Quarter Brick High Voltage, 3.3V, 30A Reference Design

National Semiconductor
RD-183
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1.0 Design Specifications

Inputs	Output #1
VinMin=36V	Vout1=3.3V
VinMax=75V	Iout1=up to 30A

2.0 Design Description

The LM5035C evaluation board is designed to provide the design engineer with a fully functional power converter based on the Half Bridge topology to evaluate the LM5035C controller.

The LM5035C is a functional variant of the LM5035B Half-Bridge PWM Controller. The amplitude of the SR control signals are 5V instead of the VCC level. The evaluation board is provided in an industry standard quarter-brick footprint.

3.0 Features

The performance of the evaluation board is as follows:

- Input operating range: 36V to 75V
- Output voltage: 3.3V
- Output current: 0 to 30A
- Measured efficiency: 89% at 30A, 92% at 15A
- Frequency of operation: 400 kHz
- Board size: 2.28 x 1.45 x 0.5 inches
- Load Regulation: 0.2%
- Line Regulation: 0.1%
- Line UVLO (33.9V/31.9V on/off)
- Line OVP (79.4V/78.3V off/on)
- Hiccup current limit

4.0 Schematic

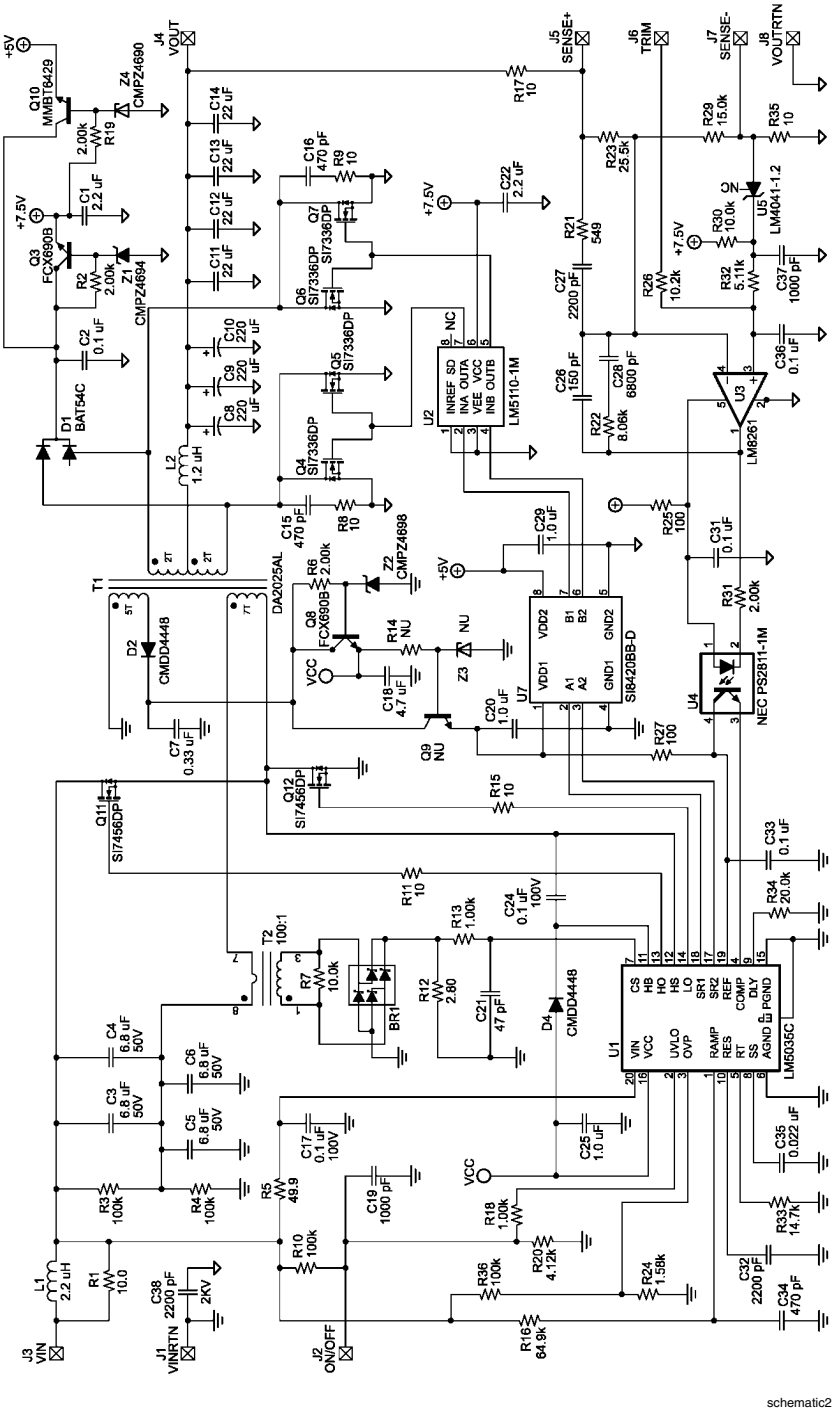

FIGURE 1. Application Circuit: Input 36 to 75V, Output 3.3V, 30A

5.0 Bill of Materials

Item	Part Description	Qty	Ref Designator	Remark
1	LM5035C Controller MH20	1	U1	NSC LM5035CMH
2	LM5110-1M Dual Driver	1	U2	NSC LM5110-1M
3	LM8261M5 Op Amp SOT23-5	1	U3	NSC LM8261M5
4	LM4041AIM3-1.2 Ref Amp SOT23	1	U5	NSC LM4041AIM3-.12
5	Opto-Coupler PS2811-1M	1	U4	NEC PS2811-1M
6	Digital Isolator IC SOIC-8	1	U6	Silicon Labs SI8420BB-D
7	Cer Cap 47pF 50V COG 0603	1	C21	TDK C1608COG1H470J
8	Cer Cap 150pF 50V COG 0603	1	C26	TDK C1608COG1H151J
9	Cer Cap 470pF 50V COG 0603	1	C34	TDK C1608COG1H471J
10	Cer Cap 1000pF 50V X7R 0603	2	C19, C37	TDK C1608X7R1H102K
11	Cer Cap 2000pF 50V COG 0603	2	C27, C32	TDK C1608COG1H222J
12	Cer Cap 6800pF 50V COG 0603	1	C28	TDK C1608COG1H682J
13	Cer Cap 0.022uF 25V COG 0603	1	C35	TDK C1608COG1E223J
14	Cer Cap 0.1uF 50V X7R 0603	3	C2, C33, C36	TDK C1608X7R1H104K
15	Cer Cap 1.0uF 16V X7R 0603	2	C25, C31, C29, C20	TDK C1608X7R1C105K
16	Cer Cap 470pF 50V COG 0805	2	C15, C16	KEMT C0805C471M5RAC
17	Cer Cap 0.1uF 100V X7R 0805	2	C17, C24	TDK C2012X7R2A104K
18	Cer Cap 0.33uF 50V X7R 0805	1	C7	TDK C2012X7R1H334K
19	Cer Cap 2.2uF 16V X7R 0805	2	C1, C22	TDK C2012X7R1C225K
20	Cer Cap 4.7uF 16V X7R 1206	1	C18	TDK C3216X7R1C475K
21	Cer Cap 22uF 6.3V X5R 1206	4	C11–C14	TDK C3216X5R0J226M
22	Cer Cap 2200pF 2000V X7R 1812	1	C38	TDK C4532X7R3D222K
23	Cer Cap 6.8uF 50V X7R 1812	4	C3–C6	TDK C4532X7R1H685M
24	POSCAP 220uF 6.3V	3	C8–C10	Sanyo 6TPE220MI
25	Res 2.8 Ohm 0.1W 1% 0603	1	R12	Vishay CRCW06032R80F
26	Res 10 Ohm 0.1W 1% 0603	2	R17, R35	Vishay CRCW060310R0F
27	Res 100 Ohm 0.1W 1% 0603	3	R25, R27	Vishay CRCW06031000F
28	Res 549 Ohm 0.1W 1% 0603	1	R21	Vishay CRCW06035490F
29	Res 1K Ohm 0.1W 1% 0603	4	R13, R18	Vishay CRCW06031001F
30	Res 1.58K Ohm 0.1W 1% 0603	1	R24	Vishay CRCW06031581F
31	Res 2.0K Ohm 0.1W 1% 0603	1	R31	Vishay CRCW06032001F
32	Res 4.12K Ohm 0.1W 1% 0603	1	R20	Vishay CRCW06034121F
33	Res 5.11K Ohm 0.1W 1% 0603	1	R32	Vishay CRCW06035111F
34	Res 8.06K Ohm 0.1W 1% 0603	1	R22	Vishay CRCW06038061F
35	Res 10K Ohm 0.1W 1% 0603	2	R7, R30	Vishay CRCW06031002F
36	Res 10.2K Ohm 0.1W 1% 0603	1	R26	Vishay CRCW06031022F
37	Res 14.7K Ohm 0.1W 1% 0603	1	R33, R46	Vishay CRCW06031472F

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Item	Part Description	Qty	Ref Designator	Remark
38	Res 15K Ohm 0.1W 1% 0603	1	R29, R41	Vishay CRCW06031502F
39	Res 20K Ohm 0.1W 1% 0603	1	R34	Vishay CRCW06032002F
40	Res 25.5K Ohm 0.1W 1% 0603	1	R23	Vishay CRCW06032552F
41	Res 100K Ohm 0.1W 1% 0603	2	R3, R4	Vishay CRCW06031003F
42	NU 0805	1	R14	NU
43	Res 10 OHM 1/10W 1% 0805	3	R1, R11, R15	Vishay CRCW080510R0F
44	Res 49.9 OHM 1/10W 1% 0805	1	R5	Vishay CRCW080549R9F
45	Res 2K OHM 1/10W 1% 0805	1	R2, R19	Vishay CRCW08052001F
46	Res 10K OHM 1/10W 1% 0805	1	R6	Vishay CRCW08051002F
47	Res 64.9K OHM 1/10W 1% 0805	1	R16	Vishay CRCW08056492F
48	Res 100K OHM 1/10W 1% 0805	2	R10, R36	Vishay CRCW08051003F
49	Res 10 OHM 1% 2010	2	R8, R9	Vishay CRCW201010R0F
50	Schottky, Diode, 75V 150mA SOT23	1	D1	BAV70-TP
51	Diode, 75V 250mA SOD-323	2	D2, D4	Central CMDD4448
52	Diodes, Rectifier, Bridge, 30V	1	BR1	BAT54BRW
53	Zener 8.2V 5% SOT23	1	Z1	Central CMPZ4694
54	Zener 11V 5% SOT23	1	Z2	Central CMPZ4698
55	Zener 5.6V, 5% SOT23	1	Z4	Central CMPZ4690
	NU SOT23	1	Z3	NU
56	N-FET 100V 25m ohm	2	Q1, Q2	Vishay Si7456DP
57	N-FET 30V 3m ohm	4	Q4–7	Vishay Si7336ADP
58	NPN, ZETEX 45V 2A	2	Q3, Q8	ZETEX FCX690B
59	NPN, ON SEMI 45V, 225mW	1	Q10	MMBT6429LT1G
60	NU	1	Q9	NU
61	Inductor 2.2uH 5.4A	1	L1	TDK RLF7030T-2R2M5R4
62	Inductor 1.2uH 37A	1	L2	Coilcraft SER2010-122MX
63	Transformer 8:5:2:2	1	T1	Coilcraft DA2025-AL
64	Current XFR 100:1, 10A	1	T2	Pulse Engr P8208
65	Test Pin, Brick 0.040X0.5	6	J1–3, J5–7	Mill-Max 3104-2-00-80-00-00-08-0
66	Test Pin, Brick 0.080X0.375	2	J4, J8	Mill-Max 3231-2-00-01-00-00-08-0

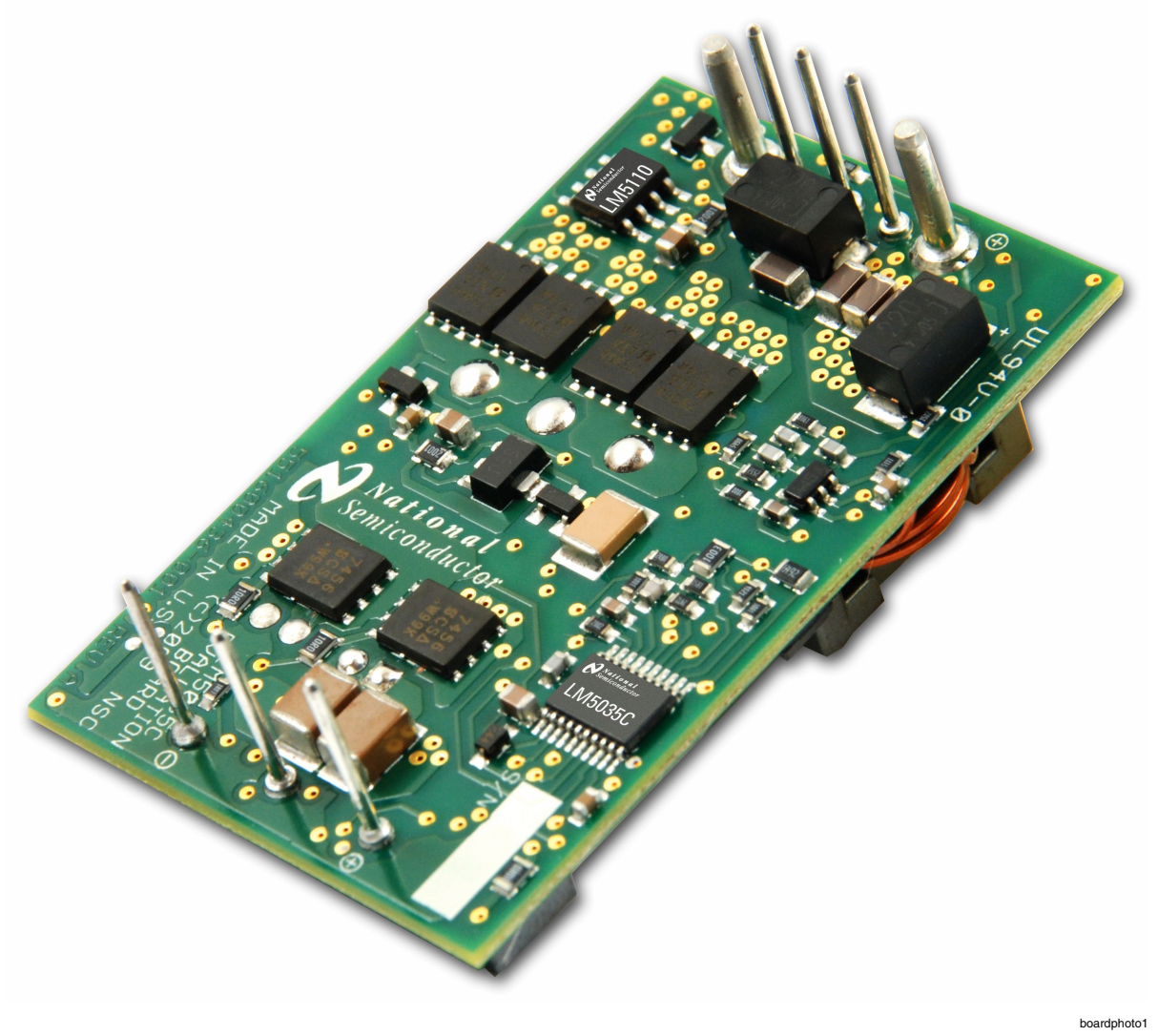
FIGURE 3. LM5035CEVAL BOM page 1

6.0 Other Operating Values

Operating Values

Description	Parameter	Value	Unit
Modulation Frequency	Frequency	400	KHz
Total output power	Pout	100	W
Control scheme	Control scheme	Half-Bridge	
Static load regulation	Static load	200	mV
Static Line regulation	Static Line	100	mV
Steady State Efficiency (at 30A)	Efficiency	89	%
Steady State Efficiency (at 15A)	Efficiency	92	%

7.0 Board Photos



boardphoto1

FIGURE 4. LM5035CEVAL Board Photo

8.0 Hardware Description

A through discussion of this design can be found in Application Note 2043 **LM5035CEVAL Evaluation Board Documentation** (http://www.national.com/an/AN/AN-2043.pdf)

The manufacturing files for this design are located at: RD-183 (http://www.national.com/rd/RDhtml/RD-183.html)

Notes

Notes

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