

LT8642S 18V, 10A Synchronous Step-Down Silent Switcher 2

DESCRIPTION

Demonstration circuit 2560A is a 18V, 10A synchronous step-down Silent Switcher®2 with spread spectrum frequency modulation featuring the LT®8642S. The demo board is designed for 1.2V output from a 2.8V to 18V input. The LT8642S is a compact, ultralow emission, high efficiency, and high speed synchronous monolithic step-down switching regulator. The integrated bypass capacitors optimize all the fast current loops and make it easier to minimize EMI/EMC emissions by reducing layout sensitivity. Selectable spread spectrum mode can further improve EMI/EMC performance. Fast minimum on-time of 20ns enables high V_{IN} to low V_{OUT} conversion at high frequency.

The LT8642S switching frequency can be programmed either via a resistor or external clock over a 200kHz to 3MHz range. The default frequency of demo circuit 2560A is 2MHz. The SYNC pin on the demo board is grounded (JP1 at BURST position) by default for low ripple Burst Mode® operation. To synchronize to an external clock, move JP1 to SYNC and apply the external clock to the SYNC terminal. Spread spectrum mode and forced continuous mode can be selected respectively 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 LT8642S temperature rising on DC2658A demo board under 8A and 10A 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 (with and without EMI filter) is shown on Figure 3. The red line in Radiated EMI Performance is the CISPR32 Class B limit. The figure shows that the LT8642S circuit passes the test without the EMI filter.

The LT8642S data sheet gives a complete description of the part, operation and application information. The data sheet must be read in conjunction with this demo manual for demo circuit 2560A. The LT8642S is assembled in a 4mm × 4mm LQFN package with exposed pads 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.](#)

All registered trademarks and trademarks are the property of their respective owners.

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

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Input Supply Range		2.8		18	V
V_{OUT}	Output Voltage		1.164	1.2	1.236	V
I_{OUT}	Maximum Output Current		10			A
f_{SW}	Switching Frequency		1.925	2	2.075	MHz
EFF	Efficiency	$V_{IN} = 12V, V_{OUT} = 1.2V, I_{OUT} = 10A$		84.0		%

PERFORMANCE SUMMARY

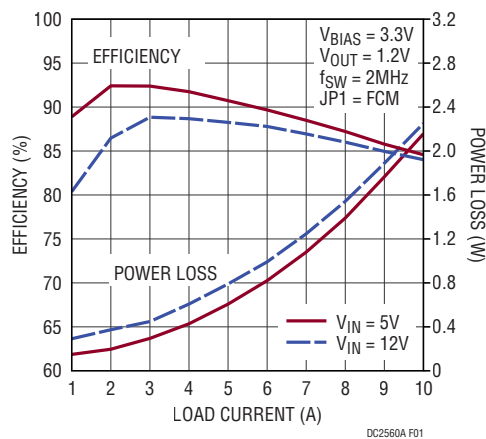


Figure 1. LT8642S Demo Circuit DC2560A Efficiency vs Load Current (Input from VIN Terminal)

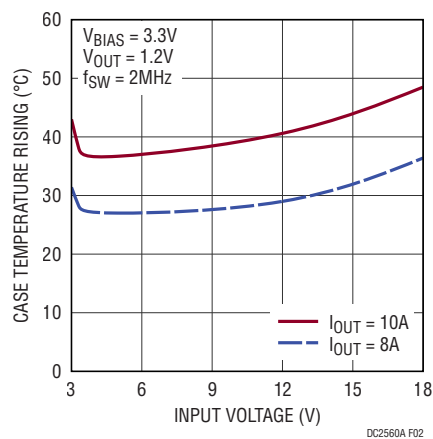
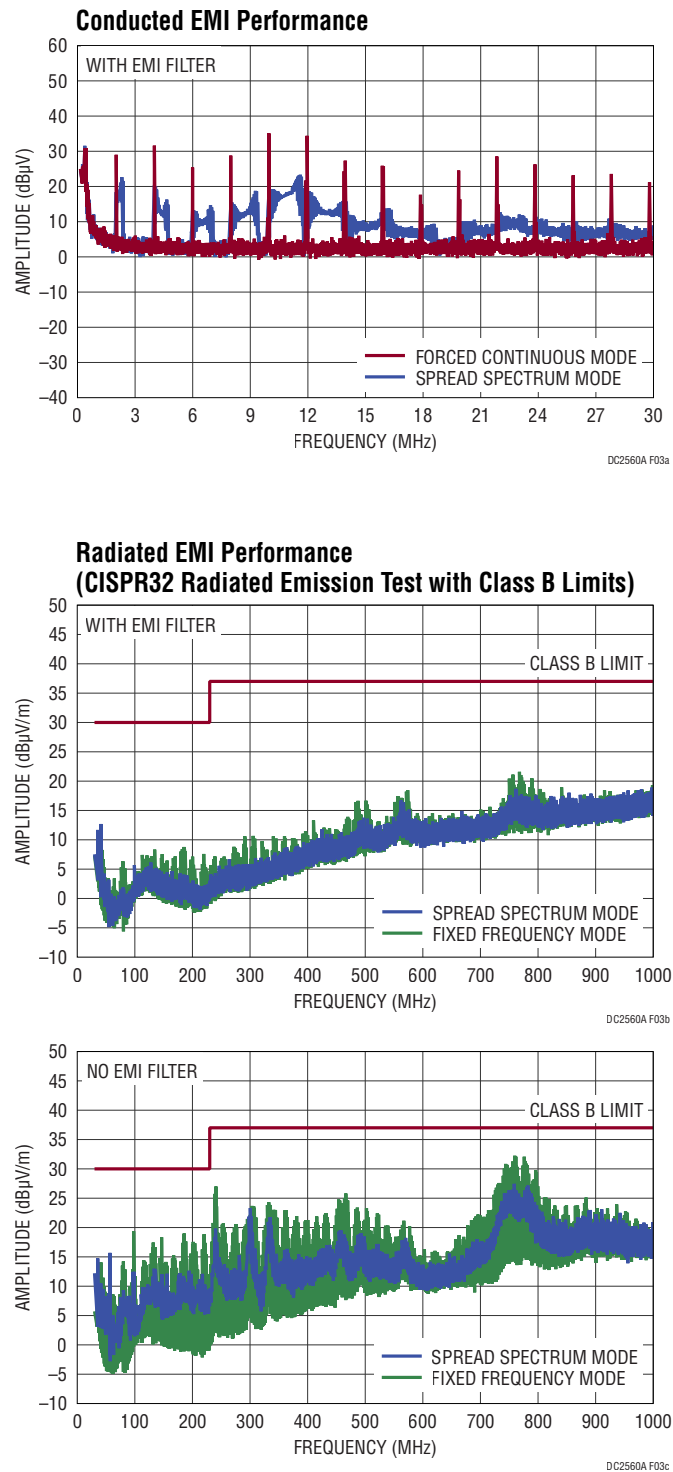


Figure 2. LT8642S Demo Circuit DC2560A Case Temperature Rising vs Input Voltage

PERFORMANCE SUMMARY



**Figure 3. LT8642S Demo Circuit DC2560A EMI Performance
(12V Input to 1.2V Output at 10A, $f_{sw} = 2\text{MHz}$)**

QUICK START PROCEDURE

Demonstration circuit 2560A is easy to set up to evaluate the performance of the LT8642S. Refer to Figure 4 for proper measurement equipment setup and follow the procedure 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. See Figure 5 for the proper scope technique. Figure 6 shows the output voltage ripple measured at the output capacitor C9.

1. Place JP1 on BURST position.
2. With power off, connect the input power supply to VIN and GND. If the input EMI filter is desired, connect the input power supply to VIN_EMI and GND.
3. With power off, connect the load from VOUT to GND.
4. To read the input voltage and output voltage accurately, the voltage meters should be connected to VIN SENSE and VO SENSE turret pins.

5. Turn on the power at the input.

NOTE. Make sure that the input voltage does not exceed 18V.

6. Check for the proper output voltage ($V_{OUT} = 1.2V$).

NOTE. If there is no output, temporarily disconnect the load to make sure that the load is not set too high or is shorted.

7. Once the proper output voltage is established, adjust the load within the operating ranges and observe the output voltage regulation, ripple voltage, efficiency and other parameters.
8. An external clock can be added to the SYNC terminal when SYNC function is used (JP1 on the SYNC position). Please make sure that R2 should be chose to set the LT8642S switching frequency equal to or below the lowest SYNC frequency. JP1 can also set LT8642S in spread spectrum mode (JP1 on the SPREAD-SPECTRUM position) or forced continuous mode (JP1 on the FCM position).

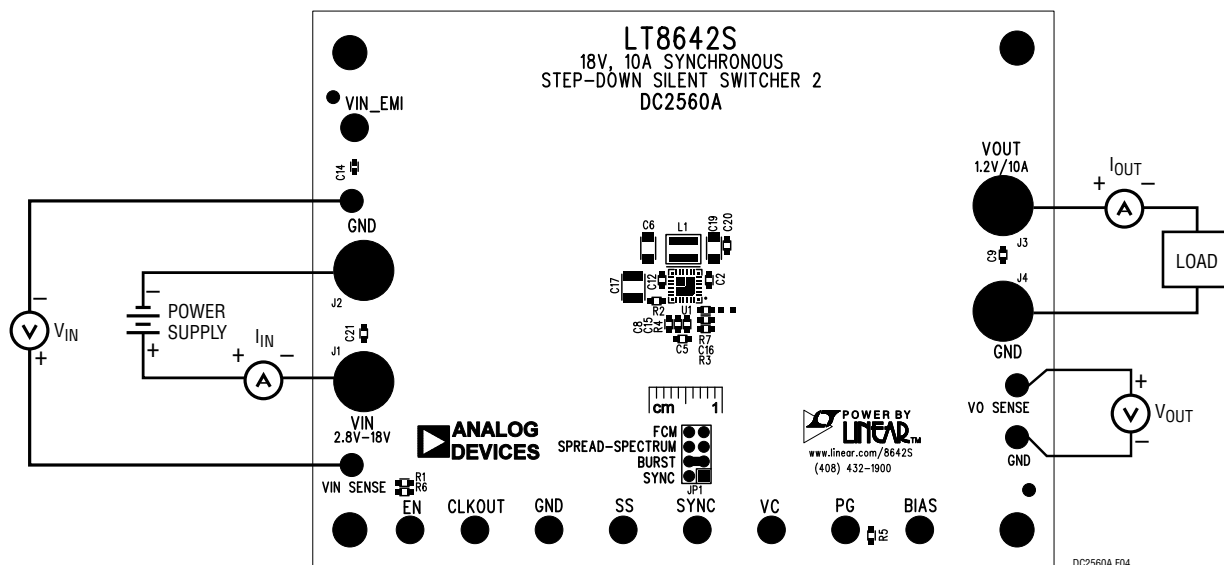


Figure 4. Proper Measurement Equipment Setup

QUICK START PROCEDURE

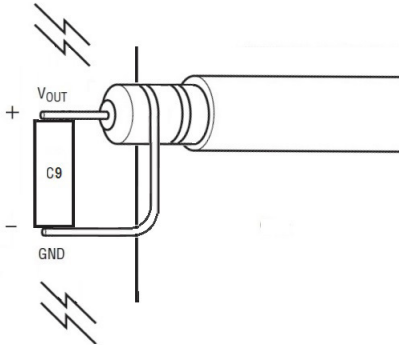


Figure 5. Measuring Output Ripple at Output Capacitor C9

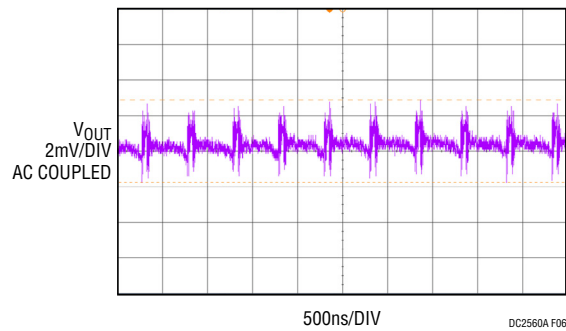


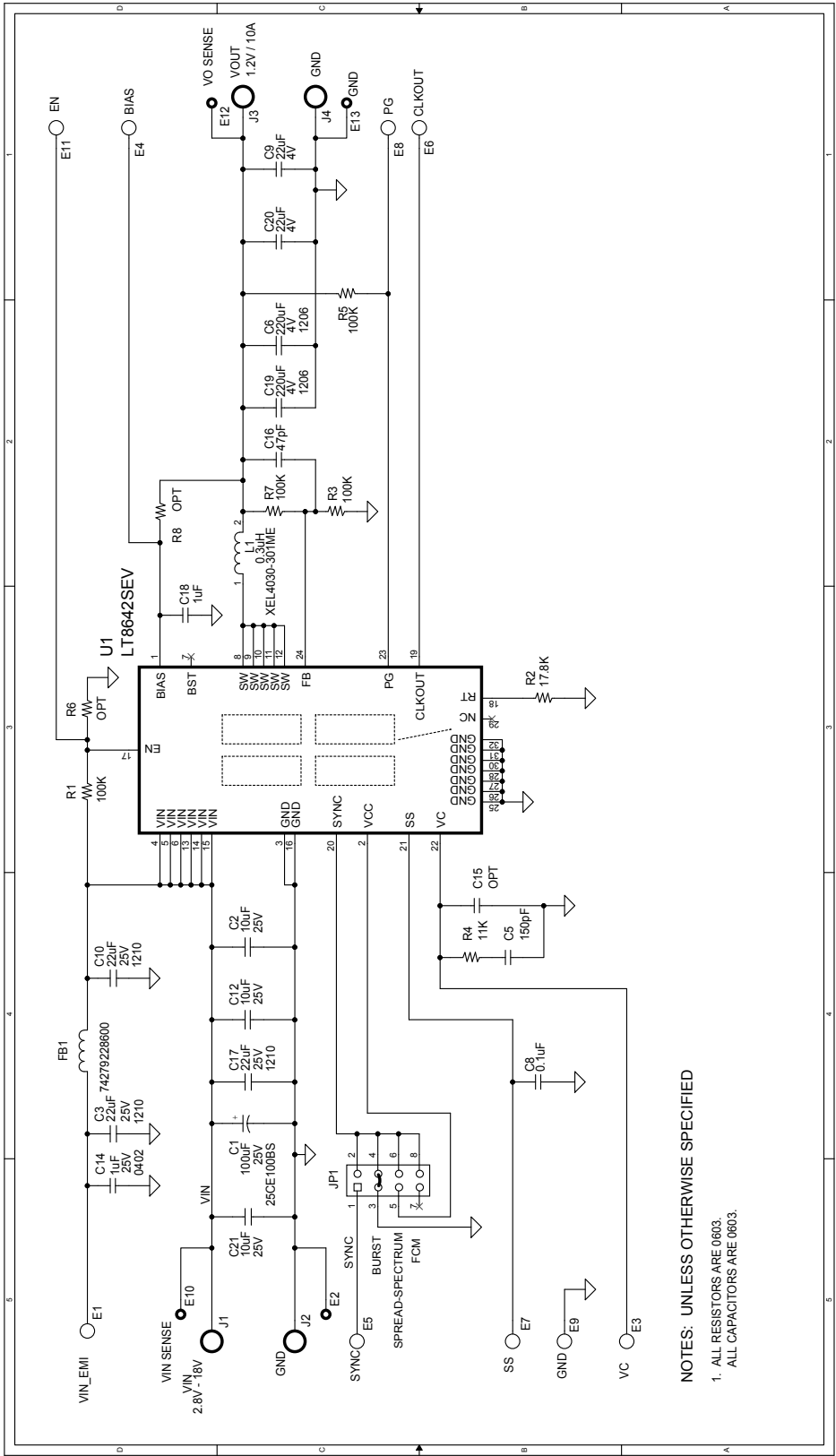
Figure 6. LT8642S Demo Circuit DC2560A Output Voltage Ripple
(12V Input, $I_{OUT} = 10A$, Full BW)

DEMO MANUAL DC2560A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C2, C12	CAP, X5R, 10 μ F, 25V, 20%, 0603	MURATA, GRM188R61E106MA73D
2	1	C5	CAP, C0G, 150pF, 50V, 5%, 0603	MURATA, GRM1885C1H151JA01D
3	2	C6, C19	CAP, X5R, 220 μ F, 4V, 20% 1206	MURATA, GRM31CR60G227ME11L
4	1	C8	CAP, X7R, 0.1 μ F, 16V, 10%, 0603	MURATA, GRM188R71C104KA01D
5	2	C9, C20	CAP, X5R, 22 μ F, 4V, 20%, 0603	MURATA, GRM186R60G226ME15D
6	1	C16	CAP, NP0, 47pF, 50V, 5%, 0603	MURATA, GRM1885C1H470JA01D
7	1	C17	CAP, X7R, 22 μ F, 25V, 10%, 1210	MURATA, GRM32ER71E226KE15L
8	1	L1	INDUCTOR, 0.3 μ H	COILCRAFT, XEL4030-301MEB
9	4	R1, R3, R5, R7	RES., CHIP, 100k, 1/10W, 1%, 0603	VISHAY, CRCW0603100KFKEA
10	1	R2	RES., CHIP, 17.8k, 1/10W, 1%, 0603	VISHAY, CRCW060317K8FKEA
11	1	R4	RES., CHIP, 11k, 1/10W, 1%, 0603	VISHAY, CRCW060311K0FKEA
12	1	U1	I.C., STEP-DOWN SWITCHER, 4mm x 4mm LQFN	ANALOG DEVICES., LT8642SEV#PBF
Additional Demo Board Circuit Components				
1	1	C1	CAP, ALUM 100 μ F, 25V	SUN ELECT., 25CE100BS
2	2	C3, C10	CAP, X7R, 22 μ F, 25V, 10%, 1210	MURATA, GRM32ER71E226KE15L
3	1	C14	CAP, X5R, 1 μ F, 25V, 10%, 0402	MURATA, GRM155R61E105KA12D
4	1	C21	CAP, X5R, 10 μ F, 25V, 20%, 0603	MURATA, GRM188R61E106MA73D
5	0	C15 (OPT)	CAP, OPTION, 0603	
6	1	C18	CAP, X7R, 1 μ F, 10V, 10%, 0603	MURATA, GRM188R71A105KA61D
7	1	FB1	BEAD, FERRITE, 60 Ω , 0603	WURTH ELEKTRONIK, 74279228600
8	0	R6, R8 (OPT)	RES., OPTION, 0603	
Hardware: For Demo Board Only				
1	9	E1, E3-E9, E11	TESTPOINT, TURRET, 0.094"	MILL-MAX, 2501-2-00-80-00-00-07-0
2	4	E2, E10, E12, E13	TESTPOINT, TURRET, 0.064"	MILL-MAX, 2308-2-00-80-00-00-07-0
3	1	JP1	2X4, 0.079 DOUBLE ROW HEADER	WURTH ELEKTRONIK, 62000821121
4	1	XJP1	SHUNT, 0.079" CENTER	WURTH ELEKTRONIK, 60800213421
5	4	J1-J4	JACK BANANA	KEYSTONE, 575-4
6	4	MH1-MH4	STAND-OFF, NYLON 0.50" TALL	WURTH ELEKTRONIK, 702935000

SCHEMATIC DIAGRAM



DEMO MANUAL DC2560A



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.

Legal Terms and Conditions

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at One Technology Way, Norwood, MA 02062, USA. Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS (\$100.00). EXPORT. Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. GOVERNING LAW. This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.