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LINEAR TECHNOLOGY DC2088A DC Converter with Power System Management Instruction Manual

DEMO MANUAL DC2088A
High Density LTC3880
Step-Down DC/DC Converter with
Power System Management

Contents [**hide**]

DESCRIPTION

Demonstration circuit 2088A is a high current, high density, two-phase single output synchronous buck converter featuring the LTC3880EUJ, a dual-phase current mode controller. The LT C ® 3880 has the PMBus interface and power system management functions.

The layout of DC2088A is very compact and the total solution is within a 1.0″ × 1.0″ area. The DrMOS is used on the board for high current, high efficiency. The input range of this board is from 7V to 14V, and the output voltage can be programmed from 0.8V to 1.8V, with an output current up to 50A. The factory default setting for the output is 1.0V. The DC2088A also has an on-board dynamic load circuit, which makes it easy for the customer to evaluate the transient performances.

The DC2088A powers up to default settings and produces power based on configuration resistors or NVM without

the need for any serial bus communication. This allows easy evaluation of the DC/DC converter aspects of the LTC3880. To fully explore the extensive power system management features of the parts, download the GUI software LTpowerPlay onto your PC and use LT C 's I2 C/ SMBus/PMBus Dongle DC1613A to connect to the board. LTpowerPlay allows the user to reconfigure the part on the fly and store the configuration in EEPROM, view telemetry of voltage, current, temperature and fault status.

GUI DOWNLOAD

The software can be downloaded from:

www.linear.com/ltpowerplay

For more details and instructions on LTpowerPlay, please refer to "LTpowerPlay for LTC3880 Quick Start Guide". Design files for this circuit board are available at

http://www.linear.com/demo

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PERFORMANCE SUMMARY

Specifications are at TA = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
VIN	Input Supply Range		7	12	14	V
VOUT	Output Voltage Range	IOUT = 0A TO 50A, VIN = 7.0V to 14V	0.8	1.0	1.8	V
IOUT	Output Current Range		0		50	A
fSW	Factory Default Switching		425			kHz
EFF	Peak Efficiency	VOUT = 1.0V, See Figures 4.	87.8			%

Quick start proceDure

Demonstration circuit 2088A makes it easy to set up to evaluate the performances of the LTC3880. Refer to Figure 2 for proper measurement equipment setup and follow the procedure below:

NOTE. When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the output voltage ripple by
touching the probe tip directly across the C14. See Figure 3 for proper scope probe technique.

1. Make sure jumpers are in the following positions:

JUMPER	POSITION	FUNCTION
JP1	ON	Drives ON
JP2	OFF	LED

2. With power off, connect the input power supply to VIN and GND. Connect active load to the output.

3. Make sure RUN switch (SW) is OFF.

4. Turn on the power at the input.

   NOTE. Make sure that the input voltage does not exceed 16V.

5. Turn on RUN switch as desired.

6. Check for the correct output voltage from E4 to E6.

VOUT = 1.0V ± 0.5% (1.005V ~ 0.995V)

NOTE. If there is no output, temporarily disconnect the load to make sure that the load is not set too high.

7. Once the proper output voltage is established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters.

8. Connect the dongle and control the output voltages from the GUI. See "LTpowerPlay QUICK START" session for details.

CONNECTING A PC TO DC2088A

You can use a PC to reconfigure the power management features of the LTC3880 such as: nominal VOUT, margin set points, OV/UV limits, temperature fault limits, sequenc-ing parameters, the fault log, fault responses, GPIO and other functionality. The DC1613A dongle may be plugged in regardless of whether or not VIN is present. The Dongle can be hot plugged.
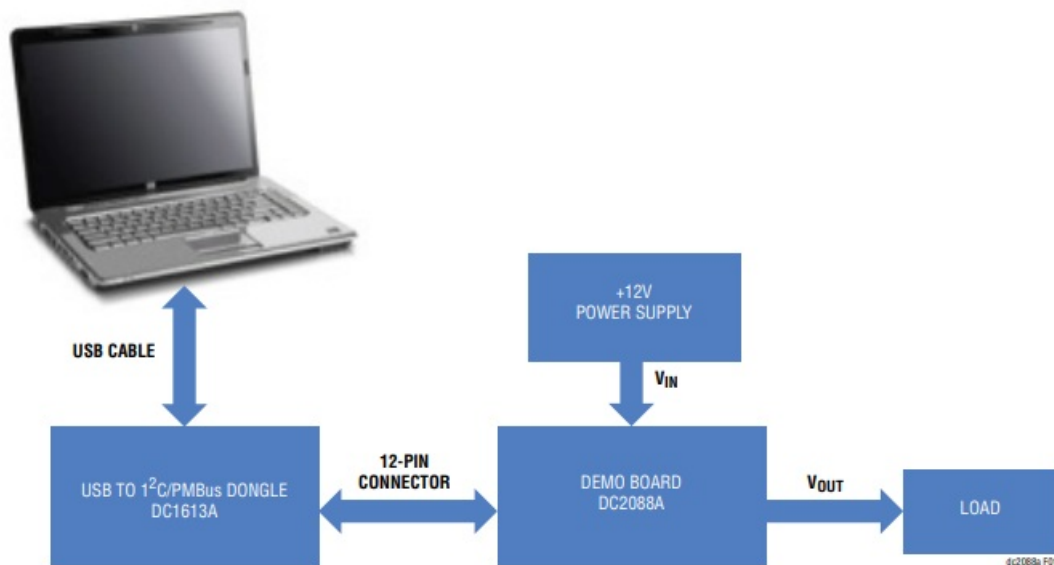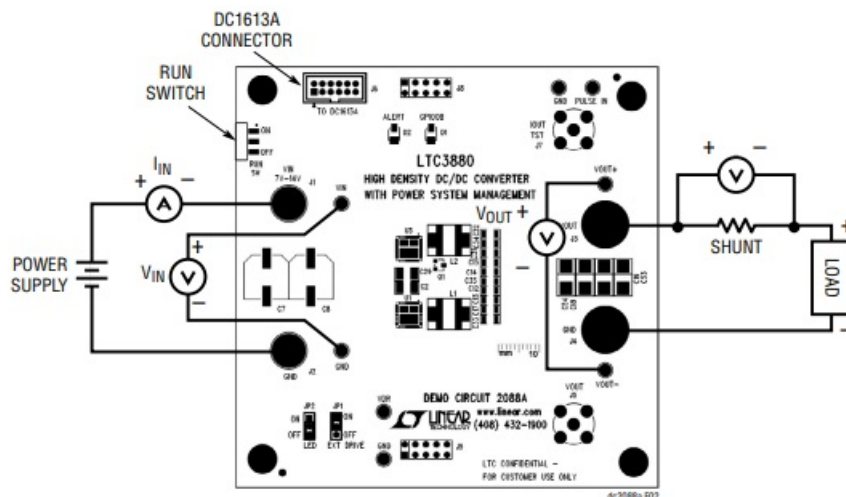

Figure 1. Demo Setup with PC

Figure 2. Power Test Setup

MEASURING EFFICIENCY (SEE FIGURE 2)

- To accurately measure efficiency of any configuration, do the following:
- Set JP1, JP2 to OFF position to disable all the auxiliary circuits.
- Make sure R4, R10 not stuffed.

- Provide an external 5V for the gate drive, and connect it to E15 and E16.
- Measure VIN across the input ceramic capacitor (C29). Measure VOUT across the output ceramic capacitor (C14). Add the driver loss (VDR • IDR) to the total ef-ficiency calculation.

EVALUATING THE LTC3880-1

For applications that require the highest possible efficiency, the LTC3880-1 allows the user to supply the bias voltage and gate driver current from an external power supply.
Please install R4 (0Ω). Then, the 5V gate drive for the DrMOS will also provide power to the EXTVCC. To accurately measure efficiency of a demo board containing the
LTC3880-1,

- Set JP1, JP2 to OFF to disable the LDO.
- Connect an external 5V power supply to E15, E16.
- Measure VIN across the input ceramic capacitor (C29).

  Measure VOUT across the output ceramic capacitor (C14).

MEASURING OUTPUT RIPPLE VOLTAGE

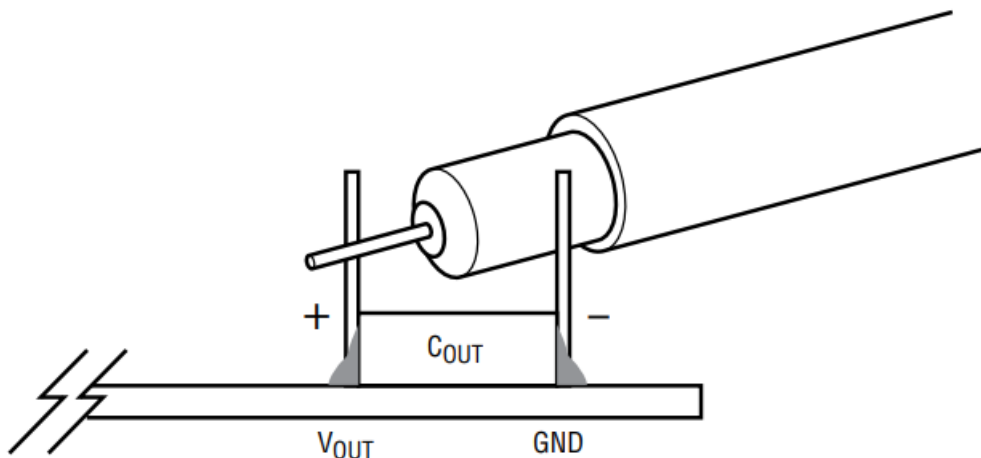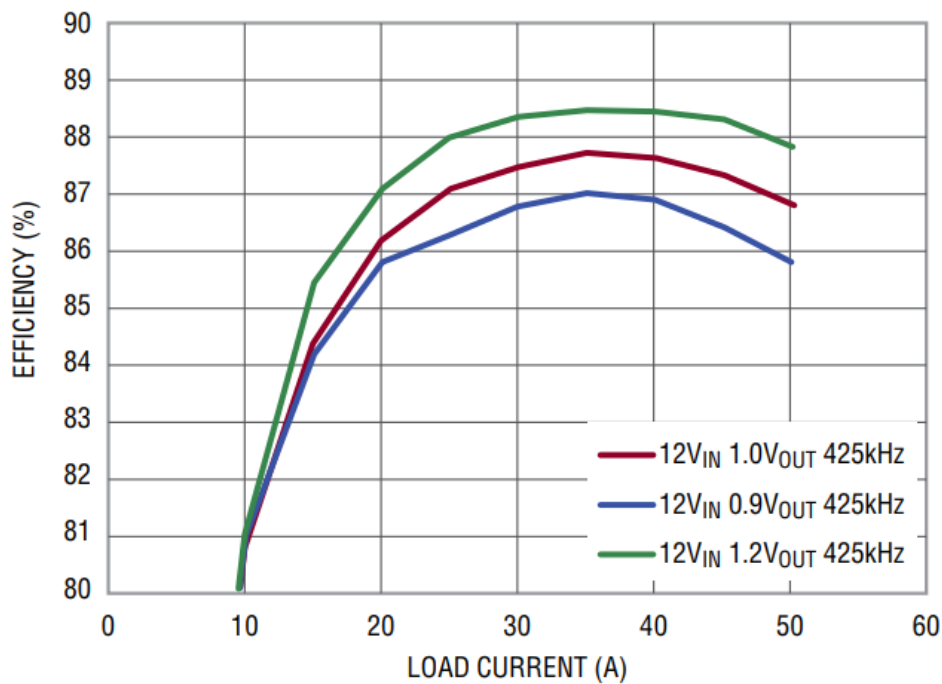An accurate ripple measurement may be performed by using the below configuration across C16.

Figure 3. Measuring Output Voltage Ripple

Figure 4. Typical Efficiency Curves DC2088A, 12V$_{IN}$, f$_{SW}$ = 425kHz, V$_{OUT}$ = 1.2V, 1.0V, 0.9V

LTpowerPlay Software GUI

LTpowerPlay is a powerful Windows based development environment that supports Linear Technology power system management ICs, including the LTC3880, LTC3883, LTC2974 and LTC2978. The software supports a variety of different tasks. You can use LTpowerPlay to evaluate Linear Technology ICs by connecting to a demo board system. LTpowerPlay can also be used in an offline mode (with no hardware present) in order to build a multichip configuration file that can be saved and reloaded at a later time. LTpowerPlay provides unprecedented diagnostic and debug features. It becomes a valuable diagnostic tool during board bring-up to program or tweak the power management scheme in a system, or to diagnose power issues when bringing up rails. LTpowerPlay utilizes the DC1613A USB-to-SMBus controller to communicate with one of many potential targets, including the LTC3880's DC2088A demo system, or a customer board. The software also provides an automatic update feature to keep the software current with the latest set of device drivers and documentation. The LTpowerPlay software can be downloaded from: **www.linear.com/ltpowerplay**

To access technical support documents for LT C Digital Power Products visit Help. View online help on the LTpowerPlay menu.
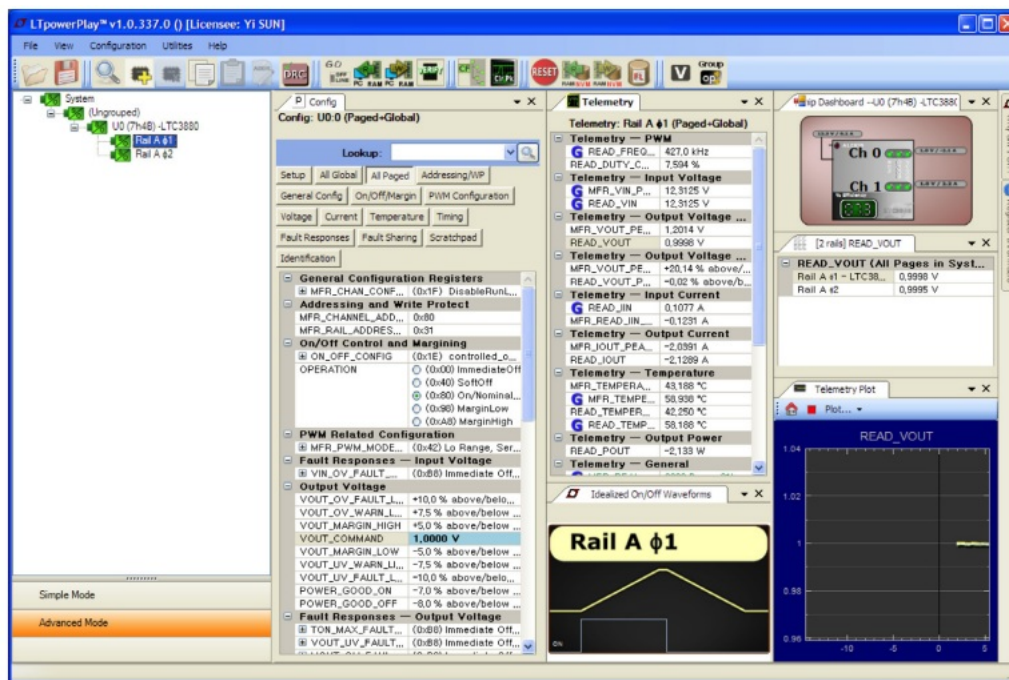
Figure 3. Measuring Output Voltage Ripple

LTpowerPlay QUICK START PROCEDURE
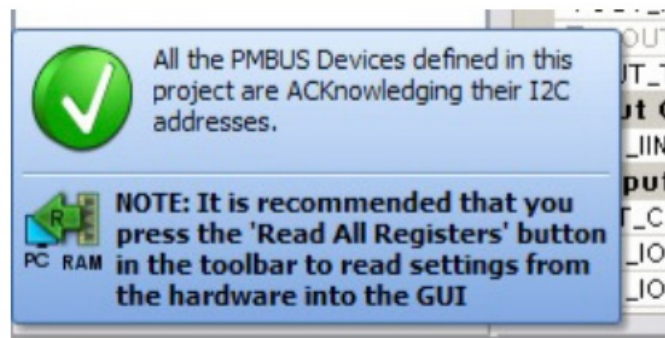
The following procedure describes how to use LTpowerPlay to monitor and change the settings of LTC3880.

1. Download and install the LTPowerPlay GUI: **http://linear.com/ltpowerplay**

2. Launch the LTpowerPlay GUI. a. The GUI should automatically identify the DC2088A. The system tree on the left hand side should look like this:
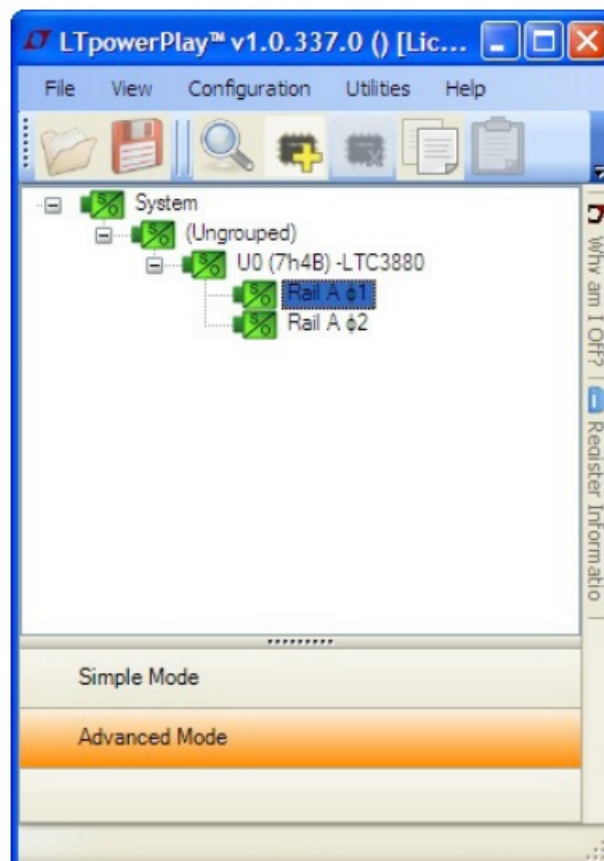
b. A green message box shows for a few seconds in the lower left hand corner, confirming that the LTC3880 and

the LTC3883 are communicating:

All the PMBUS Devices defined in this project are ACKnowledging their I2C addresses.

NOTE: It is recommended that you press the 'Read All Registers' button in the toolbar to read settings from the hardware into the GUI

c. In the Toolbar, click the "R" (RAM to PC) icon to read the RAM from the LTC3880 and the LTC3883This reads the configuration from the RAM of LTC3883 and loads it into the GUI.

 d. If you want to change the output voltage to a different value, like 1.5V. In the Config tab, type in 1.5 in the VOUT_COMMAND box, like this:
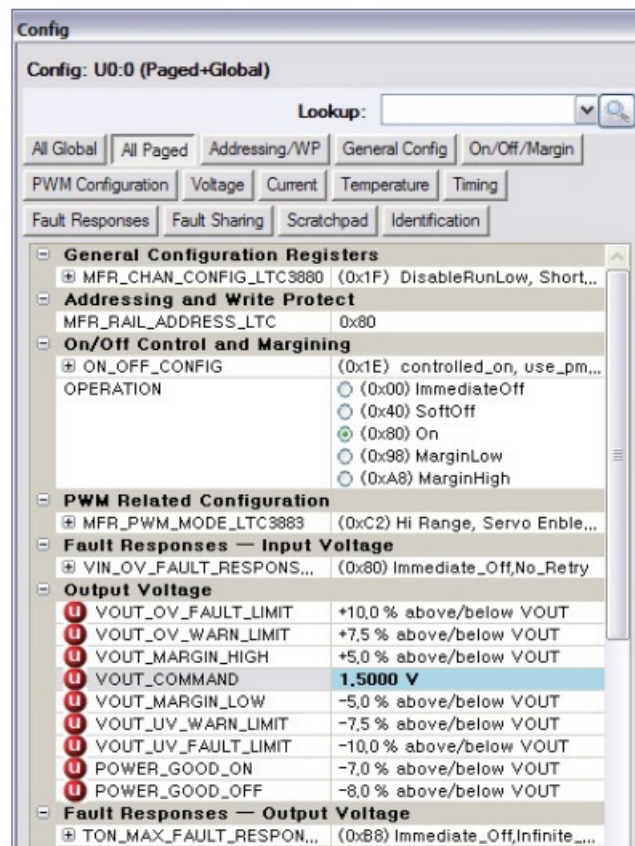
Then, click the "W" (PC to RAM) icon to write these register values to the LTC3880 and the LTC3883. After finishing this step, you will see the output voltage will change to 1.5V.

 If the write is successful, you will see the following message:

Success

Successfully Verified Registers for all 1 chips

OK

e. You can save the changes into the NVM. In the tool bar, click "RAM to NVM" button, as following

 f. Save the demo board configuration to a (*.proj) file. Click the Save icon and save the file. Name it whatever you want.

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER

Required Circuit Components

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	4	C1, C2, C28, C29	CAP., X5R, 22µF, 25V, 10%,1210	AVX, 12103D226KAT
2	2	C5, C30	CAP., X5R, 1µF, 10V, 20%, 0603	AVX, 0603ZD105MAT2A
3	6	C4, C10, C11, C16, C27, C36	CAP., X5R, 1µF, 10V, 20%, 0402	AVX, 0402ZD105MAT2A
4	1	C6	CAP., X5R, 10µF, 10V, 20%, 0603	SAMSUNG, CL10A106MP8NNNC
5	3	C3, C9, C26	CAP., X7R, 0.1µF, 25V, 10%, 0603	AVX, 06033C104KAT
6	2	C7, C8	CAP., OS-CON, 330µF, 16V, 20%	SANYO, 16SVP330M
7	20	C12-C15, C17, C31-C35, C43-C52	CAP., X5R, 100µF, 6.3V, 20%,1206	TAYO YUDEN, JMK316BJ107ML-T
8	2	C18, C19	CAP., POSCAP, 470µF, 2.5V, D2E	SANYO 2R5TPE470M9

9	2	C22, C37	CAP., X5R, 0.22μF, 16V, 20%, 0402	TDK, C1005X5R1C224M
10	1	C23	CAP., X7R, 1nF, 25V, 10%, 0402	AVX, 04023C102KAT2A
11	1	C24	CAP., NPO, 100pF,25V, 10%, 0402	AVX,04023A101KAT2A
12	1	C25	CAP., X5R, 10nF, 25V, 10%, 0402	AVX, 04023D103KAT2A
13	2	L1, L2	INDUCTOR, SMT POWER IND. 0.16μH	COILCRAFT., XAL7070-161ME
14	1	Q1	TRANS GP SS PNP 40V SOT-23	ON SEMI MMBT3906LT1G
15	1	Q3	MOSFET P-CH 20V, 0.58A, SOT-23	VISHAY, TP0101K-T1-E3
16	6	R2, R11, R12, R16, R17, R30	RES., CHIP, 0, 1%, 0402	VISHAY, CRCW04020000Z0ED
17	4	R1, R13, R36, R66	RES., CHIP, 0, 1%, 0603	VISHAY, CRCW06030000Z0EA
18	2	R3, R15	RES., CHIP, 10, 1%, 0603	VISHAY, CRCW060310R0FKEA
19	2	R7, R19	RES., CHIP, 10k, 1%, 0402	VISHAY, CRCW040210K0FKED
20	5	R18, R20, R22, R24, R39	RES., CHIP, 10k, 1%, 0603	VISHAY, CRCW060310K0FKEA
21	1	R6	RES., CHIP, 1, 1%, 0402	VISHAY, CRCW04021R00FKED
22	4	R8, R9, R25, R27	RES., CHIP, 825, 1%, 0402	VISHAY, CRCW0402825RJNED

23	1	R14	RES., CHIP, 6.81k, 1%, 0402	VISHAY, CRCW04026K81FKED
24	1	R23	RES., CHIP, 20k, 1%, 0402	VISHAY,CRCW040220K0FKED
25	1	R28	RES., CHIP, 17.8k, 1%, 0402	VISHAY,CRCW040217K8FKED
26	1	R31	RES., CHIP, 16.2k, 1%, 0603	VISHAY, CRCW060316K2FKEA
27	1	R33	RES., CHIP, 24.9k, 1%, 0603	VISHAY, CRCW060324K9FKEA
28	1	R34	RES., CHIP, 4.32k, 1%, 0603	VISHAY, CRCW06034K32FKEA
29	1	R40	RES., CHIP, 15.8k, 1%, 0603	VISHAY, CRCW060315K8FKEA
30	2	U1, U3	IC, HIGH FREQUENCY DrMOS MOUDLE	FAIRCHILD, FDMF6823A
31	1	U2	IC, LTC3880EUJ, QFN 6mm ´ 6mm	LTC., LTC3880EUJ#PBF

Additional Circuit Components

1	2	CBYP1, CBYP2	CAP., X7R, 0.01µF,16V, 10%, 0603	AVX, 0603YC103KAT
2	2	COUT1, COUT2	CAP., X5R, 10µF,25V, 20%,1206	TDK, C3216X7R1E106M
3	1	C40	CAP., X7R, 1µF, 16V, 10%, 1206	AVX, 1206YC105KAT
4	1	C41	CAP., X7R, 0.1µF, 25V, 10%, 0603	AVX, 06033C104KAT
5	1	C39	CAP., X5R, 1µF, 16V, 20%, 0805	AVX, 0805YD105MAT
6	0	C20, C21, C53, C54	CAP., POSCAP, 470µF, 2.5V, D 2E	SANYO 2R5TPE470M9
7	1	C38	CAP., X5R, 2.2µF, 16V, 10%, 0805	AVX, 0805YD225KAT
8	1	C42	CAP., X5R, 10nF, 25V, 10%, 0603	AVX, 06033D103KAT
9	1	C55	CAP., X7R, 0.1µF,16V, 10%, 0603	AVX, 0603YC104KAT

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
10	1	D1	LED GREEN S-GW TYPE SMD	ROHM, SML-010FTT86L
11	1	D2	LED RED S-TYPE GULL WING SMD	ROHM, SML-010VTT86L
12	1	D3	DIODE, SCHOTTKY, SOD-323	CENTRAL CMDSH-3TR
13	1	Q2	MOSFET SPEED SRS 30V 30A LFPAK	RENESAS, RJK0305DPB-00#J0
14	1	Q3	MOSFET P-CH 20V 0.58A SOT-23	VISHAY, TP0101K-T1-E3

15	1	Q5	MOSFET N-CH 60V 115MA SOT-23	FAIRCHILD, 2N7002A-7-F
16	7	R54-R60	RES., CHIP, 0, 1%, 0603	VISHAY, CRCW06030000Z0EA
17	1	R51	RES., CHIP, 10, 1%, 0603	VISHAY, CRCW060310R0FKEA
18	2	R38, R48	RES., CHIP, 10k, 1%, 0603	VISHAY, CRCW060310K0FKEA
19	2	R43, R44,	RES., CHIP, 100k, 1%, 0603	VISHAY, CRCW0603100KFKEA
20	1	R10	RES., CHIP, 30, 1%, 2512	VISHAY, CRCW251230R0FKEA
21	0	R21, R62, R63 (OPT)	RES., 0402	
22	0	R4, R5, R26, R29, R32, R35 (OPT)	RES., 0603	
23	0	R47 (OPT)	RES., 0805	
24	1	R37	RES., CHIP, 200, 1%, 0603	VISHAY, CRCW0603200RFKEA
25	1	R41	RESISTOR .010Ω 1W, 1% 2512	PANASONIC, ERJ-M1WSF10MU
26	1	R42	RES., CHIP, 127, 1%, 0603	VISHAY, CRCW0603127RFKEA
27	2	R45, R46	RES., CHIP, 4.99k, 1%, 0603	VISHAY, CRCW06034K99FKEA
28	1	R49	RES., CHIP, 6.19k, 1%, 0603	VISHAY, CRCW06036K19FKEA

29	1	R50	RES., CHIP, 3.4k, 1%, 0603	VISHAY, CRCW06033K40FKEA
30	2	R52, R53	RES., CHIP, 2k, 1%, 0603	VISHAY, CRCW06032K00FKEA
31	1	U4	IC, SERIAL EEPROM	MICROCHIP 24LC025-I/ST
32	1	U5	IC, LT3029IMSE, MSOP, 16 PIN	LTC., LT3029IMSE#PBF

Hardware

1	8	E1, E2, E4, E6, E11, E12, E15, E16	TESTPOINT, TURRET, .062″	MILL-MAX, 2308-2-00-80-00-00-07-0
2	2	J1, J2	JACK, BANANA	KEYSTONE 575-4
3	2	J3, J4	STUD, TEST PIN	PEM KFH-032-10
4	4	J3, J4(X2)	NUT, BRASS 10-32	ANY #10-32
5	2	J3, J4	RING, LUG #10	KEYSTONE, 8205, #10
6	2	J3, J4	WASHER, TIN PLATED BRASS	ANY #10
7	2	J5, J7	CONN, BNC, 5-PINS	CONNEX, 112404
8	1	J6	CONN HEADER 12POS 2mm STR DL PCB	FCI 98414-G06-12ULF

9	1	J8	HEADER., DOUBLE ROW, RIGHT ANGLE 2 ´ 5 PIN	MILL-MAX 802-40-010-20-001000
10	1	J9	SOCKET, DOUBLE ROW, 2 ´ 5 PIN	MILL-MAX 803-43-010-20-001000
11	2	JP1, JP2	HEADER 3 PIN 0.079 SINGLE ROW	SULLIN, NRPN031PAEN-RC
12	2	JP1, JP2	SHUNT	SAMTEC, 2SN-BK-G
13	1	SW	SWITCH SLIDE 1PDT 6VDC 0.3A SMT	C & K JS102011SAQN
14	4	STANDOFF	STANDOFF, SNAP ON	KEYSTONE_8831
15	1	STENCIL	STENCIL	

SCHEMATIC DIAGRAM

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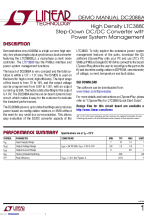
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Documents / Resources

	LINEAR TECHNOLOGY DC2088A DC Converter with Power System Management [pdf] Instruction Manual DC2088A, DC2088A DC Converter with Power System Management, DC Converter with Power System Management, Power System Management, System Management