

IC for Multifunction Telephones Monolithic IC LAG640

Outline

This IC was developed for use in multifunctional telephones with security features; it has the following functions.

Features

1. Incorporates efficient switching regulator with broad input voltage range
 V_{OUT} 5V \pm 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.
 Can be switched between two different input modes
3. Internal system reset circuit
 5V line abnormal voltage detection circuit
 Watchdog timer reset circuit
4. Internal speaker amp
 260 mW typ. at 8 Ω 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 (LAG640D)

Absolute Maximum Ratings (Ta=25°C)

Item	Symbol	Ratings	Units
Operating temperature	T _{OPR}	-20~+70	°C
Storage temperature	T _{STG}	-40~+125	°C
Power supply current	V _{CC} max.	46	V
Allowable loss	P _d	750	mW

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

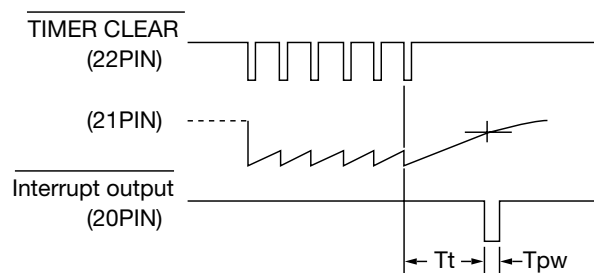
Item	Symbol	Measurement circuit	Measurement conditions	Min.	Typ.	Max.	Units
SWR unit							
Output voltage (5V)	V _{O1}	1	V _{CC} =15~45V I _L =0~250mA	4.75	5.00	5.25	V
Output voltage (5V)	V _{O2}	1	V _{CC} =13~45V I _L =0~200mA	4.70	5.00	5.25	V
Output ripple voltage	V _r	1	I _L =250mA			50	mV _{P-P}
Reactive current	I _{CCQ}	1	I _L =0mA Amp & Transmission unit		6	10	mA
SWR oscillation 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	ΔV _S	2	ΔV _S =V _O -V _S	0.2			V
Output current while on	I _{RON}	2	V _O =4V	10	20		mA
Leakage output current while off	I _{ROFF}	2	V _O =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 F_{audio}=1kHz)

Item	Symbol	Measurement circuit	Measurement conditions	Min.	Typ.	Max.	Units
Power amp unit							
Amp gain	G _V	1	V _{oa} =0.775V _{rms}	37	40	43	dB
Maximum distortion-free output	P _o max.	1	THD=10%	150	260		mV
Distortion	THD	1	P _o =100mW			5	%
Attenuation at 100 Hz	GF1/GF0	1	F _o =1kHz, F _l =100Hz V _{oa} =0.775V _{rms}		-14		dB
Attenuation at 10 Hz	GF2/GF0	1	F ₂ =10 kHz, above conditions		-8		dB
Input IMP 1	R _{IN1}	3	Mute off	10	15		kΩ
Input IMP 2	R _{IN2}	3	Mute on	2.5	3.5		kΩ
Residual noise 1	V _{no1}	1	Mute on AUDIO IN 20mV _{rms} I _L =10 70mA 1.5kHz Transmission unit on Ft=1kHz			0.5	mV _{rms}
Residual noise 2	V _{no2}	1	Mute off AUDIO OFF I _L =10 70mA 1.5kHz Transmission unit on Ft=1kHz			1.2	mV _{rms}
Beep sound generator unit							
Beep sound frequency	F _b	1		0.85	1.0	1.15	kHz
Beep off switching point	I _{bsw}	1	Pin 9 input current	20	35	48	μA
Beep sound output 1	V _{ob1}	1	Pin 9 connected to GND through 4.7k Amp output voltage	1.0	1.4	1.8	V _{rms}
Beep sound output 2	V _{ob2}	1	Pin 9 connected to GND through 47k	0.11	0.16	0.22	V _{rms}
Watchdog timer unit							
Timer time	T _t	1	cf. watchdog timer waveform diagram	2.4	3.0	3.6	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
Timer-clearing pulse width	T _{cl}	1		5			μS
Transmission circuit unit							
Transmission output voltage (1)	V _{to1}	2	R _L =110Ω, peak value across pins L3-L4	5.1	5.8	6.6	V _{p-p}
Transmission output voltage (2)	V _{to2}	2	R _L =1Ω, peak value across pins L3-L4	5.5	6.2	7.0	V _{p-p}
L3 pin voltage	V _{L3}	2	No signal	4.0	4.4	4.8	V
L4 pin voltage	V _{L4}	2	No signal	0.5	0.7	0.9	V
Reception sensitivity	V _{rs}	2		0.8	1.0	1.2	V _{p-p}
Input IMP	R _{IN3}	4	Both pins 7 and 8	14	20	26	kΩ
Transmission delay time	T _{d1}	2	cf. transmit/receive waveform diagrams		0.4		μS
Transmission delay time	T _{d2}	2	cf. transmit/receive waveform diagrams		0.4		μS
Transmission delay time	T _{d3}	2	cf. transmit/receive waveform diagrams		0.8		μS
Transmission delay time	T _{d4}	2	cf. transmit/receive waveform diagrams		0.8		μS
Reception output H voltage	V _{roH}	2	R _L =10kΩ	4.5			V
Reception output L voltage	V _{roL}	2	R _L =1.5kΩ			0.5	V
General logic unit characteristics							
H level input voltage	V _{IH}	3		2.4			V
L level input voltage	V _{IL}	3				0.8	V
H level input current	I _{IH}	3	V _{IN} =2.4V			10	μA
L level input current	I _{IL}	3	V _{IN} =0.4V			-300	μA

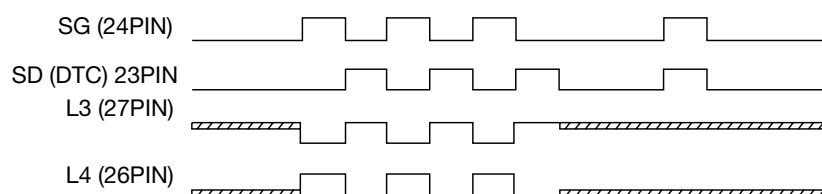
Watchdog Timer Waveform Diagrams



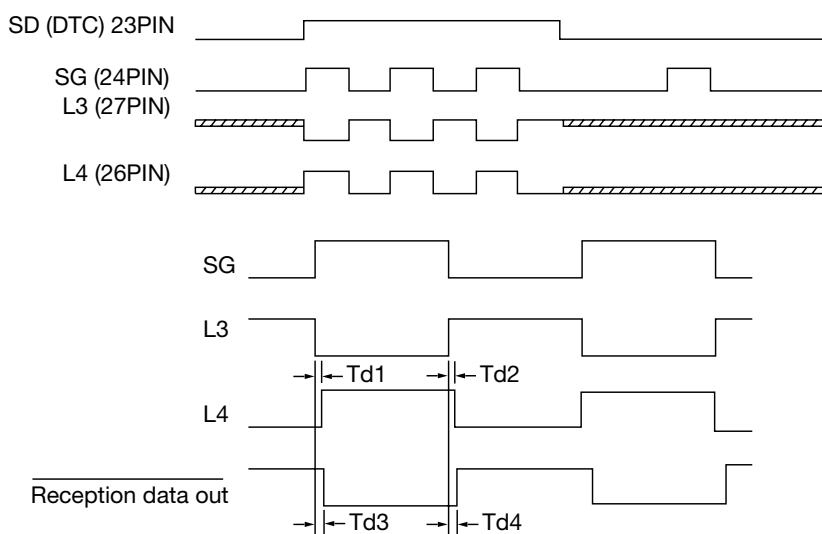
Note: Pulses to clear the timer must have a width of $5\mu s$ or more.

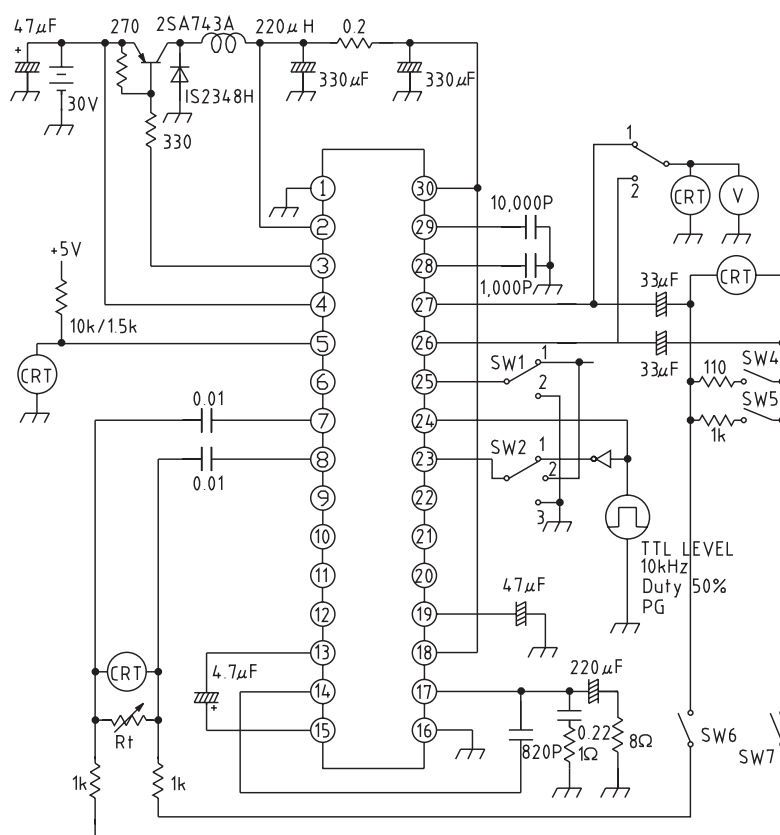
Transmit/receive Waveform

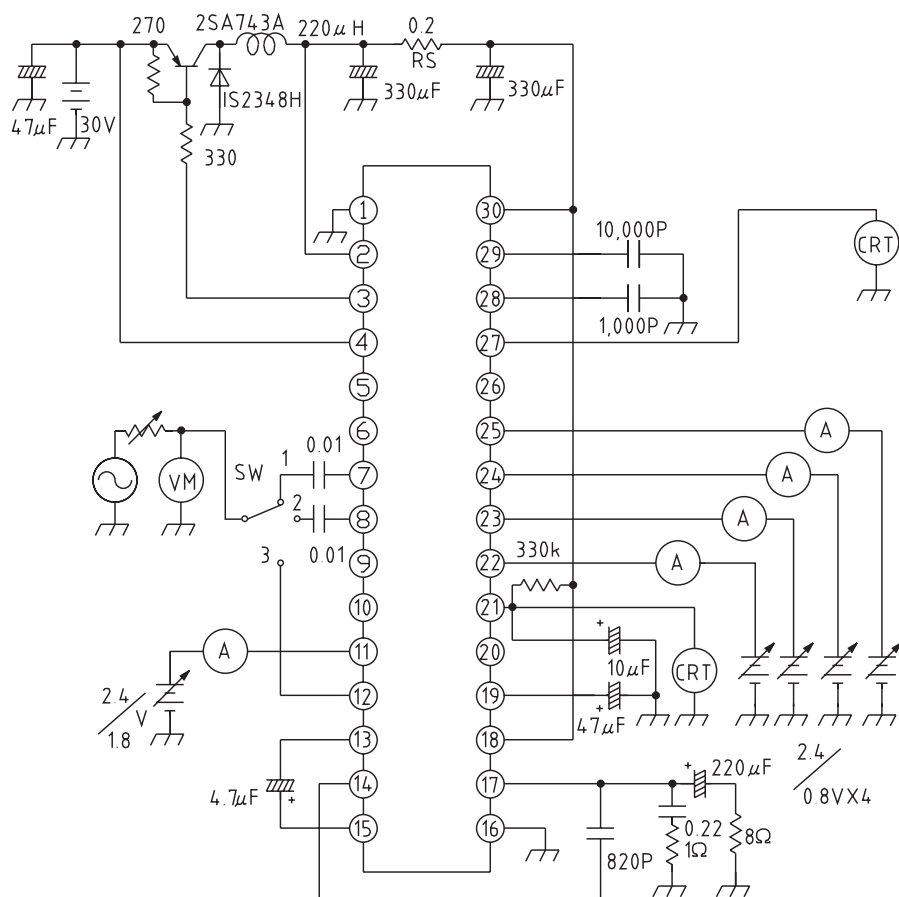
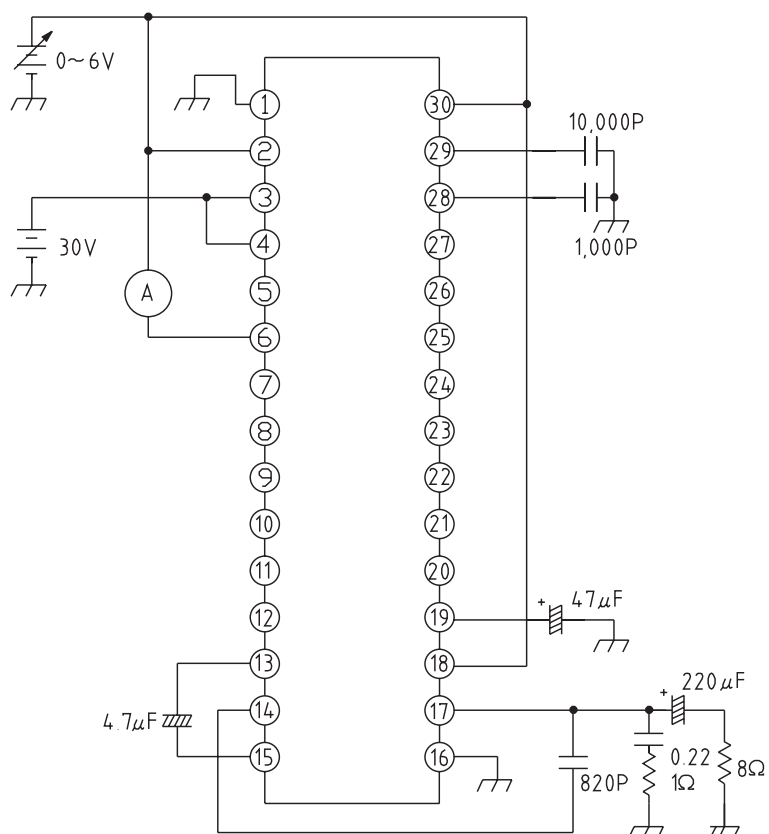
1. When pulling pin 25 up to V_{DD} (+5V)



2. When shorting pin 25 to GND







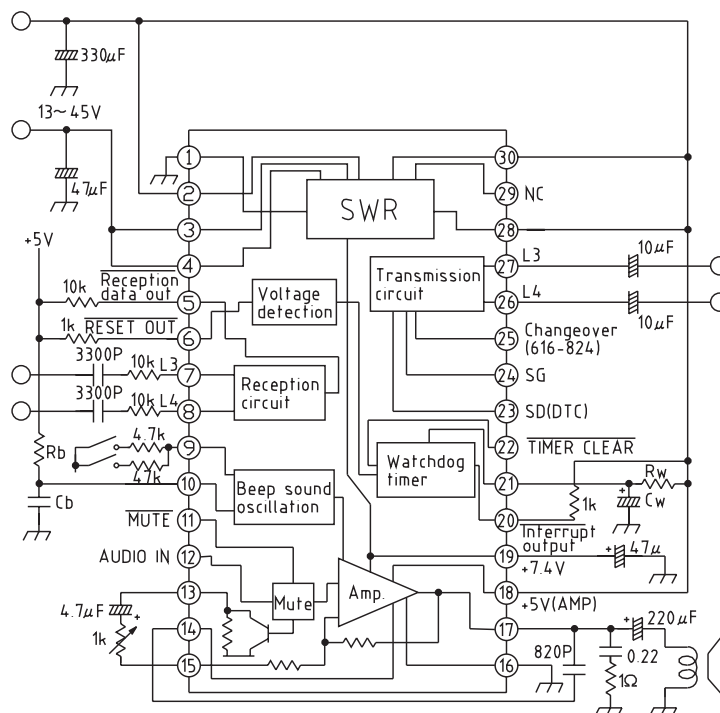
Switch Operation (Measurement circuit 1)

Measurement item	SW1	SW2	SW3	SW4	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	○	×	○	2	Using 400Hz-15kHz BPF
Vno2	×	×	○	2	Using 400Hz-15kHz BPF
Fb, IbSW, Vob1, Vob2	○	×	○	1	
Tt, TPW, Vwon, Tcl	—	×	○	1	cf. watchdog timer waveform diagram
		↓ ○			
IWOFF	—	×	×	1	

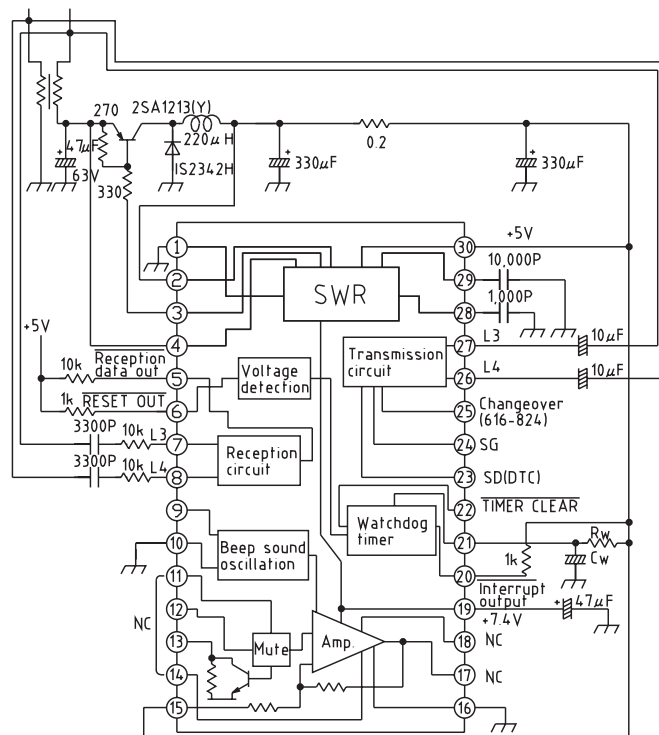
Switch Operation (Measurement circuit 2)

Measurement	SW1	SW2	SW3	SW4	SW5	SW6	SW7	
Vto1	1	1	—	○	×	×	×	Peak value across pins L3, L4
	2	2	—	○	×	×	×	Peak value across pins L3, L4
Vto2	1	1	—	×	○	×	×	Peak value across pins L3, L4
	2	2	—	×	○	×	×	Peak value across pins L3, L4
VL3	2	3	1	×	×	×	×	
VL4	2	3	2	×	×	×	×	
Vrs	2	2	—	○	×	○	○	Measured with Rt adjusted
Td1~Td4	2	2	—	○	×	○	○	cf. transmit/receive waveform diagrams
VroH, VroL	2	2	—	○	×	○	○	

(SWR circuit not used)



(Speaker amp not used)



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

Notes on Use

1. Protection from high-frequency noise

In consideration of applications in which telephone sets are connected over long distances, this IC is designed for high withstand and static breakdown voltages at pins 3 and 4, which are in danger of being exposed to electrostatic charge and high-frequency noise.

Pins 3 and 4	DC withstand voltage	46V or higher
	Static breakdown voltage (human body buildup method, 200pF, 0Ω)	±1000V or higher
Other pins	DC withstand voltage	15V or higher
	Static breakdown voltage (human body buildup method, 200pF, 0Ω)	±300V or higher

However, the IC may be damaged by adverse mounting or use conditions, and so it is recommended that a surge suppressor be inserted between pin 4 and GND.

2. Protection from surge currents

A diode for capacitor charging is connected between data transmission output pins 26 and 27 as shown below; the surge current ratings shown below should not be exceeded.

If these ratings are to be exceeded, it is recommended that a resistance R for surge current limiting or a diode Dt for absorption be inserted.

Internal diode maximum ratings	I_o	100mA
	I_F (peak)	500mA
	I_F (surge)	700mA

