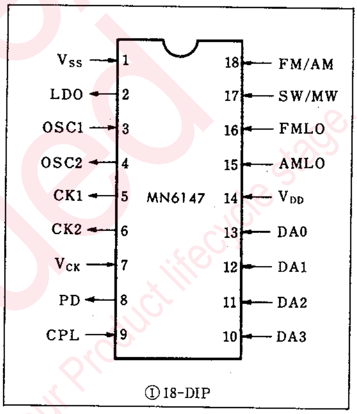
MN6147

COMS PLL Frequency Synthesizer for FM-AM Stereo Tuners

■ Outline

The MN6147 is a high-performance LSI designed for the PLL frequency synthesizer system for FM-AM stereo tuners. It is capable of directly processing an FM signal and has various functions for Hi-Fi stereo tuners. It can also process SW and LW signals.
It operates on single +5V power. A clock circuit can be backed up by a battery.

■ Pin Configuration

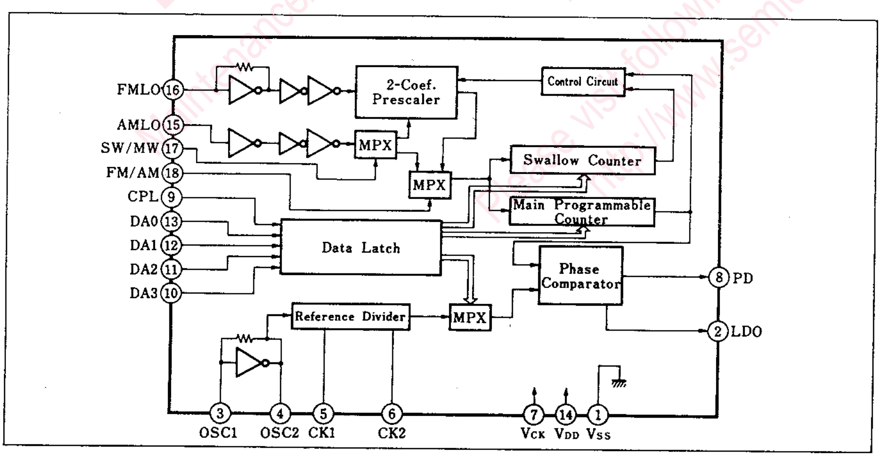


① 18-DIP

■ Features

- Capable of selecting 6 kinds of reference frequencies; 25, 10, 9, 5, 2.5, and 1 kHz.
- FM filter frequency shift: ±25 Hz, Resolution: 25 kHz, IF filter frequency shift: ±25 kHz, ±50 kHz, ±75 kHz
- 5 pins for 4-bit parallel data input, and data input clock 1 input and data input
- 2 input pins for programmable frequency divider; for FM and for SW/MW/LW
- With 562.5 kHz and 250 Hz output pins as control output

■ Block Diagram



■ Absolute Maximum Ratings (V_{SS}=0V, Ta=25°C)

Item	Symbol	Rating	Unit
Supply voltage	V_{DD}	−0.3～+10	V
Input voltage	V_I	−0.3～V_{DD}+0.3	V
Output voltage	V_O	−0.3～V_{DD}+0.3	V
Power dissipation	P_D	250	mW
Operating ambient temperature	T_{opr}	−30～+70	°C
Storage temperature	T_{stg}	−55～+100	°C

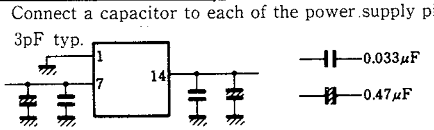
■ Operating Conditions (V_{SS}=0V, Ta=−30 to +70°C)

Item	Symbol	Condition	min.	typ.	max.	Unit
Supply voltage(1)	V_{DD}		4.5	5	5.5	V
Supply voltage(2)	$V_{(CK)}$	Clock Supply	3.5	5	5.5	V

■ Electrical Characteristics (V_{DD}=+4.5 to 6.0 V, V_{SS}=0V, Ta=−30 to +70°C)

Item	Symbol	Condition	min.	typ.	max.	Unit
Supply current	I_{DD}	V_{DD}=5V, Ta=25°C		20	30	mA
Total power consumption	P_{tot}			100	150	mW
Supply current	$I_{(CK)}$	Clock current, $V_{(CK)}$=+5V, Ta=25°C		0.6	1.5	mA
Input Pins(DA0-DA3, CPL, FM/AM, SW/MW)						
Input voltage high level	$V_{IH(1)}$	V_{DD}=5V	2.4		V_{DD}	V
Input voltage low level	$V_{IL(1)}$		V_{SS}		0.8	V
Input current	$I_{I(1)}$	V_I=V_{SS}～V_{DD}			±10	µA
Input Pin(FMLO)						
Input voltage	$V_{I(1)}$		1.0			V_{p-p}
Input current	$I_{I(2)}$	$V_{I(1)}$=0 V or 5 V	±10	±50	±250	µA
Input frequency(max.)	$f_{i(FM)}$	V_{DD}=4.5～5.5V	120			MHz
Input Pin(AMLO)						
Input voltage	$V_{I(2)}$		1.0			V_{p-p}
Input current	$I_{I(3)}$	$V_{I(2)}$=0 or 5 V	±1	±5	±25	µA
Input frequency(max.)	$f_{i(AM)}$	V_{DD}=4.5～5.5V	30			MHz
Oscillator Circuit Pins(OSC1, OSC2)						
Oscillation frequency	f_{osc}			4.5		MHz
Output Pin(PD)						
Output current high level	$I_{OH(1)}$	V_{DD}=5V, V_O=3V	−0.8			mA
Output current low level	$I_{OL(1)}$	V_{DD}=5V, V_O=2V	0.8			mA
Output current(Open)	I_O	V_{DD}=5V, V_O=V_{SS}～V_{DD}			+0.1	nA
Output Pins(CK1, CK2)						
Output voltage high level	$V_{OH(1)}$	V_{DD}=5V, $I_{OH(1)}$=100µA	4.0			V
Output voltage low level	$V_{OL(1)}$	V_{DD}=5V, $I_{OL(1)}$=100µA			0.4	V
Output Pin(LDO)						
Output voltage high level	$V_{OH(2)}$	V_{DD}=5V, I_{OH}=−200µA	4.0			V
Output voltage low level	$V_{OL(2)}$	V_{DD}=5V, I_{OL}=200µA			0.4	V

Note) Connect a capacitor to each of the power supply pins V_{DD}, $V_{(CK)}$ and V_{SS} for use. Input capacitance(FMLO, AMLO)=3pF typ.

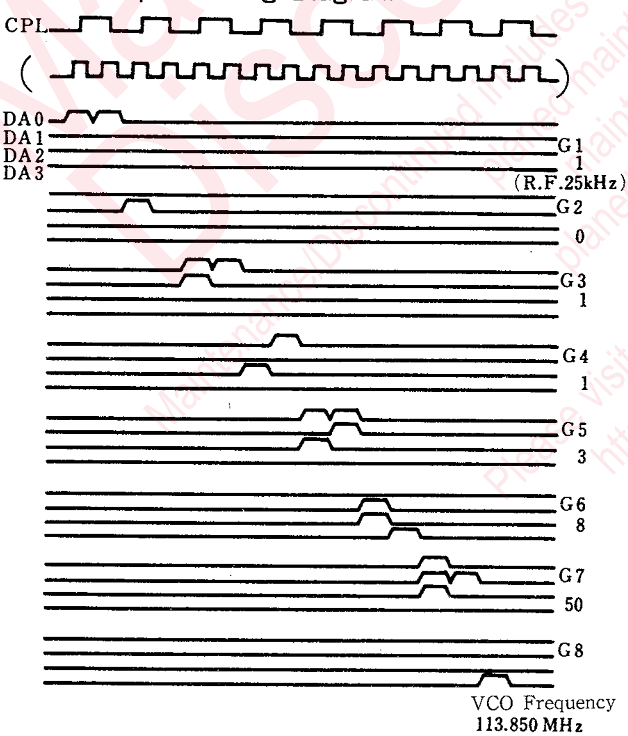


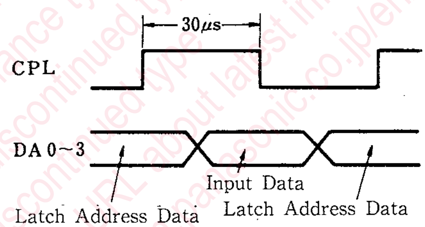
Pin Descriptions

Pin No.	Symbol	Description
1	V_{SS}	Ground
2	LDO(QO)	Lock detector output(oscillator circuit output)
3	OSC1	4.5 MHz crystal oscillation
4	OSC2	
5	CK1	Clock output 1(562.5 kHz*)
6	CK2	Clock output 2(250 Hz)
7	V_{CK}	Frequency divider circuit for real time clock battery backup(5 V)
8	PD	Phase detector output(3-state)
9	CPL	Latch clock
10	DA3	Data and address input(MSB)
11	DA2	Data and address input
12	DA1	
13	DA0	Data and address input(LSB)
14	V_{DD}	Main power(5 V)
15	AMLO	AM local oscillation signal input
16	FMLO	FM local oscillation signal input
17	SW/MW	SW/MW switching
18	FM/AM	FM/AM switching

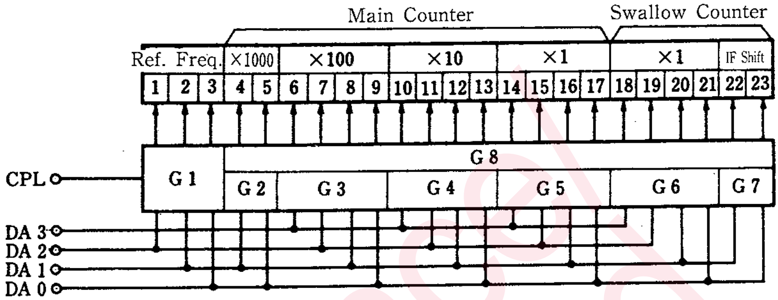
Following three clock frequencies, 187.5 kHz, 375 kHz and 1.125 MHz, can also be available by changing inner wiring.

Data Input Timing Diagram





■ Relations between Data Input Pins and Programmable Counters



Latch Group Selector Code Table

Input Code \ Latch	G1	G2	G3	G4	G5	G6	G7	G8
DA3	L	L	L	L	L	L	L	H
DA2	L	L	L	H	H	H	H	×
DA1	L	H	H	L	L	H	H	×
DA0	H	L	H	L	H	L	H	×

IF Shift Table

Input Code \ kHz	0	25	50	75
DA1	L	L	H	H
DA0	L	H	L	H

Ref. Frequency(rl) Selector Code Table

Input Code \ kHz	2.5	25	9	10	5	1
DA2	L	L	L	L	H	H
DA1	L	L	H	H	L	H
DA0	L	H	L	H	×	×

FM, SW and MW(LW) Signal Processing Switching Table

Input Signal		Selector Pin Code	
Signal	Pin	FM/AM⑱	SW/MW⑰
FM	⑯	H	×
SW	⑮	L	H
MW(LW)	⑮	L	L

■ Data Input Example

Bit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Weight	(2	1)	(8	4	2	1)	(8	4	2	1)	(8	4	2	1)	(8	4	2	1)	(2	1)			

Ref. Freq. | ×1000 | ×100 | ×10 | ×1 (Main Counter) | ×1 | IF Shift (Swallow Counter)

[Example 1] For FM;

Bit: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Data: (0 0 1)(0 0)(0 0 0 0)(1 0 0 1)(0 1 0 1)(0 0 1 0)(0 0) → 0 0 9 5 2 0

Freq. dividing ratio N=952×4+0=3808

25 kHz VCO freq.: f=3808×25 kHz=95.200 MHz

[Example 2] For FM;

Bit: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Data: (0 0 1)(0 0)(0 0 0 1)(0 0 1 0)(0 1 1 0)(1 0 0 0)(1 0) → 0 1 2 6 8 2

Freq. dividing ratio N=1268×4+2=5074

25 kHz VCO freq.: f=5074×25 kHz=126.850 MHz

[Example 3] For SW;

Bit: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Data: (1 0 ×)(0 0)(0 0 1 0)(1 0 0 1)(0 1 0 1)(0 0 1 0 0 0) → 0 2 9 5 8

Freq. dividing ratio N=2958

5 kHz VCO freq. f=2958×5 kHz=14.790 MHz

[Example 4] For SW;

Bit: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Data: (1 1 ×)(0 1)(0 1 1 0)(1 0 0 1)(0 1 0 1)(0 0 0 1 1 1) → 1 6 9 5 7

Freq. dividing ratio N=16957

1 kHz VCO freq. f=16957×1 kHz=16.957 MHz

[Example 5] For MW;

Bit: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Data: (0 1 1)(0 0)(0 0 0 1)(0 0 1 0)(0 1 1 0)(0 0 0 0 0 0) → 0 1 2 6

Freq. dividing ratio N=126

10 kHz VCO frequency=126×10 kHz=1260 kHz

[Example 6] For MW:

Bit: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Data: (0 1 0)(0 0)(0 0 0 1)(0 0 0 1)(1 0 0 1)(0 0 0 0 0 0) → 0 1 1 9

Freq. dividing ratio N=119

9 kHz VCO freq f=119×9 kHz=1071 kHz

■ Receive Frequency Example

〔FM Band〕

Region	Frequency Band (MHz)		Channel Width (kHz)	Ref. Frequency (kHz)	Intermediate Frequency (MHz)		
Japan	76.1	89.9	100	25	−10.700,	−10.675,	−10.650
America 1	87.9	107.9	200	25	10.700,	10.725,	10.750
America 2	87.9	107.9	100	25			
Europe	87.50	108.00	50	25	10.700,	10.725,	10.750

〔AM Band〕

Region	Frequency Band		Channel Width (kHz)	Ref. Frequency (kHz)	Intermediate Frequency (kHz)
Japan	522	1611	9	9	450
America 1	530	1620	10	10	450
America 2	522	1611	9	9	450
Europe 1	522	1611	9	9	450
Europe 2	530	1620	10	10	450

〔LW Band〕

Region	Frequency Band		Channel Width (kHz)	Ref. Frequency (kHz)	Intermediate Frequency (kHz)
	146	353	9	1	450

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