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High Performance Non-isolated Buck-Boost LED Driver

FEATURES

- No Auxiliary winding for sensing and supplying
- True Buck-Boost Technology for high output voltage under universal input voltage
- Constant current control without secondary sense and feedback circuit
- Built-in 550V Power MOSFET
- ±3% LED current accuracy
- Ultra low operating current to improve efficiency
- Applications up to 18W output
- Built-in line compensation
- Cycle-by-Cycle current limiting
- Precision OVP voltage for best LED open circuit protection
- LED short circuit protection
- Over temperature compensation
- CS resistor short circuit protection.
- VCC under-voltage lockout
- Available in SOP8 and DIP8 packages

APPLICATIONS

- DC/DC or AC/DC LED Driver Applications
- Back Lighting of Flat Panel Displays

DESCRIPTION

FT883x is optimized for low cost non-isolated Buck-Boost switching mode LED driver applications. With source driving architecture, special demagnetization sensing technology and the ultra low operating current, FT883x doesn't need the auxiliary winding for output current sensing and chip power supplying. This allows FT883x to use inductors in stead of multiple-winding transformers that are typically used with other isolated LED drivers. FT883x also integrates a 550V power MOSFET that further improves the system reliability and lowers the system cost and complexity. FT883x's True Buck-Boost technology allows the system to output 120V under universal AC input with minimum bulk cap of 4.7uF or up to 150V output under high input voltage condition.

Its highly integrated functions such as Leading Edge Blanking (LEB) and built-in line compensation offer users a high efficiency and low cost solution for constant current LED driver applications.

Furthermore, FT883x offers fruitful protections like LED open and short circuit protection, over temperature compensation, CS resistor short circuit protection.

The industry leading OVP voltage accuracy ensures the best LED open circuit protection.

TYPICAL APPLICATION CIRCUIT

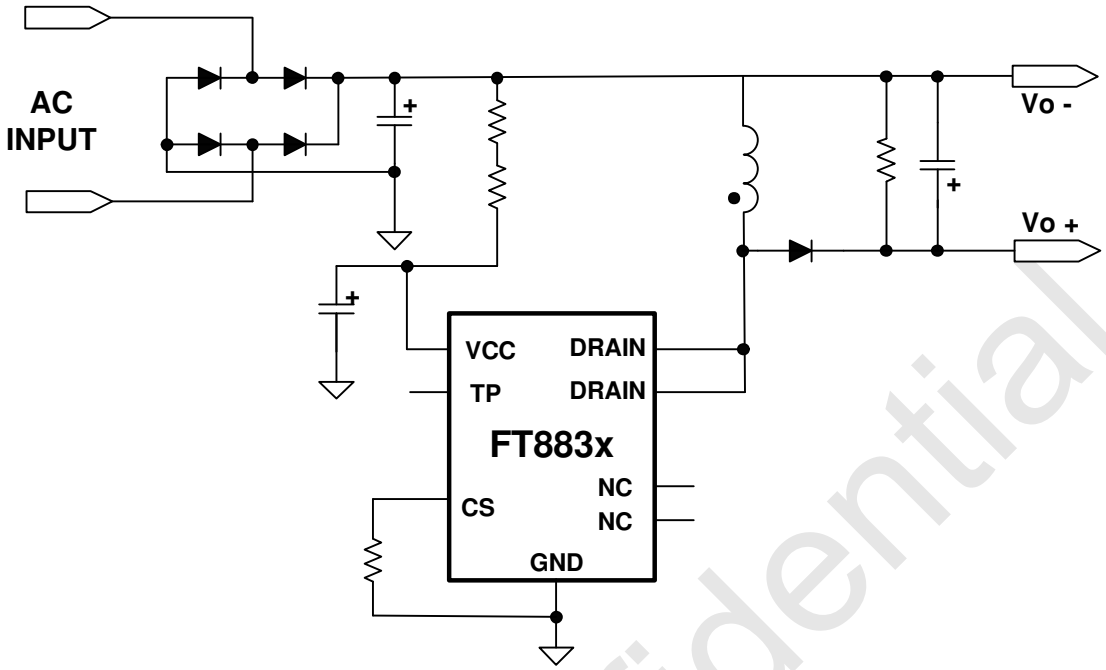


Figure 1: Typical Application Circuit

ABSOLUTE MAXIMUM RATINGS

CS to GND.....-0.3V to +7V
VCC to GND.....-0.3V to +20V
DRAIN to GND.....-0.3V to +550V
TP to GND..... -0.3V to +20V
Operating Temperature Range.....-40℃ to +125℃
Junction Temperature..... -40℃ to +150℃
Storage Temperature Range .....-60℃ to +150℃
ESD Protection HBM.....2000V
ESD Protection MM.....200V

*** Stresses exceed those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. Functional operation of the device at conditions beyond those listed in the specification is not guaranteed. Prolonged exposure to extreme conditions may affect device reliability or functionality.**

PIN CONFIGURATION

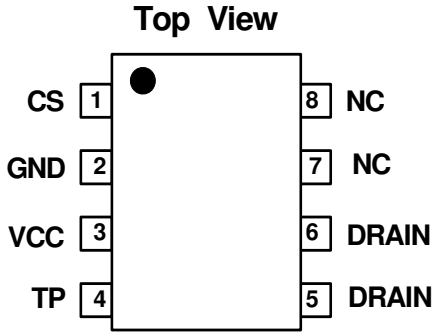


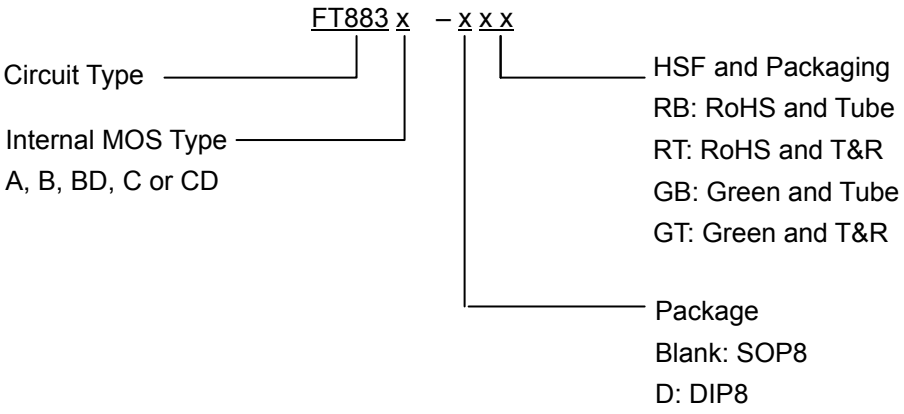
Figure 2: Pin Assignments

TERMINAL DESCRIPTION

No.	PIN	FUNCTION
1	CS	Current sense. This pin connects a current sense resistor to GND
2	GND	Ground
3	VCC	Power supply
4	TP	Test point
5,6	DRAIN	Internal high voltage MOSFET Drain
7,8	NC	No connection, must be floating

Table1

ORDERING INFORMATION



Internal MOS Type	Package	Maximum Output Power	Maximum Output Current	Maximum Output Voltage		HSF	Packaging	Ordering Code
				90V-265V	170V-265V			
A	SOP8	5W	35mA	120V	150V	RoHS	Tube	FT883A-RB
							T&R	FT883A-RT
						Green	Tube	FT883A-GB
							T&R	FT883A-GT
B	SOP8	7W	60mA			RoHS	Tube	FT883B-RB
							T&R	FT883B-RT
						Green	Tube	FT883B-GB
							T&R	FT883B-GT
BD	DIP8	9W	80mA			RoHS	Tube	FT883BD-RB
						Green	Tube	FT883BD-GB
C	SOP8	12W	100mA			RoHS	Tube	FT883C-RB
							T&R	FT883C-RT
						Green	Tube	FT883C-GB
							T&R	FT883C-GT
CD	DIP8	18W	130mA			RoHS	Tube	FT883CD-DRB
						Green	Tube	FT883CD-DGB

MARKING RULE

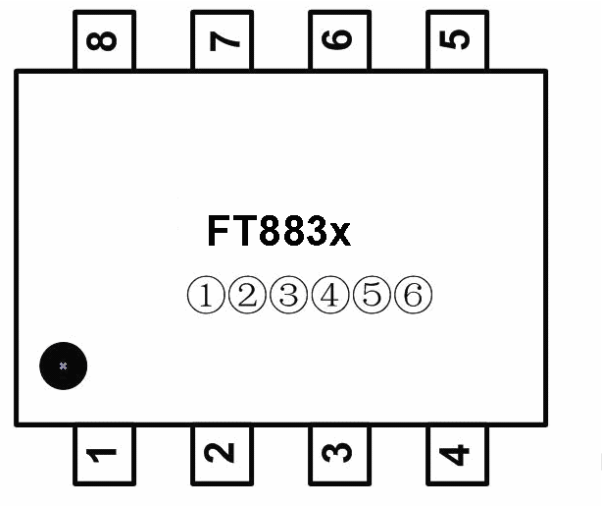


Figure 3 marking rule

①②③④⑤⑥ for internal reference

BLOCK DIAGRAM

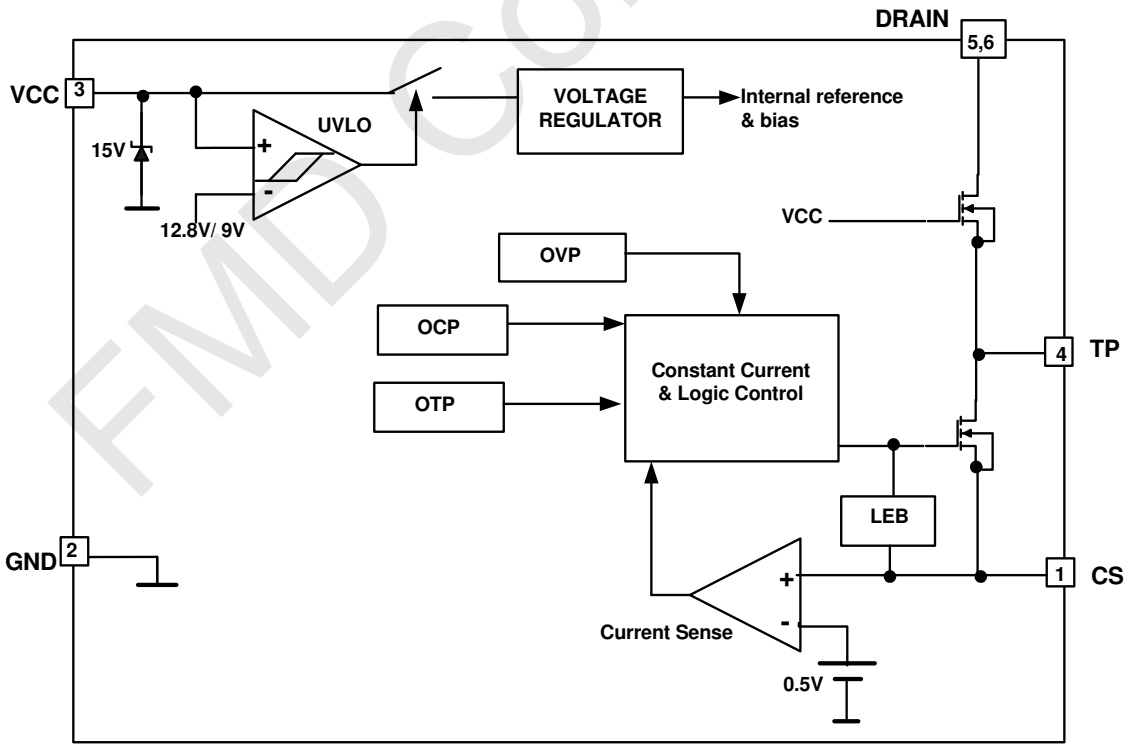


Figure 4 Block Diagram

ELECTRICAL CHARACTERISTICS

(Tj = 25°C, VCC = 14V, unless otherwise specified)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
SUPPLY VOLTAGE						
VCC_{on}	Turn-on threshold			12.8		V
VCC_{off}	Turn-off threshold			9		V
VCC_{clamp}	VCC clamp voltage			15.4		V
SUPPLY CURRENT						
Istart-up	Start-up current	Before turn-on, VCC= VCCon -1V		26		uA
Iq	Quiescent Current			110		uA
CURRENT SENSE						
V_{CS_TH}	Threshold voltage for peak current limit		485	500	515	mV
T_{LEB}	Leading edge blanking time for current sense			500		ns
T_{DELAY}	Switch off delay time			200		ns
SWITCH FREQUENCY						
F_{MIN}	Minimum working frequency			5		KHz
F_{OVP}	LED open circuit protection switching frequency			68		KHz
MAXIMUM DUTY CYCLE						
D	T_{DIS}/T duty cycle			33		%
MOSFET (FT883A)						
R_{DS_ON}	Static drain-source on-resistance	V_{GS}=10V,I_{DS}=0.5A		12		Ω
BV_{DSS}	Drain-source breakdown voltage	V_{GS}=0V,I_{DS}=250uA	550			V
I_{DSS}	Drain-source leakage current	V_{GS}=0V,V_{DS}=550V			10	uA
I_{DMAX}	Maximum Drain Current	Vd=6V		0.46		A
MOSFET (FT883B and FT883BD)						
R_{DS_ON}	Static drain-source on-resistance	V_{GS}=10V,I_{DS}=0.5A		8		Ω
BV_{DSS}	Drain-source breakdown voltage	V_{GS}=0V,I_{DS}=250uA	550			V
I_{DSS}	Drain-source leakage current	V_{GS}=0V,V_{DS}=550V			10	uA

I_{DMAX}	Maximum Drain Current	Vd=6V		0.66		A
MOSFET (FT883C and FT883CD)						
R_{DS_ON}	Static drain-source on-resistance	V_{GS}=10V,I_{DS}=0.5A		5		Ω
BV_{DSS}	Drain-source breakdown voltage	V_{GS}=0V,I_{DS}=250uA	550			V
I_{DSS}	Drain-source leakage current	V_{GS}=0V,V_{DS}=550V			10	uA
I_{DMAX}	Maximum Drain Current	Vd=6V		0.9		A
Over Temperature Compensation						
T_{SD}	Thermal compensation threshold			150		℃
T_{SD_HYS}	Thermal compensation hysteresis			25		℃

Table2

FUNCTIONAL DESCRIPTION

Operating Description

FT883x is a cost effective and high-performance non-isolated True Buck-Boost LED driver. The constant current (CC) control is achieved accurately without the secondary feedback circuit and auxiliary winding. The True Buck-Boost technology allows up to 150V output under universal input voltage.

Startup Control

The start-up current in FT883x is designed to be as low as 20uA. The VCC capacitor will be charged through a start-up resistor when the system is powered on. Once the VCC voltage reaches the start-up threshold, FT883x will start to switch . The VCC voltage of FT883x is clamped at 15V. Due to the ultra-low operating current, the auxiliary winding is not needed to supply the IC, good efficiency is achieved.

Constant Current Control

Cycle-by-Cycle current sense is adopted in FT883x, and the voltage on CS will be compared with the internal 500mV reference voltage through the current sense comparator, the MOSFET will be switched off when the voltage on CS reaches the threshold.

The primary peak current is given by: $I_{P\_PK} = \frac{500}{Rcs}(mA)$

The current in LED can be calculated by the equation: $I_{OUT} = \frac{I_{P\_PK}}{2} * \frac{T_{dis}}{T}$

Where, I_{P_PK} is the peak current in MOSFET,
T_{dis}/T is the ratio of discharge time and operation period.

Leading Edge Blanking (LEB)

Each time the power transistor is switched on, a turn-on spike occurs at the sense resistor. To avoid premature termination of the switching pulse, a 500ns leading edge blanking time is built in. Conventional RC filtering can therefore be omitted. During this blanking period, the current limit comparator is disabled and can not switch off the gate driver.

Over Voltage Protection (OVP)

FT883x features the industry leading output OVP accuracy by means of limiting the maximum system operating frequency to 68KHz. The system normal operating frequency is recommended to be around 52KHz. Output LED open circuit will trigger the over-voltage protection logic and latch, the system stops switching immediately. VCC will be pulled down and charged up again, the system works in a hiccup mode.

LED Short Circuit Protection

When LED short circuit is detected, the system works at minimum frequency (Fop=5KHz), so the power consumption is low.

CS Resistor Short or Inductor Saturation

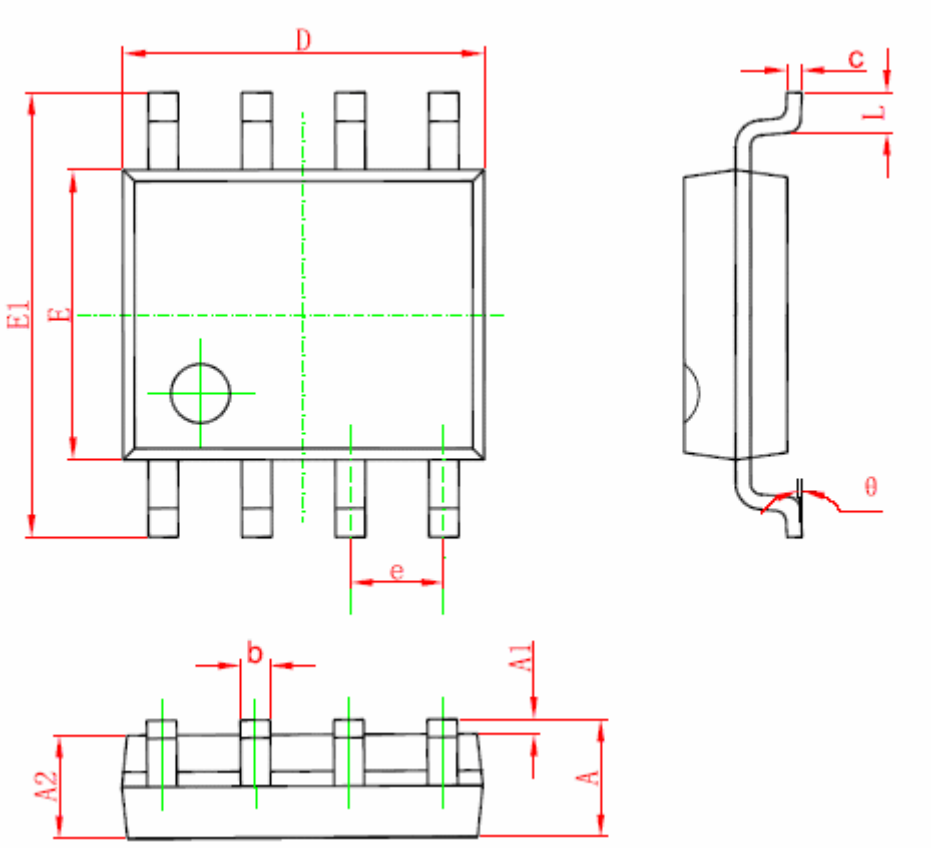
If these catastrophic fault conditions happen, the internal fast fault detection circuit will trigger and latch, the system stops switching immediately, the system VCC will be pulled down and charged up again, system

working in a hiccup mode.

Over Temperature Compensation

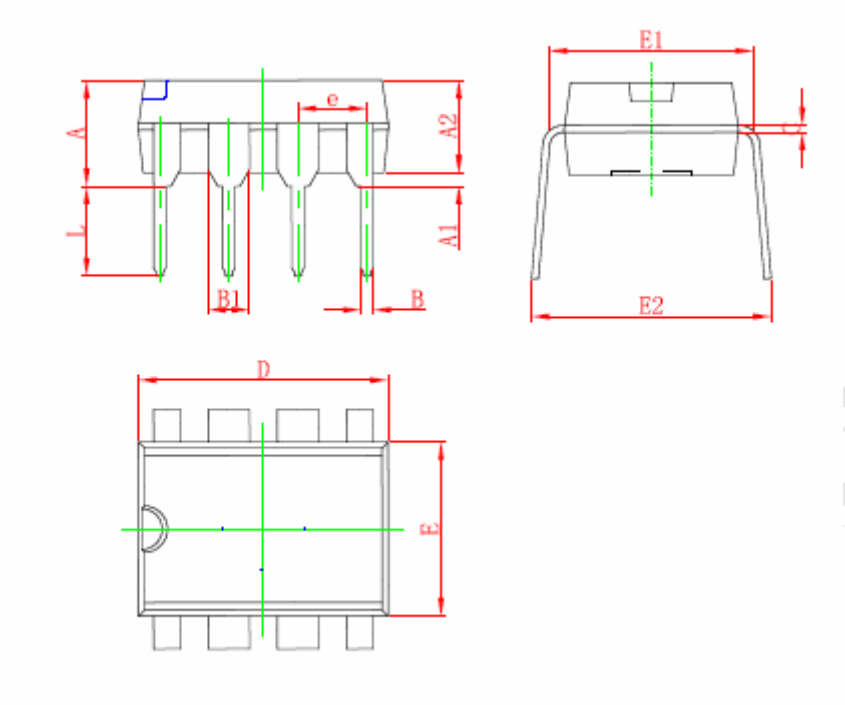
FT883x senses the die temperature after start up, and the thermal compensation threshold is set to 150℃ with a 25℃ hysteresis. When FT883x temperature rises and reaches the threshold, the output current will be reduced by half until the IC temperature falls 25℃ below the thermal compensation trigger point, at which point the output current will recover to 100% of its designed target.

SOP8 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

DIP8 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.710	4.310	0.146	0.170
A1	0.510		0.020	
A2	3.200	3.600	0.126	0.142
B	0.380	0.570	0.015	0.022
B1	1.524（BSC）		0.060（BSC）	
C	0.204	0.360	0.008	0.014
D	9.000	9.400	0.354	0.370
E	6.200	6.600	0.244	0.260
E1	7.320	7.920	0.288	0.312
e	2.540 (BSC)		0.100（BSC）	
L	3.000	3.600	0.118	0.142
E2	8.400	9.000	0.331	0.354

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