

**150kHz 3A PWM BUCK DC-DC CONVERTER****AP3001****General Description**

The AP3001 series of regulators are fixed frequency PWM buck (step-down) DC/DC converter, capable of driving a 3A load with excellent line and load regulation. These regulators are simple to use and include internal frequency compensation and a fixed frequency oscillator, so that a system adopting AP3001 requires a minimum number of external components to work.

These ICs are available in TO-220-5L, TO-220B-5L and TO-263-5L packages.

Features

- 3.3V, 5V Fixed and Adjustable Output Versions
- Guaranteed 3A Output Load Current
- 150kHz Fixed Frequency Internal Oscillator
- Excellent Line and Load Regulation
- TTL Shutdown Capability
- Low Power Standby Mode, I_Q Typically 80 μ A
- Built-in Current Limit Protection and Thermal Shutdown Circuit

Applications

- LCD Monitor and LCD TV
- On-Card DC-DC Converter
- DVD Recorder
- PDP

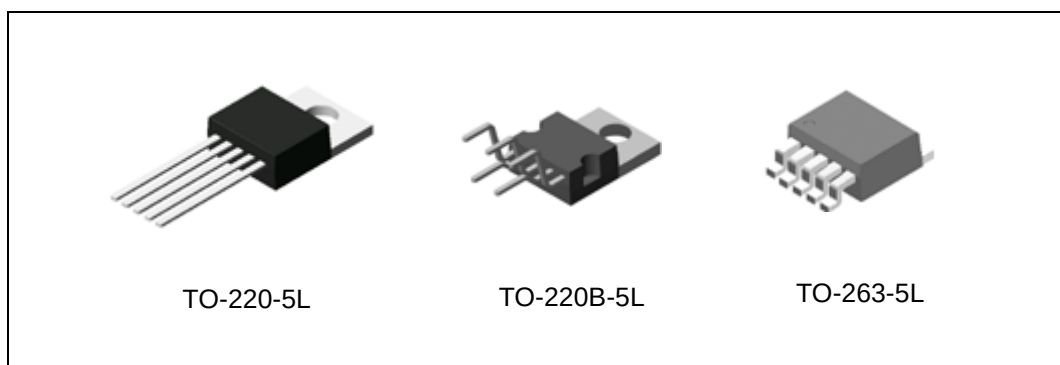


Figure 1. Package Types of AP3001



150kHz 3A PWM BUCK DC-DC CONVERTER

AP3001

Pin Configuration

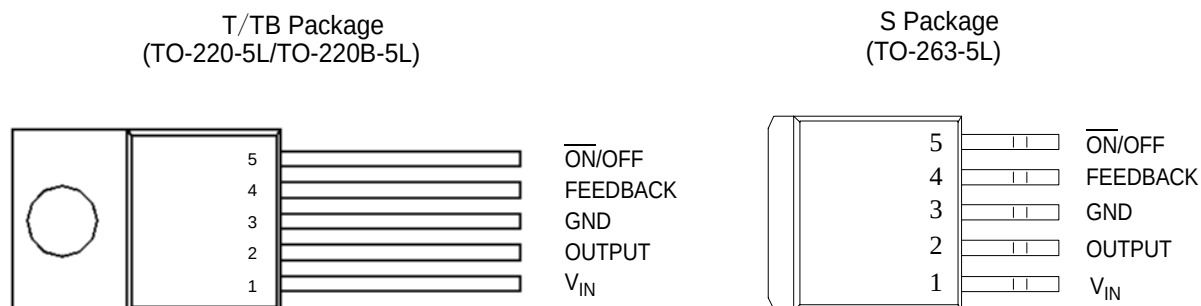


Figure 2. Pin Configuration of AP3001 (Top View)

Pin Description

Pin Number	Pin Name	Function
1	V_{IN}	Unregulated input voltage
2	OUTPUT	Switch driver output
3	GND	Ground
4	FEEDBACK	Feedback pin. For fixed version, connect it to system output. For adjustable version, connect it with an external resistor divider to program the system output voltage
5	$\overline{ON/OFF}$	The TTL logic compatible input to control the regulator on or off



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Functional Block Diagram

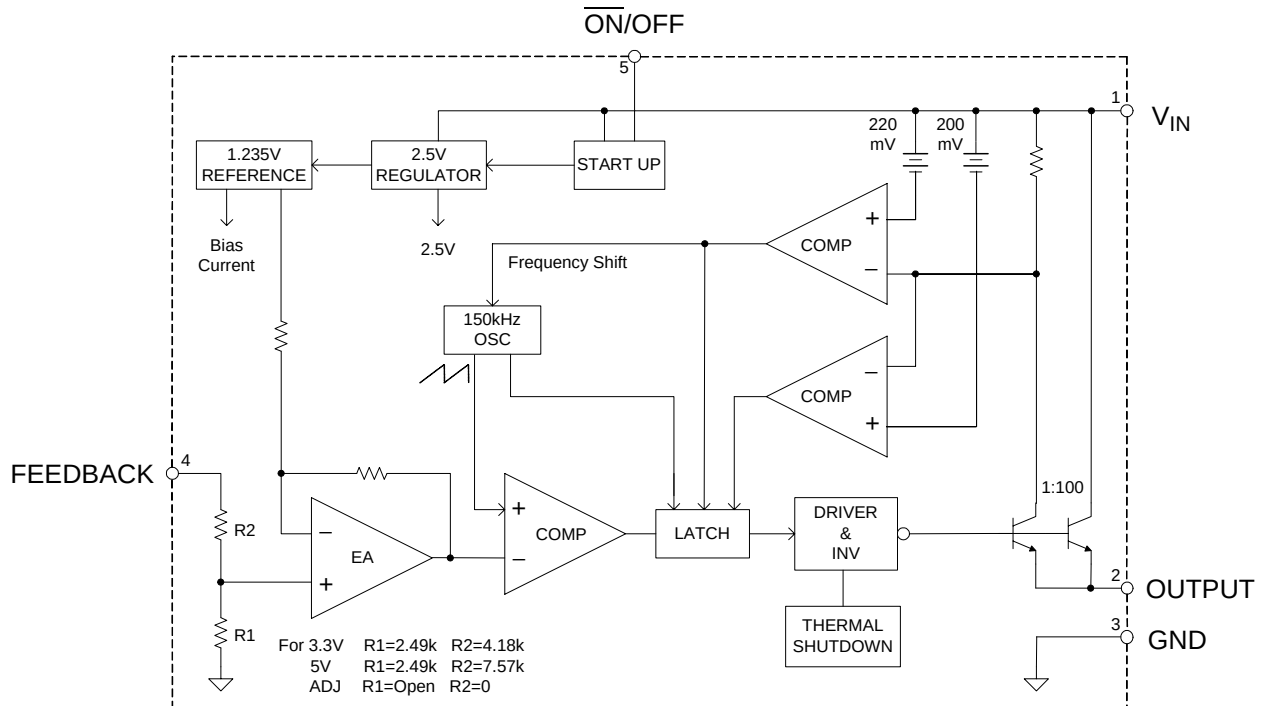
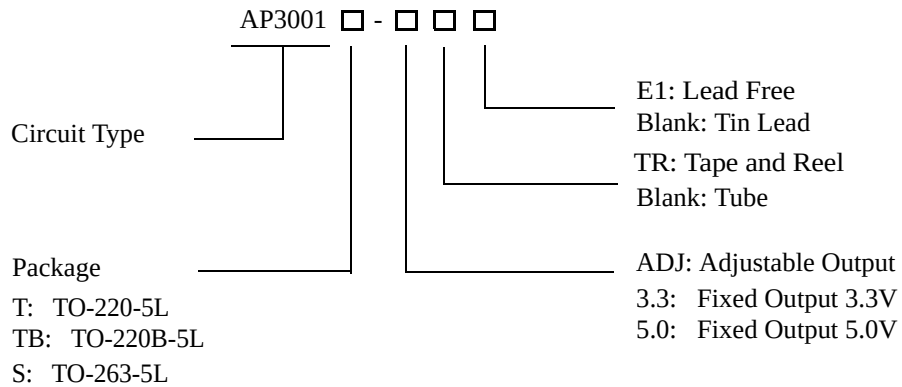


Figure 3. Functional Block Diagram of AP3001

**150kHz 3A PWM BUCK DC-DC CONVERTER****AP3001****Ordering Information**

Package	Temperature Range	Part Number		Marking ID		Packing Type
		Tin Lead	Lead Free	Tin Lead	Lead Free	
TO-220-5L	-40 to 85°C	AP3001T-ADJ	AP3001T-ADJE1	AP3001T-ADJ	AP3001T-ADJE1	Tube
		AP3001T-3.3	AP3001T-3.3E1	AP3001T-3.3	AP3001T-3.3E1	Tube
		AP3001T-5.0	AP3001T-5.0E1	AP3001T-5.0	AP3001T-5.0E1	Tube
TO-220B-5L	-40 to 85°C	AP3001TB-ADJ	AP3001TB-ADJE1	AP3001TB-ADJ	AP3001TB-ADJE1	Tube
		AP3001TB-3.3	AP3001TB-3.3E1	AP3001TB-3.3	AP3001TB-3.3E1	Tube
		AP3001TB-5.0	AP3001TB-5.0E1	AP3001TB-5.0	AP3001TB-5.0E1	Tube
TO-263-5L	-40 to 85°C	AP3001S-ADJ	AP3001S-ADJE1	AP3001S-ADJ	AP3001S-ADJE1	Tube
		AP3001S-ADJTR	AP3001S-ADJTRE1	AP3001S-ADJ	AP3001S-ADJE1	Tape & Reel
		AP3001S-3.3	AP3001S-3.3E1	AP3001S-3.3	AP3001S-3.3E1	Tube
		AP3001S-3.3TR	AP3001S-3.3TRE1	AP3001S-3.3	AP3001S-3.3E1	Tape & Reel
		AP3001S-5.0	AP3001S-5.0E1	AP3001S-5.0	AP3001S-5.0E1	Tube
		AP3001S-5.0TR	AP3001S-5.0TRE1	AP3001S-5.0	AP3001S-5.0E1	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant.



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Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value	Unit
Maximum Supply Voltage		40	V
ON/OFF Pin Input Voltage		-0.3 to 25	V
Feedback Pin Voltage		-0.3 to 25	V
Thermal Resistance (For TO-220-5L, TO-220B-5L and TO-263-5L Packages)	$R_{\theta JA}$	60	$^{\circ}\text{C}/\text{W}$
Power Dissipation ($T_A=25^{\circ}\text{C}$, No Heat Sink)	P_D	2.08	W
Operating Junction Temperature	T_J	150	$^{\circ}\text{C}$
Lead Temperature (Soldering, 10sec)	T_{LEAD}	260	$^{\circ}\text{C}$
Storage Temperature Range	T_{STG}	-65 to 150	$^{\circ}\text{C}$
ESD (Machine Model)		250	V
ESD (Human Body Model)		2500	V

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply Voltage (Note 2)	V_{IN}	AP3001-3.3V	4.75	V
		AP3001-5.0V	7.5	
		AP3001-ADJ ($V_{OUT}=12\text{V}$)	16	
Operating Junction Temperature	T_J	-40	125	$^{\circ}\text{C}$

Note 2: For detailed recommended input supply voltage range, please refer to the test "conditions" for each output voltage version. For ADJ version, the recommended supply voltage depends on the needed output voltage, the experienced formula is $1.5 \cdot V_{OUT} \leq V_{IN} \leq 2.5 \cdot V_{OUT}$ and $4.5\text{V} \leq V_{IN} \leq 36\text{V}$.


150kHz 3A PWM BUCK DC-DC CONVERTER
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Electrical Characteristics
For All Output Voltage Versions

Unless otherwise specified, $V_{IN}=12V$ for 3.3V, 5V and adjustable version, $I_{LOAD}=500mA$. Specifications with standard type face are for $T_J=25^{\circ}C$, and those with **boldface type** apply over Full Operating Temperature Range.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Feedback Bias Current	I_B	Adjustable Version Only, $V_{FB}=1.3V$		40	100 200	nA
Oscillator Frequency	f_O	(Frequency reduces when the second current limit is activated)	127 110	150	173 173	kHz
Saturation Voltage	V_{SAT}	$I_{LOAD}=3A$ (No output devices, $V_{FB}=0V$)		1.2	1.4 1.5	V
Maximum Duty Cycle (ON)	D_{MAX}	($V_{FB}=0V$)			100	%
Minimum Duty Cycle (OFF)	D_{MIN}	($V_{FB}=12V$)	0			%
Current Limit	I_{CL}	Peak Current (No output devices, $V_{FB}=0V$)	3.6 3.4	5	6.9 7.5	A
Output Leakage Current	I_L	Output=0V (No output devices, $V_{FB}=12V$)		50		μA
		Output=-1V ($V_{IN}=18V$)		2	30	mA
Quiescent Current	I_Q	($V_{FB}=12V$)		5	10	mA
Standby Quiescent Current	I_{STBY}	$\overline{ON}/OFF$ Pin=5V (Regulator OFF)		80	200 250	μA
$\overline{ON}/OFF$ Pin Logic Input Threshold Voltage	V_{IL}	Low (Regulator ON)		1.3	0.6	V
	V_{IH}	High (Regulator OFF)	2.0	1.3		
$\overline{ON}/OFF$ Pin Input Current	I_H	$V_{LOGIC}=2.5V$ (Regulator OFF)		5	15	μA
	I_L	$V_{LOGIC}=0.5V$ (Regulator ON)		0.02	5	μA

**150kHz 3A PWM BUCK DC-DC CONVERTER****AP3001****Electrical Characteristics (Continued)****For 3.3V Output Voltage Version**

Specifications with standard type face are for $T_J=25^{\circ}\text{C}$, and those with **boldface type** apply over Full Operating Temperature Range.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_{OUT}	$4.75\text{V} \leq V_{\text{IN}} \leq 10\text{V}$, $0.3\text{A} \leq I_{\text{LOAD}} \leq 3\text{A}$	3.168 3.135	3.3	3.432 3.465	V
Efficiency	η	$V_{\text{IN}}=12\text{V}$, $I_{\text{LOAD}}=3\text{A}$		73		%

For 5V Output Voltage Version

Specifications with standard type face are for $T_J=25^{\circ}\text{C}$, and those with **boldface type** apply over Full Operating Temperature Range.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_{OUT}	$7.5\text{V} \leq V_{\text{IN}} \leq 18\text{V}$, $0.3\text{A} \leq I_{\text{LOAD}} \leq 3\text{A}$	4.8 4.75	5	5.2 5.25	V
Efficiency	η	$V_{\text{IN}}=12\text{V}$, $I_{\text{LOAD}}=3\text{A}$		80		%

For ADJ Output Voltage Version

Specifications with standard type face are for $T_J=25^{\circ}\text{C}$, and those with **boldface type** apply over Full Operating Temperature Range.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Feedback Voltage	V_{FB}	$16\text{V} \leq V_{\text{IN}} \leq 28\text{V}$, $0.3\text{A} \leq I_{\text{LOAD}} \leq 2.5\text{A}$, V_{OUT} programmed for 12V	1.193 1.18	1.23	1.267 1.28	V
Efficiency	η	$V_{\text{IN}}=24\text{V}$, $I_{\text{LOAD}}=2\text{A}$, $V_{\text{OUT}}=12\text{V}$		80		%

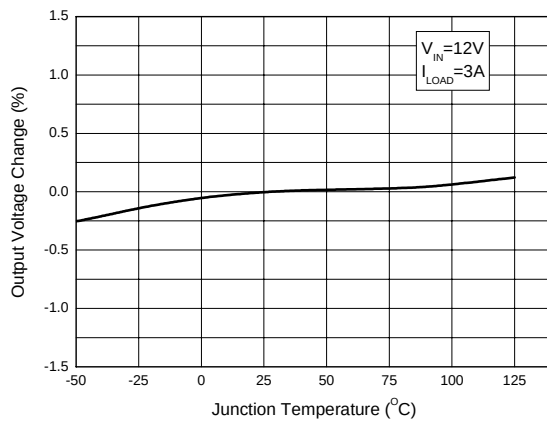
**150kHz 3A PWM BUCK DC-DC CONVERTER****AP3001****Typical Performance Characteristics**

Figure 4. Normalized Output Voltage vs. Junction Temperature

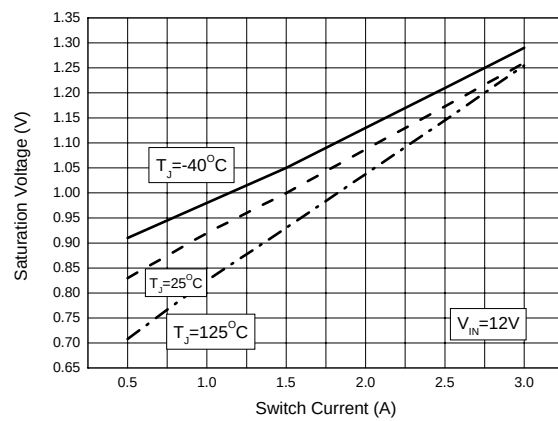


Figure 5. Output Saturation Characteristics

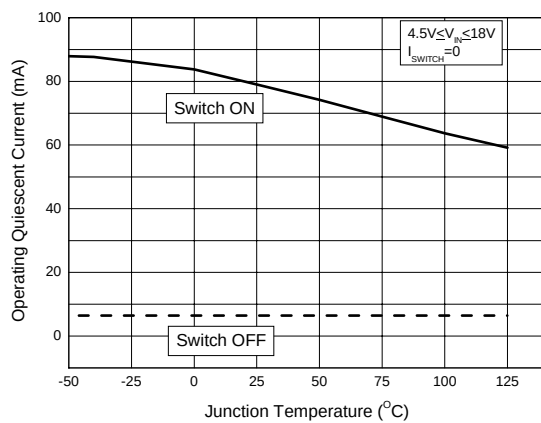


Figure 6. Operating Quiescent Current vs. Junction Temperature

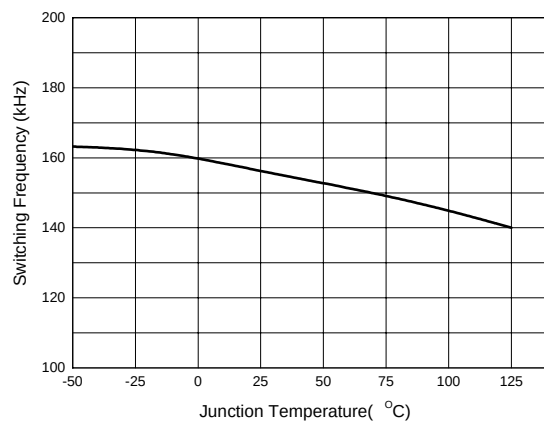


Figure 7. Switching Frequency vs. Junction Temperature



150kHz 3A PWM BUCK DC-DC CONVERTER

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Typical Performance Characteristics (Continued)

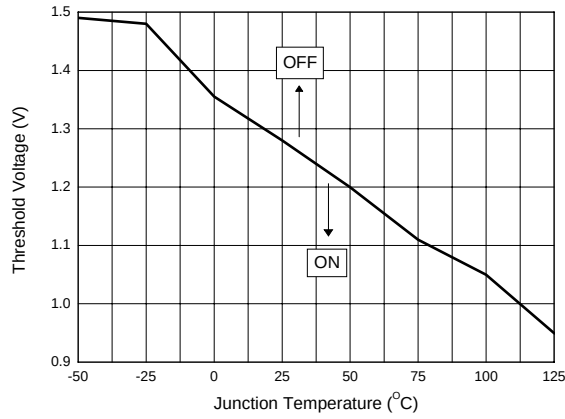


Figure 8. $\overline{\text{ON}}/\text{OFF}$ Pin Threshold Voltage vs. Junction Temperature

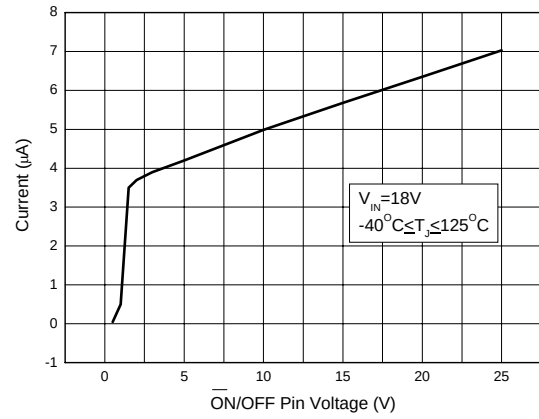


Figure 9. $\overline{\text{ON}}/\text{OFF}$ Pin Current (Sinking) vs. $\overline{\text{ON}}/\text{OFF}$ Pin Voltage

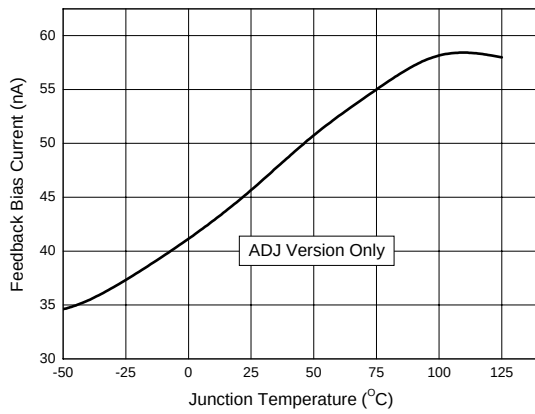


Figure 10. Feedback Bias Current vs. Junction Temperature



150kHz 3A PWM BUCK DC-DC CONVERTER

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Typical Application

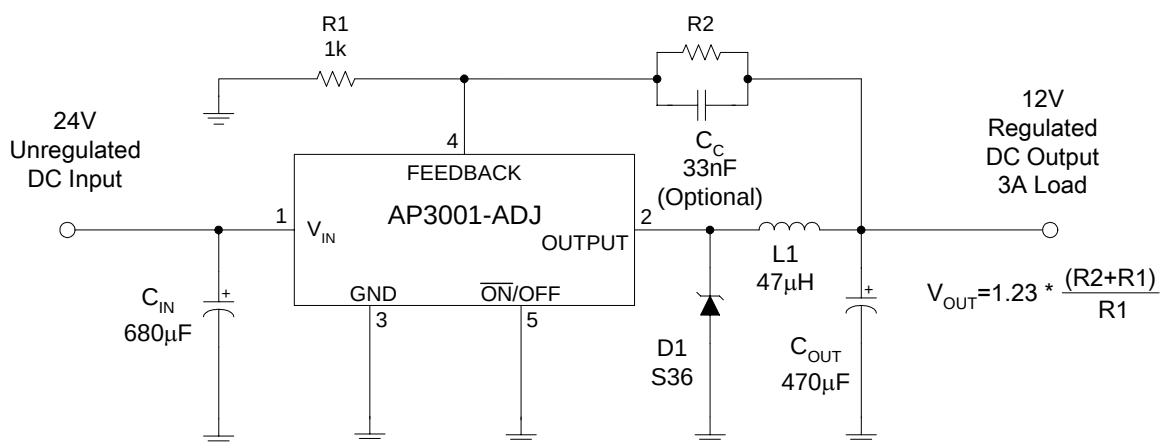


Figure 11. Typical Application of AP3001-ADJ

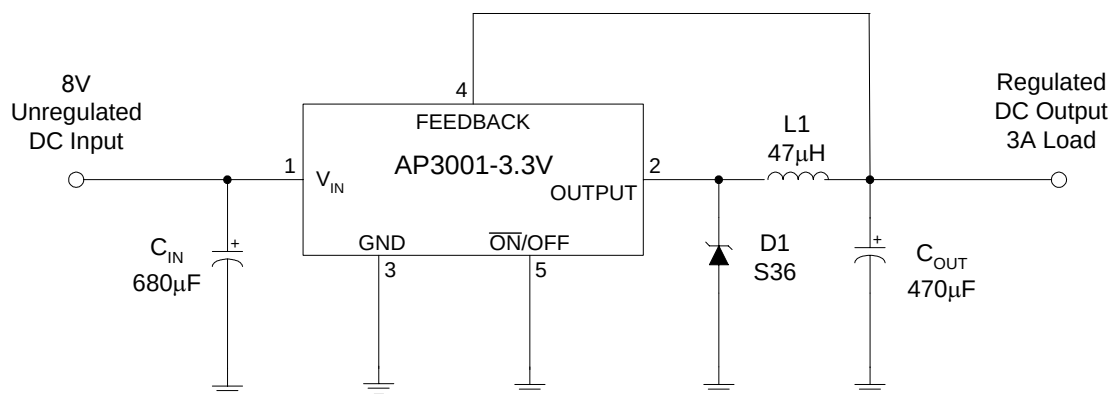


Figure 12. Typical Application of AP3001-3.3V

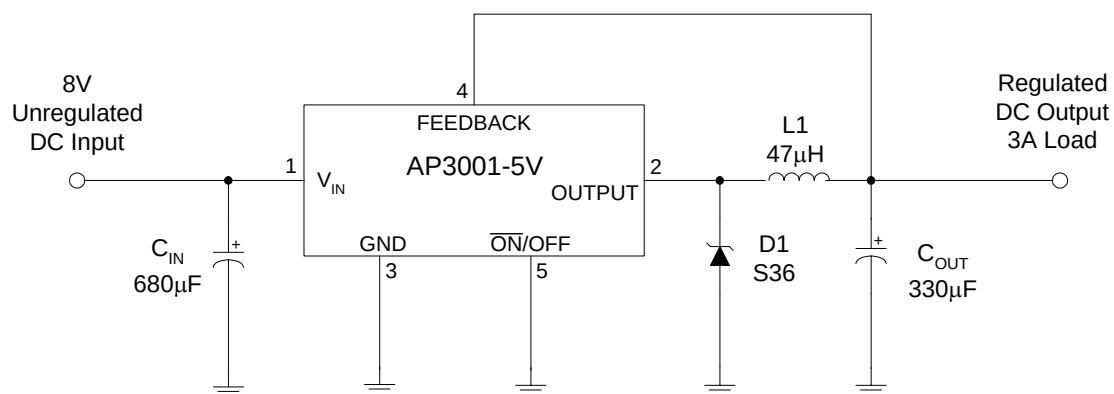
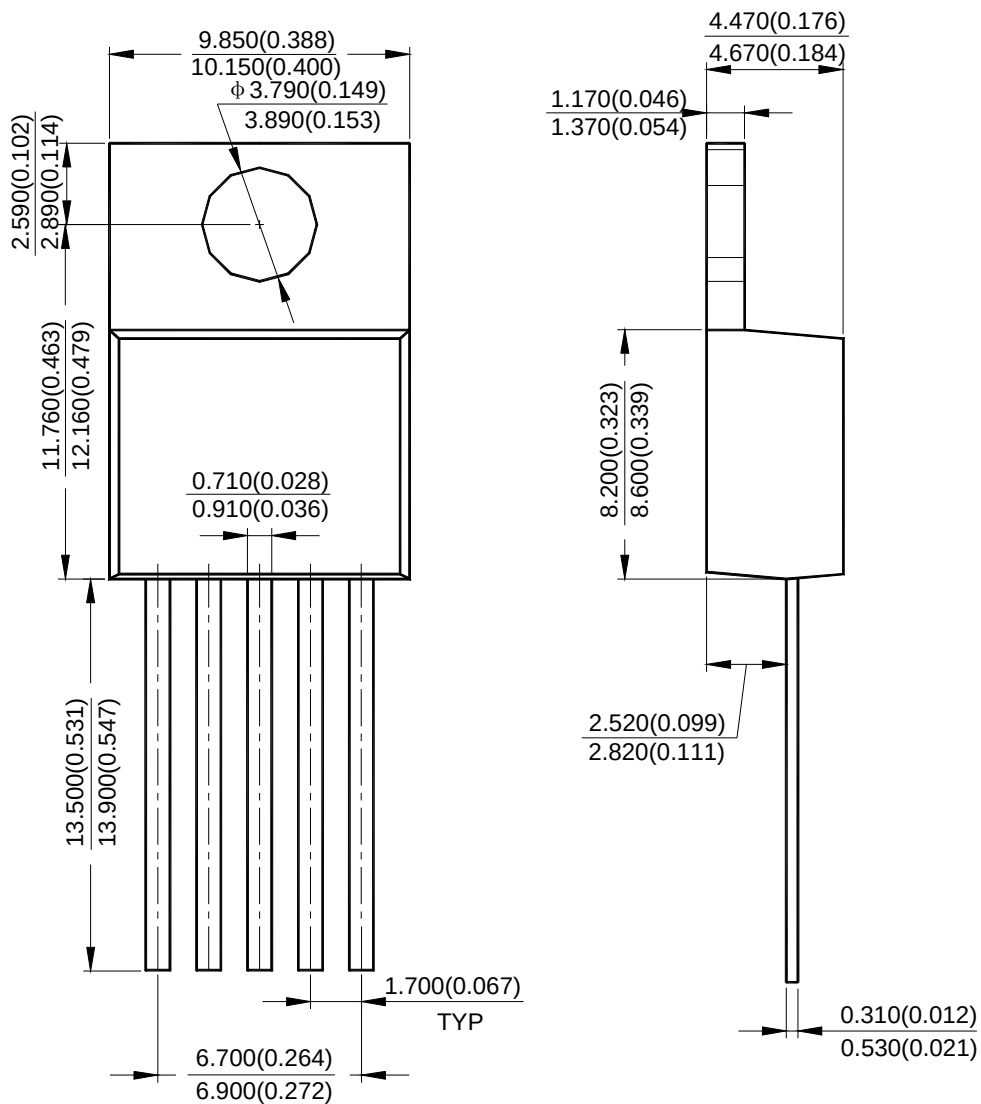
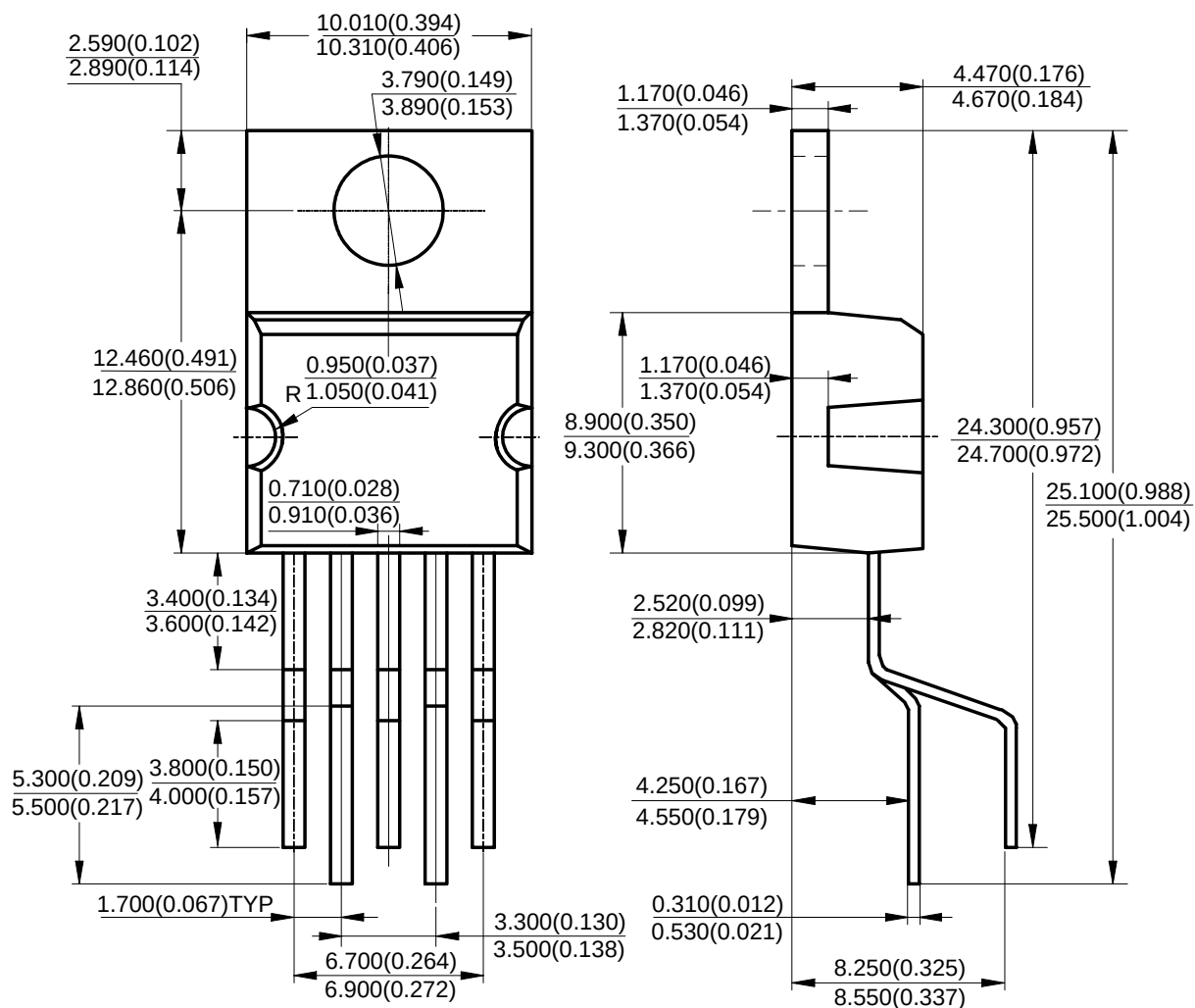
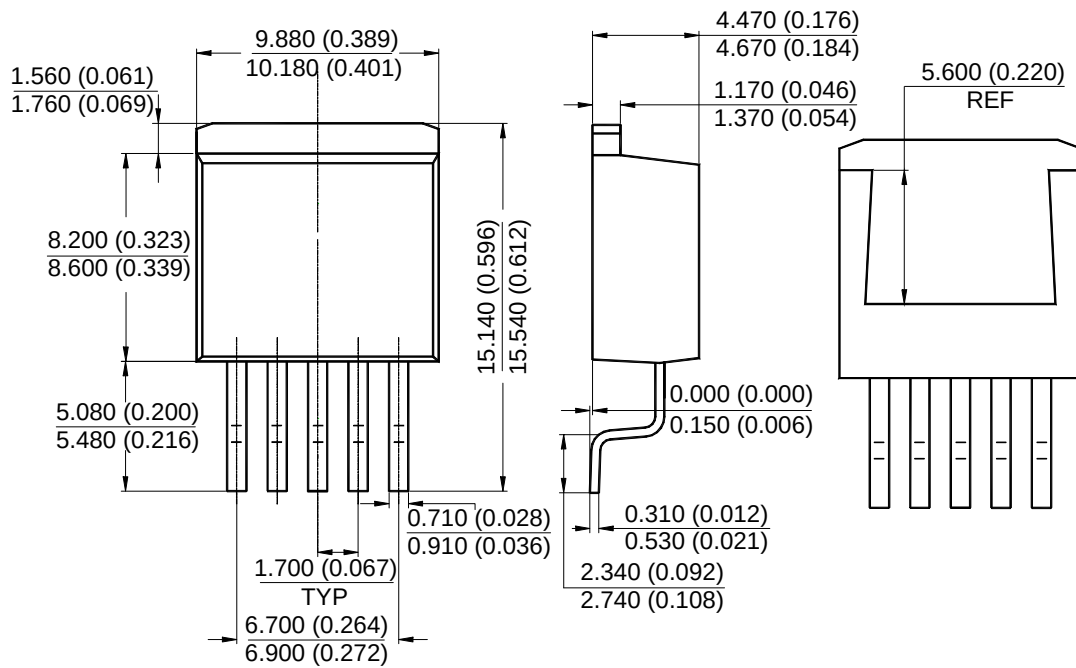
**150kHz 3A PWM BUCK DC-DC CONVERTER****AP3001****Typical Application (Continued)**

Figure 13. Typical Application of AP3001-5V

**150kHz 3A PWM BUCK DC-DC CONVERTER****AP3001****Mechanical Dimensions****TO-220-5L****Unit: mm(inch)**

**150kHz 3A PWM BUCK DC-DC CONVERTER****AP3001****Mechanical Dimensions (Continued)****TO-220B-5L****Unit: mm(inch)**

**150kHz 3A PWM BUCK DC-DC CONVERTER****AP3001****Mechanical Dimensions (Continued)****TO-263-5L****Unit: mm(inch)**



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