High Voltage PWM Controller

General Description

AT6000Z is a highly integrated current mode PWM controller for flyback converter, optimized for high performance, low standby power consumption and cost effective offline flyback converter applications.

The AT6000Z built-in multiple protection with VCC under voltage lockout (UVLO), VCC over voltage protection (OVP), high voltage startup circuit, VCC clamp, GATE clamp, cycle-by-cycle current limiting (OCP), over load protection (OLP), and leading-edge blanking (LEB) of the current sensing to prevent circuit damage occurred under abnormal conditions.

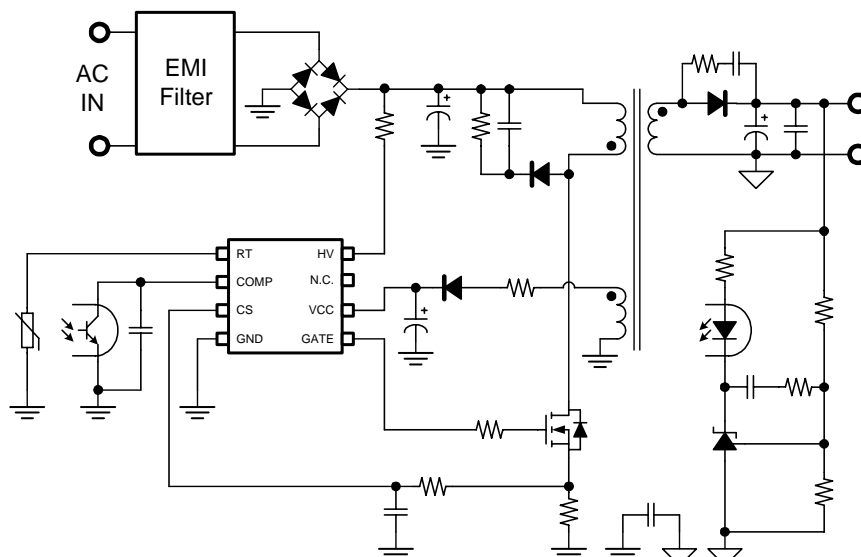The AT6000Z is available in an SOP-8L package and require very few external devices for operation.

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)**
- **VCC & Gate Voltage Clamp**
- **65kHz Switching Frequrncy**
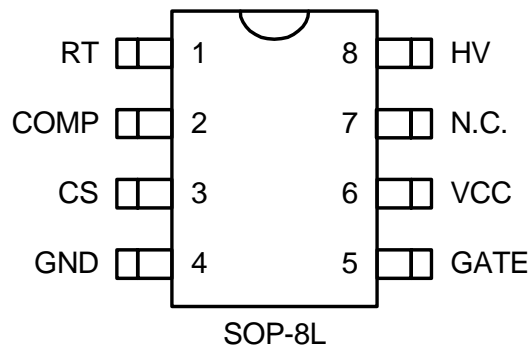- **500mA Source/500mA Sink Gate Driver**
- **SOP-8 Package**

Applications

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

Typical Application Circuit

Pin Configuration

| 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 connects to bulk capacitor via resistors for controller high voltage start-up current source.

Function Pin Description

Protection Mode

Part Number	Switching Frequency	OLP	VCC OVP	RTLP	RTHP	Int. TSD
AT6000Z	65kHz	Auto	Latch	Latch	Latch	Auto

Ordering and Marking Information

Order Number	Package	Top Marking
AT6000ZSP8	SOP-8L	AT6000Z

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
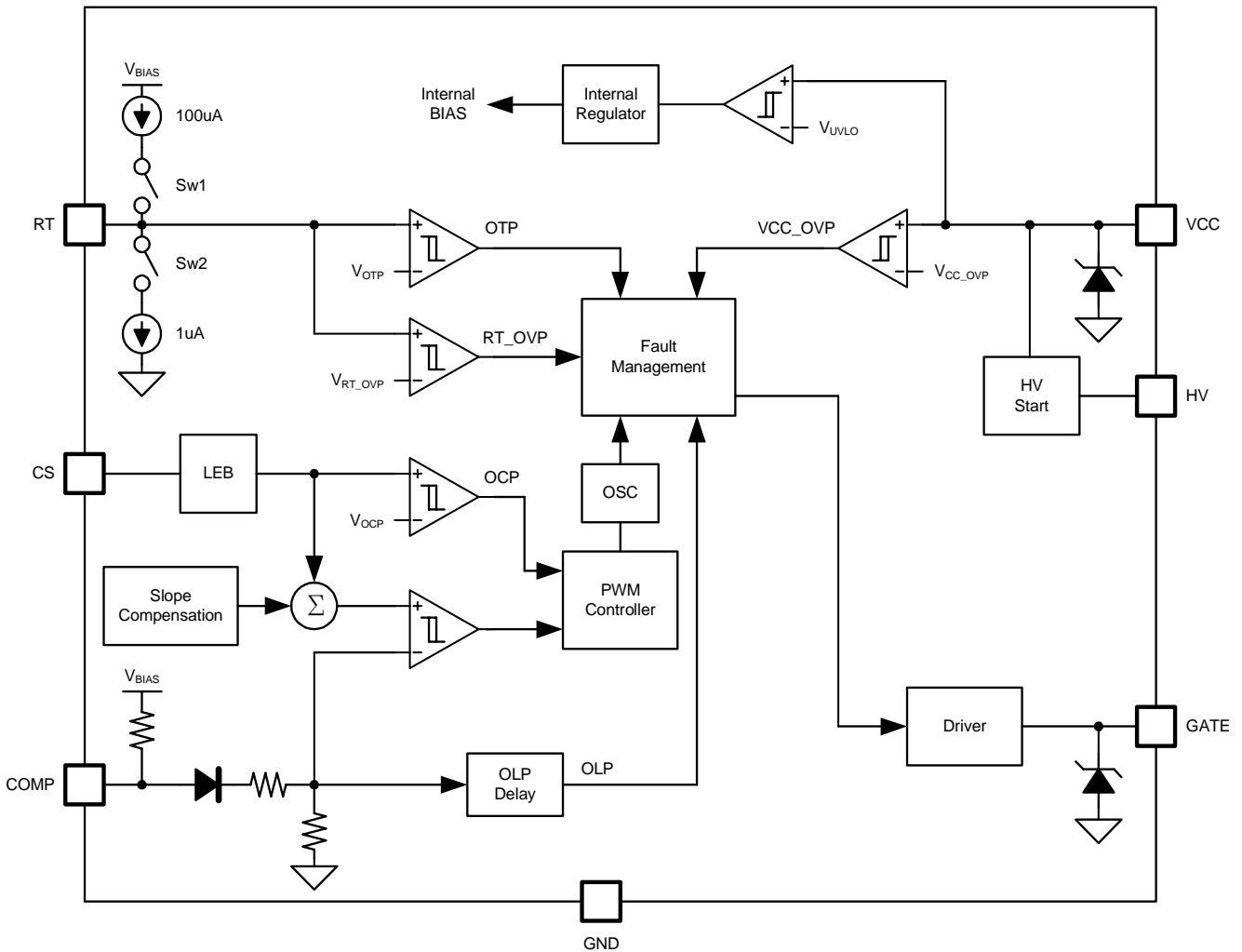
Absolute Maximum Ratings

(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

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	IHV>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	ICC>2*ICC_op	--	31	--	V
Startup Current	ICC_start		200	270	350	uA
Normal Operating Current	ICC_op	C_L=1nF	--	1.3	--	mA
Burst Mode Operating Current	ICC_bs	VCMOP<VCMOP_bs	--	0.35	--	mA
COMP Pin Section						
COMP Pull High Impedance	ZCOMP		--	20	--	kΩ
Open Loop Voltage	VCOMP_o	COMP Open	--	5	--	V
Over Load Protection Voltage	VCOMP_olp		--	4.4	--	V
Over Load Protection Debounce Time	Tdeb_olp		--	65	--	ms

Parameter		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
Oscillation Section						
Nominal Frequency	Fosc_n	VCOMP>VCOMP_f	61	65	69	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
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 Power On	tbk_rtlp		--	5.12	--	ms
TSD Section						
Internal Thermal Protection	TSD_int		--	140	--	$^{\circ}C$

Parameter		Test Conditions	Min	Typ	Max	Units
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.

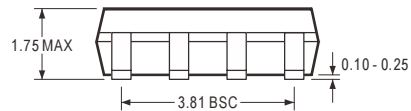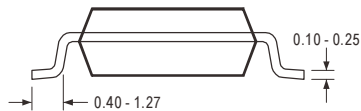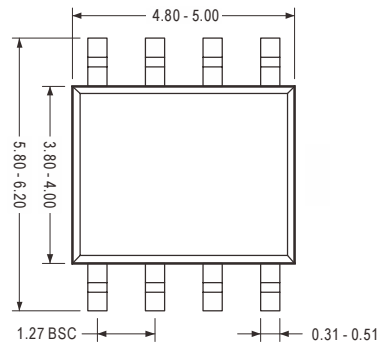## Typical Characteristics
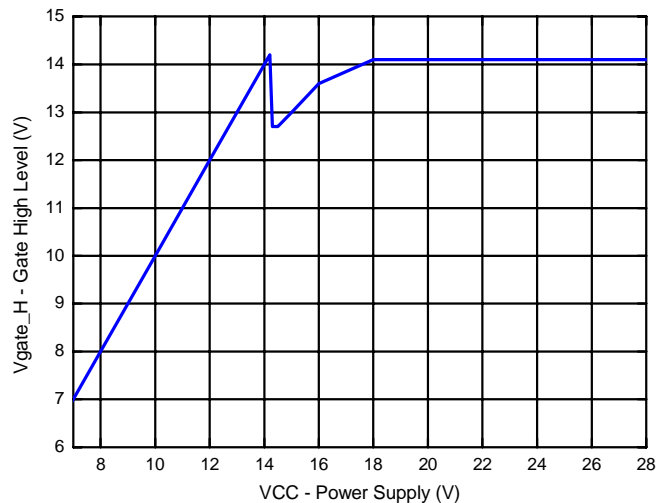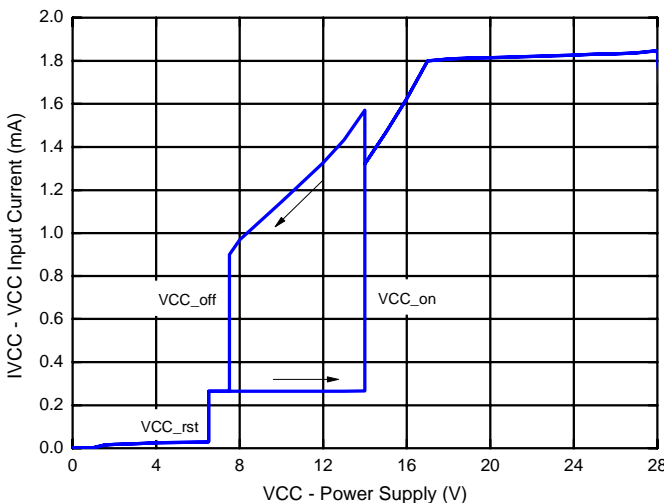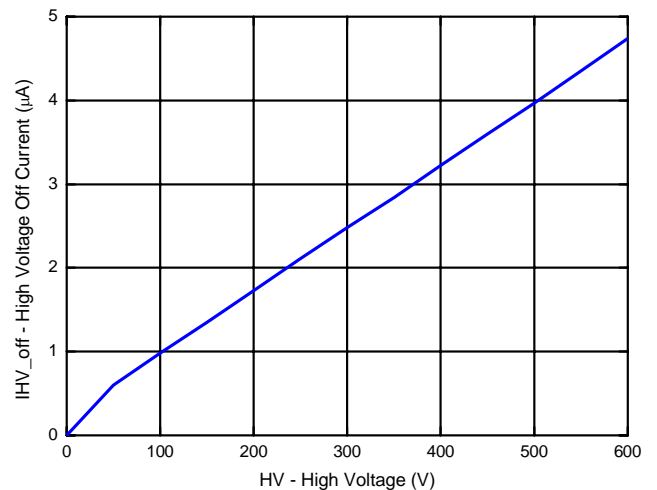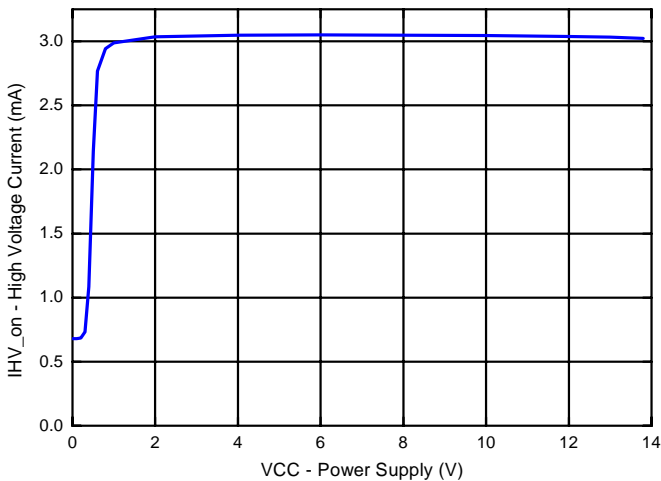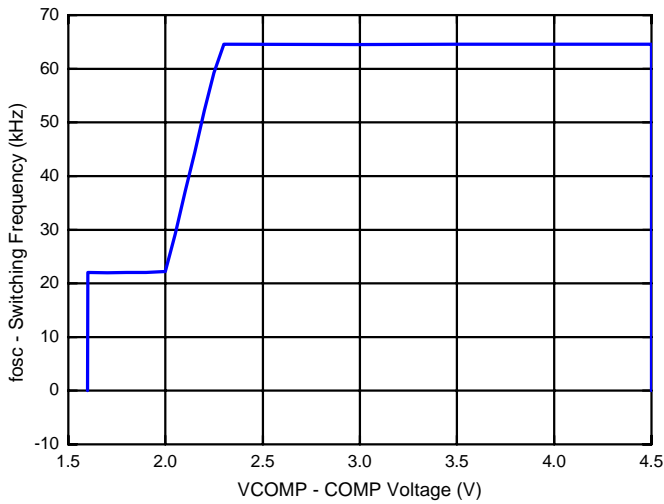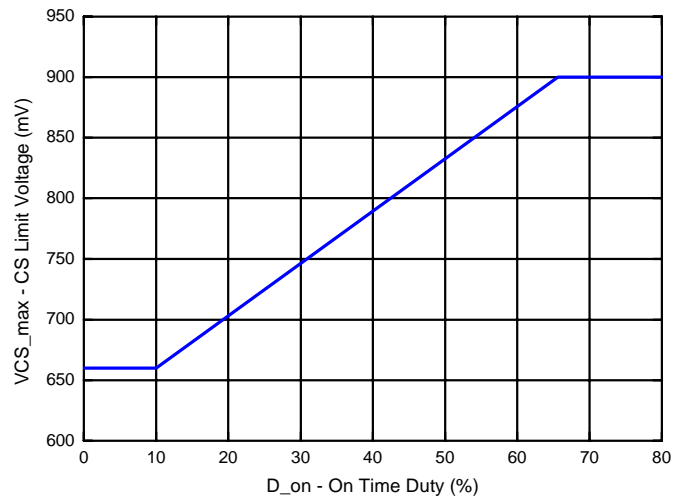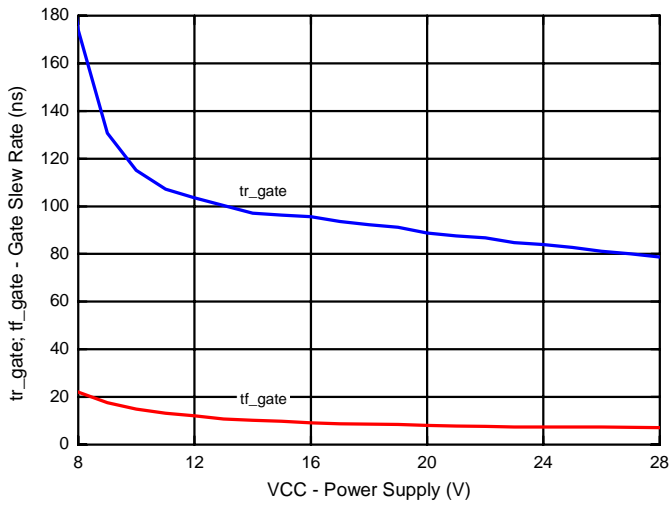
Package Information

SOP-8L
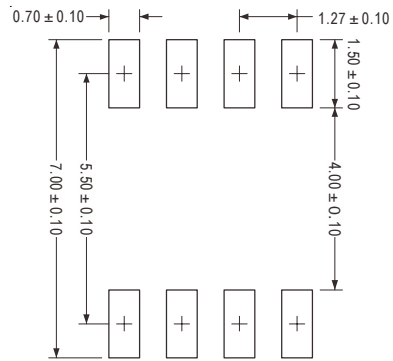
Recommended Solder Pad Layout

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.