

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>

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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.

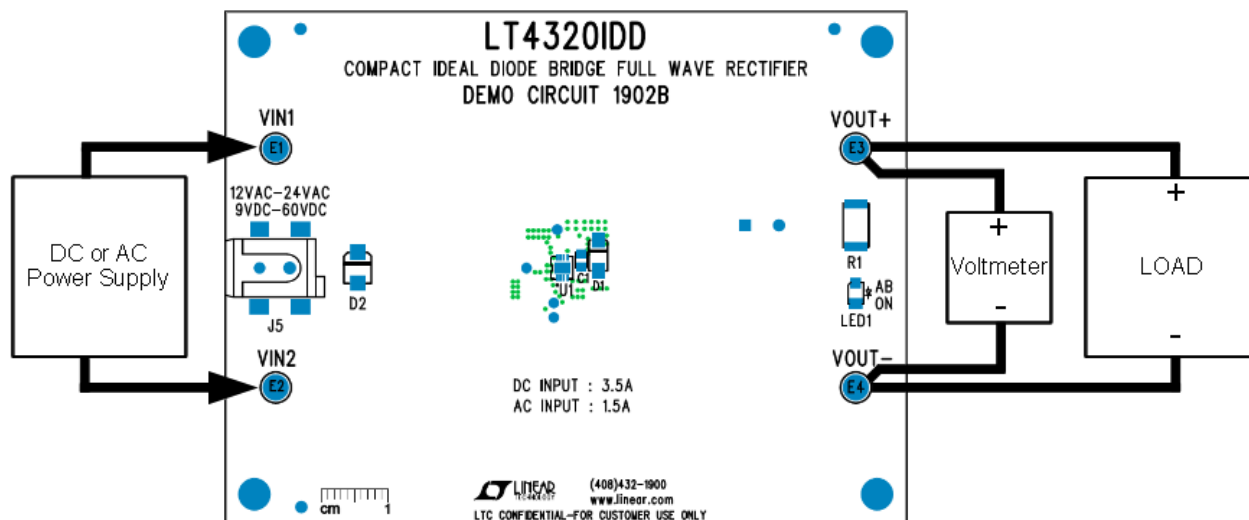


Figure 1. DC1902B Setup

THERMAL PLOT

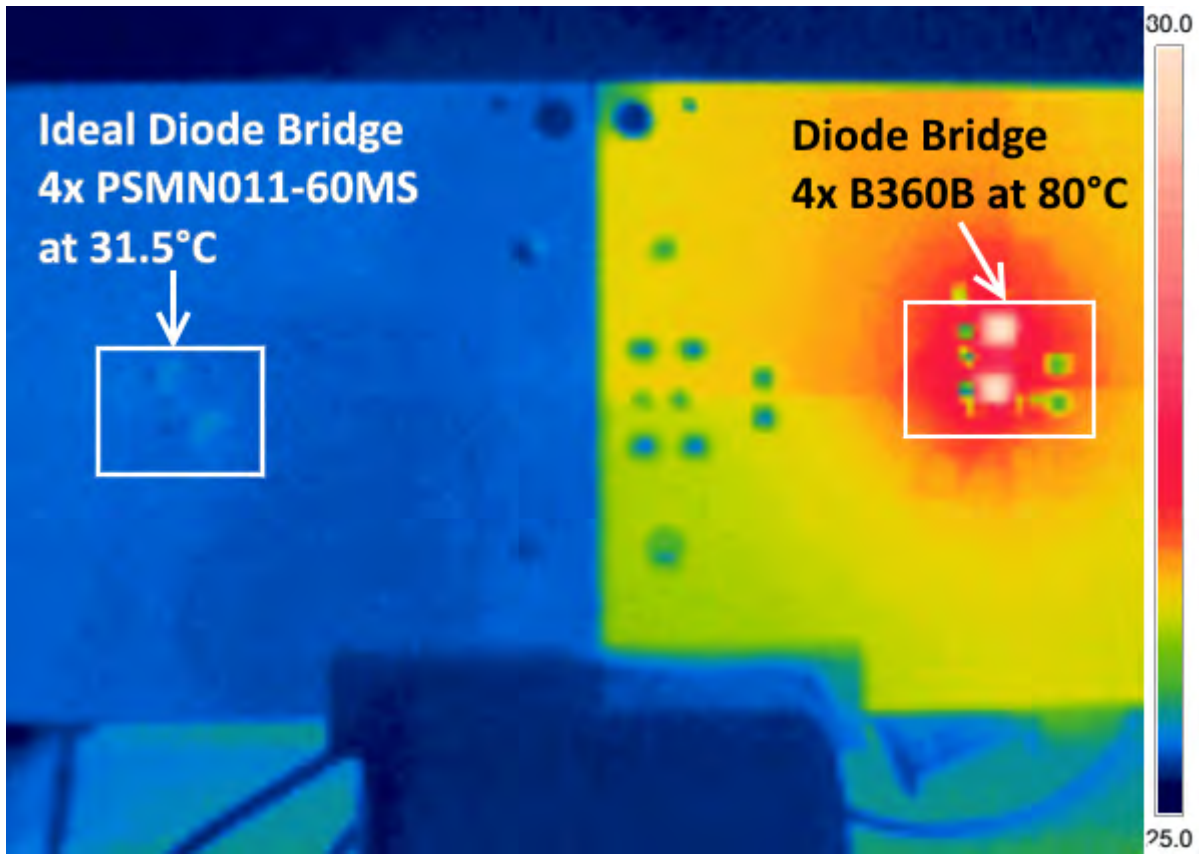


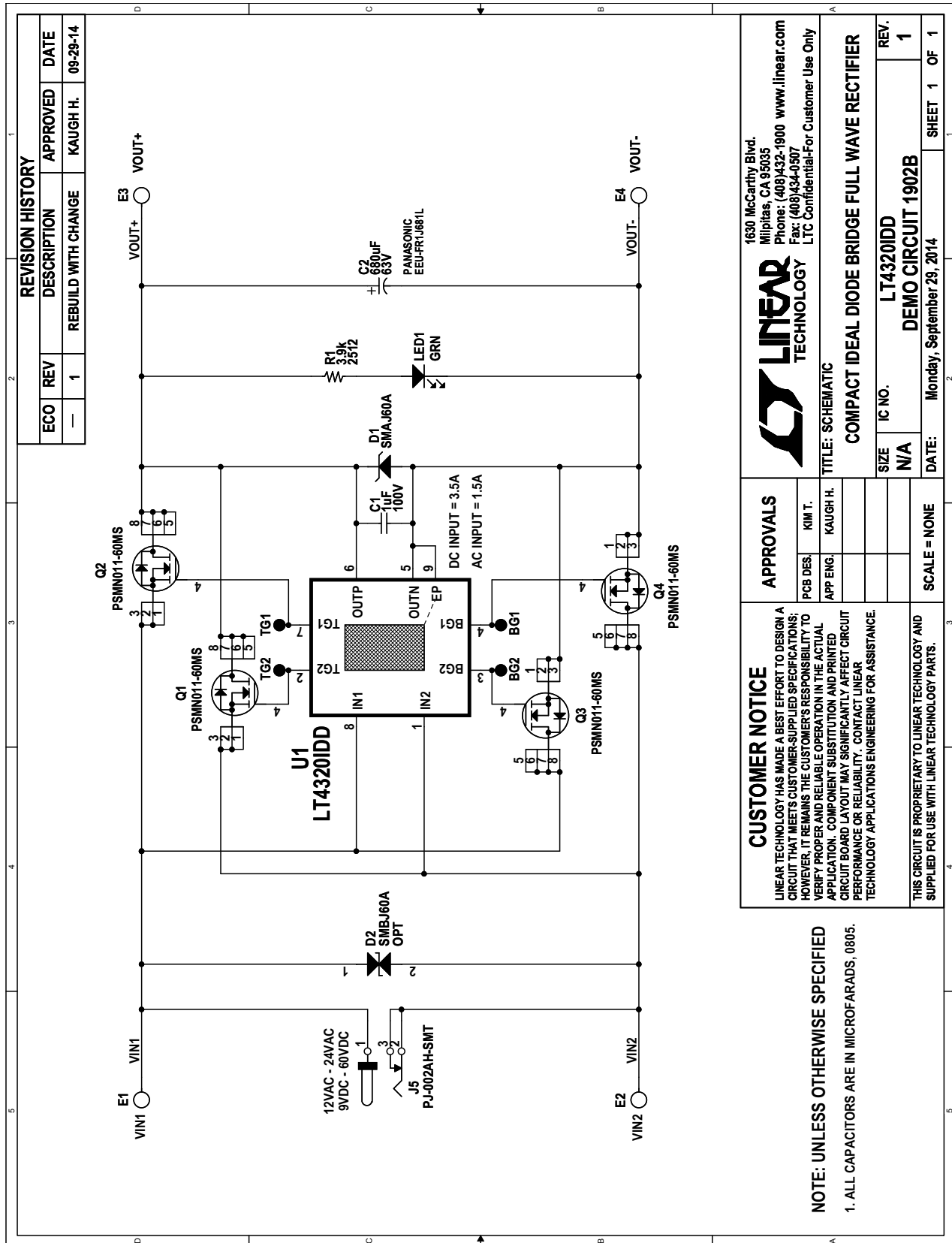
Figure 2. Ideal Diode Bridge Using Four PSMN011-60MS vs Diode Bridge Using Four B360B Passing 3ADC (VIN1 Positive with Respect to VIN2)

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



DEMO MANUAL DC1902B

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