



# 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  $\Omega$ )
- Automatic stop circuit (power switch)
- Governor circuit
- Motor speed and high-speed switching circuit
- Microphone power supply
- LED drive circuit
- Voice sensor circuit

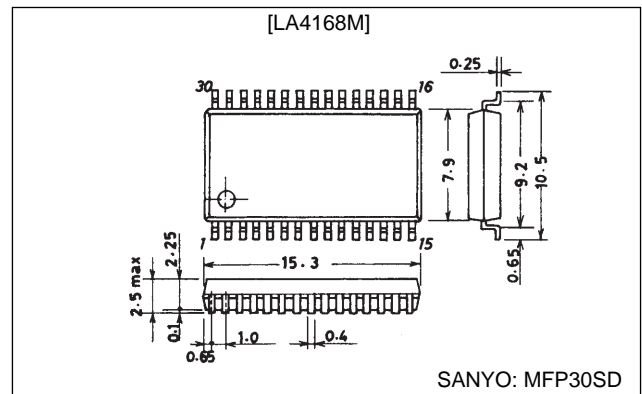
### Features

- 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 Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V <sub>CC</sub> max		4.5	V
Allowable power dissipation	P <sub>d</sub> max		800	mW
Operating temperature	T <sub>opr</sub>		-10 to +50	°C
Storage temperature	T <sub>stg</sub>		-55 to +150	°C

#### Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V <sub>CC</sub>		3.0	V
Operating voltage range	V <sub>CCop</sub>		1.8 to 3.6	V
Load resistance (power block)	R <sub>Lpwr</sub>		4	$\Omega$
Load resistance (preamplifier block)	R <sub>Lpre</sub>		10	k $\Omega$

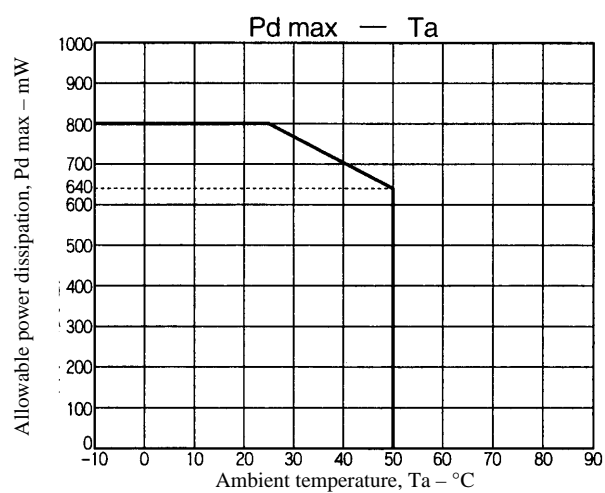
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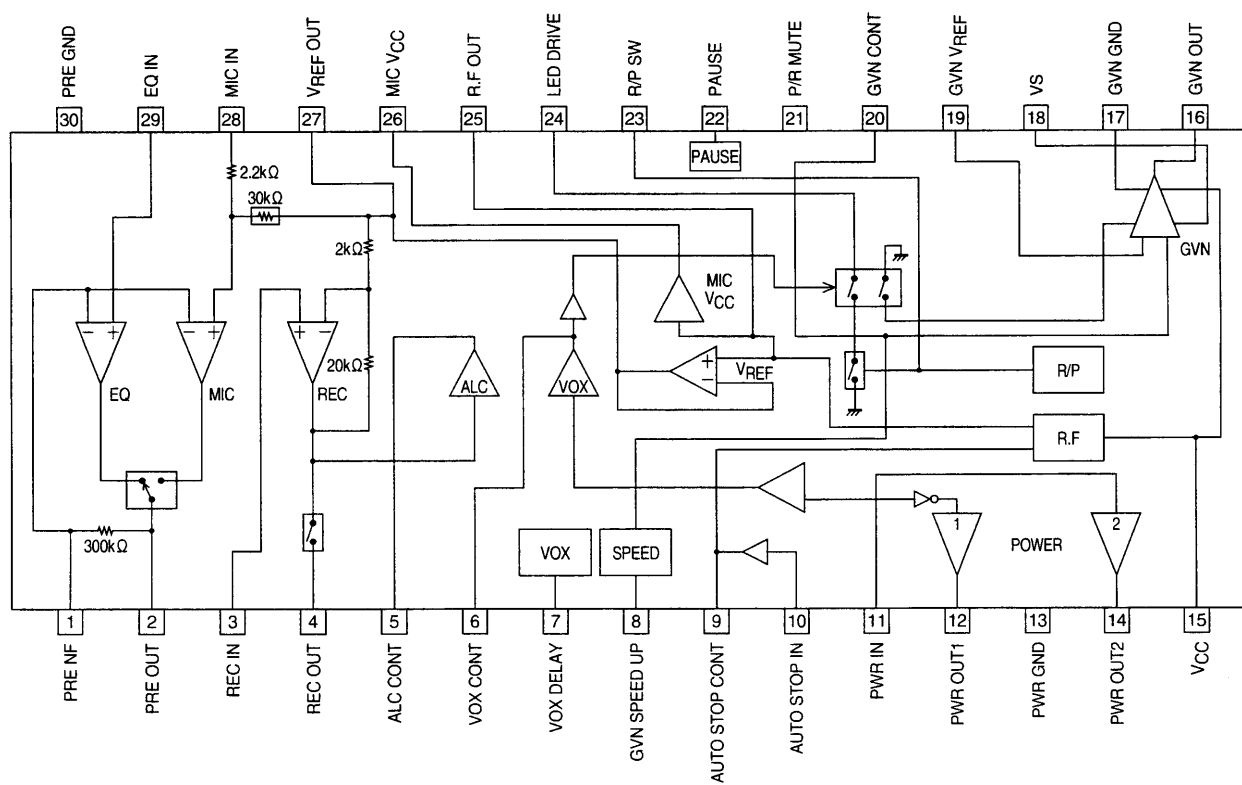
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**Operating Characteristics at Ta = 25°C, V<sub>CC</sub> = 3.0 V, R<sub>L</sub> = 4 Ω (power amplifier), R<sub>L</sub> = 10 kΩ (preamplifier), f = 1 kHz, 0 dBm = 0.775 V**

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

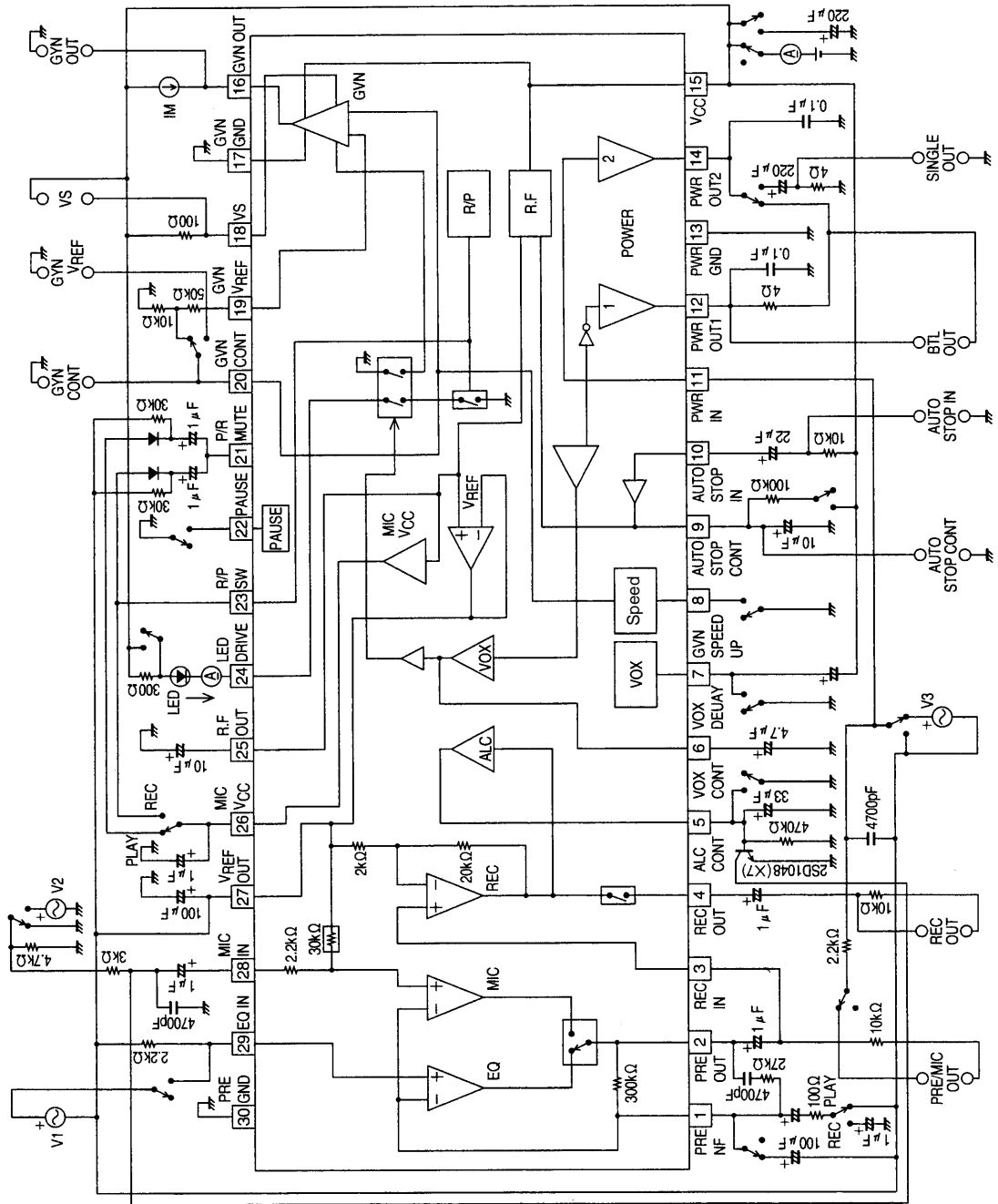


## Block Diagram



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## Test Circuit Diagram



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