DEMO CIRCUIT DC814
QUICK START GUIDE

RESISTOR SET OSCILLATORS IN SOT-23: LTC6905, LTC1799, LTC6900, LTC6905-XXX, LTC6906, LTC6907

DESCRIPTION

Demonstration circuit DC814 is for the evaluation of Linear Technology's resistor set oscillator ICs in a SOT-23 package. The DC814 is available in three sets of independent PCB assemblies:

A **Buffer Board** (DC814A-X) and

Two **DIP-8 Clock Boards** (DC814B-X) and (DC814C-X).

The buffer board contains a DIP-8 clock board mounted on a DIP-8 socket and a multi-turn potentiometer for adjusting the frequency of the DIP-8 clock. The output of the DIP-8 clock is buffered by a high speed driver (the buffer's maximum output current is ±100mA). The output of the buffer is connected thru a 50 ohm resistor to a BNC connector for driving oscilloscope probes and 50 ohm coaxial cables.

Table 1. Buffer Board Part Numbers

Buffer Board	Clock IC
DC814A-A	LTC6905
DC814A-B	LTC1799
DC814A-C	LTC6900
DC814A-D	LTC6905-133
DC814A-E	LTC6905-100
DC814A-F	LTC6905-96
DC814A-G	LTC6905-80
DC814A-H	LTC6906
DC814A-I	LTC6907

A buffer board can easily be set up for evaluation using one power supply, an oscilloscope and a frequency counter (see figure 4). A DIP-8 clock board can be removed from the buffer board and used independently as a clock source to a digital prototype system. The DIP-8 clock board has surface mount pads for installing an 0603 size resistor (RS1 on clock board) when it is used independently of the clock buffer board.

The DIP-8 clock boards for the LTC6905-XXX series do not require an RSET resistor and can be used as fixed frequency clocks. The size of the DIP-8 clock board is equivalent to the "half-size" canned crystal oscillators (13mmx13mm).

The DIP-8 clock boards can be ordered independently of a buffer board and have the following part numbers:

Table 2. 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

Design files for these circuit boards are available. Call the LTC factory.

FIGURE 1. A BUFFER BOARD (DC814A-X)

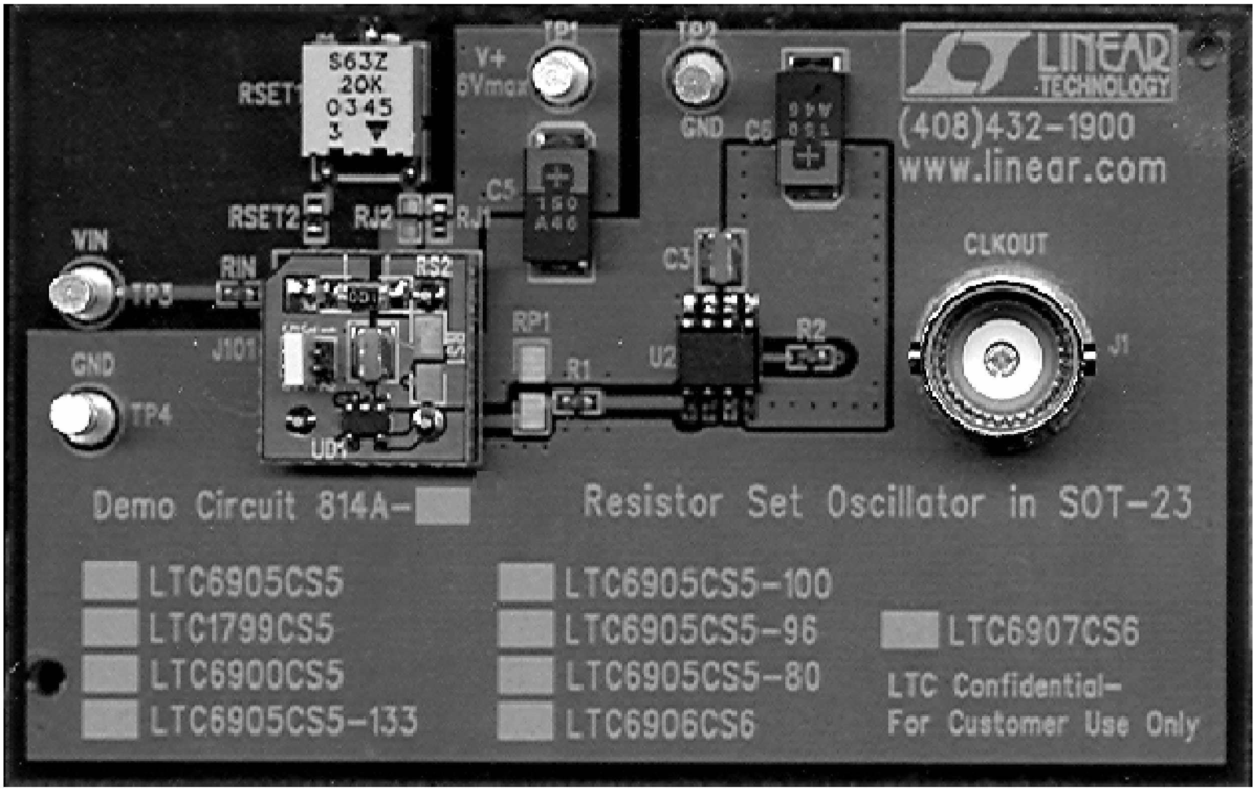
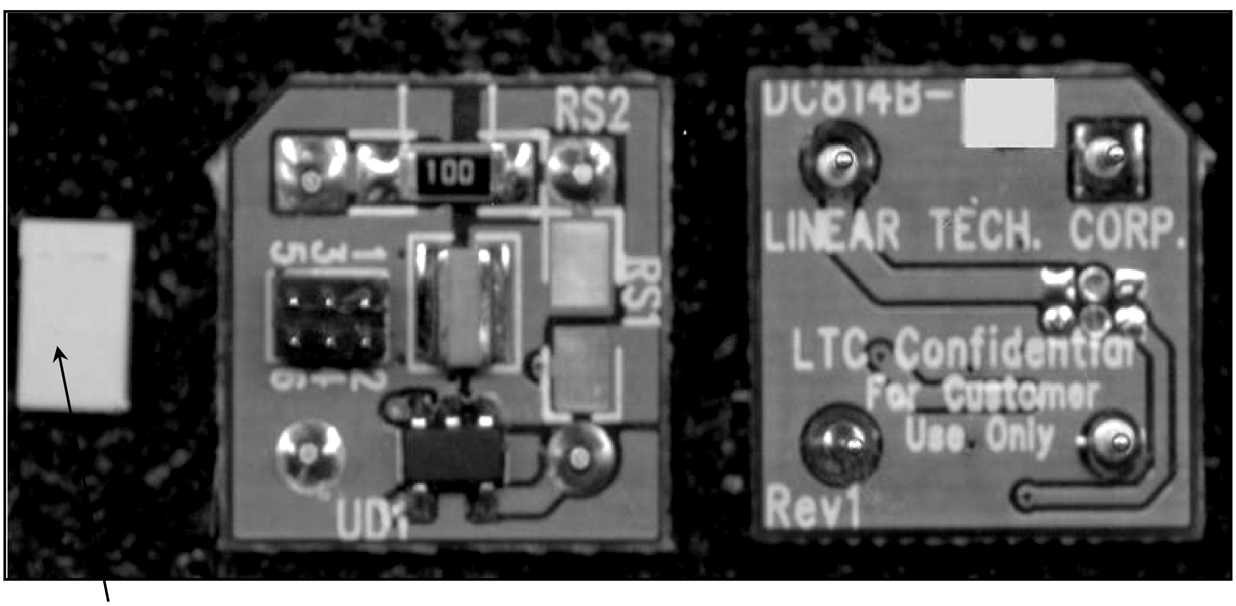
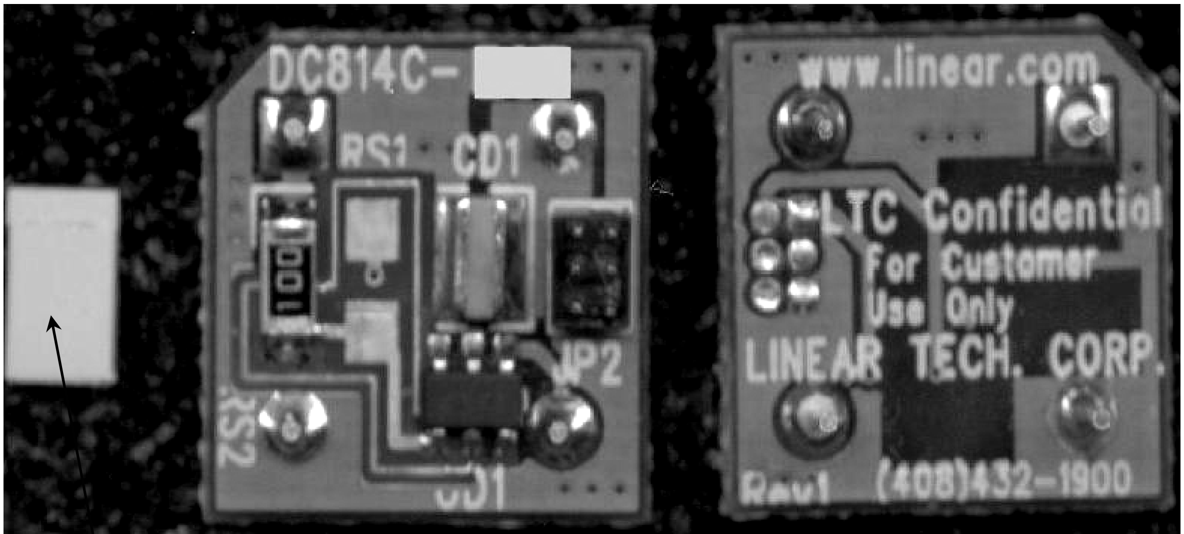


FIGURE 2. A DC814B-X DIP-8 Clock Board



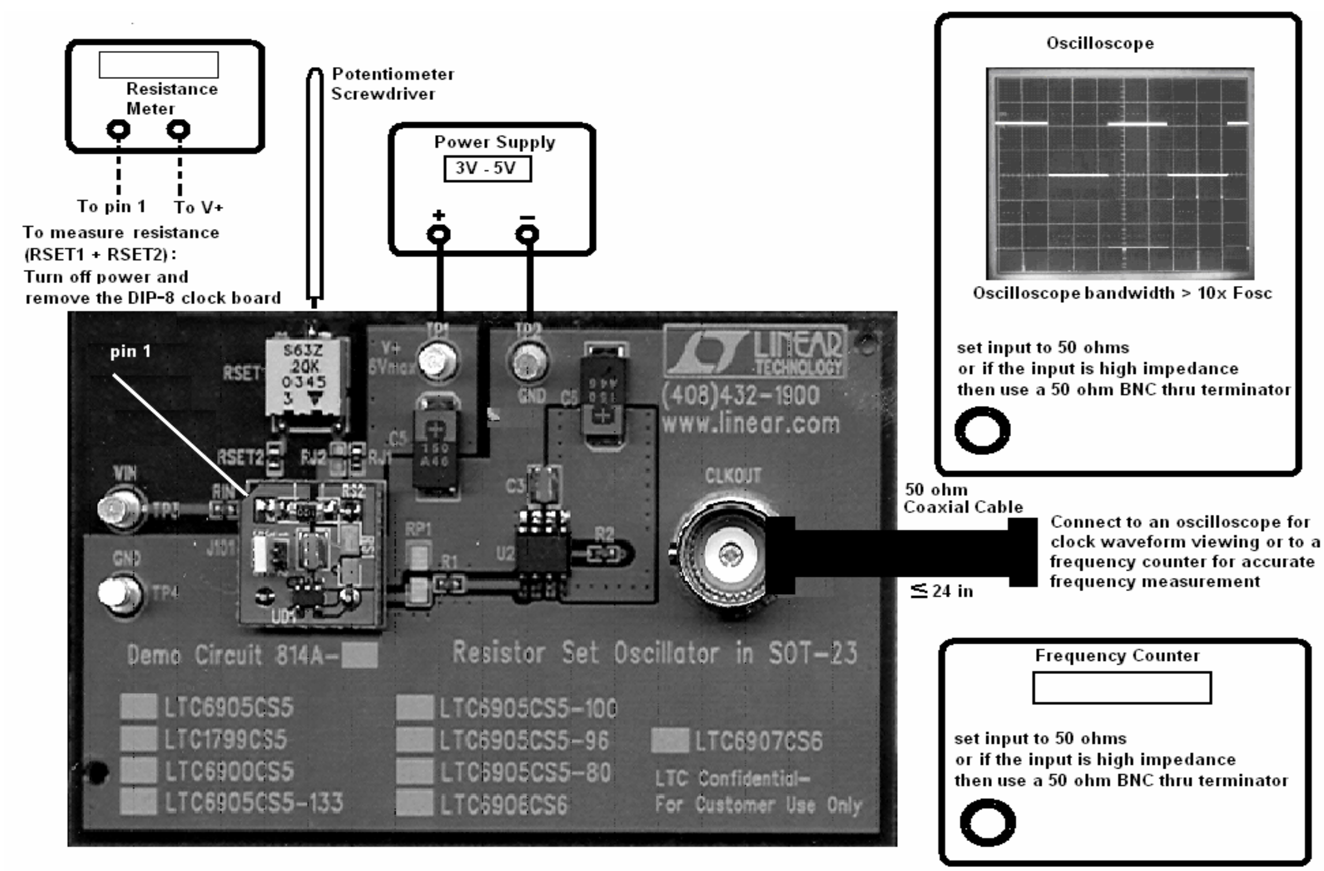
JP2 shunt to set oscillator divider input

FIGURE 3. A DC814C-X DIP-8 Clock Board



JP2 shunt to set oscillator divider input.
(1-2 of JP2 is the top row pins)

FIGURE 4. Typical Buffer Board Quick Test Set-Up



QUICK START PROCEDURE

Test Procedure: Buffer Board with DIP-8 Clock

Test Equipment:

A. a single power supply, 3V to 5V.
B. 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).
C. a frequency counter
D. a potentiometer screwdriver
E. a resistance meter

A. 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

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 3).

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 3 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 4 (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 3).

B. 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 4 (the oscilloscope input should be set to 50 ohms impedance internally or terminated externally with a 50 ohm BNC thru terminator).

2. Turn on the power supply.

3. 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).

4. 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 3).

C. Test Procedure for the VCO function of LTC6905 (DC814A-A), LTC1799 (DC814A-B) and LTC16900 (DC814A-C).

1. Turn potentiometer RSET1 fully clockwise and set the JP2 shunt on the DIP-8 clock board to 1-2.

2. Connect a voltage source to the buffer board's VIN input (refer to Figure 5) and turn on power.

3. Typical VCO voltage (VCTRL) and Frequency range:

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.

	V+=3V	V+=5V
LTC6905	0V - 1.6V	1.2V – 3.6V
	100.5MHz –168.5MHz	70MHz – 168.5MHz
	RSET = 9.09k and RIN = 40.2k	
LTC1799	0V – 3V	0V – 3.7V
	18.5MHz – 33MHz	9MHz – 33MHz
	RSET = 3.01k and RIN = 14.7k	
LTC6900	0V – 1.7V	0V – 3.7V
	12MHz – 20MHz	5MHz – 20MHz
	RSET = 9.09k and RIN = 40.2k	

FIGURE 5. VCO Circuit of Buffer Board

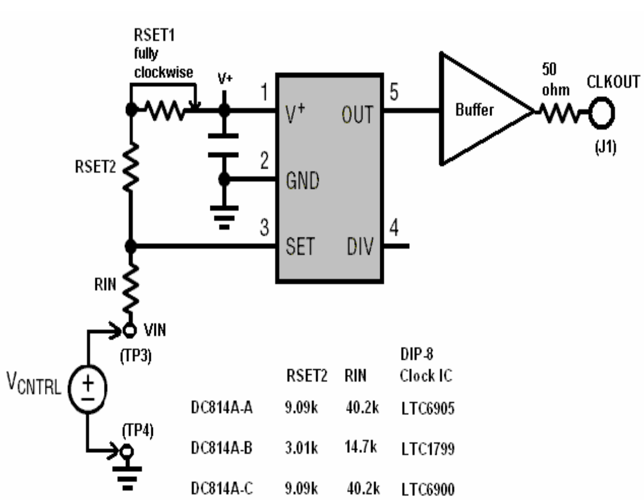


TABLE 3. Frequency Range and Accuracy of Clock ICs

RSET= (RSET1+ RSET2) on the Buffer Board and RSET= RS1 on the DIP-8 Clock Board.

LTC6905 (Board Version –A)

RSET = 3370/(2·Fosc·N-3), **(**Fosc 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)

Maximum Frequency Error at 25 °C:

±1.4% at V+=2.7V to 3.6V and ±2.2% at V+=5V

LTC1799 (Board Version –B)

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)

Maximum Frequency Error at 25 °C:

±1.5% at V+=3V and ±1.5% at V+=5V

LTC6900 (Board Version –C)

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)

Maximum Frequency Error at 25 °C:

±1.5% at V+=3V and ±1.5% at V+=5V

LTC6905-133 (Board Version –D)

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

LTC6905-100 (Board Version –E)

N = 1, 100MHz; N = 2, 50MHz; N = 4, 25MHz

Maximum Frequency Error at 25 °C: ±1.0% at V+=2.7V to 3.6V and ±1.5% typical at V+=5V

LTC6905-96 (Board Version –F)

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

LTC6905-80 (Board Version –G)

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

LTC6906 (Board Version –H)

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)

Maximum Frequency Error at 25 °C: ±0.5% at V+=2.7V to 3.6V

LTC6907 (Board Version –I)

RSET = 200/(Fosc·N), **(**Fosc in MHz and RSET in kΩ)

N = 1, 0.4MHz≤fosc≤4MH (JP2 5-6)

N = 3, 133MHz≤fosc≤1.33MHz (JP2 3-4)

N = 10, 40 kHz≤fosc≤400kHz (JP2 1-2)

Maximum Frequency Error at 25 °C: ±0.5% at V+=2.7V to 3.6V

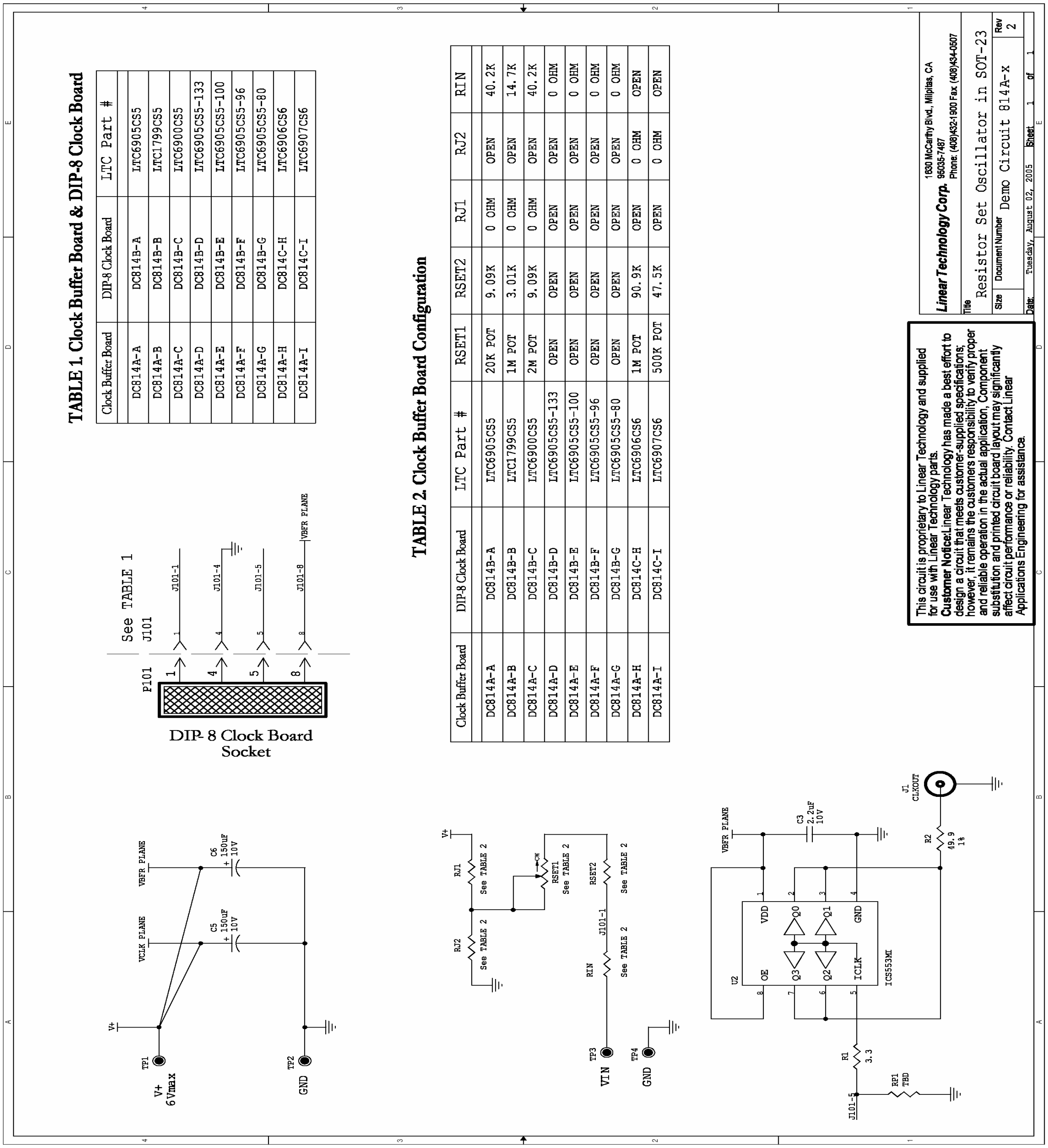
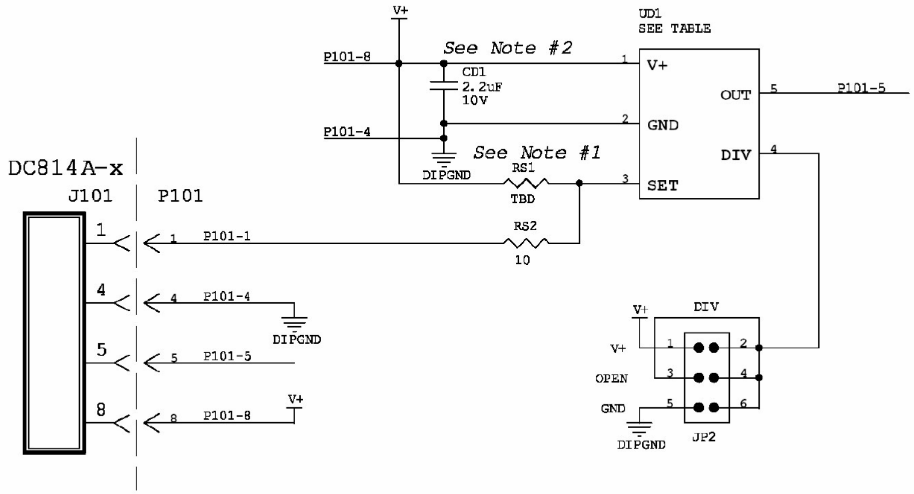


TABLE 1. Clock Buffer Board & DIP-8 Clock Board

Clock Buffer Board	DIP-8 Clock Board	LTC Part #
DC814A-A	DC814B-A	LTC6905CS5
DC814A-B	DC814B-B	LTC1799CS5
DC814A-C	DC814B-C	LTC6900CS5
DC814A-D	DC814B-D	LTC6905CS5-133
DC814A-E	DC814B-E	LTC6905CS5-100
DC814A-F	DC814B-F	LTC6905CS5-96
DC814A-G	DC814B-G	LTC6905CS5-80
DC814A-H	DC814C-H	LTC6906CS6
DC814A-I	DC814C-I	LTC6907CS6

TABLE 2. 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



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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

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Title	DIP-8 Clock Board
Size / Document Number	Demo Circuit 814B-x
Rev	2
Date:	Friday, June 10, 2005
Sheet	1 of 1

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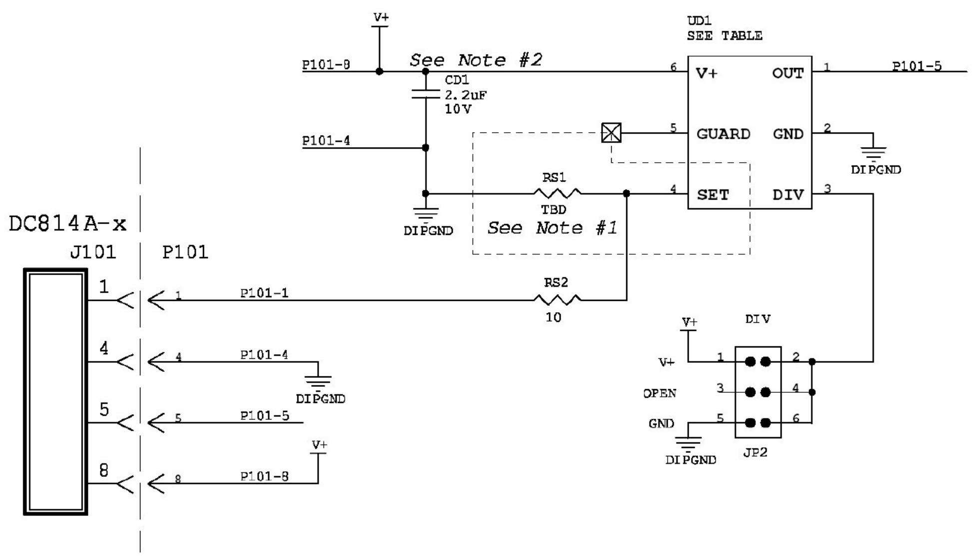

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NOTE 1. If the DIP-8 Clock Board is used independently of the Clock Buffer Board then resistor RS1 must be installed on DC814C-H, or -I.
In addition, the RS2 resistor can be removed.
(RS2 is used only for connecting the DIP-8 Clock Board to the Clock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

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Size	Document Number	Rev
	Demo Circuit 814C-x	2

Date: Tuesday, August 02, 2005 Sheet 1 of 1