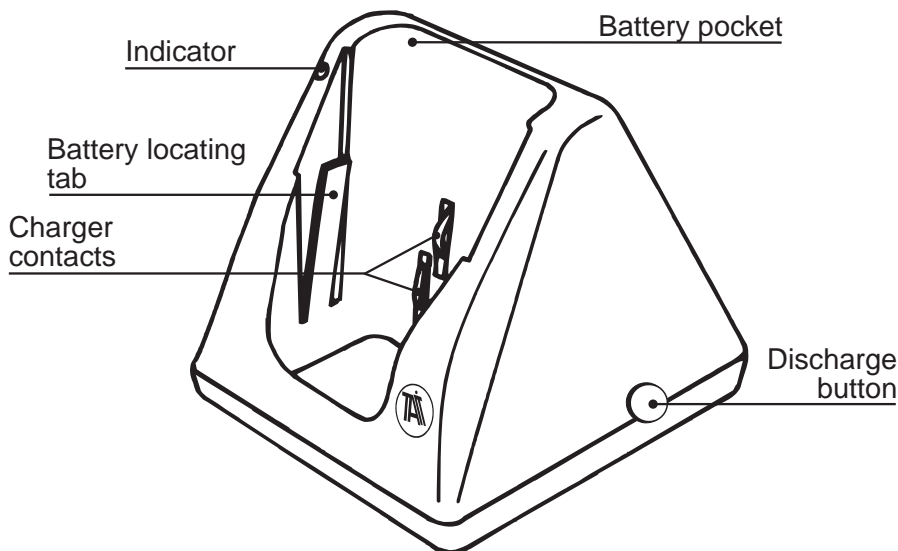


## 7.10 T3002 Fast Charger

### 7.10.1 Introduction



The T3002-0000 single desktop fast charger is designed to charge T3000 rechargeable battery packs, with a slot for either the combined battery and radio or for the battery alone. The charger has a discharge function, activated by the button on the side of the charger and a capacity check feature, providing an indication of battery capacity.

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.

Although the T3002 is primarily intended for use in desktop situations, it may be used in vehicles with a nominal 12V 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 T3002, T3002 plug packs and vehicle supply cable are available under the following IPNs:

T952-050	Vehicle Supply Cable
T952-012	T3002 Plug Pack New Zealand\Australia
T952-022	T3002 Plug Pack UK
T952-032	T3002 Plug Pack Europe
T952-042	T3002 Plug Pack USA/Canada
T3002-0000	T3002 Fast Charger

## 7.10.2 Performance Specifications

Power Supply	.. 10.8 to 16V DC, 13W 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)
Fast Charge Rate	.. 800mA
Discharge Rate	.. 400mA
Trickle Charge Rate:	
NiCd	.. 115mA
NiMH	.. 50mA
Standby Charge Rate	.. 2.2mA
Charge Duration:	
Fast (for an exhausted battery pack):	
NiCd	.. 1.5 hours (typical)
NiMH	.. 2.5 hours (typical)
Trickle:	
NiCd	.. 1 hours
NiMH	.. 2 hours
Standby	.. indefinite
End Of Charge Detection	.. - high voltage - $\Delta T$ (rate of temperature rise) - negative $\Delta V$ - high temperature cut-off - safety timer

## 7.10.3 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.

## 7.10.4 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 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 fast charging, 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 or standby 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	<ul style="list-style-type: none"> <li>• Incorrectly seated battery.</li> <li>• Charger powered but no battery present.</li> <li>• No power connected.</li> </ul>
amber	waiting	Battery present, but awaiting charge while battery is being tested (3 seconds), or until the battery is within the correct temperature range for charging.
green flashing	discharging	Battery is being being completely discharged.
red	fast charge	Fast charge in progress.
green	standby charge	Fast charge complete - trickle or standby charge in progress.
red flashing	fault	Charge suspended - faulty battery, or faulty charger.

### 7.10.4.1 Discharge Function

Regular discharging of the battery (at least weekly) will result in longer battery life.

**Note:** The 'discharge before charge' feature can only be used on batteries with a date code next to the serial number (e.g. G95). Earlier batteries cannot be discharged using a T3002.

Press the discharge button to initiate a discharge-charge cycle.

### 7.10.4.2 Cycle & Capacity Check

#### Introduction

The T3002 fast charger has a cycle and capacity check feature that discharges and charges a NiMH battery pack for 2 cycles, and a NiCd battery pack for 3 cycles. This means that the battery can be cycled and the capacity checked within a 16 hour period. The charger will then provide an indication of the batteries capacity.

The cycle and capacity check function can also be used to rejuvenate batteries that have been stored without use for a significant time, or those suffering from reduced capacity through lack of regular exercise.

When the T3002 is in the 'cycle and capacity check' mode, any discharge request by the user pressing the discharged button is ignored until the last charge cycle.

**Note:** The capacity check feature can only be used on batteries with a date code next to the serial number (e.g. G95). Earlier batteries cannot be discharged using a T3002.

#### Procedure

Insert the battery in the charger, while holding down the discharge button.

Depress the discharge button until the indicator LED has changed from amber (battery being tested) to flashing green (battery discharging). The charger is now in 'cycle and capacity check' mode.

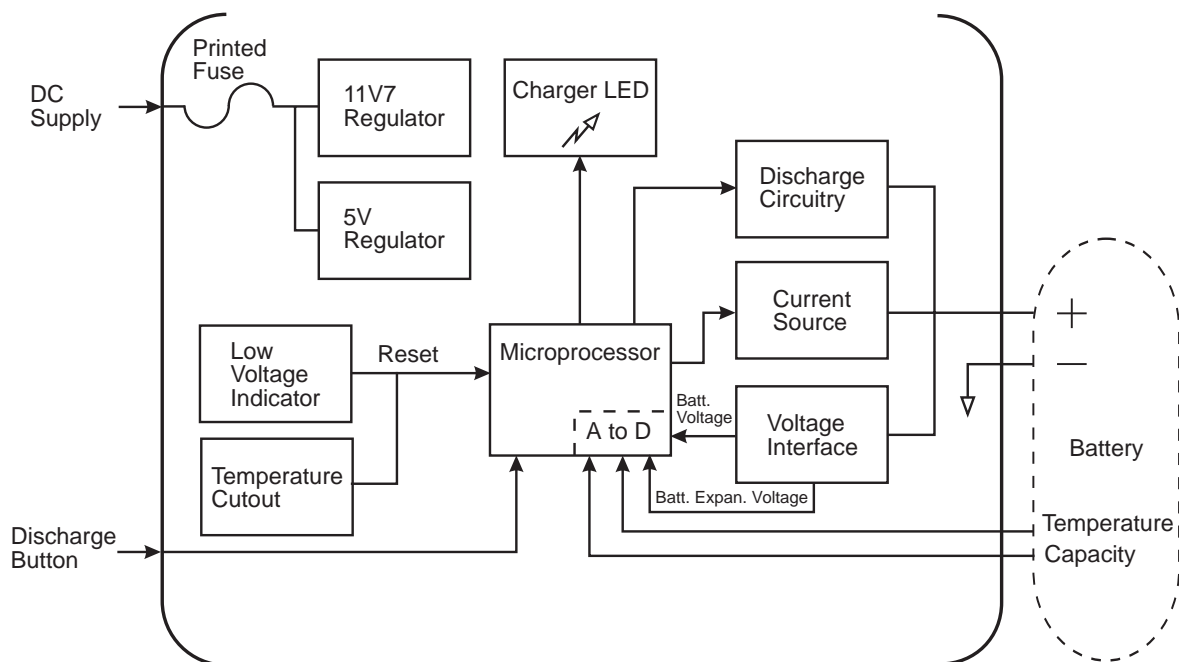
#### Battery Capacity

The last battery discharge cycle is timed to give an approximate battery capacity. The indicator LED gives the charge and capacity status, as shown in the following table.

LED	Condition	Function
amber	waiting	Battery present, but awaiting charge while battery is being tested (3 seconds), or until the battery is within the correct temperature range for charging.
green flashing	discharging	Battery is now discharging and is in 'cycle and capacity check' mode.
amber flashing	low capacity	Battery is less than 70% of the rated capacity, and will be left discharged.
green	capacity adequate	Battery capacity is adequate. Fast charge is complete and trickle or standby charge is in progress.

## 7.10.5 Circuit Description

Refer to the T3002 block diagram, shown below.



The DC supply to the charger feeds the 11.7V and 5V regulators, via a fuse.

- The 11.7V regulator supplies the current source, LED, voltage interface and temperature cutout circuitry.
- The 5V regulator supplies the microprocessor and low voltage indicator (LVI) circuitry.

Battery voltage, temperature and capacity information is presented to the microprocessor via the internal analogue to digital converter. Voltage information arrives through interface circuitry, that provides a normal battery voltage signal and an expanded voltage signal (from 8.24V to 10.5V).

This information, and any discharge request via the discharge button, is used by the microprocessor to appropriately switch on either the charging current source or the discharge circuitry.

During charging, the current source is either continuously switched on (fast charge), or switched on and off at an appropriate duty cycle to provide trickle or standby charging. The exact state of the microprocessor is indicated to the user via the charger LED.

The microprocessor can be put into a reset state if either of the following conditions occur:

- The supply voltage drops and activates the LVI circuitry.
- The internal charger temperature gets too hot and activates the temperature cut-out circuitry.



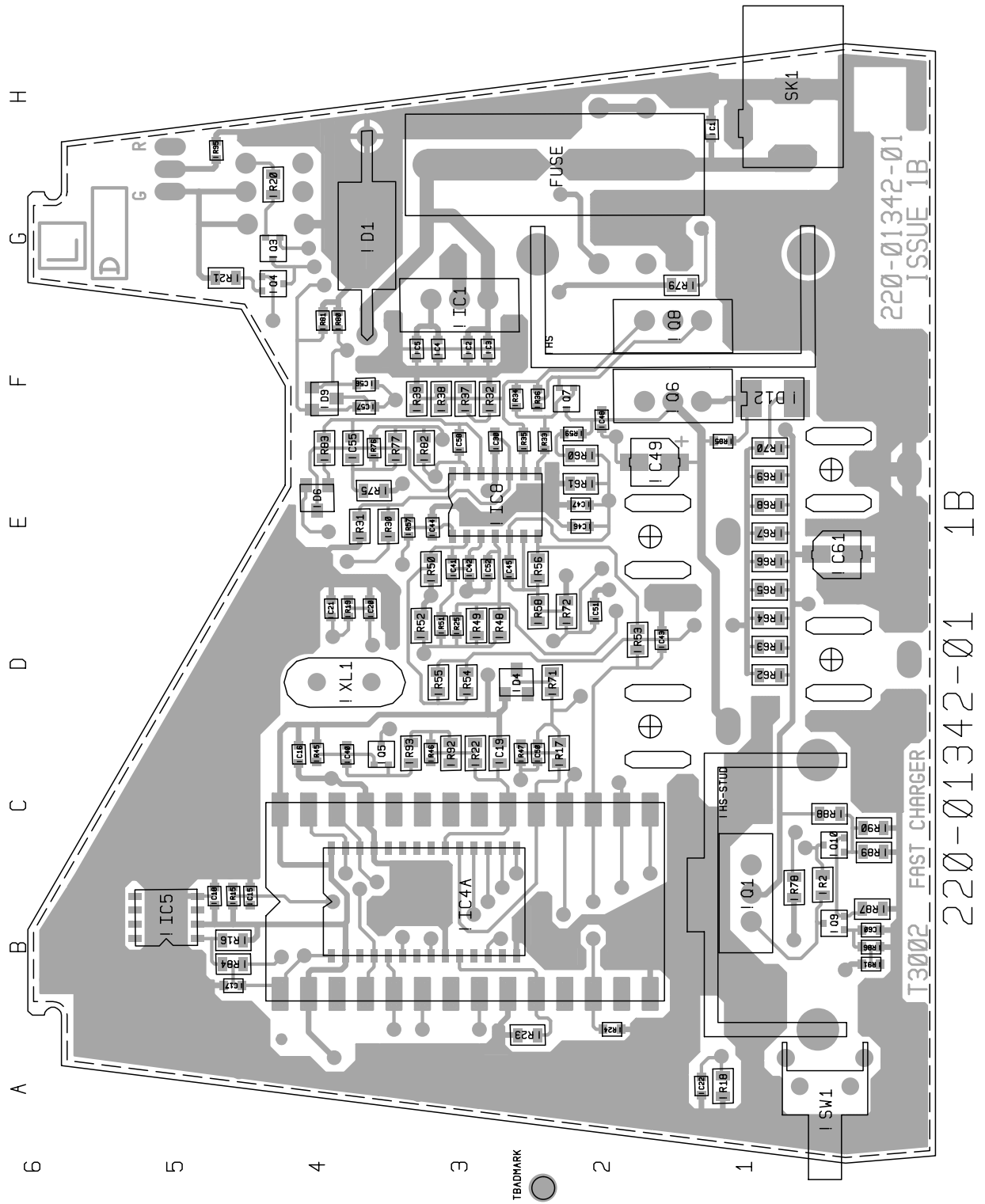
## T3002 Parts List (IPN 220-01342-01)

Ref	VAR	IPN	Description	Ref	VAR	IPN	Description
IC1		018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	IR33		038-14470-00	RES 0603 CHIP 4K7 1/16W +-5%
IC2		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16V	IR34		038-14100-00	RES 0603 CHIP 1K0 1/16W +-5%
IC3		018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	IR35		038-14470-00	RES 0603 CHIP 4K7 1/16W +-5%
IC4		018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	IR36		038-14100-00	RES 0603 CHIP 1K0 1/16W +-5%
IC5		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16V	IR37		036-11180-10	RES M/F 0805 CHIP 1E8 1%
IC15		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16	IR38		036-11180-10	RES M/F 0805 CHIP 1E8 1%
IC16		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16	IR39		036-11180-10	RES M/F 0805 CHIP 1E8 1%
IC17		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16	IR45		038-14100-00	RES 0603 CHIP 1K0 1/16W +-5%
IC18		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16	IR46		036-15100-10	RES M/F 0805 CHIP 10K 1%
IC19		018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	IR47		036-15100-10	RES M/F 0805 CHIP 10K 1%
IC20		018-12330-00	CAP 0603 CHIP 33P 50V NPO +-5%	IR48		036-15100-10	RES M/F 0805 CHIP 10K 1%
IC21		018-12330-00	CAP 0603 CHIP 33P 50V NPO +-5%	IR49		036-15100-10	RES M/F 0805 CHIP 10K 1%
IC22		018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	IR50		036-15390-10	RES M/F 0805 CHIP 39K 1%
IC25		018-15100-00	CAP 0603 CHIP 10N 50V X7R +-10%	IR51		038-14470-00	RES 0603 CHIP 4K7 1/16W +-5%
IC30		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16	IR52		036-15390-10	RES M/F 0805 CHIP 39K 1%
IC40		018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	IR53		036-15390-10	RES M/F 0805 CHIP 39K 1%
IC41		018-12180-00	CAP 0603 CHIP 18P 50V NPO +-5%	IR54		036-15100-10	RES M/F 0805 CHIP 10K 1%
IC42		018-12180-00	CAP 0603 CHIP 18P 50V NPO +-5%	IR55		036-15100-10	RES M/F 0805 CHIP 10K 1%
IC43		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16	IR56		036-16120-10	RES M/F 0805 CHIP 120K 1%
IC44		018-12180-00	CAP 0603 CHIP 18P 50V NPO +-5%	IR57		038-14100-00	RES 0603 CHIP 1K 1/16W +-5%
IC45		018-12180-00	CAP 0603 CHIP 18P 50V NPO +-5%	IR58		036-15330-00	RES M/F 0805 CHIP 33K 5%
IC46		018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	IR59		038-14100-00	RES 0603 CHIP 1K0 1/16W +-5%
IC47		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16	IR60		036-15100-10	RES M/F 0805 CHIP 10K 1%
IC48		018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	IR61		036-15100-10	RES M/F 0805 CHIP 10K 1%
IC49		016-08100-01	CAP ELECT 6X4MM CHIP 10M 20% 16V	IR62		036-11180-10	RES M/F 0805 CHIP 1E8 1%
IC50		018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	IR63		036-11180-10	RES M/F 0805 CHIP 1E8 1%
IC51		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16	IR64		036-11180-10	RES M/F 0805 CHIP 1E8 1%
IC52		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16	IR65		036-11180-10	RES M/F 0805 CHIP 1E8 1%
IC55		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16	IR66		036-11180-10	RES M/F 0805 CHIP 1E8 1%
IC56		018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	IR67		036-11180-10	RES M/F 0805 CHIP 1E8 1%
IC57		018-14100-00	CAP 0603 CHIP 1N 50V X7R +-10%	IR68		036-11180-10	RES M/F 0805 CHIP 1E8 1%
IC58		018-12180-00	CAP 0603 CHIP 18P 50V NPO +-5%	IR69		036-11180-10	RES M/F 0805 CHIP 1E8 1%
IC60		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16	IR70		036-11180-10	RES M/F 0805 CHIP 1E8 1%
IC61		016-08100-01	CAP ELECT 6X4MM CHIP 10M 20% 16V	IR71		036-15390-10	RES M/F 0805 CHIP 39K 1%
ID1		001-00012-77	(S) DIODE 1N6277A ZENER 18V 1500W	IR72		036-15100-10	RES M/F 0805 CHIP 10K 1%
ID3		008-02099-00	(S) LED RED/GREEN BI-COLOUR 3.1MM	IR75		036-15100-10	RES M/F 0805 CHIP 10K 1%
ID4		001-10000-70	(S) DIODE SMD BAV70 DUAL SWITCH SO	IR76		036-15100-10	RES M/F 0805 CHIP 10K 1%
ID6		001-10000-70	(S) DIODE SMD BAV70 DUAL SWITCH SO	IR77		036-15100-10	RES M/F 0805 CHIP 10K 1%
ID9		001-10000-70	(S) DIODE SMD BAV70 DUAL SWITCH SO	IR78		045-15100-00	RES NTC SMD 10K 5%
ID12		001-10014-03	(S) DIODE SMD MBRS140T3 SCHOTTKEY	IR79		045-15100-00	RES NTC SMD 10K 5%
IIC1		002-00078-05	(S) IC MC7805ACT 5V REG(LINEAR)1A	IR80		036-14120-00	RES M/F 0805 CHIP 1K2 5%
IIC4		002-06870-51	(LS) IC MC68HC705P6P OTP MICRO 28	IR81		036-14120-00	RES M/F 0805 CHIP 1K2 5%
IIC4A		240-04020-95	(L) SKT SMD DIP 28	IR82		036-15470-10	RES M/F 0805 CHIP 47K 1%
IIC5		002-10340-64	(S) IC SMD MC34064 LO VOLT SENSE	IR83		036-15180-10	RES M/F 0805 CHIP 18K 1%
IIC8		002-10003-24	(S) IC SMD 324 QUAD OP AMP SO14	IR84		036-13560-00	RES M/F 0805 CHIP 560E 5%
IQ1		000-00295-50	(S) XSTR MTP2955 FET TO-220	IR86		038-14100-00	RES 0603 CHIP 1K0 1/16W +-5%
IQ3		000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 S	IR87		036-13560-00	RES M/F 0805 CHIP 560E 5%
IQ4		000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 S	IR88		036-15180-10	RES M/F 0805 CHIP 18K 1%
IQ5		000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 S	IR89		036-15100-10	RES M/F 0805 CHIP 10K 1%
IQ6		000-00295-50	(S) XSTR MTP2955 FET TO-220	IR90		036-15100-10	RES M/F 0805 CHIP 10K 1%
IQ7		000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 S	IR91		038-14100-00	RES 0603 CHIP 1K0 1/16W +-5%
IQ8		000-00012-49	(S) XSTR TIP31 NPN PWR SWTCH TO220	IR92		036-15100-10	RES M/F 0805 CHIP 10K 1%
IQ9		000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323 S	IR93		036-10000-00	RES M/F 0805 CHIP ZERO OHM
IQ10		000-10084-81	(S) XSTR SMD BC848BW NPN SOT-323	ISW1		232-00010-29	(L) SWITCH TACT 3.85MM RED STEM H
IR2		036-14470-10	RES M/F 0805 CHIP 4K7 1%	SK1		240-02020-07	SKT DC JACK 5.5MM HOLE 2.5MM PIN
IR15		038-14100-00	RES 0603 CHIP 1K0 1/16W +-5%	!XL1		274-00010-33	XTAL 4MHZ TE-35 HC49U C/W TEFLON
IR16		036-15470-10	RES M/F 0805 CHIP 47K 1%			220-01342-01	(L) PCB T3002 SINGLE FAST CHARGER
IR17		036-13560-00	RES M/F 0805 CHIP 560E 5%			302-40038-00	BUTTON RED T3002 OPERATING
IR18		036-15100-10	RES M/F 0805 CHIP 10K 1%			303-20051-01	COVER TOP A1M2800 T3003 TRICKLE CHA
IR19		038-17100-00	RES 0603 CHIP 1M 1/16W +-5%			303-20052-01	COVER BTM A1M2801 T3003 TRICKLE CH
IR20		036-13820-00	RES M/F 0805 CHIP 820E 5%			303-50027-00	CONTACT A3M2818 T3000 BAT CHARGER
IR21		036-13560-00	RES M/F 0805 CHIP 560E 5%			308-13110-00	HSINK PCB MTG FOR VERT MNT TO220 C/
IR22		036-16120-10	RES M/F 0805 CHIP 120K 1%			308-13117-00	HSINK TO-220 HOR PCB MOUNTING
IR23		036-15100-10	RES M/F 0805 CHIP 10K 1%			349-00010-22	SCREW NO 4X3/8 PAN POZI PLASTITE
IR24		036-15470-10	RES M/F 0805 CHIP 47K 1%			365-00100-09	LABEL WHITE VINYL 15X11MM S/A
IR25		038-17100-00	RES 0603 CHIP 1M 1/16W +-5%			365-01450-00	LABEL BLNK 38*9MM TAMPERMARK VOID
IR30		036-16100-10	RES M/F 0805 CHIP 100K 1%			365-01498-00	LABEL MODEL ID T3002-0000
IR31		036-15180-10	RES M/F 0805 CHIP 18K 1%			369-00010-11	FOOT RUBBER BUMP-ON S/A
IR32		036-11180-10	RES M/F 0805 CHIP 1E8 1%			410-01100-00	PKG A3A723 T3003 TRICKLE CHARGER
						459-30023-00	USER GUIDE T3002 FAST CHARGER

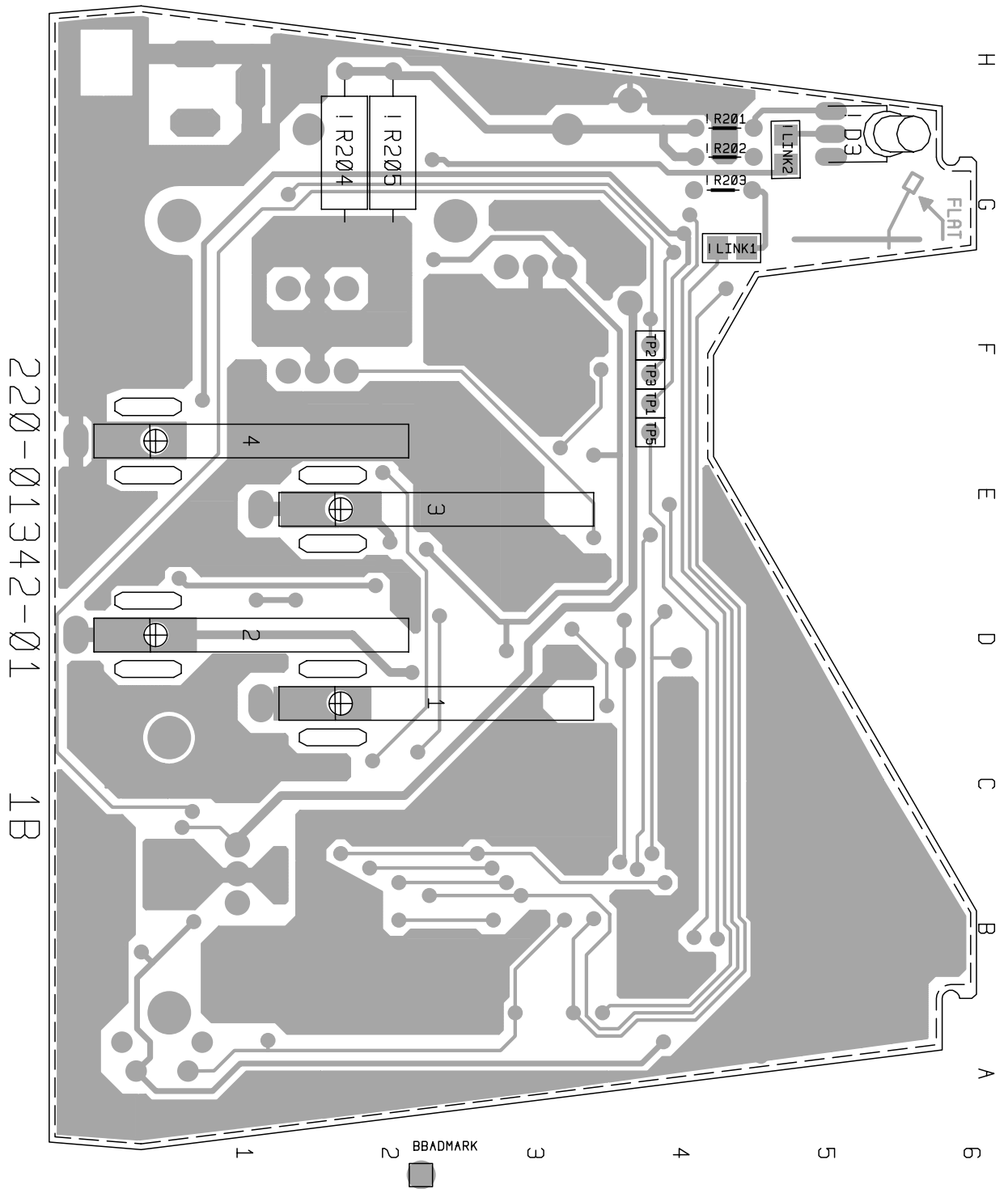
## T3002 Grid Reference Index (IPN 220-01342-01)

Device	PCB	Circuit	Device	PCB	Circuit	Device	PCB	Circuit
3	2:E1	1-L2	!LINK2	2:G5	1-J6	!R80	1:F4	1-B6
2	2:D0	1-L3	!Q1	1:B1	1-G8	!R81	1:F4	1-B6
1	2:D1	1-L4	!Q3	1:G4	1-D3	!R82	1:F3	1-B5
4	2:E0	1-L1	!Q4	1:G4	1-E3	!R83	1:F4	1-C6
			!Q5	1:C4	1-F2	!R84	1:B5	1-D6
IC1	1:H1	1-B8	!Q6	1:F2	1-H2	!R85	1:F1	1-J2
IC2	1:F3	1-C7	!Q7	1:F2	1-J5	!R86	1:B0	1-F7
IC3	1:F3	1-C7	!Q8	1:F2	1-J5	!R87	1:B0	1-F6
IC4	1:F3	1-D7	!Q9	1:B0	1-F7	!R88	1:C0	1-G7
IC5	1:F3	1-E7	!Q10	1:C0	1-G7	!R89	1:C0	1-G6
IC15	1:B5	1-A4				!R90	1:C0	1-H6
IC16	1:C4	1-C4	!R2	1:B1	1-F8	!R91	1:B0	1-F7
IC17	1:B5	1-D5	!R15	1:B5	1-B4	!R92	1:C3	1-F1
IC18	1:B5	1-E5	!R16	1:B5	1-D6	!R93	1:C3	1-F1
IC19	1:C3	1-A3	!R17	1:C2	1-A3	!R95	1:H5	1-E2
IC20	1:D4	1-B1	!R18	1:A1	1-C3	!R201	2:H5	1-J7
IC21	1:D4	1-B1	!R19	1:D4	1-B1	!R202	2:G5	1-K7
IC22	1:A1	1-D3	!R20	1:G4	1-D3	!R203	2:G5	1-K7
IC30	1:F3	1-G5	!R21	1:G5	1-E3	!R204	2:G2	1-J7
IC40	1:C4	1-F2	!R22	1:C3	1-E1	!R205	2:G2	1-J7
IC41	1:E3	1-G2	!R23	1:A3	1-C2			
IC42	1:E3	1-G2	!R24	1:A2	1-C2	SK1	1:J1	1-B8
IC43	1:D2	1-G1	!R25	1:D3	1-F3	!SW1	1:A0	1-D3
IC44	1:E3	1-H2	!R30	1:E4	1-F6			
IC45	1:E3	1-H1	!R31	1:E4	1-F5	!TP1	2:F4	1-H7
IC46	1:E2	1-H0	!R32	1:F3	1-J4	TP2	2:F4	1-B6
IC47	1:E2	1-H0	!R33	1:F2	1-H5	TP3	2:F4	1-B6
IC48	1:F2	1-J2	!R34	1:F3	1-H5	TP5	2:E4	1-D6
IC49	1:E2	1-J2	!R35	1:F3	1-H5			
IC50	1:C3	1-L3	!R36	1:F3	1-J5	!XL1	1:D4	1-B1
IC51	1:D2	1-L1	!R37	1:F3	1-J4			
IC52	1:E3	1-M5	!R38	1:F3	1-J4			
IC55	1:F4	1-A5	!R39	1:F3	1-J4			
IC56	1:F4	1-A5	!R45	1:C4	1-F2			
IC57	1:F4	1-B5	!R46	1:C3	1-F1			
IC58	1:F3	1-C6	!R47	1:C3	1-E1			
IC60	1:B0	1-F7	!R48	1:D3	1-F3			
IC61	1:E0	1-H7	!R49	1:D3	1-F3			
			!R50	1:E3	1-G3			
ID1	1:F4	1-C8	!R51	1:D3	1-G2			
ID3	2:H5	1-D2	!R52	1:D3	1-G2			
		1-E2	!R53	1:D2	1-G1			
ID4	1:D3	1-K3	!R54	1:D3	1-G3			
		1-K3	!R55	1:D3	1-G3			
ID6	1:E4	1-D6	!R56	1:E3	1-G1			
		1-D6	!R57	1:E3	1-H2			
ID9	1:F4	1-B5	!R58	1:D3	1-H1			
		1-B5	!R59	1:F2	1-H2			
ID12	1:F1	1-H3	!R60	1:F2	1-H1			
			!R61	1:E2	1-H0			
FUSE	1:H1	1-B8	!R62	1:D1	1-H3			
			!R63	1:D1	1-H3			
IHS-STUD	1:B1		!R64	1:D1	1-H3			
IHS	1:F2		!R65	1:E1	1-H3			
			!R66	1:E1	1-J3			
IIC1	1:G3	1-D7	!R67	1:E1	1-J3			
IIC4	1:B3	1-C2	!R68	1:E1	1-J3			
IIC4A	1:B3	1-C1	!R69	1:E1	1-J3			
IIC5	1:B5	1-E5	!R70	1:F1	1-J3			
IIC8	1:E3	1-L5	!R71	1:D2	1-K3			
		1-G3	!R72	1:D2	1-K2			
		1-G1	!R75	1:E4	1-A6			
		1-H5	!R76	1:F4	1-A6			
		1-C5	!R77	1:F4	1-A5			
!LINK1	2:G4	1-K7	!R78	1:B1	1-B7			
			!R79	1:G1	1-B7			

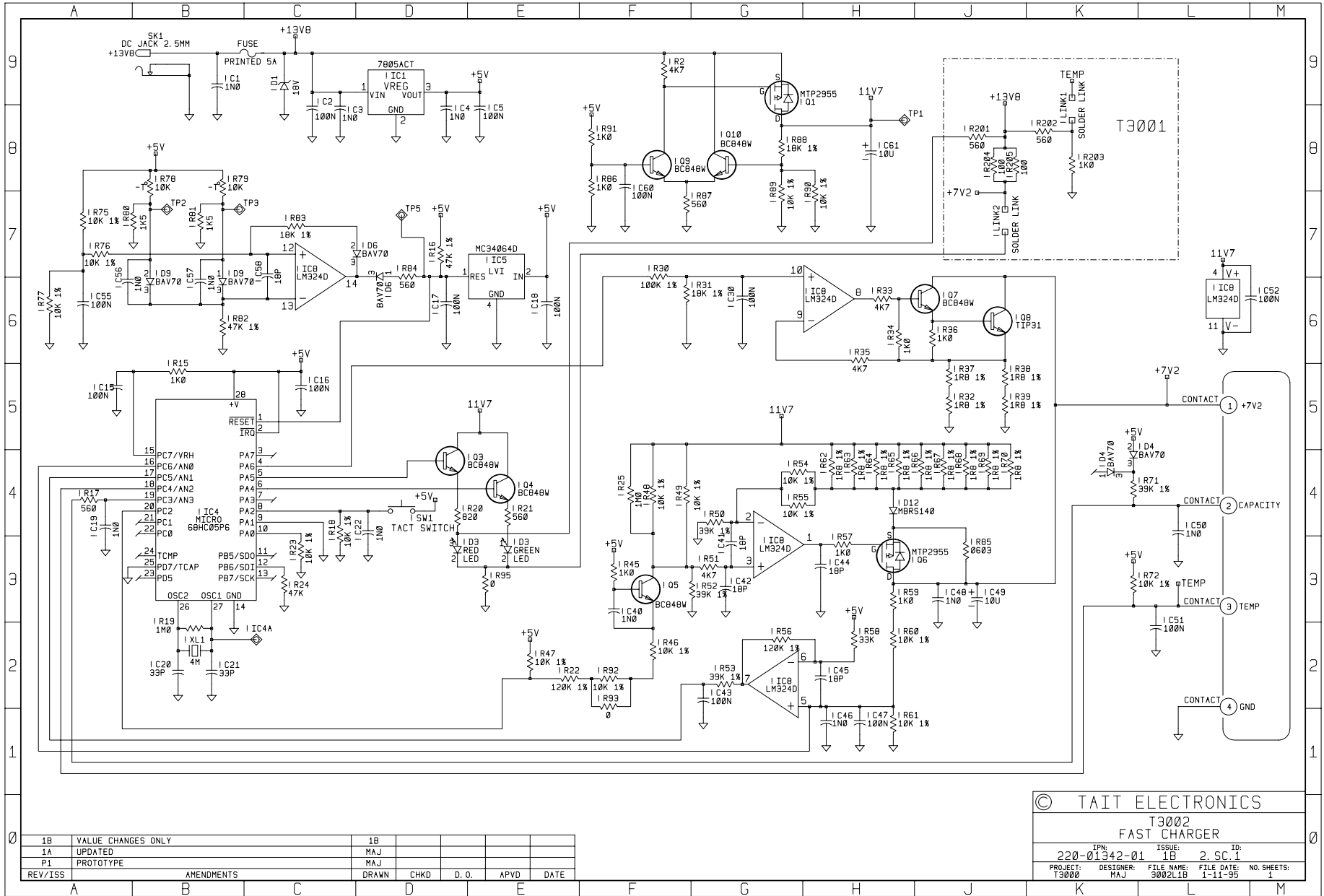




T3002 Fast Charger PCB (IPN 220-01342-01) - Top Copper



T3002 Fast Charger PCB (IPN 220-01342-01) - Bottom Copper



1B	VALUE CHANGES ONLY	1B				
1A	UPDATED	MAJ				
P1	PROTOTYPE	MAJ				
REV/ISS	AMENDMENTS	DRAWN	CHKD	D.O.	APVD	DATE

© TAIT ELECTRONICS			
T3002 FAST CHARGER			
IPN:	ISSUE:	ID:	
220-01342-01	1B	2. SC. 1	
PROJECT:	DESIGNER:	FILE NAME:	FILE DATE:
T3000	MAJ	3002L1B	1-11-95
			NO. SHEETS: 1

