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 (2.5mΩ 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

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

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}.

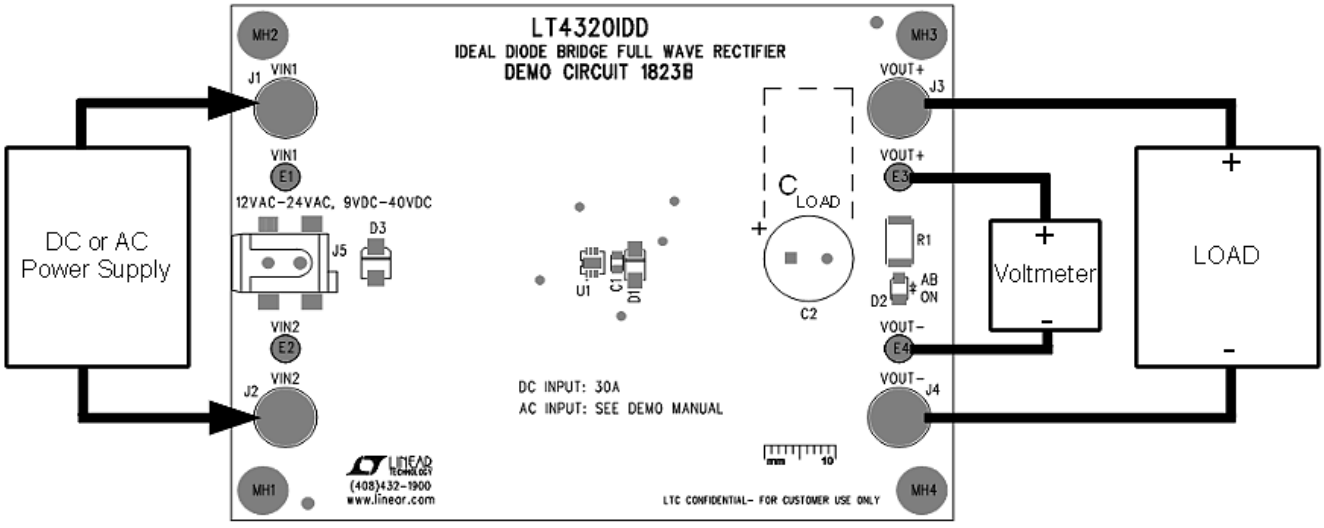


Figure 1. DC1823B Setup

THERMAL PLOTS

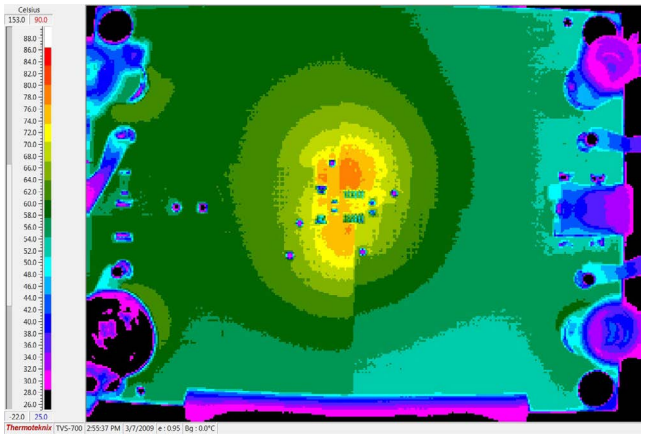


Figure 2. Top View, MOSFET Q2 and Q4 Passing 30ADC (VIN1 Positive with Respect to VIN2)

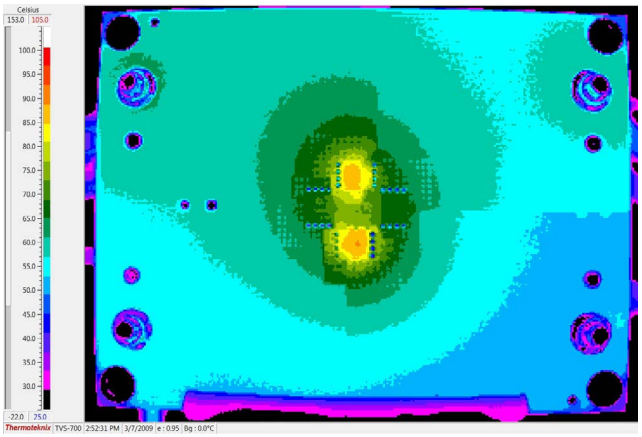


Figure 3. Bottom View, MOSFET Q2 and Q4 Passing 30ADC (VIN1 Positive with Respect to VIN2)

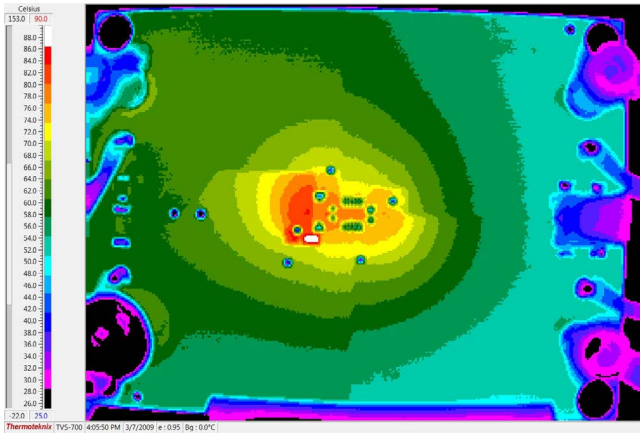


Figure 4. Top View, MOSFET Q1 and Q3 Passing 30ADC (VIN2 Positive with Respect to VIN1)

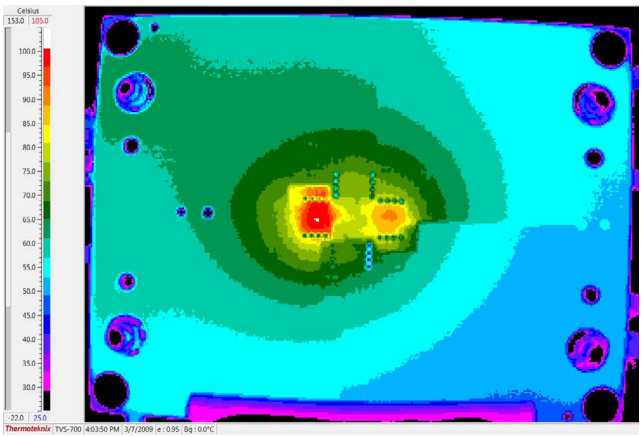


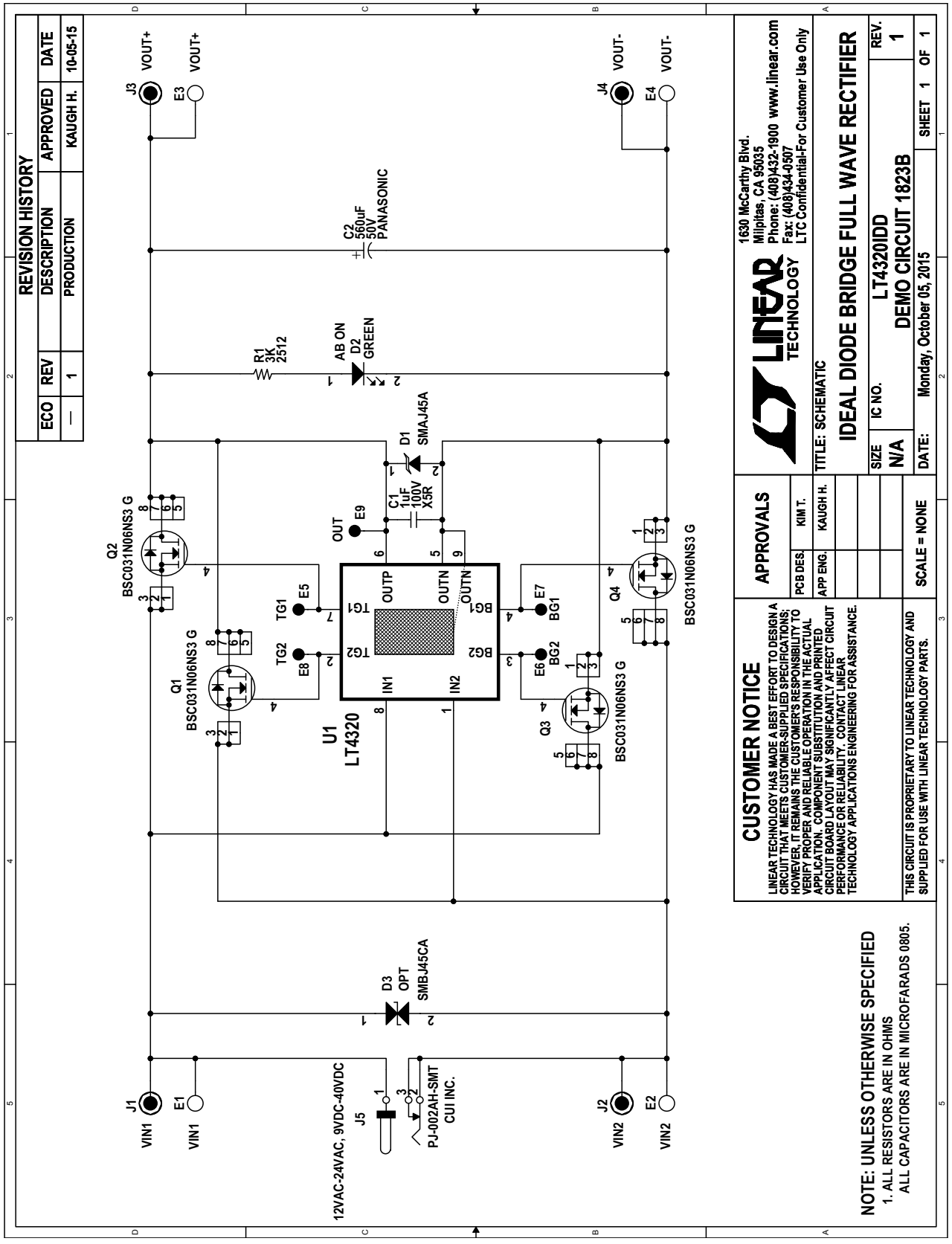
Figure 5. Bottom View, MOSFET Q1 and Q3 Passing 30ADC (VIN2 Positive with Respect to VIN1)

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP, X7S, 1µF, 100V, 0805	TDK, C2012X7S2A105K
2	1	C2	CAP, ALUM, 560µF, 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



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