General Description

The EA2208 is a constant frequency, current mode step-up converter intended for small, low power applications.   The EA2208 switches at 1.2MHz and allows the use of tiny, low cost capacitors and inductors 2mm or less in height.   Internal soft-start results in small inrush current and extends battery life.

The EA2208 features automatic shifting to pulse frequency modulation mode at light loads.   The EA2208 includes under-voltage lockout, current limiting, and thermal overload protection to prevent damage in the event of an output overload.   The EA2208 is available in a small 6 pin SOT-23 package.

Features

▶ Built-in Low $R_{DS(ON)}$ Power-MOSFETS
▶ 2V to 24V Input Voltage Range
▶ Fixed 1.2MHz Switching Frequency
▶ Internal 3.5A Switch Current Limit
▶ Adjustable Output Voltage
▶ Internal Compensation
▶ Up to 28V Output Voltage
▶ Automatic Pulse Frequency Modulation Mode at Light Loads
▶ Up to 96% Efficiency
▶ Available in SOT23-6 Package

Applications

▶ Battery-Powered Equipment
▶ Set-Top-Box
▶ LCD TVs and Flat TVs
▶ DSL and Cable Modems

Pin Configurations

```
   NC      PWR     RUN
  ┌──┐    ┌──┐    ┌──┐
  │ 6│    │ 5│    │ 4│
  └──┘    └──┘    └──┘
  ┌──────────────────┐
  │                  │
  │     Marking      │
  │                  │
  └──────────────────┘
  ┌──┐    ┌──┐    ┌──┐
  │ 1│    │ 2│    │ 3│
  └──┘    └──┘    └──┘
 SWITCH   GND     FBK
```

SOT-23-6

Pin Description

| Pin Name	Function Description	Pin No.
SWITCH	Power switch output pin. Connect SWITCH pin to power inductor and output rectifier.	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. Don't leave this pin floating.	4
PWR	The EA2208 power input pin. It is recommended to use a 22uF MLCC capacitor between PWR pin and GND pin. The ceramic capacitor must be placed as close to the PWR pin as possible to avoid noise interference.	5
NC	No Connect.	6

Function Block Diagram
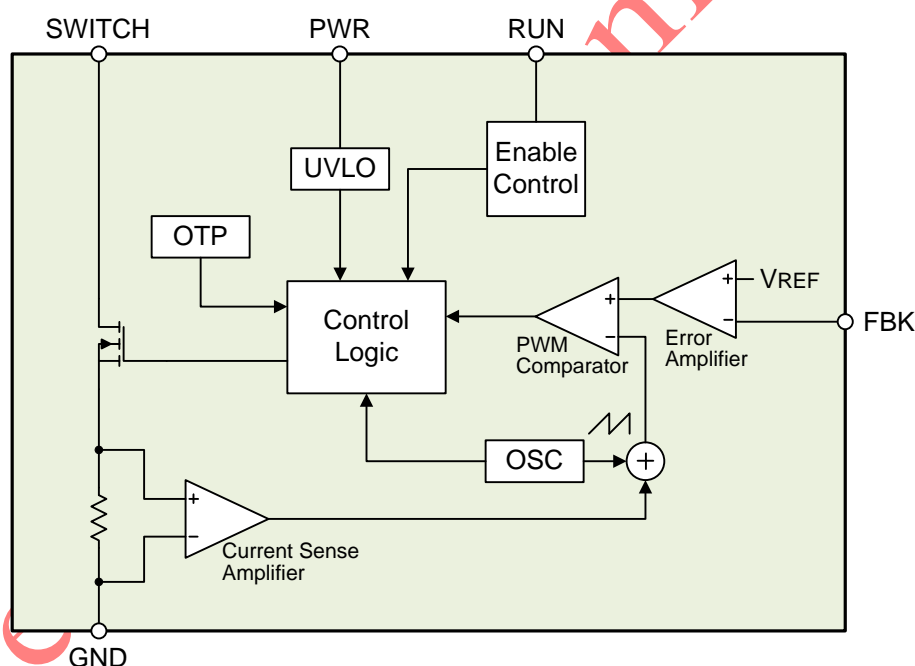
Figure 1. EA2208 internal function block diagram

Absolute Maximum Ratings

Parameter	Value
Input Supply Voltage (V_{PWR})	-0.3V to +26V
RUN Pin Input Voltage (V_{RUN})	-0.3V to +26V
SWITCH Pin Voltage (V_{SWITCH})	-0.3V to +30V
FBK Pin Voltage (V_{FBK})	-0.3V to +6V
Ambient Temperature operating Range (T_A)	-40°C to +85°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

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 Supply Voltage (V_{PWR})	+2V to +24V
Junction Temperature Range (T_J)	-40°C to +125°C

Electrical Characteristics

V_{PWR}=5V, V_{RUN}=5V, T_A=25°C, unless otherwise noted

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage	V_{PWR}		2		24	V
Shutdown Supply Current	I_{SD}	V_{RUN} = 0V		0.1	1	uA
Quiescent Current (PFM)	I_{Q-PFM}	V_{FBK} = 0.7V, Non switching		100	200	uA
Quiescent Current (PWM)	I_{Q-PWM}	V_{FBK} = 0.5V, switching		1.6	2.2	mA
UVLO Threshold	V_{UVLO}	V_{PWR} Rising			1.98	V
UVLO Hysteresis	$V_{UV-HYST}$			0.1		V
Reference Voltage	V_{REF}		0.588	0.6	0.612	V
FBK Input Bias Current	I_{FBK}	V_{FBK} = 0.6V	-50	-10		nA
Switching Frequency	F_{SW}			1.2		MHz
Maximum Duty Cycle	D_{MAX}		90			%
NMOS On-Resistance	$R_{DS(ON)}$			80	150	mΩ
NMOS Current Limit	I_{LIM}	V_{PWR} = 5V, duty cycle = 50%		3.5		A
SWITCH Leakage Current	$I_{LEAK-SWITCH}$	V_{SWITCH} = 20V	-1		1	uA
RUN Pin Input Low Voltage	V_{RUN-L}				0.4	V
RUN Pin Input High Voltage	V_{RUN-H}		1.5			V
Thermal Shutdown Threshold	T_{OTP}			155		°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.
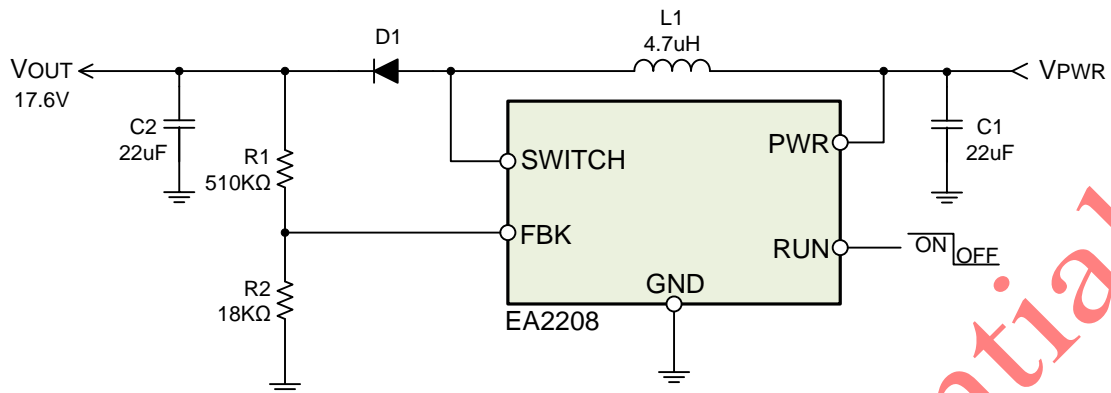
Application Circuit Diagram

Figure 2. EA2208 typical application circuit diagram
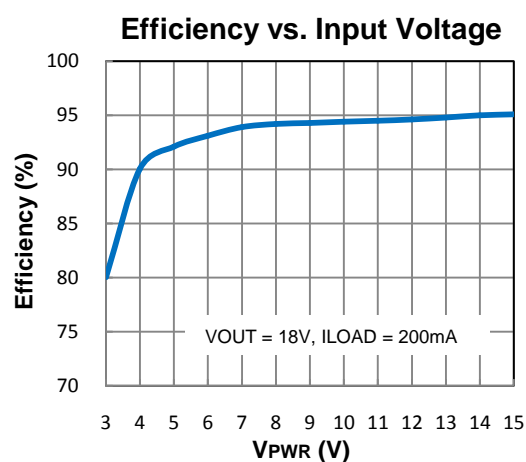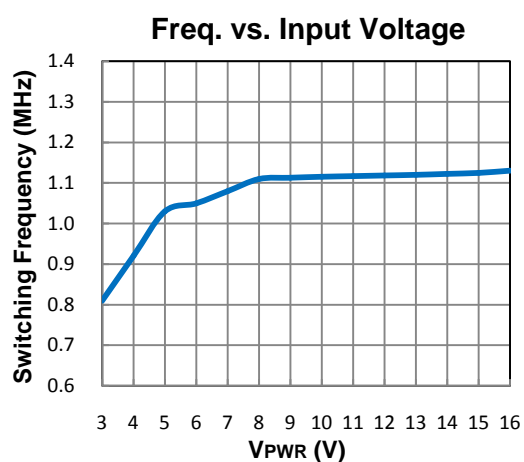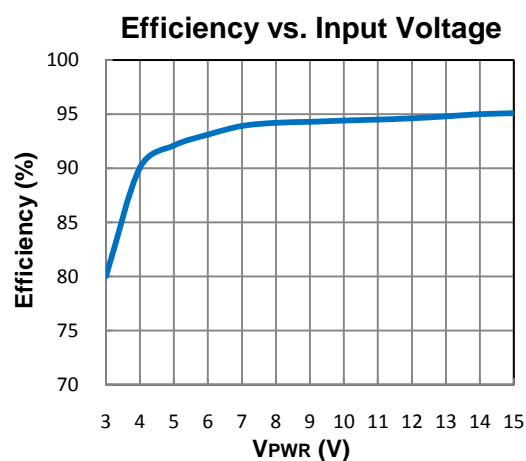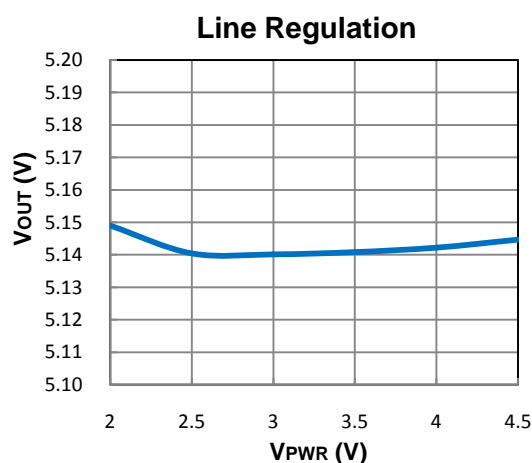
Ordering Information

Part Number	Package Type	Packing Information
EA2208T6R	SOT-23-6	Tape & Reel / 3000

Note (1):"T6": Package type code.

(2):"R": Tape & Reel.

Typical Operating Characteristics

V_{PWR}=5V, V_{OUT}=12V, L1=4.7uH, C1=C2=22uF, T_A=25°C, unless otherwise noted

Efficiency vs. Load Current

Efficiency vs. Load Current

Line Regulation

Efficiency vs. Input Voltage

Freq. vs. Input Voltage

Efficiency vs. Input Voltage
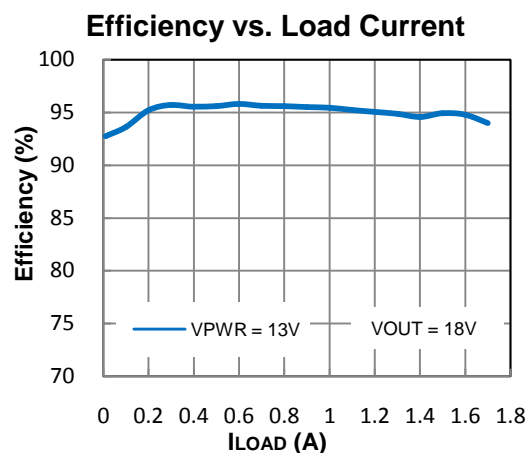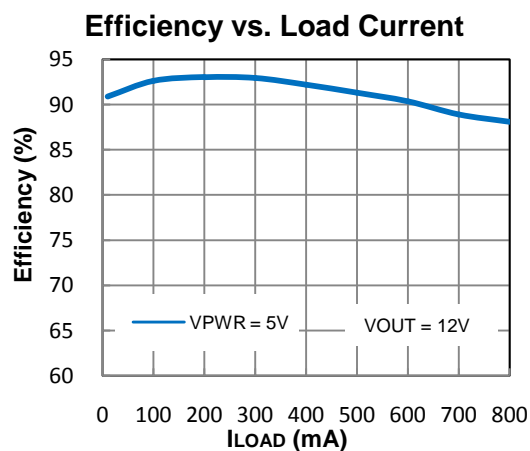
Application Information

Output Voltage Setting

The EA2208 output voltage can be set via a resistor divider (R1, R2). The output voltage is calculated by following equation:

$$V_{OUT} = 0.6 \times \frac{R1}{R2} + 0.6 \text{ V}$$

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. The suggested value of input / output capacitors are 22uF.

Inductor Selection

The recommended values of inductor are 4.7uH to 10uH. Small size and better efficiency are the major concerns for portable device. The inductor should have low core loss at 1.2MHz and low DCR for better efficiency. To avoid inductor saturation, the current rating should be considered.

Diode Selection

Schottky diodes with low forward voltages are recommended for EA2208. Ensure the diode current rating exceed the output current and the peak inductor current. The diode's reverse breakdown voltage should be larger than the output voltage.

PCB Layout Recommendations

For EA2208 PCB layout considerations, please refer to the following suggestions in order to get good performance.
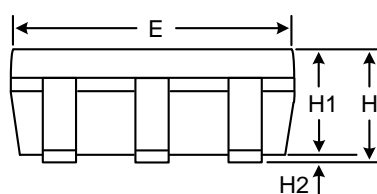- ► High current path traces need to be widened.
- ► Place the input and output capacitors as close as possible to the device to reduce noise interference.
- ► The GND pin should be connected to a large area ground plane
- ► Keep the feedback path (from V_{OUT} to FBK) away from the noise node (ex. SWITCH).
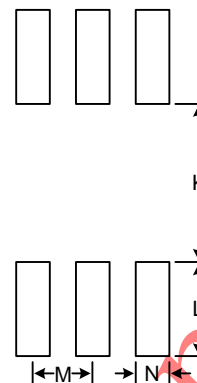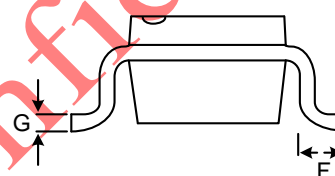
Package Information

SOT-23-6 Package
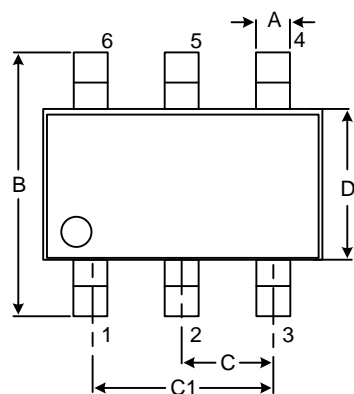
Top View

Side View

Recommended Layout Pattern

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		