Order Number: MCUK000201C8

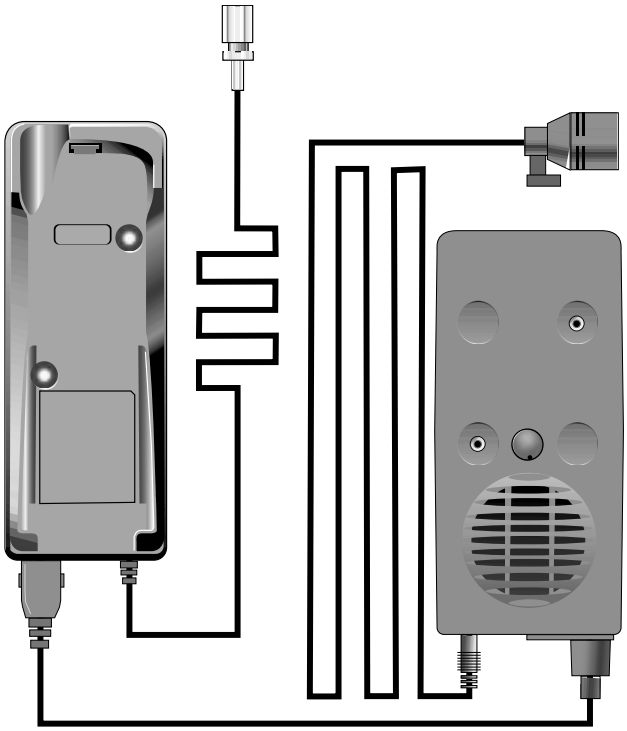
Service Manual

Handsfree Car Kit

EB-HFD30Z
EB-HFD70Z
EB-HFD90Z

GSM

Specification



Input voltage	13.8 V ± 1.0 V
Over voltage protection	20.2 V +0.8 V / -1.2 V
Current consumption	
Operational: Idle Mode: Standby:	2.0A max. (normal sound) 150 mA max. (no sound) 1 mA max.(logic power off)
Ignition signal	H Level: ON L Level: OFF
Speaker Output Power	1.5 W
Speaker impedance	8 Ω
Antenna (H/F mode)	External
Operating temperature	-20 to +60 °C
Storage temperature	-40 to +80 °C
Charging temperature	-5 to +35 °C

WARNING

This service information is designed for experienced repair technicians only and is not designed for use by the general public. It does not contain warnings or cautions to advise non-technical individuals of potential dangers in attempting to service a product.
Products powered by electricity should be serviced or repaired only by experienced professional technicians. Any attempt to service or repair the product or products dealt with in this service manual by anyone else could result in serious injury or death.

Panasonic®

Issue 1
Revision 0

Company Liability

Other patents applying to material contained in this publication:

BULL CP8 PATENTS

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ENGLAND

WARNINGS AND CAUTIONS

WARNING

The equipment described in this manual contains polarized capacitors utilising liquid electrolyte. These devices are entirely safe provided that neither a short-circuit nor a reverse polarity connection is made across the capacitor terminals.
FAILURE TO OBSERVE THIS WARNING COULD RESULT IN DAMAGE TO THE EQUIPMENT OR, AT WORST, POSSIBLE INJURY TO PERSONNEL RESULTING FROM ELECTRIC SHOCK OR THE AFFECTED CAPACITOR EXPLODING. EXTREME CARE MUST BE EXERCISED AT ALL TIMES WHEN HANDLING THESE DEVICES.

Caution

The equipment described in this manual contains electrostatic devices (ESDs). Damage can occur to these devices if the appropriate handling procedure is not adhered to.

ESD Handling Precautions

A working area where ESDs may be safely handled without undue risk of damage from electrostatic discharge, must be available. The area must be equipped as follows:

Working Surfaces: - All working surfaces must have a dissipative bench mat, SAFE for use with live equipment, connected via a 1 MΩ resistor (usually built into the lead) to a common ground point.

Wrist Strap - A quick release skin contact device with a flexible cord, which has a built in safety resistor of approximately 1 MΩ shall be used. The flexible cord must be attached to a dissapative earth point.

Containers - All containers and storage must be of the conductive type.

Batteries

This equipment may contain an internal battery in addition to the external battery packs. These batteries are recyclable and should be disposed of inaccordance with local legislation. They must not be incinerated, or disposed of as ordinary rubbish.

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1 INTRODUCTION

1.1. Purpose of this Manual

This Service Manual contains the information and procedures required for installing, operating and servicing the Panasonic GSM Personal Cellular Mobile Telephone system operating on the GSM Digital Cellular Network.

The manual is structured to provide service engineering personnel with the following information and procedures:

1. General and technical information - provides a basic understanding of the equipment, kits and options, together with detailed information for each of the major component parts.
2. Installation and operating information - provides instructions for unpacking, installing and operating the equipment.
3. Servicing information - provides complete instructions for the testing, disassembly, repair and reassembly of each major component part. Step-by-step troubleshooting information is given to enable the isolation and identification of a malfunction, and thus determine what corrective action should be taken. The test information enables verification of the integrity of the equipment after any remedial action has been carried out.
4. Illustrated parts list - provided to enable the identification of all equipment components, for the ordering of spare / replacement parts.

The procedures described in this manual must be performed by qualified service engineering personnel, at an authorised service centre.

The service engineering personnel are responsible for fault diagnosis and repair of all equipment described in this manual.

1.2. Handsfree Car Mount Kit

The Handsfree Car Mount Kit enables the handportable to be mounted in a vehicle, and to operate in handsfree mode.

Either the Cigar Lighter Cable or the Power Supply Cable can be used with the Handsfree unit. The Cigar Lighter Cable can be used for easy and quick fitting, or the power supply cable can be used for a more permanent fitting.

The telephone can be operated in handheld mode by removing it from the Holder.

The handsfree unit also provides external power for the handheld internal charger.

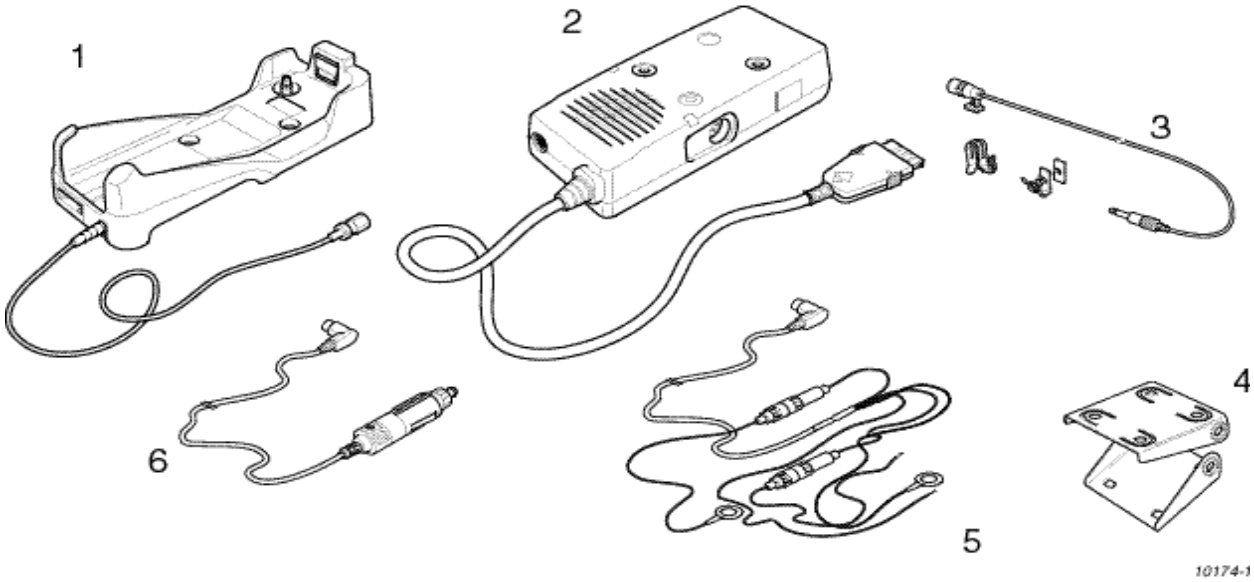

Figure 1.1: Handsfree Car Mount Kit

ITEM	DESCRIPTION	PART No.		
		GD30 / GD50	GD70	GD90
1	Holder with RF Cable	EB-KAD31	EB-KAD71	EB-KAD91
2	Handsfree Unit	EB-HFD30	EB-HFD70	EB-HFD90
3	Handsfree Microphone	EBM1177		
4	Adjustable Angle Brackets, set of 2	EBN0001		
5	Power Supply Cable	WP76001A		
6	Cigar Lighter Cable (Optional)	WC70135		

1.3. Second Handset

A second handset may be used with the Handsfree Car Mount Kit.

ITEM	DESCRIPTION	PART No.
1	Handset	TBA
2	Cradle	TBA

2 OPERATING INSTRUCTIONS

2.1. Controls and Connectors

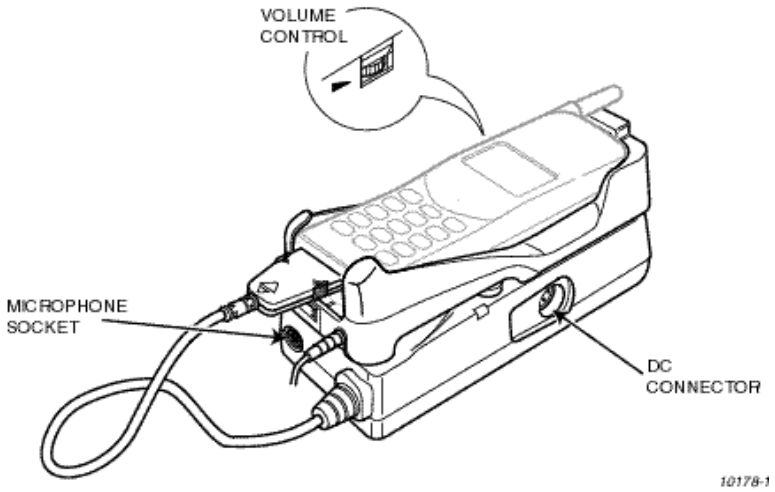

Figure 2.1: Controls and Connectors

2.2. Handsfree Operation

When the telephone is inserted into the Holder, the antenna connection is made to the vehicle installed antenna. Connecting the Handsfree connector into the telephone will divert the internal microphone and loudspeaker connections to the handsfree loudspeaker and microphone units. Control of the loudspeaker volume will be maintained from the Handsfree unit.

The Handsfree unit will be activated when the vehicle ignition is ON.

The telephone can be used without having to remove it from the Holder, by speaking into the microphone and listening to the speaker. If the mute option is connected, the car radio will be automatically muted during a call.

2.3. Telephone Operation

Operation of the telephone when installed in the Car Mount Kit is very similar to normal handheld operation but with the following differences:

- Operation of the internal speaker and microphone of the telephone will be overridden by those of the Car Mount Kit.
- The Keep Alive timer will delay the switching off of the telephone when the vehicle ignition is turned off. Any calls in progress when the ignition is switched off will be allowed to continue. The timer will not start until after the call is finished.
- When the Automatic Answer function is switched on, the call will be connected without pressing any keys.
- The ring volume cannot be turned off.

Adjusting the Speaker volume

Adjust the speaker volume by using the volume adjust the thumbwheel on the side of the Handsfree Unit.

2.4. Charging

Make sure that the vehicle ignition is switched on, the Battery Pack is attached to the telephone and that the Handsfree cable is connected. Charging will commence immediately.

3 TECHNICAL DESCRIPTION

3.1. Introduction

The handsfree unit provides a handsfree function for car use and provides charging power for the phone and consists of the following:

5. Microphone pre-amplifier.
6. Loudspeaker pre-amplifier.
7. Internal Loudspeaker.
8. Data adaptor socket for a Data Adaptor (PCMCIA) card, SMS Cable, RS232C Direct Cable or Second Handset.
9. Facility to connect an optional audio only second handset to provide an 'Off Hook' function. (This is necessary as the phone RF and the interface connectors do not allow the use of a coiled cable for 'Off Hook' operation.)
10. Designed for vehicles with 12 V nominal, negative ground supplies only.
11. Volume control.
12. Option of two plug-in power cables. One with Ignition sense and Radio mute for permanent installation and one with a Cigar Lighter Plug for consumer installation.

Connection to the external (vehicle) antenna is provided within the Holder

The unit does not have an echo cancellation or acoustic path cancellation features, as these are incorporated within the telehone.

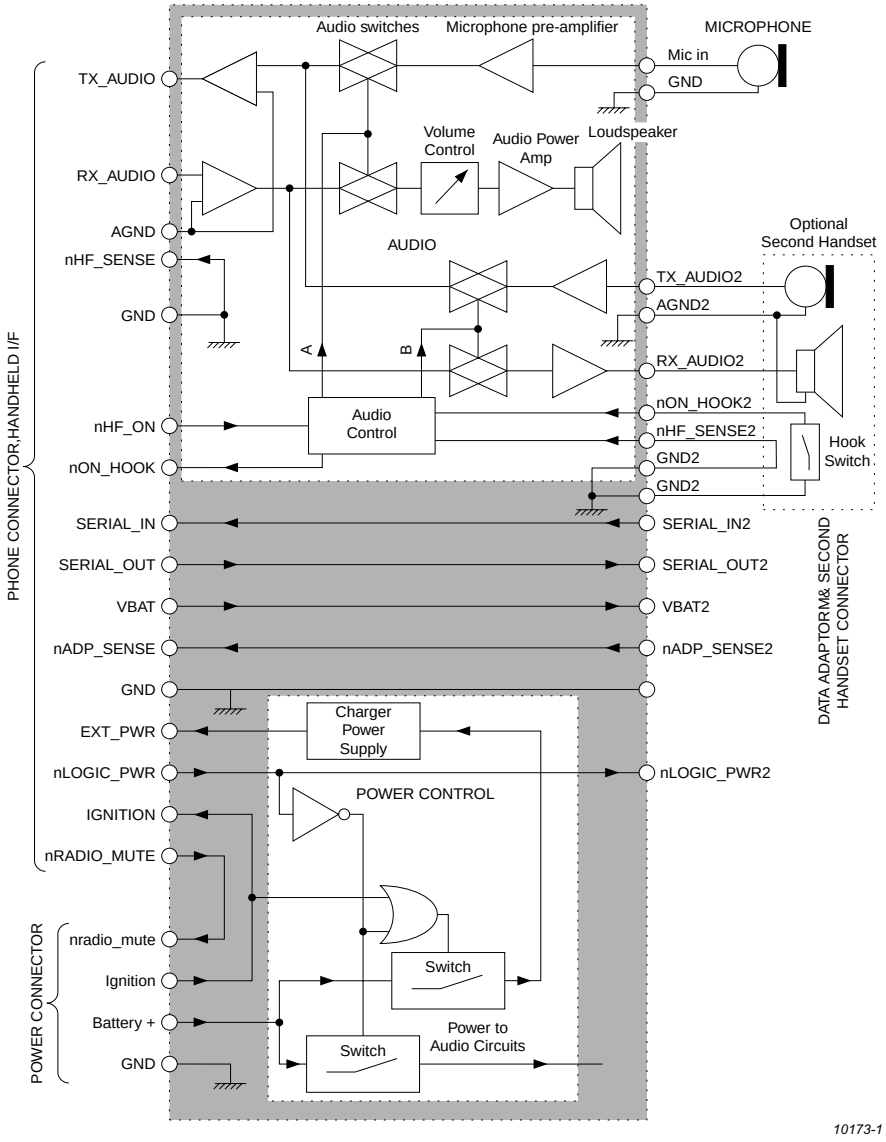

Figure 3.1: Handsfree Block Diagram

3.2. Tx Audio

The external microphone connects to SKT2. The voice signal from the microphone is filtered through FL118 to eliminate TDMA noise. R100 and R102 are for biasing Vcc, which is 5 V. C106 eliminates any noise produced from the power supply. U101 is an inverting amplifier with a gain of approximately 20.

U100 is a two pole switch that provides an On path during a call and Off when there is no call, therefore effectively muting the microphone. U102 is for amplification bias, before the signal is passed through a differential amplifier (U103), which rejects any noise created between the handset ground and the handsfree unit ground.

The TX_AUDIO signal is then passed to the telephone, which performs echo and noise cancellation functions.

3.3. Rx Audio

The signal is received on A8 and PL1, after having already been processed in the handset. U115 is a differential amplifier. U114 and U116 are two pole switches enabling the path to be either On or Off. If U116 is on then U117 drives the optional second handset.

If U114 is on, then the handsfree unit is on. R136 is a variable resistor which controls the volume, via a thumbwheel on the side of the handsfree case. Further amplification is provided by U112, before the output is fed to the loudspeaker.

3.4. Audio Control

Audio control is a basic logic section, which is used to control the switches U100, U104, U114 and U116. This ensures that the second handset is activated if being used. It also de-activates the echo-cancellation process if the 2nd handset is used, as this is no longer required.

3.5. Power Control and Supply

U201 is the main control element for the charging and main power supplies. U200 and TR200 provide current limitation control.

U202 is a voltage regulator that provides a 5 V supply (VCC) for the handsfree unit. D205 provides protection for the supply by switching the power off to the unit should the battery voltage rise above 18 V.

The IGNITION signal from the power connector swithes on the charging and is controlled by U201. Two external LEDs are visible on the case of the handsfree unit, which are powered on as the ignition line becomes active. Their function is to provide On/Off indication for the handsfree unit.

4 INTERFACES AND TEST POINTS

4.1. Interfaces

The handsfree unit provides a handsfree function for car use and provides charging power for the phone and consists of the following:

4.1.1. Power Connector

No.	Signal Name	H/F <=> Car	Function
1	Battery +	<==	Positive car battery connection
2	Ignition	<==	Car ignition switch position sense
3	NC	-	Not connected
4	GND	<==	Negative car battery connection
5	NC	-	Not connected
6	nRadio Mute	==>	Handsfree output to mute Car radio

4.1.2. Phone Connector, Handheld I/F

No.	Signal Names	Telephone <=> H/F	Function
A1	GND	-	Power supply and digital ground
A2	PA_ON	-	Not connected
A3	n.LOGIC_PWR	==>	Handheld accessory power control
A4	IGNITION	<==	Handheld car ignition state sense
A5	VBAT	==>	Handheld battery output for accessories
A6	nHF_SENSE	<==	Handheld sense input to detect Handsfree
A7	nRADIO_MUTE	==>	Handheld radio mute output
A8	RX_AUDIO	==>	Handsfree audio input
A9	-	-	Spare
B1	EXT_PWR	<==	Handheld charge input
B2	nON_HOOK	<==	Handsfree 'On Hook' output
B3	SERIAL_OUT	==>	Handheld serial data output
B4	SERIAL_IN	<==	Handheld serial data input
B5	nADP_SENSE	<==	Handheld accessory sense
B6	nHF_ON	==>	Handsfree audio control input
B7	AGND	-	Handsfree audio input and output ground
B8	TX_AUDIO	<==	Handsfree audio output
B9	GND	-	Power supply and digital ground

4.1.3. Microphone Connector

	Signal Name	Telephone<=>H/F	Function
Tip	Mic In	<==	Microphone bias and Handsfree audio input
Screen	GND	-	Ground

4.1.4. Data Adaptor

	Signal Name	Telephone<=>H/F	Function
1	GND2	-	Power supply and digital ground
2	PA_ON2	-	Not used
3	nLOGIC_PWR2	==>	Handheld accessory power control
4	IGNITION2	-	Not used
5	VBAT2	==>	Handheld power supply output for accessories
6	nHF_SENSE2	<==	Second Handset connected detect
7	nRADIO_MUTE2	-	Not used
8	RX_AUDIO2	==>	Second Handset Audio
9	-	-	Spare
10	EXT_PWR2	-	Not used
11	nON_HOOK2	<==	Second handset 'On Hook' output
12	SERIAL_OUT2	==>	Handheld serial data output
13	SERIAL_IN2	<==	Handheld serial data input
14	nADP_SENSE2	<==	Handheld accessory sense
15	nHF_ON2	-	Not used
16	AGND2	-	Audio Ground
17	TX_AUDIO2	<==	Second Handset Audio
18	GND2	-	Power supply and digital ground

4.2. Test Points

TP No.	Description	Location
TP1	AUDIO CONTROL	TR102 Pin 3
TP2	BATTERY+	SK1 Pin 1
TP3	nLOGIC_PWR	FL206, R221
TP4	Vcc	U202 Pin 1
TP5	EXT_PWR	C203, FL200
TP6	GROUND	
TP7	MICROPHONE AUDIO	FL100, C109
TP8	MICROPHONE INPUT	SKT2 Pin 5
TP9	Tx AUDIO2 (FILTER)	FL103, FL119
TP10	nHF_ON	FL105, R122
TP11	Rx AUDIO	FL111, R138
TP12	AGND	FL112, R144
TP13	Tx AUDIO	R109, FL101
TP14	LOUDSPEAKER	PL2 Pin 2
TP15	GROUND	PL2 Pin 1
TP16	Rx_AUDIO2	PL3 Pin 8
TP17		U107 Pin 10

5 INSTALLATION GUIDE

5.1. General

This section describes the procedure used to install the GSM handportable unit into a negative-grounded vehicle.

Caution

Do not attempt to install this equipment into a positive-grounded vehicle.
Do not attempt to supply power to the equipment from a positive-grounded vehicle.

5.2. Handsfree Car Mount Kit

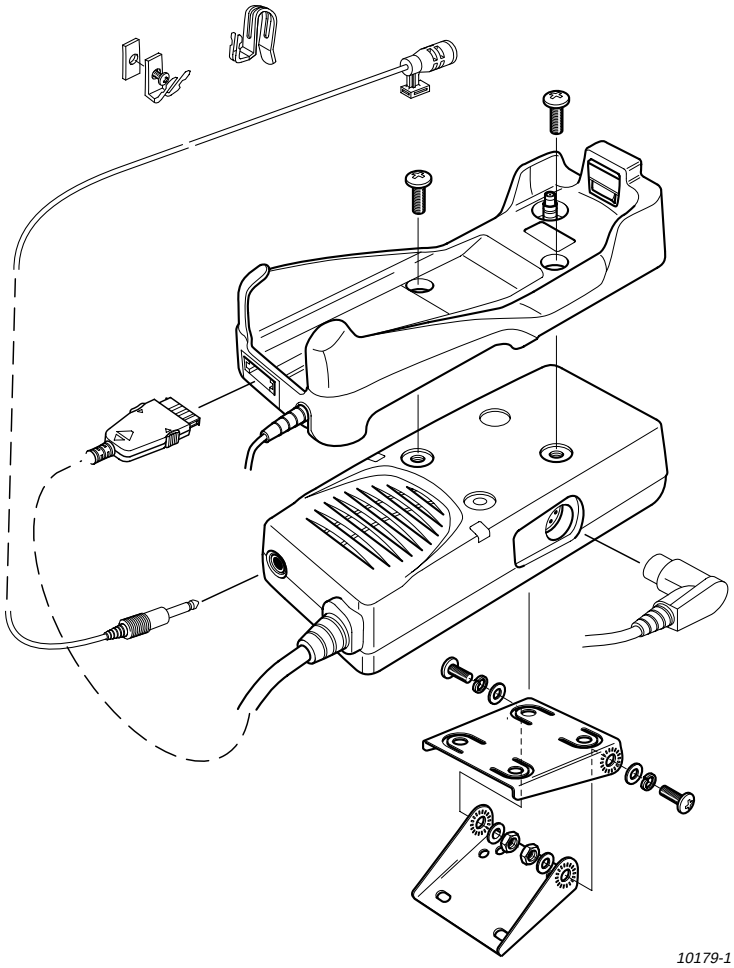

Figure 5.1: Handsfree Car Mount Kit

5.2.1. Preparation

The following points should be considered when choosing a location for the handsfree unit:

1. Ensure that the location does not obstruct normal operation/functioning of the vehicle.
2. Ensure that the location does not affect passenger accommodation, or is subject to excessive shocks.
3. Ensure that the location will allow easy operation of the unit.
4. Ensure that the location provides a secure fixing for the unit.
5. Avoid direct exposure to the sun's rays, or to rain.
6. Ensure that the location takes due consideration of cable routing requirements.
7. Considering the points listed above, the recommended locations for mounting the handsfree unit are the Dashboard, Armrest storage compartment or the Centre Console.

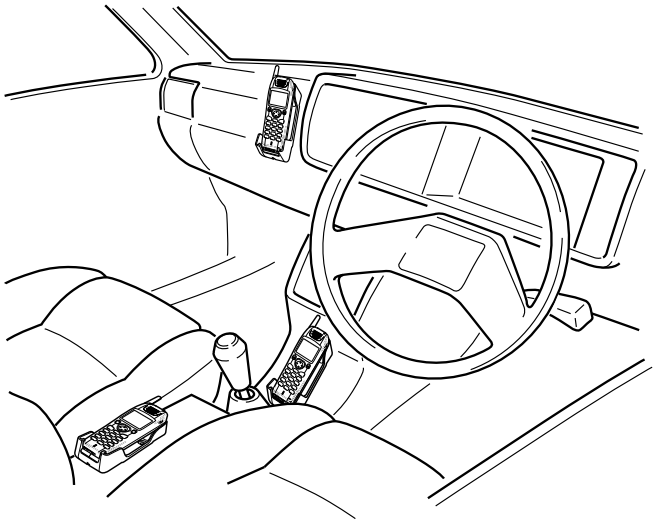

Figure 5.2: Handsfree Cradle Unit Locations

5.2.2. Mounting the Holder and Handsfree Unit

The Holder and Handsfree Unit can be mounted together using one Adjustable Angle Bracket as shown below:

Note that one half of the Bracket must be secured to the base of the Handsfree Unit and the other half to the mounting location before the bracket is assembled.

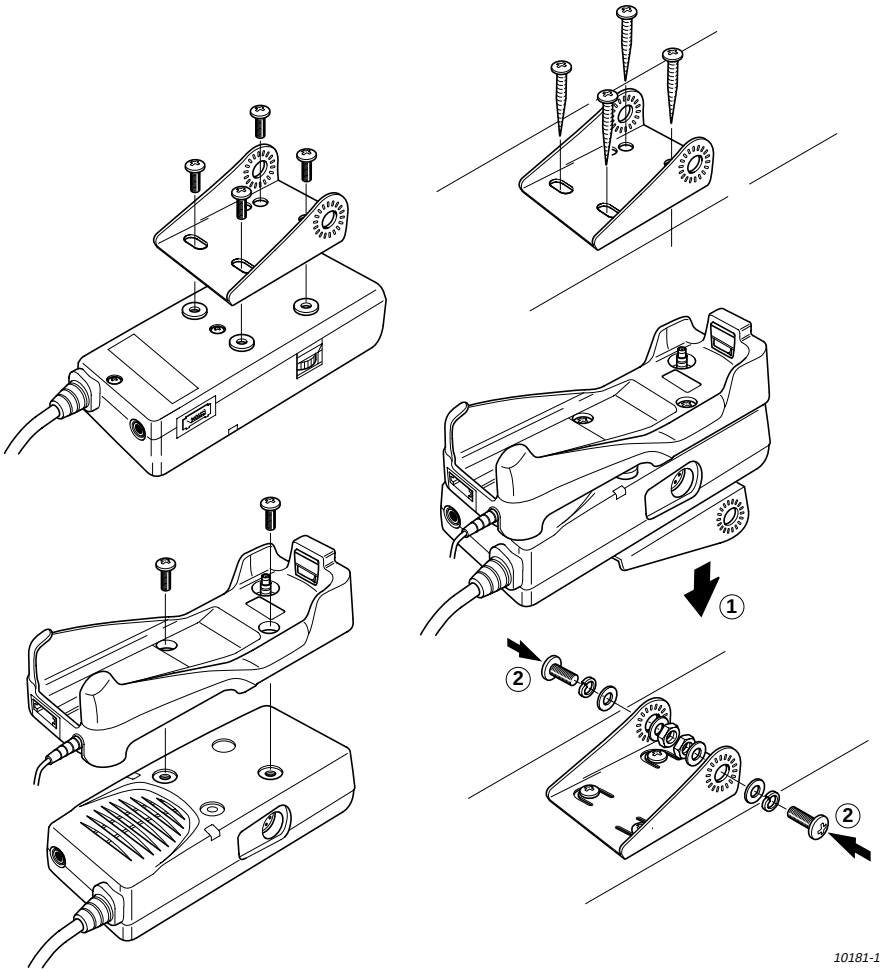

Figure 5.3: Mounting the Holder and Handsfree Unit

Note that the second Adjustable Angle Bracket may be used to mount the Holder at an alternative location to the Handsfree Unit, if required:

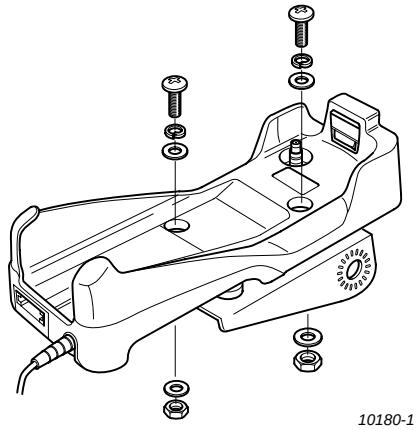

Figure 5.4: Mounting the Holder Unit

5.2.3. Installing the Handsfree Microphone

The following points should be considered when installing the handsfree microphone:

1. That it does not obstruct the operation of the vehicle.
2. That it does not affect the normal passenger accommodation.
3. That the microphone should face the driver's mouth, at a distance of approximately 30cm.

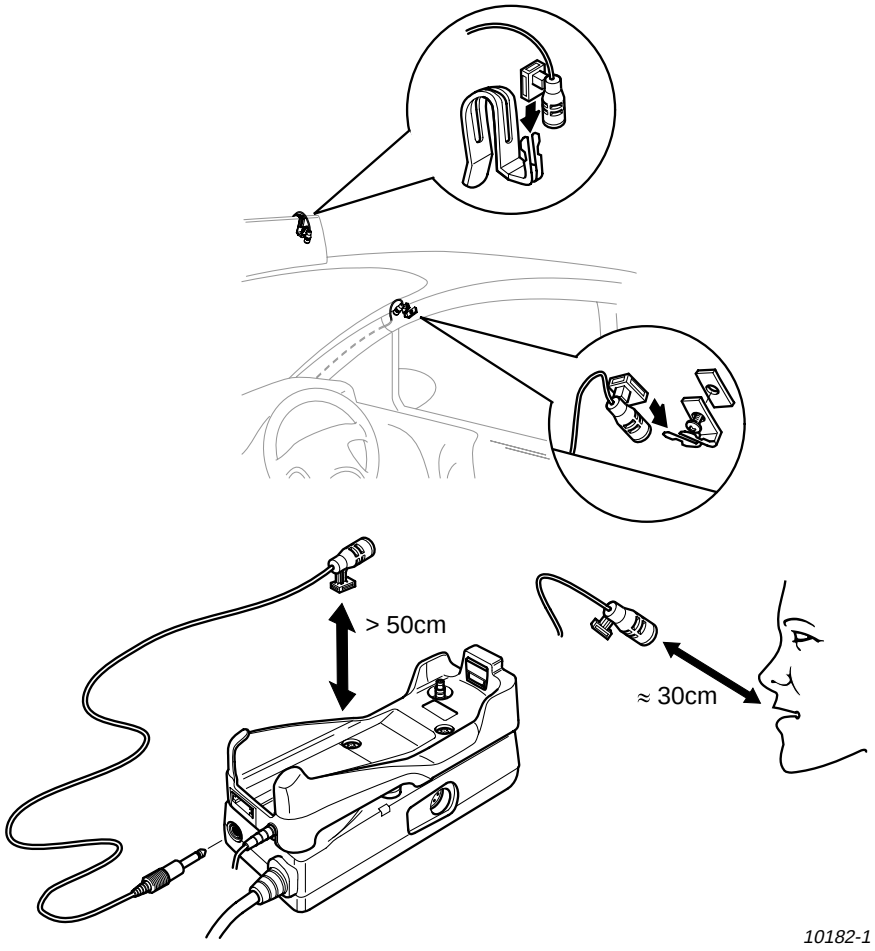

Figure 5.5: Microphone Installation

Mounting the Microphone to the Sun Visor

1. Insert the projection on the microphone clip into the hole of the microphone base.
2. Mount the microphone on to the sun visor as shown in the diagram.
3. Connect the microphone lead to the connector on the Handsfree Unit.

Mounting the Microphone to the Dashboard

1. Attach the adhesive pad to the dashboard clip.
2. Drill a 1 mm hole at the mounting location and mount the clip using a M2.5 self-tapping screw.
3. Insert the projection of the clip into the microphone base, ensuring that it points towards the driver's mouth.
4. Connect the handsfree microphone to the Handsfree Unit.

5.2.4. Antenna

For best reception, mount the antenna on the vehicle roof.

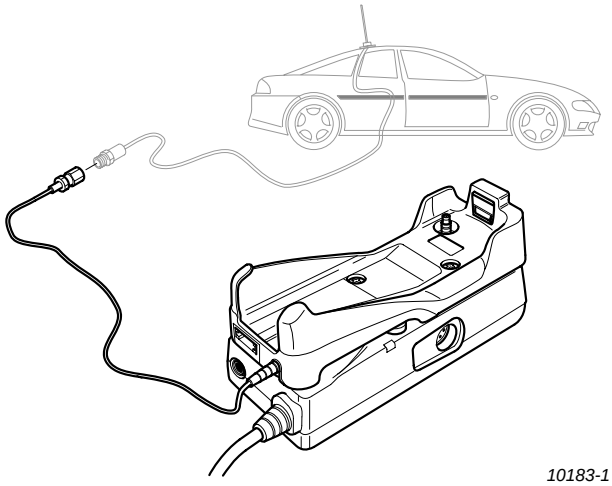

Figure 5.6: Vehicle Antenna Connection

5.2.5. Wiring

Caution

Do not shorten or remove any item from the DC Power Cable. Removal of fuse holders or any part of the cable could result in damage to the vehicle's electrical systems and invalidate any warranty provided by the manufacturer.

Any excess cable should be wound neatly and secured by tie-wraps.

Caution

The Music Mute lead has an open-collector connection. This lead MUST be connected to the standard Mute connector of ICE equipment only. It is not suitable for powering car radios directly..

Use the supplied Power Supply Cable to permanently connect the Car Mount Kit into the vehicle wiring as shown in the diagram below.

Wiring Guide

Colour	Connection	Fuse
Black	Ground	-
Blue	Ignition	3A
Red	Battery (+)	3A
Yellow	Radio Mute	-

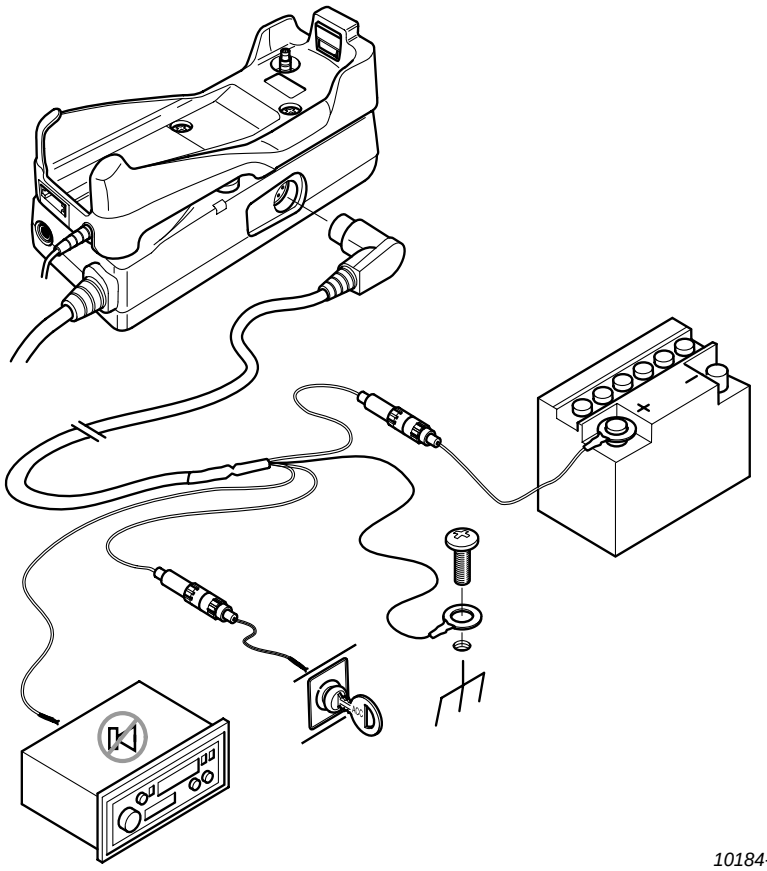

Figure 5.7: Power Cable Connections

Alternatively, connect the EasyFit Cable between the Holder and the vehicle cigarette lighter socket. Note that this cable does not cater for Radio Mute and will draw power whenever there is power to the cigarette lighter. It is recommended that the EasyFit cable is removed from the cigarette lighter when the vehicle is not running.

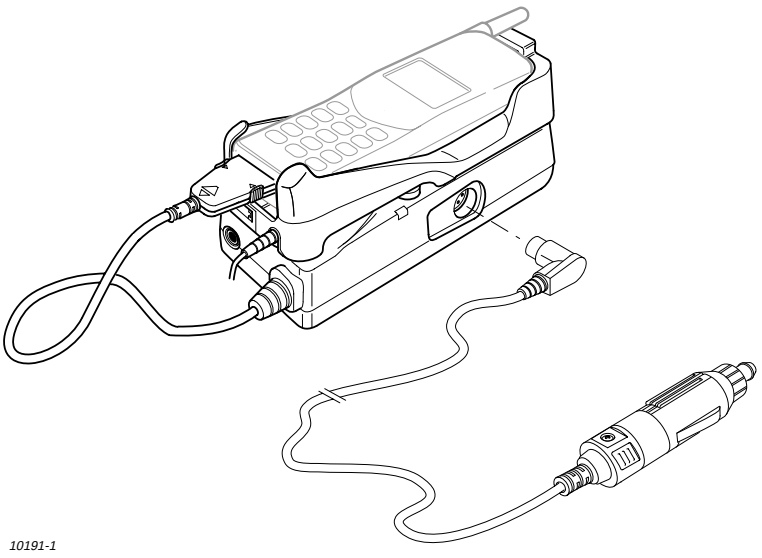

Figure 5.8: Cigarette Lighter Cable Connector

6 DISASSEMBLY / REASSEMBLY INSTRUCTIONS

6.1. General

This section provides disassembly and reassembly procedures for the Handsfree Car Kit.

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Wrist Strap - A quick release skin contact device with a flexible cord, which has a built in safety resistor of approximately 1 MΩ shall be used. The flexible cord must be attached to a dissapative earth point.

Containers - All containers and storage must be of the conductive type.

6.2. Disassembly

1. Remove the holder from the unit (2 screws).

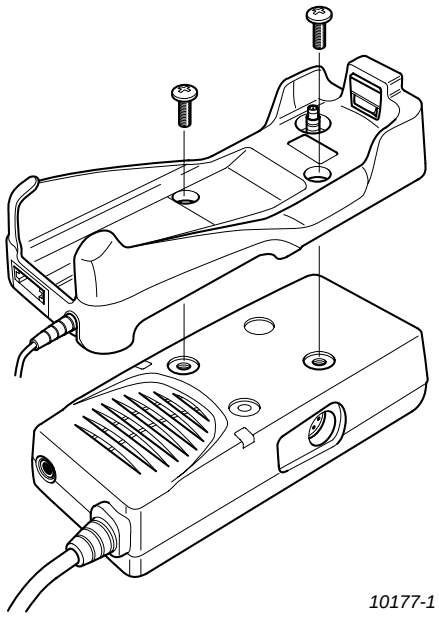


Figure 6.1: Holder Removal

2. Remove the back cover from the unit by removing the cover securing screw.

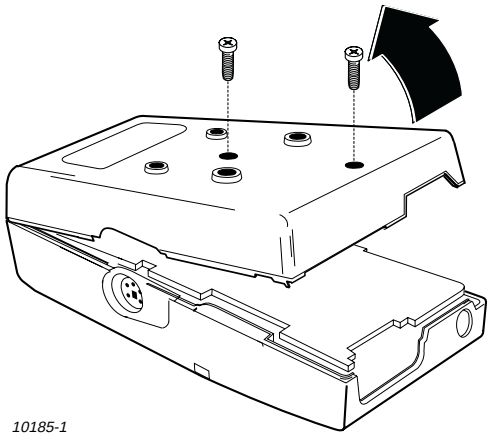


Figure 6.2: Removal of Cover

3. Pull back the PCB retaining clip and lift out the PCB. Disconnect the phone interface cable and speaker cable from the PCB.

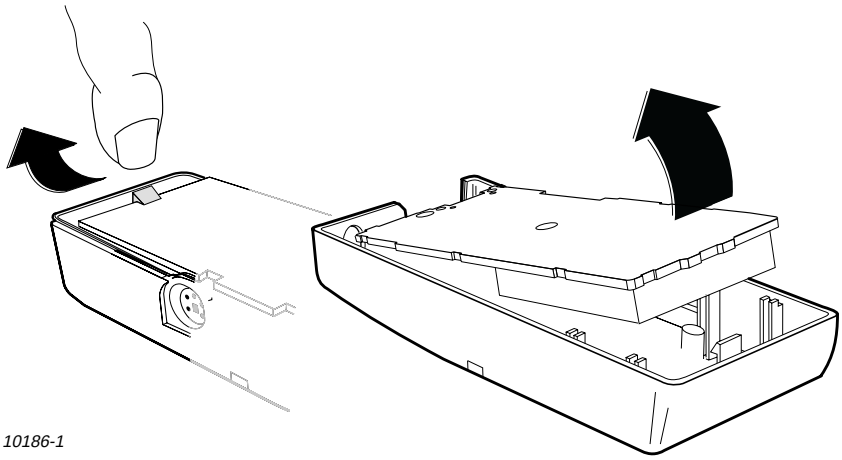


Figure 6.3: PCB Removal

6.3. Reassembly

1. Position the cables into the case moulding, ensuring that the interface cable grommet is seated securely in the case moulding and the microphone socket is also located in the case moulding.

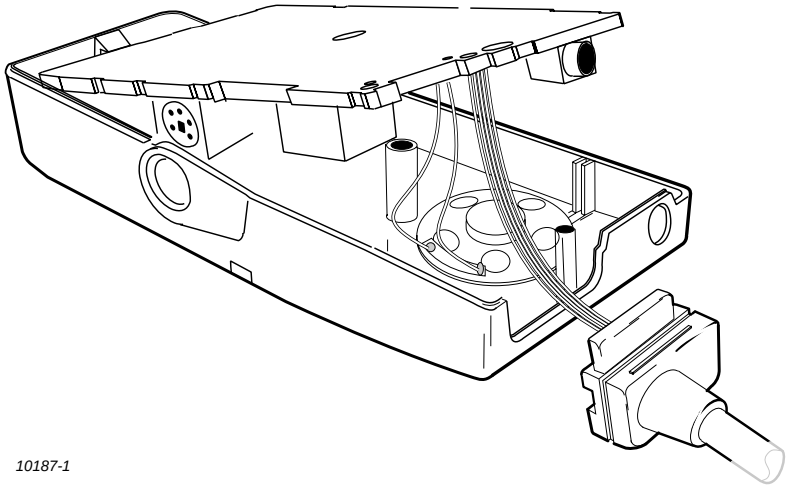


Figure 6.4: Reassembly: Cable Positioning

2. Replace the back cover of the unit and tighten the cover securing screw.

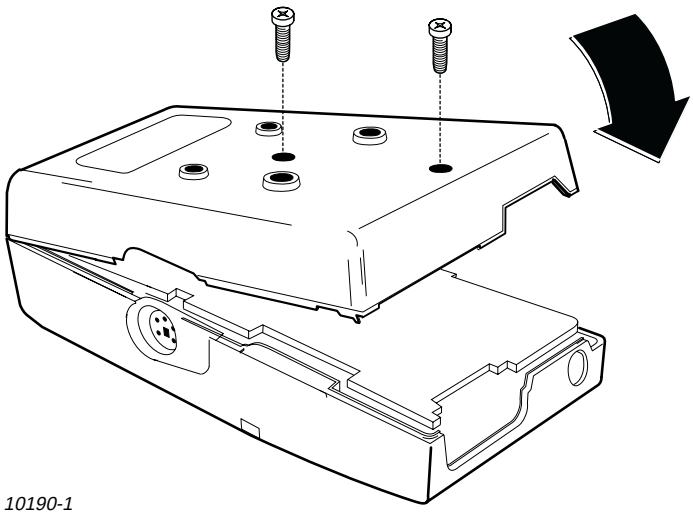


Figure 6.5: Replacement of Cover

7 REPLACEMENT PARTS LIST

7.1. Sub-Assemblies

7.1.1. Handsfree Unit

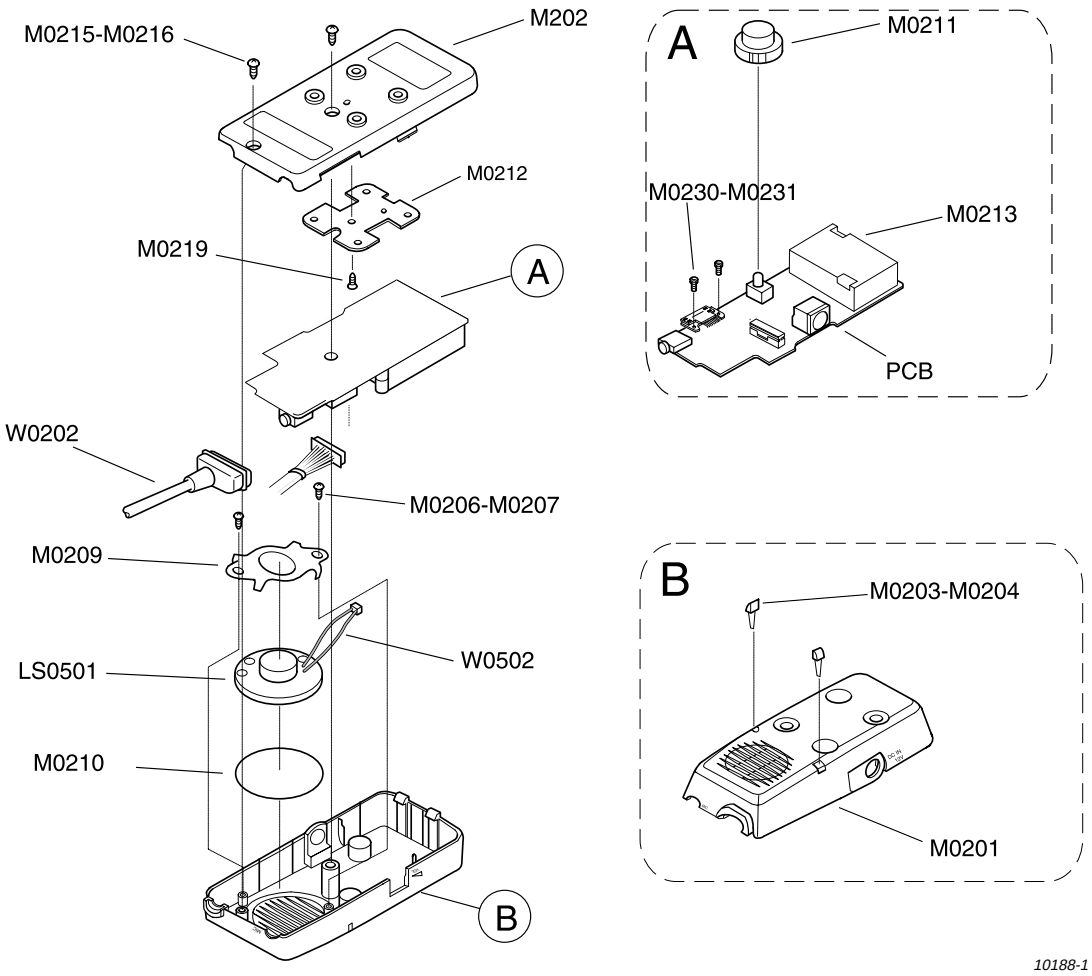


Figure 6.1: Handsfree Unit

Ref	Part Number	Description
M0201	1NA510A	GD70 HANDSFREE COVER
M0202	1PA516A	CASE
M0203	2QA538A	HANDSFREE LED LENS
M0204	2QA538A	HANDSFREE LED LENS
M0206	XTB2.6+6GFXK	SCREW M2.6 x 6mm
M0207	XTB2.6+6GFXK	SCREW M2.6 x 6mm
M0209	1B70106A	SPEAKER BRACKET
M0210	6V10031A	SPEAKER NET
M0211	5FJ5129AB	VOLUME KNOB
M0212	4EA525A	BRACKET
M0213	4JA534A	SHIELD CASE

Ref	Part Number	Description
M0215	XTB2.6+12GFXK	SCREW M2.6 x 12mm
M0216	XTB2.6+12GFXK	SCREW M2.6 x 12mm
M0219	XTB2.6+6GFXK	SCREW M2.6 x 6mm
M0230	XTB2.6+10GFX	SCREW M2.6 x 10mm
M0231	XTB2.6+10GFX	SCREW M2.6 x 10mm
PCB	HFGD70AS02	HANDSFREE PCB COMPLETE
LS0501	VS45U0208	SPEAKER 8R 1.5W
W0502	WC70152A	SPEAKER CABLE (75mm)
W0202	WC76016A	INTERFACE CABLE

7.1.2. Holder Unit

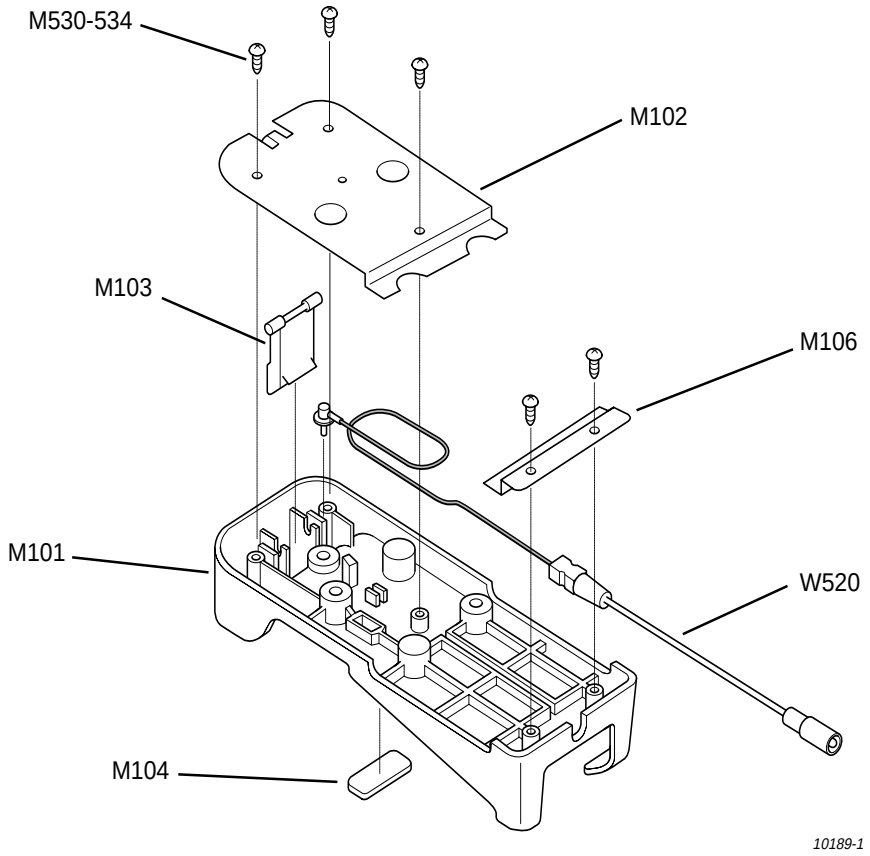


Figure 6.2: Holder Unit

Ref	GD30 / GD50r	GD70	GD90	Description
M101	1PA533A	1PA517A	1PA527A	CAR HOLDER MOULDING
M102	4HA530A	4HA520A	4HA525A	HOOK SPRING
M103	2RA518A	2RA540A	2RA518A	HOOK
M104	5U70049B	5U70049B	5U70049B	CUSHION FOR HOLDER G4 HANDSFREE
M106	4EA516A	4EA516A	4EA516A	G520 CABLE BRACKET
M107	6RA516A	6RA516A	6RA516A	CAP (GD70 CAR HOLDER)
M530	XTB2.6+6GFXK	XTB2.6+6GFXK	XTB2.6+6GFXK	SCREW M2.6 x 6mm
M531	"	"	"	
M532	"	"	"	
M533	"	"	"	
M534	"	"	"	
W520	WC76017A	WC76017A	WC76017A	RF CABLE

7.2. Handsfree Car Kits Complete

7.2.1. EB-HFD30Z (GD30 / GD50)

Model EB-HFD30Z		Name: GD30 / GD50 Handsfree Car Kit	
Ref	Part Number	Description	Notes
BRKT1	EB-N0002C	ADJUSTABLE ANGLE BRACKET 2	
BRKT2	EB-N0002C	ADJUSTABLE ANGLE BRACKET 2	
CABLE1	WC70187B	G600 BASIC HANDSFREE POWER SUP	
CABLE2	WC76013A	G520 H/F POWER SUPPLY CABLE	
HOLDR	EB-KAD31	HOLDER WITH RF CABLE GD31	
MIC	EB-M76600N	CAR MICROPHONE KIT GD70	
OI001	7LA834D	GD30 / GD50 HANDSFREE OPERATING INSTR.	

7.2.2. EB-HFD70Z (GD70)

Model EB-HFD70Z		Name: GD70 Handsfree Car Kit	
Ref	Part Number	Description	Notes
BRKT1	EB-N0002C	ADJUSTABLE ANGLE BRACKET 2	
BRKT2	EB-N0002C	ADJUSTABLE ANGLE BRACKET 2	
CABLE1	WC70187B	G600 BASIC HANDSFREE POWER SUP	
CABLE2	WC76013A	G520 H/F POWER SUPPLY CABLE	
H/FUNIT	EB-HFD70	GD70 HANDSFREE UNIT	
HOLDR	EB-KAD71	HOLDER WITH RF CABLE GD31	
MIC	EB-M76600N	CAR MICROPHONE KIT GD70	
OI001	7LA834B	GD70 HANDSFREE OPERATING INSTRUCTIONS	

7.2.3. EB-HFD90Z (GD90)

Model EB-HFD90Z		Name: GD90 Handsfree Car Kit	
Ref	Part Number	Description	Notes
BRKT1	EB-N0002C	ADJUSTABLE ANGLE BRACKET 2	
BRKT2	EB-N0002C	ADJUSTABLE ANGLE BRACKET 2	
CABLE1	WC70187B	G600 BASIC HANDSFREE POWER SUP	
CABLE2	WC76013A	G520 H/F POWER SUPPLY CABLE	
H/FUNIT	EB-HFD70	GD70 HANDSFREE UNIT	
HOLDR	EB-KAD91	HOLDER WITH RF CABLE GD91	
MIC	EB-M76600N	CAR MICROPHONE KIT GD70	

7.3. Microphone Kit

Model EB-HFDxx		Name: Handsfree Unit	
Ref	Part Number	Description	Notes
M0101	4G31674B	MICROPHONE HOLDER	
M0102	4G32105	MICROPHONE HOLDER	
M0103	4R13358	MICROPHONE CUSHION	
M0107	XTB2510AFN	SCREW (XTB2.5+10AFN)	
MK0101	HM76600N	MICROPHONE FOR CAR KIT C/W 1nF	

7.4. Handsfree PCB Assembly

Model: HFGD70AS02		Name: Handsfree PCB Assembly	
Ref	Part Number	Description	Grid
C100	F1H1C104A043	CAP CER 100nF 10% 16V X5R SMD	A4
C101	F1H1C104A043	CAP CER 100nF 10% 16V X5R SMD	F1
C102	F1H1C104A043	CAP CER 100nF 10% 16V X5R SMD	F1
C103	F1H1C104A043	CAP CER 100nF 10% 16V X5R SMD	F2
C104	F1H1C104A043	CAP CER 100nF 10% 16V X5R SMD	D1
C105	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	A4
C106	F3G0J3360001	CAP TANT 33uF 20% 6.3V SMD CAS	A3
C107	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	F1
C108	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	F2
C109	F0F1H2240001	CAP FILM 220nF 20% 50V SMD 505	A4
C110	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	A4
C111	F1H1C104A043	CAP CER 100nF 10% 16V X5R SMD	A4
C112	F1H1C104A043	CAP CER 100nF 10% 16V X5R SMD	A4
C113	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	A3
C114	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	F2
C115	F1J1C474A045	CAP CER 470nF 10% 16V X7R SMD	F2
C116	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	F2
C117	F1J1C474A045	CAP CER 470nF 10% 16V X7R SMD	E2
C118	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	C4
C119	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	F2
C120	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	C4
C121	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	F2
C122	F3G0J3360001	CAP TANT 33uF 20% 6.3V SMD CAS	A4
C123	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	F2
C124	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	F1
C125	F3G0J3360001	CAP TANT 33uF 20% 6.3V SMD CAS	A3
C126	F1J1C474A045	CAP CER 470nF 10% 16V X7R SMD	F2
C127	F0F1H2240001	CAP FILM 220nF 20% 50V SMD 505	B3
C128	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	F1

Model: HFGD70AS02		Name: Handsfree PCB Assembly	
Ref	Part Number	Description	Grid
C129	F1H1C104A043	CAP CER 100nF 10% 16V X5R SMD	F1
C130	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	F1
C131	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	F1
C132	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	C4
C133	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	C4
C134	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	F1
C135	ECEV1EA221P	CAP ALUM 220uF 20% 25V SMD 10.	E4
C136	F1H1C104A043	CAP CER 100nF 10% 16V X5R SMD	E4
C137	ECEV1CA221P	CAP ALUM 220uF 20% 16V SMD 10.	D3
C138	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	B2
C139	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	B2
C140	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	E1
C142	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	E4
C143	ECJ1VB1H472K	CAP CER 4.7nF 10% 50V X7R SMD	C4
C144	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	E1
C145	F1J1H104A425	CAP CER 100nF -20+80% 50V Y5V	E4
C146	ECEV0JS220WR	CAP ALUM 22uF 20% 6.3V SMD 5.4	E4
C147	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	C3
C148	F1H1H103A219	CAP CER 10nF 10% 50V X7R SMD 1	E1
C149	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	E1
C150	F1H1C104A043	CAP CER 100nF 10% 16V X5R SMD	E1
C151	F1H1H103A219	CAP CER 10nF 10% 50V X7R SMD 1	D1
C152	F1H1C104A043	CAP CER 100nF 10% 16V X5R SMD	C3
C153	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	D1
C154	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	C4
C155	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	C4
C156	F1H1C104A043	CAP CER 100nF 10% 16V X5R SMD	C3
C157	ECEV0JS220WR	CAP ALUM 22uF 20% 6.3V SMD 5.4	C3
C158	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	C3
C159	ECEV0JS220WR	CAP ALUM 22uF 20% 6.3V SMD 5.4	C3
C160	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	C3

Model: HFGD70AS02		Name: Handsfree PCB Assembly	
Ref	Part Number	Description	Grid
C161	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	C4
C162	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	E1
C163	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	D3
C164	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	E4
C165	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	E4
C166	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	F2
C167	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	A4
C168	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	A3
C169	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	A3
C170	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	F1
C171	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	E1
C172	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	F1
C173	F1J1H104A425	CAP CER 100nF -20+80% 50V Y5V	E4
C174	F1H1H103A219	CAP CER 10nF 10% 50V X7R SMD 1	C4
C200	F1H1H103A219	CAP CER 10nF 10% 50V X7R SMD 1	A1
C201	F1H1C104A043	CAP CER 100nF 10% 16V X5R SMD	B1
C202	ECEV0JS220WR	CAP ALUM 22uF 20% 6.3V SMD 5.4	E3
C203	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	C4
C204	EEVFC1A151P	CAP ALUM 150uF 20% 10V SMD 6.2	E4
C205	F1H1C104A043	CAP CER 100nF 10% 16V X5R SMD	B1
C206	F1H1C104A043	CAP CER 100nF 10% 16V X5R SMD	C4
C207	EEVFC1A151P	CAP ALUM 150uF 20% 10V SMD 6.2	F4
C208	F1H1H102A219	CAP CER 1nF 10% 50V X7R SMD 16	B1
C209	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	B1
C210	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	C4
C211	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	C4
C212	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	C4
C213	EEVFC1H220P	CAP ALUM 22uF 20% 50V SMD 6.2x	E3
C214	EEVFC1H470P	CAP ALUM 47uF 20% 50V SMD 10.2	E3
C215	EEVFC1H470P	CAP ALUM 47uF 20% 50V SMD 10.2	F3
C216	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	D4

Model: HFGD70AS02		Name: Handsfree PCB Assembly	
Ref	Part Number	Description	Grid
C217	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	D3
C218	ECEV1EA221P	CAP ALUM 220uF 20% 25V SMD 10.	D4
C219	F1J1H104A425	CAP CER 100nF -20+80% 50V Y5V	C3
C220	F1H1C104A043	CAP CER 100nF 10% 16V X5R SMD	C3
C221	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	C4
C222	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	C4
C223	F1H1H103A219	CAP CER 10nF 10% 50V X7R SMD 1	F1
C224	F1J1H104A425	CAP CER 100nF -20+80% 50V Y5V	B1
C225	F1J1H104A425	CAP CER 100nF -20+80% 50V Y5V	D4
C226	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	E1
C227	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	D4
C228	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	E1
C229	F1H1H220A230	CAP CER 22pF 5% 50V NP0 SMD 16	E1
C230	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	E1
C231	F1H1H101A230	CAP CER 100pF 5% 50V NP0 SMD 1	E1
C232	F1H1H102A219	CAP CER 1nF 10% 50V X7R SMD 16	C4
C233	F1H1H103A219	CAP CER 10nF 10% 50V X7R SMD 1	C4
D100	MAZ812000L	DIODE	E2
D101	MAZ812000L	DIODE	E2
D102	MAZ812000L	DIODE	E1
D103	MAZ812000L	DIODE	E1
D104	MAZ812000L	DIODE	E1
D105	MAZ812000L	DIODE	E1
D106	MAZ812000L	DIODE	D1
D200	B0JCMC000003	DIODE 40V 1.5A	E3
D202	B0JCMC000003	DIODE 40V 1.5A	F3
D203	B0ECMM000001	DIODE S3D 200V 3A SMD DO214AB	C4
D204	MAZ824000L	DIODE PLANAR S MINI MOLD 2 PIN	E2
D205	MA8160TX	DIODE 16V	E2
D206	MA3S132E0L	DIODE 100MA 80V	C4

Model: HFGD70AS02		Name: Handsfree PCB Assembly	
Ref	Part Number	Description	Grid
D207	MAZ80560LL	DIODE ZENER L RANK 5.3-5.58V S	C4
D208	B3ABB0000049	DIODE LED GREEN 10-56mcd 20mA	C3
D209	B3ABB0000049	DIODE LED GREEN 10-56mcd 20mA	C4
FL100	ACB1608M040T	FILTER	A3
FL101	ACB1608M040T	FILTER	D1
FL102	ACB1608M040T	FILTER	A4
FL103	ACB1608M040T	FILTER	E1
FL104	ACB1608M040T	FILTER	E1
FL105	ACB1608M040T	FILTER	D2
FL106	ACB1608M040T	FILTER	D2
FL107	ACB1608M040T	FILTER	F1
FL108	ACB1608M040T	FILTER	E1
FL109	ACB1608M040T	FILTER	E4
FL110	J0JGC0000007	SUPPRESSOR EMI FERRITE 10 OHM	E4
FL111	ACB1608M040T	FILTER	D2
FL112	ACB1608M040T	FILTER	D2
FL113	ACB1608M040T	FILTER	E4
FL115	ACB1608M040T	FILTER	A3
FL116	ACB1608M040T	FILTER	A4
FL117	ACB1608M040T	FILTER	A4
FL118	J0LB00000028	INDUCTOR FERRITE CHIP 1000OHM	A3
FL119	ACB1608M040T	FILTER	F1
FL120	ACB1608M040T	FILTER	F1
FL121	ACB1608M040T	FILTER	F1
FL122	J0LB00000028	INDUCTOR FERRITE CHIP 1000OHM	A3
FL200	J0JGC0000007	SUPPRESSOR EMI FERRITE 10 OHM	D2
FL201	ACB1608M040T	FILTER	D2
FL202	ACB1608M040T	FILTER	D2
FL203	ACB1608M040T	FILTER	D2
FL204	ACB1608M040T	FILTER	D2
FL205	J0JHC0000003	SUPPRESSOR EMI FERRITE 150 OHM	D4

Model: HFGD70AS02		Name: Handsfree PCB Assembly	
Ref	Part Number	Description	Grid
FL206	ACB1608M040T	FILTER	D2
FL207	ACB1608M040T	FILTER	C4
FL208	ACB1608M040T	FILTER	D3
FS201	K5D402AZ0001	FILTER 4 A	D4
PL002	K1KA02A00079	DF13C-2P-1.25V21 CONNECTOR	B4
R100	ERJ3GEYJ392V	CHIP RESISTOR 3K9 OHM +/-5% 1/	A3
R101	ERJ3GEYJ104V	CHIP RESISTOR 100K OHM +/-5% 1	A4
R102	ERJ3GEYJ821V	CHIP RESISTOR 820 OHM +/-5% 1/	A3
R103	ERJ3GEYJ224V	CHIP RESISTOR 220K OHM +/-5% 1	F1
R104	ERJ3GEYJ472V	CHIP RESISTOR 4K7 OHM +/-5% 1/	A4
R105	ERA6YED104V	100k OHM 100mW RESISTOR	F2
R106	ERJ3GEYJ223V	CHIP RESISTOR 22K OHM +/-5% 1/	F2
R107	ERA6YED473V	47k OHM 100mW RESISTOR	F2
R108	ERJ3GEYJ471V	CHIP RESISTOR 470 OHM +/-5% 1/	E2
R109	ERJ3GEYJ101V	CHIP RESISTOR 100 OHM +/-5% 1/	E2
R110	ERJ3GEYJ105V	CHIP RESISTOR 1M OHM +/-5% 1/1	F2
R111	ERJ3GEYJ105V	CHIP RESISTOR 1M OHM +/-5% 1/1	A4
R112	ERJ3GEYJ103V	CHIP RESISTOR 10K OHM +/- 5% 1	F2
R113	ERA6YED473V	47k OHM 100mW RESISTOR	F2
R114	ERJ3GEYJ224V	CHIP RESISTOR 220K OHM +/-5% 1	F2
R115	ERJ3GEYJ103V	CHIP RESISTOR 10K OHM +/- 5% 1	F2
R116	ERJ3GEYJ392V	CHIP RESISTOR 3K9 OHM +/-5% 1/	F1
R117	ERA6YED104V	100k OHM 100mW RESISTOR	F2
R118	ERJ3GEYJ104V	CHIP RESISTOR 100K OHM +/-5% 1	F1
R119	ERJ3GEYJ821V	CHIP RESISTOR 820 OHM +/-5% 1/	F1
R120	ERJ3GEYJ472V	CHIP RESISTOR 4K7 OHM +/-5% 1/	F1
R121	ERJ3GEYJ105V	CHIP RESISTOR 1M OHM +/-5% 1/1	F1
R122	ERJ3GEYJ102V	CHIP RESISTOR 1K OHM +/-5% 1/1	E2
R123	ERJ3GEYJ223V	CHIP RESISTOR 22K OHM +/-5% 1/	E2
R124	ERJ3GEYJ221V	CHIP RESISTOR 220 OHM +/-5% 1/	E2

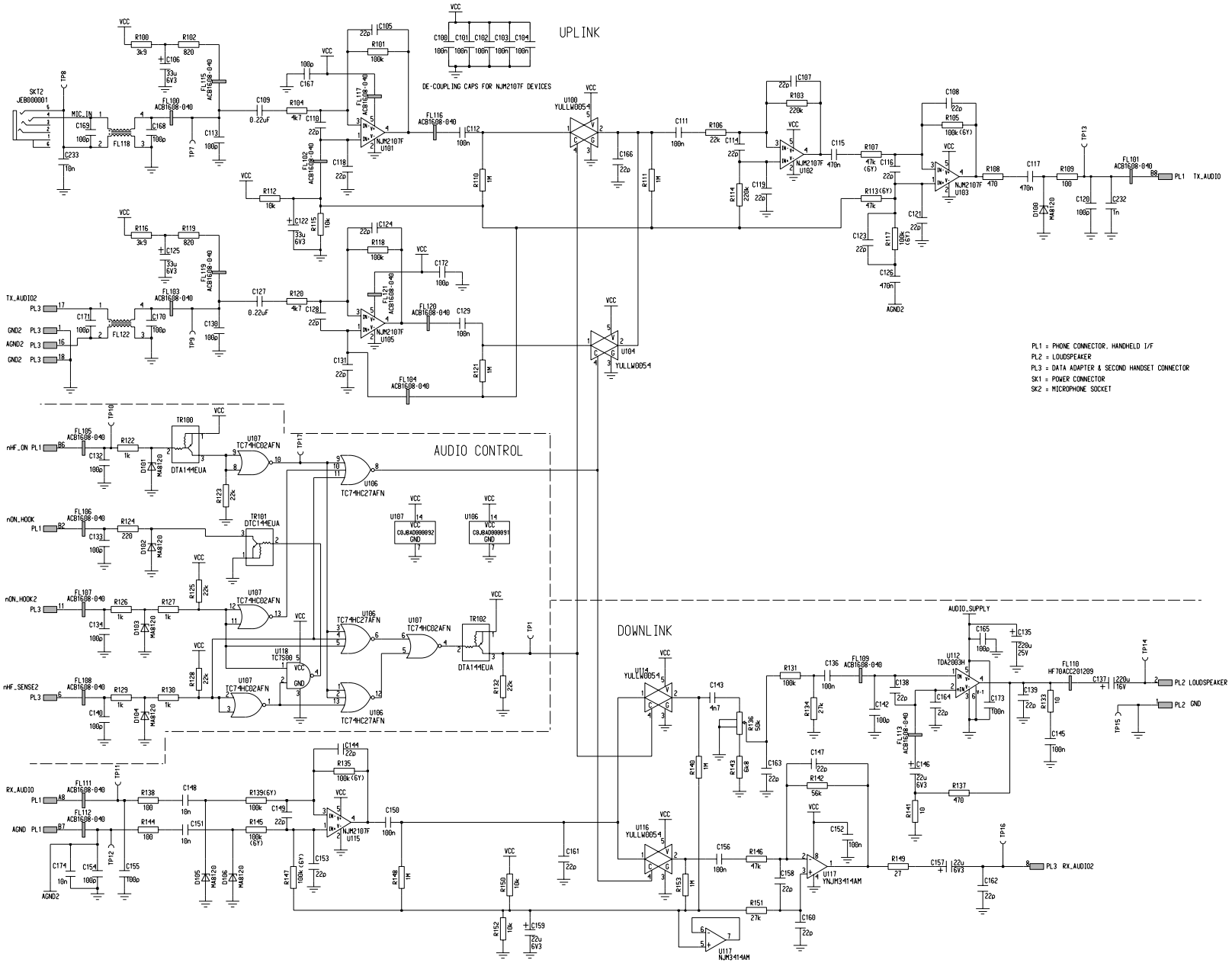
Model: HFGD70AS02		Name: Handsfree PCB Assembly	
Ref	Part Number	Description	Grid
R125	ERJ3GEYJ223V	CHIP RESISTOR 22K OHM +/-5% 1/	E1
R126	ERJ3GEYJ102V	CHIP RESISTOR 1K OHM +/-5% 1/1	E1
R127	ERJ3GEYJ102V	CHIP RESISTOR 1K OHM +/-5% 1/1	E1
R128	ERJ3GEYJ223V	CHIP RESISTOR 22K OHM +/-5% 1/	E1
R129	ERJ3GEYJ102V	CHIP RESISTOR 1K OHM +/-5% 1/1	E1
R130	ERJ3GEYJ102V	CHIP RESISTOR 1K OHM +/-5% 1/1	E1
R131	ERJ3GEYJ104V	CHIP RESISTOR 100K OHM +/-5% 1	E4
R132	ERJ3GEYJ223V	CHIP RESISTOR 22K OHM +/-5% 1/	E1
R133	ERJ6GEYJ100V	CHIP RESISTOR 10 OHM +/-5% 1/1	E4
R134	ERJ3GEYJ273V	CHIP RESISTOR 27K OHM +/-5% 1/	E4
R135	ERA6YED104V	100k OHM 100mW RESISTOR	E1
R137	ERJ6GEYJ471V	CHIP RESISTOR 470 OHM +/-5% 1/	E4
R138	ERJ3GEYJ101V	CHIP RESISTOR 100 OHM +/-5% 1/	E2
R139	ERA6YED104V	100k OHM 100mW RESISTOR	E1
R140	ERJ3GEYJ105V	CHIP RESISTOR 1M OHM +/-5% 1/1	C3
R141	ERJ6GEYJ100V	CHIP RESISTOR 10 OHM +/-5% 1/1	E4
R142	ERJ3GEYJ563V	CHIP RESISTOR 56K OHM +/-5% 1/	C3
R143	ERJ3GEYJ682V	CHIP RESISTOR 6K8 OHM +/-5% 1/	D3
R144	ERJ3GEYJ101V	CHIP RESISTOR 100 OHM +/-5% 1/	E2
R145	ERA6YED104V	100k OHM 100mW RESISTOR	D1
R146	ERJ3GEYJ473V	CHIP RESISTOR 47K OHM +/-5% 1/	C3
R147	ERA6YED104V	100k OHM 100mW RESISTOR	D1
R148	ERJ3GEYJ105V	CHIP RESISTOR 1M OHM +/-5% 1/1	C3
R149	ERJ14NF27R0U	RESISTOR 27 OHM 1% 1/4W SMD 32	C3
R150	ERJ3GEYJ103V	CHIP RESISTOR 10K OHM +/- 5% 1	C3
R151	ERJ3GEYJ273V	CHIP RESISTOR 27K OHM +/-5% 1/	C3
R152	ERJ3GEYJ103V	CHIP RESISTOR 10K OHM +/- 5% 1	C3
R153	ERJ3GEYJ105V	CHIP RESISTOR 1M OHM +/-5% 1/1	C3
R200	ERJ3GEYJ334V	CHIP RESISTOR 330K OHM +/-5% 1	A1
R201	ERA6YED153V	15k OHM 100mW RESISTOR	B1
R202	ERJ3GEYJ473V	CHIP RESISTOR 47K OHM +/-5% 1/	B1

Model: HFGD70AS02		Name: Handsfree PCB Assembly	
Ref	Part Number	Description	Grid
R203	ERA6YED473V	47k OHM 100mW RESISTOR	A1
R204	ERA6YED133V	RESISTOR 13K 1/10W SM 2012	B1
R205	ERA6YED103V	10k OHM 100mW RESISTOR	A2
R206	ERJ3GEYJ472V	CHIP RESISTOR 4K7 OHM +/-5% 1/	A2
R207	ERJ3GEYJ101V	CHIP RESISTOR 100 OHM +/-5% 1/	A1
R209	ERJ12NF1000U	RESISTOR 100 OHM 1% 1/2W SMD 4	A1
R210	ERA6YED153V	15k OHM 100mW RESISTOR	B1
R211	ERA6YED103V	10k OHM 100mW RESISTOR	A1
R212	ERA6YED183V	RESISTOR 18K 1/10W SM 2012	A1
R213	ERA6YED272V	2k7 OHM 100mW RESISTOR	A1
R214	ERJ3GEYJ102V	CHIP RESISTOR 1K OHM +/-5% 1/1	B1
R215	ERJ3GEYJ153V	CHIP RESISTOR 15K OHM +/-5% 1/	B4
R216	ERJ3GEYJ221V	CHIP RESISTOR 220 OHM +/-5% 1/	A1
R217	ERJ3GEYJ103V	CHIP RESISTOR 10K OHM +/- 5% 1	E2
R218	ERJ3GEYJ221V	CHIP RESISTOR 220 OHM +/-5% 1/	D4
R219	ERJ3GEYJ473V	CHIP RESISTOR 47K OHM +/-5% 1/	E2
R220	ERJ3GEYJ103V	CHIP RESISTOR 10K OHM +/- 5% 1	C4
R221	ERJ3GEYJ222V	CHIP RESISTOR 2K2 OHM +/-5% 1/	E2
R222	ERJ3GEYJ103V	CHIP RESISTOR 10K OHM +/- 5% 1	C4
R223	ERJ3GEYJ104V	CHIP RESISTOR 100K OHM +/-5% 1	C4
R224	ERJ6GEYJ332V	RESISTOR 3.3K OHM 5% 1/10W SMD	D2
R225	ERJ3GEYJ103V	CHIP RESISTOR 10K OHM +/- 5% 1	B2
R226	ERJ3GEYJ103V	CHIP RESISTOR 10K OHM +/- 5% 1	B2
R227	ERJ3GEYJ471V	CHIP RESISTOR 470 OHM +/-5% 1/	C4
R228	ERJ3GEYJ102V	CHIP RESISTOR 1K OHM +/-5% 1/1	E2
TR100	B1GDCFNN0007	TRANSISTOR DTA144EUA PNP WITH	E2
TR101	B1GBCFNN0009	TRANSISTOR DTC144EUA NPN WITH	E2
TR102	B1GDCFNN0007	TRANSISTOR DTA144EUA PNP WITH	E2
TR200	2SD601AQSTX	TRANSISTOR 150MHZ 25V 200MW	A1
TR203	B1GDCFNN0007	TRANSISTOR DTA144EUA PNP WITH	E2
TR204	B1GDCFEM0002	TRANSISTOR DTA123JKA PNP WITH	E2

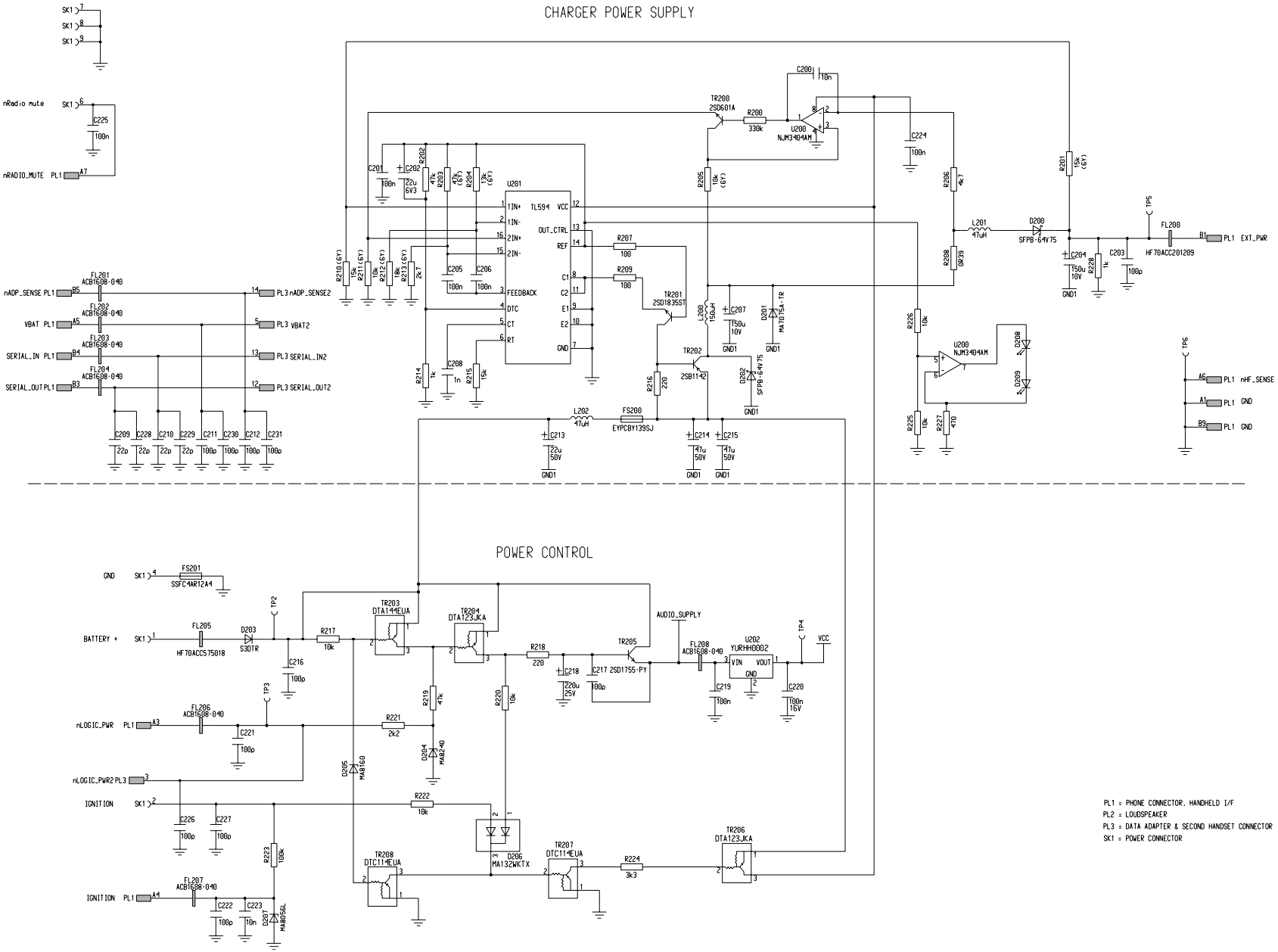
Model: HFGD70AS02		Name: Handsfree PCB Assembly	
Ref	Part Number	Description	Grid
TR205	2SD17550PL	TRANSISTOR 50MHZ 60V	D3
TR206	B1GDCFEM0002	TRANSISTOR DTA123JKA PNP WITH	D2
TR207	DTC114EUAT06	TRANSISTOR DTC114EUA NPN WITH	D2
TR208	DTC114EUAT06	TRANSISTOR DTC114EUA NPN WITH	D2
U100	C0JBAS000061	IC C2MOS BILATERAL SWITCH 200m	A4
U101	C0ABAB000015	IC NJM2107F SINGLE OP AMP SMD	A4
U102	C0ABAB000015	IC NJM2107F SINGLE OP AMP SMD	F2
U103	C0ABAB000015	IC NJM2107F SINGLE OP AMP SMD	F1
U104	C0JBAS000061	IC C2MOS BILATERAL SWITCH 200m	E1
U105	C0ABAB000015	IC NJM2107F SINGLE OP AMP SMD	F1
U106	C0JBAD000091	IC TC74HC27AFN T 3I/P NOR GATE	E1
U107	C0JBAD000092	IC TC74HC02AFN Q 2I/P NOR GATE	E2
U114	C0JBAS000061	IC C2MOS BILATERAL SWITCH 200m	C3
U115	C0ABAB000015	IC NJM2107F SINGLE OP AMP SMD	D1
U116	C0JBAS000061	IC C2MOS BILATERAL SWITCH 200m	C3
U117	C0ABBA000054	IC NJM3414AM DUAL OP AMP SMD D	C3
U118	C0JBAC000109	IC TC7S00FU NAND GATE SMD SSOP	E1
U200	C0ABBA000027	INTEGRATED CIRCUIT DUAL CPE AM	B2
U201	C1CB00000531	5V 300KHz IC	A1
U202	C0CBADC00011	REGULATOR 3 TERMINAL TYPE	C3

8 CIRCUIT DIAGRAMS

8.1 Audio Circuits



8.2 Power Supply and Charging Circuits



9 LAYOUT DIAGRAMS