

# KENWOOD

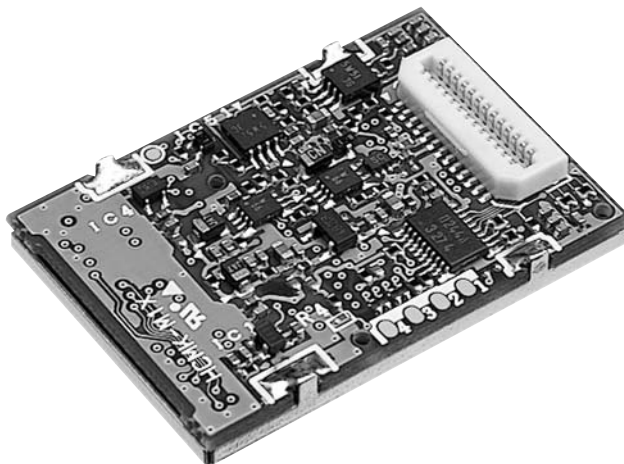
## **Document Copyrights**

Copyright 2006 by Kenwood Corporation. All rights reserved.

No part of this manual may be reproduced, translated, distributed, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, for any purpose without the prior written permission of Kenwood.

## **Disclaimer**

While every precaution has been taken in the preparation of this manual, Kenwood assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained herein. Kenwood reserves the right to make changes to any products herein at any time for improvement purposes.



---

## CONTENTS

---

### CIRCUIT DESCRIPTION

Recording/Playback Operation .....	2
I/O Ports .....	2
Beat Shift Circuit .....	3
Amateur Transceiver Identification .....	3

### SEMICONDUCTOR DATA

MCU : HD6433024D01TE (IC2) .....	4
Reset IC : S-80930CNNBG80 (IC1) .....	5
Analog Switch : TC7W66FK (IC53, IC54) .....	5
Bus Switch with Level Shifting : TC7MBD3244AFK (IC57) .....	5

### COMPONENTS DESCRIPTION .....

### PARTS LIST .....

### PC BOARD

ACCESSORY UNIT (X42-3250-60) .....	8
------------------------------------	---

### SCHEMATIC DIAGRAM .....

### TERMINAL FUNCTION .....

BACK COVER

---

## CIRCUIT DESCRIPTION

### Recording/Playback Operation

#### ■ Recording

The audio signal input from the AI pin (CN1 pin 12) passes through a buffer amplifier (IC52 2/2) and goes to an anti-aliasing filter amplifier (IC52 1/2).

The audio signal is amplified by approx. 30 times by IC52 1/2 and unwanted signal components exceeding 4kHz are cut by an LPF.

The amplified audio signal is input to pin 78 of the MCU (IC2 : Micro Controller Unit).

The MCU converts the audio signal to a digital data (by 8kHz/8-bit sampling) and writes it into a flash memory (IC3, IC5).

When the input level of the AI pin is 100mVp-p, the MCU input becomes approx. 3Vp-p, and the maximum S/N can be achieved.

If a signal exceeding 100mVp-p is input to the AI pin, it is clipped by IC52 so that the MCU input does not exceed 3Vp-p to protect the MCU against over-voltage input.

#### ■ Playback and Prerecorded Voice

The audio signal saved in flash memory (IC3, IC5) is converted to an analog signal by the MCU (IC2) and output as a playback signal from pin 84.

This playback signal passes through two LPFs to cut harmonic components and is input to the attenuator circuit.

The attenuator circuit consists of analog switch ICs (IC53, IC54) and division resistors (R64, R66, R67, R71, R72).

The signal attenuated by the attenuator circuit is converted to a low impedance by an output buffer (IC55), then output from the AO pin (CN1 pin 11).

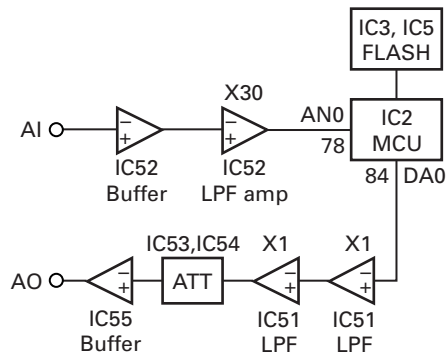


Fig. 1 Signal flow

#### ■ Attenuator Circuit

An attenuator circuit with division resistors is built by controlling four analog switches of IC53 and IC54 with pins 95 to 98 of the MCU (IC2).

The output level is changed in 8 steps with 4-bit data.

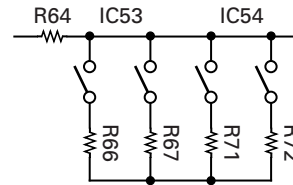


Fig. 2 ATT circuit

#### ■ Attenuator Circuit Control Table

	95pin PA2 ATT1	96pin PA3 ATT2	97pin PA4 ATT3	98pin PA5 ATT4	
Vol0	Lo	Lo	Lo	Lo	100%
Vol1	Hi	Lo	Lo	Lo	69%
Vol2	Lo	Hi	Lo	Lo	55%
Vol3	Hi	Hi	Lo	Lo	44%
Vol4	Lo	Lo	Hi	Lo	36%
Vol5	Lo	Hi	Hi	Lo	28%
Vol6	Lo	Lo	Lo	Hi	15%
Vol7	Lo	Lo	Hi	Hi	12%

### I/O Ports

The VGS-1 is a 3V system unit, but it can be adapted to both 3V and 5V systems for external connection devices with an 8-bit CMOS bus switch (IC57).

IC57 can convert levels from 3V to 3V, from 3V to 5V, or from 5V to 3V.

#### ■ If the External Device is a 3V System

It can be connected without a pull-up resistor.

#### ■ If the External Device is a 5V System

If the external connection device is a 5V system, the VGS-1 output ports (BUSY, SO, PLAY) must be pulled up to 5V. The waveform may become irregular due to IC57 output capacity and pull-up resistance.

BUSY and PLAY are Hi/Lo logic output ports and are not much affected by pull-up resistance.

Even when 3V or 5V is input to an input port, the IC57 output is 3V.

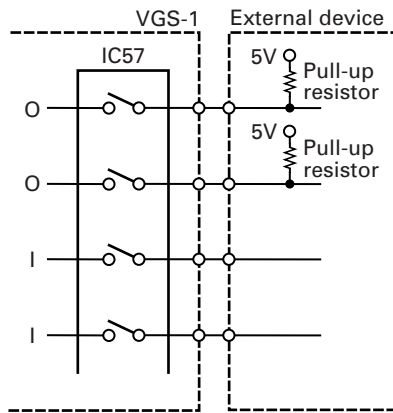
#### • UART Control

For UART control, the maximum communication speed is 115200 bps, and SO pull-up resistor recommends approx 10kΩ.

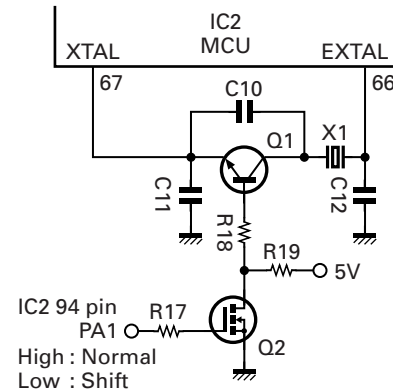
#### • Synchronous Control

SO is not used for synchronous control. Only PLAY and BUSY must be pulled up.

## CIRCUIT DESCRIPTION



**Fig. 3 External device, pull-up resistor**



**Fig. 4 Beat shift circuit**

### ■ AI Input Port

If input exceeds 100mVp-p, the input signal is clipped and distortion occurs.

It is necessary to make setting so that no signals exceeding 100mVp-p are input.

If the input level lowers, S/N decreases, so the maximum input not exceeding 100mVp-p must be used.

### ■ AO Output Port

When recording is performed with a 100mVp-p input, the playback output becomes an approx. 2.8Vp-p level.

If Pre-recorded Voice is generated, the output is approx 2Vp-p.

### Beat Shift Circuit

To prevent VGS-1 clock oscillation for the MCU (IC2) from causing spurious reception to transceivers to which VGS-1 is connected, the clock oscillator (11.0592MHz) has a beat shift circuit with a transistor switch (Q1).

### ■ Beat Shift Circuit Off

Pin 94 of the MCU (IC2) goes Low level, Q2 turns off, and Q1 turns on because a 5V bias is applied to its base. In this condition, C10 is shorted, so the oscillation frequency is unchanged.

### ■ Beat Shift Circuit On

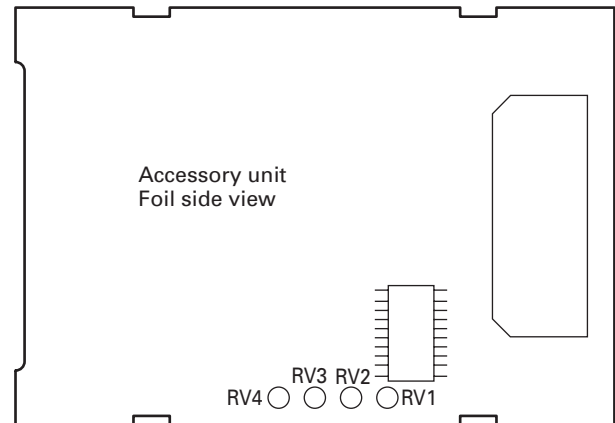
Pin 94 of the MCU goes High level, Q2 turns on, and Q1 turns off because its base is pulled down to GND. In this condition, C10 is connected in series to the crystal oscillator and the oscillation frequency increases by approx. 150ppm.

### Amateur Transceiver Identification

The VGS-1 can be set as an amateur transceiver or a Land Mobile Radio transceiver in the factory.

When it is used as a Land Mobile Radio transceiver, internal data in the VGS-1 is changed to suit the Land Mobile Radio transceiver, so it cannot be used as an amateur transceiver.

The VGS-1 set as a Land Mobile Radio transceiver can be identified because the RV4 land on the PCB is at High level. The default is Low level.



**Fig. 5 RV4**

## SEMICONDUCTOR DATA

## MCU : HD6433024D01TE (IC2)

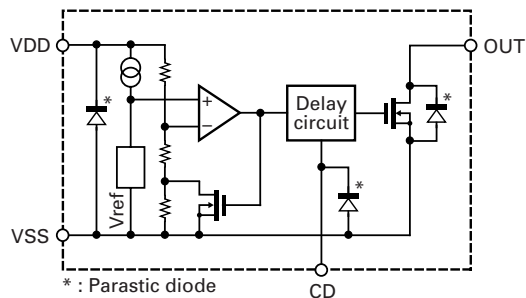
Pin No.	Port Name	I/O	Function	Remarks
1	VCC1	I	3.3V	
2	BUSY	O	Busy state output	Hi : BUSY
3	PLAY	O	Playback state output	Hi : PLAY
4~9	NC	O	Not used	
10	FWE	O	Not used	Pull Down
11	VSS1	I	GND	
12	NC	O	Not used	
13	TXD1	O	Serial data output	
14	RXD0	I	Not used	Pull Up
15	RXD1	I	Serial data input	
16	NC	O	Not used	
17	SCK1	I	Serial clock input	
18~20	RV1~RV3	I/O		
21	RV4	O	AMR correspondence output	Lo : For AMR
22	VSS2	I	GND	
23	NC	O	Not used	
24	USEL	I	UART bit rate selection	Lo : 19200bps, Hi : 115200bps
25	SELF	I	Transceiver connection selection	Lo : Transceiver connected
26	P47	I		Lo
27~34	D8~D15	I/O	Data bus	↔ IC3 · IC5
35	VCC2	I	3.3V	
36~43	A0~A7	O	Address bus	→ IC3 · IC5
44	VSS3	I	GND	
45~56	A8~A19	O	Address bus	→ IC3 · IC5
57	VSS4	I	GND	
58	_WAIT	I	Not used	Pull Up
59	_BREQ	I	Not used	Pull Up
60	NC	O	Not used	
61	fai	O	For system clock frequency check	
62	_STBY	I	Not used	Pull Up
63	RESET	I	Reset input	Lo : RESET
64	NMI	I	Not used	Pull Up
65	VSS5	I	GND	
66	EXTAL	I	System clock input	11.0592 MHz
67	XTAL	I	System clock input	11.0592 MHz
68	VCC3	I	3.3V	
69	NC	O	Not used	
70	OE	O	SRAM/Flash memory read output	Lo : Read, → IC3 · IC5
71	WE	O	SRAM/Flash memory write output	Lo : Write, → IC3 · IC5
72	NC	O	Not used	
73	MD0	I	Microcomputer operation mode input 0	Hi
74	MD1	I	Microcomputer operation mode input 1	Lo
75	MD2	I	Microcomputer operation mode input 2	Hi
76	AVCC	I	3.3V	Analog power supply
77	VREF	I	3.3V	Analog reference voltage

## SEMICONDUCTOR DATA

Pin No.	Port Name	I/O	Function	Remarks
78	AN0	I	A/D conversion (Voice input)	
79~83	AN1~AN5	I	Not used	Pull Down
84	DA0	O	D/A conversion (Voice output)	
85	NC	O	Not used	
86	AVSS	I	GND	Analog GND
87	EN	I	Enable input/Power save release interruption	Lo : Enable
88	_CS3	O	Chip select output (IC5)	Lo : Chip select
89	_CS2	O	Chip select output (IC3)	Lo : Chip select
90	_CS1	O	Chip select output (SRAM)	Lo : Chip select
91	NC	O	Not used	
92	VSS6	I	GND	
93	RD/_BY	I	Flash memory busy input	Lo : BUSY (Erasing / Writing), ← IC3 · IC5
94	PA1	O	Beat shift control	Hi : ON
95~98	ATT1~ATT4	O	Voice output attenuation control	Hi : ON
99	AFM	O	Voice output mute control	Hi : ON
100	A20	O	Address bus	→ IC3 · IC5

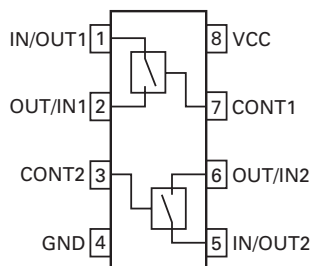
### Reset IC : S-80930CNNBG80 (IC1)

#### ■ Block Diagram



### Analog Switch : TC7W66FK (IC53, IC54)

#### ■ Block Diagram



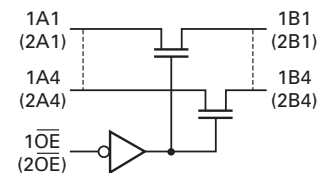
#### ■ Truth Value Table

CONTROL	SWITCH FUNCTION
H	ON
L	OFF

### Bus Switch with Level Shifting

#### : TC7MBD3244AFK (IC57)

#### ■ System Figure



#### ■ Truth Value Table

Input $\overline{OE}$	Function
L	A port = B port
H	Disconnect

## COMPONENTS DESCRIPTION / PARTS LIST

### Accessory Unit (X42-3250-60)

Ref.No.	Use / Fncion	Opration / Condition
Q1	SW : 3V→5V Level Shifting	When the beat shift is operating : ON
Q2	Beat Shift Switch	When the beat shift is operating : OFF
Q51	Audio Mute Switch	When a playback output is completed : ON
IC1	Reset	For MCU (IC2) and Flash memory (IC3, IC5)
IC2	MCU	
IC3	SRAM with Flash memory	Firmware and data record
IC4	Inverter	Switching SRAM of IC3 and IC5
IC5	SRAM with Flash memory	Firmware and data record
IC51	Low Pass Filter	LPF for a playback output
IC52	Buffer + Filter AMP	For recording input signals
IC53	Analog Switch	Attenuator Control
IC54	Analog Switch	Attenuator Control
IC55	Buffer	Buffer for a playback output
IC56	3V Regulator	3V Power Supply
IC57	Bus Switch with Level Shifting	3V↔5V Level Shifting & 3V↔3V Bus Switch

\* New Parts.  $\Delta$  indicates safety critical components.  
 Parts without **Parts No.** are not supplied.  
 Les articles non mentionnes dans le **Parts No.** ne sont pas fournis.  
 Teile ohne **Parts No.** werden nicht geliefert.

**K** : USA  
**T** : England  
**X** : Australia  
**W** : World  
**P** : Canada  
**E** : Europe  
**M** : Other Areas  
**M** : South East Asia

### VGS-1 ACCESSORY UNIT (X42-3250-60)

Ref. No.	Address	New parts	Parts No.	Description	Desti-nation
<b>VGS-1</b>					
			B62-1741-00	INSTRUCTION MANUAL	
			F10-2492-04	SHIELDING COVER	
		*	G13-1974-04	CUSHION (21X21X1.0)	
		*	G13-1992-04	CUSHION (21X21X2.5)	
		*	G13-1993-04	CUSHION (20X30X2.0)	
		*	G13-1994-04	CUSHION (20X30X12)	
		*	G13-1995-04	CUSHION (20X30X1.0)	
<b>ACCESSORY UNIT (X42-3250-60)</b>					
C1			CK73GB1A105K	CHIP C 1.0UF K	
C2			CC73HCH1H101J	CHIP C 100PF J	
C3			CK73HB1H471K	CHIP C 470PF K	
C4			CK73HB1A104K	CHIP C 0.10UF K	
C5			CK73HB1C103K	CHIP C 0.010UF K	
C6			CK73HB1A104K	CHIP C 0.10UF K	
C7			CC73HCH1H101J	CHIP C 100PF J	
C8			CK73GB1A105K	CHIP C 1.0UF K	
C9			CK73HB1H102K	CHIP C 1000PF K	
C10			CC73HCH1H030B	CHIP C 3.0PF B	
C11,12			CC73HCH1H150J	CHIP C 15PF J	
C13			CK73HB1A104K	CHIP C 0.10UF K	
C14			CK73HB1H471K	CHIP C 470PF K	
C15			CK73HB1A104K	CHIP C 0.10UF K	
C16			CK73HB1H471K	CHIP C 470PF K	
C51			CK73GB1A105K	CHIP C 1.0UF K	
C52			CK73HB1C822K	CHIP C 8200PF K	
C53			CK73HB1H102K	CHIP C 1000PF K	
C54			CK73HB1C822K	CHIP C 8200PF K	
C55			CK73HB1A104K	CHIP C 0.10UF K	
C56			CK73HB1H102K	CHIP C 1000PF K	
C57			CK73HB1H681K	CHIP C 680PF K	
C58			CK73HB1C103K	CHIP C 0.010UF K	
C59			CC73HCH1H101J	CHIP C 100PF J	
C60			CK73HB1C103K	CHIP C 0.010UF K	
C61			CC73HCH1H101J	CHIP C 100PF J	
C62			CK73HB1A104K	CHIP C 0.10UF K	
C63			C92-0772-05	CHIP-TAN 10UF 6.3WV	
C64			CC73HCH1H101J	CHIP C 100PF J	
C65			CK73HB1C103K	CHIP C 0.010UF K	
C66			CC73HCH1H101J	CHIP C 100PF J	
C67			CK73HB1A104K	CHIP C 0.10UF K	

## PARTS LIST

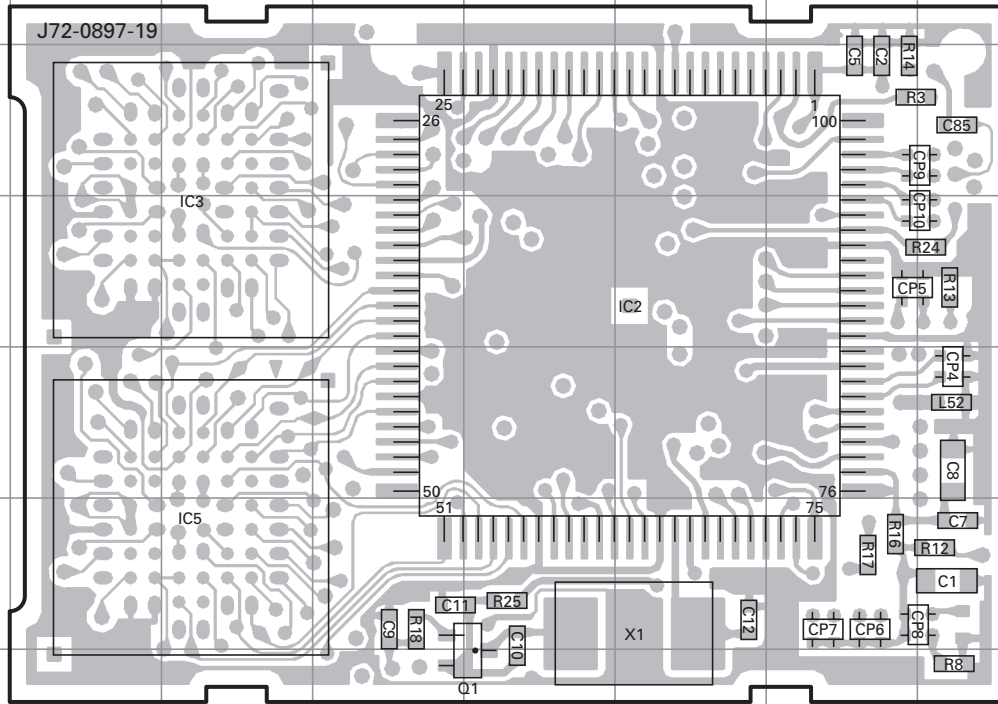
### ACCESSORY UNIT (X42-3250-60)

Ref. No.	Address	New parts	Parts No.	Description	Desti-nation	Ref. No.	Address	New parts	Parts No.	Description	Desti-nation
C68			CK73HB1C103K	CHIP C 0.010UF K		R72			RK73HB1J123J	CHIP R 12K J 1/16W	
C69			C92-0772-05	CHIP-TAN 10UF 6.3VW		R74,75			RK73HB1J103J	CHIP R 10K J 1/16W	
C70			CK73HB1H471K	CHIP C 470PF K		R76			RK73HB1J101J	CHIP R 100 J 1/16W	
C71			CK73GB1A105K	CHIP C 1.0UF K		R77			R92-1368-05	CHIP R 0 OHM	
C72			CK73HB1H471K	CHIP C 470PF K		R78			RK73HB1J101J	CHIP R 100 J 1/16W	
C73			CK73HB1A104K	CHIP C 0.10UF K		R87			RK73HB1J474J	CHIP R 470K J 1/16W	
C74			CK73GB1A105K	CHIP C 1.0UF K		R88			RK73HB1J105J	CHIP R 1.0M J 1/16W	
C75			CC73HCH1H101J	CHIP C 100PF J		R89			RK73HB1J103J	CHIP R 10K J 1/16W	
C76,77			CK73HB1H102K	CHIP C 1000PF K		R91			RK73HB1J224J	CHIP R 220K J 1/16W	
C78			CK73HB1H471K	CHIP C 470PF K		R92			R92-1368-05	CHIP R 0 OHM	
C80			CK73HB1H471K	CHIP C 470PF K		IC1			S-80930CNNBG80	MOS IC	
C82,83			CK73HB1H471K	CHIP C 470PF K		IC2		*	HD6433024D01TE	MCU	
C84,85			CK73HB1H102K	CHIP C 1000PF K		IC3		*	MB84VD21091KW2	ROM IC	
C86			C92-0634-05	CHIP-TAN 0.33UF 16VW		IC4			TC7S04FU	MOS IC	
C87			CK73HB1A104K	CHIP C 0.10UF K		IC5		*	MB84VD21091KW2	ROM IC	
C88			CK73HB1C103K	CHIP C 0.010UF K		IC51,52			TC75W51FU	MOS IC	
C89			CK73HB1H102K	CHIP C 1000PF K		IC53,54			TC7W66FK	MOS IC	
C90			CK73HB1E472K	CHIP C 4700PF K		IC55			TC75S51FE	MOS IC	
CN1		*	E40-6358-05	PIN ASSY SOCKET		IC56			XC6204B332M	MOS IC	
L51-53			L92-0163-05	BEADS CORE		IC57		*	TC7MBD3244AFK	MOS IC	
X1		*	L77-1950-05	CRYSTAL RESONATOR (11.0592MHZ)		Q1			DTC114YE	DIGITAL TRANSISTOR	
CP3			RK75HA1J103J	CHIP-COM 10K J 1/16W		Q2			2SK1824	FET	
CP4-10			RK75HA1J473J	CHIP-COM 47K J 1/16W		Q51			2SK1824	FET	
CP51,52			RK75HA1J472J	CHIP-COM 4.7K J 1/16W							
CP54-57			RK75HA1J561J	CHIP-COM 560 J 1/16W							
R1			RK73HB1J224J	CHIP R 220K J 1/16W							
R2			RK73HB1J103J	CHIP R 10K J 1/16W							
R3			RK73HB1J472J	CHIP R 4.7K J 1/16W							
R4			R92-1368-05	CHIP R 0 OHM							
R5			RK73HB1J224J	CHIP R 220K J 1/16W							
R6			RK73HB1J104J	CHIP R 100K J 1/16W							
R8			R92-1368-05	CHIP R 0 OHM							
R12			RK73HB1J104J	CHIP R 100K J 1/16W							
R13			RK73HB1J473J	CHIP R 47K J 1/16W							
R14			RK73HB1J224J	CHIP R 220K J 1/16W							
R16			RK73HB1J100J	CHIP R 10 J 1/16W							
R17			RK73HB1J472J	CHIP R 4.7K J 1/16W							
R18			R92-1368-05	CHIP R 0 OHM							
R19			RK73HB1J103J	CHIP R 10K J 1/16W							
R23			R92-1368-05	CHIP R 0 OHM							
R24			RK73HB1J102J	CHIP R 1.0K J 1/16W							
R25			R92-1368-05	CHIP R 0 OHM							
R27,28			R92-1368-05	CHIP R 0 OHM							
R51-53			RK73HB1J223J	CHIP R 22K J 1/16W							
R54			RK73HB1J472J	CHIP R 4.7K J 1/16W							
R55			RK73HB1J473J	CHIP R 47K J 1/16W							
R56-58			RK73HB1J223J	CHIP R 22K J 1/16W							
R59			RK73HB1J393J	CHIP R 39K J 1/16W							
R60			RK73HB1J473J	CHIP R 47K J 1/16W							
R61			RK73HB1J122J	CHIP R 1.2K J 1/16W							
R62			RK73HB1J152J	CHIP R 1.5K J 1/16W							
R63			RK73HB1J473J	CHIP R 47K J 1/16W							
R64			RK73HB1J103J	CHIP R 10K J 1/16W							
R66			RK73HB1J562J	CHIP R 5.6K J 1/16W							
R67			RK73HB1J182J	CHIP R 1.8K J 1/16W							
R69			RK73HB1J473J	CHIP R 47K J 1/16W							
R71			RK73HB1J223J	CHIP R 22K J 1/16W							

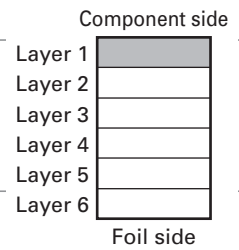


# VGS-1 PC BOARD

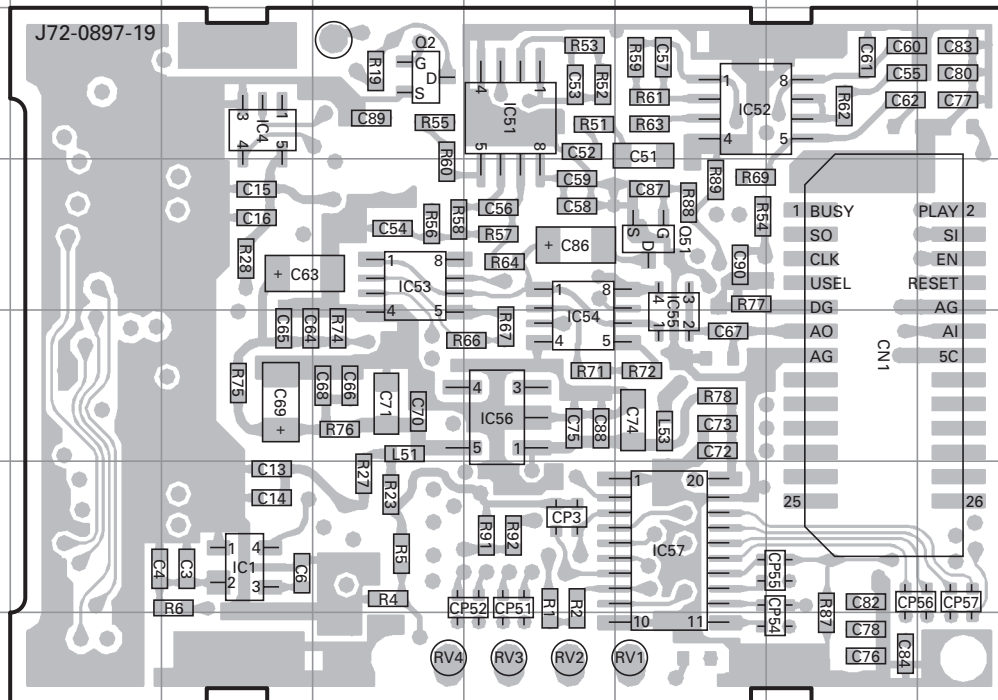
## ACCESSORY UNIT (X42-3250-60) Component side view (J72-0897-19)



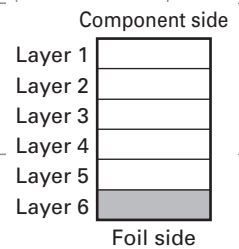
Ref. No.	Address
IC2	4F
IC3	4C
IC5	6C
Q1	7E



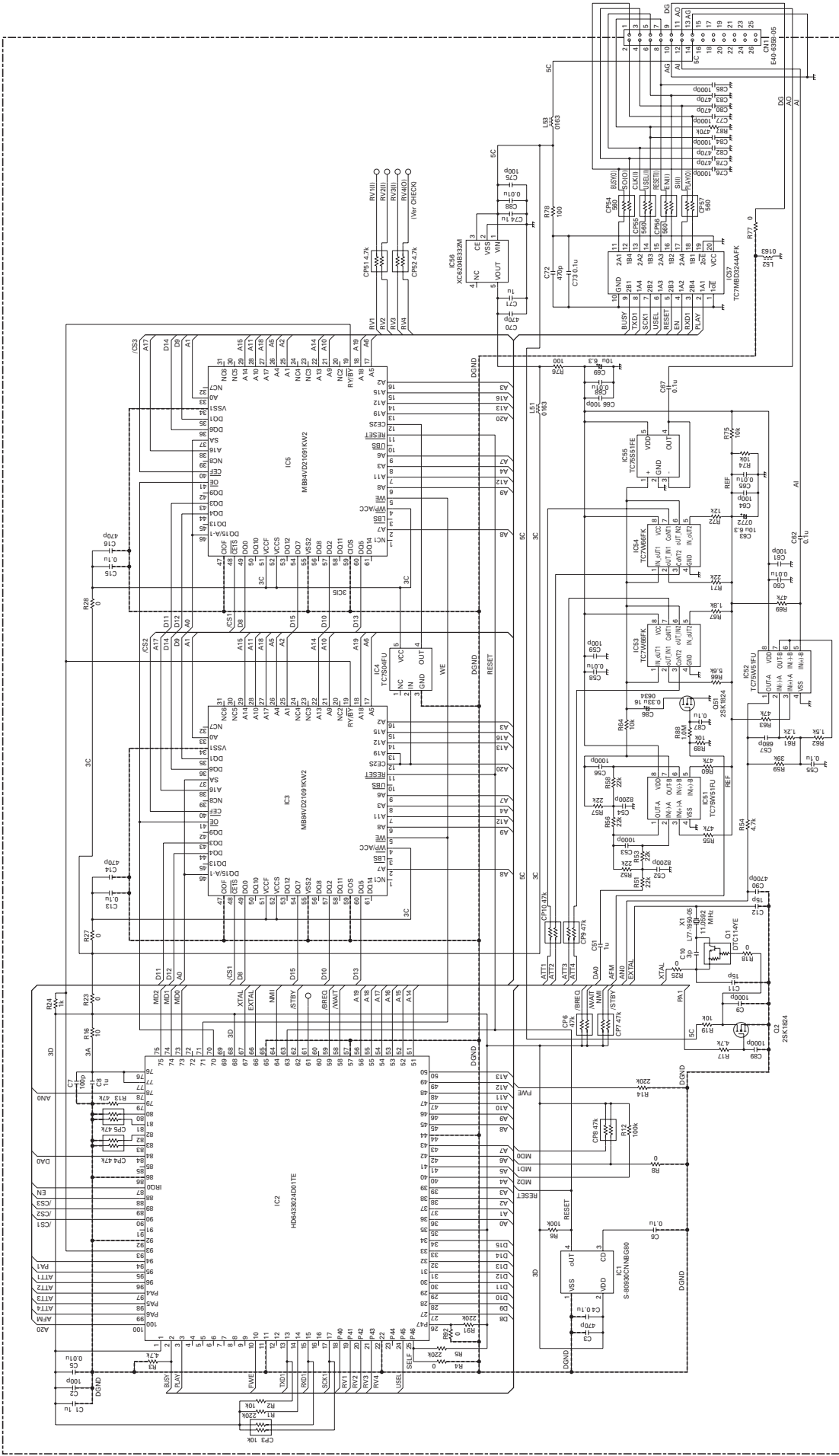
## ACCESSORY UNIT (X42-3250-60) Foil side view (J72-0897-19)



Ref. No.	Address
IC1	12C
IC4	9C
IC51	9E
IC52	9F
IC53	10D
IC54	11E
IC55	11F
IC56	11E
IC57	12F
Q2	9D
Q51	10F



# SCHEMATIC DIAGRAM VGS-1



1  
2  
3  
4  
5  
6  
7  
9

## TERMINAL FUNCTION

### Accessory Unit CN1

Pin No.	Name	I/O	Function	Remarks
1	BUSY	O	Busy signal output	Hi : During the Flash memory writing data/During communication command processing
2	PLAY	O	Playback signal output	Hi : During Playback Output
3	SO	O	Serial data output	Control command data input
4	SI	I	Serial data input	Control command data output (At the time of UART control)
5	CLK	I	Serial synchronous clock input	At the time of clock synchronous control
6	EN	I	Enable input	Lo : Enable/Power save release/Recording or Playback stop
7	USEL	I	Bit rate select signal input for UART	Hi : 115200bps, Lo : 19200bps
8	RST	I	Reset signal input	Lo : Reset
9	DGND	-	Digital GND	
10	AGND	-	Analog GND	
11	AO	O	Prerecorded Voice & Playback output	
12	AI	I	Recording voice input	
13	AGND	-	Analog GND	
14	5C	I	5V Regulator	
15~26			NC	

## KENWOOD CORPORATION

2967-3, Ishikawa-machi, Hachioji-shi, Tokyo, 192-8525 Japan

### KENWOOD U.S.A. CORPORATION

P.O. BOX 22745, 2201 East Dominguez Street, Long Beach, CA 90801-5745, U.S.A.

### KENWOOD ELECTRONICS CANADA INC.

6070 Kestrel Road, Mississauga, Ontario, Canada L5T 1S8

### KENWOOD ELECTRONICS DEUTSCHLAND GMBH

Rembrücker Str. 15, 63150 Heusenstamm, Germany

### KENWOOD ELECTRONICS BELGIUM N.V.

Leuvensesteenweg 248 J, 1800 Vilvoorde, Belgium

### KENWOOD ELECTRONICS FRANCE S.A.

13, Boulevard Ney, 75018 Paris, France

### KENWOOD ELECTRONICS U.K. LIMITED

KENWOOD House, Dwight Road, Watford, Herts., WD18 9EB United Kingdom

### KENWOOD ELECTRONICS EUROPE B.V.

Amsterdamsesweg 37, 1422 AC Uithoorn, The Netherlands

### KENWOOD ELECTRONICS ITALIA S.p.A.

Via G. Sirtori, 7/9 20129 Milano, Italy

### KENWOOD IBERICA S.A.

Bolivia, 239-08020 Barcelona, Spain

### KENWOOD ELECTRONICS AUSTRALIA PTY. LTD.

(A.C.N. 001 499 074)

16 Giffnock Avenue, Centrecourt Estate, North Ryde, N.S.W. 2113 Australia

### KENWOOD ELECTRONICS (HONG KONG) LTD.

Unit 3712-3724, Level 37, Tower one Metroplaza, 223 Hing Fong Road, Kwai Fong, N.T., Hong Kong

### KENWOOD ELECTRONICS TECHNOLOGIES(S) PTE LTD.

Sales Marketing Division

1 Ang Mo Kio Street 63, Singapore 569110

