

Not Recommended for New Designs



AP1511

PWM CONTROL 5A 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
- Lead-Free Package: SOP-16L
- Lead Free Finish/RoHS Compliant (Note 1)

General Description

AP1511 consists of step-down switching regulator with PWM control. These devices include a reference voltage source, oscillation circuit, error amplifier, internal PMOS and etc.

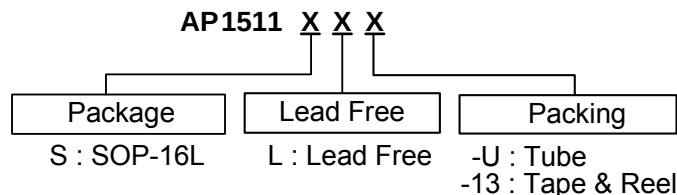
AP1511 provides low-ripple power, high efficiency, and excellent transient characteristics. The PWM control circuit is able to vary the duty ratio linearly from 0 up to 100%. This converter also contains an error amplifier circuit as well as a soft-start circuit that prevents overshoot at startup. An 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-16L mini-package, providing such outstanding features as low current consumption. Since this converter can accommodate an input voltage up to 23V, it is also suitable for the operation via an AC adapter.

Applications

- Microprocessor core supply
- Networking power supply
- Telecom power supply
- LCD MNT, TV power supply

Ordering Information



Note: 1. RoHS revision 13.2.2003. Glass and High Temperature Solder Exemptions Applied, see *EU Directive Annex Notes 5 and 7*.

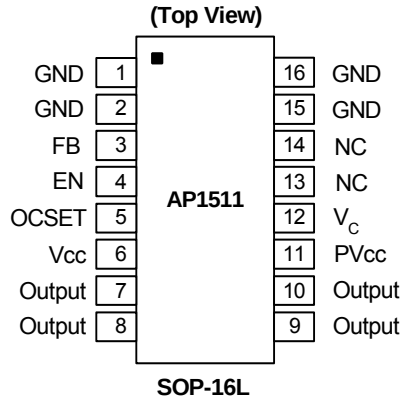
Device	Package Code	Packaging (Note 2)	Tube		13" Tape and Reel	
			Quantity	Part Number Suffix	Quantity	Part Number Suffix
AP1511S	S	SOP-16L	50	-U	2500/Tape & Reel	-13

Note: 2. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at <http://www.diodes.com/datasheets/ap02001.pdf>.

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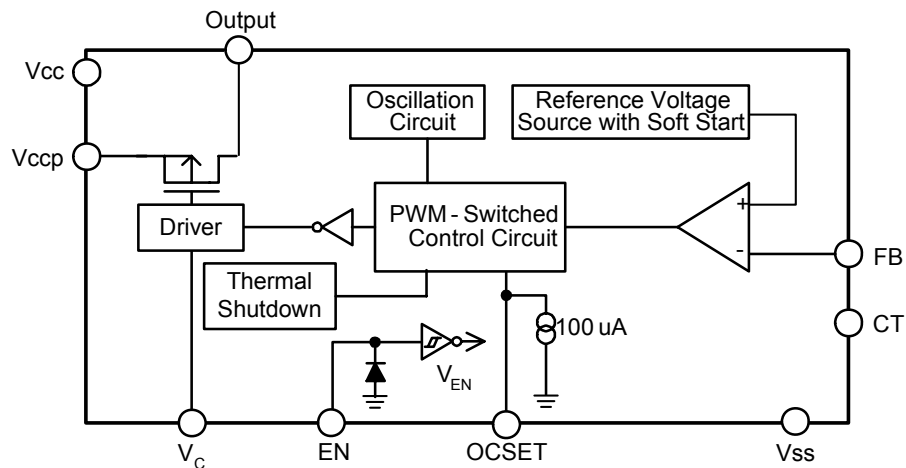
Pin Assignments



Pin Descriptions

Pin Name	Pin No.	Description
GND	1	GND pin
GND	2	GND pin
FB	3	Feedback pin
EN	4	H: Normal operation L: Step-down operation stopped
OCSET	5	Add an external resistor to set max output current.
Vcc	6	Signal Vcc
Output	7	Switch output pin
Output	8	Switch output pin
Output	9	Switch output pin
Output	10	Switch output pin
PVcc	11	Power Vcc
V _c	12	Voltage clamp pin
NC	13	Not connected
NC	14	Not connected
GND	15	GND pin
GND	16	GND pin

Block Diagram



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Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
ESD HBM	Human Body Model ESD Protection	5	KV
ESD MM	Machine Model ESD Protection	350	V
V_{CC}	V_{CC} Pin Voltage	$V_{SS} - 0.3$ to $V_{SS} + 25$	V
V_{FB}	V_{OUT} Pin Voltage	$V_{SS} - 0.3$ to V_{CC}	V
V_{EN}	EN Pin Voltage	$V_{SS} - 0.3$ to $V_{CC} + 0.3$	V
V_{OUTPUT}	Switch Pin Voltage	$V_{SS} - 0.3$ to $V_{IN} + 0.3$	V
P_D	Power Dissipation (Note 3)	Internally limited	mW
T_{OP}	Operating Junction Temperature	-20 to +125	°C
T_{ST}	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.

Note: 3. Due to the IC and SBD and Inductor were hot in high current, if you need to reduce the operation temperature that you must increase the component space or thermal dissipation space.

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{IN}	Input Voltage	3.6	23	V
I_{OUT}	Output Current	0	5	A
T_A	Operating Ambient Temperature	-20	125	°C

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Electrical Characteristics ($V_{IN} = 12V$, $T_A = 25^\circ C$, unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ.	Max	Unit
V_{FB}	Feedback Voltage	--	0.784	0.8	0.816	V
I_{FB}	Feedback Bias Current	$I_{OUT} = 0.1A$	-	0.1	0.5	μA
I_{SW}	Switch Current	--	5.5	-	-	A
I_{SSS}	Current Consumption During Power Off	$V_{EN} = 0V$	-	10	-	μA
$\frac{\Delta V_{OUT}}{V_{OUT}}$	Line Regulation	$V_{IN} = 3.6V \sim 23V$	-	1	2	%
$\frac{\Delta V_{OUT}}{V_{OUT}}$	Load Regulation	$I_{OUT} = 0 \text{ to } 5A$	-	0.5	1	%
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	-	-	KHz
V_{SH}	Power-Off Pin Input Voltage	Evaluate oscillation at SW pin	2.0	-	-	V
V_{SL}		Evaluate oscillation stop at SW pin	-	-	0.8	
I_{SH}	Power-Off 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
$R_{DS(on)}$	Internal MOSFET Rdson	$V_{IN} = 5V$, $V_{FB} = 0V$	-	70	100	m Ω
		$V_{IN} = 12V$, $V_{FB} = 0V$	-	50	70	
η	Efficiency	$V_{IN} = 12V$, $V_{OUT} = 5V$ $I_{OUT} = 5A$	-	90	-	%
θ_{JA}	Thermal Resistance Junction-to-Ambient	SOP-16 (Note 4)	-	156	-	$^\circ C/W$
θ_{JC}	Thermal Resistance Junction-to-case	SOP-16 (Note 4)	-	11	-	$^\circ C/W$

Note: 4. Test conditions for SOP-16L: No heat sink.

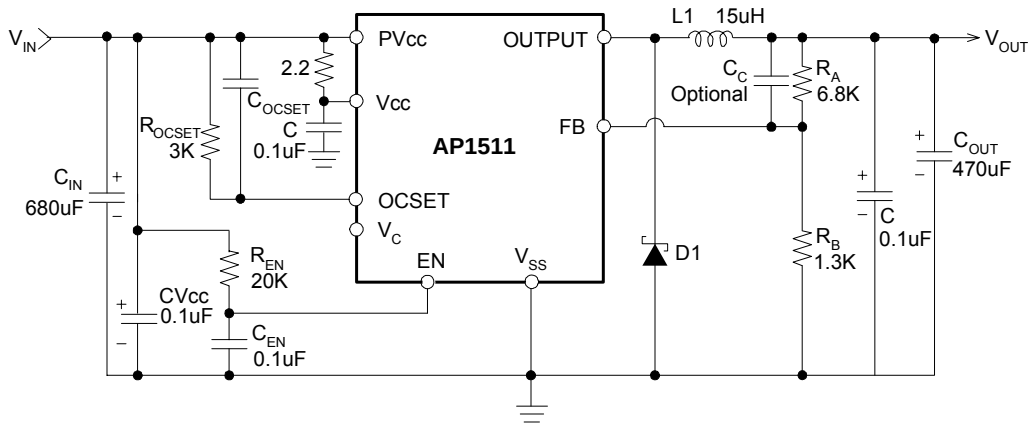
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Typical Application Circuit

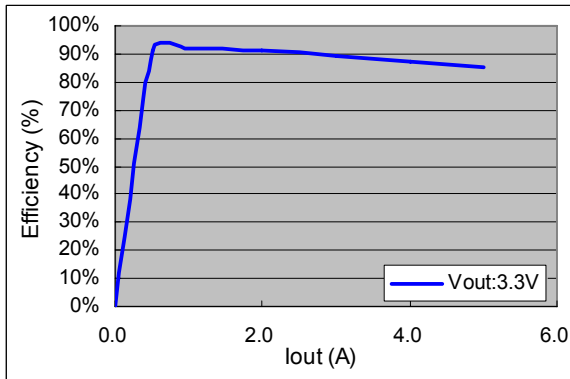


Note: $V_{OUT} = V_{REF} \times (1 + R_A/R_B)$
 $R_B = 1K \sim 10K \text{ ohm}$

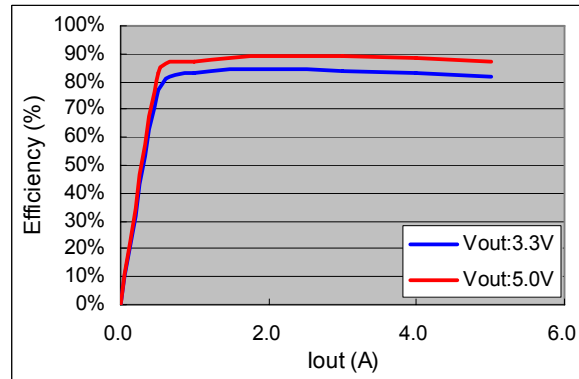
$V_{IN} = 12V, I_{MAX} = 5A$			
V_{OUT}	2.5V	3.3V	5V
L1 Value	10uH	12uH	15uH

Typical Performance Characteristics

Efficiency (Vin = +5V)



Efficiency (Vin = +12V)



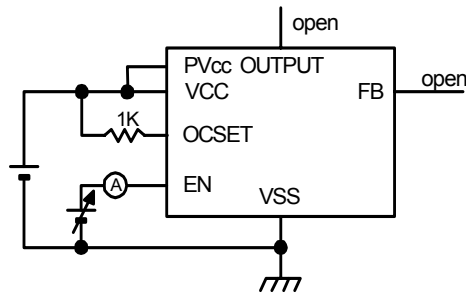
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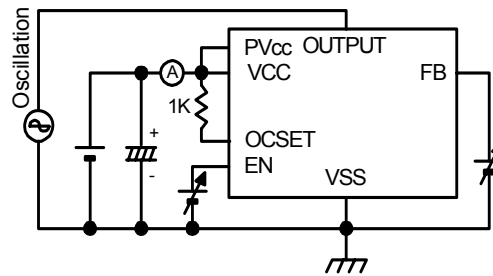
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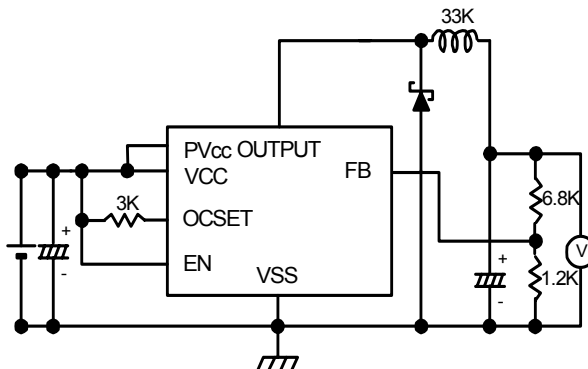
Test Circuit



Enable function test



Feedback function test



Operation function test

Function Description

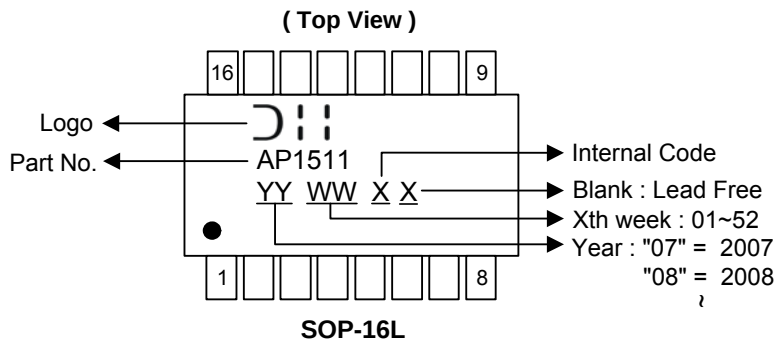
PWM Control

The AP1511 consists of DC/DC converters that employ a pulse-width modulation (PWM) system. In converters of the AP1511, the pulse width varies in a range from 0 to 100%, according to the load current. The 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.

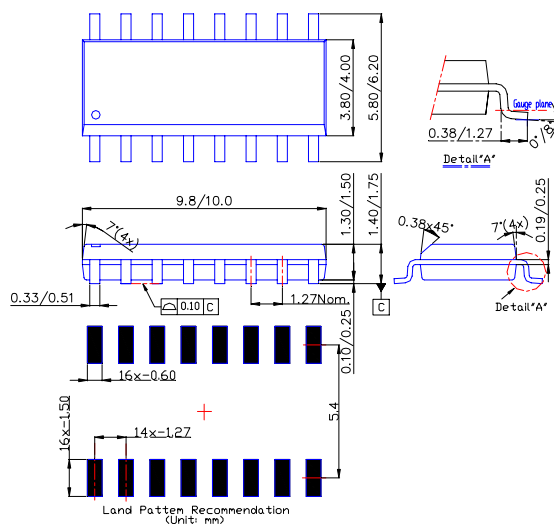


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Marking Information



Package Information (All Dimensions in mm)



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