



**THE DATASHEET OF**  
**AP1605SG-13**



## 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).

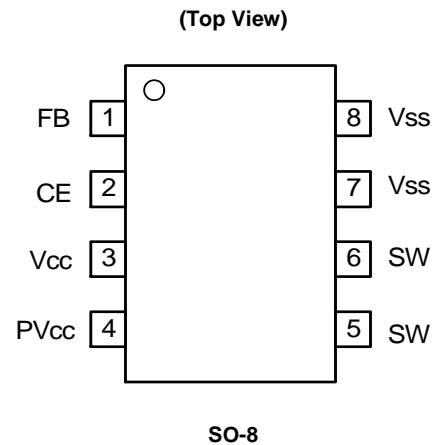
With the addition of an internal P-channel Power MOS, a coil, capacitors, and a diode connected externally, these ICs can function as step-down switching regulators. They serve as ideal power supply units for portable devices when coupled with the SO-8 mini-package, providing such outstanding features 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.

## Features

- Low Current Consumption:
  - In Operation: 100µA max.
  - Power Off: 2µA 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
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

## Pin Assignments

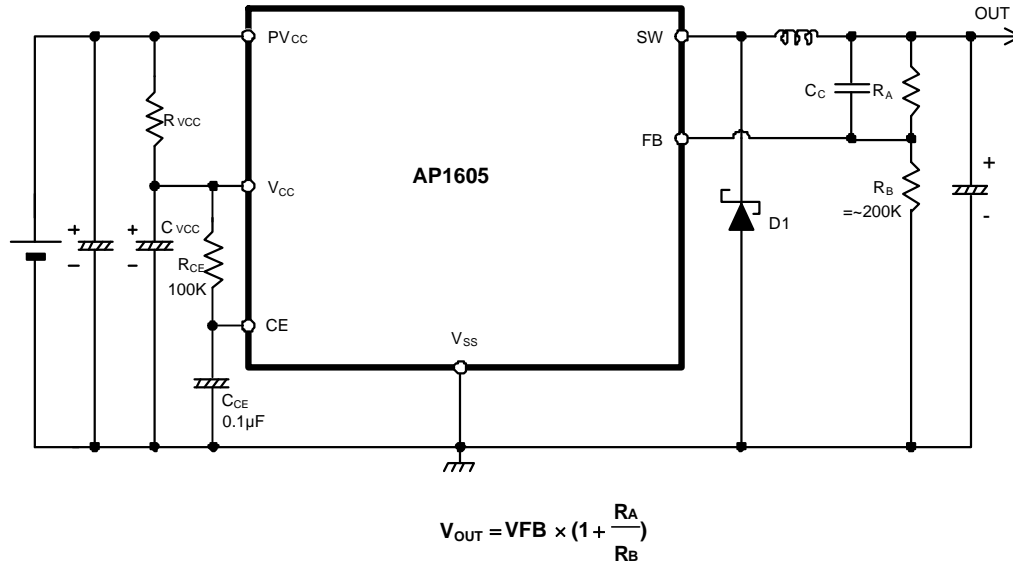


## Applications

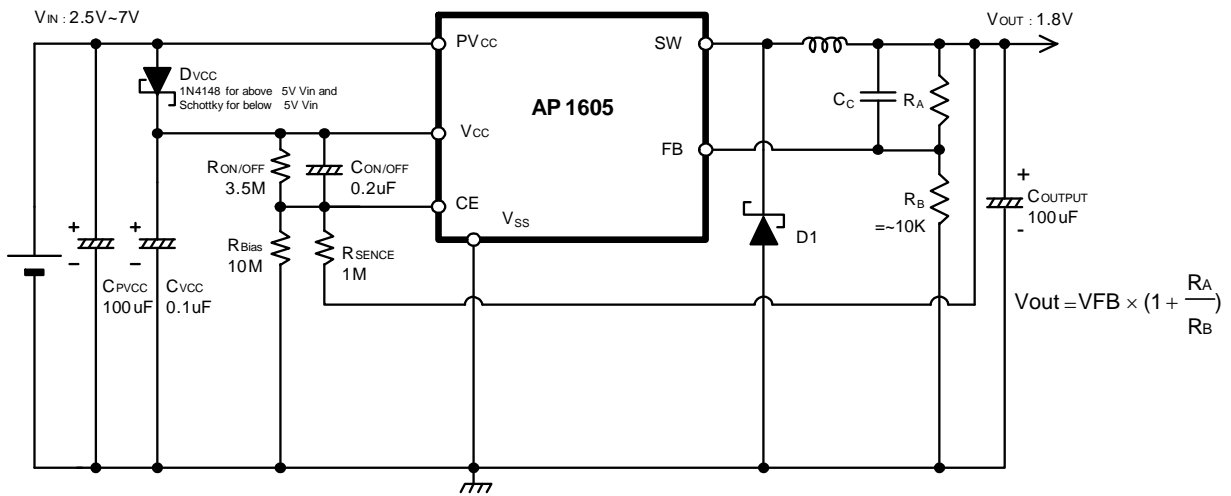
- On-board Power Supply of Battery Devices for Portable Telephones, Electronic Notebooks, PDA, and Other Hand-held Sets
- Power Supplies for Audio Equipment, Including Portable CD Players and Headphone Stereo Equipment
- Fixed Voltage Power Supply for Cameras, Video Equipment and Communications Equipment
- 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

**Typical Applications Circuit**

(1) Normal Application



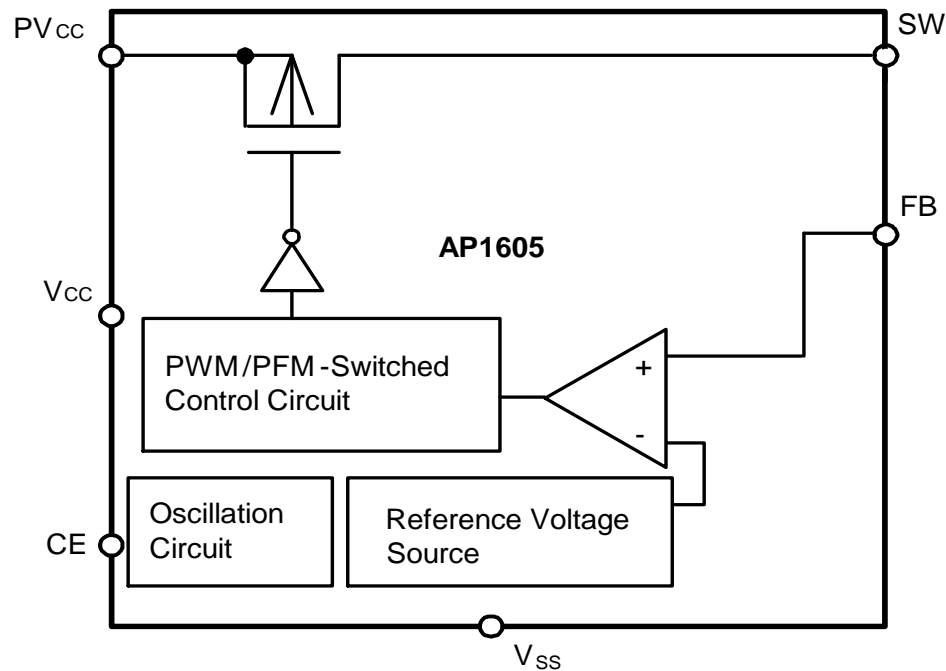
(2) Application with Short Circuit Protection



## Pin Descriptions

Pin Number	Pin Name	Description
1	FB	Feedback pin
2	CE	Chip Enable: H: Enable L: Disable
3	V <sub>CC</sub>	IC signal power supply pin, add a 10Ω resistor to PV <sub>CC</sub> and a 0.1μF capacitor to GND.
4	PV <sub>CC</sub>	IC power supply pin
5, 6	SW	Switch Pin. Connect external inductor/diode here. Minimize trace area at this pin to reduce EMI.
7, 8	V <sub>SS</sub>	GND Pin

## Functional Block Diagram



## Absolute Maximum Ratings

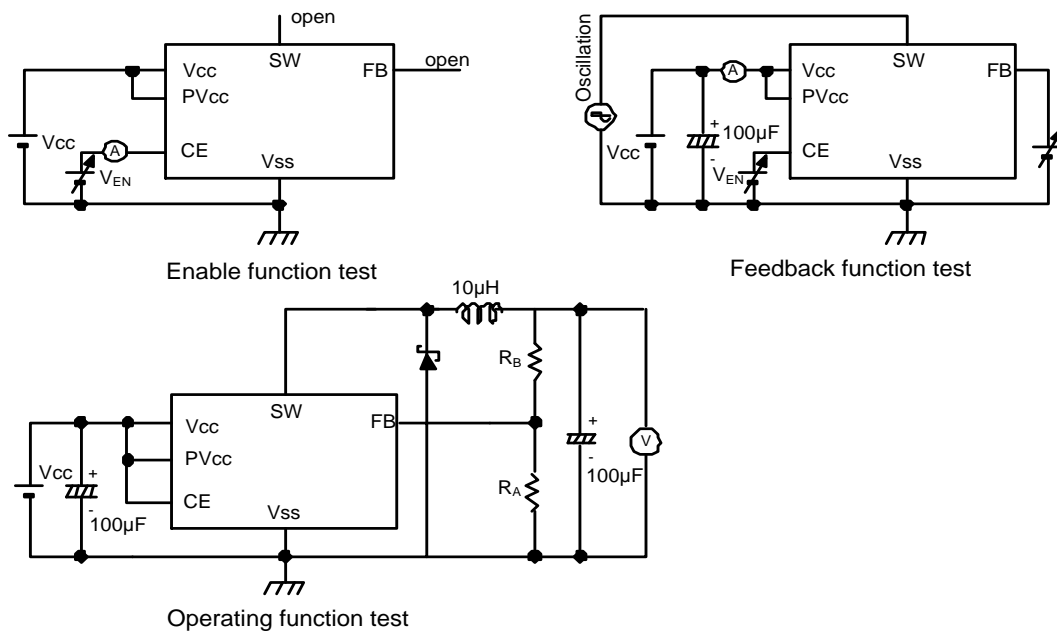
Symbol	Parameter	Rating	Unit
V <sub>CC</sub>	V <sub>CC</sub> Pin Voltage	V <sub>SS</sub> - 0.3 to V <sub>SS</sub> + 8	V
PV <sub>CC</sub>	PV <sub>CC</sub> Pin Voltage	V <sub>SS</sub> - 0.3 to V <sub>SS</sub> + 8	V
FB	FB Pin Voltage	V <sub>SS</sub> - 0.3 to V <sub>SS</sub> + 8	V
V <sub>CE</sub>	CE Pin Voltage	V <sub>SS</sub> - 0.3 to V <sub>SS</sub> + 8	V
V <sub>SW</sub>	SW Pin Voltage	V <sub>SS</sub> - 0.3 to V <sub>IN</sub> + 0.3	V
P <sub>D</sub>	Power Dissipation	1200	mW
T <sub>OPR</sub>	Operating Temperature Range	-20 to +85	°C
T <sub>STG</sub>	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.

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

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 $POWER_{ON}$	$V_{OUT} = 2.5V$	—	35	100	$\mu A$
$I_{SSS}$	Current Consumption During Power Off	$V_{ON/OFF} = 0V$	—	—	2	$\mu A$
$\Delta V_{OUT1}$	Line Regulation	2.5V to 7V @ $I_{OUT} = 0.1A$	—	0.2	0.5	%
$\Delta V_{OUT2}$	Load Regulation	0.1A to 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	
$I_{SH}$	CE Pin Input Leakage Current	—	-0.1	—	0.1	$\mu A$
$I_{SL}$		—	-0.1	—	0.1	$\mu A$
EFFI	Efficiency	$V_{IN} = 5V$ , $V_{OUT} = 2.5V$ , $I_{OUT} = 1A$	—	93	—	%

**Test Circuit**



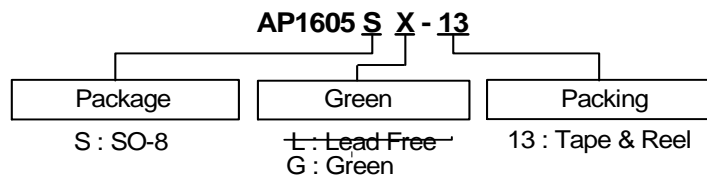
## Functional Description

### 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.

## Ordering Information

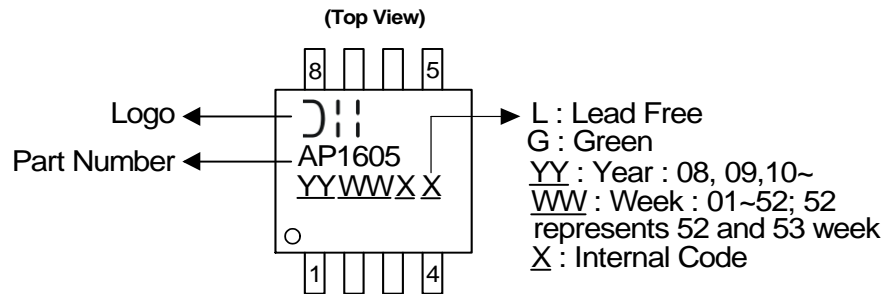


Part Number (Note 4)	Package Code	Package (Note 5)	Green	Quantity	Part Number Suffix		Status (Note 4)
					Tube	13" Tape and Reel	
AP1605SG-13	S	SO-8	Green	2500	NA	-13	In production

Notes: 4. All Lead-Free variants are End of life without replacement.  
 5. For packaging details, go to our website at: <https://www.diodes.com/design/support/packaging/diodes-packaging/diodes-package-outlines-and-pad-layouts/>.

## Marking Information (Note 5)

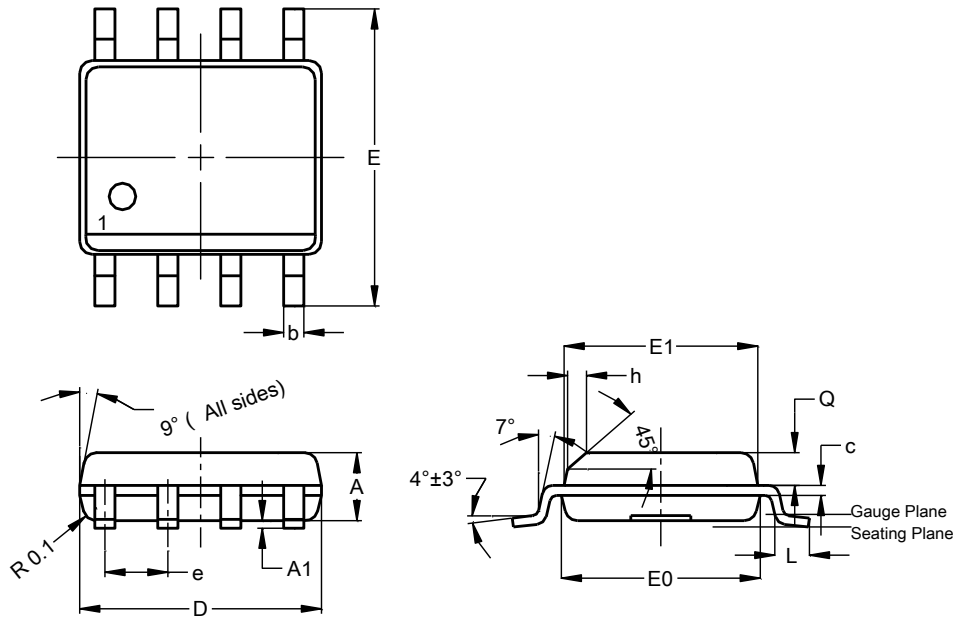
(1) SO-8



## Package Outline Dimensions

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

### SO-8



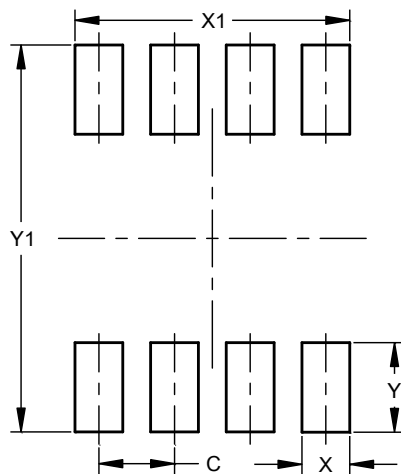
SO-8			
Dim	Min	Max	Typ
A	1.40	1.50	1.45
A1	0.10	0.20	0.15
b	0.30	0.50	0.40
c	0.15	0.25	0.20
D	4.85	4.95	4.90
E	5.90	6.10	6.00
E1	3.80	3.90	3.85
E0	3.85	3.95	3.90
e	--	--	1.27
h	-	--	0.35
L	0.62	0.82	0.72
Q	0.60	0.70	0.65

All Dimensions in mm

## Suggested Pad Layout

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

### SO-8



Dimensions	Value (in mm)
C	1.27
X	0.802
X1	4.612
Y	1.505
Y1	6.50

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