Part D T828 Power Amplifier

Caution: **There are no user serviceable components in these power amplifiers. Refer all servicing to your nearest Tait Dealer or Customer Service Organisation.**

This part of the manual is divided into five sections, as listed below. There is a detailed table of contents at the start of each section.

Section	Title
1	General Information
2	Circuit Operation
3	Initial Adjustment
4	Fault Finding
5	PCB Information

1 T828 General Information

This section provides a brief description of the T828 power amplifier, along with detailed specifications and a list of types available.

The following topics are covered in this section.

1.1 Introduction

The T828 is an FM base station power amplifier designed for single or multichannel operation within the frequency range 66 to 88MHz. The output power capability is 10 to 60W.

The PA comprises a broad band, two stage drive amplifier whose output is split to drive two separate output stages. The outputs from these final stages are then recombined and filtered before being fed to the output socket. This type of balanced output stage offers two advantages over single ended types:

- improved intermodulation performance in the presence of high signal levels from adjacent transmitters;
- enhanced reliability: if one of the two output stages fails, the transmitter can still produce one quarter of its rated power.

VSWR and thermal protection are incorporated into the basic design, while monitoring and alarm signals are available for both forward and reverse power. The output power is adjustable from the front panel.

The circuitry is built on a single PCB which is mounted directly on a die-cast chassis/ heatsink. Extensive use is made of surface mount technology.

The T828 has a width of 60mm and occupies a single space in a Tait rack frame, which has the ability to accommodate up to seven standard modules.

1.2 Specifications

1.2.1 Introduction

The performance figures given are minimum figures, unless otherwise indicated, for equipment operating at standard room temperature (+22°C to +28°C) and standard test voltage (13.8V DC).

Where applicable, the test methods used to obtain the following performance figures are those described in the ETS specification. Refer to Section 1.2.3 for details of test standards.

Details of test methods and the conditions which apply for Type Approval testing in all countries can be obtained from Tait Electronics Ltd.

1.2.2 General

Power Output:

Rated Power	.. 50W
Maximum Power	.. 60W
Range Of Adjustment	.. 10 to 60W (typical)

Note: Actual power used will depend on regulatory requirements.

Input Power	.. 1W ±300mW
Duty Cycle Rating (@ 13.8V supply)	.. 50W continuous to +60°C without fan[1]
	.. 60W continuous to +40°C without fan[1]
Intermodulation (PA with output isolator)	.. -70dBc or -40dBi[2] with 25dB isolation & interfering signal of -30dBc

Mismatch Capability:

Ruggedness	.. refer to your nearest Tait Dealer or Customer Service Organisation
Stability	.. 5:1 VSWR (all phase angles)

Supply Voltage:

Operating Voltage	.. 10.8 to 16V DC
Standard Test Voltage	.. 13.8V DC
Polarity	.. negative earth only
Polarity Protection	.. crowbar diode

1. The use of a fan is to be preferred at high temperatures. Adequate ventilation must always be provided through base station equipment cabinets.
2. dBi denotes the level of intermodulation product relative to the interfering signal.

Maximum Supply Current (@ 50W):

Standby		.. 50mA
Transmit		.. 11A

Spurious Emissions:

Conducted	- Transmit	.. -36dBm to 1GHz -30dBm to 4GHz
	- Standby	.. -57dBm to 1GHz -47dBm to 4GHz
Radiated	- Transmit	.. -36dBm to 1GHz -30dBm to 4GHz
	- Standby	.. -57dBm to 1GHz -47dBm to 4GHz

Operating Temperature Range .. -30°C to +60°C

Dimensions:

Height	.. 183mm
Width	.. 60mm
Length	.. 340mm

Weight .. 3.1kg

1.2.3 Test Standards

Where applicable, this equipment is tested in accordance with the following standards.

1.2.3.1 European Telecommunication Standard

ETS 300 086 January 1991

Radio equipment and systems; land mobile service; technical characteristics and test conditions for radio equipment with an internal or external RF connector intended primarily for analogue speech.

ETS 300 113 March 1996

Radio equipment and systems; land mobile service; technical characteristics and test conditions for radio equipment intended for the transmission of data (and speech) and having an antenna connector.

ETS 300 219 October 1993

Radio equipment and systems; land mobile service; technical characteristics and test conditions for radio equipment transmitting signals to initiate a specific response in the receiver.

ETS 300 279 February 1996

Radio equipment and systems; electromagnetic compatibility (EMC) standard for private land mobile radio (PMR) and ancillary equipment (speech and/or non-speech).

1.2.3.2 DTI CEPT Recommendation T/R-24-01

Annex I: 1988

Technical characteristics and test conditions for radio equipment in the land mobile service intended primarily for analogue speech.

Annex II: 1988

Technical characteristics of radio equipment in the land mobile service with regard to quality and stability of transmission.

1.2.3.3 Telecommunications Industry Association

ANSI/TIA/EIA-603-1992

Land mobile FM or PM communications equipment measurement and performance standards.

1.3 Product Codes

The three groups of digits in the T820 Series II product code provide information about the model, type and options fitted, according to the conventions described below.

The following explanation of T820 Series II product codes is not intended to suggest that any combination of features is necessarily available in any one product. Consult your nearest Tait Dealer or Customer Service Organisation for more information regarding the availability of specific models, types and options.

Model

The Model group indicates the basic function of the product, as follows:

T82X-XX-XXXX
- T825 receiver
- T826 25W transmitter
- T827 exciter
- T828 50W power amplifier

Type

The Type group uses two digits to indicate the basic RF configuration of the product.

The first digit in the Type group designates the frequency range:

T82X-**X**X-XXXX
- '1' for 66-88MHz

The second digit in the Type group indicates the channel spacing:

T82X-X**X**-XXXX
- '0' for wide bandwidth (25kHz)
- '5' for narrow bandwidth (12.5kHz)

Options

T82X-XX-**XXXX**

The Options group uses four digits and/or letters to indicate any options that may be fitted to the product. This includes standard options and special options for specific customers. '0000' indicates a standard Tait product with no options fitted. The large number of options precludes listing them here.

1.4 Standard Product Range

The following table lists the range of standard T828 types (i.e. no options fitted and no cyclic keying) available at the time this manual was published. Consult your nearest Tait Dealer or Customer Service Organisation for more information.

Frequency Range (MHz)	66-88
PA Type: T828-	10-0500

You can identify the PA type by checking the product code printed on a label on the rear of the heatsink (Figure 1.1 in Part A shows typical labels).

2 T828 Circuit Operation

This section provides a basic description of the circuit operation of the T828 power amplifier.

Refer to Section 5 where the parts lists, grid reference index and diagrams will provide detailed information on identifying and locating components.

The following topics are covered in this section.

2.1 Introduction

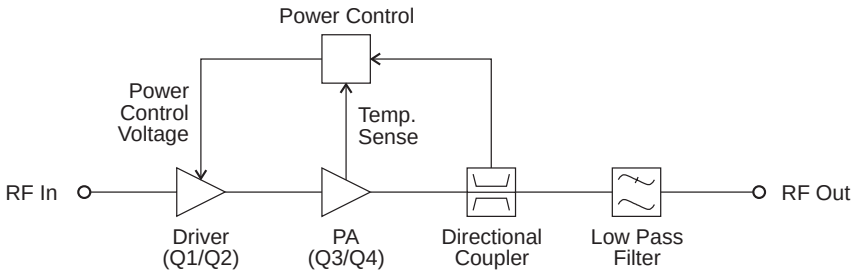


Figure 2.1 T828 High Level Block Diagram

The T828 comprises a four-stage RF power amplifier, the final two stages of which are combined, and extensive control circuitry.

The configuration of each of the main circuit blocks may be seen on a functional level in Figure 2.1.

2.2 RF Circuitry

(Refer to the RF section circuit diagram in Section 5.)

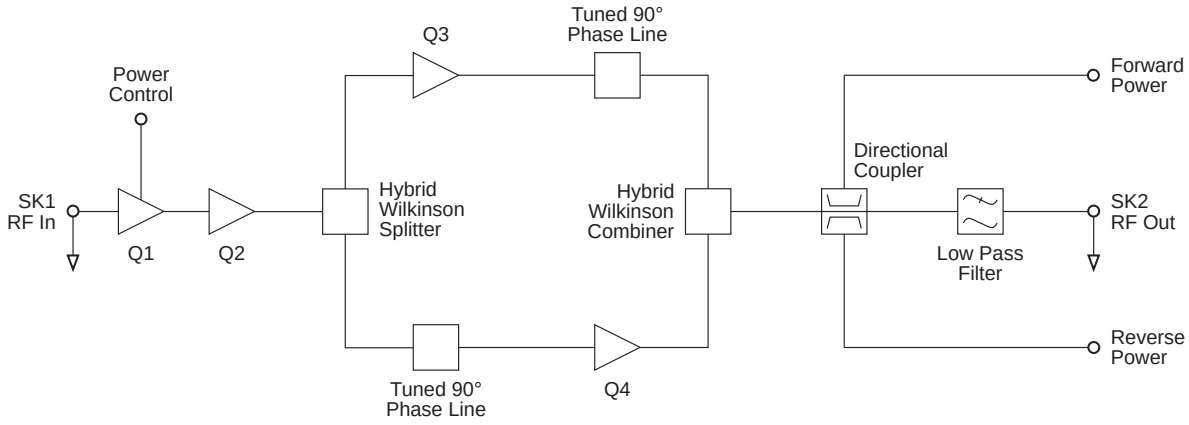


Figure 2.2 T828 RF Circuitry Block Diagram

The driver stage of the T828 consists of a two-stage transistor amplifier (Q1, Q2) which delivers 20W. This signal is split via a hybrid Wilkinson splitter (L220, L221) and used to drive the two final amplifiers (Q3, Q4). The outputs from the finals are combined with a hybrid Wilkinson combiner (L250, L251) and passed to the antenna socket via a directional coupler and a low pass filter.

The directional coupler senses forward and reflected power, which is rectified (D201, D200) and passed to the control circuitry for metering, alarm and power control purposes.

Power control is via a series pass transistor (Q16), which controls the supply voltage on the collector of the driver transistor (Q1).

2.3 Control Circuitry

(Refer to the control section circuit diagram in Section 5.)

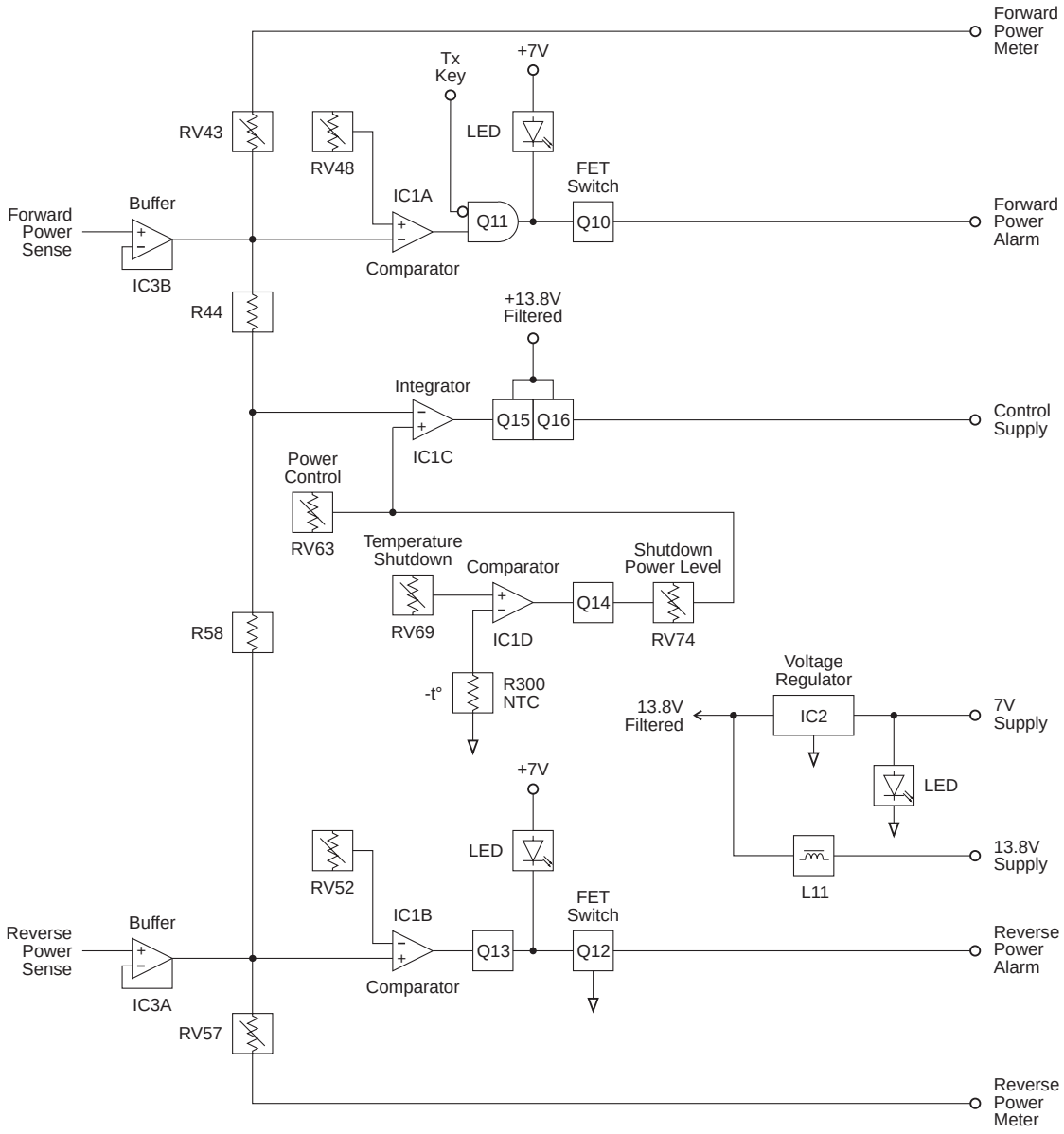


Figure 2.3 T828 Control Circuitry Block Diagram

2.3.1 Power Control

The DC voltages from the directional coupler representing forward and reflected power are buffered by the voltage followers IC3b and IC3a respectively. Their outputs are summed at an integrator (IC1c), which drives the series pass control element (Q16).

Forward and reflected power are summed so that, under high output VSWR, the power control turns the PA down. This is because the control loop adjusts for the same DC voltage from the directional coupler that would have been present if there were no reflected power.

2.3.2 Thermal Protection

At excessively high temperatures, the output power will automatically reduce to a preset level, thus preventing the PA from overheating.

A thermistor controlled voltage divider (R68, R300) applies a voltage to a comparator with hysteresis (IC1d). The threshold of the comparator is independently set by RV69. This sets the shutdown temperature.

The output from the comparator and driver Q14 is summed into the power control network via RV74 so that the power level to which the PA must turn down may be set.

2.3.3 Forward And Reverse Power Alarms

If forward power drops below, or reverse power rises above, presettable limits, alarms may be triggered.

The alarm outputs are open drain configuration and are low under normal conditions (i.e. forward and reverse power levels are normal).

IC1a and IC1b form comparators with thresholds adjusted via RV48 (forward power) and RV52 (reverse power) respectively. The inputs are from the forward and reverse power signals from the directional coupler, buffered by IC3b and IC3a. Thus, the power levels at which the forward and reverse power alarms are triggered are defined by RV48 and RV52 respectively.

2.3.4 Forward And Reverse Power Metering

Forward and reverse power signals from buffers IC3b and IC3a are available for metering purposes. The output currents are adjustable via RV43 (forward power) and RV57 (reverse power).

3 T828 Initial Adjustment

Caution: **This equipment contains CMOS devices which are susceptible to damage from static charges. Refer to Section 1.2 in Part A for more information on anti-static procedures when handling these devices.**

The following section describes the full adjustment procedure to be carried out before operating the T828.

Note: The T828 requires no RF tuning or alignment.

Refer to Section 5 where the parts lists, grid reference index and diagrams will provide detailed information on identifying and locating components.

The following topics are covered in this section.

3.1 Test Equipment Required

- DC power supply capable of delivering 15A at 13.8V (e.g. Tait T807).
- Multimeter or DMM (e.g. Fluke 77).
- RF power meter usable 66-88MHz (e.g. HP 435 series or Bird Wattmeter).
- Thru-line wattmeter with 5W element.
- 150W 30dB 50 ohm attenuator.
- 150W 3dB 50 ohm pad.
- 'BNC' to 'N' type adaptors (e.g. Amphenol, Greenpar).
- Appropriate trimming tools.

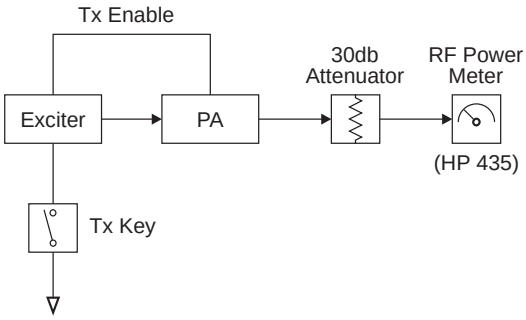


Figure 3.1 T828 Test Equipment Set-up

3.2 Optimising Intermodulation Performance

Note: If the T828 is to be used in countries where intermodulation performance is a Type Approval requirement (e.g. Europe, UK), or if intermodulation performance is of particular concern, the two 50 ohm Teflon coax phasing sections provided must be fitted.

3.2.1 Trimming

The Teflon phasing sections supplied are cut for 66MHz. If the required operating frequency is greater than 66MHz, you must trim both sections to the correct length according to the following formula:

$$\text{length of centre conductor (cm)} = \frac{5250}{\text{frequency (MHz)}}$$

Note: If the T828 is to be used over a band of frequencies, trim both sections for the centre operating frequency.

Trim the ends of the Teflon coax as shown in Figure 3.2 (dimensions shown in mm).

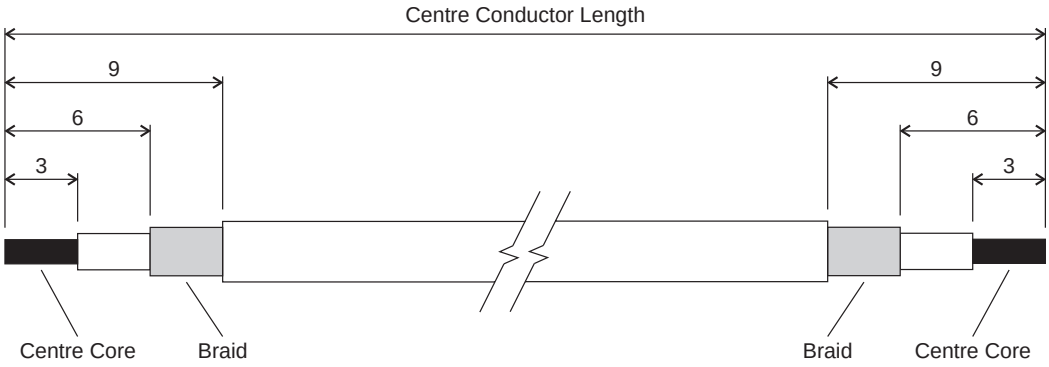


Figure 3.2 T828 Phasing Section Trimming Detail

3.2.2 Fitting

Note: If the Teflon phasing sections have been unbound for trimming, they must be rebound in the same way as the original components.

Remove the wire links fitted in locations TL1 and TL2 (refer to Figure 3.3).

Fit the Teflon phasing sections as shown in Figure 3.3 and solder the terminations as shown in Figure 3.4.

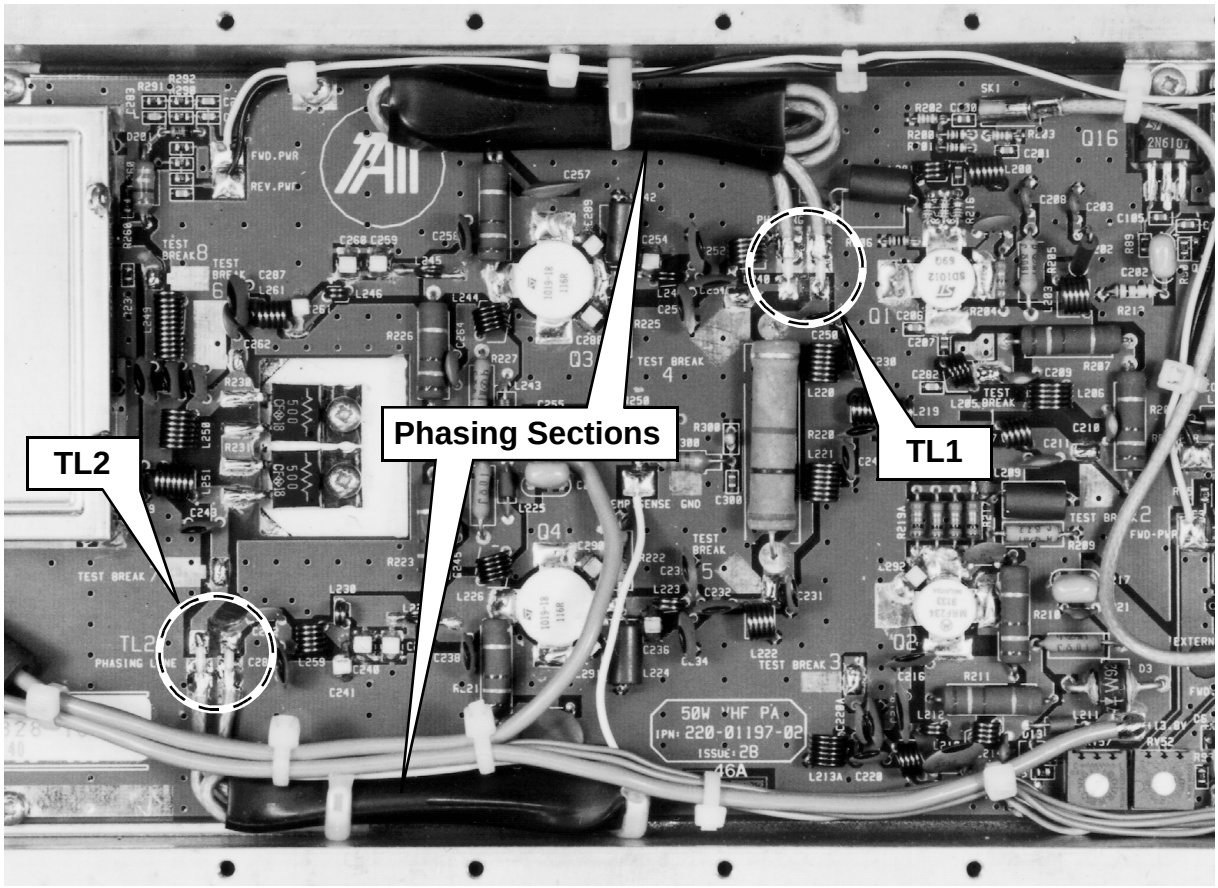


Figure 3.3 T828 Phasing Section Location

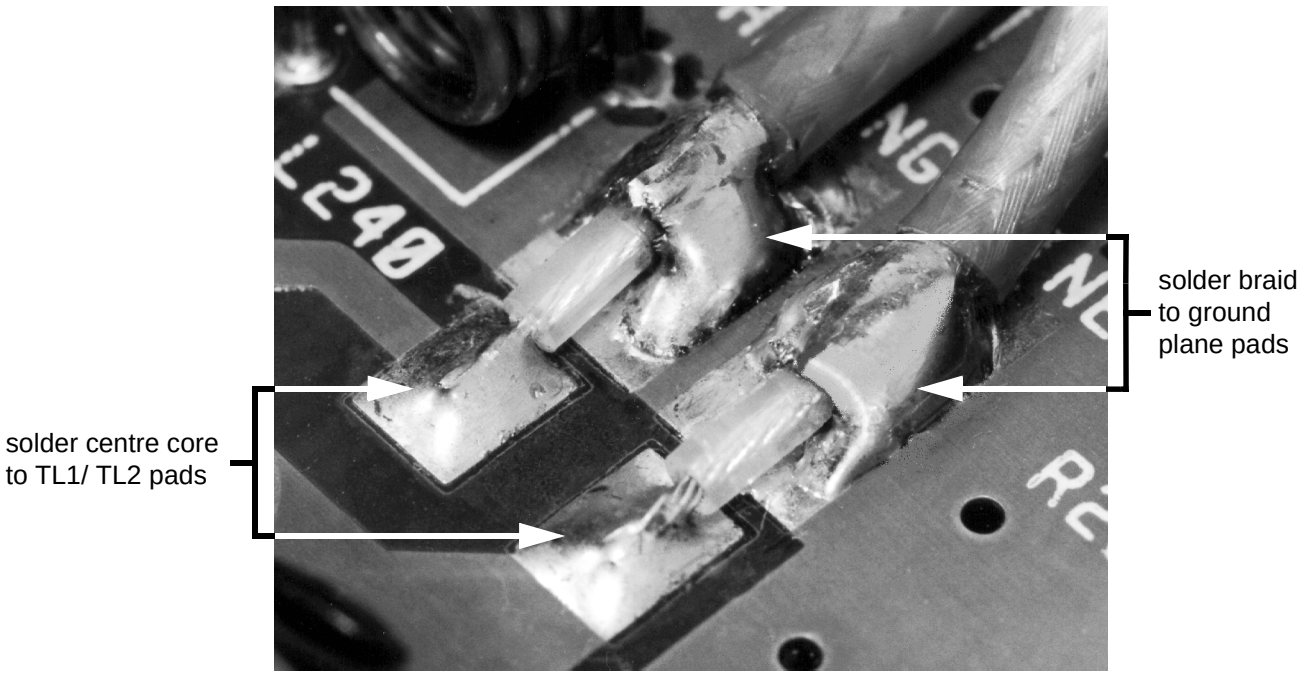


Figure 3.4 T828 Phasing Section Soldering Detail

3.3 Preliminary Checks

Check for short circuits between the positive rail and earth.

Set up the test equipment as in Figure 3.1.

Connect the T828 to a 13.8V DC supply.

Check that the quiescent current is approximately 45mA.

To key the transmitter, earth the key line (D-range 1 pin 13) on the exciter.

Check that the power supply is still at 13.8V under load.

Check that the regulated power control supply is approximately 7V.

Note: The output power and alarm levels should be set with the cover shield on. If the cover is removed for other adjustment procedures, make a final check of the output power and alarm levels with the cover shield on.

3.4 Setting The Output Power

Caution: **If the temperature shutdown power level has not yet been set or is unknown, check that the unit does not overheat while setting the output power.**

Note 1: Cables and connectors can easily cause a power loss of several watts if either too long or poorly terminated. Always use the shortest possible lead between the T828 and power meter.

Note 2: You will need appropriate extension leads if you wish to carry out the adjustment procedures with the T828 withdrawn from the rack in the latched position. Alternatively, disconnect and withdraw the T828 and reconnect it behind the rack.

Note 3: The actual power used may be limited by regulatory requirements.

Connect the exciter output to the PA input via a thru-line wattmeter with a 5W full scale reading. Special SMC/BNC leads will be required.

Connect an RF power meter to the PA output. Set the front panel power control preset (RV63) fully clockwise.

Key on the drive source.

Check that the power output exceeds 60W.

Adjust RV63 to reduce the power output to the required level (e.g. 50W).

3.5 High Temperature Shutdown Power Level

Note: The temperature shutdown circuit is factory set to approximately 130°C and 20W. RV69 and RV74 should not be readjusted if normal operation is required.

Power up the T828 and adjust the power control pot. (RV63) for the normal operating power level.

Turn the temperature set pot. (RV69) fully anticlockwise to avoid RF power cycling between the levels set by RV63 and RV74.

Apply heat to the NTC (R300) with the tip of a soldering iron.

Adjust the shutdown power level pot. (RV74) to the desired level. For continuous operation during fault conditions, set the shutdown power in the range 10 to 20W.

For normal operation, i.e. shutdown under extreme PA internal temperatures (approx. 130°C) or excessive dissipation in the splitter balance resistor (R220), adjust the temperature set pot. (RV69) for a voltage reading of 150mV at TP1 (pin 12 of the LM324D [IC1]).

3.6 Remote Forward Power Meter Calibration

If a remote meter is connected, adjust the forward power meter calibration control (RV43) for the remote reading to agree with the RF power meter reading.

3.7 Remote Reverse Power Meter Calibration

If a remote meter is connected, connect a 50 ohm 3dB pad (with the output open circuit) to the PA output.

Apply RF drive and Tx key.

Adjust the reverse power meter calibration control (RV57) for a quarter of the forward power reading.

3.8 Setting Alarm Levels

Note: If forward and reverse power metering is being used, set up their calibration (Section 3.6 and Section 3.7) before setting the alarm levels.

3.8.1 Forward Power

Power up the T828 and adjust the front panel power control (RV63) so that the output power is at the alarm level required (e.g. 40W if the PA normally operates at 50W).

Adjust the forward power alarm set control (RV48) so that the forward power alarm LED lights.

Check the alarm level setting by adjusting the power up and down and observing the alarm LED. A few watts hysteresis can be expected.

Readjust RV63 for the normal operating level.

Note: Remote indication is available at D-range pin 3.

3.8.2 Reverse Power

Power up the T828 and adjust the front panel power control (RV63) for the normal operating power level.

Place a known mismatch of the required value (e.g. 3:1 VSWR) and adjust the reverse power alarm set control (RV52) so that the reverse power alarm LED lights.

Example: A VSWR of 3:1 can be simulated by connecting an unterminated 3dB pad (100W) to the PA output. This will result in a return loss of 6dB.

Note: Remote indication is available at D-range pin 4.

4 T828 Fault Finding

Caution: **This equipment contains CMOS devices which are susceptible to damage from static charges. Refer to Section 1.2 in Part A for more information on anti-static procedures when handling these devices.**

The following test procedures and fault finding flow charts may be used to help locate a hardware problem, however they are by no means a complete fault finding procedure. If you still cannot trace the fault after progressing through them in a logical manner, contact your nearest Tait Dealer or Customer Service Organisation. If necessary, you can get additional technical help from Customer Support, Radio Systems Division, Tait Electronics Ltd, Christchurch, New Zealand (full contact details are on page 2).

Refer to Section 5 where the parts lists, grid reference index and diagrams will provide detailed information on identifying and locating components.

The following topics are covered in this section.

4.1 Visual Checks

Remove the side cover from the T828 and inspect the PCB for damaged or broken components, paying particular attention to the surface mounted devices (SMDs). Also check for defective solder joints.

Refer to Section 4.7, Section 4.8 and Section 3 of Part A for more details on repair and replacement of components.

4.2 Component Checks

If you suspect a transistor is faulty, you can assess its performance by measuring the forward and reverse resistance of the junctions. Unless the device is completely desoldered, first make sure that the transistor is not shunted by some circuit resistance. Use a good quality EVM (e.g. Fluke 75) for taking the measurements (or a 20k ohm/V or better multimeter, using only the medium or low resistance ranges).

The collector current drawn by multi-junction transistors is a further guide to their performance.

If an IC is suspect, the most reliable check is to measure the DC operating voltages. Due to the catastrophic nature of most IC failures, the pin voltages will usually be markedly different from the recommended values in the presence of a fault. The recommended values can be obtained from either the circuit diagram or the component data catalogue.

4.3 DC Checks

Note: No RF power is to be applied during these checks.

Check that +13.8V is present on the collectors of Q1, Q2, Q3 and Q4. Make this measurement when the transmitter is not keyed.

Check that +13.8V is present at pin 4 of IC1 and pin 8 of IC3.

Check that 7.0V is present at the output of regulator IC2.

4.4 RF Checks

4.4.1 General

You can measure in-circuit RF levels around Q1 and Q2 with an RF probe on which the earth lead has been shortened to a minimum (i.e. 13mm); refer to the PA Fault Finding Chart (Section 4.6.1). You must measure all other stages with a power meter at the 50Ω points in the circuit.

For problems with the power control circuitry, refer to the Power Control Fault Finding Chart (Section 4.6.2).

4.4.2 PA Faults

If a PA fault has occurred, or is suspected, it is easier to find if the various stages are isolated by use of the test breaks (refer to Figure 4.1) and each stage analysed individually. Eight 50 ohm test break points have been included throughout the RF circuitry to enable individual transistor stages to be tested.

Testing may be performed by removing the solder short across the test break and soldering a 50 ohm test lead to the appropriate signal and earth pads.

Note 1: Use good quality 50Ω coax for the "flying" test leads.

Note 2: Ensure each output is terminated in a 50Ω load of the correct power rating.

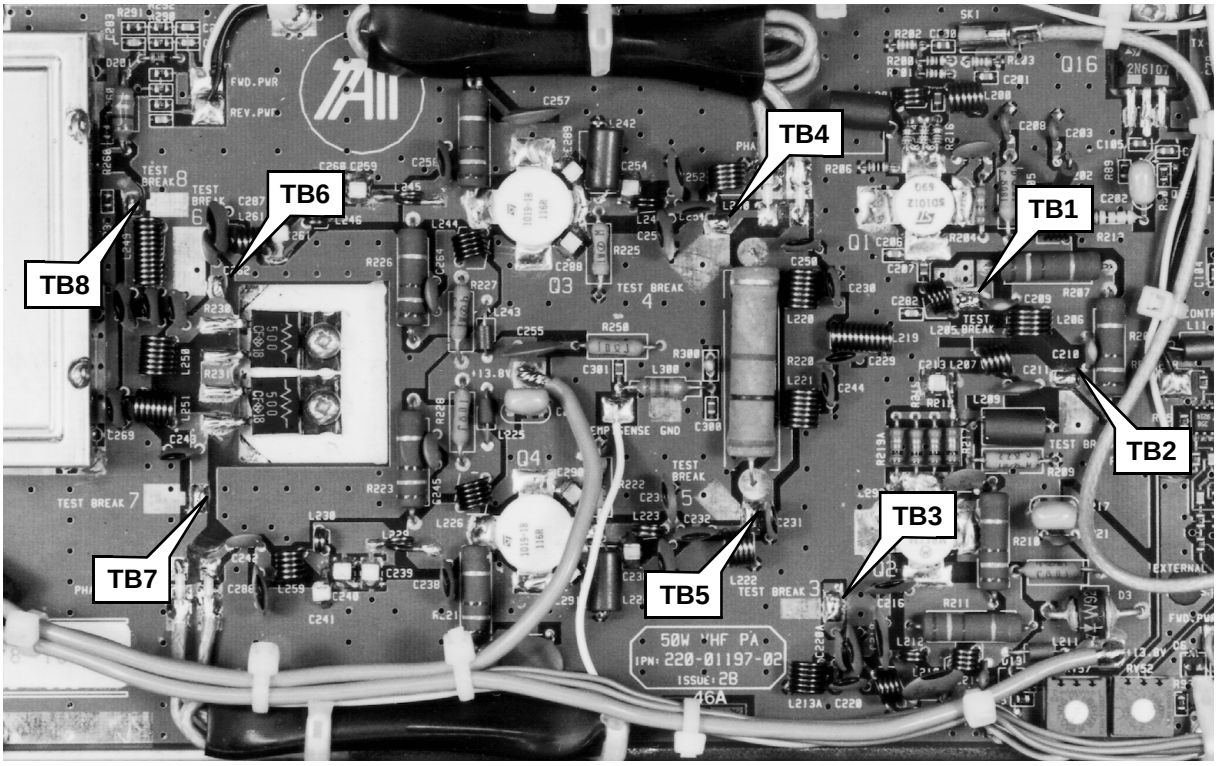


Figure 4.1 T828 Test Break Point Location

4.5 Voltage Chart

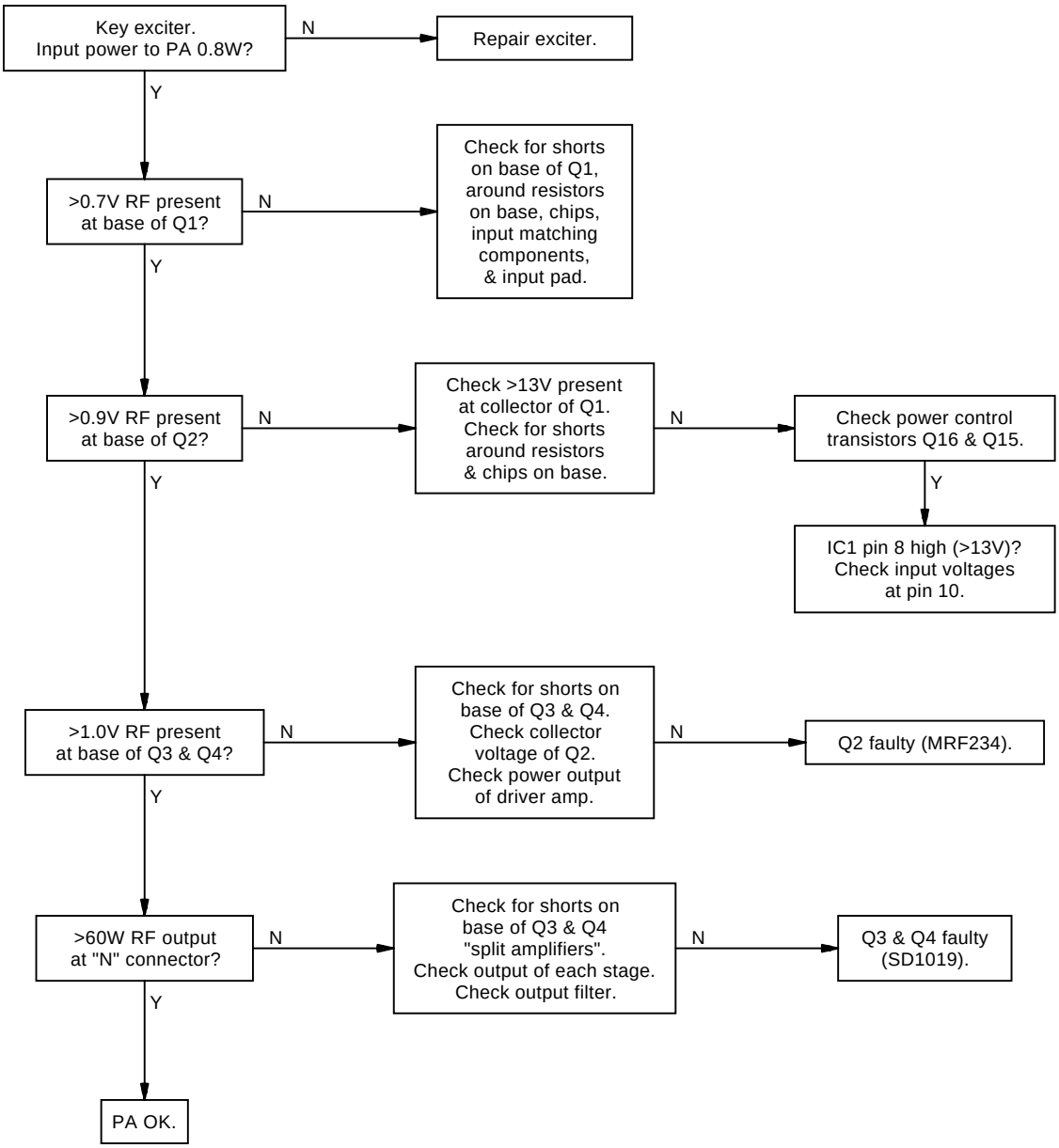
Test conditions:

- typical DC voltages measured with Fluke 77 DVM
- supply voltage 13.8V at socket
- transmitter unkeyed
- allow ±20% for spread of transistor characteristics.

Device	Emitter	Base	Collector
Q1	0.0V	0.0V	13.0V
Q2	0.0V	0.0V	13.8V
Q3	0.0V	0.0V	13.8V
Q4	0.0V	0.0V	13.8V
Q11	1.8V	2.2V	5.9V
Q13	0.0V	0.0V	5.9V
Q15	13.0V	13.6V	13.6V
Q16	13.8V	13.6V	13.0V

4.6 Fault Finding Charts

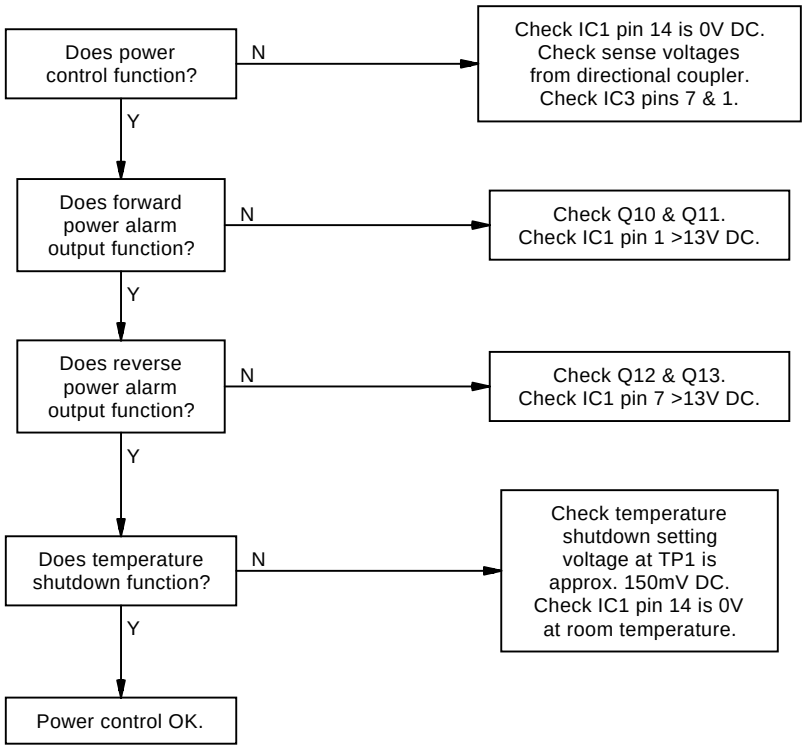
4.6.1 PA



4.6.2 Power Control

Normal operating conditions:

Measurement	Output Power	
	10W	50W
forward power at "FWD-PWR" pad (beside IC3)	1V	2.6V
reverse power at "REV-PWR" pad (beside IC3)	<10mV	50mV
IC1 pin 8	4.8V	6.8V
RV63/R64 (RV63 wiper)	7V	7V
L202	4.13V	6.2V



4.7 Replacing RF Power Transistors

Caution: **Failure to comply with the following procedure can result in failure of the device due to poor heatsinking, or worse, can endanger the health of the assembler if the beryllium oxide die carrier is smashed during assembly.**

Caution: **As the location of certain components in the PA is critical to performance, it is important that any components removed or disturbed are refitted in *exactly* the same position. Before attempting to remove a transistor, note the location of any other components that will also need to be removed. Replacing each component in its original location will help to maintain the performance of the PA.**

Caution: **Do not apply too much heat or pressure to the PCB pads and tracks as you may damage them or lift them from the PCB, causing permanent damage to the PA.**

Desolder and remove the components from around the transistor.

Desolder the transistor tabs by heating with a soldering iron and lifting away from the PCB with a screwdriver or thin stainless steel spike. Unscrew the transistor stud nut and remove the device.

Remove any excess solder from the PCB pads with solder wick.

Trim the tabs of the replacement transistor so that the device sits neatly on the PCB pads provided.

Lightly tin the underside of the transistor tabs.

Apply a small amount of heatsink compound (Dow-Corning 340 or equivalent) to the transistor mounting surface. Sufficient compound should be used to ensure an even film over the entire mounting surface.

Place the transistor on the PCB in the correct orientation and ensure the tabs are flush to the surface.

Lightly solder one tab to the PCB, then torque down the retaining nut to the correct torque (0.7Nm/6in.lbf.).

Caution: **Do not solder all the tabs before torquing down otherwise the device may be broken.**

Solder all transistor tabs to the PCB.

Replace each component in exactly the same position as noted previously.

4.8 Removing The PCB From The Heatsink

Note: This is a lengthy procedure and should be considered only after all other checks have been carried out. There are no components on the bottom of the PCB.

Remove the harmonic filter shield lid.

Remove the 50 ohm output N-type connector by unscrewing it from the heatsink casting and desoldering it from the PCB.

Unplug the 50 ohm input coaxial cable from the PCB, unscrew the BNC connector from the heatsink, and remove the connector and cable (cutting cable ties as required).

Desolder the positive and negative power feed wires from the PCB.

Desolder the alarm and metering wires from the PCB.

Remove the 2 screws securing the D-range connector and PCB to the heatsink and withdraw the assembly and wires from the heatsink (cutting cable ties as required).

Remove the transistor stud nuts.

Remove the mounting screws for the TO-220 devices: R230, R231 and Q16.

Remove the 10 PCB retaining screws.

Push the three LEDs out of their front panel grommets.

Lift the PCB gently from the heatsink to gain access to the underside of the board.

Note: R230/231 and Q1-Q4 may be stuck down with heatsink compound. You may need to carefully prise them away from the heatsink with a small screwdriver.

Caution: **Keep the heatsink compound clean while the PCB is detached. Any objects caught in the heatsink compound underneath the device which prevent effective earthing and/or heatsinking may cause the device to fail.**

Caution: **Do not operate the PA with the PCB detached as the heatsink is used for earthing and heat dissipation.**

To replace the PCB, reverse the order of removal, taking care that the wiring is correctly positioned and not 'pinched'.

Q1-Q4: Torque down the retaining nut to the correct torque (0.7Nm/ 6in.lbf.).

Make sure that the heatsink compound has stayed clean, and that the insulating pad for Q16 is not damaged.

If you have difficulty refitting the LEDs, try pushing the body of the LED back into the grommet with a thin screwdriver or spike.

5 T828 PCB Information

Caution: **This equipment contains CMOS devices which are susceptible to damage from static charges. Refer to Section 1.2 in Part A for more information on anti-static procedures when handling these devices.**

This section provides the following information on the T828 power amplifier:

- parts lists
- grid reference index
- PCB layouts
- circuit diagrams.

5.1 Introduction

Product Type Identification

You can identify the PA type by checking the product code printed on a label on the rear of the chassis/heatsink (product codes are explained in Section 1.3 in this Part of the manual, and Figure 1.1 in Part A shows typical labels).

PCB Identification

All PCBs are identified by a unique 10 digit "internal part number" (IPN), e.g. 220-01390-02, which is screen printed onto the PCB (usually on the top side), as shown in the example below:

The last 2 digits of this number define the issue status, which starts at 00 and increments through 01, 02, 03, etc. as the PCB is updated. Some issue PCBs never reach full production status and are therefore not included in this manual. A letter following the 10 digit IPN has no relevance in identifying the PCB for service purposes.

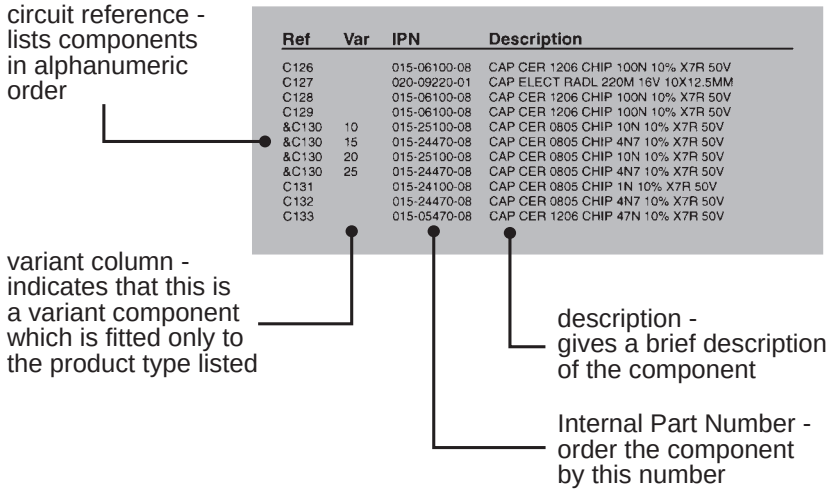
Note: It is important that you identify which issue PCB you are working on so that you can refer to the appropriate set of PCB information.

Parts Lists

The 10 digit numbers (000-00000-00) in this Parts List are "internal part numbers" (IPNs). We can process your spare parts orders more efficiently and accurately if you quote the IPN and provide a brief description of the part.

The components listed in this parts list are divided into two main types: those with a circuit reference (e.g. C2, D1, R121, etc.) and those without (miscellaneous and mechanical).

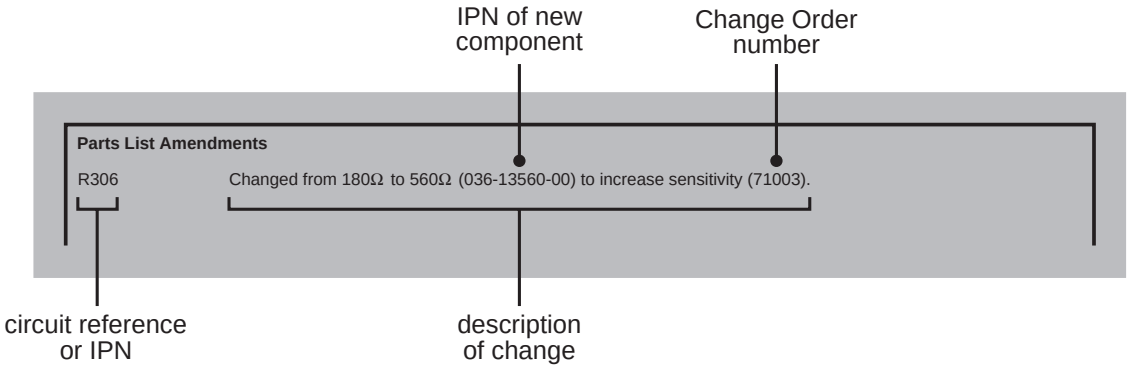
Those with a circuit reference are grouped in alphabetical order and then in numerical order within each group. Each component entry comprises three or four columns, as shown below:



The miscellaneous and mechanical section lists the variant and common parts in IPN order.

Parts List Amendments

At the front of the parts list is the Parts List Amendments box (an example of which is shown below). This box contains a list of component changes which took place after the parts list and diagrams in this section were compiled. These changes (e.g. value changes, added/deleted components, etc.) are listed by circuit reference in alphanumeric order and supersede the information given in the parts list or diagrams. Components without circuit references are listed in IPN order. The number in brackets at the end of each entry refers to the Tait internal Change Order document.

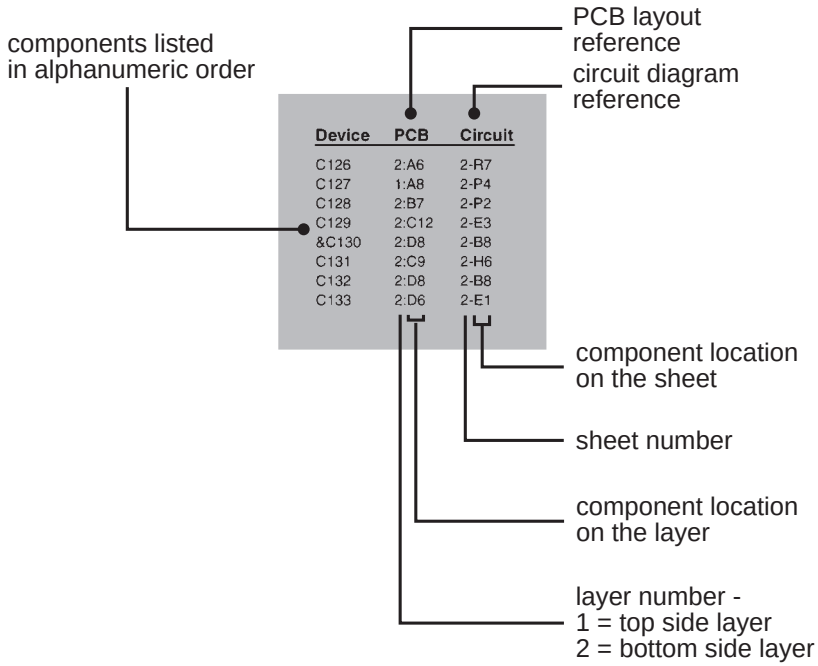


Variant Components

A variant component is one that has the same circuit reference but different value or specification in different product types. Where two products share the same PCB, the term “variant” is also used to describe components unplaced in one product. Variant components have a character prefix, such as “&”, “=” or “#”, before the circuit reference (e.g. &R100).

Grid Reference Index

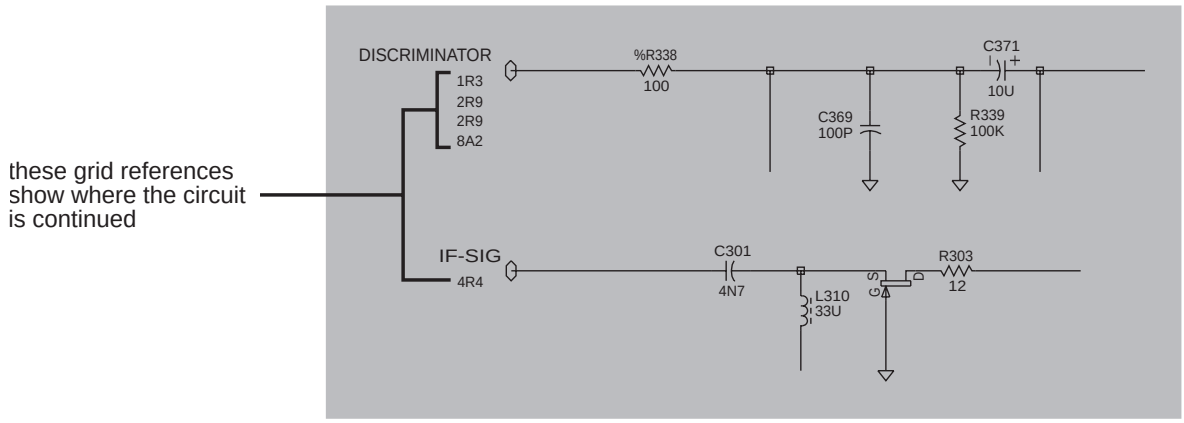
This section contains a component grid reference index to help you find components and labelled pads on the PCB layouts and circuit diagrams. This index lists the components and pads in alphanumeric order, along with the appropriate alphanumeric grid references, as shown below:



Using CAD Circuit Diagrams

Reading a CAD circuit diagram is similar to reading a road map, in that both have an alphanumeric border. The circuit diagrams in this manual use letters to represent the horizontal axis, and numbers for the vertical axis. These circuit diagram "grid references" are useful in following a circuit that is spread over two or more sheets.

When a line representing part of the circuitry is discontinued, a reference will be given at the end of the line to indicate where the rest of the circuitry is located, as shown below. The first digit refers to the sheet number and the last two characters refer to the location on that sheet of the continuation of the circuit (e.g. 1R3).



5.2 T828 Power Amplifier PCB

This section contains the following information.

T828 Parts List (IPN 220-01197-02)

How To Use This Parts List

The components listed in this parts list are divided into two main types: those with a circuit reference (e.g. C2, D1, R121, etc.) and those without (miscellaneous and mechanical).

Those with a circuit reference are grouped in alphabetical order and then in numerical order within each group. Each component entry comprises three or four columns: the circuit reference, variant (if applicable), IPN and description. A number in the variant column indicates that this is a variant component which is fitted only to the product type listed. Static sensitive devices are indicated by an (S) at the start of the description column.

The miscellaneous and mechanical section lists the variant and common parts in IPN order. Where possible, a number in the legend column indicates their position in the mechanical assembly drawing.

The Parts List Amendments box below lists component changes that took place after the parts list and diagrams in this section were compiled. These changes (e.g. value changes, added/deleted components, etc.) are listed by circuit reference in alphanumeric order and supersede the information given in the parts list or diagrams. Components without circuit references are listed in IPN order.

Parts List Amendments

RV63	2k 10 turn pot (IPN 044-04200-03) replaced with better quality 2k 15 turn pot (IPN 044-04200-06) and pot cover (IPN 044-04200-07) (710800).

Ref	Var	IPN	Description
C76		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C77		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C78		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C80		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C81		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C84		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C85		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C86		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C87		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C90		015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V
C91		025-08100-02	CAP TANT BEAD 10M 10% 16V
C92		015-25100-08	CAP CER 0805 CHIP 10N 10% X7R 50V
C93		015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V
C95		015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V
C96		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C99		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C100		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C101		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C103		015-25100-08	CAP CER 0805 CHIP 10N 10% X7R 50V
C104		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C105		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C107		015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V
C108		015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V
C109		015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V
C111		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C112		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C200		015-24470-08	CAP CER 0805 CHIP 4N7 10% X7R 50V
C201		015-22560-01	CAP CER 0805 CHIP 56P 5% NPO 50V
C202		020-07470-04	CAP ELECT RADL 4M7 25V 20% 8X13MM SOLID
C203		011-54100-01	CAP CER AI 1N 10% T/C B 63V
C204		011-54470-03	CAP CER AI 4N7 10% T/C B 50V
C205		015-23120-01	CAP CER 0805 CHIP 120P 5% NPO 50V
C206		015-22270-01	CAP CER 0805 CHIP 27P 5% NPO 50V
C207		015-24470-08	CAP CER 0805 CHIP 4N7 10% X7R 50V
C208		011-54100-01	CAP CER AI 1N 10% T/C B 63V
C209		011-52390-01	CAP CER AI 39P 5% N150 50/63V
C210		011-52390-01	CAP CER AI 39P 5% N150 50/63V
C211		011-53120-01	CAP CER AI 120P 5% N150 50/63V
C213		015-03470-03	CAP CER CHIP 470P 5% NPO 200V HIQ GRH11
C214		011-54100-01	CAP CER AI 1N 10% T/C B 63V
C215		011-54470-03	CAP CER AI 4N7 10% T/C B 50V
C216		010-02680-00	CAP CER 68P 5% NPO 500V 9.5MM OD DD09
C217		020-07470-04	CAP ELECT RADL 4M7 25V 20% 8X13MM SOLID
C218		010-03150-01	CAP CER 150P 5% NPO 500V
C219		010-02680-00	CAP CER 68P 5% NPO 500V 9.5MM OD DD09
C220		010-02390-00	CAP CER 39P 5% NPO 500V 7.5MM OD DD07
C220A		010-02390-00	CAP CER 39P 5% NPO 500V 7.5MM OD DD07
C221		011-54100-01	CAP CER AI 1N 10% T/C B 63V
C223		010-03150-01	CAP CER 150P 5% NPO 500V
C229		010-02820-00	CAP CER 82P 5% NPO 500V 9.5MM OD DD09
C230		010-02390-00	CAP CER 39P 5% NPO 500V 7.5MM OD DD07
C231		010-02390-00	CAP CER 39P 5% NPO 500V 7.5MM OD DD07
C232		010-02560-00	CAP CER 56P 5% NPO 500V 8.0MM OD DD08
C234		010-02680-00	CAP CER 68P 5% NPO 500V 9.5MM OD DD09
C235		010-02680-00	CAP CER 68P 5% NPO 500V 9.5MM OD DD09
C236		015-03470-03	CAP CER CHIP 470P 5% NPO 200V HIQ GRH11
C237		017-15470-01	CAP CER SURFACE BARRIER 47N 20% 50V
C238		010-02560-00	CAP CER 56P 5% NPO 500V 8.0MM OD DD08
C239		015-03150-03	CAP CER CHIP 150P 5% NPO 300V HIQ GRH11
C240		015-03150-03	CAP CER CHIP 150P 5% NPO 300V HIQ GRH11
C241		015-02680-03	CAP CER CHIP 68P 5% NPO 500V HIQ GRH111
C242		010-04100-01	CAP CER 1N 10% T/C B 500V
C243		010-02390-00	CAP CER 39P 5% NPO 500V 7.5MM OD DD07
C244		010-02390-00	CAP CER 39P 5% NPO 500V 7.5MM OD DD07
C245		010-04100-01	CAP CER 1N 10% T/C B 500V
C250		010-02390-00	CAP CER 39P 5% NPO 500V 7.5MM OD DD07
C251		010-02560-00	CAP CER 56P 5% NPO 500V 8.0MM OD DD08
C252		010-02680-00	CAP CER 68P 5% NPO 500V 9.5MM OD DD09
C253		010-02680-00	CAP CER 68P 5% NPO 500V 9.5MM OD DD09
C254		015-03470-03	CAP CER CHIP 470P 5% NPO 200V HIQ GRH11
C255		017-15470-01	CAP CER SURFACE BARRIER 47N 20% 50V
C256		020-07470-04	CAP ELECT RADL 4M7 25V 20% 8X13MM SOLID
C257		017-15470-01	CAP CER SURFACE BARRIER 47N 20% 50V
C258		010-02560-00	CAP CER 56P 5% NPO 500V 8.0MM OD DD08
C259		015-03150-03	CAP CER CHIP 150P 5% NPO 300V HIQ GRH11
C260		015-03150-03	CAP CER CHIP 150P 5% NPO 300V HIQ GRH11
C261		015-02680-03	CAP CER CHIP 68P 5% NPO 500V HIQ GRH111
C262		010-04100-01	CAP CER 1N 10% T/C B 500V
C263		010-02390-00	CAP CER 39P 5% NPO 500V 7.5MM OD DD07
C264		010-04100-01	CAP CER 1N 10% T/C B 500V
C265		010-02390-00	CAP CER 39P 5% NPO 500V 7.5MM OD DD07
C269		010-02390-00	CAP CER 39P 5% NPO 500V 7.5MM OD DD07
C270		010-02820-00	CAP CER 82P 5% NPO 500V 9.5MM OD DD09
C271		015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V
C271A		015-21680-01	CAP CER 0805 CHIP 6P8 +/-0.25P NPO 50V
C272		015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V
C273		015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V
C274		015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V
C275		015-02330-03	CAP CER CHIP 33P 5% NPO 500V HIQ GRH111
C276		015-02470-03	CAP CER CHIP 47P 5% NPO 500V HIQ GRH111
C277		015-02220-03	CAP CER CHIP 22P 5% NPO 500V HIQ GRH111
C278		015-02470-03	CAP CER CHIP 47P 5% NPO 500V HIQ GRH111
C279		015-02220-03	CAP CER CHIP 22P 5% NPO 500V HIQ GRH111
C280		015-02470-03	CAP CER CHIP 47P 5% NPO 500V HIQ GRH111
C281		015-02330-03	CAP CER CHIP 33P 5% NPO 500V HIQ GRH111
C282		015-22680-01	CAP CER 0805 CHIP 68P 5% NPO 50V
C283		015-21680-01	CAP CER 0805 CHIP 6P8 +/-0.25P NPO 50V
C286		010-02680-00	CAP CER 68P 5% NPO 500V 9.5MM OD DD09
C287		010-02680-00	CAP CER 68P 5% NPO 500V 9.5MM OD DD09
C288		015-03560-03	CAP CER CHIP 560P 5% NPO 100V HIQ GRH11
C289		015-03560-03	CAP CER CHIP 560P 5% NPO 100V HIQ GRH11
C290		015-03560-03	CAP CER CHIP 560P 5% NPO 100V HIQ GRH11
C291		015-03560-03	CAP CER CHIP 560P 5% NPO 100V HIQ GRH11
C292		015-03560-03	CAP CER CHIP 560P 5% NPO 100V HIQ GRH11
C300		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
C301		015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V
D3		001-00011-60	(S) DIODE SR2607 6A/30V
D5		008-00013-32	(S) LED 3MM RED LO CURRENT NO MTG
D6		001-10000-70	(S) DIODE SMD BAV70 DUAL SWITCH SOT-23 CO
D10		008-00013-35	(S) LED 3MM GREEN LO CURRENT NO MTG
D11		008-00013-32	(S) LED 3MM RED LO CURRENT NO MTG
D13		001-10000-70	(S) DIODE SMD BAV70 DUAL SWITCH SOT-23 C
D200		001-00013-45	(S) DIODE SCHOTTKY 1SS97/2
D201		001-00013-45	(S) DIODE SCHOTTKY 1SS97/2
IC1		002-10003-24	(S) IC SMD 324 QUAD OP AMP SO14
IC2		002-00014-62	(S) IC 317L 100MA REG 3 TERMINAL TO-92
IC3		002-10003-58	(S) IC SMD LM358 DUAL OP AMP
L11		065-00010-04	BEAD FERRITE F8 4X2X5MM
L200		052-08135-55	COIL A/W 5.5T/3.5MM HOR 0.8MM WIRE
L201		052-08135-25	COIL A/W 2.5T/3.5MM HOR 0.8MM WIRE
L202		065-00010-08	BEAD FERRITE 4S3 3*0.7*10MM RED
L203		052-08145-45	COIL A/W 4.5T/4.5MM HOR 0.8MM WIRE
L204		065-00010-01	BEAD FERRITE 3B 6 HOLE
L205		052-08140-35	COIL A/W 3.5T/4.0MM HOR 0.8MM WIRE
L206		052-08160-35	COIL A/W 3.5T/6.0MM HOR 0.8MM WIRE
L207		052-08130-45	COIL A/W 4.5T/3.0MM HOR 0.8MM WIRE
L209		065-00010-01	BEAD FERRITE 3B 6 HOLE
L210		052-08130-35	COIL A/W 3.5T/3.0MM HOR 0.8MM WIRE
L211		065-00010-11	BEAD FERRITE 4S3 3*1*4MM RED
L212		052-08130-15	COIL A/W 1.5T/3.0MM HOR 0.8MM WIRE
L213		052-08140-35	COIL A/W 3.5T/4.0MM HOR 0.8MM WIRE
L213A		052-08145-55	COIL A/W 5.5T/4.5MM HOR 0.8MM WIRE
L219		052-08131-05	COIL A/W 10.5T/3.0MM HOR 0.8MM WIRE
L220		052-08140-65	COIL A/W 6.5T/4.0MM HOR 0.8MM WIRE
L221		052-08140-65	COIL A/W 6.5T/4.0MM HOR 0.8MM WIRE
L222		052-08145-45	COIL A/W 4.5T/4.5MM HOR 0.8MM WIRE
L223		052-08140-15	COIL A/W 1.5T/4.0MM HOR 0.8MM WIRE
L224		065-00010-01	BEAD FERRITE 3B 6 HOLE
L225		065-00010-11	BEAD FERRITE 4S3 3*1*4MM RED
L226		052-08140-45	COIL A/W 4.5T/4.0MM HOR 0.8MM WIRE
L229		052-08335-10	COIL A/W 1T/3.5MM SMD 0.8MM WIRE
L230		052-08125-15	COIL A/W 1.5T/2.5MM HOR 0.8MM WIRE
L240		052-08145-45	COIL A/W 4.5T/4.5MM HOR 0.8MM WIRE
L241		052-08140-15	COIL A/W 1.5T/4.0MM HOR 0.8MM WIRE
L242		065-00010-01	BEAD FERRITE 3B 6 HOLE
L243		065-00010-11	BEAD FERRITE 4S3 3*1*4MM RED
L244		052-08140-45	COIL A/W 4.5T/4.0MM HOR 0.8MM WIRE
L245		052-08335-10	COIL A/W 1T/3.5MM SMD 0.8MM WIRE
L246		052-08125-15	COIL A/W 1.5T/2.5MM HOR 0.8MM WIRE
L249		052-08131-15	COIL A/W 11.5T/3.0MM HOR 0.8MM WIRE
L250		052-08140-65	COIL A/W 6.5T/4.0MM HOR 0.8MM WIRE
L251		052-08140-65	COIL A/W 6.5T/4.0MM HOR 0.8MM WIRE
L254		052-08135-85	COIL A/W 8.5T/3.5MM HOR 0.8MM WIRE
L255		052-08155-45	COIL A/W 4.5T/5.5MM HOR 0.8MM WIRE
L256		052-08140-25	COIL A/W 2.5T/4.0MM HOR 0.8MM WIRE
L257		052-08155-45	COIL A/W 4.5T/5.5MM HOR 0.8MM WIRE
L258		052-08135-85	COIL A/W 8.5T/3.5MM HOR 0.8MM WIRE
L259		052-08130-45	COIL A/W 4.5T/3.0MM HOR 0.8MM WIRE
L260		056-00021-52	IND FXD 820NH 10% NON MAGNETIC
L260A		056-00021-60	IND FXD 330NH 6.6X2.7MM AXIAL NON MAGN
L261		052-08130-45	COIL A/W 4.5T/3.0MM HOR 0.8MM WIRE
L300		056-00021-00	IND FXD 3.3UH AXIAL
Q1		000-00021-65	(S) XSTR SD1012-9 NPN STUD MTG VHF PWR
Q2		000-00030-74	(S) XSTR MRF234 STUD MTG RF PWR 25W 90MH
Q3		000-00022-66	(S) XSTR SD1019-18 VHF PWR 40W STUD MTD
Q4		000-00022-66	(S) XSTR SD1019-18 VHF PWR 40W STUD MTD
Q10		000-00020-70	(S) XSTR BS170 JFET TO-92 SMALL SIG
Q11		000-10008-17	(S) XSTR SMD BC817-25 NPN SOT-23 AF LO P
Q12		000-00020-70	(S) XSTR BS170 JFET TO-92 SMALL SIG
Q13		000-10008-17	(S) XSTR SMD BC817-25 NPN SOT-23 AF LO P
Q14		000-10008-48	(S) XSTR SMD BCW60/BC848B215 NPN SOT23 A
Q15		000-10008-17	(S) XSTR SMD BC817-25 NPN SOT-23 AF LO P
Q16		000-00030-95	(S) XSTR 2N6107 PNP TO-220 AF PWR
R36		036-13680-00	RES M/F 0805 CHIP 680E 5%
R38		036-17100-00	RES M/F 0805 CHIP 1M 5%
R39		036-16100-00	RES M/F 0805 CHIP 100K 5%
R42		036-15100-00	RES M/F 0805 CHIP 10K 5%
R44		036-14470-00	RES M/F 0805 CHIP 4K7 5%
R47		036-15270-00	RES M/F 0805 CHIP 27K 5%
R49		036-13680-00	RES M/F 0805 CHIP 680E 5%
R50		036-13680-00	RES M/F 0805 CHIP 680E 5%
R55		036-17100-00	RES M/F 0805 CHIP 1M 5%
R56		036-15100-00	RES M/F 0805 CHIP 10K 5%
R58		036-14470-00	RES M/F 0805 CHIP 4K7 5%
R61		036-13220-00	RES M/F 0805 CHIP 220E 5%
R62		036-14100-00	RES M/F 0805 CHIP 1K 5%
R64		036-14470-00	RES M/F 0805 CHIP 4K7 5%
R67		036-15100-00	RES M/F 0805 CHIP 10K 5%
R68		036-14470-00	RES M/F 0805 CHIP 4K7 5%
R73		036-16220-00	RES M/F 0805 CHIP 220K 5%
R74		036-14470-00	RES M/F 0805 CHIP 4K7 5%

Ref	Var	IPN	Description
R75		036-14470-00	RES M/F 0805 CHIP 4K7 5%
R76		036-14220-00	RES M/F 0805 CHIP 2K2 5%
R77		036-14220-00	RES M/F 0805 CHIP 2K2 5%
R78		036-14270-00	RES M/F 0805 CHIP 2K7 5%
R79		036-13220-00	RES M/F 0805 CHIP 220E 5%
R80		036-13100-00	RES M/F 0805 CHIP 100E 5%
R81		036-14100-00	RES M/F 0805 CHIP 1K 5%
R82		036-14470-00	RES M/F 0805 CHIP 4K7 5%
R83		036-14100-00	RES M/F 0805 CHIP 1K 5%
R84		036-14470-00	RES M/F 0805 CHIP 4K7 5%
R85		036-14100-00	RES M/F 0805 CHIP 1K 5%
R86		036-14100-00	RES M/F 0805 CHIP 1K 5%
R87		036-12100-00	RES M/F 0805 CHIP 10E 5%
R89		036-13100-00	RES M/F 0805 CHIP 100E 5%
R90		036-15100-00	RES M/F 0805 CHIP 10K 5%
R92		036-14100-00	RES M/F 0805 CHIP 1K 5%
R93		036-14560-00	RES M/F 0805 CHIP 5K6 5%
R94		036-14100-00	RES M/F 0805 CHIP 1K 5%
R95		036-14100-00	RES M/F 0805 CHIP 1K 5%
R96		036-14100-00	RES M/F 0805 CHIP 1K 5%
R97		036-14100-00	RES M/F 0805 CHIP 1K 5%
R98		036-12100-00	RES M/F 0805 CHIP 10E 5%
R99		036-14270-00	RES M/F 0805 CHIP 2K7 5%
R100		036-14470-00	RES M/F 0805 CHIP 4K7 5%
R200		030-02120-20	RES FILM 12E 5% 0.4W 4X1.6MM
R201		030-02120-20	RES FILM 12E 5% 0.4W 4X1.6MM
R202		030-53820-20	RES FILM AI 820E 5% 0.4W 4X1.6MM
R203		030-53820-20	RES FILM AI 820E 5% 0.4W 4X1.6MM
R204		030-03270-10	RES FILM 270E 5% 0.5W 7X2.5MM
R205		032-33180-00	RES M/F PWR 180E 5% 1W 12X4.5MM
R206		030-52100-20	RES FILM AI 10E 5% 0.4W 4X1.6MM
R207		032-33180-01	RES M/F PWR 180E 5% 2.5W 17X5MM
R208		032-33180-01	RES M/F PWR 180E 5% 2.5W 17X5MM
R209		032-32220-00	RES M/F PWR 22E 5% 1W 12X4.5MM
R210		032-33180-01	RES M/F PWR 180E 5% 2.5W 17X5MM
R211		032-33180-01	RES M/F PWR 180E 5% 2.5W 17X5MM
R212		032-32100-00	RES M/F PWR 10E 5% 1W 10X4MM
R213		030-01100-00	RES FILM 1E 5% 0.25W 7X2.5MM
R214		030-52180-20	RES FILM AI 18E 5% 0.4W 4X1.6MM
R215		030-52180-20	RES FILM AI 18E 5% 0.4W 4X1.6MM
R216		030-52180-20	RES FILM AI 18E 5% 0.4W 4X1.6MM
R217		030-01100-10	RES FILM 1E 5% 0.5W 7X2.5MM
R218		030-01100-10	RES FILM 1E 5% 0.5W 7X2.5MM
R219		030-01100-10	RES FILM 1E 5% 0.5W 7X2.5MM
R219A		030-01100-10	RES FILM 1E 5% 0.5W 7X2.5MM
R220		032-33100-02	RES M/F PWR 100E 5% 6W 33X9MM
R221		032-33180-01	RES M/F PWR 180E 5% 2.5W 17X5MM
R222		032-32220-00	RES M/F PWR 22E 5% 1W 12X4.5MM
R223		032-33180-01	RES M/F PWR 180E 5% 2.5W 17X5MM
R224		032-33180-01	RES M/F PWR 180E 5% 2.5W 17X5MM
R225		032-32220-00	RES M/F PWR 22E 5% 1W 12X4.5MM
R226		032-33180-01	RES M/F PWR 180E 5% 2.5W 17X5MM
R227		032-32100-00	RES M/F PWR 10E 5% 1W 10X4MM
R228		032-32100-00	RES M/F PWR 10E 5% 1W 10X4MM
R230		039-02500-01	RES DUMP LOAD 50E 1% 10W TO-220 NIKKOHM
R231		039-02500-01	RES DUMP LOAD 50E 1% 10W TO-220 NIKKOHM
R232		036-13100-00	RES M/F 0805 CHIP 100E 5%
R233		036-13100-00	RES M/F 0805 CHIP 100E 5%
R250		032-32100-00	RES M/F PWR 10E 5% 1W 10X4MM
R260		036-13270-00	RES M/F 0805 CHIP 270E 5%
R290		036-14100-00	RES M/F 0805 CHIP 1K 5%
R291		036-15470-00	RES M/F 0805 CHIP 47K 5%
R292		036-14100-00	RES M/F 0805 CHIP 1K 5%
R293		036-14100-00	RES M/F 0805 CHIP 1K 5%
R294		036-15470-00	RES M/F 0805 CHIP 47K 5%
R295		036-14100-00	RES M/F 0805 CHIP 1K 5%
R300		045-04470-01	RES NTC 4K7 5% 5MM DISC
RV43		042-05470-09	RES PRESET 50K CERMET 9.5MM SQ FLAT
RV48		042-04500-08	RES PRESET 5K CERMET 9.5MM SQ FLAT
RV52		042-04500-08	RES PRESET 5K CERMET 9.5MM SQ FLAT
RV57		042-05470-09	RES PRESET 50K CERMET 9.5MM SQ FLAT
RV63		044-04200-03	RES PRESET MULTITURN 2K 10T PNL MTG
RV69		042-04220-02	RES PRESET 2K CERMET 9.5MM SQ FLAT TOP
RV74		042-05470-09	RES PRESET 50K CERMET 9.5MM SQ FLAT
SK1		240-02100-44	SKT COAX MINI JACK PCB MTG ANGLED

T828 Mechanical & Miscellaneous Parts (220-01197-02)

IPN	Description
008-00014-79	S)LED 3MM RED WITH WIRE
008-00014-80	S)LED 3MM GREEN WITH WIRE
065-00010-08	BEAD FERR 4S3 3*0.7*10MM RED
065-00010-20	BEAD FERRITE BALUN 4B1 PHILIPS
070-01001-00	D-RANGE 15 WAY COMPL T800
201-00030-01	WIRE #1 T/C WIRE 7/0.2MM PVC BROWN 1x 410mm
201-00030-02	WIRE #1 T/C WIRE 7/0.2MM PVC RED 3x 20mm
201-00030-03	WIRE #1 T/C WIRE 7/0.2MM PVC ORANGE 1x 235mm
201-00030-04	WIRE #1 T/C WIRE 7/0.2MM PVC YELLOW 1x 325mm
201-00030-05	WIRE #1 T/C WIRE 7/0.2MM PVC GREEN 1x 265mm
201-00030-06	WIRE #1 T/C WIRE 7/0.2MM PVC BLUE 1x 410mm
201-00030-07	WIRE #1 T/C WIRE 7/0.2MM PVC VIOLET 1x 410mm
201-00030-09	WIRE #1 T/C WIRE 7/0.2MM PVC WHITE 1x 285mm
201-00030-10	WIRE #1 T/C WIRE 7/0.2MM PVC BLACK 1x 310mm, 3x 25mm-FOR LEDS
201-00050-12	CABLE AUTO 152 RED 28/0.3MM PVC 1x 290mm, 1x 220mm
201-00050-20	CABLE AUTO 152 BLACK 28/0.3MM PVC 1x 40mm
206-00010-11	CABLE COAX 50 OHM RG316-U PTFE 2x 790mm (90 deg phase section
209-00010-25	STRIP CU 3*0.35 SLOT CAR TRACK
219-02609-00	COAX 190MM 1 MINI PIN 1 PNL JK
220-01197-02	PCB T828 PA
240-02010-54	SKT 15W DRANGE PNL MTG 125 C
240-02100-06	SKT COAX N TYPE PNL MTG OPEN TERMN
240-06010-14	CLAMP LATCHING 15 W D RANGE
240-06010-15	BLOCK LATCHING 15W D RANGE
303-23117-00	COVER SIDE COMPL A2M2223
303-50005-00	CONTACT A4M2311 SPRING EARTH
308-01007-01	HANDLE BASE STATION SERIES II
308-13068-01	HSINK DIECAST A1M2274
316-06617-00	PNL PA NO INP DRV SER II SNGL
316-85018-00	PIN A4M1397 COAX CONDUCTOR N-type connector extension
319-01147-00	SHIELD A3M2224 WALL T859 PA
319-01148-00	SHIELD A3M2225 LID T859 PA
345-00040-06	SCRW M3*8MM P/POZ ST BZ
345-00040-16	SCRW M3X20MM P/POZ ST BZ
349-00020-07	SCRW 4-40 X 5/16 P/POZ T/T BLK
349-00020-09	SCRW T/T 4-40X3/8 IN P/POZ BLK
349-00020-36	SCREW TT M3X8m PANTORX BLK
352-00010-29	NUT M4 NYLOC HEX
352-00010-35	NUT 8-32 UNC HEX XSTR MTG Q1 & Q2
352-00010-36	NUT 10-32 UNF LARGE STUD Q3 & Q4
353-00010-10	WSHR M3 FLAT 7MM*0.6MM ST BZ Q16
356-00010-03	TAG SOLDER 3MM LONG M614/3.2
360-00010-41	BUSH SHORTY BLK
362-00010-07	GASKET SIL INSULATING TO-220 Q16
362-00010-13	BUSH INSULATING 1.1MM TOP HAT Q16
362-00010-33	GROMMET LED MTG 3MM
365-00011-53	LABEL 104*37MM
365-01540-00	LABEL PA TYPE APPL/SERIAL NO
369-00010-14	TIE CABLE NYLON 100*2.6MM
399-00010-56	BAG PLASTIC 200*250MM
400-00020-69	HEATSHRINK 12.7MM
410-01081-00	CRTN T800 PRNTD 402X192X66MM

T828 Grid Reference Index (IPN 220-01197-02)

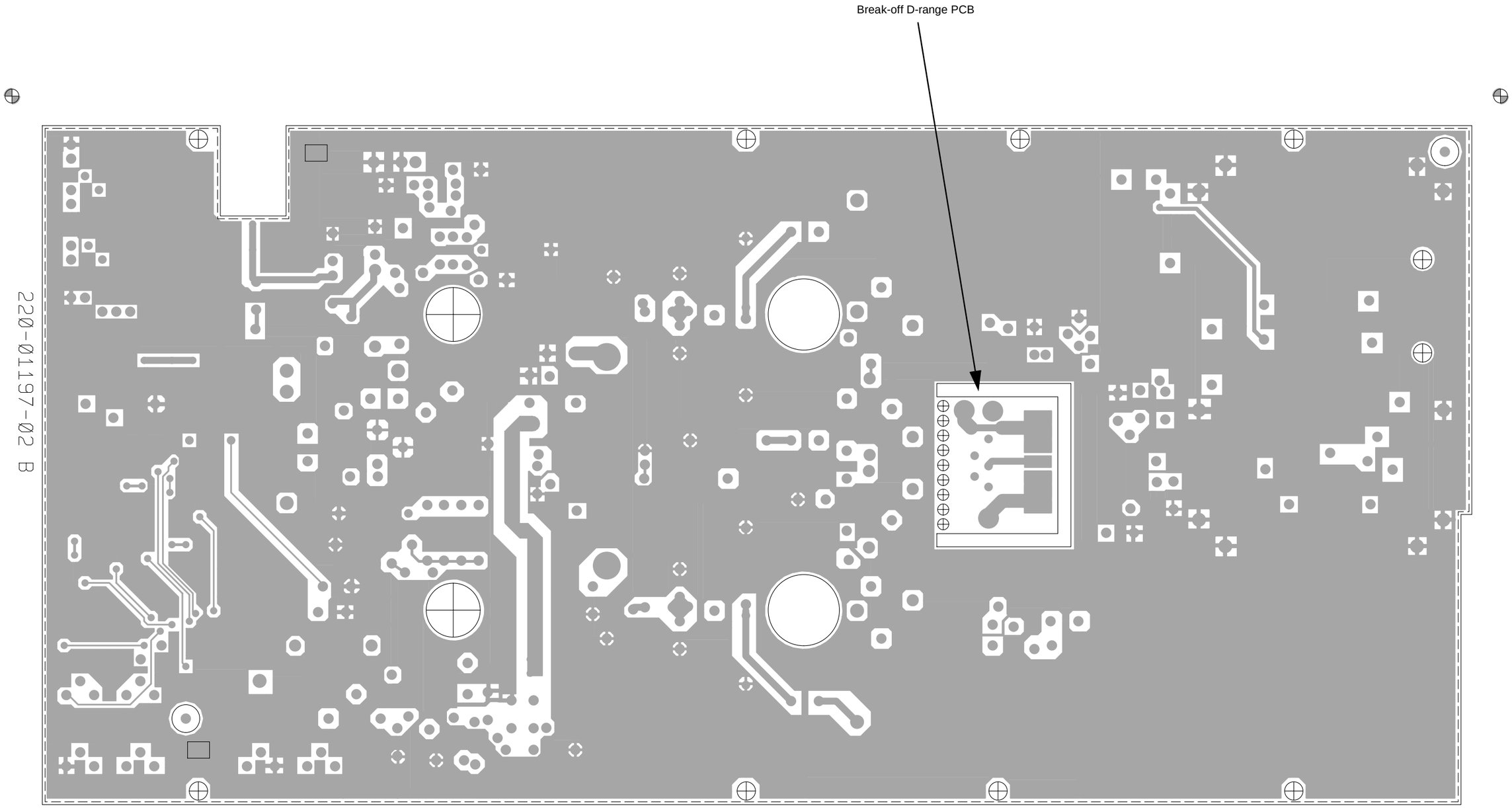
How To Use This Grid Reference Index

The first digit in the PCB layout reference is a "1" or "2", indicating the top or bottom side layout respectively, and the last two characters give the location of the component on that diagram.

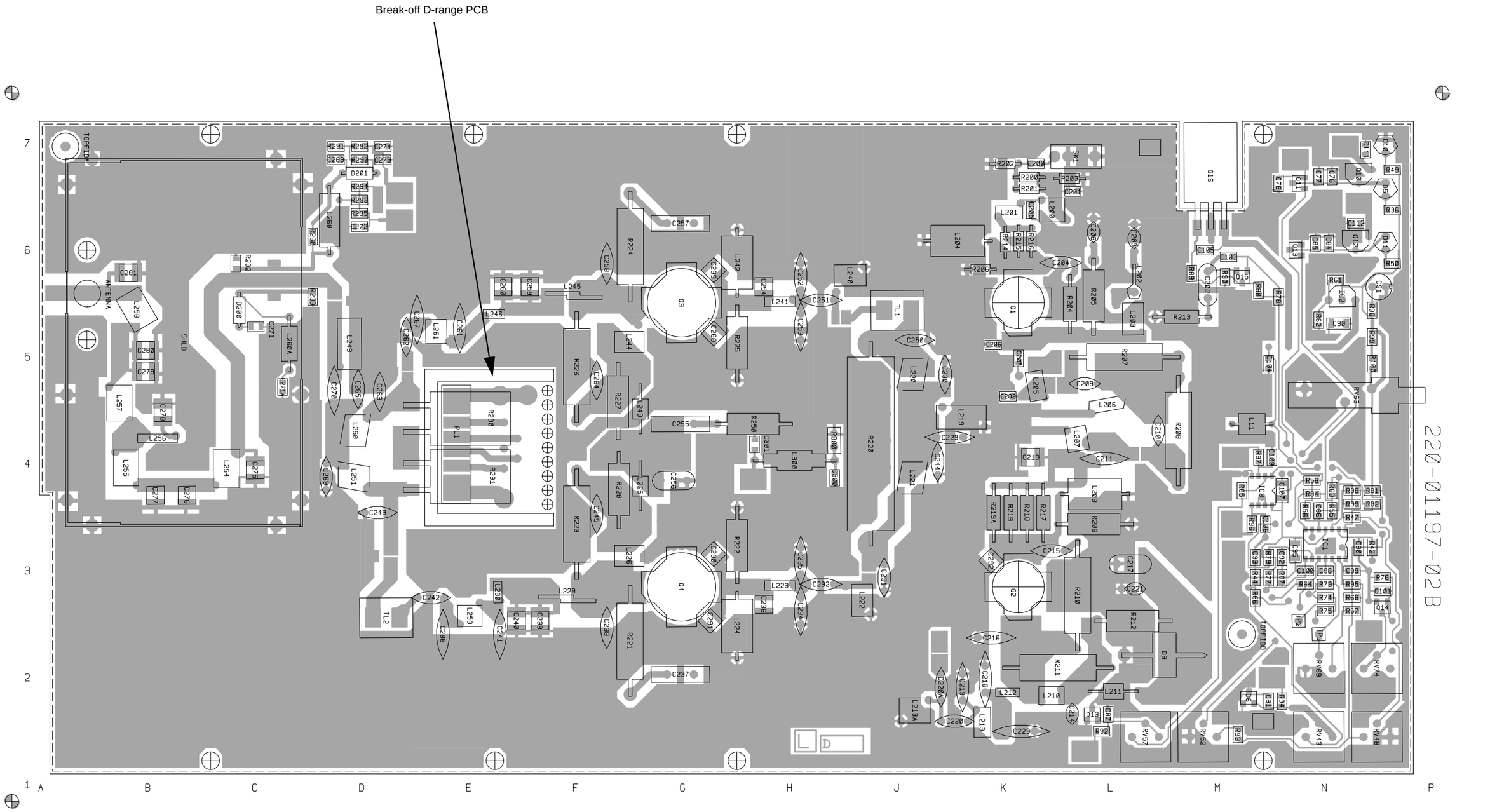
The first digit in the circuit diagram reference is the sheet number, and the last two characters give the location of the component on that sheet.

Device	PCB	Circuit	Device	PCB	Circuit	Device	PCB	Circuit	Device	PCB	Circuit
C76	1:N7	2-B6	C240	1:E3	1-G1	IC1	1:N3	2-H0	Q2	1:K3	1-L8
C77	1:N7	2-C6	C241	1:E3	1-H1			2-F7	Q3	1:G6	1-F3
C78	1:N7	2-D5	C242	1:E3	1-H2			2-E4	Q4	1:G3	1-F1
C80	1:N3	2-F6	C243	1:D4	1-J1			2-N4	Q10	1:N7	2-B7
C81	1:N2	2-G5	C244	1:J4	1-A2			2-N1	Q11	1:N7	2-D6
C84	1:N6	2-C4	C245	1:F4	1-F2	IC2	1:N6	2-K4	Q12	1:N6	2-C4
C85	1:N6	2-C4	C250	1:J5	1-B3	IC3	1:M4	2-J7	Q13	1:N6	2-D4
C86	1:N4	2-E3	C251	1:H6	1-C3			2-H6	Q14	1:P3	2-P1
C87	1:L2	2-G3	C252	1:H6	1-D3			2-H3	Q15	1:M6	2-Q4
C90	1:N5	2-K4	C253	1:H5	1-D3				Q16	1:M7	2-R4
C91	1:P6	2-N4	C254	1:H6	1-E3	L11	1:N4	1-N9			
C92	1:N3	2-P5	C255	1:G4	1-E4	L200	1:K7	1-C7	R36	1:P6	2-C5
C93	1:M3	2-N5	C256	1:G4	1-F4	L201	1:K6	1-C7	R38	1:N4	2-E6
C95	1:N3	2-H0	C257	1:G6	1-F3	L202	1:L6	1-D9	R39	1:N4	2-E5
C96	1:N3	2-N2	C258	1:F6	1-G3	L203	1:L5	1-D9	R42	1:N3	2-G6
C99	1:N3	2-M0	C259	1:F6	1-G3	L204	1:J6	1-D7	R44	1:M3	2-H6
C100	1:N3	2-N4	C260	1:E6	1-H3	L205	1:K5	1-E8	R47	1:N4	2-F5
C101	1:P3	2-P1	C261	1:E5	1-H3	L206	1:L5	1-G7	R49	1:P7	2-C5
C103	1:M6	2-Q4	C262	1:D5	1-J4	L207	1:L4	1-J7	R50	1:P6	2-D5
C104	1:N5	2-R5	C263	1:D5	1-J3	L209	1:L4	1-L7	R55	1:N4	2-E3
C105	1:M6	2-R5	C264	1:F5	1-G4	L210	1:K2	1-L8	R56	1:N4	2-F4
C107	1:N4	2-H7	C265	1:D5	1-L2	L211	1:L2	1-L9	R58	1:N4	2-H5
C108	1:M3	2-J6	C269	1:D4	1-L2	L212	1:K2	1-M8	R61	1:N6	2-L4
C109	1:N4	2-J4	C270	1:D5	1-L3	L213	1:K2	1-N8	R62	1:N5	2-L4
C111	1:N7	2-A7	C271	1:C5	1-N3	L213A	1:J2	1-P7	R64	1:N3	2-N4
C112	1:N6	2-B4	C271A	1:C5	1-M3	L219	1:K4	1-A2	R67	1:N3	2-M2
C200	1:K7	1-B7	C272	1:D6	1-P3	L220	1:J5	1-B3	R68	1:N3	2-L2
C201	1:L7	1-B7	C273	1:D7	1-M1	L221	1:J4	1-B2	R73	1:N3	2-N2
C202	1:M6	1-C9	C274	1:D7	1-N1	L222	1:J3	1-C1	R74	1:N3	2-N1
C203	1:L6	1-D9	C275	1:C4	1-N2	L223	1:H3	1-D1	R75	1:N3	2-P1
C204	1:L6	1-D8	C276	1:B4	1-P2	L224	1:H2	1-F1	R76	1:P3	2-P1
C205	1:K6	1-C7	C277	1:B4	1-P2	L225	1:G4	1-F2	R77	1:N3	2-P5
C206	1:K5	1-E7	C278	1:B5	1-P2	L226	1:F3	1-F2	R78	1:N6	2-Q4
C207	1:K5	1-E8	C279	1:B5	1-Q2	L229	1:F3	1-G2	R79	1:N3	2-N5
C208	1:L6	1-E9	C280	1:B5	1-Q2	L230	1:E3	1-H2	R80	1:M6	2-Q5
C209	1:L5	1-G8	C281	1:B6	1-R2	L240	1:J6	1-C3	R81	1:N4	2-D6
C210	1:L4	1-G8	C282	1:K5	1-E7	L241	1:H6	1-D3	R82	1:N4	2-D6
C211	1:L4	1-J8	C283	1:D7	1-M2	L242	1:H6	1-F3	R83	1:N4	2-D3
C213	1:K4	1-J7	C286	1:E3	1-H1	L243	1:G4	1-F4	R84	1:N4	2-D4
C214	1:L2	1-L9	C287	1:E5	1-H3	L244	1:F5	1-F4	R85	1:M4	2-F3
C215	1:L3	1-L8	C288	1:G5	1-E3	L245	1:F6	1-G4	R86	1:M3	2-G6
C216	1:K2	1-M7	C289	1:G6	1-F3	L246	1:E5	1-H4	R87	1:N3	2-P5
C217	1:L3	1-M8	C290	1:G3	1-E1	L249	1:D5	1-L2	R89	1:M6	2-R4
C218	1:K2	1-M7	C291	1:G3	1-F1	L250	1:D4	1-K3	R90	1:M6	2-Q3
C219	1:K2	1-N7	C292	1:K3	1-L7	L251	1:D4	1-K2	R92	1:L2	2-D3
C220	1:K2	1-N8	C300	1:H4	1-C2	L254	1:C4	1-N3	R93	1:M2	2-F5
C220A	1:J2	1-P8	C301	1:H4	1-D2	L255	1:B4	1-P3	R94	1:N2	2-F7
C221	1:L3	1-M8				L256	1:B4	1-P2	R95	1:N3	2-M1
C223	1:K2	1-M7	D3	1:M2	2-A1	L257	1:B5	1-Q3	R96	1:M3	2-K7
C229	1:K4	1-A2	D5	1:P7	2-C6	L258	1:B6	1-R3	R97	1:M4	2-K4
C230	1:J5	1-A2	D6	1:M2	2-G5	L259	1:E3	1-H2	R98	1:N5	2-M5
C231	1:J3	1-B1			2-G5	L260	1:D6	1-M2	R99	1:N5	2-M4
C232	1:H3	1-C1	D10	1:P7	2-C4	L260A	1:C5	1-N3	R100	1:N5	2-M4
C234	1:H3	1-D1	D11	1:P6	2-D4	L261	1:E5	1-H4	R200	1:K7	1-B7
C235	1:H3	1-D1	D13	1:L2	2-F2	L300	1:H4	1-C2	R201	1:K7	1-B7
C236	1:H3	1-E1			2-F2				R202	1:K7	1-B7
C237	1:G2	1-F2	D200	1:C5	1-N3	PL1	1:E5	2-B0	R203	1:L7	1-B7
C238	1:F3	1-G1	D201	1:D7	1-M2				R204	1:L6	1-D8
C239	1:F3	1-G1				Q1	1:K6	1-D7	R205	1:L6	1-D9

Device	PCB	Circuit	Device	PCB	Circuit	Device	PCB	Circuit	Device	PCB	Circuit
R206	1:K6	1-D7									
R207	1:L5	1-G7									
R208	1:M5	1-G7									
R209	1:L3	1-L7									
R210	1:L3	1-L8									
R211	1:L2	1-L8									
R212	1:L3	1-L9									
R213	1:L5	1-C8									
R214	1:K6	1-D8									
R215	1:K6	1-D7									
R216	1:K6	1-D7									
R217	1:K4	1-K8									
R218	1:K4	1-K8									
R219	1:K4	1-K8									
R219A	1:K4	1-K7									
R220	1:J5	1-B2									
R221	1:G2	1-F2									
R222	1:H3	1-F1									
R223	1:F4	1-G2									
R224	1:G7	1-F4									
R225	1:H6	1-F3									
R226	1:F5	1-G4									
R227	1:F4	1-G4									
R228	1:F4	1-G2									
R230	1:E4	1-K3									
R231	1:E4	1-K2									
R232	1:C6	1-N2									
R233	1:D6	1-M3									
R250	1:G4	1-E4									
R260	1:D6	1-M2									
R290	1:D7	1-M2									
R291	1:D7	1-N1									
R292	1:D7	1-N2									
R293	1:D7	1-N4									
R294	1:D7	1-P3									
R295	1:D6	1-P4									
R300	1:H4	1-C2									
RV43	1:N1	2-G6									
RV48	1:P1	2-F5									
RV52	1:M1	2-F5									
RV57	1:L1	2-F3									
RV63	1:N5	2-M4									
RV69	1:N2	2-M2									
RV74	1:P2	2-P2									
SK1	1:L7	1-A7									
TL1	1:J5	1-C3									
TL2	1:D3	1-J2									
TP1	1:N2	2-N2									
TP2	1:N3	2-P1									

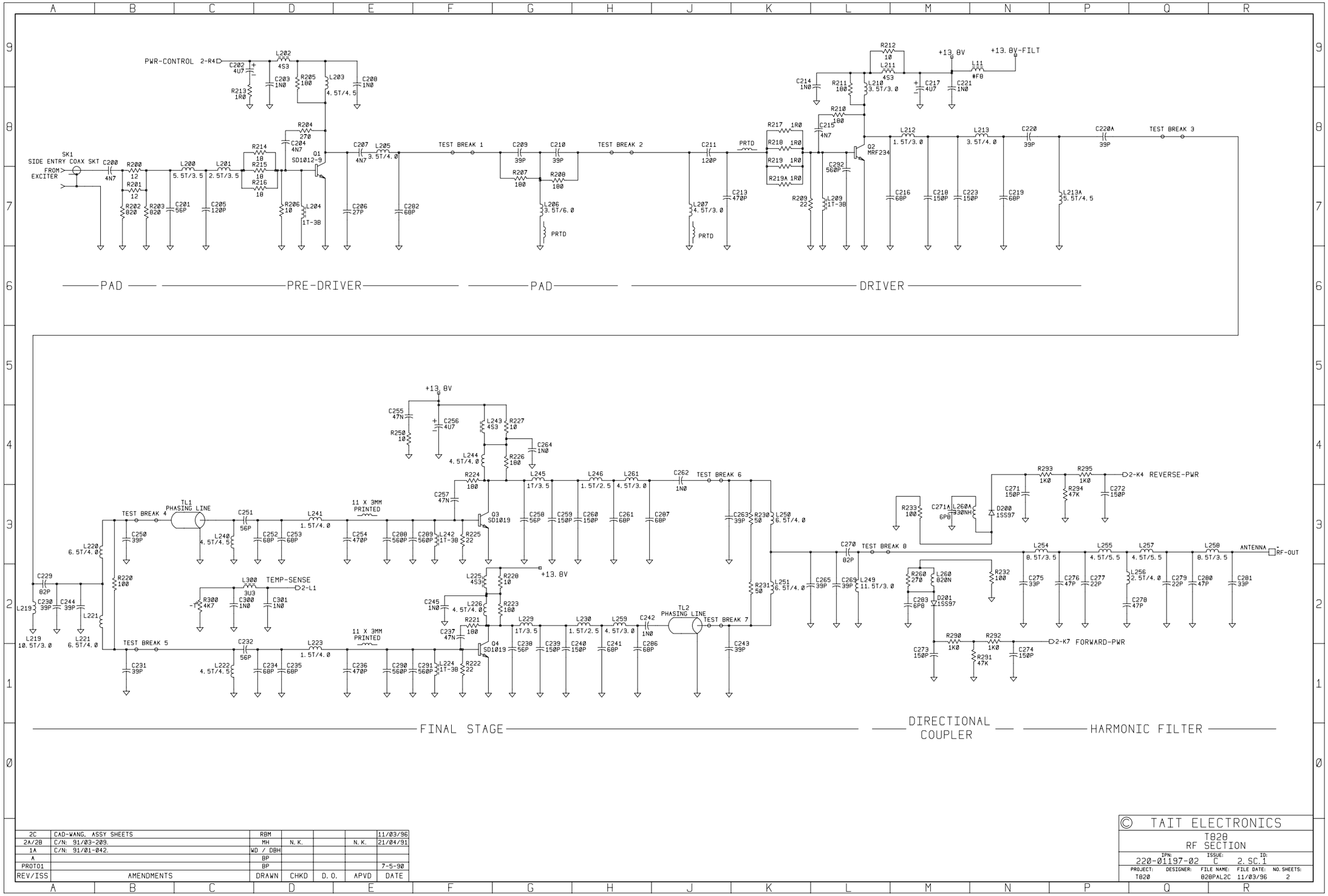


T828 PCB Layout - Bottom Side
220-01197-02



T828 PCB Layout - Top Side
220-01197-02

01/07/00



REV/ISS	AMENDMENTS	DRAWN	CHKD	D.O.	APVD	DATE
2C	CAD-WANG. ASSY SHEETS	RBM				11/03/96
2A/2B	C/N: 91/03-209.	MH	N.K.		N.K.	21/04/91
1A	C/N: 91/01-042.	WD / DBH				
A		BP				
PROTO1		BP				7-5-90

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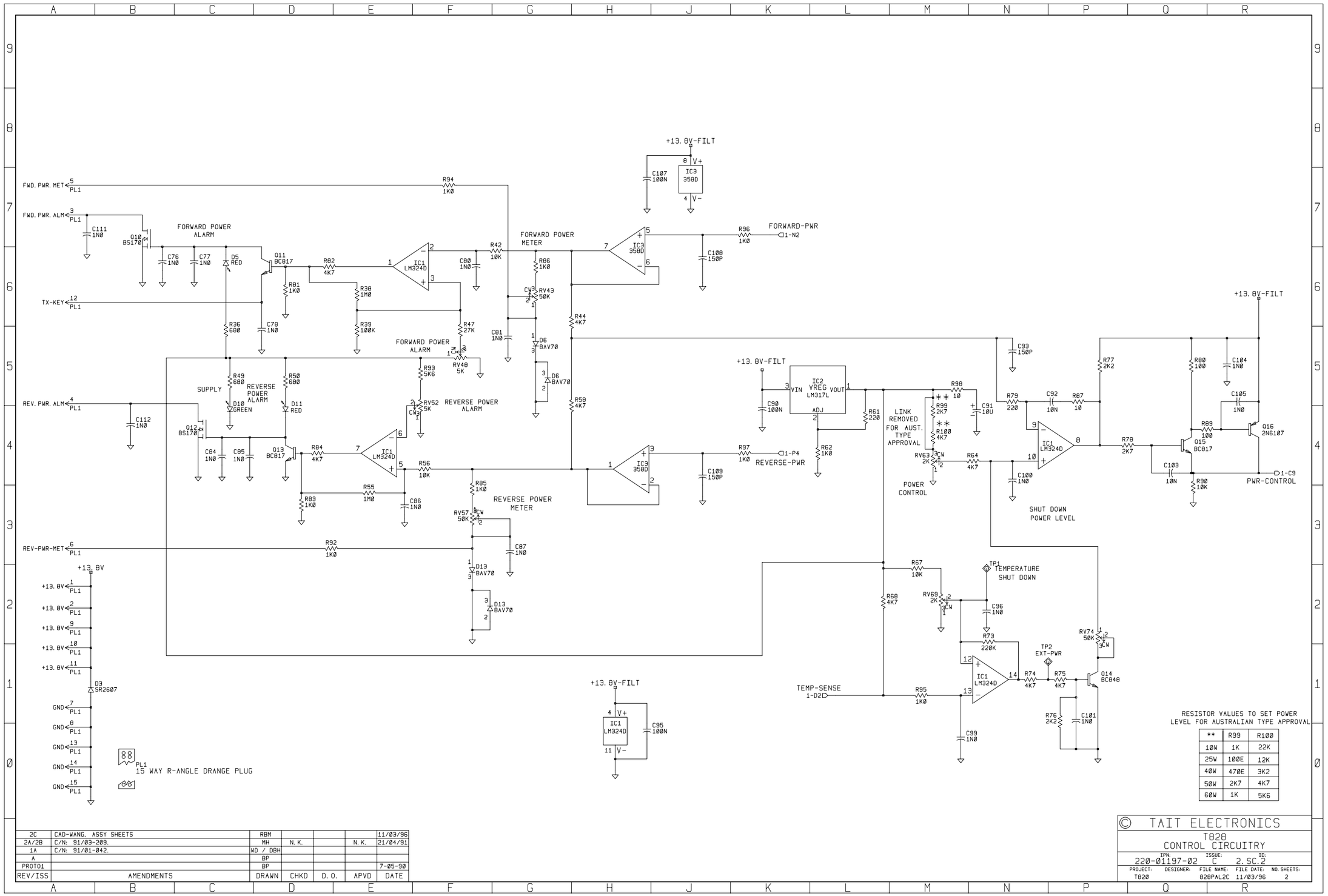
T828
RF SECTION

IPN:	ISSUE:	ID:
220-01197-02	C	2.SC.1

PROJECT:	DESIGNER:	FILE NAME:	FILE DATE:	NO.SHEETS:
T828		B28PAL2C	11/03/96	2

Sheet 1 - T828 RF Section
220-01197-02



Sheet 2 - T828 Control Section
220-01197-02