

# 10W Off-line PWM Converters

## Product Overview

DK1203 is a secondary feedback flyback AC-DC off-line switching power supply controller IC. The IC is designed with highly integrated CMOS circuitry and has protection functions for output short circuit, secondary open circuit, over temperature, over voltage, etc. The IC has built-in high-voltage power tubes and self-powered lines, and features very few peripheral components and simple transformer design (only two windings are required for the transformer of the isolated output circuit).

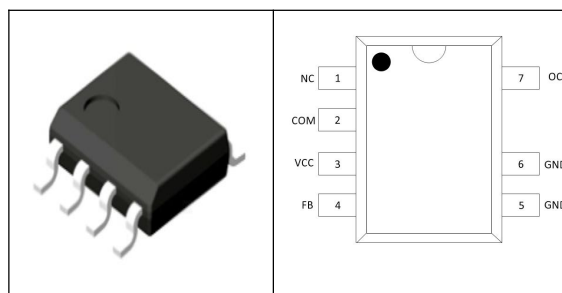
## Main Features

- Full voltage input 85V-265V
- Built-in 700V high voltage power tubes
- Built-in high-voltage constant-current starting circuit, eliminating the need for external starting resistors
- Standby power consumption less than 0.3W
- 65KHz PWM Switching Frequency
- Over temperature, over current, over voltage and output short circuit, secondary open circuit protection
- Patented self-powered technology eliminates the need for external auxiliary winding power
- Built-in frequency jittering function that automatically reduces the operating frequency when in standby, meeting European green energy standards (< 0.3W) while reducing the ripple of the output voltage
- Built-in ramp compensation circuit to ensure circuit stability at low voltage and high power output circuit stability at low voltage and high power output
- Frequency jitter reduces EMI filtering costs
- 4KV ESD test for anti-static

## Typical Applications

- LED Power Supply
- Power adapter
- Induction cookers, air conditioners, DVDs, set-top boxes and other small home appliances

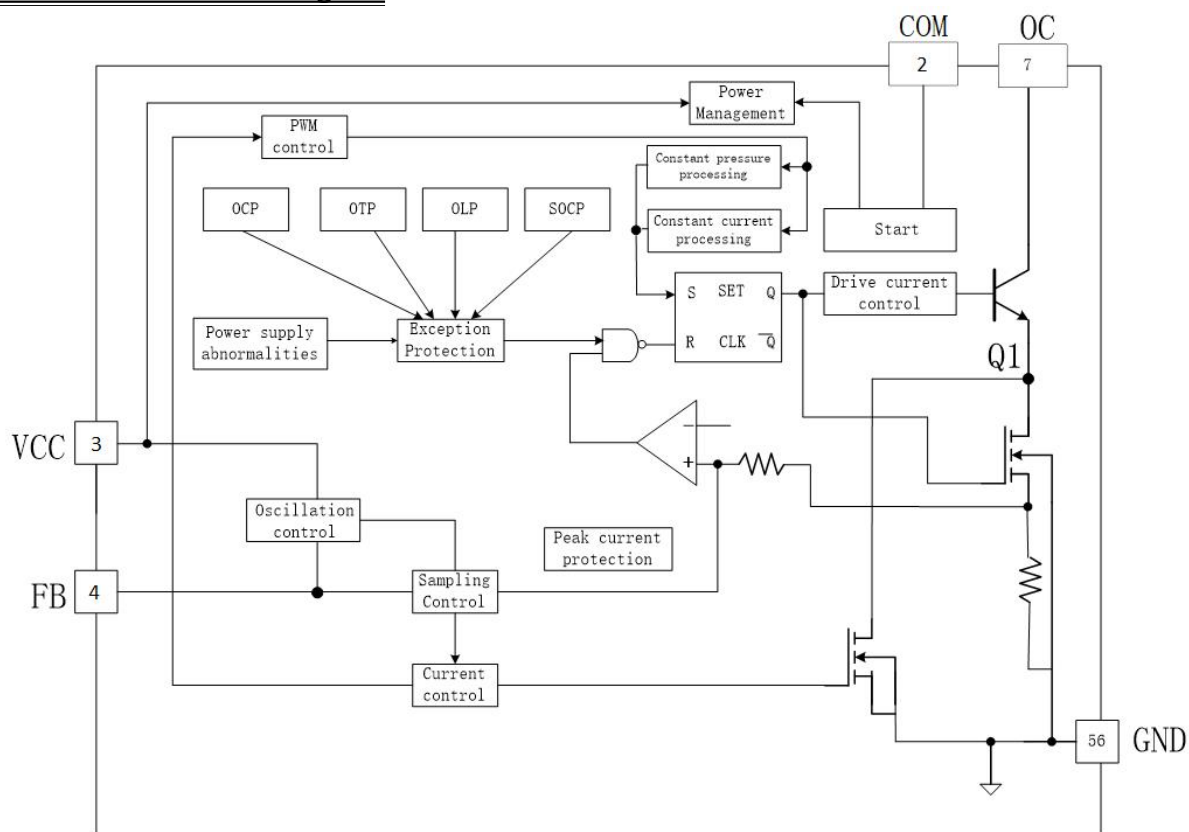
## Pins Configuration



**Pins Function**

Pin No.	Pin Name	Description
1	NC	Empty pin, no internal electrical connection
2	COM	Power on start pin, connect 2.2M resistor to high-voltage OC pin
3	VCC	Power supply pin, external 10uF to 47uF capacitor to ground
4	FB	Feedback control pin, connected to 1nF~10nF capacitor
5,6	GND	Ground
7	OC	Output pin, internally connected to high-voltage power transistor, externally connected to switch transformer

**Functional Structure Diagram**



**Absolute Maximum Ratings (TA=25°C Unless otherwise noted)**

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage VCC	U <sub>S</sub>	-0.3		8	V
Supply current VCC	I <sub>S</sub>		100		mA
Pin Voltage	U <sub>PV</sub>	-0.3		VDD+0.3	V
Power tube withstand voltage	U <sub>PP</sub>	-0.3		730	V
Peak current	I <sub>PEAK</sub>			800	mA
Total power dissipation	P <sub>TOT</sub>		600		mW
Operating temperature range	T <sub>R</sub>	-25		125	°C
Storage temperature range	T <sub>STG</sub>	-55		150	°C
Welding temperature	T <sub>W</sub>		280/5S		°C

**Electric Characteristics (TA=25°C Unless otherwise noted)**

Parameter	Conditions	Min	Typ	Max	Unit
Operating voltage section					
VCC operating voltage	AC input 85V-----265V		4.7		V
VCC start-up voltage	AC input 85V-----265V		4.9		V
VCC restart voltage	AC input 85V-----265V		3.4		V
VCC protect voltage	AC input 85V-----265V		5.8		V
VCC operating current	VCC=4.7V, FB=2.2V	10	20	30	mA
Start-up section					
High voltage starting current	AC input 265V			1.2	mA
Start-up time	AC input 85V, C=100uF			500	ms
Power section					
Power tube withstand voltage	I <sub>OC</sub> =1mA	700			V
Power tube protection voltage	L <sub>P</sub> =1.2mH		610		V
Peak current protection	VCC=4.7V FB=1.3V--3V	650	720	800	mA
Power tube maximum current	VCC=4.7V FB=1.3V--3V	600	660	700	mA
PWM output frequency	VCC=4.7V FB=1.6V--3.0V	50	65	70	KHz
	VCC=4.7V FB=1.3V--1.6V	0.5		65	KHz

Other					
Temperature protection	VCC=5V FB=1.6V--3.6V	120	125	130	°C
LEB time	VCC=4.7V		250		ns
Minimum switch on time	VCC=4.7V		500		ns
Duty Cycle	VCC=4.7V FB=1.6V--3.6V	5		75	%
Standby power consumption				270	mW

## Function Descriptions

### 1. Power on and start

The IC has a built-in high-voltage startup current source; when the VDD voltage is less than the startup voltage at power-on, the triode is turned on to charge the external VDD storage capacitor. When the VDD voltage reaches 4.9V start voltage, the start current source is turned off, the start process is finished, and the control logic starts to output PWM pulses.

### 2. Soft start

At the end of power-on start-up, in order to prevent the transformer core from saturating and over-stressing the power tubes and secondary rectifier tubes that may occur during the output voltage build-up process, the IC has a built-in 4ms soft-start circuit with a maximum primary peak current of 330mA and a clock frequency of 65K during the first 4ms. at the end of start-up, the maximum primary peak current is 660mA and the clock frequency is 65K.

### 3. PWM output

A PWM cycle consists of 3 parts:

Inductor charging stage (switching tube turn-on):  $T1=LP*IP/Vin$ ;

Inductive discharge phase (switching tube off):  $T1=LP*IP/Vvor$ ;

OC resonant phase with resonant period:  $T=2 (LP*COC)^{1/2}$ .

IC 65KHz fixed frequency output mode, turn-on time controlled by FB feedback voltage.

### 4. FB detection and feedback control

A capacitor is connected externally to the Fb pin to smooth the Fb voltage. The external capacitor affects the feedback transient characteristics of the circuit and the stable operation of the circuit, and can be selected between 1nF and 10nF for typical applications;

A maximum  $I_p$  current of 660mA when the Fb voltage pass 3.6V;

As the Fb voltage gradually decreases from 3.6V to 2.8V, the  $I_p$  current gradually decreases from a maximum current of 660mA to

$$I_P = T_1 * V_{in} / LP, \quad T_1 \text{ min} = 500\text{ns}.$$

The operating frequency is fixed at 65kHz when the Fb voltage between 3.6V to 2.8V, and decreases as the FB voltage decreases from 2.8V to 1.6V. When the Fb voltage is below 1.6V, the circuit will stop the PWM output.

## 5. Self-powered technology

The IC uses a patented self-powered technology to control the voltage of VDD at around 4.7V, providing the IC own current consumption without the need for external auxiliary windings to provide it. The self-powered circuit can only provide the IC current consumption and cannot provide power to the external circuit.

## 6. Over-temperature protection

Any time the IC temperature is detected to exceed  $125^{\circ}\text{C}$ , the over-temperature protection is immediately activated, the output pulse is stopped, the power tube is turned off and the abnormal protection mode is entered.

## 7. Primary short circuit protection

When the current in the primary coil of the external transformer is too high, if the current in the primary coil reaches 660mA at 500ns after the soft start, the chip immediately turns off the power tube and enters abnormal protection mode.

## 8. Power abnormalities

When the VCC voltage falls below 3.4V due to an external abnormality, the IC will turn off the power tube for restart.

When the VCC voltage is higher than 5.8V due to external abnormality, the VCC overvoltage protection is immediately activated, stopping the output pulse and entering the abnormal protection mode.

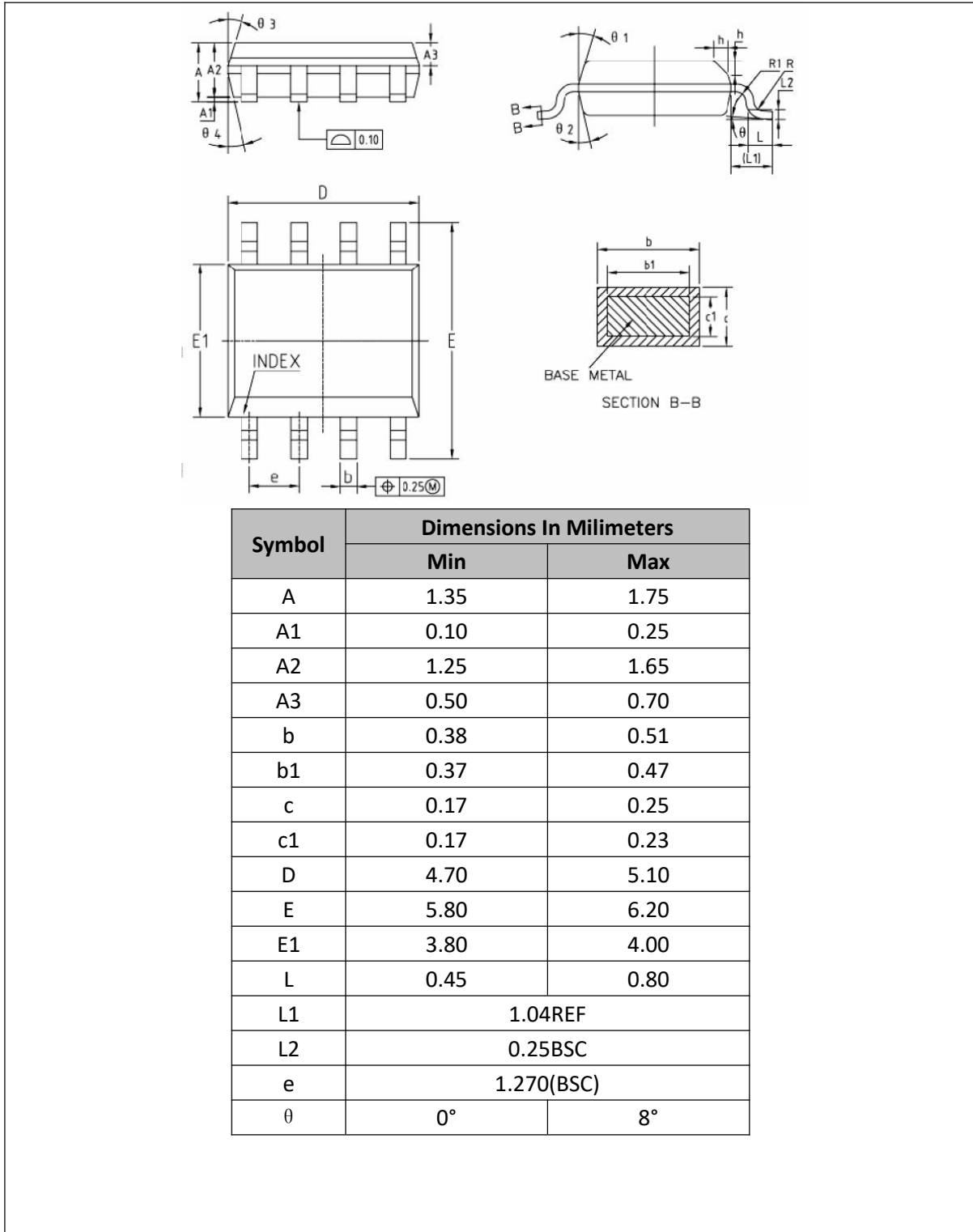
## 9. Short circuit and overload protection

When the secondary output is short circuited or overloaded, the FB voltage will be higher than 3V; In some applications, due to the high starting current required by inductive loads such as motors during startup, the circuit may experience short-term overload. Therefore, the judgment time for the first

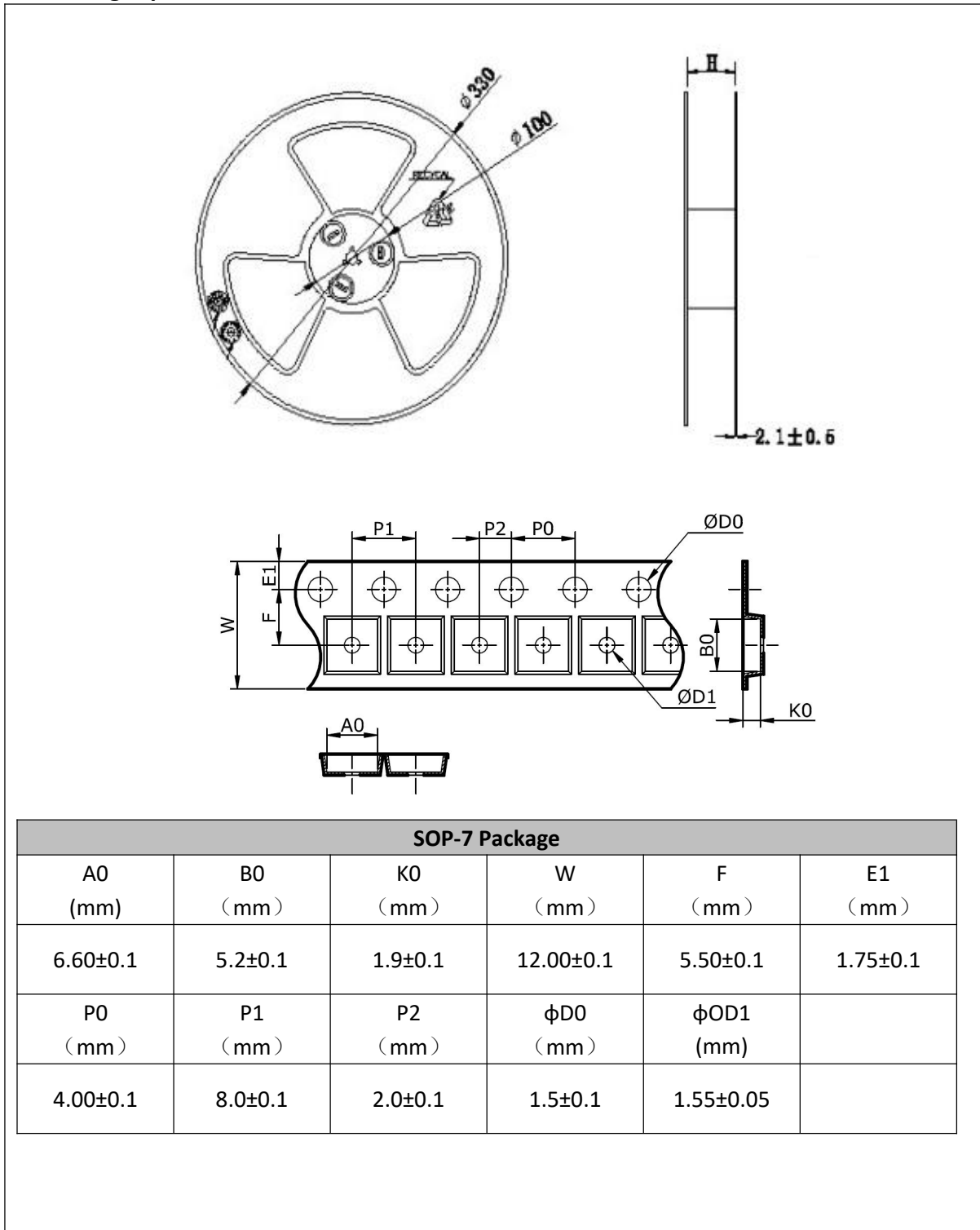


**Package shape and size diagram**

**1. SOP-7**



**2. Package specification**





**Caution: This product is a static sensitive component, please pay a attention to protect! The scope of ESD damage can be extended from minor performance to equipment failure. Precision IC may be damaged, which may result in component parameters not meeting the published specifications.**

- Thanks for using our products. We recommend that you read the specifications carefully before using.
- Dongke Semiconductor Co., Ltd reserves the right of change specifications without prior notice.
- Dongke Semiconductor Co., Ltd assumes no liability for any use of its products for special purposes.
- Dongke Semiconductor Co., Ltd has no obligation to support the use and application of products for special purposes.
- Dongke Semiconductor Co., Ltd will not transfer its patents and any other relevant licensing rights.
- Any semiconductor product may fail or break down under certain conditions. The buyer is responsible to abide by safety standards and take safety measures when designing and manufacturing applications using products of Dongke Semiconductor Co., Ltd to avoid potential failure risk which may cause personal injury or property loss.