



LA4168M

Record/Playback System for Microcassette and Compact Cassette Recorders

Overview

The LA4168M is a record/playback system IC for microcassette and compact cassette recorders. The LA4168M is an extremely high-functionality IC that includes a motor control governor circuit, a voice sensor circuit that detects sounds and turns motor on or off, a power switch control circuit that receives an electrical signal from a photosensor and turns all of the IC function blocks on or off, and a circuit that increases the speed of the motor during playback.

Functions

- Microphone and playback preamplifiers
- Record amplifier
- Power amplifier (BTL, 4 Ω)
- Automatic stop circuit (power switch)
- Governor circuit
- Motor speed and high-speed switching circuit
- Microphone power supply
- LED drive circuit
- Voice sensor circuit

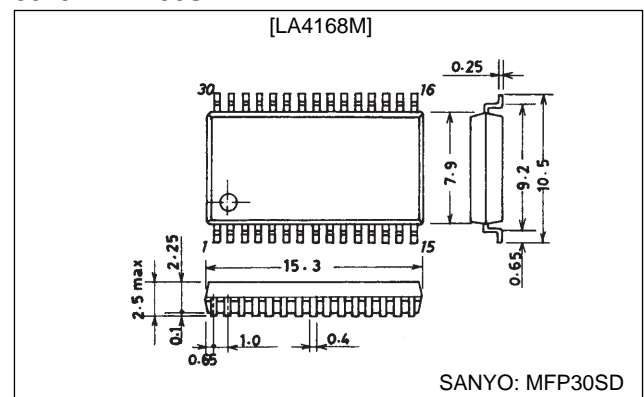
Features

- Includes a voice switch that can turn the governor on or off.
- Includes a power switch circuit that can turn all the IC function blocks on or off from a photosensor signal. During record, the IC can automatically turn the governor on or off according to the microphone input level, and furthermore, the governor on/off level can be continuously adjusted from an external control knob. (The control used for volume adjustment during playback.)
- Continuously variable microphone monitor level.
- Includes a drive pin for an LED that lights only when the governor is on in record mode.

Package Dimensions

unit: mm

3073A-MFP30SD



Specifications

Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC \text{ max}}$		4.5	V
Allowable power dissipation	$P_d \text{ max}$		800	mW
Operating temperature	T_{opr}		-10 to +50	$^\circ\text{C}$
Storage temperature	T_{stg}		-55 to +150	$^\circ\text{C}$

Operating Conditions at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		3.0	V
Operating voltage range	$V_{CC \text{ op}}$		1.8 to 3.6	V
Load resistance	(power block)	R_{LPwr}	4	Ω
	(preamplifier block)	R_{Lpre}	10	k Ω

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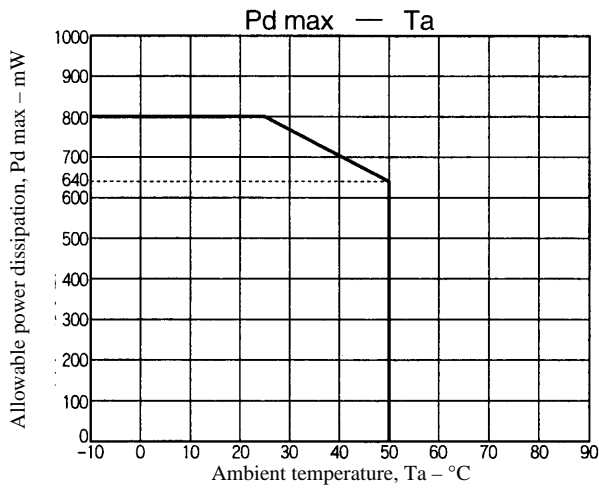
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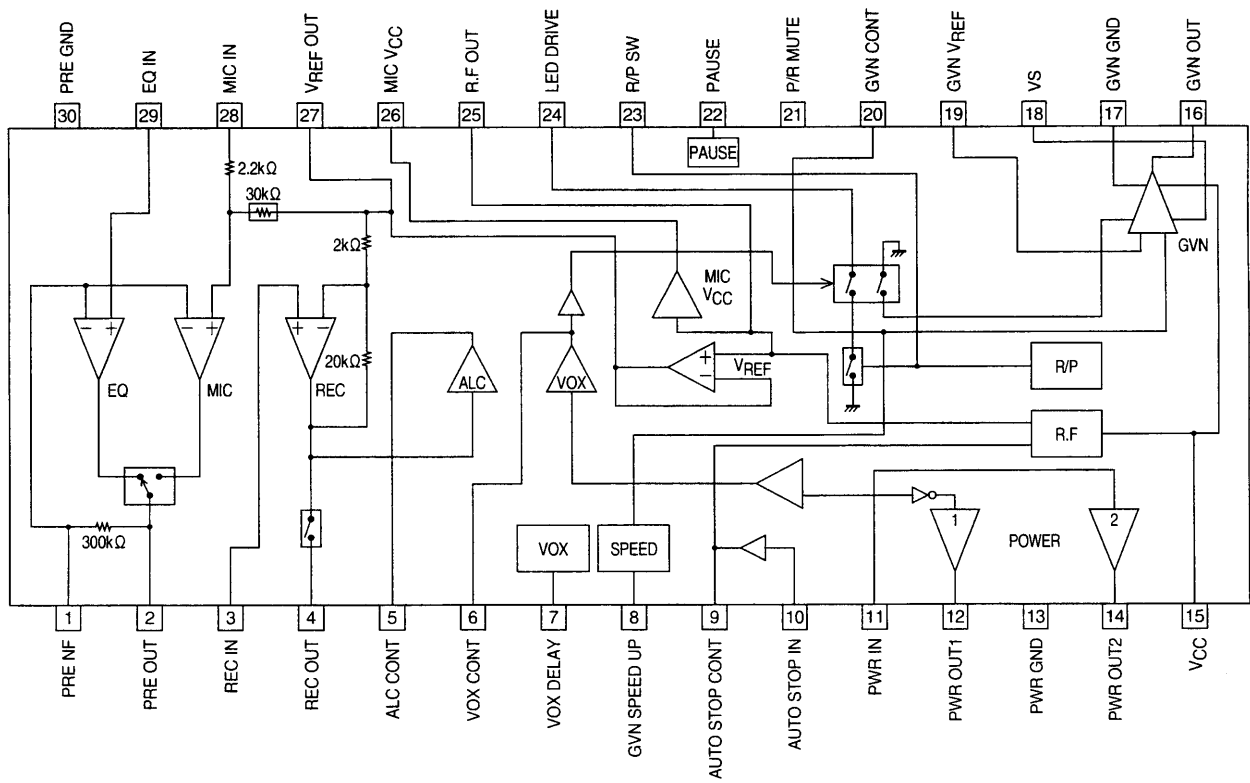
Operating Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 3.0\text{ V}$, $R_L = 4\ \Omega$ (power amplifier), $R_L = 10\ \text{k}\Omega$ (preamplifier), $f = 1\ \text{kHz}$, $0\ \text{dBm} = 0.775\ \text{V}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[PRE + POWER + GVN]						
Standby current	I_{STB}	With pin 9 connected to V_{CC} through a 100-k Ω resistor	25	170	250	μA
[PRE + POWER]						
Quiescent current	$I_{\text{CC-R}}$	REC MODE, $V_i = 0\ \text{V}$	6	12	18	mA
	$I_{\text{CC-P}}$	PLAY MODE, $V_i = 0\ \text{V}$, VOL MIN	12	18	25	mA
Voltage gain	V_{GTP}	PLAY MODE, $V_O = -5\ \text{dBm}$	71.5	74	76.5	dB
[EQ AMP]						
Voltage gain (open loop)	V_{GOP}	$C_{\text{NF}} = 100\ \mu\text{F}$	80	85		dB
Voltage gain (closed loop)	V_{GP}		50	52	54	dB
Maximum output voltage	$V_{\text{OP max}}$	THD = 1 %	0.5	0.75		V
Total harmonic distortion	THD_P	$V_O = 0.3\ \text{V}$		0.2	0.6	%
Equivalent input noise voltage	V_{NIP}	$R_g = 2.2\ \text{k}\Omega$, DIN audio		1.0	2.0	μV
Ripple rejection ratio	R_{rp}	$R_g = 2.2\ \text{k}\Omega$, $f_R = 1\ \text{kHz}$ filter	45	60		dB
[MIC AMP] VOL MIN, ALC OFF						
Voltage gain (closed loop)	V_{GM1}	ALC OFF	43	45	47	dB
Maximum output voltage	V_{OmaxM}	THD = 1 %, $R_L = 10\ \text{k}\Omega$	0.5	0.75		V
Total harmonic distortion	THD_M	$V_O = 0.3\ \text{V}$		0.6	1.0	%
Equivalent input noise voltage	V_{NIM}	$R_g = 3\ \text{k}\Omega$, DIN audio		2.0	4.0	μV
Ripple rejection ratio	SVRR	$R_g = 3\ \text{k}\Omega$, $f_R = 1\ \text{kHz}$ filter	40	53		dB
Input resistance	R_{IM}		24	32	40	$\text{k}\Omega$
[MIC + REC] VOL MIN						
Voltage gain (closed loop)	V_{GRT}	ALC OFF	63.5	65.5	67.5	dB
Maximum output voltage	V_{OmaxR}	THD = 5 %	0.6	1.0		V
Output noise voltage	V_{NORT}	MIC Input, $R_g = 3\ \text{k}\Omega$, DIN audio		3.5	8.0	mV
Ripple rejection ratio	R_{rRT}	$R_g = 3\ \text{k}\Omega$, $f_R = 1\ \text{kHz}$, 1 kHz filter	20	32		dB
[POWER AMP]						
Voltage gain (closed loop)	V_{GBTL}	BTL ON, $V_O = -10\ \text{dBm}$	21.5	24	26.5	dB
Voltage gain (closed loop)	V_{GSIN}	Single, $V_O = -10\ \text{dBm}$	20.5	23	25.5	dB
Output power	POBTL	THD = 10 %, BTL ON	200	350		mW
	POSIN	THD = 10 %, Single	50	120		mW
Total harmonic distortion	THD_{BTL}	BTL ON, $V_O = 0.25\ \text{V}$	0.1	0.8	2	%
Output noise voltage	V_{NOBTL}	BTL ON, $R_g = 0\ \text{k}\Omega$		20	50	μV
Ripple rejection ratio	R_{rBTL}	BTL ON, $R_g = 0\ \text{k}\Omega$, $f_R = 1\ \text{kHz}$, 1 kHz filter	50	70		dB
Output DC offset	V_{DCOFF}	BTL ON, $R_g = 0\ \text{k}\Omega$	0	10	50	mV
Input resistance	R_{INBTL}		21	30	39	$\text{k}\Omega$
[ALC]						
ALC width	ALC_W	The input level width from the point the ALC circuit operates to the point the harmonic distortion reaches 5%	40	67		dB
ALC harmonic distortion	ALC_{THD}	$V_{\text{im}} = -40\ \text{dBm}$		1.0	2.0	%
ALC output	$\text{ALC } V_O$	$V_{\text{im}} = -40\ \text{dBm}$	0.33	0.43	0.53	V
ALC start input	$\text{ALC } V_{\text{IN}}$	$V_{\text{im}} = -40\ \text{dBm}$	-79	-74	-69	dBm
[Voice Sensor (VOX)]						
Operation start input voltage	$V_{\text{OP min}}$	VOLUME (10 k Ω) max	-90	-85	-80	dBm
Input hysteresis	$V_{\text{O HL}}$		3	6	9	dB
[Auto-Stop]						
Operation voltage	$V_{\text{I ATS}}$	The pin 9 voltage at the point the auto-stop circuit operates	0.65	0.7		V
[LED]						
LED drive current	I_{LED}	The input current when shorted through a 300- Ω resistor	8	15	22	mA
[GVN]						
Reference voltage	V_{ref}	$I_m = 100\ \text{mA}$	1.1	1.25	1.4	V
Current division ratio	K	$I_m = 50 - 100\ \text{mA}$	45	50	55	
Residual voltage	V_{sat}	$V_{\text{REF}} = \text{CONT}$, $I_m = 200\ \text{mA}$	0.1	0.2	0.5	V
The CONT pin voltage in speed up mode	V_{cont}		0.35	0.41	0.47	V
Reference voltage/voltage characteristics	$\frac{\Delta V_{\text{ref}}}{V_{\text{ref}}}/\Delta V_{\text{CC}}$	$V_{\text{CC}} = 1.8\ \text{to } 4.5\ \text{V}$, $I_m = 100\ \text{mA}$	0	0.2	0.6	%/V
Current division ratio/voltage characteristics	$\frac{\Delta K}{K}/\Delta V_{\text{CC}}$	$V_{\text{CC}} = 2.0\ \text{to } 4.5\ \text{V}$, $I_m = 50 - 100\ \text{mA}$	0	0.3	0.7	%/V
Reference voltage/current characteristics	$\frac{\Delta V_{\text{ref}}}{V_{\text{ref}}}/\Delta I_m$	$I_m = 50 - 200\ \text{mA}$	0	0.002	0.03	%/mA
Current division ratio/current characteristics	$\frac{\Delta K}{K}/\Delta I_m$	$I_m = 50 - 100\ \text{mA to } 150 - 200\ \text{mA}$	-0.07	0.03	+0.07	%/mA

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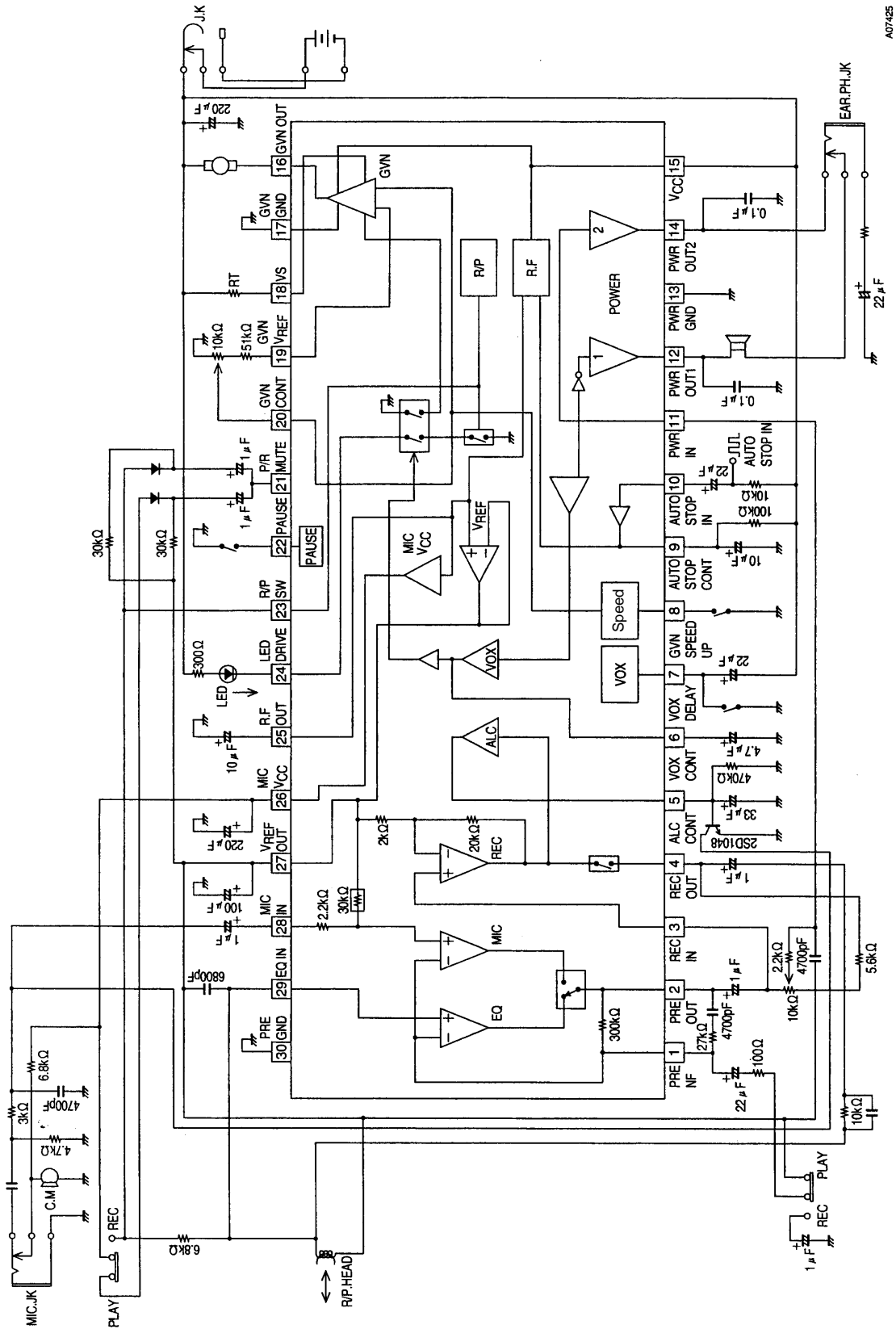


Block Diagram



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Sample Application Circuit



For the record/playback switch described above, during playback the power supply ripple may be output from the REC OUT pin (pin 4) and influence the EQIN pin (pin 29). This problem can be minimized by adding a 5.6-kΩ resistor between pin 4 and pin 27.

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