# LT8625SP
# 18V, 8A Synchronous Step-Down Silent Switcher with Low Noise Reference

## DESCRIPTION

Demonstration circuit 3002A is a 18V, 8A synchronous step-down Silent Switcher® 3 with ultralow noise, high efficiency and power density featuring the LT®8625SP. The input voltage range of DC3002A is 2.7V to 18V. The default demo board setting is 1V at 8A maximum DC output current. The LT8625SP is a compact, ultralow noise, ultralow emission, high efficiency and high speed synchronous monolithic step-down switching regulator. The uniquely designed combination of the ultralow noise reference and the third-generation Silent Switcher architecture enables the LT8625SP to achieve both high efficiency and excellent wideband noise performance. Minimum on-time of 15ns allows high $V_{IN}$ to low $V_{OUT}$ conversion at high frequencies.

The LT8625SP switching frequency can be programmed either via oscillator resistor or external clock over a 300kHz to 4MHz range. The default frequency of demo circuit 3002A is 2MHz. The SYNC pin on the demo board is grounded by default for low ripple pulse skip mode operation. To synchronize to an external clock, move JP1 to SYNC and apply the external clock to the SYNC terminal. Forced Continuous Mode (FCM) can be selected by moving JP1 shunt. Figure 1 shows the efficiency of the circuit at 5V input and 12V input in forced continuous mode operation (input from $V_{IN}$ terminal). Figure 2 shows the LT8625SP temperature rising on DC3002A demo board under 6A and 8A load conditions.

The demo board has an EMI filter installed. This EMI filter can be included by applying the input voltage at the VIN_EMI terminal. The EMI performance of the board is shown on Figure 3. The red line in Radiated EMI Performance is the CISPR32 Class B limit. In addition to the excellent EMI performance, the regulator also features ultralow noise over a wide frequency range, as is shown on Figure 4.

The LT8625SP data sheet gives a complete description of the part including operation and application information. The data sheet must be read in conjunction with this demo manual for demo circuit 3002A. The LT8625SP is assembled in a 4mm × 3mm LQFN package with exposed pads and exposed die for low thermal resistance. The layout recommendations for low EMI operation and maximum thermal performance are available in the data sheet section Low EMI PCB Layout and Thermal Considerations.

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



## PERFORMANCE SUMMARY

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

| PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| Input Voltage Range $V_{IN}$ | | 2.7 | | 18 | V |
| Output Voltage | | 0.992 | 1.0 | 1.008 | V |
| Default Switching Frequency | | 1.93 | 2.0 | 2.07 | MHz |
| Maximum Output Current | Derating is Necessary for Certain $V_{IN}$ and Thermal Conditions | 8 | | | A |
| Efficiency | $V_{IN}$ = 12V, $f_{SW}$ = 2MHz, $V_{OUT}$ = 1V at $I_{OUT}$ = 8A | | 75 | | % |

## PERFORMANCE SUMMARY

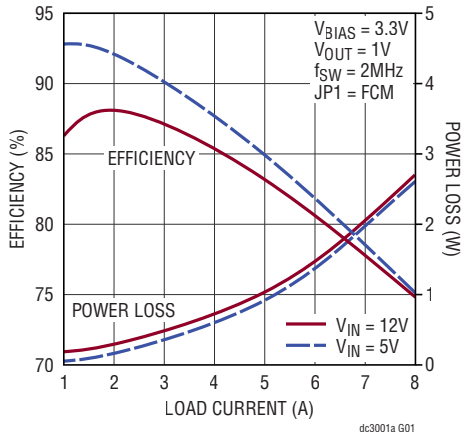



**Figure 1. LT8625SP Demo Circuit DC3002A Efficiency vs Load Current (Input from $V_{IN}$ Terminal)**

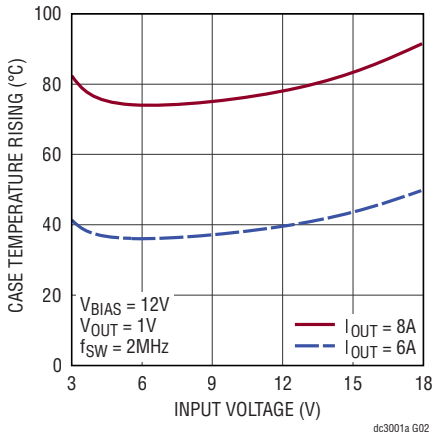



**Figure 2. Temperature Rising vs $V_{IN}$**

**Radiated EMI Performance (CISPR32 Radiated Emission Test with Class B Limits)**

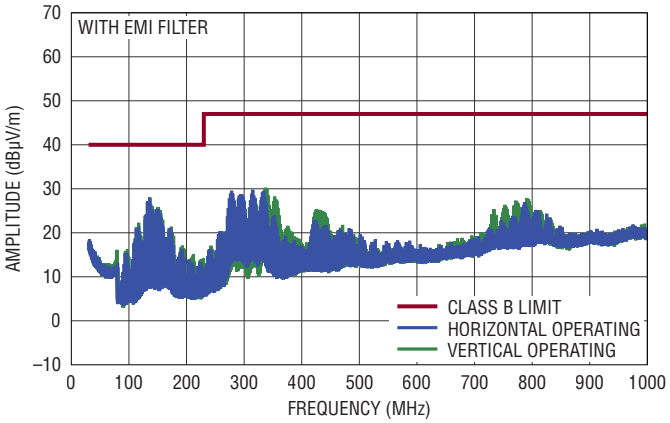



**Figure 3. LT8625SP Demo Circuit DC3002A EMI Performance (12V Input to 1.0V Output at 3A, $f_{SW}$ = 2MHz)**

**Noise Spectral Density**

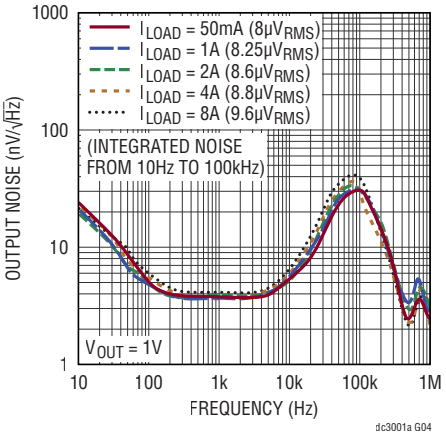



**Figure 4. LT8625SP Demo Circuit DC3002A Noise Spectral Density (12V Input to 1.0V Output, $f_{SW}$ = 2MHz)**

## QUICK START PROCEDURE

Demonstration circuit 3002A is easy to set up to evaluate the performance of LT8625SP. Please refer to Figure 5 for proper equipment setup and follow the test procedures 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 output capacitor. For input voltage ripple and the remote output voltage ripple, they can also be measured through the SMA connectors via VIN_SENSE and VO_SENSE. Figure 7 shows the output voltage ripple measured at the output capacitor C20 through VO_SENSE SMA connector.

1. Place JP1 on FCM position.
2. With power off, connect the input power supply to VIN_EMI (E1) and GND (E2). If the input EMI filter is not desired, connect the input power supply between VIN (E17) and GND (E18) turrets.
3. With power off, connect the load from VOUT (E19) to GND (E20).
4. Connect the DMM between the input test points: VIN_SENSE (E3) and SENSE_GND (E4) to monitor the input voltage. Connect DMM between VO_SENSE (E10) and SENSE_GND (E11) to monitor the output voltage.
5. Turn on the power supply at the input.

   NOTE: Make sure that the input voltage does not exceed 18V.
6. Check for the proper output voltage ($V_{OUT}$ = 1V)

   NOTE: If there is no output, temporarily disconnect the load to make sure that the load is not set too high.
7. Once the input and output voltages are properly established, adjust the load current within the operating range of 0A to 8A max per channel. Observe the output voltage regulation, output voltage ripples, switching node waveform, load transient response and other parameters.
8. An external clock can be added to the SYNC terminal when SYNC function is used (JP1 on the SYNC position). The RT resistor (R4) should be chosen to set the LT8625SP switching frequency at least 20% below the lowest SYNC frequency.

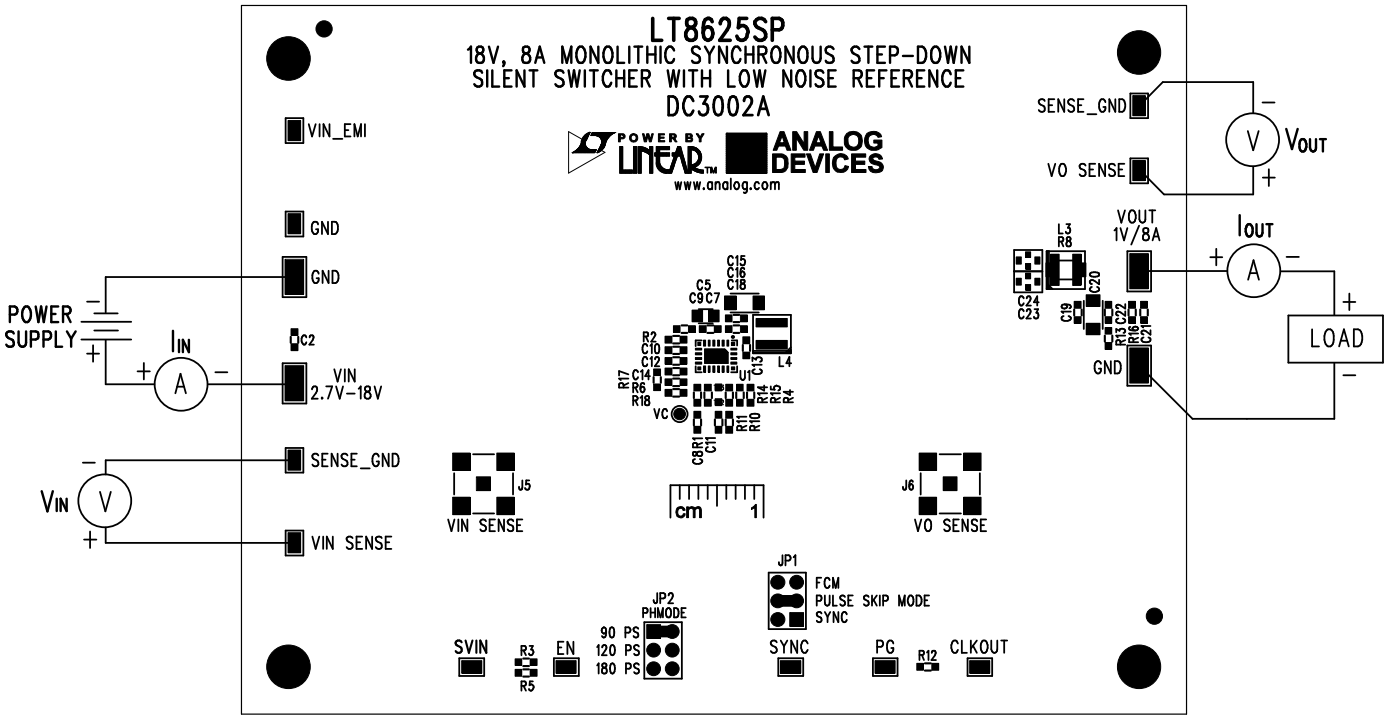



**Figure 5. Proper Measurement Equipment Setup**

## TYPICAL PERFORMANCE CHARACTERISTICS

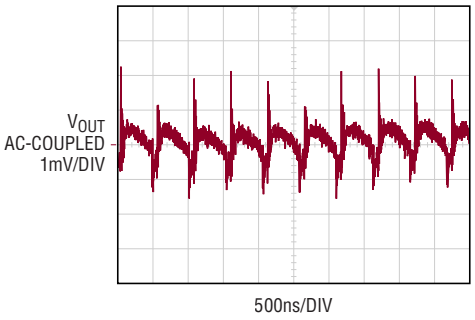



**Figure 6. LT8625SP Demo Circuit DC3002A Output Voltage Ripple Measured through J6 (12V Input, $I_{OUT}$ = 8A, Full BW)**

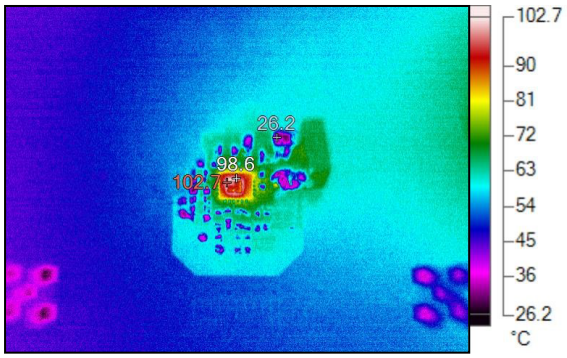



**Figure 7. Thermal Performance at $V_{IN}$ = 12V, $f_{SW}$ = 2MHz, $V_{OUT}$ = 1.0V, $I_{LOAD}$ = 8A, $T_A$ = 25°C**

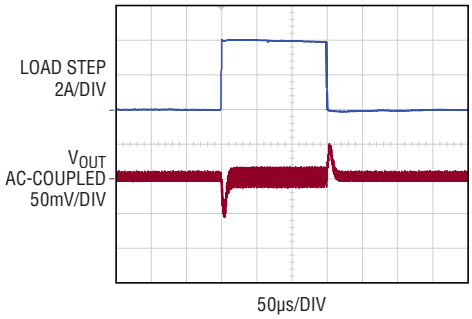



**Figure 8. Transient Responses with Load Steps 0A to 4A to 0A at dI/dt = 4A/µs**

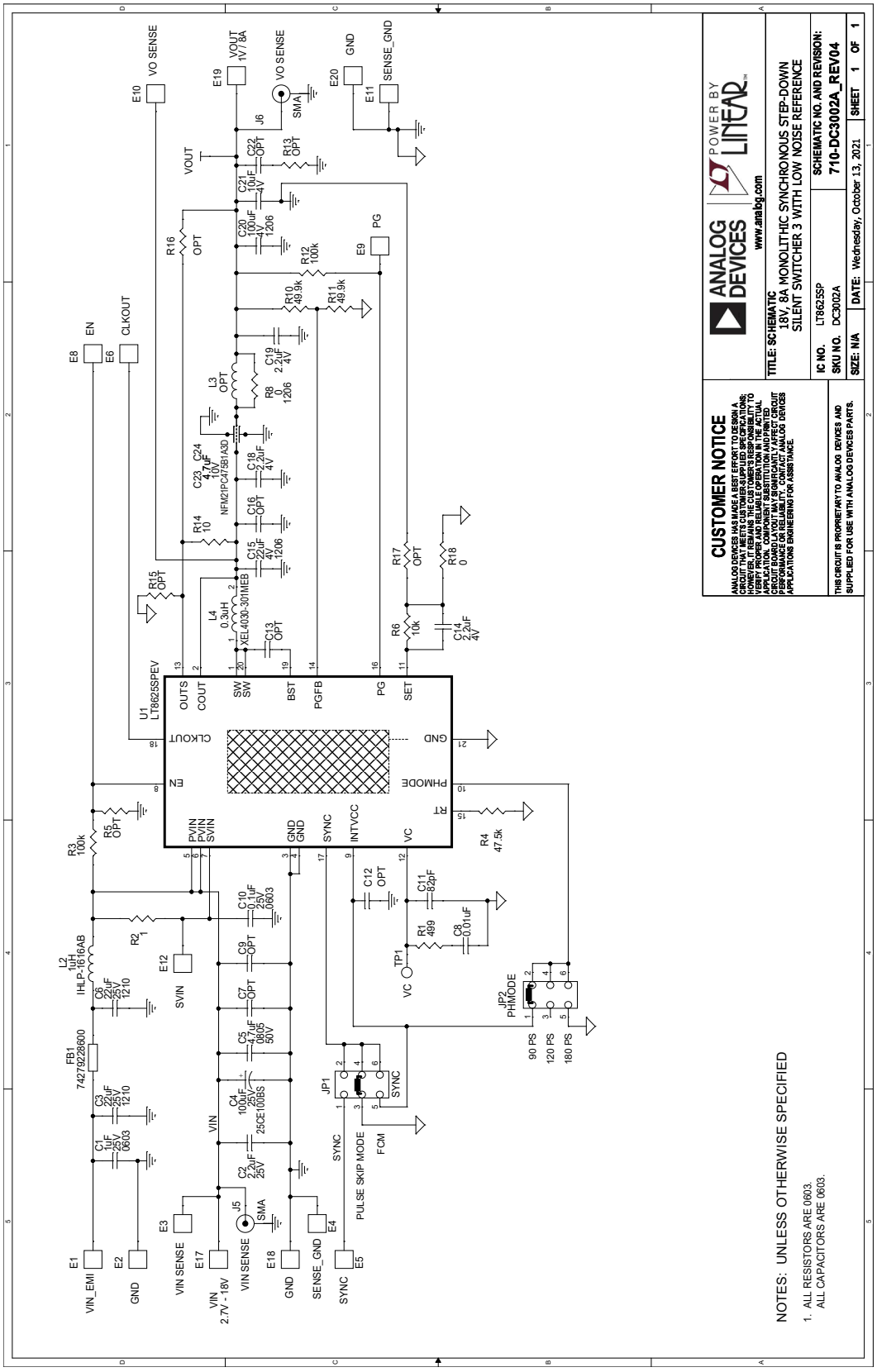
## PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|---|---|---|---|
| **Required Circuit Components** | | | | |
| 1 | 1 | C1 | CAP., 1µF, X7R, 25V, 10%, 0603 | TAIYO YUDEN, TMK107B7105KA-T |
| 2 | 1 | C2 | CAP., 2.2µF, X7S, 25V, 10%, 0603 | MURATA, GRM188C71E225KE11D |
| 3 | 2 | C3, C6 | CAP., 22µF, X7R, 25V, 10%, 1210 | AVX, 12103C226KAT2A |
| 4 | 1 | C4 | CAP., 100µF, ALUM ELECT, 25V, 20%, 6.3mm × 7.7mm, CE-BS SERIES | SUN ELECTRONIC INDUSTRIES CORP, 25CE100BS |
| 5 | 1 | C5 | CAP., 4.7µF, X7S, 50V, 10%, 0805 | MURATA, GRM21BC71H475KE11K |
| 6 | 0 | C7, C9, C12, C13, C16, C22 | CAP., OPTION, 0603 | |
| 7 | 1 | C8 | CAP., 0.01µF, X7R, 50V, 10%, 0603 | AVX, 06035C103KAT2A |
| 8 | 1 | C10 | CAP., 0.1µF, X7R, 25V, 10%, 0603 | AVX, 06033C104KAT2A |
| 9 | 1 | C11 | CAP., 82pF, X7R, 50V, 10%, 0603 | KEMET, C0603C820K5RAC7867 |
| 10 | 3 | C14, C18, C19 | CAP., 2.2µF, X7S, 4V, 10%, 0603 | TDK, CGB3B1X7S0G225K055AC |
| 11 | 1 | C15 | CAP., 22µF, X7R, 4V, 10%, 1206, AEC-Q200 | TAIYO YUDEN, AMK316AB7226KLHT |
| 12 | 1 | C20 | CAP., 100µF, X5R, 4V, 20%, 1206 | TAIYO YUDEN, AMK316BJ107ML-T |
| 13 | 1 | C21 | CAP., 10µF, X7S, 4V, 20%, 0603 | TDK, C1608X7S0G106M080AB |
| 14 | 2 | C23, C24 | CAP., 4.7µF, FEEDTHRU, 10V, 20%, 0805, 3-TERM, SMD, EMI FILTER, 6A | MURATA, NFM21PC475B1A3D |
| 15 | 11 | E1-E6, E8-E12 | TEST POINT, BRASS CONTACT, TIN PLATING, 2.00mm × 1.20mm × 1.40mm, VERT, SMT, NATURAL | HARWIN, S2751-46R |
| 16 | 4 | E17-E20 | TEST POINT, SILVER PLATE, PHOSPHOR BRONZE, 3.81mm × 2.03mm, 2.29mm H, SMT | KEYSTONE, 5019 |
| 17 | 1 | FB1 | IND., 60Ω AT 100MHz, PWR, FERRITE BEAD, 25%, 5100mA, 15mΩ, 0603 | WURTH ELEKTRONIK, 74279228600 |
| 18 | 2 | J5, J6 | CONN., RF/COAX, SMA JACK, FEMALE, 1 PORT, VERT, ST, SMT, 50Ω, Au | MOLEX, 0732511350 |
| 19 | 2 | JP1, JP2 | CONN., HDR, MALE, 2 × 3, 2mm, VERT, ST, THT | WURTH ELEKTRONIK, 62000621121 |
| 20 | 1 | L2 | IND., 1µH, PWR, SHIELDED, 20%, 4A, 52.5mΩ, 1616AB, IHLP-01 SERIES | VISHAY, IHLP1616ABER1R0M01 |
| 21 | 0 | L3 | IND., OPTION | |
| 22 | 1 | L4 | IND., 0.3µH, PWR, SHIELDED, 20%, 18.9A, 3.1mΩ, 4.3mm × 4.3mm, XEL4030, AEC-Q200 | COILCRAFT, XEL4030-301MEB |
| 23 | 4 | MP1-MP4 | STANDOFF, NYLON, SNAP-ON, 0.375" | KEYSTONE, 8832 |
| 24 | 1 | R1 | RES., 499Ω, 1%, 1/10W, 0603, AEC-Q200 | VISHAY, CRCW0603499RFKEA |
| 25 | 1 | R2 | RES., 1Ω, 1%, 1/10W, 0603, AEC-Q200 | VISHAY, CRCW06031R00FKEA |

## PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|---|---|---|---|
| 26 | 2 | R3, R12 | RES., 100k, 1%, 1/10W, 0603, AEC-Q200 | VISHAY, CRCW0603100KFKEA |
| 27 | 1 | R4 | RES., 47.5k, 1%, 1/10W, 0603 | VISHAY, CRCW060347K5FKEA |
| 28 | 0 | R5, R13-R17 | RES., OPTION, 0603 | |
| 29 | 1 | R6 | RES., 10k, 1%, 1/10W, 0603, AEC-Q200 | VISHAY, CRCW060310K0FKEA |
| 30 | 1 | R8 | RES., 0Ω, 3/4W, 1206, PULSE PROOF, HIGH PWR, AEC-Q200 | VISHAY, CRCW12060000Z0EAHP |
| 31 | 2 | R10, R11 | RES., 49.9k, 1%, 1/10W, 0603 | VISHAY, CRCW060349K9FKEA |
| 32 | 1 | R18 | RES., 0Ω, 1/10W, 0603, AEC-Q200 | VISHAY, CRCW06030000Z0EA |
| 33 | 1 | U1 | IC, SYN. STEP-DOWN Silent Switcher, LQFN-20 | ANALOG DEVICES, LT8625SPJV#TRMPBF |
| 34 | 2 | XJP1, XJP2 | CONN., SHUNT, FEMALE, 2 POS, 2mm | WURTH ELEKTRONIK, 60800213421 |

# SCHEMATIC DIAGRAM



## REVISION HISTORY

| REV | DATE | DESCRIPTION | PAGE NUMBER |
|---|---|---|---|
| A | 5/24 | Initial release | — |

**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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