

## LTC4419

# 18V Dual Input Micropower PowerPath™ Prioritizer

## DESCRIPTION

Demonstration circuit 2160A uses the [LTC®4419](#) to provide backup switchover, keeping the output load powered during brown out or power loss conditions. Priority is assigned by supply connection to the V1 and V2 inputs. The power source connected to V1 has a higher priority and is monitored by undervoltage switchover threshold comparator CADJ (pin ADJ). If V1 exceeds 1.55V and ADJ is above 1.097V for 64ms, V1 is considered valid, and the LTC4419 connects V1 to the load. If V1 drops below 1.52V, or ADJ drops below 1.047V, V1 is considered invalid, and the LTC4419 powers the load from V2. The DC2160A is populated to provide switchover when V1 drops below  $10.19V \pm 0.33V$ . The upper limit for V1 is the maximum operating voltage, 18V; however, the recommended V1 voltage is 12V. The resistive divider (R1-R2) of the first auxiliary comparator CMP1 is adjusted to trigger the comparator when VCMP1\_TOP's voltage is in the 9.92V to 10.74V range. Practically, any voltage from the operating range can be selected for V2, however, 5V is recommended to have a standard voltage level.

The second auxiliary comparator CMP2 divider (R8-R7) is adjusted to trigger the comparator when VCMP2\_TOP's voltage is in the 3.26V to 3.53V range. Overcurrent (0.5A to 1.6A) and thermal protection inherent to the LTC4419 allows safe prioritization. Overtemperature protection is activated when the junction temperature exceeds 125°C.

Another inherent feature – reverse supply protection – protects the prioritizer and load when a negative voltage (up to –15V) is applied to any input – V1 or V2.

The LTC4419's “break-before-make” switching method prevents cross conduction between input channels. The LTC4419 does not connect any input source to the load until the input voltage exceeds the output by 50mV. This eliminates reverse current from the output into the selected input supply.

**Design files for this circuit board are available at <http://www.linear.com/demo/DC2160A>**

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## PERFORMANCE SUMMARY

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

| SYMBOL                    | PARAMETER                                       | CONDITIONS                                         | MIN   | TYP   | MAX   | UNITS |
|---------------------------|-------------------------------------------------|----------------------------------------------------|-------|-------|-------|-------|
| V1, V2, V <sub>OUT</sub>  | V1, V2, V <sub>OUT</sub> Operating Supply Range |                                                    | 1.8   |       | 18    | V     |
| R <sub>ON</sub>           | Switch Resistance                               | V1 = V2 = 5V, I <sub>OUT</sub> = –100μA            | 1     | 2     | 5     | Ω     |
| t <sub>VALID(V1)</sub>    | Input Qualification Time                        | V1 Rising, ADJ Rising                              | 34    | 64    | 94    | ms    |
| V <sub>THA</sub>          | ADJ Threshold                                   | ADJ Falling                                        | 1.032 | 1.047 | 1.062 | V     |
| V <sub>HYSTA</sub>        | ADJ Comparator Hysteresis                       | ADJ Rising                                         | 30    | 50    | 70    | mV    |
| V <sub>THC</sub>          | CMP1, CMP2 Threshold                            | CMP1, CMP2 Falling                                 | 0.378 | 0.387 | 0.396 | V     |
| V <sub>HYSTC</sub>        | CMP1, CMP2 Hysteresis                           | CMP1, CMP2 Rising                                  | 7.5   | 10    | 12.5  | mV    |
| I <sub>LIM</sub>          | Current Limit                                   | V1 = V2 = 8.4V                                     | 0.5   | 1.1   | 1.6   | A     |
| V <sub>REV</sub>          | Reverse Comparator Threshold                    | (V1, V2) – V <sub>OUT</sub> for Power Path Turn-On | 25    | 50    | 75    | mV    |
| t <sub>SWITCH</sub>       | Switch Break-Before-Make Time                   | V1 = V2 = 5V, I <sub>OUT</sub> < –10mA             | 1     | 2.5   | 5     | μs    |
| V <sub>1_SWITCHOVER</sub> | Demo Board Switchover Voltage                   |                                                    | 9.6   | 9.92  | 10.24 | V     |
| V <sub>1_ALARM</sub>      | Demo Board V1 Alarmed Voltage                   |                                                    | 9.92  | 10.32 | 10.74 | V     |
| V <sub>2_ALARM</sub>      | Demo Board V2 Alarmed Voltage                   |                                                    | 3.26  | 3.38  | 3.53  | V     |

# DEMO MANUAL DC2160A

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## OVERVIEW

The DC2160A includes the LTC4419 2-input prioritizer (U1), LDO regulator with 2.5V output voltage (U2-LT1763) for powering LEDs and logic, four LEDs (D4-D7) for visual information, two jumpers (JP1, JP2) for selecting the power source for the LDO, push button (SW1) for engaging freshness seal mode, and a few turrets for connecting the board to power sources, load

and measuring instrument. Auxiliary components—LDO and logic—are placed on the bottom side of board.

The DC2160A design permits operation of each channel over its full operating voltage range.

Provision is made for increasing the hysteresis of auxiliary comparator 1 and auxiliary comparator 2 by placing optional resistors R17/R19.

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## TURRETS

**V1 (E1):** 12V supply input; should not exceed +18V, and should be larger than –15V.

**V2 (E8):** 5V supply input; should not exceed +18V, and should be larger than –15V.

**ADJ (E3):** Adjustable comparator non-inverting input for setting switchover threshold level.

**VCMP1\_TOP (E2):** Input for voltage monitored by first auxiliary comparator CMP1.

**VCMP2\_TOP (E7):** Input for voltage monitored by second auxiliary comparator CMP2.

**CMP1 (E4):** First auxiliary comparator CMP1 non-inverting input.

**CMP2 (E6):** Second auxiliary comparator CMP2 non-inverting input.

**GND (E5, E11, and E12):** Common ground terminal.

**OUT (E9):** Output for up to 2A load.

**LDO\_EXT (E13):** Positive terminal for external auxiliary 3.5V to 20V power supply.

**V2P5V (E10):** LDO output voltage terminal (2.5V).

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## JUMPERS

**JP1, LDO:** ON/OFF switch for LDO.

**JP2, LDO\_POWER:** Power supply selection for LDO.

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## LEDS

**D4:** Indicates LDO output voltage.

**D5:** Indicates first auxiliary comparator output stage (CMPOUT1 pin).

**D6:** Indicates second auxiliary comparator output stage (CMPOUT2 pin).

**D7:** Indicates powering load from V2 source.

## QUICK START PROCEDURE

Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Place JP1 in position ON and JP2 in position EXTER\_POWER. Turn off all external switches SW1-SW4. Connect turrets ADJ and GND with external wire.
2. Adjust V1 supply output to 12.0V, V2 to 5V, and auxiliary power supply to 10V. Use 30 $\Omega$  resistive load.
3. Turn all external switches SW1-SW4 on.
4. Place scope probes at the ADJ and OUT turrets. Disconnect the turrets ADJ and GND and measure the time between events when the ADJ pin voltage reaches 1.097V and when the output voltage starts to rise. The qualification time should be in the range 34ms to 94ms.
5. Turning SW1 off or decreasing V1 to 9V initiates switchover from V1 to V2. Turning SW1 back to on or increasing V1 above 10.5V initiates switchover from V2 to V1 with a qualification time delay.
6. Turn all external switches SW1-SW4 off again and connect turrets ADJ and GND with external wire. Use 5 $\Omega$  resistive load. Place current probe to measure load current.
7. Turn all external switches SW1-SW4 on. Disconnect the turrets ADJ and GND and observe overcurrent transients with cooling period and thermal protection.

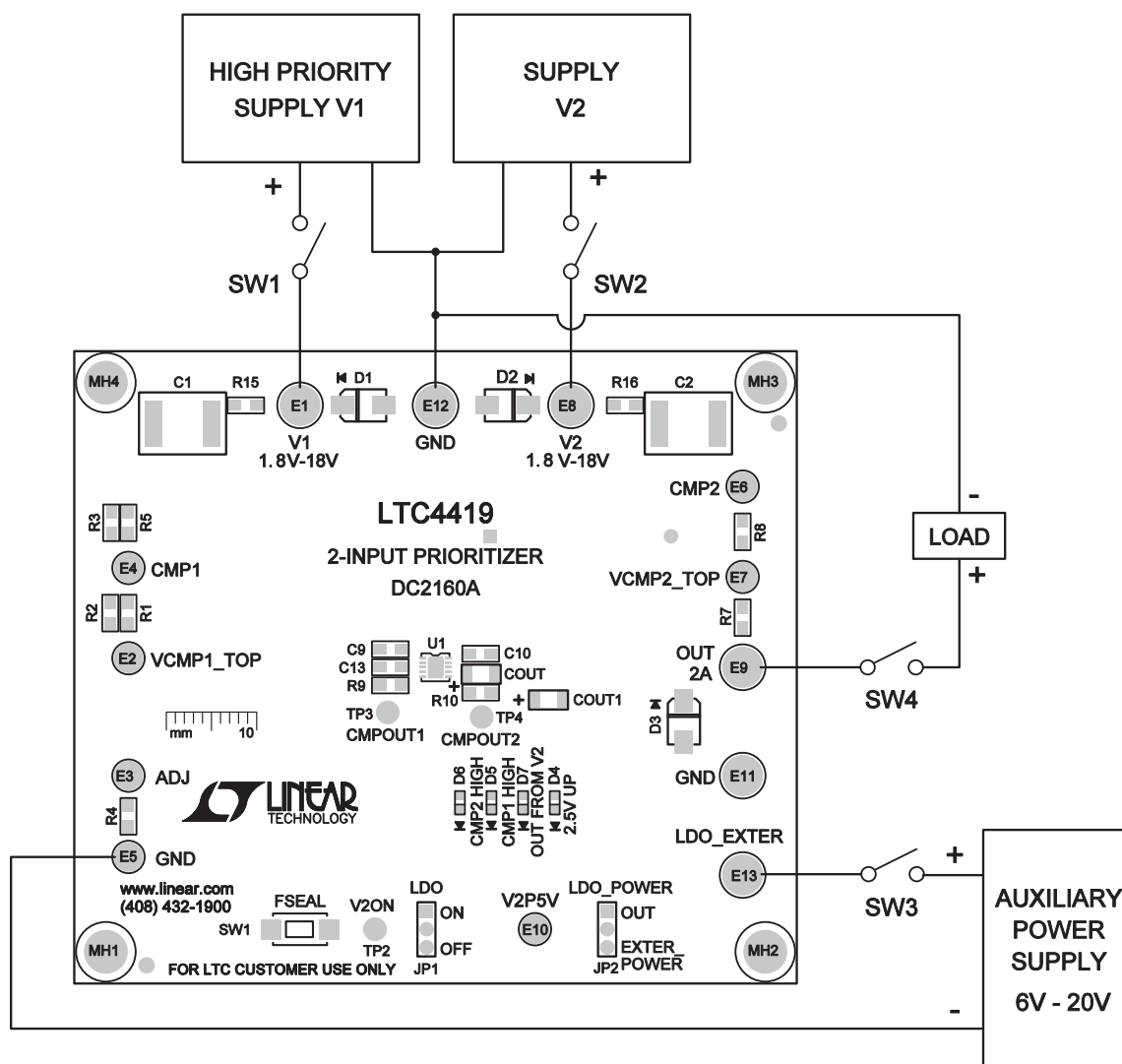


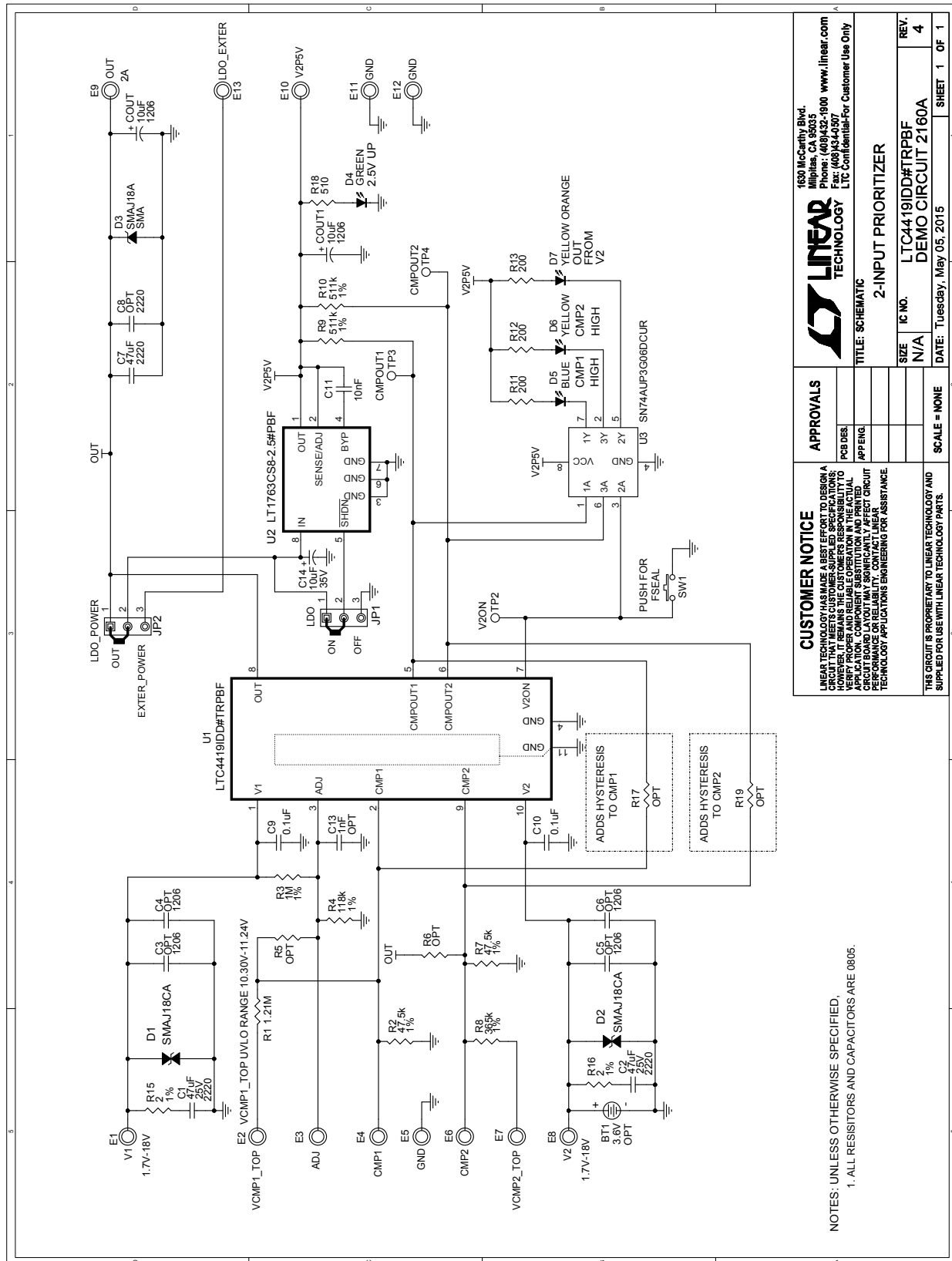
Figure 1. Proper Measurement Equipment Setup

# DEMO MANUAL DC2160A

## PARTS LIST

| ITEM | QTY | REFERENCE                   | PART DESCRIPTION                             | MANUFACTURER/PART NUMBER          |
|------|-----|-----------------------------|----------------------------------------------|-----------------------------------|
| 1    | 0   | BT1                         | HOLDER, BATTERY 20mm OPTION                  | KEYSTONE 1066 OPTION              |
| 2    | 2   | COUT1,COUT                  | CAP, 1206 10 $\mu$ F 20% 25V TANT            | AVX F951E106MAAAQ2                |
| 3    | 3   | C1, C2, C7                  | CAP, 2220 47 $\mu$ F 20% 25V X5R             | TDK CKG57NX5R1E476M500JH          |
| 4    | 0   | C3, C4, C5, C6              | CAP, 1206 OPTION                             | OPTION                            |
| 5    | 0   | C8                          | CAP, 2220 OPTION                             | OPTION                            |
| 6    | 2   | C9, C10                     | CAP, 0805 0.1 $\mu$ F 10% 25V X5R            | AVX 08053C104KAT2A                |
| 7    | 1   | C11                         | CAP, 0805 10nF 10% 16V X7R                   | AVX 0805YC103KAT2A                |
| 8    | 0   | C13                         | CAP, 0805 1nF 10% 50V X7R OPTION             | AVX 08055C102KAT OPTION           |
| 9    | 1   | C14                         | CAP, 7343 10 $\mu$ F 10% 35V TANT            | AVX TPSD106K035R0300              |
| 10   | 2   | D1, D2                      | DIODE, 400 WATT TRANSIENT VOLTAGE SUPPRESSOR | LITTELFUSE INC. SMAJ18CA          |
| 11   | 1   | D3                          | DIODE, 400 WATT TRANSIENT VOLTAGE SUPPRESSOR | LITTELFUSE INC. SMAJ18A           |
| 12   | 1   | D4                          | LED, 0603 GREEN                              | WURTH ELEKTRONIK 150060GS75000    |
| 13   | 1   | D5                          | LED, 0603 BLUE                               | WURTH ELEKTRONIK 150060BS75000    |
| 14   | 1   | D6                          | LED, 0603 YELLOW                             | WURTH ELEKTRONIK 150060YS75000    |
| 15   | 1   | D7                          | LED, 0603 YELLOW ORANGE                      | LITEON LTST-C190KFKT              |
| 16   | 6   | E1, E8, E9, E11, E12, E13   | TURRET                                       | MILL-MAX 2501-2-00-80-00-00-07-0  |
| 17   | 7   | E2, E3, E4, E5, E6, E7, E10 | TURRET                                       | MILL MAX 2308-2-00-80-00-00-07-0  |
| 18   | 2   | JP1, JP2                    | HEADER, 2mm, 3-PIN                           | WURTH 62000311121                 |
| 19   | 4   | MH1, MH2, MH3, MH4          | STANDOFF, SNAP ON                            | KEYSTONE_8831                     |
| 20   | 1   | R1                          | RES, 0805 1.21M PHMS 1% 1/8W                 | VISHAY CRCW08051M21FKEA           |
| 21   | 2   | R2, R7                      | RES, 0805 47.5k 5% 1/8W                      | VISHAY CRCW080547K5FKEA           |
| 22   | 1   | R3                          | RES, 0805 1M 1% 1/8W                         | VISHAY CRCW08051M00FKEA           |
| 23   | 1   | R4                          | RES, 0805 118k 1% 1/8W                       | VISHAY CRCW0805118KFKEA           |
| 24   | 0   | R5                          | RES, 0805 69.8k 1% 1/8W OPTION               | VISHAY CRCW080569K8FKEA OPTION    |
| 25   | 0   | R6                          | RES, 0805 OPTION                             | OPTION                            |
| 26   | 1   | R8                          | RES, 0805 365k 1% 1/8W                       | VISHAY CRCW0805365KFKEA           |
| 27   | 2   | R9, R10                     | RES, 0805 511k 1% 1/8W                       | VISHAY CRCW0805511KFKEA           |
| 28   | 3   | R11, R12, R13               | RES, 0805 200 $\Omega$ 1% 1/8W               | VISHAY CRCW0805200RFKEA           |
| 29   | 2   | R15, R16                    | RES, 0805 2 $\Omega$ 1% 1/8W                 | VISHAY CRCW08052R00FKEA           |
| 30   | 0   | R17, R19                    | RES, 0805 1M 1% 1/8W OPTION                  | VISHAY CRCW08051M00FKEA OPTION    |
| 31   | 1   | R18                         | RES, 0805 510 $\Omega$ 5% 1/8W               | VISHAY CRCW0805510RJNEA           |
| 32   | 1   | SW1                         | SWITCH, MOMENTARY, PUSH BUTTON               | WURTH 434 123 050 816             |
| 33   | 1   | U1                          | IC, LTC4419IDD#TRPBF                         | LINEAR TECH LTC4419IDD#TRPBF      |
| 34   | 1   | U2                          | IC, 500mA LOW NOISE LDO MICROPOWER REGULATOR | LINEAR TECH LT1763CS8-2.5#PBF     |
| 35   | 1   | U3                          | IC, LOW-POWER TRIPLE INVERTER BUFFER/DRIVER  | TEXAS INSTRUMENTS SN74AUP3G06DCUR |
| 36   | 2   | XJP1, XJP2                  | SHUNT, 2mm                                   | WURTH 60800213421                 |

## SCHEMATIC DIAGRAM



|                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                                       |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------|--|
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| LINEAR TECHNOLOGY<br>1630 McCarthy Blvd.<br>Milpitas, CA 95035<br>Phone: (408) 432-1900 www.linear.com<br>Fax: (408) 434-5907<br>LTC Confidential For Customer Use Only                                                                                                                                                                                                                                                 |  | <b>TITLE: SCHEMATIC</b><br><b>2-INPUT PRIORITIZER</b> |  |
| <b>SIZE</b><br>N/A                                                                                                                                                                                                                                                                                                                                                                                                      |  | <b>IC NO.</b><br>LTC4419DD#TRPBF                      |  |
| <b>DATE:</b> Tuesday, May 05, 2015                                                                                                                                                                                                                                                                                                                                                                                      |  | <b>REV.</b><br>4                                      |  |
| <b>SCALE:</b> NONE                                                                                                                                                                                                                                                                                                                                                                                                      |  | <b>SHEET</b> 1 OF 1                                   |  |

# DEMO MANUAL DC2160A

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