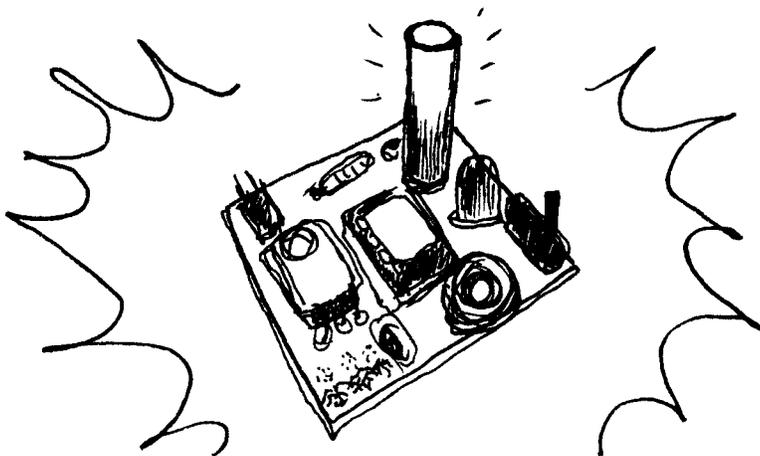


SOLDERING IS EASY

HERE'S HOW TO DO IT



BY: **MITCH ALTMAN**
(SOLDERING WISDOM)

ANDIE NORDGREN
(COMICS ADAPTATION)

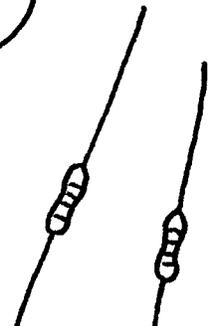
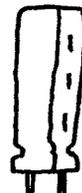
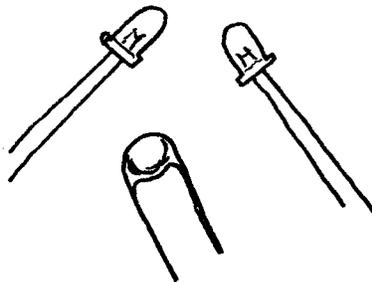
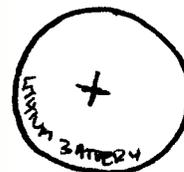
JEFF KEYZER
(LAYOUT AND EDITING)



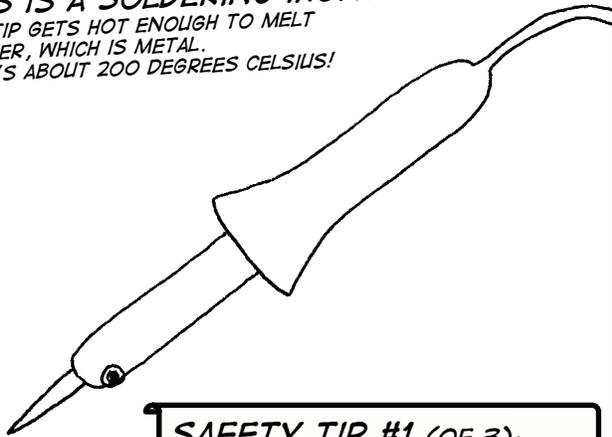
DISTRIBUTE WIDELY!

DOWNLOAD THIS COMIC BOOK AND
SHARE IT WITH YOUR FRIENDS!

[HTTP://MIGHTYOHM.COM/SOLDERCOMIC](http://mightyohm.com/soldercomic)

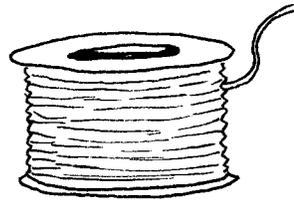


THIS IS A SOLDERING IRON.
ITS TIP GETS HOT ENOUGH TO MELT
SOLDER, WHICH IS METAL.
THAT'S ABOUT 200 DEGREES CELSIUS!



SAFETY TIP #1 (OF 3):
IF YOU TOUCH THE TIP, YOU
WILL LET GO VERY QUICKLY!

IT IS ACTUALLY HOLLOW
AND FILLED WITH ROSIN
(SIMILAR TO THE STUFF USED TO
MAKE BOWS FOR VIOLINS
STICKY).



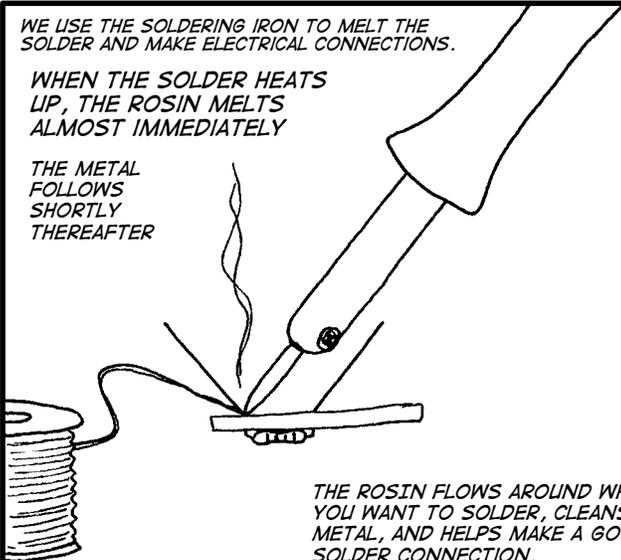
THE ELEMENTS
SN AND PB

THIS IS SOLDER.
IT IS MADE OF METAL, USUALLY TIN AND LEAD.

WE USE THE SOLDERING IRON TO MELT THE
SOLDER AND MAKE ELECTRICAL CONNECTIONS.

WHEN THE SOLDER HEATS
UP, THE ROSIN MELTS
ALMOST IMMEDIATELY

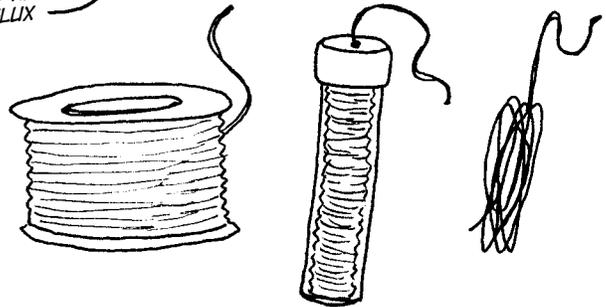
THE METAL
FOLLOWS
SHORTLY
THEREAFTER



THE ROSIN FLOWS AROUND WHAT
YOU WANT TO SOLDER, CLEANS THE
METAL, AND HELPS MAKE A GOOD
SOLDER CONNECTION.

THE BEST SOLDER FOR ELECTRONICS HAS
ROSIN CORE AND IS 60% TIN, 40% LEAD.

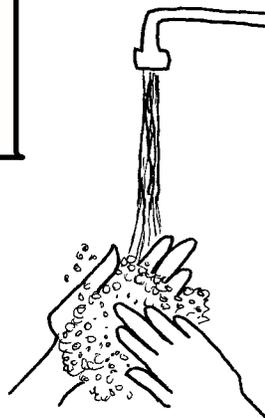
ALSO KNOWN
AS FLUX



OTHER TYPES OF SOLDER INCLUDE LEAD-FREE, BUT
THIS HAS TOXIC CHEMICALS. IT IS NOT AS EASY TO
USE AND CAN CORRODE THE SOLDERING IRON TYPE
QUICKLY. IF USED, DO NOT BREATHE IN THE NASTY
SMOKE.

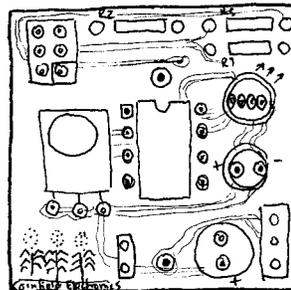
SAFETY TIP #2 (OF 3):

LEAD IS POISONOUS. IT GETS
ON YOUR SKIN WHEN YOU HOLD THE
SOLDER, SO WASH YOUR HANDS
AFTER SOLDERING!



THERE ARE MANY WAYS TO CONNECT ELECTRONIC PARTS
TOGETHER, BUT PERHAPS THE EASIEST WAY IS WITH A
PRINTED CIRCUIT BOARD

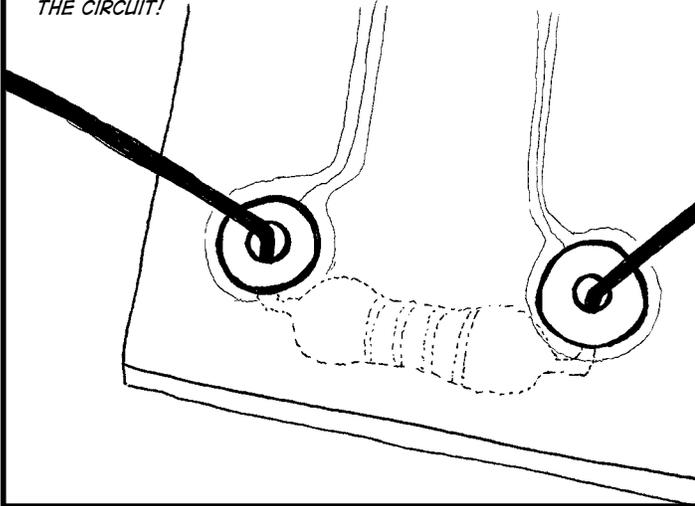
PCB OR
JUST
"THE
BOARD"



THE PCB MAKES
IT EASY BECAUSE
IT HAS
PADS FOR
EACH PART.

IF YOU LOOK CAREFULLY AT THE PCB, YOU WILL
SEE LINES CONNECTING PADS TOGETHER WITH
OTHER PADS - THESE LINES ARE CALLED TRACES.

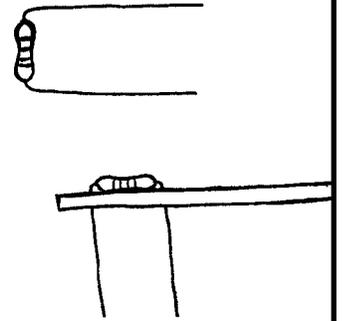
MOST PADS HAVE A HOLE IN THE MIDDLE - THIS IS WHERE THE LEAD POKES THROUGH AND MAKES A CONNECTION TO THE CIRCUIT!



STARTING WITH A RESISTOR, BEND THE TWO LEADS OF THE RESISTOR DOWN THE WIDTH OF THE PART, LIKE THIS:

THEN PLACE THE TWO LEADS THROUGH THE TWO PADS ON THE PCB FOR THIS RESISTOR.

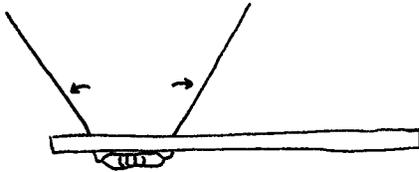
YOU PUSH THE RESISTOR'S LEADS THROUGH THE PADS UNTIL THE PART RESTS FLAT ON THE PCB



FOR MOST PCBs, ALL OF THE PARTS ARE PLACED THROUGH THE PADS ON THE PRINTED SIDE OF THE PCB (WHICH WE'LL CALL THE TOP OF THE BOARD), AND WE'LL SOLDER ALL OF THE PADS ON THE BOTTOM OF THE BOARD.

THEN YOU TURN THE PCB OVER SO WE CAN SOLDER THE TWO PADS.

AS YOU TURN THE PCB OVER, YOU WILL NEED TO HOLD THE RESISTOR WITH YOUR FINGER SO IT DOESN'T FALL OUT OF THE BOARD.

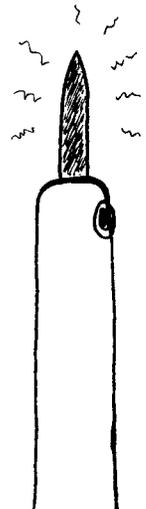


THEN YOU BEND THE LEADS OF THE RESISTOR OUTWARDS AT ABOUT 45 DEGREES SO THE PART WON'T FALL OUT WHILE WE SOLDER IT IN PLACE.

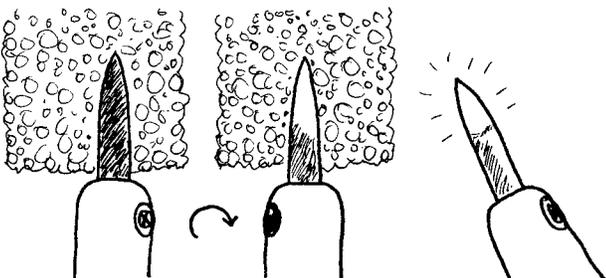
GOT IT? GREAT!

AS I SAID EARLIER, SOLDERING IRONS GET HOT ENOUGH TO MELT METAL. THAT MEANS THAT THE TIPS GET HOT ENOUGH TO OXIDIZE QUICKLY, WHICH BASICALLY MEANS THAT THEY GET DIRTY JUST SITTING IN THE AIR!

THE OXIDES ARE AN INSULATOR FOR HEAT, SO WE WANT TO CLEAN THEM OFF THE TIP BEFORE EACH SOLDER CONNECTION SO THE HEAT FLOWS NICELY AND WE CAN MAKE GOOD SOLDER CONNECTIONS.



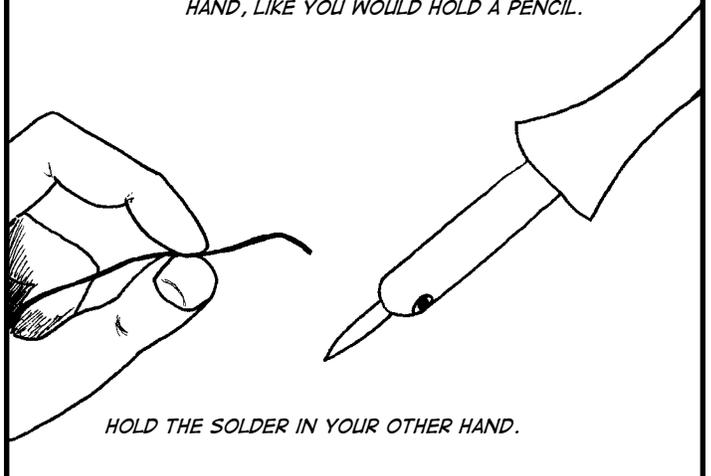
THIS IS WHY WE HAVE A WET SPONGE: SCRAPE THE TIP ACROSS THE SPONGE WHILE ROTATING TO CLEAN THE OXIDES OFF THE TIP.



THIS SHOULD MAKE THE TIP SILVERY AND SOMEWHAT SHINY - READY TO SOLDER. REMEMBER TO CLEAN THE TIP LIKE THIS BEFORE EACH CONNECTION YOU MAKE - THE TIPS OXIDIZE QUICKLY! IF THE TIP IS NICE AND SILVERY AND SHINY, YOU CAN MAKE GOOD CONNECTIONS.

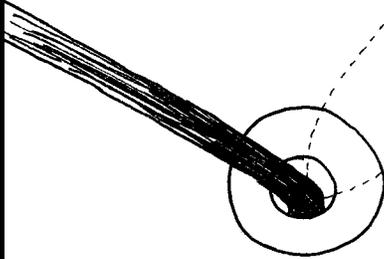
TIME TO ACTUALLY SOLDER!

HOLD THE SOLDERING IRON IN YOUR DOMINANT HAND, LIKE YOU WOULD HOLD A PENCIL.

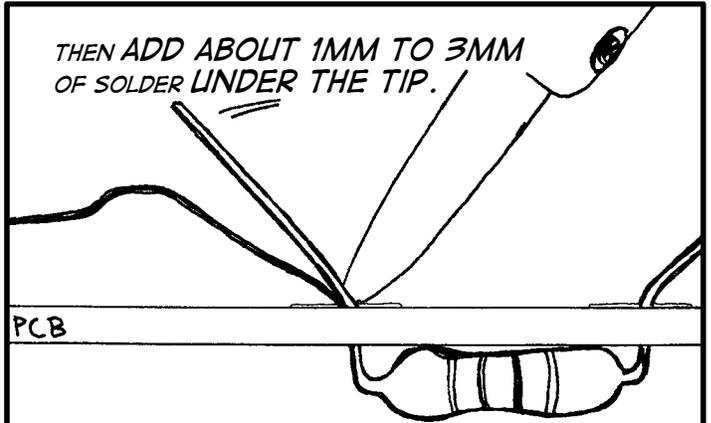


HOLD THE SOLDER IN YOUR OTHER HAND.

TOUCH THE CLEANED TIP TO BOTH THE PAD AND THE LEAD OF THE PART YOU WANT TO SOLDER. KEEP IT THERE FOR ABOUT 1 SECOND, SO EVERYTHING HEATS UP NICELY.

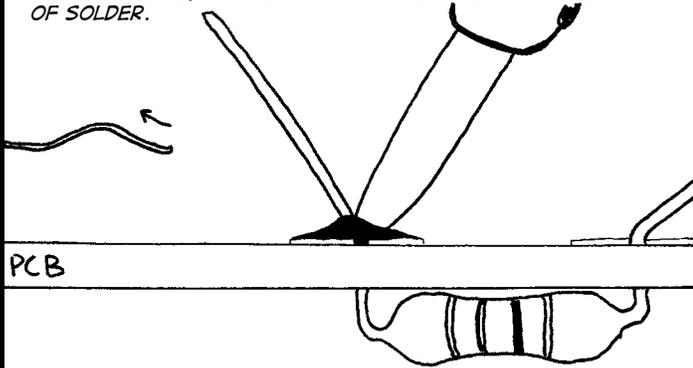


THEN ADD ABOUT 1MM TO 3MM OF SOLDER UNDER THE TIP.



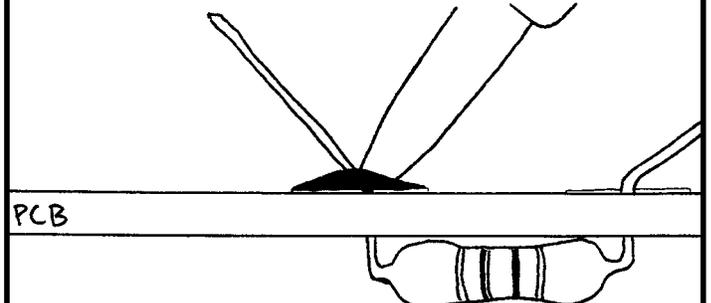
DON'T ADD THE SOLDER ABOVE THE TIP, SINCE IT WILL JUST FLOW ONTO THE TIP WHICH IS NOT ANY GOOD.

THE SOLDER WON'T MELT UNTIL IT ACTUALLY TOUCHES THE HOT SOLDERING IRON TIP, BUT ONCE IT TOUCHES THE TIP, THAT'S WHEN IT MELTS, AND YOU CAN THEN ADD YOUR 1MM TO 3MM OF SOLDER.



THEN, PULL THE SOLDER AWAY.

BUT - AND THIS IS VERY IMPORTANT - KEEP THE SOLDERING IRON TIP ON THE PAD AND LEAD FOR ABOUT 1 MORE SECOND SINCE IT TAKES TIME FOR THE SOLDER TO FLOW AROUND THE PAD AND THE LEAD, AND IT WILL ONLY FLOW WHEN IT IS HOT.



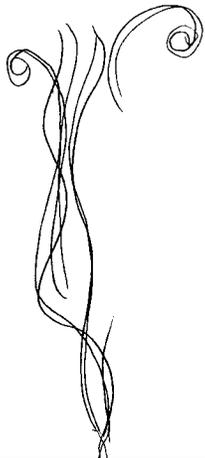
THEN PULL THE SOLDERING IRON AWAY, AND TAKE A LOOK AT YOUR PERFECT SOLDER CONNECTION!

PLEASE NOTE THAT THE SOLDER COOLS DOWN AND HARDENS QUICKLY ALL ON ITS OWN. IT ONLY TAKES ABOUT A SECOND.

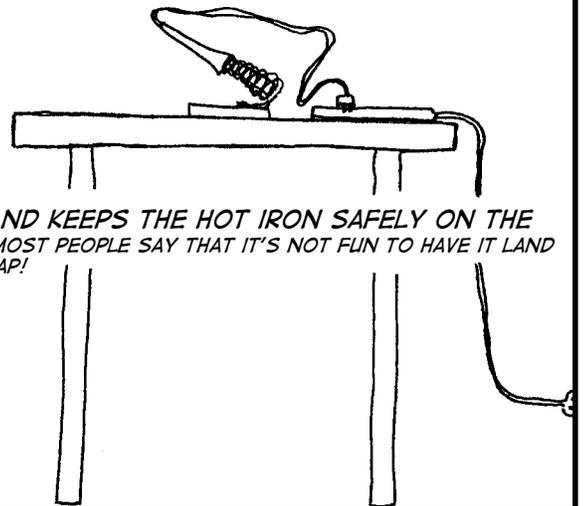
THAT SMOKE THAT YOU SAW WHEN THE TIN/LEAD SOLDER MELTS IS THE ROSIN VAPORIZING.

IT CONTAINS SOME CHEMICALS THAT ARE NOT GOOD FOR YOU, SO TRY NOT TO BREATHE IT!

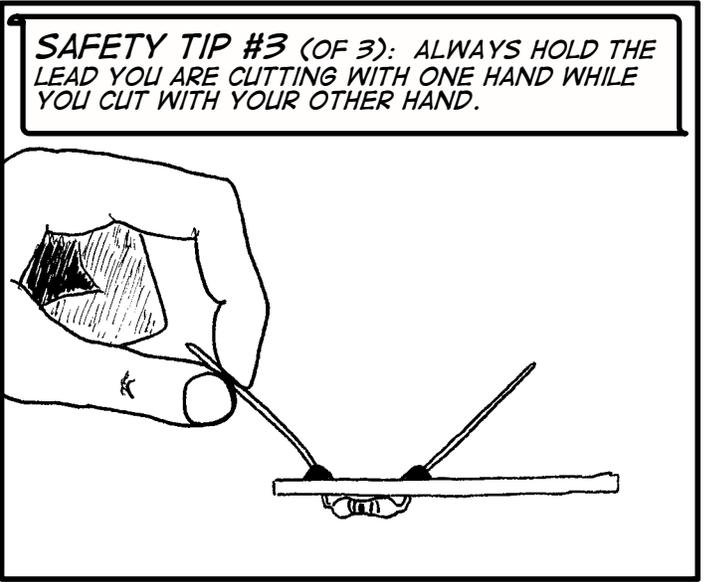
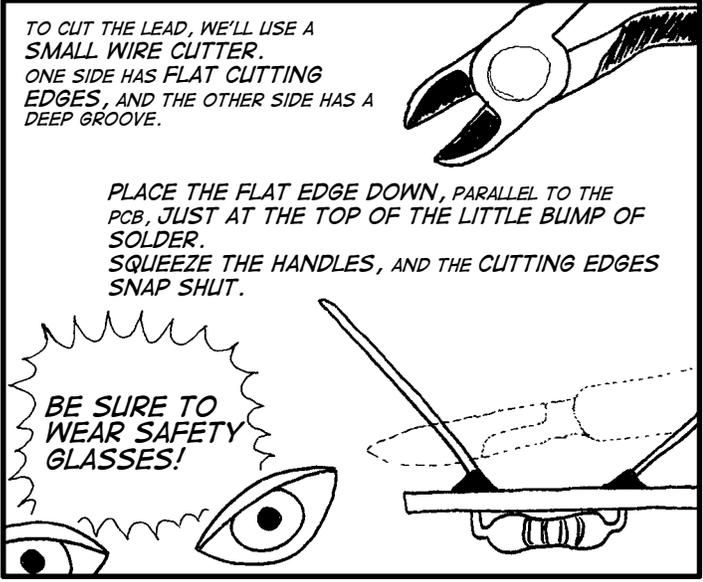
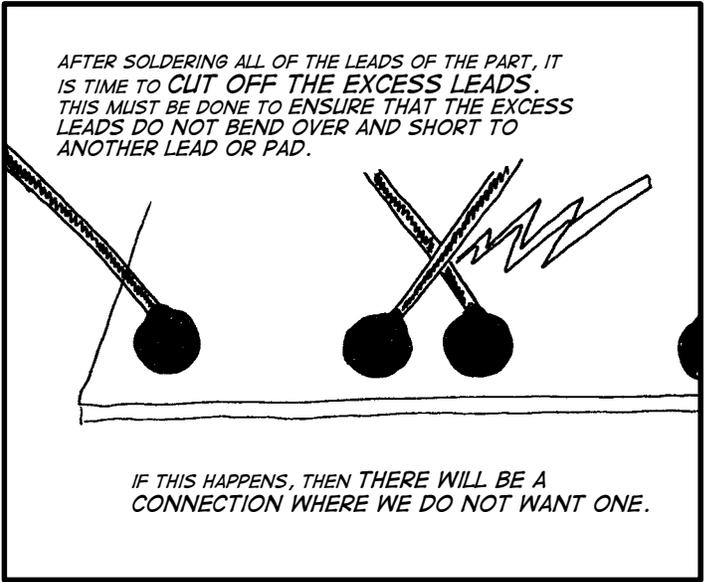
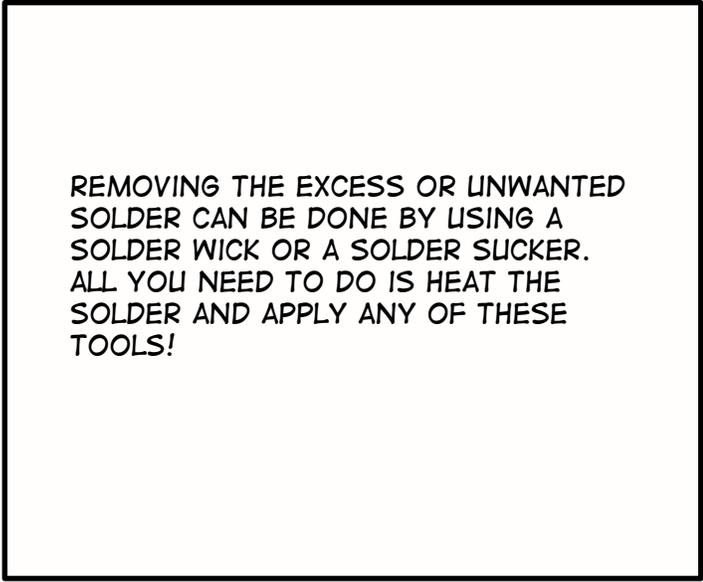
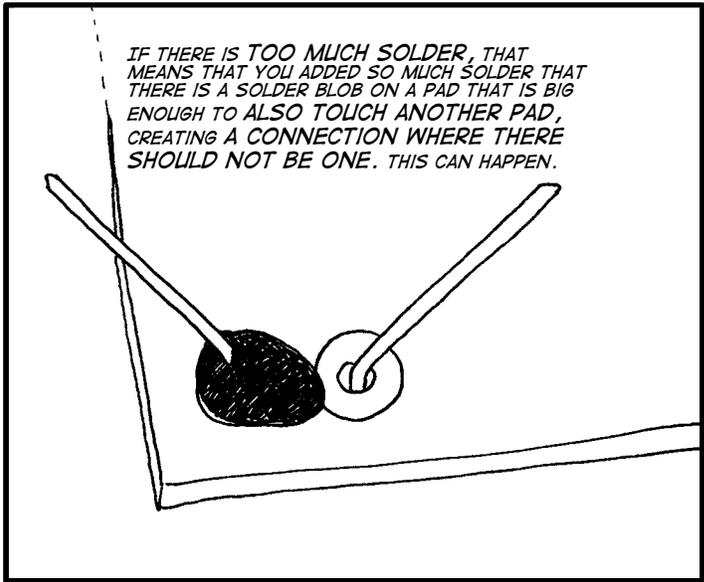
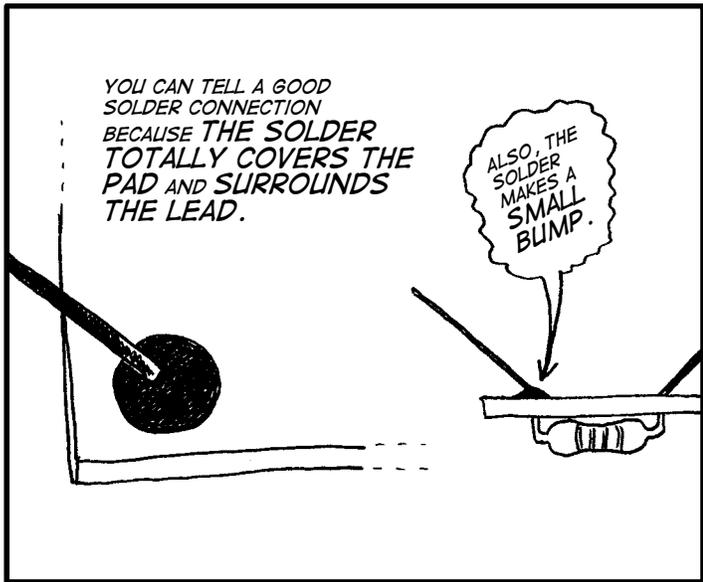
YOU CAN BLOW GENTLY ON THE CONNECTION AS YOU SOLDER TO KEEP THE SMOKE AWAY FROM YOUR LUNGS.



NOW PUT THAT SOLDERING IRON BACK IN ITS STAND WHILE WE'RE NOT USING IT.



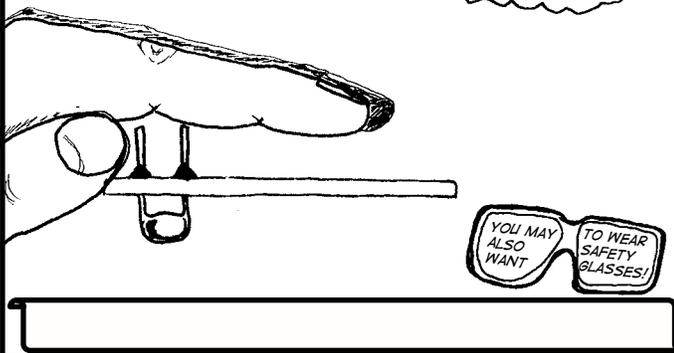
THE STAND KEEPS THE HOT IRON SAFELY ON THE TABLE. MOST PEOPLE SAY THAT IT'S NOT FUN TO HAVE IT LAND IN YOUR LAP!



IF THE EXCESS LEAD IS TOO SHORT TO HOLD ONTO (BUT LONG ENOUGH TO POTENTIALLY SHORT OUT TO SOMETHING ON YOUR PCB), THEN POSITION THE WIRE CUTTER, HOLD YOUR FINGERS OVER THE LEAD,

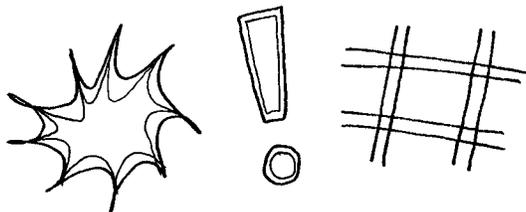
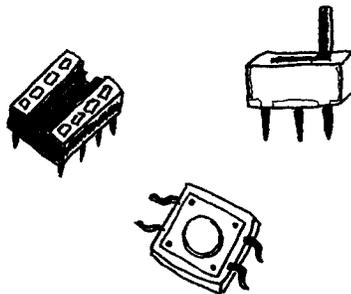
AND THEN **SQUEEZE**.

THIS WILL KEEP THE EXCESS LEAD FROM HITTING ANYONE IN THE EYE (OR SHORTING OUT SOMEWHERE ON YOUR PROJECT)



YOU MAY ALSO WANT TO WEAR SAFETY GLASSES!

LEADS THAT ARE ALREADY VERY SHORT, SUCH AS IC SOCKETS, DO NOT NEED TO BE CUT - THEY HAVE LEADS THAT ARE TOO SHORT TO BEND OVER AND MAKE SHORTS.



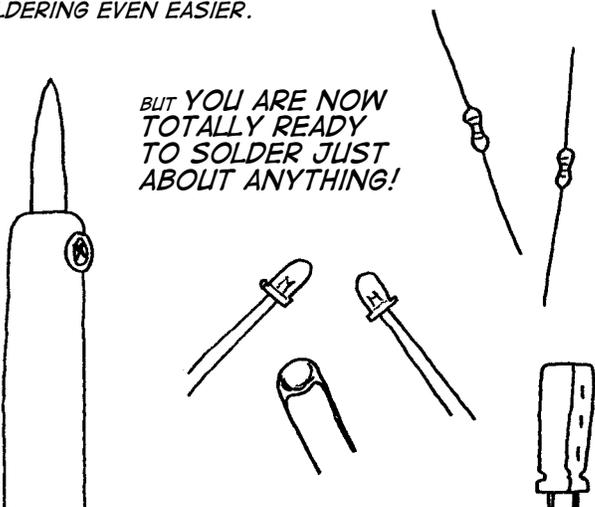
IF YOU MAKE A MISTAKE, IT IS TOTALLY OK. ALL MISTAKES ARE FIXABLE (THOUGH SOME ARE EASIER THAN OTHERS).

AND MAKING MISTAKES IS HOW WE LEARN TO BECOME BETTER AT EVERYTHING WE DO.

WHILE SOLDERING IS EASY, UNSOLDERING TAKES LOTS OF PRACTICE. AND IF YOU MAKE A MISTAKE, YOU GET TO HAVE SOME PRACTICE!

AS YOU SOLDER MORE, YOU WILL PICK UP MANY TIPS AND TRICKS THAT WILL MAKE SOLDERING EVEN EASIER.

BUT YOU ARE NOW TOTALLY READY TO SOLDER JUST ABOUT ANYTHING!



DISTRIBUTE WIDELY!

ENJOY!

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