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).

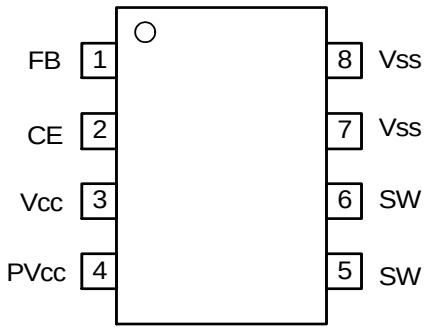
With the addition of an internal P-channel Power MOS, a coil, capacitors, and a diode connected externally, these ICs can function as step-down switching regulators. They serve as ideal power supply units for portable devices when coupled with the SO-8 mini-package, providing such outstanding features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

Pin Assignments

(Top View)



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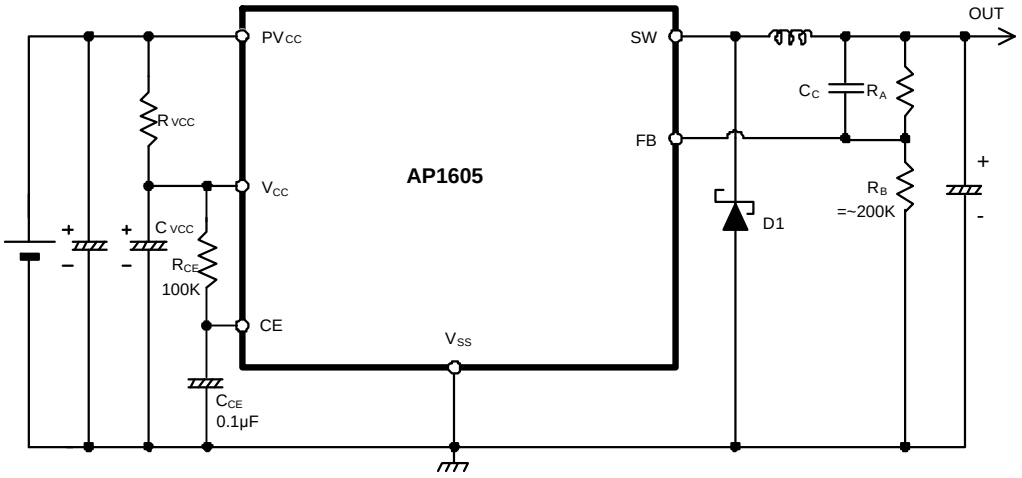
Applications

- 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

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 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.

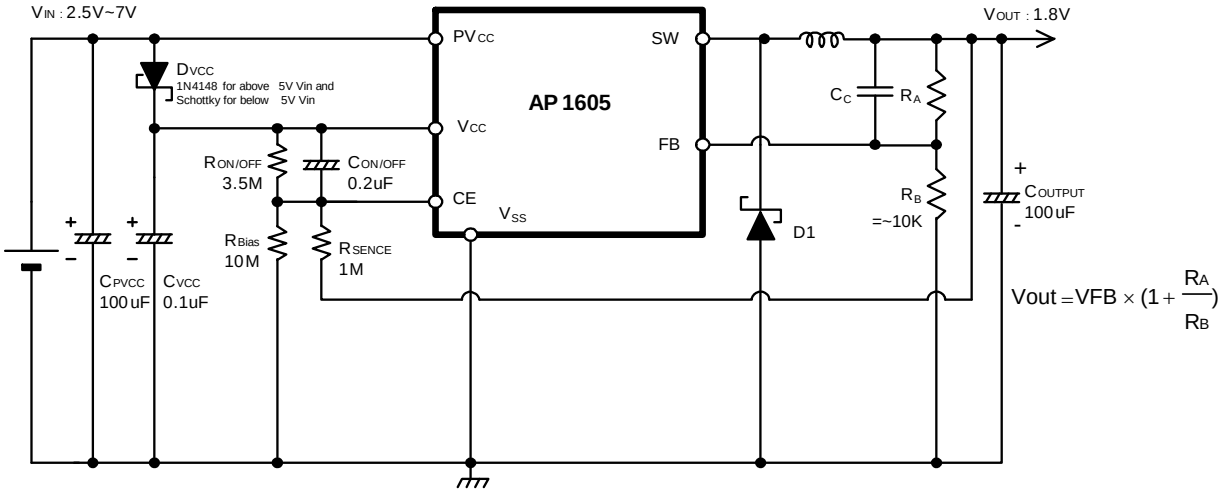
Typical Applications Circuit

(1) Normal Application



$$V_{OUT} = VFB \times (1 + \frac{R_A}{R_B})$$

(2) Application with Short Circuit Protection

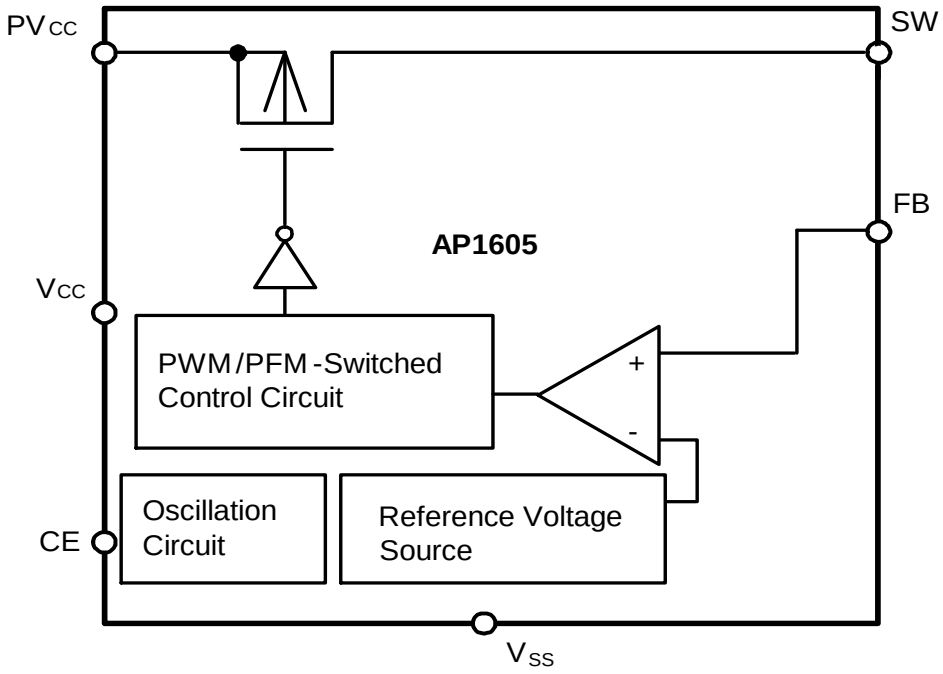


$$Vout = VFB \times (1 + \frac{R_A}{R_B})$$

Pin Descriptions

Pin Number	Pin Name	Description
1	FB	Feedback pin
2	CE	Chip Enable: H: Enable L: Disable
3	V_{CC}	IC signal power supply pin, add a 10Ω resistor to PV_{CC} and a 0.1μF capacitor to GND.
4	PV_{CC}	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_{SS}	GND Pin

Functional Block Diagram



Absolute Maximum Ratings

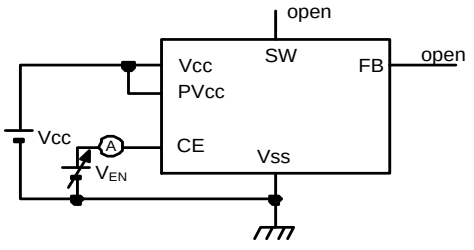
Symbol	Parameter	Rating	Unit
V_{CC}	V_{CC} Pin Voltage	V_{SS} - 0.3 to V_{SS} + 8	V
PV_{CC}	PV_{CC} Pin Voltage	V_{SS} - 0.3 to V_{SS} + 8	V
FB	FB Pin Voltage	V_{SS} - 0.3 to V_{SS} + 8	V
V_{CE}	CE Pin Voltage	V_{SS} - 0.3 to V_{SS} + 8	V
V_{SW}	SW Pin Voltage	V_{SS} - 0.3 to V_{IN} + 0.3	V
P_D	Power 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.

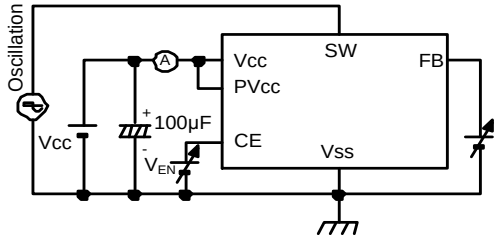
Electrical Characteristics (V_{IN} = 5V, T_A = +25°C, unless otherwise specified.)

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	μA
I_{SSS}	Current Consumption During Power Off	$V_{ON/OFF}$ = 0V	—	—	2	μA
ΔV_{OUT1}	Line Regulation	2.5V to 7V @ I_{OUT} = 0.1A	—	0.2	0.5	%
ΔV_{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	μA
I_{SL}		—	-0.1	—	0.1	μA
EFFI	Efficiency	V_{IN} = 5V, V_{OUT} = 2.5V, I_{OUT} = 1A	—	93	—	%

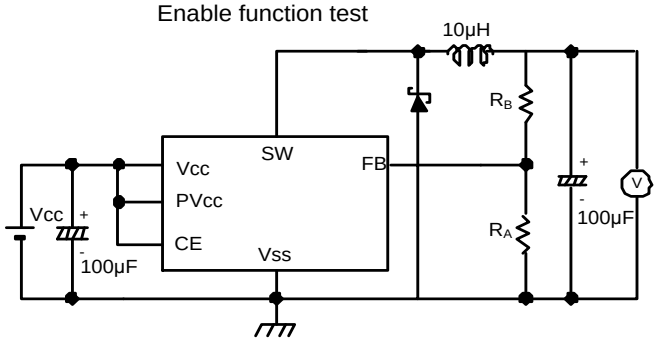
Test Circuit



Enable function test



Feedback function test



Operating function test

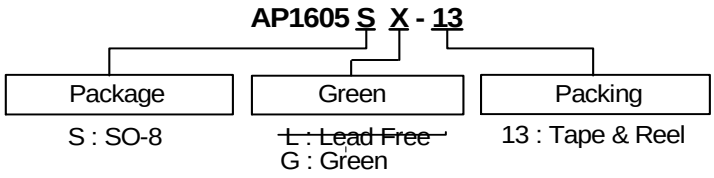
Functional Description

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

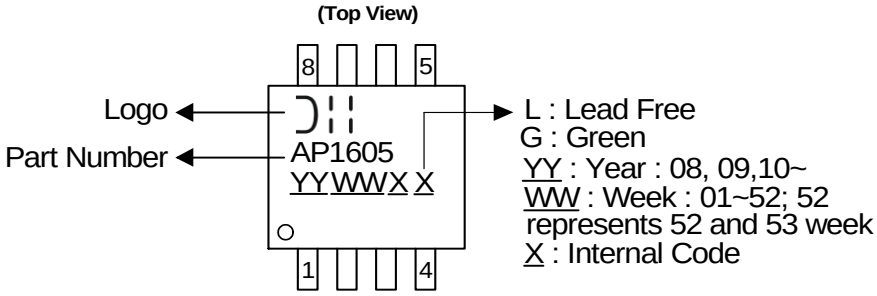


Part Number (Note 4)	Package Code	Package (Note 5)	Green	Quantity	Part Number Suffix		Status (Note 4)
					Tube	13'' Tape and Reel	
AP1605SG-13	S	SO-8	Green	2500	NA	-13	In production

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)

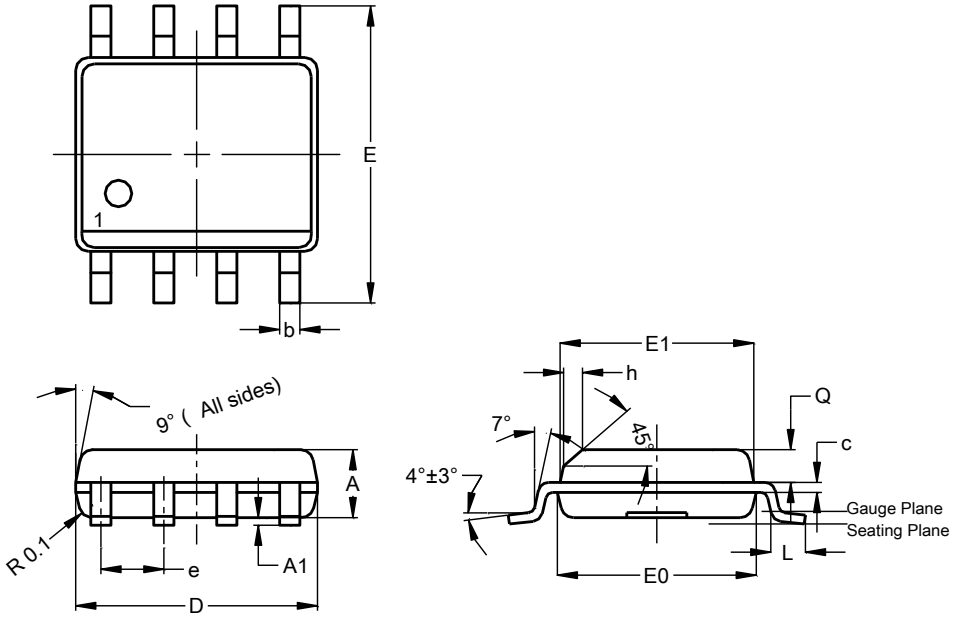
(1) SO-8



Package Outline Dimensions

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

SO-8



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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.

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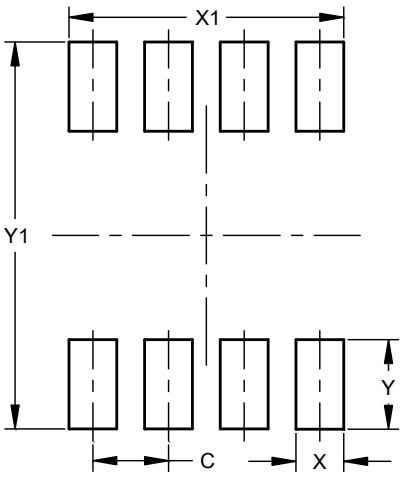

Dimensions	Value (in mm)
C	1.27
X	0.802
X1	4.612
Y	1.505
Y1	6.50

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