LP3792

Low Standby Power Off-Line PSR Driver

Description

The LP3792 is a high performance AC/DC power supply controller for battery charger and adapter applications. The device uses Pulse Frequency Modulation (PFM) method to build discontinuous conduction mode (DCM) flyback power supplies.

The LP3792 provides accurate constant voltage, constant current (CV/CC) regulation without requiring opto-coupler and the secondary control circuitry. It also eliminates the need of loop compensation circuitry while maintaining good stability.

The LP3792 can achieve excellent regulation and high average efficiency which is suitable for US DoE VI requirement, yet meets no-load consumption less than 75 mW.

The LP3792 provides many protections which include OVP ,OTP and output short protection.

The LP3792 is available in SOT23-6.

Features

- Drive power MOS and Suitable for US DoE VI application
- Valley voltage Turn on to advance efficiency
- The external drive MOS
- High precision CC/CV output
- ≦75 mW Standby power
- Proprietary cable voltage drop compensation
- FB Pin open-short Protection
- VCC Pin UVLO Protection
- Over temperature Protection

Application

- Adapters/Chargers for Cell/cordless Phones, PDAs, MP3 and Other Portable Devices
- Upgrading the best choice - linear power supply and RCC switching power supply
- Standby and Auxiliary Power Supplies

Typical Application

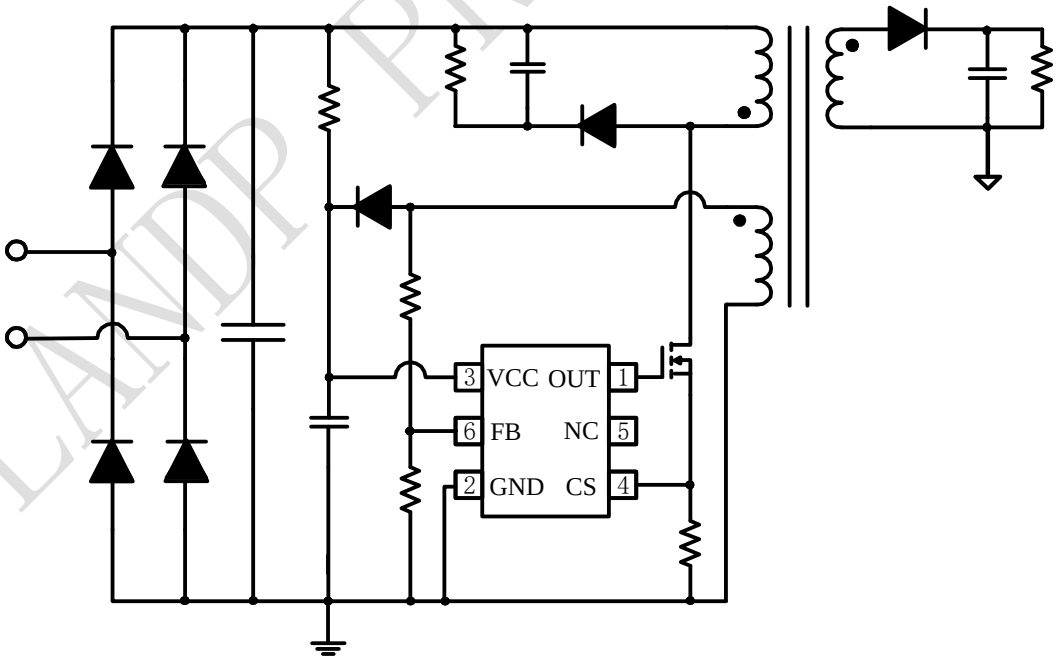


Figure 1: Typical Application Circuit

Ordering Information

Version	Package	Packing Form	Marking
LP3792	SOT23-6	Tape 3,000 Piece/Roll	92XXX

Pin Definition

92：LP3792

XXX：IC Indetifier

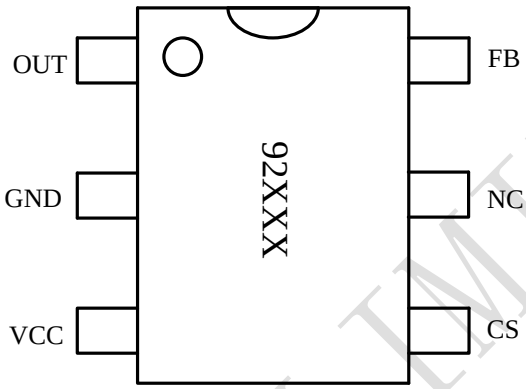


Figure 2: Pin Definition

Terminal Description

Number	Definition	Description
1	OUT	Drive port, connect the gate of MOS
2	GND	The ground pin of the IC
3	VCC	The power supply pin for the IC
4	CS	The primary side current signal input which is used for cycle to cycle current limit
5	NC	Don’t connect IC
6	FB	The input of the primary side feedback voltage

Absolute Maximum Ratings (note 1)

Symbol	Description	Parameter Scope	Unit
VCC	The IC supply voltage	-0.3~30	V
CS	The current sensing input	-0.3~7	V
OUT	Drive port	-0.3~30	
FB	The input pin of the PSR feedback voltage	-40~8.5	V
P_{DMAX}	The power dissipation(note2)	0.45	W
θ_{JA}	The thermal resistance from junction to ambient	240	℃/W
T_J	Operating junction temperature range	-40 to 150	℃
T_{STG}	The storage temperature range	-55 to 150	℃
	ESD (note3)	2	KV

Note 1: *Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. Under "recommended operating conditions" the device operation is assured, but some particular parameter may not be achieved. The electrical characteristics table defines the operation range of the device, the electrical characteristics is assured on DC and AC voltage by test program. For the parameters without minimum and maximum value in the EC table, the typical value defines the operation range, the accuracy is not guaranteed by spec.*

Note 2: *The maximum power dissipation decrease if temperature rise, it is decided by T_{JMAX}, θ_{JA}, and environment temperature (T_A). The maximum power dissipation is the lower one between $P_{DMAX} = (T_{JMAX} - T_A)/\theta_{JA}$ and the number listed in the maximum table.*

Note 3: *Human Body mode, 100pF capacitor discharge on 1.5KΩ resistor*

Electrical Characteristics (Notes 4, 5) (Unless otherwise specified, V_{CC}=16V and T_A=25 ℃)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Supply Voltage Section						
V_{CC_ST}	V_{CC} Start up Voltage	V_{CC} Rising	14	15.5	18	V
V_{CC_UVLO}	V_{CC} UVLO Voltage	V_{CC} Falling	6.5	7	7.5	V
V_{CC_OVP}	V_{CC} Over Voltage			28		V
I_{ST}	V_{CC} Start up Current	V_{CC}= $V_{CC\text{-}ST}$- 1V	0	0.2	0.6	uA
I_{cc}	V_{CC} Operating Current			500		uA
MOS Driver Section						
V_{OUT}	Driving Voltage			18		V
Current Sense Section						
V_{CS1}	The high load current threshold			500		mV
V_{CS2}	The light load current threshold			330		mV
T_{LEB}	The Leading Edge Blanking Time			200		ns
T_{DELAY}	The turn off delay of the BJT			200		ns
Feedback Section						
R_{FB}	The input resistance of the FB	V_{FB}=4V	1	1.6	2	MΩ
V_{FB}	The reference voltage of FB		3.94	4	4.06	V
Output Cable Compensation Section						
V_{COMP_LINE}	The Output cable compensation parameter	V_{FB}=-10V，R_{LINE}=30K		120		mV
Working frequency						
F_{NO_LOAD}	Standby frequency			1.3		KHz
F_{MAX}	Maximum working frequency			132		KHz
Protection Section						
V_{FB_OVP}	FB over voltage reference		6.5	7	7.5	V
T_{ON_MAX}	Maximum turn on time			25		uS
T_{SD}	The over temp reference			150		℃
T_{HYS}	The hysteresis window of OTP			70		℃

Note 4: *production testing of the chip is performed at 25 ℃.*

Note 5: *the maximum and minimum parameters specified are guaranteed by test, the typical value are guaranteed by design, characterization and statistical analysis*

Internal Block Diagram

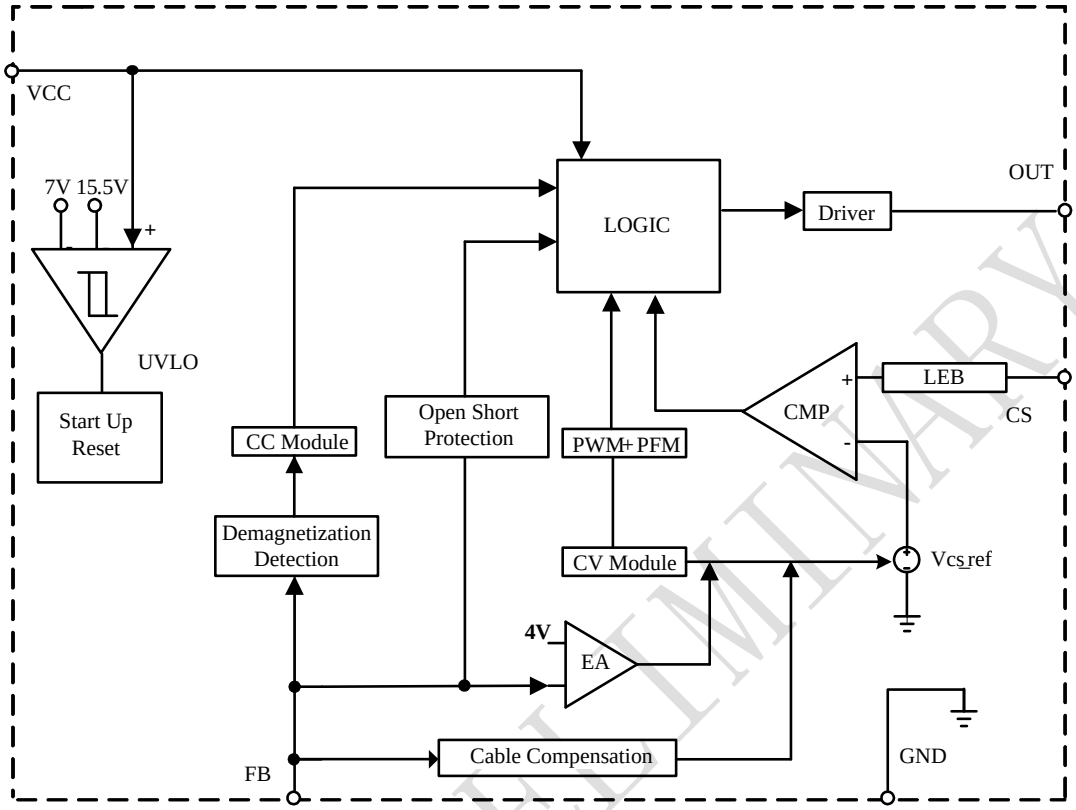


Figure 3: Internal Block Diagram

Application Information

The LP3792 is a high performance AC/DC power supply controller for battery charger and adapter applications. The device uses Pulse Frequency Modulation (PFM) method to build discontinuous conduction mode (DCM) flyback power supplies

Start Up

After system powered up, the VCC pin capacitor is charged up by the start up resistor. When the VCC pin voltage reaches the turn on threshold, the internal circuits start operating. Because of the very small startup current, the startup resistor can de designed very large to achieve low standby power. After the IC start up, the VCC voltage is supplied by the transformer auxiliary winding.

Peak Current Control

The IC detects the transformer primary side current cycle by cycle by the external Rcs resistor. When the voltage on the Rcs higher than the internal voltage reference 500mV, the IC will turn off the MOS

The heavy load current limit can be calculated by the following formula:

$$I_{P\_PK} = \frac{500}{R_{cs}} (mA)$$

The internal peak comparator involves a 500ns LEB time.

The output current can be calculated by the following formula：

$$I_O = \frac{2}{7} \times I_{P\_PK} \times \frac{N_P}{N_S}$$

For which the Np is the transformer primary winding turns, Ns is the transformer secondary winding turns and the Ip_pk is the peak current limit.

The CV Control and Output Voltage Setting

LP3792 achieves the constant voltage regulation by sampling the auxiliary winding voltage when the secondary side demagnetization. The output voltage can be calculated by the following formula:

$$V_O = \frac{4 * (R_{FBL} + R_{FBH})}{R_{FBL}} * \frac{Ns}{Naux}$$

For which the R_{FBL} is the FB pull down resistor and the R_{FBH} is the FB pull up resistor and the N_{aux} is the transformer auxiliary winding turns.

Protection Function

LP3792 offers rich protection functions to improve the system reliability, including FB resistor open short protection, output short protection and over temperature protection.

PCB Layout

The following rules should be followed in LP3792 PCB layout:

Bypass Capacitor

The bypass capacitor on V_{CC} pin should be as close as possible to the V_{CC} Pin and GND pin.

FB Pin

The FB divided resistor should be as close as possible to the FB Pin and as far as possible to the voltage noise point.

Ground Path

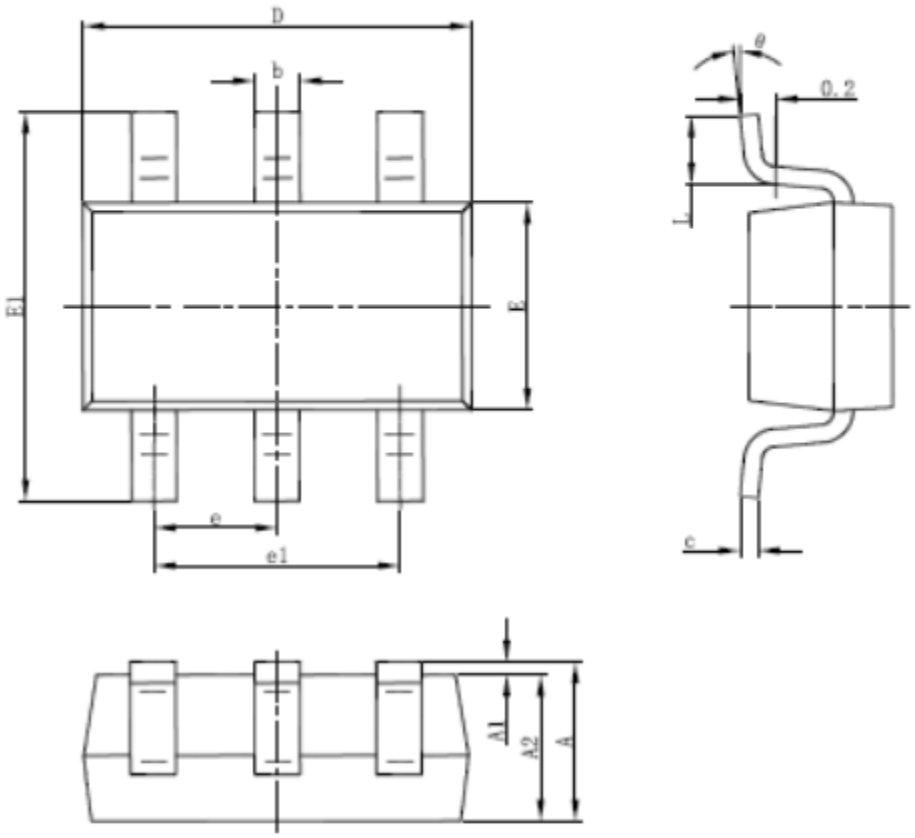
The power ground path for current sense should be short, and the power ground path should be separated from small signal ground path.

The Area of Power Loop

The area of main current loop should be as small as possible to reduce EMI radiation, such as the inductor, the power MOS, the output diode and the bus capacitor loop.

Physical Dimensions

SOT-23-6 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°