



# AP1605

## PWM/PFM DUAL-MODE STEP-DOWN SWITCHING REGULATOR

### Features

- Low current consumption:  
In operation: 100 $\mu$ A max.  
Power off: 2 $\mu$ A max.
- Input voltage: 2.5V to 7V  
Adjustable version ( $\pm 2.5\%$ )
- PWM/PFM dual Mode
- Oscillation frequency: 300KHz (Typ.)
- With a power-off function.
- Built-in internal SW P-channel MOS
- Lead Free and Green Package: SOP-8L
- Lead Free Finish/RoHS Compliant (Note 1)

### General Description

AP1605 consists of CMOS step-down switching regulator with PWM/PFM dual mode control. These devices include a reference voltage source, oscillation circuit, error amplifier, internal PMOS and etc.

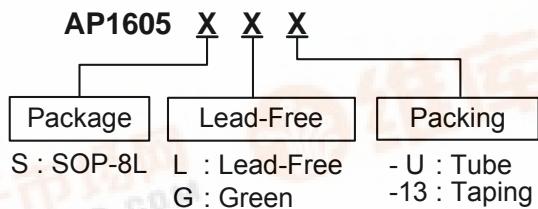
AP1605 provides low-ripple power, high efficiency, and excellent transient characteristics. The PWM/PFM control circuit is able to vary the duty ratio linearly 0%~0.25% (PFM) and 25%~100% (PWM).

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 7V, it is also ideal when operating via an AC adapter.

### Applications

- On-board power supply of battery devices for portable telephones, electronic notebooks, PDA, and other hand-held sets
- Power supplies for audio equipment, including portable CD players and headphone stereo equipment
- Fixed voltage power supply for cameras, video equipment and communications equipment
- Power supplies for microcomputers.
- Conversion from four Ni-H or Ni-Cd cells or two lithium-ion cells to 3.3V/3V
- Conversion of AC adapter input to 5V/3V

### Ordering Information



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

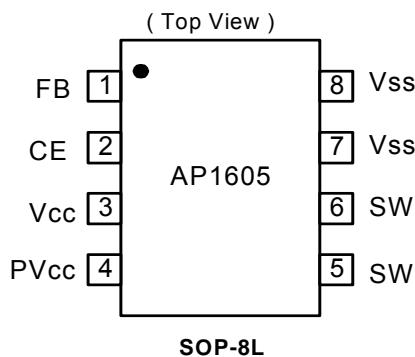
Device (Note 2)	Package Code	Packaging	Tube		13" Tape and Reel	
			Quantity	Part Number Suffix	Quantity	Part Number Suffix
AP1605S	S	SOP-8L	100	-U	2500/Tape & Reel	-13

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**

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**Pin Descriptions**

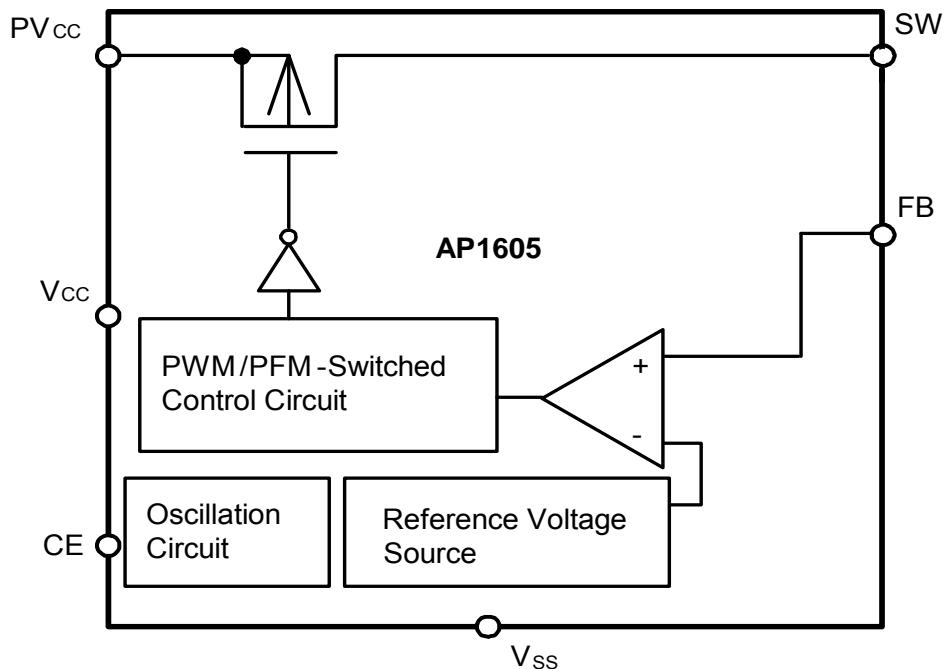
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Pin Name	Pin No. SOP	Description
FB	1	Feedback pin
CE	2	Chip Enable: H: Enable L: Disable
Vcc	3	IC signal power supply pin, add a 10Ω resistor to PVcc and a 0.1μF capacitor to GND.
PVcc	4	IC power supply pin
SW	5, 6	Switch Pin. Connect external inductor/diode here. Minimize trace area at this pin to reduce EMI.
Vss	7, 8	GND Pin

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**Block Diagram**

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**Absolute Maximum Ratings**

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Symbol	Parameter	Rating	Unit
$V_{CC}$	$V_{CC}$ Pin Voltage	$V_{SS} - 0.3$ to $V_{SS} + 8$	V
$PV_{CC}$	$PV_{CC}$ Pin Voltage	$V_{SS} - 0.3$ to $V_{SS} + 8$	V
FB	FB Pin Voltage	$V_{SS} - 0.3$ to $V_{SS} + 8$	V
$V_{CE}$	ON/OFF Pin Voltage	$V_{SS} - 0.3$ to $V_{SS} + 8$	V
$V_{SW}$	Switch Pin Voltage	$V_{SS} - 0.3$ to $V_{IN} + 0.3$	V
$P_D$	Power Dissipation	1200	mW
$T_{OPR}$	Operating Temperature Range	-20 to +85	°C
$T_{STG}$	Storage Temperature Range	-20 to +125	°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.

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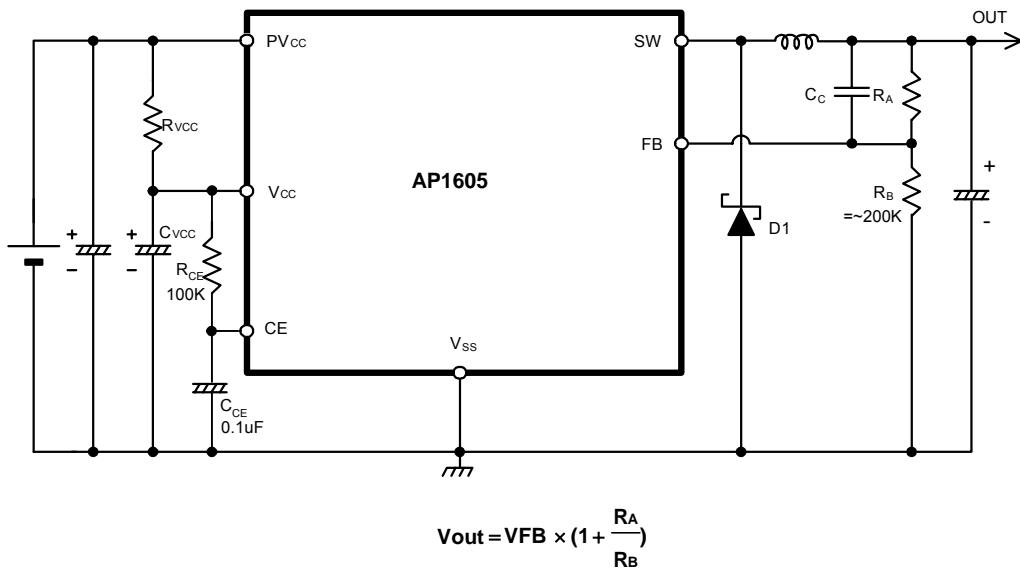
**Electrical Characteristics (  $V_{IN} = 5V$ ,  $T_A = 25^\circ C$ , unless otherwise specified )**

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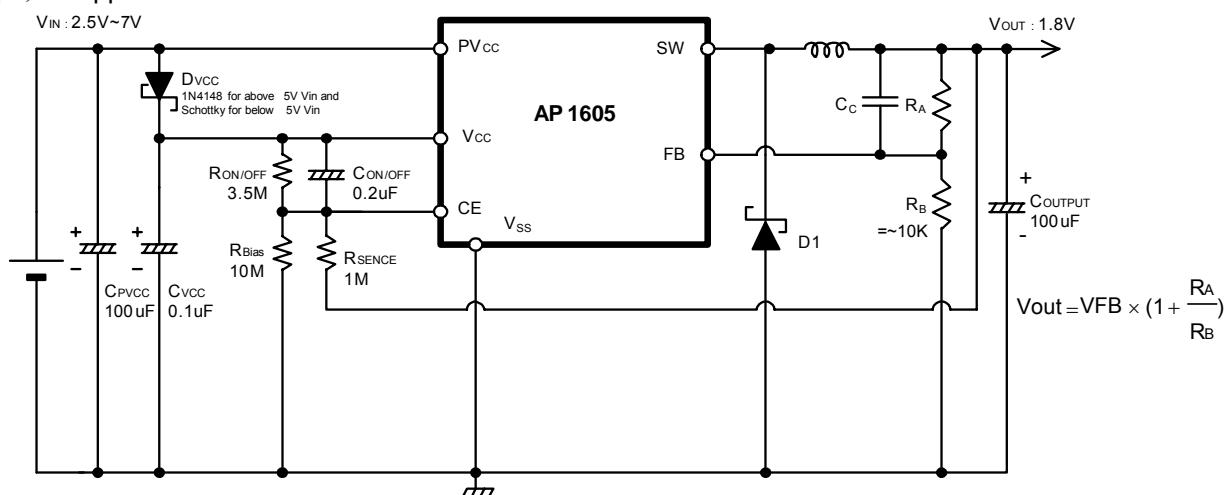
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{IN}$	Input Voltage	AP1605 Series	2.5	--	7	V
$V_{REF}$	Internal Reference Voltage		1.1625	1.2	1.2375	V
$V_{UVLO}$	UVLO Voltage	Voltage required to maintain $V_{OUT}$	--	--	2.2	V
MAXDTY	Maximum Duty Ratio		100	--	--	%
PFMDTY	PFM Duty Ratio		15	25	35	%
$I_{SW}$	Switch Current	Duty = 50%	3	--	--	A
$I_{SS}$	Current Consumption POWER <sub>ON</sub>	$V_{OUT} = 2.5V$	--	35	100	µA
$I_{SSS}$	Current Consumption During Power Off	$V_{ON/OFF} = 0V$	--	--	2	µA
$\Delta V_{OUT1}$	Line Regulation	$2.5V \sim 7V$ @ $I_{OUT} = 0.1A$	--	0.2	0.5	%
$\Delta V_{OUT2}$	Load Regulation	$0.1A \sim 3A$	--	1	1.5	%
$F_{OSC}$	Oscillation Frequency		220	300	380	KHz
$V_{CEH}$	CE Pin "High" Voltage	Evaluate oscillation at SW pin	0.65	--	--	$*V_{CC}$
$V_{CEL}$	CE Pin "Low" Voltage	Evaluate oscillation stop at SW pin	--	--	0.2	
$I_{SH}$	Power-Off Pin Input	--	-0.1	--	0.1	µA
$I_{SL}$	Leakage Current	--	-0.1	--	0.1	µA
EFFI	Efficiency	$V_{IN} = 5V$ , $V_{OUT} = 2.5V$ $I_{OUT} = 1A$	--	93	--	%

## Typical Application Circuit

## (1) Normal Application



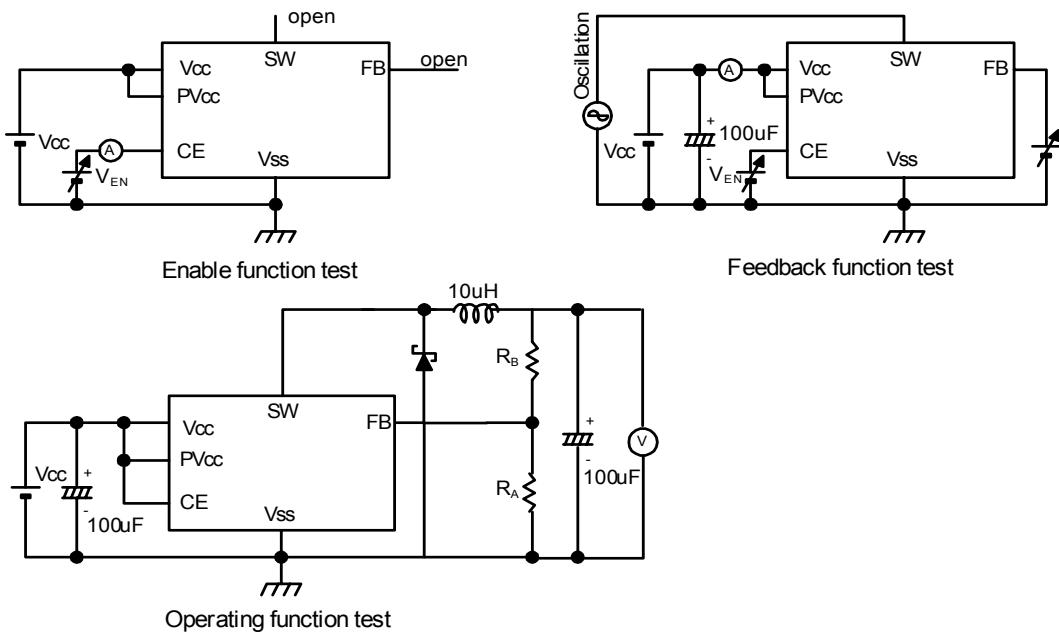
## (2) Application with Short Circuit Protection



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## Test Circuit

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## Function Description

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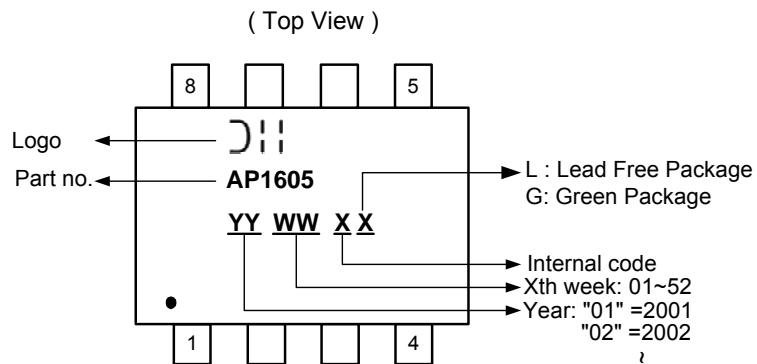
### PWM/PFM Control (AP1605 Series)

The AP1605 consists of DC/DC converters that employ a PWM/PFM auto-switch system.

In converters of the AP1605, the PFM mode varies in a range of duty cycle from 0% to 25%, and the PWM mode varies in a range of duty cycle from 25% 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.

## Marking Information

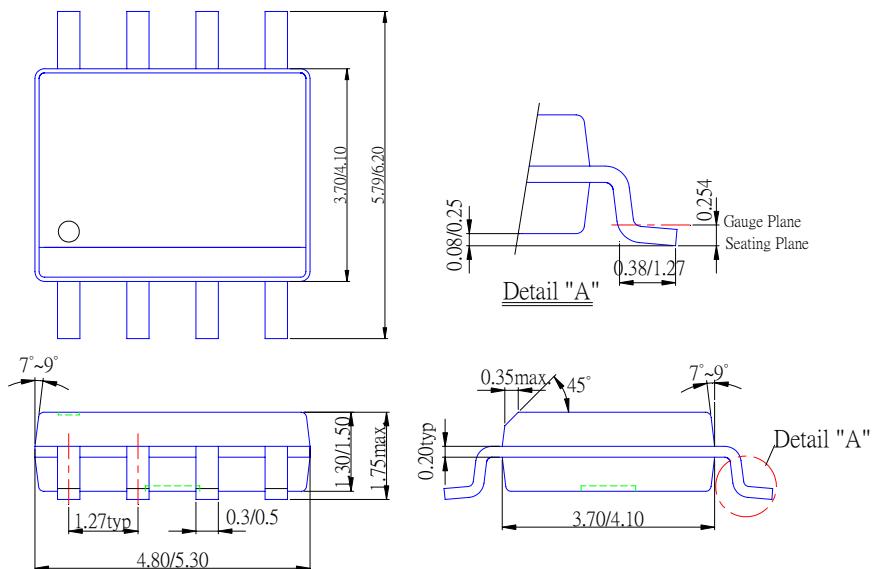
### (1) SOP-8L



Device	Package	Identification Code
AP1605S	SOP-8L	AP1605

## Package Information ( All Dimensions in mm )

### Package Type: SOP-8L





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