not possible grasp the component body, but do not apply too much force or you will damage it. 2) Apply heat to the pad on the solder side (bottom side) of the PC-board to allow the solder to melt, and gently pull the lead out of the pad. 3) Repeat step #1 and #2 for the other lead. 4) Use a solder sucker or braid to remove any remaining solder from the pad hole. In cases where there is a lot of solder on the pad, use a solder sucker or braid to remove most of the solder before you attempt step #1 to #3. 5) Insert the new component and solder accordingly.

For Integrated Circuits (ICs) or multiple-pin components follow these steps: 1) Use a solder sucker or braid to remove as much solder as possible from each pad. 2) With your fingernails or needle-nose pliers, gently wiggle each lead to make sure that it is no longer held in place by any remaining solder. If it is, repeat step #1. 3) Once all the leads are free, gently pull on the component to remove it. 4) Insert the new component and solder accordingly.

NOTE

Components that have been physically damaged or have overheated during the removal process should be replaced. They will probably no longer work as intended. And if so, you will have to repeat the removal process and may run the risk of damaging the PC-board pads.

Desoldering tips for SMT components

In short, there is no easy way to remove multiple-pin SMT components using a soldering iron with a simple conical or chisel type tip. The reason is that all of the SMT components leads/pads need to be simultaneously heated for proper removal. Special soldering iron attachments and desoldering stations do exist for this purpose. If you do not have access to either, and need to remove a multiple-pin SMT component, you really have no choice but to destroy the component in the process. In most cases (if you are careful) SMT resistors and capacitors can be removed with a simple soldering iron without damage. But be especially careful with ceramic capacitors or separation of the internal metallized layers may result, due to access heat.

For removing multiple-pin SMT components, follow these simple steps: 1) With a pair of sharp diagonal cutters, cut each lead as close as possible to the component body. Be careful not to cut or scratch any of the nearby traces or pads. 2) Once all the leads are cut, remove the component's body. 3) Apply heat to one of the pad, and with a solder sucker or braid remove the attached lead and any access solder. 4) Repeat step #3 for the remaining pads. 5) Apply solder paste onto the pads. 6) Place the new component and reflow accordingly.

For removing SMT resistors and capacitors follow these simple steps: 1) With smaller SMT packages (like 0603), apply heat to one of the pad/lead until the solder starts to reflow from both pads/leads. Heat will quickly conduct to the other pad/lead. As soon as this starts to happen grasp the component body with a pair of metal tweezers, and gently lift it away from the pads. For more effective removal, the tweezers tip should not make contact with the component leads or pads. For larger SMT packages, position the soldering iron tip so it makes contact with both leads/pads. When the solder starts to reflow gently push one of the tweezers tip under the component body, and lift it away from the pads. 3) Place the new or correct component and reflow accordingly. In most cases, there will be sufficient solder remaining on the pads for subsequent reflow. If not, apply some solder paste onto the pads before placing the component, and reflow accordingly.

Reading SMT Resistors and Capacitors value

A 3-digit number is used for SMT resistors value identification. The first two digits represent the numeric value, and the third digit is the multiplier.

Ceramic chip SMT capacitors are usually not marked. For Electrolytic and Tantalum capacitors a 3-digit number is used for value identification. The first two digits represent the numeric value, and the third digit is the multiplier.

Resistors:
272 = 2.7K
103 = 10K
474 = 470K

Capacitors:
22pF = 220
0.01uF = 103
0.1uF = 104

Section 4

Getting Familiar With The Kit

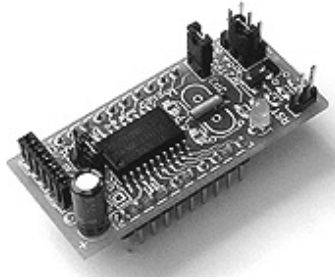


Figure 1. Completed MSP430, M-20 Module

Checking the Kit Content

Before you start building the Kit check the package content, identify each component, and put a (X) in the space provided in the components list. If any components are missing or appear to be damaged, refer to the warranty section of this Assembly Guide for replacement instructions. It is best to first group-together similar components like resistors, capacitors, diodes, and so on. It will make the actual identification easier.

NOTE

Handling electrostatic sensitive components:

This Kit uses Integrated Circuits (ICs) and other active components (Transistors) that may be damaged if subjected to electrostatic discharge. As a precaution, make sure that you use a grounding wrist strap or touch a conductive (grounded) surface before handling such components. Doing so, should discharge your body of any potentially damaging electrostatic charge! This is especially important if your work-area is in a low-humidity environment. It is also recommended that you store such components in electrostatic safe bags (as shipped from the factory) until needed.

MSP430, M–20K Module Components List

X	DESIGNATOR	QTY	DESCRIPTION	Notes
—	U1	1	Microcontroller, MSP430F11xxxIDW, SOIC–20 pkg	*, #
—	Q1	1	Transistor, FJV3104RMTF, NPN, 47K/47K, SOT–23	**
—	Q2	1	Transistor, FJV4104RMTF, PNP, 47K/47K, SOT–23	***
—	LED1	1	LED, Green, Low Current, T–1 pkg	
—	R1	1	Resistor, 47K, 5%, 1/16W, SMT 0603 pkg (marked 473)	
—	R2	1	Resistor, 22K, 5%, 1/16W, SMT 0603 pkg (marked 223)	
—	R3	1	Resistor, 100K, 5%, 1/16W, SMT 0603 pkg (marked 104)	
—	R4	1	Resistor, 1K, 5%, 1/16W, SMT 0603 pkg (marked 102)	
—	C1	1	Capacitor, 10uF, 16V, 20%, Lytic, Radial	
—	C2, C3	2	Capacitor, 0.1uF, 16V, 10%, Cerm, SMT 0603 pkg	
—	J1	1	Connector, FFC/FPC, 1mm, Straight	
—	JP1	1	Header, single–row, 3–Pins	
—	JP2	1	Header, double–row, 6–Pins	
—	JP3, RST	2	Header, single–row, 2–Pins	
—	SH1 – SH4	4	Shorting Block, (0.1” o.c.)	
—		1	Blank PC–Board	
—		1	User’s Guide (Quick–Start, printed version)	
			<u>Optional Components:</u>	
—	Y1	1	Crystal, Tuning Fork Type, 32.768Khz	#
—	C4, C5	2	Capacitor, 22pF, 16V, 10%, Cerm, SMT 0603 pkg	
—	REC1, REC2	2	Receptacle, single–row, 10–Pins	
—	HDR1, HDR2	2	Header, single–row, 10–Pins	

(*) Any MSP430F11xxxIDW, 20–pin SOIC device can be used

(**) NPN Transistor, marked R24

(***) PNP Transistor, marked R74

(#) User supplied component

MSP430, M–28K Module Components List

X	DESIGNATOR	QTY	DESCRIPTION	Notes
—	U1	1	Microcontroller, MSP430F12xxIDW, SOIC–28 pkg	*, #
—	Q1	1	Transistor, FJV3104RMTF, NPN, 47K/47K, SOT–23	**
—	Q2	1	Transistor, FJV4104RMTF, PNP, 47K/47K, SOT–23	***
—	R1	1	Resistor, 47K, 5%, 1/16W, SMT 0603 pkg (marked 473)	
—	R2	1	Resistor, 22K, 5%, 1/16W, SMT 0603 pkg (marked 223)	
—	R3	1	Resistor, 100K, 5%, 1/16W, SMT 0603 pkg (marked 104)	
—	C1	1	Capacitor, 10uF, 16V, 20%, Lytic, Radial	
—	C2, C3	2	Capacitor, 0.1uF, 16V, 10%, Cerm, SMT 0603 pkg	
—	J1	1	Connector, FFC/FPC, 1mm, Straight	
—	JP1	1	Header, single–row, 3–Pins	
—	JP2	1	Header, double–row, 6–Pins	
—	RST	1	Header, single–row, 2–Pins	
—	SH1 – SH3	3	Shorting Block, (0.1” o.c.)	
—		1	Blank PC–Board	
—		1	User’s Guide (Quick–Start, printed version)	
			<u>Optional Components:</u>	
—	Y1	1	Crystal, Tuning Fork Type, 32.768Khz	#
—	C4, C5	2	Capacitor, 22pF, 16V, 10%, Cerm, SMT 0603 pkg	
—	REC1, REC2	2	Receptacle, single–row, 14–Pins	
—	HDR1, HDR2	2	Header, single–row, 14–Pins	

(*) Any MSP430F12xxIDW, 28–pin SOIC device can be used

(**) NPN Transistor, marked R24

(***) PNP Transistor, marked R74

(#) User supplied component

MSP430, M–20 and M–28 Components Placement Details

Figure 2.
MSP430, M–20 Module
(Not to Scale)

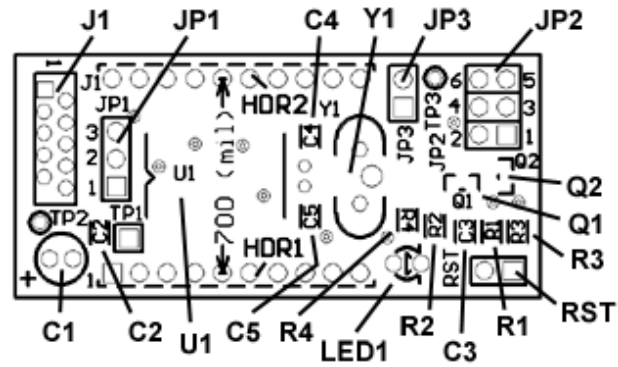
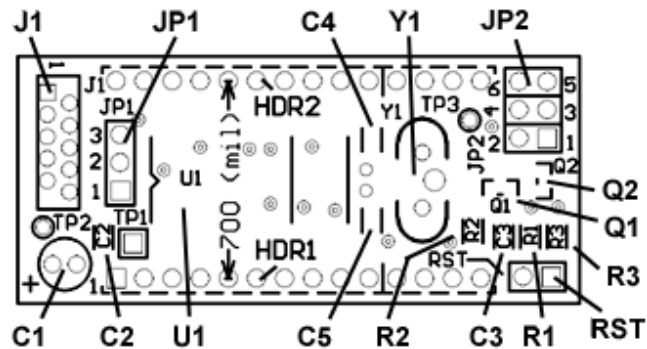


Figure 3.
MSP430, M–28 Module
(Not to Scale)



Before you proceed, take a few minutes to familiarize yourself with the layout of the PC-board. As a general rule, for multiple-pin components, EMBEDDEDkits uses a square pad and/or a square marking on the component footprint, to denote pin #1. The location of where each component is to be installed and corresponding designator, is clearly marked on the PC-board. SMT Transistors must be installed as shown in their corresponding footprint. The outline of polarized capacitors are marked with a (+) to denote the positive lead of the capacitor.

Section 5

MSP430, M-20 and M-28 Module Assembly Instructions

Step-By-Step Assembly Instructions

Read through the step-by-step assembly instructions to determine if your skill level is sufficient to build this Kit. Once you have started construction, the Kit cannot be returned for a refund!

NOTE

For brevity, from now on:

The word dispense or dispensed implies the application of a bead or amount of solder paste with either the SPA-3 or a spatula, using the suggested method described for each device. It also implies the necessary positioning and manipulation of the PC-board to facilitate proper dispensing of the solder paste.

For SMT components, the word place or placement implies the necessary manipulation, positioning and alignment of the component onto its designated PC-board footprint. This action will require the use of ESD safe tweezers, or a vacuum pick-up tool to grasp the component. For larger SMT components, your thumb and index finger can be used to grasp the component by its outer edges for initial placement. Final positioning (for proper alignment of the component leads and PC-board footprint pads) can be accomplished by using the tip of pair of ESD safe tweezers, to shift the part as needed.

The word reflow implies the action of soldering (by applying heat) the SMT component lead(s) to the PC-board pad(s).

For SMT components, the word install implies: first dispense and then place.

For through-hole components, the word install implies the following steps: 1) Insert the component into its designated PC-board footprint. 2) Slightly bend two or more leads of the component to hold it in place. 3) Turn the PC-board over. 4) Solder and trim the component leads. 5) Check for proper solder connections, solder shorts and solder splashes.

For additional instructions and tips on how to solder SMT components, read the EMBEDDEDkits “Solder Paste Applicator User’s Guide”.

NOTE

Before you proceed, read the label attached to the Solder Paste container (or storage package) and review the appropriate Solder Paste “Material Safety Data Sheet” (MSDS). Solder paste manufacturers or distributors include the MSDS when you purchase the product, or may have it available on their website. The MSDS of the Solder Paste used in EMBEDDEDkits, Solder Paste Applicator (Part # SPA-3) is included with the tool. The solder paste (in its entirety, or unused portion), and other items used in handling and storing/dispensing the solder paste should be disposed as outlined in the MSDS.

__ 1. If the Solder Paste was stored in a refrigerated environment, allow it to warm up to ambient temperature before use. Do not attempt to accelerate the warming process!

__ 2. This step only applies to solder paste in a jar. After the solder paste has warmed-up, stir vigorously for a minimum of (2) minutes before use. Use a plastic knife or similar, disposable object.

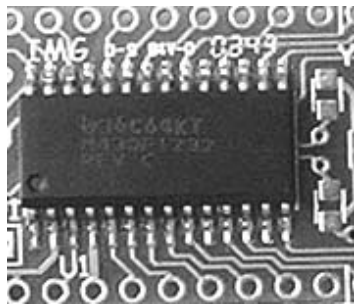
__ 3. Turn ON the soldering station, and set the temperature control to 520 degrees Fahrenheit (approx 270 degrees Celsius). Allow the soldering station to reach the set temperature.

NOTE

After you complete each step check your work. Your solder joints should be free of excess solder, and should appear shiny. Solder shorts between pads or solder splashes should be removed before proceeding to the next step. To prevent PC-board solder-side obstructions, trim through-hole components leads after you are done soldering each component. Trim the leads flush with, or slightly above the PC-board surface, but make sure not to scratch/damage any nearby traces.

Installing the SMT, MSP430 Microcontroller and Transistors

__ 4. Dispense solder paste onto U1 pads, starting from pad #1. Rotate the PC-board as required.



NOTE

Observe the “Handling electrostatic sensitive components” precaution when installing U1, Q1 and Q2.

__ 5. For use flexibility, U1 is supplied by the user. Place Microcontroller U1 (MSP430F11xxxIDW for Module M-20 or MSP430F12xxIDW for Module M-28). Hold U1 in place with your fingers or ESD safe tweezers, and reflow pin-1. Carefully rotate the PC-board 180 degrees and reflow pin-20, or pin-28 (depending on U1). This is to initially secure the component in place. So at first, complete reflow is not necessary. Reflow the remaining pins, and if needed reflow the starting (2) pins again.

__ 6. Dispense solder paste onto Q1 pads. Rotate the PC-board as needed.

__ 7. Dispense solder paste onto Q2 pads. Rotate the PC-board as needed.

NOTE

For SMT transistors, resistors and capacitors apply (after proper alignment) slight downward pressure with the tip of a pair of metal tweezers on top of the component body to hold in place. This should be done prior to and during reflow. Make sure not to make contact with the component leads, or proper reflow may not take place.

___ 8. Locate and place NPN Transistor Q1, FJV3104RMTF (marked R24). To start, reflow pin-3 (single lead side). This is to initially secure the component in place. So at first, complete reflow is not necessary. Reflow the remaining pins, and if needed reflow pin-3 again.

___ 9. Locate and place PNP Transistor Q2, FJV4104RMTF (marked R74). To start, reflow pin-3 (single lead side). This is to initially secure the component in place. So at first, complete reflow is not necessary. Reflow the remaining pins, and if needed reflow pin-3 again.

Installing the SMT Capacitors and Resistors

___ 10. Dispense solder paste onto C2 and C3 pads. Rotate the PC-board as needed.

___ 11. Locate, place and reflow C2 (0.1uF, Ceramic) Capacitor.

___ 12. Locate, place and reflow C3 (0.1uF, Ceramic) Capacitor.

___ 13. Dispense solder paste onto R1, R2, R3 and R4 (M-20 Module only) pads. Rotate the PC-board as needed.

___ 14. M-20 Module only: Locate and install R4 (1K, 5%, marked 102) Resistor.

___ 15. Locate and install R2 (22K, 5%, marked 223) Resistor.

___ 16. Locate and install R1 (47K, 5%, marked 473) Resistor.

___ 17. Locate and install R3 (100K, 5%, marked 104) Resistor.

Installing the Connector and Operation Selection Jumper Headers

NOTE

The component bottom (lower) side should rest on the PC-board top surface after insertion and during soldering.

When installing the FFC Connector, Operation Selection Jumper Headers or Connection Headers, use the following general instructions: 1) Insert the component into its designated footprint. 2) Use your index finger of one hand to hold the component in place, and turn the PC-board over. 3) With the other hand grab the soldering iron and melt and retain a small amount of solder on its tip. 4) Select a component lead that is not in direct contact with your finger and temporarily solder it, to hold the component in place. Pay attention to what you are doing to prevent possible burns! 5) Rest the PC-Board on your work-table, and solder the remaining leads. 6) If necessary, re-solder the first lead. For the mentioned components, it is not necessary to trim the leads after soldering.

Refer to Fig. 2 or Fig. 3 for the location and orientation of the Module components.

___ 18. Locate connector J1. This is a 10-pin, Flat Flex Cable (FFC) vertical connector. Before insertion, align the connector pin #1 marking with J1 footprint pin #1 marking. Solder as outlined in the general instructions. Do not apply excess heat to the pins, or you may damage the connector!

___ 19. Locate Jumper Header JP1. This is a single-row, 3-pin header. Insert in the designated footprint and solder as outlined in the general instructions.

__ 20. Locate Jumper Header JP2. This is a dual–row, 6–pin header. Insert in the designated footprint and solder as outlined in the general instructions.

__ 21. Only applies to the M–20 Module. Locate Jumper Header JP3. This is a single–row, 2–pin header. Insert in the designated footprint and solder as outlined in the general instructions.

Installing the through–hole Capacitor

__ 22. Locate and install C1 (10uF, Electrolytic) Capacitor.

Installing the Operation Selection Jumpers

The M–28 and M–20 Module operation mode is configured via installation of, or removal of “Jumpers” (shorting blocks) from Jumper Header JP1, JP2, JP3 (M–20 Module only) and RST (optional).

NOTE

JPn: a–b, denotes installation of jumper onto Jumper Header (n), pins (a) and (b).

When the module is connected to EMBEDDEDkits, JT–EASY or other MSP430 compatible JTAG Interface Board, JP2 must be set to JP2: 2–4 instead of JP2: 4–6 (default), or the MSP430 internal JTAG interface will not be enabled.

Consult EMBEDDEDkits “M–SERIES, MSP430 MODULES: Model M–28 and M–20 User’s Guide” for additional information on jumper settings.

Jumpers default setting:

M–28 Module – JP1: 1–2, JP2: 4–6 (stand–alone mode), JP2: 3–5 and RST (open circuit).

M–20 Module – JP1: 1–2, JP2: 4–6 (stand–alone mode), JP2: 3–5, JP4: 1–2 and RST (open circuit).

Installing the optional components (only if needed)

__ 23. Locate Jumper Header RST. This is a single–row, 2–pin header. Insert in the designated footprint and solder as outlined in the general instructions.

__ 24. Locate and install LED1 (M–20 Module only). The LED short lead is the Cathode, which should be inserted in the footprint pad marked with a vertical line.

__ 25. Locate and install Connection Header HDR1 and HDR2. Insert in the designated footprints and solder. Depending on the module, these can be single–row 10–pin, or 14–pin headers. The headers should be kept perpendicular to the PC–board bottom surface while soldering. A perfboard with holes spaced at 0.1” o.c. can be used for this purpose. Do not use a breadboard for this, or you will damage it!

NOTE

Only one type of Crystal can be installed at a time. Through-hole pads are provided for both Crystals. Both the M-28P/O/K and M-20P/O/K Modules are supplied with a 32.768Khz cylindrical-type, low-frequency Crystal. Regardless of which Crystal is installed, it is recommended that its case be soldered to the PC-board rectangular ground pad.

Most of the high-frequency crystals will require external loading-capacitors for proper operation. Pads for soldering the (2) SM capacitors C4 and C5 (case size 0603 or 0805) are located near the crystal case outline. In most cases the value of C4 and C5 is around 12 to 22pF.

Consult the appropriate MSP430 manual for setting the Special Function Register (SFR) to select/enable the Crystal operation.

Installing the Crystal

- __ 27. Locate and install the 32.768Khz low-frequency Crystal (supplied).
- __ 28. Or install an HC49/US or HC49/U high-frequency Crystal (user supplied).
- __ 29. If necessary, install the appropriate C4 and C5 Capacitors (user supplied).

Section 6

Testing the Module

The completed M-28 or M-20 Module can be tested with one of the I/O Test Programs. Each I/O test program toggles the MSP430 ports I/O pins, to verify proper connection/operation. The shared JTAG pins (P1.4, P1.4, P1.6 and P1.7) do not require direct testing, since JTAG communication can only take place if they are working properly. Use M28test.asm to test the M-28 Module, and M20test.asm to test the M-20 Module. The I/O Test programs can be downloaded from EMBEDDEDkits website.

Required equipment and tools:

- ___ JT-E100A/K, JTAG Interface Tool with FFC JTAG cable (Part # FFC-10)
- ___ Parallel Port cable (Part # 25P-PPC)
- ___ IAR Kickstart, or similar Compiler/Assembler w/Debugger
- ___ Voltmeter with clip-on leads, or Oscilloscope with probe

Running the MSP430 I/O Test program

___ Connect the male end of the Parallel Port Cable to the host PC. Connect the other end to the JT-E100A/K, J1 connector.

___ Connect one end of the FFC JTAG cable to the Module J1 connector. Connect the other end to the JT-E100A/K, J3 connector.

___ Clip-on the ground lead of the voltmeter or oscilloscope to Test Point (GND). For convenience, the JT-E100A/K (GND) Test Point can be used instead. Leave the other lead unconnected for now.

___ Turn ON the PC, and start the IAR Kickstart, or similar program.

___ Load or Copy-and-Paste the appropriate I/O Test Program. Compile and Link accordingly, and program the Module's MSP430 Flash Memory. From the debugger issue the Run Target (or similar) command.

NOTE

The I/O Test program toggle rate is slow enough to be detected with a voltmeter. If the I/O pin is working properly, the voltmeter display should toggle between an observable (max) and (min) voltage level. With an oscilloscope, the displayed waveform should toggle between the VOH (logic-high) and VIL (logic-low) voltage level.

Checking the M-28 Module I/O pins

___ Sequentially connect the positive voltmeter lead, or oscilloscope probe tip to I/O port P1 (P1.0 to P1.3), P2 (P2.0 to P2.5) and P3 (P3.0 to P3.7) to verify voltage level toggle.

Checking the M-20 Module I/O pins

___ Sequentially connect the positive voltmeter lead, or oscilloscope probe tip to I/O port P1 (P1.0 to P1.3) and P2 (P2.0 to P2.5) to verify voltage level toggle.