



# THE DATASHEET OF SD384EVK



# SD384EVK LMH0384 Evaluation Board User Guide

National Semiconductor  
EVK User Manual  
Gary Melchior  
September 11, 2009



## Overview

The SD384 Evaluation Kit (EVK) enables evaluation of the LMH0384 3G/HD/SD SDI Adaptive Cable Equalizer.

## Evaluation Kit (SD384EVK) Contents

The EVK contains the following parts:

- SD384EVK board assembly with the LMH0384 cable equalizer
- SD384EVK User Guide

## Evaluation Board Description

Figure 1 shows the SD384 evaluation board and highlights some of its features.

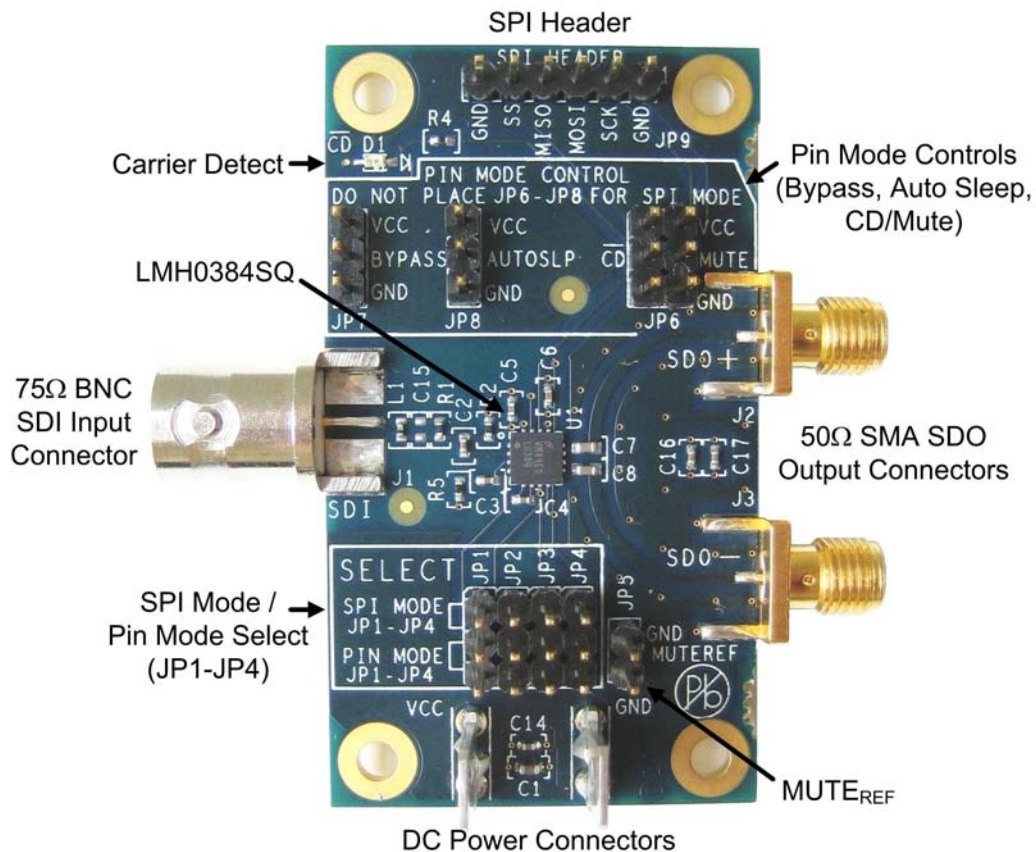


Figure 1. SD384 Evaluation Board

## SDI Input and SDO Output

The SDI input connector (J1) is a 75Ω BNC connector. The SDI input should conform to the SMPTE 424M, SMPTE 292M, or SMPTE 259M standards.

The SDO output connectors (J2 and J3) are 50Ω SMA connectors. When using only one side of the output pair, the other side should be terminated with a 50Ω SMA termination. For example, when only using the SDO output,  $\overline{SDO}$  should be terminated with a 50Ω SMA termination.

## DC Power Connectors

The VCC and GND power connectors should be powered with a DC input voltage of 3.3V ± 5% (3.6V maximum).

## SPI Mode / Pin Mode Select (JP1 – JP4)

JP1, JP2, JP3, and JP4 are used to select between SPI Mode or Pin mode. To select Pin Mode, set four jumpers as shown in Figure 2, and to select SPI Mode, set four jumpers as shown in Figure 3. Either Pin Mode or SPI mode must be selected for proper operation; do not leave JP1-JP4 open.

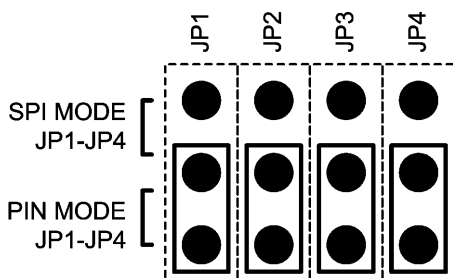


Figure 2. Pin Mode Select

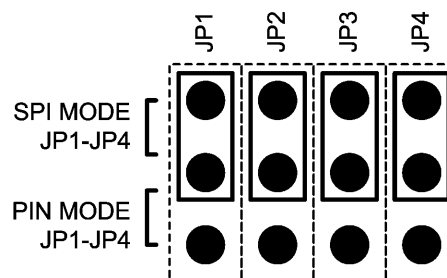


Figure 3. SPI Mode Select

## MUTE<sub>REF</sub> (JP5)

JP5 allows control of the MUTE<sub>REF</sub> function and may be used in either Pin Mode or SPI Mode. MUTE<sub>REF</sub> is an input voltage used to set the threshold for  $\overline{CD}$ . The MUTE<sub>REF</sub> DC input voltage should be between 0V and 3.3V. Refer to the LMH0384 datasheet for details. Leave JP5 unconnected for normal operation.

## Pin Mode Controls (JP6 – JP8)

JP6, JP7, and JP8 are used to control LMH0384 features while the device is configured for Pin Mode. **Jumpers should not be placed on JP6, JP7, or JP8 while the device is configured for SPI Mode.**

## $\overline{CD}$ and MUTE (JP6)

JP6 allows Carrier Detect ( $\overline{CD}$ ) monitoring and MUTE control.  $\overline{CD}$  is high when no input signal is present. MUTE may be used to force the outputs on or off, or tied to  $\overline{CD}$  to allow automatic mute operation based on the input signal. To activate mute and force the outputs into a muted condition, set the jumper to pull MUTE to VCC. To turn off mute so that the outputs will never mute, set the jumper to tie MUTE to GND. For normal operation, set the jumper to tie  $\overline{CD}$  to MUTE for automatic mute control. The LMH0384 MUTE pin has an internal pulldown (to disable mute), so JP6 may be left unconnected and the LMH0384 will never mute.

## BYPASS (JP7)

JP7 allows control of the equalization BYPASS function. To put the device into bypass mode, set the jumper to pull BYPASS to VCC. To turn off bypass (for normal operation) set the jumper to pull BYPASS to GND. The LMH0384 BYPASS pin has an internal pulldown (to disable bypass), so JP7 may be left unconnected for normal operation.

## AUTO SLEEP (JP8)

JP8 allows control of the AUTO SLEEP function. To put the device into auto sleep mode in which it will power down when no input is detected, set the jumper to pull AUTO SLEEP to VCC. To turn off auto sleep and prevent the LMH0384 from automatically powering down, set the jumper to pull AUTO SLEEP to GND. The LMH0384 AUTO SLEEP pin has an internal pullup (to enable auto sleep), so JP8 may be left unconnected to enable auto sleep mode.

## SPI Header (JP9)

JP9 is the SPI (Serial Peripheral Interface) header. It allows access to the SPI pins ( $\overline{SS}$ , MISO, MOSI, and SCK) while the LMH0384 is in SPI mode. These pins may be connected to a standard SPI controller to access the LMH0384 SPI registers. Refer to the LMH0384 datasheet for details.

## Carrier Detect LED (D1)

D1 shows the status of Carrier Detect. This LED is GREEN when an input signal has been detected, and OFF when no input is detected. D1 shows the status of Carrier Detect while in Pin Mode or SPI Mode.

## Typical Performance

Figures 4 and 5 show typical output waveforms of the SD384, with the 1m of Belden 1694A cable on the input and 110m of Belden 1694A cable on the input, respectively. The input signal is a 2.97 Gbps PRBS10, and the output signal is measured on the Agilent DCA-J 86100C Oscilloscope.

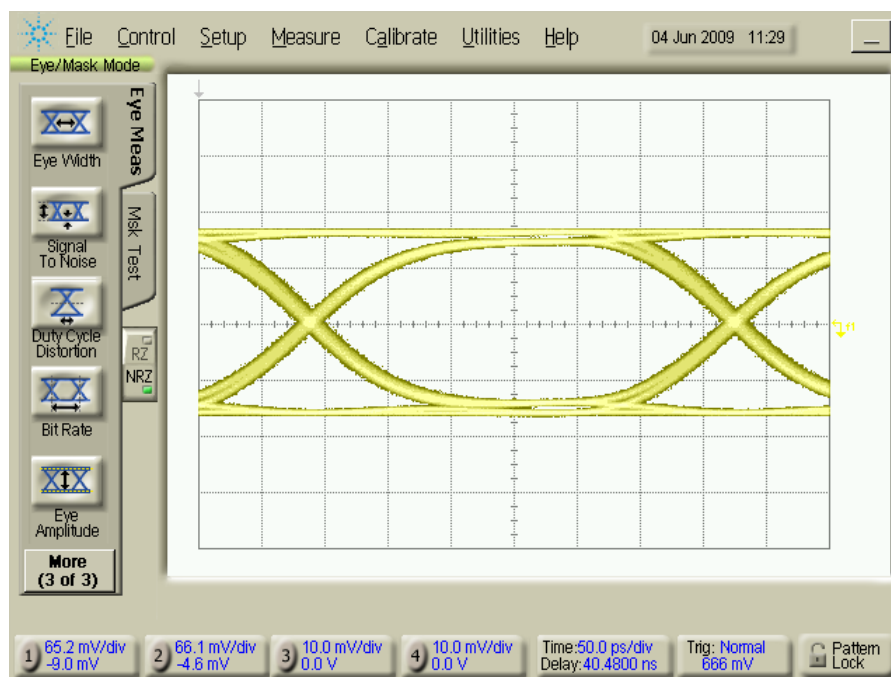


Figure 4. SD384 Output Waveform at 2.97 Gbps with 1m Belden 1694A Cable

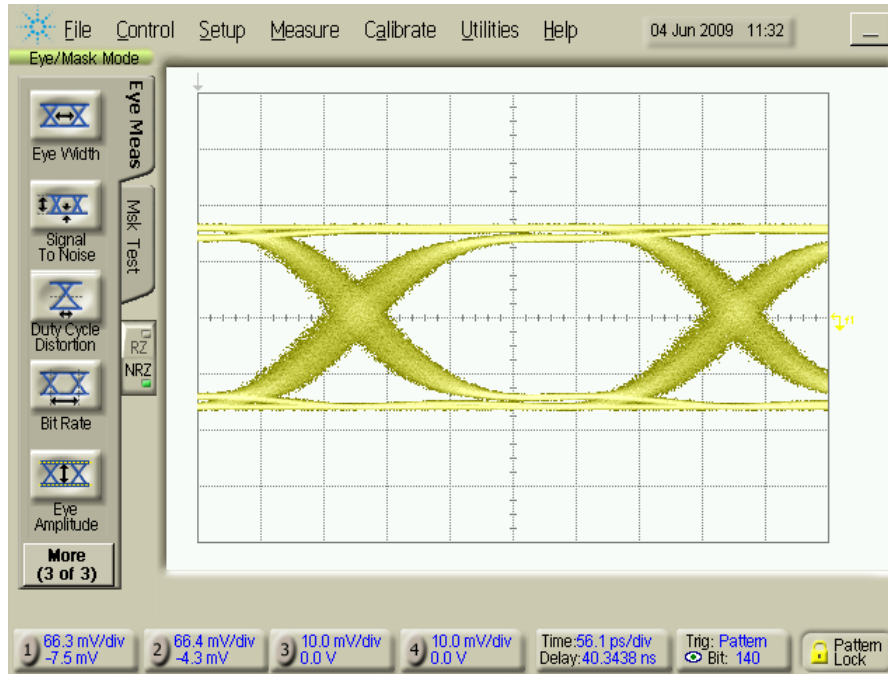
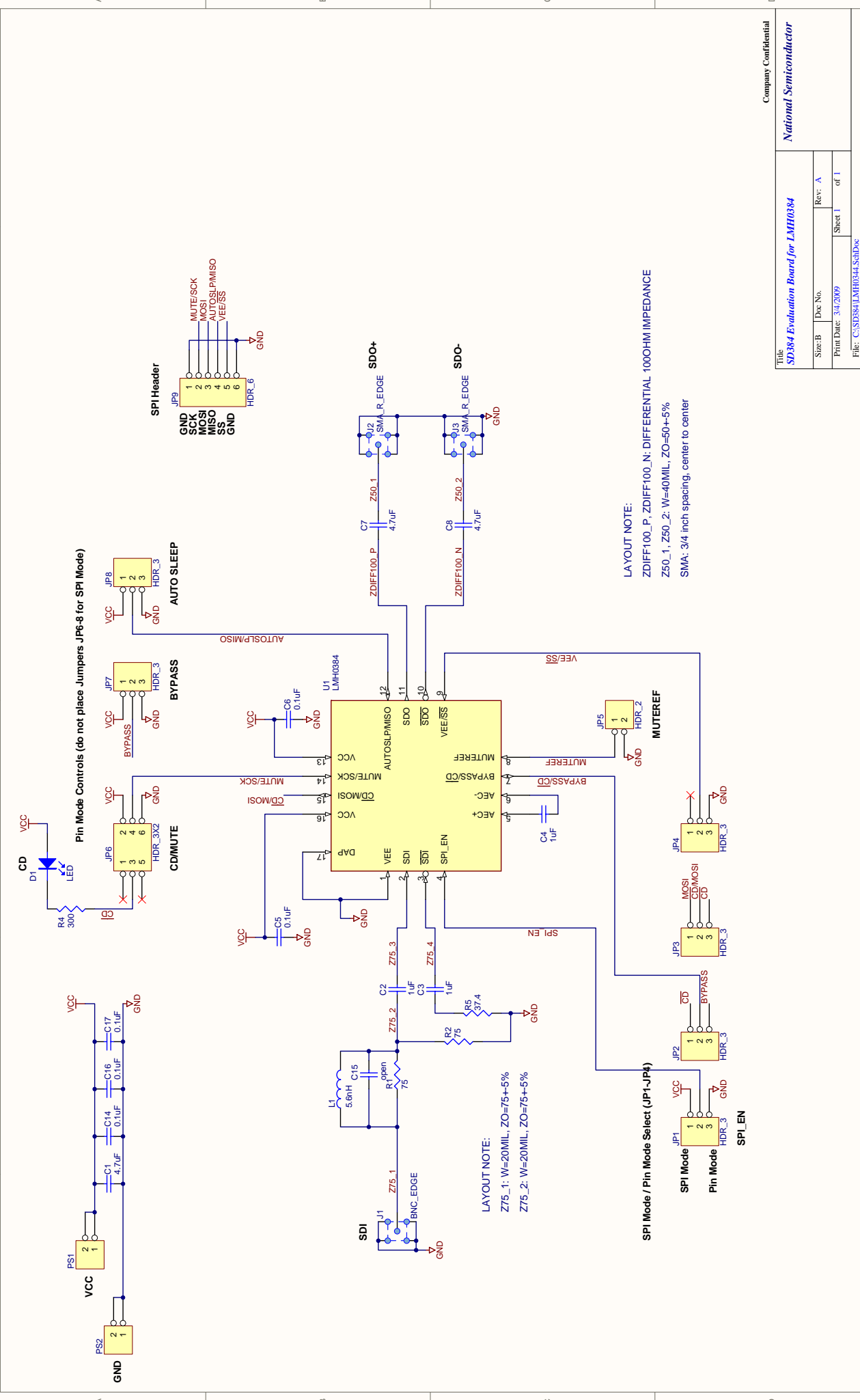


Figure 5. SD384 Output Waveform at 2.97 Gbps with 110m Belden 1694A Cable

## Bill of Materials

Reference Designator	Qty	Description	Manufacturer	Manufacturer Part No.
C1, C7, C8	3	Capacitor, 4.7uF, 6.3V, X5R, 0603	Panasonic - ECG	ECJ-1VB0J475M
C2, C3, C4	3	Capacitor, 1uF, 6.3V, X5R, 0402	Panasonic - ECG	ECJ-0EB0J105M
C5, C6, C14, C16, C17	5	Capacitor, 0.1uF, 16V, X5R, 0402	Panasonic - ECG	ECJ-0EB1C104K
D1	1	LED, Green, 0603	Lite-On	LTST-C190GKT
J1	1	BNC, Amphenol, 75-ohm, edge launch	Amphenol	31-6009
J2, J3	2	SMA, 50-ohm, edge launch	Johnson Components	142-0701-851
JP1, JP2, JP3, JP4, JP7, JP8	6	Header, 3x1, 0.1"	3M/ESD	929834-02-36
JP5	1	Header, 2x1, 0.1"	3M/ESD	929834-02-36
JP6	1	Header, 3x2, 0.1"	3M/ESD	929836-02-36
JP9	1	Header, 6x1, 0.1"	3M/ESD	929834-02-36
L1	1	Inductor, 5.6nH, 0402	Murata	LQP15MN5N6B02D
PS1, PS2	2	PCB Quick-Fit Male Terminal, .052" diameter, .250" tab size	Keystone Electronics	1287-ST
R1, R2	2	Resistor, 75-ohm, 1/16W, 1%, 0402	Yageo	RC0402FR-0775RL
R5	1	Resistor, 37.4-ohm, 1/16W, 1%, 0402	Vishay/Dale	CRCW040237R4FKED
R4	1	Resistor, 300-ohm, 1/10W, 5%, 0402	Panasonic - ECG	ERJ-2GEJ301X
U1	1	LMH0384 Cable Equalizer, LLP-16	National Semiconductor	LMH0384SQ

## Schematic



Pin Mode Controls (do not place Jumpers JP6-8 for SPI Mode)

LAYOUT NOTE:  
Z75\_1: W=20MIL, ZO=75+5%  
Z75\_2: W=20MIL, ZO=75+5%

LAYOUT NOTE:  
ZDIFF100\_P, ZDIFF100\_N: DIFFERENTIAL 100OHM IMPEDANCE  
Z50\_1, Z50\_2: W=40MIL, ZO=50+5%  
SMA: 3/4 inch spacing, center to center

Title: <b>SD384 Evaluation Board for LMH0384</b>	
Size: B	Doc No.
Print Date: 3/4/2009	Rev: A
File: C:\SD384\LMH0384.SchDoc	Sheet 1 of 1

## 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

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
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>
OMAP Mobile Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

TI E2E Community Home Page

[e2e.ti.com](http://e2e.ti.com)

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2012, Texas Instruments Incorporated

## Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

 [View SD384EVK](#) on WIN SOURCE

 [Texas Instruments](#) Information

## Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management