

### ■ Features

- Provides two regulated voltages
  - one PWM Regulator
  - one Linear Controller
- Output voltage: 3.3V, 5V, 12V and adjustable output version
- Adjustable version output voltage range, 1.23V to 12V $\pm$ 2%
- 200Khz  $\pm$ 10% fixed switching frequency
- Thermal-shutdown and current-limit protection
- Shutdown control input(EN pin)
- Operating voltage can be up to 18V
- Output load current: 2A
- 7-pin SOP package
- Low power standby mode
- Built-in switching transistor on chip

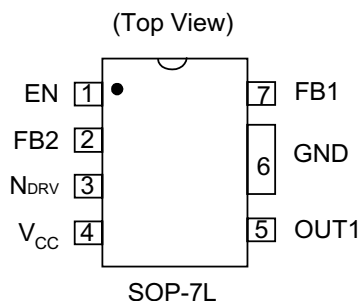
### ■ Applications

- Simple High-efficiency step-down regulator
- On-card switching regulators
- Positive to negative converter

### ■ General Description

The AP1502 series are monolithic IC that design for PWM and linear power controller. The PWM regulator ability of driving a 2A load without additional transistor component. Due to reducing the number of external component, the board space can be saved easily. The external shutdown function can be controlled by logic level and then come into standby mode. The internal compensation makes feedback control have good line and load regulation without external design. Regarding protected function, thermal shutdown is to prevent over temperature operating from damage, and current limit is against over current operating of the output switch. The AP1502 series operates at a switching frequency of 200Khz thus allowing smaller sized filter components than what would be needed with lower frequency switching regulators. Other features include a guaranteed  $\pm$ 2% tolerance on output voltage under specified input voltage and output load conditions, and  $\pm$ 10% on the oscillator frequency. The output version included fixed 3.3V, 5V, 12V, and an adjustable type. The linear controller ability of driving an external NPN transistor, which current limit set 30mA & 50mA pre-driver of AP1502 and AP1502A. The packages are available in a standard SOP7 package.

### ■ Pin Assignments



### ■ Pin Descriptions

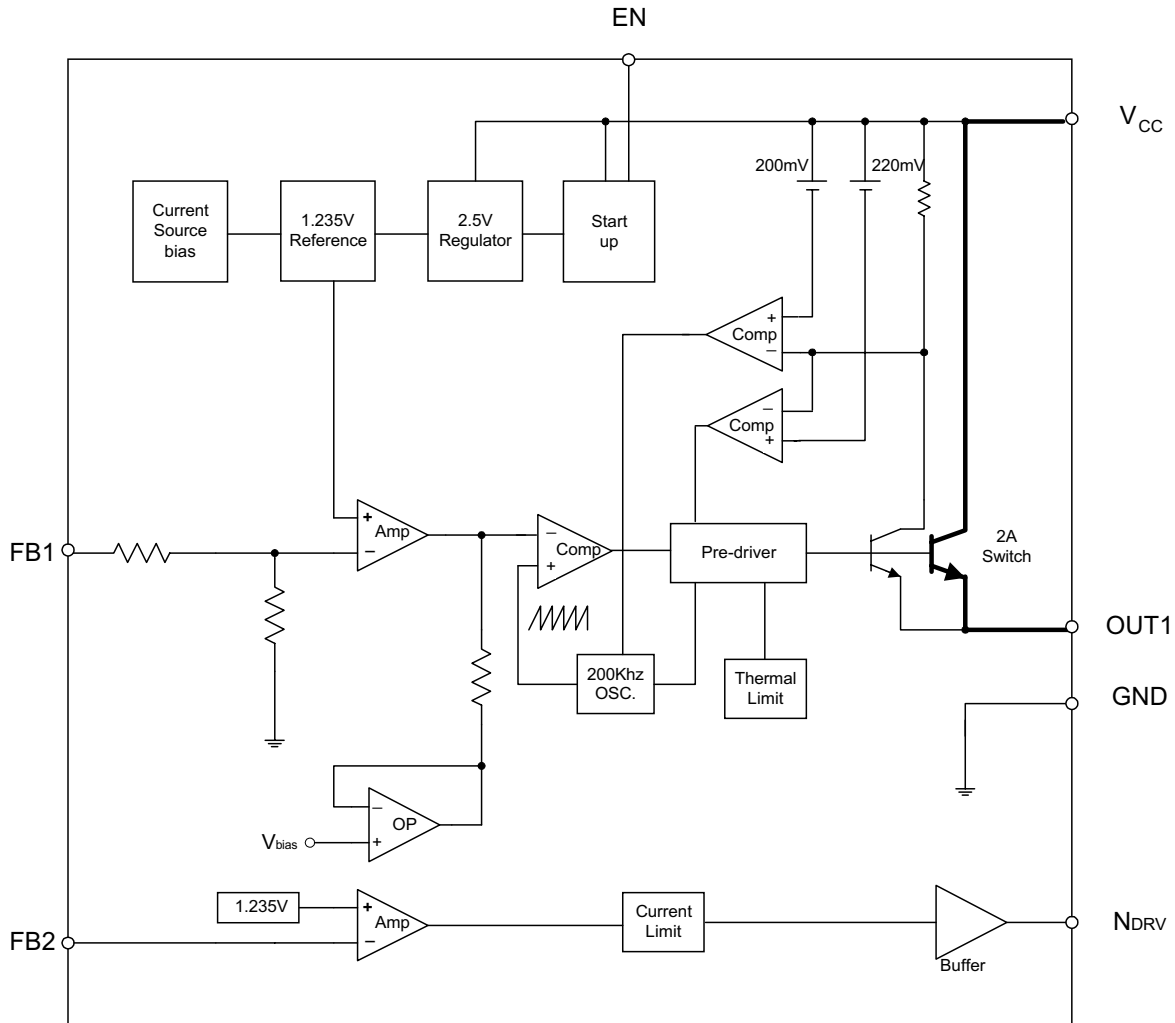
Name	Description
V <sub>CC</sub>	Operating voltage input
OUT1	Switching output
GND	Ground
FB1 FB2	Output voltage feedback control
EN	ON/OFF Shutdown
N <sub>DRV</sub>	Linear Controller Driving External NPN



■ **Ordering Information**

AP1502 X XX X X			
Type	Output version	Package	Packing
Linear pre-driver Blank : 30mA A : 50mA	Blank:Adjustable 33 : 3.3V 50 : 5.0V 12 : 12V	S : SOP-7L	Blank : Tube A : Taping

■ **Block Diagram**





■ **Absolute Maximum Ratings**

Symbol	Parameter	Rating	Unit
V <sub>CC</sub>	Supply Voltage	20	V
V <sub>EN</sub>	EN Pin input voltage	-0.3 to +20	V
V <sub>FB</sub>	Feedback Pin voltage	-0.3 to +20	V
V <sub>OUT</sub>	Output voltage to ground	-1	V
V <sub>NDRV</sub>	Linear driver voltage to ground	-0.3 ≤ V ≤ 20	V
P <sub>D</sub>	Power dissipation	Internally limited	W
T <sub>ST</sub>	Storage temperature	-65 to 150	°C
T <sub>OP</sub>	Operating temperature	-40 to +125°	°C
V <sub>OP</sub>	Operating voltage	4.5 to 18	V

■ **Electrical Characteristics (All Output Voltage Versions & Channels)**

Unless otherwise specified, V<sub>IN</sub>=12V for 3.3V, 5V, adjustable version and V<sub>IN</sub>=18V for the 12V version. I<sub>LOAD</sub> = 0.5A.

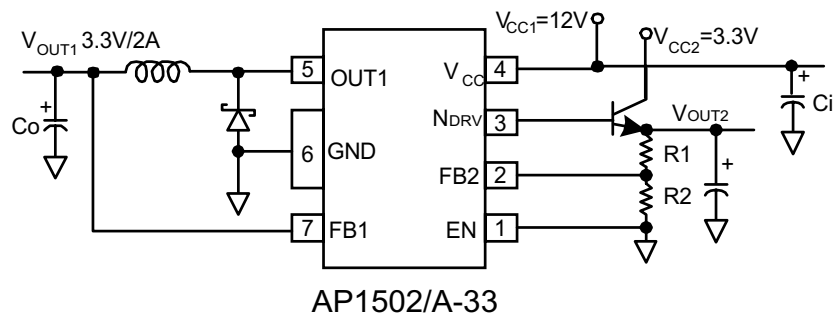
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I <sub>B</sub>	Feedback bias current	V <sub>FB1/2</sub> =1.3V		10	50	nA
F <sub>OSC</sub>	oscillator frequency		180	200	220	Khz
V <sub>SAT</sub>	saturation voltage	I <sub>OUT</sub> =2A no outside circuit V <sub>FB1</sub> =0V force driver on		1.16	1.4	V
DC	Max. Duty Cycle(ON)	V <sub>FB1</sub> =0V force driver on		100		%
	Min. Duty cycle(OFF)	V <sub>FB1</sub> =12V force driver off		0		
I <sub>CL1</sub>	current limit	peak current no outside circuit V <sub>FB1</sub> =0 force driver on	2.4	2.8	3.2	A
I <sub>L</sub>	Output = 0	no outside circuit V <sub>FB1/2</sub> =12 force driver off V <sub>CC1</sub> =18V			50	uA
	Output = 1			2	30	mA
I <sub>Q</sub>	Quiescent Current	V <sub>FB1/2</sub> =12V force driver off		5	10	mA
I <sub>STBY</sub>	Standby Quiescent Current	EN (ON/OFF) pin=5V V <sub>CC1</sub> =18V		80	200	uA
					250	
V <sub>IL</sub>	ON/OFF pin logic input threshold voltage	low (regulator ON)	-	1.3	0.6	V
V <sub>IH</sub>		high (regulator OFF)	2.0		-	
I <sub>H</sub>	EN (ON/OFF) pin logic input current	V <sub>LOGIC</sub> =2.5V (OFF)		5	15	uA
I <sub>L</sub>	ON/OFF pin input current	V <sub>LOGIC</sub> =0.5V (ON)		0.02	5	
I <sub>CL2</sub>	Output current current limit (AP1502)	V <sub>CC1</sub> =5V, V <sub>OUT2</sub> =V <sub>FB2</sub> =0V	25	30	35	mA
	Output current Current limit (AP1502A)		40	50	60	mA
V <sub>FB2</sub>	Output Feedback Voltage	4.75V ≤ V <sub>CC1</sub> ≤ 18V 3.0V ≤ V <sub>CC2</sub> ≤ 18V 0.2A ≤ I <sub>LOAD</sub> ≤ 2A	1.205	1.23	1.255	V
θ <sub>JC</sub>	Thermal Resistance	Junction to case		15		°C/W
θ <sub>JA</sub>	Thermal Resistance	Junction to ambient		90		°C/W

### ■ Electrical Characteristics (Continued)

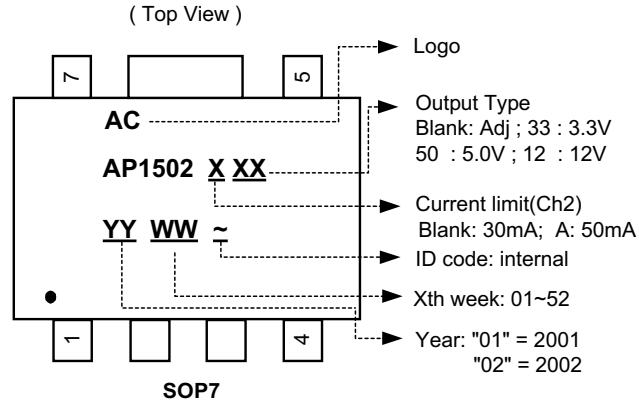
Specifications are for full operating temperature range, the other types are for  $T_J=25^{\circ}\text{C}$ ,  $4.75\text{V} \leq V_{\text{IN}} \leq 18\text{V}$

	Symbol	Parameter	Conditions	Typ.	Limit	Unit
AP1502-ADJ AP1502A-ADJ	$V_{\text{FB1}}$	Output Feedback	$4.5\text{V} \leq V_{\text{CC1}} \leq 18\text{V}$ $0.2\text{A} \leq I_{\text{LOAD}} \leq 2\text{A}$	1.23	1.205 1.255	V $V_{\text{MIN}}$ $V_{\text{MAX}}$
	$\eta$	Efficiency	$V_{\text{CC1}} = 12\text{V}$ , $I_{\text{LOAD}}=2\text{A}$ , $V_{\text{OUT}}$ programmed for 3V	77		%
AP1502-3.3V	$V_{\text{OUT1}}$	Output voltage	$4.5\text{V} \leq V_{\text{CC1}} \leq 18\text{V}$ $0.2\text{A} \leq I_{\text{LOAD}} \leq 2\text{A}$	3.3	3.23 3.37	V $V_{\text{MIN}}$ $V_{\text{MAX}}$
	$\eta$	Efficiency	$V_{\text{CC1}} = 12\text{V}$ , $I_{\text{LOAD}}=2\text{A}$	77		%
AP1502-5V	$V_{\text{OUT1}}$	Output voltage	$7.0\text{V} \leq V_{\text{CC1}} \leq 18\text{V}$ $0.2\text{A} \leq I_{\text{LOAD}} \leq 2\text{A}$	5	4.90 5.10	V $V_{\text{MIN}}$ $V_{\text{MAX}}$
	$\eta$	Efficiency	$V_{\text{CC1}} = 12\text{V}$ , $I_{\text{LOAD}}=2\text{A}$	84		%
AP1502-12V	$V_{\text{OUT1}}$	Output voltage	$15\text{V} \leq V_{\text{CC1}} \leq 18\text{V}$ $0.2\text{A} \leq I_{\text{LOAD}} \leq 2\text{A}$	12	11.75 12.25	V $V_{\text{MIN}}$ $V_{\text{MAX}}$
	$\eta$	Efficiency	$V_{\text{CC1}} = 15\text{V}$ , $I_{\text{LOAD}}=2\text{A}$	91		%

### ■ Typical Application Circuit

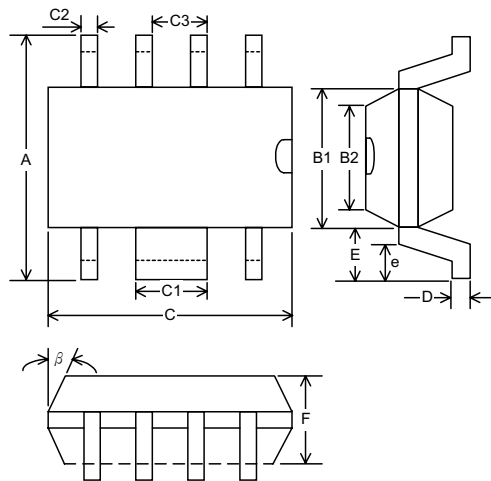


■ **Marking Information**



■ **Package Information**

Package Type: SOP-7L



Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A	5.79	5.99	6.19
B1	3.83	3.91	3.99
B2	3.78	3.86	3.94
C	4.80	4.87	4.94
C1	1.57	1.67	1.77
C2	0.32	0.4	0.48
C3	1.17	1.27	1.37
D	0.19	0.22	0.25
E	1.04 Ref.		
e	0.48	0.68	0.88
F	1.35	1.45	1.55
$\beta$	7°		