General Description

The EA8421 is a 800mA buck regulator, designed to operate from 5V to 40V input voltage range. Built-in 400mΩ high side Power-MOSFET has up to 92% efficiency, ideal for 800mA output current applications. The fixed 600KHz operating frequency allowing the use of small inductor and ceramic capacitor. The EA8421 has complete protection functions, including cycle-by-cycle current limit, short circuit protection, OTP and UVLO protection. The internal compensation design allows users to more simplified application, and can reduce the cost of external components. The EA8421 is available in the SOT-23-6 package and easy to use.

Features

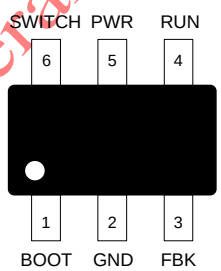
- 5V to 40V Input Voltage Range
- Output Adjustable Down to 0.8V
- 800mA Continuous Load Current
- Fixed 600KHz Switching Frequency
- Efficiency Up to 92%
- 400uA Quiescent Current
- Internal Compensation
- Internal Soft-Start Function
- Cycle-by-Cycle Current Limit
- Input UVLO Protection
- Auto Recovery Short Circuit Protection
- Auto Recovery OTP Protection
- Available in SOT-23-6 Package

Applications

- Distributed Power Systems
- Smart Phones
- Power Meters
- Portable Handsets

Pin Configurations

(TOP VIEW)



SOT-23-6

Pin Description

Pin Name	Function Description	Pin No.
BOOT	The power input of the internal high side N-MOSFET gate driver. Connect a 100nF ceramic capacitor from BOOT pin to SWITCH pin.	1
GND	Ground pin.	2
FBK	Feedback input. Connect FBK pin and GND pin with voltage dividing resistors to set the output voltage.	3
RUN	The device turns on/turns off control input. The EA8421 on/off state can be controlled by RUN pin voltage level. Connect RUN pin to PWR pin with a 150KΩ pull up resistor for automatic startup. Don't leave RUN pin floating.	4
PWR	The EA8421 power input pin. Recommended to use a 10uF MLCC capacitor between PWR pin and GND pin.	5
SWITCH	Internal MOSFET switching output. Connect SWITCH pin with a low pass filter circuit to obtain a stable DC output voltage.	6

Function Block Diagram

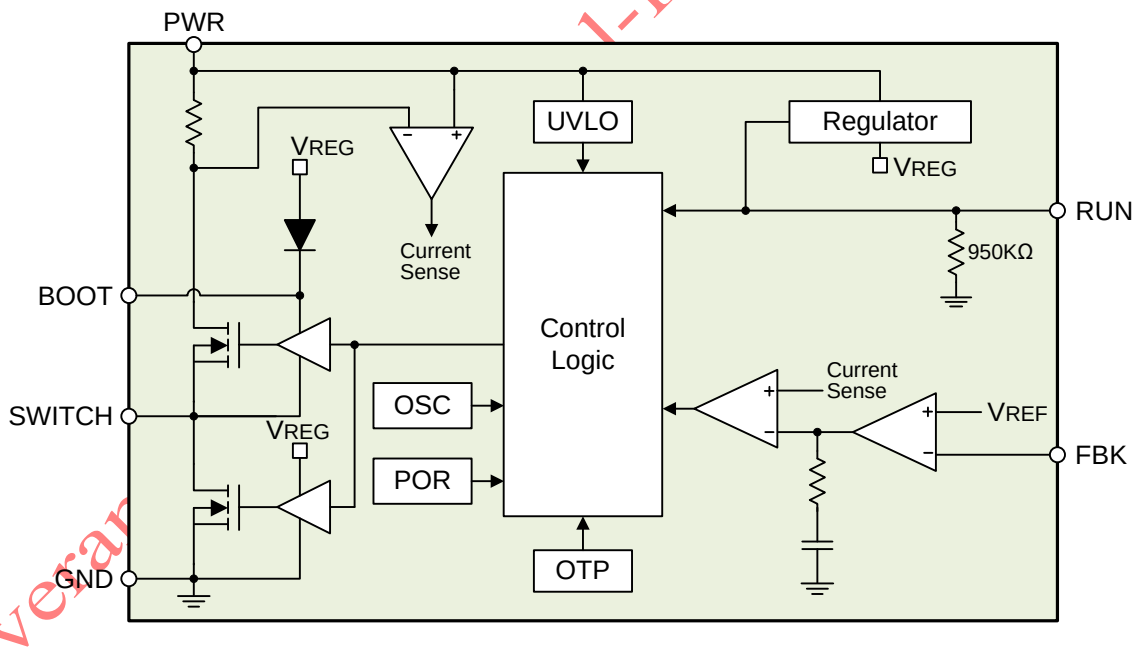


Figure 1. EA8421 internal function block diagram

Absolute Maximum Ratings

Parameter	Value
Input Voltage (V_{PWR})	-0.3V to +45V
RUN Pin Input Voltage (V_{RUN})	-0.3V to +45V
BOOT Pin Voltage (V_{BOOT})	V_{SWITCH}-0.3V to V_{SWITCH}+5V
SWITCH Pin Voltage (V_{SWITCH})	-1V to +45V
FBK Pin Voltage (V_{FBK})	-0.3V to +6V
Junction Temperature Range (T_J)	-55°C to +125°C
Maximum Junction Temperature (T_{Jmax})	+150°C
Lead Temperature (Soldering, 10 sec)	+260°C
Storage Temperature Range (T_S)	-65°C to +150°C
ESD (HBM)	2KV

Note (1):Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. Exposure to "Absolute Maximum Ratings" conditions for extended periods may affect device reliability and lifetime.

Package Thermal Characteristics

Parameter	Value
SOT-23-6 Thermal Resistance (θ_{JC})	125°C/W
SOT-23-6 Thermal Resistance (θ_{JA})	250°C/W
SOT-23-6 Power Dissipation at T_A=25°C (P_{Dmax})	0.5W

Note (1): P_{Dmax} is calculated according to the formula: $P_{DMAX}=(T_{JMAX}-T_A)/\theta_{JA}$.

Recommended Operating Conditions

Parameter	Value
Input Voltage (V_{PWR})	+5V to +40V
RUN Pin Input Voltage (V_{RUN})	-0.3V to +40V

Electrical Characteristics

V_{PWR}=12V, V_{OUT}=3.3V, T_A=25°C, unless otherwise noted

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage	V_{PWR}		5		40	V
Shutdown Supply Current	I_{SD}	V_{RUN} = 0V		2	10	uA
		T_J = -55°C to 125°C			20	uA
Quiescent Current	I_Q	V_{RUN} = 2V, V_{FBK} = 105% V_{REF}, I_{LOAD} = 0A		400	600	uA
		T_J = -55°C to 125°C			1	mA
Reference Voltage	V_{REF}	5V ≤ V_{PWR} ≤ 40V	0.784	0.8	0.816	V
Switching Frequency	F_{SW}			600		KHz
High Side MOSFET On-Resistance	$R_{DS(ON)-HM}$			400		mΩ
Low Side MOSFET On-Resistance	$R_{DS(ON)-LM}$			250		mΩ
High Side MOSFET Current Limit	I_{LIM-HM}			2		A
High Side MOSFET Leakage Current	$I_{LEAK-HM}$	V_{RUN} = 0V, V_{SWITCH} = 0V		0	10	uA
RUN Pin Input Low Voltage	V_{RUN-L}				0.4	V
RUN Pin Input High Voltage	V_{RUN-H}		2			V
RUN Pin Pull-Low Resistance	R_{RUN}			950		KΩ
Maximum Duty Cycle	D_{MAX}			92		%
High Side MOSFET Minimum On Time	T_{ONMIN}			80		ns
Internal Soft-Start Time				1		ms
Thermal Shutdown Threshold	T_{OTP}			160		°C

Note (1): MOSFET on-resistance specifications are guaranteed by correlation to wafer level measurements.
(2): Thermal shutdown specifications are guaranteed by correlation to the design and characteristics analysis.

Application Circuit Diagram

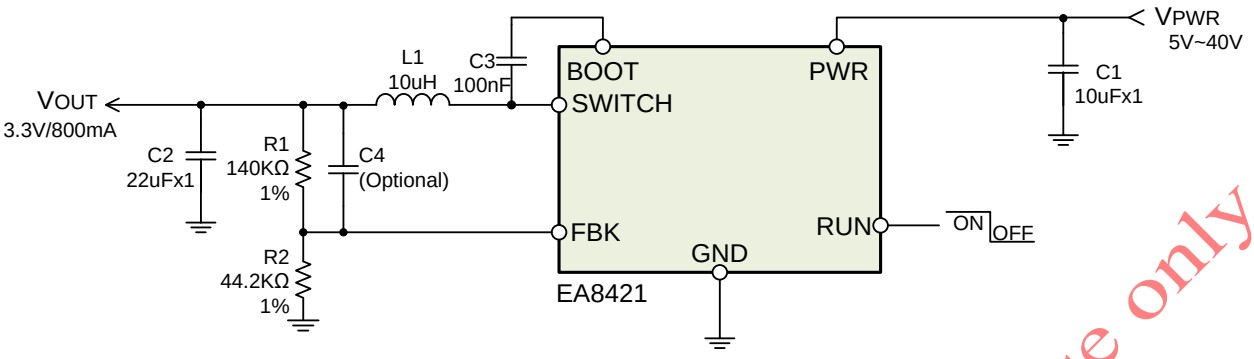


Figure 2. Typical application circuit diagram

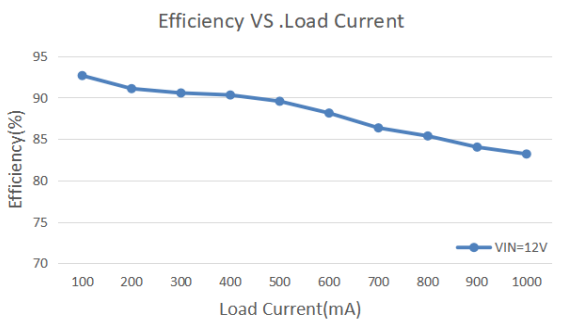
Ordering Information

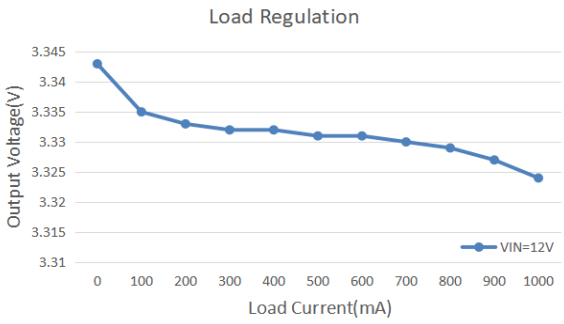
Part Number	Package Type	Packing Information
EA8421T6R	SOT-23-6	Tape & Reel / 3000

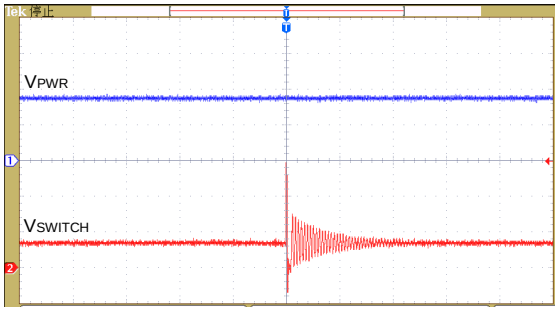
Note (1):"T6": Package type code.
(2):"R": Tape & Reel.

Typical Operating Characteristics

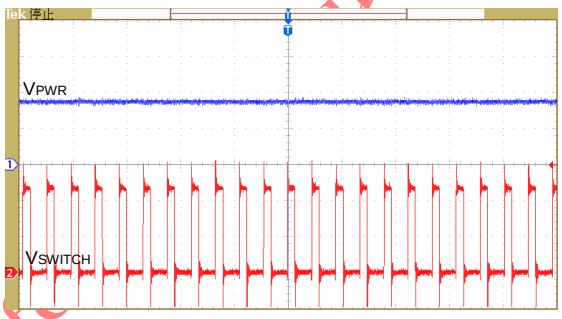
V_{PWR}=12V, V_{OUT}=3.3V, L1=10uH, C1=10F, C2=22uF, T_A=25°C, unless otherwise noted



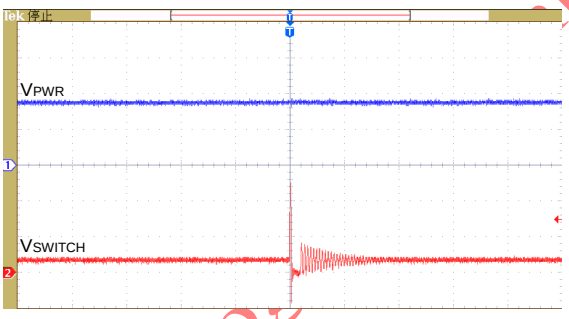




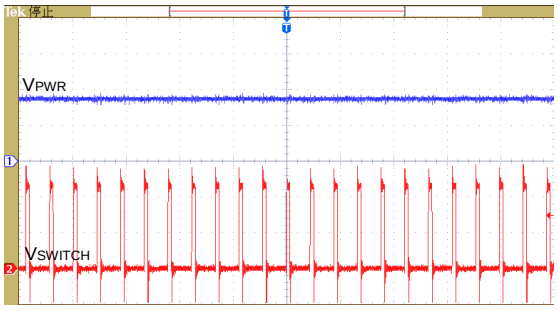
V_{PWR}=12V, I_{OUT}=0A Switching Waveform



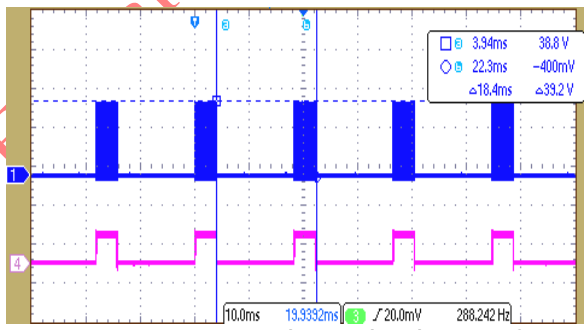
V_{PWR}=12V, I_{OUT}=0.8A Switching Waveform



V_{PWR}=24V, I_{OUT}=0A Switching Waveform



V_{PWR}=24V, I_{OUT}=0.8A Switching Waveform



V_{PWR}=24V, I_{OUT}=0A Short-Circuit Waveform

Application Information

Enable Control

The EA8421 use RUN pin to control the regulator turns on / turns off. When the RUN pin input voltage is higher than 2V, the EA8421 enters the operating mode. Drive the RUN pin input voltage lower than 0.4V to ensure the EA8421 into shutdown mode, as shown in Figure3. When the device works in the shutdown mode, the shutdown supply current is less than 2uA. The EA8421 also provides automatic startup function as shown in Figure 4. Connect RUN pin and PWR pin with a 150KΩ resistor, when the PWR supply input voltage increasing and higher than RUN pin threshold voltage, the EA8421 will enter operating mode automatically.

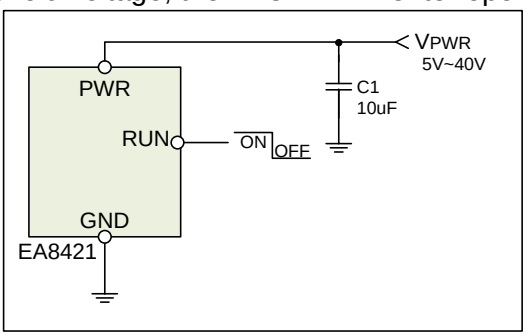


Figure 3. Enable control by RUN pin voltage

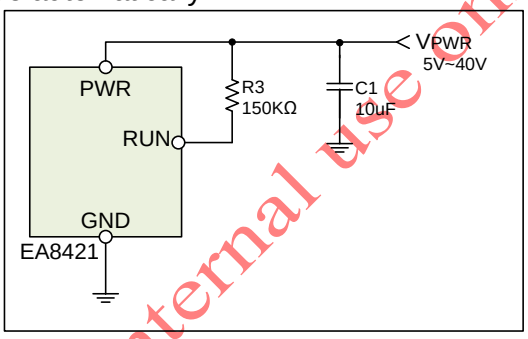


Figure 4. Automatic startup application circuit

Output Voltage Setting

The EA8421 output voltage can be set via a resistor divider (R1, R2). The output voltage is calculated by following equation:

$$V_{OUT} = 0.8 \times \frac{R1}{R2} + 0.8\ V$$

Taking into account the loop stability, R1 resistance value must be greater than 100KΩ. The following table lists common output voltage and the corresponding R1, R2 resistance value for reference.

Output Voltage	R1 Resistance	R2 Resistance	Tolerance
5V	220KΩ	30KΩ	1%
3.3V	140KΩ	44.2KΩ	1%
1.8V	200KΩ	100KΩ	1%
1.2V	100KΩ	100KΩ	1%

Input / Output Capacitors Selection

The input capacitors are used to suppress the noise amplitude of the input voltage and provide a stable and clean DC input to the device. Because the ceramic capacitor has low ESR characteristic, so it is suitable for input capacitor use. It is recommended to use X5R or X7R MLCC capacitors in order to have better temperature performance and smaller capacitance tolerance. In order to suppress the output voltage ripple, the MLCC capacitor is also the best choice.

Output Inductor Selection

The output inductor selection mainly depends on the amount of ripple current through the inductor ΔI_L. Large ΔI_L will cause larger output voltage ripple and loss, but the user can use a smaller inductor to save cost and space. On the contrary, the larger inductance can get smaller ΔI_L and thus the smaller output voltage ripple and loss. But it will increase the space and the cost. The inductor value can be calculated as:

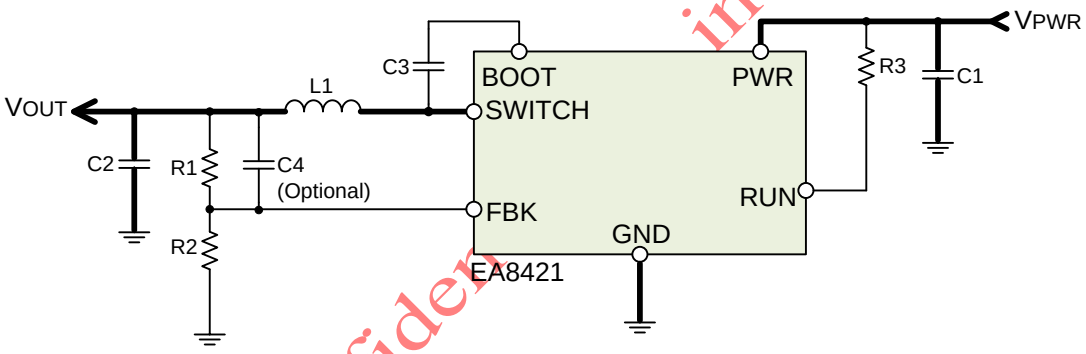
$$L = \frac{V_{PWR} - V_{OUT}}{\Delta I_L \times F_{SW}} \times \frac{V_{OUT}}{V_{PWR}}$$

For most applications, 10uH to 22uH inductors are suitable for EA8421.

PCB Layout Recommendations

For EA8421 PCB layout considerations, please refer to the following suggestions in order to get good performance.

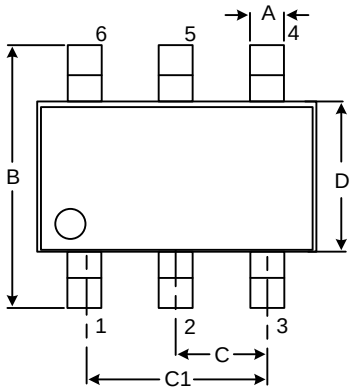
- High current path traces (shown as Figure 5.) need to be widened.
- Place the input capacitors as close as possible to the PWR pin to reduce noise interference.
- Keep the feedback path (from V_{OUT} to FBK) away from the noise node (ex. SWITCH).
- SWITCH is a high current noise node. Complete the layout by using short and wide traces.



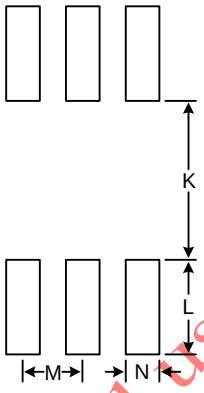
* Bold lines indicate high current paths

Package Information

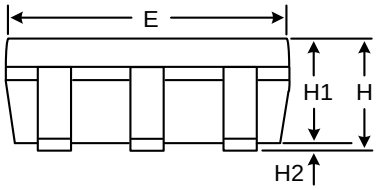
SOT-23-6 Package



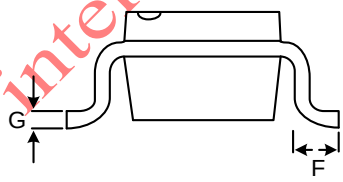
Top View



Recommended Layout Pattern



Side View



Front View

Unit: mm

Symbol	Dimension Min	Dimension Max	Symbol	Dimension Typ
A	0.25	0.52	K	1.40
B	2.59	3.01	L	1.40
C	0.85	1.05	M	0.95
C1	1.70	2.10	N	0.65
D	1.40	1.80		
E	2.70	3.10		
F	0.30	0.62		
G	0.08	0.25		
H	0.89	1.35		
H1	0.89	1.20		
H2	0.00	0.15		

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