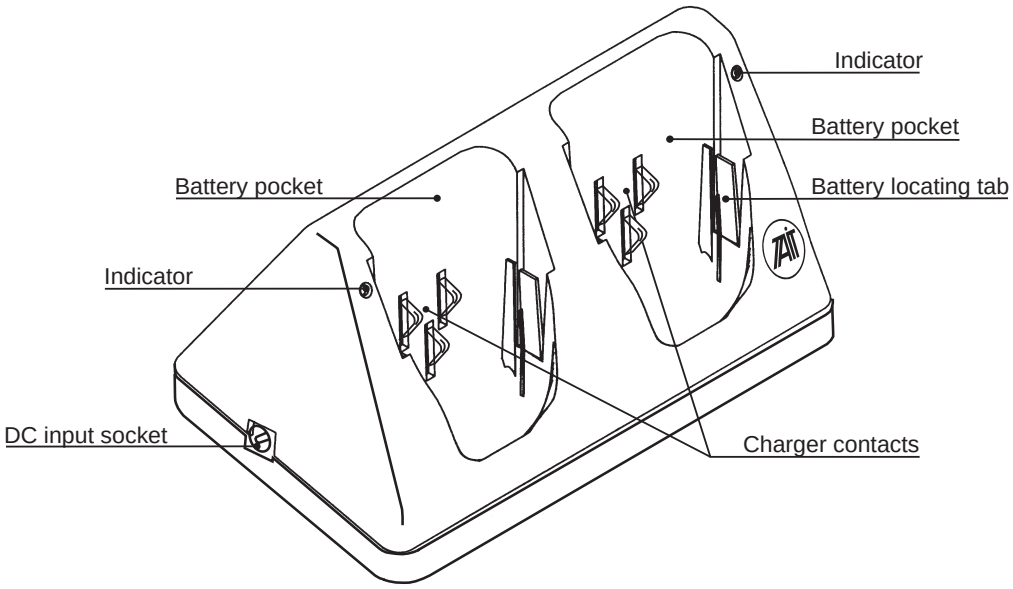
7.12 T3004 Rapid Charger

7.12.1 Introduction



The T3004-0000 dual desktop rapid charger is designed to charge one or two T3000 rechargeable battery packs, with two slots for either the combined battery and radio or for the battery alone. The charger is powered by either a dedicated T952 AC/DC plug pack, complying with the local requirements of the country into which it is sold, or a suitable DC supply. Batteries are charged sequentially if two are placed in the charger.

Although the T3004 is primarily intended for use in desktop situations, it may be used in vehicles with a nominal 12V or 24V supply voltage, in conjunction with the T952-050 vehicle supply cable. The vehicle supply cable is 1.5m long and has a cigarette lighter adapter plug at one end and a DC jack (centre pin positive) at the other.

The T3004, T3004 plug packs and vehicle supply cable are available under the following IPNs:

T952-050	Vehicle Supply Cable
T952-014	T3004 Plug Pack Australia/New Zealand
T952-024	T3004 Plug Pack UK
T952-034	T3004 Plug Pack Europe
T952-044	T3004 Plug Pack USA
T3004-0000	T3004 Rapid Charger

7.12.2 Performance Specifications

Power Supply..	..	10.7 to 32V DC, 30W maximum
Battery Capacity	..	up to 2AH
Battery Types	..	NiCd and NiMH
Operating Temperature	..	+5°C to +40°C (best performance between +15°C to +25°C)
Rapid Charge Rate	..	C/1
Trickle Charge Rate:		
NiCd	..	C/10 (average)
NiMH	..	C/40 (average)
Standby Charge Rate	..	C/360
Charge Duration:		
Rapid (for an exhausted battery pack)	..	up to 1.5 hours (1 hour nominal)
Trickle:		
NiCd	..	3 hours
NiMH	..	2 hours
Standby	..	indefinite
End Of Charge Detection	..	- high voltage - ΔT (rate of temperature rise) - negative ΔV - high temperature cut-off - safety timer

7.12.3 Warnings

- **Avoid extreme temperatures and direct sunlight when charging a T3000 battery pack. The required temperature range for the charger is 5°C to 40°C. Charging efficiency is maximised around normal room temperature i.e. 15°C to 25°C.**

- **To give maximum battery life, do not recharge the battery until the 'low battery warning' is activated. This will avoid reduced battery capacity.**

7.12.4 Operation

Place the charging unit on a stable horizontal surface and power the unit either from the T952 plug pack or the T952-050 vehicle supply cable.

Check that the connectors are properly pushed home to ensure reliable electrical contact.

Place the battery to be charged, with or without its radio, into the charging unit with the 4 silver contacts to the rear.

- To locate a battery pack correctly in the charger, lean the top of the battery as far forward as possible to seat the bottom of the battery. Pivot the battery back against the contacts and it should snap into place.

- After about 1 hour, the charge current terminates. The green LED then illuminates, indicating that trickle charge has commenced.

- The battery may be left in the charger until needed, where it will be trickle charged with no risk of damage.

- The indicator beside the pocket indicates the charge status, as shown in the following table.

LED	Condition	Function
off	charging suspended	• Battery awaiting charge. • Incorrectly seated battery. • Input supply voltage too low. • Charger powered but no battery present. • No power connected.
amber	test (3 seconds)	Battery presence has been detected and testing has begun.
red	rapid charge	Rapid charge in progress.
green	standby charge	Rapid charge complete - trickle or standby charge in progress.
red flashing	fault	Charge suspended - faulty battery, or faulty charger.

7.12.5 Circuit Description

The T3004 rapid charger can be divided into three functional areas:

- DC to DC switchmode converter.
- Two linear current regulators (one for each battery pocket).
- Microprocessor control and monitor functions.

1 DC To DC Switchmode Converter

Power Supply

The T3004 is powered by either a dedicated T952 AC/DC plug pack, consisting of a mains transformer, full wave rectifier, and smoothing capacitor, or by a 12V or 24V vehicle battery.

The DC supply is fed via a printed 5A fuse and reverse/over voltage protection diode (D1) to two DC linear voltage regulators, IC1 and IC2.

Regulator IC1 provides a 2% 5V reference to the microprocessor and is the reference voltage standard for the unit. Regulator IC2 feeds the switchmode IC, IC3, and limits its maximum voltage to nominally 13.75V and ensures that the maximum gate voltage rating of Q6 is not exceeded at high supply voltages.

Switchmode Supply

The switchmode supply operates at a frequency of 134kHz (determined by the time constant R11xC14), and generates a sawtooth waveform at the base of emitter follower Q1, that feeds an attenuated version of this waveform to pin 3 of IC3. This converts the current control mode of IC3 to voltage control mode.

A square wave is generated at pin 6 of IC3 to feed the gate of Q6, with a duty cycle that is determined by the feedback voltage on pin 2 of IC3. This voltage is compared with half the internal reference voltage, and stabilises at 2.5V.

For example, if Q7 is off, the output voltage (measured at the top of R35) has a maximum value of:

$$\left(\frac{2.5\text{V}}{1\text{k}\Omega}\right) \times (3.9\text{k}\Omega + 1\text{k}\Omega) \;=\; 12.25\text{V}$$

R16, C16, and C17 are the feedback components around IC3's internal inverting mode op-amp. These components, together with R27, R28, and C28, are chosen to provide both closed loop stability and a response time adequate to reduce 100Hz supply ripple to an acceptable level.

IC3 exhibits under voltage sensing with a start-up threshold of 8.4V and only switches on its internal 5V reference at pin 8 when this threshold is exceeded. Q6, an N channel power MOSFET is the main switching transistor. When Q6 is on, energy is stored in the primary winding of the 1:1 transformer T1, and is released via the secondary winding and diode D7, when it is off.

C23 and C31 are the main smoothing capacitors and minimise the switching frequency ripple voltage. The output voltage is approximated by:

$$Vo = \frac{VsK}{(1-K)}$$

where K is the fractional on-time of Q6 and Vs is the supply voltage.

Transistors Q4 and Q5 provide a 'soft start'. Q11 switches the switchmode on when Q11 switches off, resulting in Q4 switching on. C26 charges via R22 and the emitter of Q5 drops as a controlled voltage ramp. As this voltage drops, the output voltage ramps up, attempting to preserve the virtual earth at pin 2 of IC3 at 2.5V. This results in the required soft start.

2 Linear Current Regulators

Two identical circuits control the charge current to the appropriate battery pocket. If both batteries are present, the microprocessor arbitrates over which battery is charged first. These constant current regulators share a common 0.2Ω current sensing resistance, consisting of nine parallel 1.8Ω resistors (R68, R69, R70, R71, R72, R74, R75, R76, R77).

The battery under charge defines the charge current as a function of the battery's internal capacity resistor. If the battery in the left pocket is being charged, the battery capacity resistor is in series with R64 and is connected to the microprocessor via R80. With R80 pulled high by the microprocessor port, the current to the emitter of Q8 is zero.

With the microprocessor's port in the high impedance state, the resulting current in Q8 sets a voltage drop across R61 and R62 which is transferred by the negative feedback loop (consisting of the op-amp and Q9) to the current sensing resistors R68 to R76. This translates to a constant current available at the drain of Q9 to charge the battery. If the battery is open circuit, the gate of Q9 will be driven to ground and switch off Q10. The collector of Q10 signals the resulting open circuit condition to the microprocessor.

The differential drain source voltage drop across Q9 is monitored via diode D10 and the emitter of Q7. This results in a current in Q7 which reduces the switchmode output voltage so that it tracks the battery voltage over a limited window and therefore limits the power dissipation in Q9. At low battery voltages, Q7 is fully on and R36 limits the lower switchmode voltage tracking limit to around 9.2V.

To avoid the upper common mode input voltage limit of the op-amp, the op-amp's supply is boosted by the square wave from IC3 pin 6 and superimposed via C30 and D9 on to the switchmode output voltage. This is peak detected by the second half of D9, smoothed and provides the boosted op-amp supply voltage of approximately 25V.

3 Microprocessor Control And Monitor Functions

The microprocessor monitors the following battery parameters:

- battery temperature
- battery voltage
- expanded battery voltage
- battery cell type i.e. NiCad or NiMH

Each T3000 battery pack contains a battery temperature sensing thermistor which forms a potential divider with R125 (left pocket) or R130 (right pocket). The resulting voltage is a function of temperature. This is sensed via the analogue multiplexer, IC6, and is interpreted by the microprocessor.

If a battery in the left pocket is being charged, the potential divider consisting of R84, R95 and R96 translates the battery voltage through to the microprocessor via IC6.

The expanded battery voltage is available via the op-amp output pin 1. This approximately maps battery voltage ranges from 8.24V to 10.5V to 0V to 5V at the op-amp output, and is again sensed via IC6 and interpreted by the microprocessor.

The peak negative ripple of the power supply voltage is monitored and the charger is disabled if the supply voltage drops below 10.5V. The potential divider formed by R1 and R2 sample the supply voltage via the emitter follower Q26 and peak detector emitter follower Q21. This voltage is directly sampled by the microprocessor's AD. If the peak negative voltage is less than 10.5V, the battery charger is disabled until the supply is removed and then restored.

The low voltage reset IC, IC5, resets the microprocessor if its supply drops below approximately 4.75V.

Two dual red/green LEDS are utilised to display the charge status of each battery. A third colour amber is displayed when both the red and green colours of the LED are switched on.

T3004 Parts List (IPN 220-01270-03)

Ref	IPN	Description	Ref	IPN	Description
C1	018-14100-00	CAP 0603 CHIP 1N 50V X7R 1080	C78	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%
C2	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	C79	015-25470-08	CAP CER 0805 CHIP 47N 10% X7R 50V
C3	015-25470-08	CAP CER 0805 CHIP 47N 10% X7R 50V	C80	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%
C4	015-25470-08	CAP CER 0805 CHIP 47N 10% X7R 50V	C81	018-12180-00	CAP 0603 CHIP 18P 50V NPO +-5%
C5	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	C82	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V
C6	016-08100-01	CAP ELECT 6X4MM CHIP 10M 20% 16V	C83	018-12180-00	CAP 0603 CHIP 18P 50V NPO +-5%
C7	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	C84	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%
C8	020-08560-09	CAP ELECT RADL 56M 50V 6.3X15.5MM L/S			
C9	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	D1	001-00153-30	(S) DIODE 1.5KE33P ZENER 33V TRANSIENT
C10	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	D2	001-10000-99	(S) DIODE SMD BAV99 DUAL SWTCH SNGLE LI
C12	016-08100-01	CAP ELECT 6X4MM CHIP 10M 20% 16V	D3	001-10000-99	(S) DIODE SMD BAV99 DUAL SWTCH SNGLE LI
C13	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	D4	001-00012-91	(S) DIODE 16V TRANSIENT SUPPRESSOR
C14	015-24330-08	CAP CER 0805 CHIP 3N3 10% X7R 50V	D5	001-10036-00	(LS) SMD DIODE SCHOTTKY MBR360 3A 60V I
C15	018-15100-00	CAP 0603 CHIP 10N 50V X7R +-10%	D7	001-10036-00	(LS) SMD DIODE SCHOTTKY MBR360 3A 60V I
C16	015-24330-08	CAP CER 0805 CHIP 3N3 10% X7R 50V	D9	001-10000-99	(S) DIODE SMD BAV99 DUAL SWTCH SNGLE II
C17	015-24330-08	CAP CER 0805 CHIP 3N3 10% X7R 50V	D10	001-10000-99	(S) DIODE SMD BAV99 DUAL SWTCH SNGLE I
C20	020-08560-09	CAP ELECT RADL 56M 50V 6.3X15.5MM L/S	D11	001-10032-00	(S) DIODE MBRD320 SMD RECTIFIER
C21	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	D12	001-10032-00	(S) DIODE MBRD320 SMD RECTIFIER
C22	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V			
C23	020-19120-00	(L) CAP ELECT RADL 1200M 35V 16*25MM LXF	IC1	002-00078-05	(S) IC MC7805ACT 5V REG(LINEAR)1AMP TO-2
C25	018-15100-00	CAP 0603 CHIP 10N 50V X7R +-10%	IC2	002-00014-62	(S) IC 317L 100MA REG 3 TERMINAL TO-92
C26	016-07100-01	CAP ELECT 6X4MM CHIP 1M 20% 16V	IC3	002-00384-30	(S) IC UC3843/A CURRENT MODE CONTROLLE
C28	015-25150-08	CAP CER 0805 CHIP 15N 10% X7R 50V	IC4	002-06870-51	(LS) IC MC68HC705P6P OTP MICRO 28DIP
C29	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	IC5	002-10340-64	(S) IC SMD MC34064 LO VOLT SENSE
C30	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	IC6	002-11405-10	(S) IC SMD MC14051BDR2 CMOS 8INPUT ANA
C31	020-19120-00	(L) CAP ELECT RADL 1200M 35V 16*25MM LXF	IC8	002-10003-24	(S) IC SMD 324 QUAD OP AMP SO14
C32	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%			
C33	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	LEFT	008-02099-00	(S) LED RED/GREEN BI-COLOUR 3.1MM DIA 3
C34	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	L1	056-00010-15	IND FXD TAIT NO 15 5T ON 3B BEAD
C35	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	L2	056-00010-15	IND FXD TAIT NO 15 5T ON 3B BEAD
C36	020-09470-07	CAP 470M 16V 20% ELEC VERT 8*20 3.5MM L/	L3	056-00010-15	IND FXD TAIT NO 15 5T ON 3B BEAD
C37	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%			
C38	016-08100-01	CAP ELECT 6X4MM CHIP 10M 20% 16V	Q1	000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 SMALL
C39	016-07100-01	CAP ELECT 6X4MM CHIP 1M 20% 16V	Q4	000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 SMALL
C40	016-07100-01	CAP ELECT 6X4MM CHIP 1M 20% 16V	Q5	000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 SMALL
C41	018-15100-00	CAP 0603 CHIP 10N 50V X7R +-10%	Q6	000-10200-60	(S) XSTR SMD MTD20N06HDLT4 N-CHANNEL P
C42	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	Q7	000-10085-71	(S) XSTR SMD BC857BW PNP SOT-323 SMALL
C43	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	Q8	000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 SMALL
C44	018-12180-00	CAP 0603 CHIP 18P 50V NPO +-5%	Q9	000-10295-51	(S) XSTR SMD MTD2955ET4 P CHANNEL PWR
C45	018-12470-00	CAP 0603 CHIP 47P 50V NPO +-5%	Q10	000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 SMALL
C46	018-12180-00	CAP 0603 CHIP 18P 50V NPO +-5%	Q11	000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 SMALL
C47	018-12330-00	CAP 0603 CHIP 33P 50V NPO +-5%	Q12	000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 SMALL
C48	018-12330-00	CAP 0603 CHIP 33P 50V NPO +-5%	Q13	000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 SMALL
C49	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	Q14	000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 SMALL
C50	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	Q15	000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 SMALL
C51	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	Q16	000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 SMALL
C52	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	Q17	000-10295-51	(S) XSTR SMD MTD2955ET4 P CHANNEL PWR
C56	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	Q18	000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 SMALL
C57	015-25470-08	CAP CER 0805 CHIP 47N 10% X7R 50V	Q19	000-10085-71	(S) XSTR SMD BC857BW PNP SOT-323 SMALL
C58	016-08100-01	CAP ELECT 6X4MM CHIP 10M 20% 16V	Q20	000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 SMALL
C59	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	Q21	000-10085-71	(S) XSTR SMD BC857BW PNP SOT-323 SMALL
C60	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%			
C61	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	R1	036-15390-10	RES M/F 0805 CHIP 39K 1%
C63	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	R2	038-14680-00	RES 0603 CHIP 6K8 1/16W +-5%
C64	014-06470-00	CAP TANT CHIP 470N 25V +-20% 6X3.2X2.5MM	R3	038-15150-00	RES 0603 CHIP 15K 1/16W +-5%
C65	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	R4	036-16120-10	RES M/F 0805 CHIP 120K 1%
C66	018-12470-00	CAP 0603 CHIP 47P 50V NPO +-5%	R7	036-15100-10	RES M/F 0805 CHIP 10K 1%
C67	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	R8	038-14100-00	RES 0603 CHIP 1K0 1/16W +-5%
C70	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	R9	038-14100-00	RES 0603 CHIP 1K0 1/16W +-5%
C71	014-06470-00	CAP TANT CHIP 470N 25V +-20% 6X3.2X2.5MM	R10	038-14220-00	RES 0603 CHIP 2K2 1/16W +-5%
C72	018-12470-00	CAP 0603 CHIP 47P 50V NPO +-5%	R11	036-14390-00	RES M/F 0805 CHIP 3K9 5%
C73	015-06100-08	CAP CER 1206 CHIP 100N 10% X7R 50V	R14	038-15150-00	RES 0603 CHIP 15K 1/16W +-5%
C74	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	R15	036-15100-10	RES M/F 0805 CHIP 10K 1%
C75	018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	R16	036-15220-00	RES M/F 0805 CHIP 22K 5%
C76	018-12470-00	CAP 0603 CHIP 47P 50V NPO +-5%	R20	038-13100-00	RES 0603 CHIP 100E 1/16W +-5%
C77	016-08100-01	CAP ELECT 6X4MM CHIP 10M 20% 16V	R21	036-15100-10	RES M/F 0805 CHIP 10K 1%

Ref	IPN	Description
R22	036-15470-10	RES M/F 0805 CHIP 47K 1%
R24	038-12100-00	RES 0603 CHIP 10E 1/16W +-5%
R25	038-12100-00	RES 0603 CHIP 10E 1/16W +-5%
R26	036-14390-00	RES M/F 0805 CHIP 3K9 5%
R27	038-13100-00	RES 0603 CHIP 100E 1/16W +-5%
R28	036-15100-10	RES M/F 0805 CHIP 10K 1%
R32	038-13100-00	RES 0603 CHIP 100E 1/16W +-5%
R33	036-15100-10	RES M/F 0805 CHIP 10K 1%
R34	038-14100-00	RES 0603 CHIP 1K0 1/16W +-5%
R35	036-14390-00	RES M/F 0805 CHIP 3K9 5%
R36	036-14820-00	RES M/F 0805 CHIP 8K2 5%
R37	036-15100-10	RES M/F 0805 CHIP 10K 1%
R38	036-14820-00	RES M/F 0805 CHIP 8K2 5%
R39	038-14680-00	RES 0603 CHIP 6K8 1/16W +-5%
R40	038-15150-00	RES 0603 CHIP 15K 1/16W +-5%
R41	038-12220-00	RES 0603 CHIP 22E 1/16W +-5%
R42	038-12470-00	RES 0603 CHIP 47E 1/16W +-5%
R43	038-14680-00	RES 0603 CHIP 6K8 1/16W +-5%
R46	036-15470-10	RES M/F 0805 CHIP 47K 1%
R47	038-14470-00	RES 0603 CHIP 4K7 1/16W +-5%
R48	036-15470-10	RES M/F 0805 CHIP 47K 1%
R49	038-14100-00	RES 0603 CHIP 1K0 1/16W +-5%
R50	036-15470-10	RES M/F 0805 CHIP 47K 1%
R51	036-15100-10	RES M/F 0805 CHIP 10K 1%
R52	038-17100-00	RES 0603 CHIP 1M 1/16W +-5%
R53	036-15470-10	RES M/F 0805 CHIP 47K 1%
R56	036-13820-00	RES M/F 0805 CHIP 820E 5%
R57	036-13560-00	RES M/F 0805 CHIP 560E 5%
R58	036-13820-00	RES M/F 0805 CHIP 820E 5%
R59	036-13560-00	RES M/F 0805 CHIP 560E 5%
R60	038-14470-00	RES 0603 CHIP 4K7 1/16W +-5%
R61	036-15100-10	RES M/F 0805 CHIP 10K 1%
R62	036-15100-10	RES M/F 0805 CHIP 10K 1%
R63	038-14220-00	RES 0603 CHIP 2K2 1/16W +-5%
R64	036-15390-10	RES M/F 0805 CHIP 39K 1%
R67	038-14470-00	RES 0603 CHIP 4K7 1/16W +-5%
R68	036-11180-10	RES M/F 0805 CHIP 1E8 1%
R69	036-11180-10	RES M/F 0805 CHIP 1E8 1%
R70	036-11180-10	RES M/F 0805 CHIP 1E8 1%
R71	036-11180-10	RES M/F 0805 CHIP 1E8 1%
R72	036-11180-10	RES M/F 0805 CHIP 1E8 1%
R73	038-14470-00	RES 0603 CHIP 4K7 1/16W +-5%
R74	036-11180-10	RES M/F 0805 CHIP 1E8 1%
R75	036-11180-10	RES M/F 0805 CHIP 1E8 1%
R76	036-11180-10	RES M/F 0805 CHIP 1E8 1%
R77	036-11180-10	RES M/F 0805 CHIP 1E8 1%
R80	036-13560-00	RES M/F 0805 CHIP 560E 5%
R84	038-14100-00	RES 0603 CHIP 1K0 1/16W +-5%
R85	036-15470-10	RES M/F 0805 CHIP 47K 1%
R86	036-15470-10	RES M/F 0805 CHIP 47K 1%
R87	036-15100-10	RES M/F 0805 CHIP 10K 1%
R90	036-15390-10	RES M/F 0805 CHIP 39K 1%
R91	036-16120-10	RES M/F 0805 CHIP 120K 1%
R93	036-15330-00	RES M/F 0805 CHIP 33K 5%
R95	036-15100-10	RES M/F 0805 CHIP 10K 1%
R96	036-15100-10	RES M/F 0805 CHIP 10K 1%
R98	038-14220-00	RES 0603 CHIP 2K2 1/16W +-5%
R100	036-15390-10	RES M/F 0805 CHIP 39K 1%
R101	038-14470-00	RES 0603 CHIP 4K7 1/16W +-5%
R102	036-15100-10	RES M/F 0805 CHIP 10K 1%
R103	036-15100-10	RES M/F 0805 CHIP 10K 1%
R104	038-14470-00	RES 0603 CHIP 4K7 1/16W +-5%
R105	038-14470-00	RES 0603 CHIP 4K7 1/16W +-5%
R106	036-13560-00	RES M/F 0805 CHIP 560E 5%
R107	036-15390-10	RES M/F 0805 CHIP 39K 1%
R108	036-16120-10	RES M/F 0805 CHIP 120K 1%
R109	036-15330-00	RES M/F 0805 CHIP 33K 5%
R110	036-15100-10	RES M/F 0805 CHIP 10K 1%

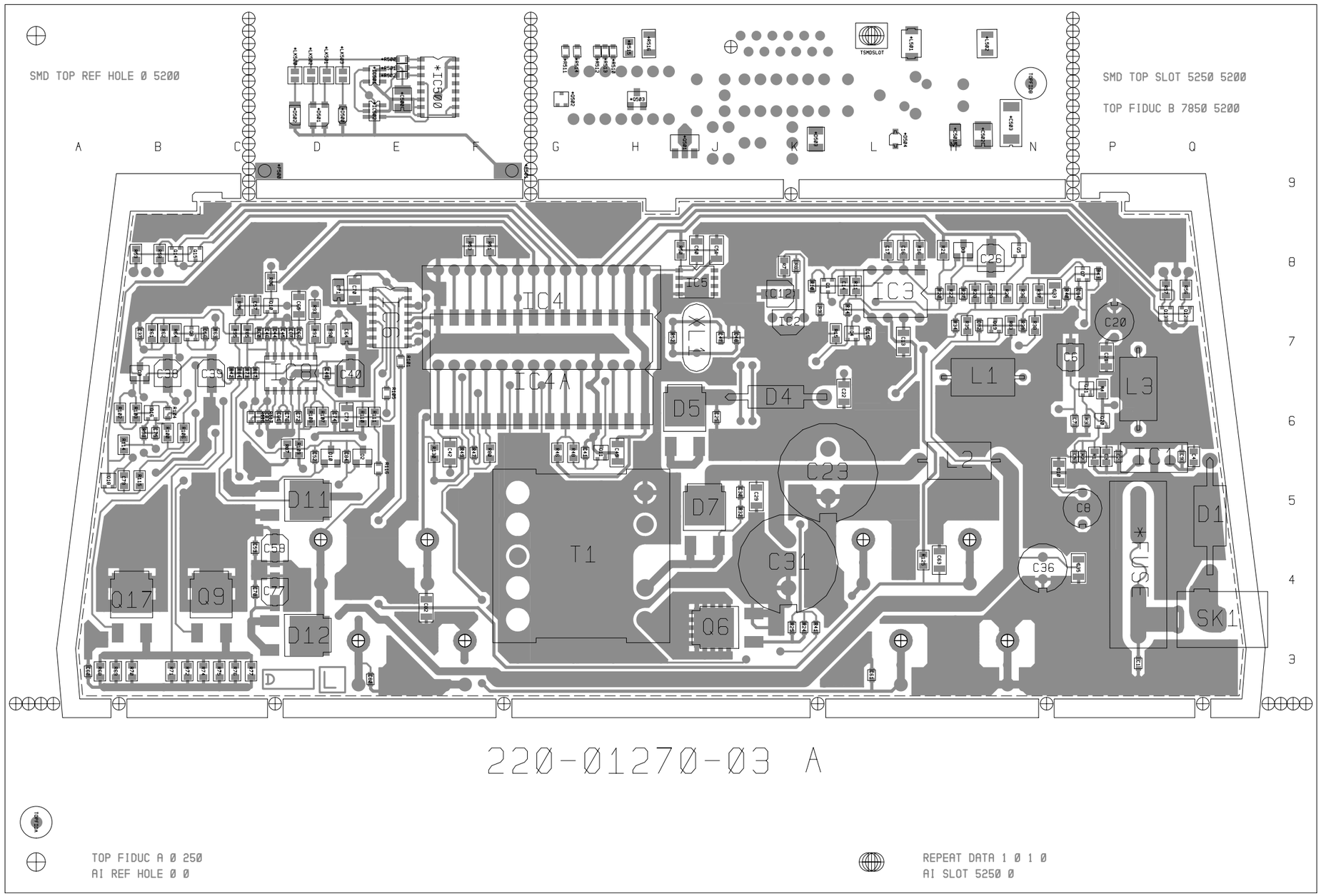
Ref	IPN	Description
R111	036-15100-10	RES M/F 0805 CHIP 10K 1%
R114	036-15470-10	RES M/F 0805 CHIP 47K 1%
R115	036-15470-10	RES M/F 0805 CHIP 47K 1%
R116	038-14100-00	RES 0603 CHIP 1K0 1/16W +-5%
R117	038-14470-00	RES 0603 CHIP 4K7 1/16W +-5%
R118	038-14470-00	RES 0603 CHIP 4K7 1/16W +-5%
R125	036-15100-10	RES M/F 0805 CHIP 10K 1%
R130	036-15100-10	RES M/F 0805 CHIP 10K 1%
RIGHT	008-02099-00	(S) LED RED/GREEN BI-COLOUR 3.1MM DIA
SK1	240-02020-07	SKT DC JACK 5.5MM HOLE 2.5MM PIN PCB MN
T1	053-01068-00	XFMR T3004 SWITCHMODE
XL1	274-00010-33	XTAL 4MHZ TE-35 HC49U C/W TEFLON INS
	065-00010-20	BEAD FERRITE BALUN 4B1 PHILIPS L1, L2, L3
	220-01270-03	PCB T3004 DUAL DESKTOP RAPID BATTERY C
	240-04020-64	SKT JACK AN 0.98MM PCB MTG 64 WAY SIL S
	265-00010-61	FUSE 5A 5X20MM NORMAL BLOW C/W HOLDC
	303-03032-00	COVER A1M2849 TOP T3000 RAPID CHARGER
	303-03033-00	COVER A1M2847 BTM T3000 RAPID CHARGER
	303-50027-00	CONTACT A3M2818 T3000 BAT CHARGER +7V2 CAP GND TEMP
	349-00010-22	SCREW NO 4X3/8 PAN POZI PLASTITE
	353-00010-10	WASHER M3 FLAT 7MM*0.6MM ST BZ
	365-01430-01	(L) LABEL MODEL ID T3004-0000
	365-01450-00	LABEL BLNK 38*9MM TAMPERMARK VOID (TR
	369-00010-11	FOOT RUBBER BUMP-ON S/A
	369-00020-40	TAPE POLY FILM S/A UHMW 5421 2 PIECES 25MM EACH
	410-01108-00	BOX T3004 RAPID CHARGER

T3004 Grid Reference Index (IPN 220-01270-03)

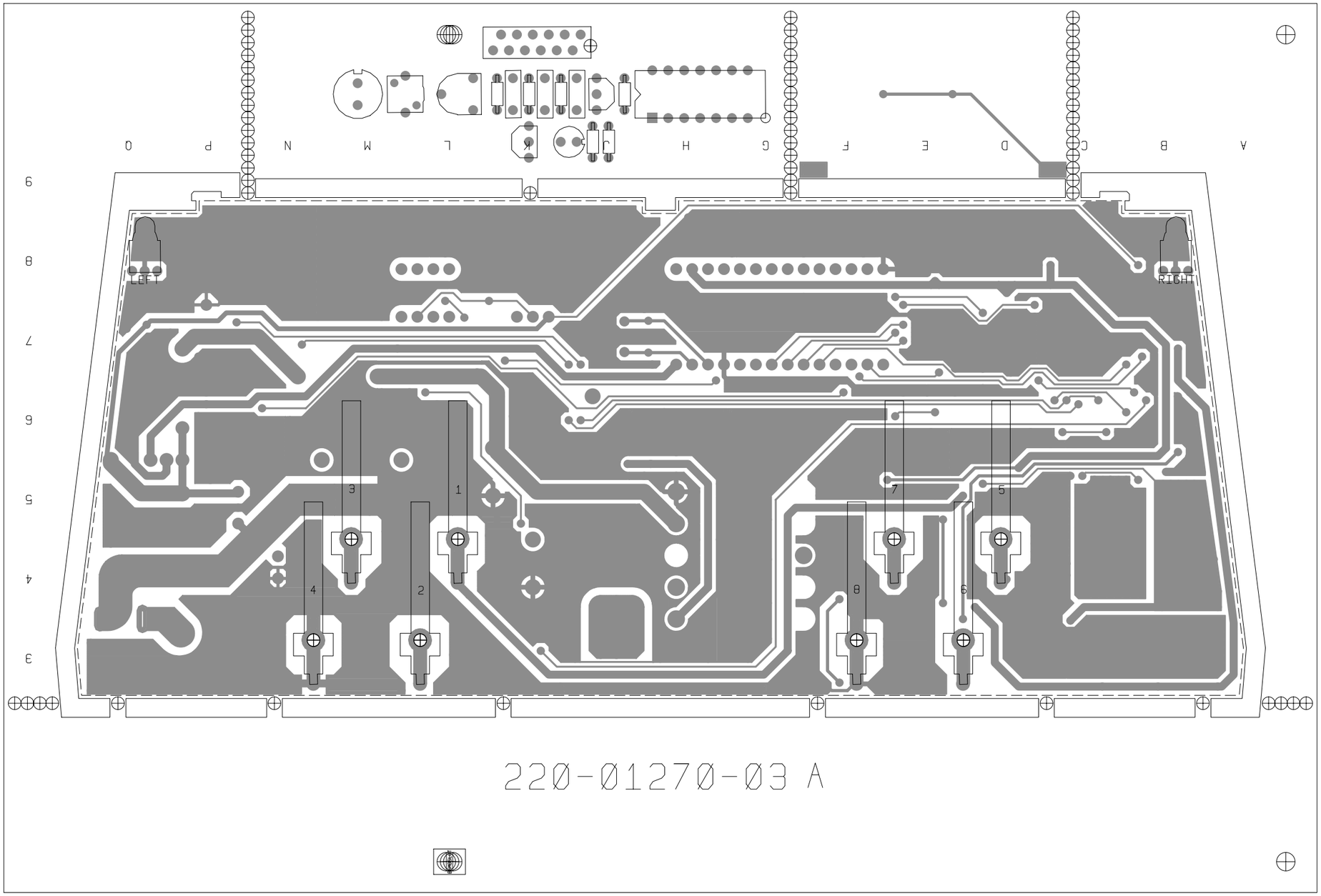
Device	PCB	Circuit
C1	1:P3	1-A9
C2	1:P6	1-C8
C3	1:P6	1-B8
C4	1:Q6	1-D8
C5	1:P6	1-B7
C6	1:P7	1-D7
C7	1:P6	1-D7
C8	1:P5	1-E9
C9	1:Q6	1-C8
C10	1:N5	1-D9
C12	1:K8	1-E8
C13	1:L7	1-F8
C14	1:L8	1-E7
C15	1:L7	1-G8
C16	1:L8	1-G7
C17	1:L8	1-G7
C20	1:P7	1-G9
C21	1:P7	1-G9
C22	1:L6	1-H9
C23	1:K5	1-J9
C25	1:J6	1-J9
C26	1:N8	1-H8
C28	1:N8	1-K7
C29	1:K5	1-K9
C30	1:J5	1-L9
C31	1:K4	1-L9
C32	1:M7	1-M9
C33	1:N8	1-M8
C34	1:P8	1-N8
C35	1:P4	1-P9
C36	1:N4	1-P9
C37	1:B7	1-M7
C38	1:B7	1-Q9
C39	1:C7	1-Q9
C40	1:D7	1-R9
C41	1:G6	1-A6
C42	1:F6	1-B6
C43	1:D7	1-R9
C44	1:D7	1-M7
C45	1:D7	1-M6
C46	1:C7	1-N7
C47	1:J7	1-C1
C48	1:J7	1-D1
C49	1:H6	1-E6
C50	1:J8	1-F6
C51	1:J8	1-G6
C52	1:D6	1-N6
C56	1:C7	1-L6
C57	1:C8	1-N5
C58	1:D4	1-P6
C59	1:C4	1-P6
C60	1:A3	1-Q7
C61	1:L3	1-R6
C63	1:M4	1-R5
C64	1:D7	1-L4
C65	1:D8	1-N4
C66	1:D7	1-M4
C67	1:D7	1-M4
C70	1:E8	1-K0
C71	1:D8	1-L0
C72	1:D6	1-M0
C73	1:D6	1-N0
C74	1:D6	1-M0
C75	1:B6	1-L2
C76	1:D6	1-M2
C77	1:D4	1-P2
C78	1:C4	1-P2
C79	1:B5	1-K1
C80	1:E3	1-R2
C81	1:D6	1-M3
C82	1:E4	1-R1
C83	1:C6	1-N2
C84	1:D6	1-N2
*C500	1:E10	2-E3
*C501	1:M10	2-B2
*C502	1:M10	2-C2
*C503	1:N10	2-C2
*C504	2:K10	2-G1
*C505	2:K10	2-G1
*C506	2:J10	2-G1
*C507	2:K10	2-G0
*C508	2:M10	2-G0
D1	1:Q6	1-B9
D2	1:E6	1-N2
D3	1:M8	1-H8
D4	1:J6	1-J9
D5	1:J6	1-J8
D7	1:J5	1-K9
D9	1:B7	1-Q9
		1-Q9
D10	1:D6	1-N6
D11	1:D5	1-Q7
D12	1:D3	1-Q3
*D500	1:D10	2-D4
*D501	1:D10	2-D4
		2-D4
*D502	1:D10	2-C4
*D503	1:K10	2-D2
*D504	1:L10	2-D2
*FUSE	1:P3	1-B9
IC1	1:Q6	1-C8
IC2	1:K7	1-D8
IC3	1:M8	1-F7
IC4	1:H8	1-E2
IC4A	1:G7	1-D2
IC5	1:J8	1-G6
IC6	1:E7	1-J0
IC8	1:D7	1-M5
		1-M7
		1-M3
		1-M1
		1-R9
*IC500	1:F10	2-C0
		2-E4
		2-G4
*IC501	1:E10	2-D0
		2-F4
*IC502	1:E10	2-D0
		2-F4
*IC504	2:H10	2-E0
LEFT	2:Q8	1-G3
		1-G3
L1	1:M7	1-H9
L2	1:N6	1-L9
L3	1:P7	1-E9
*LK500	1:D10	2-C4
*L500	2:M10	2-F0
*LK501	1:D10	2-D4
*L501	1:M11	2-A2
*LK502	1:D10	2-D4
*L502	1:M11	2-B2
*LK503	1:D10	2-D4
*P500	1:C9	2-A1
*P501	1:F9	2-A1
Q1	1:K8	1-E8
Q4	1:L7	1-H8
Q5	1:N8	1-J8
Q6	1:J3	1-J7
Q7	1:P8	1-L8
Q8	1:B7	1-L6
Q9	1:C4	1-N7
Q10	1:C8	1-M6
Q11	1:H6	1-B6
Q12	1:Q7	1-G5
Q13	1:Q7	1-G4
Q14	1:B8	1-G4
Q15	1:C8	1-H4
Q16	1:B6	1-L2
Q17	1:B4	1-N3
Q18	1:A5	1-K1
Q19	1:N7	1-L9
Q20	1:P6	1-C7
Q21	1:P6	1-C7
*Q501	1:J10	2-E2
*Q502	1:G10	2-F2
*Q503	1:H10	2-G2
*Q504	2:J10	2-G2
*Q505	2:K10	2-G2
RIGHT	2:B8	1-H3
		1-G3
R1	1:P6	1-B7
R2	1:P6	1-C7
R3	1:P6	1-C7
R4	1:P6	1-D7
R7	1:K8	1-E8

Device	PCB	Circuit
R8	1:K8	1-E8
R9	1:K7	1-E7
R10	1:K8	1-E7
R11	1:L8	1-F8
R14	1:L7	1-F8
R15	1:L7	1-G8
R16	1:M8	1-F7
R20	1:M8	1-H8
R21	1:M8	1-H8
R22	1:M8	1-H8
R24	1:K3	1-H7
R25	1:K3	1-H7
R26	1:N8	1-J7
R27	1:M8	1-J7
R28	1:M8	1-K7
R32	1:J5	1-K9
R33	1:N7	1-M9
R34	1:M7	1-L8
R35	1:M7	1-L8
R36	1:N8	1-L8
R37	1:N8	1-M8
R38	1:N7	1-M8
R39	1:N7	1-M8
R40	1:N8	1-M8
R41	1:K3	1-Q9
R42	1:C7	1-Q9
R43	1:P8	1-N8
R46	1:G6	1-A6
R47	1:F6	1-B5
R48	1:G6	1-A6
R49	1:F6	1-C6
R50	1:J8	1-F6
R51	1:F8	1-E3
R52	1:J7	1-C2
R53	1:F8	1-E2
R56	1:Q8	1-G4
R57	1:Q8	1-G4
R58	1:B8	1-G4
R59	1:B8	1-H4
R60	1:C7	1-M6
R61	1:B7	1-L7
R62	1:B7	1-M7
R63	1:C7	1-L7
R64	1:B7	1-L6
R67	1:C7	1-M7
R68	1:A3	1-N7
R69	1:B3	1-P7
R70	1:B3	1-P7
R71	1:B3	1-P7
R72	1:B3	1-P7
R73	1:C7	1-N7
R74	1:C3	1-N7
R75	1:C3	1-N7
R76	1:C3	1-N7
R77	1:C3	1-N7
R80	1:F6	1-L5
R84	1:C7	1-Q7
R85	1:C7	1-N6
R86	1:C8	1-M6
R87	1:D6	1-M5
R90	1:D7	1-L4
R91	1:D7	1-M5
R93	1:D7	1-M5
R95	1:C7	1-N4
R96	1:C8	1-N4
R98	1:B6	1-L3
R100	1:B6	1-L2
R101	1:E7	1-J1
R102	1:B6	1-L3
R103	1:B6	1-M3
R104	1:B6	1-M2
R105	1:E6	1-K0
R106	1:B6	1-L1
R107	1:D6	1-L0
R108	1:D6	1-M1
R109	1:D6	1-M1
R110	1:E6	1-N0
R111	1:E6	1-N0
R114	1:B6	1-K2
R115	1:B5	1-L1
R116	1:E5	1-Q3
R117	1:C6	1-N3
R118	1:C6	1-N3
R125	1:M4	1-Q5
R130	1:F6	1-Q1
*R500	1:E11	2-E5
*R501	1:E11	2-E4
*R502	1:E10	2-G3
*R510	1:H11	2-E1
*R511	1:G11	2-E1
*R512	1:H11	2-E1
*R513	1:H11	2-F1
*R514	1:G11	2-F1
*R515	1:H11	2-G1
*R516	1:H11	2-G1
*R517	2:K10	2-E1
*R518	2:K10	2-E1
*R519	2:J10	2-E1
*R520	2:K10	2-F1
*R521	2:J10	2-F1
*R523	2:J10	2-F1
*RV524	2:L10	2-E0
SK1	1:R4	1-A9
*SK500	2:J11	2-E0
T1	1:G4	1-K9
XL1	1:J7	1-C1

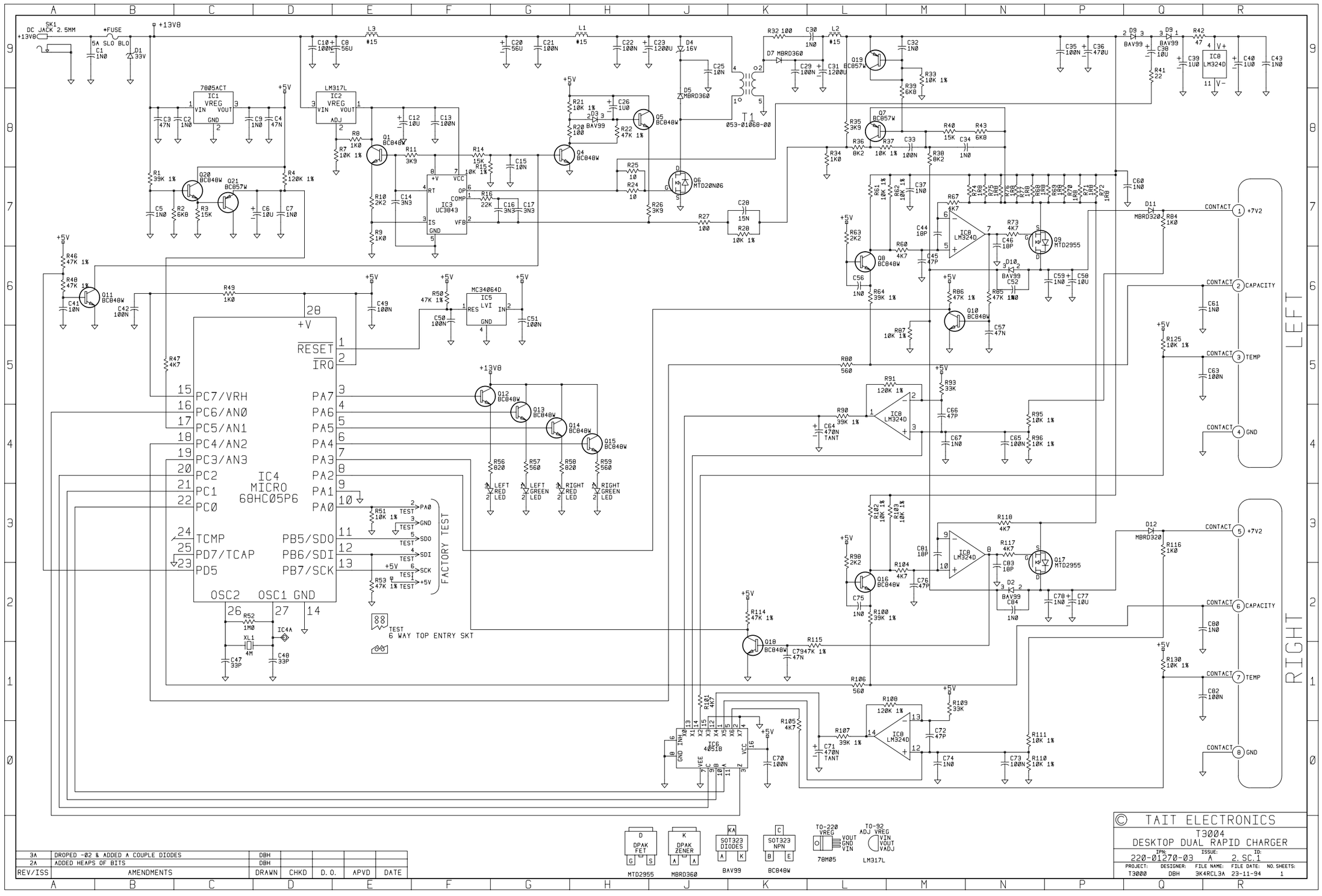
Device	PCB	Circuit



T3004 Rapid Charger PCB Layout (IPN 220-01270-03) - Top Side



T3004 Rapid Charger PCB Layout (IPN 220-01270-03) - Bottom Side


SK1 DC JACK 2.5MM
+13V8
*FUSE
5A SLO BLO
C1 1N0
D1 33V
7805ACT
IC1 VREG
VIN VOUT GND
LM317L
IC2 VREG
VIN VOUT ADJ
C3 47N
C2 1N0
C9 1N0
C4 47N
C10 100N
C9 56U
L3 #15
C20 56U
C21 100N
L1 #15
C22 100N
C23 1200U
D4 16V
C25 10N
D5 MBRD360
D7 MBRD360
R32 100
C30 1N0
L2 #15
C29 100N
C31 1200U
Q19 BC857W
C32 1N0
R33 10K 1%
R39 6K8
C35 100N
C36 470U
D9 BAV99
C38 10U
R41 22
C39 1U0
IC8 LM324D
R42 47
C40 1U0
C43 1N0
T1 053-01068-00
R21 10K 1%
D3 BAV99
R20 100
C26 1U0
R22 47K 1%
Q5 BC848W
R25 10
R24 10
Q6 MTD20N06
R26 3K9
R27 100
C28 15N
R28 10K 1%
Q7 BC857W
R35 3K9
R34 1K0
R36 8K2
R37 10K 1%
C33 100N
R38 8K2
R40 15K
R43 6K8
C34 1N0
R1 39K 1%
Q20 BC848W
Q21 BC857W
R4 120K 1%
C5 1N0
R2 6K8
R3 15K
C6 10U
C7 1N0
Q1 BC848W
R8 1K0
R7 10K 1%
C12 10U
C13 100N
R11 3K9
R14 15K
R15 10K 1%
C15 10N
R10 2K2
C14 3N3
R9 1K0
IC9 UC3843
R16 22K
C16 3N3
C17 3N3
Q4 BC848W
R61 10K 1%
R62 10K 1%
C37 1N0
R67 4K7
R66 10K 1%
R65 10K 1%
R68 10K 1%
R69 10K 1%
R70 10K 1%
R71 10K 1%
R72 10K 1%
C60 1N0
D11 MBRD320
R84 1K0
CONTACT 1 +7V2
R63 2K2
C44 10P
IC8 LM324D
R73 4K7
Q9 MTD2955
C46 10P
C45 47P
Q8 BC848W
R60 4K7
C56 1N0
R64 39K 1%
D10 BAV99
C52
C59 1N0
C58 10U
R86 47K 1%
R85 47K 1%
Q10 BC848W
C57 47N
R87 10K 1%
CONTACT 2 CAPACITY
C61 1N0
CONTACT 3 TEMP
C63 100N
CONTACT 4 GND
R125 10K 1%
LEFT
R46 47K 1%
R48 47K 1%
Q11 BC848W
C41 10N
C42 100N
R49 1K0
C49 100N
R50 47K 1%
C50 100N
IC5 MC34064D
RES LVI IN GND
C51 100N
R47 4K7
28 +V
RESET 1
IRQ 2
15 PC7/VRH
16 PC6/AN0
17 PC5/AN1
18 PC4/AN2
19 PC3/AN3
20 PC2
21 PC1
22 PC0
IC4 MICRO 68HC05P6
24 TCMP
25 PD7/TCAP
23 PD5
OSC2 OSC1 GND
26 27 14
R52 1M0
IC4A
XL1 4M
C47 33P
C48 33P
PA7 3
PA6 4
PA5 5
PA4 6
PA3 7
PA2 8
PA1 9
PA0 10
PB5/SDO 11
PB6/SDI 12
PB7/SCK 13
Q12 BC848W
Q13 BC848W
Q14 BC848W
Q15 BC848W
R56 820
R57 560
R58 820
R59 560
LEFT RED 2 LED
LEFT GREEN 2 LED
RIGHT RED 2 LED
RIGHT GREEN 2 LED
R51 10K 1%
R53 47K 1%
FACTORY TEST
PA0 GND SDO SDI SCK +5V
TEST 6 WAY TOP ENTRY SKT
R80 560
R91 120K 1%
R90 39K 1%
C64 470N TANT
IC8 LM324D
R93 33K
C66 47P
C67 1N0
R95 10K 1%
C65 100N
R96 10K 1%
R102 10K 1%
R103 10K 1%
R98 2K2
Q16 BC848W
R104 4K7
C76 47P
C75 1N0
R100 39K 1%
R110 4K7
C81 10P
IC8 LM324D
R117 4K7
Q17 MTD2955
C83 10P
D2 BAV99
C84 1N0
C78 1N0
C77 10U
D12 MBRD320
R116 1K0
CONTACT 5 +7V2
CONTACT 6 CAPACITY
C80 1N0
CONTACT 7 TEMP
C82 100N
CONTACT 8 GND
R130 10K 1%
RIGHT
R114 47K 1%
Q18 BC848W
R115 47K 1%
C79 47N
R106 560
R101 4K7
IC6 4051B
R105 4K7
R107 39K 1%
C71 470N TANT
R108 120K 1%
IC8 LM324D
R109 33K
C72 47P
C74 1N0
R111 10K 1%
C73 100N
R110 10K 1%
C70 100N
D DPAK FET G S MTD2955
K DPAK ZENER A A MBRD360
KA SOT323 DIODES A K BAV99
C SOT323 NPN B E BC848W
TO-220 VREG VOUT GND VIN 78M05
TO-92 ADJ VREG VIN VOUT VADJ LM317L
© TAIT ELECTRONICS
T3004
DESKTOP DUAL RAPID CHARGER
IPN: 220-01270-03
ISSUE: A
ID: 2.SC.1
PROJECT: T3000
DESIGNER: DBH
FILE NAME: 3K4RCL3A
FILE DATE: 23-11-94
NO. SHEETS: 1
3A DROPED -02 & ADDED A COUPLE DIODES DBH
2A ADDED HEAPS OF BITS DBH
REV/ISS AMENDMENTS DRAWN CHKD D.O. APVD DATE