



LAG665F

LINEAR INTEGRATED CIRCUIT

IC FOR HEADPHONE STEREOS

DESCRIPTION

The LAG665 is a monolithic integrated circuit, designed for use in headphone stereos, and incorporates dual preamp, power amp, electronic VR and motor control circuits.

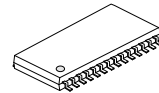
It can be used in a simple circuit configuration which requires very few external components.

FEATURES

*1-Chip stereo tape recorder with motor speed controller.

*Operating supply voltage range: $V_{CC}=2\sim 5V$

*Good volume control



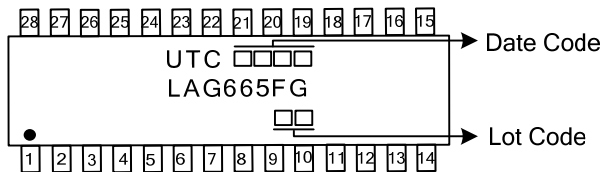
SOP-28

ORDERING INFORMATION

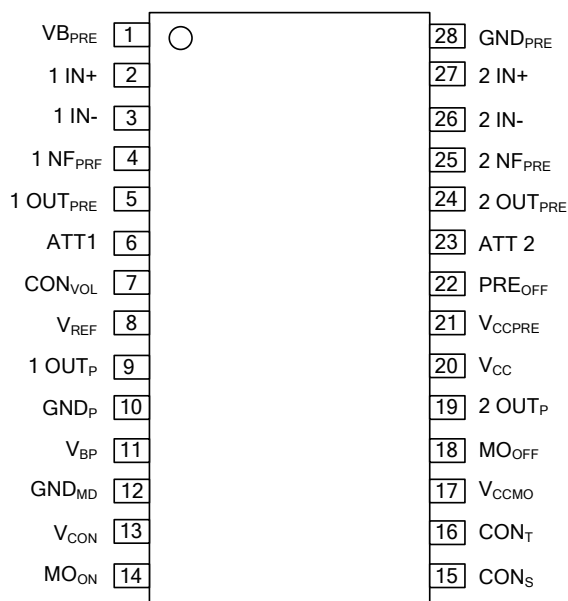
Ordering Number	Package	Packing
LAG665FG-S28-R	SOP-28	Tape Reel

<p>LAG665FG-S28-R</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Green Package</p>	<p>(1) R: Tape Reel</p> <p>(2) S28: SOP-28</p> <p>(3) G: Halogen Free and Lead Free</p>
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MARKING



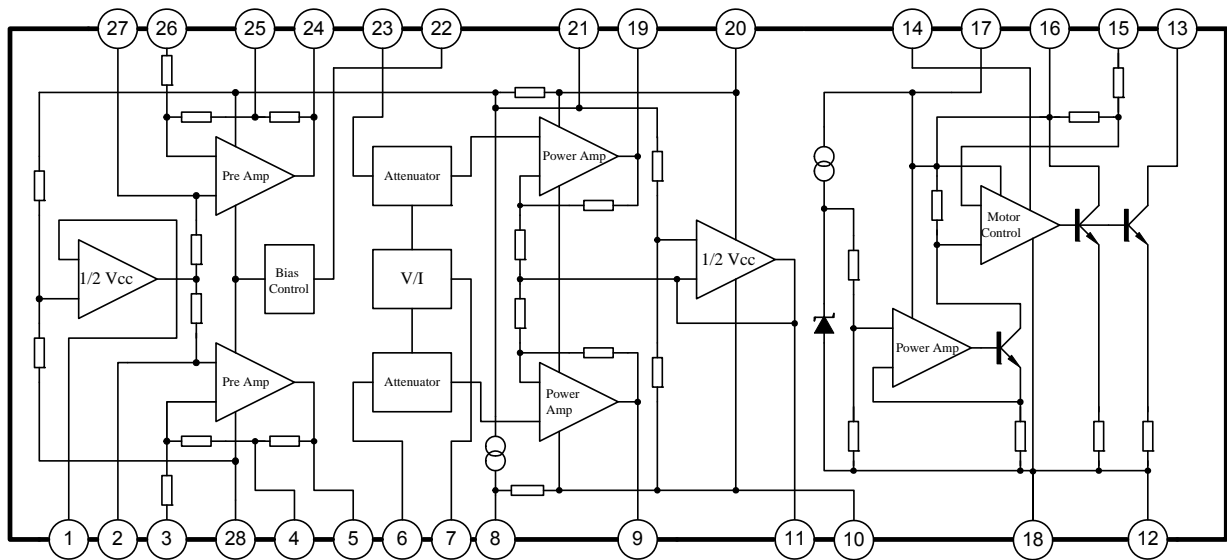
■ PIN CONFIGURATION



■ PIN FUNCTION DESCRIPTIONS

PIN NO.	SYMBOL	DESCRIPTION
1	VB _{PRE}	Pre Amp Bias Voltage
2	1 IN+	Channel 1 "+" Input
3	1 IN -	Channel 1 "-" Input
4	1 NF _{PRE}	Feedback 1
5	1 OUT _{PRE}	Pre Amp Output 1
6	ATT 1	Attenuator 1
7	CON _{VOL}	Volume Control
8	V _{REF}	Reference Voltage
9	1 OUT _P	Power Amp Output 1
10	GND _P	Power GND
11	V _{BP}	Power Amp Bias Voltage
12	GND _{MD}	Motor GND
13	V _{CON}	Motor Control Voltage
14	MO _{ON}	Motor Forced Start
15	CON _S	Speed Control
16	CON _T	Torqul Control
17	V _{CCMO}	Motor Power Control
18	MO _{OFF}	Motor Forced Stop
19	2 OUT _P	Power Amp Output 2
20	V _{CC}	Supply Voltage
21	V _{CCPRE}	Supply Voltage
22	PRE _{OFF}	Pre Amp Off
23	ATT 2	Attenuator 2
24	2 OUT _{PRE}	Pre Amp Output 2
25	2 NF _{PRE}	Feedback 2
26	2 IN-	Channel 2 "-" Input
27	2 IN+	Channel 2 "+" Input
28	GND _{PRE}	Pre GND

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS ($T_A=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	V_{CC}	-0.3~+7.5	V
Power Dissipation	P_D	450	mW
Operating Voltage	V_{OP}	2~5	V
Operating Temperature	T_{OPR}	-20~+65	$^{\circ}\text{C}$
Storage Temperature	T_{STG}	-40~+125	$^{\circ}\text{C}$

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ ELECTRICAL CHARACTERISTICS ($V_{CC}=6\text{V}$, $T_A=25^{\circ}\text{C}$, unless otherwise specified)

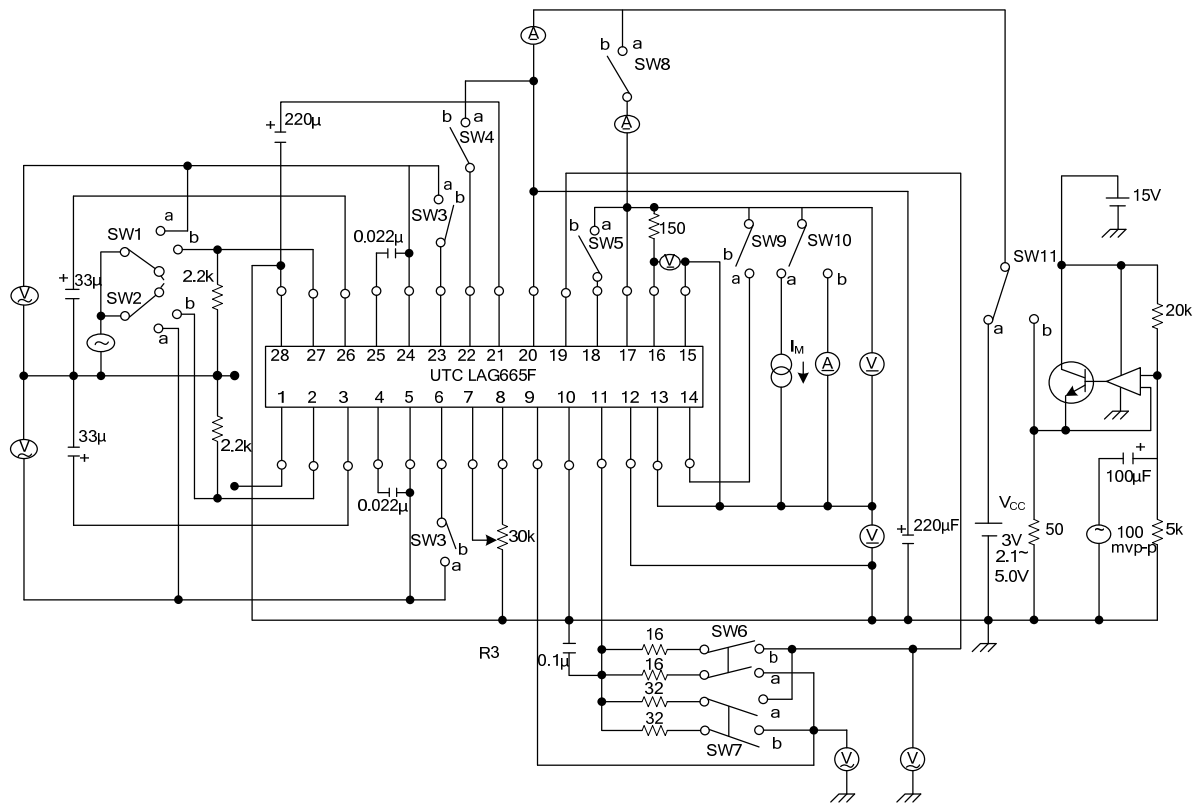
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Supply Current	I_{CC}	$V_{IN}=0\text{V}$, $I_M=0\text{mA}$		18	25	mA
PRE-AMPLIFIER ($V_{CC}=3.0\text{V}$, $f=1\text{kHz}$)						
Open Loop Gain	G_{VO}	$V_O=-10\text{dBm}$, $R_L=\infty$		72		dB
Close Loop Gain	G_{VC}	$V_O=-10\text{dBm}$	40	42	44	dB
Maximum Output Voltage	V_{OM}	THD=10%	0.45	0.6		V_{RMS}
Total Harmonic Distortion	THD	$V_{OUT}=400\text{mV}_{RMS}$		0.05	0.5	%
Output Noise Voltage	V_{ON}	$V_{IN}=0$, $R_G=2.2\text{k}$, BPF(30~20kHz)		150	300	μV_{RMS}
Input Impedance	Z_{IN}	$V_{OUT}=-10\text{dBm}$	18	22		k Ω
Cross Talk between CH	CT	$R_G=2.2\text{k}$, $V_{OUT}=-10\text{dBm}$	30			dB
Output Voltage when Pre-Off	V_{O_OFF}	$V_{IN}=100\text{mV}_{RMS}$			-50	dB
Output Impedance when Pre-Off	R_{O_OFF}			10		k Ω
Input Impedance when Pre-Off	R_{I_OFF}			10		k Ω
Attenuator ($V_{CC}=3.0\text{V}$, $f=1\text{kHz}$, $R_L=16\Omega$)						
Maximum Input Voltage	V_{I_MAX}		0.2			V_{RMS}
Maximum Attenuation	V_{A_MAX}	$V_{CONT}=\text{Min}$	66			dB
Attenuation Error	V_{AERR}	$V_{CONT}=\text{Max}$		0		dB
Input Impedance	Z_{IA}		15	20		k Ω
Control Terminal Input Impedance	Z_{ICOT}		100			k Ω
Power Amplifier ($V_{CC}=3.0\text{V}$, $f=1\text{kHz}$, $R_L=16\Omega$)						
Voltage Gain	GV	$P_{OUT}=5\text{mW}$	26	28	30	dB
Channel Voltage Difference	ΔGV	$V_{CONT}=\text{Max}$		0	3	dB
Maximum Output Power I	P_{OM1}	THD=10%, $R_L=32\Omega$	20	28		mW
Maximum Output Power II	P_{OM2}	THD=10%, $R_L=16\Omega$	30			mW
Total Harmonic Distortion	THD	$P_{OUT}=5\text{mW}$		0.2	2	%
Cross Talk between CH	C_T	$P_{OUT}=5\text{mW}$	20	30		dB
Output Noise Voltage	V_{ON}	$R_G=2.2\text{k}$, $V_{CONT}=\text{Min}$		0.25	1.0	mV_{RMS}
Ripple Rejection	RR	$V_{CC}=3\text{V}$, 100Hz, 100mVp-p	34	40		dB
Pre + Pulse Boost + Power Noise	V_{NTO}	$V_{IN}=0\text{V}$, $R_G=2.2\text{k}$, $V_{CONT}=\text{Max}$		6	9	mV_{RMS}

■ ELECTRICAL CHARACTERISTICS ($V_{CC}=6V, T_A=25^{\circ}C$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Motor Control ($V_{CC}=3V, I_M=100mA$)						
Current Consumption	IMC			3	5	mA
Starting Current	IMS		500			mA
Reference Voltage	V_{REF}	Pin 15~Pin 16	0.72	0.8	0.87	V
Reference Voltage Change I	$V_{REF} 1$	$V_{CC}=2.1\sim 5V$ (Note)		0.05		%/V
Reference Voltage Change II	$V_{REF} 2$	$I_M=25\sim 250mA$		0.01		%/mA
Reference Voltage Change III	$V_{REF} 3$	$T_A=-10\sim 50^{\circ}C$		0.01		%/°C
Current Factor	K		32	38	43	
Current Factor Change I	K1	$V_{CC}=2.1\sim 5V$		0.5		%/V
Current Factor Change II	K2	$I_M=25\sim 250mA$		0.05		%/mA
Current Factor Change III	K3	$T_A=-10\sim 50^{\circ}C$		0.02		%/°C
Saturation Voltage at Forced ON	V_{CESA}	$I_M=200mA, Pin 14=V_{CC}$			0.6	V
Input Impedance at Forced ON Pin	R_{ION}			5.6		K Ω
Leakage Current at Forced OFF	IML				200	μA
Input Impedance at Forced OFF Pin	R_{ICON}			33		K Ω

Note: Voltage across pins 13 and 19 (motor pins) fluctuates.

■ TEST CIRCUIT



■ SWITCH MATRIX

ITEM	SYMBOL	SW No.											TEST CONDITION
		1	2	3,3'	4	5	6	7	8	9	10	11	
AMP													
Supply Current	I_{CC}	c	c	a	b	b	a	b	b	b	a	a	$I_M=0mA, V_R=\max$
Close Loop Gain	G_{VC}	b	b	b	b	b	a	b	b	b	a	a	$V_O=-10dBm$
Maximum Output Voltage	V_{OM}	b	b	b	b	b	a	b	b	b	a	a	THD=10%
Total Harmonic Distortion	THD	b	b	b	b	b	a	b	b	b	a	a	$V_O=400mV$
Output Noise Voltage	V_{ON}	c	c	b	b	b	a	b	b	b	a	a	B.P.F.(20~30kHz)
Cross Talk between CH	C_T	b/c	c/b	b	b	b	a	b	b	b	a	a	$V_O=244mV, V_O=-10dBm$
Output Voltage when Preamp Off	V_{O_OFF}	b	b	b	a	b	a	b	b	b	a	a	$V_{IN}=100mV_{RMS}$
Attenuator													
Maximum Input Voltage	V_{L_MIX}	a	a	a	a	b	a	b	b	b	a	a	$V_R=Mid, THD=10\%$
Maximum Attenuation	V_{A_MAX}	a	a	a	a	b	a	b	b	b	a	a	Difference in V_O output when $V_R=\max.$ and output voltage when $V_R=\min$
Power AMP													
Voltage Gain	GV	a	a	a	a	b	a	b	b	b	a	a	$P_{OUT}=5mW$
Channel Voltage Difference	ΔGV	a	a	a	a	b	a	b	b	b	a	a	Channel output difference at $V_R=\max$
Maximum Output Power I	$P_{OM\ 1}$	a	a	a	a	b	b	a	b	b	a	a	$R_L=32\Omega, THD=10\%$
Maximum Output Power II	$P_{OM\ 2}$	a	a	a	a	b	a	b	b	b	a	a	$R_L=16\Omega, THD=10\%$
Total harmonic distortion ratio	THD	a	a	a	a	b	a	b	b	b	a	a	$P_{OUT}=5mW$
Crosstalk between channels	C_T	a/c	c/a	a	a	b	a	b	b	b	a	a	$P_{OUT}=5mW$ measured with channels swapped output voltage when $V_R=\min$
Output noise voltage	V_N	c	c	a	b	b	a	b	b	b	a	a	$V_R=\min$
Ripple Rejection	RR	c	c	b	a	b	a	b	b	b	a	b	$V_R=\max$
Pre+power noise	V_{NTO}	c	c	a	b	b	a	b	b	b	a	a	$V_R=\max$
Consumption current	I_{MC}	c	c	a	a	b	a	b	a	b	a	a	$I_M=0mA$
Startup current	I_{MS}	c	c	a	a	b	a	b	a	b	b	a	
Reference voltage	V_{REF}	c	c	a	a	b	a	b	a	b	a	a	$I_M=100mA$ (15~16 Pin)
Reference voltage fluctuation I	V_{REF1}	c	c	a	a	b	a	b	a	b	a	a	$I_M=100mA, V_{CC}=2.1\sim 5.0V$ (13~17 Pin)
Reference voltage fluctuation II	V_{REF2}	c	c	a	a	b	a	b	a	b	a	a	$V_{CC}=3.0V, I_M=25\sim 250mA$

■ SWITCH MATRIX (Cont.)

ITEM	SYMBOL	SW No.											TEST CONDITION
		1	2	3,3'	4	5	6	7	8	9	10	11	
Output voltage on forced on	V_{CESA}	c	c	a	a	a	a	b	a	b	a	a	$V_{CC}=3V,$ $f_{OSC}=1kHz, R_L=16\Omega$ $I_M=200mA$
Leakage current on forced off	IML	c	c	a	a	b	a	b	a	a	b	a	

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