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MT7842
Non-isolated APFC BUCK LED Driver

DESCRIPTION

The MT7842 is a high-PF, non-isolate LED Driver IC. The floating-ground, high-side BUCK topology makes full wave detection possible. High precision output current is achieved. MT7842 works in Quasi-Resonant Mode (QRM), which improves both of efficiency and EMI performance. The system integrates the ultra-high voltage power supply circuit, the start-up resistor and power supply diode are not needed. Low external component count and cost is achieved.

Various protections such as over voltage protection (OVP), over current protection (OCP) and over temperature compensation, etc. are embedded to improve reliability. The MT7842 integrates 550V MOSFET, which further simplifies external circuit.
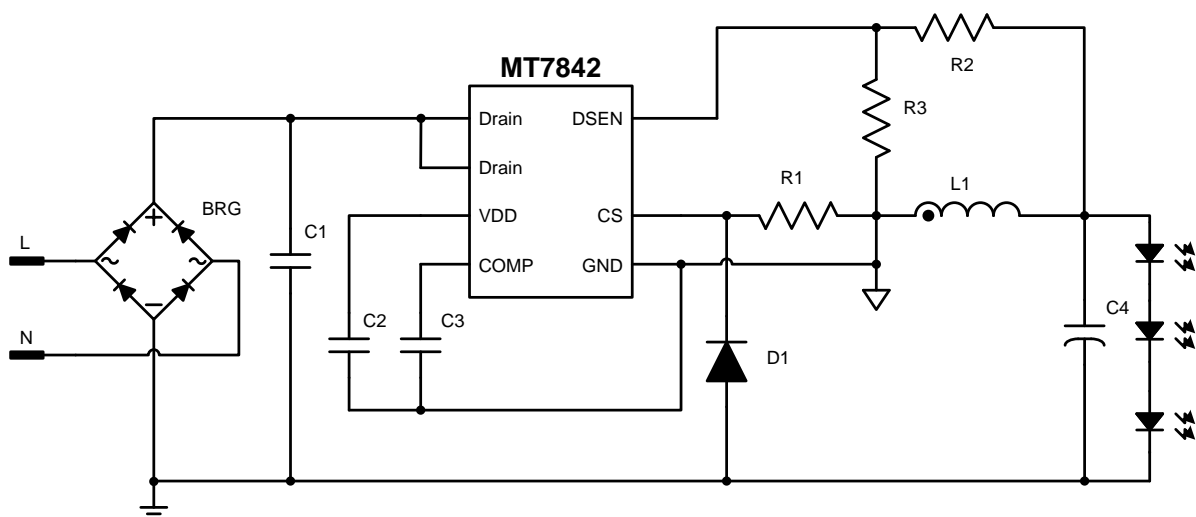
FEATURES

- Single-stage active power factor correction (PFC > 0.90)
- Ultra-high voltage power supply without start-up resistor and power supply diode
- High accurate LED current ($\pm$3%)
- Good Line and Load Regulation ($\pm$2%)
- Quasi-Resonant mode (QRM) operation
- Various protection schemes.
- Available in SOP7 packages

APPLICATIONS

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

Typical Application Circuit

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ABSOLUTE MAXIMUM RATINGS

|	
VDD Pin Voltage	-0.3V to 30V
Drain Pin Voltage	-0.3V to 550V
COMP/CS/DSEN Pins Voltage	-0.3V to 6V
Lead Temperature (soldering, 10 sec.)	260°C
P_{DMAX} (maximum power consumption)	0.8W
Storage Temperature	-55°C to 150°C
Junction Temperature (Tj)	150°C

RECOMMENDEDE OPERATING CONDITIONS

Supply voltage	7.2V to 12V
Operating Temperature (Environment)	-40°C to 105°C
Output Power	≤ 9W @ ≤90°C (Environment temperature)

THERMAL RESISTANCE

Junction to ambient (R$_{\theta JA}$)	128°C/W

PIN CONFIGURATIONS

(SOP7)
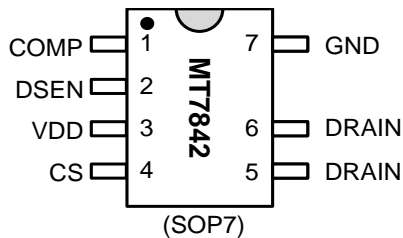
Chip Mark

MT7842
X YY WW XX

—— Manufacture code
—— Week code
—— Year code
—— Manufacture code
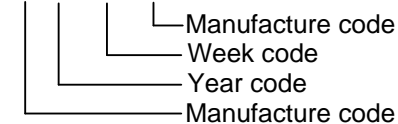
PIN DESCRIPTION

Name	Pin No.	Description
COMP	1	Internal EA's output pin. Connect a capacitor to ground for frequency compensation.
DSEN	2	Feedback pin for inductor zero current crossing detection.
VDD	3	Power Supply pin.
CS	4	Source of internal MOSFET, and Current Sense pin.
DRAIN	5,6	Drain of internal MOSFET.
GND	7	Ground pin.

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ELECTRICAL CHARACTERISTICS

(Test conditions: V_{DD}=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		12		V
UVLO	Under Voltage Lockout	VDD Ramp-down from (V_{STP}+1V)		7.2		V
I_{STP}	Start-up Current	VDD=12V	20	30	50	μA
V_{DD_OP}	VDD operation voltage			12		V
Power Supply Current						
I_Q	Quiesent Current			400		uA
Control Loop (DSEN Pin)						
V_{REF-FB}	Voltage Reference for Feedback Loop	Close the Feedback Loop	196	200	204	mV
SCP	Threshold of Short Circuit Protection at DSEN Pin		350	400		mV
OVP	Over Voltage Protection of DSEN Pin			3.2	3.4	V
LEB1	Leading Edge Blank for DSEN Pin			2		us
MinT	Minimum Switching Period			10		us
Current Sense Pin (CS Pin)						
OCP	Threshold of Over Current Protection at CS Pin			1.4		V
LEB2	Leading Edge Blank for CS Pin			300		ns
Thermal Protection						
T_{Trig}	Temperature compensation trigger point			150		°C
Internal MOSFET (DRAIN Pin)						
Ron	Internal MOSFET turn-on resistance	VGS=10V/I_{DS}=1.0A		5.5		Ω
BV_{DSS}	Breakdown voltage	VGS=0V/I_{DS}=250uA	550			V

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BLOCK DIAGRAM
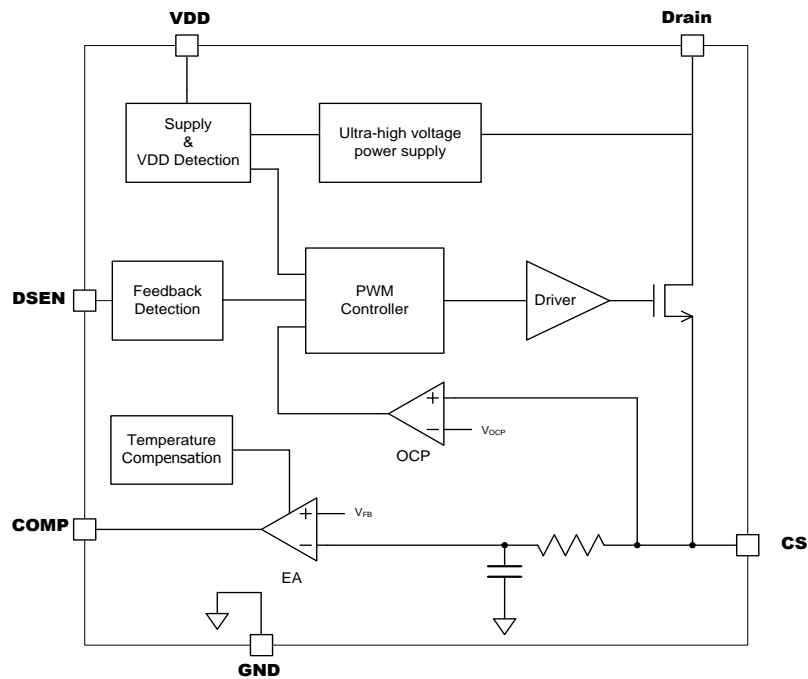
APPLICATION INFORMATION

The MT7842 integrates power factor correction function and works in Quasi-Resonant Mode (QRM). The LED current can be accurately regulated through sensing the inductor current signal.

Averaged Current Control

The MT7842 accurately regulates LED current through sensing the inductor current signal. The LED current can be easily set by:

$$I_{LED} = \frac{V_{FB}}{R_S}$$

Where V_{FB} (=200mV) is the internal reference voltage and R_S is an external current sensing resistor (Rs is the R1 in circuit in page1).

Start Up and High Voltage Power Supply

MT7842 integrates ultra-high voltage power supply circuit, the VDD directly gets the power from the drain pin (Pin5&6). 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 reaches 12V. The COMP pin is, therefore, pre-charged during this process. The internal control loop is established. Once the voltage of COMP reaches 1.4V, the whole system works in normal operation mode.
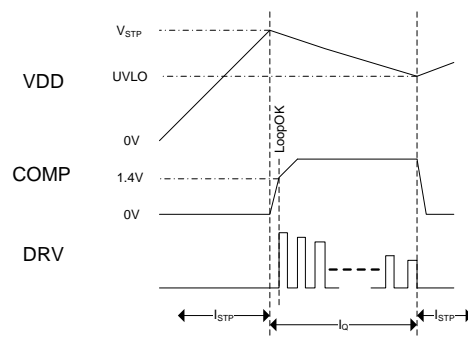

Fig.1   Start up sequence

As the VDD goes below 7.2V, the system is considered to be UVLO, the PWM signal of DRV goes low, and the voltage of COMP is discharged

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to 0V. The detailed start-up sequence is shown in Fig. 1.

When the system works in normal operation, the MT7842 controls the internal ultra-high voltage power supply circuit to charge the VDD capacitor. The circuit stops to provide power once the VDD voltage exceeds 12V, and resumes provide power as the 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 DRV signal goes low for better noise immunity, as shown in Fig. 2.
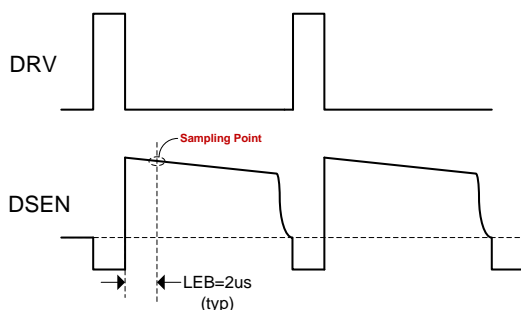

Fig.2   Auxiliary Signal Sensing

Hiccup Mode

Once detected any fault conditions, such as, over-voltage (OV), short-circuit (SC) conditions, the MT7842 goes into hiccup mode. PWM signal is turned off. The chip quiescent current drops lower (about 100uA). After about 240ms, the internal ultra-high voltage power supply circuit stops providing power to VDD. VDD is therefore discharged by the MT7842 itself consumption. Then VDD continues to drop below UVLO threshold. A start-up sequence is initiated.

If the fault conditions are removed, the LED driver goes back to normal.

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

Over-voltage Protection

The MT7842 integrates Over Voltage Protection function. If the DSEN voltage exceeds 3.2V three times accumulatively during PWM OFF period (Refer to "Auxiliary Sensing"), the MT7842 gets in 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):

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

Short-circuit Protection

The short-circuit protection is triggered if the DSEN voltage is detected below 400mV during OFF period for a continuous time of 5 to 10ms. The MT7842 gets into hiccup mode.

Over-current Protection

The MT7842 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 150°C, the compensation circuit starts to reduce output current along with the temperature increasing. As the junction temperature drops below 150°C, the output current back to normal level. This thermal fold back scheme prevents the system goes into thermal runaway.

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PACKAGE INFORMATION

SOP-7 PACKAGE OUTLINE AND DIMENSIONS
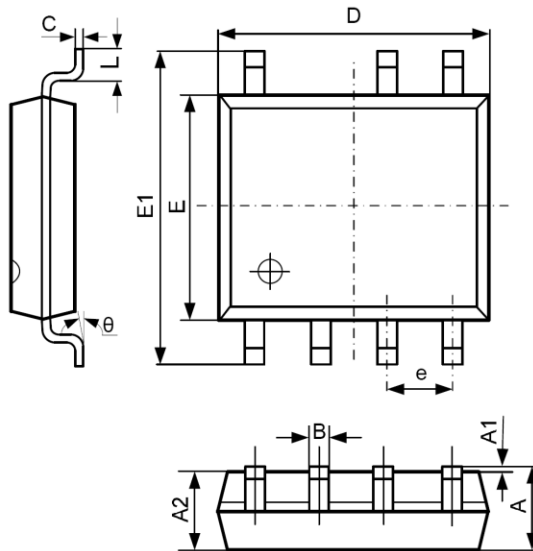
SYMBOL	DIMENSION IN MILLIMETERS		DIMENSION IN INCHES	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270 TYP		0.050 TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

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