

## 8 Accessories

This Section provides information on T2000 Series II accessories.

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## 8.1 T2008 Power Supply

The following topics are covered in this Section:

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## 8.1.1 Operation

The T2008 Power Supply is a mains operated power supply designed to provide the DC supply requirements of the T2000 Series II radios. It uses switch mode technology to control the regulation of the output voltage, which results in a power supply with a higher temperature rating, improved efficiency and greater reliability.

The power supply can either be operated with the radio sitting on top as a desk top unit, or with the radio and power supply detached as two separate units (refer to Section 8.1.5, "Installation").

The T2008 has protection circuits for overcurrent, overtemperature and overvoltage protection circuitry. Current limiting is included to restrict the peak current to about 9.5A. In addition, a self-restoring thermal shutdown keeps the temperature of the switching transistor within the 'safe operation area ratings'. The point of thermal shutdown is also dependant on the load current, to allow for a higher duty cycle rating at lower output currents. The output voltage and thermal shutdown points are factory preset.

The power supply also has a limited capability to float charge a lead acid battery under constant voltage conditions (refer to Section 8.1.5, "Installation").

## 8.1.2 Performance Specifications

### Input

T2000-21, -23, -24:

Voltage .. 230V  $\pm$ 10% (limits: 207-253V AC)  
 Frequency .. 50Hz

T2000-22:

Voltage .. 115V  $\pm$ 10% (limits: 105-130V AC)  
 Frequency .. 60Hz

Power .. 200VA maximum  
 (mains input +10%, current limited output)

Mains Supply Plug:

T2008-21 .. New Zealand  
 T2008-22 .. USA  
 T2008-23 .. UK  
 T2008-24 .. European

### Output

Voltage .. 13.8V DC (adjustable 12.5 to 14.5V)

Current:

Intermittent Operation .. 6.5A at 33% duty cycle (maximum 2  
 ( $T_A = 25^\circ\text{C}$ , input 230V) minutes on)  
 Peak Rating .. 8A max. (duration limited by thermal  
 shutdown)  
 Continuous Rating .. 4.5A maximum  
 ( $T_A = 25^\circ\text{C}$ , input 230V)

Voltage Regulation ..  $\pm$ 5%  
 (supply variation  $\pm$ 10%, currents up  
 to 6A, temp. range  $-10^\circ\text{C}$  to  $+60^\circ\text{C}$ )

### Protection

Current Limiting ( $T_A = 25^\circ\text{C}$ ) .. 9.5A nominal  
 (10A secondary fuse available)

Overvoltage .. 16V  $\pm$ 5% by zener transient  
 suppression diode (not self-restoring)

Thermal Overload .. shutdown occurs at approximately  
 ('cold' start @  $25^\circ\text{C}$ , input = 115/230V)  $95^\circ\text{C}$  heatsink temperature (7A  
 continuous after 1 hour)

**Input:**

Primary Fuse:	
T2008-21, -23, -24	.. 1A time delayed
T2008-22	.. 3A
Thermal Cutout	.. integral with transformer

**General**

Ripple and Noise .. less than 10mVrms  
0 to 6.0A, mains voltage  $\pm 10\%$

Operating Temperature Range ..  $-10^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$

Weight .. 3.0kg

**Dimensions:**

Height	.. 95mm
Length	.. 225mm
Width	.. 150mm

## 8.1.3 Precautions



### Caution: Lethal Voltages

The power supply contains voltages that may be lethal. The unit should not be dismantled without first disconnecting the mains supply. Servicing should be carried out only by qualified technicians.



### Caution: Ventilation

If the power supply is operated at high output currents and/or a high duty cycle rate for a prolonged period of time (e.g. more than 10 minutes), the heatsink will become very hot. **Do not touch.**

**Do not** operate the power supply in a sealed cabinet. Ensure that there is an adequate airflow past the unit, and in particular past the heatsink at the back of the unit.



### Caution: Mains Supply Cord

If the mains supply cord needs replacing, it must be replaced with a mains supply cord of the same size and type as originally fitted.



### Caution: Transmit Power

When using a T2008 and radio at a fixed location, it is advisable to check the maximum allowable transmit power, as defined by the local radio regulatory authority. This is commonly in the range of 1 to 5W, and exceeding this output power may result in prosecution.



### Caution: Current Rating

If the duty cycle (33%) of the radio and power supply is likely to be exceeded, then the radio output power must be reduced to ensure that the current drawn from the power supply does not exceed its rating.

It is advisable to check the current drawn from the power supply, regardless of duty cycle, if the radio is operated at full power (25W). Variations in antenna VSWR can result in current drain, which may exceed the rating of the supply.

## 8.1.4 Circuit Operation

Refer to the diagram to the rear of this Section.

### Input Rectifier

The mains supply is connected to the primary of the transformer via the supply cord, input fuse and on/off switch.

A conventional bridge rectifier is used across the secondary winding of the transformer, with both positive and negative leads being isolated from earth. Five PCB mounted smoothing capacitors are used to produce a 23V DC bus from the 18Vrms secondary of the transformer. The ripple on the DC bus is 4V peak to peak, with an output current of 6A.

The front panel LED is illuminated when mains power is applied.

### Transistor Switch

Voltage regulation is provided by the complementary Darlington configuration of Q1 and Q2. The switching of this pair is derived directly from IC1 (TL494).

When Q1 is turned on, current flows in inductors L1, L2 and L3 to supply the output. Capacitors C6 and C7 hold the output voltage at a nominal 13.8V. When Q1 turns off, the current flowing in the inductors continues to flow, via diode D1.

C8, C9 and L3 form a common mode filter to suppress conducted noise at the output.

### Control Circuit

A pulse width modulating IC (IC1) controls the switching of Q1 and thus the regulation of the output voltage. A voltage divider (R4, R5 and RV1) converts the output voltage to a 5V nominal level. It is then compared to IC1s temperature compensated internal 5V reference. The length of time Q1 is turned on is proportional to the difference between the reference and the output voltage. Feedback compensation is provided by C10, C11, R6 and R7, while R10 improves the transient response for the feedback circuit.

### Current Limiting

Current limiting is provided by monitoring the voltage across the current sense resistor (R18). When the current is increased to approximately 9.5A, the voltage on pin 15 of IC1 decreases to a point where the pulse width of the switching waveform decreases. In addition, a 10A fuse is provided in the secondary circuit of the power supply.



## Over Voltage

Overvoltage protection is provided by diode D2 and fuse F2. D2 is a 16V zener transient suppression diode that reacts instantly to overvoltage DC or spikes. If an overvoltage condition persists, causing excessive power dissipation in D2, it will become short circuit, causing F2 to blow. F2 will need to be replaced before operation of the power supply is possible. D2 will need to be replaced to restore overvoltage protection.

## Thermal Shutdown

Transistor Q3 is mounted on the heatsink and its junction temperature therefore closely follows that of both the heatsink and Q1. Q3 is biased by R12 and RV2. As the temperature of the heatsink increases, the temperature of the base-emitter junction of Q3 also increases, which results in the  $V_{be}$  of Q3 decreasing. At 95°C, the base-emitter voltage is exceeded by the biasing voltage, and Q3 switches on. As a result, Q4 turns off, and the 'deadtime pin' (pin 4 of IC1) is pulled high. The 'deadtime' is now 100%, which means Q1 is completely turned off.

## 8.1.5 Installation

The T2008 power supply is designed to provide the DC supply requirements of the Tait T2000 two way radios. It can be operated either with the radio sitting on top as a desk top unit, or with the radio and power supply detached as two separate units. The bottom case includes two screw recesses for wall mounting. The two way radio then can be mounted in its cradle next to the supply, or operated away from it, e.g. on a desk top, etc.

If the radio and the power supply are operated away from each other, an extension cable for the DC supply would have to be used. To keep the voltage drop of this extension cable reasonably low, the wiring should be of sufficient gauge to carry the required load. It is recommended that a minimum wire size of 1.5mm is used.

The power supply requires a mains supply of 230V nominal 50Hz or 115V nominal 60Hz, as set out in Section 8.1.2.

If the power supply is run at a high duty cycle rate, high continuous output currents and/or high mains input voltage, it will generate a considerable amount of heat. An adequate flow of cooling air past the unit, particularly past the heatsink, is therefore essential for reliable operation. Do not operate the power supply in a completely enclosed cabinet.

**Caution:** Do not touch the heatsink after prolonged heavy duty operation. Keep the heatsink away from anything affected by heat (plastics, etc).

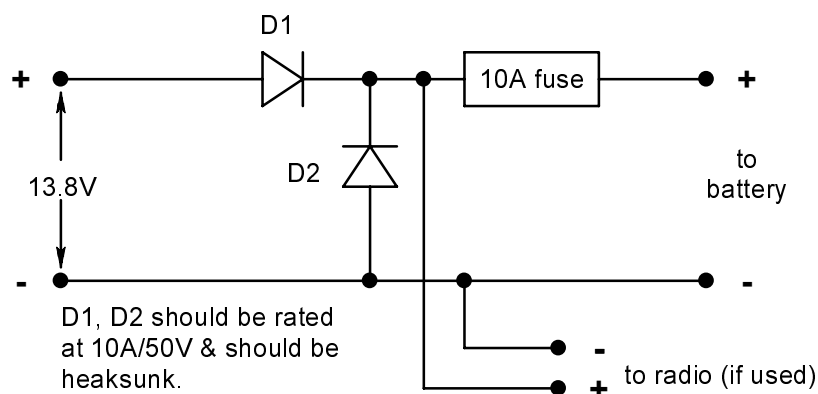
The microphone clip supplied with every power supply may be attached to the side of the top cover with the supplied screws and spacer, which fits between the clip and cover. The hook switch monitor wire should be connected as shown in the wiring diagram.

## Float Charging A Lead Acid Battery

The power supply has a limited capability to float charge a lead acid battery under constant voltage conditions. The performance is limited by the way the power supply's continuous output current rating is limited (typically 4.5A at 20°C).

The following diagram shows an external protection circuit, consisting of two diodes with the appropriate ratings (i.e. 10A/50V), to be used when float charging a lead acid battery. This circuit prevents damage to the power supply due to reverse current, or the battery being connected with reverse polarity.

The current limit prevents charging from being excessive, should a discharged battery be connected. The output voltage of the power supply does not compensate for the temperature dependence of lead acid batteries.



*Figure 8.1.1 Float Charging Protection Circuit*

## 8.1.6 Introduction To Servicing

All sub-assemblies within the T2008 power supply (e.g. transformer, PCB/heatsink) are housed in a specially moulded plastic case with no screws. The top and bottom halves of the plastic case are fastened by four self-tapping screws.

All electrical components except the transformer and LED are mounted on either the larger regulator/heatsink PCB or on the smaller mains input PCB. Disassembly

**Caution:** Disconnect the unit from the mains supply before attempting to remove the top case.



### Caution: Lethal Voltages

The power supply contains voltages that may be lethal. The unit should not be dismantled without first disconnecting the mains supply. Servicing should be carried out only by qualified technicians.



### Caution: Ventilation

If the power supply is operated at high output currents and/or a high duty cycle rate for a prolonged period of time (e.g. more than 10 minutes), the heatsink will become very hot. **Do not touch.**

**Do not** operate the power supply in a sealed cabinet. Ensure that there is an adequate airflow past the unit and in particular past the heatsink at the back of the unit.



### Caution: Mains Supply Cord

If the mains supply cord needs replacing, it must be replaced with a mains supply cord of the same size and type as originally fitted.

## To Remove The Top Case

Turn the unit upside down and remove the two self-tapping screws.

Turn the unit back on its feet and remove the two top screws.

Carefully lift the top case away from the unit.

All the sub-assemblies are now easily accessible, and can be lifted out as necessary.

## To Replace the Switching Transistor (Q1)

Unsolder the leads of the transistor using solder wick or a solder sucker.

Remove the appropriate screws and carefully lift off the transistor.

Mount the new transistor using a silicon insulating gasket on the underside. Do not use any other insulators (mica, etc) as they are unlikely to fit under Q1 and/or would require thermal compound.

Refit the two screws for Q1 from the copper side of the PCB. Isolate each of these two mounting screws from touching the heatsink with a 3mm length of silicone rubber sleeving. Use spring washers under the two nuts.

Carefully position the PCB onto the heatsink before tightening the two screws/nuts.

Ensure that Q3 sits firmly against the walls in its slot on the heatsink.

Resolder the leads of the transistor.

## Reassembly

Reassembly is carried out in the reverse order to disassembly.

## 8.1.7 Setting Up The Power Supply

### Test Equipment Required

- Ammeter: 10A DC
- Voltmeter: 0 - 20V DC
- Load Resistor: 0 - 100 $\Omega$ , 10A (variable)
- Short circuit plug-in link: IPN 240-04020-62
- Ohmmeter: infinity to 0 $\Omega$

### Preliminary

Refer to the T2008 circuit and wiring diagrams to the rear of this Section.

Check with the ohmmeter that the heatsink is electrically isolated from the negative output.

Connect the variable load in series with the ammeter across the output terminals (see wiring diagram for the pin configuration of the output plug).

Set the load to maximum resistance (minimum load current).

Connect the DC voltmeter across the power supply output terminals.

The DC output wiring should be of sufficient gauge to carry the load current required. It is recommended that a minimum wire size of 1.5mm is used.

Plug in the mains connector.

### Output Voltage

Switch on the power supply.

Set RV1 for an output voltage of 13.8V.

Switch off the power supply.

### Thermal Shutdown (TSD)

Before setting up the temperature shutdown, ensure that the power supply is at ambient temperature, i.e. it has not been running recently with any significant load current. The temperature shutdown is based on a heatsink ambient temperature of 25°C.

Disconnect the load resistor.

Insert the plug-in link (1 - 2).

Switch on the power supply.

Set RV2 (TSD) so that the power supply just shuts down.

Switch off the power supply.

Remove the plug-in link.

## Output Current Limit

Reconnect the load resistor.

Switch on the power supply.

Decrease the load resistance (current rises) and set it for an output current of approximately 9.5A.

Decrease the load resistance and the voltage output should drop, indicating that current limiting is in progress.

**If the power supply is very hot, the current limit circuit may cause the unit to switch off completely. If this occurs, switch off the mains supply and wait approximately one minute. The power supply should now operate normally.**

## 8.1.8 Fault Finding

The checks listed below have been included to provide assistance in locating faults. It is sometimes convenient to disable a complete section of the power supply in order to isolate a fault. If individual sections are isolated the rest of the unit should operate normally (refer to Figure 8.1.2, "Typical Waveforms" for details).

### Component Checks

Faulty diodes and transistors can generally be found by a simple ohmmeter check, as follows (an AVO model 8 or equivalent meter should be used for taking the measurements, using only the medium or low resistance ranges):

Set the ohmmeter to the ohms x 1 range.

Measure the forward and reverse resistance of each junction. The resistance in one direction should be low (generally 30 to 100 $\Omega$ ), and the resistance in the other direction should be high. In a faulty transistor or diode, the junctions will usually be either short or open circuited.

**Note:** Other components in the circuit may affect these readings unless the junctions are isolated.

The collector current drawn by multijunction transistors is a further guide to their operating performance.

### Typical Voltages

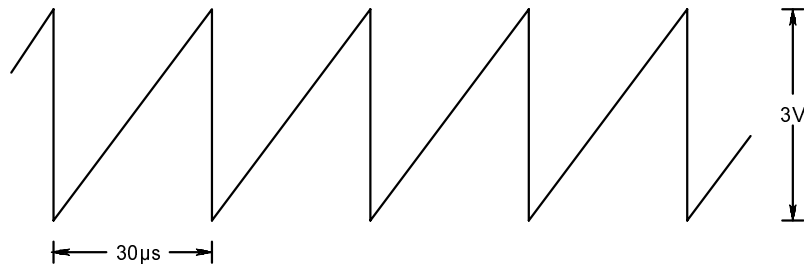
The following table shows voltages under normal operating conditions, and those following thermal shutdown:

	Normal Operation (V)	Thermal Shutdown Operating (V)
output voltage	13.8	0
Q3 base-emitter voltage	0.2 approx.	0.7 approx.
Q4 base-emitter voltage	0.7 approx.	0 approx.
IC1 pin 4 voltage	0	5
IC1 pin 14 (voltage reference)	5	5

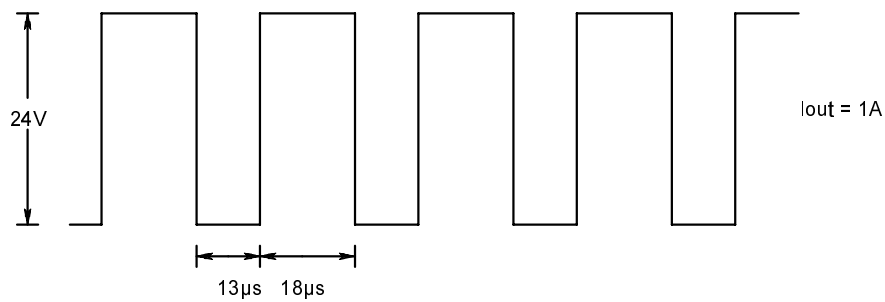


## Typical Waveforms

The following waveforms can be expected under the stated conditions.



Pin 5 (oscillator - all conditions of current (0A - full current)).



Pin11 (feed to switching transistors).

If  $I_{out} = 0A$  (i.e. open circuit), no switching occurs & pin 11 is at 25V DC.

**Figure 8.1.2 Typical Waveforms**

## 8.1.9 Repair

The T2008 power supply requires specialised component replacement techniques. Before attempting repair, refer to Section 3.4, "Repair".



## 8.1.10 PCB Information

### T2008 Parts List (IPN 220-01170-03)

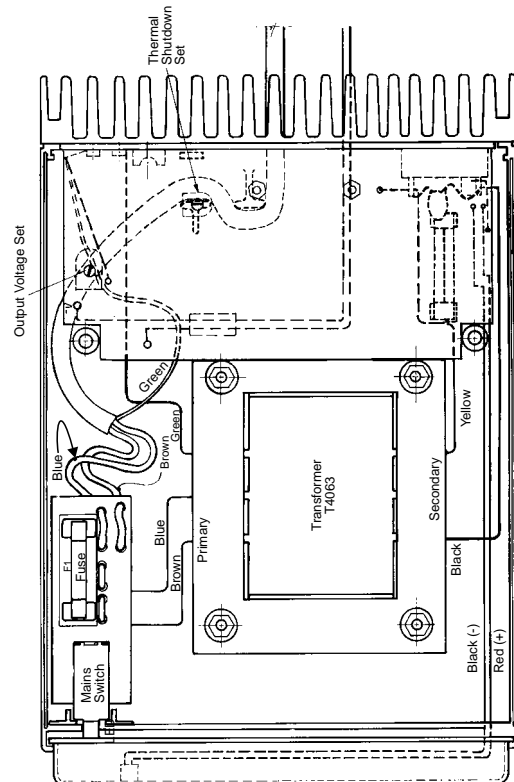
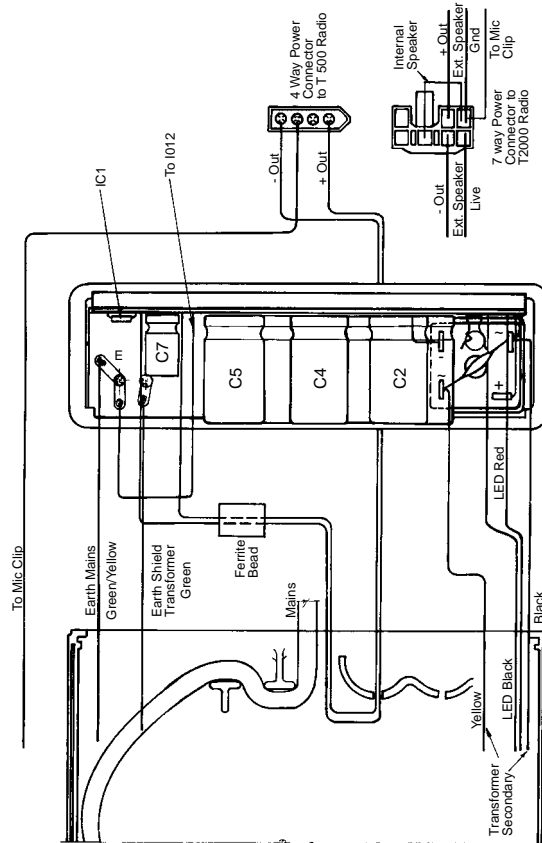
Ref	VAR	IPN	Description	Ref	VAR	IPN	Description
CBR		017-15470-01	CAP CER SURFACE BARRIER 47N 20% 50				
C1		020-19220-03	CAP ELECT RADL 2200M 35V 16X31MM				
C2		020-19220-03	CAP ELECT RADL 2200M 35V 16X31MM				
C3		020-19220-03	CAP ELECT RADL 2200M 35V 16X31MM				
C4		020-19220-03	CAP ELECT RADL 2200M 35V 16X31MM				
C5		020-19220-03	CAP ELECT RADL 2200M 35V 16X31MM				
C6		020-19220-03	CAP ELECT RADL 2200M 35V 16X31MM				
C7		020-09470-02	CAP ELECT RADL 470M 16V 10X20MM				
C8		017-15470-01	CAP CER SURFACE BARRIER 47N 20% 50				
C9		051-00006-06	WIRE LINK T/C				
C10		022-05150-01	CAP MYLAR 15N 10% 50V				
C11		022-04220-01	CAP MYLAR 2N2 10% 50V				
C14		022-05100-01	CAP MYLAR 10N 10% 50V				
D1		001-00011-50	(S) DIODE MUR810 8A 100V FAST RECOV				
D2		001-00012-91	(S) DIODE 16V TRANSIENT SUPPRESSOR				
F1	21	265-00010-45	FUSE 1A CARTRIDGE 6*32MM SLOBLOW				
F1	22	265-00010-05	FUSE 3A CARTRIDGE 6*32MM BS4265				
F1	23	265-00010-45	FUSE 1A CARTRIDGE 6*32MM SLOBLOW				
F1	24	265-00010-45	FUSE 1A CARTRIDGE 6*32MM SLOBLOW				
F2		265-00010-07	FUSE 10A CARTRIDGE 6*32MM BS4265				
IC1		002-00016-63	(S) IC TL494/594 SMPS PWM CTRL				
LED1		008-00012-52	(S) LED 2MM TOWER 5MM BASE RED				
L1		056-00010-47	IND FXD 125UH PWR CHOKE TOROIDAL				
L2		056-00010-20	IND FXD 25UH PWR CHOKE				
PL1		240-00020-68	HEADER 2WAY PCB MTG STD				
Q1		000-00022-07	(S) XSTR 2N3772 NPN PWR TO-204				
Q2		000-00012-15	(S) XSTR BD234 PNP AF PWR TO126				
Q3		000-00011-10	(S) XSTR BC548B/BC547B NPN AF SML S1				
Q4		000-00011-10	(S) XSTR BC548B/BC547B NPN AF SML S1				
R1		030-53120-20	RES FILM AI 120E 5% 0.4W 4X1.6MM				
RV1		042-03470-01	RES PRESET 470E CARBON 10MM FLAT				
RB1		001-00011-37	(S) DIODE BRIDGE RECT 50V/25AMP				
RV2		042-03470-01	RES PRESET 470E CARBON 10MM FLAT				
R2		033-03330-00	RES MP816 PWR FILM 330E 10% 16W TO-2				
R3		030-52330-20	RES FILM AI 33E 5% 0.4W 4X1.6MM				
R4		030-54680-20	RES FILM AI 6K8 5% 0.4W 4X1.6MM				
R5		030-54390-20	RES FILM AI 3K9 5% 0.4W 4X1.6MM				
R6		030-54180-20	RES FILM AI 1K8 5% 0.4W 4X1.6MM				
R7		030-55100-20	RES FILM AI 10K 5% 0.4W 4X1.6MM				
R8		030-54470-20	RES FILM AI 4K7 5% 0.4W 4X1.6MM				
R9		030-53120-20	RES FILM AI 120E 5% 0.4W 4X1.6MM				
R10		030-55680-20	RES FILM AI 68K 5% 0.4W 4X1.6MM				
R11		030-55100-20	RES FILM AI 10K 5% 0.4W 4X1.6MM				
R12		030-54330-20	RES FILM AI 3K3 5% 0.4W 4X1.6MM				
R13		030-54390-20	RES FILM AI 3K9 5% 0.4W 4X1.6MM				
R14		030-55220-20	RES FILM AI 22K 5% 0.4W 4X1.6MM				
R15		030-54330-20	RES FILM AI 3K3 5% 0.4W 4X1.6MM				
R16		030-53470-20	RES FILM AI 470E 5% 0.4W 4X1.6MM				
R17		030-53470-20	RES FILM AI 470E 5% 0.4W 4X1.6MM				
R18		039-10018-63	RES WIRE WOUND 0.017E A4M1863 T508				
R20		030-56220-20	RES FILM AI 220K 5% 0.4W 4X1.6MM				
R21		030-53100-20	RES FILM AI 100E 5% 0.4W 4X1.6MM				
SW1		232-00010-21	SWITCH PUSH SPST MAINS ON/OFF				
*T1	21	053-00010-53	XFMR T4063A 230V MAINS PROTECTED				
*T1	22	053-00010-51	XFMR T4065 115V MAINS T508				
*T1	23	053-00010-53	XFMR T4063A 230V MAINS PROTECTED				
*T1	24	053-00010-53	XFMR T4063A 230V MAINS PROTECTED				

**T2008 Mechanical & Miscellaneous Parts**

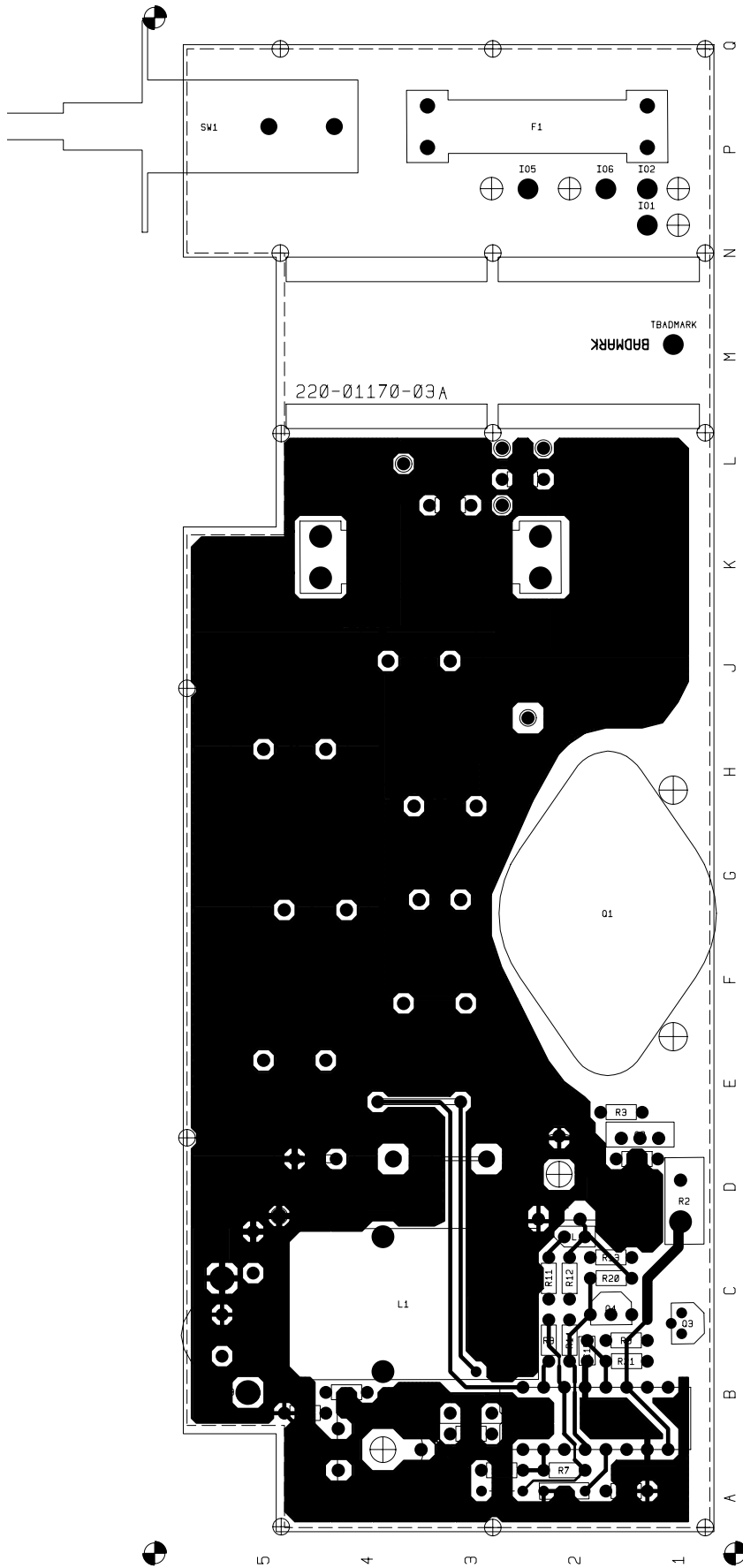
<b>IPN</b>	<b>Description</b>	<b>IPN</b>	<b>Description</b>
065-00010-20	BEAD FERRITE BALUN 4B1 PHILIPS		
200-00010-03	WIRE T/C 0.9MM	400-00020-03	2X5MM OVER M3X12MM PAN POZI SCREWS.
201-00030-02	WIRE #1 T/C WIRE 7/0.2MM PVC RED LED WIRING-330MM		SLEEIVING 1MM SIL RUBBER D1 WIRING
201-00030-04	WIRE #1 T/C WIRE 7/0.2MM PVC YELLOW INTERNAL SPEAKER LINK (REFER TO WIRING DIAG.)	400-00020-05	SLEEIVING 1.5MM SIL RUBBER LED WIRES, Q1
201-00030-05	WIRE #1 T/C WIRE 7/0.2MM PVC GREEN C8 & C9 WIRING TO HEATSINK	409-20008-01	USER GUIDE T2008 PWR SUPPLY
201-00030-10	WIRE #1 T/C WIRE 7/0.2MM PVC BLACK	410-00010-36	PKG POLY FOAM 2 PCS T508 A1M1860
201-00030-10	WIRE #1 T/C WIRE 7/0.2MM PVC BLACK LED WIRING - 330MM, MIC CLIP - 300MM.	410-01038-01	PKG SLEEVE CARD T2008 KIWI P.O.
205-00010-03	CABLE TWIN CYCLE FLEX 2/7/0.2MM BLACK	410-01087-00	CRTN T508/T2008PS OUTER (5 X UNITS)
205-00010-06	CABLE TWIN AUTO 153 2/28/0.3 RED & BLACK		<b>T2008-21 VARIANT PARTS</b>
220-01170-03	PCB T508-21	240-00010-18	PLUG 3 PIN MLDED ON 2.4M 0.75MM2 230V MAINS NEW ZEALAND MAINS SUPPLY PLUG (T2008-21)
232-00010-21	SWITCH PUSH SPST MAINS ON/OFF		<b>T2008-22 VARIANT PARTS</b>
240-00026-19	PLUG HOUSING 7-POS CONN 172495-1	240-00010-19	PLUG US 3PIN MOULDED ON 2.4M FLEX 120V 10A USA MAINS SUPPLY PLUG (T2008-22)
240-00026-20	PLUG RECEPTL 7-POS CONN 172773-1		<b>T2008-23 VARIANT PARTS</b>
240-02010-75	SKT RECEPTL T2000 172775-1	240-00010-22	PLUG MLDED 3PIN ON 2.0M 5AMP 240V MAINS UK MAINS SUPPLY PLUG (T2008-23)
240-04021-63	CONN 2WAY 24AWG (BLACK) INLINE HRMAPHR.		<b>T2008-24 VARIANT PARTS</b>
252-00010-02	CLIP MIC MTG	240-00010-20	(L) PLUG EURO SAFETY PLUG WITH 2.5M CABLE EUROPEAN MAINS SUPPLY PLUG (T2008-24)
265-00010-07	FUSE 10A CARTRIDGE 6*32MM BS4265		
302-05220-00	(L) BRKT HEAT TRANSFER T508/T2008		
303-03031-00	CASE 1 PR TOP/BTTM PLASTIC COMPL		
308-13064-01	HSINK A1M1755 DCAST T508/2008		
316-06442-00	PNL FRT A3A697 COMPL T2008 PWR SUPPLY		
319-30055-00	SPACER A4M2615 MIC MTG T2008		
340-00010-06	FUSE CLIP PCB MTG 6.3MM CARTRIDGE FUSE		
340-00011-52	COVER INSULATING FUSEHLD R PCB MTD		
345-00040-08	SCREW M3*12MM PAN POZI ST BZ Q1 MOUNTING AND PCB TO HEATSINK		
349-00010-28	SCREW NO6X1/2 PAN POZI TYPE 25		
349-00010-33	SCREW SLFTAP NO 6*3/4IN TYPE AB PAN PZI BZ FOR WALL MOUNTING		
349-00010-40	SCREW SELFTAP NO 8X3/8IN AB PAN SLOT BZ		
349-00010-40	SCREW SELFTAP NO 8X3/8IN AB PAN SLOT BZ		
349-00020-30	SCREW TAPTITE M3X6MM PAN PZI BZ EARTH PCB TO HEATSINK MOUNTING X 2		
349-00020-31	SCREW TAPTITE M3X10MM PAN POZI BZ		
349-00020-45	SCREW TAPTITE M4X20MM PAN POZI BZ BRIDGE RECTIFIER MOUNTING		
352-00010-08	NUT M3 COLD FORM HEX ST BZ Q1 MOUNTING		
353-00010-10	WASHER M3 FLAT 7MM*0.6MM ST BZ		
353-00010-12	WASHER M3 SPRING BZ Q1 MOUNTING		
353-00010-24	WASHER M4 FLAT ST BZ A4M1957		
353-00010-24	WASHER M4 FLAT ST BZ A4M1957 BRIDGE RECTIFIER MOUNTING		
356-00010-04	TAG SOLDER 3MM HEAVY DUTY EARTH MAINS EARTH TAG TO HEATSINK		
356-00010-05	TAG SOLDER 4MM LONG M6144/4.2		
362-00010-09	GASKET SIL INSULATING TO-3 Q1		
365-00011-54	LABEL WHITE RW1556/2 90*24MM SPECIAL ADHESV		
365-00100-03	LABEL BLANK 10.8X30MM S/A METLSD POLYES		
365-00100-04	LABEL BLANK 30X6.7MM S/A METALLISED POLYES		
365-00100-07	LABEL BLANK 47X30MM S/A METLSD POLYES		
365-00100-20	LABEL WHITE S/A 28X11MM QUIKSTIK RW718/4		
365-01372-00	LABEL POWER CORD CODE/WARNING		
369-00010-05	FOOT PLASTIC 10MM SQ SELF ADHESIVE BLACK		
369-00010-14	TIE CABLE NYLON 100*2.6MM		
369-00020-25	SPONGE RUBBER 3/8 INCH SQ SKELLERUP S3 TOP CASE 2 X 56MM		
369-00020-45	TAPE AL FOIL S/A 3M NO 425		
399-00010-10	RUBBER BAND NO 33 MAINS PLUG		
399-00010-51	BAG PLASTIC 75*100MM		
399-00010-59	BAG PLASTIC 225*300MM		
400-00010-30	SLEEIVING 3MM PVC 2X 3.5MM		
400-00010-30	SLEEIVING 3MM PVC		

## T2008 Grid Reference Index (IPN 220-01170-03)

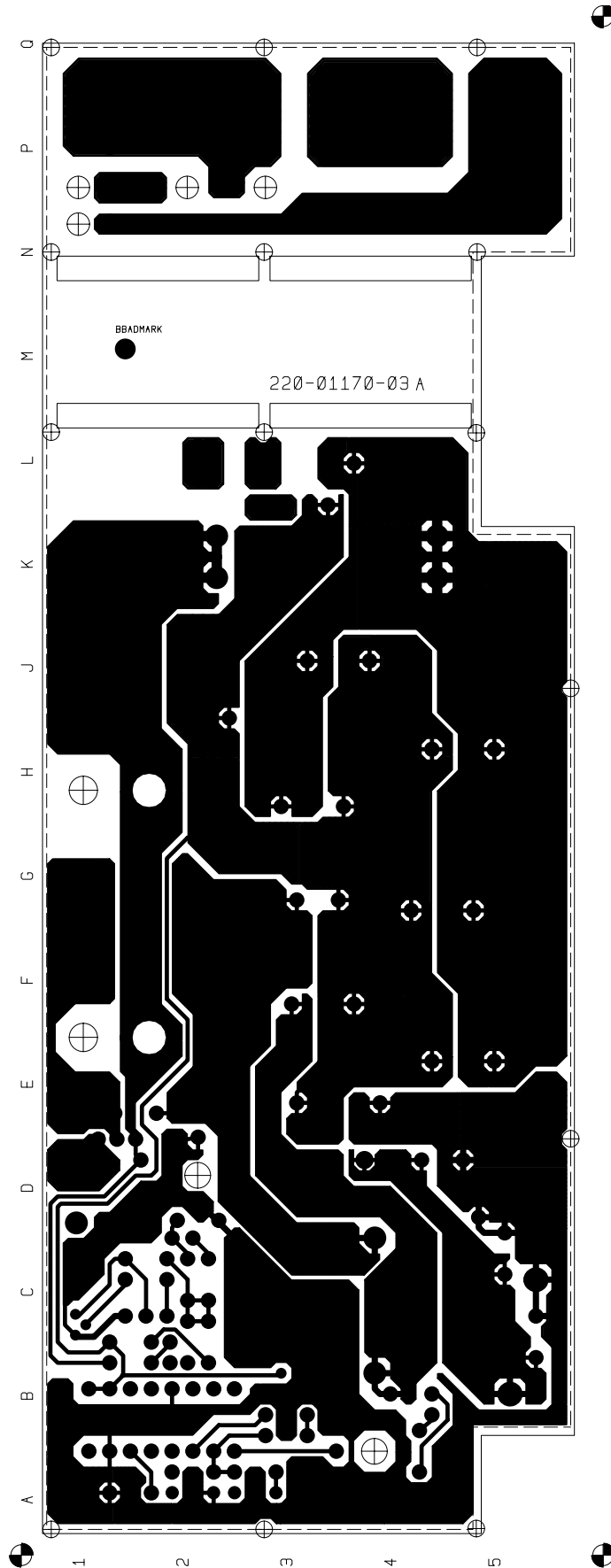
Device	PCB	Circuit	Device	PCB	Circuit	Device	PCB	Circuit
C1	1:J4	1-E7	R18	1:E4	1-J6			
C2	1:H5	1-E7	R20	1:C2	1-F1			
C3	1:H3	1-F7	R21	1:B1	1-G4			
C4	1:G5	1-F7						
C5	1:E5	1-F7	SW1	1:P5	1-A7			
C6	1:F3	1-J7						
C7	1:C5	1-K7	*T1		1-B7			
C8	1:C5	1-L7						
C10	1:A3	1-E4						
C11	1:B3	1-F3						
C14	1:A2	1-G1						
C15	1:C2	1-G4						
D1	1:G3	1-J7						
D2	1:D5	1-K6						
F1	1:P1	1-B7						
F2	1:K5	1-G7						
IC1	1:B3	1-G2						
IO1	1:N1	1-A7						
IO2	1:P1	1-A7						
IO3	1:B5	1-L7						
IO4	1:C5	1-L6						
IO5	1:P3	1-B8						
IO6	1:P2	1-B6						
IO7	1:L4	1-D8						
IO8	1:J3	1-D6						
IO9	1:L2	1-D6						
IO10	1:L3	1-D5						
IO11	1:L3	1-D5						
IO12	1:D5	1-L7						
LED1		1-C5						
L1	1:B4	1-J7						
L2	1:D4	1-K7						
PL1	1:D2	1-D2						
		1-D1						
		1-D0						
Q1	1:G2	1-H7						
Q2	1:E2	1-H7						
Q3	1:C1	1-E1						
Q4	1:C2	1-F2						
RB1		1-D7						
R1	1:D1	1-H7						
RV1	1:B4	1-J6						
RV2	1:D2	1-E1						
R2	1:D1	1-H5						
R3	1:E2	1-H7						
R4	1:B4	1-J7						
R5	1:B4	1-J6						
R6	1:A3	1-E4						
R7	1:A2	1-E3						
R8	1:C2	1-E3						
R9	1:C2	1-F2						
R10	1:B3	1-F3						
R11	1:C2	1-E2						
R12	1:C2	1-E2						
R13	1:C2	1-E2						
R14	1:C2	1-F2						
R15	1:A2	1-G1						
R16	1:L3	1-D6						
R17	1:L3	1-D5						



T2008 Power Supply Wiring Diagram (IPN 220-01170-02 shown)

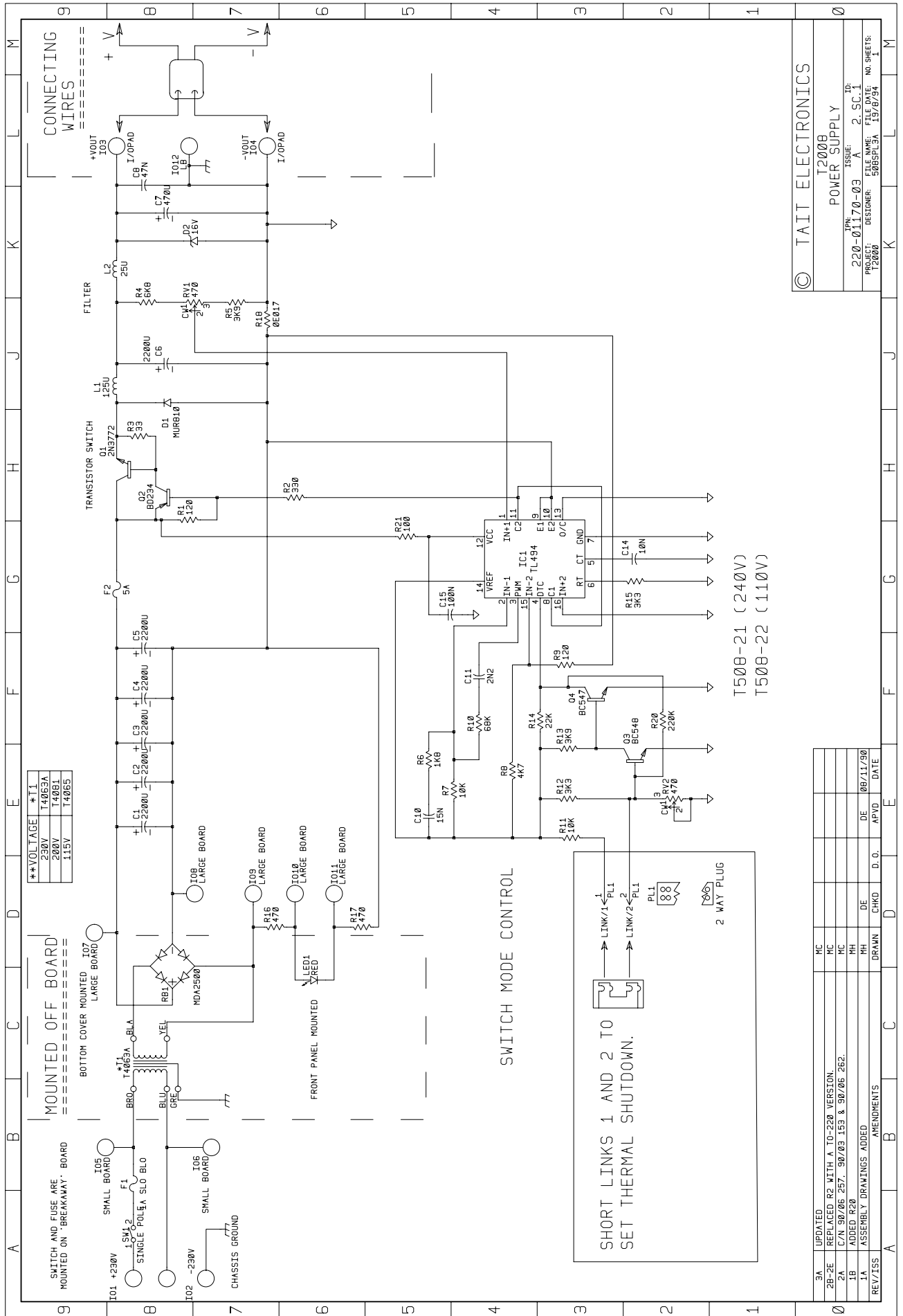


T2008 Power Supply PCB Layout - Top Side (IPN 220-01170-03)



T2008 Power Supply PCB Layout - Bottom Side (IPN 220-01170-03)





**\*\*VOLTAGE \*T1**

230V	T4063A
200V	T4061
1.15V	T4065

**MOUNTED OFF BOARD**  
 =====  
 BOTTOM COVER MOUNTED T07 LARGE BOARD  
 FRONT PANEL MOUNTED T04, T08, T09, T10, T11 LARGE BOARD  
 CHASSIS GROUND

SHORT LINKS 1 AND 2 TO SET THERMAL SHUTDOWN.  
 LINK/1  
 LINK/2  
 FL1  
 2 WAY PLUG

T508-21 (240V)  
 T508-22 (110V)

© TAIT ELECTRONICS

T2008
POWER SUPPLY
ISSUE: 2. S.C.1
PROJECT: 220-01170-03
DESIGNER: 3065PL3A
FILE NAME: 13/07/94
NO. SHEETS: 1

REV/ISS	AMENDMENTS	DRWN	CHKD	D. O.	APVD	DATE
3A	UPDATED	MC				
2B-2E	REPLACED R2 WITH A 10-220 VERSION	MC				
2A	C/N 90/06 257, 90/03 155 & 90/06 262.	MC				
1B	ADDED R20	PH				
1A	ASSEMBLY DRAWINGS ADDED	PH				



## 8.2 Connection To External Devices

### 8.2.1 Introduction

The spare external pin in the T2000 power connector (refer to Figure 8.4.1) may be wired to any of the option connections tabled in Section 5.9, "Options Interface Specifications". The most commonly used connections (hush, horn, emergency and auxiliary), are explained below.

The T2010 and T2015 can be programmed to have channel selection controlled via S15 on the T2000 logic PCB.

### 8.2.2 Applications

#### Hush

An active +5V signal is supplied to this line each time the PTT is pressed or a valid transmission is received (i.e. audio is heard), and is commonly used to mute a car radio. It may be connected directly to some modern stereo systems, otherwise an interface device will be required. This signal is sometimes referred to as the 'external mute'.



#### Horn

This is used in a Selcall system where an external alert has been programmed. An active +5V signal is supplied to this line when the radio goes into the external alert cycle. This signal will either be pulsed, steady or ringing, depending on the radio model and programming.

#### Emergency

This is used to put the radio into emergency mode for a Selcall system and is activated when the input is switched to ground.

#### Auxiliary

An active +5V signal is switched to this line when the front panel **auxiliary** key  (T2010, T2015 & T2020 models) or **function** key  (trunked models) is active. This is programmable with both latching and momentary operation available.

### **8.2.3 Connections**

The spare external pin in the power connector is connected to an option by linking the appropriate option pin to the EXTERNAL pin on options connector S14 (refer to Section 5.9, "Options Interface Specifications").

The recommended linking method is to crimp a short length of 7/0.2mm PVC wire between the appropriate connections on a 16-way Micromatch plug (IPN 240-00026-24), which can then be plugged onto the options connector.

### **8.2.4 T2010 & T2015 BCD Selection**

The front panel keys do not function when the T2010 or T2015 is programmed for channel selection control via the BCD lines.

Access to the BCD lines is via S15 on the logic PCB. Refer to Section 5.9, "Options Interface Specifications" details.

## 8.3 T2000-500 & T2000-600 1-7W Versions

This Section describes how to convert a T2000-500 or T2000-600 radio to operate between 1 and 7W.

**Note:** T2000-500 and T2000-600 1 to 7W radios are currently type approved only in Australia and Germany.

The following topics are covered in this Section:

Section	Title	Page
8.3.1	Components Required	8.3.2
8.3.2	Fitting	8.3.2
8.3.3	Set-Up	8.3.4
8.3.4	Specifications	8.3.4

## 8.3.1 Components Required

To convert a T2000-500 and T2000-600 to low power, the following components are required:

	Description	IPN	Quantity
<b>Low Power Common Parts</b>	56 $\Omega$ SRF16 resistor	030-02560-20	2
	T2000-500/600 replacement transistor PCB	220-01287-00	1
	radio type label	-	1
	appropriate type approval label	-	1
<b>T2000-500 Low Power Parts</b>	5p6 NP0 500V GRM42-2 chip capacitor	015-01560-06	2
	22p NP0 500V GRM42-2 chip capacitor	015-02220-06	3
<b>T2000-600 Low Power Parts</b>	4p7 NP0 500V GRM42-2 chip capacitor	015-01470-06	1
	5p6 NP0 500V GRM42-2 chip capacitor	015-01560-06	1
	18p NP0 500V GRM42-2 chip capacitor	015-02180-06	2

## 8.3.2 Fitting

- 1 Refer to Figure 8.3.1.

Remove L315, L316, L317 and \*R319 from the top side of the PA.

Crush and remove the ferrite bead which forms part of L314, so that only the wire link remains.

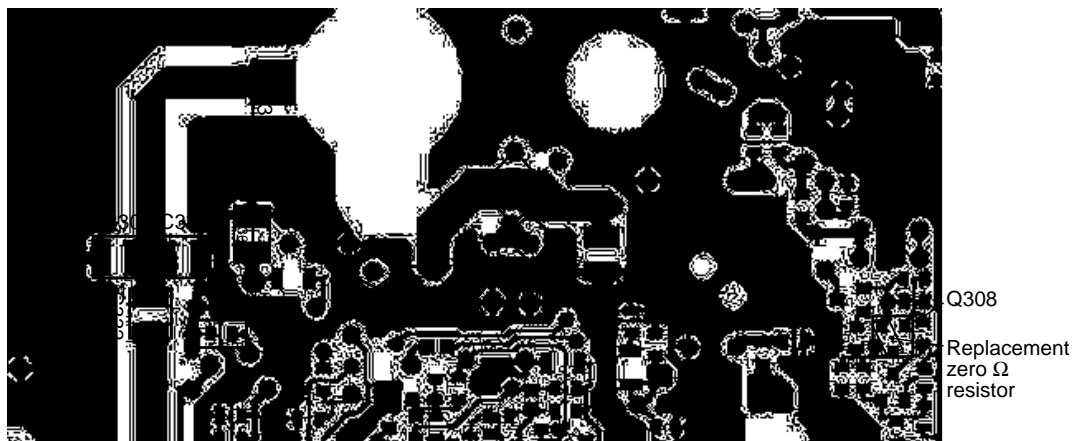


Figure 8.3.1 T2000-500/600 PA - Top Side

- 2 Refer to Figure 8.3.2.

Remove the following components from the bottom side of the PA:  
C323, \*C324, C325, \*C327, \*C329 and Q306.

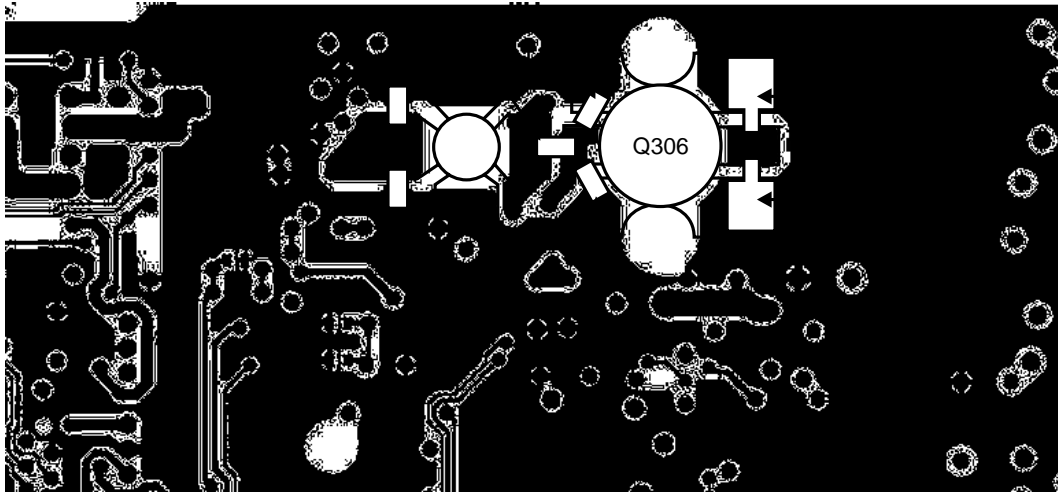


Figure 8.3.2 T2000-500/600 PA - Bottom Side

- 3 Remove the output matching capacitors, \*C330, C331 and \*C332 from the top side of the PA (shown in Figure 8.3.1).

Solder the replacement capacitors in the original positions, as follows:

	T2000-500	T2000-600
*C330	5p6	-
C331	5p6	4p7
*C332	22p	5p6

- 4 **Replacement Transistor Fitting**

Refer to Figure 8.3.3.

- a Tin the underside of the replacement transistor PCB.

Place the PCB as shown, and sweat-solder into position, soldering the centre strip first, followed by the other strips.

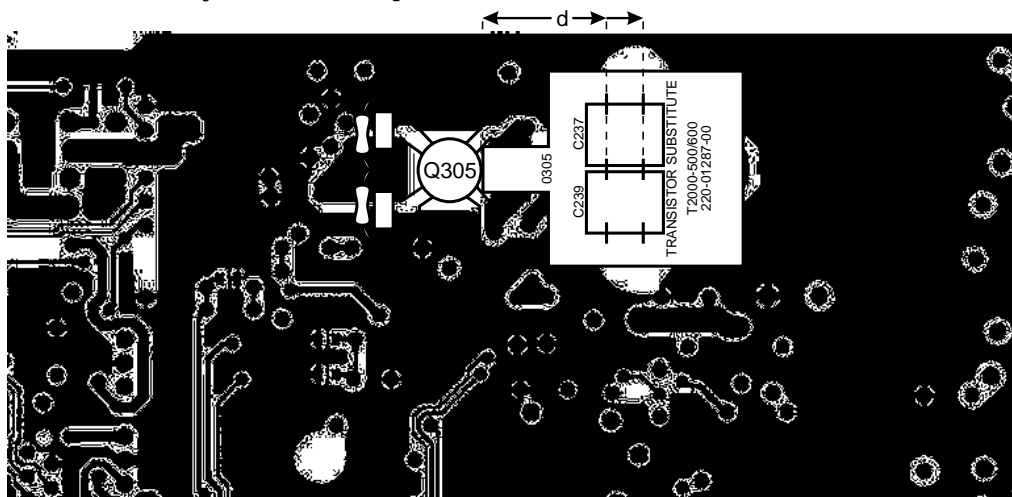


Figure 8.3.3 T2000-500/600 PA - Bottom Side

- b** Solder the chip capacitors onto the replacement transistor PCB, in the positions shown. Refer to the table below for capacitor values and the distance 'd'.

	T2000-500	T2000-600
Capacitor Value	22p	18p
Distance (d)	14.5mm*	11.5mm

\* d is 13mm if Q305 is a BLW81 transistor

**Note:** The distance 'd' shown in Figure 8.3.3 is measured from the edge of the transistor top cap to the centre of the capacitors.

- c** Solder the 2 SRF16 resistors in the positions shown. Keep the leads as short as possible and ensure the resistors do not cause a short circuit.
- 5** Replace the radio type label and type approval certificate number label on the heatsink fins with the new type label and corresponding type approval certificate number label.

### 8.3.3 Set-Up

- 1** Adjust RV324 to set the required output power level.

**Note:** If the output power is set to 1W for RF control purposes, program the radio for high power and adjust RV324 for 1W.

- 2** Seal RV324 with permanent adhesive so that the power cannot be readjusted.

### 8.3.4 Specifications

Frequency Range:

T2000-500	.. 400 to 470MHz
T2000-600	.. 450 to 520MHz

Supply Voltage .. 0.8 to 16V DC

Power Output .. adjustable 1 to 7W

Temperature Range .. -30°C to +60°C

Stability (power output set to >1W) .. transmitter stable into 5:1 VSWR (all phase angles)



## 8.4 T2000-05 Remote Speaker Kit

The T2000-05 remote speaker kit provides a 4Ω external speaker for T2010, T2015 and T2030 models.

### 8.4.1 Components Required

The T2000-05 kit contains the following components:

Quantity	Description
1	T2000 speaker complete with mounting bracket and thumb screws
2	M4 self tapping screws
2	'U' type captive nuts for self tapping screws
5m	speaker wire complete with receptacles and speaker socket

### 8.4.2 Fitting

- 1 Choose a suitable mounting position for the speaker.

With the speaker fitted to the mounting bracket, check that it does not interfere with the operation of any of the vehicle controls.

- 2 Fix the speaker mounting bracket securely in the chosen location with suitable fasteners. Two M4 self tapping screws and 'U' type captive nuts have been supplied for this purpose.

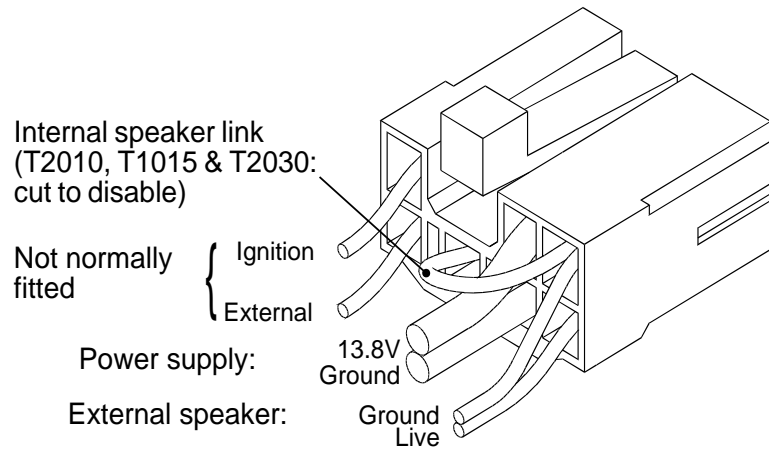
**Caution:** Check before drilling that the drill will not damage any components or wiring behind the panel.

- a If drilling directly into metal, drill two 3.5mm holes in the appropriate locations and secure the bracket with the supplied M4 self tapping screws.
  - b If mounting the bracket to any other material, such as plastic, drill two 4.5mm holes and attach the bracket with the M4 screws and captive nuts. Slide a captive nut over the edge of the panel to align with each hole, ensuring that the screw will pass through the larger hole to thread into the smaller hole.
  - c If neither of the above methods is appropriate, M4 screws, nuts and shakeproof washers are equally suitable.
- 3 Attach the speaker to the mounting bracket with the thumbscrews.

**4** Refer to Figure 8.4.1.

Remove the existing internal speaker link and insert the three speaker wire receptacles into the appropriate power connector holes, as shown.

If the internal speaker is not required, cut the internal speaker ground link.



*Figure 8.4.1 T2000 Power Connector*

**5** Plug the speaker into the socket provided on the speaker wire, neatly loop any excess wire and secure with a cable tie.

Peel the protective plastic off the “Tait” label on the front of the speaker.

## 8.5 T2000-06 Desktop Microphone Kit

### 8.5.1 Introduction

The T2000-06 desktop microphone has an internal omni-directional dynamic element, pre-amplifier and compressor loop. The microphone output is adjustable by a potentiometer (R11) which is accessible through a hole in the bottom of the case.

The desktop microphone has a switch provided for hookswitch monitoring, which can be locked if required.

### 8.5.2 Fitting

The T2000-06 has grommets for both Series I and II radios fitted to the microphone cord.

- 1 Remove the Series I grommet from the microphone cord.
- 2 Fit the desktop microphone lead to the T2000 control head microphone socket, then push the grommet in place.

### 8.5.3 T2000-06 Set-Up

Both the desktop microphone and the T2000 radio have an internal compressor and it is advisable that the T2000 compressor be disabled to avoid the possibility of 'hunting'.

This can be done either by disabling the T2000 compressor or by adjusting the output level at the desktop microphone.

#### Method 1

- 1 Disable the internal T2000 compressor by solder shorting the pads labelled 'ALC disable' on the logic PCB.
- 2 Observe the waveform at TP606 with an oscilloscope, and whistle into the microphone at close range.  
Adjust the output level of the microphone until the waveform is just below clipping.

#### Method 2

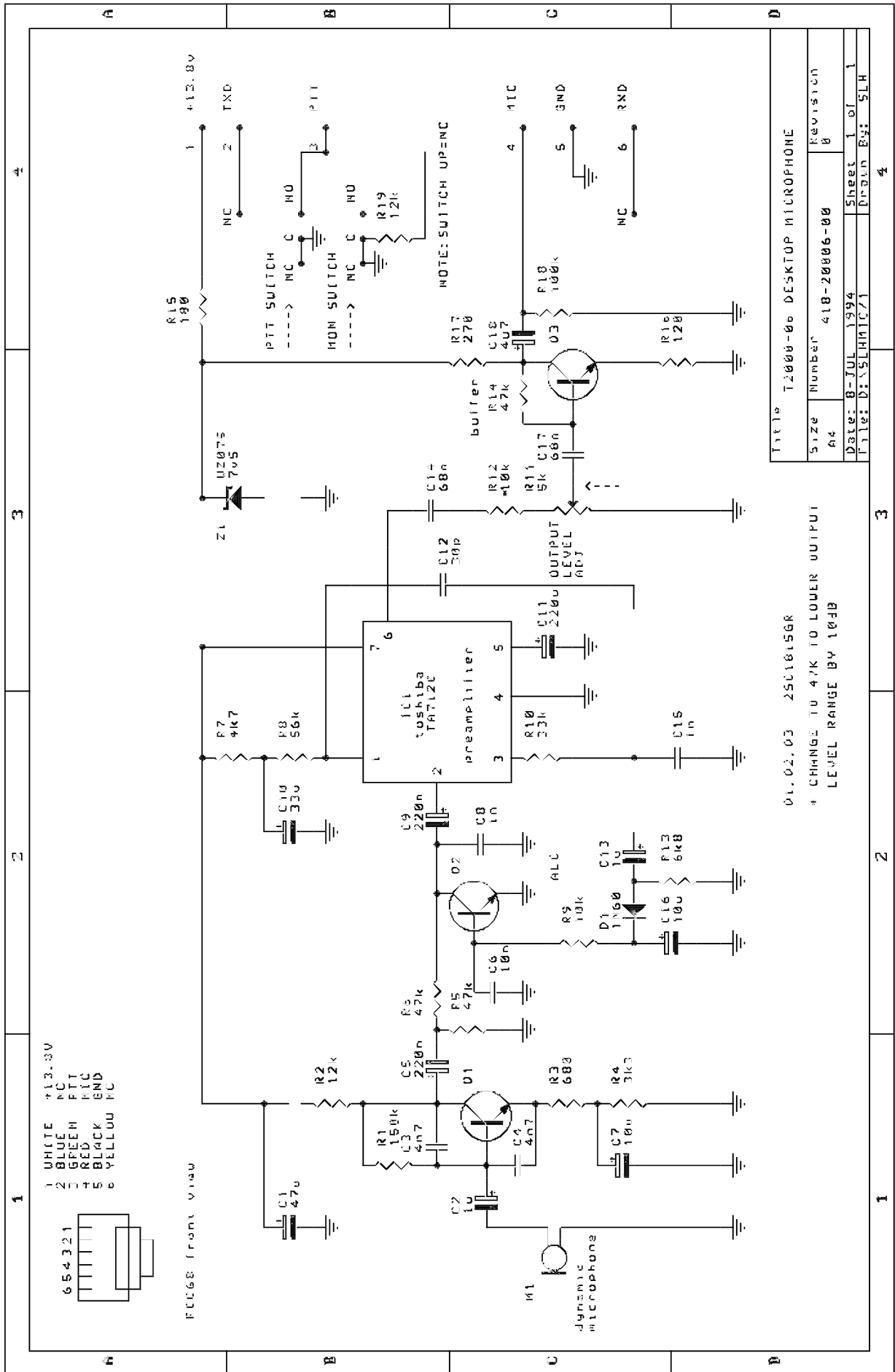
- 1 Leave the T2000 internal compressor enabled.
- 2 Set the transmitter average deviation by whistling into the microphone at the required distance from the microphone.

- 3 Adjust the output level at the microphone to approximately 80% deviation ( $\pm 4\text{kHz}$  for wide band or  $\pm 2\text{kHz}$  for narrow band).

## 8.5.4 Sensitivity

Under some conditions, the microphone may pick up excessive background noise. In this situation, the output can be reduced using *either* of the procedures described below:

- 1 Change the value of R12 from  $10\text{k}\Omega$  to  $47\text{k}\Omega$  (refer to the circuit diagram). This will result in a 10dB output reduction.
- 2 Fit a 2K2 pot parallel with the microphone element.  
Adjust the output level to suit.





## 8.6 T2000-07 DTMF Microphone Kit

The T2000-07 DTMF microphone has an omni-directional dynamic element and internal DTMF tone generator. The DTMF tone level is adjustable by an internal potentiometer (VR1) which is accessible when the rear case is removed.

The DTMF microphone is intended for use with all T2000 Series II radios.

### 8.6.1 Fitting

The T2000-07 has grommets for both Series I and II radios fitted to the microphone cord.

- 1 Remove the Series I grommet from the microphone cord.
- 2 Fit the DTMF microphone lead to the T2000 control head microphone socket, then push the grommet in place.

### 8.6.2 Operation

- 1 The microphone LED is used to indicate 'key pressed'. The LED is on for normal operation and is off when a DTMF key is pressed.
- 2 The PTT switch changes the microphone input to the radio from DTMF tone to the dynamic microphone. This is to prevent the microphone signals distorting the DTMF tones.
- 3 The operation of a DTMF key automatically operates the transmitter PTT and holds it on for a short time after the release of the DTMF key. This is to hold the transmitter on during interdigital pauses.

### 8.6.3 T2000-07 Set-Up

Remove the microphone back cover and set the DTMF tone level to approximately 80% deviation ( $\pm 4\text{kHz}$  for wide band or  $\pm 2\text{kHz}$  for narrow band).

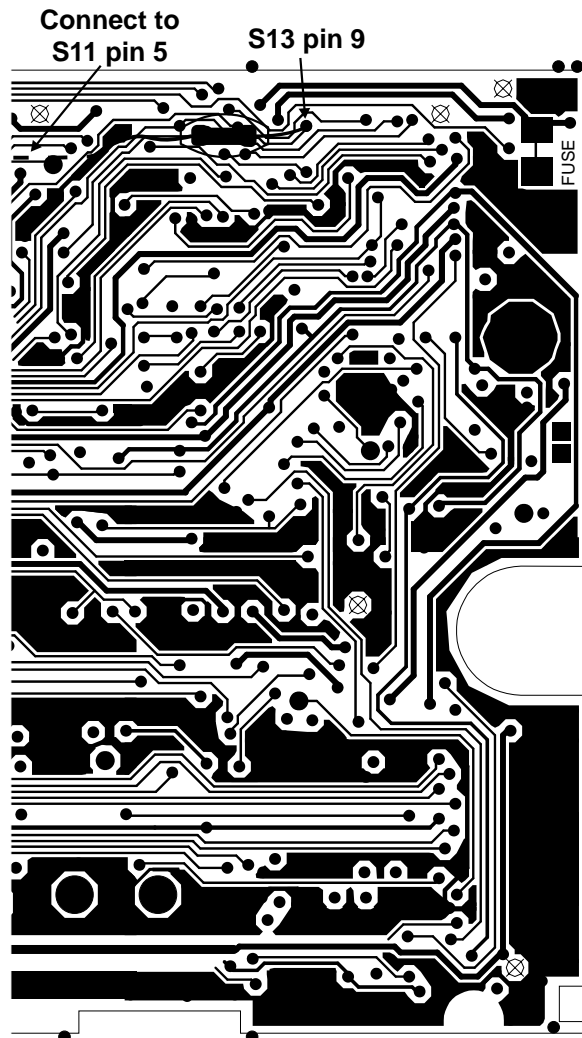
#### DTMF Sidetone (T2010 & T2015 only)

The DTMF tone output is also fed into the receive data line and can be used to provide a sidetone.

- 1 Refer to the diagram on the following page.  
Solder a resistor to S13 pin 9 (RX-BEEP) on the bottom side of the T2010 control PCB.

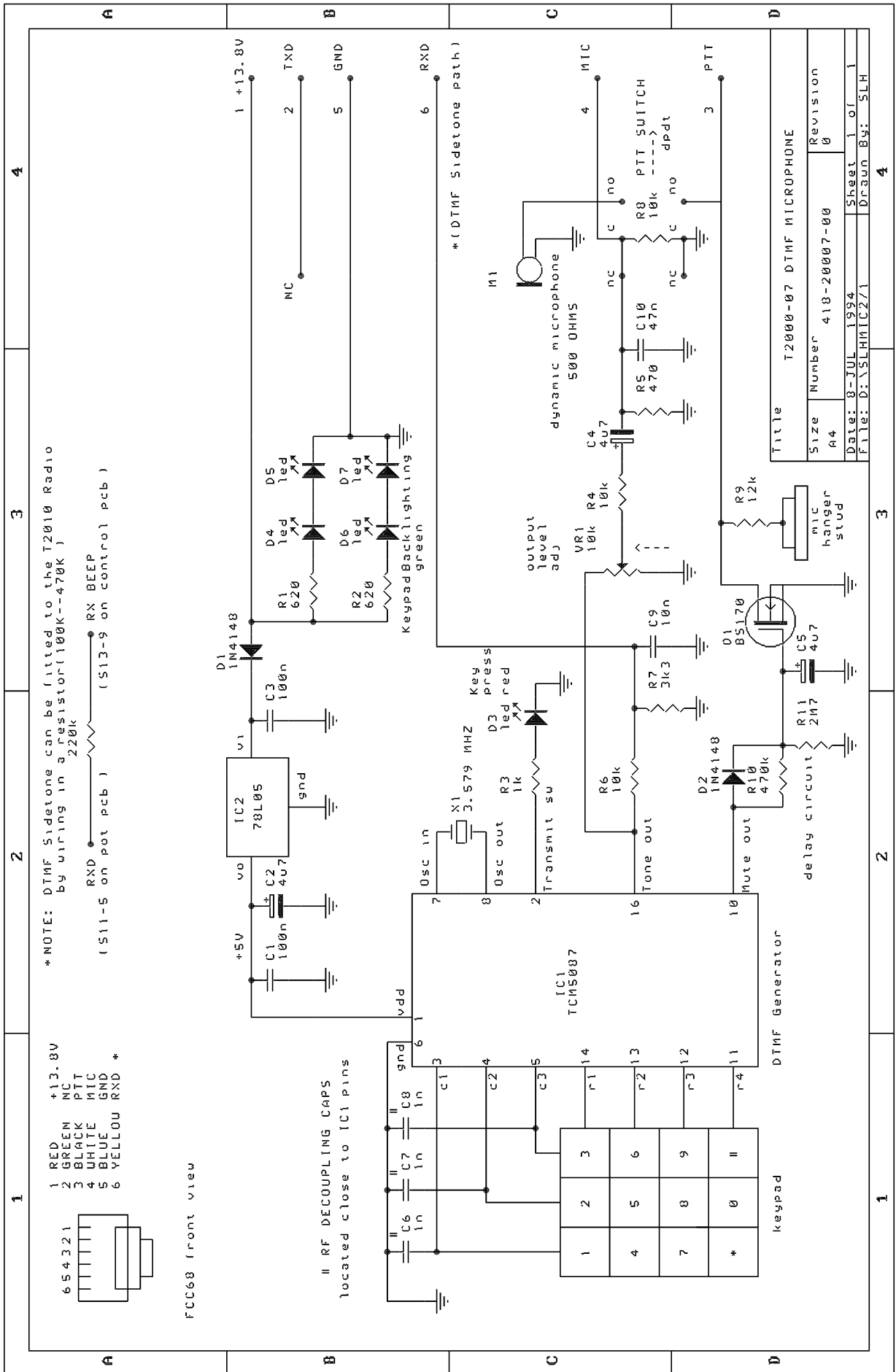
The value of the resistor adjusts the sidetone level and is between 100k $\Omega$  and 470k $\Omega$ , typically 220k $\Omega$

- 2 Slide a length of silicone sleeving over the resistor, and connect a wire between the resistor and S11 pin 5 (RXD) on the pot PCB, as shown.



*T2010 & T2015 Logic PCB - Bottom Side*







## 8.7 T2000-34 Selcall Kit

The T2000-34 kit provides selective tone calling (Selcall) facilities for T2010 and T2015 model T2000 Series II radios.

The Selcall kit consists of a small module and a 5MHz crystal that are fitted to the radio's logic PCB. This option allows selective individual or group calls within a fleet of radios, on channels that have Selcall programmed. Selcall parameters and features are set up and enabled during programming. Both Sigtec and International group formats are supported by the T2000-34 PCB.

Refer to Section 8.7.3, "Programming" for a list of user-selected features. The following topics are covered in this Section:

<b>Section</b>	<b>Title</b>	<b>Page</b>
8.7.1	Components Required	8.7.2
8.7.2	Fitting	8.7.2
8.7.3	Programming	8.7.3

## 8.7.1 Components Required

The T2000-34 kit contains the following components:

Quantity	Description
1	T2000-34 Selcall module
1	5MHz crystal with insulator

## 8.7.2 Fitting

Refer to Figure 8.7.1 and Section 7.10, "T2010 & T2015 HC05 Logic PCB".

- 1 Remove the top cover of the radio by unscrewing the four cover screws, unscrew the logic PCB and fold-out.
- 2 Unplug the connecting looms, if required.
- 3 Place the Selcall module flat on the logic PCB, as shown in Figure 8.7.1, with the component side facing upwards.  
Solder the leads on the bottom side of the PCB and trim as necessary.
- 4 Fit the supplied 5MHz crystal flat on the PCB in location '#X502' as follows:  
Peel the protective backing off the self-adhesive foam tape on the underside of the crystal.  
Insert the crystal leads into the holes provided and press the crystal down onto the PCB.  
Solder the leads on the underside of the PCB and trim as necessary.
- 5 Reconnect any looms that were unplugged in step 2.  
Refit the logic PCB to the radio and secure with the three retaining screws.  
Refit the top cover and secure with the four retaining screws.

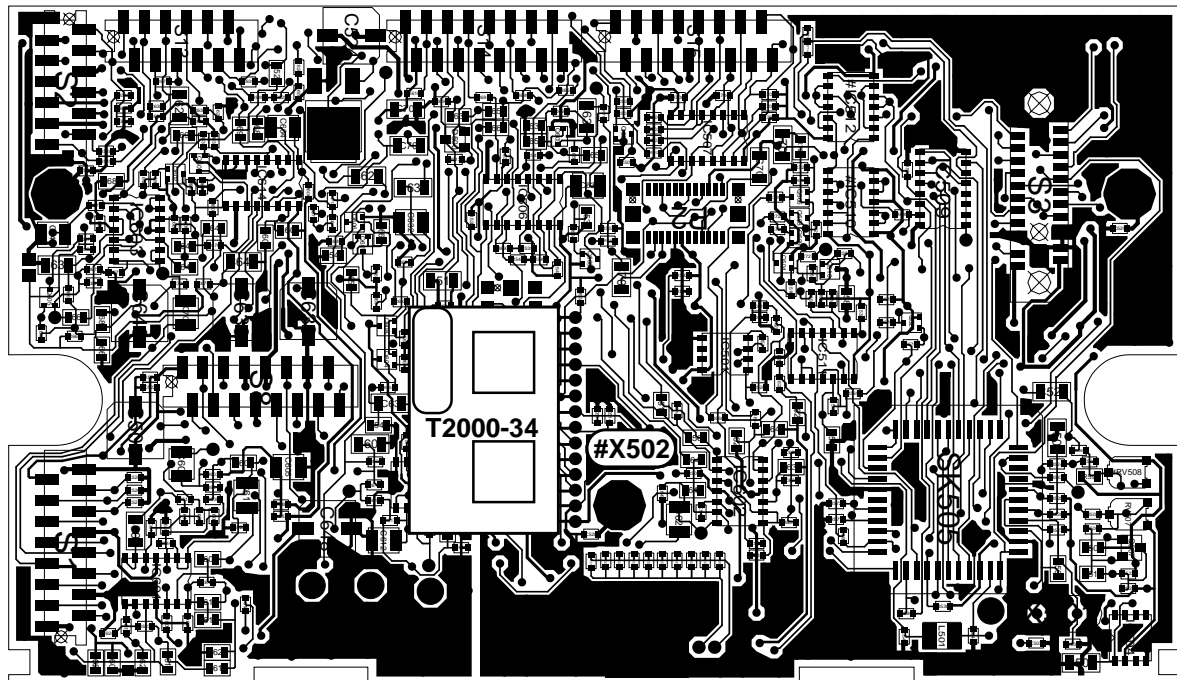


Figure 8.7.1 T2000-34 Selcall PCB Mounting - T2010 & T2015 Logic PCB (top side)

## 8.7.3 Programming

The radio must now be reprogrammed to set the various Selcall parameters listed in the following table. Refer to the manual supplied with the T2000-20 programming kit for details.

Parameter	Selection
Tone Set	CCIR, EIA, EEA, ZVEI-1, ZVEI-2, ZVEI-3, DZVEI, PZVEI
Tone Frequencies	16 tones corresponding to the International Standard for the selected tone set, plus 'no tone'
Tone Period	20*, 33, 40, 50*, 60*, 70 & 100ms
Lead-In Delay	between 0 & 5100ms in 20ms steps
Lead-In Tone	any of the 16 valid tones, or 'no tone'
Decode Sequence	individual or group decode
Encode	preset
Group Decode Format	Sigtec or International
Auto Acknowledge	enabled or disabled
Group Dialling	enabled or disabled

<b>Parameter</b>	<b>Selection</b>
Deferred Calling	enabled or disabled
ANI Sequence	leading, trailing or random encoding
Emergency Sequence	enabled or disabled
Alert	internal and external durations
Tone Blanking	standard

\* These tone periods are not defined by international standards. Wherever possible, use the international standard tone periods.

## 8.8 T2000-36 Selcall Kit

The T2000-36 Selcall PCB plugs into an options connector on the top side of the logic PCB, and provides selective tone calling (Selcall) facilities for T2010, T2015, T2020 or T2050 model T2000 Series II radios.

This option allows selective individual or group calls within a fleet of radios, on channels that have Selcall programmed. Selcall parameters and features are set up and enabled during programming. Both Sigtec and International group formats are supported by the T2000-36 PCB.

The following topics are covered in this Section:

<b>Section</b>	<b>Title</b>	<b>Page</b>
8.8.1	Components Required	8.8.2
8.8.2	Fitting	8.8.2
8.8.3	PCB Information	8.8.4

## 8.8.1 Components Required

The T2000-36 Selcall kit contains the following components:

Quantity	Description
1	T2000-36 PCB assembly
12mm	PVC foam tape

## 8.8.2 Fitting

- 1 Refer to Figure 8.8.1.

Remove the top cover of the radio by unscrewing the four cover screws, unscrew the logic PCB and fold-out.

Position the T2000-36 PCB as shown, and plug into the connector on the T2000 logic PCB:

Model	PCB IPN	Connector Circuit Reference
T2010 & T2015	220-01377-01	P1
T2020 & T2050	220-01344-02	#T3K44

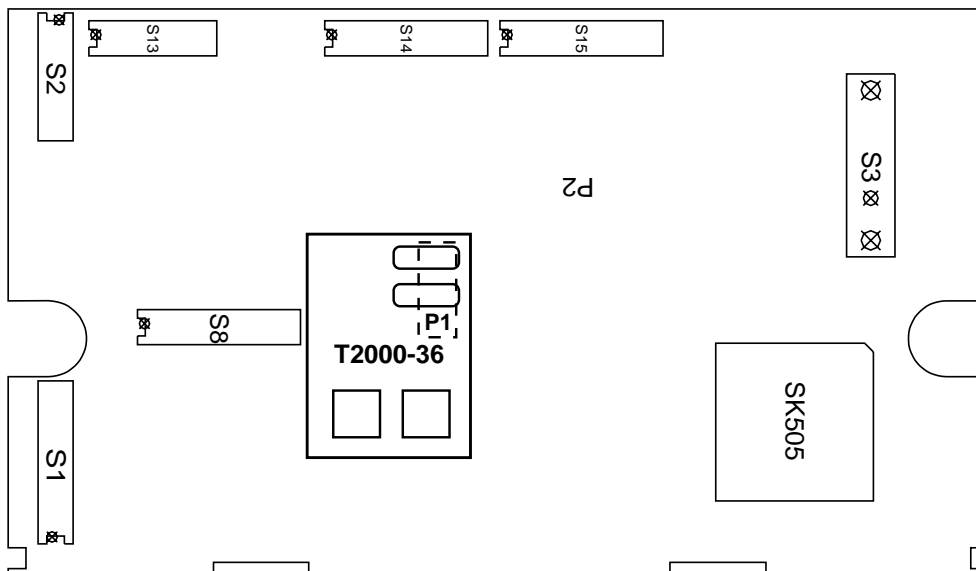


Figure 8.8.1 T2000-36 Selcall PCB Mounting



- 2** Position the foam tape provided on top of XL2, on the T2000-36 Selcall PCB.
- 3** Carefully fold the logic PCB back in position and secure using the three logic PCB retaining screws.  
Refit the top cover.
- 4** Refer to the T2000 Programming Software User's Manual (IPN 439-22000-02, or later) for set-up information.

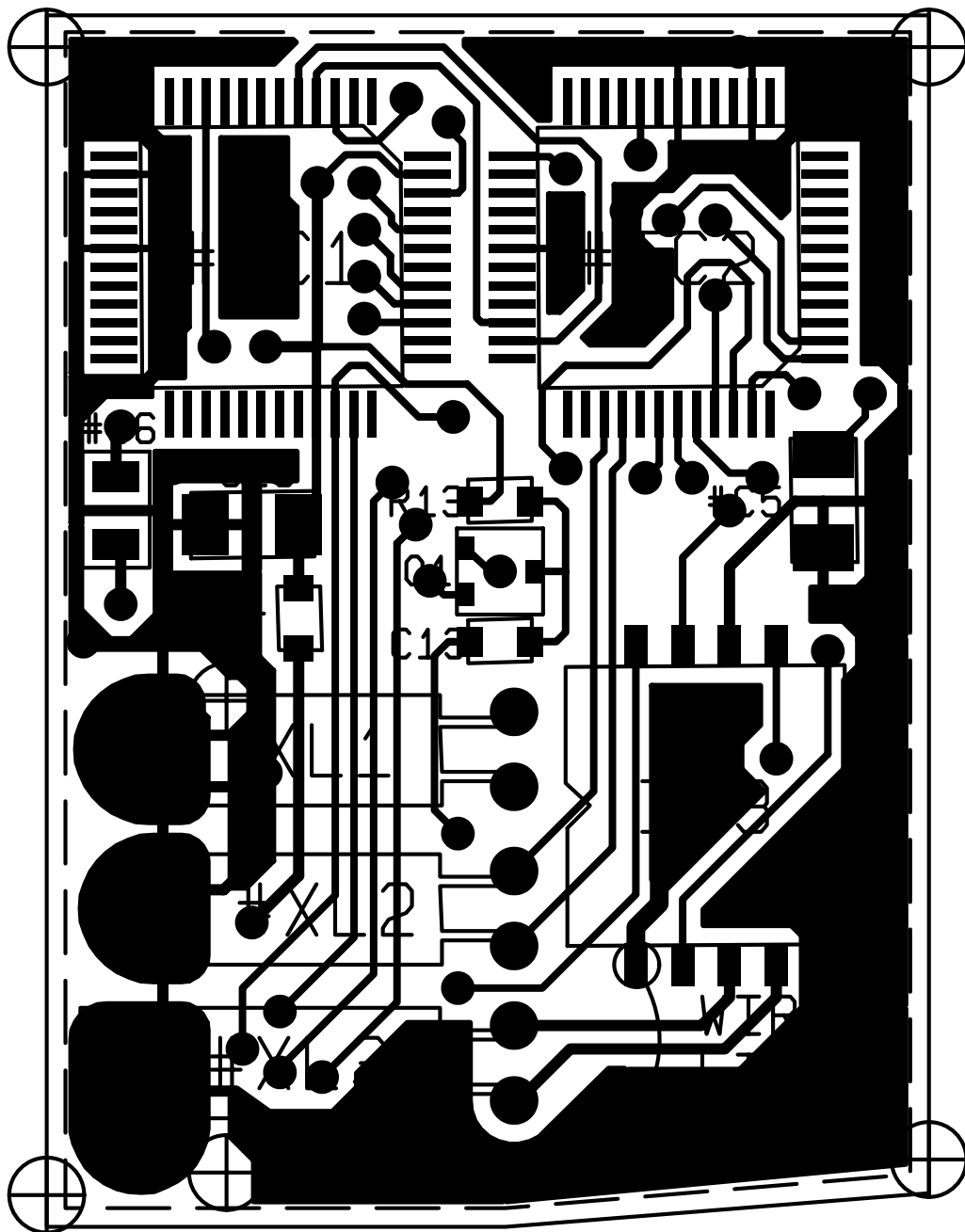
## 8.8.3 PCB Information

### T2000-36 Parts List (IPN 220-01313-02)

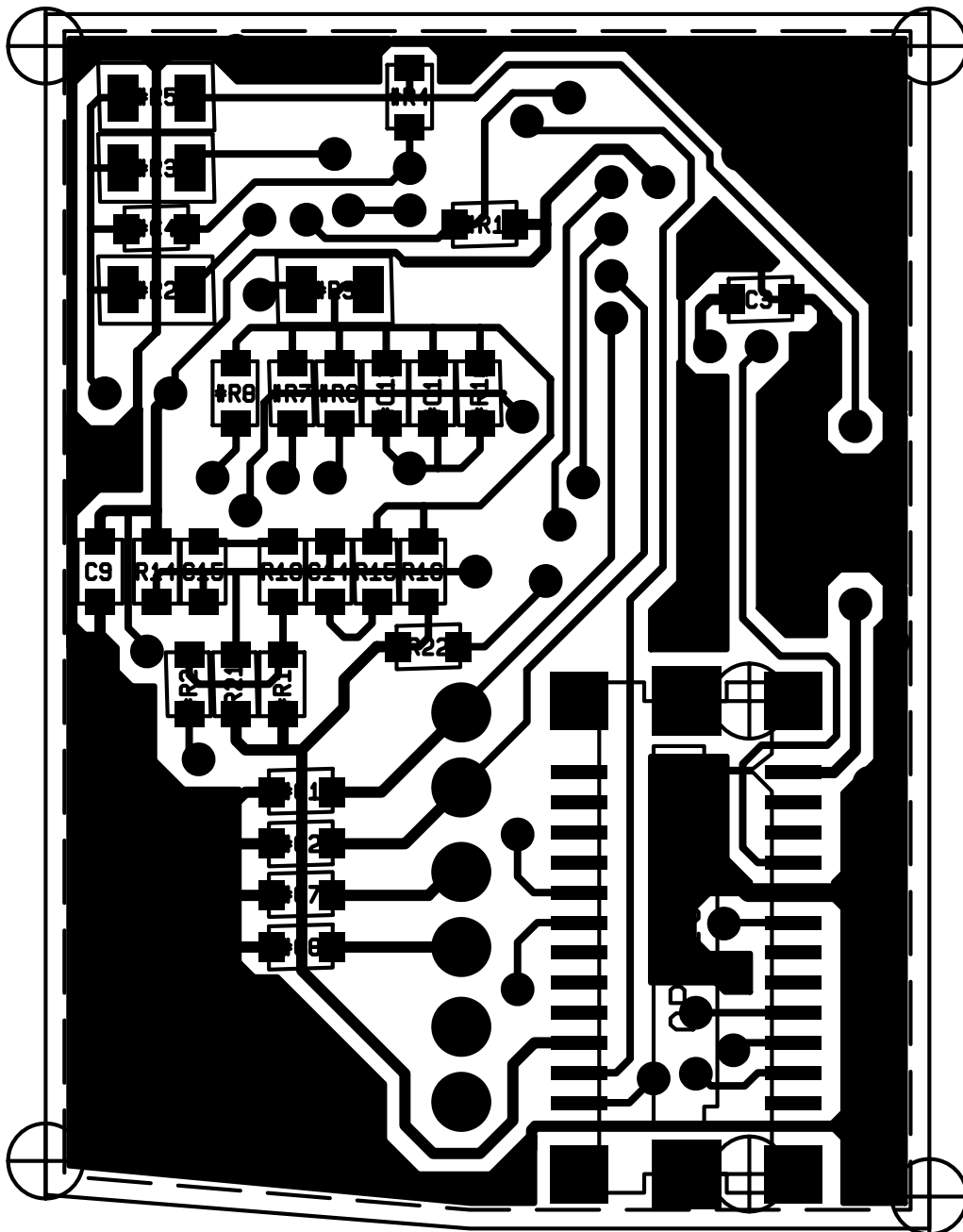
Ref	IPN	Description	Ref	IPN	Description
#C1	018-12330-00	CAP 0603 CHIP 33P 50V NPO +-5%			
#C2	018-12150-00	CAP 0603 CHIP 15P 50V NPO +-5%			
C3	018-15100-00	CAP 0603 CHIP 10N 50V X7R +-10%			
#C4	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%			
#C5	014-06470-00	CAP TANT CHIP 470N 25V +-20% 6X3			
#C6	015-24220-08	CAP CER 0805 CHIP 2N2 10% X7R 50V			
#C7	018-12330-00	CAP 0603 CHIP 33P 50V NPO +-5%			
#C8	018-12150-00	CAP 0603 CHIP 15P 50V NPO +-5%			
C9	018-15100-00	CAP 0603 CHIP 10N 50V X7R +-10%			
#C11	018-15100-00	CAP 0603 CHIP 10N 50V X7R +-10%			
#C12	018-15100-00	CAP 0603 CHIP 10N 50V X7R +-10%			
C13	018-15100-00	CAP 0603 CHIP 10N 50V X7R +-10%			
C14	018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16V			
C15	018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16V			
C18	014-06470-00	CAP TANT CHIP 470N 25V +-20% 6X3			
#IC1	002-10001-02	(L) IC SMD SIGTEC SD-12 SELCALL (PAI			
#IC2	002-10001-01	(L) IC SMD SIGTEC MD-09 SELCALL (PAI			
OPTSKT	240-10000-02	CONN SMD 24WAY (SKT/CAP)			
Q1	000-10084-81	(S) XSTR SMD BC848BWNPN SOT-323 S			
#R1	038-15470-00	RES 0603 CHIP 47K 1/16W +-5%			
#R2	036-15330-00	RES M/F 0805 CHIP 33K 5%			
#R3	036-16330-00	RES M/F 0805 CHIP 330K 5%			
#R4	038-15470-00	RES 0603 CHIP 47K 1/16W +-5%			
#R5	036-15820-00	RES M/F 0805 CHIP 82K 5%			
#R6	038-14220-00	RES 0603 CHIP 2K2 1/16W +-5%			
#R7	038-14470-00	RES 0603 CHIP 4K7 1/16W +-5%			
#R8	038-15100-00	RES 0603 CHIP 10K 1/16W +-5%			
#R9	036-15220-00	RES M/F 0805 CHIP 22K 5%			
#R10	038-15470-00	RES 0603 CHIP 47K 1/16W +-5%			
R13	038-15150-00	RES 0603 CHIP 15K 1/16W +-5%			
R14	038-16100-00	RES 0603 CHIP 100K 1/16W +-5%			
R15	038-15470-00	RES 0603 CHIP 47K 1/16W +-5%			
R16	038-14220-00	RES 0603 CHIP 2K2 1/16W +-5%			
R18	038-13470-00	RES 0603 CHIP 470E 1/16W +-5%			
#R19	038-13470-00	RES 0603 CHIP 470E 1/16W +-5%			
R21	038-15270-00	RES 0603 CHIP 27K 1/16W +-5%			
R22	038-14330-00	RES 0603 CHIP 3K3 1/16W +-5%			
R24	038-11470-00	RES 0603 CHIP 4E7 1/16W +-5%			
#XL1	274-01064-00	(L) XTAL 5.0125MHZ MINIATURE CYL			
#XL2	274-01065-00	(L) XTAL 8.00MHZ MINIATURE CYL			

### Mechanical & Miscellaneous Parts

220-01313-02	PCB T3000-4400 SELCALL AND DTMF OPTION BOARD
369-00020-50	TAPE SA TESAMOLL 5*3



T2000-36 Selcall PCB (IPN 220-01313-02) - Top Side



T2000-36 Selcall PCB (IPN 220-01313-02) - Bottom Side





## 8.9 T2000-40 DTMF Kit

The T2000-40 DTMF kit provides DTMF dialling facilities for T2020 model T2000 Series II radios. It consists of a small module which is fitted to the control head PCB. Once installed, all parameters (such as tone durations and hold times) can be programmed as required.

### 8.9.1 Fitting

- 1 Remove the four screws from the back of the control head and remove the back cover, taking care not to lose the captive nuts.

Unplug the connecting loom from the control head PCB, if required.

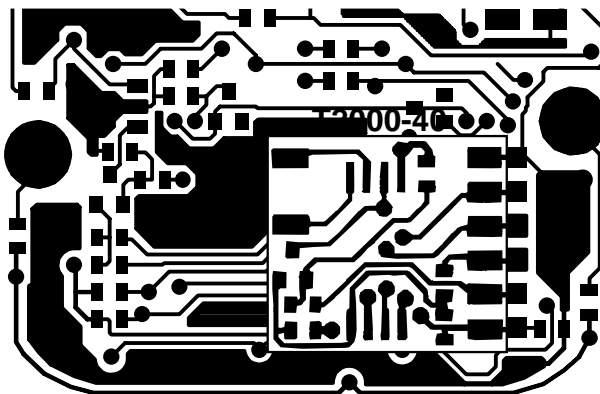
- 2 Refer to the diagram below.

Place the DTMF module flat on the control head PCB in location 'S20' with the component side facing upwards.

Solder in place, checking that each pin is correctly positioned over the appropriate pad.

- 3 Reconnect the loom (if plugged in step 1), refit the loom cable into the cable restraint in the back cover, and screw the cover back into place.

Ensure that the captive nuts are correctly located in the back cover before fitting.



*T2000-40 DTMF Module Mounting - T2020 Control Head PCB (top side)*

### 8.9.2 Programming

The radio must now be programmed with the various DTMF parameters. Refer to the manual supplied with the T2000-20 programming kit for details.







## 8.10 T2000-A450X CTCSS & Scrambler Kit

The T2000-A450X CTCSS and scrambler PCB plugs into an options connector on the top side of the T2000 Series II logic PCB, and can be configured in two ways:

Product Code	Option	T201X	T2020	T203X	T2040	T2050
T2000-A4500	CTCSS	x	x	✓	✓	x
T2000-A4502	Scrambler	✓	✓	✓	✓	✓

The CTCSS option is used in trunked radios, and has 38 independent receive and transmit tones, set by solder links on the T2000-A450X PCB.

The scrambler option can be used in either trunked or conventional radios, and is enabled/disabled by the auxiliary (  ) key (conventional models) or function (  ) key (trunked models). The scrambler uses a simple frequency inversion algorithm that prevents casual eavesdropping by other radio users. After descrambling, the recovered speech suffers from some degradation in clarity.

**Note:** The T2000-A4500 CTCSS kit is only compatible with the following radio and PGM software versions:

Radio	Radio Software Version	PGM Software Version
T2030	3.24 or later	later than 1.44
T2035	3.28 or later	
T2040	5.36 or later	later than 2.57

The following topics are covered in this Section:

Section	Title	Page
8.10.1	Components Required	8.10.2
8.10.2	Fitting	8.10.2
8.10.3	T2000-A450X Link Options	8.10.3
8.10.4	PCB Information	8.10.5

## 8.10.1 Components Required

The T2000-A450X kits contain the following components:

Quantity	Description
1	T2000-A450X PCB assembly
12mm	PVC foam tape

## 8.10.2 Fitting

- 1 Refer to Figure 8.10.1.

Remove the top cover of the radio by unscrewing the four cover screws, unscrew the logic PCB and fold out.

- 2 Select the T2000-A450X link options, as described in Section 8.10.3, "T2000-A450X Link Options".

Position the T2000-A450X PCB as shown, and plug into the connector on the T2000 logic PCB:

Model	PCB IPN	Connector Circuit Reference
T2010 & T2015	220-01377-01 or later	P2
T2020, T203X, T2040 & T2050	220-01344-02 or later	#T3K45

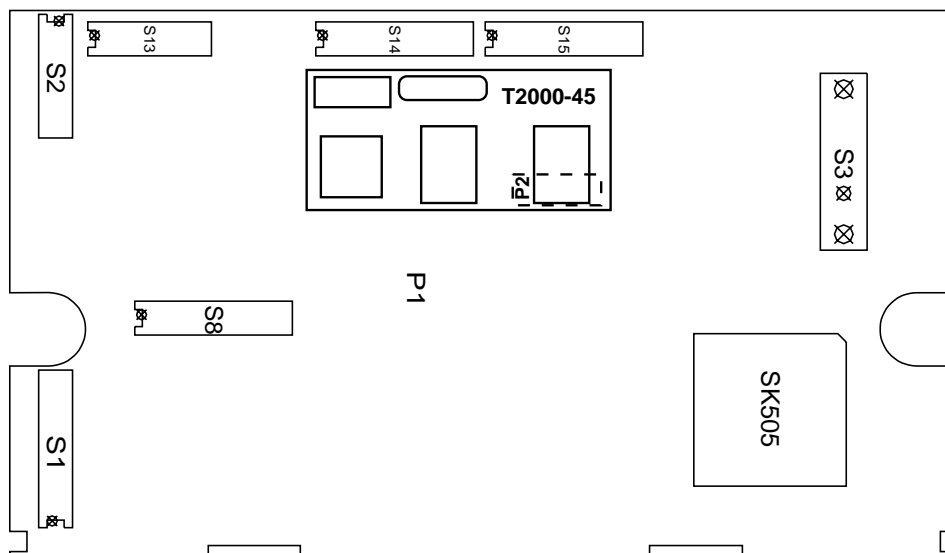


Figure 8.10.1 T2000-A450X PCB Mounting (T201X logic PCB shown)

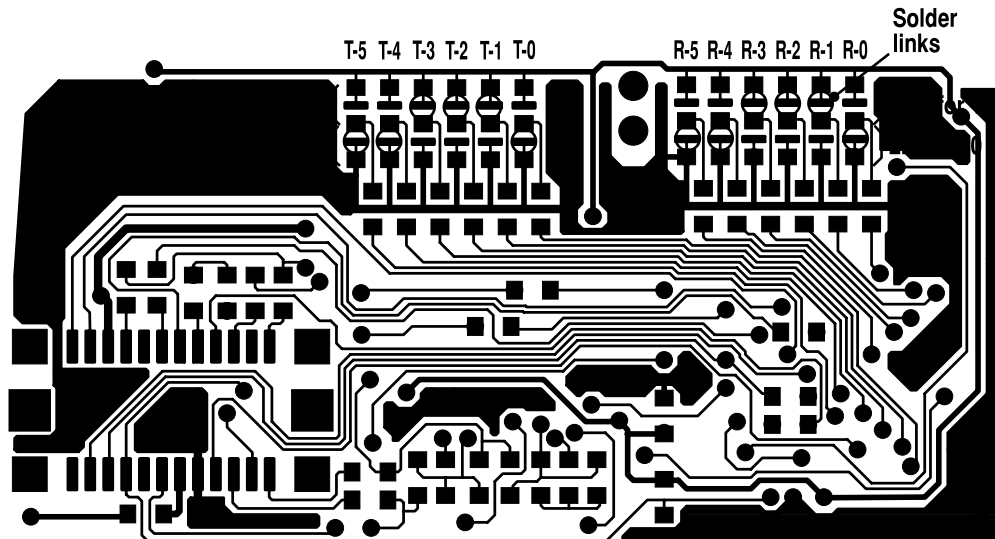
- 2 Position the foam tape provided on top of #IC5, on the T2000-A450X PCB.
- 3 Carefully fold the logic PCB back in position and secure using the three logic PCB retaining screws.  
Refit the top cover.

## 8.10.3 T2000-A450X Link Options

There are 2 groups of links on the underside of the T2000-A4500 PCB, the receive (R) group and the transmit (T) group. Each group contains 6 bits that are pulled logic high or low, by either solder links or zero ohm resistors.

The receive settings are set by links R-0 to R-5 and the transmit settings by links T-0 to T-5. A short to the 5V line represents a '1', and a short to ground represents a '0'.

The following diagram shows the T2000-A450X PCB, with links indicated.



T2000-A450X PCB IPN 220-01335-04 (bottom side):  
links for transmit & receive 110.9Hz CTCSS frequency shown.

### T2000-A4500 CTCSS PCB Links

The following table gives the linking details for the 38 independent transmit and receive CTCSS frequencies.

Tone Number	R-5 T-5	R-4 T-4	R-3 T-3	R-2 T-2	R-1 T-1	R-0 T-0	CTCSS Frequency (Hz)
1	0	0	0	0	0	0	67
2	0	0	0	0	0	1	71.9
3	0	0	0	0	1	0	74.4
4	0	0	0	0	1	1	77
5	0	0	0	1	0	0	79.7
6	0	0	0	1	0	1	82.5
7	0	0	0	1	1	0	85.4
8	0	0	0	1	1	1	88.5
9	0	0	1	0	0	0	91.5
10	0	0	1	0	0	1	94.8
11	0	0	1	0	1	0	97.4
12	0	0	1	0	1	1	100
13	0	0	1	1	0	0	103.5
14	0	0	1	1	0	1	107.2
15	0	0	1	1	1	0	110.9

Tone Number	R-5 T-5	R-4 T-4	R-3 T-3	R-2 T-2	R-1 T-1	R-0 T-0	CTCSS Frequency (Hz)
16	0	0	1	1	1	1	114.8
17	0	1	0	0	0	0	118.8
18	0	1	0	0	0	1	123
19	0	1	0	0	1	0	127.3
20	0	1	0	0	1	1	131.8
21	0	1	0	1	0	0	136.5
22	0	1	0	1	0	1	141.3
23	0	1	0	1	1	0	146.2
24	0	1	0	1	1	1	151.4
25	0	1	1	0	0	0	156.7
26	0	1	1	0	0	1	162.2
27	0	1	1	0	1	0	167.9
28	0	1	1	0	1	1	173.8
29	0	1	1	1	0	0	179.9
30	0	1	1	1	0	1	186.2
31	0	1	1	1	1	0	192.8
32	0	1	1	1	1	1	203.5
33	1	0	0	0	0	0	210.7
34	1	0	0	0	0	1	218.1
35	1	0	0	0	1	0	225.7
36	1	0	0	0	1	1	233.6
37	1	0	0	1	0	0	241.8
38	1	0	0	1	0	1	250.3

### T2000-A4502 Scrambler PCB Links

The T2000-A4502 has the following R settings linked during manufacture. The T settings have no effect.

R-5	R-4	R-3	R-2	R-1	R-0
1	1	1	1	1	1

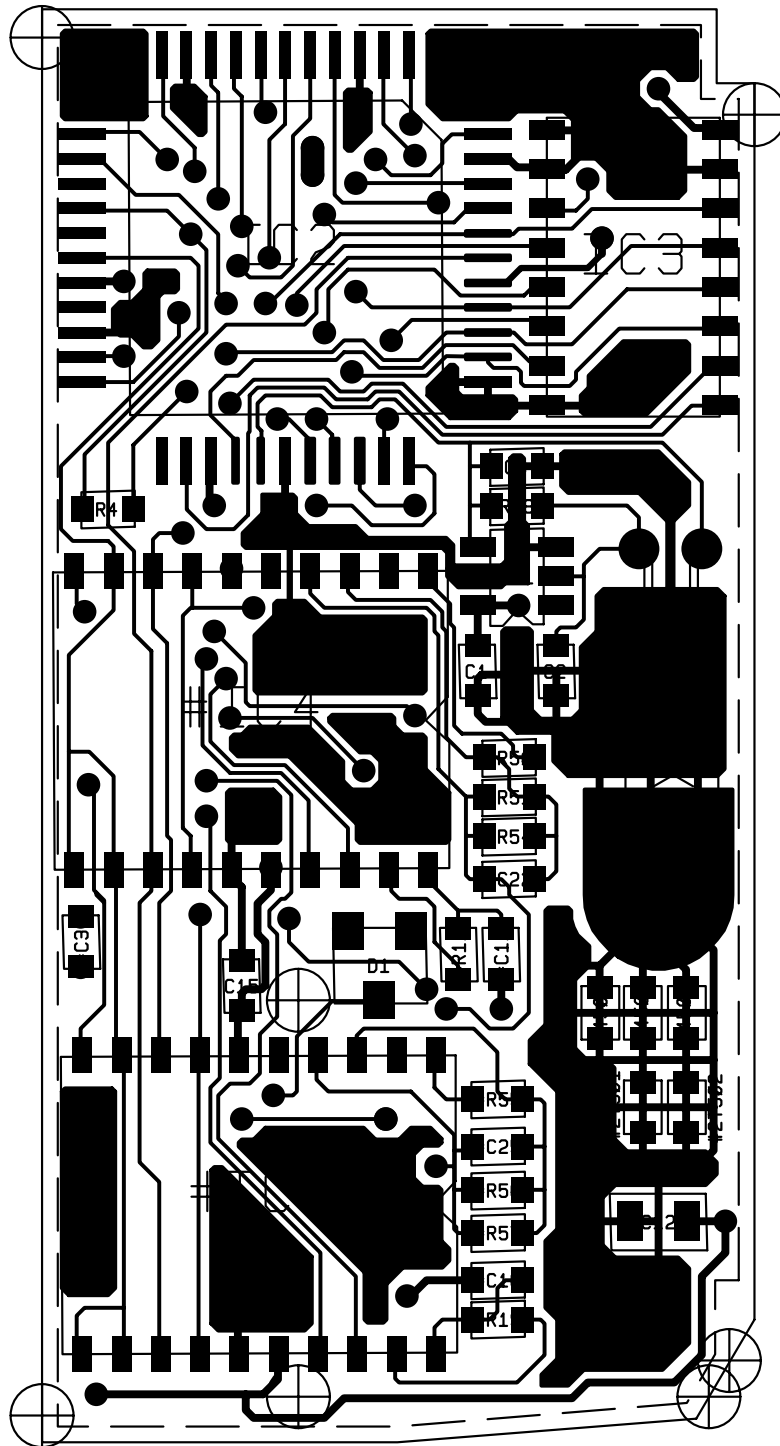
## 8.10.4 PCB Information

### T2000-A450X Parts List (IPN 220-01335-04)

Ref	Var	IPN	Description	Ref	Var	IPN	Description
#4500	CTCSS	038-10000-00	RES 0603 CHIP ZERO OHM 1/16W +	R58		038-17100-00	RES 0603 CHIP 1M 1/16W +5%
#2T502	SCRAM	038-10000-00	RES 0603 CHIP ZERO OHM 1/16W +	#R60	SCRAM	038-11470-00	RES 0603 CHIP 4E7 1/16W +5%
C1		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V	XL1		274-01063-00	(L) XTAL 3.579545MHZ MINITURE CYLINDRICA
C2		018-12330-10	CAP 0603 CHIP 33P 50V NPO +-1%			220-01298-01	(L) PCB FLEXI T3000 OPTIONS LOOM
C3		018-12150-10	CAP 0603 CHIP 15P 50V NPO +-1%			220-01335-04	PCB T3000-4500 CTCSS OPTION BOARD
C6		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V			365-00011-38	LABEL STATIC WARNING YELLOW A4A315
#C11	CTCSS	018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V			365-00011-54	LABEL WHITE RW1556/2 90*24MM SPECIAL AD
#C11	SCRAM	018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16V			369-00020-49	TAPE SA TESAMOLL 9*3 (25 M ROLLS)
C12		015-27100-10	CAP CER 0805 CHIP 1M +80-20% Y5V 16V			369-00020-50	TAPE SA TESAMOLL 6*3MM (25 M ROLLS)
#C13	CTCSS	018-15100-00	CAP 0603 CHIP 10N 50V X7R +-10%			399-00010-86	BAG STATIC SHIELDING 127X203MM
C15		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16V			410-01064-01	PKG HEADER CARD (NEW TAIT LOGO)
#C16	SCRAM	018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16V			418-24500-00	FITTING INS T2000-45 SCRAMBLER KIT
#C22	CTCSS	018-13150-00	CAP 0603 CHIP 150P 50V NPO +-5%				
#C22	SCRAM	018-13150-00	CAP 0603 CHIP 150P 50V NPO +-5%				
#C25	SCRAM	018-13150-00	CAP 0603 CHIP 150P 50V NPO +-5%				
#C30	CTCSS	018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16V				
D1		001-10000-70	(S) DIODE SMD BAV70 DUAL SWITCH SOT-23				
IC1		002-74900-40	(LSH) IC SMD TC7S04F SINGLE INV GATE SO-				
IC2		002-18937-10	LSH) IC SMD Z89371-16FSC OTP DSP 44PIN Q				
IC3		002-74917-30	LSH) IC SMD 74HC173D 4BIT DTYPE REGISTE				
#IC4	CTCSS	002-11454-80	LSH) IC SMD MC145480DW PCM CODEC F				
#IC4	SCRAM	002-11454-80	LSH) IC SMD MC145480DW PCM CODEC F				
#IC5	SCRAM	002-11454-80	LSH) IC SMD MC145480DW PCM CODEC F				
OPTION		240-10000-09	CONN SMD 24WAY (SKT/CAP WITH MTG LUGS				
R1		038-15150-00	RES 0603 CHIP 15K 1/16W +-5%				
R4		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
#R6	CTCSS	038-15470-00	RES 0603 CHIP 47K 1/16W +-5%				
#R6	SCRAM	038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
#R7	CTCSS	038-14330-00	RES 0603 CHIP 3K3 1/16W +-5%				
#R8	SCRAM	038-11470-00	RES 0603 CHIP 4E7 1/16W +-5%				
#R9	CTCSS	038-16470-00	RES 0603 CHIP 470K 1/16W +-5%				
#R9	SCRAM	038-11470-00	RES 0603 CHIP 4E7 1/16W +-5%				
#R10	CTCSS	038-14470-00	RES 0603 CHIP 4K7 1/16W +-5%				
#R10	SCRAM	038-11470-00	RES 0603 CHIP 4E7 1/16W +-5%				
#R11	CTCSS	038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
#R11	SCRAM	038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R13		038-11470-00	RES 0603 CHIP 4E7 1/16W +-5%				
#R15	SCRAM	038-11470-00	RES 0603 CHIP 4E7 1/16W +-5%				
#R17	SCRAM	038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
#R18	SCRAM	038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
#R19	SCRAM	038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
#R22	CTCSS	038-15150-00	RES 0603 CHIP 15K 1/16W +-5%				
#R22	SCRAM	038-15150-00	RES 0603 CHIP 15K 1/16W +-5%				
#R23	SCRAM	038-15150-00	RES 0603 CHIP 15K 1/16W +-5%				
R30		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R31		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R32		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R33		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R34		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R35		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R36		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R37		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R38		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R39		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R40		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R41		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R42		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R43		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R44		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
#R50	CTCSS	038-16100-00	RES 0603 CHIP 100K 1/16W +-5%				
#R50	SCRAM	038-16100-00	RES 0603 CHIP 100K 1/16W +-5%				
#R51	CTCSS	038-16470-00	RES 0603 CHIP 470K 1/16W +-5%				
#R51	SCRAM	038-16100-00	RES 0603 CHIP 100K 1/16W +-5%				
#R53	SCRAM	038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
#R54	CTCSS	038-16220-00	RES 0603 CHIP 220K 1/16W +-5%				
#R55	SCRAM	038-16100-00	RES 0603 CHIP 100K 1/16W +-5%				
#R56	SCRAM	038-16100-00	RES 0603 CHIP 100K 1/16W +-5%				

Variants: CTCSS = CTCSS option  
SCRAM = Scrambler option



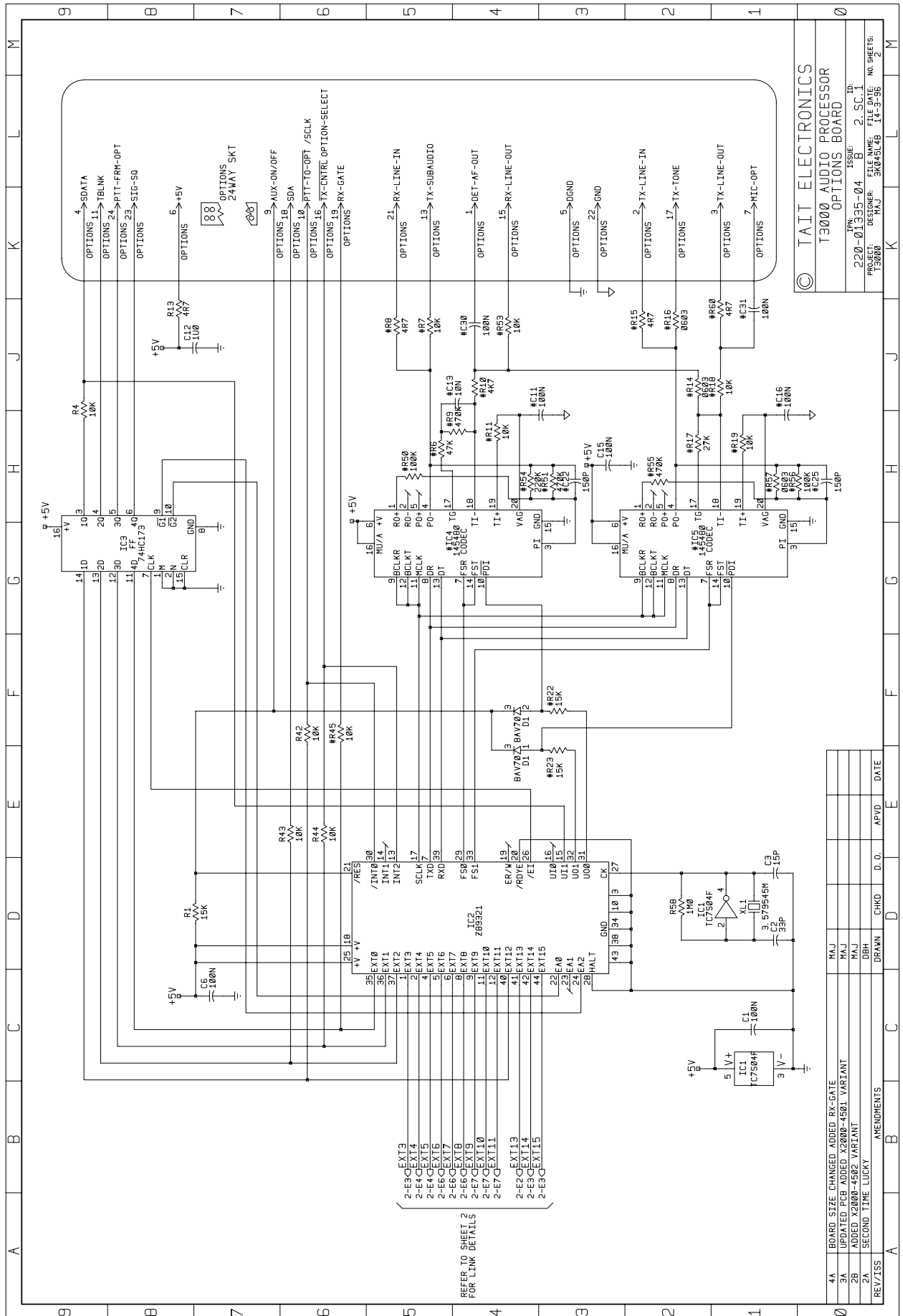


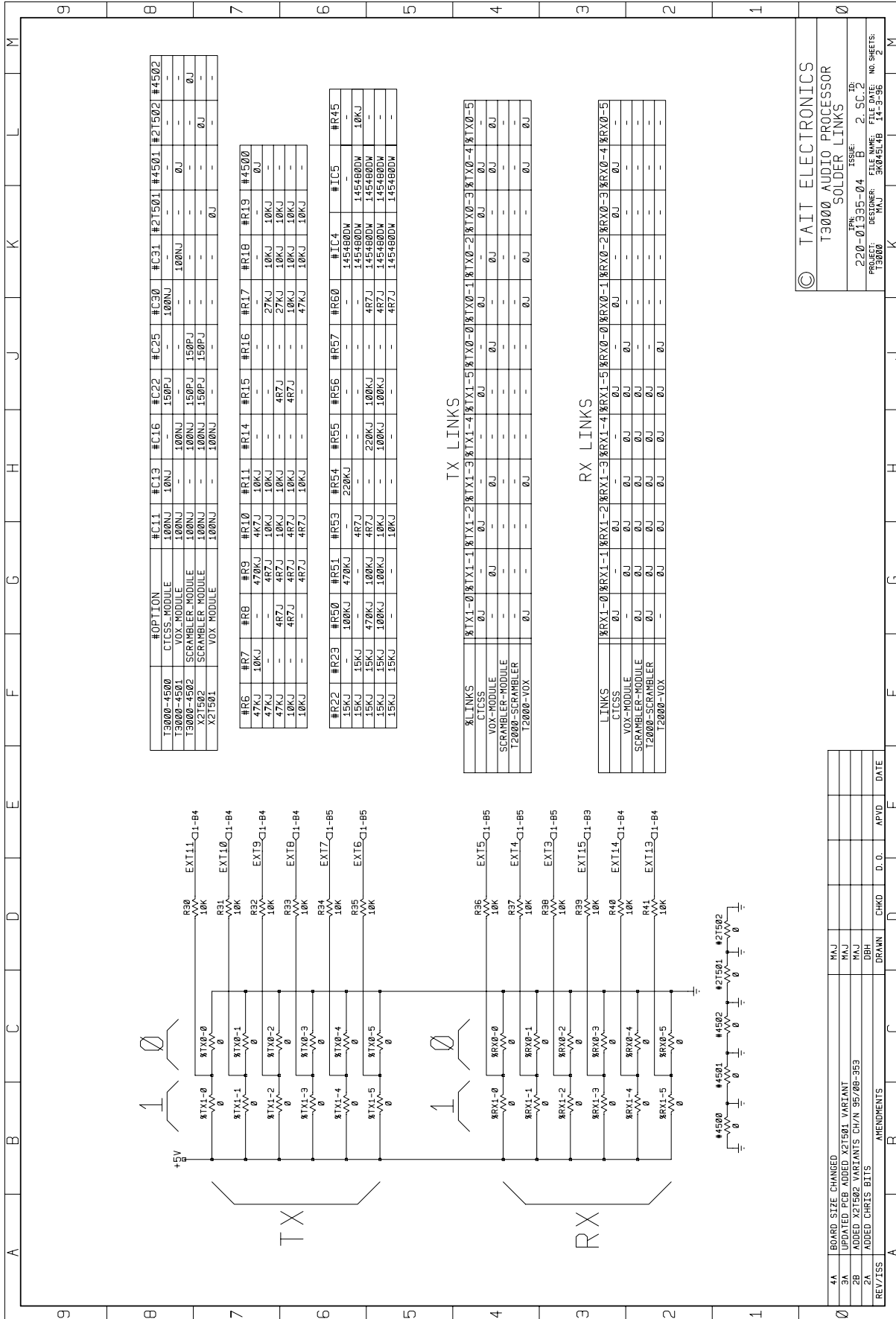
220-01335-04 A

T2000-A450X PCB (IPN 220-01335-04) - Top Side









© TAIT ELECTRONICS  
T3000 AUDIO PROCESSOR  
SOLDER LINKS

PROJECT: 220-01395-04  
DESIGNER: TAJ  
FILE NAME: 3606516  
ISSUE: B  
FILE DATE: 14-3-98  
NO. SHEETS: 2

REV/ISS	CHANGED	D.O.	APVD	DATE
1A	BOARD SIZE CHANGED			
1B	ADDED X21501 VARIANT			
1C	ADDED X21502 VARIANTS			
1D	ADDED X21502 VARIANTS CHN 55/08-2953			
1E	ADDED CHRIS BITS			
1F	AMENDMENTS			
1G				
1H				
1I				
1J				
1K				
1L				
1M				

## 8.11 T2000-50 Handsfree Kit

The T2000-50 handsfree kit is designed for use with all T2000 Series II mobiles, and allows communication through the normal PTT microphone, or 'handsfree' operation through a directional microphone.

When 'handsfree' operation is being used, the transmitter is activated either by the foot-switch (Manually Operated Transmit) or automatically, by detecting the sound of a voice. The latter is known as the Voice Operated Transmit (VOX) mode. VOX operation is only intended for use in quiet modern vehicles.

**Note:** With trunked radios, a call needs to be established before VOX or footswitch becomes operative. Normal handsfree operation can be used on a conventional channel.

The following topics are covered in this Section:

Section	Title	Page
8.11.1	Components Required	8.11.2
8.11.2	Fitting	8.11.2
8.11.3	Fitting The Complete Unit In The Vehicle	8.11.3
8.11.4	T2000-50 Set-Up	8.11.5
8.11.5	Signal Specifications	8.11.7
8.11.6	Specifications	8.11.8
8.11.7	Circuit Description	8.11.8
8.11.8	PCB Information	8.11.10

## 8.11.1 Components Required

The T2000-50 kit contains the following components:

Quantity	Description
1	T2000-50 PCB assembly
1	directional microphone (with optional sunvisor clip or tie clip)
1	footswitch
1	9 way D-range assembly with 2 in-line connectors & microphone socket attached
1	shroud (alternative shroud - not required for T2000 Series II radios)
1	2 way in-line connector
3	M3x8 pan Pozi Taptite screws
2	4-40x¼ pan Pozi Taptite screws (black)

## 8.11.2 Fitting

- 1 Refer to Figure 8.11.1.

Remove the top cover of the radio by unscrewing the four cover screws, unclip the D-range blanking plate in the rear of the T2000 radio, unscrew the logic PCB and fold-out.

Position the T2000-50 PCB as shown, and connect the Micromatch connectors P13 and P14 to S13 and S14 on the T2000 logic PCB.

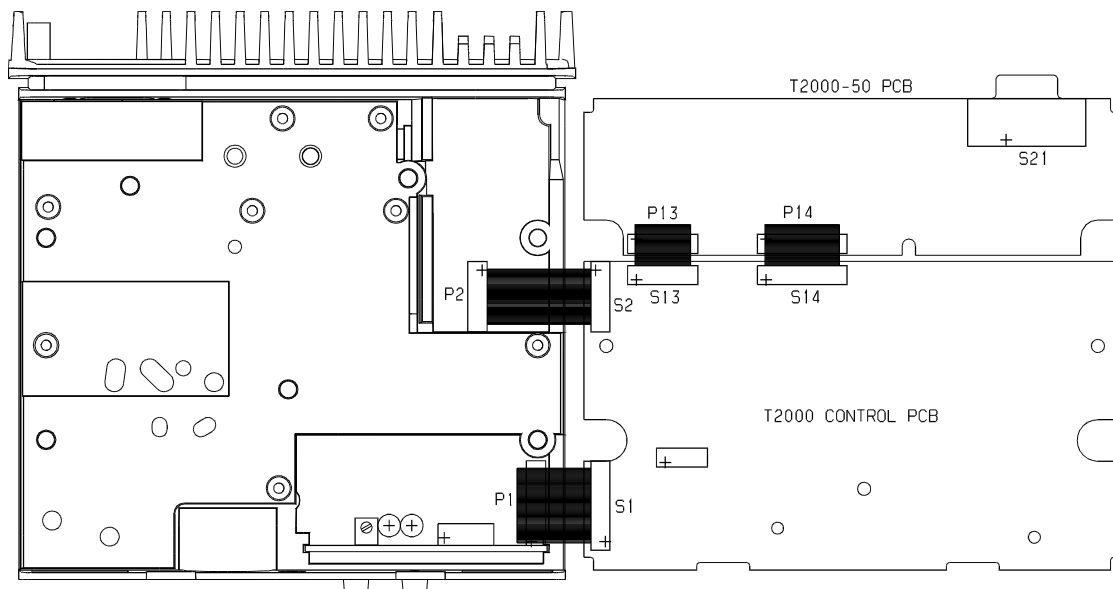


Figure 8.11.1 T2000-50 Handsfree PCB Mounting

- 2 **T2010 & T2015:** Remove R513 (0Ω resistor) on the logic PCB.

- 3 After manufacture, the T2000-50 PCB links are left open and will need to be customer selected. For details of optional links, refer to the Link Options Table in the circuit diagram.

Non-trunked radios: standard links are 4B and 5A.

- 4 Set up the T2000-50, as described in Section 8.11.4, "T2000-50 Set-Up".

A +5V logic signal is provided to indicate VOX activity (S21 pin 7). 'VOX' (violet wire) and 'ground' (grey wire) are both available from the D-range assembly red in-line connector.

A spare in-line connector is also included in the kit for interfacing to an appropriate visual indicator e.g. an LED.

- 5 Carefully fold the logic and T2000-50 PCBs back in position, guiding the D-range connector through the hole provided in the T2000 chassis.

Check that no electrolytic capacitors are touching the T2000 chassis (e.g. C21 or C51.)

- 6 Secure using the three logic PCB retaining screws and the three M3x8 screws provided and refit the top cover.

Plug the D-range assembly provided in the kit into the D-range connector (S21).

**Note:** Holes are provided in the T2000 chassis for the D-range plug locking screws. Use the two black 4-40x¼ Taptite screws provided in the kit to form the threads.

## 8.11.3 Fitting The Complete Unit In The Vehicle

### Microphone Mounting

The handsfree directional microphone plugs into the T2000 via the D-range assembly microphone socket. The positioning of the microphone is important for correct operation of the handsfree unit and some experimentation may be necessary to obtain the best performance from the VOX.



- The microphone should be mounted in a position 20cm or less from the driver.
- The microphone location should be free from vibration.
- The microphone must face the driver.

### Footswitch Mounting

The footswitch plugs into the D-range interface via the black 2 way in-line connector. It is recommended that the footswitch be screwed to the floor.

**Note:** The 3m lengths of the footswitch and microphone can be effectively extended by fitting a standard 9 way D-range extender cable between the radio and the D-range assembly. These extension cables are not included as standard but are available from most computer outlets.

## Radio Programming

The radio may need reprogramming to accommodate the handsfree unit. The **auxiliary** key  for the T2010, T2015 and T2020 or the **function** key  for trunked radios must be programmed for latching if VOX mode is to be used. Refer to the T2000 programming manual.

For T203X and T2040 radios, the 'handsfree' option will also need to be selected under 'Specifications' (refer to the 'Specifications' section of the programming manual).

## Vox Sensitivity

Although the VOX circuitry has been designed to operate in varying conditions, it may be necessary to change the minimum threshold for VOX operation.

Monitor TP5 without the directional microphone connected and adjust RV67. Turning RV67 clockwise increases sensitivity, and anticlockwise decreases sensitivity.

**Note:** For the majority of applications, it is recommended that the setting is left at the factory setting of 0.8V.

## 8.11.4 T2000-50 Set-Up

### Test Equipment Required

**Note:** T2000-50 set-up should only be necessary after major repair.

- AF signal generator
- modulation analyser
- high impedance voltmeter (e.g. VTVM)
- oscilloscope
- power supply (+13.8V)
- RF power meter or load
- 30dB RF attenuator

The following diagram shows a typical test set-up.

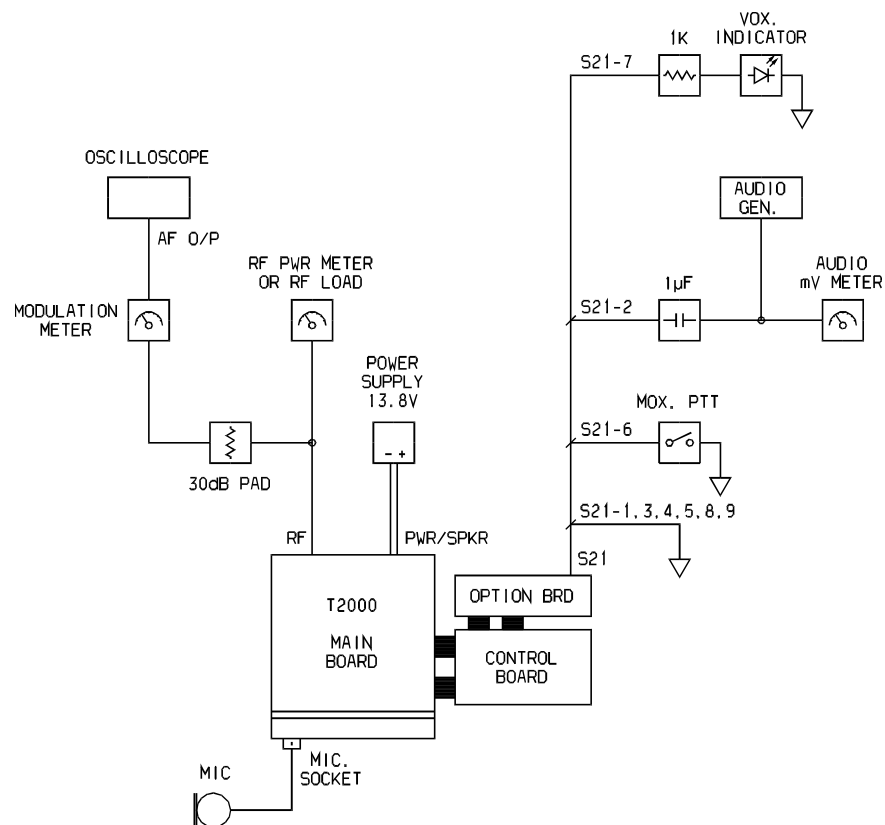


Figure 8.11.2 Test Equipment Set-Up

### Test

- 1 Set up the equipment as shown in Figure 8.11.2, and set the audio generator to 1kHz at a level of 0.8mV.

Switch on the T2000 and check the increase in current with the T2000-50 fitted is less than 30mA.

- 2 Switch on the MOX (Manually Operated Transmit) PTT and check that the modulation is at approximately 60% of full system deviation. Check that no audio path is evident through the normal microphone.

Activate the PTT on the normal microphone and check that there is now an audio path through the microphone.

- 3 With no audio, adjust RV67 for 0.8V at TP5.

Remove the TCXO PCB to operate the /IN-LOCK signal and check that the DC level now goes to 6.5V  $\pm$ 0.5V. Replace the TCXO.

- 4 Increase the audio level by 10dB.

With all PTTs off, activate the auxiliary  $\text{\textcircled{A}}$  or function  $\text{\textcircled{Fn}}$  keys (radio is in VOX mode).

Sweep the audio generator slowly from 1kHz to 100Hz and back again and check that the transmitter keys between 700Hz  $\pm$ 70Hz and 250Hz  $\pm$ 25Hz.

When going from receive to transmit the radio should key instantly at these cut-offs. When going from transmit to receive check there is a delay of approximately 1.5 seconds.

Check that VOX transmit is inhibited if the channel is busy (assuming LINK4B is fitted).

- 5 Switch on the MOX PTT and set the audio generator to 1kHz at a level of -50dBm (3mV).

Monitor TP9 and check that the level on the scope is 1.2Vp-p  $\pm$ 0.2V.

Increase the audio level by 10dB and check that the level on the scope is about the same.

Decrease audio level by 20dB. After observing the charging action of the compressor, the level on the scope should be 0.4Vp-p  $\pm$ 0.1V.

**Trunking only:** The audio at TP9 should be there on an assigned channel, a non-trunked channel or in test mode. When the radio is on a control channel or hunting for a control channel, the audio should be muted.

- 6 A final system check can be done with the directional microphone and footswitch.



## 8.11.5 Signal Specifications

The following table describes S21 pin-outs, and relevant interface signals on S13 and S14 (T2000 logic PCB). S21 is the 9 way D-type connector mounted on the heatsink at the rear of the radio.

Pin No.	Signal	Description	Level
S21-1	GND		
S21-2	MIC	Input for directional mic. audio	
S21-3	GND		
S21-4	GND		
S21-5	GND		
S21-6	FT-SWTCH	Requests handsfree transmit.	
S21-7	VOX	Output signalling valid VOX operation.	
S21-8	GND		
S21-9	GND		
S13-6	TX-LINE-IN	Electret microphone audio switched in during handsfree transmit.	300mVp-p at 60% mod. 1kHz
S13-7	RX-GTD-AF	Used to provide VOX trunking inhibit for received speech.	110mVrms at 60% mod. 1kHz
S13-11	OPTIONS-GND	Provides the ground for the options circuitry.	
S14-1	+13.8V	Powers the +8V regulator used to supply audio circuitry	10.8V to 16V DC available current 200mA
S14-2	+5V	Used to supply power for the logic circuitry.	available current 150mA
S14-3	BUSY	Used to mute invalid audio when transmitter has been inhibited.	carrier detect 0V = busy
S14-5	/PTT-TO-OPT	Echoed to S14-6 for normal PTT request. Switches off S13-6.	5V pull-up 0V = Tx
S14-6	/PTT-FRM-OPT	Provides the signal for the radio to transmit.	5V CMOS 0V = Tx
S14-7	/IN-LOCK	Used to inhibit VOX Tx requests when the radio is out of lock.	synthesiser lock detect 0V = lock (lock-up time <20ms)
S14-11	CALL-SW	Used by trunking software to mute invalid audio.	5V CMOS 5V = mute

The following diagram shows the pin designations of S21, viewed from the rear of the radio.

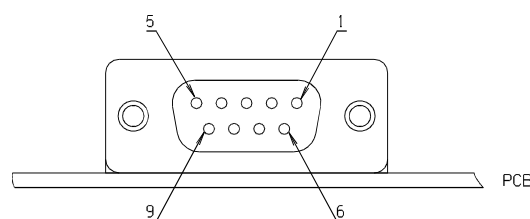


Figure 8.11.3 9 Way D-Range Connector (S21)

## 8.11.6 Specifications

Current	.. <30mA
Operating Temperature Range	.. -30 to +60°C ambient
Audio:	
Input For 60% Deviation	.. 1mVrms ± 0.1mV (1kHz, 600Ω)
Microphone	.. uni-directional electret
Microphone sensitivity	.. -67dB ±3db (0dB = 1V/μbar)
Distortion	.. <5%
Delay From Audio To PTT Request	.. 20ms (typical)

## 8.11.7 Circuit Description

Audio is fed into the preamplifier circuitry (Q1) from the electret microphone via pin 2 of the 9 way D-range (S21). The pre-amplified audio is then split and goes into the speech bandpass filter and the noise filter.

The speech bandpass filter consists of a 4th order 250Hz high pass filter (IC1) and a gain stage (IC1) with a 3kHz rolloff. Audio then goes into the compressor circuitry (IC1). When PTT is requested by the logic circuitry, IC2 switches and the audio is driven into the TX-LINE-IN at a low impedance. After the high pass filter, audio is tapped off into the speech VOX filter (IC4), which provides a low pass cutoff of 700Hz. This, combined with the previous high pass filter, gives the speech VOX filter cutoffs of 250Hz and 700Hz.

The second path of the audio after the preamplifier is to the noise filter (IC3). This consists of a 2nd order high pass filter below 100Hz.

After the gain adjusting stages (IC3 & IC4) each filter goes into a precision rectifier (IC3 & IC4), where their appropriate DC level is presented to a comparator (IC3 pins 12, 13 & 14). The negative input has a potentiometer (RV67) providing a DC offset, which is used to provide a minimum VOX threshold. This minimum threshold decreases with VOX activity to provide some hysteresis. The negative input is also held high via IC2, preventing the comparator switching until the synthesiser lock detect line (IN/LOCK) is low. The positive input has a zener diode to prevent VOX activating when both inputs are in saturation.

The switching circuitry after the comparator output has a slow decay provided by R69 and C31. IC5 will only allow a VOX PTT request if the AUX line has been taken high. Two NAND gates in IC5 allow a handsfree PTT request (VOX or MOX) to proceed unless the PTT-IN line has been taken low. A valid handsfree PTT request will mute the ordinary microphone and switch IC2, whereas a PTT-IN signal will be mirrored on the PTT line, without switching in the handsfree audio or muting the ordinary microphone.

The CALL line is used by trunking software to mute the handsfree audio when the audio path has been invalidly switched in (i.e. on a control channel). Similarly, the BUSY line is used to mute the audio if TX inhibit on busy is used.

## **Trunking Continuous Carrier Systems**

Optional circuitry is provided by IC7 to inhibit the VOX signal from the received audio, instead of BUSY. LINK4 is removed to disable the BUSY inhibit and the RX-AUDIO inhibit is enabled by changing LINK5A to LINK5B.

Receiver gated audio is buffered by IC7 pins 12, 13 & 14 and split off to feed into the VOX noise path (IC3 pins 5, 6 & 7) and also to a precision rectifier formed around IC7, pins 1, 2 & 3. The rectified audio signal is compared by IC7 pins 5, 6 & 7, and operates the inhibit circuit, Q14.

## 8.11.8 PCB Information

## T2000-50 Parts List (IPN 220-01210-03)

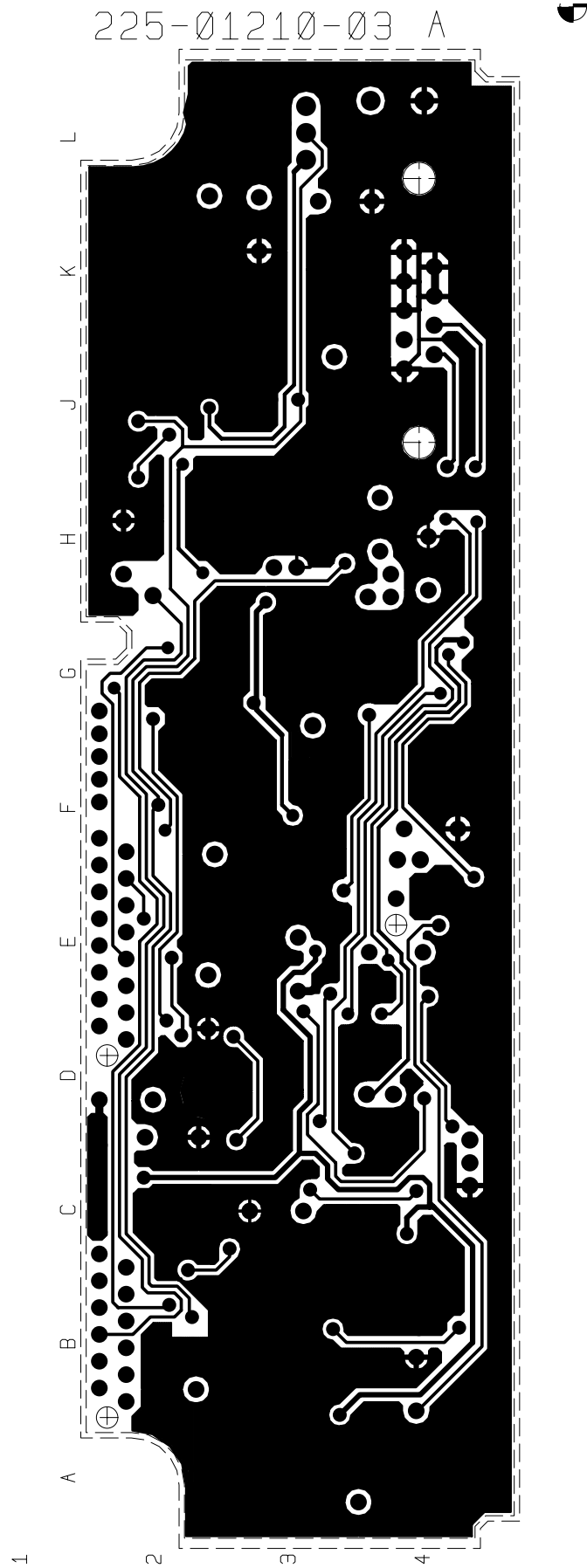
Ref	IPN	Description	Ref	IPN	Description
C1	020-57470-10	CAP ELECT AI RDL 4U7 50V LO ESR	IC1	002-10003-24	(S) IC SMD 324 QUAD OP AMP SO14
C2	015-25220-08	CAP CER 0805 CHIP 22N 10% X7R 50V	IC2	002-10040-53	(S) IC 4053 SMD TRIPLE 2CH MULTI-PLRXR
C2A	015-25100-08	CAP CER 0805 CHIP 10N 10% X7R 50V	IC3	002-10003-24	(S) IC SMD 324 QUAD OP AMP SO14
C3	015-24470-08	CAP CER 0805 CHIP 4N7 10% X7R 50V			
C4	020-58470-05	CAP ELECT AI RDL 47M 16V 6.3X7MM	IC4	002-10003-24	(S) IC SMD 324 QUAD OP AMP SO14
C5	015-25150-08	CAP CER 0805 CHIP 15N 10% X7R 50V	IC5	002-74900-00	(S) IC SMD 74HC00 QUAD 2 I/P NAND
C6	015-25150-08	CAP CER 0805 CHIP 15N 10% X7R 50V	IC6	002-10078-08	(S) IC SMD 78L08 8V REG SO8
C7	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	IC7	002-10003-24	(S) IC SMD 324 QUAD OP AMP SO14
C8	015-06100-08	CAP CER 0805 CHIP 15N 10% X7R 50V	IC8	002-00014-62	(S) IC 317L 100MA REG 3 TERMINAL TO-92
C9	015-25150-08	CAP CER 0805 CHIP 15N 10% X7R 50V			
C10	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	P13	240-00026-26	CONN PADLE BRD 12 WAY MICRO MATCH 1-215
C11	015-23680-08	CAP CER 0805 CHIP 680P 10% X7R 50V	P13A	240-00020-51	PLUG 12 WAY 2*6 FLAT CABLE TERMN
C12	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	P14	240-00026-24	CONN PADLE BRD 16 WAY MICRO MATCH 1-215
C13	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	P14A	240-00020-54	PLUG 16 WAY 2X8 FLAT CABLE TERMN MICROM
C14	015-21470-01	CAP CER 0805 CHIP 4P7 +/-0.25P NPO 50V			
C15	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	Q1	000-10008-48	(S) XSTR SMD BCW60/BC848B215 NPN SOT23 A
C16	020-58470-05	CAP ELECT AI RDL 47M 16V 6.3X7MM	Q2	000-10008-48	(S) XSTR SMD BCW60/BC848B215 NPN SOT23 A
C17	020-58470-05	CAP ELECT AI RDL 47M 16V 6.3X7MM	Q3	000-10008-57	(S) XSTR SMD BCW70/BC857-215 PNP SOT23 AF
C18	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	Q4	000-10008-48	(S) XSTR SMD BCW60/BC848B215 NPN SOT23 A
C19	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	Q5	000-10008-48	(S) XSTR SMD BCW60/BC848B215 NPN SOT23 A
C20	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	Q6	000-10008-48	(S) XSTR SMD BCW60/BC848B215 NPN SOT23 A
C21	020-57470-10	CAP ELECT AI RDL 4U7 50V LO ESR	Q7	000-10008-57	(S) XSTR SMD BCW70/BC857-215 PNP SOT23 AF
C22	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	Q8	000-10008-57	(S) XSTR SMD BCW70/BC857-215 PNP SOT23 AF
C23	020-58470-05	CAP ELECT AI RDL 47M 16V 6.3X7MM	Q9	000-10008-48	(S) XSTR SMD BCW60/BC848B215 NPN SOT23 A
C25	015-25150-08	CAP CER 0805 CHIP 15N 10% X7R 50V	Q10	000-10008-57	(S) XSTR SMD BCW70/BC857-215 PNP SOT23 AF
C26	015-25150-08	CAP CER 0805 CHIP 15N 10% X7R 50V	Q11	000-10008-48	(S) XSTR SMD BCW60/BC848B215 NPN SOT23 A
C27	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	Q12	000-10008-48	(S) XSTR SMD BCW60/BC848B215 NPN SOT23 A
C28	020-57470-10	CAP ELECT AI RDL 4U7 50V LO ESR	Q13	000-10008-57	(S) XSTR SMD BCW70/BC857-215 PNP SOT23 AF
C29	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	Q14	000-10008-48	(S) XSTR SMD BCW60/BC848B215 NPN SOT23 A
C30	020-57470-10	CAP ELECT AI RDL 4U7 50V LO ESR			
C31	020-58100-04	CAP ELECT AI RDL 10M 16V 4X7MM	R1	036-14470-00	RES M/F 0805 CHIP 4K7 5%
C32	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	R2	036-14270-00	RES M/F 0805 CHIP 2K7 5%
C33	015-25150-08	CAP CER 0805 CHIP 15N 10% X7R 50V	R3	036-14100-00	RES M/F 0805 CHIP 1K 5%
C34	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	R4	036-14680-00	RES M/F 0805 CHIP 6K8 5%
C35	015-25150-08	CAP CER 0805 CHIP 15N 10% X7R 50V	R5	036-14270-00	RES M/F 0805 CHIP 2K7 5%
C36	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	R6	036-15100-00	RES M/F 0805 CHIP 10K 5%
C37	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	R7	036-13220-00	RES M/F 0805 CHIP 220E 5%
C38	020-57470-10	CAP ELECT AI RDL 4U7 50V LO ESR	R8	036-14220-00	RES M/F 0805 CHIP 2K2 5%
C39	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	R9	036-15390-00	RES M/F 0805 CHIP 39K 5%
C40	015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V	R10	036-15330-00	RES M/F 0805 CHIP 33K 5%
C40A	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	R11	036-15470-00	RES M/F 0805 CHIP 47K 5%
C41	015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V	R13	036-15100-00	RES M/F 0805 CHIP 10K 5%
C41A	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	R14	036-15820-00	RES M/F 0805 CHIP 82K 5%
C42	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	R15	036-15150-00	RES M/F 0805 CHIP 15K 5%
C43	020-57470-10	CAP ELECT AI RDL 4U7 50V LO ESR	R16	036-14100-00	RES M/F 0805 CHIP 1K 5%
C44	015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V	R17	036-16100-00	RES M/F 0805 CHIP 100K 5%
C45	015-25150-08	CAP CER 0805 CHIP 15N 10% X7R 50V	R18	036-15100-00	RES M/F 0805 CHIP 10K 5%
C46	015-25150-08	CAP CER 0805 CHIP 15N 10% X7R 50V	R19	036-15100-00	RES M/F 0805 CHIP 10K 5%
C47	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	R20	036-12100-00	RES M/F 0805 CHIP 10E 5%
C48	015-24100-08	CAP CER 0805 CHIP 1N 10% X7R 50V	R21	036-15100-00	RES M/F 0805 CHIP 10K 5%
C49	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	R22	036-16100-00	RES M/F 0805 CHIP 100K 5%
C50	015-25100-08	CAP CER 0805 CHIP 10N 10% X7R 50V	R23	036-15100-00	RES M/F 0805 CHIP 10K 5%
C51	020-57100-55	CAP ELECT AI RDL 1UF 50V 4X7MM	R24	036-15470-00	RES M/F 0805 CHIP 47K 5%
C52	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	R25	036-15220-00	RES M/F 0805 CHIP 22K 5%
C53	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	R26	036-17100-00	RES M/F 0805 CHIP 1M 5%
C54	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	R27	036-17100-00	RES M/F 0805 CHIP 1M 5%
C55	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	R28	036-17100-00	RES M/F 0805 CHIP 1M 5%
C56	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	R29	036-15100-00	RES M/F 0805 CHIP 10K 5%
C57	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	R30	036-14180-00	RES M/F 0805 CHIP 1K8 5%
C58	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	R31	036-17100-00	RES M/F 0805 CHIP 1M 5%
C59	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	R32	036-15100-00	RES M/F 0805 CHIP 10K 5%
C60	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	R33	036-14270-00	RES M/F 0805 CHIP 2K7 5%
C61	020-57470-10	CAP ELECT AI RDL 4U7 50V LO ESR	R34	036-14470-00	RES M/F 0805 CHIP 4K7 5%
C62	015-23150-01	CAP CER 0805 CHIP 150P 5% NPO 50V	R35	036-10000-00	RES M/F 0805 CHIP ZERO OHM
C63	015-25100-08	CAP CER 0805 CHIP 10N 10% X7R 50V	R36	036-16150-00	RES M/F 0805 CHIP 150K 5%
C64	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	R37	036-14100-00	RES M/F 0805 CHIP 1K 5%
D1	001-10000-99	(S) DIODE SMD BAV99 DUAL SWTCH SINGLE SO	R38	036-16100-00	RES M/F 0805 CHIP 100K 5%
D2	001-10000-99	(S) DIODE SMD BAV99 DUAL SWTCH SINGLE SO	R39	036-16220-00	RES M/F 0805 CHIP 220K 5%
D3	001-10000-99	(S) DIODE SMD BAV99 DUAL SWTCH SINGLE SO	R40	036-17100-00	RES M/F 0805 CHIP 1M 5%
D4	001-10084-51	(S) DIODE ZENER SMD BZX84C5V1 SOT23	R41	036-14100-00	RES M/F 0805 CHIP 1K 5%
D5	001-10000-99	(S) DIODE SMD BAV99 DUAL SWTCH SINGLE SO	R42	036-15100-00	RES M/F 0805 CHIP 10K 5%
D6	001-10000-99	(S) DIODE SMD BAV99 DUAL SWTCH SINGLE SO	R43	036-16100-00	RES M/F 0805 CHIP 100K 5%
D7	001-10084-36	(S) DIODE ZENER SMD BZX84C3V6 SOT23	R44	036-15470-00	RES M/F 0805 CHIP 47K 5%
D8	001-10000-99	(S) DIODE SMD BAV99 DUAL SWTCH SINGLE SO	R45	036-14100-00	RES M/F 0805 CHIP 1K 5%
			R46	036-13470-00	RES M/F 0805 CHIP 470E 5%



## T2000-50 Grid Reference Index (IPN 220-01210-03)

Device	PCB	Circuit	Device	PCB	Circuit	Device	PCB	Circuit	Device	PCB	Circuit
C1	1:L3	1-B9				Q7	1:E3	1-K5	R74	1:E3	1-K4
C2	1:K3	1-B8				Q8	1:D3	1-P5	R75	1:D4	1-L5
C2A	1:K3	1-B8	IC1	1:J3	1-Q0	Q9	1:D3	1-Q5	R76	1:G4	1-M7
C3	1:K2	1-C7			1-E7	Q10	1:D4	1-K3	R77	1:D4	1-N2
C4	1:K3	1-B8			1-F7	Q11	1:G4	1-G6	R78	1:D3	1-N5
C5	1:L2	1-C8			1-H8	Q12	1:E4	1-C3	R79	1:C3	1-R5
C6	1:L2	1-D8	IC2	1:G3	1-K8	Q13	1:G4	1-R4	R80	1:D3	1-P4
C7	1:J2	1-C9			1-M9	Q14	1:E2	1-J3	R81	1:D3	1-Q5
C8	1:J2	1-E8			1-F6	R1	1:K3	1-A9	R82	1:D3	1-Q5
C9	1:K2	1-F8			1-E6	R2	1:L3	1-C9	R83	1:D4	1-L3
C10	1:B4	1-R1	IC3	1:F3	1-R0	R3	1:K3	1-B8	R83A	1:C4	1-L2
C11	1:J3	1-H8			1-B5	R4	1:K3	1-B8	R84	1:B2	1-K1
C12	1:K3	1-H8			1-C5	R5	1:K2	1-B7	R85	1:B3	1-K1
C13	1:J3	1-J8			1-E4	R6	1:K3	1-C8	R86	1:B3	1-J0
C14	1:H3	1-K9			1-G5	R7	1:L3	1-C9	R87	1:B3	1-H0
C15	1:J3	1-J7	IC4	1:B3	1-R0	R8	1:L3	1-C8	R88	1:B3	1-H1
C16	1:H2	1-K7			1-D0	R9	1:J2	1-D7	R89	1:B3	1-H0
C17	1:H4	1-K7			1-F1	R10	1:K2	1-E9	R90	1:B4	1-G1
C18	1:G2	1-N9			1-H1	R11	1:H4	1-P3	R91	1:B4	1-G0
C19	1:H2	1-N9			1-J0	R13	1:K2	1-E7	R92	1:B3	1-J0
C20	1:C2	1-L0	IC5	1:D3	1-S0	R14	1:J2	1-F7	R93	1:A3	1-F1
C21	1:D2	1-P5			1-L5	R15	1:K2	1-F9	R94	1:A3	1-F1
C22	1:C2	1-M0			1-M4	R16	1:G4	1-P4	R95	1:A3	1-F1
C23	1:D2	1-M0		1-N5		R17	1:J2	1-K2	R96	1:A2	1-F2
C24	1:F3	1-G6			1-P5	R18	1:K2	1-F7	R97	1:A3	1-E1
C25	1:F2	1-B6	IC6	1:C2	1-L0	R19	1:J3	1-G9	R98	1:A3	1-E0
C26	1:F2	1-B6	IC7	1:C4	1-Q0	R20	1:C2	1-L0	R99	1:A3	1-E0
C27	1:E2	1-C5			1-Q7	R21	1:J3	1-G7	R100	1:A4	1-D0
C28	1:L4	1-N1			1-N6	R22	1:K3	1-H8	R101	1:A4	1-D0
C29	1:G3	1-D5			1-P8	R23	1:J3	1-H7	R102	1:A4	1-C0
C30	1:F4	1-F4			1-N0	R24	1:J3	1-J8	R103	1:A4	1-C0
C31	1:E3	1-H4	IC8	1:L3	1-M2	R25	1:J3	1-J8	R104	1:A4	1-C0
C32	1:H2	1-K4	LNK1	1:F2	1-Q2	R26	1:J4	1-J7	R105	1:A4	1-B0
C33	1:A3	1-K0	LNK1A	1:G2	1-P2	R27	1:H3	1-K8	R106	1:E4	1-K2
C34	1:L3	1-L1	LNK1B	1:G2	1-Q2	R28	1:J3	1-K9	R107	1:H5	1-B2
C35	1:B3	1-H1	LNK1C	1:F2	1-Q2	R29	1:J3	1-K8	R108	1:H4	1-B3
C36	1:B2	1-G1	LNK1D	1:F2	1-Q2	R30	1:H2	1-K7	R109	1:E4	1-C3
C37	1:A3	1-E0	LNK2	1:H3	1-L7	R31	1:H3	1-K7	R110	1:E5	1-D3
C38	1:B4	1-B0	LNK2A	1:H3	1-L7	R32	1:H3	1-L8	R111	1:G4	1-R4
C39	1:F3	1-E5	LNK3	1:D4	1-M4	R33	1:H2	1-L9	R112	1:D3	1-L3
C40	1:H4	1-B2	LNK3A	1:D4	1-M4	R34	1:H3	1-L7	R113	1:H3	1-M3
C40A	1:H5	1-A2	LNK4	1:H4	1-N4	R35	1:H3	1-L7	R114	1:B3	1-J1
C41	1:H4	1-B3	LNK4A	1:H4	1-N4	R36	1:H3	1-L7	R115	1:G4	1-R4
C41A	1:H4	1-A3	LNK4B	1:H4	1-N4	R37	1:H3	1-M7	R116	1:B4	1-Q9
C42	1:A4	1-D0	LNK5	1:C4	1-Q8	R38	1:G4	1-M8	R117	1:B4	1-R6
C43	1:H4	1-P3	LNK5A	1:C4	1-Q8	R39	1:G4	1-H6	R118	1:C3	1-Q6
C44	1:K4	1-A8	LNK5B	1:D4	1-R8	R40	1:H2	1-M9	R119	1:C3	1-P7
C45	1:B4	1-H0	P13	1:B2	1-R9	R41	1:H3	1-M3	R120	1:C3	1-P6
C46	1:B3	1-G0			1-R8	R42	1:H3	1-M8	R121	1:C3	1-N7
C47	1:L3	1-L1			1-R8	R43	1:G4	1-G6	R122	1:C3	1-N6
C48	1:L3	1-M1			1-R9	R44	1:E4	1-G3	R123	1:C4	1-N7
C49	1:L3	1-N1			1-R7	R45	1:L3	1-M1	R124	1:C4	1-N7
C50	1:C4	1-Q8			1-R7	R46	1:L3	1-M2	R125	1:C4	1-M6
C51	1:C3	1-P6			1-R6	R47	1:F3	1-A6	R126	1:D4	1-K4
C52	1:G4	1-P7			1-R9	R48	1:F2	1-B6	R127	1:E2	1-J3
C53	1:H3	1-L8			1-R7	R49	1:F3	1-B4	R128	1:E3	1-J4
C54	1:B2	1-G1			1-R7	R50	1:F3	1-B4	R129	1:E3	1-H5
C55	1:G3	1-P0			1-R8	R51	1:F2	1-B5	R131	1:B4	1-R7
C56	1:B4	1-B6			1-R8	R52	1:F4	1-F4	R132	1:B5	1-Q7
C57	1:F2	1-C6	P14	1:D2	1-R6	R53	1:F2	1-C5	R133	1:C5	1-N8
C58	1:J2	1-H6			1-R6	R54	1:F2	1-C5	R134	1:F3	1-D6
C59	1:J3	1-Q9			1-R5	R55	1:F2	1-C5	R135	1:B3	1-P6
C60	1:D2	1-R6			1-R2	R56	1:F3	1-C6	R136	1:F3	1-D5
C61	1:E2	1-K3			1-R3	R57	1:F3	1-D5	S21	1:J4	1-A3
C62	1:C4	1-R7			1-R2	R58	1:F2	1-D4			1-A4
C63	1:C4	1-Q8			1-R5	R59	1:G3	1-E4			1-A2
C64	1:C5	1-N8			1-R3	R60	1:F4	1-E4			1-A9
					1-R3	R61	1:F3	1-E5			1-A7
D1	1:G3	1-F5			1-R2	R62	1:F4	1-E4			1-A2
		1-F5			1-R2	R63	1:G4	1-F4			1-A4
D2	1:E3	1-H5			1-R3	R64	1:F4	1-F5			1-A8
		1-H5			1-R4	R65	1:E4	1-D4			1-A2
D3	1:A4	1-C0			1-R4	R66	1:E3	1-C4	TP1	1:L2	1-C7
		1-C1			1-R5	R67	1:F4	1-G5	TP2	1:J3	1-J9
D4	1:E4	1-A0			1-R5	RV67	1:E4	1-C3	TP3	1:F3	1-C5
D5	1:E4	1-F4				R68	1:G3	1-D3	TP4	1:G3	1-D4
		1-E4	Q1	1:K2	1-C8	R69	1:E3	1-H5	TP5	1:F4	1-G4
D6	1:B4	1-Q7	Q2	1:H3	1-J8	R70	1:F3	1-H4	TP6	1:F4	1-G3
		1-Q7	Q3	1:H3	1-L8	R70A	1:F4	1-G4	TP7	1:B2	1-F0
D7	1:C3	1-P6	Q4	1:H3	1-M7	R71	1:E3	1-J5	TP8	1:A4	1-D1
D8	1:C4	1-N6	Q5	1:G4	1-M8	R72	1:E3	1-J5	TP9	1:H2	1-P9
		1-M6	Q6	1:E3	1-J5	R73	1:E3	1-K5			





T2000-50 Handsfree PCB (IPN 220-01210-03) - Bottom Side