

www.ti.com

SBVS016B - SEPTEMBER 1978 – REVISED JULY 2008

## DUAL ISOLATED DC/DC CONVERTER

### FEATURES

- DUAL ISOLATED  $\pm 5V$  TO  $\pm 16V$  OUTPUTS
- HIGH BREAKDOWN VOLTAGE: 8000V Test
- LOW LEAKAGE CURRENT:  
 $< 1\mu A$  at 240V/60Hz
- LOW COST PER ISOLATED CHANNEL
- SMALL SIZE: 27.9mm x 27.9mm x 7.6mm  
 (1.1" x 1.1" x 0.3")

### APPLICATIONS

- MEDICAL EQUIPMENT
- INDUSTRIAL PROCESS CONTROL
- TEST EQUIPMENT
- DATA ACQUISITION SYSTEMS
- NUCLEAR INSTRUMENTATION

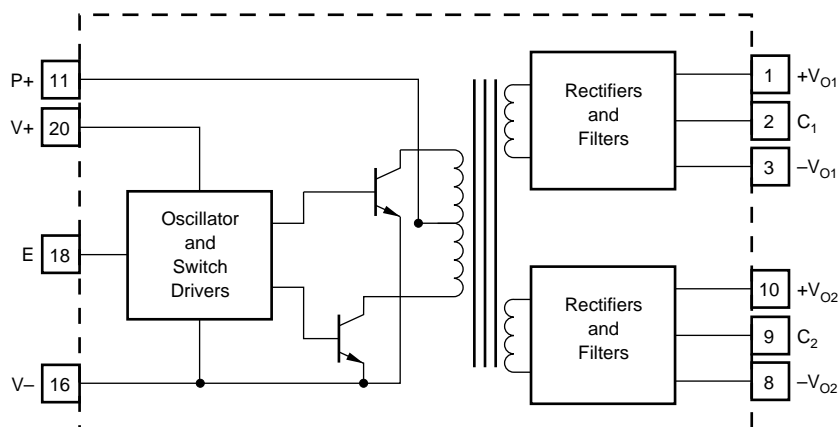
### DESCRIPTION

The 722 converts a single  $5V_{DC}$  to  $16V_{DC}$  input into a pair of bipolar output voltages of the same value as the input voltage. The converter is capable of providing a total output current of 64mA at rated voltage accuracy and up to 200mA without damage.

The two output channels are isolated from the input and from each other. They may be connected independently, in series for higher output voltage or in parallel for higher output current, as a single channel isolated DC/DC converter.

Integrated circuit construction of the 722 reduces size and cost. High isolation breakdown voltages and low leakage currents are assured by special design and construction that includes use of a high dielectric strength, low leakage coating used on the internal assembly.

A self-contained 900kHz oscillator drives switching circuitry, which is designed to eliminate the common problem of input current spiking due to transformer saturation or crossover switching.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

All trademarks are the property of their respective owners.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

Supply Voltage, V+ to V- .....	16V
Input Current .....	275mA
Operating Temperature .....	-25°C to +80°C
Storage Temperature .....	-55°C to +125°C
Junction Temperature .....	-55°C to +125°C

NOTE: (1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.



## ELECTROSTATIC DISCHARGE SENSITIVITY

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

## PACKAGE/ORDERING INFORMATION<sup>(1)</sup>

PRODUCT	PACKAGE-LEAD	PACKAGE DESIGNATOR	SPECIFIED TEMPERATURE RANGE <sup>(2)</sup>	PACKAGE MARKING	ORDERING NUMBER	TRANSPORT MEDIA, QUANTITY
722	DIP-20	JND	-25°C to +85°C	722	722G	Rails, 17
722BG	DIP-20	JND	-25°C to +85°C	722BG	722BG	Rails, 17
722MG	DIP-20	JND	-25°C to +85°C	722MG	722MG	Rails, 17

NOTES: (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at [www.ti.com](http://www.ti.com). (2) -25°C to +60°C for 16mA ≤ I<sub>LOAD</sub> ≤ 40mA per output.

# ELECTRICAL CHARACTERISTICS

At  $T_A = +25^\circ\text{C}$ ,  $V_{IN} = 15\text{VDC}$ ,  $C = 0.47\mu\text{F}$ , and  $R_1$  selected per typical characteristic, unless otherwise noted.

PARAMETER	CONDITIONS	722			722BG			722MG			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
<b>INPUT</b>											
Rated Input Voltage			15		*	*	*	*	*	*	VDC
Input Voltage Range <sup>(1)</sup>		5		16	*	*	*	*	*	*	VDC
Input Current	Total Output Current = 12mA		50		*	*	*	*	*	*	mA
	Total Output Current = 64mA		105	120	*	*	*	*	*	*	mA
	Total Output Current = 64mA at $T_A = +85^\circ\text{C}$		120		*	*	*	*	*	*	mA
Input Ripple <sup>(2)</sup>	Total Output Current = 160mA		—	—	225	275	—	—	—	—	mA
	Total Output Current = 12mA		3		*	*	*	*	*	*	mA, pk
	Total Output Current = 64mA		6		*	*	*	*	*	*	mA, pk
	Total Output Current = 160mA		—		12		—	—	—	—	mA, pk
<b>ISOLATION</b>											
Test Voltages	Input-to-Output, 5 seconds, min			8000			*			*	Vpk
	Input-to-Output, 1 minute, min			—			—			2500	Vrms
Rated Voltages	Channel-to-Channel, 5 seconds, min			5000			*			*	Vpk
	Input-to-Output, continuous			3500			*			*	V
	Channel-to-Channel, continuous			2000			*			*	V
Isolation Impedance	Input-to-Output		10    6		*		*		*	*	$\text{G}\Omega    \text{pF}$
Leakage Current <sup>(3)</sup>	Input-to-Output, 240V, 60Hz			1			*		*	*	$\mu\text{A}$
<b>OUTPUT</b>											
Rated Output Voltages <sup>(4)</sup>	$I_{\text{LOAD}} = 3\text{mA}$ per Output	15		16.6	*		*	*	*	*	VDC
	$I_{\text{LOAD}} = 16\text{mA}$ per Output	14.3		16.2	*		*	*	*	*	VDC
Output Current	$I_{\text{LOAD}} = 40\text{mA}$ per Output	—	—	—	13.0	14.2	16.2	—	—	—	VDC
	Total of All Outputs			200	*		*	*	*	*	mA
	Any One Output <sup>(5)</sup>	3		100	*		*	*	*	*	mA
Load Regulation			(5)		*		*	*	*	*	mVpk
Ripple Voltage	$I_{\text{LOAD}} = 3\text{mA}$ per Output		15		*		*	*	*	*	mVpk
	$I_{\text{LOAD}} = 16\text{mA}$ per Output		35	100	*		*	*	*	*	mVpk
	$I_{\text{LOAD}} = 40\text{mA}$ per Output		—		50		*	*	*	*	mVpk
Tracking Error between Dual Outputs	Balanced Loads		$\pm 200$		*		*	*	*	*	mVDC
Sensitivity to Input Voltage Changes			1.13		*		*	*	*	*	V/V
Output Voltage Temperature Coefficient	$T_A = T_{\text{SPECIFICATION RANGE}}$		$\pm 0.02$		*		*	*	*	*	$\% / ^\circ\text{C}$
<b>TEMPERATURE</b>											
Specification	$I_{\text{LOAD}} \leq 16\text{mA}$ per Output	-25		+85	*		*	*	*	*	$^\circ\text{C}$
	$I_{\text{LOAD}} \leq 40\text{mA}$ per Output	-25		+60	*		*	*	*	*	$^\circ\text{C}$
Storage Junction Temperature		-55		+125	*		*	*	*	*	$^\circ\text{C}$
				+125	*		*	*	*	*	$^\circ\text{C}$

\* Specifications same as 722.

NOTES: (1) For ambient temperature above  $+70^\circ\text{C}$ , the input voltage is 12.5V (max). The input voltage remains 16V (max) if case temperature is kept below  $+85^\circ\text{C}$ . (2) External capacitor across P+ to V- pins and 12" of #24 wire to  $V_{IN}$ . (3) Reference UL544, paragraph 27.5, Leakage Current. (4) See Typical Characteristics. (5) A minimum output current of 3mA at each output is recommended to maintain output voltage accuracy.

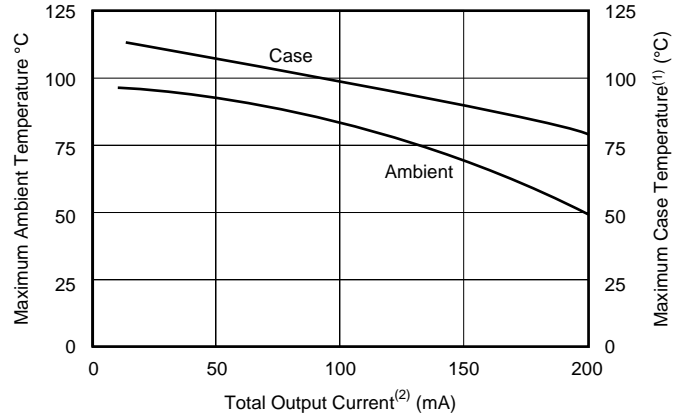
# TYPICAL CHARACTERISTICS

At  $T_A = +25^\circ\text{C}$ ,  $V_{IN} = 15\text{VDC}$ ,  $C = 0.47\mu\text{F}$ , and  $R_1$  selected per typical characteristic, unless otherwise noted.

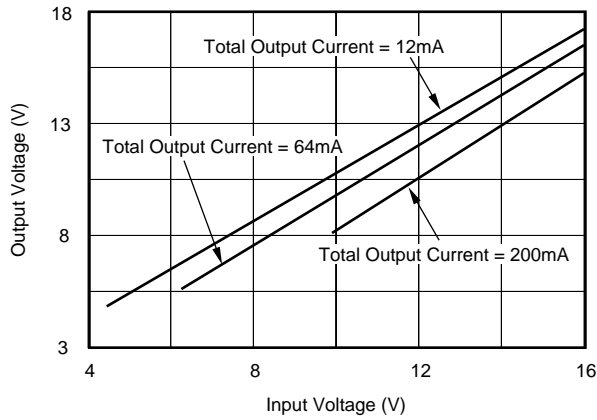
SELECTION OF  $R_1$  OR EXTERNAL VOLTAGE  $V_+$  FOR MINIMUM INTERNAL POWER DISSIPATION

		MAXIMUM OUTPUT CURRENT FROM ANY SINGLE OUTPUT		
		<16mA	16mA to 30mA	30mA
Input Voltage (V)	>13	1.3k $\Omega$	820 $\Omega$	510 $\Omega$
	11 to 13	820 $\Omega$	510 $\Omega$	200 $\Omega$
	9 to 11	510 $\Omega$	200 $\Omega$	0 $\Omega$
	8 to 9	200 $\Omega$	0 $\Omega$	—
	<8	0 $\Omega$	—	—
$V_{+EXT}$		6.5V	7.5V	9.0V

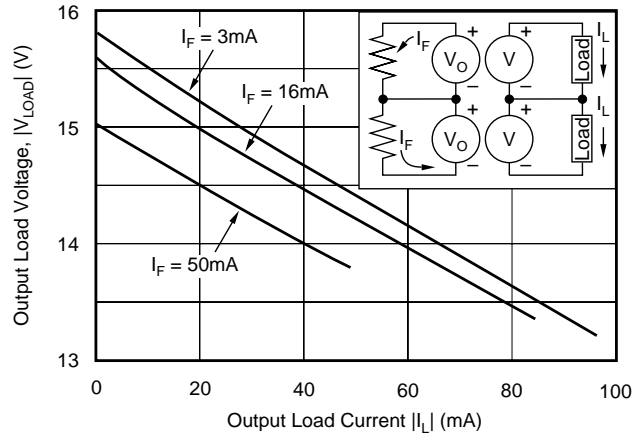
MAXIMUM SAFE OPERATING TEMPERATURE vs TOTAL OUTPUT CURRENT



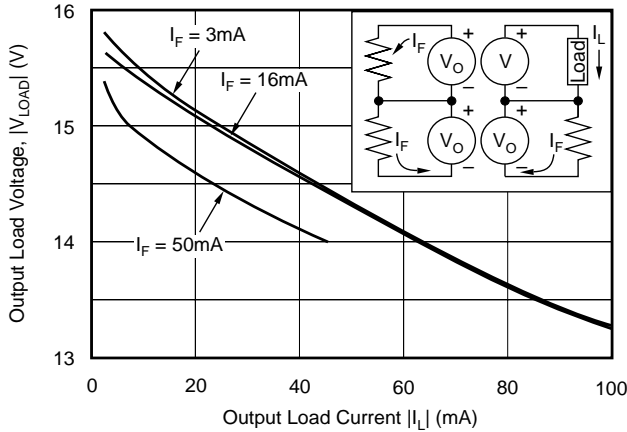
OUTPUT VOLTAGE vs INPUT VOLTAGE



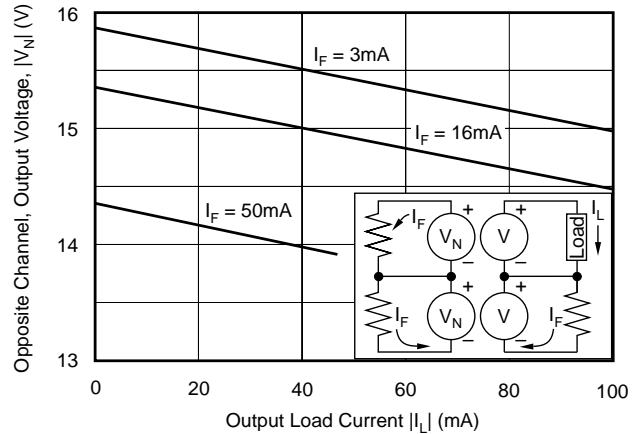
SINGLE-CHANNEL LOAD REGULATION



SINGLE OUTPUT LOAD REGULATION



CHANNEL-TO-CHANNEL INTERACTION



NOTES: (1) Using a 104mm x 19mm x 1.6mm aluminum strip mounted to the bottom of the case with heat sink compound. (2) Total output current is the sum of the currents for each individual output.

# TYPICAL CHARACTERISTICS (Cont.)

At  $T_A = +25^\circ\text{C}$ ,  $V_{IN} = 15\text{VDC}$ ,  $C = 0.47\mu\text{F}$ , and  $R_1$  selected per typical characteristic, unless otherwise noted.

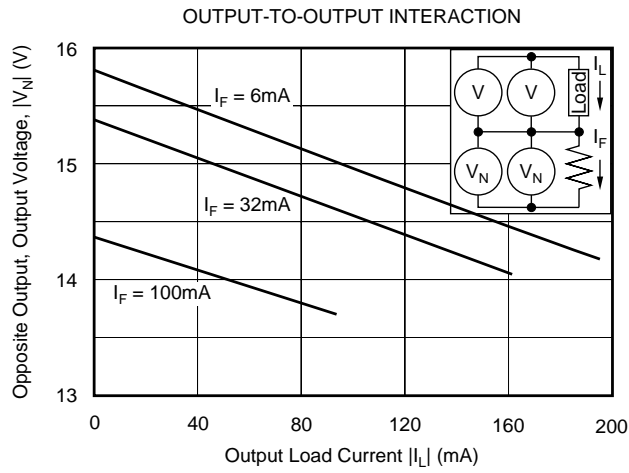
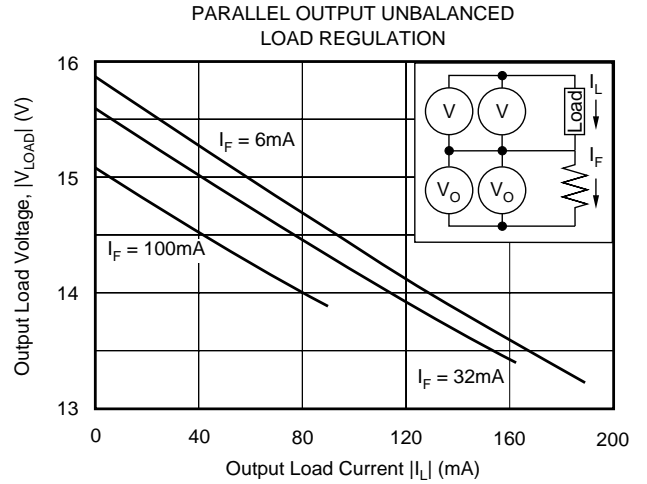
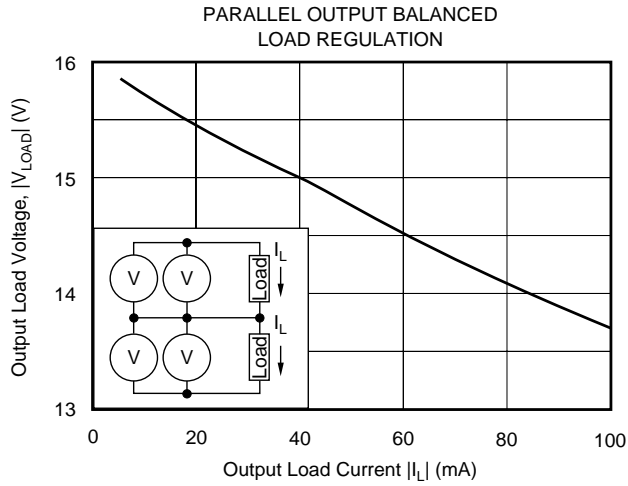




Figure 2 illustrates how the 722 can provide isolated input power to the input stage of two 3650s connected in the two-port configuration. Power for the output stage is provided by the system +15V and -15V supplies. Input stages are isolated from each other and from the system supply. In this situation, the 722 input-to-output isolation specification applies to the amplifier input-to-output voltages, whereas the channel-to-channel 722 specification applies to the voltage existing between I/P Com #1 and I/P Com #2.

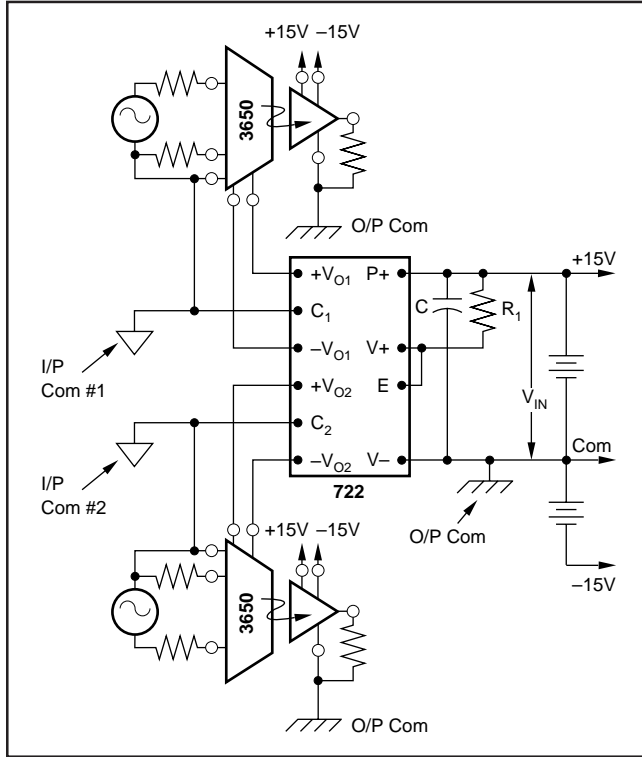


FIGURE 2. Two-Port Isolation with Two 3650s.

## SHORT CIRCUIT PROTECTION

The circuit in Figure 3 may be added to the input of the 722 to protect it from damage in situations where too much current is demanded from the outputs—such as a short circuit from an output to its common. The circuit limits input current to approximately 150mA for an input voltage of 15VDC (for  $\beta$  of 2N2219 of 50).

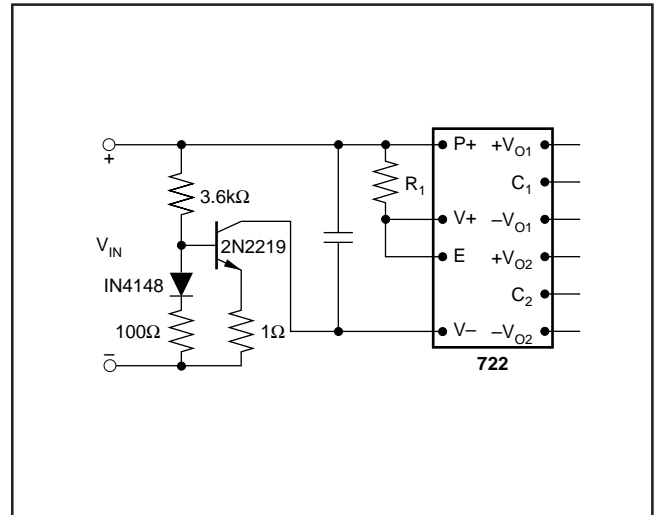


FIGURE 3. Short-Circuit Protection.

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
0722BG	NRND	CDIP	JND	20		TBD	Call TI	Call TI
0722MG	NRND	CDIP	JND	20		TBD	Call TI	Call TI
722G	OBSOLETE	CDIP	JND	20		TBD	Call TI	Call TI

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

**Important Information and Disclaimer:**The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.





## 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

Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>

### Applications

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
Wireless	<a href="http://www.ti.com/wireless">www.ti.com/wireless</a>

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2009, Texas Instruments Incorporated