

LTM4650EY-1

Dual Phase Single 50A DC/DC μ Module Regulator

DESCRIPTION

Demonstration circuit 2479A-B features the LTM[®]4650EY-1, the high efficiency, high density, dual 25A, single 50A switch mode step-down power module regulator. The input voltage is from 4.5V to 15V. The output voltage is programmable from 0.6V to 1.8V. DC2479A-B is configured as dual-phase, single-output, which can deliver up to 50A maximum. The board designs with minimum components to demonstrate this high efficiency, high density μ Module. As explained in the data sheet, output current de-rating is necessary for certain V_{IN} , V_{OUT} , and thermal conditions.

These features and the availability of the LTM4650EY-1 in a compact 16mm \times 16mm \times 5.01mm BGA package make it ideal for use in many high-density point-of-load applications. The LTM4650-1 data sheet must be read in conjunction with this demo manual for working on or modifying the demo circuit DC2479A-B.

Design files for this circuit board are available at <http://www.linear.com/demo/DC2479A-B>

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BOARD PHOTO

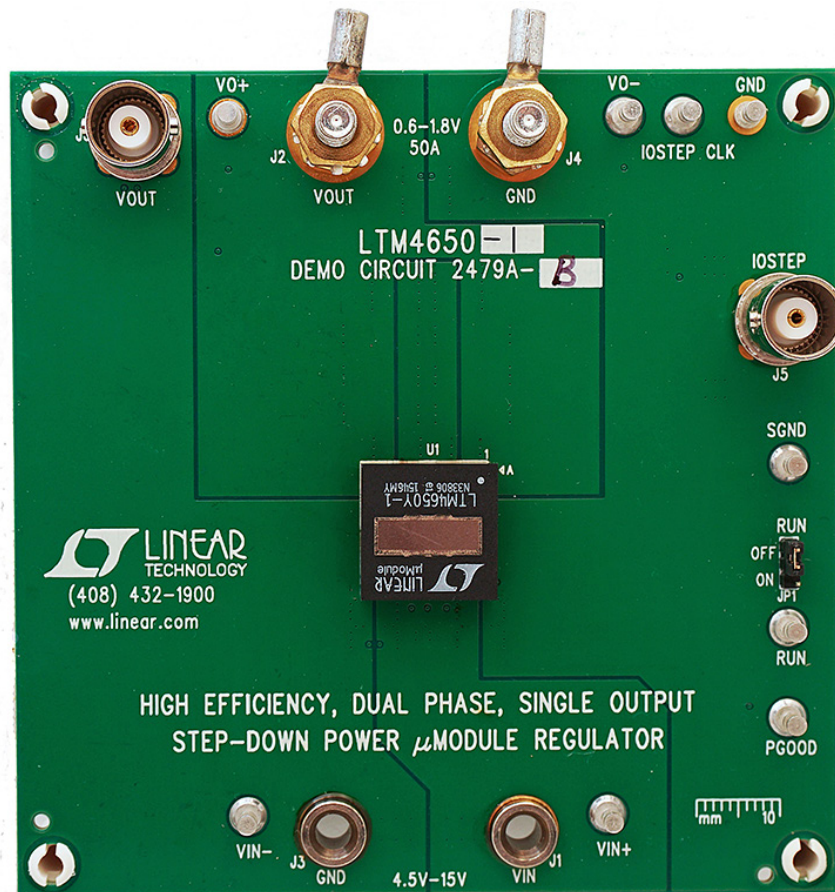


Figure 1. LTM4650-1/DC2479A-B Demo Board

DEMO MANUAL DC2479A-B

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

| PARAMETER | CONDITIONS/NOTES | VALUE |
|-----------------------------------|--|---|
| Input Voltage Range | | 4.5V ~ 15V |
| Output Voltage V_{OUT} | $V_{IN} = 4.5\sim 15\text{V}$, $I_{OUT} = 0\sim 50\text{A}$ | $1.0\text{V} \pm 1.5\%$ (0.985V ~ 1.015V) |
| Maximum Continuous Output Current | De-Rating is Necessary for Certain V_{IN} , V_{OUT} and Thermal Conditions, See Data Sheet for Detail. | 50A |
| Default Operating Frequency | | 500kHz |
| Efficiency | $V_{IN} = 12\text{V}$, $V_{OUT} = 1.0\text{V}$, $I_{OUT} = 50\text{A}$, $f_{SW} = 500\text{ kHz}$ | 86.6%, See Figure 4 |
| Load Transient | $V_{IN} = 12\text{V}$, $V_{OUT} = 1.0\text{V}$, $I_{STEP} = 25\text{A}$ to 37.5A | < 60mV _{P-P} , See Figure 5 |

QUICK START PROCEDURE

Demonstration circuit DC2479A-B is easy to set up to evaluate the performance of the LTM4650EY-1. Please refer to Figure 1 for proper measurement setup and follow the procedure below:

1. With power off, connect the input power supply, load and meters as shown in Figure 2. Preset the load to 0A and V_{IN} supply to 12V.
2. Turn on the power supply at the input. The output voltage should be $1.0\text{V} \pm 1.5\%$ (0.985V~1.015V).
3. Once the proper output voltage is established, adjust the load within the operating range and observe the output

voltage regulation, output voltage ripple, efficiency and other parameters. Output ripple can be measured at J6 with BNC cables.

4. (Optional) For optional load transient test, apply an adjustable pulse signal between “IOSTEP CLK” and “GND” test point. Pulse amplitude (3V~3.5V) sets the load step current amplitude. The output transient current can be monitored at the BNC connector J5 (10mV/A). The pulse signal should have very small duty cycle (< 10%) to limit the thermal stress on the transient load circuit.

QUICK START PROCEDURE

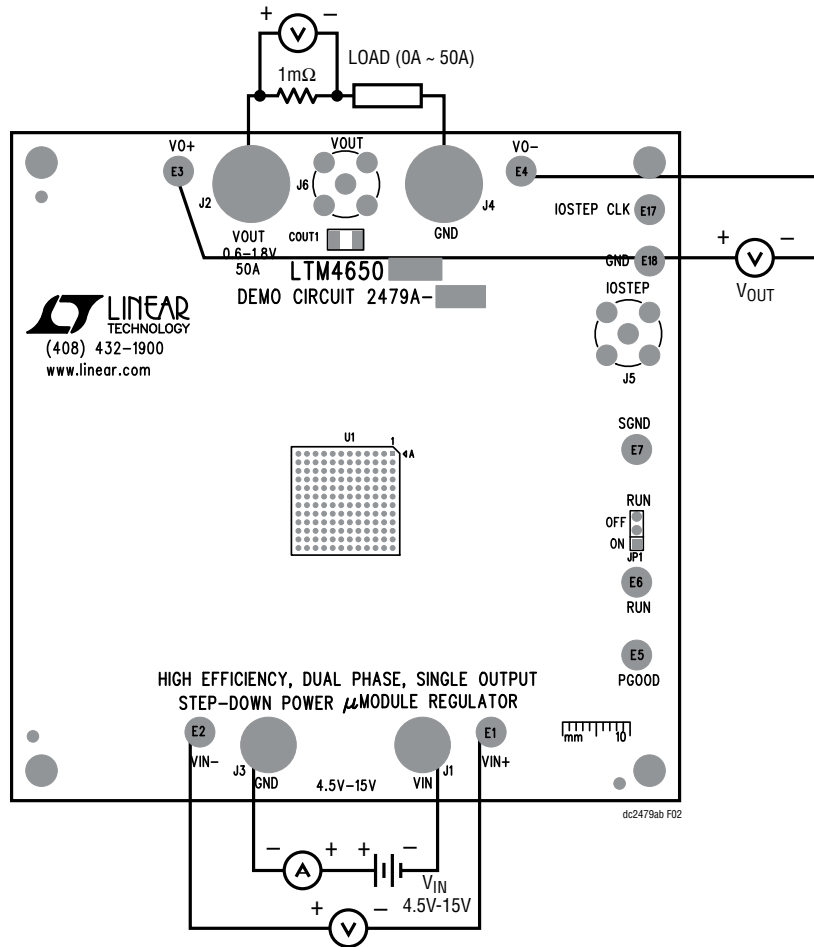


Figure 2. Test Setup of DC2479A-B

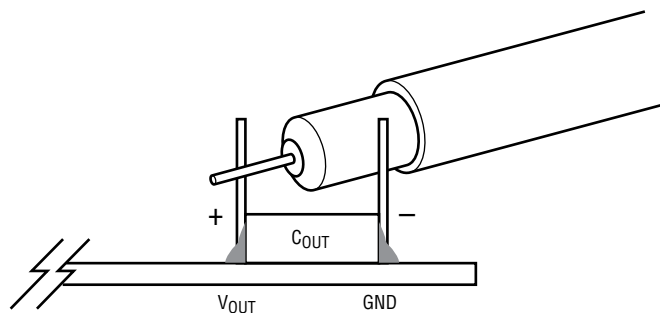


Figure 3. Measuring Output Voltage Ripple

QUICK START PROCEDURE

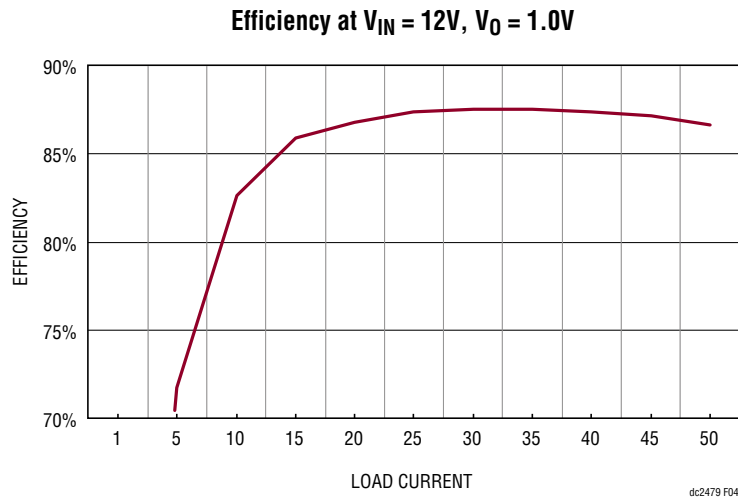


Figure 4. Efficiency vs Load Current at $V_{IN} = 12V$, $V_O = 1V$, $f_{SW} = 500kHz$

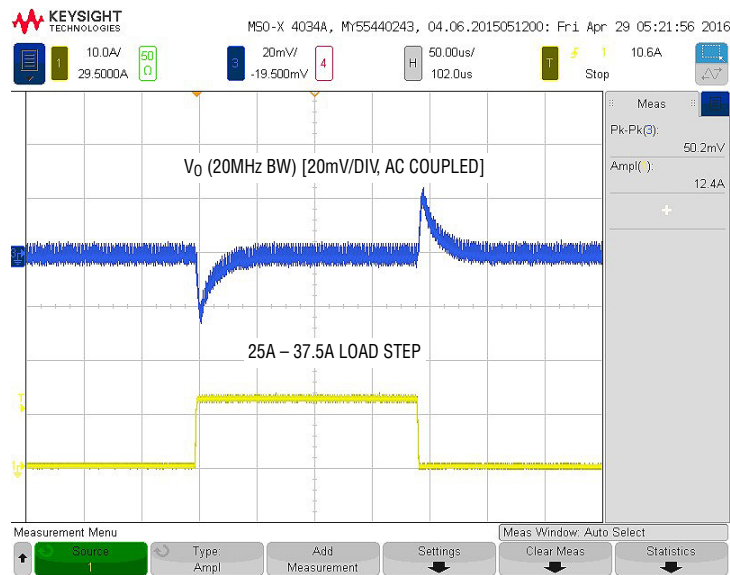


Figure 5. Measured 25A – 37.5A Load Transient Response ($V_{IN} = 12V$, $V_{OUT} = 1.0V$, $f_{SW} = 500kHz$)

QUICK START PROCEDURE

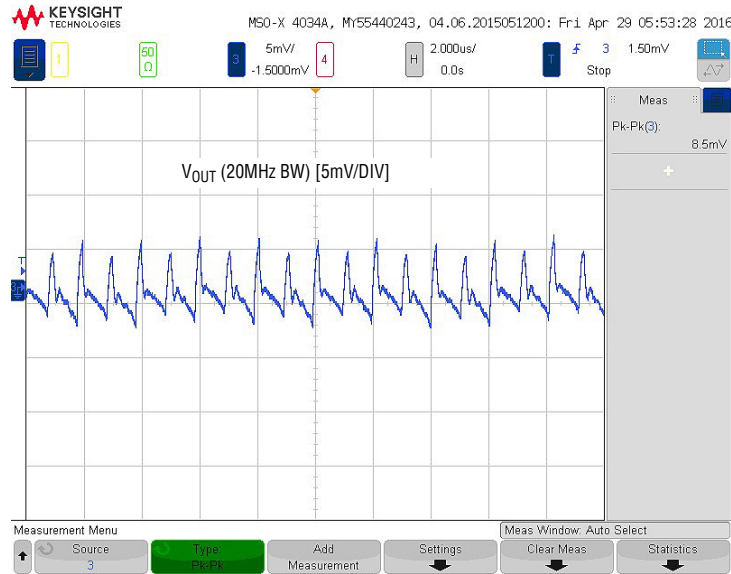


Figure 6. Output Voltage Ripple at $V_{IN} = 12V$, $V_{OUT} = 1V$, $I_{OUT} = 50A$, $f_{SW} = 500kHz$

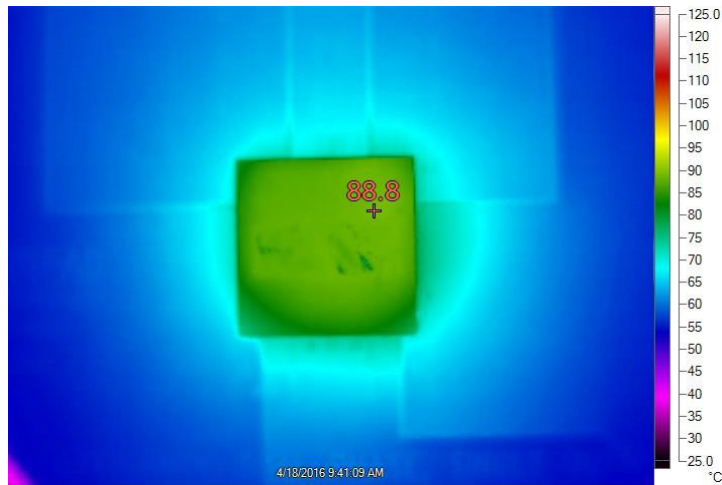


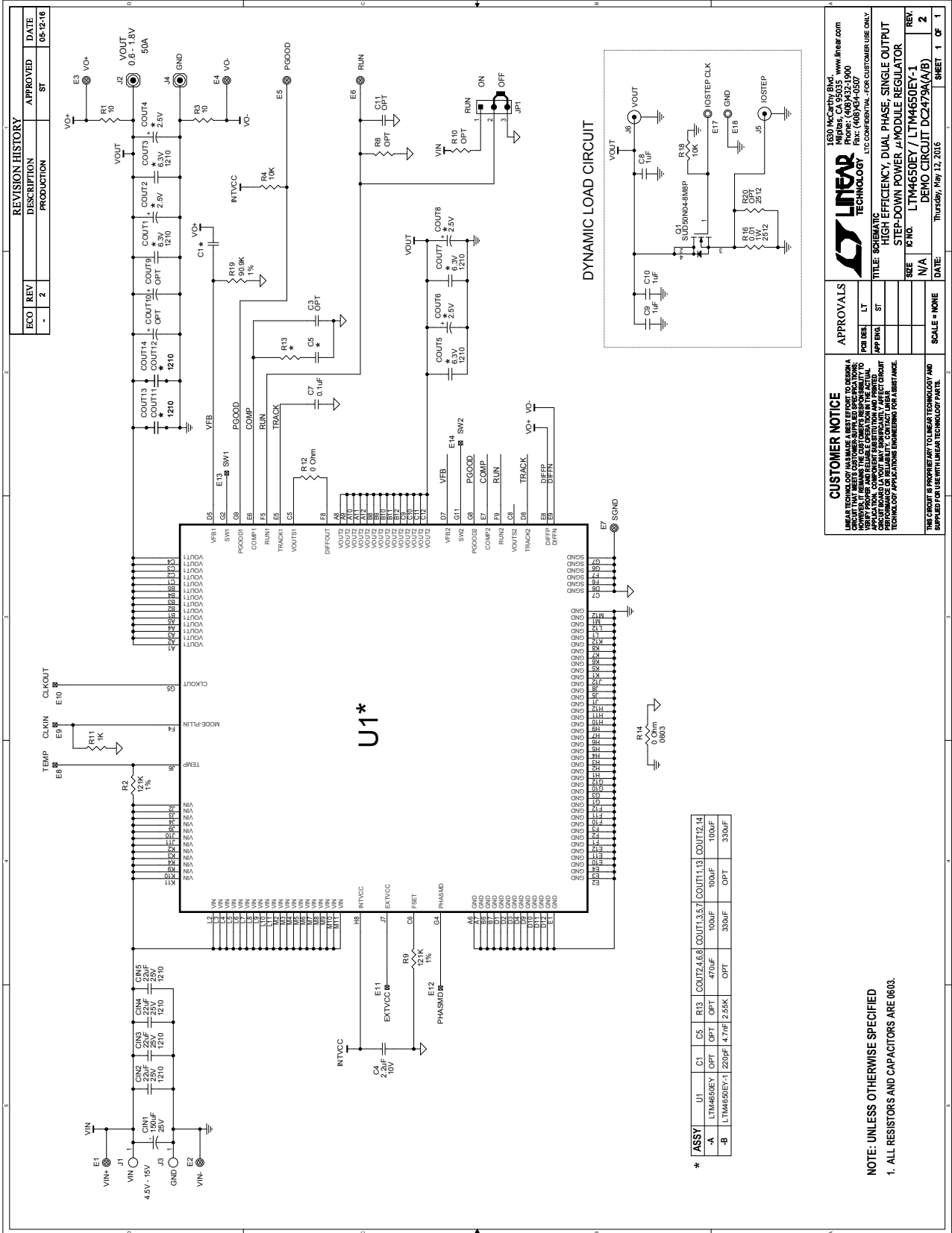
Figure 7. Thermal Performance at $V_{IN} = 12V$, $V_{OUT} = 1V$, $I_{OUT} = 50A$, $T_A = 23.8^\circ C$, No Air Flow

DEMO MANUAL DC2479A-B

PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|-----|-------------------------------------|-------------------------------------|-----------------------------------|
| Required Circuit Components | | | | |
| 1 | 1 | CIN1 | CAP, 150µF, 25V, Aluminum Electr., | SUN ELECT., 25CE150AX |
| 2 | 4 | CIN2, CIN3, CIN4, CIN5 | CAP, X5R, 22µF, 25V, 10%, 1210 | MURATA, GRM32ER61E226KE15L |
| 3 | 6 | COU11, COU12, COU13, COU14 | CAP, X5R, 330µF, 4V, 20%, 1210 | MURATA, GRM32ER60G337ME05L |
| 4 | 1 | C1 | CAP, X5R, 220pF, 50V, 10%, 0603 | AVX, 06035A221KAT2A |
| 5 | 1 | C4 | CAP, X5R, 2.2µF, 10V, 10%, 0603 | MURATA, GRM188R61A225KE34D |
| 6 | 1 | C5 | CAP, X7R, 4.7nF, 50V, 10%, 0603 | AVX, 06035C472KAT2A |
| 7 | 1 | C7 | CAP, X5R, 0.1µF, 25V, 10%, 0603 | AVX, 06033D104KAT2A |
| 8 | 3 | C8, C9, C10 | CAP, X7R, 1µF, 10V, 10%, 0603 | AVX, 0603ZC105KAT2A |
| 9 | 1 | Q1 | XSTR, SUD50N04-8M8P-4GE3 MOSFET | VISHAY, SUD50N04-8M8P-4GE3 |
| 10 | 2 | R1, R3 | RES., 10, 1%, 1/10W, 0603 | VISHAY, CRCW060310R0FKEA |
| 11 | 2 | R2, R9 | RES., 121k, 1%, 1/10W, 0603 | VISHAY, CRCW0603121KFKEA |
| 12 | 2 | R4, R18 | RES., 10k, 1%, 1/10W, 0603 | VISHAY, CRCW060310K0FKEA |
| 13 | 1 | R11 | RES., 1k, 1%, 1/10W, 0603 | VISHAY, CRCW06031K00FKEA |
| 14 | 1 | R13 | RES., 2.55k, 1%, 1/10W, 0603 | VISHAY, CRCW060320K55FKEA |
| 15 | 1 | R16 | RES., 0.01Ω, 1W, 2512 | VISHAY, WSL2512R0100FEA |
| 16 | 1 | R19 | RES., 90.9k, 1%, 1/10W, 0603 | VISHAY, CRCW060390K9FKEA |
| 17 | 1 | U1 | LTM4650EY-1#PBF, 16 × 16 × 5.01 BGA | LINEAR TECH., LTM4650EY-1#PBF |
| Additional Demo Board Circuit Components | | | | |
| 1 | 0 | COU2, COU4, COU6, COU8, COU9, COU10 | CAP, OPT, SANYO-D4D | OPT |
| 2 | 0 | COU11, COU13 | CAP, OPT, 1210 | OPT |
| 3 | 0 | C3, C11 | CAP, OPT, 0603 | OPT |
| 4 | 0 | R8, R10 | RES., OPT, 0603 | OPT |
| 5 | 2 | R12, R14 | RES., 0Ω, 1/10W, 0603 | VISHAY, CRCW06030000Z0EA |
| 6 | 0 | R20 | RES., OPT, 2512 | OPT |
| Hardware: For Demo Board Only | | | | |
| 1 | 9 | E1-E7, E17, E18 | TESTPOINT, TURRET, .094" | MILL-MAX, 2501-2-00-80-00-00-07-0 |
| 2 | 0 | E8-E14 | TESTPAD SMD | TESTPAD SMD |
| 3 | 1 | JP1 | HEADER, 3 PIN 2mm SINGLE ROW | WURTH ELEKTRONIK, 620-003-111-21 |
| 4 | 2 | J1, J3 | JACK BANANA | KEYSTONE, 575-4 |
| 5 | 2 | J2, J4 | STUD, TESTPIN | PEM KFH-032-10 |
| 6 | 4 | J2, J4 (x2) | NUT, BRASS 10-32 | ANY #10-32 |
| 7 | 2 | J2, J4 | RING, LUG #10 | KEYSTONE #10 |
| 8 | 2 | J2, J4 | WASHER, TIN PLATED BRASS | ANY #10 |
| 9 | 2 | J5, J6 | CONN, BNC, 5 PINS | CONNEX 112404 |
| 10 | 1 | XJP1 | SHUNT 2mm | WURTH ELEKTRONIK, 608-002-134-21 |

SCHEMATIC DIAGRAM



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DEMO MANUAL DC2479A-B

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