# LTM4625
# Tiny 3A DC/DC Inverting Buck-Boost µModule Regulator

## DESCRIPTION

Demonstration circuit 2721A-B features the LTM®4625EY µModule® regulator, a tiny high performance high efficiency step-down regulator configured as an inverting buck-boost regulator. DC2721A-B has an operating input voltage range of 4V to 15V and is able to provide an output current of up to 3A. The output voltage can be programmed from –0.6V and –5.5V. The LTM4625EY is a complete DC/DC point of load regulator in a thermally enhanced 6.25mm × 6.25mm × 5.01mm BGA package requiring only a few input and output capacitors. The LTM4625 data sheet must be read in conjunction with this demo manual for working on or modifying demo circuit 2721A-B.

**Design files for this circuit board are available .**

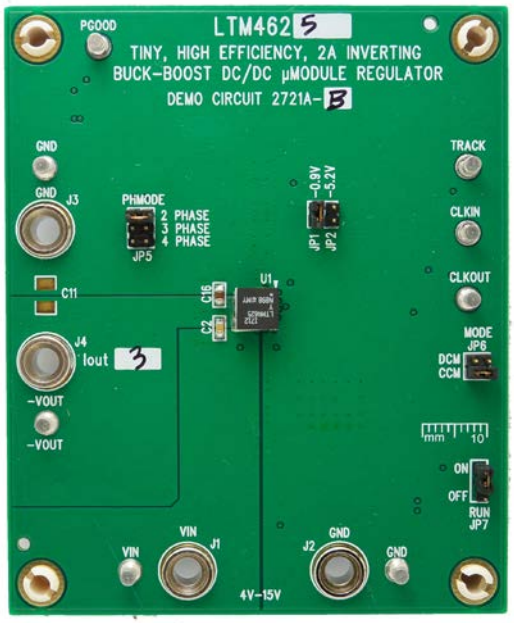


## PERFORMANCE SUMMARY

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

| PARAMETER | CONDITIONS/NOTES | VALUE |
|---|---|---|
| Input Voltage Range | | 4V to 15V |
| Output Voltage $V_{OUT}$ | Jumper Selectable | $–0.9V_{DC}$, $–5.2V_{DC}$ |
| Maximum Continuous Output Current | Derating is Necessary for Certain Operating Conditions. See Data Sheet for Details | $3A_{DC}$ |
| Default Operating Frequency | | 1MHz |
| Efficiency | $V_{IN}$ = 12V, $V_{OUT}$ = –2.5V, $I_{OUT}$ = 3A | 84% See Figure 2 |

## BOARD PHOTO



## QUICK START PROCEDURE

Demonstration circuit 2721A-B is an easy way to evaluate the performance of the LTM4625EY. Please refer to Figure 1 for test setup connections and follow the procedure below.

1. With power off, place the jumpers in the following positions for a typical –0.9$V_{OUT}$ application:

| JP7 | JP5 | JP1 |
|---|---|---|
| RUN | MODE | $V_{OUT}$ Select |
| ON | CCM | –0.9V |

2. Before connecting input supply, load and meters, preset the input voltage supply to be between 4V to 15V. Preset the load current to 0A.
3. With power off, connect the load, input voltage supply and meters as shown in Figure 1.
4. Turn on input power supply. The output voltage meter should display the selected output voltage ± 2%.
5. Once the proper output voltage is established, adjust the load current within the 0A to 3A range and observe the load regulation, efficiency, and other parameters. Output voltage ripple should be measured across C12 with a BNC cable terminated into 50Ω and an oscilloscope.
6. To observe increased light load efficiency place the mode pin jumper (JP5) in the DCM position.
7. Level shifting circuits are provided for PGOOD, CLKIN and RUN signals. The CLKIN turret E6 can be connected to a ground referenced clock with amplitude up to 3.3V for optional external clock synchronization. The PGOOD turret E8 provides a ground referenced 3.3V PGOOD signal.
8. Note that CLKOUT and TRACK signals are not level shifted and are referenced to –VOUT. If ground referenced CLKOUT output and TRACK input signals are desired, external level shifting circuits for these pins are necessary.

## QUICK START PROCEDURE

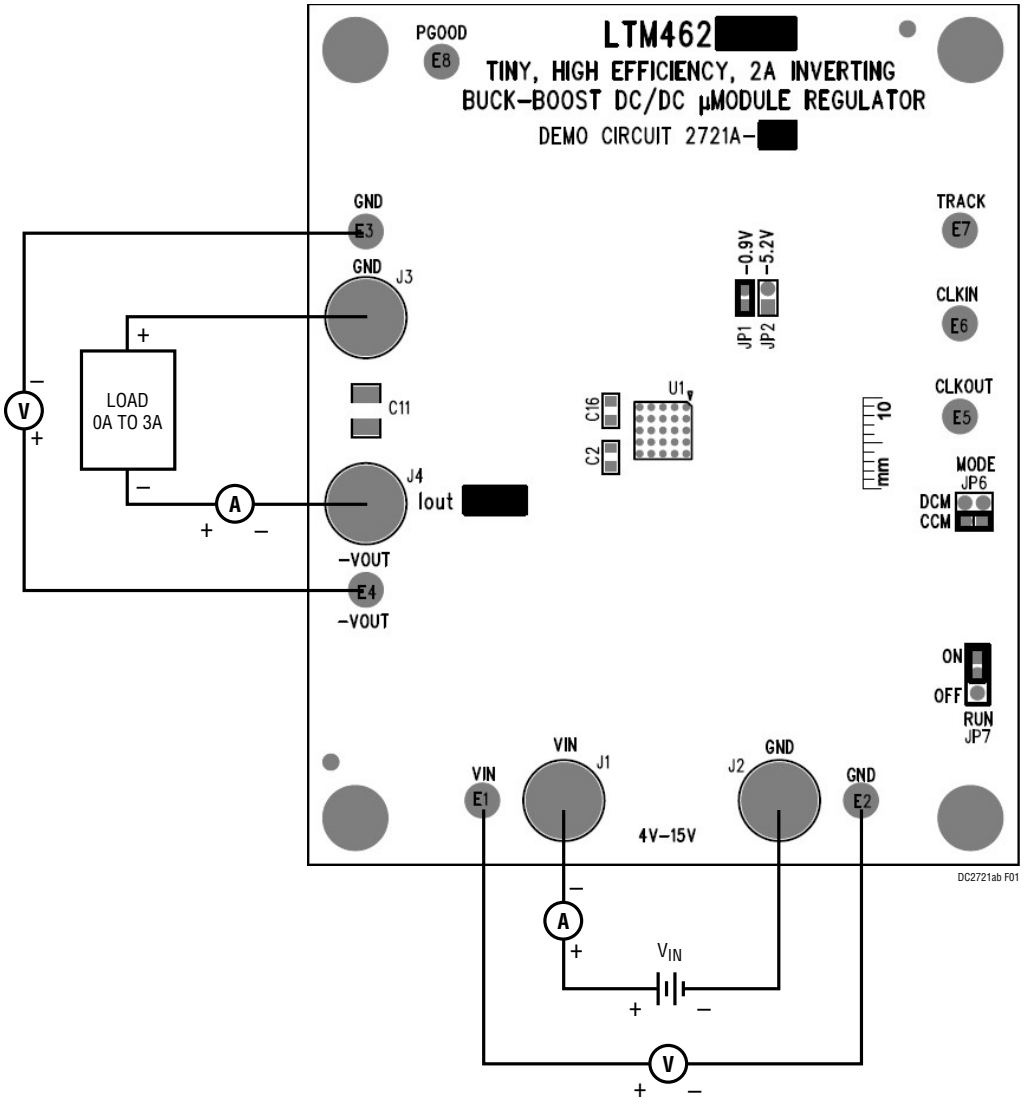



**Figure 1. Test Setup**

## QUICK START PROCEDURE

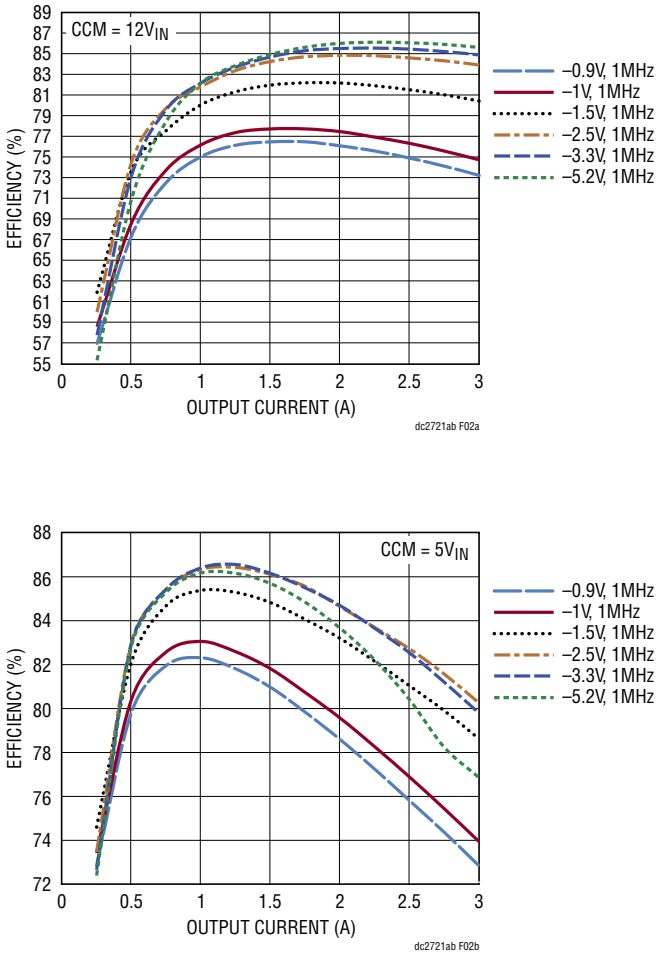
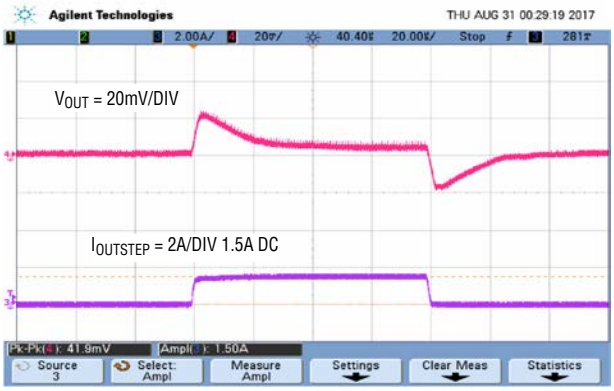


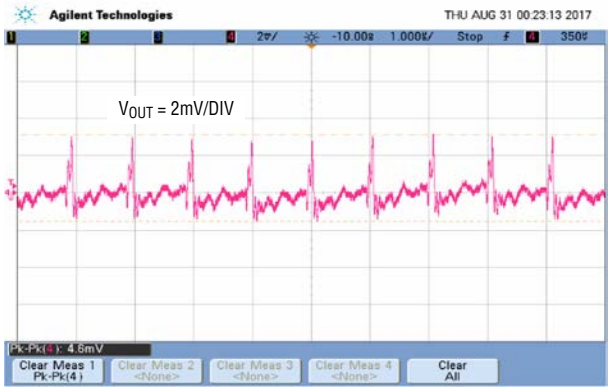

**Figure 2. Measured Supply Efficiency at $12V_{IN}$ and $5V_{IN}$**

# QUICK START PROCEDURE



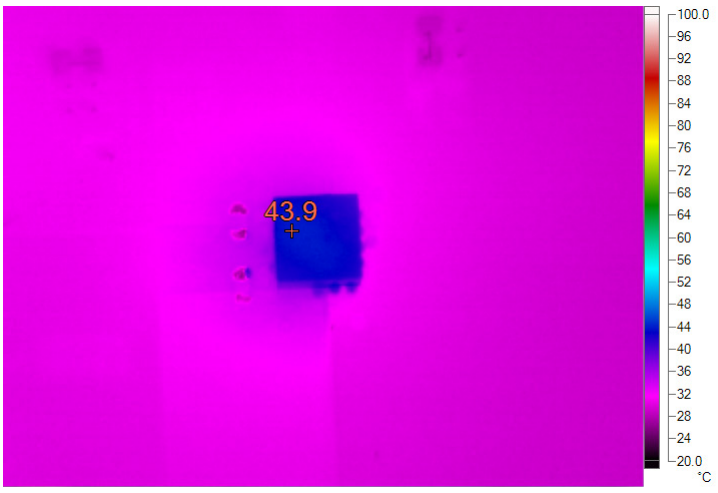

| $V_{IN}$ (V) | $V_{OUT}$ (V) | $C_{OUT}$ |
|---|---|---|
| 12 | –0.9 | 1 × 100µF/6.3V + 1 × 22µF/6.3V + 1 × 47µF/6.3V |

**Figure 3. Measured Load Transient Response (0A to 1.5A Load Step)**




| $V_{IN}$ (V) | $V_{OUT}$ (V) | $I_{OUT}$ (A) | $C_{OUT}$ |
|---|---|---|---|
| 12 | –0.9 | 3 | 1 × 100µF/6.3V + 1 × 22µF/6.3V + 1 × 47µF/6.3V |

**Figure 4. Measured $V_{OUT}$ Ripple**




| $V_{IN}$ (V) | $V_{OUT}$ (V) | $I_{LOAD}$ (A) | $f_{SW}$ (MHz) | $T_{AMBIENT}$ (C) | FORCED AIRFLOW (LFM) |
|---|---|---|---|---|---|
| 12 | –0.9 | 3 | 1 | 25 | 0 |

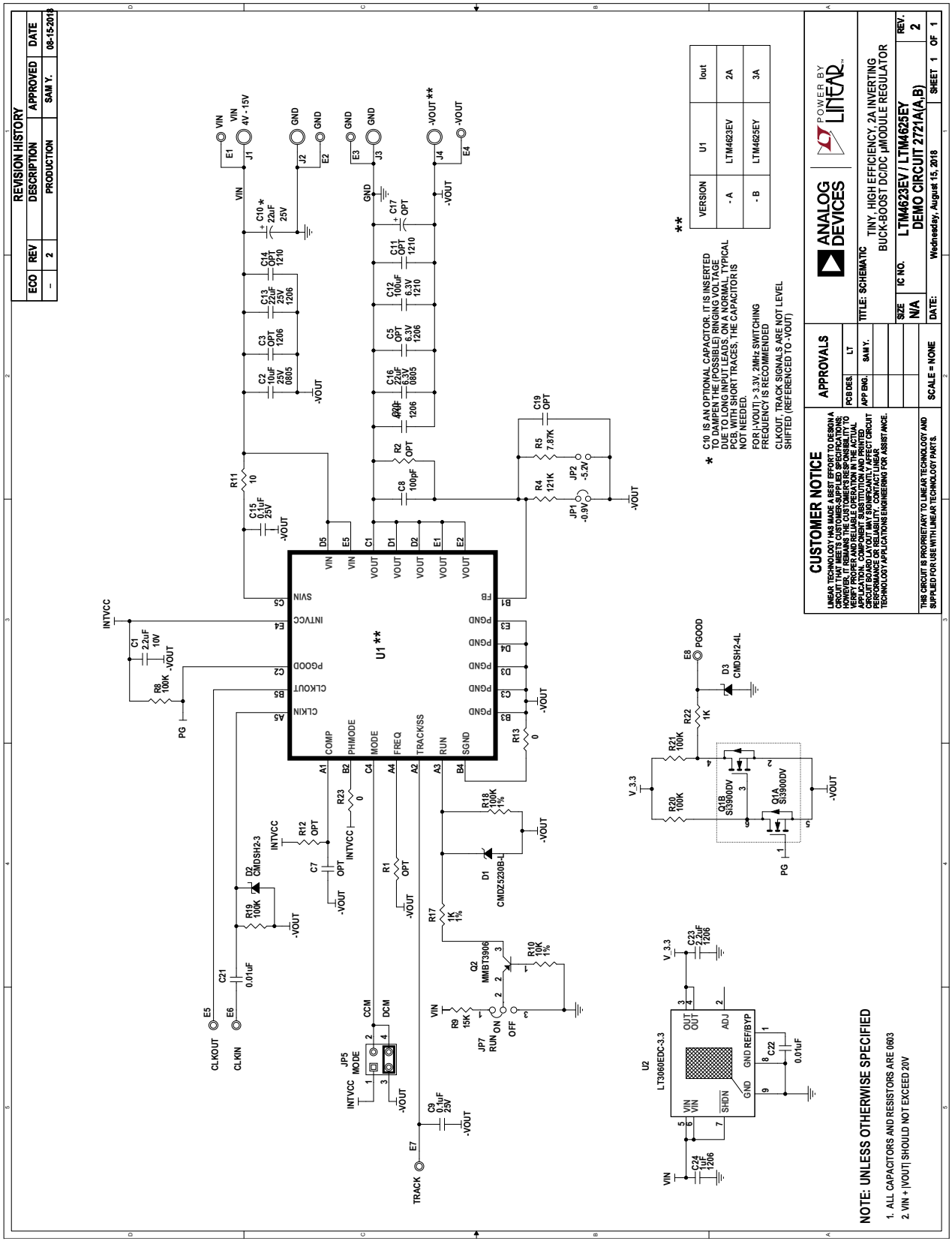
**Figure 5. Measured Case Temperature**

## PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|---|---|---|---|
| **Required Circuit Components** | | | | |
| 1 | 1 | C1 | CAP., 2.2uF, X5R, 10V, 10%, 0603 | MURATA, GRM188R61A225KE34D |
| 2 | 1 | C2 | CAP., 10uF, X5R, 25V, 10%, 0805 | AVX, 08053D106KAT2A |
| 3 | 1 | C12 | CAP., 100uF, X5R, 6.3V, 20%,1210 | MURATA, GRM32ER60J107ME20L |
| 4 | 1 | C16 | CAP., 22uF, X5R, 6.3V, 20%, 0805 | TDK, C2012X5R0J226M125AC |
| 5 | 1 | C20 | CAP., 47uF, X5R, 6.3V, 20%,1206 | TDK, C3216X5R0J476M160AC |
| 6 | 1 | R4 | RES., 121k, 1/10W, 1%, 0603 | VISHAY, CRCW0603121KFKEA |
| 7 | 1 | U1 | I.C., STEP-DOWN µMODULE REGULATOR, BGA-25 | ANALOG DEVICES, LTM4625EY#PBF |
| **Additional Demo Board Circuit Components** | | | | |
| 1 | 0 | C3,C5 (OPT) | CAP., OPTION, 1206 | OPT |
| 2 | 0 | C7,C19 (OPT) | CAP., OPTION, 0603 | OPT |
| 3 | 1 | C8 | CAP., 100pF, X7R, 50V, 10%, 0603 | AVX, 06035C101KAT2A |
| 4 | 2 | C9,C15 | CAP., 0.1uF, X5R, 25V, 10%, 0603 | AVX, 06033D104KAT2A |
| 5 | 1 | C10 | CAP., 22uF, TANT. POLY., 25V, 20%, 7343 | PANSONIC, 25TQC22MV |
| 6 | 0 | C11,C14 (OPT) | CAP., OPTION, 1210 | OPT |
| 7 | 1 | C13 | CAP., 22uF, X5R, 16V, 10%, 1206 | MURATA, GRM31CR61C226ME15L |
| 7 | 1 | C23 | CAP., 2.2uF, X5R, 10V, 10%,1206 | AVX, 1206ZD225KAT2A |
| 7 | 1 | C24 | CAP., 1uF, X7R, 25V, 10%,1206 | AVX, 12063C105KAT2A |
| 8 | 0 | C17 (OPT) | CAP., OPTION, 7343 | OPT |
| 9 | 2 | C21,C22 | CAP., 0.01uF, X7R, 16V, 10%, 0603 | AVX, 0603YC103KAT2A |
| 10 | 1 | D1 | DIODE, ZENER, SOD323 | CENTRAL SEMI., CMDZ5230B-L |
| 11 | 1 | D2 | DIODE, SCHOTTKY, SOD323 | CENTRAL SEMI., CMDSH2-3 |
| 12 | 1 | D3 | DIODE, SCHOTTKY, SOD323 | CENTRAL SEMI., CMDSH2-4L |
| 13 | 1 | Q1 | XSTR., MOSFET, N-CHAN., 20V, TSOP-6 | VISHAY, Si3900DV-T1-GE3 |
| 14 | 1 | Q2 | XSTR., PNP 40V 0.2A SOT-23 | ON SEMI., MMBT3906LT1G |
| 15 | 0 | R1,R2,R12 (OPT) | CAP., OPTION, 0603 | OPT |
| 16 | 1 | R5 | RES., 7.87k, 1/10W, 1%, 0603 | VISHAY, CRCW06037K87FKEA |
| 17 | 5 | R8,R18,R19,R20,R21 | RES., 100k, 1/10W, 1%, 0603 | VISHAY, CRCW0603100KFKEA |
| 18 | 1 | R9 | RES., 15k, 1/10W, 1%, 0603 | VISHAY, CRCW060315KF0KEA |
| 19 | 1 | R10 | RES., 10k, 1/10W, 1%, 0603 | VISHAY, CRCW060310K0FKEA |
| 20 | 1 | R11 | RES., 10 OHMS, 1/10W, 1%, 0603 | VISHAY, CRCW060310R0FKEA |
| 21 | 2 | R13,R23 | RES., 0 OHM, 1/10W, 0603 | VISHAY, CRCW06030000Z0EA |
| 22 | 2 | R17,R22 | RES., 1k, 1/10W, 1%, 0603 | VISHAY, CRCW06031K0FKEA |
| 23 | 1 | U2 | IC, REG LDO 3.3V 0.1A DFN8 | ANALOG DEVICES, LT3060EDC-3.3#TRPBF |
| **Hardware: For Demo Board Only** | | | | |
| 1 | 8 | E1,E2,E3,E4,E5,E6,E7,E8 | TEST POINT, TURRET, 0.094", MTG. HOLE | MILL MAX 2501-2-00-80-00-00-07-0 |
| 2 | 2 | JP1,JP2 | CONN., HEADER, 1X2, 2mm | WURTH ELEKTRONIK, 62000211121 |
| 3 | 1 | JP5 | CONN., HEADER, 2X2, 2mm | WURTH ELEKTRONIK, 62000421121 |
| 4 | 1 | JP7 | CONN., HEADER, 1X3, 2mm | WURTH ELEKTRONIK, 62000311121 |
| 5 | 4 | XJP1,XJP5,XJP6,XJP7 | CONN., SHUNT, FEMALE, 2 POS, 2mm | WURTH ELEKTRONIK, 60800213421 |
| 6 | 4 | J1,J2,J3,J4 | CONN., BANANA JACK, FEMALE, THT, NON-INSULATED, SWAGE, 0.218" | KEYSTONE, 575-4 |
| 7 | 4 | MH1,MH2,MH3,MH4 | STANDOFF, NYLON, SNAP-ON , 0.375" | KEYSTONE, 8832 |

Rev.A

# SCHEMATIC DIAGRAM




Rev.A

**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.

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