



## 2. PAM2401 General Description

The PAM2401 is a high efficiency, current mode, fixed frequency, step-up DC/DC converter with true output disconnect and inrush current limiting. The device includes a 0.10 $\mu$  N-channel MOSFET switch and a 0.15 $\mu$  P-channel synchronous rectifier. This product has the ability to simply program the output voltage from 2.5V to 5.0V. The switching frequency is 1.0MHz, programmable current limit set by an external resistor from 1.0A to 3.0A with internal soft-start. When loading became light, the converter will automatically enter into PSM to improve the efficiency. Quiescent current is only 150 $\mu$ A during Pulse Skip Mode operation, maximizing battery life in portable applications. Other features include < 1 $\mu$ A shutdown, anti-ringing control, Hiccup mode short protection, over voltage protection and over temperature protection.

The PAM2401 is available in MSOP-8 and U-DFN3030-12 packages.

## 3. Key Features

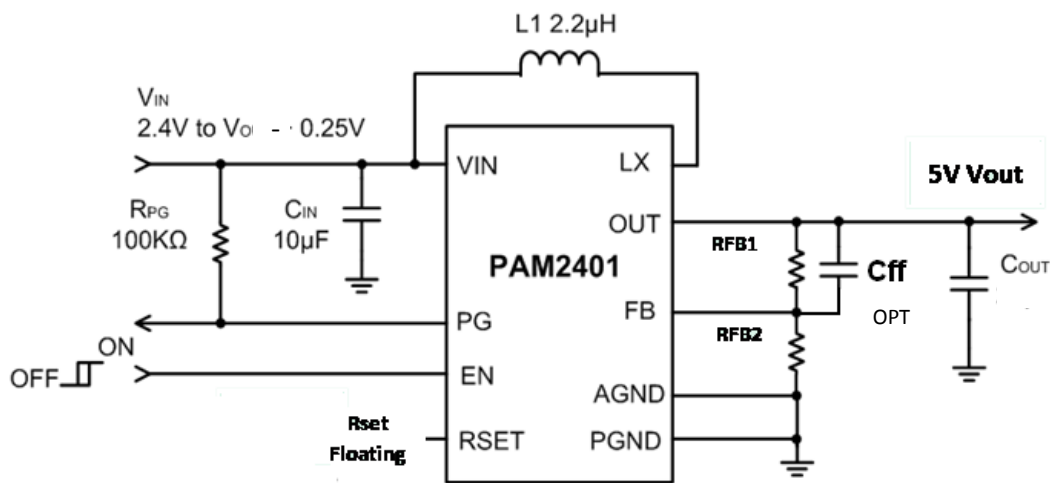
- Up to 95% Efficiency
- True Output Disconnect
- Inrush Current Limiting When Power On
- Output Current up to 1000mA at Vin=3V and Vout=5.0V
- Fixed Frequency Operation Up to 1MHz
- 0.9V to 4.75V Input Range
- 2.5V to 5.0V Adjustable Output Voltage
- Programmable Current Limit
- MSOP-8 and UDFN3030-12 packages
- Guaranteed 1.0V Start-Up
- Internal Soft-Start
- Internal Compensation
- Pulse Sipping Mode at Light Load Operation
- Hiccup Mode Short Protection
- Over Voltage Protection
- Over Temperature Protection
- <1 $\mu$ A Shutdown Current
- Power Good Indicator

## 4. Application

- Handheld Computers
- Cordless Phones
- GPS Receivers
- Battery Backup Supplies

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## 5. EV Board Schematic



### Output Voltage Set Equation

The output voltage of the PAM2401 VOUT is set by an external resistor divider from VOUT to ground as shown in figure 1. The divider tap is connected to the FB pin, and the typical value of the voltage at the FB pin is 0.6V. The following equation is used to set the VOUT:

$V_{OUT} = 0.6(1 + R_{FB1}/R_{FB2})$  For example, if output voltage of 5V is needed, with a chosen RFB2 value of 110 kΩ, the value of RFB1 can be calculated according to the equation, so a 825kΩ resistor should be chosen for RFB1.

Vo	RFB1	RFB2
3.3V	680K	150K
3.6V	750K	150K
4.2V	620K	100K
5V	825K	110K

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### Inductor Selection

To select an inductor for use in PAM2401 applications, it is worth noting that the inductor current saturation rating should be larger than the possible peak inductor current to ensure proper operation, and should have low DCR(DC resistance). Using an inductor the saturation current of which is lower than required can cause a dramatic drop in the inductance and can decay the maximum output current levels severely. For most applications, the value of the inductor should be in the range of 1.5uH to 4.7uH. Its value is chosen based on the desired ripple current. Larger value inductors result in lower ripple currents, and smaller value inductors result in higher ripple currents. A 1.5uH or 2.2uH inductor will be the best choice for most PAM2401 applications. The following equation can also help give a good approximate value for the inductor.

$$L = V_{IN} \times D / (\Delta I_L \times f)$$

D: Duty Cycle =  $1 - V_{IN}/V_{OUT}$  f: Switching Frequency = 1.0MHz

$\Delta I_L$ : Ripple Current in the Inductor, i.e. 20% to 40% of the maximum inductor current ( $I_p$ ).

Vo	3.3V	3.6V	4.2V	5V
L	1.5uH	1.5uH	1.5uH	2.2uH

### Output and Input Capacitor Selection

#### Input Capacitor

At least a 10 uF input capacitor is recommended to reduce the input ripple and switching noise for normal operating conditions, while a 10~22uF capacitor may be required for higher power and dynamic loads. Larger values and lower ESR (Equivalent Series Resistance) may be needed if the application require very low input ripple. It follows that ceramic capacitors are a good choice for applications. Note that the input capacitor should be located as close as possible to the IC.

#### Output Capacitor

A minimum output capacitor value of 22uF is recommended and may be increase to a larger value. For output lower than 4.2V application, the minimum value of output capacitor should be 32uF at least. The ESR of the output capacitor is important because it determines the peak to peak output voltage ripple by the following equation:

$$\Delta V_{OUT} \gg 2\Delta I_L \times RESR$$

Multilayer ceramic capacitors are an excellent choice as they have extremely low ESR and are available in small footprints.

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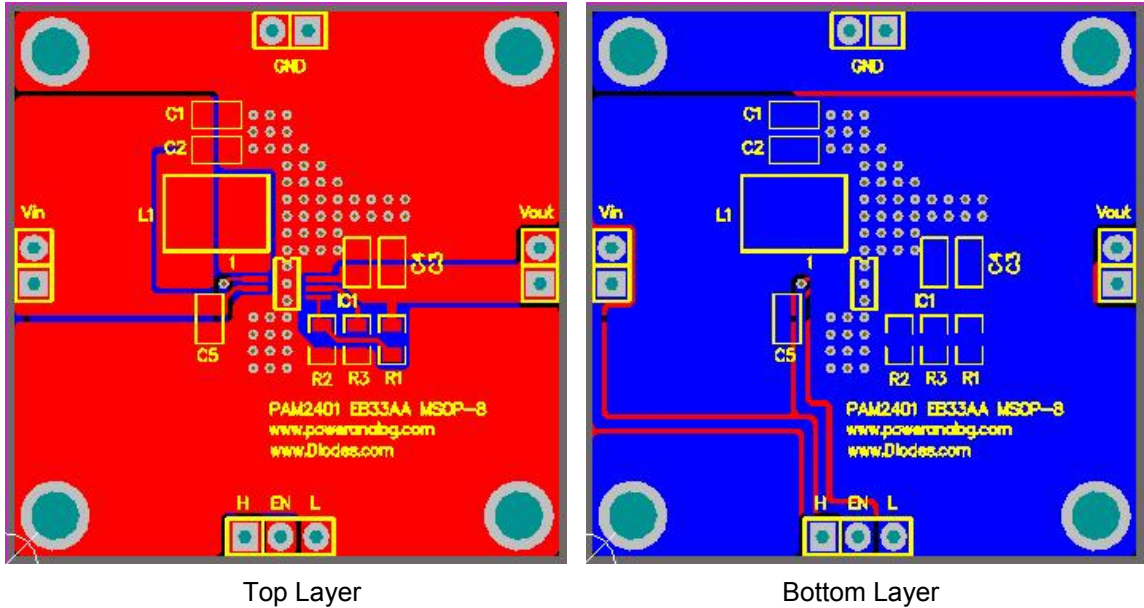
## 7. PCB Layout Guidance

Careful PCB layout is important for proper operation. Use the following guidelines for good PCB layout:

- (1) Minimize the area of the high current switching loop to avoid excessive switching noise.
- (2) Connect high-current input and output components with short and wide connections.
- (3) Connect all GND together with short, wide traces or a ground plane. Maximizing the width of the power ground traces improves efficiency and reduces output-voltage ripple and noise spikes. If vias are unavoidable, use multiple vias in parallel to reduce resistance and inductance.
- (4) Place the  $V_{in}$  bypass capacitor as close to the device as possible. The input capacitor should be connected directly to  $V_{in}$  and GND pins with a wide trace.
- (5) Place the output voltage setting-divider resistors as close to the FB pin as possible. The divider's center trace should be kept short. Avoid running the sensing traces near SW trace.
- (6) For the good thermal dissipation, PAM2401 has a heat dissipate pad in the bottom side, it should be soldered to PCB surface. For the copper area can't be large in the component side, so we can use multiple vias connect to other side of the PCB.
- (7) Refer to the PAM2401 evaluation board for an example of proper board layout.

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## 8. PCB Layout Example



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