# Low Power, High Accuracy, Low Cost Offline Switcher

## FEATURES

- Low Cost BUCK, Very Few Component
- Fast Startup: 50mS
- Low Standby Power: 50mW
- High Accuracy: ±3%
- Fixed 47KHz Frequency
- ±5% Frequency Jittering, improving EMI
- Integrated 500V Power MOS and 500V Startup MOS
- OVP, OTP, OCP, SCP
- AC Input Range: 85~264Vac
- DC input Range: 30~380Vdc
- Package：TO-92, SOT23-3

## TYPICAL APPLICATION

- Small Home Appliance
- Auxiliary Supplies
- Linear or RCC Power Replacement

## DESCRIPTION

HM2710B is a high performance, high accuracy, low cost buck power switcher, which integrates a peak-current mode PWM controller and a 500V Power MOS.

HM2710B integrates the 500V startup MOS and the current sense resistor, to reduce external component. Internal frequency jittering and soft-driver can effectively improve EMI performance.

HM2710B provides function of over-voltage protection, over-temperature protection, circle by circle over-current protection, output short circuit protection, to prevent the circuit being damaged from the abnormal conditions。

HM2710B is available in package of TO-92 and SOT23-3.

## TYPICAL APPLICATION CIRCUIT

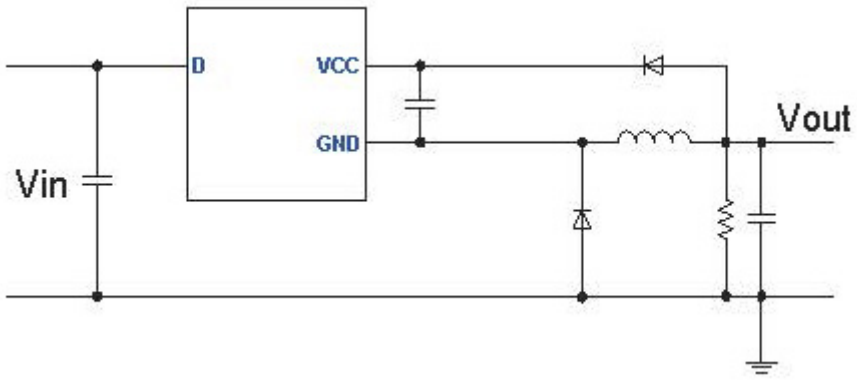



**Figure 1: Typical Application**

## ABSOLUTE MAXIMUM RATINGS

VCC……-0.3V~7V
D……-0.3V~500V
Junction to Ambient Thermal Resistance($\theta_{JA}$)……150℃/W
Operating Temperature……-40℃to +85℃
Junction Temperature Range……-40℃to+150℃
Storage Temperature Range……-55℃ to +150℃
ESD, Human Body Model……2KV
Lead Temperature……300℃

***Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.***

## Recommended Operating Condition

AC Vin……85~264Vac
DC Vin…… 30~380Vdc
Ambient Temperature……-40~65℃

## PIN Definition and Marking Rule

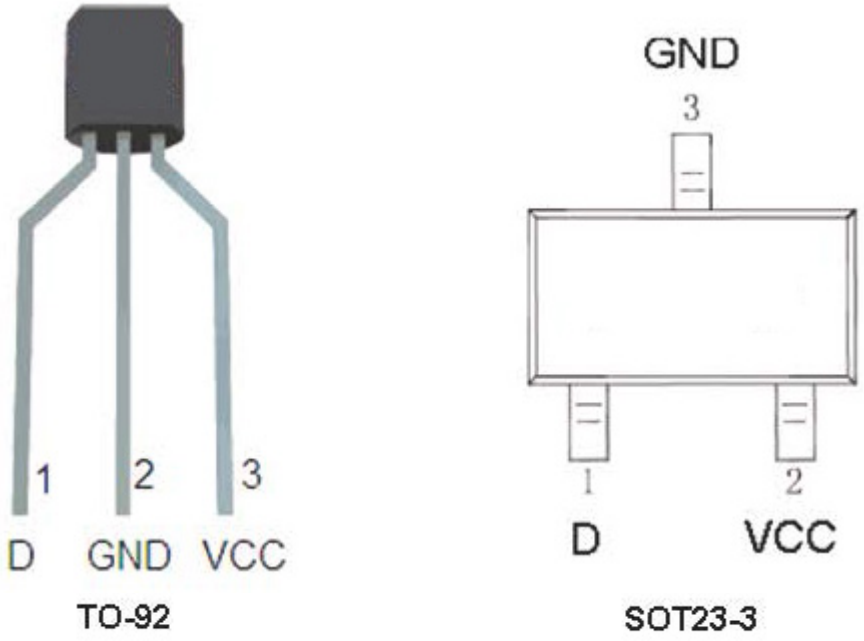



**Figure 2: Package Top View**

## Pin Definition

| TO-92 | SOT23-3 | Name | Description |
|---|---|---|---|
| 1 | 1 | D | Drain of MOSFET |
| 2 | 3 | GND | Ground for the chip，and the source of Power MOS |
| 3 | 2 | VCC | Power Supply |

**Table 1 HM2710B Pin Description**

## Maximum Output Current

| Package | Maximum output current @180~264Vac | Maximum output current @90~264Vac |
|---|---|---|
| TO-92 | 130mA | 120mA |
| SOT23-3 | 120mA | 110mA |

Block Diagram

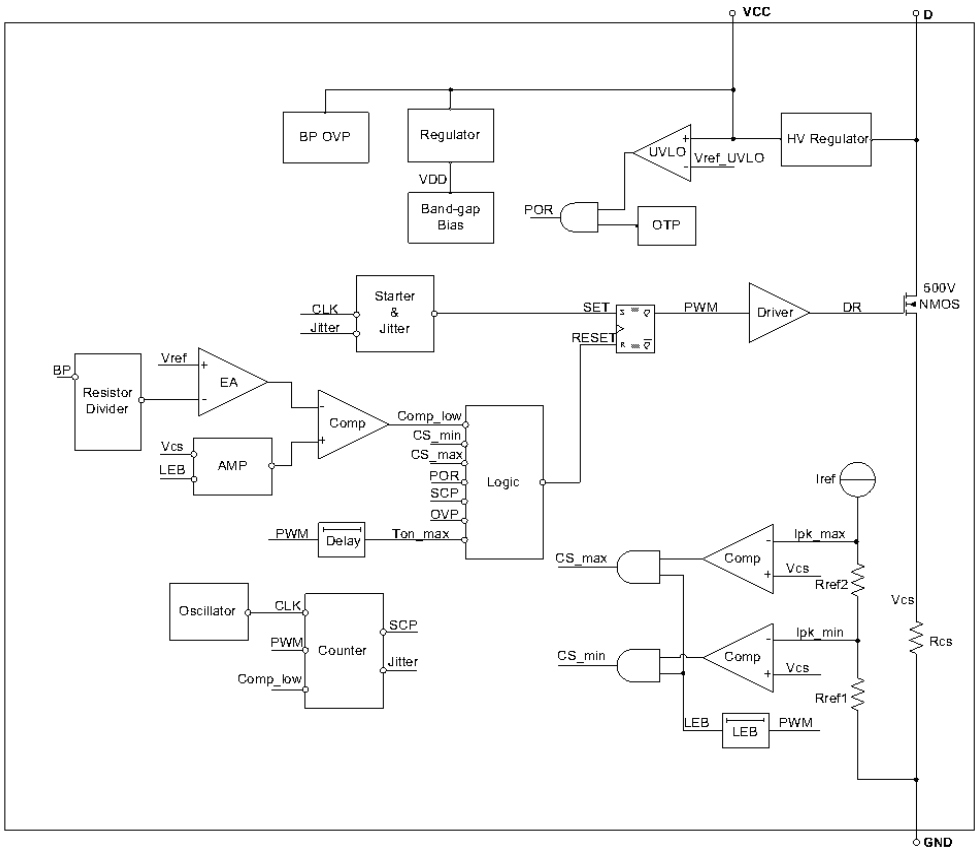



**Figure3: HM2710B Block Diagram**

## ELECTRICAL CHARACTERISTICS

(VCC= 5V, $T_A$ = 25°C unless otherwise specified)

| Parameter | Symbel | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Operating Current | Is1 | Non-Switching | | 610 | | uA |
| | Is2 | Switching | | 670 | | uA |
| VCC Charge Current | ICH1 | VCC=0V | | 1.57 | | mA |
| | ICH2 | VCC=4V | | 1.33 | | mA |
| VCC UVLO | UVLO_H | VCC rising | | 4.7 | | V |
| | UVLO_L | VCC falling | | 4.2 | | V |
| VCC OVP | OVP_H | VCC rising | | 8.6 | | V |
| Maximum On Time | Ton_max | | | 6 | | uS |
| Leading Edge Blanking Time | LEB | | | 300 | | nS |
| Operating Frequency | F_OP | | | 47 | | KHz |
| Minimum Peak Current | Min.Ipeak | | | 150 | | mA |
| Maximum Peak Current | Max.Ipeak | | | 300 | | mA |
| Over-Temperature Protection | OTP_H | Temperature-rising | | 150 | | ℃ |
| | OTP_L | Temperature-falling | | 75 | | ℃ |
| On Resistance | RDSON | ID=50mA | | 26 | | Ω |
| Drain-Source Leakage Current | ILeakage | VD=450V | | | 15 | uA |
| Drain-Source breakdown voltage | BVDSS | | 500 | | | V |
| Driving rising time | Tr | | | 80 | | nS |
| Driving falling time | Tf | | | 40 | | nS |
| Maximum Ouput current @Vout=5V | Iout_max | 220Vac | 120 | | | mA |
| | | 110Vac | 110 | | | mA |
| Startup time | Tstart | | | | 50 | mS |
| Maximum loading Current @Startup | Iload_st | | 110 | | | mA |

**Table 2**

## APPLICATION INFORMANCE

### Power Supply and Standby Power

HM2710B integrates a 500V startup circuit, which can charge the VCC to 5V directly from Drain pin, so as to reduce traditional startup resistor. Once the output voltage is above 5V, the 500V startup circuit will shutdown to reduce standby power. HM2710B standby power is typically lower than 50mW.

### VCC UVLO

A UVLO comparator with built-in hysteresis is implemented in HM2710B, with turn-on and turn-off threshold set at 4.7V and 4.2V respectively.

### Over Voltage Protection

When VCC voltage is higher than the OVP threshold voltage 8.5V, HM2710B will shutdown the Power MOS immediately, meanwhile a 1mA current will through from VCC to GND.

### High Accuracy Control

HM2710B implements high performance error amplifier and accurate reference, to ensure the output accuracy and line/load regulation.

### Frequency Jittering

HM2710B is a WM switcher, with a fixed frequency 47KHz. HM2710B implements a ±5% frequency jittering, which can effectively improving EMI performance

### Leading Edge Blanking

Each time the power MOSFET is switched on, a turn-on spike will inevitably occur across the internal sense resistor. To avoid false trigger, a 300ns leading-edge blanking time is built in. During this blanking period, the current-limit comparator is disabled and can not switch off the gate driver.

### Over Current Protection

The HM2710B has the over current protection function built in. An internal circuit detects the power MOS current level, when the current is larger than a threshold level, the gate output will switch off immediately until next cycle.

### Over Temperature Protection

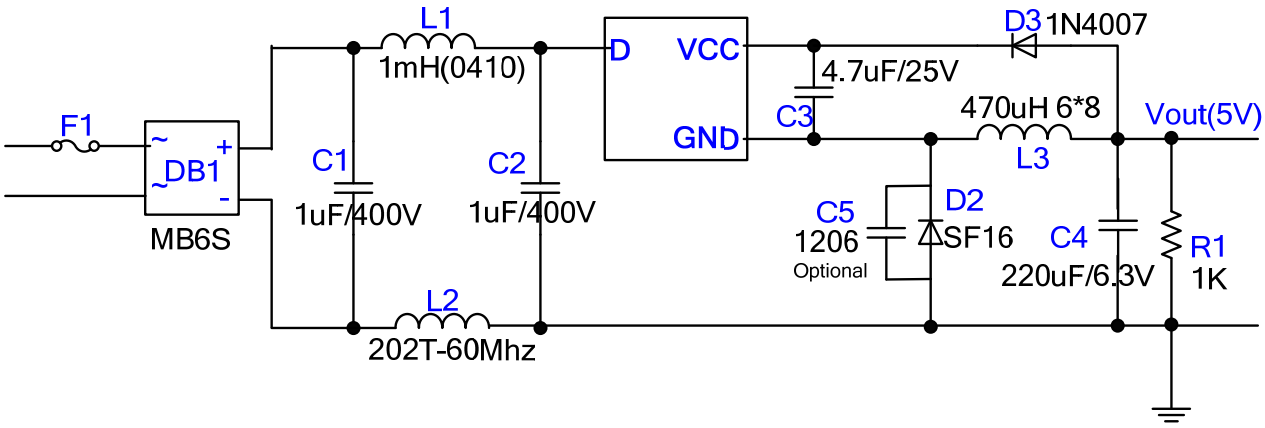
When temperature is higher than OTP threshold 150℃，HM2710B will shutdown the power MOS. Until temperature is lower than 75℃，the power MOS will work normally.

### Short Circuit Protection

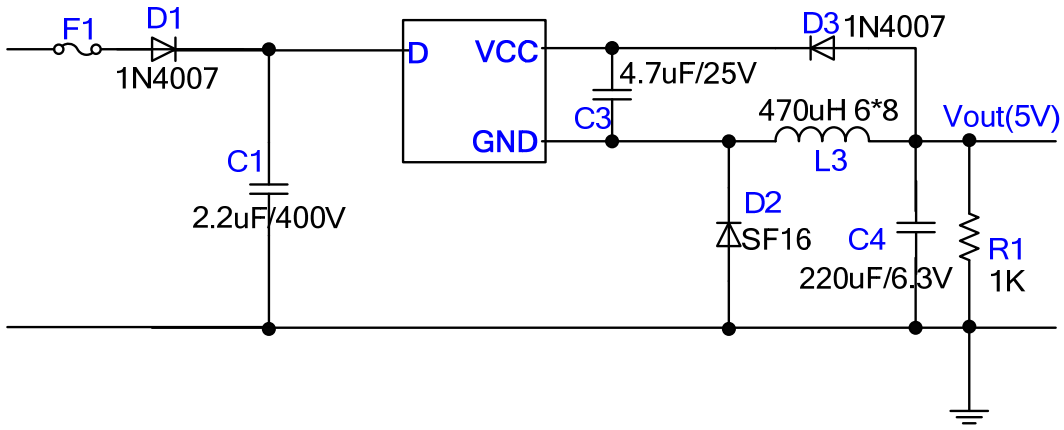
When short circuit happens, HM2710B will enter “auto-restart” mode. If the output feedback voltage is larger than internal setting reference for over 3072 cycles, than the power MOS will shutdown for 500mS.

## Typical Application Project

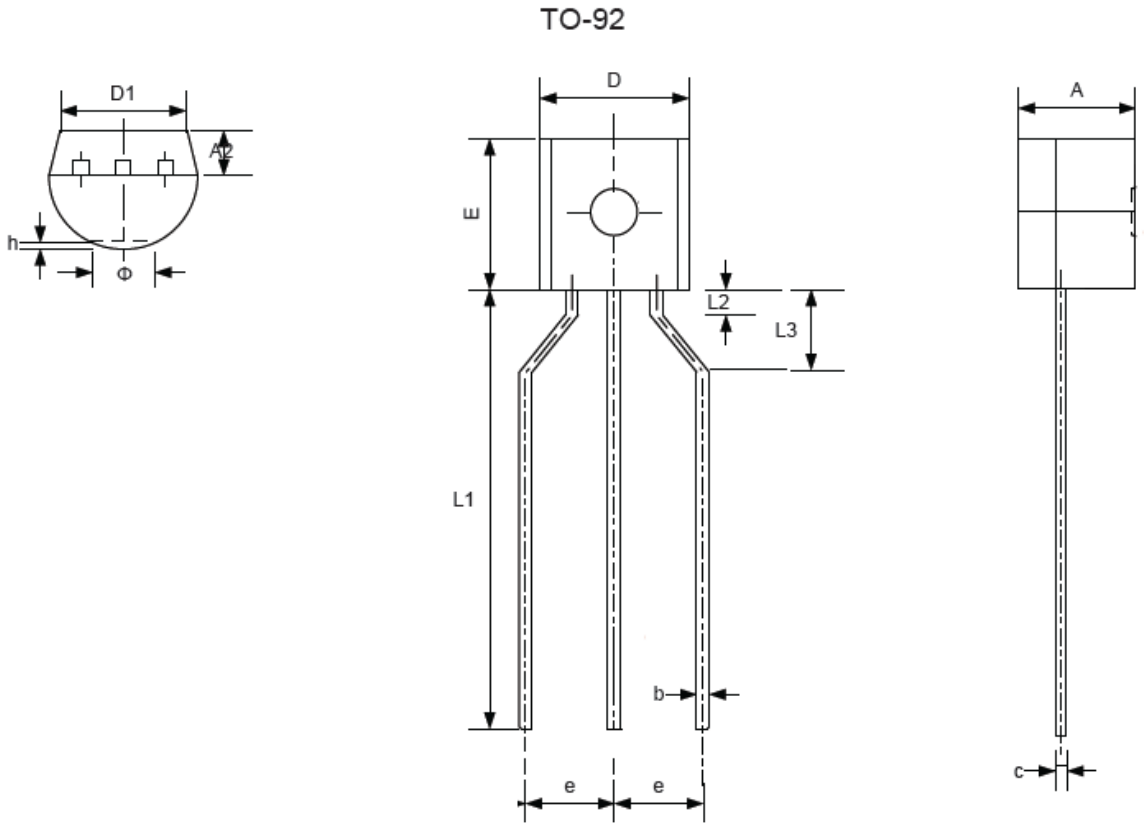
Project1: EMC-Requirement (5V0.12A)




Project2: None EMC-Requirement (5V0.12A)

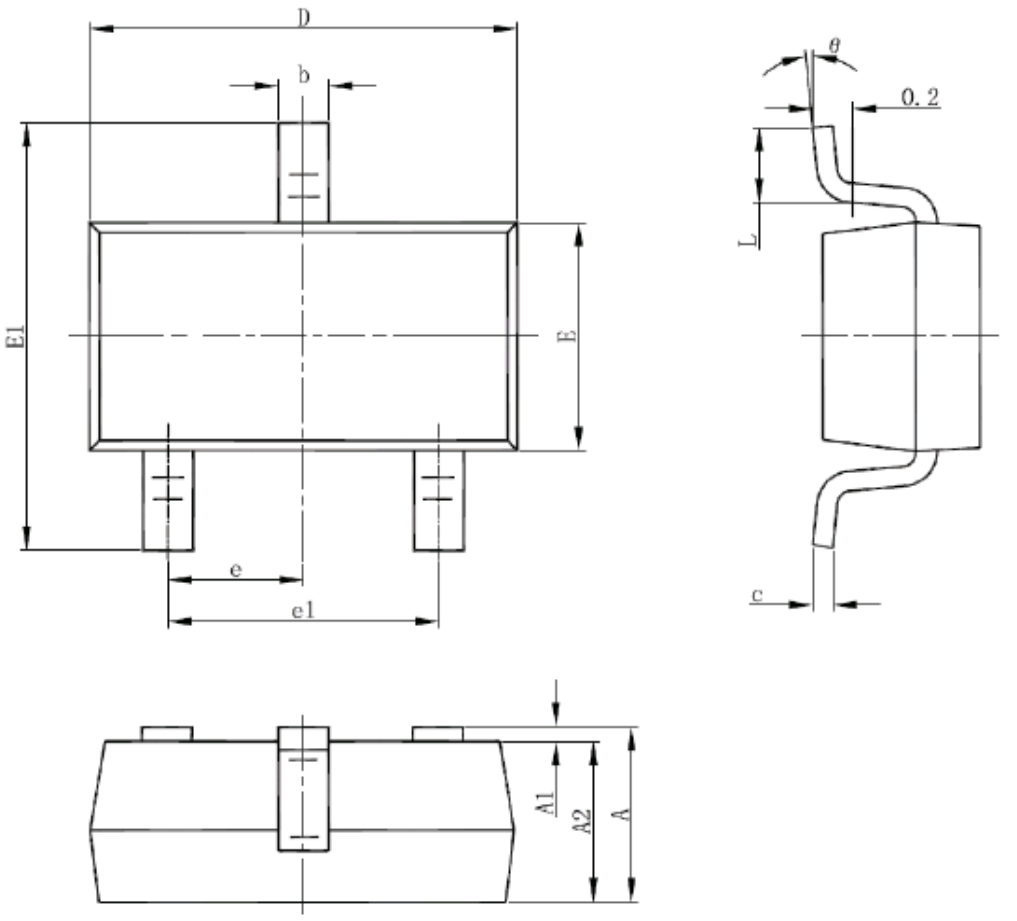


## Package Figure (TO-92)




| Symbol | Size (mm) | | Size (inch) | |
|---|---|---|---|---|
| | min | max | min | max |
| A | 3.300 | 3.700 | 0.130 | 0.146 |
| A2 | 1.100 | 1.400 | 0.043 | 0.055 |
| b | 0.380 | 0.550 | 0.015 | 0.022 |
| c | 0.360 | 0.510 | 0.014 | 0.020 |
| D | 4.400 | 4.700 | 0.173 | 0.185 |
| D1 | 3.430 | - | 0.135 | - |
| E | 4.300 | 4.700 | 0.169 | 0.185 |
| e | 2.440 | 2.640 | 0.096 | 0.104 |
| h | 0.000 | 0.380 | 0.000 | 0.015 |
| L1 | 12.50 | 14.500 | 0.492 | 0.571 |
| L3 | 2.500 | 3.500 | 0.098 | 0.138 |
| θ | - | 1.600 | - | 0.063 |

## Package Figure (SOT23-3)




| 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° |