SPECIFICATION

1. DESCRIPTION

The DK2649PA is a secondary side flyback type PWM (Pulse Width Modulation) Mode Power Controlling IC with high performance and low standby power. With integrated 650V high voltage MOSFET, it is suitable for applications of power supply within 15W output. Under no-load or light load, it works in green mode to reduce the switching loss and improve the working efficiency. The hopping frequency of is set at 25kHz, which can effectively avoid audio noise during operation. The integrated totem-pole driving structure in the chip can effectively improve the EMI characteristics of the application and the soft start control of the switch.

2. APPLICATIONS

· Mobile phone charger, PD charger
· PDA/ Digital camera/DV power adapter
· DVB power supply
· Open frame power supply
· PC Auxiliary Power Supply

3. MAIN FEATURES

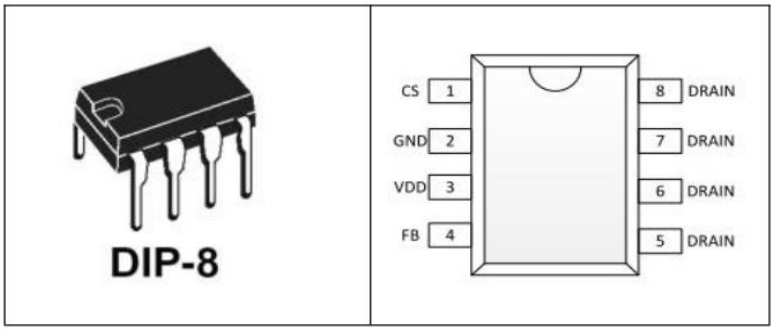
· 85V—265V wide range AC power input.
· Build-in 650V MOSFET.
· Soft start technology
· 4 KV Anti-Static ESD test.
· Frequency jittering function, improve EMC characteristic.
· Built-in Leading Edge Blanking (LEB) function
· Frequency hopping mode, improve light load efficiency and reduce standby power consumption
· Standby power <75mW @230VAC input.
· Internal Ramp Compensation circuit to keep the stability of the circuit in low voltage and high power output condition
· Over current, Over loading, Over temperature, Over voltage, secondary side open circuit and output short circuit Protection.

4. POWER RANGE

Model Number	DK2649PA/DIP-8
Input Voltage	85-265V AC
MAX. output power	15W

Remark: Tested in enclosed environment @45℃.

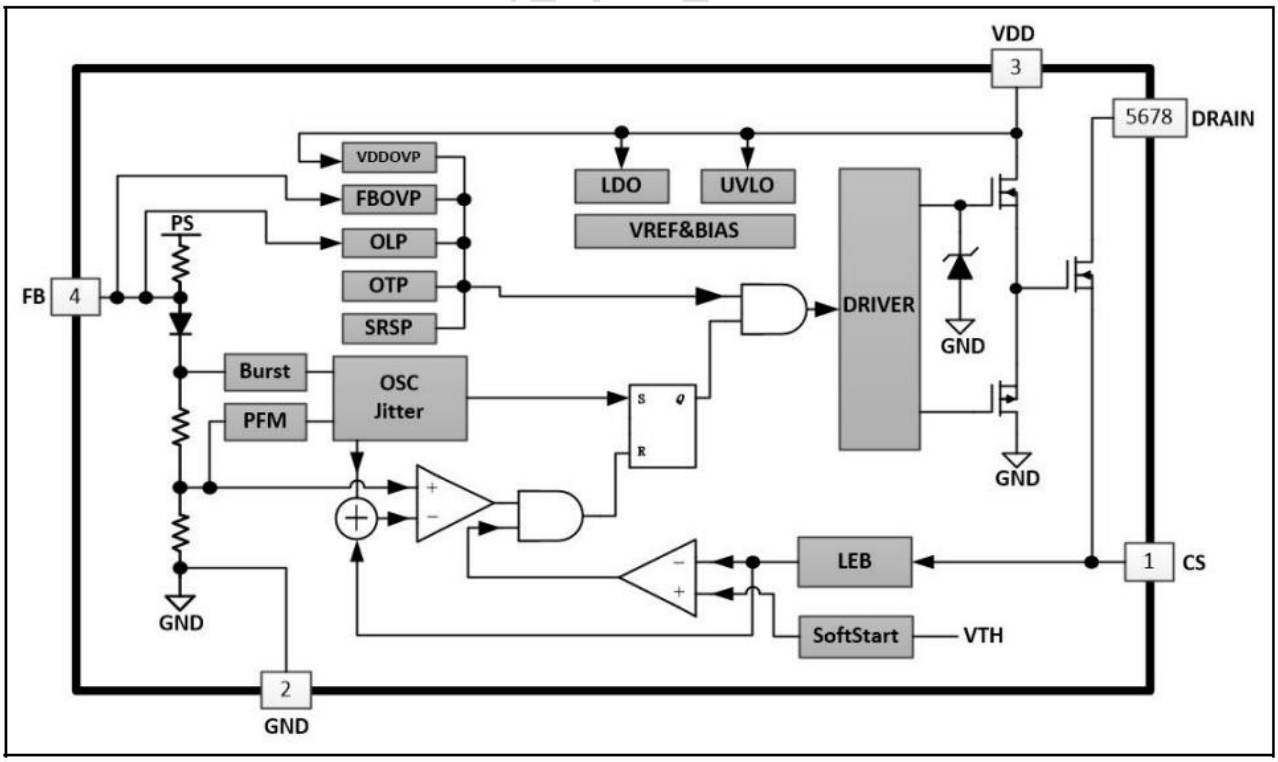
5. CONNECTION DIAGRAM



PIN FUNCTION

Pin No.	Pin Name	Function
1	CS	Current detecting pin
2	GND	Ground reference
3	VDD	Power supply pin
4	FB	Feedback control pin
5, 6, 7, 8	OC	Open drain pin of internal MOSFET

6. Functional Structure Diagram



7. Absolute Maximum Rating

Parameter	Symbol	Min	Typ	Max	Unit
Drain voltage of MOSFET	V_{DRAIN_MAX}			650	V
VDD Supply Voltage	V_{DD}			40	V
Supply Current	I_{DD}			10	mA
FB Input voltage	V_{FB}	-0.3		7	V
CS Input voltage	V_{CS}	-0.3		7	V
Junction Temperature	T_J		150		℃
Storage Temperature Range	T_{STG}	-55		155	℃
Soldering Temperature	T_W		280/5S		℃

8. Electrical Characteristics（T_A = 25℃）

Parameter	Testing Condition	Min	Typ	Max	Unit
VDD (Working Voltage)	AC INPUT 85V-----265V	9	17	34	V
IDD_ST (Star-up current)	VDD=11V, test VDD current		5	20	uA
IOP (Working current)	VDD=17V, VFB=3V, VCS=0V		0.83		mA
Vuvlo (ON) Under voltage protection		7.0	7.7	8.4	V
Vuvlo (OFF) Under voltage protection		6.5	6.9	9	V
V_{DD_ET} Hopping frequency protection	FB=0V, CS=0V	7.2	8.2	8.7	V
V_{OVP} Over voltage protection	VDD=17V, VFB=3V, VCS=0V	35	35.7	38	V
V_{FB_OPEN} Open-Loop Voltage		4.8	5.55	6.2	V
I_{FB_SHORT} FB short circuit current	VDD=17V		0.24		mA
V_{TH_GREEN} Green mode	VDD=17V, VCS=0V,VFB=3V, FB decreasing, frequency at Drain less than 35KHZ		2.2		V
V_{TH_BM} Frequency hopping mode	VDD=17V, FB decreasing		1.6		V
T_{LEB} Leading Edge Blanking			270		ns
Z_{CX_IN} CS pin input resistance			40		kΩ
V_{TH_OC} CS pin over current threshold	VDD=17V, VFB=3V, CS increase until MOSFET cuts off		0.7		V
T_{D_OC} OCP delay	Delay time between OCP till MOSFET cut off		120		ns
T_{osc} Jittering frequency	VDD=17V, V_{FB}=3V, V_{CS}=0V	60	65	70	KHz
D_{MAX} Duty Cycle Ratio	VDD=17V, V_{FB}=3.3V, V_{CS}=0V	65	70	85	%
F_{BRUST} Hopping Frequency			25		KHz
ΔF_{OSC} Jittering frequency range		-4		4	%
$R_{DS(ON)}$ Conduction Resistance			4	4.5	Ω
T_{OTP} Temperature protection			150		℃

9. OPERATION PRINCIPLE

9.1 Start Up

With its internal high voltage and low current driving circuit, for most of the AC/DC application, DK2649PA can achieve rapid start up with a 2MΩ, 1/8W start up resistor and suitable VDD capacitor, so that to decrease power consumption. The typical working current of DK2649PA is about 0.83mA, and the overall efficiency can be improved under the unique frequency hopping control mode.

9.2 Soft Start

With its built-in 4mS soft start circuit, DK2649PA can buffer the switching stress on MOSFET when the circuit is started. Once the VDD voltage reaches At UVLO (OFF), the soft start circuit will be activated, the peak current limiting voltage will gradually reach 0.7 V from 0V. And this soft start would happen with each restart process.

9.3 Frequency Jittering

With its internal frequency jittering function, DK2649PA improves EMC characteristic and simplifies circuit design.

9.4 Frequency hopping mode

Most of the losses of the system under no-load or light load are caused by the switching loss of MOSFET, the core loss of transformer and buffer loss of the network. The biggest loss comes from switching loss, so reducing the switching frequency of the system can effectively reduce the loss.

When the system works normally, the frequency is adjusted by the loop and IC. Under no-load or light load, the switching frequency will be reduced to improve the efficiency. When the voltage of FB drops below 1.6V, the IC will enter the frequency hopping mode. In frequency hopping mode, only when VDD is lower than the preset level or the FB voltage is higher than 1.6V, the gate drive of the IC works, otherwise the gate drive circuit remains off to reduces switching loss and standby power consumption. The frequency of frequency hopping mode is set outside the audio range to ensure no audio noise during normal operation.

9.5 Circuit sampling and LEB

DK2649PA adopts current mode PWM and variable frequency PFM control mode to provide cycle by cycle current limiting protection. The power transistor current is connected by sampling resistance detection on CS pin. When the internal power transistor is just opened, the reverse recovery current of the diode in the buffer network and the discharge current of the leakage source capacitance of the power transistor will cause a high voltage spike on the sampling resistor, resulting in misjudgment of the IC. However, the DK2649PA has a leading edge blanking time of 270ns on the CS pin, which can shield the impact of this spike on the chip. Therefore, there is no RC filter network outside the CS pin. During the leading edge blanking, the current limiting comparator does not work and the power transistor cannot be closed. The PWM duty cycle of the IC is determined by both of the voltage on the sampling resistor and the voltage on FB.

9.6 Slope Compensation

With its slope compensation circuit, DK2649PA superimposes the voltage sawtooth signal on the sampled current signal. When the IC works in CCM mode, especially when the duty cycle is greater than 50%, the sub harmonic oscillation of the loop is avoided.

9.7 MOSFET Driving

Too weak driving capacity will lead to high switching loss, and too strong driving is prone to EMI problems. DK2649PA adopts unique driving technology with optimized totem-pole structure. Through reasonable output driving capacity and dead time, better EMI characteristics and low loss are obtained.

9.8 Protections

DK2649PA has perfect protection functions, including cycle by cycle current limiting protection (OCP), overload protection (OLP), over temperature protection (OTP), VDD over-voltage protection, under voltage protection (UVLO) and output Schottky anomaly protection.

DK2649PA has built-in current limiting point line voltage compensation function, which can ensure that the current limiting point of the circuit is constant within the full working voltage range (85vac-265vac), so that the power is constant.

When overload or short circuit occurs, FB voltage will exceed V_{TH_PL} (overload protection FB threshold). If fb voltage keeps above V_{TH_PL} over the time of T_{D_PL}, the overload protection circuit of the chip starts to work. The chip turns off the power transistor until the next time restart process.

When the circuit is started, the auxiliary winding of the transformer provides energy to the VDD capacitor. When the VDD voltage exceeds Vovp, the overvoltage protection circuit works, the chip turns off the power transistor, the circuit can resume normal operation after entering VDD restart.

When the VDD voltage drops below Vuvlo, the under voltage protection (U_{VLO}) circuit of the chip works. The chip turns off the power transistor, the IC enters VDD restart process.

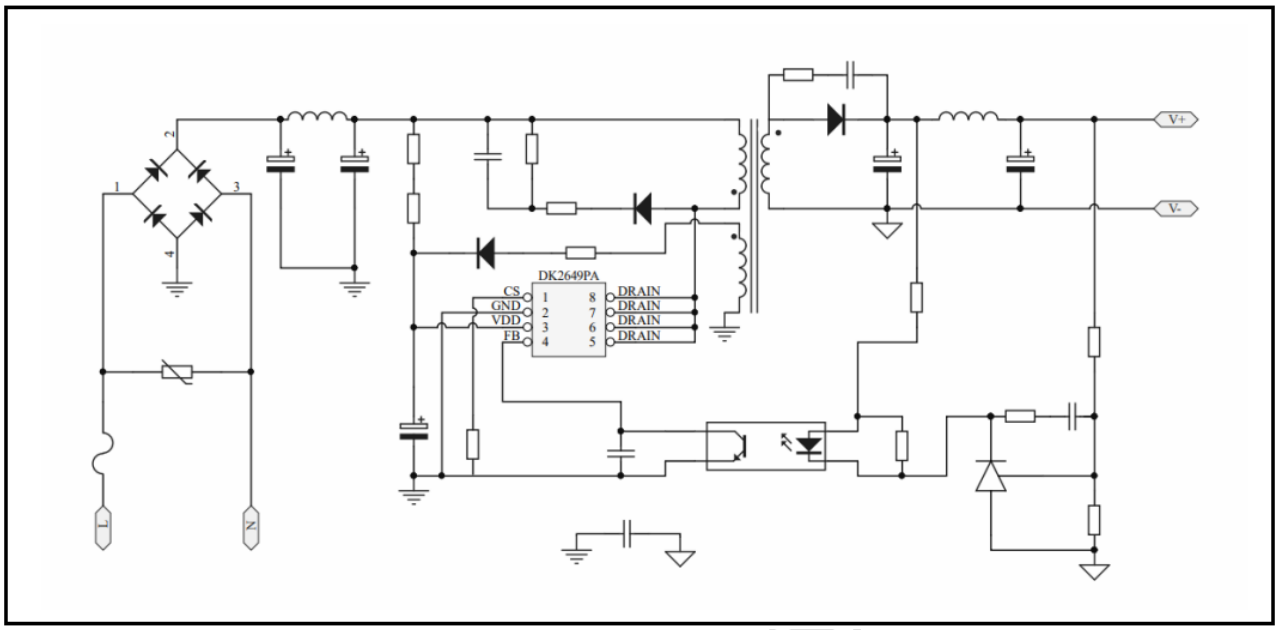
10. SPECIAL NOTICE FOR PBC LAYOUT DESIGN

10.1 Heating of IC mainly comes from transistor, which is connected with DRAIN pin. So enlarge the copper area around the DRAIN pin and tin-plating requirement are necessary in PCB design for heat releasing. Keep it in certain distance away from heating components such as transformer.

10.2 DRAIN pin is the high voltage part of the IC, peak voltage is as high as 650V, so it should be at least 1.5mm far away from the low voltage part in the PCB, so that to avoid circuit breakdown and discharging.

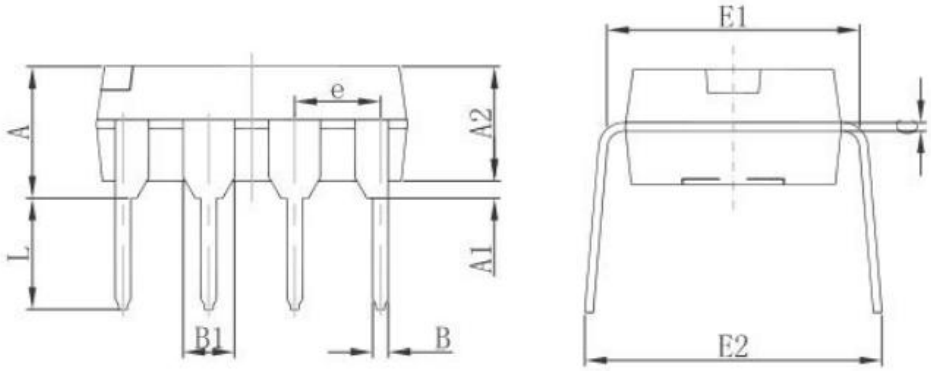
10.3 As there is inductance leakage in transformer, it is suggested to use P/S/P way to wind the transformer so that to reduce the leakage inductance.

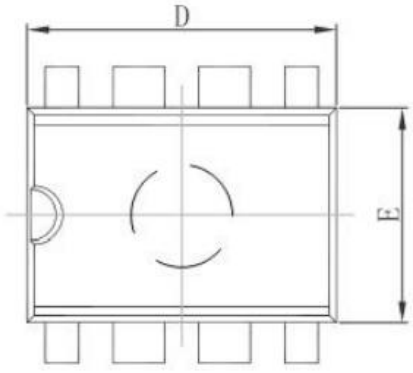
11. TYPICAL APPLICATION SCHEMATIC



12. MECHANICAL AND PACKING INFORMATION

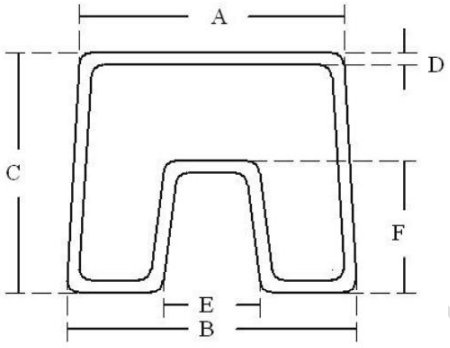
DIP-8 Package:





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

Packing in Tube:



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

Packing quantity

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

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.

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