IC for Multifunction Telephones
Monolithic IC LAG639

Outline

This IC was developed for use in home-use telephone and small-scale telephone systems, and incorporates data transmission functions (AMI).

Features

1. Incorporates efficient switching regulator with broad input voltage range
   V_{OUT} 5V±0.25 I_L 250mA (13~45V)
   V_{IN} 15~45V
2. Internal data transmission/reception circuits
   Data can be superposed on the power supply line for transmission.
   AMI format is used for transmission route coding.
3. Internal system reset circuit
   5V line abnormal voltage detection circuit
   Watchdog timer reset circuit
4. Internal speaker amp
   260 mW typ. at 8Ω load
   Mute pin
5. Internal beep sound generator circuit
   With pin to vary audio volume (also used to turn beep sound on and off)

Package

SDIP-30A (LAG639D)

Absolute Maximum Ratings (Ta=25℃)

Item	Symbol	Ratings	Units
Operating temperature	T_{OPR}	–20~+70	℃
Storage tempereture	T_{STG}	–40~+125	℃
Power supply voltage	V_{CC} max.	46	V
Allowable loss	Pd	750	mW

Electrical Characteristics (Except where noted otherwise, Ta=25°C, V_{CC}=30V)

Item	Symbol	Measurement circuit	Measurement conditions	Min.	Typ.	Max.	Units
SWR unit							
Output voltage	V_{O1}	1	V_{CC}=15~45V I_L=0~250mA	4.75	5.00	5.25	V
Output voltage	V_{O2}	1	V_{CC}=13~45V I_L=0~200mA	4.70	5.00	5.25	V
Output ripple voltage	Vr	1	I_L=250mA			50	mV_{P-P}
Reactive current	I_{CCQ}	1	I_L=0mA Amp & reception off		6	10	mA
SWR transmission frequency	F_{OSC}	1			80		kHz
Output current on short-circuit	I_{OS}	1	R_S=0.2Ω	70	110	150	mA
Power supply voltage detection unit							
Detection voltage	V_S	2	*	4.30	4.50	4.80	V
Detection drop voltage	$\triangle V_S$	2	$\triangle$ V_S=Vo–V_S	0.2			V
Output current while on	IR_{ON}	2	Vo=4V	10	20		mA
Leakage output current while off	IR_{OFF}	2	Vo=5.25V			1	µA

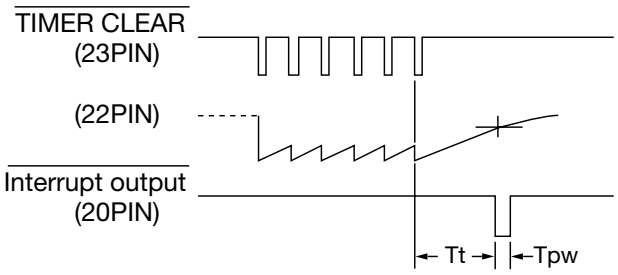
Note: The asterisk (*) indicates that the power supply voltage detection unit characteristics are standards in the transient power on/off states. However, for convenience the detection voltage is taken to be the value of V_O when V_O in measurement circuit 2 is varied and the pin 6 output state is switched from off to on.

Electrical Characteristics (Except where noted otherwise, Ta=25°C, V_{CC}=30V Faudio=1kHz)

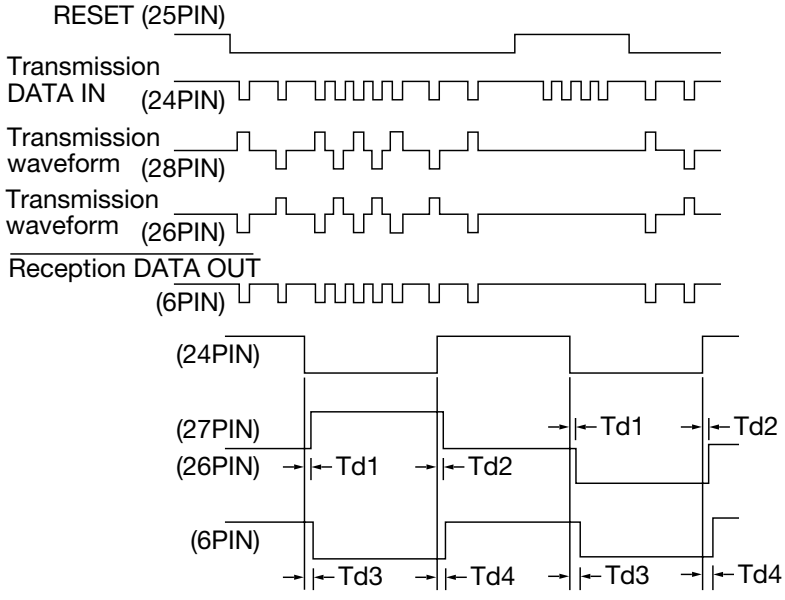
Item	Symbol	Measurement circuit	Measurement conditions	Min.	Typ.	Max.	Units
Power amp unit							
Amp gain	G_V	1	Voa=0.775Vrms	35	38	41	dB
Maximum distortion-free output	P_O max.	1	THD=10%	150	260		mV
Distortion	THD	1	P_O=100mW			2	%
Attenuation at 100 Hz	GF1/GF0	1	F_O=1kHz, Fl=100Hz Voa=0.775Vrms		–14		dB
Attenuation at 10 Hz	GF2/GF0	1	F2=10 kHz, above conditions		–8		dB
Input IMP1	$R_{IN}1$	3	Mute off	10	15		kΩ
Input IMP2	$R_{IN}2$	3	Mute on	2.5	3.5		kΩ
Residual noise 1	Vno1	1	Mute on AUDIO IN 20mVrms IL=10 70mA 1.5kHz Transmission unit ON Ft=1kHz			0.5	mVrms
Residual noise 2	Vno2	1	Mute off AUDIO OFF IL=10 70mA 1.5kHz Transmission unit ON Ft=1kHz			1.2	mVrms

Item	Symbol	Measurement circuit	Measurement conditions	Min.	Typ.	Max.	Units
Beep sound generator unit							
Beep sound frequency	Fb	1		0.85	1.0	1.15	kHz
Beep off switching point	Ibsw	1	Pin 9 input current	20	35	48	µA
Beep sound output 1	Vob1	1	Pin 9 connected to GND through 4.7k Amp output voltage	1.0	1.4	1.8	Vrms
Beep sound output 2	Vob2	1	Pin 9 connected to GND through 47k	0.11	0.16	0.22	Vrms
Watchdog timer unit							
Timer time	Tt	1	cf. watchdog timer waveform diagram	0.8	1.0	1.2	S
Output pulse width	T_{PW}	1	cf. watchdog timer waveform diagram T=beep sound period	0.45 (1/2T)		1.1 (1T)	mS
Output voltage while on	V_{WON}	1				0.5	V
Leakage output current while off	I_{WOFF}	1				1	µA
Transmission circuit unit							
Transmission output voltage	Vto	1	Both pins 27 and 28	3.8	4.2	4.6	V_{P-P}
Transmission waveform symmetry	Vtr	1	Vt1/Vt2	0.75	1	1.25	
Reception sensitivity	Vrs	1		1.0	1.2	1.5	V_{P-P}
Noise resistance	Vrn	1	Level at which no errors are output	0.8			V_{P-P}
Input IMP	$R_{IN}3$	3	Both pins 7and 8	25	36	46	kΩ
Transmission delay time	Td1	1	cf. transmit/receive waveform diagrams		0.5		µS
Transmission delay time	Td2	1	cf. transmit/receive waveform diagrams		0.4		µS
Transmission delay time	Td3	1	cf. transmit/receive waveform diagrams		1.2		µS
Transmission delay time	Td4	1	cf. transmit/receive waveform diagrams		1.5		µS
Reception output H voltage	VroH	1		4			V
Reception output L voltage	VroL	1				0.5	V
Transmission waveform LOSS 1	Vtloss1	1	Vt=5V applied, power on	4.5			V_{P-P}
Transmission waveform LOSS 2	Vtloss2	1	Vt=5V applied, power off	4.5			V_{P-P}
General logic unit characteristics							
H level input voltage	ViH	3		2.4			V
L level input voltage	ViL	3				0.8	V
H level input current	IiH	3	V_{IN}=2.4V			10	µA
L level input current	IiL	3	V_{IN}=0.4V			–300	µA

Watchdog timer waveform

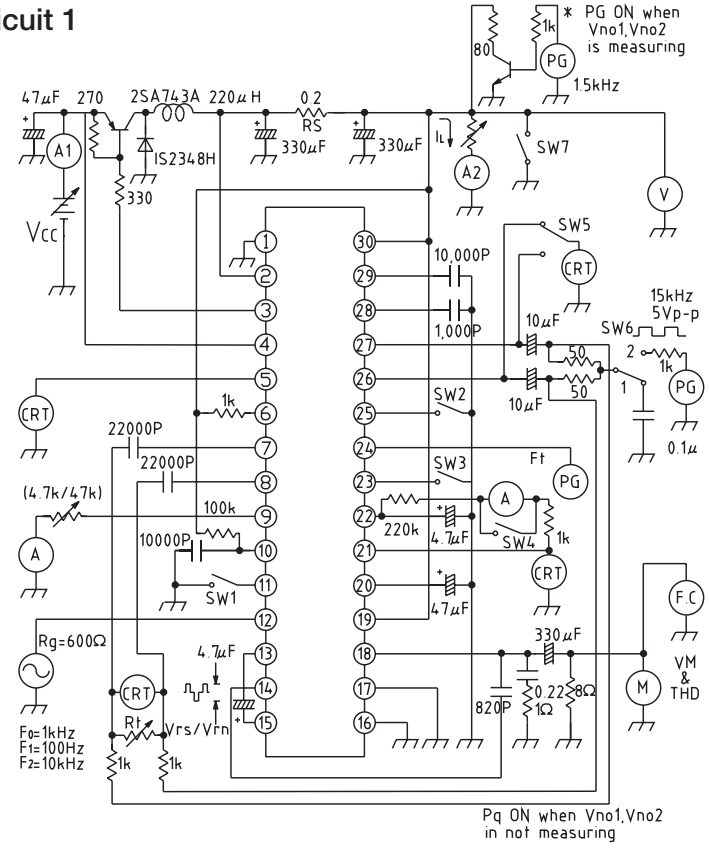


Transmission/Reception waveform

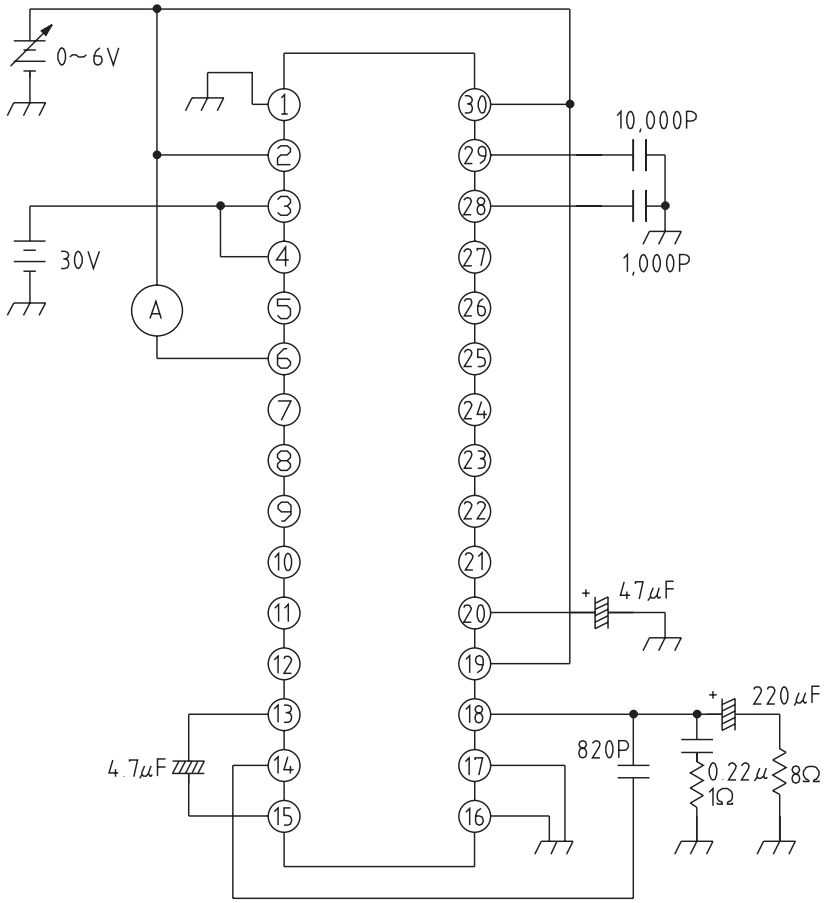


Measuring Circuit

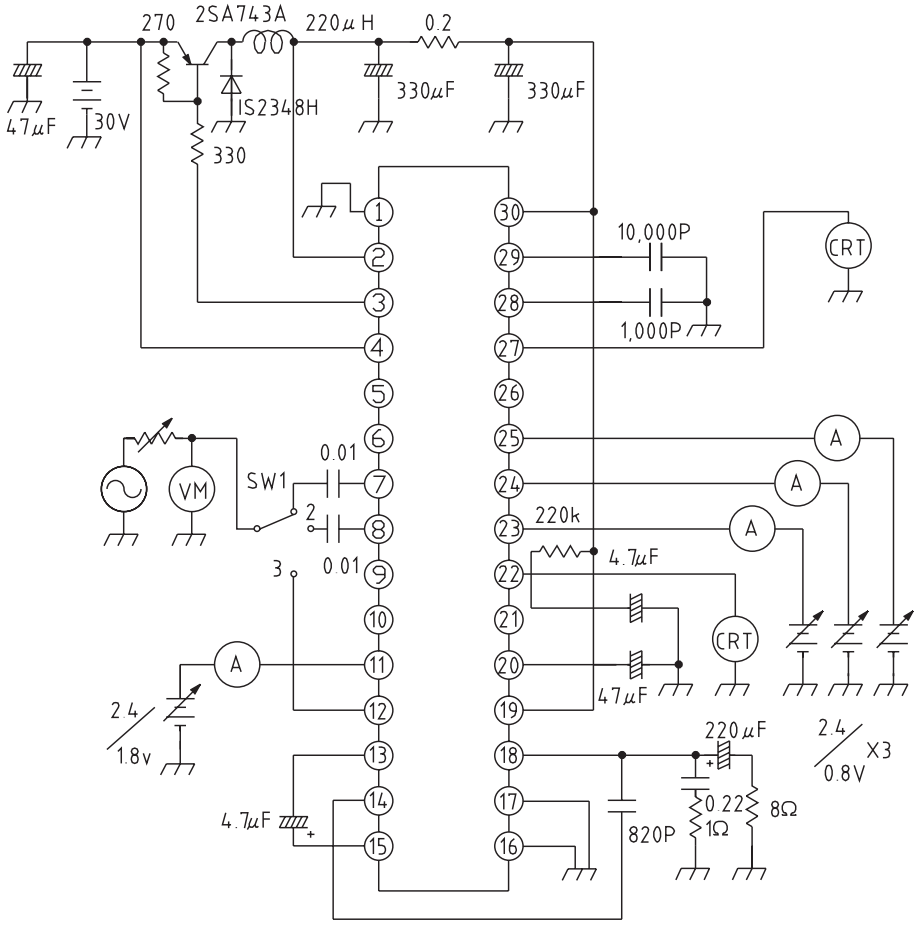
Measuring Cuicuit 1



Measuring Cuicuit 2



Measuring Cuicuit 3

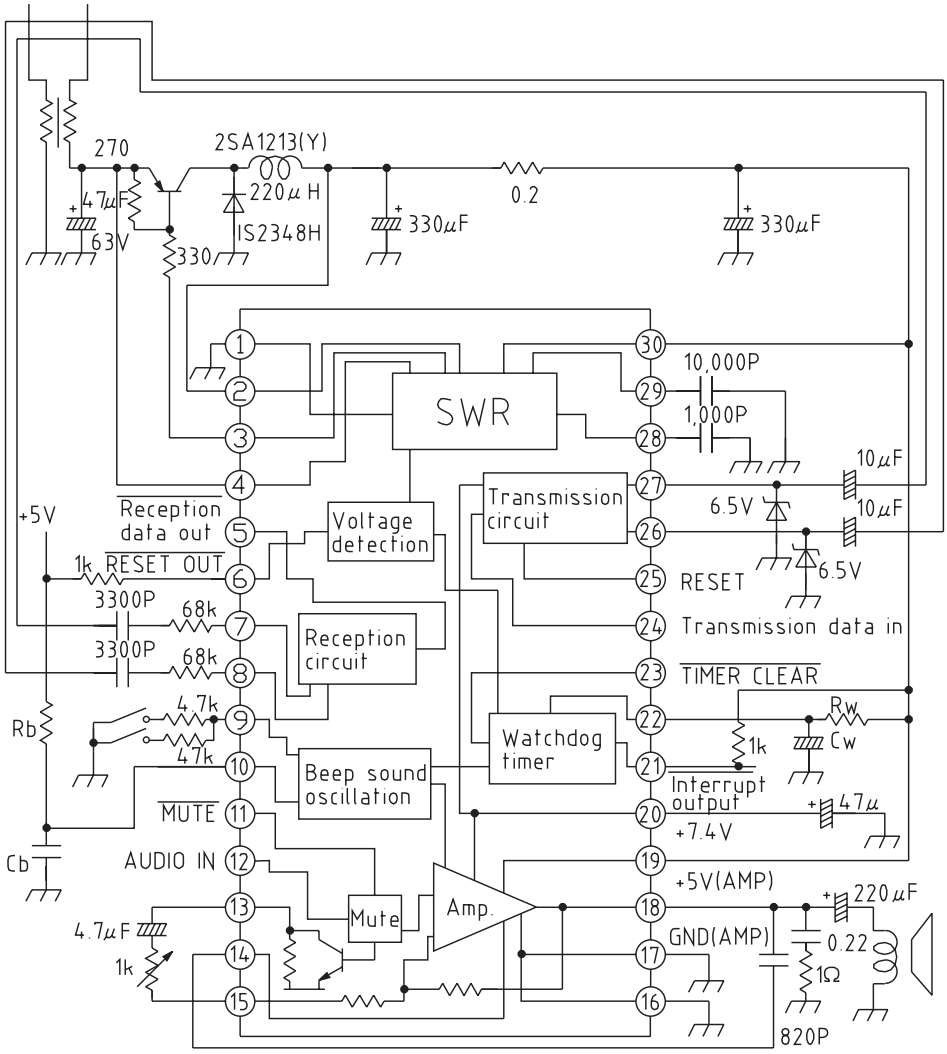


Switch Operation (Measurement circuit 1)

Measurement item	SW1	SW2	SW3	SW4	SW5	SW6	Other conditions
Vo1, Vo2	○	×	×	○	–	1	
Vr	○	×	×	○	–	1	No spike noise
Iccq	○	×	×	○	–	1	A1 only
Ios	○	×	×	○	–	1	A2 only
Gv, Po max., THD GF1/GF0, GF2/GF0	×	×	×	○	–	1	THD measured after passing through 400Hz-15kHz BPF
Vno1	○	○	×	○	–	1	Using 400Hz-15kHz BPF
Vno2	×	○	×	○	–	1	Using 400Hz-15kHz BPF
Fb, IbSW, Vob1, Vob2	○	×	×	○	–	1	
Tt, Tpw, Vwon	–	–	× ↓ ○	○	–	1	cf. watchdog timer waveform diagram
Iwoff	–	–	×	×	–	1	
Vto, Vtr	○	○	×	○	*	1	SW5-1, 2 measured
Vrs, Vrn	○	○	×	○	–	1	Measured with Rt adjusted
Td, VroH, VroL	○	○	×	○	–	1	cf. transmit/receive waveform diagrams
Vtloss 1	○	×	×	○	*	2	With power on, SW5-1, 2 measured
Vtloss 2	○	×	×	○	*	2	With power on, SW5-1, 2 measured

Note: Circles and X's mean the switch display should be on and off respectively; dashes (–) mean either state is allowed.

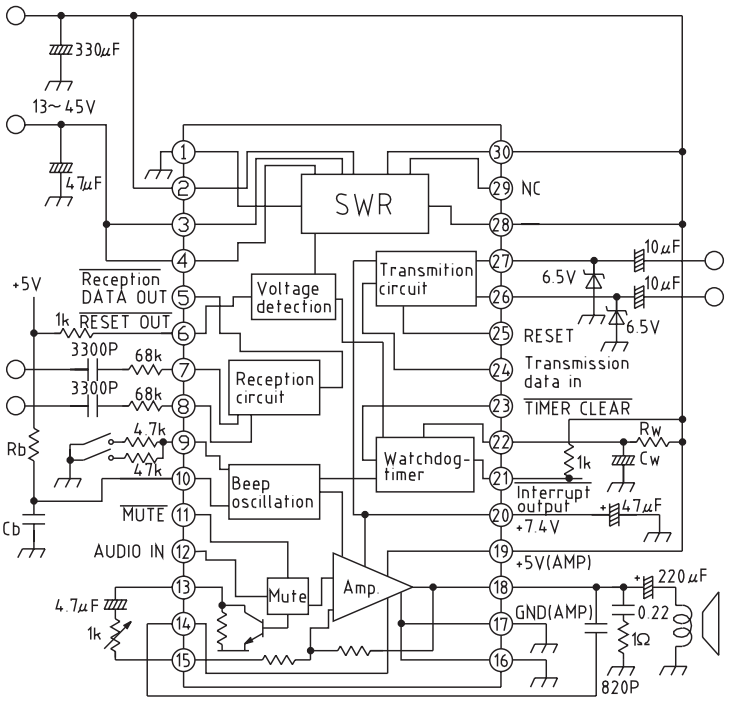
Block Diagram and Application Circuits



1. The watchdog timer time is determined by the values of Rw and Cw.
   Tt ≒ Rw•Cw where Rw is 56kΩ to 560kΩ
   Cw is between 0.01μF and 10μF
2. The beep sound frequency is determined by Rb and Cb.
   Fb ≒ 1/Rb•Cb where Rb is 56 kΩ to 330kΩ
   Cb is between 4700PF and 22,000PF.
3. The beep sound volume can be varied through the resistance connected to pin 10. At 4.7kΩ the voltage is approx. 4V_{P-P}, and at 47kΩ it is about 0.4V_{P-P}.
4. In overload protection operation the voltage across pins 1 to 30 is tested, with a limit of 100 ±20mV. On load shorting, the test voltage is dropped to about 1/4 to conserve power.

Additional application example 1

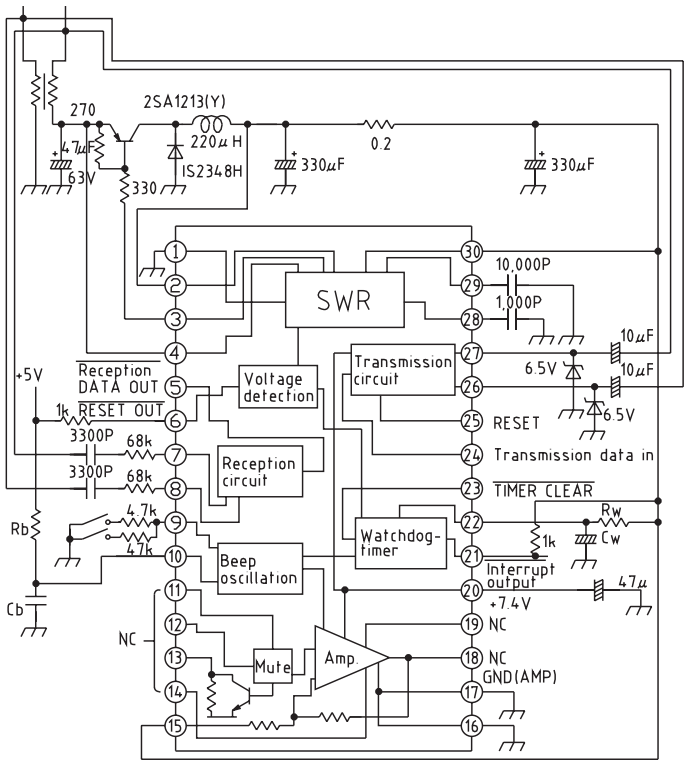
(SWR circuit not used)



Even when a 5V external voltage can be supplied, an addition voltage of 13 to 45V must be applied to pins 3 and 4 in order to obtain an internal biased power supply of 7.4V.

Additional application example 2

(Speaker amp not used)



In order to prevent abnormal oscillation of the amplification circuit, a 5V power supply must be connected to pin 15 to halt amplification functions.