

High Voltage PWM Controller

General Description

AT6002H is a highly integrated current mode PWM control for flyback converter, optimized for high performance, low standby power consumption and cost effective offline flyback converter applications.

The AT6002H built-in multiple protection with VCC under voltage lockout (UVLO), VCC over voltage protection (OVP), VCC clamp, GATE clamp, cycle-by-cycle current limiting (OCP), over load protection (OLP), RT Low Level Protection(RTLP), RT High Level Protection(RTHP), and leading-edge blanking (LEB) of the current sensing to prevent circuit damage occurred under abnormal conditions.

The AT6002H also has an X-cap discharge function to discharge the X-cap when the input is unplugged and Brown-out protection function.

The AT6002H is available in an SOP-8L package and require very few external devices for operation.

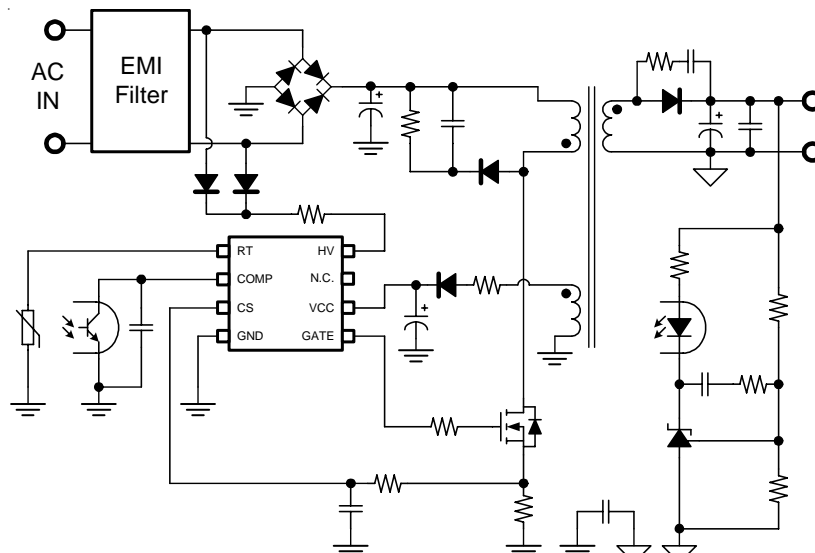
Features

- High Voltage Startup Circuit
- VCC Under Voltage Lockout (UVLO)
- VCC Over voltage Protection (OVP)
- Cycle-by-Cycle Current Limiting (OCP)
- Over Load Protection (OLP)
- Connection of an NTC for Over Temperature Protection (OTP)
- Leading Edge Blanking (LEB)
- X-CAP Discharge Function
- Brown-out Protection
- VCC & Gate Voltage Clamp
- 500mA Source/500mA Sink Gate Driver
- 100kHz Switching Frequency with Frequency Hopping for Reducing EMI
- SOP-8 Package

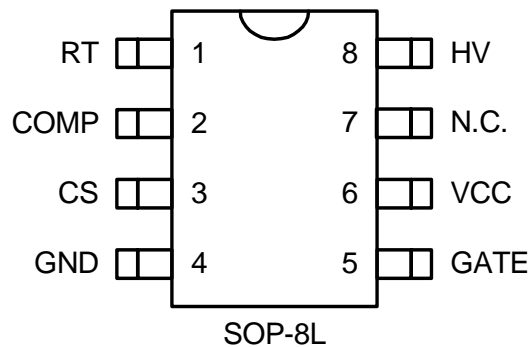
Applications

- AC/DC Switching Power Adaptor
- Battery Charger
- Open Frame Switching Power Supply

Typical Application Circuit



Pin Configuration



Function Pin Description

Pin No.	Pin Name	Description
1	RT	Temperature Detection. An internal current source allows the direct connection of an NTC for over temperature detection.
2	COMP	Voltage Feedback. This pin connecting an opto-coupler to monitor output for regulation control loop.
3	CS	Current Sense. This pin sense primary MOSFET current.
4	GND	Ground.
5	GATE	PWM Signal Output. This pin output to drive the external power MOSFET.
6	VCC	Power Supply.
7	N.C.	No Connection.
8	HV	High Voltage. This pin connecting to X-cap capacitor via resistors to be a high voltage start-up current source, and to implement X-cap discharge and Brown in/out detection.

Protection Mode

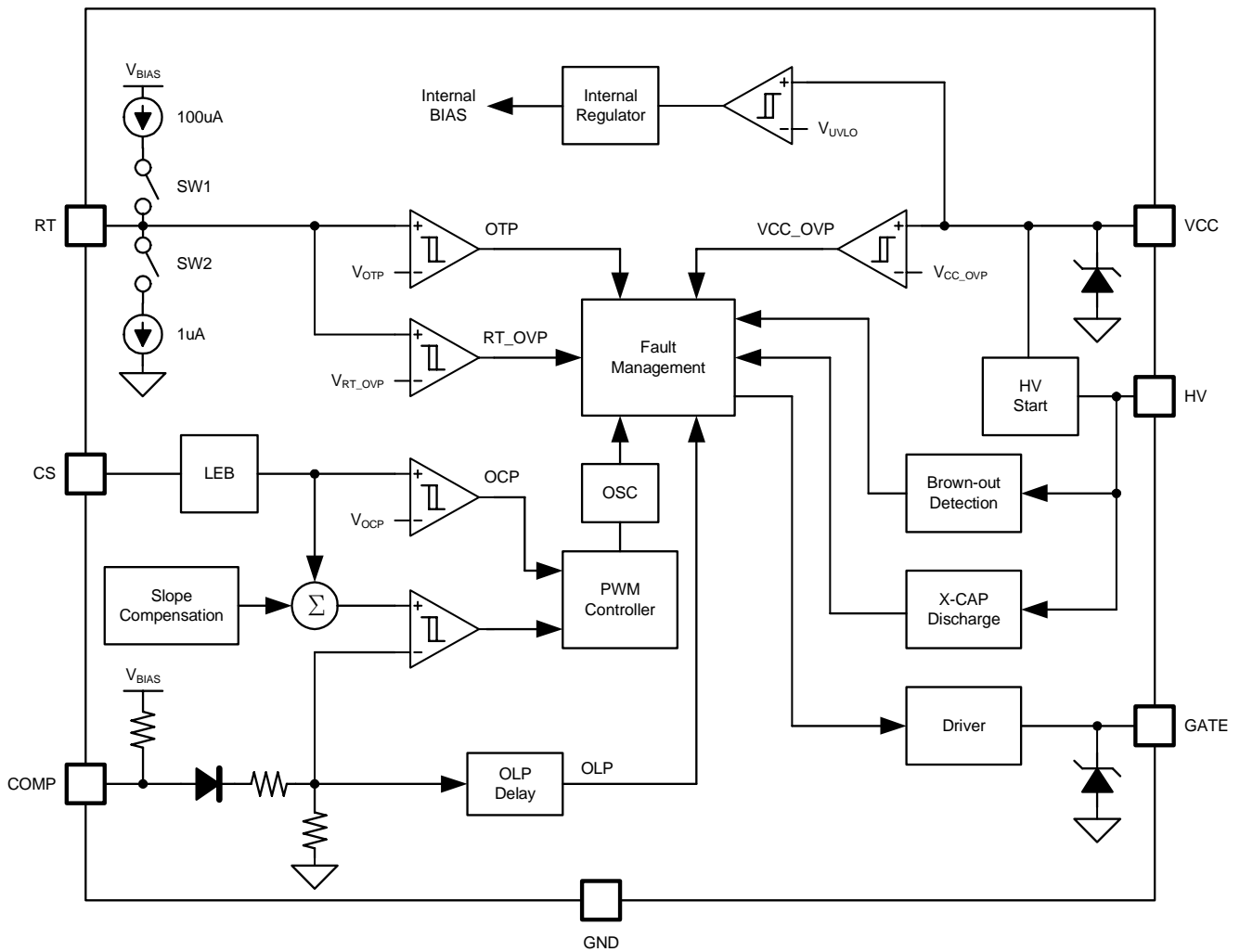
Part Number	Switching Frequency	OLP	VCC OVP	RTL P	RTH P	Int. TSD
AT6002H	100kHz	Auto	Latch	Auto	Latch	Auto

Ordering and Marking Information

Order Number	Package	Top Marking
AT6002HSP8	SOP-8L	AT6002H

Note: Aplustek products are compatible with the current IPC/JEDEC J-STD-020 requirement. They are halogen-free, RoHS compliant and 100% matte tin (Sn) plating that are suitable for use in SnPb or Pb-free soldering processes.

Function Blocks





Absolute Maximum Ratings

(Note1)

Supply Input Voltage, VCC	-----	-0.3V to +32V
High-Voltage Pin, HV	-----	- 0.3V to +600V
RT, COMP, CS	-----	-0.3V to +7V
GATE	-----	-0.3V to +20V
Storage Temperature Range	-----	-65°C to +150°C
Junction Temperature	-----	-40°C to +150°C
Lead Temperature Range(Soldering 10sec)	-----	260°C

ESD Rating (Note2)

HBM(Human Body Mode, Except HV Pin)	-----	4KV
HBM(Human Body Mode, HV Pin)	-----	1.5KV
MM(Mechine Mode)	-----	400V

Thermal Characteristics

Package Thermal Resistance (Note3)

SOP-8L θ_{JA}	-----	250°C/W
SOP-8L θ_{JC}	-----	140°C/W

Power Dissipation, PD @ TA = 25°C

SOP-8L	-----	400mW
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Electrical Characteristics

(V_{CC} = 12V, T_A = +25°C unless otherwise specified.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Supply Input Section						
Operating Voltage			8	--	27	V
Power On Voltage	VCC_on		13.5	14	14.5	V
Holdup Voltage	VCC_hold	I _{HV} >1mA	8	8.5	9	V
Power Off Voltage	VCC_off		7	7.5	8	V
Reset Voltage	VCC_rst		6	6.5	7	V
Over Voltage Protection Voltage	VCC_ovp		27	28.5	30	V
Internal Zener Clamp	VCC_clamp	I _{CC} >2*I _{CC_op}	--	31	--	V
Startup Current	I _{CC_start}		200	270	350	uA
Normal Operating Current	I _{CC_op}	C _L =1nF	--	1.3	--	mA
Burst Mode Operating Current	I _{CC_bs}	V _{CMOP} <V _{CMOP_bs}	--	0.35	--	mA
COMP Pin Section						
COMP Pull High Impedance	ZCOMP		--	20	--	kΩ
Open Loop Voltage	V _{COMP_o}	COMP Open	--	5	--	V
Over Load Protection Voltage	V _{COMP_olp}		--	4.4	--	V
Over Load Protection Debounce Time	T _{deb_olp}		--	65	--	ms



Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
High Voltage Section						
High-Voltage Current	IHV_on	VCC>1V	2.5	3	3.5	mA
Initial High-Voltage Current	IHV0_on	VCC=0V	--	0.67	--	mA
High-Voltage Off Current	IHV_off	VHV=600V,VCC>VCC_on	--	--	20	uA
Brown In Threshold			101	106	111	V
Brown In Delay Time			--	200	--	us
Brown Out Threshold			94	99	104	V
Brown Out Delay Time			--	90	--	ms
Xcap Discharge Current			--	2	--	mA
Xcap Debounce Time			--	90	--	ms
Xcap Discharge Time			--	500	--	ms
HV Resister Range			--	20	40	kΩ
Oscillation Section						
Nominal Frequency	Fosc_n	VCOMP>VCOMP_f	94	100	106	kHz
Green Frequency	Fosc_gr	VCOMP_bs<VCOMP<VCOMP_gr	--	24	--	kHz
COMP Threshold for Frequency Reduction	VCOMP_f	Fosc<Fosc_n	--	2.2	--	V
COMP Voltage for Green Frequency	VCOMP_gr	Fosc=Fosc_gr	--	2	--	V
COMP Threshold for Zero Duty	VCOMP_bs		--	1.6	--	V
Frequency Hopping Range		Fosc=Fosc_n	--	+5	--	%
Current Sense Section						
Delay to Output			--	--	100	ns
Leading Edge Blanking Time	t_leb	VCS>1.1V	--	350	--	ns
Minimum On Time	ton_min		--	710	--	ns
CS Threshold at Max Duty	VCS_max	Fosc=Fosc_n	0.885	0.9	0.915	V
Input Impedance	ZCS		1	--	--	MΩ
Soft Start Time	tss		--	0.5	--	ms
GATE Section						
Maximum Duty Cycle	Dmax	Max Frequency	71	80	89	%
Output Voltage Low	Vol	VCC=15V, I _o =20mA Sinking	--	0.12	0.25	V
Output Voltage High	Voh	VCC=15V, I _o =20mA Sourcing	9	11	--	V
Rising Time	tr	CL=1nF,Vgate from 2V to 6V	--	88	--	ns
Falling Time	tf	CL=1nF,Vgate from 6V to 2V	--	10	--	ns
Gate Voltage Clamping	Vgate_clamp	VCC=27V	12	14	16	V

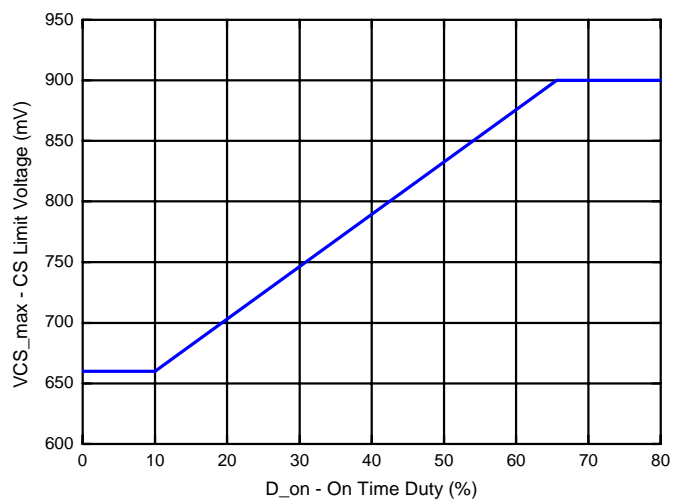
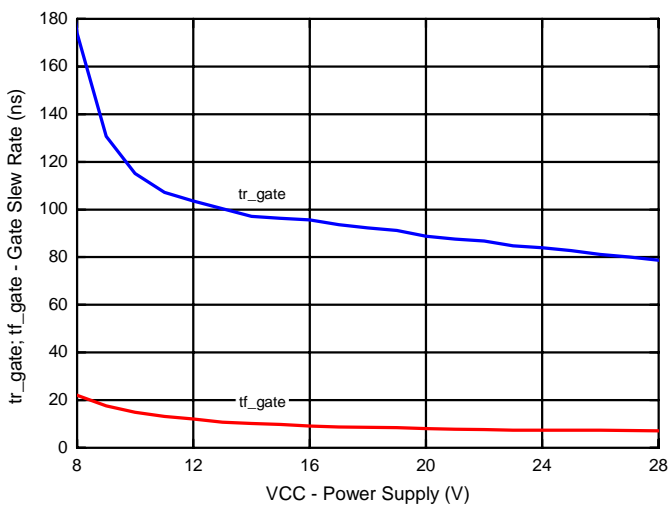
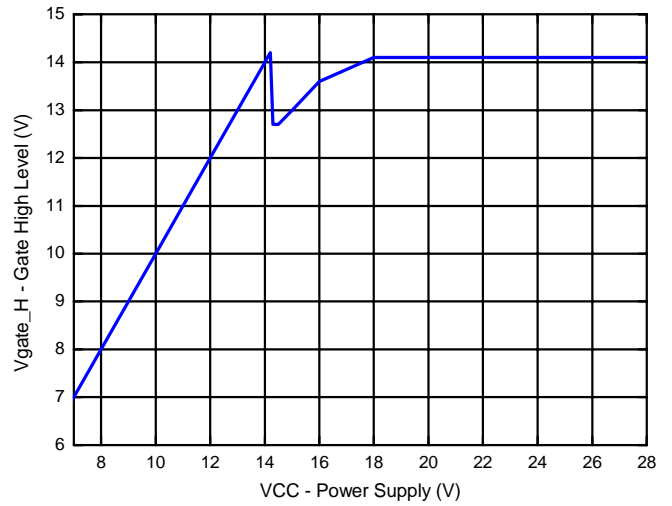
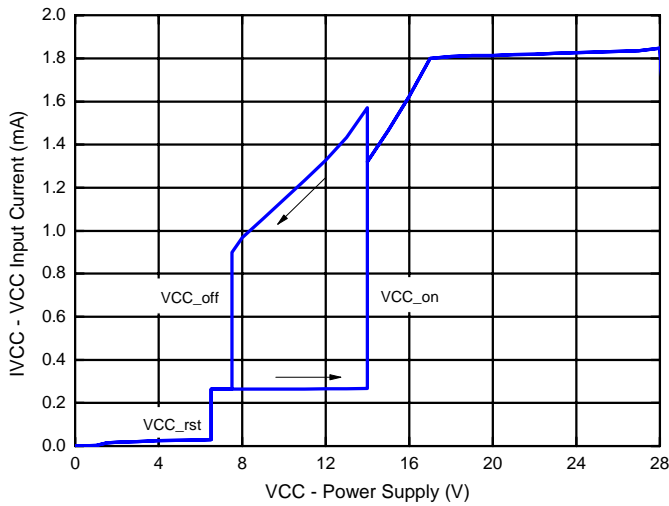
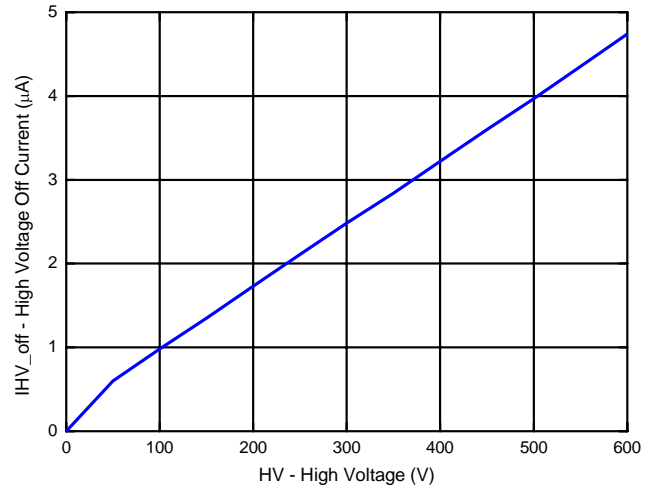
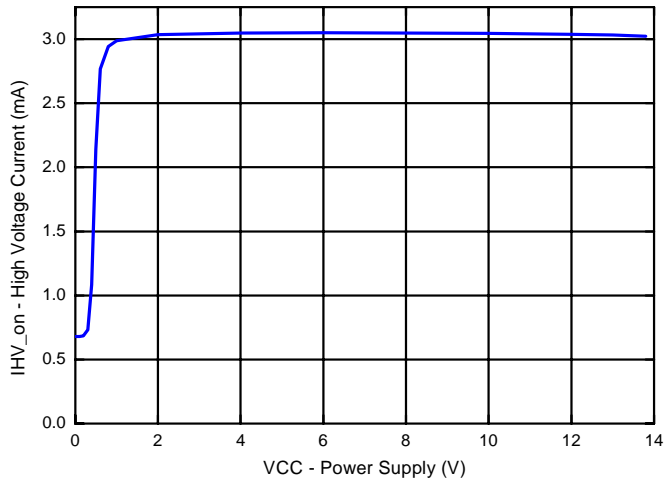


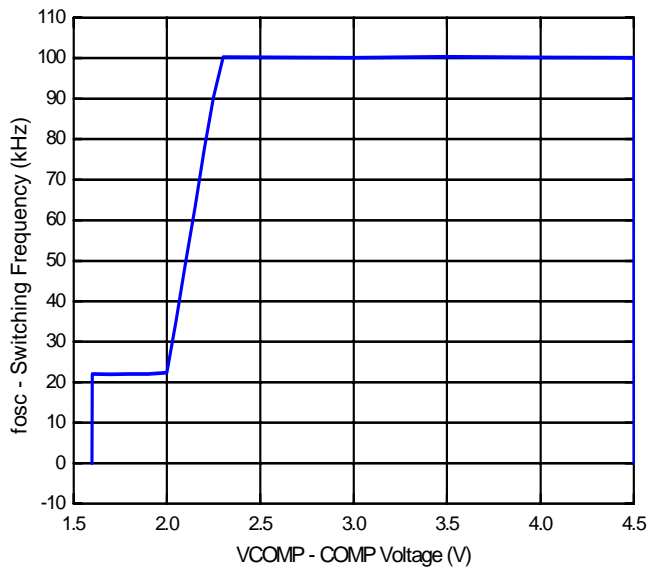
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
RT Pin Section						
Floating Voltage of RT	VRT_o	RT Open	2.1	2.3	2.5	V
RT Sourcing Current	IRT	RT < 1.5V	95	100	105	uA
RT High Level Protection	VRTTHP		3.325	3.5	3.675	V
RT Low Level Protection	VRTTLP		0.95	1	1.05	V
RT Low Protection Blanking Time after Brown In	tbk_rtlp		--	5.12	--	ms
TSD Section						
Internal Thermal Protection			--	140	--	°C
Fault Section						
Fault Recycle Time	tcyc_fault		--	1	--	s
Fault Debounce Time (Exclude OLP)	tdeb_fault		--	75	--	us

Note 1. Exceeding these limits may impair the life of the device. Exposure to absolute maximum rating conditions for long periods may affect device reliability.

Note 2. θ_{JA} is measured with the component mounted on a high effective thermal conductivity test board in free air. The exposed pad of the package is soldered directly on the PCB.

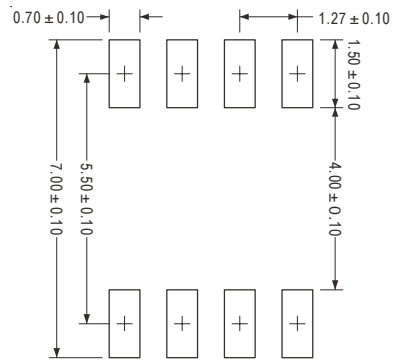
Typical Characteristics



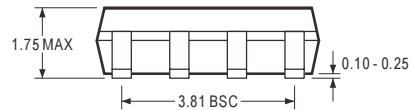
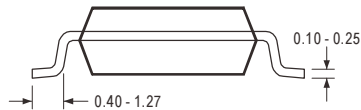
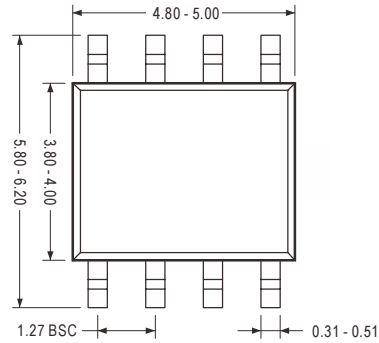


Package Information

SOP-8L



Recommended Solder Pad Layout



Note

1. Package Outline Unit Description:

BSC: Basic. Represents theoretical exact dimension .

MAX: Maximum dimension specified.

MIN: Minimum dimension specified.

REF: Represents dimension for reference use only. The value is not the device specification.

TYP: Represents as a typical value. The value is not the device specification.

2. All linear dimensions are in Millimeters.