



DESCRIPTION

The AP8269 is available in SOP8 Packages.

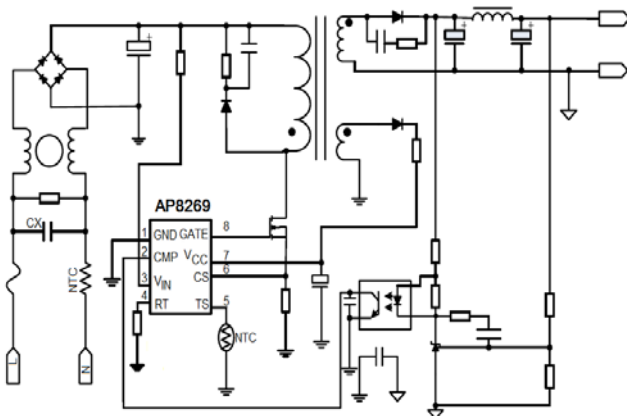
ORDERING INFORMATION

Package Type	Part Number	
SOP8	M8	AP8269M8R
		AP8269M8VR
Note	R: Tape & Reel V: Halogen free Package	
AiT provides all RoHS products Suffix " V " means Halogen free Package		

FEATURES

- Frequency jitter function to improve EMI performance of power supply
- No-audible-noise green mode Control
- External Programmable PWM Switching Frequency
- Internal Slope Compensation
- Low V_{CC} Startup Current and Low Operating Current
- Leading Edge Blanking
- UVLO
- Gate Max Output Voltage Clamp at 18V
- Overload Protection (OLP)
- Line Compensation Over Current Protection (OCP)
- With or without V_{CC} OVP
- External programmable OTP
- Available in SOP8 Packages

TYPICAL APPLICATION

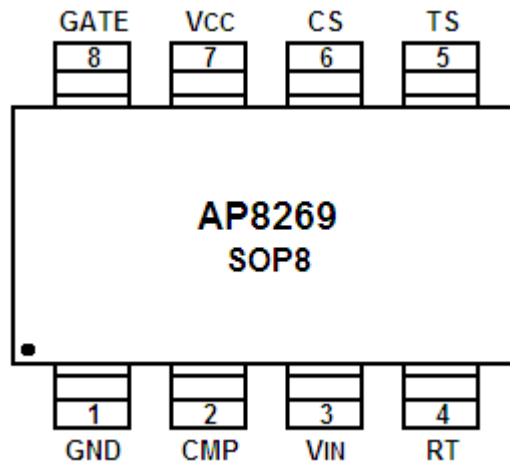


APPLICATION

- Offline AC/DC flyback converter for
- Battery Charger
- Power Adaptor
- Set-Top Box Power Supplies
- Open-frame SMPS



PIN DESCRIPTION



Top View

Pin #	Symbol	I/O	Function
1	GND	P	Ground
2	CMP	I	Feedback input pin. The PWM duty cycle is determined by voltage level into this pin and the current-sense signal at Pin sense.
3	V _{IN}	I	Star up supply and line sense Pin
4	RT	I	Internal Oscillator frequency setting pin. A resistor connected between RI and GND sets the PWM frequency.
5	TS	I	OTP sense pin, connect a NTC resistor to GND.
6	CS	I	Current sense input pin. Connected to MOSFET current sensing resistor node.
7	V _{CC}	P	Chip DC power supply pin.
8	GATE	O	Totem-pole gate drive output for the power MOSFET.



ABSOLUTE MAXIMUM RATINGS

V _{CC} /V _{IN} , DC Supply	30V
V _{CC} , Zener Clamp Voltage	V _{CC_Clamp} +0.1V
V _{CC} , Clamp Continuous Current	10mA
V _{CMP} , Input Voltage	-0.3 to 7V
V _{CS} , Input Voltage to CS Pin	-0.3 to 7V
V _{TS} , Input Voltage to TS Pin	-0.3 to 7V
V _{RT} , Input Voltage to RT Pin	-0.3 to 7V
T _J , Min/Max Operating Junction Temperature	-20°C to 150°C
T _{STG} , Min/Max Storage Temperature	-55°C to 150°C
Lead Temperature (Soldering, 10secs)	260°C

Stresses above may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITION

Parameter	Symbol	Min	Max	Unit
V _{CC} Supply Voltage	V _{CC}	12	23	V
RT Resistor Value	RT	24	31	KΩ
Operating Ambient Temperature	T _A	-20	85	°C



ELECTRICAL CHARACTERISTICS

T_A = 25°C, V_{CC}=16V, R_T=24KΩ, unless otherwise specified

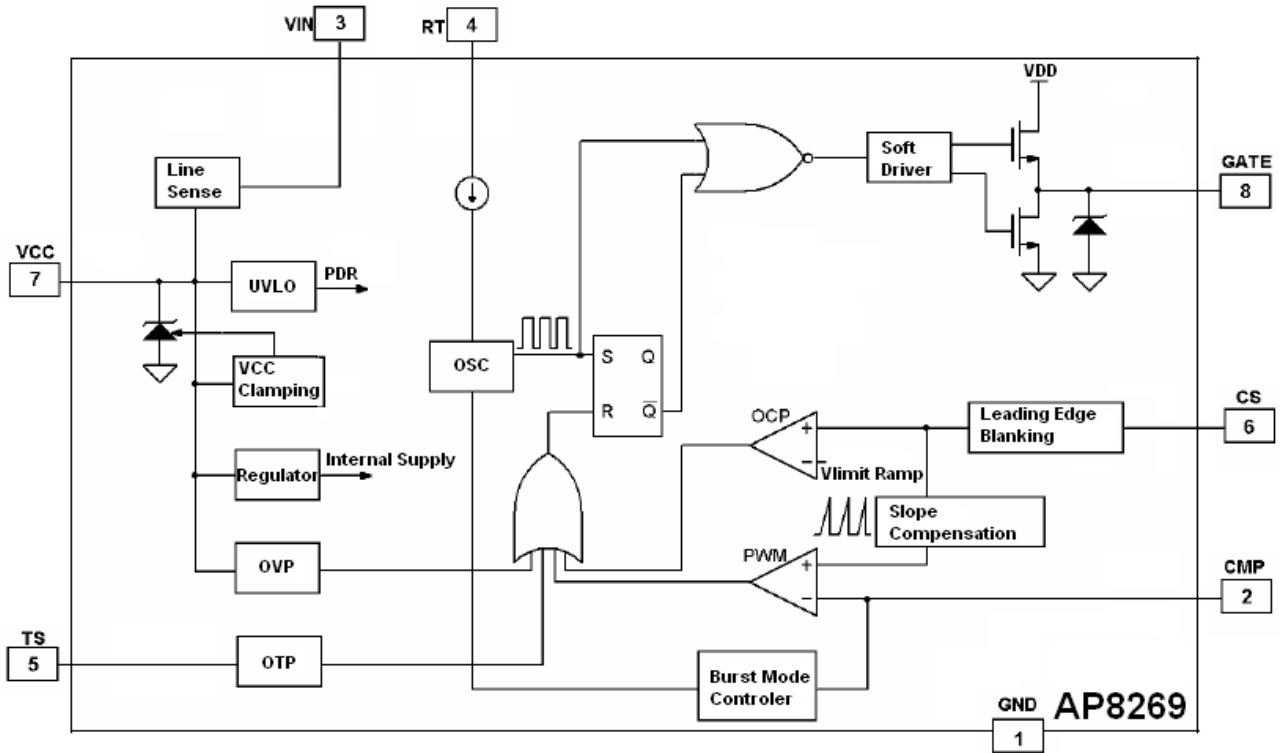
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage (V_{CC})						
V _{CC} Under Voltage Lockout Enter	UVLO(Enter)		9.5	10.5	12.0	V
V _{CC} Under Voltage Lockout Exit (Startup)	UVLO(Exit)		15.5	16.5	17.5	V
V _{CC} Over Voltage Protection Enter	OVP(ON)		23.5	25	26.5	V
V _{CC} Over Voltage Protection Exit (Recovery)	OVP(OFF)		22.0	23.5	25.0	V
OVP Hysteresis	OVP_Hys	OVP(ON)-OVP(OFF)	-	1.5	-	V
V _{CC} OVP Debounce time	T _D _OVP		-	80	-	μS
V _{CC} Zener Clamp Voltage	V _{CC} _Clamp	I(V _{CC})=5mA	-	34.5	-	V
V _{CC} Start up Current	I_V _{CC} _Startup	V _{CC} =15V, Measure current into V _{CC}	-	5.5	20	μA
Operation Current	I_V _{CC} _Operation	V _{CMP} =3V	-	2.3	-	mA
Feedback Input Section(CMP Pin)						
PWM Input Gain	A _{VCS1}	ΔV _{CMP} / Δ V _{CS1}	-	2.8	-	V/V
V _{CMP} Open Voltage	V _{CMP} _Open		-	6.4	-	V
CMP pin short circuit current	I _{CMP} _Short	Short CMP pin to GND, measure current	-	0.64	-	mA
Zero Duty Cycle CMP Threshold Voltage	V _{TH} _0D		-	-	1.6	V
Burst Mode CMP Threshold Voltage	V _{TH} _BM		-	2.2	-	V
Power Limiting CMP Threshold Voltage	V _{TH} _PL		-	4.4	-	V
Power limiting Debounce Time	T _D _PL		-	80	-	mS
Input Impedance	Z _{CMP} _IN		-	7.2	-	KΩ
Current Sense input(CS Pin)						
CS Input Leading Edge Blanking Time	T _{blanking}		-	250	-	nS
Sense Input	Z _{CS} _IN		-	30	-	KΩ
Over Current Detection and Control Delay	T _D _OC		-	120	-	nS
Current Limiting Threshold at No Compensation	V _{TH} _OC_0		0.85	0.93	0.98	V
Current Limiting Threshold at Compensation	V _{TH} _OC_1		-	0.83	-	V



Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Oscillator						
Normal Oscillation Frequency	F _{osc}		60	65	70	KHz
Frequency Temperature Stability	Δf_{Temp}	-20°C to 100°C	-	2%	-	-
Frequency Voltage Stability	$\Delta f_{V_{CC}}$	V _{CC} = 12-25V	-	2%	-	
Operating RT Range	RT_range		12	24	60	K Ω
RT open voltage	V _{RT_open}		-	2	-	V
Burst Mode Base Frequency	F _{BM}		-	22	-	KHz
Maximum Duty Cycle	DC_max		75	80	85	%
Minimum Duty Cycle	DC_min		-	-	0	-
Gate Drive Output						
Output Low Level	V _{OL}	I _{OUT} = -20mA	-	-	0.3	V
Output High Level	V _{OH}	I _{OUT} = +20mA	11	-	-	V
Output Clamp Voltage Level	V _{G_Clamp}	V _{CC} =22V	-	20	-	V
Output Rising Time	T _r	C _L = 1nf	-	255	-	nS
Output Falling Time	T _f	C _L = 1nf	-	35	-	nS
Over Temperature Protection						
Output Current of TS pin	I _{TS}		-	70	-	μ A
OTP Threshold Voltage	V _{TH_OTP}		1.015	1.065	1.115	V
OTP Recovery Threshold Voltage	V _{TH_OTP_off}		-	1.165	-	V
OTP De-bounce Time	TD _{OTP}		-	100	-	μ S
TS Pin Open Voltage	V _{TS_Open}		-	3.75	-	V
Frequency Shuffling						
Frequency Modulation range	Δf_{OSC}		-3	-	3	%
Shuffling Frequency	Freq_Shuffling	R _T =24K Ω	-	32	-	Hz



BLOCK DIAGRAM





DETAILED INFORMATION

Over-view description

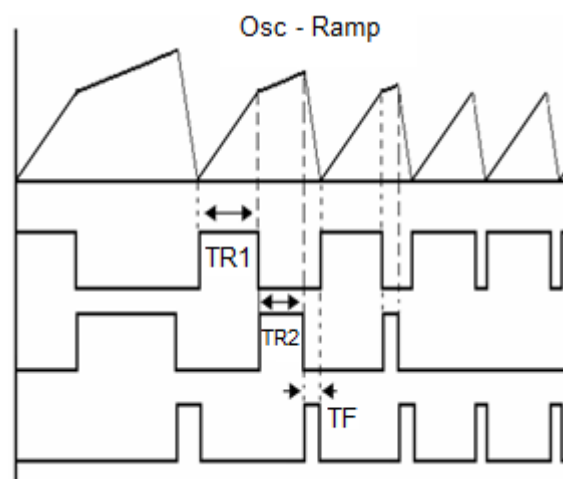
The AP8269 includes all necessary function to build an easy and cost effective solution for low power supplies to meet the international power conservation requirements.

Start-up current

Startup current of AP8269 is designed to be very low so that V_{CC} could be charged up above UVLO (exit) threshold level and device starts up quickly. Also a large value startup resistor can be used to minimize the power loss.

Green Mode Operation

At light load or no load condition, the switch loss become the major loss of the power supply, to reduce the power wasted in light and no load condition, based on a special designed voltage controlled oscillator, green mode operation of the power supply can be achieved by using AP8269. The controller will judge the load condition base on the voltage of CMP pin. In light load the CMP voltage will decrease, when V_{CMP} is lower than a set threshold voltage, a CMP depending time ($TR2$) will be generated by the oscillator and decrease the operating frequency of the power supply, the minimum frequency is set about 22KHz. The function block and the working waveform can be depicted as below:



When V_{CMP} decrease further, the power supply will enter into burst mode operation to decrease the power consumed at no load condition. Besides there is no audible noise in any load condition.



Oscillator Operation

A resistor from RT pin to ground will generate a constant current source for AP8269. This current is used to charge/discharge an internal capacitor and hence the internal clock and switching frequency are determined. Increase the resistance will decrease the current source and reduce the switching frequency. The relation between R_T and switching frequency is:

$$f_{PWM} = \frac{1560}{R_T (K\Omega)} (KH)$$

Built-in Slope Compensation

The sensed voltage across the sense resistor is used for PWM control, and pulse by pulse current limit, built-in slope compensation circuit adds a voltage ramp onto the current sense input voltage. This greatly improves the close loop stability and prevents the sub-harmonic oscillation of peak current mode PWM control scheme.

Leading Edge Blanking

Each time when the power MOSFET is switched on, a turn-on spike will inevitably occur on the sense-resistor. To avoid premature termination of the switching pulse, a 250nSec leading-edge blanking time is built in. Conventional RC filtering can therefore be omitted. During this blanking period, the current-limit comparator is disabled and it can't switch off the gate driver.

Gate Driver

The output stage of AP8269 is a fast totem pole gate driver. Cross conduction has been avoided to minimize heat dissipation, increases efficiency and enhances reliability. The output driver is clamped by an internal 18V Zener diode in order to protect power MOSFET transistors against undesirable gate over voltage. A soft driving waveform is implemented to minimize EMI.

Frequency Jitter

The frequency jitter function is integrated in the controller, the jitter is modulated by a periodic signal, the modulate signal frequency is much smaller than the oscillator frequency, By this way , the EMI noise has a wider spectrum with lower amplitudes.



Over Temperature Protection

A NTC resistor in series with a regular resistor should connect between T_s and GND for temperature sensing and protection. NTC resistor value becomes lower when the ambient temperature rises. With the fixed internal current I_{TS} flowing through the resistors, the voltage at T_s pin becomes lower at high temperature. The internal OTP circuit is triggered and shutdown the MOSFET when the sensed input voltage is lower than V_{TH_OTP} .

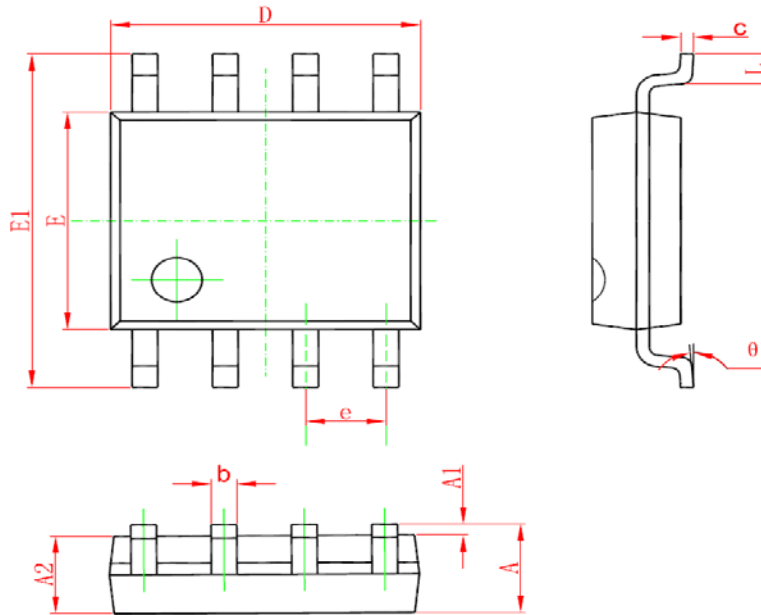
Protect Functions

To increase the reliability of power supply system many protection functions is integrated in this controller, including Cycle-by-Cycle current limiting (OCP), Over Load Protection (OLP) and over voltage clamp, Under Voltage Lockout on V_{CC} (UVLO). At overload condition when CMP input voltage exceeds power limit threshold value for more than TD_PL (power limit debounce time), the controller reacts to shut down the output power MOSFET. Device restarts when V_{CC} voltage drops below UVLO limit. V_{CC} is supplied by transformer auxiliary winding output. It is clamped when V_{CC} is higher than threshold value. The power MOSFET is shut down when V_{CC} drops below UVLO limit and device enters power on start-up sequence thereafter.



PACKAGE INFORMATION

Dimension in SOP8 Package (Unit: mm)



Symbol	Min	Max
A	1.350	1.750
A1	0.100	0.250
A2	1.250	1.400
b	0.380	0.510
c	0.25(BSC)	
D	4.800	5.000
E	3.800	4.000
E1	5.800	6.200
e	1.270(BSC)	
L	0.450	0.800
θ	0°	8°



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