

# AN8090, AN8090S

## Overvoltage Protective Circuits Built-in Switching Power Supply

### Overview

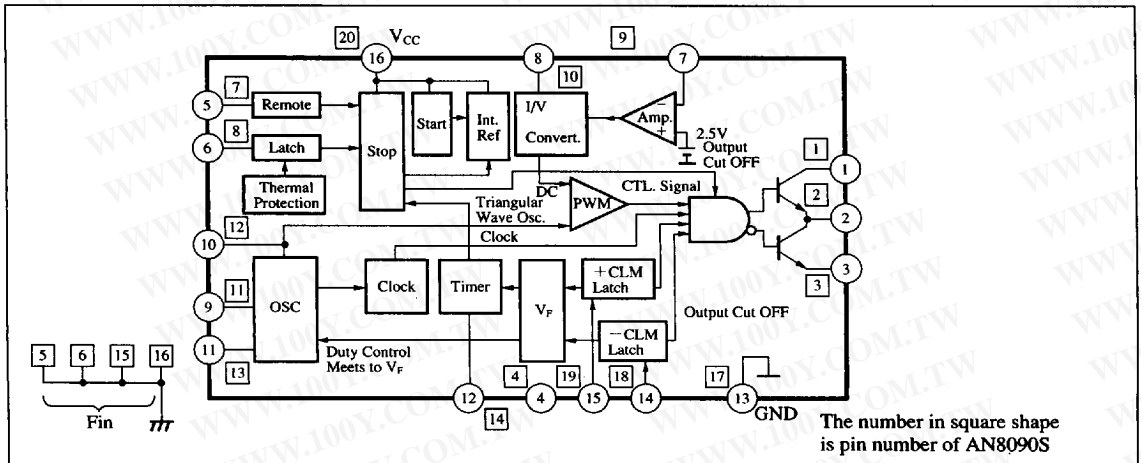
The AN8090 and the AN8090S enables high-speed control up to 500 kHz and have various protective functions for over-current, overvoltage, and thermal protection in order to improve reliability of the power supply.

### Features

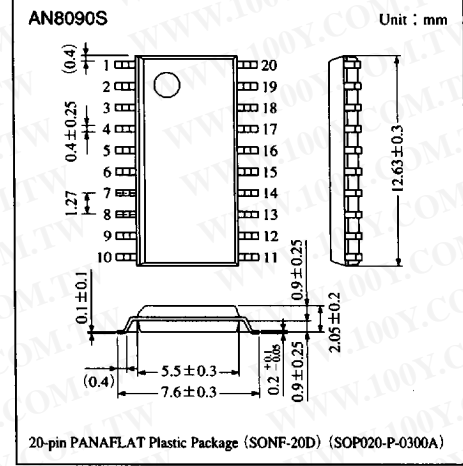
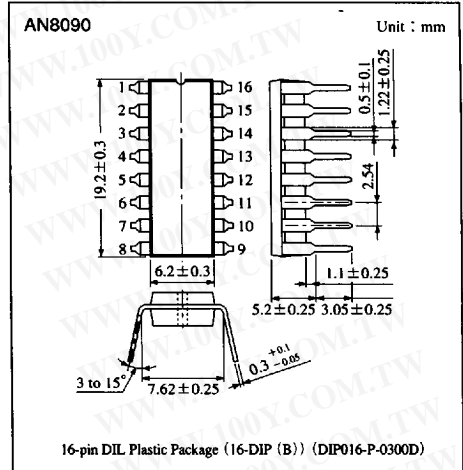
- 500 kHz PWM control frequency and miniaturized
- Capable of directly driving the large-capacity MOS FET
- Provided with 2-channel overcurrent protective function for positive side and negative side, and intermittent operating function as protection when an over-current state advanced further
- Provided with over-voltage protective and over-heat protective functions
- Provided with the ON/OFF function to start/stop operating the power supply with external signals and the error amplifier required for secondary control
- 16-DIP package for the AN8090 and SONF-20D for the AN8090S

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### Block Diagram



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Voltage Regulators

### Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	35	V
Peak output current	I <sub>O(peak)</sub>	±2	A
Maximum continuous output current	I <sub>O(max.)</sub>	±0.15	A
Power dissipation	P <sub>D</sub>	1.5 *	W
Operating ambient temperature	T <sub>opr</sub>	-30 to +85	°C
Storage temperature	AN8090	-55 to +150	°C
	AN8090S	-40 to +125	

\* For the AN8090S, Ta ≤ 25°C when mounting onto the glass epoxy substrate (substrate size = 5cm × 5cm × 0.45cm)

### Recommended Operating Range (Ta=25°C)

Parameter	Symbol	Range
Operating supply voltage range	V <sub>CC</sub>	Stop voltage to 34V

### Electrical Characteristics (Ta=25°C)

Parameter	Symbol	Condition	min	typ	max	Unit
Operating voltage range	V <sub>CC</sub>		—	—	34	V
Start voltage	V <sub>CC(start)</sub>		15.2	16	17.2	V
Stop voltage	V <sub>CC(stop)</sub>		9	10	10.9	V
Start/stop voltage difference	ΔV <sub>CC</sub>	ΔV <sub>CC</sub> = V <sub>CC(start)</sub> - V <sub>CC(stop)</sub>	5	6	7	V
Prestart circuit current	I <sub>CCL</sub>	V <sub>CC</sub> = 14.5V Ta = 25°C	50	80	120	μA
		V <sub>CC</sub> = 14.5V -30°C ≤ Ta ≤ 85°C	40	80	160	μA
Circuit current	I <sub>CCO</sub>	V <sub>CC</sub> = 30V	10	15	21	mA
ON/OFF pin H threshold voltage	V <sub>TH ON/OFF</sub>		2.1	2.6	3.1	V
ON/OFF pin L threshold voltage	V <sub>TL ON/OFF</sub>		1.9	2.4	2.9	V
ON/OFF pin hysteresis voltage	ΔV <sub>T ON/OFF</sub>		0.1	0.2	0.3	V
Oscillation frequency	f <sub>OSC</sub>	R1 = 17kΩ, R2 = 22kΩ, CF = 220pF	180	200	220	kHz
Duty ratio	Γ <sub>DUTY</sub>	R1 = 17kΩ, R2 = 22kΩ, CF = 220pF	45	48	51	%
Oscillation waveform upper limit voltage	V <sub>OSCH</sub>		4	4.4	4.8	V
Oscillation waveform lower limit voltage	V <sub>OSCL</sub>		1.8	2	2.2	V
Oscillation waveform upper/lower limit voltage difference	ΔV <sub>OSC</sub>		2.1	2.4	2.7	V
Output low voltage	V <sub>OL1</sub>	V <sub>CC</sub> = 18V, I <sub>O</sub> = 10mA	—	0.05	0.4	V
	V <sub>OL2</sub>	V <sub>CC</sub> = 18V, I <sub>O</sub> = 100mA	—	0.7	1.4	V
	V <sub>OL3</sub>	V <sub>CC</sub> = 5V, I <sub>O</sub> = 10mA	—	0.69	1	V
	V <sub>OL4</sub>	V <sub>CC</sub> = 5V, I <sub>O</sub> = 100mA	—	1.3	2	V
Output high voltage	V <sub>OH1</sub>	V <sub>CC</sub> = 18V, I <sub>O</sub> = -10mA	16	16.5	—	V
	V <sub>OH2</sub>	V <sub>CC</sub> = 18V, I <sub>O</sub> = -100mA	15.5	16	—	V
Overheat protection operating temperature	T <sub>TS</sub>		120	140	160	°C

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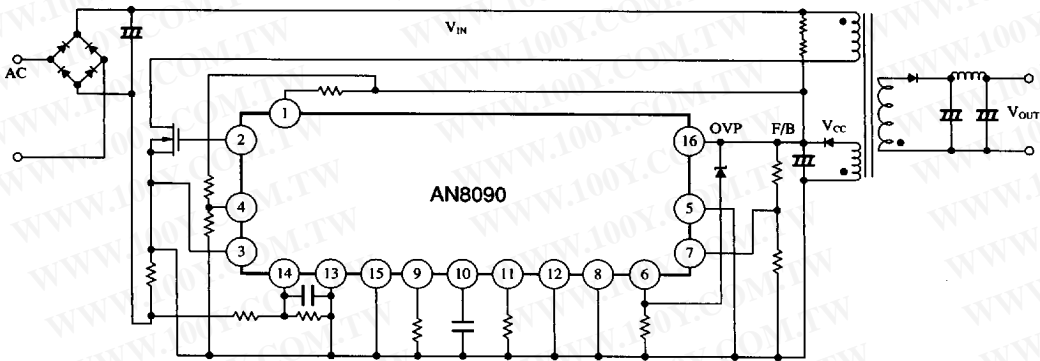
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## Pin Descriptions

Pin No.		Symbol	Description
DIL	SO		
1	1	$V_C$	Pin to apply the supply voltage to the output transistor
2	2	$V_{OUT}$	IC output pin. Drives the MOS-FET or bipolar transistor.
3	3	$V_{OUT.COM}$	Output transistor ground pin
4	4	$V_F$	Detects the mean level of output pulses and provides output duty control and timer control.
5	7	ON/OFF	Pin to turn on/off the IC. The IC stops at "H" (output = "L") and starts at "L".
6	8	OVP	Detects an over-voltage and stops the IC; the stop state is held.
7	9	$V_{IN}$	Pin to feed back the output voltage of the power supply. It has internal gain.
8	10	$I_{IN}$	Pin to feed back the output voltage of the power supply.
9	11	$T_{ON}$	Pin to connect the resistor which determines the tilting of the charge period of an internally oscillated triangular wave.
10	12	$C_F$	Pin to connect the capacitance which determines the frequency of an internally oscillated triangular wave.
11	13	$T_{OFF}$	Pin to connect the resistor which determines the tilting of the discharge period of an internally oscillated triangular wave.
12	14	$C_T$	Pin to connect the capacitance which determines a timer control frequency.
13	17	GND	Ground pin for the system.
14	18	CLM <sup>-</sup>	Overcurrent detection pin on the negative potential side.
15	19	CLM <sup>+</sup>	Overcurrent detection pin on the positive potential side.
16	20	$V_{CC}$	Pin to apply the supply voltage. Detects the start and stop voltage.
—	5	FIN(GND)	Pin directly connected to the IC chip. Joint use for discharge and GND.
—	6	FIN(GND)	Pin directly connected to the IC chip. Joint use for discharge and GND.
—	15	FIN(GND)	Pin directly connected to the IC chip. Joint use for discharge and GND.
—	16	FIN(GND)	Pin directly connected to the IC chip. Joint use for discharge and GND.

## Application Circuit

### 1) AN8090 flyback application



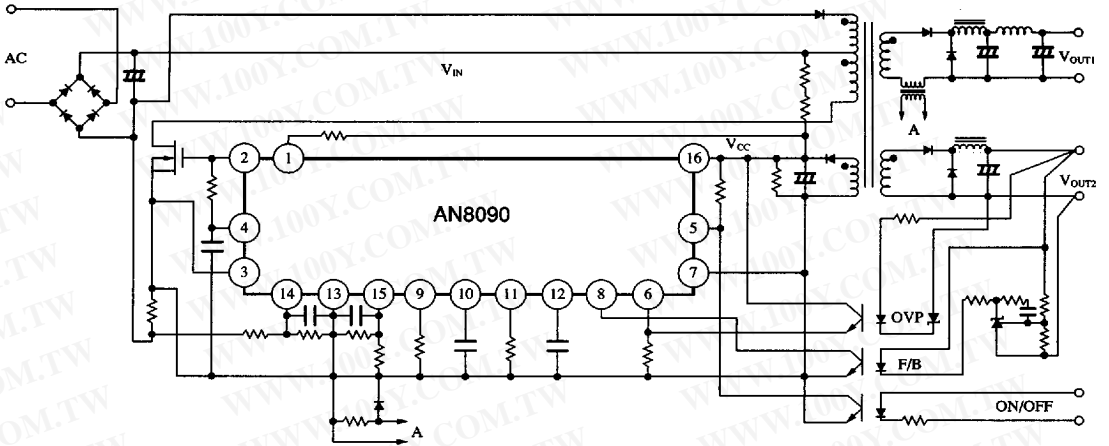
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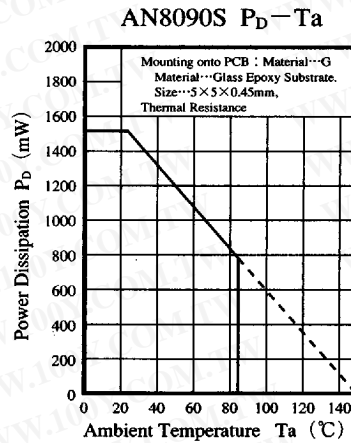
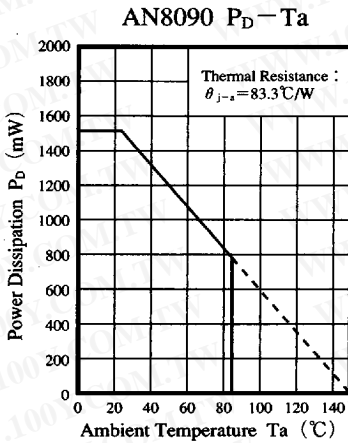
■ Application Circuit (cont.)

2) AN8090 feed-forward application



■ Supplementary Descriptions

● Characteristic Charts



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■ Supplementary Descriptions (cont.)

● Timing Charts

In Case of Normal Operation

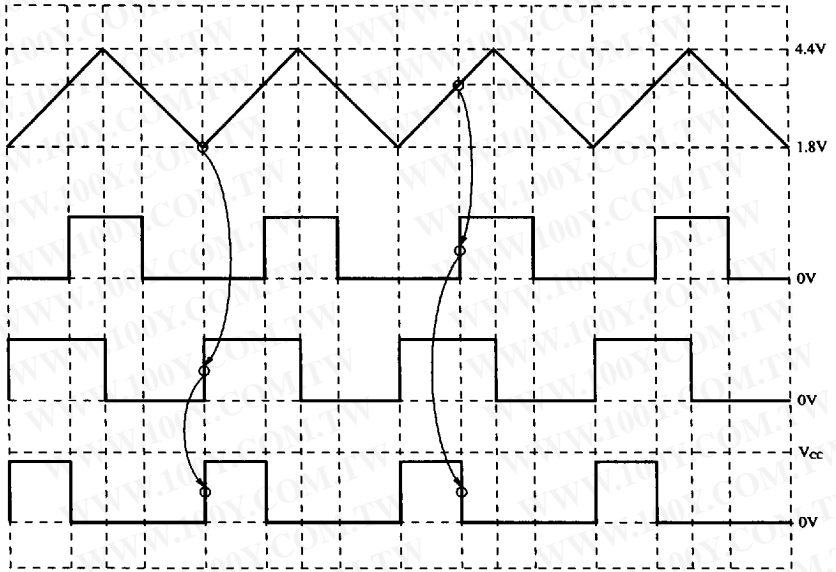
Feedback Voltage from  $V_{IN}$  or  $I_{IN}$

OSC Oscillation Waveform

PWM Output Waveform

Internal Clock Waveform

$V_{OUT}$  Output Waveform



In Case of Current Limiting Operation (Note 1)

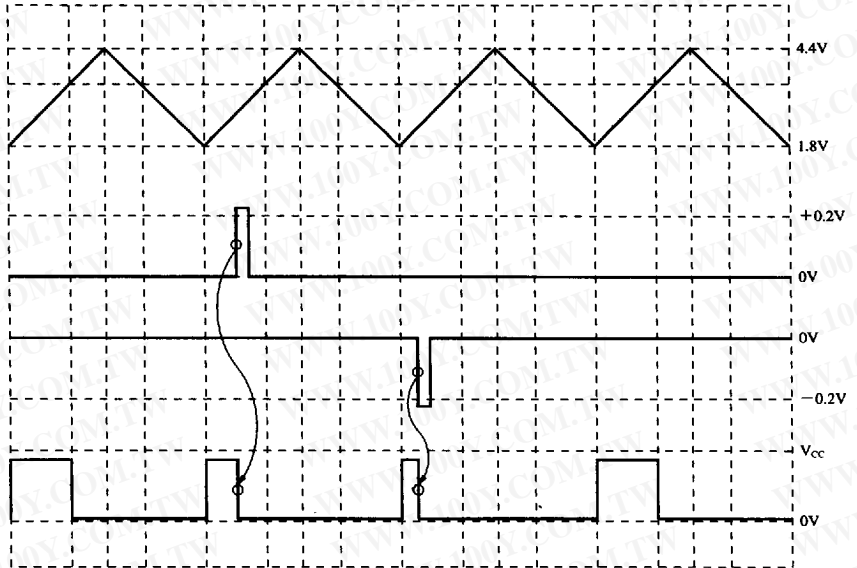
Feedback Voltage from  $V_{IN}$  or  $I_{IN}$

OSC Oscillation Waveform

+CLM Waveform

-CLM Waveform

$V_{OUT}$  Output Waveform



Voltage Regulators

Note 1) The  $V_F$  pin voltage should be higher than the  $T_{OFF(max)}$  control start voltage ( $\leq 4V$ ).

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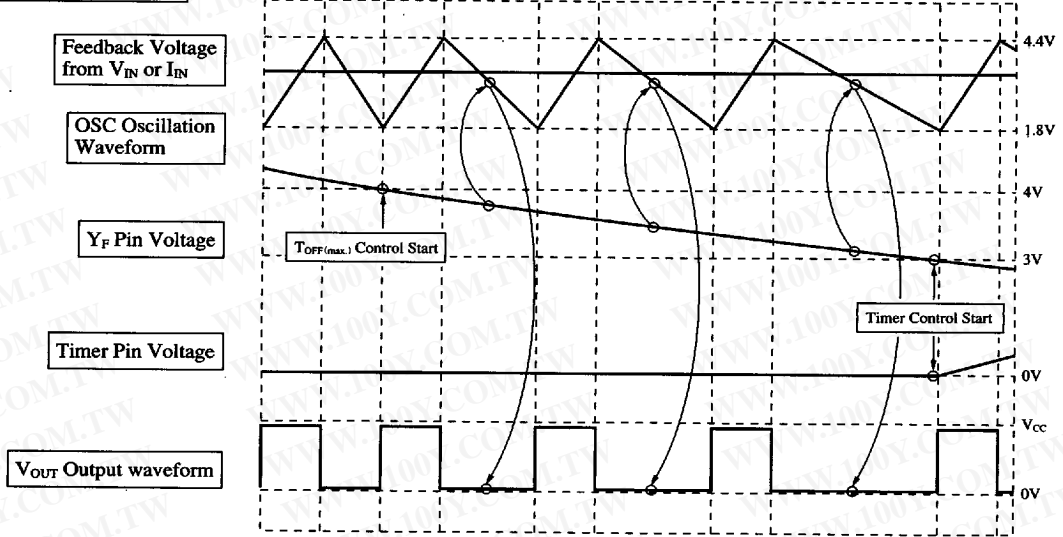
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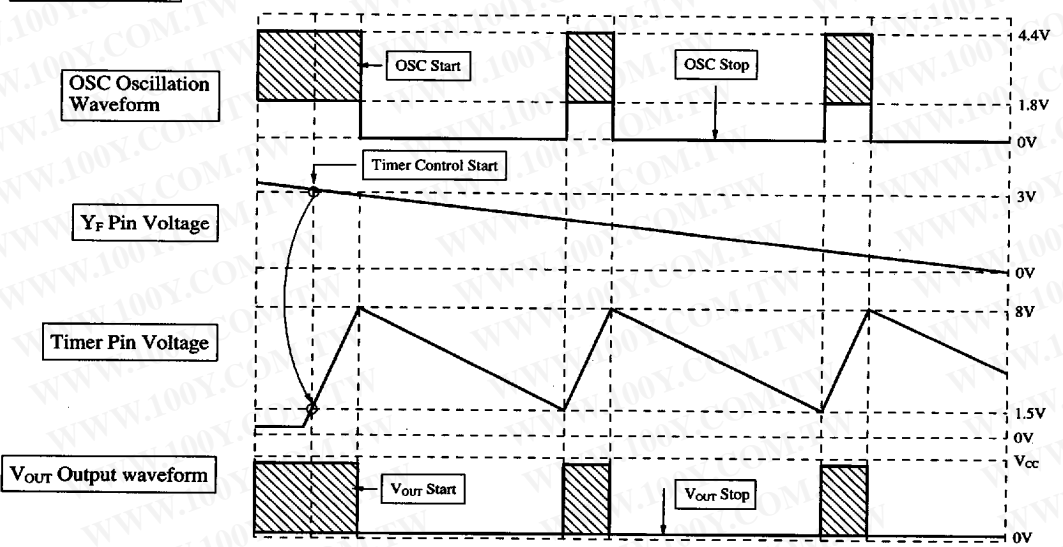
■ Supplementary Descriptions (cont.)

● Timing Charts (cont.)

In Case of  $T_{OFF(max)}$  Control Operation Note 2)



In Case of Timer Control Operation Note 3)



Note 2) In case of current limiting operation ( $CLM+ \geq 0.2V$  and  $CLM- \leq -0.2V$ ),  $T_{OFF(max)}$  control and timer control work.  
 Note 3) Even during timer control operation, the OFF period of OSC ( $V_{OUT}$ ) is controlled by  $T_{OFF(max)}$  control.

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