

# AP1501

## 150KHz, 3A PWM Buck DC/DC Converter

(Preliminary)

### ■ Features

- Output voltage: 3.3v, 5V, 12V and adjustable output version
- Adjustable version output voltage range, 1.2V to 37V $\pm$ 4%
- 150KHz  $\pm$ 15% fixed switching frequency
- Voltage mode non-synchronous PWM control
- Thermal-shutdown and current-limit protection
- ON/OFF shutdown control input
- Operating voltage can be up to 40V
- Output load current: 3A
- TO220-5L and TO263-5L packages
- Low power standby mode
- Build-in switching transistor on chip

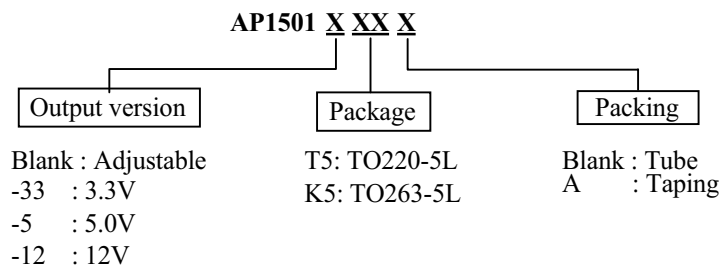
### ■ Applications

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

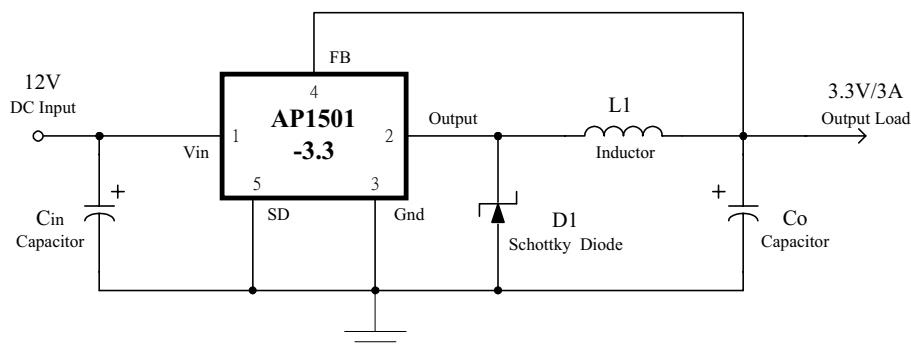
### ■ General Descriptions

The AP1501 series are monolithic IC that design for a step-down DC/DC converter, and own the ability of driving a 3A 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 AP1501 series operates at a switching frequency of 150kHz thus allowing smaller sized filter components than what would be needed with lower frequency switching regulators. Other features include a guaranteed  $\pm$ 4% tolerance on output voltage under specified input voltage and output load conditions, and  $\pm$ 15% on the oscillator frequency. The output version included fixed 3.3V, 5V, 12V, and an adjustable types. The packages are available in a standard 5-lead TO-220 package and a 5-lead TO-263.

### ■ Ordering Information



### ■ Typical Circuit



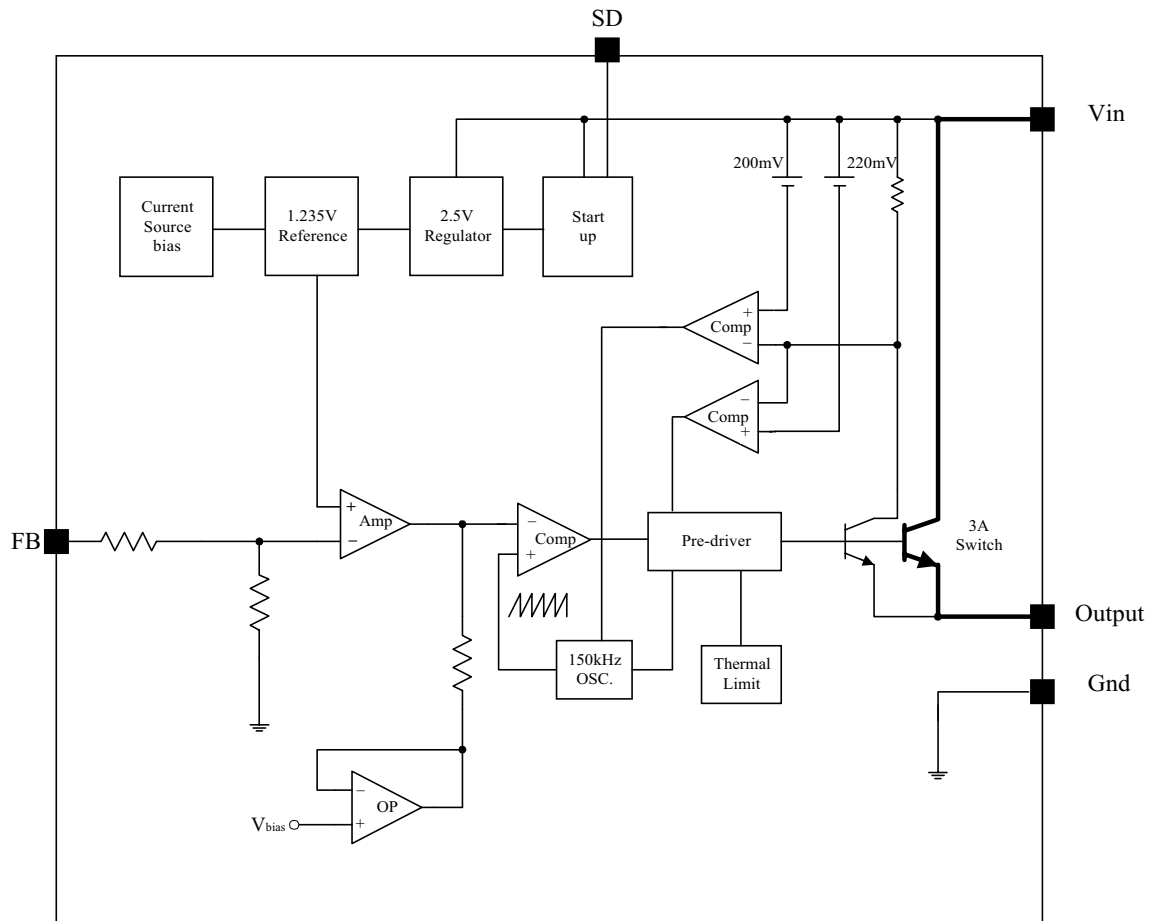
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## ■ Block Diagrams



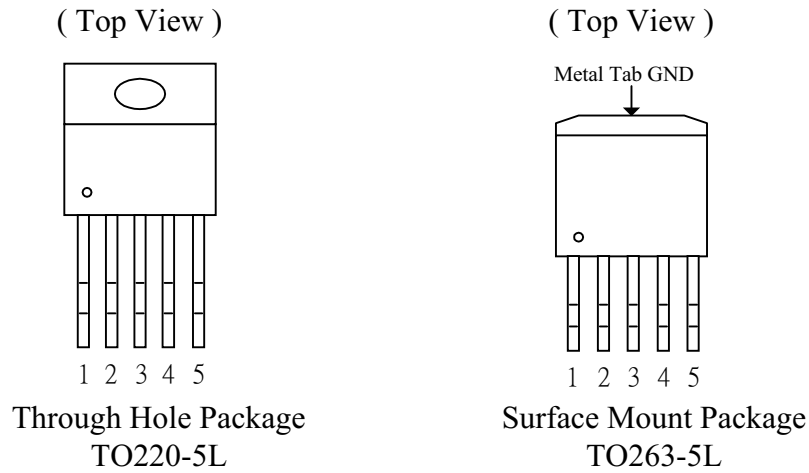
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## ■ Pin Assignments



## ■ Pin Descriptions

Pin No.	Symbol	Parameter
1	VCC	Operating voltage input
2	OUT	Switching output
3	GND	Ground
4	FB	Output voltage feedback control
5	SD	ON/OFF Shutdown

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( Preliminary )

## ■ Absolute Maximum Ratings

Characteristic	Value	Unit
Supply Voltage	45	V
ON/OFF Pin input voltage	$-0.3 \leq V \leq 25$	V
Feedback Pin voltage	$-0.3 \leq V \leq 25$	V
Output voltage to Ground	-1	V
Power dissipation	Internally limited	W
Storage temperature	-65 to 150	°C
Operating temperature	-40 to +125°	°C
Operating voltage	4.5 to 40	V

## ■ Electrical Characteristics ( All Output Voltage Versions )

Unless otherwise specified,  $V_{in}=12V$  for 3.3V, 5V, adjustable version and  $V_{in}=24V$  for the 12V version.  $I_{load} = 0.5A$ .

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
Ib	Feedback bias current	Vfb=1.3V		10	50	nA
					<b>100</b>	
fo	oscillator frequency		127	150	173	KHz
			<b>110</b>		<b>173</b>	
Vsat	saturation voltage	Iout=3A no outside circuit Vfb=0 force driver on		1.16	1.4	V
					<b>1.5</b>	
DC	Max. Duty Cycle(ON)	Vfb=0 force driver on		100		%
	Min. Duty cycle(OFF)	Vfb=12 force driver off		0		
ICL	current limit	peak current no outside circuit Vfb=0 force driver on	3.6	4.5	6.9	A
					<b>7.5</b>	
IL	Output = 0	no outside circuit Vfb=12 force driver off			50	uA
	Output = 1	Vin=40V		2	30	mA
IQ	Quiescent Current	Vfb=12 force driver off		5	10	mA
Istby	Standby Quiescent Current	ON/OFF pin=5V Vin=40V		80	200	uA
					<b>250</b>	
VIL	ON/OFF pin logic input threshold voltage	low (regulator ON)	-	1.3	0.6	V
VIH		high (regulator OFF)	2.0		-	
IH	ON/OFF pin logic input threshold voltage	Vlogic=2.5V (ON)		5	15	uA
IL	ON/OFF pin input current	Vlogic=0.5V (OFF)		0.02	5	

Note: Specifications with **boldface type** are for full operating temperature range, the other type are for  $T_j=25^\circ\text{C}$ .

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( Preliminary )

## ■ Electrical Characteristics ( Continued )

Specifications with **boldface type** are for full operating temperature range, the other types are for T<sub>j</sub>=25 °C.

	Symbol	Parameter	conditions	Typ	Limit	Units
AP1501-ADJ	V <sub>FB</sub>	Output Feedback	4.75 ≤ V <sub>in</sub> ≤ 40V 0.2A ≤ I <sub>load</sub> ≤ 3A V <sub>OUT</sub> programmed for 3V( Figure 1)	1.23	1.193/ <b>1.18</b> 1.267/ <b>1.28</b>	V Vmin Vmax
	η	Efficiency	V <sub>in</sub> = 12V, I <sub>Load</sub> = 3A	73		%
AP1501-3.3V	V <sub>OUT</sub>	Output voltage	4.5V ≤ V <sub>in</sub> ≤ 40V 0.2A ≤ I <sub>load</sub> ≤ 3A	3.3	3.168/ <b>3.135</b> 3.432/ <b>3.465</b>	V Vmin Vmax
	η	Efficiency	V <sub>in</sub> = 12V, I <sub>Load</sub> = 3A	73		%
AP1501-5V	V <sub>OUT</sub>	Output voltage	7V ≤ V <sub>in</sub> ≤ 40V 0.2A ≤ I <sub>load</sub> ≤ 3A	5	4.8/ <b>4.75</b> 5.2/ <b>5.25</b>	V Vmin Vmax
	η	Efficiency	V <sub>in</sub> = 12V, I <sub>Load</sub> = 3A	80		%
AP1501-12V	V <sub>OUT</sub>	Output voltage	15V ≤ V <sub>in</sub> ≤ 40V 0.2A ≤ I <sub>load</sub> ≤ 3A	12	11.52/ <b>11.4</b> 12.48/ <b>12.6</b>	V Vmin Vmax
	η	Efficiency	V <sub>in</sub> = 12V, I <sub>Load</sub> = 3A	90		%



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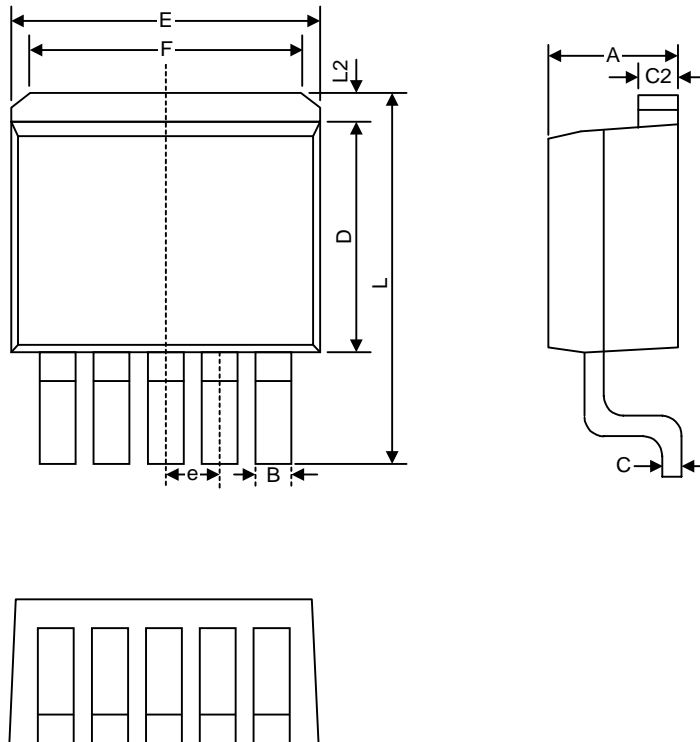
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## ■ Package Outline & Dimension ( Continued )

(2). Package Type: TO263-5L



DIM.	Milimeters		Inches	
	MIN.	MAX.	MIN.	MAX.
A	4.06	4.83	.160	.190
B	0.76	1.02	.030	.040
C	0.36	0.64	.014	.025
C2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
E	9.78	10.54	.385	.415
E	1.57	1.85	.062	.073
F	6.60	7.11	.260	.280
L	15.11	15.37	.595	.605
L2	-	1.4	-	.055