DESCRIPTION

MT7853BS is a high-PF, non-isolate LED driver. The floating-ground, high-side BUCK topology makes full wave detection possible, high precision output current is achieved. MT7853BS works in Quasi-Resonant Mode (QRM), which improves both efficiency and EMI performance.

The system integrates the ultra-high voltage power supply circuit, start-up resistor and power supply diode are not needed; integrated with compensation circuit, COMP pin and COMP capacitor are eliminated. Besides, MT7853BS can meet low THD requirements through internal THD compensation circuit.

Various protections with self-recovery, such as over voltage protection (OVP), over current protection (OCP) and over temperature compensation, etc. are embedded to improve reliability. MT7853BS integrates 650V MOSFET, which further simplifies peripheral circuit.

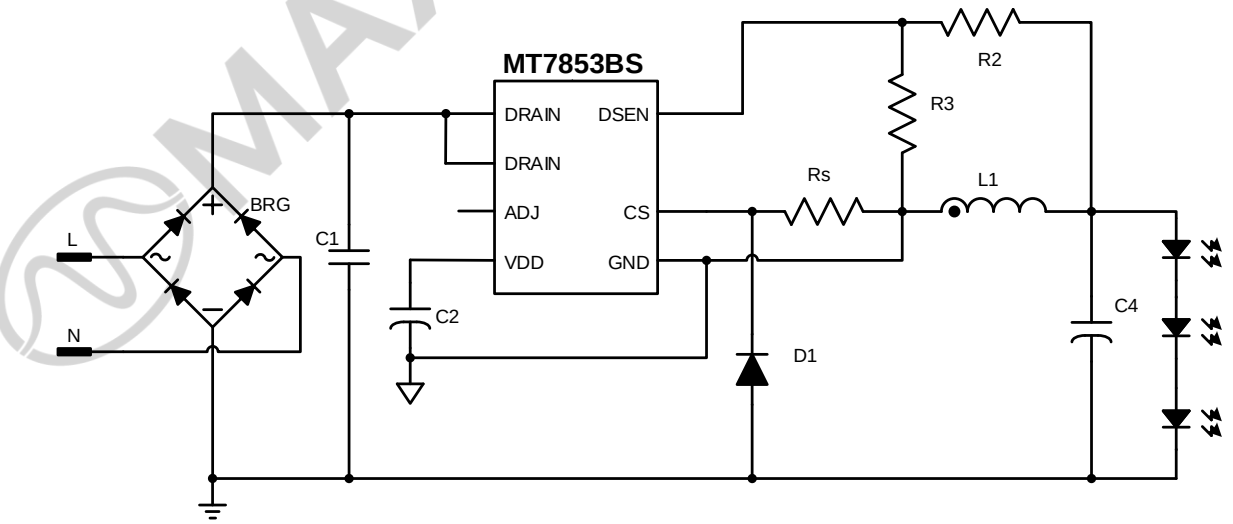
FEATURES

- Single-stage active power factor correction (PFC > 0.9)
- Ultra-high voltage power supply without start-up resistor and power supply diode
- Built-in compensation circuit, no COMP capacitor is needed
- Integrate THD compensation circuit, THD<15%
- High subharmonic-Distortion-Suppression
- High accurate LED current (±3%)
- Good Line and Load Regulation (±2%)
- Operates in QRM
- Various protection schemes
- Available in SOP7 package

APPLICATIONS

- E14/E27/PAR30/PAR38/GU10 LED lamp
- T8/T10 LED tube
- Other LED lighting applications

TYPICAL APPLICATION CIRCUIT



ABSOLUTE MAXIMUM RATINGS

VDD Pin Voltage	-0.3V to 30V
DRAIN Pin Voltage	-0.3V to 650V
CS/DSEN/ADJ Pins Voltage	-0.3V to 6V
Lead Temperature (soldering, 10 sec.)	260°C
Maximum Power Consumption (P_{DMAX})	1W
Storage Temperature (T_{STG})	-55°C to 150°C
Junction Temperature (T_J)	-40°C to 150°C

RECOMMENDED OPERATING CONDITIONS

Supply Voltage	7.2V to 12V
Operating Temperature (Environment)	-40°C to 125°C
Input Power (Environment temperature≤90°C)	≤22W @176VAC~265VAC ≤16W @85VAC~265VAC

THERMAL RESISTANCE①

Junction to Ambient ($R_{\theta JA}$)	128°C/W
Junction to Case ($R_{\theta JC}$)	90°C/W

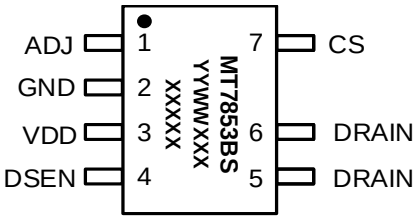
Note:

① *$R_{\theta JA}$, $R_{\theta JC}$ are measured in the natural convection at T_A = 25°C on a low effective single layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard. Test condition: Device mounted on 2" X 2" FR-4 substrate PCB, 2oz copper, with minimum recommended pad on top layer and thermal vias to bottom layer ground plane.*

ORDERING INFORMATION

Part Number	Package	Packing Method	Moisture Sensitivity Level	Chip Mark
MT7853BS	SOP7	Tape 4,000 Pcs/Reel	3	MT7853BS YYWWXXX XXXXX

PIN CONFIGURATIONS



(SOP7)

注释：

MT7853BS: 产品型号

Y: 年代码
W: 周代码
X: 内部代码

PIN DESCRIPTION

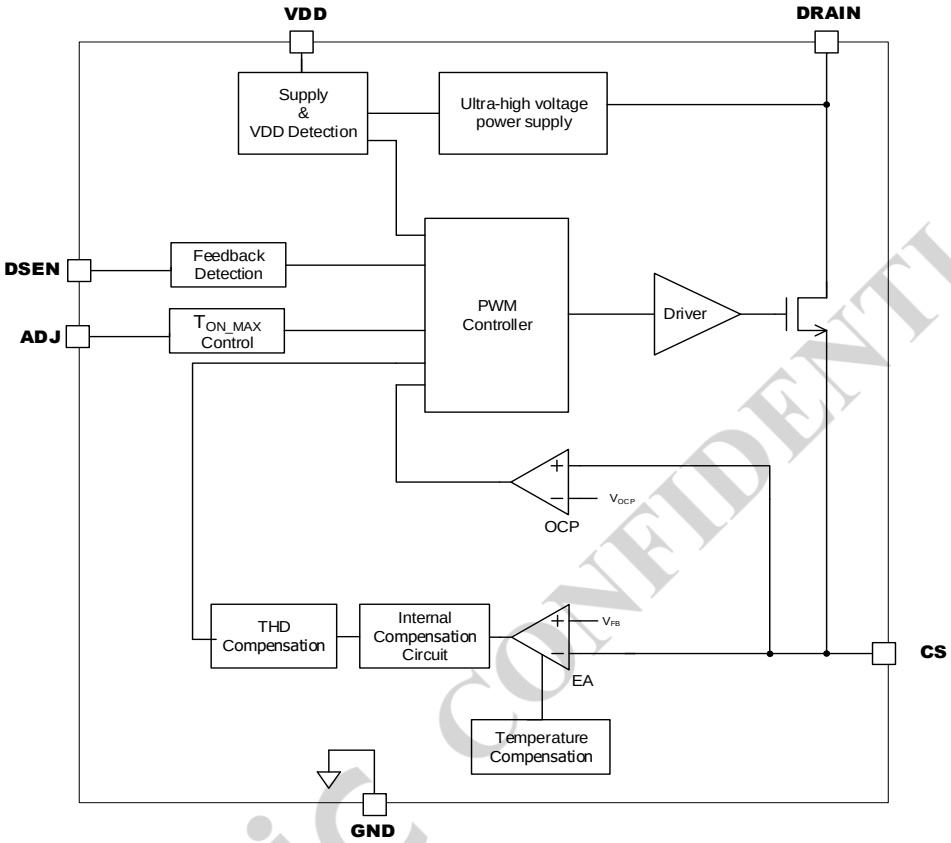
Name	Pin No.	Description
ADJ	1	T_{ON_MAX} adjusting pin. When this pin is left floating, T_{ON_MAX} is maximum.
GND	2	Chip ground.
VDD	3	Power supply pin.
DSEN	4	Feedback pin for inductor zero current crossing detection. Connect to the output or auxiliary winding through resistor divider to reflect the output voltage.
DRAIN	5,6	Drain of internal MOSFET and the input of ultra-high voltage power supply.
CS	7	Source of internal MOSFET and current sense pin.

ELECTRICAL CHARACTERISTICS

Test conditions: VDD=12V, T_A=25°C unless otherwise stated.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Start-up (VDD Pin)						
V_{STP}	Start-up voltage	VDD ramp-up from 0V	10.8	12	13.2	V
V_{UVLO}	Under voltage lockout	VDD ramp-down from (V_{STP}+1V)	7	8	9	V
I_{STP}	Start-up current	VDD=12V	15	30	50	μA
Power Supply Current						
I_Q	Quiescent current		0.33	0.4	0.5	mA
Control Loop (DSEN Pin)						
V_{REF-FB}	Voltage reference for feedback loop	Close the feedback loop	194	200	206	mV
V_{OVP}	Over voltage protection of DSEN pin		3.0	3.2	3.5	V
T_{LEB1}	Leading edge blank for DSEN pin		1.56	2	2.44	us
T_{MIN}	Minimum switching period		7.8	10	12.2	us
T_{OFF_MAX}	Maximum OFF time		195	250	305	μs
T_{ON_MAX}	Maximum ON time	Refer to "T_{ON_MAX} Adjusting" section	21	27.5	35	μs
Current Sense Pin (CS Pin)						
V_{OCP}	Threshold of over current protection at CS pin		1.3	1.4	1.5	V
T_{LEB2}	Leading edge blank for CS pin		240	300	360	ns
Thermal Protection						
T_{OTR}	Temperature compensation trigger point		142.5	150	157.5	°C
Internal MOSFET (DRAIN Pin)						
R_{DSON}	Internal MOSFET turn-on resistance	V_{GS}=10V/I_{DS}=1.0A		4.7		Ω
BV_{DSS}	Breakdown voltage	V_{GS}=0V/I_{DS}=250uA	650			V

BLOCK DIAGRAM



APPLICATION INFORMATION

MT7853BS integrates compensation circuit, which eliminates COMP pin and COMP capacitor. It completely avoids the disturbance caused by board-level leakage or interference on the COMP pin. The system starts up fast.

MT7853BS integrates an adaptive THD compensation circuit. The compensation value will be automatically adjusted according to the system operating mode, without any external compensation circuit, the system can achieve less than 15%@220Vac and can effectively reduce the odd harmonic components to meet the IEC61000-3-2 standard. It's insensitive to inductance and the inductance can be selected arbitrarily in a wide range.

Averaged Current Control

MT7853BS accurately regulates LED current through sensing the inductor current signal. The LED current can be easily set by equation (1):

$$I_{LED} = \frac{V_{FB}}{R_S} \quad \text{---------- (1)}$$

Where V_{FB} (=200mV) is the internal reference voltage and R_S is an external current sensing resistor (Refer to the typical application circuit in page1).

Start Up and High Voltage Power Supply

MT7853BS integrates ultra-high voltage power supply circuit, the VDD directly gets the power from the DRAIN pin without start-up resistor and

power supply diode. During start-up, the capacitor at VDD is charged through the internal ultra-high voltage power supply circuit. The internal control logic starts to work when VDD voltage reaches 12V.

As VDD voltage goes below 8V, the system is considered to be UVLO, the MOSFET is turned off.

When the system works in normal operation, MT7853BS controls the internal ultra-high voltage power supply circuit to charge the VDD capacitor. The circuit stops to provide power once VDD voltage exceeds 12V, and resumes as VDD voltage lower than 11.5V. So the VDD voltage keeps in about 12V as the system works in normal operation.

Auxiliary Sensing

The voltage waveform of the inductor is sensed during PWM OFF period for switching logic control, over-voltage protection (OVP), short-circuit protection (SCP), etc.

The DSEN pin senses the inductor voltage through a resistor divider. The sampling strobe window is 2us LEB (Leading Edge Blanking) time right after the MOSFET is turned off for better noise immunity, as shown in Fig. 2.

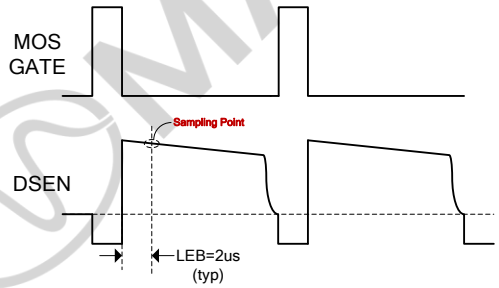


Fig.2 Auxiliary Signal Sensing

Hiccup Mode

Once detected any fault condition, such as, over-voltage (OV), short-circuit (SC), MT7853BS goes into hiccup mode. PWM signal is turned off, and the chip quiescent current drops lower (to about 100uA). After about 400ms, the internal ultra-high voltage power supply circuit stops providing power to VDD. The VDD capacitor is therefore discharged. Then VDD continues to drop below UVLO threshold. A start-up sequence is initiated. If the fault condition is removed, the chip will go back to normal at next startup process.

The hiccup mode keeps the system at low power dissipation state during fault conditions, enhancing system reliability.

Over-voltage Protection

MT7853BS integrates over voltage protection function. If the DSEN voltage exceeds 3.2V three times accumulatively within 1ms (Refer to “Auxiliary Sensing”), MT7853BS goes into hiccup mode to protect the system and lower the power consumption. The threshold of over voltage protection for LED can be set as following (refer to the application circuit in page 1):

$$V_{OUT\_OV} = 3.2 \times (1 + \frac{R2}{R3}) \quad \text{---------- (2)}$$

Short-circuit Protection

If MAX_OFF is triggered for a continuous time of 12ms to 16ms. MT7853BS goes into hiccup mode.

Over-current Protection

MT7853BS immediately turns off the power MOSFET once the voltage at CS pin exceeds 1.4V. This cycle by cycle current limitation scheme prevents the relevant components, such as power MOSFET, inductor, etc. from damage.

Temperature Compensation

When the junction temperature reaches T_{OTR} (±7.5°C), the compensation circuit starts to reduce output current along with the temperature increasing. As the junction temperature drops below T_{OTR} (±7.5°C), the output current back to normal level. This thermal fold back scheme prevents the system goes into thermal runaway.

T_{ON_MAX} Adjusting

The T_{ON_MAX} can be set through adjusting the ratio of R_{ADJ} and R_{DSEN}, as shown in Fig. 3.

R_{ADJ}/R_{DSEN} Ratios	T_{ON_MAX} (μs)
0	4.4
1.5	4.9
2.5	5.5
3.5	6.4
4.5	7.3
5.5	8.8
6.5	11
∞	27.5

Refer to the typical application circuit in page1, the R_{DSEN} is the total equivalent resistance at DSEN pin, so it is the parallel value of R2 and R3, since R2 is much larger than R3, R_{DSEN} is approximately equal to R3.

Limited by T_{ON_MAX}, the output current begins to decrease when the main voltage is lower than a certain threshold. The lower the T_{ON_MAX}, the main voltage threshold will be higher.

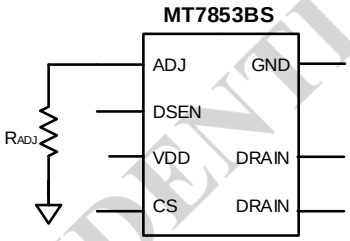
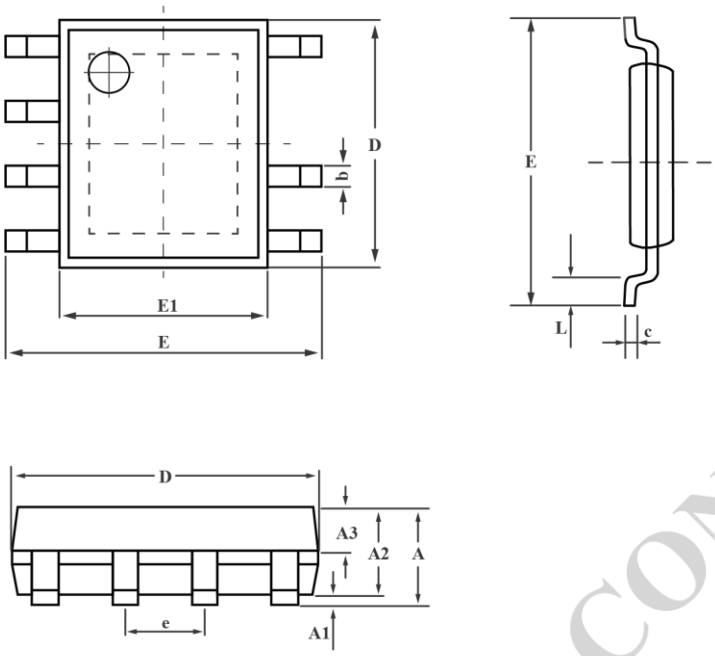


Fig.3 T_{ON_MAX} Adjusting

PACKAGE INFORMATION

SOP7 PACKAGE OUTLINE AND DIMENSIONS



SYMBOL	MILIMETER		
	MIN	NOM	MAX
A	1.35	-	1.75
A1	0.10	-	0.25
A2	1.30	1.40	1.50
A3	0.55	0.65	0.70
b	0.33	-	0.51
c	0.17	-	0.25
D	4.70	4.90	5.10
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
L	0.40	0.60	0.80

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