

Integrated CV offline current mode PWM power management IC

FEATURES

- Supports discontinue mode, continue mode operation
- Integrated 650V MOSFET
- $\pm 1\%$ constant voltage accuracy
- Meet COC V5 energy efficiency, standby power consumption $< 75\text{mW}$
- Fixed 65KHz switching frequency
- Ultra-wide VDD operating voltage range (9V~70V)
- **Green Mode and Burst Mode Control**
- Ultra-low start-up and operating current
- **Built-in Frequency Shuffling to Reduce EMI**
- Integrated internal ramp compensation for current mode control
- Integrated auto-recovery mode protection:
 - VDD undervoltage & overvoltage protection (UVLO & OVP)
 - Secondary diode short protection (SDSP)
 - Built-in chip over-temperature protection (OTP)
 - Cycle-by-cycle current limit (OCP)
 - Overload protection (OLP)
 - Leading Edge Blanking (LEB)
 - Power-on soft start function (Soft Start)

TYPICAL APPLICATIONS

- chargers and adapters
- Motor Drive Power Supplies

GENERAL DESCRIPTION

The DP222X is a high-performance PWM controller designed for offline flyback power supplies. The chip uses current mode control and can support discontinue and continue mode operation for isolated power supply applications with constant voltage output.

The DP222X has an internal high-precision 65KHz switching frequency oscillator with dither function to optimize EMI performance. The chip works in green mode and burst mode, and the standby power consumption is less than 75mW, meeting the requirement of COC V5 energy efficiency.

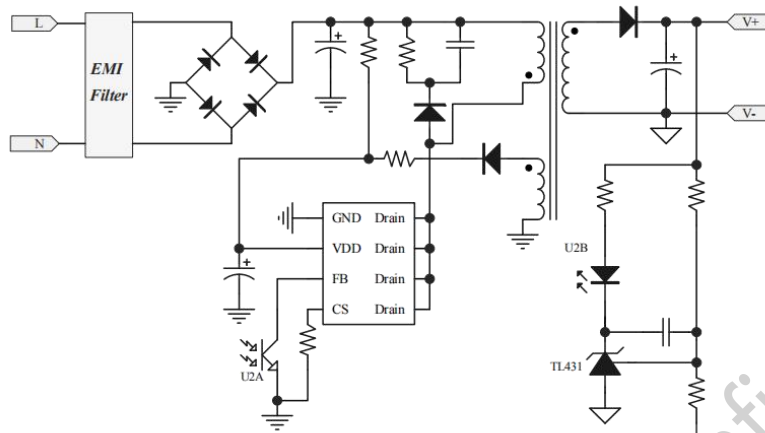
The DP222X is equipped with complete protection functions, including: VDD under voltage protection (UVLO), VDD overvoltage protection (OVP), cycle-by-cycle current limit (OCP), short-circuit protection (SCP), overload protection (OLP), output rectifier short-circuit protection (SDSP), internal chip over temperature protection (On-Chip OTP), soft start, VDD clamping, etc.

ACKAGING INFORMATION

Package	Description
SOP8	Halogen free, braided tape reel,4000pcs/reel

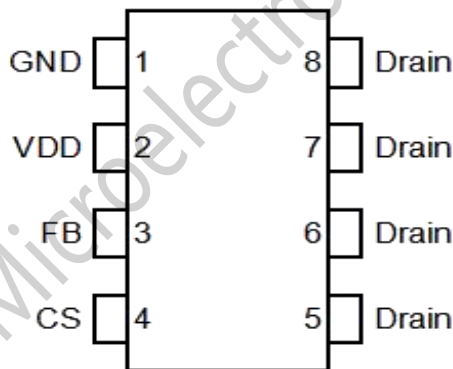


TYPICAL APPLICATION SCHEMATIC



PRODUCT DESCRIPTION

➤ PIN CONFIGURATION



➤ PIN FUNCTION DESCRIPTION

symbol	Name	Description
1	GND	IC ground pin
2	VDD	IC Power supply pin
3	FB	System feedback pin. The loop regulation is achieved by connecting a photo-coupler to this pin. PWM duty cycle is determined by this pin voltage and the current sense signal at Pin 4
4	CS	Current Sense Input Pin
5,6,7,8	Drain	Drain of built-in high-voltage power MOS



➤ **TYPICAL OUTPUT POWER TABLE⁽¹⁾**

Type	230VAC ± 15% ⁽²⁾	85-265VAC
	Adapter ⁽³⁾	Adapter ⁽³⁾
DP2221	/	15W
DP2222	/	18W
DP2223	/	20W
DP2224	/	25W
DP2225	/	30W

➤ **PRODUCT MARK**



DP222X for product name:

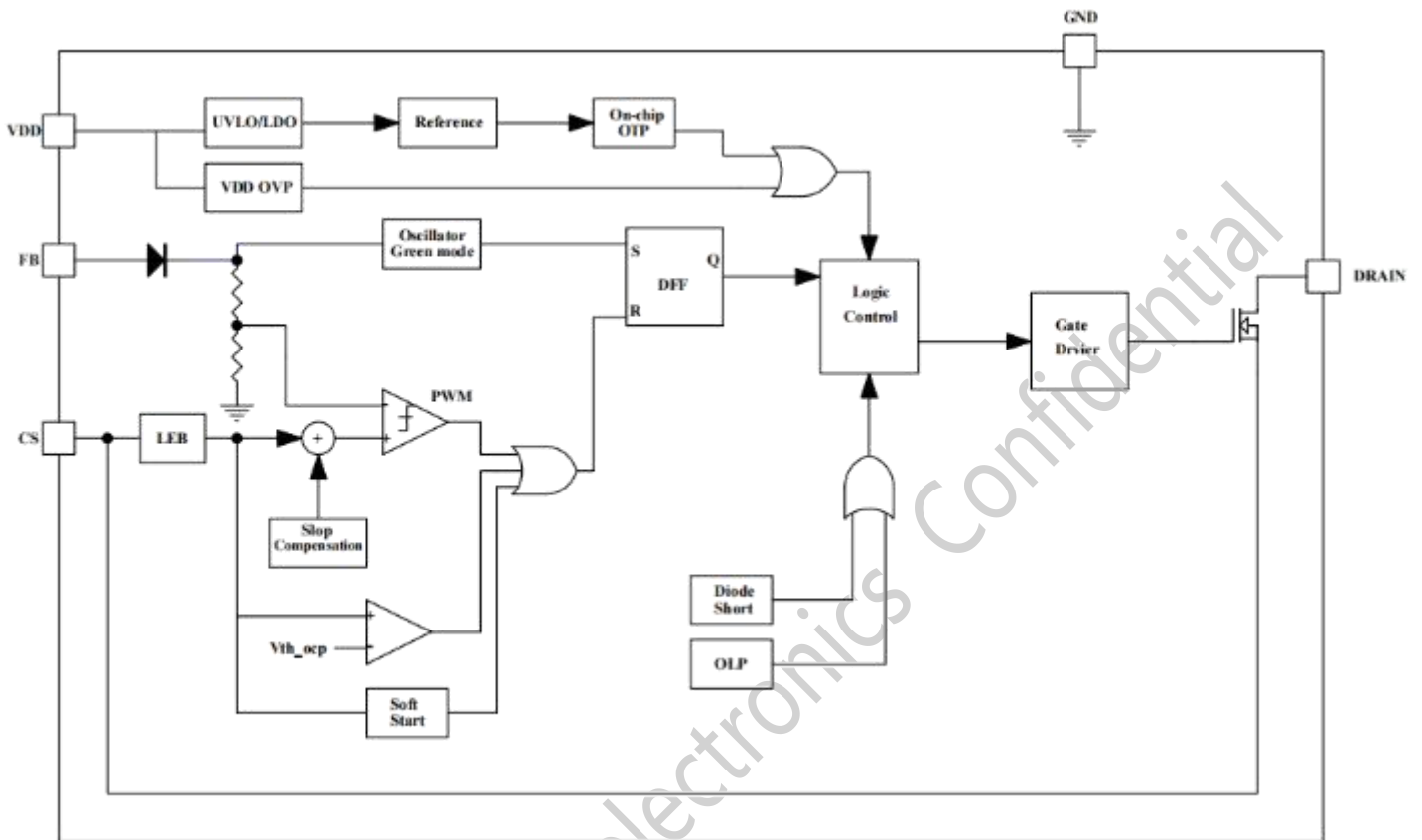
XXXXXX, the first X represents the last NO of year, 2014 is 4; The second X represents the month, in A-L 12 letters; The third and fourth X on behalf of the date, 01-31 said; The last X represents the wafer batch code.

➤ **ABSOLUTE MAXIMUM RATINGS**

Parameter	Value	Unit
VDD DC Supply Voltage	-0.3~85	V
FB, CS Voltage	-0.3 to 7	V
Drain Voltage	-0.3 to 650	V
Package Thermal Resistance---Junction to Ambient (RθjA)-SOP8	90	°C/W
Package Thermal Resistance---Junction to Housing- SOP8	45	°C/W
Maximum Junction Temperature	175	°C
Storage Temperature Range	-65 to 150	°C
Lead Temperature (Soldering, 10sec.)	260	°C
ESD Human Body Model	3	kV
ESD Machine Model	250	V



BLOCK DIAGRAM





ELECTRICAL CHARACTERISTICS (TA= 25°C,VDD=16V, If not otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Unit
Supply Voltage Section (VDD Pin)						
I _{VDD_st}	VDD Start-up current			5	15	uA
I _{VDD_Op}	VDD Operation Current	V _{FB} =3V		0.9	1.3	mA
I _{VDD_standby}	VDD Standby Current	V _{FB} =0V		0.6	0.9	mA
V _{DD_ON}	VDD Under Voltage Lockout Exit		18	20	22	V
V _{DD_OFF}	VDD Under Voltage Lockout Enter		6	7	8	V
V _{DD_OVP}	VDD OVP Clamp Voltage		73	77	80	V
Control Function Section (FB Pin)						
V _{FB_Open}	FB Open Circuit Voltage		4.7	5.2	5.8	V
I _{FB_Short}	FB Short Circuit Voltage	FB in short	160	220	290	uA
V _{TH_OLP}	Over load protection FB voltage threshold			4.2		V
T _{D_OLP}	Over load protection delay time		65	70	75	ms
Current Sense Input Section (CS Pin)						
T _{ss}	Soft start time		3	4	5	ms
T _{LEB}	Leading Edge Blanking			300		ns
V _{ocp-min}	Over current Protection Minimum Threshold Voltage		485	500	515	mV
V _{ocp-max}	Over current Protection Maximum Threshold Voltage		690	710	730	mV
V _{dsp}	Secondary rectifier diode short-circuit protection threshold voltage			1.1		V
T _{dsp}	Secondary diode short-circuit protection delay time			4		Cycle
Oscillator section						
F _{osc}	Operating frequency		60	65	70	KHz
ΔF _{osc}	Frequency jitter range		-5		5	%
T _{jitter}	Frequency jitter period			4		ms
D _{max}	Maximum Duty Cycle			80		%
F _{burst}	Burst Frequency		20	22	24	KHz
Overheat protection section (OTP)						
T _{OTP}	Over temperature protection level			155		°C



Integrated Constant Voltage Offline Current Mode PWM Power Management

T _{Otp-rec}	Over-temperature protection recovery level			125		°C
MOSFET (Drain)						
V _{BR}	Power MOS Drain Source Breakdown Voltage	DP2221	650			V
		DP2222	650			V
		DP2223	650			V
		DP2225	650			V
		DP2224	700			V
I _d	Continuous drain current	DP2221		4		A
		DP2222		5		A
		DP2223		3		A
		DP2224		5		A
		DP2225		8		A
R _{ds-on}	Static drain on resistance	DP2221		2.6	3.1	Ω
		DP2222		1.8	2.4	Ω
		DP2223		1.7	2.0	Ω
		DP2224		1.1	1.3	Ω
		DP2225		0.48	0.58	Ω



OPERATION DESCRIPTION

● System Start-Up Operation

Before the IC starts to work, DP222X consumes only startup current (typically 5uA) which allows a large value startup resistor to be used to minimize the standby power loss. When VDD reaches turn-on voltage of 20V (typical), DP222X begins switching and the IC operation current is increased to be 0.9mA (typical). The hold-up capacitor continues to supply VDD before the auxiliary winding of the transformer takes control.

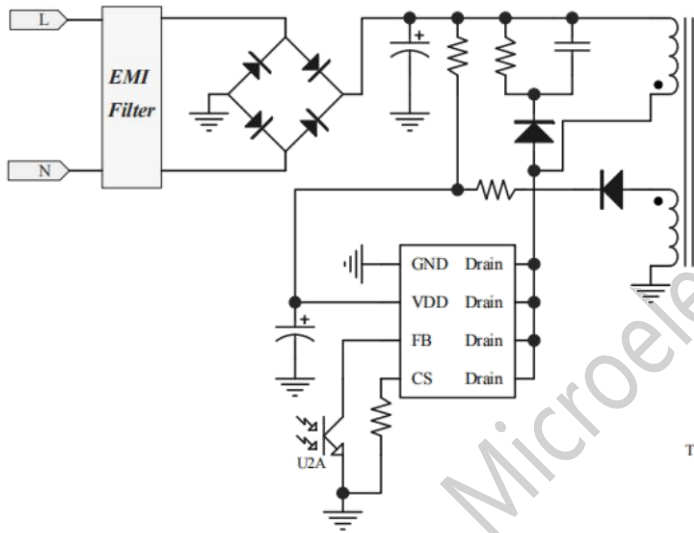


Fig1

● Oscillator with dither function

The DP222X is internally calibrated and the PWM switching frequency is strictly fixed at 65 KHz. To improve system EMI performance, the chip comes with a $\pm 5\%$ range jitter function.

● Green energy-saving working mode

Under light load and no-load conditions, the system losses mainly come from the switching losses proportional to the switching frequency. Therefore, in

order to meet the requirement of green energy saving, DP222X reduces the switching cycles by skipping some switching pulses or by reducing the switching frequency.

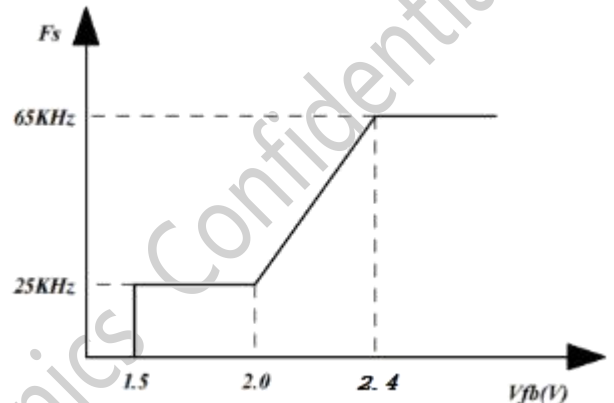


图 2

● Internal slope compensation

For the traditional current mode control, it is crucial to avoid the system stability problem when the duty cycle exceeds 50% in the continuous mode. This greatly increases the stability of the system in continuous mode, avoids sub-harmonic oscillations and reduces the output voltage ripple.

● Leading Edge Blanking (LEB)

Due to the integrated capacitor of the primary MOSFET and the reverse recovery of the secondary output diode, a voltage spike is generated on the sampling resistor when the power MOSFET turns on instantaneously. To avoid the GATE signal being turned off incorrectly, the chip has an internal integrated frontside fading function. During this time (300ns typical), the PWM comparator stops operating and the GATE output is not allowed to turn off. Frontier Fade



- **Overheat protection**

When the chip junction temperature exceeds 155 °C, the chip stops working; only when the junction temperature is below 125 °C, the chip can start working again.

- **Soft Start**

The DP222X has an integrated soft-start function with a typical value of 4ms, which is achieved by increasing the overcurrent protection threshold and switching frequency cycle by cycle during the start-up phase. This function helps to avoid saturation of the transformer and to reduce the stress on the secondary diode. Each system restart will be accompanied by a soft-start process.

- **Overload protection (OLP)**

When an overload occurs and the FB voltage exceeds VTH_OLP for more than 70ms, the chip enters overload protection mode and starts to restart automatically. 70ms protection delay helps to avoid false protection during power-on overshoot

- **Output rectifier short-circuit protection**

When the CS voltage reaches 1.1V continuously and lasts for more than 4 cycles, it will trigger the IC's secondary diode short-circuit protection function and the IC will enter restart mode

- **Automatic restart protection**

Once a fault is detected, the chip immediately stops the switching action, after which the VDD voltage drops because the chip cannot be powered by the auxiliary winding. When

VDD voltage drops to the OFF voltage VDD_OFF (7V typical), the protection logic is reset and the chip operating current is simultaneously reduced to the start-up current IVDD_st (5uA typical). After that, the VDD voltage rises again, and when the VDD voltage exceeds the ON voltage VDD_ON (20V typical), the chip switches again. If the fault still exists, then the system will continue to repeat the above protection action; otherwise, the system resumes normal operation. Relying on the above functions, the system can be targeted to start and stop the opening

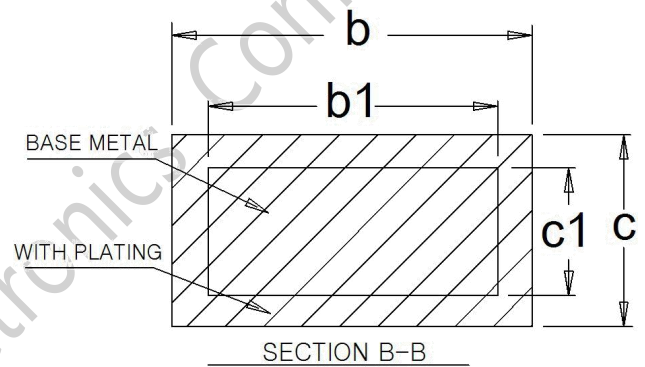
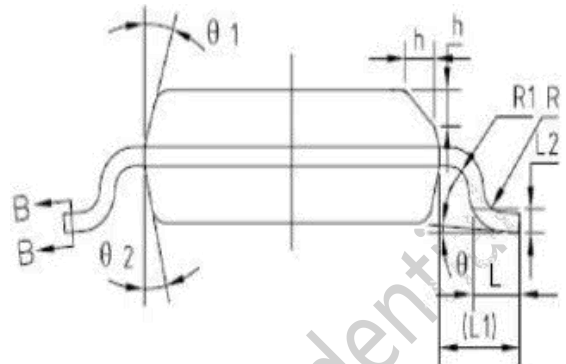
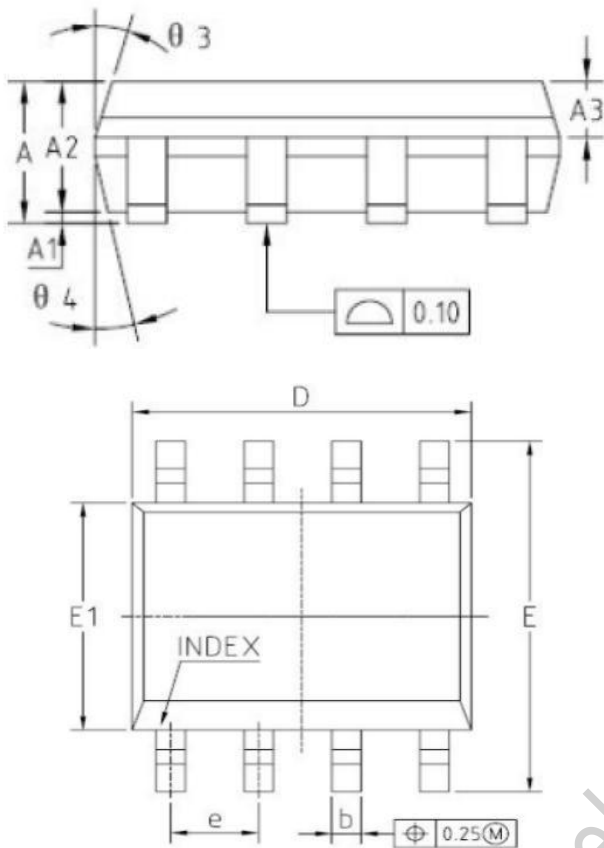
- **VDD Overvoltage protection (OVP)**

When the VDD voltage exceeds 77V (typical), the chip stops the switching action. When the VDD voltage starts to drop and falls below the shutdown voltage VDD_OFF (7V typical), the system starts to restart.



PACKAGE DIMENSION

SOP8



Symbol	Dimensions in Millimeters		
	Min	Nom	Max
A	1.45	1.55	1.65
A1	0.10	0.15	0.20
A2	1.353	1.40	1.453
A3	0.55	0.60	0.65
b	0.38	-	0.51
b1	0.37	0.42	0.47
c	0.17	-	0.25
c1	0.17	0.20	0.23
D	4.85	4.90	4.95
E	5.85	6.00	6.15
E1	3.85	3.90	3.95
e	1.245	1.27	1.295
L	0.45	0.60	0.75
L1	-	1.050REF	-
L2	-	0.250BSC	-
Ø1-Ø4	12° REF		
h	0.40REF		
R	0.15° REF		
R1	0.15° REF		



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