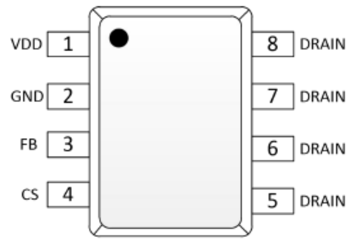
Features

- Wide Voltage Input 85-265V_{AC}
- Switching frequency 65KHz
- Built-in 650V MOSFET
- Soft start
- Frequency-hopping mode
- Built-in slope compensation
- Low standby consumption <75mW@230V_{AC}
- Rich protection: OLP,OCP,OTP,UVLO
- Power capability ≤30W


DIP-8



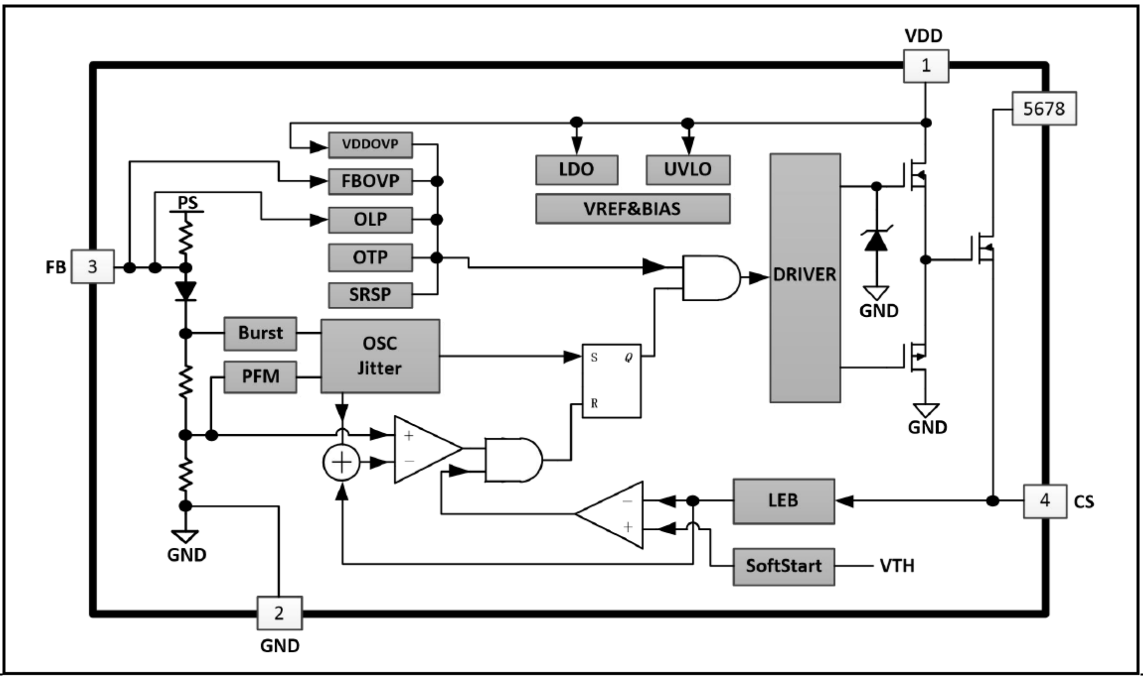
Description

A202ADM is a high-performance, low-power PWM control chip with a built-in 650V high-voltage power MOSFET, suitable for power solutions up to 30W. In PWM mode, the switching frequency of the chip is fixed, which is set internally by the chip. Under no-load or light load, the chip operates in green mode to reduce switch losses and improve the overall efficiency of the machine. The frequency hopping rate of A202ADM is set at 25KHz, which can effectively avoid audio noise during operation. The integrated totem pole drive structure inside the chip can effectively improve the EMI characteristics of the system, Soft start control with switch.

Table 1. PIN FUNCTION

PIN	Symbol	Description
1	V_{DD}	Supply Voltage
2	GND	Ground
3	FB	Feedback Input
4	CS	Current Sense
5,6,7,8	DRAIN	MOSFET Drain

Functional Block Diagram



Absolute Maximum Ratings

Table 2.

Symbol	Minimum	Typical	Maximum	Unit
$V_{Drain\text{-}max}$		650	700	V
V_{DD}			40	V
I_{DD}			10	mA
V_{FB}	-0.3		8	V
V_{CS}	-0.3		8	V
T_R	-25		125	°C
T_{STG}	-45		155	°C
T_J		150		°C
T_W		280/5s		°C

Table 3. Electrical characteristics

Symbol	Description	Condition	Value			Unit
			Min.	Typ.	Max.	
V_{DD}	Supply voltage	AC Input: 85V-265V	9.5	17	36.5	V
I_{DD_ST}	Startup current	V_{DD}=11V		1.5	2	uA
I_{OP}	Operating supply current	V_{DD}=17V, V_{FB}=3V, V_{CS}=0V		0.83		mA
$V_{uvlo(ON)}$		VDD drops to IC OFF	7.5	8.1	8.7	V
$V_{uvlo\ (OFF)}$		VDD rises to IC ON	16.3	18.1	19.9	V
V_{DD_ET}	Frequency-hopping protection voltage	FB=0V，CS=0V	7.7	8.5	9.1	V
V_{OVP}	V_{cc} OVP	V_{DD}=17V, V_{CS} =0V, V_{FB} =3V	37	40	43	V
V_{FB_OPEN}	FB Open-loop voltage		6.4	7.1	7.7	V
V_{TH_PL}	overloaded, FB voltage	V_{DD}=17V, FB rises till to frequency of DRAIN disappears	4.5	5	5.5	V
V_{TH_GREEN}	Green mode	V_{DD}=17V, V_{CS}=0V, V_{FB}=3V, FB drops till to frequency of DRAIN is less than 35KHz		2.2		V
V_{TH_BM}	Frequency-hopping Mode	V_{DD}=17V, FB drops		1.2		V
T_{LEB}	Leading edge blanking time			400		ns
T_{stop}	MOSFET shut off dwell time when abnormal	V_{DD}=17V, output diode is shorted	1.8	2	2.2	s
Z_{CS_IN}	Input impedance of CS			40		KΩ
V_{cs_opph}	Overcurrent protection threshold of CS at 85VAC and maximum output power	V_{DD}=17V, V_{FB}=4.2V, CS rises till to MOSFET shut off	690	720	750	mV
V_{cs_oppL}	Overcurrent protection threshold of CS at 265VAC and maximum output power	V_{DD}=17V, V_{FB}=3.6V, CS rises till to MOSFET shut off	540	560	580	mV
V_{cs_max}	Over-current protection threshold of CS when overload	V_{DD}=17V, V_{FB}=6V, CS rises till to MOSFET shut off	770	800	830	mV
T_{D_OC}	Overcurrent protection delay time	Overcurrent protection to MOSFET turn-off delay time		120		ns

F_{OSC}	Oscillation Frequency	V_{DD}=17V, V_{FB}=3V, V_{CS}=0V	60	65	70	KHz
F_{OSC}	Green Mode Frequency	V_{DD}=17V, V_{FB}=1.4V, V_{CS}=0V	23	25	27	KHz
D_{MAX}	Maximum Duty Cycle	V_{DD}=17V, V_{FB}=3.3V, V_{CS}=0V		75		%
F_{BURST}	Frequency of frequency-hopping			25		KHz
ΔF_{OSC}	Frequency Jitter Range		-5		5	%
$R_{DS(ON)}$	Drain to Source On-state Resistance		1.2	1.3	1.4	Ω
T_{OTP}	Maximum protection temperature			150		℃

Description

The A202ADM is a high-performance, low-consumption switching power supply control chip suitable for power supply solutions within 30W. It has built-in functions such as frequency-hopping and frequency dithering function, which can effectively reduce standby power consumption, improve the EMI performance of the system, and meet the EU's sixth-level energy efficiency standard.

1. Startup

The A202ADM has an extremely low startup current and built-in high-voltage startup circuit. For different AC/DC solutions, choose a suitable V_{DD} capacitor, it can achieve a quick startup within wide voltage range 85-265VAC. The typical value of the operating current of A202ADM is around 0.83mA, and under the unique frequency - hopping control mode, the efficiency can be improved.

2. Soft Startup

The A202ADM has a built-in 2ms soft-start circuit, which can buffer the switching stress of MOSFET when the circuit startup. Once the V_{DD} voltage reaches $U_{VLO(OFF)}$, the soft start will be activated, and the current-limiting voltage gradually increases from 0 to 0.8V. Each restart is followed by a soft start.

3. Frequency Dithering

The A202ADM has a built-in frequency dithering function, which can effectively improve the EMI characteristics of the system and simplify the circuit design.

4. Frequency Hopping

When the system is in no-load or light-load conditions, most of the system losses are composed of the switching losses of MOSFET, the core losses of transformer, and the losses of buffer network. Among them, the largest loss comes from the switching losses. Therefore, reducing the switching frequency of the system can effectively reduce the losses.

When the system is operating normally, the frequency is regulated by the loop and the IC. When the system is in no-load or light-load conditions, the switching frequency will decrease to improve efficiency. When the voltage of FB drops below 1.2V, IC will enter the frequency-hopping mode. Under frequency-hopping mode, the gate drive of IC only works when the V_{DD} voltage is lower than the preset-level or the FB voltage is higher than 1.2V. Otherwise, the gate drive circuit remains off to reduce switching losses and standby consumption. The frequency of frequency-hopping is set outside audio range to ensure no audio noise during normal operation.

5. Oscillation Frequency

The maximum switching frequency of A202ADM is 65KHz, and no external circuit is required for setting.

6. Current Sampling and Leading - Edge Blanking

The A202ADM uses current-mode PWM and PFM control methods, providing cycle-by-cycle current limiting protection. The MOSFET current is detected by a sampling resistor connected to CS PIN. When the MOSFET is just turned on, the reverse recovery current of the diode in the buffer network and the discharge current of MOSFET's drain-source capacitance can cause a very high voltage spike on the sampling resistor, leading to misjudgment by the chip. However, the A202ADM has a 400ns leading-edge blanking time set on CS pin.

This leading-edge blanking time can shield the influence of this spike on the chip, so there is no need for an external RC filter network at the CS pin. During the leading-edge blanking time, the current-limiting comparator does not work and cannot turn off MOSFET. The duty cycle is jointly determined by the voltage on the sampling resistor and the voltage on FB.

7. Slope Compensation

The A202ADM provides slope compensation, superimposing a voltage sawtooth signal on the sampled current signal. When the chip operates in CCM mode, especially when the duty cycle is greater than 50%, it avoids sub-harmonic oscillations in the loop.

8. MOSFET Drive

The A202ADM uses a unique drive technology. If the drive capability is too weak, it will result in high switching losses; if the drive is too strong, EMI problems are likely to occur. The A202ADM uses an optimized totem-pole structure. Through reasonable output drive capability and dead-time, it achieves better EMI characteristics and lower losses.

9. Protection Functions

The A202ADM has comprehensive protection functions, including cycle-by-cycle current limiting protection (OCP), overload protection (OLP), over-temperature protection (OTP), V_{DD} over-voltage protection, under-voltage protection (UVLO), and output Schottky abnormal protection.

The A202ADM has a built-in line-voltage compensation function for the current-limiting point, which can ensure that the current-limiting point remains constant within the full operating voltage range 85-265VAC of circuit, thus ensuring constant power output.

When an overload or short-circuit occurs, the FB voltage will exceed $\mathbf{V_{TH\_PL}}$. When the V_{DD} is lower than $\mathbf{V_{uvlo(ON)}}$, the chip's overload protection circuit starts to work. The chip turns off MOSFET. After a delay of T_{stop}, it enters the V_{DD} restart, after the restart is completed, the circuit can resume normal operation.

After the circuit starts, the auxiliary winding of transformer provides energy to the V_{DD} capacitor. When the VDD voltage exceeds V_{ovp}, the over-voltage protection circuit works. The chip turns off MOFET. After a delay of T_{stop}, it enters the V_{DD} restart. After the restart is completed, the circuit can resume normal operation.

When the FB voltage is lower than $\mathbf{V_{TH\_PL}}$ and the V_{DD} voltage drops below U_{VLO}, the under-voltage lockout (U_{VLO}) circuit of chip turns off the chip. After the V_{DD} restart is completed, the circuit can resume normal operation.

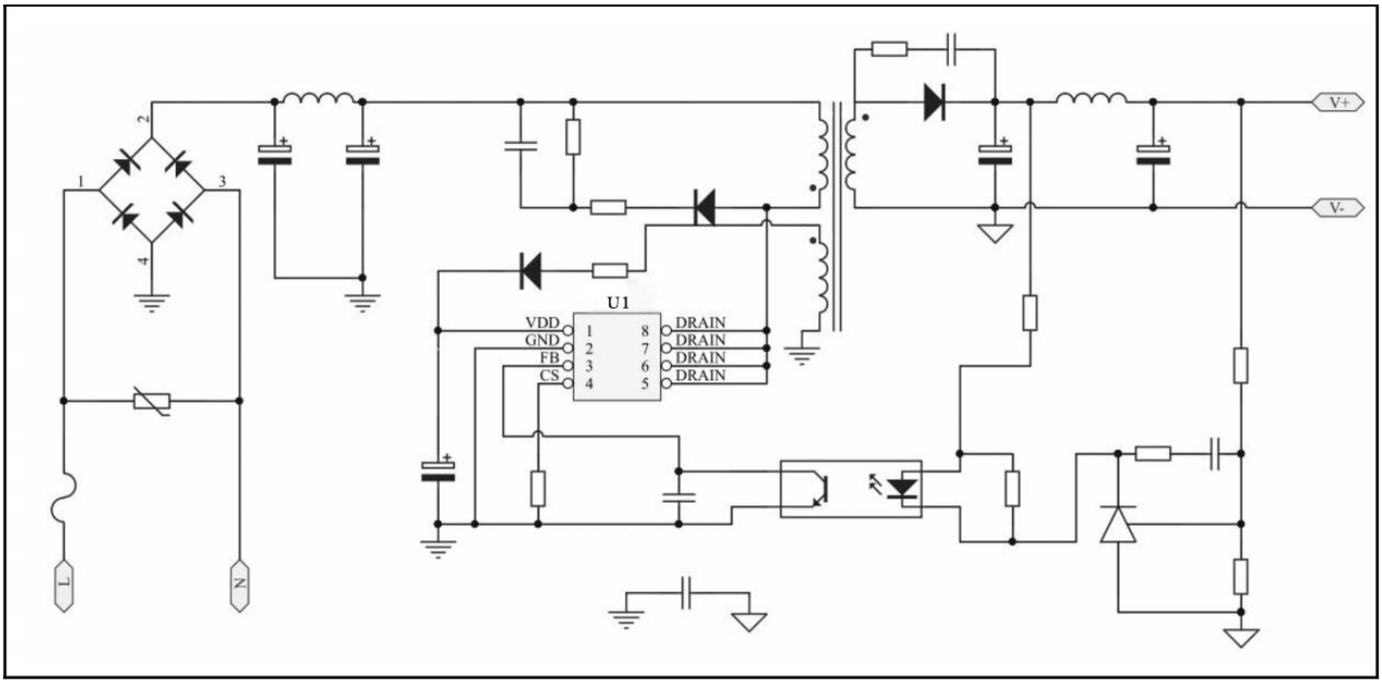
10. Design Key Points

Power devices need heat dissipation. The main heat of chip comes from MOSFET, which is connected to the DRAIN pin. Therefore, when doing PCB layout, the area of the copper foil externally connected to the DRAIN pin should be increased and tin-plated to enhance the heat dissipation capacity. Keep an appropriate distance from heat-generating components such as transformers to reduce the thermal effect. At the same time, this part is also the AC signal part. When doing EMI/EMC design, this position should be kept as far away from the input part as possible to minimize electromagnetic/capacitive coupling.

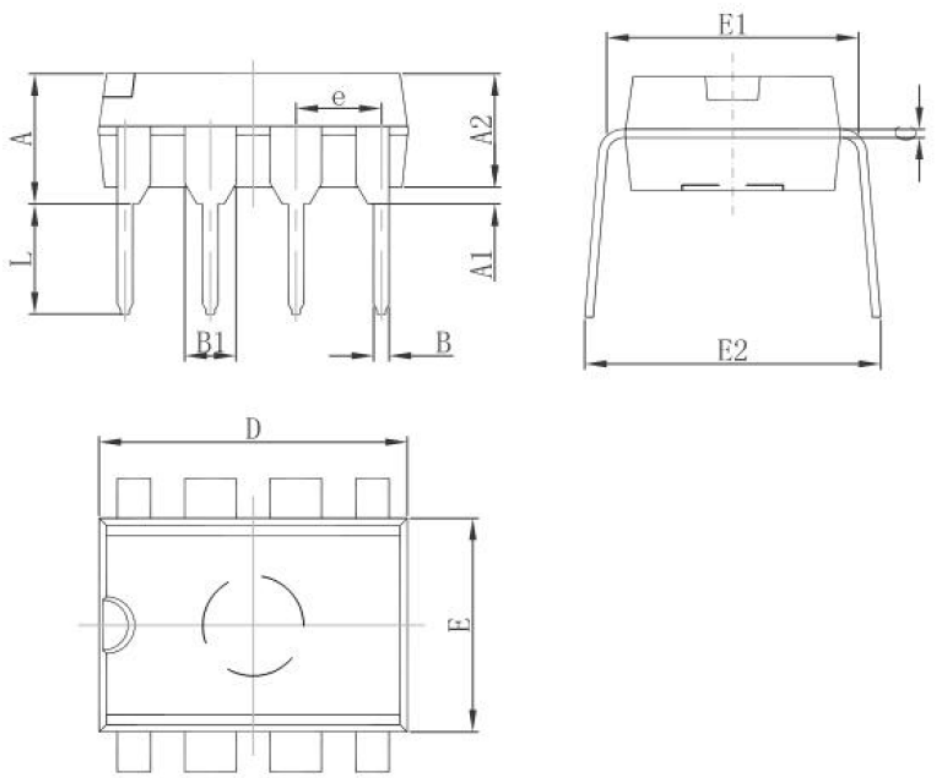
The DRAIN pin of chip is the high-voltage part of chip, with a maximum voltage of over 650V. Therefore, in the circuit layout, a safety distance of 1.5mm or more should be maintained from the low-voltage part to avoid the breakdown and discharge phenomenon in the circuit.

Leakage inductance of the transformer: Since the transformer is not an ideal device, there must be leakage inductance during the manufacturing process. Leakage inductance will affect the quality and safety of the product, so it should be reduced. The leakage inductance should be controlled within 5% of the inductance. The sandwich winding method can reduce the leakage inductance.

11. Typical Application Circuit Diagram

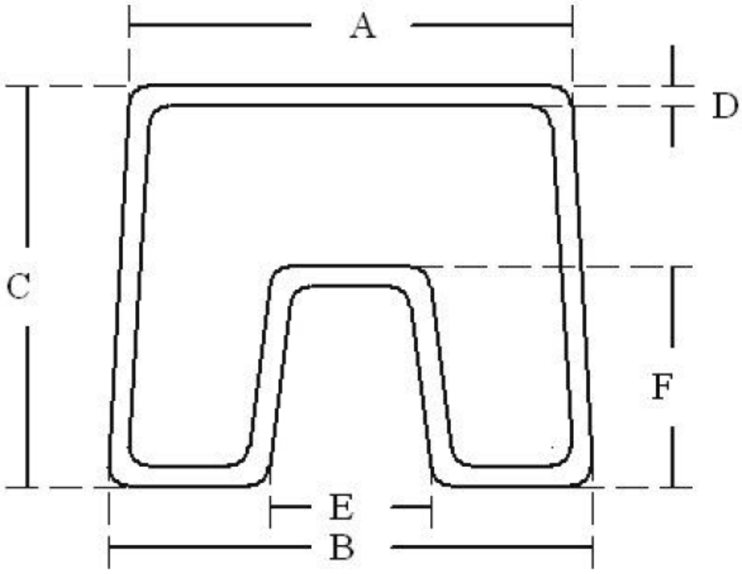


12. DIP-8 PACKAGE OUTLINE DIMENSIONS



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	9.200	0.331	0.354

13. Tube Package



Symbol	Dimensions In Milimeters		
	Min	Rated Value	Max
A	11.00	11.50	12.00
B	11.50	12.00	12.50
C	10.00	10.50	11.00
D	0.40	0.50	0.60
E	3.50	4.00	4.50
F	5.00	5.50	5.10

QTY/tube	QTY/inner carton	QTY/master carton
50	2000	20000

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