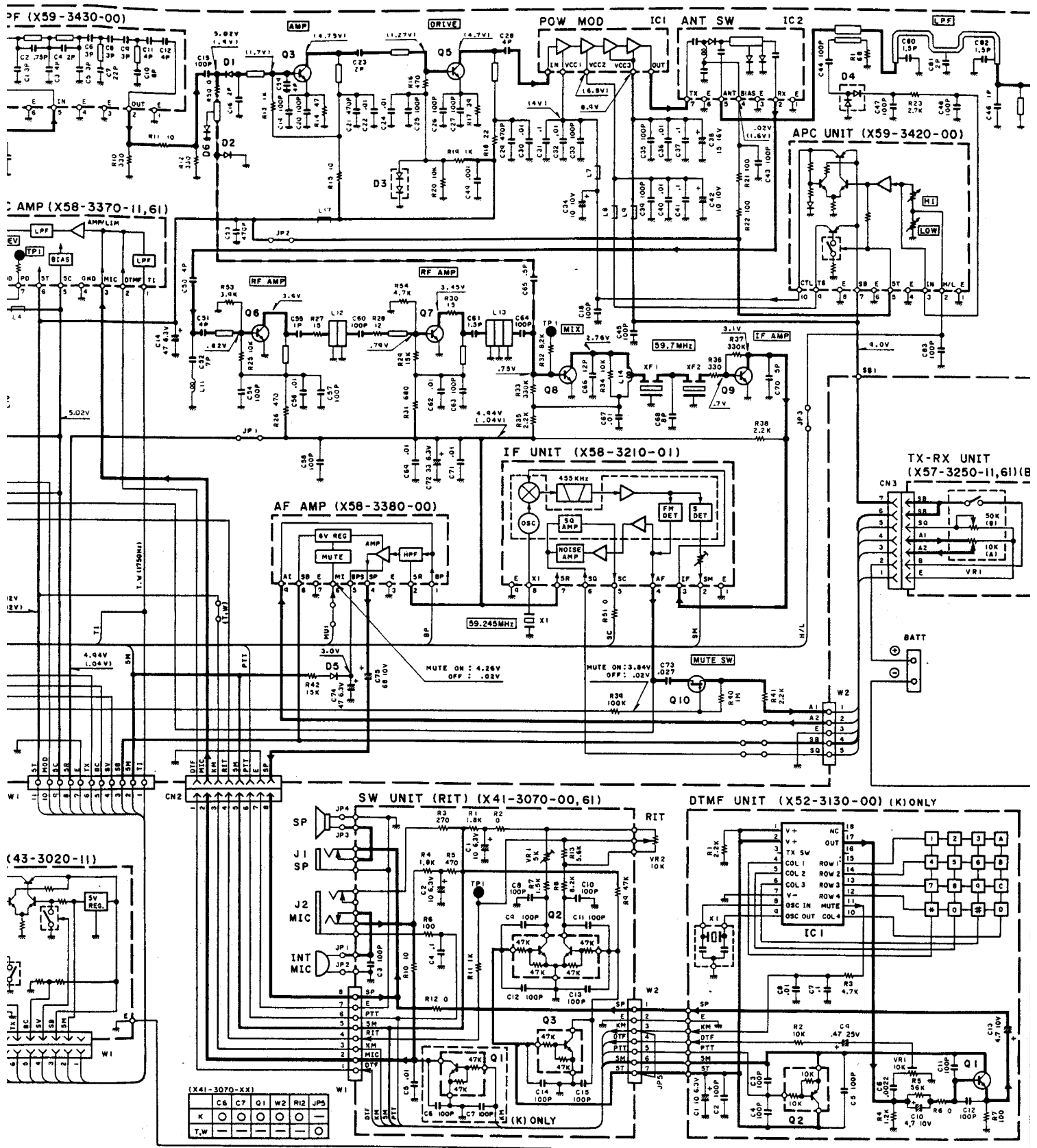
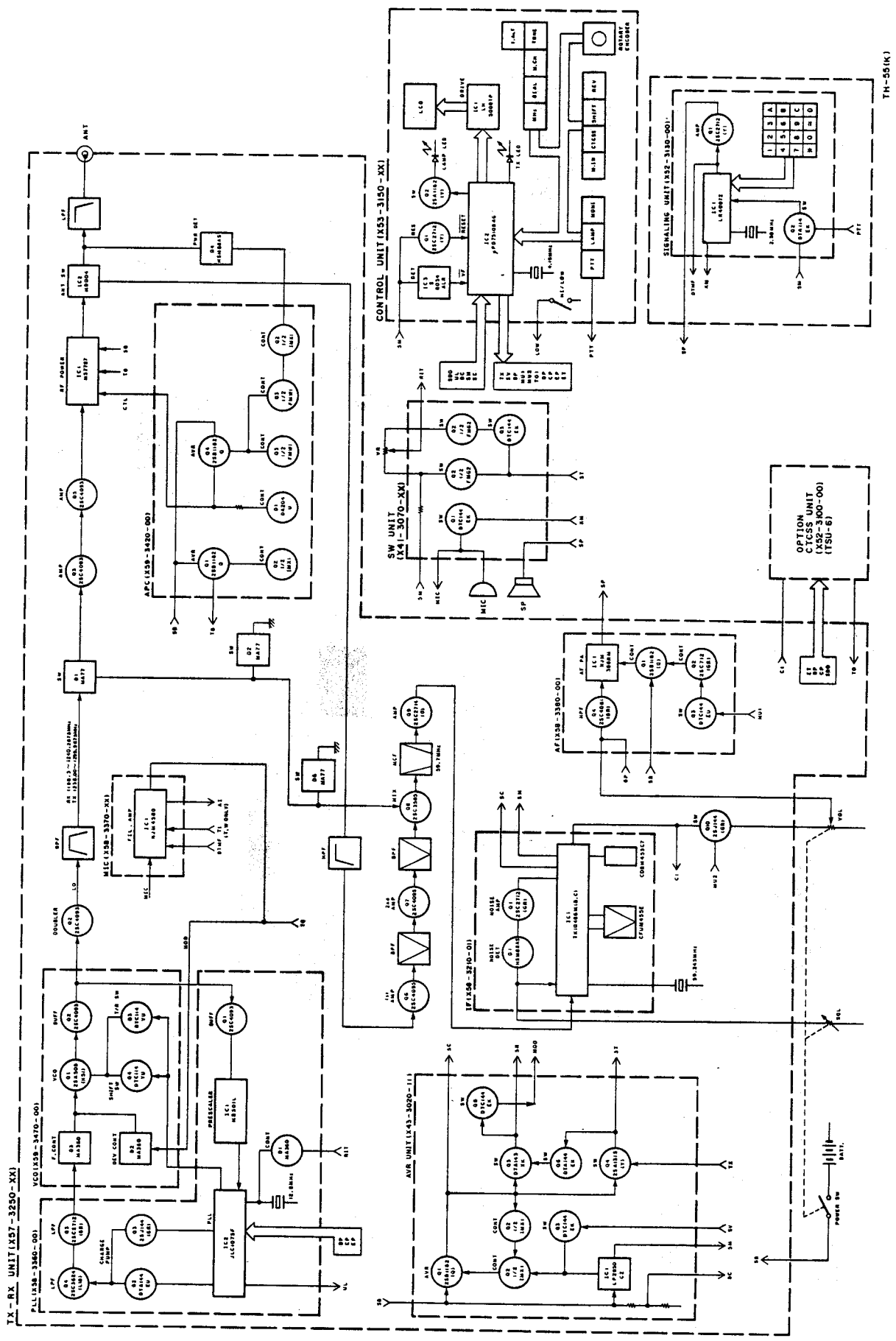


SCHEMATIC DIAGRAM TH-55AT



BLOCK DIAGRAM

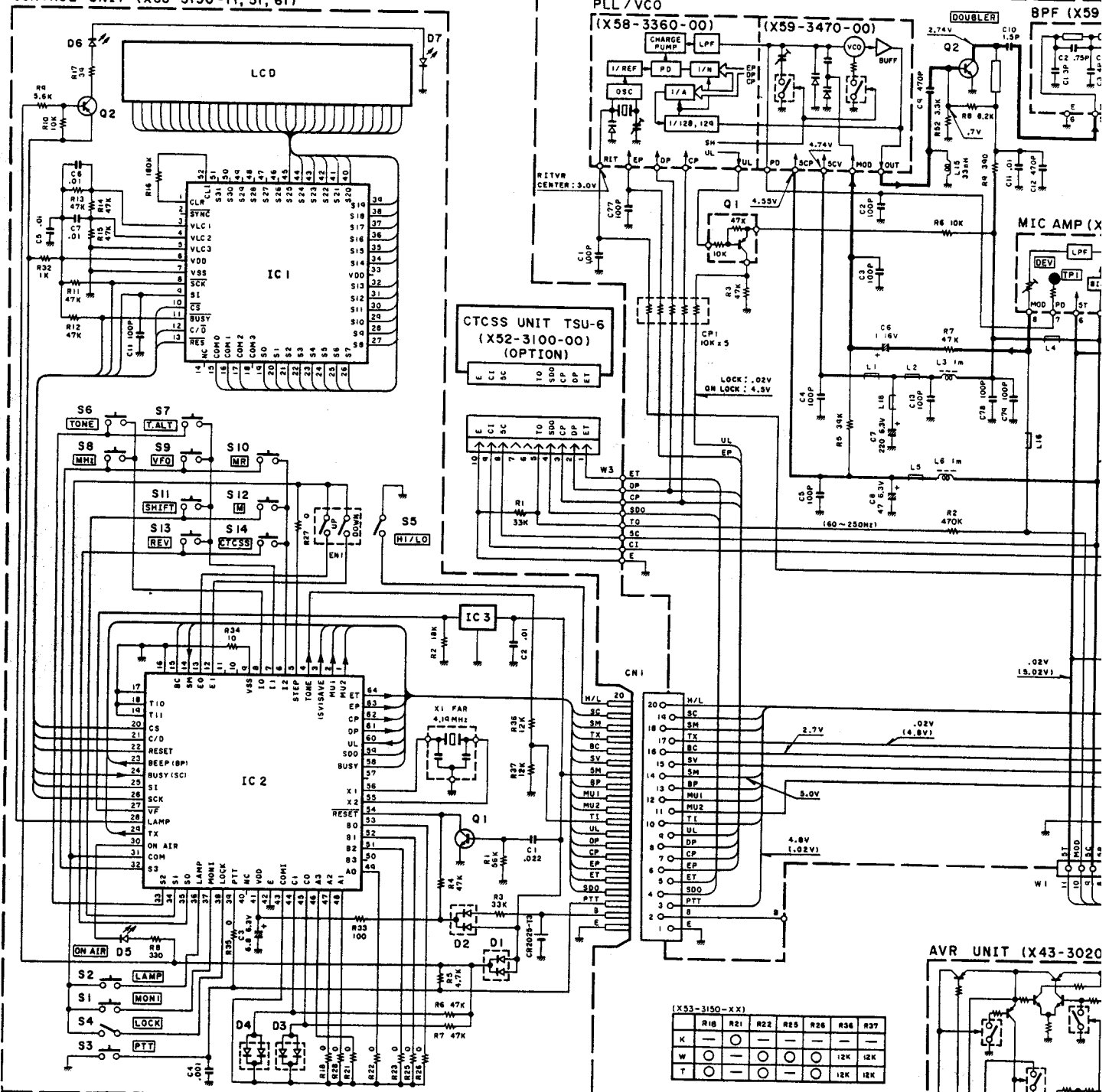
C



Signal line Control line Common DC line

CONTROL UNIT (X53-3150-11, 51, 61)

TX-RX UNIT (X57-3250-11, 61) (A/3)



- (X53-3150-XX)
 IC1 : LH5008TP
 IC2 : μPD75108AG
 IC3 : S8054 ALR-LN
 Q1 : 2SC2712(Y)
 Q2 : 2SA1162(Y)
 D1, 2 : 1SS184
 D3, 4 : 1SS181

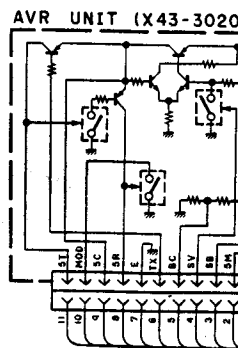
- (X57-3250-XX)
 IC1 : M57787
 IC2 : MD-004
 Q1 : DTA114YU
 Q2, 3, 5 : 2SC4093(R27)
 Q6, 7 : 2SC4095(R47.6)
 Q8 : 2SC3585(R44.3)
 Q9 : 2SC2714(O)
 Q10 : 2SJ144(GR)

- D1, 2, 6 : MA77
 D3 : DA204K
 D4 : HSM88AS
 D5 : MA110

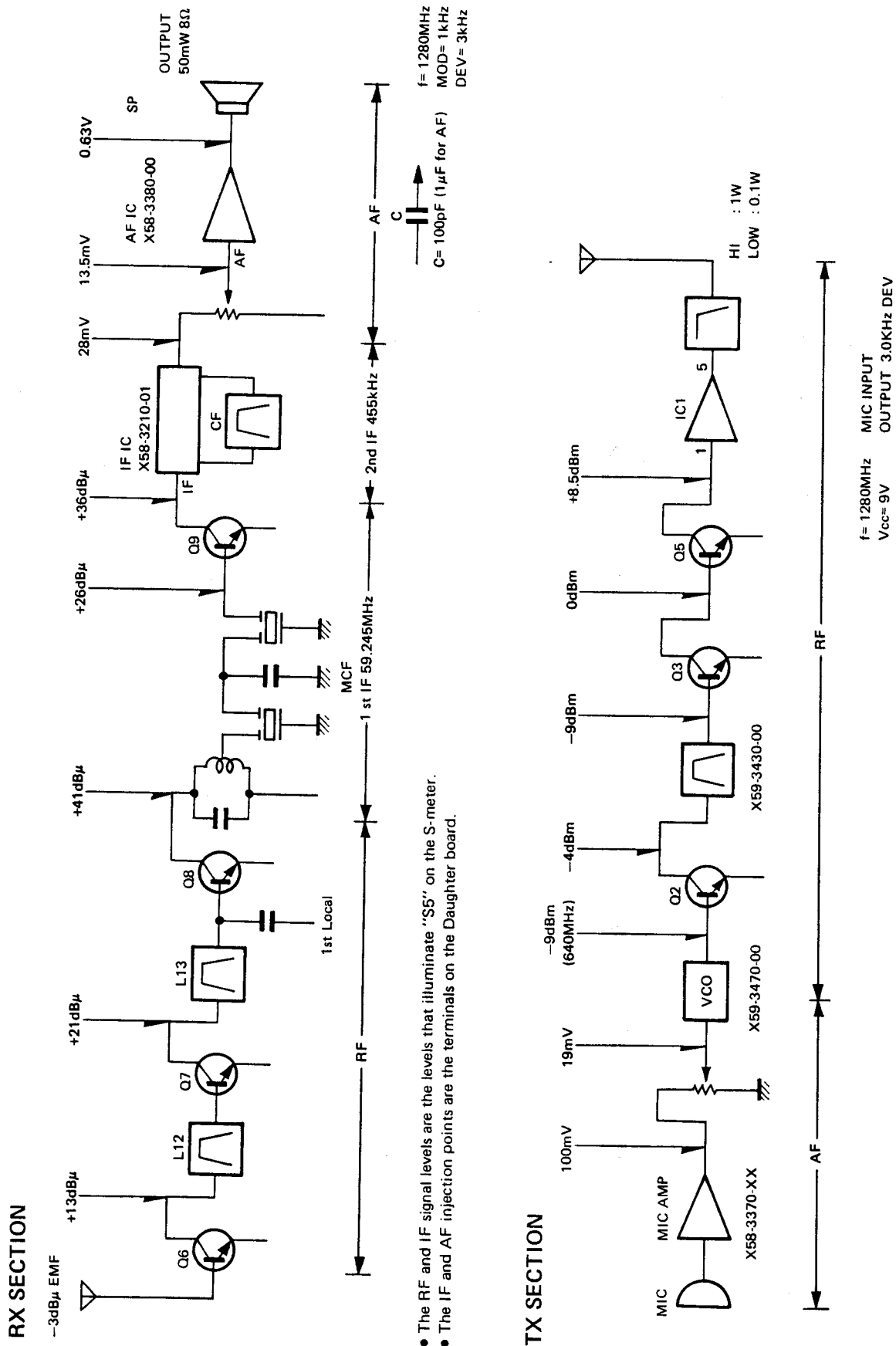
(X53-3150-XX)

R18	R21	R22	R25	R26	R36	R37
K	—	—	—	—	—	—
T	—	—	—	12K	12K	—
W	—	—	—	—	—	—

- (X41-3070-XX)
 Q1, 3 : DTC144EK
 Q2 : FMG2
 (X52-3130-00)
 IC1 : LR40872
 Q1 : 2SC2712(GR)
 Q2 : DTA114EK



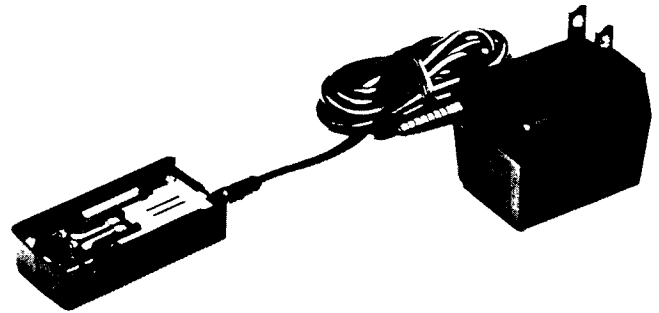
LEVEL DIAGRAM



TERMINAL FUNCTIONS/BC-9 (BATTERY CHARGER)

Connector No.	Terminal No.	Terminal Name	Function
TX-RX UNIT (A/3) – CONTROL UNIT			
CN1	1	E	Ground.
	2	B	Not used.
	3	PTT	PTT SW signal. "L" : TX, "H" : RX.
	4	SDO	Tone signal match/mismatch identification signal.
	5	ET	Tone enable.
	6	EP	PLL enable.
	7	CP	Clock signal.
	8	DP	PLL tone serial data.
	9	UL	PLL unlock signal.
	10	TI	1750Hz tone signal. TH-55E
	11	MU2	Mute signal. "H" : Mute.
	12	MU1	Mute signal. "H" : Mute.
	13	BP	Beep signal.
	14	5M	5V power supply for MUP and MIC.
	15	SV	SAVE signal output. "L" : Save, "H" : Normal.
	16	BC	Battery voltage check signal.
	17	TX	Transmit/receive switching signal. "L" : TX, "H" : RX.
	18	SM	S-meter signal.
	19	SC	Busy signal.
	20	H/L	High/Low power switching signal.
TX-RX UNIT (A/3) – TSU-6			
W3	1	ET	Tone enable.
	2	DT	Tone serial data.
	3	CT	Clock signal.
	4	SDO	Tone signal match/mismatch identification signal.
	5	TO	Tone output.
	6	PTT	Not used.
	7	CO	Not used.
	8	5C	5V power supply.
	9	CI	Audio signal input.
	10	E	Ground.
TX-RX UNIT (A/3) – SWITCH UNIT			
CN2	1	DTMF	DTMF signal. TH-55AT
	2	MIC	Signal line from microphone.
	3	KM	MIC mute signal.
	4	RIT	RIT voltage.
	5	5M	5V power supply for MUP and MIC.
	6	PTT	External standby line.
	7	E	Ground.
	8	SP	Signal line to built in speaker.
TX-RX UNIT (A/3) – TX-RX UNIT (B/3)			
W2	1	A1	AF volume input line.
	2	A2	AF amplifier input line.
	3	E	Ground.
	4	SB	B power supply after power switch.
	5	SQ	Squelch volume input line.
TX-RX UNIT (A/3) – AVR UNIT			
W1	1	TI	Not used.
	2	5M	5V power supply for MPU and MIC.
	3	SB	B power supply after power switch.
	4	SV	Battery save signal.
	5	BC	Battery voltage check signal.
	6	TX	Transmit signal.
	7	E	Ground.
	8	5C	Common 5V power supply.
	9	5R	5V power supply for receive.
	10	MOD	Not used.
	11	5T	5V power supply for transmit.

BC-9 EXTERNAL VIEW



BC-9 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
		A02-0814-03	Case (Charge adapter)
		A40-0622-04	Bottom plate
		B42-3301-04	Label (LA) (K)
		E23-0494-04	Terminal ⊖
		E23-0605-04	Terminal ⊕
		G13-0852-04	Cushion
		J19-1426-03	Terminal holder

TH-55AT/E

BC-10 (COMPACT CHARGER)

BC-10 EXTERNAL VIEW

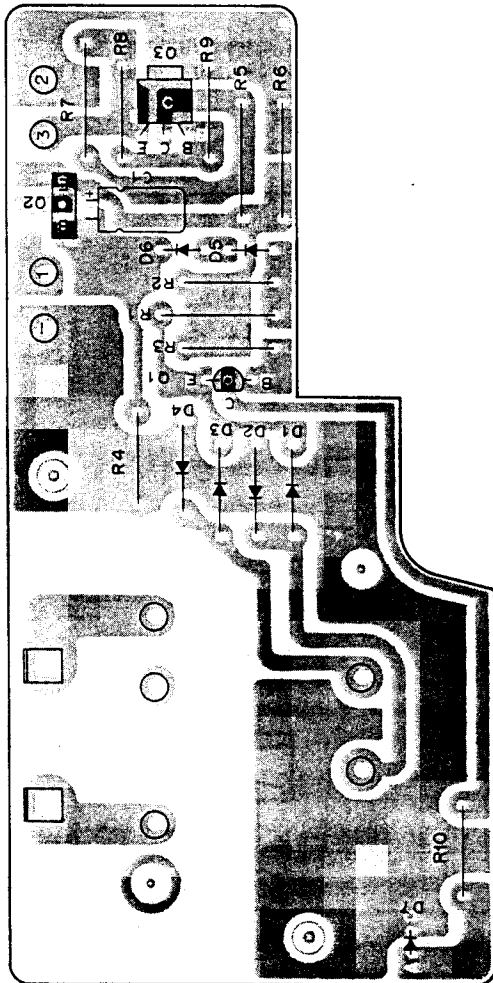


BC-10 PARTS LIST

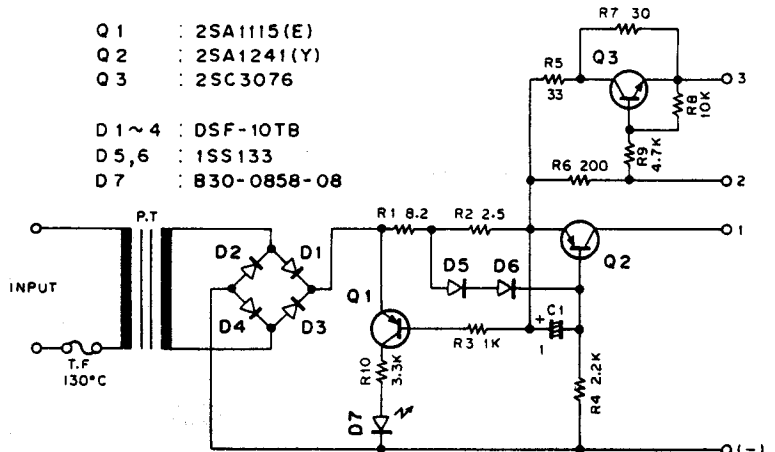
* : New Parts

Ref. No.	New Parts	Parts No.	Description
D7	*	A02-0828-08	Case (Upper) K,M,M2
	*	A02-0829-08	Case (Upper) X,T,W
	*	A02-0832-08	Case (Lower)
	*	B30-0858-08	LED SR615D
	*	B50-8203-08	Instruction manual K,M,M2,X,W
	*	B50-8204-08	Instruction manual T
	*	E30-2097-08	AC power cord K,M,M2
	*	E30-2098-08	AC power cord X
	*	E30-2099-08	AC power cord T
	*	E30-2100-08	AC power cord W
	*	L01-8027-08	Power transformer 220V M,W
	*	L01-8111-08	Power transformer 120V K,M2
	*	L01-8152-08	Power transformer 240V X,T
Q1		2SA1115(E)	Transistor
	Q2	2SA1241(Y)	Transistor
	Q3	2SC3076	Transistor
D1-4	*	DSF-10TB	Diode
	D5, 6	1SS133	Diode

BC-10 PC BOARD VIEW



BC-10 CIRCUIT DIAGRAM



BC-11 (RAPID CHARGER)

BC-11 EXTERNAL VIEW



BC-11 CIRCUIT DESCRIPTION

General

The BC-11 is a rapid charger for the PB-5 to PB-9 Ni-Cd batteries for TH-25, TH-45 and TH-55.

Theory of Operation

The operation of each block is explained below.

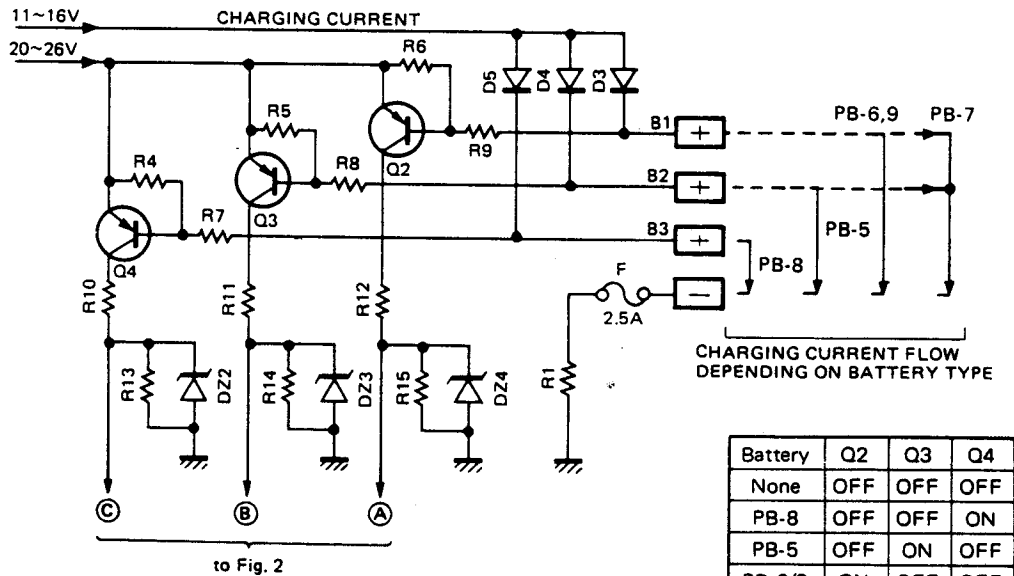
1) + 11V AVR Circuit

This AVR circuit, consisting of a 2SD600F transistor (Q1) and DZA11Y Zener diode (DZ1) provides an output of approximately +11V as the reference voltage for the charging circuit consisting of IC2 to IC5.

2) Battery Pack Detect Circuit

This circuit detects whether a battery pack is inserted in the charger. Outputs from this circuit are routed to the reset circuit and the battery recognition circuit.

When a PB-6 or PB-9 is inserted in the charger, a small amount of current flows from Q2 : 2SA608E through R9 to the charging terminal B1 and Q2 turns on. As a result, an output of approximately 11V appears at (A) in Figure 1. Similarly when a PB-5 or PB-7 is inserted Q3 : 2SA608E turns on and approximately 11V is provided at output (B). When a PB-8 is inserted Q4 : 2SA608E turns on and approximately 11V is provided at output (C).



Battery	Q2	Q3	Q4
None	OFF	OFF	OFF
PB-8	OFF	OFF	ON
PB-5	OFF	ON	OFF
PB-6/9	ON	OFF	OFF
PB-7	ON	ON	OFF

Table 1

Fig. 1 Battery Pack Detect Circuit Block Diagram

BC-11 (RAPID CHARGER)

3) Reset Circuit/Charge Status Memory Circuit/ Display Circuit

The reset circuit initializes the charging status memory circuit.

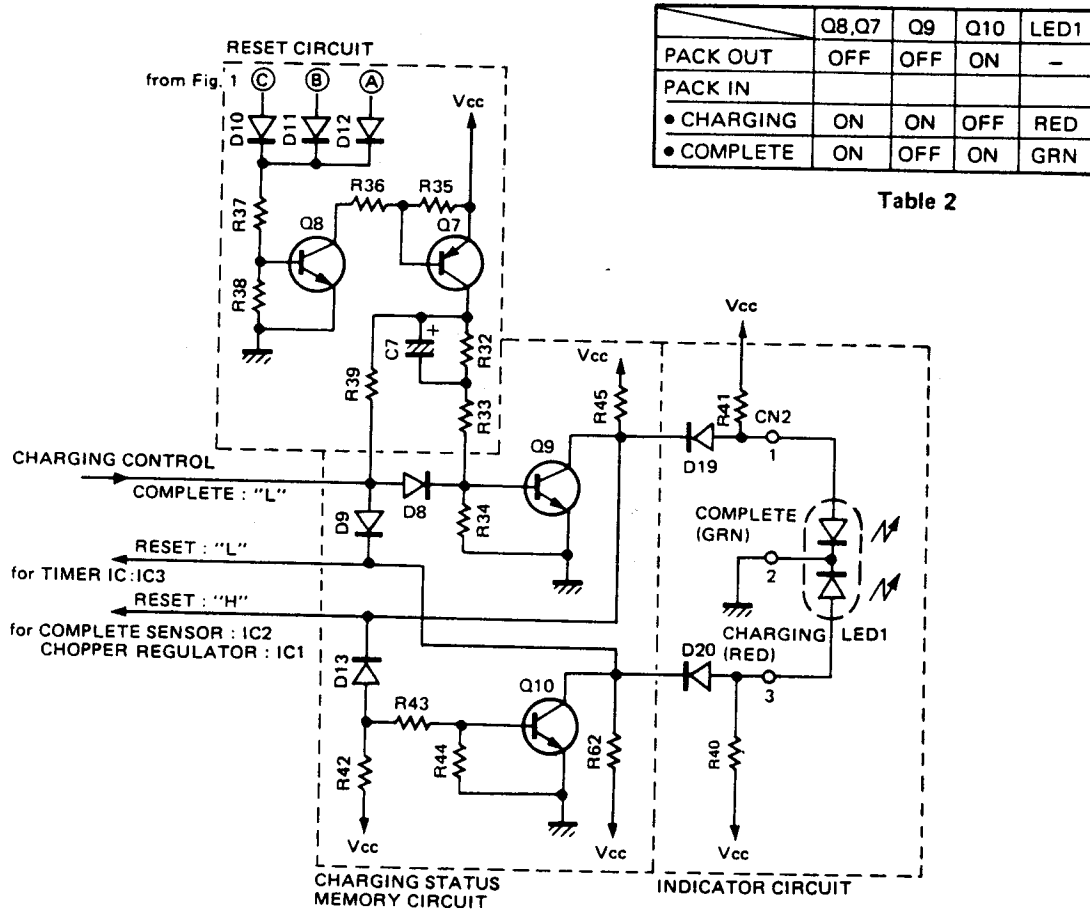


Fig. 2 Reset Circuit/Charge Status Memory Circuit/Display Circuit Block Diagram

The charge status memory circuit is an R-S flip-flop configured from transistors and resistors. The two states of the flip-flop are called COMPLETE and CHARGING. Outputs from the flip-flop drive the LED in the indicator circuit and reset the timer, complete sensor, and chopper regulator. In the COMPLETE state Q9 : 2SC536E is off and Q10 : 2SC536E is on. In the CHARGING state Q9 is on and Q10 is off.

When a battery pack is not inserted, Q8 : 2SC536E and Q7 : 2SC536E turn off. As there is no base voltage to Q9, Q9 also turns off. The base of Q10 receives enough bias from Vcc to turn on, resulting in 0V at the collector. The current flow through R41 to the COMPLETE indicator in LED1 which glows green, because of Q9 if off.

When the battery pack is inserted Q8 and Q7 turn on. As soon as Q7 turns on, charging current flows through R33, R34, and Q9 to C7 and Q9 turns on. The base voltage of Q10, which is connected to Q9 through diode D13, then drops and Q10 turns off. Since Q10 is off, current flows through R40 to the CHARGING indicator in LED1, which glows red to indicate that the battery is charging. When charging of C7 is completed, on-current continues to flow to the base of Q9 through R39 and D8.

When charging is completed the complete sensor (IC2) outputs a Low ("L") signal that ends the flow of current to the base of Q9, turning Q9 off. As a result current flows through R41 to the COMPLETE indicator in LED1, which glows green to indicate that charging is complete.

BC-11 (RAPID CHARGER)

4) Battery Recognition Circuit

The battery recognition circuit uses NAND logic to recognize the battery type from the outputs from the battery pack detect circuit. Outputs from this circuit are sent to the charging current limiting circuit and sensor level switching circuit.

	INPUT		OUTPUT		
	A	B	D	F	G
PB-5	L	H	H	H	L
PB-6	H	L	H	L	H
PB-7	H	H	L	L	H
PB-8	L	L	H	L	L
PB-9	H	L	H	L <td>H</td>	H

Table 3

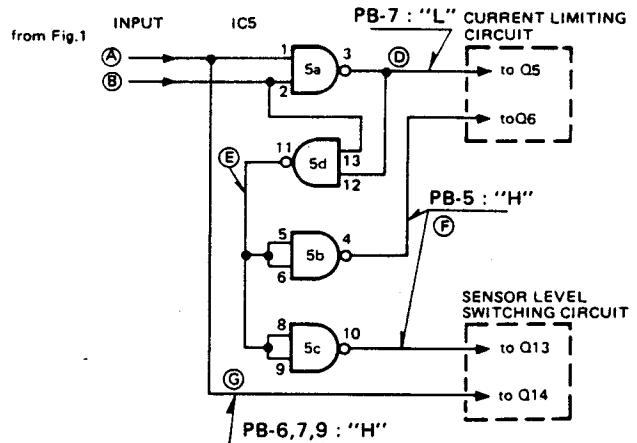


Fig. 3 Battery Recognition Circuit Block Diagram

5) Charging Current Limiting Circuit

This circuit receives the output of the battery recognition circuit and limits the charging current according to the type (current capacity) of battery. The charging current ICR is detected as a voltage drop across R1 (0.15Ω), which is provided to pin 3 of the operational amplifier IC4(1/2) : LA6393A. Pin 4 receives a reference voltage (VREF) used as a comparison standard for limiting the charging current. The VREF is changed by ON and OFF of Q5 and Q6 (See Table 4).

Pin 2 of IC4 : LA6393S provides "L" output when $V_{REF} < V_{CR}$, stopping the operation of the chopper regulator (IC1 : STK772B) and reducing the charging current. The charging current is limited by the formula :

$$I_{CR \text{ MAX}} (A) = V_{REF} (V) / 0.15(\Omega)$$

	Q5	Q6	VREF	ICR MAX
PB-5	OFF	ON	0.15V	1.0A
PB-6	OFF	OFF	0.25V	1.7A
PB-7	ON	OFF	0.36V	2.4A
PB-8	OFF	OFF	0.25V	1.7A
PB-9	OFF	OFF	0.25V	1.7A

Table 4

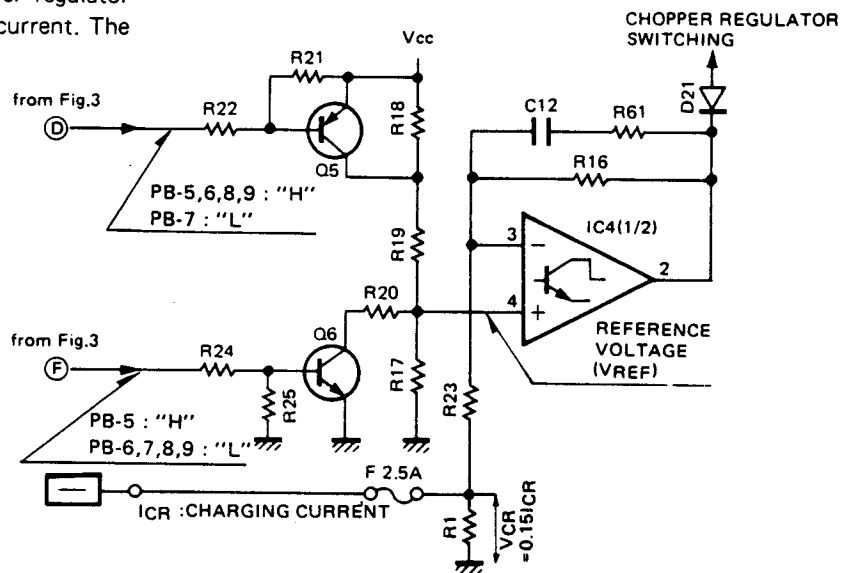


Fig. 4 Charging Current Limiting Circuit Block Diagram

BC-11 (RAPID CHARGER)

6) Sensor Level Switching Circuit

This circuit receives the output of the battery recognition circuit and aligns the voltages supplied to the charging status detect circuit according to the battery type (voltage) so that they are nearly equal at completion of charging.

	SHIFT Es(V)	Q11	Q12
PB-5	2.0	ON	OFF
PB-6	2.0	OFF	ON
PB-7	2.0	OFF	ON
PB-8	7.6	OFF	OFF
PB-9	2.0	OFF	ON

Table 5

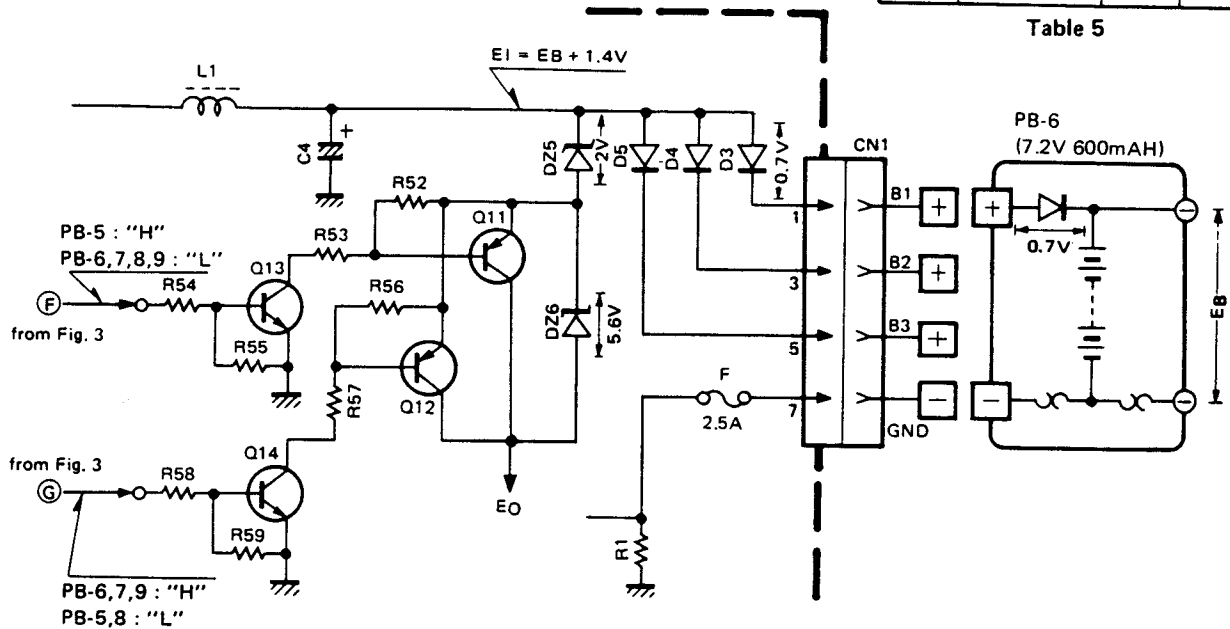


Fig. 5 Sensor Level Switching Circuit Block Diagram

The pin voltages while the Ni-Cd battery is charging are approximately 1.2 times the voltages at the completion of charging. (See Figure 6.)

The battery terminal voltage E_B is as follows:

Approximately 14.4V for the PB-8

Approximately 8.6V for the PB-5, 6, 7, 9

The charging line voltage E_I is the E_B voltage plus a 1.4V voltage drop added by a diode.

$$E_I = E_B + 1.4V \dots (1)$$

The E_I voltage is output with a level shift as the voltage E_O to the charging status detect circuit via Zener diode DZ6 and diodes D17 and D18. The amount of the shift is controlled by switching Q11 : 2SA608E and Q12 : 2SA608E on and off. (See Table 5.) If Eq. (1) is substituted into E_O in Table 5, the results are:

$$PB-8 : E_O = E_B - 6.2V$$

$$PB-5, 6, 7, 9 : E_O = E_B - 0.6V$$

At the completion of charging the value is approximately 8V.

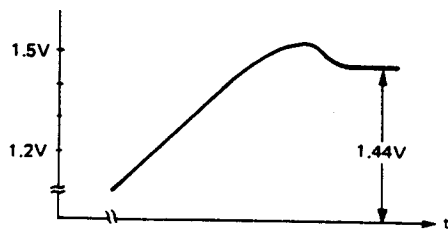


Fig. 6 The pin voltages while the Ni-CD Battery is charging

BC-11 (RAPID CHARGER)

7) Charging Status Detect Circuit

This circuit detects the completion of charging and outputs a signal to stop charging. When no battery pack is inserted or charging is completed, a High ("H") Reset signal is applied to D15. When a battery is inserted the Reset signal applied to D15 is cleared. When the Reset signal is cleared, pin 4 of IC2 : KCH-1003 holds the reset state due to the charge in C8 for the duration of the R46-C8 time constant, then goes "L" to clear the reset state. Pins 8 and 9 of IC2 receive divided portions of the battery voltage. These inputs are tracked as the charging is performed in the long-term memory capacitor "MD". As the Ni-Cd battery charges, the battery voltage reaches a peak, then declines. (See Figure 6.) The MD stores the peak voltage, which is compared with the divided voltages at pins 8 and 9. When the difference ΔV is the same, a "L" signal is output from pin 11 to indicate that charging is complete. The signal indicating completion of charging is applied to the charging status memory circuit.

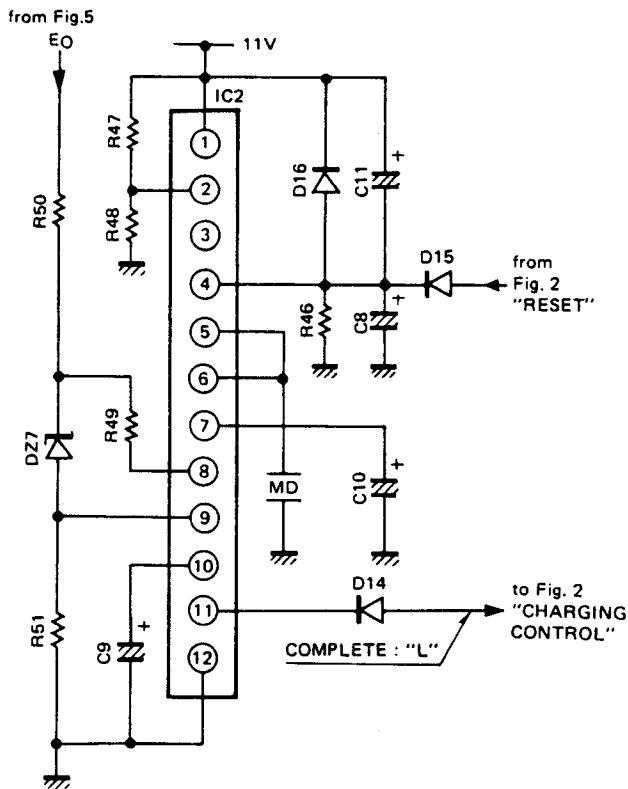


Fig. 7 Charging Status Detect Circuit Block Diagram

8) Timer Circuit

Battery defects may result in charging continuing indefinitely without completion, so this timer outputs a signal that stops charging approximately 1.7 hours after charging begins. When charging begins and the Reset signal is cleared at pin 3, IC3 : AN6780 begins counting. At the first count of 16384 pin 6 goes from "H" to "L". The output from pin 6 is connected to the Stop input (pin 2), so the output of IC3 is held in the "L" state until IC3 receives another Reset signal (for example, when the battery is removed).

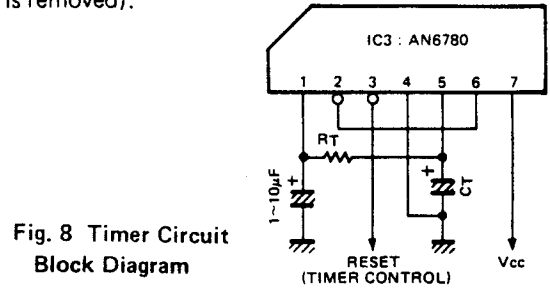


Fig. 8 Timer Circuit Block Diagram

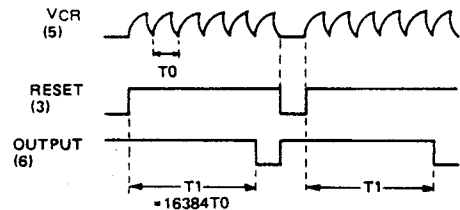


Fig. 9 TIMER TIME T1 (s) $\approx 11RT(K\Omega) \cdot CT(\mu F)$
TIMER TIME T1 (s) $\approx 11 \times 47(K\Omega) \cdot 10(\mu F) = 5170 (s)$

9) Voltage Comparator Circuit

This circuit monitors the output (EO) of the sensor level switching circuit and indirectly detects abnormal conditions in the battery pack connected to the charging terminal. When the EO voltage falls to 5.2V or lower, the charging control line goes "L" to halt charging.

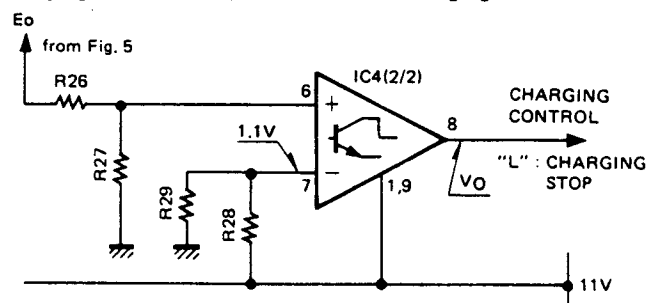


Fig. 10 Voltage Comparator Circuit Block Diagram

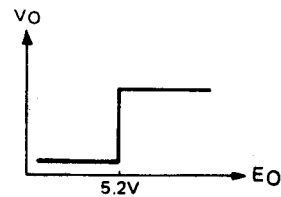


Fig. 11

BC-11 (RAPID CHARGER)

× New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Telle ohne Parts No. werden nicht geliefert.

BC-11 PARTS LIST

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名/規格	Desti- nation 仕向	Re- marks 備考
BC-11						
1	1A	*	A02-0815-08	CASE		
2	1A,1B	*	A02-0817-08	BATTERY POCKET		
3	1B		B46-0411-00	WARRANTY CARD	K	
4	1B	*	B50-8134-08	INSTRUCTION MANUAL		
5	1B	*	E23-0604-05	TERMINAL		
△ 6	2A		E30-2038-08	AC CORD	K,M,M2	
△ 6	2A		E30-2072-08	AC CORD	W	
△ 6	2A		E30-2073-08	AC CORD	T	
△ 6	2A		E30-2095-08	AC CORD	X	
8	2B	*	H01-8128-08	ITEM CARTON CASE		
9	2B		H10-2584-02	POLYSTYRENE FOAMED FIXTURE (L)		
10	2B		H10-2585-02	POLYSTYRENE FOAMED FIXTURE (R)		
11	3A		J02-0439-05	FOOT		
12	3A		J39-0424-05	SPACER		
△ T1	2A		L01-8081-08	POWER TRANSFORMER (AC120V)	K,M2	
△ T1	2A		L01-8112-08	POWER TRANSFORMER (AC220V)	M,W	
△ T1	2A		L01-8122-08	POWER TRANSFORMER (AC240V)	T,X	
A	3A		N30-3006-41	MACHINE SCREW (M3 X 6)		
B	2A,1B		N34-4006-46	MACHINE SCREW (M4 X 6 TR)		
C	2A,1B		N35-4006-45	MACHINE SCREW (M4 X 6 BI) BLK		
D	2A		N87-3008-46	TAPTITE SCREW (φ3 X 8 BR)		
E	1A		N89-3008-45	TAPTITE SCREW (φ3 X 8 BI) BLK		
SW1	3A		S36-1407-05	POWER SW		
7	3B	*	W02-0399-08	CHARGE CONTROL UNIT		
CHARGE CONTROL UNIT (W02-0399-08)						
C1			CE04EW1V222M	ELECTRO 2200μF 35WV		
C2			CE04EW1C470M	ELECTRO 47μF 16WV		
C3			CE04EW1H010M	ELECTRO 1μF 50WV		
C4			CE04EW1E471M	ELECTRO 470μF 25WV		
C5,6			CE04EW1C100M	ELECTRO 10μF 16WV		
C7			CE04EW1A101M	ELECTRO 100μF 10WV		
C8			CE04EW1C100M	ELECTRO 10μF 16WV		
C9,10			CE04EW0J101M	ELECTRO 100μF 6.3WV		
C11			CE04EW1C330M	ELECTRO 33μF 16WV		
C12			CK45B1H102K	CERAMIC 0.001μF 50WV		
C14			CE04EW1H010M	ELECTRO 1μF 50WV		

E: Scandinavia & Europe H: Audio Club K: USA P: Canada W: Europe

A: Saudi Arabia T: England U: PX(Far East, Hawaii)

UE: AAFES(Europe) X: Australia M: Other Areas

△ indicates safety critical components.

BC-11 (RAPID CHARGER)

× New Parts

Parts without Parts No. are not supplied.

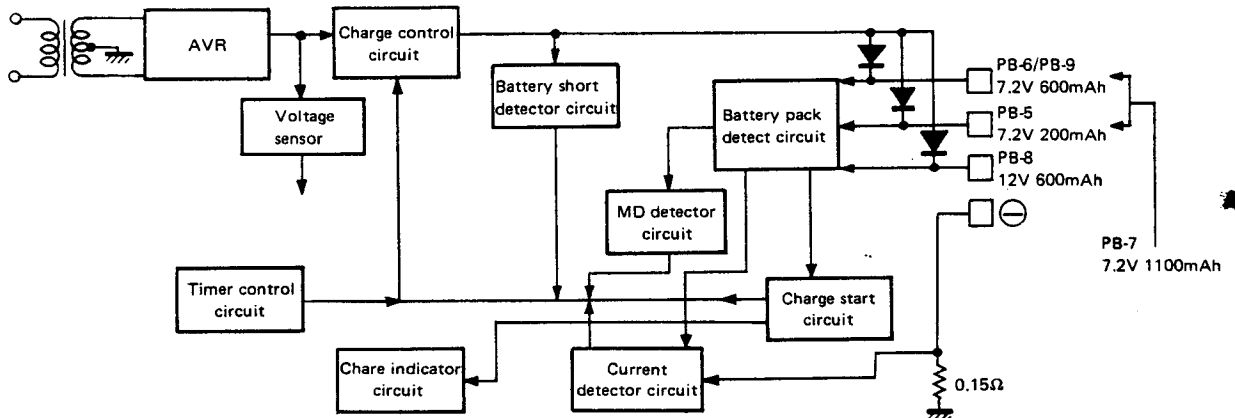
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Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
MD			C91-1038-08	ELECTRO		
△ F1			F05-2525-05	FUSE (2.5A)	W,X	
△ F1			F06-2522-05	FUSE (2.5A)	M,M2,T	
△ F1			F06-2523-05	FUSE (2.5A)	K	
—			J13-0039-05	FUSE HOLDER	W	
L1			L33-0694-08	CHOKE COIL (470μH)		
R1			R92-0683-08	FL-PROOF 0.15Ω 4W		
D1-5			DSA26B	DIODE		
D6-16			DS442	DIODE		
D19-21			DS442	DIODE		
DZ1			GZA11Y	ZENER DIODE (11V)		
DZ2-4			GZA10Z	ZENER DIODE (10V)		
DZ5			GZA2.0X	ZENER DIODE (2V)		
DZ6			GZA5.6X	ZENER DIODE (5.6V)		
DZ7			GZA7.5Y	ZENER DIODE (7.5V)		
DZ8			GZA3.0X	ZENER DIODE (3V)		
IC1			STK772B	IC (CHOPPER REGULATOR)		
IC2			KCH-1003	IC (VOLTAGE SENSOR)		
IC3			AN6780	IC (TIMER)		
IC4			LA6393S	IC (DUAL OP IC)		
IC5			LC4011B	IC (QUADRUPLE NAND GATE)		
Q1			2SD600F,KF	TRANSISTOR		
Q2-5			2SA608E,F	TRANSISTOR		
Q6			2SC536E,F	TRANSISTOR		
Q7			2SA608E,F	TRANSISTOR		
Q8-10			2SC536E,F	TRANSISTOR		
Q11,12			2SA608E,F	TRANSISTOR		
Q13,14			2SC536E,F	TRANSISTOR		
LED1	2A		SLP-540D	LED (RED/GRN)		

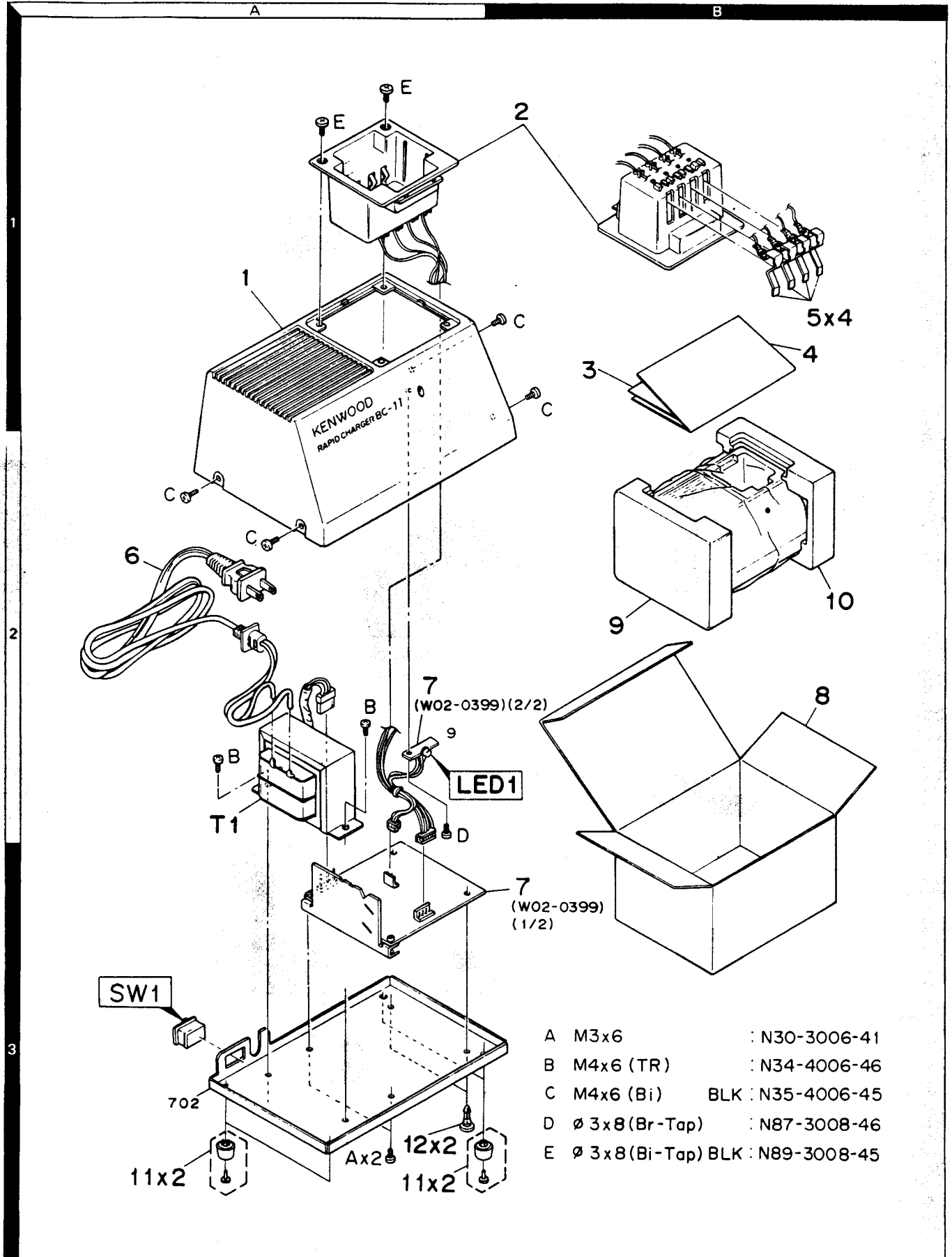
BC-11 BLOCK DIAGRAM

AC120V : K, M2
AC220V : M, W
AC240V : T, X



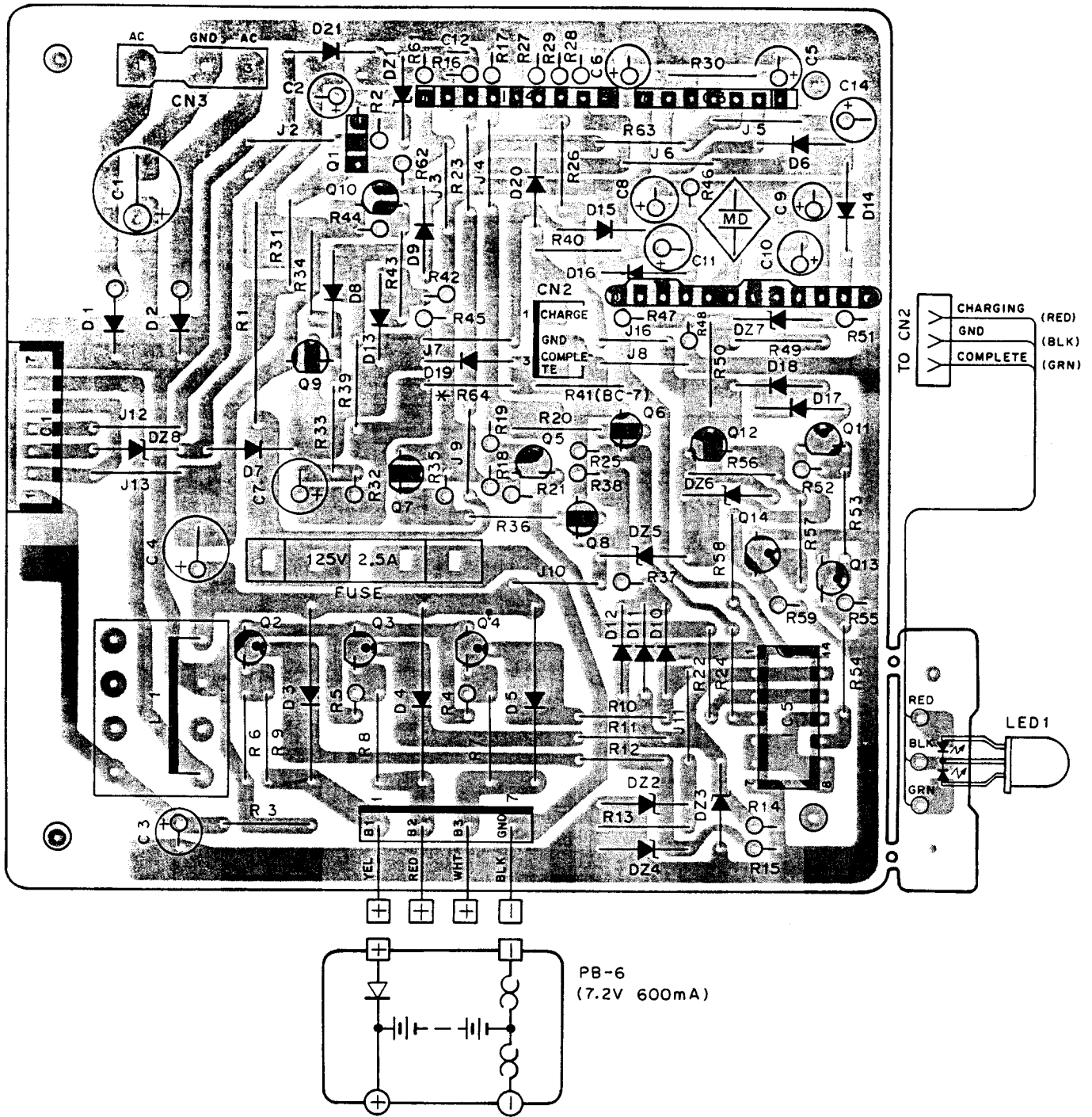
BC-11 (RAPID CHARGER)

BC-11 DISASSEMBLY/PACKING



BC-11 (RAPID CHARGER)

BC-11 PC BOARD VIEW



- Q1 : 2SD600F,KF Q2-5,7,11,12 : 2SA608E,F Q6,8-10,13,14 : 2SC536E,F
 IC1 : STK772B IC2 : KCH-1003 IC3 : AN6780 IC4 : LA6393S IC5 : LC4011B
 D1-5 : DSA26B D6-16,19-21 : DS442
 DZ1 : GZA11Y DZ2-4 : GZA10Z DZ5 : GZA2.0X DZ6 : GZA5.6X DZ7 : GZA7.5Y DZ8 : GZA3.0X

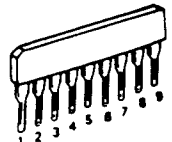
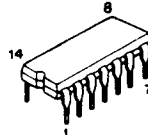
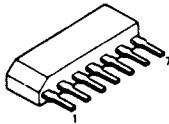
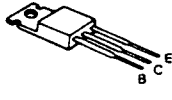
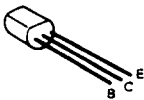
2SA608E
2SA608F

2SC536E 2SD600F
2SC536F 2SD600KF

AN6780

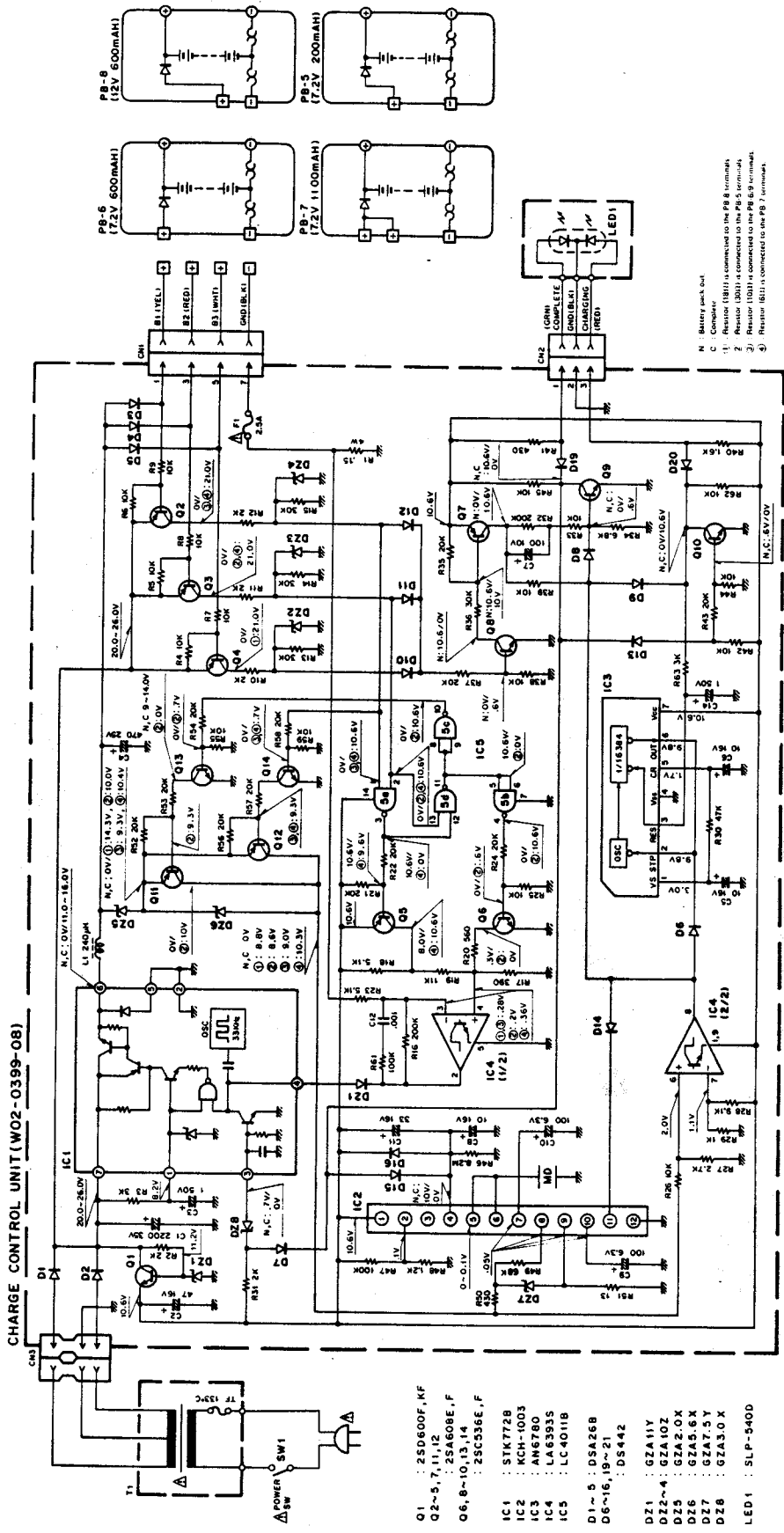
LC4011B

LA6393S



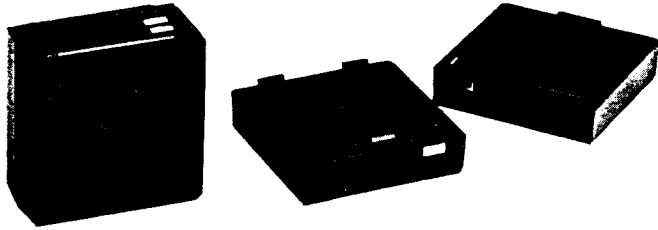
BC-11 (RAPID CHARGER)

BC-11 CIRCUIT DIAGRAM



BT-6 (AAA MANGANESE/ALKALINE BATTERY CASE)/ DC-1 (DC ADAPTER)

BT-6 EXTERNAL VIEW

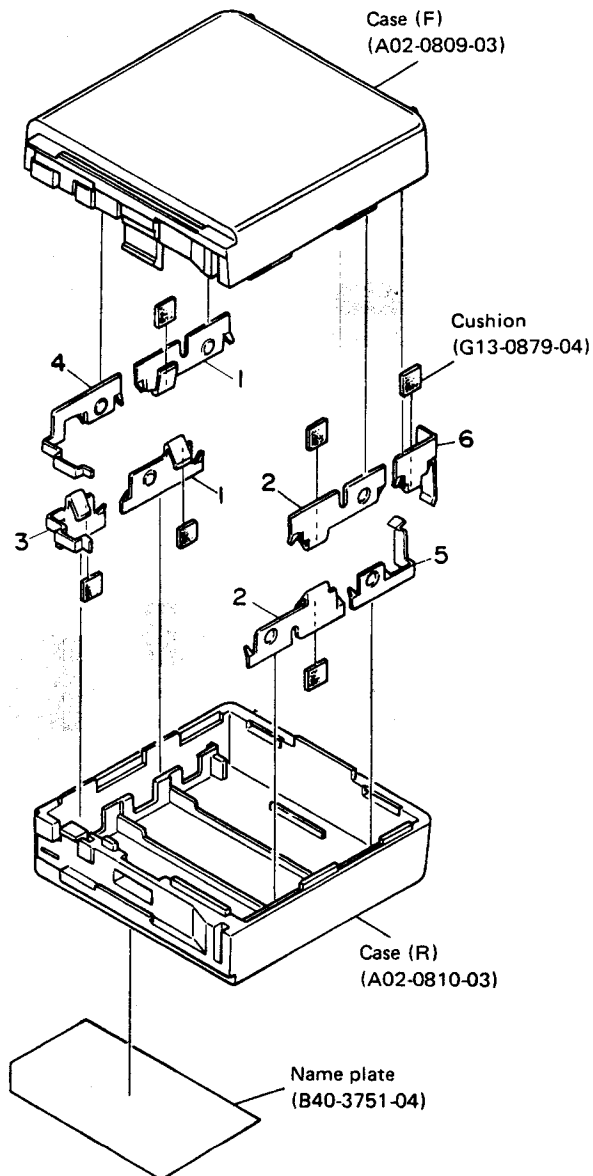


BT-6 PARTS LIST

Ref. No.	New Parts	Parts No.	Description
1	*	E23-0496-04	Terminal A
2	*	E23-0497-04	Terminal B
3	*	E23-0498-04	Terminal C
4	*	E23-0499-04	Terminal D
5	*	E23-0500-04	Terminal E
6	*	E23-0601-04	Terminal F

* : New Parts

BT-6 DISASSEMBLY



DC-1 EXTERNAL VIEW

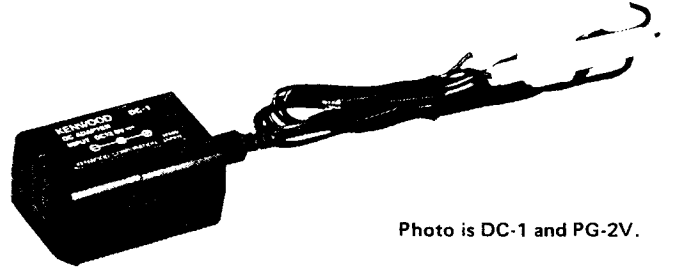


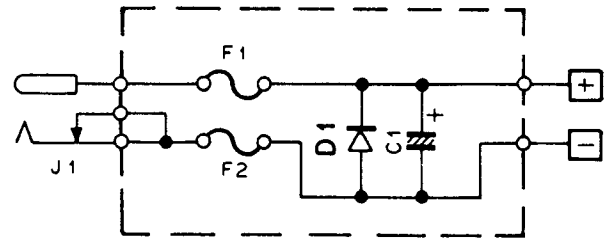
Photo is DC-1 and PG-2V.

DC-1 PARTS LIST

Ref No.	New Parts	Parts No.	Description
C1		CW04EW1C102M	Electro 1000 μ F 16VV
J1		E03-0165-05	DC jack
		F06-3026-05	Fuse (3A)
	*	J13-0410-05	Fuse holder
D1		DSA3A1	Diode

* : New Parts

DC-1 CIRCUIT DIAGRAM



D1 : DSA3A1

DC-1 SPECIFICATIONS

Electrical characteristic

Max. input voltage 16V

Max. current 2A

Dimensions 58 W x 36.5 H x 29.5 D (mm)

Weight 40g