LT3748 Design schematic –
different output voltages

6. Select the Feedback resistor

$$R_{FB} = \frac{6.04k\Omega \bullet N_{PS} \bullet ((V_{OUT} + V_{F(DIODE)}) + 0.55V)}{1.223V}$$

7. Select the Output Capacitor

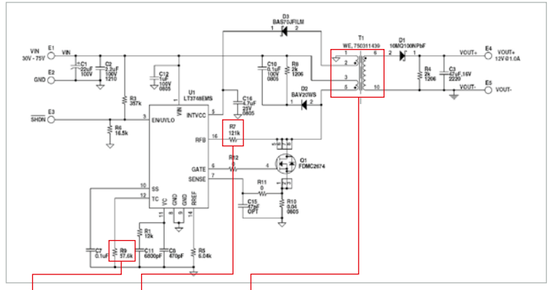
$$C_{OUT} = \frac{L_{PRI} \bullet I_{LIM}^{\ 2}}{2 \bullet \Delta V_{MAX} \bullet V_{OUT}}$$

8. Check if Snubber Circuitry is necessary. Select a capacitor 2-3 times of MOSFET output capacitance
a) probe drain of the MOSFET switch (i.e. Si7738DP - 150V)
b) probe anode of the output diode, when MOSFET turns on (i.e.SBR 8U60P5 – 60V)

a) $V_{PROBE} < V_{DS}$ b) $V_{PROBE} < V_{R(DIODE)}$

If above mentioned requirements are not given decrease R8 to lower the spike for a) and b)

More design support notes to download
www.we-online.com/LT

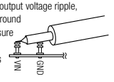


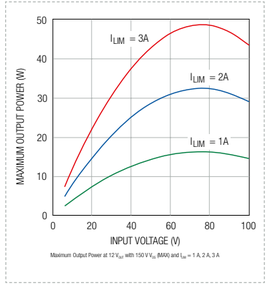
			Application		
R_{TC}	R_{FB}	Transformer	Input Voltage	Output Voltage	Output current
19.0 kΩ	90.9 kΩ	750 311 688	30-75	3.3 V	4 A
28.0 kΩ	115 kΩ	750 311 689	30-75	5 V	3 A
57.6 kΩ	121 kΩ	750 311 439	30-75	12 V	1 A

DEMOBOARD USAGE

1. With power off, connect the input power supply to VIN and GND
2. Turn on the power at the input.
   NOTE: Make sure that the input voltage does not exceed 30V
3. Check for the proper output voltages.
   NOTE: If there is no output, temporarily disconnect the load to make sure that the load is not set too high.
4. Once the proper output voltage is established, adjust the load within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters.

NOTE: When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage rippleby touching the probe tip directly across the VIN or VOUT and GND terminals.





High power up to 12 W

WÜRTH ELEKTRONIK

LT3748

100 V Isolated Flyback Controller with primary side sensing 12 V/1 A

Order Code 750 107
Version 1.0

Evaluation Board for LT3748

Input: 30-75 V
Output: 12 V up to 1 A

different setups possible:
Output: 3.3 V up to 4 A
Output: 5 V up to 3 A

Power	Order Code	IC
up to 2.5 W	750 105	LT3574
up to 7 W	750 103	LT3573
up to 10 W	750 106	LT3575
up to 12 W	750 107	LT3748
up to 30 W	750 108	LT3748

LT3748 – 8 Design Tips

1. Select the transformer turns ratio to accomodate the diode reverse voltage and maximize the efficiency

$$N_{PS} = \frac{N_P}{N_S} \qquad V_{DS(MAX)} = \frac{V_{IN(MAX)}}{N_{PS}} + V_{OUT} \qquad I_{OUT(MAX)} \approx 0.8 \bullet (1 - D) \bullet N_{PS} \bullet \frac{I_{LIM}}{2}$$

$$D = \frac{(V_{OUT} + V_{F(DIODE)}) \bullet N_{PS}}{[V_{IN} + ((V_{OUT} + V_{F(DIODE)}) \bullet N_{PS})]} \qquad I_{DIODE(RMS)} = \sqrt{(I_{LIM} + N_{PS})^2 \bullet \frac{(1 - D)}{3}}$$

2. Calculate the Sense Resistor Value

$$R_{SENSE} = \frac{100\ mV}{I_{LIM}}$$

3. Select a transformer based on inductance and saturation current requirements (see table page page 4 to 7). Dependent on size restrictions you may have to increase the switching frequency to choose a lower primary inductance and following a smaller transformer package. Verify if the inductance is large enough to satisfy the minimum on and off times of LT3748.

$$L_{PRI} \le \frac{V_{IN} \bullet (V_{OUT} + V_{F(DIODE)}) \bullet N_{PS}}{f_{SW} \bullet I_{LIM} \bullet [(V_{OUT} + V_{F(DIODE)}) \bullet N_{PS} + V_{IN\ (MIN)}]}$$

Verification

$$L_{PRI} \ge \frac{(V_{OUT} + V_{F(DIODE)}) \bullet N_{PS} \bullet R_{SENSE} \bullet 400ns}{15mV} \qquad L_{PRI} \ge \frac{V_{IN(MAX)} \bullet R_{SENSE} \bullet 250ns}{15mV}$$

4. Select a MOSFET Switch by considering the leakage of the transformer which will cause the drain to ring.A verification in the final design has to be done, if a snubber circuit needs to be added to meet the voltage requirements.

$$V_{DS} = V_{IN} + ((V_{OUT} + V_{F(DIODE)}) \bullet N_{PS})$$

5. Select the Output Diode, where maximizing the efficiency is the goal, minimizing the maximum voltage requirement V_{IN} may allow the use of a diode with a lower reverse bias rating and a lower forward drop which could further increase efficiency.

Available transformers for

simple isolated flyback converters with primary side sensing – ex stock

Reference to Linear Technology Specification				all possible OFF THE SHELF transformer*											
up to 3 W	up to 7 W	up to 14 W	external MOSFET	WE Order Code	Power (W)	Core	U_{in} (V)		U_{out} (V)	I_{out} (A)	Turns ratio N_p:N_s	L_{pri} (µH)	Leakage (nH)	Isolation (V)	I_{sat} (A)
			LT3748	**750 311 691**	< 10	EP5	8 - 15		150	0.001	5:1	60	1000	1500	0.25
	LT3573			**750 310 799**	< 10	EP7	18 - 30		15	0.4	1:1	25	125	1500	2
LT3574	LT3573			**750 370 040**	< 10	EP7	18 - 30		5	1	3:1	30	200	1500	1.7
LT3574	LT3573			**750 370 041**	< 10	EP7	18 - 30		5	1	3:1	50	450	1500	1.6
LT3574	LT3573			**750 370 047**	< 10	EP7	18 - 30		5	1	3:1	30	150	1500	1.7
	LT3573			**750 370 058**	< 10	EP7	18 - 30		15	0.4	1:1	25	185	1500	2
	LT3573			**750 370 059**	< 10	EP7	18 - 30		5	1	3:1	50	500	1500	1.6
			LT3748	**750 311 692**	< 10	EP7	8 - 15		± 150	0.001	5:1	80	2000	1500	1
	LT3573			**750 370 042**	< 10	ER9.5	5		5	0.2	1:1	15	250	1500	1.5
	LT3573	LT3575		**750 310 471**	< 10	EP10	9 - 30		5	1	3:1	25	430	1500	2.6
	LT3573	LT3575		**750 310 559**	< 10	EP10	12 - 30		3.3	1.3	4:1	24	500	1500	2.1
	LT3573	LT3575		**750 310 562**	< 10	EP10	18 - 30		12	0.5	2:1	25	500	1500	2.8
	LT3573	LT3575		**750 310 563**	< 10	EP10	18 - 30		12	0.4	2:1	25	500	1500	2.8
LT3574	LT3573	LT3575		**750 310 564**	< 10	EP10	12 - 30		± 5	1	3:1	63	600	1500	
			LT3748	**750 311 486**	< 10	EP13	12		± 200	0.002	1:10	100	4500	1500	2
			LT3748	**750 811 048**	< 10	EE16	100-400		30	0.3	4.387:1	1500	14000	IEC61558-2-17	0.65
			LT3748	**750 311 889**	< 10	EFD25	28		250	0.1	1:5	37	160	500	2.95
		LT3575		**750 311 303**	10 - 15	EP10	9 - 30		5	3	5:1	50	800	1500	2.25
LT3574		LT3575		**750 311 304**	10 - 15	EP10	9 - 30		5	3	4:1	50	850	1500	2.5
		LT3575		**750 311 305**	10 - 15	EP10	9 - 30		12	1	3:1	50	1200	1500	2.8
		LT3575		**750 311 306**	10 - 15	EP10	9 - 30		12	1	3:1	100	1750	1500	1.65
LT3574		LT3575		**750 311 307**	10 - 15	EP10	9 - 30		24	0.5	2:1	100	2000	1500	1.9
LT3574		LT3575		**750 311 308**	10 - 15	EP10	9 - 30		24	0.5	1:1	100	2100	1500	2.1
	LT3573	LT3575		**750 311 675**	10 - 15	EP10	9 - 30		5	2	3:1	25	130	1500	2.5
		LT3575	LT3748	**750 311 567**	10 - 15	EP10	10 - 40		5	3	2:1	7	800	1500	11.2
			LT3748	**750 311 424**	10 - 15	EP13	36		12	1	3:1	100	900	1500	2.4
			LT3748	**750 311 456**	10 - 15	EP13	36		12	1	3:1	100	900	2500	2.4
		LT3575	LT3748	**750 311 458**	10 - 15	EP13	36		3.3	4	3:1	15	175	2500	5
		LT3575	LT3748	**750 311 564**	10 - 15	EP13	10 - 40		5	3	3:1	9.07	120	1500	8
		LT3575	LT3748	**750 311 624**	10 - 15	EP13	10 - 40		15	1	1.5:1	9	180	1500	> 8
		LT3575		**750 311 625**	10 - 15	EP13	10 - 40		3.3	4	4:1	9	350	1500	> 8
		LT3575	LT3748	**750 311 856**	10 - 15	EP13	16 - 24		(4x) 15	(4x) 0.2	1:4:4:4:4	3,8	250	1000	>12
		LT3575		**750 311 342**	10 - 15	EFD20	36		5	3	2:1	15	650	1500	5.8
			LT3748	**750 311 911**	10 - 15	EE 20	16 - 24		(4x) 15	(4x) 0.2	1:3:3:3:3	6.8	100	1500	

*dependent on application transformer specification can differ slightly to datasheet

Reference to Linear Technology Specification				all possible OFF THE SHELF transformer*											
up to 3 W	up to 7 W	up to 14 W	external MOSFET	WE Order Code	Power (W)	Core	U_{in} (V)		U_{out} (V)	I_{out} (A)	Turns ratio N_p:N_s	L_{pri} (µH)	Leakage (nH)	Isolation (V)	I_{sat} (A)
		LT3575		**750 311 422**	15 - 25	EP13	36		5	4	5:1	50	600	1500	3.3
		LT3575	LT3748	**750 311 423**	15 - 25	EP13	36		5	4	2:1	50	600	1500	3.85
		LT3575	LT3748	**750 311 439**	15 - 25	EP13	37 - 57		12	2.1	2:1	37	750	1500	2.8
		LT3575	LT3748	**750 311 457**	15 - 25	EP13	36		5	4	4:1	50	600	2500	3.7
		LT3575		**750 311 688**	15 - 25	EP13	36		5	4	5:1	50	600	1500	3.1
		LT3575	LT3748	**750 311 689**	15 - 25	EP13	36		5	4	4:1	50	600	2500	3.7
				750 311 385	25 - 35	EP13	18 - 60		13	2.3	1.25:1	15	100	1500	6.75
				750 310 617	25 - 35	EFD20	9 - 36		12	3	1:1.16	4,5	150	1500	
				750 311 597	25 - 35	EFD20	20 - 48		5	6.0	3:1	6	300	1500	9,5
				750 311 598	25 - 35	EFD20	20 - 48		12	2.5	2:1	8.3	300	1500	9
			LT3748	**750 311 599**	25 - 35	EFD20	20 - 48		15	2	3:2	8	500	1500	12
			LT3748	**750 311 600**	25 - 35	EFD20	30 - 75		15	2	2:1	12	500	1500	11
			LT3748	**750 311 604**	25 - 35	EFD20	20 - 48		24	1.3	1:1	8	300	1500	9.5
				750 311 605	25 - 35	EFD20	30 - 75		5	6	7:2	15	500	1500	9.5
			LT3748	**750 311 607**	25 - 35	EFD20	30 - 75		12	2.5	5:2	14	500	1500	9,5
			LT3748	**750 311 608**	25 - 35	EFD20	30 - 75		24	1.3	3:2	12	500	1500	9
			LT3748	**750 311 797**	35 - 45	EFD20	18 - 100		12	2.5	2.5:1	14	210	4000	11.5
				750 311 589	35 - 45	EFD25	20 - 48		5	9	3:1	6	200	1500	18
			LT3748	**750 311 590**	35 - 45	EFD25	20 - 48		12	3.8	2:1	8	200	1500	18
			LT3748	**750 311 591**	35 - 45	EFD25	20 - 48		15	3	3:2	8	200	1500	20
			LT3748	**750 311 592**	35 - 45	EFD25	20 - 48		24	1.9	1:1	8	200	1500	18
				750 311 593	35 - 45	EFD25	30 - 75		5	9	7:2	15	300	1500	18
			LT3748	**750 311 594**	35 - 45	EFD25	30 - 75		12	3.8	5:2	15	400	1500	18
			LT3748	**750 311 595**	35 - 45	EFD25	30 - 75		15	3	2:1	12	200	1500	16
			LT3748	**750 311 596**	35 - 45	EFD25	30 - 75		24	1.9	3:2	12	200	1500	18
				750 311 771	35 - 45	EFD25	100 - 400		15	3	6:1	500	5000	2500	2.5
				750 310 988	35 - 45	EFD25	12		48	0.85	1:4.42	14	200	1500	> 15
			LT3748	**750 311 783**	> 45 W	EFD25	19 - 70		24	2.5	1.5:1	20	170	1500	16

*dependent on application transformer specification can differ slightly to datasheet

All transformers can be used for all listed ICs under certain conditions. Please review 8 Design Tips on page 02.