

Evaluating the ADATE318 600 MHz Dual Integrated DCL with PPMU, VHH Drive Capability, Level Setting DACs, and On-Chip Calibration Engine**FEATURES**

- ▶ Full-features evaluation board for the [ADATE318](#)
- ▶ Supply voltages: +21 V and -10 V, on-board voltage regulators
- ▶ Signal inputs and outputs breakout through SMA connectors
- ▶ Differential pairs provided with 50 Ω -controlled impedance traces with equal lengths
- ▶ LED indicators for read and write data
- ▶ PC software for control through USB

EVALUATION KIT CONTENTS

- ▶ EVAL-ADATE318BCPZ

EQUIPMENT NEEDED

- ▶ PC running Windows[®]
- ▶ USB 2.0 port and USB 2.0 high-speed A cable to B cable
- ▶ Benchtop power supplies and connector cables
- ▶ Data timing generator (DTG) or equivalent
- ▶ Oscilloscope

ADDITIONAL DOCUMENTS REQUIRED

- ▶ [ADATE318](#) data sheet

SOFTWARE NEEDED

- ▶ [ADATE318 Evaluation Software](#)

GENERAL DESCRIPTION

The EVAL-ADATE318BCPZ is a full-featured evaluation board designed to allow the user to simply evaluate all features of the ADATE318 dual-integrated driver, comparator, and active load (DCL) with a per pin parametric measurement unit (PPMU). The EVAL-ADATE318BCPZ features breakout connections through the Subminiature Version A (SMA) terminals for all of the signal inputs and outputs. The differential pairs are provided with 50 Ω -controlled impedance traces with equal lengths.

The EVAL-ADATE318BCPZ only takes in +21 V and -10 V supplies, and the on-board regulators provide the required device supplies. The EVAL-ADATE318BCPZ can be controlled through the on-board connectors or through the USB port of a Windows-based PC using the [ADATE318 Evaluation Board Software](#). The default setup is for control through the USB port. Communication with the [ADATE318 Evaluation Board Software](#) is through the USB, and the light emitting diode (LED) indicators on the EVAL-ADATE318BCPZ provide displays for the read and write data.

The ADATE318 data sheet provides full details on all the functionalities of the ADATE318 device, as well as the information on each of the registers within the ADATE318, and must be consulted when using the EVAL-ADATE318BCPZ. All documents and software tools are available on the ADATE318 product page.

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REVISION HISTORY**12/2022—Revision 0: Initial Version**

EVALUATION BOARD PHOTOGRAPH

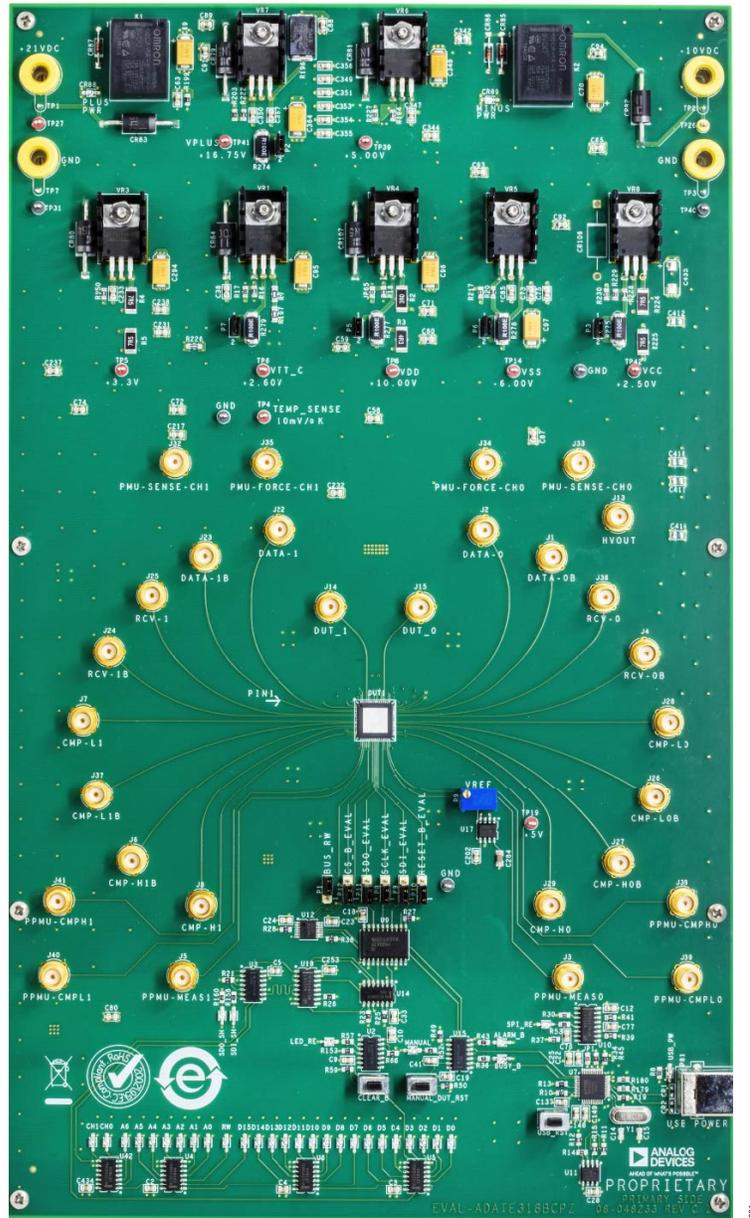


Figure 1. EVAL-ADATE318BCPZ

QUICK START GUIDE

To run the EVAL-ADATE318BCPZ with the [ADATE318](#) for the first time, take the following steps:

1. Install the software. Note that the evaluation software must be installed before connecting the EVAL-ADATE318BCPZ, or the USB communications may not function properly.
 - a. To install the required USB drivers and software to the PC, download the [ADATE318 Evaluation Software](#) from the [EVAL-ADATE318](#) product page and run the **setup.exe** file. By default, all software, documentation, and setup files copy to **C:\ProgramData\Microsoft\Windows\Start Menu\Programs\ADATE318 Evaluation Board Software**.
2. Restart the computer.
3. Plug in the hardware.
 - a. Turn the following power supplies on:
 - ▶ 21 V DC = 21 V
 - ▶ -10 V DC = -10 V
 - ▶ GND = 0 V
 - b. Using the USB cable, connect the EVAL-ADATE318BCPZ to the PC. Most Windows computers automatically install the USB drivers the first time a powered FTDI chip is connected through the USB. However, the user can retrieve the drivers from the FTDI D2xx direct drivers page, if required.
4. Open the **ADATE318 Evaluation Software** using one of the following options:
 - ▶ Select the **ADATE318 Evaluation Board Software** in the Windows **Start** menu (see [Figure 2](#)).

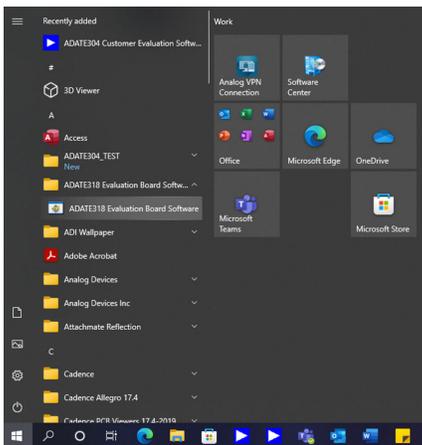


Figure 2. ADATE318 Evaluation Board Software in Start Menu

- ▶ Search for the **ADATE318 Evaluation Board Software** using the Windows search feature, and then select the **ADATE318 Evaluation Board Software** in the results pane (see [Figure 3](#)).

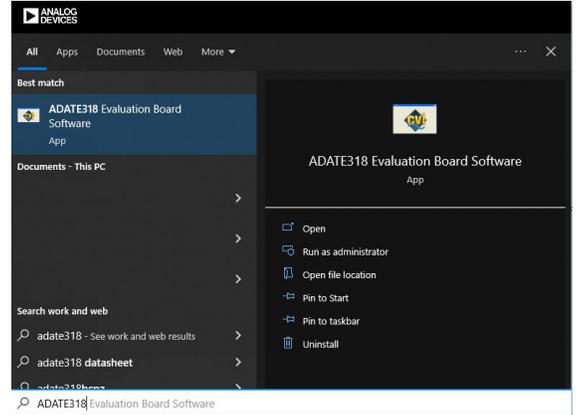


Figure 3. Windows Search

5. Verify that the PC is communicating with the hardware.
 - a. When the **ADATE318 Evaluation Board Software** opens, the main window opens if there are no issues (see [Figure 4](#)). Otherwise, a command prompt indicating any error pops up. [Figure 5](#) shows an example of an error prompt with four asterisks. Follow all the recommendations within the prompt window before attempting to start the software again.

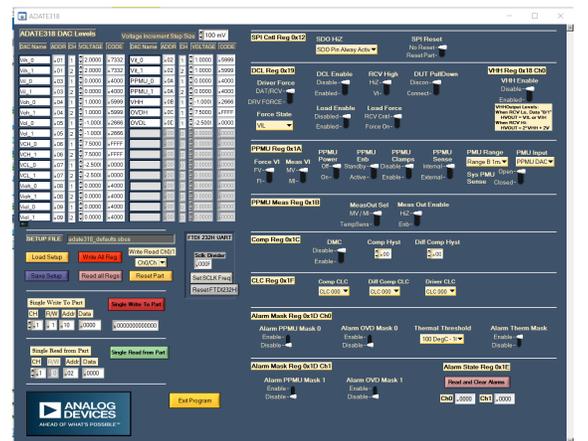


Figure 4. ADATE318 Main Window

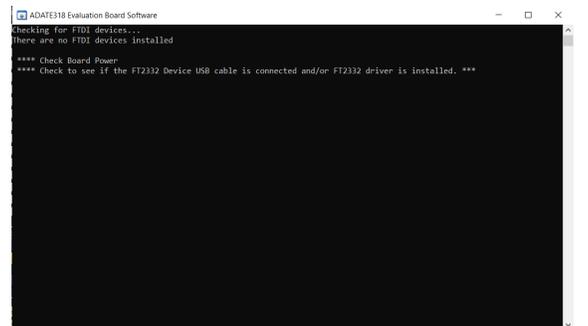


Figure 5. Error Prompt Example

- b. To verify the hardware communication, click on the **Reset Part** button, and then click on the **Read all Regs** button in the main window. If there is a successful communication,

QUICK START GUIDE

the software user interface (see Figure 6) and command prompt (see Figure 7) reflects the default values (see the ADATE318 data sheet for more information). If the user interface and the command prompt do not reflect the default values, perform the following steps:

1. Close the ADATE318 Evaluation Board Software.
2. Disconnect the USB cable.
3. Turn off the power supply.
4. Activate the power supply again.
5. Reconnect the USB cable.
6. Open the ADATE318 Evaluation Board Software, click the **Reset Part** button, and then click the **Read all Regs** button again to confirm if the user interface (see Figure 6) and command prompt (see Figure 7) reflects the default values of the registers.

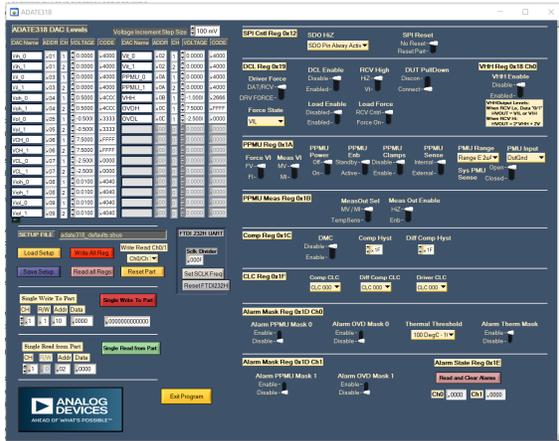


Figure 6. User Interface Default Values

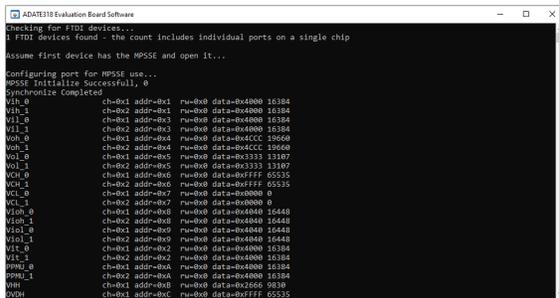


Figure 7. Command Prompt Default Values

EVALUATION BOARD HARDWARE

POWER SUPPLIES

Provide the following external power supplies:

- ▶ 21 V between +21 V DC and GND
- ▶ -10 V between -10 V DC and GND

The GND input is provided on the EVAL-ADATE318BCPZ. Each device supply is decoupled to GND with a 10 μ F and 0.1 μ F

capacitor. Each device supply pin is again decoupled with a 0.1 μ F capacitor to GND. See the [Figure 13](#) and [Figure 14](#) for reference.

DEFAULT JUMPER SETUP

The default setup is for control by the PC through the USB port. The default link options are listed in [Table 1](#).

Table 1. Default Jumper Setup

Jumper No.	Default	Function
P2	Inserted	Current measurement terminal for VPLUS (0.1 Ω sense resistor)
P7	Inserted	Current measurement terminal for VTT_C (0.1 Ω sense resistor)
P5	Inserted	Current measurement terminal for VDD (0.1 Ω sense resistor)
P6	Inserted	Current measurement terminal for VSS (0.1 Ω sense resistor)
P3	Inserted	Current measurement terminal for VCC (0.1 Ω sense resistor)
P1	Pin 2 to Pin 3	BUS_RW control to indicate whether SPI bus is reading or writing
P12	Pin 1 to Pin 2	Device SPI chip select (CS_B_EVAL), on-board or external
P11	Pin 1 to Pin 2	Device SPI target device out (SDO_EVAL), on-board or external
P8	Pin 1 to Pin 2	Device SPI clock (SCLK_EVAL), on-board or external
P9	Pin 1 to Pin 2	Device SPI target device input (SDI_EVAL), on-board or external
P10	Pin 1 to Pin 2	Device reset signal (RESET_B_EVAL), on-board or external

EVALUATION BOARD HARDWARE

USING THE EVAL-ADATE318BCPZ

The EVAL-ADATE318BCPZ requires two voltage supplies (+21 V and -10 V). The +21 V and -10 V supplies are enough to power the entire board including the digital portion. The evaluation board also has SMA provision for both the inputs and outputs. The evaluation board EVAL-ADATE318BCPZ must be controlled through the USB

and can be used with the provided software for easy access to user registers within the [ADATE318](#). Designed to be interactive, the EVAL-ADATE318BCPZ also features an LED array at the bottom portion to help the user know that the correct data are being written to or read from the device.

EVALUATION BOARD SOFTWARE

SOFTWARE OPERATION

To start the **ADATE318 Evaluation Board Software**, follow these steps:

1. Use the Windows search feature to find the **ADATE318 Evaluation Board Software**.
2. When the search displays the **ADATE318 Evaluation Board Software**, select it. The main **ADATE318 Evaluation Board Software** window opens as shown in [Figure 4](#). Note that the software loads the `adate318_default.sbus` file upon startup.

The main **ADATE318 Evaluation Board Software** window provides controls for the main functions of the [ADATE318](#), including access to the DAC registers. The main window of the **ADATE318 Evaluation Board Software** also includes the following panels:

- ▶ The **ADATE318 DAC Levels** panel allows the user to write to the DACs within the ADATE318.
- ▶ The single read and write panel allows the user to read or write to a specific register, for example, the DAC register or the control register.
- ▶ The control register panel allows the user to configure the settings of the ADATE318.

DAC LEVELS

The **ADATE318 DAC Levels** panel, located in the upper-left corner of the user interface, lists all the current settings of the DACs within the ADATE318 (see [Figure 8](#)). Changing the values in the number field and pressing **Enter** (on the keyboard) in the **ADATE318 DAC Levels** panel is equivalent to writing that value to the specific DAC. The corresponding value (hex code or voltage) changes accordingly.

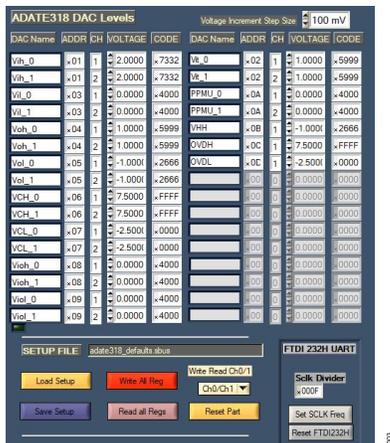


Figure 8. ADATE318 DAC Levels Panel

SETUP FILE

The **SETUP FILE** panel allows the user to load or save register settings for all DAC and control registers for quicker testing, by clicking the **Load Setup** button or the **Save Setup** button (see [Figure 9](#)).

To write the current DAC and control registers values displayed in the GUI to the ADATE318, click the **Write All Reg** button.

The user can read back the DAC and control registers from the ADATE318 and display each reading to the main window, as well as update the DAC Levels and control registers of the GUI, by clicking the **Read All Regs** button.

The **Write Read Ch0/1** drop down menu sets which channel the Control Registers panel sends the commands to. The user can select either one channel or both channels to be written at the same time. Note that this drop down menu affects the writing and displaying of the control registers only and does not influence the **Write All Reg**, **Read All Regs**, **Load Setup**, or **DAC Levels** buttons.

The user can reset the device by clicking the **Reset Part** button. To have the main window match the device's settings after a reset, click **Read all Regs**.

To set the SCLK frequency, modify the **SLCK Divider** field and click the **Set SCLK Freq** button to apply the set value. Note that the higher the SLCK divider, the slower the SCLK is as shown by this equation:

$$SCLK = 60 \text{ MHz} / ((1 + SCLK \text{ Divider}) \times 2)$$

The FTDI232H, the microcontroller chip being used on the board, can also be reset through the **Reset FTDI232H** button.

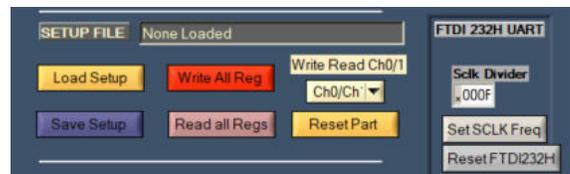


Figure 9. Setup File Panel

SINGLE READ AND WRITE FUNCTIONS

The single read and write functions of the user interface (see [Figure 10](#)) makes it easy for the user to write to or read from the specific registers as required. Note that when reading from a register, it is not necessary to fill the **Data** field as this field shows the data read from the device.



Figure 10. Single Read and Write Functions Panel

EVALUATION BOARD SCHEMATICS AND SILKSCREENS

900

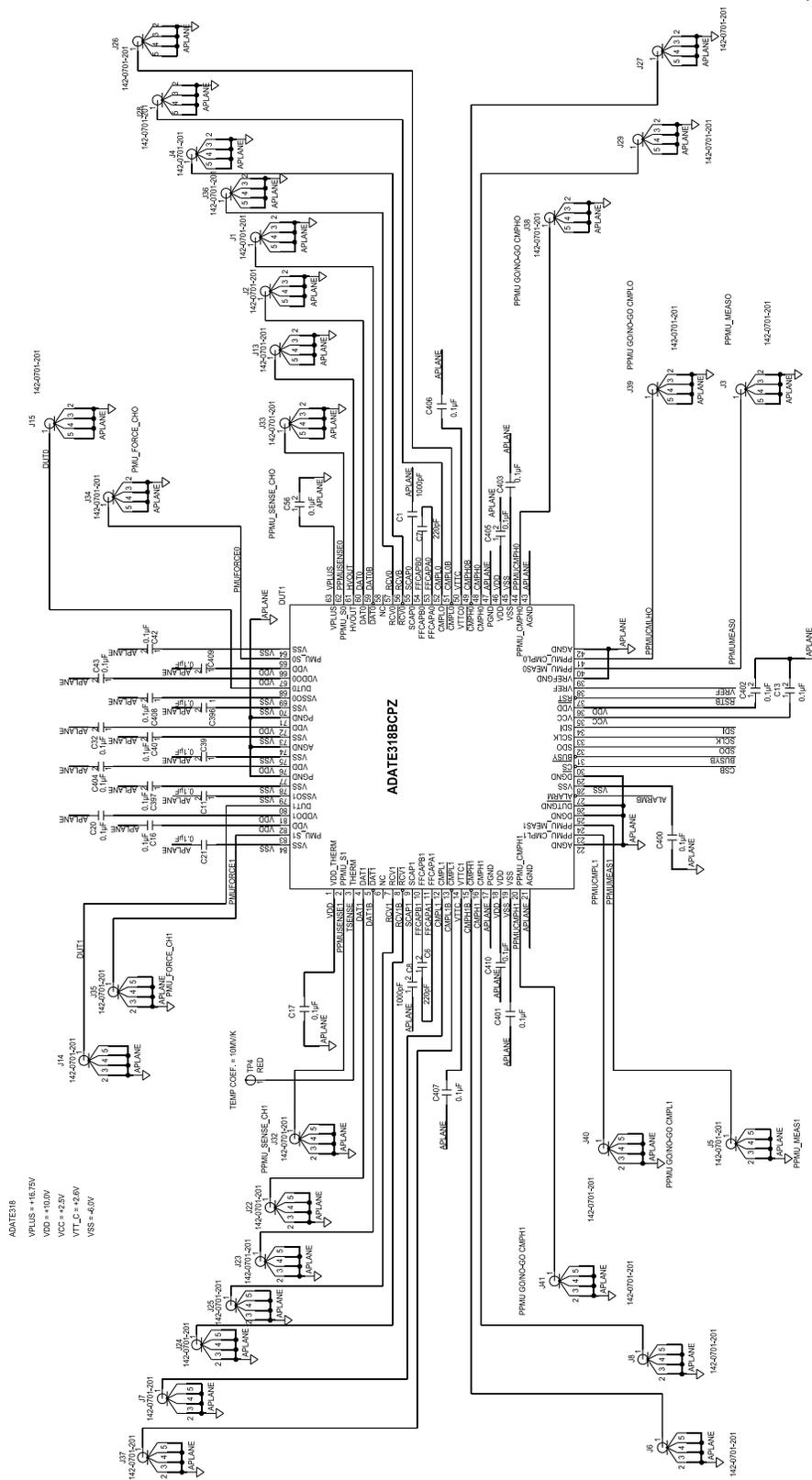


Figure 12. EVAL-ADATE318BCPZ Schematic, Page 1

EVALUATION BOARD SCHEMATICS AND SILKSCREENS

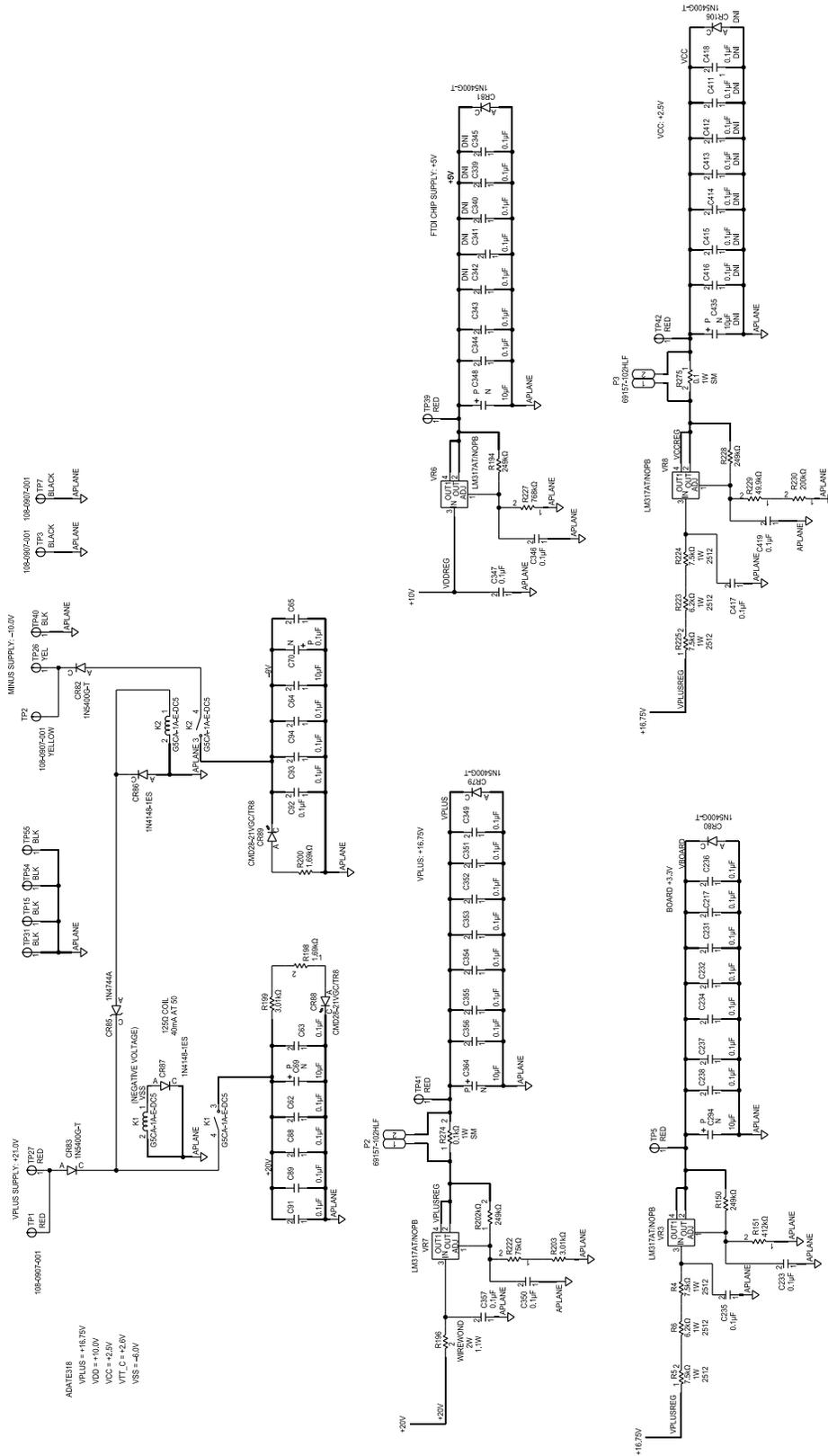


Figure 13. EVAL-ADATE318BCPZ Schematic, Page 2

EVALUATION BOARD SCHEMATICS AND SILKSCREENS

800

ADATE318

- VPLUS = +16.25V
- VDD = +10.0V
- VCC = +2.5V
- VTL_C = +2.5V
- VSS = -6.0V

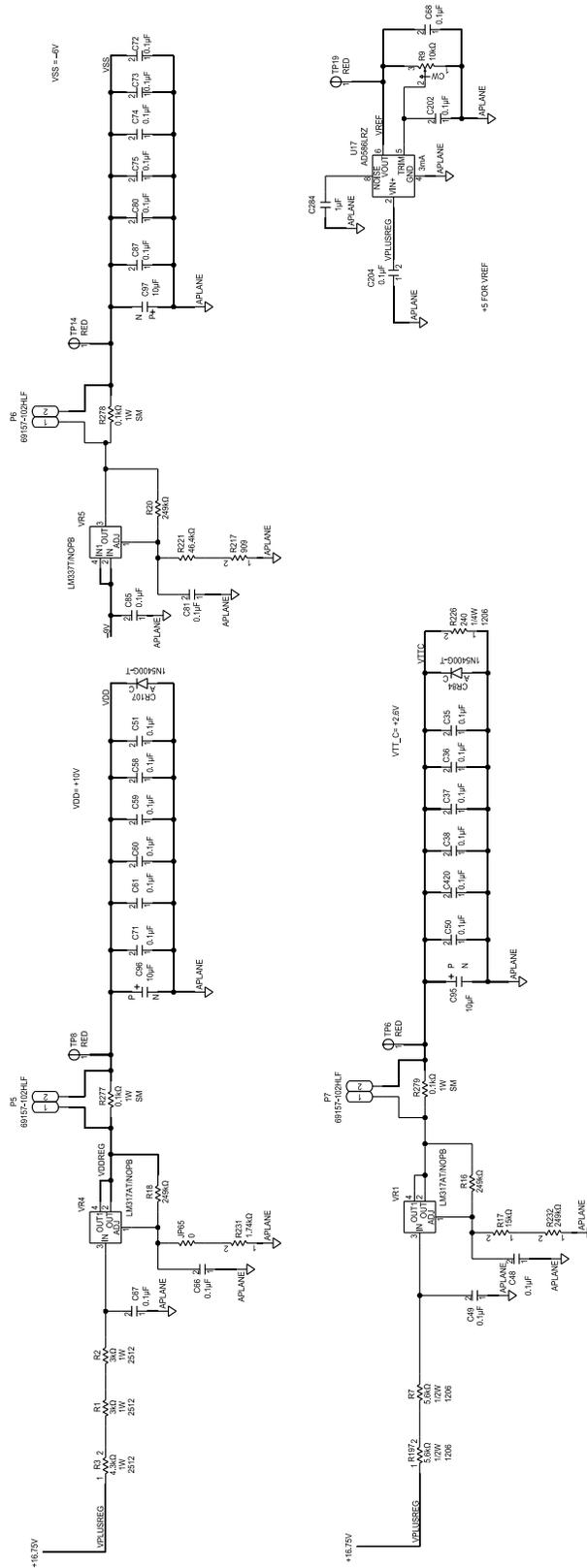


Figure 14. EVAL-ADATE318BCPZ Schematic, Page 3

EVALUATION BOARD SCHEMATICS AND SILKSCREENS

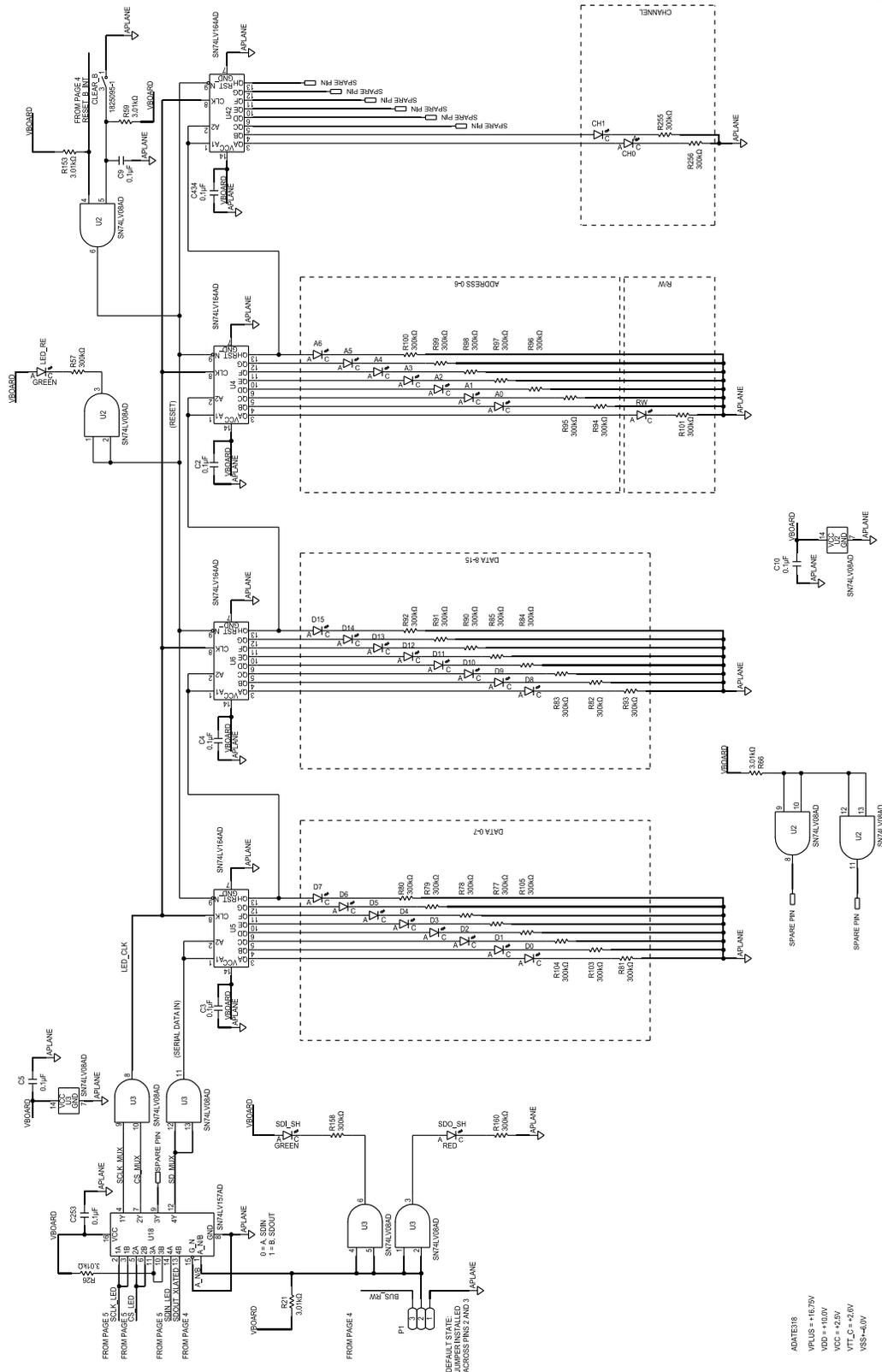


Figure 17. EVAL-ADATE318BCPZ Schematic, Page 6

EVALUATION BOARD SCHEMATICS AND SILKSCREENS

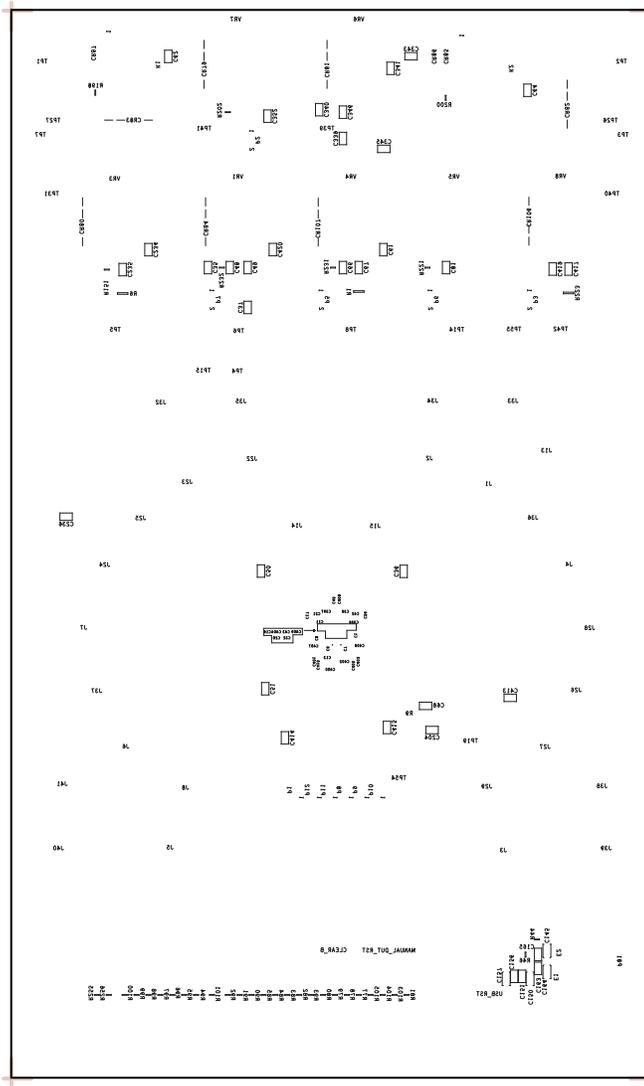


Figure 19. EVAL-ADATE318BCPZ Silkscreen, Secondary

ORDERING INFORMATION

BILL OF MATERIALS

Quantity	Reference Designator	Description	Part No.	Manufacturing
1		Printed circuit board (PCB)	08_048233b	Analog Devices, Inc.
29	A0 to A6, ALARM_B, BUSY_B, CH0, CH1, D0 to D15, RW, SDO_SH	LED clear, surface-mounted device (SMD) (red)	CMD2821SDRC/TR8	Visual Communications Company
2	C1, C8	0.001 μ F capacitors, plastic film	ECH-U1H102JX5	Panasonic
110	C2 to C5, C9, C10 to C12, C13, C16, C17 to C24, C28, C32, C33, C35 to C43, C48 to C51, C56, C58, C59 to C68, C71, C72, C73, C74, C75, C80, C81, C85, C87, C88, C89, C91, C92, C93, C94, C137, C148, C149, C151, C156, C163, C165, C202, C204, C217, C231 to C238, C253, C343, C344, C346, C347, C349 to C357, C396, C397, C400 to C410, C417, C419, C420, C434	0.1 μ F capacitors, ceramic chip, X7R	08051C104KAT2A	AVX Corporation
2	C14, C15	27 pF capacitors, ceramic, NPO	CC0805JRNPO9BN270	Yageo
4	C145, C150, C157, C164	4.7 μ F capacitors, tantalum	TAJA475K020RNJ	AVX Corporation
3	C25, C76, C77	4.7 μ F capacitors, multilayer ceramic chip, X7R	C2012X7R1E475K125AB	TDK
1	C284	1 μ F capacitor, ceramic chip 1206, X7R	GMK316B7105KL-T	Taiyo Yuden
8	C69, C70, C95, C96, C97, C294, C348, C364	10 μ F capacitors, tantalum chip	TPSD106K035R0125	AVX Corporation
2	C6, C7	220 pF capacitors, ceramic, NPO	CC0805JRNPO9BN221	Yageo
3	CLEAR_B, MANUAL_DUT_RST, USB_RST	Switches, push button, SPST-NO 0.4 A, 20 V	1825095-1	TE Connectivity
2	CR1, CR2	Diode Zener suppressors electrostatic discharge (ESD) 24 V DC, 0603	PGB1010603	Littelfuse
7	CR79, CR80, CR81, CR82, CR83, CR84, CR107	Diode rectifiers	1N5400G-T	Diodes Incorporated
1	CR85	Diode Zener	1N4744A	Fairchild Semiconductor
2	CR86, CR87	Diode general-purpose 75 V 200 mA, DO35	1N4148-1ES	Microsemi
7	CR88, CR89, LED_RE, MANUAL, SDI_SH, SPI_RE, USB_PW	LED unicolor green, 570 nm	CMD28-21VGC/TR8	Visual Communications Comp.
1	DUT1	600 MHz, dual-integrated DCL with PPMU, VHH drive capability, level setting DACs, and on-chip calibration engine	ADATE318BCPZ	Analog Devices
2	E1, E2	600 Ω inductors, ferrite chips surface mount	BLM18EG601SN1D	Murata Manufacturing
29	J1 to J8, J13, J14, J15, J22 to J29, J32 to J41	PCB connector coax SMA straight	142-0701-201	Cinch Connectivity Solutions
1	JP1	0 Ω resistor, jumper	ERJ-6GEY0R00V	Panasonic
4	JP65, R30, R179, R180	0 Ω resistors, thick film chip	ERJ-6GEY0R00V	Panasonic
2	K1, K2	Relay, general-purpose, 15 A SPST-NO	G5CA-1A-E-DC5	Omron
6	P1, P8 to P12	Berg PCB connector header straight male 3 position	TSW-103-08-G-S	Samtec
5	P2, P3, P5, P6, P7	Berg PCB connector jumpers straight male 2 position	69157-102HLF	Amphenol FCI
1	P81	PCB connector receptacle side entry shielded data link (SDL)	USB-B-S-F-B-TH-R	Tyco Electronics
2	R1, R2	3 Ω resistors, thick film chip	ERJ-1TYJ3R0U	Panasonic

ORDERING INFORMATION

Quantity	Reference Designator	Description	Part No.	Manufacturing
19	R10, R21, R23, R25, R26, R27, R28, R34, R38, R44, R45, R46, R49, R50, R59, R66, R153, R199, R203	3.01 k Ω resistors, precision thick film chip, SMD, 0805	ERJ-6ENF3011V	Panasonic
33	R36, R43, R52, R53, R57, R77 to R85, R90 to R101, R103 to R105, R158, R160, R255, R256	300 k Ω resistors, film, SMD, 0805	ERJ-6GEYJ301V	Panasonic
5	R11, R12, R15, R39, R41	10 k Ω resistors, precision thick film chip, SMD, 0805	ERJ-6ENF1002V	Panasonic
1	R13	39 k Ω resistor, film, SMD, 0805	MC 0.1W 0805 1% 39K	Multicomp (SPC)
1	R14	2.05 k Ω resistor, precision thick film chip, SMD, 0805	ERJ-6ENF2051V	Panasonic
8	R16, R18, R20, R150, R194, R202, R228, R232	249 Ω resistors, precision thick film chip, SMD, 0805	ERJ-6ENF2490V	Panasonic
2	R8, R151	412 Ω resistors, precision thick film chip, SMD, 0805	ERJ-6ENF4120V	Panasonic
1	R17	15 Ω resistor, precision thick film chip, SMD, 0805	ERJ-6ENF15R0V	Panasonic
1	R19	12 k Ω resistor, film, SMD, 0805	MC 0.1W 0805 1% 12K	Multicomp (SPC)
1	R196	2 Ω resistor, wire wound precision power	WSC45272R000FEA	Vishay
2	R7, R197	5.6 Ω resistors, thick film chip, SMD, 1206	ERJ-8BQF5R6V	Panasonic
2	R198, R200	1.69 k Ω resistors, precision thick film chip, SMD, 0805	ERJ-6ENF1691V	Panasonic
1	R217	909 Ω resistor, precision thick film chip, SMD, 0805	ERJ-6ENF9090V	Panasonic
1	R221	46.4 Ω resistor, precision thick film chip SMD, 0805	ERJ-6ENF46R4V	Panasonic
1	R222	75 Ω resistor, precision thick film chip, SMD, 0805	ERJ-6ENF75R0V	Panasonic
2	R6, R223	6.2 Ω resistors, thick film chip, SMD, 2512	ERJ-1TYJ6R2U	Panasonic
4	R4, R5, R224, R225	7.5 Ω resistors, thick film chip, SMD, 2512	ERJ-1TYJ7R5U	Panasonic
1	R226	240 Ω , resistor, SMD, 1206	ERJ-8ENF2400V	Panasonic
1	R227	768 Ω resistor, precision thick film chip, SMD, 0805	ERJ-6ENF7680V	Panasonic
1	R229	49.9 Ω resistor, precision thick film chip, SMD, 0805	ERJ-6ENF49R9V	Panasonic
1	R230	200 Ω resistor, precision thick film chip, SMD, 0805	ERJ-6ENF2000V	Panasonic
1	R231	1.74 k Ω resistor, precision thick film chip, SMD, 0805	ERJ-6ENF1741V	Panasonic
5	R274, R275, R277, R278, R279	0.1 Ω resistors, SMD	RW1S0BAR100FE	Ohmite
1	R3	4.3 Ω resistor, chip, SMD, 2512	ERJ-1TYJ4R3U	Panasonic
1	R37	330 k Ω resistor, film, SMD, 0805	ERJ-6GEYJ334V	Panasonic
1	R9	10 k Ω resistor, through-hole trimmer, variable 3/8 inch square top ADJ	3299W-1-103LF	Bourns
4	TP1, TP2, TP3, TP7	PCB connector banana jack insulated terminals	108-0907-001	Cinch Connectivity Solutions
10	TP4, TP5, TP6, TP8, TP14, TP19, TP27, TP39, TP41, TP42	PCB connector test points red	TP-104-01-02	Components Corporation
5	TP15, TP31, TP40, TP54, TP55	PCB connector test points black	TP-104-01-00	Components Corporation
1	TP26	PCB connector test point yellow	TP-104-01-04	Components Corporation
1	U10	IC-transistor-transistor logic (IC-TTL) dual one shot	SN74LV123AD	Texas Instruments
1	U11	IC-CMOS 2K 16-bit microwire-compatible serial electrically erasable programmable read-only memory (EEPROM)	93LC56B-I/SN	Microchip Technology
1	U12	Low-voltage 1.15 V to 5.5 V, 4 channel, bidirectional, logic-level translator	ADG3304BRUZ	Analog Devices
1	U14	IC-TTL quadruple 2-input EX-OR	SN74LV86AD	Texas Instruments
3	U2, U3, U15	IC-TTL quadruple 2-input positive-AND gates	SN74LV08AD	Texas Instruments
1	U17	High precision 5 V reference	AD586LRZ	Analog Devices

ORDERING INFORMATION

Quantity	Reference Designator	Description	Part No.	Manufacturing
1	U18	IC-TTL quad 2LINE to 1LINE selector and mux	SN74LV157AD	Texas Instruments
4	U4, U5, U6, U42	IC-TTL 8-bit PAR-OUT Serial Shift Register	SN74LV164AD	Texas Instruments
1	U7	IC 1-channel high-speed USB to multipurpose universal asynchronous receiver and transmitter (UART) and first in first out (FIFO)	FT232HL-REEL	FTDI
1	U9	IC-TTL octal buffer and driver with 3 straight out	SN74ALVC244DW	Texas Instruments
6	VR1, VR3, VR4, VR6, VR7, VR8	Linear IC 3-term adjustable regulators, 1x M000386 and 1x M021972	LM317AT/NOPB	Texas Instruments
1	VR5	Linear IC adjustable negative regulators, add 1x M000386 and 1x M021972	LM337T/NOPB	Texas Instruments
1	Y1	12.000 MHz, IC crystal quartz	ECS-120-20-4X	ECS
11	Mechanical parts	Shunts, 2.54 mm pitch open top grip, black	881545-2	TE Connectivity
7	Mechanical parts	Mounting kit for transistor outline (TO)-220 heat sinks	4880G	Aavid Thermalloy
7	Mechanical parts	Heat sinks, TO-202	577404B00000G	Aavid Thermalloy
8	Mechanical parts	Screws, pan high-definition Phillips, 4 to 40 x 1/4 inch	91735A102	McMaster-Carr
8	Mechanical parts	Standoffs, F aluminum threaded round, 4 to 40 x 1 1/2 inch	93330A462	McMaster-Carr
12	C339, C340 to C342, C345, C411 to C416, C418	0.1 μ F ceramic capacitors, 100 V, 10%, X7R, 0805 (components are part of the PCB or are not to be installed)	08051C104KAT2A	AVX Corporation
1	C435	10 μ F tantalum capacitor, 35 V, 10% 7343-31, 0.125 Ω (components are part of the PCB or are not to be installed)	TPSD106K035R0125	AVX Corporation
1	CR106	Diode rectifier (components are part of the PCB or are not to be installed)	1N5400G-T	Diodes Incorporated

ORDERING INFORMATION**NOTES****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.

Legal Terms and Conditions

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS (\$100.00). EXPORT. Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. GOVERNING LAW. This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.

