DC306A Demo Board Quick Start Guide
LT1795 and LT1361 ADSL Line Driver / Receiver

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The DC306A demo board contains all of the necessary circuitry to interface an ADSL AFE (Analog Front End) to a telephone line. It utilizes the LT1795 500mA high-speed Dual Driver amplifier in the small TSSOP power package and the LT1361 Low-noise, high-speed Dual Receiver amplifier. Line isolation and coupling is achieved through a 1:1.4 transformer.

This demo board has several configuration and control options managed by the position of six jumpers:

- The board can easily be configured for split +/-12V supplies or single supply operation. AFE interface signals are DC coupled and biased to 0Vdc with split supplies and VCC/2 with single supply operation.

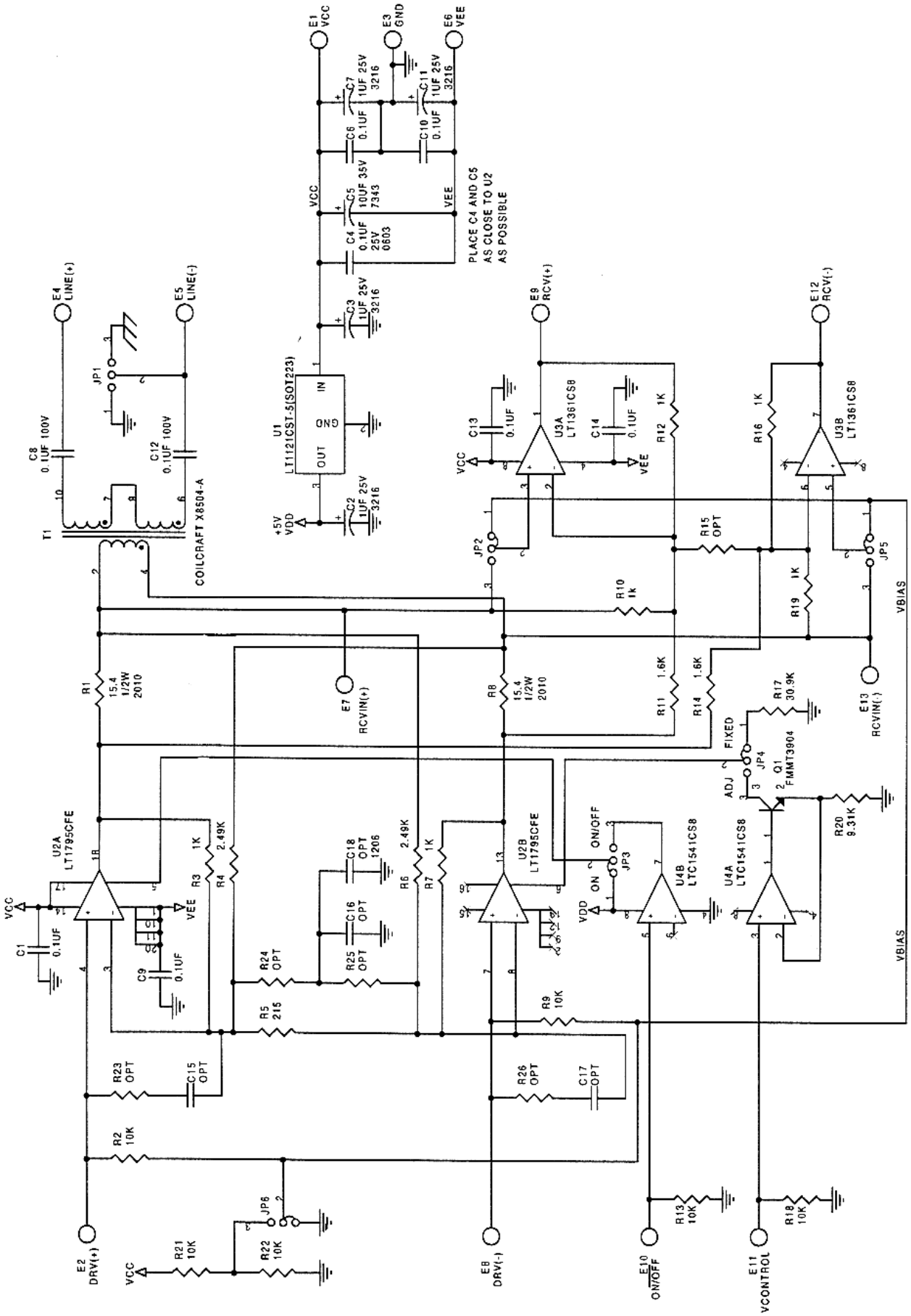
- The quiescent operating current of the LT1795 line driver can be adjusted from an external control voltage (0V to +3V) or set to a fixed value of approximately 14mA per amplifier.

- An external ON/OFF logic control signal can be used to enable or disable the line driver or this function can be fixed in the ON state.

- The LT1361 differential receiver can be configured to provide local transmit echo cancellation or as a simple differential amplifier monitoring the signal appearing at the primary of the line coupling transformer.

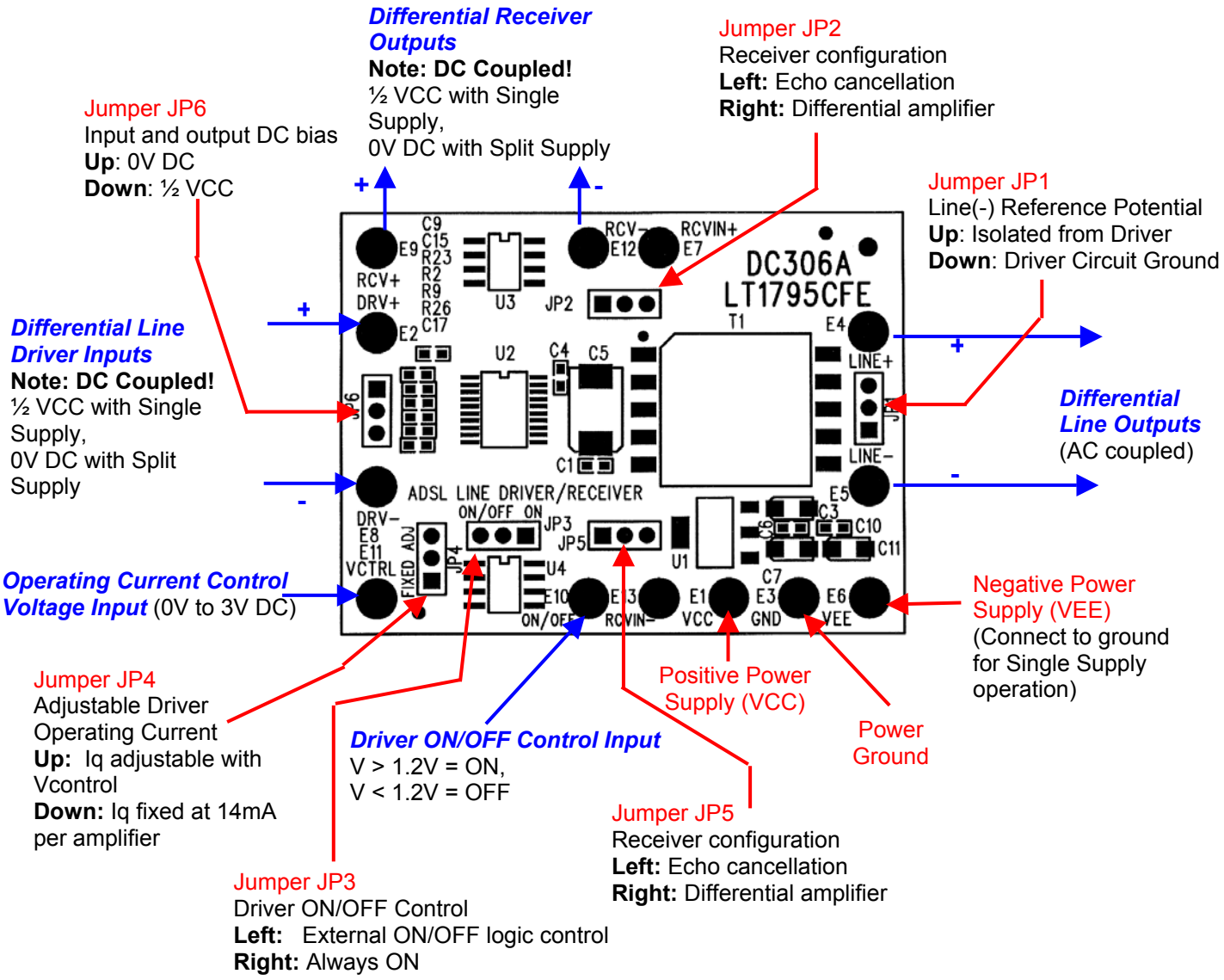
- The connection to the phone line is AC coupled. The LINE(-) connection can be connected to the driver circuit ground potential or can be isolated (floating).

As delivered, DC306A has the following default settings:
Supply Voltage: +/-12V split supplies
Quiescent current control: Fixed to 14mA/amplifier
ON/OFF control: Fixed to ON
Receiver configuration: Echo cancellation
Line interface: Line(-) is connected to the driver circuit ground.



DC306A Demo Board Orientation Diagram

Top (IC Side) View



Posts E7 and E13 are test points. These points allow monitoring the signal at the the primary of the line coupling transformer.

Operation Notes

Caution #1! This circuit board has components on both the top and bottom sides. Care must be taken to not allow either side to rest on a conductive plane.

Caution #2! The transmit inputs and receiver outputs are DC coupled. With single supply operation each of these points are biased to ½ VCC. With split supplies the inputs and outputs are biased to 0V DC. It may be necessary to add coupling capacitors in series with the connections to the AFE.

Demo Board Connections

Power Supply

Connect a +12V power supply to VCC (post E1) and –12V to VEE (post E6) with the power supply ground to GND (post E3).

For single supply operation connect the supply to VCC, ground to GND and also connect VEE to GND (post E6 to postE3). Maximum supply voltage is 36 Volts. For single supply also move jumper JP6 to the Down position to DC bias the circuits to ½ supply.

Transmit Input Signals

DC306A only accepts differential input signals. Connect the two outputs from the AFE or transmit channel filter to the DRV+ (post E2) and DRV- (post E8) terminals. Each of these input terminals are DC biased through 10KΩ resistors. Consider this if the AFE outputs themselves have a DC bias potential. If it is desired to use a single ended signal source then a wideband 1:1 transformer splitter (Mini-Circuits model ZSCJ-2-2 for example) should be used to create a differential input signal. The gain of the line driver section is 12 V/V from the differential inputs to the signal placed on the phone line.

Receiver Output Signals

To detect the received signals from the line connect the RCV+ (post E9) and RCV- (post E12) terminals to the differential AFE inputs or receive channel filter inputs. With the echo cancellation configuration of the receiver these outputs are the signals developed across the transformer back termination resistors with first order cancellation of any transmitted signal. The receiver gain is unity. There is no filtering on DC306A in the receive channel. The receiver outputs are directly from an amplifier (low impedance) and have a DC bias of either 0V or ½ VCC.

Phone Line Connections

Connect the outputs LINE+ (post E4) and LINE- (post E5) to an actual phone line or line simulator box. These outputs are ac coupled. Depending on the connection of jumper JP1 the line can be completely isolated from DC306A or one side, LINE-, can be made common with the power ground of the driver circuit.

Active Termination Technique

The LT1795 line driver circuit uses an active termination technique. This helps to minimize the power consumed by the entire driver circuitry by reducing the resistance value and therefore the power loss of the transformer back termination resistors. Positive feedback, through resistors R4 and R6, maintains the proper matching to the line impedance of 100Ω.

Adjusting the Operating Current

An additional positive DC voltage source can be connected to the VCTRL (Vcontrol, post E11) terminal. This voltage is converted to a current used to set the quiescent operating current of the LT1795 driver. To have this programmability jumper JP4 must be placed in the Up position. In the Down position the operating current of the driver is fixed at 14mA per amplifier. When adjusting the operating current of the LT1795 the relationship is as follows:

$$\text{Isupply(mA/amplifier)} \cong 115 \bullet \left[\frac{\text{Vcontrol}}{9.31}\right]$$

A 0V to +3V control range would set the quiescent current to 0mA to 37mA per amplifier, however at the high end an LT1795 current limit circuit holds the maximum quiescent current to approximately 30mA/amplifier.

This adjustability allows for the analysis of dynamic performance, mainly distortion and bandwidth, versus quiescent power dissipation. For a given set of operating requirements the quiescent power dissipation of the driver can be backed off until transmission performance (BER or Bit Error Rate) is impaired. Then a value of required quiescent current can be determined that will also provide the least amount of power dissipation in the driver.

ON/OFF Control

A logic control signal can be connected to the ON/OFF (post E10) terminal to allow a system to disable the transmit driver when not needed. This terminal is the input to an LTC1541 voltage comparator with a 1.2V threshold. An input voltage less than this threshold turns the driver OFF. This voltage should not be allowed to exceed +5V which is the supply voltage of the comparator. Jumper JP3, when set to the left enables this external control. With JP3 to the right the driver is ON continuously.

Heat Spreading

The LT1795CFE driver is packaged in a 20-pin TSSOP power package where the metal lead-frame beneath the die is left exposed to promote heat transfer and maximize power dissipation in a very small package. DC306A is built with a four layer board and a small metal plane (1oz copper is used) on each layer is used to provide heat sinking. Each layer is connected together through 12 small plated through vias that also promote heat transfer. The thermal management system used on DC306A produces a thermal resistance from the LT1795 die attach junction to ambient of approximately 40°C/W. When operated at room temperature, 25°C ambient, with 20dBm of power being driven to a 100Ω phone line load, the junction temperature of the LT1795 is between 65°C and 70°C.

Optional Components

The optional components shown on the schematic (labeled OPT) are not on the board. These components are for use with a future version of the LT1795 and for setting the gain of the receiver when configured as a differential amplifier. To configure the board as a differential receiver amplifier, move jumpers JP2 and JP5 to the Right position, remove resistors R10, R11, R14 and R19. Add a resistor in the location of R15 to set the gain of the differential amplifier.

For assistance in using this demo board contact:
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