DPLL for 46/49MHz Cordless Telephone

GM6533

Preliminary

Rev. 2.0

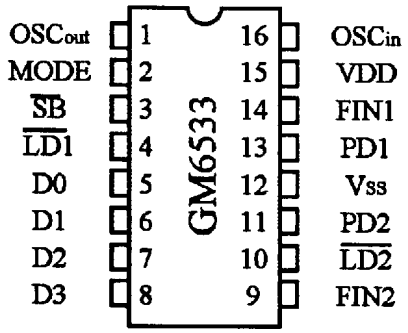
June. 1995

Description

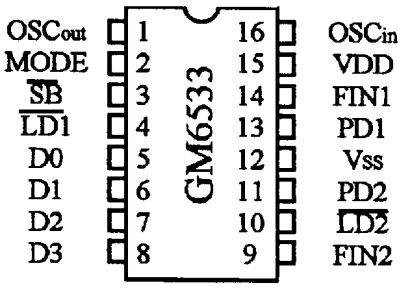
The GM6533 is dual phase-locked frequency synthesizer intended for use primarily in 46/49 MHz band cordless phone with up to 10 channels. This part contains two ROM programmable counters for receive and transmit loops with two independent phase detect circuits. A common reference oscillator and reference divider are shared by the receive and transmit circuits.

Other features include two lock detect circuits for transmit loop and receive loop, illegal code default, a buffered oscillator output for mixing purposes in the system, and 4 bit binary code interface with MCU for channel pair programming.

Pin Configuration



16 DIP



16 SOP

Features

- 10 channel ROM for 46/49 MHz cordless phone
- On-chip oscillator circuit supports external crystal
- Operating power consumption (3.0mA @2.5V)
- 2.5V to 5.5V supply range
- Two Lock detect signals :
  - LD1 - Lock detect signal for receive loop
  - LD2 - Lock detect signal for transmit loop
- Standby mode for power saving (1.5mA @2.5V)
- 16 Pin DIP (300mil), 16 Pin SOP (300mil)

Absolute Maximun Ratings (Voltage Referenced to Vss)

SYMBOL	RATING	VALUE	UNIT
V_{DD}	DC Supply Voltage	-0.5 to 6	V
V_{IN}	Input Voltage, All Input	-0.5 to V_{DD} +0.5	V
I_{IN}, I_{OUT}	DC Current Drain per Pin	10.0	mA
I_{DD}, I_{SS}	DC Current Drain V_{DD} or Vss Pins	30.0	mA
T_{STG}	Storage Temperature Range	-65 to 150	℃

* The device contains circuitry to protect the inputs against damage due to high static voltages or electric fields ; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

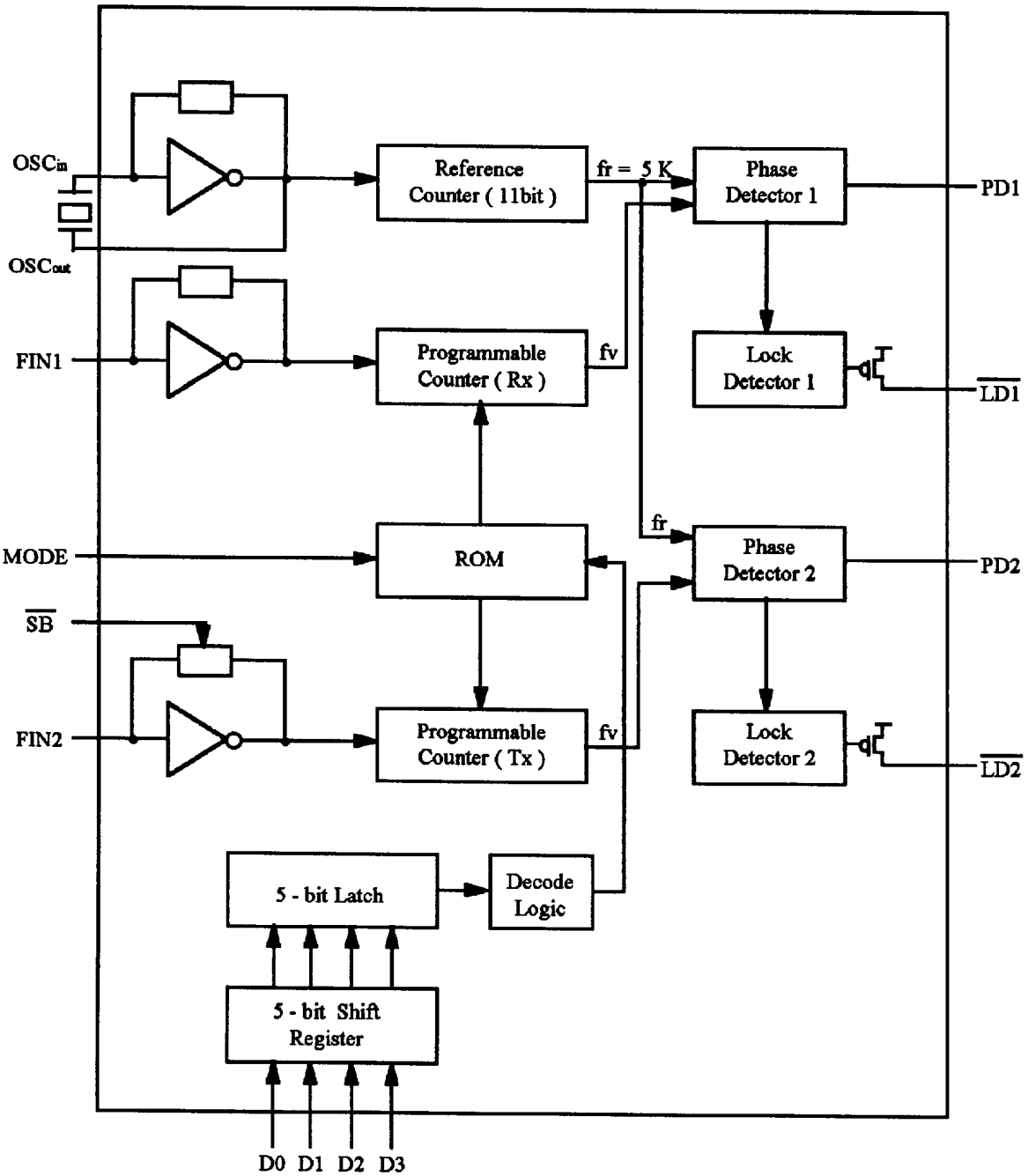
For proper operation it is recommened that V_{IN} and V_{OUT} be constrained to the range Vss < (V_{IN} or V_{OUT}) < V_{DD}.

Unused inputs must always be tied to an appropriate logic voltage level (Vss or V_{DD}).

Operating Range

SYMBOL	VALUE	UNIT
V_{DD}	2.5 ~ 5.5	V
T_A	- 40 ~ 75	℃

Block Diagram



Pin Description

PIN NO.	TERMINAL NAME	INPUT OUTPUT	FUNCTION
15	V_{DD}	Power Supply	This pin is positive supply potential and may be ranged from 2.5 to 5.5 volt with respect to V_{SS}.
12	Vss		This pin is negative supply potential and usually grounded.
16	OSC_{in}	Input	These pins form a reference oscillator when connected to an external parallel-resonant crystal. For a 46/49 MHz cordless phone application, a 10.24 MHz crystal is needed. OSC_{IN} may also serve as an input for externally generated reference signal. This signal is typically ac coupled to OSC_{IN}, but for larger signals (standard CMOS logic levels) dc coupling may also used. In external reference mode, no connection is required for OSC_{OUT}.
1	OSC_{out}		
14	FIN1	Input	These pins are inputs to the divide-by-N receive and transmit counters, respectively. These signals are typically derived from the loop VCO and are ac coupled. For larger amplitude signals (standard CMOS logic levels), dc coupling may be used. The minimum input level is 200mV_{P-P} (@60MHz).
9	FIN2		
13	PD1	Output	These pins are three-state outputs of the transmit and receive phase detectors for use as loop error signals. Frequency fv > fr or fv leading, Output = Negative pulses Frequency fv < fr or fv lagging, Output = Positive pulses Frequency fv = fr and phase coincidence, Output = High - Impedance state.
11	PD2		
2	MODE	Input	Mode is for determining whether the part is to be used in the Base-set or Hand-set of a cordless phone. Internally, this pin is used in the decoding logic for selecting the ROM address. When high, the device is set in the Base-set mode, and when low, the device is set in the Hand-set mode. This input has an internal pull down.

Pin Description (continued)

PIN NO.	TERMINAL NAME	INPUT OUTPUT	FUNCTION
3	$\overline{SB}$	Input	The standby pin is used to save power when not transmitting. When high, the transmit and receive loops are in operation. When low, the transmit loop is disabled, thereby reducing power consumption. This input has an internal pull down device.
4	$\overline{LD1}$	Output	This lock detect signal is associated with the receive loop. The lock output goes high to indicate an output-of-lock condition. This is a P-channel open drain output.
4	$\overline{LD2}$	Output	This lock detect signal is associated with the transmit loop. The lock output goes high to indicate an output-of-lock condition. This is a P-channel open drain output.
5~8	D0~D3	Input	These pins provide the 4-bit binary code for selecting the one of 10 channels to be locked in both the transmit and receive loop. Other input combinations will be defaulted the channel 10 by the decode logic. The frequency assignment with reference to Mode and D0~D3 is shown in table 1,2. These inputs have internal pull down devices.

Electrical Characteristics

DC Characteristics (Voltages Referenced to Vss, T_A = 25℃)

CHARACTERISTIC			SYMBOL	V_{DD}	Min.	Typ.	Max.	UNIT
Power Supply Voltage Range			V_{DD}		2.5		5.5	V
Output Voltages I_{OUT} = 0 V_{IN} = V_{DD} or 0		0 level	V_{OL}	2.5 5.5			0.05 0.05	V
		1 level	V_{OH}	2.5 5.5	2.45 5.45			
Input Voltages V_{OUT} = 0.5 or V_{DD} - 0.5		0 level	V_{IL}	2.5 5.5			0.75 1.65	V
		1 level	V_{IH}	2.5 5.5	1.75 3.85			
Output Current	source	V_{OH} = 2.2 V_{OH} = 5.0	I_{OH}	2.5 5.5	0.18 0.55			-mA
	sink	V_{OL} = 0.3 V_{OL} = 0.5	I_{OL}	2.5 5.5	0.18 0.55			mA
Input Current V_{IL} = 0 V_{IH} = V_{DD} - 0.5		OSC_{in}, FIN1, FIN2	I_{IL}	2.5 5.5			30 66	-μA
		SB, $\overline{Mode}$, D0~D3		2.5 5.5			1.0 1.0	
		OSC_{in}, FIN1, FIN2	I_{IH}	2.5 5.5			30 66	μA
		SB, $\overline{Mode}$, D0~D3		2.5 5.5			50 121	
Input Capacitance			C_{IN}				8.0	pF
Output Capacitance			C_{OUT}				8.0	pF
Standby Current			I_{DS}	2.5 5.5			1.5 3.5	mA
Operating Current (200mV_{PP} input at FIN1, FIN2)			I_{DD}	2.5 5.5			3.0 6.0	mA
3-State Leakage Current (V_{OUT} = 0 or 5.5V)			I_{OZ}	5.5			+/-1.0	μA

Switching Characteristics (T_A = 25℃, C_L = 50 pF)

CHARACTERISTIC		SYMBOL	V_{DD}	Min.	Typ.	Max.	UNIT
Output Rise Time		t_{TLH}	2.5 5.5			200 100	ns
Output Fall Time		t_{THL}	2.5 5.5			200 100	ns
Input Rise and Fall Time OSC_{in}		t_f, t_r	2.5 5.5			5.0 4.0	ns
Maximum Frequency Input = 250mV_{PP} sine wave	OSC_{in} FIN1 FIN2	f_{max}	2.5 - 5.5 2.5 - 5.5 2.5 - 5.5			16 60 60	MHz

Table 1. Input Frequencies of Each Channel at Handset

CHANNEL					RX-FREQ (MHz)	RECEIVE		TX-FREQ (MHz)	TRANSMIT		MODE
D3	D2	D1	D0	CH		FIN1(MHz)	N(A)		FIN2(MHz)	N(B)	
0	0	0	1	1	46.610	35.915	7183	49.670	49.670	9934	0
0	0	1	0	2	46.630	35.935	7187	49.845	49.845	9969	0
0	0	1	1	3	46.670	35.975	7195	49.860	49.860	9972	0
0	1	0	0	4	46.710	36.015	7203	49.770	49.770	9954	0
0	1	0	1	5	46.730	36.035	7207	49.875	49.875	9975	0
0	1	1	0	6	46.770	36.075	7215	49.830	49.830	9966	0
0	1	1	1	7	46.830	36.135	7227	49.890	49.890	9978	0
1	0	0	0	8	46.870	36.175	7235	49.930	49.930	9986	0
1	0	0	1	9	46.930	36.235	7247	49.990	49.990	9998	0
1	0	1	0	10	46.970	36.275	7255	49.970	49.970	9994	0

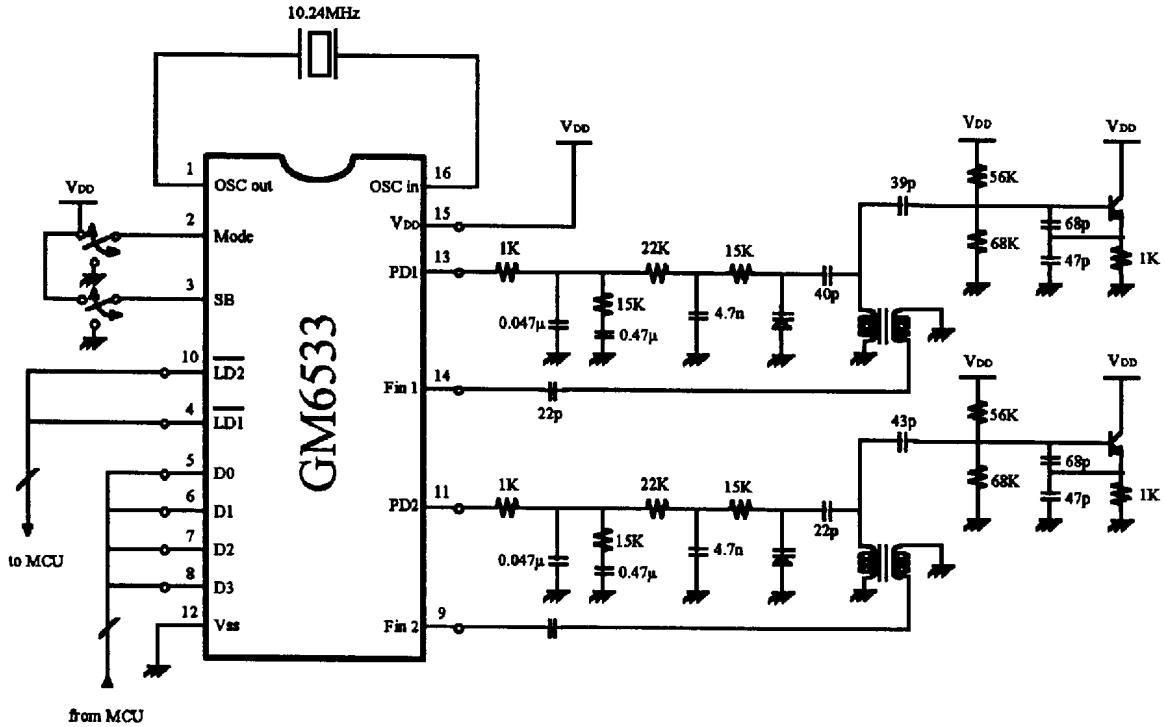
Note : 1. Power up and other illegal input will be defaulted to channel 10 in GM6533.
2. 1st IF frequency of receive is 10.695MHz, 2nd IF is 455KHz.
3. N = FIN (KHz) / 5KHz.

Table 2. Input Frequencies of Each Channel at Baseset

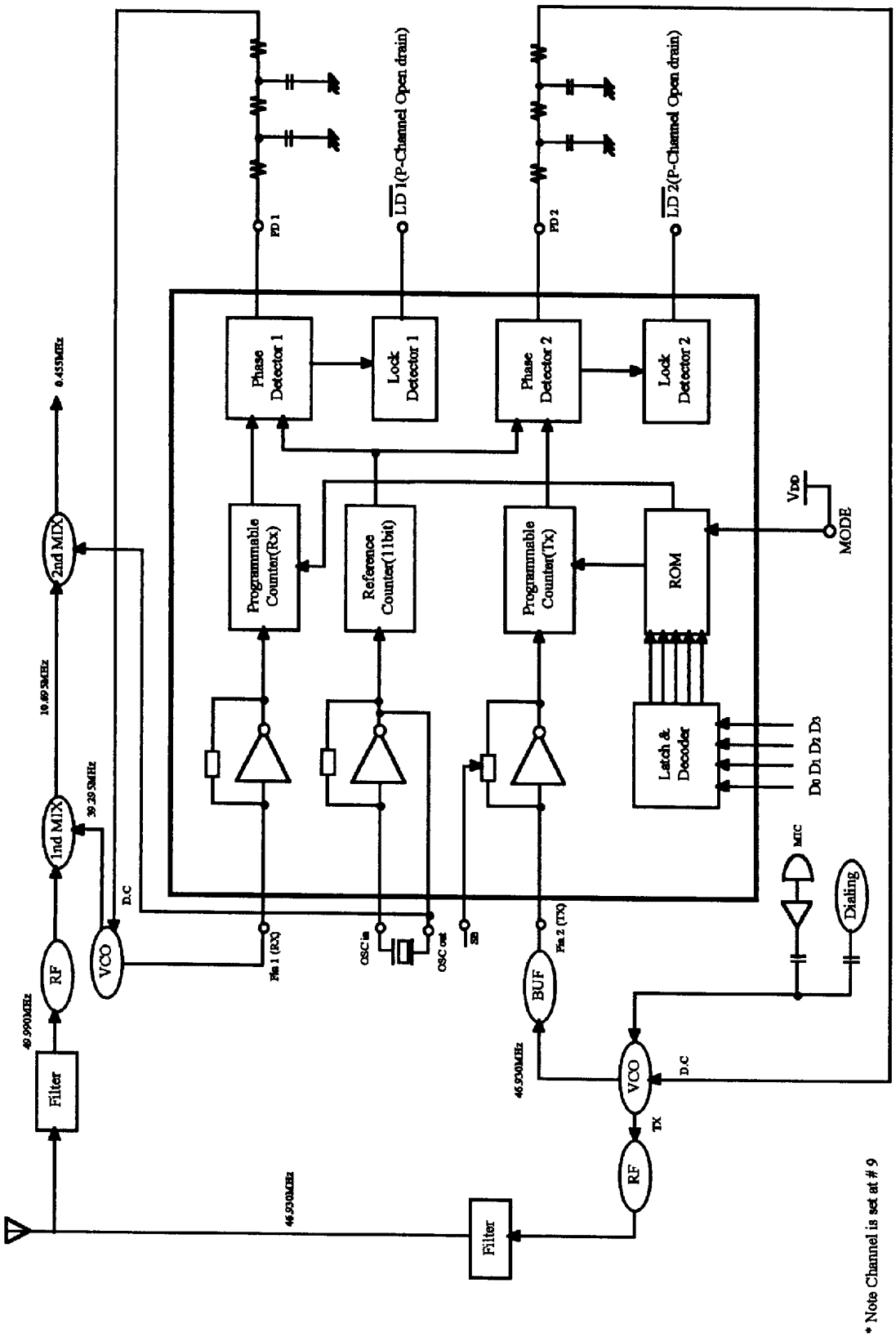
CHANNEL					RX-FREQ (MHz)	RECEIVE		TX-FREQ (MHz)	TRANSMIT		MODE
D3	D2	D1	D0	CH		FIN1(MHz)	N(A)		FIN2(MHz)	N(B)	
0	0	0	1	1	49.670	38.975	7795	46.610	46.610	9322	1
0	0	1	0	2	49.845	39.150	7830	46.630	46.630	9326	1
0	0	1	1	3	49.860	39.165	7833	46.670	46.670	9334	1
0	1	0	0	4	49.770	39.075	7815	46.710	46.710	9342	1
0	1	0	1	5	49.875	39.180	7836	46.730	46.730	9346	1
0	1	1	0	6	49.830	39.135	7827	46.770	46.770	9354	1
0	1	1	1	7	49.890	39.195	7839	46.830	46.830	9366	1
1	0	0	0	8	49.930	39.235	7847	46.870	46.870	9374	1
1	0	0	1	9	49.990	39.295	7859	46.930	46.930	9386	1
1	0	1	0	10	49.970	39.275	7855	46.970	46.970	9394	1

Note : 1. Power up and other illegal input will be defaulted to channel 10 in GM6533.
2. 1st IF frequency of receive is 10.695MHz, 2nd IF is 455KHz.
3. N = FIN (KHz) / 5KHz.

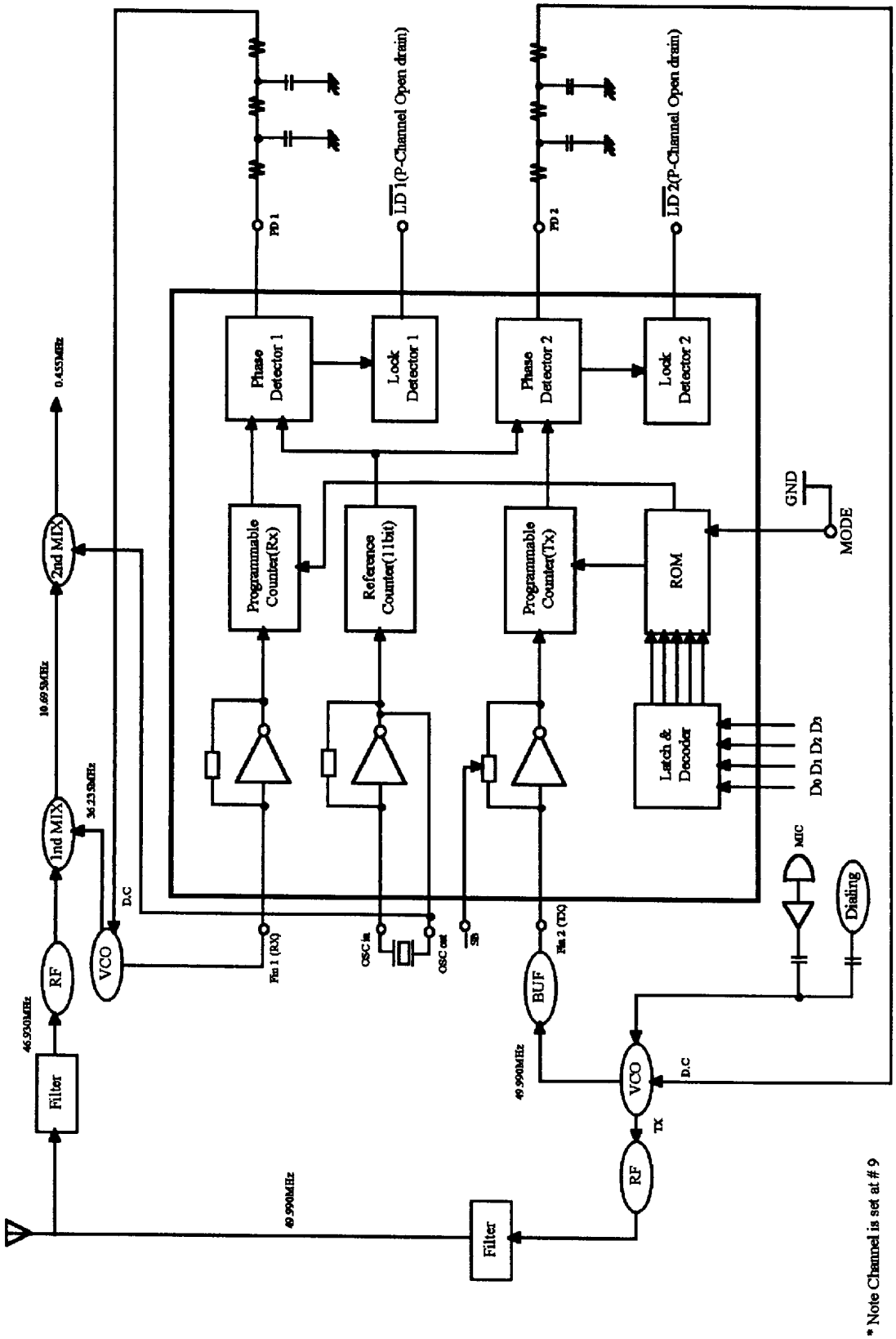
Low Pass Filter & VCO Test Circuit



PLL Application In 46/49MHz Telephone 10 Channel Base Set



PLL Application In 46/49MHz Telephone 10 Channel Hand Set



Switching Waveform