

200KHz, 1A PWM Buck DC/DC Converter & 1 Linear CTRL

■ Features

- Provides two regulated voltages
 - one PWM Regulator (Direct output or Drive NPN)
 - one Linear Controller (Drive NPN or N-MOS)
- Output voltage: 3.3V, 5V, 12V and adjustable
- Adjustable version:
 - Output voltage range, 1.2V 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 20V
- Output current: 1A (PWM Controller)
- Package: SOP7 (AP1502)
- Low power standby mode
- Build-in switching transistors on chip

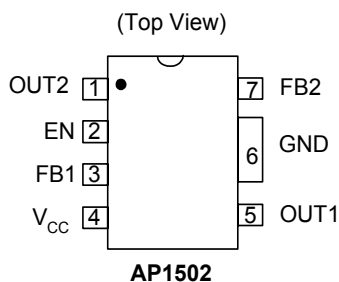
■ Applications

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

■ General Descriptions

The AP1502 series are monolithic IC's containing a PWM and a linear power controller. The PWM regulator has an ability of driving a 1A load without additional external transistors. Due to the reduced the number of external components, board space can be saved easily. The external shutdown function can be controlled by logic level and switching the IC into standby mode. The internal compensation provides a good line and load regulation without external components. Regard the protecting functions: Thermal shutdown is to prevent the IC from damage by operating on over temperature, and current limit is against over current in 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 version range included for the PWM part fixed output voltages of 3.3V, 5V, 12V, and an adjustable version. The linear controller is able to drive an external NPN transistor, which a current limit set to 30mA pre-driver of AP1502 series. The IC's are available in a standard SOP7 package for AP1502.

■ Pin Assignments



■ Pin Descriptions

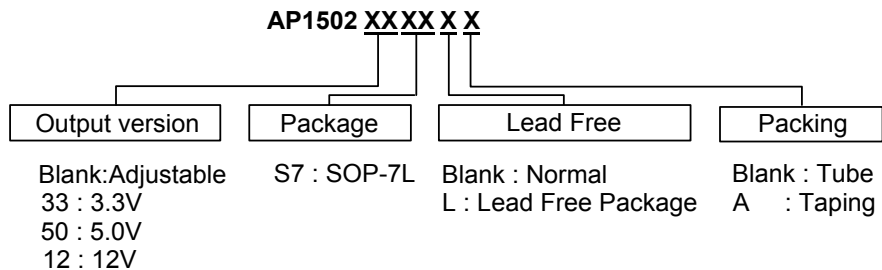
Name	Description
V _{CC}	Operating voltage input
OUT1	Switching output (Direct output or drive external NPN)
GND	Ground
FB1 FB2	Output voltage feedback control
EN	ON/OFF Shutdown
OUT2	Linear Controller Driving External NPN



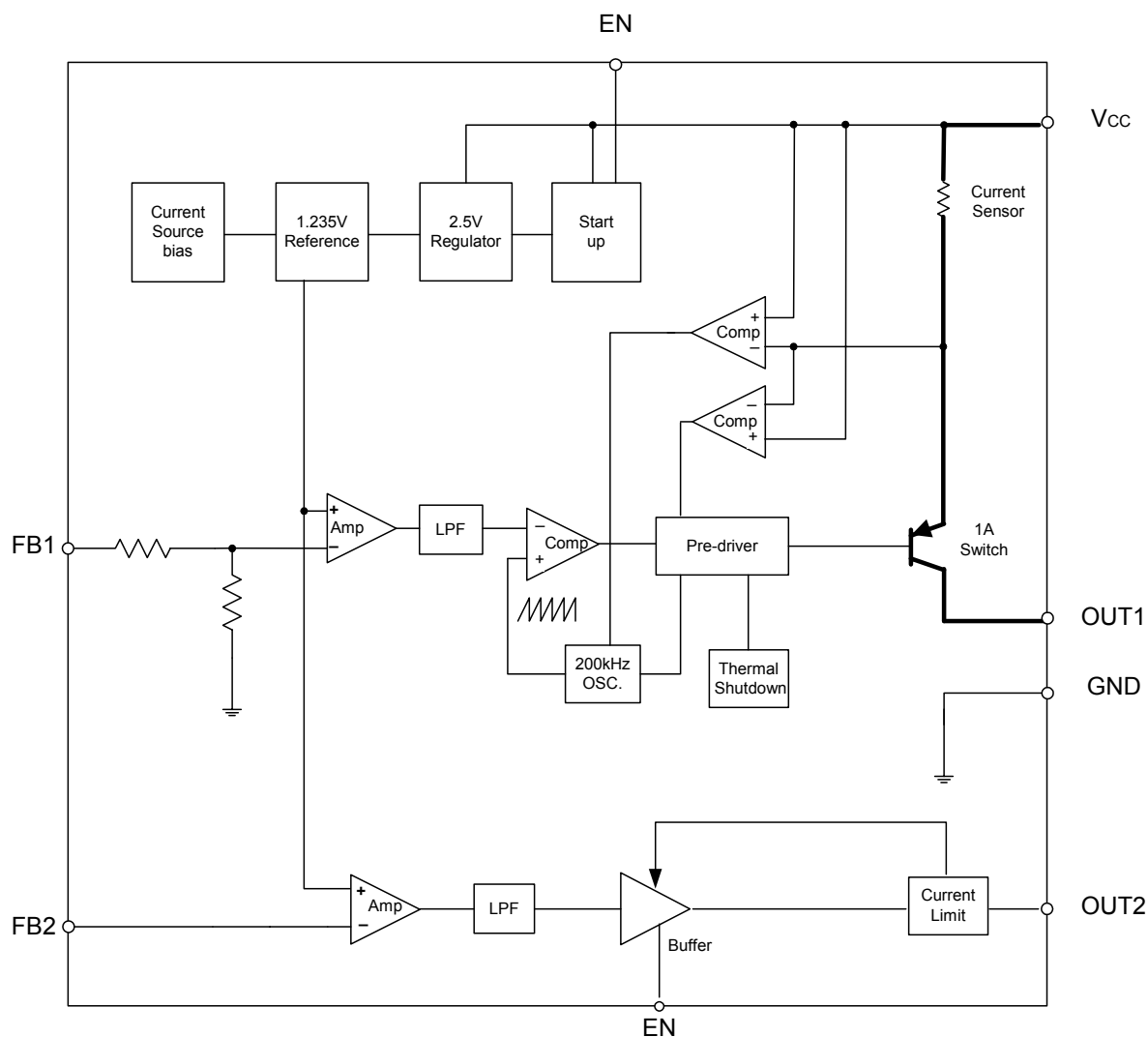
AP1502

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■ Ordering Information



■ Block Diagram



**■ Absolute Maximum Ratings**

Symbol	Parameter	Rating	Unit
V _{CC}	Supply Voltage	22	V
V _{EN}	EN Pin input voltage	-0.3 ≤ V ≤ 22	V
V _{FB}	Feedback Pin voltage	-0.3 ≤ V ≤ 22	V
V _{OUT1}	Output voltage to ground	-1	V
V _{OUT2}	Linear driver voltage to ground	-0.3 ≤ V ≤ 22	V
P _D	Power dissipation	Internally limited	W
T _{ST}	Storage temperature	-65 to 150	°C
T _{OP}	Operating temperature	-40 to +125°	°C
V _{OP}	Operating voltage	4.5 to 20	V

■ Electrical Characteristics (All Output Voltage Versions & Channels)

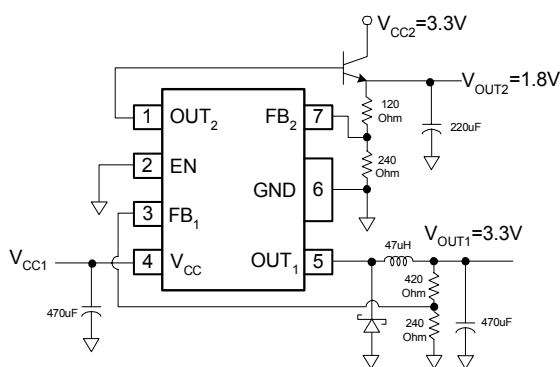
Unless otherwise specified AP1502, Vin=12V for 3.3V, 5V, adjustable version and Vin=20V for the 12V version. I_{LOAD} = 0.2A.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I _{B1/2}	Feedback bias current	V _{FB1/2} =1.3V(FB1,adj Version)		100	1000	nA
F _{OSC}	Oscillator frequency		150	200	250	KHz
V _{SAT1}	Saturation voltage (V _{CC} -V _{OUT1})	I _{OUT} =0.8A V _{FB1} =0 force driver on		0.9		V
V _{SAT2}	Saturation voltage (V _{CC} -V _{OUT2})	I _{OUT} =20mA(no external NPN or N-MOS) V _{FB1} =0V force driver on		0.6		V
DC	Max. Duty Cycle(ON)	V _{FB1} =0V force driver on		100		%
	Min. Duty cycle(OFF)	V _{FB1} =12V force driver off		0		%
I _{CL1}	Current limit(OUT1)	peak current V _{FB1} =0V force driver on		1.1		A
I _{LEAK1}	OUT1 Leakage Current	V _{FB1} =12V force driver off V _{CC} =20V	OUT1= 0 V		50	uA
			OUT1= -1V	2	30	mA
I _Q	Quiescent Current (V _{CC})	V _{FB1/2} =12V force driver off		6		mA
I _{STBY}	Standby Quiescent Current	EN(ON/OFF) pin=5V V _{CC} =20V		60	100	uA
V _{IL}	EN pin logic input threshold voltage	low (regulator ON)	-	1.3	0.6	V
V _{IH}		High (regulator OFF)	2.0		-	
I _H	EN pin input current	V _{LOGIC} =2.5V (regulator OFF)		-0.03		uA
I _L	EN pin input current	V _{LOGIC} =0.5V (regulator ON)		0.3		
I _{CL2}	Current limit (OUT2)	V _{CC} =5V, V _{OUT2} =V _{FB2} =0V		50		mA
V _{FB2}	OUT2 Voltage Feedback	4.75V ≤ V _{CC1} ≤ 20V 3.0V ≤ V _{CC2} ≤ 20V 0.2A ≤ I _{LOAD} ≤ 1A, T _A =25°C	1.225	1.25	1.275	V
θ _{JC}	Thermal Resistor	Junction to Case		15		°C/W
θ _{JA}	Thermal Resistor	Junction to Ambient		90		°C/W

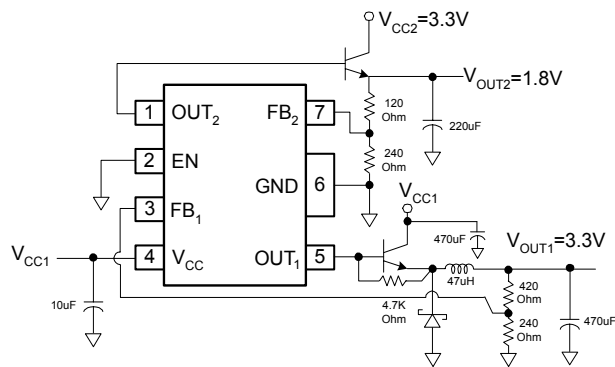
■ Electrical Characteristics (Continued)

	Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
AP1502-ADJ	V_{FB1}	Output Feedback	$4.5V \leq V_{CC} \leq 20V$ $0.2A \leq I_{LOAD} \leq 0.9A$	1.225	1.25	1.275	V
	η	Efficiency	$V_{IN} = 12V, I_{LOAD}=0.9A,$ V_{OUT} programmed for 3V		73		%
AP1502-3.3V	V_{OUT1}	Output voltage	$4.75V \leq V_{CC} \leq 20V$ $0.2A \leq I_{LOAD} \leq 0.9A$	3.23	3.3	3.37	V
	η	Efficiency	$V_{IN} = 12V, I_{LOAD}=0.9A$		73		%
AP1502-5V	V_{OUT1}	Output voltage	$7.0V \leq V_{CC} \leq 20V$ $0.2A \leq I_{LOAD} \leq 0.9A$	4.90	5	5.10	V
	η	Efficiency	$V_{IN} = 12V, I_{LOAD}=0.9A$		77		%
AP1502-12V	V_{OUT1}	Output voltage	$15V \leq V_{CC} \leq 20V$ $0.2A \leq I_{LOAD} \leq 0.9A$	11.75	12	12.25	V
	η	Efficiency	$V_{IN} = 20V, I_{LOAD}=0.9A$		82		%

■ Typical Application Circuit

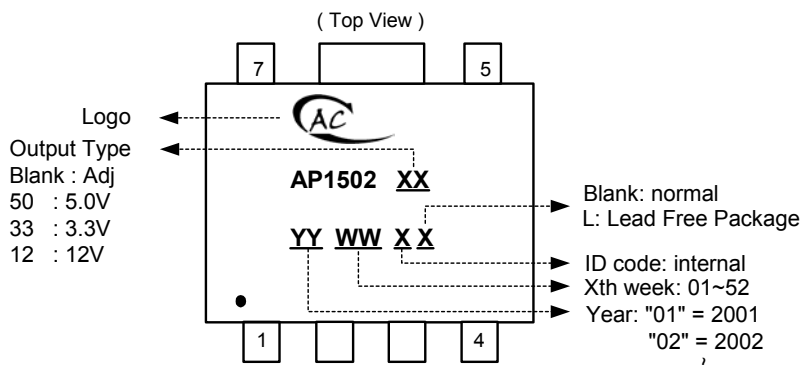


AP1502 (1)



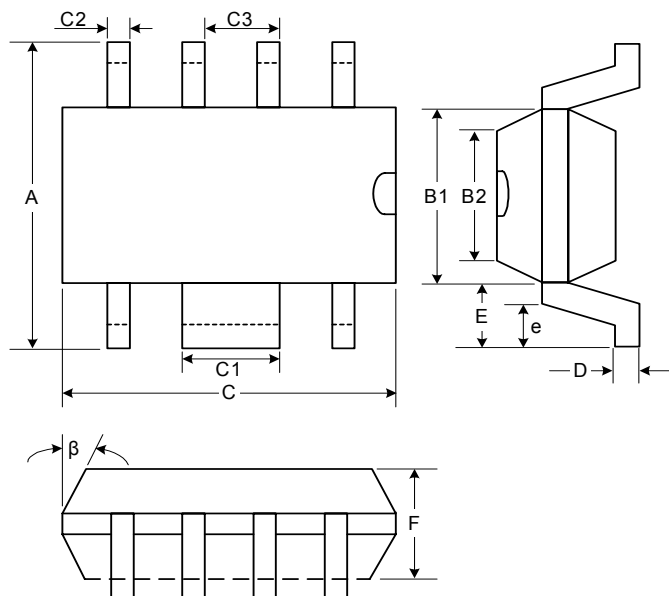
AP1502 (2)

■ Marking Information



■ Package Information

Package Type: SOP-7L



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	5.79	5.99	6.19	0.228	0.236	0.244
B1	3.83	3.91	3.99	0.151	0.154	0.157
B2	3.78	3.86	3.94	0.149	0.152	0.155
C	4.80	4.87	4.94	0.189	0.192	0.194
C1	1.57	1.67	1.77	0.062	0.066	0.070
C2	0.32	0.4	0.48	0.013	0.016	0.019
C3	1.17	1.27	1.37	0.046	0.050	0.054
D	0.19	0.22	0.25	0.007	0.009	0.010
E	1.04REF			0.041REF		
e	0.48	0.68	0.88	0.019	0.027	0.035
F	1.35	1.45	1.55	0.053	0.057	0.061
β	7°			7°		