

LTC4281

Hot Swap Controller with I²C Compatible Monitoring

DESCRIPTION

Demonstration circuit 2278A features the **LTC[®]4281** hot swap controller. The LTC4281 is well suited to high power applications because the precise monitoring capability and accurate current limiting reduces the extremes in which both loads and power supplies must safely operate. Non-volatile configuration allows for flexibility in the autonomous generation of alerts and response to faults. The LTC4281 provides a rich set of features to support hot swap applications including:

- 12-/16-Bit ADC Monitors Current, Voltage, Power and Energy
- I²C/SMBus Interface
- Non-Volatile Configuration and Logging Functions
- Generates Alerts on ADC Measurements Outside Limits

- Software Adjustable Current Limit with Foldback
- Three General Purpose Input/Outputs

Available in a 28-pin 4mm × 5mm QFN package, the LTC4281 is showcased on DC2278A configured for a 12V, 50A application. The DC2278A-B has an included programming socket to allow programming an LTC4281 for prototyping purposes prior to its permanent installation on a PCB. The DC2278A-A does not have this socket. By changing a few passive components, 2.9V to 30V applications can easily be evaluated.

Design files for this circuit board are available at <http://www.linear.com/demo/DC2278A>

LT, LT, LTC, LTM, Linear Technology, LTpowerPlay and the Linear logo are registered trademarks and QuikEval is a trademark of Linear Technology Corporation. All other trademarks are the property of their respective owners.

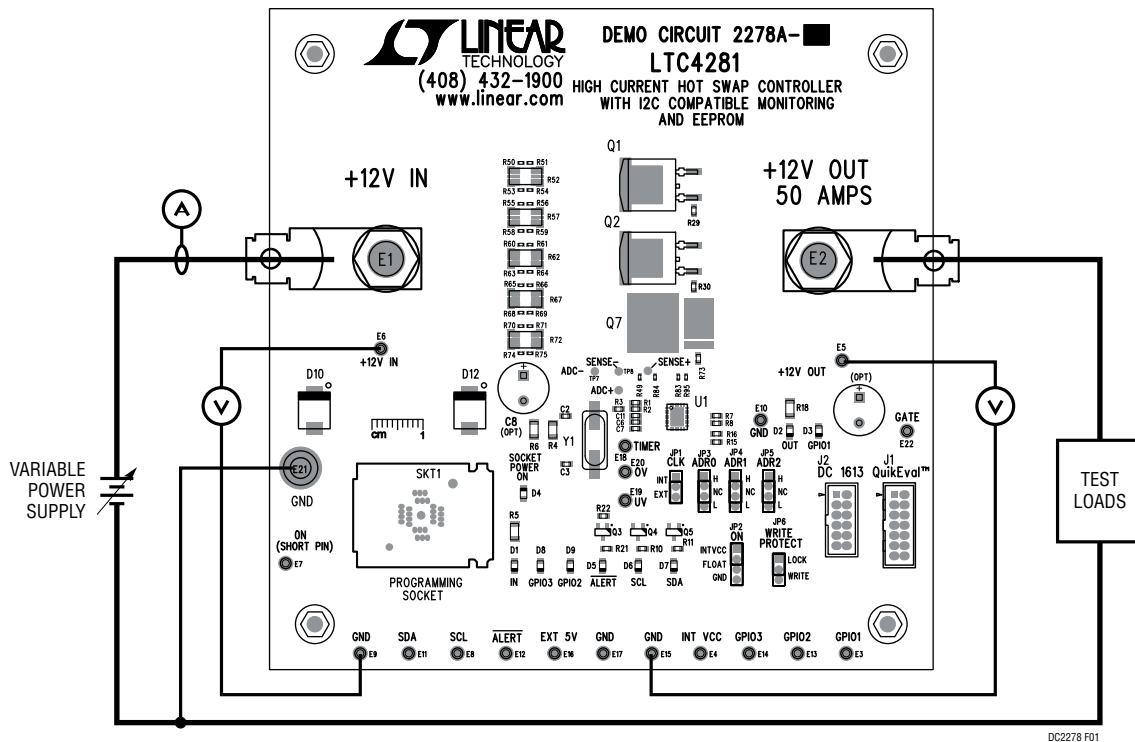


Figure 1. Proper Measurement Equipment Setup

DEMO MANUAL DC2278A

PERFORMANCE SUMMARY Specifications are at $T_A = 25^\circ\text{C}$

PARAMETER	CONDITIONS	VALUE
Input Supply Voltage Range		2.9V to 30V
Nominal Operating Voltage		12.0V
Overvoltage Lockout	Nominal	15.0V
Undervoltage Lockout	Nominal	11.1V
Output Current Limit	Nominal	52.5A
Maximum Load Capacitance	Nominal	10,000 μF
Timer Expiration Period	Nominal	4ms

QUICK START PROCEDURE

Table. Power Input and Output Connections

NOMENCLATURE	CONNECTOR	DESCRIPTION
12V _{IN}	E1	12V Power In
12V _{OUT} 50A	E2	12V Power Out
GND	E21 (Banana)	Power Supply Common

Table 2. Test Points, Turrets

NOMENCLATURE	TURRET	DESCRIPTION
GPIO1	E3	GPIO1 Pin I/O
V _{CC}	E4	Internal V _{CC}
12V _{OUT}	E5	12V _{OUT} Monitor
12V _{IN}	E6	12V _{IN} Monitor
ON (SHORT PIN)	E7	ON Pin Monitor/Input
SCL	E8	I ² C Serial Clock Input
GND	E9, E10, E15, E17	Ground
SDA	E11	I ² C Serial Data Input/Output
ALERT	E12	ALERT Pin
GPIO2	E13	GPIO2 Pin I/O
GPIO3	E14	GPIO3 Pin I/O
EXT 5V	E16	
TIMER	E18	TIMER Pin
UV	E19	UV Pin
OV	E20	OV Pin
GATE	E22	GATE Pin

Table 3. LED Indicators

NOMENCLATURE	LED	DESCRIPTION
IN	D1 (Green)	Input Power Indicator
OUT	D2 (Green)	Output Power Indicator
GPIO1	D3 (Green)	GPIO1 Logic Low Indicator

QUICK START PROCEDURE

Table 3. LED Indicators

SOCKET POWER ON	D4 (Red)	Programming Socket SKT1 Powered
ALERT	D5 (Red)	ALERT Pin Logic Low
SCL	D6 (Green)	Serial Clock Active
SDA	D7 (Green)	Serial Data Active
GPIO3	D8 (Green)	GPIO3 Logic Low
GPIO2	D9 (Green)	GPIO2 Logic Low

Table 4. Jumpers

NOMENCLATURE	JUMPER	DESCRIPTION
CLK: INT, EXT	JP1	Internal/External Clock Select
ON: INTV _{CC} , FLOAT, GND	JP2	ON Input Select, V _{CC} , Float (External), GND
ADRO: H, NC, L	JP3	Address Pin ADRO Select
ADR1: H, NC, L	JP4	Address Pin ADR1 Select
ADR2: H, NC, L	JP5	Address Pin ADR2 Select
WRITE PROTECT: LOCK, WRITE	JP6	Write Protect for EEPROM

Table 5. Connectors

NOMENCLATURE	CONNECTOR	DESCRIPTION
QuikEval™	J1	Connection for DC590 Aux Demo Board
DC1613	J2	Connection for DC1613 Aux Demo Board

Operating Principles

The LTC4281 is a low voltage, high current hot swap controller that has a 2.9V to 33V operating range and a 45V absolute maximum voltage for the V_{DD} pin. This demo circuit is populated for 12V operation, but it can easily be readjusted for any voltage between 2.9V and 30V by replacing R1, R2, and R7 (top resistors in the UV/OV divider and the FB divider). The DC2278A as supplied by the factory is populated with a pair of PSMN1R5-30BLE MOSFETs in D2PAK packages. A total of five 2.5mΩ sense resistors are used, providing typically 50A of load current. The current limit and circuit breaker thresholds can be adjusted by changing the sense resistors R52, R57, R62, R67 and R72 and/or the value of ΔV_{SENSE} via addressable registers in the LTC4281. Several locations for MOSFET packages as well as additional sense resistors are available on the front and rear of the PCB for higher current configurations.

Quick Start Procedure (Without Software)

DC2278A is easy to set up to evaluate the performance of the LTC4281. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below.

WARNING

The DC2278A is capable of operation in excess of 50A. At this current and power level, there is a danger of serious personal injury and equipment damage if proper techniques are not used. All cabling between the power supply and the load should be capable of handling the current levels used.

Additionally, the high currents and fast transients can cause unexpected voltage drops in cables connecting the test equipment to the DC2278A due to parasitic resistance and inductance. The cable drops may cause ground loops for the current via various cables and scope probes. This will cause unexplained ringing, distorted oscilloscope waveforms, voltage and current spikes, and signals appearing to be below ground.

QUICK START PROCEDURE

A common sneak path for current is the third wire grounds used on power cords of test equipment in use. Using ground lifting connectors at the wall outlet won't necessarily alleviate these effects since most equipment has line bypassing capacitors between the mains voltage and local chassis ground. Isolating test equipment using line isolation transformers with low primary to secondary capacitance is recommended. Probe ground leads may intercept induced fields from the high current paths and should be minimized or avoided

Another method to remove these artifacts is the use of a differential scope probe connected between the signal to be observed and a ground connection located close to the point of measurement.

Also be careful to not allow an open ground from the power supply or load to cause return current through the grounds of the various devices connected to the demo board. This may present a fire hazard or cause damage to the test equipment.

Jumper Positions

JUMPER	NAME	POSITION
JP1	CLK	EXT
JP2	ON	INTV _{CC}
JP3	ADRO	NC
JP4	ADR1	NC
JP5	ADR2	NC
JP6	WRITE PROTECT	LOCK

Powering Up

Connect power supply capable of 60A at 0V to 20V to the 12V input as shown in Figure 1. Verify cabling shown in extra bold lines is capable of carrying 60A safely. The GND connection does not handle high current so no high current cabling is required.

Generally, an electronic load will be used. If this is true, use it in the constant resistance mode. Use in constant current will prevent start up because of current foldback in the LTC4281. Current foldback is used to minimize

dissipation in the MOSFETs used as pass devices with the LTC4281. To affect this, current is initially limited to approximately 1/3 of full limit until the output voltage is above 10V. If a constant current load is used and set to 50A, the LTC4281 will not start up and a current fault will be reported.

UV/OV Thresholds

With no load on the output, slowly increase the voltage on the input to the board. Observe the input voltage when LED D2 (OUT) illuminates. This voltage should be between 10.7V and 11.4V. Continue increasing the voltage until D2 is extinguished. This should occur between 14.4V and 15.3V.

Output Voltage Slew Rate

With no load connected, observe the output voltage between turret 12V_{OUT} (E5), and GND. Apply 12V to the 12V_{IN} connector. The output voltage should slew from 0V to 12V in 10ms to 25ms.

Output Current Limit

Turn off power supply and connect electronic load to the DC2278A as shown in Figure 1. Disable electronic load. Adjust power supply to 12V and verify its current level is set to >60A.

Slowly increase conductance of the electronic load while monitoring current. As the load increases to around 50A, the output voltage and current will fall to zero. Note the current where this occurs. This should be 47.5A to 52.5A.

Ability to Charge Output Capacitor

Turn off power supply and disconnect electronic load. Replace load with a 10,000µF capacitor rated at 15V or greater. Turn on power supply and observe that the output voltage rises to 12V indicating the DC2278A has connected to the load and successfully charged the output capacitance. Monitor the current during the period when the capacitor is charging, it should be a maximum of 12A.

QUICK START PROCEDURE

Software Control with LTpowerPlay®

LTpowerPlay is a convenient PC software GUI that gives complete access to the registers of the LTC4281, and many other Linear Technology power system management parts. Use it in offline mode to build a system configuration file even with no hardware plugged-in, and use it with hardware connected to configure and debug your application. LTpowerPlay communicates using the I²C bus in the demo system (covered in this manual), or in your real-world product environment. It provides unprecedented control over the Linear Technology ICs on the I²C bus. Use

it during board bring-up to tune and optimize the power system parameters. Use it during system debug to view critical system information and troubleshoot board design or manufacturing issues. LTpowerPlay includes extensive help and documentation under the help menu. Online help includes quick start videos and tutorials, and detailed technical documentation from the Linear Technology website. Getting started with LTpowerPlay is easy. Simply download and install the PC software from here:

<http://www.linear.com/ltpowerplay>



Figure 2. DC2278A-A Demo Board Connected to DC1613 I²C-to-USB Converter

QUICK START PROCEDURE

The DC1613 USB-to-I²C adapter interfaces the PC running LTpowerPlay to the DC2278A board. Connect the DC1613 adapter to the PC through a USB cable, and connect the DC2278A board through the ribbon cable to connector J2 (Figure 2).

Launch the LTpowerPlay GUI on the PC. The software identifies the DC1613 controller, then the DC2278A board, and begins communicating through the I²C bus with the LTC4281. Once this communication has been established, the GUI displays its main window (Figure 3).

The LTpowerPlay GUI divides information into separate panes in the window. On the left is the system tree pane (Figure 4), displaying a list of all Linear Technology devices identified on the I²C bus. For a single LTC4281 device, the tree is small, but if other supported devices are present on the I²C bus, LTpowerPlay will add them. Click on

a device in this list to selectively access it. Information in other panes pertains to the selected device.

LTpowerPlay System Tree

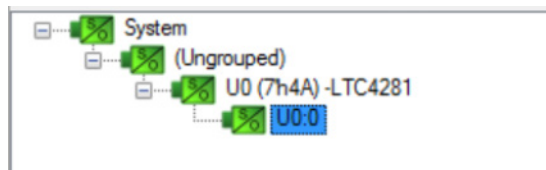


Figure 4. LTpowerPlay System Tree

To the right of the system tree is the configuration register pane. The Figure 5 view shows all of the writable user-configurable registers available on the selected device. The GUI offers clickable buttons and fields to edit the information in these registers.

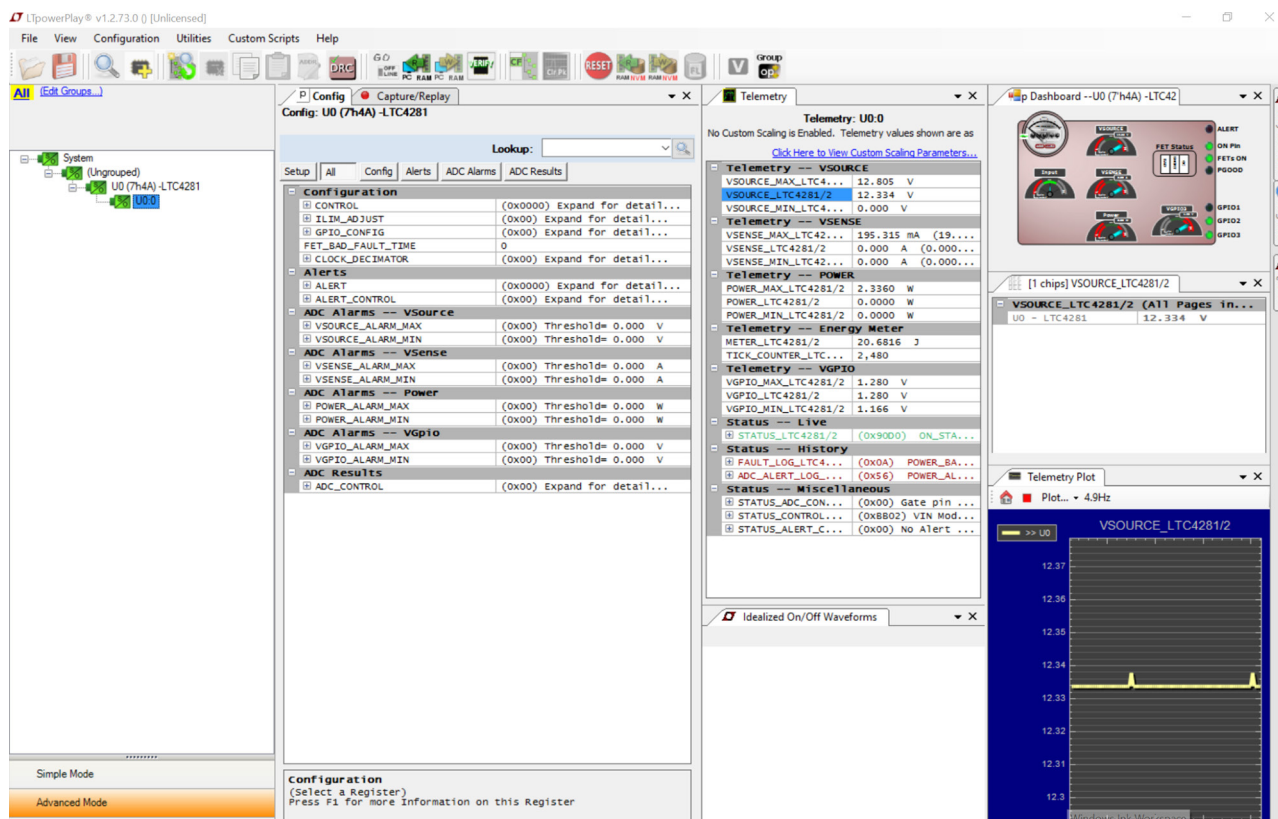


Figure 3. LTpowerPlay GUI Window

QUICK START PROCEDURE

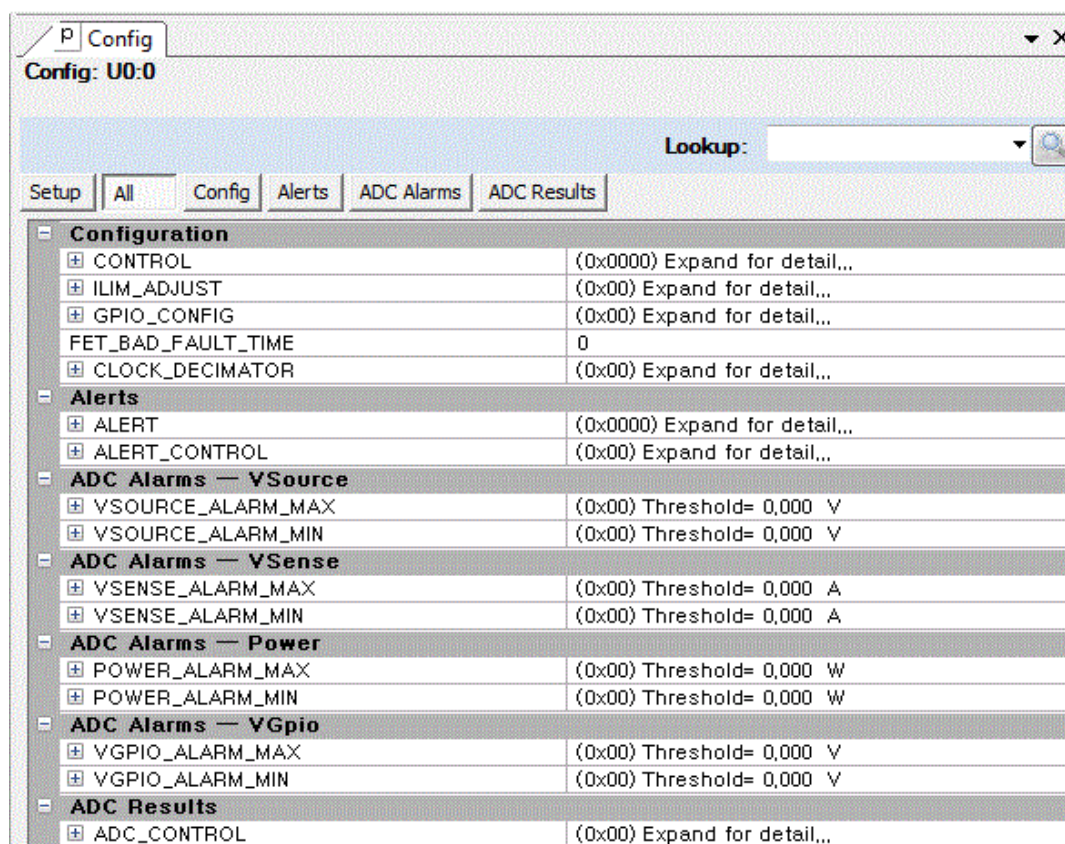


Figure 5. LTpowerPlay Configuration Registers

Update register contents by clicking or typing to change the desired registers. Then selecting the PC to RAM button in the top toolbar (Figure 6). LTpowerPlay writes changes to the updated registers.



Figure 6. PC to RAM Button

Right of center in LTpowerPlay is the telemetry pane (Figure 7), displaying read-only information contained in the status registers of the selected part. The GUI periodically polls the I²C bus and updates the telemetry content, along with a user-friendly interpretation of the bits.

QUICK START PROCEDURE

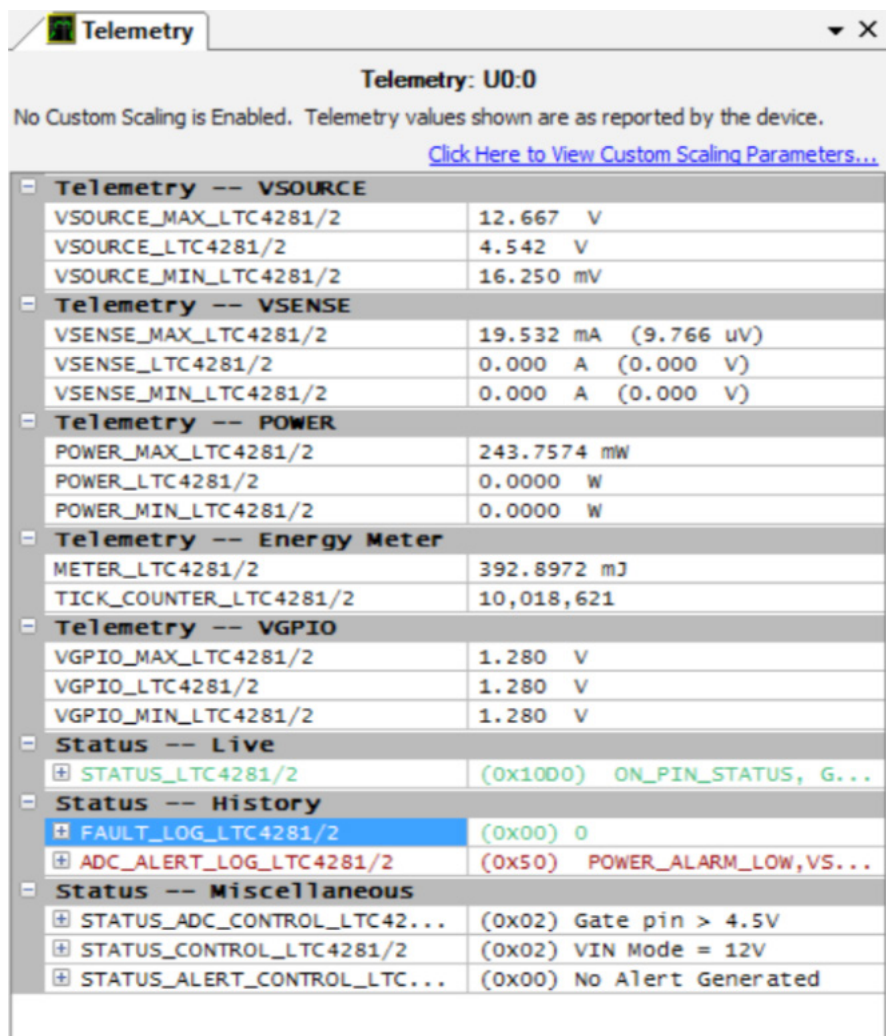


Figure 7. LTpowerPlay Telemetry

In the upper right corner of LTpowerPlay is the chip dashboard pane (Figure 8), displaying a graphical representation of the part status in a friendly, easy-to-understand format. The meter in the upper left of the panel displays the static input energy to the card in watts. The small dials in the center of the input energy meter display the energy used in kilojoules. The VSOURCE meter displays the voltage at the SOURCE pin of the LTC4281, which is the same as V_{OUT} . The Input meter displays the voltage input at the V_{DD} pin of the LTC4281. VSENSE indicates the input current derived by dividing the voltage measured across the sense resistor by the value of the sense resistor. The power meter displays the SOURCE voltage multiplied

by the current sense voltage and scaled to indicate the power in watts. VGPIO3 displays the voltage at GPIO3 when it is configured as an analog input. The FET Status annunciators show the status of the pass MOSFETs as described in the FET-Bad Fault section of the data sheet. GPIO1, GPIO2 and GPIO3 show the status of the general purpose input/output pins.

On the lower right of the GUI window is the telemetry plot pane (Figure 9). By selecting various measurement functions in the telemetry pane, a graphic display of that function versus time is displayed. This gives an instant indication on how that function varies with time.

QUICK START PROCEDURE

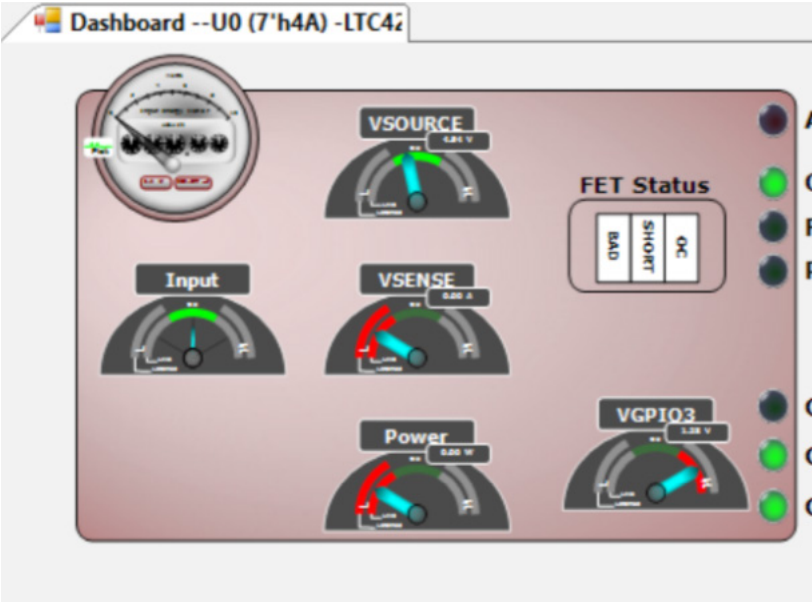


Figure 8. LTpowerPlay Chip Dashboard

QUICK START PROCEDURE

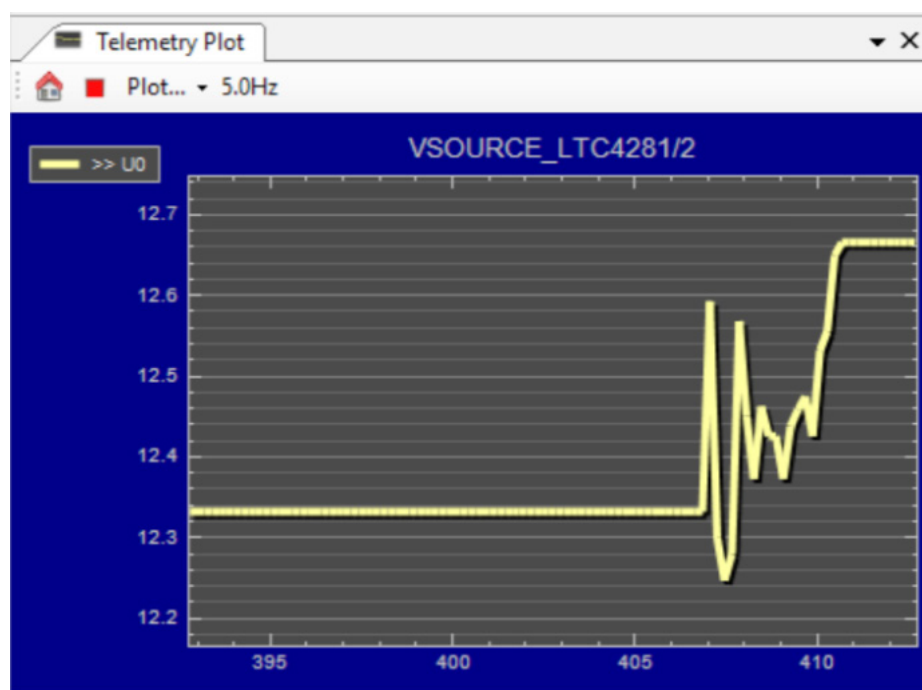


Figure 9. LTpowerPlay Telemetry Plot

QUICK START PROCEDURE

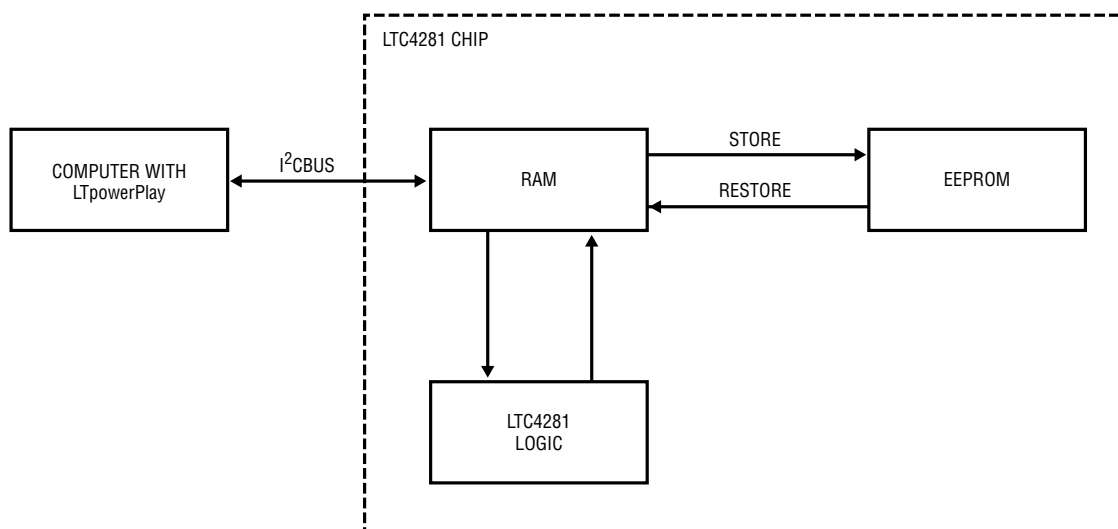


Figure 10. LTC4281 RAM and Non-Volatile Memory

The LTC4281 is highly configurable through its register set. Refer to the LTC4281 data sheet for a complete discussion of the registers and functions available. Get immediate access to detailed help for the selected register in LTpowerPlay by pressing the F1 key on your keyboard.

The LTC4281 features non-volatile EEPROM that holds device configuration information and a snapshot of past fault information. When the part receives power it executes a power-on reset, and restores the contents of the EEPROM to its operating RAM. Following this power-on restore, operating RAM can be modified with I²C bus commands that modify the part behavior. These modifications are effected by using the PC>RAM button in the toolbar. Also included in the toolbar are buttons for reading the internal RAM data on the PC by using the RAM>PC button on the toolbar. Similarly, there are buttons for moving the contents of the RAM to the NVM (EEPROM) and vice versa using the RAM>NVM and NVM>RAM buttons on the toolbar.

Programming Socket

The DC2278A-B board includes a programming socket. This socket in conjunction with the LTpowerPlay software GUI and DC1613 USB-to-I²C adapter may be used to program the EEPROM of multiple LTC4281 ICs prior to their installation on a PC board.

Please refer to Application Note 145, <http://cds.linear.com/docs/en/application-note/AN145f.pdf>, and refer to Option 1A. Use the device address 0x88, which is the address to which the programming socket is hard wired. Also verify that the LTC4281 already soldered on the board (U1) is set to a different address than 0x88 to prevent a conflict.

Follow the instructions for Option 1A on page 3 of Application Note 145.



Figure 11. Read Write NVM Buttons on Toolbar

DEMO MANUAL DC2278A

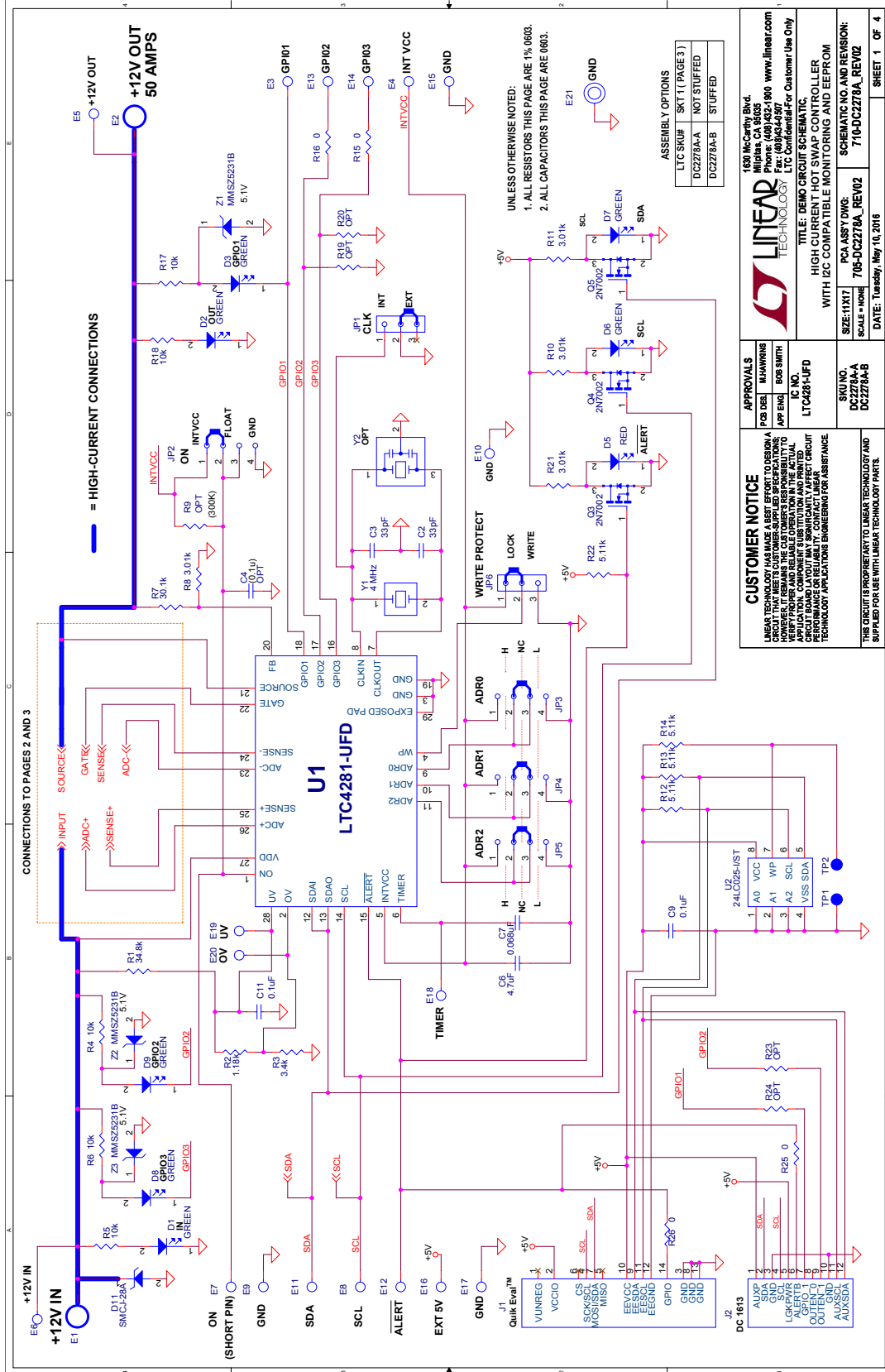
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	2	C1, C8	CAP, OPTION, ALUM. ELECT., SMD	OPTION
2	2	C2, C3	CAP, 33pF, X7R, 16V, 5%, 0603	AVX, 0603YC330JAT2A
3	1	C4	CAP, OPTION, 0603	OPTION
4	2	C5, C9	CAP, 0.1µF, X7R, 16V, 10%, 0603	AVX, 0603YC104KAT2A
5	1	C6	CAP, 4.7µF, X5R, 16V, 10%, 0603	TDK, C1608X5R1C475K080AC
6	1	C7	CAP, 0.068µF, X7R, 16V, 10%, 0603	AVX, 0603YC683KAT2A
7	1	C10	CAP, 0.027µF, X7R, 50V, 10%, 0603	AVX, 06035C273KAT2A
8	1	C11	CAP, 0.1µF, X7R, 25V, 20%, 0603	TDK, C1608X7R1E104M080AA
9	1	C12	CAP, 0.022µF, X7R, 50V, 5%, 0805	KEMET, C0805C223J5RACTU
10	7	D1-D3, D6-D9	LED, GREEN, WATERCLEAR, 0805	WURTH ELEKTRONIK, 150080GS75000
11	2	D4, D5	LED, RED, WATER CLEAR, 2 PIN SMD	LITE-ON TECHNOLOGY CORP, LTST-C170EKT
12	4	D10-D13	DIODE, TVS, 28V, 1500W, SMC	DIODES INC., SMCJ28A-13-F
13	2	E1, E2	LUG, TONGUE, OFFSET FLOATING, ONE HOLE	PENCOM, EL1664
14	19	E3-E20, E22	TEST POINT, TURRET, 0.064" MTG. HOLE, 0.125" THICK PCB	MILL-MAX, 2308-4-00-80-00-00-07-0
15	1	E21	CONN., BANANA JACK, FEMALE, THT, NON-INSULATED, SWAGE	KEYSTONE, 575-4
16	1	J1	CONN., HDR., MALE, 2x7, 2mm, THT, VERT, SHROUDED	MOLEX, 87831-1420
17	1	J2	CONN., HDR., SHROUDED, 2X6, 2mm, THT, VERT	FCI, 98414-G06-12ULF
18	2	JP1, JP6	CONN., HDR., MALE, 1X3, 2mm, THT, STRT	SAMTEC, TMM-103-02-L-S
19	4	JP2-JP5	CONN., HDR., MALE, 1X4, 2mm, THT, STRT	SAMTEC, TMM-104-02-L-S
20	1	LB1	LABEL SPEC, DEMO BOARD SERIAL NUMBER	BRADY, THT-96-717-10
21	4	MP1-MP4	BUMPER, RECESSED, #4 SCREW, BLACK	KEYSTONE, 727
22	4	MP5-MP8	WASHER, FLAT, #4, SS 18-8	PENCOM, WA1021
23	4	MP9-MP12	SCREW, MACHINE, #4-40 X 1/2, PHILLIPS PH, SS	PENCOM, SC3389
24	4	MP13-MP16	WASHER, LOCK, INT. TOOTH, #4, SS	PENCOM, WA1196
25	4	MP17-MP20	NUT, HEX, #4-40, SS 18-8	PENCOM, NU1043
26	2	MP21, MP22	SCREW, MACHINE, 1/4-20 X 7/8, HEX WASHER HEAD, SS	PENCOM, SE6037
27	4	MP23-MP26	WASHER, FLAT, SS 18-8, 1/4 IN.	PENCOM, WA3491
28	2	MP27, MP28	WASHER, LOCK, INT. TOOTH, 1/4 IN., SS	PENCOM, WA1374
29	2	MP29, MP30	NUT, HEX, 1/4-20, SS 18-8	PENCOM, NU1006
30	1	PCB1	PCB, DC2278A	MAO BANG, 600-DC2278A
31	2	Q1, Q2	XSTR., MOSFET N-CHAN, 30V, 120A, D2PAK	NXP SEMICONDUCTORS, PSMN1R5-30BLE
32	3	Q3-Q5	XSTR., MOSFET N-CH, 60V, 300mA, SOT-23	VISHAY, 2N7002K-T1-GE3
33	1	Q6	TRANSISTOR, MOSFET, N-CH., SO-10, OPTIONAL	ST MICROELECTRONICS, STV300NH02L
34	2	Q7, Q8	MOSFET, N-CH, OPTION	OPTION
35	1	Q9	TRANSISTOR, MOSFET, N-CH., SOT-669-OPTIONAL	NXP, PSMN2R0-30YLE
36	1	R1	RES., 34.8kΩ, 1%, 1/10W, 0603	VISHAY, CRCW060334K8FKEA
37	1	R2	RES., 1.18kΩ, 1%, 1/10W, 0603	YAGEO, RC0603FR-071K18L
38	1	R3	RES., 3.4kΩ, 1%, 1/10W, 0603	NIC, NRC06F3741TRF

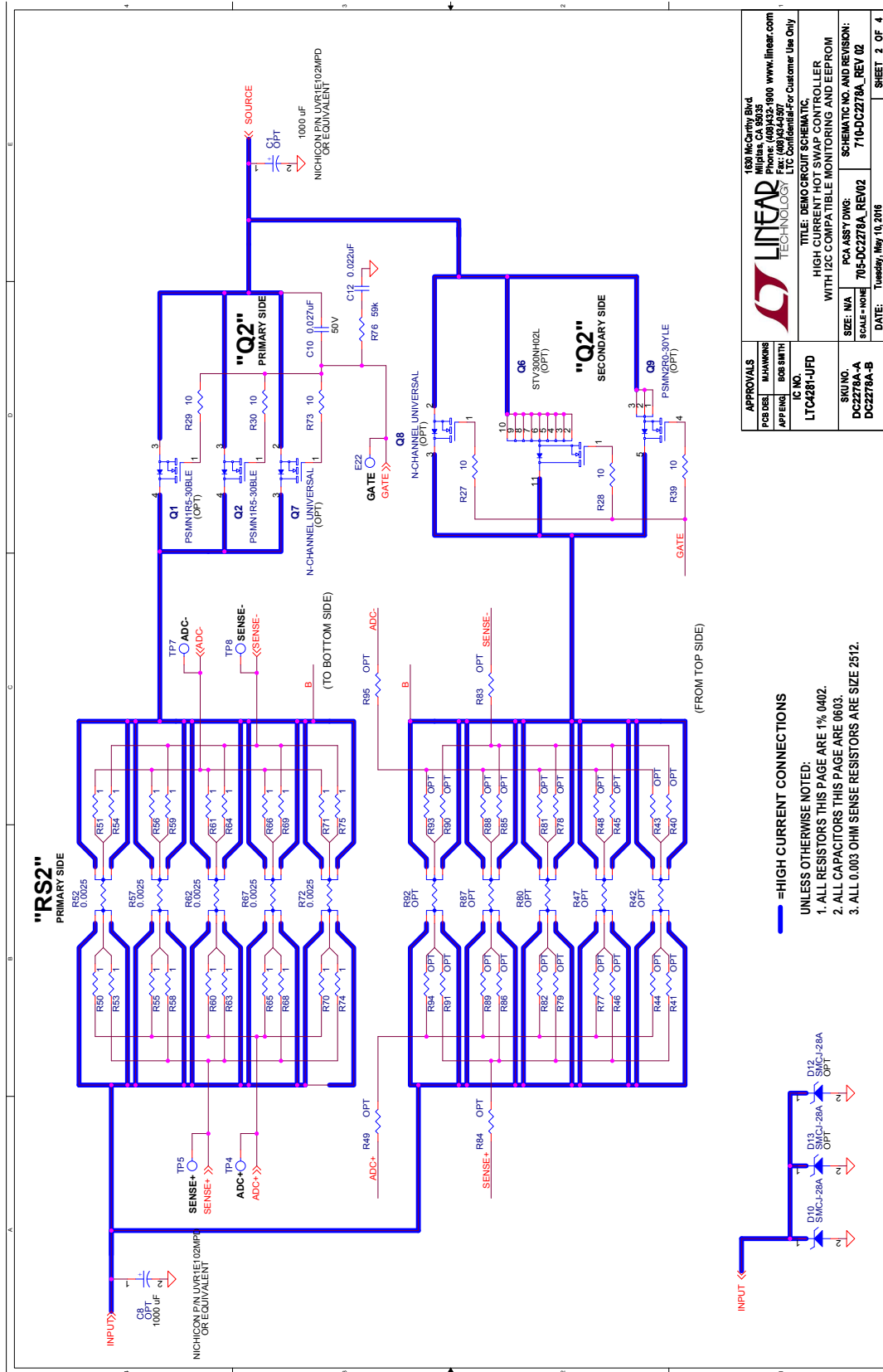
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
39	5	R4-R6, R17, R18	RES., 10k Ω , 5%, 1/4W, 1206	PANASONIC, ERJ8GEYJ103V
40	1	R7	RES., 30.1k Ω , 1%, 1/10W, 0603	PANASONIC, ERJ3EKF3012V
41	4	R8, R10, R11, R21	RES., 3.01k Ω , 1%, 1/10W, 0603	VISHAY, CRCW060333K01FKEA
42	8	R9, R19, R20, R23, R24, R34-R36	RES., OPTION, 0603	OPTION
43	4	R12-R14, R22	RES., 5.11k Ω , 1%, 1/10W, 0603	PANASONIC, ERJ3EKF5111V
44	8	R15, R16, R25, R26, R31-R33, R38	RES., 0 Ω , 1/10W, 0603	VISHAY, CRCW06030000Z0EA
45	6	R27-R30, R39, R73	RES., 10 Ω , 5%, 1/10W, 0603	PANASONIC, ERJ3GEYJ100V
46	1	R37	RES., 2k Ω , 1%, 1/10W, 0603	NIC, NRC06F2001TRF
47	24	R40, R41, R43-R46, R48, R49, R77-R79, R81-R86, R88-R91, R93-R95	RES., OPTION, 0402	OPTION
48	5	R42, R47, R80, R87, R92	RES., OPTION, 2512	OPTEK TECHNOLOGY (TT ELECTRONICS), LRMAT2512-R003FT4
49	20	R50, R51, R53-R56, R58-R61, R63-R66, R68-R71, R74, R75	RES., 1 Ω , 1%, 1/16W, 0402	VISHAY, CRCW04021R00FKED
50	5	R52, R57, R62, R67, R72	RES., METAL ELEMENT, 0.0025 Ω , 1%, 3W, 2512	TT ELECTRONICS, ULRG3-2512-R0025-F-LF-SLT
51	1	R76	RES., 59k Ω , 1%, 1/10W, 0603	VISHAY, CRCW060359K0FKEA
52	1	SKT1	CONN., SOCKET, CLAMSHELL, 28 LEAD, SMT, 5x4mm QFN	PLASTRONICS, 28QN50S25040
53	6	TP1, TP2, TP4, TP5, TP7, TP8	TESTPOINT, PCB COPPER FEATURE	N/A
54	1	U1	IC, HI-CURRENT HOT SWAP CONTROLLER, QFN	LINEAR TECHNOLOGY, LTC4281IUFDPBF
55	1	U2	IC, MEMORY, EEPROM, 2k-bit, 400kHz, TSSOP-8	MICROCHIP, 24LC025-I/ST
56	6	XJP4-XJP6, XJP10-XJP12	CONN., SHUNT, FEMALE, 2 POS, 2mm	SAMTEC, 2SN-BK-G
57	1	Y1	CRYSTAL, 4 MHz, 18pF, \pm 50ppm, 11.4mm x 4.7mm, 2Pad SMD	ABRACON CORPORATION, ABLS-4.000MHZ-B4-T
58	1	Y2	RESONATOR, 4MHz, SMT, OPTION	MURATA, CSTCR4M00G53-R0 (OPTION)
59	3	Z1-Z3	DIODE, ZENER, 5.1V, 500mW, SOD-123	FAIRCHILD, MMSZ5231B

SCHEMATIC DIAGRAM



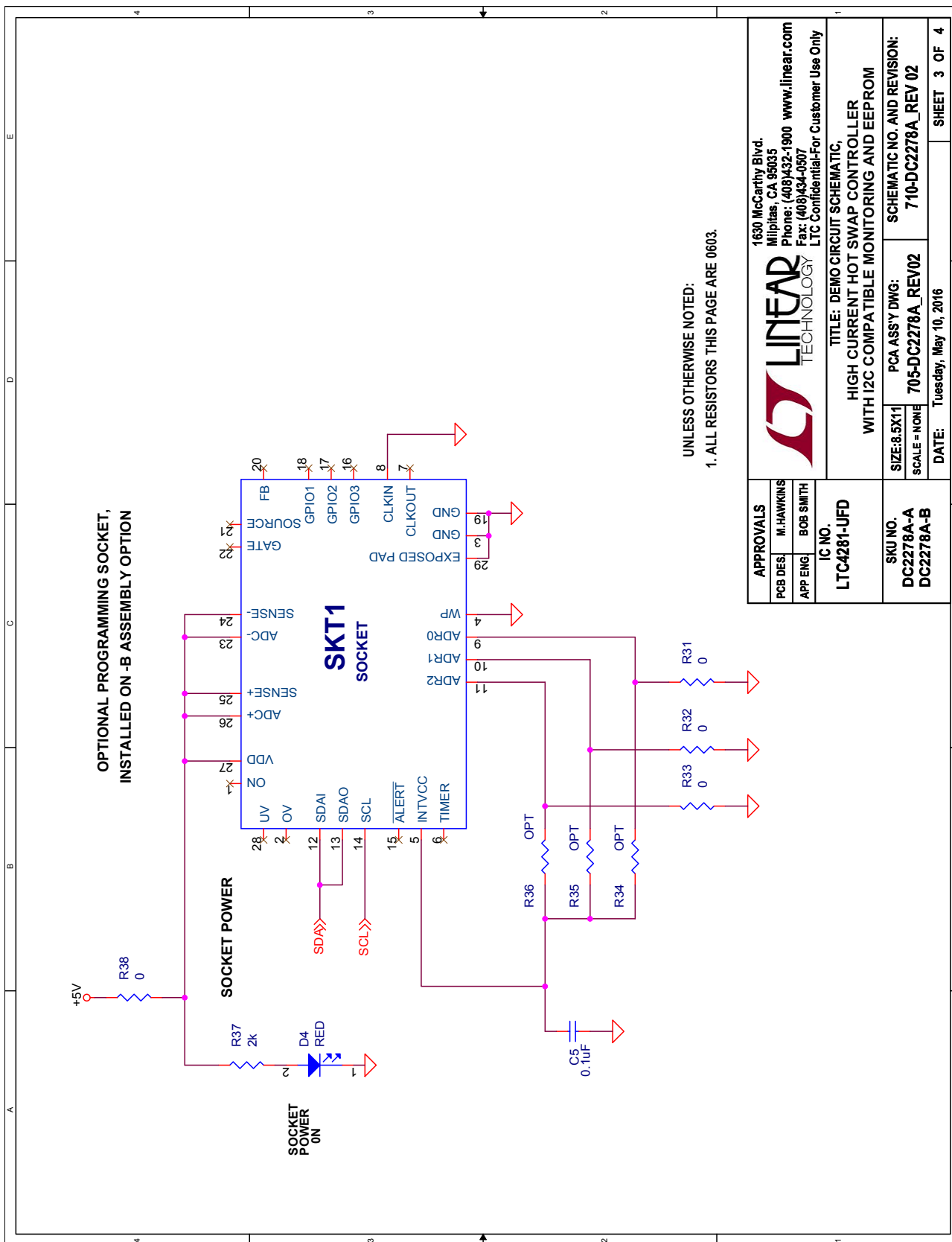
SCHEMATIC DIAGRAM



APPROVALS		1600 McCarty Blvd Milpitas, CA 95035 www.linear.com
PCB DES	BLAWONS	Phone: (408)441-9700
APPRA	BOB SMITH	Fax: (408)441-9701
IC NO.		LTC Confidential For Customer Use Only
LTC4281-JFD		TITLE: DEMO CIRCUIT SCHEMATIC
		HIGH CURRENT HOT SWAP CONTROLLER
		WITH I2C COMPATIBLE MONITORING AND EEPROM
SKU NO.	SIZE: N/A	SCHEMATIC NO. AND REVISION:
DC2278A-A	SCALE=NONE	705-DC2278A_REV02
DC2278A-B	DATE:	Tuesday, May 10, 2016
		SHEET 2 OF 4

- HIGH CURRENT CONNECTIONS**
- UNLESS OTHERWISE NOTED:
1. ALL RESISTORS THIS PAGE ARE 1% 0402.
 2. ALL CAPACITORS THIS PAGE ARE 0603.
 3. ALL 0.003 OHM SENSE RESISTORS ARE SIZE 2512.


SCHEMATIC DIAGRAM



APPROVALS		1630 McCarthy Blvd. Milpitas, CA 95035 Phone: (408)432-1900 www.linear.com Fax: (408)434-0507 LTC Confidential-For Customer Use Only	
PCB DES:	M.HAWKINS	LINEAR TECHNOLOGY	TITLE: DEMO CIRCUIT SCHEMATIC, HIGH CURRENT HOT SWAP CONTROLLER WITH I2C COMPATIBLE MONITORING AND EEPROM
APP ENG:	BOB SMITH		
IC NO. LTC4281-UFD		SIZE: 8.5X11	PCA ASSY DWG: 705-DC2278A_REV02
SKU NO. DC2278A-A DC2278A-B		SCALE = NONE	SCHEMATIC NO. AND REVISION: 710-DC2278A_REV 02
		DATE: Tuesday, May 10, 2016	SHEET 3 OF 4

SCHEMATIC DIAGRAM

PCA ADDITIONAL PARTS	
MP1	BUMPER, RECESSED,#4, SCREW,BLACK
MP2	BUMPER, RECESSED,#4, SCREW,BLACK
MP3	BUMPER, RECESSED,#4, SCREW,BLACK
MP4	BUMPER, RECESSED,#4, SCREW,BLACK
MP5	WASHER,FLAT,#4, SS 18-8
MP6	WASHER,FLAT,#4, SS 18-8
MP7	WASHER,FLAT,#4, SS 18-8
MP8	WASHER,FLAT,#4, SS 18-8
MP9	SCREW, MACHINE #4-40 X 1/2,PHILLIPS PH,SS
MP10	SCREW, MACHINE #4-40 X 1/2,PHILLIPS PH,SS
MP11	SCREW, MACHINE #4-40 X 1/2,PHILLIPS PH,SS
MP12	SCREW, MACHINE #4-40 X 1/2,PHILLIPS PH,SS
MP13	WASHER, LOCK,INT. TOOTH,#4,SS
MP14	WASHER, LOCK,INT. TOOTH,#4,SS
MP15	WASHER, LOCK,INT. TOOTH,#4,SS
MP16	WASHER, LOCK,INT. TOOTH,#4,SS
MP17	NUT, HEX #4-40,SS 18-8
MP18	NUT, HEX #4-40,SS 18-8
MP19	NUT, HEX #4-40,SS 18-8
MP20	NUT, HEX #4-40,SS 18-8
MP21	SCREW, MACHINE, 1/4-20 X 7/8,HEX WASHER HEAD, SS
MP22	SCREW, MACHINE, 1/4-20 X 7/8,HEX WASHER HEAD, SS
MP23	WASHER, FLAT,SS 18-8,1/4 IN.
MP24	WASHER, FLAT,SS 18-8,1/4 IN.
MP25	WASHER, FLAT,SS 18-8,1/4 IN.
MP26	WASHER, FLAT,SS 18-8,1/4 IN.
MP27	WASHER, LOCK,INT. TOOTH, 1/4 IN.,SS
MP28	WASHER, LOCK,INT. TOOTH, 1/4 IN.,SS
MP29	NUT, HEX, 1/4-20,SS 18-8
MP30	NUT, HEX, 1/4-20,SS 18-8
LB1	LABEL
PCB1	PCB, DC2278A REV02

APPROVALS		 <p>1630 McCarthy Blvd. Milpitas, CA 95035 Phone: (408)432-1900 www.linear.com Fax: (408)434-0507 LTC Confidential-For Customer Use Only</p>
PCB DES	M.HAWKINS	
APP ENG	BOB SMITH	
IC NO. LTC4281-UFD		TITLE: DEMO CIRCUIT SCHEMATIC, HIGH CURRENT HOT SWAP CONTROLLER WITH I2C COMPATIBLE MONITORING AND EEPROM
SKU NO. DC2278A-A DC2278A-B		SIZE: 8.5X11 PCA ASSY DWG: 705-DC2278A_REV02 SCALE = NONE DATE: Tuesday, May 10, 2016 SHEET 4 OF 4

dc2278af

DEMO MANUAL DC2278A

DEMONSTRATION BOARD IMPORTANT NOTICE

Linear Technology Corporation (LTC) provides the enclosed product(s) under the following **AS IS** conditions:

This demonstration board (DEMO BOARD) kit being sold or provided by Linear Technology is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not provided by LTC for commercial use. As such, the DEMO BOARD herein may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including but not limited to product safety measures typically found in finished commercial goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may or may not meet the technical requirements of the directive, or other regulations.

If this evaluation kit does not meet the specifications recited in the DEMO BOARD manual the kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user releases LTC from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. Also be aware that the products herein may not be regulatory compliant or agency certified (FCC, UL, CE, etc.).

No License is granted under any patent right or other intellectual property whatsoever. **LTC assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind.**

LTC currently services a variety of customers for products around the world, and therefore this transaction **is not exclusive**.

Please read the DEMO BOARD manual prior to handling the product. Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged.**

This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

Mailing Address:

Linear Technology
1630 McCarthy Blvd.
Milpitas, CA 95035

Copyright © 2004, Linear Technology Corporation