

LTM4626 20V_{IN}, 12A Step-Down µModule Regulator

DESCRIPTION

Demonstration circuit 2665A-A features the **LTM[®]4626** µModule[®] regulator, a high performance, high efficiency step-down regulator. The LTM4626 is a complete DC/DC point-of-load regulator in a thermally enhanced 6.25mm × 6.25mm × 3.87mm BGA package. The LTM4626 has an operating input voltage range of 3.1V to 20V and provides an output current up to 12A. The output voltage is programmable from 0.6V to 5.5V and can be remotely sensed. The stacked inductor design improves thermal dissipation and significantly reduces the package area. Output voltage tracking is available through the TRACK/SS

pin for supply rail sequencing. External clock synchronization is available through the SYNC/MODE pin. For high efficiency at low load currents, select DCM mode operation using the MODE jumper (JP7) in less noise sensitive applications. The LTM4626 data sheet must be read in conjunction with this demo manual for working on or modifying DC2665A-A.

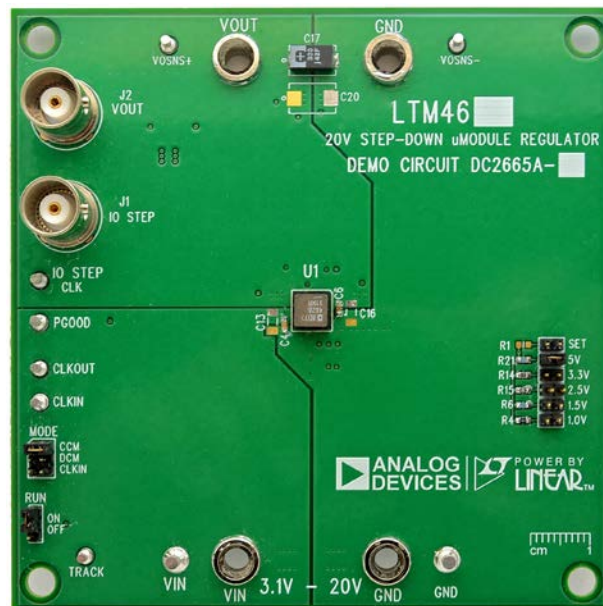
Design files for this circuit board are available.

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

PERFORMANCE SUMMARY Specifications are at T_A = 25°C

PARAMETER	CONDITIONS/NOTES	UNITS
Input Voltage Range		3.1V to 20V
Output Voltage V _{OUT}	Jumper Selectable	1V _{DC} , 1.5V _{DC} , 2.5V _{DC} , 3.3V _{DC} , 5V _{DC}
Maximum Continuous Output Current	Derating is Necessary for Certain Operating Conditions. See Data Sheet for Details	12A _{DC}
Default Operating Frequency		600kHz
Efficiency	V _{IN} = 12V, V _{OUT} = 1.5V, I _{OUT} = 15A	88.5%

BOARD PHOTO



QUICK START PROCEDURE

Demonstration circuit 2665A-A is an easy way to evaluate the performance of the LTM4626EY. Please refer to Figure 1 for test setup connections and follow the procedure below.

1. With power off, place the jumpers in the following positions:

JP8	JP7	JP1 TO JP6
RUN	MODE	V _{OUT} Select
ON	CCM	1.5V

2. Before connecting input supply, load and meters, pre-set the input voltage supply to be between 3.1V to 20V. Preset the load current to 0A.
3. With power off, connect the load, input voltage supply and meters as shown in Figure 1.
4. Turn on input power supply. The output voltage meters for each phase should display the programmed output voltage $\pm 1.5\%$.

5. Once the proper output voltage is established, adjust the load current within the 0A to 12A range and observe the load regulation, efficiency, and other parameters. Output voltage ripple should be measured across the furthest output cap with a BNC cable and oscilloscope from J2.
6. To observe increased light load efficiency, place the MODE pin jumper (JP7) in the DCM position.
7. For optional load transient testing, an onboard transient circuit is provided to measure transient response. Place a positive pulse signal between the IO_STEP_CLK pin and GND pins. The pulse amplitude sets the load step current amplitude. The pulse width should be short ($< 1\text{ms}$) and pulse duty cycle should be low ($< 15\%$) to limit the thermal stress on the load transient circuit. The load step can be monitored with a BNC connected to J1 (5mV/A).

QUICK START PROCEDURE

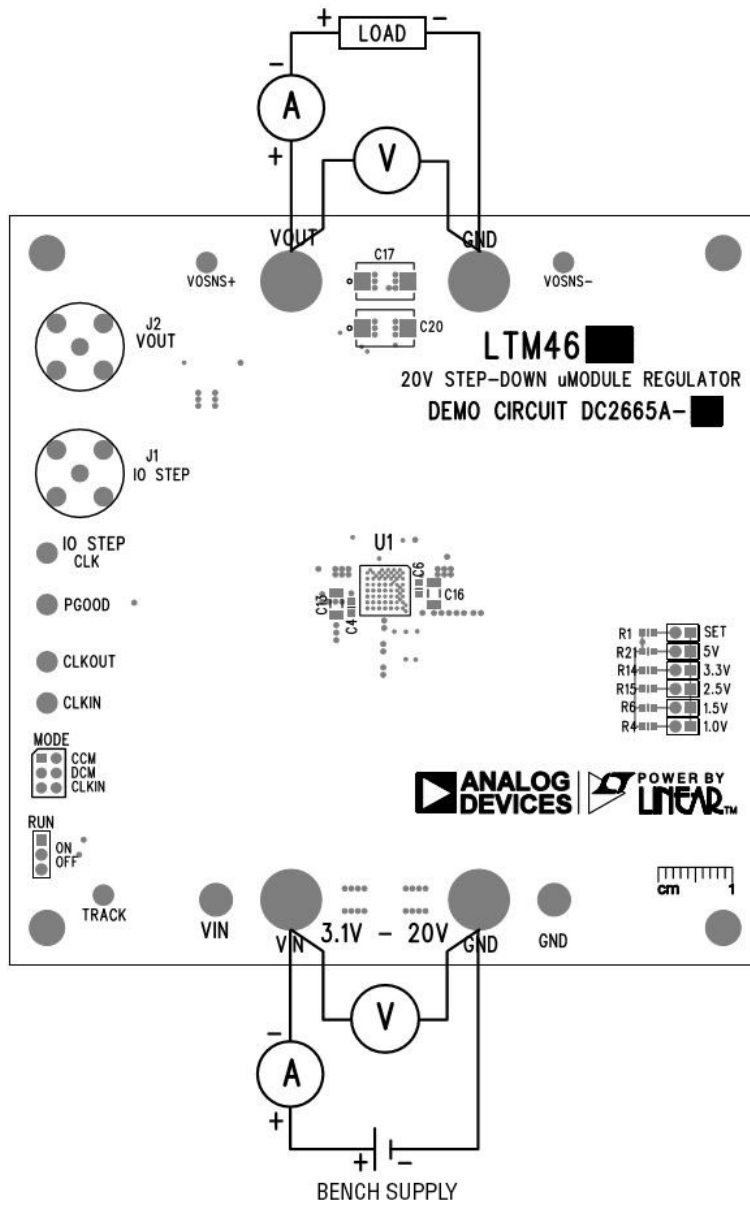
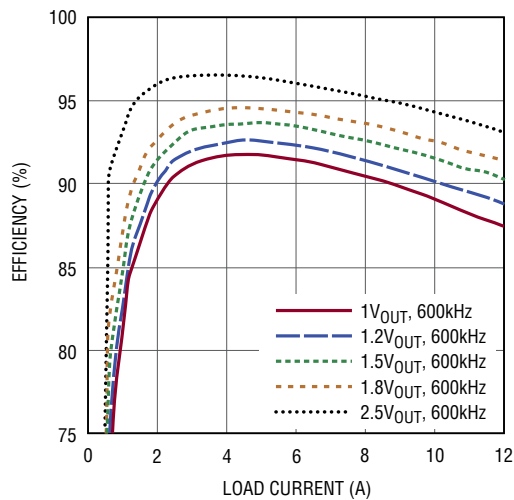
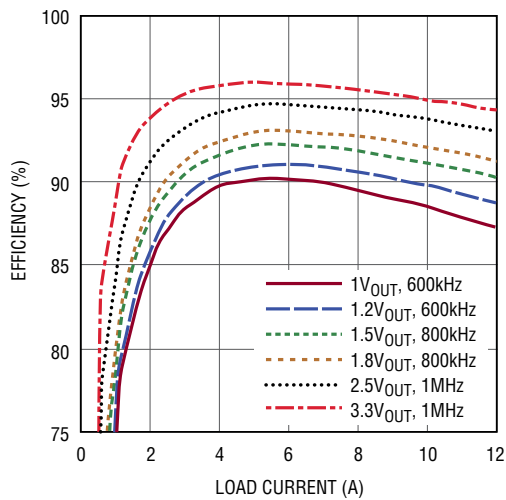


Figure 1. Test Setup of DC2665A-A

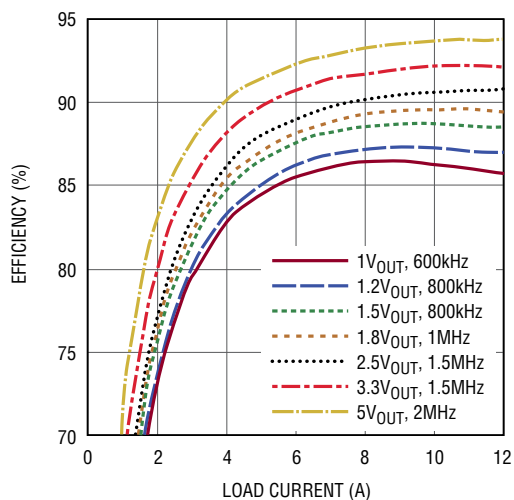
QUICK START PROCEDURE



a) 3.3V_{IN} CCM Efficiency vs Load Current



b) 5V_{IN} CCM Efficiency vs Load Current



c) 12V_{IN} CCM Efficiency vs Load Current

Figure 2. Measured Supply Efficiency at 3.3V_{IN}, 5V_{IN} and 12V_{IN}

QUICK START PROCEDURE

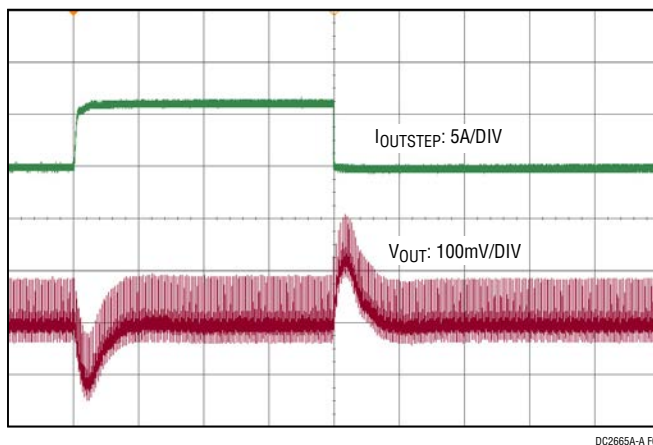


Figure 3. Load Transient (6A to 12A) Response Waveform at 12V_{IN} and 1.5V_{OUT}, 50μs/DIV

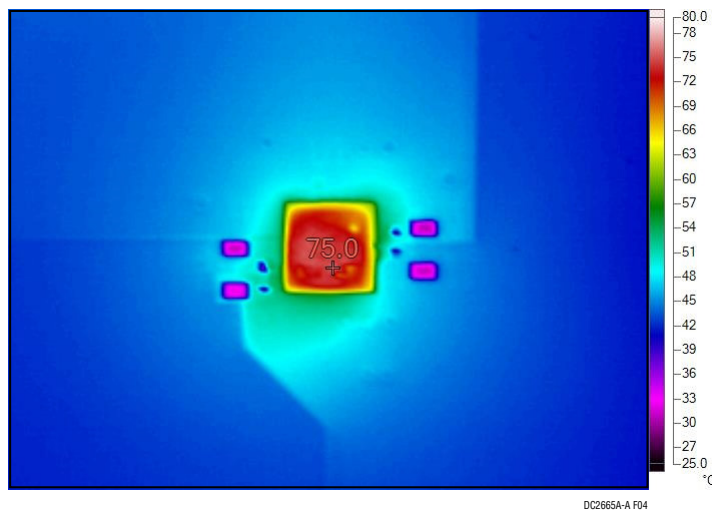


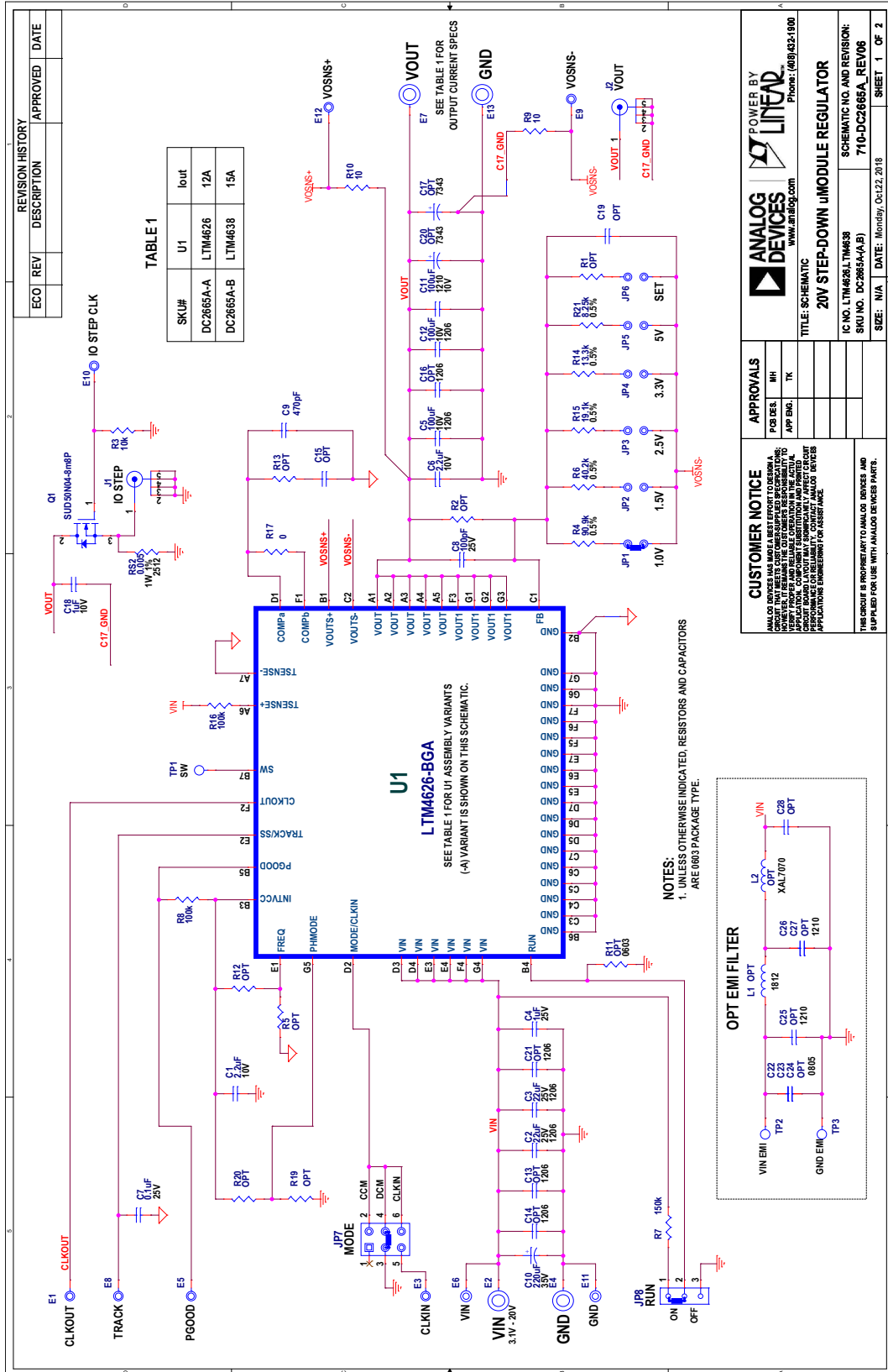
Figure 4. Measured Thermal Capture at 12V_{IN} and 1.5V_{OUT}, 12A_{OUT} at 25°C Ambient with No Airflow

DEMO MANUAL DC2665A-A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C1, C6	CAP, 2.2 μ F, X7R, 10V, 20%, 0603	TDK, C1608X7R1A225M080AC
2	2	C2, C3	CAP, 22 μ F, X5R, 25V, 10%, 1206	AVX, 12063D226KAT2A
3	1	C4	CAP, 1 μ F, X7R, 25V, 10%, 0603	MURATA, GRM188R71E105KA12D
4	2	C5, C12	CAP, 100 μ F, X5R, 10V, 20%, 1206	TDK, C3216X5R1A107M160AC
5	1	C7	CAP, 0.1 μ F, X7R, 25V, 10%, 0603	AVX, 06033C104KAT2A
6	1	C8	CAP, 100pF, X7R, 25V, 5%, 0603	AVX, 06033C101JAT2A
7	1	C9	CAP, 470pF, X7R, 50V, 10%, 0603	AVX, 06035C471KAT2A
8	1	C10	CAP, ALUM ELECT, 220 μ F, 35V	SUN ELEC, 35HVH220M
9	1	C11	CAP, 100 μ F, X5R, 10V, 20%, 1210	MURATA, GRM32ER61A107ME20L
10	1	C18	CAP, 1 μ F, X7R, 10V, 20%, 0603	AVX, 0603ZC105MAT2A
11	1	R3	RES, AEC-Q200, 10k Ω , 1%, 1/10W, 0603	VISHAY, CRCW060310K0FKEA
12	1	R4	RES, 90.9k Ω , 0.5%, 1/16W, 0603	SUSUMU, RR0816P-9092-D-93C
13	1	R6	RES, 40.2k Ω , 0.5%, 1/16W, 0603	SUSUMU, RR0816P-4022-D-59C
14	1	R7	RES, AEC-Q200, 150k Ω , 5%, 1/10W, 0603	PANASONIC, ERJ3GEYJ154V
15	2	R8, R16	RES, 100k Ω , 1%, 1/10W, 0603	STACKPOLE, RMCF0603FG100K
16	2	R9, R10	RES, 10 Ω , 1%, 1/10W, 0603	VISHAY, CRCW060310R0FKEA
17	1	R14	RES, 13.3k Ω , 0.5%, 1/16W, 0603	SUSUMU, RR0816P-1332-D-13C
18	1	R15	RES, 19.1k Ω , 0.5%, 1/16W, 0603	SUSUMU, RR0816P-1912-D-28C
19	1	R17	RES, AEC-Q200, 0 Ω , 1/10W, 0603	VISHAY, CRCW06030000Z0EA
20	1	R21	RES, 8.25k Ω , 0.5%, 1/16W, 0603	SUSUMU, RR0816P-8251-D-89H
21	1	RS2	RES, SENSE, 0.005 Ω , 1%, 1W, 2512	VISHAY, WSL25125L000FEA
22	1	Q1	XSTR, MOSFET, N-CH, 40V, TO-252 (DPAK)	VISHAY, SUD50N04-8M8P-4GE3
23	1	U1	IC, 20V, 12A STEP-DOWN μ MODULE REG.	ANALOG DEVICES, INC. LTM4626EY#PBF
Additional Demo Board Circuit Components				
24	0	C15, C19	CAP, OPTION, 0603	OPTION
25	0	C25, C26, C27, C28	CAP, OPTION, 1210	OPTION
26	0	C13, C14, C16, C21	CAP, OPTION, 1206	OPTION
27	0	C17, C20	CAP, OPTION, 7343	OPTION
28	0	C22, C23, C24	CAP, OPTION, 0805	OPTION
29	0	L1	IND, OPTION, 1812	OPTION
30	0	L2	IND, OPTION	OPTION
31	0	R1, R2, R5, R11, R12, R13, R19, R20	RES, OPTION, 0603	OPTION
32	1	R17	RES, AEC-Q200, 0 Ω , 1/10W, 0603	VISHAY, CRCW060310R0FKEA
Hardware: For Demo Board Only				
33	7	E1, E3, E5, E8, E9, E10, E12	TESTPOINT, TURRET 0.064"	MILL-MAX, 2308-2-00-80-00-00-07-0
34	4	E2, E4, E7, E13	JACK, BANANA	KEYSTONE, 575-4
35	2	E6, E11	TESTPOINT, TURRET 0.094"	MILL-MAX, 2501-2-00-80-00-00-07-0
36	2	J1, J2	CONN, BNC, 5 PINS	AMPHENOL RF, 112404
37	6	JP1, JP2, JP3, JP4, JP5, JP6	HEADER, 1x2, 2mm	SULLINS, NRPNO21PAEN-RC
38	1	JP7	HEADER, 2x3, 2mm	SULLINS, NRPNO32PAEN-RC
39	1	JP8	HEADER, 1x3, 2mm	SAMTEC, TMM-103-02-L-S
40	4	MP1, MP2, MP3, MP4	STAND-OFF, NYLON 0.50" TALL	KEYSTONE, 8833(SNAP ON)
41	3	XJP1, XJP7, XJP8	SHUNT, 2mm	SAMTEC, 2SN-BK-G

SCHEMATIC DIAGRAM





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.