LTC1775 High Power No R_{SENSE} Stepdown Controller

DESCRIPTION

Demonstration Circuit (1775) is a constant frequency stepdown (buck) regulator for high power applications using the LTC1775 No R_{SENSE} controller. The regulator delivers up to 10A at fixed output voltages of 3.3V and 5V. The output voltage can also be adjusted with an external feedback divider from 1.19V up to 12V. Input voltages can range from 4.5V up to 28V.

The LTC1775 controller uses a current mode, constant frequency architecture to switch a pair of N-channel power MOSFETs. Current mode control is provided without using a sense resistor by monitoring the voltage drop across the MOSFET switches in order to determine the inductor current. By eliminating the power loss in the sense resistor, efficiencies in excess of 95% are readily achieved without sacrificing the advantages of current mode control such as inherent current limiting, excellent rejection of line transients, and simple compensation.

At low output currents, the LTC1775 automatically changes to Burst Mode™ operation to reduce switching losses and maintain high operating efficiency. Additionally, the supply current can be shut down to less than 20uA to maximize battery life in portable applications. This board is intended for applications such as notebook computers, automotive electronics, and distributed power systems. **Gerber files for this circuit board are available. Call the LTC factory.**

PERFORMANCE SUMMARY Operating Temperature Range 0C to 50C

SYMBOL	CONDITIONS	VALUE
V_{IN}	Input Voltage Range (Maximum input voltage limited by external MOSFET and input capacitor)	4.5V to 28V
$I_{OUT(MAX)}$	Maximum Output Current	10A
V_{OUT}	Output Voltage (Jumper selectable)	3.3V, 5V
	Output Voltage (Adjustable, limited by output capacitor)	1.19V to 12V
$\Delta V_{OUT(RIPPLE)}$	Output Voltage Ripple at V_{IN}=10V, V_{OUT}=5V, I_{OUT}=5A	50mV
	Output Voltage Ripple at V_{IN}=10V, V_{OUT}=5V, I_{OUT}=0.5A (Burst Mode)	100mV
$\Delta V_{OUT(LOADREG)}$	Load Regulation, I_{OUT}=0A to 10A, Continuous Mode	-0.2%
$\Delta V_{OUT(LINEREG)}$	Line Regulation, V_{IN}=4.5V to 20V, Continuous Mode	0.05%
I_Q	Supply Current at V_{IN}=10V, I_{OUT}=0A, FCB=INTV_{CC} (Burst Mode), EXTV_{CC}=5V	300uA
	Supply Current in Shutdown at V_{IN}=10V	15uA
I_{EXTVCC}	EXTV_{CC} Pin Current at V_{IN}=10V, I_{OUT}=0A, FCB=INTV_{CC} (Burst Mode), EXTV_{CC}=5V	550uA
$V_{RUN/SS}$	RUN/SS Pin Threshold	1.4V
f	Switching Frequency, SYNC=0V	150kHz

TYPICAL PERFORMANCE CHARACTERISTICS AND BOARD PHOTO

PACKAGE AND SCHEMATIC DIAGRAMS

TOP VIEW

(Package Drawing)

S PACKAGE
16-LEAD PLASTIC SO

(Schematic Drawing)

PARTS LIST

This parts list is out of date, use latest list from J. Larson.

REFERENCE DESIGNATOR	QUANTITY	PART NUMBER	DESCRIPTION	VENDOR	TELEPHONE
C_1	1		Optional		
C_B	1	?	0.47uF 16V Y5V Chip Capacitor	AVX	
C_{C1}	1	08055C222	2.2nF 50V 10% NPO Chip Capacitor	AVX	
C_{C2}	1	08055A221	220pF 50V 10% NPO Chip Capacitor	AVX	
C_F	1	0805YC104MAT	0.1uF 50V X7R Chip Capacitor	AVX	
C_{IN1}-C_{IN3}	3	THCR70E1H226 ZT	22uF 50V Y5U Chip Capacitor	United Chemi-con	
C_{OUT1}, C_{OUT2}	2	16SP270M	270uF 16V 20% OS-CON Capacitor	Sanyo	
C_{OUT3}	1	GRM235Y5V106 Z	10uF 16V 10% Chip Capacitor	Murata	
C_{SS}	1	0805YC104MAT	0.1uF 16V X7R Chip Capacitor	AVX	
C_{VCC}	1	TAJA475H020R	4.7uF 16V 20% Tantalum Capacitor	AVX	
D1	1	MBRS140T3	1A 40V Schottky diode	Motorola	
D_B	1	CMDSH-3	100mA 30V Schottky diode	Central	
D_Z	1	CMPZ5253B	6.8V 20mA zener diode	Central	
E1-E9	9	2501-2	Turret Terminal	Mill-Max	
JP1-JP4	4	?	2 Pin Header	Comm Con	
JP5-JP6	2	?	3 Pin Header	Comm Con	
JP7	1	?	4 Pin Header	Comm Con	
JP1-JP7	7	CC1J2MM-138-G	Jumper	Comm Con	
L1	1	ETQPAF4RH	4.8uH 10A Inductor	Panasonic	
M1, M2	2	SUD50N03-10	N-channel MOSFET	Siliconix	
Q_1, Q_3, Q_5	3	FMMT619	NPN Transistor	Zetex	
Q_2, Q_4	2	FMMT720	PNP Transistor	Zetex	
Q_5	3	FCX619	NPN Transistor	Zetex	
R_1	1	CR10-113JM	11kΩ 1/10W 1% Chip Resistor	Tad	
R_2	1	3266 Y-1-104	100kΩ Potentiometer	Bourns	
R_3	1	CR10-100JM	10Ω 1/10W 1% Chip Resistor	Tad	
R_{C1}	1	CR10-103JM	10kΩ 1/10W 5% Chip Resistor	Tad	
R_F	1	CR10-1R0JM	1Ω 1/10W 5% Chip Resistor	Tad	
R_Z	1	CR10-152JM	1.5kΩ 1/10W 5% Chip Resistor	Tad	
U1	1	LTC1775CS		LTC	

QUICK START GUIDE

Please follow the procedure below to quickly and easily configure the demonstration circuit for evaluation.

1. Refer to Figure 4 for the correct arrangement of measurement equipment.

2. Select the desired output voltage with the V_{PROG} pin jumper JP7. The upper position (5V) sets the output to 5V and the middle position (3.3V) sets the output to 3.3V. Placing the jumper JP7 in the lower (12V) position and removing the jumper JP3 (ADJ BYPASS) makes the output adjustable from 1.2V to 12V with the potentiometer R2.

3. Set the SYNC pin jumper JP6 to the lower position (150K) for 150KHz operation.

4. Set the FCB pin jumper JP5 to the upper position (BURST) to enable Burst Mode operation.

5. Remove the $EXTV_{CC}$ supply jumper (JP4) so that the LTC1775 supplies its own gate drive.

6. Check that the gate drive jumpers JP1 and JP2 are in place. This disables the optional gate drive buffers.

7. Connect the input power supply across the IN terminal (E6) and the input GND terminal (E7) located at the bottom of the board. Be careful not to apply input voltages above 28V or else the MOSFETs may be damaged.

8. Connect the load between the OUT terminal (E9) and the output GND terminal (E8) located on the right side of the board.

OPERATION

(Insert text A)
An optional 6V $EXTV_{CC}$ supply derived from the input voltage is provided on the board. This can be connected using jumper JP4.

(Insert text B)
External Driver Buffers

The LTC1775 drivers are adequate for driving up to about 30nC into the MOSFET switches. When using large single, or multiple, MOSFET switches, external buffers may be needed to provide additional gate drive capability. The demonstration circuit includes optional external bipolar driver buffers. These are bypassed when jumpers JP1 and JP2 are in place. By removing these jumpers, the external buffers become active. This makes it easy to compare the converter behavior and efficiency with and without external buffers. Note that the bipolar drivers reduce the signal swing at the MOSFET gates. Thus, it is recommended that the 6V $EXTV_{CC}$ circuit be used (set jumper JP4) when the driver buffers are active.