❖ **GENERAL DESCRIPTION**

The APE1901 is high efficient step-up DC/DC converter. Large output current is possible having a built in internal N channel MOSFET, and using an external coil and diode.

The APE1901 can be operated at switching frequencies of 500kHz allowing for easy filtering and low noise, the size of the external components can be reduced.

Output voltage is programmable with 1.0V of standard voltage supply internal, and using externally connected components, output voltage (FB) can be set up at will.

This converter also contains an error amplifier circuit as well as a soft-start circuit that prevents inrush-current at startup. An enable function and thermal shutdown functions are built inside.
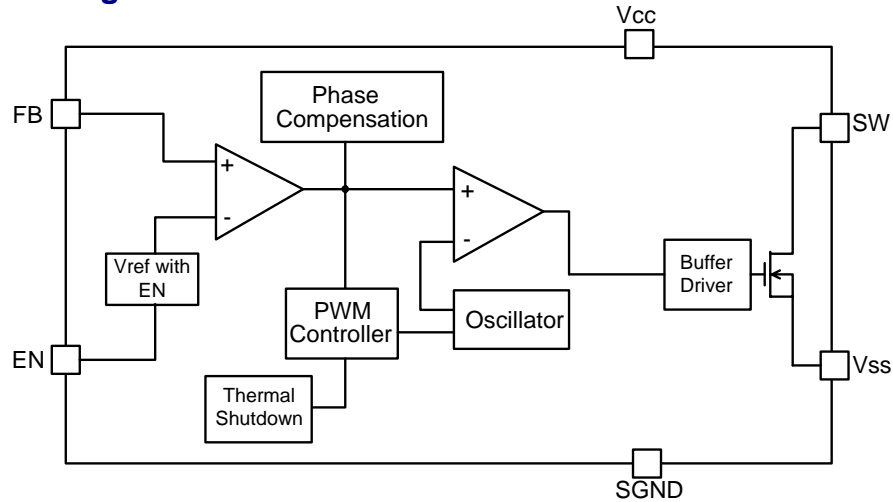
❖ **FEATURES**

- Input voltage: 3V to 15V
- Output voltage: 3.3V to 28V(±2.5%）
- Duty ratio: 0% to 80% PWM control
- Switch current: 3A(MAX)
- Oscillation frequency: 500KHz.
- Enable function
- Soft-start function
- Thermal Shutdown function
- Built-in internal SW N-channel MOS
- SOP-8L Pb-Free Package.

❖ Block Diagram

❖ PIN ASSIGNMENT

The package of AX5101A is SOP-8L; the pin assignment is given by:

(Top View)

```
SGND  1        8  Vss
EN    2        7  Vss
VCC   3  APE1901  6  SW
FB    4        5  SW
```

SOP-8L

Name	Description
SGND	Signal ground pin.
EN	Power-off pin H：normal operation(Step-up) L：Step-up operation stopped (All circuits deactivated)
V_{CC}	IC power supply pin
FB	Feedback pin
SW	Switch pin. Connect external inductor & diode here.
V_{SS}	GND pin

❖ ORDER/MARKING INFORMATION

Order Information	Top Marking
APE1901X X Frequency Package Type A ：500Khz M: SOP-8L	1901AM ► Part number Y WW SSS ► ID code: internal ► WW: 01~52 ► Year : 6 = 2006

Step-up PWM DC/DC Converter

❖ **Absolute Maximum Ratings** (at Ta=25℃)

Characteristics	Symbol	Rating	Unit
VCC Pin Voltage	V_{CC}	V_{SS} - 0.3 to V_{SS} + 15	V
Feedback Pin Voltage	V_{FB}	V_{SS} - 0.3 to V_{CC}	V
ON/OFF Pin Voltage	V_{EN}	V_{SS} - 0.3 to V_{CC}	V
Switch Pin Voltage	V_{SW}	V_{SS} - 0.3 to 30	V
Power Dissipation	PD	Internally limited	mW
Storage Temperature Range	T_{ST}	-40 to +150	℃
Operating Temperature Range	T_{OP}	-20 to +125	℃
Operating Supply Voltage	V_{OP}	+3 to +15	V
Thermal Resistance from Junction to case	θ_{JC}	25	℃/W
Thermal Resistance from Junction to ambient	θ_{JA}	70	℃/W

Note : θ_{JA} is measured with the PCB copper area of approximately 2 in²(Multi-layer) that need connect to SW pins(5&6) of the APE1901.

❖ **Electrical Characteristics** (V_{IN} = 6V, V_{OUT}=12V, Ta=25℃, unless otherwise specified)

Characteristics	Symbol	Conditions		Min	Typ	Max	Units
Feedback Voltage	V_{FB}	I_{OUT}=0.1A		0.98	1.00	1.02	V
Quiescent Current	I_{CCQ}	V_{FB}=1.5V force driver off			4	6	mA
Feedback Bias Current	I_{FB}	I_{OUT}=0.1A		-	0.1	0.5	uA
Shutdown Supply Current	I_{SD}	V_{EN} =0V		-	2	10	uA
Switch Current	I_{SW}			3.2	-	-	A
Oscillation Frequency	F_{OSC}	SW pin		400	500	600	KHz
EN Pin Logic input threshold voltage	V_{SH}	High (regulator ON)		2.0	-	-	V
	V_{SL}	Low (regulator OFF)		-	-	0.8	
EN Pin Input Current	I_{SH}	V_{EN}=2.5V (ON)		-	20	-	uA
	I_{SL}	V_{EN}=0.3V (OFF)		-	-10	-	uA
Soft-Start Time	T_{SS}			0.3	4	8	ms
Internal MOSFET R_{DSON}	R_{DSON}	V_{CC}=3V, V_{FB}=0V		-	50	70	mΩ
		V_{CC}=5V, V_{FB}=0V			40	60	
		V_{CC}=12V, V_{FB}=0V		-	30	50	
Efficiency	EFFI	V_{CC} = 6V, V_{OUT} = 12V	I_{sw} = 2A	-	93	-	%
			I_{sw} = 3A		92		
Maximum Duty Cycle	DC_{MAX}	V_{FB}=0.4V		-	80	-	%
Minimum Duty Cycle	DC_{MIN}	V_{FB}=1.2V		-	0	-	
Thermal shutdown Temp	TSD				125		℃

❖ Application Circuit

1. VCC=6V, VOUT=12V/0.8A
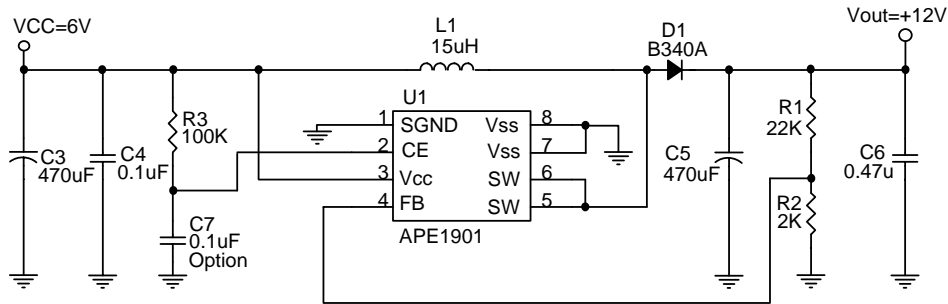
1. $VOUT = VREF \times (1 + \dfrac{R1}{R2})$

   $VREF = 1.0V$; R2 suggest 0.75K ~ 2.5k

2. VCC=6V, VOUT=12V/1.4A
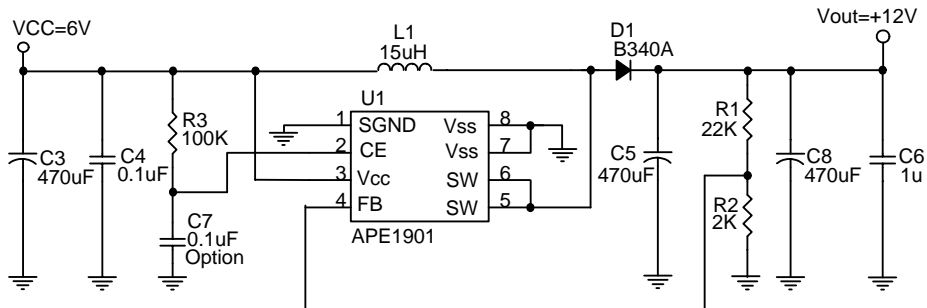
V_{IN}=6V, I_{SW}=3A			
V_{OUT}	12V	18V	24V
L1 Value	15uH	22uH	27uH

3. VCC=12V, VOUT=18V/1.8A
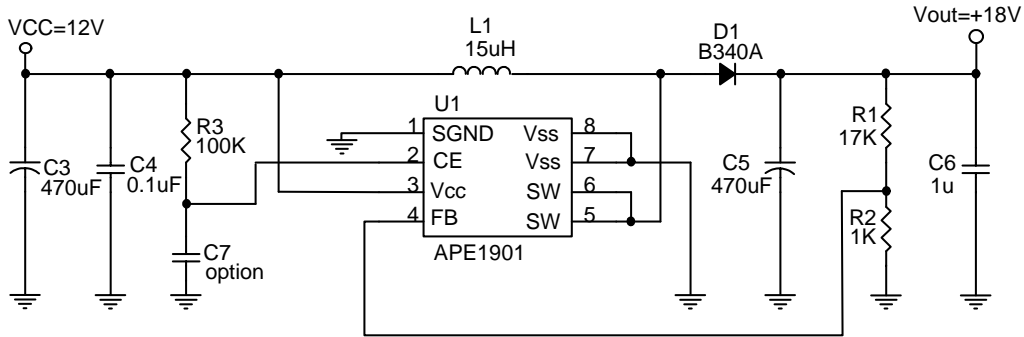
V$_{IN}$=12V, I$_{SW}$=3A			
V$_{OUT}$	18V	24V	28V
L1 Value	15uH	22uH	27uH

4. VCC=3.0V, VOUT=5V/0.45A
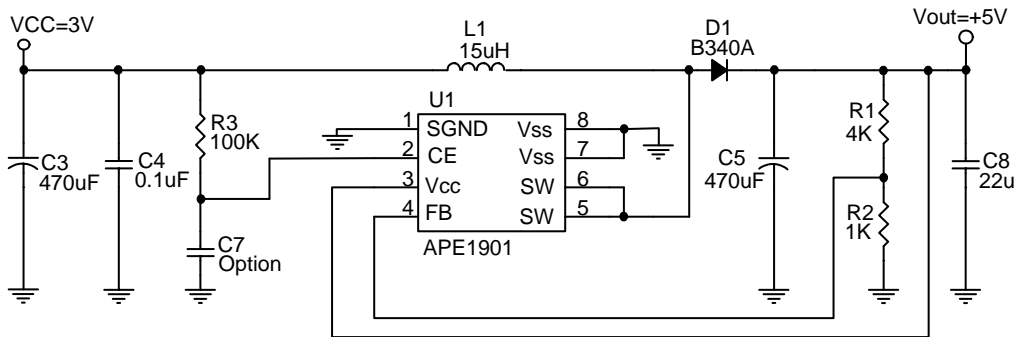
❖ Function Descriptions

PWM Control

    The APE1901 consists of DC/DC converters that employ a pulse-width modulation (PWM) system.

In converters of the APE1901, the pulse width varies in a range from 0 to 80%, 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.

Setting the Output Voltage

Application circuit item shows the basic application circuit with APE1901 adjustable output version. The external resistor sets the output voltage according to the following equation:

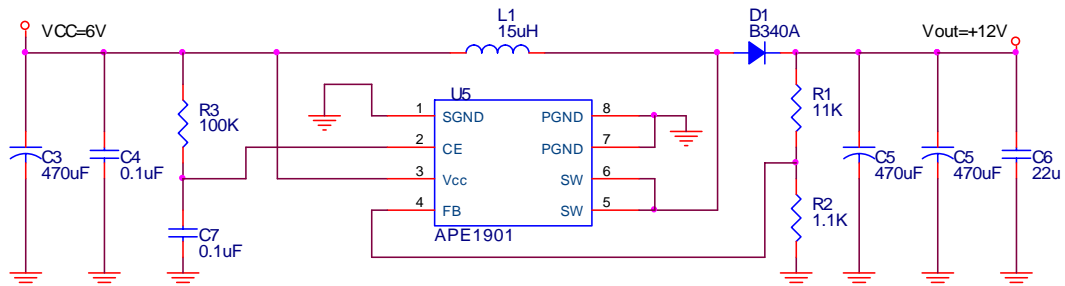$$V_{OUT} = 1.0V \times \left(1 + \frac{R1}{R2}\right)$$

Output Voltage Ripple

Application circuit item shows the basic application circuit with APE1901. The output voltage ripple (V_{RIPPLE}) very lager at high switch current(I_{SW}=3A, $V_{RIPPLE} \fallingdotseq 0.7V$), external π filters can reduce output voltage ripple or add MLCC 22uF at output(see next page for output ripple wave):

a. π filters
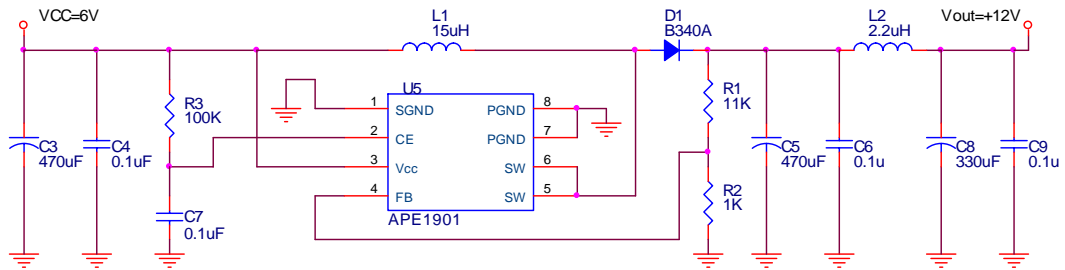
b. C6=22uF(MLCC)

PCB layout guide

If you need low Tc & Tj or large PD(Power Dissipation), The dual SW pins(5&6) at the SOP-8L package are internally connected to die pad, The PCB layout should allow for maximum possible copper area at the V_{CC} pins of the APE1901.
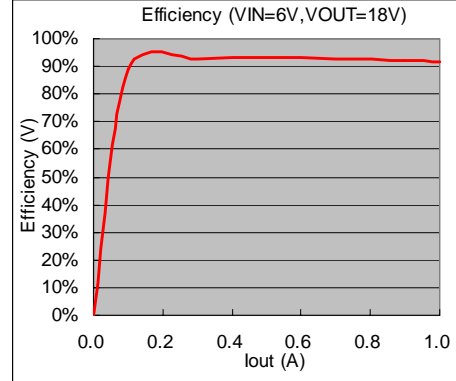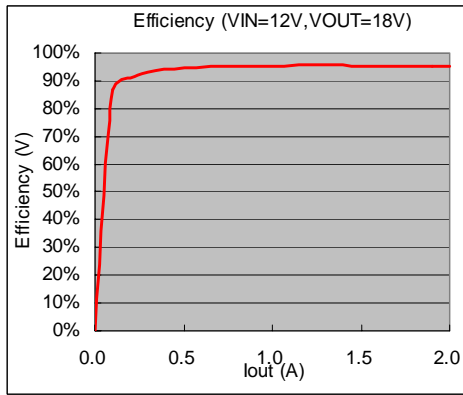
Advanced Power Electronics Corp.
Step-up PWM DC/DC Converter

❖ Typical Characteristics

Efficiency
(V_{IN}=6V, V_{OUT}=12V/1.4A)

Efficiency (VIN=6V,VOUT=12V)
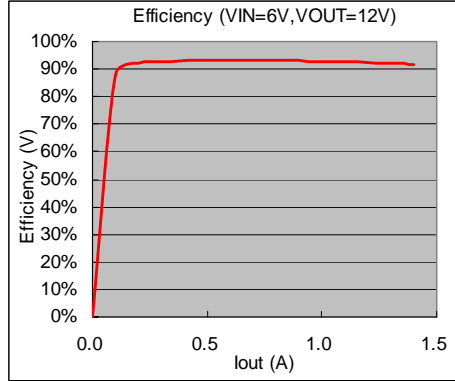
Efficiency
(V_{IN}=6V, V_{OUT}=18V/1.0A)

Efficiency (VIN=6V,VOUT=18V)

Efficiency
(V_{IN}=12V, V_{OUT}=18V/2.0A)

Efficiency (VIN=12V,VOUT=18V)

VOUT RIPPLE=710mV
(V_{IN}=6V, I_{IN}=3A, V_{OUT}=12V/1.4A)
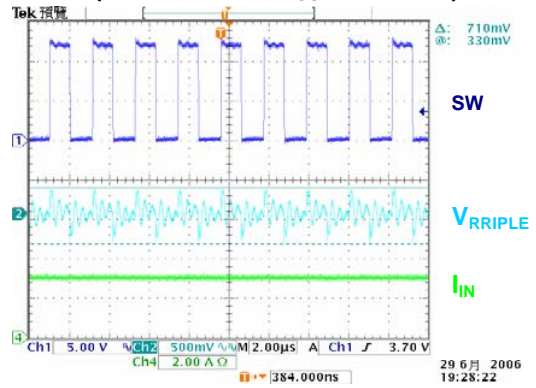
(C6=22uF(MLCC – PAGE 6))
VOUT RIPPLE=102mV
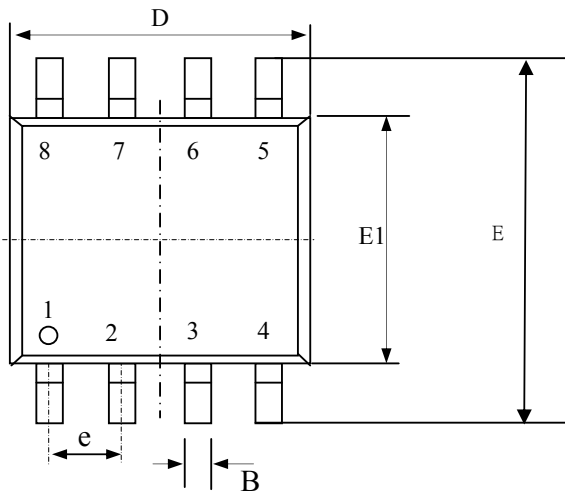**(V_{IN}=6V, I_{IN}=3A, V_{OUT}=12V/1.4A**
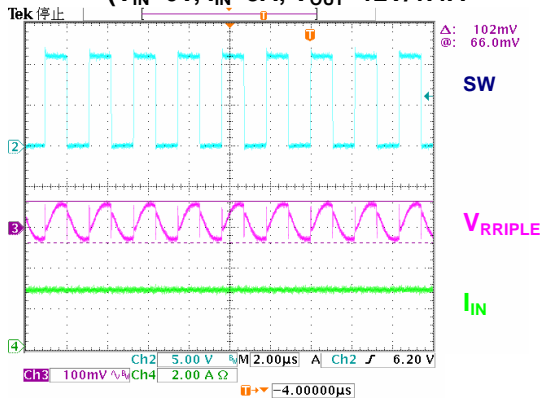
(external π filters – PAGE 6)
VOUT RIPPLE=17mV
(V_{IN}=6V, I_{IN}=3A, V_{OUT}=12V/1.4A)

ADVANCED POWER ELECTRONICS CORP.
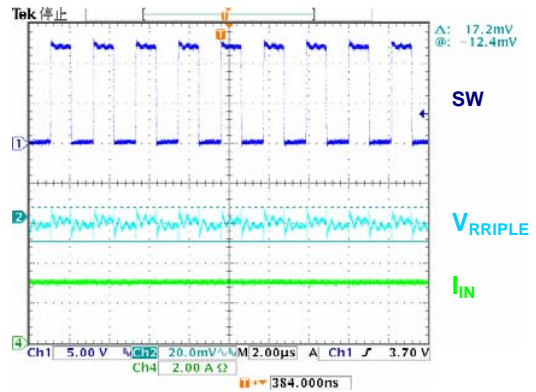
Package Outline : SO-8

SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.10	0.18	0.25
B	0.33	0.41	0.51
C	0.19	0.22	0.25
D	4.80	4.90	5.00
E1	3.80	3.90	4.00
E	5.80	6.15	6.50
L	0.38	0.71	1.27
θ	0	4.00	8.00
e	1.27 TYP		

DETAIL A
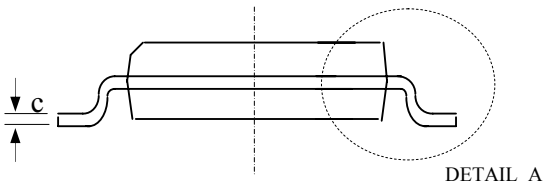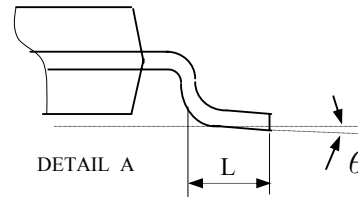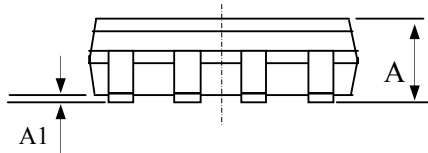
1.All Dimension Are In Millimeters.

2.Dimension Does Not Include Mold Protrusions.

DETAIL A

Part Marking Information & Packing : SO-8

1901AM
YWWSSS
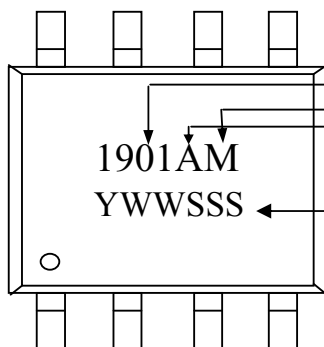
Part Number

Package Code

Frequency

Date Code (YWWSSS)

Y：Last Digit Of The Year

WW：Week

SSS：Sequence