

LT4320

Ideal Diode Bridge Controller

DESCRIPTION

Demonstration circuit 1823B features the ideal diode bridge controller **LT[®]4320** suitable for applications that require high current AC to DC full-wave rectification or DC polarity correction (see Table 2).

The LT4320 drives four N-channel MOSFETs to perform full-wave rectification functionally similar to a diode bridge but with much lower power dissipation. This topology eases thermal design, and increases usable output voltage. In addition, an all N-channel topology has benefits over a P-channel topology such as a wider selection of MOSFETs, lower cost, lower $R_{DS(ON)}$, and smaller footprint.

Only a few essential components are required to operate the LT4320 as an ideal diode bridge: four N-channel MOSFETs, a bypass ceramic capacitor, and an AC

smoothing capacitor (C_{LOAD}). The DC1823B includes four very low $R_{DS(ON)}$ N-channel MOSFETs (2.5m Ω typical) to support high current applications. When an AC voltage source is used, the onboard C_{LOAD} (C2) capacitor allows for up to 1.5A of average output current. Add additional C_{LOAD} capacitance to support higher current AC applications. A unidirectional TVS (D1) is included to protect the application from brief overvoltage events up to the part rating. A footprint for bidirectional TVS (D3) is also included and is recommended for electrically harsh conditions.

Design files for this circuit board are available at <http://www.linear.com/demo/DC1823B>

LT, LT, LTC, LTM, Linear Technology and the Linear logo are registered trademarks of Linear Technology Corporation. All other trademarks are the property of their respective owners.

PERFORMANCE SUMMARY

Table 1. DC Efficiency of the DC1823B at Various Load Currents

DC INPUT VOLTAGE (V)	DC OUTPUT VOLTAGE (V)	DC LOAD CURRENT (A)	EFFICIENCY (%) (TYPICAL)
20.004	19.966	10.008	99.81
20.005	19.906	20.013	99.51
20.006	19.825	30.012	99.10

DEMO MANUAL DC1823B

QUICK START PROCEDURE

1. Connect a DC or AC power supply to VIN1 and VIN2 in any polarity as shown in Figure 1. Make sure the output voltage of the DC or AC power supply is within the input voltage range of the DC1823B as shown in Table 2.
2. Connect a load and a voltmeter across VOUT+ to VOUT- as shown in Figure 1.
3. For a DC input, raise the output voltage of the DC power supply to the desired level. Check the DC1823B output voltage across VOUT+ to VOUT-. The reading should be very close to the input voltage of the DC1823B.
4. For an AC input, raise the output voltage of the AC power supply to the desired level. Make sure the load current is within the current limits as shown in Table 2 with the demo board supplied C_{LOAD}. Add additional C_{LOAD} capacitance, if higher output load current is desired. Refer to the LT4320 data sheet for guidance on selecting C_{LOAD}. With an oscilloscope in place of the output voltmeter, make sure the lowest point of the output voltage (droop) is above minimum operating voltage specified in the LT4320 data sheet.

Note: Maximum load current with an AC input should be limited to about 17A due to MOSFET and PCB limitations.

Table 2. Maximum Load Current per Input Voltage and Type of Voltage Source

VOLTAGE SOURCE	INPUT VOLTAGE	MAXIMUM LOAD CURRENT
DC	9VDC TO 40VDC	30A
AC	12VAC _{RMS}	0.7A*
AC	24VAC _{RMS}	1.5A*

*Limited by demo board supplied C_{LOAD}.

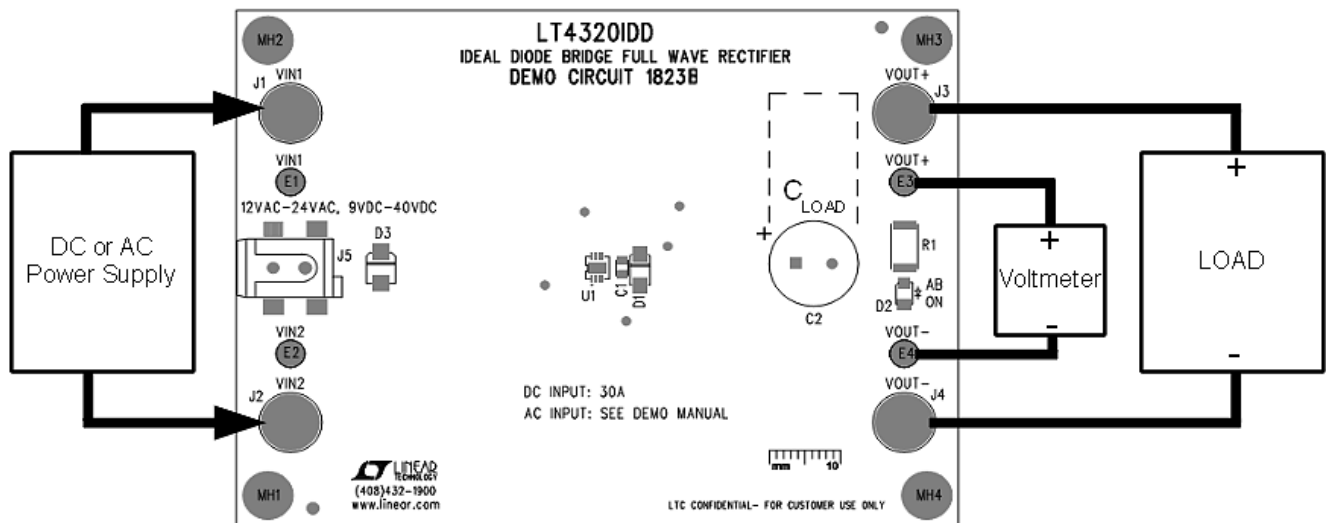


Figure 1. DC1823B Setup

THERMAL PLOTS

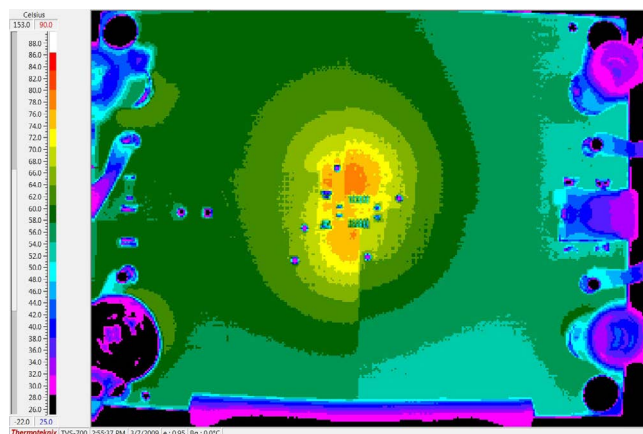


Figure 2. Top View, MOSFET Q2 and Q4 Passing 30ADC (VIN1 Positive with Respect to VIN2)

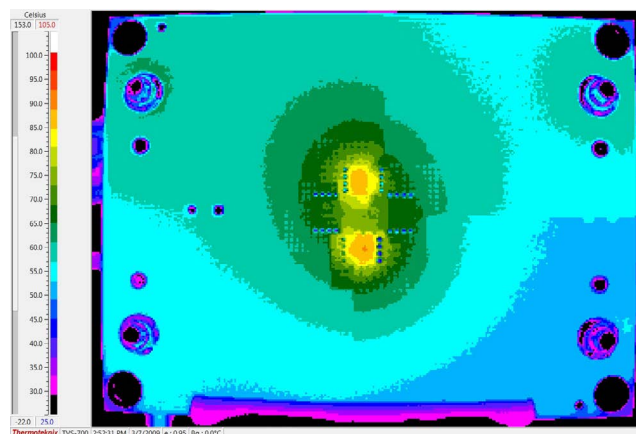


Figure 3. Bottom View, MOSFET Q2 and Q4 Passing 30ADC (VIN1 Positive with Respect to VIN2)

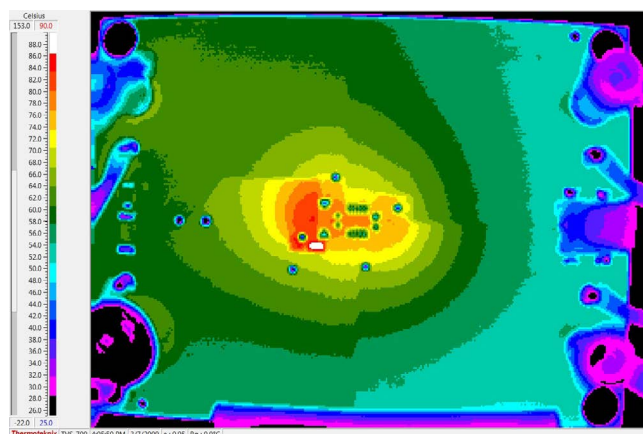


Figure 4. Top View, MOSFET Q1 and Q3 Passing 30ADC (VIN2 Positive with Respect to VIN1)

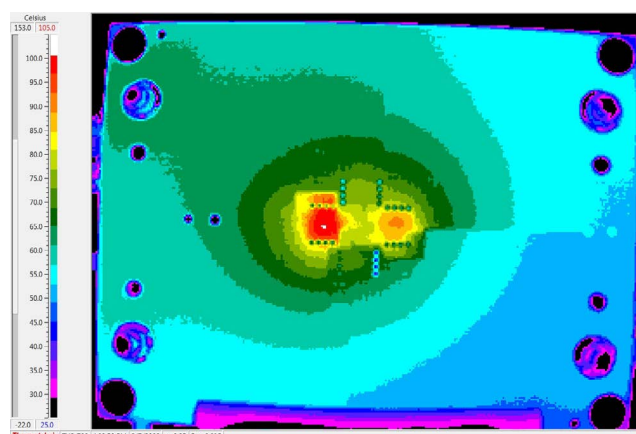


Figure 5. Bottom View, MOSFET Q1 and Q3 Passing 30ADC (VIN2 Positive with Respect to VIN1)

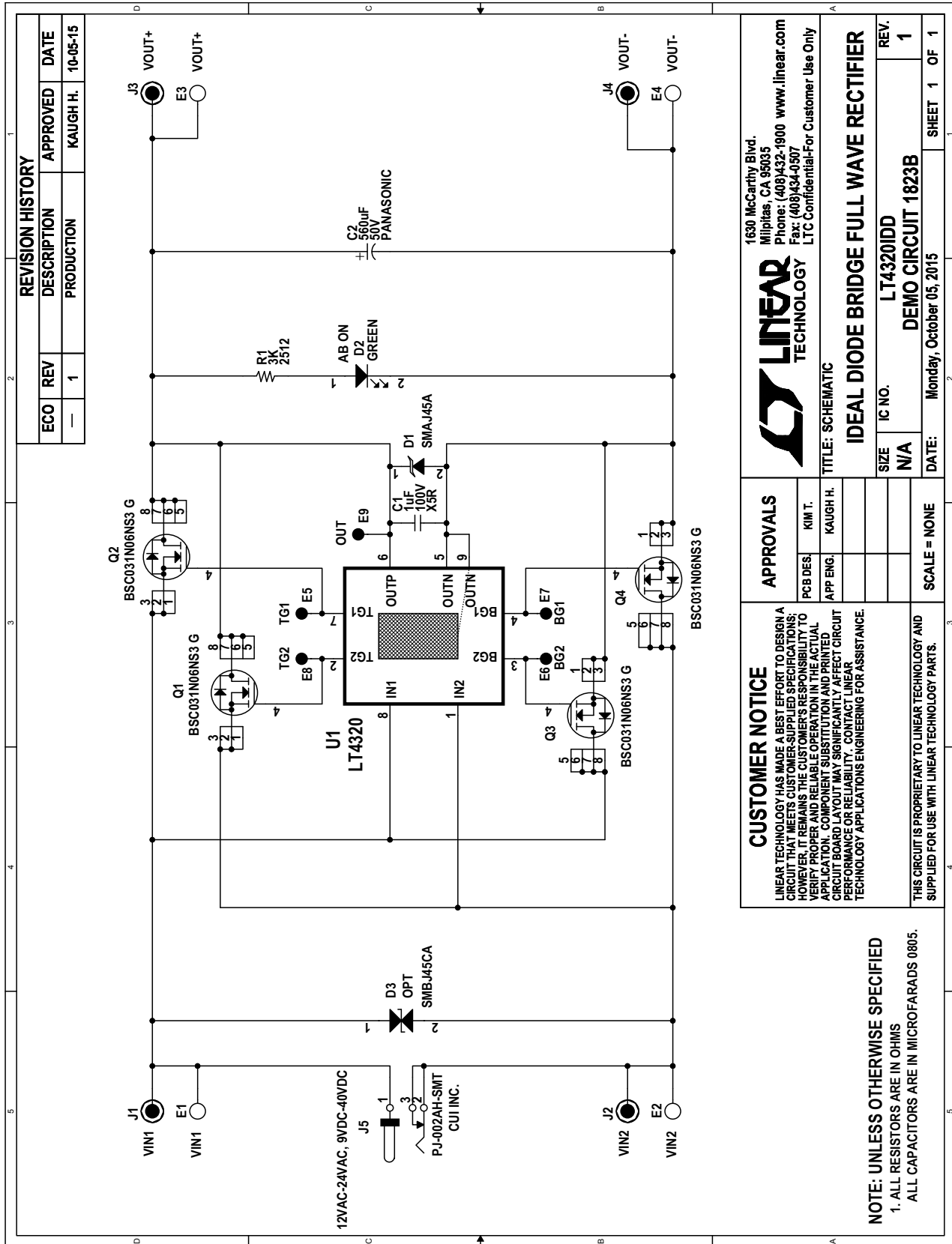
DEMO MANUAL DC1823B

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP, X7S, 1 μ F, 100V, 0805	TDK, C2012X7S2A105K
2	1	C2	CAP, ALUM, 560 μ F, 50V,	PANASONIC, EEU-FM1H561
3	4	Q1, Q2, Q3, Q4	MOSFET, BSC031N06NS3 G SO8-POWERPAK	INFINEON, BSC031N06NS3 G
4	1	U1	IC, LT4320IDD, DFN8DD	LINEAR TECHNOLOGY, LT4320IDD
Optional Circuit Components				
1	1	D1	DIODE, TVS UNIDIRECT 400W 45V SMA	DIODES, SMAJ45A-13-F
2	1	D2	LED, GREEN, LED ROHM-SML-01	ROHM, SML-012P8TT86
3	0	D3	DIODE, OPT SMBJ45CA SMB-DIODE	DIODES, OPT SMBJ45CA-13-F
4	4	E1 TO E4	TP, TURRET, 0.094"	MILL-MAX 2501-2-00-80-00-00-07-0
5	0	E5 TO E9	PAD SMT	PAD SMT
6	4	J1 TO J4	CONN, BANANA JACK,	KEYSTONE 575-4
7	1	J5	CONN, JACK PJ-002AH-SMT	CUI INC PJ-002AH-SMT
8	1	R1	RES, CHIP 3k, 5% 2512	VISHAY, CRCW25123K00JNEG
9	4	MH1 TO MH4	STAND-OFF, NYLON 0.50" TALL	KEYSTONE, 8833 (SNAP ON)
10	1		FAB, PRINTED CIRCUIT BOARD	DEMO CIRCUIT, DC1823B

Note: The DC1823B uses a different green LED D2 as the one on DC1823A was obsoleted.

SCHEMATIC DIAGRAM



REVISION HISTORY				
ECO	REV	DESCRIPTION	APPROVED	DATE
—	1	PRODUCTION	KAUGH H.	10-05-15

LINEAR TECHNOLOGY
 1630 McCarthy Blvd.
 Milpitas, CA 95035
 Phone: (408)432-1900 www.linear.com
 Fax: (408)434-0507
 LTC Confidential-For Customer Use Only

LINEAR TECHNOLOGY

TITLE: SCHEMATIC
IDEAL DIODE BRIDGE FULL WAVE RECTIFIER

SIZE IC NO. REV.
 N/A LT4320IDD 1

DATE: Monday, October 05, 2015 SHEET 1 OF 1

APPROVALS	
PCB DES	KIM T.
APP ENG.	KAUGH H.
SCALE	SCALE = NONE

CUSTOMER NOTICE
 LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS CUSTOMER-SUPPLIED SPECIFICATIONS; HOWEVER, IT REMAINS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRCUIT BOARD LAYOUT MAY SIGNIFICANTLY AFFECT CIRCUIT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE.

THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.

NOTE: UNLESS OTHERWISE SPECIFIED
 1. ALL RESISTORS ARE IN OHMS
 ALL CAPACITORS ARE IN MICROFARADS 0805.

DEMO MANUAL DC1823B

DEMONSTRATION BOARD IMPORTANT NOTICE

Linear Technology Corporation (LTC) provides the enclosed product(s) under the following **AS IS** conditions:

This demonstration board (DEMO BOARD) kit being sold or provided by Linear Technology is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not provided by LTC for commercial use. As such, the DEMO BOARD herein may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including but not limited to product safety measures typically found in finished commercial goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may or may not meet the technical requirements of the directive, or other regulations.

If this evaluation kit does not meet the specifications recited in the DEMO BOARD manual the kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user releases LTC from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. Also be aware that the products herein may not be regulatory compliant or agency certified (FCC, UL, CE, etc.).

No License is granted under any patent right or other intellectual property whatsoever. **LTC assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind.**

LTC currently services a variety of customers for products around the world, and therefore this transaction **is not exclusive**.

Please read the DEMO BOARD manual prior to handling the product. Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged.**

This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

Mailing Address:

Linear Technology
1630 McCarthy Blvd.
Milpitas, CA 95035

Copyright © 2004, Linear Technology Corporation