

**2A 420kHz PWM BUCK DC-DC CONVERTER**
**AP3005**

## General Description

The AP3005 is a 420kHz fixed frequency PWM buck (step-down) DC-DC converter, capable of driving a 2A load with high efficiency, low ripple and excellent line and load regulation. The device includes a voltage reference, an oscillation circuit, an error amplifier, an internal PMOS and etc.

The PWM control circuit is able to adjust the duty ratio linearly from 0 to 100%. The enable function, over current protection function, short circuit protection function and soft-start function are built inside. When OCP or SCP happens, the operation frequency will be reduced from 420kHz to 40kHz. An internal compensation block is employed to minimize external components.

The AP3005 serves as an ideal power supply unit for portable devices, especially for chip set power in portable systems. It's widely used for PDVD, LCD monitor and DPF chip set powers.

The AP3005 is available in SOIC-8 package.

## Features

- 2A Constant Output Current
- 130mΩ  $R_{DS(ON)}$  Internal Power MOSFET Switch
- Up to 94% Efficiency
- Fixed 420kHz Frequency
- Wide 4.75V to 25V Input Voltage Range
- Output Voltage Adjustable from 0.8V to 21V
- Built in Thermal Shutdown Function
- Built-in Current Limit Function
- Built-in Soft-Start Function
- Support Ceramic or Electrolytic Capacitors

## Applications

- Portable DVD
- LCD Monitor/LCD TV
- Digital Photo Frame
- ADSL
- Set-up Box



Figure 1. Package Type of AP3005

**2A 420kHz PWM BUCK DC-DC CONVERTER**

**AP3005**

**Pin Configuration**

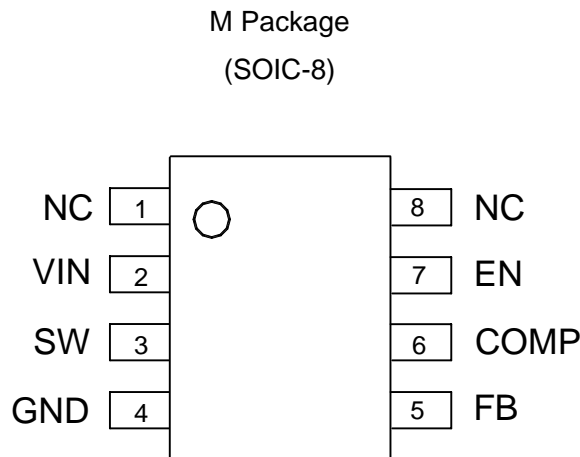


Figure 2. Pin Configuration of AP3005 (Top View)

**Pin Description**

Pin Number	Pin Name	Function
1, 8	NC	No Connection
2	VIN	Supply Voltage Input Pin. The AP3005 operates from a 4.75V to 25V DC voltage. Bypass VIN to GND with a suitable large capacitor to eliminate noise on the input
3	SW	Power Switch Output Pin. SW is the switch node that supplies power to the output
4	GND	Ground Pin.
5	FB	Feedback Pin. Through an external resistor divider network, FB senses the output voltage and regulates it. To prevent current limit run away in a short circuit fault condition, the frequency feedback comparator lowers the oscillator frequency to 40kHz when the FB voltage is below 0.52V. The feedback threshold voltage is 0.8V
6	COMP	Compensation Pin. This pin is the output of the error amplifier. Frequency compensation is done at this pin by connecting a series RC to ground (parallel a C if necessary)
7	EN	Enable Pin. Drive EN pin high to turn on the device, drive it low to turn off. Default of this pin is high level

**Functional Block Diagram**

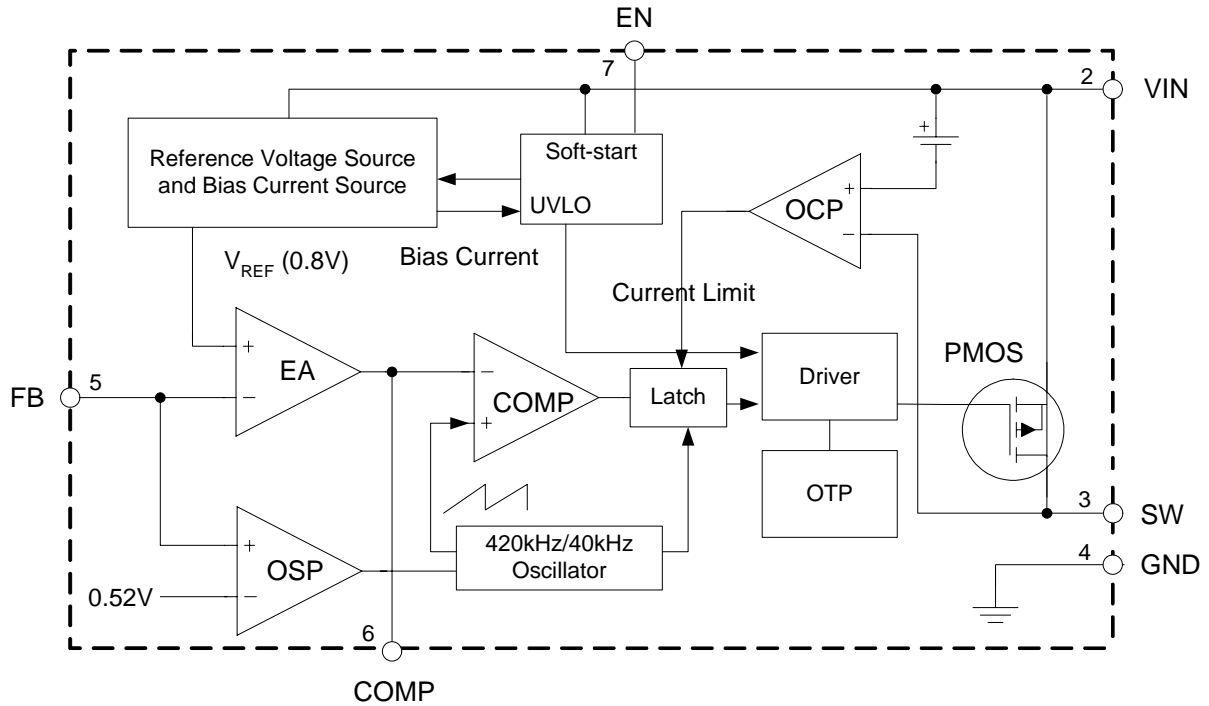
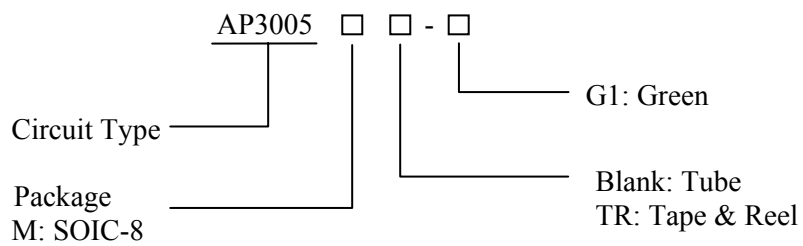


Figure 3. Functional Block Diagram of AP3005

**Ordering Information**



Package	Temperature Range	Part Number	Marking ID	Packing Type
SOIC-8	-40 to 125°C	AP3005M-G1	3005M-G1	Tube
		AP3005MTR-G1	3005M-G1	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "G1" suffix in the part number, are RoHS compliant and green.

**2A 420kHz PWM BUCK DC-DC CONVERTER****AP3005****Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Value	Unit
Input Voltage	$V_{IN}$	-0.3 to 30	V
FB Pin Voltage	$V_{FB}$	-0.3 to 6	V
EN Pin Voltage	$V_{EN}$	-0.3 to $V_{IN}$	V
COMP Pin Voltage	$V_{COMP}$	-0.3 to 6	V
SW Pin Voltage	$V_{SW}$	-0.3 to $V_{IN}$	V
Power Dissipation	$P_D$	Internally limited	mW
Thermal Resistance (Junction to Ambient, No Heat Sink, Free Air)	$\theta_{JA}$	100	°C/W
Operating Junction Temperature	$T_J$	150	°C
Storage Temperature	$T_{STG}$	-65 to 150	°C
Lead Temperature (Soldering, 10sec)	$T_{LEAD}$	260	°C
ESD (Human Body Model)	ESD	2000	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
Input Voltage	$V_{IN}$	4.75	25	V
Output Voltage	$V_{OUT}$	0.8	21	V
Operating Junction Temperature	$T_J$	-40	125	°C

**2A 420kHz PWM BUCK DC-DC CONVERTER****AP3005****Electrical Characteristics** $V_{CC}=12V$ ,  $V_{OUT}=5V$ ,  $T_A=25^{\circ}C$ , unless otherwise specified.

Parameters	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage	$V_{IN}$		4.75		25	V
Shutdown Quiescent Current	$I_{SHDN}$	$V_{EN}=0.4V$		44	60	$\mu A$
Quiescent Current	$I_Q$	$V_{EN}=2V$ , $V_{FB}=1.3V$		1.3	2.5	mA
Feedback Voltage	$V_{FB}$	$V_{IN}=5V$ to $25V$	0.784	0.8	0.816	V
Feedback Bias Current	$I_{FB}$	$V_{FB}=1.3V$		-0.1	-0.5	$\mu A$
Switch Current Limit	$I_{LIM}$	$T_C=25^{\circ}C$	2.5	3.4		A
Oscillator Frequency	$f_{OSC}$		336	420	504	kHz
Frequency of Current Limit or Short Circuit Protection	$f_{OSC1}$	$V_{FB}<0.52V$		40		kHz
Error Amplifier Voltage Gain	$G_V$			1000		V/V
Error Amplifier Transconductance	$G_S$			700		$\mu A/V$
EN Pin Threshold	$V_H$		1.5			V
	$V_L$				0.7	V
EN Pin Input Leakage Current	$I_{EN}$	$V_{EN}=2.5V$		-5	-10	$\mu A$
Internal PMOS ON Resistance	$R_{DSON}$	$V_{IN}=12V$ , $V_{FB}=0.65V$ , $V_{EN}=12V$ , $I_{OUT}=2A$ , $T_C=25^{\circ}C$		130	150	$m\Omega$
Maximum Duty Cycle	$D_{MAX}$	$V_{FB}=0.65V$ , $I_{SW}=0.1A$			100	%
Thermal Shutdown	$T_{OTSD}$			155		$^{\circ}C$
Thermal Shutdown Hysteresis	$T_{HYS}$			20		$^{\circ}C$



**2A 420kHz PWM BUCK DC-DC CONVERTER**

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**Typical Performance Characteristics**

$V_{CC}=12V$ ,  $V_{OUT}=5V$ ,  $T_A=25^\circ C$ , unless otherwise specified.

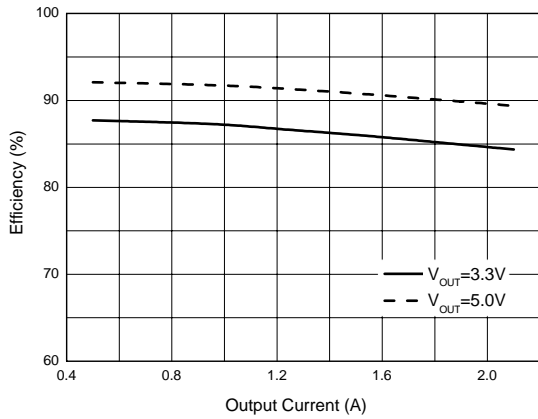


Figure 4. Efficiency vs. Output Current

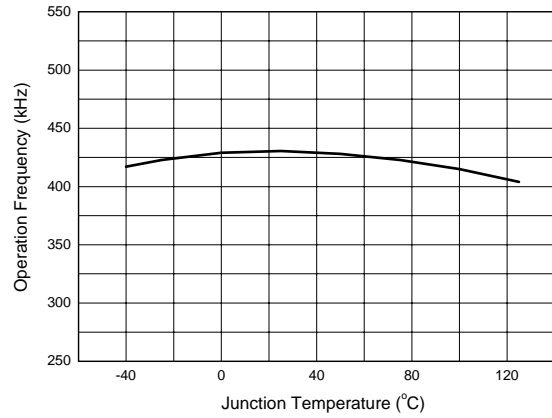


Figure 5. Operation Frequency vs. Junction Temperature

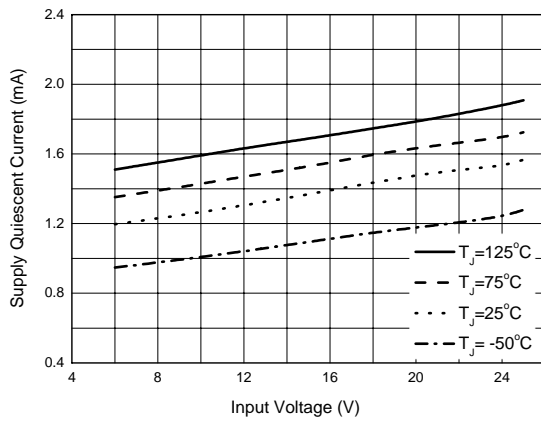


Figure 6. Supply Quiescent Current vs. Input Voltage

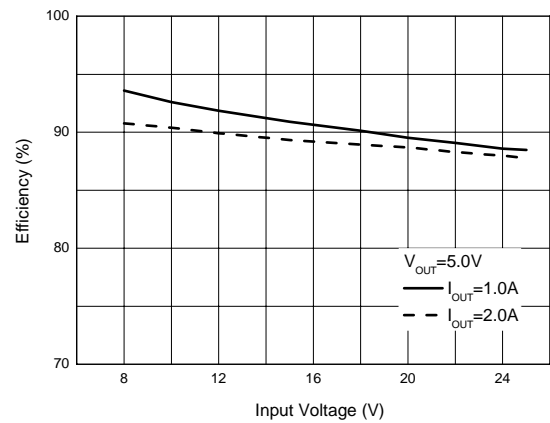


Figure 7. Efficiency vs. Input Voltage



**2A 420kHz PWM BUCK DC-DC CONVERTER**

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**Typical Performance Characteristics (Continued)**

$V_{CC}=12V$ ,  $V_{OUT}=5V$ ,  $T_A=25^\circ C$ , unless otherwise specified.

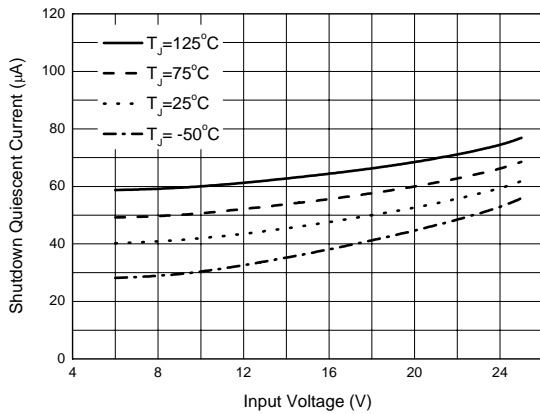


Figure 8. Shutdown Quiescent Current vs. Input Voltage

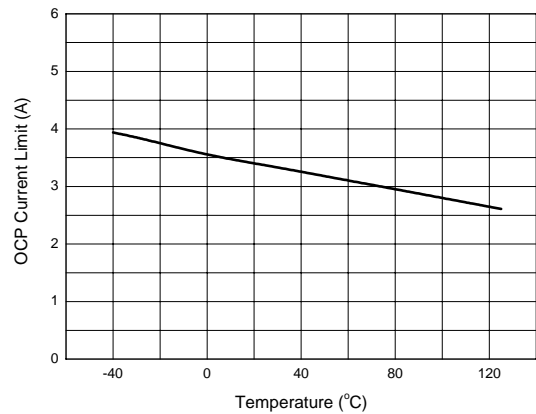


Figure 9. OCP Current Limit vs. Temperature

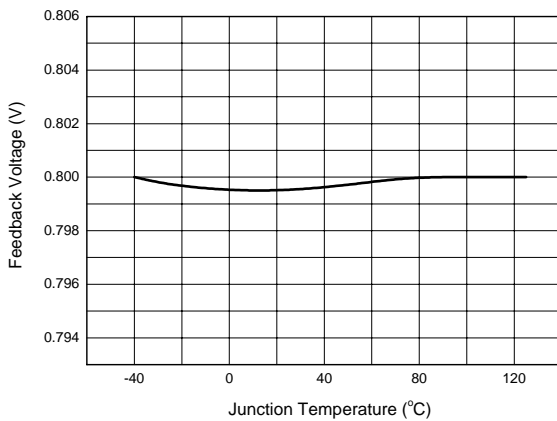


Figure 10. Feedback Voltage vs. Junction Temperature

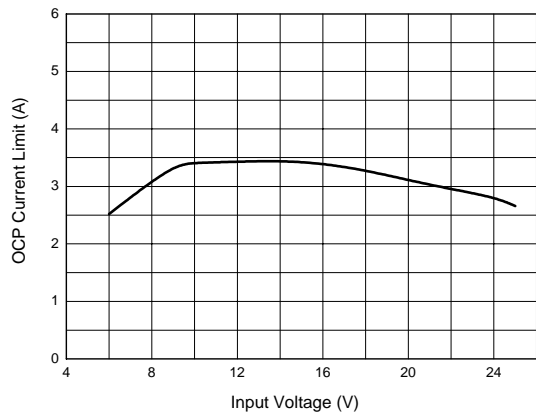


Figure 11. OCP Current Limit vs. Input Voltage

**2A 420kHz PWM BUCK DC-DC CONVERTER**

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**Typical Performance Characteristics (Continued)**

$V_{CC}=12V$ ,  $V_{OUT}=5V$ ,  $T_A=25^\circ C$ , unless otherwise specified.

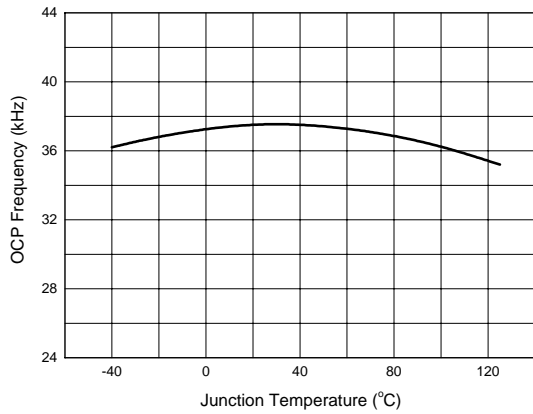


Figure 12. OCP Frequency vs. Junction Temperature

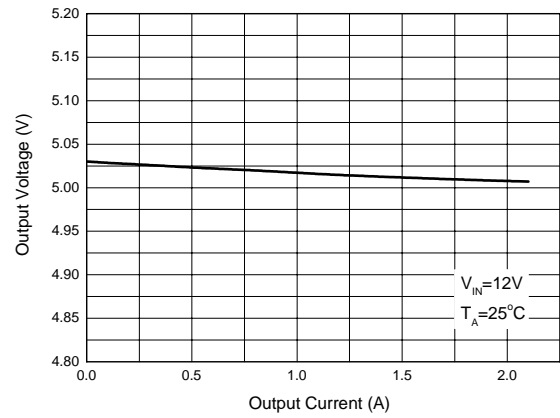


Figure 13. Output Voltage vs. Output Current

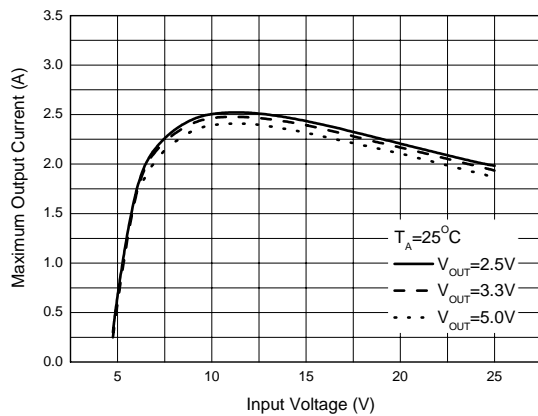


Figure 14. Maximum Output Current vs. Input Voltage



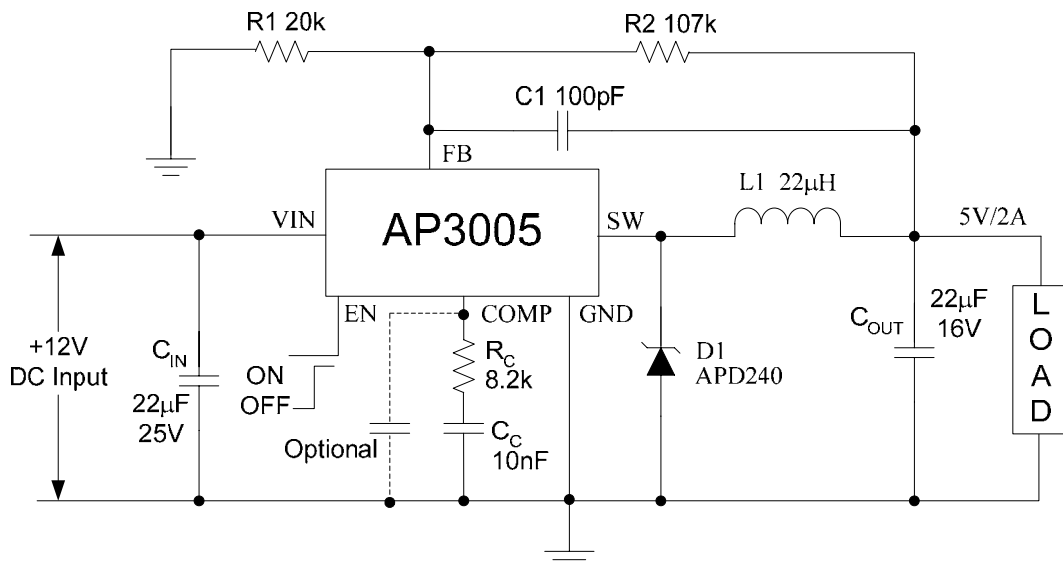
**2A 420kHz PWM BUCK DC-DC CONVERTER**
**AP3005**
**Typical Application**
 $(V_{IN}=12V, V_{OUT}=5V, I_{OUT}=2A)$ 


Figure 15. Typical Application 1 of AP3005 Applied with Ceramic Input and Output Capacitors

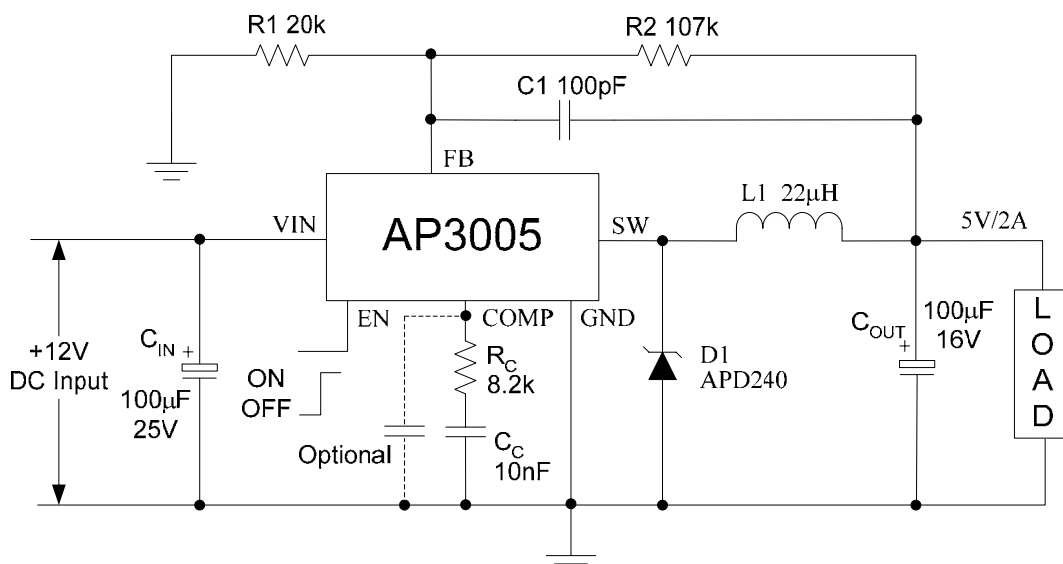
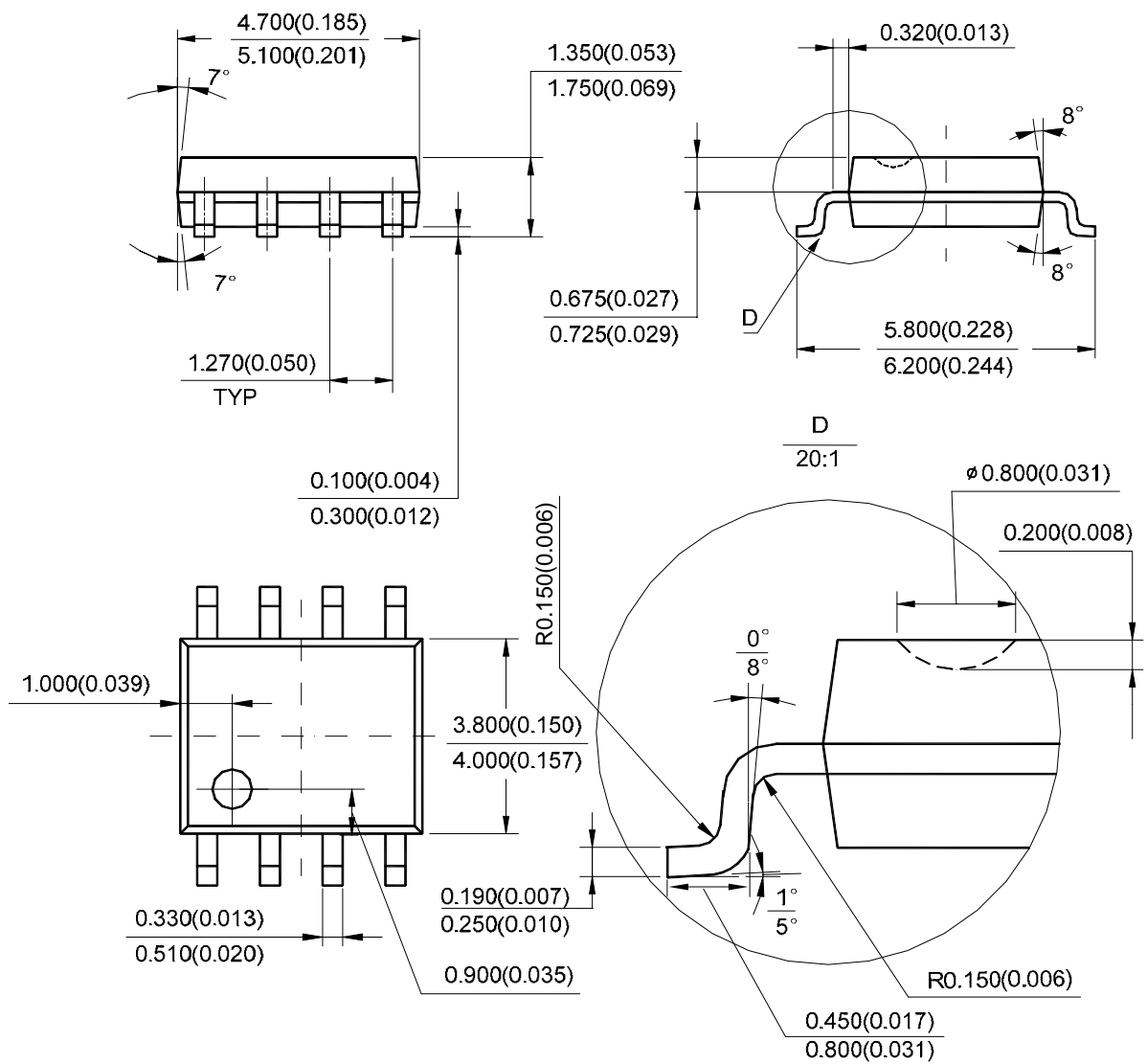


Figure 16. Typical Application 2 of AP3005 Applied with Electrolytic Input and Output Capacitors

**Mechanical Dimensions**

**SOIC-8**

**Unit: mm(inch)**



Note: Eject hole, oriented hole and mold mark is optional.



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#### **MAIN SITE**

##### **- Headquarters**

##### **BCD Semiconductor Manufacturing Limited**

No. 1600, Zi Xing Road, Shanghai ZiZhu Science-based Industrial Park, 200241, China  
Tel: +86-21-24162266, Fax: +86-21-24162277

##### **- Wafer Fab**

##### **Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd.**

800 Yi Shan Road, Shanghai 200233, China  
Tel: +86-21-6485 1491, Fax: +86-21-5450 0008

#### **REGIONAL SALES OFFICE**

##### **Shenzhen Office**

##### **Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd., Shenzhen Office**

Unit A Room 1203, Skyworth Bldg., Gaoxin Ave. 1.S., Nanshan District, Shenzhen, China  
Tel: +86-755-8826 7951  
Fax: +86-755-8826 7865

##### **Taiwan Office**

##### **BCD Semiconductor (Taiwan) Company Limited**

4F, 298-1, Rui Guang Road, Nei-Hu District, Taipei, Taiwan  
Tel: +886-2-2656 2808  
Fax: +886-2-2656 2806

##### **USA Office**

##### **BCD Semiconductor Corp.**

30920 Huntwood Ave. Hayward, CA 94544, USA  
Tel : +1-510-324-2988  
Fax: +1-510-324-2788