

### Description

The LP3783 is a high performance AC/DC power supply controller for battery charger and adapter applications which integrated 750V high voltage BJT. The device uses Pulse Frequency Modulation (PFM) method to build discontinuous conduction mode (DCM) flyback power supplies.

The LP3783 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 LP3783 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 LP3783 provides many protections which include OVP ,OTP and output short protection.

The LP3783 is available in SOP7.

### Features

- Suitable for 5V/2A US DoE VI application
- Valley voltage Turn on to advance efficiency
- 750V BJT integrated
- High precision CC/CV output
- $\leq 75$  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

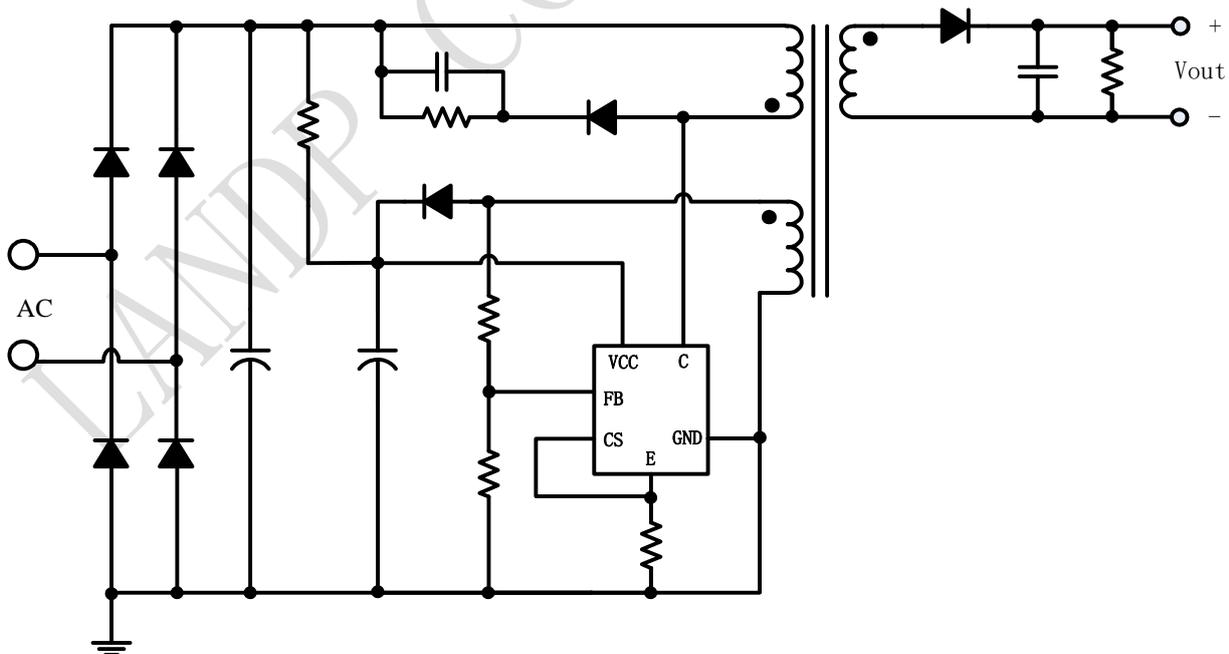


Figure 1: Typical Application Circuit

### Ordering Information

Version	Package	Packing Form	Marking
LP3783A	SOP7	Tape 3,000 Piece/Roll	LP3783 Axxxxxxx
LP3783B	SOP7	Tape 3,000 Piece/Roll	LP3783 Bxxxxxxx

### Pin Definition

X: A/B

xxxxxxx: IC Identifier

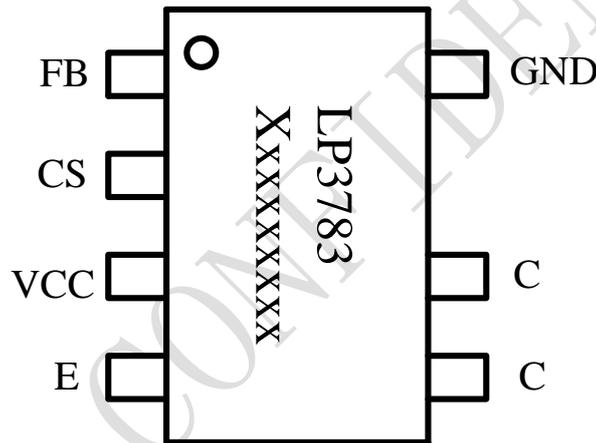


Figure 2: Pin Definition

### Terminal Description

Number	Definition	Description
1	FB	The input of the primary side feedback voltage
2	CS	The primary side current signal input which is used for cycle to cycle current limit
3	VCC	The power supply pin for the IC
4	E	The emitter pin of the integrated BJT
5, 6	C	The collector pin of the integrated BJT
7	GND	The ground pin of the IC

**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
FB	The input pin of the PSR feedback voltage	-40~8.5	V
P <sub>DMAX</sub>	The power dissipation(note2)	0.45	W
$\theta_{JA}$	The thermal resistance from junction to ambient	120	°C/W
$\theta_{JC}$	The thermal resistance from junction to case	70	°C/W
T <sub>J</sub>	Operating junction temperature range	-40 to 150	°C
T <sub>STG</sub>	The storage temperature range	-55 to 150	°C
	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<sub>JMAX</sub>,  $\theta_{JA}$ , and environment temperature (T<sub>A</sub>). The maximum power dissipation is the lower one between P<sub>DMAX</sub> = (T<sub>JMAX</sub> - T<sub>A</sub>)/ $\theta_{JA}$  and the number listed in the maximum table.

**Note 3:** Human Body mode, 100pF capacitor discharge on 1.5K $\Omega$  resistor

**Recommended Operation Conditions**

Version	Vin: 90VAC~265VAC, 50/60Hz
LP3783A	10.5W (5V/2100mA)
LP3783B	12.0W (5V/2400mA)

**Electrical Characteristics (Notes 4, 5)** (Unless otherwise specified,  $V_{CC}=15V$  and  $T_A=25^\circ C$ )

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>Supply Voltage Section</b>						
$V_{CC\_ST}$	$V_{CC}$ Start up Voltage	$V_{CC}$ Rising	14	15.5	18	V
$V_{CC\_UVLO}$	$V_{CC}$ UVLO Voltage	$V_{CC}$ Falling	3.5	4	4.5	V
$I_{ST}$	$V_{CC}$ Start up Current	$V_{CC}=V_{CC\_ST}-1V$	0	0.2	0.6	$\mu A$
$I_{CC}$	$V_{CC}$ Operating Current			500		$\mu A$
<b>BJT Driver Section</b>						
$I_{SOURCE}$	BJT Driving Current		30	35	40	mA
$I_{SINK}$	BJT Pull Down Current		450	500	550	mA
<b>Current Sense Section</b>						
$V_{CS1}$	The high load current threshold			500		mV
$V_{CS2}$	The light load current threshold			330		mV
$T_{LEB}$	The Leading Edge Blanking Time			500		ns
$T_{DELAY}$	The turn off delay of the BJT			200		ns
<b>Feedback Section</b>						
$R_{FB}$	The input resistance of the FB	$V_{FB}=4V$	1	1.6	2	$M\Omega$
$V_{FB}$	The reference voltage of FB		3.94	4	4.06	V
<b>Output Cable Compensation Section</b>						
$V_{COMP\_LINE}$	The Output cable compensation parameter	$V_{FB}=-10V, R_{LINE}=30K$		120		mV
<b>Protection Section</b>						
$V_{FB\_OVP}$	FB over voltage reference		6.5	7.0	7.5	V
$T_{ON\_MAX}$	Maximum turn on time			25		$\mu S$
$T_{SD}$	The over temp reference			150		$^\circ C$
$T_{HYS}$	The hysteresis window of OTP			30		$^\circ C$
<b>Integrated BJT Parameter</b>						
$V_{CBO}$	BJT CB break down voltage	$I_C=0.1mA$	750			V
$I_{CESAT}$	Collector limit current	$I_B=40mA$		1.0		A

Note 4: production testing of the chip is performed at 25 °C.

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

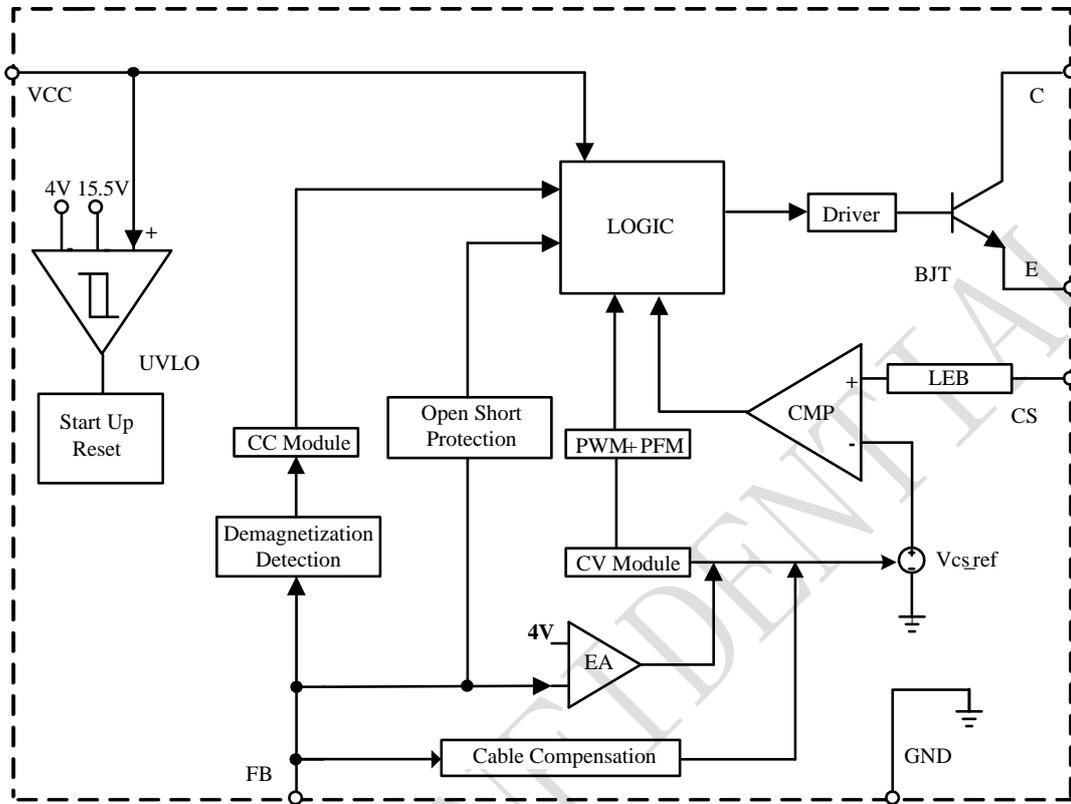


Figure 3: Internal Block Diagram

### Application Information

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#### 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 be 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 BJT

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.

**Low Standby Power Off-Line PSR Driver**

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  $N_p$  is the transformer primary winding turns,  $N_s$  is the transformer secondary winding turns and the  $I_{p\_pk}$  is the peak current limit.

**The CV Control and Output Voltage Setting**

LP3783 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:

$$V_o = \frac{4 * (R_{FBL} + R_{FBH})}{R_{FBL}} * \frac{N_s}{N_{aux}}$$

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**

LP3783 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 LP3783 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 BJT, the output diode and the bus capacitor loop.

**C Pin**

To increase the copper area of C pin for better thermal dissipation. However too large copper area may compromise EMI performance.

### Physical Dimensions

