



# LA8604M

## Narrowband FM IF Stage

### Overview

The LA8604M is a narrowband FM IF stage IC that incorporates all the functional blocks for a complete IF stage, including noise filtering, making it ideal for use in cordless telephones.

The LA8604M comprises a second-stage oscillator, a mixer, an IF amplifier, an FM detector, and noise detector, amplifier and rectifier circuits. A signal level meter output which is linear over a wide dynamic range of up to 70dB is also incorporated.

The LA8604M operates from a 2.4 to 6V supply and is available in 24-pin MFPs.

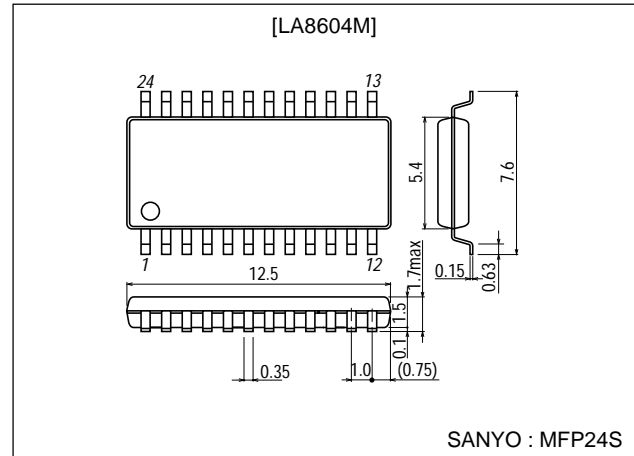
### Features

- On-chip mixer, IF amplifier and limiter.
- On-chip noise filter buffer.
- 70dB (typ) signal level meter linearity.
- Signal level meter output buffer.
- 2.4 to 6V supply.
- 24-pin MFP.

### Package Dimensions

unit:mm

3112A-MFP24S



### Specifications

#### Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V <sub>CC max</sub>		8	V
Maximum power dissipation	P <sub>d max</sub>		300	mW
Operating temperature	T <sub>opr</sub>		-20 to +75	°C
Storage temperature	T <sub>stg</sub>		-40 to +125	°C

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

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V <sub>CC</sub>		3	V
Operating supply voltage range	V <sub>CC op</sub>		2.4 to 6.0	V

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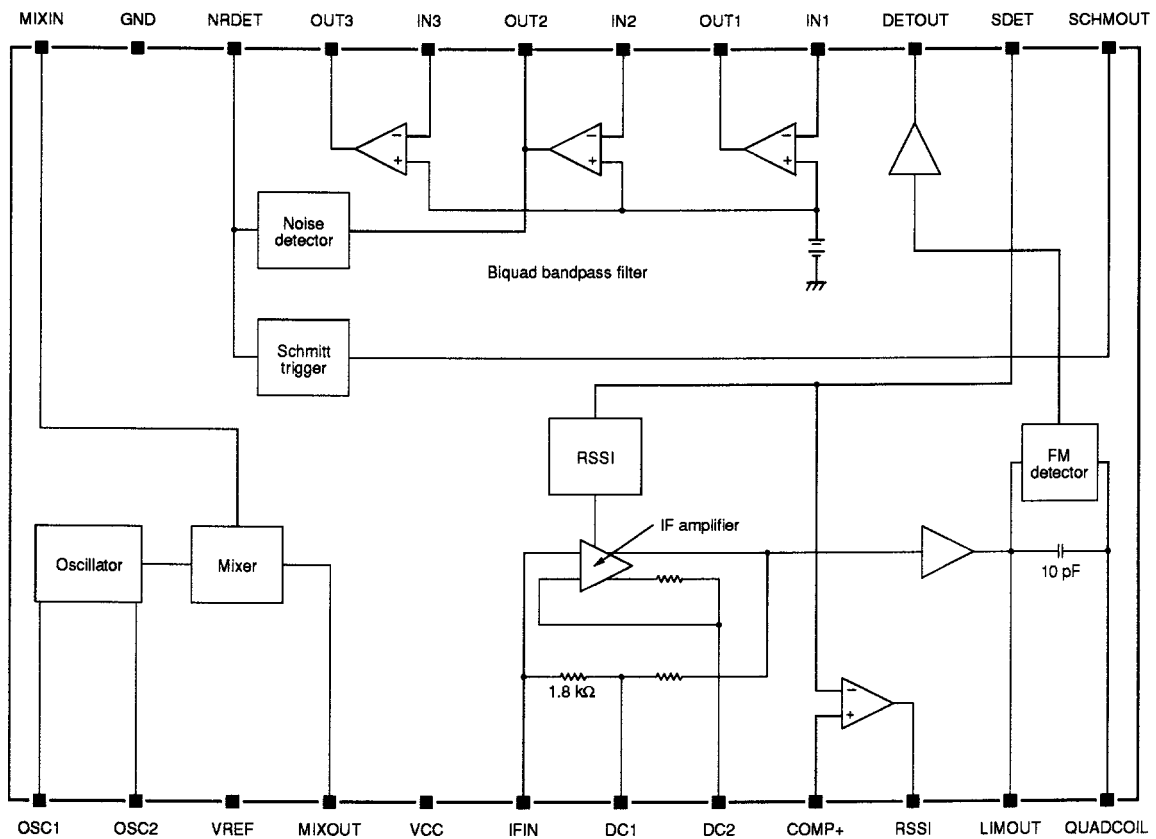
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**Operating Characteristics** at  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 3\text{V}$ ,  $f_C = 21.7\text{MHz}$ ,  $f_{\text{mod}} = 1\text{kHz}$ ,  $\Delta f = \pm 3\text{kHz}$

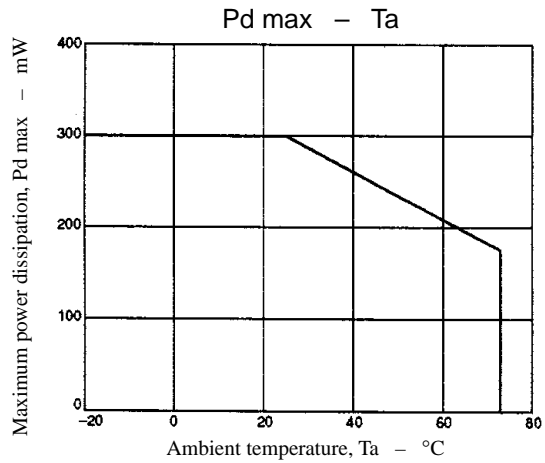
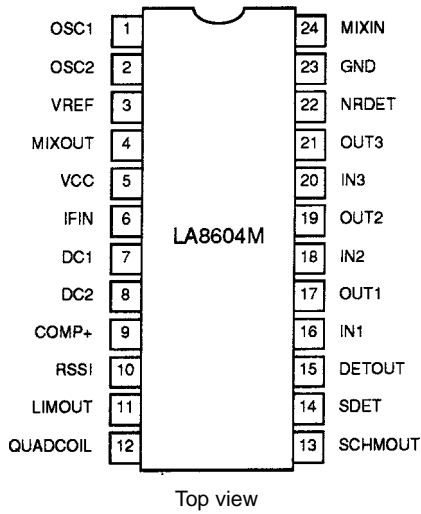
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current	$I_{\text{CCO}}$			2.8	3.8	mA
-3dB limiting sensitivity	-3dBLS	$V_I = 80\text{dB}\mu$ , -3dB input		5	11	dB $\mu$
Demodulation output voltage	$V_O$	$V_I = 80\text{dB}\mu$	115	170	230	mV
Signal-to-noise ratio	S/N	$V_I = 80\text{dB}\mu$ , zero modulation	54	60		dB
		$V_I = 20\text{dB}\mu$ , zero modulation	20	25		dB
Amplitude modulation rejection ratio	AMR	30% AM modulation	30	40		dB
Total harmonic distortion	THD	$V_I = 80\text{dB}\mu$		0.7	2.0	%
		$V_I = 10\text{dB}\mu$	1.1	1.4		V
Noise detector output voltage	$V_{\text{ND}}$	$V_I = 30\text{dB}\mu$		0	0.1	V
			10	18	25	dB $\mu$
Schmitt-trigger level	SH			1		dB
Schmitt-trigger hysteresis	SHhy					
						0.5
Schmitt-trigger output voltage	$V_{\text{SH}}$	$V_I = 10\text{dB}\mu$	2.8			V
		$V_I = 25\text{dB}\mu$		0.1	0.3	V
Signal meter output voltage	$V_{\text{SM}}$	$V_I = 5\text{dB}\mu$	0.8	1.1	1.4	V
		$V_I = 50\text{dB}\mu$	1.3	1.6	2.0	V
		$V_I = 80\text{dB}\mu$	2.8			V
RSSI output voltage	$V_{\text{RSSI}}$	$V_I = 5\text{dB}\mu$				V
		$V_I = 35\text{dB}\mu$			0.5	V
Mixer conversion gain	$G_M$			20		dB
Mixer input frequency					90	MHz
Mixer input resistance				3.6		k $\Omega$
Mixer output resistance				1.8		k $\Omega$
IF amplifier input resistance				1.8		k $\Omega$
FM detector output impedance				2.4		k $\Omega$

## Block Diagram



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## Pin Assignment



## Pin Functions

Number	Name	Equivalent circuit	Description
1	OSC1		Colpitts oscillator crystal connection. Nominal voltage is $V_{CC}$ .
2	OSC2		Colpitts oscillator crystal connection. Nominal voltage is $V_{CC}-0.7V$ .
3	VREF		1.2V reference voltage output.
4	MIXOUT		Mixer buffer output. Nominal voltage is $V_{CC}-0.3V$ .
5	$V_{CC}$		Supply voltage.
6	IFIN		IF amplifier input. Nominal voltage is $V_{CC}-0.9V$ .
7	DC1		IF amplifier feedback network connections. Nominal voltage is $V_{CC}-0.9V$ .
8	DC2		

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Number	Name	Equivalent circuit	Description
9	COMP+		RSSI comparator threshold input.
10	RSSI		Open-collector, RSSI comparator output.
11	LIMOUT		Limiter amplifier output. Nominal voltage is 0.2V.
12	QUADCOIL		Detector tuning network connection. Nominal voltage is $V_{CC}$ .
13	SCHMOUT		Open-collector, noise comparator Schmitt-trigger output.
14	SDET		Signal strength detector output. Nominal voltage is in the range 0.1 to 1.5V.
15	DETOUT		FM detector output. Nominal voltage is 1.2V.
16	IN1		Operational amplifier 1 inverting input. Nominal voltage is 1.0V.
17	OUT1		Operational amplifier 1 output. Nominal voltage is 1.0V.
18	IN2		Operational amplifier 2 inverting input. Nominal voltage is 1.0V.
19	OUT2		Operational amplifier 2 output. Nominal voltage is 1.0V.

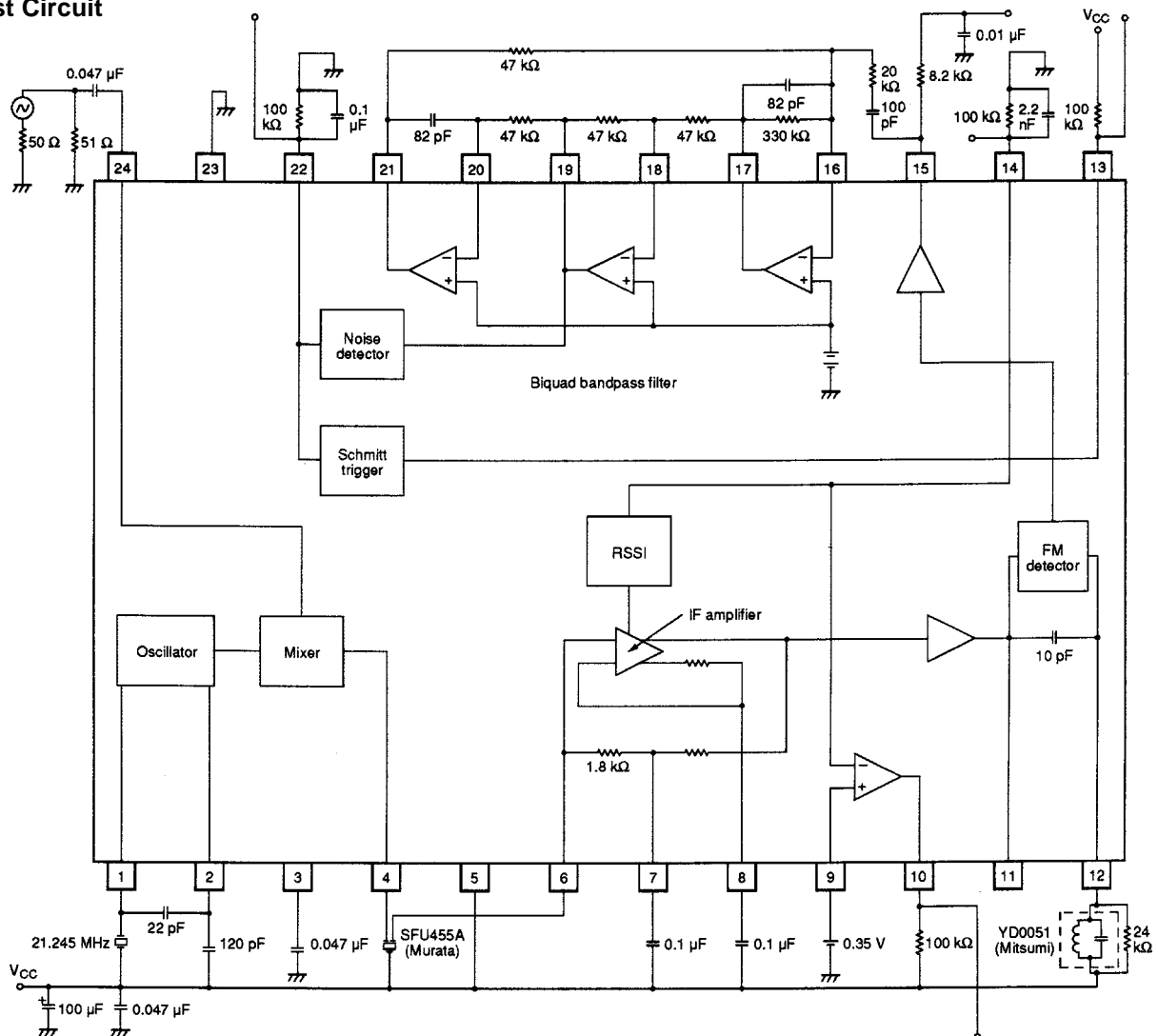
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Number	Name	Equivalent circuit	Description
20	IN3		Operational amplifier 3 inverting input. Nominal voltage is 1.0V.
21	OUT3		Operational amplifier 3 output. Nominal voltage is 1.0V.
22	NRDET		Noise detector output. Nominal voltage is in the range 0 to 1.4V.
23	GND		Ground
24	MIXIN		Mixer input. Nominal voltage is 1.2V.

## Test Circuit



Sample Application Circuits

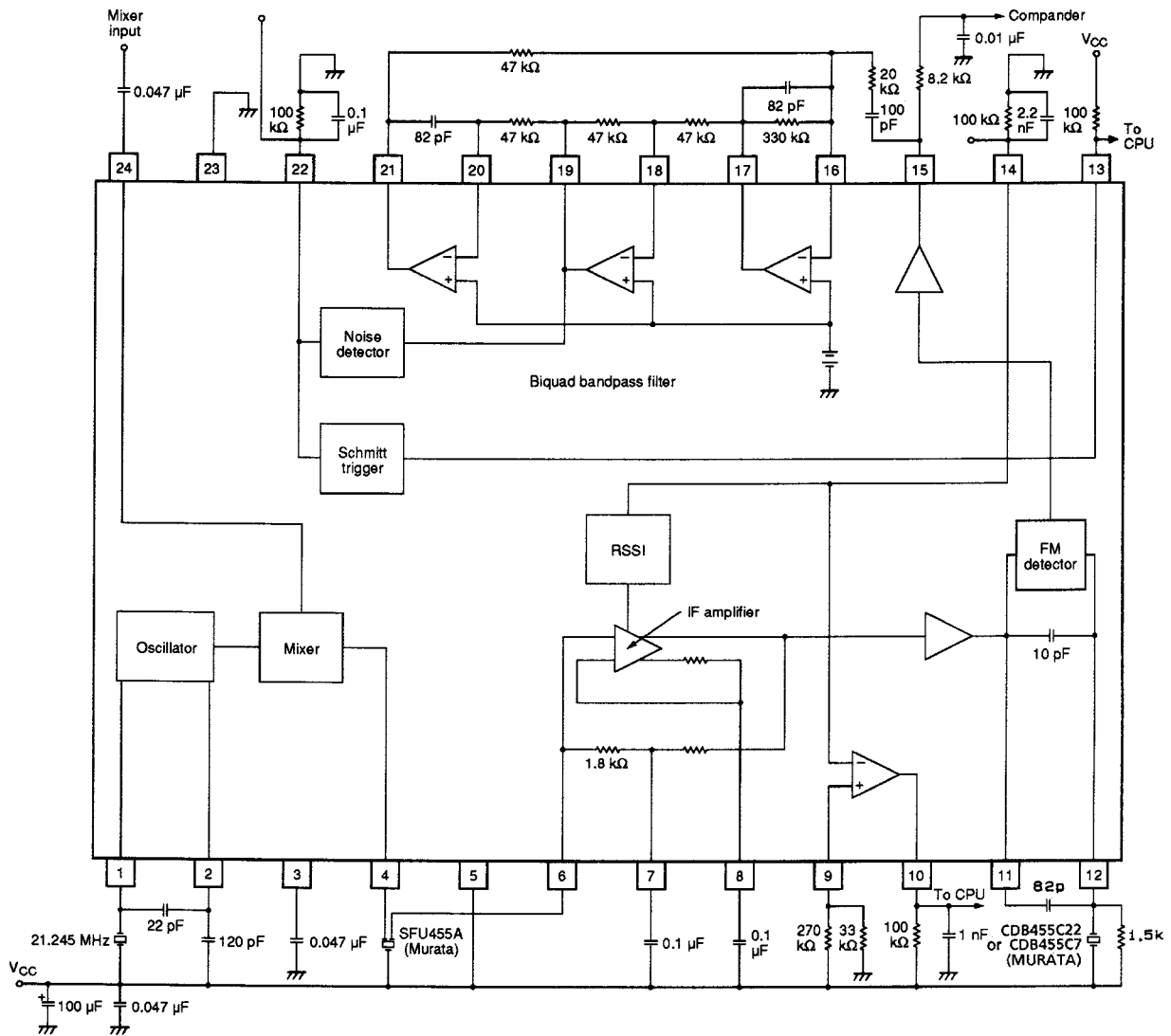


Figure 1. Crystal detector

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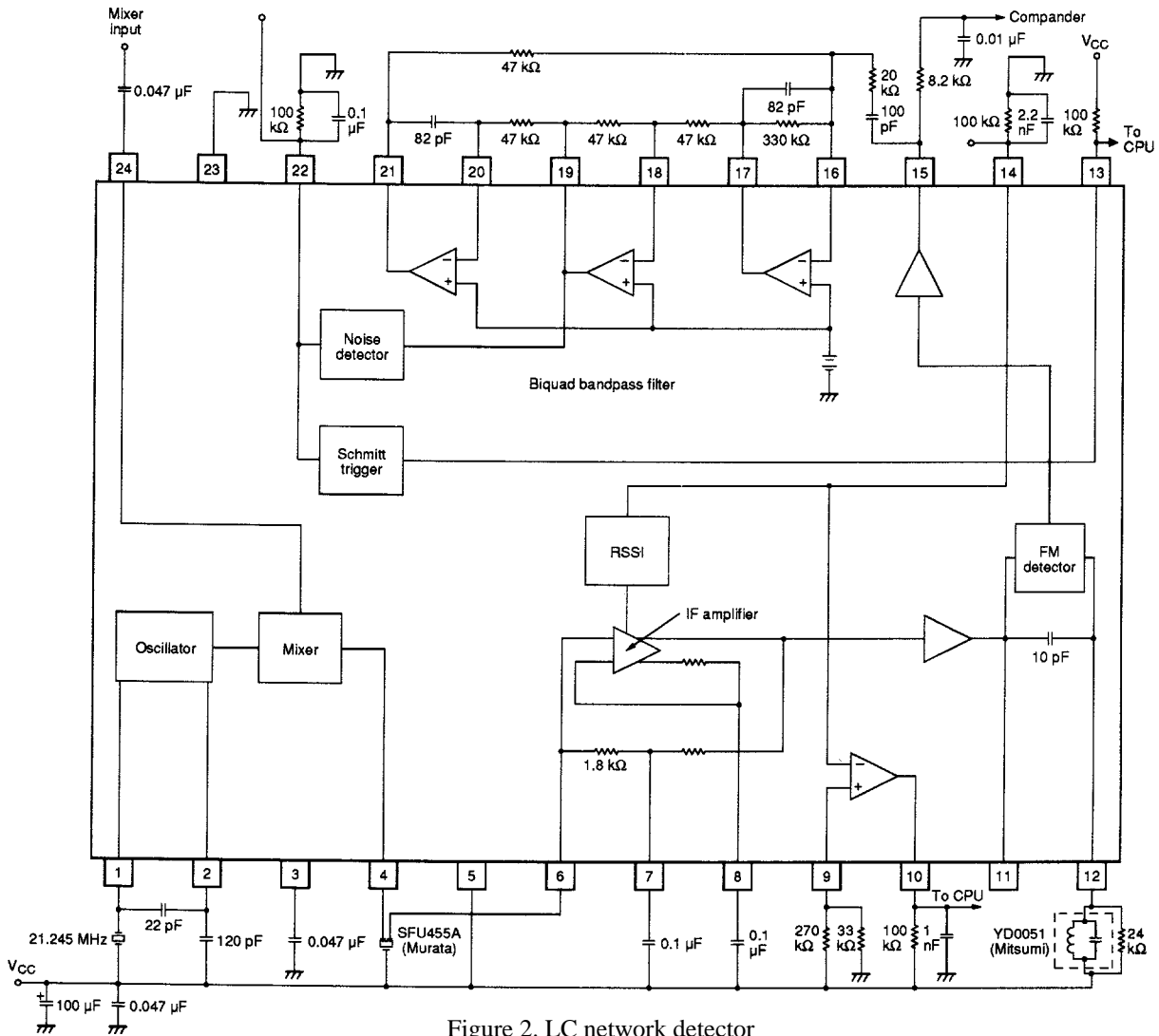


Figure 2. LC network detector

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