MN6147

COMS PLL Frequency Synthesizer for FM-AM Stereo Tuners

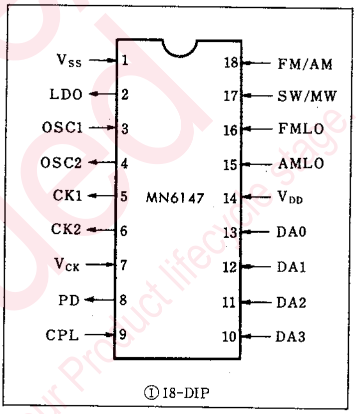
■ Outline

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.

■ Features

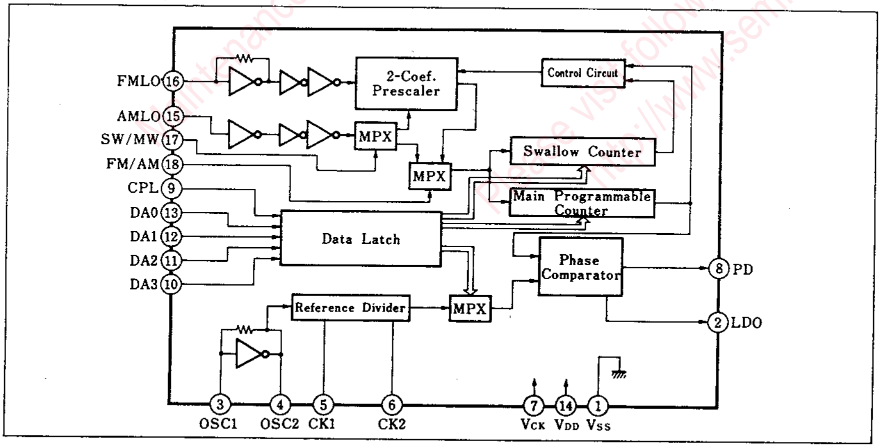
- Capable of selecting 6 kinds of reference frequencies; 25, 10, 9, 5, 2.5, and 1 kHz.
- FM filter frequency shift: ±25 Hz, Resolution: 25 kHz, IF filter frequency shift: ±25 kHz, ±50 kHz, ±75 kHz
- 5 pins for 4-bit parallel data input, and data input clock 1 input and data input
- 2 input pins for programmable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

■ Pin Configuration



①18-DIP

■ Block Diagram



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

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

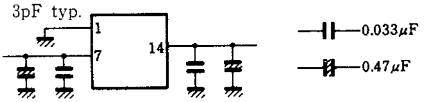
■ Operating Conditions($V_{SS}=0V$, $Ta=-30$ to $+70°C$)

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	$I_{I(1)}$	$V_I=V_{SS}\sim V_{DD}$			±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.)	$f_{i(FM)}$	$V_{DD}=4.5\sim5.5V$	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.)	$f_{i(AM)}$	$V_{DD}=4.5\sim5.5V$	30			MHz
Oscillator Circuit Pins(OSC1, OSC2)						
Oscillation frequency	fosc			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	$V_{DD}=5V$, $V_O=V_{SS}\sim V_{DD}$			+0.1	nA
Output Pins(CK1, CK2)						
Output voltage high level	$V_{OH(1)}$	$V_{DD}=5V$, $I_{OH(1)}=100\mu A$	4.0			V
Output voltage low level	$V_{OL(1)}$	$V_{DD}=5V$, $I_{OL(1)}=100\mu A$			0.4	V
Output Pin(LDO)						
Output voltage high level	$V_{OH(2)}$	$V_{DD}=5V$, $I_{OH}=-200\mu A$	4.0			V
Output voltage low level	$V_{OL(2)}$	$V_{DD}=5V$, $I_{OL}=200\mu A$			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.

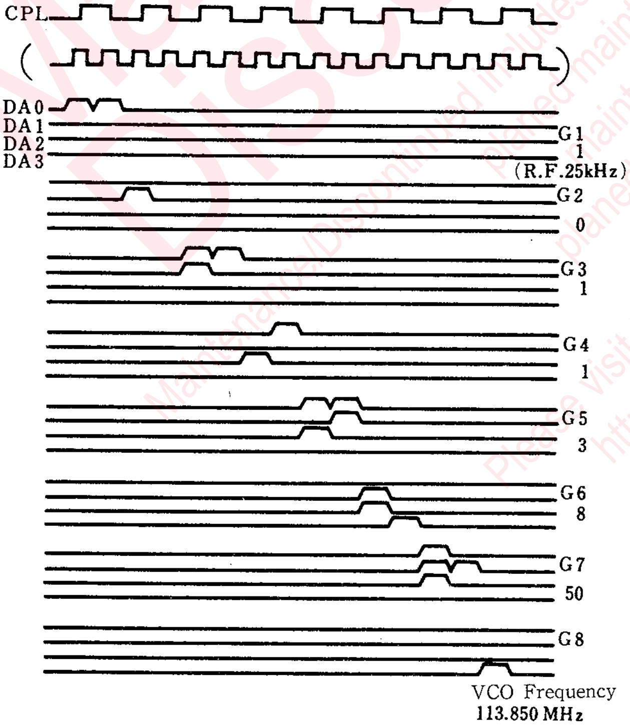


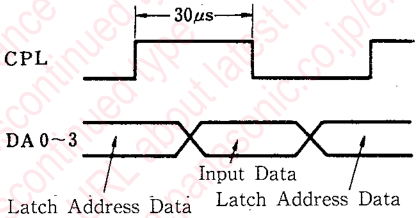
Pin Descriptions

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

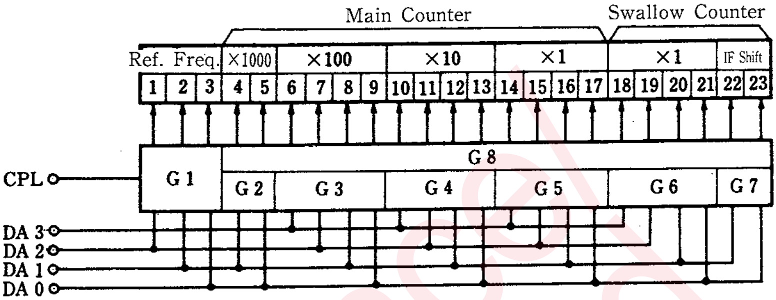
Following three clock frequencies, 187.5 kHz, 375 kHz and 1.125 MHz, can also be available by changing inner wiring.

Data Input Timing Diagram





■ Relations between Data Input Pins and Programmable Counters



Latch Group Selector Code Table

Latch / Input Code	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

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

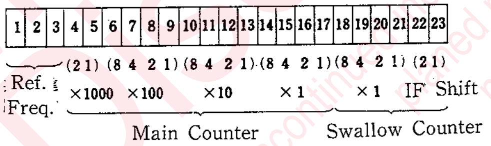
Ref. Frequency(rl) Selector Code Table

kHz / Input Code	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



〔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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