



# 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

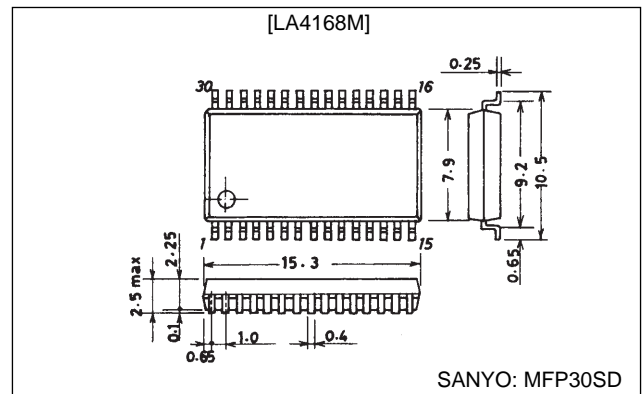
### Features

- 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 $T_a = 25^\circ\text{C}$

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	$\Omega$
	(preamplifier block)	$R_{Lpre}$	10	k $\Omega$

**SANYO Electric Co., Ltd. Semiconductor Business Headquarters**

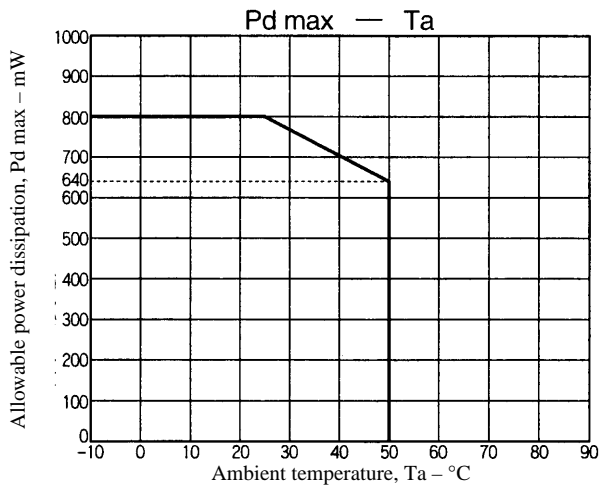
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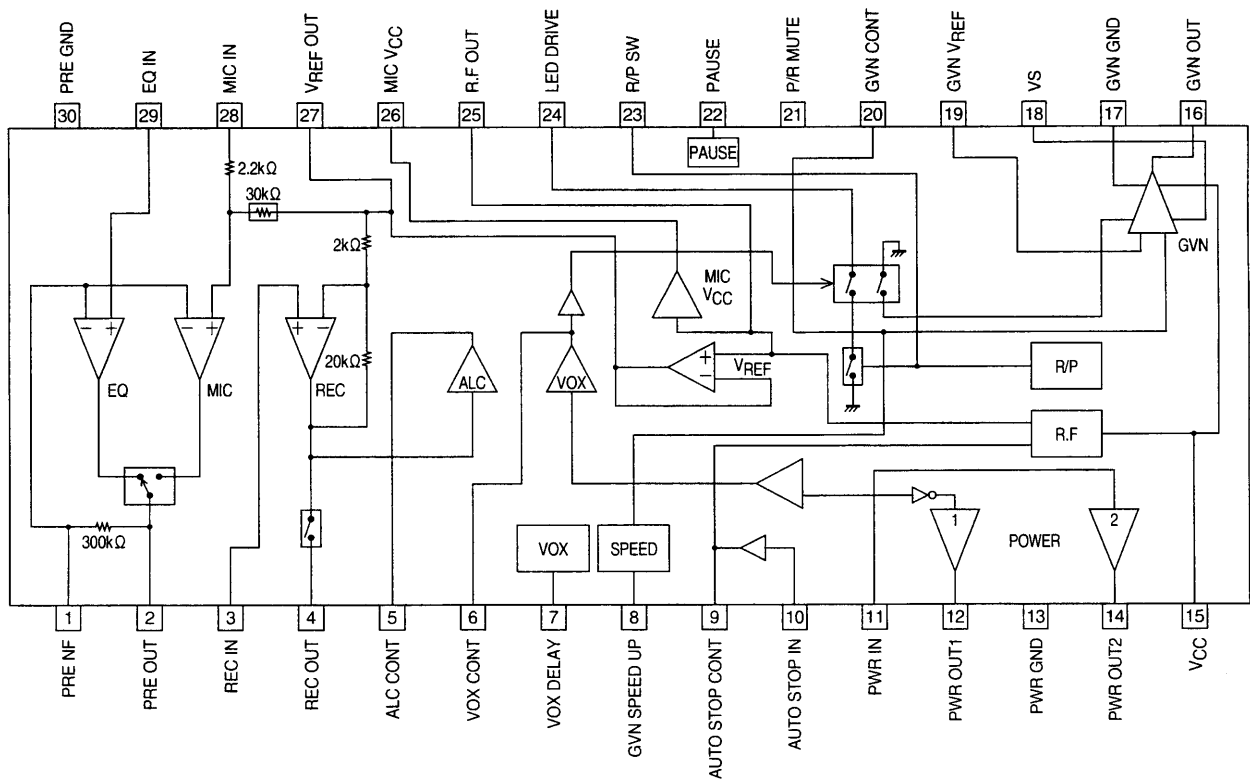
**Operating Characteristics at Ta = 25°C, V<sub>CC</sub> = 3.0 V, R<sub>L</sub> = 4 Ω (power amplifier), R<sub>L</sub> = 10 kΩ (preamplifier), f = 1 kHz, 0 dBm = 0.775 V**

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
<b>[PRE + POWER + GVN]</b>						
Standby current	I <sub>STB</sub>	With pin 9 connected to V <sub>CC</sub> through a 100-kΩ resistor	25	170	250	μA
<b>[PRE + POWER]</b>						
Quiescent current	I <sub>CC-R</sub>	REC MODE, Vi = 0 V	6	12	18	mA
	I <sub>CC-P</sub>	PLAY MODE, Vi = 0 V, VOL MIN	12	18	25	mA
Voltage gain	VG <sub>TP</sub>	PLAY MODE, V <sub>O</sub> = -5 dBm	71.5	74	76.5	dB
<b>[EQ AMP]</b>						
Voltage gain (open loop)	VG <sub>OP</sub>	C <sub>NF</sub> = 100 μF	80	85		dB
Voltage gain (closed loop)	VG <sub>P</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>	Rg = 2.2 kΩ, DIN audio		1.0	2.0	μV
Ripple rejection ratio	R <sub>rp</sub>	Rg = 2.2 kΩ, f <sub>R</sub> = 1 kHz filter	45	60		dB
<b>[MIC AMP] VOL MIN, ALC OFF</b>						
Voltage gain (closed loop)	VG <sub>M1</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>	Rg = 3 kΩ, DIN audio		2.0	4.0	μV
Ripple rejection ratio	SVRR	Rg = 3 kΩ, f <sub>R</sub> = 1 kHz filter	40	53		dB
Input resistance	R <sub>IM</sub>		24	32	40	kΩ
<b>[MIC + REC] VOL MIN</b>						
Voltage gain (closed loop)	VG <sub>RT</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, Rg = 3 kΩ, DIN audio		3.5	8.0	mV
Ripple rejection ratio	R <sub>rRT</sub>	Rg = 3 kΩ, f <sub>R</sub> = 1 kHz, 1 kHz filter	20	32		dB
<b>[POWER AMP]</b>						
Voltage gain (closed loop)	VG <sub>BTL</sub>	BTL ON, V <sub>O</sub> = -10 dBm	21.5	24	26.5	dB
Voltage gain (closed loop)	VG <sub>SIN</sub>	Single, V <sub>O</sub> = -10 dBm	20.5	23	25.5	dB
Output power	PO <sub>BTL</sub>	THD = 10 %, BTL ON	200	350		mW
	PO <sub>SIN</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, Rg = 0 kΩ		20	50	μV
Ripple rejection ratio	R <sub>rBTL</sub>	BTL ON, Rg = 0 kΩ, f <sub>R</sub> = 1 kHz, 1 kHz filter	50	70		dB
Output DC offset	V <sub>DCOFF</sub>	BTL ON, Rg = 0 kΩ	0	10	50	mV
Input resistance	R <sub>INBTL</sub>		21	30	39	kΩ
<b>[ALC]</b>						
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
<b>[Voice Sensor (VOX)]</b>						
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
<b>[Auto-Stop]</b>						
Operation voltage	V <sub>I ATS</sub>	The pin 9 voltage at the point the auto-stop circuit operates	0.65	0.7		V
<b>[LED]</b>						
LED drive current	I <sub>LED</sub>	The input current when shorted through a 300-Ω resistor	8	15	22	mA
<b>[GVN]</b>						
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	$\frac{\Delta K}{K} / \Delta I_m$	I <sub>m</sub> = 50 – 100 mA to 150 – 200 mA	-0.07	0.03	+0.07	%/mA

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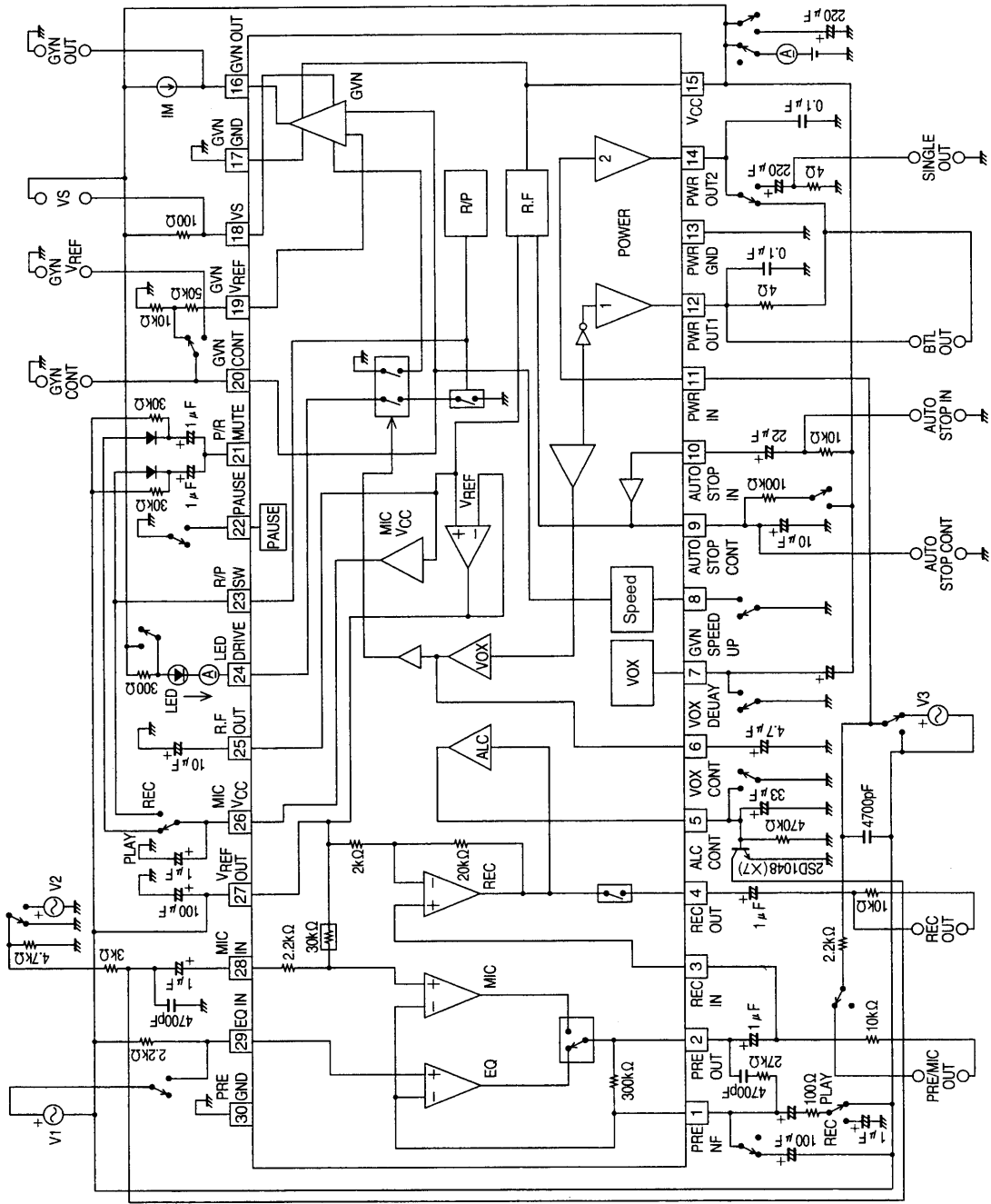
## Block Diagram



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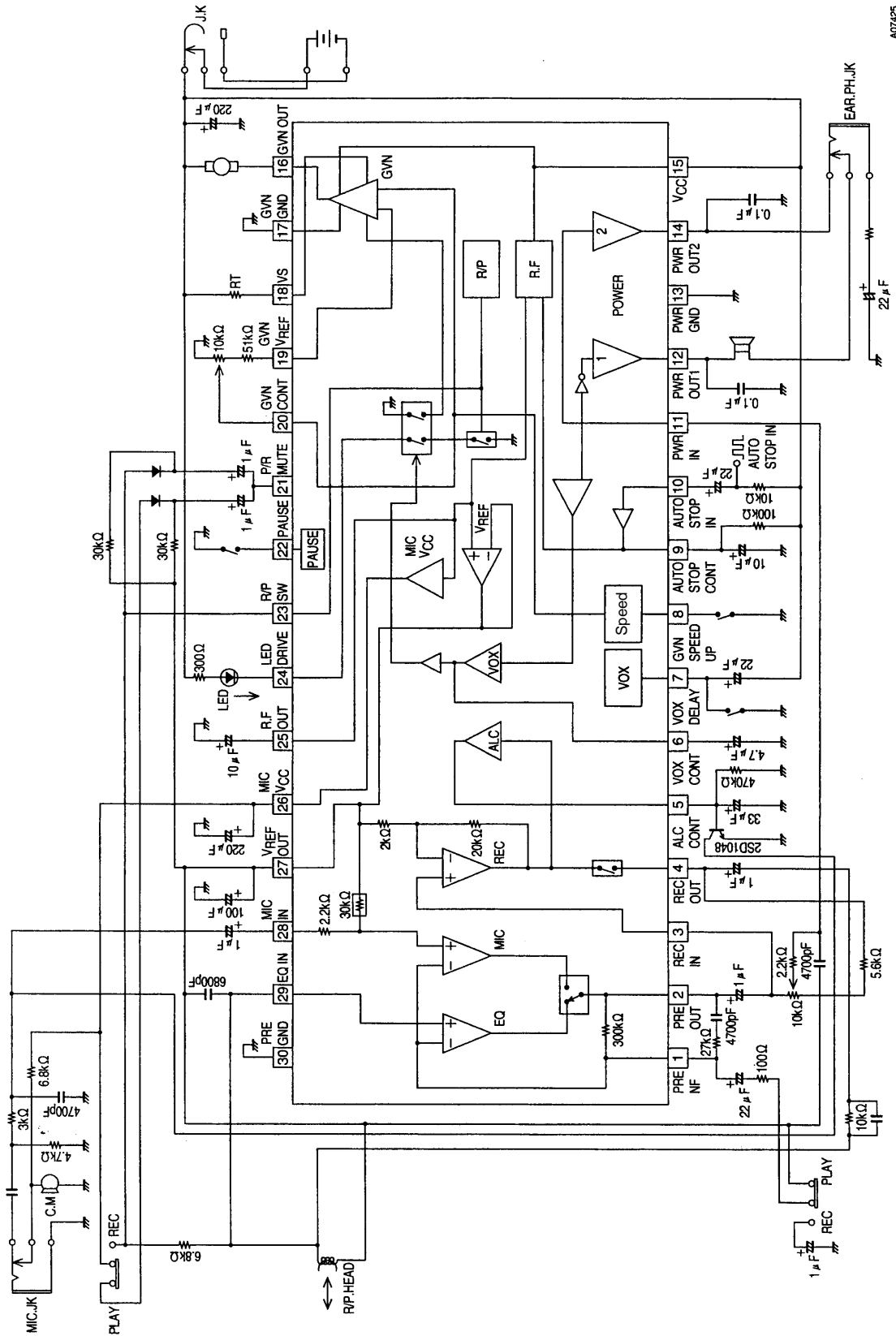
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Test Circuit Diagram



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Sample Application Circuit



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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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