ANALOG DEVICES LT8625SP Silent Switcher with Low Noise Reference Instruction Manual

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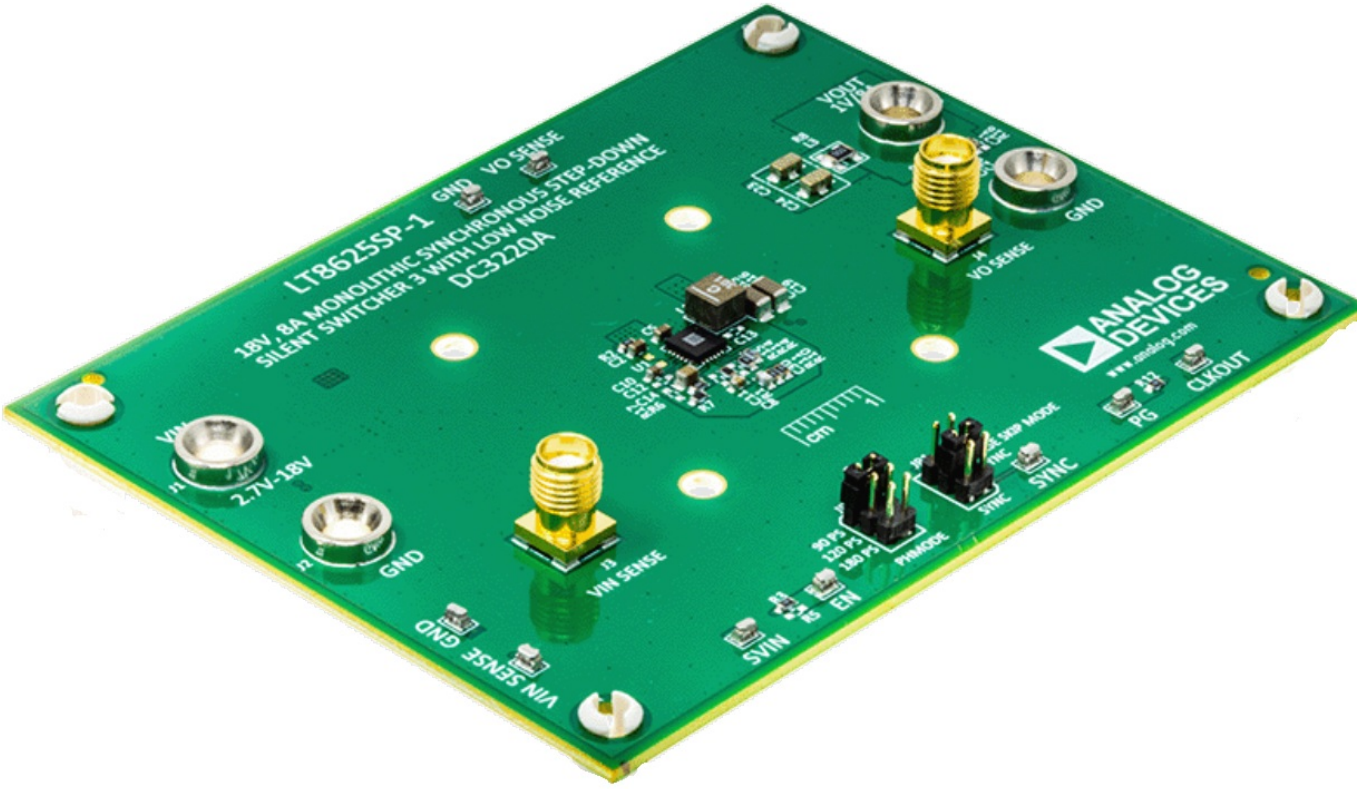


Contents

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 VIN to low VOUT 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 VIN 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

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range VIN		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 VIN and Thermal Conditions	8			A
Efficiency	VIN = 12V, fSW = 2MHz, VOUT = 1V at IOUT = 8A	75			%

PERFORMANCE SUMMARY

Figure 1. LT8625SP Demo Circuit DC3002A
Efficiency vs Load Current (Input from VIN Terminal)

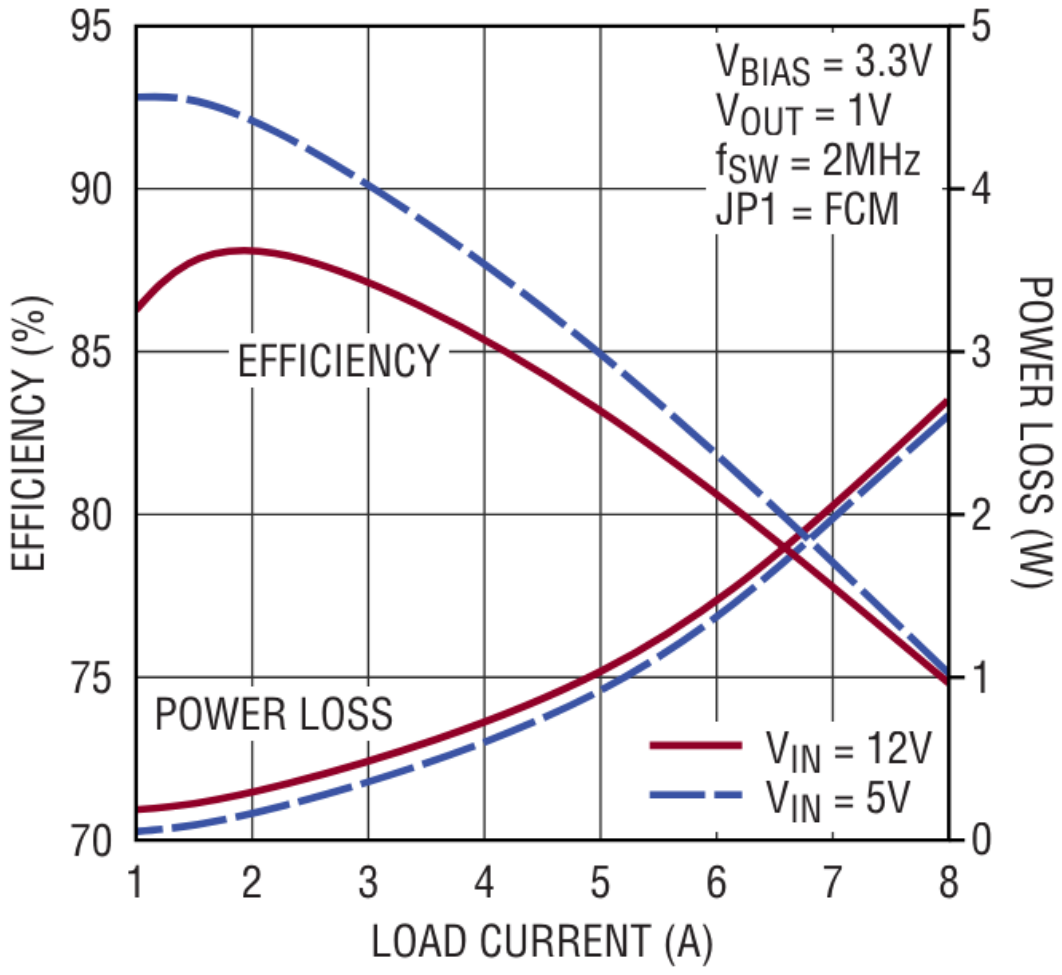


Figure 2. Temperature Rising vs VIN

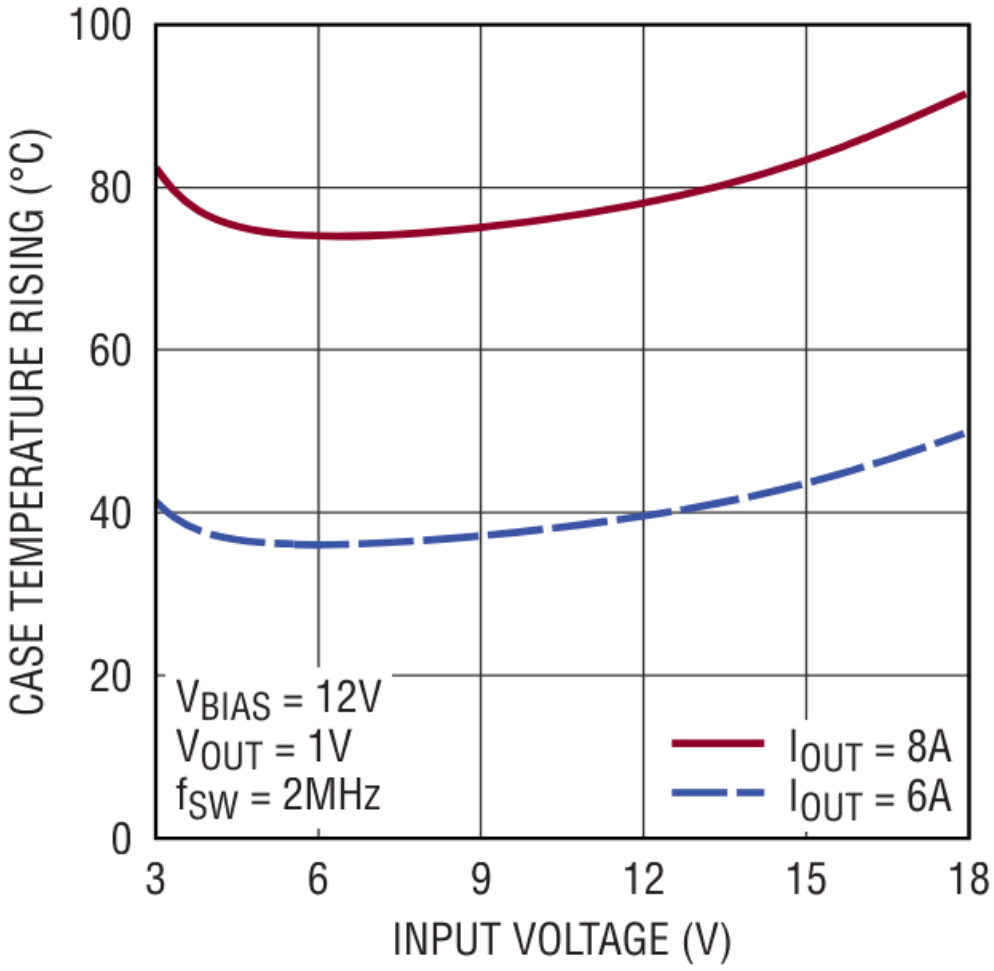


Figure 3. LT8625SP Demo Circuit DC3002A EMI Performance (12V Input to 1.0V Output at 3A, fSW = 2MHz)

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

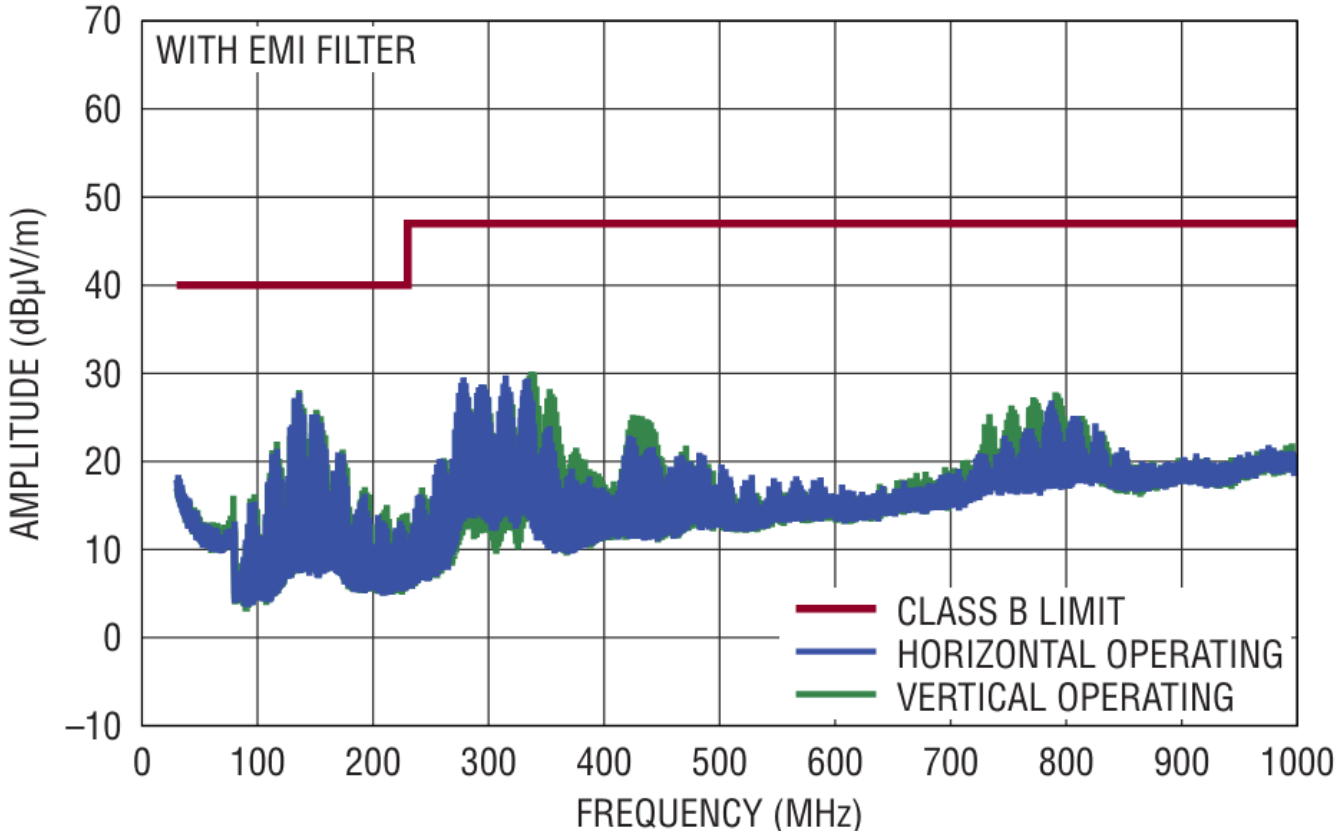
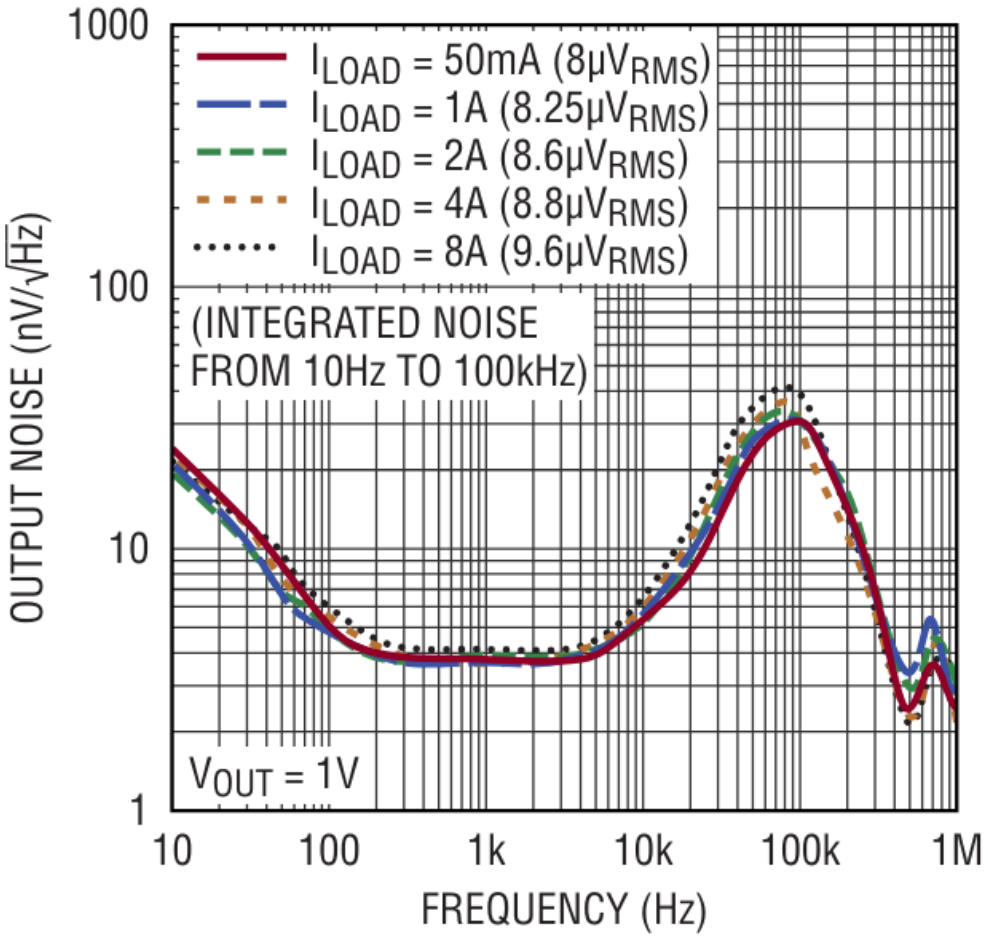


Figure 4. LT8625SP Demo Circuit DC3002A Noise Spectral Density (12V Input to 1.0V Output, fSW = 2MHz)

Noise Spectral Density

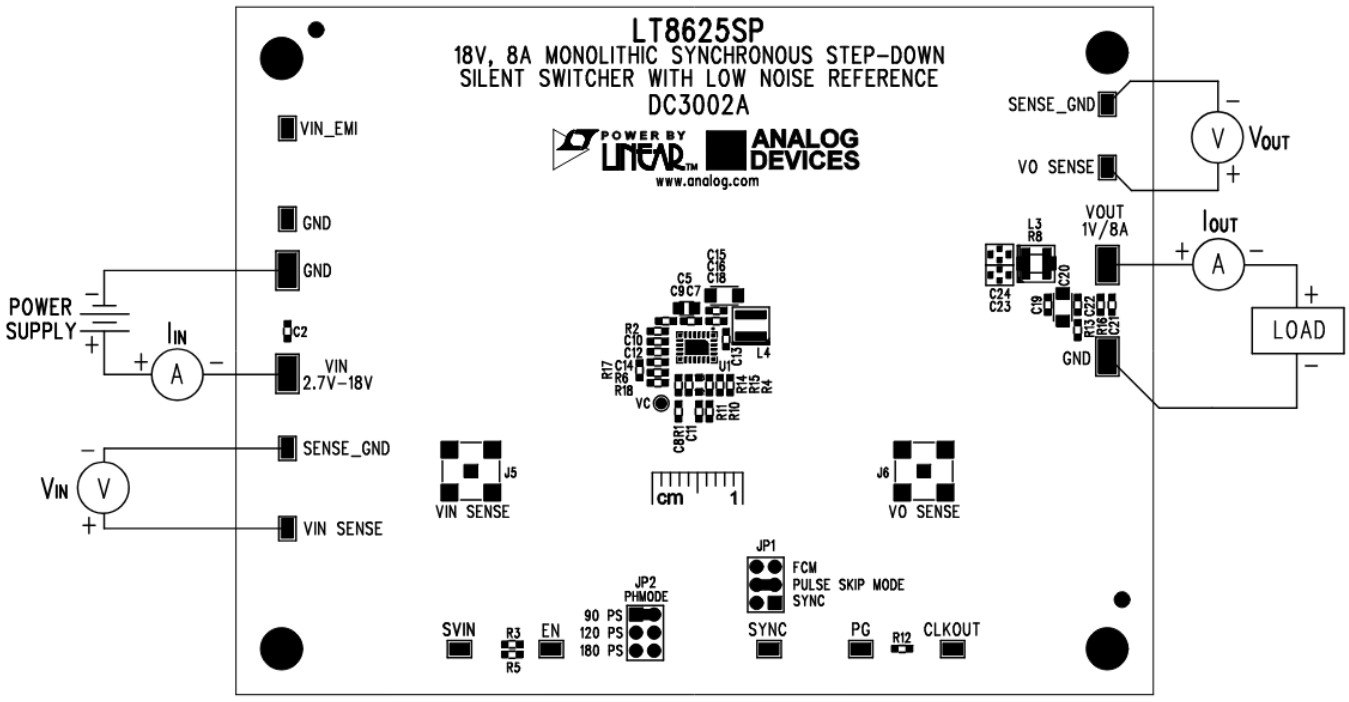


QUICK START PROCEDURE

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 (VOUT = 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.



TYPICAL PERFORMANCE CHARACTERISTICS

Figure 6. LT8625SP Demo Circuit DC3002A Output Voltage Ripple Measured through J6 (12V Input, IOUT = 8A, Full BW)

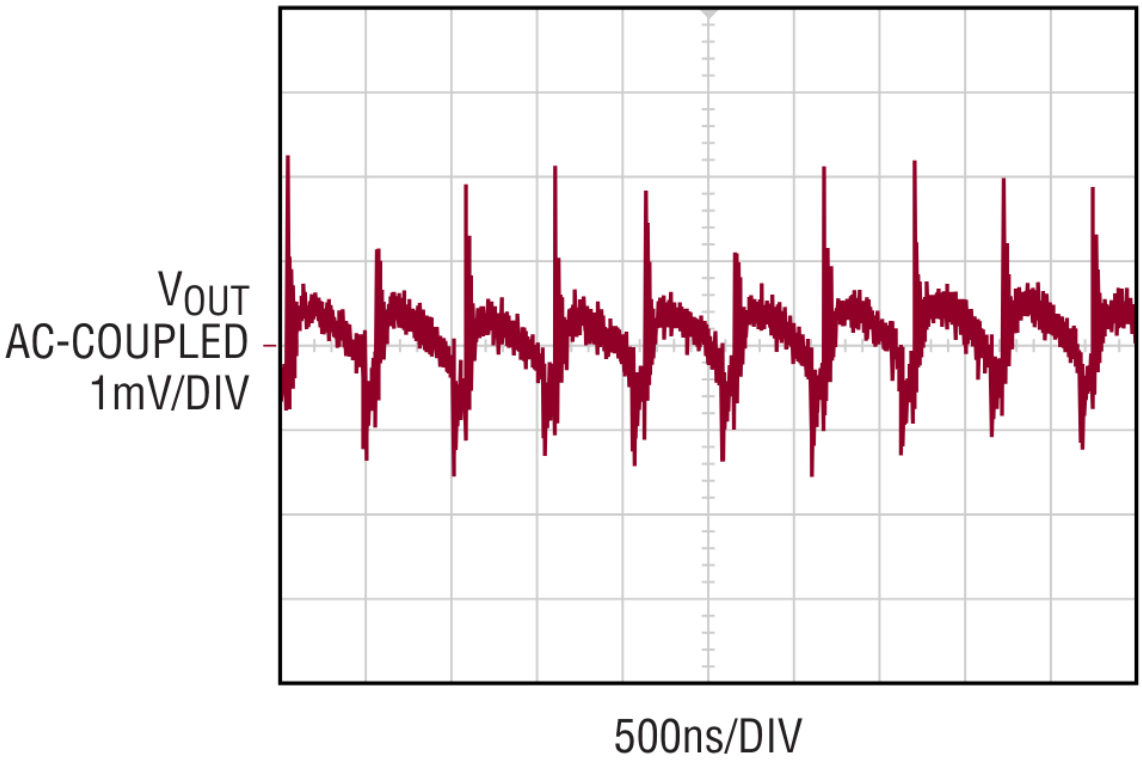


Figure 7. Thermal Performance at VIN = 12V, fSW = 2MHz, VOUT = 1.0V, ILOAD = 8A, TA = 25°C

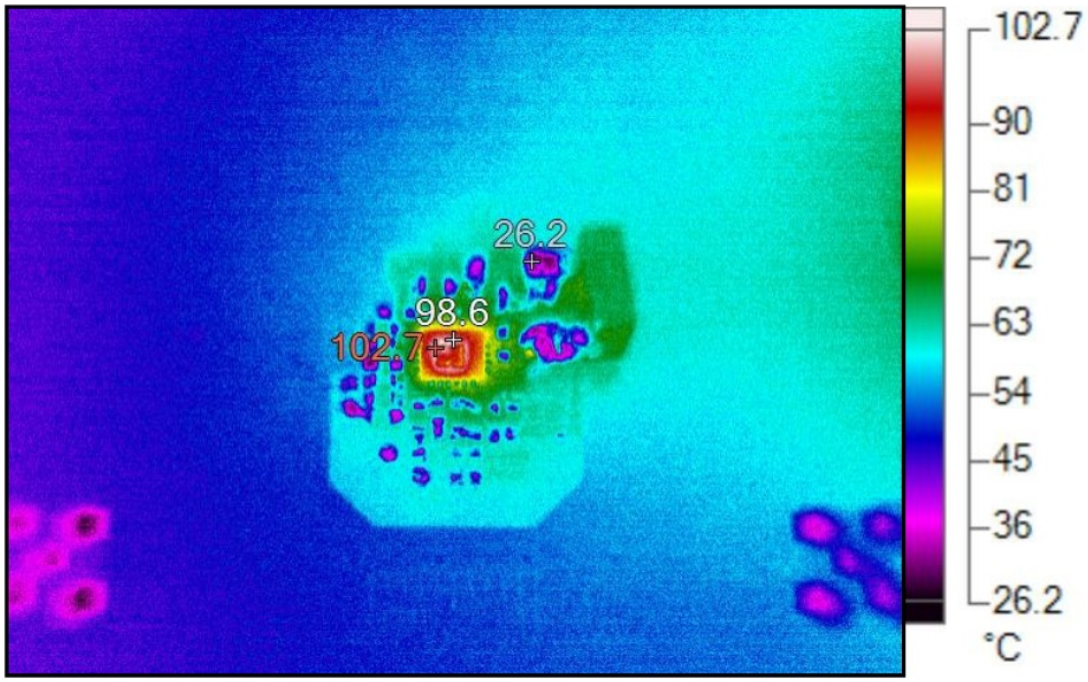
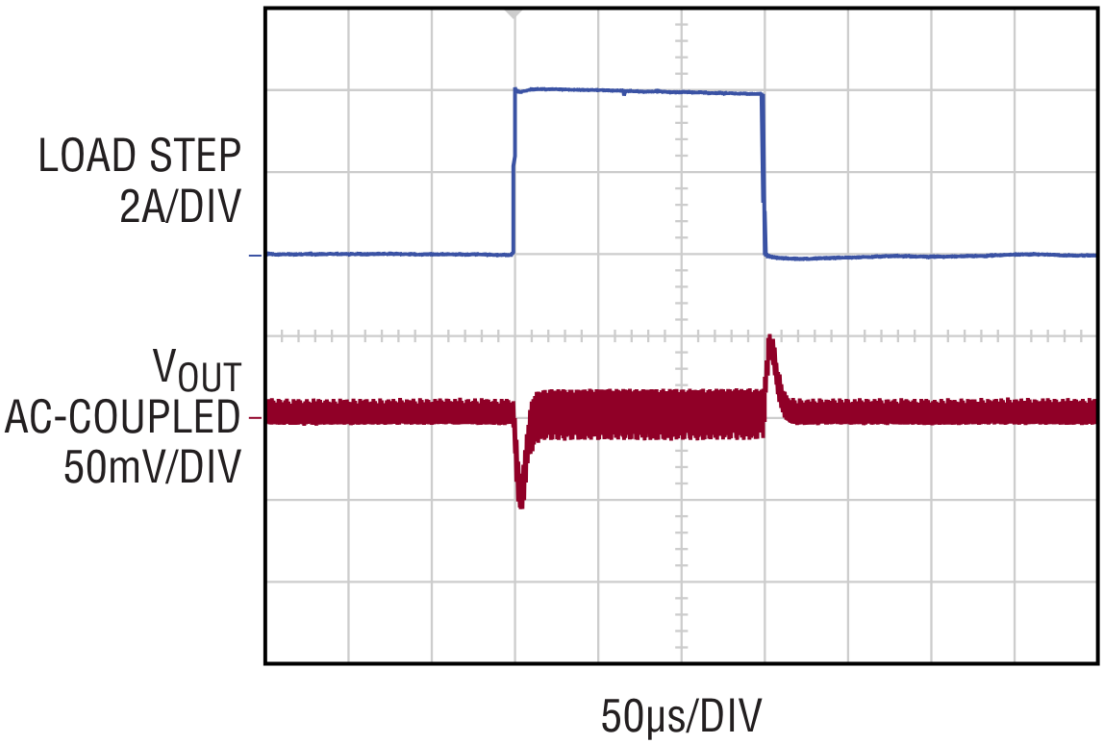


Figure 8. Transient Responses with Load Steps 0A to 4A to 0A at dI/dt = 4A/µs



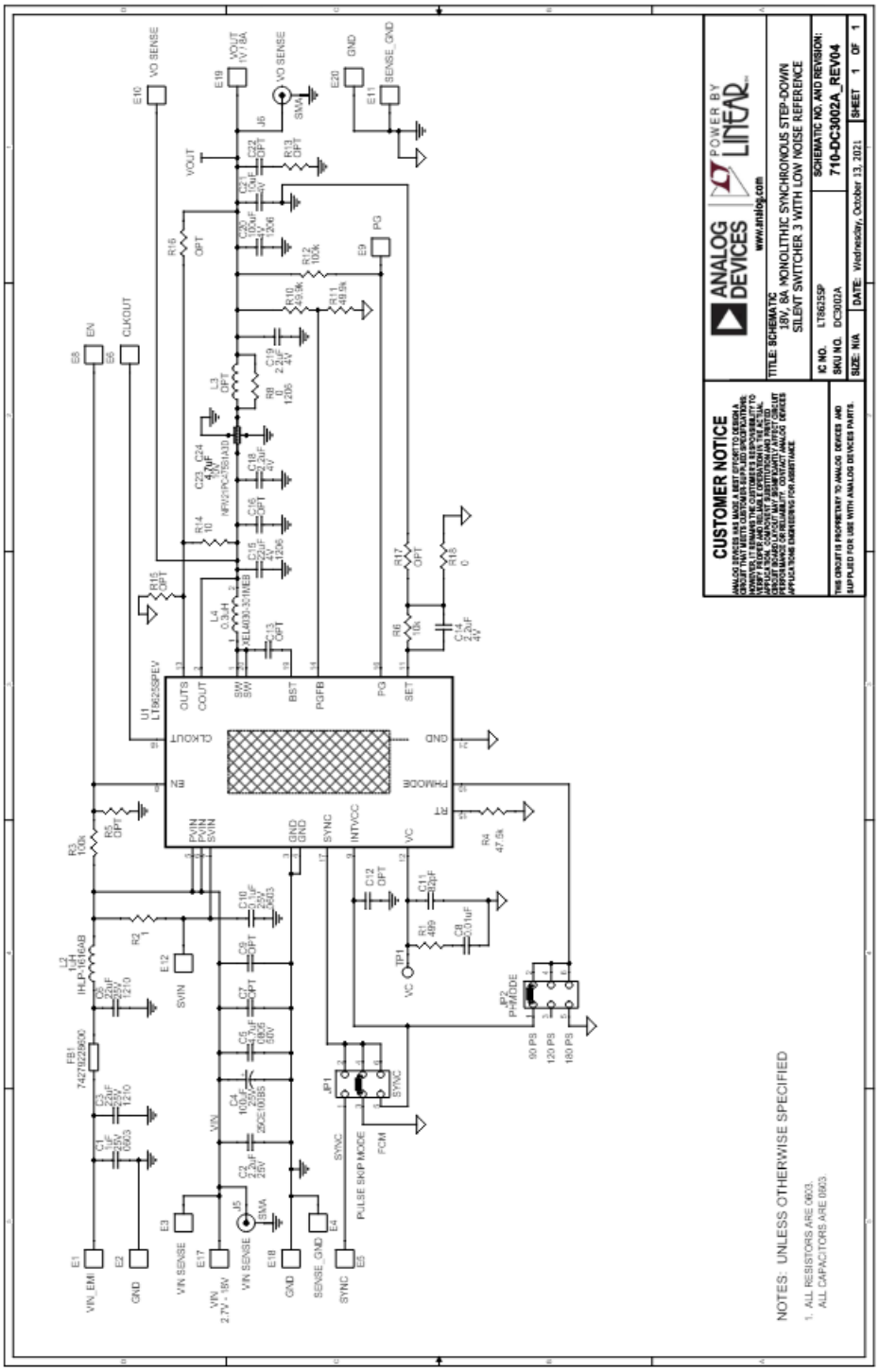
PARTS LIST

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, 2.29 mm 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

ITEM	QTY	**REFERENCE**	**PART** DESCRIPTION	**MANUFACTURER/PARTNUMBER**
26	2	R3. R12	RES., 100k, 1%, 1/10W, 0603, AEC- 0200	VISHAYC, RCW0603100KFKEA
27	1	R4	RES., 47.Sk, 1%,1/10W. 0603	VISHAYC. RCW060347K5FKEA
28	0	RS, R13·R17	RES., OPTION, 0603	
29	1	R6	RES., 10k, 1%.1/10W, 0603, AEC-0200	VISHAYC. RCW060310KOFKEA
30	1	R8	RES., OQ, 3/4W, 1206, PULSE PROOF, HIGH PWR, AEC·0200	VISHA,YCRCWl206COOOZOEA HP
31	2	Rl 0, R11	RES., 49.9k,1%,1/1OW, 0603	VISHAYC. RCW060349K9FKEA
32	1	RIB	RES., OQ, 1/10W, 0603, AEC·0 200	VISHAYC, RCW06030000ZOEA
33	1	Ul	IC, SYN. STEP·DOWNSilent Switcher. LOFN•20	ANALOG DEVICES, LT8625SPJVIRTMPBF
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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Documents / Resources

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References

- **User Manual**