Maintenance Manual

M-RKTM Standard Vehicular Charger 344A4616P1

Enhanced Vehicular Charger 344A4616P2



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TABLE OF CONTENTS

	Page
SPECIFICATIONS	4
DESCRIPTION	6
STANDARD VEHICULAR CHARGER (344A4616P1)	6
ENHANCED VEHICULAR CHARGER (344A4616P2)	6
ELECTRICAL DESCRIPTION	7
Accessory Connector	7
Alternator Noise Transient Filter	7
High Rate Constant Current Source	7
Charge Control	7
Power Supply	7
Charge Control Microcontroller	10
HI/Low Temperature Limit Detector	10
Audio Amplifier	10
5- Volt Regulator	10
Missenhana Connector	10
Antenna Connector	10
Antenna Connector (UDC)	10
Bunassing	10
Dypassing	10
Sincluing	10
OPERATION	10
MOBILE CHARGER	10
Standard Vehicular Charger (Repeater Control) (344A4616P1)	11
Enhanced Vehicular Charger (344A4616P2)	11
BATTERV CHARGER DETAILS	13
	12
CIRCUIT ANALISIS	15
CHARGING CIRCUITS	13
Input Clamp, Filter And Power Switch	13
Battery Pack Capacity Sensing Switch	13
12-Volt Switching Regulator Circuit	14
Fast-Charge Circuit	14
Slow-Charge Circuit	14
EXTERNAL SPEAKER AMPLIFIER (Vehicular Charger Only)	14
EXTERNAL MICROPHONE AMPLIFIER (Vehicular Charger Only)	15
MAINTENANCE	15
DISASSEMBLY PROCEDURE	16
ADJUSTMENT PROCEDURES	16
BATTERY PACK TEST SIMULATOR CONSTRUCTION	17

Continued

Continued

TABLE OF CONTENTS

	Page
IC DATA	18
PARTS LIST	20
VEHICULAR CHARGER MAIN BOARD 344A4616P1 (PCB1)	20
VEHICULAR CHARGER MAIN BOARD 344A4616P2 (PCB2)	22
SCHEMATIC DIAGRAM	27
ILLUSTRATIONS	

Figure 1A - M-RK Vehicular Charger	8
Figure 1B - M-RK Vehicular Charger	9
Figure 2 - Charger with M-RK II Personal Radio Inserted	12
Figure 3 - UDC Rotary Latch Knob	12
Figure 4 - M-RK Vehicular Charger Block Diagram	15
Figure 5 - Battery Pack Test Simulator	17

SPECIFICATIONS*

GENERAL

Size (H x W x D)

Weight

Indicator Lights Charging (high rate) Ready Transmit Repeater Enabled Red LED (P1 only)

Radio Latch

Maximum Recharge Times 1200 mAh Battery Pack 1700 mAh Battery Pack

Temperature Limits Charging Operating

Charge Fault Detection

Duty Cycle

ELECTRICAL

Nominal Input Voltage Input Voltage Limits 200 x 176 x 50 mm (7.8 x 6.9 x 1.9 inches)

1.2 Kg (2.6 lbs. [avoir.])

Yellow LED Green LED Red LED (P2 only)

Rotary knob with push-button release (lockable)

60 minutes 60 minutes

+5 to +45°C -30 to +60°C

shorted cell and charge temperature limits

100% receive, 10% transmit

13.8 Vdc (negative ground)10.8 to 16.6 Vdc

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SPECIFICATIONS*

Maximum Current Drains	
Off	5 mA
On And Not Charging	100 mA
Charging And Radio Squelched	2.0 Amperes
Charging And Ext. Spkr. At Rated Output	3.5 Amperes
Battery Charge Currents Fast Charge Slow Charge	1200 mA ±150 mA 100 mA ±20 mA
External Speaker Amplifier Rated Audio Power Output	10 Watts
External Speaker Amplifier Maximum Audio Distortion	5% at 10 Watts
External Speaker Amplifier Frequency Response	±1 dB from 300 to 3000 Hz
Antenna Port Impedance	50 ohms
Maximum Antenna Port Loss	1.0 dB from UDC to TNC connector

ENVIRONMENTAL TESTS

STANDARD	METHOD	PROCEDURE	TEST
MIL STD 810-C/D	514.2	VIII CAT F	Vibration
	514.2	Х	Vibration
	514.3	I CAT 1 & 10	Vibration
MIL STD 810-C/D	516.2	I & II	Shock
	516.3	Ι	Shock
MIL STD 810-C/D	502.1	Ι	Low Temperature
	502.2	II	Low Temperature
MIL STD 810-C/D	501.1	Ι	High Temperature
	501.2	II	High Temperature
MIL STD 810-C/D	501.2	II	Operational Temperature
MIL STD 810-C/D	503.1	Ι	Temperature Shock
MIL STD 810-C/D	503.2	Ι	Temperature Shock
MIL STD 810-C/D	507.1	II	Humidity
	507.2	II	Humidity
MIL STD 810-C/D	500.1	II	Low Pressure
	500.2	II	Low Pressure
EIA RS-316-B			Temperature
EIA RS-316-B			Supply Voltage
EIA RS-316-B			Vibration
EIA RS-316-B			Humidity

* These specifications are intended primarily for use by service personnel. Refer to the appropriate Specification Sheet for complete specifications.

DESCRIPTION

Ericsson GE Vehicular Charger/Repeater units 344A4616P1 (Part 1) and 344A4616P2 (Part 2) provide a mobile charging capability for either the M-RK I or M-RK II personal hand held radios. These charger/repeater units operate with either the standard high capacity (19A149838P1 - 1200 mAh), or the extra high capacity (344A3278P1 - 1700 mAh) nickel-cadmium battery packs. The personal radio battery pack has a charging current applied whenever the radio is inserted into the charging sleeve. An enable/disable function is included for the Part 1 (Vehicular Repeater System) charger.

With the Part 1 charger, the Vehicular Repeater System is active only when the M-RK radio is <u>not</u> in the charging sleeve. When the M-RK is out of the charging sleeve only then can the M-RK transmitted signal be routed through the repeater. Inserting the radio into the charging sleeve switches off the repeater.

With the radio out of the charging sleeve, the repeater enable switch must also be in the enable position for repeater operation. This switch is part of the repeater receiver. When it is in the on position the **RED** LED labeled **RPT** lights.

When a radio is inserted into the charger, charging contacts are automatically made at the back of the radio. A radio detect microswitch (S1), located near the charging contacts, applies power and the fast charge begins, provided the battery is in the acceptable temperature range. A second microswitch determines the charging rate required based upon battery size.

The High/Low temperature limit detector circuit measures battery pack temperature by monitoring the resistance of the battery thermistor. It provides a signal to the charge microprocessor if the battery is within acceptable temperature limits for fast charging.

The radio can be operated while in a Part 2 charger. Provision for this operation is designed into the charger with a vehicular antenna and a remote microphone connected at the bottom of the charger (Refer to Figure 1B). The connections to the radio required for this operation are made through the Universal Devices Connector (UDC) when the radio is inserted in the charger by turning the front panel rotary latch knob clockwise to the locking position. In this position the UDC contacts meet with mating contacts on the M-RK I or II personal radio for operation and the radio is locked into the charger. Pushing a release button on the top of the rotary latch knob releases and disconnects the radio from operation. This release button arrangement is supplied with a key that can be used to lock the push-button in the clockwise (locked) position. With the lock engaged, the

release cannot be pressed. This locks the radio to the charger and it cannot be removed.

STANDARD VEHICULAR CHARGER (344A4616P1)

The front panel of this charger contains three (3) indicator lights; **RPT**, **RDY**, and **CHRG**, an **ON/OFF** switch for the Repeater Radio and the **UDC ROTARY LATCH KNOB** (Refer to Figure 1A and 1B).

 Indicator Lights: **RPT** (Red) - Lights if the Repeater Radio is powered ON.

RDY (Green) - Lights if the Battery is 90 to 100 percent charged and the charger reverts to "trickle" charge.

CHRG (Yellow) - Lights when radio is first inserted in the charger. Indicates Radio is being "fast" charged.

(2) Repeater ON/OFF switch:

Turning this switch ON any time the M-RK personal radio is out of the charger powers the repeater radio and lights the Red Indicator light.

(3) UDC Rotary Latch Knob:

This knob latches the M-RK personal radio in the charger and only secures the radio into the charger. When the latch is activated, no other electrical connections are made to the radio. It should *always* be latched when the radio is in the charger and the vehicle is moving.

ENHANCED VEHICULAR CHARGER (344A4616P2)

The front panel of this charger contains three (3) indicator lights; **TX, RDY**, and **CHRG**, an **ON/OFF** volume control switch for operation of the M-RK personal radio as a mobile radio, an option push-button, and the **UDC ROTARY LATCH KNOB** (Refer to Figure 1A).

(1) **Indicator Lights**:

TX (Red) - Lights if the M-RK transmitter is active.

RDY (Green) - Lights if the Battery is 90 to 100 percent charged and the charger reverts to "trickle" charge.

CHRG (Yellow) Lights when radio is first inserted in the charger. Indicates Radio is being "fast" charged.

(2) **ON/OFF** Volume Control Switch:

This switch powers the radio for operation as a mobile. Check to assure that the UDC LATCH KNOB is in the "engaged" position.

(3) **Option Push-Button**:

This button can be programmed for many functions, but factory programming causes the same action as the M-RK "Clear" function. (See the M-RK Operator's Manual LBI-38732 (or LBI-38733).

(4) **UDC Rotary Latch Knob**:

This knob latches the M-RK personal radio in the charger and connects the UDC to all circuits within the charger to allow M-RK radio operation as a mobile radio. It should *always* be latched when the radio is in the charger and the vehicle is moving.

ELECTRICAL DESCRIPTION

The M-RK Vehicular Charger provides the following electrical functions (see to Figure 2):

- Accessory connector
- Alternator noise/transient filter
- High rate constant current source
- Charge control
- Power Supply
- Charge control microcontroller
- Hi/Low temperature limit detector
- Audio Amplifier
- 5-Volt regulator
- Remote control logic interface
- Microphone connector
- Antenna connector
- Universal Devices Connector (UDC)
- Bypassing
- Shielding

Accessory Connector

A DB15 Accessory Connector (CN1) provides connections for the power cable, speaker leads emergency foot switch, hookswitch and optional control unit leads to the charger. DC power from the vehicle battery is routed through the on/off power switch in the radio insert and then to the alternator noise filter.

Alternator Noise/Transient Filter

This filter reduces the alternator noise on the incoming DC power to prevent noise form being heard from the receiver or appearing on the transmitted signal. The transient filter prevents damage due to reverse polarity dc voltages, or from high voltage, positive or negative voltage spikes, caused by automotive electronics.

High Rate Constant Current Source

This is an active constant current source used to regulate charge current. It has adequate heatsinking to dissipate the heat created with 16.5 Vdc input and a battery pack with one shorted cell.

Charge Control

The charge control enables or disables the high rate constant charge current. This circuit is connected in the constant current source and is controlled by the charge control microcontroller (IC4)

Power Supply

This is a current limited, constant voltage power supply which is enabled when the radio is in the transmit condition. This power supply will power the radio when the battery is completely discharged by forcing a minimum voltage of 7.5 V to appear across the battery pack. The current limiting prevents damage to the regulator when a battery pack with one or more shorted cells is in the charging insert. This power supply is enabled by the T/R output lead at the radio UDC. The red PTT indicator lights when the power supply is enabled. The power supply is designed to prevent the trickle charge from flowing into the power supply when the power supply is turned off and in the receive mode.

Charge Control Microprocessor

Functions performed by this controller are:

- 1. Shorted cell detection
- 2. Battery removal sensor
- 3. Battery charger latch
- 4. Minus delta V sensor for charge control
- 5. Charge indicator control and fault display



Figure 1A - M-RK Vehicular Chargers



Figure 1B - M-RK Vehicular Charger

Hi/Low Temperature Limit detector

This circuit measures battery pack temperature by monitoring the resistance on the battery thermistor. It provides a signal to the charge control microprocessor if the battery is in acceptable temperature limits for fast charging.

Audio Amplifier

Receiver audio at a fixed level from the radio UDC is amplified by this audio amplifier (IC6) to 10 watts of audio power output. The audio level is adjusted by an audio taper volume control (VR1) in the vehicular charger. This amplifier is enabled or disabled by the UDC **MUTE OUT** lead to prevent alternator noise or other transients from being heard while the radio is in the squelched condition. Audio transients caused by enabling or disabling the amplifier are minimized so that they are not audible. The amplifier is capable of continuous duty operation at rated power.

5-Volt Regulator

This regulator (IC2) provides DC power for the radio control microprocessor and the charge control microprocessor if necessary. The regulator provides a reset signal for the microprocessors if it falls out of regulation due to low input voltage.

Remote Control Logic Interface

The Remote Control Logic Interface takes serial data control signals from the radio UDC and translates these signals to IEE485 logic levels. This is to comply with the **ORION™** control unit data interface. This logic is standard on all 344A4616P2 chargers.

Microphone Connector

The microphone connector provides connections for the external microphone, PTT switch, Channel Guard hookswitch and earpiece audio for external handsets.

Antenna Connector

This is a TNC connector which is connected to the radio UDC RF connector with low loss coax. Termination's are carefully shielded to prevent RF energy from interfering with the charger electronics.

Universal Devices Connector (UDC)

The M-RK Universal Devices Connector (PCB4) provides control and audio interface leads for the vehicular charger. When the radio is operating, the configuration of the UDC jack is set by a programming resistor connected to the UDC sense on Pin 8. The charger has an internal dip switch that can connect one of three resistor values to the sense pin. The values of the three resistors are 3160, 5360 and 6490 ohms. The M-RK vehicular charger is shipped from the factory with the 3160 ohm resistor connected. The software is written so that with this configuration, the remote control operation is enabled. The **ORION** control unit will assume full control of radio operation including remoting of the M-RK display information.

RF Bypassing

Because the vehicular charger may be installed in vehicles containing other high powered radio equipment, all leads connecting to the charger are passed to prevent malfunction caused by RF energy fed into the charger. The charger operates normally when a 10 watt transmitter coupled through a 3 dB pad is AC coupled to any pin on the microphone, power or accessory connector.

Shielding

The charge control microprocessor is capable of creating signals that will interfere with the normal operation of the M-RK receiver. The microprocessor is shielded so that harmonics of the clock frequencies used can not be heard by the M-RK radio receiver. The M-RK is programmed to exact harmonics of internal clock frequencies. When the antenna connected to a 1/4 wave antenna placed 1 meter from the charger, no self quieting or heterodyne signals should be heard.

OPERATION

MOBILE CHARGER

Operation of the Charger is possible in three configurations:

- **1.** as a standard vehicular charger and repeater control.
- **2.** as an Enhanced Charger providing added operational features.

3. as an Enhanced Charger operating through the **ORION™** Control Head. For operation in configuration (3) see the applicable Operator's Manual.

<u>Standard Vehicular Charger (with Repeater)</u> (344A4616P1)

Operation of the chargers is automatic when the M-RK personal radio is inserted into the charging sleeve. The radio is inserted in the charger when the battery pack needs recharging. With the charger standard model, no operation of the radio is possible while the radio battery is charging. Operation of the radio with this model charger is done after the personal radio battery is charged, it is removed from the charger and (normally) is taken outside the vehicle and operated through a repeater radio. Note that the vehicular repeater is automatically disabled when the radio is in the charger unit for recharging. Charging commences immediately, whether or not the UDC INTERFACE is engaged.

The radio is normally operated through a vehicular repeater with this charger to improve communication range. For this operation, the operator takes the following steps:

- **1.** Remove the radio from the charger.
- **2.** Turn on the radio.
- **3.** Turn on the vehicular repeater using the small knob at the lower left corner of the radio front panel. The RPT indicator light, in the upper left corner of the front panel, glows RED when the repeater is ON.
- **4.** After monitoring the channel for activity and finding it free, press PTT and make your call.

Enhanced Vehicular Charger (344A4616P2)

The Enhanced Vehicular Charger (344A4616P2) allows the M-RK Personal radio to operate in the charger while the battery pack is simultaneously being charged. The procedure is as follows:

1. Before attempting to insert the M-RK personal radio in the charger, verify that the ROTARY LATCH KNOB is in the released position. If not, unlock if necessary and press down on the RELEASE BUTTON until the knob snaps to the released position.

– NOTE –

The radio unit should never be inserted or removed from the charger using the antenna as a handle.

- 2. Insert the M-RK Personal Radio into the charger by sliding it down into the slot. The radio should be inserted so that the front of it faces the top of the charger unit (as shown in Figure 2). When fully inserted, the radio extends approximately 1/8" inch above the front of the charger. The fast charge begins immediately and the yellow charge indicator is illuminated.
- **3.** Engage the interfacing UDC by turning the ROTARY LATCH KNOB approximately 1/4 turn in a clockwise direction until it clicks into the latched position. This connects the M-RK radio to the Vehicular Charger audio circuits and to the external antenna. The radio cannot be removed from this position until the UDC is unlatched using the RELEASE BUTTON in the center of the ROTARY LATCH KNOB.
- 4. If desired, the radio can now be locked into the charger to prevent unauthorized removal. To lock the radio in the charger, insert the key in the hole in the RELEASE BUTTON, turn in a clockwise direction until it stops and remove the key. To unlock the radio, insert the key and turn it in a counterclockwise direction.
- **5.** Turn the radio on by rotating its power onoff/VOLUME knob clockwise out of the detent (OFF) position.
- 6. The charger and radio are now set for mobile operation. Use the charger VOLUME CONTROL KNOB to adjust the external speaker volume level and use the MICROPHONE PTT button to transmit. The red TRANSMIT INDICATOR lights when the radio is transmitting.
- 7. When removal of the M-RK is necessary, disengage the UDC INTERFACE by pressing down on the RELEASE BUTTON until the ROTARY LATCH KNOB snaps to the released position. (If the Rotary Latch Knob is locked, it must be unlocked before it will snap release. See step 5. above.) Grip the radio on its sides and pull it out of the charger.

NOTE -

NEVER insert or remove the radio from the charger unit by pulling on the antenna, or using it as a handle, as this may damage the antenna.



Figure 2 - Charger with M-RK II Personal Radio Inserted



UDC Released





BATTERY CHARGER DETAILS

NOTES

To maximize nickel cadmium battery life, the M-RK vehicular chargers are designed with automatic controls which limit the rapid charging of M-RK batteries if the internal battery temperature is below 0° C (+32° F) or above +45 ° C (+113° F). The charger indicates this high or low internal temperature condition by a yellow LED which blinks at a slow rate.

If a slow blinking, yellow LED is observed, the operator must wait until the internal battery temperature stabilizes within the allowable range before restarting the charging procedure by removing and re-inserting the radio into the charger.

In a vehicular application, with either high ambient temperature inside or outside of the vehicle, the automatic charging control will often prevent rapid charging or limit the time of rapid charging.

In other situations, where the operator inserts and removes the radio many times during a short period of time, the automatic control will sense a high internal battery temperature (due to start-up rapid charging of the battery) and will prevent further rapid charging of the battery until the internal temperature of the battery stabilizes within the acceptable range.

When the M-RK radio (with its battery pack) is placed in the charger, the radio battery pack is charged. The fast or "rapid" charge feature, normally is applied immediately, and is controlled by the microprocessor circuits within the charger. The following details apply to the battery charge feature:

- Normally, when initially placed in the charger, the battery pack is fast charged and the yellow charge indicator glows continuously until it is near a full charge (between 90% and 100% full charge). At this time the charger switches to a slow or "trickle" charge rate and completes the charge. During the "trickle" charge the green ready indicator is illuminated.
- The yellow CHARGE INDICATOR lights when the unit is fast charging.
- If the CHARGE INDICATOR flashes, the battery is not being fast charged. Several factors

may cause this to occur. These include, dirty battery pack contacts, an extremely hot or cold battery pack, or a defective battery pack.

- The yellow CHARGE INDICATOR turns off and the green READY INDICATOR turns on when the unit has completed the fast charge and the "trickle" charge commences.
- If the battery pack is completely dead, M-RK mobile mode operation can continue normally (with a P2 Enhanced Charger unit). To do this, insert the radio (with the dead battery pack) into the charger and engage the UDC INTERFACE for operation.
- Normal engagement of the UDC INTERFACE is not necessary for battery charge operation, but is required to operate an M-RK Personal radio in the enhanced vehicular charger during the charging cycle. The UDC INTERFACE ROTARY LATCH KNOB should also be in the "engaged" position whenever the vehicle is moving, for both the standard and enhanced models, to firmly hold the radio in the charger in case of an accident.

CIRCUIT ANALYSIS

CHARGING CIRCUITS

Input Clamp, Filter And Power Switch

Operating power for the charger is applied to connector CN1, Pins 1 (-) and 15 (+). Zener diode D1 provides over-voltage and reverse-polarity protection for the charger by clamping excessive or reverse voltages. Capacitors C2 and C3 and inductor L1 form a pi-filter for the dc input power.

Inserting a battery pack into the slot closes on/off power switch SW1 located near the bottom of the charger slot. With this switch closed, 13.8 Vdc (nominal) power from CN1, Pin 15 is applied to the 12-Volt switching regulator circuit IC1 and the fast-charge microcontroller circuit IC4. This turns the charger on.

Battery Pack Capacity Sensing Switch

Switch SW2 is used to sense the capacity of the battery pack. This is a normally-open switch located just below SW1 in the charger slot. SW2 will close only when an extra-high capacity battery pack is installed in the slot.

When SW2 closes, PNP transistor Q3 switches the current-limit rating of 12-Volt switching regulator IC1 to provide extra current needed during a fast charge.

12-Volt Switching Regulator Circuit

The 12-Volt switching regulator circuit is formed by integrated circuit IC1, transformer T1, MOSFET (Metal-Oxide Semiconductor Field Effect Transistor) Q1, and associated components. This circuit outputs a well-regulated 12.0 Vdc power source over the specified input voltage range (10.8 - 16.6 Vdc) to provide the charging power to the slow and fast charge circuits. It supplies approximately 2.0 amperes of current during fast-charge periods.

Switching regulator IC1 (MB3759) is the heart of the 12-Volt regulator circuit. It switches transistors Q1 and Q2 on and off to develop alternating currents in the primary and secondary of T1. The resulting secondary currents are rectified by D4, filtered by C14, and applied to the slow and fast-charge series pass elements (R29 and Q4 respectively).

Feedback for the regulator is provided by the attenuator network formed by resistors R19 - R21. The feedback voltage on IC1, Pin 1 is 5.0 Vdc. An error amplifier in IC1 compares this voltage to a reference voltage that is generated within the IC. The error amplifier output then controls the switching control circuitry in IC1.

MOSFET Q1 is mounted on the on the aluminum heat sink inside the unit to provide heat dissipation. However, since it is operating in the non-linear region, Q1 generates very little heat under normal operating conditions. Transistor Q2 controls the conduction of Q1. When the base of Q2 goes low, Q2 conducts harder and Q1 shuts off. When the base of Q2 goes high, Q2 conducts less and Q1 switches on. This switching on and off causes the alternating current in transformer T1.

Fast-Charge Circuit

The fast (rapid) charge circuit incorporated in the charger is a microcontroller-controlled circuit (IC4) that senses several battery conditions to determine if the battery pack needs to be and can be fast charged. The microcontroller circuit monitors the battery pack terminal voltage and internal temperature.

Slow-Charge Circuit

If the unit is not fast charging, it will slow charge the battery pack. The slow charge circuit is a simple tricklecharge circuit that is formed by 2-Watt dropping resistor R29 and diode D6. When the fast-charge circuit turns off, these components supply approximately 4 milliamps of current from the 12-Volt switching supply.

EXTERNAL SPEAKER AMPLIFIER (VEHICULAR CHARGER ONLY)

Integrated circuit IC6 (LA4475) is the audio power amplifier IC that drives the external speaker. This IC is mounted on the aluminum heat sink inside the unit to provide heat dissipation. Audio from the radio on the RX AF OUT line (UDC, Pin 9) passes through a mute switch in IC5 and the volume control before it is applied to IC6 for amplification.

One switch in quad bilateral switch IC5 (4066 type) is used as the mute switch. This switch is controlled by the MUTE OUT line (UDC, Pin 5) from the radio. The radio pulls this line low (typically less than 0.1 Vdc) to completely mute the external speaker. The MUTE OUT line is connected to the control input of the switch at IC5, Pin 5. When the external speaker audio is active (not muted), MUTE OUT is high and the RX AF OUT audio passes though IC5 (Pin 4 to Pin 3) to volume control VR1.

Volume control VR1 provides operator adjustment for the external speaker audio. This rotary control also has an on/off switch that allows the operator to turn the repeater operation on or off through transistor Q23.

The volume control on the top of the radio is disabled when the radio is placed in the charger and latched in. Attenuated audio from the wiper of VR1 is applied to the input of IC6 at Pin 13. Typical signal level at Pin 13 is _____ V rms (_____ V p-p) when VR1 is fully clockwise and the radio is receiving a 1 kHz tone.

Audio power amplifier IC6 provides approximately ______dB of power gain. This IC has differential outputs that drive the speaker with up to 10 watts of audio power. The outputs are routed to pins on the DB-25 connector on the bottom of the unit (CN1, Pins 18 and 19). Switched dc operating power for IC6 is applied to IC6, Pin 3 from the collector of transistor Q4. Inductor L4 and the capacitors connected IC6, Pin 3 provide filtering and decoupling for the dc supply.

EXTERNAL MICROPHONE AMPLIFIER (VEHICULAR CHARGER ONLY)

The external microphone amplifier circuit consist of +6 volt regulator IC8, operational amplifier IC9 and Field Effect Transistor Q15. The input to the amplifier is through microphone connector CN2, Pin 1 and connects through dc blocking capacitor C58 to the negative input terminal of IC9 (Pin 6). Voltage regulator IC8 provides the +6 volts required to operate IC9. Transistor Q15 controls the feedback for IC9 and the gain of the

amplifier. When the **Push-To-Talk (PTT)** switch on the external microphone is pushed, the gate of Q15 goes low and the amplifier circuit provides _____dB of gain for the microphone input. The output of the amplifier is from IC9, Pin 7 through blocking capacitors C63 and C103 to the UDC, PCB4, Pin 4 (TP4) **EXT. MIC IN**.

MAINTENANCE

The Maintenance section contains Disassembly Procedures Troubleshooting Procedures, and Adjustment Procedures. A Test Adaptor can be constructed to



Figure 4- M-RK Vehicular Charger Block Diagram

facilitate servicing the Vehicular Charger. The Test Adaptor is used to simulate actual battery pack conditions and determine if the charger is working properly. Simulations include cold battery pack, battery pack normal range temperature, and hot battery pack. Information pertinent to construction of the Test Adaptor is found in the last section of this manual.

DISASSEMBLY PROCEDURE

- 1. Remove radio from charger (UDC in released position).
- 2. Remove charger from vehicle.
- 3. Remove the Charger Top Cover.
 - a. Remove three Phillips head screws from the bottom of the charger near the back edge.
 - b. Next, remove the sliding radio cover (polycarbonate resin) section of the top cover. This cover slides down toward the back of the charger after the bottom edge is raised to escape small locking ridges in the mating plastic piece. Free the sliding cover by inserting the tip of a flat blade screw driver in the small notch at the back center of the cover and gently pry to lift the cover over the ridges and slip it back about 3/8 inches. From this position the sliding portion of the cover can be lifted straight up and off.
 - c. The remainder of the cover can now be tilted up from the back edge, rotating around the front lower edge of the charger, until it is approximately 45° from horizontal, and then slipped forward and off. The front panel with all switches and indicators remains attached to the base casting.

4. Remove the four (4) Phillips head screws from the RF protective shield covering the circuit components.

ADJUSTMENT PROCEDURE

The only adjustment to the M-RK vehicular charger is the setting of dip switches S3 and S5. The factory DIP switch settings for both the Part 1 and Part 2 chargers is as follows:

SW3	1	2	3	4	5	6	7
Part 1	ON	OFF	ON	ON	ON	OFF	OFF
Part 2	ON	OFF	ON	ON	ON	OFF	OFF



The M-RK radio is designed with Rx an Tx serial data ports the UDC. This allows the radio to be remotely controlled. The Part 2 vehicular charger contains remote control logic (IC10) which buffers these data signals to IEE-485 levels that are compatible with the ORION control units. M-RK software is written so that this remote control operation is enabled when the 3160 ohm resistor(SW3-5) is connected to the UDC sense pin. In this configuration, the ORION control unit assumes full control of radio operation including remoting of the M-RK display information.

The following switch settings are required for several operational modes. Any switch settings not defined below cannot be used and must be avoided.

SWITCH NUMBERS							
1 2 3 4 5 6 7							
ON	OFF	X	Х	Х	X	X	
OFF	ON	X	Х	Х	X	X	
X	X	X	ON	Х	X	X	
X	X	X	OFF	Х	X	X	
X	X	X	Х	ON	OFF	OFF	
X	X	X	Х	OFF	ON	X	
X	X	ON	OFF	OFF	OFF	OFF	
X	X	OFF	OFF	OFF	OFF	OFF	

Ignition A+ - Inhibited Ignition A+ - Enabled Option Switch - Inhibited Option Switch - Enabled Display Invert - Normal Display Invert - Inverted ORION Control Head - inhibited ORION Control Head - Enabled

BATTERY PACK TEST SIMULATOR CONSTRUCTION

This test battery pack simulator must be adapted to a dummy battery pack which will fit into the sleeve of the charger under test. The dummy battery pack should have a mechanism to operate the microswitch in the charger sleeve so that charge currents for short and long batteries can be measured.





TEST PROCEDURE

- 1. With the vehicular charger connected to the normal 13.8 Vdc supply, plug the test circuit (adaptor) into the charging sleeve. When inserted, the yellow LED "CHRG" indicator must light.
- 2. Calibrate the adaptor by setting the 8.7-volt supply to 8.7 Vdc \pm 0.1 Vdc. the ammeter on the adapter must read the following:

SHORT BATTERY	LONG BATTERY
CHARGE CURRENT	CHARGE CURRENT
1170 to 1430 mA	1710 to 2090 mA

Linear: Switching Regulator IC1, IC7

 $(FUJITSU MB3759PF OR NEC \mu PC494GS)$

CONNECTION DIAGRAM [Top View]



Digital: Quad Bilateral Switch IC5

(HITACHI HD74HC4066FP OR NEC μPD74HC4066GS)



LOGIC DIAGRAM (1/4)



FUNCTION TABLE

Control	Switch
L	OFF
Н	ON

 $\mathsf{GND} \leq \mathsf{Vin} \leq \mathsf{V_{cc}}$

 $\mathsf{GND} \leqq \mathsf{Vout} \leqq \mathsf{V_{cc}}$

Linear: +6-Volt Regulator IC8 (JRC NJM78L06T OR NEC µPC78L06T)



PIN ASSIGNMENT

Regulator Auxiliary Function IC3

(FUJITSU MB3773PF)



Linear: Operational Amplifier IC9

(NEC µPC358G2 OR HITACHI HA17904FP)



EQUIVALENT CIRCUIT (1/2 Circuit)



PARTS LIST

VEHICULAR CHARGER MAIN BOARD
344A4616P1 (PCB1)

SymbolCramic: 0.001 μ f ±10%, 50 V. thunSYMBOLPART NUMBERDESCRIPTION (78)Cramic: 0.001 μ f ±10%, 50 V. thunPCD2Vehicular Charger LLD Board CONNECTORS 6 Conductor Winh Leads.Cramic (78)Ceramic: 0.001 μ f ±10%, 50 V. thunCN7Genetic Connector Winh Leads. 	VEHICULAR CHARGER MAIN BOARD 344A4616P1 (PCB1)		SYMBOL	PART NUMBER	DESCRIPTION	
SYMBOL PART NUMBERDESCRIPTIONfm C75 C78 C78 		Is	ssue 1	C67		Ceramic: 0.001 µF +10% 50 V
CharlerDistrict PropertiesDistrict PropertiesCr3Cr3Cr3Ceranic: 0.001 μ F ±10%, 50 V. thu <b< td=""><td>SYMBOL</td><td>PART NUMBER</td><td>DESCRIPTION</td><td>thru</td><td></td><td>$10.001 \mu r \pm 10.0, 50 v.$</td></b<>	SYMBOL	PART NUMBER	DESCRIPTION	thru		$10.001 \mu r \pm 10.0, 50 v.$
PCB2Vehicult Charge LED BoardC78 thru (S0)Ceranic: 0.001 $\mu^{r} \pm 10\%, 50 V$. thru (S0)Ceranic: 0.11 $\mu^{r} \pm 10\%, 50 V$. thru (S0)Ceranic: 0.11 $\mu^{r} \pm 10\%, 50 V$. (C0)CN76-Conductor With Leads. (C102C101Ceranic: 0.11 $\mu^{r} \pm 10\%, 50 V$. (C102DIODES Supresser.LED1Yellow, Rectangular. Red, Rectangular. PCU3D1Supresser. Silicon.Supresser. Silicon.PCB3Microphone Connector Universal Device Connector V.D1Silicon. Silicon.Silicon. Silicon.C1NOTE: Paris Listed are for reference only.Ceranic: 0.11 $\mu^{r} \pm 10\%, 25 V$. V.D7Silicon: Dual diodes, common cathodoC3Electrolytic, aluminum: 1500 $\mu^{r}, 25$ V.D8Silicon: Dual diodes, common cathodoC4Ceranic: 0.11 $\mu^{r} \pm 10\%, 25 V$. Electrolytic, aluminum: 1500 $\mu^{r}, 25$ V.D9Silicon: Dual diodes, common cathodoC6Ceranic: 0.11 $\mu^{r} \pm 10\%, 25 V$. Electrolytic, aluminum: 1500 $\mu^{r}, 10^{r}, 50$ D1Silicon: Dual diodes, common cathodoC7Ceranic: 0.11 $\mu^{r} \pm 10\%, 25 V$. CD18Silicon: Dual diodes, common cathodoC8Ceranic: 0.11 $\mu^{r} \pm 10\%, 25 V$. CD18Silicon: NNNC10Ceranic: 0.11 $\mu^{r} \pm 10\%, 25 V$. CD12Silicon, NNNC11Electrolytic, aluminum: 1500 $\mu^{r}, 16$ V.Ceranic: 0.11 $\mu^{r} \pm 10\%, 25 V$. CD1C13Ceranic: 0.11 $\mu^{r} \pm 10\%, 25 V$. CCeranic: 0.11 $\mu^{r} \pm 10\%, 55 V$. CSilicon, PNP <t< td=""><td>STRIDOL</td><td>TAKI NUMBER</td><td>DESCRIPTION</td><td>C75</td><td></td><td></td></t<>	STRIDOL	TAKI NUMBER	DESCRIPTION	C75		
CN7 \cdots -CONNECTORS- \cdots \ln^{Hu} (S0)Connic: 0.1 µF ±10%, 25 V. C101CN7 $LEDS-\cdots$ C101C101LED1Y ellow, Rectangular. Green, Rectangular.D1Suppresser. Silicon.LED2Green, Rectangular. Green, Rectangular.D1Silicon.PCB4Universal Device Connector Universal Device Connector.D3Silicon.PCB4Universal Device Connector D4D3Silicon.C1NOTE: Parts Iside are for reference only.Ceramic: 0.1 µF ±10%, 25 V. DD6Silicon.C2reference only.Electrolytic, aluminum: 330 µF, 25 V. CD8Silicon: Dnal diodes, common ceramic: 0.1 µF ±10%, 25 V. DD8C3Electrolytic, aluminum: 200 µF, 25 V. CD9Silicon: Dnal diodes, common ceramic: 0.1 µF ±10%, 25 V. D10Silicon: Dnal diodes, common ceramic: 0.1 µF ±10%, 25 V. D11Silicon: Dnal diodes, common ceramic: 0.1 µF ±10%, 25 V. D11C6Ceramic: 0.1 µF ±10%, 25 V. CD15Silicon: Dnal diodes, common clambde.C8Ceramic: 0.1 µF ±10%, 25 V. CD18Silicon: Neal diodes, common clambde.C14Electrolytic, aluminum: 160 µF, 25 V. CD22Silicon, Neal Silicon, NealC15Ceramic: 0.1 µF ±10%, 25 V. Electrolytic, aluminum: 160 µF, 25 V. CCeramic: 0.1 µF ±10%, 50 V. Q2Silicon, NPN, Silicon, NPN, Silicon, NPN, Silicon, NPN, Sili	PCB2		Vehicular Charger LED Board	C78		Ceramic: 0.001 μ F ±10%, 50 V.
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			CONNECTORS	thru		
CN76-Conductor With Leads.C101 CluzCeramic: 0.1 μ T ±10%, 25 V.LED1Yellow, Rectangular. Green, Rectangular.D1 D2 Silicon, Zener.Supresser. Silicon, Zener.LED2Ked, Rectangular. Universal Devices ConnectorD3 D4Silicon, Zener. Silicon.PCB4Universal Devices ConnectorD4 D5 D7Silicon.C1NOTE: Parts reference only.Ceramic: 0.1 μ F ±10%, 25 V. V.D7 D7Silicon. Silicon.C2reference only.Electrolytic, aluminum:: 1500 μ F, 25 V.D8 D10 and dodes, common silicon: Dud diodes, common citabale.C3Electrolytic, aluminum:: 1500 μ F, 25 V.D9 D10 and Silicon: Dud diodes, common citabale.C4Ceramic: 0.1 μ F ±10%, 25 V. V.D10 and Ceramic: 0.1 μ F ±10%, 25 V. V.D10 and cathode.C6Ceramic: 0.1 μ F ±10%, 25 V. V.D15Silicon: Dud diodes, common cathode.C7Ceramic: 0.1 μ F ±10%, 25 V. V.D15Silicon: Dud diodes, common cathode.C8Ceramic: 0.1 μ F ±10%, 25 V. V.D18Silicon: Dud diodes, common cathode.C10Ceramic: 0.1 μ F ±10%, 25 V. V.D22Silicon, rener. V.C11Electrolytic, aluminum:: 150 μ F, 16 VNDUCTORS Silicon, NPN.C12Ceramic: 0.1 μ F ±10%, 25 V. C13Ceramic: 0.1 μ F ±10%, 25 V. C14Silicon, NPN.C14Electrolytic, aluminum:: 150 μ F, 16 VNDUCTORS Silicon, NPN.C15Ceramic: 0.1			CONNECTORS	C80		
LED1 LED2 LED3	CN7		6-Conductor With Leads.	C101		Ceramic: $0.1 \ \mu F \pm 10\%$, 25 V.
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $			I FDS	C102		
LED1 LED2 Velow, Recangular. LED3 RCB3 Creen, Rectingular. RCB3 Creen, Rectingular. RCB4 Universal Devices Connector Linear site of the second s			LED5			
	LED1		Yellow, Rectangular.			~
LED3 PCB3Red, Rectangular. Microphone Connector Universal Devices Connector D4D2 D3 D3Silicon, Zeter. Silicon, Zeter.PCB4NOTE: Parts listed are for reference only.Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 330 μ F, 25 V.D6 D7Silicon. Daal diodes, common cathode.C3Electrolytic, aluminum: 330 μ F, 25 V.D8Silicon: Daal diodes, common cathode.C4Ceramic: 0.1 μ F ±10%, 25 V. V.D9Silicon: Daal diodes, common 	LED2		Green, Rectangular.	D1		Suppresser.
PCB3Microphone ConnectorD3Silicon, Zener.PCB4Universal Devices ConnectorD4Silicon,C1NOTE: PartsCeramic: $0.1 \mu F \pm 10\%, 25 V.$ D7Silicon.C2reference only.Electrolytic, aluminum: $1500 \mu F, 25 V.$ D8Silicon: Dual diodes, commonC3Electrolytic, aluminum: $1500 \mu F, 25 V.$ D10Silicon: Dual diodes, commonC4Ceramic: $0.1 \mu F \pm 10\%, 25 V.$ D10Silicon: Dual diodes, commonC5V.Ceramic: $0.1 \mu F \pm 10\%, 25 V.$ D11Silicon: Dual diodes, commonC6Ceramic: $0.1 \mu F \pm 10\%, 25 V.$ D15Silicon: Dual diodes, commonC6Ceramic: $0.1 \mu F \pm 10\%, 25 V.$ D15Silicon: Dual diodes, commonC6Ceramic: $0.1 \mu F \pm 10\%, 25 V.$ D15Silicon: Dual diodes, commonC7Ceramic: $0.1 \mu F \pm 10\%, 25 V.$ D18Silicon: Dual diodes, commonC8Ceramic: $0.1 \mu F \pm 10\%, 25 V.$ D18Silicon: Dual diodes, commonC10Ceramic: $0.1 \mu F \pm 10\%, 25 V.$ D22Silicon, NDAC11Electrolytic, aluminum: $1500 \mu F, 16 V.$ $TRANSISTORS$ C12Ceramic: $0.1 \mu F \pm 10\%, 50 V.$ Q2Silicon, NPNC13Ceramic: $0.1 \mu F \pm 10\%, 50 V.$ Q3Silicon, NPNC14Electrolytic, aluminum: $100 \mu F, 25 V.$ G7Silicon, NPNC15Ceramic: $0.1 \mu F \pm 10\%, 50 V.$ Q4Silicon, NPNC16Ceramic: $0.1 \mu F \pm 10\%, 50 V.$ Q5Silicon, NPNC17Electrolytic, aluminum: $10 \mu F, 2$	LED3		Red, Rectangular.	D2		Silicon.
PCB4Durvess Lovces ConnectorDes and andSilicon.C1NOTE: Paris listed are for reference only.Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 1300 μ F, 25 V.De DSilicon: Dual diodes, common cathode.C3Electrolytic, aluminum: 1300 μ F, 25 V.De DSilicon: Dual diodes, common cathode.C4Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 1200 μ F, 25 V.De DSilicon: Dual diodes, common cathode.C6Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 470 μ F, 50 V.D1Silicon: Dual diodes, common cathode.C7Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 470 μ F, 50 V.D18Silicon: Dual diodes, common cathode.C8Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 470 μ F, 50 V.D22Silicon. Dual diodes, common cathode.C10Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 1500 μ F, 16 V	PCB3		Microphone Connector	D3		Silicon
C1NOTE: Parts iscel are for reference only.Cramic: $0.1 \ \muF \pm 10\%, 25 \ V.$ Dif Dif DifSilicon: Dual diodes, common cathede.C3Ference only.Electrolytic, aluminum: 130 \ \muF, 25 \ V.DBSilicon: Dual diodes, common cathede.C3Electrolytic, aluminum: 1500 \ \muF, 25 \ V.D0Silicon: Dual diodes, common cathede.C4Caramic: $0.1 \ \muF \pm 10\%, 25 \ V.D0Silicon: Dual diodes, commoncathede.C5Caramic: 0.1 \ \muF \pm 10\%, 25 \ V.D10Silicon: Dual diodes, commoncathede.C6Caramic: 0.1 \ \muF \pm 10\%, 25 \ V.D11Silicon: Dual diodes, commoncathede.C7Caramic: 0.1 \ \muF \pm 10\%, 25 \ V.D18Silicon: Dual diodes, commoncathede.C8Caramic: 0.1 \ \muF \pm 10\%, 25 \ V.D18Silicon: Dual diodes, commoncathede.C9Electrolytic, aluminum: 1500 \ \muF, 16 \ V.D22Silicon, rener.C10Caramic: 0.1 \ \muF \pm 10\%, 25 \ V.L1Inductor.C13Caramic: 0.1 \ \muF \pm 10\%, 25 \ V.Q1Silicon, Nchannel MOSFET,Silicon, NPNC14Electrolytic, aluminum: 1500 \ \muF, 16 \ V.Silicon, PNPSilicon, PNP.C15Caramic: 0.1 \ \muF \pm 10\%, 25 \ V.Q2Silicon, PNP.C16Caramic: 0.1 \ \muF \pm 10\%, 50 \ V.Silicon, PNP.Silicon, PNP.C17Caramic: 0.1 \ \muF \pm 10\%, 50 \ V.Q3Silicon, PNP.C18Electrolytic, aluminum: 10 \ \muF, 25 \ V.Silicon, PNP.Silicon, PNP.C19Electrolytic, aluminum: 10 \ \muF, 25 \ V.Caram$	PCB4		Universal Devices Connector	D4 D5		Silicon
C1 Ised are for reference only.Ceramic: $0.1 \ \mu F \pm 10\%, 25 \ V.$ Percolytic, aluminum: $30 \ \mu F, 25 \ V.$ Percolytic, aluminum: $1500 \ \mu F, 25 \ V.$ 			CAPACITORS	and		Shicon.
C1NOTE: Parts listed are for reference only.C ramic: $0.1 \ \mu^{F} \pm 10\%, 25 \ V.$ Electrolytic, aluminum: $300 \ \mu^{F}, 25 \ V.$ D8Silicon: Dual diodes, common cathode.C3Electrolytic, aluminum: $200 \ \mu^{F}, 25 \ V.$ D9Silicon: Dual diodes, common cathode.Silicon: Dual diodes, common cathode.C4Electrolytic, aluminum: $200 \ \mu^{F}, 25 \ V.$ D10Silicon: Dual diodes, common cathode.Silicon: Dual diodes, common cathode.C6Carmic: $0.1 \ \mu^{F} \pm 10\%, 25 \ V.$ D10Silicon: Dual diodes, common cathode.Silicon: Dual diodes, common cathode.C6Carmic: $0.1 \ \mu^{F} \pm 10\%, 25 \ V.$ D18Silicon: Dual diodes, common cathode.C7Carmic: $0.1 \ \mu^{F} \pm 10\%, 25 \ V.$ D18Silicon: Dual diodes, common cathode.C8Carmic: $0.1 \ \mu^{F} \pm 10\%, 25 \ V.$ D12Silicon. zener.C10Carmic: $0.1 \ \mu^{F} \pm 10\%, 25 \ V.$ L1Inductor.C13Electrolytic, aluminum: 1500 \ \mu^{F}, 16 \ V.Silicon, N-Annel MOSFET.C14Electrolytic, aluminum: 100 \ \mu^{F}, 25 \ V.Q1Silicon, NPNC15Carmic: $0.1 \ \mu^{F} \pm 10\%, 50 \ V.$ Q2Silicon, NPNC16Carmic: $0.1 \ \mu^{F} \pm 10\%, 50 \ V.$ Q3Silicon, NPNC17Carmic: $0.1 \ \mu^{F} \pm 10\%, 50 \ V.$ Q4Silicon, NPNC18Electrolytic, aluminum: 100 \ \mu^{F}, 25 \ V.Q3Silicon, NPNC19Electrolytic, aluminum: 100 \ \mu^{F}, 25 \ V.Silicon, NPN.C20Electrolytic, aluminum: 100 \ \mu^{F}, 25 \ V.Carmic: 0.1				D6		
C2Issed are for reference only.Electrolytic, aluminum: 330 μ F, 25 V.D8Cuthode.Silicon: Dual diodes, common cuthode.C3Electrolytic, aluminum: 1500 μ F, 25 V.D9D9Silicon: Dual diodes in series.Silicon: Dual diodes, common cuthode.C4Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 220 μ F, 25 V.D11Silicon: Dual diodes, common cuthode.C6Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 47 μ F, 50 V.D12Silicon: Zener.C7Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 47 μ F, 50 V.D22Silicon, Zener.C10Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 1500 μ F, 16 V.D22Silicon, Nethanel MOSFET.C13Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 1500 μ F, 16 V.L1Inductor.C14Electrolytic, aluminum: 1500 μ F, 16 V.Ceramic: 0.1 μ F ±10%, 25 V. Q3Silicon, Nethanel MOSFET.C15Ceramic: 0.1 μ F ±10%, 50 V.Q3Silicon, NPN.C16Ceramic: 0.1 μ F ±10%, 50 V.Q4Silicon, NPN.C17Ceramic: 0.1 μ F ±10%, 25 V. Ceramic: 0.1 μ F ±10%, 25 V.Q4Silicon, NPN.C18Electrolytic, aluminum: 100 μ F, 25 V.Q20Silicon, NPN.C19Electrolytic, aluminum: 100 μ F, 25 V.Q4Silicon, NPN.C20Electrolytic, aluminum: 100 μ F, 25 V. Ceramic: 0.1 μ F ±10%, 25 V.D8-25 Connector 6-pin Solder in placeC21Ceramic: 0.1 μ F ±10%, 25 V. Ceramic: 0.1 μ F ±10%, 25 V. Ce	C1	NOTE: Parts	Ceramic: 0.1 µF ±10%, 25 V.	D7		Silicon: Dual diodes, common
C2reference only.Electrolytic, aluminum: 330 µF, 25 V.D8Silicon: Dual diodes, common cathode.C3Liberrolytic, aluminum: 1500 µF, 25 V.D9 D10 andSilicon: Dual diodes, common cathode.Silicon: Dual diodes, common cathode.C4Ceramic: 0.1 µF ±10%, 25 V. Electrolytic, aluminum: 20 µF, 25 V.D15Silicon: Dual diodes, common cathode.C6Ceramic: 0.1 µF ±10%, 25 V. Electrolytic, aluminum: 47 µF, 50 V.D18Silicon: Dual diodes, common cathode.C7Ceramic: 0.1 µF ±10%, 25 V. Electrolytic, aluminum: 1500 µF, 16 V.D18Silicon: Dual diodes, common cathode.C10Ceramic: 0.1 µF ±10%, 25 V. P.L1Inductor.C13Electrolytic, aluminum: 1500 µF, 16 VTRANSISTORSC14Electrolytic, aluminum: 1500 µF, 16 VTRANSISTORSC15Ceramic: 0.1 µF ±10%, 25 V. Q4Silicon, PNP.C16Ceramic: 0.1 µF ±10%, 50 V. Q4Silicon, PNP.C17Ceramic: 0.1 µF ±10%, 25 V. Q4Silicon, PNP.C18Electrolytic, aluminum: 100 µF, 25 V.Q6C19Electrolytic, aluminum: 100 µF, 25 V.Q7Silicon, PNP.Silicon, PNP.C19Electrolytic, aluminum: 100 µF, 25 V. Ceramic: 0.1 µF ±10%, 25 V. Ceramic: 0.1	62	listed are for				cathode.
C3 V. Electrolytic, aluminum: 1500 μ F, 25 D9 Silicon: Dual diodes in series. C4 Ceramic: 0.1 μ F ±10%, 25 V. D10 Silicon: Dual diodes in series. C5 V. D11 D11 C6 Ceramic: 0.1 μ F ±10%, 25 V. D15 Silicon: Dual diodes, common C7 Ceramic: 0.1 μ F ±10%, 25 V. D15 Silicon: Dual diodes, common C8 Ceramic: 0.1 μ F ±10%, 25 V. D18 Silicon: Dual diodes, common C9 Electrolytic, aluminum: 47 μ F, 50 D22 Silicon, Dual diodes, common C10 Ceramic: 0.1 μ F ±10%, 25 V. L1 Inductor. C13 Ceramic: 0.1 μ F ±10%, 25 V. Q1 Silicon, Nechamel MOSFET. C14 Electrolytic, aluminum: 1500 μ F, 16 RANSISTORS V. Q2 Silicon, PNP. Silicon, PNP. C14 Electrolytic, aluminum: 100 μ F, 25 V. Q1 Silicon, PNP. C15 Ceramic: 0.1 μ F ±10%, 25 V. Q2 Silicon, PNP. Silicon, PNP. C16 V. Q2 Silicon, PNP. Silicon, PNP. Silicon, PNP. Silicon, PNP. Silicon, PNP. Silicon,	C2	reference only.	Electrolytic, aluminum: 330 µF, 25	D8		Silicon: Dual diodes, common
C3Electrolytic, aluminum: 1500 μ F, 25D9Silicon: Dual diodes in series.C4Ceramic: 0.1 μ F ±10%, 25 V.andSilicon: zener.C5Electrolytic, aluminum: 220 μ F, 25D15Silicon: Dual diodes in series.C6Ceramic: 0.1 μ F ±10%, 25 V.D15Silicon: Dual diodes, commonC7Ceramic: 0.1 μ F ±10%, 25 V.D18Silicon: Dual diodes, commonC8Ceramic: 0.1 μ F ±10%, 25 V.D18Silicon: Dual diodes, commonC9Electrolytic, aluminum: 4.7 μ F, 50D22Silicon: Dual diodes, commonC10Ceramic: 0.1 μ F ±10%, 25 V.L1Inductor.C13Electrolytic, aluminum: 1500 μ F, 16·····-INDUCTORS-····C14Electrolytic, aluminum: 100 μ F, 25Q2C15Ceramic: 0.1 μ F ±10%, 25 V.Q1C16V.Q2C17Ceramic: 0.1 μ F ±10%, 50 V.Q5C18Electrolytic, aluminum: 100 μ F, 25Q6C19Electrolytic, aluminum: 100 μ F, 25Q8C19Electrolytic, aluminum: 100 μ F, 25Q8C20Electrolytic, aluminum: 10 μ F, 25 V.····CONNECTORS-···C21Ceramic: 0.1 μ F ±10%, 25 V.CN3C22Electrolytic, aluminum: 10 μ F, 25 V.·····CONNECTORS-···C23Ceramic: 0.1 μ F ±10%, 25 V.CN3C24Ceramic: 0.1 μ F ±10%, 25 V.CN3C25Ceramic: 0.1 μ F ±10%, 25 V.CN3C24Ceramic: 0.1 μ F ±10%, 25 V.CN3C25Ceramic: 0.1 μ F ±10%, 25 V. <td>G2</td> <td></td> <td>V.</td> <td></td> <td></td> <td>cathode.</td>	G 2		V.			cathode.
C4 Caramic: 0.1 μ F ±10%, 25 V. D10 and Silicon: zener. C5 Electrolytic, aluminum: 220 μ F, 25 D11 Silicon: Dual diodes, common C6 Caramic: 0.1 μ F ±10%, 25 V. D15 Silicon: Dual diodes, common C7 Caramic: 0.1 μ F ±10%, 25 V. D18 Silicon: Dual diodes, common C8 Ceramic: 0.1 μ F ±10%, 25 V. D22 Silicon: zener. C10 Caramic: 0.1 μ F ±10%, 25 V. D22 Silicon, zener. C14 Electrolytic, aluminum: 1500 μ F, 16 TRANSISTORS C15 Caramic: 0.1 μ F ±10%, 25 V. Q2 Silicon, N-channel MOSFET. C16 V. Q2 Silicon, PNP. C17 Ceramic: 0.1 μ F ±10%, 50 V. Q4 Silicon, PNP. C18 Q4 Silicon, PNP. Silicon, PNP. C19 Electrolytic, aluminum: 10 μ F, 25 V. Q2 Silicon, PNP. C21 Electrolytic, aluminum: 10 μ F, 25 V. Q3 Silicon, PNP. C22 Electrolytic, aluminum: 10 μ F, 25 V. Q4 Silicon, PNP. C33 Ceramic: 0.1 μ F ±10%, 25 V. Q4 Silicon, PNP. Silicon, PNP	03		Electrolytic, aluminum: 1500 μ F, 25	D9		Silicon: Dual diodes in series.
C4Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 220 μ F, 25 V.and D11C5Electrolytic, aluminum: 47 μ F, 50 V.D15Silicon: Dual diodes, common cathode.C6Ceramic: 10 μ F ±10%, 25 V. Electrolytic, aluminum: 47 μ F, 50 V.D18Silicon: Dual diodes, common cathode.C9Electrolytic, aluminum: 47 μ F, 50 V.D22Silicon: Dual diodes, common cathode.C10Ceramic: 0.1 μ F ±10%, 25 V. UL1Inductor.C13Electrolytic, aluminum: 1500 μ F, 16 VINDUCTORSC14Electrolytic, aluminum: 1500 μ F, 16 VRANSISTORSC15Ceramic: 0.1 μ F ±10%, 25 V. Q2Q1C16V.Q2C17Ceramic: 0.1 μ F ±10%, 50 V. Q4Q3C18Electrolytic, aluminum: 100 μ F, 25 V.Q8C19Electrolytic, aluminum: 100 μ F, 25 V. Electrolytic, aluminum: 100 μ F, 25 V. C20Q9C19Electrolytic, aluminum: 100 μ F, 25 V. Electrolytic, aluminum: 10 μ F ±10%, 25 V. C21Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 1 μ F, 25 V. C22Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 1 μ F, 25 V. C23Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 1 μ F, 25 V. C24Ceramic: 0.1 μ F ±10%, 25 V. C31CN1C26Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 1 μ F, 25 V. C24Ceramic: 0.1 μ F ±10%, 25 V. C31CN1C26Ceramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 1 μ F, 25 V. C31CN1DB-25 Connector 6-pin Solder in pla	64		V.	D10		Silicon: zener.
CSHelectrolytic, aluminum: 220 µF, 25D 11C6Ceramic: $0.1 µF \pm 10\%, 25 V.$ D15Silicon: Dual diodes, common cathode.C7Ceramic: $10.1 µF \pm 10\%, 55 V.$ D18Silicon: Dual diodes, common cathode.C8Ceramic: $0.1 µF \pm 10\%, 55 V.$ D18Silicon, zener.C10Ceramic: $0.1 µF \pm 10\%, 25 V.$ L1Inductor.C13Ceramic: $0.1 µF \pm 10\%, 25 V.$ L1Inductor.C14Electrolytic, aluminum: 1500 µF, 16·····RANSISTORS-····V.Ceramic: $0.1 µF \pm 10\%, 25 V.$ Q1Silicon, PNP.C15Ceramic: $0.1 µF \pm 10\%, 50 V.$ Q2Silicon, PNP.C16V.Q2Silicon, PNP.C17Ceramic: $0.01 µF \pm 10\%, 50 V.$ Q6Silicon, PNP.andCeramic: $0.01 µF \pm 10\%, 50 V.$ Q6Silicon, PNP.andCeramic: $0.01 µF \pm 10\%, 50 V.$ Q2Silicon, PNP.andCeramic: $0.01 µF \pm 10\%, 50 V.$ Q3Silicon, PNP.andCeramic: $0.01 µF \pm 10\%, 50 V.$ Q6Silicon, PNP.C19Electrolytic, aluminum: $10 µF, 25 V.$ Q9Silicon, PNP.C20Electrolytic, aluminum: $10 µF, 25 V.$ Ceramic: $0.1 µF \pm 10\%, 25 V.$ CN1C21Ceramic: $0.1 µF \pm 10\%, 25 V.$ CN1DB-25 ConnectorC23Ceramic: $0.1 µF \pm 10\%, 25 V.$ CN1CDB-25 ConnectorC24Ceramic: $0.1 µF \pm 10\%, 25 V.$ IC1Linear: Switching Regulator.C25Ceramic: $0.1 µF \pm 10\%, 25 V.$ IC2Digital: Quad Bilateral Switch.<	C4		Ceramic: $0.1 \mu F \pm 10\%$, 25 V.	and		
C6V. Ceramic: 0.1 μ F ±10%, 25 V. Cramic: 0.1 μ F ±10%, 25 V. Electrolytic, aluminum: 4.7 μ F, 50D18Silicon: Dual diodes, common cathode.C9Electrolytic, aluminum: 4.7 μ F, 50D22Silicon: Dual diodes, common cathode.C10Ceramic: 0.1 μ F ±10%, 25 V. UD22Silicon: Dual diodes, common cathode.C10Ceramic: 0.1 μ F ±10%, 25 V. UL1Inductor.C14Electrolytic, aluminum: 1500 μ F, 16 V	CS		Electrolytic, aluminum: 220 μ F, 25	D11		
LoCeramic: 0.1 μ F ±10%, 25 V. Ceramic: 470 μ F ±10%, 25 V. Electrolytic, aluminum: 47 μ F, 50 V.D18cathode. cathode.C9Electrolytic, aluminum: 47 μ F, 50 V.D22Silicon. Dual diodes, common cathode.C10Ceramic: 0.1 μ F ±10%, 25 V. V.L1Inductor.C13Electrolytic, aluminum: 1500 μ F, 16 V.11·····BNDUCTORS-···C14Electrolytic, aluminum: 1500 μ F, 16 V.11·····RANSISTORS-···C15Ceramic: 0.1 μ F ±10%, 50 V. Q4Q3Silicon, N-channel MOSFET. Silicon, N-channel MOSFET. Silicon, NPN. Silicon, NPN. Silicon, NPN.C16Ceramic: 0.01 μ F ±10%, 50 V. Q4Q4 Q5Silicon, NPN. Silicon, NPN. Silico	04		V.	D15		Silicon: Dual diodes, common
C/Ceramic: 3/1 μ = 10%, 25 V.D18Shitcon: Dual diodes, commonC8Ceramic: 0.1 μ = 10%, 25 V.D22Shitcon: Dual diodes, commonC9Electrolytic, aluminum: 47 μ F, 50D22Shitcon: Dual diodes, commonC10V.Electrolytic, aluminum: 47 μ F, 50D22Shitcon: Dual diodes, commonC11Ceramic: 0.1 μ = 10%, 25 V.L1Inductor.C12Electrolytic, aluminum: 1500 μ F, 16V.Shitcon: PNP.C15Ceramic: 0.1 μ = ±10%, 25 V.Q2Shitcon, PNP.andCeramic: 0.01 μ = ±10%, 50 V.Q5Shitcon, NPN.C18Electrolytic, aluminum: 100 μ F, 25Q6Shitcon, NPN.C19Electrolytic, aluminum: 100 μ F, 25 V.Q2Shitcon, NPN.C20Electrolytic, aluminum: 10 μ F, 25 V.Q2Shitcon, NPN.C21Ceramic: 0.1 μ F ±10%, 25 V.Q20Shitcon, NPN.C22Electrolytic, aluminum: 1 μ F, 25 V.CNICNIC23Ceramic: 0.1 μ F ±10%, 25 V.CNIDB-25 ComectorC24Ceramic: 0.1 μ F ±10%, 25 V.IC1Linear: Switching Regulator.C25Ceramic: 0.1 μ F ±10%, 25 V.IC2Electrolytic, aluminum: 1 μ F, 25 V.C26Ceramic: 0.1 μ F ±10%, 25 V.IC3Inear: Switching Regulator.C27Electrolytic, aluminum: 1 μ F, 25 V.IC4Inear: Switching Regulator.C26Ceramic: 0.1 μ F ±10%, 25 V.IC4Inear: Switching Regulator.C27C28Electrolytic, aluminum: 1 μ F, 25 V. <td< td=""><td>C6</td><td></td><td>Ceramic: $0.1 \mu\text{F} \pm 10\%$, 25 V.</td><td>510</td><td></td><td>cathode.</td></td<>	C6		Ceramic: $0.1 \mu\text{F} \pm 10\%$, 25 V.	510		cathode.
C8Ceramic: 0.1 μ f ±10%, 25 V. C10D22Cathode. Silicon, Zener.C10Ceramic: 0.1 μ F ±10%, 25 V.D22Silicon, Zener.C11Ceramic: 0.1 μ F ±10%, 25 V.L1Inductor.C13Electrolytic, aluminum: 1500 μ F, 16· · · · TRANSISTORS-···Silicon, NeN.C14Electrolytic, aluminum: 1500 μ F, 16· · · · TRANSISTORS-···Silicon, NeN.C15Ceramic: 0.1 μ F ±10%, 25 V.Q1Silicon, NeN.C16Ceramic: 0.01 μ F ±10%, 50 V.Q4Silicon, NPN.C17Ceramic: 0.01 μ F ±10%, 50 V.Q6Silicon, NPN.C18Electrolytic, aluminum: 100 μ F, 25 V.Q2Silicon, NPN.C19Electrolytic, aluminum: 10 μ F, 25 V.Q2Silicon, NPN.C20Electrolytic, aluminum: 10 μ F, 25 V.Q2Silicon, NPN.C21Ceramic: 0.1 μ F ±10%, 25 V.Q2Silicon, NPN.C22Electrolytic, aluminum: 1 μ F, 25 V.CN1DB-25 ConnectorC23Ceramic: 0.1 μ F ±10%, 25 V.CN1CP32 ConnectorC24Ceramic: 0.1 μ F ±10%, 25 V.CN1CP32 ConnectorC25Ceramic: 0.1 μ F ±10%, 25 V.CN1CP32 ConnectorC26Ceramic: 0.1 μ F ±10%, 25 V.CN1CP32 ConnectorC27Electrolytic, aluminum: 1 μ F, 25 V.CN1CP32 ConnectorC31Ceramic: 0.1 μ F ±10%, 25 V.C1Electrolytic, aluminum: 1 μ F, 25 V.C26Ceramic: 0.1 μ F ±10%, 25 V.C1Electrolytic, aluminum: 1 μ F, 25 V. </td <td>C7</td> <td></td> <td>Ceramic: $4/0 \text{ pF} \pm 5\%$, 50 V.</td> <td>D18</td> <td></td> <td>Silicon: Dual diodes, common</td>	C7		Ceramic: $4/0 \text{ pF} \pm 5\%$, 50 V.	D18		Silicon: Dual diodes, common
19Electrolytic, aluminum: 4,7 µF, 50D22Silicon, Zender.C10V.Ceramic: 0.1 µF ±10%, 25 V.IIIInductor.C13Electrolytic, aluminum: 1500 µF, 16V.Q1Silicon, N-channel MOSFET.C14Electrolytic, aluminum: 100 µF, 16Q1Silicon, N-PR.C15Ceramic: 0.1 µF ±10%, 25 V.Q2Silicon, PNP.andQ3Silicon, PNP.C16Ceramic: 0.1 µF ±10%, 50 V.Q5Silicon, PNP.C17Ceramic: 0.01 µF ±10%, 50 V.Q5Silicon, PNP.C18Ceramic: 0.1 µF ±10%, 25 V.Q8Silicon, PNP.C19Electrolytic, aluminum: 10 µF, 25Q8Silicon, PNP.C20Electrolytic, aluminum: 10 µF, 25 V.Q2Silicon, PNP.C21Ceramic: 0.1 µF ±10%, 25 V.Q2Silicon, PNP.C22Electrolytic, aluminum: 10 µF, 25 V.CNIDB-25 ConnectorC24Ceramic: 0.1 µF ±10%, 25 V.CNICNIC25Ceramic: 0.1 µF ±10%, 25 V.CNICIC26Ceramic: 0.1 µF ±10%, 25 V.CNICIC27Electrolytic, aluminum: 1 µF, 25 V.CNICIC26Ceramic: 0.1 µF ±10%, 25 V.CICIC27Electrolytic, aluminum: 1 µF, 25 V.CAIElectrolytic, aluminum: 1 µF, 25 V.C26Ceramic: 0.1 µF ±10%, 25 V.CIDigital: Microcontroller.C30Electrolytic, aluminum: 1 µF, 25 V.CAIDigital: Microcontroller.C31Ceramic: 0.1 µF ±10%, 25 V.CIDigital:	C8		Ceramic: $0.1 \mu\text{F} \pm 10\%$, 25 V.	D22		cathode.
C10 thu C13V. Ceramic: $0.1 \ \mu\text{F} \pm 10\%, 25 \text{ V}.$ L1INDUCTORSC14Electrolytic, aluminum: $1500 \ \mu\text{F}, 16$ V.Q1 Q2 Q3Silicon, N-channel MOSFET. Silicon, PNP.C15 and C16Ceramic: $0.1 \ \mu\text{F} \pm 10\%, 25 \text{ V}.$ Q1 Q2 Q3Silicon, N-channel MOSFET. Silicon, PNP.C16 C17 C17Ceramic: $0.01 \ \mu\text{F} \pm 10\%, 50 \text{ V}.$ Q3 Q4 Q5 Q6 Q7Silicon, PNP. Silicon, PNP.C18 C19 C19Electrolytic, aluminum: $100 \ \mu\text{F}, 25 \text{ V}.$ Q2 Q6 Q7Silicon, PNP. Silicon, PNP.C20 C21 C22 C22 C23 C4 C23Electrolytic, aluminum: $100 \ \mu\text{F}, 25 \text{ V}.$ Q20 Q2Silicon, PNP. Silicon, PNP.C23 C24 C4 <b< td=""><td>C9</td><td></td><td>Electrolytic, aluminum: 4.7 μF, 50</td><td>D22</td><td></td><td>Silicon, zener.</td></b<>	C9		Electrolytic, aluminum: 4.7 μ F, 50	D22		Silicon, zener.
C10Ceramic: 0.1 μ F ±10%, 25 V.L1Inductor.C13Electrolytic, aluminum: 1500 μ F, 16····TRANSISTORS-···C14Electrolytic, aluminum: 1500 μ F, 16····TRANSISTORS-···C15Ceramic: 0.1 μ F ±10%, 25 V.Q2andQ3Silicon, N-chamel MOSFET.C16Q4Silicon, PNP.C17Ceramic: 0.01 μ F ±10%, 50 V.Q5andQ6Silicon, PNP.C18Q7Q9C19Electrolytic, aluminum: 100 μ F, 25 V.Q2C20Electrolytic, aluminum: 100 μ F, 25 V.Q2C21Ceramic: 0.1 μ F ±10%, 25 V.Q2C22Electrolytic, aluminum: 10 μ F, 25 V.Silicon, NPN.C23Ceramic: 0.1 μ F ±10%, 25 V.····-CONNECTORS-···C24Ceramic: 0.1 μ F ±10%, 25 V.····-CONSECTORS-···C25Ceramic: 0.1 μ F ±10%, 25 V.CN1C26Ceramic: 0.1 μ F ±10%, 25 V.CN1C27Electrolytic, aluminum: 1 μ F, 25 V.CN1C26Ceramic: 0.1 μ F ±10%, 25 V.IC1andCeramic: 0.1 μ F ±10%, 25 V.IC2C26Ceramic: 0.1 μ F ±10%, 25 V.IC3C27Electrolytic, aluminum: 1 μ F, 25 V.IC3C28Electrolytic, aluminum: 1 μ F, 25 V.IC3C30Electrolytic, aluminum: 1 μ F, 25 V.IC4C31Ceramic: 0.1 μ F ±10%, 25 V.IC5C31Ceramic: 0.1 μ F ±10%, 25 V.IC5C31Ceramic: 0.1 μ F ±10%, 25 V.IC4C32Cer	C10					
Inductor.Inductor.C13Electrolytic, aluminum: 1500 µF, 16C14Electrolytic, aluminum: 1500 µF, 16V.Q1Silicon, N-channel MOSFET.andCeramic: 0.1 µF ±10%, 25 V.Q2C16Q4Silicon, PNP.C17Ceramic: 0.01 µF ±10%, 50 V.Q5andQ6Silicon, NPN.C18Electrolytic, aluminum: 100 µF, 25Q8C19Electrolytic, aluminum: 100 µF, 25Q8C20V.Q2Electrolytic, aluminum: 10 µF, 25 V.Q2C21Ceramic: 0.1 µF ±10%, 25 V.Q2C22Electrolytic, aluminum: 1 µF, 25 V.Silicon, NPN.C23Ceramic: 0.1 µF ±10%, 25 V.CN1C24Ceramic: 0.1 µF ±10%, 25 V.CN3C35Electrolytic, aluminum: 1 µF, 25 V.CN3C26Ceramic: 0.1 µF ±10%, 25 V.CN3C27Electrolytic, aluminum: 1 µF, 25 V.CN3C28Electrolytic, aluminum: 1 µF, 25 V.CN3C30Electrolytic, aluminum: 1 µF, 25 V.CN3C31Ceramic: 0.1 µF ±10%, 25 V.IC1C32Electrolytic, aluminum: 1 µF, 25 V.CSC33Ceramic: 0.1 µF ±10%, 25 V.IC2C34Ceramic: 0.1 µF ±10%, 25 V.IC2C35Ceramic: 0.1 µF ±10%, 25 V.IC3C36Electrolytic, aluminum: 1 µF, 25 V.IC3C37Electrolytic, aluminum: 1 µF, 25 V.IC4C31Ceramic: 0.1 µF ±10%, 25 V.IC4	C10 thm		Ceramic: 0.1 μ F ±10%, 25 V.	T 1		T 1 /
C13 C14Electrolytic, aluminum: 1500 µF, 16 V.Q1 Q2 Q3 	C13			LI		Inductor.
C11Decempter, administration 1500 µr, 160Q1C15Ceramic: 0.1 µF ±10%, 25 V.Q2andQ3C16Q3C17Ceramic: 0.01 µF ±10%, 50 V.Q5andQ6C18Q7C19Electrolytic, aluminum: 100 µF, 25Q8V.Q2C20Electrolytic, aluminum: 10 µF, 25 V.Q2C21Ceramic: 0.1 µF ±10%, 25 V.Q2C22Electrolytic, aluminum: 11 µF, 25 V.Q2C23Ceramic: 0.1 µF ±10%, 25 V.CN1C24Ceramic: 0.1 µF ±10%, 25 V.CN3C25Ceramic: 0.1 µF ±10%, 25 V.CN3C26Ceramic: 0.1 µF ±10%, 25 V.CN1C27Electrolytic, aluminum: 1 µF, 25 V.CN3C30Ceramic: 0.1 µF ±10%, 25 V.CN3C30Electrolytic, aluminum: 1 µF, 25 V.CSC30Electrolytic, aluminum: 1 µF, 25 V.CSC31Ceramic: 0.1 µF ±10%, 25 V.CSC32Electrolytic, aluminum: 1 µF, 25 V.CSC31Ceramic: 0.1 µF ±10%, 25 V.CSC32Electrolytic, aluminum: 1 µF, 25 V.CSC33Electrolytic, aluminum: 1 µF, 25 V.CSC34Ceramic: 0.1 µF ±10%, 25 V.CSC35Electrolytic, aluminum: 1 µF, 25 V.CSC36Ceramic: 0.1 µF ±10%, 25 V.CSC37Electrolytic, aluminum: 1 µF, 25 V.CSC38Electrolytic, aluminum: 1 µF, 25 V.CSC39Electrolytic, aluminum: 1 µF, 25 V. <td< td=""><td>C14</td><td></td><td>Electrolytic aluminum: 1500 uF 16</td><td></td><td></td><td>TRANSISTORS</td></td<>	C14		Electrolytic aluminum: 1500 uF 16			TRANSISTORS
C15 and C16 C17Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V .Q1 Q2 Q3 Q3 Q3 Q4 Q4 Q5 Q4 Q5 Q6 Q4 Q5 Q6 Q6 Q6 Q6 Q7 Q8 Q8 Q8 Q9 Q9 Q10 Q10 Q110 Silicon, PNP. Silicon, PN	011		V	01		
and Cl6Ceramic: 0.1 μ F 10%, 25 V.Q2 Q3Silicon, PNF.Cl7 and Cl8Ceramic: 0.01 μ F ±10%, 50 V.Q3 Q4Silicon, PNP (with bias resistors). Silicon, NPN.Cl8 Cl9Electrolytic, aluminum: 100 μ F, 25 V.Q7 Q9Silicon, PNP. Silicon, PNP. Silicon, NPN.C20 Cl1 C21Electrolytic, aluminum: 10 μ F, 25 V. C22 C22Q20 Ceramic: 0.1 μ F ±10%, 25 V. C23 C24Ceramic: 0.1 μ F ±10%, 25 V. C24CNI CNNECTORSC24 C25 C26 C27 C26 C27 C27 C27 C28 C28 C28 C29Ceramic: 0.1 μ F ±10%, 25 V. C29 Ceramic: 0.1 μ F ±10%, 25 V. C31 C27 C29 Ceramic: 0.1 μ F ±10%, 25 V. C31 C29 Ceramic: 0.1 μ F ±10%, 25 V. C31 C30 C23IC1 Linear: μ F ±10%, 25 V. C31 Ceramic: 0.1 μ F ±10%, 25 V. C31 C29IC1 Ceramic: 0.1 μ F ±10%, 25 V. C31 Ceramic: 0.1 μ F ±10%, 25 V. C31 Ceramic: 0.1 μ F ±10%, 25 V. C31 Ceramic: 0.1 μ F ±10%, 25 V. C31 Caramic: 0.1 μ F ±10%, 25 V. C31 Ceramic: 0.1 μ F ±10%, 25 V. C31 Caramic: 0.1 μ F ±10%, 25 V. C31 Ceramic: 0.1 μ F ±10%, 25 V. C31 Cera	C15		Ceramic: 0.1 µF +10% 25 V	QI		Silicon, N-channel MOSFET.
C16 C17 andCeramic: $0.01 \ \mu\text{F} \pm 10\%$, $50 \ V$.Q3 Q4 Q5 Q5 Q5 Q6 Q6 Q7 Q7 Q7 Q8 Q19Silicon, PNP. Silicon,	and		10,0,25 V.	Q2 Q2		Silicon, PNP.
C17 and C18Ceramic: $0.01 \ \mu\text{F} \pm 10\%$, $50 \ \text{V}$.Qf Qf QfSilicon, NPN. 	C16			Q3 04		Silicon PNP
and C18C18C18C18C19Electrolytic, aluminum: 100 μ F, 25Q6 Q7Silicon, NPN (with bias resistors). Silicon, PNP (with bias resistors). Silicon, PNP.C20Electrolytic, aluminum: 10 μ F, 25 V. 	C17		Ceramic: 0.01 µF ±10%, 50 V.	05		Silicon NPN
C18 C19C18 C19C17 Electrolytic, aluminum: $100 \ \mu\text{F}$, 25 V.Q7 Q8 Q9Silicon, PNP. Silicon, PNP. Silicon, PNP. Silicon, PNP.C20 C21 C21 C22 C22 C23 C44 C47 C44 C47 C24 C44 C47 C25 C24 C25 C26 C44 C47 C27 C26 C26 C44 C47 C47 C27 C26 C27 C26 C44 C47 C47 C27 C28 C29 C29 C47 C29 C47 C29 C47 C20 C47 C21 C47 C21 C47 C47 C47 C47 C22 C22 C47 C23 C47 C47 C24 C47 C47 C24 C47 C47 C25 C26 C47 C27 C28 C47 C29 C47 C30 C31 C47 C29 C47 C31 C47 C29 C47 C47 C31 C47 C47 C47 C47 C47 C47 C47 C47 C47 C47 C47 C47 C47 C47 C47 C47 C48 C47 <br< td=""><td>and</td><td></td><td>•</td><td>06</td><td></td><td>Silicon, PNP (with bias resistors).</td></br<>	and		•	06		Silicon, PNP (with bias resistors).
C19Electrolytic, aluminum: $100 \ \mu\text{F}$, 25Q8Silicon, PNP (with bias resistors).C20Electrolytic, aluminum: $10 \ \mu\text{F}$, 25 V.Q9Silicon, PNP.C21Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.Q20Silicon, NPN.C22Electrolytic, aluminum: $1 \ \mu\text{F}$, 25 V.Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.CN1C23Ceramic: $100 \ p\text{F} \pm 5\%$, 50 V.CN3DB-25 ConnectorandCeramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.CN3DB-25 ConnectorC24Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.CN3INTEGRATED CIRCUITSC25C26Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.IC1andElectrolytic, aluminum: $1 \ \mu\text{F}$, 25 V.IC2C28Electrolytic, aluminum: $1 \ \mu\text{F}$, 25 V.IC3C30Electrolytic, aluminum: $1 \ \mu\text{F}$, 25 V.IC4C31Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.IC5andCeramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.IC5C30Electrolytic, aluminum: $1 \ \mu\text{F}$, 25 V.IC5C31Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.IC5andCeramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.IC5andCeramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.IC5C31Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.IC4C32Image: Net All film: 100 ohms \pm 5\%, 1/10WWMetal film: 100 ohms ±5\%, 1/10	C18			07		Silicon, PNP.
C20V.Q9Silicon, PNP.C21Ceramic: $0.1 \ \mu F \pm 10\%$, 25 V.Q20Silicon, NPN.C22Electrolytic, aluminum: $1 \ \mu F$, 25 V.Ceramic: $0.1 \ \mu F \pm 10\%$, 25 V.CN1C23Ceramic: $0.1 \ \mu F \pm 10\%$, 25 V.CN1DB-25 ConnectorC24Ceramic: $100 \ p F \pm 5\%$, 50 V.CN36-pin Solder in placeandC25Ceramic: $0.1 \ \mu F \pm 10\%$, 25 V.IC1Linear: Switching Regulator.C26Ceramic: $0.1 \ \mu F \pm 10\%$, 25 V.IC1Linear: Switching Regulator.C27Electrolytic, aluminum: $1 \ \mu F$, 25 V.IC3IC4C29Ceramic: $0.1 \ \mu F \pm 10\%$, 25 V.IC5Digital: Microcontroller.C30Electrolytic, aluminum: $1 \ \mu F$, 25 V.IC5Digital: Quad Bilateral Switch.C31Ceramic: $0.1 \ \mu F \pm 10\%$, 25 V.R1Metal film: 100 ohms $\pm 5\%$, 1/10wWR2Metal film: 4.7 ohms $\pm 5\%$, 1/10	C19		Electrolytic, aluminum: 100 µF, 25	Q8		Silicon, PNP (with bias resistors).
C20Electrolytic, aluminum: $10 \ \mu\text{F}$, $25 \ V$. Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$. Electrolytic, aluminum: $1 \ \mu\text{F}$, $25 \ V$. Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$. Ceramic: $100 \ p\text{F} \pm 5\%$, $50 \ V$.Q20Silicon, NPN. CONNECTORSC23Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$. Ceramic: $100 \ p\text{F} \pm 5\%$, $50 \ V$.CN1 CN3DB-25 Connector 6-pin Solder in placeC24Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$. and C25IC1 IC2 IC2IC1 IC2 IC3Linear: Switching Regulator. Linear: Switching Regulator. IC2 IC3C26Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$. Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$. Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$. Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$. Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$. Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$. Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$. Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$. Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$. Regulator Auxiliary Function Digital: Microcontroller. Digital: Quad Bilateral Switch. RESISTORSC30Electrolytic, aluminum: $1 \ \mu\text{F}$, $25 \ V$. Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$.R1 R2and C32Electrolytic, aluminum: $1 \ \mu\text{F}$, $25 \ V$. R1R1 R2* COMPONENTS ADDED, DELETED OR CHANGED BYR2			V.	Q9		Silicon, PNP.
C21 C22Ceramic: $0.1 \ \mu\text{F} \pm 10\%, 25 \ \text{V}.$ Electrolytic, aluminum: $1 \ \mu\text{F}, 25 \ \text{V}.$ C23CN1 CN1DB-25 Connector 6-pin Solder in placeC24 and C25Ceramic: $100 \ p\text{F} \pm 5\%, 50 \ \text{V}.$ CN1 CN3DB-25 Connector 6-pin Solder in placeC25 C26 and C27 C28Ceramic: $0.1 \ \mu\text{F} \pm 10\%, 25 \ \text{V}.$ IC1 IC2 IC3Linear: Switching Regulator. Linear: Switching Regulator. IC4 IC5C29 C30 C31 C32Electrolytic, aluminum: $1 \ \mu\text{F}, 25 \ \text{V}.$ C31 C32IC4 Ceramic: $0.1 \ \mu\text{F} \pm 10\%, 25 \ \text{V}.$ IC4 IC5* COMPONENTS ADDED, DELETED OR CHANGED BYR1 WR2Metal film: $4.7 \ ohms \pm 5\%, 1/10$ W	C20		Electrolytic, aluminum: 10 µF, 25 V.	Q20		Silicon, NPN.
C22Electrolytic, aluminum: 1 μ F, 25 V. Ceramic: 0.1 μ F ±10%, 25 V. Ceramic: 100 pF ±5%, 50 V.CN1DB-25 Connector 6-pin Solder in placeand C25Ceramic: 0.1 μ F ±10%, 25 V.CN3INTEGRATED CIRCUITSC26 and C27 C28Ceramic: 0.1 μ F ±10%, 25 V.IC1 IC2 IC3Linear: Switching Regulator. Linear: +5-Volt Regulator. IC3C30 C31 C32Electrolytic, aluminum: 1 μ F, 25 V. Ceramic: 0.1 μ F ±10%, 25 V.IC4 IC5Digital: Microcontroller. Digital: Quad Bilateral Switch. RESISTORS* COMPONENTS ADDED, DELETED OR CHANGED BYR2W	C21		Ceramic: 0.1 µF ±10%, 25 V.			CONNECTORS
C23 C24 and C25Ceramic: $0.1 \ \mu\text{F} \pm 10\%, 25 \ \text{V}.$ Ceramic: $100 \ \text{pF} \pm 5\%, 50 \ \text{V}.$ CN1 CN3DB-25 Connector 6-pin Solder in place INTEGRATED CIRCUITSC26 and C27 C28Ceramic: $0.1 \ \mu\text{F} \pm 10\%, 25 \ \text{V}.$ IC1 IC2 IC2 IC3Linear: Switching Regulator. Linear: $+5-\text{Volt Regulator.}$ IC3C29 C30 C31 C32Electrolytic, aluminum: $1 \ \mu\text{F}, 25 \ \text{V}.$ Ceramic: $0.1 \ \mu\text{F} \pm 10\%, 25 \ \text{V}.$ IC4 IC5C31 C32Ceramic: $0.1 \ \mu\text{F} \pm 10\%, 25 \ \text{V}.$ IC5 R1R1 R2Metal film: $100 \ \text{ohms} \pm 5\%, 1/10 \ W.$ * COMPONENTS ADDED, DELETED OR CHANGED BYR2	C22		Electrolytic, aluminum: 1 µF, 25 V.			CONNECTORS
C24 and C25Ceramic: 100 pF $\pm 5\%$, 50 V.CN36-pin Solder in place INTEGRATED CIRCUITSC25 C26 and C27 C28 C28 C29 C30 C31 C32Ceramic: 0.1 μ F $\pm 10\%$, 25 V. Electrolytic, aluminum: 1 μ F, 25 V. Electrolytic, aluminum: 1 μ F, 25 V. C31 C32IC1 IC2 IC3 Ceramic: 0.1 μ F $\pm 10\%$, 25 V. Electrolytic, aluminum: 1 μ F, 25 V. Electr	C23		Ceramic: 0.1 µF ±10%, 25 V.	CN1		DB-25 Connector
and C25Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.IC1 IC2INTEGRATED CIRCUITSand C27Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.IC1 IC2Linear: Switching Regulator. Linear: ± 5 -Volt Regulator.C28Electrolytic, aluminum: $1 \ \mu\text{F}$, 25 V.IC4Digital: Microcontroller. Digital: Microcontroller.C30Electrolytic, aluminum: $1 \ \mu\text{F}$, 25 V. C31IC5Digital: Quad Bilateral Switch. $ \text{RESISTORS}$ and C32Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.R1Metal film: 100 ohms $\pm 5\%$, 1/10 W.* COMPONENTS ADDED, DELETED OR CHANGED BYR2W	C24		Ceramic: 100 pF ±5%, 50 V.	CN3		6-pin Solder in place
C25Caramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.IC1Linear: Switching Regulator.andC27IC2IC2IC2C28Electrolytic, aluminum: $1 \ \mu\text{F}$, 25 V.IC4Digital: Microcontroller.C29Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.IC5Digital: Quad Bilateral Switch.C30Electrolytic, aluminum: $1 \ \mu\text{F}$, 25 V.IC5Digital: Quad Bilateral Switch.C31Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.R1Metal film: 100 ohms $\pm 5\%$, 1/10C32R1R2Metal film: 4.7 ohms $\pm 5\%$, 1/10	and					INTEGRATED CIRCUITS
C26Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$.IC1Linear: Switching Regulator.andIC2IC2IC2C27IC3IC3C28Electrolytic, aluminum: $1 \ \mu\text{F}$, $25 \ V$.IC4C29Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$.IC5C30Electrolytic, aluminum: $1 \ \mu\text{F}$, $25 \ V$.IC5C31Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, $25 \ V$.IC5andR1Metal film: $100 \ \text{ohms} \pm 5\%$, $1/10 \ W$. * COMPONENTS ADDED, DELETED OR CHANGED BY R2W	C25					INTEGRATED CIRCOTIS
and C27 C28Electrolytic, aluminum: 1 μ F, 25 V. C29IC2 IC3IC2 IC3Linear: +5-Volt Regulator. Regulator Auxiliary Function Digital: Microcontroller. Digital: Quad Bilateral Switch. RESISTORSC30Electrolytic, aluminum: 1 μ F, 25 V. C31IC5Digital: Microcontroller. Digital: Quad Bilateral Switch. RESISTORSC31Ceramic: 0.1 μ F ±10%, 25 V. C31R1Metal film: 100 ohms ±5%, 1/10 W. R2* COMPONENTS ADDED, DELETED OR CHANGED BYR2W	C26		Ceramic: $0.1 \mu F \pm 10\%$, 25 V.	IC1		Linear: Switching Regulator.
C27 C28 C29Electrolytic, aluminum: $1 \ \mu\text{F}$, 25 V. Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V. Electrolytic, aluminum: $1 \ \mu\text{F}$, 25 V. Electrolytic, aluminum: $1 \ \mu\text{F}$, 25 V. C31 C32IC3 IC4 IC5Regulator Auxiliary Function Digital: Microcontroller. Digital: Quad Bilateral Switch. RESISTORSR1 WR2Metal film: 100 ohms $\pm 5\%$, 1/10 W				IC2		Linear: +5-Volt Regulator.
C29 C30 C31 C32Ceramic: $0.1 \ \mu\text{F} \pm 10\%, 25 \ V.$ Electrolytic, aluminum: $1 \ \mu\text{F}, 25 \ V.$ Electrolytic, aluminum: $1 \ \mu\text{F}, 25 \ V.$ Electrolytic, aluminum: $1 \ \mu\text{F}, 25 \ V.$ Caramic: $0.1 \ \mu\text{F} \pm 10\%, 25 \ V.$ R1 R2IC4 IC5 R1 R2Digital: Microcontroller. Digital: Quad Bilateral Switch. RESISTORS Metal film: 100 ohms $\pm 5\%, 1/10$ W* COMPONENTS ADDED, DELETED OR CHANGED BYR2	C28		Electrolytic aluminum: 1 UE 25 V	IC3		Regulator Auxiliary Function
C27C30Electrolytic, aluminum: 1 μ F, 25 V. Caramic: 0.1 μ F ±10%, 25 V.ICSDigital: Quad Bilateral Switch. RESISTORSand C32Caramic: 0.1 μ F ±10%, 25 V.R1Metal film: 100 ohms ±5%, 1/10 W. R2* COMPONENTS ADDED, DELETED OR CHANGED BYR2	C29		Ceramic: $0.1 \text{ µF} + 10\% 25 \text{ V}$	IC4		Digital: Microcontroller.
C31 Ceramic: 0.1 μF ±10%, 25 V. R1 Metal film: 100 ohms ±5%, 1/10 and C32 R1 R2 Wetal film: 4.7 ohms ±5%, 1/10 * COMPONENTS ADDED. DELETED OR CHANGED BY R2 Wetal film: 4.7 ohms ±5%, 1/10	C30		Electrolytic aluminum: $1 \cup E = 25 V$	105		Digital: Quad Bilateral Switch.
and C32 Ceramic. 0.1 μr ² ±10%, 25 V. R1 Metal film: 100 ohms ±5%, 1/10 * COMPONENTS ADDED, DELETED OR CHANGED BY R2 Wetal film: 4.7 ohms ±5%, 1/10	C31		Coramic: $0.1 \ \mu\text{E} \pm 10\% 25 \ \text{V}$			RESISTORS
C32 R1 Metal film: 100 ohms ±5%, 1/10 * COMPONENTS ADDED, DELETED OR CHANGED BY R2 Metal film: 4.7 ohms ±5%, 1/10 W W W	and		Ceranne. 0.1 μ F ±10%, 25 V.	D1		
* COMPONENTS ADDED, DELETED OR CHANGED BY W. Metal film: 4.7 ohms ±5%, 1/10 W	C32			KI		Nietal film: 100 ohms $\pm 5\%$, 1/10
* COMPONENTS ADDED, DELETED OR CHANGED BY				R2		w. Metal film: 4.7 ohms ±5% 1/10
	* COMPON	ENTS ADDED. DEL	ETED OR CHANGED BY	K2		W

PRODUCTION CHANGES.

Continued

Continued					
SYMBOL	PART NUMBER	DESCRIPTION	SYMBOL	PART NUMBER	DESCRIPTION
R3		Metal film: 2K ohms $\pm 5\%$, 1/10 W.	R49		Metal film: 47K ohms $\pm 1\%$, 1/10 W.
R4		Metal film: 10 ohms $\pm 5\%$, 1/10 W.	R50		Metal film: 4.7K ohms $\pm 5\%$, 1/10 W.
R5		Metal film: 10K ohms $\pm 5\%$, 1/10 W.	R51		Metal film: 120 ohms $\pm 5\%$, 2W.
R6		Metal film: 22K ohms $\pm 1\%$, 1/10 W.	R52		
R7		Metal film: 100K ohms $\pm 5\%$, 1/10	R53		Metal film: 1K ohms $\pm 5\%$, 1/10 W.
50		W.	R54		Metal film: 100 ohms $\pm 5\%$, 1/10 W.
R8		Metal film: 1K ohms $\pm 5\%$, 1/10 W.	R55		Metal film: 3 ohms $\pm 5\%$, 1/10W.
R9		Metal film: 2.2K ohms $\pm 5\%$, 1/10	R90		Metal film: 2K ohms $\pm 5\%$, 1/10 W.
D 10		W. $M_{2} = 1.61 m_{2} 47K_{2} m_{2} m_{3} + 10(-1/10) W$	R91		Matal films 510 almost 50/ 1/10 W
R10 D11		Metal film: $4/K$ onms $\pm 1\%$, $1/10$ W.	R92		Metal film: $510 \text{ onms } \pm 5\%$, $1/10 \text{ W}$.
KII D12		Metal film: 18K onms $\pm 1\%$, 1/10 W.	K100		Metal IIIm: $2K$ onms $\pm 5\%$, $1/10$ w.
R12 P12		Metal film: 1 5K ohms $\pm 3\%$, 1/10 W.	D 102		
K15		We tai mini. 1.3K ominis ± 1.70 , 1/10	R102 R103		Metal film: 5.1K ohms +5% 1/10 W
P 14		We tal film: 100 ohms ±5% 1/10 W	R103		Metal film: 1.8K ohms $\pm 5\%$, 1/10 W.
R14 R15		Metal film: 56K ohms $\pm 1\%$, 1/10 W.	R108		Metal film: $10K \text{ ohms } \pm 3\%$, $1/10 \text{ W}$.
R16		Metal film: 130K ohms $\pm 1\%$, 1/10 W. Metal film: 130K ohms $\pm 1\%$, 1/10	K105		
R17		w. Metal film: 4.7K ohms ±5%, 1/10	SW1		Short Battery Microswitch
		W.	SW2		Long Battery Microswitch
R18		Metal film: 0.1 ohms $\pm 10\%$.	SW3		7-position DIP switch.
R19		Metal film: 1.5K ohms $\pm 1\%$, 1/10 W.			VIBRATOR
R20 R21		Metal film: 10K ohms $\pm 1\%$, 1/10 W. Metal film: 8.2K ohms $\pm 1\%$, 1/10	X1		Ceramic: 1.0 MHz.
R22		W. Metal film: 100 ohms +5% 1/10 W			-VARIABLE RESISTOR-
R23		Metal film: 4.7K ohms $\pm 5\%$, 1/10	VR1		10K ohm variable resistor
R24		Carbon: 150 ohms $\pm 5\%$, 1/2 W.			TRANSFORMER
R25		Carbon: 120 ohms $\pm 5\%$, 1/2 W.	T1		Transformer
R26 R27		Metal film: 10K ohms \pm 5%, 1/10 W. Metal film: 1.2K ohms \pm 5%, 1/10			TERMINALS
R28		W. Metal film: 1.5K ohms ±5%, 1/10 W	TP13-15		Sliding, Spring loaded, Charging Current and Signal.
R29		Metal film: $82 \text{ ohms} + 5\%$, 2 W .			
R30		Metal film: 2.2K ohms $\pm 5\%$. 1/10			MISCELLANEOUS
and		W.			
R31				344A4616P10	Power Cable for Part 2 charger.
R32		Metal film: 47K ohms $\pm 5\%$, 1/10 W.		344A4616P11	Mounting bracket and hardware for
and				24444616012	Part 1&2.
R33				344A4010P12	Power Cable for Part I charger.
R34		Metal film: 5.6K ohms ±5%, 1/10 W.			
R35		Metal film: 1M ohms $\pm 5\%$, 1/10 W.			
R36		Metal film: 300 ohms $\pm 5\%$, 1/10 W.			
and					
R37					
R38		Metal film: 4.7K ohms ±5%, 1/10 W.			
R39		Metal film: 10K ohms $\pm 1\%$, 1/10 W.			
R40		Metal film: 18K ohms $\pm 1\%$, 1/10 W.			
R41		Metal film: 47K ohms $\pm 5\%$, 1/10 W.			
R42		Metal film: 51K ohms $\pm 1\%$, 1/10 W.			
R43		Metal film: 4.7K ohms ±5%, 1/10 W.			
R45		Metal film: 1K ohms $\pm 5\%$. 1/10 W.			
R46		Metal film: 2.2K ohms $\pm 5\%$. 1/10			
R47		W. Metal film: 5.1K ohms +5% 1/10			
N+7		We and the set of the			
K48		We with the set of th			

PARTS LIST

VEHICULAR CHARGER MAIN BOARD 344A4616P2 (PCB1)

Issue 1			SYMBOL	PART NUMBER	DESCRIPTION
SYMBOL	PART NUMBER	DESCRIPTION	C15		Ceramic: 0.1 µF ±10%, 25 V.
PCB2		Vehicular Charger LED Board	and		• *
		CARACITORS	C16 C17		Ceramic: $0.01 \mu\text{F} + 10\% 50 \text{ V}$
		CAPACITORS	and		$\frac{1}{10}$
C105		Ceramic: $0.1 \ \mu F \pm 10\%$, 25 V.	C18		
C106			C19		Electrolytic, aluminum: 100 µF, 25
C107	NOTE: Parts	Ceramic: 0.001 μF ±10%, 25 V.	C20		v. Electrolytic. aluminum: 10 µF. 25 V.
C109	listed are for	C	C21		Ceramic: 0.1 µF ±10%, 25 V
C108	reference only.	Ceramic: $0.01 \ \mu\text{F} \pm 10\%$, 25 V.	C22		Electrolytic, aluminum: 1 µF, 25 V.
C110		Ceramic: $0.1 \mu\text{F} \pm 10\%$, 25 V.	C23		Ceramic: $0.1 \mu\text{F} \pm 10\%$, 25 V
and			C24 and		Ceramic: 100 pF $\pm 5\%$, 50 V.
C111			C25		
		CONNECTORS	C26		Ceramic: 0.1 μ F ±10%, 25 V.
CN7		6-Conductor With Leads.	and C27		
			C28		Electrolytic, aluminum: 1 µF, 25 V.
			C29		Ceramic: 0.1 μ F ±10%, 25 V.
LED1 LED2		Yellow, Rectangular. Green Rectangular	C30		Electrolytic, aluminum: 1 µF, 25 V.
LED2 LED3		Red, Rectangular.	C31 and		Ceramic: $0.1 \mu\text{F} \pm 10\%$, 25 V.
		INTEGRATED CIRCUITS	C32		
1011			C33		Ceramic: 0.01 μF ±10%, 50 V.
ICII		Digital: Dual J-K Flip-Flop with Clear	C34		Ceramic: $0.15 \ \mu\text{F} \pm 10\%$, 25 V.
IC12		Digital:	C35		
IC13		Digital: Schmitt Trigger.	C36		Electrolytic, aluminum: 220 µF, 16
and IC14			and C27		V.
1014			C37 C38		Electrolytic, aluminum: 100 µF, 16
		TRANSISTORS			V.
Q21		Silicon, NPN:	C39		Electrolytic, aluminum: 100 µF, 25
		RESISTORS	C40		Ceramic: $0.001 \ \mu\text{F} \pm 10\%$, 50 V.
R94		Metal film: 10K ohms $\pm 5\%$, 1/10 W.	C41		Ceramic: 0.1 μ F ±10%, 25 V.
		SWITCHES	C42		Electrolytic, aluminum: 100 µF, 16
SWA		Momentary contact SDST	C43		v.
PCB3	344A4485	Microphone Connector	C44		Electrolytic, aluminum: 1000 µF, 25
PCB4	344A3859	Universal Devices Connector	and C45		V.
		CAPACITORS	C43 C46		Electrolytic aluminum: 22 µF 25 V
C1		Coromic: $0.1 \text{ uE} \pm 10\%$ 25 V	C47		Ceramic: $0.1 \mu\text{F} \pm 10\%$, 25 V.
C1 C2		Electrolytic. aluminum: 330 μ F. 25	C48		Ceramic: 470 pF ±5%, 50 V.
		V.	C49 C50		Ceramic: $0.01 \ \mu\text{F} \pm 10\%$, 50 V.
C3		Electrolytic, aluminum: 1500 µF, 25	thru		Ceramic: 0.1 μ F ±10%, 25 V.
C5		V. Electrolytic aluminum: 220 µF, 25	C52		
0.5		V.	C53		Electrolytic, aluminum: 100 µF, 25
C6 C7		Ceramic: 0.1 µF ±10%, 25 V. Ceramic: 470 pF +5%, 50 V.	C54		Electrolytic, aluminum: 1000 μF, 25
C8		Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.	C55		V. Electrolytic aluminum: 2200 uF 10
C9		Electrolytic, aluminum: 4.7 µF, 50	200		V.
C10		v. Ceramic: 0.1 μF +10%, 25 V	C56		Ceramic: $0.1 \ \mu\text{F} \pm 10\%$, 25 V.
thru			C57		Electrolytic, aluminum: 100 µF, 25
C13 C14		Electrolytic aluminum: 1500 uF 16	C58		Ceramic: 0.1 µF ±10%, 25 V.
		V.			Continued

Continued	-				
SYMBOL	PART NUMBER	DESCRIPTION	SYMBOL	PART NUMBER	DESCRIPTION
C59		Ceramic: 0.01 µF ±10%, 50 V.	Q8		Silicon, PNP (with bias resistors).
and			Q9		Silicon, PNP.
C60			Q10,		Silicon, PNP (with bias resistors).
C61		Ceramic: $0.1 \ \mu F \pm 10\%$, 25 V.	Q11		
C62		Ceramic: 100 pF ±5%, 50 V.	Q12		Silicon, NPN.
C63		Ceramic: 0.1 µF ±10%, 25 V.	Q13		Silicon, PNP.
and			Q14		Silicon, P-channel MOSFET.
C64			Q15		Silicon, N-channel MOSFET.
C67		Ceramic: 0.001 μ F ±10%, 50 V.	Q16		Silicon, NPN (with bias resistors).
thru			thru		
C100			Q19		
C101		Ceramic: $0.1 \ \mu F \pm 10\%$, 25 V.	Q20		Silicon, NPN.
thru			Q22		Silicon, NPN (with bias resistors).
C103			Q23		Silicon, PNP (with bias resistors).
C104		Ceramic: 0.001 µF ±10%, 50 V.			CONNECTORS
C112		Ceramic: 0.001 μ F ±10%, 50 V.	CN1		DB-25 Connector.
		DIODES	CN2		7-pin Solder in place.
			CN3		6-pin Solder in place
D1		Suppresser	CN4		12-pin Solder in place
D2		Silicon	CN5		7-pin Solder in place
D3		Silicon zener	CN6		9-pin Solder in place.
D3 D4		Silicon	CN7		6-Conductor With Leads
D4 D5		Silicon	CN8		12-pin Solder in place
and		Sincon.	CN9		Co-axial connector
De			CN10		Co axial TNC connector
D0		Silicon: Dual diodas, common	CIVIO		Co-axial five connector
D/		cathode.			INTEGRATED CIRCUITS
D8		Silicon: Dual diodes, common	IC1		Linear: Switching Regulator.
		cathode	IC2		Linear: +5-Volt Regulator.
D9		Silicon: Dual diodes in series.	IC3		Regulator Auxiliary Function
			IC4		Digital: Microcontroller.
D10		Silicon: zener.	IC5		Digital: Quad Bilateral Switch.
and			IC6		Linear: Audio Amplifier.
D11			IC7		Linear: 7.5 Volt Switching
D12		Silicon: Dual diodes, common			Regulator.
		cathode.	IC8		Linear: +6-Volt Regulator.
D13		Silicon: Dual diodes, common	IC9		Linear: Op Amp.
		cathode.	IC10		RS-485 Communications Interface
D14		Silicon: Dual diodes, common			
thru		cathode.			RESISTORS
D16			R 1		Metal film: 100 ohms +5% 1/10
D17		Silicon, zener.	K1		W
D18,		Silicon: Dual diodes, common	D)		Metal film: $4.7 \text{ obms} \pm 5\% = 1/10$
D19		cathode.	112		W
D20,		Silicon: Dual diodes in series.	P2		Motol film: $2K$ ohms $\pm 5\%$ 1/10 W
D21			R/		Metal film: 10 obms $\pm 5\%$, 1/10 W.
D22		Silicon, zener.	R5		Metal film: 10K ohms $\pm 5\%$, 1/10 W.
		INDUCTORS	Dé		W.
Т 1		Inductor	R6		Metal film: 22K ohms $\pm 1\%$, 1/10
		Inductor.	77		W.
13		maactor.	к/		Nietai film: 100K ohms $\pm 5\%$, 1/10
					W.
L4			R8		Metal film: 1K ohms $\pm 5\%$, 1/10 W.
		TRANSISTORS	R9		Metal film: 2.2K ohms $\pm 5\%$, 1/10
01		Silicon N-channel MOSFFT	R10		W. Metal film: 47K ohms +1% 1/10
Q2		Silicon, PNP.			W.
Q3		Silicon, PNP (with bias resistors).	R11		Metal film: 18K ohms $\pm 1\%$, 1/10
Q4		Silicon, PNP.			W.
Q5		Silicon, NPN.	R12		Metal film: 1K ohms $\pm 5\%$, 1/10 W.
Q6		Silicon, PNP (with bias resistors).			
Q7		Silicon, PNP			Continued

PARTS LIST

Continued			SYMBOL	PART NUMBER	DESCRIPTION
SYMBOL	PART NUMBER	DESCRIPTION	R57		Metal film: 3 ohms +5% 1/10W
D12		Matal films 1 5K above 1 10/ 1/10	R58		
R13		Metal film: 1.5K onms $\pm 1\%$, 1/10	R59		Metal film: 22K ohms +1%, 1/10 W
R14		w. Metal film: 100 ohms +5% 1/10 W	R60		Metal film: 100K ohms $\pm 5\%$, 1/10
R14 R15		Metal film: 56K ohms ± 3.0 , 1/10 W.			W.
R15 R16		Metal film: 130K ohms $\pm 1\%$, 1/10 W.	R61		Metal film: 1K ohms $\pm 5\%$, 1/10 W.
		W.	R62		Metal film: 2.2K ohms $\pm 5\%$, 1/10
R17		Metal film: 4.7K ohms $\pm 5\%$, 1/10			W.
		W.	R63		Metal film: 1K ohms $\pm 5\%$, 1/10 W.
R18		Metal film: 0.1 ohms $\pm 10\%$.	R64		Metal film: 10K ohms $\pm 5\%$, 1/10 W.
R19		Metal film: 1.5K ohms $\pm 1\%$, 1/10	R65		Metal film: $4/K$ onms $\pm 5\%$, $1/10$ W.
D .20		W.	and		Wetai IIIII. IK OIIIIS $\pm 1\%$, 1/10 w.
R20		Metal film: 10K ohms $\pm 1\%$, 1/10 W.	R67		
K21		Wetai film: 8.2K onms $\pm 1\%$, 1/10	R68		Metal film: 1K ohms $\pm 5\%$, 1/10 W.
R22		w. Metal film: 100 ohms +5% 1/10 W	R69		Metal film: 2.2K ohms $\pm 5\%$, 1/10
R22 R23		Metal film: $4.7K$ ohms $\pm 5\%$, $1/10$ W.			W
1120		W.	R70		Metal film: 10K ohms $\pm 5\%$, 1/10 W.
R24		Carbon: 150 ohms ±5%, 1/2 W.	R71		Metal film: 47 ohms $\pm 5\%$, 1/4 W.
R25		Carbon: 120 ohms ±5%, 1/2 W.	R72		Metal film: 0.1 ohms $\pm 1\%$, 1/10 W.
R26		Metal film: 10K ohms $\pm 5\%$, 1/10 W.	R73		Metal film: 8.2K ohms $\pm 1\%$, 1/10
R27		Metal film: 1.2K ohms $\pm 5\%$, 1/10	D74		W. Matal films 4.7K ahma + 50(-1/10)
D a a		W.	К/4		Wetai IIIII: 4.7K OIIIIS $\pm 3\%$, 1/10
R28		Metal film: 1.5K ohms \pm 5%, 1/10	R75		Metal film: 5360 ohms 1/10 W
P 20		W. Matal film: 82 ohms ±5% 2 W	R76		Metal film: 6490 ohms, 1/10 W.
R29		Metal film: 2.2K ohms $\pm 5\%$, 2 W.	R77		Metal film: 3160, 1/10 W.
and		W.	R78		Metal film: 100K ohms $\pm 5\%$, 1/10
R31					W.
R32		Metal film: 47K ohms \pm 5%, 1/10 W.	R79		Metal film: 3K ohms $\pm 5\%$, 1/10 W.
and			R80		Metal film: 620 ohms
R33			R81,		Metal film: 33K ohms \pm 5%, 1/10 W.
R34		Metal film: 5.6K ohms $\pm 5\%$, 1/10	R82		Matal films 10K ahma + 50/ 1/10 W
D.25		W.	R84		Metal film: 220K ohms $\pm 5\%$, 1/10 w.
R35		Metal film: 1M ohms $\pm 5\%$, 1/10 W.	104		W
and		Wetai IIIII: 500 onitis $\pm 5\%$, 1/10 w.	R85		Metal film: 10K ohms $\pm 5\%$, 1/10 W.
R37			thru		
R38		Metal film: 4.7K ohms $\pm 5\%$, 1/10	R88		
		W.	R89		Metal film: 2K ohms $\pm 5\%$, 1/10 W.
R39		Metal film: 10K ohms $\pm 1\%$, 1/10 W.	thru		
R40		Metal film: 18K ohms $\pm 1\%$, 1/10 W.	R91		No. 1 C1 510 1 50/ 1/10 W
R41		Metal film: $47K$ ohms $\pm 5\%$, $1/10$ W.	R92		Metal film: 510 ohms \pm 5%, 1/10 W.
R42		Metal film: 51K ohms $\pm 1\%$, 1/10 W.	R95 P04		Metal film: 10K ohms $\pm 5\%$, 1/10 W.
R43		Metal film: 4./K ohms $\pm 5\%$, 1/10	R95		Metal film: $62K$ ohms $\pm 5\%$, $1/10$ W.
R44		w. Metal film: 47K ohms +5% 1/10 W	R96		Metal film: 100 ohms $\pm 5\%$, 1/10 W.
R44 R45		Metal film: $1K$ ohms $\pm 5\%$, $1/10$ W.	thru		·····
R45 R46		Metal film: 2.2K ohms $\pm 5\%$, 1/10 W.	R98		
		W.	R99		Metal film: 1.5K ohms $\pm 5\%$, 1/10
R47		Metal film: 5.1K ohms ±5%, 1/10			W.
		W.	R100		Metal film: 2K ohms $\pm 5\%$, 1/10 W.
R48		Metal film: 68K ohms $\pm 5\%$, 1/10	thru D 102		
- 10		W.	R102 R103		Metal film: 5.1K ohms $\pm 5\%$ 1/10
K49		Metal film: 47K ohms $\pm 1\%$, 1/10 W.	K105		W
K3U		Wetai film: 4./K ohms $\pm 5\%$, 1/10	R104.		Open
R51		Metal film: 120 ohms +5% 2W	R105		I.
R52			R108		Metal film: 1.8K ohms ±5%, 1/10
R53		Metal film: 1K ohms $\pm 5\%$, 1/10 W.			W.
R54		Metal film: 100 ohms ±5%, 1/10 W.	R109		Metal film: 10K ohms $\pm 1\%$, 1/10 W.
R55		Metal film: 3 ohms $\pm 5\%$, 1/10W.			
R56		Metal film: 220 ohms ±5%, 1W.			
					Continued

SYMBOL	PART NUMBER	DESCRIPTION
		SWITCHES
SW1 SW2 SW3 SW4 SW5		Short Battery Microswitch Long Battery Microswitch 7-position DIP switch. Momentary contact, SPST. 1-position DIP switch.
		VIBRATOR
X1		Ceramic: 1.0 MHz.
		-VARIABLE RESISTOR-
VR1		10K ohm variable resistor
		TRANSFORMER
T1		Transformer
		TERMINALS
TP13-15		Sliding, Spring loaded, Charging Current and Signal



1/3



2/3





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