LM3430

Application Note 1529 LM3430 Evaluation Board

Literature Number: SNVA187B

LM3430 Evaluation Board

National Semiconductor
Application Note 1529
Chris Richardson
August 2007

Specifications Of The Board

The Evaluation Board has been designed for testing of various circuits using the LM3430 boost regulator controller. A complete schematic for all the components is shown in *Figure 3*. The board is two layers with components and power paths in 1oz. copper. The board is 62mil FR4 laminate.

Example Circuit

The example circuit which comes on the evaluation board delivers a 48V ±2% output voltage at currents up to 700 mA and switches at 600 kHz. The input voltage range is optimized between 10.8V and 26.4V. The measured efficiency of the converter is 96% at an input voltage of 24V and an output current of 0.7A.

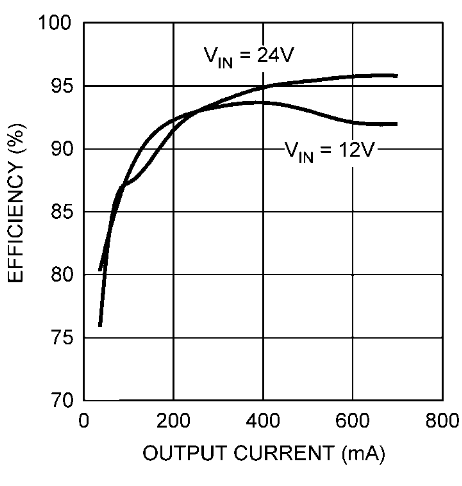


FIGURE 1. Efficiency

Powering The Converter

The example circuit for the LM3430 Evaluation Board is optimized to run at inputs of 12V or 24V, however the circuit will operate with input voltages ranging from 6.0V to 40.0V connected between the 'VIN' and 'GND' terminals on the right side of the board. Fixed loads, resistors, and variable electronic loads can be connected between the 'Vo' and 'GND' terminals on the left side of the board. The Bill of Materials table lists all the components used in the example circuit.

Enabling The Converter

The **OFF** terminal controls the state of the converter while power is applied to the input terminals. The LM340 is disabled whenever the voltage at **OFF** is a logic high. (Above 2.0V.) The LM3430 is enabled whenever the **OFF** terminal is open-circuited or connected to ground. Upon enabling the LM3430 will perform a soft-start, after which the output is ready to supply current to the load.

Testing The Converter

Figure 4 shows a block diagram of connections for making measurements of efficiency. The wires used for making connections at both the input and output should be rated to at least 10A of continuous current and should be no longer than is needed for convenient testing. A series ammeter capable of measuring 10A or more should be used for both the input and the output lines. Dedicated voltmeters should be connected with their positive and negative leads right at the four power terminals at the sides of the evaluation board. This measurement technique minimizes the resistive loss in the wires that connect the evaluation board to the input power supply and the electronic load.

Output voltage ripple measurements should be taken directly across the 100 nF ceramic capacitor **Cox**, placed right between the output terminals. Care must be taken to minimize the loop area between the oscilloscope probe tip and the ground lead. One method to minimize this loop is to remove the probe's spring tip and 'pigtail' ground lead and then wind bare wire around the probe shaft. The bare wire should contact the ground of the probe, and the end of the wire can then contact the ground side of **Cox**. Figure 5 shows a diagram of this method.

MOSFET Footprints

The LM3430 evaluation board has a footprint for a single MOSFET with an SO-8 package using the industry standard pinout. (See *Figure 2*) This footprint can also accept newer MOSFET packages that are compatible with SO-8 footprints.

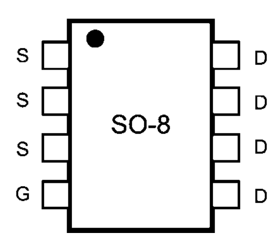


FIGURE 2. SO-8 MOSFET Pinout

Permanent Components

The following components should remain the same for any new circuits evaluated on the LM3430 evaluation board:

Name	Value
Cox, Cinx	0.1 µF
Cf	1 µF
Csns	1 nF
Rpd	10 kΩ
Rs1	100Ω

Additional Footprints

The 100 pF capacitor **Csyc** provides an AC input path for external clock synchronization. Detection of the sync pulse requires a peak voltage level greater than 3.8V at the RT/SYNC pin. Note that the DC voltage at RT/SYNC is approximately 2V to allow compatibility with 3.3V logic. The sync pulse width should be set between 15 ns to 150 ns by the external components. The **Rt** resistor is always required, whether the oscillator is free running or externally synchronized. **Rt** must be selected so that the free-running oscillator frequency is below the lowest synchronization frequency.

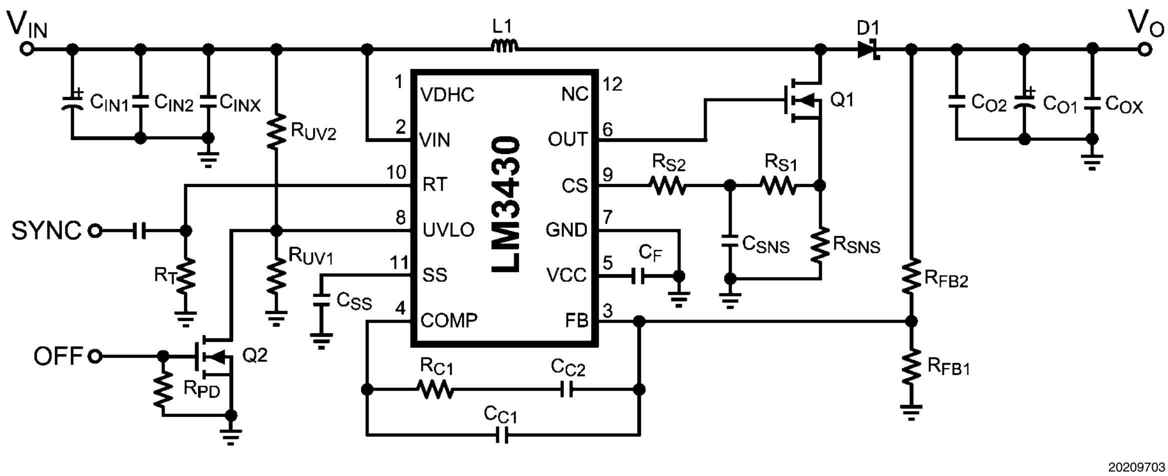


FIGURE 3. Circuit Schematic

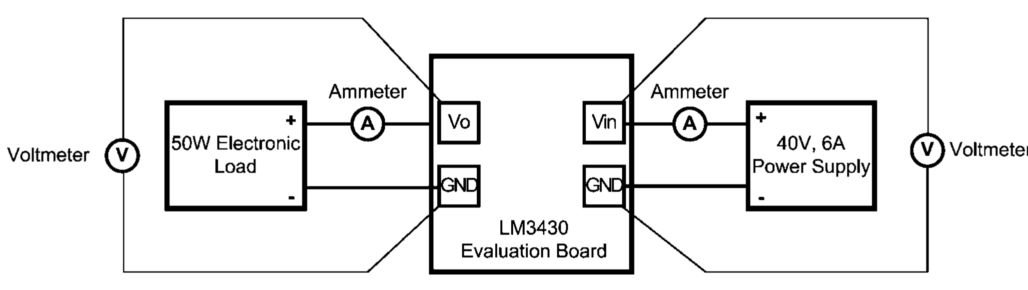


FIGURE 4. Efficiency Measurement Setup

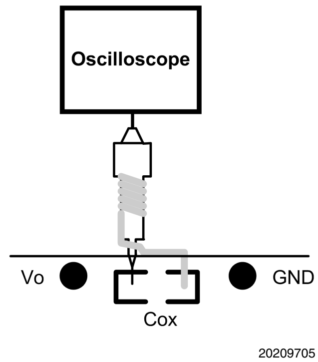
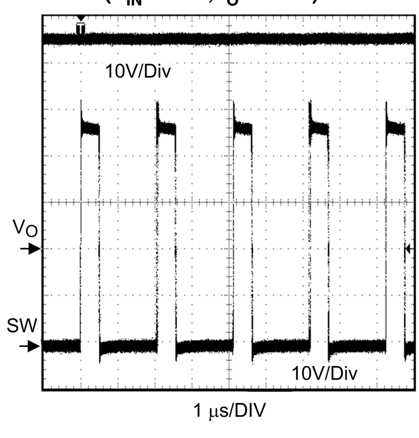


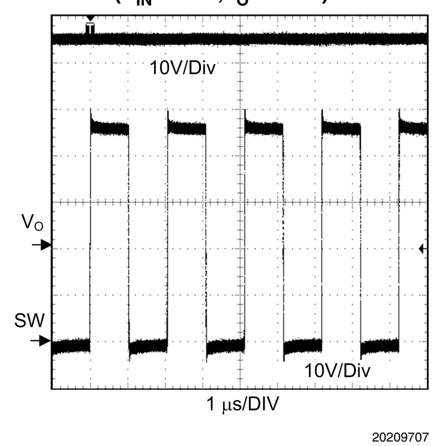
FIGURE 5. Output Voltage Ripple Measurement Setup

Typical Performance Characteristics

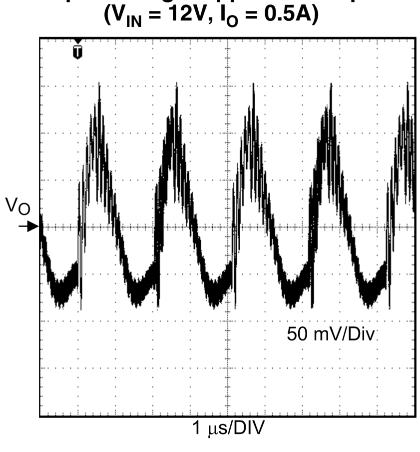
Switch Node Voltage (V_{IN} = 12V, I_O = 0.5A)



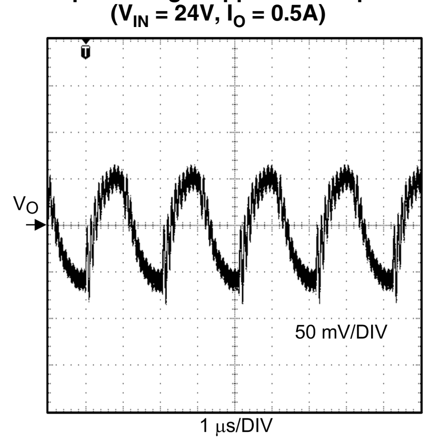
Switch Node Voltage (V_{IN} = 24V, I_O = 0.5A)



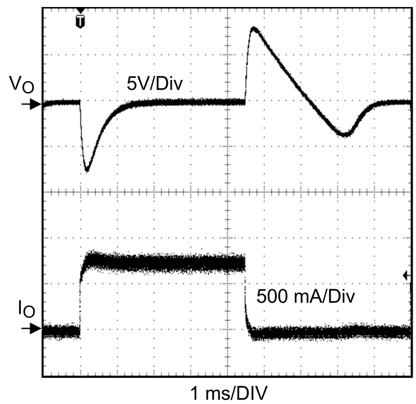
Output Voltage Ripple AC Coupled (V_{IN} = 12V, I_O = 0.5A)



Output Voltage Ripple AC Coupled (V_{IN} = 24V, I_O = 0.5A)

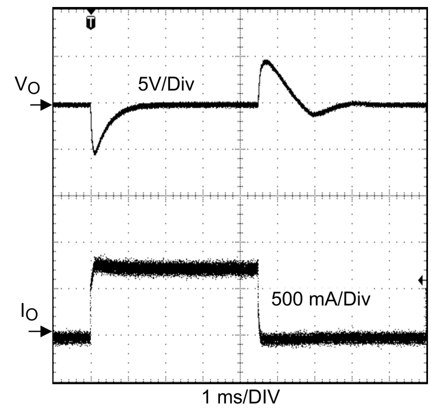


Load Transient Response
(V_{IN} = 12V, I_O = 0 to 0.7A)



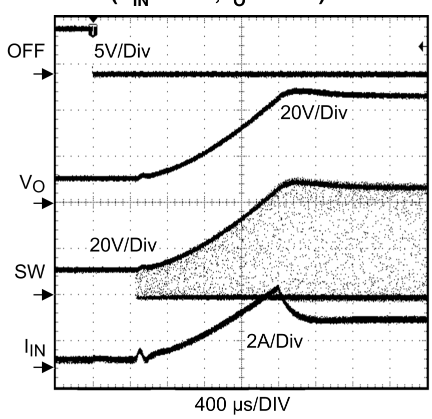
20209710

Load Transient Response
(V_{IN} = 24V, I_O = 0 to 0.7A)



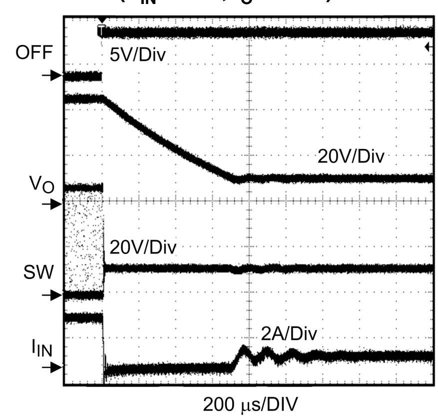
20209711

Start Up
(V_{IN} = 12V, I_O = 0.5A)



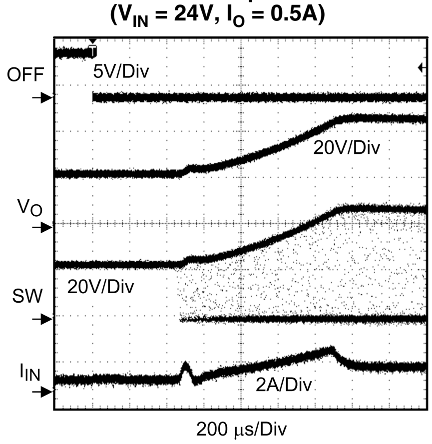
20209712

Shutdown
(V_{IN} = 12V, I_O = 0.5A)



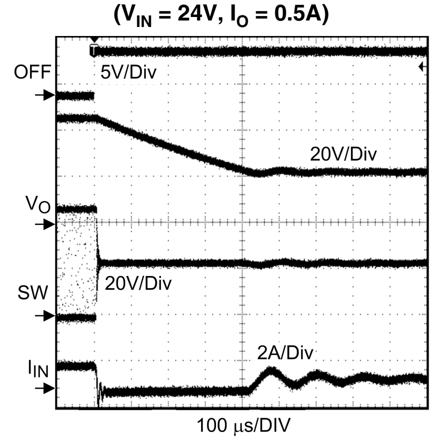
20209713

Start Up
(V_{IN} = 24V, I_O = 0.5A)



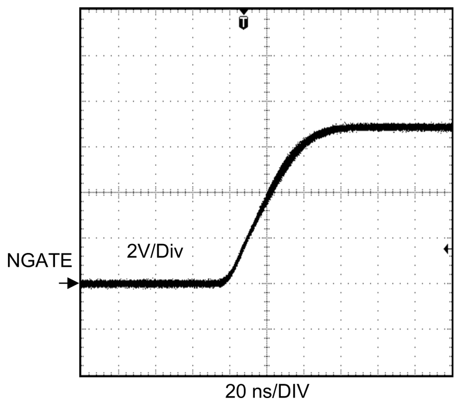
20209714

Shutdown
(V_{IN} = 24V, I_O = 0.5A)



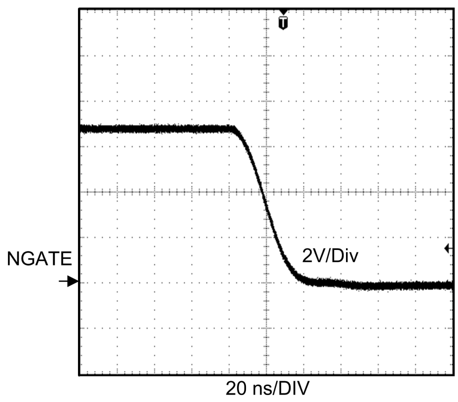
20209715

NGATE Rise Time (V_{IN} = 12V, no-load, Si4850DY)



20209716

NGATE Fall Time (V_{IN} = 12V, no-load, Si4850DY)

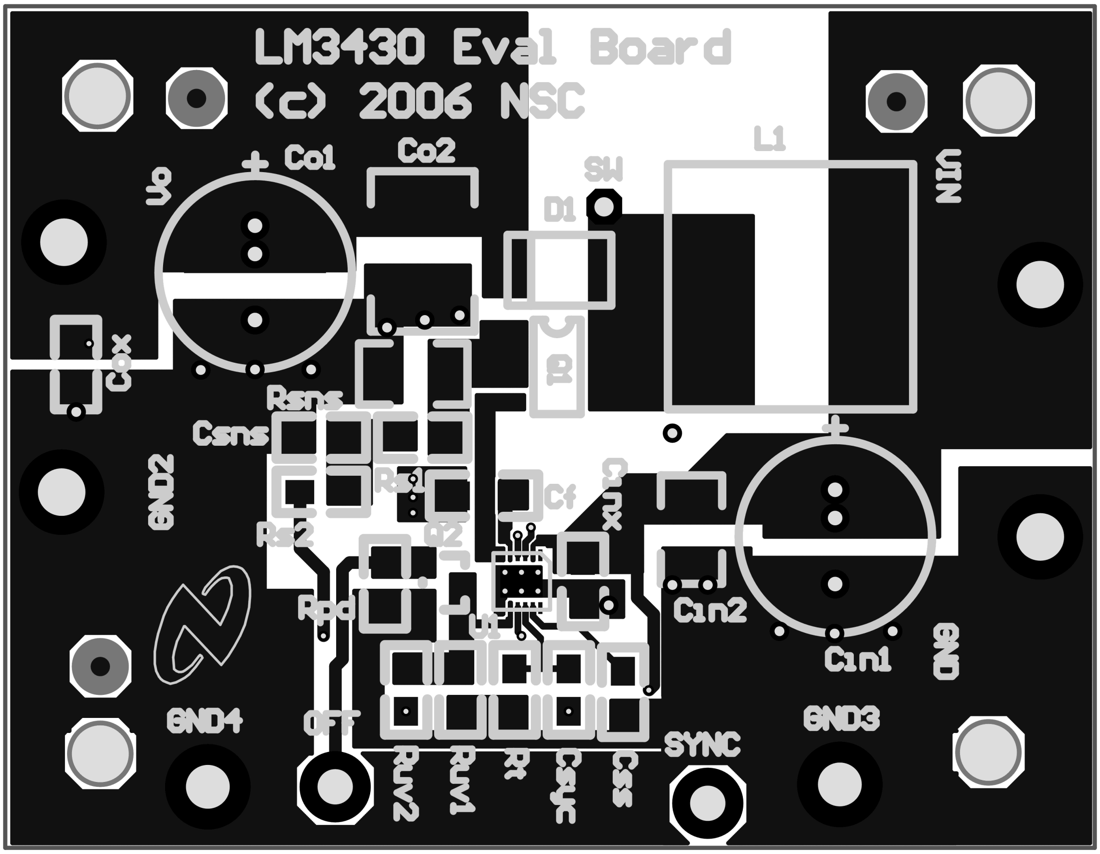


20209717

Bill of Materials

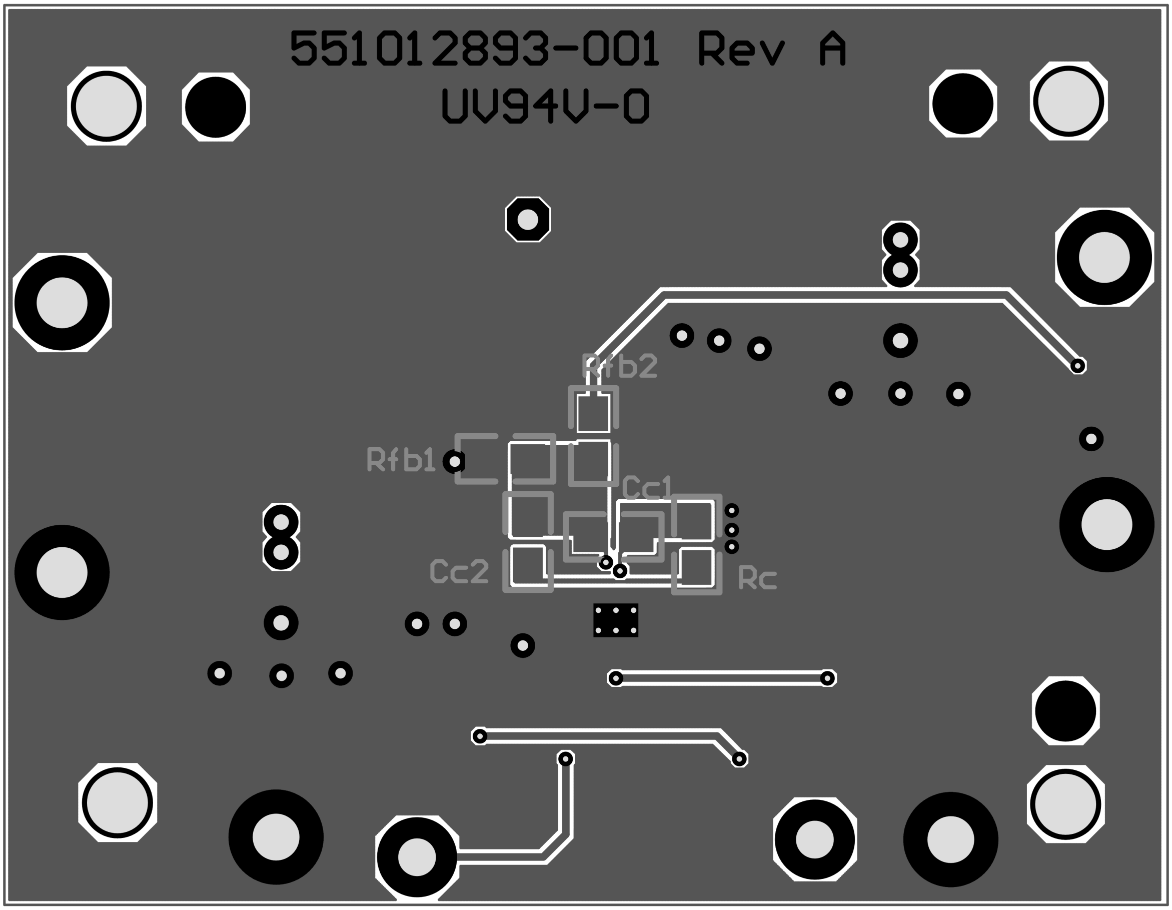
ID	Part Number	Type	Size	Parameters	Qty	Vendor
U1	LM3430	Low-Side Controller	LLP-12		1	NSC
Q1	Si4850EY	MOSFET	SO-8	60V, 31mΩ, 27nC	1	Vishay
D1	CMSH3-60M	Schottky Diode	SMB	60V, 3A	1	Central Semi
L1	PF0553.333NL	Inductor	12.5x12.5 x8mm	33µH, 6.22A, 60mΩ	1	Pulse
Cin1 Cin2	C4532X7R1H475M	Capacitor	1812	4.7µF, 50V	2	TDK
Co1 Co2	C5750X7R2A475M	Capacitor	2220	4.7µF, 100V, 2mΩ	2	TDK
Cf	C3216X7R1E105K	Capacitor	1206	1µF, 25V	1	TDK
Cinx Cox	C2012X7R2A104M	Capacitor	0805	100nF 100V	2	TDK
Cc1	VJ0805Y222KXXAT	Capacitor	0805	2.2nF 10%	1	Vishay
Cc2	VJ0805Y224KXXAT	Capacitor	0805	220nF 10%	1	Vishay
Css	VJ0805Y103KXXAT	Capacitor	0805	10nF 10%	1	Vishay
Csns	VJ0805Y102KXXAT	Capacitor	0805	1nF 10%	1	Vishay
Csyc	VJ0805A101KXXAT	Capacitor	0805	100pF 10%	1	Vishay
Rc	CRCW08051621F	Resistor	0805	1.62kΩ 1%	1	Vishay
Rfb1	CRCW08055360F	Resistor	0805	536Ω 1%	1	Vishay
Rfb2	CRCW08052002F	Resistor	0805	20kΩ 1%	1	Vishay
Rs1	CRCW0805331J	Resistor	0805	330Ω 5%	1	Vishay
Rs2	CRCW08054990F	Resistor	0805	499Ω 1%	1	Vishay
Rsns	WSL2010 0.1 1%	Resistor	2010	0.1Ω 1%, 0.5W	1	Vishay
Rt	CRCW08053402F	Resistor	0805	34kΩ 1%	1	Vishay
Ruv1 Ruv2	CRCW0805103J	Resistor	0805	10kΩ 5%	2	Vishay
VIN, Vo GND GND2	160-1026	Terminal	0.094”		4	Cambion
GND3 GND4 OFF SYNC	160-1512	Terminal	0.062”		4	Cambion

PC Board Layout



20209718

Top Layer and Top Overlay



20209719

Bottom Layer

Notes

Notes

National Semiconductor Americas Customer Support Center
Email: new.feedback@nsc.com
Tel: 1-800-272-9959

National Semiconductor Europe Customer Support Center
Fax: +49 (0) 180-530-85-86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 69 9508 6208
English Tel: +49 (0) 870 24 0 2171
Français Tel: +33 (0) 1 41 91 8790

National Semiconductor Asia Pacific Customer Support Center
Email: ap.support@nsc.com

National Semiconductor Japan Customer Support Center
Fax: 81-3-5639-7507
Email: jpn.feedback@nsc.com
Tel: 81-3-5639-7560

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