LT8625S
18V, 8A Synchronous Step-Down Silent Switcher with Low Noise Reference

DESCRIPTION

Demonstration circuit 3219A is a 18V, 8A synchronous step-down Silent Switcher® 3 with ultralow noise, high efficiency and power density featuring the LT®8625S. The input voltage range of DC3219A is 2.7V to 18V. The default demo board setting is 1V at 8A maximum DC output current. The LT8625S 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 LT8625S 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 LT8625S switching frequency can be programmed either via oscillator resistor or external clock over a 300kHz to 4MHz range. The default frequency of demo circuit 3219A 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 force continuous mode operation (input from VIN terminal). Figure 2 shows the LT8625S temperature rising on DC3219A 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 LT8625S 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 3219A. The LT8625S is assembled in a 4mm × 3mm LQFN package. 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	1.008	V
Default Switching Frequency		1.93	2	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		74.7		%

PERFORMANCE SUMMARY

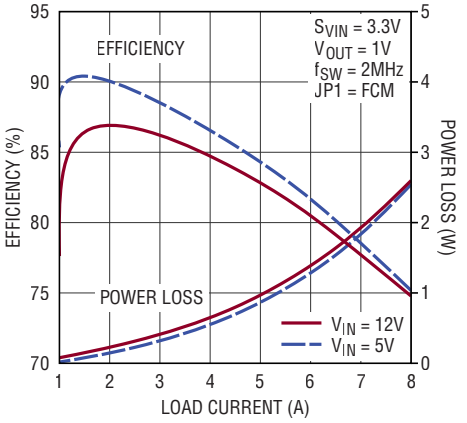


Figure 1. LT8625S Demo Circuit DC3219A Efficiency vs Load Current (Input from V_{IN} Terminal)

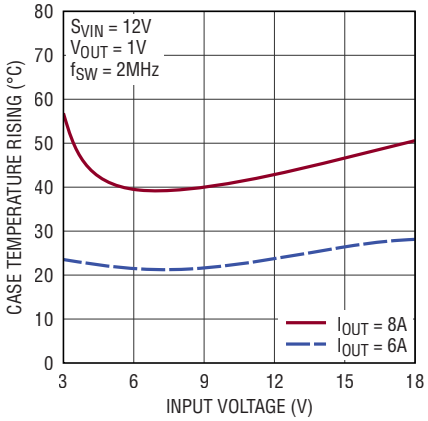


Figure 2. Temperature Rising vs V_{IN}

Radiated EMI Performance (CISPR32 Radiated Emission Test)

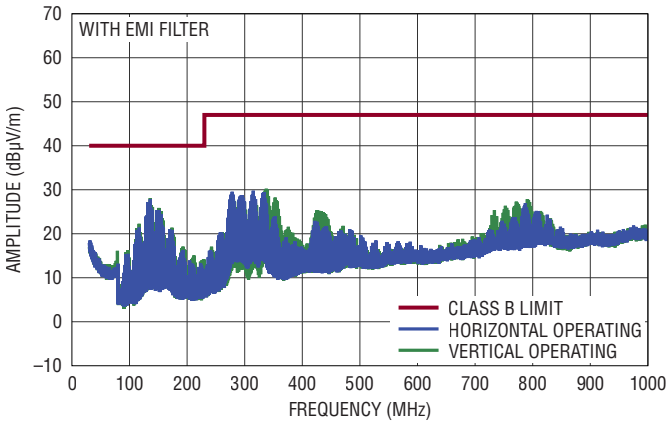


Figure 3. LT8625S Demo Circuit DC3219A EMI Performance (12V Input to 1V Output at 3A, f_{SW} = 2MHz)

Noise Spectral Density

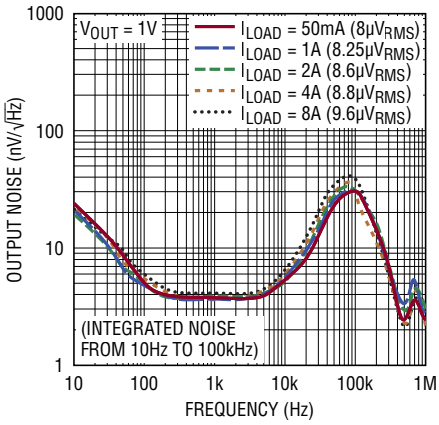


Figure 4. LT8625S Demo Circuit DC3219A Noise Spectral Density (12V Input to 1V Output, f_{SW} = 2MHz)

QUICK START PROCEDURE

Demonstration circuit 3219A is easy to set up to evaluate the performance of LT8625S. 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 6 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 R_T resistor (R4) should be chosen to set the LT8625S switching frequency at least 20% below the lowest SYNC frequency.

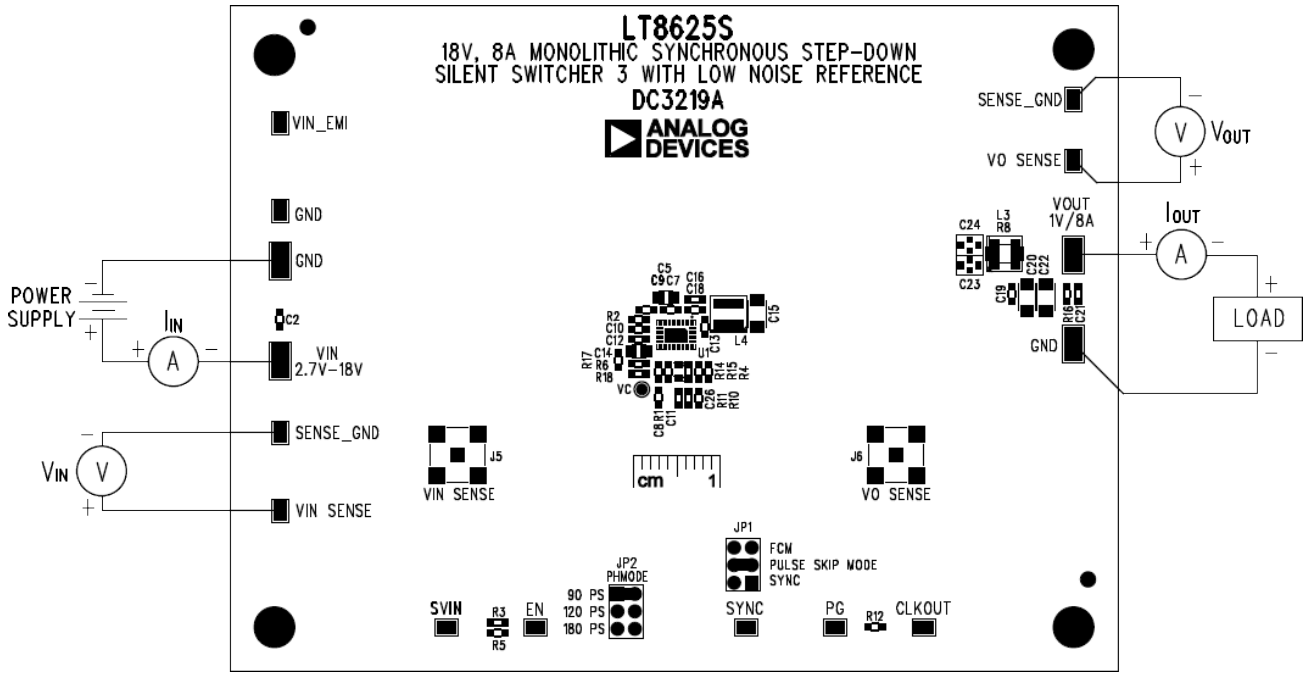


Figure 5. Proper Measurement Equipment Setup

TYPICAL PERFORMANCE CHARACTERISTICS

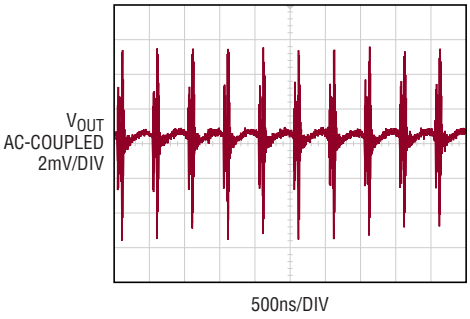


Figure 6. LT8625S Demo Circuit DC3219A Output Voltage Ripple Measured through J6 (12V Input, I_{OUT} = 8A, 200MHz BW)

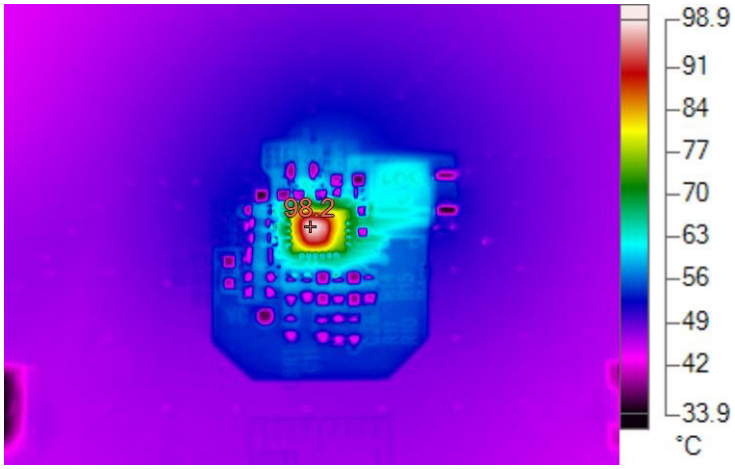


Figure 7. Thermal Performance at V_{IN} = 12V, f_{SW} = 2MHz, V_{OUT} = 1V, I_{LOAD} = 8A, T_A = 25°C

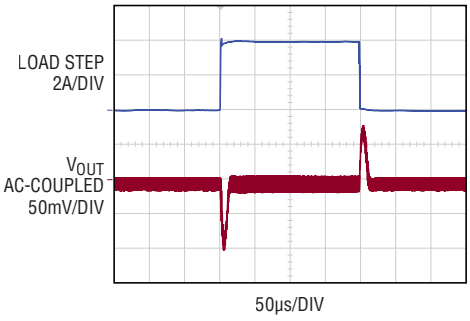


Figure 8. Transient Responses with Load Steps 0A to 4A to 0A at dI/dt = 4A/µs

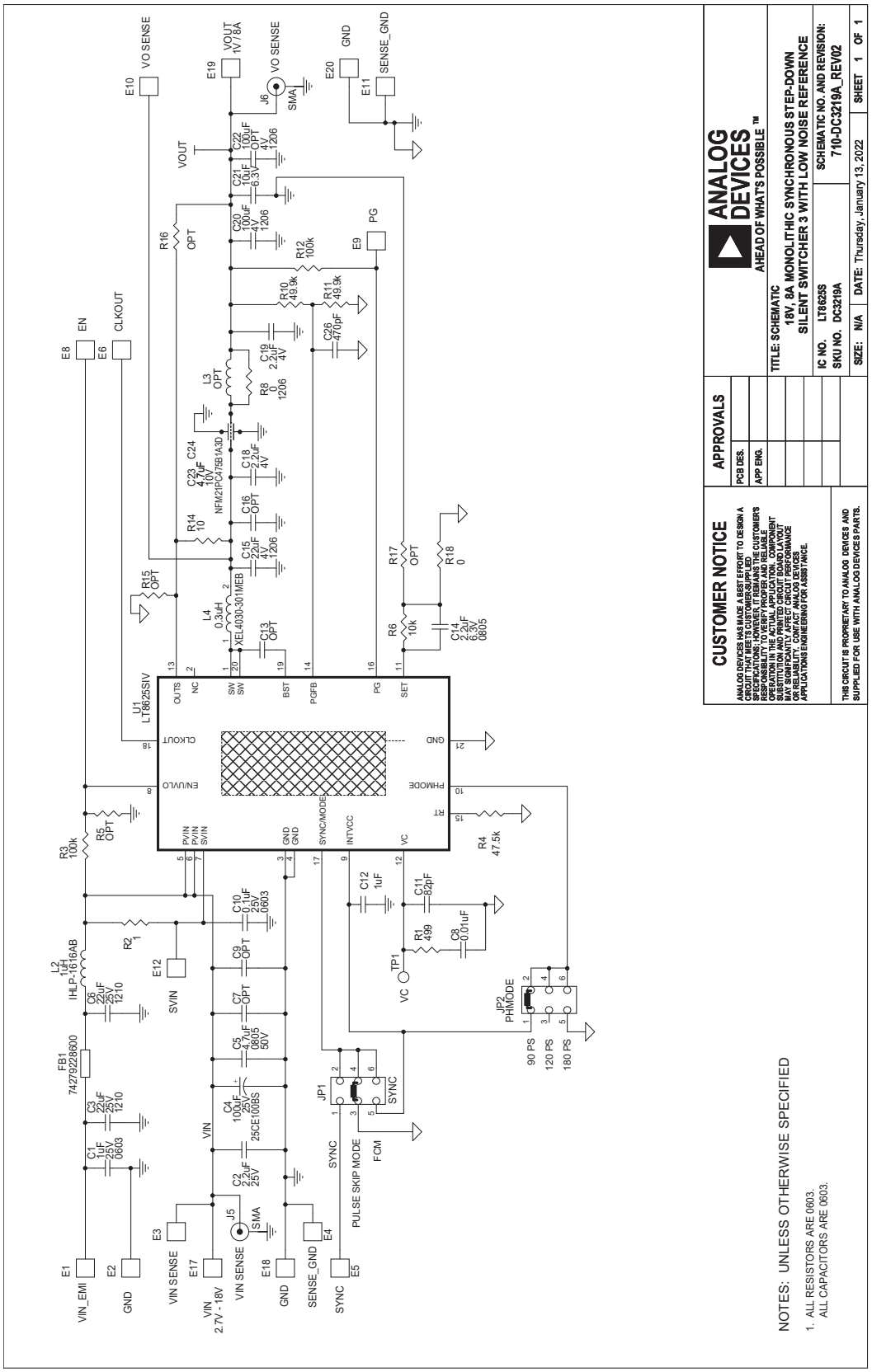
PARTS LIST

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, C13, C16	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	1	C12	CAP., 1µF, X7R, 10V, 10%, 0603	AVX, 0603ZC105KAT2A
11	1	C14	CAP., 2.2µF, X7R, 6.3V, 10%, 0805	YAGEO, CC0805KKX7R5BB225
12	1	C15	CAP., 22µF, X7R, 4V, 10%, 1206, AEC-Q200	TAIYO YUDEN, AMK316AB7226KLHT
13	2	C18, C19	CAP., 2.2µF, X7S, 4V, 10%, 0603	TDK, CGB3B1X7S0G225K055AC
14	1	C20	CAP., 100µF, X5R, 4V, 20%, 1206	TAIYO YUDEN, AMK316BJ107ML-T
15	0	C22	CAP., 100µF, X5R, 4V, 20%, 1206	TAIYO YUDEN, AMK316BJ107ML-T
16	1	C21	CAP., 10µF, X7S, 6.3V, 20%, 0603	TDK, C1608X7S0J106M080AC
17	2	C23, C24	CAP., 4.7µF, FEEDTHRU, 10V, 20%, 0805, 3-TERM, SMD, EMI FILTER, 6A	MURATA, NFM21PC475B1A3D
18	1	C26	CAP., 470pF, X7R, 10V, 10%, 0603	WURTH ELEKTRONIK, 885012206006
19	11	E1-E6, E8-E12	TEST POINT, 0805, 2mm × 1.25mm × 1.45mm, PROBE PAD, FOIL, VERT, SMT, NATURAL	TE CONNECTIVITY, 1625854-2
20	4	E17-E20	TEST POINT, SILVER PLATE, PHOSPHOR BRONZE, 3.81mm × 2.03mm, 2.29mm H, SMT	KEYSTONE, 5019
21	1	FB1	IND., 60Ω AT 100MHz, PWR, FERRITE BEAD, 25%, 5100mA, 15mΩ, 0603	WURTH ELEKTRONIK, 74279228600
22	2	J5, J6	CONN., RF/COAX, SMA JACK, FEMALE, 1PORT, VERT, ST, SMT, 50Ω, Au	MOLEX, 0732511350
23	2	JP1, JP2	CONN., HDR, MALE, 2×3, 2mm, VERT, ST, THT	WURTH ELEKTRONIK, 62000621121
24	1	L2	IND., 1µH, PWR, SHIELDED, 20%, 4A, 52.5mΩ, 1616AB, IHLP-01 Series	VISHAY, IHLP1616ABER1R0M01
25	1	L4	IND., 0.3µH, PWR, SHIELDED, 20%, 18.9A, 3.1mΩ, 4.3mm × 4.3mm, XEL4030, AEC-Q200	COILCRAFT, XEL4030-301MEB
26	4	MP1-MP4	STANDOFF, NYLON, SNAP-ON, 0.375"	KEYSTONE, 8832
27	1	R1	RES., 499Ω, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW0603499RFKEA
28	1	R2	RES., 1Ω, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW06031R00FKEA

PARTS LIST

29	2	R3, R12	RES., 100k, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW0603100KFKEA
30	1	R4	RES., 47.5k, 1%, 1/10W, 0603	VISHAY, CRCW060347K5FKEA
31	0	R5, R15-R17	RES., OPTION, 0603	
32	1	R6	RES., 10k, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW060310K0FKEA
33	1	R8	RES., 0Ω, 3/4W, 1206, PULSE PROOF, HIGH PWR, AEC-Q200	VISHAY, CRCW12060000Z0EAHP
34	2	R10, R11	RES., 49.9k, 1%, 1/10W, 0603	VISHAY, CRCW060349K9FKEA
35	1	R14	RES., 10Ω, 1%, 1/10W, 0603	VISHAY, CRCW060310R0FKEA
36	1	R18	RES., 0Ω, 1/10W, 0603, AEC-Q200	VISHAY, CRCW06030000Z0EA
37	1	U1	IC, SYN. STEP-DOWN Silent Switcher, LQFN-20	ANALOG DEVICES, LT8625SIV#PBF
38	2	XJP1, XJP2	CONN., SHUNT, FEMALE, 2-POS, 2mm	WURTH ELEKTRONIK, 60800213421

SCHEMATIC DIAGRAM



REVISION HISTORY

REV	DATE	DESCRIPTION	PAGE NUMBER
A	4/24	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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