## General Description

The 9083 step-up switching regulator generates an output voltage of up to 28V from an input voltage as low as 2.3V. Ideal for applications where space is limited, it switches at 1.0MHz, allowing the use of tiny, low cost and low profile external components. Its internal 4A, 80m Ω NMOS switch provides high efficiency even at heavy load, while the constant frequency, current mode architecture results in low, predictable output noise that is easy to filter. Internal frequency compensation is designed to accommodate ceramic output capacitors, further reducing noise. The device features very low shutdown current of 0.5uA.

The 9083 is available in SOT-23-6 package.

## Features

- Internal 4A MOSFET Switch
- 1.0MHZ Switching Frequency
- Integrated Soft-Start
- 2.3V to 24V Input Voltage
- Up to 28V Output Voltage
- Up to 93% Efficiency
- Automatic PFM Mode at Light loads
- Cost effective for using smaller devices
- Low profile(1mm):SOT-23-6 package

## Application

- White LED Driver Supply
- Battery Back-up

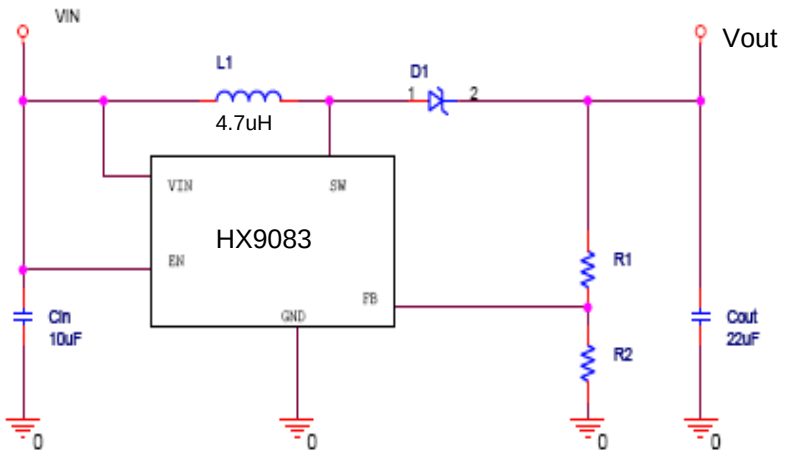
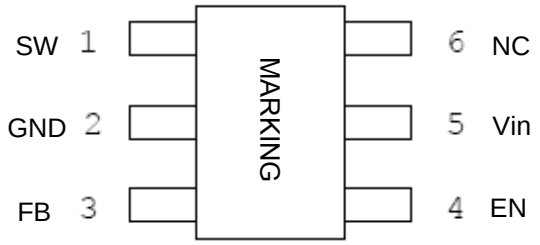



**Figure 1 Typical Application Circuit**

## Ordering Information

| Input Voltage | Package | Pcs/Reel | Part Number (Tape and Reel) |
|---|---|---|---|
| -0.3 to 26V | SOT23-6 | 3000 | HX9083 |

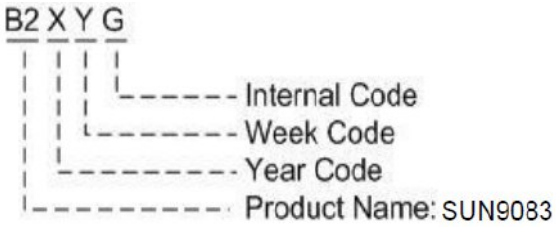
# Package/Order Information




SOT23-6

**Figure 2 PIN Configuration**

| Part Number | Top Mark | Temp Range |
|---|---|---|
| HX 9083 | B2XYG | -40°C to +85°C |




## Pin Description

| PIN NUMBER | PIN NAME | PIN DESCRIPTION |
|---|---|---|
| 1 | SW | Switch Output. Connect this pin to the inductor. |
| 2 | GND | Ground. |
| 3 | FB | Feedback Input. The voltage at this pin is regulated to 0.6V. Connect to the resistor divider between output and ground to set output voltage |
| 4 | EN | Enable Input. When higher than 1.5V, this pin turns the IC on. When lower than 0.3V, this pin turns the IC off. |
| 5 | Vin | Power Supply |
| 6 | NC | No Connected |

## Absolute Maximum Ratings

(Note: Do not exceed these limits to prevent damage to the device. Exposure to absolute maximum rating conditions for long periods may affect device reliability.)

| PARAMETER | VALUE | UNIT |
|---|---|---|
| Supply Voltage VIN | -0.3 to 26 | V |

| | | |
|---|---|---|
| EN Voltage | -0.3 to 26 | V |
| SW Voltage | -0.3 to 30 | V |
| Operating Ambient Temperature | -40 to 85 | °C |
| Maximum Junction Temperature | 125 | °C |
| Storage Temperature | -55 to 150 | °C |
| Lead Temperature (Soldering, 10 sec) | 300 | °C |

## Electrical Characteristics

($V_{IN}$ = 3.6V, $T_A$= 25°C unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Input Voltage Range | $V_{IN}$ | | 2.3 | | 24 | V |
| Quiescent Current | Iq | $V_{FB}$ =0.7V EN=Vin, $I_{Load}$ =0 | | 65 | 120 | uA |
| Shutdown Current | | $V_{EN}$ =0V, $V_{IN}$ =3.3V | | 0.5 | 1 | |
| Regulated Feedback Voltage | $V_{FB}$ | $T_a$ =25°C | 0.588 | 0.6 | 0.612 | V |
| | | 0< $T_a$ < 85°C | 0.6865 | 0.6 | 0.6135 | |
| | | -40°C < $T_a$ <85°C | 0.585 | 0.6 | 0.615 | |
| Reference Voltage Line Regulation | | $V_{IN}$ =2.3V to 24V | | 0.05 | 0.5 | % |
| Output Voltage Load Regulation | | | | 0.5 | | % |
| Current Limit | $I_{PEAK}$ | | | 4 | | A |
| Oscillator Frequency | $F_{OSC}$ | $V_{FB}$=0.6V or $V_{OUT}$ =100% | 0.8 | 1.0 | 1.2 | MHz |
| Rds(ON) of N-channel FET | | $I_{SW}$ =-100mA | | 80 | 150 | mΩ |
| Enable Threshold | | $V_{IN}$ = 1.6V to 5.5V | 0.3 | 1.5 | | V |
| Enable Leakage Current | | | -0.1 | | 0.1 | μA |
| SW Leakage Current | | $V_{EN}$ = 0V, $V_{SW}$ = 0V or 5V, $V_{IN}$ = 5V | | | 1 | uA |

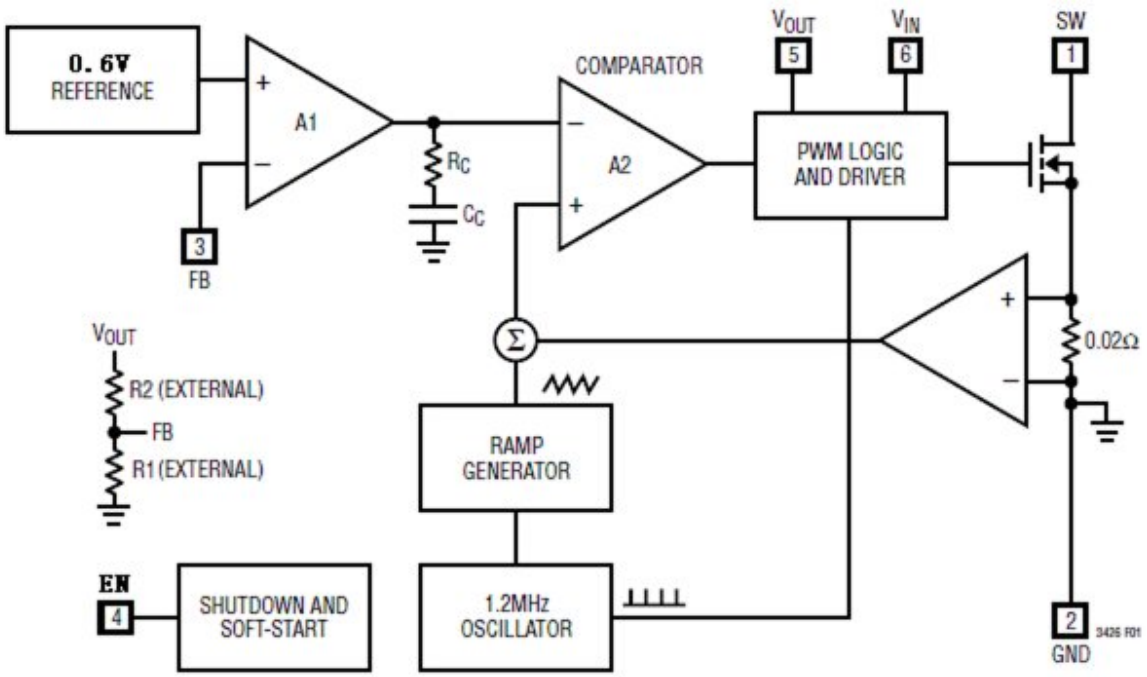



**Figure 3 Functional Block Diagram**

# FUNCTIONAL DESCRIPTION

## NORMAL OPERATION

The 9083 is a monolithic 1.0MHz boost converter housed in a 6-lead SOT-23 package. The device features fixed frequency, current mode PWM control for excellent line and load regulation. The low $R_{ds(on)}$ NMOS switch enables the device to maintain high efficiency over a wide range of load current. Operation of the feedback loop which sets the peak inductor current to keep the output in regulation can be best understood by referring to the Block Diagram in Figure 1. At the start of each clock cycle a latch in the PWM logic is set and the NMOS switch is turned on. The sum of a voltage proportional to the switch current and a slope compensating voltage ramp is fed to the positive input to the PWM

comparator. When this voltage exceeds either a voltage proportional to the 4A current limit or the PWM control voltage, the latch in the PWM logic is reset and NMOS switch is turned off. The PWM control voltage at the output of the error amplifier is the amplified and compensated difference between the feed- back voltage on the FB pin and the internal reference voltage of 0.6V. If the control voltage increases, more current is delivered to the output. When the control voltage exceeds the $I_{LIMIT}$ reference voltage, the peak current is limited to a minimum of 4A. The current limit helps protect the 9083 internal switch and external components connected to it. If the control voltage decreases, less current is delivered to the output. During load transients control voltage may decrease to the point where no switching occurs until the feedback voltage drops below the reference. The 9083 has an integrated soft-start feature which slowly ramps up the feedback control node from 0V. The soft-start is initiated when EN is pulled high.

# APPLICATION INFORMATION

## INDUCTOR SELECTION

The 9083 can utilize small surface mount inductors due to its 1.0MHz switching frequency. A 4.7μH or 22 μH inductor will be the best choice for most 9083 applications.

The inductor should have low DCR (DC resistance) to reduce the I2R power losses, and must be able to handle the peak inductor current without saturating.

Several inductor manufacturers are listed in Table 1 Selected inductor by actual application:

| *Manufacturer* | *Part Number* | *Inductance(uH)* | *DRC max (Ohms)* | *Dimensions L*W*H(mm3)* |
|---|---|---|---|---|
| Murata | LQH5BPN | 4.7 | 0.03 | 5*5*2 |
| | LQH32PN | 4.7 | 0.06 | 3.2*2.5*1.7 |
| Sumida | CDRH3D16 | 4.7 | 0.03 | 4*4*1.8 |
| | | 4.7 | 0.07 | |

**Table 1. Recommend Surface Mount Inductors**

## Diode Selection

A Schottky diode is recommended for use with the 9083.Use of a low forward voltage diode such as the ON Semiconductor MBRA210LT3 is recommended. A Schottky diode rated at 4A is recommended for use with the 9083.

## INPUT CAPACITOR SELECTION

The input capacitor reduces input voltage ripple to the converter, low ESR ceramic capacitor is highly recommended. For most applications, a 10~22uF capacitor is used. The input capacitor should be placed as close as possible to VIN and GND.

Recommended: Murata GRM32ER61A106KA01L

Murata GRM32NR61A226KE19L

## OUTPUT CAPACITOR SELECTION

A low ESR output capacitor is required in order to maintain low output voltage ripple. In the case of ceramic output capacitors, capacitor ESR is very small and does not contribute to the ripple, so a lower capacitance value is acceptable when ceramic capacitors are used. A 22uF ceramic output capacitor is suitable for most applications.

Recommended: Murata GRM32NR61A226KE19L

## OUTPUT VOLTAGE PROGRAMMING

In the adjustable version, the output voltage is set by a resistive divider according to the following equation:

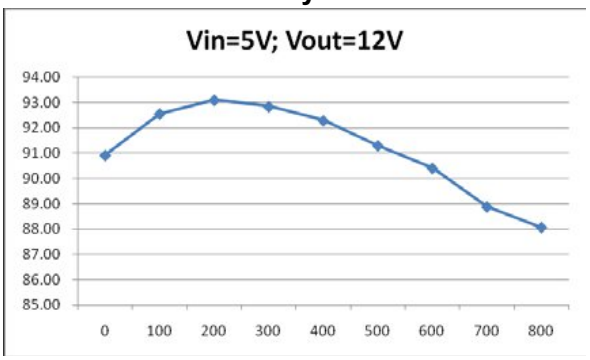
$$R_1 = R_2 \times \left( \frac{V_{OUT}}{0.6} - 1 \right)$$

Typically choose R2=20K and determine R1 from the following equation:

Connect a small capacitor across R2 feed forward capacitance at the FB pin for better performance.

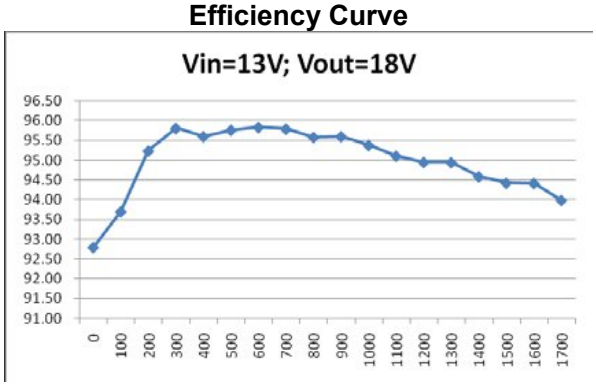
## Typical Performance Characteristics

**Efficiency Curve**



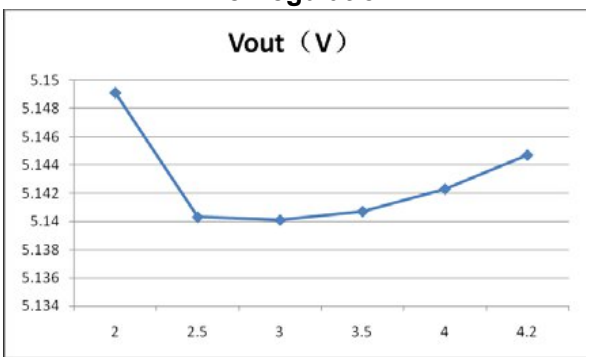

$I_{OUT}$ (mA)

**Efficiency Curve**



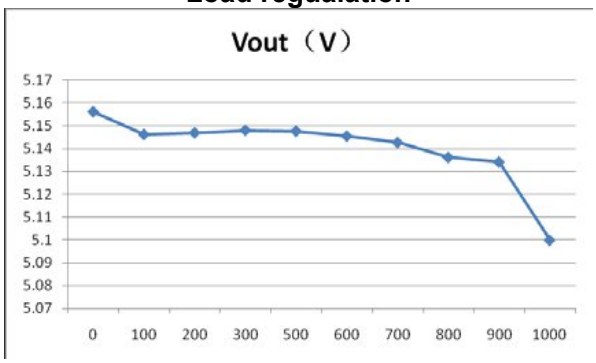

$I_{OUT}$ (mA)

**line Regulation**



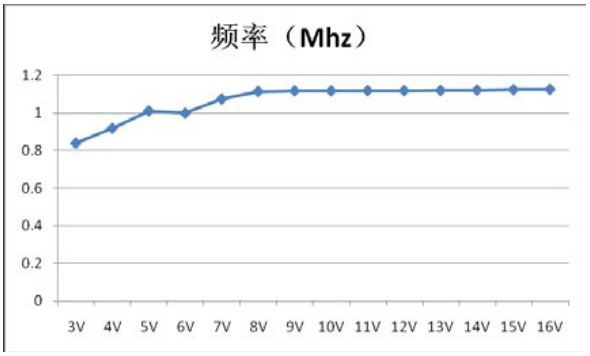

$V_{IN}$ (V)

**Load regulation**

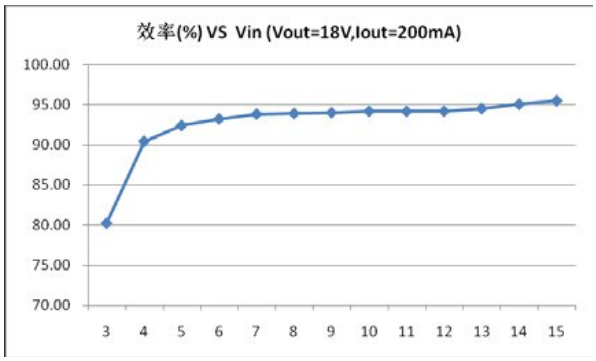



$I_{OUT}$ (mA)

**Freq VS $V_{IN}$**

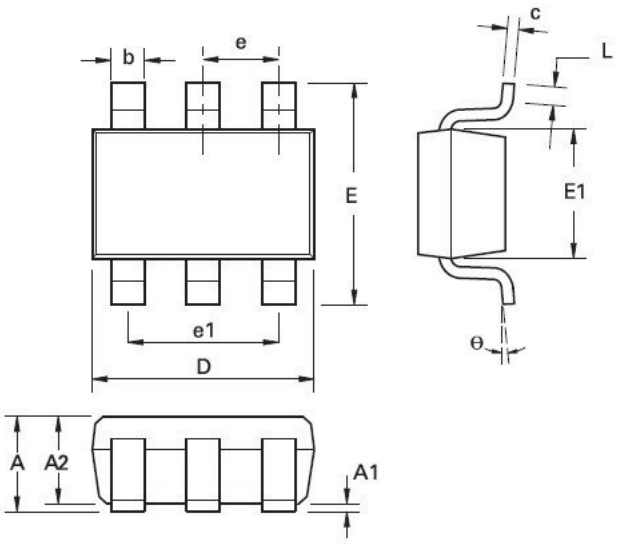



**Efficiency VS $V_{IN}$**



## Surface mounted, 6 pin package

## Package outline




| DIM | Millimeters | | Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 0.90 | 1.45 | 0.0354 | 0.0570 |
| A1 | 0.00 | 0.15 | 0.00 | 0.0059 |
| A2 | 0.90 | 1.30 | 0.0354 | 0.0511 |
| b | 0.35 | 0.50 | 0.0078 | 0.0196 |
| C | 0.09 | 0.26 | 0.0035 | 0.0102 |
| D | 2.70 | 3.10 | 0.1062 | 0.1220 |
| E | 2.20 | 3.20 | 0.0866 | 0.1181 |
| E1 | 1.30 | 1.80 | 0.0511 | 0.0708 |
| L | 0.10 | 0.60 | 0.0039 | 0.0236 |
| e | 0.95 REF | | 0.0374 REF | |
| e1 | 1.90 REF | | 0.0748 REF | |
| L | 0° | 30° | 0° | 30° |

**Note:** Controlling dimensions are in millimeters. Approximate dimensions are provided in inches