



# SANYO Semiconductors DATA SHEET

## LV23002M — Bi-CMOS IC For Radio Cassette and Mini Component System 1-chip Tuner IC Incorporating PLL

### Overview

The LV23002M is a one-chip tuner IC incorporating PLL for radio cassette and mini component system.

### Features

- AM
- FM-FE
- FM-IF
- MPX
- PLL

### Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC \text{ max}}$	$V_{CC}$	7.0	V
	$V_{DD \text{ max}}$	$V_{DD}$	5.0	V
Maximum input voltage	$V_{IN1 \text{ max}}$	CE, DI, CL	5.0	V
	$V_{IN2 \text{ max}}$	XIN	$V_{DD}+0.3$	V
Maximum output voltage	$V_{O1 \text{ max}}$	DO	6.0	V
	$V_{O2 \text{ max}}$	XOUT, PD	$V_{DD}+0.3$	V
	$V_{O3 \text{ max}}$	BO1, BO2, AOUT	12.0	V
Allowable power dissipation	$P_d \text{ max}$	$T_a \leq 70^\circ\text{C}$ Mounted on a glass epoxy board. Board size : 114.3 mm×76.1mm = 1.6mm	400	mW
Operating temperature	$T_{opr}$		-20 to +70	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-40 to +125	$^\circ\text{C}$

Note : This product should be handled with care because the resistance of one pin against electrostatic discharge damage is low.

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# LV23002M

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

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	$V_{CC}$		5.0	V
	$V_{DD}$		3.0	V
Operating supply voltage range	$V_{CC\ op}$		4.0 to 6.0	V
	$V_{DD\ op}$		2.5 to 3.6	V

Note : Use the product with the supply voltage applied to  $V_{CC}$  and  $V_{DD}$ .

## PLL block Allowable Operating Range at $T_a = -20$ to $+70^\circ\text{C}$ , $V_{SS} = 0\text{V}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Supply voltage	$V_{DD}$		2.5		3.6	V
Input high level voltage	$V_{IH}$	CE, CL, DI	$0.7V_{DD}$		5.0	V
Input low level voltage	$V_{IL}$	CE, CL, DI	0		$0.3V_{DD}$	V
Output voltage	$V_{O1}$	DO	0		6.0	V
	$V_{O2}$	BO1, BO2, AOUT	0		10	V
Operating frequency	$f_{IN1}$	XIN ; $V_{IN1}$		75		kHz
	$f_{IN2}$	FMIN ; $V_{IN2}$	10		160	MHz
	$f_{IN3}$	AMIN (SNS = 1) ; $V_{IN3}$	2		40	MHz
	$f_{IN4}$	AMIN (SNS = 0) ; $V_{IN4}$	0.5		10	MHz

Note : Due attention must be paid on leak because the XIN pin has an extremely high input impedance.

## Operating Characteristics at $T_a = 25^\circ\text{C}$ , $V_{CC} = 5.0\text{V}$ , $V_{DD} = 3.0\text{V}$ , See the specified circuit.

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[FM-FE characteristics] : $f_c = 98\text{MHz}$ , $f_m = 1\text{kHz}$ , $22.5\text{kHzdev}$ .						
3dB sensitivity	3dB LS	60dB $\mu\text{V}$ EMF, 30%mod output reference, -3dB input		3		dB $\mu\text{V}$ EMF
Actual sensitivity	QS	S/N = Input at S/N = 30dB		10		dB $\mu\text{V}$ EMF
[FM-IF monaural characteristics] : $f_c = 10.7\text{MHz}$ , $f_m = 1\text{kHz}$ , $75\text{kHzdev}$ .						
Demodulation output	$V_O$	100dB $\mu\text{V}$ , 12pin output	210	330	420	mVrms
Channel balance	CB	100dB $\mu\text{V}$ , 13pin output /12pin output	-1.5	0	+1.5	dB
Signal-to-noise ratio	S/N	100dB $\mu\text{V}$ , 12pin output	68	75		dB
Total harmonic distortion (Monaural)	THD	100dB $\mu\text{V}$ , 12pin output		0.3	1.5	%
3dB sensitivity	3dB LS	$V_O$ reference, Input level at which $V_O$ reference is -3dB.		38	44	dB $\mu\text{V}$
IF count sensitivity	IF-C3	SDC0 = 1, SDC1 = 0, 18pin(DO) output	45	51	61	dB $\mu\text{V}$
Mute attenuation	Mute-Att	100dB $\mu\text{V}$ , 12pin output		68		dB
[FM-IF stereo characteristics] : $f_c = 10.7\text{MHz}$ , $f_m = 1\text{kHz}$ , $L+R = 90\%$ , $\text{Pilot} = 10\%$ , $V_{IN} = 100\text{dB}\mu\text{V}$						
Separation	SEP	L-mod, 12pin output /13pin output	28	40		dB
Total harmonic distortion (Main)	THD	Main-mod, 12pin output		0.5	1.5	%
Stereo ON sensitivity	ST-ON	Stereo operation ON at Pilot = 5.5% Stereo not ON at Pilot = 0.6%				
Cap challenge	CR	Stereo ON at $f_m = 18.6\text{kHz}$ and 10% modulation $f_m = 19.4\text{kHz}$ , Stereo ON at $f_m = 19.4\text{kHz}$ and 10% modulation				

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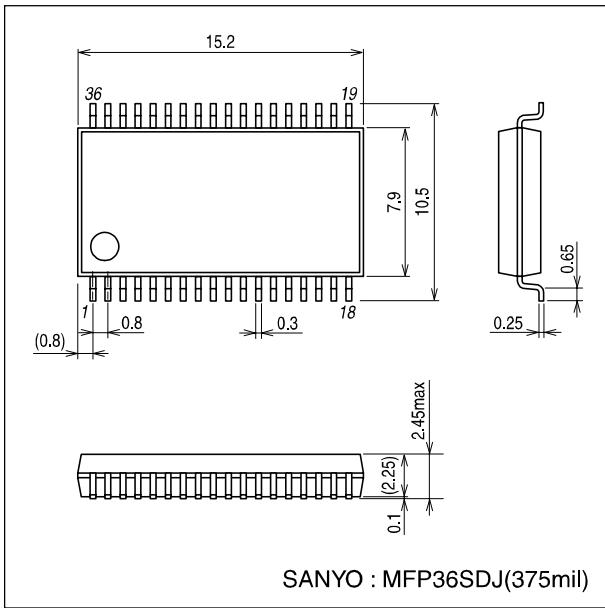
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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[AM characteristics] : $f_c = 1000\text{kHz}$ , $f_m = 1\text{kHz}$ , 30%mod						
Detection output 1	$V_{O1}$	23dB $\mu\text{V}$ , 12pin output	20	40	80	mVrms
Detection output 2	$V_{O2}$	80dB $\mu\text{V}$ , 12pin output	60	110	160	mVrms
Signal-to-noise ratio 1	S/N1	23dB $\mu\text{V}$ , 12pin output	15	20		dB
Signal-to-noise ratio 2	S/N2	80dB $\mu\text{V}$ , 12pin output	47	54		dB
Total harmonic distortion	THD	80dB $\mu\text{V}$ , 12pin output		1.2	3.0	%
IF count sensitivity	IF-C	18pin(DO) output	16	26	36	dB $\mu\text{V}$
Low-range attenuation	LOW-CUT	$V_{O2}$ reference, Pin 12 output at $f_m = 100\text{Hz}$	5	8	11	dB
[Current dissipation]						
Current dissipation	ICCFM	No input in FM mode	20	30	40	mA
	ICCAM	No input in AM mode	10	20	30	
	$I_{DD}$	$f_r = 83\text{MHz}$ , $X'_{tal} = 75\text{kHz}$ , No input to tuner	1	2	5	
[PLL characteristics]						
Internal return resistance	$R_f$	XIN		8		$M\Omega$
Built-in output resistance	$R_d$	XOUT		250		$k\Omega$
Hysteresis width	VHIS	CE, CL, DI		$0.1V_{DD}$		V
Output high level voltage	$V_{OH}$	PD ; $I_O = -1\text{mA}$	$V_{DD}-1.0$			V
Output low level voltage	$V_{OL1}$	PD ; $I_O = 1\text{mA}$			1.0	V
	$V_{OL2}$	BO1, BO2 ; $I_O = 1\text{mA}$			0.25	V
		BO1, BO2 ; $I_O = 5\text{mA}$			1.25	V
	$V_{OL3}$	DO ; $I_O = 1\text{mA}$			0.25	V
$V_{OL4}$	AOUT ; $I_O = 1\text{mA}$ , AIN = 2.0V			0.5	V	
Input high level current	$I_{IH1}$	CE, CL, DI ; $V_I = 6.0\text{V}$			5.0	$\mu\text{A}$
	$I_{IH2}$	XIN ; $V_I = V_{DD}$	0.16		0.9	$\mu\text{A}$
	$I_{IH3}$	AIN ; $V_I = 6.0\text{V}$			200	nA
Input low level current	$I_{IL1}$	CE, CL, DI ; $V_I = 0\text{V}$			5.0	$\mu\text{A}$
	$I_{IL2}$	XIN ; $V_I = 0\text{V}$	0.16		0.9	$\mu\text{A}$
	$I_{IL3}$	AIN ; $V_I = 0\text{V}$			200	nA
Output off-leak current	IOFF1	BO1, AOUT, BO2 ; $V_O = 10\text{V}$			5.0	$\mu\text{A}$
	IOFF2	DO ; $V_O = 6.0\text{V}$			5.0	$\mu\text{A}$
"H" level 3-state off-leak current	IOFFH	PD ; $V_O = 6.0\text{V}$		0.01	200	nA
"L" level 3-state off-leak current	IOFFL	PD ; $V_O = 0\text{V}$		0.01	200	nA

Package Dimensions

unit : mm  
3263



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