

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

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Pin Configuration

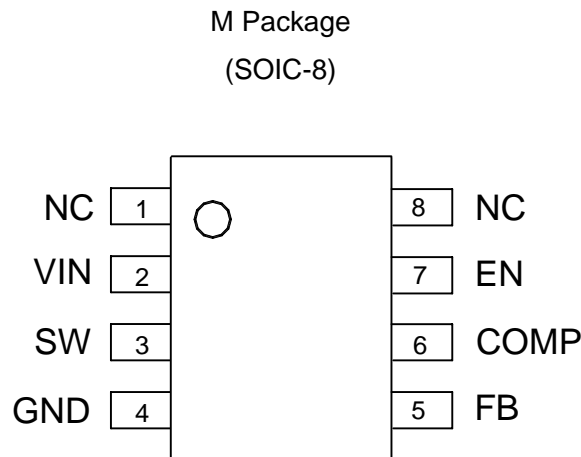


Figure 2. Pin Configuration of AP3005 (Top View)

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 |

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Functional Block Diagram

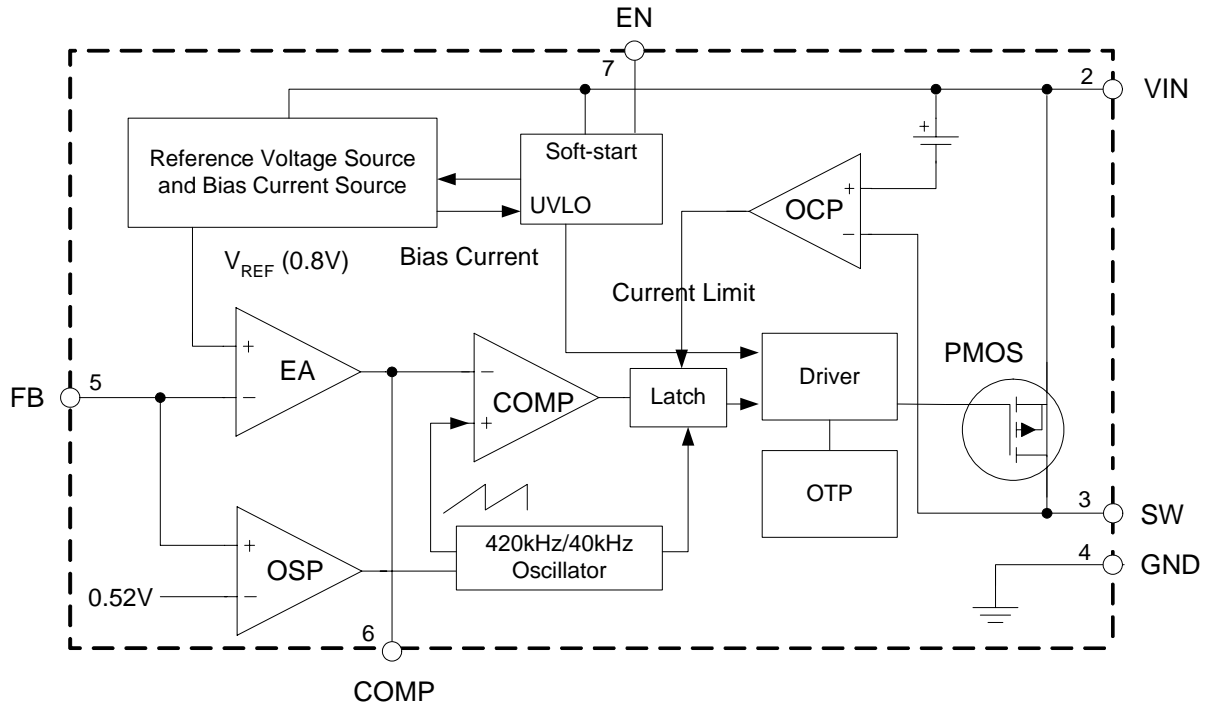
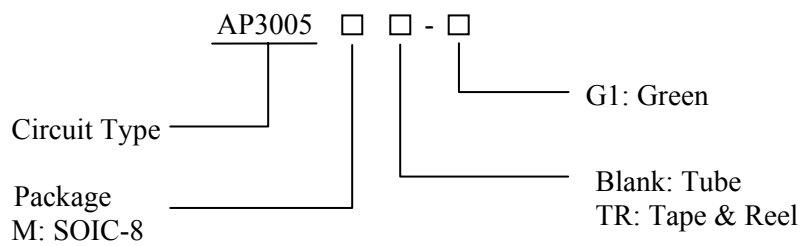


Figure 3. Functional Block Diagram of AP3005

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) | θ_{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 | μA |
| 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 | μA |
| 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 | μA |
| 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 | | $^{\circ}C$ |



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Typical Performance Characteristics

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

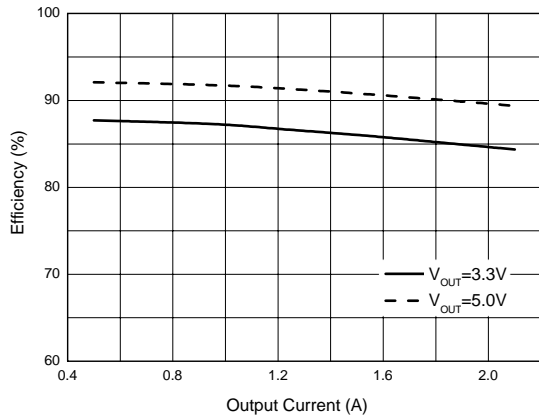


Figure 4. Efficiency vs. Output Current

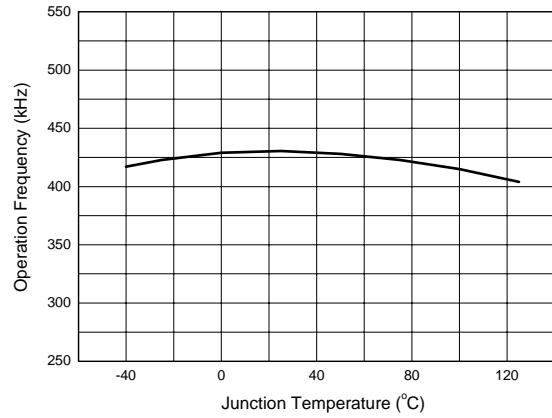


Figure 5. Operation Frequency vs. Junction Temperature

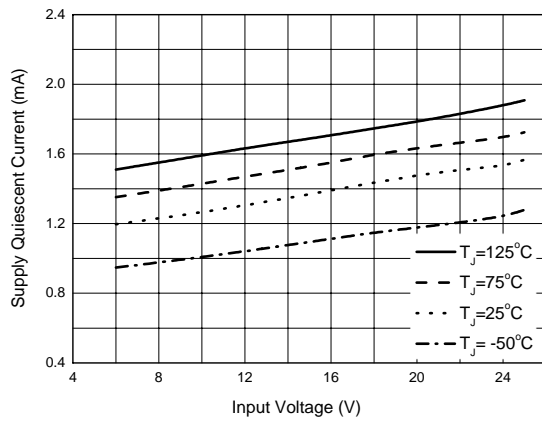


Figure 6. Supply Quiescent Current vs. Input Voltage

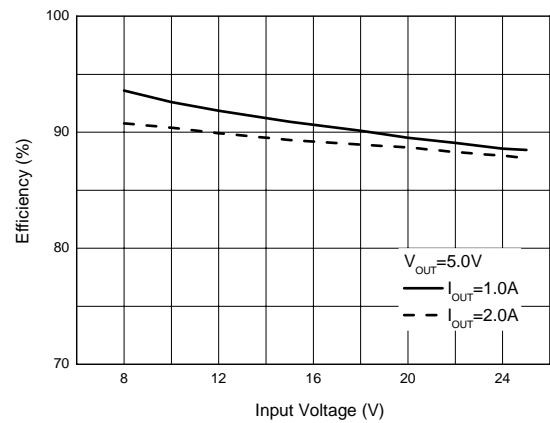


Figure 7. Efficiency vs. Input Voltage



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Typical Performance Characteristics (Continued)

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

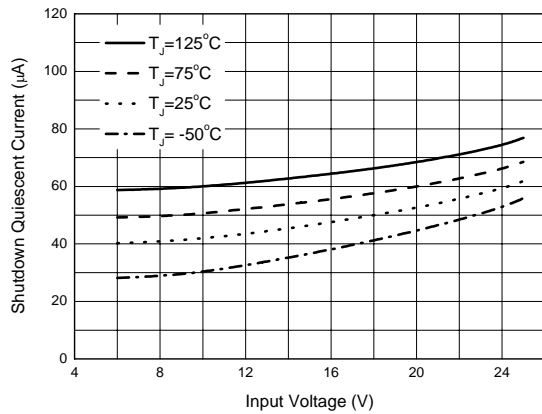


Figure 8. Shutdown Quiescent Current vs. Input Voltage

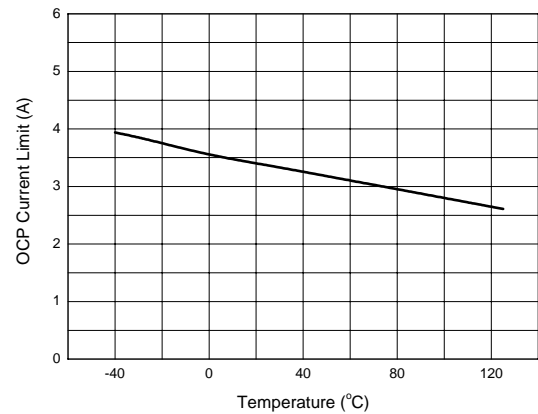


Figure 9. OCP Current Limit vs. Temperature

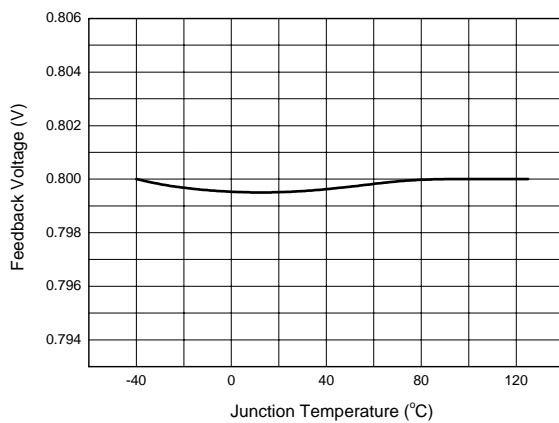


Figure 10. Feedback Voltage vs. Junction Temperature

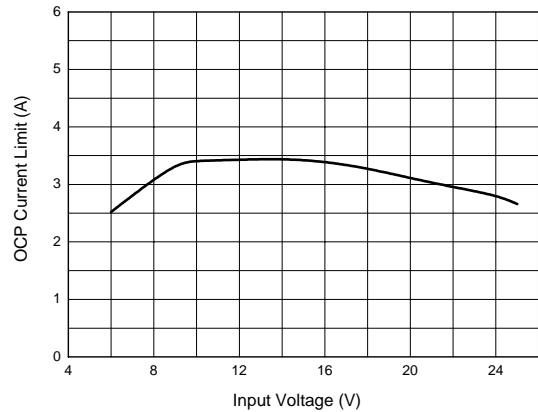


Figure 11. OCP Current Limit vs. Input Voltage

Typical Performance Characteristics (Continued)

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

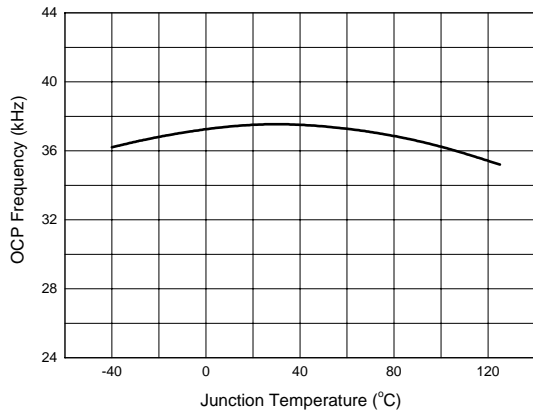


Figure 12. OCP Frequency vs. Junction Temperature

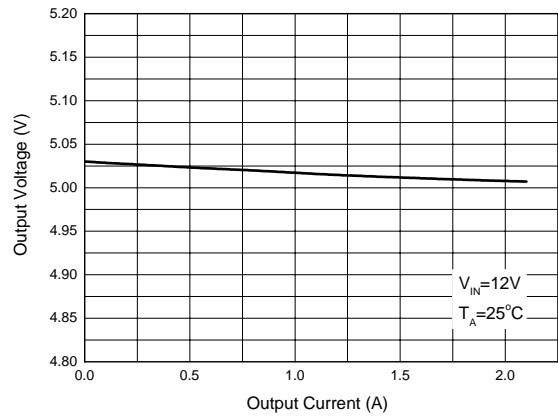


Figure 13. Output Voltage vs. Output Current

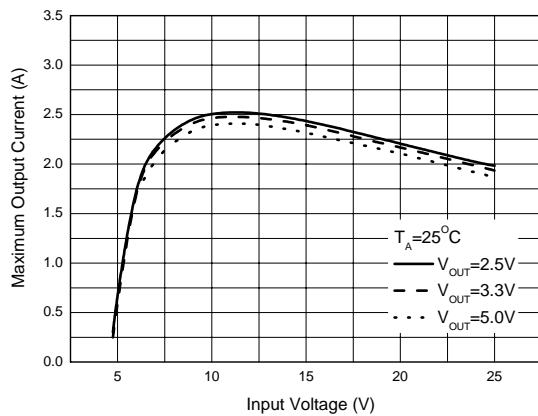


Figure 14. Maximum Output Current vs. Input Voltage

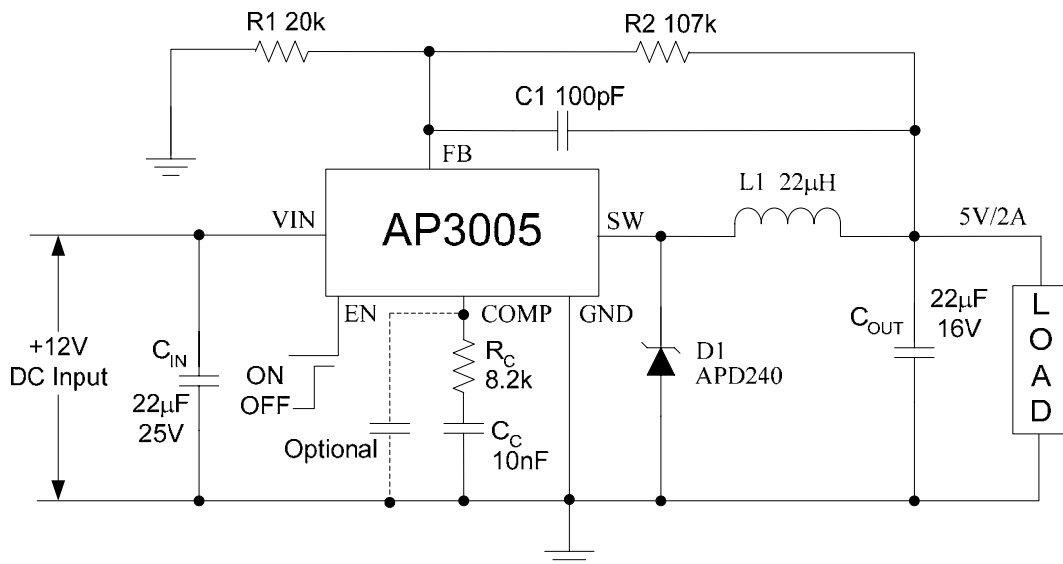
2A 420kHz PWM BUCK DC-DC CONVERTER
AP3005
Typical Application
 $(V_{IN}=12V, V_{OUT}=5V, I_{OUT}=2A)$


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

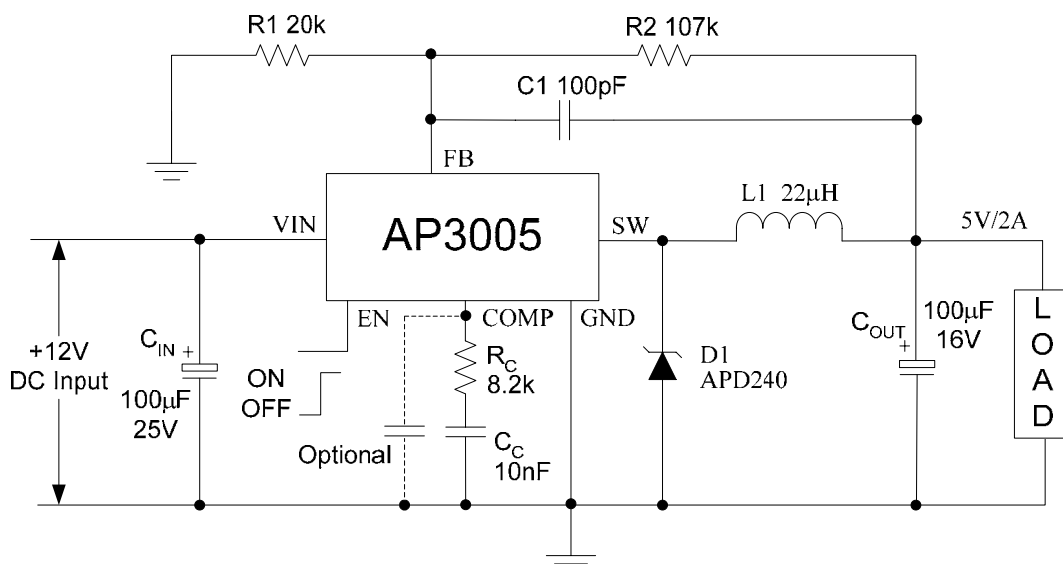
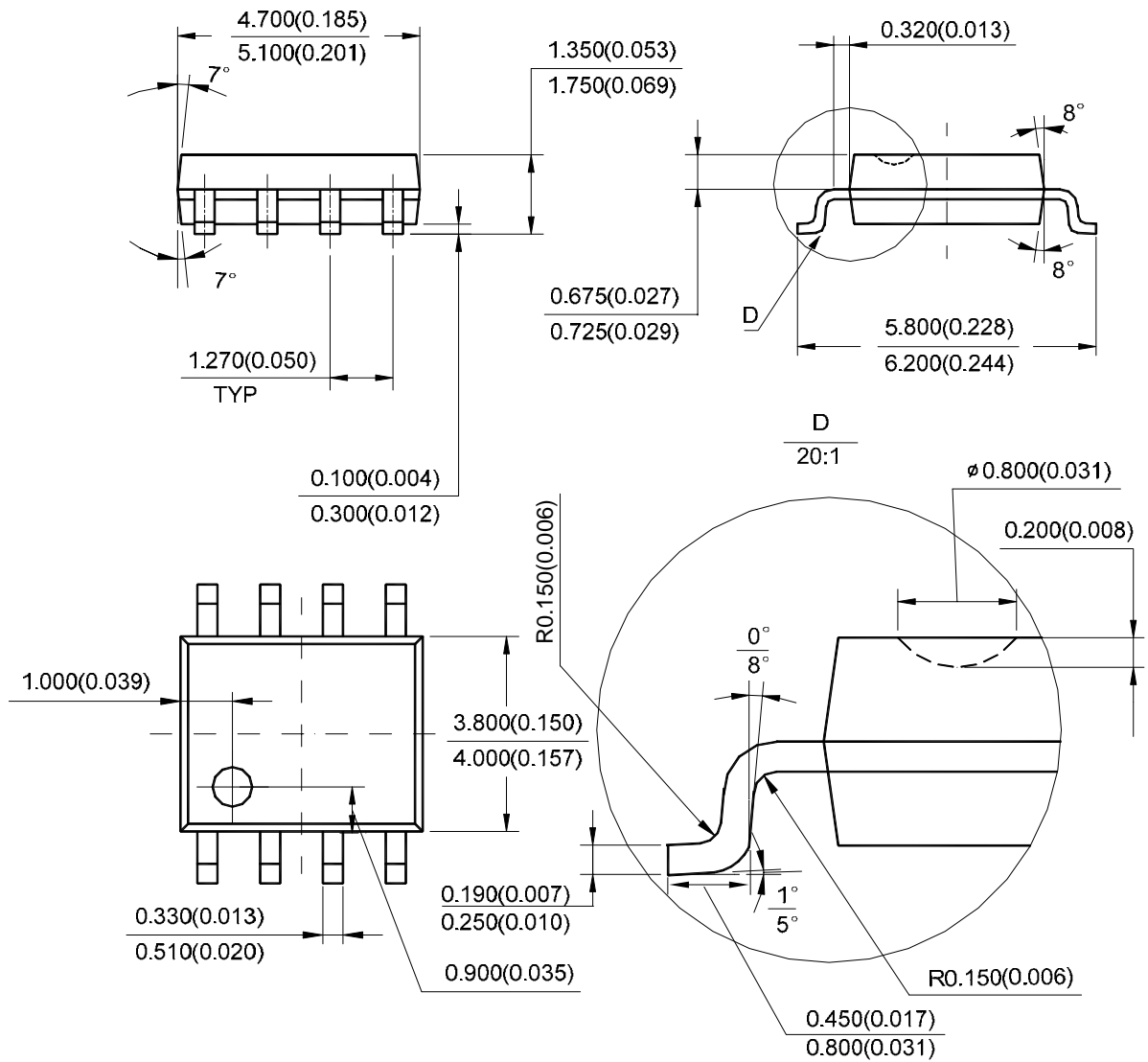


Figure 16. Typical Application 2 of AP3005 Applied with Electrolytic Input and Output Capacitors

Mechanical Dimensions

SOIC-8

Unit: mm(inch)



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



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