

Advance Information

PLL Frequency Synthesizer

The MC12179 is a monolithic Bipolar synthesizer integrating the high frequency prescaler, phase/frequency detector, charge pump, and reference oscillator/buffer functions. When combined with an external loop filter and VCO, the MC12179 serves as a wide bandwidth PLL. Motorola's advanced Bipolar MOSAIC™ V technology is utilized for low power operation at a 5.0V supply voltage. The device is designed for operation up to 2.8GHz for wide bandwidth applications such as CATV down converters and satellite receiver tuners.

- 2.8GHz Maximum Operating Frequency
- Low Power Supply Current of 3.5mA Typical, Including I_{CC} and I_p Currents
- Supply Voltage of 5.0V Typical
- Integrated Divide by 256 Prescaler
- On-Chip Reference Oscillator/Buffer
- Digital Phase/Frequency Detector with Linear Transfer Function
- Balanced Charge Pump Output
- Space Efficient 8-Lead SOIC
- Operating Temperature Range of -40°C to $+85^{\circ}\text{C}$
- Synthesizer With Phase Inverted Charge Pump Output Available – Please Consult a Motorola Representative

MC12179

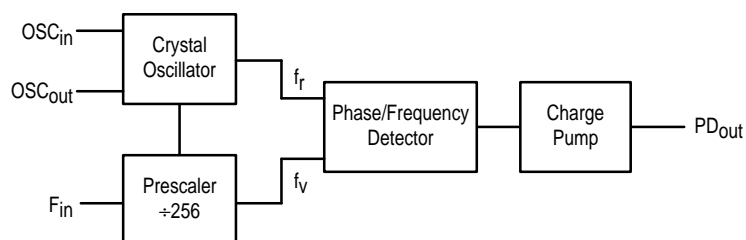
MECL PLL COMPONENTS

PLL Frequency Synthesizer

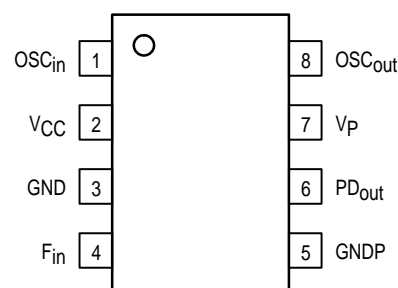


D SUFFIX
PLASTIC SOIC PACKAGE
CASE 751-05

BLOCK DIAGRAM



Pinout: 8-Lead SOIC (Top View)



MAXIMUM RATINGS*

Symbol	Parameter	Value	Unit
V_{CC}	Power Supply Voltage, Pin 2	-0.5 to $+6.0$	VDC
V_p	Power Supply Voltage, Pin 7	V_{CC} to $+6.0$	VDC
T_{stg}	Storage Temperature Range	-65 to $+150$	$^{\circ}\text{C}$

* Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

MOSAIC V is a trademark of Motorola, Inc.

This document contains information on a new product. Specifications and information herein are subject to change without notice.



ELECTRICAL CHARACTERISTICS ($V_{CC} = 4.5$ to $5.5V$; $V_P = V_{CC}$ to $5.5V$; $T_A = -40$ to $+85^\circ C$)

Symbol	Characteristic	Min	Typ	Max	Unit	Condition
I_{CC}	Supply Current for V_{CC}		3.1		mA	Note 1
I_P	Supply Current for V_P		0.4		mA	Note 1
F_{IN}	Operating Frequency f_{INmax} f_{INmin}	2800		500	MHz	Note 2
F_{OSC}	Operating Frequency Crystal Mode External Oscillator OSC_{in}			11 11	MHz	Note 3 Note 4
V_{IN}	Input Sensitivity F_{in}	100		1000	mV _{P-P}	Note 2
V_{OSC}	Input Sensitivity External Oscillator OSC_{in}	500		2200	mV _{P-P}	Note 4
I_{OSC}	Input Current		130 -310		μA	$OSC_{in} = V_{CC}$ $OSC_{in} = V_{CC} - 2.2V$
V_{IH}	Input HIGH Voltage (OSC_{in})	$V_{CC} - 0.85$		V_{CC}	V	
V_{IL}	Input LOW Voltage (OSC_{in})	$V_{CC} - 2.20$		$V_{CC} - 1.35$	V	
V_{OH}	Output HIGH Voltage (PD_{out})	$V_P - 0.5$			V	$I_{OH} = -2.0mA$
V_{OL}	Output LOW Voltage (PD_{out})			0.5	V	$I_{OL} = 2mA$
I_{OH}	Output Source Current (PD_{out})	-1.5	-2.0	-2.5	mA	$V_P = 5.0V$, $V_{PDout} = V_P/2$
I_{OL}	Output Sink Current (PD_{out})	1.5	2.0	2.5	mA	$V_P = 5.0V$, $V_{PDout} = V_P/2$
I_{OZ}	Output Leakage Current (PD_{out})			TBD	nA	

1. V_{CC} or $V_P = 5.0V$; $F_{IN} = 2.56GHz$; $F_{OSC} = 10MHz$ crystal; PD_{out} open.

2. AC coupling, F_{IN} measured with a 1000pF capacitor.

3. Assumes C_1 and C_2 (Figure 1) limited to $\leq 30pF$ each including stray and parasitic capacitances for a maximum 11MHz crystal.

4. AC coupling to OSC_{in} .

PIN NAMES

Pin	I/O	Function	Pin No.
OSC_{in}	I	Oscillator Input — An external parallel-resonant, fundamental crystal is connected between OSC_{in} and OSC_{out} to form an internal reference oscillator (crystal mode). External capacitors C_1 and C_2 , as shown in Figure 1, are required to set the proper crystal load capacitance and oscillator frequency. The values of the capacitors are dependent on the crystal chosen (up to a maximum of 30pF each including parasitic and stray capacitances). For an external reference oscillator, an external signal is AC-coupled to the OSC_{in} pin with a 1000pF coupling capacitor, with no connection to OSC_{out} . The AC-coupled signal must be at least 500mV _{P-P} and less than 2200mV _{P-P} . DC-coupling can be applied directly to the OSC_{in} pin for large amplitude signals limited to the V_{IL} and V_{IH} levels as specified in the Electrical Characteristics table, with no connection to OSC_{out} .	1
V_{CC}	—	Positive Power Supply.	2
GND	—	Ground.	3
F_{in}	I	Prescaler Input — This input is typically the loop VCO signal AC coupled into the F_{in} pin.	4
GNDP	—	Ground — For charge pump circuitry.	5
PD_{out}	O	Single ended phase/frequency detector output (charge pump output). Three-state current sink/source output for use as a loop error signal when combined with an external low pass filter. The phase/frequency detector is characterized by a linear transfer function.	6
V_P	—	Positive power supply for charge pump.	7
OSC_{out}	O	Oscillator output, for use with an external crystal as shown in Figure 1.	8

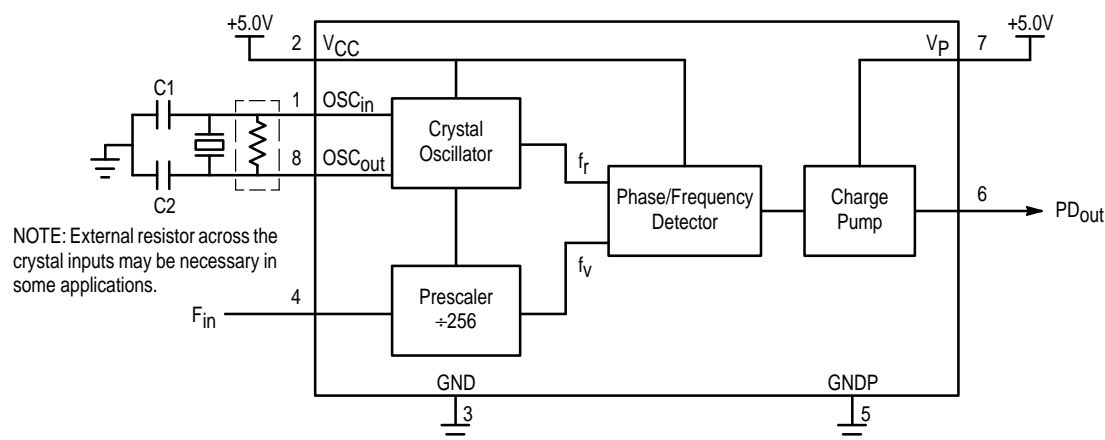


Figure 1. MC12179 Expanded Block Diagram

PHASE CHARACTERISTICS

The phase comparator in the MC12179 is a high speed digital phase/frequency detector circuit. The circuit determines the "lead" or "lag" phase relationship and time difference between the leading edges of the VCO (f_v) signal and the reference (f_r) input. The detector can cover a range of $\pm 2\pi$ radian of f_v/f_r phase difference. The operation of the charge pump output is shown in Figure 2.

f_v leads f_r in phase OR $f_v > f_r$ in frequency

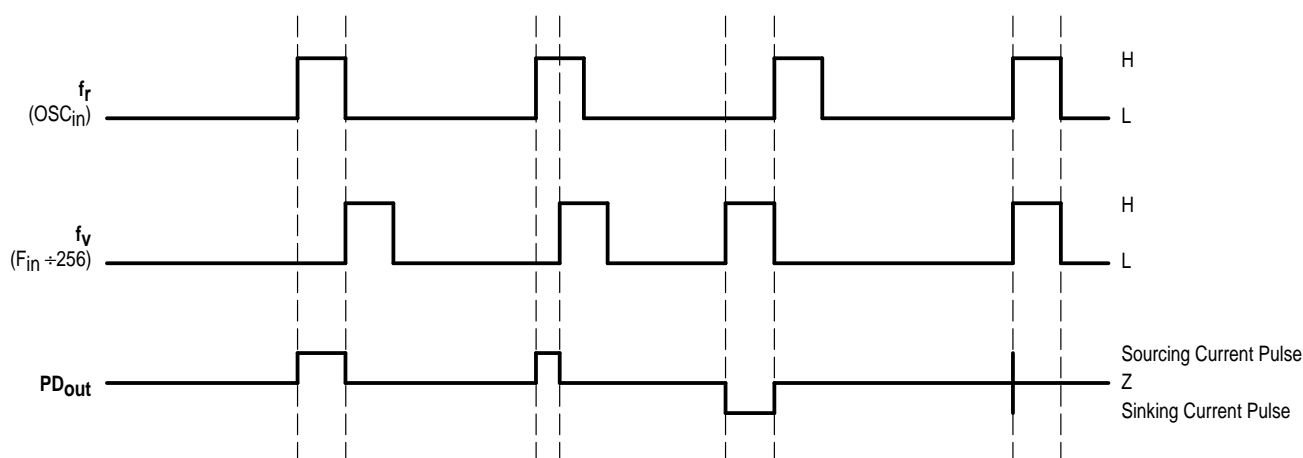
When the phase of f_v leads that of f_r or the frequency of f_v is greater than f_r , the PDout output will pulse LOW from a high impedance (HIGH-Z) state (current sinking pulse). The signal on PDout indicates to the VCO to decrease in frequency to bring the loop into lock.

f_v lags f_r in phase OR $f_v < f_r$ in frequency

When the phase of f_v lags that of f_r or the frequency of f_v is less than f_r , the PDout output will pulse HIGH from a HIGH-Z state (current sourcing pulse). The signal on PDout indicates to the VCO to increase in frequency to bring the loop to lock.

$f_r = f_p$ in phase and frequency

When the phase and frequency of f_v and f_r are equal, the output PDout remains in the HIGH-Z state, except for the narrow source and sink self-canceling current pulses to eliminate the deadband. This situation indicates that the loop is in lock. The phase/frequency detector will cause either a wider sink or source current pulse to occur as necessary to maintain the loop in its locked state.



H = High voltage level; L = Low voltage level; Z = High impedance

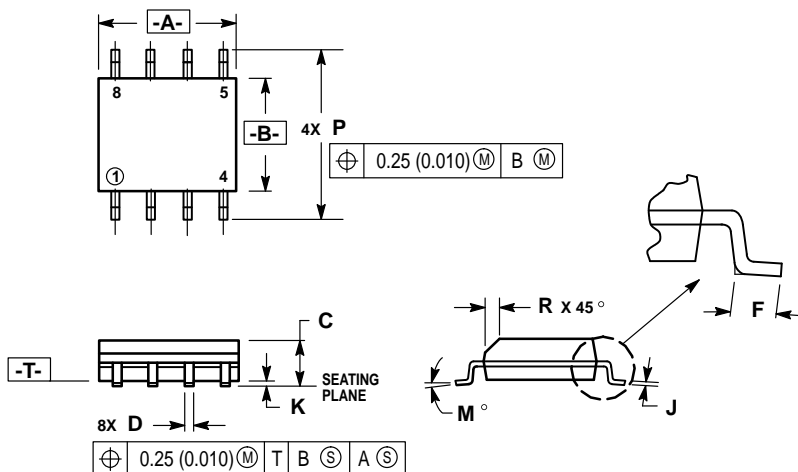
NOTES: Phase difference detection range: $\sim -2\pi$ to 2π

Synthesizer with PDout charge pump output phase inversion available, please consult a Motorola representative.

Figure 2. Phase/Frequency Detector and Charge Pump Waveforms

OUTLINE DIMENSIONS


D SUFFIX
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CASE 751-05
ISSUE M



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.196
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.18	0.25	0.007	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

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