AP1510

PWM Control 3A Step-Down Converter

■ Features

- Input voltage: 3.6V to 23V.
- Output voltage: 0.8V to V_{CC}.
- Duty ratio: 0% to 100% PWM control
- Oscillation frequency: 300KHz typ.
- Soft-start, Current limit, Enable function
- Thermal Shutdown function
- Built-in internal SW P-channel MOS
- SOP-8L **Pb-Free** Package.

■ Applications

- PC Motherboard
- LCD Monitor
- Graphic Card
- DVD-Video Player
- Telecom Equipment
- ADSL Modem
- Printer and other Peripheral Equipment
- Microprocessor core supply
- Networking power supply

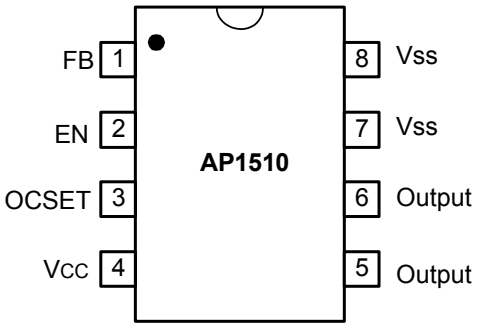
■ General Description

AP1510 consists of step-down switching regulator with PWM control. These devices include a reference voltage source, oscillation circuit, error amplifier, internal PMOS and etc.

AP1510 provides low-ripple power, high efficiency, and excellent transient characteristics. The PWM control circuit is able to very the duty ratio linearly from 0 up to 100%. This converter also contains an error amplifier circuit as well as a soft-start circuit that prevents overshoot at startup. An enable function, an over current protect function and a short circuit protect function are built inside, and when OCP or SCP happens, the operation frequency will be reduced from 300KHz to 30KHz. Also, an internal compensation block is built in to minimum external component count.

With the addition of an internal P-channel Power MOS, a coil, capacitors, and a diode connected externally, these ICs can function as step-down switching regulators. They serve as ideal power supply units for portable devices when coupled with the SOP–8L mini-package, providing such outstanding features as low current consumption. Since this converter can accommodate an input voltage of up to 23V, it is also ideal when operating via an AC adapter.

■ Pin Assignments

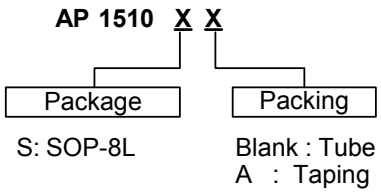


■ Pin Descriptions

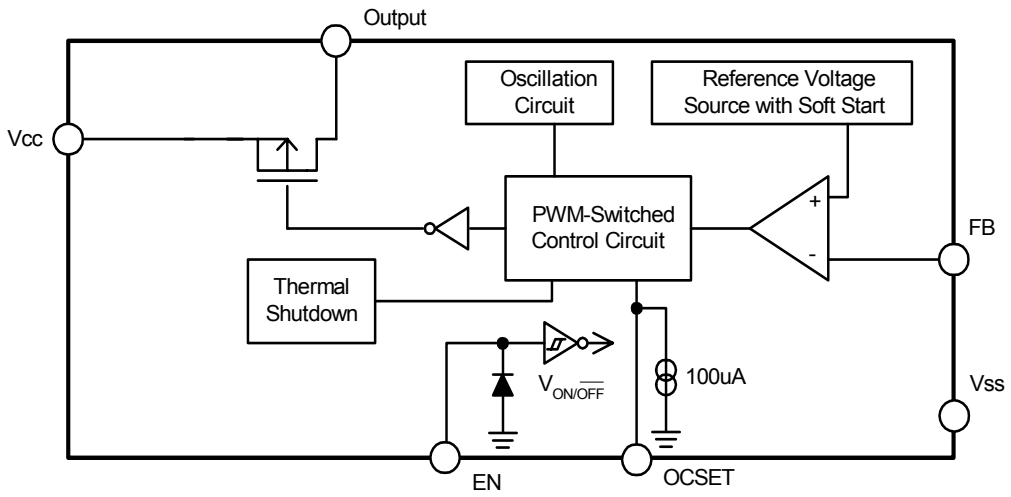
Name	Pin	Description
FB	1	Feedback pin.
EN	2	Power-off pin H: Normal operation (Step-down operation) L: Step-down operation stopped (All circuits deactivated)
OCSET	3	Add an external resistor to set max output current.
Vcc	4	IC power supply pin
Output	5、6	Switch Pin. Connect external inductor/diode here. Minimize trace area at this pin to reduce EMI.
Vss	7、8	GND Pin

This datasheet contains new product information. Anachip Corp. reserves the rights to modify the product specification without notice. No liability is assumed as a result of the use of this product. No rights under any patent accompany the sale of the product.

■ Ordering Information



■ Block Diagram



■ Absolute Maximum Ratings

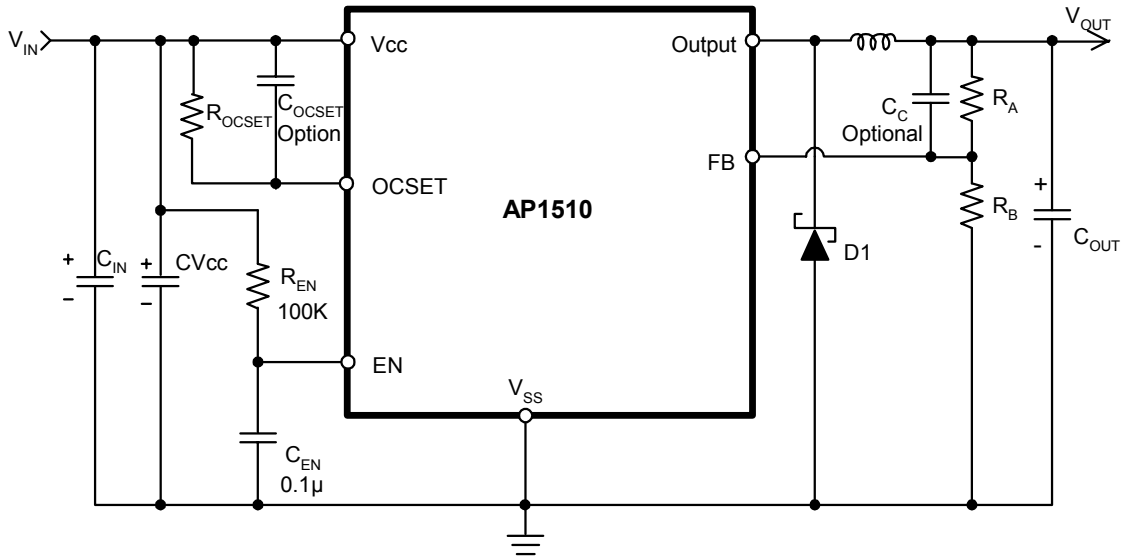
Symbol	Parameter	Rating	Unit
V_{CC} *1	V_{CC} Pin Voltage	V_{SS} - 0.3 to V_{SS} + 25	V
V_{FB}	Feedback Pin Voltage	V_{SS} - 0.3 to V_{CC}	V
$V_{ON/\overline{OFF}}$ *1	ON/OFF Pin Voltage	V_{SS} - 0.3 to V_{IN} + 0.3	V
V_{OUTPUT}	Switch Pin Voltage	V_{SS} - 0.3 to V_{IN} + 0.3	V
P_D	Power Dissipation	Internally limited	mW
T_{OPR}	Operating Temperature Range	-20 to +125	°C
T_{STG}	Storage Temperature Range	-40 to +150	°C

Caution: The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

■ Electrical Characteristics (V_{IN} = 12V, T_a=25°C, unless otherwise specified)

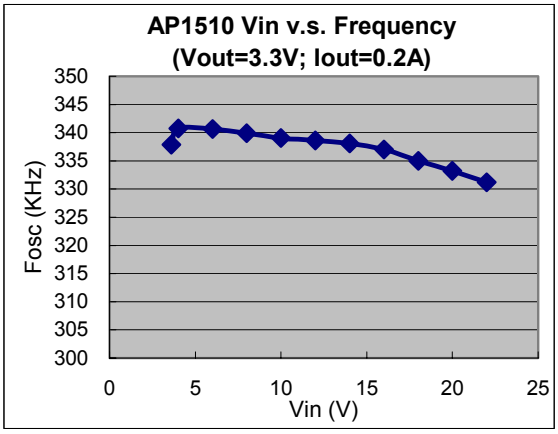
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{FB}	Feedback Voltage	I_{OUT}=0.1A	0.784	0.8	0.816	V
V_{IN}	Input Voltage	--	3.6	-	23	V
ISW	Switch Current	--	3.5	-	-	A
I_{SSS}	Current Consumption During Power Off	$V_{ON/OFF}$ =0V	-	10	-	μA
ΔV_{OUT} /V_{OUT}	Line Regulation	V_{IN} = 5V~23V, I_{OUT}=0.2A	-	1	2	%
ΔV_{OUT} /V_{OUT}	Load Regulation	I_{OUT} = 0.1 to 3A	-	0.2	0.5	%
f_{OSC}	Oscillation Frequency	Measure waveform at SW pin	240	300	360	KHz
f_{OSC1}	Frequency of Current Limit or Short Circuit Protect	Measure waveform at SW pin	10	30	60	KHz
V_{SH}	EN Pin Input Voltage	Evaluate oscillation at SW pin	2.0	-	-	V
V_{SL}		Evaluate oscillation stop at SW pin	-	-	0.8	
I_{SH}	EN Pin Input Leakage Current	--	-	20	-	μA
I_{SL}		--	-	-10	-	μA
I_{OCSET}	OCSET Pin Bias Current	--	75	90	105	μA
T_{SS}	Soft-Start Time	--	0.3	2	5	ms
R_{DSON}	Internal MOSFET Rdson	V_{IN}=5V, V_{FB}=0V	-	110	150	mΩ
		V_{IN}=12V, V_{FB}=0V	-	70	100	
EFFI	Efficiency	V_{IN} = 12V, V_{OUT} = 5V I_{OUT} = 3A	-	91	-	%

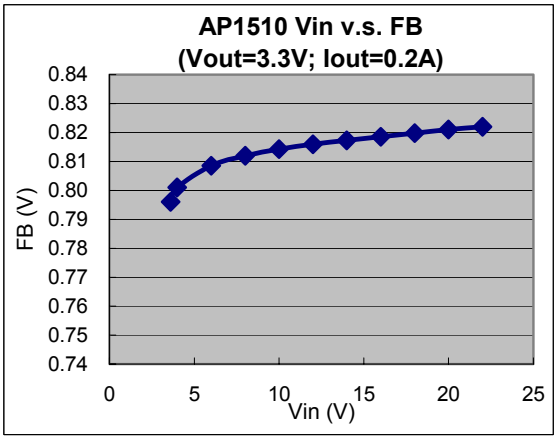
■ Typical Application Circuit

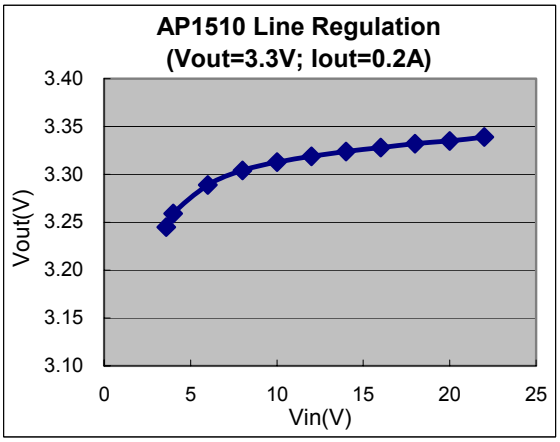


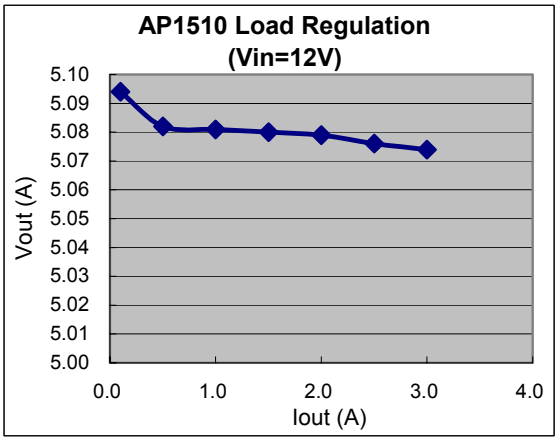
Note: $V_{OUT} = V_{FB}$ x (1+R_A/R_B)
R_B=0.7K~5K ohm

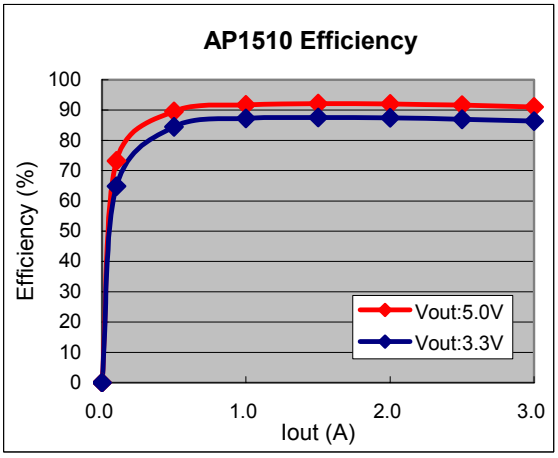
■ Typical Performance Characteristics





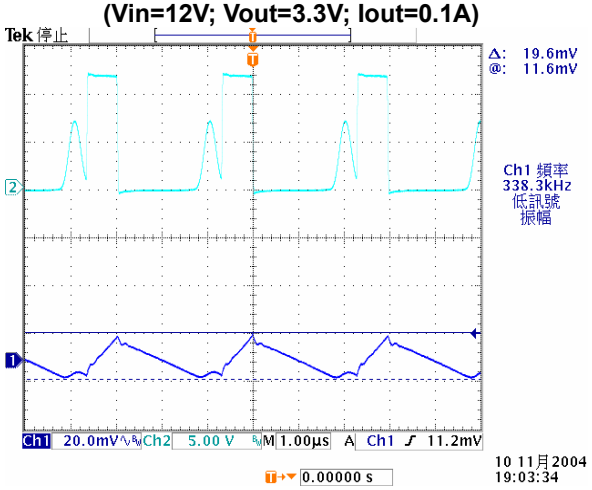




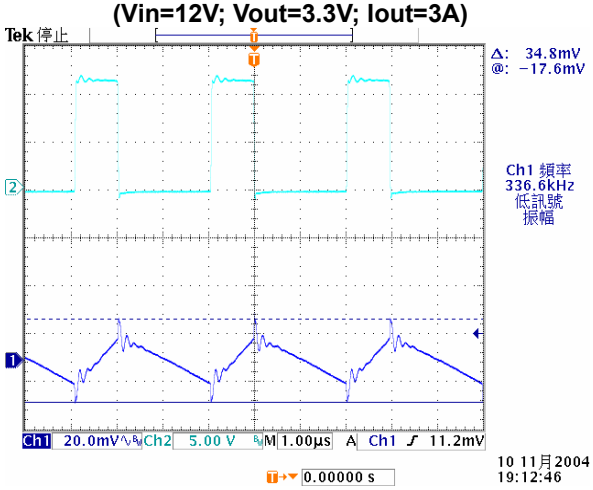


■ Typical Performance Characteristics (Continued)

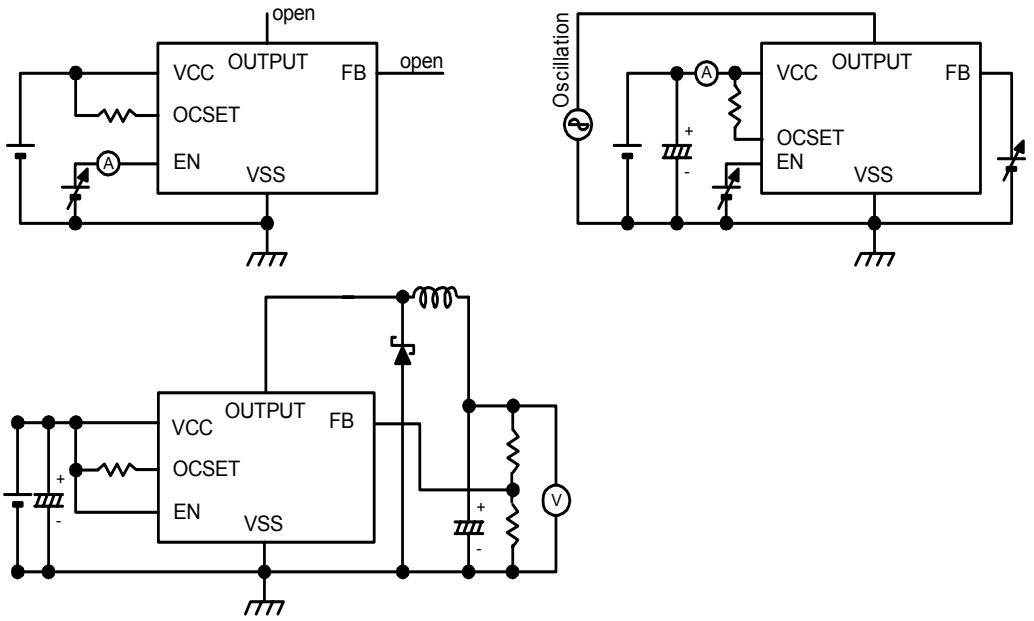
AP1510 Vout Ripple (Vin=12V; Vout=3.3V; Iout=0.1A)



AP1510 Vout Ripple (Vin=12V; Vout=3.3V; Iout=3A)



■ Test Circuit



■ Function Description

PWM Control

The AP1510 consists of DC/DC converters that employ a pulse-width modulation (PWM) system.
In converters of the AP1510, the pulse width varies in a range from 0 to 100, according to the load current, and yet ripple voltage produced by the switching can easily be removed through a filter because the switching frequency remains constant. Therefore, these converters provide a low-ripple power over broad ranges of input voltage and load current.

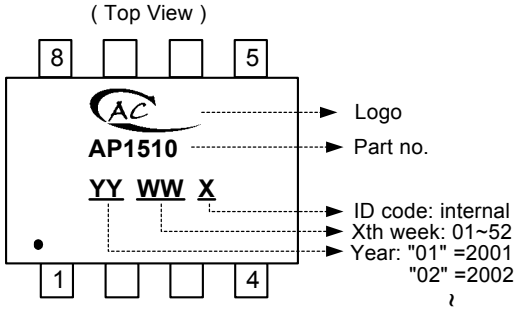
Under Voltage Lockout

The under voltage lockout circuit of the AP1510 assures that the high-side MOSFET driver outputs remain in the off state whenever the supply voltage drops below set parameters. Lockout occurs if V_{CC} falls below 3.3V. Normal operation resumes once V_{CC} rises above 3.5V.

$R_{DS(ON)}$ Current Limiting

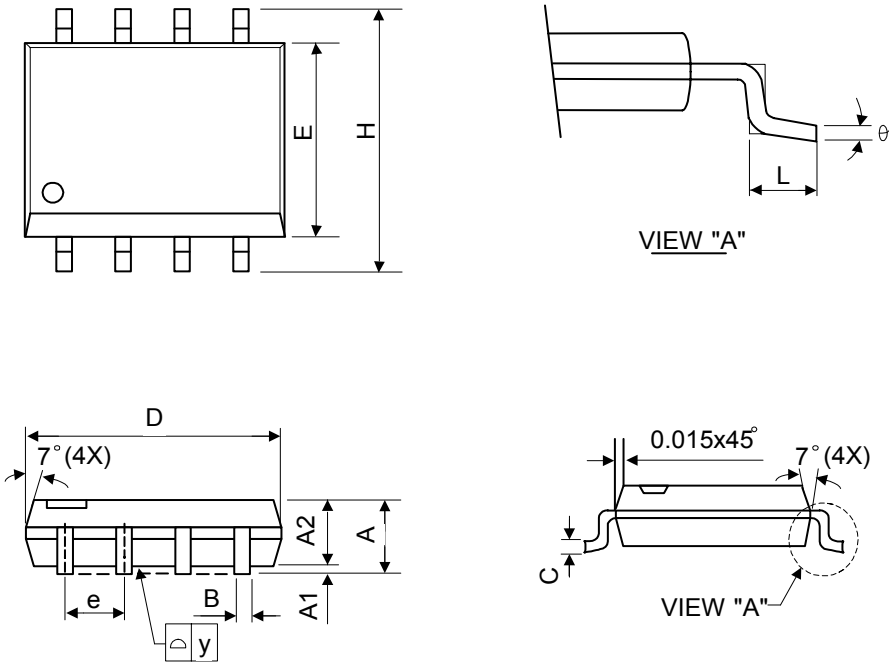
The current limit threshold is setting by connecting an external resistor from V_{CC} supply to OCSET. The voltage drop across this resistor is due to the 100uA internal sink sets the voltage at the pin. When the PWM voltage is less than the voltage at OCSET, an over-current condition occurs.

■ Marking Information



■ Package Information

Package Type: SOP-8L



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.40	1.60	1.75	0.055	0.063	0.069
A1	0.10	-	0.25	0.040	-	0.100
A2	1.30	1.45	1.50	0.051	0.057	0.059
B	0.33	0.41	0.51	0.013	0.016	0.020
C	0.19	0.20	0.25	0.0075	0.008	0.010
D	4.80	5.05	5.30	0.189	0.199	0.209
E	3.70	3.90	4.10	0.146	0.154	0.161
e	-	1.27	-	-	0.050	-
H	5.79	5.99	6.20	0.228	0.236	0.244
L	0.38	0.71	1.27	0.015	0.028	0.050
y	-	-	0.10	-	-	0.004
θ	0^{O}	-	8^{O}	0^{O}	-	8^{O}