LT3798
Isolated No Opto-Coupler Flyback Controller with PFC

DESCRIPTION

Demonstration circuit 1817B is an off-line isolated flyback converter featuring the LT®3798. The demo board provides a single constant-voltage output of 24V at 2A. It is optimized to operate over a wide AC input voltage range (90VAC to 265VAC, 47Hz to 63Hz). Output voltage accuracy stays within ±5% over the whole input voltage and load range. It provides a high power factor (>0.95) enabling the design to be used worldwide. It is also designed to comply with the IEC 61000-3-2 Class D harmonics standard and the EN55015B conducted EMI standard.

The LT3798 controls an isolated flyback converter in boundary mode, suitable for applications with voltage or current regulation. Its novel sensing scheme delivers a well regulated output voltage or current to the secondary side without the use of an opto-coupler.

The LT3798 is available in a low profile, thermally enhanced 16-lead MSOP package.

The LT3798 data sheet gives a complete description of the part, operation and application information. The data sheet must be read in conjunction with this quick start guide for demo circuit 1817B.

Design files for this circuit board are available at http://www.linear.com/demo/DC1817B

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PERFORMANCE SUMMARY (T_A = 25°C)

PARAMETER	CONDITIONS	MIN	TYP	MAX
Input Range	Line Frequency, 47Hz to 63Hz	90VAC	120VAC	265VAC
Output Voltage			24V	
Efficiency	90VAC to 265VAC, 2A I_{OUT}		87%	
Power Factor	24V/2A Output, 90VAC to 265VAC	0.99	0.98	0.95

QUICK START PROCEDURE

IMPORTANT NOTE TO CUSTOMERS:

HIGH VOLTAGES ARE PRESENT ON THE DEMO CIRCUIT, AND CAN LEAD TO LETHAL INJURIES TO HUMAN BODY. ONLY QUALIFIED PERSONNEL SHOULD OPERATE IT. IT IS STRONGLY RECOMMENDED TO USE SAFETY GLASSES AND AN ISOLATION TRANSFORMER.

NOTE: Improper components replacement on the demo circuit can cause performance deteriorations, circuit malfunction, property damage, and even life threatening injuries. Contact Linear Technology applications engineers for proper component replacement.

Demonstration circuit 1817B is easy to set up to evaluate the performance of the LT3798. Refer to Figure 1 for proper measurement equipment setup and follow this procedure:

1. Connect an adjustable load between + and – output terminals.
2. With power off, connect the input power supply to Line (L) input and Neutral (N) input.
3. Turn on the power at the input.

NOTE. Make sure that the input voltage does not exceed the maximum input voltage (265VAC).

4. Check for the proper output voltage.

Once the proper output voltage is established, adjust the input voltage and/or the load and observe the output voltage regulation, efficiency, power factor and other parameters.

Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

Figure 2. Efficiency vs Input Voltage

Figure 3. V_{OUT} vs Load Current

Figure 4. Power Factor vs Input Voltage

Input Line Voltage and Current

Figure 5. 120VAC (PF = 0.99)

$I_{IN(AC)}$ (1A/DIV)

$V_{IN(AC)}$ (200V/DIV)

Figure 6. 230VAC (PF = 0.97)

QUICK START PROCEDURE

Switch Node Voltage

Figure 7. 120VAC (V_{SW} = 450V)

V_{SW}
(100V/DIV)

Figure 8. 230VAC (V_{SW} = 630V)

Output Current and Switch Node Voltage During Output Short

Figure 9. 120VAC

$I_{C(VIN)}$
(20V/DIV)

I_{OUT}
(5A/DIV)

V_{SW}
(200V/DIV)

Figure 10. 230VAC

Figure 11. Output Ripple at 120VAC, 2A Load

V_{OUT}
(1V/DIV)

Figure 12. Output Ripple at 230VAC, 2A Load

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	B1	RECTIFIER, BRIDGE 600V 0.8A	DIODES INC. HD06-T
2	1	CAC1	CAP, 0.1µF 20% 250V/275VAC ECQ-UL	PANASONIC, ECQUAAF104M
3	1	C2	CAP, FILM, 0.22µF 20% 400V	PANASONIC ECQE4224KF
4	1	C3	CAP, 10µF 20% 50V ALUM	RUBYCON 50YXJ10M 5X11
5	1	C6	CAP, 0805 0.1µF 10% 50V X7R	TDK, C2012X7R1H104K
6	1	C7	CAP, 0805 2.2µF 10% 50V X5R	TDK, C2012X5R1H225K
7	1	C8	CAP, 0805 4.7µF 20% 16V X5R	AVX 0805YD475MAT2A
8	2	C10, C11	CAP, 1000µF 20% 35V ELEC	NIPPON CHEMI-CON ELXV350ETD102MK30S
9	1	C13	CAP, 1210 2.2nF, 5% 630V U2J	MURATA, GRM32A7U2J222JW31D
10	1	C20	CAP, 2.2nF 20% 400V, Y5U TYPE "Y1"	VISHAY, 440LD22-R
11	2	C12, C21	CAP, 0805 22pF ±0.25pF 50V NP0	AVX, 08055A220CAT2A
12	2	C23, C25	CAP, 1210 10µF 20% 35V X5R	MURATA, GRM32ER7YA106KA12L
13	1	C24	CAP, 1206 47pF 10% 630V NPO	AVX, 1206CA470KAT1A
14	1	D1	DIODE, ULTRA FAST RECTIFIER	CENTRAL SEMI, CMR1U-10M
15	1	D2	DIODE, FAST SWITCHING	DIODES INC, BAV20W-7-F
16	1	D5	DIODE, SUPER BARRIER RECIFIER 20A	DIODES INC SBR20A200CTB
17	1	D8	DIODE, SWITCH 100V 400MW SOD123	DIODES INC, 1N4148W-7-F
18	1	F1	FUSE, 2.5A, FAST ACTING	COOPER BUSSMAN, SS-5F-3.15A
19	1	L2	CHOKE, D CODE DOUBLE CHOKE	TDK/EPCOS, B82731H2701A030
20	1	L1	INDUCTOR, 1mH, 0.78A RADIAL 1000µH	TDK, TSL1315RA-102JR78-PF
21	1	Q1	MOSFET, N-CH 650V 21A D2PAK	INFINEON, IPB60R165CP
22	2	R1, R2	RES, 1206 100k 1% 1/4W	VISHAY CRCW1206100KFKEA
23	1	R3	RES, 0805 100k 1% 1/8W	VISHAY, CRCW0805100KFKEA
24	1	R4	RES, 0805 5.49k 1% 1/8W	VISHAY, CRCW08055K49FKEA
25	1	R5	RES, 0805 68Ω 5% 1/8W	VISHAY, CRCW080568R0JKEA
26	1	R25	RES, 0805 20Ω 1% 1/8W	VISHAY, CRCW080520R0FKEA
27	1	R7	RES, 0805 33k 5% 1/8W	VISHAY, CRCW080533K0JNEA
28	1	R8	RES, 0.03Ω 1/4W 1% 1206 SMD	VISHAY, WSL1206R0300FEA
29	1	R9	RES, 1210 510Ω 5% 1/2W	VISHAY, CRCW1210510RJNEA
30	2	R10, R11	RES, 1206 499k 1% 1/4W	VISHAY CRCW1206499KFKEA
31	1	R18	RES, 0805 10k 1% 1/8W	VISHAY, CRCW080510K0FKEA
32	1	R19	RES, 0805 40.2k 1% 1/8W	VISHAY, CRCW080540K2FKEA
33	1	R20	RES, 0805 31.6k 1% 1/8W	VISHAY, CRCW080531K6FKEA
34	1	R37	RES, 0805 0Ω 5% 1/8W	VISHAY, CRCW08050000Z0EA
35	2	R27, R28	RES, 1206 510Ω 5% 1/4W	VISHAY CRCW1206510KJKEA
36	1	R32	RES, 1210 51k 5% 1/2W	VISHAY, CRCW121051K0JNEA
37	1	R35	RES, 0805 2.4M 5% 1/8W	VISHAY, CRCW08052M40JNEA
38	1	R36	RES, 0805 301k 1% 1/8W	VISHAY, CRCW0805301KFKEA
39	1	R38	RES, 0805 24.9k 1% 1/8W	VISHAY, CRCW080524K9FKEA

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
40	1	T1	XFMR, FLYBACK	WÜRTH ELECTONIK, 750811248
41	1	U1	IC, ISOLATED FLYBACK CONTROLLER	LINEAR TECHNOLOGY LT3798EMSE#PBF
42	1	V1	VARISTOR, 320V RMS 13.5MM RADIAL	VISHAY VDRS10P320BSE
Additional Circuit Components				
1	0	R23	RES, 0805, OPTION	OPTION
Hardware/Components (For Demo Board Only)				
1	2	J1, J2	TERMINAL BLOCK, 2 POSITION	WEIDMULLER, 1715250000
2	4	MH1 TO MH4	STAND-OFF, NYLON, 0.25"	KEYSTONE, 8831 (SNAP-ON)

SCHEMATIC DIAGRAM

Figure 13. DC1817B Demo Circuit Schematic

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Mailing Address:

Linear Technology

1630 McCarthy Blvd.

Milpitas, CA 95035

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Linear Technology Corporation
1630 McCarthy Blvd., Milpitas, CA 95035-7417
(408) 432-1900 • FAX: (408) 434-0507 • www.linear.com

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Тел: +7 (812) 336 43 04 (многоканальный)
Email: org@lifeelectronics.ru

www.lifeelectronics.ru