

# LT6411

## 650MHz Differential ADC Driver / Dual Selectable Gain Video Amplifier


### DESCRIPTION

Demonstration circuit 1108 features the LT6411 Dual Amplifier and ADC Driver. It incorporates a variety of passive components to support configurations for varied applications, including large AC-coupling capacitors for video applications. Single-ended or differential input and output configurations are possible with on-board component changes. The LT6411 supports both a single +5V power supply as well as split  $\pm 5V$  supplies.

The LT6411 is a high-speed differential amplifier with superior distortion and noise performance, perfect for demanding video distribution, communications, and other high-

speed signal chain applications. The LT6411 accepts single-ended or differential inputs with almost no difference in distortion performance. The topology of the LT6411 allows the flexibility of selecting various gains without the use of extra resistors. The LT6411 consumes only 16mA of supply current (80mW) when enabled, and includes a low-power shutdown mode for additional power savings.

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

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### QUICK START PROCEDURE

Table 1 shows the function of each SMA connector on the board. Refer to Figure 1 for the connection diagram and follow the procedure below:

1. Connect the power supply as shown. The power labels of VCC and GND are used to apply a single +5V to +10V supply; by default, VEE is connected to GND through resistor R21. Jumper JP1 enables or shuts down the LT6411.
2. Apply an input signal to J1. A low-distortion, low noise signal source with an external high-order filter will yield the best performance. DC1108's input is impedance-matched to  $75\Omega$ ; no external termination is necessary. To use a  $50\Omega$  source instead of a  $75\Omega$  source, replace impedance-matching resistor R6 with a  $57.6\Omega$  0603 resistor.

3. Observe the output via J2 and/or J3. The default gain is +2, relative to the single-ended input. The outputs have  $75\Omega$  series resistors.

**Table 1: DC1108 SMA Connector Descriptions**

CONNECTOR	FUNCTION
J1 (IN1)	Board Input. Use this connector to supply an input to the DC1108. Drive from a $75\Omega$ signal source, no external termination necessary. Resistor R6 provides a $75\Omega$ impedance match. Input is AC coupled by default.
J4 (IN2)	Board Input. <b>Connected to GND through resistor R20 by default.</b> Resistor can be removed to drive the DC1108 differentially. Input is AC coupled by default.
J2 (OUT1)	Output. By default, connected by a $75\Omega$ series resistor for video cable driving.
J3 (OUT2)	Output. By default, connected by a $75\Omega$ series resistor for video cable driving.

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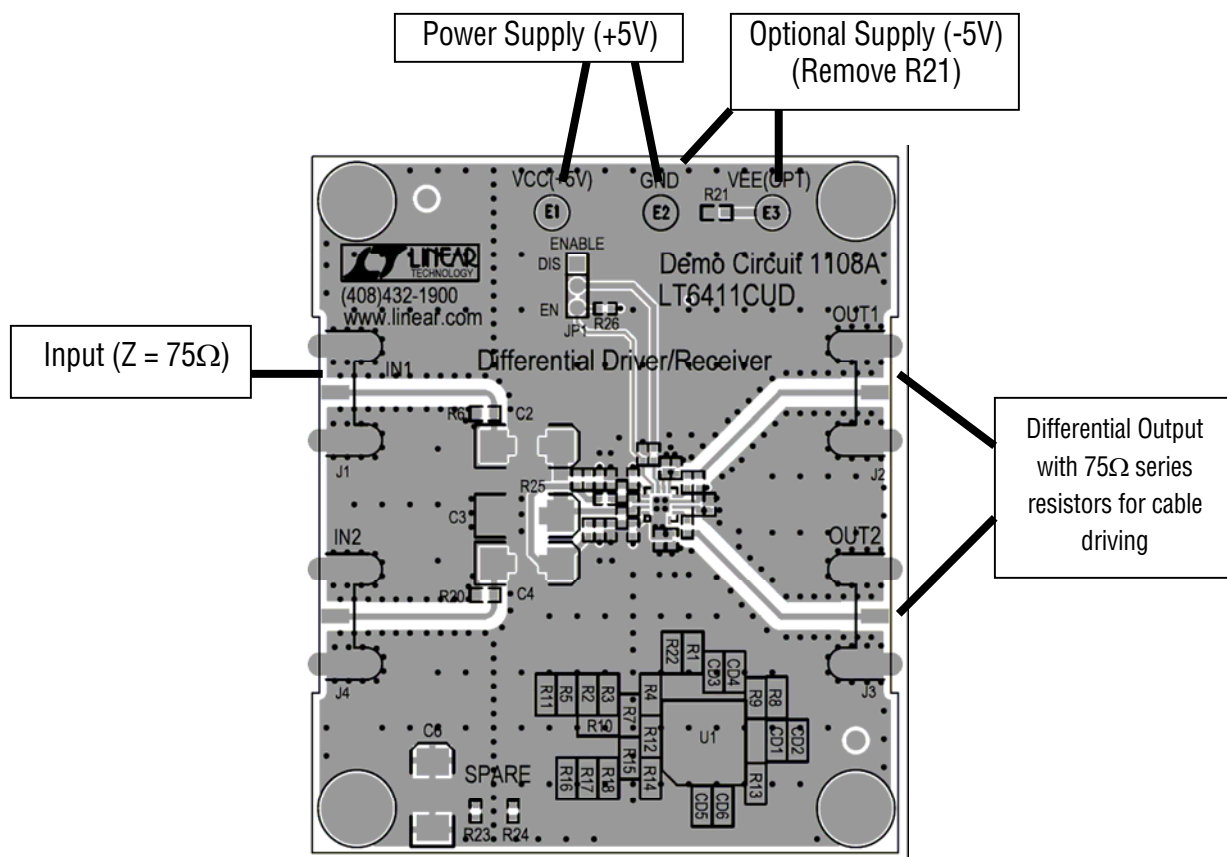


Figure 1. DC1108 Default Board Evaluation Setup – Single Ended Input, AC-Coupled. Gain = +2

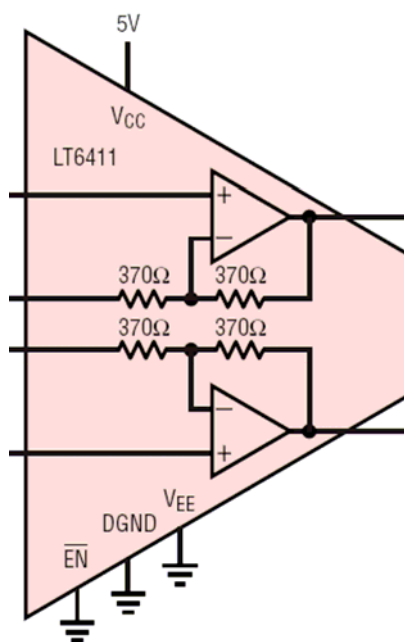


Figure 2. Block Diagram of LT6411 Internal Amplifiers and Resistors

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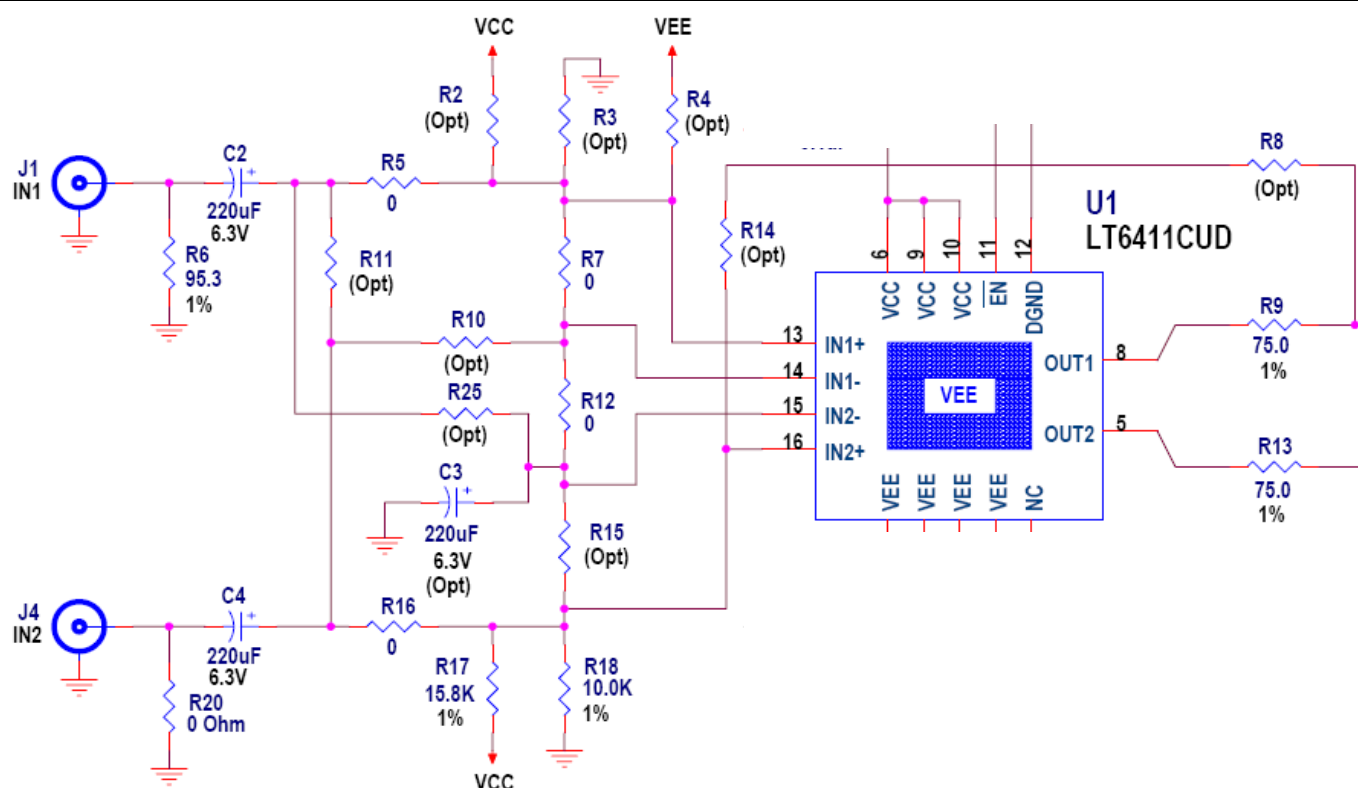


Figure 3. Input and Output Networks of the DC1108 Demo Board

## ADDITIONAL INFORMATION

Although the DC1108 demo board is ready to use out of the box, it has features that you can access by adding, removing or changing components on the board. These are described below.

### ENABLE (SHUTDOWN)

The enable (shutdown) function of the LT6411 is controlled by JP1. To enable the part, move the on-board JP1 jumper to the lower (EN) position. To place the driver in a low-power shutdown mode, move the jumper into the upper (DIS) position.

**NOTE.** The input bias resistors R2/R3 and R17/R18 enable current flow from VCC to GND, and must be accounted for when measuring the current of the LT6411, especially in shutdown.

## GROUND AND VEE CONNECTIONS

DC1108's GND connector is connected to the board's ground planes. By default, VEE is also connected to the ground planes via R21. However, the LT6411 is capable of running on up to 10V power supply voltage (or  $\pm 5V$ ). Therefore, the LT6411 VEE pins and exposed paddle are floating, and connected to the ground plane through bypass capacitors. By removing R21 and powering the LT6411 through the VEE turret (E3), the user can provide split supplies to the LT6411.

## INPUT AND OUTPUT VOLTAGE RANGES

The input range of the LT6411 (Pins 13 and 16) extends from 1V above VEE to 1V below VCC. The inverting inputs, Pins 14 and 15, do not have this limitation, and can be driven from rail to rail. The outputs, Pins 8 and 5, can swing to within 1.3V of either supply (less under heavy load). These ranges can be limiting factors, especially when using DC1108 without the AC-coupling capacitors.

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By default, R17 and R18 set the LT6411 input/output common-mode voltage to 2.1V, which is the LT6411's lowest-distortion bias point (see datasheet, page 10).

DGND should be tied to VEE. On the board, removing R22 and populating R26 will accomplish this adjustment.

### SPARE COMPONENTS

DC1108 comes with spare components for use when evaluating different circuit configurations. C6, R23, and R24 are an extra 220μF capacitor and 0Ω resistors, respectively. See the next section below (Flexible Configurations) for some examples of possible configurations for the LT6411 on DC1108.

### FLEXIBLE CONFIGURATIONS

The LT6411 is a dual amplifier with internal gain and feedback-setting resistors. This simple, intuitive topology allows the user to test many different circuit configurations on DC1108 simply by changing the resistors on the board. Refer to Figure 3 for the networks at the inputs and outputs of the LT6411. Table 2 describes only some of the myriad configurations possible on DC1108. Contact the LTC factory for assistance with any of these configurations, or if your configuration needs differ from what is shown.

For DC-coupled configurations, C2, C3, and C4 can be replaced by 1206-size surface mount resistors.

### SETTING DGND

The DGND pin (Pin 12) is the reference voltage for the Enable Low pin (Pin 11). On a single +5V supply, when the EN pin is pulled to within 0.4V of the DGND pin, the part is enabled. However, there are two restrictions on the voltage compliance of the DGND pin, which is discussed in the datasheet:

$$V_{CC} - V_{DGND} \geq 3V$$

$$-0.5V \leq V_{\overline{EN}} - V_{DGND} \leq 5.5V$$

These two voltage compliance restrictions are easy to meet on a single +5V or split ±5V supply by tying DGND to the ground plane, which by default is done on the demo board. However, if using split supplies and  $V_{CC} < 3V$ , then the first requirement will not be met, and

**Table 2: Example DC1108 Configurations**

FUNCTION	CONFIGURATION
<b>VIDEO AMPLIFIER, LINE OR ADC DRIVER CONFIGURATIONS</b>	
Single Ended Input Gain = +2 AC-Coupled Differential Outputs	No changes necessary (default)
Single Ended Input Gain = +1 AC-Coupled Differential Outputs	Remove R6. Install 37.5Ω at R5. Install 40.2Ω at R3. (resistors attenuate and Z-match to 75Ω)
Differential Input Gain = +1 AC-Coupled Differential Outputs	Remove R6, R20 (or use for Z-Match). Remove R12 and C3. Install R2, R3 to match R17, R18. Install 0Ω at R7 and R15.
Differential Input Gain = +2 AC-Coupled Differential Outputs	Remove R6, R20 (or use for Z-Match). Remove R7. Install R2, R3 to match R17, R18. Install 220μF at C3.
Differential Input Gain = +3 AC-Coupled Differential Outputs	Remove R6, R20 (or use for Z-Match). Remove C3, R7 and R12. Install R10 and R25 (0Ω).
<b>VIDEO SIGNAL SPLITTER</b>	
Single Ended Input Gain = +1 AC-Coupled Redundant Outputs	Remove R20 and/or C4. Install R11 (0Ω). Remove R12 and C3. Install 0Ω at R7 and R15.
Single Ended Input Gain = +2 AC-Coupled Redundant Outputs	Remove R20 and/or C4. Install R11 (0Ω). Remove R7. Install 220μF at C3.
<b>CASCADED AMPLIFIERS, GAIN = +4</b>	
Single Ended Input Gain = +4 AC-Coupled Single Output at J3	Remove R16, R7, R12. Install R10 (0Ω). Move R17, R18 resistors to R2, R3. Install R8, R14 (0Ω). Change R9 to 20Ω (for gain flatness). Install 220μF at C3.

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