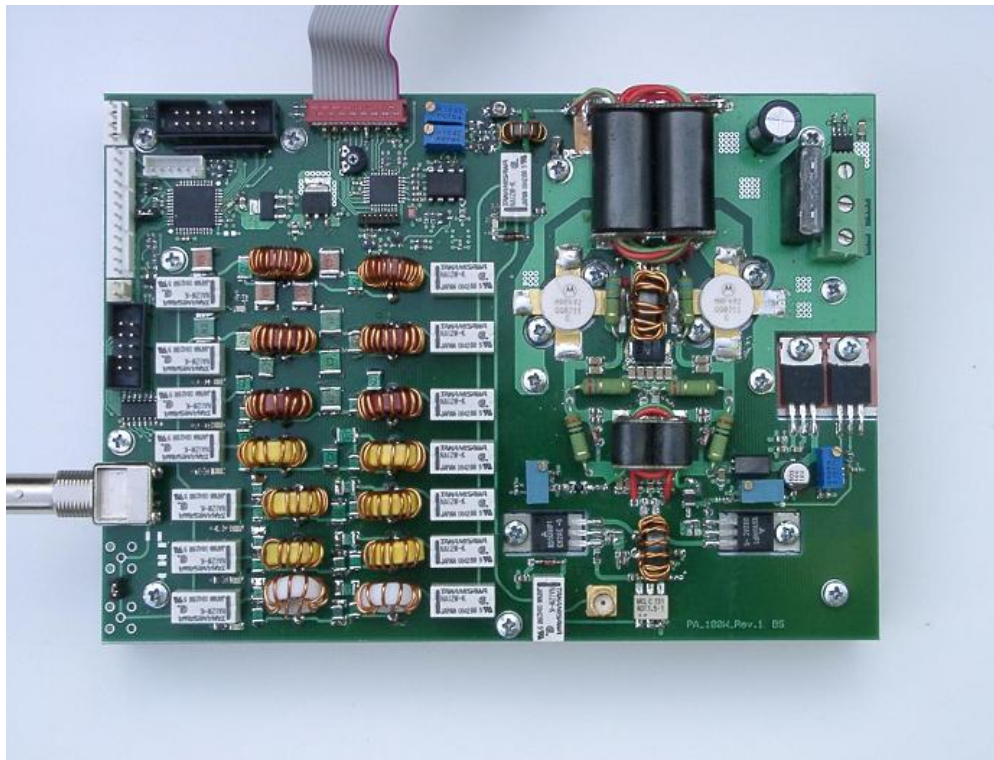


## High Performance Software Defined Radio

Open Source Hardware and Software Project

Project Description: <http://openhpsdr.org>



### Hardware Project #6 **HERCULES Board** Part #2 The Making of HERCULES

Schematics / Board Design Gerd Loch, DJ8AY

Text Horst Gruchow, DL6KBF

Graphics and Layout Horst Gruchow, DL6KBF

## Preface

Since the start of the HPSDR development in March 2006 quite a lot has been achieved within this open and public HAMRADIO project. At present (Feb. 2010) it is the first time that all components for a full 100W transceiver are available and the interest of HAM operators is increasing day by day. This can be heard everyday on the HAM bands.

The acceptance of such a complex project sinks or swims with the availability of the hardware after the software and firmware has reached a high degree of 'ripeness'. Especially in Europe the acceptance of the HPSDR project was a problem because the hardware had to be purchased from the US. This caused a lot of reluctance.

This problem has been solved due to the outstanding commitment of Gerd Loch, DJ8AY, who – after the worlds first available MERCURY digital receiver board and his antenna switch – now presents his third HPSDR development – a 100W power amplifier that can be directly connected to PENELOPE.

Gerd offers the PA as a pre-assembled kit as well as an empty PCB. For everybody who does not fear death and devil and wants to build the project from scratch I have written the following assembly instructions. The step-by-step method - already approved in other HPSDR projects - should not give any problems. Much success for all who accept the challenge.

73

Horst  
DL6KBF

## Vorwort

Seit dem Beginn der HPSDR Entwicklung im März 2006 hat sich viel in diesem offenen und öffentlichen Amateurfunk-Projekt bewegt. Zum jetzigen Zeitpunkt (Februar 2010) stehen erstmals alle Komponenten für einen vollwertigen 100W-Transceiver zur Verfügung und das Interesse der Funkamateure an diesem Projekt nimmt Tag für Tag zu. Dieses kommt in Gesprächen auf den Amateurfunk-Bändern deutlich zum Ausdruck.

Die Verbreitung so eines komplexen Projektes steht und fällt ja mit der Verfügbarkeit der Hardware, nachdem auf der Software- bzw. Firmwareseite aktuell ein hoher 'Reifegrad' erreicht ist. Besonders in Europa war die Akzeptanz des HPSDR-Projekts bisher ein Problem, da die Hardware aus den USA bezogen werden musste. Da gab es Berührungsängste.

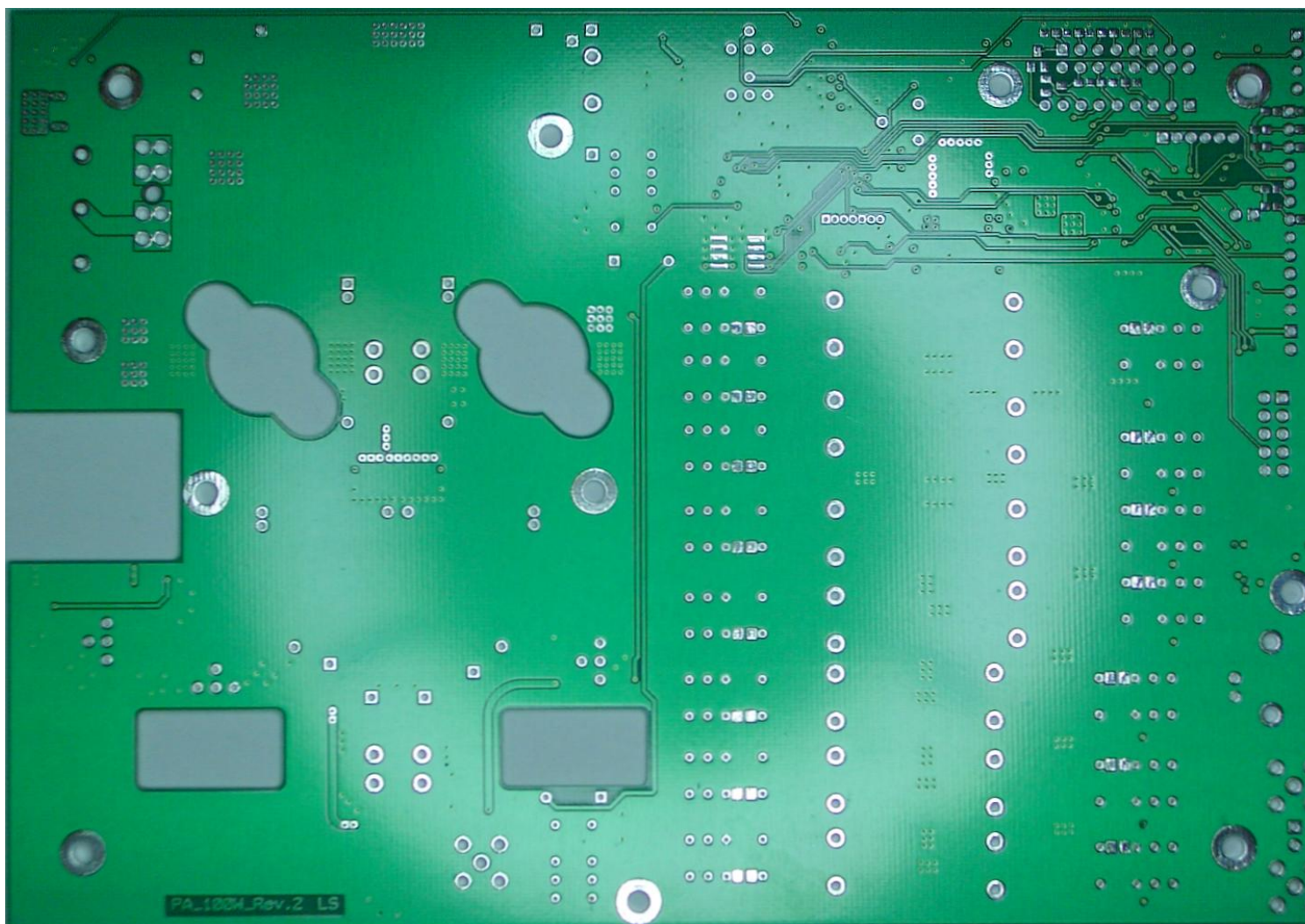
Dieses Problem ist nun durch das hervorragende Engagement von Gerd Loch, DJ8AY, gelöst, der nach dem weltweit ersten verfügbaren MERCURY-Digitalempfängerboard im Frühjahr 2008 und seinem Antennenschalter seine dritte Eigenentwicklung in das HPSDR-Projekt einbringt – eine 100W Transistorendstufe, die direkt von PENELOPE angesteuert werden kann.

Gerd bietet die Endstufe sowohl in vorbestückter Bausatzform als auch als Leerplatine an. Für alle, die wie ich Tod und Teufel nicht fürchten und das Projekt von Grund auf selber bauen wollen, habe ich die folgende Bauanleitung verfasst. Mit der von mir schon an anderen HPSDR-Projekten ausprobierten Schritt-für-Schritt-Methode sollte das Bestücken der Platine kein Problem sein. Ich wünsche allen Nachbauern viel Erfolg.

73

Horst  
DL6KBF

## PCB Backside





### Item 1 BOTTOM

CAP CER 10nF 50V 0603

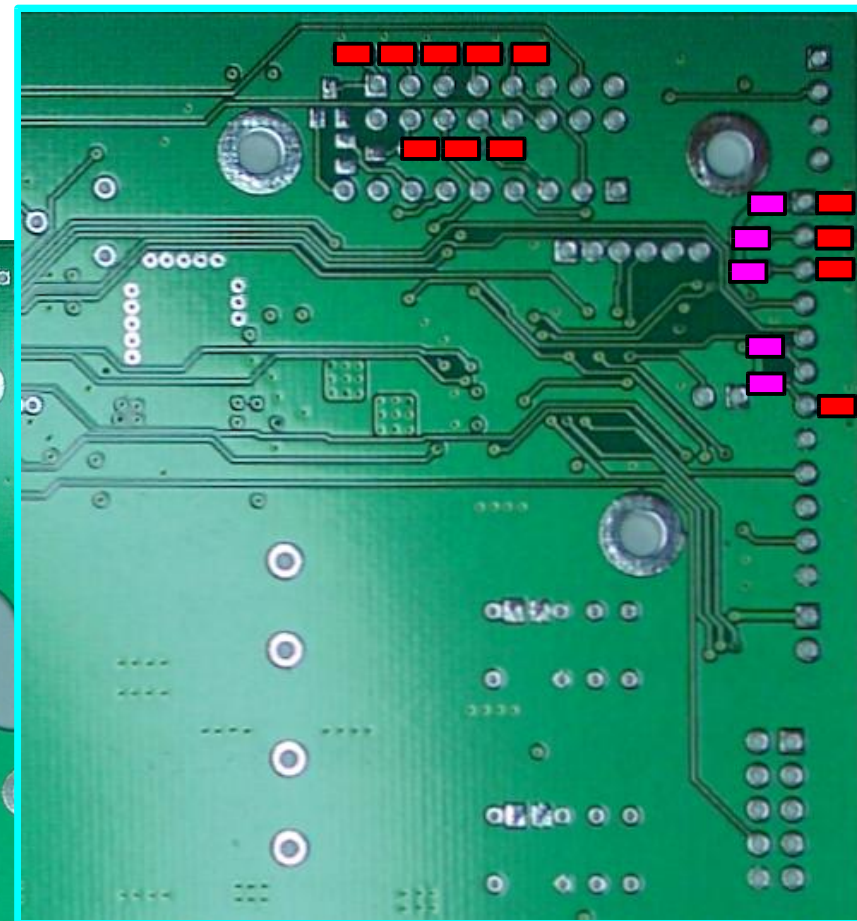
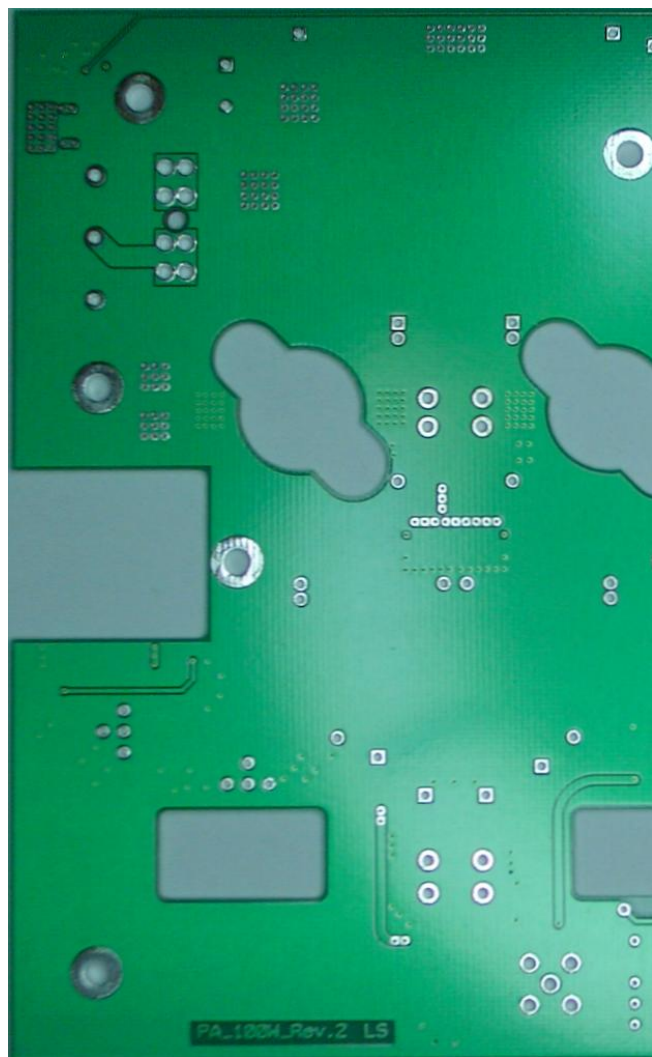
| Pos  | Reel/Tick |
|------|-----------|
| C070 |           |
| C071 |           |
| C072 |           |
| C073 |           |
| C120 |           |
| C121 |           |
| C122 |           |
| C123 |           |
| C124 |           |
| C125 |           |
| C126 |           |
| C127 |           |



### Item 2 BOTTOM

RES 10k 0603

| Pos | Reel/Tick |
|-----|-----------|
| R33 |           |
| R34 |           |
| R35 |           |
| R36 |           |
| R37 |           |



### Item 3 BOTTOM

CAP CER 100nF 0805

| Pos  | Reel/Tick |
|------|-----------|
| CK00 |           |
| CK01 |           |
| CK02 |           |
| CK03 |           |
| CK04 |           |
| CK05 |           |
| CK06 |           |
| CK07 |           |
| CK08 |           |
| CK09 |           |
| CK10 |           |
| CK11 |           |
| CK12 |           |
| CK15 |           |
| CK16 |           |



### Item 4 BOTTOM

LM75AD SO8

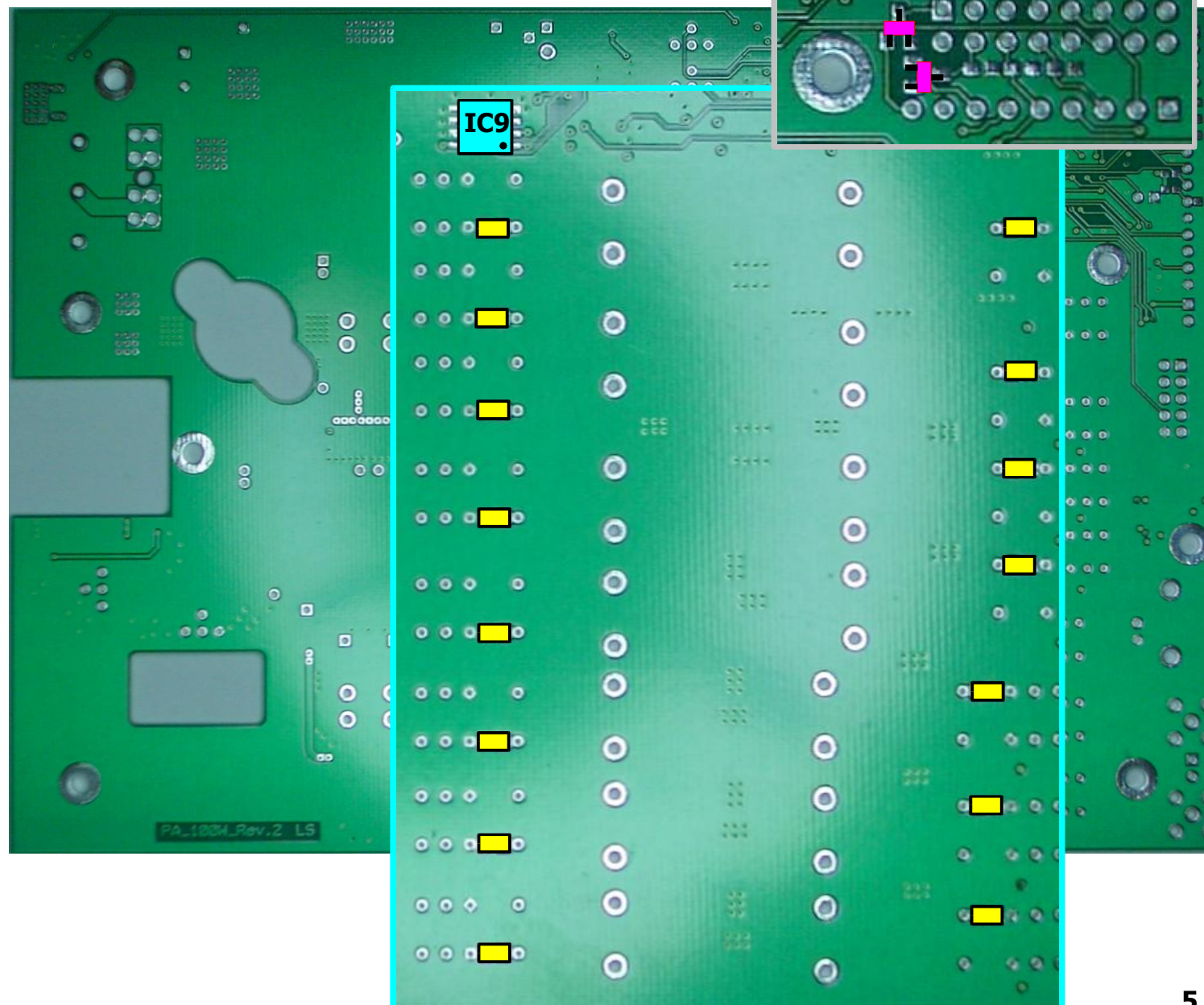
| Pos | Reel/Tick |
|-----|-----------|
| IC9 |           |



### Item 4a BOTTOM

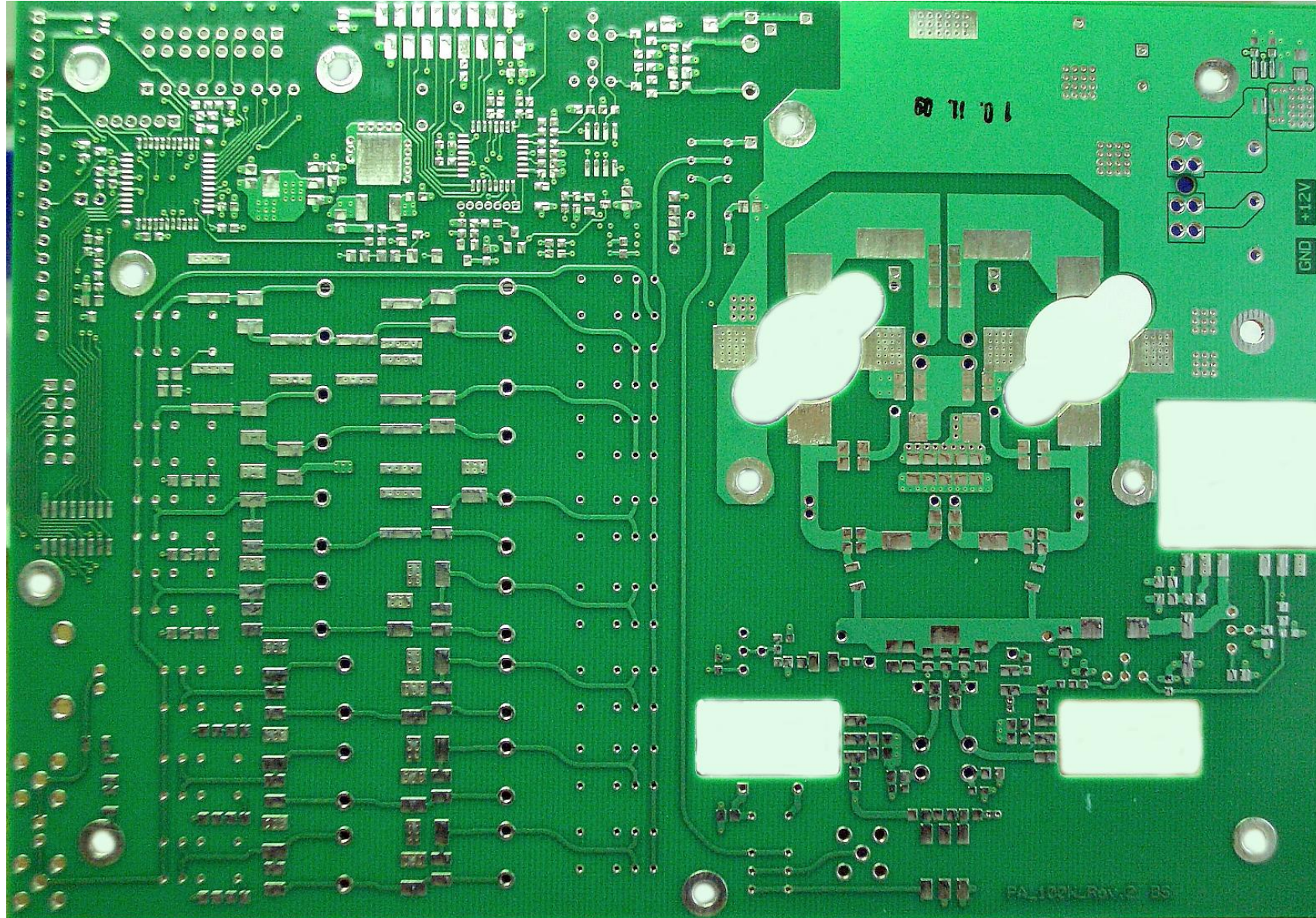
BAS40

| Pos  | Reel/Tick |
|------|-----------|
| D101 |           |
| D102 |           |

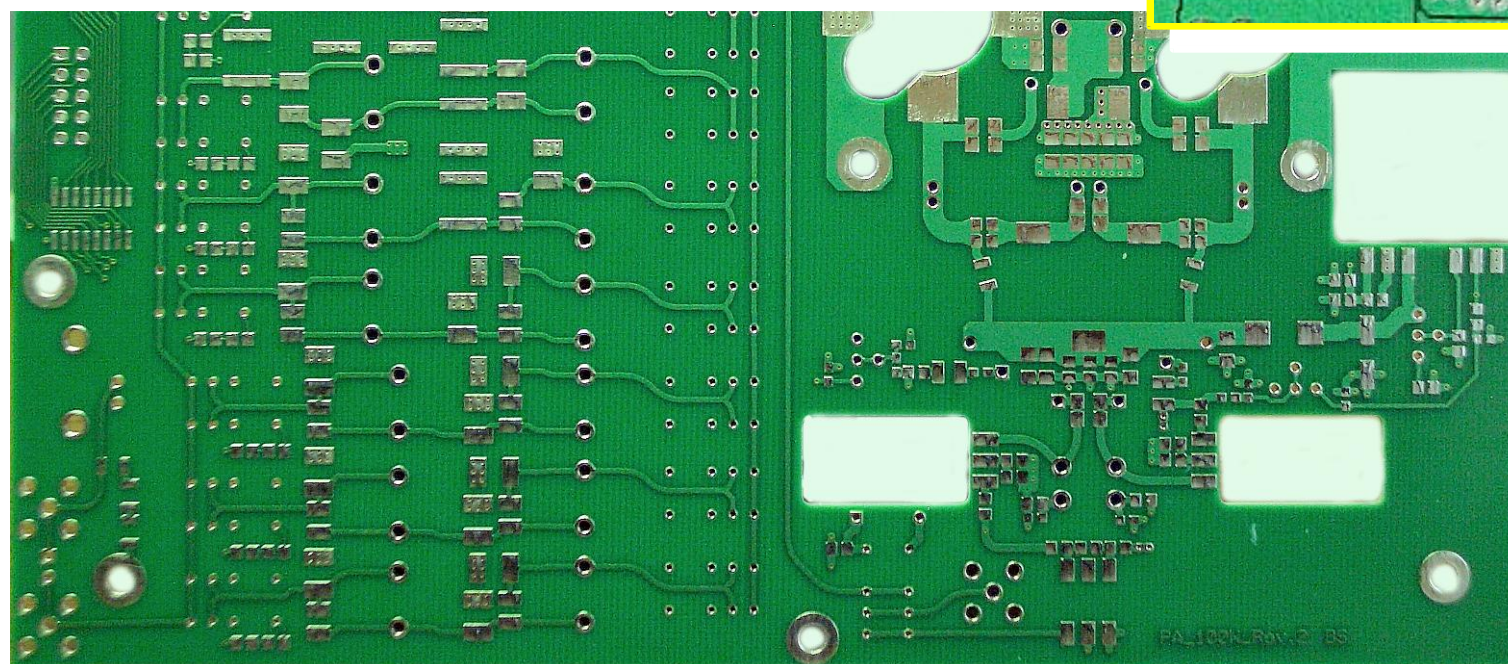
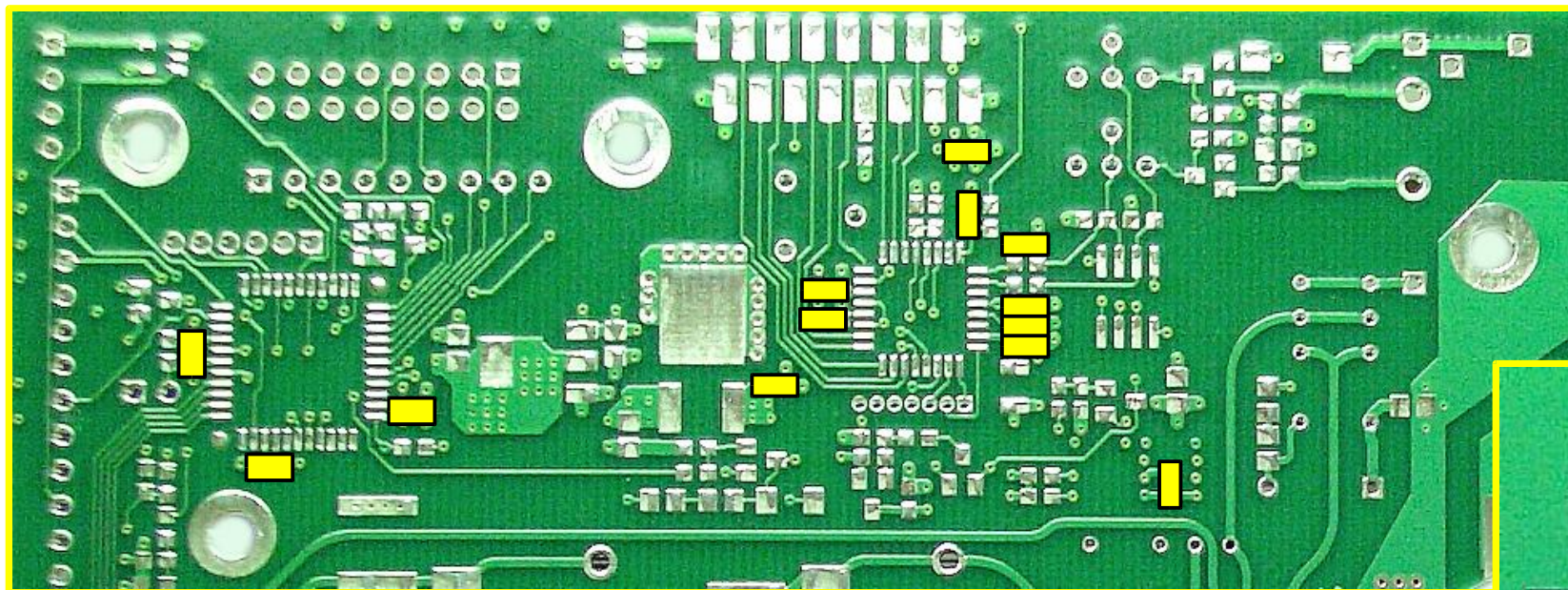




## PCB Frontside



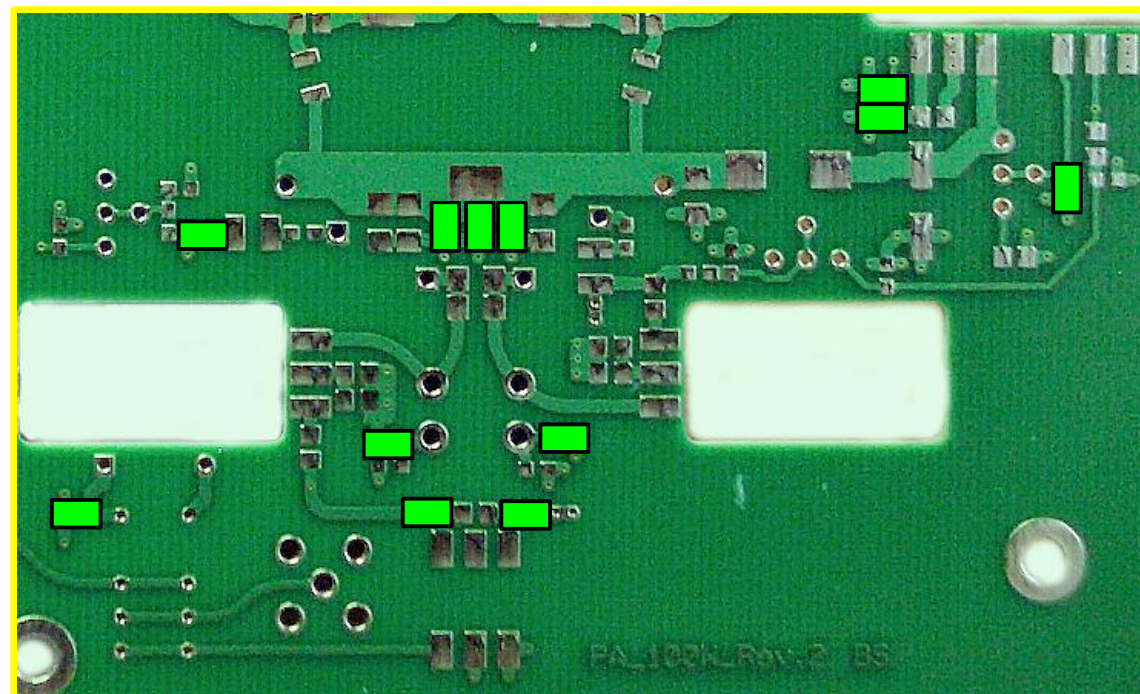
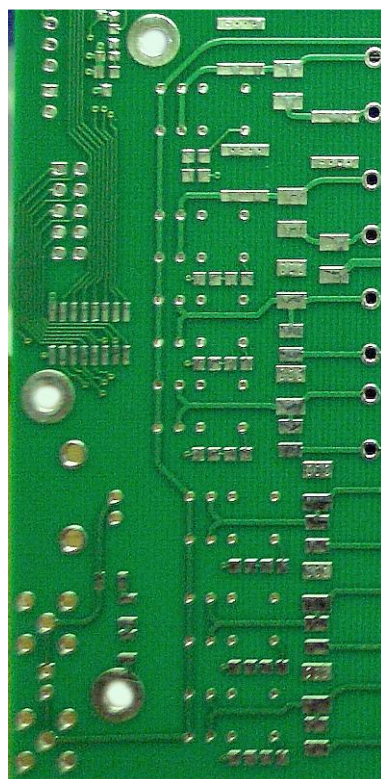
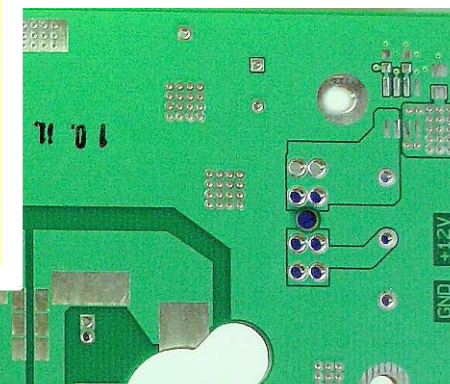
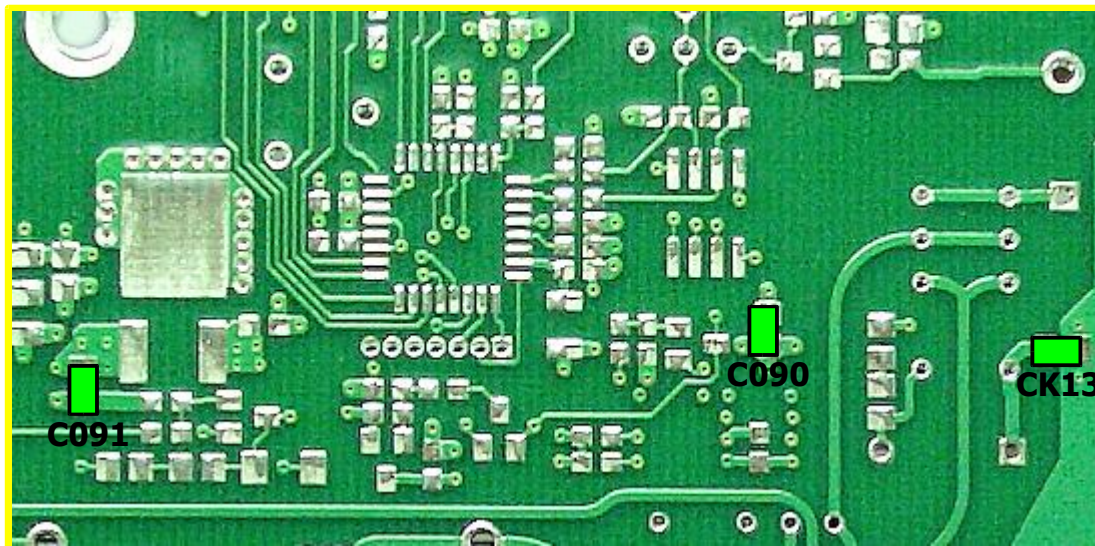




| Item 1 TOP         |           |
|--------------------|-----------|
| CAP CER 100nF 0603 |           |
| Pos                | Reel/Tick |
| C052               |           |
| C085               |           |
| C086               |           |
| C087               |           |
| C150               |           |
| C152               |           |
| C153               |           |
| C154               |           |
| C155               |           |
| C156               |           |
| C157               |           |
| C158               |           |
| C159               |           |
| C160               |           |

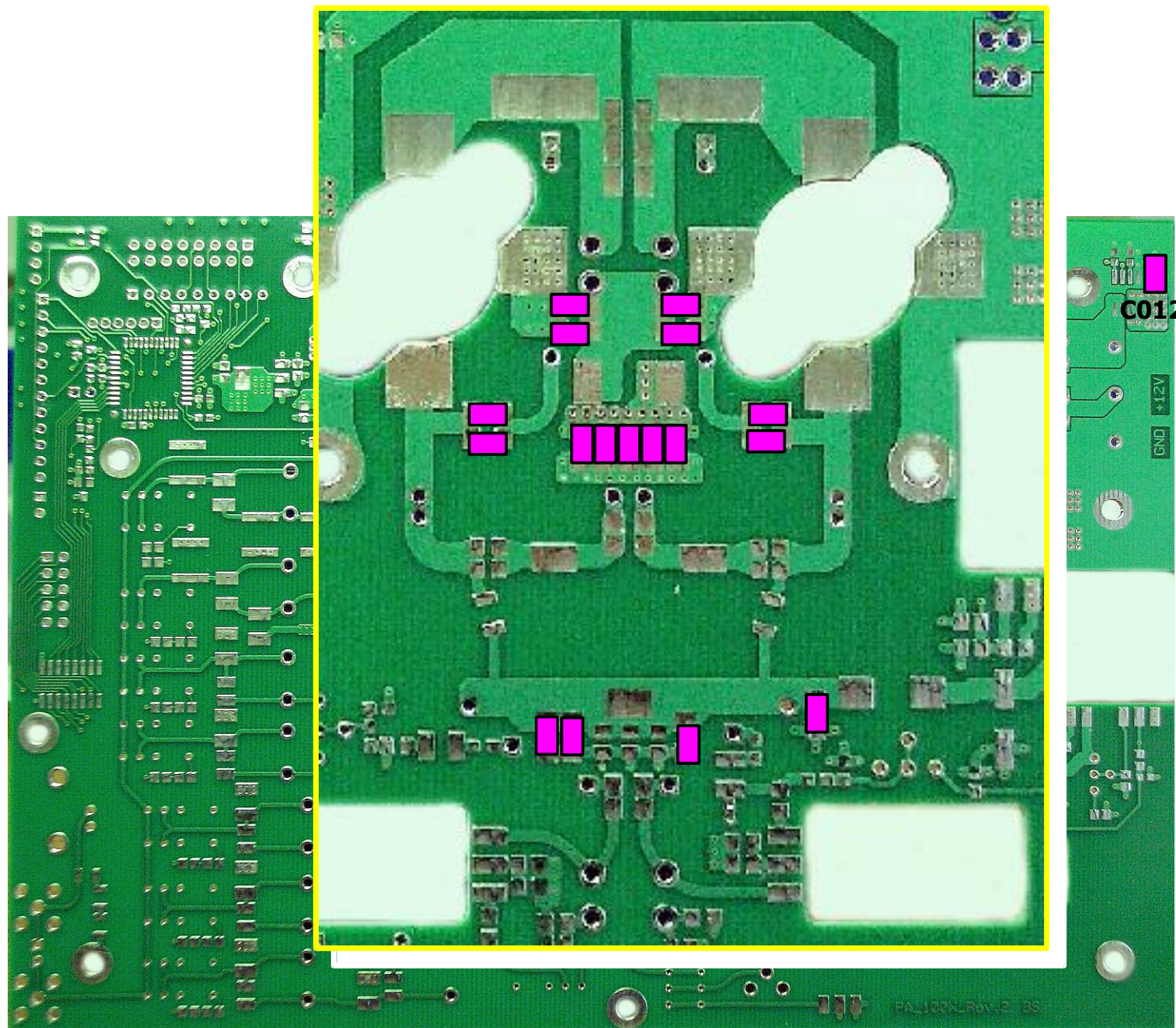


| Item 2 TOP         |           |
|--------------------|-----------|
| CAP CER 100nF 0805 |           |
| Pos                | Reel/Tick |
| C044               |           |
| C045               |           |
| C047               |           |
| C055               |           |
| C056               |           |
| C058               |           |
| C062               |           |
| C064               |           |
| C065               |           |
| C090               |           |
| C091               |           |
| C092               |           |
| C147               |           |
| CK13               |           |
| CK14               |           |

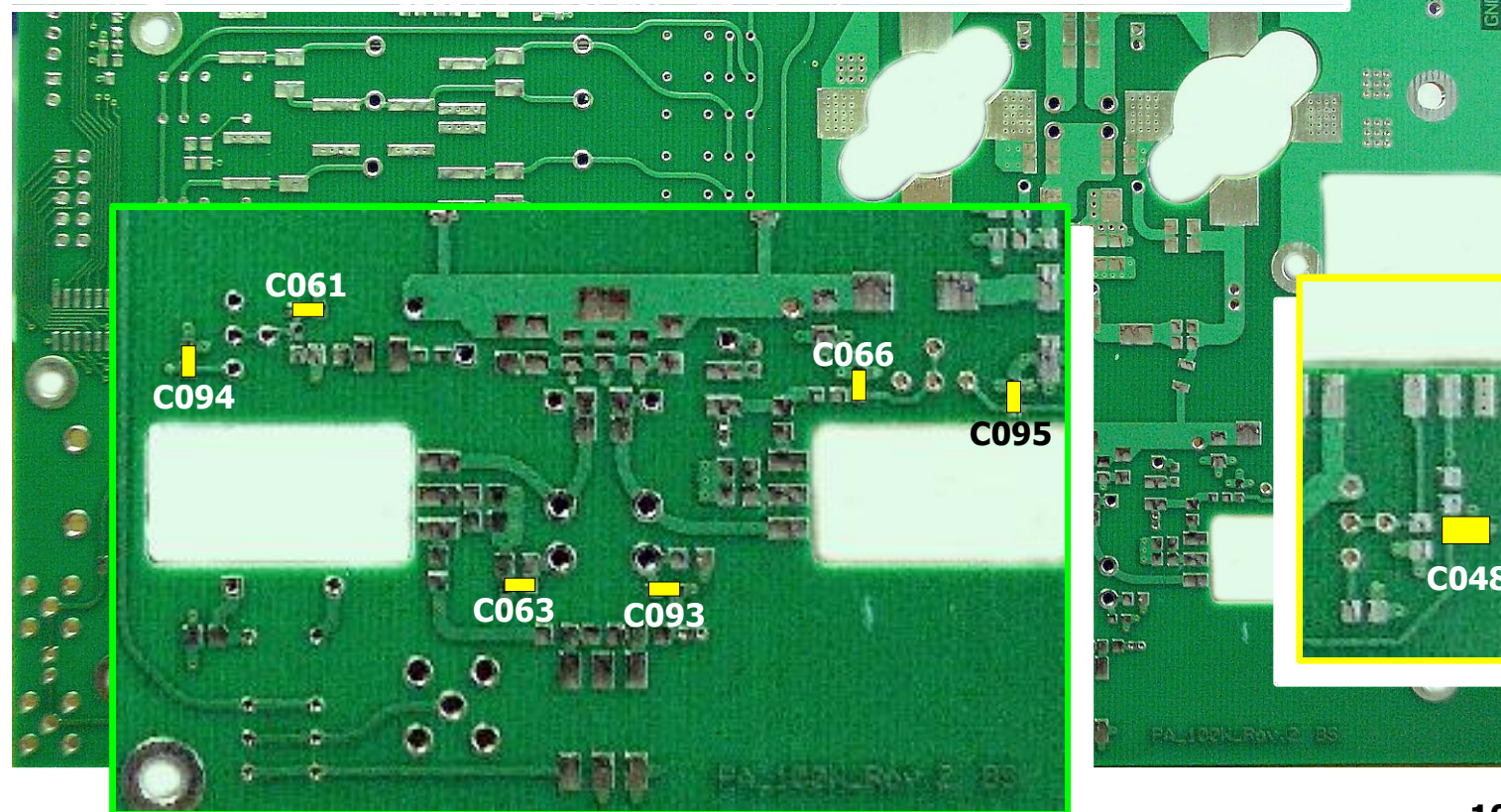
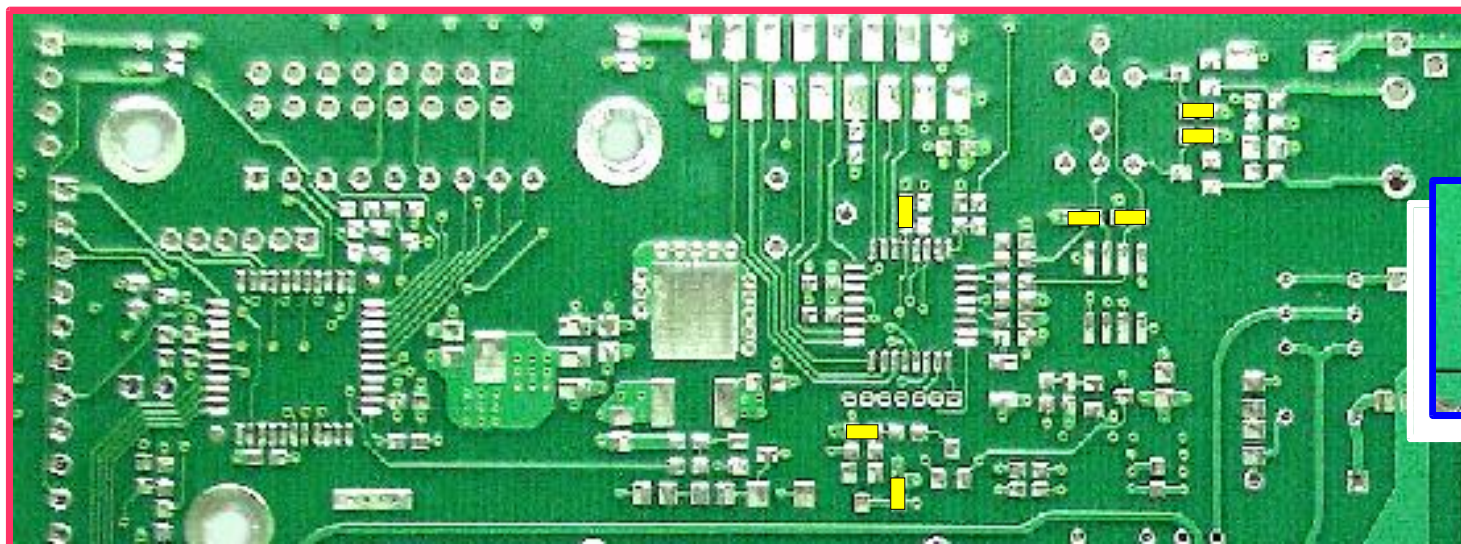




| Item 3 TOP         |           |
|--------------------|-----------|
| CAP CER 100nF 1206 |           |
| Pos                | Reel/Tick |
| C006               |           |
| C007               |           |
| C008               |           |
| C009               |           |
| C010               |           |
| C012               |           |
| C036               |           |
| C037               |           |
| C076               |           |
| C077               |           |
| C078               |           |
| C079               |           |
| C108               |           |
| C109               |           |
| C110               |           |
| C111               |           |
| C136               |           |
| C137               |           |







| Item 4 TOP        |           |
|-------------------|-----------|
| CAP CER 10nF 0603 |           |
| Pos               | Reel/Tick |
| C048              |           |
| C051              |           |
| C054              |           |
| C060              |           |
| C061              |           |
| C063              |           |
| C066              |           |
| C068              |           |
| C069              |           |
| C075              |           |
| C093              |           |
| C094              |           |
| C095              |           |
| C151              |           |
| C161              |           |





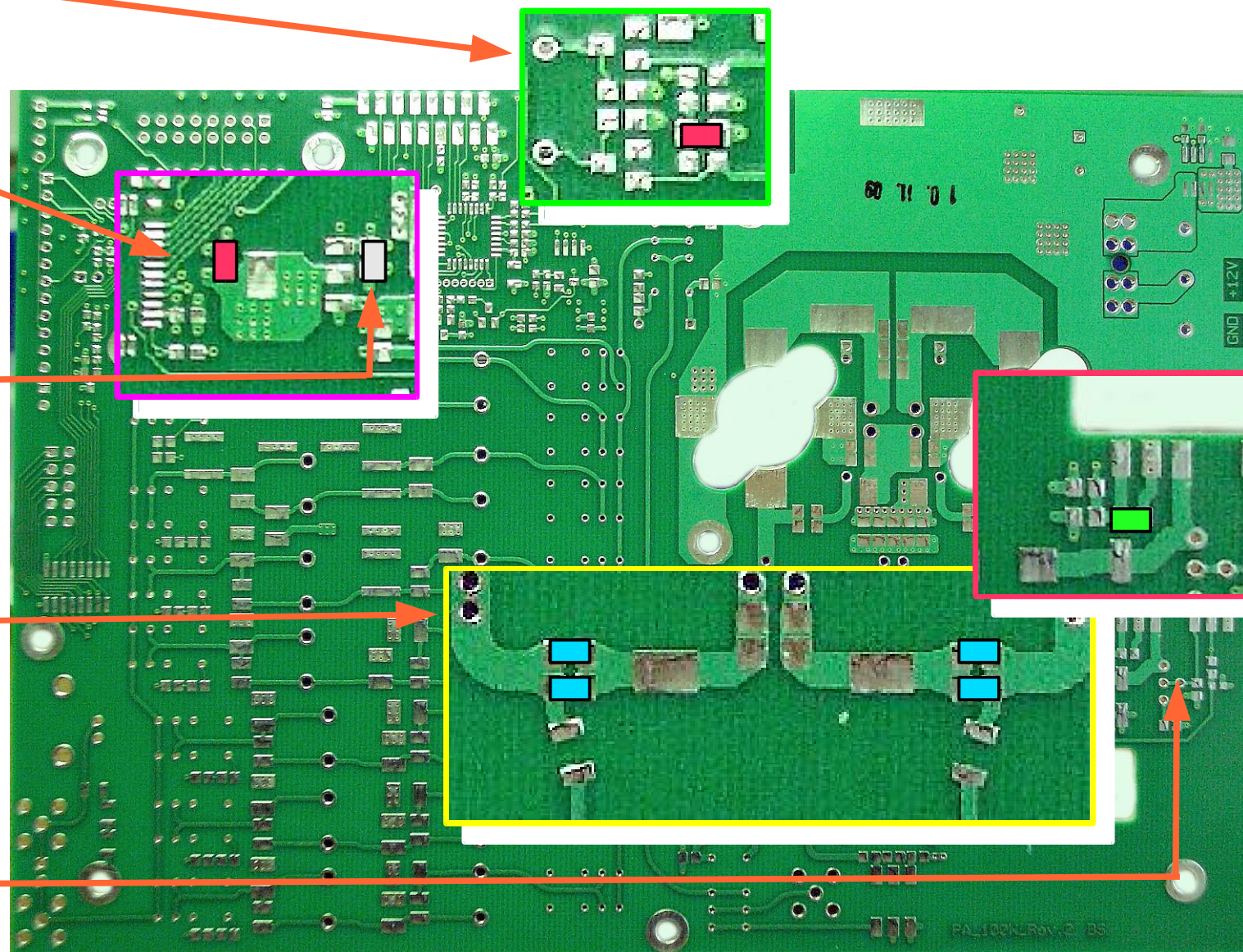
| Item 5 TOP         |           |
|--------------------|-----------|
| CAP CER 100pF 0805 |           |
| Pos                | Reel/Tick |
| C050               |           |

| Item 6 TOP             |           |
|------------------------|-----------|
| CAP CER 10uF/6.3V 0805 |           |
| Pos                    | Reel/Tick |
| C088                   |           |

| Item 7 TOP           |           |
|----------------------|-----------|
| CAP CER 1uF/16V 0805 |           |
| Pos                  | Reel/Tick |
| C089                 |           |

| Item 8 TOP               |           |
|--------------------------|-----------|
| CAP CER 3.300pF/50V 0805 |           |
| Pos                      | Reel/Tick |
| C043                     |           |
| C046                     |           |
| C143                     |           |
| C146                     |           |

| Item 9 TOP         |           |
|--------------------|-----------|
| CAP CER 330nF 0805 |           |
| Pos                | Reel/Tick |
| C074               |           |





**Item 10 TOP**

CAP MICA 12pF Code **C1**

| Pos  | Reel/Tick |
|------|-----------|
| C039 |           |
| C083 |           |



**Item 11 TOP**

CAP MICA 15pF Code **E1**

| Pos   | Reel/Tick |
|-------|-----------|
| C034  |           |
| C041  |           |
| C081  |           |
| C082a |           |



**Item 12 TOP**

CAP MICA 22pF Code **J1**

| Pos  | Reel/Tick |
|------|-----------|
| C027 |           |
| C032 |           |



**Item 13 TOP**

CAP MICA 47pF Code **S1**

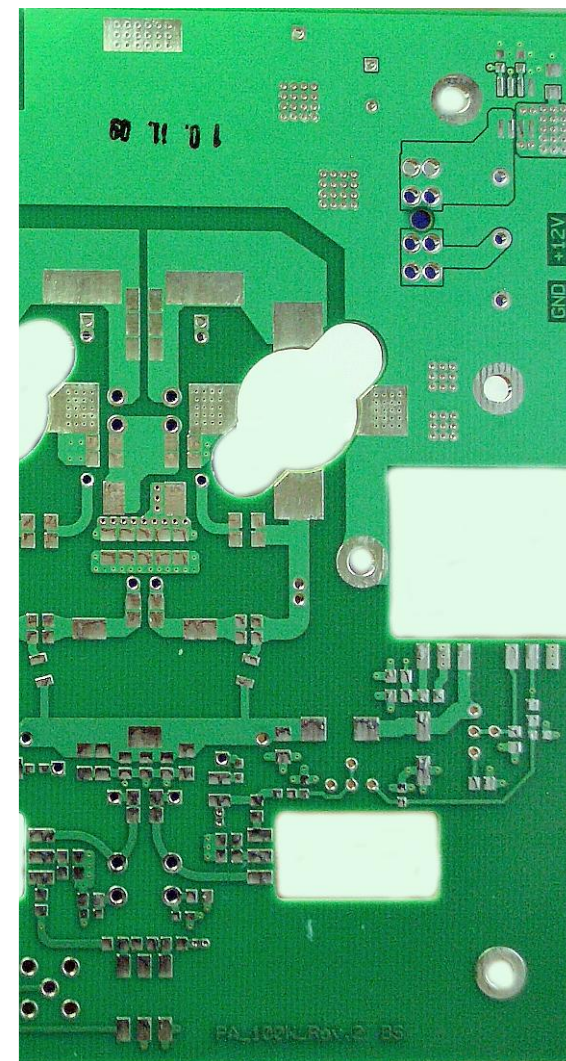
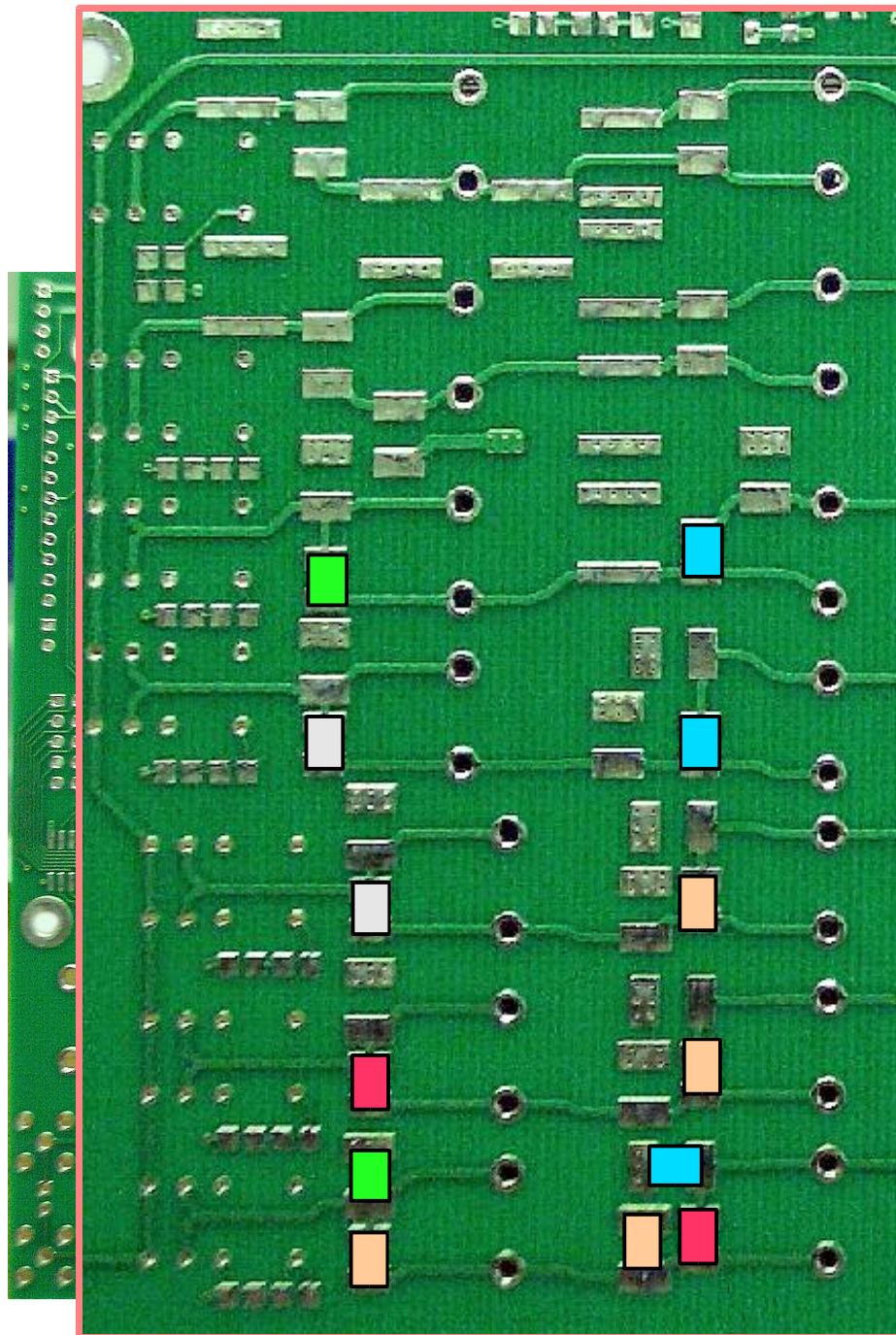
| Pos  | Reel/Tick |
|------|-----------|
| C020 |           |
| C029 |           |
| C084 |           |



**Item 14 TOP**

CAP MICA 68pF Code **W1**

| Pos  | Reel/Tick |
|------|-----------|
| C019 |           |
| C080 |           |





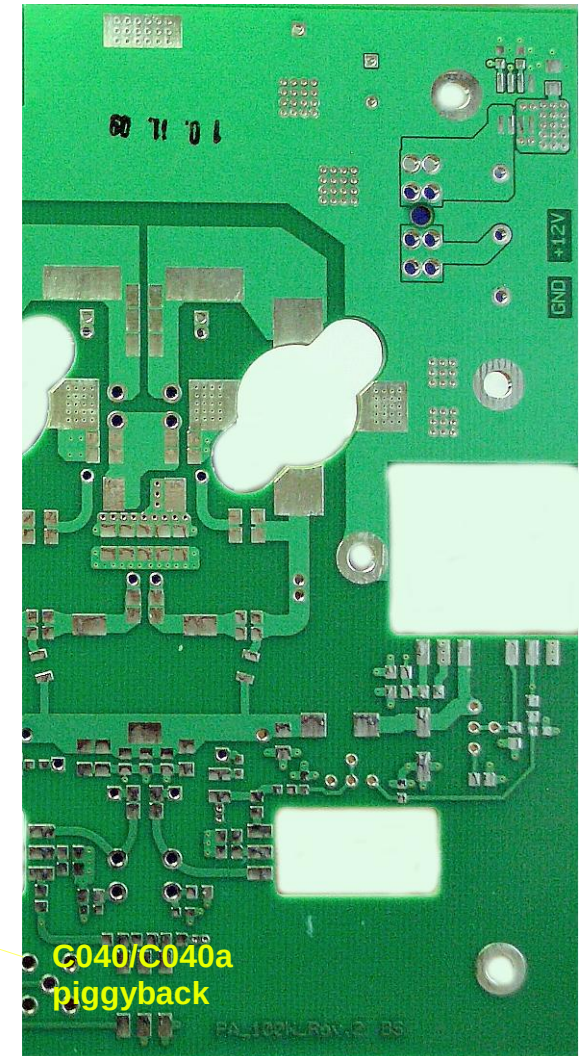
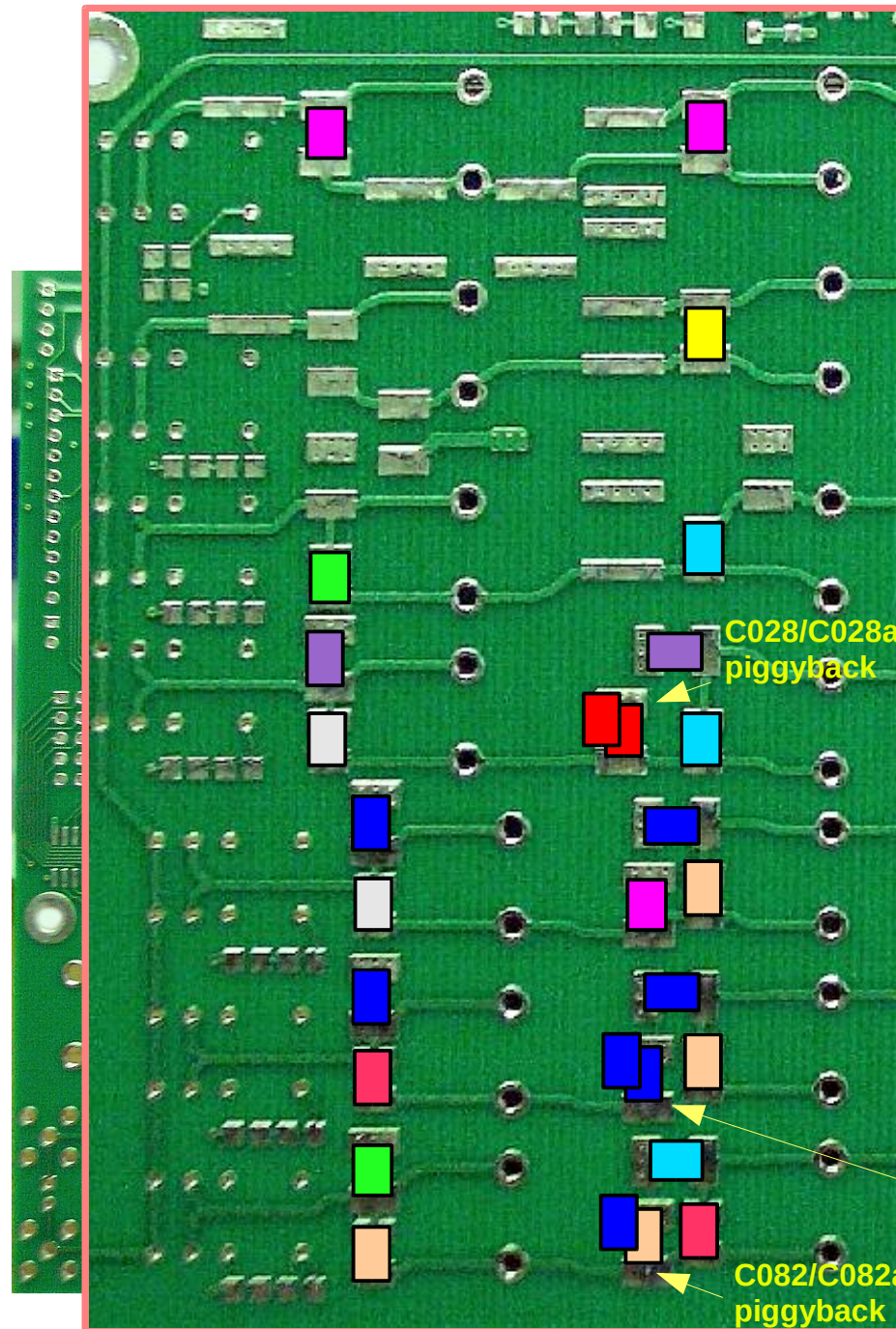
| Item 15 TOP                   |           |  |
|-------------------------------|-----------|--|
| CAP MICA 100pF Code <b>A2</b> |           |  |
| Pos                           | Reel/Tick |  |
| C031                          |           |  |
| C035                          |           |  |
| C038                          |           |  |
| C040                          |           |  |
| C040a                         |           |  |
| C042                          |           |  |
| C082                          |           |  |

| Item 16 TOP                   |           |  |
|-------------------------------|-----------|--|
| CAP MICA 120pF Code <b>C2</b> |           |  |
| Pos                           | Reel/Tick |  |
| C026                          |           |  |
| C030                          |           |  |

| Item 17 TOP                   |           |  |
|-------------------------------|-----------|--|
| CAP MICA 150pF Code <b>E2</b> |           |  |
| Pos                           | Reel/Tick |  |
| C028                          |           |  |
| C028a                         |           |  |

| Item 18 TOP                   |           |  |
|-------------------------------|-----------|--|
| CAP MICA 180pF Code <b>G2</b> |           |  |
| Pos                           | Reel/Tick |  |
| C016                          |           |  |

| Item 19 TOP                   |           |  |
|-------------------------------|-----------|--|
| CAP MICA 220pF Code <b>J2</b> |           |  |
| Pos                           | Reel/Tick |  |
| C002                          |           |  |
| C004                          |           |  |
| C033                          |           |  |





| Item 20 TOP            |           |
|------------------------|-----------|
| CAP MICA 390pF Code Q2 |           |
| Pos                    | Reel/Tick |
| C014                   |           |
| C021                   |           |
| C024                   |           |



| Item 21 TOP            |           |
|------------------------|-----------|
| CAP MICA 680pF Code W2 |           |
| Pos                    | Reel/Tick |
| C013                   |           |



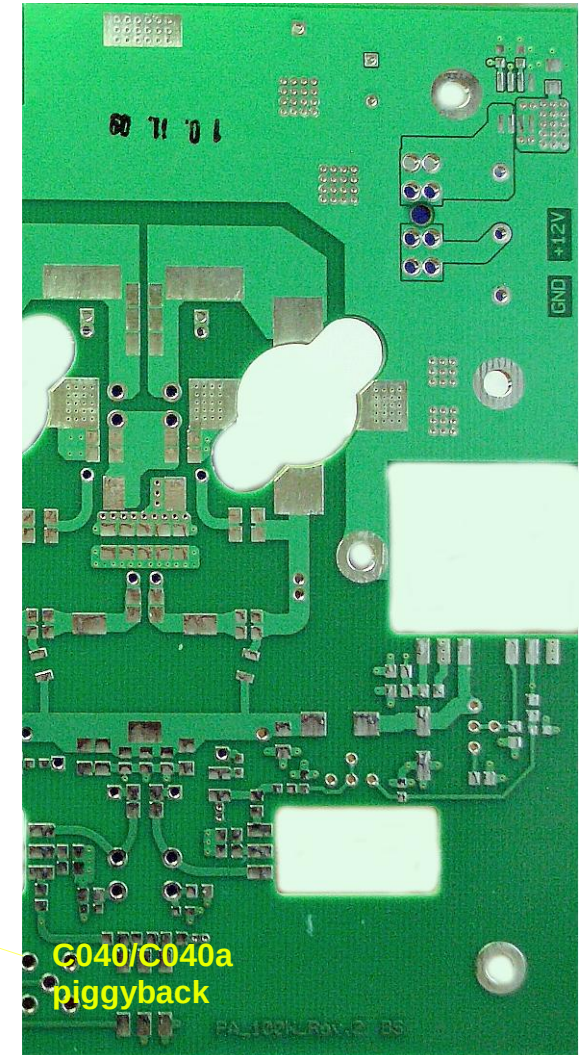
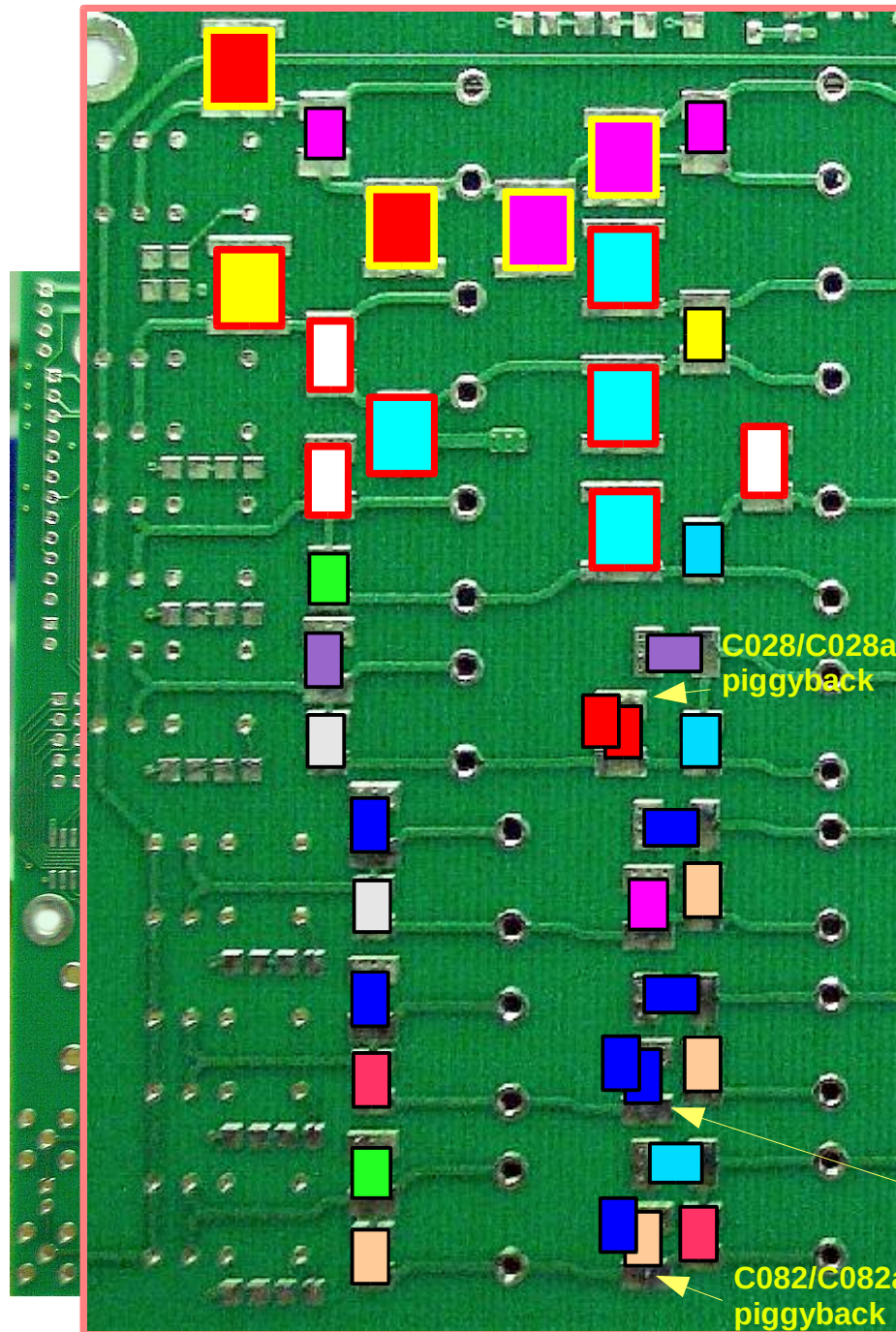
| Item 22 TOP            |           |
|------------------------|-----------|
| CAP MICA 750pF Code X2 |           |
| Pos                    | Reel/Tick |
| C015                   |           |
| C017                   |           |
| C018                   |           |
| C022                   |           |



| Item 23 TOP             |           |
|-------------------------|-----------|
| CAP MICA 1200pF Code C3 |           |
| Pos                     | Reel/Tick |
| C001                    |           |
| C003                    |           |



| Item 24 TOP             |           |
|-------------------------|-----------|
| CAP MICA 1500pF Code E3 |           |
| Pos                     | Reel/Tick |
| C003a                   |           |
| C005                    |           |





| Item 24a TOP        |           |
|---------------------|-----------|
| CAP MICA 180pF 1206 |           |
| Pos                 | Reel/Tick |
| C023                |           |
| €023a               | d.n.p.    |



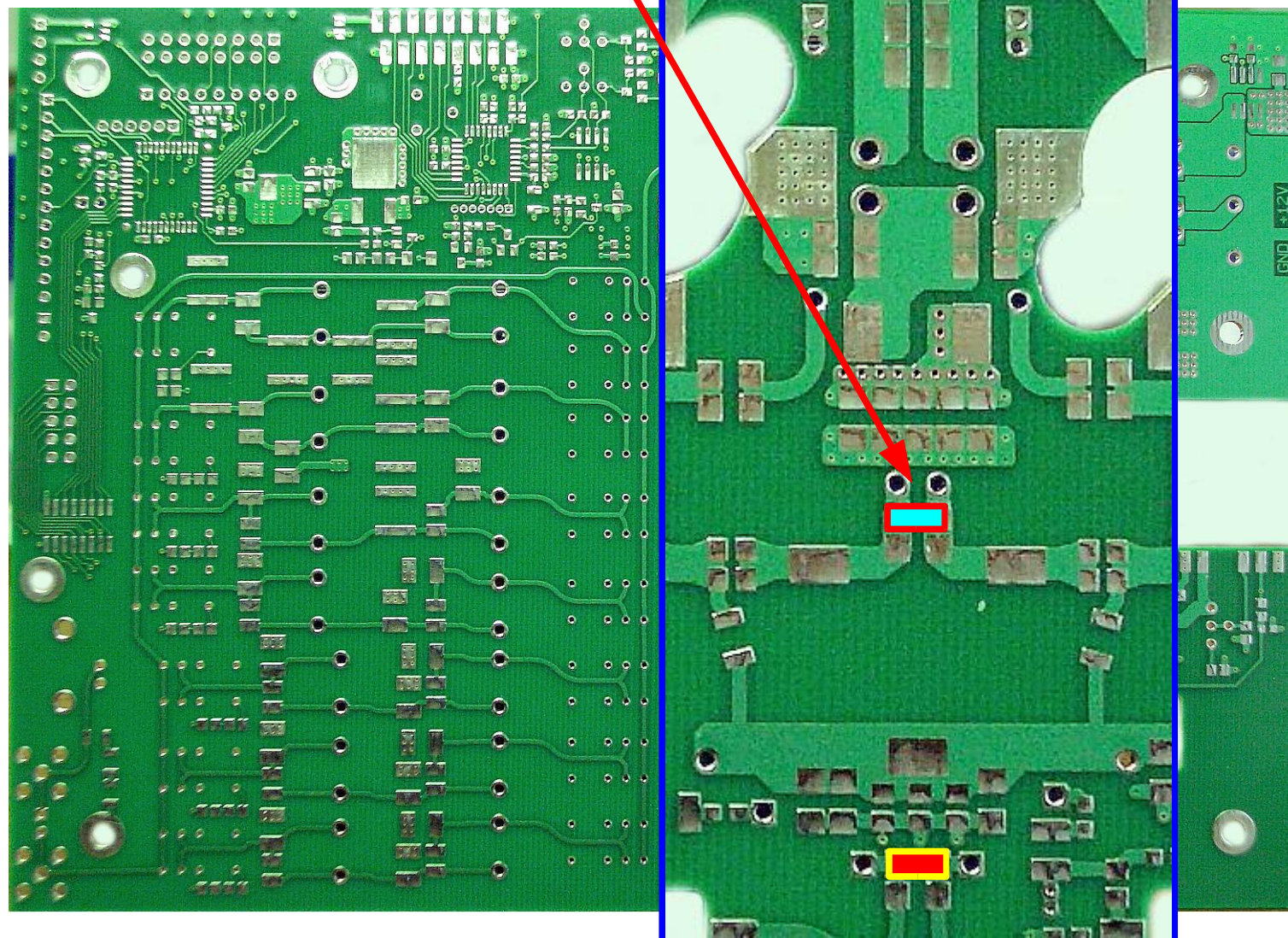
| Item 24b TOP      |           |
|-------------------|-----------|
| CAP CER 33pF 1206 |           |
| Pos               | Reel/Tick |
| C057              |           |
| €057a             | d.n.p.    |



| Item 24c TOP        |           |
|---------------------|-----------|
| CAP MICA 680pF 1210 |           |
| Pos                 | Reel/Tick |
| C025                |           |
| €053                | d.n.p.    |
| €067                | d.n.p.    |

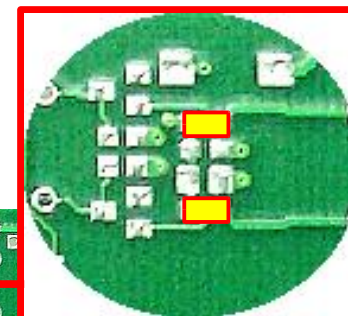
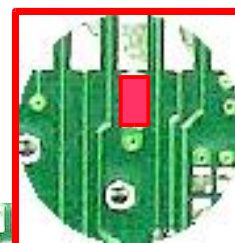
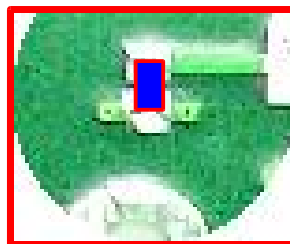


These capacitors should be soldered to the corresponding end plates of RF transformers T1 resp. T2

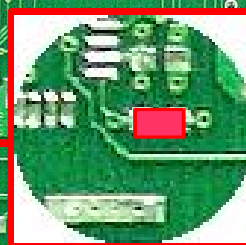
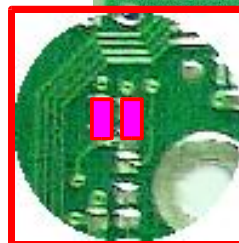




| Item 25 TOP  |           |
|--------------|-----------|
| RES 0R0 0603 |           |
| Pos          | Reel/Tick |
| R59          |           |
| R60          |           |



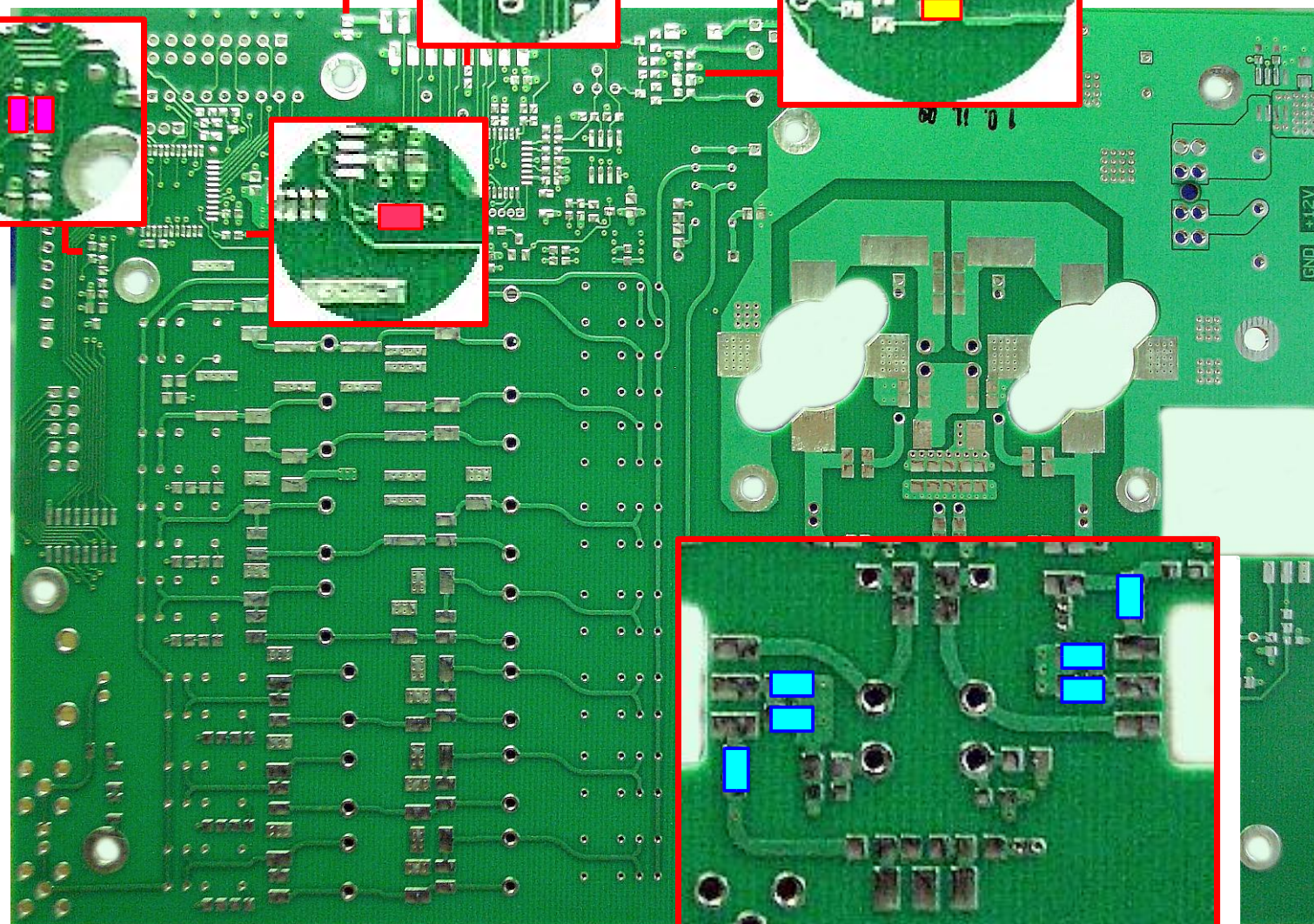
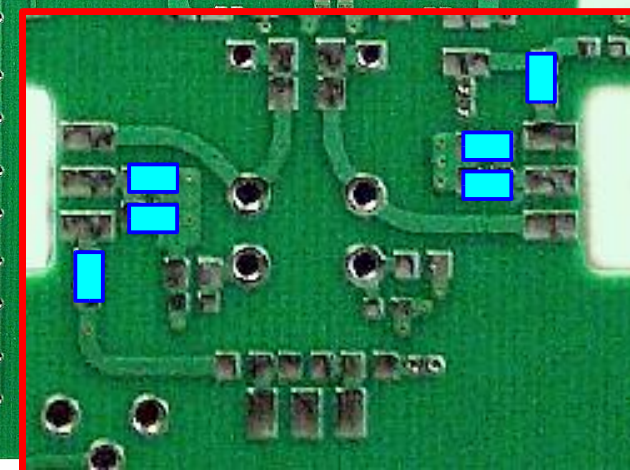
| Item 26 TOP  |           |
|--------------|-----------|
| RES 2R2 0805 |           |
| Pos          | Reel/Tick |
| R01          |           |
| R02          |           |
| R47          |           |
| R48          |           |
| R49          |           |
| R50          |           |



| Item 27 TOP  |           |
|--------------|-----------|
| RES 10R 0603 |           |
| Pos          | Reel/Tick |
| R52          |           |

| Item 28 TOP  |           |
|--------------|-----------|
| RES 22R 0603 |           |
| Pos          | Reel/Tick |
| R08          |           |
| R15          |           |

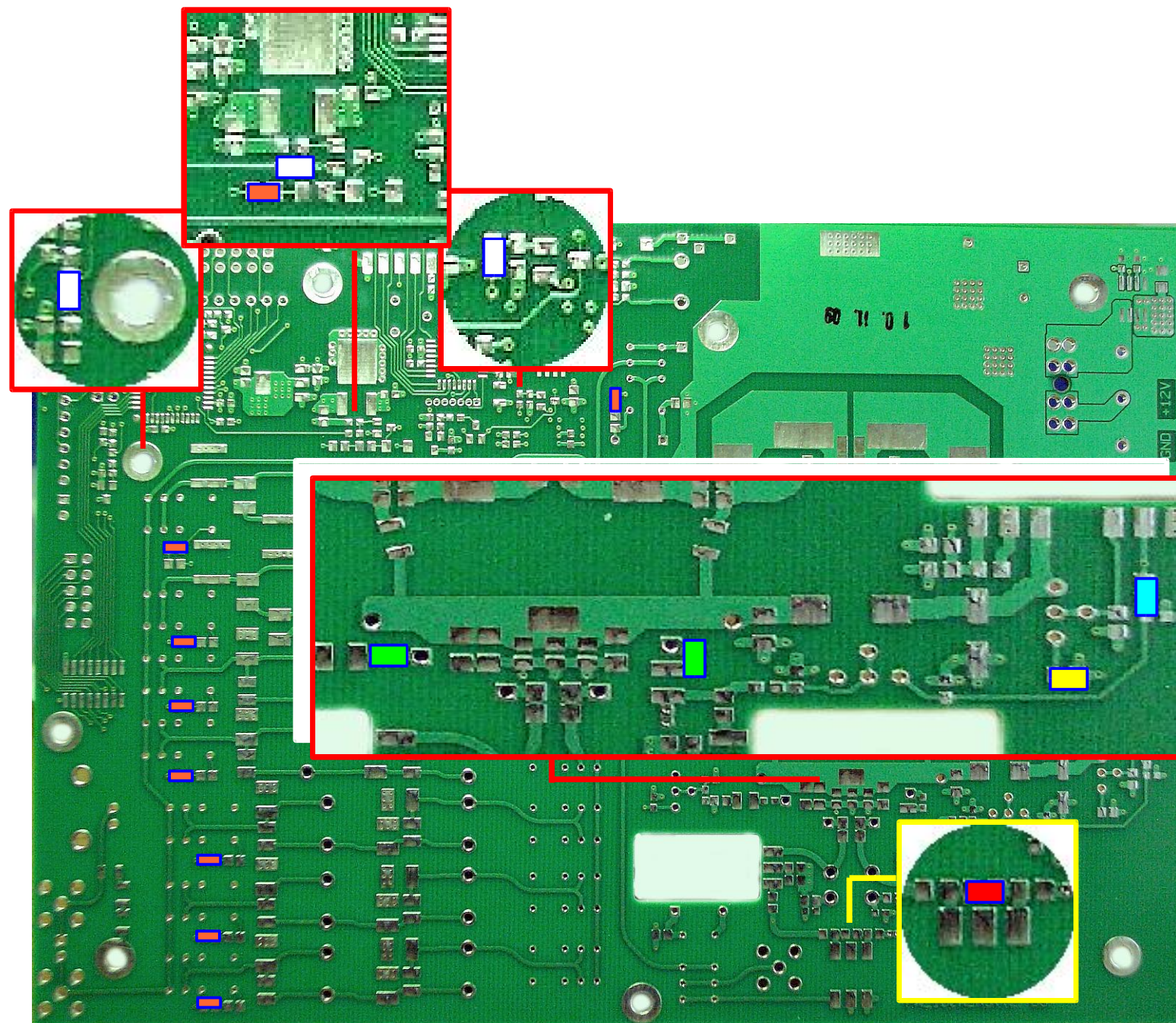
| Item 29 TOP  |           |
|--------------|-----------|
| RES 47R 0603 |           |
| Pos          | Reel/Tick |
| R30          |           |
| R31          |           |







1



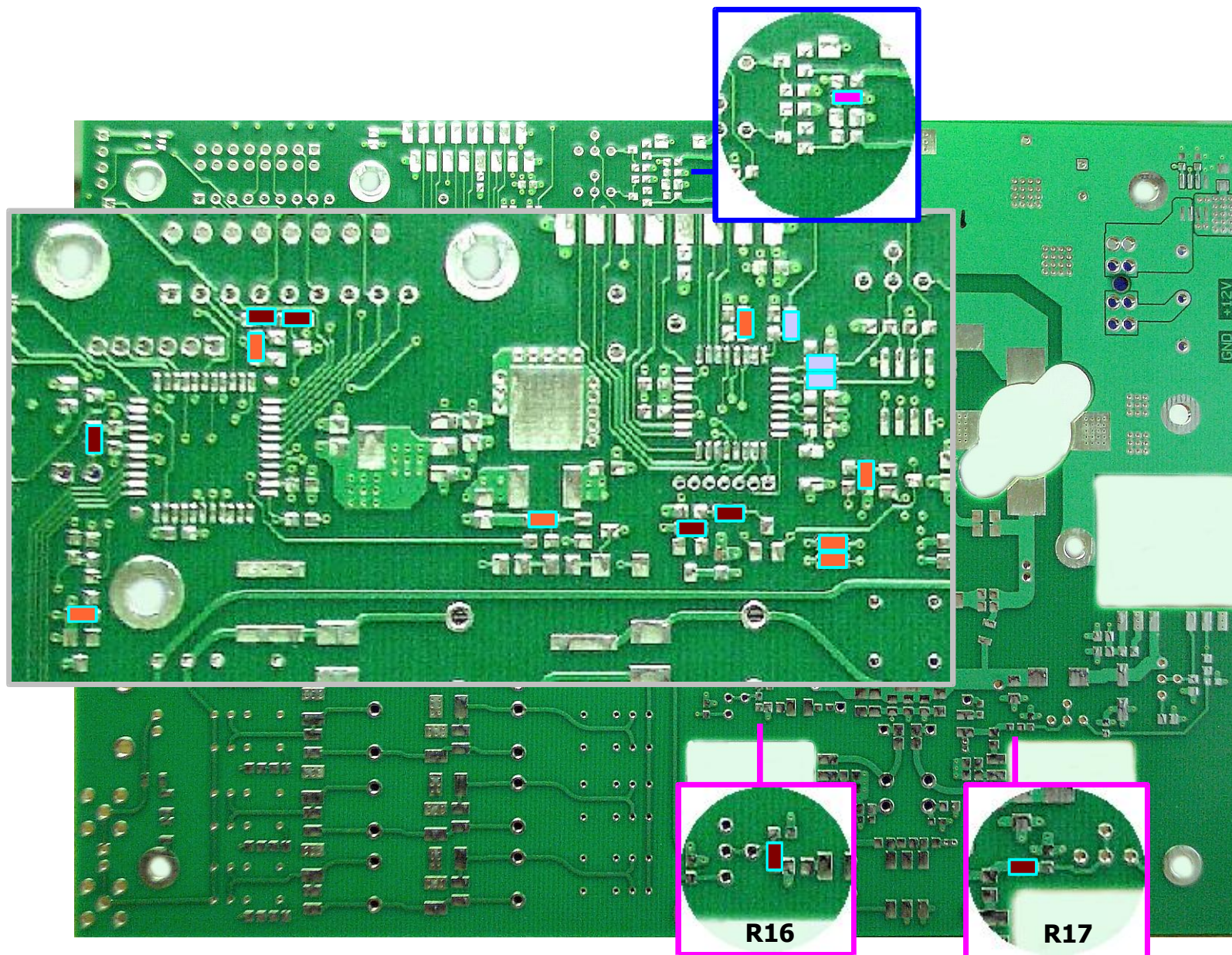


| Item 36 TOP  |           |
|--------------|-----------|
| RES 3k3 0603 |           |
| Pos          | Reel/Tick |
| R10          |           |
| R11          |           |
| R16          |           |
| R17          |           |
| R18          |           |
| R19          |           |
| R29          |           |

| Item 37 TOP   |           |
|---------------|-----------|
| RES 4k75 0603 |           |
| Pos           | Reel/Tick |
| R09           |           |

| Item 38 TOP  |           |
|--------------|-----------|
| RES 10k 0603 |           |
| Pos          | Reel/Tick |
| R14          |           |
| R32          |           |
| R38          |           |
| R44          |           |
| R56          |           |
| R57          |           |
| R58          |           |

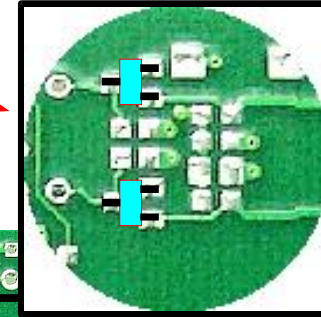
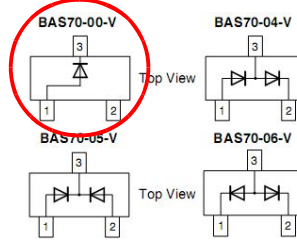
| Item 39 TOP   |           |
|---------------|-----------|
| RES 100k 0603 |           |
| Pos           | Reel/Tick |
| R53           |           |
| R54           |           |
| R55           |           |



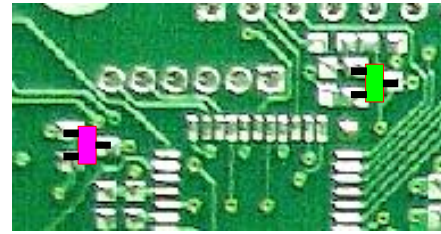


## ...the Making of

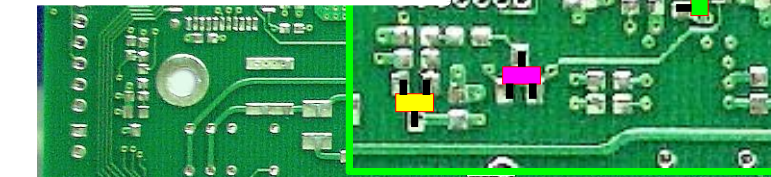
| Item 40 TOP    |           |
|----------------|-----------|
| 1N4148-DO35H/V |           |
| Pos            | Reel/Tick |
| V2             |           |
| V3             |           |



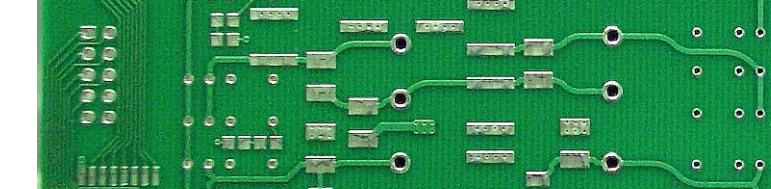
| Item 41 TOP    |           |
|----------------|-----------|
| BAS70-00 SOT23 |           |
| Pos            | Reel/Tick |
| D1             |           |
| D2             |           |



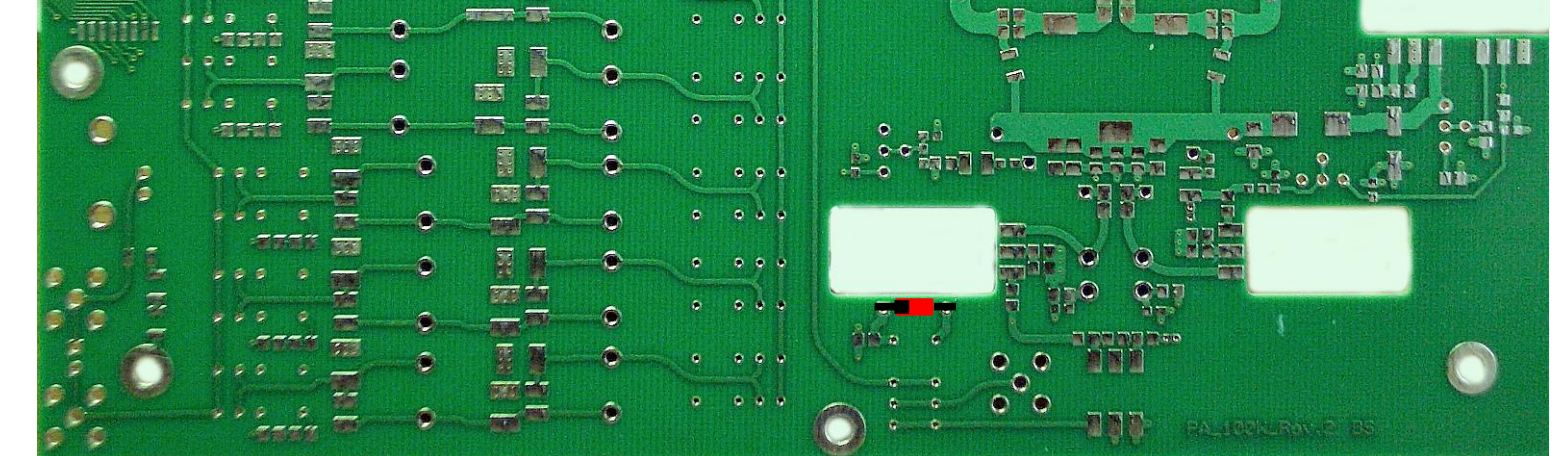
| Item 42 TOP |           |
|-------------|-----------|
| BAT54A      |           |
| Pos         | Reel/Tick |
| D3          |           |
| D4          |           |



| Item 43 TOP    |           |
|----------------|-----------|
| BC807-40-SOT23 |           |
| Pos            | Reel/Tick |
| Q06            |           |



| Item 44 TOP    |           |
|----------------|-----------|
| BC817-40-SOT23 |           |
| Pos            | Reel/Tick |
| Q08            |           |
| Q09            |           |



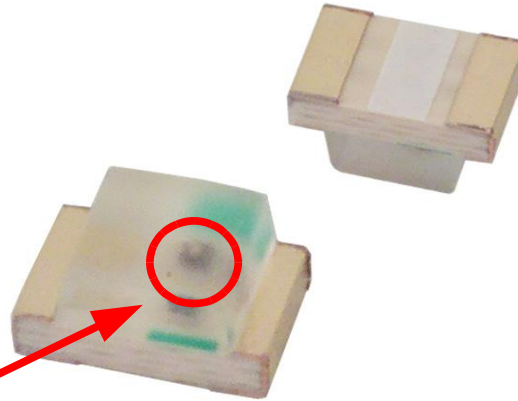


## Special Instructions: Placing LEDs

### How to determine the polarity of the 0805 LEDs?

It can be difficult to find out the polarity of the tiny 0805 LEDs if you don't know what to look for.

The Lite-ON® LEDs used in the JANUS BOM are easy to determine the polarity. Looking on them under a magnifying glass you can see that the LED dice (photo) is visible and off-center from the body. This is the anode (+) side which has to match with + on the PCB.



**LED Dice**

The ones which I am using have a little mark printed on the bottom:

Cathode



Anode

Cathode



Anode



| Item 45 TOP  |           |
|--------------|-----------|
| LED-0805 GRN |           |
| Pos          | Reel/Tick |
| LED1         |           |
| LED2         |           |
| LED3         |           |
| LED4         |           |
| LED6         |           |
| LED7         |           |
| LED8         |           |
| LED9         |           |



| Item 46 TOP |           |
|-------------|-----------|
| LED-0805 RD |           |
| Pos         | Reel/Tick |
| LED11       |           |



| Item 47 TOP        |           |
|--------------------|-----------|
| NC7ST08M5X-SOT23-5 |           |
| Pos                | Reel/Tick |
| IC8                |           |



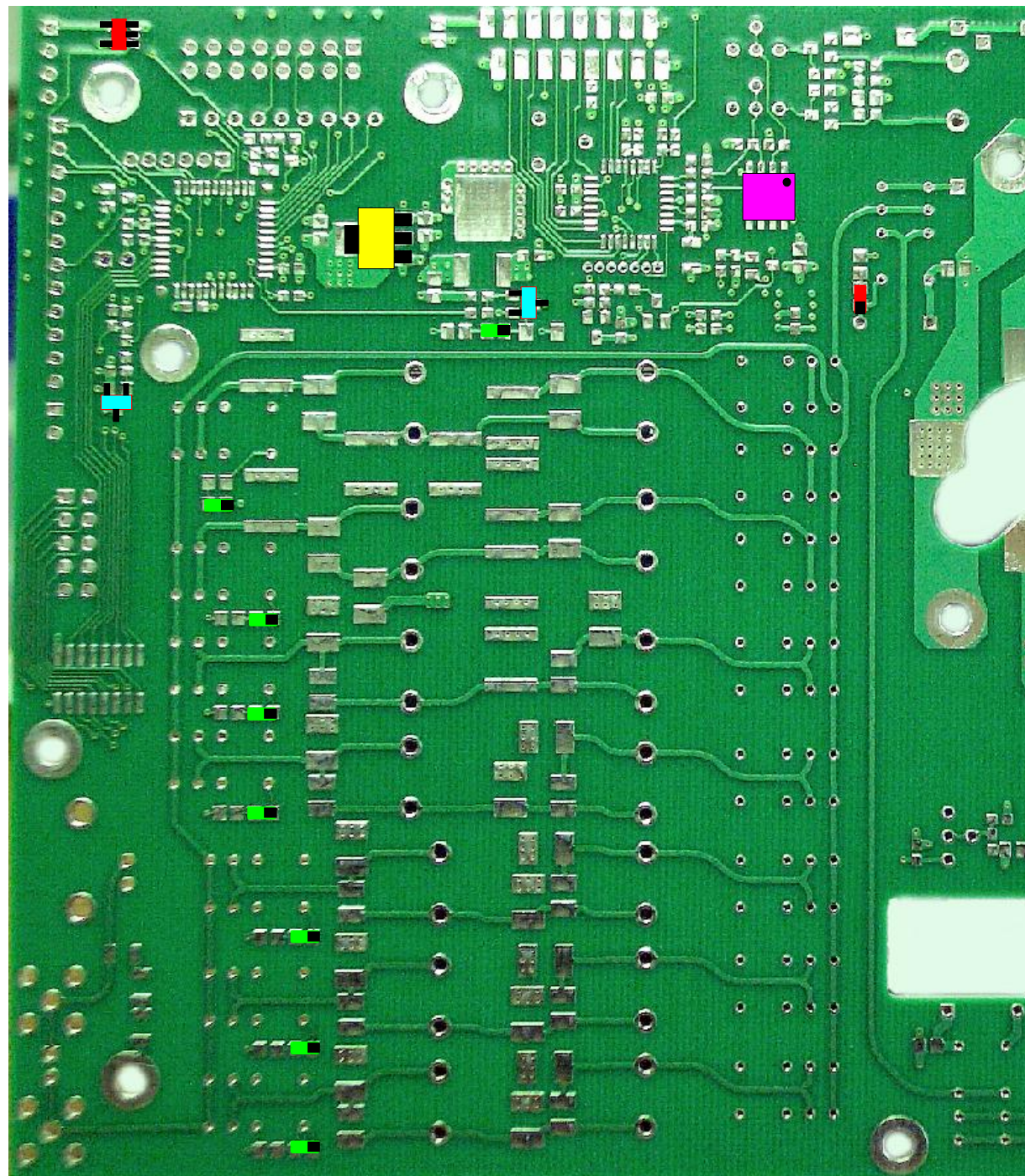
| Item 48 TOP        |           |
|--------------------|-----------|
| REG1117-3.3-SOT223 |           |
| Pos                | Reel/Tick |
| IC2                |           |



| Item 49 TOP |           |
|-------------|-----------|
| TLC0832 SO8 |           |
| Pos         | Reel/Tick |
| IC3         |           |



| Item 50 TOP     |           |
|-----------------|-----------|
| TSM2302CX-SOT23 |           |
| Pos             | Reel/Tick |
| Q11             |           |
| Q12             |           |

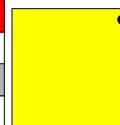




| Item 51 TOP    |           |
|----------------|-----------|
| ULN2003AD-SO16 |           |
| Pos            | Reel/Tick |
| IC5            |           |



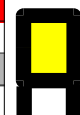
| Item 52 TOP     |           |
|-----------------|-----------|
| XC9572XL-VQFP44 |           |
| Pos             | Reel/Tick |
| IC7             |           |



| Item 53 TOP    |           |
|----------------|-----------|
| ATMEGA8 TQFP32 |           |
| Pos            | Reel/Tick |
| IC6            |           |



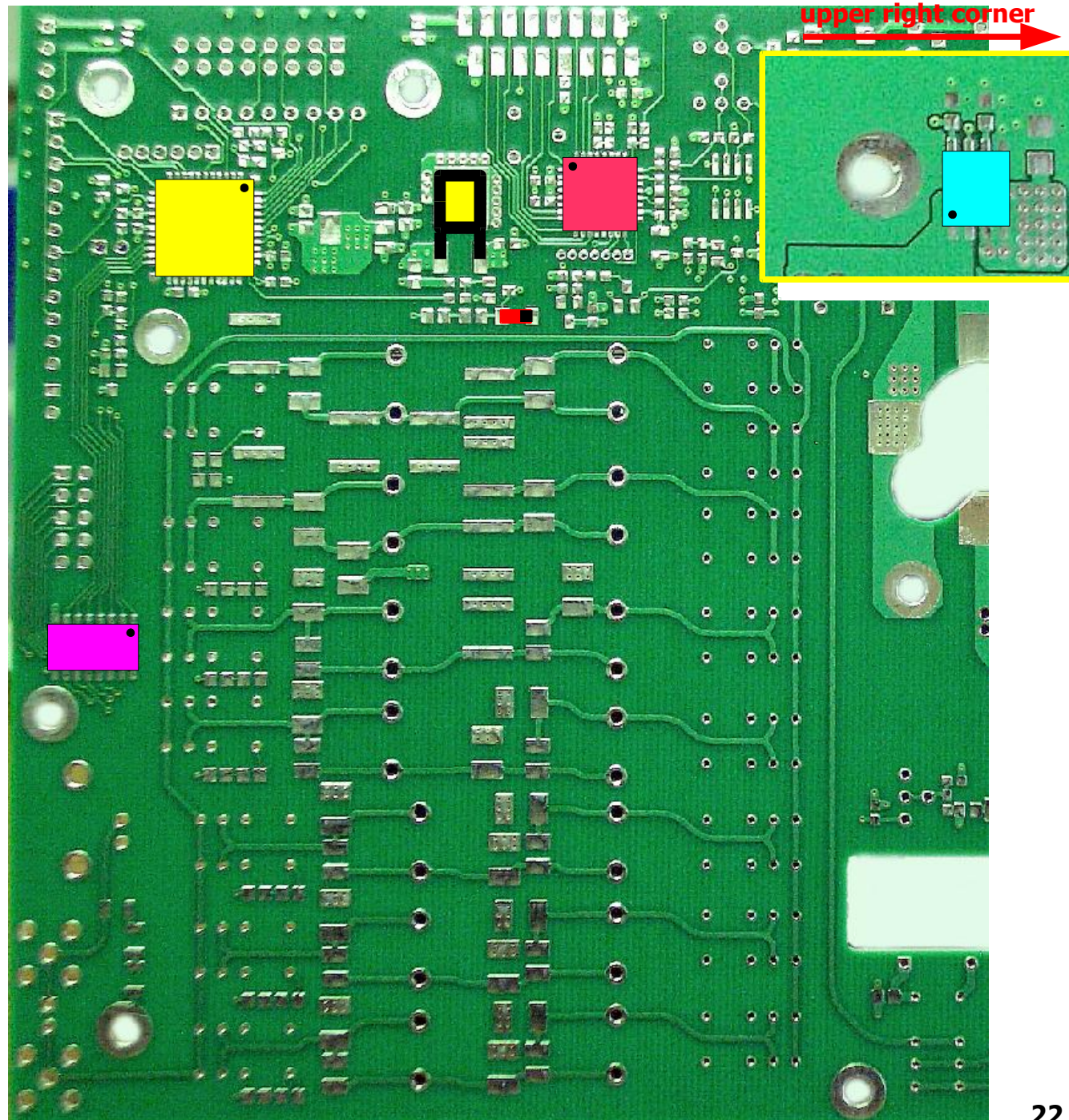
| Item 54 TOP      |           |
|------------------|-----------|
| 78M05-TO252-DPAK |           |
| Pos              | Reel/Tick |
| IC4              |           |



| Item 55 TOP       |           |
|-------------------|-----------|
| ACS712ELCTR-20A-T |           |
| Pos               | Reel/Tick |
| IC1               |           |



| Item 55a TOP |           |
|--------------|-----------|
| LL4148       |           |
| Pos          | Reel/Tick |
| D9           |           |





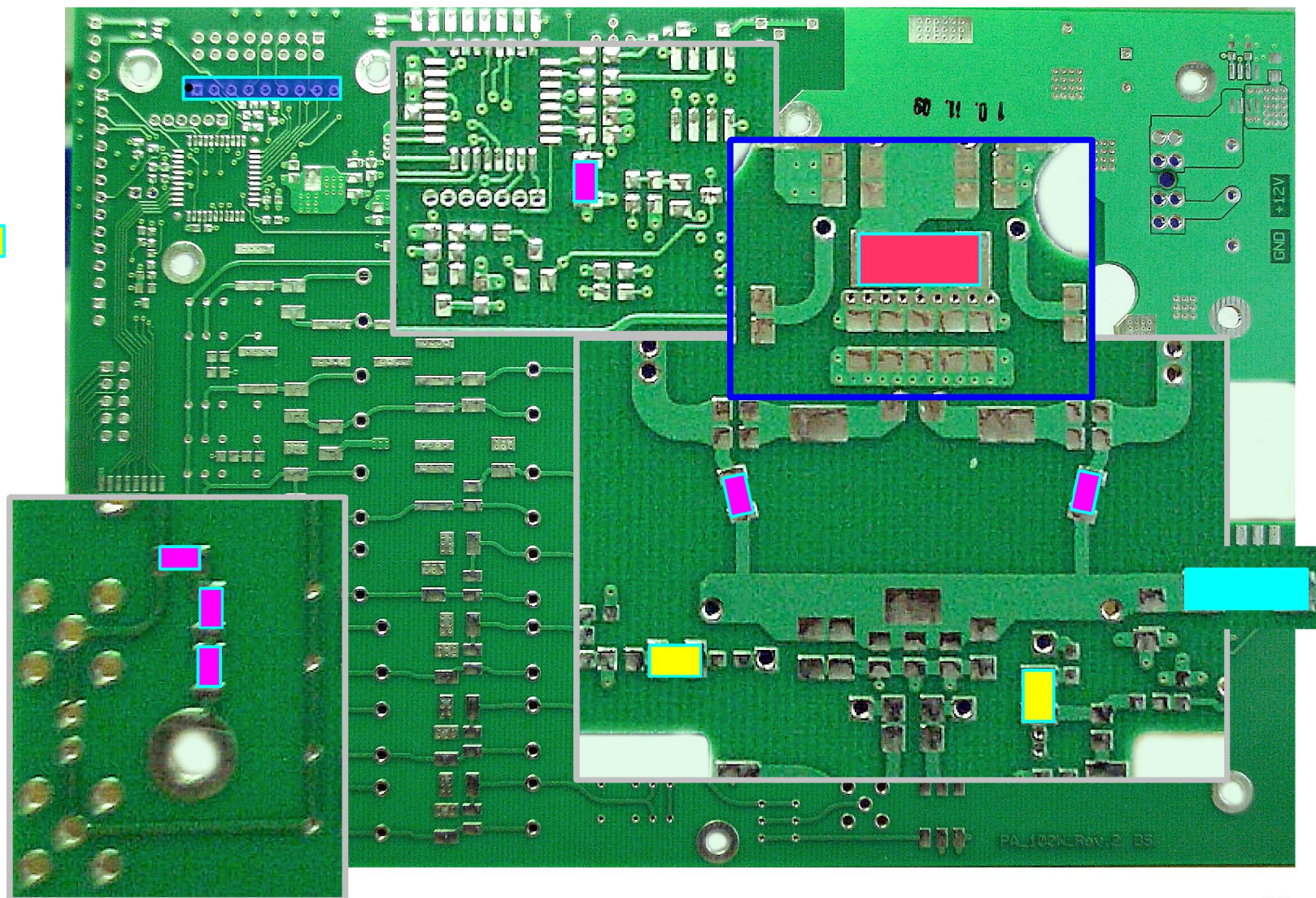
| Item 56 TOP   |           |
|---------------|-----------|
| IND 10uH 1206 |           |
| Pos           | Reel/Tick |
| L14           |           |
| L14a          |           |
| L14b          |           |
| L15           |           |
| L16           |           |
| L20           |           |

| Item 57 TOP    |           |
|----------------|-----------|
| IND 680nH 1210 |           |
| Pos            | Reel/Tick |
| L13            |           |
| L13A           |           |

| Item 58 TOP                  |           |
|------------------------------|-----------|
| 0,25uH-18A-HC-6,6x7,3-Wuerth |           |
| Pos                          | Reel/Tick |
| L19                          |           |

| Item 59 TOP                      |           |
|----------------------------------|-----------|
| 5-HOLE Ferrit Wuerth-7427512 SMD |           |
| Pos                              | Reel/Tick |
| L21                              |           |

| Item 60 TOP        |           |
|--------------------|-----------|
| RES NET 8x10k SIP9 |           |
| Pos                | Reel/Tick |
| RN1                |           |





| Item 61 TOP             |           |
|-------------------------|-----------|
| TRIM-C SMD 4-25pF 4,5x4 |           |
| Pos                     | Reel/Tick |
| C049                    |           |



| Item 62 TOP            |           |
|------------------------|-----------|
| MINI CIRCUITS ADT1,5-1 |           |
| Pos                    | Reel/Tick |
| T7                     |           |



| Item 63 TOP                  |           |
|------------------------------|-----------|
| ECAP 100uF/25V SMD-D-6.6x6.6 |           |
| Pos                          | Reel/Tick |
| C059                         |           |



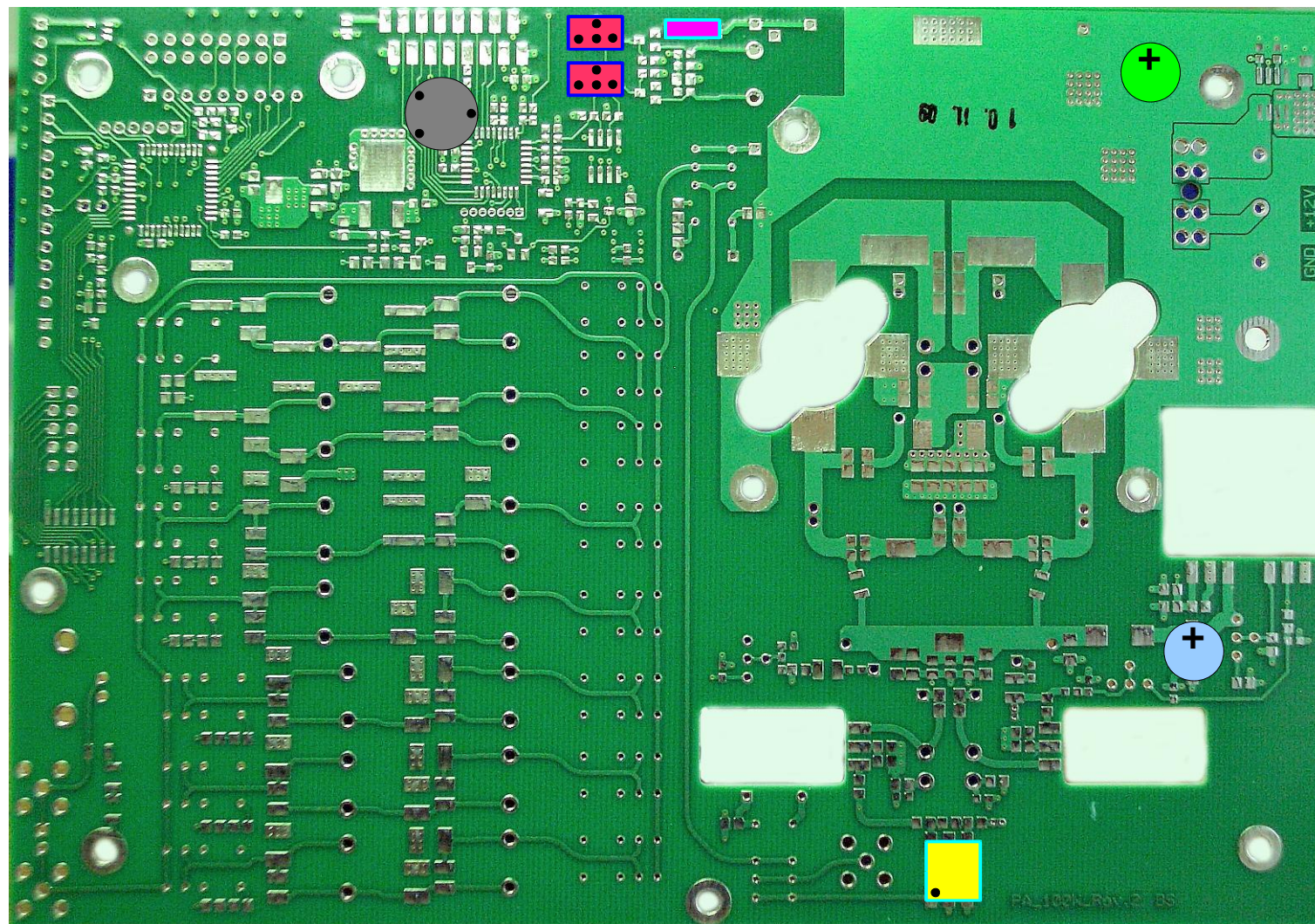
| Item 64 TOP              |           |
|--------------------------|-----------|
| ECAP 470uF/25V RM5-D10.5 |           |
| Pos                      | Reel/Tick |
| C011                     |           |



| Item 65 TOP  |           |
|--------------|-----------|
| POT 10K PT6H |           |
| Pos          | Reel/Tick |
| VR4          |           |



| Item 66 TOP     |           |
|-----------------|-----------|
| POT 100K 3296YW |           |
| Pos             | Reel/Tick |
| VR3             |           |
| VR5             |           |





**Item 67 TOP**

POT 10K 3296YW

Pos Reel/Tick

VR1

VR6

**Item 68 TOP**

POT 100R 3296YW

Pos Reel/Tick

VR2

**Item 69 TOP**

RES 10R0-2W

Pos Reel/Tick

R04

R06

**Item 70 TOP**

RES 2R7-2W

Pos Reel/Tick

R03

R05

**Item 71 TOP**

RES 39R-2W

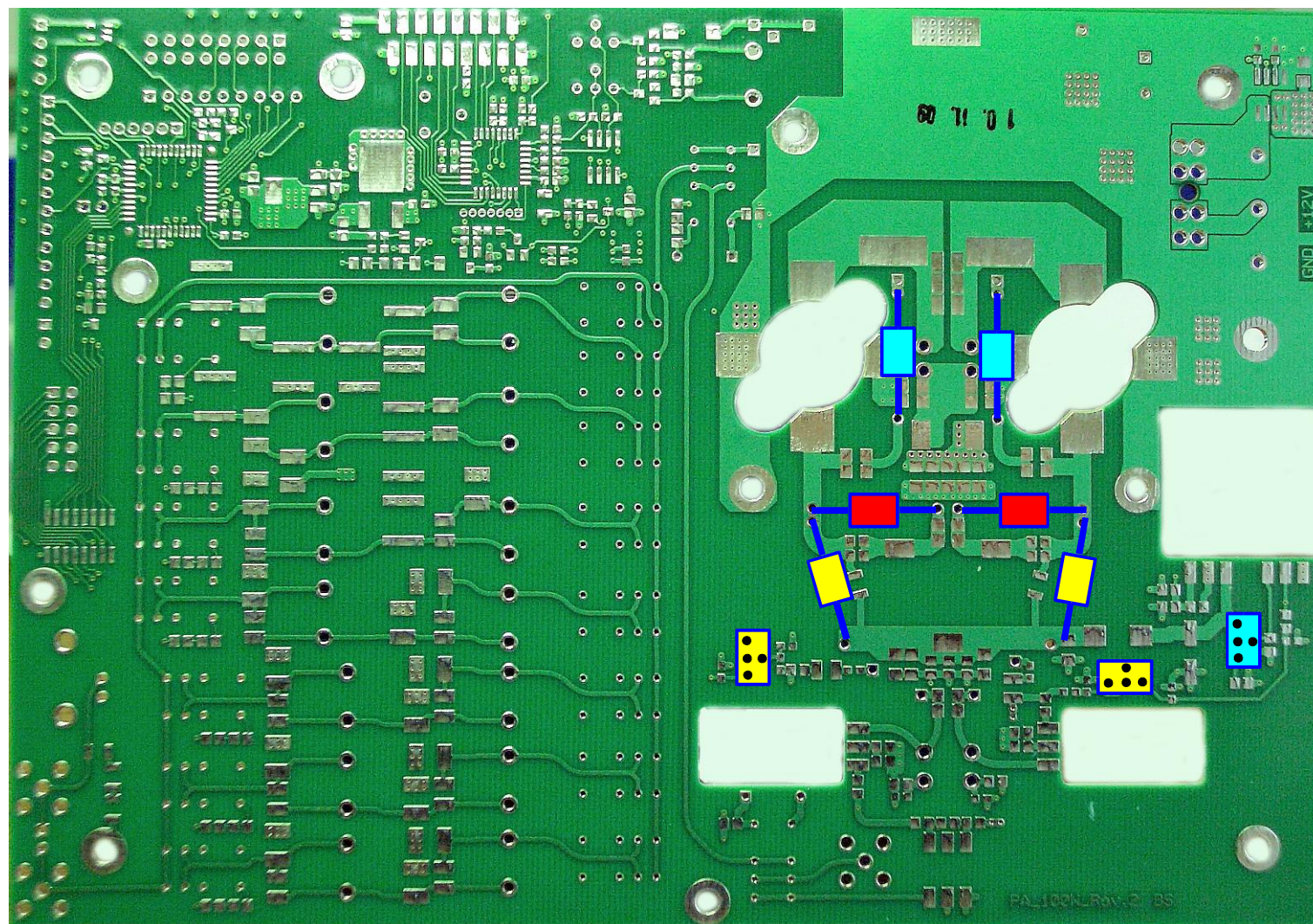
Pos Reel/Tick

R45

R46



**Don't place R45 and R46 yet.  
Put them aside until you have  
finished the rest of the job.**

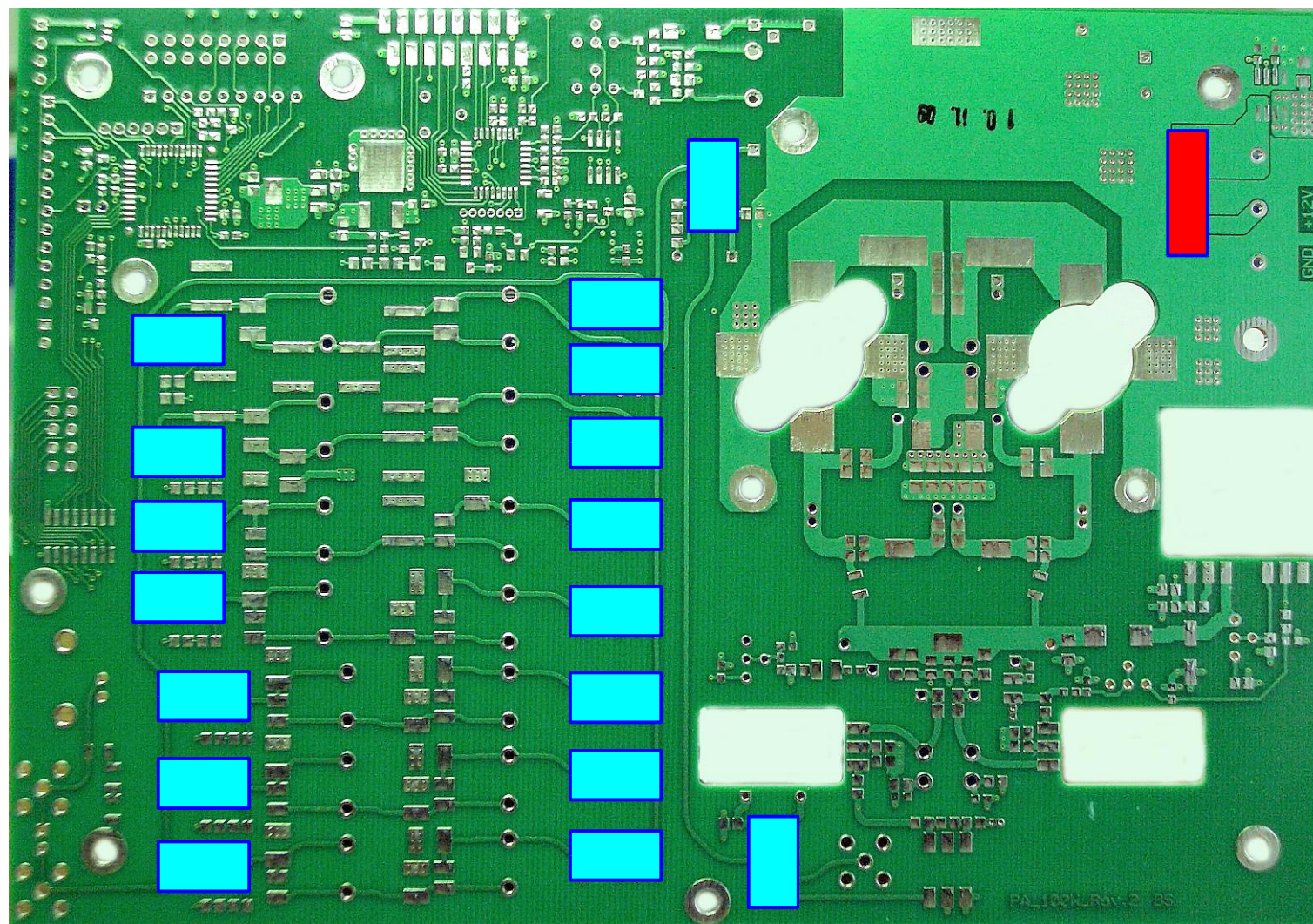




| Item 72 TOP           |           |
|-----------------------|-----------|
| REL PCB 2XJM NA-12W-K |           |
| Pos                   | Reel/Tick |
| K01                   |           |
| K02                   |           |
| K03                   |           |
| K04                   |           |
| K05                   |           |
| K06                   |           |
| K07                   |           |
| K08                   |           |
| K09                   |           |
| K10                   |           |
| K11                   |           |
| K12                   |           |
| K13                   |           |
| K14                   |           |
| K15                   |           |
| K16                   |           |
| K17                   |           |



| Item 73 TOP      |           |
|------------------|-----------|
| FUSEHOLDER FLR42 |           |
| Pos              | Reel/Tick |
| Si1              |           |





| Item 74 TOP           |           |
|-----------------------|-----------|
| PHOENIX-GMKDS3/3-7.62 |           |
| Pos                   | Reel/Tick |
| J01                   |           |

Main PWR Connector

| Item 75 TOP      |           |
|------------------|-----------|
| Molex 22-23-2021 |           |
| Pos              | Reel/Tick |
| J02              |           |

Fan Connector

| Item 76 TOP   |           |
|---------------|-----------|
| BNC PRINT 90° |           |
| Pos           | Reel/Tick |
| J03           |           |

Antenna Connector

| Item 77 TOP   |           |
|---------------|-----------|
| SMA PRINT 90° |           |
| Pos           | Reel/Tick |
| J04           |           |
| J05           |           |

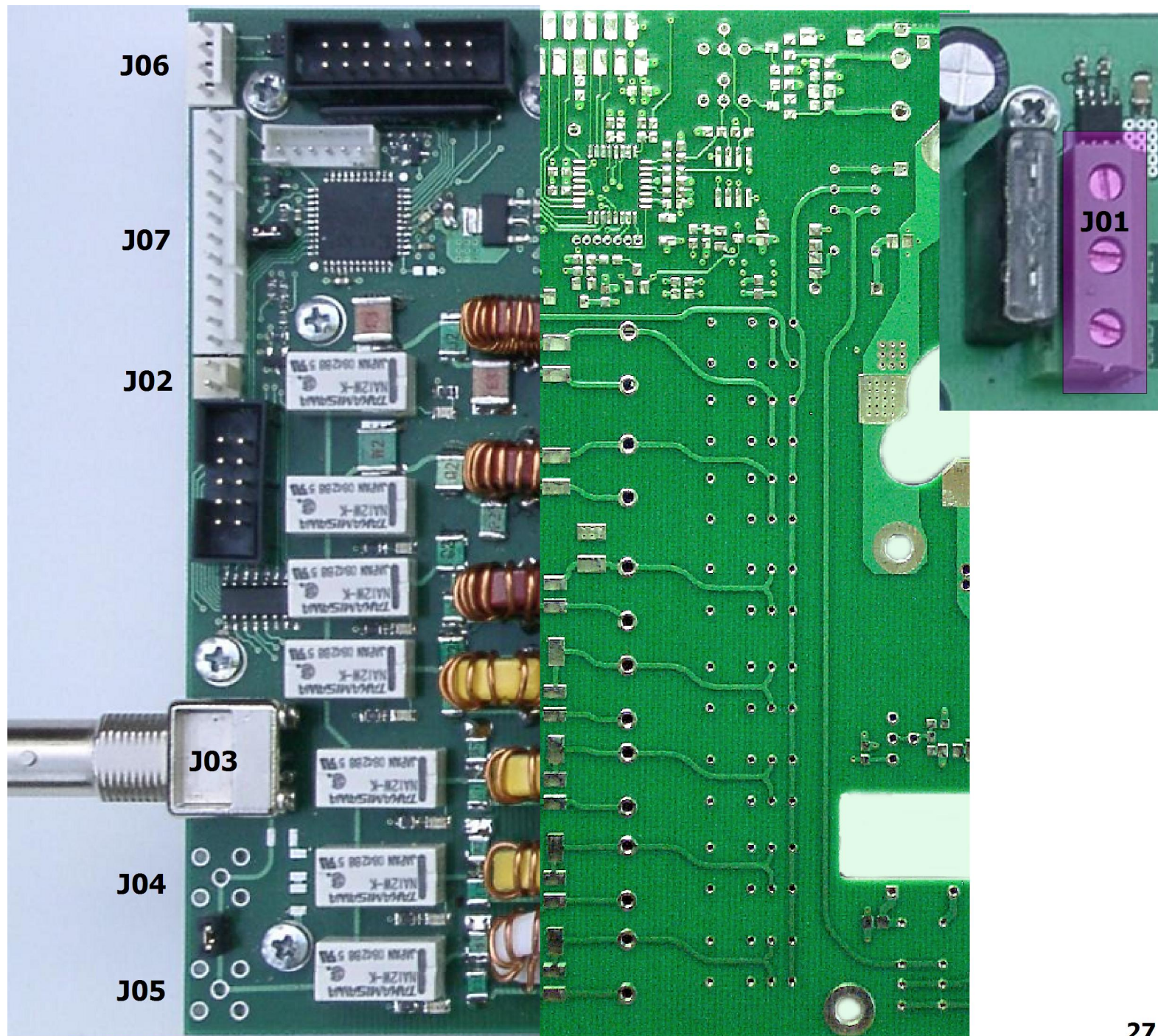
J05 RF to ATU – J04 RF from ATU

| Item 78 TOP      |           |
|------------------|-----------|
| Molex 22-23-2041 |           |
| Pos              | Reel/Tick |
| J06              |           |

ATU Control Lines

| Item 79 TOP      |           |
|------------------|-----------|
| Molex 22-23-2121 |           |
| Pos              | Reel/Tick |
| J07              |           |

Ext. RFE Control Lines





**Item 80 TOP**

SMA PRINT 180°

|     |           |
|-----|-----------|
| Pos | Reel/Tick |
|-----|-----------|

|     |  |
|-----|--|
| J08 |  |
|-----|--|

**RF INPUT from PENELOPE**

**Item 81 TOP**

J5X2-WR10W

|     |           |
|-----|-----------|
| Pos | Reel/Tick |
|-----|-----------|

|     |  |
|-----|--|
| J09 |  |
|-----|--|

**FilterRLY Control Lines for ext. Use**

**Item 82 TOP**

J8X2-WR16W

|     |           |
|-----|-----------|
| Pos | Reel/Tick |
|-----|-----------|

|     |  |
|-----|--|
| J10 |  |
|-----|--|

**From PENELOPE J6**

**Item 83 TOP**

JST-B6B-PH-K-S-6Pins-RM2.00

|     |           |
|-----|-----------|
| Pos | Reel/Tick |
|-----|-----------|

|     |  |
|-----|--|
| J11 |  |
|-----|--|

**XILINX Programming Connector**

**Item 84 TOP**

AMP Micro-Match 338069-16Pins

|     |           |
|-----|-----------|
| Pos | Reel/Tick |
|-----|-----------|

|     |  |
|-----|--|
| J12 |  |
|-----|--|

**Ext. DISPLAY Connector**

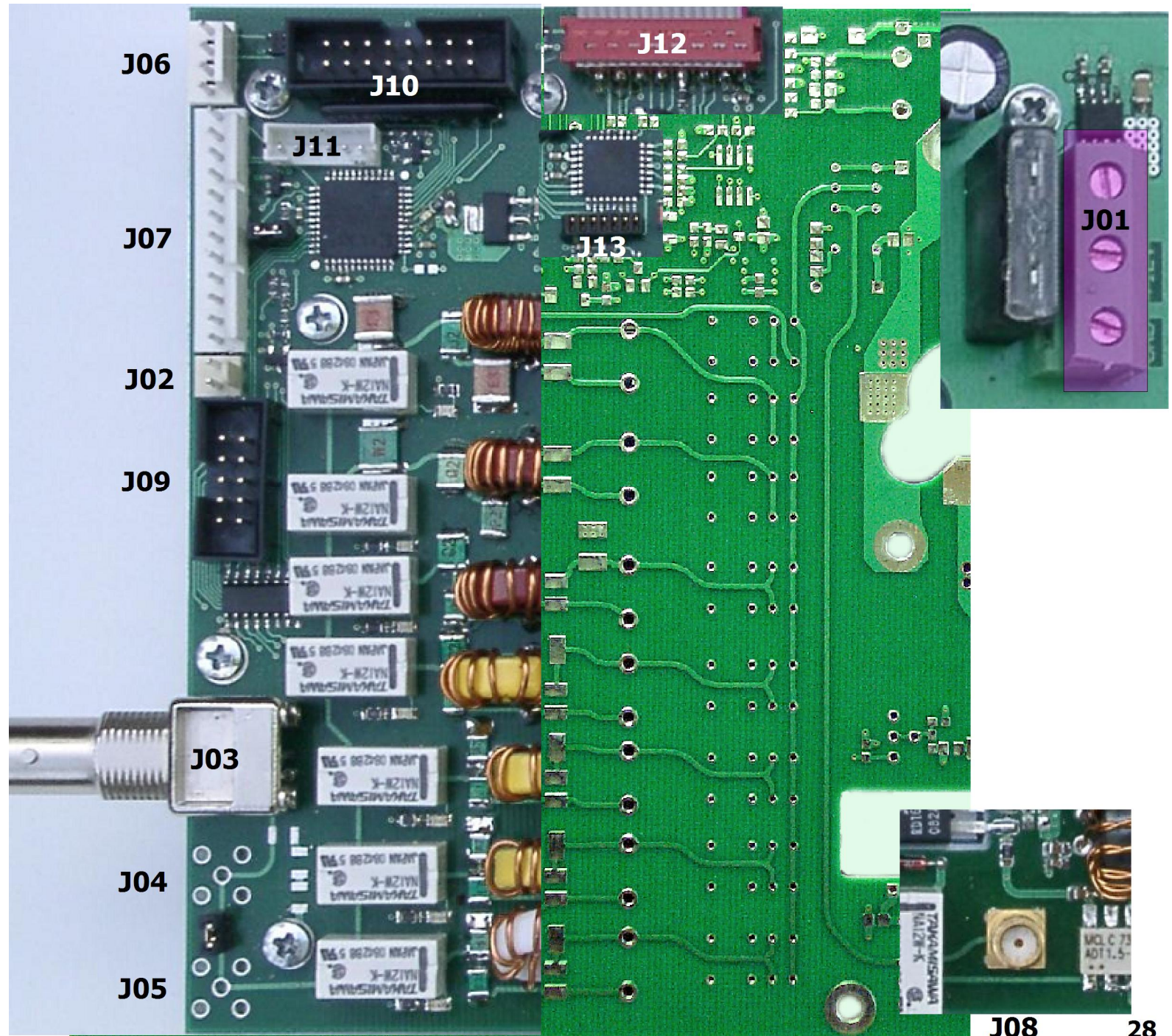
**Item 85 TOP**

J1X7-SIP7-1.27

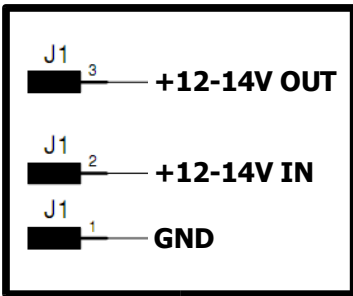
|     |           |
|-----|-----------|
| Pos | Reel/Tick |
|-----|-----------|

|     |  |
|-----|--|
| J13 |  |
|-----|--|

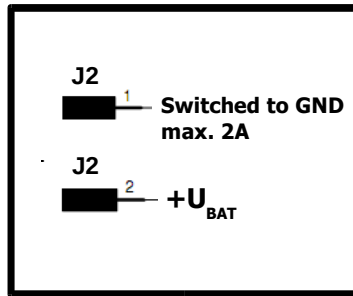
**ATMega8 Programming Connector**



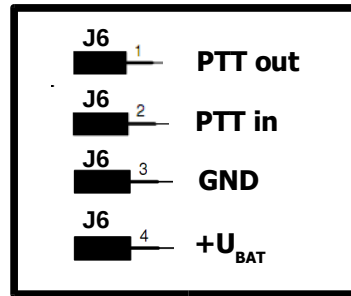




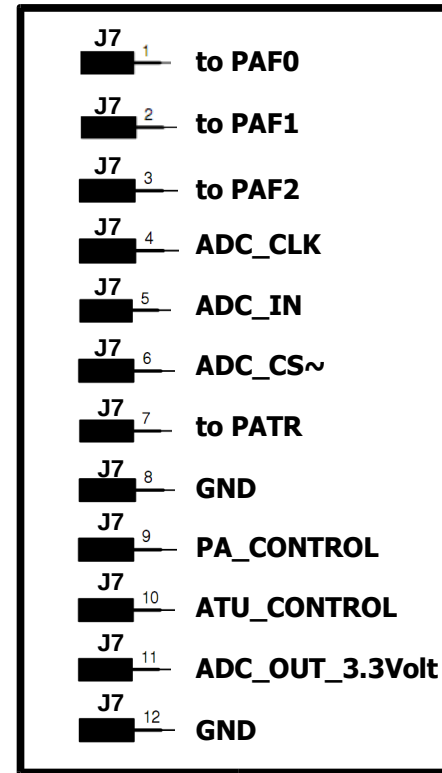
J01 Main PWR Connector



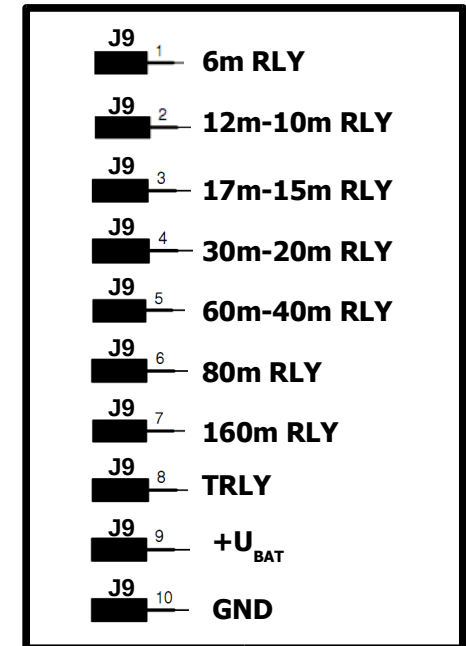
J02 Fan Connector



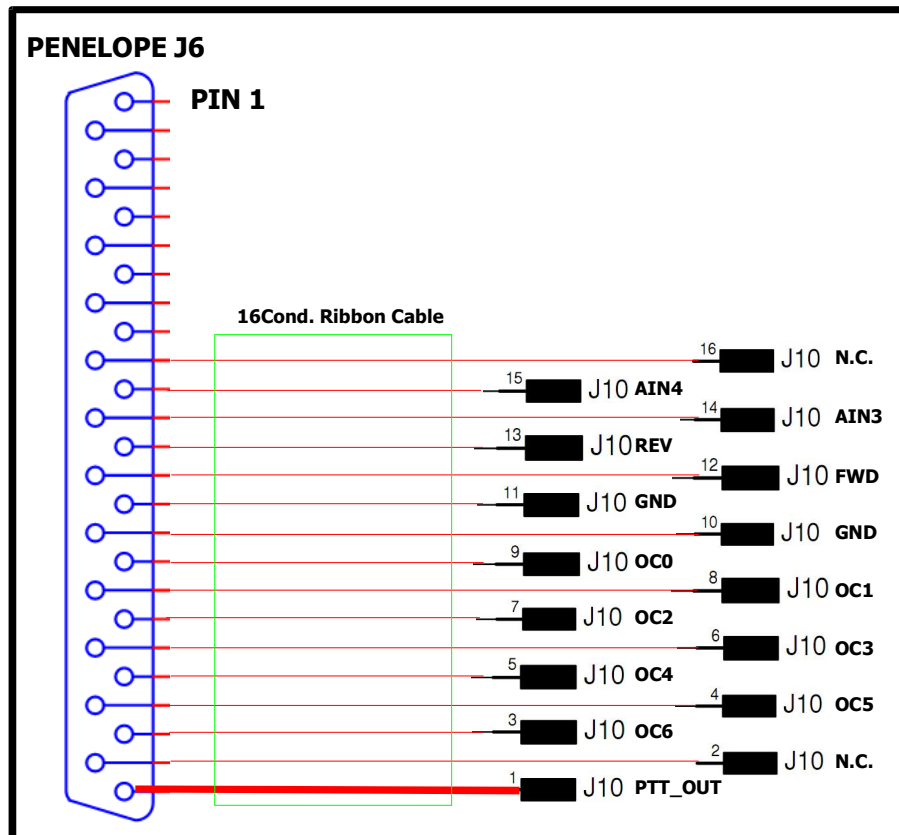
J06 ATU Control Lines



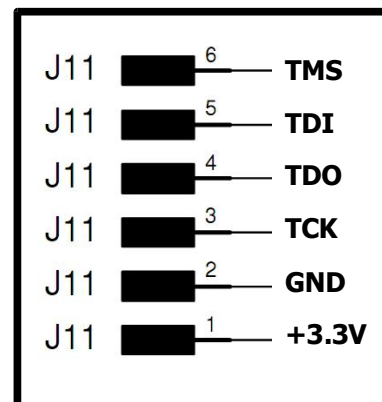
J07 RFE Control Lines



J09 FilterRLY Control Lines for ext. Use

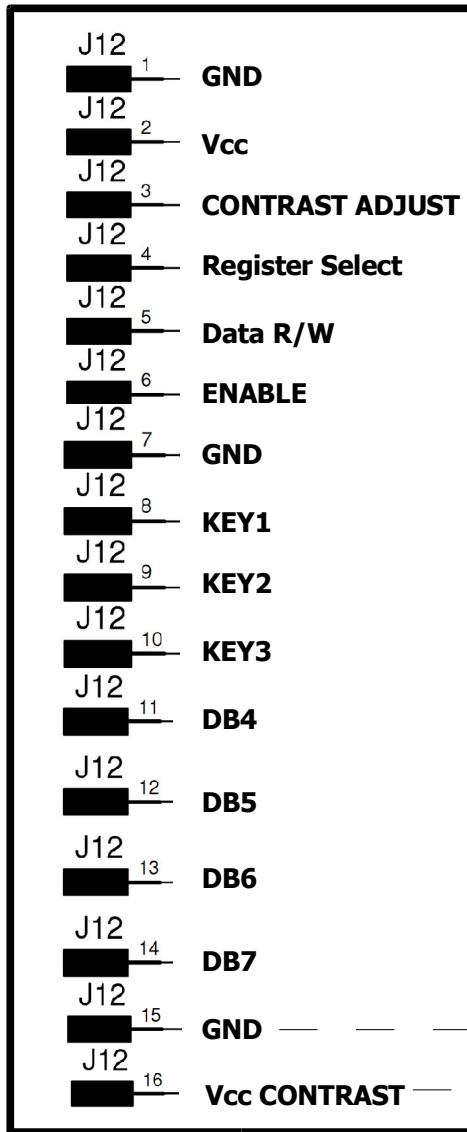


J10 From PENELOPE J6

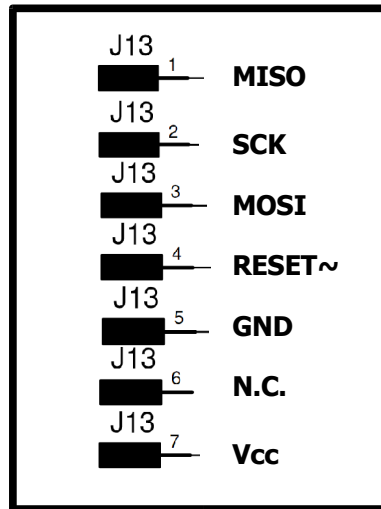


J11 XILINX Programming Connector





J12 Ext. DISPLAY Connector



J13 ATmega8 Programming Connector

— BackLight A+  
— BackLight K-



**Attention**  
Please connect separately if your display has this kind of backlight terminals. The one I am using is of this type!

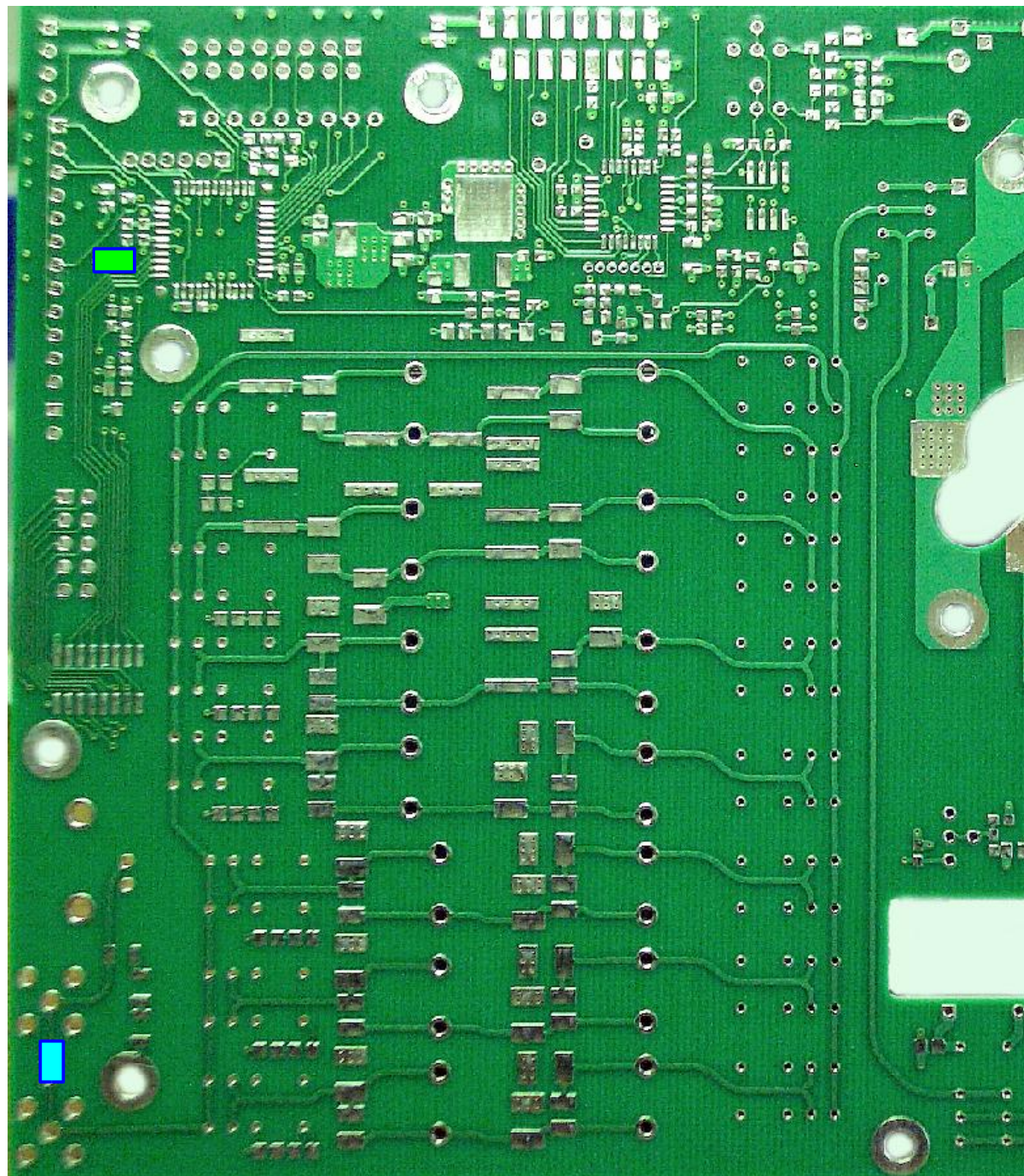


| Item 86 TOP |           |
|-------------|-----------|
| J1X2-SIP2   |           |
| Pos         | Reel/Tick |
| JP01        |           |

**Place this jumper if you  
don't use an ATU**

| Item 87 TOP |           |
|-------------|-----------|
| J1X2-WR2    |           |
| Pos         | Reel/Tick |
| JP10        |           |

**Place this jumper if you  
want the LP filters to be  
active on RX**





| Item 88 TOP               |           |
|---------------------------|-----------|
| 160m Filter Toroids T50-2 |           |
| Pos                       | Reel/Tick |
| L01                       |           |
| L02                       |           |



Inductivity L01 4 $\mu$ H  
 Inductivity L02 4 $\mu$ H  
 Wire 0.35mm  
 No. of Turns L01 28  
 No. of Turns L02 28

| Item 89 TOP              |           |
|--------------------------|-----------|
| 80m Filter Toroids T50-2 |           |
| Pos                      | Reel/Tick |
| L03                      |           |
| L04                      |           |



Inductivity L03 1.5 $\mu$ H  
 Inductivity L04 1.8 $\mu$ H  
 Wire 0.8mm  
 No. of Turns L03 17  
 No. of Turns L04 19

| Item 90 TOP              |           |
|--------------------------|-----------|
| 40m Filter Toroids T50-2 |           |
| Pos                      | Reel/Tick |
| L05                      |           |
| L06                      |           |



Inductivity L05 1.2 $\mu$ H  
 Inductivity L06 1.3 $\mu$ H  
 Wire 0.8mm  
 No. of Turns L05 15  
 No. of Turns L06 15

| Item 91 TOP              |           |
|--------------------------|-----------|
| 20m Filter Toroids T50-6 |           |
| Pos                      | Reel/Tick |
| L07                      |           |
| L08                      |           |



Inductivity L07 620nH  
 Inductivity L08 560nH  
 Wire 1.0mm  
 No. of Turns L07 10  
 No. of Turns L08 10

| Item 92 TOP              |           |
|--------------------------|-----------|
| 15m Filter Toroids T50-6 |           |
| Pos                      | Reel/Tick |
| L09                      |           |
| L10                      |           |

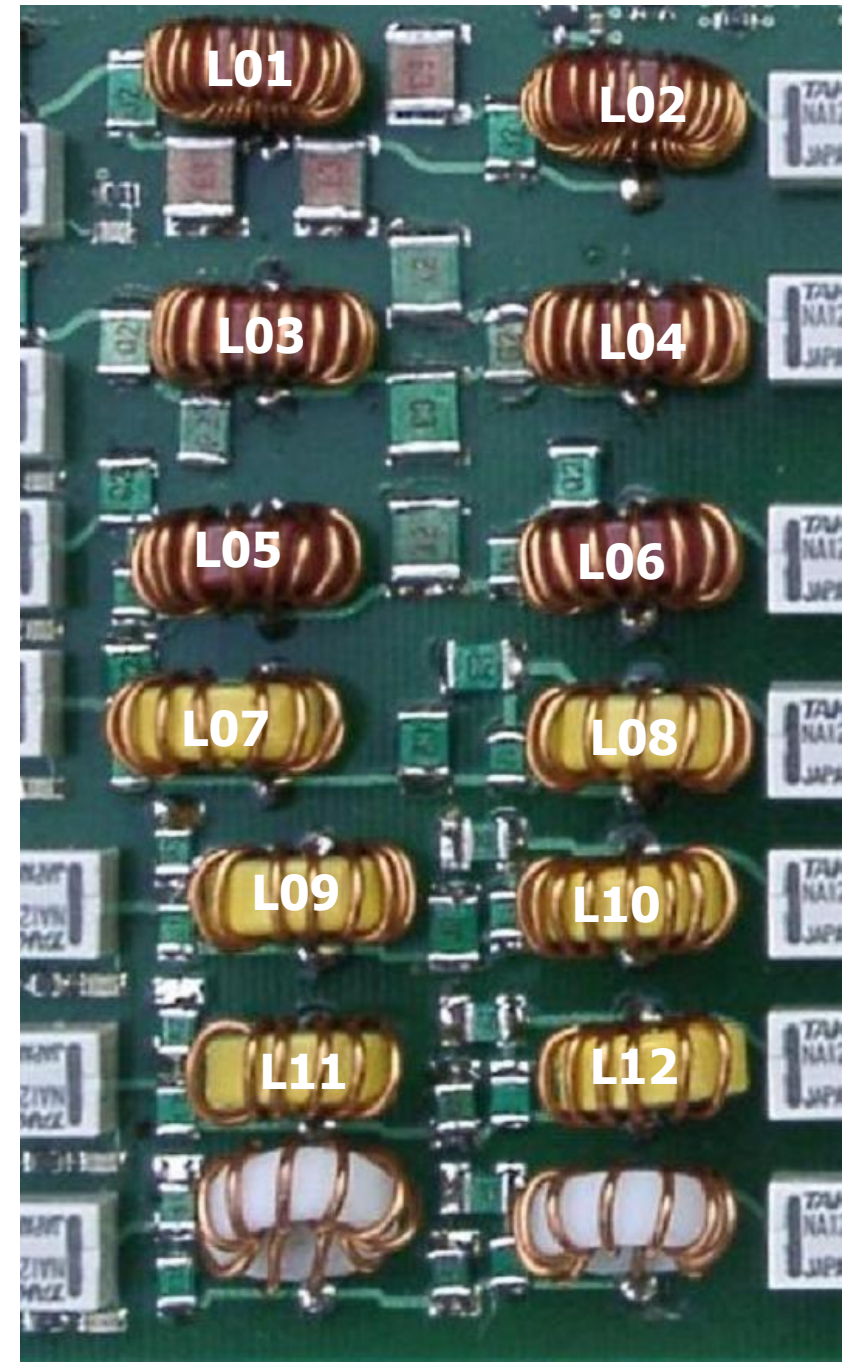


Inductivity L09 430nH  
 Inductivity L10 430nH  
 Wire 1.0mm  
 No. of Turns L09 9  
 No. of Turns L10 9

| Item 93 TOP              |           |
|--------------------------|-----------|
| 10m Filter Toroids T50-6 |           |
| Pos                      | Reel/Tick |
| L11                      |           |
| L12                      |           |

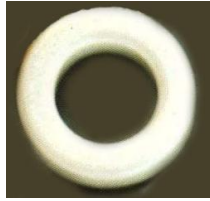


Inductivity L11 300nH  
 Inductivity L12 300nH  
 Wire 1.0mm  
 No. of Turns L11 7  
 No. of Turns L12 7





| Item 94 TOP            |           |
|------------------------|-----------|
| 6m Filter Toroids PTFE |           |
| Pos                    | Reel/Tick |
| L17                    |           |
| L18                    |           |



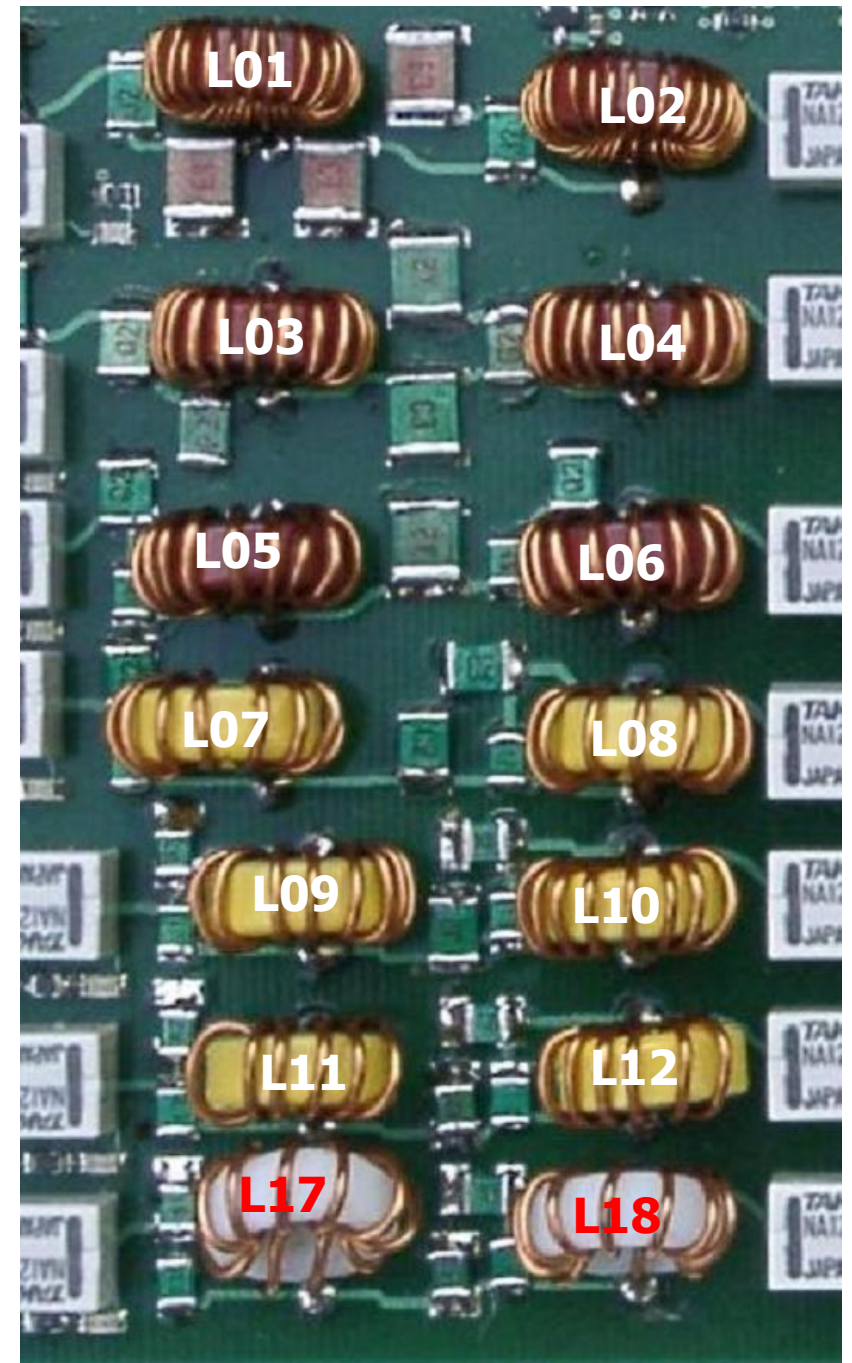
|                  |       |
|------------------|-------|
| Inductivity L17  | 137nH |
| Inductivity L18  | 143nH |
| Wire             | 1.0mm |
| No. of Turns L17 | 10    |
| No. of Turns L18 | 10    |

Cut 5mm slices from 15mm OD PTFE rod,  
drill 10mm hole in the center and shape edges  
into a toroid with a knife or file

or

make circular shaped air coil

**All coils should be tuned as close as possible to their  
nominal values by means of an LC-Meter**





| Item 95 TOP    |           |
|----------------|-----------|
| Toroid FT37-43 |           |
| Pos            | Reel/Tick |
| T4             |           |

## Transformer SWR Sensor

### Primary

Wire

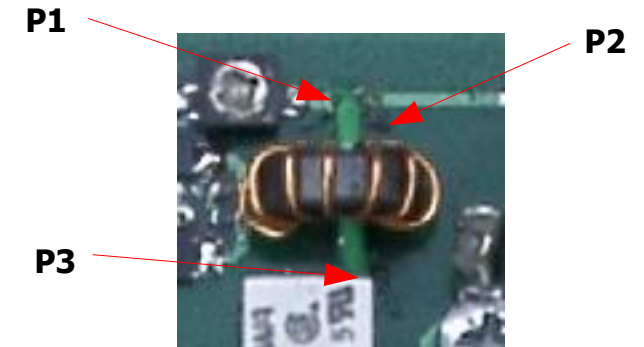
0.5mm

No of Turns

6

### Secondary

use a piece of RG178 (PTFE), solder core to TH P1 and braid to TH P2  
stick through toroid and solder core to TH P3



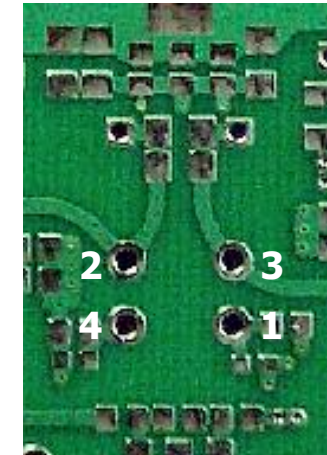
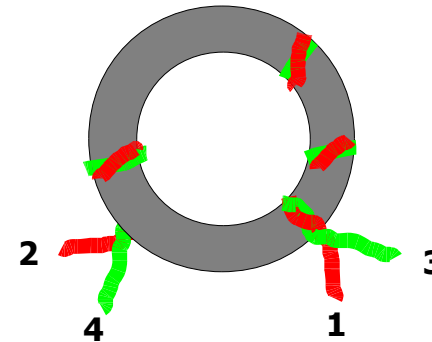
| Item 96 TOP    |           |
|----------------|-----------|
| Toroid FT50-43 |           |
| Pos            | Reel/Tick |
| T6             |           |

Wire

0.5mm

No of Turns

13 bifilar



| Item 97 TOP    |           |
|----------------|-----------|
| Toroid FT50-43 |           |
| Pos            | Reel/Tick |
| T8             |           |

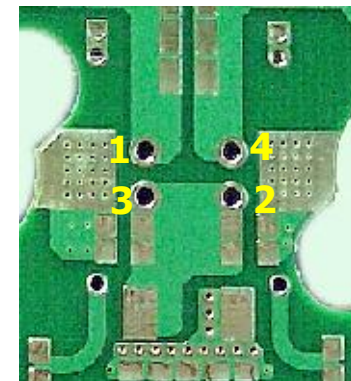
Wire

0.8mm

No of Turns

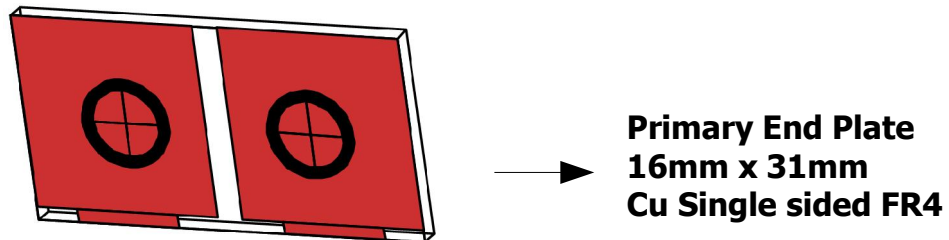
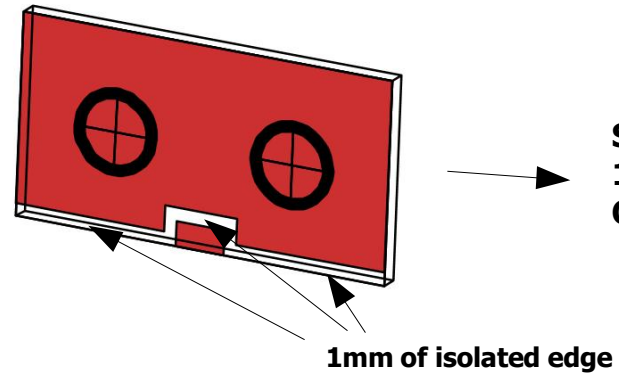
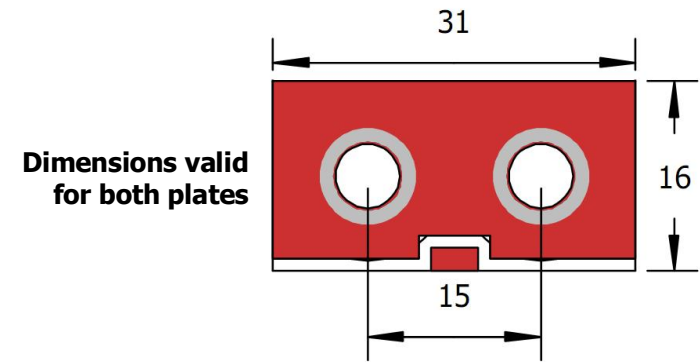
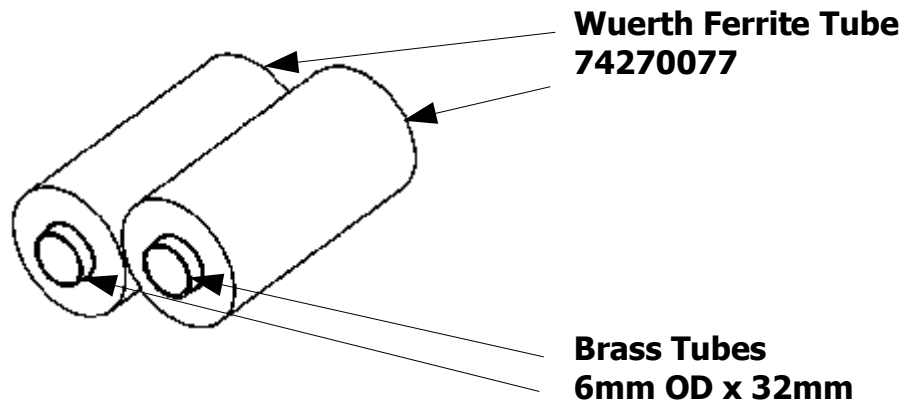
8 bifilar

Don't place toroid T8 yet.  
Put it aside until you have finished  
the rest of the job.

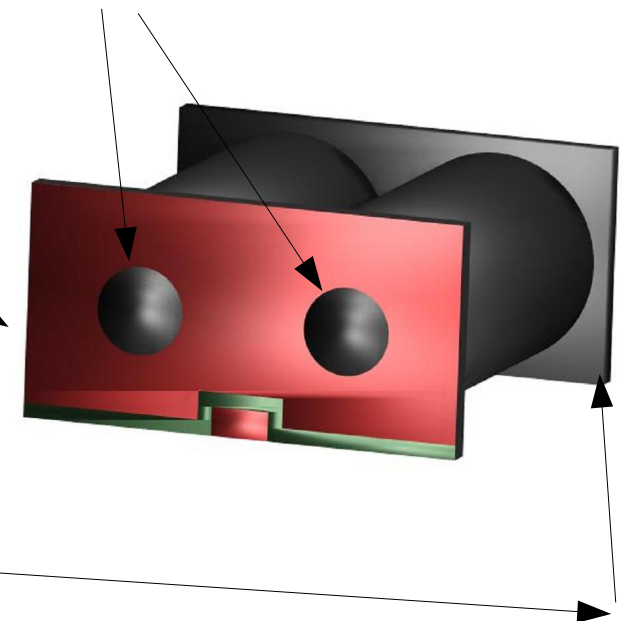




## Building the Final Output Transformer T1

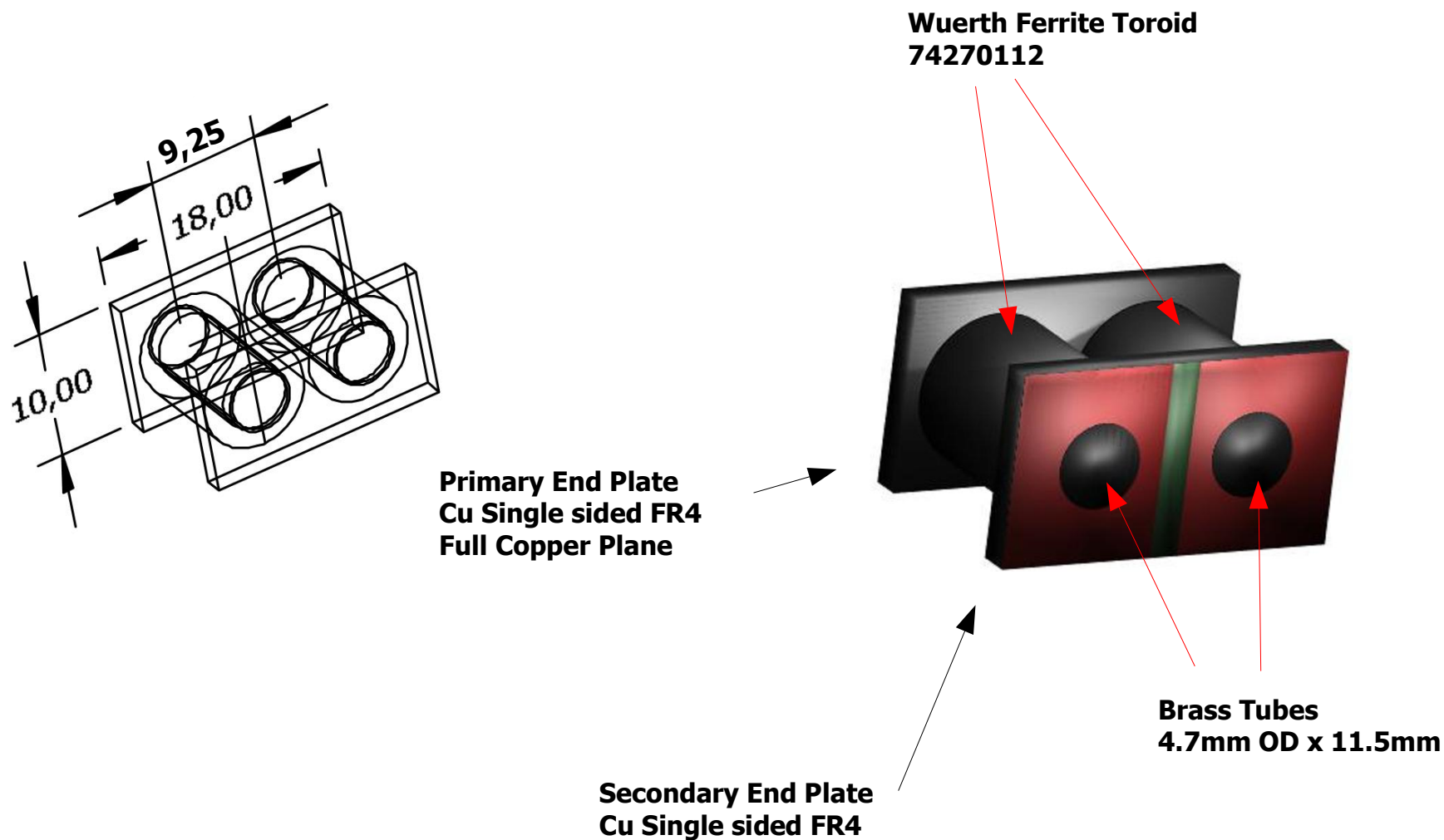


**Solder Brass Tubes to Copper Layer**





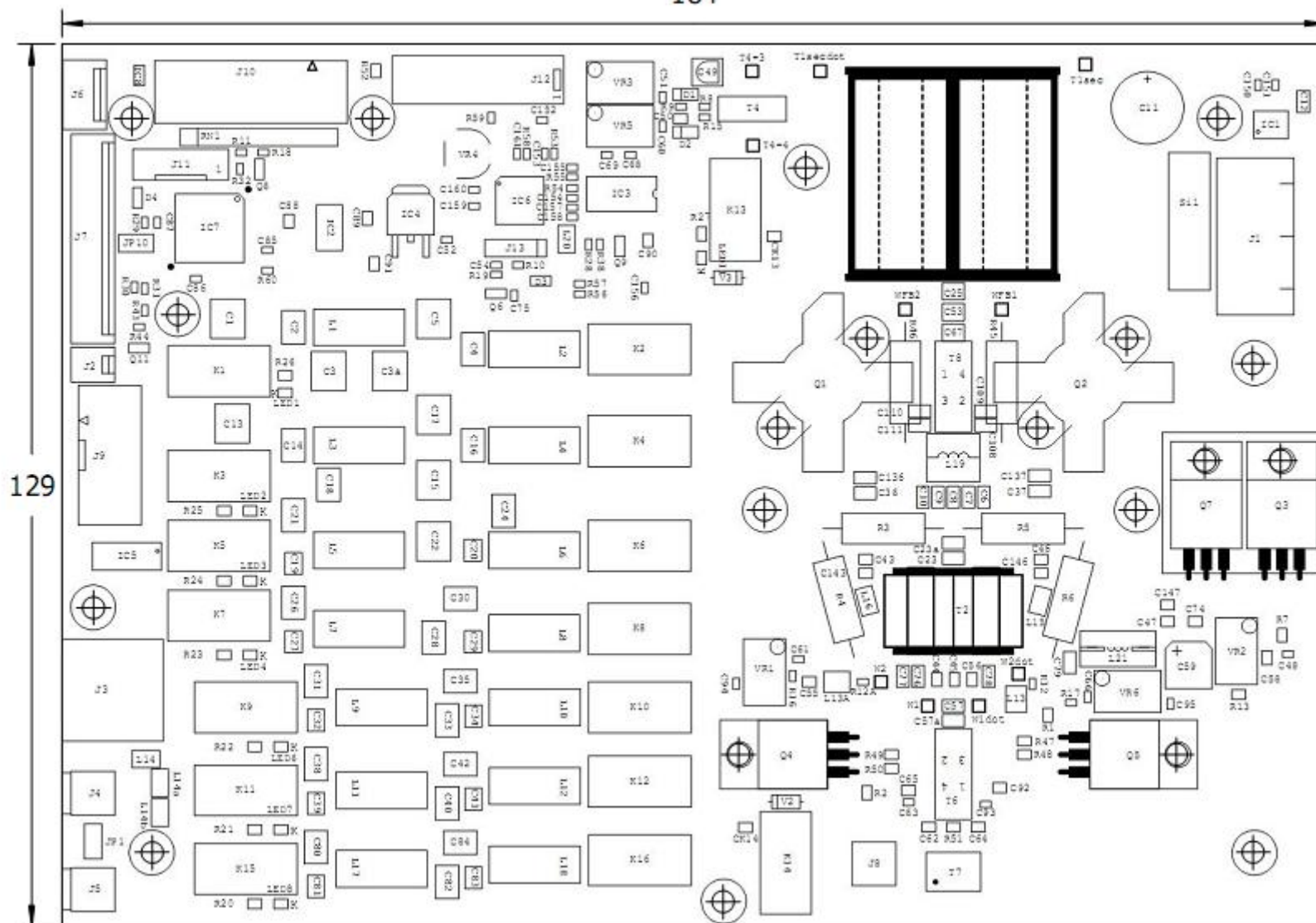
## Building the Final Input Transformer T2



**Do not place the transformers T1 and T2 yet!**

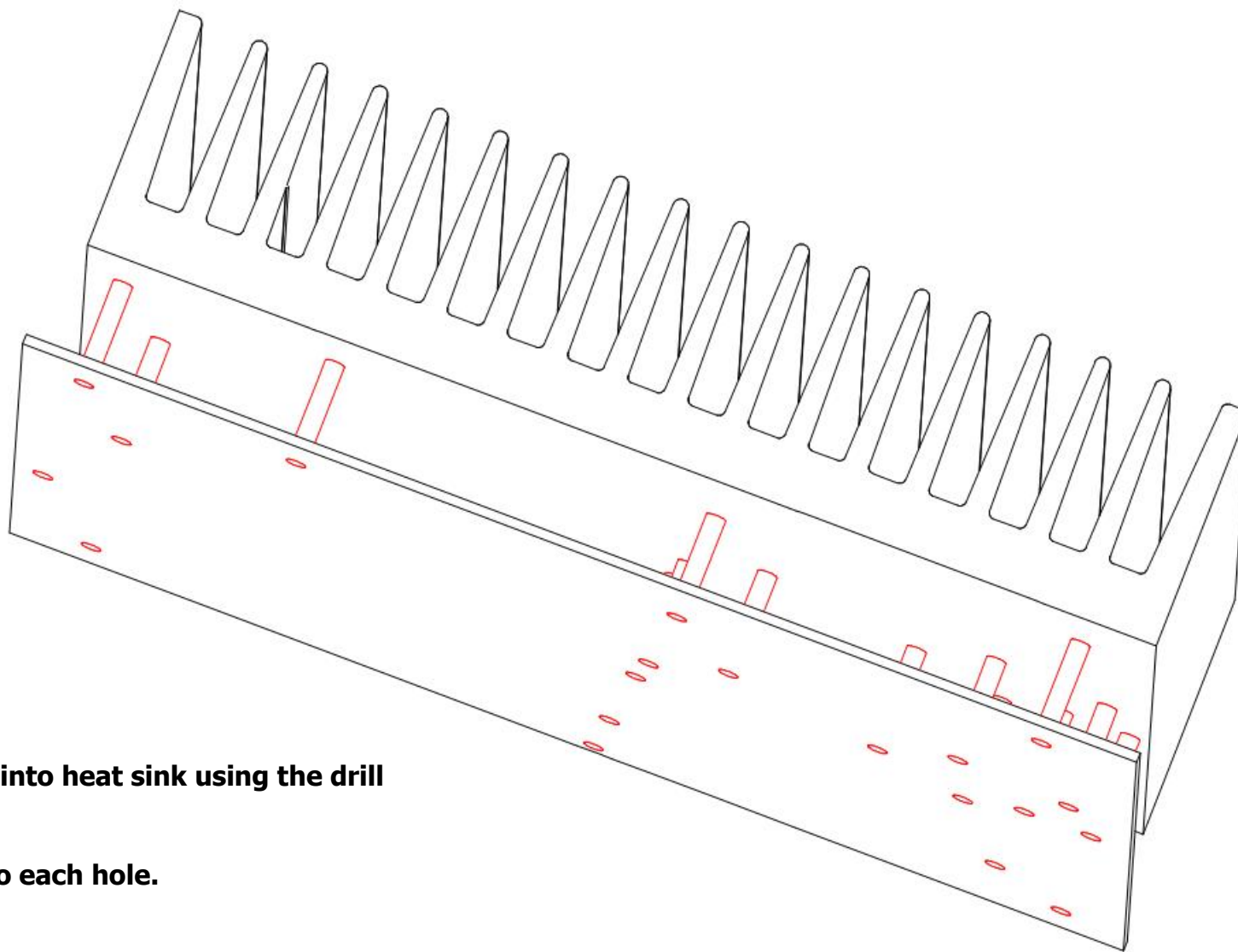


## 184





**Heat Sink Fischer SK519**  
**130mm x 177,5mm**



**Drill 2.5mm holes into heat sink using the drill pattern.**

**Tap M3 thread into each hole.**

**Done!**





**12x M3x10mm Screws to bolt down PCB**  
**12x M3 Nuts as Spacers at PCB Bottom**

**Use MICA insulator kit to mount Q03 and Q07**



| Item 98 TOP |                    |
|-------------|--------------------|
| Transistors |                    |
| Pos         | Reel/Tick          |
| Q01         | MRF492             |
| Q02         | MRF492             |
| Q03         | TIP29C-TO220 SMD   |
| Q04         | RD16HHF1-TO220_SMD |
| Q05         | RD16HHF1-TO220_SMD |
| Q07         | TIP31C-TO220_SMD   |

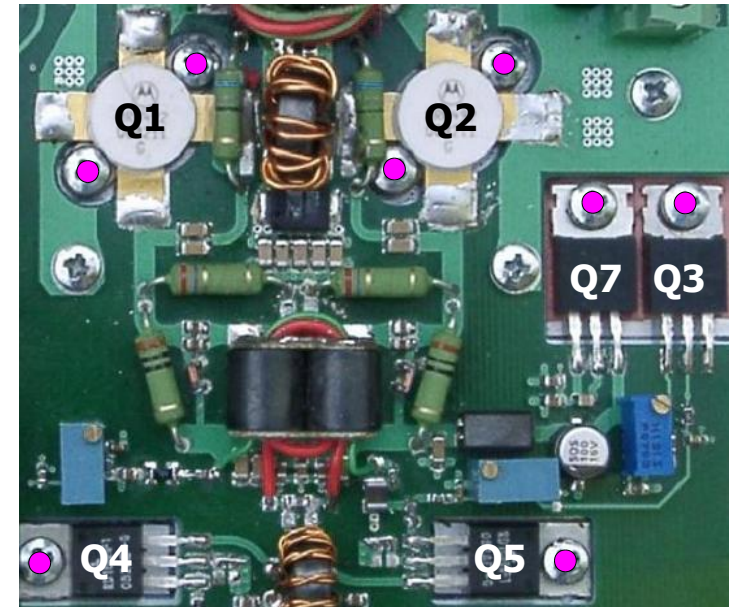
**8x M3x6mm Screws to bolt down Transistors**

**Do not apply any heat conductive paste at this time.**

**When you have placed the transistors then solder their leads to the matching pads**

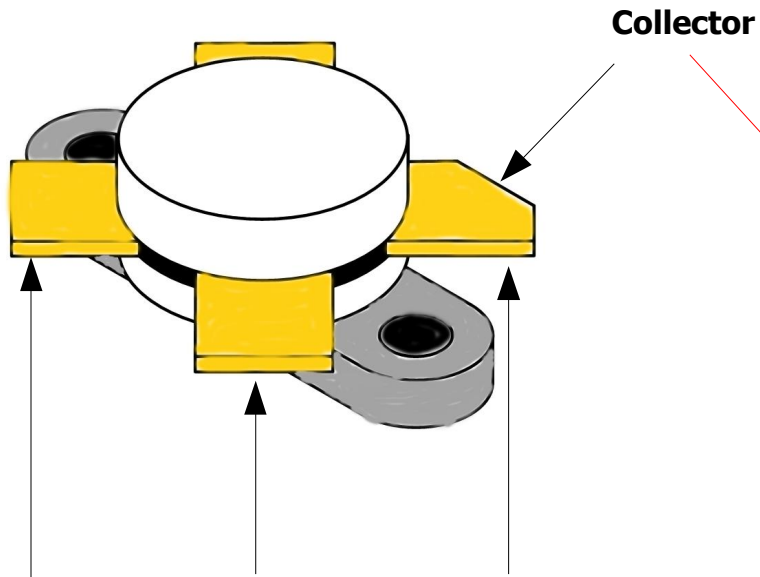
**You might have to shorten the leads of the TO220 transistors.**

**Bolt down the PCB onto the heat sink using the screws and nuts on the left.**  
**In order to get the PCB tight push it down onto the nuts in order to prevent these from turning.**  
**To fully tighten the screws you might have to loosen the screws repeatedly and tighten again.**  
**Make sure that the nuts are tight against the bottom of the PCB.**





## Soldering instructions for the RF power transistors MRF492



**First tin the undersides of the four leads with a thin layer of solder. Length about 5mm towards the ends**

**Then put a thin layer of tin on the four solder pads on the PCB**



**Mount the transistor to the heat sink.**

**Apply heat to each lead pressing it down onto the solder pad with the soldering iron and a pair of tweezers. As soon as the solder is liquid remove the soldering iron and just press the lead with the tweezers until the solder has cooled down.**

**Apply additional solder around the edges of the leads.**

**Don't forget to hold down the lead with the tweezers until the solder has cooled down.**



**Unbolt the PCB from the heat sink for final assembly and inspection.**

**Solder the RF transformers T1 and T2 onto their matching pads.**

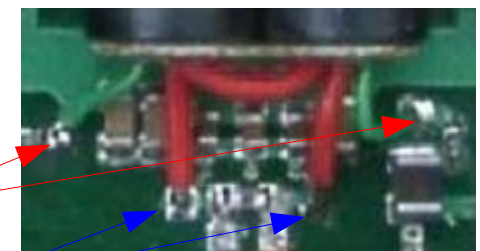
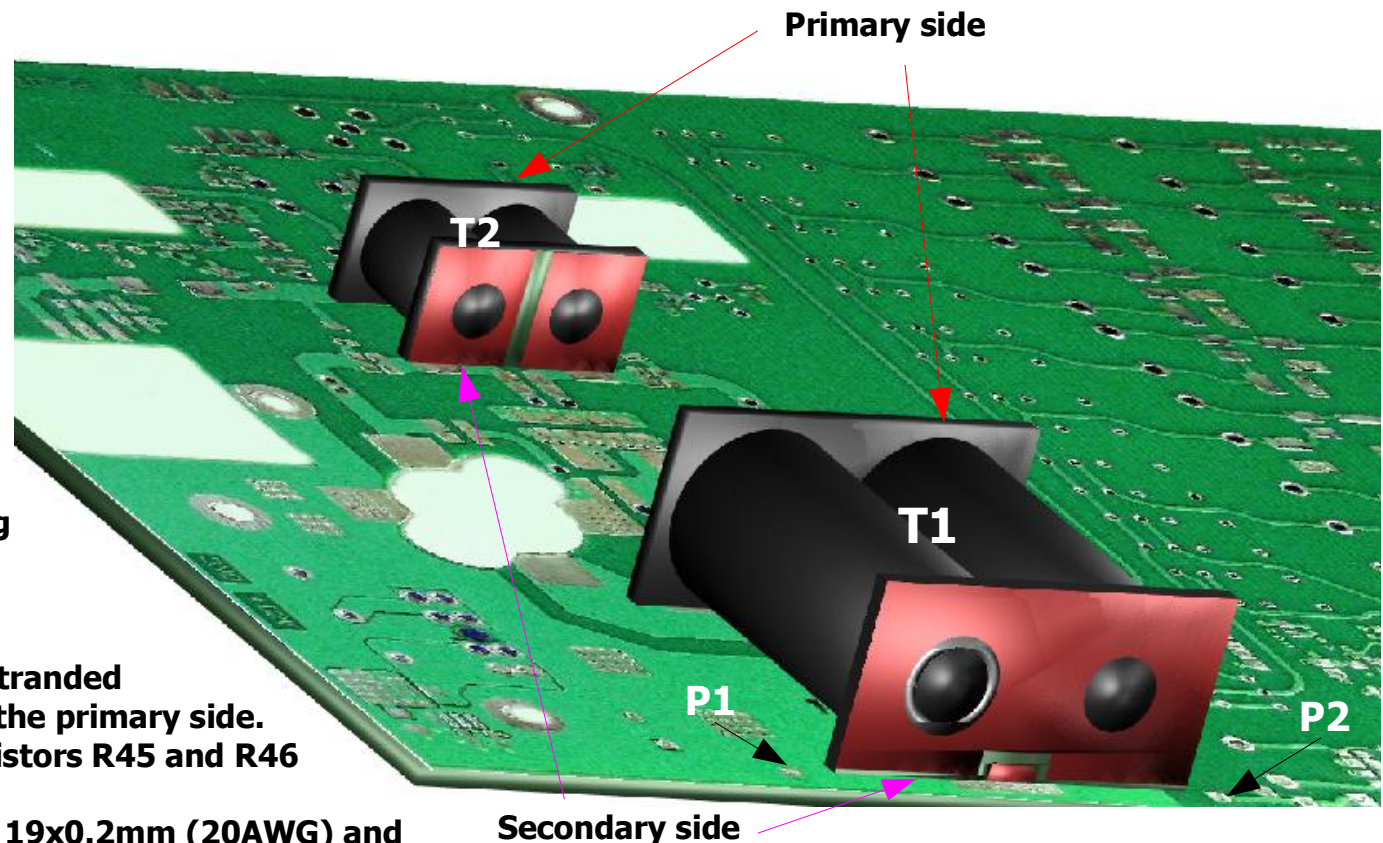
**Now wind the RF transformers according to the following instructions:**

**Output transformer T1**

- a. Make one winding of PTFE insulated stranded wire 7x0.12mm (28AWG) starting on the primary side. Connect to the TH pads where the resistors R45 and R46 are located.
- b. Put one strand of PTFE insulated wire 19x0.2mm (20AWG) and one PTFE insulated strand 7x0.2mm (24AWG) in parallel and make four windings starting from the secondary side. Twist the dismantled ends of the parallel wires together and solder to the two TH pads located on the secondary side (P1 and P2 in image)

**Input transformer T2**

- a. Make one winding of PTFE insulated stranded wire 7x0.2mm (24AWG) starting from the primary side.
- b. Make three windings of PTFE insulated stranded wire 19x0.2mm (20AWG) starting from the primary side.





**Go back to page 34 and place the toroid T8.**

**Go back to page 25 and place the 39R-2W resistors R45 and R46.**

**Bolt the PCB onto the heat sink for final assembly and inspection.**

**Follow the mounting instructions on page 39.**

**Apply some heat conductive paste to the MRFs and to the RD16HHFs.**

**After the assembly please check the gap between PCB and heat sink  
that there is not any contact to the heat sink.**

**DONE!**



## Appendix A - BOM Organizer

| Item 1 BOTTOM         |           | Item 3 BOTTOM cont'd |           | Item 2 TOP         |           | Item 3 TOP cont'd      |           |
|-----------------------|-----------|----------------------|-----------|--------------------|-----------|------------------------|-----------|
| CAP CER 10nF 50V 0603 |           | CAP CER 100nF 0805   |           | CAP CER 100nF 0805 |           | CAP CER 100nF 1206     |           |
| Pos                   | Reel/Tick | Pos                  | Reel/Tick | Pos                | Reel/Tick | Pos                    | Reel/Tick |
| C070                  |           | CK09                 |           | C044               |           | C109                   |           |
| C071                  |           | CK10                 |           | C045               |           | C110                   |           |
| C072                  |           | CK11                 |           | C047               |           | C111                   |           |
| C073                  |           | CK12                 |           | C055               |           | C136                   |           |
| C120                  |           | CK15                 |           | C056               |           | C137                   |           |
| C121                  |           | CK16                 |           | C058               |           |                        |           |
| C122                  |           |                      |           | C062               |           | Item 4 TOP             |           |
| C123                  |           | Item 4 BOTTOM        |           | C064               |           | CAP CER 10nF 0603      |           |
| C124                  |           | LM75AD SO8           |           | C065               |           | Pos                    | Reel/Tick |
| C125                  |           | Pos                  | Reel/Tick | C090               |           | C048                   |           |
| C126                  |           | IC9                  |           | C091               |           | C051                   |           |
| C127                  |           | Item 4a BOTTOM       |           | C092               |           | C054                   |           |
|                       |           | BAS40                |           | C147               |           | C060                   |           |
| Item 2 BOTTOM         |           | Pos                  | Reel/Tick | CK13               |           | C061                   |           |
| RES 10k 0603          |           | D101                 |           | CK14               |           | C063                   |           |
| Pos                   | Reel/Tick | D102                 |           |                    |           | C066                   |           |
| R33                   |           |                      |           |                    |           | C068                   |           |
| R34                   |           | Item 1 TOP           |           |                    |           | C069                   |           |
| R35                   |           | CAP CER 100nF 0603   |           | Item 3 TOP         |           | C075                   |           |
| R36                   |           | Pos                  | Reel/Tick | CAP CER 100nF 1206 |           | C093                   |           |
| R37                   |           | C052                 |           | Pos                | Reel/Tick | C094                   |           |
|                       |           | C085                 |           | C006               |           | C095                   |           |
| Item 3 BOTTOM         |           | C086                 |           | C007               |           | C151                   |           |
| CAP CER 100nF 0805    |           | C087                 |           | C008               |           | C161                   |           |
| Pos                   | Reel/Tick | C150                 |           | C009               |           |                        |           |
| CK00                  |           | C152                 |           | C010               |           | Item 5 TOP             |           |
| CK01                  |           | C153                 |           | C012               |           | CAP CER 100pF 0805     |           |
| CK02                  |           | C154                 |           | C036               |           | Pos                    | Reel/Tick |
| CK03                  |           | C155                 |           | C037               |           | C050                   |           |
| CK04                  |           | C156                 |           | C076               |           |                        |           |
| CK05                  |           | C157                 |           | C077               |           | Item 6 TOP             |           |
| CK06                  |           | C158                 |           | C078               |           | CAP CER 10uF/6.3V 0805 |           |
| CK07                  |           | C159                 |           | C079               |           | Pos                    | Reel/Tick |
| CK08                  |           | C160                 |           | C108               |           | C088                   |           |



## Appendix A - BOM Organizer

|                              |           |                                |           |                               |           |                                |                   |
|------------------------------|-----------|--------------------------------|-----------|-------------------------------|-----------|--------------------------------|-------------------|
| <b>Item 7 TOP</b>            |           | <b>Item 13 TOP</b>             |           | <b>Item 18 TOP</b>            |           | <b>Item 24 TOP</b>             |                   |
| CAP CER 1uF/16V 0805         |           | CAP MICA 47pF Code <b>S1</b>   |           | CAP MICA 180pF Code <b>G2</b> |           | CAP MICA 1500pF Code <b>E3</b> |                   |
| Pos                          | Reel/Tick | Pos                            | Reel/Tick | Pos                           | Reel/Tick | Pos                            | Reel/Tick         |
| C089                         |           | C020                           |           | C016                          |           | C003a                          |                   |
|                              |           | C029                           |           |                               |           | C005                           |                   |
|                              |           | C084                           |           |                               |           |                                |                   |
| <b>Item 8 TOP</b>            |           | <b>Item 14 TOP</b>             |           | <b>Item 19 TOP</b>            |           | <b>Item 24a TOP</b>            |                   |
| CAP CER 3.300pF/50V 0805     |           | CAP MICA 68pF Code <b>W1</b>   |           | CAP MICA 220pF Code <b>J2</b> |           | CAP MICA 180pF 1206            |                   |
| Pos                          | Reel/Tick | Pos                            | Reel/Tick | Pos                           | Reel/Tick | Pos                            | Reel/Tick         |
| C043                         |           | C019                           |           | C002                          |           | C023                           |                   |
| C046                         |           | C080                           |           | C004                          |           | <del>C023a</del>               | <del>d.n.p.</del> |
| C143                         |           |                                |           | C033                          |           |                                |                   |
| C146                         |           |                                |           |                               |           |                                |                   |
| <b>Item 9 TOP</b>            |           | <b>Item 15 TOP</b>             |           | <b>Item 20 TOP</b>            |           | <b>Item 24b TOP</b>            |                   |
| CAP CER 330nF 0805           |           | CAP MICA 100pF Code <b>A2</b>  |           | CAP MICA 390pF Code <b>Q2</b> |           | CAP CER 33pF 1206              |                   |
| Pos                          | Reel/Tick | Pos                            | Reel/Tick | Pos                           | Reel/Tick | Pos                            | Reel/Tick         |
| C074                         |           | C031                           |           | C014                          |           | C057                           |                   |
|                              |           | C035                           |           | C021                          |           | <del>C057a</del>               | <del>d.n.p.</del> |
|                              |           | C038                           |           | C024                          |           |                                |                   |
| <b>Item 10 TOP</b>           |           | <b>Item 16 TOP</b>             |           | <b>Item 21 TOP</b>            |           | <b>Item 24c TOP</b>            |                   |
| CAP MICA 12pF Code <b>C1</b> |           | CAP MICA 120pF Code <b>C2</b>  |           | CAP MICA 680pF Code <b>W2</b> |           | CAP MICA 680pF 1210            |                   |
| Pos                          | Reel/Tick | Pos                            | Reel/Tick | Pos                           | Reel/Tick | Pos                            | Reel/Tick         |
| C039                         |           | C040a                          |           | C013                          |           | C025                           |                   |
| C083                         |           | C042                           |           |                               |           | <del>C053</del>                | <del>d.n.p.</del> |
|                              |           | C082                           |           |                               |           | <del>C067</del>                | <del>d.n.p.</del> |
| <b>Item 11 TOP</b>           |           | <b>Item 17 TOP</b>             |           | <b>Item 22 TOP</b>            |           |                                |                   |
| CAP MICA 15pF Code <b>E1</b> |           | CAP MICA 150pF Code <b>E2</b>  |           | CAP MICA 750pF Code <b>X2</b> |           |                                |                   |
| Pos                          | Reel/Tick | Pos                            | Reel/Tick | Pos                           | Reel/Tick |                                |                   |
| C034                         |           | C026                           |           | C015                          |           |                                |                   |
| C041                         |           | C030                           |           | C017                          |           |                                |                   |
| C081                         |           |                                |           | C018                          |           |                                |                   |
| C082a                        |           |                                |           | C022                          |           |                                |                   |
| <b>Item 12 TOP</b>           |           | <b>Item 23 TOP</b>             |           |                               |           |                                |                   |
| CAP MICA 22pF Code <b>J1</b> |           | CAP MICA 1200pF Code <b>C3</b> |           |                               |           |                                |                   |
| Pos                          | Reel/Tick | Pos                            | Reel/Tick |                               |           |                                |                   |
| C027                         |           | C001                           |           |                               |           |                                |                   |
| C032                         |           | C003                           |           |                               |           |                                |                   |



## Appendix A - BOM Organizer

| Item 25 TOP  |           |  | Item 30 TOP   |           |  | Item 35 TOP cont'd |           |  | Item 39 TOP    |           |
|--------------|-----------|--|---------------|-----------|--|--------------------|-----------|--|----------------|-----------|
| RES 0R0 0603 |           |  | RES 100R 0805 |           |  | RES 1k5 0805       |           |  | RES 100k 0603  |           |
| Pos          | Reel/Tick |  | Pos           | Reel/Tick |  | Pos                | Reel/Tick |  | Pos            | Reel/Tick |
| R59          |           |  | R07           |           |  | R26                |           |  | R53            |           |
| R60          |           |  |               |           |  | R27                |           |  | R54            |           |
|              |           |  |               |           |  | R40                |           |  | R55            |           |
| Item 26 TOP  |           |  | Item 31 TOP   |           |  | Item 36 TOP        |           |  | Item 40 TOP    |           |
| RES 2R2 0805 |           |  | RES 120R 0603 |           |  | RES 3k3 0603       |           |  | 1N4148-DO35H/V |           |
| Pos          | Reel/Tick |  | Pos           | Reel/Tick |  | Pos                | Reel/Tick |  | Pos            | Reel/Tick |
| R01          |           |  | R12           |           |  | R10                |           |  | V2             |           |
| R02          |           |  | R12A          |           |  | R11                |           |  | V3             |           |
| R47          |           |  |               |           |  | R16                |           |  |                |           |
| R48          |           |  | Item 32 TOP   |           |  | R17                |           |  | Item 41 TOP    |           |
| R49          |           |  | RES 220R 0805 |           |  | R18                |           |  | BAS70-00 SOT23 |           |
| R50          |           |  | Pos           | Reel/Tick |  | R19                |           |  | Pos            | Reel/Tick |
|              |           |  | R13           |           |  | R29                |           |  | D1             |           |
|              |           |  |               |           |  |                    |           |  | D2             |           |
| Item 27 TOP  |           |  | Item 33 TOP   |           |  | Item 37 TOP        |           |  | Item 42 TOP    |           |
| RES 10R 0603 |           |  | RES 330R 0805 |           |  | RES 4k75 0603      |           |  | BAT54A         |           |
| Pos          | Reel/Tick |  | Pos           | Reel/Tick |  | Pos                | Reel/Tick |  | Pos            | Reel/Tick |
| R52          |           |  | R51           |           |  | R09                |           |  | D3             |           |
|              |           |  |               |           |  |                    |           |  | D4             |           |
| Item 28 TOP  |           |  | Item 34 TOP   |           |  | Item 38 TOP        |           |  | Item 43 TOP    |           |
| RES 22R 0603 |           |  | RES 470R 0603 |           |  | RES 10k 0603       |           |  | BC807-40-SOT23 |           |
| Pos          | Reel/Tick |  | Pos           | Reel/Tick |  | Pos                | Reel/Tick |  | Pos            | Reel/Tick |
| R08          |           |  | R28           |           |  | R14                |           |  | Q06            |           |
| R15          |           |  | R39           |           |  | R32                |           |  |                |           |
|              |           |  | R43           |           |  | R38                |           |  | Item 44 TOP    |           |
|              |           |  |               |           |  | R44                |           |  | BC817-40-SOT23 |           |
| Item 29 TOP  |           |  | Item 35 TOP   |           |  | R56                |           |  | Pos            | Reel/Tick |
| RES 47R 0603 |           |  | RES 1k5 0805  |           |  | R57                |           |  | Q08            |           |
| Pos          | Reel/Tick |  | Pos           | Reel/Tick |  | R58                |           |  | Q09            |           |
| R30          |           |  | R20           |           |  |                    |           |  |                |           |
| R31          |           |  | R21           |           |  |                    |           |  |                |           |
|              |           |  | R22           |           |  |                    |           |  |                |           |
|              |           |  | R23           |           |  |                    |           |  |                |           |
|              |           |  | R24           |           |  |                    |           |  |                |           |
|              |           |  | R25           |           |  |                    |           |  |                |           |



## Appendix A - BOM Organizer

|                    |           |                     |           |                                  |           |                          |           |
|--------------------|-----------|---------------------|-----------|----------------------------------|-----------|--------------------------|-----------|
| <b>Item 45 TOP</b> |           | <b>Item 51 TOP</b>  |           | <b>Item 57 TOP</b>               |           | <b>Item 64 TOP</b>       |           |
| LED-0805 GRN       |           | ULN2003AD-SO16      |           | IND 680nH 1210                   |           | ECAP 470uF/25V RM5-D10.5 |           |
| Pos                | Reel/Tick | Pos                 | Reel/Tick | Pos                              | Reel/Tick | Pos                      | Reel/Tick |
| LED1               |           | IC5                 |           | L13                              |           | C011                     |           |
| LED2               |           |                     |           | L13A                             |           |                          |           |
| LED3               |           | <b>Item 52 TOP</b>  |           |                                  |           | <b>Item 65 TOP</b>       |           |
| LED4               |           | XC9572XL-VQFP44     |           | <b>Item 58 TOP</b>               |           | POT 10K PT6H             |           |
| LED6               |           | Pos                 | Reel/Tick | 0,25uH-18A-HC-6,6x7,3-Wuerth     |           | Pos                      | Reel/Tick |
| LED7               |           | IC7                 |           | Pos                              | Reel/Tick | VR4                      |           |
| LED8               |           |                     |           | L19                              |           |                          |           |
| LED9               |           | <b>Item 53 TOP</b>  |           |                                  |           | <b>Item 66 TOP</b>       |           |
|                    |           | ATMEGA8 TQFP32      |           | <b>Item 59 TOP</b>               |           | POT 100K 3296YW          |           |
| <b>Item 46 TOP</b> |           | Pos                 | Reel/Tick | 5-HOLE Ferrit Wuerth-7427512 SMD |           | Pos                      | Reel/Tick |
| LED-0805 RD        |           | IC6                 |           | Pos                              | Reel/Tick | VR3                      |           |
| Pos                | Reel/Tick |                     |           | L21                              |           | VR5                      |           |
| LED11              |           | <b>Item 54 TOP</b>  |           |                                  |           |                          |           |
|                    |           | 78M05-TO252-DPAK    |           | <b>Item 60 TOP</b>               |           | <b>Item 67 TOP</b>       |           |
| <b>Item 47 TOP</b> |           | Pos                 | Reel/Tick | RES NET 8x10k SIP9               |           | POT 10K 3296YW           |           |
| NC7ST08M5X-SOT23-5 |           | IC4                 |           | Pos                              | Reel/Tick | Pos                      | Reel/Tick |
| Pos                | Reel/Tick |                     |           | RN1                              |           | VR1                      |           |
| IC8                |           | <b>Item 55 TOP</b>  |           |                                  |           | VR6                      |           |
|                    |           | ACS712ELCTR-20A-T   |           | <b>Item 61 TOP</b>               |           |                          |           |
| <b>Item 48 TOP</b> |           | Pos                 | Reel/Tick | TRIM-C SMD 4-25pF 4,5x4          |           | <b>Item 68 TOP</b>       |           |
| REG1117-3.3-SOT223 |           | IC1                 |           | Pos                              | Reel/Tick | POT 100R 3296YW          |           |
| Pos                | Reel/Tick |                     |           | C049                             |           | Pos                      | Reel/Tick |
| IC2                |           | <b>Item 55a TOP</b> |           |                                  |           | VR2                      |           |
|                    |           | LL4148              |           | <b>Item 62 TOP</b>               |           |                          |           |
| <b>Item 49 TOP</b> |           | Pos                 | Reel/Tick | MINI CIRCUITS ADT1,5-1           |           | <b>Item 69 TOP</b>       |           |
| TLC0832 SO8        |           | D9                  |           | Pos                              | Reel/Tick | RES 10R0-2W              |           |
| Pos                | Reel/Tick | <b>Item 56 TOP</b>  |           | T7                               |           | Pos                      | Reel/Tick |
| IC3                |           | IND 10uH 1206       |           |                                  |           | R04                      |           |
|                    |           | Pos                 | Reel/Tick | <b>Item 63 TOP</b>               |           | R06                      |           |
| <b>Item 50 TOP</b> |           | L14                 |           | ECAP 100uF/25V SMD-D-6.6x6.6     |           |                          |           |
| TSM2302CX-SOT23    |           | L14a                |           | Pos                              | Reel/Tick | <b>Item 70 TOP</b>       |           |
| Pos                | Reel/Tick | L14b                |           | C059                             |           | RES 2R7-2W               |           |
| Q11                |           | L15                 |           |                                  |           | Pos                      | Reel/Tick |
| Q12                |           | L16                 |           |                                  |           | R03                      |           |
|                    |           | L20                 |           |                                  |           | R05                      |           |



## Appendix A - BOM Organizer

|                       |           |                             |           |                               |           |                          |           |
|-----------------------|-----------|-----------------------------|-----------|-------------------------------|-----------|--------------------------|-----------|
| <b>Item 71 TOP</b>    |           | <b>Item 76 TOP</b>          |           | <b>Item 84 TOP</b>            |           | <b>Item 91 TOP</b>       |           |
| RES 39R-2W            |           | BNC PRINT 90°               |           | AMP Micro-Match 338069-16Pins |           | 20m Filter Toroids T50-6 |           |
| Pos                   | Reel/Tick | Pos                         | Reel/Tick | Pos                           | Reel/Tick | Pos                      | Reel/Tick |
| R45                   |           | J03                         |           | J12                           |           | L07                      |           |
| R46                   |           |                             |           |                               |           | L08                      |           |
| <b>Item 72 TOP</b>    |           | <b>Item 77 TOP</b>          |           | <b>Item 85 TOP</b>            |           | <b>Item 92 TOP</b>       |           |
| REL PCB 2XUM NA-12W-K |           | SMA PRINT 90°               |           | J1X7-SIP7-1.27                |           | 15m Filter Toroids T50-6 |           |
| Pos                   | Reel/Tick | Pos                         | Reel/Tick | Pos                           | Reel/Tick | Pos                      | Reel/Tick |
| K01                   |           | J04                         |           | J13                           |           | L09                      |           |
| K02                   |           | J05                         |           |                               |           | L10                      |           |
| K03                   |           | <b>Item 78 TOP</b>          |           | <b>Item 86 TOP</b>            |           | <b>Item 93 TOP</b>       |           |
| K04                   |           | Molex 22-23-2041            |           | J1X2-SIP2                     |           | 10m Filter Toroids T50-6 |           |
| K05                   |           | Pos                         | Reel/Tick | Pos                           | Reel/Tick | Pos                      | Reel/Tick |
| K06                   |           | J06                         |           | JP01                          |           | L11                      |           |
| K07                   |           | <b>Item 79 TOP</b>          |           | <b>Item 87 TOP</b>            |           | L12                      |           |
| K08                   |           | Molex 22-23-2121            |           | J1X2-WR2                      |           |                          |           |
| K09                   |           | Pos                         | Reel/Tick | Pos                           | Reel/Tick | <b>Item 94 TOP</b>       |           |
| K10                   |           | J07                         |           | JP10                          |           | 6m Filter Toroids PTFE   |           |
| K11                   |           | <b>Item 80 TOP</b>          |           | <b>Item 88 TOP</b>            |           | Pos                      | Reel/Tick |
| K12                   |           | SMA PRINT 180°              |           | 160m Filter Toroids T50-2     |           | L17                      |           |
| K13                   |           | Pos                         | Reel/Tick | Pos                           | Reel/Tick | L18                      |           |
| K14                   |           | J08                         |           | L01                           |           | <b>Item 95 TOP</b>       |           |
| K15                   |           |                             |           | L02                           |           | Toroid FT37-43           |           |
| K16                   |           | <b>Item 81 TOP</b>          |           | <b>Item 89 TOP</b>            |           | Pos                      | Reel/Tick |
| K17                   |           | J5X2-WR10W                  |           | 80m Filter Toroids T50-2      |           | T4                       |           |
| <b>Item 73 TOP</b>    |           | Pos                         | Reel/Tick | Pos                           | Reel/Tick | <b>Item 96 TOP</b>       |           |
| FUSEHOLDER FLR42      |           | J09                         |           | L03                           |           | Toroid FT50-43           |           |
| Pos                   | Reel/Tick |                             |           | L04                           |           | Pos                      | Reel/Tick |
| Si1                   |           | <b>Item 82 TOP</b>          |           | <b>Item 90 TOP</b>            |           | T6                       |           |
| <b>Item 74 TOP</b>    |           | J8X2-WR16W                  |           | 40m Filter Toroids T50-2      |           | <b>Item 97 TOP</b>       |           |
| PHOENIX-GMKDS3/3-7.62 |           | Pos                         | Reel/Tick | Pos                           | Reel/Tick | Toroid FT50-43           |           |
| Pos                   | Reel/Tick | J10                         |           | L05                           |           | Pos                      | Reel/Tick |
| J01                   |           |                             |           | L06                           |           | T8                       |           |
| <b>Item 75 TOP</b>    |           | <b>Item 83 TOP</b>          |           |                               |           |                          |           |
| Molex 22-23-2021      |           | JST-B6B-PH-K-S-6Pins-RM2.00 |           |                               |           |                          |           |
| Pos                   | Reel/Tick | Pos                         | Reel/Tick |                               |           |                          |           |
| J02                   |           | J11                         |           |                               |           |                          |           |



## Appendix A - BOM Organizer

|                    |                    |  |  |  |
|--------------------|--------------------|--|--|--|
|                    |                    |  |  |  |
| <b>Item 98 TOP</b> |                    |  |  |  |
| Transistors        |                    |  |  |  |
| Pos                | Reel/Tick          |  |  |  |
| Q01                | MRF492             |  |  |  |
| Q02                | MRF492             |  |  |  |
| Q03                | TIP29C-TO220 SMD   |  |  |  |
| Q04                | RD16HHF1-TO220 SMD |  |  |  |
| Q05                | RD16HHF1-TO220 SMD |  |  |  |
| Q07                | TIP31C-TO220 SMD   |  |  |  |
|                    |                    |  |  |  |
|                    |                    |  |  |  |
|                    |                    |  |  |  |
|                    |                    |  |  |  |
|                    |                    |  |  |  |
|                    |                    |  |  |  |
|                    |                    |  |  |  |
|                    |                    |  |  |  |