# LTC3887EUJ Dual Phase Step-Down DC/DC Controller with Digital Power System Management

## DESCRIPTION

Demonstration circuit 2263A is a high current, high efficiency, synchronous buck converter featuring the LTC®3887EUJ, a dual-phase current mode controller. The LTC3887 has the PMBus interface and power system management functions.

The DC2263A uses discrete MOSFETs in the power stage. The input range of this board is from 7V to 14V. The output voltage can be programmed from 0.8V to 1.8V with an output current up to 25A per phase. The DC2263A has two versions: The DC2263A-A uses a sense resistor and provides two outputs while the DC2263A-B uses DCR current sensing and provides a dual-phase single output. The factory default setting for the output voltage is 1.0V. The DC2263A also has an onboard dynamic load circuit, which makes it easy for the customer to evaluate the transient performances.

The DC2263A 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 LTC3887. To fully explore the extensive power system management features of the parts, download the GUI software LTpowerPlay onto your PC and use LTC's I²C/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

For more details and instructions along with downloading LTpowerPlay, go to the following link.

http://www.linear.com/ltpowerplay

**Design files for this circuit board are available at http://www.linear.com/demo/DC2263A**

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## PERFORMANCE SUMMARY

**Specifications are at $T_A$ = 25°C**

**DC2263A-A Assembly (Dual Output)**

| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| $V_{IN}$ | Input Supply Range | | 7 | 12 | 14 | V |
| $F_{SW}$ | Factory Default Switching | | | 425 | | kHz |
| $V_{OUT0}$ | CH0 Output Voltage Range | $I_{OUT0}$ = 0A TO 25A, $V_{IN}$ = 7.0V to 14V | 0.8 | 1.0 | 1.8 | V |
| $I_{OUT0}$ | CH0 Output Current Range | | 0 | | 25 | A |
| EFF | CH0 Peak Efficiency | $V_{OUT0}$ = 1.0V, See Figures 4 | | 86.5 | | % |
| $V_{OUT1}$ | CH1 Output Voltage Range | $I_{OUT1}$ = 0A TO 25A, $V_{IN}$ = 7.0V to 14V | 0.8 | 1.0 | 1.8 | V |
| $I_{OUT1}$ | CH1 Output Current Range | | 0 | | 25 | A |
| EFF | CH1 Peak Efficiency | $V_{OUT1}$ = 1.0V, See Figures 4 | | 86.5 | | % |

**DC2263A-B Assembly (Single Output)**

| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| $V_{IN}$ | Input Supply Range | | 7 | 12 | 14 | V |
| $V_{OUT0}$ | Output Voltage Range | $I_{OUT}$ = 0A TO 50A, $V_{IN}$ = 7.0V to 14V | 0.8 | 1.0 | 1.8 | V |
| $I_{OUT0}$ | Output Current Range | | 0 | | 50 | A |
| $F_{SW}$ | Factory Default Switching | | | 425 | | kHz |
| EFF | Peak Efficiency | $V_{OUT}$ = 1.0V, See Figures 5 | | 87.8 | | % |

## QUICK START PROCEDURE

Demonstration circuit 2263A makes it easy to set up to evaluate the performances of the LTC3887. 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 C34 for CH0 and C32 for CH1. See Figure 3 for proper scope probe technique.

1. Make sure jumpers are in the following positions:

| JUMPER | POSITION | FUNCTION |
|---|---|---|
| JP1 | C | GPIO0B to GPIO1B |
| JP2 | NC for -A, C for -B | RUN0 to RUN1 |
| JP3 | OFF | EXTVCC_DRV |

2. With power off, connect the input power supply to $V_{IN}$ and GND. Connect active load to the output.
3. Make sure both RUN switches (SW1, SW2) are OFF.
4. Turn on the power at the input.

   NOTE: Make sure that the input voltage does not exceed 16V.
5. Turn on both SW1 (for RUN0), and SW2 (for RUN1) switches as desired.
6. Check for the correct output voltage from TP4 to TP16 for CH0, TP3 to TP20 for CH1. $V_{OUT0}/V_{OUT1}$ = 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 voltage from the GUI. See LTpowerPlay QUICK START session for details.

### Connecting a PC to DC2263A

You can use a PC to reconfigure the power management features of the LTC3887 such as: nominal $V_{OUT}$, margin set points, OV/UV limits, temperature fault limits, sequencing parameters, the fault log, fault responses, GPIO and other functionality. The DC1613A dongle may be plugged in regardless of whether or not $V_{IN}$ is present. Dongle can be hot plugged.

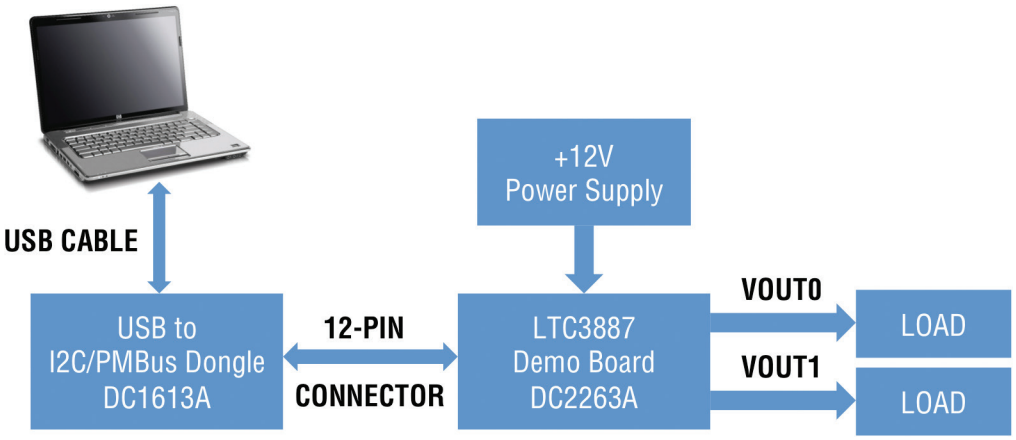



**Figure 1. Demo Setup with PC**

## QUICK START PROCEDURE

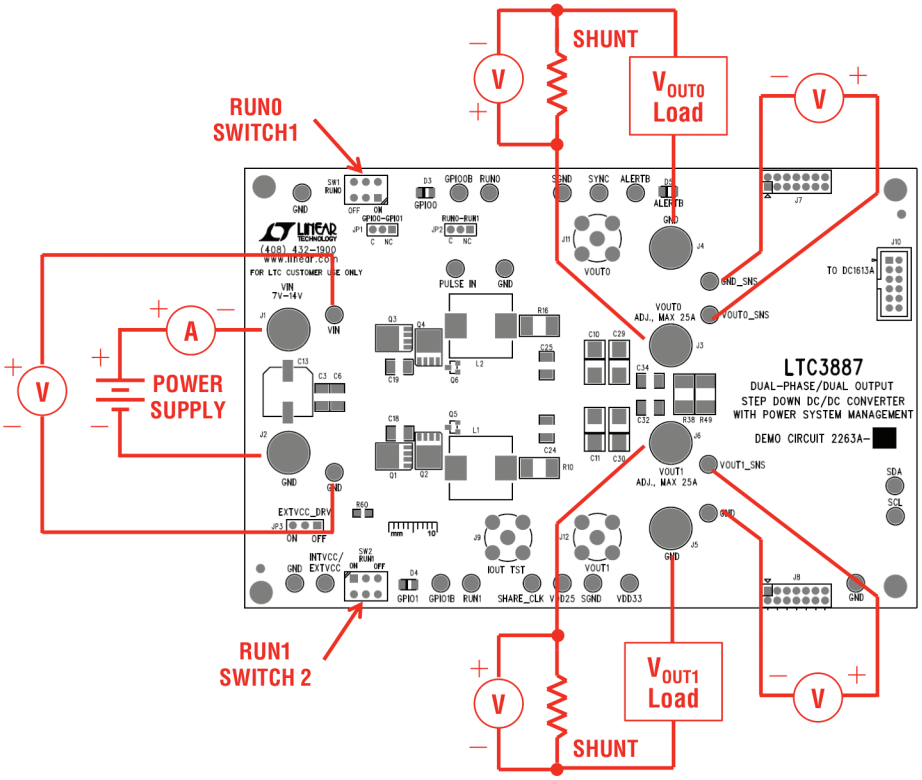



**Figure 2. Power Test Setup**

### Measuring Efficiency

To accurately measure efficiency of any configuration, do the following:

- Set JP3 to OFF position to disable the auxiliary circuits.
- DC2263A-A version. Measure $V_{IN}$ across the input ceramic capacitor (C19 for CH0, C18 for CH1). Measure $V_{OUT}$ across the output ceramic capacitor (C25 for CH0, C24 for CH1).
- DC2263A-B version. Measure $V_{IN}$ across the input ceramic capacitor C19. Measure $V_{OUT}$ across the output ceramic capacitor C25.

### Measuring Output Ripple Voltage

An accurate ripple measurement may be performed by using the configuration across C34 as shown in Figure 3.

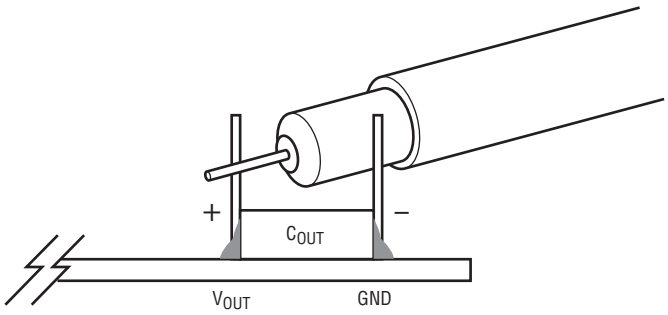



**Figure 3. Measuring Output Voltage Ripple**

## QUICK START PROCEDURE

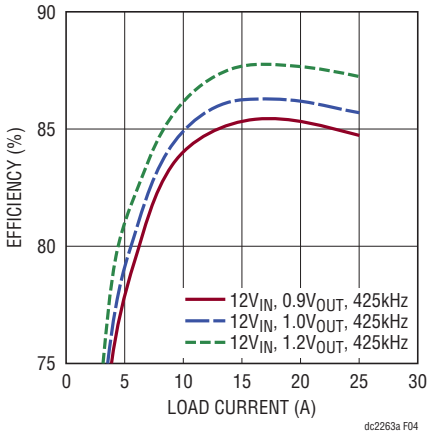



**Figure 4. Typical Efficiency Curves DC2263A-A, $f_{SW}$ = 425kHz**

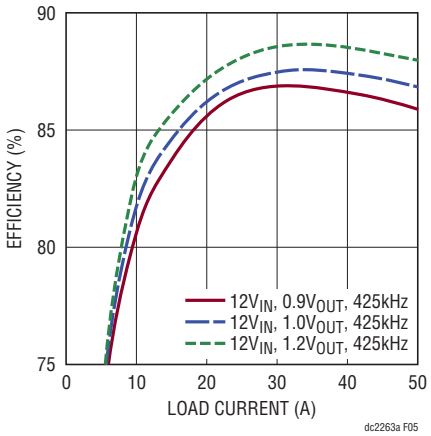



**Figure 5. Typical Efficiency Curves DC2263A-B, $f_{SW}$ = 425kHz**

## LTpowerPlay SOFTWARE GUI

LTpowerPlay is a powerful Windows based development environment that supports Linear Technology power system management ICs, including the LTC3880, LTC3883, LTC3882 and LTC3887. 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 LTC3887's DC2263A 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:

http://www.linear.com/ltpowerplay

To access technical support documents for LTC Digital Power Products visit Help. View online help on the LTpowerPlay menu.

## LTpowerPlay QUICK START PROCEDURE

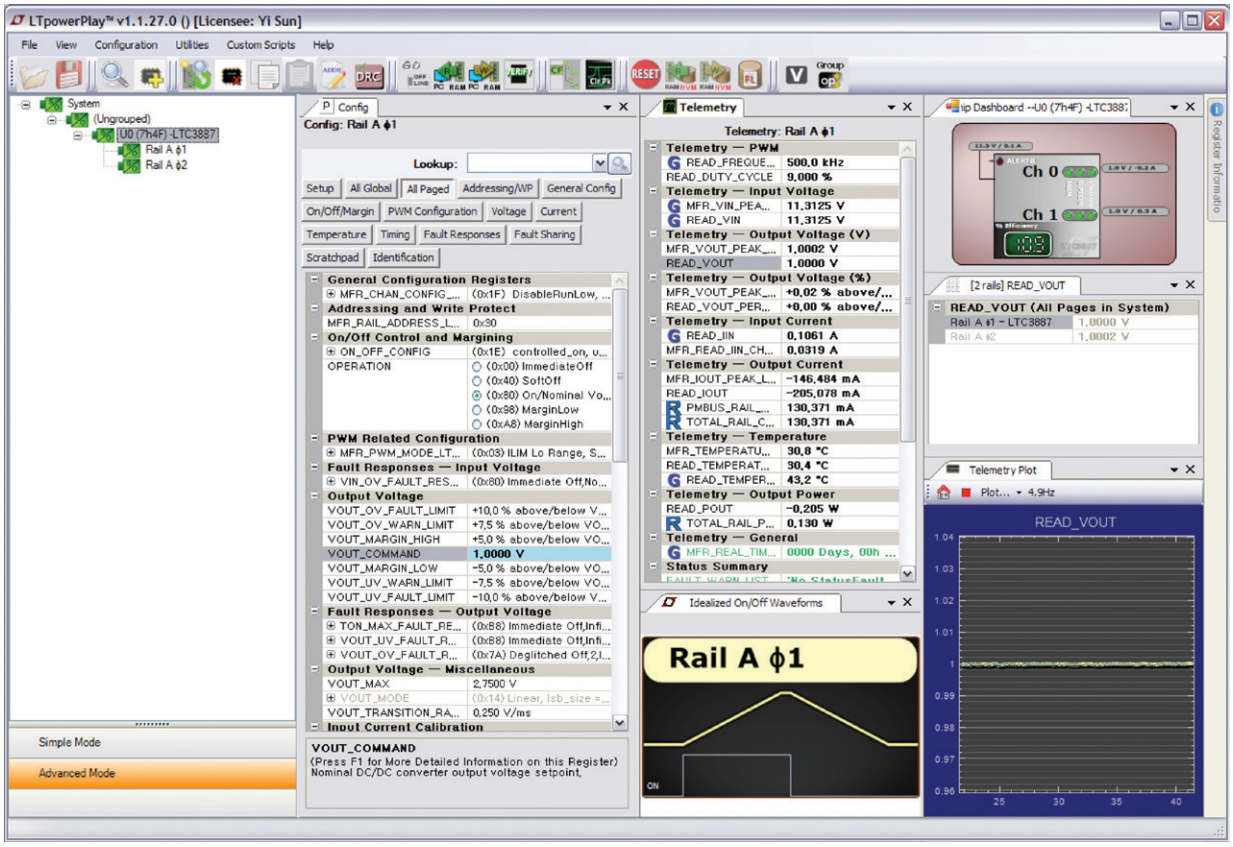



**Figure 6. LTpowerPlay Main Interface**

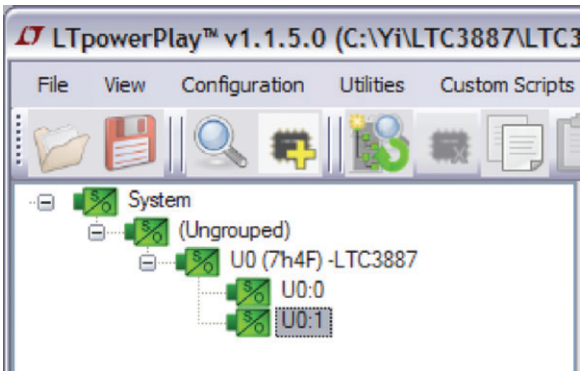
The following procedure describes how to use LTpowerPlay to monitor and change the settings of LTC3887.

1. Download and install the LTpowerPlay GUI:

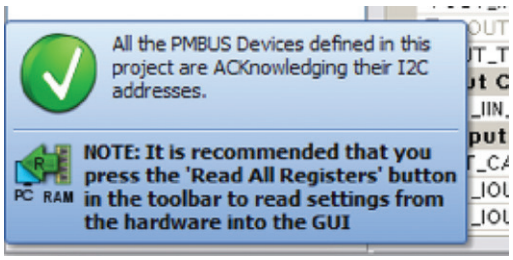
   http://www.linear.com/ltpowerplay

2. Launch the LTpowerPlay GUI.

   a. The GUI should automatically identify the DC2263A. The system tree on the left hand side should look like this:



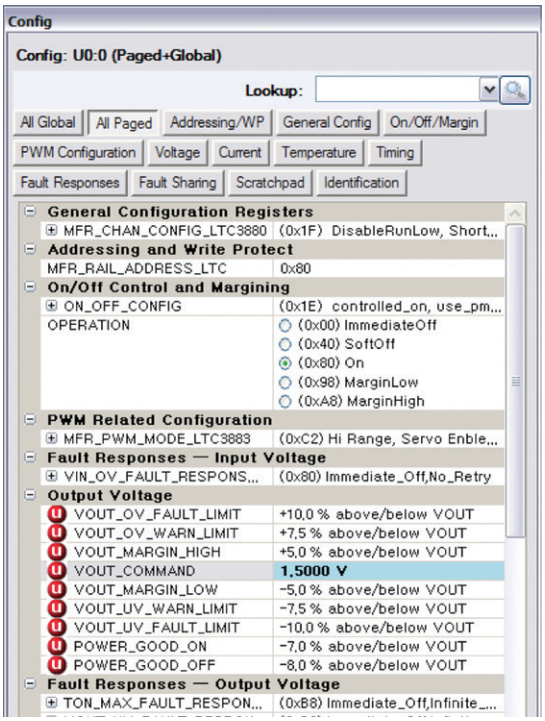

   b. A green message box shows for a few seconds in the lower left hand corner, confirming that the LTC3887 is communicating:




   c. In the Toolbar, click the “R” (RAM to PC) icon to read the RAM from the LTC3887. This reads the configuration from the RAM of LTC3887 and loads it into the GUI.

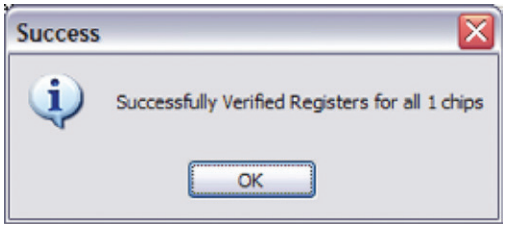
## LTpowerPlay QUICK START PROCEDURE

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 LTC3887. 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:




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 with a new filename.

## PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|---|---|---|---|
| **Required Circuit Components: DC2063A-A** | | | | |
| 1 | 2 | C1, C2 | CAP., X5R, 100nF, 25V, 10%, 0603 | AVX, 06033C104KAT2A |
| 2 | 2 | C21, C22 | CAP., X7R 1nF 50V 0603 | AVX 06035C102KAT2A |
| 3 | 1 | C5 | CAP., 4.7µF, X5R, 25V, 10%, 0805 | AVX, 08053D475KAT2A |
| 4 | 1 | C9 | CAP., X5R, 1µF, 25V, 10%, 0603 | AVX, 06033D105KAT2A |
| 5 | 4 | C10, C11, C29, C30 | CAP., POSCAP 330µF 6V D3L | PANASONIC, 6TPF330M9L |
| 6 | 2 | C12, C14 | CAP., X5R, 10nF, 16V, 10%, 0603 | AVX, 0603YC103KAT2A |
| 7 | 1 | C13 | CAP., OS-CON, 150µF, 35V | SUN ELECTRONIC INDUSTRIES CORP., 35HVP150M |
| 8 | 2 | C15, C16 | CAP., X7R 47pF 5% 50V 0603 | AVX, 06035C470JAT2A |
| 9 | 2 | C7, C8 | CAP., C0G, 3300pF, 50V, 5%, 0603 | KEMET, C0603C332J5GACTU |
| 10 | 1 | C17 | CAP., 0.22µF, X7R, 16V, 10%, 0603 | AVX, 0603YC224KAT2A |
| 11 | 4 | C18, C19, C27, C28 | CAP., 22µF, X5R, 25V, 20%, 1210 | AVX, 12103D226MAT2A |
| 12 | 6 | C20, C23, C24, C25, C32, C34 | CAP., X5R, 100µF, 6.3V, 20%, 1210 | AVX 12106D107MAT2A |
| 13 | 1 | C48 | CAP., X5R, 4.7µF, 16V, 10%, 0603 | TDK C1608X5R1C475K |
| 14 | 2 | D1, D2 | DIODE, SCHOTTKY, SOD-323 | CENTRAL SEMI., CMDSH-3TR |
| 15 | 2 | L1, L2 | IND, 0.22µH | WURTH ELEKTRONIK, 744305022 |
| 16 | 2 | Q1, Q3 | XSTR, POWER MOSFET LFPAK | INFINEON, BSC050NE2LS |
| 17 | 4 | Q2, Q4 | XSTR, POWER MOSFET LFPAK | INFINEON, BSC010NE2LSI |
| 18 | 9 | R8, R9, , R25, R45, R6, R29, R30, R34, R71, R76 | RES., CHIP, 0Ω, 1% 0603 | NIC, NRC06ZOTRF |
| 19 | 11 | R27, R28, R39, R40, R41, R42, R43, R44, R57 | RES., CHIP, 10k, 1% 0603 | NIC, NRC06F1002TRF |
| 20 | 3 | R52, R56, R59 | RES., CHIP, 2Ω, 1%, 0603 | NIC, NRC06F2R00TRF |
| 21 | 2 | R3, R4 | RES., CHIP, 6.49k, 1% 0603 | NIC, NRC06F6491TRF |
| 22 | 2 | R10, R16 | RES SENSE., CHIP, 0.001Ω, 1% 2512 | VISHAY, WSL25121L000FEA |
| 23 | 4 | R11, R12, R13, R14 | RES., CHIP, 100Ω, 1% 0603 | NIC NRC06F1000TRF |
| 24 | 1 | U1 | IC, LTC3887EUJ, QFN 6mm × 6mm | LINEAR TECH.LTC3887EUJ#10C9-1PBF-ES |
| **Additional Demo Board Circuit Components** | | | | |
| 1 | 1 | C31 | CAP., X5R, 100nF, 25V, 10%, 0603 | AVX, 06033C104KAT2A |
| 2 | 0 | C3, C6, C35, C36 | CAP., OPT 1210 | OPT |
| 3 | 2 | C26, C33 | CAP., X5R, 10nF, 16V, 10%, 0603 | AVX, 0603YC103KAT2A |
| 4 | 0 | C4, C38 | CAP., OPT 0603 | OPT |
| 5 | 1 | C40 | CAP., X7R, 1µF, 50V, 10%, 1206 | AVX 12065C105KAT2A |
| 6 | 2 | C41, C47 | CAP., X5R, 2.2µF, 50V, 10%, 0805 | MURATA GRM21BR61H225KA73L |
| 7 | 0 | C42, C43, C44, C45 | CAP., POSCAP OPT D3L | OPT |
| 8 | 1 | C49 | CAP., X5R, 4.7µF, 16V, 10%, 0603 | TDK C1608X5R1C475K |
| 9 | 1 | C54 | CAP., X7R, 1µF, 16V, 10%, 0805 | MURATA GRM21BR71C105KA01L |
| 10 | 2 | D3, D4 | LED 3×2mm 560nm GRN WTR CLR SMD | ROHM, SML-010FTT86 |
| 11 | 1 | D5 | LED 3×2mm 650nm RED WTR CLR SMD | ROHM, SML-010VTT86 |
| 12 | 0 | D6, D7 | LED OPT SOD-323 | OPT |
| 13 | 2 | Q5, Q6 | TRANS GP SS PNP 40V SOT23 | ON SEMI, MMBT3906LT1G |
| 14 | 0 | Q7, Q8 | OPT | OPT |

## PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|---|---|---|---|
| 15 | 2 | Q12, Q13 | MOSFET N-CH 60V 115MA SOT23 | FAIRCHILD, 2N7002 |
| 16 | 2 | Q14, Q19 | MOSFET P-CH 20V 0.58A SOT23 | VISHAY, SI2365EDS-T1-GE3 |
| 17 | 1 | Q15 | MOSFET SPEED SRS 30V 30A LFPAK | RENESAS, RJK0305DPB-00#J0 |
| 18 | 0 | R5, R33, R62, R77, R81, R82, R84, R86, R96, R1, R2, R7, R15, R26, R69, R17, R18, R19, R20, R21, R22, R23, R24, R32, R67, R73, R74 | RES., OPT 0603 | OPT |
| 19 | 3 | R51, R79, R80 | RES., CHIP, 0Ω, 1% 0603 | NIC, NRC06Z0TRF |
| 20 | 2 | R58, R92 | RES., CHIP, 10k, 1% 0603 | NIC, NRC06F1002TRF |
| 21 | 2 | R36, R37 | RES., CHIP, 4.99k, 1%, 0603 | NIC, NRC06F4991TRF |
| 22 | 2 | R53, R54 | RES., CHIP, 200Ω, 1% 0603 | NIC, NRC06F2000TRF |
| 23 | 1 | R55 | RES., CHIP, 127Ω, 1%, 0603 | NIC, NRC06F1270TRF |
| 24 | 0 | R60 | RES., OPT 0805 | OPT |
| 25 | 1 | R61 | RES., CHIP, 100k, 1% 0603 | NIC NRC06F1003TRF |
| 26 | 2 | R63, R64 | RES., CHIP, 10Ω, 1% 0603 | NIC NRC06F10R0TRF |
| 27 | 1 | R68 | RES SENSE., CHIP, 0.01Ω, 1% 2512 | VISHAY, WSL2512R0100FEA |
| 28 | 1 | R93 | RES., CHIP, 15.8k, 1% 0603 | NIC, NRC06F1582TRF |
| 29 | 0 | R100 | RES SENSE., OPT 2512 | OPT |
| 30 | 1 | R101 | RES SENSE., CHIP, 0Ω, 1%, 1W 2512 | VISHAY WSL251200000ZEA9 |
| 31 | 4 | R38, R46, R49, R50 | RES SENSE., OPT 2512 | OPT |
| 32 | 1 | U2 | IC, 24LC05-I/ST TSSOP-8_4.4mm | MICROCHIP, 24LC025-I/ST |
| 33 | 1 | U3 | IC, LT1129CS8-5, SO8NB | LINEAR TECH, LT1129CS8-5 |
| **Hardware: For Demo Board Only** | | | | |
| 1 | 2 | JP1, JP2 | HEADER, 1×3 2mm | SULLIN, NRPN031PAEN-RC |
| 2 | 2 | XJP1, XJP2 | SHUNT, 2mm | SAMTEC 2SN-BK-G |
| 3 | 1 | JP3 | HEADER, 1×3 0.1" | WURTH ELEKTRONIK, 61300311121 |
| 4 | 1 | XJP3 | SHUNT, 0.1" BLK | WURTH ELEKTRONIK, 60900213421 |
| 5 | 6 | J1, J2, J3, J4, J5, J6 | CONN., JACK, BANANA, NON-INSULATED, 0.218" | KEYSTONE, 575-4 |
| 6 | 1 | J7 | CONN., HEADER, 2×7, 2mm, R/A (F) | SULLINS, NPPN072FJFN-RC |
| 7 | 1 | J8 | CONN., HEADER, 2×7, 2mm, R/A (M) | MOLEX, 87760-1416 |
| 8 | 3 | J9, J11, J12 | CONN., BNC PC MOUNT RECEPT. JACK, 50Ω, TF-4 POST | AMPHENOL CONNEX, 112404 |
| 9 | 1 | J10 | HEADER, 2×6 2mm STR DL PCB | FCI 98414-G06-12ULF |
| 10 | 4 | STAND-OFF | STAND-OFF, NYLON 0.50" TALL | KEYSTONE, 8833(SNAP ON) |
| 11 | 2 | | STENCILS TOP AND BOTTOM | STENCIL DC2263A |

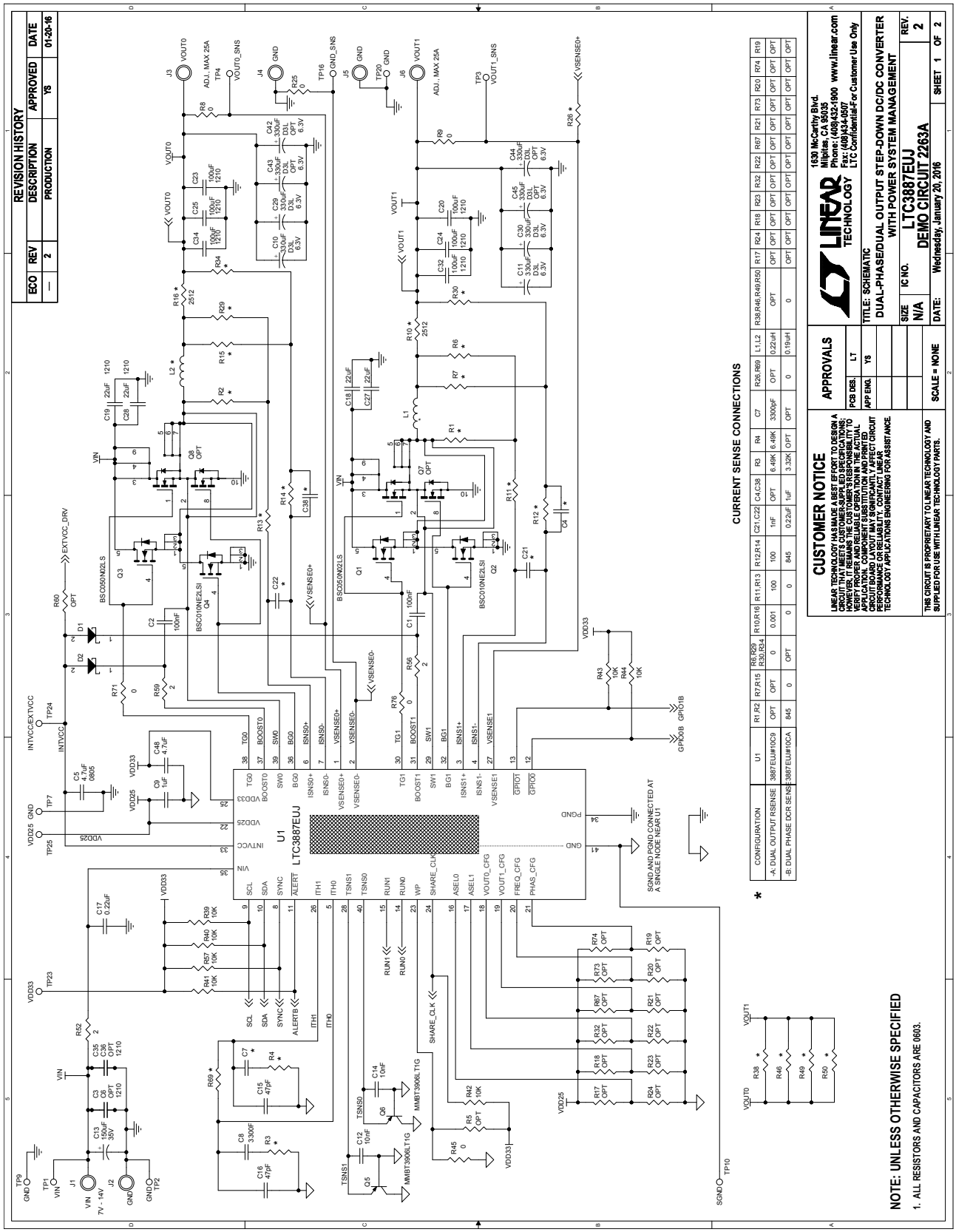
## PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|---|---|---|---|
| **Required Circuit Components: DC2063A-B** | | | | |
| 1 | 2 | C1, C2 | CAP., X5R, 100nF, 25V, 10%, 0603 | AVX, 06033C104KAT2A |
| 2 | 1 | C5 | CAP., X5R, 4.7µF, 25V 0805 | AVX, 08053D475KAT2A |
| 3 | 1 | C9 | CAP., X5R, 1µF, 25V, 10%, 0603 | AVX, 06033D105KAT2A |
| 4 | 2 | C4, C38 | CAP., X5R 1µF 25V 10% 0603 | MURATA GRM188R61E105KA12D |
| 5 | 1 | C8 | CAP., C0G, 3300pF, 50V, 5%, 0603 | KEMET, C0603C332J5GACTU |
| 6 | 4 | C10, C11, C29, C30 | CAP., POSCAP 330µF 6V D3L | PANASONIC, 6TPF330M9L |
| 7 | 2 | C12, C14 | CAP., X5R, 10nF, 16V, 10%, 0603 | AVX, 0603YC103KAT2A |
| 8 | 1 | C13 | CAP., OS-CON, 150µF, 35V | SUNCON, 35HVP150M |
| 9 | 2 | C15, C16 | CAP., 47PF, X7R, 50V, 5%, 0603 | AVX, 06035C470JAT2A |
| 10 | 1 | C17, C21, C22 | CAP., 0.22µF, X7R, 16V, 10%, 0603 | AVX, 0603YC224KAT2A |
| 11 | 4 | C18, C19, C27, C28 | CAP., 22µF, X5R, 25V, 20%, 1210 | AVX, 12103D226MAT2A |
| 12 | 6 | C20, C23, C24, C25, C32, C34 | CAP., X5R, 100µF, 6.3V, 20%, 1210 | AVX 12106D107MAT2A |
| 13 | 1 | C48 | CAP., X5R, 4.7µF, 16V, 10%, 0603 | TDK C1608X5R1C475K |
| 15 | 2 | D1, D2 | DIODE, SCHOTTKY, SOD-323 | CENTRAL SEMI., CMDSH-3TR |
| 16 | 2 | L1, L2 | IND, 0.19µH | WURTH ELECTRONIC, 744355019 |
| 17 | 2 | Q1, Q3 | XSTR, POWER MOSFET LFPAK | INFINEON, BSC050NE2LS |
| 18 | 4 | Q2, Q4 | XSTR, POWER MOSFET LFPAK | INFINEON, BSC010NE2LSI |
| 19 | 9 | R8, R9, R25, R45, R7, R15, R26, R69, R71, R76 | RES., 0Ω, 0603 | NIC, NRC06ZOTRF |
| 20 | 4 | R1, R2, R12, R14 | RES., 845Ω, 1% , 0603 | NIC NRC06F8450TRF |
| 21 | 1 | R3 | RES., 3.32k, 1%, 0603 | NIC, NRC06F3321TRF |
| 22 | 11 | R27, R28, R39, R40, R41, R42, R43, R44, R57 | RES., CHIP, 10k, 1% 0603 RES., 10k, 1%, 0603 | NIC, NRC06F1002TRF |
| 23 | 3 | R52, R56, R59 | RES., CHIP, 2, 1%, 0603 | YAGEO, RC0603FR-072RL |
| 24 | 6 | R10, R16, R38, R46, R49, R50 | RES SENSE., CHIP, 0, 1%, 1W 2512 | VISHAY WSL251200000ZEA9 |
| 26 | 1 | U1 | IC, LTC3887EUJ, QFN 6mm × 6mm | LINEAR TECH.LTC3887EUJ#10CA-1PBF-ES |
| **Additional Demo Board Circuit Components** | | | | |
| 1 | 1 | C31 | CAP., X5R, 100nF, 25V, 10%, 0603 | AVX, 06033C104KAT2A |
| 2 | 0 | C3, C6, C35, C36 | CAP., OPT 1210 | OPT |
| 3 | 2 | C26, C33 | CAP., X5R, 10nF, 16V, 10%, 0603 | AVX, 0603YC103KAT2A |
| 4 | 0 | C7 | CAP., OPT 0603 | OPT |
| 5 | 1 | C40 | CAP., X7R, 1µF, 50V, 10%, 1206 | AVX 12065C105KAT2A |
| 6 | 2 | C41, C47 | CAP., X5R, 2.2µF, 50V, 10%, 0805 | MURATA GRM21BR61H225KA73L |
| 7 | 0 | C42, C43, C44, C45 | CAP., POSCAP OPT D3L | OPT |
| 8 | 1 | C49 | CAP., X5R, 4.7µF, 16V, 10%, 0603 | TDK C1608X5R1C475K |
| 9 | 1 | C54 | CAP., X7R, 1µF, 16V, 10%, 0805 | MURATA GRM21BR71C105KA01L |
| 10 | 2 | D3, D4 | LED 3×2mm 560nm GRN WTR CLR SMD | ROHM, SML-010FTT86 |
| 11 | 1 | D5 | LED 3×2mm 650nm RED WTR CLR SMD | ROHM, SML-010VTT86 |
| 12 | 0 | D6, D7 | LED OPT SOD-323 | OPT |
| 13 | 2 | Q5, Q6 | TRANS GP SS PNP 40V SOT23 | ON SEMI, MMBT3906LT1G |
| 14 | 0 | Q7, Q8 | OPT | OPT |

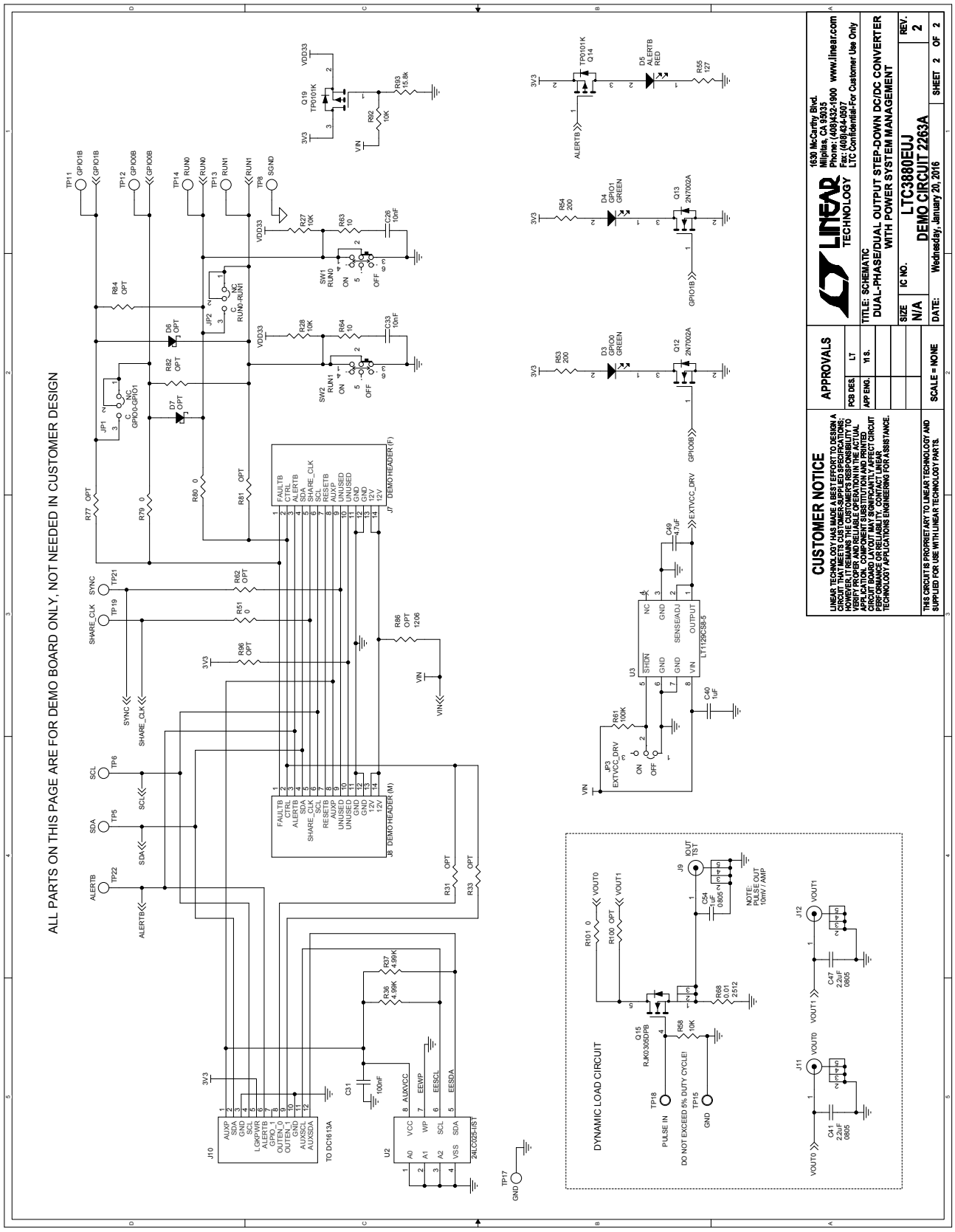
## PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|---|---|---|---|
| 15 | 2 | Q12, Q13 | MOSFET N-CH 60V 115MA SOT23 | FAIRCHILD, 2N7002 |
| 16 | 2 | Q14, Q19 | MOSFET P-CH 20V 0.58A SOT23 | VISHAY, SI2365EDS-T1-GE3 |
| 17 | 1 | Q15 | MOSFET SPEED SRS 30V 30A LFPAK | RENESAS, RJK0305DPB-00#J0 |
| 18 | 0 | R5, R33, R62, R77, R81, R82, R84, R86, R96, R4, R6, R11, R13, R29, R30, R34, R17, R18, R19, R20, R21, R22, R23, R24, R32, R67, R73, R74 | RES., OPT 0603 | OPT |
| 19 | 3 | R51, R79, R80 | RES., 0Ω, 0603 | NIC, NRC06Z0TRF |
| 20 | 2 | R58, R92 | RES., 10k, 1%, 0603 | NIC, NRC06F1002TRF |
| 21 | 2 | R36, R37 | RES., CHIP, 4.99k, 1%, 0603 | NIC, NRC06F4991TRF |
| 22 | 2 | R53, R54 | RES., CHIP, 200Ω, 1% 0603 | NIC, NRC06F2000TRF |
| 23 | 1 | R55 | RES., CHIP, 127Ω, 1%, 0603 | NIC, NRC06F1270TRF |
| 24 | 0 | R60 | RES., OPT 0805 | OPT |
| 25 | 1 | R61 | RES., CHIP, 100k, 1% 0603 | NIC NRC06F1003TRF |
| 26 | 2 | R63, R64 | RES., CHIP, 10Ω, 1% 0603 | NIC NRC06F10R0TRF |
| 27 | 1 | R68 | RES SENSE., CHIP, 0.01Ω, 1% 2512 | VISHAY, WSL2512R0100FEA |
| 28 | 1 | R93 | RES., CHIP, 15.8k, 1% 0603 | NIC, NRC06F1582TRF |
| 29 | 0 | R100 | RES SENSE., OPT 2512 | OPT |
| 30 | 1 | R101 | RES SENSE., CHIP, 0Ω, 1%, 1W 2512 | VISHAY WSL251200000ZEA9 |
| 31 | 1 | U2 | IC, 24LC05-I/ST TSSOP-8_4.4mm | MICROCHIP, 24LC025-I/ST |
| 32 | 1 | U3 | IC, LT1129CS8-5, SO8NB | LINEAR TECH, LT1129CS8-5 |
| **Hardware: For Demo Board Only** | | | | |
| 1 | 2 | JP1, JP2 | HEADER, 1×3 2mm | SULLIN, NRPN031PAEN-RC |
| 2 | 2 | XJP1, XJP2 | SHUNT, 2mm | SAMTEC 2SN-BK-G |
| 3 | 1 | JP3 | HEADER, 1×3 0.1" | WURTH ELEKTRONIK, 61300311121 |
| 4 | 1 | XJP3 | SHUNT, 0.1" BLK | WURTH ELEKTRONIK, 60900213421 |
| 5 | 6 | J1, J2, J3, J4, J5, J6 | CONN., JACK, BANANA, NON-INSULATED, 0.218" | KEYSTONE, 575-4 |
| 6 | 1 | J7 | CONN., HEADER, 2×7, 2mm, R/A (F) | SULLINS, NPPN072FJFN-RC |
| 7 | 1 | J8 | CONN., HEADER, 2×7, 2mm, R/A (M) | MOLEX, 87760-1416 |
| 8 | 3 | J9, J11, J12 | CONN., BNC PC MOUNT RECEPT. JACK, 50Ω, TF-4 POST | AMPHENOL CONNEX, 112404 |
| 9 | 1 | J10 | HEADER, 2×6 2mm STR DL PCB | FCI 98414-G06-12ULF |
| 10 | 4 | STAND-OFF | STAND-OFF, NYLON 0.50" TALL | KEYSTONE, 8833(SNAP ON) |
| 11 | 2 | | STENCILS TOP AND BOTTOM | STENCIL DC2263A |

## SCHEMATIC DIAGRAM



## SCHEMATIC DIAGRAM



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Mailing Address:

Linear Technology
1630 McCarthy Blvd.
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- Техническая поддержка проекта;
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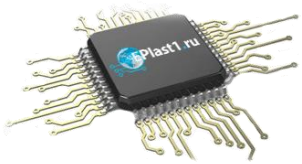


**Как с нами связаться**

**Телефон:** 8 (812) 309 58 32 (многоканальный)
**Факс:** 8 (812) 320-02-42
**Электронная почта:** org@eplast1.ru
**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.