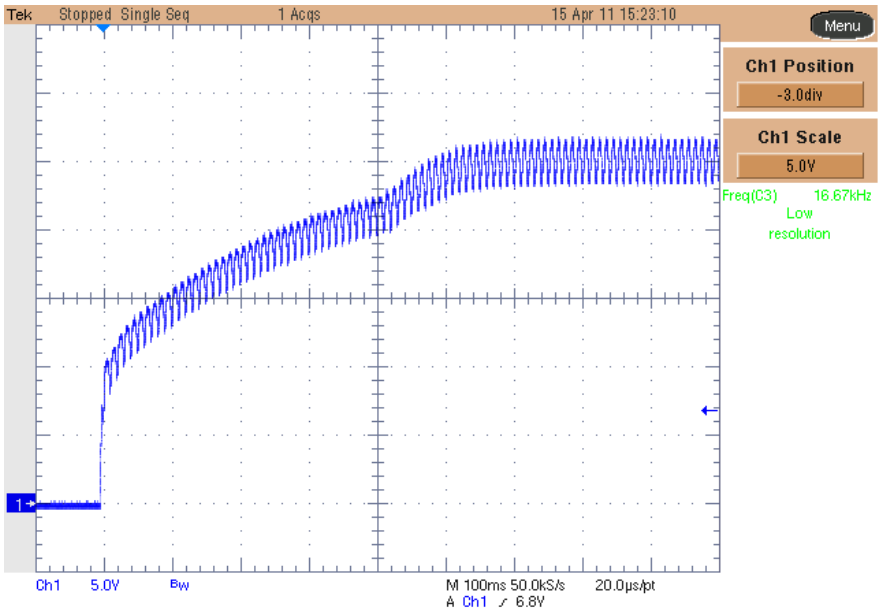
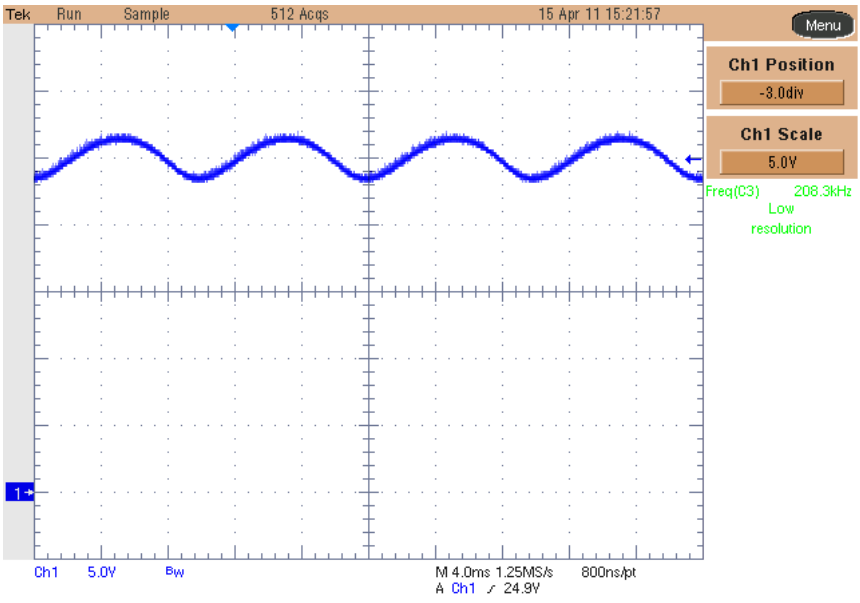
1 Startup

The output voltage at startup is shown in the image below. Input voltage was set to 230Vac and both outputs fully loaded.
Channel 1: Output voltage (5V/div, 100ms/div, 20MHz BWL).



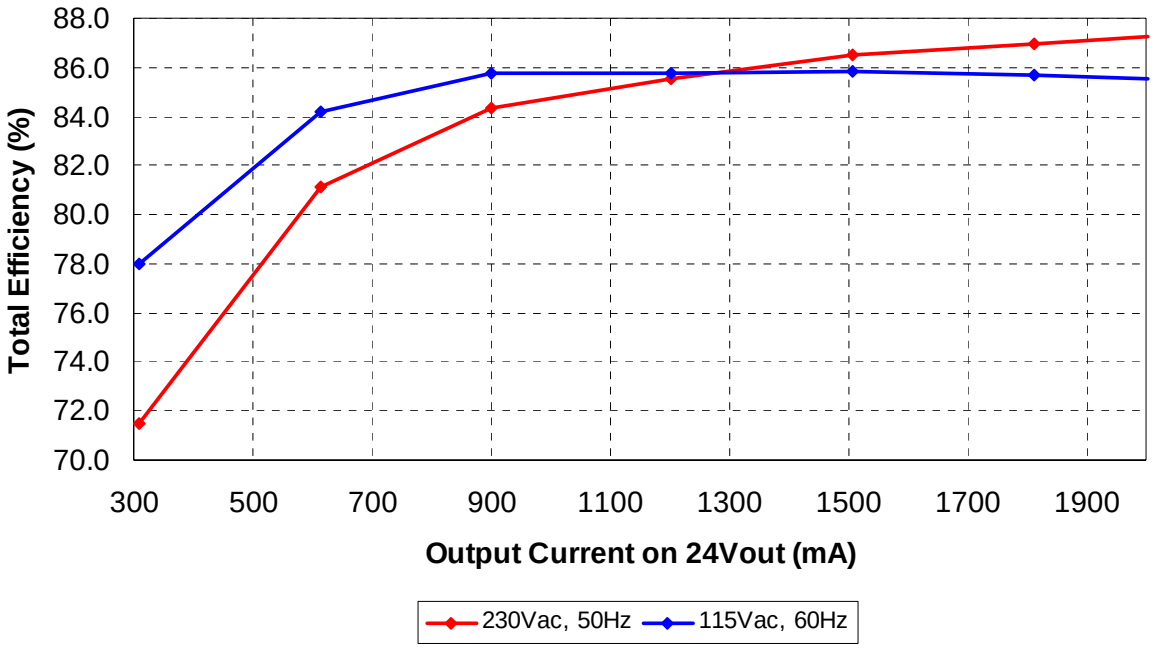
2 Output Ripple Voltage

The output ripple voltage is shown in the plot below. The source and load setup was the same as above.
Channel 1: Output voltage (5 V/div, 4ms/div, dc coupling, 20MHz BWL).



3 Efficiency

The efficiency data are shown in the tables and graph below.

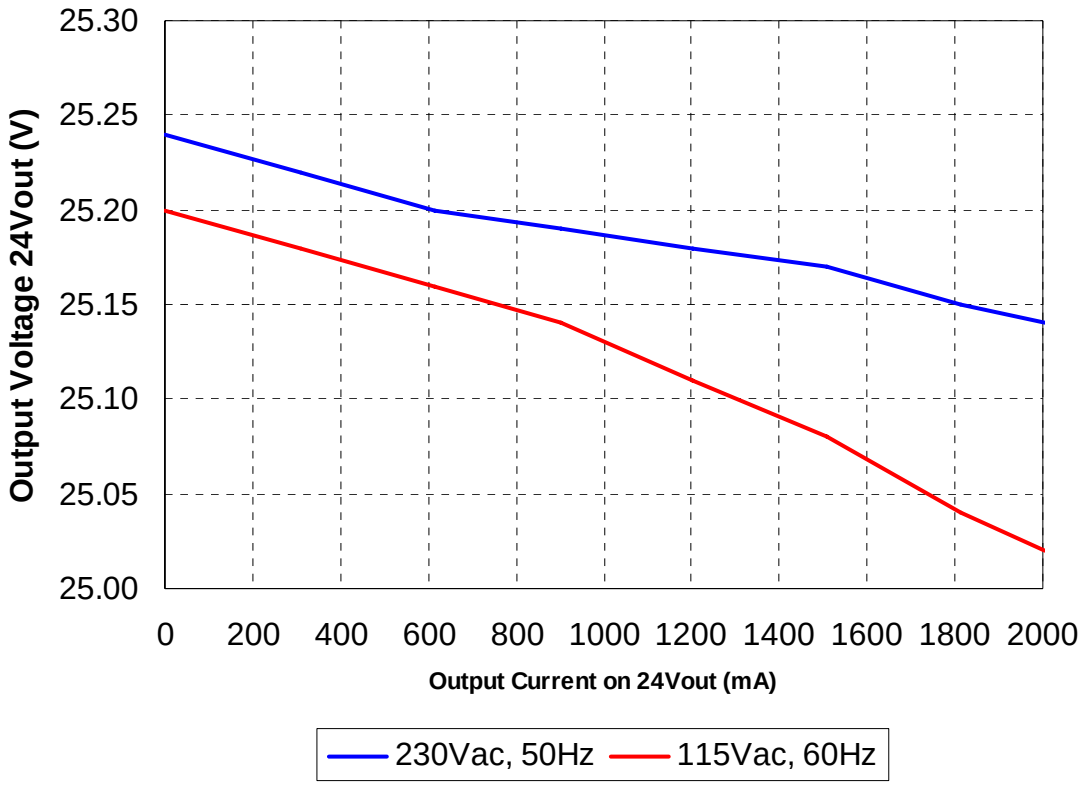


Iout 24V (mA)	Vout 24V (Vdc)	Iout 5V (mA)	Vout 5V (Vdc)	Pout (W)	Vin (Vac)	Pin (W)	Ploss (W)	Eff (%)	PF (%)
0.0	25.24	0.0	5.01	0.00	230	1.04	1.04	0.00	16.7
308.3	25.22	100.6	5.01	8.28	230	11.58	3.30	71.50	63.35
613.5	25.20	200.7	5.00	16.46	230	20.30	3.84	81.10	79.45
901.6	25.19	300.2	4.99	24.21	230	28.70	4.49	84.35	85.21
1202	25.18	401.4	4.99	32.27	230	37.74	5.47	85.50	88.77
1507	25.17	500.0	4.99	40.43	230	46.75	6.32	86.47	90.89
1811	25.15	600.5	4.99	48.54	230	55.81	7.27	86.98	92.36
2004	25.14	600.4	4.99	53.38	230	61.18	7.80	87.25	92.95

Iout 24V (mA)	Vout 24V (Vdc)	Iout 5V (mA)	Vout 5V (Vdc)	Pout (W)	Vin (Vac)	Pin (W)	Ploss (W)	Eff (%)	PF (%)
0.0	25.20	0.0	5.01	0.00	115	0.66	0.66	0.00	28.2
308.6	25.18	101.6	5.01	8.28	115	10.62	2.34	77.96	92.88
613.7	25.16	200.9	5.00	16.45	115	19.53	3.08	84.20	96.56
901.4	25.14	300.2	5.00	24.16	115	28.18	4.02	85.74	97.42
1201	25.11	400.6	4.99	32.16	115	37.50	5.34	85.75	97.7
1506	25.08	501.3	4.99	40.27	115	46.91	6.64	85.85	97.91
1811	25.04	600.9	4.99	48.35	115	56.44	8.09	85.66	97.97
2004	25.02	600.9	4.99	53.14	115	62.11	8.97	85.56	97.98

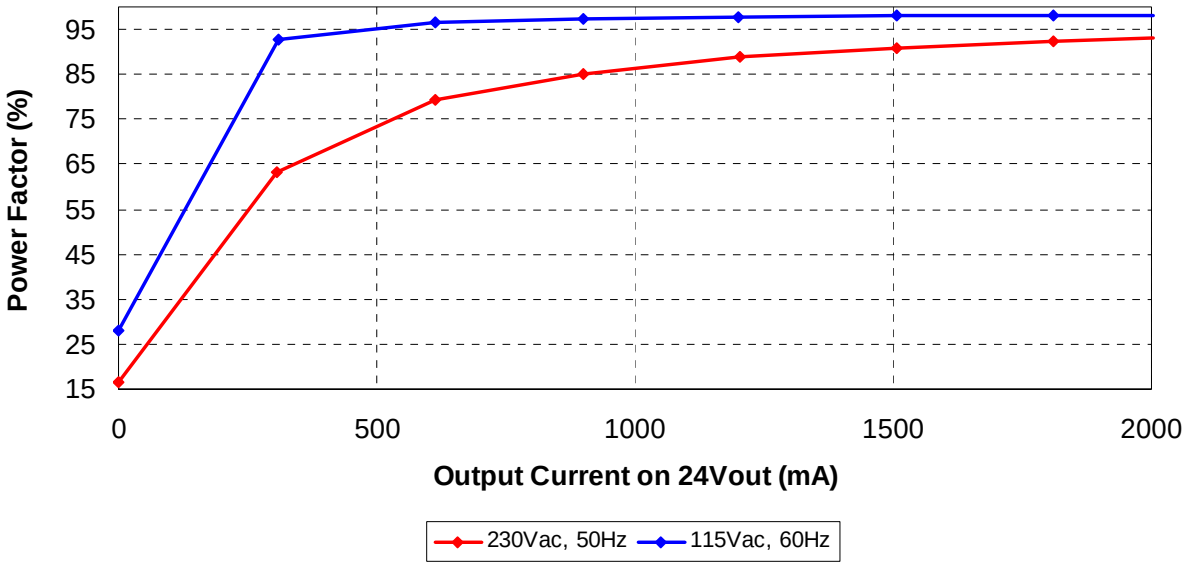
4 Output Voltage Regulation

The output voltage (24Vout) versus output current graph is plotted below.



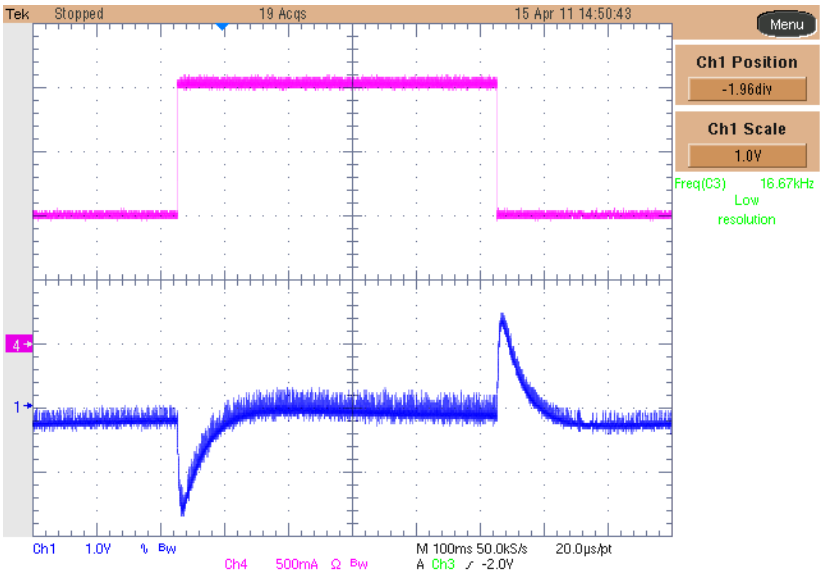
5 Power Factor

The Power Factor graph for the two nominal input voltages (230Vac, 50Hz and 115Vac 60Hz) is shown below:



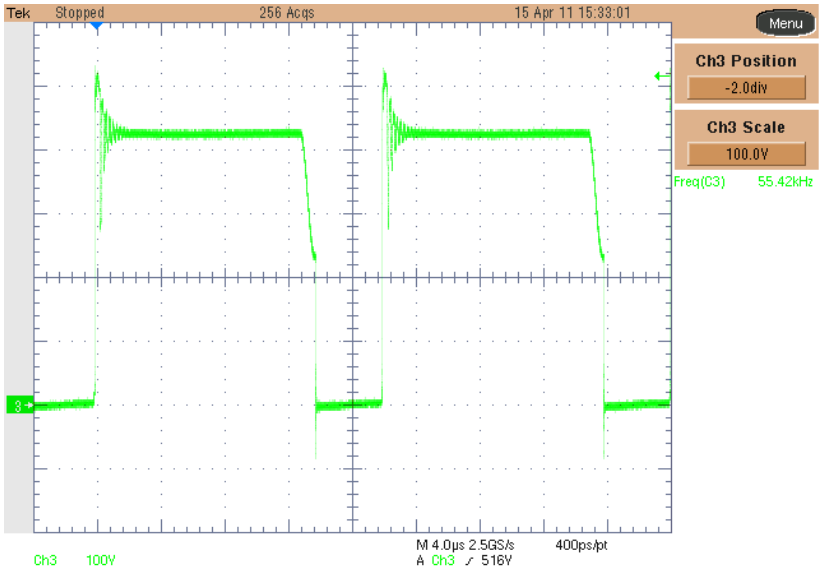
6 Transient Response

The output voltage (24Vout) transient response is shown in the plot below. The input was set to 270Vdc and the load switched between 1A and 2A.
Channel 1: Output voltage on 24Vout (1 V/div, ac coupled, 100ms/div, 20MHz BWL)
Channel 4: Output current (500mA/div, dc coup.)



7 Switching Node Waveform

The image below shows the voltage on the drain of Q1, with a 230Vac input, and full load on both outputs. Channel 3 shows the drain voltage (100V/div, 4us/div, no BWL).

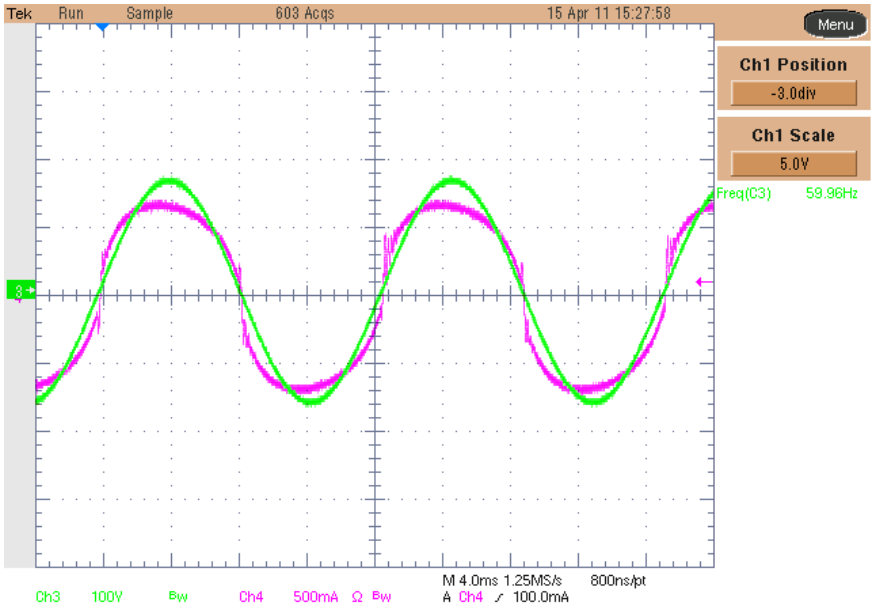


8 Input Voltage and Current Waveforms

The images below show the input voltage and current while the source was set to the two different input voltages and the converter was fully loaded on both outputs.

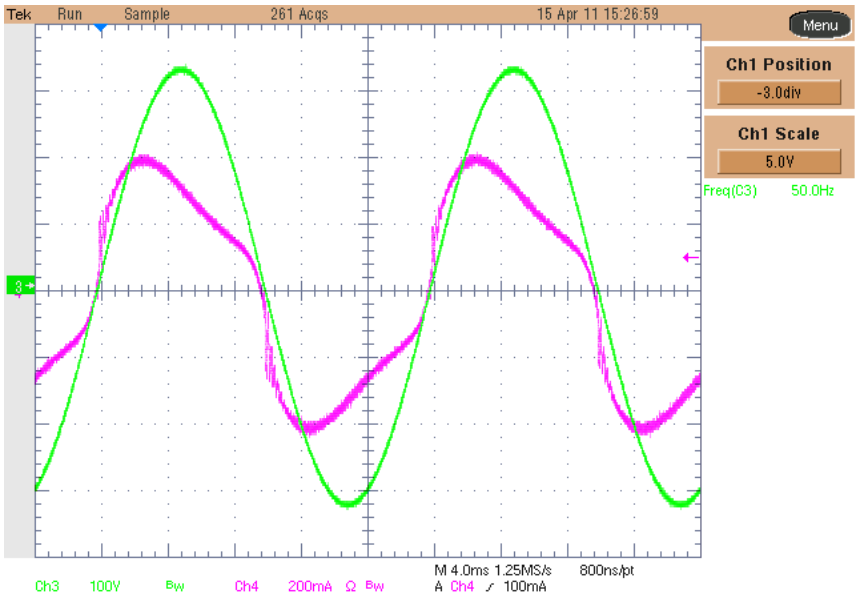
Vin = 115Vac, 60Hz

Channel 3: Input voltage (100V/div, 4ms/div); Channel 4: Input current (500mA/div)



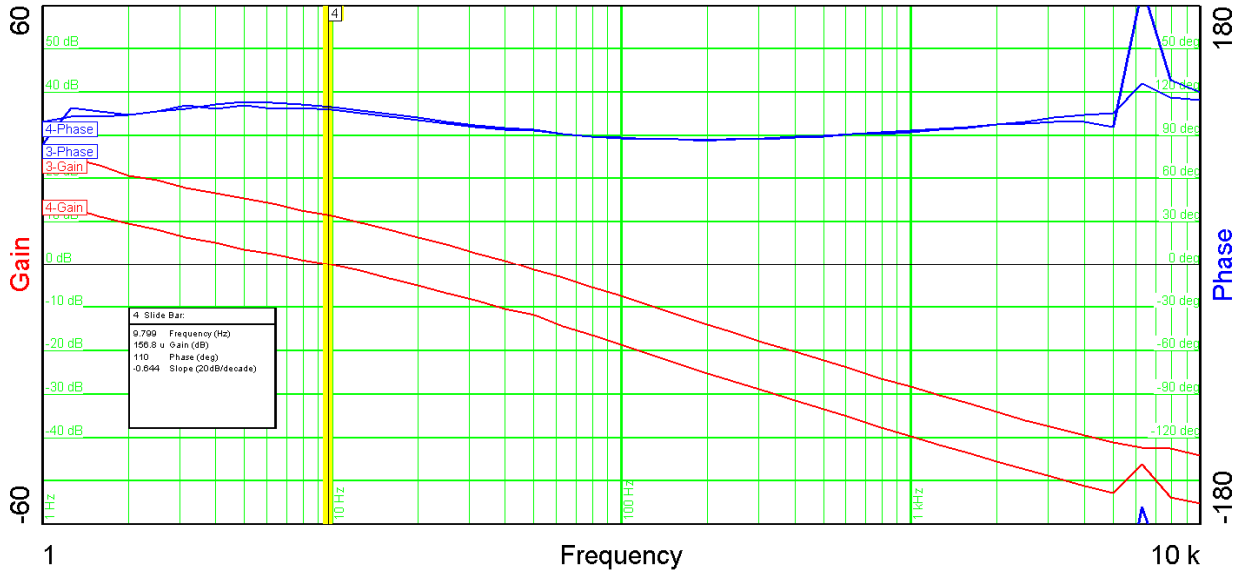
Vin = 230Vac, 50Hz

Channel 3: Input voltage (100V/div, 4ms/div); Channel 4: Input current (200mA/div)



9 Loop Response

The image below shows the loop response of the converter (on the 24Vout) measured with a 120Vdc input and 266Vdc @ 2A load. Worst case phase margin is 93.6 deg. and crossover frequency is 43.93 Hz.



IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Audio	www.ti.com/audio	Communications and Telecom	www.ti.com/communications
Amplifiers	amplifier.ti.com	Computers and Peripherals	www.ti.com/computers
Data Converters	dataconverter.ti.com	Consumer Electronics	www.ti.com/consumer-apps
DLP® Products	www.dlp.com	Energy and Lighting	www.ti.com/energy
DSP	dsp.ti.com	Industrial	www.ti.com/industrial
Clocks and Timers	www.ti.com/clocks	Medical	www.ti.com/medical
Interface	interface.ti.com	Security	www.ti.com/security
Logic	logic.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Power Mgmt	power.ti.com	Transportation and Automotive	www.ti.com/automotive
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Mobile Processors	www.ti.com/omap		
Wireless Connectivity	www.ti.com/wirelessconnectivity		
	TI E2E Community Home Page		e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265