

LT4320
Ideal Diode Bridge Controller

DESCRIPTION

Demonstration circuit 1902B features the ideal diode bridge controller LT[®]4320 suitable for applications that require low to medium current AC to DC full-wave rectification or DC polarity correction and a small compact solution (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 DC1902B includes low $R_{DS(ON)}$ N-channel MOSFETs (10m Ω typical) to support low to medium 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 (D2) is also included and is recommended for electrically harsh conditions.

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

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 DC1902B at Various Input Voltages

DC INPUT VOLTAGE (V)	DC OUTPUT VOLTAGE (V)	DC LOAD CURRENT (A)	EFFICIENCY (%) (TYPICAL)
12.046	11.977	3.500	99.43
20.045	19.972	3.500	99.64
40.025	39.952	3.500	99.82

DEMO MANUAL DC1902B

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 DC1902B 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 DC1902B output voltage across VOUT+ to VOUT-. The reading should be very close to the input voltage of the DC1902B.
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} (C2). Add additional C_{LOAD} capacitance, if higher output load current is desired. With an oscilloscope in place of the output voltmeter, make sure the lowest point of the output voltage (droop) is above the minimum operating voltage specified in the LT4320 data sheet.

Note: Maximum load current with an AC input should be limited to about 3A 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 60VDC	3.5A
AC, 60Hz	12VAC _{RMS}	0.7A*
AC, 60Hz	24VAC _{RMS}	1.5A*

*Limited by demo board supplied C2.

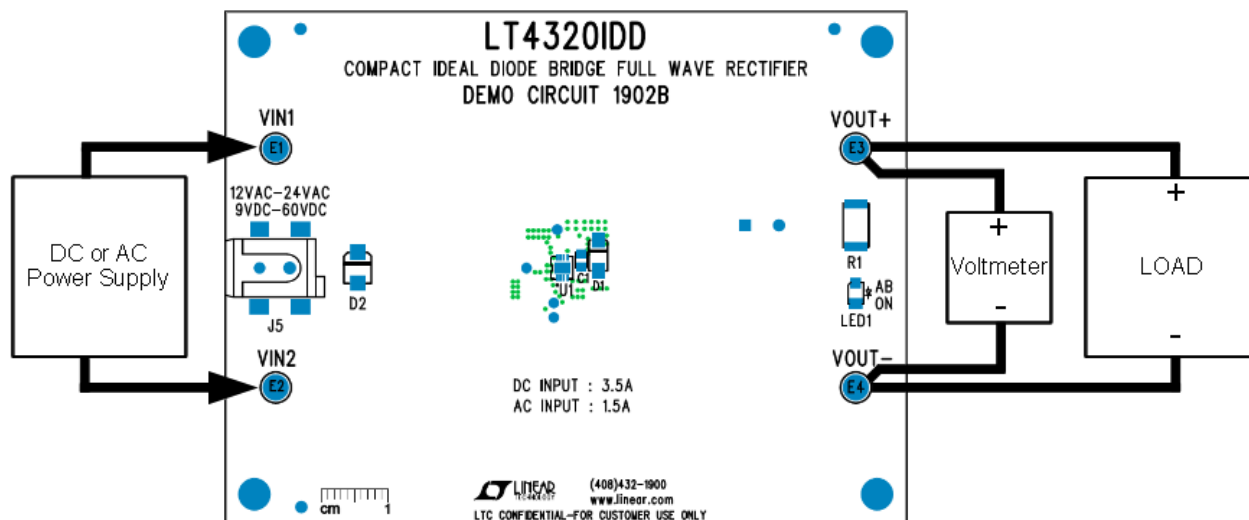


Figure 1. DC1902B Setup

THERMAL PLOT

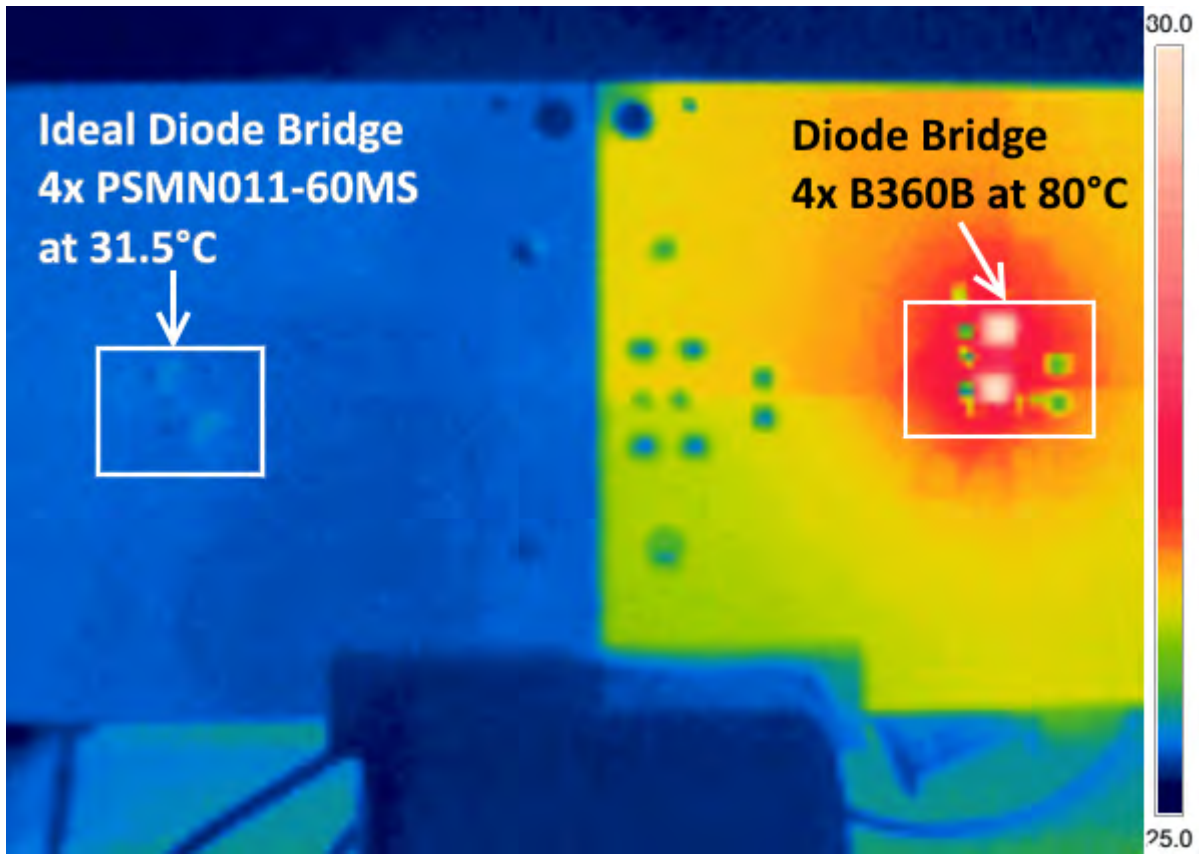


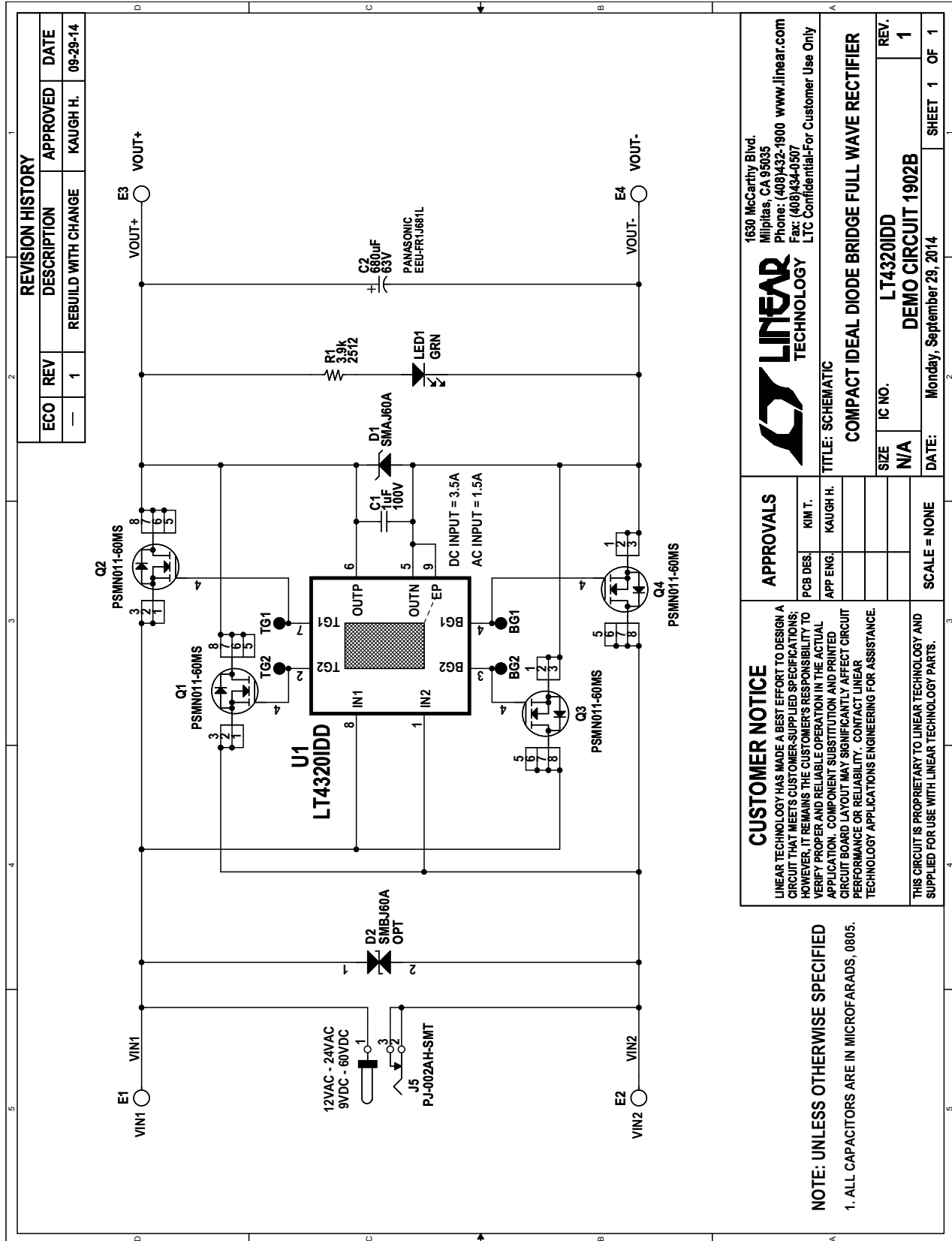
Figure 2. Ideal Diode Bridge Using Four PSMN011-60MS vs Diode Bridge Using Four B360B Passing 3ADC (VIN1 Positive with Respect to VIN2)

DEMO MANUAL DC1902B

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP, X7S, 1 μ F, 100V, 10% 0805	TDK, C2012X7S2A105K
2	1	C2	CAP, ALUM, 680 μ F 63V, C-SANYO-12.5X35	PANASONIC, EEU-FR1J681L
3	1	U1	IC, LT4320IDD, DFN8DD	LINEAR TECHNOLOGY, LT4320IDD#PBF
4	4	Q1 TO Q4	MOSFET, N-CH, 60V, LFPAK33	NXP, PSMN011-60MS
Optional Circuit Components				
1	1	D1	DIODE, TVS 400W, SMA-DIODE	DIODES INC, SMAJ60A-13-F
2	0	D2	DIODE, SMBJ60CA	OPT
3	4	E1 TO E4	TP, TURRET, 0.094"	MILL-MAX, 2501-2-00-80-00-00-07-0
4	1	J5	CONN, POWER JACK 2.1X5.5MM HI CUR SMD	CUI INC, PJ-002A-SMT
5	1	LED1	LED, GREEN SMD	ROHM, SML-010FTT86L
6	1	R1	RES, CHIP 3.9k, 5% 2512	VISHAY, CRCW25123K90JNEG
7	4	MH1 TO MH4	STAND-OFF, NYLON 0.50" TALL	KEystone, 8833 (SNAP ON)

SCHEMATIC DIAGRAM



LINEAR TECHNOLOGY
 1630 McCarthy Blvd.
 Milpitas, CA 95035
 Phone: (408)432-1900 www.linear.com
 Fax: (408)434-0907
 LTC Confidential-For Customer Use Only

TITLE: SCHEMATIC
COMPACT IDEAL DIODE BRIDGE FULL WAVE RECTIFIER

SIZE: N/A IC NO.: LT4320IDD
 REV.: 1
 DATE: Monday, September 29, 2014 SHEET 1 OF 1

APPROVALS

PCB DES.	KIM T.
APP ENG.	KAUGH H.
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 CAPACITORS ARE IN MICROFARADS, 0805.