Evaluating the LTC6373 Programmable Gain Instrumentation Amplifier

FEATURES

- Fully featured evaluation board for the LTC6373
- Jumper or Arduino options for LTC6373 gain selection
- Access to LTC6373 output common mode pin to control output level shifting
- Flexible power supply option (±15 V or a single 9 V to 12 V)

ONLINE RESOURCES

- Design files for this circuit board are available

GENERAL DESCRIPTION

Demo circuit DC2398A features the LTC6373 Programmable Gain Instrumentation Amplifier. The circuit's gain can be controlled in several ways, such as by simply setting onboard jumpers or by connecting an Arduino or Linduino (DC2026C) microcontroller board. The LTC6373 has fully differential outputs with independent common mode level shifting. The output common mode level can be set by the IC's internal default or overdriven by the user. The DC2398A can be powered by external bench supplies (typically ±15 V), but optionally also demonstrates the use of the LTC3265 dual low noise charge pump to generate ±15 V rails from a single 9 V to 12 V input supply.

EVALUATION BOARD PHOTOGRAPH

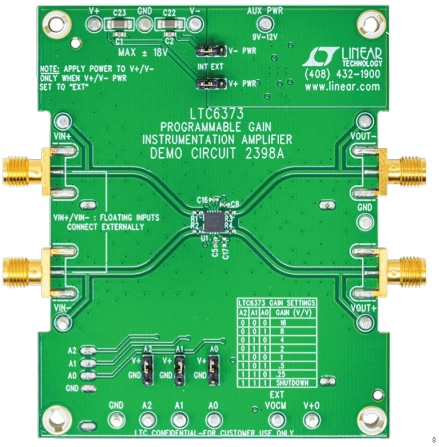

Figure 1. LTC6373 Evaluation Board

TABLE OF CONTENTS

REVISION HISTORY

9/2023—Rev. 0 to Rev. A

Updated Format (Universal)..... 1
Changes to User Guide Title..... 1
Added Features Section..... 1
Added Online Resources Section..... 1
Change to General Description Section..... 1
Added Evaluation Board Photograph Section and Figure 1; Renumbered Sequentially..... 1
Changes to Figure 2..... 3
Change to Hardware Configuration Section..... 4
Changed Schematic Diagram Section to Evaluation Board Schematic Section..... 5
Changes to Figure 3..... 5
Changes to Figure 4..... 6
Changed Parts List Section to Ordering Information Section..... 7
Changes to Table 3..... 7

10/2020—Revision 0: Initial Version

QUICK START PROCEDURE

1. Set the jumpers labeled V− PWR and V+ PWR to the INT position. This configures the board to route internally generated supplies to the LTC6373 amplifier.
2. Connect a power supply of 9 V to 12 V between the AUX PWR and GND pins.
3. Connect an input voltage source between the VIN+ and VIN− inputs, using either the SMA connectors or turrets (but not both —the SMA and turret are shorted together on the board).
4. Set the jumpers for A2/A1/A0 to the desired gain configuration, described in the table on the board. For example, for a Gain = 16, set all jumpers A2/A1/A0 to GND.
5. Observe the differential output between the VOUT+ and VOUT− turrets.

See Figure 2 for a minimal effort initial hook-up of the board. To adapt to specific needs, read the Hardware Configuration section.

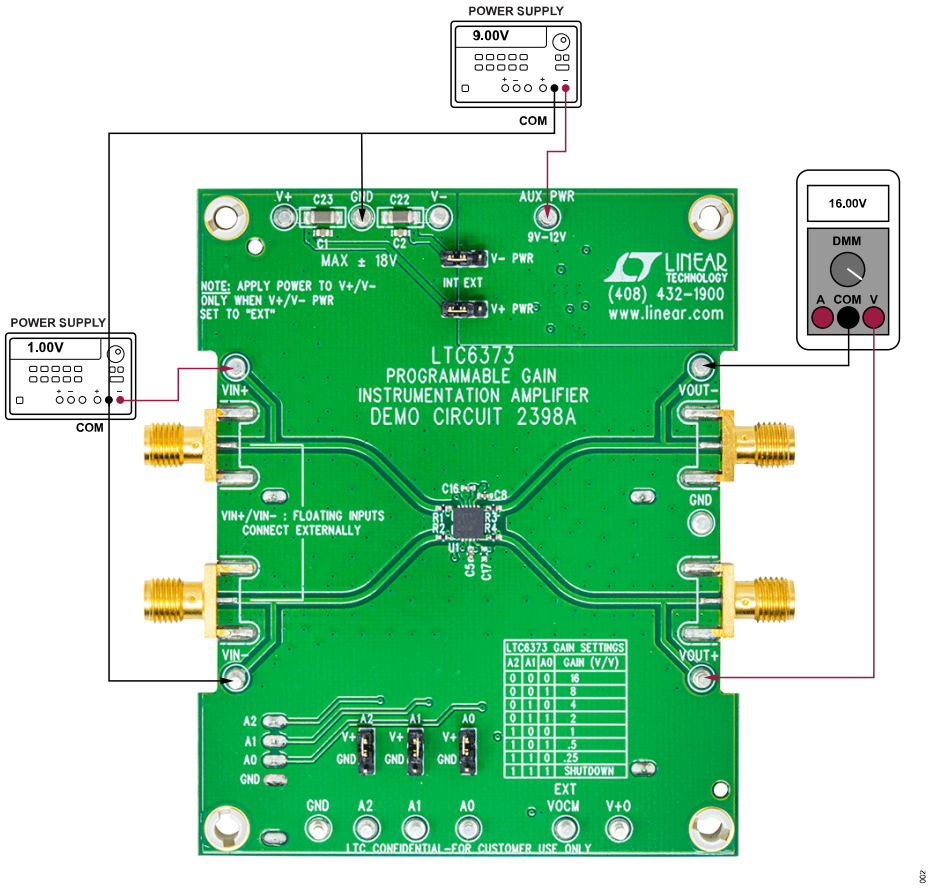

Figure 2. Quick Connection

HARDWARE CONFIGURATION

Apply power to the board using either the AUX PWR or the V^+/V^- pins, but not both. To use a conventional lab power supply rather than the onboard LTC3265 dual charge-pump, first set jumpers V– PWR and V+ PWR to the EXT position. Then, apply power between the V^+, V^-, and GND turrets.

Table 1. Choose One of the Above Two Methods to Apply Power to the Board

Power Source	V^- PWR Jumper	V^+ PWR Jumper	Operation
AUX PWR	INT	INT	LTC3265 dual charge pump (on back of board) generates ±15 V supplies from AUX PWR and delivers to LTC6373
V^+, V^-	EXT	EXT	Lab power supply connected to V^+, V^- turrets delivers power to LTC6373

By default, leave the EXT VOCM turret disconnected. Optionally, to bias the output common mode at a voltage different from the level generated internally by the LTC6373, connect the desired voltage bias between the EXT VOCM turret and GND. Alternatively, placeholders R7/R8/R9 (on the back of the board) can set an output common mode voltage by onboard resistor dividers (see Figure 3).

By default, leave the V+O turret disconnected. Optionally, the LTC6373 features a separate positive output power supply pin V+O. By default, the board shorts this together to the V^+ power supply. To bias V+O separate from V^+, first remove R22 (on the back of the board) and then apply the desired voltage level to the V+O jumper. To ensure good linearity, verify that there is at least 0.1 µF of bypass capacitance stuffed at C17. See the LTC6373 data sheet for details.

By default, leave the A2/A1/A0 turrets disconnected, because the A2/A1/A0 jumpers already determine the voltage levels at these programming pins. Optionally, to configure the LTC6373 by using the A2/A1/A0 turrets, first remove the A2/A1/A0 jumpers.

By default, leave the HD1 header pins (on the back of the board) disconnected. Optionally, these header pins can be used to configure the LTC6373 gain setting, overriding the setting determined by the jumpers. Referring to the back of the board, header HD1, along with associated corner pins, are spaced so that an Arduino Uno compatible microcontroller board (such as DC2026C Linduino One) can connect to the programming pins of this demo board. If connected in this manner, the table lists the mapping of the Arduino pins to the LTC6373 pins. Associated Arduino code is trivial, and an example can be found online along with this demo manual.

Table 2. Mapping of LTC6373 Pins to Arduino Pins When Using Optional Header HD1

LTC6373 Pin	Arduino Uno Pin
A2	Pin 11
A1	Pin 12
A0	Pin 13
GND	GND

By default, observe the outputs of the circuit using turrets VOUT+ and VOUT–. Optionally, to observe the LTC6373 outputs by using the SMA connectors rather than the VOUT+, VOUT– turrets, the board has the flexibility to replace the 50 Ω R3/R4 resistors with back-termination resistors. This may be needed depending on length and impedance of output cable and termination on the other side of the cable.

By default, the board does not apply separate filtering between the input/output connectors and the LTC6373. Optionally, RC lowpass filters can be installed at the input and/or output of the amplifier. Replace 0 Ω R1/R2 and 50 Ω R3/R4 by the desired series resistor value, and populate the desired capacitors on the back of the board. See Figure 3 for details.

EVALUATION BOARD SCHEMATIC

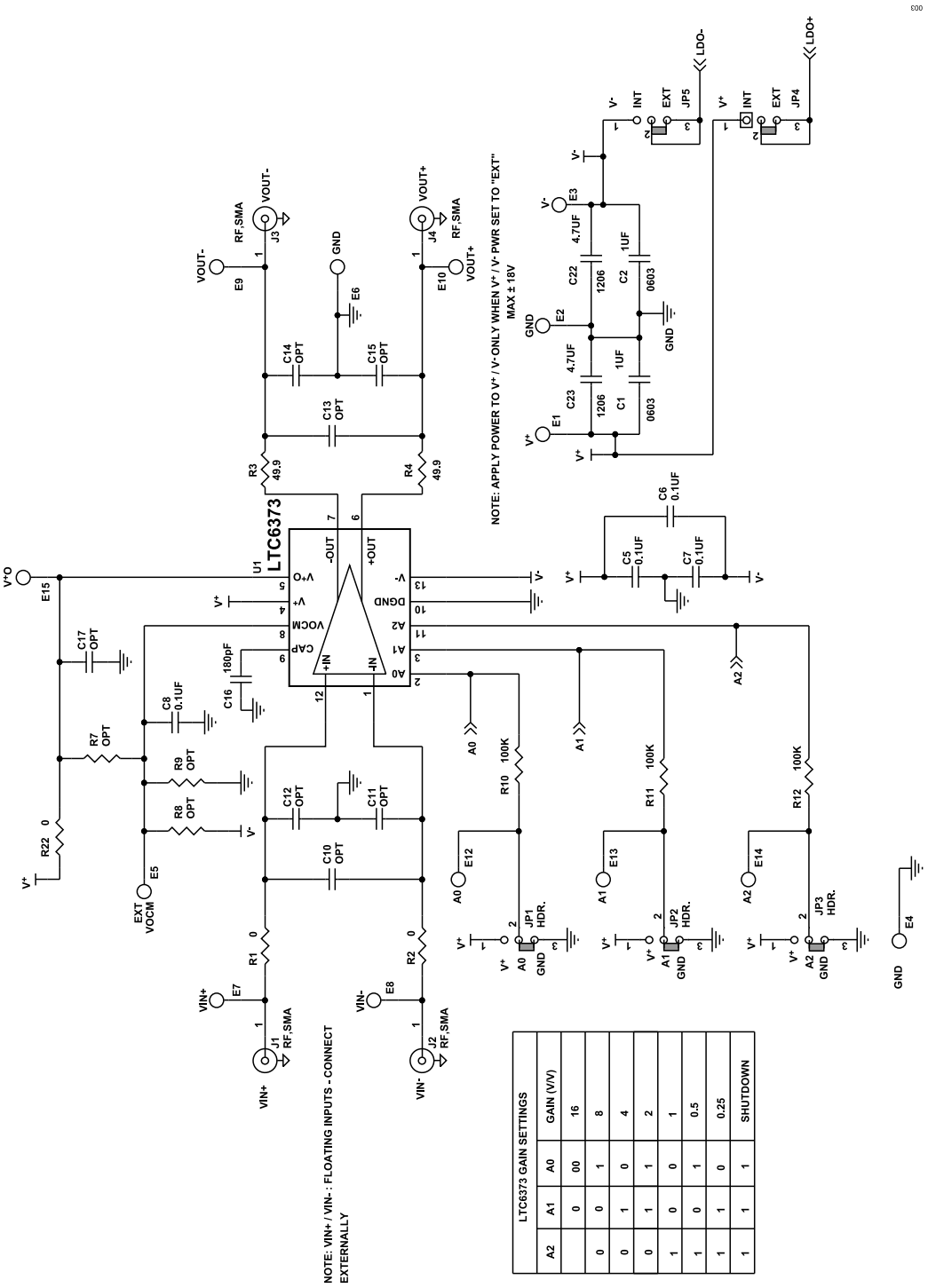

Figure 3. DC2398A Schematic, PGIA Section

EVALUATION BOARD SCHEMATIC

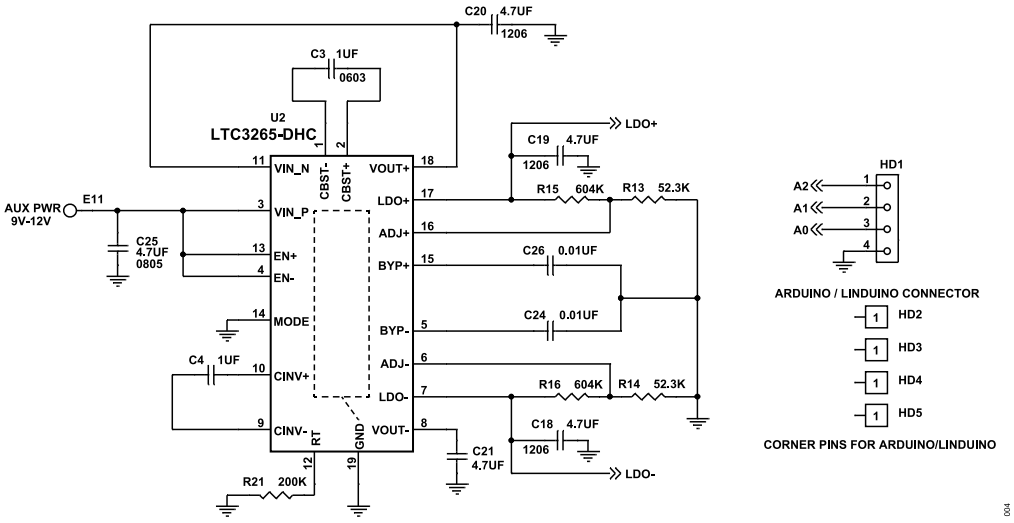

Figure 4. DC2398A Schematic, Power Section

ORDERING INFORMATION

Table 3. Required Circuit Components

Item	Qty.	Reference	Part Description	Part No.	Manufacturer
1	4	C1, C2, C3, C4	Capacitor, 1 µF, X7R, 50 V, 10%, 0603	06035C105KAT2A CC0603KRX7R9BB105 UMK107AB7105KA-T	AVX Yageo Taiyo Yuden
2	4	C5, C6, C7, C8	Capacitor, 0.1 µF, X7R, 50 V, 10%, 0402	04025C104KAT2A GRM155R71H104KE14D GRM155R71H104KE14J UMK105B7104KV-FR C1005X7R1H104K050BB	AVX Murata Murata Taiyo Yuden TDK
3	0	C10, C11, C12, C13, C14, C15, C17	Capacitor, not installed, 0402		
4	1	C16	Capacitor, 180 pF, C0G/NP0, 50 V, 5%, 0402	GRM1555C1H181JA01D NMC0402NPO181J50TRPF UMK105CG181JV-F	Murata NIC Taiyo Yuden
5	6	C18, C19, C20, C21, C22, C23	Capacitor, 4.7 µF, X7R, 50 V, 10%, 1206	GRM31CR71H475KA12L C3216X7R1H475K160AC 12065C475KAT2A NMC1206X7R475K50TRPLPF	Murata TDK AVX NIC
6	2	C24, C26	Capacitor, 0.01 µF, X7R, 50 V, 10%, 0402	C0402C103K5RAC7867 C0402C103K5RACTU GRM155R71H103KA88D C1005X7R1H103K050BB	Kemet Kemet Murata TDK
7	1	C25	Capacitor, 4.7 µF, X5R, 35 V, 10%, 0805	0805DD475KAT2A GRM219R6YA475KA73D C2012X5R1V475K125AC	AVX Murata TDK
8	15	E1, E2, E3, E4, E5, E6, E7, E8, E9, E10, E11, E12, E13, E14, E15	Test point, turret, 0.064 in mounting hole, 0.125 in thick printed circuit board (PCB)	2308-4-00-80-00-00-07-0	Mill-Max
9	1	HD1	Connector, header, male, 1 × 4, 2.54 mm, vertical, straight, through hole	TSW-104-07-L-S	Samtec
10	4	HD2, HD3, HD4, HD5	Connector, header, male, 1 pin, 2.54 mm, straight, through hole, 10 µin Au contact, Sn tail	TSW-101-07-L-S	Samtec
11	4	J1, J2, J3, J4	Connector, RF, surface-mount type A, jack, female, receptacle, end launch, straight, 50 Ω, tab contact, Au	142-0701-851	Cinch Connectivity Solutions Johnson
12	5	JP1, JP2, JP3, JP4, JP5	Connector, header, male, 1 × 3, 2 mm, vertical, straight, through hole	NRPN031PAEN-RC	Sullins Connector Solutions
13	1	LB1	Label specifications, demo board serial number	THT-96-717-10	Brady
14	4	MP1, MP2, MP3, MP4	Standoff, nylon, snap on, 0.375 in	8832	Keystone
15	1	PCB1	PCB, DC2398A	600-DC2398A	Analog Devices, Inc. Approved Supplier
16	3	R1, R2, R22	Resistor, 0 Ω, 1/16 W, 0402	MCR01MZPJ000 CRCW04020000Z0ED NRC04ZOTRF RC0402JR-070RL	ROHM Vishay NIC Yageo
17	2	R3, R4	Resistor, 49.9 Ω, 1%, 1/16 W, 0402	MCR01MZPF49R9	ROHM
18	0	R7, R8, R9	Resistor, not installed, 0402		
19	3	R10, R11, R12	Resistor, 100 kΩ, 1%, 1/16 W, 0402, AEC-Q200	CRCW0402100KFKED NRC04F1003TRF	Vishay NIC
20	2	R13, R14	Resistor, 52.3 kΩ, 1%, 1/16 W, 0402, AEC-Q200	NRC04F5232TRF RMCF0402FT52K3 CRCW040252K3FKED	NIC Stackpole Electronics, Inc. Vishay

ORDERING INFORMATION

Table 3. Required Circuit Components (Continued)

Item	Qty.	Reference	Part Description	Part No.	Manufacturer
21	2	R15, R16	Resistor, 604 kΩ, 1%, 1/16 W, 0402, AEC-Q200	CRCW0402604KFKED NRC04F6043TRF	Vishay NIC
22	1	R21	Resistor, 200 kΩ, 1%, 1/16 W, 0402	NRC04F2003TRF ERJ2RKF2003X CRCW0402200KFKED RC0402FR-07200KL	NIC Panasonic Vishay Yageo
23	1	U1	IC, 36 V, fully differential programmable gain instrumentation amplifier with 25 pA Ib, dual flat no lead-12	LTC6373IDFM#PBF	Analog Devices
24	1	U2	IC, low noise dual supply, dual flat no lead-18	LTC3265EDHC#PBF	Analog Devices
25	5	XJP6, XJP7, XJP8, XJP9, XJP10	Connector, shunt, female, 2 position, 2 mm	60800213421	Wurth Elektronik

ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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