**SILICON OSCILLATOR
DEMONSTRATION CIRCUIT:
LTC1799, LTC6900, LTC6905, LTC6905-XXX,
LTC6906, LTC6907, LTC6908-X**

DESCRIPTION

Demonstration circuit DC814 provides a simple evaluation circuit for Linear Technology's resistor-set and fixed frequency silicon oscillators. For each silicon oscillator, there are two demo boards:

Board 1, a DIP-8 Clock Board

(a silicon oscillator is mounted on this board).

Board 2, a Buffer Board

(a board with a high speed driver for the DIP-8 Clock Board).

DIP-8 CLOCK BOARDS

A DIP-8 Clock Board is a small printed circuit board containing a silicon oscillator that is pin compatible with "half-size" canned crystal oscillators (13mm X 13mm). For the resistor-settable versions, the DIP-8 Clock Boards have surface mount pads for installing 0603 size resistors to program the output frequency (RS1 on clock board).

All of the resistor-settable oscillators, except for the LTC6908-x, have a divider input. For these DIP-8 Clock Boards, an optional jumper is provided to set the divider value.

The LTC6905-xxx series are fixed frequency oscillators and their DIP-8 Clock Boards do not require a frequency setting resistor.

The LTC6908-x boards have a modulation control input (MOD) and the corresponding DIP-8 Clock Boards provide an optional jumper to configure the spread spectrum frequency modulation (SSFM). A jumper can be used to disable the SSFM or set the rate to 1 of 3 rates (see datasheet for details on the SSFM rate selection).

A DIP-8 Board is ordered independently (see Table 1).

BUFFER BOARDS

The Buffer Boards contain a buffering circuit designed specifically for DIP-8 Clock Boards. The DIP-8 Clock Board mounts onto a DIP-8 socket on the Buffer Board. A multi-turn potentiometer on the Buffer Board is provided to adjust oscillator frequency of a DIP-8 Clock Board (a potentiometer is not required for the LTC6905-X series).

A unique Buffer Board is available for each DIP-8 Board (see Table 2).

A high-speed driver with a maximum output current of ±100mA buffers the output of the DIP-8 clock. The output of the buffer is connected through a 50ohm resistor to a BNC connector for driving 50-ohm coaxial cables.

NOTE: The DC814D-J and DC814D-K (DIP-8 Clock Boards for the LTC6908-1 & LTC6908-2) have an additional output (OUT2). The user can install a pin for access to this output. However, the DIP-8 board will not fit into the buffer board with an installed pin for OUT2. The user must bend this pin or install a 90° pin to use the DC814D-x DIP-8 Clock Boards with the buffer boards.

Design files for this circuit board are available. Call the LTC factory.

Table 1. DIP-8 Clock Board Part Numbers

DIP-8 Clock Board	Clock IC
DC814B-A	LTC6905
DC814B-B	LTC1799
DC814B-C	LTC6900
DC814B-D	LTC6905-133
DC814B-E	LTC6905-100
DC814B-F	LTC6905-96
DC814B-G	LTC6905-80
DC814C-H	LTC6906
DC814C-I	LTC6907
DC814D-J	LTC6908-1
DC814D-K	LTC6908-2

Table 2. Buffer Board Part Numbers

Buffer Board*	**Clock IC**
DC814A2-A	LTC6905
DC814A2-B	LTC1799
DC814A2C	LTC6900
DC814A2-D	LTC6905-133
DC814A2-E	LTC6905-100
DC814A2-F	LTC6905-96
DC814A2-G	LTC6905-80
DC814A2-H	LTC6906
DC814A2-I	LTC6907
DC814A2-J	LTC6908-1
DC814A2-K	LTC6908-2

* A DC814A2-X is version two of the Buffer Board. The first release of the Buffer Board is DC814A-X and is compatible with a DIP-8 Clock Board.

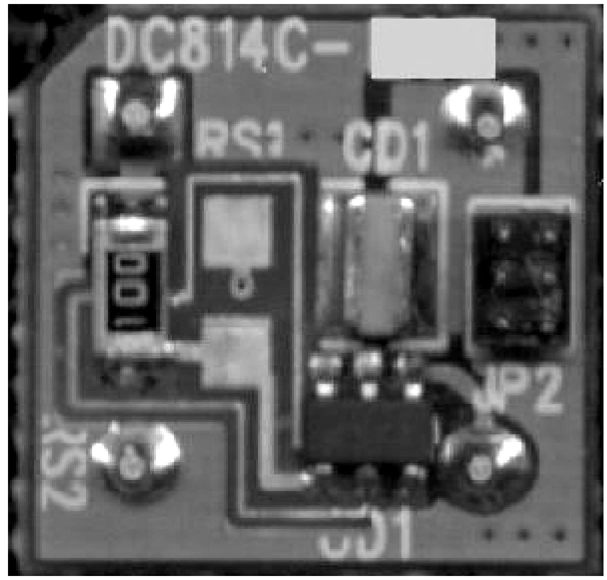


Figure 2. DC814C-X DIP-8 Clock Board
(Top side view)

Figure 1. DC814B-X DIP-8 Clock Board
(Top side view)

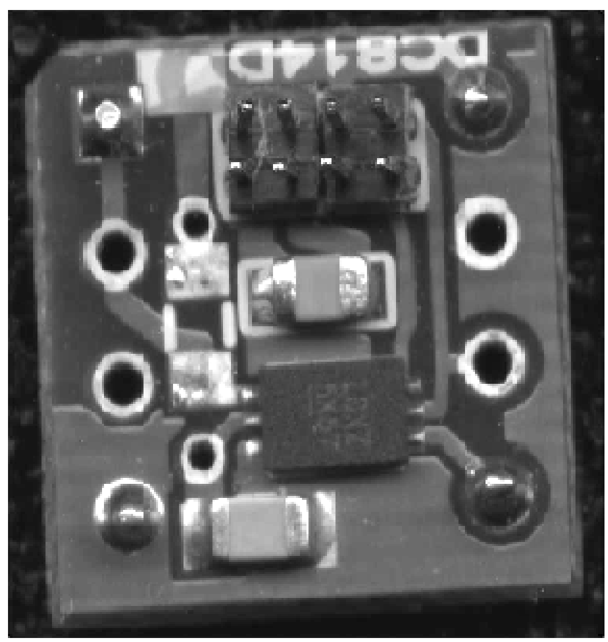


Figure 3. DC814D-X DIP-8 Clock Board
(Top side view)

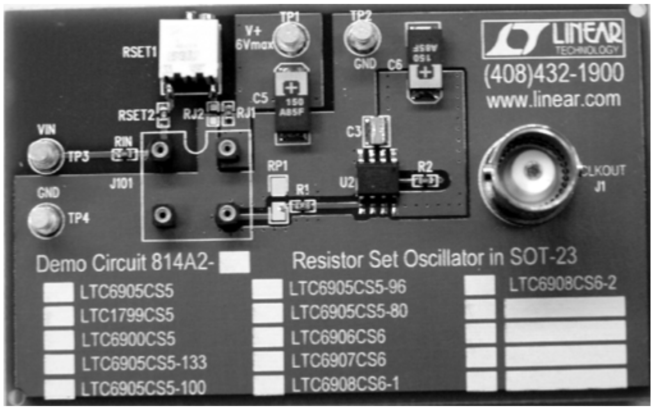


Figure 4. The DC814A2-X Buffer Board

QUICK START PROCEDURE

TEST PROCEDURE: BUFFER BOARD WITH DIP-8 CLOCK

Test Equipment:

1. A single power supply, 3V to 5V.
2. An oscilloscope with a bandwidth of at least 10x the highest clock IC frequency (for example, the highest frequency of the LTC6905 is 170MHz and the oscilloscope bandwidth should be at least 1.7GHz).
3. A frequency counter
4. A potentiometer screwdriver
5. A resistance meter

1. Test Procedure for the Resistor SET ICs:

IC	Buffer Board
LTC6905	DC814A-A
LTC1799	DC814A-B
LTC6900	DC814A-C
LTC6906	DC814A-H
LTC6907	DC814A-I
LTC6908-1	DC814A-J
LTC6908-2	DC814A-K

1. Remove DIP-8 clock board from buffer board
2. Set the jumper shunt on the DIP-8 clock board to the divider value, N, for the frequency range of interest (refer to Table 5).

NOTE: On DC814D-J or K DIP-* board only N=1 is available in the JP1 1-2 position with spread spectrum modulation disabled. JP1 positions 3-4, 5-6 and 7-8 set the spread spectrum modulation rate to fout/16, fout/32 and fout/64 respectively.

3. Connect a resistance meter from the V+ turret to pin 1 of the buffer board socket (see figure 4). Adjust the buffer board potentiometer (RSET1) to set the total resistance (RSET1 plus RSET2) for the desired frequency. Table 5 shows the equation for RSET (RSET1 plus RSET2). The resistor designator for the RSET resistor on the DIP-8 clock board is RS1.

NOTE: The frequency adjustment is very coarse when the potentiometer is turned near the fully clockwise position.

4. Connect buffer board to a single power supply and an oscilloscope as shown in Figure 6 (the oscilloscope input should be set to 50 ohms impedance internally or terminated externally with a 50 ohm BNC thru terminator).
5. Insert the DIP-8 clock board on the buffer board and turn on the power supply.
6. The oscilloscope waveform should be a 0V to V+/2 squarewave (the output of the clock is divided by two by 50 ohms in series with the buffer output and the 50 ohm oscilloscope input).
7. Connect the buffer board CLKOUT to a frequency counter to measure the frequency precisely (the maximum frequency error at 25 °C is listed in Table 5).

2. Test Procedure for the Fixed Frequency ICs.

IC	Buffer Board
LTC6905-133	DC814A-D
LTC6905-100	DC814A-E
LTC6905-96	DC814A-F
LTC6905-80	DC814A-G

1. Connect buffer board with the DIP-8 clock to a single power supply and an oscilloscope as shown in Figure 6 (the oscilloscope input should be set to 50 ohms impedance internally or terminated externally with a 50 ohm BNC thru terminator). Turn on the power supply.
2. The oscilloscope waveform should be a 0V to V+/2 squarewave (the output amplitude of the clock is divided by two by 50 ohms in series with the buffer output and the 50 ohm oscilloscope input).
3. Connect the buffer board CLKOUT to a frequency counter to measure the frequency precisely (the maximum frequency error at 25 °C is listed in Table 4).

3. Test Procedure for a VCO circuit.

LTC6905 (DC814A-A), LTC1799 (DC814A-B) and LTC6900 (DC814A-C).

1. Turn potentiometer RSET1 fully clockwise.
2. Connect a voltage source to the buffer board's VIN (VCNTRL) input (refer to Figure 5)
3. Set the V+ voltage to the buffer board to 3V or 5V and the JP2 jumber on the DIP-8 board in the divide by 1 position (JP2 1-2 for LTC6905 and JP2 5-6 for LTC1799 and LTC6900).

NOTE: The typical VCO control voltage range depends on the clock IC, the ratio of the RSET and RIN resistors and the V+ voltage. VCO operation is not guaranteed if the VCO voltage forces the clock's frequency outside the frequency range shown on Table 3. Refer to the LTC6905 data sheet for a VCO design guide or to a May 2002 Linear Technology Magazine article: How to use the LTC6900 as a VCO.

Figure 5. Buffer Board VCO circuit

LTC6905	V+ =3V, VCNTR: 0V-2V Frequency Range: 102.5MHz – 186.1MHz	
	RSET = 9.09k and RIN = 40.2k, N=1	
LTC1799	V+ =3V, VCNTR: 0V-2V Frequency Range: 18.1MHz – 31.5MHz	V+ =5V, VCNTR: 0V-4V Frequency Range: 8.5MHz – 31.5MHz
	RSET = 3.01k and RIN = 14.7k, N=1	
LTC6900	V+ =3V, VCNTR: 0V-2V Frequency Range: 12.1MHz – 21.5MHz	V+ =5V, VCNTR: 0V-4V Frequency Range: 4.8MHz – 21.5MHz
	RSET = 9.09k and RIN = 40.2k, N=1	

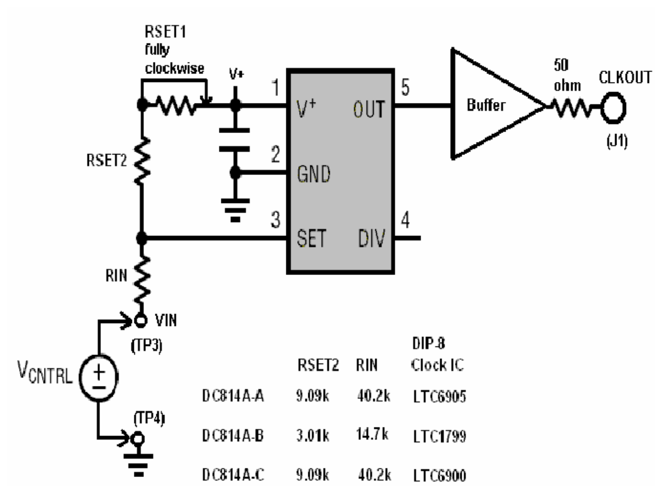


Figure 5. Buffer Board VCO circuit

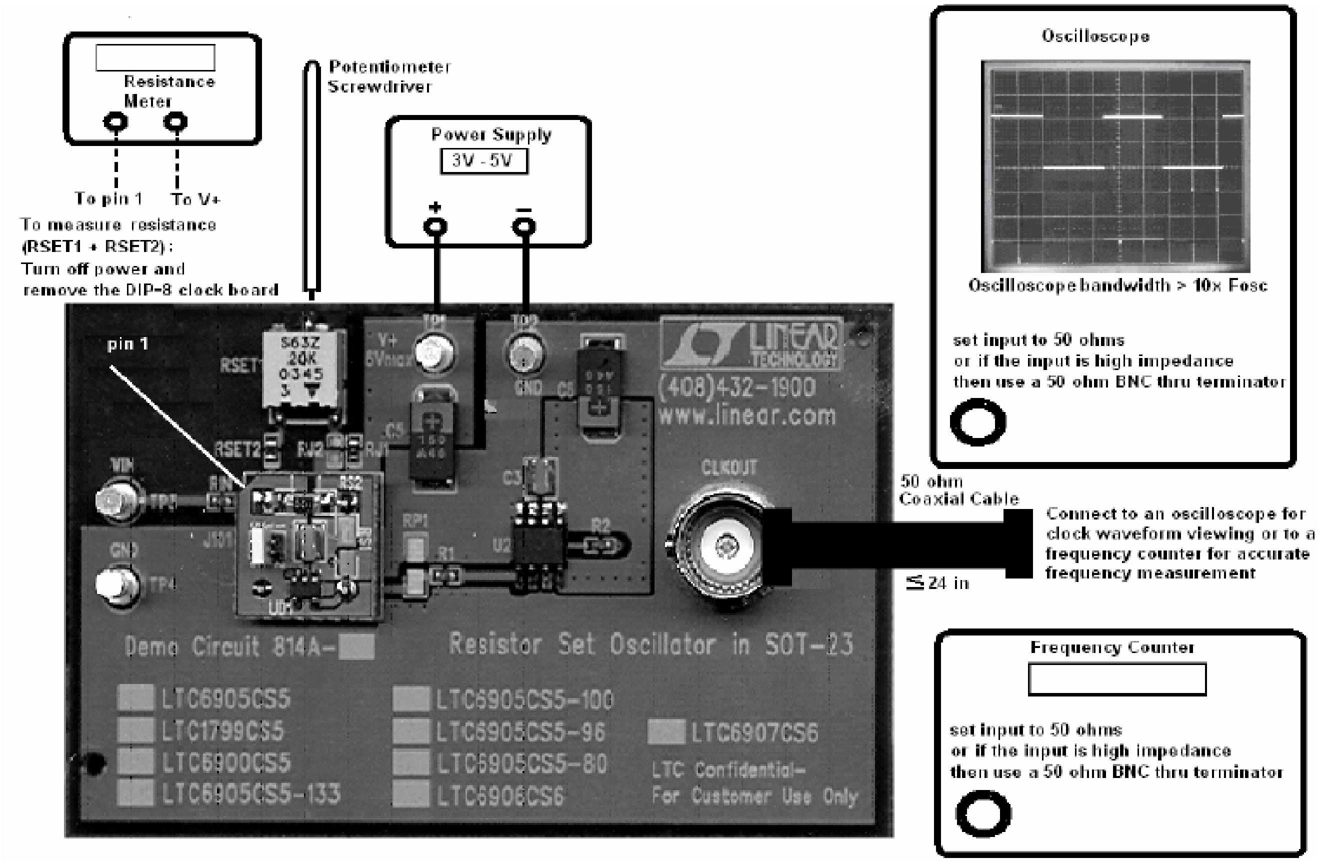


Figure 6. Typical Buffer Board Quick Test Set-Up

Table 4. Frequency Accuracy for Fixed Frequency Oscillators

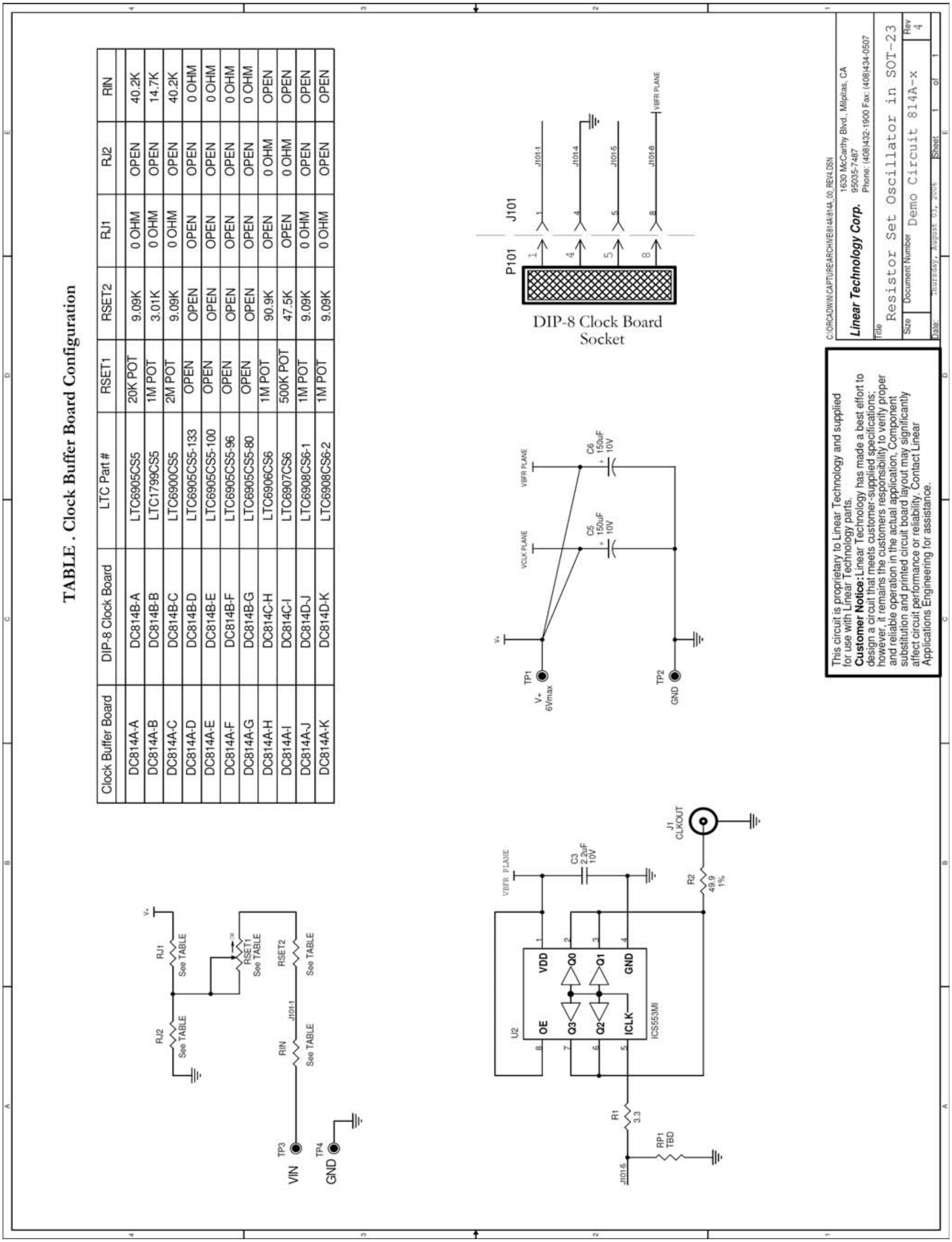
LTC6905-133 (Board Version –D)	LTC6905-96 (Board Version –F)
N = 1, 133MHz; N = 2, 66.7MHz; N = 4, 33.5MHz Maximum Frequency Error at 25 °C: ±1.0% at V+=2.7V to 3.6V and ±1.5% typical at V+=5	N = 1, 96MHz; N = 2, 48MHz; N = 4, 24MHz Maximum Frequency Error at 25 °C: ±1.0% at V+=2.7V to 3.6V and ±1.5% typical at V+=5V
LTC6905-100 (Board Version –E)	**LTC6905-80 (Board Version –G)**
N = 1, 133MHz; N = 2, 66.7MHz; N = 4, 33.5MHz Maximum Frequency Error at 25 °C: ±1.0% at V+=2.7V to 3.6V and ±1.5% typical at V+=5V	N = 1, 80MHz, N = 2, 40MHz; N = 4, 20MHz Maximum Frequency Error at 25 °C: ±1.0% at V+=2.7V to 3.6V and ±1.5% typical at V+=5V

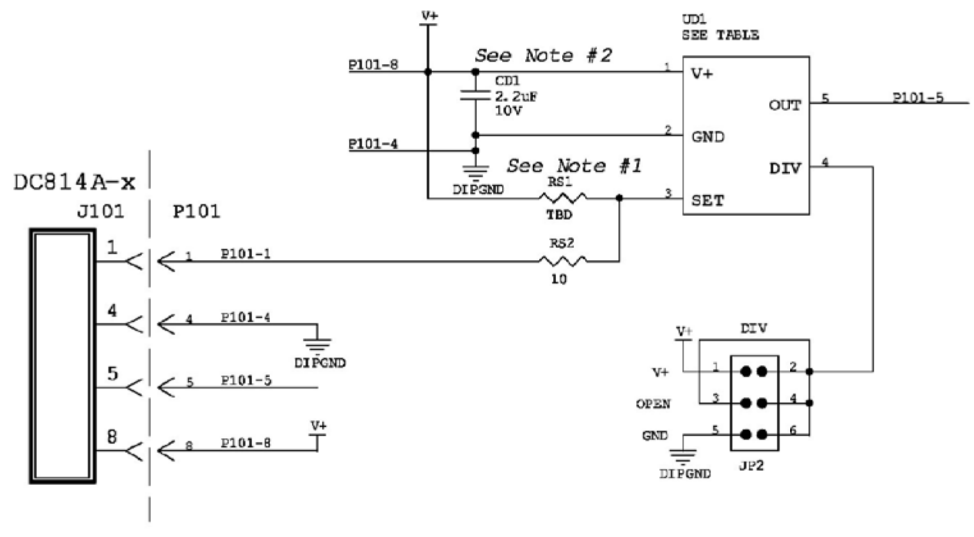
Table 5. Frequency Range and Accuracy of Resistor SET Oscillators.

LTC6905 (Board Version –A)	LTC6906 (Board Version –H)
RSET = 3370/(2·Fosc·N-3), (Fosc is in MHz and RSET in kΩ) N = 1, 69MHz≤ fosc≤170MHz (JP2 1-2) N = 2, 34MHz≤fosc≤85MHz (JP2 3-4) N = 4, 17MHz≤fosc≤42MHz (JP2 5-6) Max Frequency Error at 25 °C: ±1.4% at V+=2.7V to 3.6V and ±2.2% at V+=5V	RSET = 100/(Fosc·N), (Fosc in MHz and RSET in kΩ) N = 1, 0.1MHz≤ fosc≤ 1MHz (JP2 5-6) N = 3, 33kHz≤fosc≤333kHz (JP2 3-4) N = 10, 10kHz≤fosc ≤100kHz (JP2 1-2) Max Frequency Error at 25 °C: ±0.5% at V+=2.7V to 3.6V
LTC1799 (Board Version –B)	**LTC6907 (Board Version –I)**
RSET = 100/(Fosc·N), (Fosc in MHz and RSET in kΩ) N = 1, 0.1MHzfosc≤33MHz (JP2 5-6) N=10, 10kH ≤fos≤3.3MHz (JP2 3-4) N = 100, 1kHz≤ fosc≤330kHz (JP2 1-2) Max Frequency Error at 25 °C: ±1.5% at V+=3V and ±1.5% at V+=5V	RSET = 200/(Fosc·N), (Fosc in MHz and RSET in kΩ) N = 1, 0.4MHz≤fosc≤4MHz (JP2 5-6) N = 3, 133MHz≤fosc≤1.33MHz (JP2 3-4) N = 10, 40 kHz≤fosc≤400kHz (JP2 1-2) Max Frequency Error at 25 °C: ±0.5% at V+=2.7V to 3.6V
LTC6900 (Board Version –C)	**LTC6908-1 (Board Version –J)**
RSET = 200/(Fosc·N) (Fosc in MHz and RSET in kΩ) N = 1, 0.1MHz≤fosc≤20MHz (JP2 5-6) N = 10, 10kHz≤fosc≤2MHz (JP2 3-4) N = 100, 1kHz≤fosc≤200kHz (JP2 1-2) Max Frequency Error at 25 °C: ±1.5% at V+=3V and ±1.5% at V+=5V	RSET = 100/(Fosc) (Fosc in MHz and RSET in kΩ) N=1 (JP1 1-2 or STOP position with spread spectrum modulation disabled) Max Frequency Error at 25 °C: ±2% at V+=2.7V to 5V (50kHz to 10MHz)
	LTC6908-2 (Board Version –K)
	RSET = 100/(Fosc) (Fosc in MHz and RSET in kΩ) N=1 (JP1 1-2 or STOP position with spread spectrum modulation disabled) Max Frequency Error at 25 °C: ±2% at V+=2.7V to 5V (50kHz to 10MHz)

TABLE . Clock Buffer Board Configuration

Clock Buffer Board	DIP-8 Clock Board	LTC Part #	RSET1	RSET2	RJ1	RJ2	RIN
DC814A-A	DC814B-A	LTC6905CS5	20K POT	9.09K	0 OHM	OPEN	40.2K
DC814A-B	DC814B-B	LTC1799CS5	1M POT	3.01K	0 OHM	OPEN	14.7K
DC814A-C	DC814B-C	LTC6900CS5	2M POT	9.09K	0 OHM	OPEN	40.2K
DC814A-D	DC814B-D	LTC6905CS5-133	OPEN	OPEN	OPEN	OPEN	0 OHM
DC814A-E	DC814B-E	LTC6905CS5-100	OPEN	OPEN	OPEN	OPEN	0 OHM
DC814A-F	DC814B-F	LTC6905CS5-96	OPEN	OPEN	OPEN	OPEN	0 OHM
DC814A-G	DC814B-G	LTC6905CS5-80	OPEN	OPEN	OPEN	OPEN	0 OHM
DC814A-H	DC814C-H	LTC6906CS6	1M POT	90.9K	OPEN	0 OHM	OPEN
DC814A-I	DC814C-I	LTC6907CS6	500K POT	47.5K	OPEN	0 OHM	OPEN
DC814A-J	DC814D-J	LTC6908CS6-1	1M POT	9.09K	0 OHM	OPEN	OPEN
DC814A-K	DC814D-K	LTC6908CS6-2	1M POT	9.09K	0 OHM	OPEN	OPEN





This circuit is proprietary to Linear Technology and supplied for use with Linear Technology parts.
Customer Notice: Linear Technology has made a best effort to design a circuit that meets customer-supplied specifications; however, it remains the customers responsibility to verify proper and reliable operation in the actual application, Component substitution and printed circuit board layout may significantly affect circuit performance or reliability. Contact Linear Applications Engineering for assistance.

NOTE 2. The 2.2uF power supply bypass capacitor is intentionally larger than a typical application requires. A typical application will have large, bulk bypass capacitors on the board in addition to a smaller (0.1uF) ceramic (or better) bypass capacitor placed directly at the part's supply pins. Demo boards go into unknown, prototyping environments where the wiring and distance from the power supply varies greatly. As a conservative measure, this demo board uses a large bypass capacitor. Consult the part's datasheet for more information on supply bypassing.

NOTE 1. If the DIP-8 Clock Board is used independently of the Clock Buffer Board then resistor RS1 must be installed on DC814B-A, -B or -C.
In addition, the RS2 resistor can be removed for DC814A-A, -B and -C.
(RS2 is used only for connecting the DIP-8 Clock Board to the Clock Buffer Board potentiometer).
RS1 is not used for DC814B-D, -E, -F and -G
(the frequency programming resistor is internally connected in an LTC6905-X IC).
RS2 for DC814B-D to G connects the output enable of an LTC6905-X to pin 1.
(Output is Enabled with pin 1 floating or to V+ and Output is Off with 1 to ground).

DC814B-A LTC6905 RS1=3370/(2·Fosc·N-3) Fosc in MHz and RS1 in kΩ

N = 1, 69MHz ≤ fosc ≤ 170MHz (JP2 1-2)
N = 2, 34MHz ≤ fosc ≤ 85MHz (JP2 3-4)
N = 4, 17MHz ≤ fosc ≤ 42MHz (JP2 5-6)

DC814B-B LTC1799 RS1=100/(Fosc·N) Fosc in MHz and RS1 in kΩ

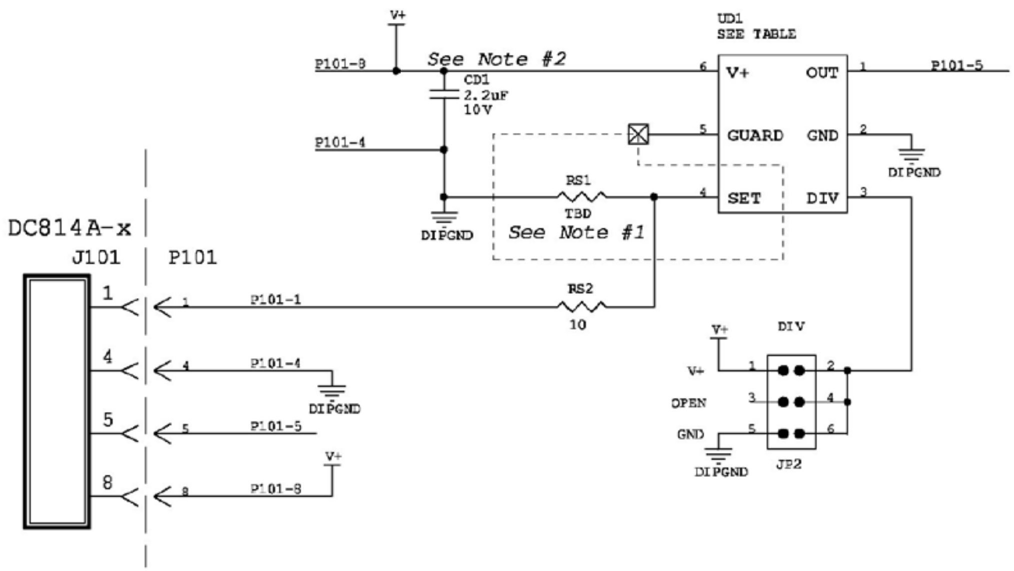
N = 1, 0.1MHz ≤ fosc ≤ 33MHz (JP2 5-6)
N=10, 10kHz ≤ fosc ≤ 3.3MHz (JP2 3-4)
N = 100, 1kHz ≤ fosc ≤ 330kHz (JP2 1-2)

DC814B-C LTC6900 RS1=200/(Fosc·N) Fosc in MHz and RS1 in kΩ

N = 1, 0.1MHz ≤ fosc ≤ 20MHz (JP2 5-6)
N = 10, 10kHz ≤ fosc ≤ 2MHz (JP2 3-4)
N = 100, 1kHz ≤ fosc ≤ 200kHz (JP2 1-2)

DIP-8 Clock Assembly	UD1
DC814B-A	LTC6905CS5
DC814B-B	LTC1799CS5
DC814B-C	LTC6900CS5
DC814B-D	LTC6905CS5-133
DC814B-E	LTC6905CS5-100
DC814B-F	LTC6905CS5-96
DC814B-G	LTC6905CS5-80

Linear Technology Corp. 1630 McCarthy Blvd., Milpitas, CA 95035-7487
Phone: (408)432-1900 Fax: (408)434-0507
Title: DIP-8 Clock Board
Size | Document Number: Demo Circuit 814B-x | Rev: 2
Date: Friday, June 10, 2005 | Sheet 1 of 1



This circuit is proprietary to Linear Technology and supplied for use with Linear Technology parts.
Customer Notice: Linear Technology has made a best effort to design a circuit that meets customer-supplied specifications; however, it remains the customers responsibility to verify proper and reliable operation in the actual application, Component substitution and printed circuit board layout may significantly affect circuit performance or reliability. Contact Linear Applications Engineering for assistance.

NOTE 2. The 2.2uF power supply bypass capacitor is intentionally larger than a typical application requires. A typical application will have large, bulk bypass capacitors on the board in addition to a smaller (0.1uF) ceramic (or better) bypass capacitor placed directly at the part's supply pins. Demo boards go into unknown, prototyping environments where the wiring and distance from the power supply varies greatly. As a conservative measure, this demo board uses a large bypass capacitor. Consult the part's datasheet for more information on supply bypassing.

NOTE 1. If the DIP-8 Clock Board is used independently of the Clock Buffer Board then resistor RS1 must be installed on DC814C-H, or -I.
In addition, the RS2 resistor can be removed.
(RS2 is used only for connecting the DIP-8 Clock Board to the Clock Buffer Board potentiometer).

DC814C-H **LTC6906** **RS1=100/(Fosc·N)** Fosc in MHz and RS1 in kΩ

N = 1, 0.1MHz ≤ fosc ≤ 1MHz (JP2 5-6)
N = 3, 33kHz ≤ fosc ≤ 333kHz (JP2 3-4)
N = 10, 10kHz ≤ fosc ≤ 100kHz (JP2 1-2)

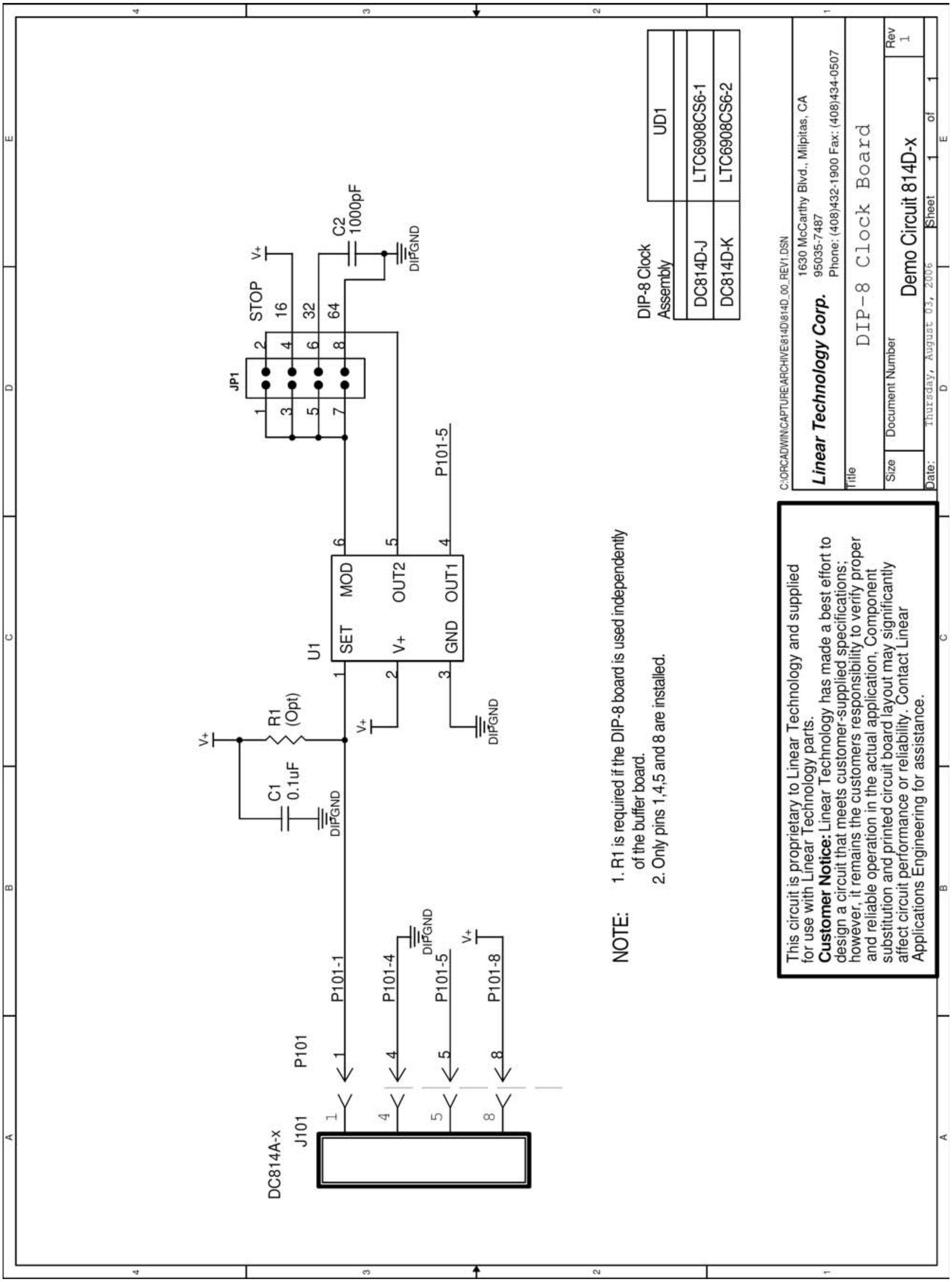
DC814C-I **LTC6907** **RS1=200/(Fosc·N)** Fosc in MHz and RS1 in kΩ

N = 1, 0.4MHz ≤ fosc ≤ 4MHz (JP2 5-6)
N = 3, 133kHz ≤ fosc ≤ 1.33MHz (JP2 3-4)
N = 10, 40 kHz ≤ fosc ≤ 400kHz (JP2 1-2)

DIP-8 Clock Assembly	UD1
DC814C-H	LTC6906CS6
DC814C-I	LTC6907CS6

Linear Technology Corp. 1630 McCarthy Blvd., Milpitas, CA 95035-7487
Phone: (408)432-1900 Fax: (408)434-0507

Title: DIP-8 Clock Board
Size | Document Number: Demo Circuit 814C-x | Rev: 2
Date: Tuesday, August 02, 2005 | Sheet 1 of 1


DC814A-x
J101
P101
P101-1
P101-4
P101-5
P101-8
DIPGND
V+
C1
0.1uF
R1
(Opt)
U1
SET
V+
GND
MOD
OUT2
OUT1
JP1
STOP
16
32
64
C2
1000pF
P101-5
NOTE: 1. R1 is required if the DIP-8 board is used independently of the buffer board.
2. Only pins 1,4,5 and 8 are installed.
DIP-8 Clock Assembly
UD1
DC814D-J
LTC6908CS6-1
DC814D-K
LTC6908CS6-2
This circuit is proprietary to Linear Technology and supplied for use with Linear Technology parts.
Customer Notice: Linear Technology has made a best effort to design a circuit that meets customer-supplied specifications; however, it remains the customers responsibility to verify proper and reliable operation in the actual application, Component substitution and printed circuit board layout may significantly affect circuit performance or reliability. Contact Linear Applications Engineering for assistance.
C:\ORCADWIN\CAPTURE\ARCHIVE\814D\814D_00_REV1.DSN
Linear Technology Corp.
1630 McCarthy Blvd., Milpitas, CA 95035-7487
Phone: (408)432-1900 Fax: (408)434-0507
Title
DIP-8 Clock Board
Size
Document Number
Demo Circuit 814D-x
Rev
1
Date: Thursday, August 03, 2006
Sheet 1 of 1